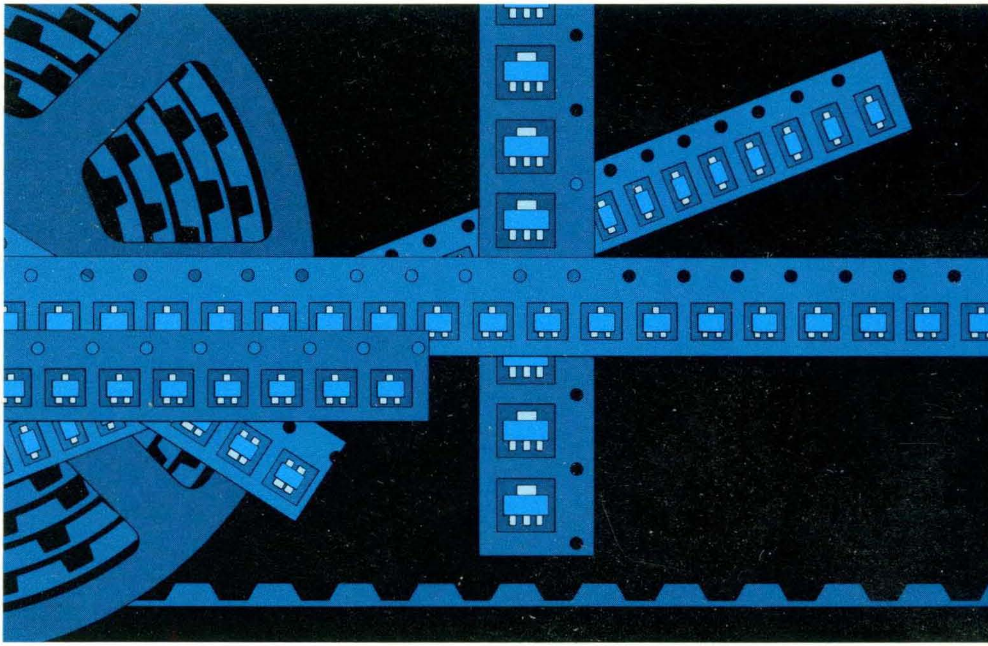
SIEMENS



Discrete Semiconductors for Surface Mounting

Data Book

SIEMENS
Discrete Semiconductors for Surface Mounting

Discrete Semiconductors for Surface Mounting

Data Book

Preface

At present the conventional through-hole mounting technology used for printed circuit assemblies is increasingly superseded by surface mounting. Instead of inserting leaded components, special miniaturized components are directly attached and soldered to the PC board. These new surface mounted devices (SMDs) and their packing are particularly suitable for automatic assembly. The major advantages of surface mounting are rationalized production, reduced board size and increased reliability.
Compared to the through-hole mounting technology, surface mounting requires more careful planning of the overall design and production process. The better the components, PC board layout, automatic placement, soldering method, testing and repair are attuned to each other, the more efficiently surface mounting can be applied.
For many years diodes and transistors have been offered as part of the family of "miniature semiconductors" or "semiconductors for film circuits". The SOT 23, which was introduced to the market in the early sixties, is the most common package type. During the mid seventies, the SOT 89 was added. Additional package types are the SOT 143, SOT 223 and SOD 123.
An outstanding design feature of these Siemens package versions is the closely tolerated clearance between device and PC board (0.1 mm), which is essential for good glueing conditions.
The available range of products is considerable. Practically all standard devices provided with leads are now available in miniature package as well.
Owing to the allround experience Siemens has gained in this field, components in conventional package types can be easily converted into components in miniature package. Thus, a quick adaption to market demands is possible. It should be especially mentioned here that LEDs are available in SOT 23 package as well.

SMD – **S**urface **M**ounted **D**evice

Literature Selector

Further literature concerning e.g. SMD technology is listed in the following survey and can be obtained from:
Siemens Components, Inc.,
186 Wood Avenue South, Iselin, NJ 08830,
1-800-888-7730, Fax (908) 632-2830

Title	Ordering code
Tuner Semiconductor Devices, Data Book	B3-B3587-X-X-7600
Transistors for Amplifier and Switching Applications, Data Book	B3-B3789-X-X-7600
Discrete Semiconductors for Surface Mounting SMD, Data Book	B3-B3497-X-X-7600
An Introduction to Surface Mounting, Product Information	B3-B3289-X-X-7600
SOT-23 Semiconductors, Off-Print	B3-B3342-X-X-7600
SMD Components, Short Form Catalog	B3-B3907-X-X-7400
Recommendation for PCB Layouts, Product Information	B3-B3580-X-X-7600
Components Library, Product Information	B9-B3695-X-X-7600
Soldering in SMD Technology, Product Information	B9-B3741-X-X-7600
SIPMOS Small-Signal Transistors	B352-B6155-XX-7400

Page

Switching diodes

Type	Maximum Ratings Characteristics ($T_{amb} = 25°C$)					Package	Page
	V_{RM} (V)	I_F (mA)	V_f at I_f (V)	(mA)	t_{rr} (ns)		
BAL 74	50	250	≤1.0	100	≤4	SOT-23	47
BAL 99	70	250	≤1.0	50	≤6	SOT-23	51
BAR 74	50	250	≤1.0	100	≤4	SOT-23	65
BAR 99	70	250	≤1.0	50	≤6	SOT-23	69
BAS 16	85	250	≤1.0	50	≤6	SOT-23	73
BAS 19	120	200	≤1.0	100	≤50	SOT-23	77
BAS 20	200	200	≤1.0	100	≤50	SOT-23	77
BAS 21	250	200	≤1.0	100	≤50	SOT-23	77
BAS 28 (Dual)	85	250	≤1.0	50	≤6	SOT-143	81
BAS 78 A	50	1000	≤1.6	1000	1 μs	SOT 223	91
BAS 78 B	100	1000	≤1.6	1000	1 μs	SOT 223	91
BAS 78 C	200	1000	≤1.6	1000	1 μs	SOT 223	91
BAS 78 D	400	1000	≤1.6	1000	1 μs	SOT 223	91
BAS 79 A (Dual)	50	1000	≤1.6	1000	1 μs	SOT 223	94
BAS 79 B (Dual)	100	1000	≤1.6	1000	1 μs	SOT 223	94
BAS 79 C (Dual)	200	1000	≤1.6	1000	1 μs	SOT 223	94
BAS 79 D (Dual)	400	1000	≤1.6	1000	1 μs	SOT 223	94
BAS 116	85	250	≤1.0	10	≤3 μs	SOT-23	97
BAV 70 (Dual)	70	250	≤1.0	50	≤6	SOT-23	106
BAV 74 (Dual)	50	250	≤1.0	100	≤4	SOT-23	110
BAV 99 (Dual)	70	250	≤1.0	50	≤6	SOT-23	114
BAV 170 (Dual)	70	250	≤1.0	10	≤3 μs	SOT-23	118
BAV 199 (Dual)	70	250	≤1.0	10	≤3 μs	SOT-23	122
BAW 56 (Dual)	70	250	≤1.0	50	≤6	SOT-23	126
BAW 78 A	50	1000	≤1.6	1000	1 μs	SOT-89	130
BAW 78 B	100	1000	≤1.6	1000	1 μs	SOT-89	130
BAW 78 C	200	1000	≤1.6	1000	1 μs	SOT-89	130
BAW 78 D	400	1000	≤1.6	1000	1 μs	SOT-89	130
BAW 79 A (Dual)	50	1000	≤1.6	1000	1 μs	SOT-89	133
BAW 79 B (Dual)	100	1000	≤1.6	1000	1 μs	SOT-89	133
BAW 79 C (Dual)	200	1000	≤1.6	1000	1 μs	SOT-89	133
BAW 79 D (Dual)	400	1000	≤1.6	1000	1 μs	SOT-89	133
BAW 100 (Dual)	70	250	≤1.0	50	≤6	SOT-143	—
BAW 101 (Dual)	300	200	≤1.3	100	1 μs	SOT-143	136
BAW 156 (Dual)	70	250	≤1.0	10	≤3 μs	SOT-23	139
BGX50A (Bridge)	70	140	≤2.6	100	≤6	SOT-143	160
SMBD 914	100	250	≤1.0	10	≤4	SOT-23	164

Switching diodes

Type	Maximum Ratings Characteristics (T_{amb} = 25°C)					Package	Page
	V_{RM} (V)	I_F (mA)	V_f at I_f (V)	(mA)	t_{rr} (ns)		
SMBD 2835 (Dual)	75	250	≤1.0	50	≤6	SOT-23	168
SMBD 2836 (Dual)	75	250	≤1.0	50	≤6	SOT-23	168
SMBD 2837 (Dual)	75	250	≤1.0	50	≤6	SOT-23	172
SMBD 2838 (Dual)	75	250	≤1.0	50	≤6	SOT-23	172
SMBD 6050	70	250	≤1.1	100	≤10	SOT-23	176
SMBD 6100 (Dual)	70	250	≤1.1	100	≤15	SOT-23	180
SMBD 7000 (Dual)	100	250	≤1.1	100	≤15	SOT-23	184

MOSFET tetrodes

Type	V_{DS} V	I_D mA	T_{ch} °C	P_{tot} mW	g_{fs} mS	G_{ps} dB	F dB	V_{DS} V	I_D mA	f MHz	Package	Page
BF 989	20	30	150	200	12	16,5	2,8	15	7	800	SOT-143	362
BF 993	20	50	150	200	25	25	1,5	15	10	200	SOT-143	370
BF 994 S	20	30	150	200	18	25	1	15	10	200	SOT-143	376
BF 995	20	30	150	200	17	23	1,8	15	10	200	SOT-143	382
BF 996 S	20	30	150	200	18	18	1,8	15	10	800	SOT-143	392
BF 997	20	30	150	200	18	25	1	15	10	200	SOT-143	399
BF 998	12	30	150	200	24	20	1	8	10	800	SOT-143	405

Schottky Diodes for General Purposes

Type	Max. ratings		Characteristics at T_A = 25°C					Package	Page
	V_R V	I_F mA	V_{BR} V	V_F mV	C_T pF	I_R µA	τ ps		
BAS 40 BAS 40-04 BAS 40-05 BAS 40-06 BAS 40-07	40	80	40	380	5	1.0	100	SOT-23 SOT-23 SOT-23 SOT-23 SOT-143	85
BAS 70 BAS 70-04 BAS 70-05 BAS 70-06 BAS 70-07	70	40	70	410	2	0.1	100	SOT-23 SOT-23 SOT-23 SOT-23 SOT-143	88
BAT 17 BAT 17-04 BAT 17-05 BAT 17-06	4	30	4	350	1	0.25	–	SOT-23 SOT-23 SOT-23 SOT-23	101
BAT 64	30	200	–	1000	6	200	–	SOT-23	104

Switching transistors

Type (NPN = N, PNP = P)		Maximum Ratings V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	Characteristics (T_{amb} = 25°C) h_{FE} at	I_C (mA)	V_{CE} (V)	$V_{CE(sat)}$ (V)	Package	Page
BSS63	P	100	800	330	150	≥30	10	5	≤0.25	SOT-23	279
BSS64	N	80	800	330	100	80	10	1	≤0.7	SOT-23	275
BSS79	N	40	800	330	250	40 - 300*	150	10	≤1.3	SOT-23	701
BSS80	P	40	800	330	250	40 - 300*	150	10	≤1.6	SOT-23	706
BSS81	N	35	800	330	250	40 - 300*	150	10	≤1.3	SOT-23	701
BSS82	P	60	800	330	250	40 - 300*	150	10	≤1.6	SOT-23	706
PZT2222	N	30	600	1500	200	100 - 300	150	10	≤0.4	SOT-223	758
PZT2222A	N	40	600	1500	200	100 - 300	150	10	≤0.3	SOT-223	758
PZT2907	P	40	600	1500	200	100 - 300	150	10	≤0.4	SOT-223	763
PZT2907A	P	60	600	1500	200	100 - 300	150	10	≤0.4	SOT-223	763
PZT3904	N	40	200	1500	300	100 - 300	10	1	≤0.3	SOT-223	768
PZT3906	P	40	200	1500	250	100 - 300	10	1	≤0.4	SOT-223	773
SMBT2222	N	30	600	330	250	100 - 300	150	10	≤0.4	SOT-23	794
SBMT2222A	N	40	600	330	300	100 - 300	150	10	≤0.3	SOT-23	794
SMBT2907	P	40	600	330	200	100 - 300	150	10	≤0.4	SOT-23	800
SMBT2907A	P	60	600	330	200	100 - 300	150	10	≤0.4	SOT-23	800
SMBT3904	N	40	200	330	300	100 - 300	10	1	≤0.3	SOT-23	806
SMBT3906	P	40	200	330	250	100 - 300	10	1	≤0.4	SOT-23	812
SMBTA70	P	40	200	330	125	40 - 400	5	10	≤0.25	SOT-23	863
SXT2222A	N	40	600	1000	300	100 - 300	150	10	≤0.3	SOT-89	883
SXT2907A	P	60	600	1000	200	100 - 300	150	10	≤0.4	SOT-89	888
SXT3904	N	40	200	1000	300	100 - 300	10	1	≤0.3	SOT-89	894
SXT3906	P	40	200	1000	250	100 - 300	10	1	≤0.4	SOT-89	900

MOSFET triodes

Type	V_{DS} V	I_D mA	T_{ch} °C	P_{tot} mW	g_{fs} mS	G_{ps} dB	F dB	V_{DS} V	I_D mA	f MHz	Package	Page
BF 543	20	30	150	200	12	22	1	10	4	200	SOT-23	302
BF 999	20	30	150	200	16	25	1	10	10	200	SOT-23	413

High voltage transistors

Type (NPN = N, PNP = P)		Maximum Ratings V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	Characteristics (T_{amb} = 25°C) h_{FE} at	I_C (mA)	V_{CE} (V)	$V_{CE(sat)}$ (V)	Package	Page
BF622	N	250	100	1000	100	≥50	25	20	≤0.5	SOT-89	326
BF623	P	250	100	1000	100	≥50	25	20	≤0.5	SOT-89	330
BF720	N	300	100	1500	100	≥40	25	20	≤0.5	SOT-223	337
BF721	P	300	100	1500	100	≥40	25	20	≤0.5	SOT-223	341
BF722	N	250	100	1500	100	≥50	25	20	≤0.5	SOT-223	337
BF 723	P	250	100	1500	100	≥50	25	20	≤0.5	SOT-223	341
BFN16	N	250	500	1000	70	≥40	30	10	≤0.4	SOT-89	418
BFN17	P	250	500	1000	100	≥40	30	10	≤0.4	SOT-89	422
BFN18	N	300	500	1000	70	≥30	30	10	≤0.5	SOT-89	418
BFN19	P	300	500	1000	100	≥30	30	10	≤0.5	SOT-89	422
BFN20	N	300	100	1000	100	≥40	25	20	≤0.5	SOT-89	426
BFN21	P	300	100	1000	100	≥40	25	20	≤0.5	SOT-89	430
BFN22	N	250	100	360	100	≥50	25	20	≤0.5	SOT-23	434
BFN23	P	250	100	360	100	≥50	25	20	≤0.5	SOT-23	438
BFN24	N	250	500	360	70	≥40	30	10	≤0.4	SOT-23	442
BFN25	P	250	500	360	100	≥40	30	10	≤0.4	SOT-23	446
BFN26	N	300	500	360	70	≥30	30	10	≤0.5	SOT-23	442
BFN27	P	300	500	360	100	≥30	30	10	≤0.5	SOT-23	446
BFN36	N	250	500	1500	70	≥40	30	10	≤0.4	SOT-223	450
BFN37	P	250	500	1500	100	≥40	30	10	≤0.4	SOT-223	454
BFN38	N	300	500	1500	70	≥30	30	10	≤0.5	SOT-223	450
BFN39	P	300	500	1500	100	≥30	30	10	≤0.5	SOT-223	454
PZTA42	N	300	500	1500	50	≥40	30	10	≤0.5	SOT-223	782
PZTA43	N	200	500	1500	50	≥40	30	10	≤0.4	SOT-223	782
PZTA92	P	300	500	1500	50	≥25	30	10	≤0.5	SOT-223	790
PZTA93	P	200	500	1500	50	≥25	30	10	≤0.4	SOT-223	790
SMBTA42	N	300	500	360	50	≥40	30	10	≤0.5	SOT-23	851
SMBTA43	N	200	500	360	50	≥40	30	10	≤0.4	SOT-23	851
SMBTA92	P	300	500	360	50	≥25	30	10	≤0.5	SOT-23	867
SMBTA93	P	200	500	360	50	≥25	30	10	≤0.4	SOT-23	867
SXTA42	N	300	500	1000	50	≥40	30	10	≤0.5	SOT-89	906
SXTA43	N	200	500	1000	50	≥40	30	10	≤0.4	SOT-89	906
SXTA92	P	300	500	1000	50	≥25	30	10	≤0.5	SOT-89	910
SXTA93	P	200	500	1000	50	≥25	30	10	≤0.4	SOT-89	910

AF transistors

*Available in h_{FE} sub groups.

Type		Maximum Ratings				Characteristics (T_{amb} = 25°C)				Package	Page
(NPN=N, PNP=P)		V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	h_{FE} at	I_C (mA)	V_{CE} (V)	$V_{CE(sat)}$ (V)		
BC807	P	45	1000	330	220	100 - 630*	100	1	≤0.7	SOT-23	191
BC808	P	25	1000	330	200	100 - 630*	100	1	≤0.7	SOT-23	191
BC817	N	45	1000	330	170	100 - 630*	100	1	≤0.7	SOT-23	195
BC818	N	25	1000	330	170	100 - 630*	100	1	≤0.7	SOT-23	195
BC846	N	65	200	330	200	100 - 450*	2	5	≤0.6	SOT-23	199
BC847	N	45	200	330	200	110 - 800*	2	5	≤0.6	SOT-23	199
BC848	N	30	200	330	200	110 - 800*	2	5	≤0.6	SOT-23	199
BC849	N	30	200	330	200	200 - 800*	2	5	≤0.6	SOT-23	199
BC850	N	45	200	330	200	200 - 800*	2	5	≤0.6	SOT-23	199
BC856	P	65	200	330	250	125 - 475*	2	5	≤0.6	SOT-23	206
BC857	P	45	200	330	250	125 - 800*	2	5	≤0.6	SOT-23	206
BC858	P	30	200	330	250	125 - 800*	2	5	≤0.6	SOT-23	206
BC859	P	30	200	330	250	220 - 900*	2	5	≤0.6	SOT-23	206
BC860	P	45	200	330	250	220 - 800*	2	5	≤0.6	SOT-23	206
BCW60	N	32	200	330	200	120 - 630*	2	5	≤0.25	SOT-23	253
BCW61	P	32	200	330	250	120 - 630*	2	5	≤0.25	SOT-23	260
BCW65	N	32	1000	330	170	100 - 630*	100	5	≤0.7	SOT-23	267
BCW66	N	45	1000	330	170	100 - 630*	100	5	≤0.7	SOT-23	267
BCW67	P	32	1000	330	200	100 - 630*	100	5	≤0.7	SOT-23	271
BCW68	P	45	1000	330	200	100 - 630*	100	5	≤0.7	SOT-23	271
BCP51	P	45	1500	1500	125	40 - 250*	150	2	≤0.5	SOT-223	221
BCP52	P	60	1500	1500	125	40 - 250*	150	2	≤0.5	SOT-223	221
BCP53	P	80	1500	1500	125	40 - 250*	150	2	≤0.5	SOT-223	221
BCP54	N	45	1500	1500	100	40 - 250*	150	2	≤0.5	SOT-223	225
BCP55	N	60	1500	1500	100	40 - 250*	150	2	≤0.5	SOT-223	225
BCP56	N	80	1500	1500	100	40 - 250*	150	2	≤0.5	SOT-223	225
BCP68	N	20	2000	1500	100	63 - 400	500	1	≤0.5	SOT-223	229
BCP69	P	20	2000	1500	100	63 - 400	500	1	≤0.5	SOT-223	233

AF transistors

*Available in *h*FE sub groups.

Type (NPN=N, PNP=P)		Maximum Ratings V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	Characteristics (T_{amb} = 25°C) h_{FE} at	I_C (mA)	V_{CE} (V)	$V_{CE(sat)}$ (V)	Package	Page
BCX41	N	125	1000	330	100	≥63	100	1	≤0.9	SOT-23	275
BCX42	P	125	1000	330	150	≥63	100	1	≤0.9	SOT-23	279
BCX51	P	45	1500	1000	125	40 - 250*	150	2	≤0.5	SOT-89	283
BCX52	P	60	1500	1000	125	40 - 250*	150	2	≤0.5	SOT-89	283
BCX53	P	80	1500	1000	125	40 - 250*	150	2	≤0.5	SOT-89	283
BCX54	N	45	1500	1000	100	40 - 250*	150	2	≤0.5	SOT-89	287
BCX55	N	60	1500	1000	100	40 - 250*	150	2	≤0.5	SOT-89	287
BCX56	N	80	1500	1000	100	40 - 250*	150	2	≤0.5	SOT-89	287
BCX68	N	20	2000	1000	100	63 - 400*	500	1	≤0.5	SOT-89	291
BCX69	P	20	2000	1000	100	63 - 400*	500	1	≤0.5	SOT-89	295
BCX70	N	45	200	330	200	120 - 630*	2	5	≤0.25	SOT-23	253
BCX71	P	45	200	330	250	120 - 630*	2	5	≤0.25	SOT-23	260
SMBT4124	N	25	200	330	300	120 - 360	2	1	≤0.3	SOT-23	818
SMBT4126	P	25	200	330	250	120 - 360	2	1	≤0.4	SOT-23	821
SMBT5086	P	50	50	330	40	≥150	10	5	≤0.3	SOT-23	824
SMBT5087	P	50	50	330	40	≥250	10	5	≤0.3	SOT-23	824
SMBT6428	N	50	200	330	100	≥250	10	5	≤0.6	SOT-23	834
SMBT6429	N	45	200	330	100	≥500	10	5	≤0.6	SOT-23	834
SMBTA05	N	60	500	330	100	≥50	10	1.0	≤0.25	SOT-23	839
SMBTA06	N	80	500	330	100	≥50	10	1.0	≤0.25	SOT-23	839
SMBTA20	N	40	200	330	125	40 - 400	5	10	≤0.25	SOT-23	847
SMBTA55	P	60	500	330	50	≥50	10	1.0	≥0.25	SOT-23	855
SMBTA56	P	80	500	330	50	≥50	10	1.0	≤0.25	SOT-23	855

Darlington Transistors

Type (NPN = N, PNP = P)		Maximum Ratings				Characteristics (T_{amb} = 25°C)				Package	Page
		V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	h_{FE} at	I_C (mA)	V_{CE} (V)	$V_{CE(sat)}$ (V)		
BCP28	P	30	800	1500	200	≥20,000	100	5	≤1.0	SOT-223	213
BCP29	N	30	800	1500	150	≥20,000	100	5	≤1.0	SOT-223	217
BCP48	P	60	800	1500	200	≥10,000	100	5	≤1.0	SOT-223	213
BCP49	N	60	800	1500	150	≥10,000	100	5	≤1.0	SOT-223	217
BCV26	P	30	800	360	200	≥20,000	100	5	≤1.0	SOT-23	237
BCV27	N	30	800	360	170	≥20,000	100	5	≤1.0	SOT-23	241
BCV28	P	30	800	1000	200	≥20,000	100	5	≤1.0	SOT-89	245
BCV29	N	30	800	1000	150	≥20,000	100	5	≤1.0	SOT-89	249
BCV46	P	60	800	360	200	≥10,000	100	5	≤1.0	SOT-23	237
BCV47	N	60	800	360	170	≥10,000	100	5	≤1.0	SOT-23	241
BCV48	P	60	800	1000	200	≥10,000	100	5	≤1.0	SOT-89	245
BCV49	N	60	800	1000	150	≥10,000	100	5	≤1.0	SOT-89	249
BSP50	N	45	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	648
BSP51	N	60	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	648
BSP52	N	80	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	648
BSP60	P	45	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	653
BSP61	P	60	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	653
BSP62	P	80	2000	1500	200	≥2,000	500	10	≤1.8	SOT-223	653
PZTA13	N	30	500	1500	125	≥10,000	100	5	≤1.5	SOT-223	778
PZTA14	N	30	500	1500	125	≥20,000	100	5	≤1.5	SOT-223	778
PZTA63	P	30	500	1500	125	≥10,000	100	5	≤1.5	SOT-223	786
PZTA64	P	30	500	1500	125	≥20,000	100	5	≤1.5	SOT-223	786
SMBT6427	N	40	500	360	130	≥20,000	100	5	≤1.5	SOT-23	830
SMBTA13	N	30	500	330	125	≥10,000	100	5	≤1.5	SOT-23	843
SMBTA14	N	30	500	330	125	≥20,000	100	5	≤1.5	SOT-23	843
SMBTA63	P	30	500	330	125	≥10,000	100	5	≤1.5	SOT-23	859
SMBTA64	P	30	500	330	125	≥20,000	100	5	≤1.5	SOT-23	859

SIPMOS® small-signal transistors

Type (n channel = N, p channel = P)		Maximum Ratings			Characteristics (T_{amb} = 25°C)				Package	Page
		V_{DS} (V)	I_D (mA)	P_t (mW)	I_{DSS} at (µA)	V_{DS} (V)	$R_{DS(on)}$ (Ω)	$V_{GS(th)}$ (V)		
BSP88	N	240	260	1500	≤20.0	240	≤6.0	≤ 1.2	SOT-223	658
BSP89	N	240	340	1500	≤60	240	≤6.0	≤ 2.0	SOT-223	663
BSP92	P	240	180	1500	≤60	240	≤20.0	≤ 2.0	SOT-223	668
BSP125	N	600	110	1500	≤0.1	600	≤45.0	≤ 2.5	SOT-223	673
BSP129*	N	240	190	1500	≤0.1	240	≤20.0	≤-0.7	SOT-223	678
BSP135*	N	600	100	1500	≤0.1	600	≤60.0	≤-0.7	SOT-223	680
BSP149*	N	200	440	1500	≤0.2	240	≤3.5	≤-0.7	SOT-223	682
BSP295	N	50	1700	1500	≤1.0	50	≤0.3	≤ 2.0	SOT-223	684
BSP296	N	100	1000	1500	≤1.0	100	≤0.8	≤ 2.0	SOT-223	689
BSP297	N	200	600	1500	≤1.0	200	≤2.0	≤ 2.0	SOT-223	694
BSP315	P	50	1000	1500	≤1.0	50	≤0.95	≤ 2.0	SOT-223	699
BSS84	P	50	130	360	≤15	50	≤10.0	≤ 2.0	SOT-23	712
BSS87	N	240	290	1000	≤60	240	≤6.0	≤ 2.0	SOT-89	716
BSS119	N	100	170	360	≤0.5	100	≤6.0	≤ 2.6	SOT-23	724
BSS123	N	100	170	360	≤1.0	100	≤6.0	≤ 2.0	SOT-23	730
BSS131	N	240	100	360	≤15	240	≤16	≤ 2.0	SOT-23	736
BSS138	N	50	200	360	0.5	50	≤3.5	≤ 1.6	SOT-23	742
BSS139*	N	250	40	360	≤0.1	250	≤100	≤-0.7	SOT-23	748
BSS192	P	240	150	1000	≤60	240	≤20	≤ 2.0	SOT-89	752
SN7002	N	60	190	360	≤1.0	60	≤5.0	≤ 2.0	SOT-23	871
SP0610T	P	60	130	360	≤1.0	60	≤10	≤ 2.0	SOT-23	877

*Depletion mode

RF transistors

Type (NPN = N, PNP = P)		Maximum Ratings V_{CEO} (V)	I_C (mA)	P_t (mW)	f_T (MHz)	Characteristics (T_{amb} = 25°C) I_{CBO} (nA)	h_{FE} at	I_C (mA)	V_{CE} (V)	Package	Page
BF517	N	15	25	280	2000	≤50	≥25	5	10	SOT-23	299
BF550	P	40	150	330	350	≤50	≥50	1	10	SOT-23	307
BF554	N	20	30	280	250	≤100	≥60	1	10	SOT-23	312
BF569	P	35	30	280	925	≤100	≥20	3	10	SOT-23	316
BF579	P	20	30	280	1600	≤100	≥20	10	10	SOT-23	319
BF599	N	25	25	280	550	≤100	≥38	7	10	SOT-23	322
BF660	P	30	25	280	700	≤50	≥30	3	10	SOT-23	334
BF770A	N	15	50	280	4500	≤50	≥30	25	8	SOT-23	345
BF771	N	12	80	300	7000	≤50	100	30	8	SOT-23	348
BF772	N	12	80	300	7000	≤50	100	30	8	SOT-143	352
BF775	N	12	30	280	3500	≤50	≥25	5	6	SOT-23	356
BF799	N	20	50	280	1100	≤100	≥40	20	10	SOT-23	359
BFP81	N	16	30	300	5800	≤100	≥50	15	10	SOT-143	458
BFP93A	N	12	50	250	5500	≤50	≥40	30	5	SOT-143	479
BFP193	N	12	80	300	7000	≤50	100	30	8	SOT-89	495
BFQ17P	N	25	300	1000	1200	≤100	≥25	150	5	SOT-89	512
BFQ19P	N	15	150	1000	5100	≤100	≥25	50	10	SOT-89	516
BFQ19S	N	15	150	1000	5100	≤100	≥25	50	10	SOT-89	520
BFQ29P	N	15	30	280	5000	≤50	≥50	10	6	SOT-23	526
BFQ64	N	20	250	1000	3000	≤200	≥25	120	5	SOT-80	536
BFQ81	N	16	30	280	5800	≤100	≥50	15	10	SOT-23	540
BFR35AP	P	12	30	280	4900	≤50	≥40	5-20	6	SOT-23	560
BFR92P	N	15	30	280	5000	≤50	≥40	14	10	SOT-23	577
BFR93A	N	12	50	250	5500	≤50	≥40	30	5	SOT-23	594
BFR93P	N	15	50	280	5000	≤50	≥30	25	5	SOT-23	602
BFR106	N	15	100	350	3700	≤100	≥25	30	6	SOT-23	611
BFR193	N	12	80	300	7000	≤50	100	30	8	SOT-23	614
BFS17P	N	15	50	280	2500	≤50	≥20	25	1	SOT-23	631
BFT92	P	15	35	200	5000	≤50	≥20	14	10	SOT-23	640
BFT93	P	12	50	200	5000	≤50	≥20	30	5	SOT-23	644

PIN diodes

Type	Maximum Ratings		Characteristics (T_{amb} = 25°C)					Package	Page
	V_R (V)	I_F (mA)	C_D (pF)	V_F (V)	R_t (Ω)	I_R at (nA)	V_R (V)		
BA582	35	100	≤1.1	≤1.0	≤0.5	20	20	SOD-123	41
BA585	50	50	≤0.6	≤1.1	≤7.0	50	30	SOD-123	43
BA885	50	50	≤0.6	≤1.1	≤7.0	50	30	SOT-23	45
BAR 14-1	100	100	≤0.5	≤1.0	9	100	50	SOT-23	55
BAR 15-1	100	100	≤0.5	≤1.0	9	100	50	SOT-23	55
BAR 16-1	100	100	≤0.5	≤1.0	9	100	50	SOT-23	55
BAR 17	100	100	≤0.55	≤1.0	9	100	50	SOT-23	58
BAR 60	100	100	0.2-0.3	≤1.1	9	100	50	SOT-143	61
BAR 61	100	100	0.2-0.3	≤1.1	9	100	50	SOT-143	61

Tuning diodes

Type	Maximum Ratings		Characteristics (T_{amb} = 25°C)				Package	Page
	V_{RM} (V)	I_F (mA)	C_D at (pF)	V_R (V)	C_D at (pF)	V_R (V)		
BB419	30	20	26-32	3	4.3-6	25	SOD-123	143
BB512	12	50	440-520	1	16.5-29	8.5	SOD-123	145
BB515	30	20	17.7	1	1.8-2.4	28	SOD-123	147
BB619	30	20	37.5-39	1	2.5-3.2	28	SOD-123	149
BB620	30	20	69	1	3.15	28	SOD-123	151
BB804	20	50	42-47.5	2	25	8	SOT-23	153
BB811	30	20	9.8	1	1	28	SOD-123	156
BB814	20	50	45	2	20	8	SOT-23	158

GaAs FETs

Type	Max. ratings				Characteristics at $T_A = 25°C$				Package	Page
	V_{DS} V	$-V_{G1S}$ V	$-V_{G2S}$ V	ID mA	I_{DSS} mA	F dB	G_{ps} dB	at f GHz		
CF 739	10	6	6	80	10	1.8	17	1.75	SOT-143	917

GaAs FETs

Type	Max. ratings			Characteristics at $T_A = 25°C$				Package	Page
	V_{DS} V	$-V_{GS}$ V	ID mA	g_m mS	F dB	G_a dB	at f GHz		
CFY 30	5	−4...+0.5	80	30	1.4	11.5	4	SOT-143	923

GaAs MMICs

Type	Characteristics at $T_A = 25°C$						Package	Page
	V_{DS} V	I_D mA	f MHz	G dB	F dB	IP_3 dBm		
CGY 50	5.5...7.5	60	200...1800	8.5	3.0	31	SOT-143	935

Temperature sensors

Type	R_{25} (typ) Ω	$R_{25\text{-Tol.}}$ I_N = 1 mA %	I t = 10 ms mA	τ Air s	Oil s	T_A °C	Package	Page
KTY 13 A	2000	±1	7	7	1	−50...+150	SOT-23	949
KTY 13 B	2000	±2	7	7	1	−50...+150	SOT-23	949
KTY 13 C	2000	±5	7	7	1	−50...+150	SOT-23	949
KTY 13 D	2000	±10	7	7	1	−50...+150	SOT-23	949

Position sensor

Type	V_{20} mV	V_{R0} mV	I_{1N} mA	R_{10} Ω	Package	Page
KSY 13	95...145	≤±30	5	900...1200	SOT-143	947

Type designation in accordance with Pro Electron

This type designation applies to small-signal semiconductor components – in contrast to integrated circuits – multiples of these components and semiconductor chips.

The number of the basic type consists of:
Two letters and a three-digit code

First letter

gives information about the material.

A. Germanium or other material with a band gap of 0.6 ··· 1.0 eV
B. Silicon or other material with a band gap of 1.0 ··· 1.3 eV
C. Gallium-arsenide or other material with a band gap of 1.3 eV
R. Compound material (e.g. cadmium-sulfide)

Second letter

indicates the function for which the device is primarily designed.

A. Diode: signal, low power
B. Diode: variable capacitance
C. Transistor: low power, audio frequency
D. Transistor: power, audio frequency
E. Diode: tunnel
F. Transistor: low power, high frequency
G. Multiple of dissimilar devices; miscellaneous devices (e.g. oscillator)
H. Diode: magnetic sensitive
L. Transistor: power, high frequency
N. Optocoupler
P. Radiation-sensitive semiconductor component
Q. Radiation-emitting semiconductor component
R. Control or switching device: low power (e.g. thyristor)
S. Transistor: low power, switching
T. Control or switching device: power (e.g. thyristor)
U. Transistor: power switching
X. Diode: multiplier, e.g. varactor, step recovery
Y. Diode: rectifier, booster
Z. Diode: voltage reference or regulator; transient voltage suppressor diode

The three-digit code of the type designation consists of:
- a three-digit number, running from 100 to 999, for devices primarily intended for consumer equipment etc.
- one letter and a two-digit number for devices primarily intended for industrial/professional equipment. This letter has no fixed meaning.

Terms and symbols (DIN 41785)

The notation of currents, voltages, powers (alternate, continuous and mean values) and types of resistance (alternate or continuous) is represented by small or capital lettering of the symbols.

Symbols

Letter symbols for currents, voltages and powers

Small letters are used for the representation of instantaneous values which vary with time.

Examples: i, v, p

Capital letters are used for the representation of continuous (dc), average (mean), root-mean-square and periodic peak (maximum) values, i.e. time-constant values of current, voltage and power.

Examples: I, V, P

Subscripts

The following subscripts are used:

E, e	emitter
B, b	base
C, c	collector
F, f	forward direction (diode in forward direction)
R, r	reverse direction (diode in reverse direction)
M, m	peak (maximum) value
av	average (mean) value

Subscripts representing peak or mean values can be omitted if there is no possibility of confusion.
Subscripts with capital letters are used for total values counted from zero, e.g. for instantaneous, continuous (dc), mean (average), root-mean-square and peak (maximum) values.

Examples: i_{C}, I_{C}, v_{BE}, V_{BE}, p_{C}, P_{C}

Subscripts with small letters are used for values of varying components, e.g. instantaneous values, peak (maximum) and root-mean-square values counted from the mean value.

Examples: i_{c}, I_{c}, v_{be}, V_{be}, p_{c}, P_{c}

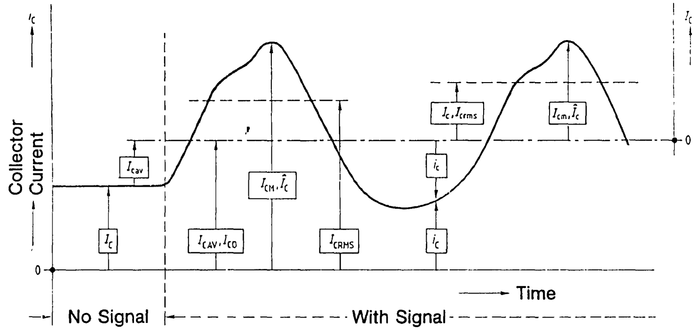
In order to distinguish peak, mean and root-mean-square values, further subscripts can be added. The recommended abbreviations are:

Peak values	M, m
Mean values (average values)	Av, av

Examples: I_{CM}, I_{CAV}, I_{cm}, I_{cav}

Sign " ^ " can also be used over the symbol for peak values:

Examples: $\hat{I}_{\mathrm{C}}$, $\hat{I}_{\mathrm{c}}$



I_C	DC value, no signal
I_{CAV}	(Arithmetic) mean value of total current (referred to zero)
I_{CM}, $\hat{I}_C$	Peak value of total current (referred to zero)
I_{CRMS}	Root-mean-square value of total current (referred to zero)
I_{cav}	(Arithmetic) mean of the varying component which is superimposed on the closed-circuit direct current I_C (referred to the DC no-signal value I_C)
I_C, I_{cms}	Root-mean-square value of the varying component (referred to the mean value I_{CAV})
I_{cm}, $\hat{I}_c$	Peak value of the varying component (referred to the arithmetic mean I_{CAV})
i_C	Instantaneous total value (referred to zero)
i_c	Instantaneous value of the varying component (referred to the arithmetic mean I_{CAV})

The following equations correspond to the given values in the above diagram:

$$I_{CAV} = I_C + I_{cav}$$
$$\hat{I}_{CM} = I_C = I_{CAV} + I_{cm}$$
$$I_{CRMS} = \sqrt{I^2{}_{CAV} + I^2{}_{crms}}$$
$$I_C = I_{CAV} + i_c$$

Standards

For detailed information please refer to the following DIN literature:

DIN 41782: Diodes
DIN 41785: Maximum Ratings
DIN 41791: General Instructions
DIN 41852: Semiconductor Technology
DIN 41853: Terms Relating to Diodes
DIN 41854: Terms Relating to Bipolar Transistors

Maximum ratings

The maximum ratings specified are absolute ratings which, if exceeded, may result in the destruction or permanent functional impairment of the component. When testing the component, as for example in respect to breakdown voltages, or during application, protection is to be provided in order to reliably ensure that maximum ratings are not exceeded.

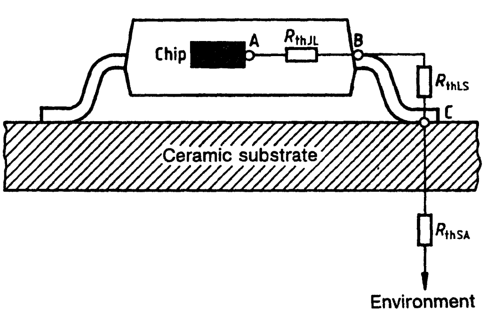
Characteristics

Typical characteristics describe the component behavior at defined operating conditions. The numerical values and diagrams pertain to the component type and shall not be considered as characteristics of an individual component. The minimum and maximum ratings stated for reasons of essential quality and application requirements describe the actual spread of the characteristics, whereas spread curves in diagrams usually specify the spread range which is to be expected. Electrical values are grouped into "static" DC values and "dynamic" AC values. The thermal resistance is closely related to the maximum ratings and, constituting the upper spread value, comes immediately after the maximum ratings. The component's case data is defined by reference to standard sheets and dimensional drawings.

Thermal resistance

The heat dissipation of SMDs depends on material and thickness of the PC board and of the conductor paths (inherent heating), as well as on the packing density (external heating). Hence, inherent and external heating determine the junction temperature, and thus the permissible thermal stress of SMDs.
The values for thermal resistance given in the data sheets should only be used for rough estimations of the junction temperature T_j, since they were measured under certain laboratory conditions, where no regard was paid to specific applications.
The thermal resistance can be calculated by:

$$R_{thJA} = R_{thJL} + R_{thLS} + R_{thSA}$$



R_{thJL} = Thermal resistance between junction and terminals of the component

R_{thLS} = Thermal resistance between terminals and solder pads of the substrate

R_{thSA} = Thermal resistance between substrate and environment, e.g. air or cooling area

The **internal thermal resistance** R_{thJL} is determined by the design of the component and can therefore be exactly specified, whereas the **external thermal resistance,** being the sum of $R_{thLS} + R_{thSA}$, depends on the individual application.

Groups according to total power dissipation

SMDs are grouped according to their max. permissible power dissipation P_{tot} :

Group	Package: SOT 23, SOT 143
I	Diodes, RF transistors, MOSFET tetrodes, sensors
II	AF and switching transistors
III	Darlington and high-voltage transistors, SIPMOS small-signal transistors

Group	Package: SOT 89
I	RF and AF transistors, SIPMOS small-signal transistors

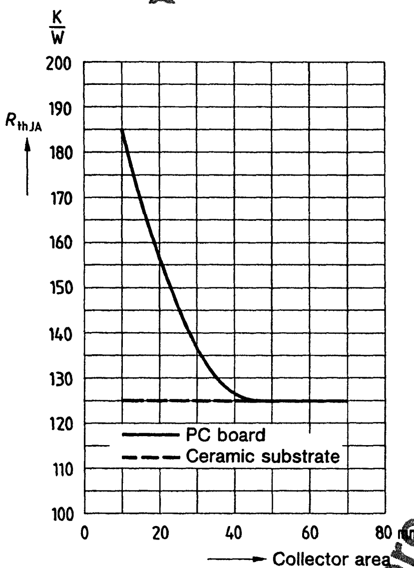
Group	Package: SOT 223
I	Diodes; AF, Darlington and high-voltage transistors; SIPMOS small-signal transistors

Package	Group	Thermal Resistance			
		R_{thJL}	R_{thLS}	R_{thSA}	R_{thJA} [1])
SOT 23 SOT 143	I	355 K/W	30 K/W	65 K/W	450 K/W
	II	280 K/W	30 K/W	65 K/W	375 K/W
	III	255 K/W	30 K/W	65 K/W	350 K/W
SOT 89	I	20 K/W	15 K/W	90 K/W	125 K/W
SOT 223	I	10 K/W		73.3 K/W	83.3 K/W

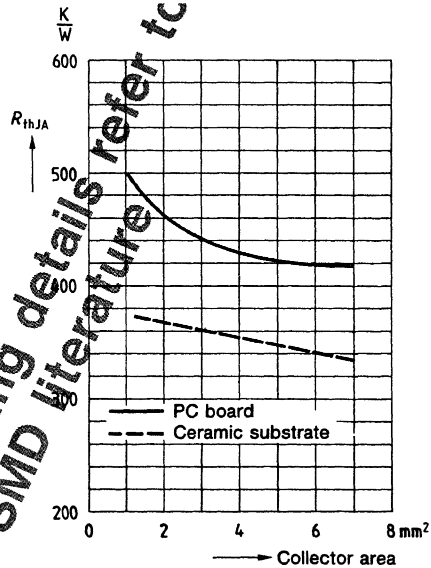
[1]) The data represents a typical value for the various component groups, which relates to a uniform alumina substrate, 15 mm x 16.7 mm x 0.7 mm in size.

In order to obtain a reduced thermal resistance, the PCB pad for the connection of the collector is enlarged. This is particularly effective when epoxy PCBs with low heat conductivity are used.

Package SOT 89



Package SOT 23, SOT 143



Generally, these specifications suffice to determine the junction temperature T_j.
The determination of the junction temperature via the temperature dependence of the diode path is more exact, however, it is extremely complicated.
If it becomes nevertheless necessary to exactly determine the junction temperature T_j, the temperature T_L of the component connections has to be measured. Then T_j can be calculated by:

$$T_j = T_L + R_{thJL} \times P_{tot}$$

Methods for measuring the temperature at component connections

- **Measuring with thermocouple element** (e.g. Thermocoax)
  For this method a miniature coated thermocouple element with low thermal capacitance is used. The element, which is coated with a heat-conducting paste, is pressed against the connection with the collector. There is hardly any influence on the device under measurement and deviations do not exceed a few percent.
- **Measuring with temperature indicators** (e.g. thermopaper)
  Temperature indicators do not cause heat dissipation and thus allow an almost exact determination of temperature. A certain degree of deviations can only result from the rough grade indication of the temperature indicators. This method is quite easy and provides sufficient accuracy. It is particularly suitable for measurement on PC boards.

AQL values and definitions of defectives

Explanations

AQL (acceptable quality level) agreements specify the sampling conditions for the incoming inspection of consignments (conformance test). AQL values in conjunction with the standard sampling inspection plans determine the acceptance or rejection of delivery lots. The size and maximum permissible number of defects of the samples is based on DIN 40080 (identical with MIL Standard 105D and IEC 410), single sampling plan for normal inspection, inspection level II. The sampling instructions of this standard are such that a delivery lot will most probably be accepted (>90%) if the defect percentage is equal or less than the specified AQL value. Generally, the average defect percentage of the products we deliver is far below the AQL value.

Definitions of defectives

A component is considered defective if it does not comply with the characteristics specified in the data sheet or in an agreed upon delivery specification. Defectives can be divided into inoperatives, which generally exclude a functional application of the component, and defectives of less significance.

Inoperatives are:

- open or short circuit,
- broken component, package, terminals or encapsulation,
- missing or incorrect marking,
- incorrect identification of terminals,
- intermixing with other component types,
- alternating orientation in a packaging tube or tape.

The remaining defectives can be divided into:

- electrical defectives
  (maximum ratings exceeded),
- mechanical defectives, e.g. dimensions not adhered to, package damaged, illegible marking, bent leads.

Grouping into major defects and minor defects according to DIN 40080 has been purposely avoided here because these terms are defined primarily on the basis of applications and not specifications. In contrast to this the defective classes that we use – for which AQL values are given below – are clearly outlined by the specification and the mentioned inoperatives.

AQL values

The AQL values valid for the different product families are comprised in the following table:

Type of defectives	AQL values
Inoperatives (mechanical and electrical)	0.1
Σ static defectives (dc)	0.4
Σ dynamic defectives (ac)	1.5
Σ mechanical defectives (package and connections)	0.4

for switching times and noise measurements an AQL of 1.5 applies.

Incoming inspection

If the user wants to carry out an incoming inspection, the use of a sampling inspection plan is recommended. The test method that is applied must be agreed upon between the user and the supplier.
The following information is necessary for judging any claims that may arise: test circuit, sample size, number of defective items found, sample of evidence, packing list.

Sampling plan for normal inspection

in accordance with DIN 40080 or ABC-Std 105D, inspection level II

Lot size	Sample size	AQL value										
		0,065	0,10	0,15	0,25	0,40	0,65	1,0	1,5	2,5	4,0	6,5
		A R	A R	A R	A R	A R	A R	A R	A R	A R	A R	A R
2 to 8	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1
9 to 15	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑
16 to 25	5	↓	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓
26 to 50	8	↓	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2
51 to 90	13	↓	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3
91 to 150	20	↓	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4
151 to 280	32	↓	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6
281 to 500	50	↓	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8
501 to 1200	80	↓	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11
1201 to 3200	125	↓	0 1	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15
3201 to 10000	200	0 1	↑	↑	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22
10001 to 35000	315	↑	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑
35001 to 150000	500	↓	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑
150001 to 500000	800	1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑
500001 and more	1250	2 3	3 4	5 6	7 8	10 11	14 15	21 22	↑	↑	↑	↑

A = Acceptance number, i.e. maximum number of defectives in a sample up to which a lot is accepted.
R = Rejection number, i.e. the number of defectives which must be found in a sample as a minimum for rejection of the lot.

Other conditions

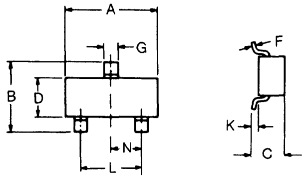
As the combination "Acceptance 0/Rejection 1" is not particularly clear, the next largest sample should be taken.

Additional information

Stating AQL values is no assurance of characteristics in a legal sense. The agreement of sampling inspections and AQL values does not prevent the customer from carrying out more extensive tests in incoming inspection and claiming replacements for individual defective components under the terms of sale. Any further liability, especially as regards the consequences of component defects, cannot be recognized.

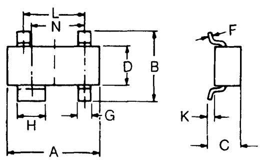
Note

Siemens has made preparations for and is interested in making agreements on ppm values with large-scale customers.



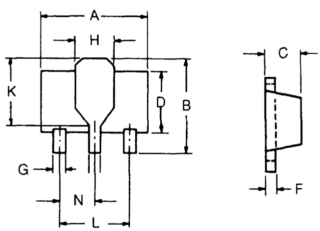
SOT 23

DIM.	SOT 23 (TO 236) MILLIMETERS MIN.	MAX.	INCHES MIN.	MAX.
A	2.80	3.0	0.110	0.118
B	2.30	2.60	0.091	0.102
C	1.0	1.10	0.039	0.043
D	1.20	1.40	0.047	0.055
F	0.09	0.15	0.0035	0.0059
G	0.38	0.48	0.015	0.019
H	—	—	—	—
K	0	0.10	0	0.0039
L	1.84	1.96	0.072	0.077
N	0.92	0.98	0.036	0.039



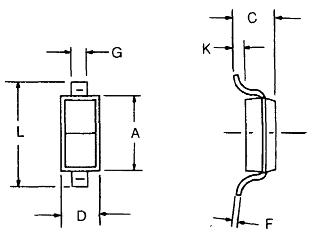
SOT 143

DIM.	SOT 143 (TO 253) MILLIMETERS MIN.	MAX.	INCHES MIN.	MAX.
A	2.80	3.0	0.110	0.118
B	2.30	2.60	0.091	0.102
C	1.0	1.10	0.039	0.043
D	1.20	1.40	0.047	0.055
F	0.09	0.15	0.0035	0.0059
G	0.38	0.48	0.015	0.019
H	0.78	0.88	0.031	0.035
K	0	0.10	0	0.0039
L	1.84	1.96	0.072	0.077
N	1.60	1.80	0.063	0.071



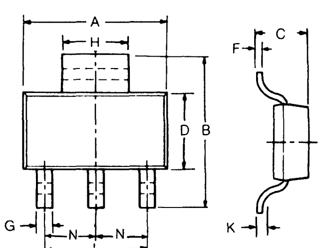
SOT 89

DIM.	SOT 89 (TO 243) MILLIMETERS MIN.	MAX.	INCHES MIN.	MAX.
A	4.40	4.60	0.173	0.181
B	—	4.25	—	0.167
C	1.40	1.60	0.55	0.63
D	—	2.60	—	0.102
F	0.25	0.39	0.0098	0.015
G	0.40	0.65	0.016	0.026
H	1.50	1.70	0.059	0.067
K	2.60	2.85	0.91	0.112
L	2.90	3.10	0.114	0.122
N	1.40	1.60	0.55	0.63



SOD 123

DIM.	SOD 123 MILLIMETERS MIN.	MAX.	INCHES MIN.	MAX.
A	2.55	2.85	0.100	0.112
B	—	—	—	—
C	0.95	1.35	0.037	0.053
D	1.40	1.70	0.055	0.067
F	—	0.15	—	0.0059
G	0.45	0.65	0.0177	0.0256
H	0.25	—	0.0098	—
K	0	0.10	0	0.0039
L	3.55	3.85	0.140	0.152
N	—	—	—	—



SOT 223

DIM.	SOT 223 MILLIMETERS MIN.	MAX.	INCHES MIN.	MAX.
A	6.30	6.70	0.248	0.264
B	6.80	7.20	0.268	0.283
C	1.50	1.70	0.059	0.067
D	3.30	3.70	0.130	0.146
F	—	0.32	—	0.013
G	0.60	0.80	0.024	0.032
H	2.90	3.10	0.114	0.122
K	0	0.10	0	0.0039
L	4.60 Typ		0.182 Typ.	
N	2.30 Typ.		0.091 Typ.	

Supply for automatic assembly

In contrast to components with wire leads, practically all SMDs can be supplied in two package forms:

- Bulk
- Tape

Bulk

The most straightforward and low-cost mode of SMD delivery is in bulk, in either antistatic or plastic containers. Contrary to components with wire leads, SMDs can be supplied in this type of packaging for automatic assembly as no bending or interlocking of terminals can occur. At the placement machine the components are suitably positioned. If required, a large quantity of components can thus be supplied in line, i.e. without interrupting the placement procedure.

Bulk packaging units

Component	Unit	Packing
Diodes Transistors LEDs Sensors	1000 pieces	Plastic container
MOSFETs, SIPMOS	2000 pieces	Antistatic container

Tape (in acc. with IEC 286–3)

Tape packaging is a frequently used form of supplying surface mounted devices. The major benefit of the tape method is that it prevents confusion of different components and meets the requirements of most placement machines. Cardboard and blister tapes are available tape forms.

The blister tape has preformed compartments corresponding to the component size, which are covered with fixing tape. Blister tapes consist either of plastic material or of plastic-clad aluminum foil.

The tapes are internationally standardized in accordance with DIN IEC 286-3. This ensures that the tapes are accepted by all machines designed for this kind of assembly. The tape width is generally between 8 mm and 12 mm but additional tape widths are at present being manufactured.

8 mm tape

For packages SOT 23, SOT 143 and SOD 123

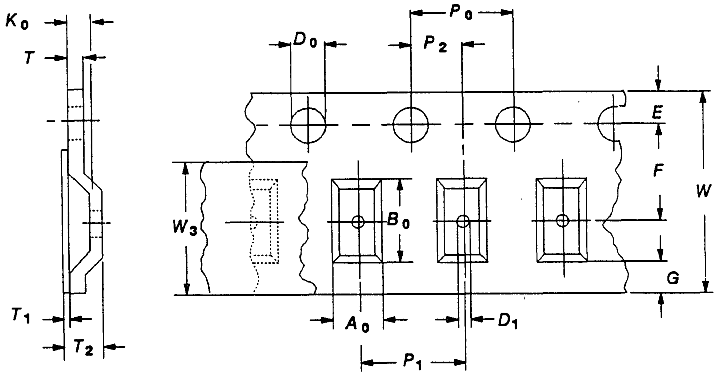
12 mm tape

For package SOT 89 and SOT 223

Tape packaging units

Size of reels	Packages SOT 23	SOT 143	SOT 89/SOT 223	SOD 123
18 cm	3000 pieces	3000 pieces	1000 pieces	3000 pieces
33 cm	10000 pieces	10000 pieces	2500 pieces	10000 pieces

Blister tape



Direction of unreeling →

SYMBOL	TAPE PACKAGE	
	8 mm SOT 23, SOT 143, SOD 123	12 mm SOT 89, SOT 223
A_0, B_0 [1] [3]), K_0 [1]),		
D_0	1.5 + 0.1	1.5 + 0.1
D_1	1 + 0.2	1.5 mm
E	1.75 ± 0.1	1.75 ± 0.1
F	3.5 ± 0.05	5.5 ± 0.05
G	0.75 mm [4])	0.75 mm
P_0	4 ± 0.1	4 ± 0.1
P_1	4	8
P_2	2 ± 0.05	2 ± 0.05
S		
T	*0.3 max*	*0.3 max*
T_1	*0.1 max*	*0.1 max*
T_2 [1]) [2])	*2.5 max*	*4.5 max*
W	*8 ± 0.3*	*12 ± 0.3*
W_3	*5.5*	*9.5*

[1]) The nominal dimension for component compartment shall be derived from the relevant component specification.

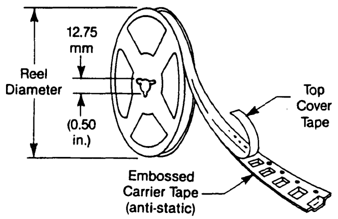
[2]) The actual dimension is given by the component height and the condition that the component cannot be turned.

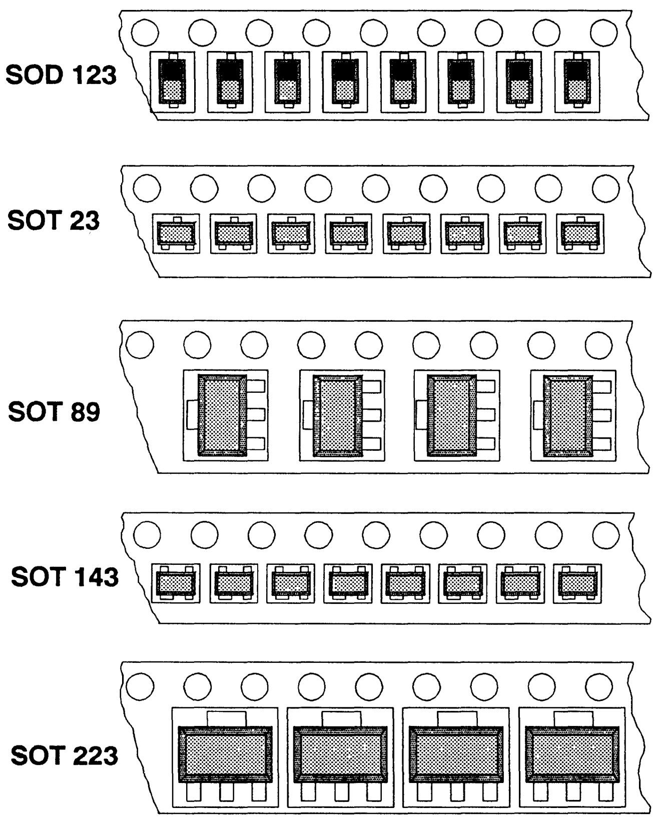
[3]) Component has to fall out of the carrier tape compartment when the still opened carrier tape is upside down. The maximum clearance is 0.5 mm or given by the maximal rotation angle allowed.

[4]) On long devices like SOD.123, G could be smaller than 0.75 mm.

Polarity and orientation of taped components

All polarized components are oriented in one direction. The mounting side is oriented to the bottom side of the component compartment. The bottom side is defined as the invisible side of the tape during unreeling.





Fixing of components

Components are prevented from falling out of the device compartment by a transparent fixing tape.

Storage of tapes

A storage temperature of 40 + 5 °C at a relative humidity of ≤ 95% is permissible up to a maximum of 240 h.

Break force of tape

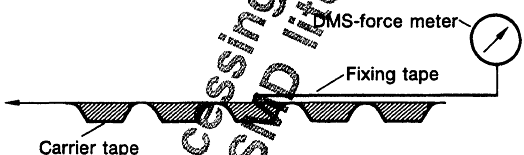
The minimum break force of the tape in the direction of unreeling ≥10 N.

Peel force of fixing tape

During peel-off the angle between the fixing tape and the direction of unreeling is 180°. The peel force of the fixing tape ranges from 0.2 N to 1.0 N.

Break force of fixing tape

The minimum break force of the fixing tape is 10 N.



Peel speed of fixing tape

The fixing tape can be peeled off at a rate of 5 mm/s to 20 mm/s.

Reel packaging

Component tapes are wound onto reels as shown in the illustration below and are then suitable for automatic assembly.

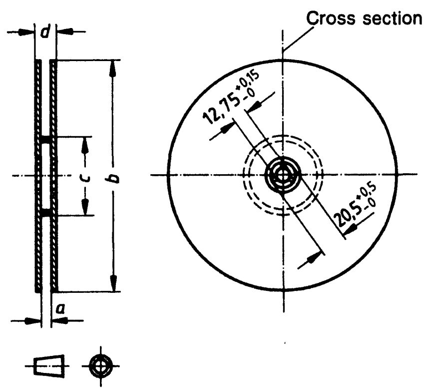
Currently available:

- Tape width = 8 mm (SOT 23, SOT 143, SOD 80) and 12 mm (SOT 89)
- Reel size = 18 cm and 33 cm.

The reels are delivered in a protective wrapping.

Reel dimensions

Dimension (mm)	SOT 23 SOT 143 SOD 123	SOT 89 SOT 223	SOT 23 SOT 143 SOD 123	SOT 89 SOT 223
a	8.4 + 1.5	12.4 + 1.5	8.4 + 1.5	12.4 + 1.5
b	180 max.	180 max.	330 max.	330 max.
c	60 min.	60 min.	100 min.	100 min.
d	14.4 max.	18.4 max.	14.4 max.	18.4 max.



Reel Labelling

Each reel is labelled with manufacturer, type, series number, and date.

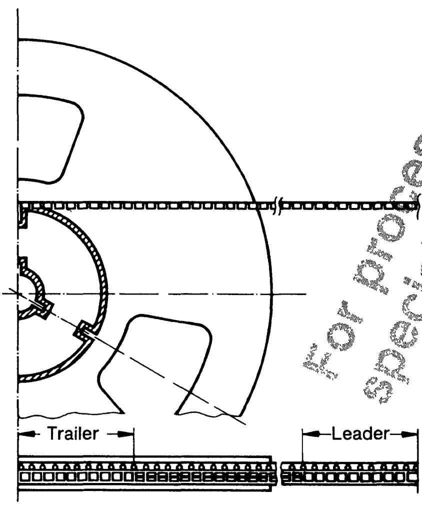
Missing components

A maximum of two consecutive components may be missing, provided that this gap is followed by six components. The number of empty places shall not exceed 0.25% of the total number of components per reel. Upon request, other agreements are possible.

Leader and trailer

Carrier tape with fixing tape, without components

Tape leader	Tape trailer
min. 400 mm (100 pitches)	min. 300 mm (75 pitches)



ESD

SMDs can also be supplied on tapes protected against electrostatic charges. During processing, the reel has therefore to be electrically connected with the placement machine, which must be grounded. This method of taping complies with IEC/T 640.

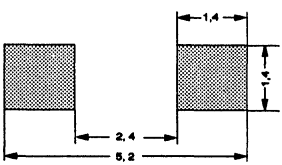
ESD ≙ **E**lectrostatically **S**ensitive **D**evices

PCB layout

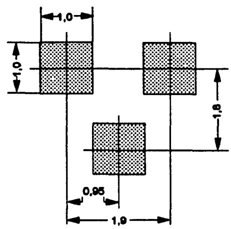
When using surface mounted devices, the PCB layout has to be accommodated to this new technology. This demand should be fulfilled not only to better utilize the packing density, but also to meet the requirements resulting from the new placement and processing system. Some factors influencing the PCB design are:

- Distance between conductor paths
- Component tolerances
- Distance between components
- Misalignment of component and conductor path

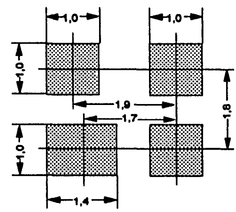
Recommended minimum solder pad dimensions (mm)



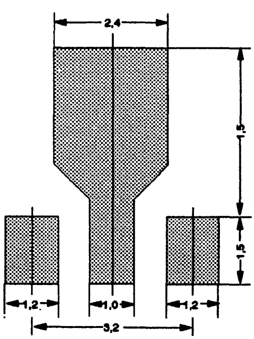
SOD 123



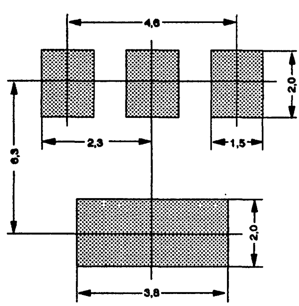
SOT 23



SOT 143



SOT 89



SOT 223

Glueing

Prior to soldering, SMDs must be fixed to the PCB by means of an adhesive. The adhesive has to fulfil the following conditions.

- Adequate adhesive strength
- Short curing time at a low temperature
- Uniform viscosity to ensure easy coating
- No chemical reactions upon curing in order not to impair component and PC board
- Straightforward exchange of components in case of repair
- As non-toxic, odorless and solvent-free as possible
- Good thermal conductivity

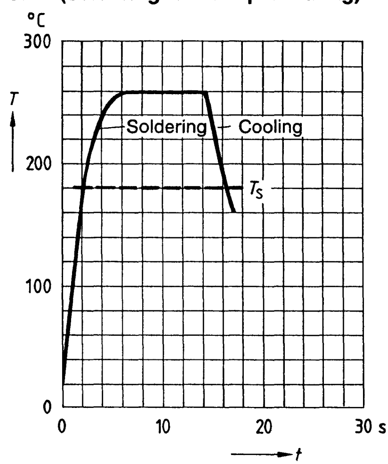
Connecting methods

The connecting method is particularly important for obtaining good electrical connections as well as for inhibiting short circuits. The choice of soldering method largely depends on the design of the PC boards (components on upper side / both sides, multilayer board), on the supplied components and on the production facilities.
In addition to manual soldering, which is only suitable for repairs, there are two automated soldering methods: flow soldering, which includes wave, drag and dip soldering, and reflow soldering.

Wave soldering

Wave soldering is the most widely used automated solder method in the manufacture of PCB assemblies.
With a maximum bath temperature of 260 °C the soldering time should not exceed 8 s. Prior to the wave the flux is applied by a fluxer.
Solder bridges and solder shadows may occur if the components are very densely packed on the wave soldering side. Therefore, with respect to soldering, the component arrangement has to be considered in the PCB layout.
Dual wave soldering equipment will in general be better suited to SMD methods. The first turbulent wave of solder ensures good wetting of all metallization areas, while the second more laminar wave removes the excess solder (solder accumulation and solder bridges).

Max. perm. temperature stress on the SMD (soldering without preheating)



T_S = Melting point of the solder

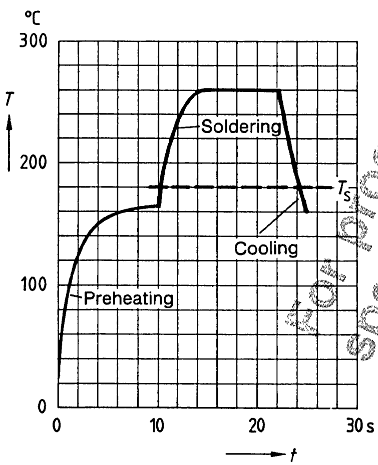
Reflow soldering

For reflow soldering a specific amount of solder, e.g. in the form of solder paste, is applied to the mounting pads. After the SMD has been placed the connection is established by one of the following methods:

- Vapor phase soldering
- Hot gas soldering
- Heated collet soldering
- Infrared soldering

The most recent reflow soldering method is vapor phase soldering, where the entire assembly is uniformly heated to a specific temperature. This form of soldering is a very gentle process, since it prevents overheating. At present, it is the best soldering method for densely positioned components of different thermal capacity.

Max. perm. temperature stress on the SMD
(soldering with preheating)



Iron soldering

Soldering with a temperature-controlled miniature iron should be used only in exceptional cases (e.g. repairs), since as well as being uneconomical there is the risk of damage to the components and to the PCB.

Soldering flux

- The soldering flux used for wave soldering is not subject to changes, i.e. use of collophony (F-SW 32 in acc. with DIN 8511).
- On the other hand, the majority of soldering pastes necessary for reflow soldering contains aggressive soldering flux, the residues of which must always be removed by cleaning.

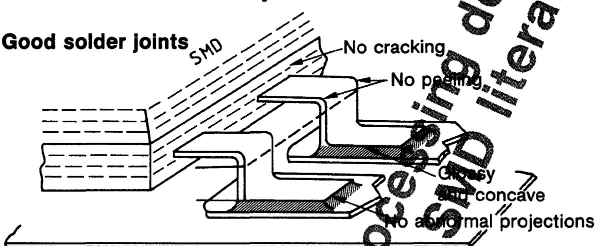
PCB cleaning

- Cleaning in solvents is permitted at approx. 70 °C to 80 °C for about 15 seconds. Detailed information is available upon request.
- Ultrasonic cleaning (double half-wave operation)
  Ultrasonic cleaning is less advisable; should it, however, be used, the following has to be taken into account:

Cleaning agent:	Isopropanol, Freon
Bath temperature:	approx. 30 °C
Duration of cleaning:	max. 30 s
Ultrasonic frequency:	40 kHz
Ultrasonic changing pressure:	approx. 0.5 bar

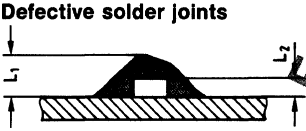
Evaluation of solder joints

Good solder joints

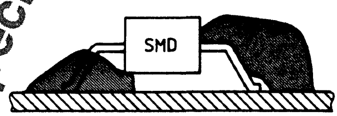


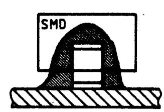
View of the concave tin area

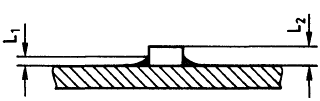
Defective solder joints



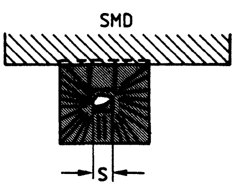
Height of tin surface $L_1 \geq 2 \times L_2$



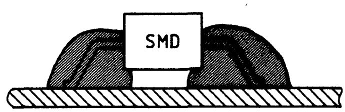




Height of tin surface $L_1 \leq 0.5\ L_2$

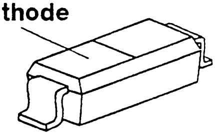


Unwetted pad area S > 5 %



Diodes

- Low-loss VHF band switch for TV/VTR tuners



Type	Marking	Ordering code (taped)	Package
BA 582	blue/S	Q62702-A829	SOD-123

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	35	V
Forward current, $T_A \leq 60$ °C	I_F	100	mA
Operation temperature range	T_{op}	-55... + 125	°C
Storage temperature range	T_{stg}	-55... + 150	°C

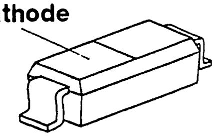
Thermal Resistance

Junction - ambient	$R_{thJAtyp.}$	600	K/W

Electrical Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Ratings			Unit
		min.	typ.	max.	
Forward voltage $I_F = 100$ mA	V_F	-	-	1	V
Reverse current $V_R = 20$ V	I_R	-	-	20	nA
Diode capacitance $f = 1$ MHz $V_R = 1$ V $V_R = 3$ V	C_T	 - 0.6	 0.92 0.85	 1.4 1.1	pF
Forward resistance $f = 100$ MHz $I_F = 3$ mA $I_F = 10$ mA	r_f	 - -	 0.55 0.36	 0.7 0.5	Ω
Reverse resistance $f = 100$ MHz $V_R = 1$ V	$1/g_p$	 -	 100	 -	kΩ
Series inductance	L_s	-	2.8	-	nH

- Current-controlled RF resistor for RF attenuators
- Frequency range 1 MHz...2 GHz



Type	Marking	Ordering code (taped)	Package
BA 585	white/R.	Q62702-A859	SOD-123

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operation temperature range	T_{op}	-55 ... +125	°C
Storage temperature range	T_{stg}	-55 ... +150	°C

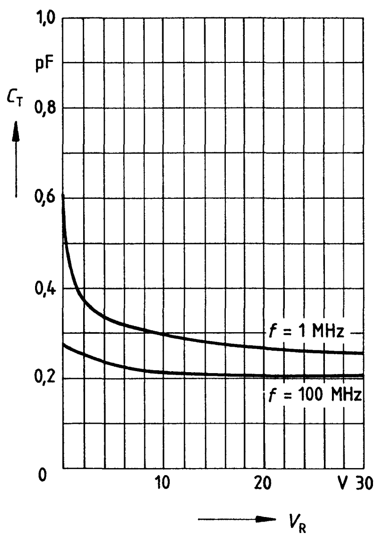
Thermal Resistance

Junction - ambient	R_{thJA}	≤450	K/W

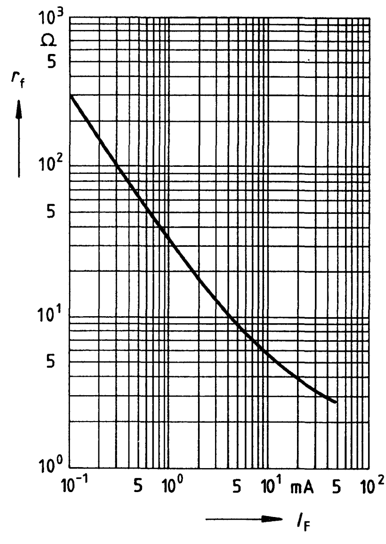
Electrical Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Ratings			Unit
		min.	typ.	max.	
Forward voltage $I_F = 50$ mA	V_F	-	-	1.1	V
Reverse current $V_R = 30$ V	I_R	-	-	50	nA
Diode capacitance $f = 1$ MHz, $V_R = 10$ V $f = 100$ MHz, $V_R = 0$ V	C_T	- -	0.28 0.23	0.6 0.4	pF
Forward resistance $f = 100$ MHz $I_F = 1.5$ mA $I_F = 10$ mA	r_f	- -	22 5	40 7	Ω
Zero bias conductance $f = 100$ MHz, $V_R = 0$ V	g_p	-	70	-	µS
Series inductance	L_s	-	2.8	-	nH

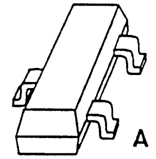
Diode capacitance $C_T = f\,(V_R)$
$f = 1$ MHz/$f = 100$ MHz



Forward resistance $r_f = f\,(I_F)$
$f = 100$ MHz



- Current-controlled RF resistor for RF attenuators
- Frequency range: 1 MHz...2 GHz
- Especially useful as antenna switch in TV-sat tuners



Type	BA 885	
Ordering code	bulk: Q62702-A742	taped: Q62702-A608
Marking	PA	

Maximum ratings

Reverse voltage	V_R	50	V
Forward current	I_F	50	mA
Operating temperature range	T_{op}	–55...+125	°C
Storage temperature range	T_{stg}	–55...+150	°C

Thermal resistance

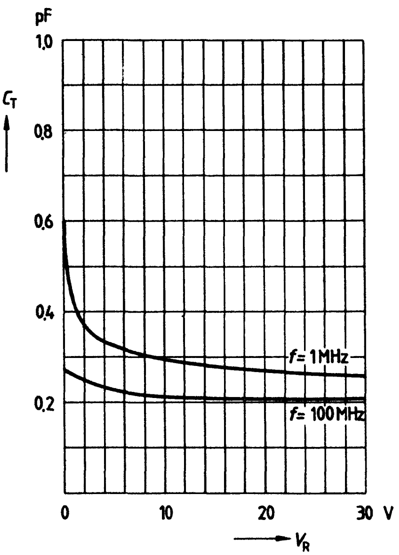
Junction – ambient	R_{thJA}	≤450	K/W[1]

[1] Package mounted on alumina 16.7 mm x 15 mm x 0.7 mm.

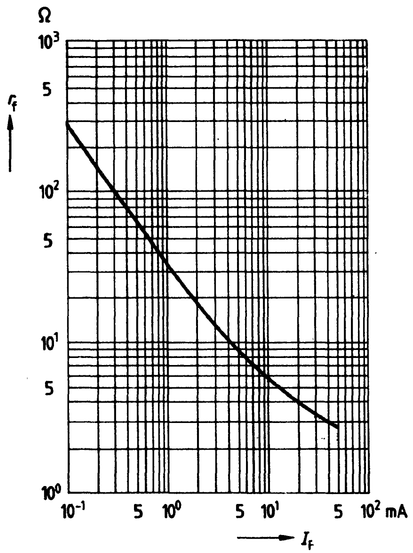
Characteristics ($T_A = 25\,°C$)

		min	typ	max	
Forward voltage $I_F = 50$ mA	V_F	–	–	1.1	V
Reverse current $V_R = 30$ V	I_R	–	–	50	nA
Diode capacitance	C_T				
$V_R = 10$ V, $f =$ 1 MHz			0.28	0.6	pF
0 V, 100 MHz			0.23	0.4	pF
Forward resistance, $f = 100$ MHz	r_f				
$I_F = 1.5$ mA		–	22	40	Ω
10 mA		–	5	7	Ω
Zero bias conductance $V_R = 0$, $f = 100$ MHz	g_p	–	70	–	μS
Series inductance	L_S	–	2	–	nH

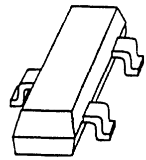
Diode capacitance $C_T = f(V_R)$
$f = 1$ MHz/100 MHz



Forward resistance $r_f = f(I_F)$
$f = 100$ MHz



- For high-speed switching



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
ⓢ BAL 74	JC	Q62702–A614	Q62702–A718	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	50	V
Peak reverse voltage	V_{RM}	50	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

ⓢ Preferred type

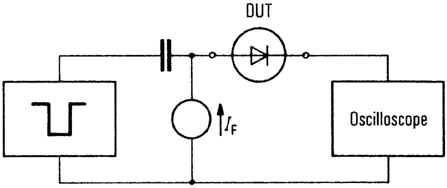
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	50	–	–	V
Forward voltage $I_F = 100$ mA	V_F	–	–	1	V
Reverse current	I_R				
$V_R = 50$ V		–	–	0,1	µA
$V_R = 50$ V, $T_A = 150\,°C$		–	–	100	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

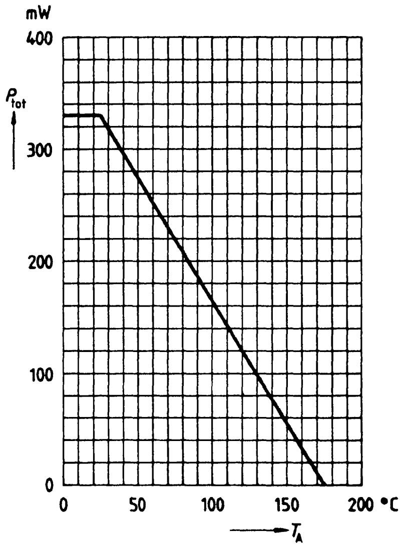
Test circuit for reverse recovery time



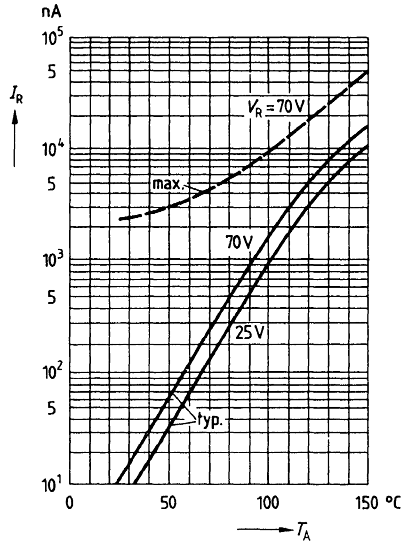
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

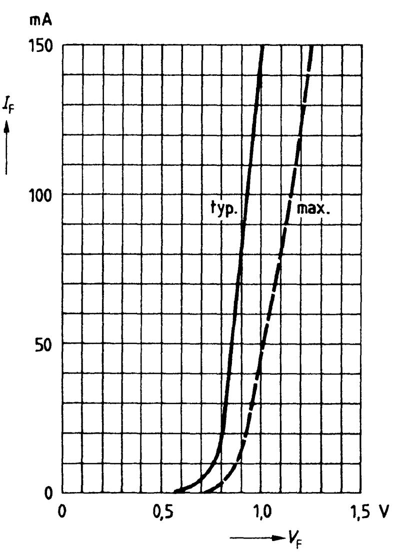
Total power dissipation $P_{tot} = f(T_A)$



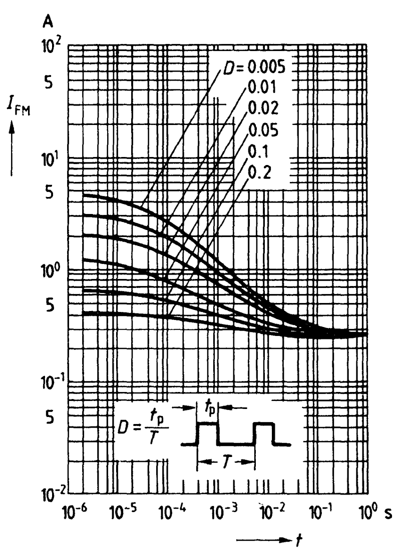
Reverse current $I_R = f(T_A)$



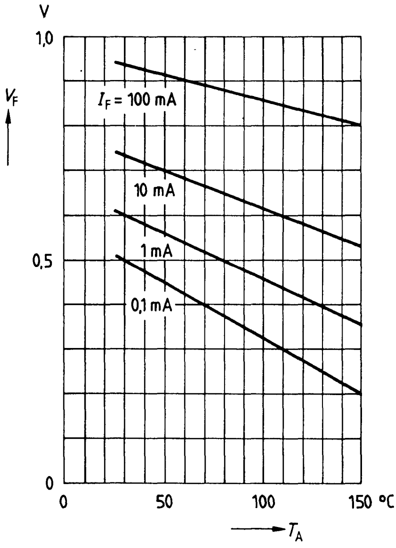
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$

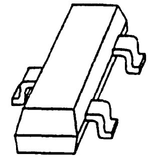


Forward voltage $V_F = f(T_A)$



Silicon Switching Diode

- For high-speed switching



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAL 99	JF	Q62702–A611	Q62702–A687	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \ldots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

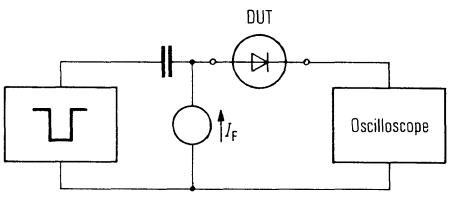
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1	V
$I_F = 150$ mA		–	–	1,25	V
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

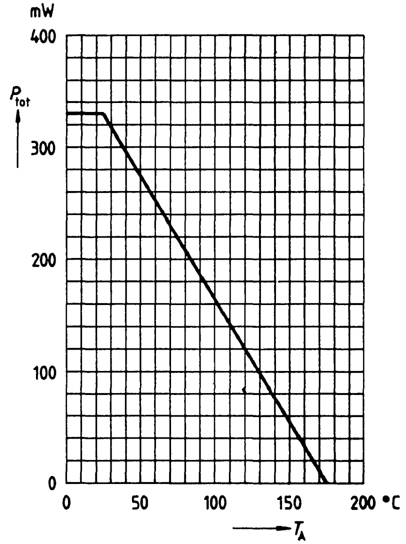
Test circuit for reverse recovery time



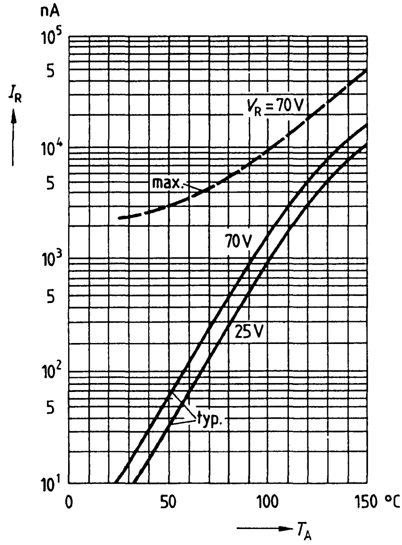
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

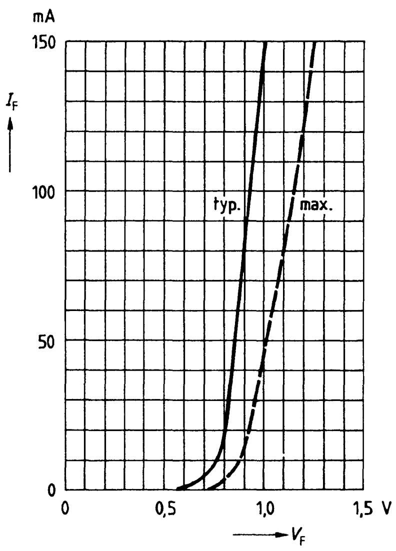
Total power dissipation $P_{tot} = f(T_A)$



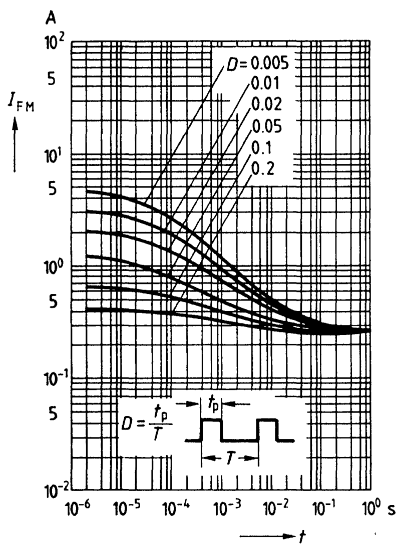
Reverse current $I_R = f(T_A)$



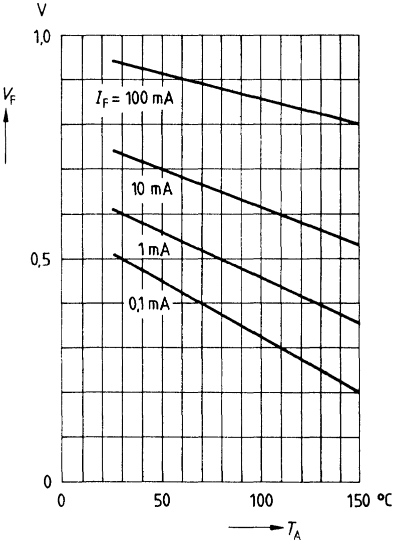
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



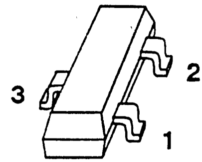
Forward voltage $V_F = f(T_A)$

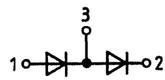
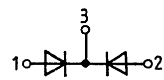
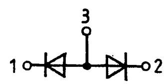


Silicon PIN Diodes

BAR 14-1 ... BAR 16-1

- RF switch, RF attenuator
- Low-distortion factor
- Long-term stability of electrical characteristics



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
BAR 14-1	L7	Q 62702 – A772		SOT-23
BAR 15-1	L8	Q 62702 – A731		
BAR 16-1	L9	Q 62702 – A773		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, $T_A = 25$ °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

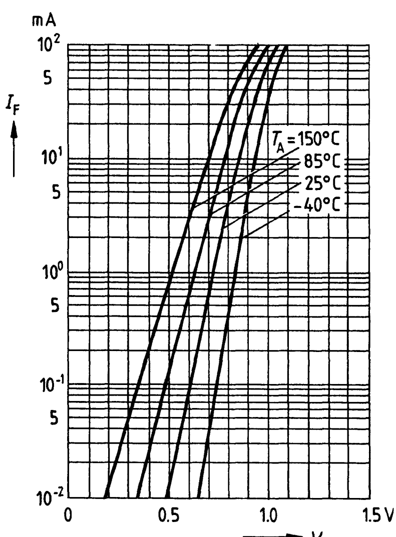
Junction – ambient[1]	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

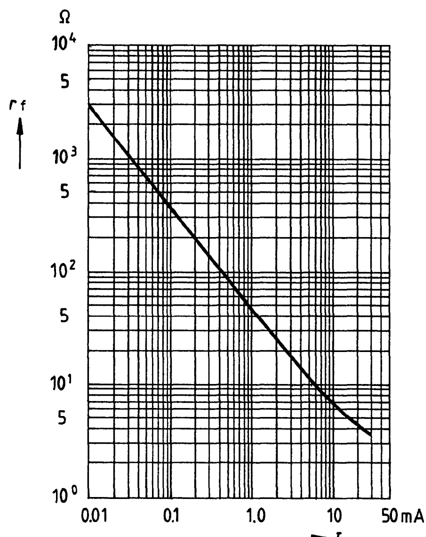
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min	typ	max	
Reverse current	I_R				
V_R = 50 V		–	–	100	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	1.05	1.25	V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.25	0.5	
V_R = 0, f = 100 MHz		–	0.2	–	
Forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	2800	–	
I_F = 0.10 mA		–	380	–	
I_F = 1 mA		–	45	–	
I_F = 10 mA		–	7	–	
Zero bias conductance V_R = 0, f = 100 MHz	g_p	–	50	–	µs
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	0.7	1	–	µs

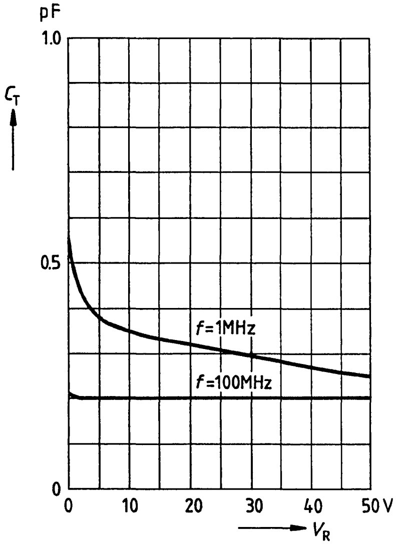
Forward current $I_F = f(V_F)$



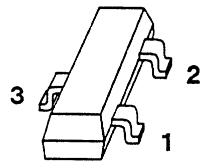
Forward resistance $r_f = f(I_F)$
f = 100 MHz



Diode capacitance C_T = f (V_R)



- Current-controlled RF resistor for RF attenuation
- Switching applications above 1 MHz



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
BAR 17	L6	Q 62702 – A785	1 ○—▷|—○ 3	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, T_A = 25 °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1]	R_{thJA}	≤450	K/W

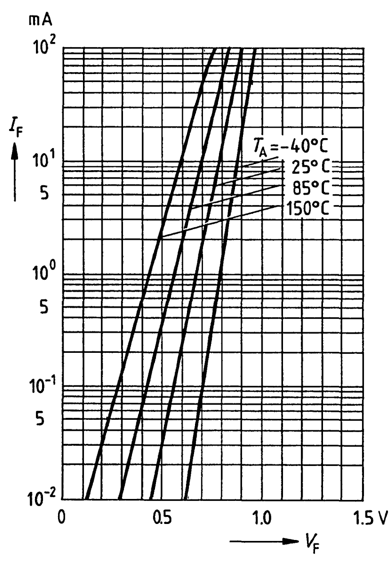
1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

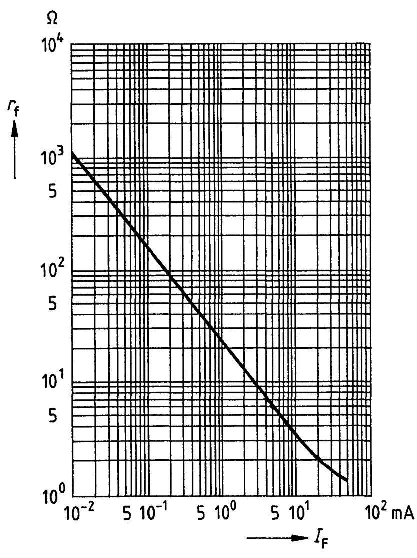
DC/AC Characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Reverse current	I_R				
V_R = 50 V		–	–	50	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	0.91	1	V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.32	0.55	
V_R = 0, f = 100 MHz		–	0.37	–	
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	4	–	µs
Forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	1150	–	
I_F = 0.1 mA		–	160	–	
I_F = 1.0 mA		–	23	–	
I_F = 10 mA		–	3.5	–	

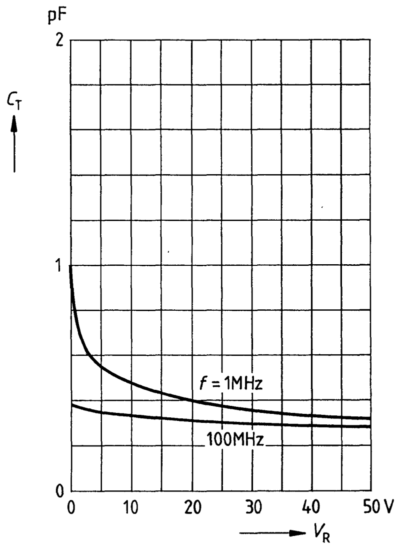
Forward current I_F = f (V_F)



Forward resistance r_f = f (I_F)
f = 100 MHz

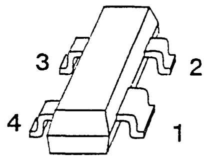


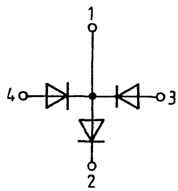
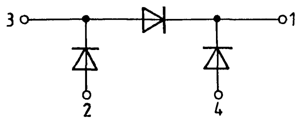
Diode capacitance C_T = f (V_R)



Silicon PIN Diodes

- For RF attenuation
- Switching applications for frequencies above 10 MHz



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
BAR 60	60	Q 62702 – A786		SOT-143
BAR 61	61	Q 62702 – A120		

Maximum Ratings per Diode

Parameter	Symbol	Values	Unit
Reverse voltage	V_R	100	V
Forward current	I_F	100	mA
Total power dissipation, T_A = 25 °C[2])	P_{tot}	140	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1]	R_{thJA}	≤450	K/W

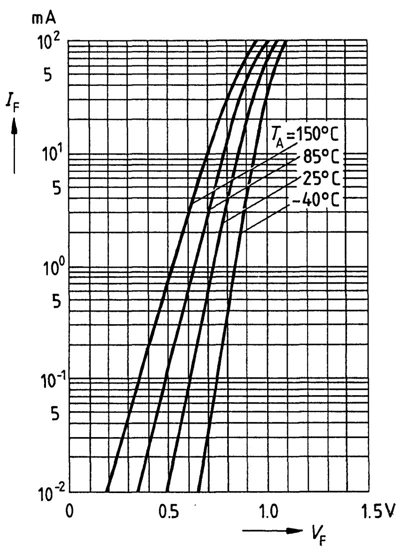
1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

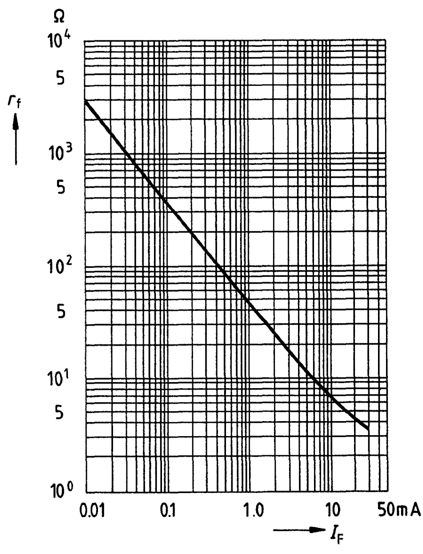
DC/AC Characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Reverse current	I_R				
V_R = 50 V		–	–	100	nA
V_R = 100 V		–	–	1	µA
Forward voltage I_F = 100 mA	V_F	–	–	1.25	V
Diode capacitance	C_T				pF
V_R = 50 V, f = 1 MHz		–	0.25	0.5	
V_R = 0, f = 100 MHz		–	0.2	–	
Differential forward resistance	r_f				Ω
f = 100 MHz, I_F = 0.01 mA		–	2800	–	
I_F = 0.1 mA		–	380	–	
I_F = 1.0 mA		–	45	–	
I_F = 10 mA		–	7	–	
Zero bias conductance V_R = 0, f = 100 MHz	g_p	–	50	–	µS
Charge carrier life time I_F = 10 mA, I_R = 6 mA	τ_L	–	1	–	µs

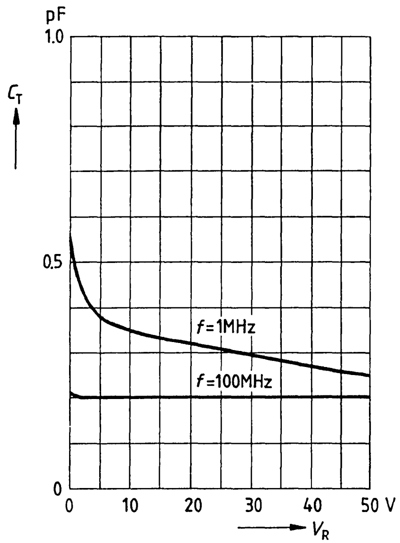
Forward current I_F = f (V_F)



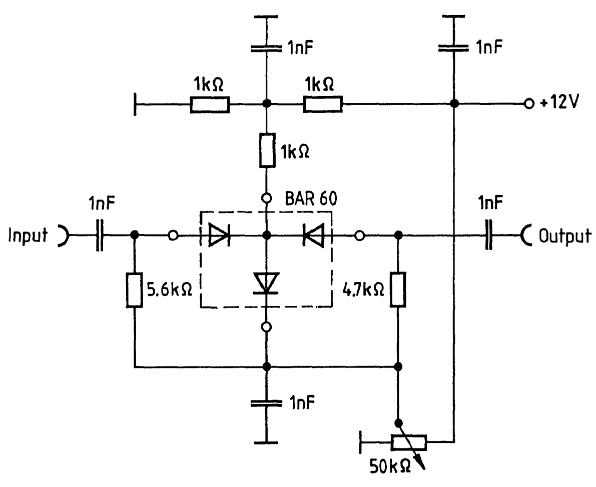
Forward resistance r_f = f (I_F)
f = 100 MHz



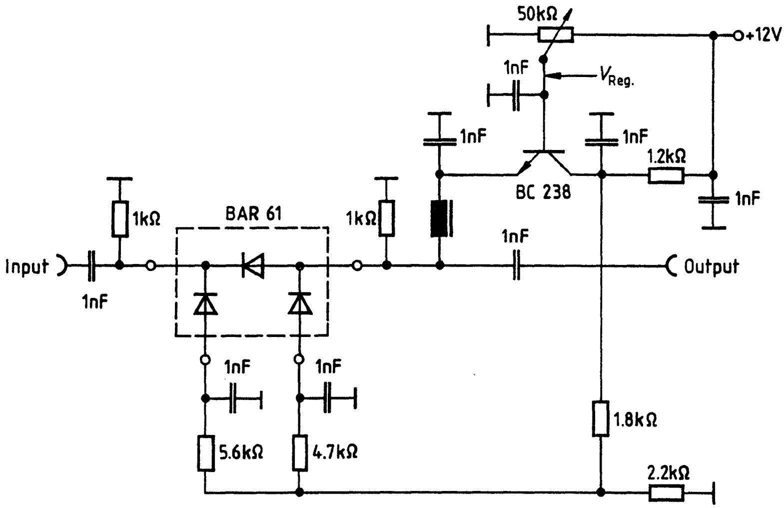
Diode capacitance C_T = f (V_R)



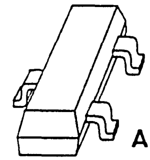
Circuit example for attenuation networks with diode BAR 60



Circuit example for attenuation networks with diode BAR 61



- For high-speed switching



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BAR 74	JB	Q62702–A615	Q62702–A704	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	50	V
Peak reverse voltage	V_{RM}	50	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4,5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

S Preferred type

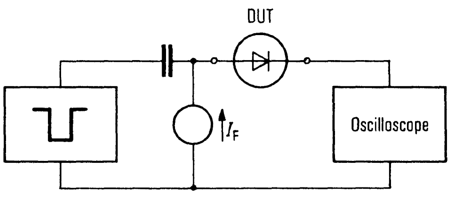
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	50	–	–	V
Forward voltage $I_F = 100$ mA	V_F	–	–	1	V
Reverse current $V_R = 50$ V $V_R = 50$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 0,1 100	 µA µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

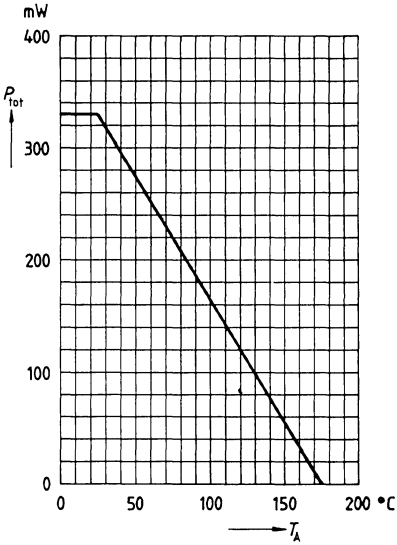
Test circuit for reverse recovery time



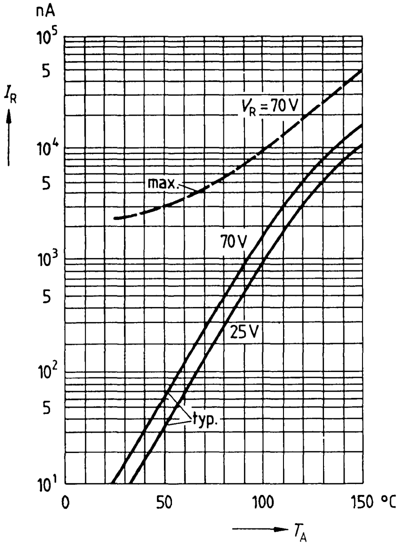
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

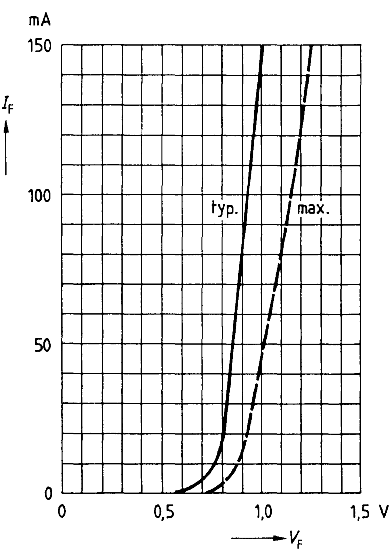
Total power dissipation $P_{tot} = f(T_A)$



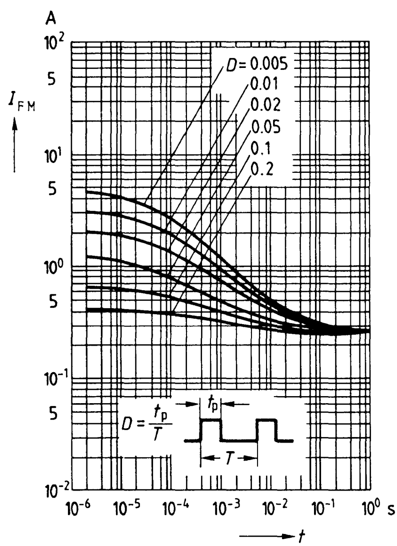
Reverse current $I_R = f(T_A)$



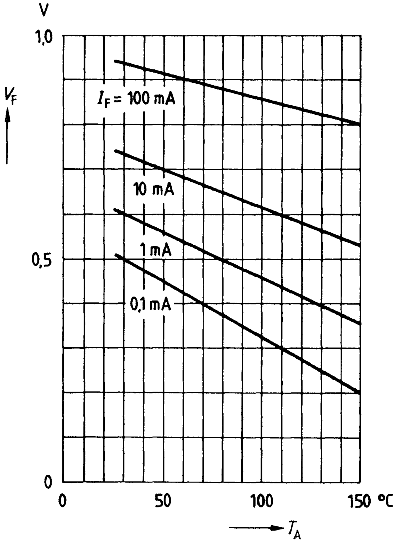
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



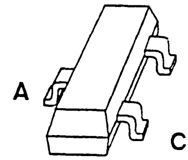
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Forward voltage $V_F = f(T_A)$



- For high-speed switching



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAR 99	JG	Q62702–A610	Q62702–A388	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

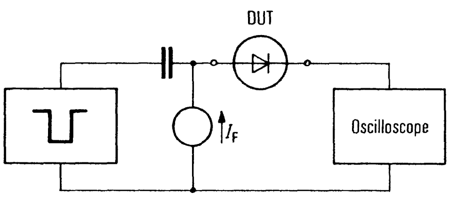
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

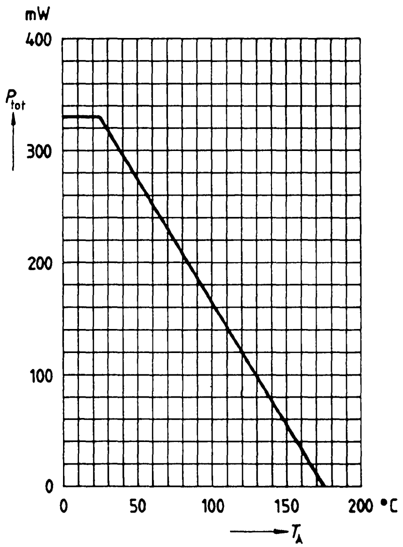
Test circuit for reverse recovery time



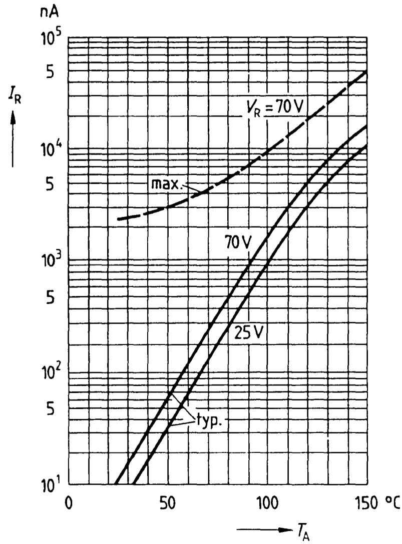
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

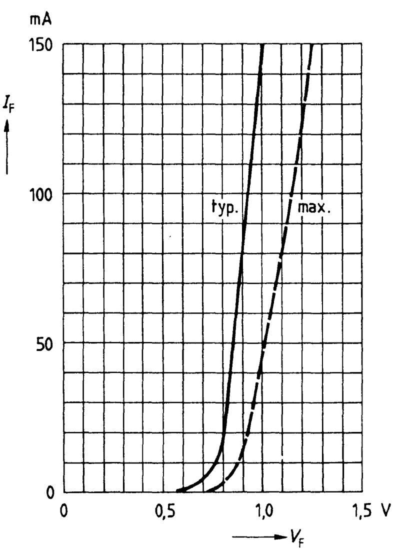
Total power dissipation $P_{tot} = f(T_A)$



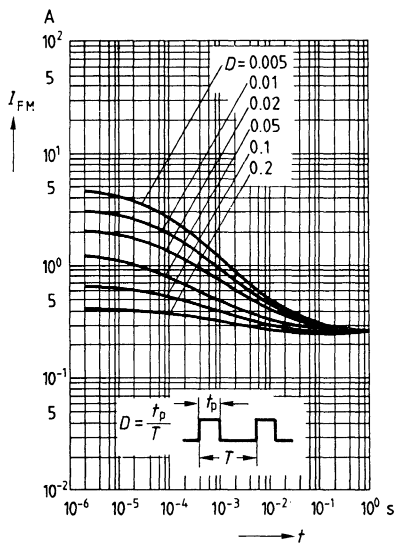
Reverse current $I_R = f(T_A)$



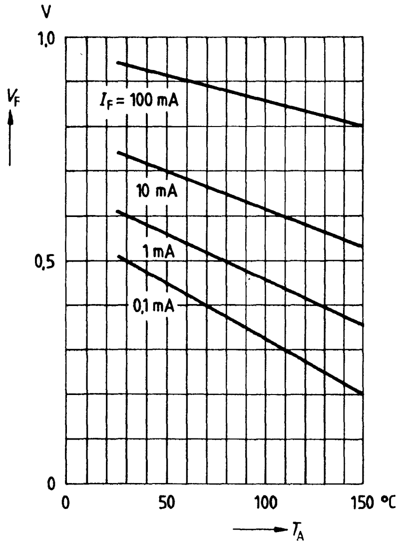
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



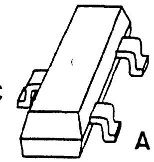
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Forward voltage $V_F = f(T_A)$



● For high-speed switching



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAS 16	A6	Q62702–A726	Q62702–A739	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	75	V
Peak reverse voltage	V_{RM}	85	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

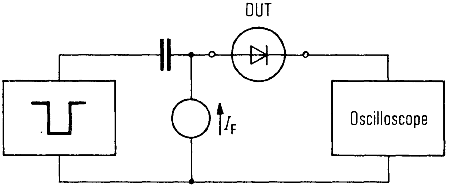
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	75	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 75$ V		–	–	1	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 75$ V, $T_A = 150\,°C$		–	–	50	µA
Forward recovery voltage $I_F = 10$ mA, $t_p = 20$ ns	V_{fr}	–	–	1,75	V

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

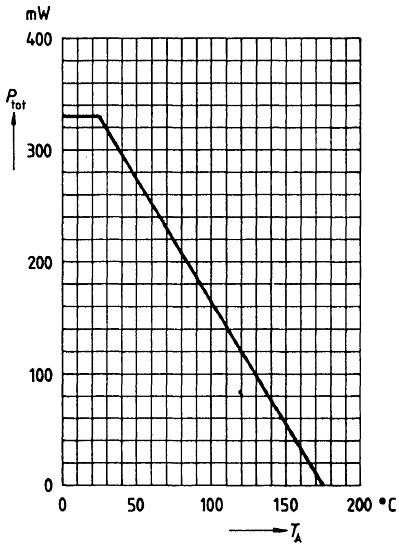
Test circuit for reverse recovery time



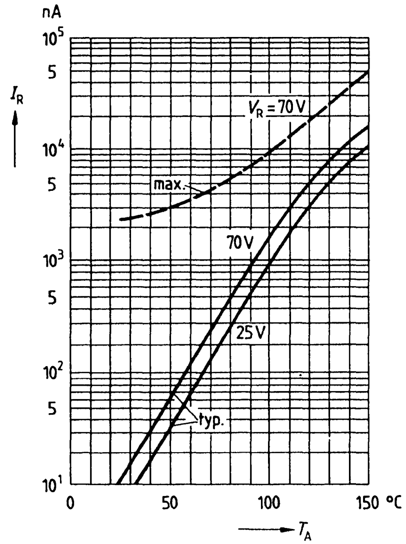
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

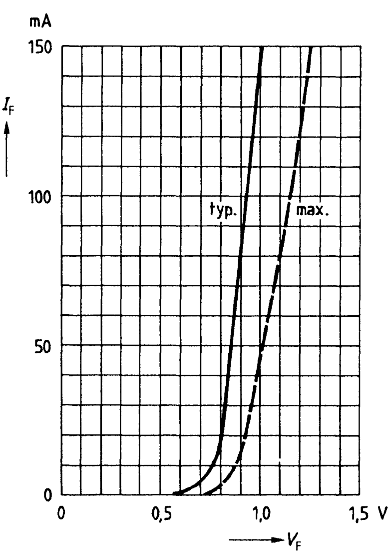
Total power dissipation $P_{tot} = f(T_A)$



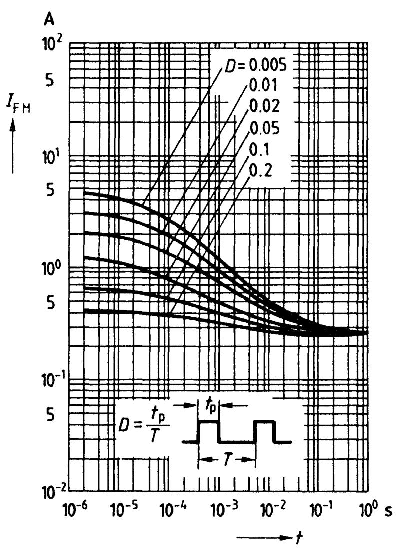
Reverse current $I_R = f(T_A)$



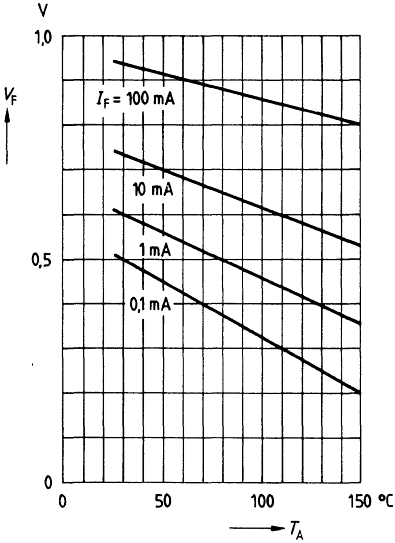
Forward current $I_F = f(V_F)$
$T_A = 25\ °C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\ °C$



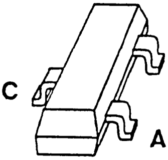
Forward voltage $V_F = f(T_A)$



Silicon Switching Diodes

BAS 19 ... BAS 21

- High-speed, high-voltage switch



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAS 19	JP	Q62702–A242	Q62702–A95	SOT 23
BAS 20	JR	Q62702–A707	Q62702–A113	SOT 23
BAS 21	JS	Q62702–A708	Q62702–A79	SOT 23

Maximum ratings

Parameter	Symbol	BAS 19	BAS 20	BAS 21	Unit
Reverse voltage	V_R	100	150	200	V
Peak reverse voltage	V_{RM}	120	200	250	V
Forward current	I_F		200		mA
Peak forward current	I_{FM}		625		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		280		mW
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		−65 ... +150		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 450		K/W

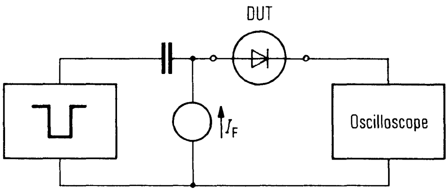
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage[1] $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$				
BAS 19		120	–	–	V
BAS 20		200	–	–	V
BAS 21		250	–	–	V
Forward voltage	V_F				
$I_F = 100$ mA		–	–	1	V
$I_F = 200$ mA		–	–	1,25	V
Reverse current	I_R				
$V_R = V_{R\,max}$		–	–	100	nA
$V_R = V_{R\,max}$; $T_j = 150\,°C$		–	–	100	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	5	pF
Reverse recovery time $I_F = 30$ mA, $I_R = 30$ mA, $R_L = 100\ \Omega$, measured at $I_R = 3$ mA	t_{rr}	–	–	50	ns

Test circuit for reverse recovery time

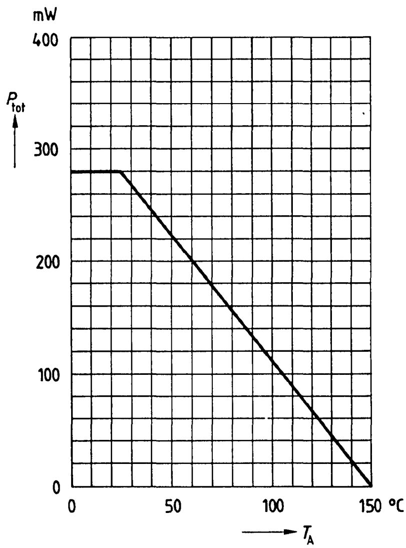


Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

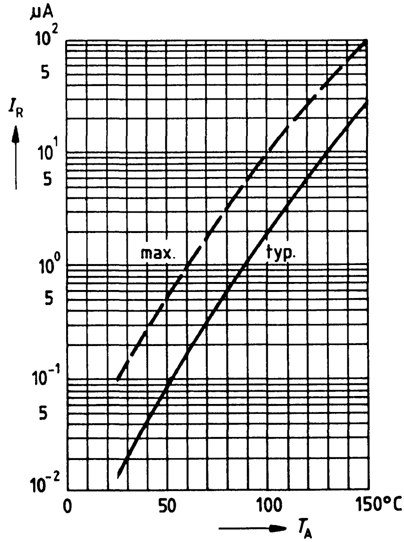
Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

[1]) Pulse test: $t_p \leq 300\ \mu s$, D = 2%.

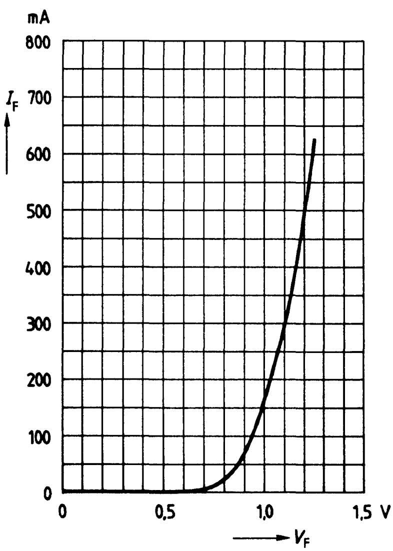
Total power dissipation $P_{tot} = f(T_A)$



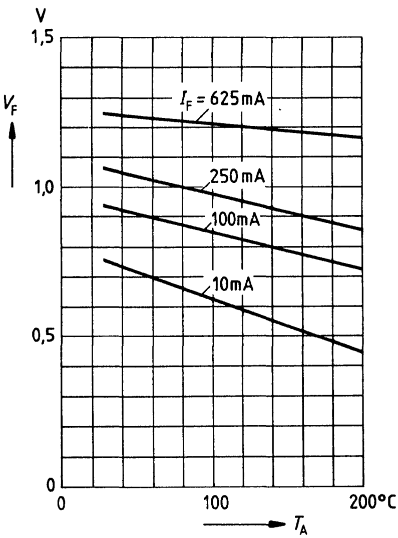
Reverse current $I_R = f(T_A)$



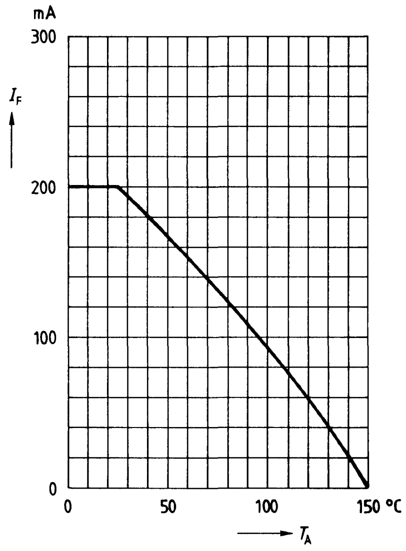
Forward current $I_F = f(V_F)$



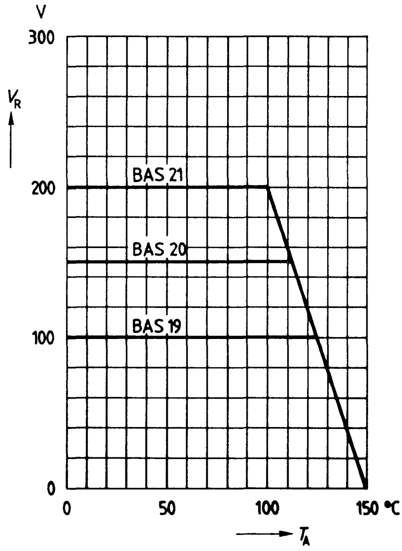
Forward voltage $V_F = f(T_A)$



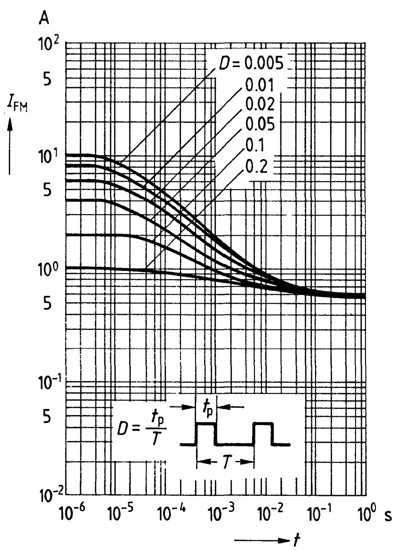
Forward current $I_F = f(T_A)$



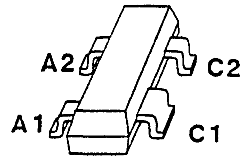
Reverse voltage $V_R = f(T_A)$



Peak forward current $I_{FM} = f(t)$



- For high-speed switching
- Electrically isolated diodes



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAS 28	JT	Q62702–A163	Q62702–A77	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	75	V
Peak reverse voltage	V_{RM}	85	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

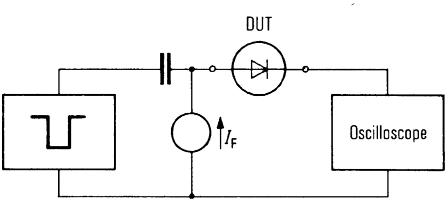
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	85	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 75$ V		–	–	1	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 75$ V, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

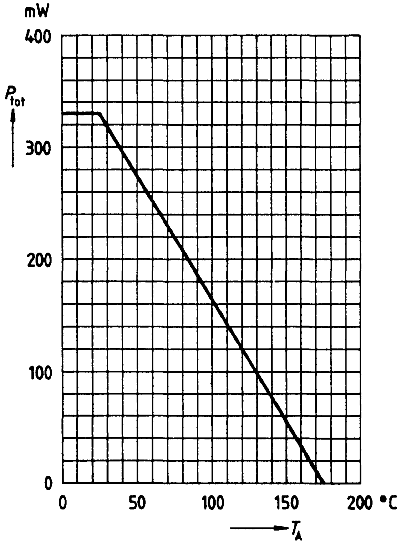
Test circuit for reverse recovery time



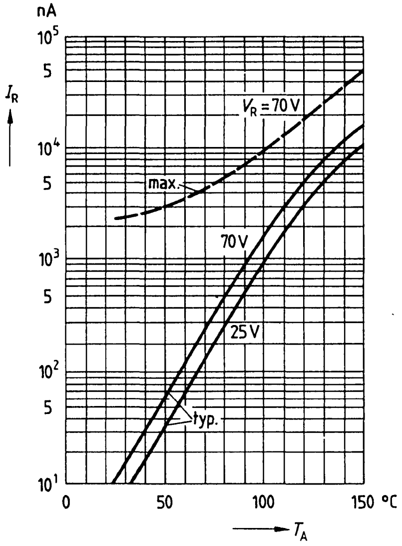
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

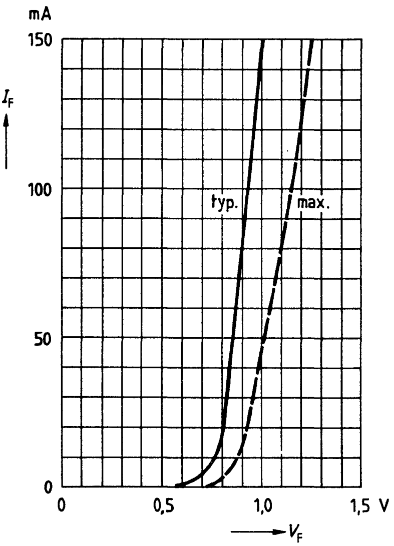
Total power dissipation $P_{tot} = f(T_A)$



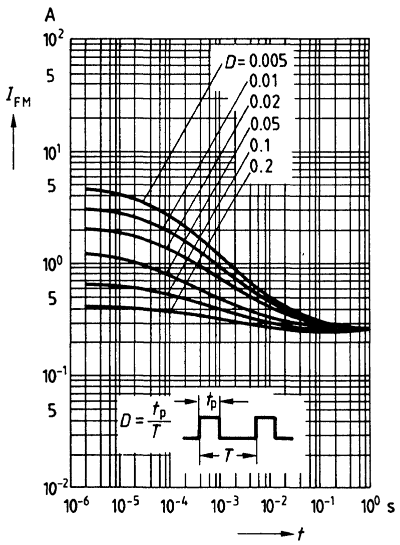
Reverse current $I_R = f(T_A)$



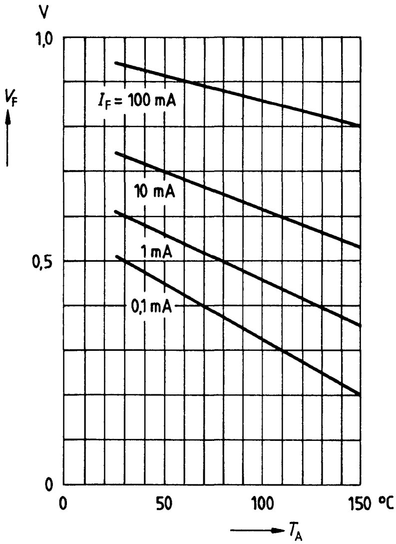
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$

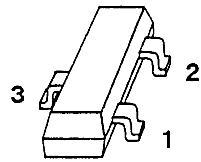


Forward voltage $V_F = f(T_A)$

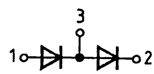
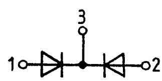
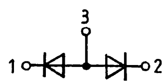


- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

≘ – available with CECC quality assessment

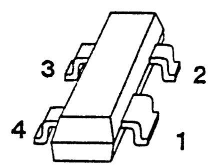


ESD: Electrostatic **d**ischarge sensitive device, observe handling precautions!

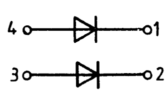
Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
≘ BAS 40	43	Q 62702 – D339		SOT-23
≘ BAS 40-04	44	Q 62702 – D980		
≘ BAS 40-05	45	Q 62702 – D979		
≘ BAS 40-06	46	Q 62702 – D978		

- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

≘ – available with CECC quality assessment



ESD: Electrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
≘ BAS 40-07	47	Q 62702 – A697		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	40	V
Forward current	I_F	40	mA
Peak forward current	I_{FRM}	80	mA
Surge forward current, $t \leq 10$ ms	I_{FSM}	200	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

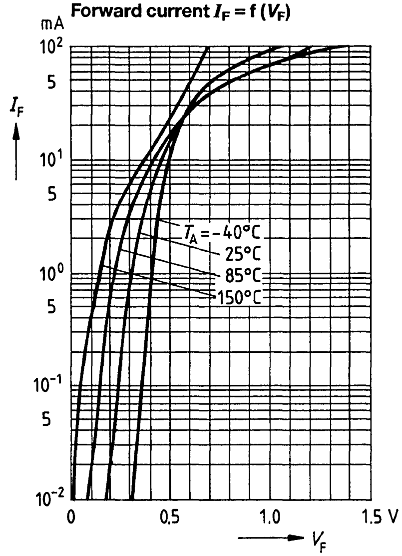
Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	40	–	–	V
Reverse current V_R = 30 V V_R = 40 V	I_R	 – –	 – –	 1 10	µA
Forward voltage I_F = 1 mA I_F = 10 mA I_F = 40 mA	V_F	 – – –	 310 450 720	 380 500 1000	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	 –	 4	 5	pF
Charge carrier life time I_F = 25 mA	τ	–	–	100	ps
Differential forward resistance I_F = 10 mA, f = 10 kHz	r_f	–	10	–	Ω

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

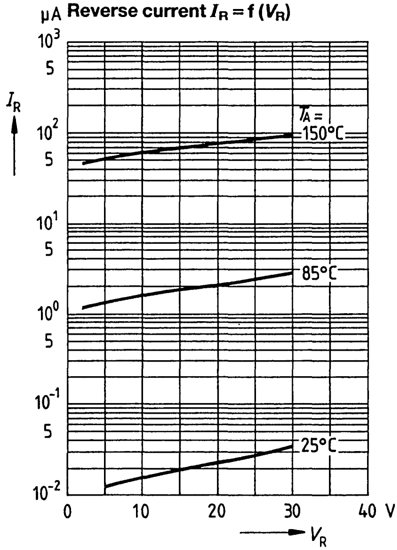
Characteristics per Diode

at T_A = 25 °C, unless otherwise specified.

Forward current $I_F = f(V_F)$

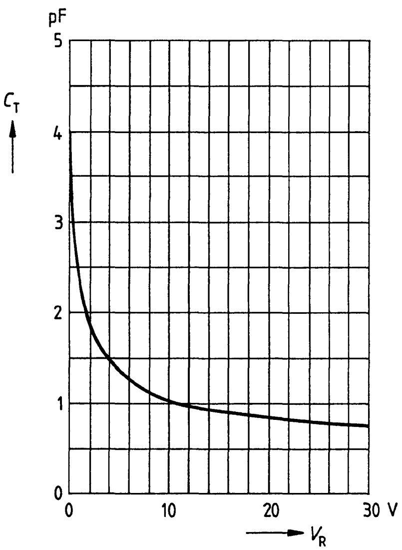


Reverse current $I_R = f(V_R)$



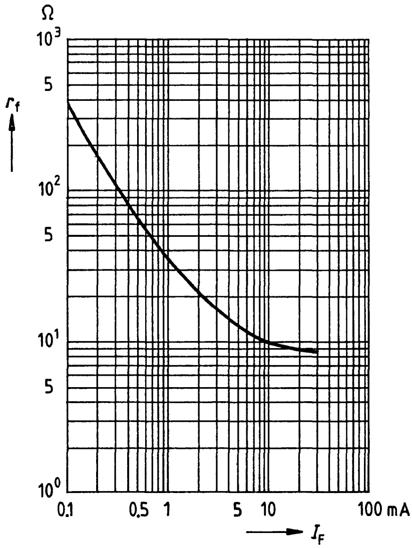
Diode capacitance $C_T = f(V_R)$

f = 1 MHz



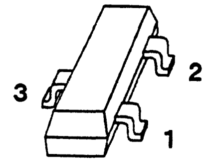
Differential forward resistance $r_f = f(I_F)$

f = 10 kHz

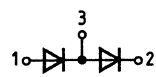
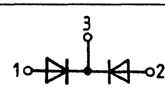
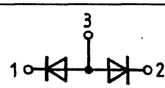


- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

€ – available with CECC quality assessment

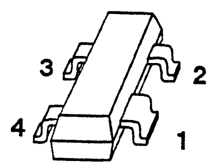


ESD: Electrostatic discharge sensitive device, observe handling precautions!

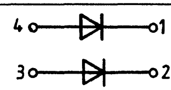
Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
€ BAS 70	73	Q 62702 – A118		SOT-23
€ BAS 70-04	74	Q 62702 – A730		
€ BAS 70-05	75	Q 62702 – A711		
€ BAS 70-06	76	Q 62702 – A774		

- General-purpose diodes for high-speed switching
- Circuit protection
- Voltage clamping
- High-level detecting and mixing

€ – available with CECC quality assessment



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package[1])
€ BAS 70-07	77	Q 62702 – A846		SOT-143

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	70	V
Forward current	I_F	15	mA
Peak forward current	I_{FRM}	40	mA
Surge forward current, $t \leq 10$ ms	I_{FSM}	100	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

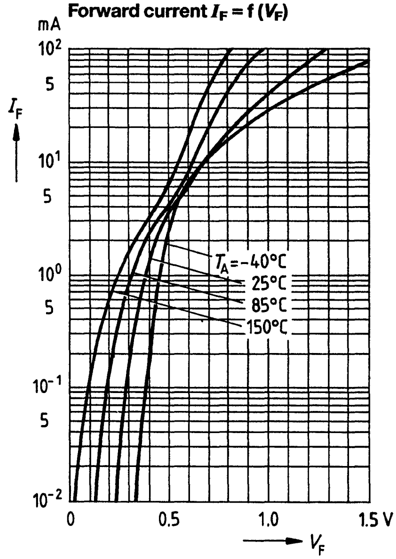
Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	70	–	–	V
Reverse current V_R = 50 V V_R = 70 V	I_R	 – –	 – –	 0.1 10	µA
Forward voltage I_F = 1 mA I_F = 10 mA I_F = 15 mA	V_F	 – – –	 380 690 780	 410 750 1000	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	1.6	2	pF
Charge carrier life time I_F = 25 mA	τ	–	–	100	ps
Differential forward resistance I_F = 10 mA, f = 10 kHz	r_f	–	30	–	Ω

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

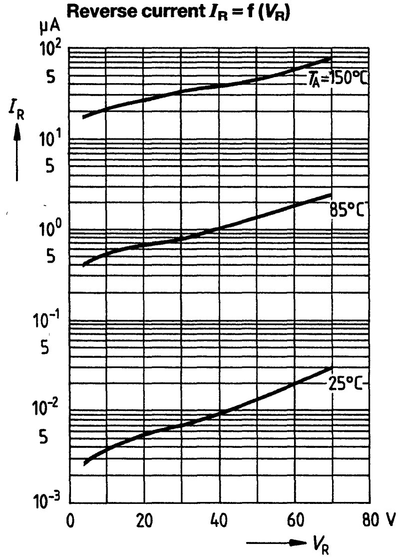
Characteristics per Diode

at T_A = 25 °C, unless otherwise specified.

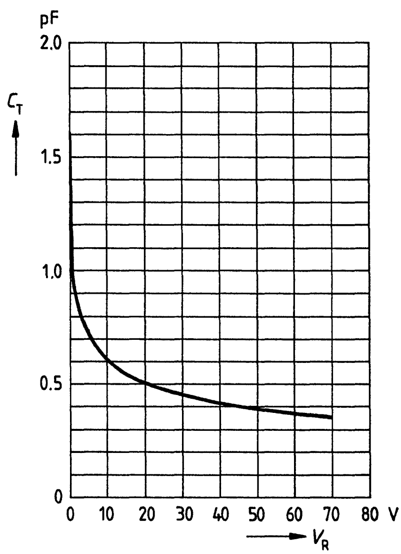
Forward current $I_F = f(V_F)$



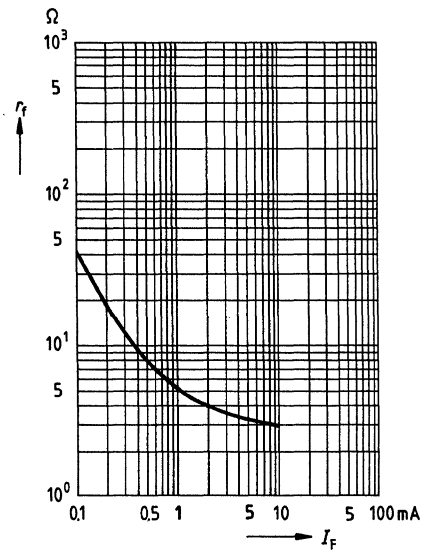
Reverse current $I_R = f(V_R)$



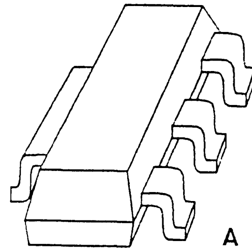
Diode capacitance $C_T = f(V_R)$
f = 1 MHz



Differential forward resistance $r_f = f(I_F)$
f = 10 kHz



- Switching applications
- High breakdown voltage



Type	Marking	Ordering code (12–mm tape)	Package*
BAS 78A	BAS 78A	Q62702 - A910	SOT-223
BAS 78B	BAS 78B	Q62702 - A911	SOT-223
BAS 78C	BAS 78C	Q62702 - A912	SOT-223
BAS 78D	BAS 78D	Q62702 - A913	SOT-223

Maximum Ratings

Parameter	Symbol	BAS 78 A	BAS 78 B	BAS 78 C	BAS 78 D	Unit
Reverse voltage	V_R	50	100	200	400	V
Peak reverse voltage	V_{RM}	50	100	200	400	V
Forward current	I_F	1				A
Peak forward current	I_{FM}	1				A
Surge forward current $t = 1 \mu s$	I_{FS}	10				A
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5				W
Junction temperature	T_j	150				°C
Storage temperature range	T_{stg}	-65 to + 150				°C

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - ambient 1)	R_{thJA}	≤83.3	K/W

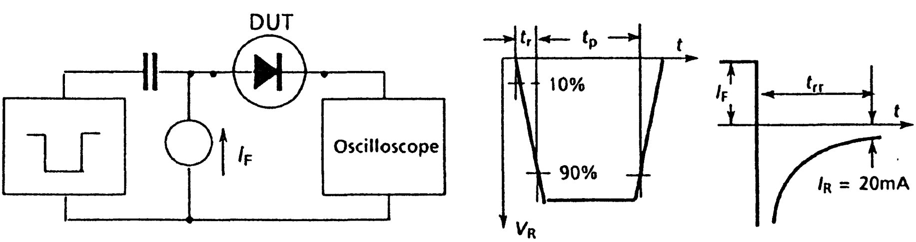
1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm. Mounting pad for the collector lead min 6 cm^2.

*) For detailed dimensions see chapter Package Outlines.

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Breakdown voltage $I_C = 10mA$, $I_B = 0$	BAS 78A BAS 78B BAS 78C BAS 78D	$V_{(BR)}$	50 100 200 400	- - - -	- - - -	V
Forward voltage [1)] $I_F = 1A$ $I_F = 2A$		V_F	- -	- -	1.6 2	V
Reverse current $V_R = V_{R\ max}$ $V_R = V_{R\ max}$, $T_A = 150$ °C		I_R	- -	- -	1 50	µA
AC Characteristics						
Diode capacitance $V_R = 0$, $f = 1$ MHz		C_D	-	10	-	pF
Reverse recovery time $I_F = 200mA$, $I_R = 200mA$, $R_L = 100\Omega$ measured at $I_R = 20mA$		t_{rr}	-	1	-	µs

Test circuit for reverse recovery time

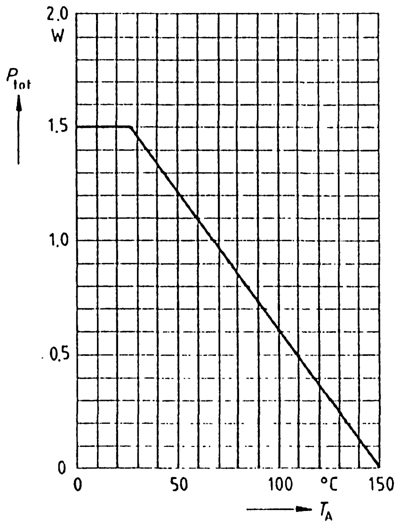


Pulse generator: $t_p = 100ns$, $D = 0.05$
$t_r = 0.6ns$, $R_i = 50\Omega$
$V_p = V_R + I_F \times R_i$

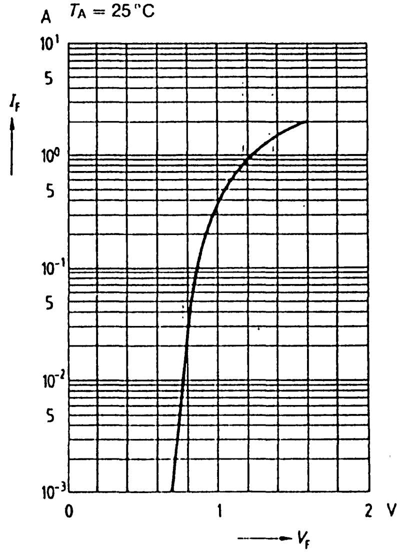
Oscilloscope: $R = 50\Omega$
$t_r = 0.35ns$,
$C \leq 1pF$

1)Pulse test conditions: $t \leq 300\mu s$; $D = 2\%$

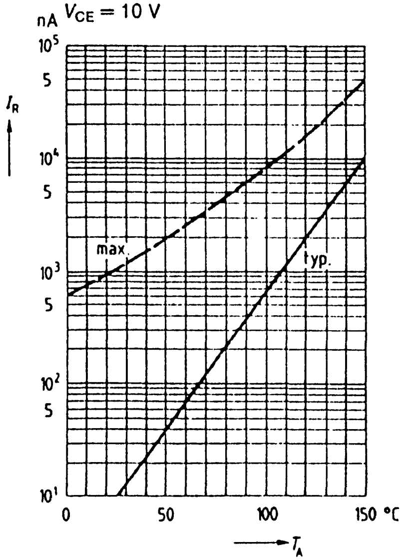
Total power dissipation $P_{tot} = f(T_A)$



Forward current $I_F = f(V_F)$
$T_A = 25\,°C$

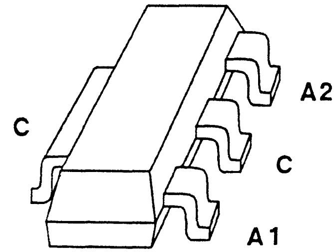


Reverse current $I_R = f(T_A)$
$V_{CE} = 10\ V$



Silicon Switching Diodes — BAS 79A... BAS 79D

- Switching applications
- High breakdown voltage
- Common cathode



Type	Marking	Ordering code (12-mm tape)	Package*
BAS 79A	BAS 79A	Q62702 - A914	SOT-223
BAS 79B	BAS 79B	Q62702 - A915	SOT-223
BAS 79C	BAS 79C	Q62702 - A916	SOT-223
BAS 79D	BAS 79D	Q62702 - A917	SOT-223

Maximum Ratings

Parameter	Symbol	BAS 79 A	BAS 79 B	BAS 79 C	BAS 79 D	Unit
Reverse voltage	V_R	50	100	200	400	V
Peak reverse voltage	V_{RM}	50	100	200	400	V
Forward current	I_F	1				A
Peak forward current	I_{FM}	1				A
Surge forward current $t = 1\,\mu s$	I_{FS}	10				A
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5				W
Junction temperature	T_j	150				°C
Storage temperature range	T_{stg}	-65 to + 150				°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

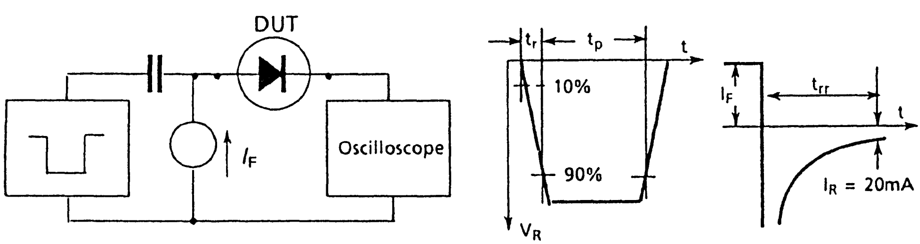
1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines.

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	Values typ.	Values max.	Unit
DC Characteristics						
Breakdown voltage		$V_{(BR)}$				V
$I_C = 10$mA, $I_B = 0$	BAS 79A		50	-	-	
	BAS 79B		100	-	-	
	BAS 79C		200	-	-	
	BAS 79D		400	-	-	
Forward voltage [1)]		V_F				V
$I_F = 1$A			-	-	1.6	V
$I_F = 2$A			-	-	2	
Reverse current		I_R				
$V_R = V_{R\,max}$			-	-	1	µA
$V_R = V_{R\,max}$, $T_A = 150$ °C			-	-	50	
AC Characteristics						
Diode capacitance $V_R = 0$, $f = 1$ MHz		C_D	-	10	-	pF
Reverse recovery time $I_F = 200$mA, $I_R = 200$mA, $R_L = 100\Omega$ measured at $I_R = 20$mA		t_{rr}	-	1	-	µs

Test circuit for reverse recovery time

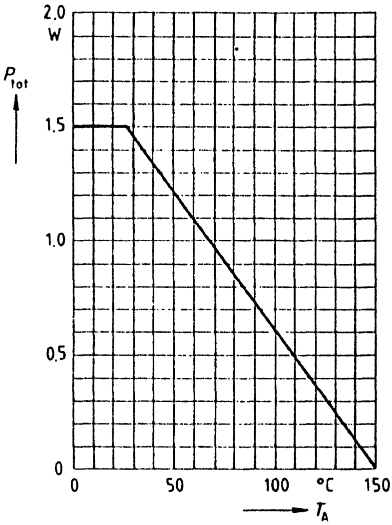


Pulse generator: $t_p = 100$ns, $D = 0.05$
$t_r = 0.6$ns, $R_i = 50\Omega$
$V_p = V_R + I_F \times R_i$

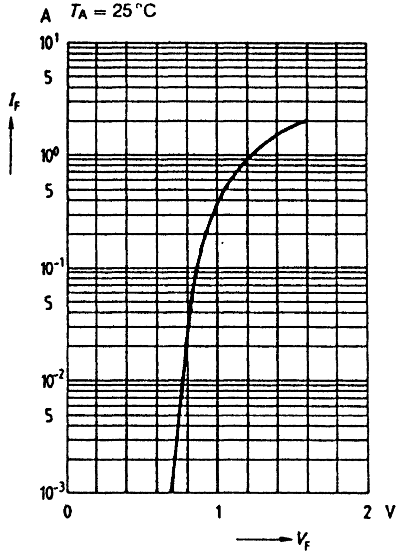
Oscilloscope: $R = 50\Omega$
$t_r = 0.35$ns,
$C \leq 1$pF

1) Pulse test conditions: $t \leqq 300$µs; $D = 2\%$

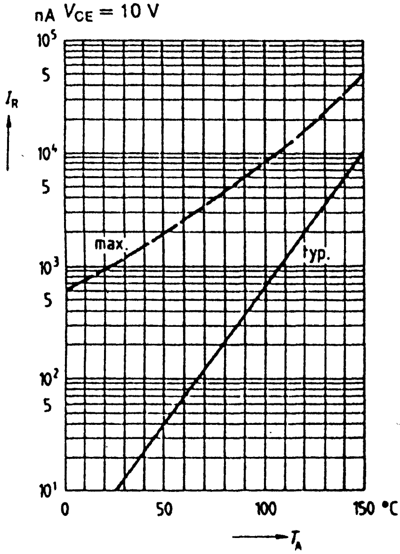
Total power dissipation $P_{tot} = f(T_A)$



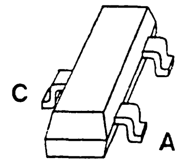
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Reverse current $I_R = f(T_A)$
$V_{CE} = 10$ V



- Low Leakage applications
- Medium speed switching times
- Single diode



Type	Marking	Ordering code 8–mm tape	Package
BAS116	JVs	Q62702-A919	SOT 23

Maximum Ratings

Description	Symbol	BAS116	Unit
Reverse voltage	V_R	75	V
Peak reverse voltage	V_{RM}	85	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current ,t = 1µs	I_{FS}	4.5	A
Total power dissipation, $T_A = 25°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction-ambient[1])	R_{thJA}	≤450	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

Characteristics

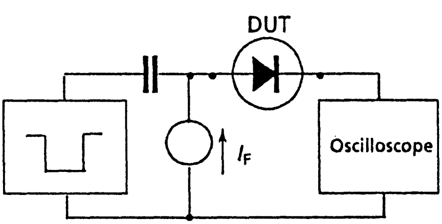
at $T_A = 25$ °C, unless otherwise specified.

Description	Symbol	Ratings min.	typ.	max.	Unit
DC Characteristics					
breakdown voltage $I_{(BR)} = 100$ µA	$V_{(BR)}$	75	-	-	V
Forward voltage	V_F				
$I_F = 1$mA		-	-	900	mV
$I_F = 10$mA		-	-	1000	mV
$I_F = 50$mA		-	-	1100	mV
$I_F = 150$mA		-	-	1250	mV
Reverse current	I_R				
$V_R = 75$V		-	-	5	nA
$V_R = 75$V, $T_A = 150$°C		-	-	80	nA

AC Characteristics

Description	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$V, $f = 1$ MHz	C_D	-	2	-	pF
Reverse recovery time $I_F = 10$mA, $I_R = 10$mA, $R_L = 100\Omega$ measured at $I_R = 1$mA	t_{rr}	-	0.5	3	µs

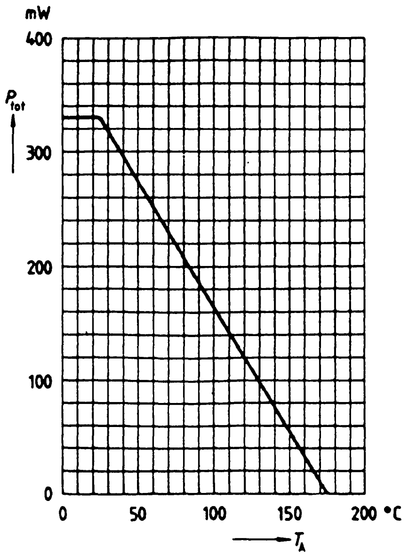
Test circuit for reverse recovery time



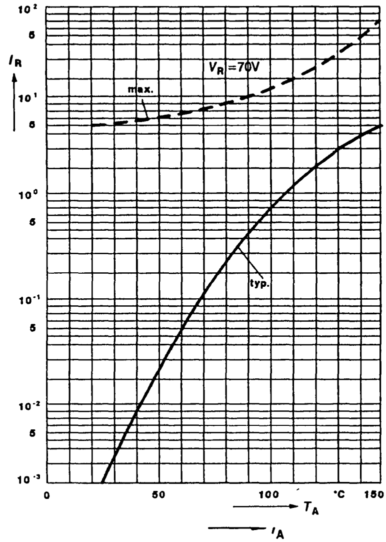
Pulse generator: $t_p = 100$ns, D = 0.05
$t_r = 0.6$ns, $R_i = 50\Omega$

Oscilloscope: R = 50Ω
$t_r = 0.35$ns,
C ≤ 1pF

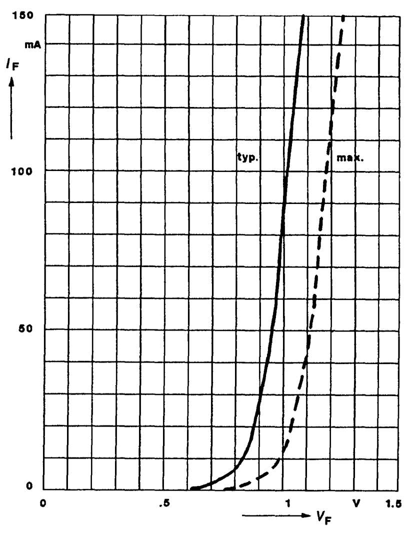
Total power dissipation $P_{tot} = f(T_A)$



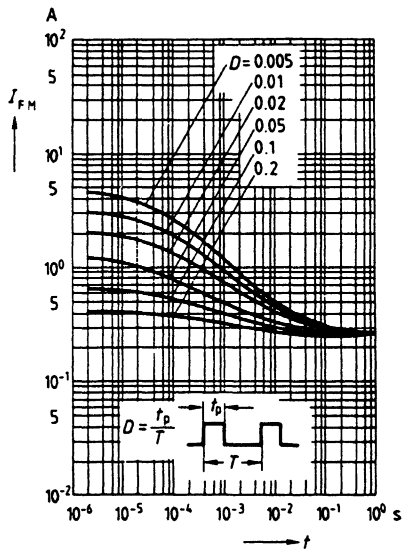
Reverse current $I_R = f(T_A)$



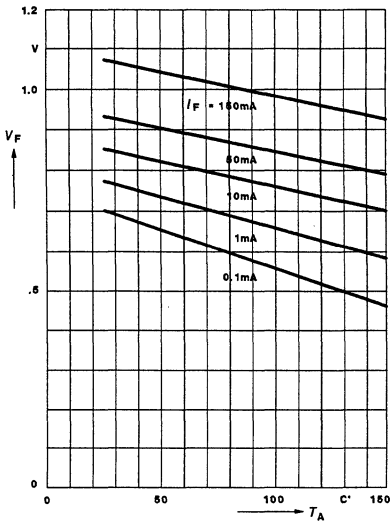
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



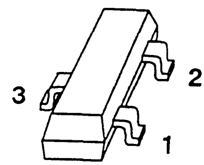
Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



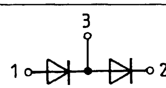
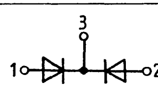
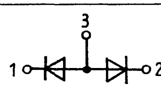
Forward voltage $V_F = f\ (T_A)$



- For mixer applications in the VHF/UHF range
- For high-speed switching



ESD: **E**lectro**s**tatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
BAT 17	53	Q 62702 – A504		SOT-23
BAT 17-04	54	Q 62702 – A775		
BAT 17-05	55	Q 62702 – A776		
BAT 17-06	56	Q 62702 – A777		

Maximum Ratings per Diode

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	4	V
Forward current	I_F	30	mA
Junction temperature	T_j	150	°C
Operating temperature range	T_{op}	–55 ... +150	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

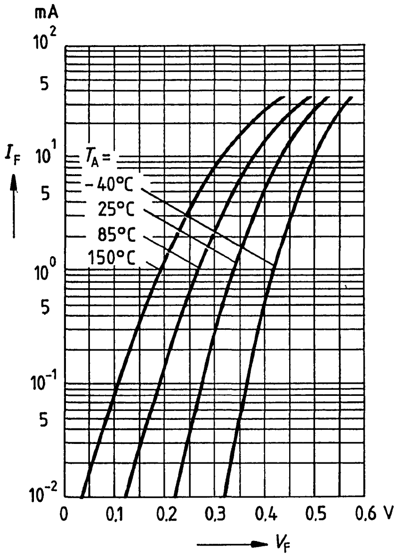
Junction – ambient[1]	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

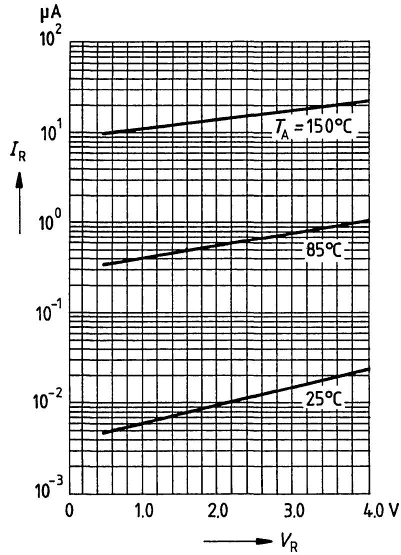
Electrical Characteristics per Diode
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Breakdown voltage I_R = 10 µA	$V_{(BR)}$	4	–	–	V
Reverse current V_R = 3 V V_R = 3 V, T_A = 60 °C V_R = 4 V	I_R	 – – –	 – – –	 0.25 1.25 10	µA
Forward voltage I_F = 0.1 mA I_F = 1 mA I_F = 10 mA	V_F	 200 – 350	 275 340 425	 350 450 600	mV
Diode capacitance V_R = 0, f = 1 MHz	C_T	–	0.75	1	pF
Differential forward resistance I_F = 5 mA, f = 10 kHz	r_f	–	8	15	Ω
Noise figure I_F = 2 mA, f = 900 MHz IF noise figure: F = 1.5 dB, f = 35 MHz	F	–	5.8	7	dB

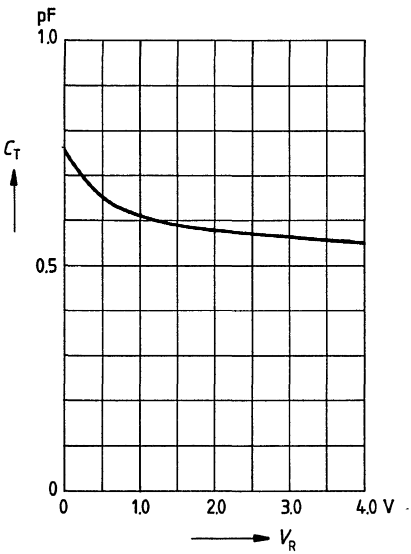
Forward current $I_F = f(V_F)$



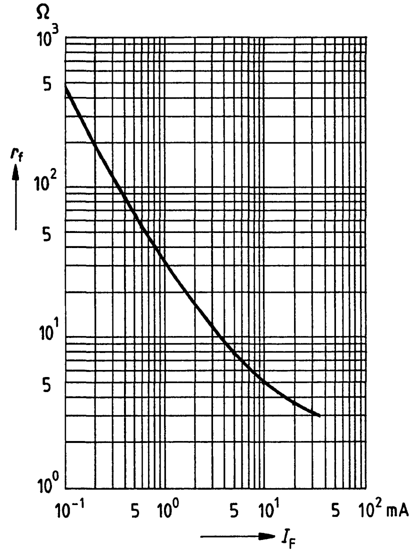
Reverse current $I_R = f(V_R)$



Diode capacitance $C_T = f(V_R)$
f = 1 MHz

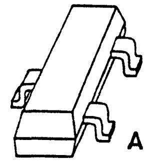


Differential forward resistance $r_f = f(I_F)$
f = 10 kHz



Silicon Schottky Diode BAT 64

- For low-loss, fast-recovery rectifiers, meter protection, bias isolation and clamping applications
- Integrated diffused guard ring
- Low forward voltage



Type	Marking	Ordering code (tape and reel)	Pin configuration	Package
BAT 64	64	Q 62702 – A879		SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	30	V
Forward current	I_F	200	mA
Average forward current (50/60 Hz, sinus)	I_{FAV}	100	mA
Surge forward current (t ≤10 ms)	I_{FSM}	800	mA
Total power dissipation ($T_A \leq 25$ °C[2]))	P_{tot}	230	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	–55 ... +150	°C

Thermal Resistance

Junction – ambient[1]	R_{thJA}	≤430	K/W

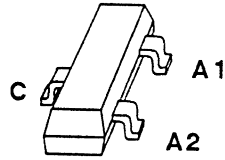
1)Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min	typ	max	
DC characteristics					
Reverse current	I_R				µA
V_R = 25 V		–	–	2	
V_R = 25 V, T_A = 125 °C		–	–	200	
Forward voltage	V_F				mV
I_F = 1 mA		–	320	–	
I_F = 10 mA		–	375	–	
I_F = 30 mA		–	420	–	
I_F = 100 mA		–	550	1000	
Diode capacitance	C_T				pF
V_R = 1 V, f = 1 MHz		–	4	6	
Reverse recovery time	t_{rr}				ns
I_F:I_{R1}:I_{R2} = 10:10:1 mA		–	–	5	

- For high-speed switching
- Common cathode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BAV 70	A4	Q68000–A3574	Q68000–A6622	SOT 23

Maximum ratings per diode

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4,5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

S Preferred type

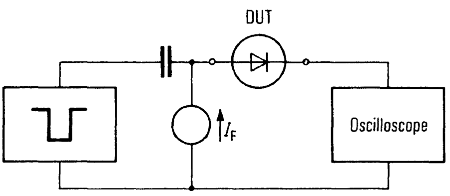
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage	V_F				
$I_F = 1\ mA$		–	–	715	mV
$I_F = 10\ mA$		–	–	855	mV
$I_F = 50\ mA$		–	–	1000	mV
$I_F = 150\ mA$		–	–	1250	mV
Reverse current	I_R				
$V_R = 70\ V$		–	–	2,5	µA
$V_R = 25\ V$, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70\ V$, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0\ V$, $f = 1\ MHz$	C_D	–	–	1,5	pF
Reverse recovery time $I_F = 10\ mA$, $I_R = 10\ mA$, $R_L = 100\ \Omega$, measured at $I_R = 1\ mA$	t_{rr}	–	–	6	ns

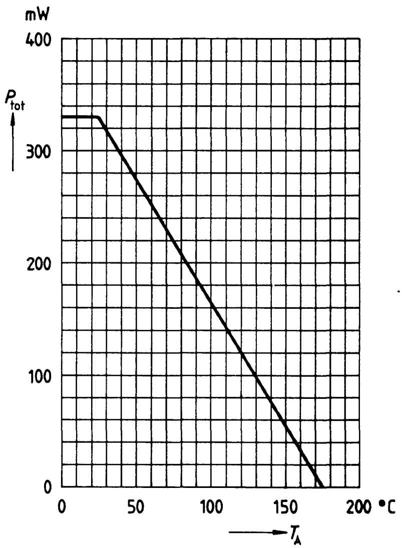
Test circuit for reverse recovery time



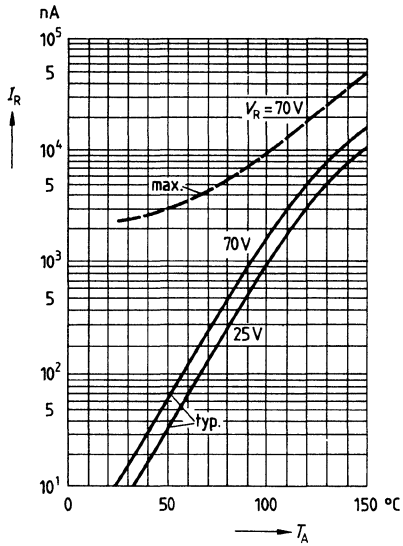
Pulse generator: $t_p = 100\ ns$, D = 0,05
$t_r = 0{,}6\ ns$, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35\ ns$
$C \leq 1\ pF$

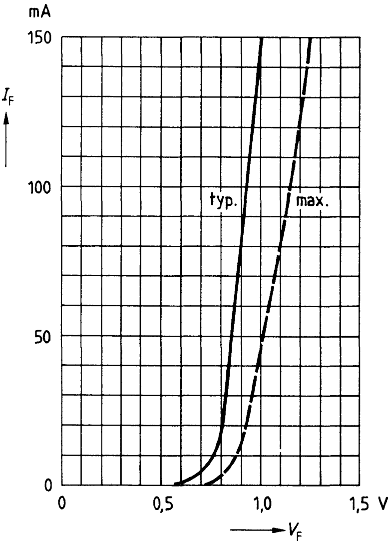
Total power dissipation $P_{tot} = f(T_A)$



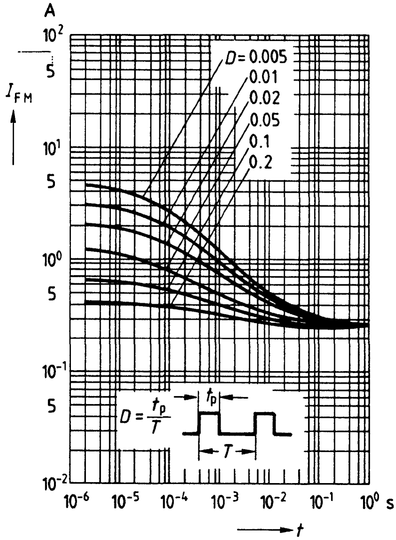
Reverse current $I_R = f(T_A)$



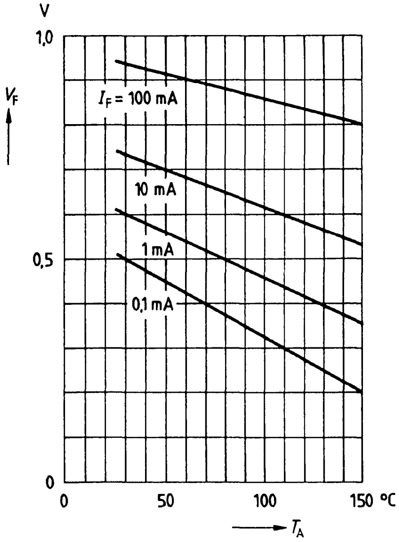
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



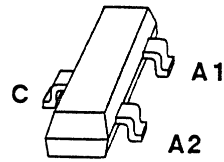
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Forward voltage $V_F = f(T_A)$



- For high-speed switching
- Common cathode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAV 74	JA	Q62702–A498	Q62702–A695	SOT 23

Maximum ratings per diode

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	50	V
Peak reverse voltage	V_{RM}	50	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

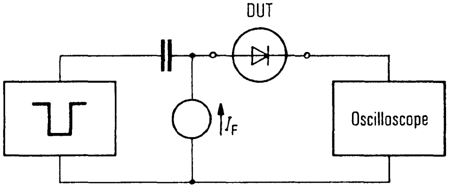
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$	50	–	–	V
Forward voltage $I_F = 100$ mA	V_F	–	–	1	V
Reverse current $V_R = 50$ V $V_R = 50$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 0,1 100	 μA μA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

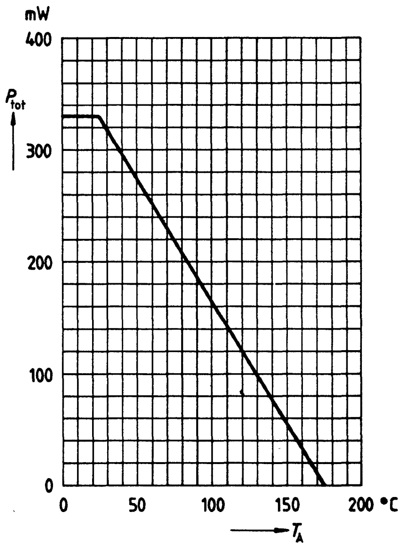
Test circuit for reverse recovery time



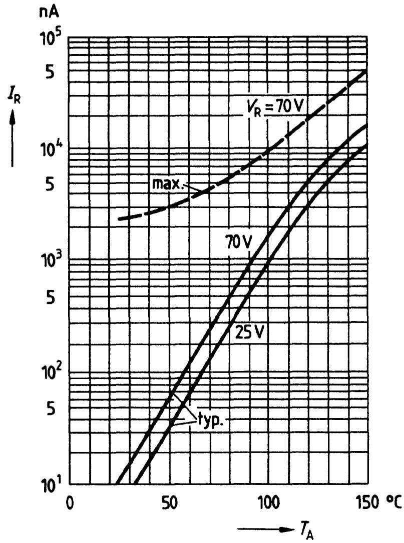
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

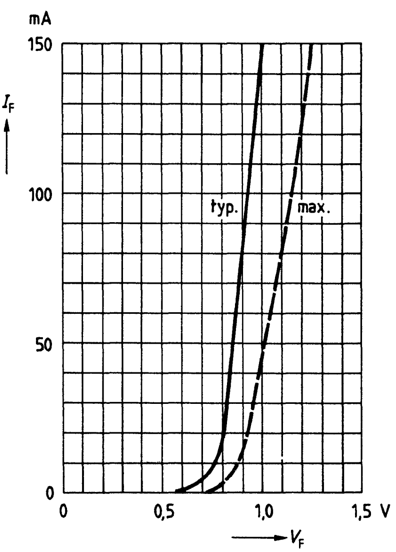
Total power dissipation $P_{tot} = f(T_A)$



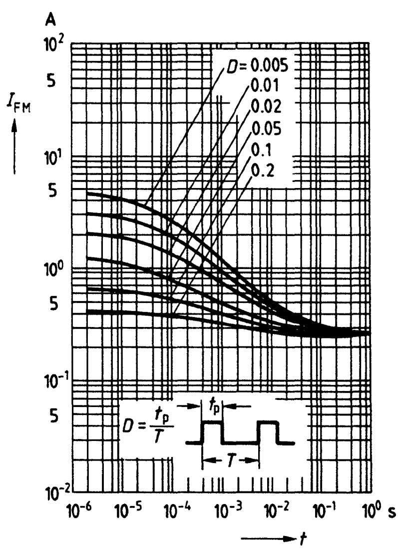
Reverse current $I_R = f(T_A)$



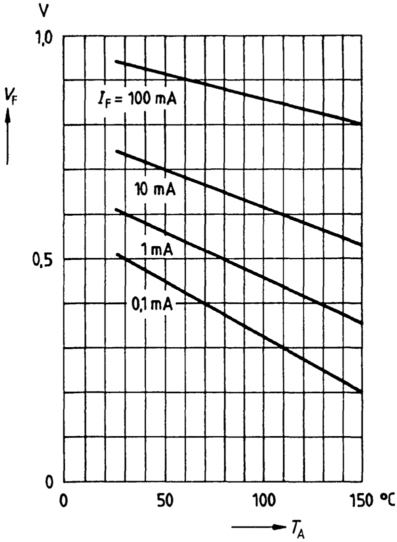
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



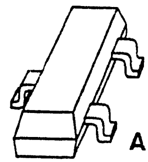
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Forward voltage $V_F = f(T_A)$



- For high-speed switching
- Connected in series



	Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S	BAV 99	A7	Q68000–A1185	Q68000–A549	SOT 23

Maximum ratings per diode

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

S Preferred type

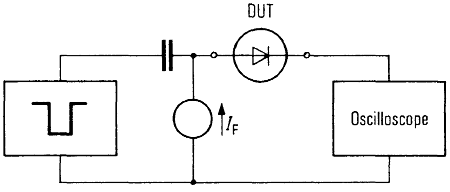
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

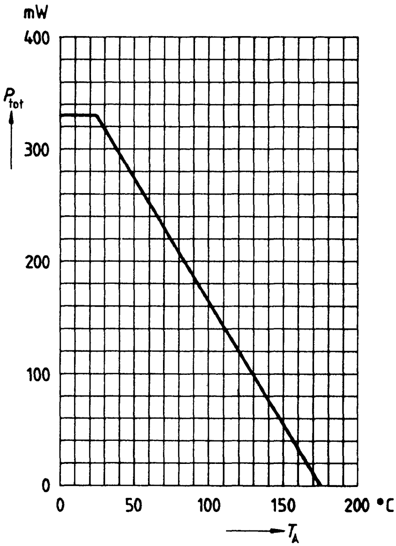
Test circuit for reverse recovery time



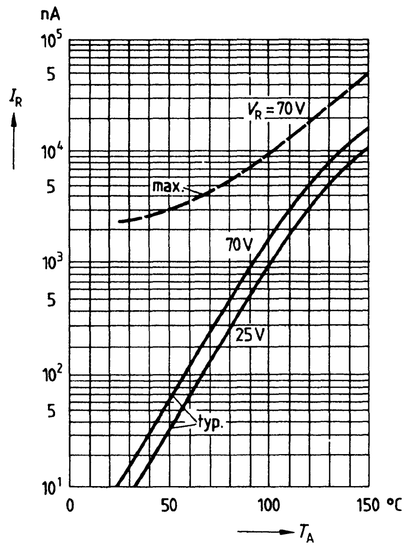
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

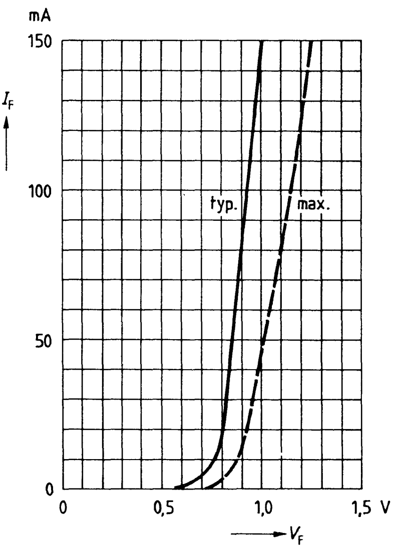
Total power dissipation $P_{tot} = f(T_A)$



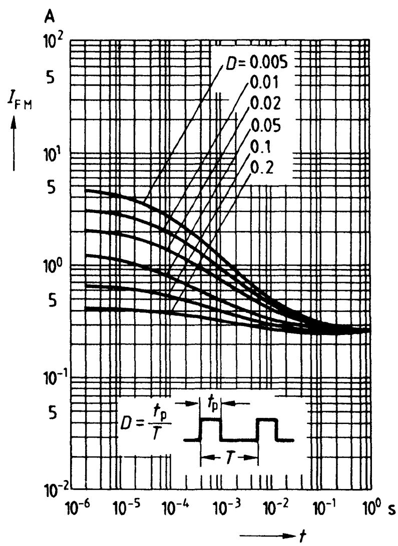
Reverse current $I_R = f(T_A)$



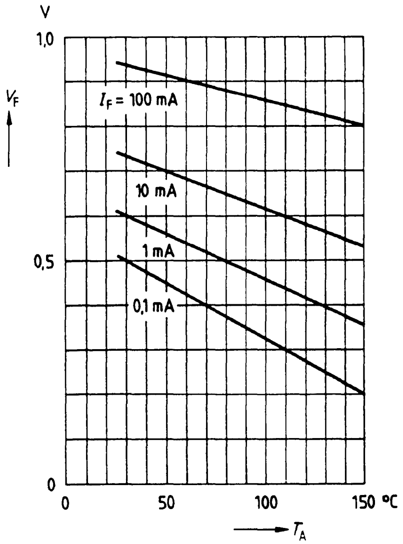
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



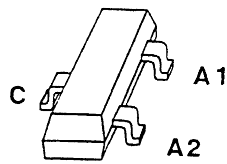
Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



Forward voltage $V_F = f(T_A)$



- Low Leakage applications
- Medium speed switching times
- Common cathode



Type	Marking	Ordering code 8–mm tape	Package
BAV170	JXs	Q62702-A920	SOT 23

Maximum Ratings

Description	Symbol	BAV170	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current ,t = 1µs	I_{FS}	4.5	A
Total power dissipation, $T_A = 25°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction-ambient[1])	R_{thJA}	≤450	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

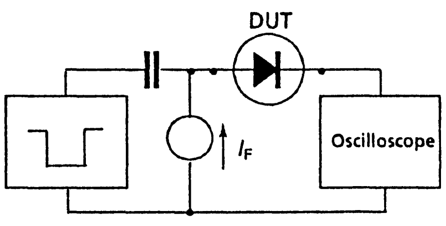
Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Description	Symbol	Ratings min.	typ.	max.	Unit
DC Characteristics					
breakdown voltage $I_{(BR)} = 100$ µA	$V_{(BR)}$	70	-	-	V
Forward voltage	V_F				
$I_F = 1$mA		-	-	900	mV
$I_F = 10$mA		-	-	1000	mV
$I_F = 50$mA		-	-	1100	mV
$I_F = 150$mA		-	-	1250	mV
Reverse current	I_R				
$V_R = 70$V		-	-	5	nA
$V_R = 70$V, $T_A = 150$°C		-	-	80	nA

AC Characteristics

Description	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$V, $f = 1$ MHz	C_D	-	2	-	pF
Reverse recovery time $I_F = 10$mA, $I_R = 10$mA, $R_L = 100\Omega$ measured at $I_R = 1$mA	t_{rr}	-	0.5	3	µs

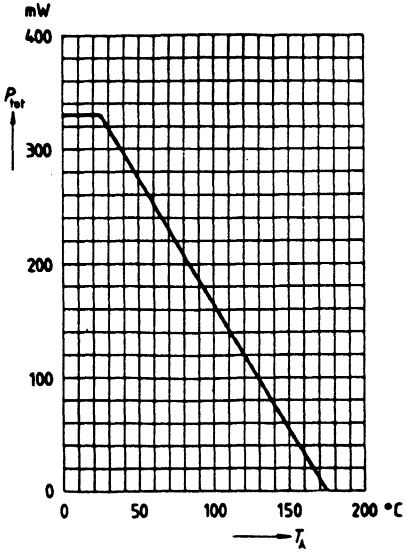
Test circuit for reverse recovery time



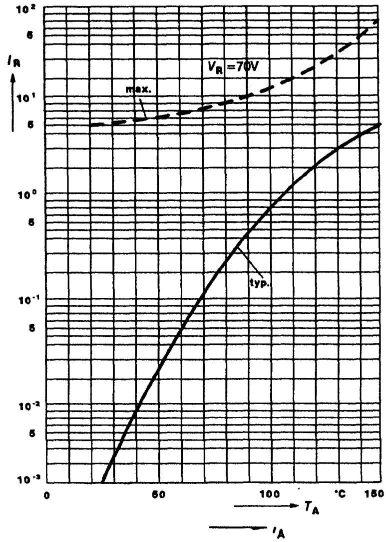
Pulse generator: $t_p = 100$ns, $D = 0.05$
$t_r = 0.6$ns, $R_i = 50\Omega$

Oscilloscope: $R = 50\Omega$
$t_r = 0.35$ns,
$C \leq 1$pF

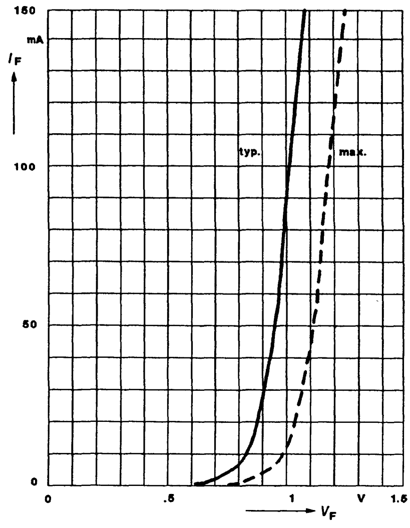
Total power dissipation $P_{tot} = f(T_A)$



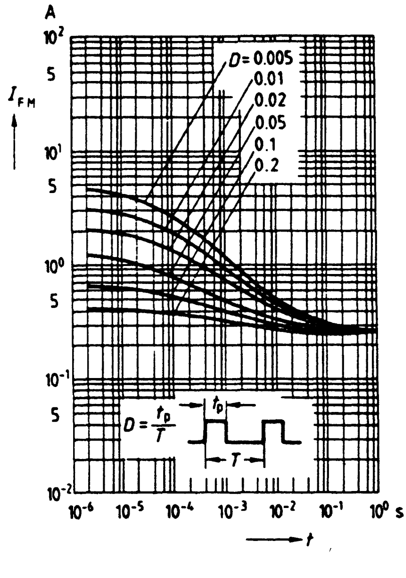
Reverse current $I_R = f(T_A)$



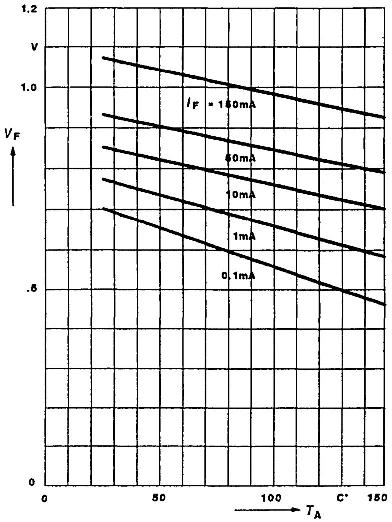
Forward current $I_F = f(V_F)$
T_A = 25 °C



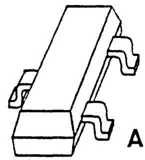
Peak forward current $I_{FM} = f(t)$
T_A = 25 °C



Forward voltage $V_F = f\ (T_A)$



- Low Leakage applications
- Medium speed switching times
- Connected in series



Type	Marking	Ordering code 8–mm tape	Package
BAV199	JYs	Q62702-A921	SOT 23

Maximum Ratings

Description	Symbol	BAV199	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current ,t = 1µs	I_{FS}	4.5	A
Total power dissipation, $T_A = 25°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction-ambient[1])	R_{thJA}	≤450	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

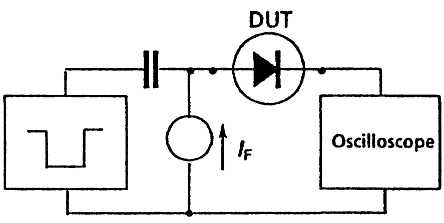
Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Description	Symbol	Ratings min.	typ.	max.	Unit
DC Characteristics					
breakdown voltage $I_{(BR)} = 100$ µA	$V_{(BR)}$	70	-	-	V
Forward voltage	V_F				
$I_F = 1$mA		-	-	900	mV
$I_F = 10$mA		-	-	1000	mV
$I_F = 50$mA		-	-	1100	mV
$I_F = 150$mA		-	-	1250	mV
Reverse current	I_R				
$V_R = 70$V		-	-	5	nA
$V_R = 70$V, $T_A = 150$°C		-	-	80	nA

AC Characteristics

Description	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$V, $f = 1$ MHz	C_D	-	2	-	pF
Reverse recovery time $I_F = 10$mA, $I_R = 10$mA, $R_L = 100\Omega$ measured at $I_R = 1$mA	t_{rr}	-	0.5	3	µs

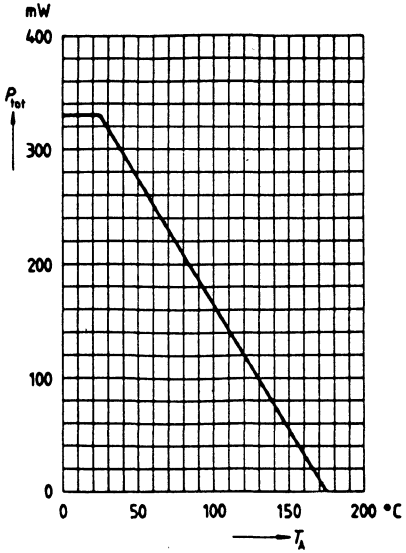
Test circuit for reverse recovery time



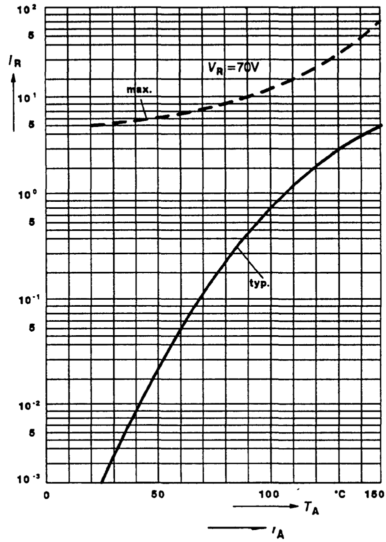
Pulse generator: $t_p = 100$ns, $D = 0.05$
$t_r \doteq 0.6$ns, $R_i = 50\Omega$

Oscilloscope: $R = 50\Omega$
$t_r = 0.35$ns,
$C \leq 1$pF

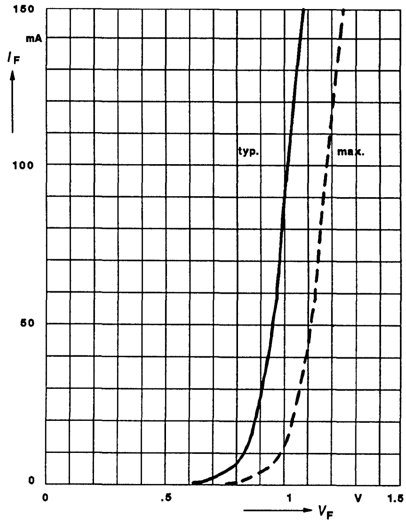
Total power dissipation $P_{tot} = f(T_A)$



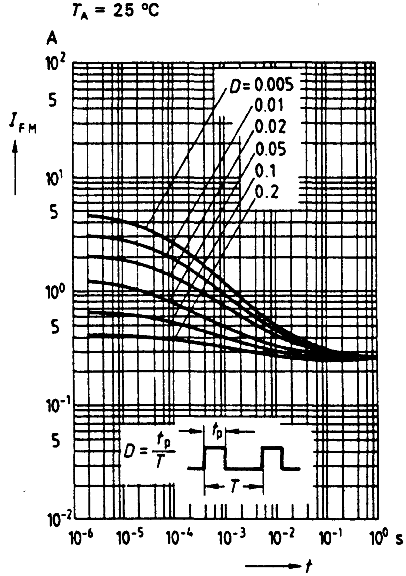
Reverse current $I_R = f(T_A)$



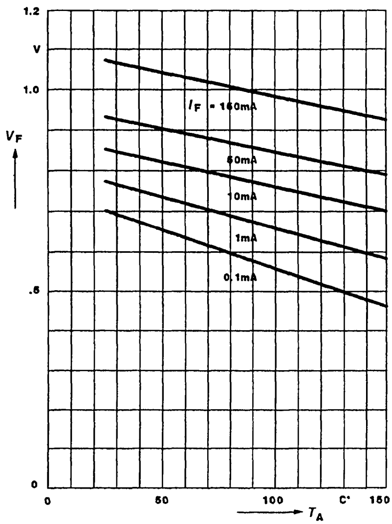
Forward current $I_F = f(V_F)$
T_A = 25 °C



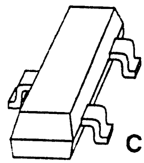
Peak forward current $I_{FM} = f(t)$
T_A = 25 °C



Forward voltage $V_F = f\ (T_A)$



- For high-speed switching applications
- Common anode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BAW 56	A1	Q62702–A471	Q62702–A688	SOT 23

Maximum ratings per diode

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4,5	A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

S Preferred type

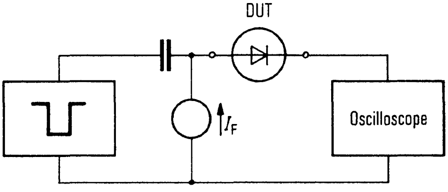
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage	V_F				
$I_F = 1$ mA		–	–	715	mV
$I_F = 10$ mA		–	–	855	mV
$I_F = 50$ mA		–	–	1000	mV
$I_F = 150$ mA		–	–	1250	mV
Reverse current	I_R				
$V_R = 70$ V		–	–	2,5	µA
$V_R = 25$ V, $T_A = 150\,°C$		–	–	30	µA
$V_R = 70$ V, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

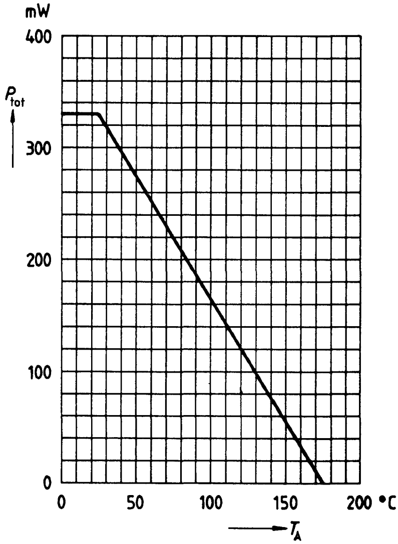
Test circuit for reverse recovery time



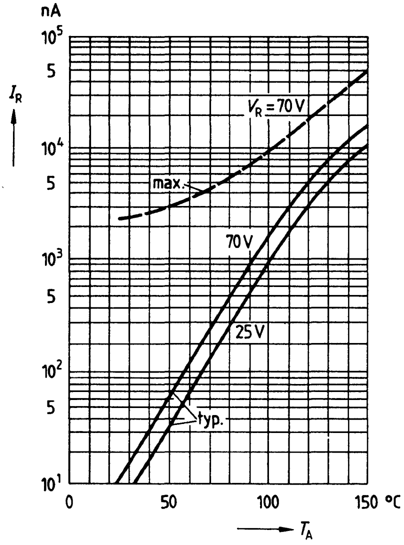
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

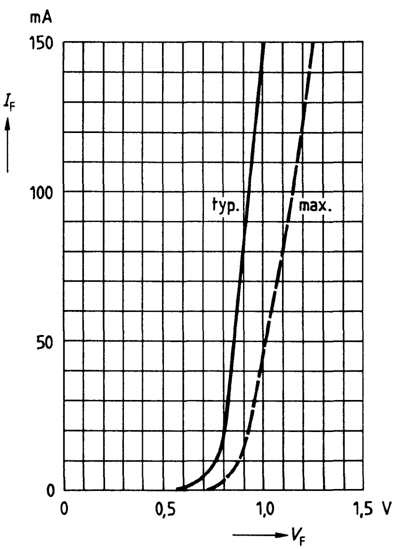
Total power dissipation $P_{tot} = f(T_A)$



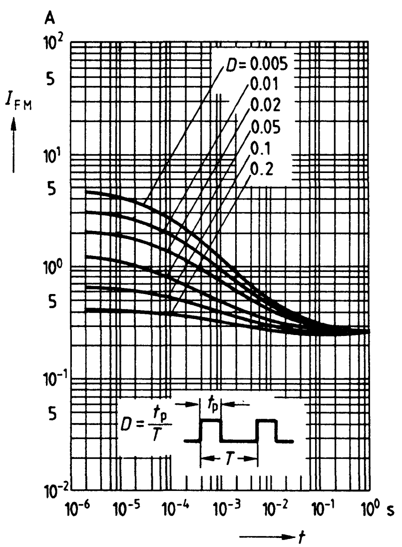
Reverse current $I_R = f(T_A)$



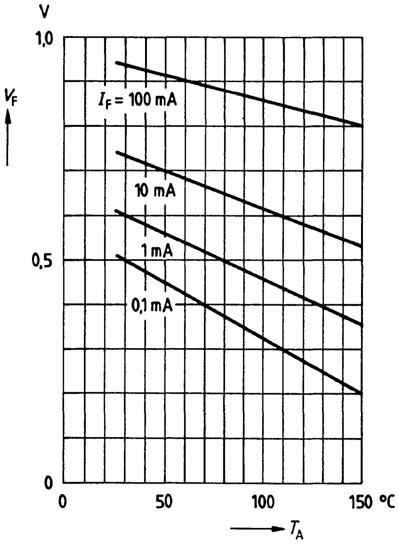
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



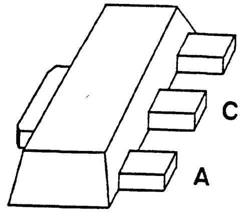
Forward voltage $V_F = f(T_A)$



Silicon Switching Diodes

BAW 78 A
... BAW 78 D

- Switching applications
- High breakdown voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAW 78 A	GA	Q62702–A675	Q62702–A778	SOT 89
BAW 78 B	GB	Q62702–A676	Q62702–A779	SOT 89
BAW 78 C	GC	Q62702–A677	Q62702–A784	SOT 89
BAW 78 D	GD	Q62702–A678	Q62702–A109	SOT 89

Maximum ratings

Parameter	Symbol	BAW 78 A	BAW 78 B	BAW 78 C	BAW 78 D	Unit
Reverse voltage	V_R	50	100	200	400	V
Peak reverse voltage	V_{RM}	50	100	200	400	V
Forward current	I_F	1				A
Peak forward current	I_{FM}	1				A
Surge forward current $t = 1\ \mu s$	I_{FS}	10				A
Total power dissipation $T_A = 25\ °C$	P_{tot}	1				W
Junction temperature	T_j	150				°C
Storage temperature range	T_{stg}	−65 ... +150				°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125				K/W

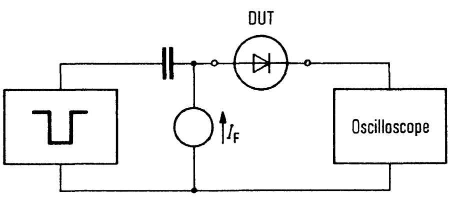
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\,\mu A$	$V_{(BR)}$				
BAW 78 A		50	–	–	V
BAW 78 B		100	–	–	V
BAW 78 C		200	–	–	V
BAW 78 D		400	–	–	V
Forward voltage[1]	V_F				
$I_F = 1\,A$		–	–	1,6	V
$I_F = 2\,A$		–	–	2	V
Reverse current	I_R				
$V_R = V_{Rmax}$		–	–	1	µA
$V_R = V_{Rmax}$, $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$, $f = 1\,MHz$	C_D	–	10	–	pF
Reverse recovery time $I_F = 200\,mA$, $I_R = 200\,mA$, $R_L = 100\,\Omega$, measured at $I_R = 20\,mA$	t_{rr}	–	1	–	µs

Test circuit for reverse recovery time

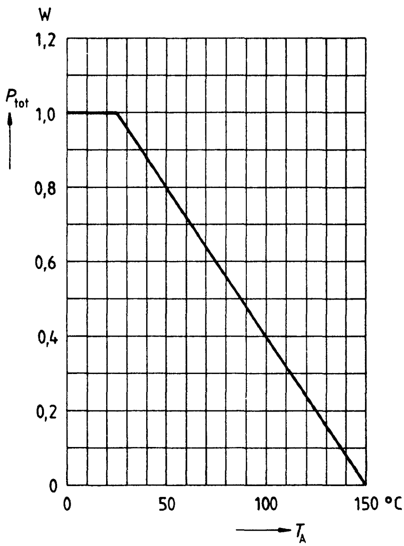


Pulse generator: $t_p = 100\,ns$, D = 0,05
$t_r = 0{,}6\,ns$, $R_i = 50$

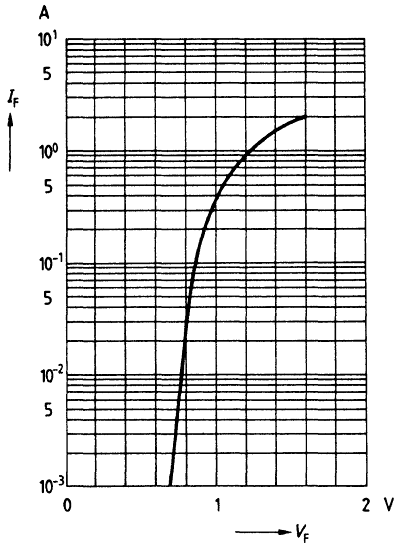
Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35\,ns$
$C \leq 1\,pF$

[1]) Pulse test: $t_p \leq 300\,\mu s$, D = 2%.

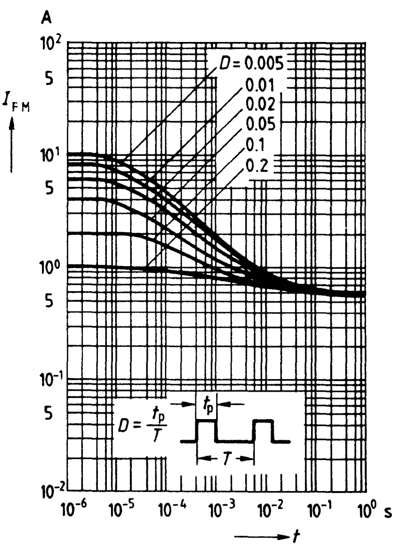
Total power dissipation $P_{tot} = f(T_A)$



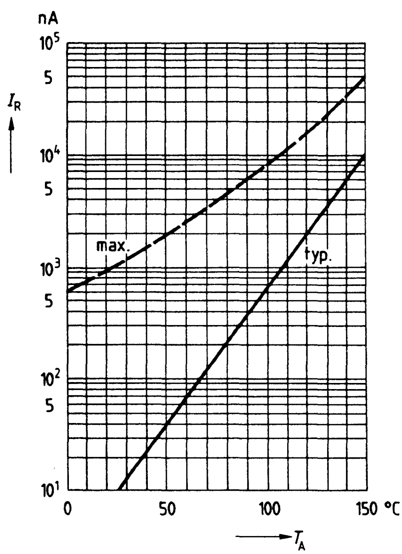
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



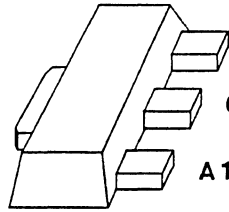
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Reverse current $I_R = f(T_A)$
$V_R = V_{R\,max}$



- For high-speed switching
- High breakdown voltage
- Common cathode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BAW 79 A	GE	Q62702–A679	Q62702–A781	SOT 89
BAW 79 B	GF	Q62702–A680	Q62702–A782	SOT 89
BAW 79 C	GG	Q62702–A681	Q62702–A771	SOT 89
BAW 79 D	GH	Q62702–A682	Q62702–A733	SOT 89

Maximum ratings per diode

Parameter	Symbol	BAW 79 A	BAW 79 B	BAW 79 C	BAW 79 D	Unit
Reverse voltage	V_R	50	100	200	400	V
Peak reverse voltage	V_{RM}	50	100	200	400	V
Forward current	I_F	1				A
Peak forward current	I_{FM}	1				A
Surge forward current $t = 1$ µs	I_{FS}	10				A
Total power dissipation $T_A = 25$ °C	P_{tot}	1				W
Junction temperature	T_j	150				°C
Storage temperature range	T_{stg}	−65 ... +150				°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125				K/W

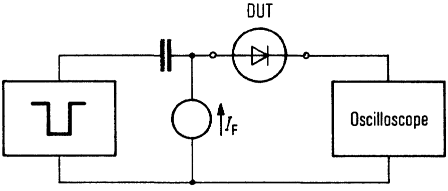
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$		$V_{(BR)}$				
	BAW 79 A		50	–	–	V
	BAW 79 B		100	–	–	V
	BAW 79 C		200	–	–	V
	BAW 79 D		400	–	–	V
Forward voltage[1]		V_F				
$I_F = 1$ A			–	–	1,6	V
$I_F = 2$ A			–	–	2	V
Reverse current		I_R				
$V_R = V_{Rmax}$			–	–	1	µA
$V_R = V_{Rmax}$, $T_A = 150\,°C$			–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$ V, $f = 1$ MHz	C_D	–	10	–	pF
Reverse recovery time $I_F = 200$ mA, $I_R = 200$ mA, $R_L = 100\ \Omega$, measured at $I_R = 20$ mA	t_{rr}	–	1	–	µs

Test circuit for reverse recovery time

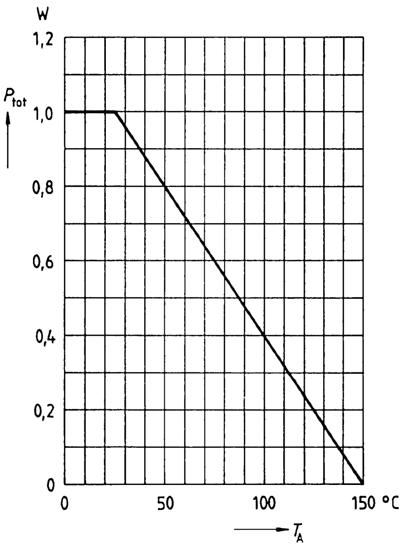


Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50$

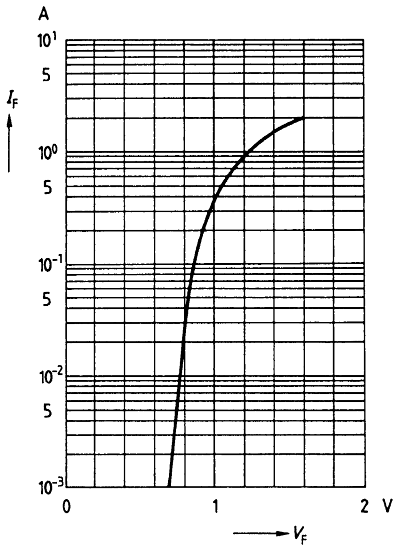
Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

[1]) Pulse test: $t_p \leq 300\ \mu s$, D = 2%.

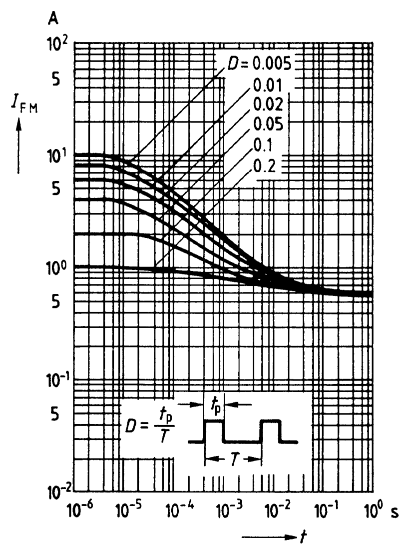
Total power dissipation $P_{tot} = f(T_A)$



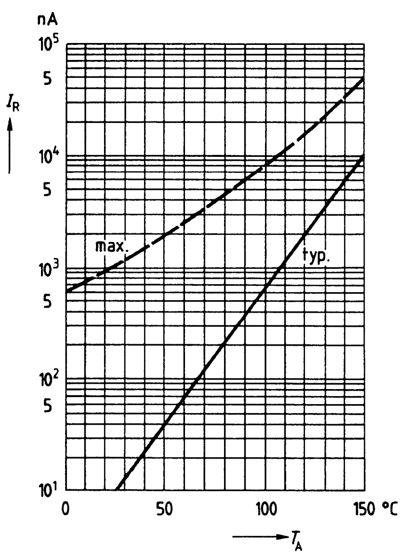
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



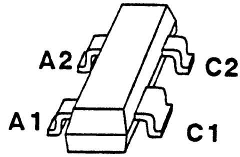
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Reverse current $I_R = f(T_A)$
$V_R = V_{R\,max}$



- Electrically isolated high-voltage medium-speed diodes



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BAW 101	JP	Q62702–A3444	Q62702–A712	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	300	V
Peak reverse voltage	V_{RM}	300	V
Forward current	I_F	200	mA
Peak forward current	I_{FM}	500	mA
Surge forward current $t = 1$ µs	I_{FS}	4,5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

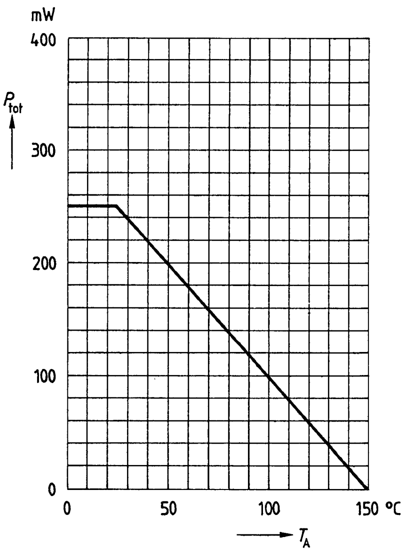
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

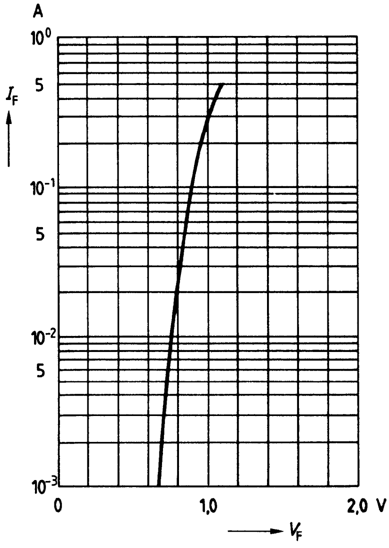
DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	300	–	–	V
Forward voltage $I_F = 100$ mA	V_F	–	–	1,3	V
Reverse current $V_R = 250$ V $V_R = 250$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 150 50	 nA µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$, $f = 1$ MHz	C_D	–	6	–	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$, measured at $I_R = 1$ mA	t_{rr}	–	1	–	µs

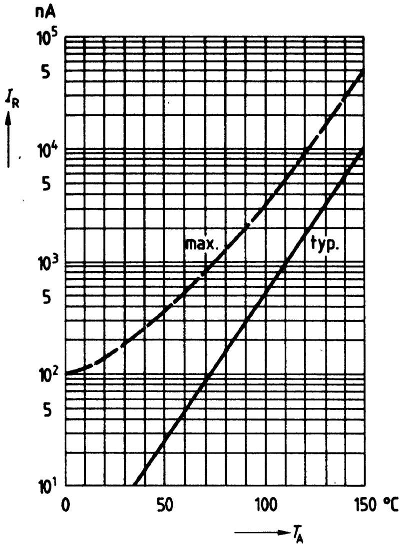
Total power dissipation $P_{tot} = f(T_A)$



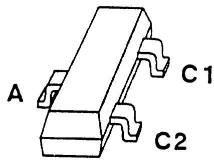
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Reverse current $I_R = f(T_A)$



- Low Leakage applications
- Medium speed switching times
- Common anode



Type	Marking	Ordering code 8–mm tape	Package
BAW156	JZs	Q62702-A922	SOT 23

Maximum Ratings

Description	Symbol	BAW156	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current ,t = 1µs	I_{FS}	4.5	A
Total power dissipation, $T_A = 25°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction-ambient[1])	R_{thJA}	≤450	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

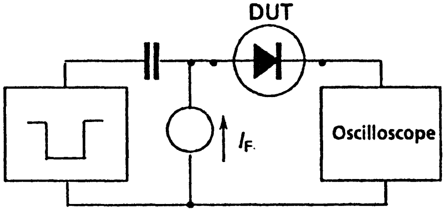
Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Description	Symbol	Ratings min.	typ.	max.	Unit
DC Characteristics					
breakdown voltage $I_{(BR)} = 100$ µA	$V_{(BR)}$	70	-	-	V
Forward voltage	V_F				
$I_F = 1$mA		-	-	900	mV
$I_F = 10$mA		-	-	1000	mV
$I_F = 50$mA		-	-	1100	mV
$I_F = 150$mA		-	-	1250	mV
Reverse current	I_R				
$V_R = 70$V		-	-	5	nA
$V_R = 70$V, $T_A = 150$°C		-	-	80	nA

AC Characteristics

Description	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$V, $f = 1$ MHz	C_D	-	2	-	pF
Reverse recovery time $I_F = 10$mA, $I_R = 10$mA, $R_L = 100\Omega$ measured at $I_R = 1$mA	t_{rr}	-	0.5	3	µs

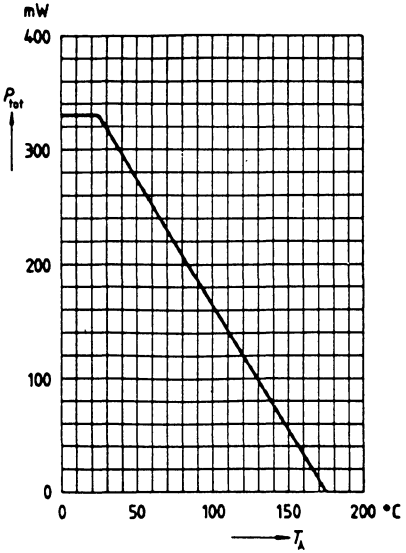
Test circuit for reverse recovery time



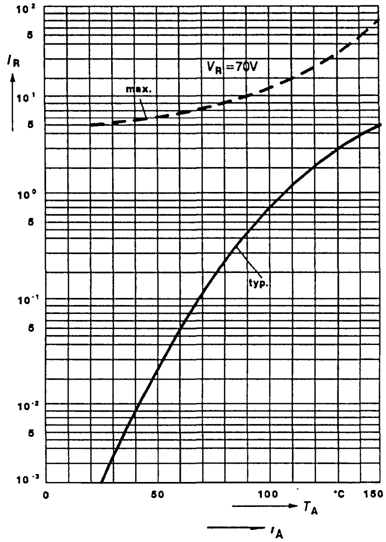
Pulse generator: $t_p = 100$ns, $D = 0.05$
$t_r = 0.6$ns, $R_i = 50\Omega$

Oscilloscope: $R = 50\Omega$
$t_r = 0.35$ns,
$C \leq 1$pF

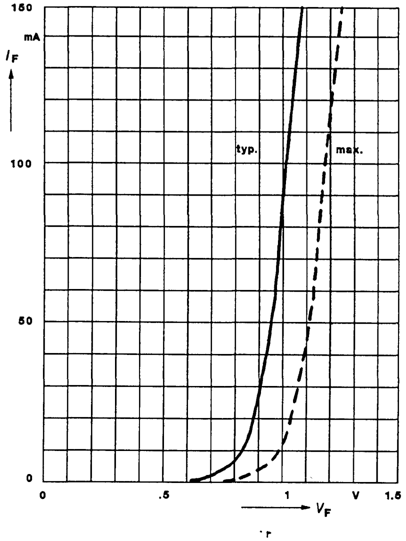
Total power dissipation $P_{tot} = f(T_A)$



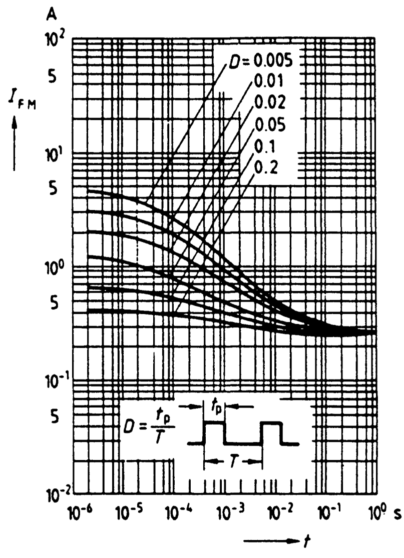
Reverse current $I_R = f(T_A)$



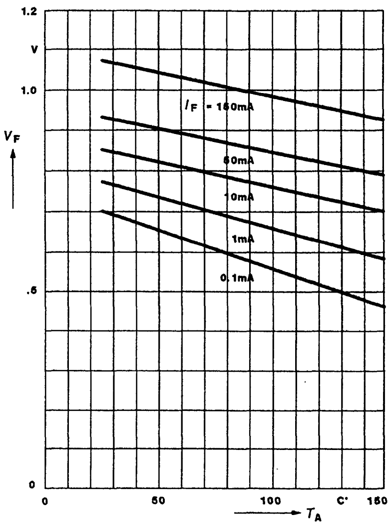
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



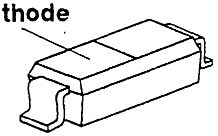
Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



Forward voltage $V_F = f\ (T_A)$



- For VHF tuned circuit applications



Type	Marking	Ordering code (taped)	Package
BB 419	white/2	Q62702-B499	SOD-123

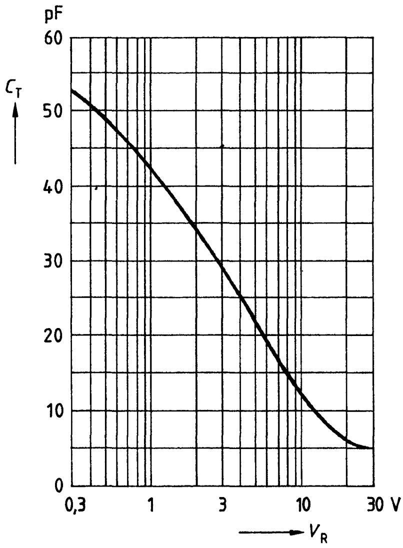
Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	28	V
Peak reverse voltage	V_{RM}	30	V
Forward current, $T_A \leq 60°C$	I_F	20	mA
Operating temperature range	T_{op}	-55 ... + 125	°C
Storage temperature range	T_{stg}	-55 ... + 150	°C

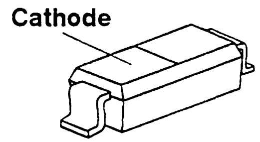
Characeristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
$V_R = 28$ V		-	-	20	
$V_R = 28$ V, $T_A = 60$ °C		-	-	200	
Diode capacitance	C_T				pF
f = 1 MHz					
V_R = 3 V		26	-	32	
V_R = 25 V		4.3	-	6	
Capacitance ratio	C_{T3V}/C_{T25V}				-
$V_R = 3$ V/25 V		5	-	6.5	
Series resistance	r_S				Ω
= 100 MHz, $C_T = 12$ pF		-	0.35	0.5	
Figure of merit	Q				-
$f = 50$ MHz, $V_R = 3$ V		-	280	-	
$f = 200$ MHz, $V_R = 25$ V			600		

Diode capacitance $C_T = f(V_R)$



- For AM tuning applications
- Specified tuning range 1...8 V



Type	Marking	Ordering code (taped)	Package
BB 512	white/M	Q62702-A479	SOD-123

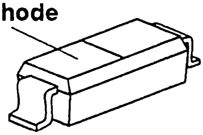
Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	12	V
Forward current, $T_A \leq 60$ °C	I_F	50	mA
Operating temperature range	T_{op}	-55 ... + 125	°C
Storage temperature range	T_{stg}	-55 ... + 150	°C

Electrical Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Reverse current	I_R				nA
$V_R = 10$ V		-	-	20	
$V_R = 10$ V, $T_A = 60$ °C		-	-	200	
Diode capacitance $f = 1$ MHz	C_T				pF
$V_R = 1$ V		440	470	520	
$V_R = 8$ V		17.5	-	34	
Capacitance ratio $V_R = 1$ V/8 V	C_{T1}/C_{T8}	15	-	-	-
Series resistance $f = 0.5$ MHz, $V_R = 1$ V	r_s	-	1.4	-	Ω
Figure of merit $f = 0.5$ MHz, $V_R = 1$ V	Q	-	480	-	-
Temperature coefficient of diode capacitance $f = 1$ MHz, $V_R = 1$ V	TC_C	-	500	-	ppm/K
Capacitance matching $V_R = 1...8$ V	$\Delta C_T/C_T$	-	-	3	%

- For UHF and VHF TV/VTR tuners



Type	BB 515
Ordering code	Q62702-B398
Marking	white/S

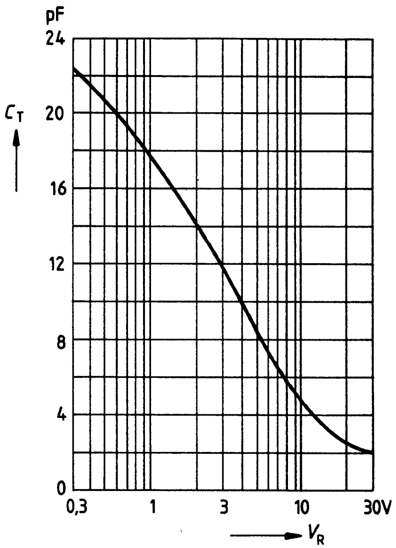
Maximum ratings

Reverse voltage	V_R	30	V
Forward current $T_A \leq 60°C$	I_F	20	mA
Operating temperature range	T_{op}	–55...+125	°C
Storage temperature range	T_{stg}	–55...+150	°C

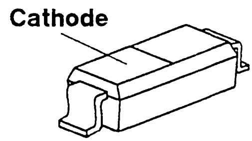
Characteristics ($T_A = 25\,°C$)

		min	typ	max	
Reverse current	I_R				
$V_R = 30$ V		–	–	10	nA
30 V, $T_A = 85\,°C$		–	–	200	nA
Diode capacitance, $f = 1$ MHz	C_T				
$V_R = 1$ V		16	–	19.5	pF
28 V		1.85	–	2.25	pF
Capacitance ratio $V_R = 1$ V, 28 V; $f = 1$ MHz	$\frac{C_T1}{C_T28}$	8	–	9.6	–
Capacitance matching $V_R = 0.5$ V...28 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%
Series resistance	r_s				
$C_T = 9$ pF, $f = 470$ MHz		–	0.5	–	Ω
Series inductance	L_s	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
$f = 1$ MHz



- For VHF/CATV TV/VTR tuners with extended frequency band



Type	BB 619
Ordering code	Q62702-B401
Marking	yellow/S

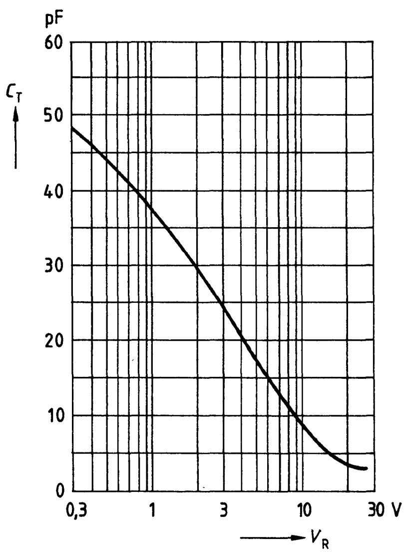
Maximum ratings

Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	–55...+125	°C
Storage temperature range	T_{stg}	–55...+150	°C

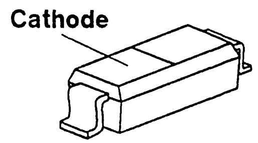
Characteristics ($T_A = 25\,°C$)

		min	typ	max	
Reverse current	I_R				
$V_R = 30$ V		–	–	10	nA
30 V, $T_A = 85\,°C$		–	–	200	nA
Diode capacitance, $f = 1$ MHz	C_T				
$V_R =$ 1 V		33.5	–	41	pF
28 V		2.4	–	2.9	pF
Capacitance ratio $V_R = 1$ V, 28 V; $f = 1$ MHz	$\frac{C_T 1}{C_T 28}$	12.5	14	–	–
Capacitance matching $V_R = 1$ V...28 V, $f = 1$ MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance $C_T = 30$ pF; $f = 100$ MHz	r_s	–	0.7	–	Ω
Series inductance	L_s	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
$f = 1$ MHz



- For Hyperband TV/VTR tuners, Bd I



Type	BB 620
Ordering code	Q62702-B403
Marking	red/S

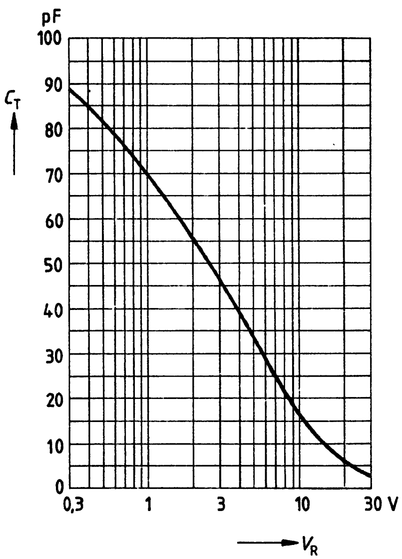
Maximum ratings

Reverse voltage	V_R	30	V
Forward current	I_F	20	mA
Operating temperature range	T_{op}	–55...+125	°C
Storage temperature range	T_{stg}	–55...+150	°C

Characteristics ($T_A = 25\,°C$)

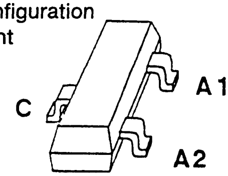
		min	typ	max	
Reverse current	I_R				
$V_R = 30$ V		–	–	10	nA
30 V, $T_A = 85\,°C$		–	–	200	nA
Diode capacitance, $f = 1$ MHz	C_T				
$V_R =$ 1 V		62	–	76	pF
28 V		2.9	–	3.4	pF
Capacitance ratio $V_R = 1$ V, 28 V; $f = 1$ MHz	$\frac{C_T1}{C_T28}$	19.5	–	25	–
Capacitance matching $V_R = 1$ V...28 V, $f = 1$ MHz	$\frac{\Delta C_T}{C_T}$	–	–	2.5	%
Series resistance	r_s				
$C_T = 30$ pF; $f = 100$ MHz		–	1.3	–	Ω
Series inductance	L_s	–	2.8	–	nH

Diode capacitance $C_T = f(V_R)$
$f = 1$ MHz



Silicon Dual Tuning Diode — BB 804

- Application in FM tuners
- Monolithic chip with common cathode for perfect tracking of both diodes
- Uniform "square law" C-V characteristics
- Ideal hifi tuning device when used in low distortion back-to-back configuration
- Available in capacitance subgroups[1]) for convenient tuner alignment



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BB 804	SF[1])	Q62702–B328	Q62702–B356	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	18	V
Peak reverse voltage	V_{RM}	20	V
Forward current $T_A \leq 60\,°C$	I_F	50	mA
Operating temperature	T_{op}	100	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C

[1]) For group coding refer to page 154.

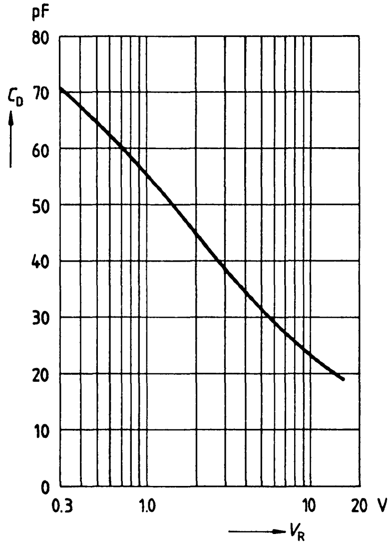
Electrical characteristics per diode

at $T_A = 25\,°C$, unless otherwise specified

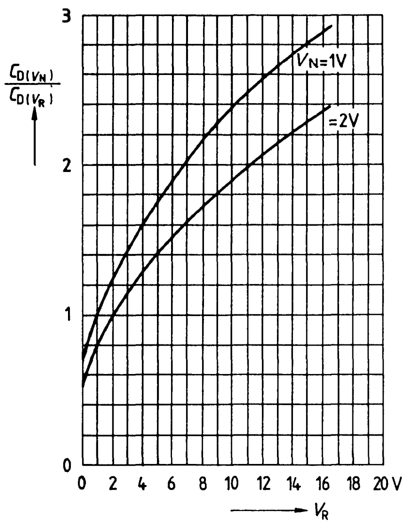
Characteristics	Symbol	min	typ	max	Unit
Reverse current	I_R				
$V_R = 16$ V		–	–	20	nA
$V_R = 16$ V, $T_A = 60\,°C$		–	–	200	nA
Diode capacitance $V_R = 2$ V, $f = 1$ MHz	C_D	42	–	47,5	pF
Capacitance ratio $V_R = 2$ V/8 V, $f = 1$ MHz	C_{D2V}/C_{D8V}	1,65	1,7	–	–
Series resistance $C_D = 38$ pF, $f = 100$ MHz	r_s	–	0,25	–	Ω
Quality factor $C_D = 38$ pF, $f = 100$ MHz	Q	–	170	–	–
Temperature coefficient of diode capacitance $V_R = 2$ V, $f = 1$ MHz	Tc_C	–	330	–	ppm/K
Capacitance groups[1]) $V_R = 2$ V, $f = 1$ MHz	C_D				
Group – no. 0		42	–	43,5	pF
Group – no. 1		43	–	44,5	pF
Group – no. 2		44	–	45,5	pF
Group – no. 3		45	–	46,5	pF
Group – no. 4		46	–	47,5	pF

[1]) The capacitance group number is marked on the component and the package labels. One packaging unit (e.g. 8 mm-tape) contains diodes of one group only. Delivery of discrete capacitance groups requires special contract.

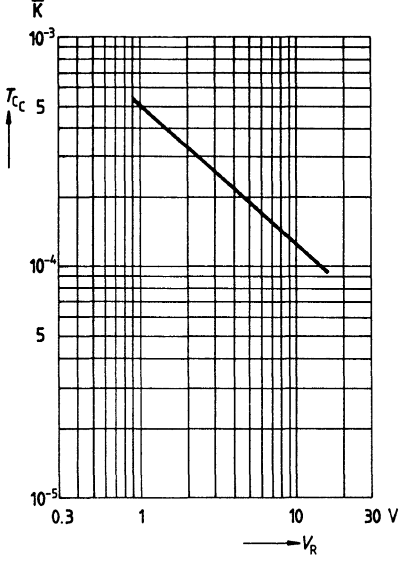
Diode capacitance per diode $C_D = f(V_R)$
$f = 1$ MHz



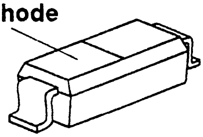
Capacitance deviation per diode
$C_{D(V_N)}/C_{D(V_R)} = f(V_R)$
$V_N = 1$ V, 2 V, $f = 1$ MHz



Temperature coefficient of diode capacitance
$TC_C = f(V_R)$
$f = 1$ MHz



- Frequency range up to 2 GHz;
  special design for use in TV-sat indoor units



Type	Marking	Ordering code (taped)	Package
BB 811	white/T.	Q62702-B478	SOD-123

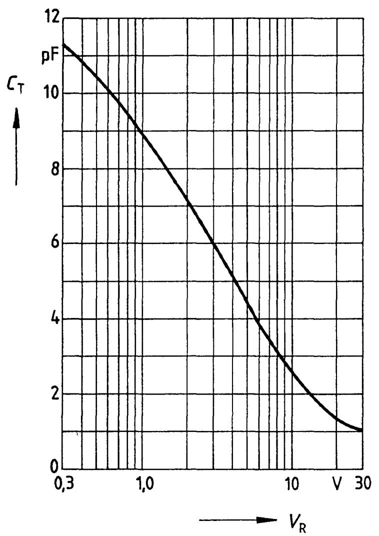
Maximum Ratings

Parameter	Symbol	Value	Unit
Reverse voltage	V_R	30	V
Forward current, $T_A \leq 60$ °C	I_F	20	mA
Operating temperature range	T_{op}	-55 ... +125	°C
Storage temperature range	T_{stg}	-55 ... +150	°C

Electrical Characteristics
at $T_A = 25$ °C, unless otherwise specified.

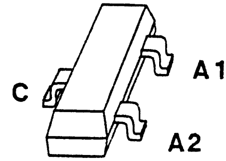
Parameter	Symbol	Ratings min.	Ratings typ.	Ratings max.	Unit
Reverse current	I_R				nA
$V_R = 30$ V		-	-	20	
$V_R = 30$ V, $T_A = 85$ °C		-	-	500	
Diode capacitance $f = 1$ MHz	C_T				pF
$V_R = 1$ V		7.8	8.8	9.8	
$_R = 28$ V		0.85	1.02	1.2	
Capacitance ratio $f = 1$ MHz, $V_R = 1$ V/28 V	C_{T1}/C_{T28}	7.8	8.6	9.5	-
Series resistance $f = 100$ MHz, $C_T = 9$ pF	r_s	-	1	-	Ω
Case capacitance $f = 1$ MHz	C_C	-	0.1	-	pF
Capacitance matching $f = 1$ MHz, $V_R = 0.5...28$ V	$\Delta C_T/C_T$	-	-	3	%
Series inductance	L_s	-	2.8		nH

Diode capacitance $C_T = f\ (V_R)$
$f = 1$ MHz



Preliminary data

- For FM radio tuners with extended frequency band
- High tuning ratio at low supply voltage (car radio)
- Monolithic chip (common cathode) for perfect dual diode tracking
- Coded capacitance groups and group matching available



Type	BB 814
Ordering code	Q62702-B404
Marking	SH

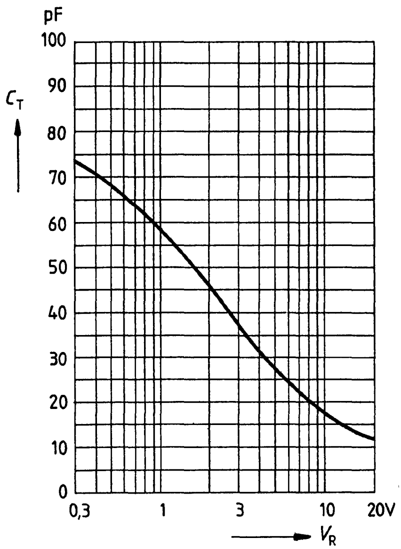
Maximum ratings per diode

Reverse voltage	V_R	18	V
Peak reverse voltage	V_{RM}	20	V
Forward current $T_A \leq 60°C$	I_F	50	mA
Operating temperature range	T_{op}	−55...+125	°C
Storage temperature range	T_{stg}	−55...+150	°C

Characteristics per diode ($T_A = 25\,°C$)

		min	typ	max	
Reverse current	I_R				
$V_R = 16$ V		–	–	20	nA
16 V, $T_A = 60\,°C$		–	–	200	nA
Diode capacitance, $f = 1$ MHz[1]	C_T				
$V_R =$ 2 V		43	44.75	46.5	pF
8 V		18.2	20.8	24	pF
Capacitance ratio $V_R = 2$ V, 8 V; $f = 1$ MHz	$\frac{C_T2}{C_T8}$	1.95	2.15	2.35	–
Capacitance matching $V_R = 2$ V, 8 V	$\frac{\Delta C_T}{C_T}$	–	–	3	%

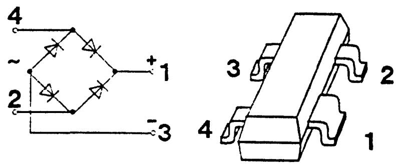
Diode capacitance $C_T = f(V_R)$
per diode, $f = 1$ MHz



[1] Capacitance groups, coded 1, 2

Code	$C_{T\,(2\,V)}$	$C_{T\,(8\,V)}$
1	43 -45	18.2-23.2 pF
2	44.5-46.5	18.8-24 pF

- Bridge configuration
- High-speed switch diode chip



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BGX 50 A	U1	Q62702–G35	Q62702–G38	SOT 143

Maximum ratings per diode

Parameter	Symbol	Ratings	Unit
Surge reverse voltage	V_{RS}	50	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	140	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

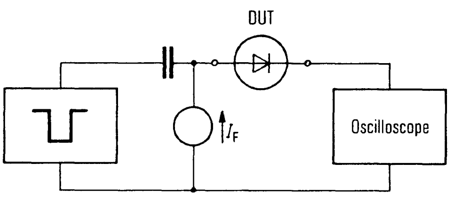
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Forward voltage (two diodes connected in series) $I_F = 100$ mA	V_F	–	–	2,6	V
Reverse current $V_R = 50$ V $V_R = 50$ V, $T_A = 150\,°C$	I_R	 – –	 – –	 0,2 100	 μA μA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$, $f = 1$ MHz	C_D	–	–	1,5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\,\Omega$ measured at $I_R = 1$ mA	t_{rr}	–	–	6	ns

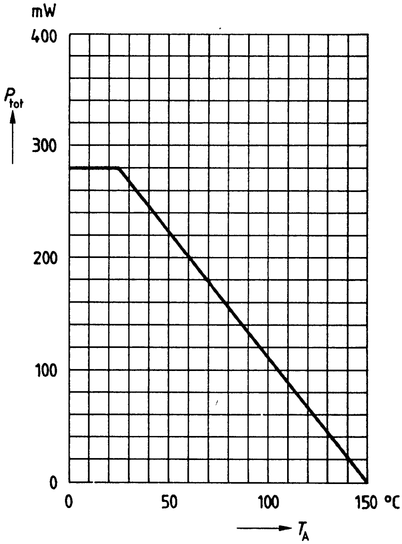
Test circuit for reverse recovery time



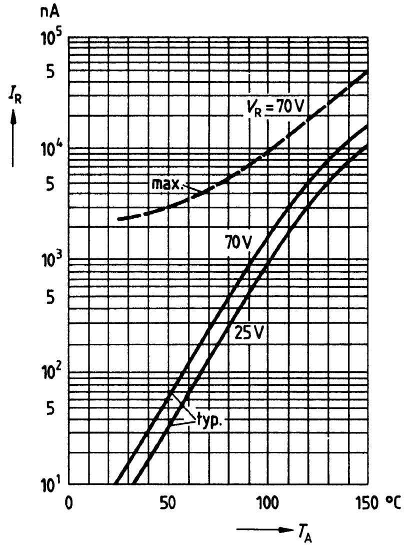
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\,\Omega$

Oscilloscope: $R = 50\,\Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

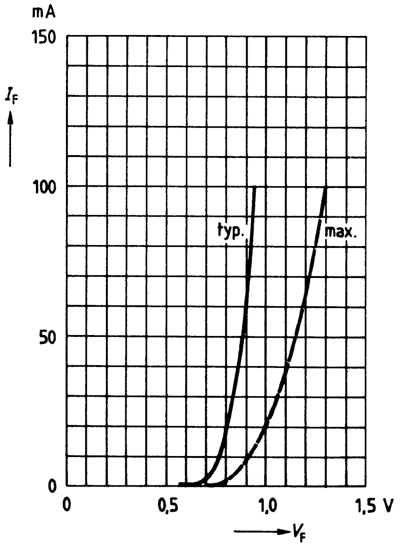
Total power dissipation $P_{tot} = f(T_A)$



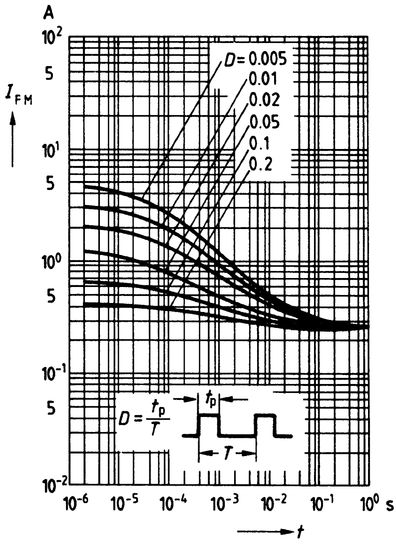
Reverse current $I_R = f(T_A)$



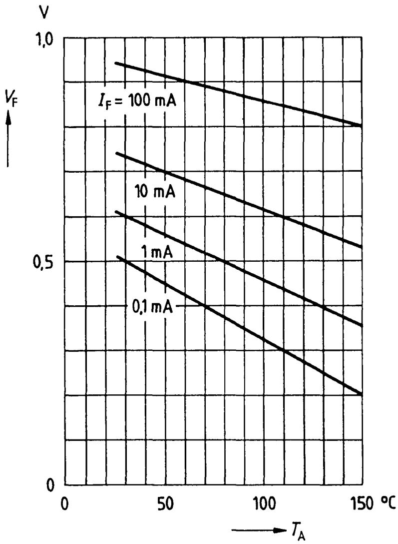
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



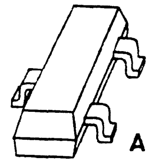
Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$



Forward voltage $V_F = f(T_A)$



- For high-speed switching applications



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBD 914	S5D	Q68000–A6418	Q68000–A625	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	100	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4,5	A
Total power dissipation $T_A = 25\,°C$	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

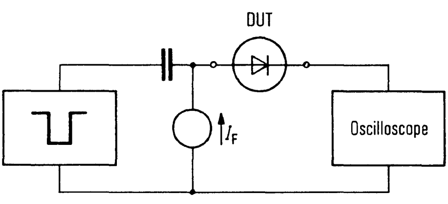
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	100	–	–	V
Forward voltage $I_F = 10$ mA	V_F	–	–	1	V
Reverse current	I_R				
$V_R = 20$ V		–	–	25	nA
$V_R = 75$ V		–	–	5	µA
$V_R = 20$ V; $T_A = 150\,°C$		–	–	30	µA
$V_R = 75$ V; $T_A = 150\,°C$		–	–	50	µA

AC characteristics	Symbol	min	typ	max	Unit
Diode capacitance $V_R = 0$, $f = 1$ MHz	C_D	–	–	2	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA $V_R = 1$ V, $R_L = 100\ \Omega$ measured at $I_R = 1$ mA	t_{rr}	–	–	4	ns

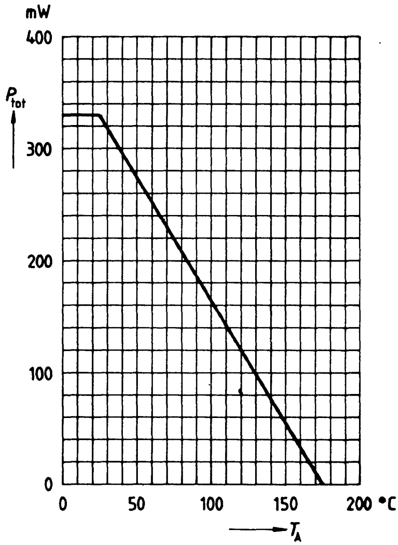
Test circuit for reverse recovery time



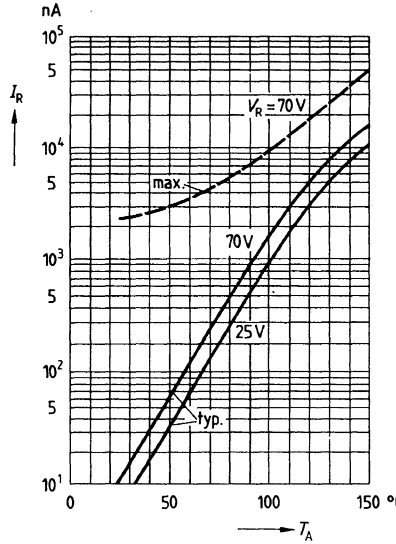
Pulse generator: $t_p = 100$ ns, D = 0,05
$t_r = 0{,}6$ ns, $R_i = 50\ \Omega$

Oscilloscope: $R = 50\ \Omega$
$t_r = 0{,}35$ ns
$C \leq 1$ pF

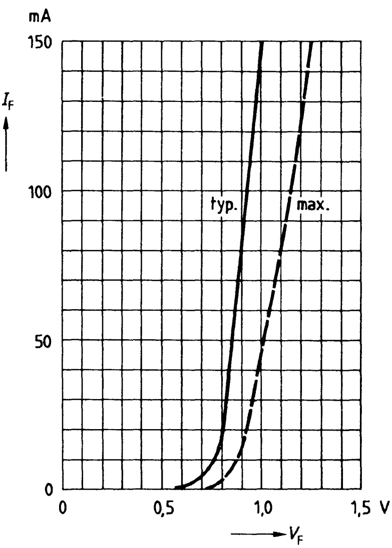
Total power dissipation $P_{tot} = f(T_A)$



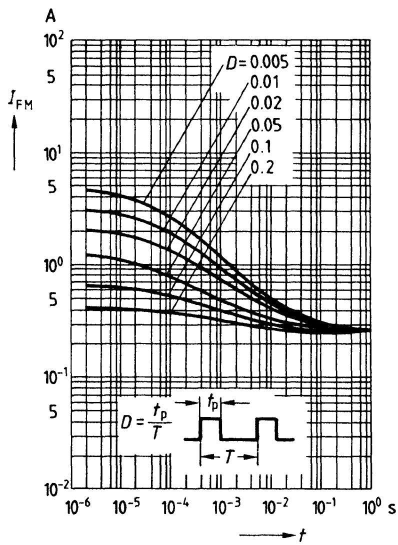
Reverse current $I_R = f(T_A)$



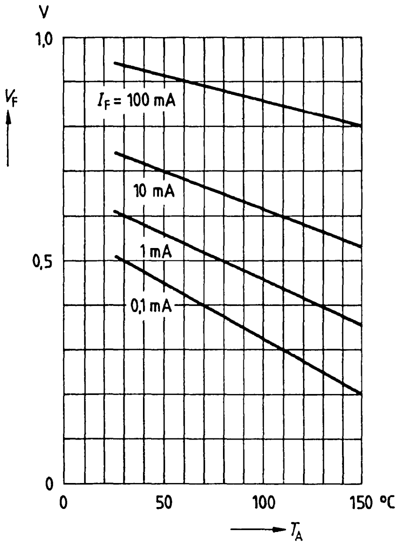
Forward current $I_F = f(V_F)$
$T_A = 25\,°C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\,°C$

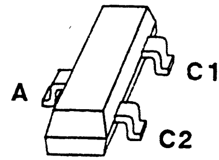


Forward voltage $V_F = f(T_A)$



Silicon Switching Diode Array

- For high-speed switching applications
- Common anode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBD 2835	SA3	upon request	upon request	SOT 23
SMBD 2836	SA2	upon request	upon request	SOT 23

Maximum ratings

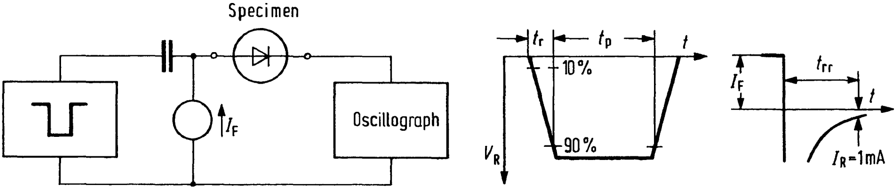
Parameter	Symbol	SMBD 2835	SMBD 2836	Unit
Reverse voltage	V_R	30	50	V
Peak reverse voltage	V_{RM}	75	75	V
Forward current	I_F	250		mA
Peak forward current	I_{FM}	250		mA
Surge forward current $t = 1\ \mu s$	I_{FS}	4.5		A
Total power dissipation $T_A = 25\ °C$	P_{tot}	330		mW
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 65 ... +150		°C
Thermal resistance				
junction - ambient package mounted on alumina 15 mm x 16.7 mm x 0.7 mm	R_{thJA}	≤ 450		K/W

Characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min.	typ.	max.	Unit
Breakdown voltage		$V_{(BR)}$				
$I_{(BR)}$ = 100 µA	SMBD 2835		75	–	–	V
	SMBD 2836		75	–	–	V
Forward voltage		V_F				
I_F = 10 mA			–	–	1000	mV
I_F = 50 mA			–	–	1000	mV
I_F = 100 mA			–	–	1200	mV
Reverse current		I_R				
V_R = 30 V	SMBD 2835		–	–	100	nA
V_R = 50 V	SMBD 2836		–	–	100	nA

AC characteristics	Symbol	min.	typ.	max.	Unit
Diode capacitance V_R = 0, f = 1 MHz	C_D	–	–	4	pF
Reverse recovery time I_F = 10 mA, I_R = 10 mA, R_L = 100 Ω measured at I_R = 1 mA	t_{rr}	–	–	6	ns

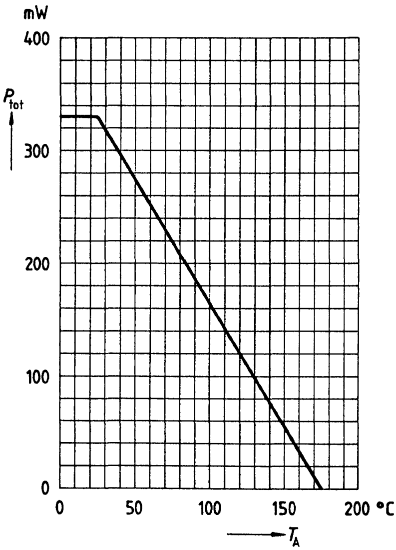
Test circuit for reverse recovery time



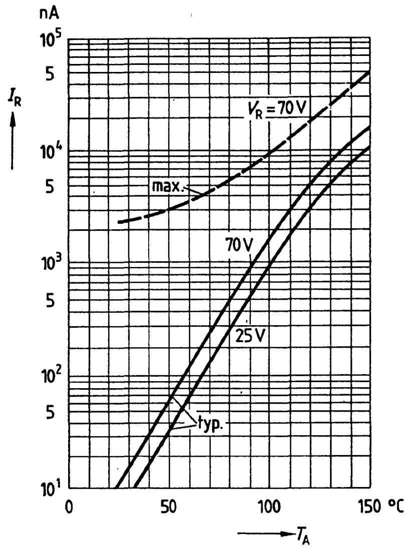
Pulse generator:
t_p = 100 ns, D = 0.05
t_r = 0.6 ns, R_i = 50 Ω

Oscillograph: R = 50 Ω
t_r = 0.35 ns
C ≤ 1 pF

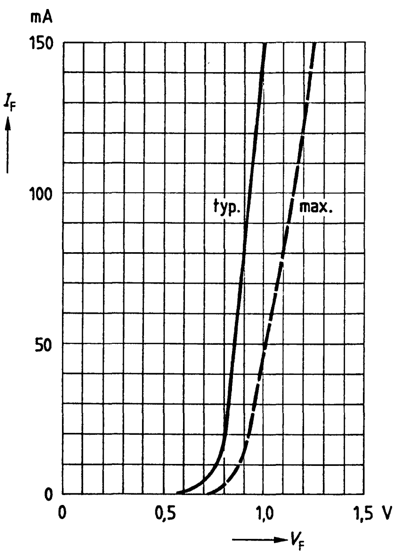
Total power dissipation $P_{tot} = f(T_A)$



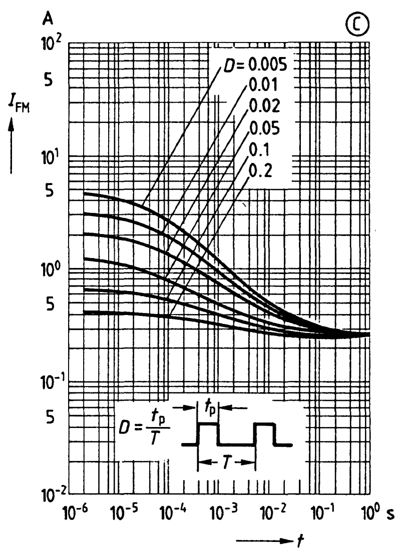
Reverse current $I_R = f(T_A)$



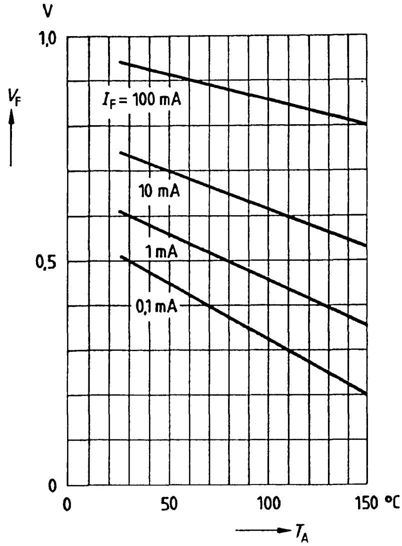
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



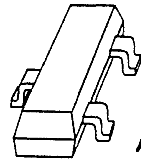
Forward voltage $V_F = f(T_A)$



Silicon Switching Diode Array

SMBD 2837/38

- For high-speed switching applications
- Common cathode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBD 2837	SA5	upon request	upon request	SOT 23
SMBD 2838	SA4	upon request	upon request	SOT 23

Maximum ratings

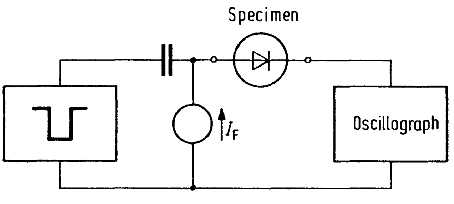
Parameter	Symbol	SMBD 2837	SMBD 2838	Unit
Reverse voltage	V_R	30	50	V
Peak reverse voltage	V_{RM}	75	75	V
Forward current	I_F	250		mA
Peak forward current	I_{FM}	250		mA
Surge forward current $t = 1$ µs	I_{FS}	4.5		A
Total power dissipation $T_A = 25$ °C	P_{tot}	330		mW
Junction temperature	T_j	175		°C
Storage temperature range	T_{stg}	– 65 ... +150		°C
Thermal resistance				
junction - ambient package mounted on alumina 15 mm x 16.7 mm x 0.7 mm	R_{thJA}	$\leq$ 450		K/W

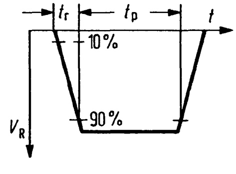
Characteristics
at $T_A = 25\ °C$, unless otherwise specified

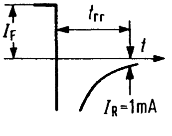
DC characteristics		Symbol	min.	typ.	max.	Unit
Breakdown voltage		$V_{(BR)}$				
$I_{(BR)} = 100\ \mu A$	SMBD 2837		75	–	–	V
	SMBD 2838		75	–	–	V
Forward voltage		V_F				
$I_F = 10\ mA$			–	–	1000	mV
$I_F = 50\ mA$			–	–	1000	mV
$I_F = 100\ mA$			–	–	1200	mV
Reverse current		I_R				
$V_R = 30\ V$	SMBD 2835		–	–	100	nA
$V_R = 50\ V$	SMBD 2836		–	–	100	nA

AC characteristics	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$, $f = 1\ MHz$	C_D	–	–	4	pF
Reverse recovery time $I_F = 10\ mA$, $I_R = 10\ mA$, $R_L = 100\ \Omega$ measured at $I_R = 1\ mA$	t_{rr}	–	–	6	ns

Test circuit for reverse recovery time



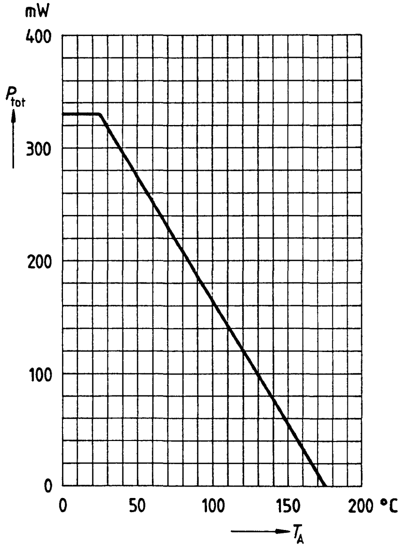




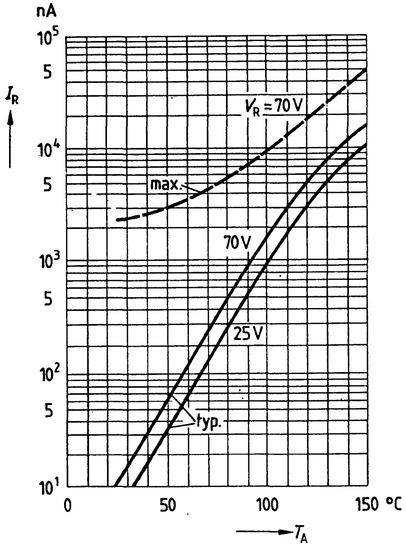
Pulse generator:
$t_p = 100\ ns$, $D = 0.05$
$t_r = 0.6\ ns$, $R_i = 50\ \Omega$

Oscillograph: $R = 50\ \Omega$
$t_r = 0.35\ ns$
$C \leq 1\ pF$

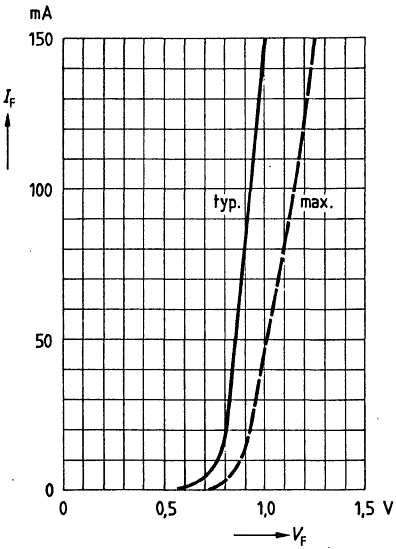
Total power dissipation $P_{tot} = f(T_A)$



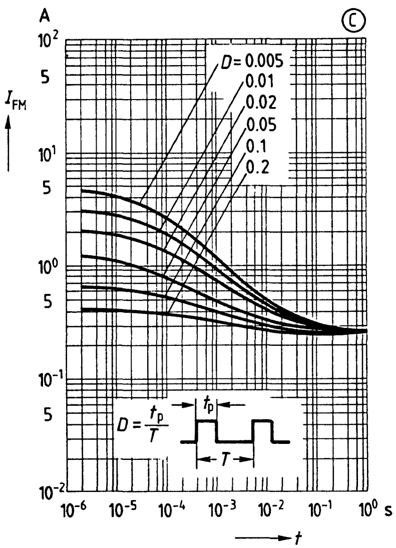
Reverse current $I_R = f(T_A)$



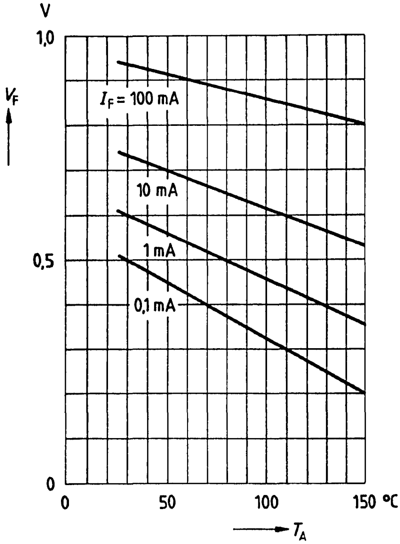
Forward current $I_F = f(V_F)$
$T_A = 25\ °C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\ °C$

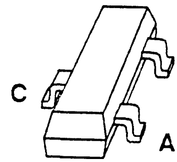


Forward voltage $V_F = f(T_A)$



Silicon Switching Diode — SMBD 6050

- For high-speed switching applications



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBD 6050	S5A	upon request	upon request	SOT 23

Maximum ratings

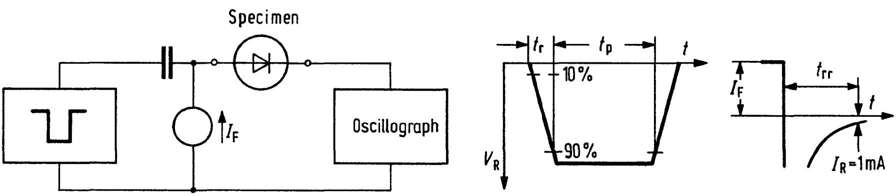
Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4.5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 65 ... +150	°C
Thermal resistance			
junction - ambient package mounted on alumina 15 mm x 16.7 mm x 0.7 mm	R_{thJA}	≤ 450	K/W

Characteristics
at $T_A = 25$ °C, unless otherwise specified

DC characteristics	Symbol	min.	typ.	max.	Unit
Breakdown voltage $I_{(BR)} = 100$ µA	$V_{(BR)}$	70	–	–	V
Forward voltage $I_F = 1$ mA $I_F = 100$ mA	V_F	 550 850	 – –	 700 1100	 mV mV
Reverse current $V_R = 50$ V	I_R	–	–	100	nA

AC characteristics	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$, $f = 1$ MHz	C_D	–	–	2.5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100$ Ω measured at $I_R = 1$ mA	t_{rr}	–	–	10	ns

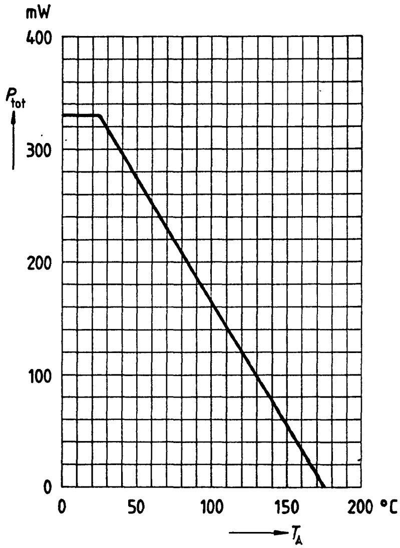
Test circuit for reverse recovery time



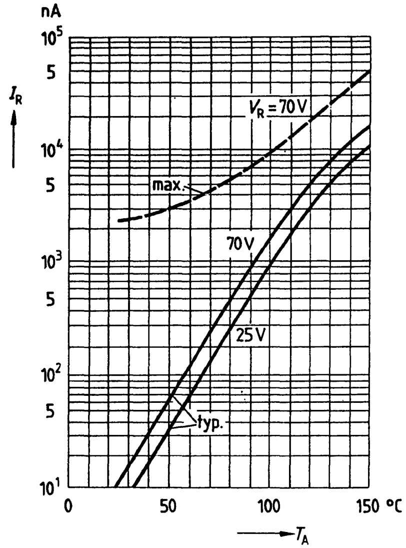
Pulse generator:
$t_p = 100$ ns, $D = 0.05$
$t_r = 0.6$ ns, $R_i = 50$ Ω

Oscillograph: $R = 50$ Ω
$t_r = 0.35$ ns
$C \leq 1$ pF

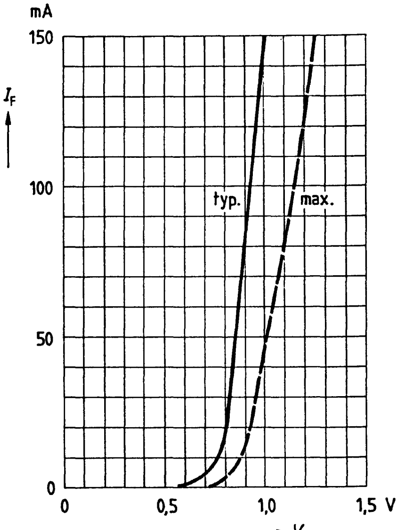
Total power dissipation $P_{tot} = f(T_A)$



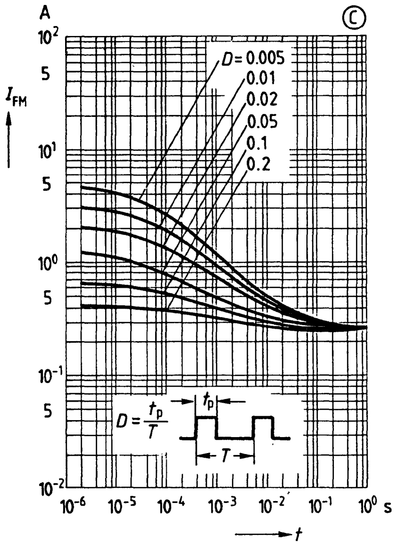
Reverse current $I_R = f(T_A)$



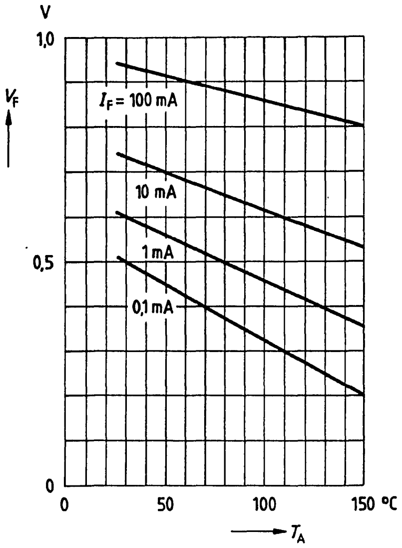
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



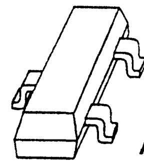
Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



Forward voltage $V_F = f(T_A)$



- For high-speed switching applications
- Common cathode



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBD 6100	S5B	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	70	V
Peak reverse voltage	V_{RM}	70	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4.5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 65 ... +150	°C
Thermal resistance			
junction - ambient package mounted on alumina 15 mm x 16.7 mm x 0.7 mm	R_{thJA}	≤ 450	K/W

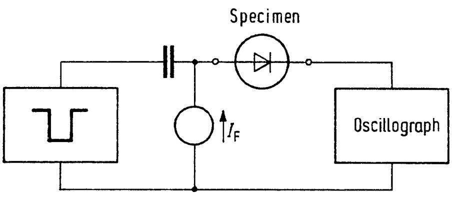
Characteristics

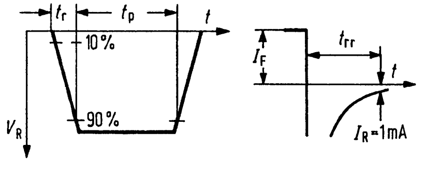
at $T_A = 25\ °C$, unless otherwise specified

DC characteristics	Symbol	min.	typ.	max.	Unit
Breakdown voltage $I_{(BR)} = 100\ \mu A$	$V_{(BR)}$	70	–	–	V
Forward voltage $I_F = 1$ mA $I_F = 100$ mA	V_F	 550 850	 – –	 700 1100	 mV mV
Reverse current $V_R = 50$ V	I_R	–	–	100	nA

AC characteristics	Symbol	min.	typ.	max.	Unit
Diode capacitance $V_R = 0$, $f = 1$ MHz	C_D	–	–	2.5	pF
Reverse recovery time $I_F = 10$ mA, $I_R = 10$ mA, $R_L = 100\ \Omega$ measured at $I_R = 1$ mA	t_{rr}	–	–	15	ns

Test circuit for reverse recovery time

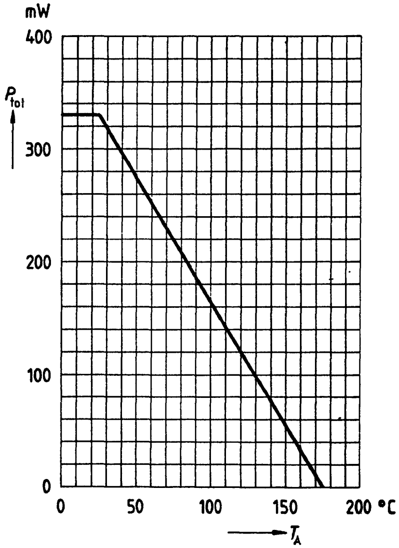




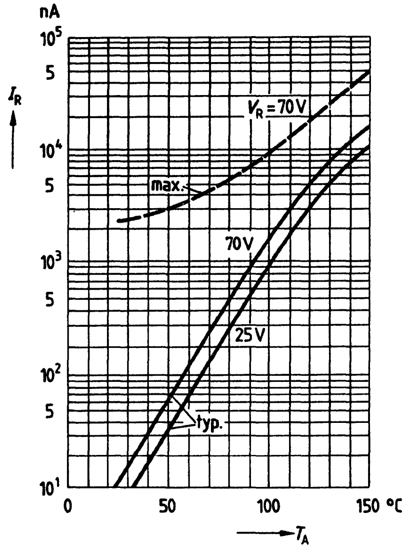
Pulse generator:
$t_p = 100$ ns, $D = 0.05$
$t_r = 0.6$ ns, $R_i = 50\ \Omega$

Oscillograph: $R = 50\ \Omega$
$t_r = 0.35$ ns
$C \leq 1$ pF

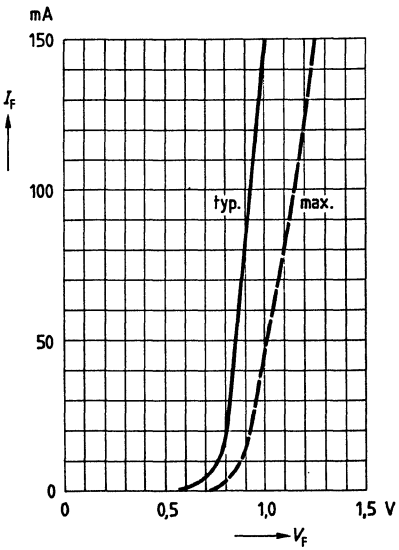
Total power dissipation $P_{tot} = f(T_A)$



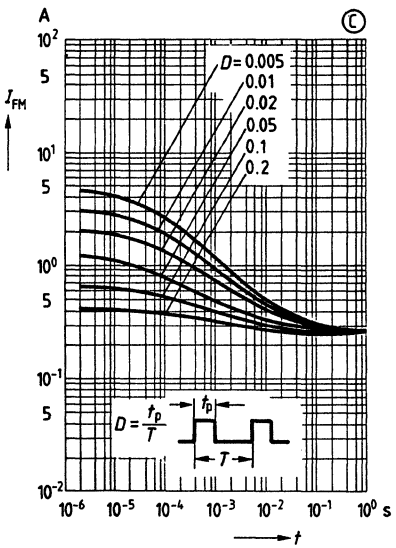
Reverse current $I_R = f(T_A)$



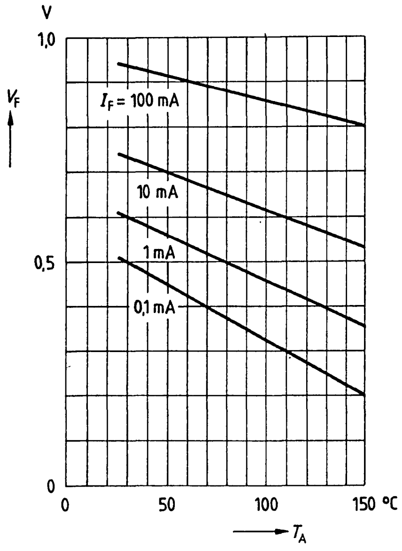
Forward current $I_F = f(V_F)$
$T_A = 25\ °C$



Peak forward current $I_{FM} = f(t)$
$T_A = 25\ °C$

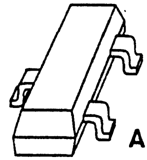


Forward voltage $V_F = f(T_A)$



Silicon Switching Diode Array — SMBD 7000

- For high-speed switching applications
- Connected in series



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBD 7000	S5C	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Reverse voltage	V_R	100	V
Peak reverse voltage	V_{RM}	100	V
Forward current	I_F	250	mA
Peak forward current	I_{FM}	250	mA
Surge forward current $t = 1$ µs	I_{FS}	4.5	A
Total power dissipation $T_A = 25$ °C	P_{tot}	330	mW
Junction temperature	T_j	175	°C
Storage temperature range	T_{stg}	– 65 ... +150	°C
Thermal resistance			
junction - ambient package mounted on alumina 15 mm x 16.7 mm x 0.7 mm	R_{thJA}	≤ 450	K/W

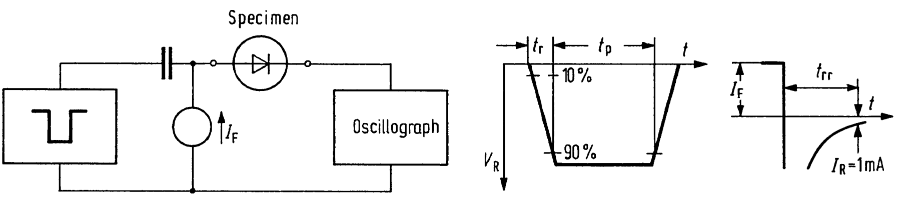
Characteristics

at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min.	typ.	max.	Unit
Breakdown voltage	$V_{(BR)}$	100	–	–	V
Forward voltage	V_F				
I_F = 1 mA		550	–	700	mV
I_F = 10 mA		670	–	820	mV
I_F = 100 mA		750	–	1100	mV
Reverse current	I_R				
V_R = 50 V		–	–	300	nA
V_R = 100 V		–	–	500	nA
V_R = 50 V, T_A = 125 °C		–	–	100	µA

AC characteristics	Symbol	min.	typ.	max.	Unit
Diode capacitance V_R = 0, f = 1 MHz	C_D	–	–	2	pF
Reverse recovery time I_F = 10 mA, I_R = 10 mA, R_L = 100 Ω	t_{rr}	–	–	15	ns

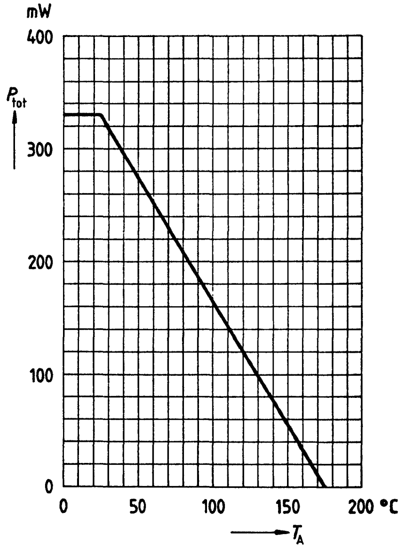
Test circuit for reverse recovery time



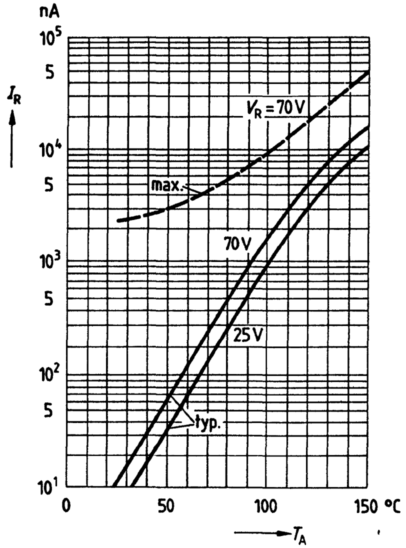
Pulse generator:
t_p = 100 ns, D = 0.05
t_r = 0.6 ns, R_i = 50 Ω

Oscillograph: R = 50 Ω
t_r = 0.35 ns
C ≤ 1 pF

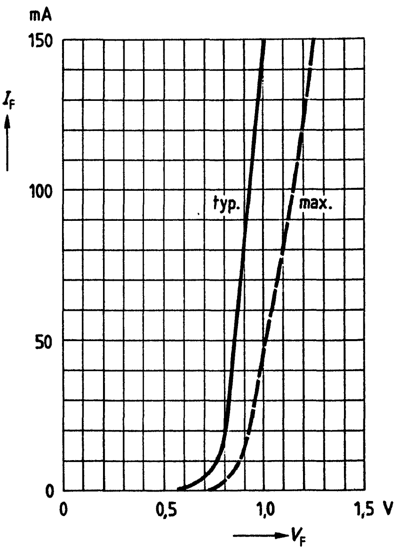
Total power dissipation $P_{tot} = f(T_A)$



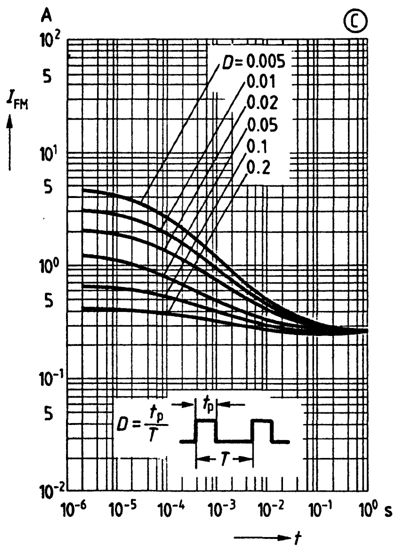
Reverse current $I_R = f(T_A)$



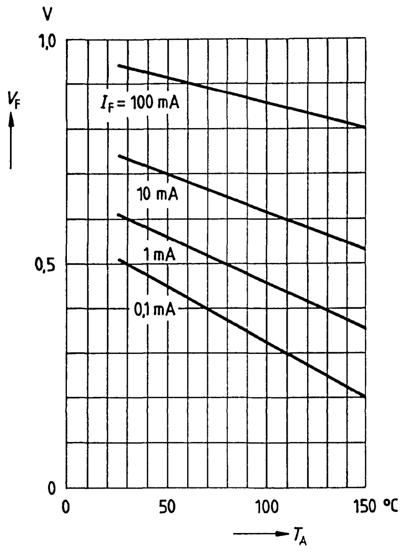
Forward current $I_F = f(V_F)$
$T_A = 25$ °C



Peak forward current $I_{FM} = f(t)$
$T_A = 25$ °C



Forward voltage $V_F = f(T_A)$

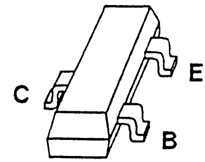


Transistors

PNP Silicon AF Transistors

BC 807
BC 808

- For general AF applications
- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BC 817, BC 818 (NPN)



Type	Marking	Type	Marking	Ordering code	Package
S BC 807–16	5A	S BC 808–16	5E	Refer to index	SOT 23
S BC 807–25	5B	S BC 808–25	5F		
S BC 807–40	5C	S BC 808–40	5G		

Maximum ratings

Parameter	Symbol	BC 807	BC 808	Unit
Collector-emitter voltage	V_{CEO}	45	25	V
Collector-base voltage	V_{CBO}	50	30	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

S Preferred type

Electrical characteristics

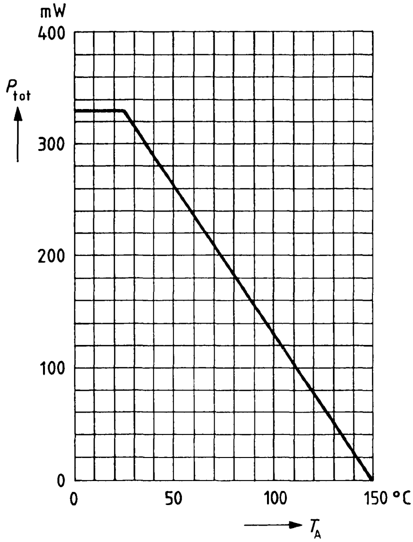
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BC 807		45	–	–	V
BC 808		25	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA	$V_{(BR)\,CBO}$				
BC 807		50	–	–	V
BC 808		30	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 25$ V		–	–	100	nA
$V_{CB} = 25$ V, $T_A = 150\,°C$		–	–	5	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	100	nA
DC current gain[1]) $I_C = 100$ mA, $V_{CE} = 1$ V	h_{FE}				
BC 807–16, BC 808–16		100	160	250	–
BC 807–25, BC 808–25		160	250	400	–
BC 807–40, BC 808–40		250	350	630	–
$I_C = 300$ mA, $V_{CE} = 1$ V					
BC 807–16, BC 808–16		60	–	–	–
BC 807–25, BC 808–25		100	–	–	–
BC 807–40, BC 808–40		170	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,7	V
Base-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{BEsat}	–	–	2	V

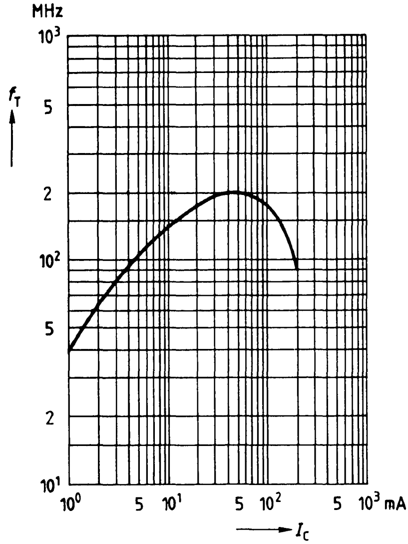
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	10	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

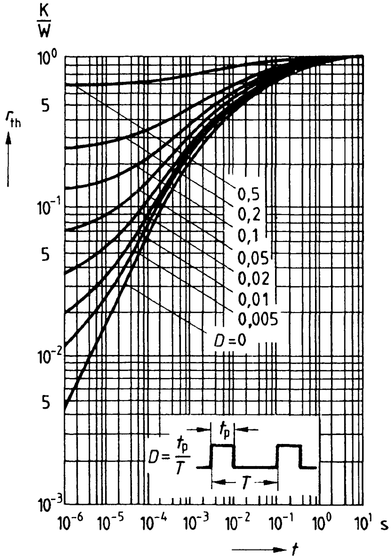
Total power dissipation $P_{tot} = f(T_A)$



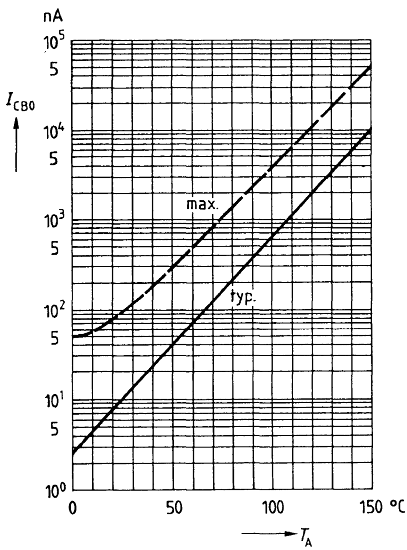
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



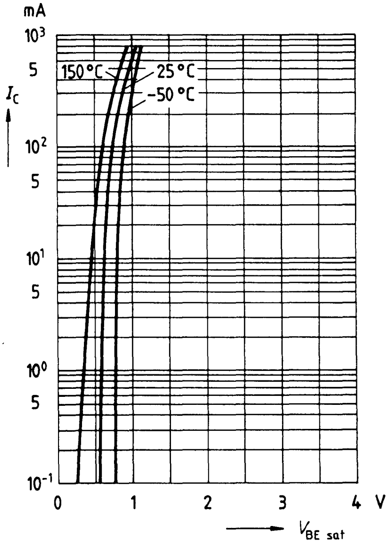
Pulse handling capability $r_{th} = f(t)$
(standardized)



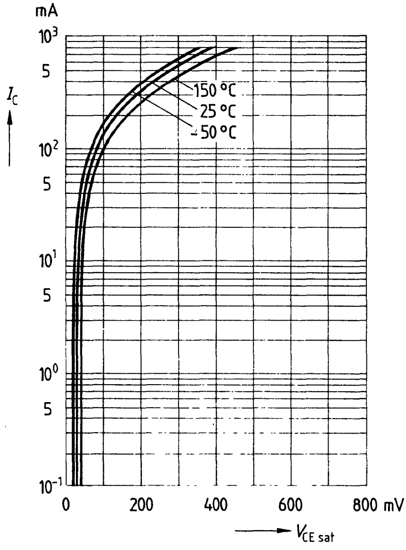
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB0} = 60$ V



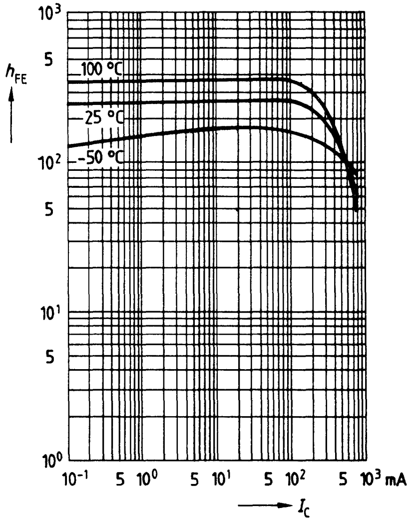
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



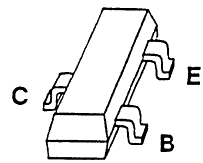
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN Silicon AF Transistors

BC 817
BC 818

- For general AF applications
- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BC 807, BC 808 (PNP)



Type	Marking	Type	Marking	Ordering code	Package
Ⓢ BC 817–16	6A	Ⓢ BC 818–16	6E	Refer to index	SOT 23
Ⓢ BC 817–25	6B	Ⓢ BC 818–25	6F		
Ⓢ BC 817–40	6C	Ⓢ BC 818–40	6G		

Maximum ratings

Parameter	Symbol	BC 817	BC 818	Unit
Collector-emitter voltage	V_{CEO}	45	25	V
Collector-base voltage	V_{CBO}	50	30	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

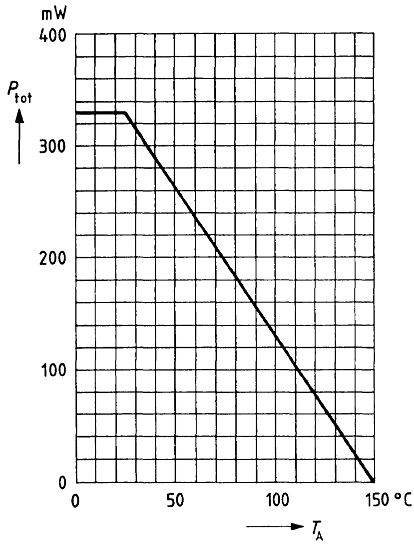
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CE0}$				
BC 817		45	–	–	V
BC 818		25	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$	$V_{(BR)\,CB0}$				
BC 817		50	–	–	V
BC 818		30	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current	I_{CB0}				
$V_{CB} = 25$ V		–	–	100	nA
$V_{CB} = 25$ V, $T_A = 150\,°C$		–	–	5	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EB0}	–	–	100	nA
DC current gain[1] $I_C = 100$ mA, $V_{CE} = 1$ V	h_{FE}				
BC 817–16, BC 818–16		100	160	250	–
BC 817–25, BC 818–25		160	250	400	–
BC 817–40, BC 818–40		250	350	630	–
$I_C = 300$ mA, $V_{CE} = 1$ V					
BC 817–16, BC 818–16		60	–	–	–
BC 817–25, BC 818–25		100	–	–	–
BC 817–40, BC 818–40		170	–	–	–
Collector-emitter saturation voltage[1] $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,7	V
Base-emitter saturation voltage[1] $I_C = 500$ mA, $I_B = 50$ mA	V_{BEsat}	–	–	2	V

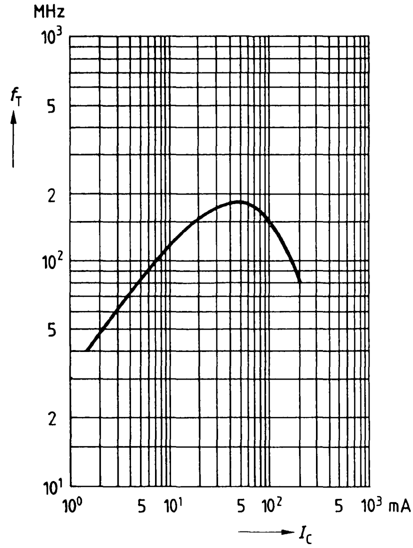
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

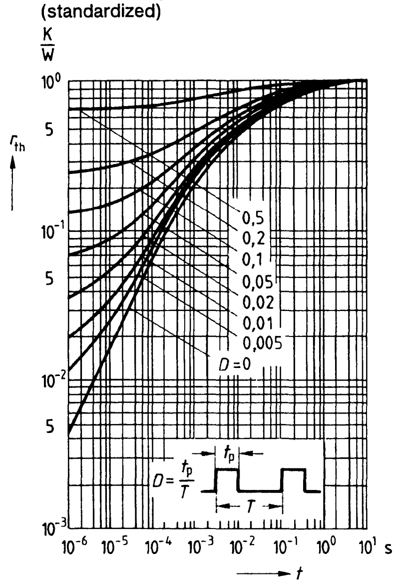
Total power dissipation $P_{tot} = f(T_A)$



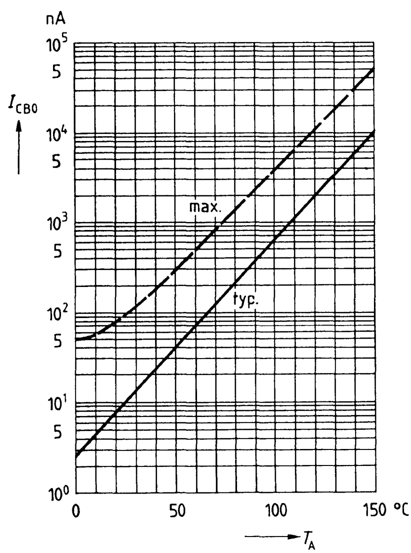
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



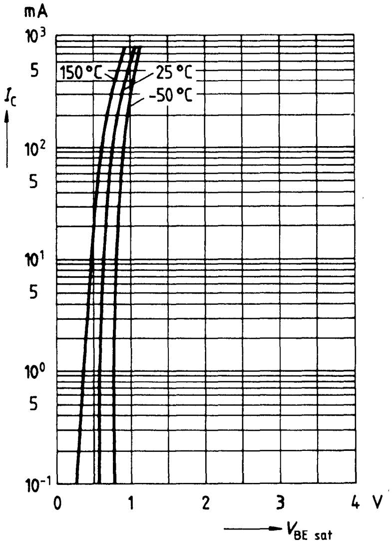
Pulse handling capability $r_{th} = f(t)$
(standardized)



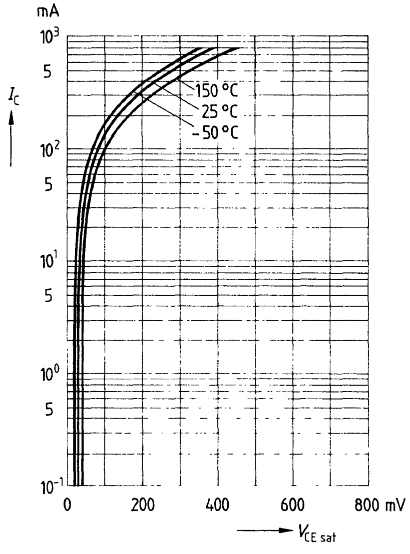
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB0} = 60$ V



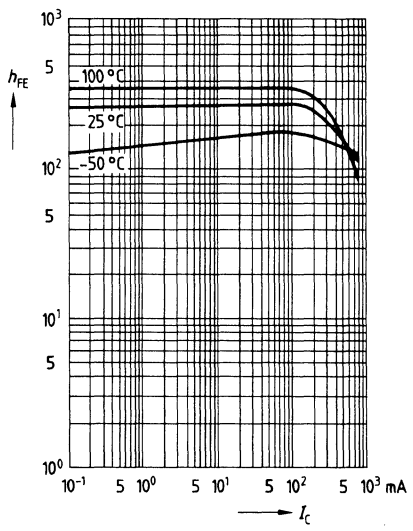
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



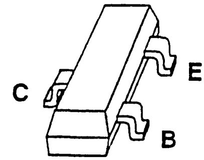
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN Silicon AF Transistors

BC 846 ... BC 850

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BC 856, BC 857, BC 859, BC 860 (PNP)



Type	Marking	Type	Marking	Ordering code	Package
S BC 846 A	1A	S BC 848 B	1K	Refer to index	SOT 23
S BC 846 B	1B	S BC 848 C	1L		
S BC 847 A	1E	BC 849 B	2B		
S BC 847 B	1F	BC 849 C	2C		
S BC 847 C	1G	BC 850 B	2F		
S BC 848 A	1J	BC 850 C	2G		

Maximum ratings

Parameter	Symbol	BC 846	BC 847, BC 850	BC 848, BC 849	Unit
Collector-emitter voltage	V_{CEO}	65	45	30	V
Collector-base voltage	V_{CBO}	80	50	30	V
Collector-emitter voltage	V_{CES}	80	50	30	V
Emitter-base voltage	V_{EBO}	6	6	5	V
Collector current	I_C		100		mA
Peak collector current	I_{CM}		200		mA
Peak base current	I_{BM}		200		mA
Peak emitter current	I_{EM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		330		mW
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375		K/W

S Preferred type

Electrical characteristics

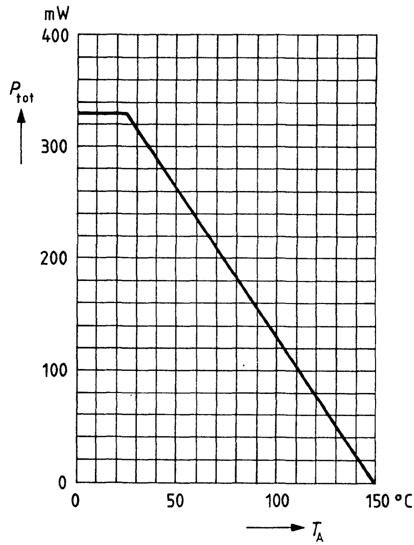
at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage	$V_{(BR)\,CEO}$				
I_C = 10 mA					
BC 846		65	–	–	V
BC 847, BC 850		45	–	–	V
BC 848, BC 849		30	–	–	V
Collector-base breakdown voltage	$V_{(BR)\,CBO}$				
I_C = 10 µA					
BC 846		80	–	–	V
BC 847, BC 850		50	–	–	V
BC 848, BC 849		30	–	–	V
Collector-emitter breakdown voltage	$V_{(BR)\,CES}$				
I_C = 10 µA, V_{BE} = 0					
BC 846		80	–	–	V
BC 847, BC 850		50	–	–	V
BC 848, BC 849		30	–	–	V
Emitter-base breakdown voltage	$V_{(BR)\,EBO}$				
I_E = 1 µA					
BC 846, BC 847		6	–	–	V
BC 848, BC 849, BC 850		5	–	–	V
Collector cutoff current	I_{CBO}				
V_{CB} = 30 V		–	–	15	nA
V_{CB} = 30 V, T_A = 150 °C		–	–	5	µA
DC current gain	h_{FE}				
I_C = 10 µA, V_{CE} = 5 V					
BC 846 A, BC 847 A, BC 848 A		–	140	–	–
BC 846 B ··· BC 850 B		–	250	–	–
BC 847 C, BC 848 C, BC 849 C, BC 850 C		–	480	–	–
I_C = 2 mA, V_{CE} = 5 V					
BC 846 A, BC 847 A, BC 848 A		110	180	220	–
BC 846 B ··· BC 850 B		200	290	450	–
BC 847 C, BC 848 C, BC 849 C, BC 850 C		420	520	800	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
I_C = 10 mA, I_B = 0,5 mA		–	90	250	mV
I_C = 100 mA, I_B = 5 mA		–	200	600	mV
Base-emitter saturation voltage[1])	V_{BEsat}				
I_C = 10 mA, I_B = 0,5 mA		–	700	–	mV
I_C = 100 mA, I_B = 5 mA		–	900	–	mV
Base-emitter voltage	$V_{BE\,(on)}$				
I_C = 2 mA, V_{CE} = 5 V		580	660	700	mV
I_C = 10 mA, V_{CE} = 5 V		–	–	770	mV

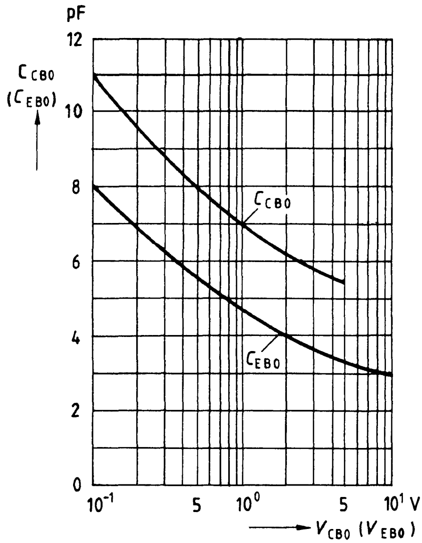
[1]) Pulse test: $t \leq 300$ µs, D = 2%.

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	250	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{11e}				
BC 846 A ... BC 848 A		–	2,7	–	kΩ
BC 846 B ... BC 850 B		–	4,5	–	kΩ
BC 847 C ... BC 850 C		–	8,7	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BC 846 A ... BC 848 A		–	1,5	–	10^{-4}
BC 846 B ... BC 850 B		–	2,0	–	10^{-4}
BC 847 C ... BC 850 C		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BC 846 A ... BC 848 A		–	200	–	–
BC 846 B ... BC 850 B		–	330	–	–
BC 847 C ... BC 850 C		–	600	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BC 846 A ... BC 848 A		–	18	–	µS
BC 846 B ... BC 850 B		–	30	–	µS
BC 847 C ... BC 850 C		–	60	–	µS
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ	F				
f = 30 Hz ... 15 kHz BC 849		–	1,4	4	dB
BC 850		–	1,4	3	dB
f = 1 kHz, Δf = 200 Hz BC 849		–	1,2	4	dB
BC 850		–	1,0	4	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 10 Hz ... 50 Hz BC 850	V_n	–	–	0,135	µV

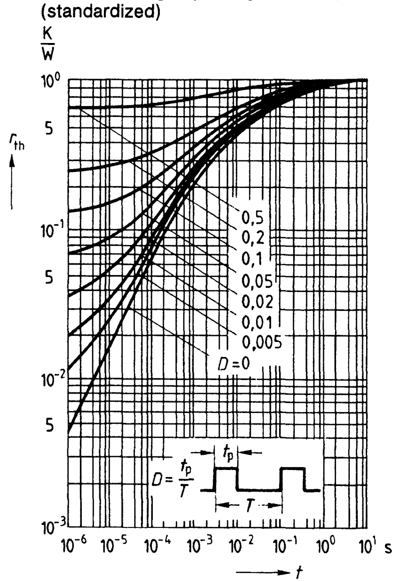
Total power dissipation $P_{tot} = f(T_A)$



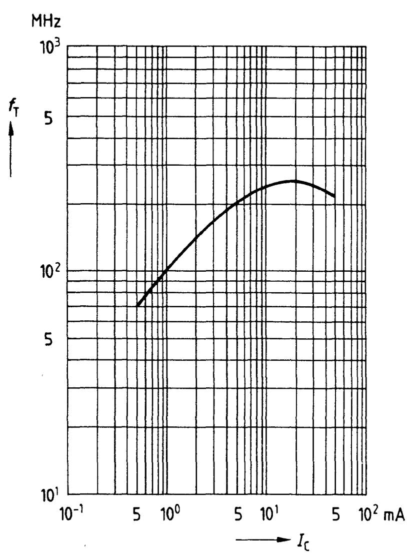
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



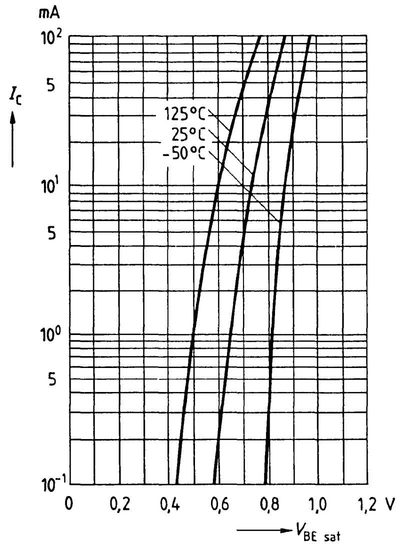
Pulse handling capability $r_{th} = f(t)$
(standardized)



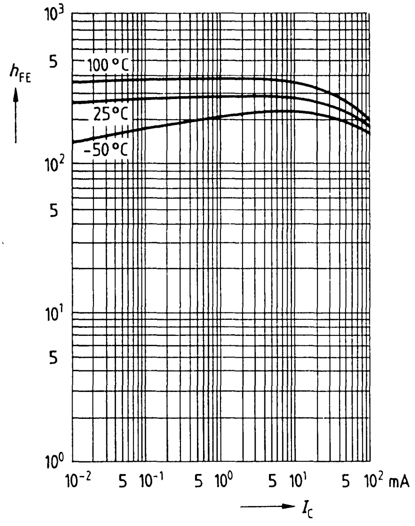
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



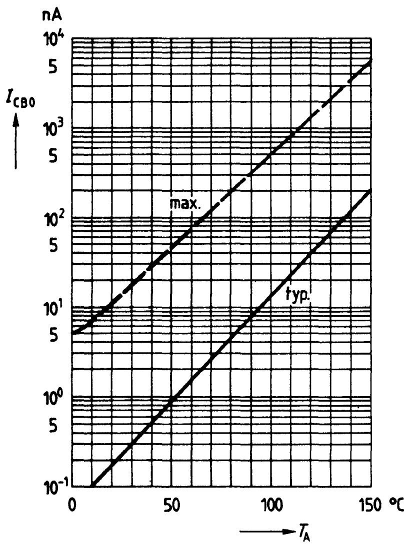
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 20$



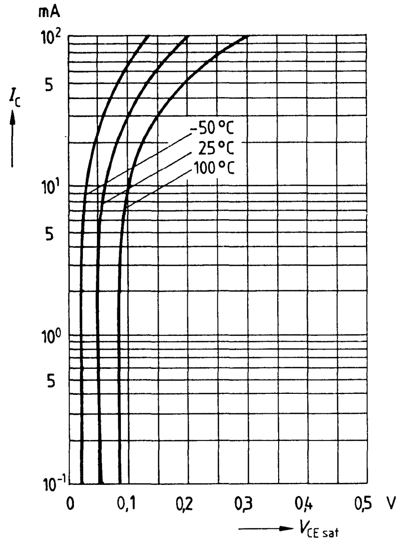
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



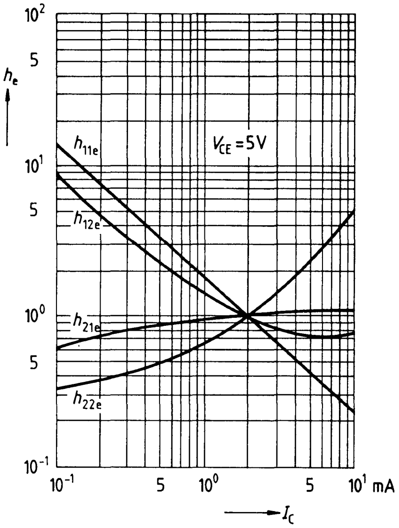
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



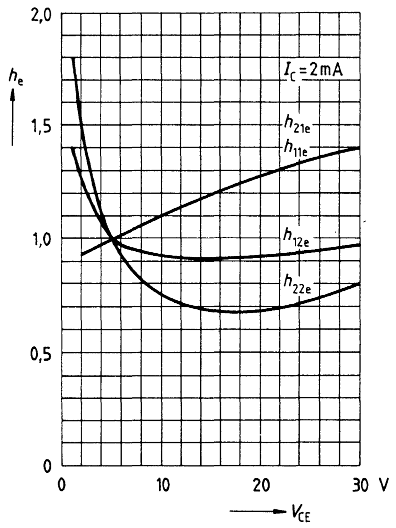
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 20$



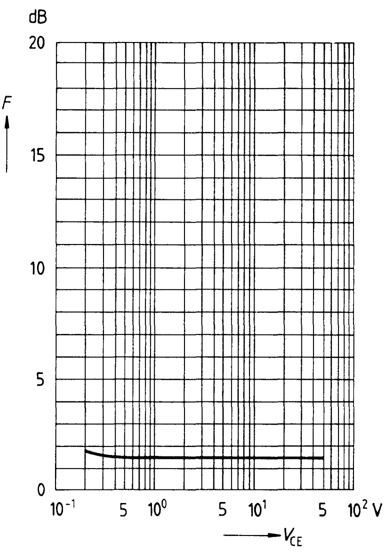
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



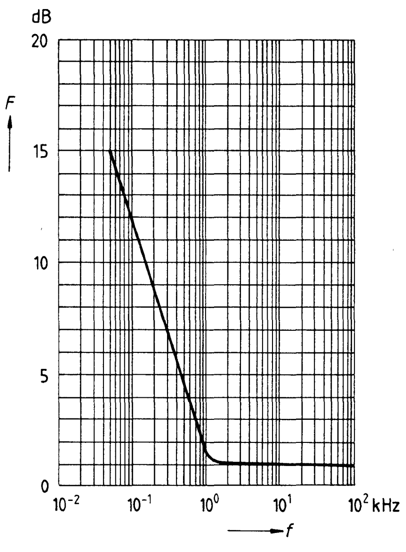
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



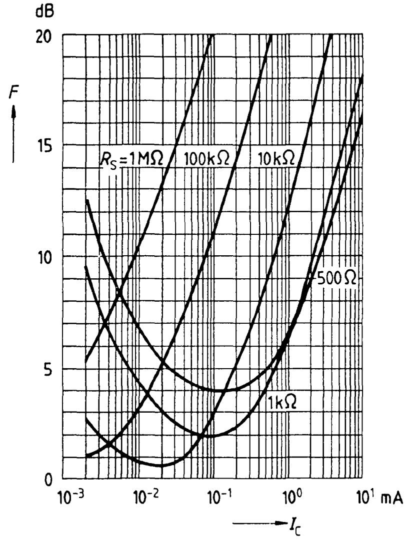
Noise figure $F = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ, $f = 1$ kHz



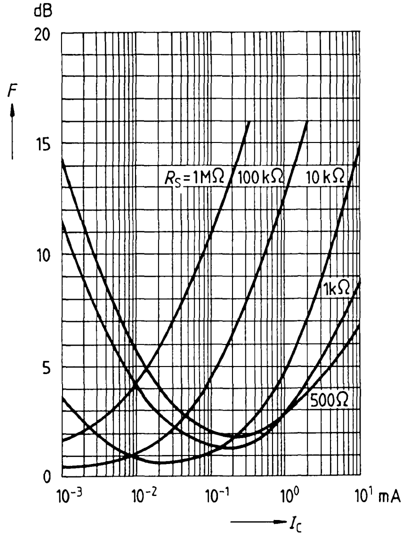
Noise figure $F = f(f)$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ



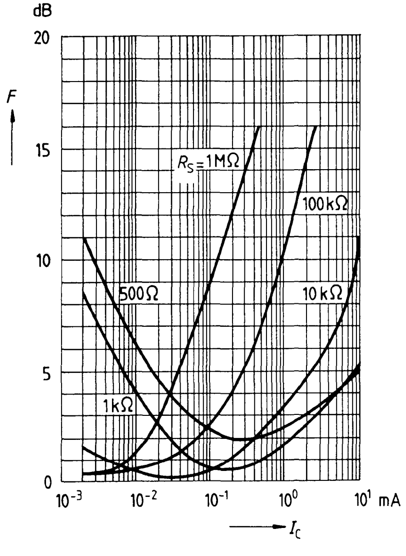
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz



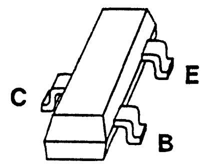
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz



PNP Silicon AF Transistors

BC 856 ... BC 860

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BC 846, BC 847, BC 849, BC 850 (NPN)



Type	Marking	Type	Marking	Ordering code	Package
S BC 856 A	3A	S BC 858 C	3L	Refer to index	SOT 23
S BC 856 B	3B	BC 859 A	4A		
S BC 857 A	3E	BC 859 B	4B		
S BC 857 B	3F	BC 859 C	4C		
S BC 857 C	3G	BC 860 B	4F		
S BC 858 A	3J	BC 860 C	4G		
S BC 858 B	3K				

Maximum ratings

Parameter	Symbol	BC 856	BC 857, BC 860	BC 858, BC 859	Unit
Collector-emitter voltage	V_{CEO}	65	45	30	V
Collector-base voltage	V_{CBO}	80	50	30	V
Collector-emitter voltage	V_{CES}	80	50	30	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		100		mA
Peak collector current	I_{CM}		200		mA
Peak base current	I_{BM}		200		mA
Peak emitter current	I_{EM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		330		mW
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		–65 ... +150		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375		K/W

S Preferred type

Electrical characteristics

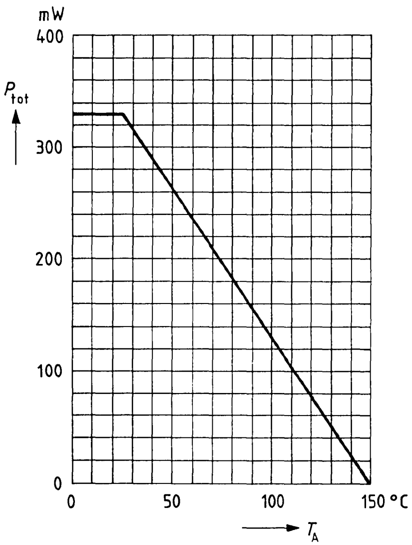
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BC 856		65	–	–	V
BC 857, BC 860		45	–	–	V
BC 858, BC 859		30	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$				
BC 856		80	–	–	V
BC 857, BC 860		50	–	–	V
BC 858, BC 859		30	–	–	V
Collector-emitter breakdown voltage $I_C = 10\,\mu A$, $V_{BE} = 0$	$V_{(BR)\,CES}$				
BC 856		80	–	–	V
BC 857, BC 860		50	–	–	V
BC 858, BC 859		30	–	–	V
Emitter-base breakdown voltage $I_E = 1\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	1	15	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	4	µA
DC current gain $I_C = 10\,\mu A$, $V_{CE} = 5$ V	h_{FE}				
BC 856 A ··· BC 859 A		–	140	–	–
BC 856 B ··· BC 860 B		–	250	–	–
BC 857 C ··· BC 860 C		–	480	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V					
BC 856 A ··· BC 859 A		125	180	250	–
BC 856 B ··· BC 860 B		220	290	475	–
BC 857 C ··· BC 860 C		420	520	800	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	75	300	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	250	650	mV
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}5$ mA		–	700	–	mV
$I_C = 100$ mA, $I_B = 5$ mA		–	850	–	mV
Base-emitter voltage	$V_{BE\,(on)}$				
$I_C = 2$ mA, $V_{CE} = 5$ V		600	650	750	mV
$I_C = 10$ mA, $V_{CE} = 5$ V		–	–	820	mV

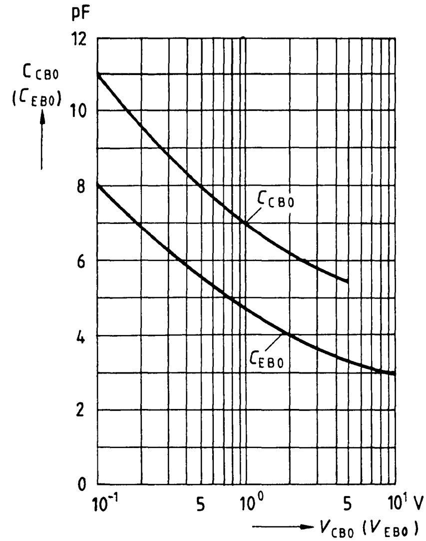
[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3	–	pF
Input capacitance $V_{CB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{11e}				
BC 856 A ... BC 859 A		–	2,7	–	kΩ
BC 856 B ... BC 860 B		–	4,5	–	kΩ
BC 857 C ... BC 860 C		–	8,7	–	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{12e}				
BC 856 A ... BC 859 A		–	1,5	–	10^{-4}
BC 856 B ... BC 860 B		–	2,0	–	10^{-4}
BC 857 C ... BC 860 C		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{21e}				
BC 856 A ... BC 859 A		–	200	–	–
BC 856 B ... BC 860 B		–	330	–	–
BC 857 C ... BC 860 C		–	600	–	–
Open-circuit output admittance $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 1$ kHz	h_{22e}				
BC 856 A ... BC 859 A		–	18	–	µS
BC 856 B ... BC 860 B		–	30	–	µS
BC 857 C ... BC 860 C		–	60	–	µS
Noise figure $I_C = 0{,}2$ mA, $V_{CE} = 5$ V, $R_S = 2$ kΩ	F				
$f = 30$ Hz ... 15 kHz BC 859		–	1,2	4	dB
BC 860		–	1,0	3	dB
$f = 1$ kHz, $\Delta f = 200$ Hz BC 859		–	1,0	4	dB
BC 860		–	1,0	4	dB
Equivalent noise voltage $I_C = 0{,}2$ mA, $V_{CE} = 5$ V, $R_S = 2$ kΩ $f = 10$ Hz ... 50 Hz BC 860	V_n	–	–	0,110	µV

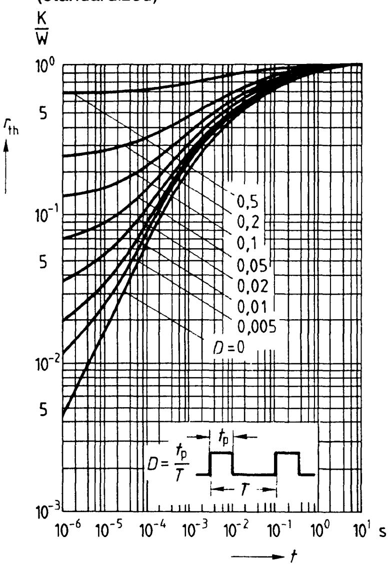
Total power dissipation $P_{tot} = f(T_A)$



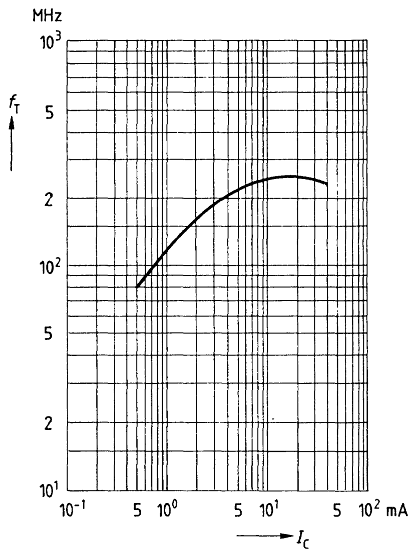
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



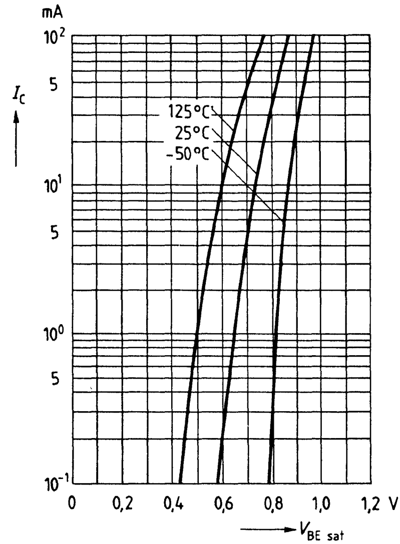
Pulse handling capability $r_{th} = f(t)$
(standardized)



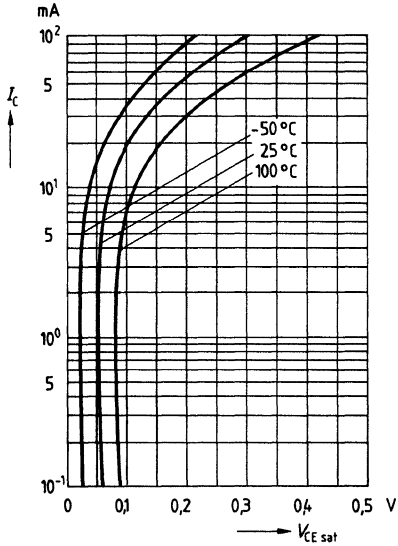
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



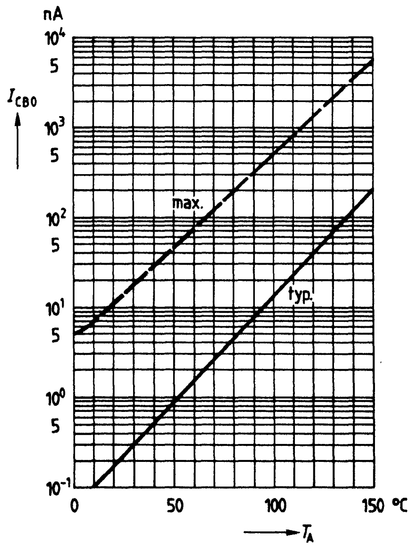
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 20$



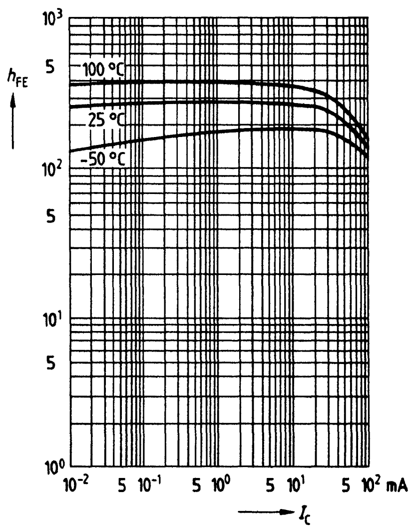
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 20$



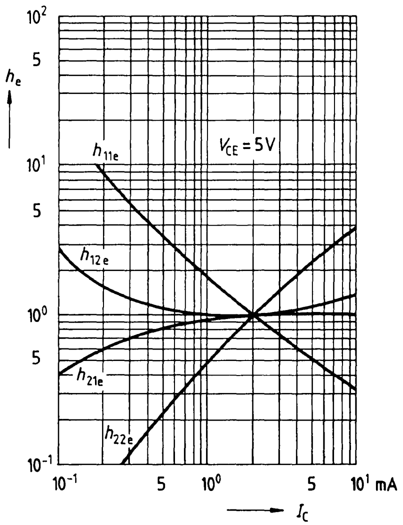
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



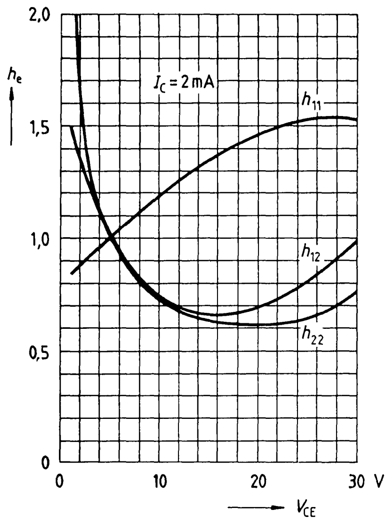
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



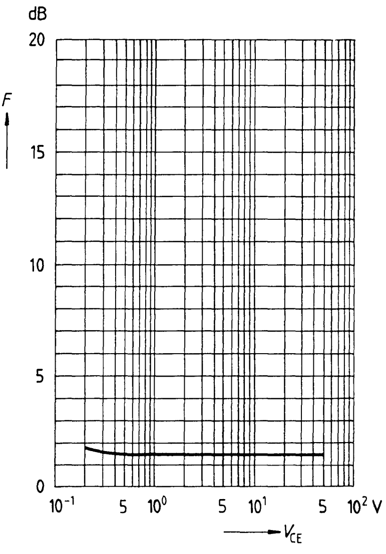
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



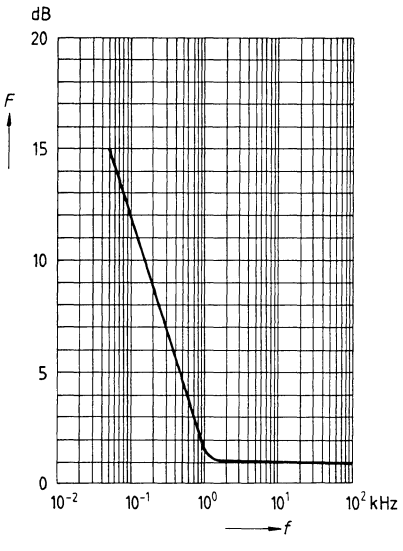
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



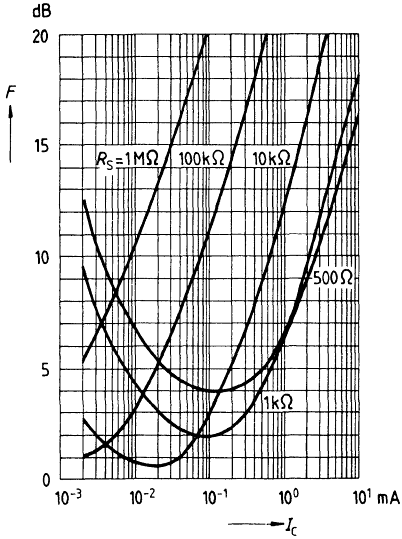
Noise figure $F = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ, $f = 1$ kHz



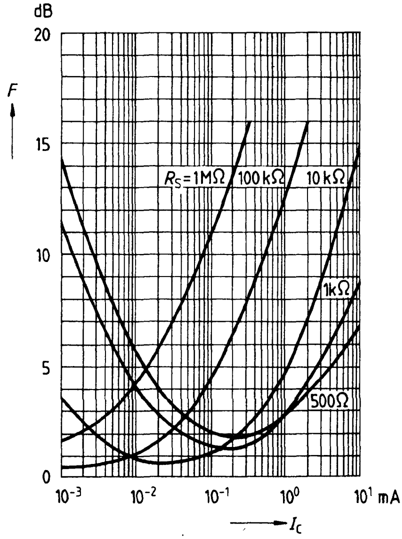
Noise figure $F = f(f)$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ, $V_{CE} = 5$ V



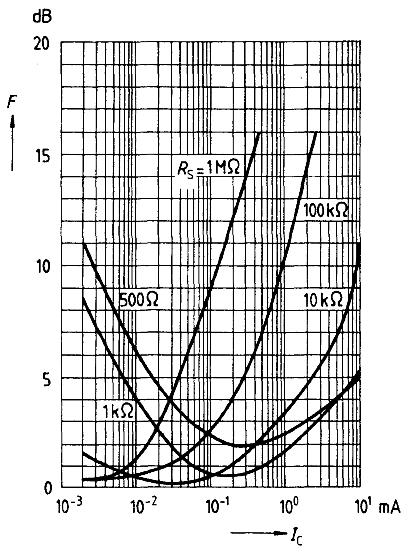
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



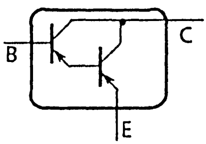
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz

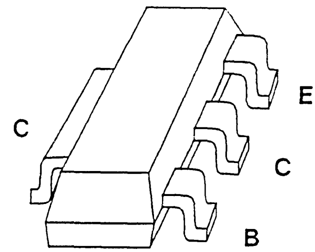


Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz



- For general AF applications
- High collector current
- High current gain
- Complementary types: BCP 29/49 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
BCP 28	BCP 28	Q62702 - C1234	SOT-223
BCP 48	BCP 48	Q62702 - C1235	SOT-223

Maximum Ratings

Parameter	Symbol	BCP 28	BCP 48	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

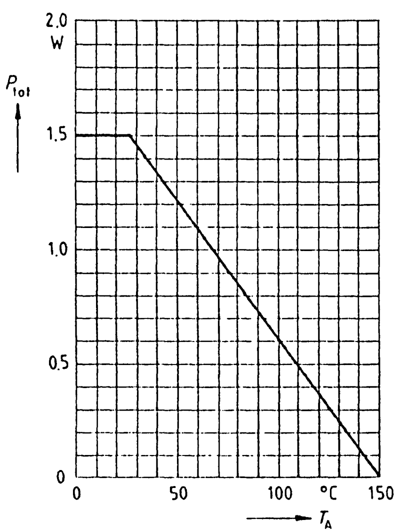
*) For detailed dimensions see chapter Package Outlines

Characteristics
at T_A = 25 °C, unless otherwise specified.

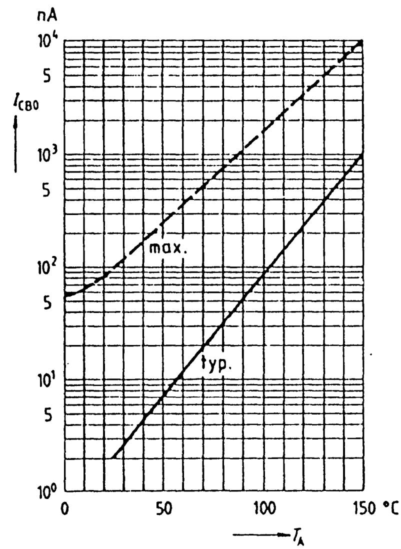
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
I_C = 1mA, I_B = 0	BCP 28		30	-	-	V
	BCP 48		60	-	-	V
Collector-base breakdown voltage 1)		$V_{(BR)CBO}$				
I_C = 100 µA, I_B = 0	BCP 28		40	-	-	V
	BCP 48		80	-	-	V
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
I_E = 10 µA, I_C = 0			10	-	-	V
Collector-base cutoff current		I_{CBO}				
V_{CB} = 30 V, I_E = 0	BCP 28		-	-	100	nA
V_{CB} = 60 V, I_E = 0	BCP 48		-	-	100	nA
V_{CB} = 30 V, I_E = 0, T_A = 150°C	BCP 28		-	-	10	µA
V_{CB} = 60 V, I_E = 0, T_A = 150°C	BCP 48		-	-	10	µA
Emitter-base cutoff current		I_{EBO}				
V_{EB} = 4 V, I_C = 0			-	-	100	nA
DC current gain 1)		h_{FE}				
I_C = 100 µA , V_{CE} = 1V	BCP 28		4000	-	-	-
	BCP 48		2000	-	-	-
I_C = 10 mA, V_{CE} = 5 V	BCP 28		10000	-	-	-
	BCP 48		4000	-	-	-
I_C = 100 mA, V_{CE} = 5 V	BCP 28		20000	-	-	-
	BCP 48		10000	-	-	-
I_C = 500 mA, V_{CE} = 5 V	BCP 28		4000	-	-	-
	BCP 48		2000	-	-	-
Collector-emitter saturation voltage		V_{CEsat}				
I_C = 100mA, I_B = 0.1mA			-	-	1.0	V
Base-emitter saturation voltage		V_{BEsat}				
I_C = 100mA, I_B = 0.1mA			-	-	1.5	V
AC Characteristics						
Transition frequency		f_T				
I_C = 50 mA, V_{CE} = 5 V, f = 100 MHz			-	200	-	MHz
Output capacitance		C_{ob}				
V_{CB} = 10 V, f = 1 MHz			-	8	-	pF

1) Pulse test conditions: t ≦ 300µs; D = 2%

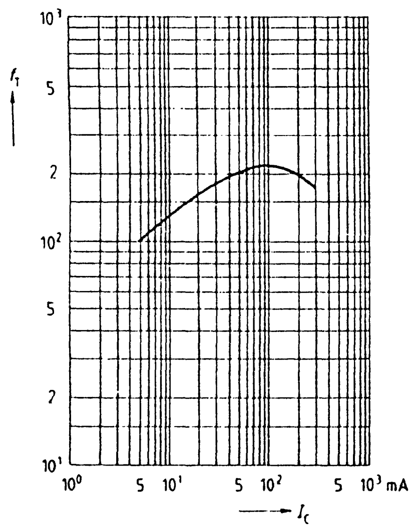
Total power dissipation $P_{tot} = f(T_A)$



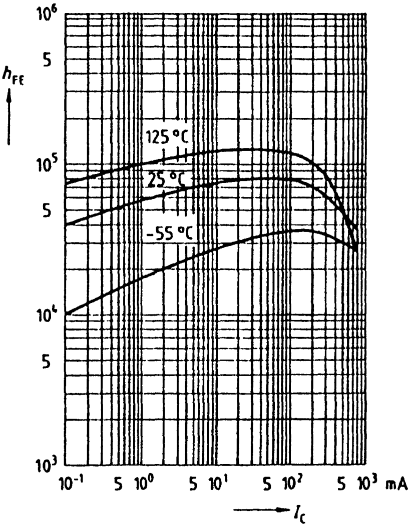
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



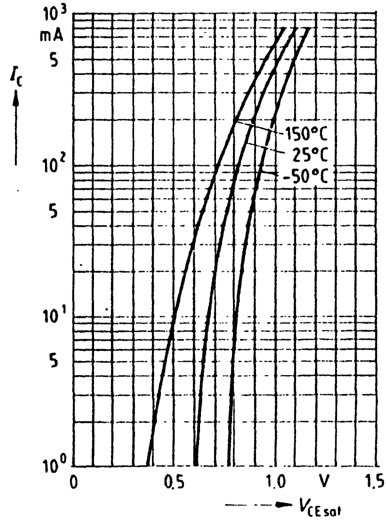
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



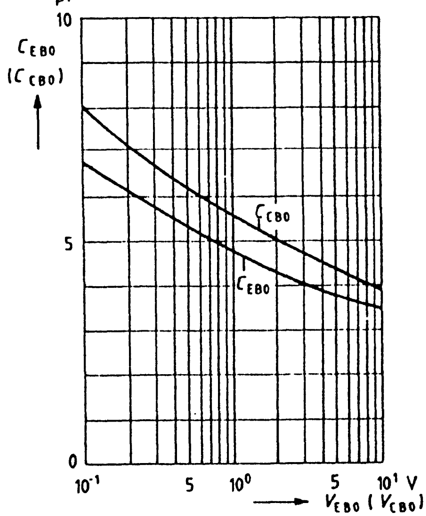
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



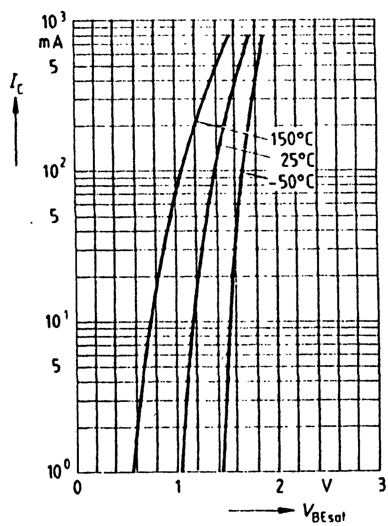
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



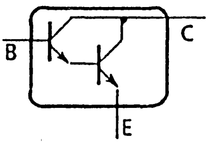
Collector-base capacitance $C_{ob} = f(V_{CB})$
Emitter-base capacitance $C_{ib} = f(V_{EB})$

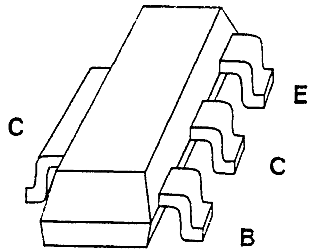


Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



- For general AF applications
- High collector current
- High current gain
- Complementary types: BCP 28/48 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BCP 29	BCP 29	Q62702 - C1236	SOT-223
BCP 49	BCP 49	Q62702 - C1237	SOT-223

Maximum Ratings

Parameter	Symbol	BCP 29	BCP49	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ [1])	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient [1])	R_{thJA}	≤ 83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

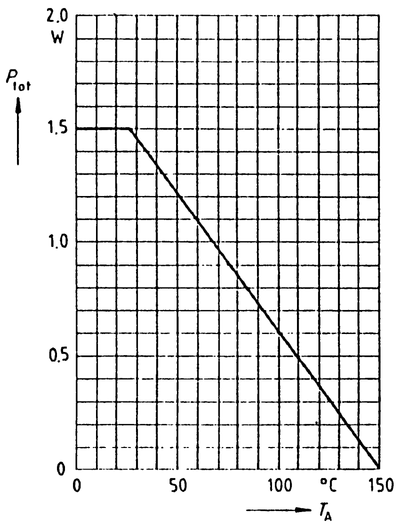
*) For detailed dimensions see chapter Package Outlines.

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

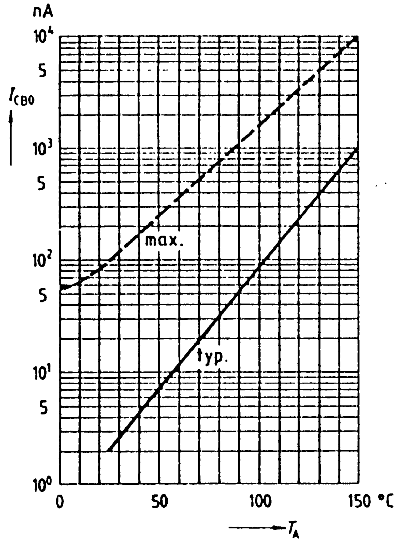
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 1$mA, $I_B = 0$	BCP 29		30	-	-	V
	BCP 49		60	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100$ µA, $I_B = 0$	BCP 29		40	-	-	V
	BCP 49		80	-	-	V
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
$I_E = 10$ µA, $I_C = 0$			10	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 30$ V, $I_E = 0$	BCP 29		-	-	100	nA
$V_{CB} = 60$ V, $I_E = 0$	BCP 49		-	-	100	nA
$V_{CB} = 30$ V, $I_E = 0$, $T_A = 150$°C	BCP 29		-	-	10	µA
$V_{CB} = 60$ V, $I_E = 0$, $T_A = 150$°C	BCP 49		-	-	10	µA
Emitter-base cutoff current		I_{EBO}				
$V_{EB} = 4$ V, $I_C = 0$			-	-	100	nA
DC current gain 1)		h_{FE}				
$I_C = 100$ µA , $V_{CE} = 1$V	BCP 29		4000	-	-	-
	BCP 49		2000	-	-	-
$I_C = 10$ mA, $V_{CE} = 5$ V	BCP 29		10000	-	-	-
	BCP 49		4000	-	-	-
$I_C = 100$ mA, $V_{CE} = 5$ V	BCP 29		20000	-	-	-
	BCP 49		10000	-	-	-
$I_C = 500$ mA, $V_{CE} = 5$ V	BCP 29		4000	-	-	-
	BCP 49		2000	-	-	-
Collector-emitter saturation voltage		V_{CEsat}				
$I_C = 100$mA, $I_B = 0.1$mA			-	-	1.0	V
Base-emitter saturation voltage		V_{BEsat}				
$I_C = 100$mA, $I_B = 0.1$mA			-	-	1.5	V
AC Characteristics						
Transition frequency		f_T				
$I_C = 50$ mA, $V_{CE} = 5$ V, $f = 100$ MHz			-	200	-	MHz
Output capacitance		C_{ob}				
$V_{CB} = 10$ V, $f = 1$ MHz			-	6.5	-	pF

1) Pulse test conditions: t ≦ 300µs; D = 2%

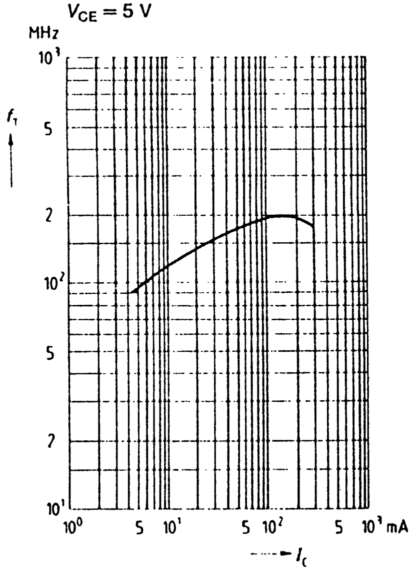
Total power dissipation $P_{tot} = f(T_A)$



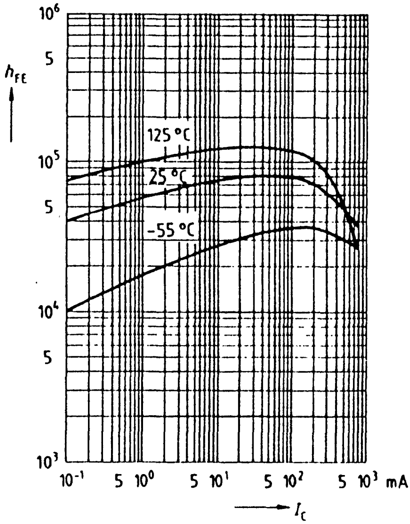
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



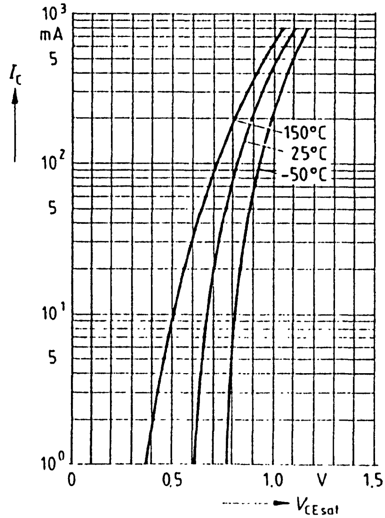
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



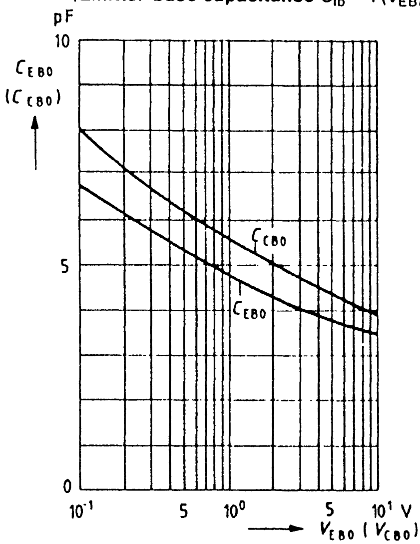
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



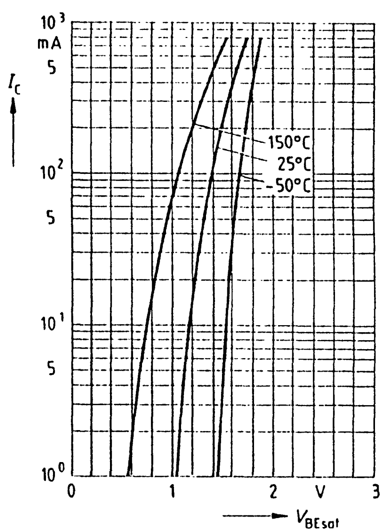
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$

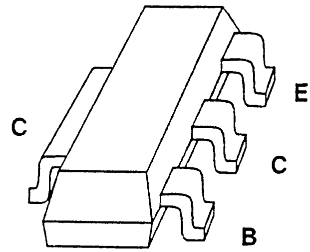


Collector-base capacitance $C_{ob} = f(V_{CB})$
Emitter-base capacitance $C_{ib} = f(V_{EB})$

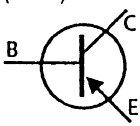


Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$





- For AF driver and output stages
- High collector current
- Low collector -emitter saturation voltage
- Complementary types: BCP 54...BCP 56 (NPN)



Type	Marking	Ordering code (12–mm tape)	Package*
BCP 51	BCP 51	Q62702 - C2107	SOT-223
BCP 51-10	BCP 51-10	Q62702 - C2109	SOT-223
BCP 51-16	BCP 51-16	Q62702 - C2110	SOT-223
BCP 52	BCP 52	Q62702 - C2146	SOT-223
BCP 52-10	BCP 52-10	Q62702 - C2112	SOT-223
BCP 52-16	BCP 52-16	Q62702 - C2113	SOT-223
BCP 53	BCP 53	Q62702 - C2147	SOT-223
BCP 53-10	BCP 53-10	Q62702 - C2115	SOT-223
BCP 53-16	BCP 53-16	Q62702 - C2116	SOT-223

Maximum Ratings

Parameter	Symbol	BCP51	BCP52	BCP53	Unit
Collector-emitter voltage	V_{CEO}	45	60	80	V
$R_{BE} \leq 1k\Omega$	V_{CER}	45	60	100	V
Collector-base voltage	V_{CBO}	45	60	100	V
Emitter-base voltage	V_{EBO}		5		V
Collector current	I_C		1		A
Peak collector current	I_{CM}		1.5		A
Base current	I_B		100		mA
Peak base current	I_{BM}		200		mA
Total power dissipation, $T_A \leq 25°C$ [1]	P_{tot}		1.5		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}	-65	to	+ 150	°C

Thermal Resistance

Junction - ambient [1])	R_{thJA}	$\leq$83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

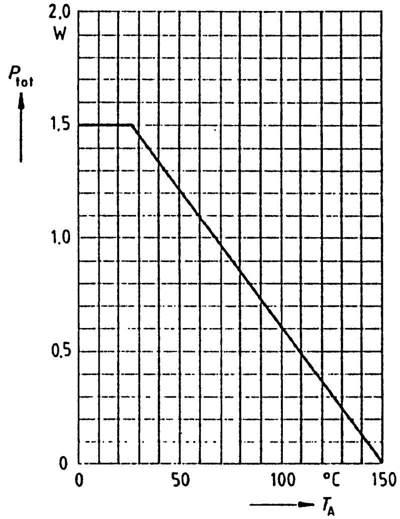
Characteristics

at $T_A = 25$ °C, unless otherwise specified.

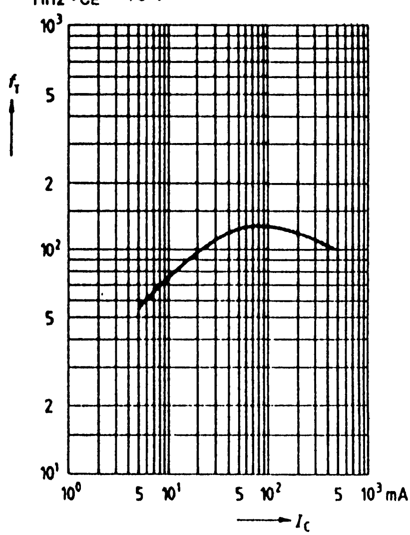
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 10\text{mA}, I_B = 0$	BCP 51		45	-	-	V
	BCP 52		60	-	-	V
	BCP 53		80	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100\mu\text{A}, I_B = 0$	BCP 51		45	-	-	V
	BCP 52		60	-	-	V
	BCP 53		100	-	-	V
Emitter-base breakdown voltage $I_E = 10\mu\text{A}, I_C = 0$		$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 30$ V, $I_E = 0$			-	-	100	nA
$V_{CB} = 30$ V, $I_E = 0$, $T_A = 150$ °C			-	-	20	µA
Emitter-base cutoff current $V_{EB} = 5$ V, $I_C = 0$		I_{EBO}	-	-	10	µA
DC current gain 1)		h_{FE}				
$I_C = 5$ mA, $V_{CE} = 2$ V			25	-	-	-
$I_C = 150$ mA, $V_{CE} = 2$ V						
	BCP 51/BCP 52/BCP 53		40	-	250	-
	BCP 51/BCP 52/BCP 53-10		63	100	160	-
	BCP 51/BCP 52/BPC 53-16		100	160	250	-
$I_C = 500$ mA, $V_{CE} = 2$ V			25	-	-	-
Collector-emitter voltage 1) $I_C = 500$ mA, $I_B = 50$ mA		V_{CEsat}	-	-	0.5	V
Base-emitter voltage 1) $I_C = 500$ mA, $V_{CE} = 2$ V		V_{BE}	-	-	1	V
AC Characteristics						
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 100$ MHz		f_T	-	125	-	MHz

1) Pulse test conditions: t ≦ 300µs; D = 2%

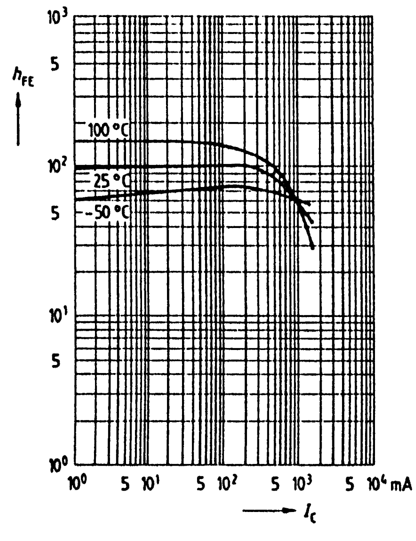
Total power dissipation $P_{tot} = f(T_A)$



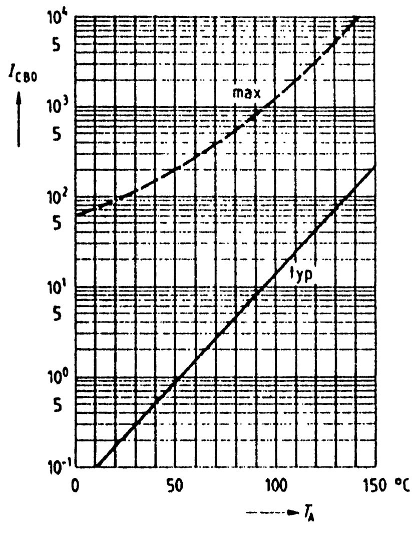
Transition frequency $f_T = f(I_C)$
MHz $V_{CE} = 10$ V



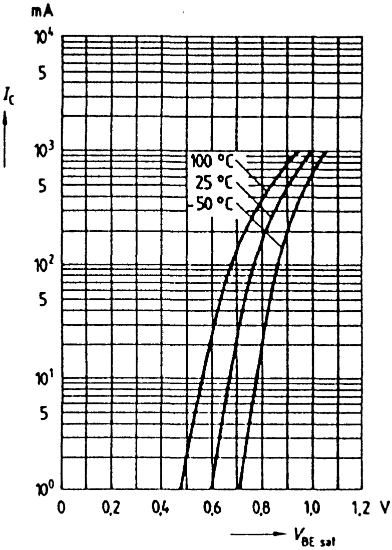
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 2$ V



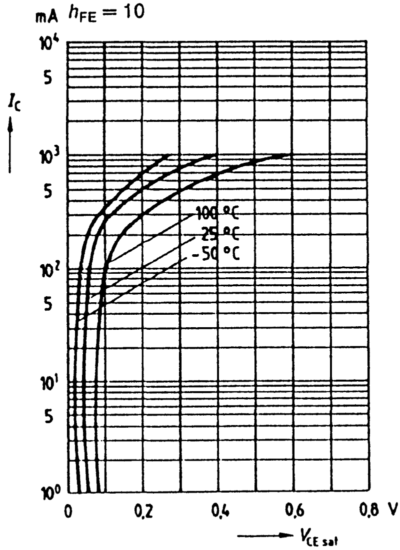
Collector cutoff current $I_{CBO} = f(T_A)$
nA $V_{CE} = 30$ V



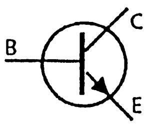
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$

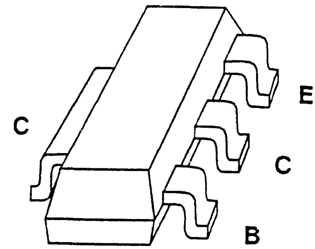


Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



- For AF driver and output stages
- High collector current
- Low collector -emitter saturation voltage
- Complementary types: BCP51...BCP53 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BCP 54	BCP 54	Q62702 - C2117	SOT-223
BCP 54-10	BCP 54-10	Q62702 - C2119	SOT-223
BCP 54-16	BCP 54-16	Q62702 - C2120	SOT-223
BCP 55	BCP 55	Q62702 - C2148	SOT-223
BCP 55-10	BCP 55-10	Q62702 - C2122	SOT-223
BCP 55-16	BCP 55-16	Q62702 - C2123	SOT-223
BCP 56	BCP 56	Q62702 - C2149	SOT-223
BCP 56-10	BCP 56-10	Q62702 - C2125	SOT-223
BCP 56-16	BCP 56-16	Q62702 - C2106	SOT-223

Maximum Ratings

Parameter	Symbol	BCP54	BCP55	BCP56	Unit
Collector-emitter voltage	V_{CEO}	45	60	80	V
$R_{BE} \leq 1k\Omega$	V_{CER}	45	60	100	V
Collector-base voltage	V_{CBO}	45	60	100	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		1		A
Peak collector current	I_{CM}		1.5		A
Base current	I_B		100		mA
Peak base current	I_{BM}		200		mA
Total power dissipation, $T_A \leq 25°C$ [1]	P_{tot}		1.5		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}	-65	to	+ 150	°C

Thermal Resistance

Junction - ambient [1]	R_{thJA}	≤ 83.3	K/W

[1] Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

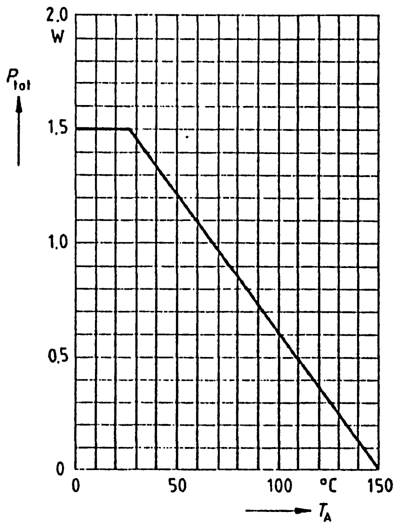
Characteristics

at $T_A = 25$ °C, unless otherwise specified.

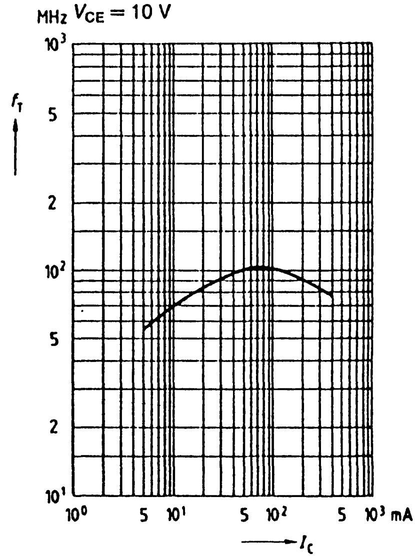
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage $I_C = 10mA, I_B = 0$	BCP 54	$V_{(BR)CEO}$	45	-	-	V
	BCP 55		60	-	-	V
	BCP 56		80	-	-	V
Collector-base breakdown voltage 1) $I_C = 100µA, I_B = 0$	BCP 54	$V_{(BR)CBO}$	45	-	-	V
	BCP 55		60	-	-	V
	BCP 56		100	-	-	V
Emitter-base breakdown voltage $I_E = 10µA, I_C = 0$		$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 30$ V, $I_E = 0$		I_{CBO}	-	-	100	nA
$V_{CB} = 30$ V, $I_E = 0$, $T_A = 150$ °C			-	-	20	µA
Emitter-base cutoff current $V_{EB} = 5V$		I_{EBO}	-	-	10	µA
DC current gain $I_C = 5$ mA, $V_{CE} = 2$ V		h_{FE}	25	-	-	-
$I_C = 150$ mA, $V_{CE} = 2$ V	BCP 54/BCP 55/BCP 56		40	-	250	-
	BCP 54/BCP 55/BCP 56-10		63	100	160	-
	BCP 54/BCP 55/BCP 56-16		100	160	250	-
$I_C = 500$ mA, $V_{CE} = 2$ V			25	-	-	-
Collector-emitter voltage 1) $I_C = 500$ mA, $I_B = 50$ mA		V_{CEsat}	-	-	0.5	V
Base-emitter voltage 1) $I_C = 500$ mA, $V_{CE} = 2$ V		V_{BE}	-	-	1	V
AC Characteristics						
Transition frequency $I_C = 50$ mA, $V_{CE} = 10V$, $f = 100$ MHz		f_T	-	100	-	MHz

1) Pulse test conditions: t ≦ 300µs; D = 2%

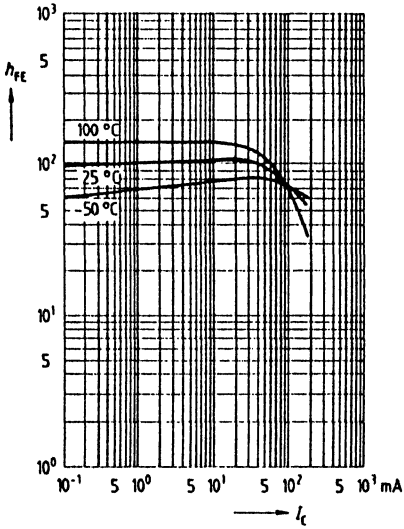
Total power dissipation $P_{tot} = f(T_A)$



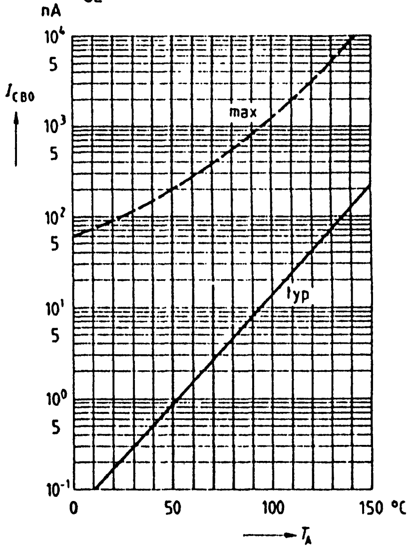
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



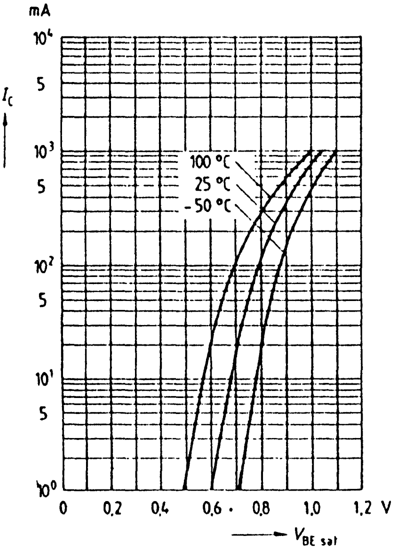
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 2$ V



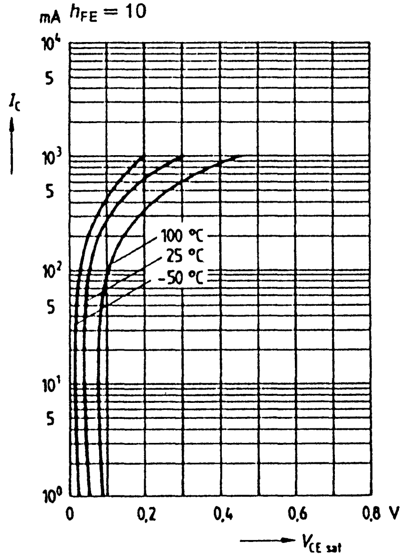
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CE} = 30$ V



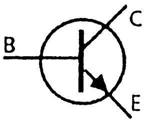
Base-emitter saturation voltage $I_c = f(V_{BE\,sat})$
$h_{FE} = 10$

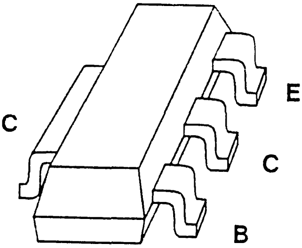


Collector-emitter saturation voltage
$I_c = f(V_{CE\,sat})$
$h_{FE} = 10$



- For general AF application
- High collector current
- High collector gain
- Low collector -emitter saturation voltage
- Complementary type: BCP 69 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BCP 68	BCP 68	Q62702 - C2126	SOT-223

Maximum Ratings

Parameter	Symbol	BCP 68	Unit
Collector-emitter voltage	V_{CEO} V_{CES}	20 25	V V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	1	A
Peak collector current	I_{CM}	2	A
Base current	I_B	100	mA
Peak base current	I_{BM}	200	mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to + 150	°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤83.3	K/W

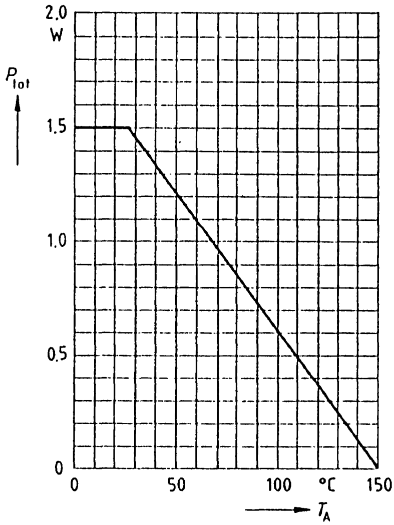
1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

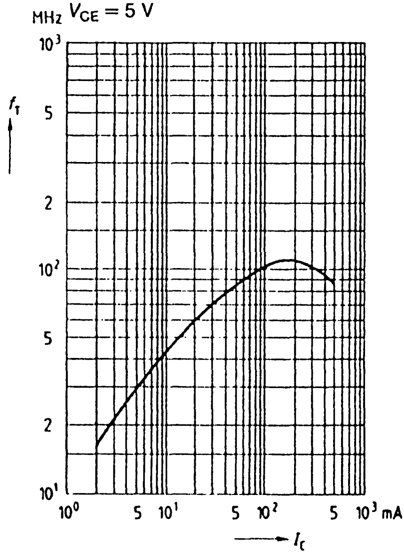
Parameter	Symbol	Values min.	Values typ.	Values max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 30$mA, $I_B = 0$	$V_{(BR)CEO}$	20	-	-	V
Collector-emitter breakdown voltage $I_C = 10$µA, $V_{BE} = 0$	$V_{(BR)CES}$	25	-	-	V
Collector-base breakdown voltage $I_C = 10$µA, $I_B = 0$	$V_{(BR)CBO}$	25	-	-	V
Emitter-base breakdown voltage $I_E = 10$µA, $I_B = 0$	$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150$°C	I_{CBO}	- -	- -	100 10	nA µA
Emitter-base cutoff current $V_{EB} = 5$ V, $I_C = 0$	I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 1$ V $I_C = 1$A, $V_{CE} = 1$V	h_{FE}	50 63 60	- - -	- 400 -	- - -
Collector-emitter voltage 1) $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	-	-	0.5	V
Base-emitter voltage 1) $I_C = 5$mA, $V_{CE} = 10$ V $I_C = 1$A, $V_{CE} = 1$V	V_{BE}	- -	0.6 -	- 1	V
AC Characteristics					
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	-	100	-	MHz

1) Pulse test conditions: t ≦ 300µs; D = 2%

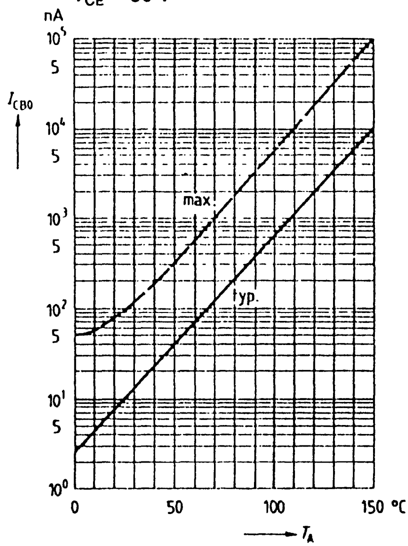
Total power dissipation $P_{tot} = f(T_A)$



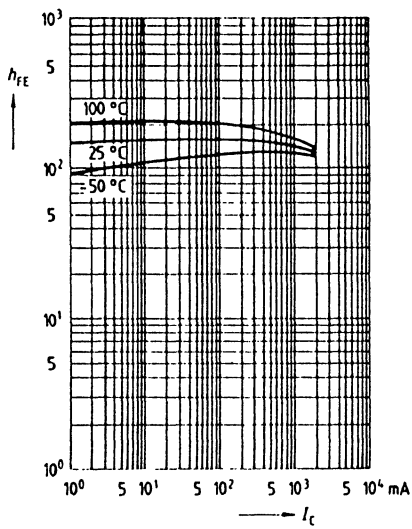
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



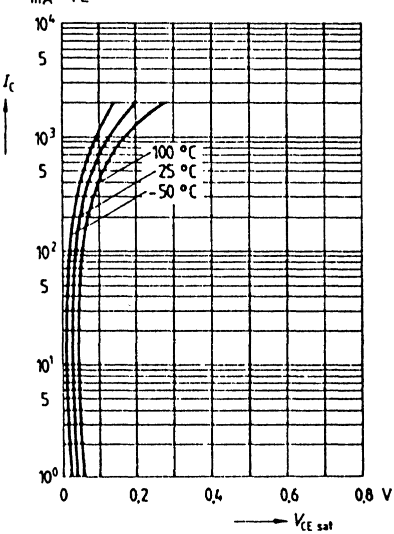
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CE} = 30$ V



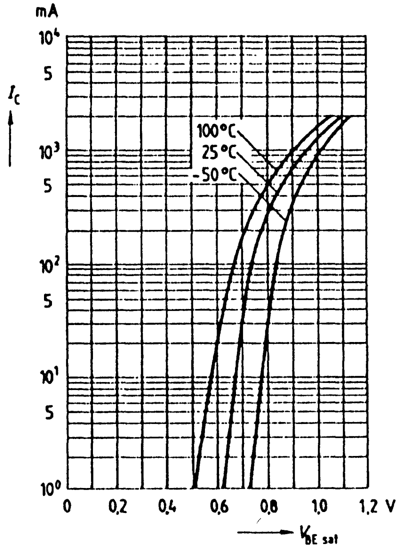
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



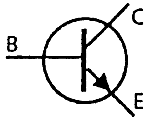
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$

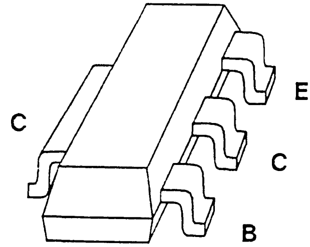


Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



- For general AF application
- High collector current
- High collector gain
- Low collector -emitter saturation voltage
- Complementary type: BCP 68 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
BCP 69	BCP 69	Q62702 - C2130	SOT-223

Maximum Ratings

Parameter	Symbol	BCP 69	Unit
Collector-emitter voltage	V_{CEO} V_{CES}	20 25	V V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	1	A
Peak collector current	I_{CM}	2	A
Base current	I_B	100	mA
Peak base current	I_{BM}	200	mA
Total power dissipation, $T_A \leq 25°C$ [1])	P_{tot}	1.5	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to + 150	°C

Thermal Resistance

Junction - ambient [1])	R_{thJA}	≤ 83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min $6cm^2$

*) For detailed dimensions see chapter Package Outlines

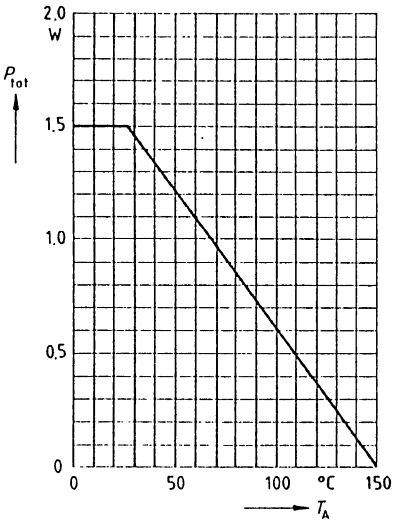
Characteristics

at $T_A = 25$ °C, unless otherwise specified.

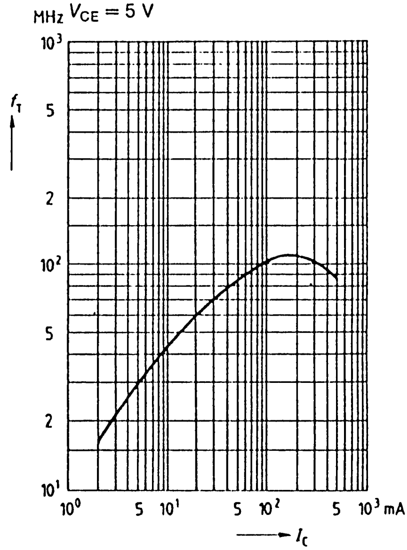
Parameter	Symbol	Values min.	Values typ.	Values max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 30mA$, $I_B = 0$	$V_{(BR)CEO}$	20	-	-	V
Collector-emitter breakdown voltage $I_C = 10\mu A$, $V_{BE} = 0$	$V_{(BR)CES}$	25	-	-	V
Collector-base breakdown voltage $I_C = 10\mu A$, $I_B = 0$	$V_{(BR)CBO}$	25	-	-	V
Emitter-base breakdown voltage $I_E = 10\mu A$, $I_B = 0$	$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150$°C	I_{CBO}	- -	- -	100 10	nA µA
Emitter-base cutoff current $V_{EB} = 5$ V, $I_C = 0$	I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} = 1$ V $I_C = 1A, V_{CE} = 1V$	h_{FE}	50 63 60	- - -	- 400 -	- - -
Collector-emitter voltage 1) $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	-	-	0.5	V
Base-emitter voltage 1) $I_C = 5mA$, $V_{CE} = 10$ V $I_C = 1A$, $V_{CE} = 1V$	V_{BE}	- -	0.6 -	- 1	V
AC Characteristics					
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	-	100	-	MHz

1) Pulse test conditions: t ≦ 300µs; D = 2%

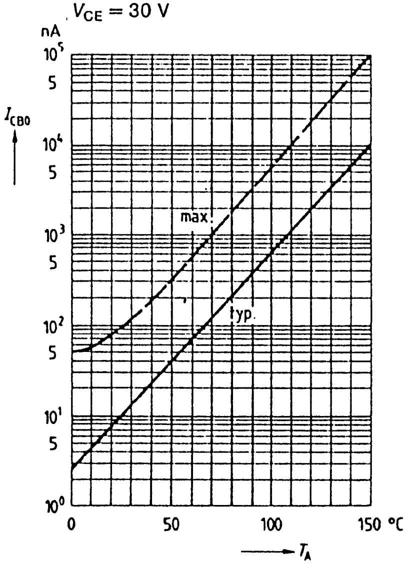
Total power dissipation $P_{tot} = f(T_A)$



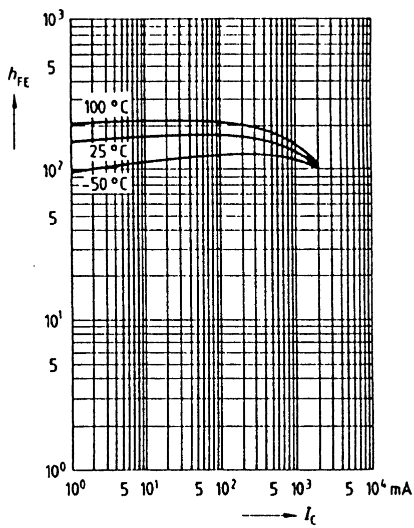
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



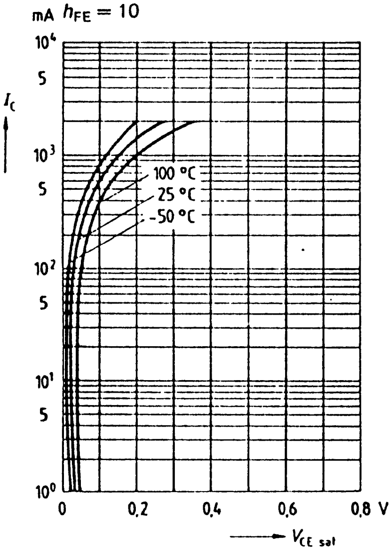
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CE} = 30$ V



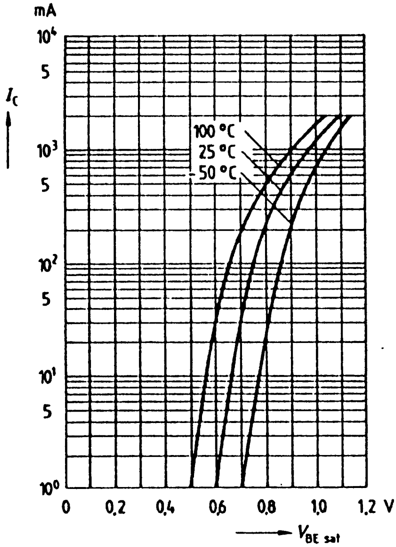
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



Collector-emitter saturation voltage
$I_c = f(V_{CE\,sat})$
$h_{FE} = 10$



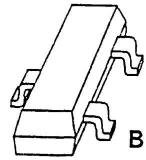
Base-emitter saturation voltage $I_c = f(V_{BE\,sat})$
$h_{FE} = 10$



PNP Silicon Darlington Transistors

BCV 26
BCV 46

- For general AF applications
- High collector current
- High current gain
- Complementary types: BCV 27, BCV 47 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BCV 26	FD	Q62702–C1151	Q62702–C1493	SOT 23
S BCV 46	FE	Q62702–C1153	Q62702–C1475	SOT 23

Maximum ratings

Parameter	Symbol	BCV 26	BCV 46	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

S Preferred type

Electrical characteristics

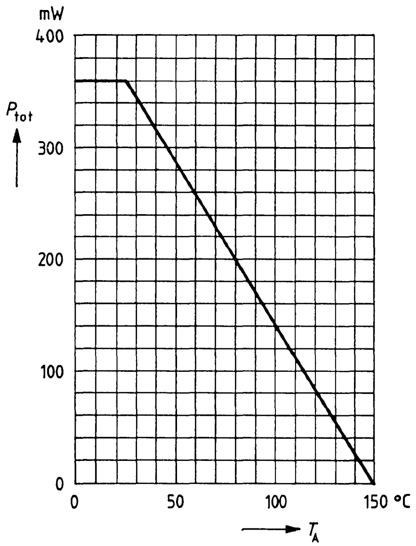
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CEO}$				
	BCV 26		30	–	–	V
	BCV 46		60	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA		$V_{(BR)\,CBO}$				
	BCV 26		40	–	–	V
	BCV 46		80	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	10	–	–	V
Collector-cutoff current		I_{CBO}				
$V_{CB} = 30$ V	BCV 26		–	–	100	nA
$V_{CB} = 60$ V	BCV 46		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 26		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 46		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V	BCV 26		4000	–	–	–
	BCV 46		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 26		10000	–	–	–
	BCV 46		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 26		20000	–	–	–
	BCV 46		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 26		4000	–	–	–
	BCV 46		2000	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

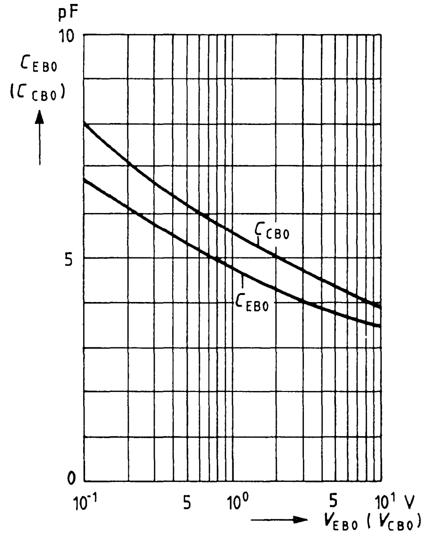
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	4,5	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%

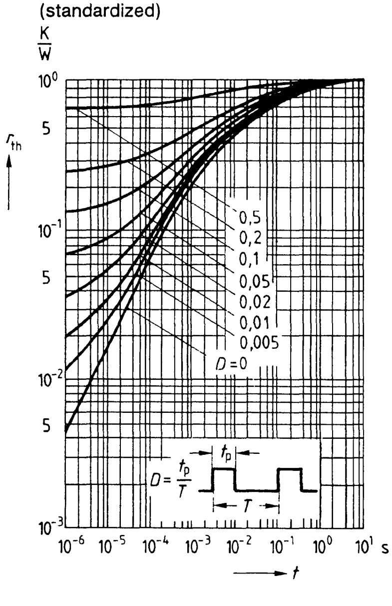
Total power dissipation $P_{tot} = f(T_A)$



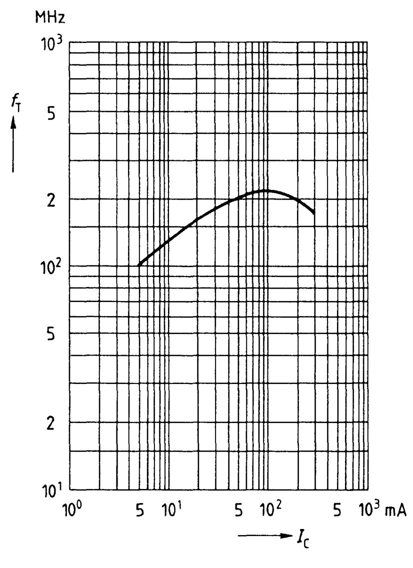
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



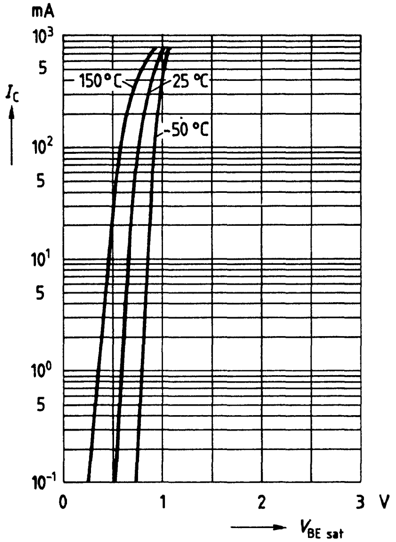
Pulse handling capability $r_{th} = f(t)$
(standardized)



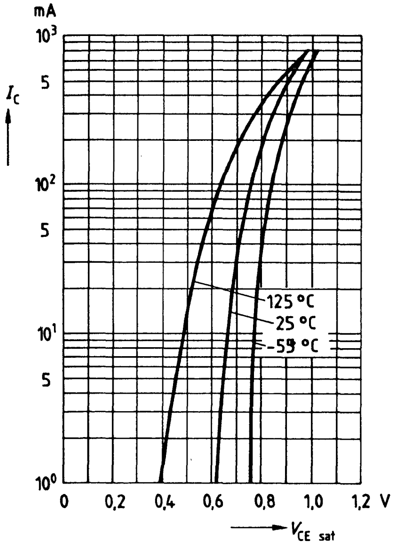
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



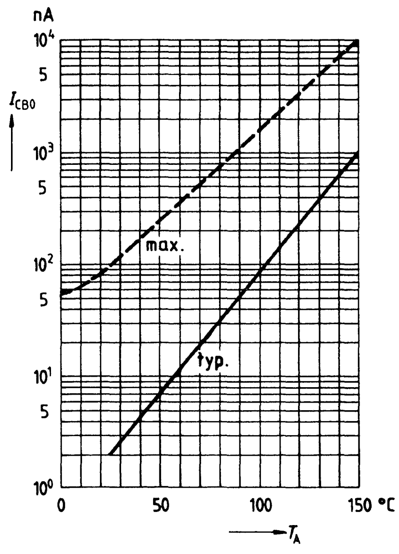
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



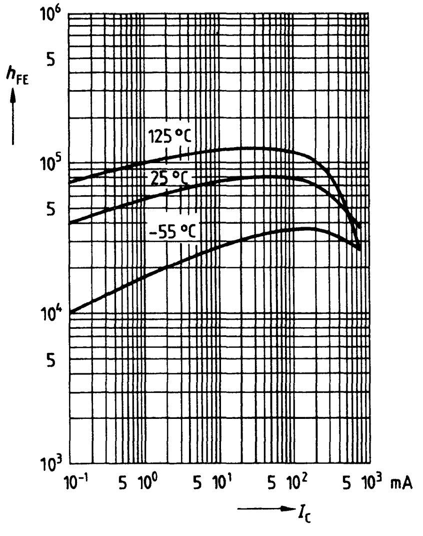
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



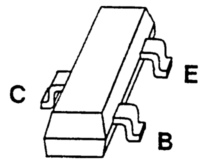
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5\,V$



NPN Silicon Darlington Transistors

BCV 27
BCV 47

- For general AF applications
- High collector current
- High current gain
- Complementary types: BCV 26, BCV 46 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BCV 27	FF	Q62702–C1152	Q62702–C1474	SOT 23
S BCV 47	FG	Q62702–C1154	Q62702–C1501	SOT 23

Maximum ratings

Parameter	Symbol	BCV 27	BCV 47	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction–ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

S Preferred type

Electrical characteristics

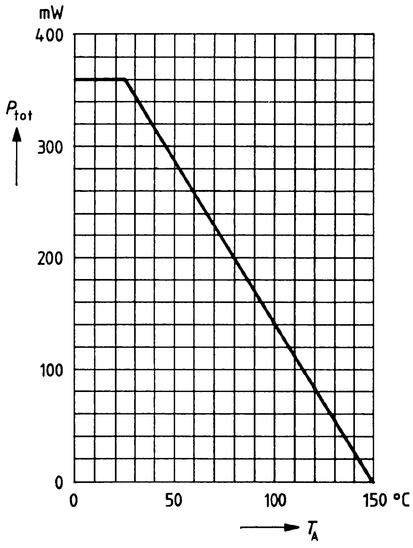
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CEO}$				
	BCV 27		30	–	–	V
	BCV 47		60	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$		$V_{(BR)\,CBO}$				
	BCV 27		40	–	–	V
	BCV 47		80	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$		$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 30$ V	BCV 27		–	–	100	nA
$V_{CB} = 60$ V	BCV 47		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 27		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 47		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1]		h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 1$ V	BCV 27		4000	–	–	–
	BCV 47		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 27		10000	–	–	–
	BCV 47		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 27		20000	–	–	–
	BCV 47		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 27		4000	–	–	–
	BCV 47		2000	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1	V
Base-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

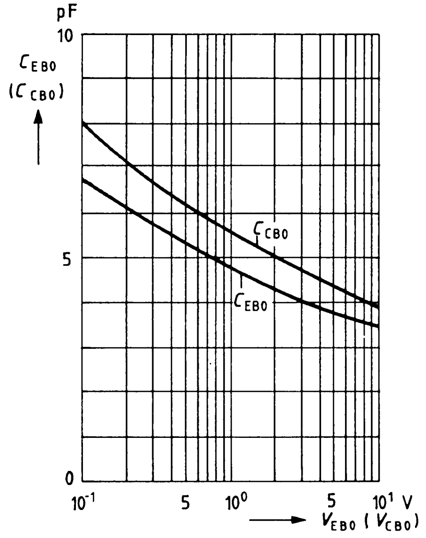
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3,5	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

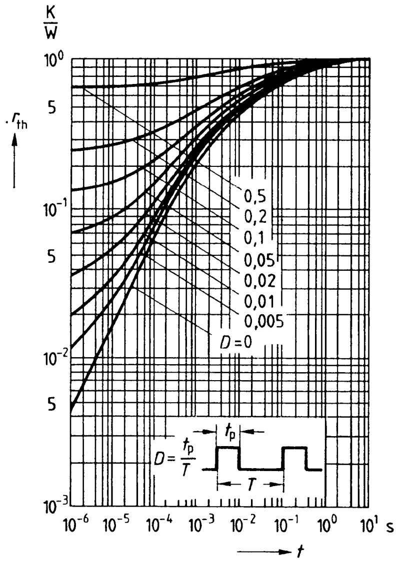
Total power dissipation $P_{tot} = f(T_A)$



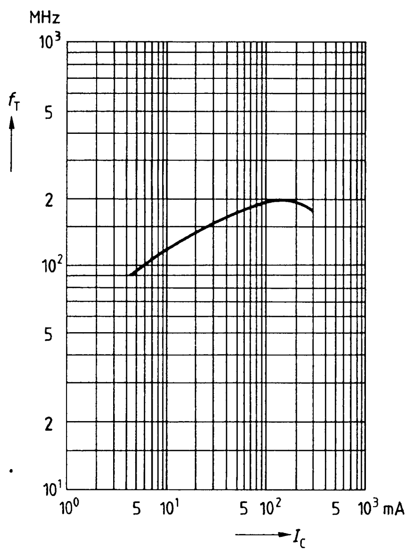
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



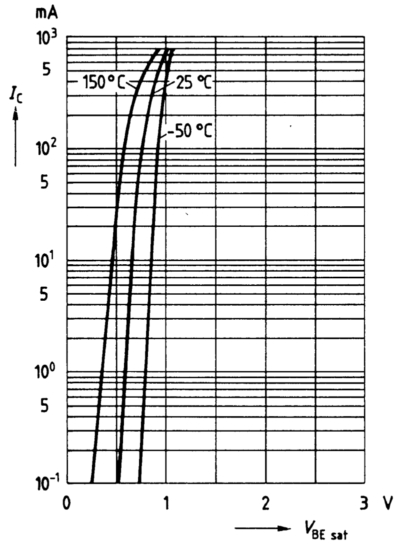
Pulse handling capability $r_{th} = f(t)$
(standardized)



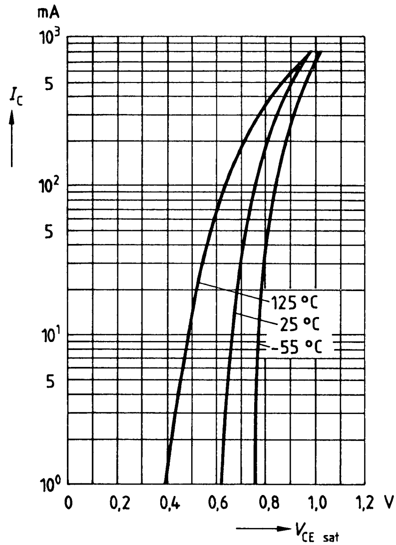
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



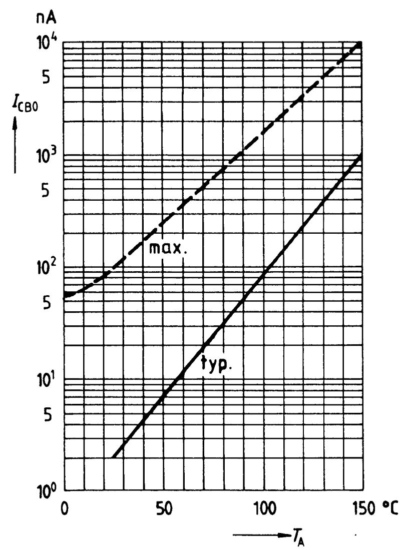
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



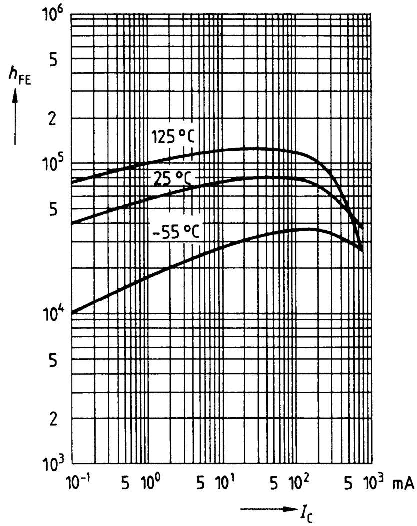
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



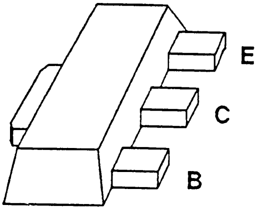
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



PNP Silicon Darlington Transistors

BCV 28
BCV 48

- For general AF applications
- High collector current
- High current gain
- Complementary types: BCV 29, BCV 49 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BCV 28	ED	Q62702–C1683	Q62702–C1852	SOT 89
BCV 48	EE	Q62702–C1685	Q62702–C1854	SOT 89

Maximum ratings

Parameter	Symbol	BCV 28	BCV 48	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \dots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

Electrical characteristics

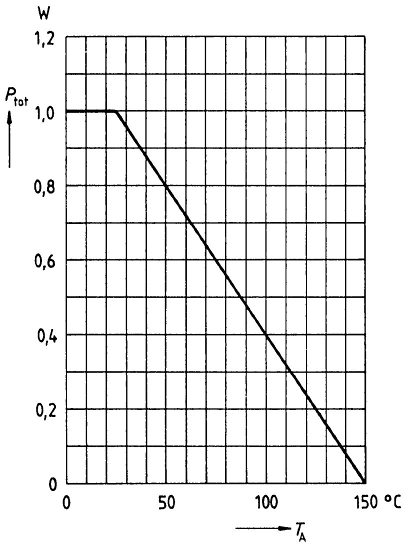
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CEO}$				
	BCV 28		30	–	–	V
	BCV 48		60	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA		$V_{(BR)\,CBO}$				
	BCV 28		40	–	–	V
	BCV 48		80	–	–	V
Emitter base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 30$ V	BCV 28		–	–	100	nA
$V_{CB} = 60$ V	BCV 48		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 28		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 48		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1]		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V	BCV 28		4000	–	–	–
	BCV 48		2000	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BCV 28		10000	–	–	–
	BCV 48		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 28		20000	–	–	–
	BCV 48		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 28		4000	–	–	–
	BCV 48		2000	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1	V
Base-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

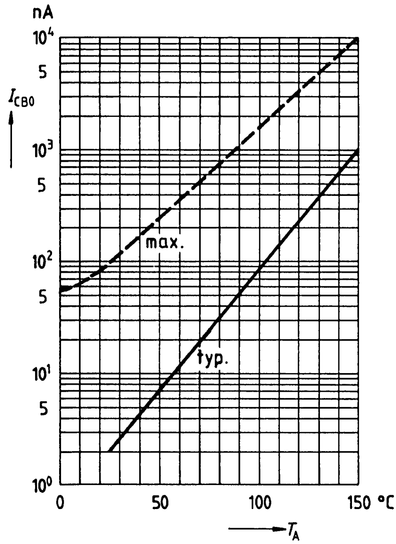
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	4,5	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

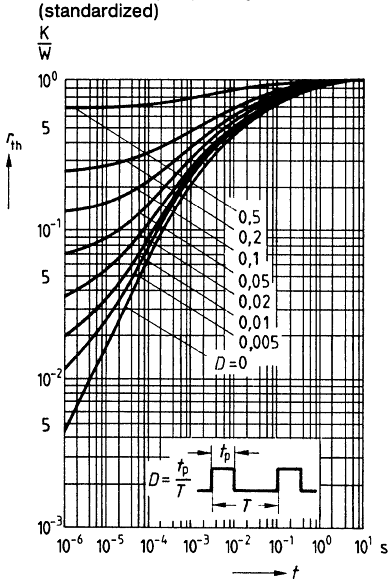
Total power dissipation $P_{tot} = f(T_A)$



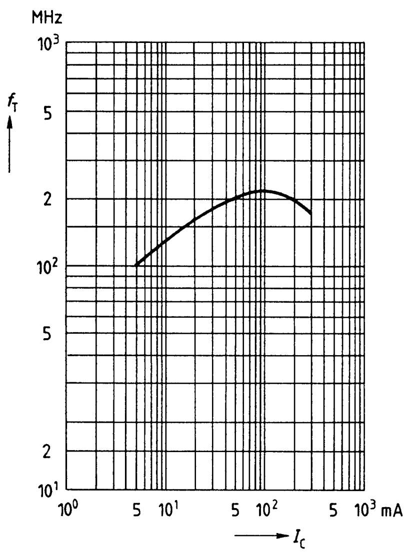
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



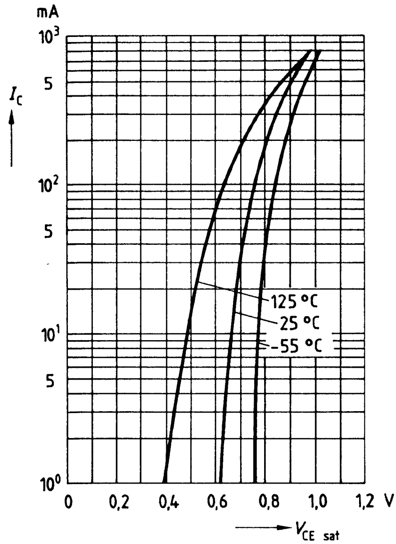
Pulse handling capability $r_{th} = f(t)$
(standardized)



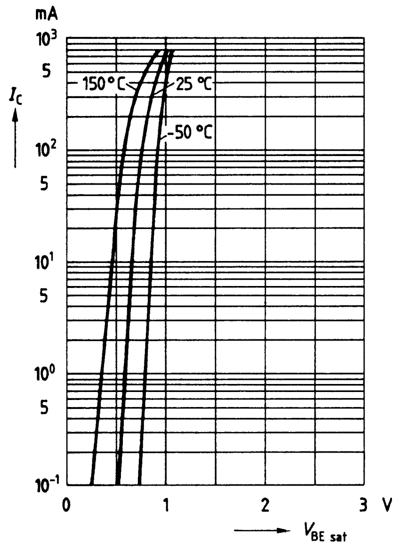
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



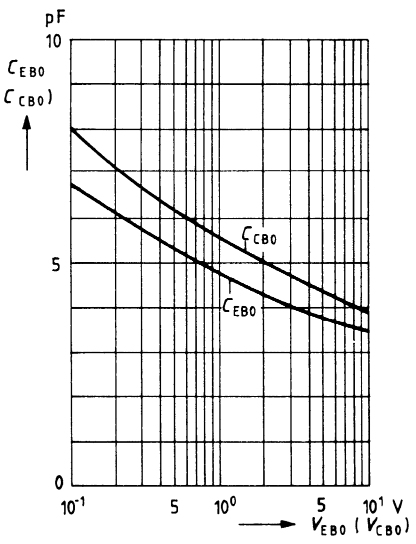
Collector-emitter saturation voltage $I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



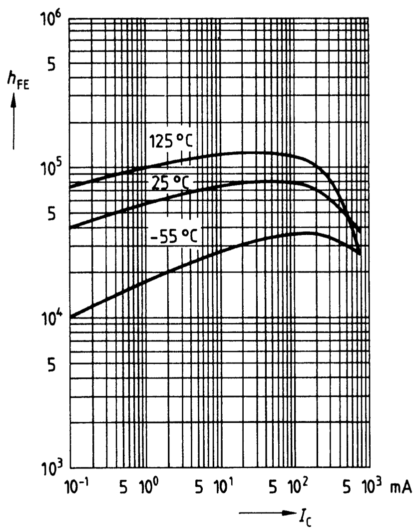
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



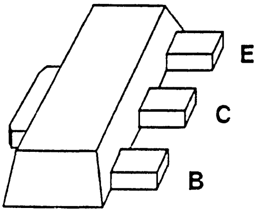
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



NPN Silicon Darlington Transistors

BCV 29
BCV 49

- For general AF applications
- High collector current
- High current gain
- Complementary types: BCV 28, BCV 48 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BCV 29	EF	Q62702–C1684	Q62702–C1853	SOT 89
BCV 49	EG	Q62702–C1686	Q62702–C1832	SOT 89

Maximum ratings

Parameter	Symbol	BCV 29	BCV 49	Unit
Collector-emitter voltage	V_{CEO}	30	60	V
Collector-base voltage	V_{CBO}	40	80	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

Electrical characteristics

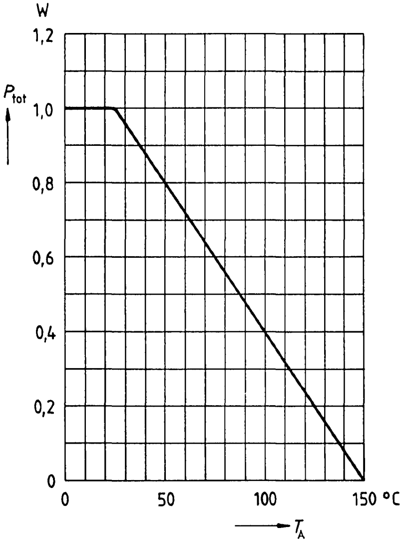
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA		$V_{(BR)\,CE0}$				
	BCV 29		30	–	–	V
	BCV 49		60	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)\,CB0}$				
	BCV 29		40	–	–	V
	BCV 49		80	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$		$V_{(BR)\,EB0}$	10	–	–	V
Collector cutoff current		I_{CB0}				
$V_{CB} = 30$ V	BCV 29		–	–	100	nA
$V_{CB} = 60$ V	BCV 49		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$	BCV 29		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	BCV 49		–	–	10	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EB0}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 1$ V	BCV 29		4000	–	–	–
	BCV 49		2000	–	–	–
$I_C =$ 10 mA, $V_{CE} = 5$ V	BCV 29		10000	–	–	–
	BCV 49		4000	–	–	–
$I_C = 100$ mA, $V_{CE} = 5$ V	BCV 29		20000	–	–	–
	BCV 49		10000	–	–	–
$I_C = 0{,}5$ A, $V_{CE} = 5$ V	BCV 29		4000	–	–	–
	BCV 49		2000	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{CEsat}	–	–	1	V
Base-emitter saturation voltage[1]) $I_C = 100$ mA, $I_B = 0{,}1$ mA		V_{BEsat}	–	–	1,5	V

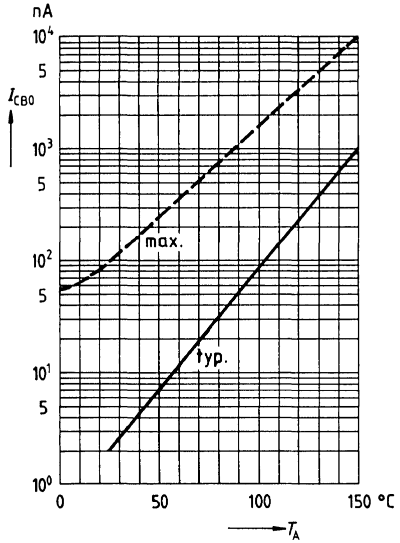
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	150	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	3,5	–	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

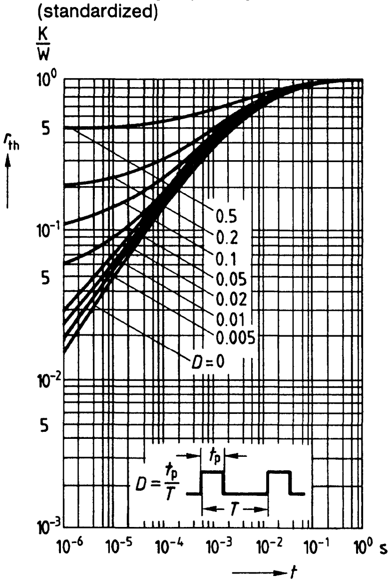
Total power dissipation $P_{tot} = f(T_A)$



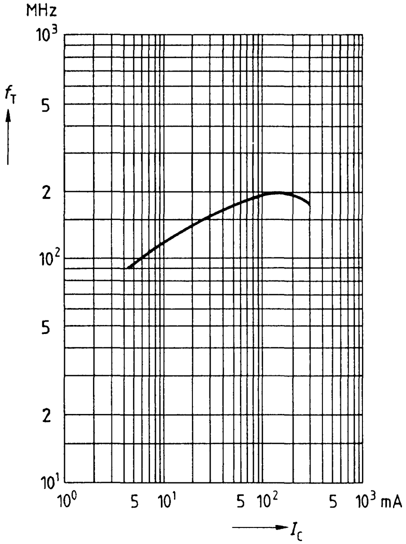
Collector cutoff current $I_{CB0} = f(T_A)$



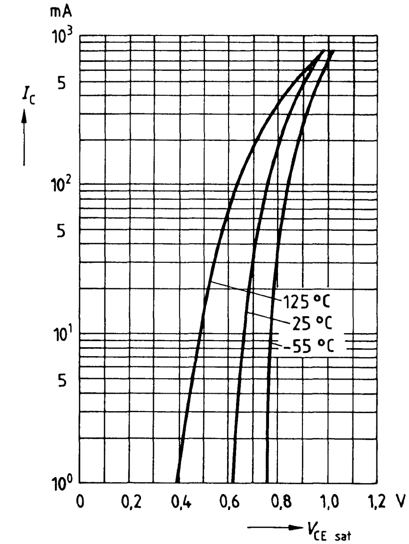
Pulse handling capability $r_{th} = f(t)$
(standardized)



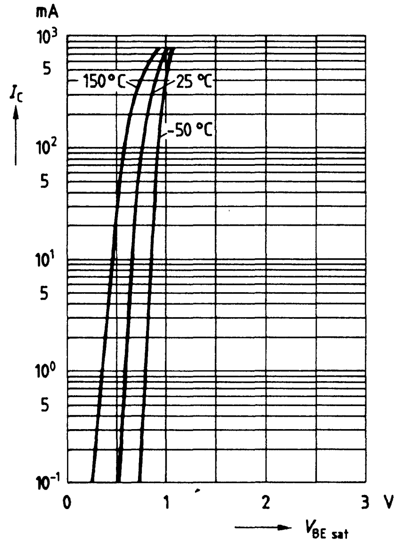
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



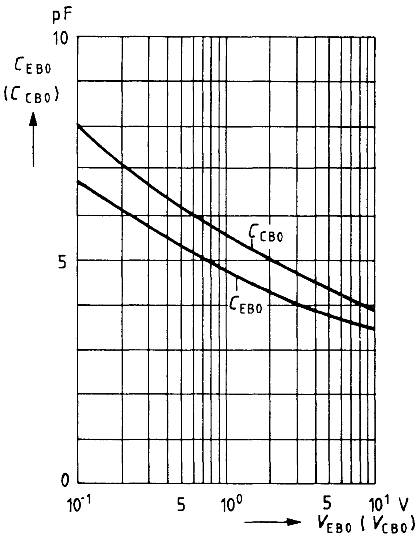
Collector-emitter saturation voltage $I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



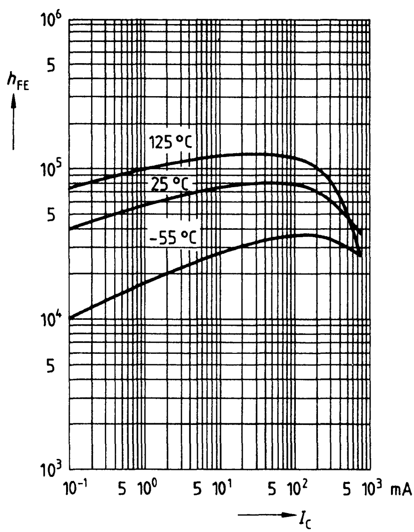
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



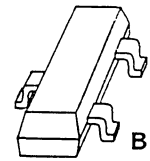
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



NPN Silicon AF Transistors

BCW 60
BCX 70

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BCW 61, BCX 71 (PNP)



Type	Marking	Type	Marking	Ordering code	Package
S BCW 60 A	AA	BCW 60 FN	AN	Refer to index	SOT 23
S BCW 60 B	AB	S BCX 70 G	AG		
S BCW 60 C	AC	S BCX 70 H	AH		
S BCW 60 D	AD	S BCX 70 J	AJ		
BCW 60 FF	AF	S BCX 70 K	AK		

Maximum ratings

Parameter	Symbol	BCW 60	BCW 60 FF	BCX 70	Unit
Collector-emitter voltage	V_{CE0}	32	32	45	V
Collector-base voltage	V_{CB0}	32	32	45	V
Emitter-base voltage	V_{EB0}	5	5	5	V
Collector current	I_C		100		mA
Peak collector current	I_{CM}		200		mA
Peak base current	I_{BM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		330		mW
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375		K/W

S Preferred type

Electrical characteristics

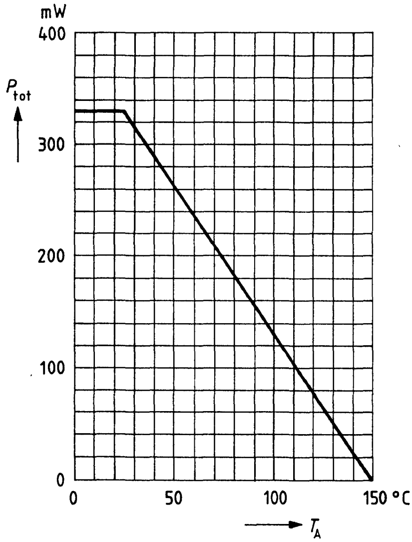
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BCW 60, BCW 60 FF		32	–	–	V
	BCX 70		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10$ µA	BCW 60, BCW 60 FF		32	–	–	V
	BCX 70		45	–	–	V
Emitter-base breakdown voltage $I_E = 1$ µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 32$ V	BCW 60, BCW 60 FF		–	–	20	nA
$V_{CB} = 45$ V	BCX 70		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 60, BCW 60 FF		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCX 70		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	20	nA
DC current gain[1])		h_{FE}				
$I_C = 10$ µA, $V_{CE} = 5$ V						
	BCW 60 A, BCX 70 G		20	140	–	–
	BCW 60 B, BCX 70 H		20	200	–	–
	BCW 60 FF, BCW 60 C, BCX 70 J		40	300	–	–
	BCW 60 FN, BCW 60 D, BCX 70 K		100	460	–	–
$I_C = 2$ mA, $V_{CE} = 5$ V						
	BCW 60 A, BCX 70 G		120	170	220	–
	BCW 60 B, BCX 70 H		180	250	310	–
	BCW 60 FF, BCW 60 C, BCX 70 J		250	350	460	–
	BCW 60 FN, BCW 60 D, BCX 70 K		380	500	630	–
$I_C = 50$ mA, $V_{CE} = 1$ V						
	BCW 60 A, BCX 70 G		50	–	–	–
	BCW 60 B, BCX 70 H		70	–	–	–
	BCW 60 FF, BCW 60 C, BCX 70 J		90	–	–	–
	BCW 60 FN, BCW 60 D, BCX 70 K		100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,12	0,25	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,20	0,55	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 10$ mA, $I_B = 0{,}25$ mA			–	0,70	0,85	V
$I_C = 50$ mA, $I_B = 1{,}25$ mA			–	0,83	1,05	V
Base-emitter voltage		$V_{BE\,(on)}$				
$I_C = 10$ µA, $V_{CE} = 5$ V			–	0,52	–	V
$I_C = 2$ mA, $V_{CE} = 5$ V			0,55	0,65	0,75	V
$I_C = 50$ mA, $V_{CE} = 1$ V[1])			–	0,78	–	V

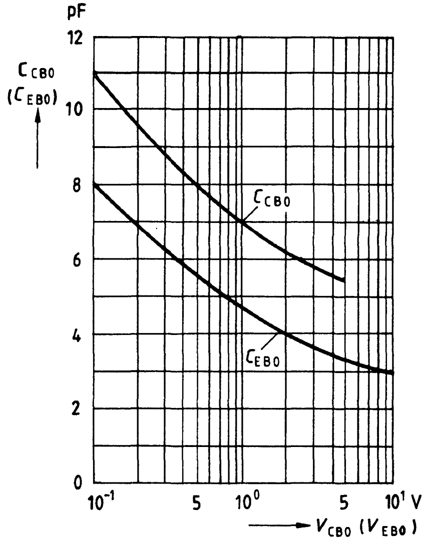
[1]) Pulse test: $t \leq 300$ µs, D = 2%.

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	250	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 MHz	h_{11e}				
BCW 60 A, BCX 70 G		–	2,7	–	kΩ
BCW 60 B, BCX 70 H		–	3,6	–	kΩ
BCW 60 FF, BCW 60 C, BCX 70 J		–	4,5	–	kΩ
BCW 60 FN, BCW 60 D, BCX 70 K		–	7,5	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BCW 60 A, BCX 70 G		–	1,5	–	10^{-4}
BCW 60 B, BCX 70 H		–	2,0	–	10^{-4}
BCW 60 FF, BCW 60 C, BCX 70 J		–	2,0	–	10^{-4}
BCW 60 FN, BCW 60 D, BCX 70 K		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BCW 60 A, BCX 70 G		–	200	–	–
BCW 60 B, BCX 70 H		–	260	–	–
BCW 60 FF, BCW 60 C, BCX 70 J		–	330	–	–
BCW 60 FN, BCW 60 D, BCX 70 K		–	520	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BCW 60 A, BCX 70 G		–	18	–	µs
BCW 60 B, BCX 70 H		–	24	–	µs
BCW 60 FF, BCW 60 C, BCX 70 J		–	30	–	µs
BCW 60 FN, BCW 60 D, BCX 70 K		–	50	–	µs
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 1 kHz, Δf = 200 Hz BCW 60 A to BCX 70 K	F	–	2	–	dB
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 1 kHz, Δf = 200 Hz BCW 60 FF, BCW 60 FN		–	1	2	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 10 Hz ··· 50 Hz BCW 60 FF, BCW 60 FN	V_n	–	–	0,135	µV

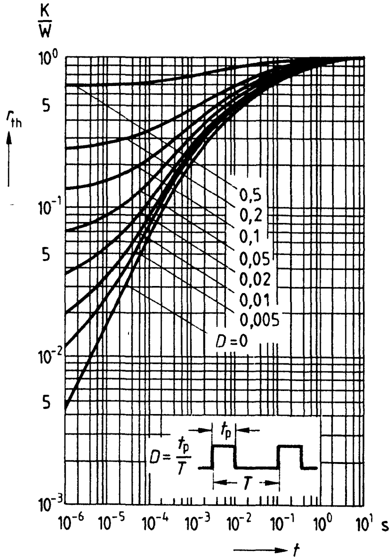
Total power dissipation $P_{tot} = f(T_A)$



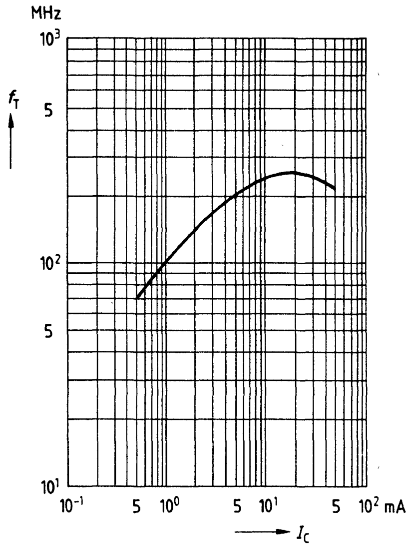
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



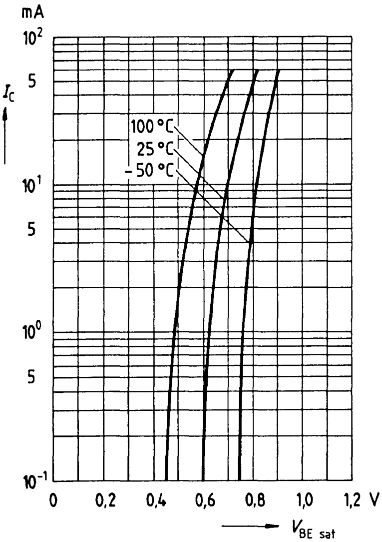
Pulse handling capability $r_{th} = f(t)$
(standardized)



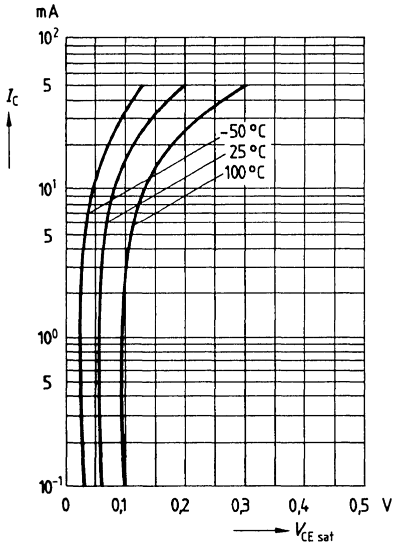
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



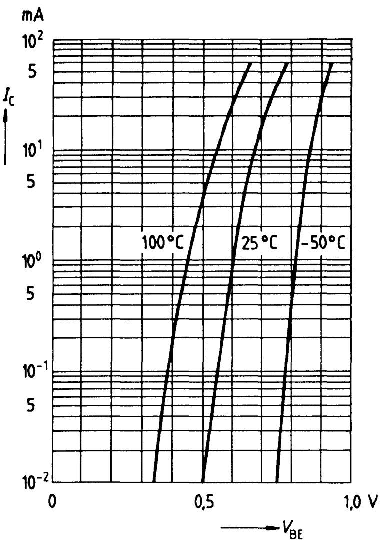
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 40$



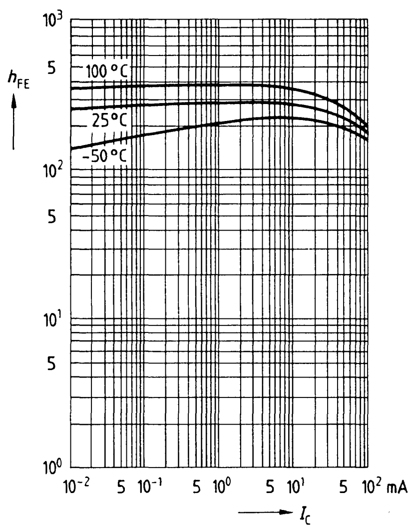
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 40$



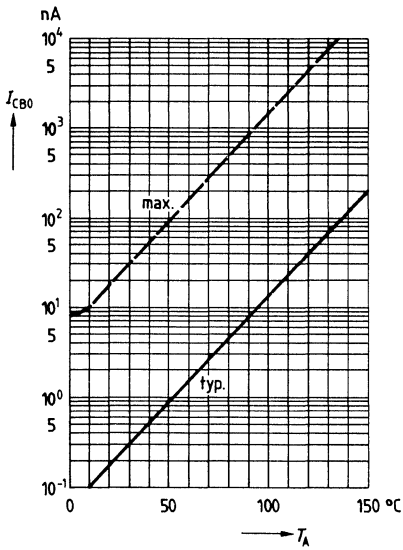
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



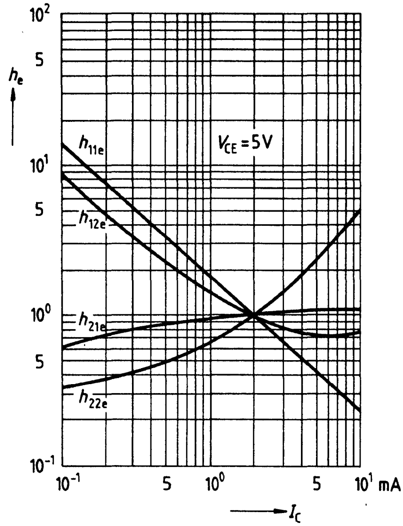
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



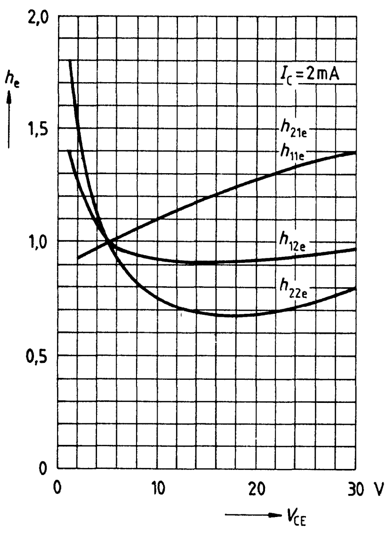
Collector cutoff current $I_{CBO} = f(T_A)$



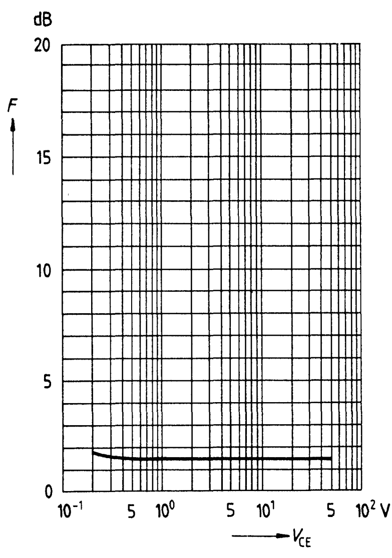
h parameter $h_e = f(I_C)$
$V_{CE} = 5$ V



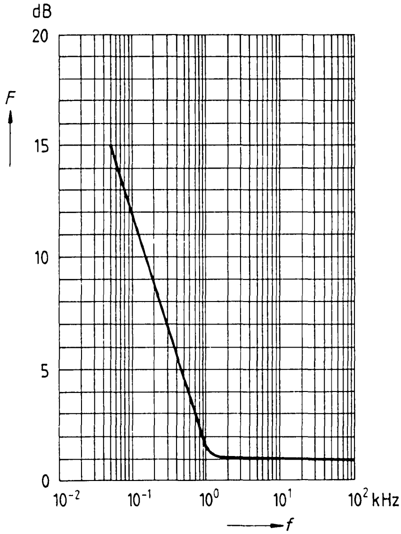
h parameter $h_e = f(V_{CE})$
$I_C = 2$ mA



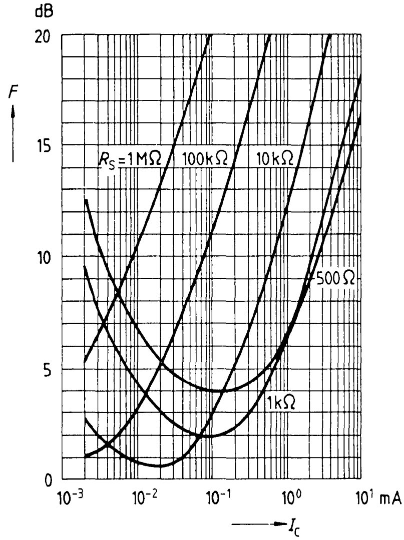
Noise figure $F = f(V_{CE})$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ, $f = 1$ kHz



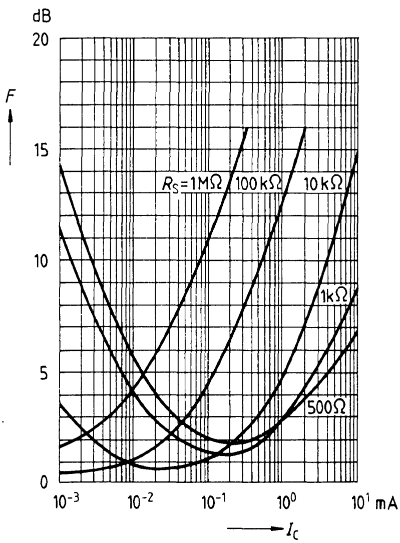
Noise figure $F = f(f)$
$I_C = 0{,}2$ mA, $R_S = 2$ kΩ, $V_{CE} = 5$ V



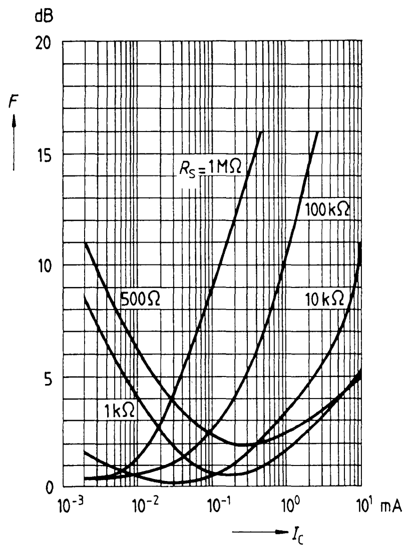
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 120$ Hz



Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 1$ kHz



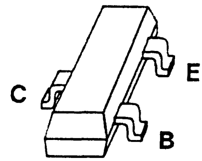
Noise figure $F = f(I_C)$
$V_{CE} = 5$ V, $f = 10$ kHz



PNP Silicon AF Transistors

BCW 61
BCX 71

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz
- Complementary types: BCW 60, BCX 70 (NPN)



Type	Marking	Type	Marking	Ordering code	Package
[S] BCW 61 A	BA	BCX 61 FN	BN	Refer to index	SOT 23
[S] BCW 61 B	BB	[S] BCX 71 G	BG		
[S] BCW 61 C	BC	[S] BCX 71 H	BH		
[S] BCW 61 D	BD	[S] BCX 71 J	BJ		
BCW 61 FF	BF	[S] BCX 71 K	BK		

Maximum ratings

Parameter	Symbol	BCW 61	BCW 61 FF	BCX 71	Unit
Collector-emitter voltage	V_{CE0}	32	32	45	V
Collector-base voltage	V_{CB0}	32	32	45	V
Emitter-base voltage	V_{EB0}	5	5	5	V
Collector current	I_C		100		mA
Peak collector current	I_{CM}		200		mA
Peak base current	I_{BM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		330		mW
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 375		K/W

[S] Preferred type

Electrical characteristics

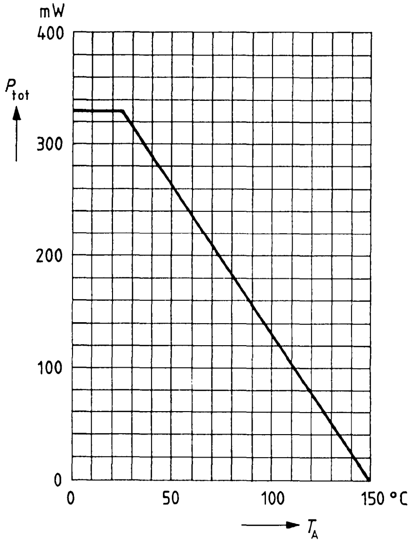
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
I_C = 10 mA	BCW 61, BCW 61 FF		32	–	–	V
	BCX 71		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
I_C = 10 µA	BCW 61, BCW 61 FF		32	–	–	V
	BCX 71		45	–	–	V
Emitter-base breakdown voltage I_E = 1 µA		$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 32 V	BCW 61, BCW 61 FF		–	–	20	nA
V_{CB} = 45 V	BCX 71		–	–	20	nA
V_{CB} = 32 V, T_A = 150 °C	BCW 61, BCW 61 FF		–	–	20	µA
V_{CB} = 45 V, T_A = 150 °C	BCX 71		–	–	20	µA
Emitter cutoff current V_{EB} = 4 V		I_{EBO}	–	–	20	nA
DC current gain[1])		h_{FE}				
I_C = 10 µA, V_{CE} = 5 V						
	BCW 61 A, BCX 71 G		20	140	–	–
	BCW 61 B, BCX 71 H		30	200	–	–
	BCW 61 FF, BCW 61 C, BCX 71 J		40	300	–	–
	BCW 61 FN, BCW 61 D, BCX 71 K		100	460	–	–
I_C = 2 mA, V_{CE} = 5 V						
	BCW 61 A, BCX 71 G		120	170	220	–
	BCW 61 B, BCX 71 H		180	250	310	–
	BCW 61 FF, BCW 61 C, BCX 71 J		250	350	460	–
	BCW 61 FN, BCW 61 D, BCX 71 K		380	500	630	–
I_C = 50 mA, V_{CE} = 1 V						
	BCW 61 A, BCX 71 G		60	–	–	–
	BCW 61 B, BCX 71 H		80	–	–	–
	BCW 61 FF, BCW 61 C, BCX 71 J		100	–	–	–
	BCW 61 FN, BCW 61 D, BCX 71 K		110	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
I_C = 10 mA, I_B = 0,25 mA			–	0,12	0,25	V
I_C = 50 mA, I_B = 1,25 mA			–	0,20	0,55	V
Base-emitter saturation voltage[1])		V_{BEsat}				
I_C = 10 mA, I_B = 0,25 mA			–	0,70	0,85	V
I_C = 50 mA, I_B = 1,25 mA			–	0,83	1,05	V
Base-emitter voltage[1])		$V_{BE(on)}$				
I_C = 10 µA, V_{CE} = 5 V			–	0,52	–	V
I_C = 2 mA, V_{CE} = 5 V			0,55	0,65	0,75	V
I_C = 50 mA, V_{CE} = 1 V			–	0,72	–	V

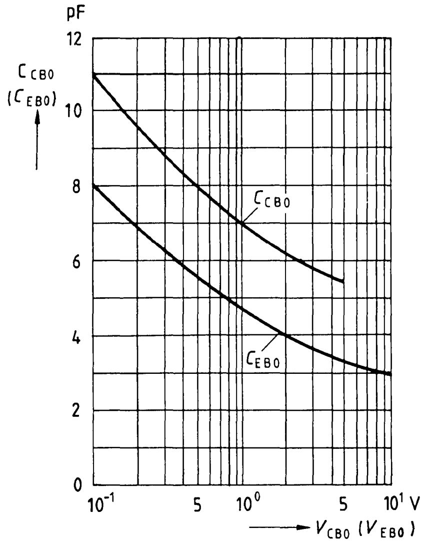
[1]) Pulse test: $t \leq$ 300 µs, D = 2%.

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 5 V, f = 100 MHz	f_T	–	250	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	3	–	pF
Input capacitance V_{CB} = 0,5 V, f = 1 MHz	C_{ib}	–	8	–	pF
Short-circuit input impedance I_C = 2 mA, V_{CE} = 5 V, f = 1 MHz	h_{11e}				
BCW 61 A, BCX 71 G		–	2,7	–	kΩ
BCW 61 B, BCX 71 H		–	3,6	–	kΩ
BCW 61 FF, BCW 61 C, BCX 71 J		–	4,5	–	kΩ
BCW 61 FN, BCW 61 D, BCX 71 K		–	7,5	–	kΩ
Open-circuit reverse voltage transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{12e}				
BCW 61 A, BCX 71 G		–	1,5	–	10^{-4}
BCW 61 B, BCX 71 H		–	2,0	–	10^{-4}
BCW 61 FF, BCW 61 C, BCX 71 J		–	2,0	–	10^{-4}
BCW 61 FN, BCW 61 D, BCX 71 K		–	3,0	–	10^{-4}
Short-circuit forward current transfer ratio I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{21e}				
BCW 61 A, BCX 71 G		–	200	–	–
BCW 61 B, BCX 71 H		–	260	–	–
BCW 61 FF, BCW 61 C, BCX 71 J		–	330	–	–
BCW 61 FN, BCW 61 D, BCX 71 K		–	520	–	–
Open-circuit output admittance I_C = 2 mA, V_{CE} = 5 V, f = 1 kHz	h_{22e}				
BCW 61 A, BCX 71 G		–	18	–	µs
BCW 61 B, BCX 71 H		–	24	–	µs
BCW 61 FF, BCW 61 C, BCX 71 J		–	30	–	µs
BCW 61 FN, BCW 61 D, BCX 71 K		–	50	–	µs
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 1 kHz, Δf = 200 Hz BCW 61 A to BCX 71 K	F	–	2	–	dB
Noise figure I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 1 kHz, Δf = 200 Hz BCW 61 FF, BCW 61 FN		–	1	2	dB
Equivalent noise voltage I_C = 0,2 mA, V_{CE} = 5 V, R_S = 2 kΩ f = 10 Hz ··· 50 Hz BCW 61 FF, BCW 61 FN	V_n	–	–	0,11	µV

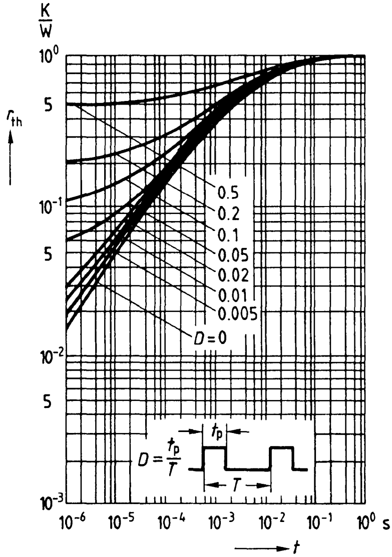
Total power dissipation $P_{tot} = f(T_A)$



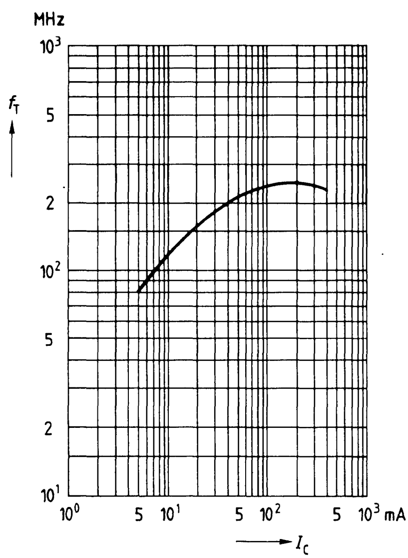
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$



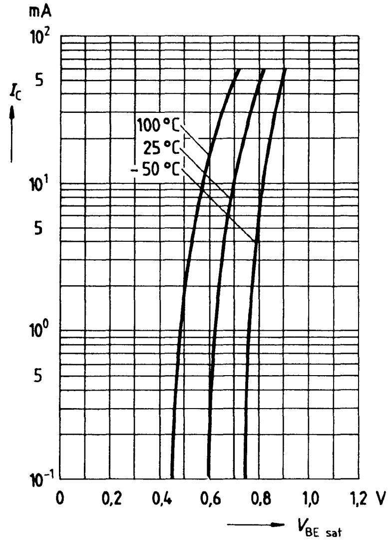
Pulse handling capability $r_{th} = f(t)$
(standardized)



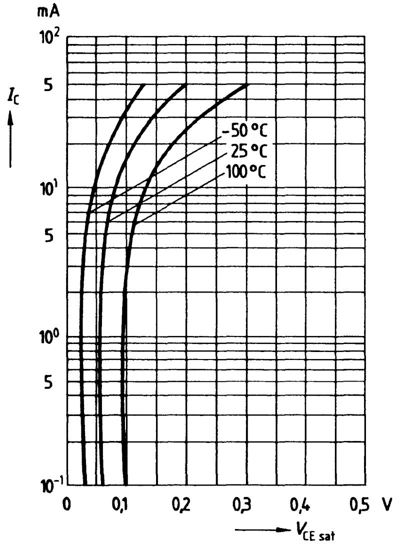
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\,V$



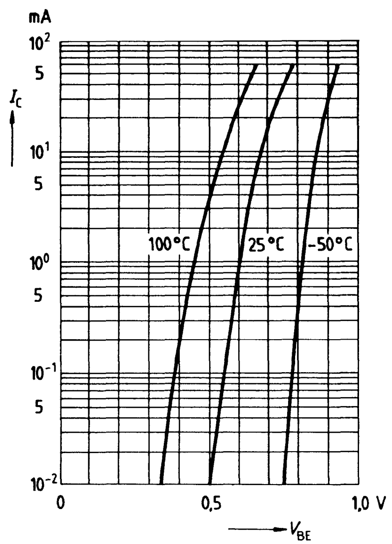
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 40$



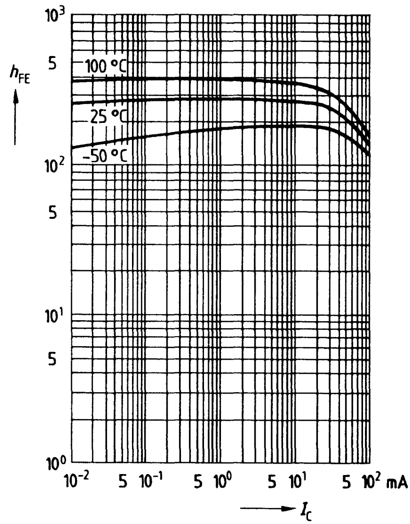
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 40$



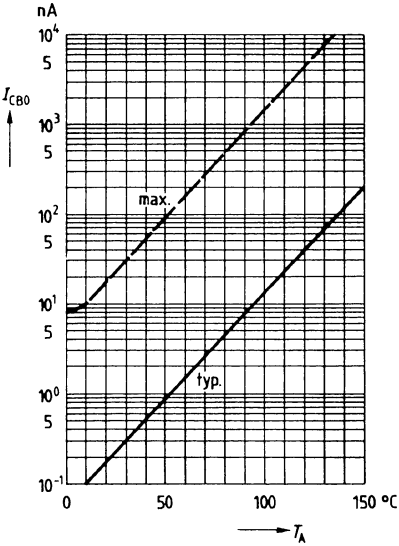
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1\ V$



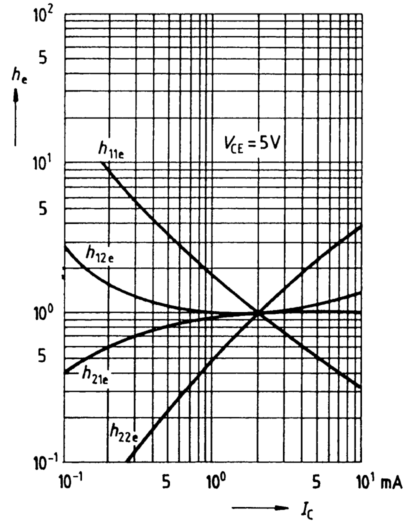
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1\ V$



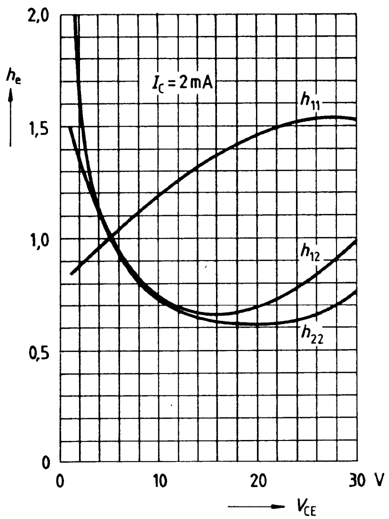
Collector cutoff current $I_{CB0} = f(T_A)$



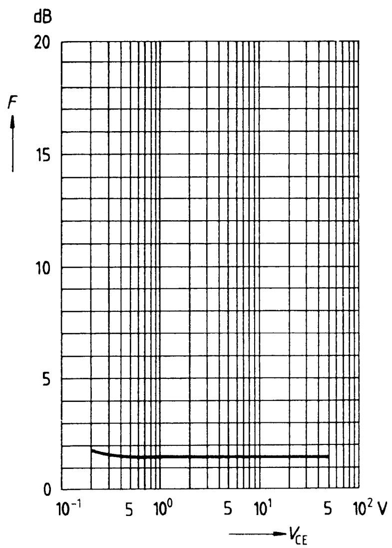
h parameter $h_e = f(I_c)$
$V_{CE} = 5$ V



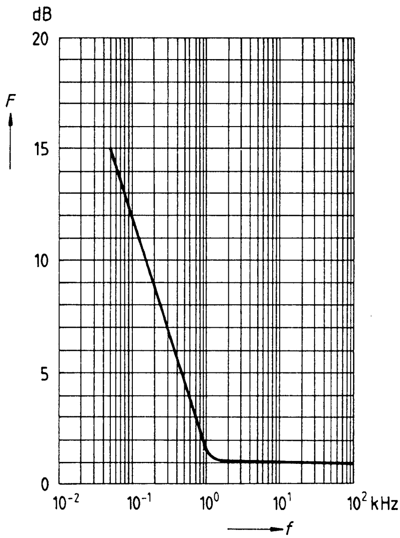
h parameter $h_e = f(V_{CE})$
$I_c = 2$ mA



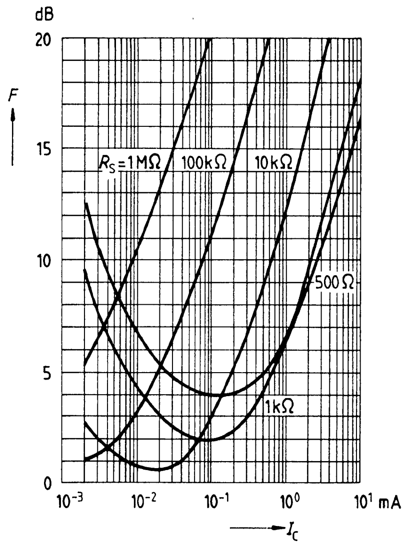
Noise figure $F = f(V_{CE})$
$I_c = 0{,}2$ mA, $R_S = 2$ kΩ, $f = 1$ kHz



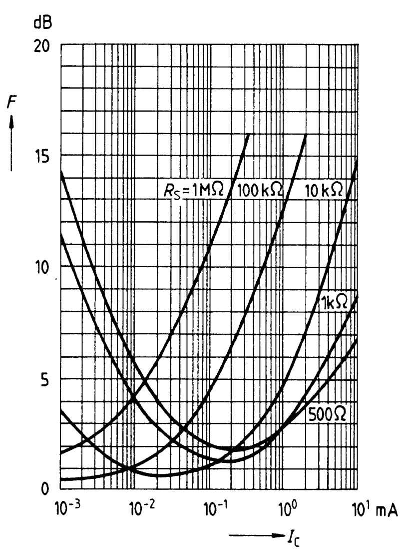
Noise figure $F = f(f)$
I_C = 0,2 mA, R_S = 2 kΩ, V_{CE} = 5 V



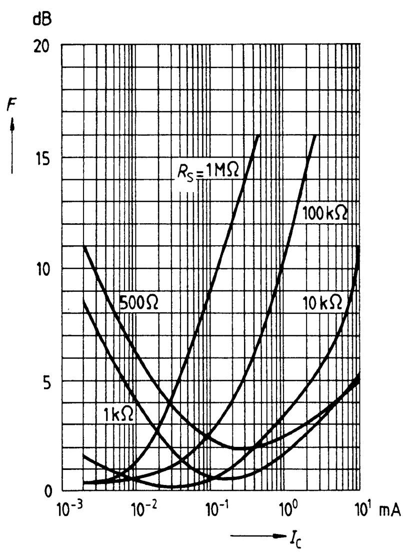
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 120 Hz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 1 kHz



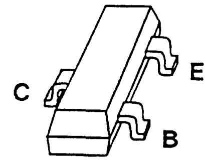
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 10 kHz



NPN Silicon AF Transistors

BCW 65
BCW 66

- For general AF applications
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BCW 67, BCW 68 (PNP)



Type	Marking	Type	Marking	Ordering code	Package
S BCW 65 A	EA	S BCW 66 F	EF	Refer to index	SOT 23
S BCW 65 B	EB	S BCW 66 G	EG		
S BCW 65 C	EC	S BCW 66 H	EH		

Maximum ratings

Parameter	Symbol	BCW 65	BCW 66	Unit
Collector-emitter voltage	V_{CEO}	32	45	V
Collector-base voltage	V_{CBO}	60	75	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

S Preferred type

Electrical characteristics

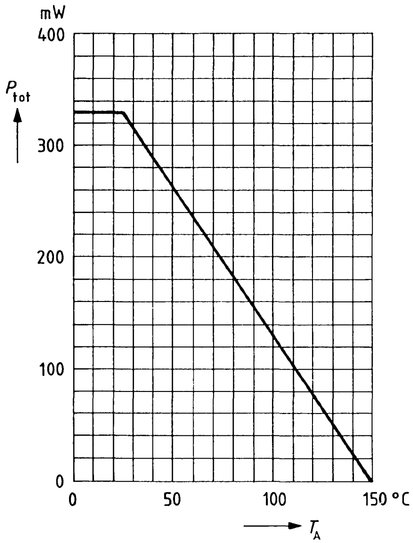
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BCW 65		32	–	–	V
	BCW 66		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10$ µA	BCW 65		60	–	–	V
	BCW 66		75	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 32$ V	BCW 65		–	–	20	nA
$V_{CB} = 45$ V	BCW 66		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 65		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCW 66		–	–	20	µA
Emitter-base cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	20	nA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 10$ V						
	BCW 65 A, BCW 66 F		35	–	–	–
	BCW 65 B, BCW 66 G		50	–	–	–
	BCW 65 C, BCW 66 H		80	–	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V						
	BCW 65 A, BCW 66 F		75	–	–	–
	BCW 65 B, BCW 66 G		110	–	–	–
	BCW 65 C, BCW 66 H		180	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V						
	BCW 65 A, BCW 66 F		100	160	250	–
	BCW 65 B, BCW 66 G		160	250	400	–
	BCW 65 C, BCW 66 H		250	350	630	–
$I_C = 500$ mA, $V_{CE} = 2$ V						
	BCW 65 A, BCW 66 F		35	–	–	–
	BCW 65 B, BCW 66 G		60	–	–	–
	BCW 65 C, BCW 66 H		100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	0,7	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	1,25	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	2,00	V

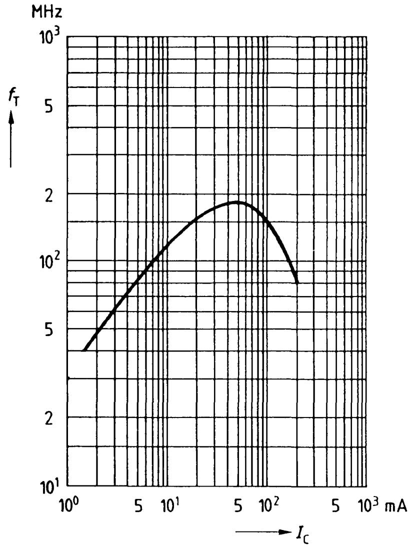
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	170	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

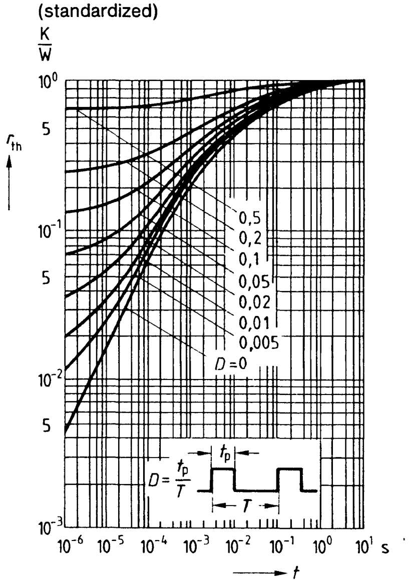
Total power dissipation $P_{tot} = f(T_A)$



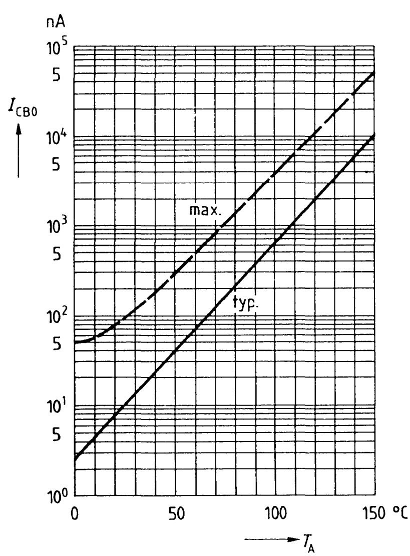
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



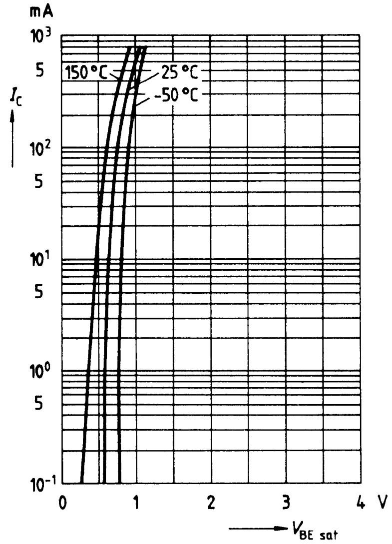
Pulse handling capability $r_{th} = f(t)$
(standardized)



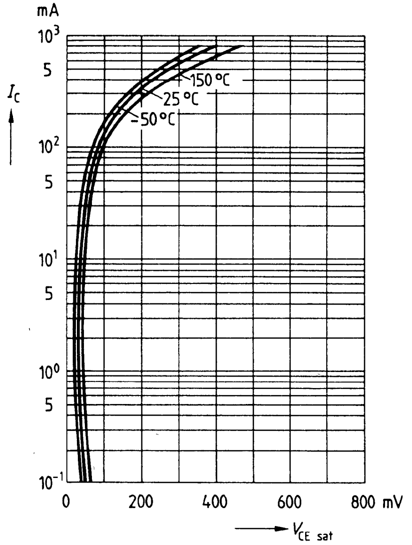
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB0} = 60$ V



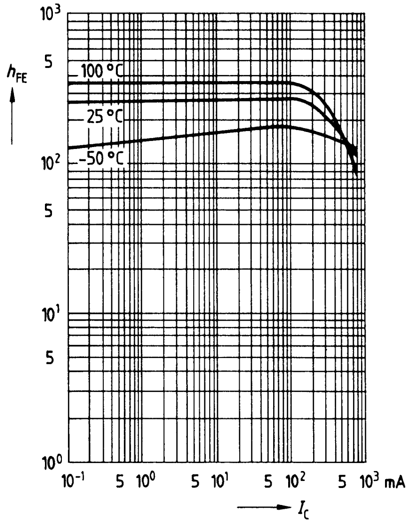
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



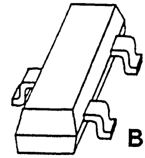
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



PNP Silicon AF Transistors

BCW 67
BCW 68

- For general AF applications
- High current gain
- Low collector-emitter saturation voltage
- Complementary types: BCW 65, BCW 66 (NPN)



Type	Marking	Type	Marking	Ordering code	Package
S BCW 67 A	DA	S BCW 68 F	DF	Refer to index	SOT 23
S BCW 67 B	DB	S BCW 68 G	DG		
S BCW 67 C	DC	S BCW 68 H	DH		

Maximum ratings

Parameter	Symbol	BCW 67	BCW 68	Unit
Collector-emitter voltage	V_{CEO}	32	45	V
Collector-base voltage	V_{CBO}	45	60	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

S Preferred type

Electrical characteristics

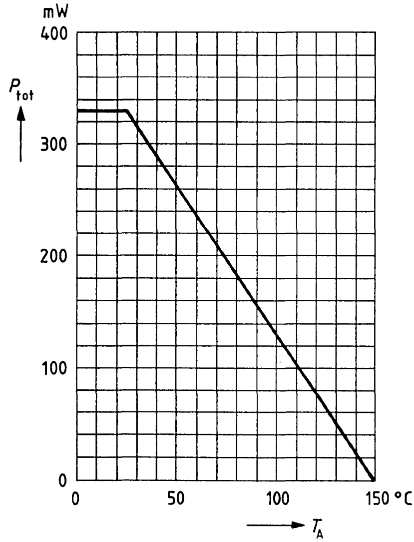
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BCW 67		32	–	–	V
	BCW 68		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10$ µA	BCW 67		45	–	–	V
	BCW 68		60	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 32$ V	BCW 67		–	–	20	nA
$V_{CB} = 45$ V	BCW 68		–	–	20	nA
$V_{CB} = 32$ V, $T_A = 150\,°C$	BCW 67		–	–	20	µA
$V_{CB} = 45$ V, $T_A = 150\,°C$	BCW 68		–	–	20	µA
Emitter-base cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	20	nA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 10$ V						
	BCW 67 A, BCW 68 F		35	–	–	–
	BCW 67 B, BCW 68 G		50	–	–	–
	BCW 67 C, BCW 68 H		40	–	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V						
	BCW 67 A, BCW 68 F		75	–	–	–
	BCW 67 B, BCW 68 G		120	–	–	–
	BCW 67 C, BCW 68 H		180	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V						
	BCW 67 A, BCW 68 F		100	160	250	–
	BCW 67 B, BCW 68 G		160	250	400	–
	BCW 67 C, BCW 68 H		250	350	630	–
$I_C = 500$ mA, $V_{CE} = 2$ V						
	BCW 67 A, BCW 68 F		35	–	–	–
	BCW 67 B, BCW 68 G		60	–	–	–
	BCW 67 C, BCW 68 H		100	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	0,7	V
Base-emitter saturation voltage[1])		V_{BEsat}				
$I_C = 100$ mA, $I_B = 10$ mA			–	–	1,25	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	2	V

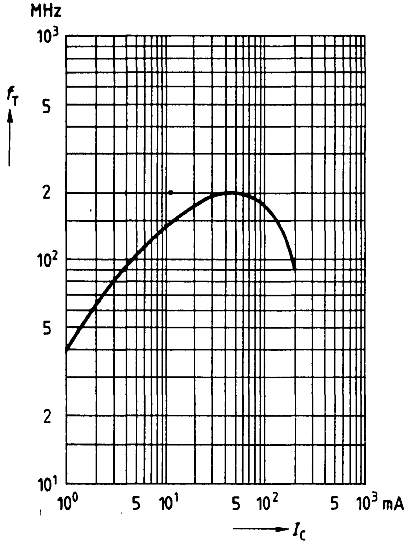
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	200	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	60	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

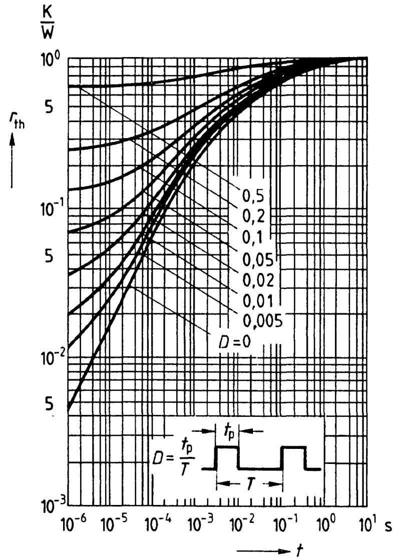
Total power dissipation $P_{tot} = f(T_A)$



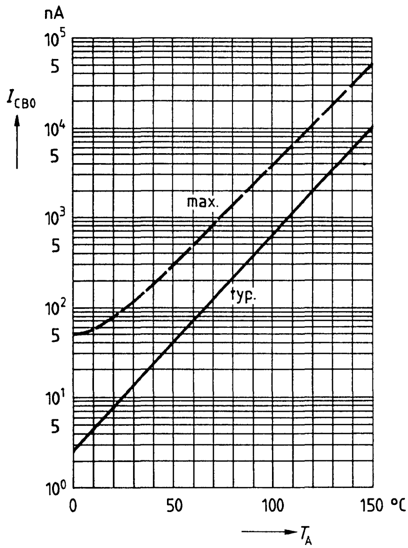
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



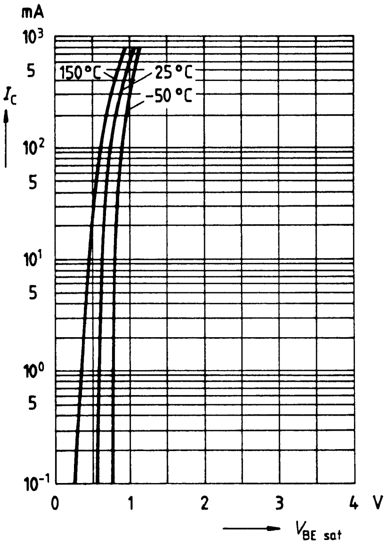
Pulse handling capability $r_{th} = f(t)$
(standardized)



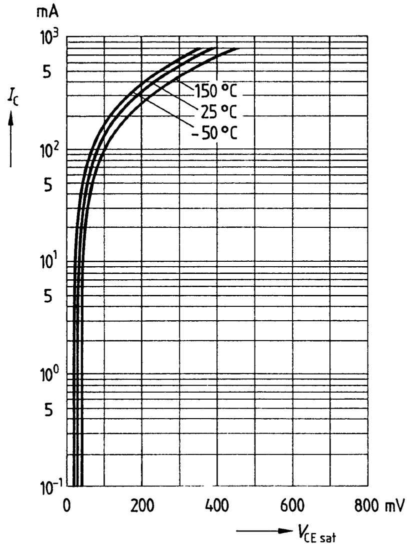
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



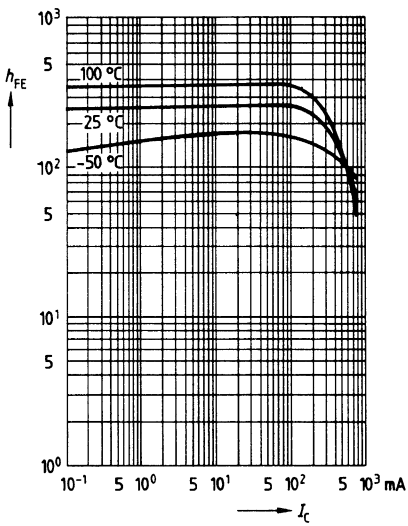
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$



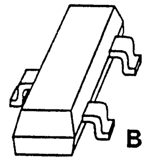
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN Silicon AF and Switching Transistors

BCX 41
BSS 64

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BCX 42, BSS 63 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BCX 41	EK	Q62702–C946	Q62702–C1659	SOT 23
BSS 64	AM	Q62702–S394	Q62702–S535	SOT 23

Maximum ratings

Parameter	Symbol	BSS 64	BCX 41	Unit
Collector-emitter voltage	V_{CEO}	80	125	V
Collector-base voltage	V_{CBO}	120	125	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \dots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

S Preferred type

Electrical characteristics

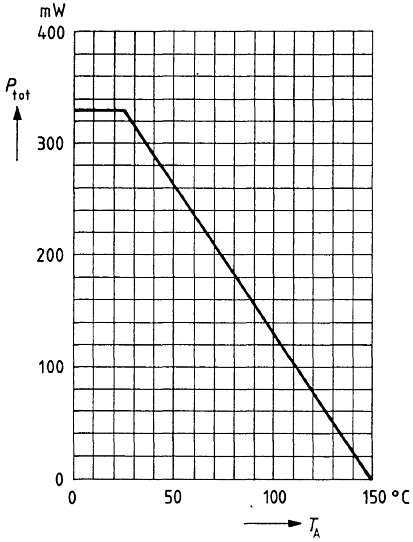
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BSS 64		80	–	–	V
	BCX 41		125	–	–	V
Collector-base breakdown voltage[1])		$V_{(BR)\,CBO}$				
$I_C = 100$ µA	BSS 64		120	–	–	V
	BCX 41		125	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 80$ V	BSS 64		–	–	100	nA
$V_{CB} = 100$ V	BCX 41		–	–	100	nA
$V_{CB} = 80$ V, $T_A = 150\,°C$	BSS 64		–	–	20	µA
$V_{CB} = 100$ V, $T_A = 150\,°C$	BCX 41		–	–	20	µA
Collector cutoff current $V_{CE} = 100$ V, $V_{BE} = 0{,}2$ V		I_{CEO}				
$T_A = 85\,°C$	BSS 64		–	–	10	µA
$T_A = 125\,°C$	BCX 41		–	–	75	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1])		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V	BCX 41		25	–	–	–
$I_C = 1$ mA, $V_{CE} = 1$ V	BSS 64		–	60	–	–
$I_C = 4$ mA, $V_{CE} = 1$ V	BSS 64		20	80	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V	BSS 64		–	80	–	–
$I_C = 20$ mA, $V_{CE} = 1$ V	BSS 64		–	55	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V	BCX 41		63	–	–	–
$I_C = 200$ mA, $V_{CE} = 1$ V	BCX 41		40	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
$I_C = 300$ mA, $I_B = 30$ mA	BCX 41		–	–	0,9	V
$I_C = 4$ mA, $I_B = 0{,}4$ mA	BSS 64		–	–	0,7	V
$I_C = 50$ mA, $I_B = 15$ mA	BSS 64		–	–	3,0	V
Base-emitter saturation voltage[1]) $I_C = 300$ mA, $I_B = 30$ mA	BCX 41	V_{BEsat}	–	–	1,4	V

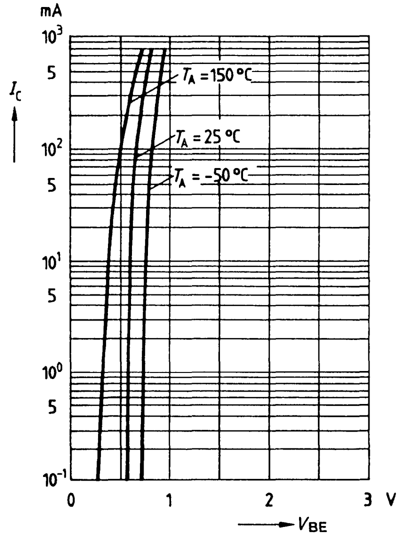
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	12	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

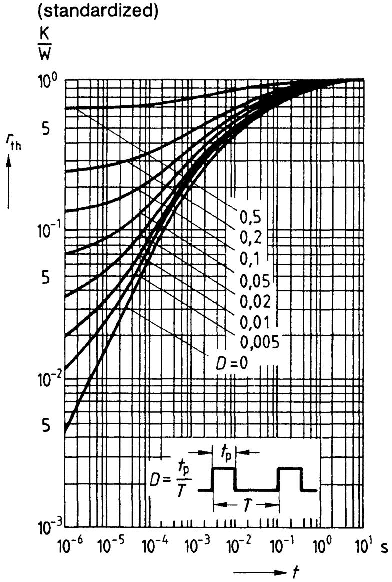
Total power dissipation $P_{tot} = f(T_A)$



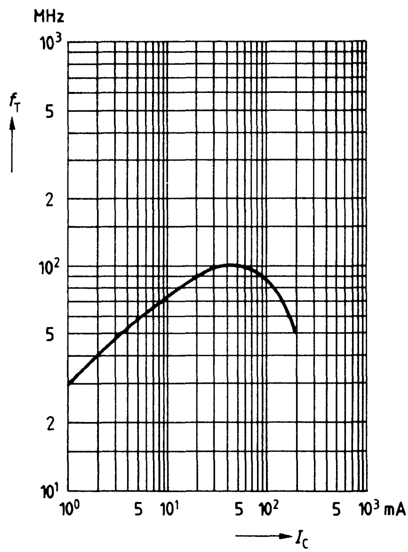
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



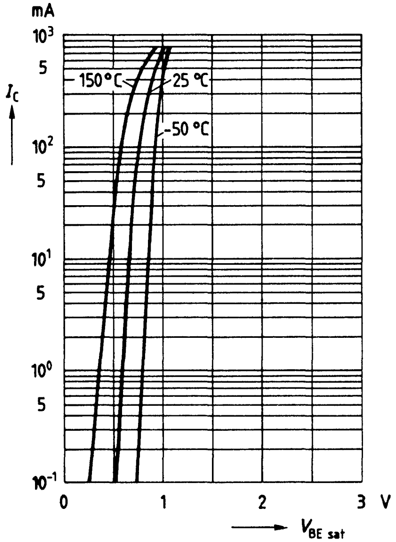
Pulse handling capability $r_{th} = f(t)$
(standardized)



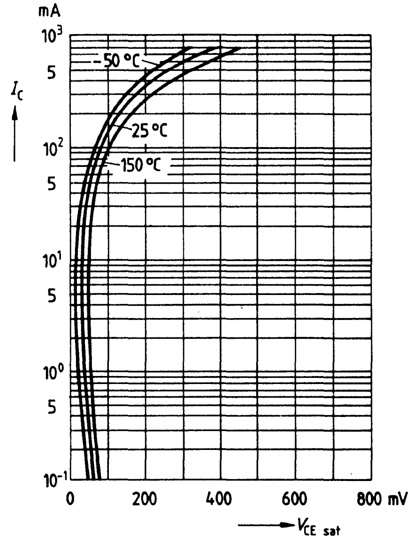
Transition frequency $f_T = f(I_c)$
$V_{CE} = 5$ V



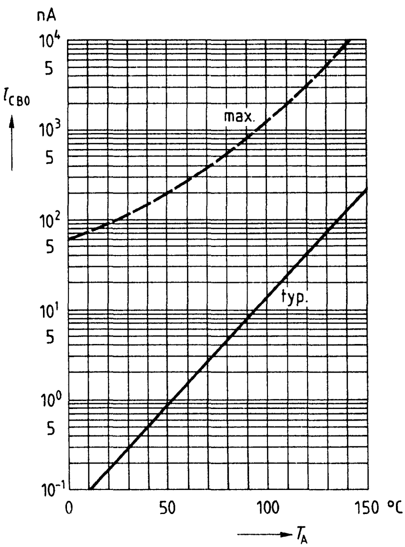
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



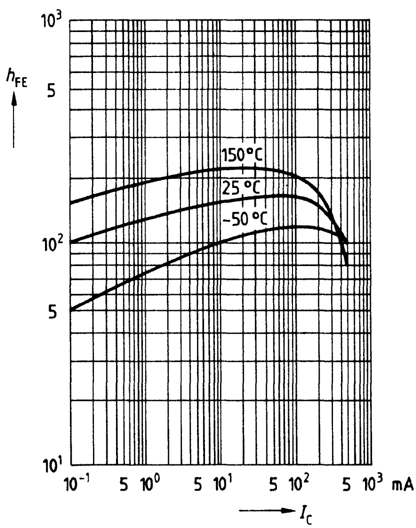
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



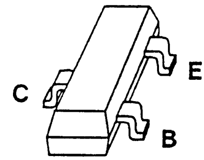
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1\,V$



PNP Silicon AF and Switching Transistors

BCX 42
BSS 63

- For general AF applications
- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BCX 41, BSS 64 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S BCX 42	DK	Q62702–C945	Q62702–C1485	SOT 23
BSS 63	BM	Q62702–S401	Q62702–S534	SOT 23

Maximum ratings

Parameter	Symbol	BSS 63	BCX 42	Unit
Collector-emitter voltage	V_{CEO}	100	125	V
Collector-base voltage	V_{CBO}	110	125	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \dots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

S Preferred type

Electrical characteristics

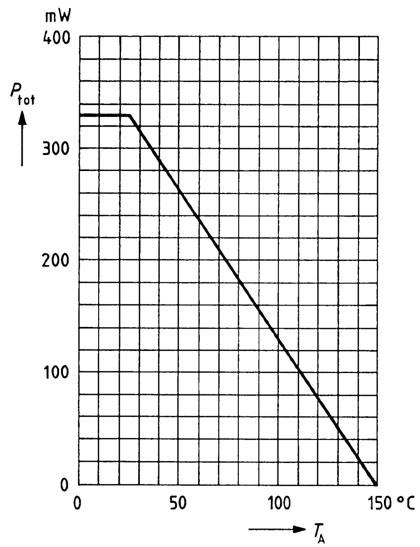
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	BCX 42		125	–	–	V
	BSS 63		100	–	–	V
Collector-base breakdown voltage[1]		$V_{(BR)\,CBO}$				
$I_C = 100$ µA	BCX 42		125	–	–	V
	BSS 63		110	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 80$ V	BSS 63		–	–	100	nA
$V_{CB} = 100$ V	BCX 42		–	–	100	nA
$V_{CB} = 80$ V, $T_A = 150\,°C$	BSS 63		–	–	20	µA
$V_{CB} = 100$ V, $T_A = 150\,°C$	BCX 42		–	–	20	µA
Collector cutoff current		I_{CEO}				
$V_{CE} = 100$ V, $V_{BE} = 0{,}2$ V						
$T_A = 85\,°C$	BCX 42		–	–	10	µA
$T_A = 125\,°C$	BCX 42		–	–	75	µA
Emitter cutoff current $V_{EB} = 4$ V		I_{EBO}	–	–	100	nA
DC current gain[1]		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V	BCX 42		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 5$ V	BSS 63		30	–	–	–
$I_C = 20$ mA, $V_{CE} = 5$ V	BSS 63		30	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V	BCX 42		63	–	–	–
$I_C = 200$ mA, $V_{CE} = 1$ V	BCX 42		40	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
$I_C = 300$ mA, $I_B = 30$ mA	BCX 42		–	–	0,9	V
$I_C = 25$ mA, $I_B = 2{,}5$ mA	BSS 63		–	–	0,25	V
$I_C = 75$ mA, $I_B = 7{,}5$ mA	BSS 63		–	–	0,9	V
Base-emitter saturation voltage[1] $I_C = 300$ mA, $I_B = 30$ mA	BCX 42	V_{BEsat}	–	–	1,4	V

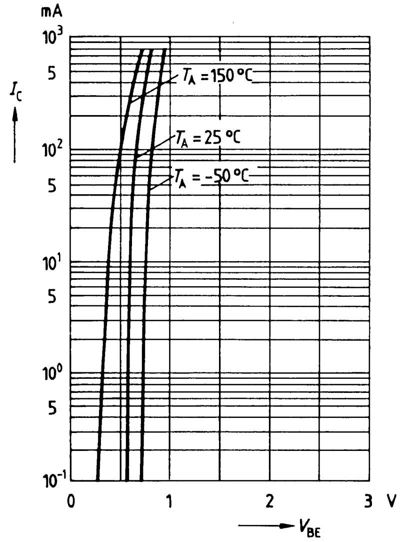
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	150	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	12	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

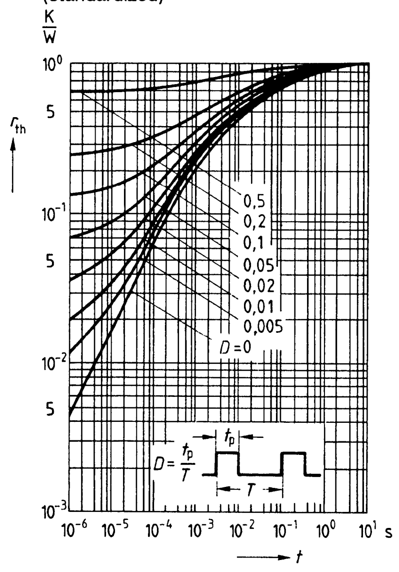
Total power dissipation $P_{tot} = f(T_A)$



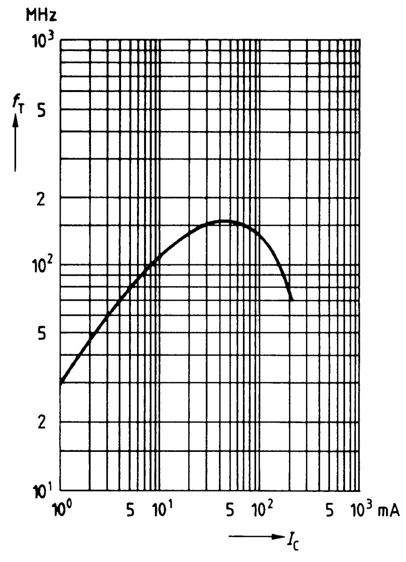
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



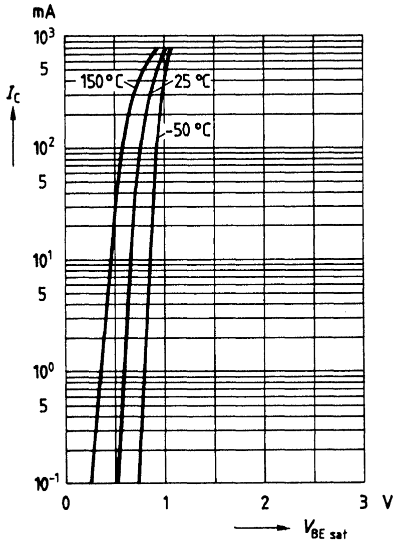
Pulse handling capability $r_{th} = f(t)$
(standardized)



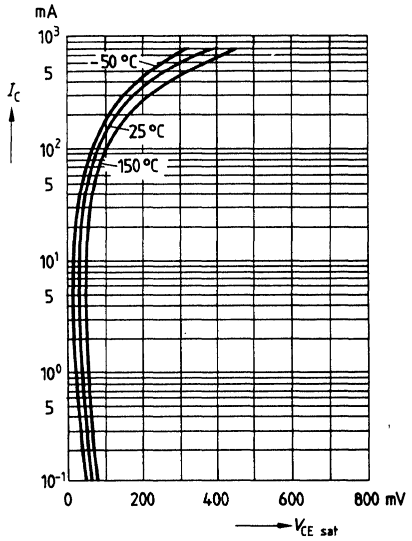
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



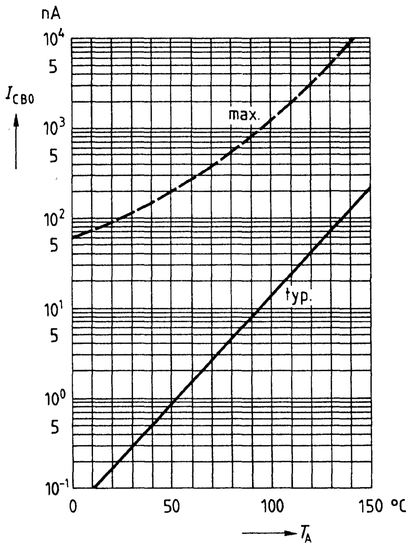
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



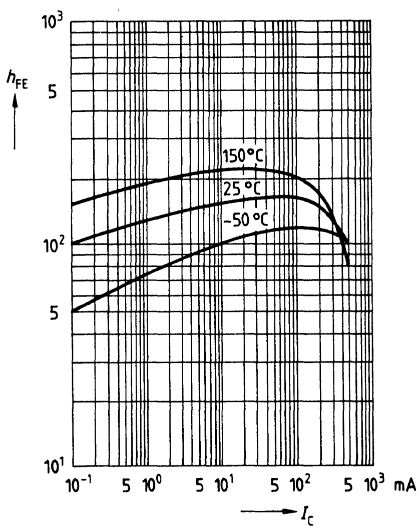
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



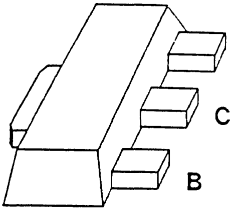
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1\ V$



- For AF driver and output stages
- High collector current
- Low collector-emitter saturation voltage
- Complementary types: BCX 54 ... BCX 56 (NPN)



Type	Marking	Type	Marking	Ordering code	Package
BCX 51–6	AB	BCX 52–16	AM	Refer to index	SOT 89
BCX 51–10	AC	BCX 53–6	AJ		
BCX 51–16	AD	BCX 53–10	AK		
BCX 52–6	AF	BCX 53–16	AL		
BCX 52–10	AG				

Maximum ratings

Parameter	Symbol	BCX 51	BCX 52	BCX 53	Unit
Collector-emitter voltage	V_{CEO}	45	60	80	V
Collector-base voltage	V_{CBO}	45	60	100	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		1		A
Peak collector current	I_{CM}		1,5		A
Base current	I_B		100		mA
Peak base current	I_{BM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		1		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		−65 ... +150		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 125		K/W

Electrical characteristics

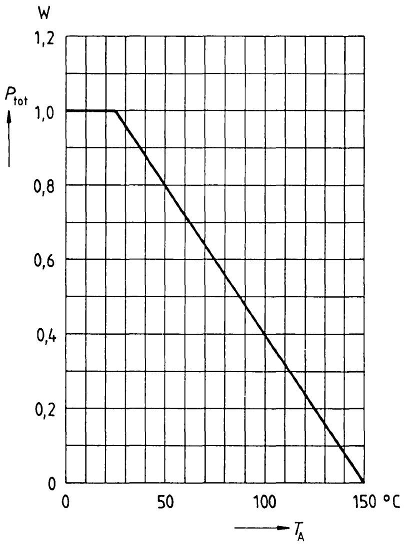
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BCX 51		45	–	–	V
BCX 52		60	–	–	V
BCX 53		80	–	–	V
Collector-base breakdown voltage $I_C = 100$ µA	$V_{(BR)\,CBO}$				
BCX 51		45	–	–	V
BCX 52		60	–	–	V
BCX 53		100	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	20	nA
DC current gain[1])	h_{FE}				
$I_C =$ 5 mA, $V_{CE} = 2$ V		25	–	–	–
$I_C = 150$ mA, $V_{CE} = 2$ V					
BCX 51, BCX 52, BCX 53–6		40	63	100	–
BCX 51, BCX 52, BCX 53–10		63	100	160	–
BCX 51–16, BCX 52–16, BCX 53–16		100	160	250	–
$I_C = 500$ mA, $V_{CE} = 2$ V		25	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1]) $I_C = 500$ mA, $V_{CE} = 2$ V	V_{BE}	–	–	1	V

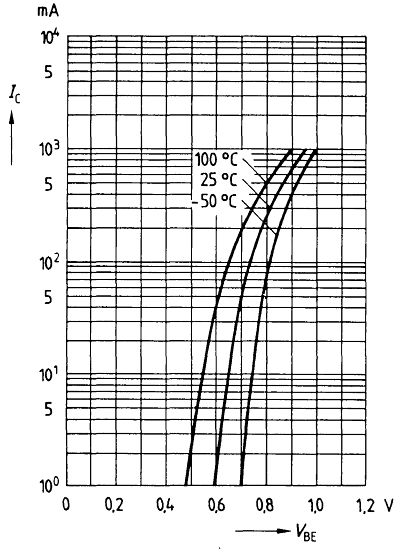
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	125	–	MHz

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

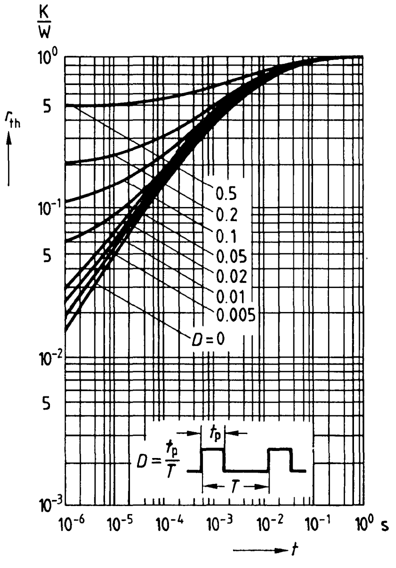
Total power dissipation $P_{tot} = f(T_A)$



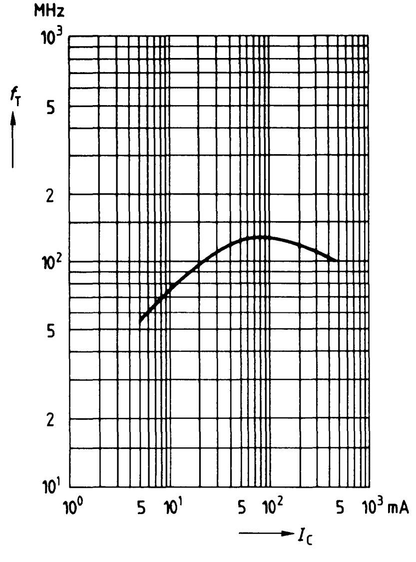
Collector current $I_C = f(V_{BE})$
$V_{CE} = 2$ V



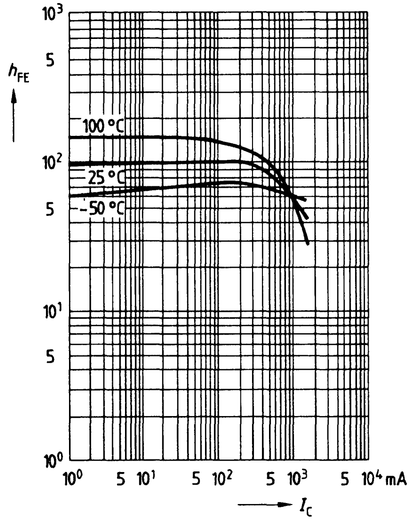
Pulse handling capability $r_{th} = f(t)$
(standardized)



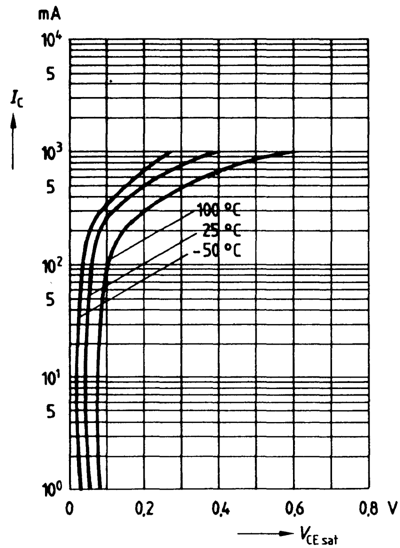
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



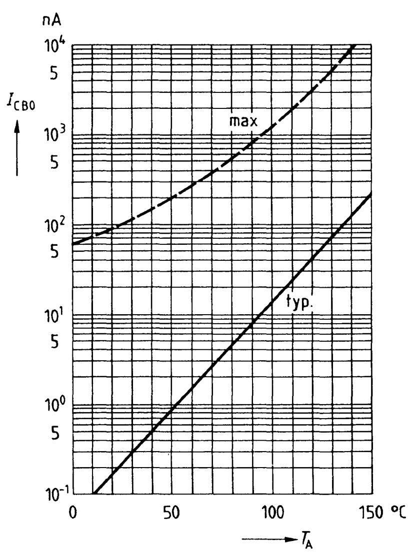
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 2$ V



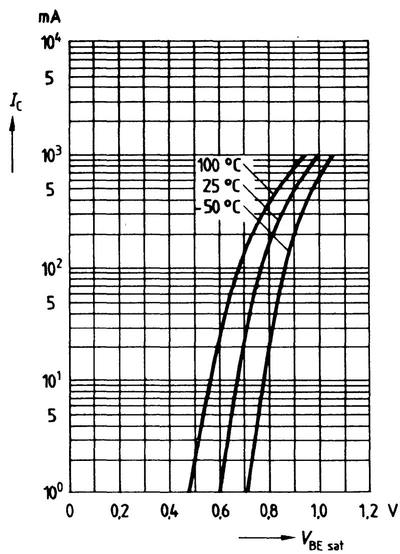
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



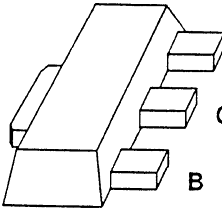
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



NPN Silicon AF Transistors



- For AF driver and output stages
- High collector current
- Low collector-emitter saturation voltage
- Complementary types: BCX 51 … BCX 53 (PNP)

Type	Marking	Type	Marking	Ordering code	Package
BCX 54-6	BB	BCX 55-16	BM	Refer to index	SOT 89
BCX 54-10	BC	BCX 56-6	BJ		
BCX 54-16	BD	BCX 56-10	BK		
BCX 55-6	BF	BCX 56-16	BL		
BCX 55-10	BG				

Maximum ratings

Parameter	Symbol	BCX 54	BCX 55	BCX 56	Unit
Collector-emitter voltage	V_{CEO}	45	60	80	V
Collector-base voltage	V_{CBO}	45	60	100	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		1		A
Peak collector current	I_{CM}		1,5		A
Base current	I_B		100		mA
Peak base current	I_{BM}		200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}		1		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}		$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}		≤ 125		K/W

Electrical characteristics

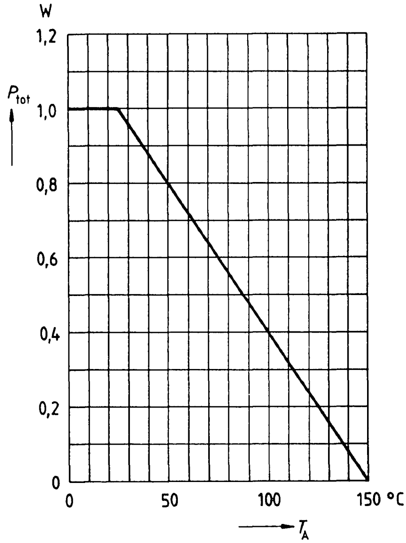
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BCX 54		45	–	–	V
BCX 55		60	–	–	V
BCX 56		80	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$	$V_{(BR)\,CBO}$				
BCX 54		45	–	–	V
BCX 55		60	–	–	V
BCX 56		100	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 30$ V		–	–	100	nA
$V_{CB} = 30$ V, $T_A = 150\,°C$		–	–	20	µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	20	nA
DC current gain[1]	h_{FE}				
$I_C = 5$ mA, $V_{CE} = 2$ V		25	–	–	–
$I_C = 150$ mA, $V_{CE} = 2$ V					
BCX 54, BCX 55, BCX 56–6		40	63	100	–
BCX 54, BCX 55, BCX 56–10		63	100	160	–
BCX 54–16, BCX 55–16, BCX 56–16		100	160	250	–
$I_C = 500$ mA, $V_{CE} = 2$ V		25	–	–	–
Collector-emitter saturation voltage[1] $I_C = 500$ mA, $I_B = 50$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1] $I_C = 500$ mA, $V_{CE} = 2$ V	V_{BE}	–	–	1	V

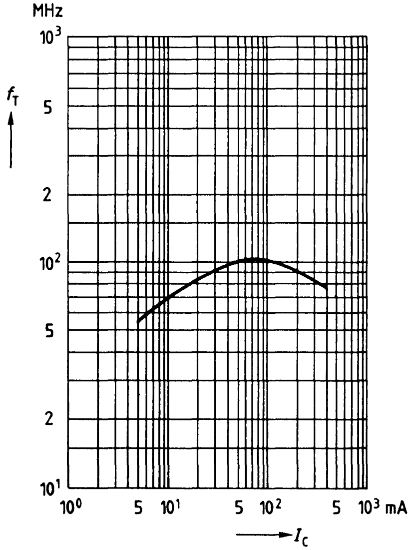
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

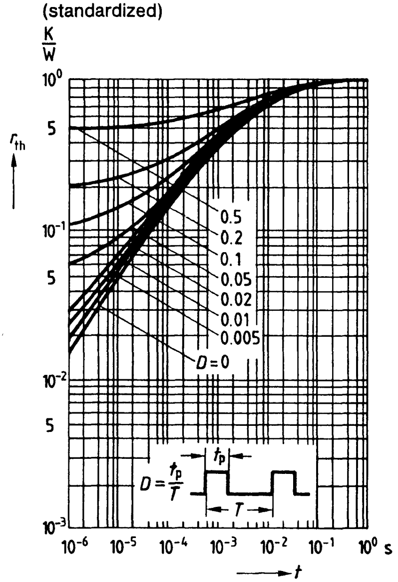
Total power dissipation $P_{tot} = f(T_A)$



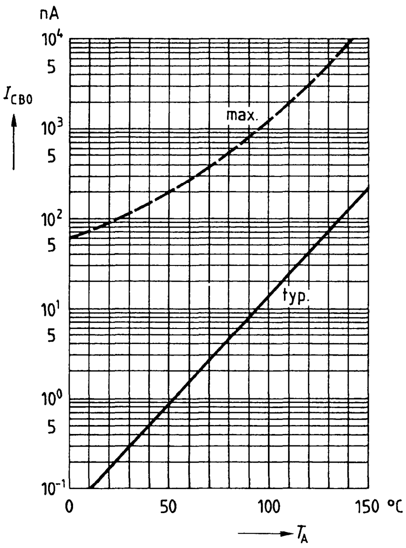
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



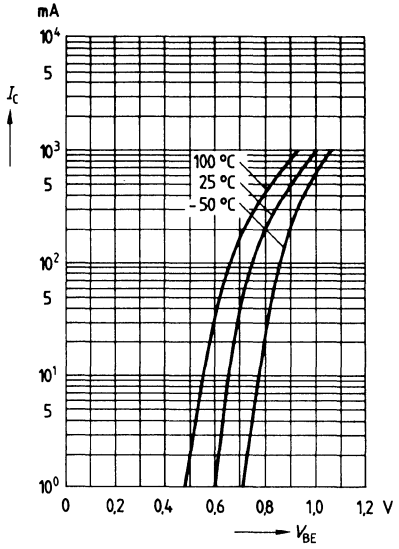
Pulse handling capability $r_{th} = f(t)$
(standardized)



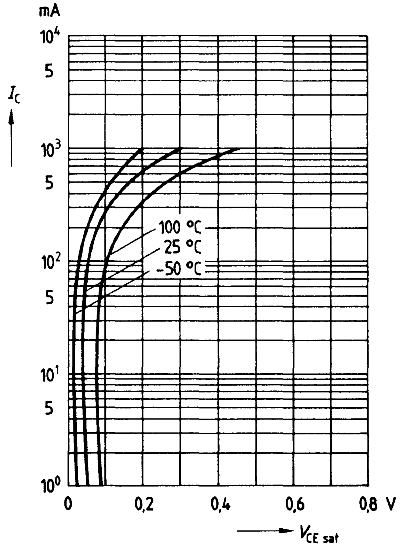
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 30$ V



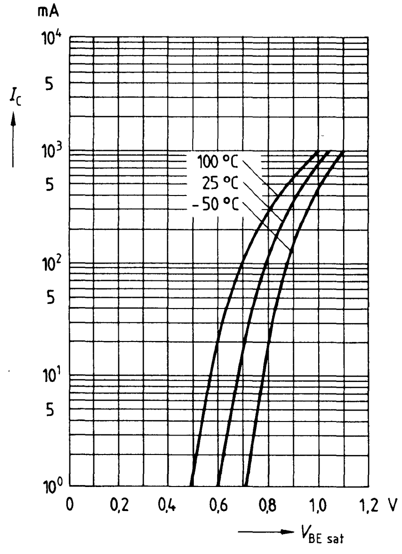
Collector current $I_C = f(V_{BE})$
$V_{CE} = 2$ V



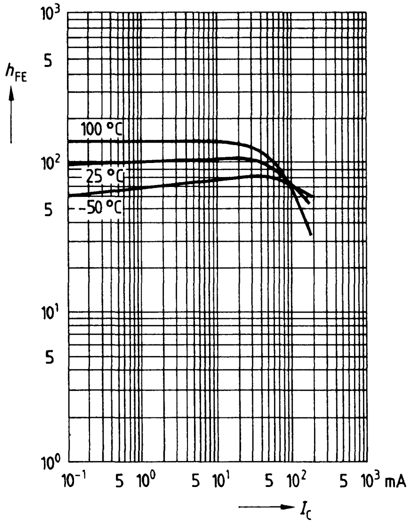
Collector-emitter saturation voltage
$I_c = f(V_{CE\,sat})$
$h_{FE} = 10$



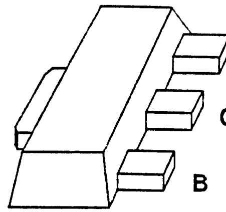
Base-emitter saturation voltage $I_c = f(V_{BE\,sat})$
$h_{FE} = 10$



DC current gain $h_{FE} = f(I_c)$
$V_{CE} = 2$ V



- For general AF applications
- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary type: BCX 69 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BCX 68–10	CB	Q62702–C1077	Q62702–C1864	SOT 89
BCX 68–16	CC	Q62702–C1078	Q62702–C1865	SOT 89
BCX 68–25	CD	Q62702–C1079	Q62702–C1866	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CE0}	20	V
Collector-base voltage	V_{CB0}	25	V
Emitter-base voltage	V_{EB0}	5	V
Collector current	I_C	1	A
Peak collector current	I_{CM}	2	A
Base current	I_B	100	mA
Peak base current	I_{BM}	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

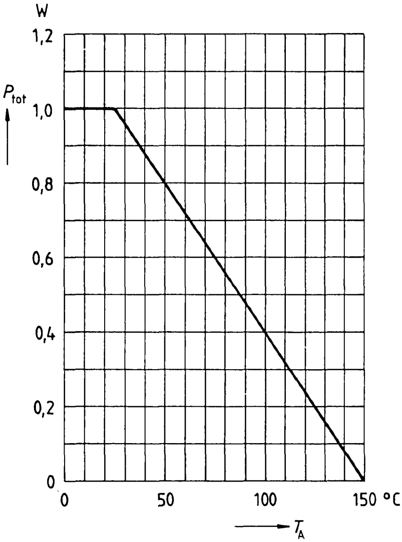
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 30$ mA	$V_{(BR)\,CE0}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CB0}$	25	–	–	V
Emitter-base breakdown voltage $I_E = 1\ \mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150\,°C$	I_{CB0}	 – –	 – –	 100 10	 nA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EB0}	–	–	10	µA
DC current gain[1]) $I_C =$ 5 mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} =$ 1 V BCX 68–10 BCX 68–16 BCX 68–25 $I_C = 1$ A, $V_{CE} = 1$ V	h_{FE}	 50 63 100 160 60	 – 100 160 250 –	 – 160 250 400 –	 – – – – –
Collector-emitter saturation voltage[1]) $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1]) $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 1$ A, $V_{CE} =$ 1 V	V_{BE}	 – –	 0,6 –	 – 1	 V V

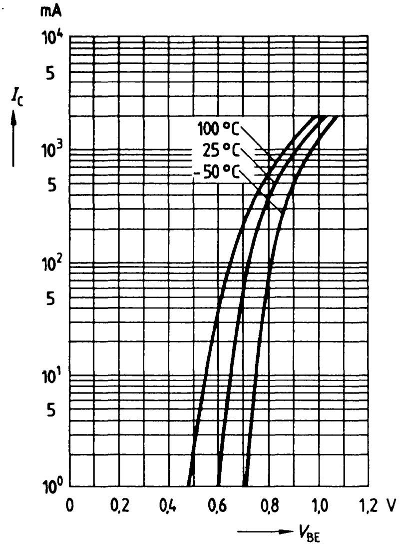
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

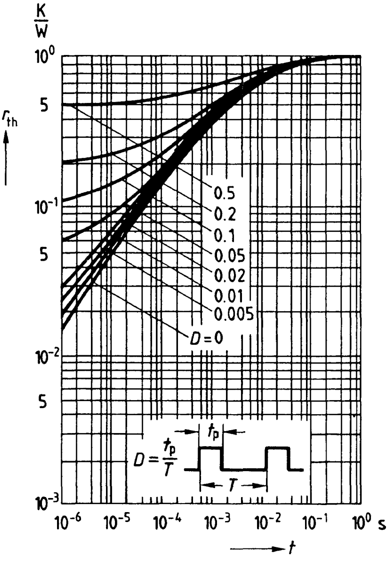
Total power dissipation $P_{tot} = f(T_A)$



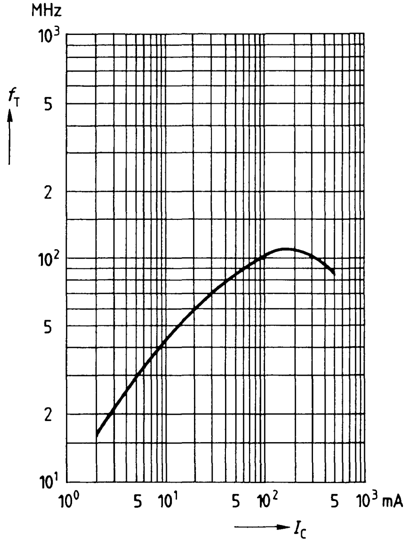
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



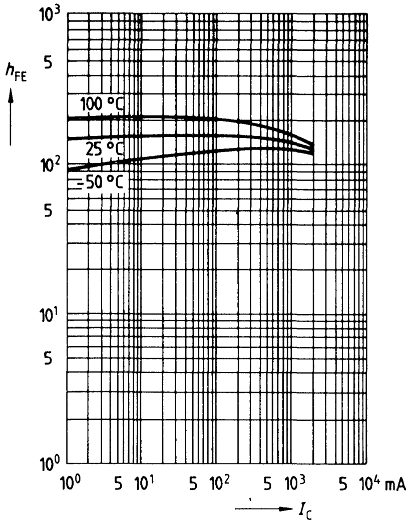
Pulse handling capability $r_{th} = f(t)$
(standardized)



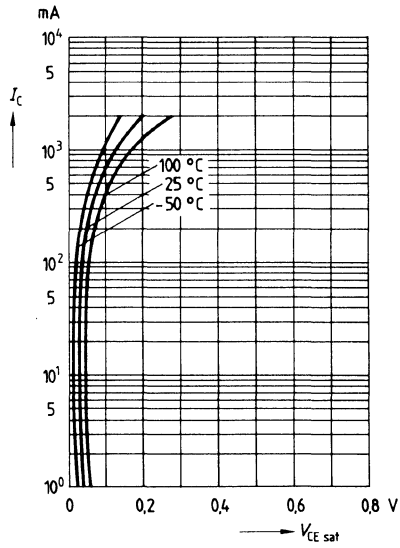
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



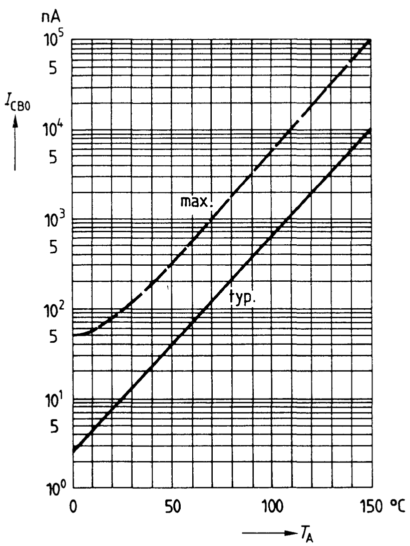
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



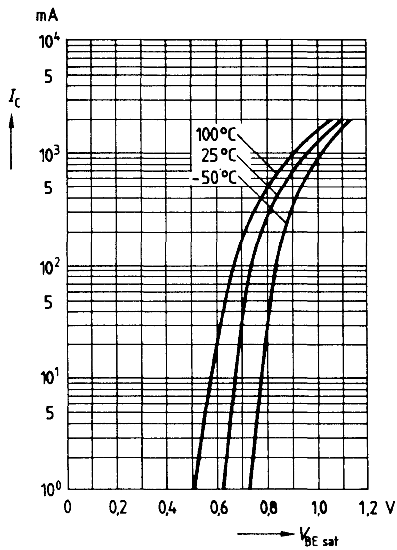
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



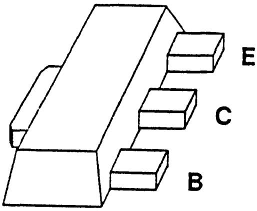
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 25$ V



Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



- For general AF applications
- High collector current
- High current gain
- Low collector-emitter saturation voltage
- Complementary type: BCX 68 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BCX 69–10	CF	Q62702–C1080	Q62702–C1867	SOT 89
BCX 69–16	CG	Q62702–C1081	Q62702–C1868	SOT 89
BCX 69–25	CH	Q62702–C1082	Q62702–C1869	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	1	A
Peak collector current	I_{CM}	2	A
Base current	I_B	100	mA
Peak base current	I_{BM}	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

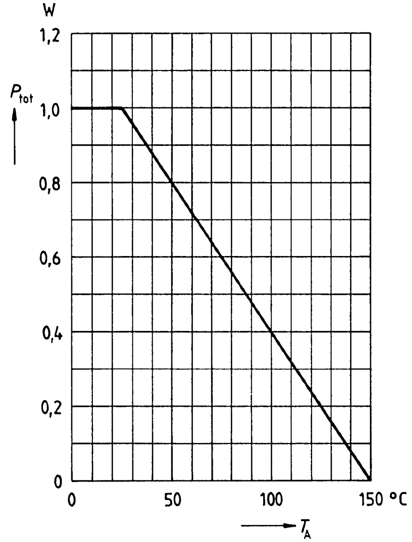
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 30$ mA	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	25	–	–	V
Emitter-base breakdown voltage $I_E = 1\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 25$ V $V_{CB} = 25$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 10	 nA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1] $I_C =$ 5 mA, $V_{CE} = 10$ V $I_C = 500$ mA, $V_{CE} =$ 1 V BCX 69–10 BCX 69–16 BCX 69–25 $I_C = 1$ A, $V_{CE} = 1$ V	h_{FE}	 50 63 100 160 60	 – 100 160 250 –	 – 160 250 400 –	 – – – – –
Collector-emitter saturation voltage[1] $I_C = 1$ A, $I_B = 100$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter voltage[1] $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 1$ A, $V_{CE} = 1$ V	V_{BE}	 – –	 0,6 –	 – 1	 V V

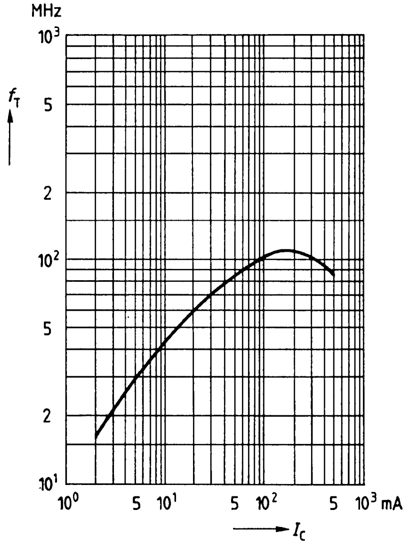
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

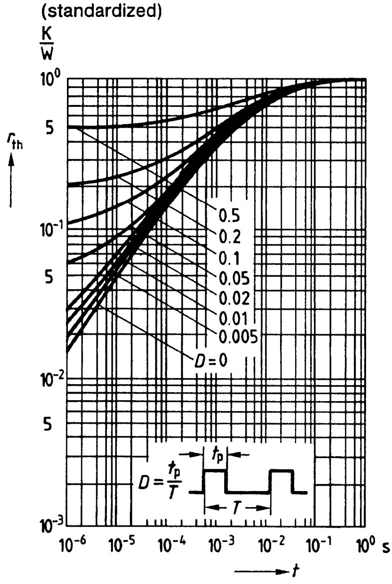
Total power dissipation $P_{tot} = f(T_A)$



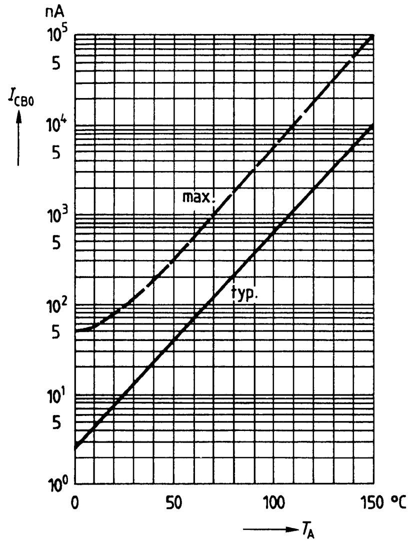
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



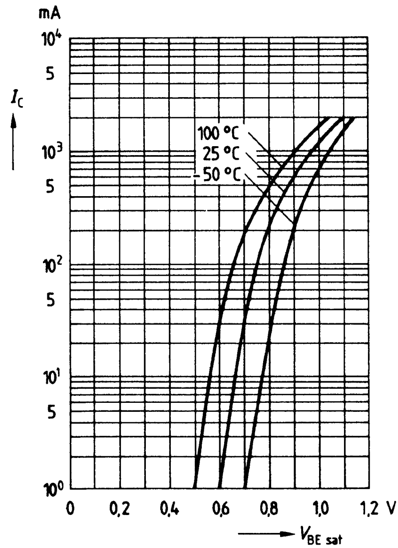
Pulse handling capability $r_{th} = f(t)$
(standardized)



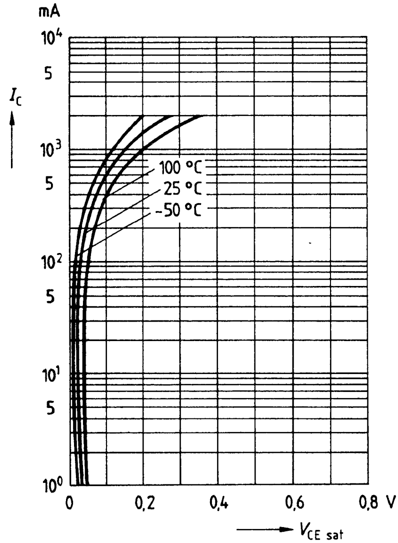
Collector cutoff current
$I_{CB0} = f(T_A)$
$V_{CB} = 25$ V



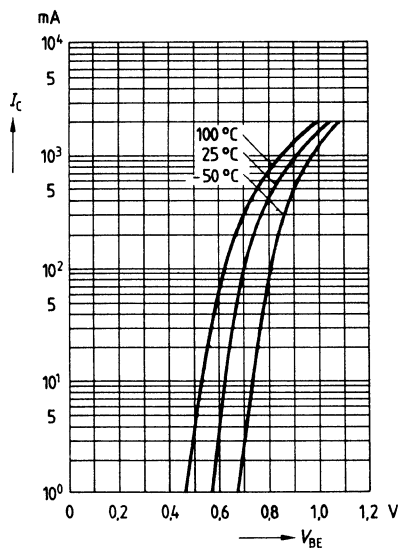
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



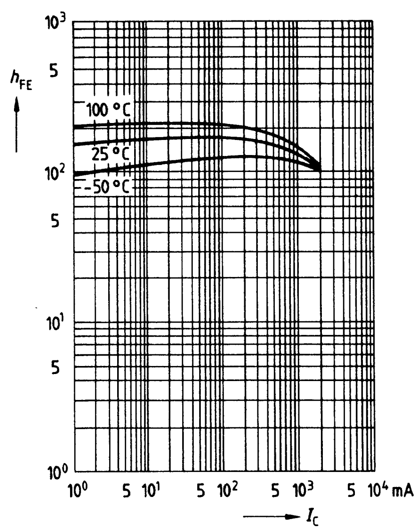
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



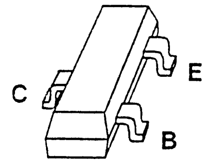
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



- Broadband amplifier and oscillator applications up to 1 GHz



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 517	LR	Q62702–F988	Q62702–F78	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	25	mA
Base current	I_B	5	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

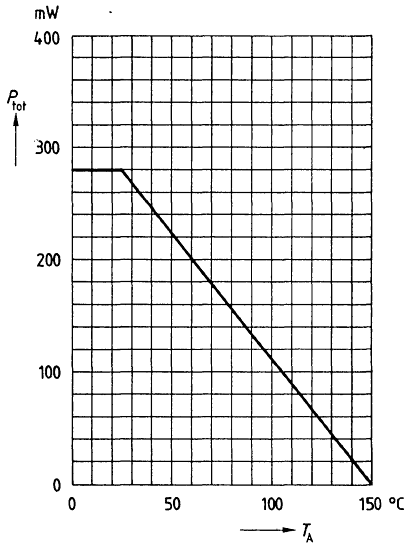
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

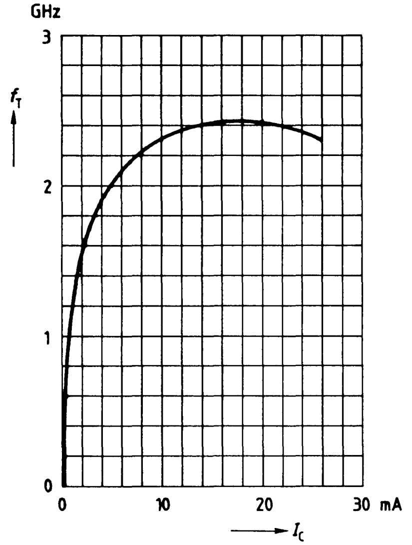
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CE0}$	15	–	–	V
Collector cutoff current $V_{CB} = 15$ V, $I_B = 0$	I_{CB0}	–	–	50	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 10$ V	h_{FE}	25	–	250	–
Collector-emitter saturation voltage $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	0,1	0,5	V
Base-emitter saturation voltage $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	0,95	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 200$ MHz	f_T	1	2	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	0,3	0,5	0,75	pF
Collector-emitter capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,26	0,4	pF
Noise figure	F				
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz		–	2,5	–	dB
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 800$ MHz		–	5,0	–	dB

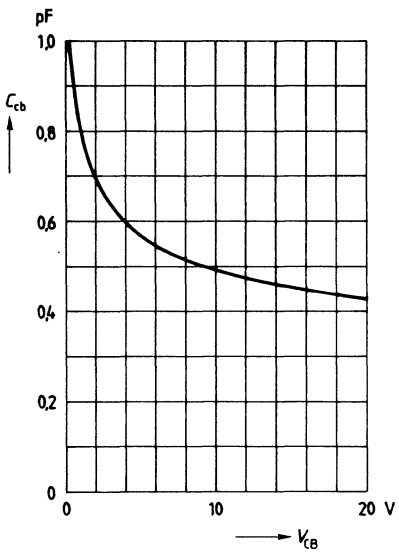
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz

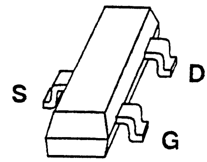


Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



Preliminary Data

- For RF stages up to 300 MHz preferably in FM applications
- I_{DSS} = 4 mA, g_{fs} = 12 mS



ESD:Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Ordering code (taped)	Package
BF 543	LD	Q62702-F1230	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	mA
Total power dissipation, $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	-55 ... +150	°C
Channel temperature	T_{ch}	150	°C
Ambient temperature range	T_A	-55 ... +150	°C

Thermal Resistance

Junction - ambient[1]	R_{thJA}	≤ 450	K/W

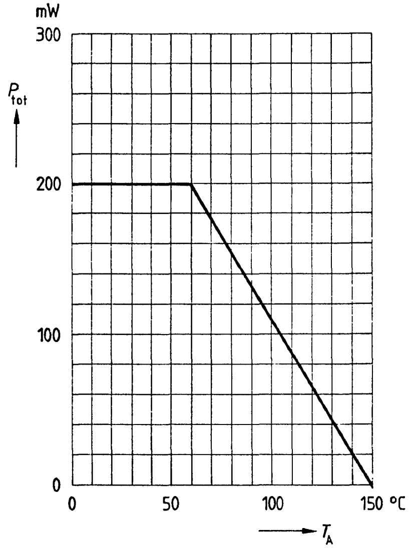
[1] Package mounted on alumina 16.7 mm x 15 mm x 0.7 mm

Electrical Characteristics
at $T_A = 25$ °C, unless otherwise specified.

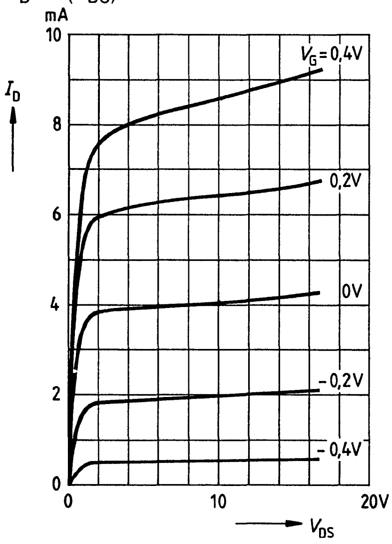
Parameter	Symbol	Value			Unit
		min.	typ.	max.	
DC characteristics					
Drain-source breakdown voltage $I_D = 10$ µA, $-V_{GS} = 4$ V	$V_{(BR)DS}$	20	-	-	V
Gate-source breadown voltage $\pm I_{GS} = 10$ mA, $V_{DS} = 0$	$\pm V_{(BR)GSS}$	7	-	12	V
Gate cutoff current $\pm V_{GS} = 6$ V, $V_{DS} = 0$	$\pm I_{GSS}$	-	-	50	nA
Drain current $V_{DS} = 10$ V, $V_{GS} = 0$	I_{DSS}	1.5	4	6.5	mA
Gate-source pinch-off voltage $V_{DS} = 10$ V, $I_D = 20$ µA	$-V_{GS(p)}$	-	0.7	1.5	V
AC characteristics					
Forward transconductance $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 1$ kHz	g_{fs}	9.5	12	-	mS
Gate-1 input capacitance $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 1$ MHz	C_{gss}	-	2.7	-	pF
Reverse transfer capacitance $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 1$ MHz	C_{dg}	-	25	-	fF
Output capacitance $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 1$ MHz	C_{dss}	-	0.9	-	pF
Power gain (test circuit) $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 200$ MHz $G_G = 2$ mS, $G_L = 0.5$ mS	G_{ps}	-	22	-	dB
Noise figure (test circuit) $V_{DS} = 10$ V, $I_D = 4$ mA, $f = 200$ MHz $G_G = 2$ mS, $G_L = 0.5$ mS	F	-	1	-	dB

Characteristics
at $T_j = 25\ °C$, unless otherwise specified.

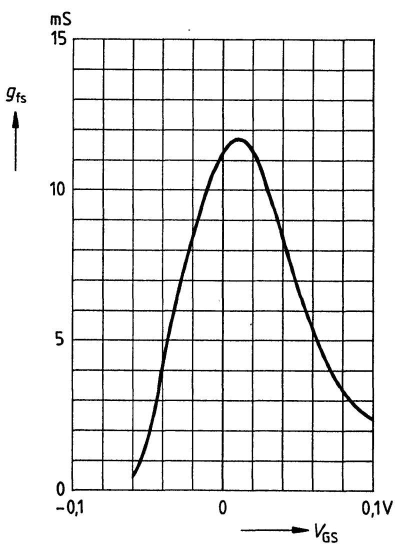
Power dissipation $P_{tot} = f\ (T_A)$



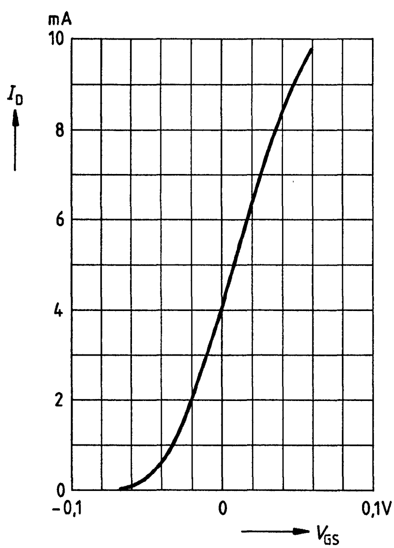
Typ. output characteristics field
$I_D = f\ (V_{DS})$



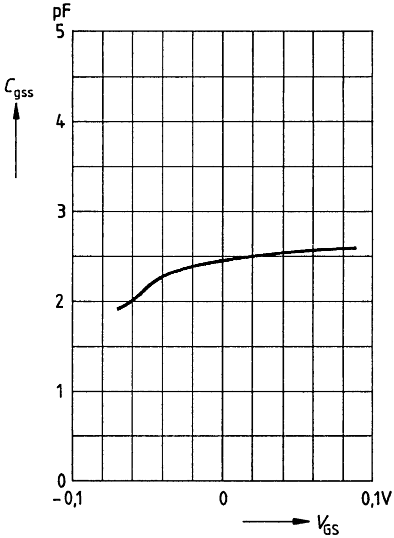
Gate transconductance $g_{fs} = f\ (V_{GS})$
$V_{DS} = 10$ V, $I_{DSS} = 4$ m A, $f = 1$ kHz



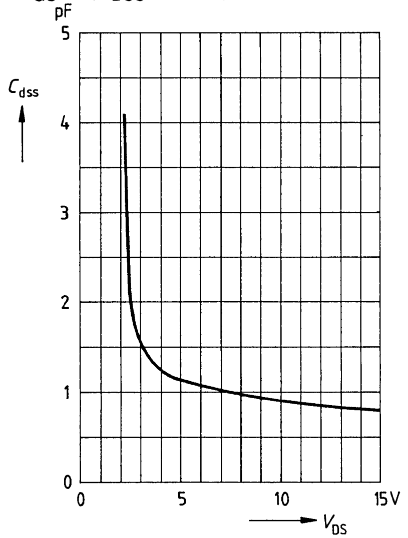
Drain current $I_D = f\ (V_{GS})$
$V_{DS} = 10$ V



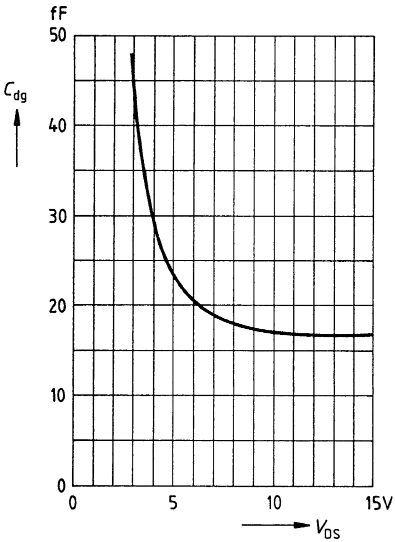
Gate input capacitance $C_{gss} = f\ (V_{GS})$
V_{DS} = 10 V, I_{DSS} = 4 mA, f = 1 MHz



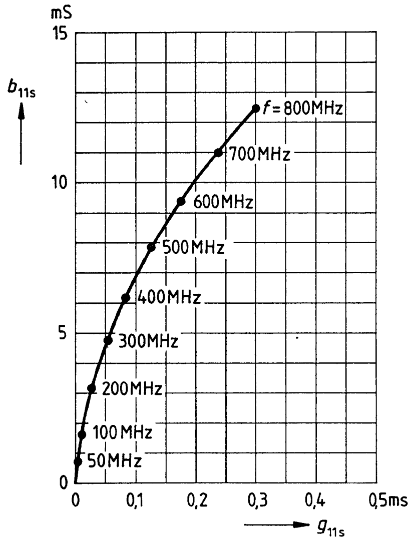
Output capacitance $C_{dss} = f\ (V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



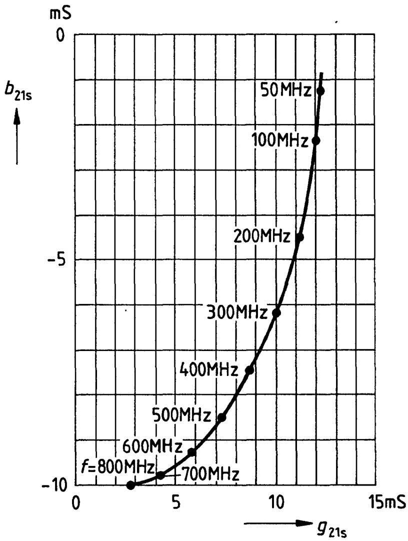
Reverse transfer capacitance $C_{dg} = f\ (V_{DS})$
V_{GS} = 0, I_{DSS} = 4 mA, f = 1 MHz



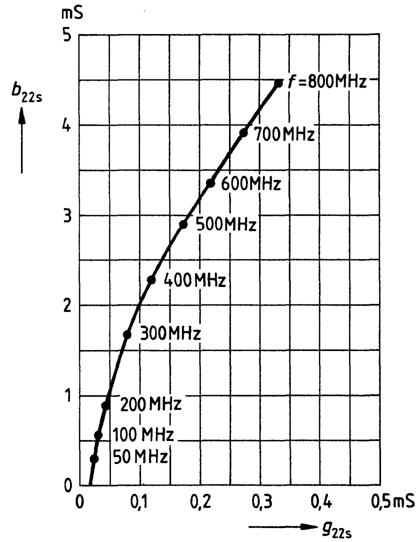
Gate 1 input admittance y_{11s}
V_{DS} = 10 V, I_{DSS} = 4 mA, V_{GS} = 0
(source circuit)



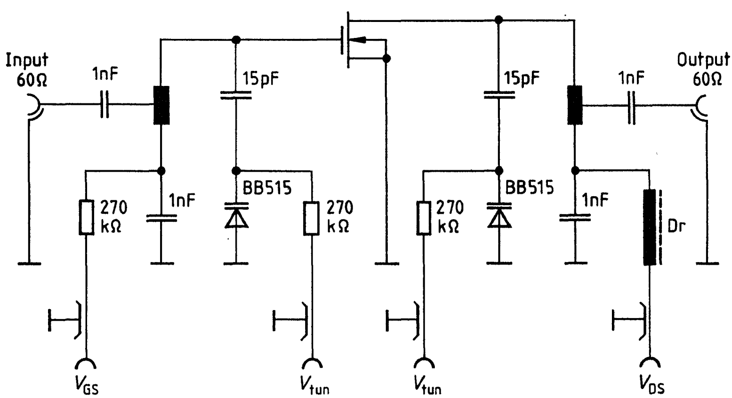
Gate 1 transconductance y_{21s}
$V_{DS} = 10$ V, $I_{DSS} = 4$ mA, $V_{GS} = 0$
(source circuit)



Output admittance y_{22s}
$V_{DS} = 10$ V, $I_{DSS} = 10$ mA, $V_{GS} = 0$
(source circuit)

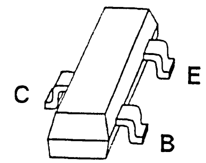


Test circuit for power gain G_p and noise figure F
$f = 200$ MHz



PNP Silicon RF Transistor BF 550

- For amplifiers in common emitter configuration up to 300 MHz
- Specially suitable for mixer applications in AM/FM radios and VHF/TV tuners
- Low collector-base capacitance due to shield diffusion
- Controlled low output admittance



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 550	LA	Q62702–F547	Q62702–F944	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	25	mA
Base current	I_B	5	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

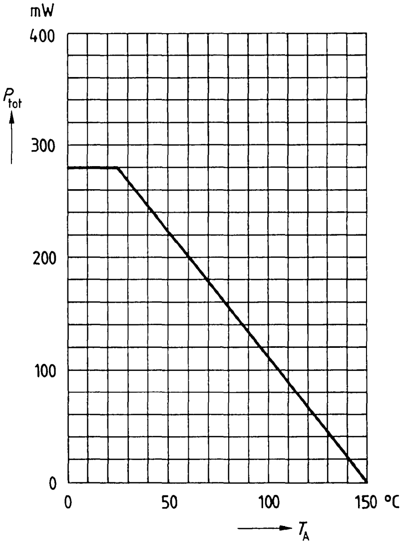
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

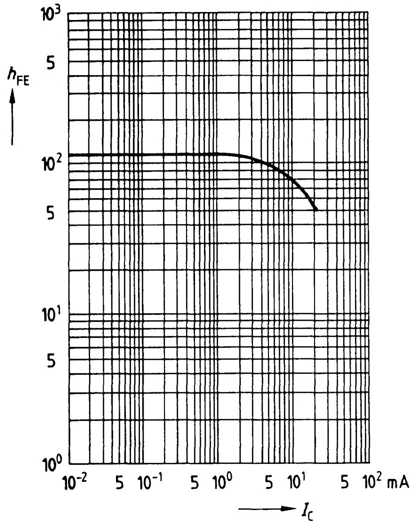
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$, $I_E = 0$	$V_{(BR)\,CBO}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$, $I_C = 0$	$V_{(BR)\,EBO}$	4	–	–	V
Collector cutoff current $V_{CB} = 30$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 1$ mA, $V_{CE} = 10$ V	h_{FE}	50	–	250	–
Base-emitter voltage $I_C = 1$ mA, $V_{CE} = 10$ V	V_{BE}	–	0,72	–	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	350	–	MHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,33	–	pF
Collector-emitter capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,67	–	pF
Noise figure	F				
$I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ kHz, $R_S = 300\ \Omega$		–	2	–	dB
$I_C = 2$ mA, $V_{CE} = 10$ V, $f = 100$ MHz, $R_S = 60\ \Omega$		–	3,4	–	dB
Four-pole characteristics, common-emitter configuration $I_C = 1$ mA, $V_{CE} = 10$ V					
$f = 0{,}45 \cdots 10$ MHz	g_{11e}	–	550	–	µs
	c_{11e}	–	17	–	pF
	$\lvert y_{21e} \rvert$	–	35	–	mS
	c_{22e}	–	1,3	–	pF
$f = 450$ kHz	g_{22e}	–	5	8	µs
$f = 10$ MHz	g_{22e}	–	5	10	µs

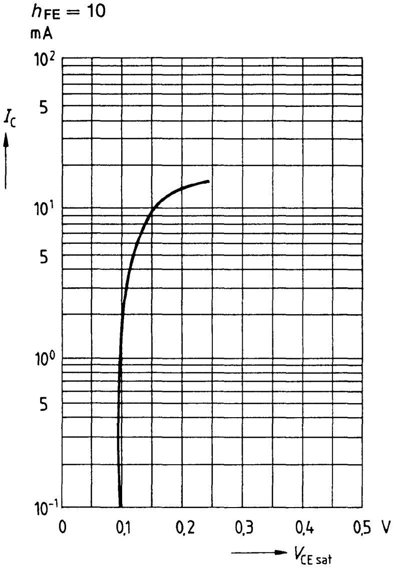
Total power dissipation $P_{tot} = f(T_A)$



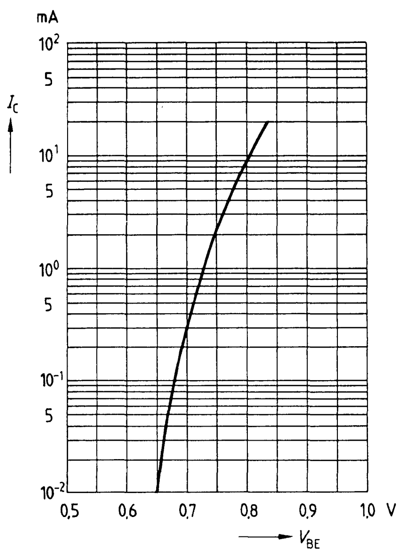
Current gain $h_{FE} = f(I_C)$
$V_{CE} = 10\ V$



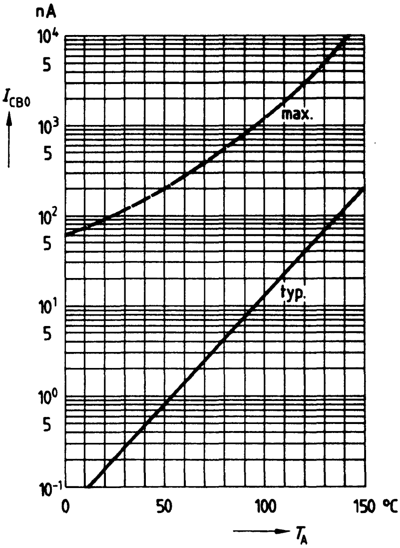
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



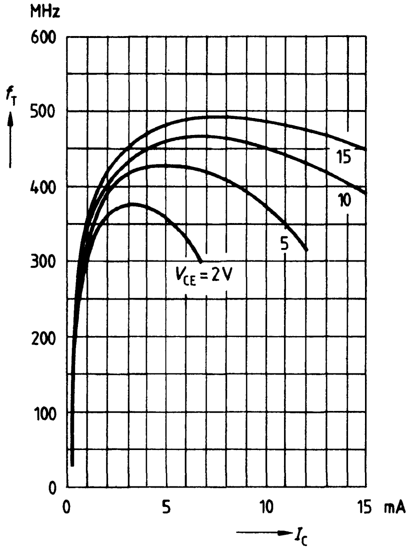
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\ V$



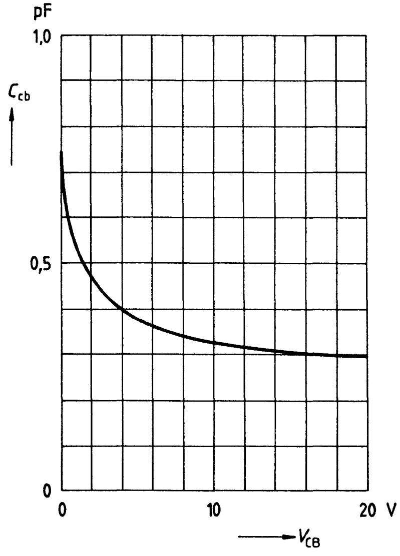
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



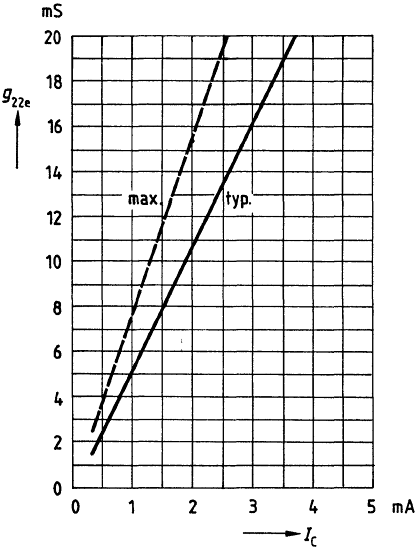
Transition frequency $f_T = f(I_c)$
$f = 100$ MHz



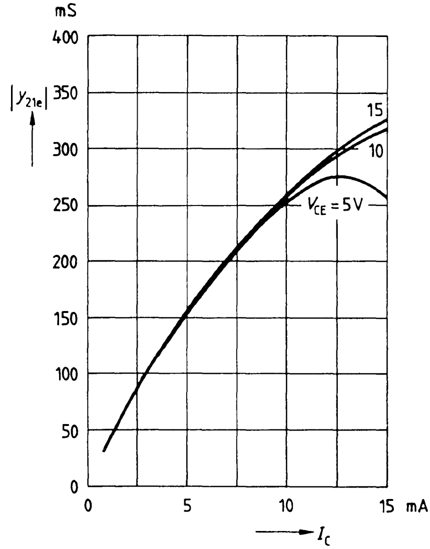
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



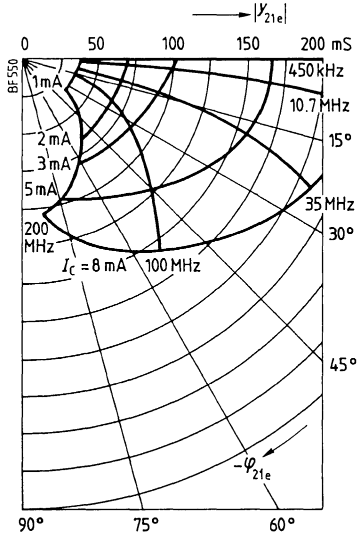
Output conductance $g_{22e} = f(I_c)$
$V_{CE} = 10$ V, $f = 500$ kHz



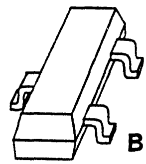
Forward transfer admittance $|Y_{21e}| = f(I_C)$
f = 10,7 MHz



Forward transfer admittance Y_{21e}
V_{CE} = 10 V



- General RF small-signal applications up to 300 MHz, amplifier, mixer and oscillator in circuits



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 554	CC	Q62702–F551	Q62702–F1042	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	30	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

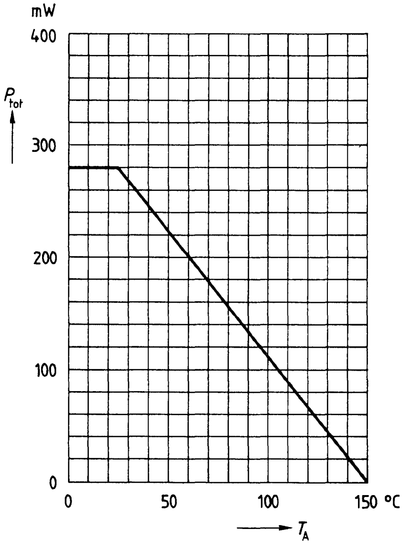
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

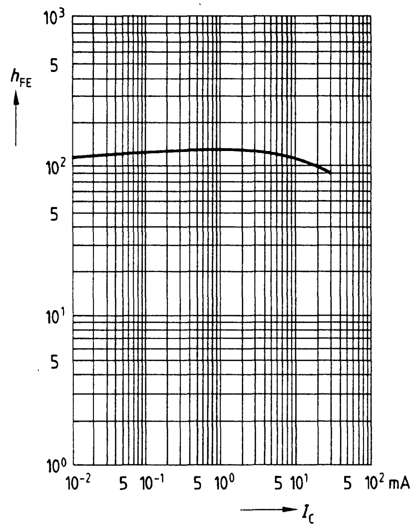
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 1$ mA, $V_{CE} = 10$ V	h_{FE}	60	–	250	–
Base-emitter voltage $I_C = 1$ mA, $V_{CE} = 10$ V	V_{BE}	–	0,7	–	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Noise figure $V_{CE} = 10$ V, $I_C = 1$ mA $f = 200$ kHz, $g_S = 2$ mS $f = 1$ MHz, $g_S = 1{,}5$ mS $f = 100$ MHz, $g_S = 10$ mS	F	 – – –	 1,5 1,2 3	 – – –	 dB dB dB
Collector-base capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,6	–	pF
Output conductance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 0{,}5 \cdots 10$ MHz	g_{22e}	–	4	–	µS

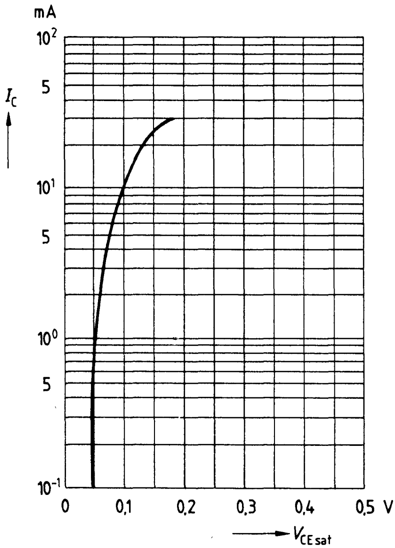
Total power dissipation $P_{tot} = f(T_A)$



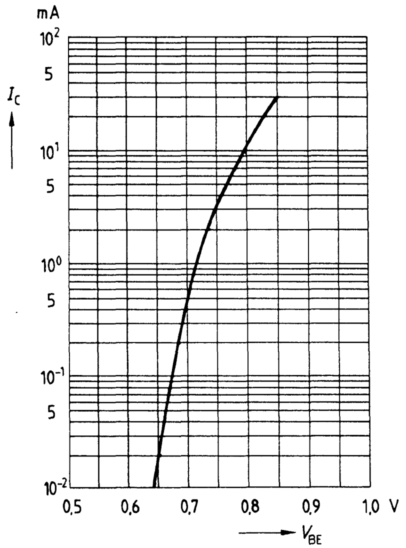
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



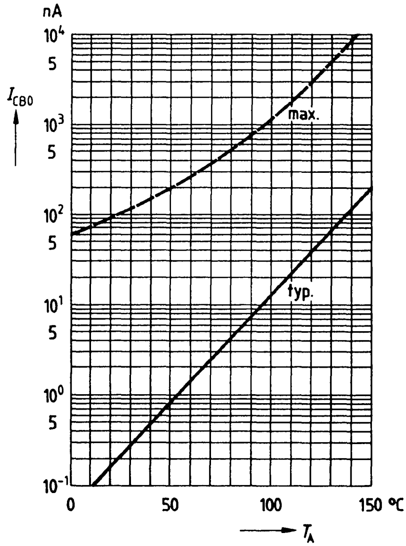
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



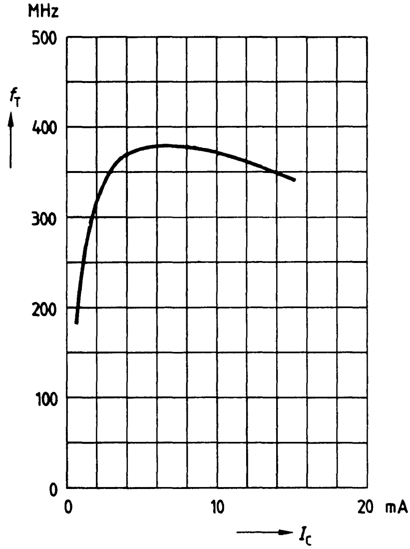
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



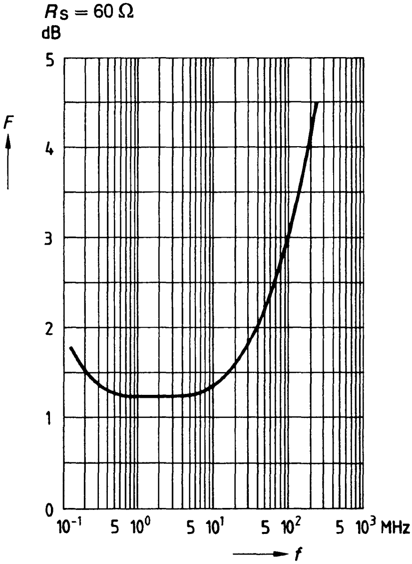
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 20$ V



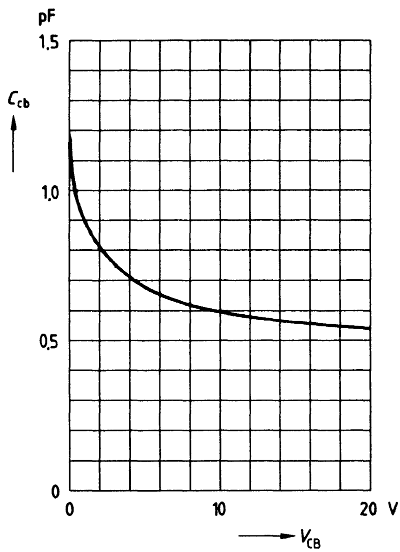
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V
$f = 100$ MHz



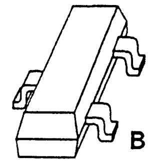
Noise figure $F = f(f)$
$V_{CE} = 10$ V, $I_C = 1$ mA,
$R_S = 60\ \Omega$



Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



- Suitable for oscillators, mixers and self-oscillating mixer stages in UHF TV tuners



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 569	LH	Q62702–F548	Q62702–F869	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	35	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	30	mA
Base current	I_B	5	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-55 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

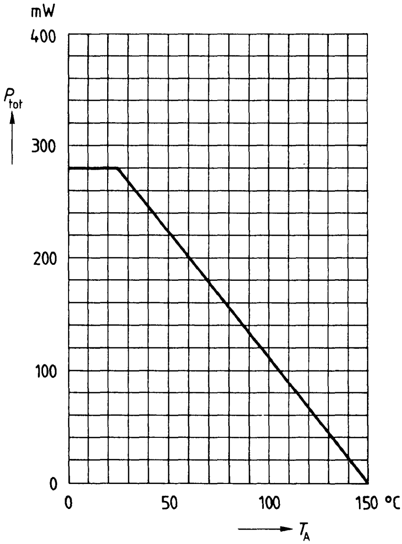
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

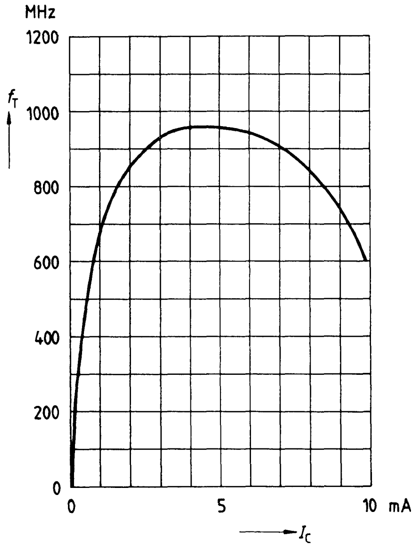
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	35	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 3$ mA, $V_{CE} = 10$ V	h_{FE}	20	50	–	–

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 3$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	950	–	MHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,32	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,15	–	pF
Power gain, common base $I_C = 3$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_L = 500\,\Omega$	G_p	–	14,8	–	dB
Noise figure $I_C = 3$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_S = 60\,\Omega$	F	–	4,5	–	dB

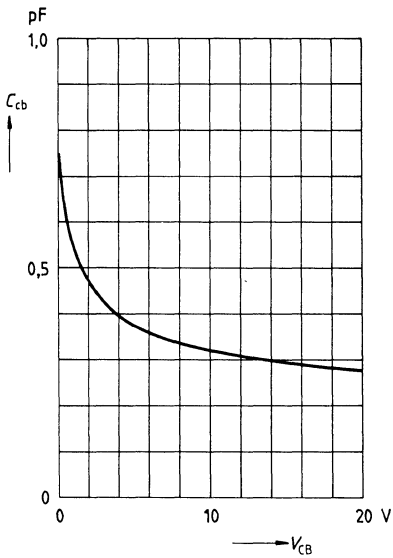
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$f = 100$ MHz, $V_{CE} = 10$ V

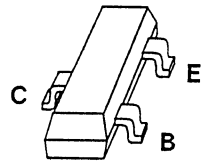


Collector capacitance
$C_{cb} = f(V_{CB})$
$f = 1$ MHz



PNP Silicon RF Transistor

- Suitable for low distortion, low noise VHF/UHF amplifier and UHF oscillator applications in TV tuners
- High transition frequency of 1.6 GHz at typical operating current of 10 mA



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 579	LJ	Q62702–F552	Q62702–F971	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	30	mA
Base current	I_B	5	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-55 \ldots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

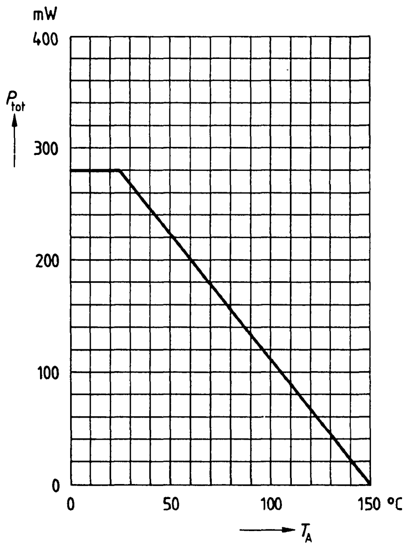
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

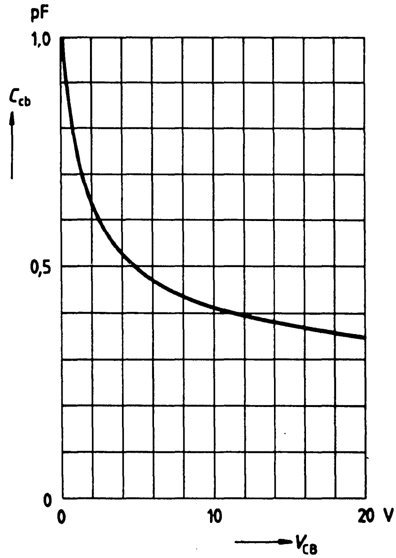
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 10$ mA, $V_{CE} = 10$ V	h_{FE}	20	–	–	–

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	1,6	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,41	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,16	–	pF
Power gain, common base $I_C = 10$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_L = 500\,\Omega$	G_p	–	16	–	dB
Noise figure $I_C = 10$ mA, $V_{CB} = 10$ V, $f = 800$ MHz $R_S = 60\,\Omega$	F	–	4	–	dB
$I_C = 10$ mA, $V_{CB} = 10$ V, $f = 200$ MHz $R_S = 60\,\Omega$		–	2,9	–	dB

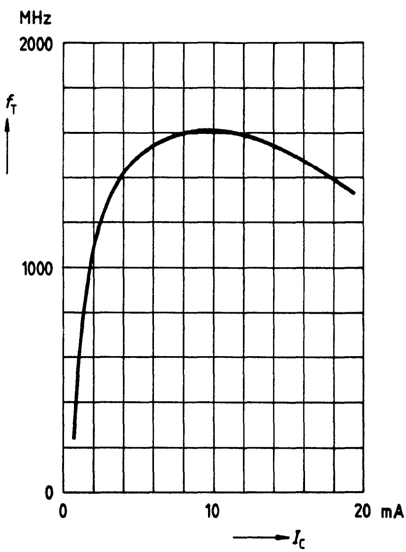
Total power dissipation $P_{tot} = f(T_A)$



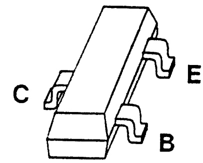
Collector-base capacitance
$C_{cb} = f(V_{CB})$
$f = 1$ MHz



Transition frequency $f_T = f(I_C)$
$f = 100$ MHz, $V_{CE} = 10$ V



- Suitable for common emitter RF, IF amplifiers
- Low collector-base capacitance due to contact shield diffusion



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 599	NB	Q62702–F550	Q62702–F979	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	25	mA
Base current	I_B	5	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

Electrical characteristics

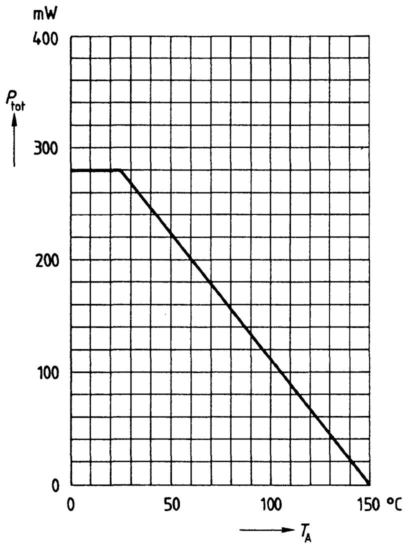
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	25	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	100	nA
DC current gain $I_C = 7$ mA, $V_{CE} = 10$ V	h_{FE}	38	70	–	–
Collector-emitter saturation voltage $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	0,15	–	V
Base-emitter voltage $I_C = 7$ mA, $V_{CE} = 10$ V	V_{BE}	–	0,78	–	V

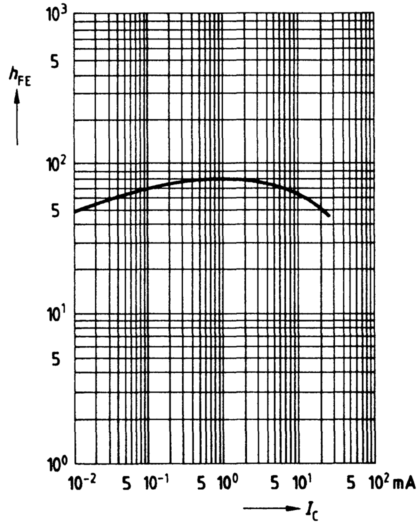
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	550	–	MHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,35	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,68	–	pF
Optimum power gain[1]) $I_C = 7$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	G_p	–	43	–	dB
Forward transfer admittance $I_C = 7$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	$\lvert Y_{21e}\rvert$	–	175	–	mS

[1]) $G_p = \frac{|Y_{21e}|^2}{4g_{11e} \cdot g_{22e}}$

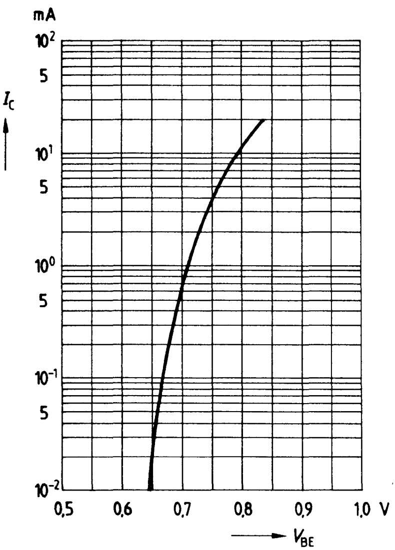
Total power dissipation $P_{tot} = f(T_A)$



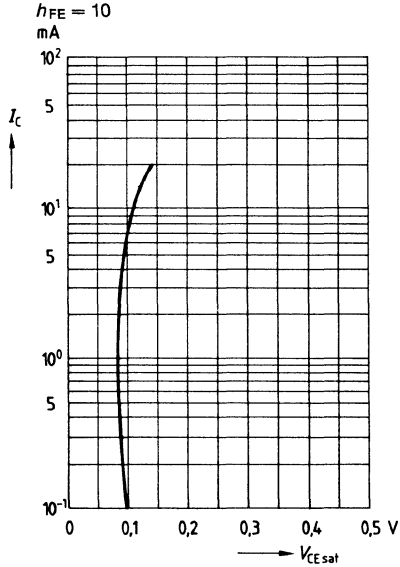
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



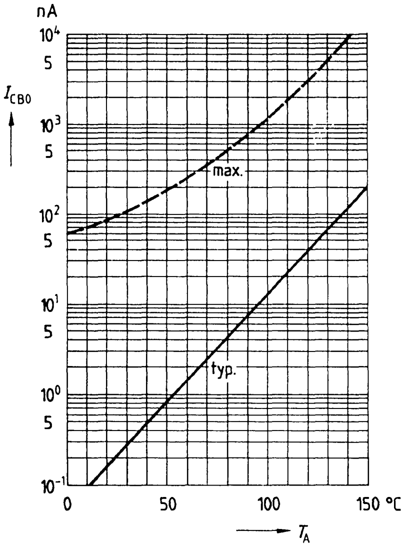
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



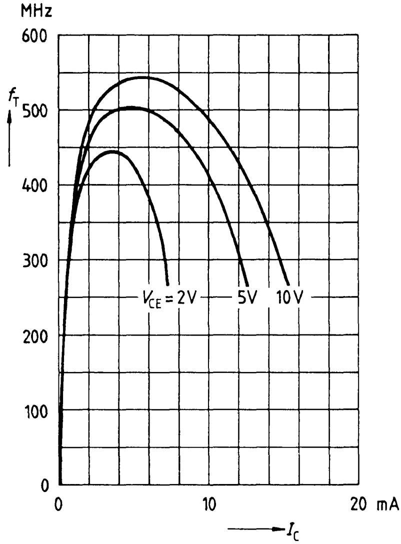
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



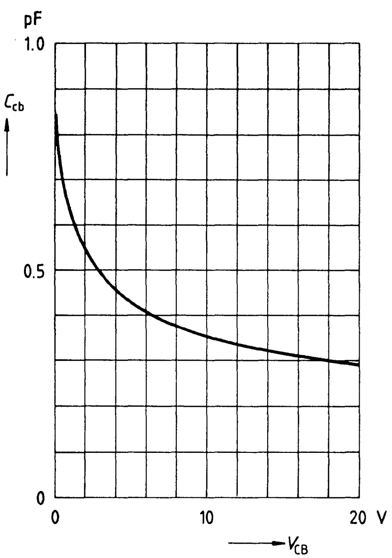
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 20$ V



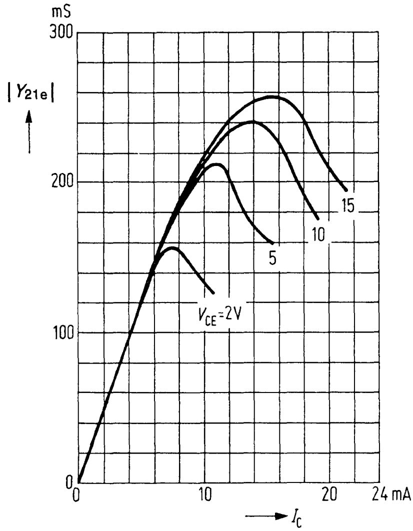
Transition frequency $f_T = f(I_C)$, $f = 100$ MHz



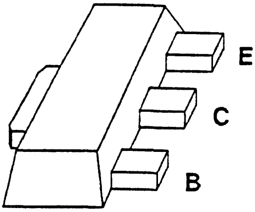
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



Forward transfer admittance $|Y_{21e}| = f(I_C)$
$f = 35$ MHz



- Suitable for video output stages in TV sets
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BF 623 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BF 622	DA	Q62702–F568	Q62702–F1052	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	250	V
Collector-base voltage	V_{CBO}	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	250	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−65 … +150	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

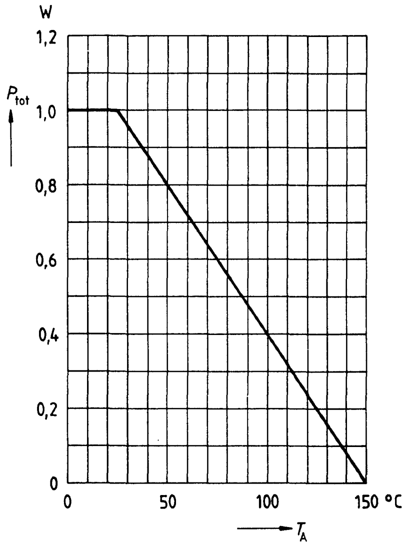
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage					
$I_C = 1$ mA	$V_{(BR)\,CE0}$	250	–	–	V
$I_C = 10$ µA, $R_{BE} = 2{,}7$ kΩ	$V_{(BR)\,CER}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)\,CB0}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current	I_{CB0}				
$V_{CB} = 200$ V		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$		–	–	20	µA
Collector cutoff current	I_{CER}				
$V_{CE} = 200$ V, $R_{BE} = 2{,}7$ kΩ		–	–	1	µA
$V_{CE} = 200$ V, $R_{BE} = 2{,}7$ kΩ, $T_A = 150\,°C$		–	–	50	µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EB0}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

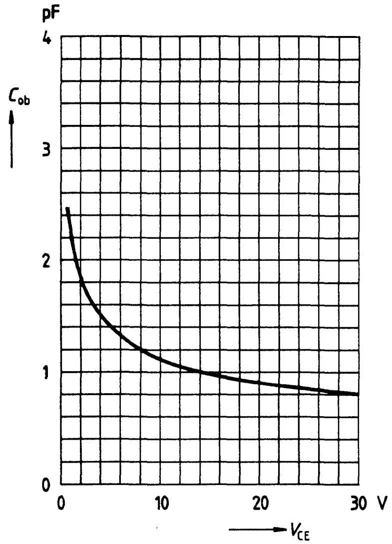
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

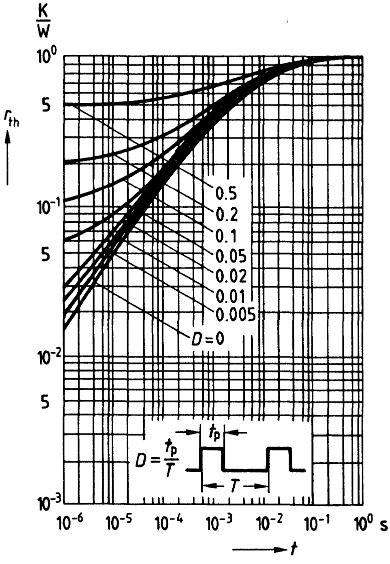
Total power dissipation $P_{tot} = f(T_A)$



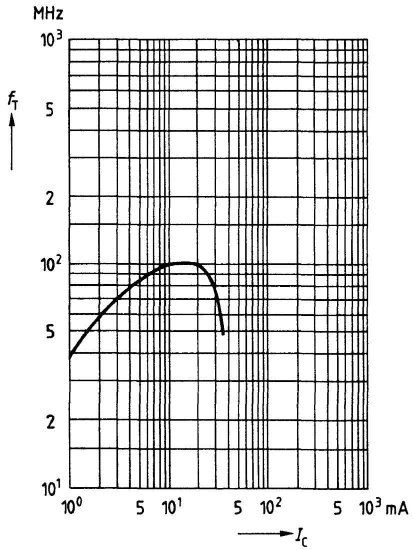
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



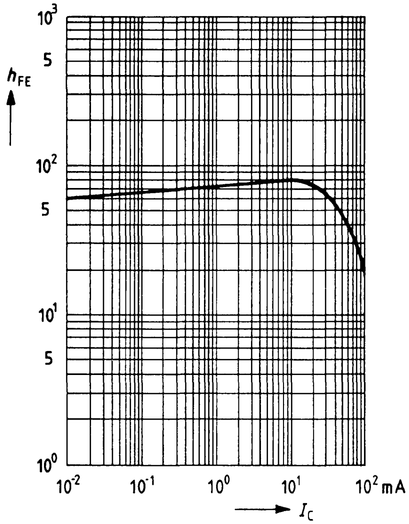
Pulse handling capability $r_{th} = f(t)$
(standardized)



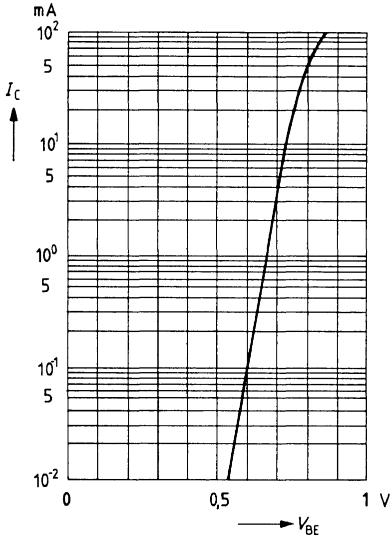
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 20$ MHz



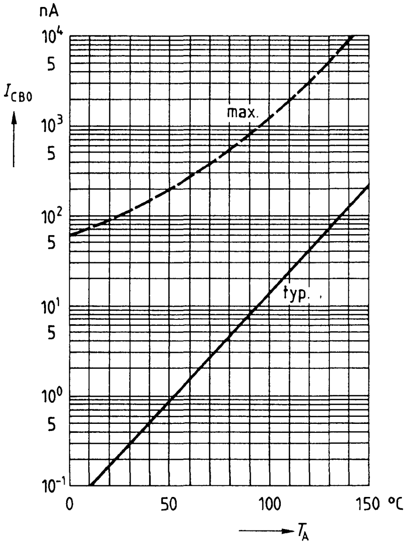
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



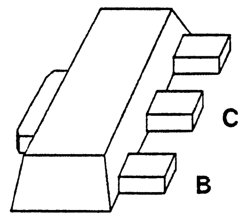
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V



- Suitable for video output stages in TV sets
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BF 622 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BF 623	DB	Q62702–F567	Q62702–F1053	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	250	V
Collector-base voltage	V_{CBO}	250	V
Collector-emitter voltage (R_{BE} = 2,7 kΩ)	V_{CER}	250	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation T_A = 25 °C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65 … + 150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

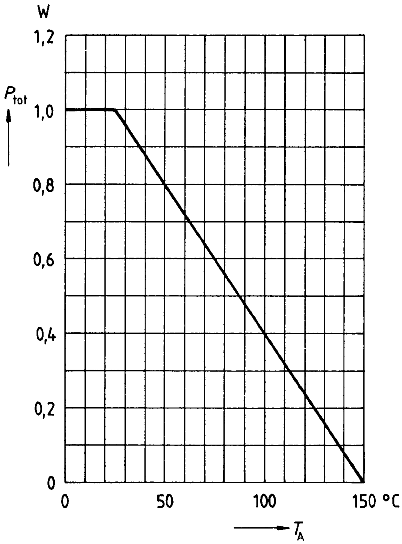
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage					
$I_C = 1$ mA	$V_{(BR)\,CEO}$	250	–	–	V
$I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$		–	–	20	µA
Collector cutoff current	I_{CER}				
$V_{CE} = 200$ V, $R_{BE} = 2{,}7\,k\Omega$		–	–	1	µA
$V_{CE} = 200$ V, $R_{BE} = 2{,}7\,k\Omega$, $T_A = 150\,°C$		–	–	50	µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

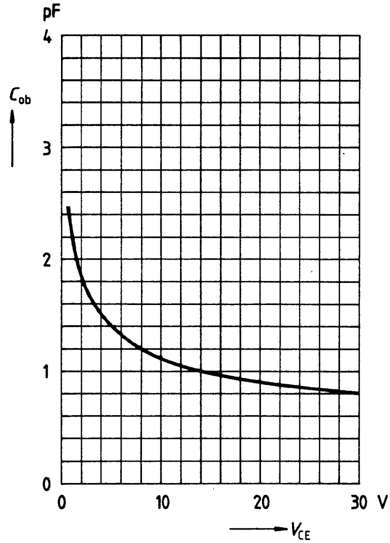
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

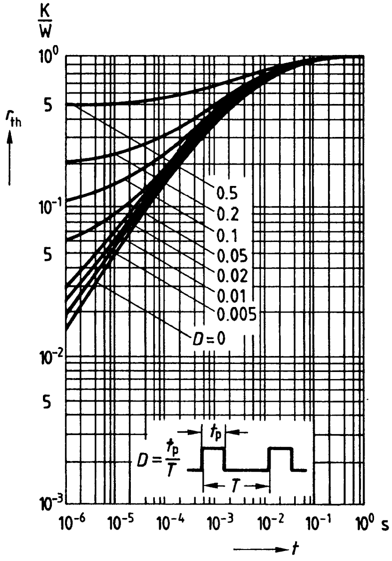
Total power dissipation $P_{tot} = f(T_A)$



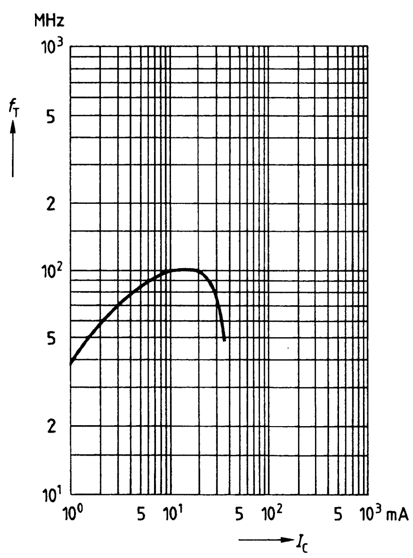
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



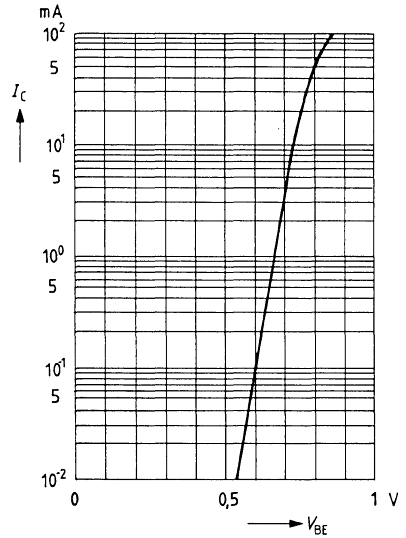
Pulse handling capability $r_{th} = f(t)$
(standardized)



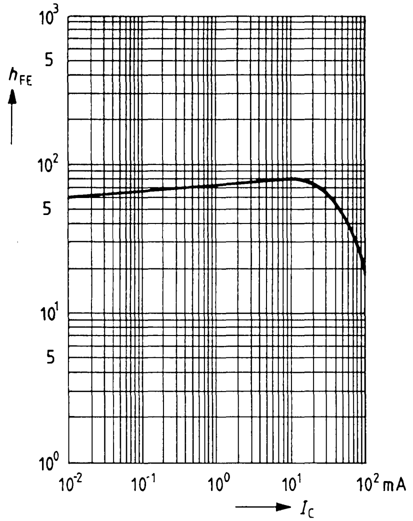
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 20$ MHz



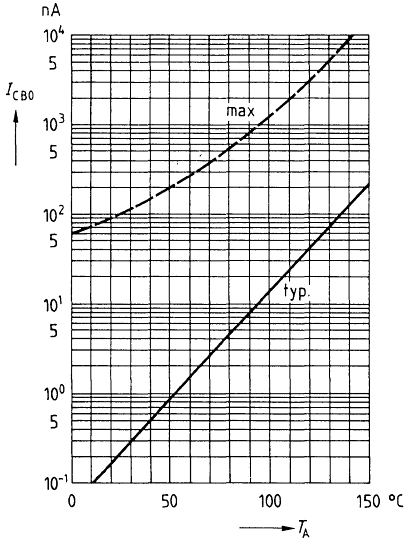
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20\ V$



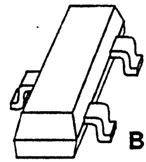
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20\ V$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200\ V$



- Particularly suitable for application in VHF tuner oscillators



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 660	LE	Q62702–F549	Q62702–F982	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	30	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	25	mA
Emitter current	I_E	30	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

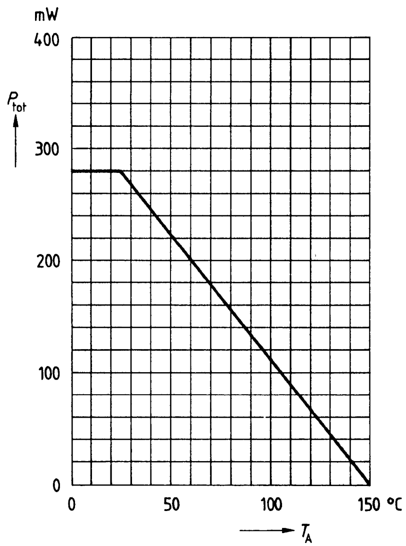
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

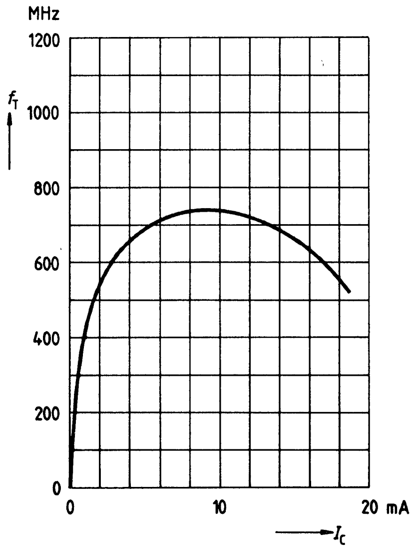
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_E = 0$	$V_{(BR)\,CEO}$	30	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_E = 0$	$V_{(BR)\,CBO}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)\,EBO}$	4	–	–	V
Collector cutoff current $V_{CB} = 20$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 3$ mA, $V_{CE} = 10$ V	h_{FE}	30	–	–	–

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	–	700	–	MHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,6	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,28	–	pF

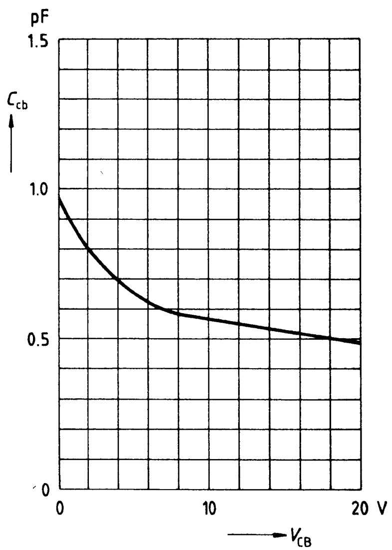
Total power dissipation $P_{tot} = f(T_A)$



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz



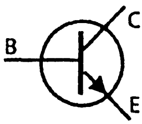
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz

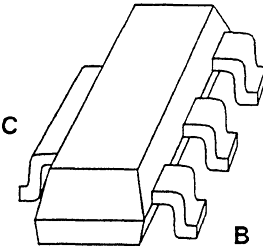


NPN Silicon High-Voltage Transistors

BF 720; BF 722

- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector -emitter saturation voltage
- Low capacitance
- Complementary types: BF 721/723 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BF 720	BF 720	Q62702 - F1238	SOT-223
BF 722	BF 722	Q62702 - F1306	SOT-223

Maximum Ratings

Parameter	Symbol	BF 720	BF 722	Unit
Collector-emitter voltage	V_{CEO} V_{CER}	- 300	250 -	V V
Collector-base voltage	V_{CBO}	300	250	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	50		mA
Peak collector current	I_{CM}	100		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

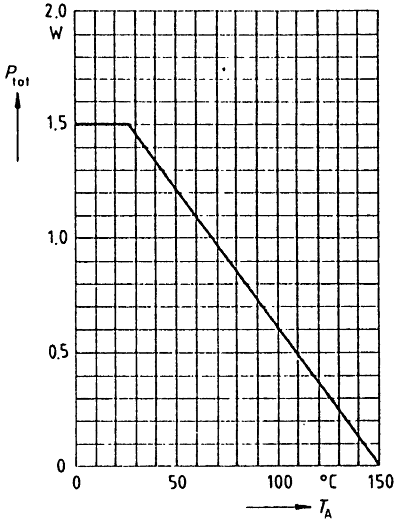
*) For detailed dimensions see chapter Package Outlines.

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

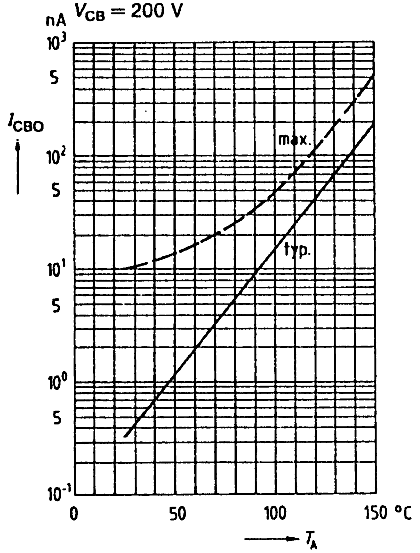
Parameter	Symbol	Values min.	typ.	max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$ BF 722	$V_{(BR)CEO}$	250	-	-	V
Collector-emitter breakdown voltage $I_C = 10$ µA, $R_{BE} = 2.7$kΩ BF 720	$V_{(BR)CER}$	300	-	-	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_B = 0$ BF 720 BF 722	$V_{(BR)CBO}$	300 250	- -	- -	V V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 200$ V, $I_E = 0$	I_{CBO}	-	-	10	nA
Collector-emitter cutoff current $V_{CE} = 200$ V, $R_{BE} = 2.7$kΩ $V_{CE} = 200$ V, $R_{BE} = 2.7$kΩ, $T_A = 150$°C	I_{CER}	-	-	50 10	nA µA
Emitter-base cutoff current $V_{EB} = 5$ V, $I_C = 0$	I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	-	-	-
Collector-emitter saturation voltage 1) $I_C = 30$ mA, $I_B = 5$ mA	V_{CEsat}	-	-	0.6	V
AC Characteristics					
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	-	100	-	MHz
Collector-base capacitance $V_{CB} = 30$ V, $I_C = 0$, $f = 1$ MHz	C_{ob}	-	0.8	-	pF

1) Pulse test conditions: $t \leqq 300$µs; D = 2%

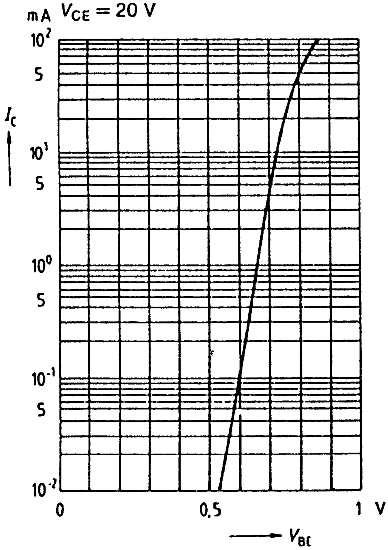
Total power dissipation $P_{tot} = f(T_A)$



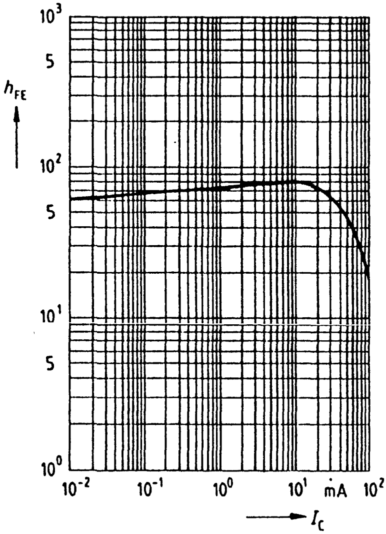
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V



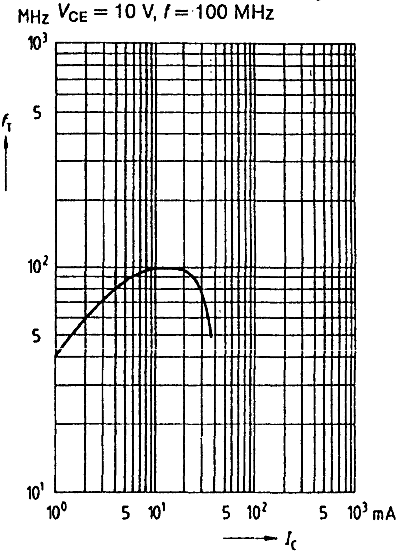
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



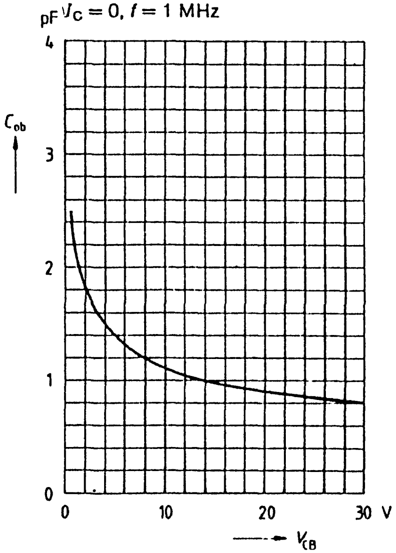
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



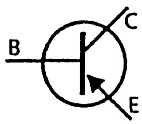
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz

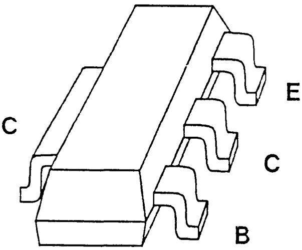


Collector-base capacitance $C_{ob} = f(V_{CB})$
$I_C = 0$, $f = 1$ MHz



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector -emitter saturation voltage
- Low capacitance
- Complementary types: BF 720/722 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
BF 721	BF 721	Q62702 - F1239	SOT-223
BF 723	BF 723	Q62702 - F1309	SOT-223

Maximum Ratings

Parameter	Symbol	BF 721	BF 723	Unit
Collector-emitter voltage	V_{CEO} V_{CER}	- 300	250 -	V
Collector-base voltage	V_{CBO}	300	250	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	50		mA
Peak collector current	I_{CM}	100		mA
Total power dissipation, $T_A \leq 25°C$ [1]	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient [1]	R_{thJA}	≤ 83.3	K/W

[1] Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

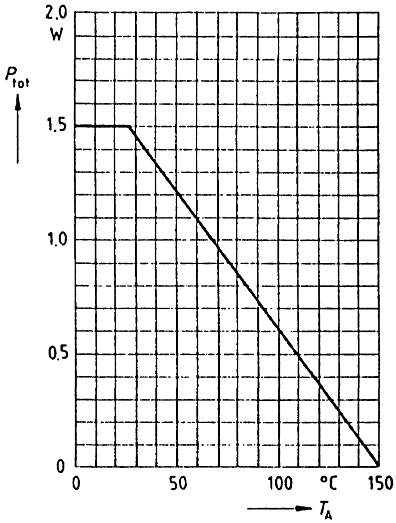
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

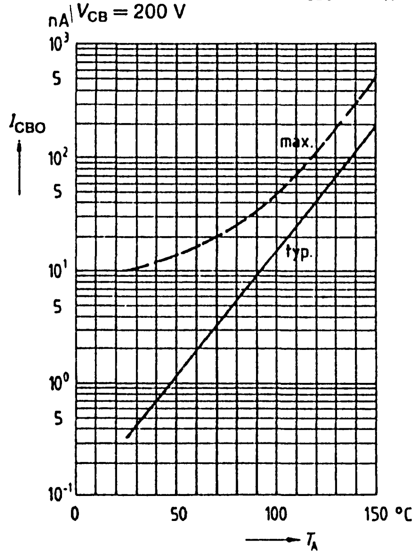
Parameter	Symbol	Values min.	typ.	max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$ BF 723	$V_{(BR)CEO}$	250	-	-	V
Collector-emitter breakdown voltage $I_C = 10$ µA, $R_{BE} = 2.7$kΩ BF 721	$V_{(BR)CER}$	300	-	-	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_B = 0$ BF 721 BF 723	$V_{(BR)CBO}$	300 250	- -	- -	V V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 200$ V, $I_E = 0$	I_{CBO}	-	-	10	nA
Collector-emitter cutoff current $V_{CE} = 200$ V, $R_{BE} = 2.7$kΩ $V_{CE} = 200$ V, $R_{BE} = 2.7$kΩ, $T_A = 150$°C	I_{CER}	-	-	50 10	nA µA
Emitter-base cutoff current $V_{EB} = 5$ V, $I_C = 0$	I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	-	-	-
Collector-emitter saturation voltage $I_C = 30$ mA, $I_B = 5$ mA	V_{CEsat}	-	-	0.6	V
AC Characteristics					
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 100$ MHz	f_T	-	100	-	MHz
Collector-base capacitance $V_{CB} = 30$ V, $I_C = 0$, $f = 1$ MHz	C_{ob}	-	0.8	-	pF

1) Pulse test conditions: $t \leqq 300$µs; D = 2%

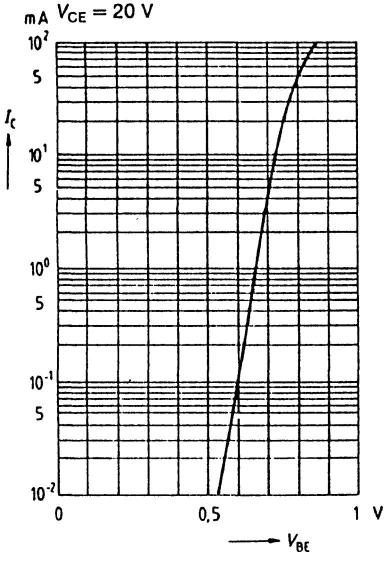
Total power dissipation $P_{tot} = f(T_A)$



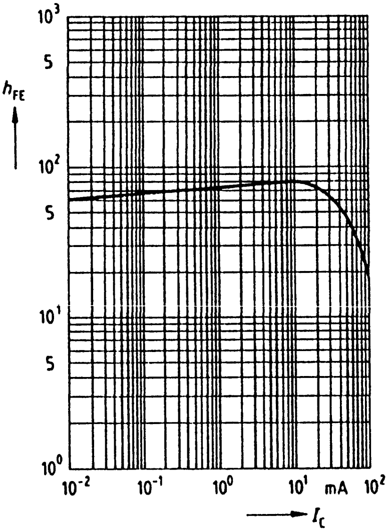
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 200$ V



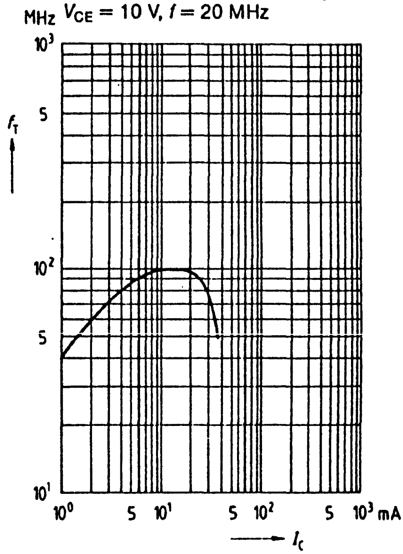
Collector current $I_c = f(V_{BE})$
$V_{CE} = 20$ V



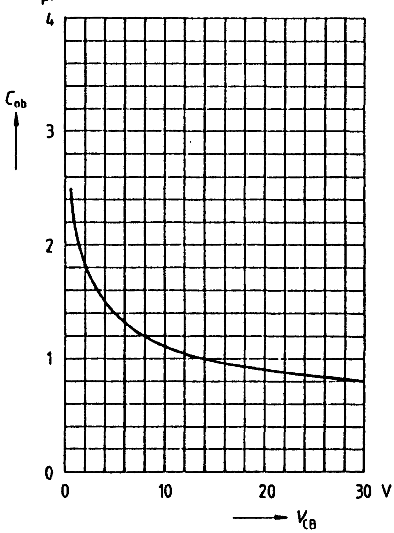
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 20$ MHz



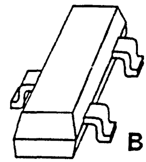
Collector-base capacitance $C_{ob} = f(V_{CB})$
$I_C = 0$, $f = 1$ MHz



NPN Silicon RF Transistor

BF 770 A

- Low-noise broadband transistor for frequencies up to 2 GHz at collector currents up to 30 mA
- Specially suitable for IF amplifiers in TV-sat tuners as well as for VCR modulators



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 770 A	LS	Q62702–F1068	Q62702–F1080	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-base voltage	V_{CB0}	15	V
Emitter-base voltage	V_{EB0}	2	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

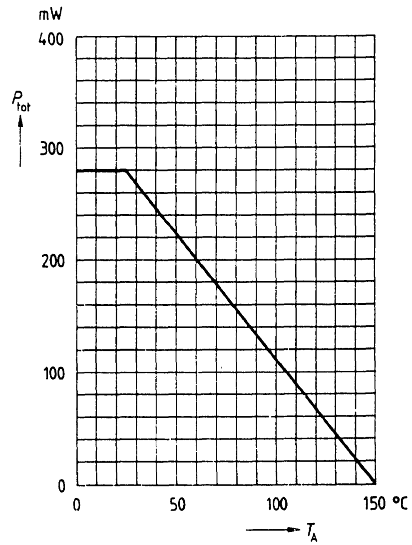
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

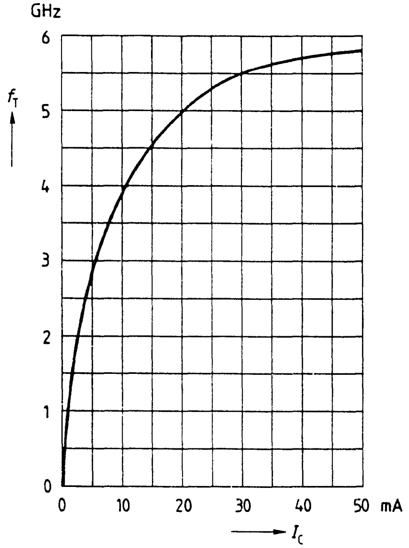
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	12	–	–	V
Collector cutoff current $V_{CB} = 5$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 30$ mA, $V_{CE} = 5$ V	h_{FE}	40	90	–	–
Collector-emitter saturation voltage $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	–	0,13	0,5	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	–	5,5	–	GHz
Collector-base capacitance $V_{CB} = 5$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,6	–	pF
Collector-emitter capacitance $V_{CB} = 5$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,3	–	pF
Noise factor $I_C = 10$ mA, $V_{CE} = 5$ V, $f = 800$ MHz	F	–	2	–	dB
Power gain $I_C = 30$ mA, $V_{CB} = 5$ V, $f = 800$ MHz	G_p	–	13	–	dB

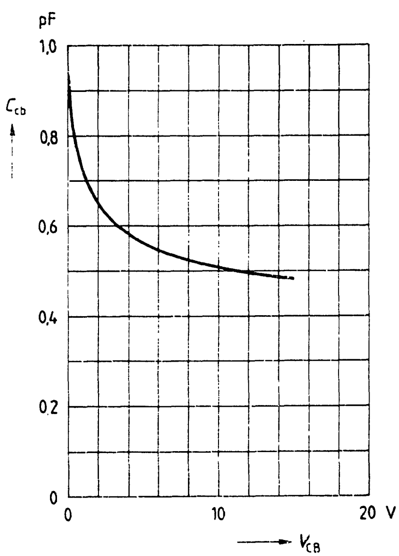
Total power dissipation $P_{tot} = f(T_A)$



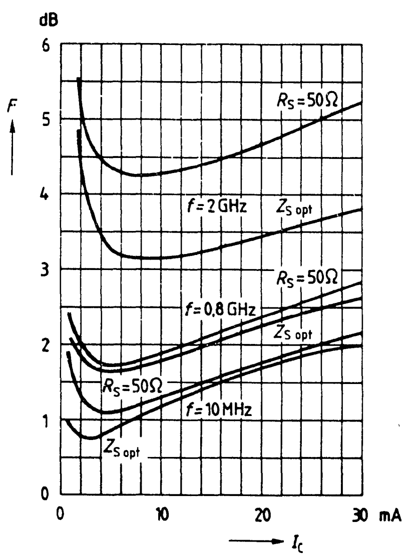
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



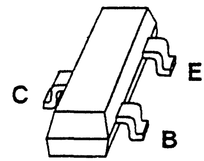
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



Noise figure $F = f(I_C)$
$V_{CE} = 8$ V



- For low noise, high gain amplifiers up to 2GHz
- For linear broadband amplifiers
- For modulators and amplifiers in VCR-tuners



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BF 771	RB	Q62702-F990	SOT 23

Maximum Ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltate	V_{CEO}	12	V
Collector-emitter voltage (V_{BE} =0)	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation ($T_A \leq 60°C$ [1]))	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C
Ambient operating temperature range	T_A	-65 to +150	°C
Thermal resistance			
Junction-ambient [1])	R_{thJA}	≤300	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

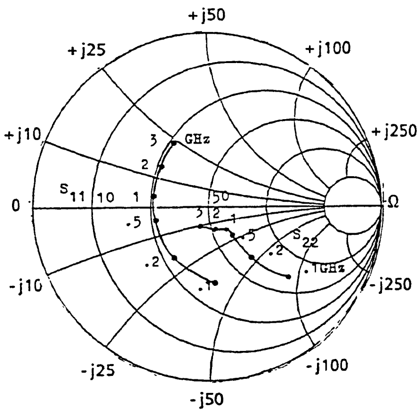
DC characteristics ($T_A = 25°C$)		min	typ	max	
Collector-emitter breakdown voltage $I_C = 1$ mA , $I_B = 0$	$V_{(BR)CEO}$	12	-	-	V
Collector-emitter cutoff current $V_{CE} = 20V$, $V_{BE} = 0$	I_{CES}	-	-	100	µA
Collector-base cutoff current $V_{CB} = 10V$, $I_E = 0$	I_{CBO}	-	-	50	nA
Emitter-base cutoff current $V_{EB} = 1V$, $I_C = 0$	I_{EBO}	-	-	1	µA
DC current gain $I_C = 5mA$, $V_{CE} = 8V$	h_{FE}	-	90	-	-
$I_C = 30mA$, $V_{CE} = 8$ V		-	100	-	
Collector-emitter saturation voltage $I_C = 50mA$, $I_B = 5mA$	V_{CEsat}	-	-	0.4	V

AC characteristics ($T_A = 25°C$)		min	typ	max	
Transition frequency I_C = 5mA, V_{CE} = 8V, f = 200MHz	f_T	-	3.5	-	GHz
I_C = 30mA, V_{CE} = 8V, f = 200MHz		-	7	-	
Collector-base capacitance V_{CB} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{cb}	-	0.68	-	pF
Collector-emitter capacitance V_{CE} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{ce}	-	0.24	-	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1MHz	C_{ibo}	-	2.2	-	pF
Output capacitance V_{CE} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{obs}	-	0.95	-	pF
Noise figure I_C = 5mA, V_{CE} = 8V, f = 10MHz, Z_S = 75Ω	F	-	0.8	-	dB
I_C = 30mA, V_{CE} = 8V, f = 800MHz, Z_S = Z_{Sopt}		-	1,7	-	
I_C = 30mA, V_{CE} = 8V, f = 1 GHz, Z_S = 50Ω		-	2	-	
Power gain I_C = 30 mA, V_{CE} = 8V, f = 800MHz, Z_S = 50Ω Z_L = Z_{Lopt}	G_{pe}	-	13.5	-	dB
Transducer gain I_C = 30mA, V_{CE} = 8V, f = 1 GHz, Z_0 = 50Ω	$\|S_{21e}\|^2$	-	11.5	-	dB
Linear output voltage two tone intermodulation test I_C = 40 mA, V_{CE} = 5V, d_{IM} = 60dB, f_1 = 806MHz, f_2 = 810MHz, Z_S = Z_L = 50Ω	$V_{o1} = V_{o2}$	-	250	-	mV
Third order intercept point I_C = 40mA, V_{CE} = 5V, f = 800MHz	IP_3	-	31	-	dBm

Common emitter S - parameters

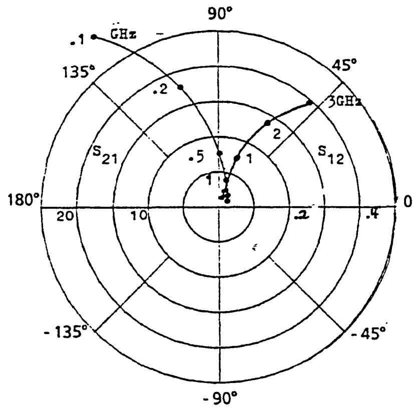
$S_{11}, S_{22} = f(f)$, Z-plane

$I_C = 30mA$, $V_{CE} = 8V$, $Z_0 = 50\Omega$

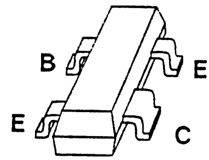


$S_{12}, S_{21} = f(f)$

$I_C = 30mA$, $V_{CE} = 8V$, $Z_0 = 50\Omega$



- For low noise, high gain amplifiers up to 2GHz
- For linear broadband amplifiers
- For modulators and amplifiers in VCR-tuners



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BF 772	RA	Q62702-F1192	SOT 143

Maximum Ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltate	V_{CEO}	12	V
Collector-emitter voltage (V_{BE} =0)	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation (T_A ≤ 60°C [1]))	P_{tot}	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C
Ambient operating temperature range	T_A	-65 to +150	°C
Thermal resistance			
Junction-ambient [1])	R_{thJA}	≤300	K/W

[1]) Package mounted on alumina 15mm x 16.7mm x 0.7mm

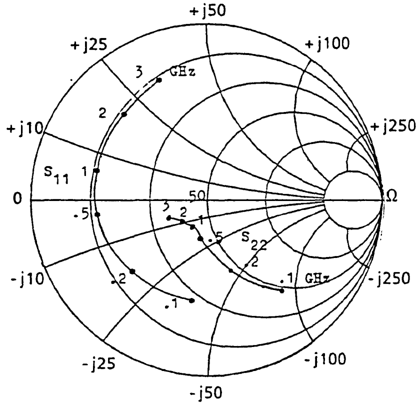
DC characteristics ($T_A = 25°C$)		min	typ	max	
Collector-emitter breakdown voltage $I_C = 1\ mA$, $I_B = 0$	$V_{(BR)CEO}$	12	-	-	V
Collector-emitter cutoff current $V_{CE} = 20V$, $V_{BE} = 0$	I_{CES}	-	-	100	µA
Collector-base cutoff current $V_{CB} = 10V$, $I_E = 0$	I_{CBO}	-	-	50	nA
Emitter-base cutoff current $V_{EB} = 1V$, $I_C = 0$	I_{EBO}	-	-	1	µA
DC current gain $I_C = 5mA$, $V_{CE} = 8V$	h_{FE}	-	90	-	-
$I_C = 30mA$, $V_{CE} = 8\ V$		-	100	-	
Collector-emitter saturation voltage $I_C = 50mA$, $I_B = 5mA$	V_{CEsat}	-	-	0.4	V

AC characteristics (T_A = 25°C)		min	typ	max	
Transition frequency I_C = 5mA, V_{CE} = 8V, f = 200MHz I_C = 30mA, V_{CE} = 8V, f = 200MHz	f_T	- -	3.5 7	- -	GHz
Collector-base capacitance V_{CB} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{cb}	-	0.6	-	pF
Collector-emitter capacitance V_{CE} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{ce}	-	0.33	-	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1MHz	C_{ibo}	-	2.3	-	pF
Output capacitance V_{CE} = 10V, V_{BE} = v_{be} = 0, f = 1MHz	C_{obs}	-	0.95	-	pF
Noise figure I_C = 5mA, V_{CE} = 8V, f = 10MHz, Z_S = 75Ω I_C = 30mA, V_{CE} = 8V, f = 800MHz, Z_S = Z_{Sopt} I_C = 30mA, V_{CE} = 8V, f = 1 GHz, Z_S = 50Ω	F	- - -	0.8 1,6 1.9	- - -	dB
Power gain I_C = 30 mA, V_{CE} = 8V, f = 800MHz, Z_S = 50Ω Z_L = Z_{Lopt}	G_{pe}	-	15	-	dB
Transducer gain I_C = 30mA, V_{CE} = 8V, f = 1 GHz, Z_0 = 50Ω	$\|S_{21e}\|^2$	-	13.5	-	dB
Linear output voltage two tone intermodulation test I_C = 40 mA, V_{CE} = 5V, d_{IM} = 60dB, f_1 = 806MHz, f_2 = 810MHz, Z_S = Z_L = 50Ω	V_{o1} = V_{o2}	-	250	-	mV
Third order intercept point I_C = 40mA, V_{CE} = 5V, f = 800MHz	IP_3	-	31	-	dBm

Common emitter S - parameters

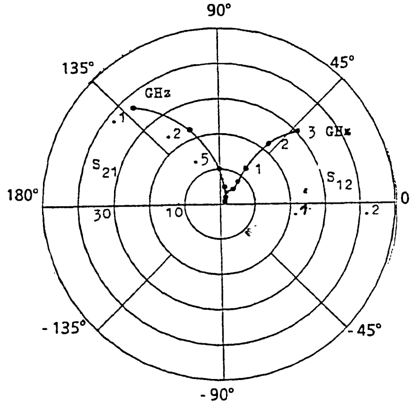
$S_{11}, S_{22} = f(f)$, Z-plane

$I_C = 30mA$, $V_{CE} =$ 8 , $Z_0 = 50\Omega$

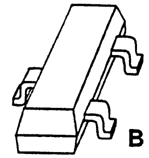


$S_{12}, S_{21} = f(f)$

$I_C = 30mA$, $V_{CE} =$ 8V , $Z_0 = 50\Omega$



- Broadband amplifier, mixer, oscillator, and switching applications up to 2 GHz
- Specially suited for use in TV-sat and UHF TV tuners



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 775	LO	Q62702–F991	Q62702–F102	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2,5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

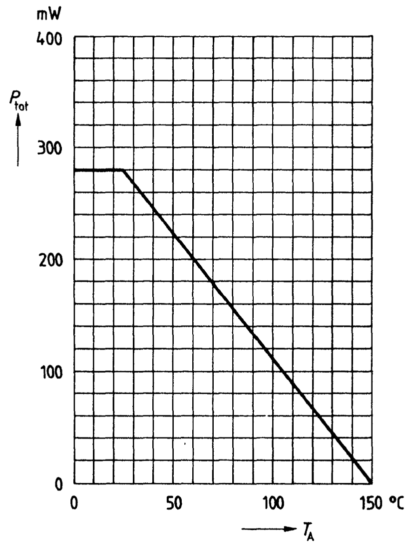
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

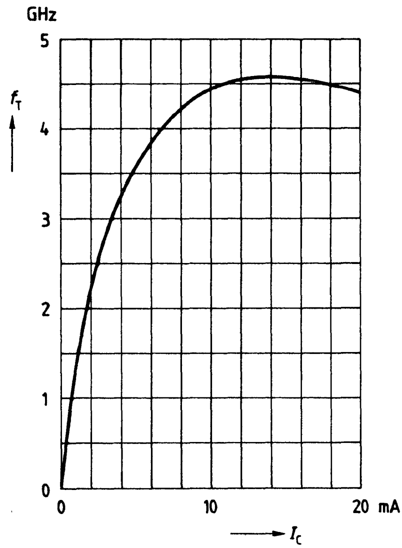
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	12	–	–	V
Collector cutoff current $V_{CB} = 10$ V, $I_E = 0$	I_{CBO}	–	–	50	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 6$ V $I_C = 20$ mA, $V_{CE} = 6$ V	h_{FE}	 40 40	 90 100	 250 –	 – –
Collector-emitter saturation voltage $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}	–	0,16	0,5	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 200$ MHz $I_C = 20$ mA, $V_{CE} = 6$ V, $f = 200$ MHz	f_T	 – –	 3,5 4,5	 – –	 GHz GHz
Collector-base capacitance $V_{CE} = 6$ V, $V_{BE} = 0$ V, $f = 1$ MHz	C_{cb}	–	0,58	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$ V, $f = 1$ MHz	C_{ce}	–	0,27	–	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 6$ V, $f = 800$ MHz	F	–	2,1	–	dB

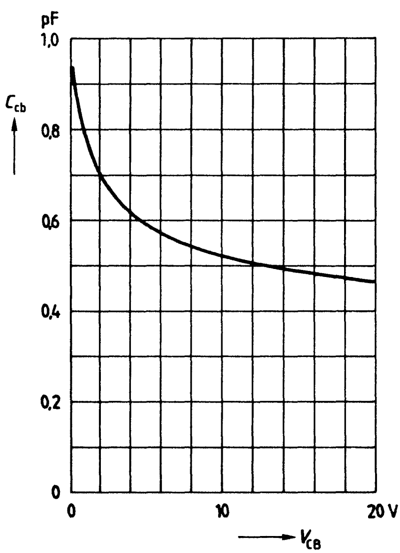
Total power dissipation $P_{tot} = f(T_A)$



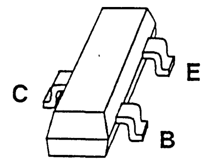
Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



- Suitable for broadband RF amplifiers up to 500 MHz in the high tuning range
- Particularly suitable for SAW filter driver application in TV tuners



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 799	LK	Q62702–F788	Q62702–F935	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	30	V
Collector-emitter voltage	V_{CER}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	35	mA
Peak collector current	I_{CM}	50	mA
Peak base current	I_{BM}	15	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

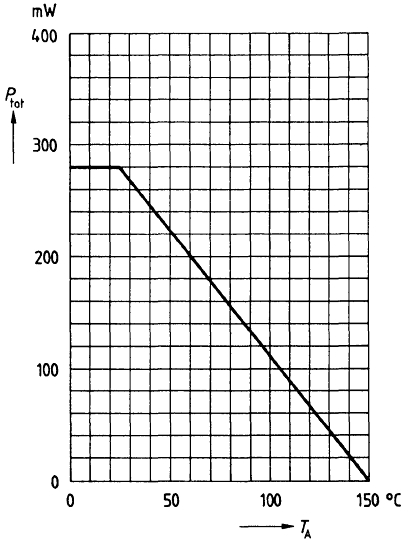
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

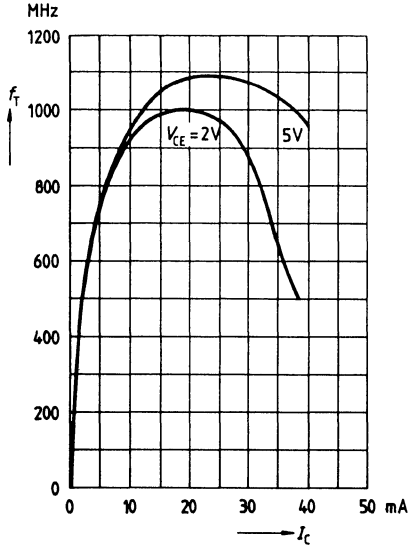
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)\,CEO}$	20	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$, $I_E = 0$	$V_{(BR)\,CBO}$	30	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	3	–	–	V
Collector cutoff current $V_{CB} = 20$ V	I_{CBO}	–	–	100	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 10$ V $I_C = 20$ mA, $V_{CE} = 10$ V	h_{FE}	 35 40	 95 100	 – 250	 – –
Collector-emitter saturation voltage $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}	–	0,15	0,5	V
Base-emitter saturation voltage $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,95	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz $I_C = 20$ mA, $V_{CE} = 8$ V, $f = 100$ MHz	f_T	 – –	 800 1100	 – –	 MHz MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz, $I_E = 0$	C_{ob}	–	0,96	–	pF
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{cb}	–	0,7	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = 0$, $f = 1$ MHz	C_{ce}	–	0,28	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 10$ V, $f = 100$ MHz $R_S = 50\,\Omega$	F	–	3	–	dB
Output conductance $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 35$ MHz	g_{22e}	–	60	–	µS

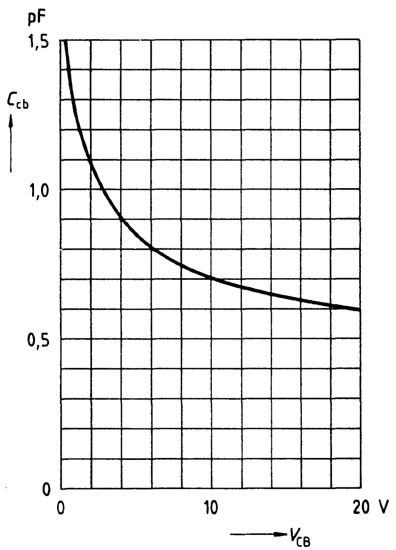
Total power dissipation $P_{tot} = f(T_A)$



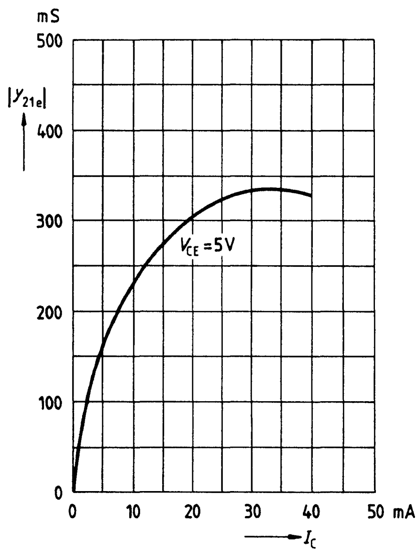
Transition frequency $f_T = f(I_C)$
$f = 100$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



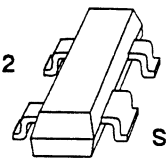
Forward transfer admittance $|Y_{21e}| = f(I_C)$
$f = 35$ MHz



Silicon N Channel MOSFET Tetrode

BF 989

- For amplifier and mixer stages in UHF and VHF TV tuners
- Low input and output capacitance



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 989	MA	Q62702–F874	Q62702–F969	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \cdots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

Electrical characteristics

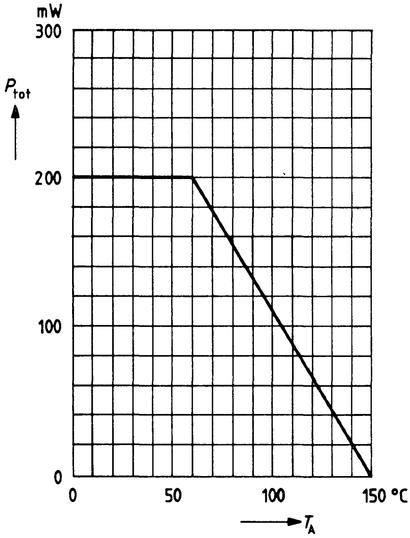
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\,\mu A$, $-V_{G1S} = -V_{G2S} = 4\,V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\,mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\,mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\,V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\,V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\,V$, $V_{G1S} = 0$, $V_{G2S} = 4\,V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G2S} = 4\,V$, $I_D = 20\,\mu A$	$-V_{G1S\,(p)}$	–	–	2,7	V
Gate 2 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G1S} = 0$, $I_D = 20\,\mu A$	$-V_{G2S\,(p)}$	–	–	2,7	V

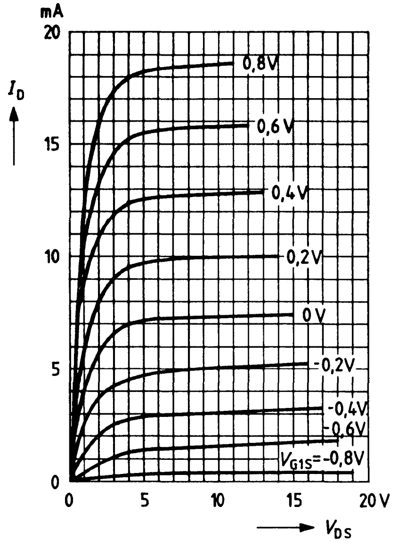
AC characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,kHz$	g_{fs}	9,5	12	–	mS
Gate 1 input capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g1ss}	–	1,8	–	pF
Gate 2 input capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g2ss}	–	1	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\,V$, $I_D = 7\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dss}	–	0,8	–	pF
Power gain (test circuits 1, 2) $V_{DS} = 15\,V$, $I_D = 7\,mA$, $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$ $f = 800\,MHz$, $G_G = 3{,}3\,mS$, $G_L = 1\,mS$	G_p	 – –	 23 16,5	 – –	 dB dB
Noise figure (test circuits 1, 2) $V_{DS} = 15\,V$, $I_D = 7\,mA$ $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$ $f = 800\,MHz$, $G_G = 3{,}3\,mS$, $G_L = 1\,mS$	F	 – –	 1,6 2,8	 – –	 dB dB
Control range (test circuit 2) $V_{DS} = 15\,V$, $V_{G2S} = 4 \cdots -2\,V$, $f = 800\,MHz$	ΔG_p	40	–	–	dB
Mixer gain (test circuit 3) $V_{DS} = 15\,V$, $V_{G2S} = 4\,V$, $f = 800\,MHz$, $f_{IF} = 36\,MHz$, $2\,\Delta f_{IF} = 5\,MHz$, $V_{osc} = 800\,mV$	G_{psc}	–	16	–	dB

[1]) G2 and S on screen potential.

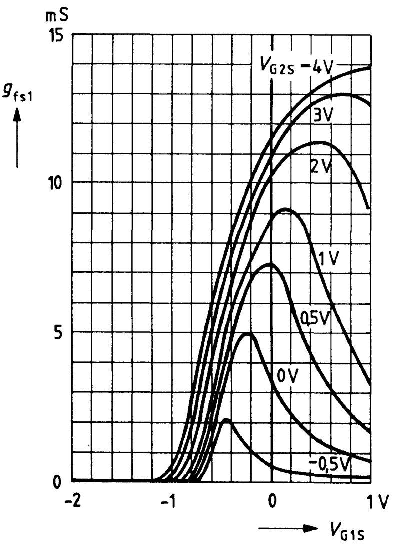
Total power dissipation
$P_{tot} = f(T_A)$



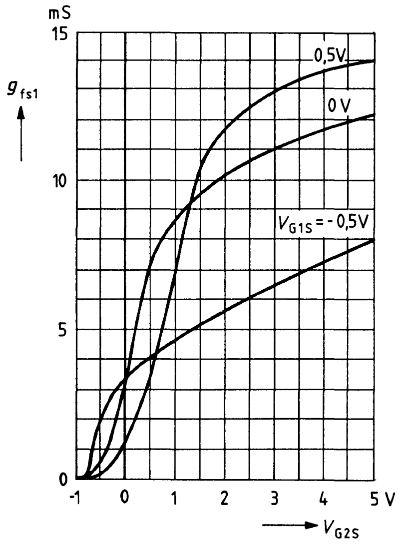
Output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



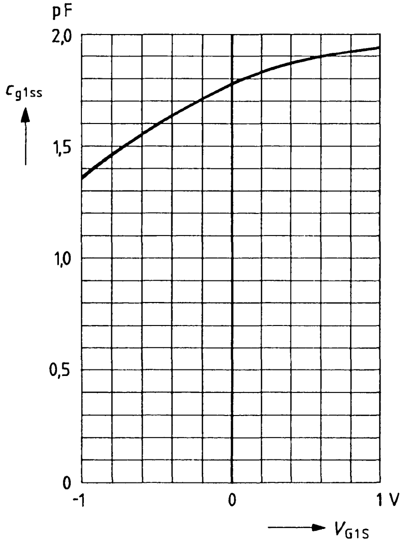
Gate 1 forward transconductance $g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ kHz



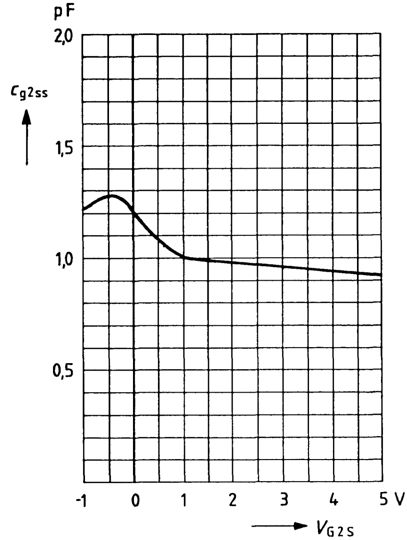
Gate 1 forward transconductance $g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ kHz



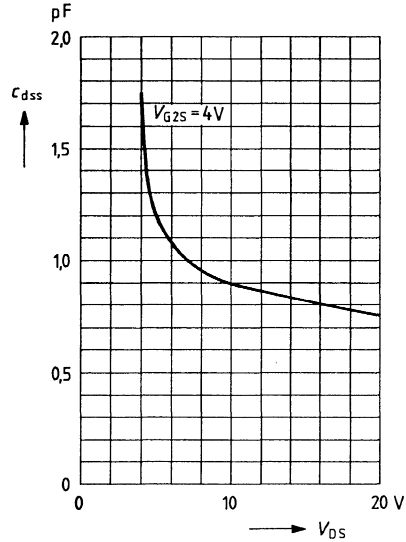
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



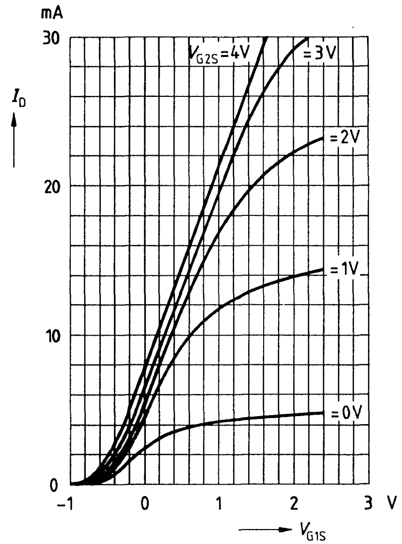
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



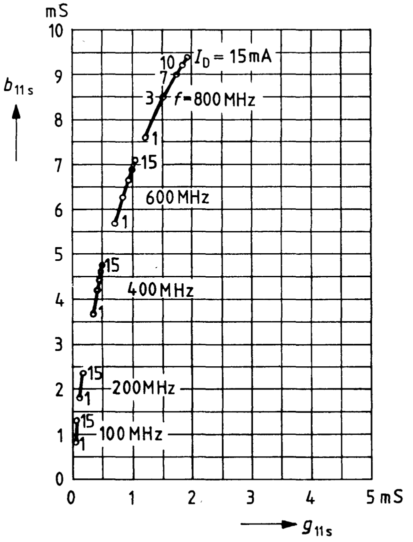
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 7$ mA, $f = 1$ MHz



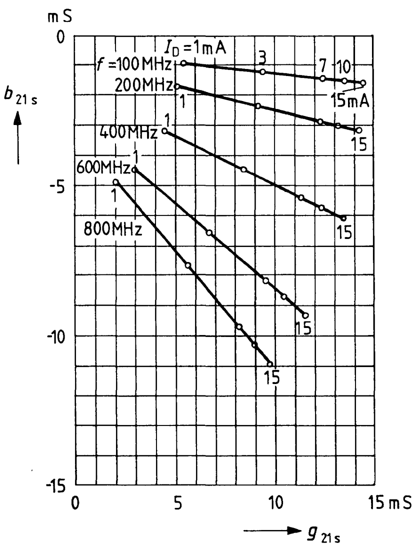
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



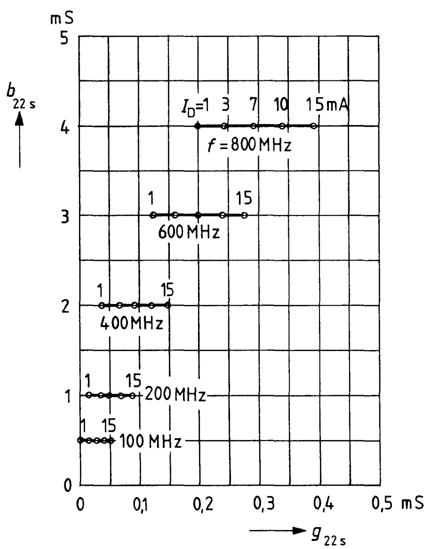
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)

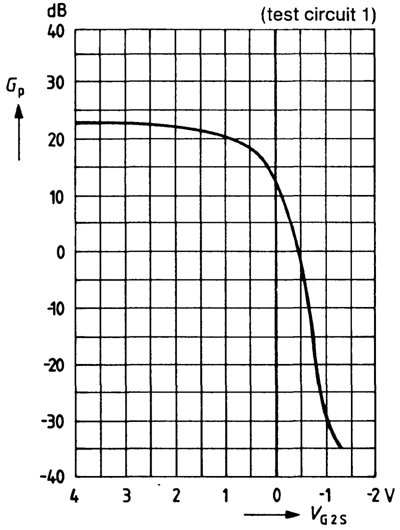


Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



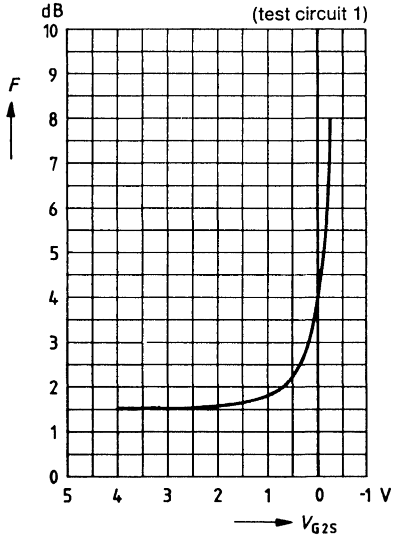
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 200$ MHz

(test circuit 1)



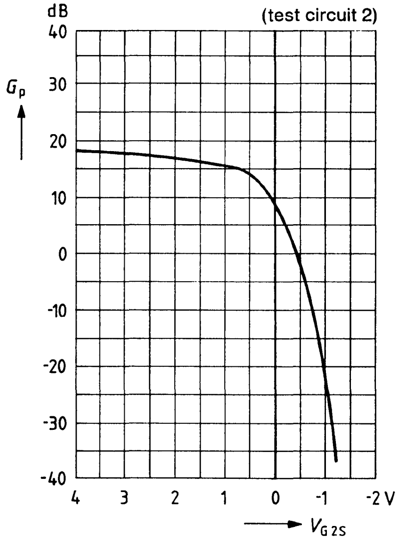
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 200$ MHz

(test circuit 1)



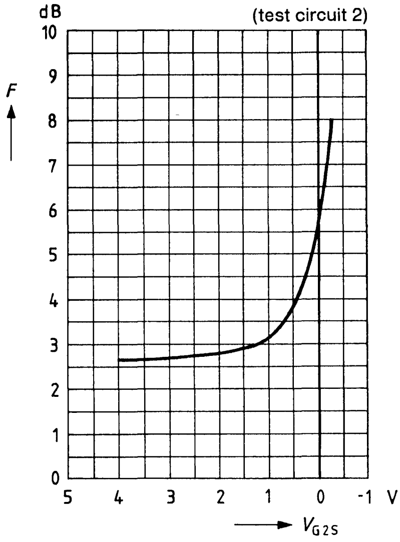
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$;
$I_{DSS} = 7$ mA, $f = 800$ MHz; $R_S = 0$

(test circuit 2)

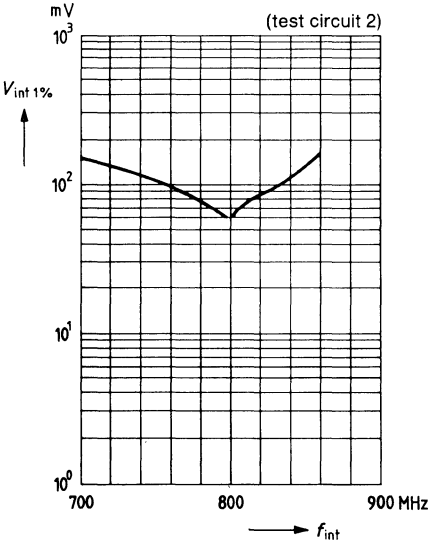


Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V; $V_{G1S} = 0$;
$I_{DSS} = 7$ mA; $f = 800$ MHz; $R_S = 0$

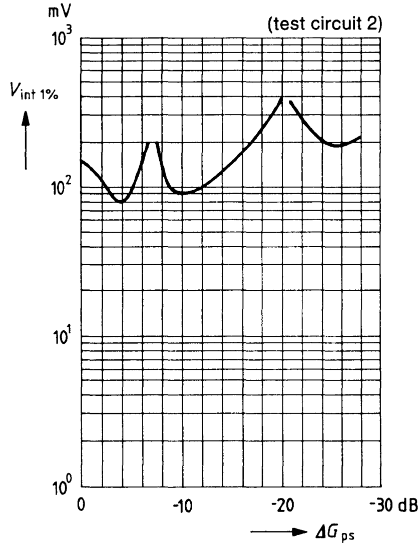
(test circuit 2)



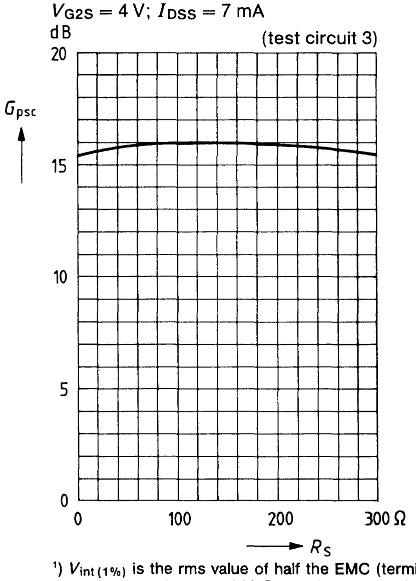
Interference voltage for 1% cross modulation
$V_{int(1\%)} = f(f_{int})$[1]; $m_{int} = 100\%$;
$V_{DS} = 15\ V$; $V_{G2S} = 4\ V$,
$V_{G1S} = 1\ V$; $R_S = 150\ \Omega$



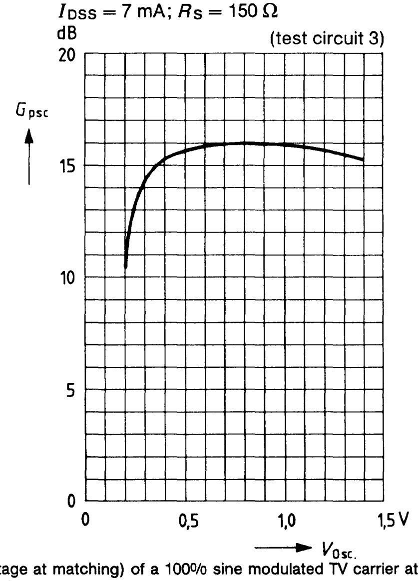
Interference voltage for 1% cross modulation
$V_{int(1\%)} = f(\Delta G_{ps})$[1]; $f_e = 800\ MHz$;
$f_{int} = 700\ MHz$; $m_{int} = 100\%$;
$V_{DS} = 15\ V$; $V_{G1S} = 1\ V$; $R_S = 150\ \Omega$



Mixer gain $G_{psc} = f(R_S)$
$f_e = 800\ MHz$; $f_{osc} = 836\ MHz$
$V_{osc} = 800\ mV$; $V_{DS} = 15\ V$
$V_{G2S} = 4\ V$; $I_{DSS} = 7\ mA$

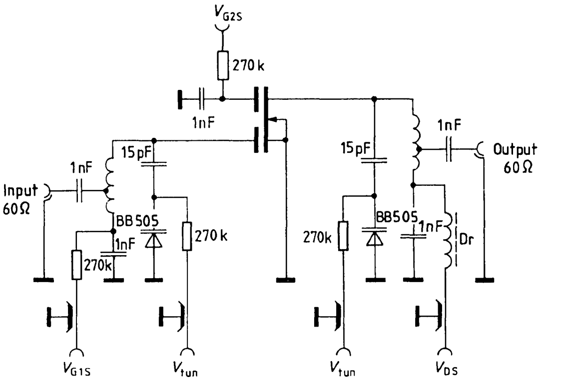


Mixer gain $G_{psc} = f(V_{osc})$
$f_e = 800\ MHz$; $f_{osc} = 836\ MHz$
$V_{DS} = 15\ V$; $V_{G2S} = 4\ V$;
$I_{DSS} = 7\ mA$; $R_S = 150\ \Omega$

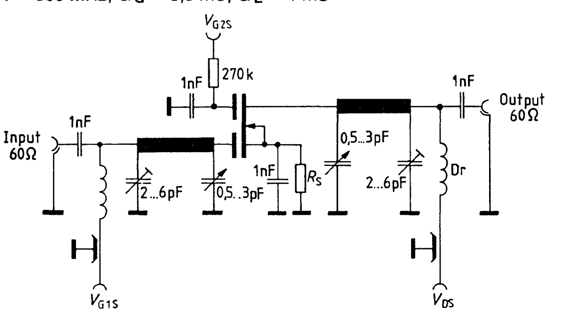


[1]) $V_{int(1\%)}$ is the rms value of half the EMC (terminal voltage at matching) of a 100% sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1% amplitude modulation on the active carrier.

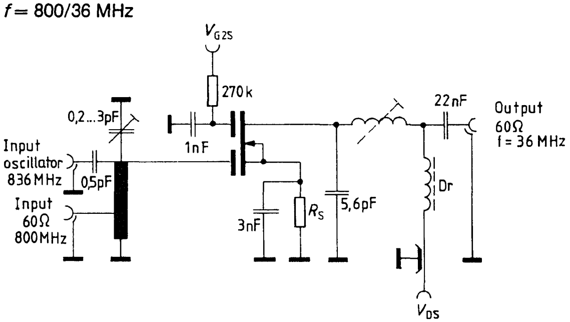
Test circuit 1, power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0{,}5$ mS



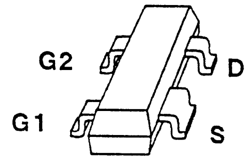
Test circuit 2, power gain, noise figure and cross modulation
$f = 800$ MHz, $G_G = 3{,}3$ mS, $G_L = 1$ mS



Test circuit 3, mixer gain
$f = 800/36$ MHz



- High gain, low distortion
- For VHF TV and FM mixer and input stages



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 993	ME	Q62702–F899	Q62702–F1018	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	50	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \cdots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

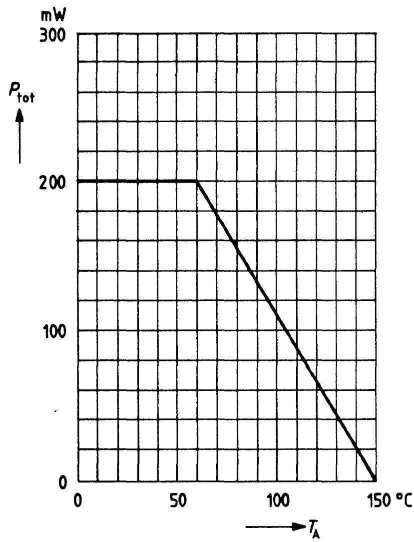
Electrical characteristics
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	6	–	40	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	3,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	3,0	V

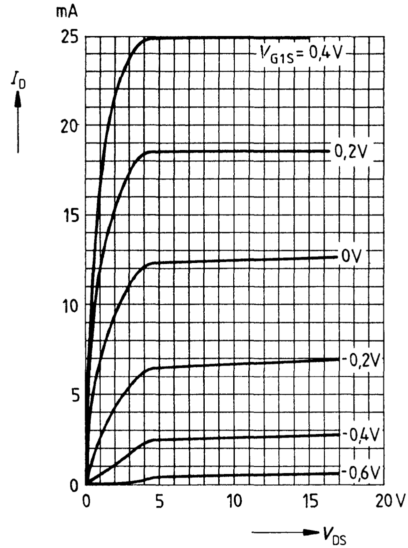
AC characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ kHz$	g_{fs}	16	25	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g1ss}	–	6	–	pF
Gate 2 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g2ss}	–	2,5	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dg1}	–	50	–	fF
Output capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dss}	–	2,5	–	pF
Power gain (see test circuit) $V_{DS} = 15\ V$, $I_D = 10\ mA$, $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $2\,\Delta f = 12\ MHz$	G_p	–	25	–	dB
Noise figure (see test circuit) $V_{DS} = 15\ V$, $I_D = 10\ mA$ $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$	F	–	1,5	–	dB

[1]) G2 and S on screen potential.

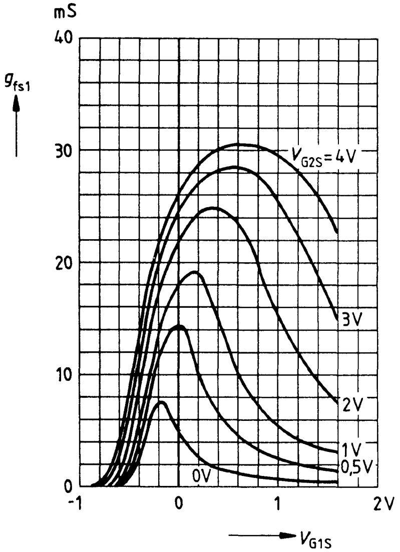
Total power dissipation $P_{tot} = f(T_A)$



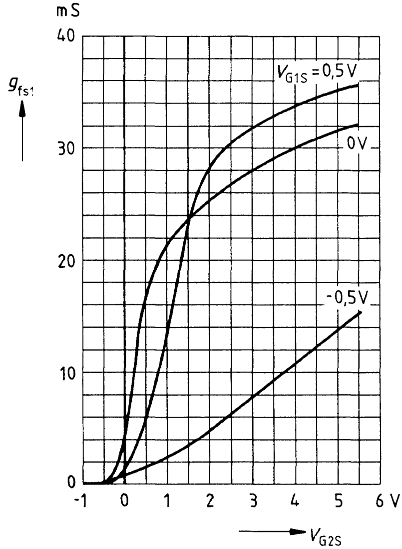
Output characteristics $I_D = f(V_{DS})$
$V_{G2S} = 4$ V



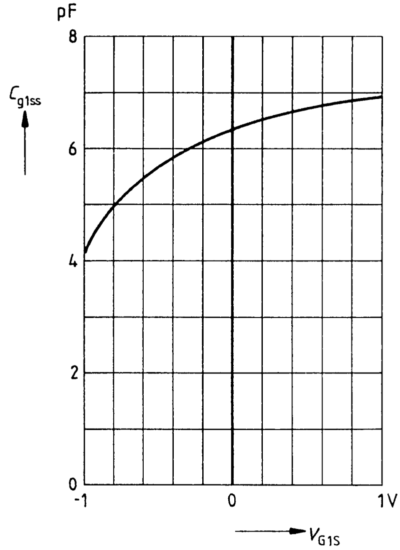
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



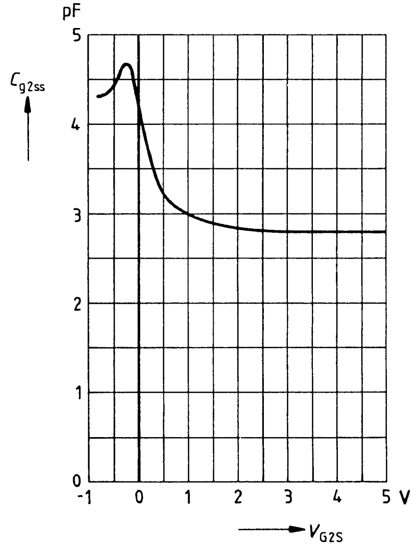
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



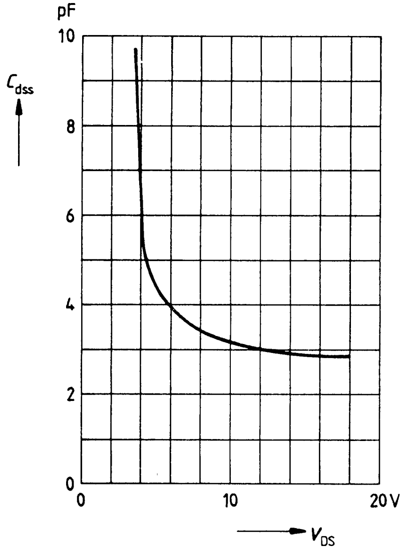
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



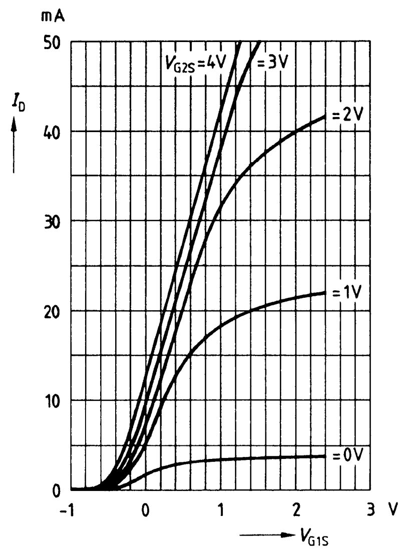
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



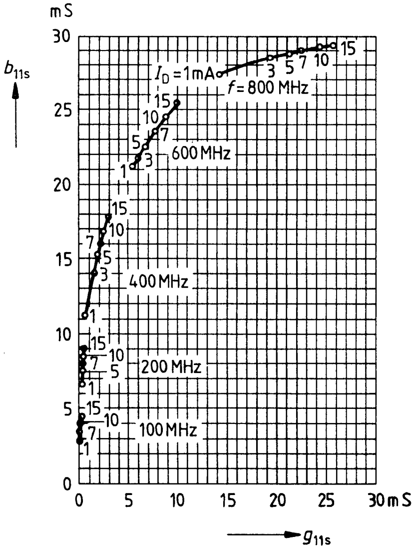
Output capacitance $C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



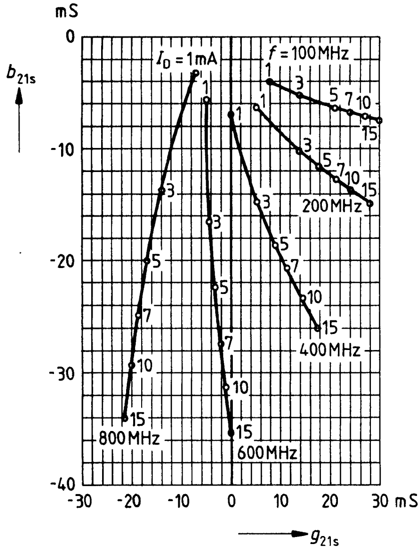
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



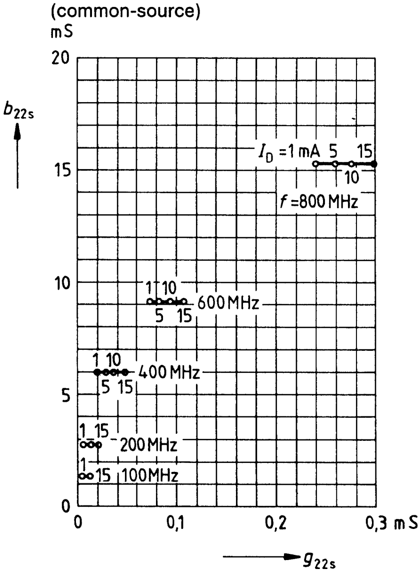
Gate 1 input admittance y_{11s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



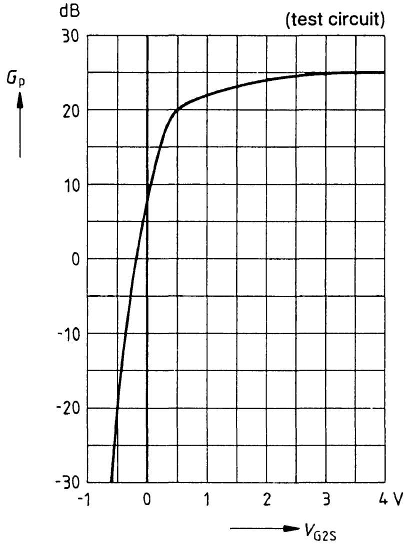
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



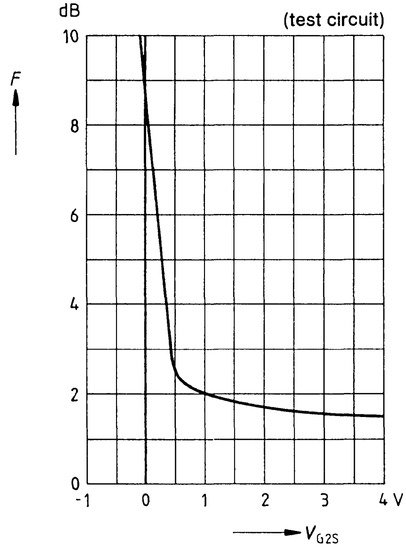
Output admittance Y_{22s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



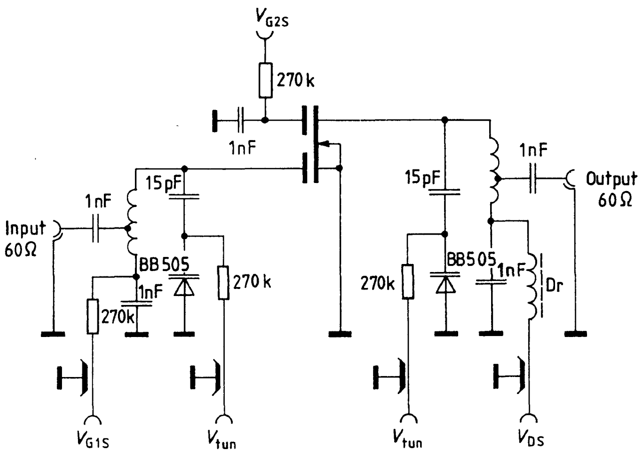
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 200$ MHz



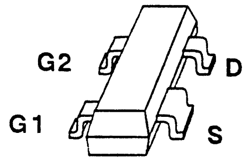
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 200$ MHz



Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0{,}5$ mS



- For VHF applications, especially for input and mixer stages with wide tuning range, e.g. in CATV tuners



Type	**Marking**	**Ordering code for versions in bulk**	**Ordering code for versions on 8 mm-tape**	**Package**
BF 994 S	MG	Q62702–F963	Q62702–F1020	SOT 143

Maximum ratings

Parameter	**Symbol**	**Ratings**	**Unit**
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \cdots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

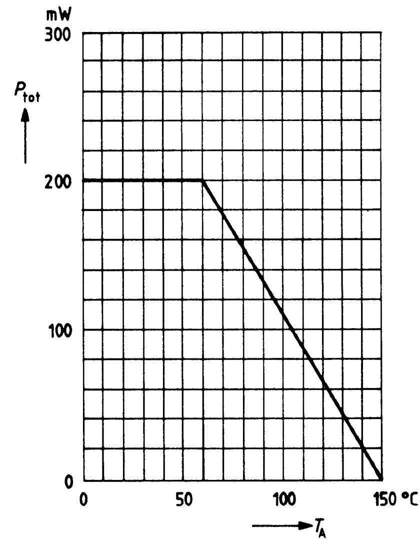
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

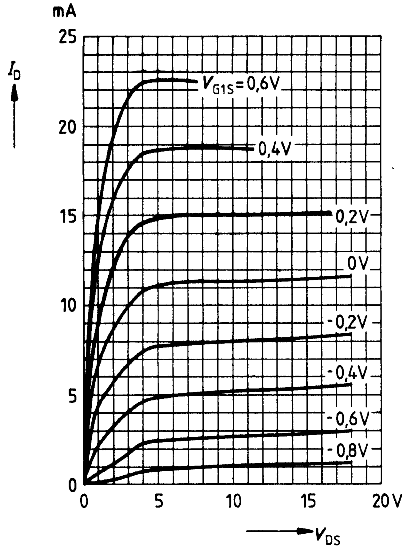
DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A,\ -V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA,\ V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA,\ V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V,\ V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V,\ V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V,\ V_{G1S} = 0,\ V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G2S} = 4\ V,\ I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V,\ V_{G1S} = 0,\ I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

AC characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V,\ I_D = 10\ mA,\ V_{G2S} = 4\ V,$ $f = 1\ kHz$	g_{fs}	15	18	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V,\ I_D = 10\ mA,\ V_{G2S} = 4\ V,$ $f = 1\ MHz$	C_{g1ss}	–	2,5	–	pF
Gate 2 input capacitance $V_{DS} = 15\ V,\ I_D = 10\ mA,\ V_{G2S} = 4\ V,$ $f = 1\ MHz$	C_{g2ss}	–	1,2	–	pF
Reverse transfer capacitance $V_{DS} = 15\ V,\ I_D = 10\ mA,\ V_{G2S} = 4\ V,$ $f = 1\ MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\ V,\ I_D = 10\ mA,\ V_{G2S} = 4\ V,$ $f = 1\ MHz$	C_{dss}	–	1	–	pF
Power gain (see test circuit) $V_{DS} = 15\ V,\ I_D = 10\ mA,$ $f = 200\ MHz,\ G_G = 2\ mS,\ G_L = 0{,}5\ mS$	G_p	–	25	–	dB
Noise figure (see test circuit) $V_{DS} = 15\ V,\ I_D = 10\ mA,$ $f = 200\ MHz,\ G_G = 2\ mS,\ G_L = 0{,}5\ mS$	F	–	1	–	dB
Control range (see test circuit) $V_{DS} = 15\ V,\ V_{G2S} = 4 \cdots -2\ V,$ $f = 200\ MHz$	ΔG_p	50	–	–	dB

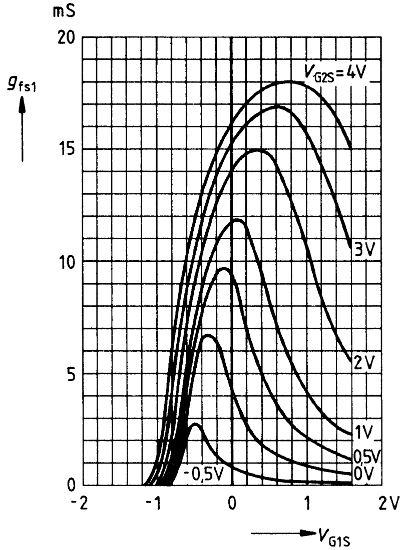
Total power dissipation $P_{tot} = f(T_A)$



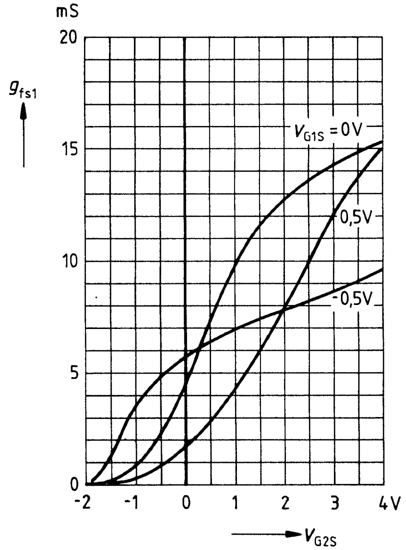
Output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



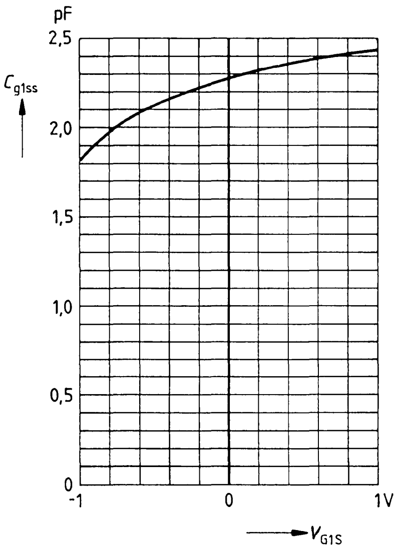
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



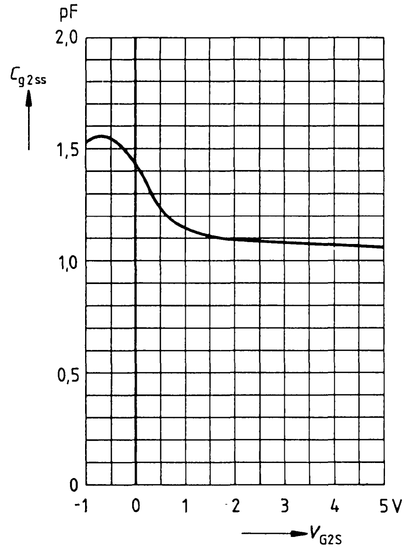
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



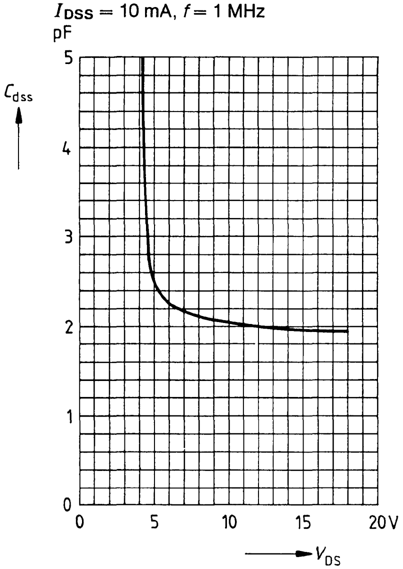
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



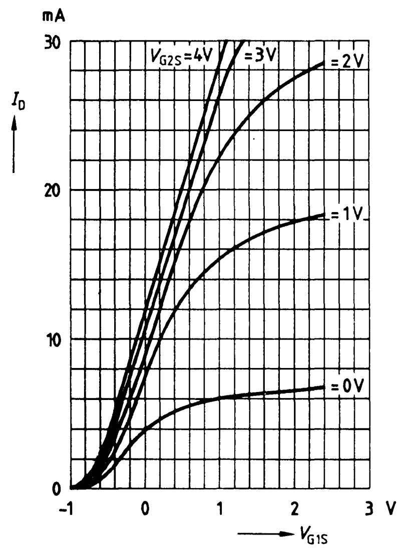
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



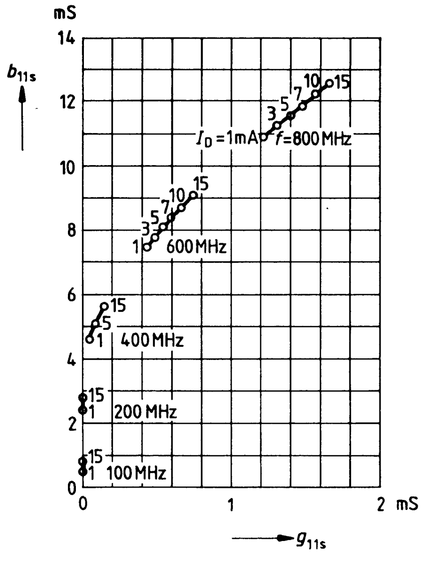
Output capacitance $C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



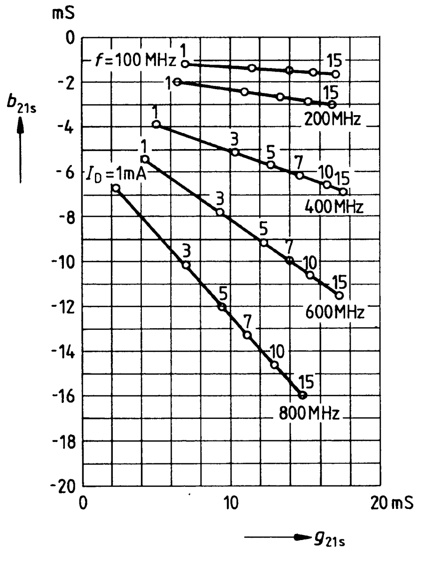
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



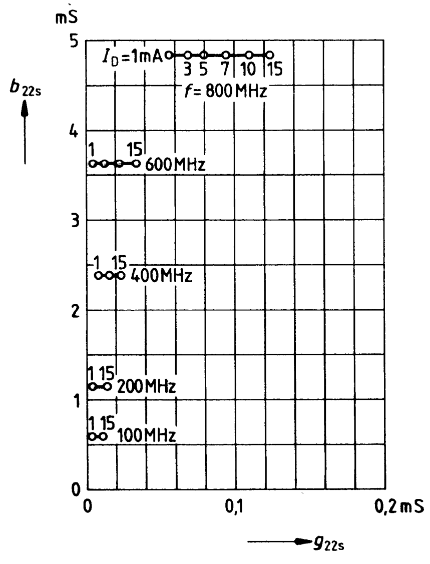
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



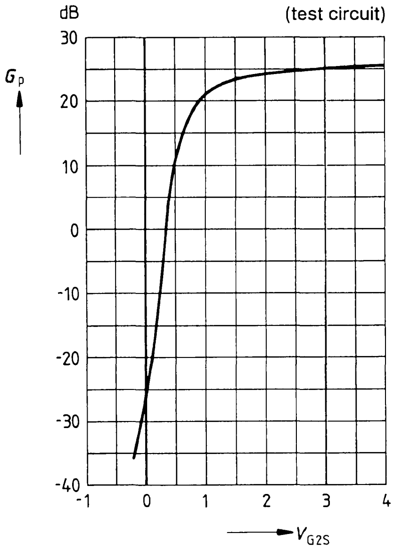
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



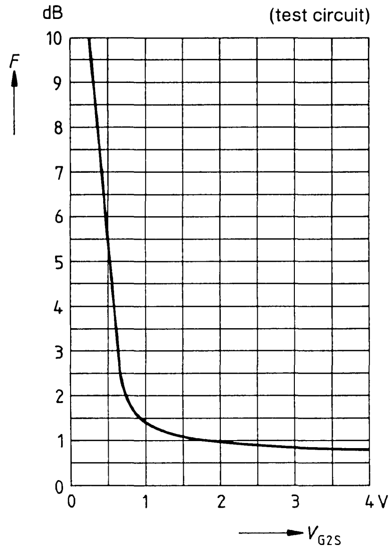
Output admittance Y_{22s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
(common-source)



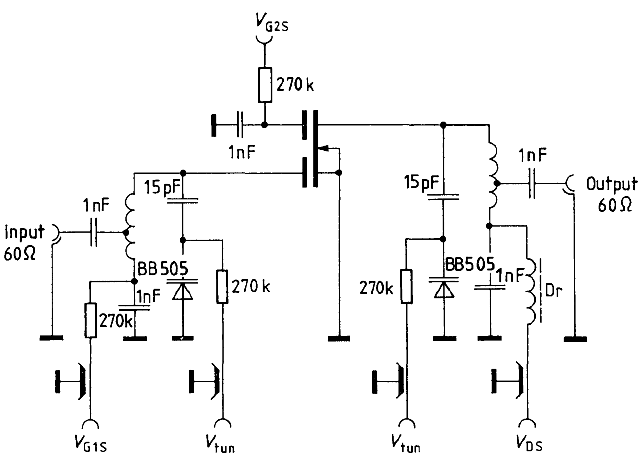
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz



Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz



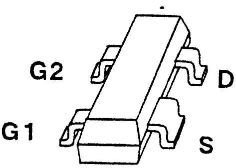
Test circuit for power gain and noise figure
$f = 200$ MHz; $G_G = 2$ mS, $G_L = 0,5$ mS



Silicon N Channel MOSFET Tetrode

BF 995

- For FM and VHF TV input and mixer stages



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 995	MB	Q62702–F872	Q62702–F936	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \cdots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

Electrical characteristics

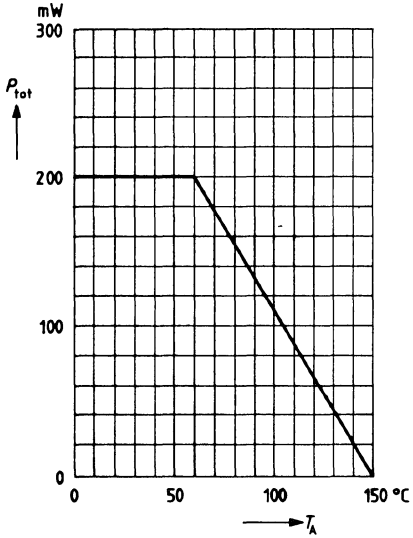
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	4	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	3,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	3,5	V

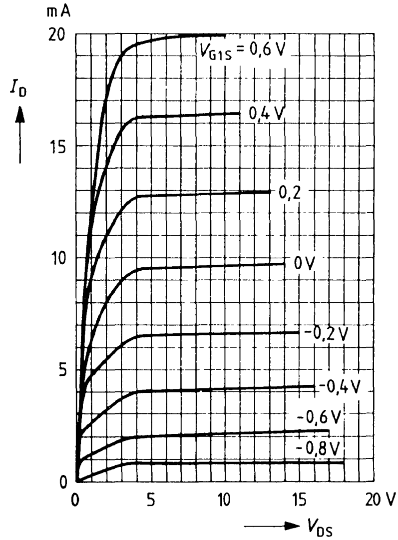
AC characteristics	Symbol	min	typ	max	Unit
Forward transconductance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 kHz	g_{fs}	12	17	–	mS
Gate 1 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g1ss}	–	3,6	–	pF
Gate 2 input capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{g2ss}	–	1,6	–	pF
Reverse transfer capacitance[1]) V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 15 V, I_D = 10 mA, V_{G2S} = 4 V, f = 1 MHz	C_{dss}	–	1,6	–	pF
Power gain (test circuit 1) V_{DS} = 15 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS 2 Δf = 12 MHz	G_p	–	23	–	dB
Noise figure (test circuit 1) V_{DS} = 15 V, I_D = 10 mA f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS	F	–	1,8	–	dB
Control range (test circuit 1) V_{DS} = 15 V, V_{G2S} = 4 ··· –2 V, f = 200 MHz	ΔG_p	–	50	–	dB
Mixer gain (additive test circuit 2) V_{DS} = 15 V, V_{G2S} = 6 V, R_S = 220 Ω f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{Osc} = 0,5 V	G_{psc}	–	16	–	dB
Mixer gain (multiplicative test circuit 3) V_{DS} = 15 V, V_{G1S} = 1,7 V, V_{G2S} = 2,5 V R_S = 220 Ω, f = 200 MHz, f_{IF} = 36 MHz 2 Δf_{IF} = 5 MHz, V_{Osc} = 2 V	G_{psc}	–	18	–	dB

[1]) G2 and S on screen potential.

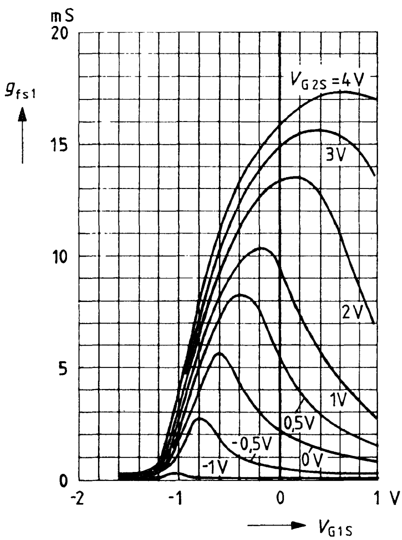
Total power dissipation $P_{tot} = f(T_A)$



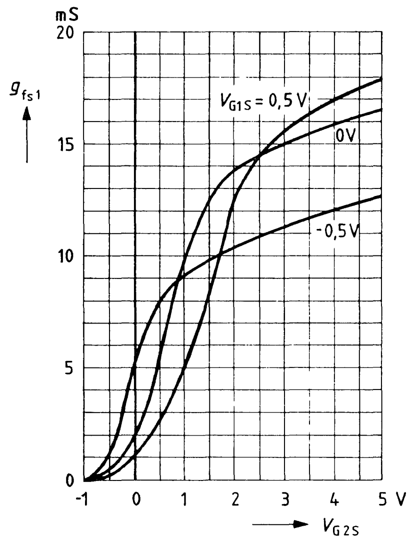
Output characteristics $I_D = f(V_{DS})$
$V_{G2S} = 4$ V



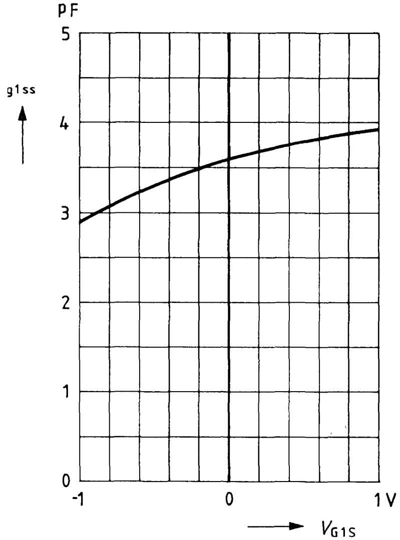
Gate 1 forward transconductance $g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



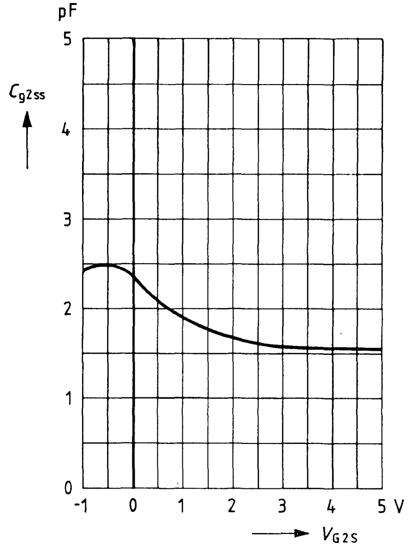
Gate 1 forward transconductance $g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



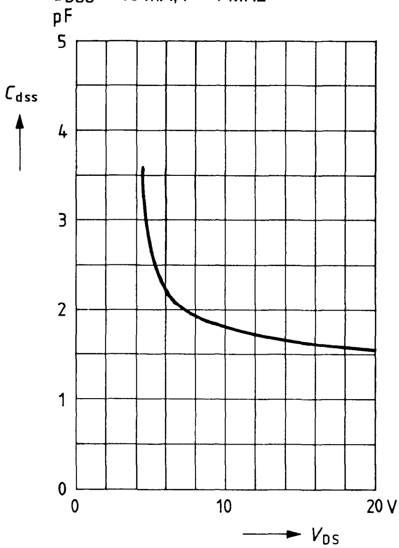
Gate 1 input capacitance $C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



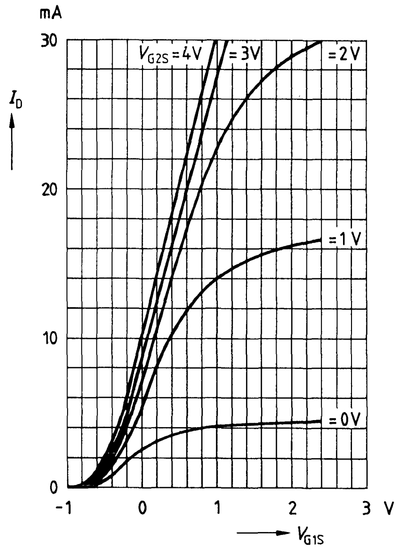
Gate 2 input capacitance $C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



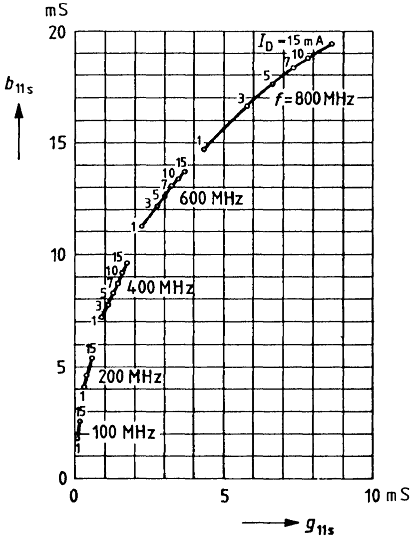
Output capacitance $C_{dss} = f(V_{DS})$
$V_{G1S} = 0$ V, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



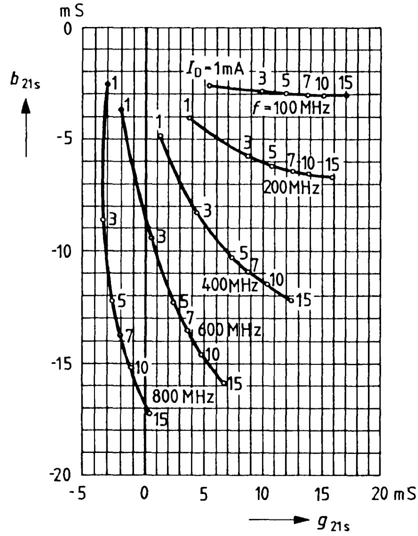
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



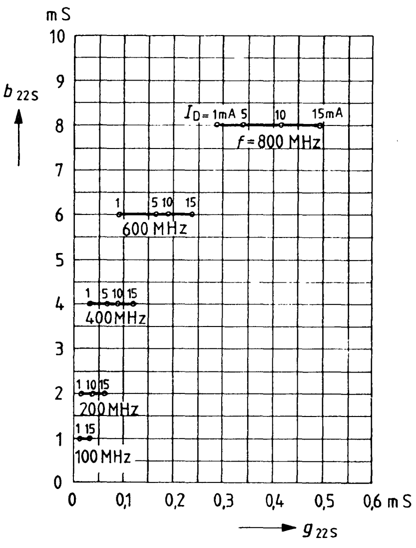
Gate 1 input admittance y_{11s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



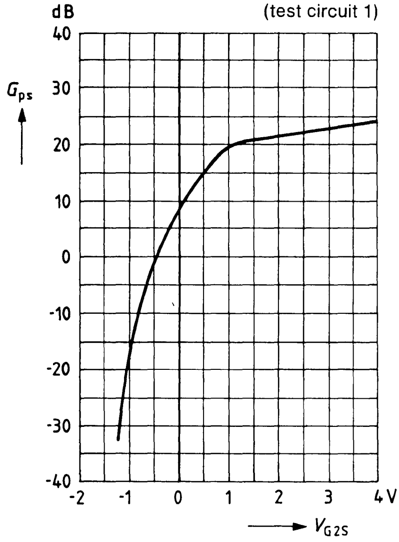
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



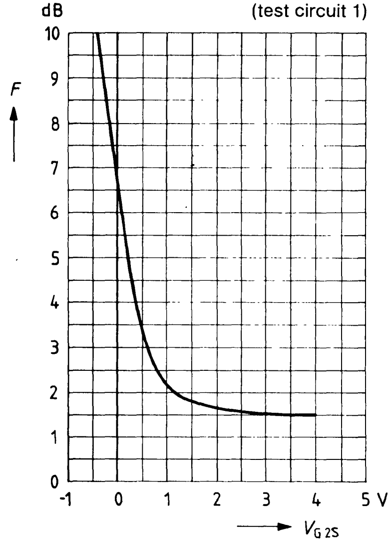
Output admittance Y_{22s}
$V_{DS} = 15\,V$, $V_{G2S} = 4\,V$
(common-source)



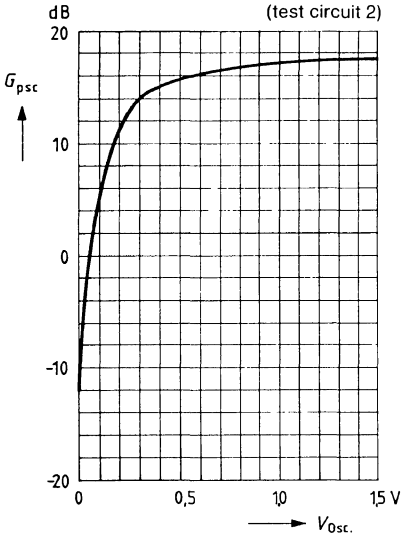
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz



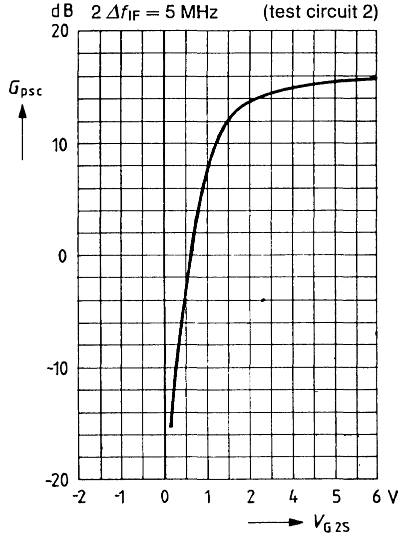
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$ V
$I_{DSS} = 10$ mA, $f = 200$ MHz



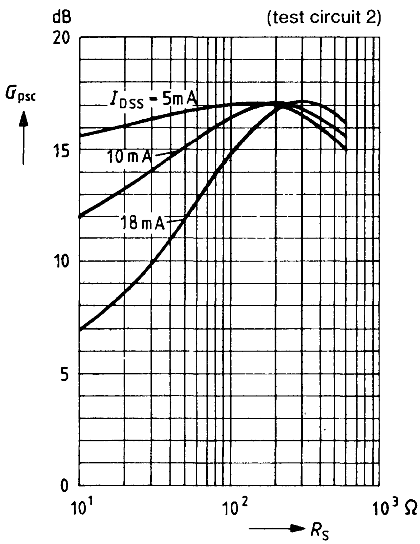
Mixer gain (additive)
$G_{psc} = f(V_{osc})$; $V_D = 15$ V; $V_{G1S} = 0$;
$V_{G2S} = 6$ V; $R_S = 220\ \Omega$; $I_{DSS} = 10$ mA;
$f = 200$ MHz; $f_{IF} = 36$ MHz;
$2\,\Delta f_{IF} = 5$ MHz
(test circuit 2)



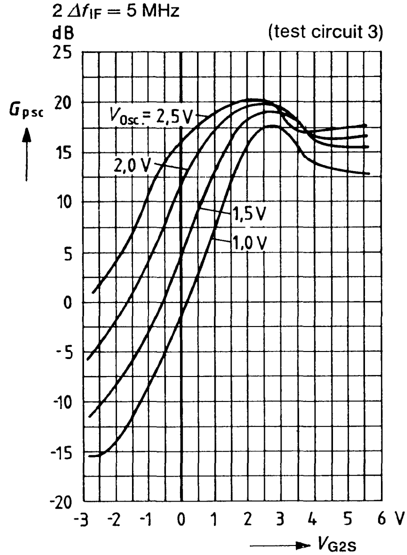
Mixer gain (additive)
$G_{psc} = f(V_{G2S})$; $V_D = 15$ V; $V_{G1S} = 0$;
$R_S = 220\ \Omega$; $V_{osc} = 0{,}5$ V;
$I_{DSS} = 10$ mA; $f = 200$ MHz;
$f_{IF} = 36$ MHz;
$2\,\Delta f_{IF} = 5$ MHz
(test circuit 2)



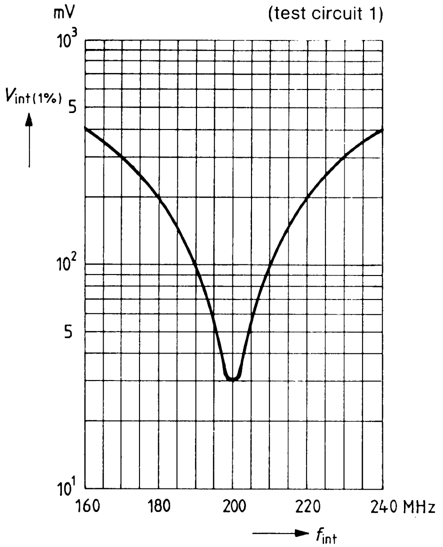
Mixer gain (additive)
$G_{psc} = f(R_S)$; $V_D = 15$ V; $V_{G1S} = 0$;
$V_{G2S} = 6$ V; $V_{osc} = 0{,}5$ V; $f = 200$ MHz;
$f_{IF} = 36$ MHz; $2\,\Delta f_{IF} = 5$ MHz
(test circuit 2)



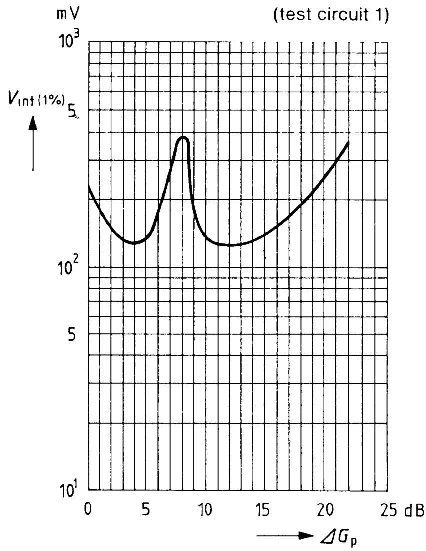
Mixer gain (multiplicative)
$G_{psc} = f(V_{G2S})$; $V_D = 15$ V; $V_{G1S} = 1{,}7$ V;
$R_S = 200\ \Omega$; $I_{DSS} = 10$ mA;
$f = 200$ MHz; $f_{IF} = 36$ MHz;
$2\,\Delta f_{IF} = 5$ MHz
(test circuit 3)



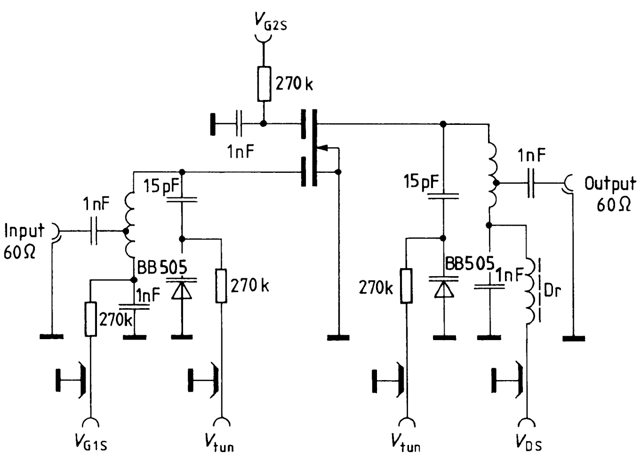
Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(f_{int})$[1]; m_{int} = 100%;
f_e = 200 MHZ; V_{DS} = 15 V; V_{G2S} = 4 V,
V_{G1S} = 0; I_{DSS} = 10 mA



Interference voltage for 1% cross modulation
$V_{int\ (1\%)} = f(\Delta G_p)$[1]; f_e = 200 MHz;
f_{int} = 221 MHz; m_{int} = 100%;
V_{DS} = 15 V; V_{G1S} = 0; I_{DSS} = 10 mA

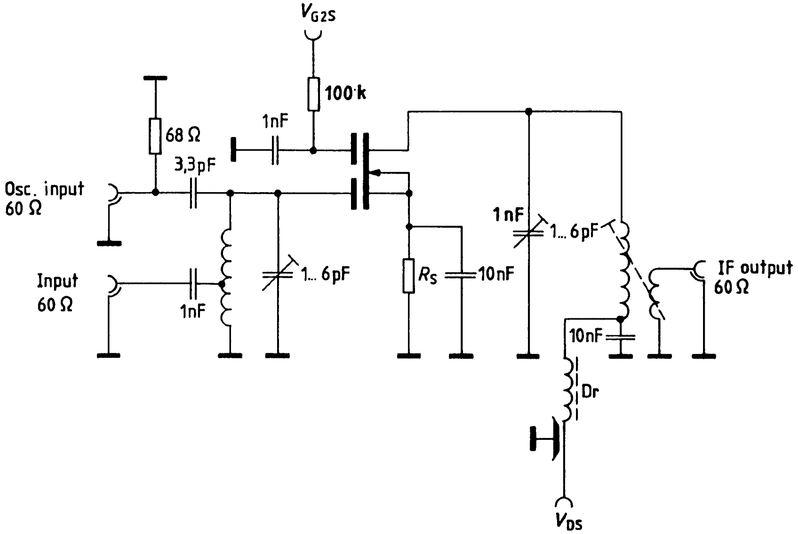


Test circuit 1, power gain, noise figure and cross modulation
f = 200 MHz; G_G = 2 mS, G_L = 0,5 mS

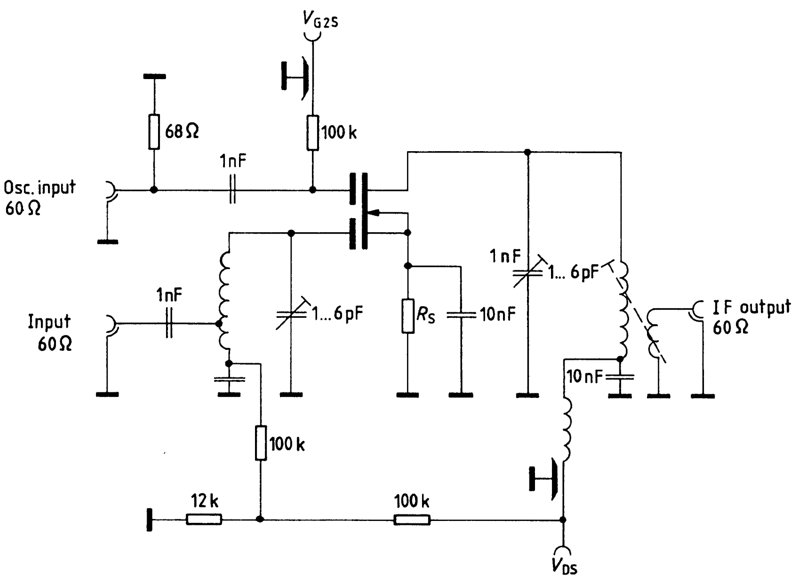


[1]) $V_{int\ (1\%)}$ is the rms value of half the EMF (terminal voltage at matching) of a 100% sine modulated TV carrier at an internal generator resistance of 60 Ω, causing 1% amplitude modulation on the active carrier.

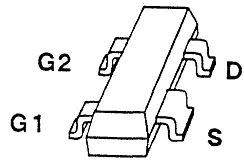
Test circuit 2, mixer gain (additive)
$f = 200$ MHz; $f_{osc} = 236$ MHz; $2\,\Delta f_{IF} = 5$ MHz



Test circuit 3, mixer gain (multiplicative)
$f = 200$ MHz; $f_{osc} = 236$ MHz; $2\,\Delta f_{IF} = 5$ MHz



- For input stages in UHF TV tuners
- High transconductance
- Low noise figure



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 996 S	MH	Q62702–F964	Q62702–F1021	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \dots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

Electrical characteristics

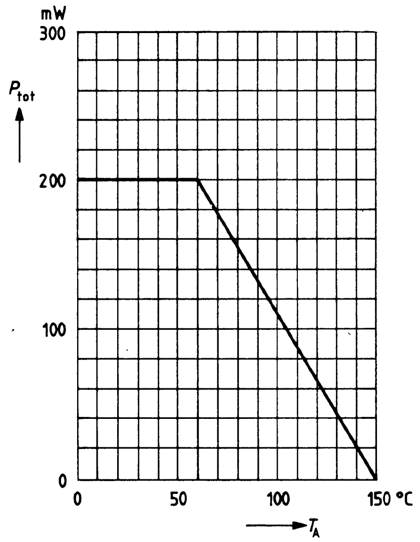
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\ mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\ mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\ V$, $V_{G1S} = 0$, $V_{G2S} = 4\ V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G2S} = 4\ V$, $I_D = 20\ \mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\ V$, $V_{G1S} = 0$, $I_D = 20\ \mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

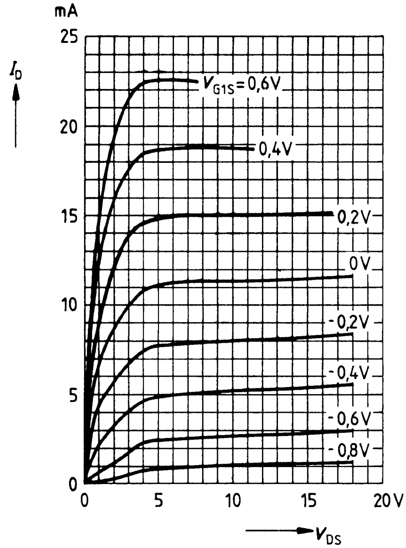
AC characteristics	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ kHz$	g_{fs}	15	18	–	mS
Gate 1 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g1ss}	–	2,3	–	pF
Gate 2 input capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{g2ss}	–	1,1	–	pF
Reverse transfer capacitance¹) $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\ V$, $I_D = 10\ mA$, $V_{G2S} = 4\ V$, $f = 1\ MHz$	C_{dss}	–	0,8	–	pF
Power gain (test circuits 1, 2) $V_{DS} = 15\ V$, $I_D = 10\ mA$, $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	G_p	 – –	 25 18	 – –	 dB dB
Noise figure (test circuits 1, 2) $V_{DS} = 15\ V$, $I_D = 10\ mA$ $f = 200\ MHz$, $G_G = 2\ mS$, $G_L = 0{,}5\ mS$ $f = 800\ MHz$, $G_G = 3{,}3\ mS$, $G_L = 1\ mS$	F	 – –	 1 1,8	 – –	 dB dB
Control range (test circuit 1) $V_{DS} = 15\ V$, $V_{G2S} = 4 \cdots -2\ V$, $f = 800\ MHz$	ΔG_p	40	–	–	dB

[1]) G2 and S on screen potential.

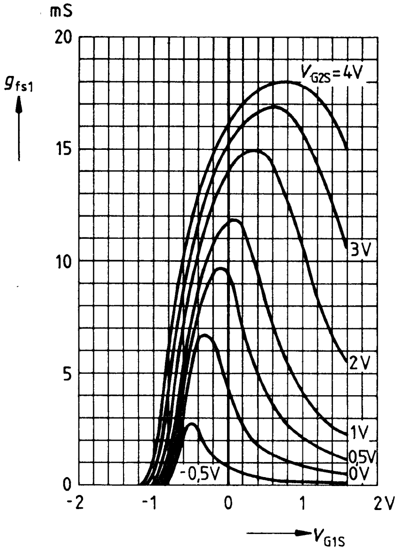
Total power dissipation
$P_{tot} = f(T_A)$



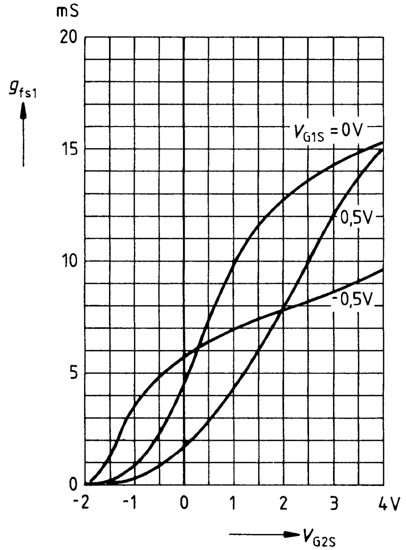
Output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



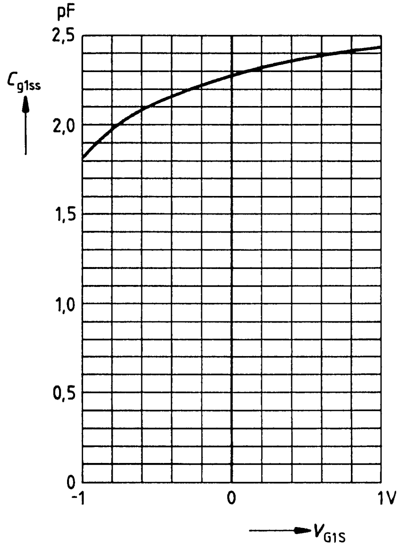
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



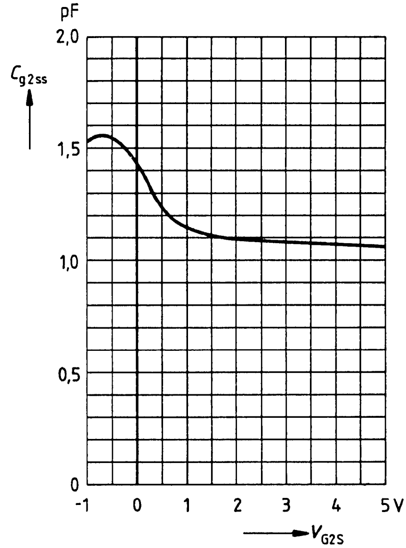
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



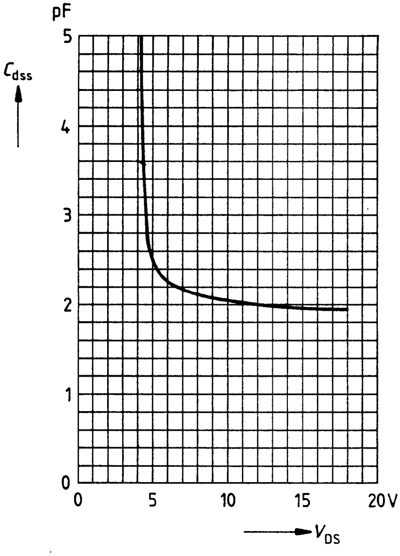
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



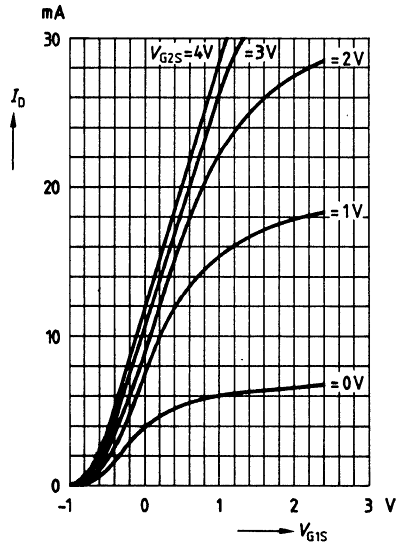
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



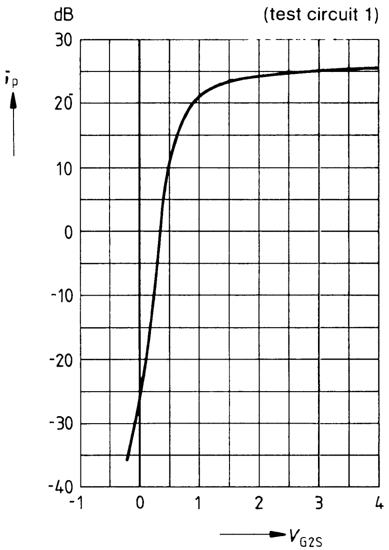
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



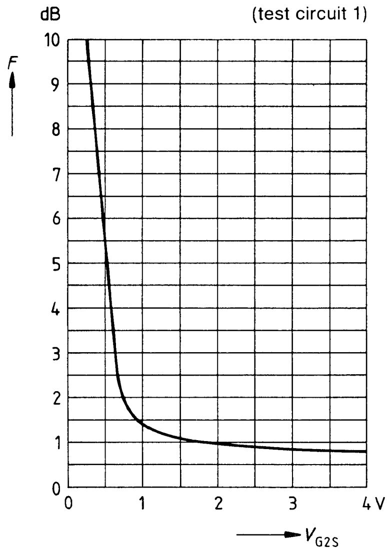
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



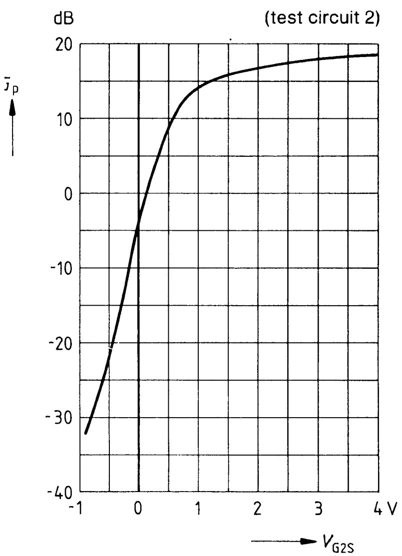
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 200$ MHz



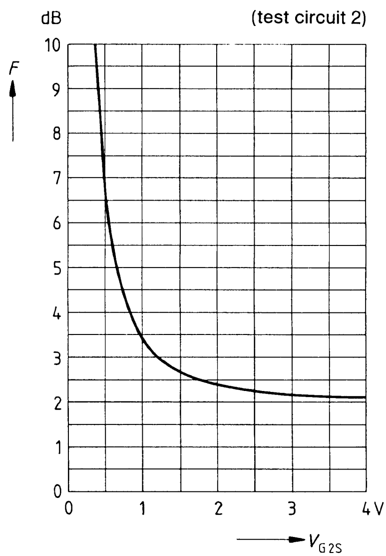
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 200$ MHz



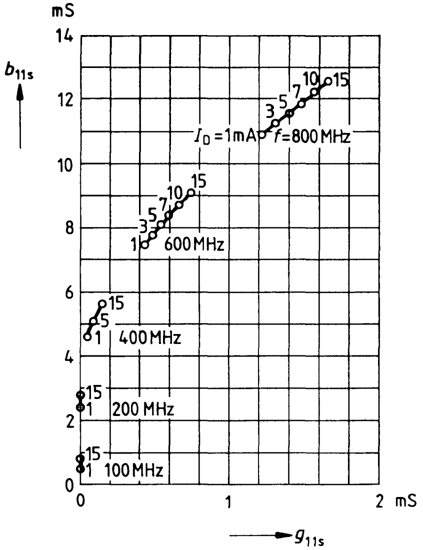
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 800$ MHz



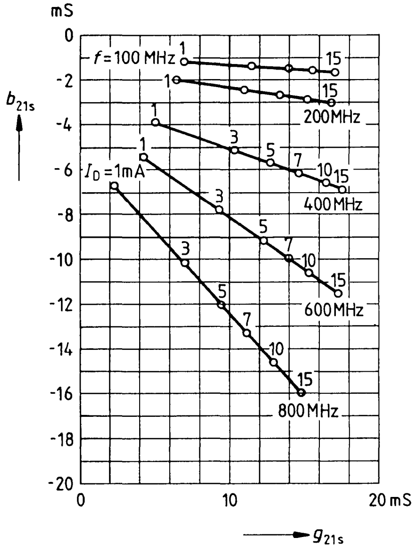
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 800$ MHz



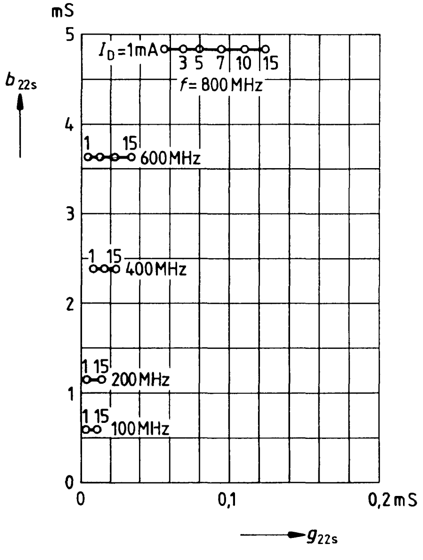
Gate 1 input admittance y_{11s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



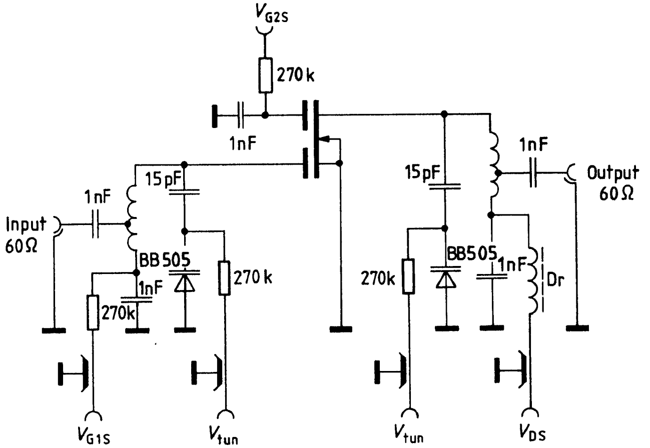
Gate 1 forward transfer admittance Y_{21s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



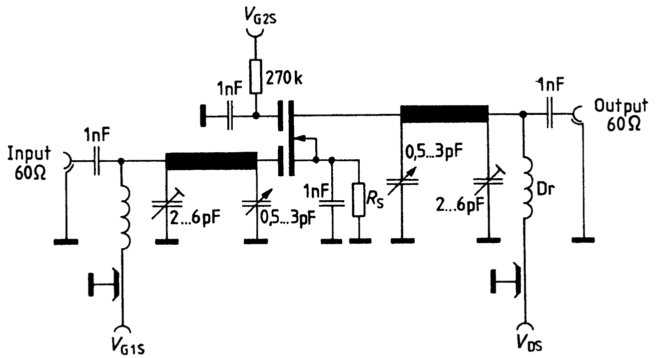
Output admittance Y_{22s}
V_{DS} = 15 V, V_{G2S} = 4 V
(common-source)



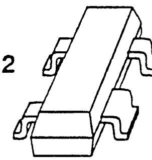
Test circuit 1, power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0,5 mS



Test circuit 2, power gain, noise figure and cross modulation
f = 800 MHz, G_G = 3,3 mS, G_L = 1,0 mS



- For VHF applications especially in TV tuners with extended VHF band
- Integrated suppression network against spurious VHF oscillations



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BF 997	MK	Q62702–F993	Q62702–F1055	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A = 60\,°C$	P_{tot}	200	mW
Storage temperature range	T_{stg}	$-55 \cdots +150$	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 450	K/W

Electrical characteristics

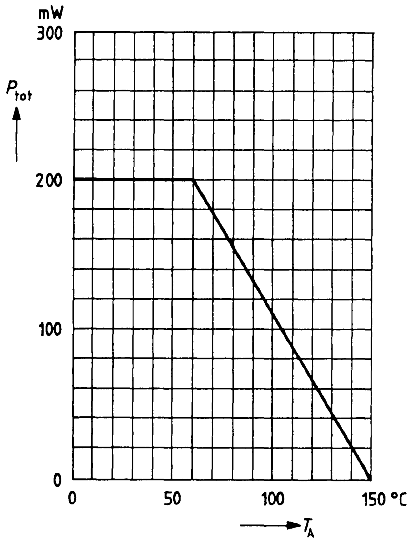
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Drain-source breakdown voltage $I_D = 10\,\mu A$, $-V_{G1S} = -V_{G2S} = 4\,V$	$V_{(BR)\,DS}$	20	–	–	V
Gate 1 source breakdown voltage $\pm I_{G1S} = 10\,mA$, $V_{G2S} = V_{DS} = 0$	$\pm V_{(BR)\,G1SS}$	8,5	–	17	V
Gate 2 source breakdown voltage $\pm I_{G2S} = 10\,mA$, $V_{G1S} = V_{DS} = 0$	$\pm V_{(BR)\,G2SS}$	8,5	–	17	V
Gate 1 source leakage current $\pm V_{G1S} = 5\,V$, $V_{G2S} = V_{DS} = 0$	$\pm I_{G1SS}$	–	–	50	nA
Gate 2 source leakage current $\pm V_{G2S} = 5\,V$, $V_{G1S} = V_{DS} = 0$	$\pm I_{G2SS}$	–	–	50	nA
Drain current $V_{DS} = 15\,V$, $V_{G1S} = 0$, $V_{G2S} = 4\,V$	I_{DSS}	2	–	20	mA
Gate 1 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G2S} = 4\,V$, $I_D = 20\,\mu A$	$-V_{G1S\,(p)}$	–	–	2,5	V
Gate 2 source pinch-off voltage $V_{DS} = 15\,V$, $V_{G1S} = 0$, $I_D = 20\,\mu A$	$-V_{G2S\,(p)}$	–	–	2,0	V

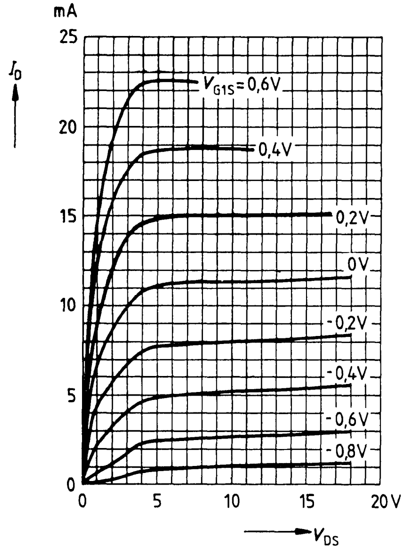
AC characteristics	Symbol	min	typ	max	Unit
Forward conductance $V_{DS} = 15\,V$, $I_D = 10\,mA$, $V_{G2S} = 4\,V$, $f = 1\,kHz$	g_{fs}	15	18	–	mS
Gate 1 input capacitance $V_{DS} = 15\,V$, $I_D = 10\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g1ss}	–	2,5	–	pF
Gate 2 input capacitance $V_{DS} = 15\,V$, $I_D = 10\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{g2ss}	–	1,2	–	pF
Reverse transfer capacitance[1]) $V_{DS} = 15\,V$, $I_D = 10\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dg1}	–	25	–	fF
Output capacitance $V_{DS} = 15\,V$, $I_D = 10\,mA$, $V_{G2S} = 4\,V$, $f = 1\,MHz$	C_{dss}	–	1	–	pF
Power gain (see test circuit) $V_{DS} = 15\,V$, $I_D = 10\,mA$, $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$	G_p	–	25	–	dB
Noise figure (see test circuit) $V_{DS} = 15\,V$, $I_D = 10\,mA$, $f = 200\,MHz$, $G_G = 2\,mS$, $G_L = 0{,}5\,mS$	F	–	1	–	dB
Control range (see test circuit) $V_{DS} = 15\,V$, $V_{G2S} = 4 \cdots -2\,V$, $f = 200\,MHz$	ΔG_p	50	–	–	dB

[1]) G2 and S on screen potential.

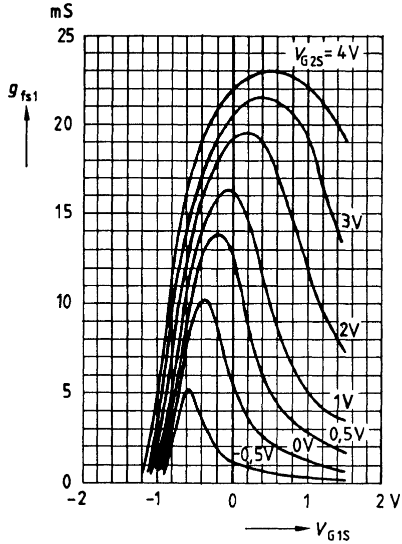
Total power dissipation
$P_{tot} = f(T_A)$



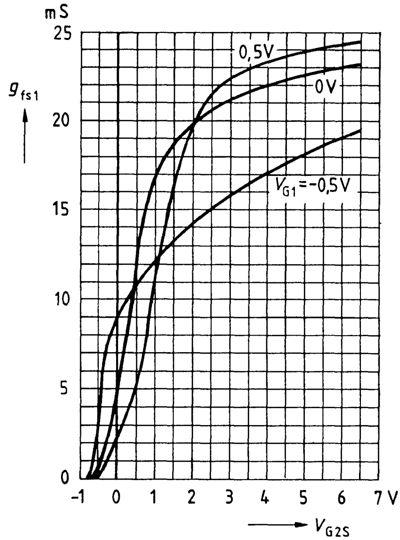
Output characteristics
$I_D = f(V_{DS})$
$V_{G2S} = 4$ V



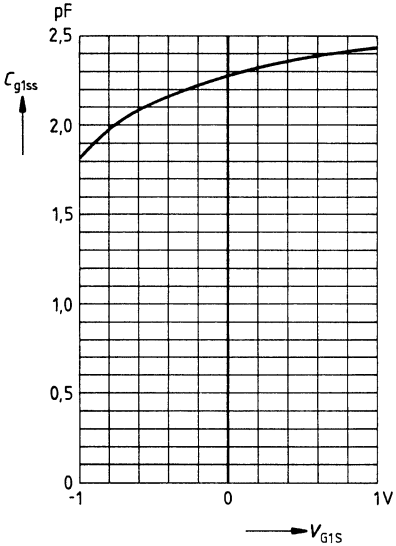
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



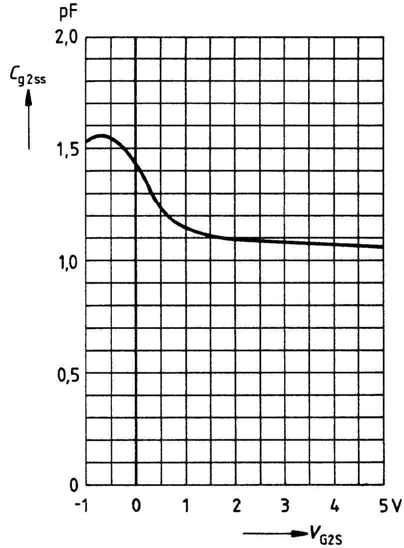
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ kHz



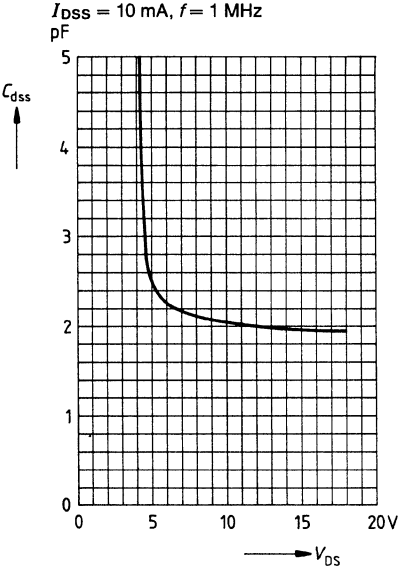
Gate 1 input capacitance
$C_{g1ss} = f(V_{G1S})$
$V_{G2S} = 4$ V, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



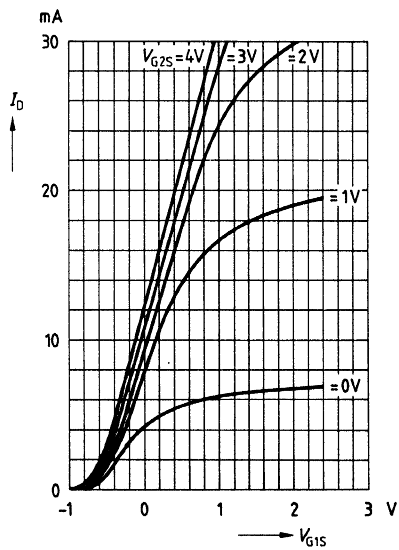
Gate 2 input capacitance
$C_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$, $V_{DS} = 15$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



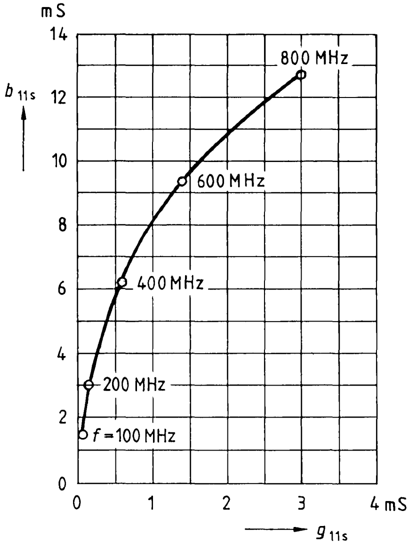
Output capacitance
$C_{dss} = f(V_{DS})$
$V_{G1S} = 0$, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



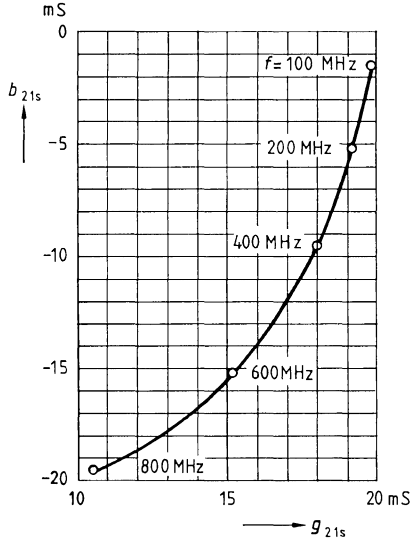
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 15$ V



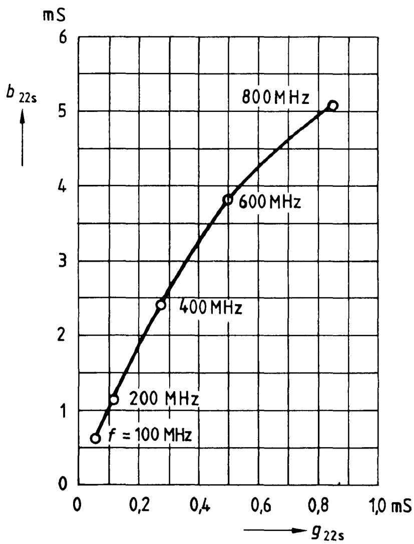
Gate 1 input admittance y_{11s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$, $I_{DSS} = 10$ mA
(common-source)



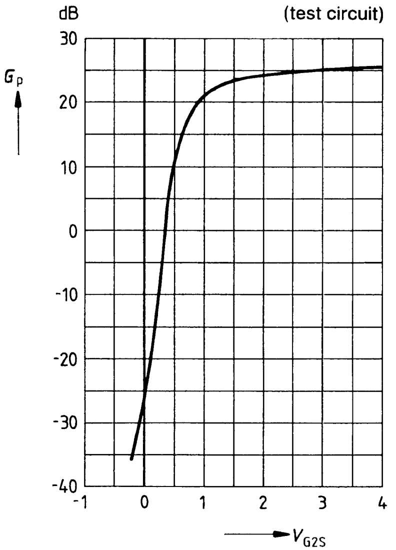
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$, $I_{DSS} = 10$ mA
(common-source)



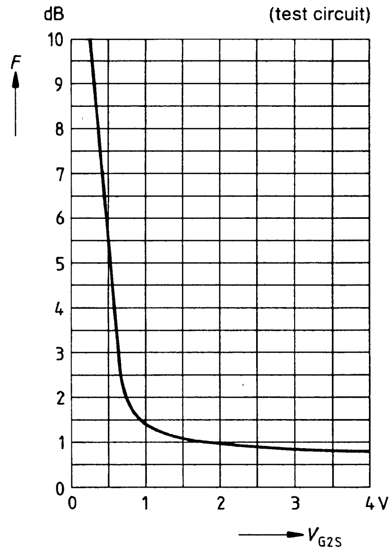
Output admittance Y_{22s}
$V_{DS} = 15$ V, $V_{G2S} = 4$ V
$V_{G1S} = 0$, $I_{DDS} = 10$ mA
(common-source)



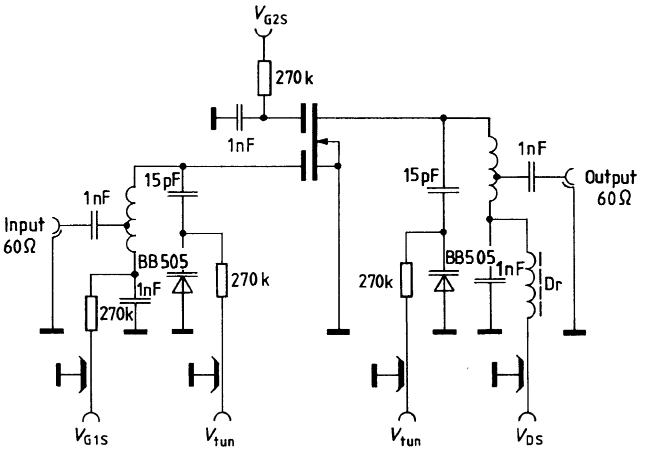
Power gain $G_p = f(V_{G2S})$
$V_{DS} = 15\text{ V}$, $V_{G1S} = 0\text{ V}$
$I_{DSS} = 10\text{ mA}$, $f = 200\text{ MHz}$



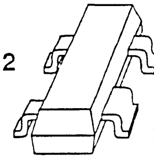
Noise figure $F = f(V_{G2S})$
$V_{DS} = 15\text{ V}$, $V_{G1S} = 0\text{ V}$
$I_{DSS} = 10\text{ mA}$, $f = 200\text{ MHz}$



Test circuit for power gain and noise figure
$f = 200\text{ MHz}$; $G_G = 2\text{ mS}$, $G_L = 0{,}5\text{ mS}$



- Short-channel transistor with high S/C quality factor
- For low-noise, gain-controlled input stages up to 1 GHz



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on tape
BF 998	MO	Q62702-F37	Q62702-F1129

Maximum ratings	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	12	V
Drain current	I_D	30	mA
Gate 1/Gate 2 source peak current	$\pm I_{G1/2SM}$	10	mA
Total power dissipation $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	–55 ... +150	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance			
Channel – ambient[1])	R_{thJA}	≤ 450	K/W

[1]) Package mounted on alumina 16.7 mm x 15 mm x 0.7 mm

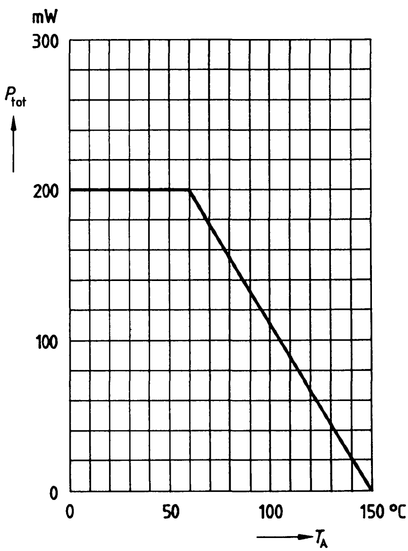
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics	**Symbol**	**min.**	**typ.**	**max.**	**Unit**
Drain-source breakdown voltage I_D = 10 µA, $-V_{G1S} = -V_{G2S}$ = 4 V	$V_{(BR)DS}$	12	–	–	V
Gate 1-source breakdown voltage $\pm I_{G1S}$ = 10 mA, $V_{G2S} = V_{DS}$ = 0	$\pm V_{(BR)G1SS}$	8	–	14	V
Gate 2-source breakdown voltage $\pm I_{G2S}$ = 10 mA, $V_{G1S} = V_{DS}$ = 0	$\pm V_{(BR)G2SS}$	8	–	14	V
Gate 1-source leakage current $\pm V_{G1S}$ = 5 V, $V_{G2S} = V_{DS}$ = 0	$\pm I_{G1SS}$	–	–	50	nA
Gate 2-source leakage current $\pm V_{G2S}$ = 5 V, $V_{G1S} = V_{DS}$ = 0	$\pm I_{G2SS}$	–	–	50	nA
Drain current V_{DS} = 8 V, V_{G1S} = 0, V_{G2S} = 4 V	I_{DSS}	2	–	18	mA
Gate 1-source pinch-off voltage V_{DS} = 8 V, V_{G2S} = 4 V, I_D = 20 µA	$-V_{G1S(p)}$	–	–	2.5	V
Gate 2-source pinch-off voltage V_{DS} = 8 V, V_{G1S} = 0, I_D = 20 µA	$-V_{G2S(p)}$	–	–	2	V

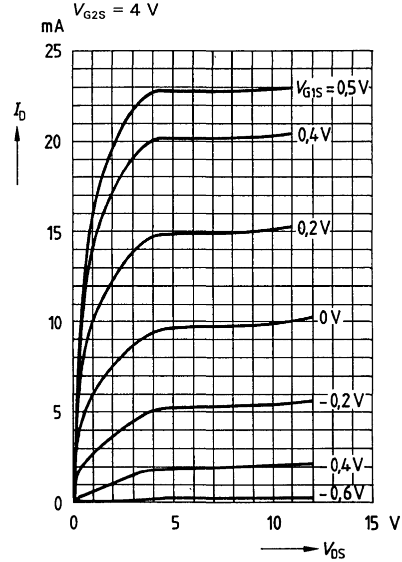
AC characteristics	**Symbol**	**min.**	**typ.**	**max.**	**Unit**
Forward transconductance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 kHz	g_{fs}	–	24	–	mS
Gate 1 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	c_{g1ss}	–	2.1	2.5	pF
Gate 2 input capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	c_{g2ss}	–	1.2	–	pF
Reverse transfer capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	c_{dg1}	–	25	–	fF
Output capacitance V_{DS} = 8 V, I_D = 10 mA, V_{G2S} = 4 V f = 1 MHz	c_{dss}	–	1.05	–	pF
Power gain	G_{ps}				
(test circuit 1) V_{DS} = 8 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V		–	28	–	dB
(test circuit 2) V_{DS} = 8 V, I_D = 10 mA, f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V		–	20	–	dB

AC characteristics	Symbol	min.	typ.	max.	Unit
Noise figure (test circuit 1) V_{DS} = 8 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS, V_{G2S} = 4 V	F	–	0.6	–	dB
(test circuit 2) V_{DS} = 8 V, I_D = 10 mA, f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS, V_{G2S} = 4 V		–	1	–	dB
Control range (test circuit 2) V_{DS} = 8 V, V_{G2S} = 4 ... –2 V f = 800 MHz	ΔG_{ps}	40	–	–	dB

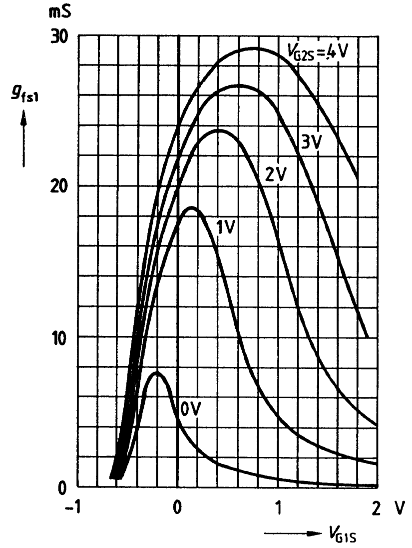
Total power dissipation $P_{tot} = f(T_A)$



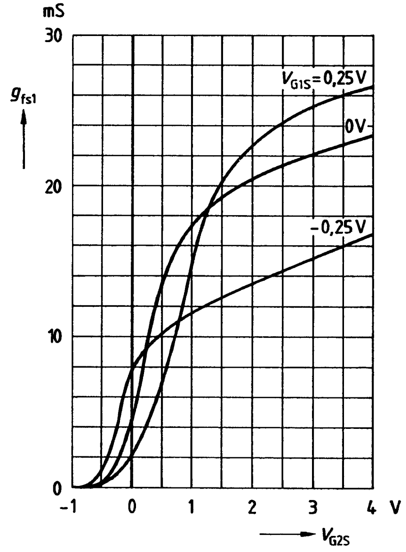
Output characteristics $I_D = f(V_{DS})$
V_{G2S} = 4 V



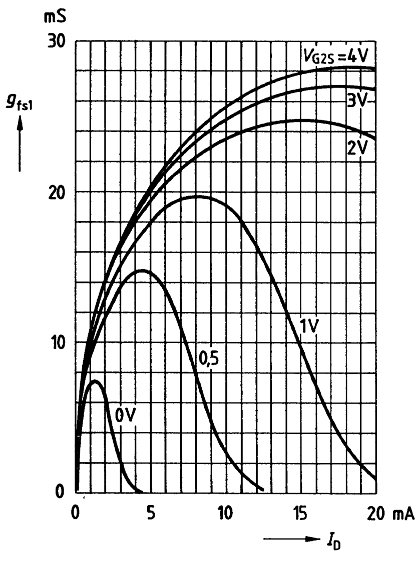
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



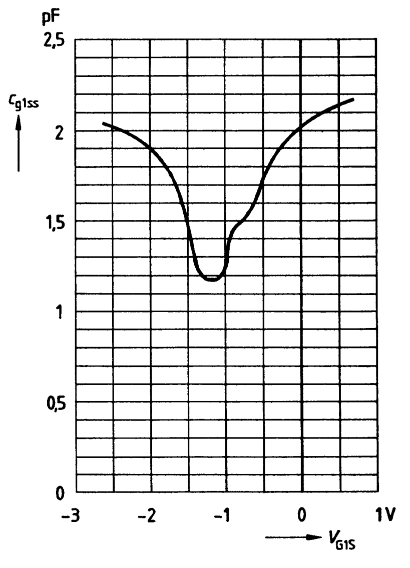
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



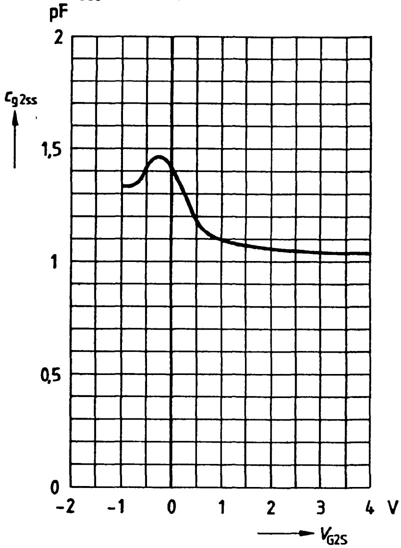
Gate 1 forward transconductance
$g_{fs1} = f(I_D)$
V_{DS} = 8 V, I_{DSS} = 10 mA, f = 1 kHz



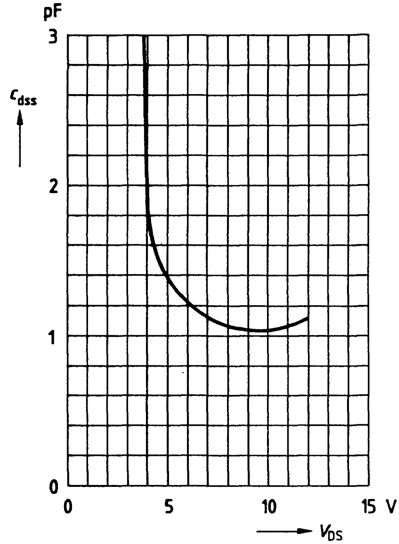
Gate 1 input capacitance $c_{g1ss} = f(V_{G1S})$
V_{G2S} = 4 V, V_{DS} = 8 V, I_{DSS} = 10 mA
f = 1 MHz



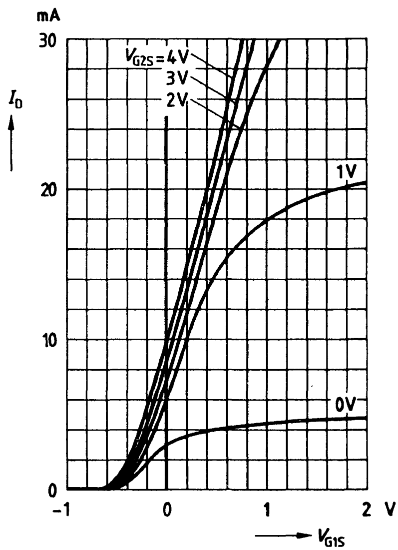
Gate 2 input capacitance $c_{g2ss} = f(V_{G2S})$
$V_{G1S} = 0$, $V_{DS} = 8$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



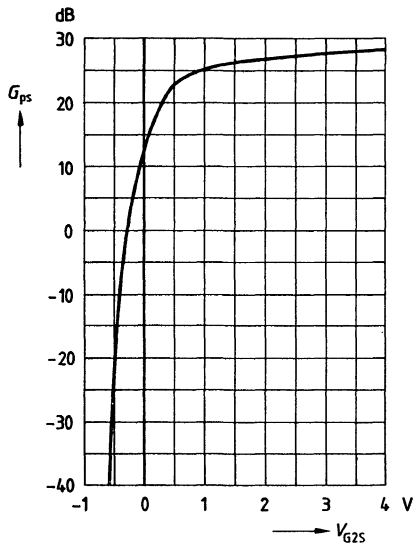
Output capacitance $c_{dss} = f(V_{DS})$
$V_{G1S} = 0$, $V_{G2S} = 4$ V
$I_{DSS} = 10$ mA, $f = 1$ MHz



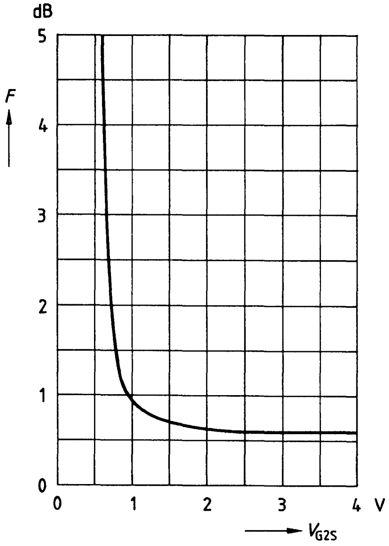
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 8$ V



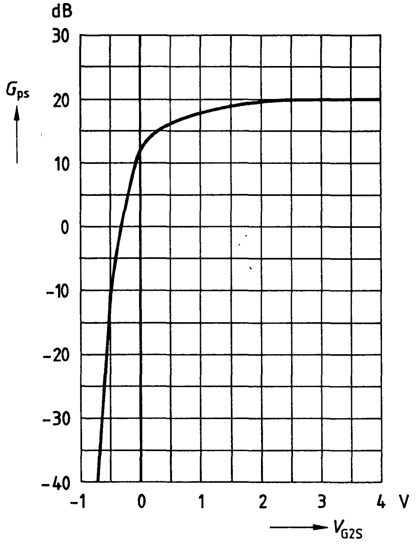
Power gain $G_{ps} = f(V_{G2S})$
$V_{DS} = 8$ V, $V_{G1S} = 0$
$I_{DSS} = 10$ mA, $f = 200$ MHz
(s. test circuit 1)



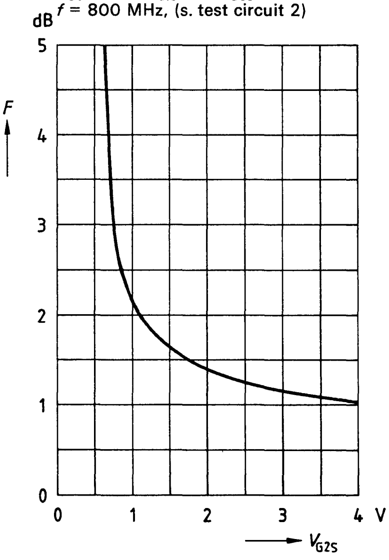
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 200 MHz, (s. test circuit 1)



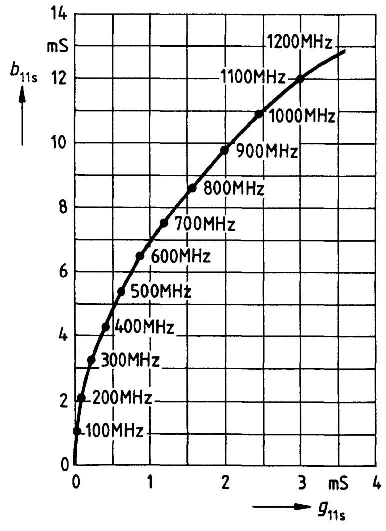
Power gain $G_{ps} = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 800 MHz, (s. test circuit 2)



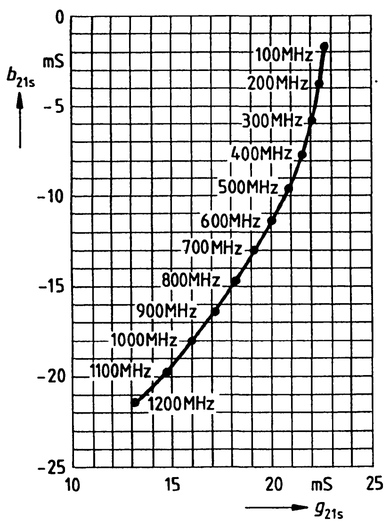
Noise figure $F = f(V_{G2S})$
V_{DS} = 8 V, V_{G1S} = 0, I_{DSS} = 10 mA,
f = 800 MHz, (s. test circuit 2)



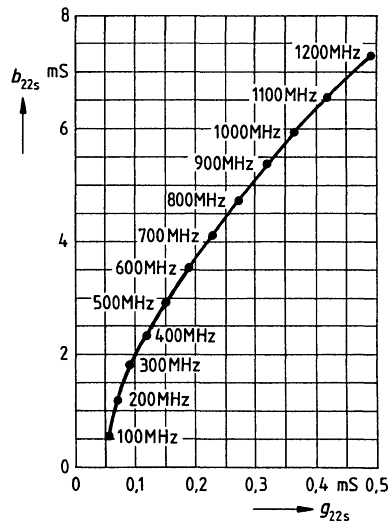
Gate 1 input admittance y_{11s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0,
I_{DSS} = 10 mA, (common-source)



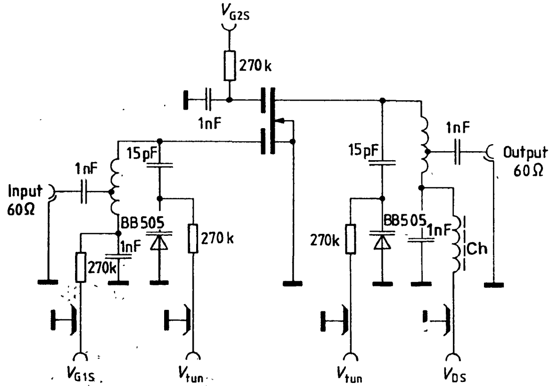
Gate 1 forward transfer admittance y_{21s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA, (common-source)



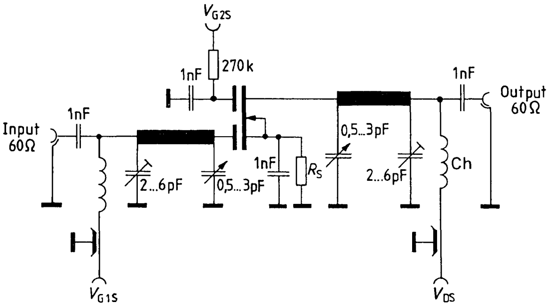
Output admittance y_{22s}
V_{DS} = 8 V, V_{G2S} = 4 V, V_{G1S} = 0
I_{DSS} = 10 mA, (common-source)



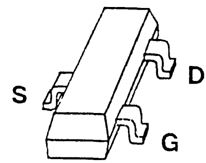
Test circuit 1, power gain and noise figure
f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS



Test circuit 2, power gain and noise figure
f = 800 MHz, G_G = 3.3 mS, G_L = 1 mS



- For high-frequency stages up to 300 MHz, preferably in FM applications



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm tape
BF 999	LB	Q62702-F38	Q62702-F1132

Maximum ratings	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	20	V
Drain current	I_D	30	mA
Gate-source peak current	$\pm I_{GSM}$	10	mA
Total power dissipation $T_A \leq 60$ °C	P_{tot}	200	mW
Storage temperature range	T_{stg}	–55 ... +150	°C
Channel temperature	T_{ch}	150	°C
Thermal resistance			
junction – ambient[1]	R_{thJA}	$\leq$ 450	K/W

[1]) Package mounted on alumina 16.7 mm × 15 mm × 0.7 mm.

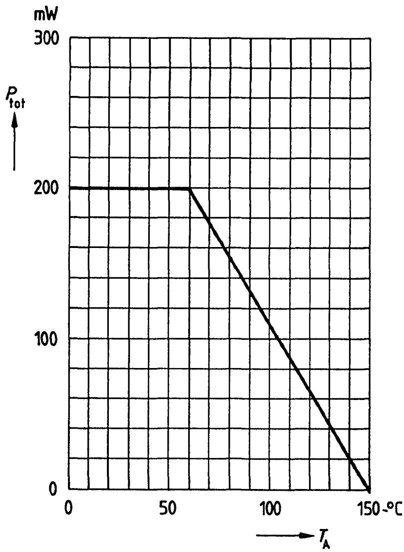
Electrical characteristics

at T_A = 25 °C, unless otherwise specified

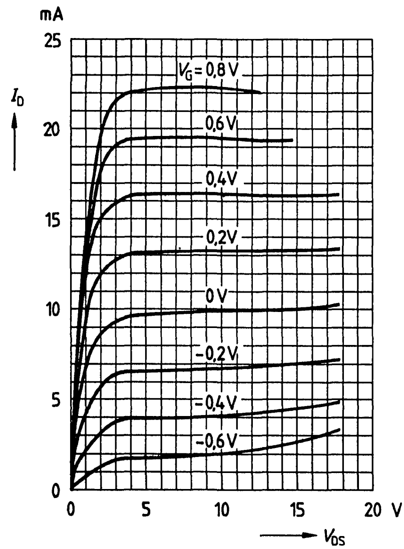
DC characteristics	Symbol	min.	typ.	max.	Unit
Drain-source breakdown voltage I_D = 10 µA, $-V_{GS}$ = 4 V	$V_{(BR)DS}$	20	–	–	V
Gate-source breakdown voltage $\pm I_{GS}$ = 10 mA, V_{DS} = 0	$\pm V_{(BR)GSS}$	6.5	–	17	V
Gate-source leakage current $\pm V_{GS}$ = 5 V, V_{DS} = 0	$\pm I_{GSS}$	–	–	50	nA
Drain current V_{DS} = 10 V, V_{GS} = 0	I_{DSS}	5	–	18	mA
Gate-source pinch-off voltage V_{DS} = 10 V, I_D = 20 µA	$-V_{GS(p)}$	–	–	2.5	V

AC characteristics	Symbol	min.	typ.	max.	Unit
Forward transconductance V_{DS} = 10 V, I_D = 10 mA, f = 1 kHz	g_{fs}	14	16	–	mS
Gate 1 input capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{gss}	–	2.7	–	pF
Reverse transfer capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{rss}	–	25	–	fF
Output capacitance V_{DS} = 10 V, I_D = 10 mA, f = 1 MHz	C_{dss}	–	1	–	pF
Power gain (test circuit) V_{DS} = 10 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS	G_p	–	25	–	dB
Noise figure (test circuit) V_{DS} = 10 V, I_D = 10 mA, f = 200 MHz, G_G = 2 mS, G_L = 0.5 mS	F	–	1	–	dB

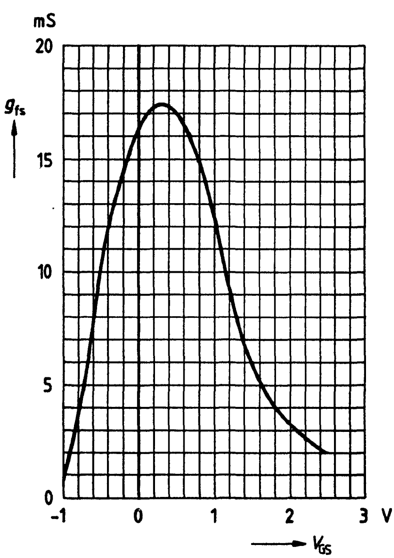
Total power dissipation $P_{tot} = f(T_A)$



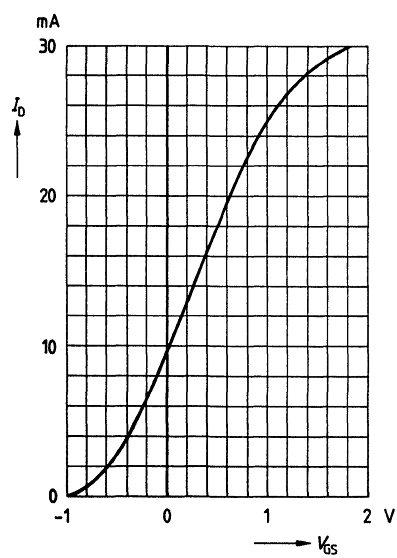
Output characteristics $I_D = f(V_{DS})$



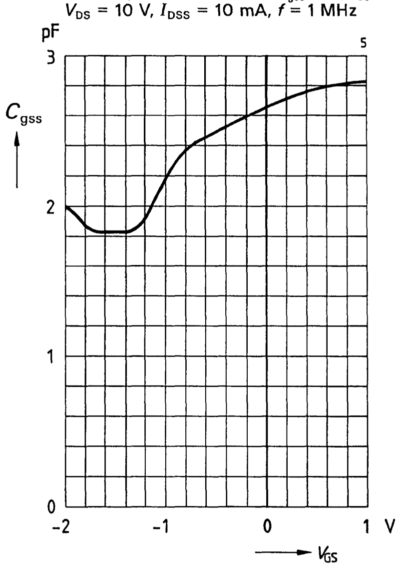
Gate transconductance $g_{fs} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 kHz



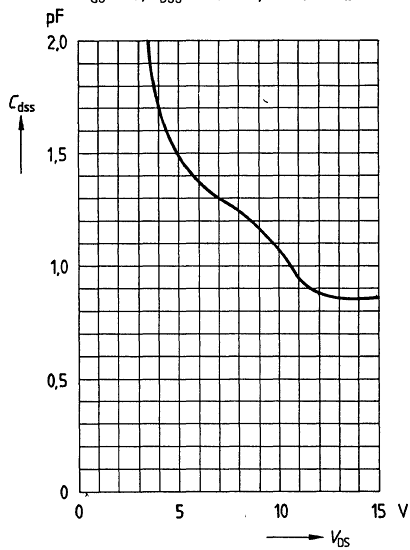
Drain current $I_D = f(V_{GS})$
V_{DS} = 10 V



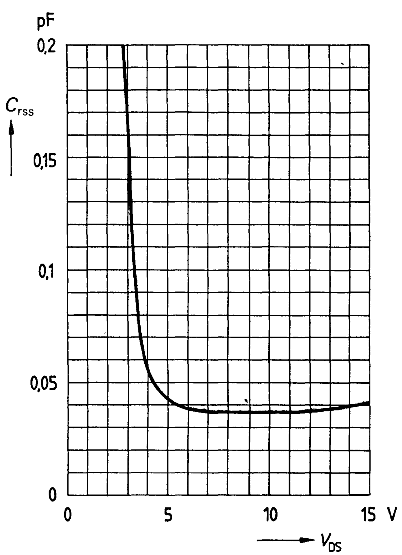
Gate input capacitance $C_{gss} = f(V_{GS})$
V_{DS} = 10 V, I_{DSS} = 10 mA, f = 1 MHz



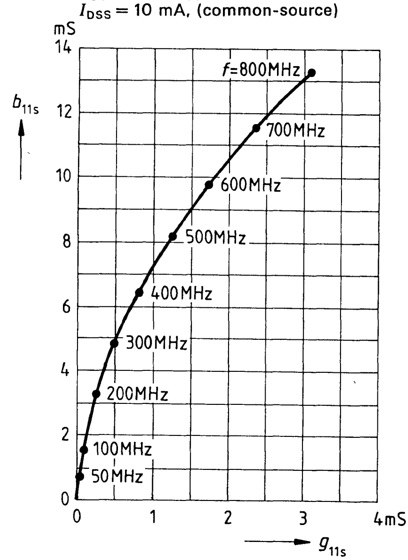
Output capacitance $C_{dss} = f(V_{DS})$
V_{GS} = 0, I_{DSS} = 10 mA, f = 1 MHz



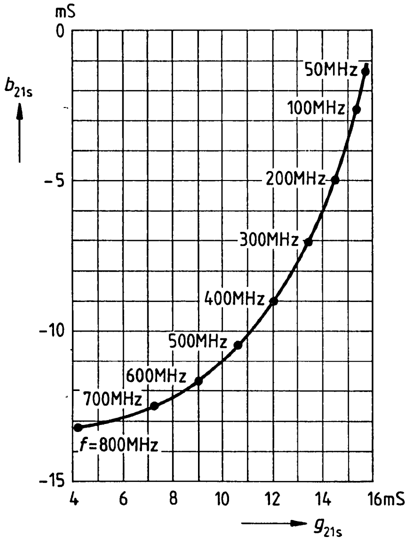
Reverse transfer capacitance $C_{rss} = f(V_{DS})$
I_{DSS} = 10 mA, f = 1 MHz, V_{GS} = 0



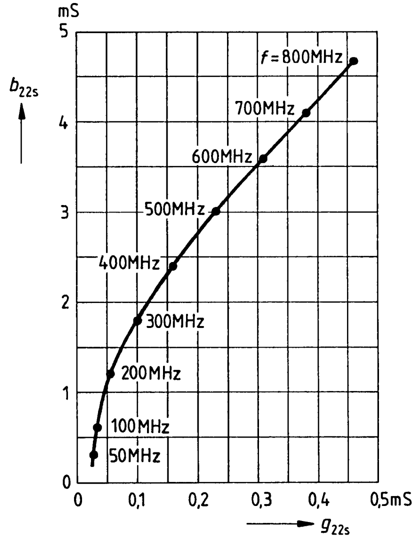
Gate 1 input admittance Y_{11s}
V_{DS} = 10 V, V_{GS} = 0,
I_{DSS} = 10 mA, (common-source)



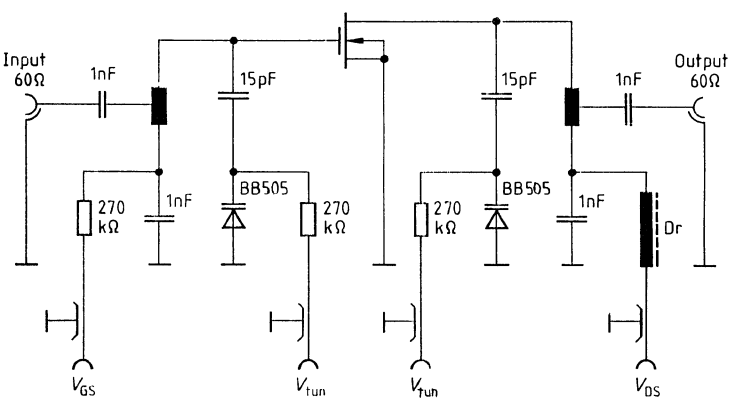
Gate 1 forward transfer admittance Y_{21s}
$V_{DS} = 10$ V, $V_{GS} = 0$,
$I_{DSS} = 10$ mA, (common-source)



Output admittance Y_{22s}
$V_{DS} = 10$ V, $V_{GS} = 0$,
$I_{DSS} = 10$ mA, (common-source)



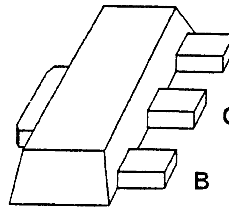
Test circuit: Power gain and noise figure
$f = 200$ MHz



NPN Silicon High-Voltage Transistors

BFN 16
BFN 18

- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BFN 17, BFN 19 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BFN 16	DD	Q62702–F694	Q62702–F885	SOT 89
BFN 18	DE	Q62702–F696	Q62702–F1056	SOT 89

Maximum ratings

Parameter	Symbol	BFN 16	BFN 18	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

Electrical characteristics

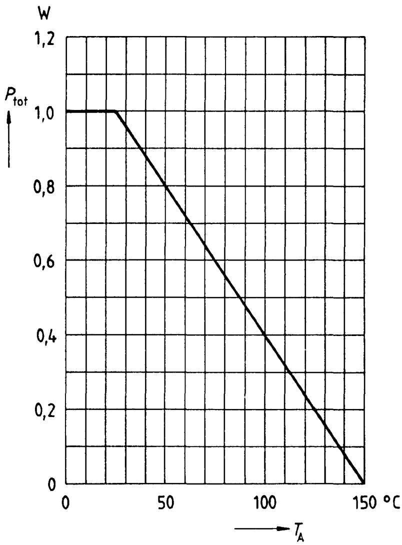
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$				
BFN 16		250	–	–	V
BFN 18		300	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$	$V_{(BR)\,CBO}$				
BFN 16		250	–	–	V
BFN 18		300	–	–	V
Emitter-base breakdown voltage $I_E = 100\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V BFN 16		–	–	100	nA
$V_{CB} = 250$ V BFN 18		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$ BFN 16		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$ BFN 18		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	100	nA
DC current gain	h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1])		40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1]) BFN 16		40	–	–	–
BFN 18		30	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}				
BFN 16		–	–	0,4	V
BFN 18		–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,9	V

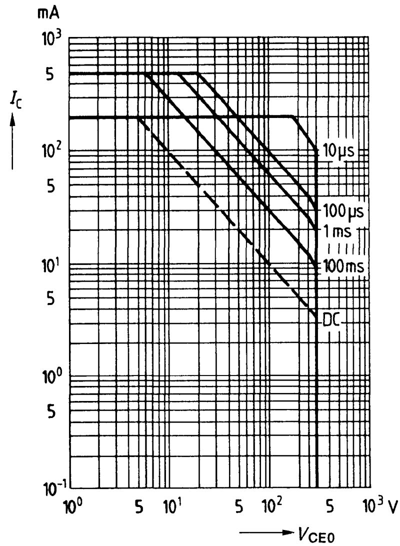
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	70	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,5	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

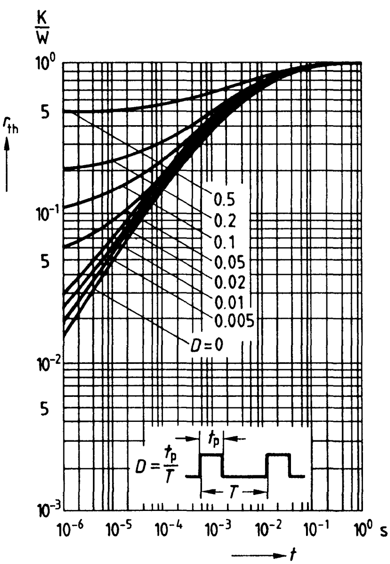
Total power dissipation $P_{tot} = f(T_A)$



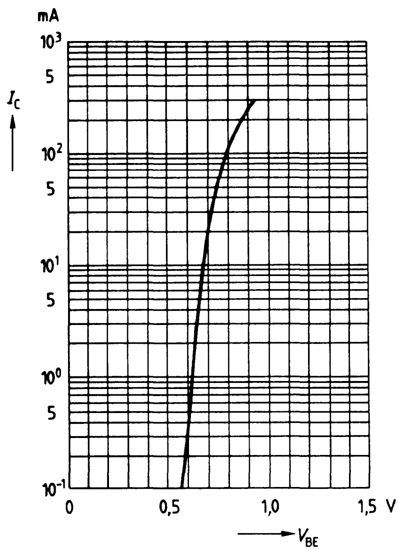
Operating range $I_C = f(V_{CE0})$
$T_A = 25\,°C$, $D = 0$



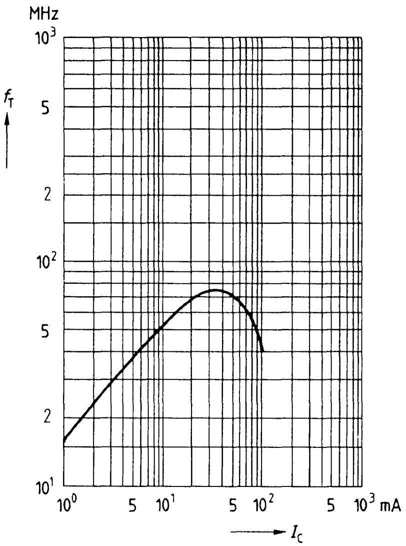
Pulse handling capability $r_{th} = f(t)$



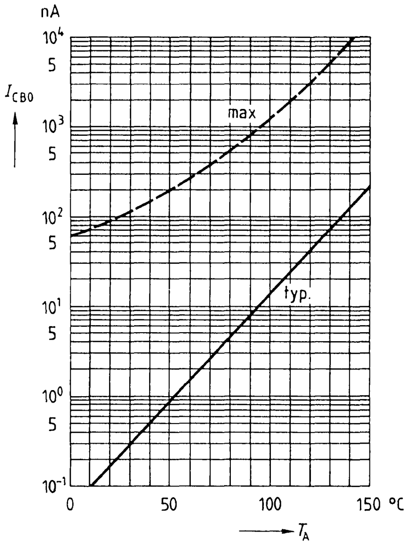
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\,V$



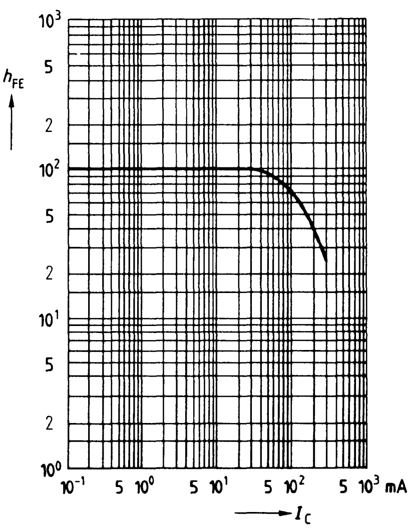
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



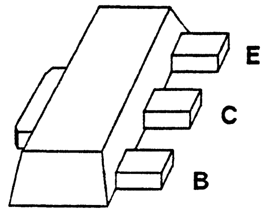
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BFN 16, BFN 18 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BFN 17	DG	Q62702–F695	Q62702–F884	SOT 89
BFN 19	DH	Q62702–F697	Q62702–F1057	SOT 89

Maximum ratings

Parameter	Symbol	BFN 17	BFN 19	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

Electrical characteristics

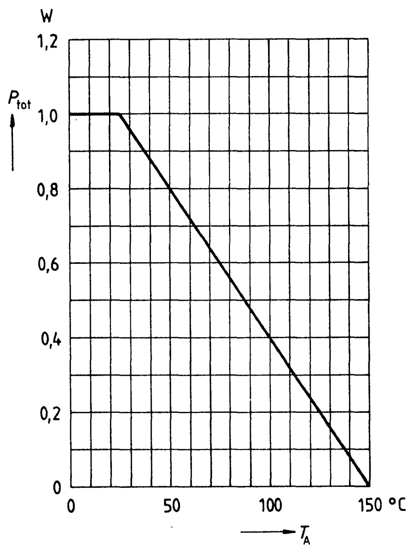
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$				
BFN 17		250	–	–	V
BFN 19		300	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$	$V_{(BR)\,CBO}$				
BFN 17		250	–	–	V
BFN 19		300	–	–	V
Emitter-base breakdown voltage $I_E = 100\,\mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V BFN 17		–	–	100	nA
$V_{CB} = 250$ V BFN 19		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$ BFN 17		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$ BFN 19		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	100	nA
DC current gain	h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V¹)		40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V¹) BFN 17		40	–	–	–
BFN 19		30	–	–	–
Collector-emitter saturation voltage¹)	V_{CEsat}				
$I_C = 20$ mA, $I_B = 2$ mA BFN 17		–	–	0,4	V
BFN 19		–	–	0,5	V
Base-emitter saturation voltage¹) $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,9	V

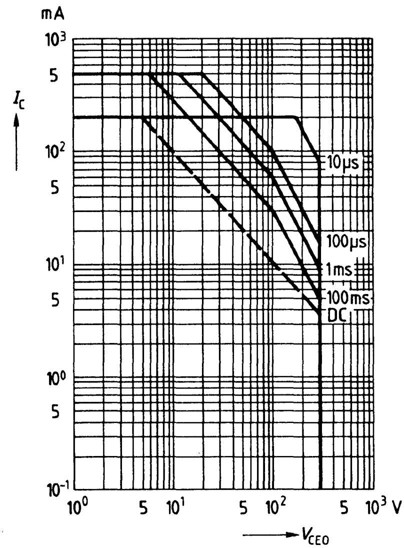
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	2,5	–	pF

¹) Pulse test: $t \leq 300\,\mu s$, D = 2%.

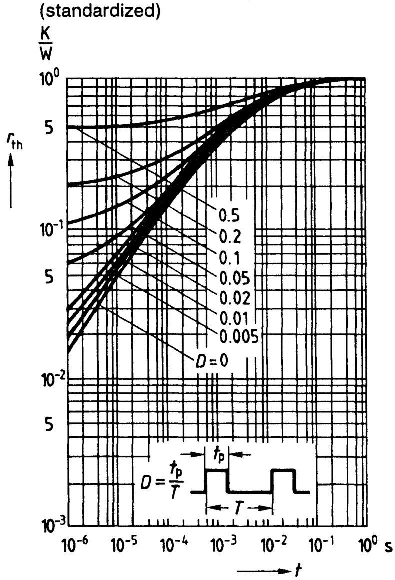
Total power dissipation $P_{tot} = f(T_A)$



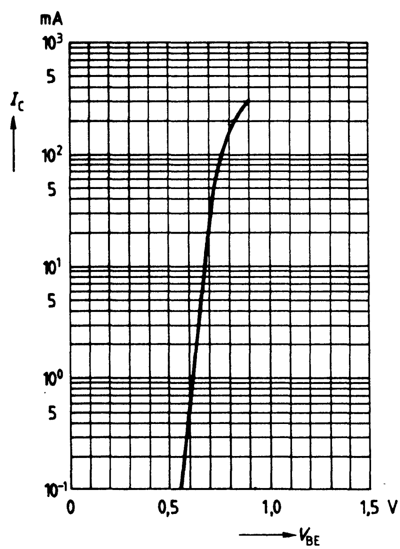
Operating range $I_C = f(V_{CE0})$
$T_A = 25\,°C$, $D = 0$



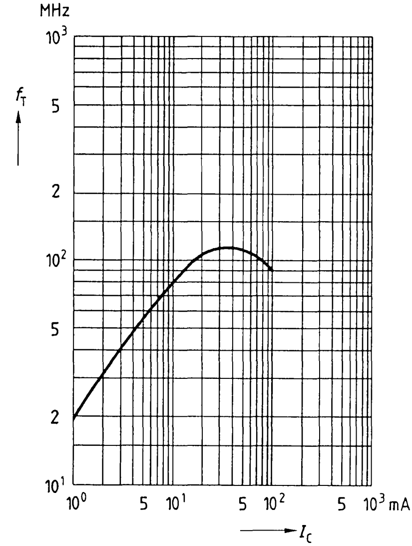
Pulse handling capability $r_{th} = f(t)$
(standardized)



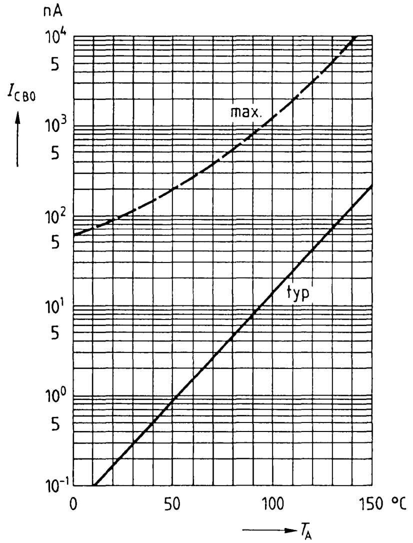
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10\,V$



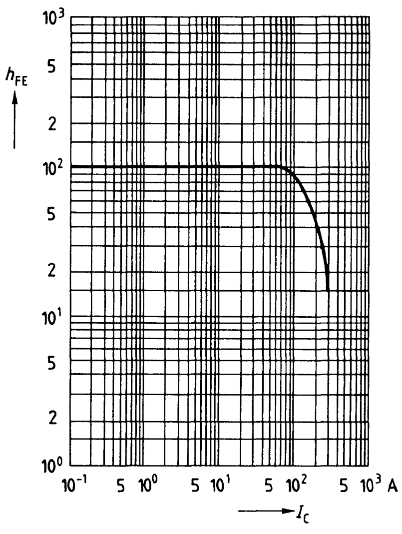
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V

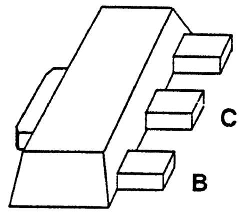


Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V





- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BFN 21 (PNP)

Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BFN 20	DC	Q62702–F584	Q62702–F1058	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	300	V
Collector-base voltage	V_{CBO}	300	V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	300	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

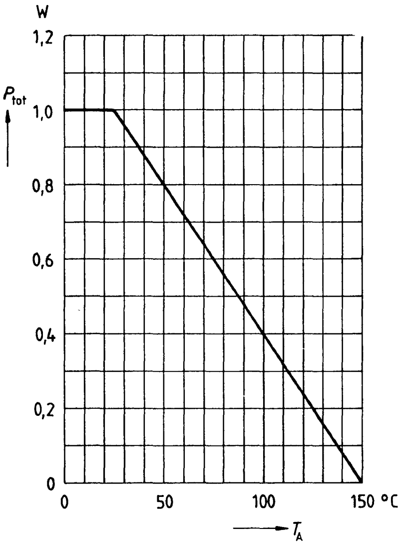
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$	300	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CB0}$	300	–	–	V
Collector-emitter breakdown voltage $I_C = 10\,\mu A$, $R_{BE} = 2{,}7\,k\Omega$	$V_{(BR)\,CER}$	300	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EB0}$	5	–	–	V
Collector cutoff current $V_{CB} = 250$ V $V_{CB} = 250$ V, $T_A = 150\,°C$	I_{CB0}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 300$ V, $R_{BE} = 2{,}7\,k\Omega$ $V_{CE} = 300$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\,k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EB0}	–	–	10	µA
DC current gain[1] $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	40	–	–	–
Collector-emitter-saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

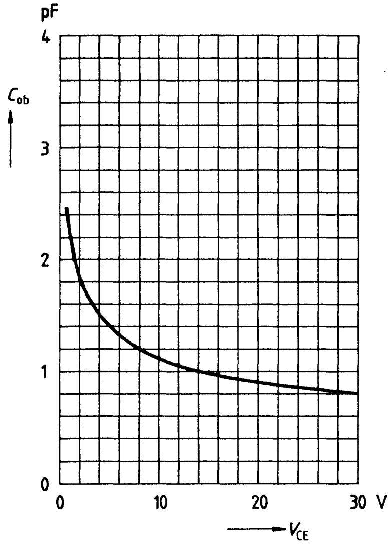
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

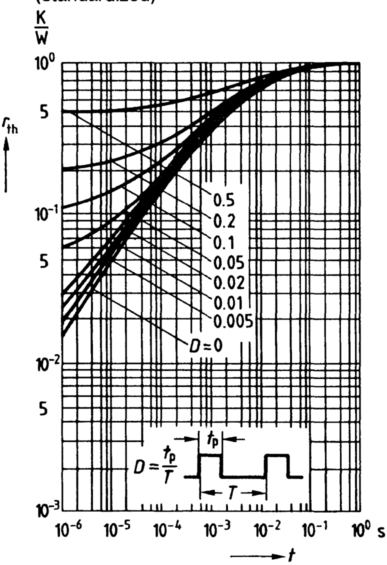
Total power dissipation $P_{tot} = f(T_A)$



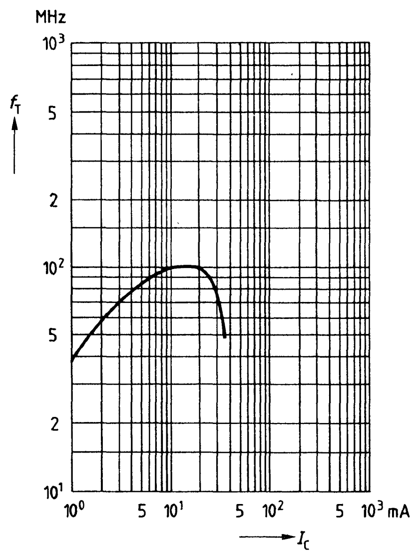
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



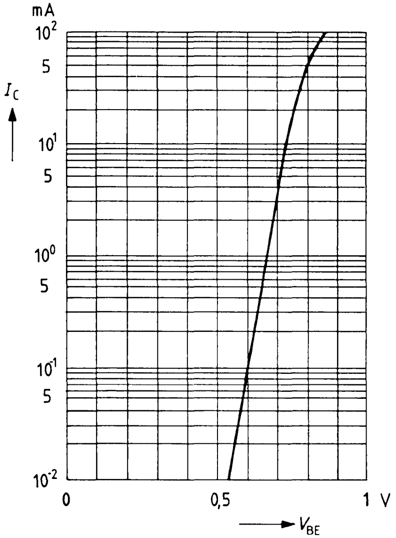
Pulse handling capability $r_{th} = f(t)$
(standardized)



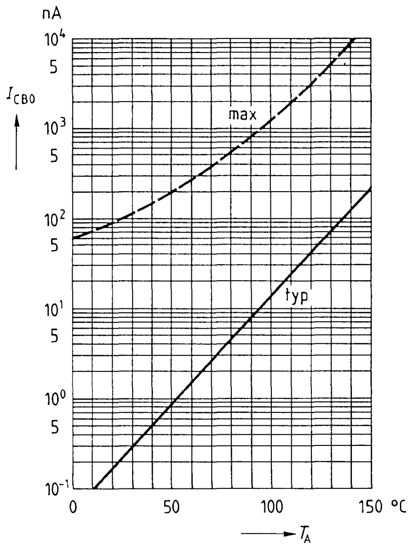
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



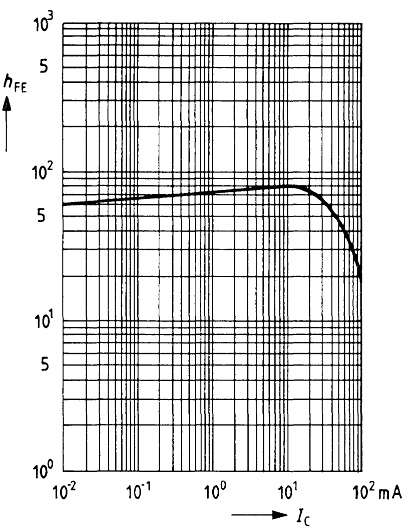
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



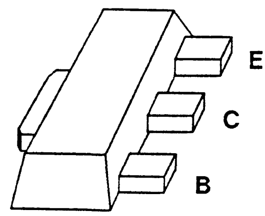
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 250$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BFN 20 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 12 mm-tape	Package
BFN 21	DF	Q62702–F585	Q62702–F1059	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	300	V
Collector-base voltage	V_{CBO}	300	V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	300	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

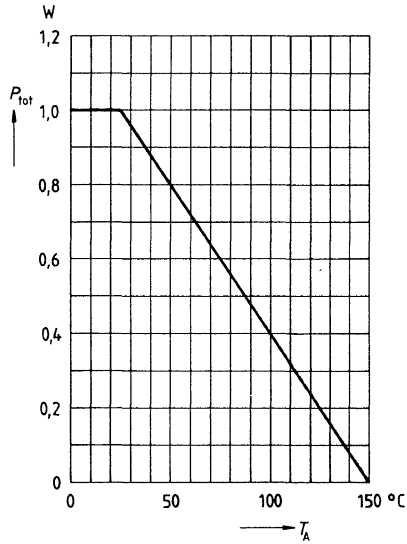
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	300	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	300	–	–	V
Collector-emitter breakdown voltage $I_C = 10\ \mu A$, $R_{BE} = 2{,}7\ k\Omega$	$V_{(BR)\,CER}$	300	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 250$ V $V_{CB} = 250$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 300$ V, $R_{BE} = 2{,}7\ k\Omega$ $V_{CE} = 300$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\ k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	40	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

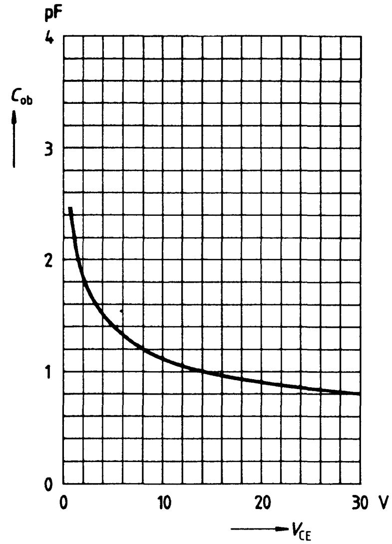
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

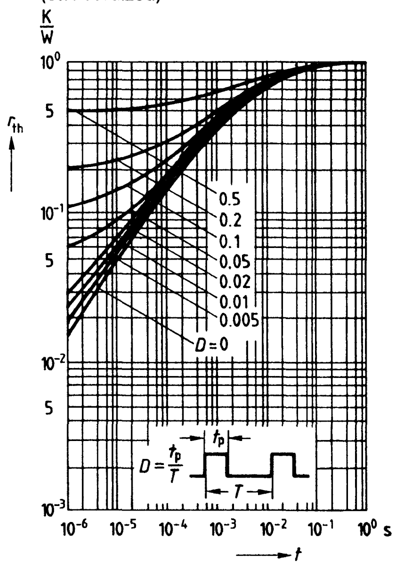
Total power dissipation $P_{tot} = f(T_A)$



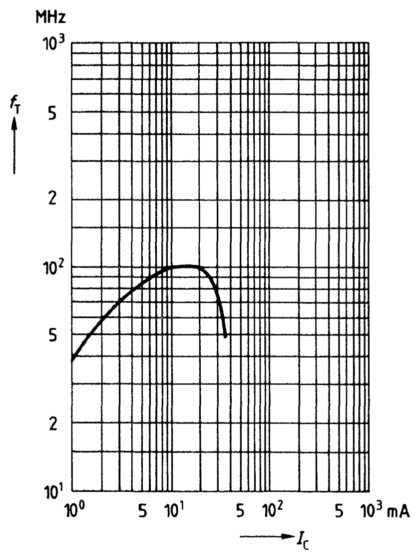
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



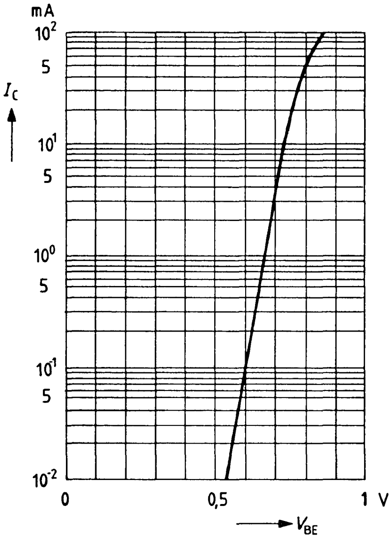
Pulse handling capability $r_{th} = f(t)$
(standardized)



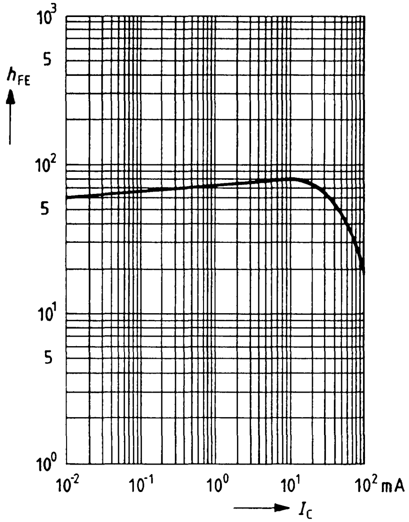
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



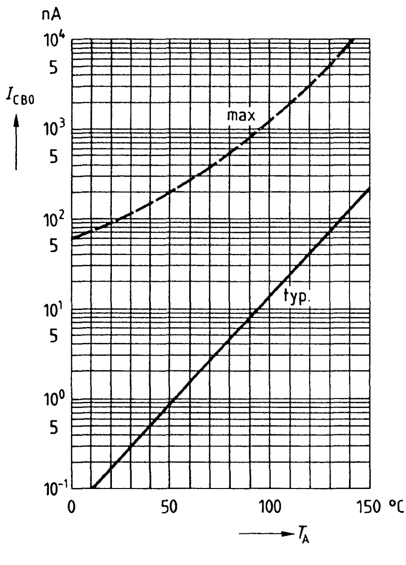
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



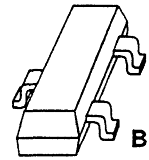
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 250$ V



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BFN 23 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BFN 22	HB	Q62702–F596	Q62702–F1024	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	250	V
Collector-base voltage	V_{CBO}	250	V
Collector-emitter voltage $R_{BE} = 2,7\ k\Omega$	V_{CER}	250	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	360	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350	K/W

Electrical characteristics

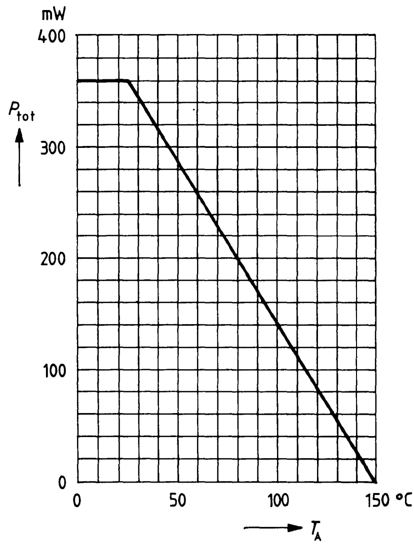
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	250	–	–	V
Collector-emitter breakdown voltage $I_C = 10\ \mu A$, $R_{BE} = 2{,}7\ k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V $V_{CB} = 200$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 250$ V, $R_{BE} = 2{,}7\ k\Omega$ $V_{CE} = 250$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\ k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1]) $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1]) $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

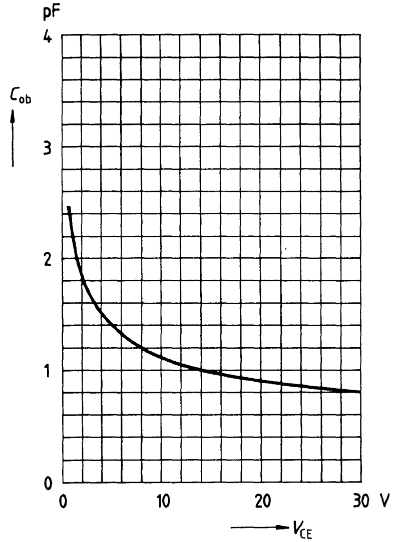
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	0,8	–	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

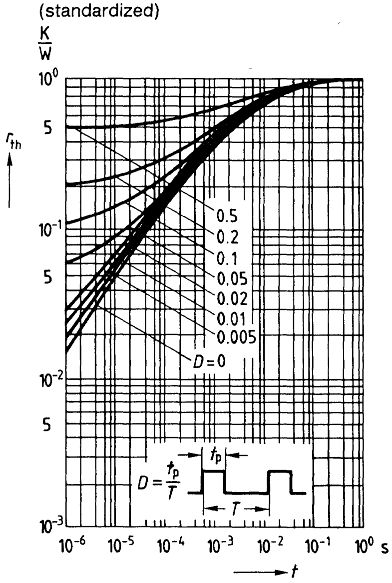
Total power dissipation $P_{tot} = f(T_A)$



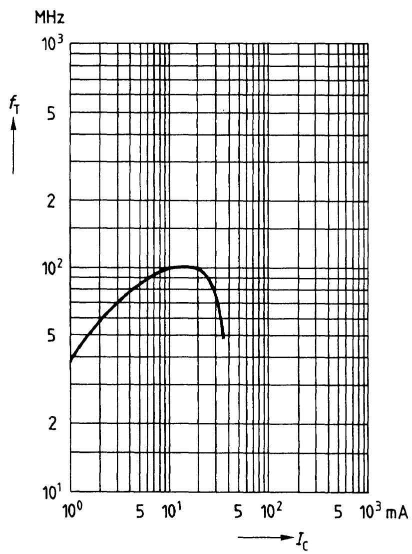
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



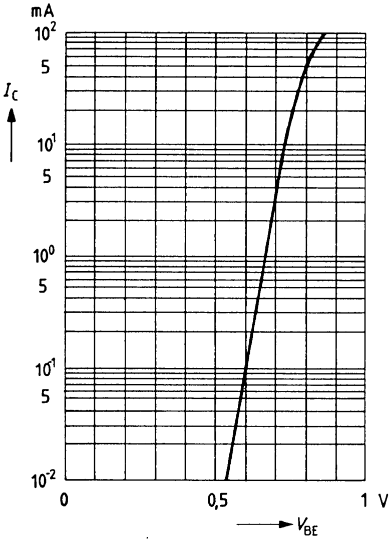
Pulse handling capability $r_{th} = f(t)$
(standardized)



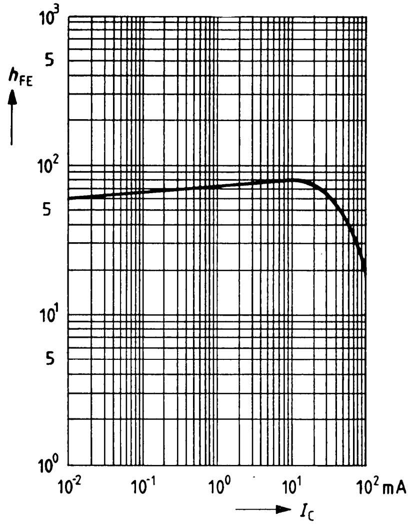
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



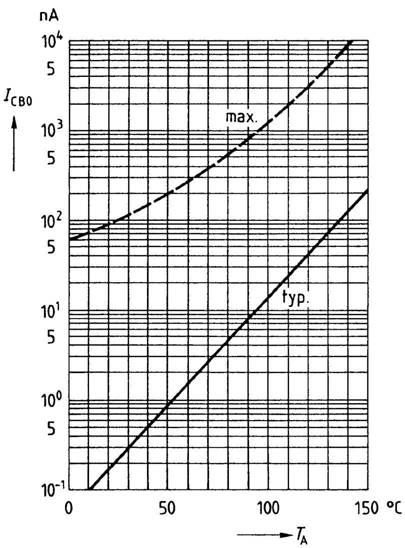
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20\ V$



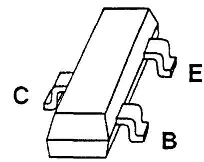
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20\ V$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200\ V$



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Low capacitance
- Complementary type: BFN 22 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BFN 23	HC	Q62702–F597	Q62702–F1064	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	250	V
Collector-base voltage	V_{CBO}	250	V
Collector-emitter voltage $R_{BE} = 2{,}7\ k\Omega$	V_{CER}	250	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	50	mA
Peak collector current	I_{CM}	100	mA
Total power dissipation $T_A = 25\ °C$	P_{tot}	360	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \ldots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350	K/W

Electrical characteristics

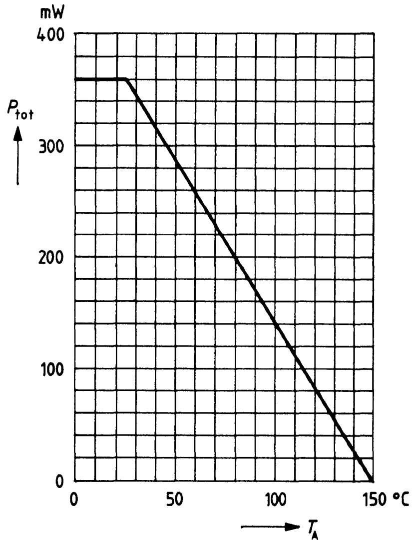
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	250	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	250	–	–	V
Collector-emitter breakdown voltage $I_C = 10\ \mu A$, $R_{BE} = 2{,}7\ k\Omega$	$V_{(BR)\,CER}$	250	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 200$ V $V_{CB} = 200$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Collector cutoff current $V_{CE} = 250$ V, $R_{BE} = 2{,}7\ k\Omega$ $V_{CE} = 250$ V, $T_A = 150\,°C$, $R_{BE} = 2{,}7\ k\Omega$	I_{CER}	 – –	 – –	 1 50	 µA µA
Emitter cutoff current $V_{EB} = 5$ V	I_{EBO}	–	–	10	µA
DC current gain[1] $I_C = 25$ mA, $V_{CE} = 20$ V	h_{FE}	50	–	–	–
Collector-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{BEsat}	–	–	1	V

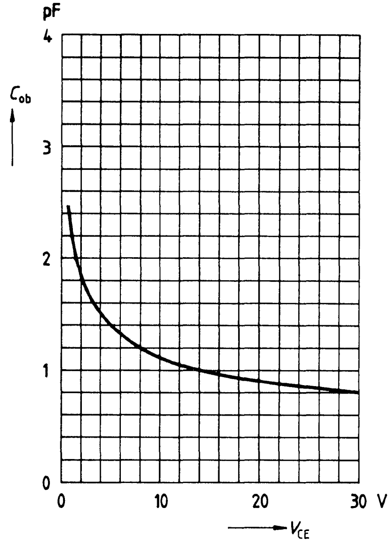
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	1,2	–	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

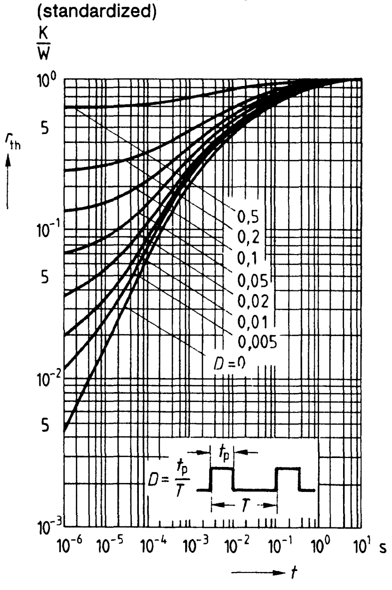
Total power dissipation $P_{tot} = f(T_A)$



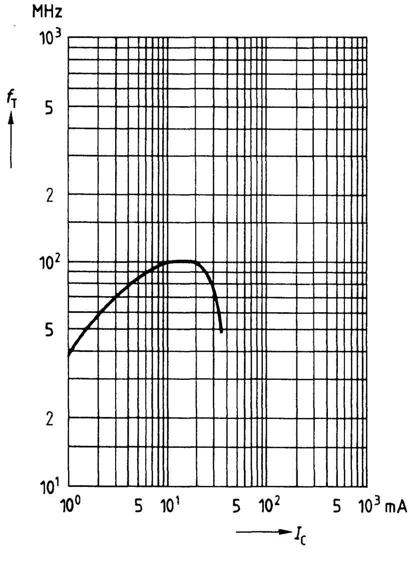
Output capacitance $C_{ob} = f(V_{CE})$
$f = 1$ MHz



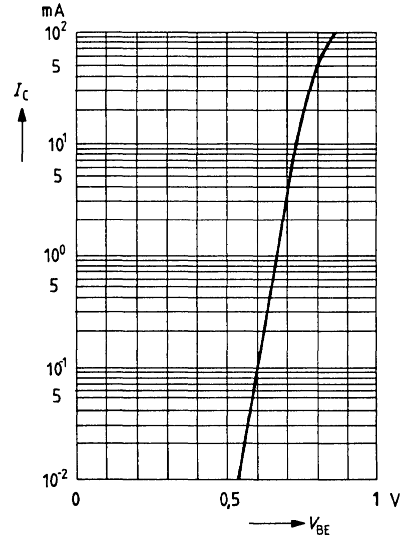
Pulse handling capability $r_{th} = f(t)$
(standardized)



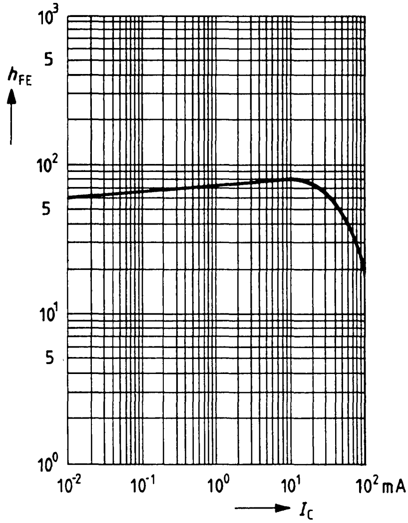
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



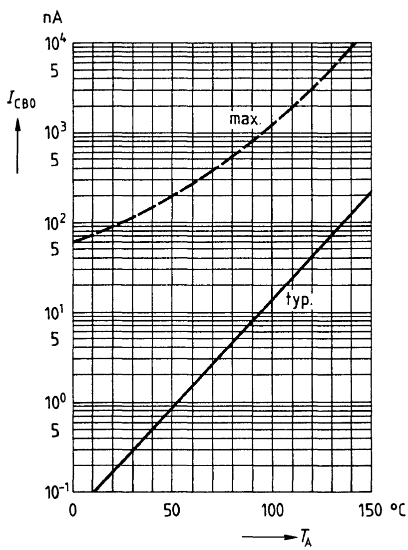
Collector current $I_C = f(V_{BE})$
$V_{CE} = 20$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 20$ V



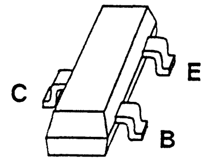
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



NPN Silicon High-Voltage Transistors

BFN 24
BFN 26

- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BFN 25, BFN 27 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BFN 24	FH	Q62702–F747	Q62702–F1065	SOT 23
BFN 26	FJ	Q62702–F750	Q62702–F976	SOT 23

Maximum ratings

Parameter	Symbol	BFN 24	BFN 26	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

Electrical characteristics

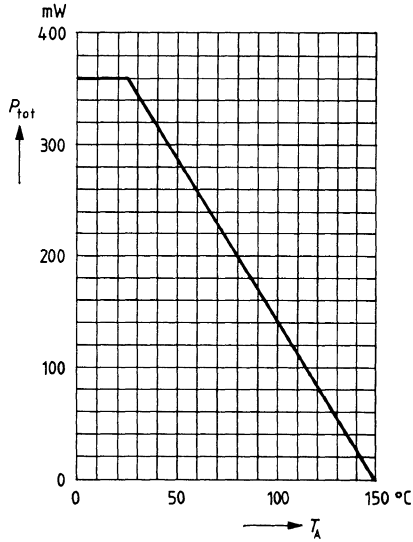
at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$				
BFN 24		250	–	–	V
BFN 26		300	–	–	V
Collector-base breakdown voltage I_C = 100 µA	$V_{(BR)CBO}$				
BFN 24		250	–	–	V
BFN 26		300	–	–	V
Emitter-base breakdown voltage I_E = 100 µA	$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
V_{CB} = 200 V BFN 24		–	–	100	nA
V_{CB} = 250 V BFN 26		–	–	100	nA
V_{CB} = 200 V, T_A = 150 °C BFN 24		–	–	20	µA
V_{CB} = 250 V, T_A = 150 °C BFN 26		–	–	20	µA
Emitter cutoff current V_{EB} = 3 V	I_{EBO}	–	–	100	nA
DC current gain	h_{FE}				
I_C = 1 mA, V_{CE} = 10 V		25	–	–	–
I_C = 10 mA, V_{CE} = 10 V[1]		40	–	–	–
I_C = 30 mA, V_{CE} = 10 V[1] BFN 24		40	–	–	–
BFN 26		30	–	–	–
Collector-emitter saturation voltage[1] I_C = 20 mA, I_B = 2 mA	V_{CEsat}				
BFN 24		–	–	0,4	V
BFN 26		–	–	0,5	V
Base-emitter saturation voltage[1] I_C = 20 mA, I_B = 2 mA	V_{BEsat}	–	–	0,9	V

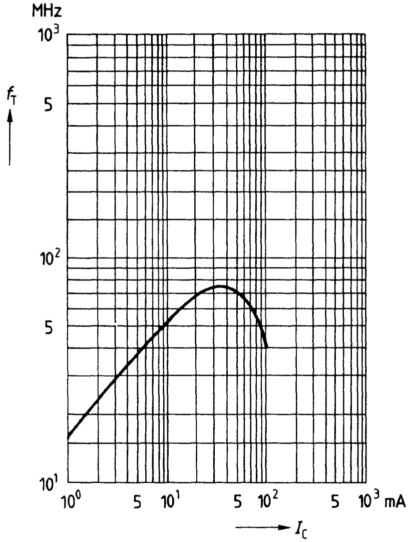
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 10 V, f = 20 MHz	f_T	–	70	–	MHz
Output capacitance V_{CB} = 30 V, f = 1 MHz	C_{ob}	–	1,5	–	pF

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

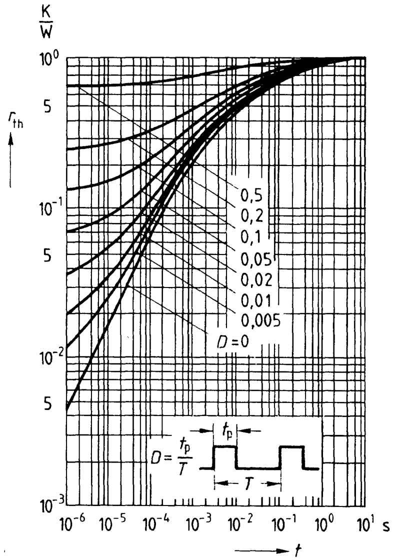
Total power dissipation $P_{tot} = f(T_A)$



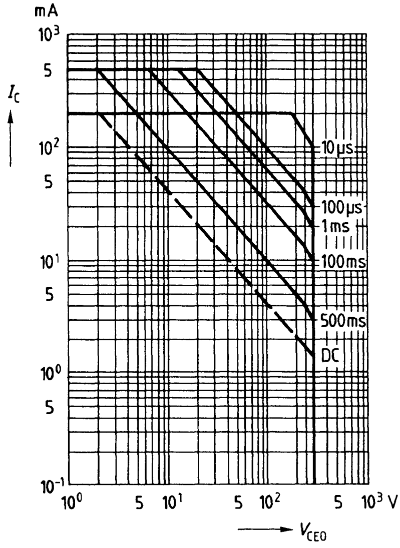
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



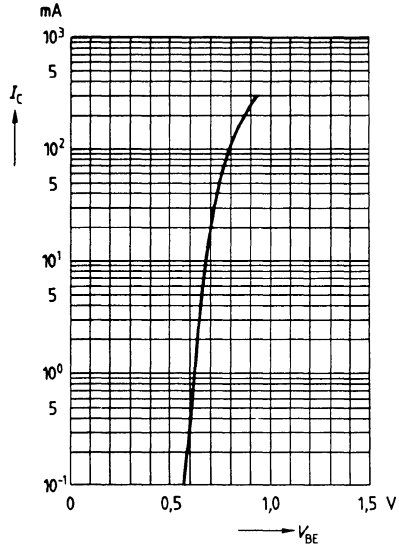
Pulse handling capability $r_{th} = f(t)$
(standardized)



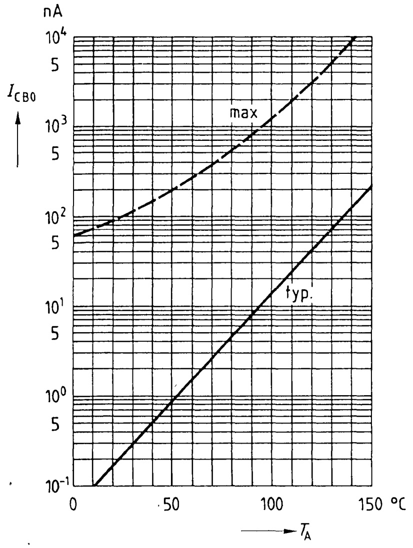
Operating range $I_C = f(V_{CE0})$
$T_A = 25\,°C$, D = 0



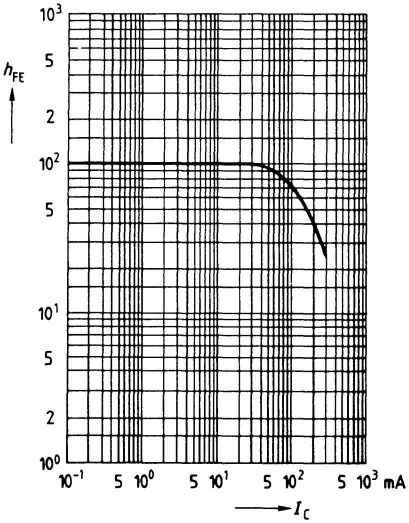
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V



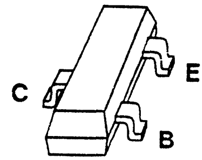
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP Silicon High-Voltage Transistors

BFN 25
BFN 27

- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: BFN 24, BFN 26 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
BFN 25	FK	Q62702–F749	Q62702–F1066	SOT 23
BFN 27	FL	Q62702–F751	Q62702–F977	SOT 23

Maximum ratings

Parameter	Symbol	BFN 25	BFN 27	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

Electrical characteristics

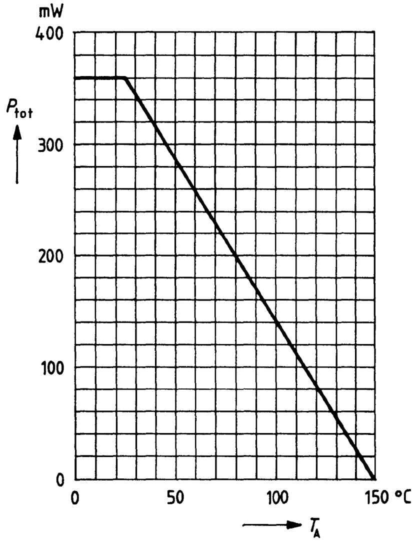
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA		$V_{(BR)\,CEO}$				
	BFN 25		250	–	–	V
	BFN 27		300	–	–	V
Collector-base breakdown voltage $I_C = 100\,\mu A$		$V_{(BR)\,CBO}$				
	BFN 25		250	–	–	V
	BFN 27		300	–	–	V
Emitter-base breakdown voltage $I_E = 100\,\mu A$		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 200$ V	BFN 25		–	–	100	nA
$V_{CB} = 250$ V	BFN 27		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$	BFN 25		–	–	20	µA
$V_{CB} = 250$ V, $T_A = 150\,°C$	BFN 27		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	100	nA
DC current gain		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]			40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1]	BFN 25		40	–	–	–
	BFN 27		30	–	–	–
Collector-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA		V_{CEsat}				
	BFN 25		–	–	0,4	V
	BFN 27		–	–	0,5	V
Base-emitter saturation voltage[1] $I_C = 20$ mA, $I_B = 2$ mA		V_{BEsat}	–	–	0,9	V

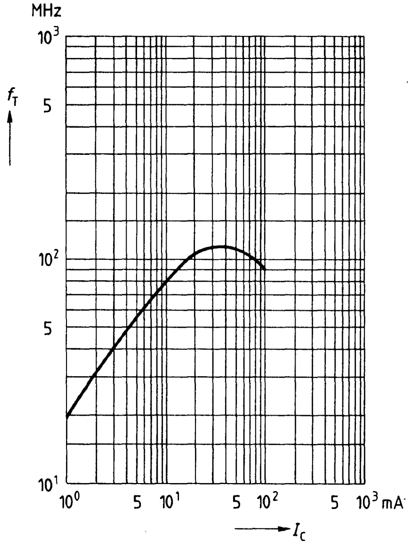
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz	C_{ob}	–	2,5	–	pF

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

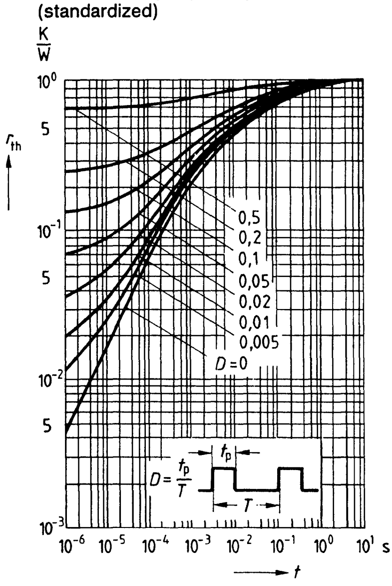
Total power dissipation $P_{tot} = f(T_A)$



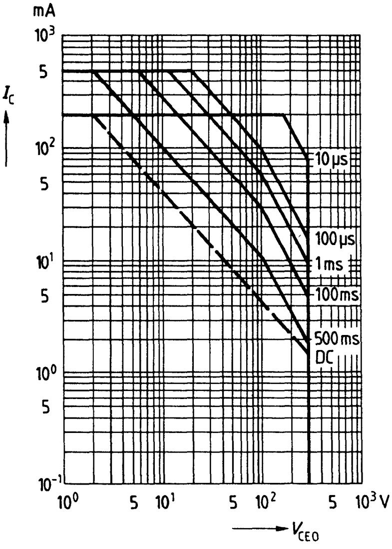
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10\ V$



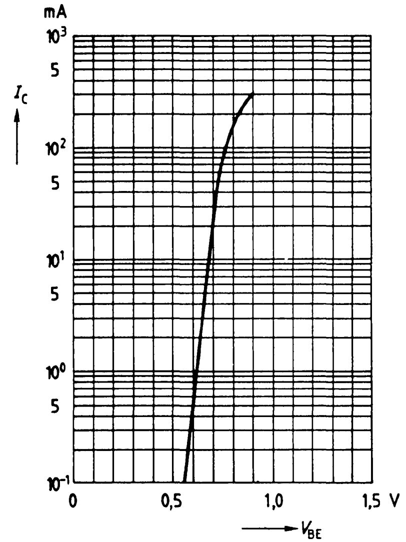
Pulse handling capability $r_{th} = f(t)$
(standardized)



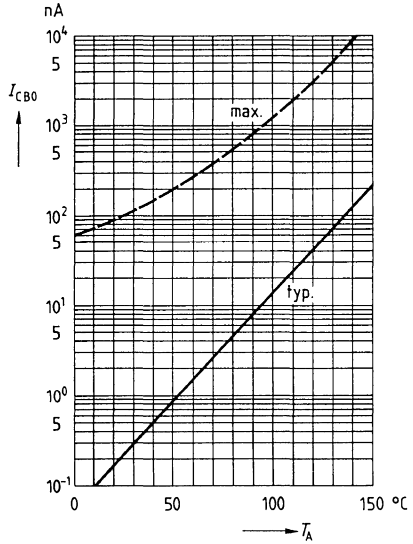
Operating range $I_C = f(V_{CE0})$
$T_A = 25\ °C$, $D = 0$



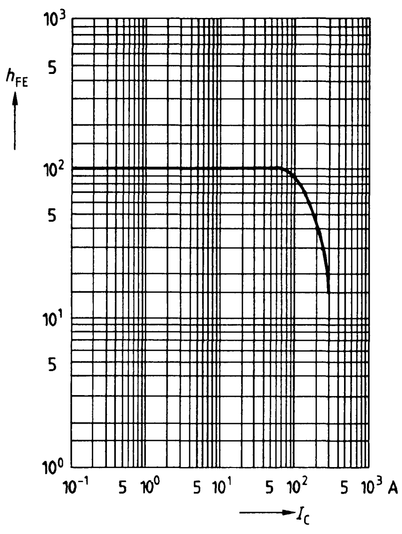
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



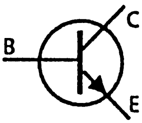
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V

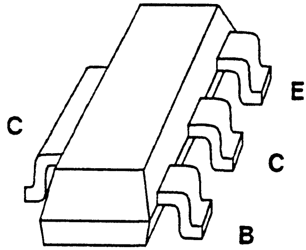


DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector -emitter saturation voltage
  Complementary types: BFN 37/39 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BFN 36	BFN 36	Q62702 - F1246	SOT-223
BFN 38	BFN 38	Q62702 - F1303	SOT-223

Maximum Ratings

Parameter	Symbol	BFN 36	BFN 38	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ [1)]	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient [1)]	R_{thJA}	≤ 83.3	K/W

[1)] Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

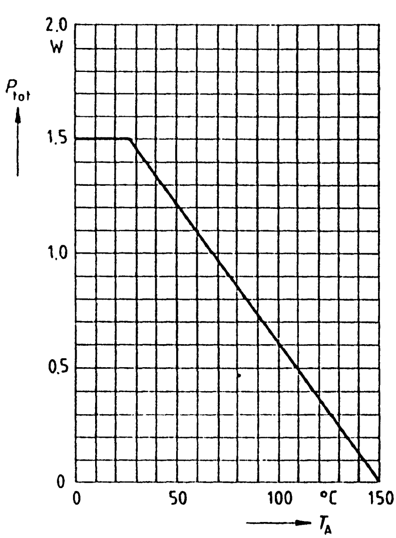
Characteristics

at $T_A = 25$ °C, unless otherwise specified.

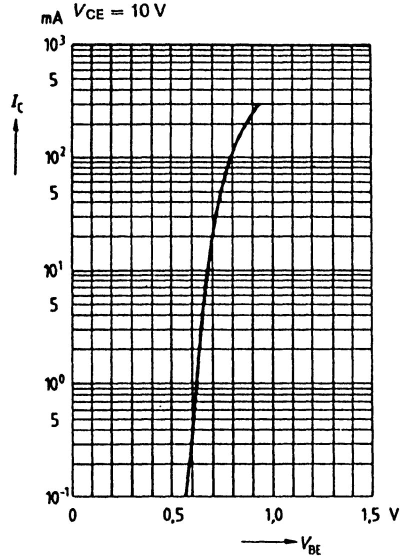
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	BFN 36	$V_{(BR)CEO}$	250	-	-	V
	BFN 38		300	-	-	V
Collector-base breakdown voltage $I_C = 100$ µA, $I_B = 0$	BFN 36	$V_{(BR)CBO}$	250	-	-	V
	BFN 38		300	-	-	V
Emitter-base breakdown voltage $I_E = 100$ µA, $I_B = 0$		$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 200$ V	BFN 36	I_{CBO}	-	-	100	nA
$V_{CB} = 250$ V	BFN 38		-	-	100	nA
$V_{CB} = 200$ V, $T_A = 150$°C	BFN 36		-	-	20	µA
$V_{CB} = 250$ V, $T_A = 150$°C	BFN 38		-	-	20	µA
Emitter-base cutoff current $V_{EB} = 4$ V, $I_C = 0$		I_{EBO}	-	-	100	nA
DC current gain 1) $I_C = 1$ mA, $V_{CE} = 10$ V		h_{FE}	25	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V			40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V	BFN 36		40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V	BFN 38		30	-	-	-
Collector-emitter saturation voltage 1) $I_C = 20$ mA, $I_B = 2$ mA	BFN 36	V_{CEsat}	-	-	0.4	V
	BFN 38				0.5	V
Base-emitter saturation voltage 1) $I_C = 20$ mA, $I_B = 2$ mA		V_{BEsat}	-	-	0.9	V
AC Characteristics						
Transition frequency $I_C = 20$ mA, $V_{CE} = 10$ V, $f = 100$ MHz		f_T	-	70	-	MHz
Output capacitance $V_{CB} = 30$ V, $f = 1$ MHz		C_{ob}	-	1.5	-	pF

1) Pulse test conditions: $t \leqq 300$µs; $D = 2$%

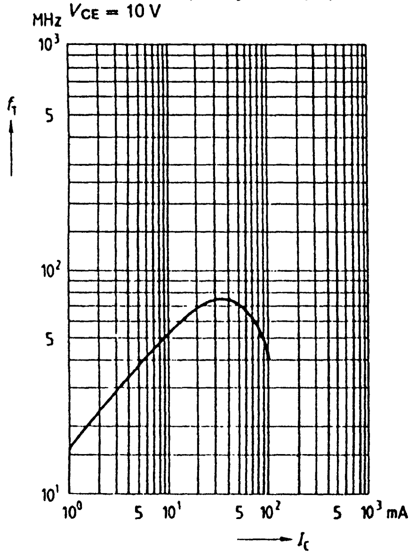
Total power dissipation $P_{tot} = f(T_A)$



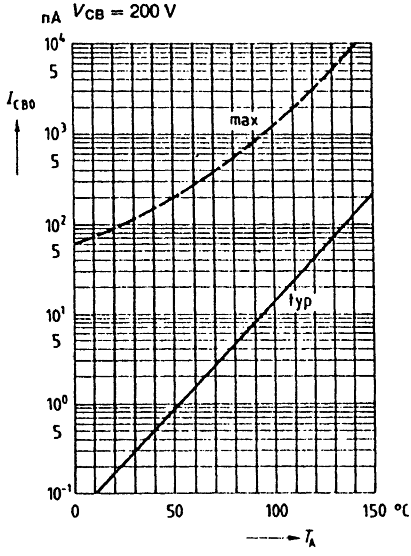
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



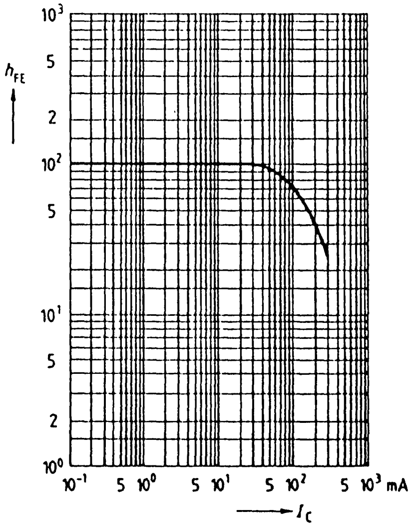
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



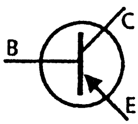
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 200$ V

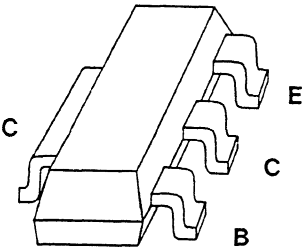


DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



- Suitable for video output stages in TV sets and switching power supplies
- High breakdown voltage
- Low collector -emitter saturation voltage
  Complementary types: BFN 36/38 (NPN)





Type	Marking	Ordering code (12–mm tape)	Package*
BFN 37	BFN 37	Q62702- F1304	SOT-223
BFN 39	BFN 39	Q62702- F1305	SOT-223

Maximum Ratings

Parameter	Symbol	BFN 37	BFN 39	Unit
Collector-emitter voltage	V_{CEO}	250	300	V
Collector-base voltage	V_{CBO}	250	300	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	200		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to	+150	°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤83.3	K/W

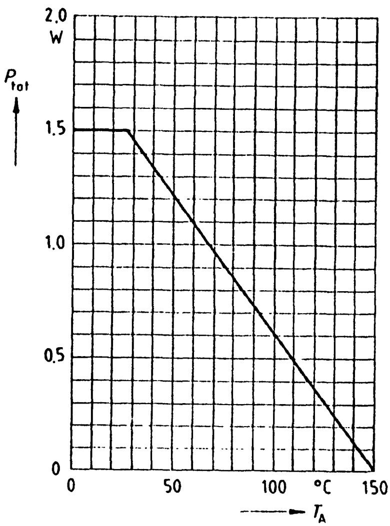
1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

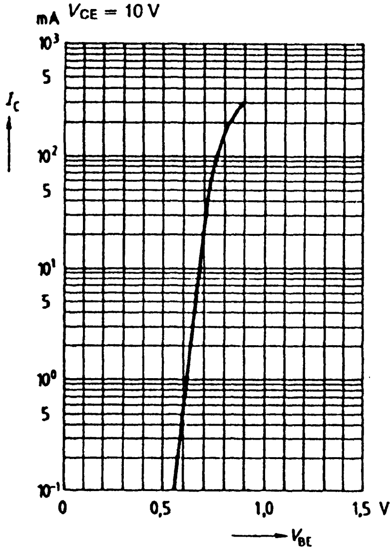
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 1$ mA, $I_B = 0$	BFN 37		250	-	-	V
	BFN 39		300	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100$ µA, $I_B = 0$	BFN 37		250	-	-	V
	BFN 39		300	-	-	V
Emitter-base breakdown voltage 1)		$V_{(BR)EBO}$				
$I_E = 100$ µA, $I_B = 0$			5	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 200$ V	BFN 37		-	-	100	nA
$V_{CB} = 250$ V	BFN 39		-	-	100	nA
$V_{CB} = 200$ V, $T_A = 150$°C	BFN 37		-	-	20	µA
$V_{CB} = 250$ V, $T_A = 150$°C	BFN 39		-	-	20	µA
Emitter-base cutoff current		I_{EBO}				
$V_{EB} = 4$ V, $I_C = 0$			-	-	100	nA
DC current gain 1)		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V			40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V	BFN 37		40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V	BFN 39		30	-	-	-
Collector-emitter saturation voltage 1)		V_{CEsat}				
$I_C = 20$ mA, $I_B = 2$ mA	BFN 37		-	-	0.4	V
	BFN 39				0.5	V
Base-emitter saturation voltage 1)		V_{BEsat}				
$I_C = 20$ mA, $I_B = 2$ mA			-	-	0.9	V
AC Characteristics						
Transition frequency		f_T				
$I_C = 20$ mA, $V_{CE} = 10$ V, $f = 100$ MHz			-	100	-	MHz
Output capacitance		C_{ob}				
$V_{CB} = 30$ V, $f = 1$ MHz			-	2.5	-	pF

1) Pulse test conditions: $t \leqq 300$µs; D = 2%

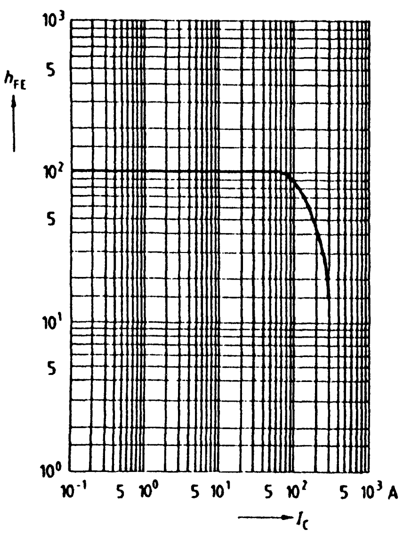
Total power dissipation $P_{tot} = f(T_A)$



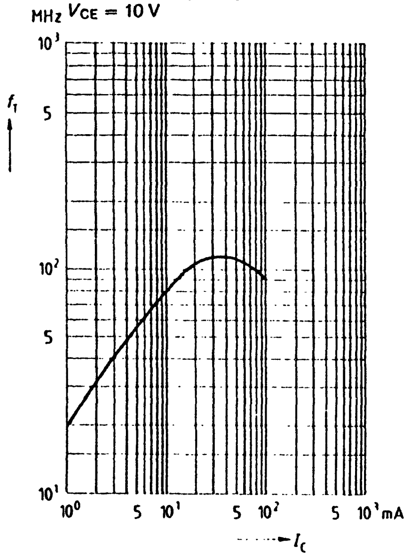
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



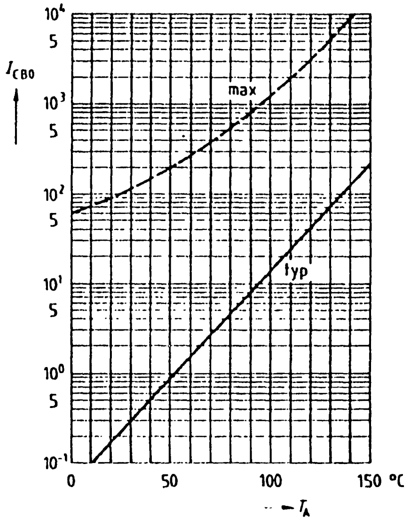
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V



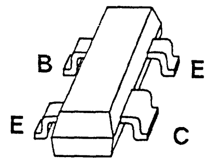
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CE} = 200$ V



NPN Silicon RF Transistor

BFP 81

- For low-noise amplifiers up to 2 GHz at collector currents from 0.5 to 25 mA.
- CECC-type in preparation: CECC 50002/...



ESD: **E**lectrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFP 81	FA	Q 62702 – F1122	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

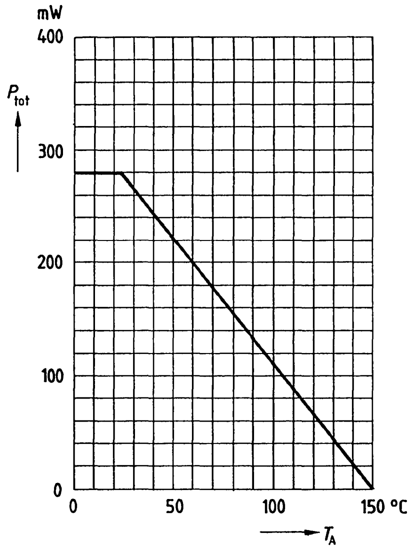
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	16	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 10 V I_C = 15 mA, V_{CE} = 10 V	h_{FE}	 50 50	 – –	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.2	0.4	V

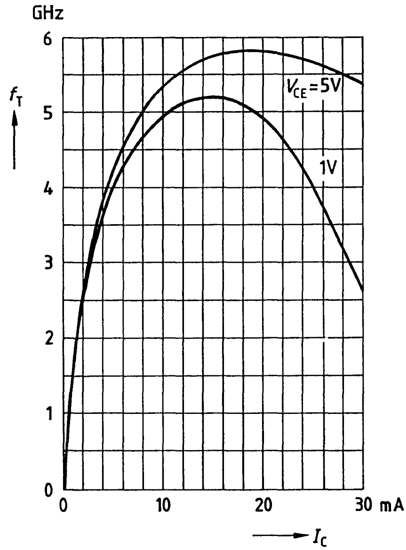
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz	f_T	 – –	 4.2 5.8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, $V_{BE} = v_{be}$ = 0, f = 1 MHz	C_{cb}	–	0.34	–	pF
Collector-emitter capacitance V_{CE} = 10 V, $V_{BE} = v_{be}$ = 0, f = 1 MHz	C_{ce}	–	0.32	–	pF
Input capacitance V_{EB} = 0.5 V, $I_C = i_c$ = 0, f = 1 MHz	C_{ibo}	–	1.2	–	pF
Output capacitance V_{CE} = 10 V, $V_{BE} = v_{be}$ = 0, f = 1 MHz	C_{obs}	–	0.65	–	pF
Noise figure I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, $Z_S = Z_{Sopt}$ I_C = 5 mA, V_{CE} = 10 V, f = 2 GHz, $Z_S = Z_{Sopt}$	F	 – – –	 0.9 1.25 2.25	 – – –	dB
Power gain I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, $Z_L = Z_{Lopt}$ I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, $Z_L = Z_{Lopt}$	G_{pe}	 – –	 15.5 16.5	 – –	dB
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	15	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

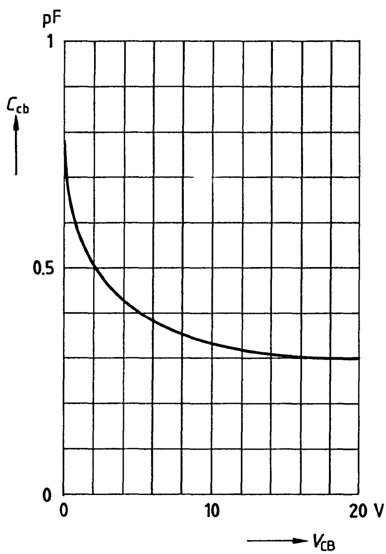
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

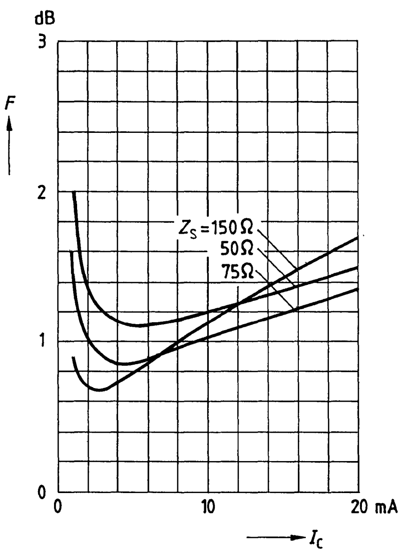
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 120 Ω)		–	–	1.1	–
0.8	1.25	16	0.26	77	9.6	0.151	1.4	15.5
2.0	2.25	10	0.32	178	8.6	0.334	2.7	8.5

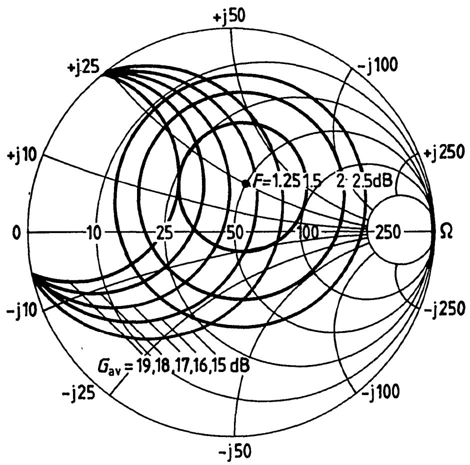
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 75 Ω)		–	–	1.2	–
0.8	1.4	17	0.21	93	8.3	0.155	1.5	16.5
2.0	2.5	11	0.33	–167	10.8	0.413	2.9	9.5

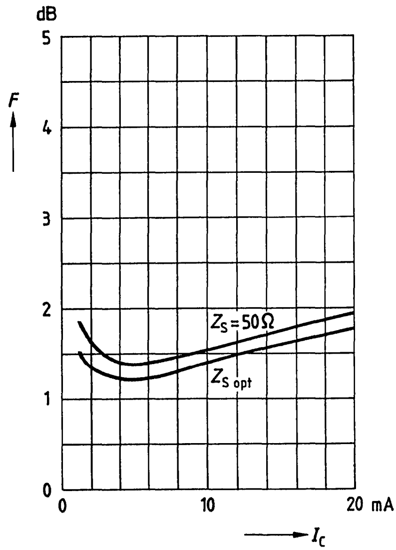
Noise figure $F = f(I_C)$
V_{CE} = 10V, f = 10 MHz



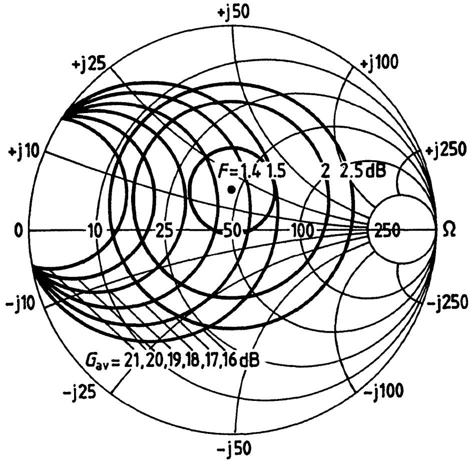
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



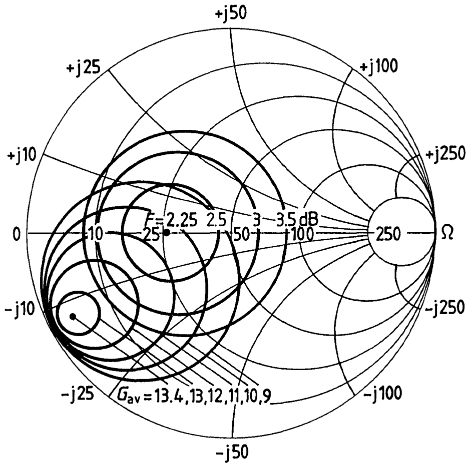
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



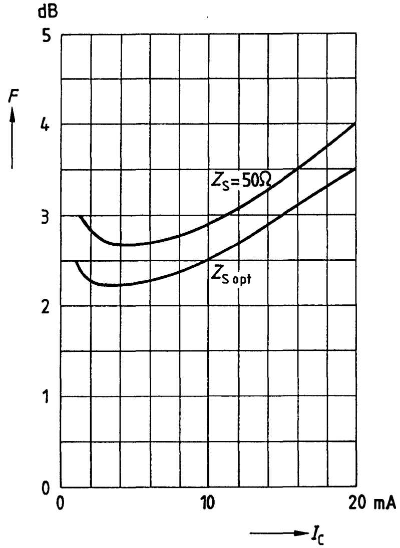
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 800 MHz



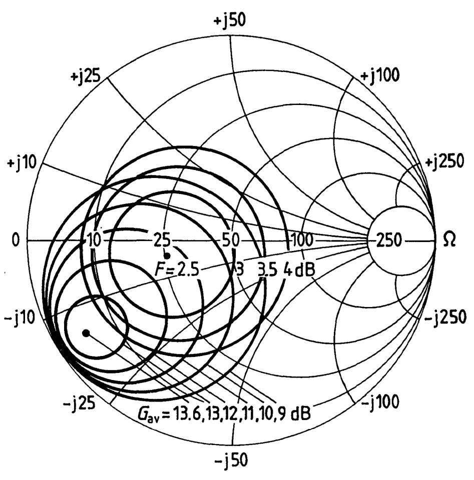
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $f = 2$ GHz



Noise figure $F = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, Z_{Lopt} (G)

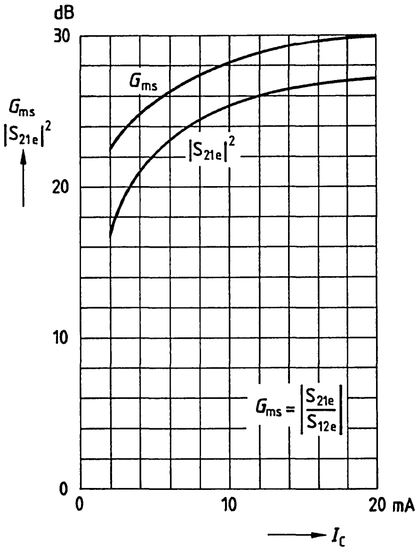


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 10$ mA, $V_{CE} = 10$ V, $f = 2$ GHz

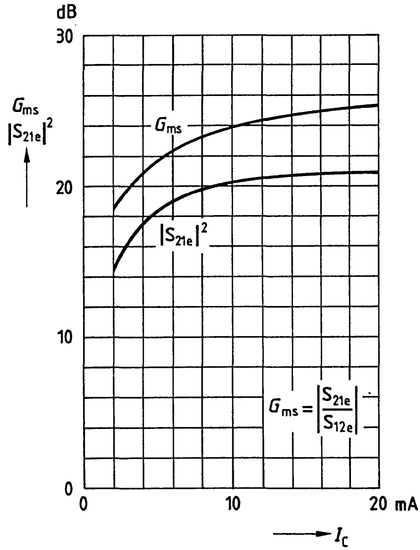


Common Emitter Power Gain

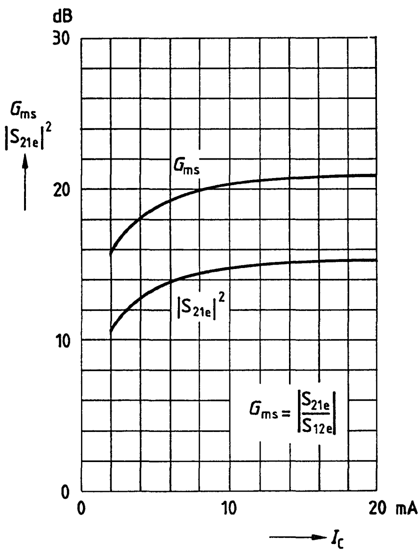
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



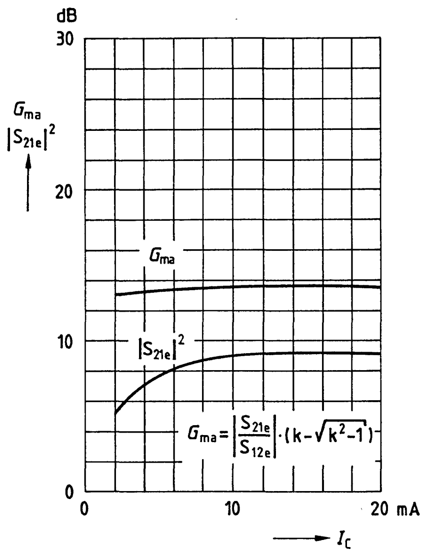
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



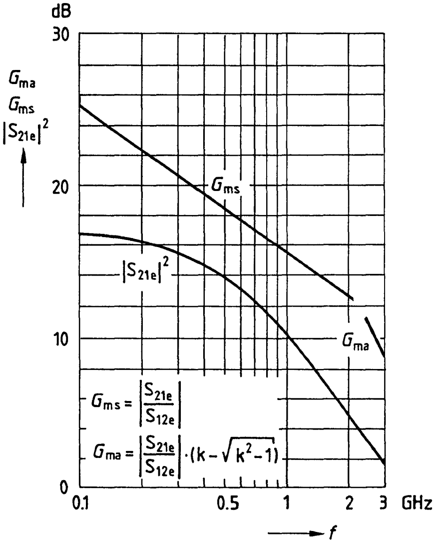
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



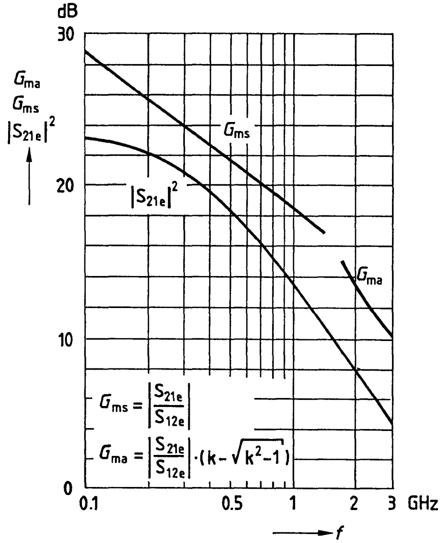
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



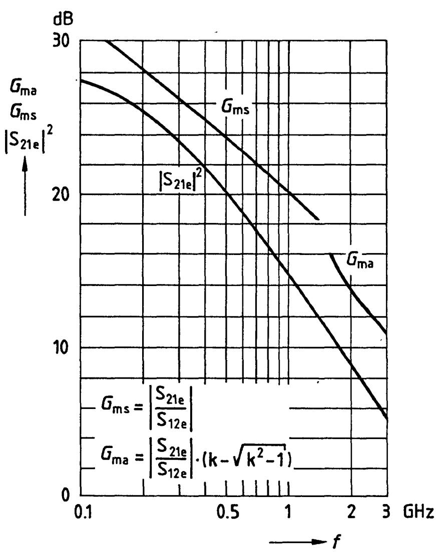
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2\text{mA}$, $V_{CE} = 10\text{ V}$, $Z_0 = 50\ \Omega$



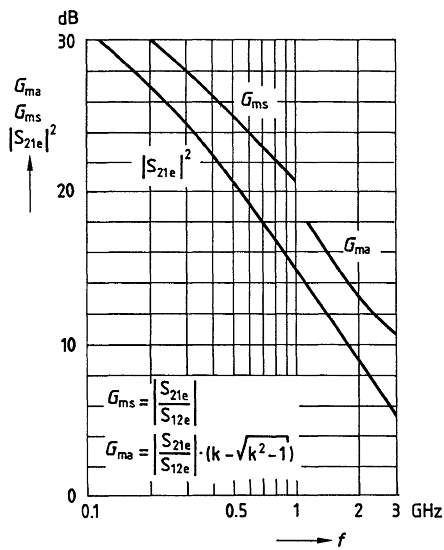
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5\text{ mA}$, $V_{CE} = 10\text{ V}$, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10\text{ mA}$, $V_{CE} = 10\text{ V}$, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20\text{ mA}$, $V_{CE} = 10\text{ V}$, $Z_0 = 50\ \Omega$



Common Emitter S Parameters

I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.959	– 18.9	3.63	166.5	0.040	78.6	0.985	– 7.9
0.15	0.948	– 28.1	3.57	159.9	0.058	72.9	0.971	–11.7
0.20	0.934	– 37.1	3.49	153.6	0.076	67.6	0.953	–15.3
0.25	0.916	– 45.8	3.39	147.3	0.092	62.6	0.931	–18.6
0.30	0.896	– 54.0	3.26	141.4	0.106	57.8	0.907	–21.7
0.40	0.868	– 69.1	3.01	131.2	0.130	49.0	0.861	–27.3
0.50	0.832	– 83.2	2.78	121.7	0.148	41.4	0.814	–32.0
0.60	0.802	– 95.6	2.54	113.2	0.161	35.0	0.773	–35.8
0.70	0.773	–107.0	2.34	105.4	0.171	29.4	0.736	–39.2
0.80	0.758	–116.5	2.15	98.6	0.180	24.6	0.709	–41.9
0.90	0.754	–126.0	2.00	92.3	0.186	19.5	0.681	–44.9
1.00	0.741	–135.0	1.86	86.2	0.188	15.2	0.655	–47.3
1.20	0.721	–150.2	1.61	75.4	0.189	8.5	0.618	–51.9
1.40	0.706	–162.6	1.42	66.3	0.188	2.7	0.595	–56.7
1.50	0.701	–168.3	1.34	62.0	0.186	0.2	0.587	–59.0
1.60	0.699	–173.8	1.27	57.7	0.184	–1.9	0.582	–61.3
1.80	0.707	176.0	1.16	49.6	0.178	–6.1	0.572	–65.6
2.00	0.711	167.0	1.05	42.1	0.170	–9.9	0.563	–69.9

I_C = 2 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.921	– 25.8	6.99	162.9	0.038	75.5	0.968	–12.0
0.15	0.904	– 38.1	6.76	154.8	0.055	68.6	0.938	–17.4
0.20	0.880	– 49.6	6.44	147.2	0.070	62.3	0.901	–22.4
0.25	0.854	– 60.4	6.11	140.1	0.083	56.5	0.861	–26.8
0.30	0.827	– 70.0	5.71	133.8	0.094	51.5	0.820	–30.5
0.40	0.798	– 87.7	5.09	123.5	0.111	42.5	0.747	–37.1
0.50	0.761	–102.9	4.50	114.1	0.122	35.6	0.681	–41.8
0.60	0.733	–115.5	3.99	106.4	0.129	30.2	0.630	–45.5
0.70	0.712	–126.4	3.58	99.5	0.134	26.0	0.589	–48.3
0.80	0.699	–135.2	3.21	93.6	0.139	22.4	0.559	–50.6
0.90	0.697	–143.1	2.95	88.5	0.142	18.7	0.532	–53.3
1.00	0.694	–151.3	2.70	83.2	0.142	15.7	0.507	–55.5
1.20	0.681	–164.8	2.30	74.1	0.142	11.5	0.474	–59.3
1.40	0.682	–175.6	2.00	66.4	0.142	8.0	0.455	–63.4
1.50	0.681	179.9	1.89	62.9	0.140	6.6	0.447	–65.4
1.60	0.679	174.9	1.78	59.1	0.139	5.7	0.444	–67.3
1.80	0.685	166.5	1.60	52.0	0.137	3.9	0.438	–71.0
2.00	0.691	158.7	1.45	45.5	0.133	2.3	0.432	–75.0

I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.930	– 22.1	7.00	165.2	0.027	77.8	0.979	– 8.6
0.15	0.914	– 32.8	6.83	158.0	0.039	71.7	0.959	–12.5
0.20	0.896	– 43.0	6.59	151.2	0.050	66.1	0.933	–16.2
0.25	0.873	– 52.6	6.32	144.7	0.060	60.9	0.905	–19.5
0.30	0.848	– 61.4	5.98	138.8	0.068	56.3	0.876	–22.4
0.40	0.821	– 78.0	5.44	129.0	0.083	47.9	0.819	–27.5
0.50	0.781	– 92.8	4.91	119.8	0.092	41.0	0.765	–31.3
0.60	0.752	–105.5	4.41	112.0	0.099	35.7	0.721	–34.3
0.70	0.725	–116.7	4.00	105.1	0.104	31.3	0.685	–36.6
0.80	0.709	–125.7	3.61	99.2	0.108	27.8	0.659	–38.5
0.90	0.705	–134.0	3.34	94.0	0.111	24.0	0.633	–40.6
1.00	0.698	–142.8	3.08	88.6	0.112	20.9	0.610	–42.5
1.20	0.679	–157.3	2.64	79.4	0.113	16.7	0.578	–45.5
1.40	0.677	–169.1	2.31	71.5	0.113	13.4	0.559	–49.0
1.50	0.675	–174.1	2.17	68.1	0.112	11.9	0.551	–50.6
1.60	0.673	–179.3	2.06	64.3	0.111	11.2	0.547	–52.2
1.80	0.675	171.7	1.84	57.2	0.109	9.8	0.540	–55.5
2.00	0.680	163.2	1.67	50.7	0.106	8.6	0.532	–58.9
2.50	0.717	146.0	1.33	36.3	0.100	10.1	0.523	–70.2
3.00	0.728	130.5	1.10	22.6	0.097	14.3	0.533	–80.1

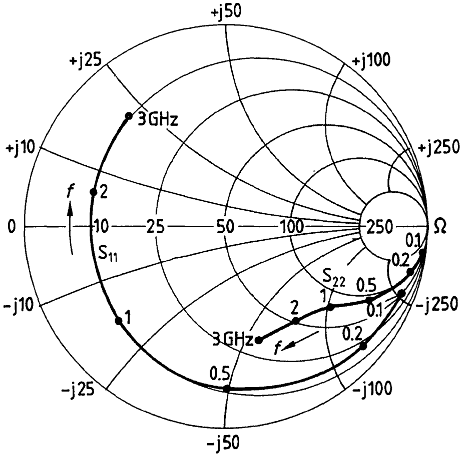
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.844	– 35.5	15.15	157.5	0.025	71.7	0.938	–15.4
0.15	0.814	– 51.6	14.18	147.7	0.035	64.0	0.885	–21.6
0.20	0.780	– 66.0	13.04	139.0	0.043	57.5	0.825	–26.8
0.25	0.747	– 78.6	11.92	131.4	0.049	52.2	0.767	–30.8
0.30	0.717	– 88.9	10.78	125.3	0.054	48.3	0.717	–33.8
0.40	0.706	–107.8	9.23	115.8	0.061	40.3	0.633	–39.3
0.50	0.670	–123.0	7.86	107.3	0.065	36.1	0.565	–41.8
0.60	0.650	–134.7	6.79	100.6	0.068	33.5	0.519	–43.5
0.70	0.635	–144.3	5.97	95.0	0.071	32.1	0.487	–44.7
0.80	0.626	–151.6	5.28	90.4	0.074	31.0	0.466	–45.9
0.90	0.637	–158.1	4.81	86.3	0.076	28.7	0.444	–47.8
1.00	0.638	–165.5	4.38	81.9	0.076	27.9	0.424	–48.8
1.20	0.631	–177.2	3.68	74.5	0.079	28.0	0.400	–50.9
1.40	0.639	173.6	3.18	68.2	0.082	27.3	0.386	–54.0
1.50	0.639	169.7	2.99	65.2	0.083	27.8	0.381	–55.3
1.60	0.639	165.3	2.82	62.0	0.084	28.3	0.379	–56.8
1.80	0.644	157.9	2.51	55.9	0.087	28.9	0.376	–59.7
2.00	0.651	151.1	2.26	50.3	0.090	29.5	0.371	–63.0
2.50	0.692	137.3	1.80	37.9	0.098	31.5	0.365	–74.6
3.00	0.704	123.8	1.49	25.5	0.109	32.5	0.377	–84.3

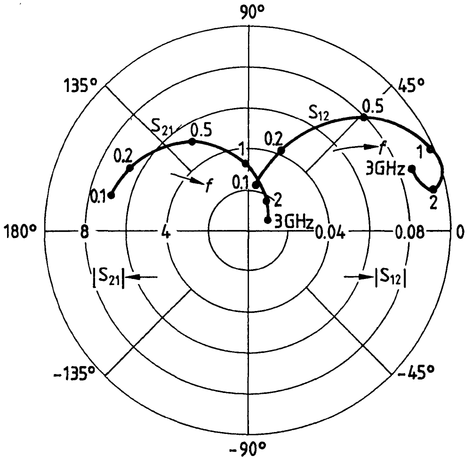
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.935	– 20.7	6.91	166.0	0.022	78.6	0.983	– 7.2
0.15	0.922	– 30.7	6.77	159.3	0.032	72.7	0.967	–10.6
0.20	0.903	– 40.3	6.56	152.7	0.042	67.7	0.945	–13.7
0.25	0.881	– 49.5	6.33	146.5	0.050	62.8	0.922	–16.6
0.30	0.857	– 57.9	6.02	140.7	0.058	58.3	0.897	–19.0
0.40	0.830	– 74.0	5.53	131.1	0.070	50.1	0.849	–23.5
0.50	0.790	– 88.5	5.01	122.1	0.079	43.4	0.802	–26.8
0.60	0.759	–101.1	4.53	114.3	0.085	38.1	0.763	–29.4
0.70	0.731	–112.2	4.13	107.4	0.090	33.8	0.731	–31.6
0.80	0.712	–121.6	3.74	101.4	0.094	30.2	0.707	–33.3
0.90	0.706	–129.9	3.47	96.2	0.097	26.6	0.684	–35.3
1.00	0.700	–138.8	3.21	90.8	0.098	23.4	0.662	–36.9
1.20	0.679	–153.7	2.76	81.4	0.099	19.2	0.632	–39.8
1.40	0.673	–166.0	2.41	73.6	0.099	16.0	0.614	–43.0
1.50	0.670	–171.0	2.27	70.0	0.098	14.6	0.607	–44.5
1.60	0.668	–176.4	2.15	66.2	0.097	14.0	0.603	–46.0
1.80	0.670	174.2	1.93	59.1	0.096	12.9	0.596	–49.0
2.00	0.674	165.4	1.75	52.7	0.093	12.0	0.589	–52.2
2.50	0.709	147.6	1.40	38.2	0.088	14.3	0.577	–62.6
3.00	0.719	131.6	1.16	24.4	0.086	19.9	0.585	–72.0

S_{11}, S_{22} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



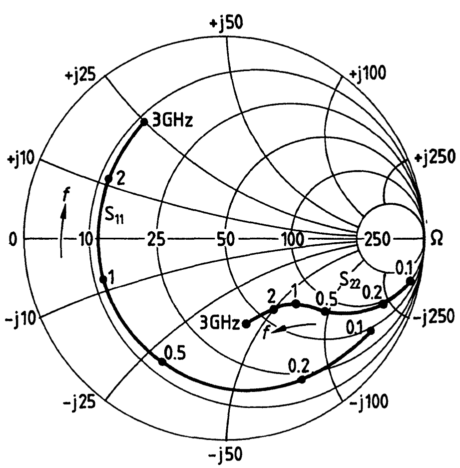
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



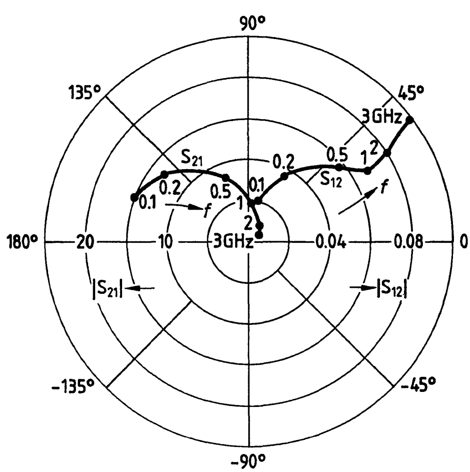
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.859	– 32.4	14.96	159.0	0.021	73.3	0.951	–12.6
0.15	0.829	– 47.4	14.12	149.7	0.029	65.9	0.907	–17.9
0.20	0.794	– 60.8	13.11	141.3	0.036	59.8	0.855	–22.3
0.25	0.762	– 72.9	12.08	133.9	0.042	54.5	0.806	–25.7
0.30	0.728	– 82.9	11.00	127.7	0.047	50.6	0.761	–28.1
0.40	0.713	–101.8	9.53	118.2	0.054	42.8	0.685	–32.8
0.50	0.672	–117.2	8.18	109.5	0.057	38.4	0.624	–34.8
0.60	0.647	–129.2	7.11	102.7	0.060	35.7	0.581	–36.3
0.70	0.628	–139.1	6.26	96.9	0.063	34.3	0.551	–37.3
0.80	0.618	–146.6	5.55	92.3	0.066	32.9	0.532	–38.3
0.90	0.626	–153.7	5.07	88.1	0.068	30.6	0.511	–39.9
1.00	0.626	–161.3	4.62	83.6	0.068	29.8	0.492	–40.7
1.20	0.618	–173.6	3.89	76.0	0.070	30.0	0.469	–42.6
1.40	0.626	176.6	3.38	69.6	0.073	29.4	0.456	–45.4
1.50	0.623	172.6	3.17	66.6	0.073	29.8	0.451	–46.5
1.60	0.626	168.1	2.99	63.4	0.074	30.5	0.448	–47.9
1.80	0.629	160.3	2.66	57.3	0.078	31.4	0.445	–50.6
2.00	0.636	153.3	2.40	51.8	0.080	32.2	0.441	–53.6
2.50	0.676	139.0	1.91	39.1	0.088	35.0	0.431	–63.9
3.00	0.689	125.1	1.58	26.5	0.099	36.5	0.440	–73.1

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



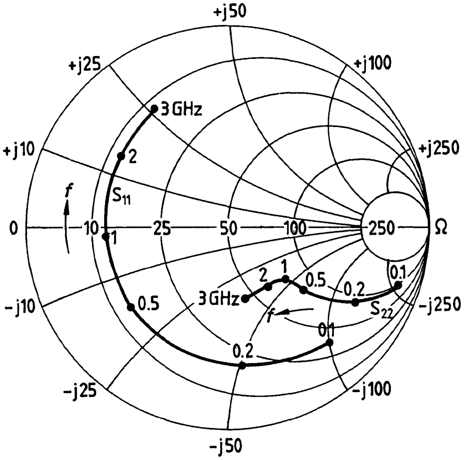
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



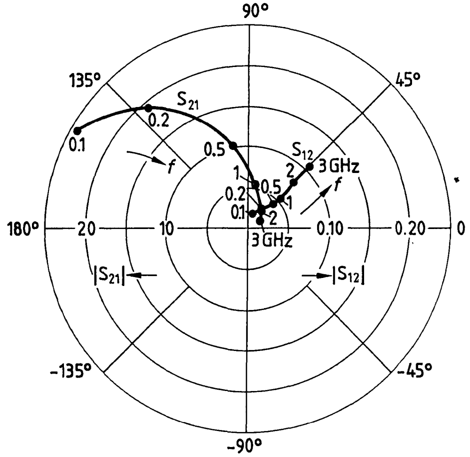
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.764	– 47.7	24.13	150.6	0.019	67.6	0.893	–18.9
0.15	0.724	– 67.5	21.53	139.2	0.025	59.2	0.812	–25.3
0.20	0.685	– 84.0	18.95	129.9	0.030	53.4	0.736	–29.8
0.25	0.653	– 97.2	16.67	122.5	0.033	49.6	0.670	–32.5
0.30	0.626	–107.2	14.62	116.8	0.036	47.1	0.622	–34.1
0.40	0.638	–125.6	12.14	108.4	0.040	40.6	0.542	–38.0
0.50	0.607	–139.8	10.06	100.8	0.042	39.7	0.486	–38.1
0.60	0.594	–150.0	8.55	95.1	0.045	40.0	0.455	–38.3
0.70	0.584	–157.9	7.42	90.3	0.048	40.7	0.434	–38.4
0.80	0.578	–163.4	6.52	86.6	0.051	40.7	0.423	–39.2
0.90	0.595	–168.9	5.92	83.0	0.053	39.1	0.406	–40.7
1.00	0.600	–175.4	5.36	79.1	0.054	40.0	0.391	–41.2
1.20	0.598	174.5	4.48	72.7	0.059	42.2	0.376	–42.8
1.40	0.610	166.6	3.88	67.1	0.064	41.9	0.366	–45.6
1.50	0.610	163.2	3.63	64.3	0.066	42.8	0.364	–46.6
1.60	0.611	159.1	3.42	61.4	0.069	43.7	0.363	–48.0
1.80	0.615	152.5	3.03	55.8	0.074	44.3	0.363	–50.9
2.00	0.623	146.5	2.73	50.7	0.079	44.4	0.360	–54.0
2.50	0.668	134.2	2.17	39.2	0.093	44.8	0.352	–64.9
3.00	0.680	121.5	1.80	27.3	0.107	43.6	0.362	–74.3

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



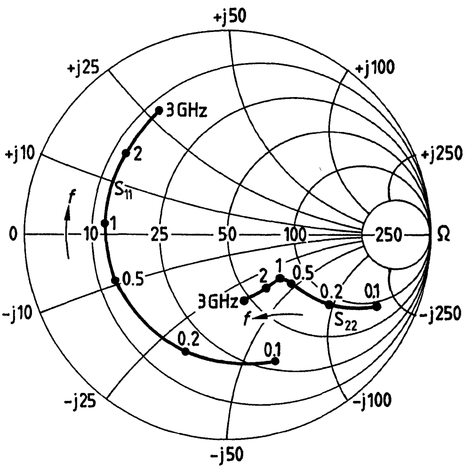
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



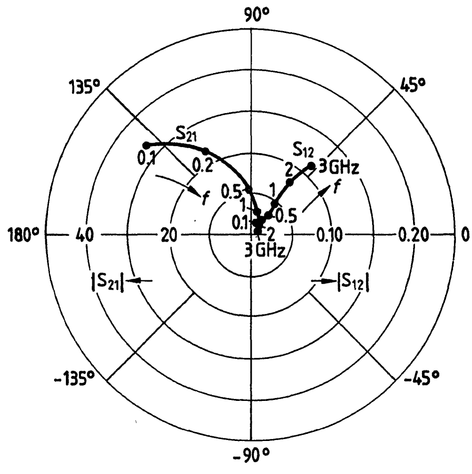
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.660	– 69.0	33.24	140.5	0.016	61.4	0.803	–25.2
0.15	0.626	– 92.6	27.53	127.9	0.020	53.9	0.690	–31.0
0.20	0.599	–109.8	22.90	118.9	0.023	49.7	0.604	–34.0
0.25	0.582	–122.2	19.35	112.3	0.025	48.1	0.543	–35.0
0.30	0.565	–130.5	16.52	107.7	0.028	47.8	0.505	–35.2
0.40	0.606	–146.0	13.34	100.5	0.030	43.4	0.436	–37.6
0.50	0.586	–157.5	10.84	94.1	0.033	46.0	0.398	–35.9
0.60	0.578	–165.4	9.10	89.4	0.036	48.0	0.379	–35.3
0.70	0.571	–171.4	7.84	85.4	0.039	49.9	0.369	–35.2
0.80	0.568	–175.4	6.86	82.3	0.043	49.9	0.365	–36.2
0.90	0.588	–179.5	6.20	79.2	0.046	48.5	0.351	–37.8
1.00	0.595	175.1	5.59	75.6	0.047	50.4	0.341	–38.1
1.20	0.597	166.7	4.66	69.8	0.054	52.4	0.333	–39.9
1.40	0.612	160.0	4.03	64.8	0.060	51.7	0.326	–43.0
1.50	0.612	156.9	3.77	62.1	0.063	52.4	0.325	–44.2
1.60	0.612	153.4	3.55	59.3	0.066	53.0	0.326	–45.7
1.80	0.617	147.4	3.14	54.0	0.073	52.8	0.328	–48.9
2.00	0.624	142.0	2.83	49.2	0.080	52.2	0.327	–52.3
2.50	0.670	131.1	2.25	38.1	0.096	50.6	0.320	–63.9
3.00	0.683	119.0	1.86	26.4	0.112	47.9	0.331	–73.7

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



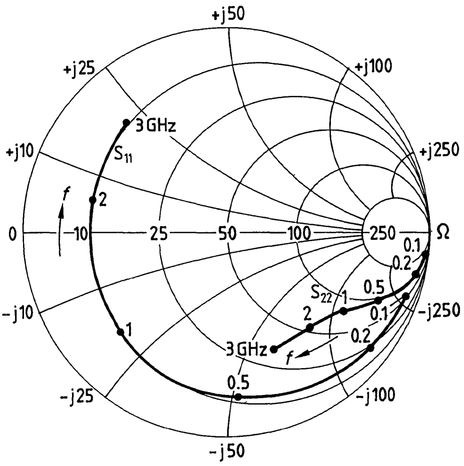
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



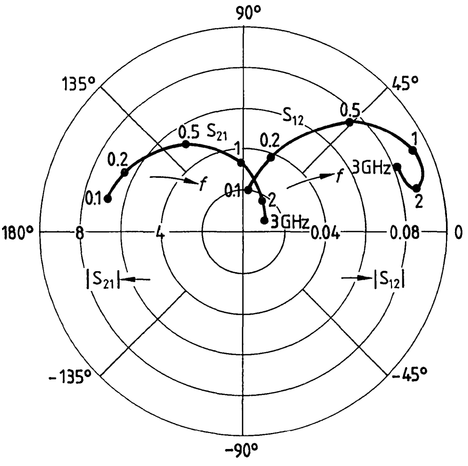
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.940	– 19.8	6.80	166.5	0.020	79.0	0.985	– 6.6
0.15	0.927	– 29.5	6.66	159.9	0.029	73.5	0.971	– 9.7
0.20	0.910	– 38.7	6.47	153.6	0.038	68.4	0.952	–12.5
0.25	0.889	– 47.5	6.27	147.5	0.046	63.7	0.930	–15.2
0.30	0.864	– 55.8	5.97	141.8	0.053	59.4	0.908	–17.4
0.40	0.838	– 71.5	5.51	132.4	0.065	51.4	0.864	–21.6
0.50	0.797	– 85.8	5.01	123.3	0.073	44.7	0.820	–24.8
0.60	0.764	– 98.2	4.55	115.6	0.080	39.4	0.785	–27.3
0.70	0.735	–109.3	4.16	108.6	0.084	35.0	0.754	–29.3
0.80	0.714	–118.6	3.77	102.7	0.088	31.5	0.731	–31.0
0.90	0.710	–127.2	3.51	97.5	0.091	27.9	0.709	–32.8
1.00	0.699	–136.3	3.25	92.0	0.092	24.8	0.689	–34.3
1.20	0.676	–151.3	2.80	82.6	0.093	20.6	0.659	–37.1
1.40	0.671	–163.8	2.46	74.7	0.094	17.3	0.642	–40.2
1.50	0.666	–168.9	2.31	71.1	0.092	16.0	0.634	–41.7
1.60	0.663	–174.5	2.19	67.3	0.091	15.4	0.630	–43.1
1.80	0.664	175.9	1.97	60.1	0.090	14.2	0.624	–45.9
2.00	0.668	166.8	1.79	53.7	0.088	13.4	0.616	–49.0
2.50	0.701	148.8	1.43	39.0	0.083	16.1	0.604	–58.9
3.00	0.715	132.6	1.18	25.3	0.082	21.8	0.611	–67.9

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



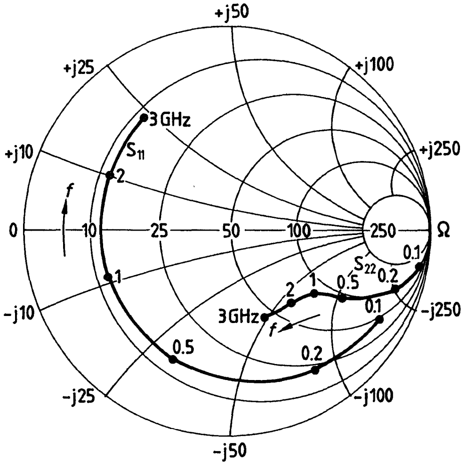
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



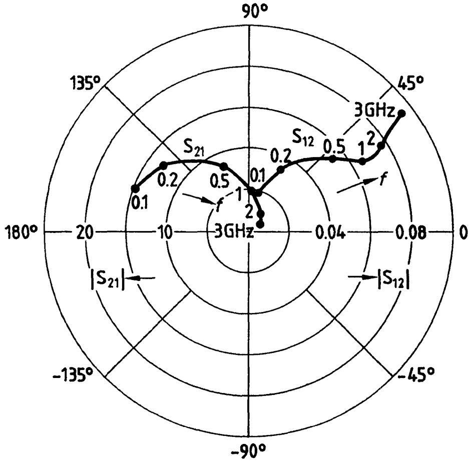
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.873	– 30.5	14.61	159.9	0.019	74.1	0.956	–11.4
0.15	0.844	– 44.7	13.87	150.9	0.027	67.1	0.917	–16.1
0.20	0.809	– 57.6	12.94	142.7	0.034	61.0	0.871	–20.2
0.25	0.775	– 69.2	11.99	135.4	0.039	56.0	0.825	–23.3
0.30	0.742	– 79.1	10.97	129.3	0.044	52.0	0.785	–25.6
0.40	0.720	– 97.6	9.57	119.8	0.051	44.3	0.714	–30.0
0.50	0.675	–113.0	8.27	111.0	0.055	39.7	0.654	–32.0
0.60	0.647	–125.3	7.20	104.1	0.058	36.8	0.613	–33.3
0.70	0.626	–135.3	6.36	98.3	0.060	35.2	0.584	–34.3
0.80	0.613	–143.2	5.65	93.5	0.063	33.9	0.565	–35.3
0.90	0.621	–150.4	5.17	89.3	0.065	31.6	0.545	–36.7
1.00	0.619	–158.4	4.72	84.6	0.065	30.7	0.526	–37.5
1.20	0.608	–171.1	3.98	77.0	0.067	30.6	0.504	–39.4
1.40	0.615	179.0	3.45	70.5	0.070	30.0	0.490	–42.0
1.50	0.613	174.7	3.24	67.5	0.071	30.3	0.485	–43.1
1.60	0.613	170.0	3.06	64.2	0.071	31.2	0.483	–44.4
1.80	0.617	162.1	2.72	58.1	0.074	32.0	0.480	–47.0
2.00	0.623	154.9	2.46	52.5	0.077	32.7	0.474	–49.8
2.50	0.665	140.1	1.96	39.8	0.084	35.9	0.463	–59.5
3.00	0.679	126.1	1.62	27.1	0.094	37.6	0.472	–68.2

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



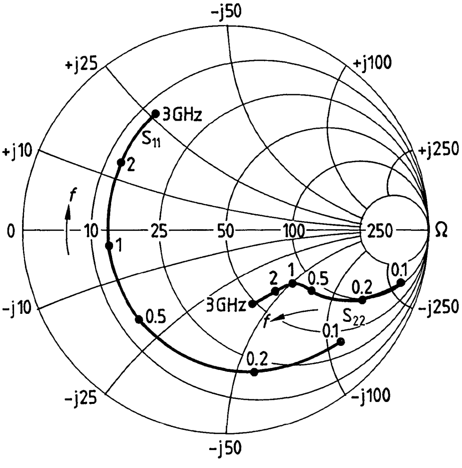
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



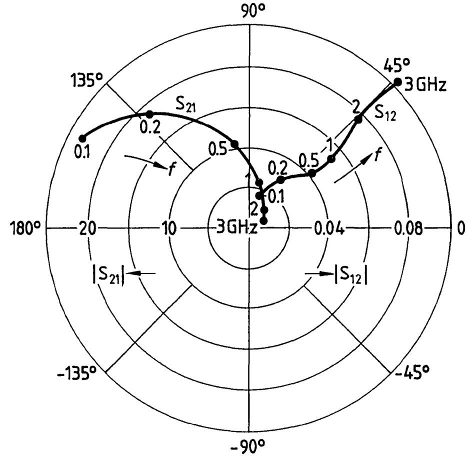
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.794	– 43.8	23.34	152.3	0.018	69.0	0.907	–16.8
0.15	0.750	– 62.4	21.08	141.1	0.024	60.8	0.835	–22.6
0.20	0.707	– 78.1	18.73	132.0	0.029	55.0	0.764	–26.8
0.25	0.670	– 91.2	16.61	124.5	0.032	50.9	0.703	–29.4
0.30	0.637	–101.2	14.65	118.7	0.035	48.3	0.657	–31.0
0.40	0.640	–120.1	12.26	110.1	0.039	41.9	0.579	–34.5
0.50	0.606	–134.5	10.22	102.3	0.042	40.5	0.526	–34.8
0.60	0.586	–145.2	8.70	96.4	0.044	40.2	0.493	–34.9
0.70	0.574	–153.6	7.56	91.5	0.046	40.8	0.472	–35.0
0.80	0.567	–159.5	6.66	87.7	0.050	40.8	0.461	–35.8
0.90	0.584	–165.2	6.05	84.1	0.052	39.3	0.445	–37.2
1.00	0.585	–172.2	5.48	80.1	0.053	40.0	0.430	–37.7
1.20	0.583	177.3	4.58	73.5	0.057	41.9	0.415	–39.1
1.40	0.594	168.9	3.97	67.8	0.062	41.8	0.405	–41.7
1.50	0.594	165.3	3.72	65.0	0.064	42.6	0.402	–42.7
1.60	0.594	161.1	3.50	62.1	0.066	43.6	0.401	–44.0
1.80	0.598	154.4	3.11	56.4	0.072	44.3	0.401	–46.7
2.00	0.607	148.0	2.80	51.3	0.076	44.5	0.397	–49.7
2.50	0.652	135.2	2.23	39.7	0.089	45.0	0.387	–59.7
3.00	0.665	122.4	1.85	27.7	0.103	44.2	0.396	–68.7

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



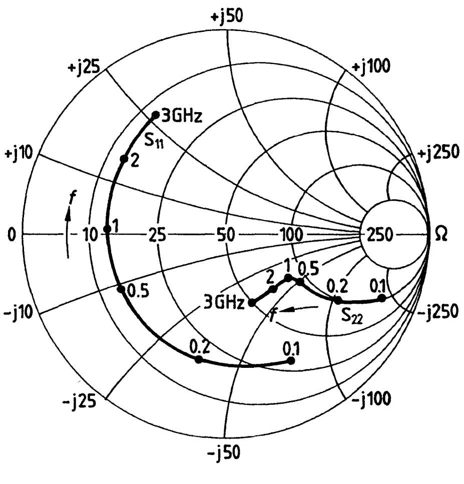
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



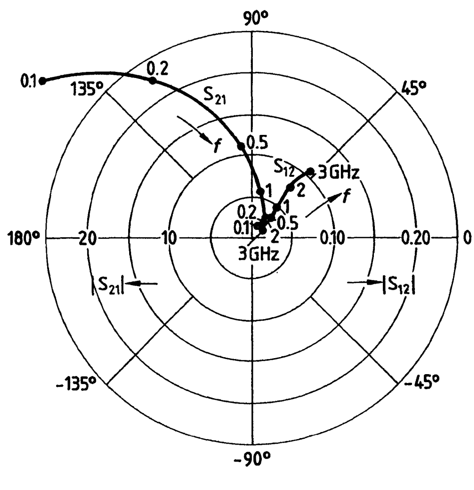
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.707	– 61.6	31.92	142.9	0.016	63.1	0.830	–22.1
0.15	0.658	– 84.0	26.93	130.5	0.020	55.1	0.728	–27.6
0.20	0.619	–101.2	22.66	121.3	0.023	50.7	0.646	–30.4
0.25	0.592	–113.9	19.30	114.4	0.025	48.6	0.587	–31.6
0.30	0.570	–122.7	16.56	109.6	0.028	47.9	0.549	–31.8
0.40	0.597	–139.7	13.46	102.1	0.030	43.4	0.480	–34.0
0.50	0.572	–152.0	10.96	95.4	0.033	45.3	0.442	–32.5
0.60	0.562	–160.7	9.22	90.5	0.036	47.1	0.423	–32.0
0.70	0.553	–167.1	7.95	86.5	0.039	48.9	0.413	–31.9
0.80	0.549	–171.5	6.97	83.2	0.043	49.0	0.408	–32.9
0.90	0.570	–176.2	6.31	80.0	0.045	47.7	0.394	–34.3
1.00	0.575	178.1	5.70	76.3	0.047	49.3	0.384	–34.6
1.20	0.575	169.2	4.75	70.4	0.053	51.4	0.376	–36.2
1.40	0.591	162.1	4.11	65.2	0.059	50.9	0.369	–39.2
1.50	0.590	158.8	3.84	62.6	0.061	51.6	0.368	–40.3
1.60	0.591	155.2	3.61	59.7	0.065	52.2	0.368	–41.7
1.80	0.596	149.1	3.21	54.4	0.071	52.0	0.370	–44.7
2.00	0.604	143.7	2.88	49.5	0.077	51.5	0.368	–47.8
2.50	0.649	132.2	2.29	38.3	0.092	50.4	0.358	–58.5
3.00	0.665	120.1	1.89	26.5	0.107	47.8	0.369	–67.8

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

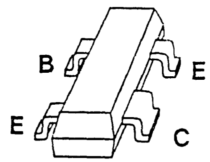


S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



- For broadband amplifiers and oscillators up to 2 GHz at collector currents from 5 to 30 mA.

- CECC-type in preparation: CECC 50002/...



ESD: **E**lectro**s**tatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFP 93A	FE	Q 62702 – F1144	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	50	mA
Base current	I_B	6	mA
Total power dissipation, $T_A \leq 25$ °C[2]	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1]	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

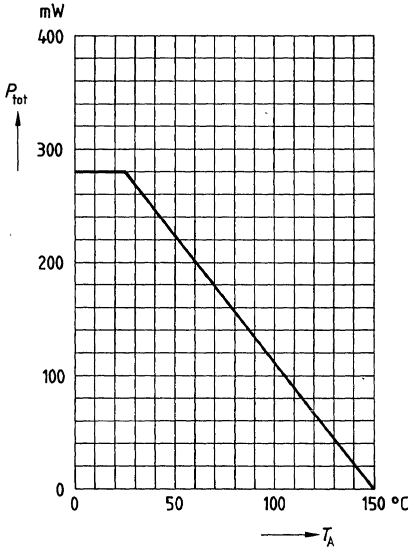
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	μA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	250	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.13	0.4	V

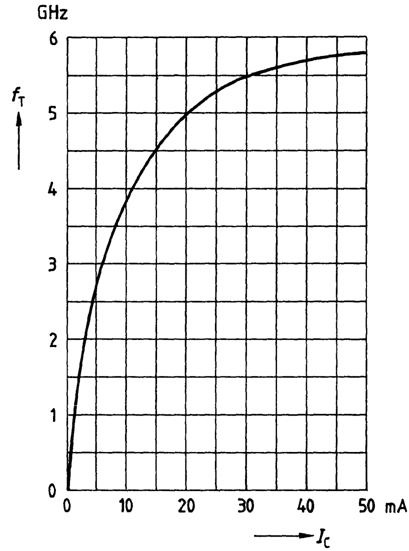
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	–	5.5	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.47	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.34	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.2	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$ $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	 – – –	 1.1 1.7 2.6	 – – –	dB
Power gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	16.5	–	dB
Transducer gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	13.4	–	dB
Linear output voltage two-tone intermodulation test $I_C = 30$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	280	–	mV
Third order intercept point $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	32	–	dBm

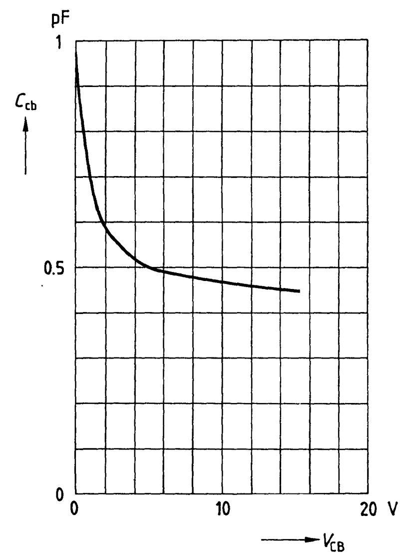
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

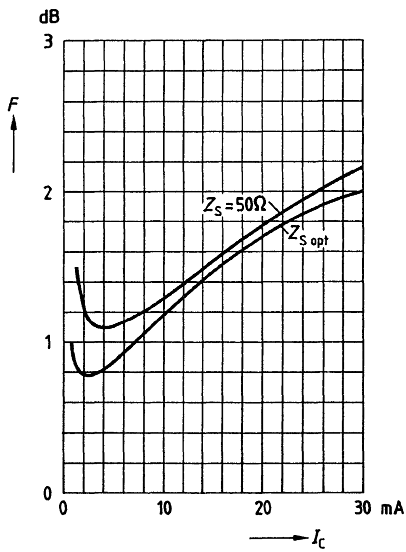
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–
0.8	1.7	13.5	0.26	124	8.3	0.199	1.8	13

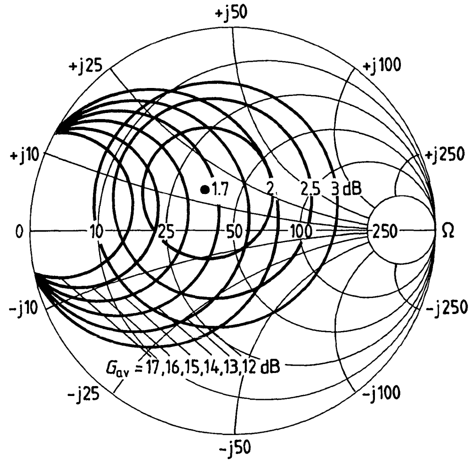
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.0	–	(Z_S = 100 Ω)		–	–	2.15	–
0.8	2.6	15.5	0.2	156	10.9	0.31	2.85	15

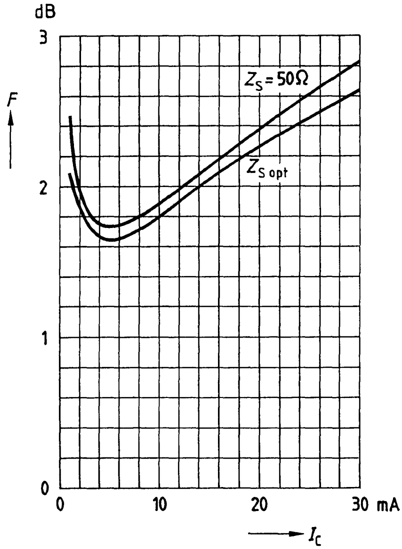
Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz



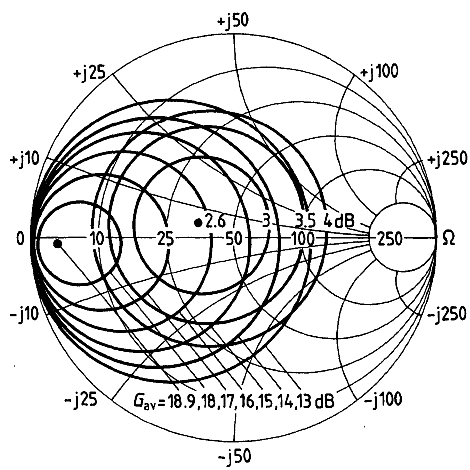
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $f = 800$ MHz



Noise figure $F = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, Z_{Lopt} (G)

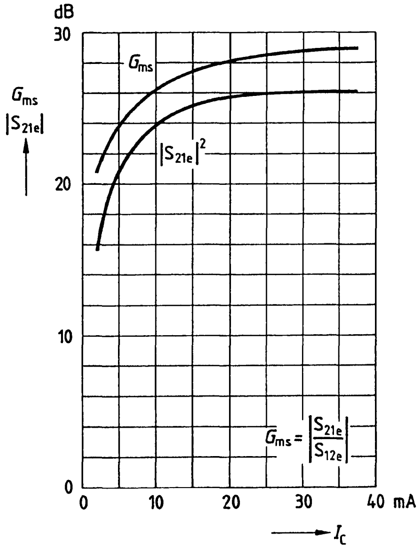


Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
$I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz

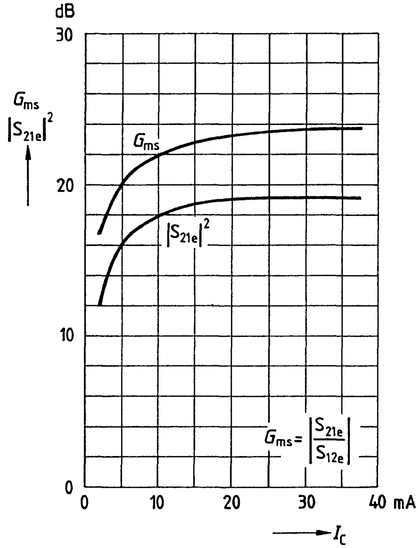


Common Emitter Power Gain

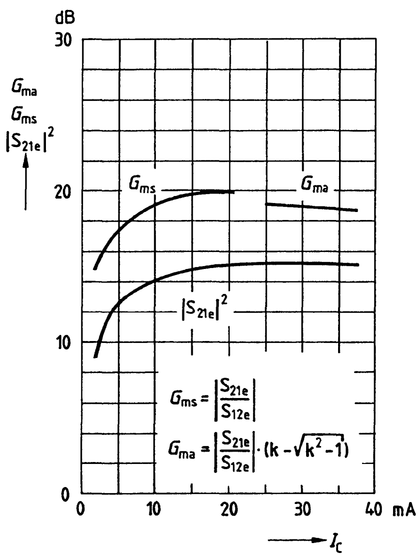
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



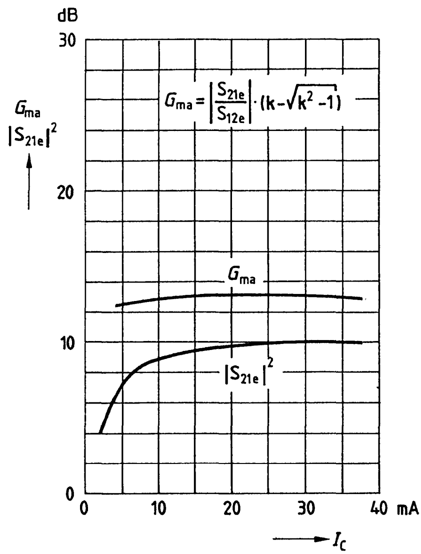
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



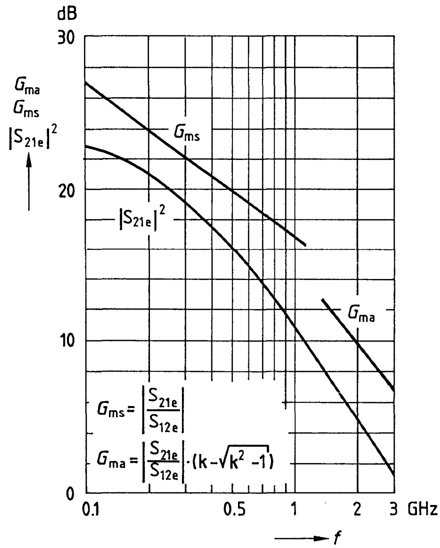
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



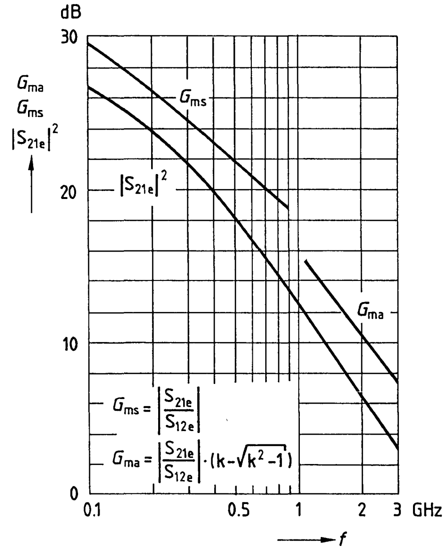
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



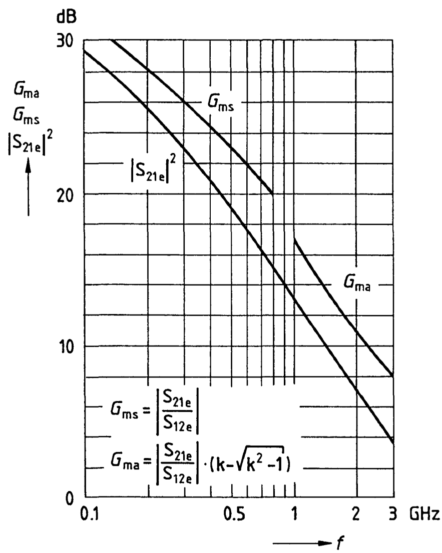
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



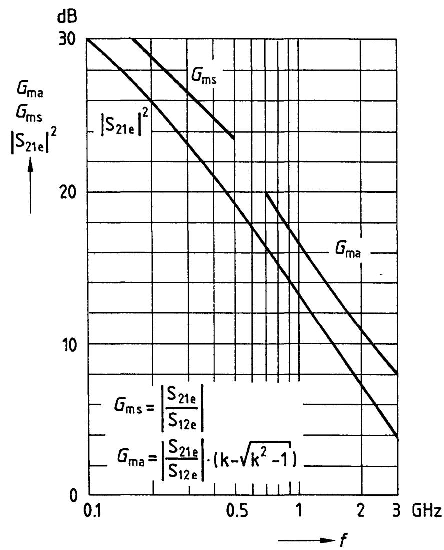
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 30$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.669	– 66.5	21.87	142.0	0.027	61.1	0.820	– 28.4
0.15	0.638	– 89.6	18.34	129.5	0.034	52.6	0.705	– 36.3
0.20	0.619	–106.6	15.41	120.3	0.039	47.7	0.612	– 41.2
0.25	0.606	–118.7	13.08	113.8	0.043	44.6	0.546	– 44.3
0.30	0.613	–127.6	11.38	109.3	0.047	41.5	0.502	– 47.1
0.40	0.636	–145.7	9.21	100.5	0.050	36.3	0.412	– 51.8
0.50	0.619	–157.9	7.51	93.5	0.051	37.3	0.359	– 52.1
0.60	0.609	–166.3	6.31	88.1	0.054	39.0	0.330	– 52.2
0.70	0.602	–172.9	5.43	83.6	0.059	40.8	0.314	– 52.5
0.80	0.604	–177.0	4.78	80.1	0.065	40.3	0.308	– 54.1
0.90	0.627	177.4	4.31	76.4	0.066	38.2	0.292	– 57.0
1.00	0.631	171.4	3.89	72.4	0.067	40.3	0.278	– 57.7
1.20	0.632	162.5	3.24	65.9	0.075	43.1	0.268	– 60.6
1.40	0.641	155.3	2.80	60.2	0.082	42.7	0.262	– 65.8
1.50	0.641	151.4	2.62	57.3	0.085	43.8	0.261	– 67.4
1.60	0.647	148.3	2.47	54.2	0.089	44.2	0.264	– 69.6
1.80	0.653	141.4	2.20	48.4	0.097	44.2	0.267	– 73.9
2.00	0.664	136.0	1.97	42.9	0.105	43.9	0.267	– 78.7
2.50	0.708	123.4	1.57	31.1	0.124	42.9	0.275	– 95.3
3.00	0.721	111.6	1.29	18.7	0.144	40.4	0.301	–107.7

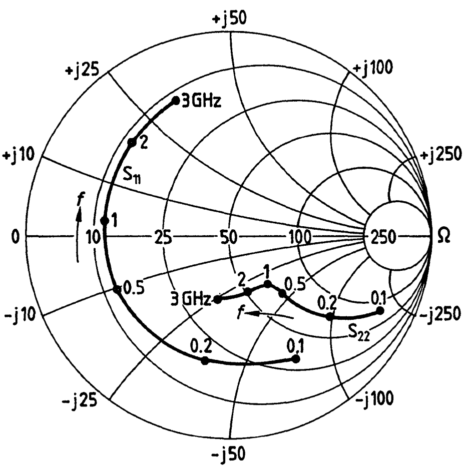
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.527	–104.9	32.22	127.4	0.019	55.0	0.636	– 43.7
0.15	0.536	–126.7	24.42	115.7	0.023	50.7	0.498	– 51.3
0.20	0.543	–139.7	19.32	108.3	0.027	50.1	0.412	– 55.1
0.25	0.548	–147.4	15.85	103.6	0.030	49.5	0.362	– 57.4
0.30	0.570	–152.2	13.55	100.5	0.034	47.2	0.333	– 60.9
0.40	0.616	–165.9	10.71	93.4	0.035	46.0	0.255	– 67.8
0.50	0.603	–174.8	8.60	87.8	0.039	51.1	0.214	– 66.9
0.60	0.596	179.3	7.16	83.5	0.044	54.4	0.196	– 66.2
0.70	0.590	175.0	6.14	79.9	0.051	55.8	0.189	– 66.1
0.80	0.592	172.6	5.38	77.1	0.058	53.6	0.190	– 68.6
0.90	0.620	168.4	4.85	73.8	0.059	52.0	0.178	– 74.0
1.00	0.625	163.1	4.37	70.3	0.062	54.6	0.165	– 74.7
1.20	0.626	155.9	3.62	64.6	0.074	55.7	0.161	– 77.8
1.40	0.637	149.7	3.13	59.5	0.083	53.7	0.160	– 84.9
1.50	0.637	146.3	2.93	56.7	0.088	54.2	0.160	– 86.3
1.60	0.645	143.4	2.75	54.0	0.093	53.9	0.164	– 88.3
1.80	0.647	137.3	2.45	48.5	0.103	52.4	0.170	– 92.6
2.00	0.658	132.7	2.19	43.4	0.112	50.6	0.174	– 98.0
2.50	0.706	121.1	1.75	32.3	0.134	47.0	0.193	–116.0
3.00	0.717	109.8	1.44	20.5	0.155	42.5	0.222	–126.6

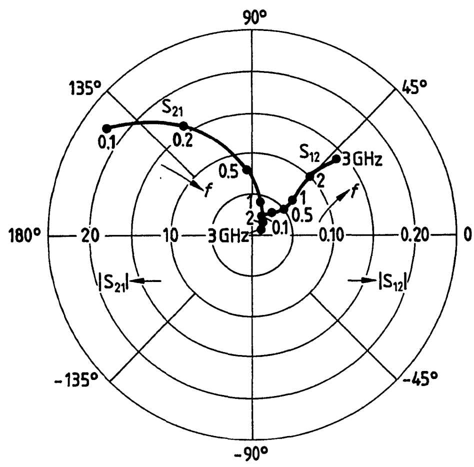
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.686	– 62.1	21.91	143.6	0.025	62.5	0.838	–25.8
0.15	0.649	– 84.6	18.59	131.2	0.032	54.0	0.730	–33.1
0.20	0.624	–101.6	15.74	121.9	0.037	49.1	0.641	–37.6
0.25	0.606	–113.9	13.44	115.3	0.041	45.7	0.577	–40.4
0.30	0.611	–123.2	11.73	110.7	0.045	42.6	0.533	–43.0
0.40	0.628	–142.1	9.54	101.8	0.048	37.3	0.443	–47.1
0.50	0.608	–154.7	7.80	94.6	0.050	37.9	0.390	–47.2
0.60	0.597	–163.6	6.56	89.2	0.053	39.5	0.362	–47.1
0.70	0.588	–170.5	5.65	84.6	0.057	41.1	0.346	–47.2
0.80	0.591	–174.8	4.97	81.0	0.063	40.7	0.339	–48.7
0.90	0.614	179.4	4.50	77.3	0.064	38.7	0.322	–51.3
1.00	0.617	173.0	4.06	73.3	0.065	40.6	0.308	–51.7
1.20	0.618	163.9	3.38	66.8	0.072	43.4	0.298	–54.3
1.40	0.627	156.4	2.92	61.0	0.079	43.1	0.291	–59.0
1.50	0.628	152.4	2.73	58.1	0.082	44.3	0.290	–60.6
1.60	0.635	149.4	2.57	55.1	0.086	44.7	0.292	–62.6
1.80	0.638	142.4	2.29	49.3	0.094	44.9	0.294	–66.8
2.00	0.650	136.8	2.06	43.7	0.100	44.6	0.294	–71.2
2.50	0.698	124.2	1.63	31.8	0.120	43.8	0.295	–86.9
3.00	0.710	112.0	1.35	19.4	0.139	41.6	0.317	–99.3

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



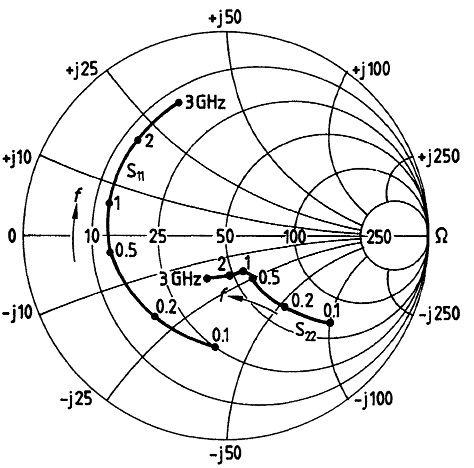
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



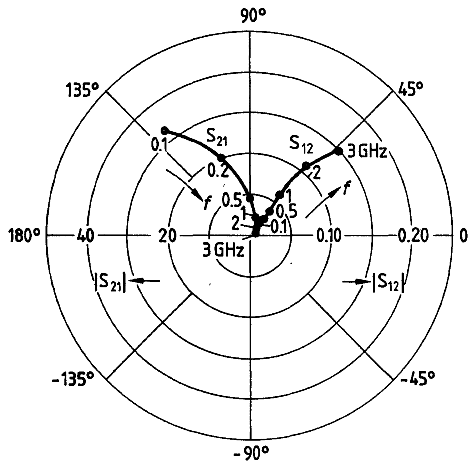
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.544	– 95.7	32.88	129.4	0.019	56.3	0.667	– 39.4
0.15	0.536	–118.5	25.24	117.5	0.023	51.3	0.532	– 46.3
0.20	0.533	–132.7	20.09	109.9	0.026	50.3	0.445	– 49.4
0.25	0.534	–141.3	16.54	105.0	0.030	49.7	0.394	– 51.3
0.30	0.554	–147.0	14.17	101.8	0.033	47.3	0.363	– 54.1
0.40	0.596	–162.1	11.25	94.5	0.035	45.8	0.283	– 59.1
0.50	0.581	–171.7	9.04	88.7	0.038	50.4	0.242	– 57.3
0.60	0.573	–178.1	7.53	84.3	0.043	53.7	0.225	– 56.1
0.70	0.566	177.2	6.45	80.7	0.050	55.2	0.218	– 55.7
0.80	0.570	174.8	5.66	77.8	0.057	53.3	0.218	– 58.2
0.90	0.598	170.2	5.11	74.5	0.058	51.7	0.203	– 62.4
1.00	0.603	164.8	4.61	71.0	0.061	54.1	0.191	– 62.4
1.20	0.603	157.3	3.82	65.2	0.072	55.4	0.186	– 64.9
1.40	0.615	151.0	3.30	60.2	0.081	53.5	0.182	– 71.1
1.50	0.616	147.4	3.08	57.4	0.085	54.1	0.182	– 72.4
1.60	0.622	144.6	2.90	54.7	0.090	53.8	0.185	– 74.6
1.80	0.625	138.5	2.58	49.3	0.100	52.3	0.190	– 79.0
2.00	0.640	133.5	2.31	44.1	0.109	50.8	0.191	– 84.1
2.50	0.687	121.8	1.84	32.9	0.130	47.3	0.200	–102.2
3.00	0.700	110.4	1.52	21.1	0.150	43.0	0.225	–113.9

S_{11}, S_{22} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



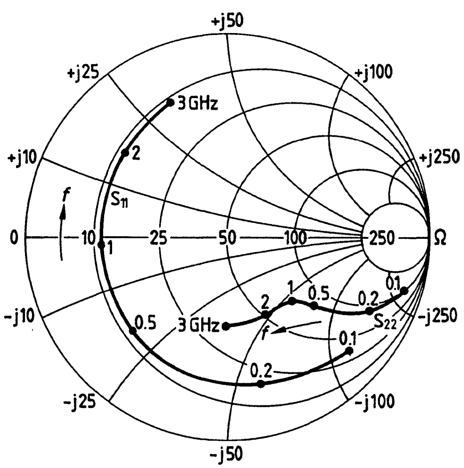
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



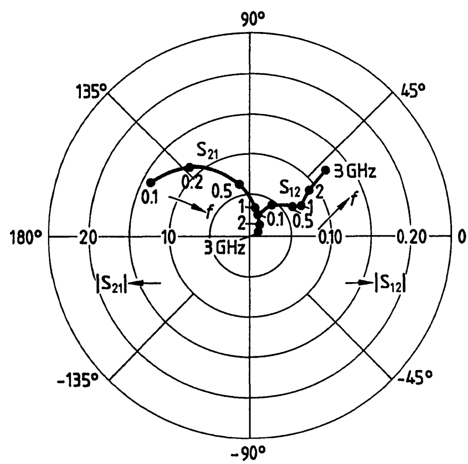
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.811	– 43.1	13.94	152.9	0.027	68.3	0.922	–16.4
0.15	0.771	– 61.5	12.68	141.8	0.037	59.7	0.856	–22.3
0.20	0.735	– 77.3	11.34	132.5	0.045	53.4	0.789	–26.7
0.25	0.703	– 90.2	10.09	125.2	0.051	48.5	0.733	–29.8
0.30	0.691	–100.7	9.03	119.6	0.056	44.2	0.689	–32.3
0.40	0.679	–121.1	7.58	109.4	0.061	36.6	0.605	–36.2
0.50	0.649	–135.9	6.35	101.0	0.063	33.5	0.550	–37.4
0.60	0.631	–147.1	5.41	94.5	0.066	32.2	0.515	–38.3
0.70	0.618	–156.0	4.71	89.0	0.068	32.1	0.494	–39.2
0.80	0.617	–162.2	4.17	84.6	0.072	31.4	0.483	–40.4
0.90	0.633	–169.4	3.78	80.3	0.073	28.8	0.465	–42.5
1.00	0.633	–176.7	3.43	75.8	0.073	29.4	0.451	–43.4
1.20	0.631	172.4	2.86	68.3	0.076	31.4	0.438	–46.3
1.40	0.636	163.5	2.48	61.9	0.080	31.6	0.428	–50.5
1.50	0.637	159.0	2.32	58.6	0.081	32.9	0.426	–52.2
1.60	0.644	155.4	2.19	55.4	0.083	33.9	0.427	–54.3
1.80	0.647	147.7	1.95	49.1	0.088	35.3	0.428	–58.3
2.00	0.658	141.2	1.75	43.2	0.092	36.5	0.426	–62.5
2.50	0.704	127.1	1.39	30.3	0.106	39.5	0.423	–76.8
3.00	0.720	114.2	1.14	17.6	0.123	40.2	0.442	–89.3

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



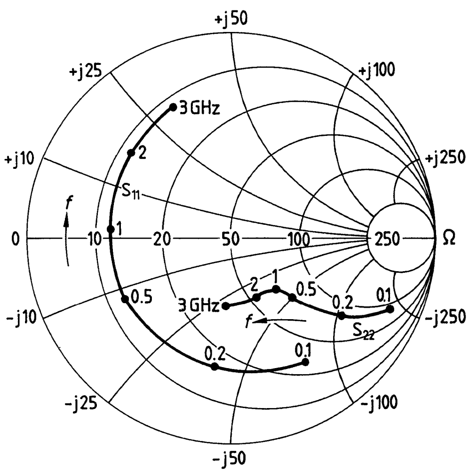
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



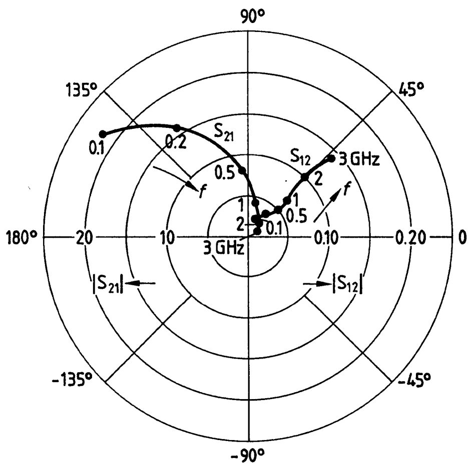
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.709	– 58.1	21.68	145.0	0.024	63.4	0.853	–23.8
0.15	0.668	– 80.0	18.62	132.6	0.031	54.8	0.750	–30.9
0.20	0.635	– 97.3	15.93	123.3	0.036	49.6	0.662	–35.3
0.25	0.605	–110.8	13.65	116.0	0.040	46.4	0.593	–37.8
0.30	0.584	–120.3	11.81	110.6	0.043	44.7	0.546	–39.0
0.40	0.612	–137.3	9.62	102.9	0.047	38.7	0.471	–43.1
0.50	0.588	–150.5	7.90	95.5	0.050	39.4	0.418	–43.1
0.60	0.574	–159.8	6.66	90.0	0.053	40.6	0.390	–43.0
0.70	0.566	–167.3	5.74	85.4	0.057	42.0	0.374	–43.3
0.80	0.566	–171.8	5.06	81.8	0.062	41.7	0.368	–44.8
0.90	0.593	–177.7	4.58	78.0	0.063	39.9	0.349	–46.8
1.00	0.591	175.9	4.13	73.9	0.065	41.7	0.336	–47.3
1.20	0.594	166.9	3.44	67.5	0.072	44.0	0.324	–49.6
1.40	0.601	159.3	2.98	61.7	0.079	43.9	0.315	–54.0
1.50	0.602	155.3	2.79	58.8	0.082	44.7	0.314	–55.7
1.60	0.605	151.8	2.62	55.7	0.086	45.3	0.315	–57.7
1.80	0.614	145.1	2.33	49.9	0.094	45.5	0.316	–61.7
2.00	0.626	139.4	2.09	44.5	0.100	45.3	0.314	–66.1
2.50	0.675	126.7	1.67	32.2	0.120	44.6	0.310	–81.5
3.00	0.690	114.1	1.38	20.3	0.139	42.3	0.327	–94.0

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



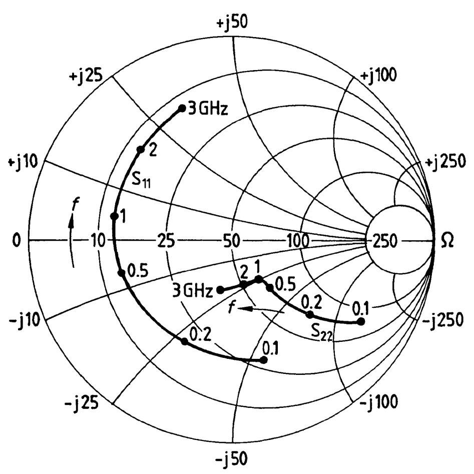
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



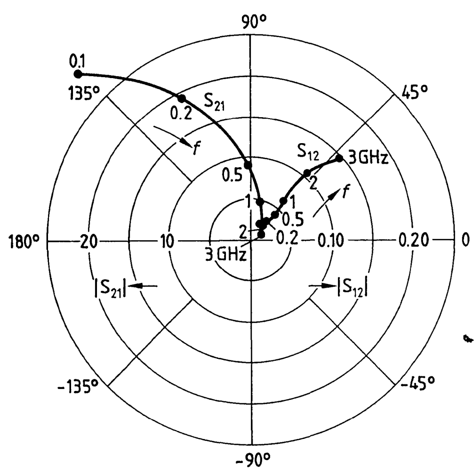
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.617	− 76.1	29.26	136.3	0.021	59.2	0.755	− 32.3
0.15	0.582	− 99.6	23.50	123.8	0.026	52.2	0.627	− 39.6
0.20	0.560	−115.8	19.20	115.3	0.030	49.3	0.536	− 43.3
0.25	0.550	−126.6	16.03	109.6	0.034	47.9	0.478	− 45.4
0.30	0.562	−134.2	13.84	105.9	0.037	45.2	0.440	− 47.9
0.40	0.591	−151.9	11.11	97.8	0.039	41.9	0.353	− 52.1
0.50	0.571	−163.2	8.99	91.4	0.042	45.4	0.307	− 50.8
0.60	0.562	−170.8	7.51	86.6	0.046	48.1	0.286	− 49.9
0.70	0.553	−176.6	6.44	82.6	0.051	50.0	0.275	− 49.7
0.80	0.557	−179.8	5.66	79.5	0.058	48.8	0.272	− 51.5
0.90	0.583	175.0	5.12	76.0	0.059	47.0	0.255	− 54.6
1.00	0.588	169.0	4.61	72.3	0.062	49.4	0.243	− 54.6
1.20	0.587	160.6	3.83	66.3	0.071	51.3	0.235	− 56.8
1.40	0.601	153.8	3.31	61.1	0.080	49.9	0.229	− 61.9
1.50	0.600	150.0	3.09	58.2	0.083	50.8	0.228	− 63.2
1.60	0.605	147.0	2.91	55.4	0.088	50.7	0.230	− 65.2
1.80	0.610	140.5	2.59	49.9	0.097	49.7	0.233	− 69.3
2.00	0.623	135.3	2.32	44.6	0.105	48.5	0.232	− 74.0
2.50	0.674	123.1	1.85	33.3	0.126	46.0	0.234	− 90.4
3.00	0.688	111.5	1.53	21.3	0.145	42.3	0.255	−102.7

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



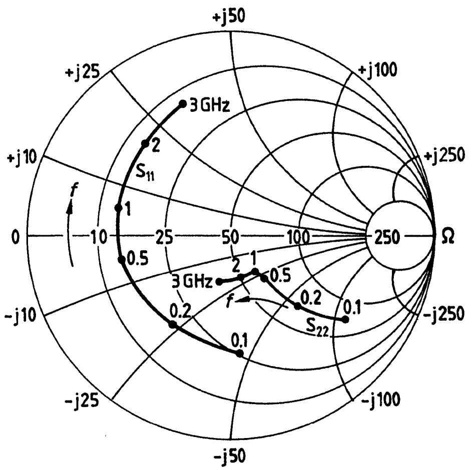
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



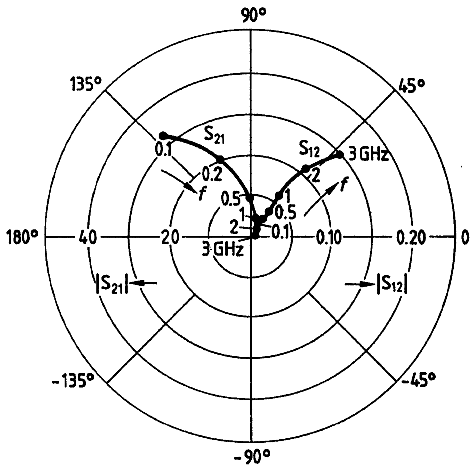
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.578	– 86.6	32.52	131.3	0.019	56.9	0.693	– 36.4
0.15	0.548	–110.0	25.24	119.2	0.024	51.6	0.561	– 43.0
0.20	0.533	–125.2	20.22	111.3	0.027	50.1	0.473	– 45.9
0.25	0.528	–134.6	16.71	106.2	0.031	49.3	0.422	– 47.5
0.30	0.545	–141.3	14.35	103.0	0.034	47.0	0.389	– 50.1
0.40	0.579	–157.7	11.43	95.4	0.035	45.1	0.307	– 54.0
0.50	0.561	–168.2	9.19	89.4	0.039	49.5	0.267	– 52.0
0.60	0.552	–174.9	7.66	84.9	0.044	52.5	0.250	– 50.7
0.70	0.543	–180.0	6.56	81.2	0.050	53.9	0.243	– 50.3
0.80	0.548	177.4	5.76	78.4	0.057	52.2	0.242	– 52.6
0.90	0.576	172.4	5.21	75.0	0.058	50.5	0.226	– 56.0
1.00	0.580	166.7	4.69	71.4	0.061	53.1	0.214	– 55.8
1.20	0.580	158.9	3.89	65.6	0.072	54.3	0.208	– 58.1
1.40	0.592	152.3	3.36	60.4	0.081	52.6	0.203	– 63.7
1.50	0.595	148.6	3.14	57.7	0.085	53.0	0.202	– 65.0
1.60	0.601	145.8	2.96	54.9	0.090	52.7	0.205	– 67.0
1.80	0.605	139.6	2.63	49.5	0.099	51.3	0.209	– 71.4
2.00	0.619	134.5	2.36	44.3	0.108	49.9	0.209	– 76.2
2.50	0.669	122.7	1.88	33.1	0.128	46.6	0.212	– 93.5
3.00	0.684	111.0	1.55	21.1	0.148	42.4	0.235	–105.7

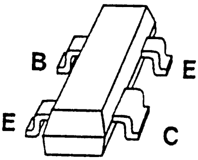
S_{11}, S_{22} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



- For low-noise, high-gain amplifiers up to 2 GHz.
- For linear broadband amplifiers.
- f_T = 8 GHz.
  F = 1.2 dB at 800 MHz.



ESD: **E**lectrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFP 193	RC	Q 62702 – F1217	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2])	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤250	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

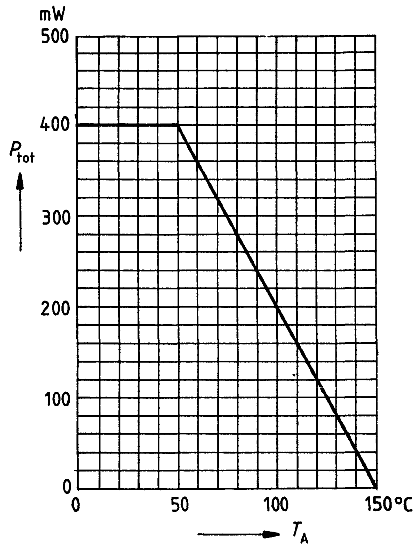
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – –	 90 100	 – –	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

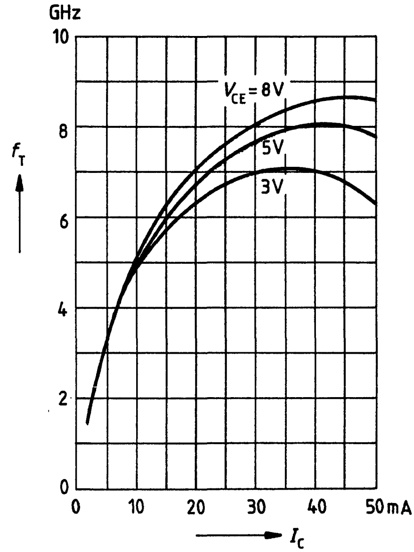
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 8 V, f = 500 MHz		–	3.5	–	
I_C = 30 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.6	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.33	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.3	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.95	–	pF
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω		–	0.8	–	
I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.6	–	
I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = 50 Ω		–	1.9	–	
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	dB
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	13.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 40 mA, V_{CE} = 5 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	250	–	mV
Third order intercept point I_C = 40 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	31	–	dBm

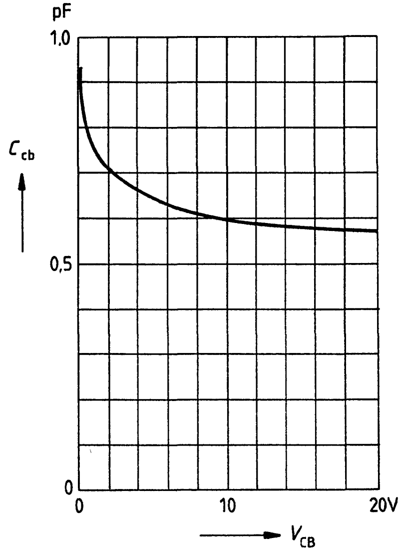
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

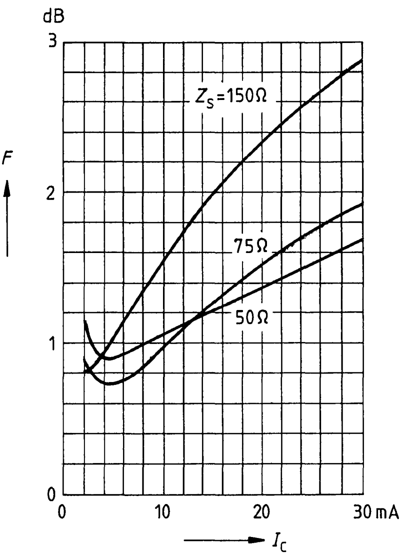
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.2	15.4	–	–	–	–	1.35	14.4
2.0	2.3	9	–	–	–	–	2.8	7

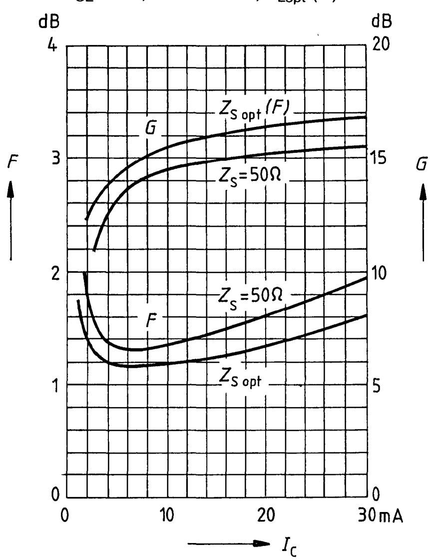
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.6	16.7	–	–	–	–	1.95	15.4
2.0	2.6	9.5	–	–	–	–	3.3	7.5

Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz

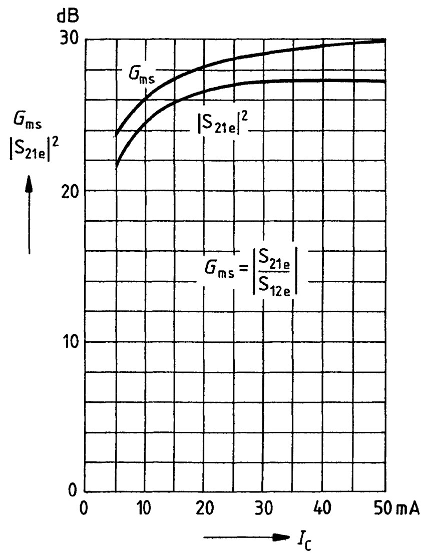


Noise figure F = f (I_C)
Power gain G = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

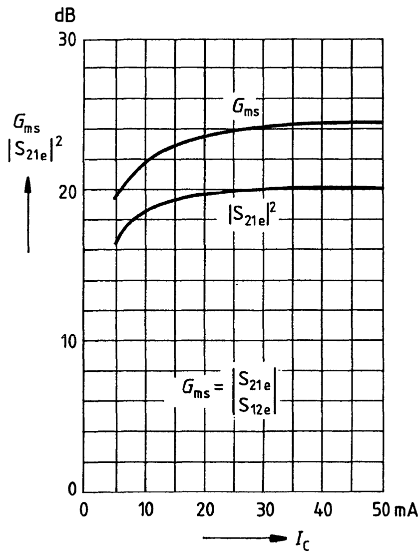


Common Emitter Power Gain

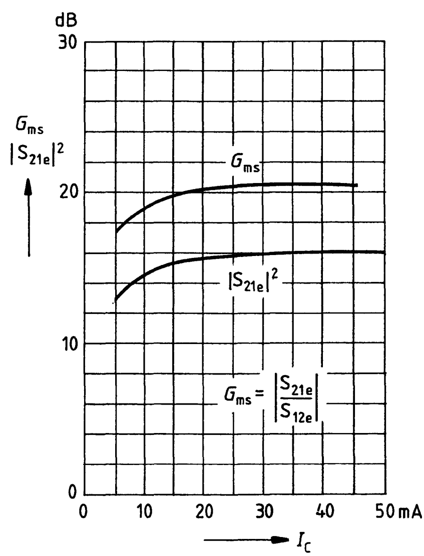
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



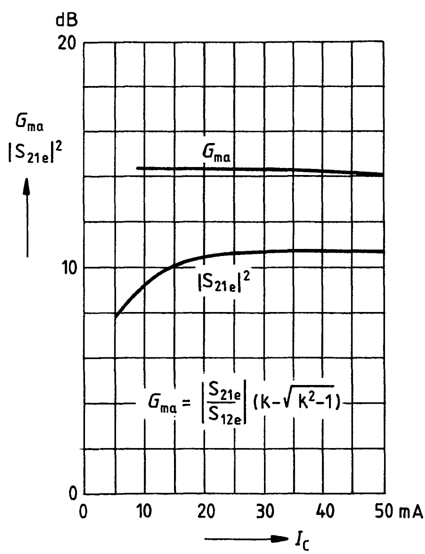
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



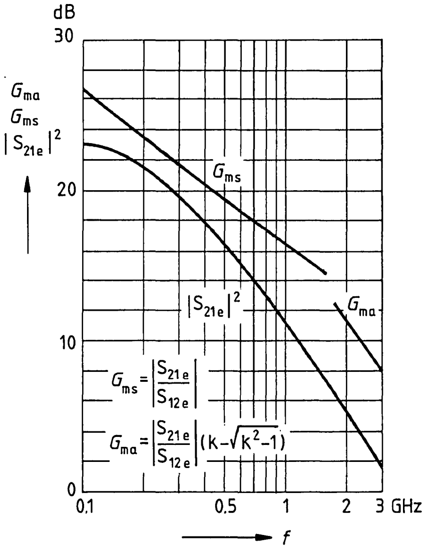
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



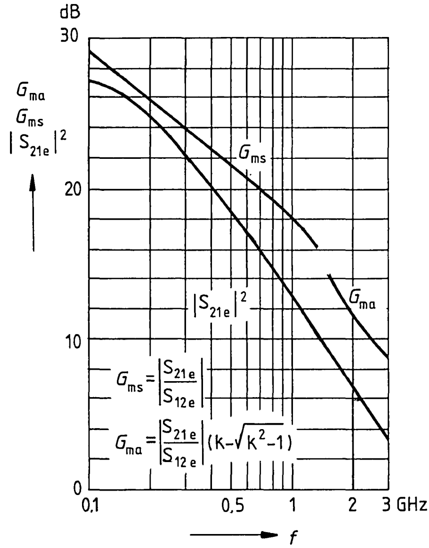
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



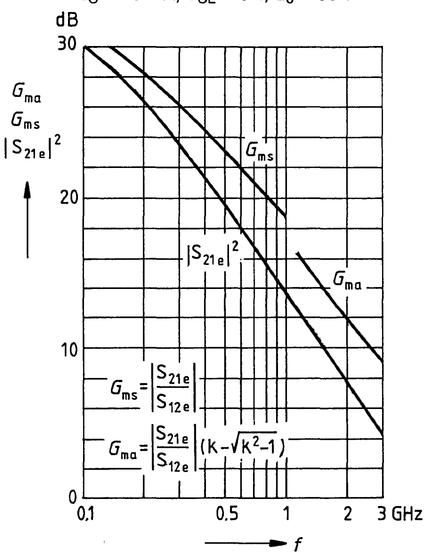
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



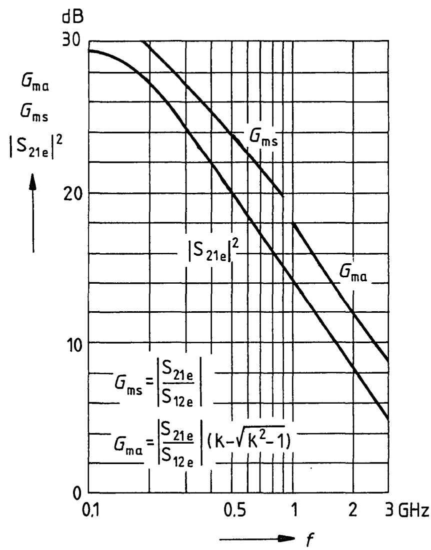
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.673	– 68.6	22.95	143.4	0.029	60.3	0.820	– 32.7
0.15	0.665	– 92.3	19.44	130.9	0.037	51.4	0.701	– 43.2
0.20	0.660	–109.9	16.49	121.6	0.042	45.5	0.602	– 50.6
0.25	0.650	–123.2	14.07	114.5	0.046	41.9	0.524	– 55.9
0.30	0.645	–132.9	12.18	109.1	0.049	39.8	0.465	– 59.5
0.40	0.666	–146.1	9.65	101.8	0.054	35.3	0.392	– 66.5
0.50	0.669	–158.2	7.98	94.9	0.055	34.2	0.329	– 71.0
0.60	0.663	–166.6	6.74	89.6	0.058	35.3	0.291	– 73.1
0.70	0.658	–173.4	5.81	85.1	0.061	36.6	0.268	– 75.0
0.80	0.657	–178.1	5.11	81.2	0.066	36.9	0.257	– 76.8
0.90	0.676	177.6	4.59	77.9	0.069	34.9	0.246	– 81.2
1.00	0.684	172.2	4.15	74.1	0.069	35.8	0.229	– 83.8
1.20	0.687	163.7	3.45	68.0	0.075	38.6	0.213	– 87.6
1.40	0.692	156.8	2.98	62.7	0.081	38.6	0.210	– 93.7
1.50	0.692	153.2	2.79	59.8	0.084	39.5	0.210	– 95.6
1.60	0.696	149.9	2.62	56.8	0.087	40.2	0.212	– 97.8
1.80	0.703	143.4	2.34	51.1	0.095	40.6	0.216	–101.4
2.00	0.714	138.0	2.09	45.9	0.101	40.5	0.219	–106.2
2.50	0.758	126.1	1.66	34.4	0.118	40.5	0.240	–122.1
3.00	0.763	113.6	1.38	23.1	0.136	38.6	0.269	–131.3

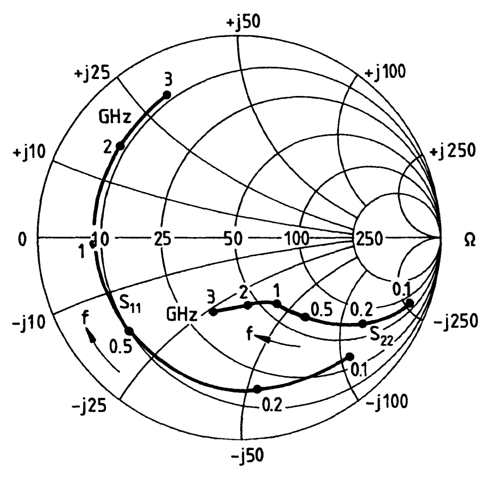
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.545	–113.4	35.23	128.3	0.020	53.9	0.631	– 54.0
0.15	0.585	–133.8	26.85	116.3	0.023	48.8	0.488	– 66.8
0.20	0.605	–146.4	21.33	108.7	0.026	47.8	0.396	– 75.5
0.25	0.611	–154.9	17.49	103.3	0.029	48.1	0.336	– 81.9
0.30	0.613	–160.5	14.77	99.5	0.032	49.0	0.294	– 86.3
0.40	0.648	–167.4	11.44	94.5	0.037	46.4	0.259	– 96.9
0.50	0.658	–176.1	9.32	89.0	0.039	50.2	0.215	–105.7
0.60	0.653	178.1	7.79	84.8	0.044	53.4	0.191	–109.5
0.70	0.649	173.6	6.67	81.2	0.050	54.9	0.179	–112.5
0.80	0.647	170.4	5.85	78.1	0.057	54.2	0.178	–114.4
0.90	0.668	167.6	5.24	75.5	0.060	51.6	0.181	–120.8
1.00	0.676	163.1	4.73	72.2	0.063	53.5	0.172	–126.1
1.20	0.680	156.3	3.93	67.0	0.073	54.9	0.165	–131.4
1.40	0.687	150.5	3.39	62.4	0.082	53.2	0.172	–137.3
1.50	0.686	147.1	3.18	59.7	0.087	53.3	0.173	–138.6
1.60	0.691	144.3	2.98	57.1	0.092	53.3	0.176	–139.8
1.80	0.697	138.6	2.66	51.9	0.102	51.8	0.181	–142.0
2.00	0.707	133.8	2.37	47.1	0.111	50.2	0.189	–145.9
2.50	0.748	123.0	1.89	36.8	0.132	46.5	0.222	–157.1
3.00	0.754	111.2	1.57	25.9	0.153	41.9	0.246	–162.1

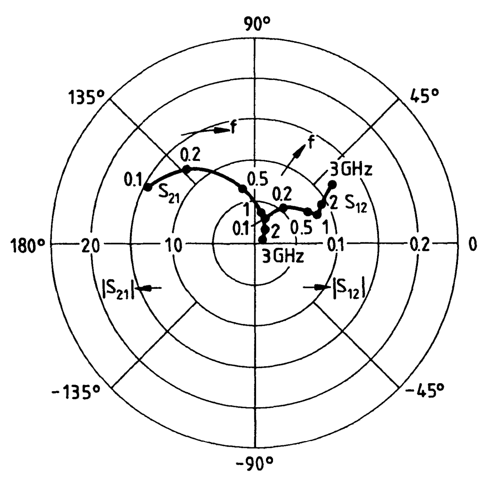
$I_C = 5$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.796	– 46.6	14.63	153.0	0.033	67.0	0.911	– 20.5
0.15	0.772	– 66.3	13.32	141.9	0.044	58.1	0.837	– 28.4
0.20	0.751	– 82.9	11.95	132.5	0.053	51.0	0.759	– 34.6
0.25	0.727	– 96.7	10.64	124.8	0.060	45.5	0.692	– 39.2
0.30	0.708	–107.6	9.46	118.7	0.065	41.5	0.636	– 42.4
0.40	0.717	–125.9	7.86	109.3	0.071	33.7	0.547	– 48.5
0.50	0.699	–140.1	6.58	101.3	0.074	30.2	0.483	– 51.4
0.60	0.690	–150.6	5.61	94.9	0.076	28.1	0.440	– 53.4
0.70	0.682	–159.2	4.89	89.5	0.078	27.2	0.411	– 55.0
0.80	0.681	–165.1	4.32	85.2	0.082	26.3	0.394	– 56.8
0.90	0.695	–171.5	3.91	81.0	0.082	23.8	0.375	– 59.3
1.00	0.700	–178.1	3.54	76.7	0.082	23.7	0.359	– 60.7
1.20	0.699	171.6	2.96	69.5	0.084	24.8	0.342	– 64.2
1.40	0.707	163.5	2.56	63.4	0.086	24.3	0.333	– 68.8
1.50	0.707	159.4	2.39	60.4	0.086	25.7	0.332	– 70.7
1.60	0.713	155.8	2.26	57.2	0.087	26.6	0.332	– 72.7
1.80	0.715	148.4	2.01	51.1	0.090	28.0	0.335	– 76.9
2.00	0.726	142.1	1.80	45.2	0.093	29.3	0.336	– 81.1
2.50	0.764	128.7	1.43	33.2	0.103	33.9	0.349	– 95.9
3.00	0.776	116.2	1.17	21.0	0.117	36.5	0.376	–106.7

S_{11}, S_{22} = f (f)
$I_C = 5$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



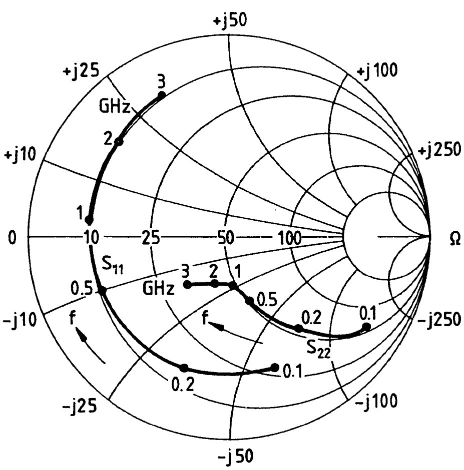
S_{12}, S_{21} = f (f)
$I_C = 5$ mA, $V_{CE} = 5$ V, $Z_0 = 50\ \Omega$



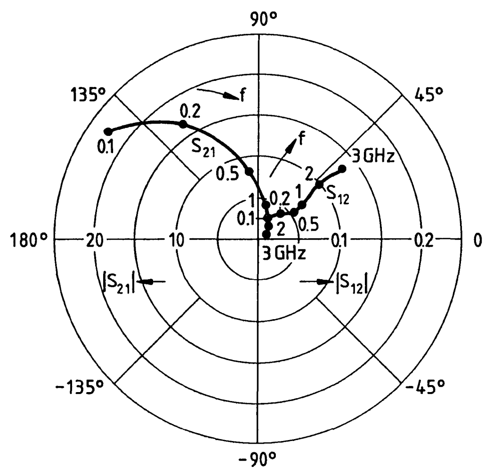
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.690	– 65.1	22.92	144.7	0.028	61.6	0.833	– 30.9
0.15	0.675	– 88.5	19.63	132.3	0.037	52.4	0.719	– 41.1
0.20	0.664	–106.2	16.74	122.8	0.042	46.6	0.619	– 48.4
0.25	0.651	–119.4	14.33	115.7	0.046	43.0	0.544	– 53.4
0.30	0.639	–128.8	12.39	110.5	0.049	40.8	0.488	– 56.7
0.40	0.674	–144.6	9.99	102.6	0.053	35.1	0.403	– 64.5
0.50	0.661	–156.5	8.19	95.7	0.055	35.0	0.343	– 67.5
0.60	0.656	–165.1	6.90	90.4	0.058	35.9	0.307	– 69.6
0.70	0.650	–171.7	5.96	86.0	0.062	36.9	0.284	– 71.2
0.80	0.649	–176.1	5.24	82.4	0.067	36.7	0.274	– 73.4
0.90	0.670	178.8	4.73	78.9	0.068	35.1	0.258	– 77.3
1.00	0.675	173.2	4.27	75.0	0.069	36.5	0.242	– 79.0
1.20	0.677	164.3	3.55	68.8	0.075	38.8	0.231	– 82.9
1.40	0.688	157.3	3.07	63.5	0.081	38.5	0.225	– 88.4
1.50	0.688	153.6	2.87	60.7	0.084	39.9	0.224	– 90.1
1.60	0.695	150.5	2.71	57.8	0.087	40.4	0.226	– 92.1
1.80	0.696	143.6	2.41	52.3	0.094	40.9	0.231	– 95.8
2.00	0.705	138.1	2.16	46.9	0.100	40.8	0.233	–100.2
2.50	0.747	125.8	1.71	35.9	0.117	41.0	0.253	–114.9
3.00	0.755	114.1	1.41	24.3	0.134	39.5	0.280	–123.8

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



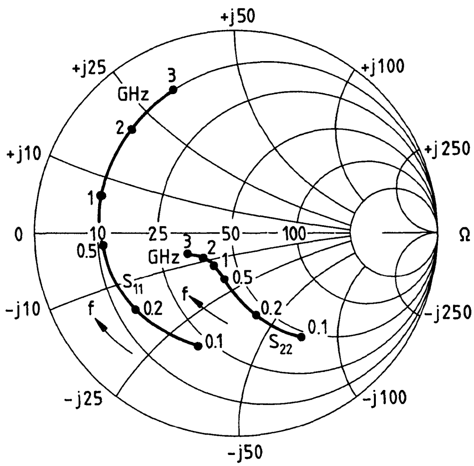
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



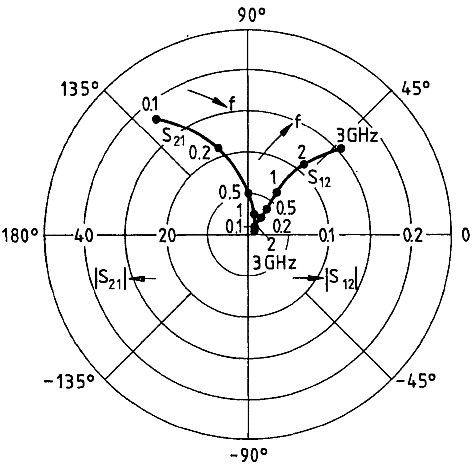
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.556	–106.4	36.18	129.6	0.020	54.6	0.648	– 51.6
0.15	0.581	–128.5	27.79	117.6	0.024	49.1	0.506	– 64.3
0.20	0.595	–142.1	22.15	109.7	0.027	47.9	0.411	– 72.7
0.25	0.597	–151.0	18.19	104.3	0.029	48.3	0.349	– 78.3
0.30	0.595	–156.4	15.32	100.6	0.033	48.9	0.312	– 81.9
0.40	0.651	–166.5	12.09	94.8	0.035	46.2	0.260	– 95.6
0.50	0.640	–174.8	9.73	89.5	0.039	50.7	0.217	–100.6
0.60	0.636	179.5	8.11	85.5	0.045	53.4	0.195	–104.4
0.70	0.633	174.9	6.97	82.0	0.051	54.7	0.184	–106.9
0.80	0.630	172.4	6.10	79.2	0.057	53.3	0.185	–109.5
0.90	0.655	168.6	5.50	76.3	0.059	51.9	0.182	–116.4
1.00	0.662	163.9	4.95	73.0	0.063	53.9	0.172	–120.0
1.20	0.664	156.8	4.11	67.7	0.074	54.8	0.169	–124.6
1.40	0.676	150.9	3.54	63.3	0.082	53.1	0.174	–130.9
1.50	0.676	147.6	3.32	60.8	0.087	53.6	0.174	–132.0
1.60	0.682	144.7	3.12	58.1	0.092	53.3	0.177	–133.4
1.80	0.683	138.8	2.78	53.1	0.102	51.8	0.184	–135.5
2.00	0.693	133.8	2.49	48.1	0.111	50.1	0.189	–139.3
2.50	0.733	122.8	1.97	38.2	0.132	46.8	0.221	–150.2
3.00	0.744	111.6	1.63	27.4	0.152	42.5	0.244	–155.3

S_{11}, S_{22} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



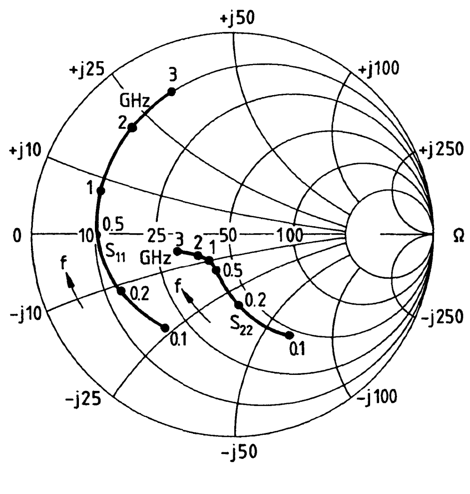
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



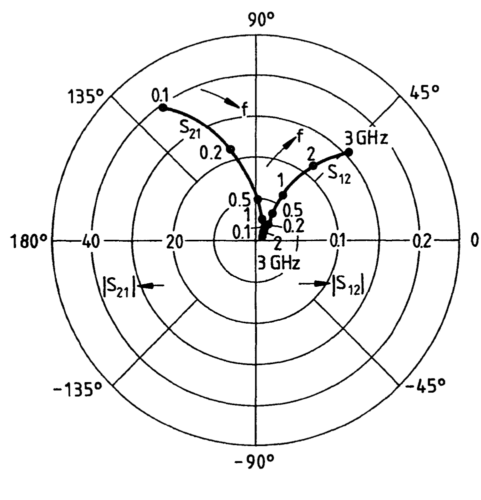
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.544	–124.1	39.07	123.8	0.017	53.8	0.560	– 59.8
0.15	0.580	–142.5	28.97	112.6	0.020	50.5	0.425	– 72.7
0.20	0.599	–153.3	22.68	105.5	0.023	51.3	0.341	– 81.3
0.25	0.602	–160.4	18.45	100.8	0.026	52.9	0.290	– 87.0
0.30	0.598	–164.3	15.46	97.7	0.029	53.7	0.262	– 90.5
0.40	0.657	–172.5	12.13	92.5	0.032	51.8	0.225	–106.1
0.50	0.647	–179.8	9.73	87.6	0.036	56.9	0.190	–111.6
0.60	0.643	175.4	8.10	83.9	0.043	59.3	0.174	–115.5
0.70	0.638	171.4	6.95	80.6	0.049	60.1	0.166	–117.8
0.80	0.635	169.3	6.08	78.0	0.056	57.7	0.171	–119.8
0.90	0.661	165.9	5.47	75.2	0.058	56.6	0.172	–126.8
1.00	0.666	161.6	4.93	72.1	0.062	58.5	0.164	–130.6
1.20	0.670	154.8	4.08	66.9	0.074	58.3	0.165	–134.6
1.40	0.682	149.3	3.53	62.6	0.083	56.5	0.172	–139.9
1.50	0.681	146.0	3.30	60.1	0.088	56.6	0.173	–141.1
1.60	0.686	143.3	3.11	57.6	0.093	56.2	0.176	–142.2
1.80	0.688	137.5	2.77	52.6	0.104	54.3	0.184	–143.7
2.00	0.698	132.6	2.47	47.7	0.113	52.3	0.190	–147.1
2.50	0.737	121.9	1.96	38.1	0.135	48.2	0.224	–156.6
3.00	0.746	111.0	1.63	27.2	0.155	43.5	0.246	–160.9

S_{11}, S_{22} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



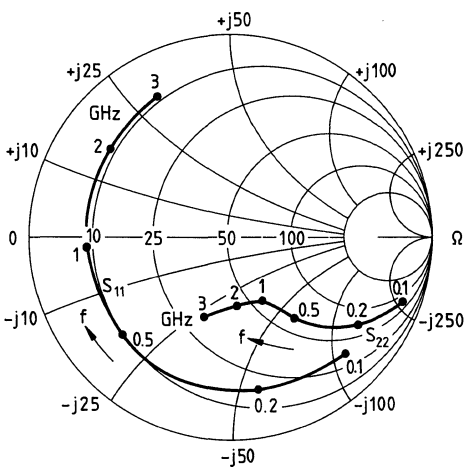
S_{12}, S_{21} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



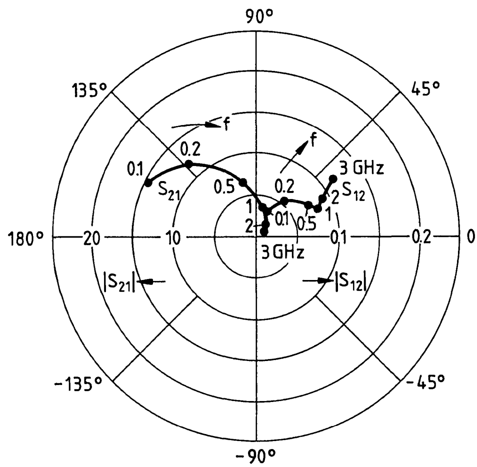
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.808	– 44.9	14.57	153.6	0.032	67.7	0.914	– 19.8
0.15	0.782	– 64.1	13.32	142.7	0.044	58.9	0.843	– 27.5
0.20	0.758	– 80.6	12.01	133.4	0.053	51.7	0.768	– 33.6
0.25	0.733	– 94.1	10.74	125.8	0.059	46.2	0.703	– 38.2
0.30	0.712	–105.1	9.56	119.5	0.064	42.2	0.647	– 41.5
0.40	0.718	–123.7	7.96	110.2	0.071	34.4	0.558	– 47.6
0.50	0.698	–138.0	6.68	102.1	0.074	30.7	0.493	– 50.5
0.60	0.687	–148.9	5.71	95.7	0.076	28.6	0.449	– 52.6
0.70	0.678	–157.6	4.98	90.3	0.078	27.4	0.420	– 54.1
0.80	0.676	–163.7	4.41	85.8	0.082	26.5	0.403	– 55.8
0.90	0.691	–170.2	3.99	81.7	0.083	24.0	0.383	– 58.3
1.00	0.694	–176.8	3.62	77.3	0.082	23.8	0.366	– 59.7
1.20	0.694	172.7	3.02	70.0	0.084	24.7	0.348	– 63.1
1.40	0.702	164.3	2.61	64.0	0.086	24.4	0.338	– 67.6
1.50	0.700	160.3	2.44	60.9	0.086	25.6	0.337	– 69.4
1.60	0.709	156.6	2.30	57.7	0.087	26.4	0.337	– 71.4
1.80	0.708	149.0	2.06	51.7	0.090	27.8	0.340	– 75.5
2.00	0.721	142.8	1.84	45.8	0.092	29.0	0.339	– 79.7
2.50	0.759	129.4	1.46	33.7	0.102	33.5	0.351	– 94.2
3.00	0.772	116.6	1.19	21.6	0.116	36.1	0.376	–105.0

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



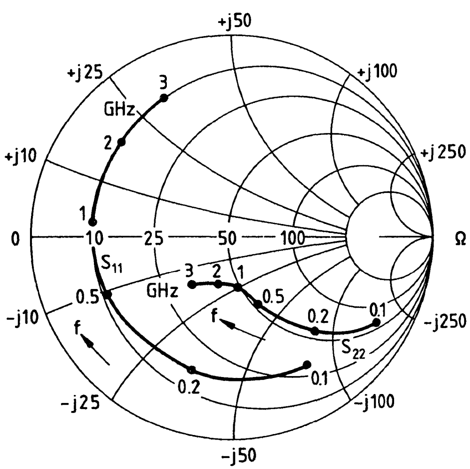
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



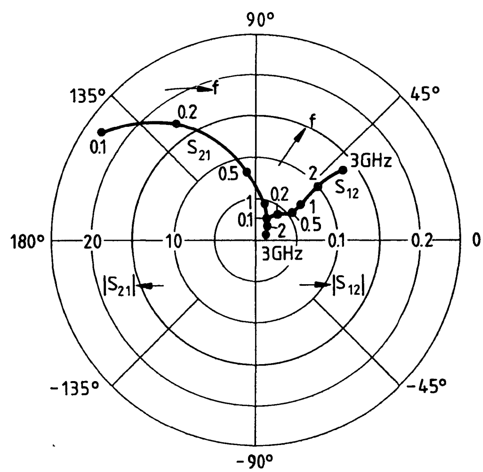
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.707	– 62.3	23.03	145.5	0.028	62.2	0.838	– 30.0
0.15	0.686	– 85.3	19.82	133.2	0.036	53.2	0.729	– 40.1
0.20	0.669	–103.0	16.98	123.8	0.042	47.3	0.631	– 47.4
0.25	0.653	–116.4	14.59	116.6	0.046	43.5	0.554	– 52.4
0.30	0.639	–126.0	12.63	111.3	0.049	41.3	0.498	– 55.7
0.40	0.670	–142.3	10.22	103.3	0.054	35.5	0.412	– 63.6
0.50	0.656	–154.4	8.39	96.3	0.056	35.3	0.351	– 66.6
0.60	0.648	–163.3	7.08	91.0	0.058	35.9	0.313	– 68.7
0.70	0.643	–170.3	6.12	86.5	0.062	36.9	0.290	– 70.3
0.80	0.642	–174.7	5.38	83.0	0.067	36.7	0.279	– 72.5
0.90	0.662	180.0	4.85	79.4	0.068	34.8	0.262	– 76.4
1.00	0.669	174.3	4.39	75.6	0.069	36.3	0.246	– 78.0
1.20	0.669	165.2	3.65	69.3	0.076	38.6	0.233	– 81.8
1.40	0.679	158.2	3.15	64.0	0.081	38.1	0.226	– 87.2
1.50	0.679	154.3	2.95	61.2	0.084	39.6	0.225	– 88.9
1.60	0.685	151.1	2.78	58.4	0.087	40.0	0.226	– 90.8
1.80	0.687	144.3	2.47	52.9	0.094	40.5	0.231	– 94.6
2.00	0.698	138.7	2.22	47.4	0.100	40.4	0.232	– 98.8
2.50	0.739	126.2	1.76	36.5	0.117	40.6	0.250	–113.6
3.00	0.748	114.3	1.45	24.9	0.134	39.2	0.276	–122.5

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



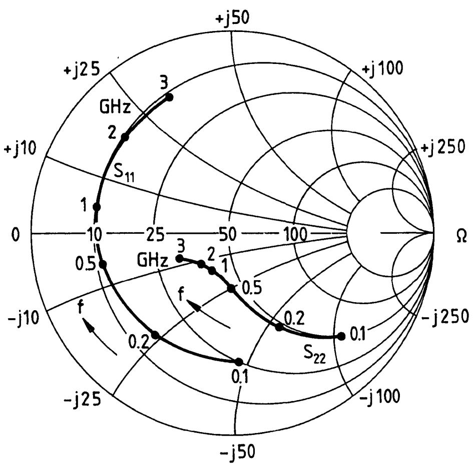
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



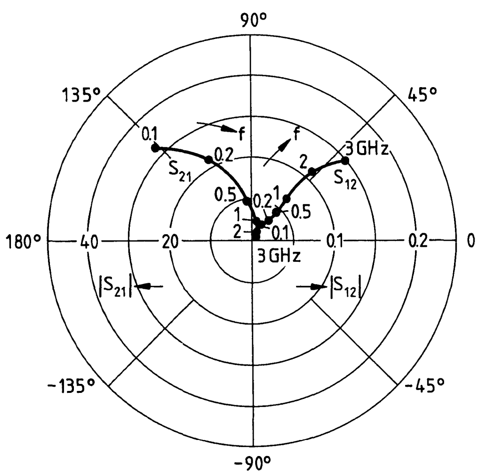
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.607	– 85.2	32.08	136.1	0.023	57.0	0.731	– 42.7
0.15	0.607	–109.4	25.79	123.6	0.029	49.5	0.592	– 54.6
0.20	0.609	–125.7	21.10	114.9	0.032	46.1	0.492	– 62.7
0.25	0.604	–137.3	17.60	108.7	0.035	44.7	0.419	– 68.5
0.30	0.600	–145.4	15.00	104.2	0.038	44.4	0.367	– 72.3
0.40	0.630	–155.3	11.73	98.4	0.043	41.3	0.315	– 81.2
0.50	0.637	–166.5	9.64	92.2	0.044	42.9	0.256	– 88.1
0.60	0.630	–173.8	8.08	87.6	0.048	45.6	0.225	– 91.0
0.70	0.624	–179.5	6.94	83.6	0.053	47.5	0.207	– 93.4
0.80	0.622	176.6	6.09	80.3	0.059	47.6	0.201	– 95.5
0.90	0.645	173.3	5.46	77.6	0.062	45.1	0.197	–101.7
1.00	0.654	168.0	4.94	74.0	0.064	46.7	0.182	–106.2
1.20	0.657	160.2	4.10	68.5	0.074	49.0	0.169	–111.1
1.40	0.663	153.9	3.54	63.7	0.081	47.8	0.170	–117.9
1.50	0.664	150.4	3.31	61.1	0.085	48.3	0.170	–119.5
1.60	0.666	147.3	3.11	58.4	0.090	48.6	0.173	–121.4
1.80	0.675	141.2	2.77	53.1	0.099	47.8	0.176	–124.2
2.00	0.684	136.1	2.48	48.2	0.107	46.6	0.181	–128.9
2.50	0.731	124.7	1.97	37.7	0.127	44.1	0.207	–143.0
3.00	0.735	112.7	1.64	26.7	0.146	40.4	0.232	–149.6

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



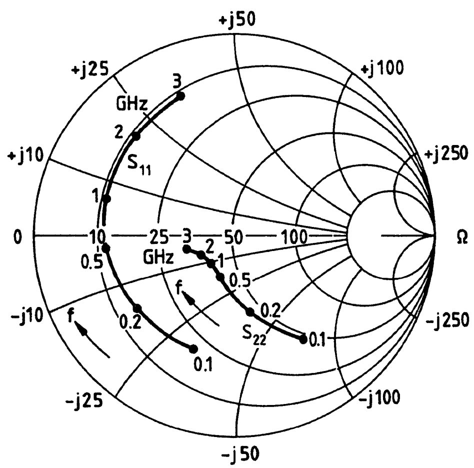
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



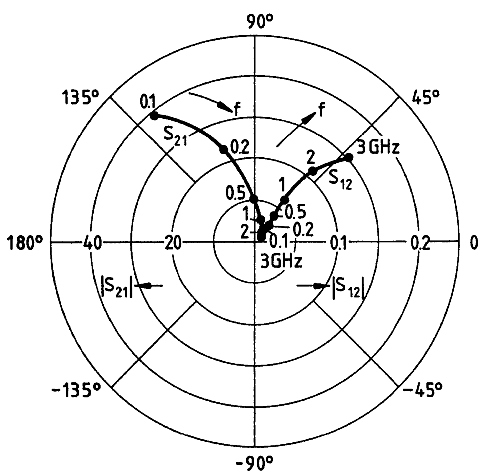
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.558	–108.0	38.69	127.7	0.019	53.5	0.614	– 54.7
0.15	0.578	–129.8	29.36	115.9	0.023	49.3	0.473	– 67.6
0.20	0.590	–143.1	23.28	108.3	0.025	48.9	0.383	– 76.2
0.25	0.589	–152.1	19.06	103.1	0.028	49.3	0.324	– 82.5
0.30	0.589	–158.1	16.07	99.4	0.031	50.1	0.284	– 86.9
0.40	0.624	–165.3	12.46	94.6	0.036	47.6	0.254	– 97.8
0.50	0.633	–174.6	10.16	89.1	0.039	51.4	0.208	–107.0
0.60	0.625	179.3	8.49	85.0	0.044	54.6	0.184	–110.8
0.70	0.620	174.6	7.26	81.5	0.050	56.1	0.173	–113.6
0.80	0.616	171.6	6.36	78.6	0.057	55.2	0.173	–115.4
0.90	0.642	168.7	5.71	76.1	0.060	52.4	0.176	–122.4
1.00	0.650	163.9	5.16	72.8	0.063	54.3	0.167	–128.0
1.20	0.654	156.9	4.27	67.7	0.074	55.5	0.159	–133.3
1.40	0.661	151.1	3.70	63.2	0.083	53.6	0.166	–139.5
1.50	0.661	147.7	3.46	60.6	0.088	53.7	0.166	–140.8
1.60	0.665	144.7	3.25	58.0	0.093	53.5	0.169	–142.0
1.80	0.671	139.1	2.89	52.9	0.103	51.8	0.174	–144.1
2.00	0.681	134.3	2.58	48.2	0.112	50.2	0.180	–148.0
2.50	0.725	123.3	2.05	38.1	0.133	46.2	0.212	–159.4
3.00	0.732	111.4	1.71	27.4	0.154	41.4	0.234	–164.2

S_{11}, S_{22} = f (*f*)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



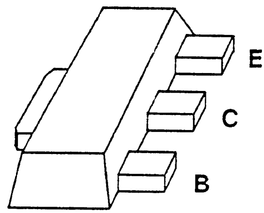
S_{12}, S_{21} = f (*f*)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFQ 17P

- For low-distortion broadband amplifiers up to 900 MHz at collector currents from 20 to 150 mA.



Type	Marking	Ordering code (tape and reel)	Package
BFQ 17P	FD	Q 62702 – F983	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	150	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	300	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤125	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

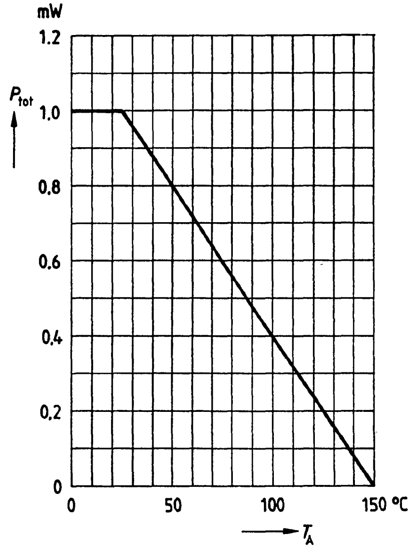
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 10 mA, I_B = 0	$V_{(BR)CEO}$	25	–	–	V
Collector-base cutoff current V_{CB} = 20 V, I_E = 0 V_{CB} = 20 V, I_E = 0, T_A = 125 °C	I_{CBO}	 – –	 – –	 0.1 20	µA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	100	nA
DC current gain I_C = 50 mA, V_{CE} = 5 V I_C = 150 mA, V_{CE} = 5 V	h_{FE}	 25 25	 – –	 – –	–
Collector-emitter saturation voltage I_C = 100 mA, I_B = 10 mA	V_{CEsat}	–	0.2	0.5	V

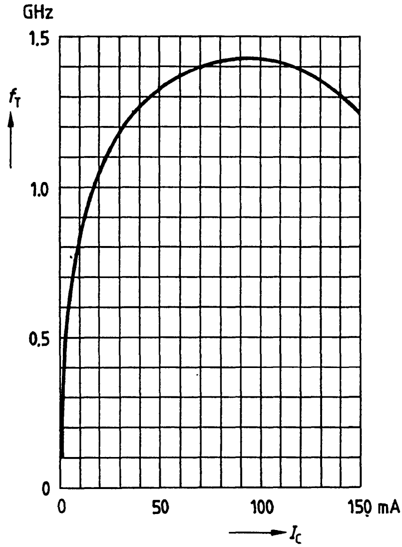
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency I_C = 70 mA, V_{CE} = 5 V, f = 200 MHz I_C = 150 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 – –	 1.4 1.2	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.9	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	13	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	2.5	4	pF
Power gain I_C = 60 mA, V_{CE} = 15 V, f = 500 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 60 mA, V_{CE} = 15 V, d_{IM} = 60 dB f_1 = 206 MHz, f_2 = 210 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	480	–	mV
Third order intercept point I_C = 60 mA, V_{CE} = 15 V, f = 200 MHz	IP_3	–	36.5	–	dBm

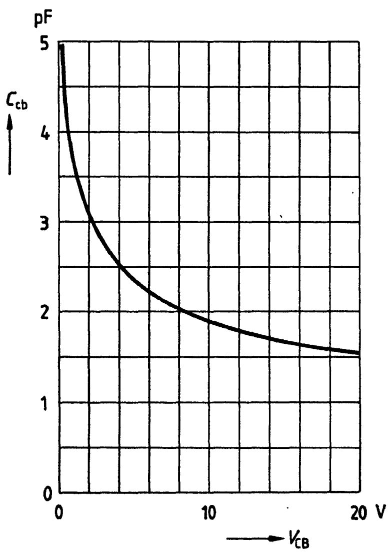
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



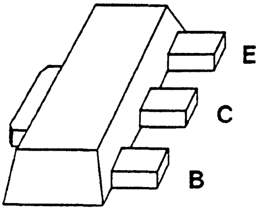
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



NPN Silicon RF Transistor

BFQ 19P

- For low-distortion broadband amplifiers in antenna and telecommunications systems at collector currents from 10 to 70 mA.



For new design refer to BFQ 19S

Type	Marking	Ordering code (tape and reel)	Package
BFQ 19P	FE	Q 62702 – F1060	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	75	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	150	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤125	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

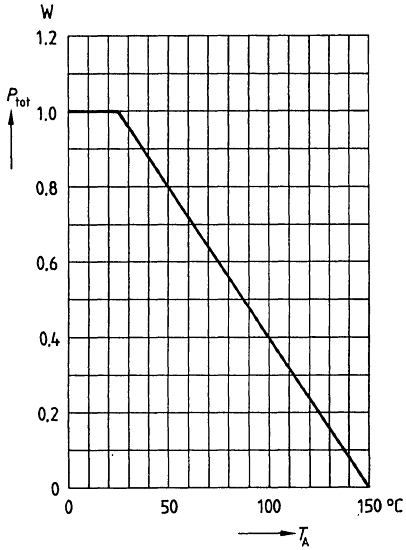
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V	h_{FE}	25	70	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

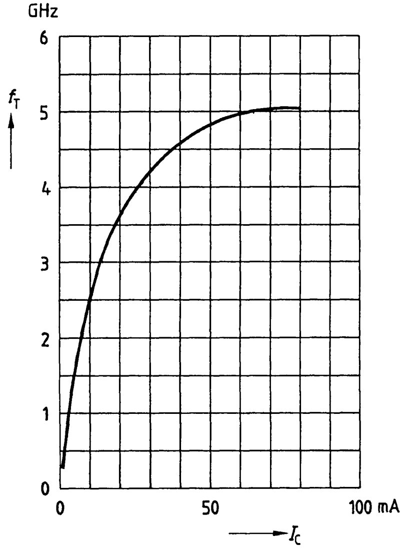
AC characteristics

Parameter	Symbol	Values min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 10 V, f = 200 MHz I_C = 75 mA, V_{CE} = 10 V, f = 200 MHz	f_T	 4 4.4	 4.8 5.1	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1.1	1.5	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.5	–	pF
Noise figure I_C = 50 mA, V_{CE} = 10 V, f = 800 MHz, $Z_S = Z_{Sopt}$	F	–	3.8	–	dB
Power gain I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 70 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, $Z_S = Z_L$ = 50 Ω	$V_{o1} = V_{o2}$	–	500	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	37	–	dBm

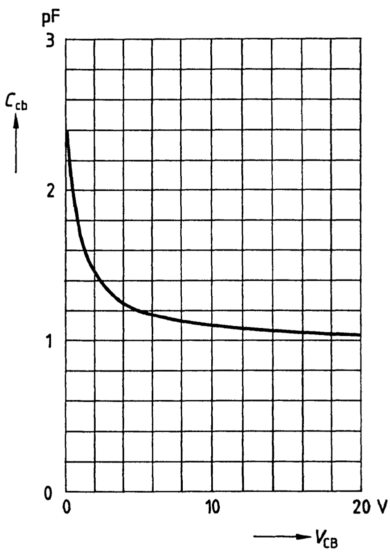
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 200 MHz



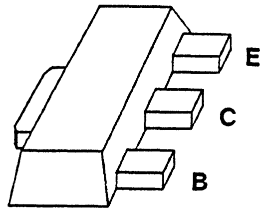
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



NPN Silicon RF Transistor — BFQ 19S

- For low-noise, low-distortion broadband amplifiers in antenna and telecommunications systems up to 1.5 GHz at collector currents from 10 to 70 mA.

- CECC-type available: CECC 50002/259.



Type	Marking	Ordering code (tape and reel)	Package
BFQ 19S	FG	Q 62702 – F1088	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	75	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	150	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤125	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

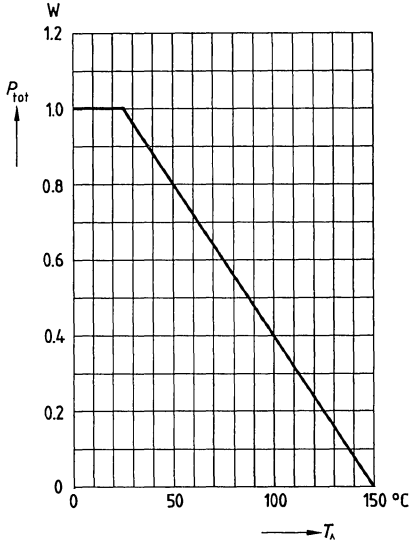
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 50 mA, V_{CE} = 10 V	h_{FE}	25	70	–	–
Collector-emitter saturation voltage I_C = 75 mA, I_B = 7.5 mA	V_{CEsat}	–	0.2	0.5	V

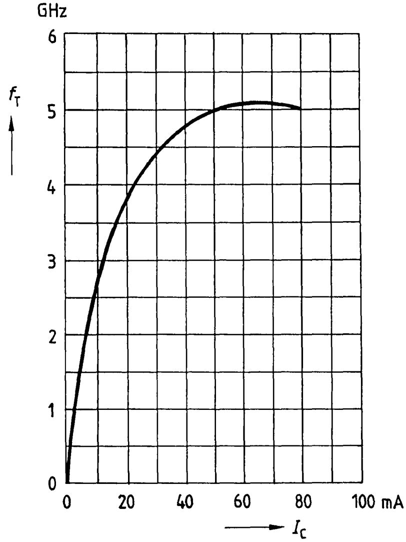
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency	f_T				GHz
I_C = 50 mA, V_{CE} = 10 V, f = 200 MHz		–	5	–	
I_C = 70 mA, V_{CE} = 10 V, f = 200 MHz		–	5.1	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	1	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.4	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	4.5	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	1.45	–	pF
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 50 Ω		–	0.9	–	
I_C = 50 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = Z_{Sopt}		–	2.8	–	
Power gain I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	11.8	–	dB
Linear output voltage two-tone intermodulation test I_C = 70 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	520	–	mV
Third order intercept point I_C = 70 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	37.5	–	dBm

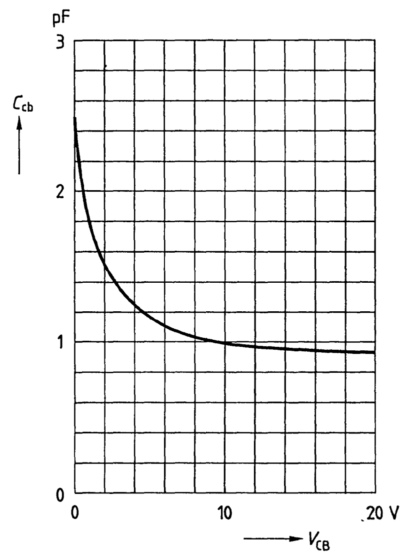
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

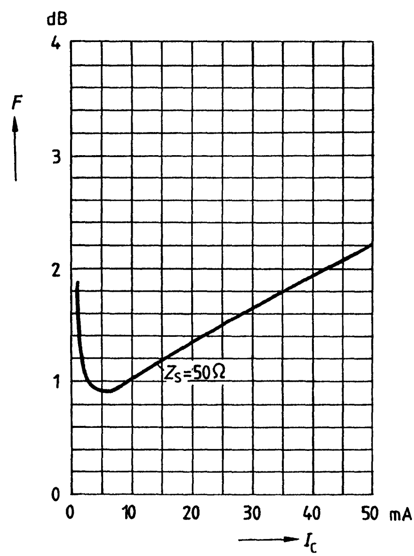
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.9	–	(Z_S = 50 Ω)		–	–	0.9	–

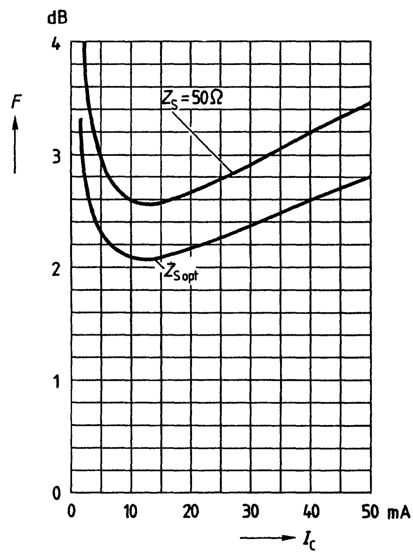
I_C = 50 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.2	–	–	–	–	–	2.2	–
0.8	2.8	–	–	–	–	–	3.5	–

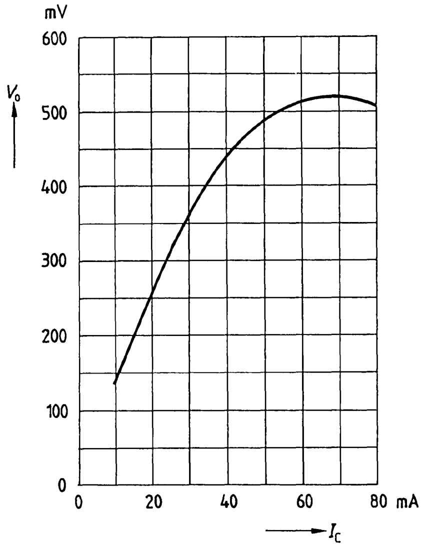
Noise figure F = f (I_C)
V_{CE} = 10 V, f = 10 MHz



Noise figure F = f (I_C)
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



Linear output voltage $V_O = f(I_C)$
$V_{CE} = 10$ V, $d_{IM} = 60$ dB, $f_1 = 806$ MHz
$f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$

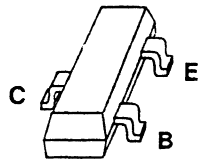


NPN Silicon RF Transistor

BFQ 29P

- For low-noise IF and broadband amplifiers up to 1 GHz at collector currents from 1 to 20 mA.

- CECC-type available: CECC 50002/258.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFQ 29P	KC	Q 62702 – F659	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

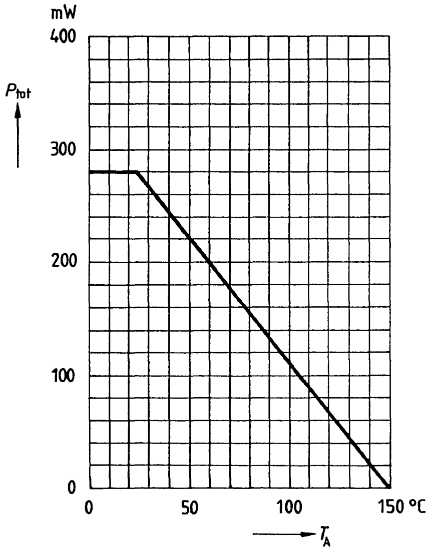
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 3 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 50	 – 140	 250 –	–
Collector-emitter saturation voltage I_C = 20 mA, I_B = 1 mA	V_{CEsat}	–	0.1	0.4	V

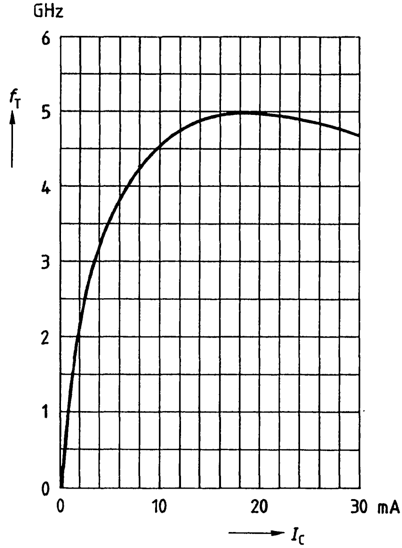
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency I_C = 3 mA, V_{CE} = 6 V, f = 200 MHz I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz	f_T	 – 3.6	 2.7 5	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.5	0.65	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.35	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.8	–	pF
Noise figure I_C = 3 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 4 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω	F	 – –	 0.9 1.5	 1.2 –	dB
Power gain I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	dB
Transducer gain I_C = 20 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	dB
Linear output voltage two-tone intermodulation test I_C = 20 mA, V_{CE} = 6 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	180	–	mV
Third order intercept point I_C = 20 mA, V_{CE} = 6 V, f = 800 MHz	IP_3	–	28	–	dBm

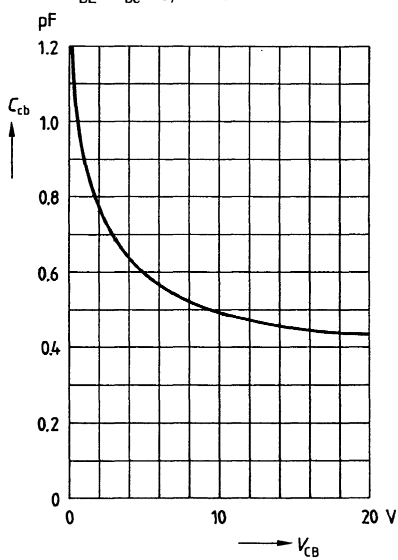
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



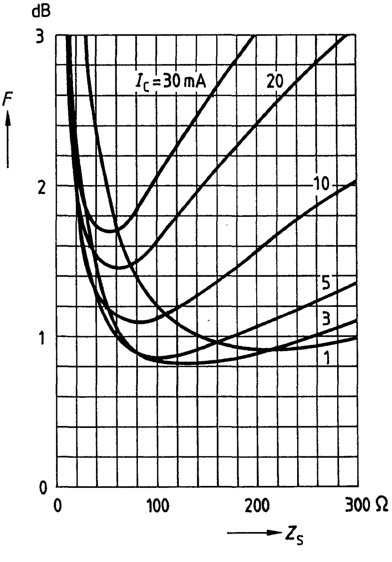
Common Emitter Noise Parameters
I_C = 3 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.85	–	(Z_S = 130 Ω)		–	–	1.2	–

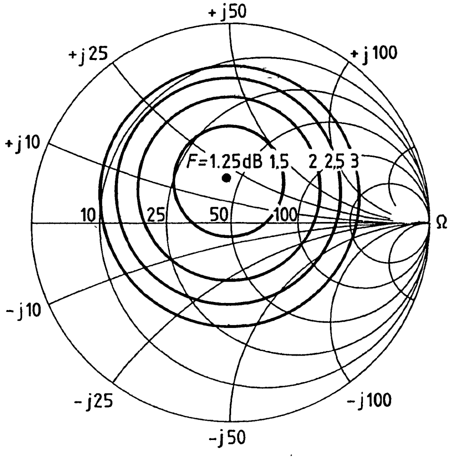
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.85	–	(Z_S = 100 Ω)		–	–	1.1	–
0.8	1.25	13	0.25	93.5	11.1	0.20	1.45	14

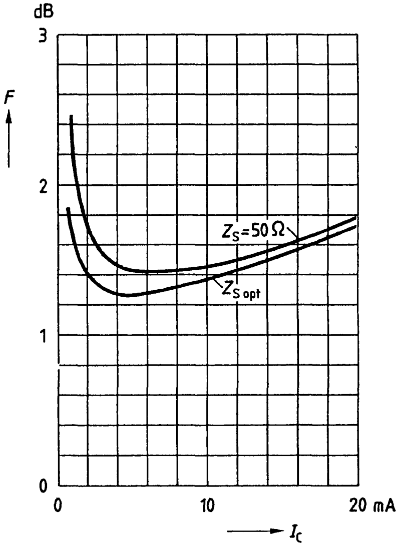
Noise figure F = f (Z_S)
V_{CE} = 6 V, f = 10 MHz



Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, $I_C = 5$ mA, $V_{CE} = 6$ V, $f = 800$ MHz



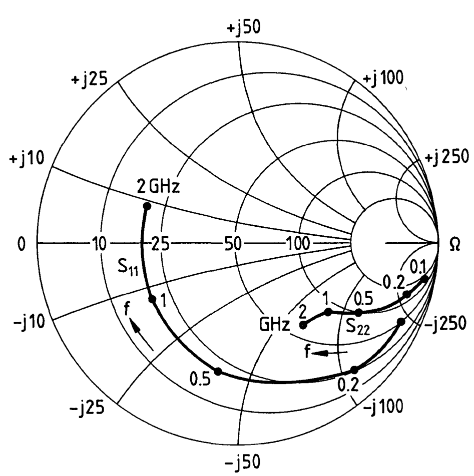
Noise figure $F = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)



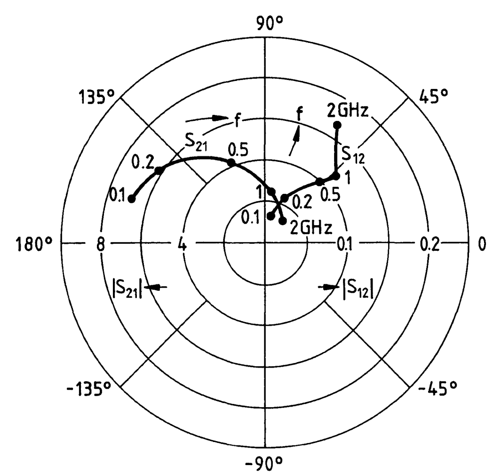
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.93	– 20	6.76	158	0.03	76	0.97	– 7
0.2	0.86	– 45	6.42	144	0.06	65	0.89	–17
0.3	0.79	– 62	5.16	133	0.08	57	0.85	–23
0.5	0.66	– 93	4.19	113	0.11	47	0.73	–29
0.8	0.50	–129	2.99	92	0.11	41	0.62	–33
1.0	0.47	–147	2.48	82	0.12	41	0.59	–35
1.2	0.45	–161	2.11	74	0.13	42	0.57	–37
1.5	0.43	179	1.78	63	0.14	47	0.55	–40
1.8	0.45	159	1.51	54	0.16	52	0.54	–46
2.0	0.46	149	1.42	48	0.17	56	0.52	–48

S_{11}, S_{22} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



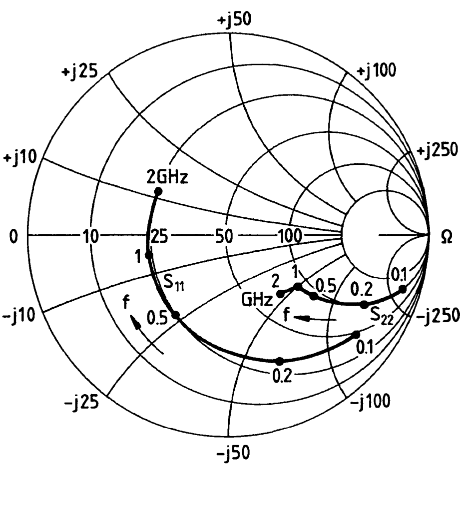
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



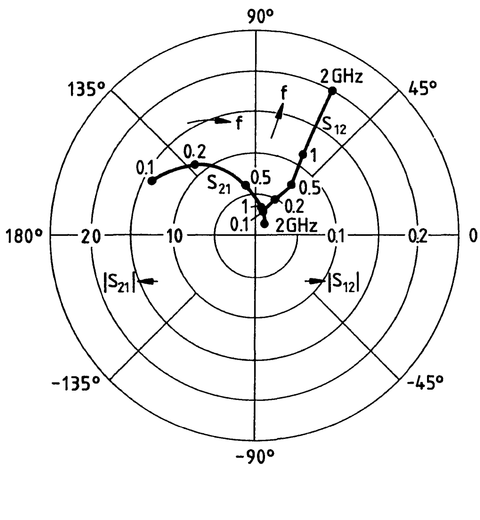
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 31	13.96	147	0.03	72	0.89	–13
0.2	0.69	– 66	11.55	129	0.05	60	0.76	–28
0.3	0.57	– 84	8.56	119	0.06	55	0.68	–31
0.5	0.46	–118	6.06	102	0.08	53	0.54	–34
0.8	0.35	–152	4.00	85	0.10	55	0.46	–33
1.0	0.34	–167	3.25	77	0.12	57	0.45	–35
1.2	0.34	–180	2.74	71	0.13	58	0.43	–36
1.5	0.34	164	2.28	61	0.16	59	0.42	–39
1.8	0.36	148	1.94	54	0.19	60	0.41	–44
2.0	0.37	139	1.80	49	0.20	60	0.39	–44

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



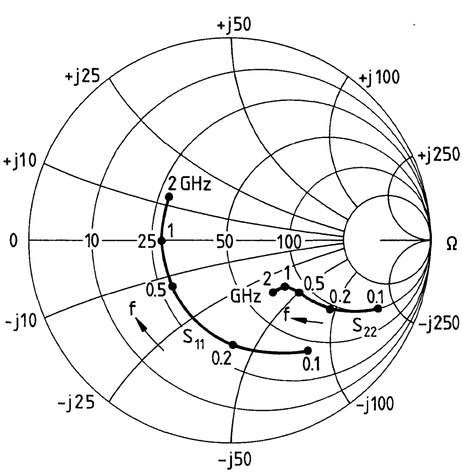
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



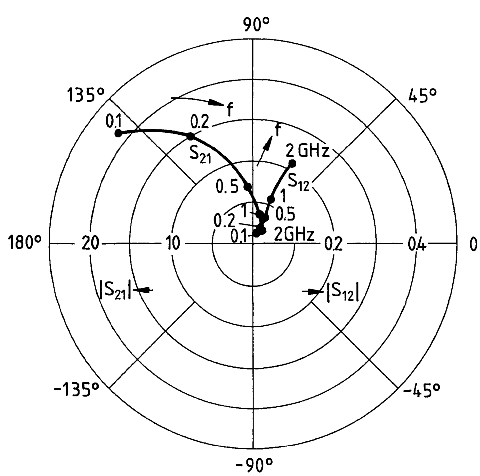
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.65	– 46	20.65	135	0.03	69	0.79	–18
0.2	0.53	– 87	14.88	117	0.04	58	0.61	–32
0.3	0.42	–104	10.41	108	0.05	59	0.54	–33
0.5	0.35	–137	6.92	94	0.07	61	0.43	–33
0.8	0.29	–169	4.47	80	0.10	63	0.39	–30
1.0	0.30	179	3.59	74	0.12	65	0.38	–32
1.2	0.30	169	3.04	69	0.14	64	0.36	–34
1.5	0.30	155	2.50	60	0.17	63	0.36	–36
1.8	0.33	141	2.11	53	0.20	62	0.35	–41
2.0	0.35	133	1.97	49	0.22	62	0.33	–42

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



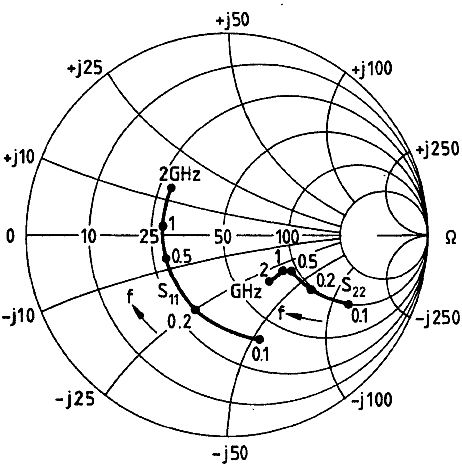
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



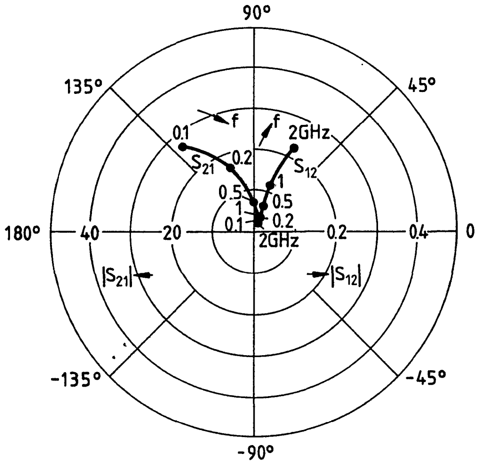
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.47	– 64	25.26	126	0.02	67	0.69	–21
0.2	0.40	–108	16.60	109	0.03	62	0.50	–32
0.3	0.33	–125	11.22	102	0.04	65	0.46	–30
0.5	0.31	–154	7.16	89	0.06	68	0.39	–28
0.8	0.28	178	4.57	77	0.09	68	0.36	–26
1.0	0.29	169	3.65	72	0.12	69	0.36	–28
1.2	0.30	161	3.09	67	0.14	68	0.35	–30
1.5	0.30	148	2.54	59	0.17	66	0.34	–33
1.8	0.33	135	2.15	52	0.21	64	0.34	–39
2.0	0.35	128	2.00	48	0.22	63	0.32	–39

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



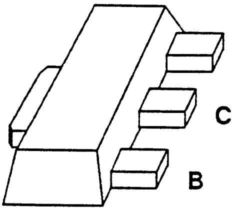
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFQ 64

- For low-distortion broadband amplifiers in antenna and telecommunications systems at collector currents from 70 to 150 mA.



Type	Marking	Ordering code (tape and reel)	Package
BFQ 64	FC	Q 62702 – F1061	SOT-89

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	20	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	200	mA
Peak collector current, $f \geq 1$ MHz	I_{CM}	250	mA
Base current	I_B	25	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	1	W
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient [1])	R_{thJA}	≤125	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

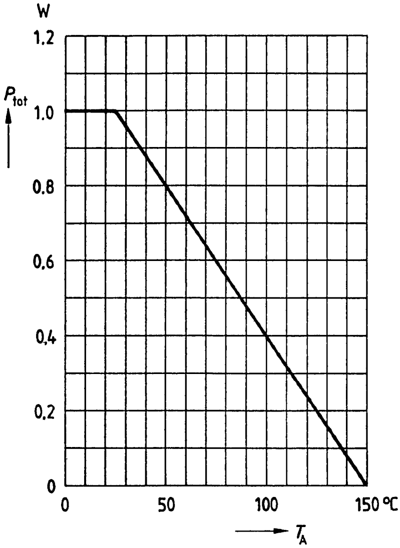
DC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Collector-emitter cutoff current V_{CE} = 30 V, V_{BE} = 0	I_{CES}	–	–	1	mA
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	200	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 120 mA, V_{CE} = 5 V	h_{FE}	25	–	–	–

AC characteristics

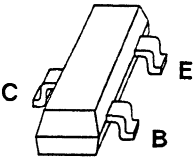
Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	–	3	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	1	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	11.5	–	pF
Power gain $I_C = 100$ mA, $V_{CE} = 10$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	10	–	dB
Linear output voltage two-tone intermodulation test $I_C = 100$ mA, $V_{CE} = 10$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	600	–	mV
Third order intercept point $I_C = 100$ mA, $V_{CE} = 10$ V, $f = 800$ MHz	IP_3	–	38.5	–	dBm

Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



- For low-noise amplifiers up to 2 GHz and broadband analog and digital applications in telecommunications systems at collector currents from 0.5 to 20 mA.

- CECC-type available: CECC 50002/257.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFQ 81	RA	Q 62702 – F1049	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	16	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	30	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

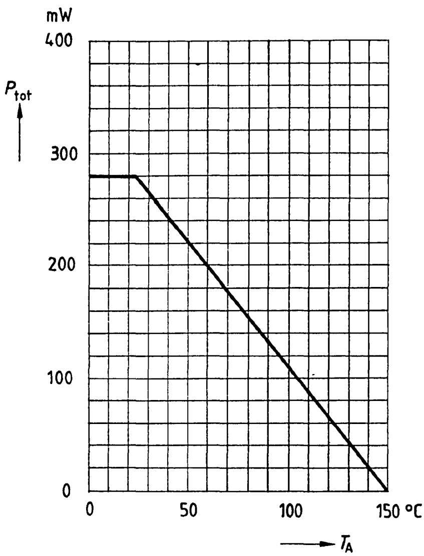
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	16	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 10 V I_C = 15 mA, V_{CE} = 10 V	h_{FE}	 50 50	 – –	 250 –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.2	0.4	V
Base-emitter voltage I_C = 10 mA, V_{CE} = 10 V	V_{BE}	–	0.78	–	V

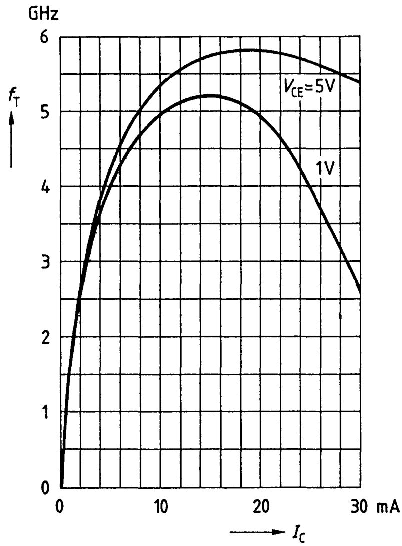
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz I_C = 15 mA, V_{CE} = 10 V, f = 200 MHz	f_T	 – –	 4.2 5.8	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.38	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.22	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.27	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.6	–	pF
Noise figure I_C = 3 mA, V_{CE} = 10 V, f = 10 MHz, Z_S = 75 Ω I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}	F	 – – –	 0.9 1.4 2.5	 – – –	dB
Power gain I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	15	–	dB
Transducer gain I_C = 20 mA, V_{CE} = 10 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.4	–	dB
Linear output voltage two-tone intermodulation test I_C = 25 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	160	–	mV
Third order intercept point I_C = 25 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	27	–	dBm

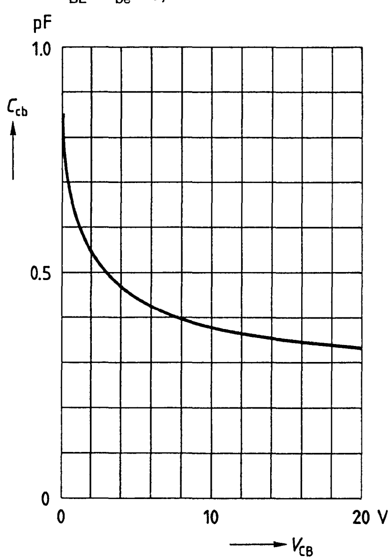
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

I_C = 3 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.7	–	(Z_S = 150 Ω)		–	–	1.2	–

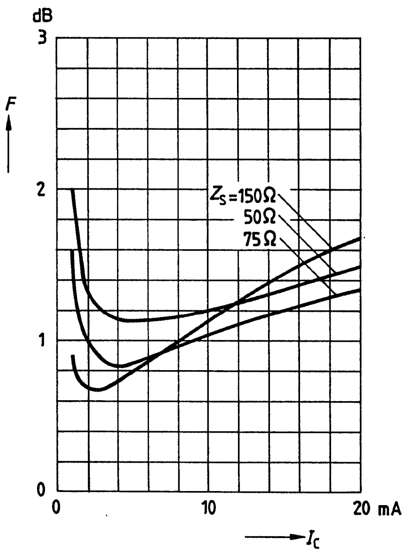
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.15	–
0.8	1.3	14.2	0.22	71.5	11.7	0.19	1.4	14

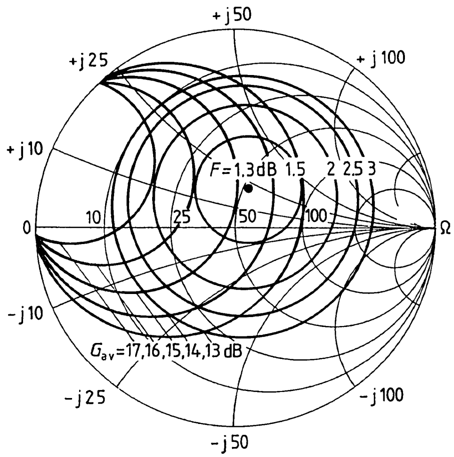
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
2.0	2.5	8.5	0.27	–139	14.2	0.39	2.8	–

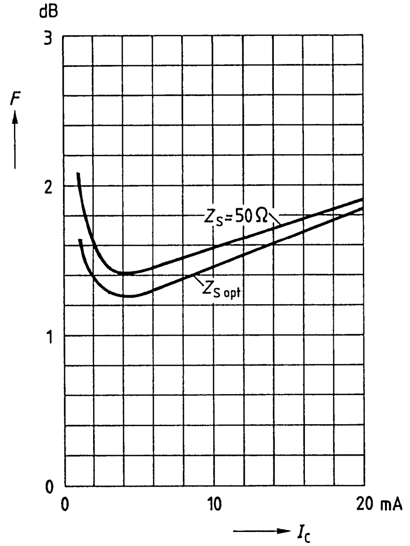
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 10 MHz



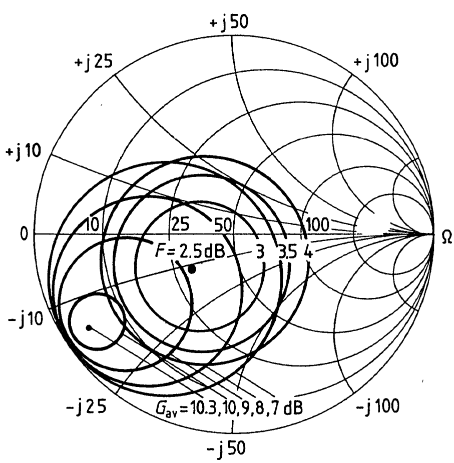
Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 5 mA, V_{CE} = 10 V, f = 800 MHz



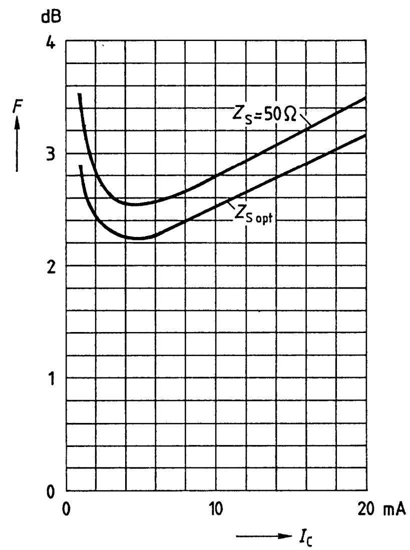
Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 800 MHz, Z_{Lopt} (G)



Circles of constant noise figure $F = f(Z_S)$ and available power gain $G_{av} = f(Z_S)$
I_C = 10 mA, V_{CE} = 10 V, f = 2 GHz

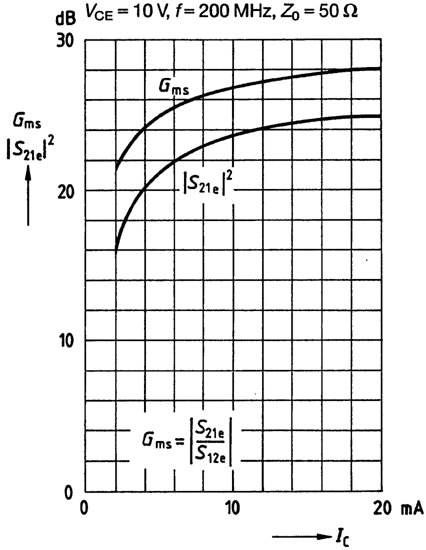


Noise figure $F = f(I_C)$
V_{CE} = 10 V, f = 2 GHz, Z_{Lopt} (G)

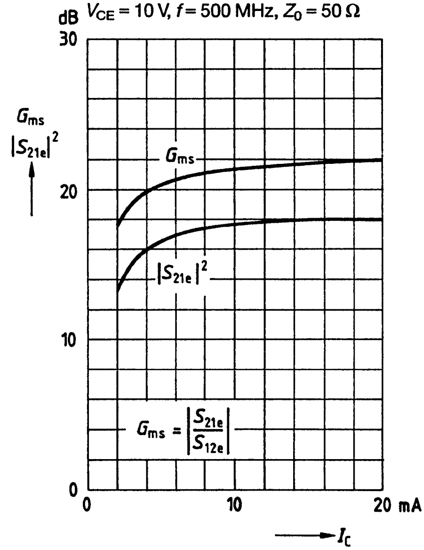


Common Emitter Power Gain

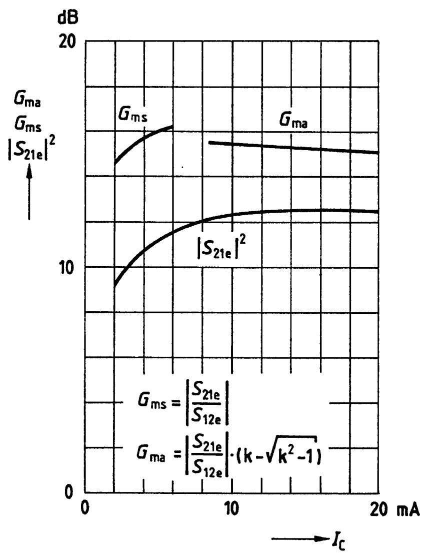
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



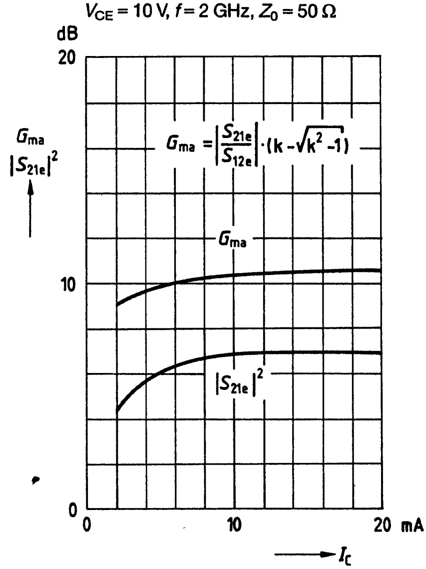
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



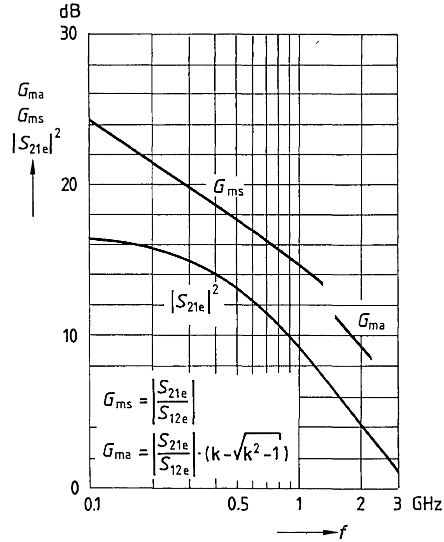
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$



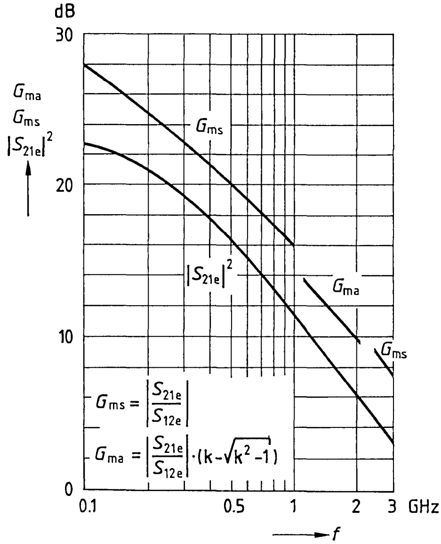
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 10$ V, $f = 2$ GHz, $Z_0 = 50\ \Omega$



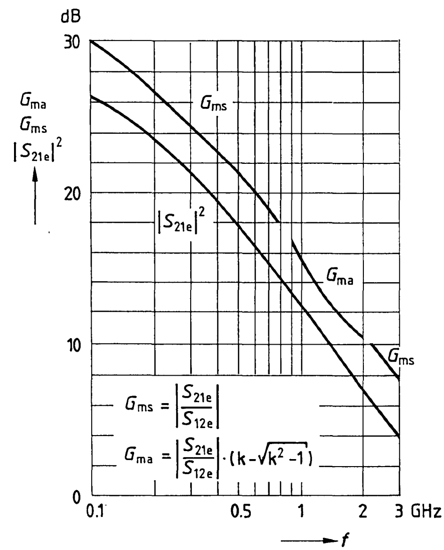
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 2$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



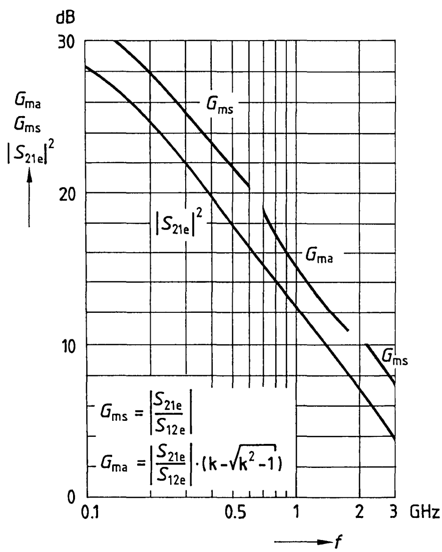
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 10$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters

I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.950	– 18.8	3.58	165.3	0.046	78.6	0.980	– 8.6
0.15	0.931	– 28.0	3.51	158.2	0.067	73.2	0.962	–12.5
0.20	0.910	– 36.9	3.42	151.3	0.087	68.1	0.939	–16.3
0.25	0.882	– 45.5	3.30	144.8	0.105	63.2	0.913	–19.8
0.30	0.854	– 53.6	3.17	138.6	0.120	58.7	0.885	–22.9
0.40	0.797	– 68.8	2.90	127.5	0.145	50.9	0.827	–28.3
0.50	0.743	– 82.4	2.64	117.9	0.163	44.6	0.775	–32.7
0.60	0.700	– 94.9	2.41	109.3	0.175	39.5	0.729	–36.2
0.70	0.659	–106.5	2.21	101.8	0.184	35.3	0.690	–39.1
0.80	0.636	–116.6	2.04	94.9	0.190	31.7	0.657	–41.4
0.90	0.612	–126.7	1.90	88.6	0.192	28.9	0.628	–43.6
1.00	0.590	–136.0	1.76	82.7	0.192	26.9	0.603	–45.5
1.20	0.566	–152.5	1.54	72.7	0.190	24.5	0.567	–49.0
1.40	0.551	–167.0	1.37	64.2	0.185	24.1	0.544	–52.7
1.50	0.546	–173.7	1.31	60.6	0.182	24.9	0.535	–54.6
1.60	0.547	–179.7	1.25	56.7	0.181	26.0	0.529	–56.6
1.80	0.548	168.9	1.15	49.8	0.179	29.1	0.518	–60.8
2.00	0.559	158.6	1.06	43.5	0.180	33.3	0.506	–65.5

I_C = 2 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.904	– 25.9	6.71	160.4	0.045	75.4	0.955	–13.1
0.15	0.869	– 38.1	6.42	151.4	0.064	68.8	0.917	–18.8
0.20	0.829	– 49.5	6.06	143.2	0.081	63.1	0.870	–23.8
0.25	0.784	– 60.0	5.67	135.9	0.094	58.1	0.823	–28.1
0.30	0.742	– 69.7	5.27	129.2	0.106	53.9	0.776	–31.7
0.40	0.668	– 86.8	4.57	118.2	0.122	47.5	0.692	–37.2
0.50	0.611	–101.3	3.99	109.1	0.133	43.1	0.627	–41.0
0.60	0.569	–114.0	3.51	101.5	0.141	40.2	0.575	–43.8
0.70	0.535	–125.4	3.14	95.0	0.147	38.3	0.535	–46.0
0.80	0.518	–135.0	2.83	89.1	0.152	37.0	0.503	–47.6
0.90	0.501	–144.8	2.59	83.8	0.156	36.4	0.476	–49.2
1.00	0.488	–153.4	2.37	78.9	0.159	36.3	0.454	–50.4
1.20	0.476	–168.4	2.04	70.6	0.166	37.3	0.422	–53.0
1.40	0.472	178.6	1.79	63.3	0.173	38.9	0.401	–56.0
1.50	0.468	172.8	1.69	60.0	0.178	40.1	0.395	–57.6
1.60	0.473	167.8	1.62	56.6	0.183	41.1	0.390	–59.4
1.80	0.477	157.8	1.48	50.5	0.195	43.0	0.380	–63.2
2.00	0.493	149.4	1.36	44.7	0.209	44.7	0.367	–67.8

I_C = 2 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.916	– 21.7	6.74	163.0	0.032	77.8	0.970	– 9.3
0.15	0.886	– 32.2	6.52	155.0	0.046	72.3	0.943	–13.4
0.20	0.851	– 42.0	6.25	147.6	0.058	67.2	0.911	–17.1
0.25	0.810	– 51.2	5.92	140.8	0.069	62.8	0.875	–20.3
0.30	0.770	– 59.9	5.58	134.5	0.078	58.9	0.840	–23.1
0.40	0.695	– 75.5	4.94	123.8	0.093	52.8	0.773	–27.2
0.50	0.629	– 89.2	4.37	114.9	0.102	48.4	0.718	–30.2
0.60	0.580	–101.6	3.90	107.3	0.110	45.6	0.673	–32.4
0.70	0.534	–112.8	3.51	100.7	0.115	43.8	0.639	–34.0
0.80	0.511	–122.7	3.18	94.8	0.120	42.5	0.611	–35.2
0.90	0.486	–132.7	2.91	89.5	0.123	42.0	0.586	–36.3
1.00	0.466	–141.9	2.68	84.6	0.126	42.1	0.567	–37.2
1.20	0.444	–158.1	2.30	76.2	0.132	43.2	0.538	–39.1
1.40	0.431	–172.8	2.03	68.9	0.139	45.4	0.520	–41.3
1.50	0.424	–179.2	1.91	65.6	0.143	46.9	0.515	–42.5
1.60	0.427	175.2	1.82	62.3	0.148	48.3	0.511	–43.9
1.80	0.426	164.1	1.66	56.3	0.159	50.9	0.503	–46.8
2.00	0.440	154.8	1.52	50.5	0.172	53.1	0.491	–50.2
2.50	0.491	133.9	1.26	38.6	0.216	57.5	0.465	–60.6
3.00	0.518	117.9	1.10	28.4	0.273	57.9	0.457	–71.6

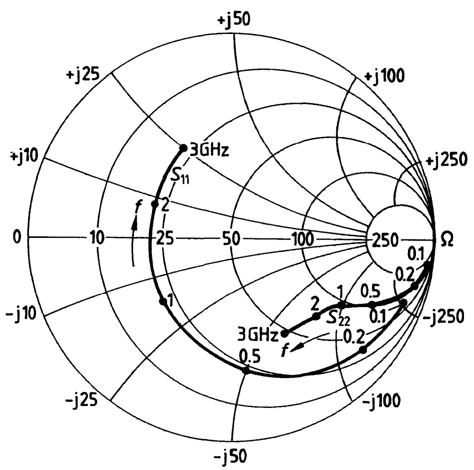
I_C = 5 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.807	– 34.6	14.10	153.1	0.029	72.7	0.912	–16.5
0.15	0.741	– 49.5	12.83	142.1	0.040	66.2	0.842	–22.4
0.20	0.673	– 62.5	11.53	132.9	0.049	61.7	0.773	–26.7
0.25	0.611	– 73.9	10.31	125.4	0.055	58.6	0.711	–29.8
0.30	0.558	– 84.1	9.23	119.2	0.061	56.4	0.659	–31.8
0.40	0.479	–101.1	7.55	109.4	0.070	54.3	0.579	–34.0
0.50	0.425	–115.1	6.33	102.1	0.078	54.0	0.527	–35.1
0.60	0.389	–127.2	5.44	96.1	0.085	54.4	0.491	–35.4
0.70	0.363	–138.1	4.77	90.9	0.093	55.2	0.465	–35.9
0.80	0.351	–146.9	4.24	86.5	0.101	55.8	0.447	–36.1
0.90	0.340	–156.1	3.82	82.3	0.108	56.6	0.431	–36.6
1.00	0.335	–164.3	3.47	78.5	0.116	57.5	0.418	–36.9
1.20	0.331	–178.1	2.95	72.0	0.132	58.6	0.399	–38.1
1.40	0.333	168.8	2.57	66.0	0.149	59.3	0.388	–39.8
1.50	0.329	163.5	2.41	63.3	0.158	59.6	0.386	–40.9
1.60	0.335	159.1	2.29	60.5	0.168	59.7	0.383	–42.2
1.80	0.341	150.4	2.07	55.3	0.186	59.5	0.378	–45.3
2.00	0.359	143.3	1.89	50.4	0.205	59.0	0.366	–48.6
2.50	0.413	126.8	1.57	39.6	0.255	57.2	0.336	–58.4
3.00	0.444	114.2	1.37	29.7	0.308	54.0	0.326	–69.1

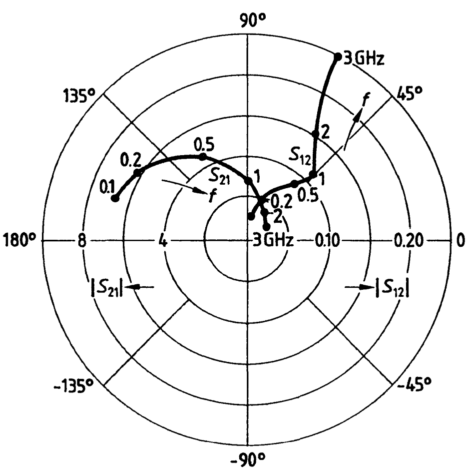
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.924	– 20.0	6.69	164.0	0.026	78.8	0.976	– 7.7
0.15	0.896	– 29.6	6.50	156.5	0.038	73.5	0.954	–11.2
0.20	0.863	– 38.8	6.25	149.4	0.048	69.0	0.927	–14.2
0.25	0.824	– 47.5	5.96	142.8	0.058	64.8	0.898	–16.9
0.30	0.785	– 55.6	5.64	136.7	0.066	61.1	0.868	–19.2
0.40	0.709	– 70.5	5.04	126.2	0.079	55.1	0.811	–22.8
0.50	0.642	– 83.6	4.49	117.4	0.088	51.0	0.763	–25.4
0.60	0.588	– 95.6	4.03	109.8	0.094	48.2	0.723	–27.2
0.70	0.539	–106.7	3.64	103.2	0.099	46.4	0.692	–28.6
0.80	0.511	–116.4	3.31	97.3	0.104	45.2	0.667	–29.7
0.90	0.481	–126.5	3.04	92.0	0.107	44.7	0.645	–30.6
1.00	0.457	–135.8	2.80	87.1	0.110	44.9	0.627	–31.4
1.20	0.427	–152.6	2.41	78.7	0.115	46.3	0.602	–33.1
1.40	0.410	–167.9	2.12	71.3	0.121	48.7	0.586	–35.0
1.50	0.402	–174.6	2.00	68.0	0.125	50.5	0.582	–36.1
1.60	0.403	179.4	1.90	64.7	0.129	52.0	0.579	–37.2
1.80	0.402	167.6	1.72	58.7	0.139	55.1	0.573	–39.8
2.00	0.415	157.7	1.58	53.1	0.151	57.8	0.563	–42.7
2.50	0.465	135.6	1.31	41.0	0.193	63.0	0.540	–51.7
3.00	0.492	119.2	1.14	30.7	0.248	64.1	0.535	–61.2

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



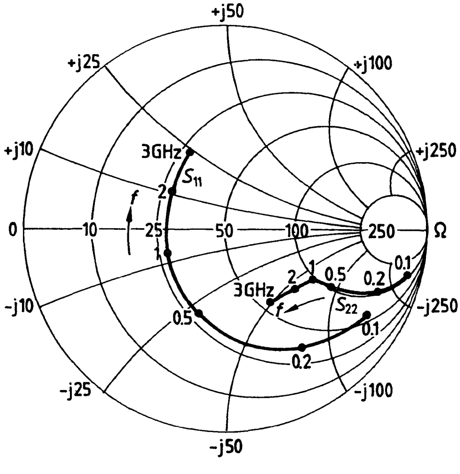
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



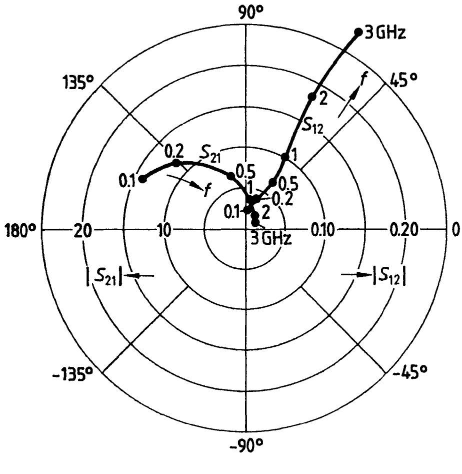
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.827	– 31.1	13.95	154.8	0.024	74.1	0.929	–13.4
0.15	0.764	– 44.7	12.83	144.3	0.034	68.3	0.872	–18.3
0.20	0.698	– 56.7	11.65	135.4	0.041	63.9	0.813	–21.9
0.25	0.634	– 67.4	10.51	127.9	0.048	60.7	0.759	–24.4
0.30	0.577	– 76.8	9.48	121.7	0.053	58.5	0.713	–26.1
0.40	0.490	– 93.0	7.83	111.8	0.061	56.2	0.641	–27.8
0.50	0.426	–106.3	6.60	104.3	0.068	55.7	0.594	–28.6
0.60	0.385	–118.4	5.69	98.2	0.075	56.2	0.561	–29.0
0.70	0.352	–129.1	4.99	93.0	0.081	57.0	0.538	–29.2
0.80	0.332	–138.4	4.45	88.5	0.088	57.7	0.521	–29.5
0.90	0.318	–147.9	4.02	84.3	0.095	58.6	0.507	–29.9
1.00	0.308	–156.8	3.66	80.5	0.102	59.4	0.497	–30.2
1.20	0.300	–171.9	3.10	74.0	0.116	61.0	0.480	–31.3
1.40	0.297	173.9	2.70	68.0	0.131	61.9	0.470	–32.9
1.50	0.294	168.2	2.53	65.2	0.139	62.5	0.469	–33.8
1.60	0.298	162.9	2.40	62.6	0.147	62.7	0.467	–35.0
1.80	0.303	153.6	2.17	57.4	0.164	63.0	0.463	–37.6
2.00	0.321	146.0	1.98	52.6	0.181	62.8	0.453	–40.4
2.50	0.379	128.4	1.65	41.8	0.228	61.8	0.426	–48.6
3.00	0.408	115.3	1.43	31.9	0.278	59.4	0.419	–57.5

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



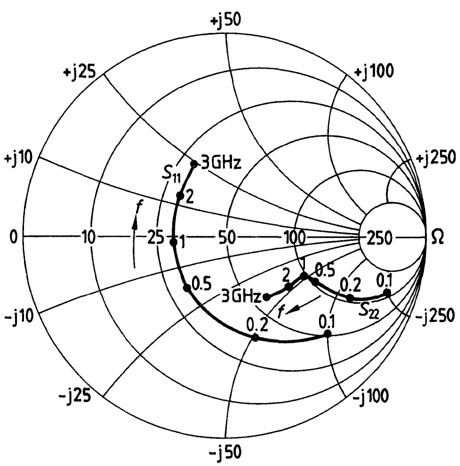
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



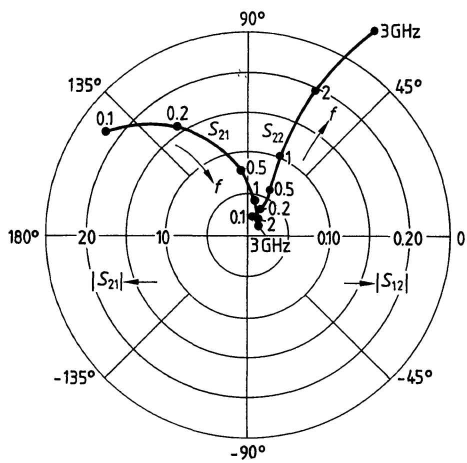
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.704	– 43.8	21.34	144.8	0.022	70.4	0.855	–19.0
0.15	0.610	– 60.5	18.27	132.6	0.029	65.1	0.763	–23.8
0.20	0.529	– 74.2	15.62	123.4	0.035	62.6	0.687	–26.4
0.25	0.465	– 85.5	13.44	116.4	0.039	61.7	0.629	–27.5
0.30	0.415	– 95.3	11.72	110.9	0.044	61.3	0.586	–27.8
0.40	0.348	–111.8	9.26	102.7	0.052	62.1	0.528	–27.5
0.50	0.304	–125.2	7.62	96.6	0.060	63.3	0.496	–27.1
0.60	0.278	–137.0	6.46	91.6	0.068	64.6	0.474	–26.7
0.70	0.261	–147.1	5.61	87.4	0.077	65.6	0.461	–26.8
0.80	0.254	–156.0	4.96	83.7	0.086	66.1	0.451	–26.9
0.90	0.248	–164.7	4.45	80.3	0.094	66.6	0.442	–27.2
1.00	0.248	–172.2	4.04	77.0	0.103	67.0	0.436	–27.5
1.20	0.250	174.1	3.41	71.4	0.121	67.2	0.424	–28.8
1.40	0.256	161.4	2.96	66.0	0.139	66.9	0.418	–30.5
1.50	0.255	156.4	2.78	63.6	0.148	66.8	0.418	–31.6
1.60	0.260	152.1	2.63	61.2	0.158	66.4	0.417	–32.8
1.80	0.266	144.3	2.37	56.5	0.177	65.6	0.413	–35.7
2.00	0.286	138.5	2.16	52.2	0.195	64.4	0.403	–38.6
2.50	0.346	123.8	1.79	41.9	0.244	61.5	0.375	–46.7
3.00	0.377	112.9	1.55	32.4	0.293	57.8	0.366	–55.6

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



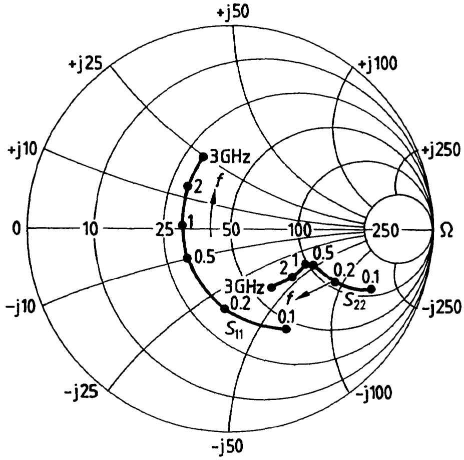
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



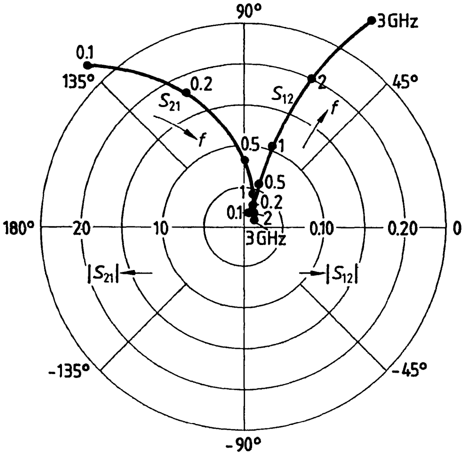
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.566	– 59.2	27.49	134.2	0.019	67.5	0.760	–22.9
0.15	0.464	– 78.4	21.82	121.9	0.024	64.6	0.655	–25.9
0.20	0.394	– 93.3	17.76	113.6	0.029	64.7	0.584	–26.3
0.25	0.345	–105.1	14.82	107.7	0.034	65.3	0.538	–25.9
0.30	0.311	–115.2	12.67	103.1	0.038	66.3	0.507	–25.1
0.40	0.271	–131.9	9.78	96.4	0.047	68.2	0.469	–23.6
0.50	0.247	–144.7	7.93	91.4	0.056	69.6	0.451	–22.9
0.60	0.236	–155.3	6.68	87.2	0.065	70.6	0.439	–22.6
0.70	0.229	–164.1	5.78	83.6	0.075	71.1	0.431	–22.8
0.80	0.228	–171.4	5.09	80.4	0.084	71.2	0.426	–23.2
0.90	0.231	–178.8	4.56	77.3	0.094	71.3	0.421	–23.8
1.00	0.232	174.7	4.13	74.4	0.103	71.2	0.417	–24.3
1.20	0.242	163.6	3.48	69.3	0.122	70.6	0.409	–25.9
1.40	0.253	152.6	3.02	64.3	0.141	69.7	0.404	–27.9
1.50	0.253	148.5	2.83	62.0	0.151	69.3	0.405	–29.1
1.60	0.258	144.9	2.68	59.7	0.161	68.6	0.404	–30.5
1.80	0.266	138.1	2.41	55.2	0.180	67.3	0.401	–33.6
2.00	0.284	133.9	2.19	51.0	0.200	65.8	0.391	–36.7
2.50	0.345	121.1	1.82	41.0	0.249	62.2	0.363	–44.8
3.00	0.374	110.8	1.58	31.7	0.297	58.1	0.353	–53.9

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



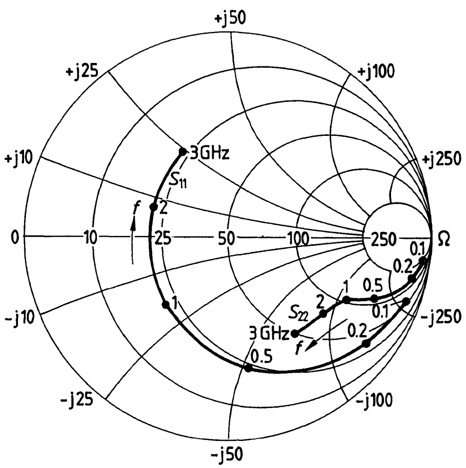
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



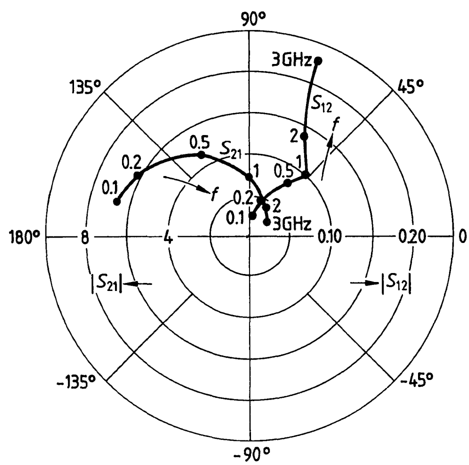
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.931	– 18.9	6.59	164.6	0.023	79.4	0.978	– 6.7
0.15	0.905	– 28.2	6.41	157.4	0.034	74.4	0.960	– 9.8
0.20	0.874	– 36.9	6.19	150.4	0.043	70.0	0.937	–12.5
0.25	0.836	– 45.2	5.92	144.1	0.052	65.9	0.911	–14.9
0.30	0.796	– 53.0	5.62	138.0	0.059	62.5	0.884	–17.0
0.40	0.722	– 67.4	5.05	127.7	0.071	56.5	0.833	–20.1
0.50	0.654	– 80.2	4.52	118.9	0.079	52.4	0.789	–22.4
0.60	0.597	– 91.9	4.06	111.3	0.085	49.7	0.753	–24.1
0.70	0.544	–102.7	3.68	104.7	0.090	47.9	0.725	–25.4
0.80	0.513	–112.3	3.35	98.9	0.094	46.6	0.702	–26.3
0.90	0.481	–122.3	3.09	93.5	0.097	46.2	0.681	–27.2
1.00	0.455	–131.7	2.85	88.5	0.100	46.5	0.666	–27.9
1.20	0.421	–148.7	2.45	80.0	0.105	47.9	0.642	–29.5
1.40	0.399	–164.4	2.16	72.6	0.110	50.5	0.628	–31.2
1.50	0.390	–171.2	2.03	69.4	0.114	52.4	0.625	–32.2
1.60	0.390	–177.8	1.93	66.1	0.118	54.0	0.622	–33.3
1.80	0.385	170.4	1.76	60.1	0.127	57.3	0.617	–35.6
2.00	0.398	160.0	1.61	54.4	0.138	60.2	0.609	–38.2
2.50	0.447	136.9	1.33	42.3	0.177	66.0	0.589	–46.2
3.00	0.478	119.7	1.15	31.8	0.229	67.7	0.587	–54.8

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



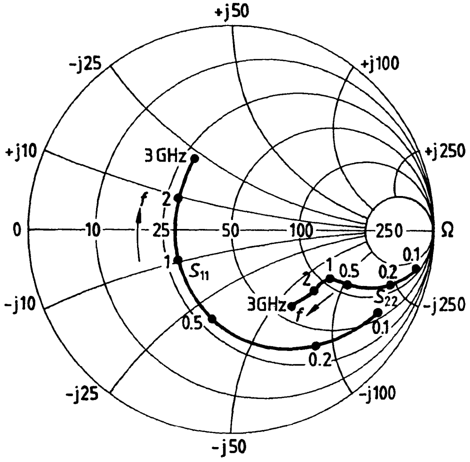
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



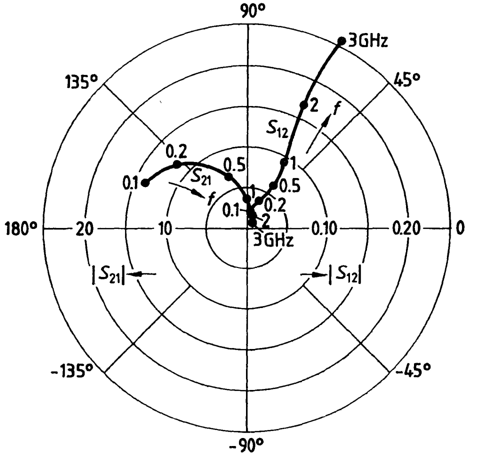
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.847	– 28.9	13.60	156.0	0.022	75.1	0.939	–11.5
0.15	0.786	– 41.7	12.60	145.9	0.030	69.5	0.889	–15.8
0.20	0.721	– 53.1	11.53	137.1	0.038	65.1	0.837	–19.0
0.25	0.657	– 63.1	10.46	129.7	0.043	61.9	0.790	–21.2
0.30	0.599	– 72.1	9.48	123.4	0.048	59.7	0.747	–22.7
0.40	0.506	– 87.6	7.89	113.5	0.056	57.2	0.682	–24.3
0.50	0.437	–100.4	6.68	105.9	0.062	56.7	0.639	–25.0
0.60	0.389	–112.2	5.77	99.6	0.069	57.0	0.607	–25.3
0.70	0.351	–122.8	5.08	94.4	0.075	57.8	0.586	–25.6
0.80	0.329	–132.0	4.53	89.8	0.081	58.5	0.570	–25.9
0.90	0.310	–141.8	4.10	85.6	0.087	59.4	0.557	–26.2
1.00	0.296	–150.7	3.73	81.7	0.093	60.4	0.548	–26.5
1.20	0.283	–166.8	3.17	75.2	0.106	61.9	0.532	–27.6
1.40	0.278	178.1	2.76	69.1	0.120	63.1	0.524	–29.0
1.50	0.273	171.8	2.58	66.4	0.127	63.9	0.523	–29.9
1.60	0.278	166.1	2.45	63.7	0.134	64.2	0.522	–31.0
1.80	0.280	156.3	2.21	58.7	0.150	64.8	0.518	–33.3
2.00	0.298	148.3	2.02	53.8	0.166	64.9	0.510	–35.9
2.50	0.357	129.4	1.67	42.9	0.209	64.6	0.487	–43.1
3.00	0.390	116.1	1.45	33.1	0.257	62.8	0.482	–51.1

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



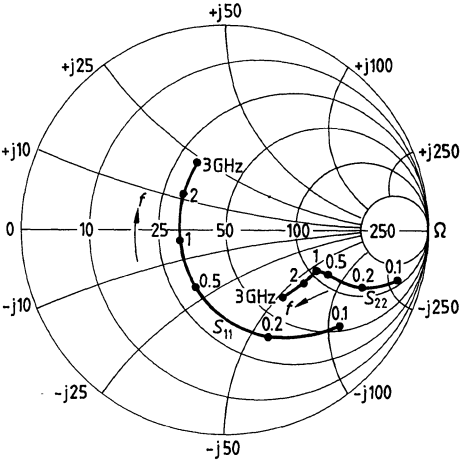
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



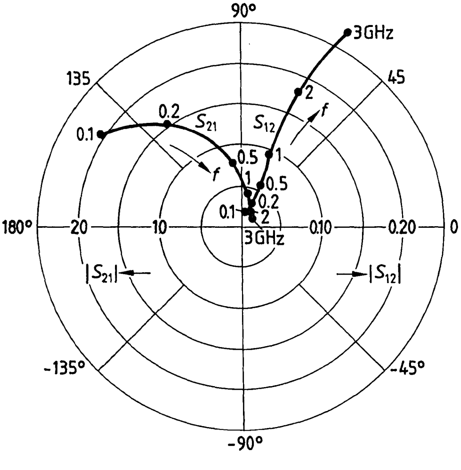
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.744	– 39.7	20.56	146.8	0.020	71.5	0.877	–16.2
0.15	0.650	– 55.4	17.86	134.8	0.027	66.3	0.798	–20.4
0.20	0.566	– 68.1	15.44	125.6	0.032	63.4	0.729	–22.7
0.25	0.497	– 78.7	13.39	118.5	0.037	62.1	0.675	–23.8
0.30	0.441	– 88.0	11.74	112.8	0.041	61.7	0.635	–24.1
0.40	0.362	–103.8	9.33	104.4	0.048	62.2	0.580	–23.9
0.50	0.310	–116.5	7.70	98.1	0.055	63.3	0.549	–23.6
0.60	0.277	–128.3	6.54	93.0	0.063	64.6	0.529	–23.3
0.70	0.254	–138.5	5.70	88.6	0.071	65.7	0.516	–23.4
0.80	0.242	–147.7	5.04	84.9	0.079	66.3	0.507	–23.6
0.90	0.234	–157.0	4.52	81.4	0.086	67.0	0.499	–23.9
1.00	0.229	–165.8	4.10	78.1	0.094	67.5	0.493	–24.2
1.20	0.227	179.4	3.46	72.4	0.111	67.9	0.483	–25.4
1.40	0.232	165.5	3.01	67.1	0.127	67.8	0.477	–27.0
1.50	0.231	159.6	2.82	64.6	0.135	68.0	0.477	–28.0
1.60	0.237	155.1	2.67	62.2	0.144	67.7	0.476	–29.1
1.80	0.242	146.5	2.40	57.6	0.161	67.2	0.474	–31.7
2.00	0.261	140.5	2.19	53.2	0.179	66.3	0.465	–34.3
2.50	0.324	124.8	1.82	42.9	0.224	64.0	0.440	–41.4
3.00	0.355	113.5	1.57	33.4	0.270	61.0	0.433	–49.3

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



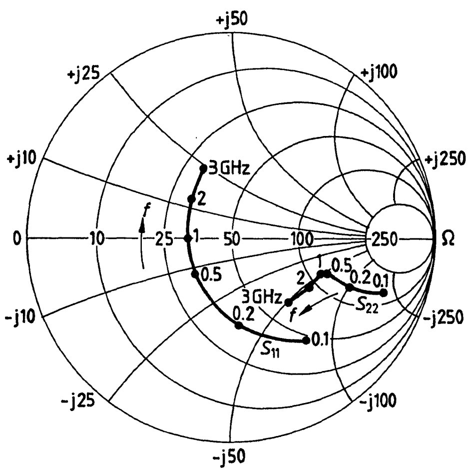
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



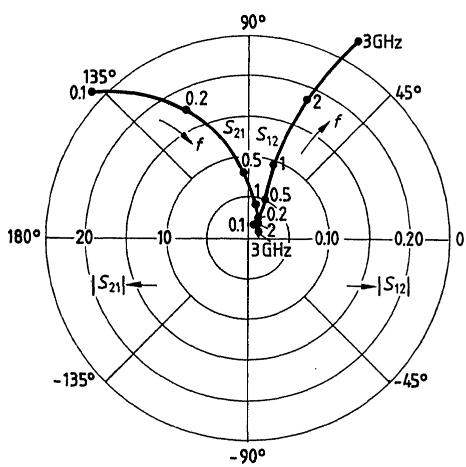
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.628	– 52.7	26.24	137.1	0.018	68.5	0.800	–19.4
0.15	0.517	– 70.3	21.27	124.7	0.023	65.1	0.705	–22.1
0.20	0.435	– 84.1	17.51	116.0	0.028	64.3	0.639	–22.7
0.25	0.376	– 95.1	14.71	109.8	0.032	64.8	0.595	–22.4
0.30	0.332	–104.6	12.62	105.0	0.036	65.6	0.565	–21.8
0.40	0.277	–121.1	9.79	98.0	0.044	67.3	0.528	–20.6
0.50	0.243	–133.6	7.97	92.7	0.052	68.9	0.510	–20.1
0.60	0.227	–145.2	6.72	88.4	0.060	70.0	0.498	–19.9
0.70	0.215	–155.2	5.82	84.7	0.069	70.7	0.492	–20.1
0.80	0.211	–163.0	5.13	81.4	0.078	71.0	0.486	–20.5
0.90	0.210	–171.5	4.59	78.3	0.086	71.2	0.481	–21.0
1.00	0.210	–179.1	4.16	75.4	0.095	71.3	0.477	–21.6
1.20	0.218	168.5	3.50	70.1	0.112	71.1	0.470	–23.0
1.40	0.227	156.3	3.04	65.0	0.130	70.4	0.466	–24.9
1.50	0.228	151.2	2.84	62.7	0.139	70.2	0.467	–26.0
1.60	0.234	147.5	2.69	60.4	0.147	69.7	0.467	–27.3
1.80	0.241	140.0	2.42	56.0	0.165	68.7	0.465	–30.0
2.00	0.260	135.5	2.21	51.7	0.183	67.5	0.456	–32.8
2.50	0.324	122.0	1.83	41.7	0.229	64.5	0.431	–40.0
3.00	0.355	111.7	1.58	32.3	0.275	61.1	0.424	–48.1

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

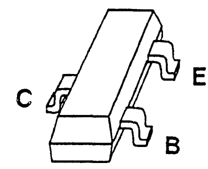


S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor **BFR 35AP**

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 to 20 mA.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 35AP	GE	Q 62702 – F 938	SOT-23

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient [1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

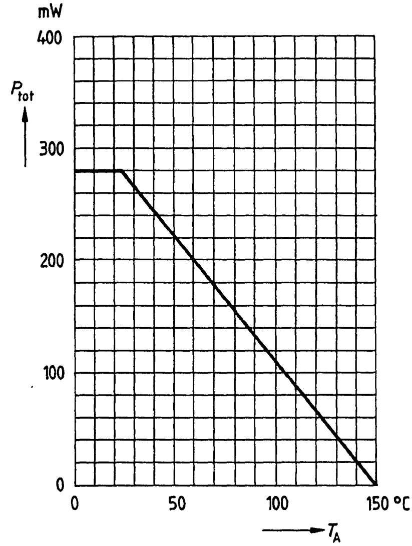
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 20 mA, V_{CE} = 6 V	h_{FE}	 40 40	 85 90	 – –	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	0.16	0.4	V

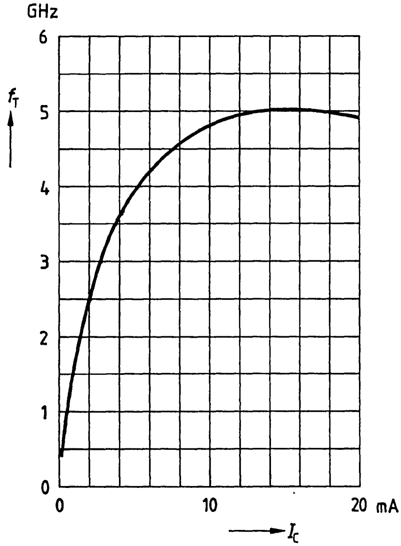
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency	f_T				GHz
I_C = 5 mA, V_{CE} = 6 V, f = 200 MHz		–	3.8	–	
I_C = 20 mA, V_{CE} = 6 V, f = 200 MHz		3.6	4.9	–	
Collector-base capacitance V_{CB} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.56	0.7	pF
Collector-emitter capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.27	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	pF
Output capacitance V_{CE} = 6 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.85	–	pF
Noise figure	F				dB
I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω		–	1.5	–	
I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt}		–	1.5	–	
I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}		–	3.9	–	
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	dB
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	dB
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	110	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	23.5	–	dBm

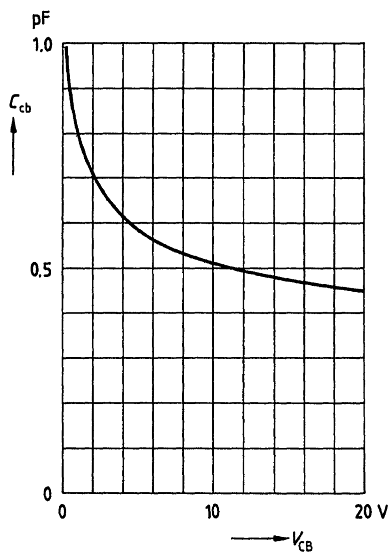
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

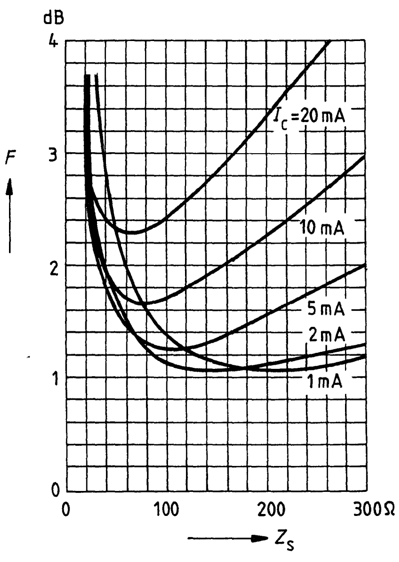
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–

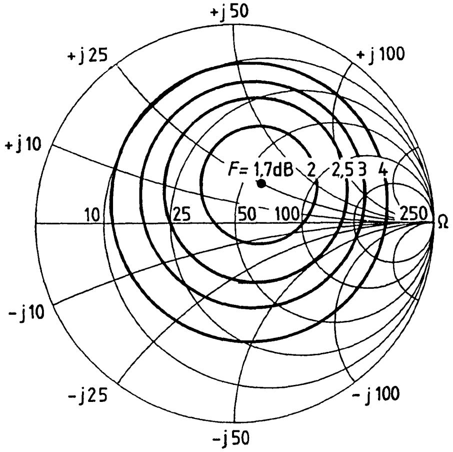
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.3	–	(Z_S = 100 Ω)		–	–	1.6	–
0.8	1.7	14.3	0.25	58.5	16.9	0.24	1.9	14

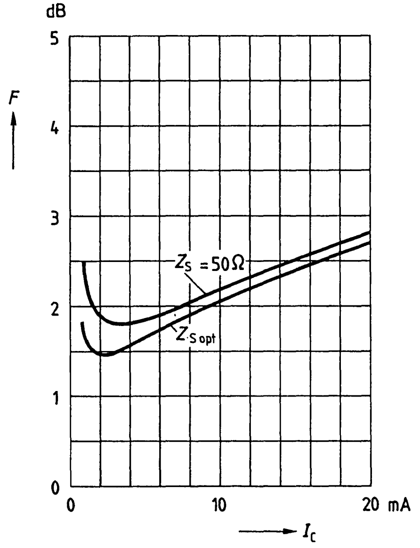
Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



Circles of constant noise figure $F = f\,(Z_S)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $f = 800$ MHz



Noise figure $F = f\,(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)



Common Emitter S Parameters

I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.967	– 12.3	1.83	168.2	0.050	81.5	0.990	– 6.7
0.15	0.956	– 18.4	1.82	162.3	0.075	77.4	0.982	–10.0
0.20	0.941	– 24.3	1.81	156.4	0.098	73.2	0.970	–13.0
0.25	0.923	– 30.2	1.78	150.8	0.120	69.3	0.955	–16.2
0.30	0.903	– 35.9	1.75	145.2	0.141	65.4	0.939	–19.1
0.40	0.859	– 47.0	1.68	134.7	0.177	58.2	0.902	–24.5
0.50	0.812	– 57.2	1.59	125.1	0.207	51.8	0.864	–29.4
0.60	0.765	– 67.2	1.51	116.1	0.231	46.2	0.826	–33.6
0.70	0.717	– 76.5	1.44	108.0	0.249	41.2	0.790	–37.4
0.80	0.686	– 85.5	1.36	100.3	0.265	36.3	0.757	–40.7
0.90	0.645	– 94.5	1.31	93.3	0.275	32.3	0.725	–43.8
1.00	0.610	–103.1	1.25	86.6	0.281	28.6	0.695	–46.4

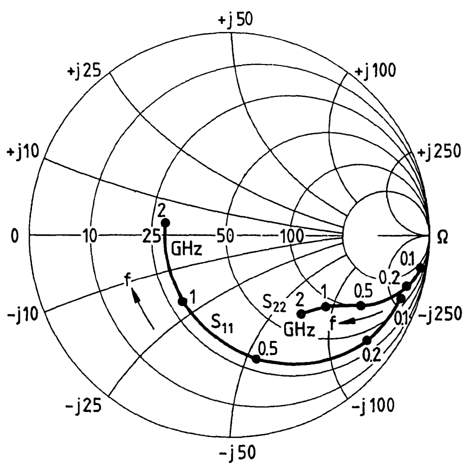
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.938	– 16.4	3.51	165.6	0.050	79.4	0.981	– 9.4
0.15	0.917	– 24.5	3.45	158.7	0.073	74.4	0.962	–13.8
0.20	0.892	– 32.2	3.37	151.9	0.095	69.6	0.938	–17.9
0.25	0.862	– 39.7	3.26	145.5	0.114	65.1	0.910	–21.9
0.30	0.829	– 46.7	3.13	139.4	0.132	60.8	0.881	–25.5
0.40	0.763	– 60.1	2.88	128.5	0.160	53.5	0.819	–31.7
0.50	0.699	– 72.0	2.64	118.9	0.182	47.6	0.761	–37.0
0.60	0.643	– 83.2	2.41	110.4	0.198	42.8	0.709	–41.2
0.70	0.591	– 93.4	2.22	102.9	0.209	38.9	0.665	–44.7
0.80	0.557	–103.0	2.05	96.1	0.219	35.5	0.626	–47.5
0.90	0.521	–112.6	1.92	89.8	0.225	32.9	0.591	–50.2
1.00	0.490	–121.7	1.79	84.0	0.229	30.8	0.559	–52.4

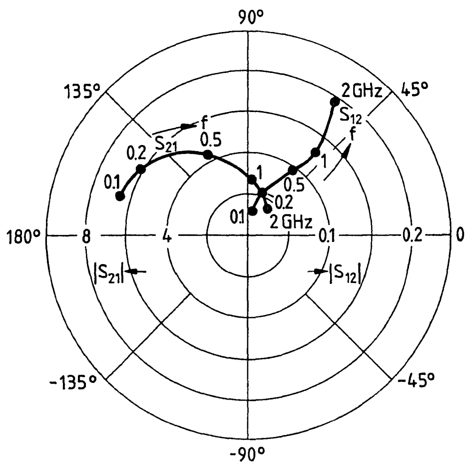
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	– 15	6.49	161	0.03	79	0.97	– 6
0.3	0.79	– 46	5.25	139	0.08	64	0.88	–22
0.5	0.66	– 71	4.49	120	0.11	55	0.77	–30
0.8	0.46	–102	3.29	98	0.13	47	0.64	–35
1.0	0.40	–119	2.80	88	0.15	46	0.60	–38
1.2	0.36	–134	2.43	80	0.15	45	0.56	–40
1.5	0.31	–156	2.03	69	0.17	48	0.53	–43
1.8	0.29	–178	1.77	60	0.19	49	0.51	–48
2.0	0.29	168	1.66	54	0.20	51	0.49	–49

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



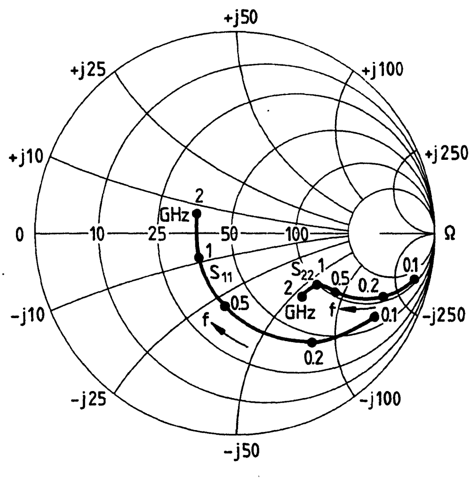
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



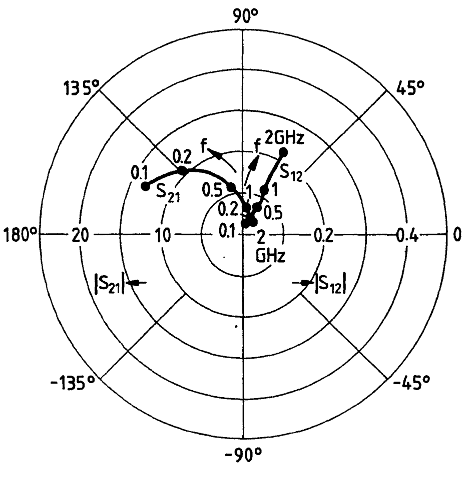
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 24	12.96	150	0.03	75	0.92	–11
0.3	0.58	– 66	8.56	123	0.06	61	0.74	–29
0.5	0.44	– 97	6.27	106	0.08	58	0.59	–35
0.8	0.28	–128	4.19	88	0.11	57	0.49	–35
1.0	0.26	–144	3.45	81	0.13	59	0.49	–36
1.2	0.24	–160	2.93	74	0.14	58	0.45	–38
1.5	0.22	179	2.43	65	0.17	59	0.44	–40
1.8	0.23	159	2.08	57	0.20	59	0.43	–45
2.0	0.25	146	1.93	52	0.22	58	0.40	–46

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



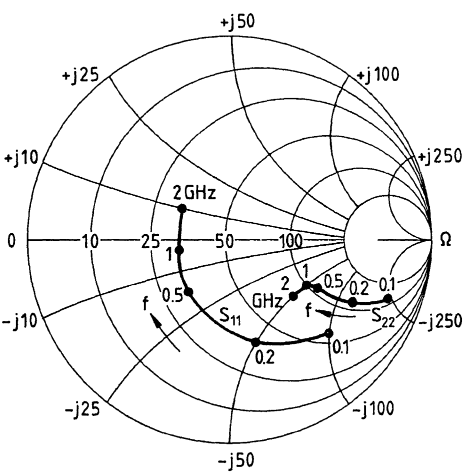
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



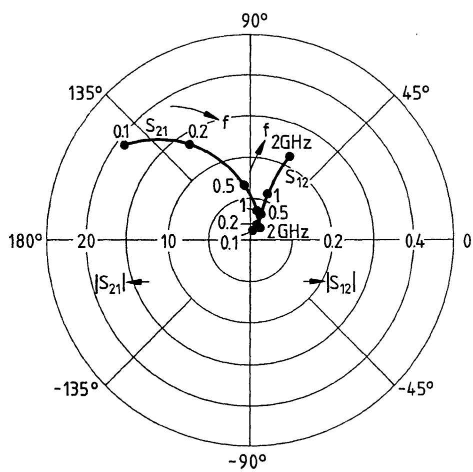
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.66	– 35	18.62	140	0.03	73	0.85	–15
0.3	0.42	– 85	10.32	113	0.05	62	0.62	–31
0.5	0.32	–116	6.92	98	0.07	63	0.50	–33
0.8	0.22	–149	4.49	83	0.10	64	0.44	–31
1.0	0.21	–164	3.65	77	0.12	65	0.43	–32
1.2	0.21	–178	3.09	71	0.14	64	0.41	–34
1.5	0.21	164	2.54	63	0.17	63	0.41	–36
1.8	0.22	147	2.18	55	0.21	62	0.40	–41
2.0	0.24	136	2.02	51	0.22	61	0.38	–42

S_{11}, S_{22} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



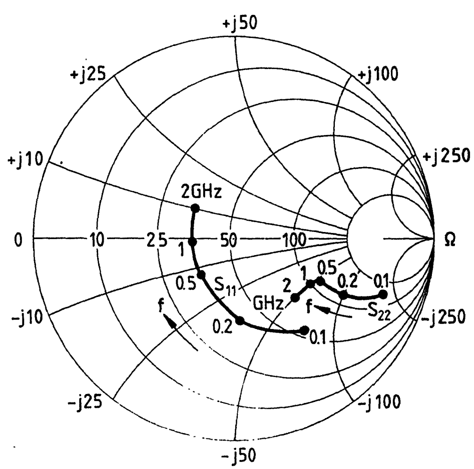
S_{12}, S_{21} = f (f)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



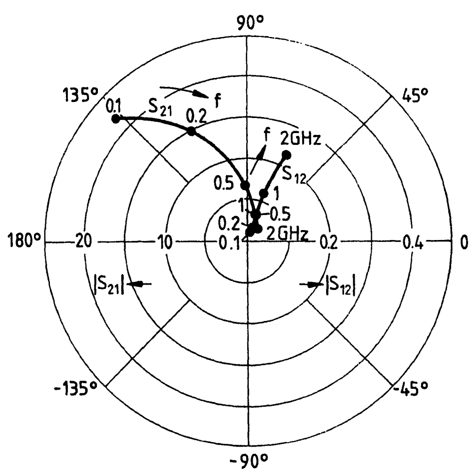
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.57	– 43	20.30	137	0.02	71	0.81	–16
0.3	0.35	– 95	10.53	109	0.05	54	0.58	–29
0.5	0.27	–127	7.00	95	0.07	66	0.48	–29
0.8	0.21	–162	4.49	80	0.10	67	0.43	–27
1.0	0.21	–174	3.65	75	0.12	68	0.43	–29
1.2	0.21	174	3.09	70	0.14	66	0.41	–31
1.5	0.22	158	2.54	61	0.17	65	0.41	–34
1.8	0.24	142	2.15	54	0.21	64	0.41	–40
2.0	0.26	133	2.00	50	0.23	63	0.39	–40

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



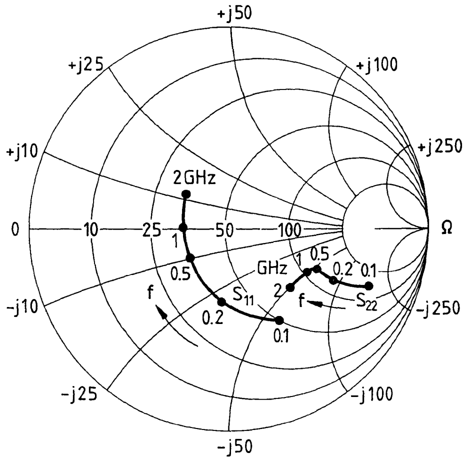
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



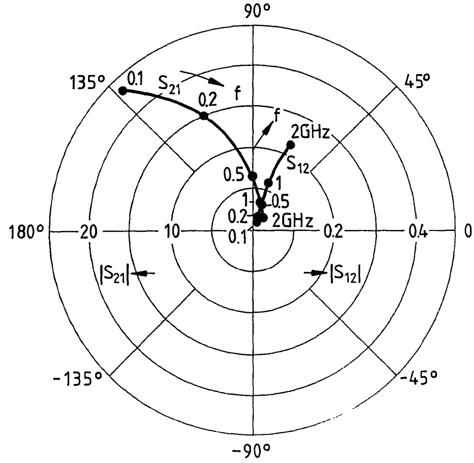
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	– 49	21.13	133	0.02	70	0.79	–16
0.3	0.32	–106	10.35	106	0.05	65	0.56	–27
0.5	0.27	–138	6.76	92	0.07	67	0.48	–27
0.8	0.22	–171	4.34	78	0.09	68	0.45	–25
1.0	0.22	179	3.49	74	0.12	69	0.44	–28
1.2	0.23	169	2.97	68	0.14	68	0.43	–30
1.5	0.24	153	2.43	60	0.17	66	0.43	–33
1.8	0.26	139	2.07	53	0.21	65	0.42	–39
2.0	0.28	131	1.93	48	0.22	64	0.40	–39

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



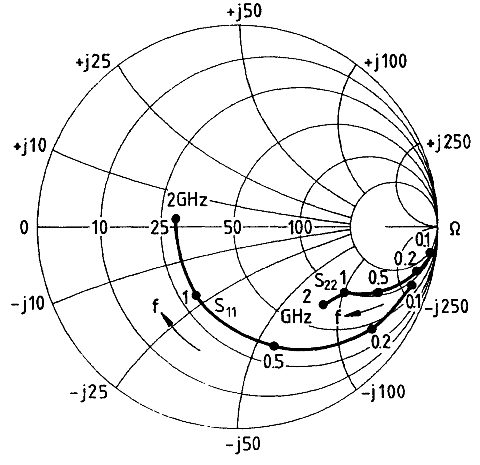
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



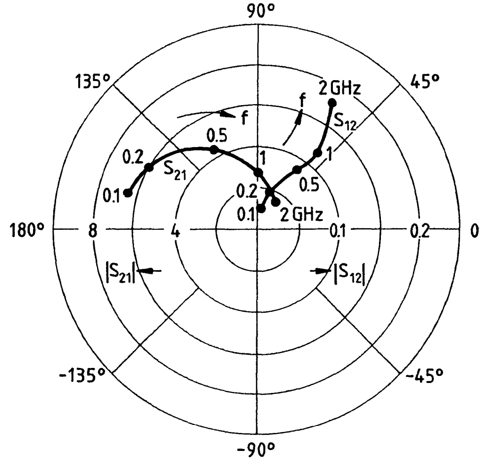
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.92	– 14	6.46	161	0.03	80	0.98	– 6
0.3	0.81	– 43	5.28	140	0.07	66	0.90	–19
0.5	0.69	– 65	4.54	122	0.10	57	0.80	–27
0.8	0.48	– 95	3.35	99	0.12	49	0.68	–33
1.0	0.42	–111	2.87	90	0.14	48	0.64	–35
1.2	0.36	–125	2.45	83	0.15	47	0.61	–38
1.5	0.30	–146	2.07	71	0.16	49	0.58	–40
1.8	0.28	–170	1.81	62	0.18	50	0.56	–45
2.0	0.27	175	1.68	56	0.19	52	0.54	–46

S_{11}, S_{22} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



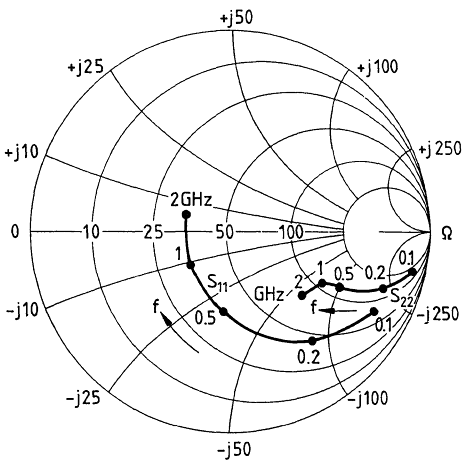
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



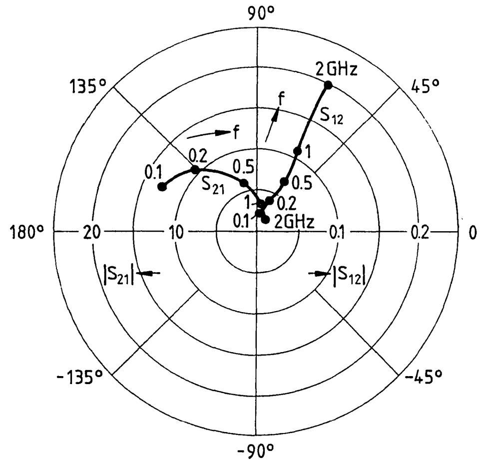
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 19	12.74	152	0.03	78	0.95	– 9
0.3	0.65	– 57	8.56	125	0.06	63	0.80	–25
0.5	0.49	– 84	6.35	107	0.08	58	0.67	–31
0.8	0.31	–112	4.29	89	0.10	55	0.56	–33
1.0	0.27	–129	3.53	82	0.13	57	0.54	–35
1.2	0.24	–144	2.97	77	0.14	57	0.51	–36
1.5	0.21	–167	2.45	67	0.16	58	0.50	–38
1.8	0.21	170	2.13	59	0.19	58	0.48	–43
2.0	0.22	155	1.96	54	0.21	58	0.47	–43

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



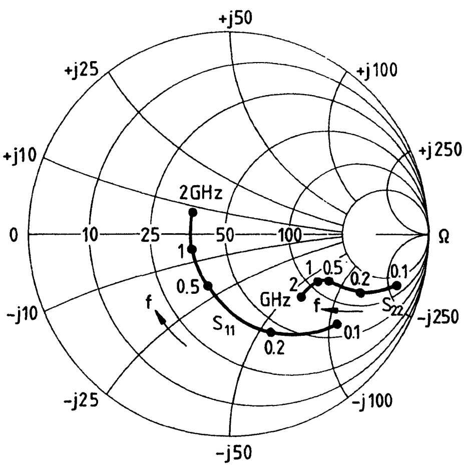
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



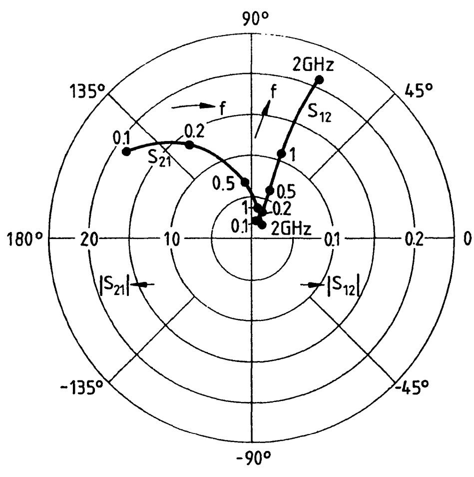
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.75	– 28	18.20	142	0.02	74	0.88	–13
0.3	0.52	– 71	10.23	114	0.05	63	0.67	–27
0.5	0.37	– 99	7.00	99	0.07	63	0.56	–29
0.8	0.23	–129	4.57	84	0.09	63	0.50	–28
1.0	0.21	–146	3.72	78	0.12	65	0.48	–29
1.2	0.20	–163	3.11	74	0.13	65	0.47	–31
1.5	0.18	177	2.56	64	0.16	64	0.46	–34
1.8	0.19	157	2.19	57	0.19	63	0.46	–39
2.0	0.20	143	2.03	53	0.21	62	0.44	–39

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



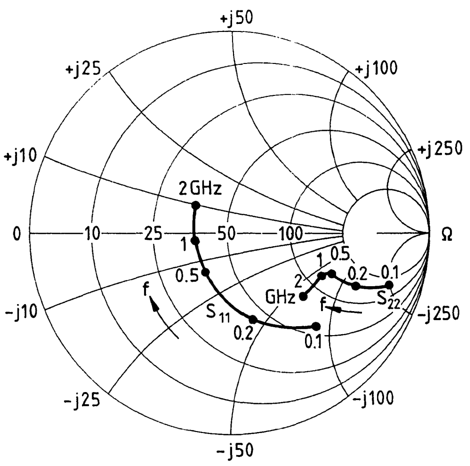
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



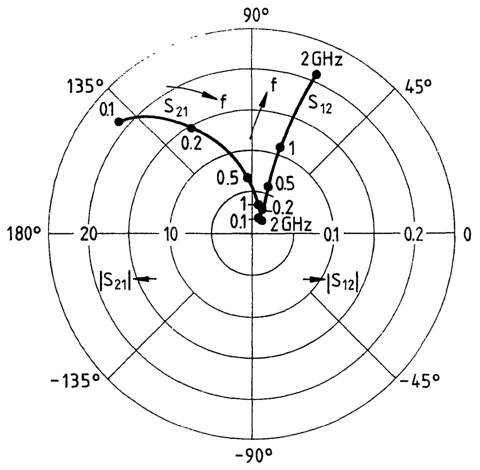
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.64	– 37	19.16	140	0.02	72	0.85	–14
0.3	0.38	– 87	10.29	112	0.04	64	0.63	–26
0.5	0.28	–117	7.00	96	0.06	66	0.53	–26
0.8	0.19	–151	4.49	81	0.09	67	0.49	–25
1.0	0.19	–166	3.65	76	0.11	68	0.49	–27
1.2	0.19	180	3.09	71	0.13	67	0.47	–29
1.5	0.19	162	2.53	62	0.16	66	0.47	–32
1.8	0.21	145	2.15	55	0.19	65	0.47	–37
2.0	0.22	134	2.01	51	0.21	64	0.45	–38

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



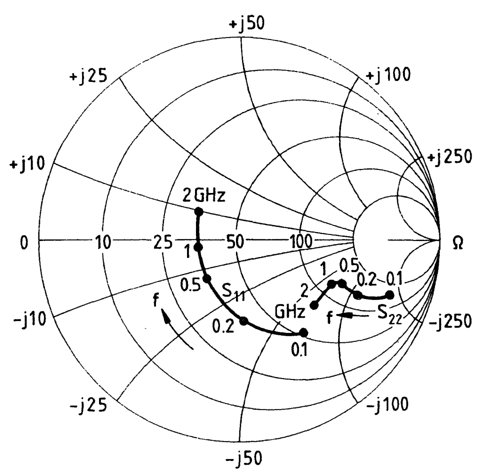
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



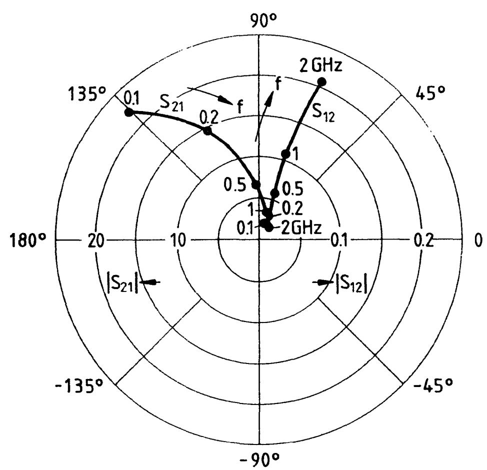
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 45	20.30	135	0.02	71	0.82	–14
0.3	0.34	– 98	10.12	108	0.04	65	0.61	–23
0.5	0.27	–129	6.72	94	0.06	68	0.54	–23
0.8	0.20	–163	4.32	79	0.09	69	0.49	–49
1.0	0.20	–176	3.47	74	0.11	70	0.50	–25
1.2	0.21	173	2.93	69	0.13	69	0.50	–27
1.5	0.21	156	2.41	60	0.16	68	0.49	–30
1.8	0.23	140	2.05	53	0.19	67	0.49	–36
2.0	0.25	131	1.92	49	0.21	65	0.47	–37

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

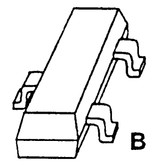


NPN Silicon RF Transistor

BFR 92P

- For broadband amplifiers up to 2 GHz and fast non-saturated switches at collector currents from 0.5 to 20 mA.

- CECC-type available: CECC 50002/254.



ESD: **E**lectrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 92P	GF	Q 62702 – F1050	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	30	mA
Base current	I_B	4	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

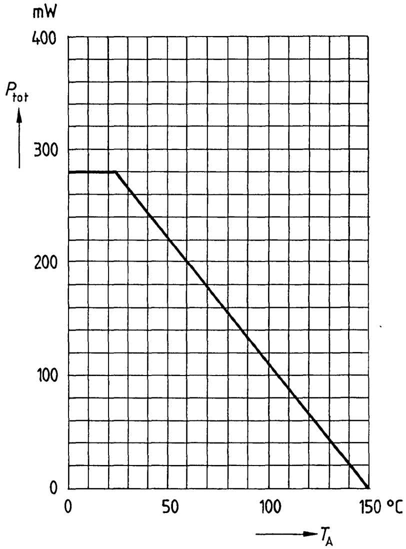
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	μA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	μA
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	40	100	–	–
Collector-emitter saturation voltage I_C = 30 mA, I_B = 3 mA	V_{CEsat}	–	–	0.4	V

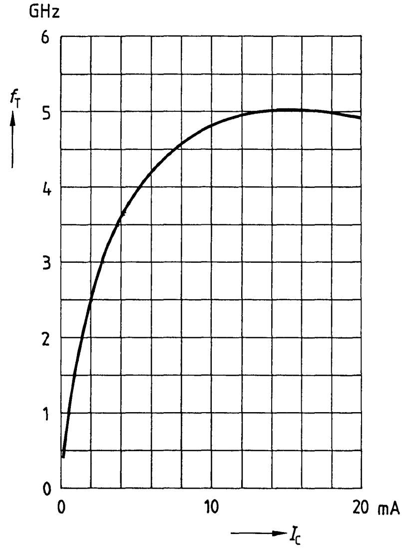
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 200 MHz I_C = 14 mA, V_{CE} = 10 V, f = 200 MHz	f_T	 – –	 3.8 5	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.5	0.7	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.27	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.9	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.77	–	pF
Noise figure I_C = 5 mA, V_{CE} = 6 V, f = 10 MHz, Z_S = 75 Ω I_C = 2 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 3 mA, V_{CE} = 10 V, f = 2 GHz, Z_S = Z_{Sopt}	F	 – – –	 1.5 1.5 3.9	 – – –	dB
Power gain I_C = 15 mA, V_{CE} = 6 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	14	–	dB
Transducer gain I_C = 15 mA, V_{CE} = 6 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11	–	dB
Linear output voltage two-tone intermodulation test I_C = 15 mA, V_{CE} = 10 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	110	–	mV
Third order intercept point I_C = 15 mA, V_{CE} = 10 V, f = 800 MHz	IP_3	–	23.5	–	dBm

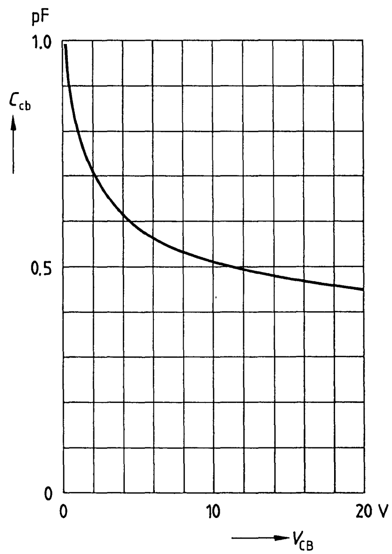
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 6$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

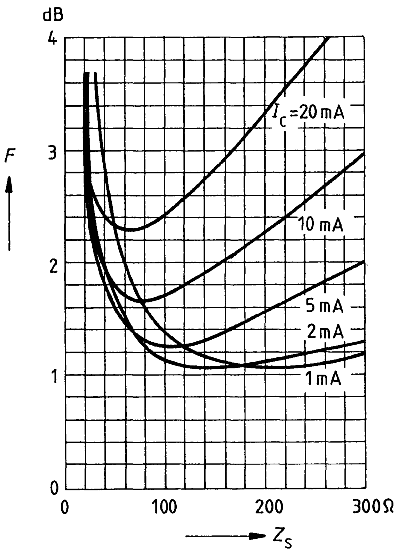
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.05	–	(Z_S = 150 Ω)		–	–	3	–

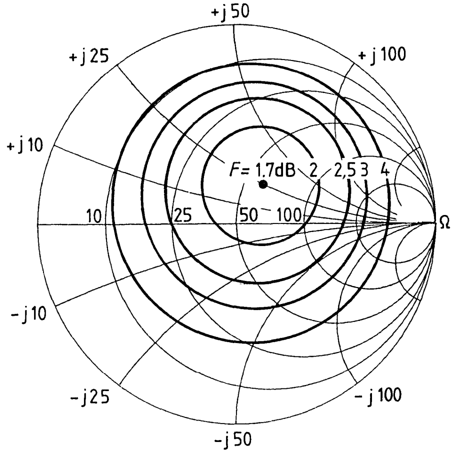
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.3	–	(Z_S ≐ 100 Ω)		–	–	1.6	–
0.8	1.7	14.3	0.25	58.5	16.9	0.24	1.9	14

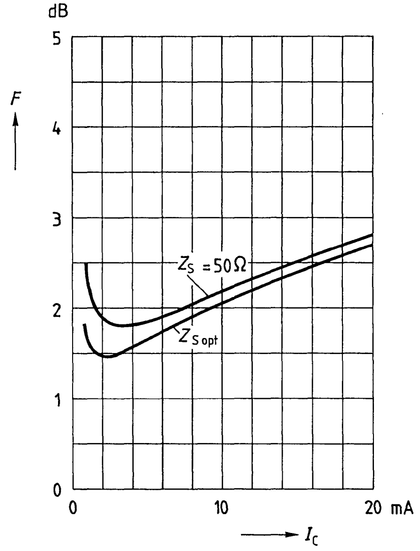
Noise figure $F = f(Z_S)$
V_{CE} = 6 V, f = 10 MHz



Circles of constant noise figure $F = f(Z_S)$
$I_C = 5$ mA, $V_{CE} = 6$ V, $f = 800$ MHz



Noise figure $F = f(I_C)$
$V_{CE} = 6$ V, $f = 800$ MHz, Z_{Lopt} (G)



Common Emitter S Parameters

I_C = 0.5 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.967	– 12.3	1.83	168.2	0.050	81.5	0.990	– 6.7
0.15	0.956	– 18.4	1.82	162.3	0.075	77.4	0.982	–10.0
0.20	0.941	– 24.3	1.81	156.4	0.098	73.2	0.970	–13.0
0.25	0.923	– 30.2	1.78	150.8	0.120	69.3	0.955	–16.2
0.30	0.903	– 35.9	1.75	145.2	0.141	65.4	0.939	–19.1
0.40	0.859	– 47.0	1.68	134.7	0.177	58.2	0.902	–24.5
0.50	0.812	– 57.2	1.59	125.1	0.207	51.8	0.864	–29.4
0.60	0.765	– 67.2	1.51	116.1	0.231	46.2	0.826	–33.6
0.70	0.717	– 76.5	1.44	108.0	0.249	41.2	0.790	–37.4
0.80	0.686	– 85.5	1.36	100.3	0.265	36.3	0.757	–40.7
0.90	0.645	– 94.5	1.31	93.3	0.275	32.3	0.725	–43.8
1.00	0.610	–103.1	1.25	86.6	0.281	28.6	0.695	–46.4

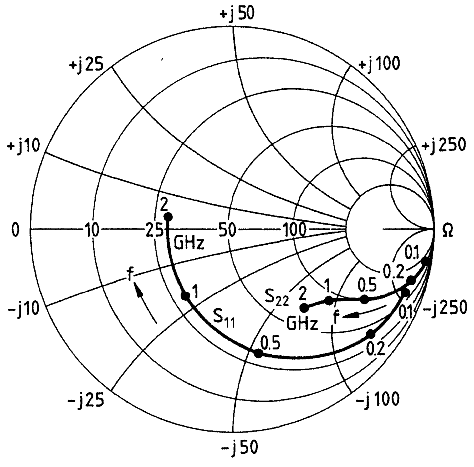
I_C = 1 mA, V_{CE} = 1 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.938	– 16.4	3.51	165.6	0.050	79.4	0.981	– 9.4
0.15	0.917	– 24.5	3.45	158.7	0.073	74.4	0.962	–13.8
0.20	0.892	– 32.2	3.37	151.9	0.095	69.6	0.938	–17.9
0.25	0.862	– 39.7	3.26	145.5	0.114	65.1	0.910	–21.9
0.30	0.829	– 46.7	3.13	139.4	0.132	60.8	0.881	–25.5
0.40	0.763	– 60.1	2.88	128.5	0.160	53.5	0.819	–31.7
0.50	0.699	– 72.0	2.64	118.9	0.182	47.6	0.761	–37.0
0.60	0.643	– 83.2	2.41	110.4	0.198	42.8	0.709	–41.2
0.70	0.591	– 93.4	2.22	102.9	0.209	38.9	0.665	–44.7
0.80	0.557	–103.0	2.05	96.1	0.219	35.5	0.626	–47.5
0.90	0.521	–112.6	1.92	89.8	0.225	32.9	0.591	–50.2
1.00	0.490	–121.7	1.79	84.0	0.229	30.8	0.559	–52.4

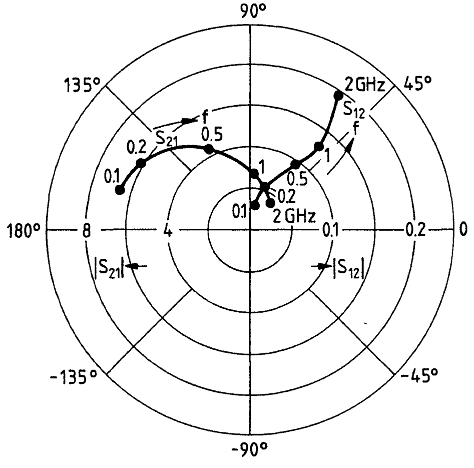
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.91	– 15	6.49	161	0.03	79	0.97	– 6
0.3	0.79	– 46	5.25	139	0.08	64	0.88	–22
0.5	0.66	– 71	4.49	120	0.11	55	0.77	–30
0.8	0.46	–102	3.29	98	0.13	47	0.64	–35
1.0	0.40	–119	2.80	88	0.15	46	0.60	–38
1.2	0.36	–134	2.43	80	0.15	45	0.56	–40
1.5	0.31	–156	2.03	69	0.17	48	0.53	–43
1.8	0.29	–178	1.77	60	0.19	49	0.51	–48
2.0	0.29	168	1.66	54	0.20	51	0.49	–49

S_{11}, S_{22} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



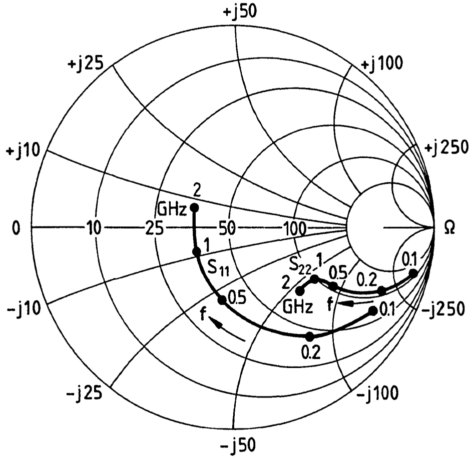
S_{12}, S_{21} = f (f)
I_C = 2 mA, V_{CE} = 6 V, Z_0 = 50 Ω



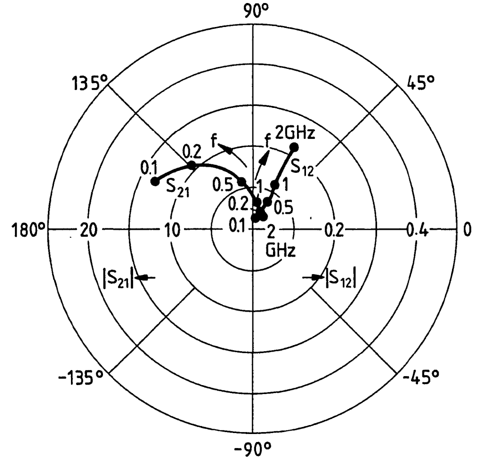
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.80	– 24	12.96	150	0.03	75	0.92	–11
0.3	0.58	– 66	8.56	123	0.06	61	0.74	–29
0.5	0.44	– 97	6.27	106	0.08	58	0.59	–35
0.8	0.28	–128	4.19	88	0.11	57	0.49	–35
1.0	0.26	–144	3.45	81	0.13	59	0.49	–36
1.2	0.24	–160	2.93	74	0.14	58	0.45	–38
1.5	0.22	179	2.43	65	0.17	59	0.44	–40
1.8	0.23	159	2.08	57	0.20	59	0.43	–45
2.0	0.25	146	1.93	52	0.22	58	0.40	–46

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



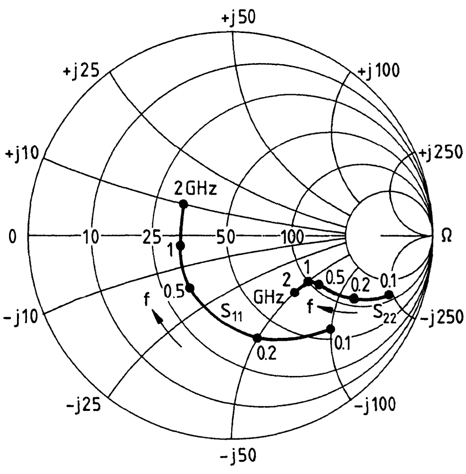
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 6 V, Z_0 = 50 Ω



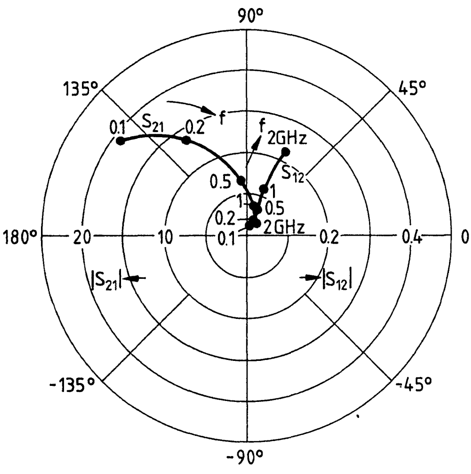
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.66	– 35	18.62	140	0.03	73	0.85	–15
0.3	0.42	– 85	10.32	113	0.05	62	0.62	–31
0.5	0.32	–116	6.92	98	0.07	63	0.50	–33
0.8	0.22	–149	4.49	83	0.10	64	0.44	–31
1.0	0.21	–164	3.65	77	0.12	65	0.43	–32
1.2	0.21	–178	3.09	71	0.14	64	0.41	–34
1.5	0.21	164	2.54	63	0.17	63	0.41	–36
1.8	0.22	147	2.18	55	0.21	62	0.40	–41
2.0	0.24	136	2.02	51	0.22	61	0.38	–42

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



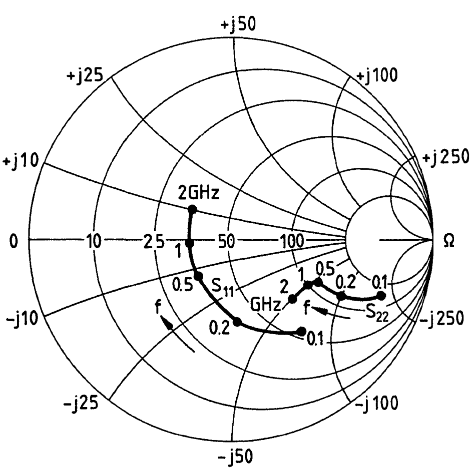
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 6 V, Z_0 = 50 Ω



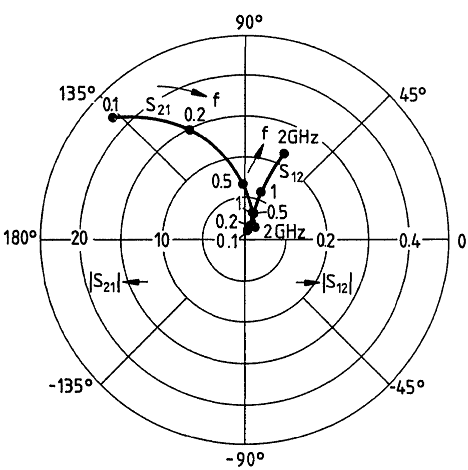
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.57	– 43	20.30	137	0.02	71	0.81	–16
0.3	0.35	– 95	10.53	109	0.05	54	0.58	–29
0.5	0.27	–127	7.00	95	0.07	66	0.48	–29
0.8	0.21	–162	4.49	80	0.10	67	0.43	–27
1.0	0.21	–174	3.65	75	0.12	68	0.43	–29
1.2	0.21	174	3.09	70	0.14	66	0.41	–31
1.5	0.22	158	2.54	61	0.17	65	0.41	–34
1.8	0.24	142	2.15	54	0.21	64	0.41	–40
2.0	0.26	133	2.00	50	0.23	63	0.39	–40

S_{11}, S_{22} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



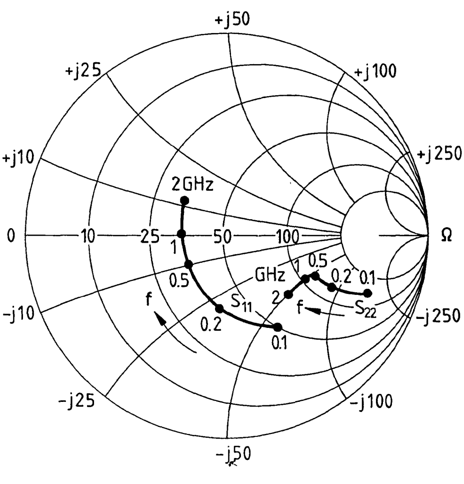
S_{12}, S_{21} = f (*f*)
I_C = 15 mA, V_{CE} = 6 V, Z_0 = 50 Ω



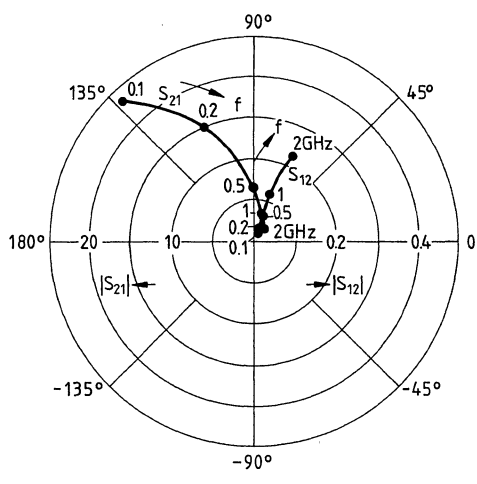
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.51	– 49	21.13	133	0.02	70	0.79	–16
0.3	0.32	–106	10.35	106	0.05	65	0.56	–27
0.5	0.27	–138	6.76	92	0.07	67	0.48	–27
0.8	0.22	–171	4.34	78	0.09	68	0.45	–25
1.0	0.22	179	3.49	74	0.12	69	0.44	–28
1.2	0.23	169	2.97	68	0.14	68	0.43	–30
1.5	0.24	153	2.43	60	0.17	66	0.43	–33
1.8	0.26	139	2.07	53	0.21	65	0.42	–39
2.0	0.28	131	1.93	48	0.22	64	0.40	–39

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



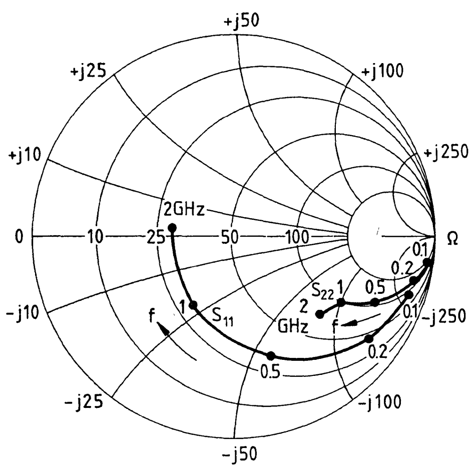
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 6 V, Z_0 = 50 Ω



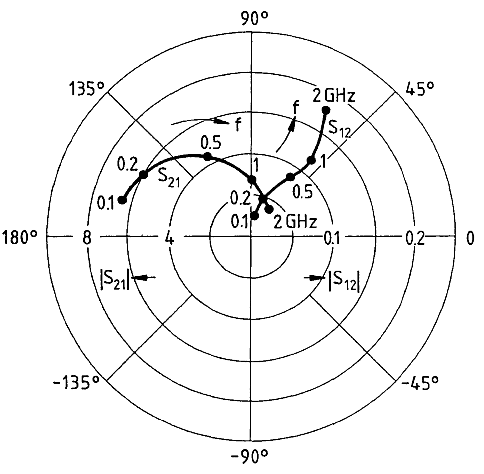
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.92	– 14	6.46	161	0.03	80	0.98	– 6
0.3	0.81	– 43	5.28	140	0.07	66	0.90	–19
0.5	0.69	– 65	4.54	122	0.10	57	0.80	–27
0.8	0.48	– 95	3.35	99	0.12	49	0.68	–33
1.0	0.42	–111	2.87	90	0.14	48	0.64	–35
1.2	0.36	–125	2.45	83	0.15	47	0.61	–38
1.5	0.30	–146	2.07	71	0.16	49	0.58	–40
1.8	0.28	–170	1.81	62	0.18	50	0.56	–45
2.0	0.27	175	1.68	56	0.19	52	0.54	–46

S_{11}, S_{22} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



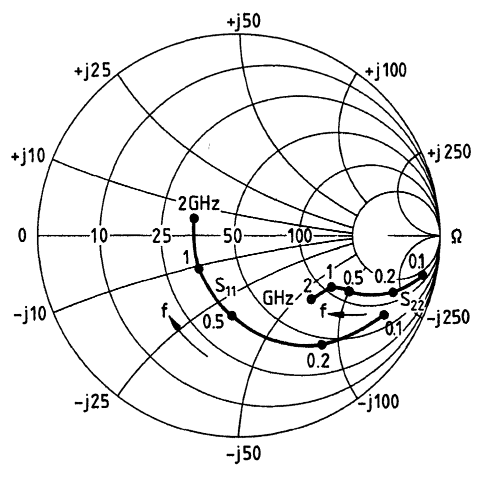
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 10 V, Z_0 = 50 Ω



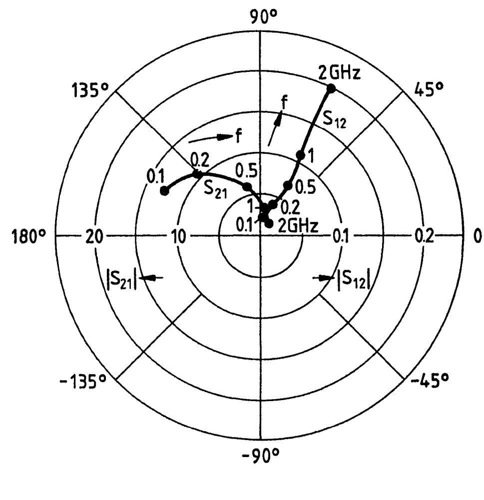
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 19	12.74	152	0.03	78	0.95	– 9
0.3	0.65	– 57	8.56	125	0.06	63	0.80	–25
0.5	0.49	– 84	6.35	107	0.08	58	0.67	–31
0.8	0.31	–112	4.29	89	0.10	55	0.56	–33
1.0	0.27	–129	3.53	82	0.13	57	0.54	–35
1.2	0.24	–144	2.97	77	0.14	57	0.51	–36
1.5	0.21	–167	2.45	67	0.16	58	0.50	–38
1.8	0.21	170	2.13	59	0.19	58	0.48	–43
2.0	0.22	155	1.96	54	0.21	58	0.47	–43

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



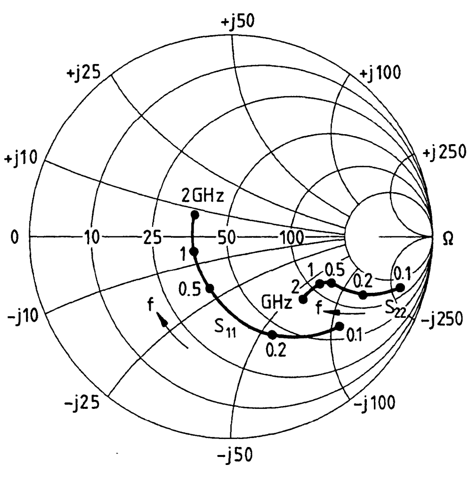
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 10 V, Z_0 = 50 Ω



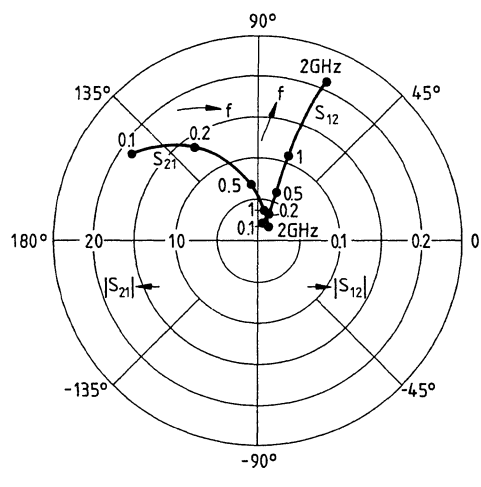
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.75	– 28	18.20	142	0.02	74	0.88	–13
0.3	0.52	– 71	10.23	114	0.05	63	0.67	–27
0.5	0.37	– 99	7.00	99	0.07	63	0.56	–29
0.8	0.23	–129	4.57	84	0.09	63	0.50	–28
1.0	0.21	–146	3.72	78	0.12	65	0.48	–29
1.2	0.20	–163	3.11	74	0.13	65	0.47	–31
1.5	0.18	177	2.56	64	0.16	64	0.46	–34
1.8	0.19	157	2.19	57	0.19	63	0.46	–39
2.0	0.20	143	2.03	53	0.21	62	0.44	–39

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



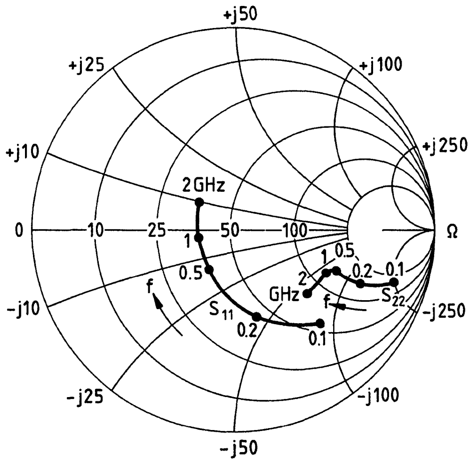
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 10 V, Z_0 = 50 Ω



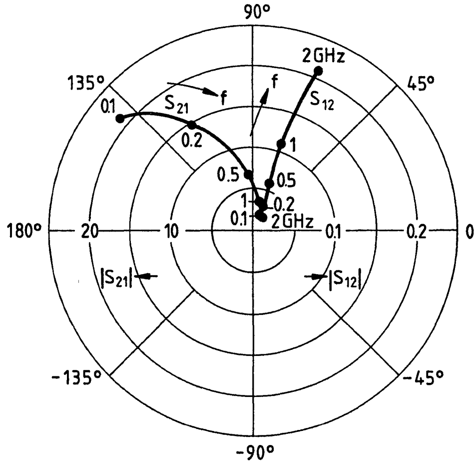
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.64	– 37	19.16	140	0.02	72	0.85	–14
0.3	0.38	– 87	10.29	112	0.04	64	0.63	–26
0.5	0.28	–117	7.00	96	0.06	66	0.53	–26
0.8	0.19	–151	4.49	81	0.09	67	0.49	–25
1.0	0.19	–166	3.65	76	0.11	68	0.49	–27
1.2	0.19	180	3.09	71	0.13	67	0.47	–29
1.5	0.19	162	2.53	62	0.16	66	0.47	–32
1.8	0.21	145	2.15	55	0.19	65	0.47	–37
2.0	0.22	134	2.01	51	0.21	64	0.45	–38

S_{11}, S_{22} = f (f)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



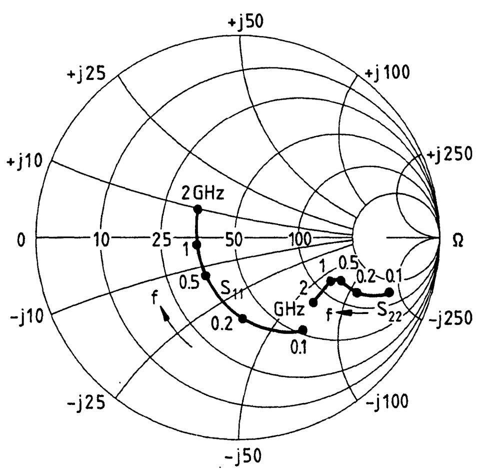
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 10 V, Z_0 = 50 Ω



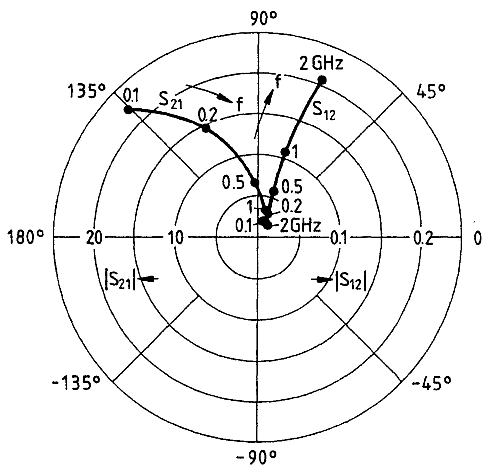
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 45	20.30	135	0.02	71	0.82	–14
0.3	0.34	– 98	10.12	108	0.04	65	0.61	–23
0.5	0.27	–129	6.72	94	0.06	68	0.54	–23
0.8	0.20	–163	4.32	79	0.09	69	0.49	–49
1.0	0.20	–176	3.47	74	0.11	70	0.50	–25
1.2	0.21	173	2.93	69	0.13	69	0.50	–27
1.5	0.21	156	2.41	60	0.16	68	0.49	–30
1.8	0.23	140	2.05	53	0.19	67	0.49	–36
2.0	0.25	131	1.92	49	0.21	65	0.47	–37

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω

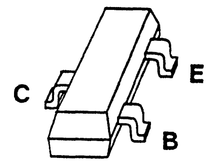


S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 10 V, Z_0 = 50 Ω



NPN Silicon RF Transistor — BFR 93A

- For low-distortion broadband amplifiers and oscillators up to 2 GHz at operating currents from 5 to 30 mA.
- CECC-type available: CECC 50002/256.



ESD: **E**lectrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 93A	R2	Q 62702 – F1086	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	50	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

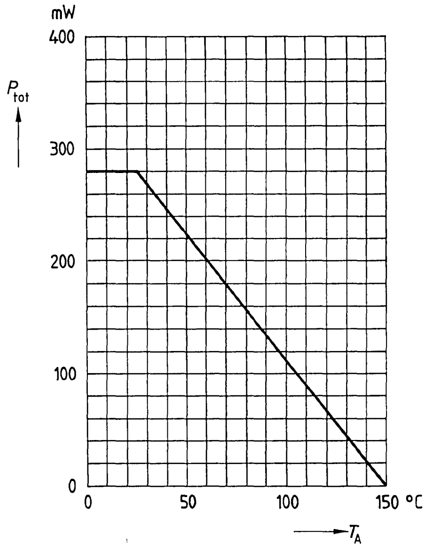
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	40	90	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.13	0.4	V

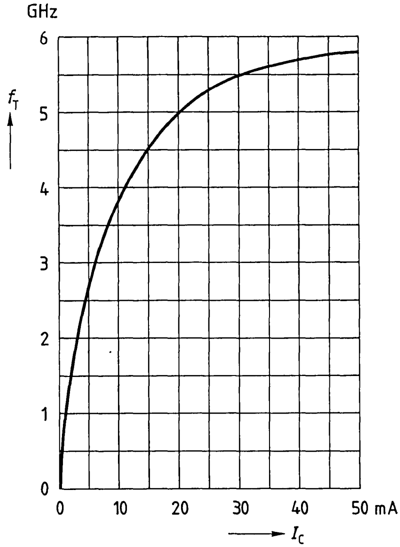
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	–	5.5	–	GHz
Collector-base capacitance $V_{CB} = 5$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.55	–	pF
Collector-emitter capacitance $V_{CE} = 5$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.28	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.1	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.8	–	pF
Noise figure $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 50\ \Omega$ $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$ $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	 – – –	 1.1 1.7 2.6	 – – –	dB
Power gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	13.5	–	dB
Transducer gain $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 1$ GHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	11.5	–	dB
Linear output voltage two-tone intermodulation test $I_C = 30$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	280	–	mV
Third order intercept point $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	32	–	dBm

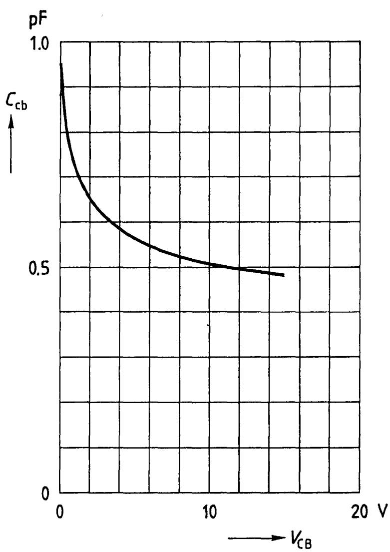
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

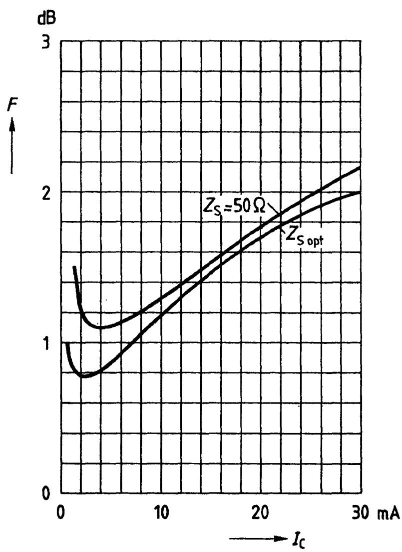
I_C = 4 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	0.8	–	(Z_S = 150 Ω)		–	–	1.1	–

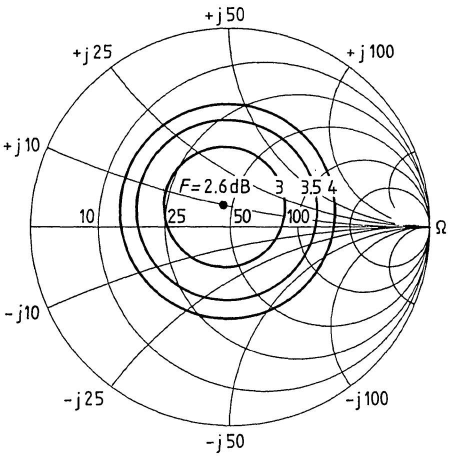
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	2.0	–	(Z_S = 100 Ω)		–	–	2.15	–
0.8	2.6	13.5	0.13	108	19.3	0.41	2.85	13

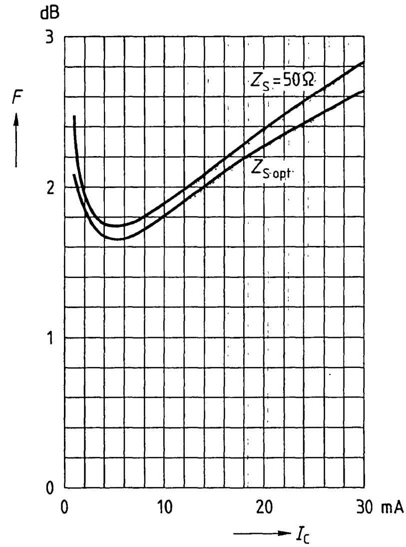
Noise figure $F = f(I_C)$
V_{CE} = 8 V, f = 10 MHz



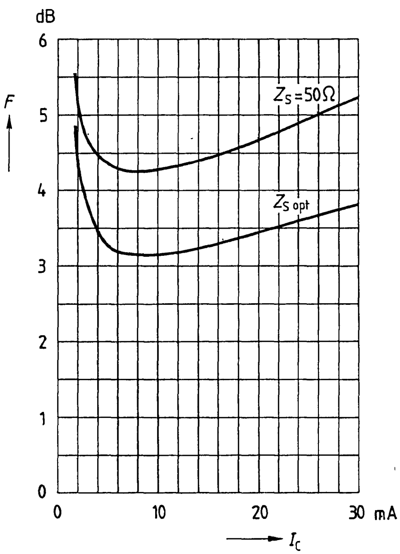
Circles of constant noise figure $F = f(Z_S)$
in Z_S-plane, $I_C = 30$ mA, $V_{CE} = 8$ V, $f = 800$ MHz



Noise figure $F = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, Z_{Lopt} (G)



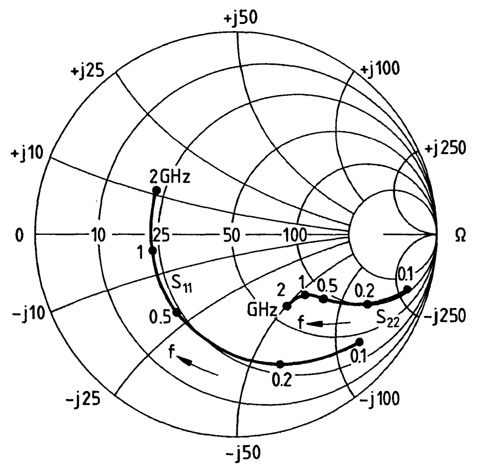
Noise figure $F = f(I_C)$
$V_{CE} = 8$ V, $f = 2$ GHz, Z_{Lopt} (G)



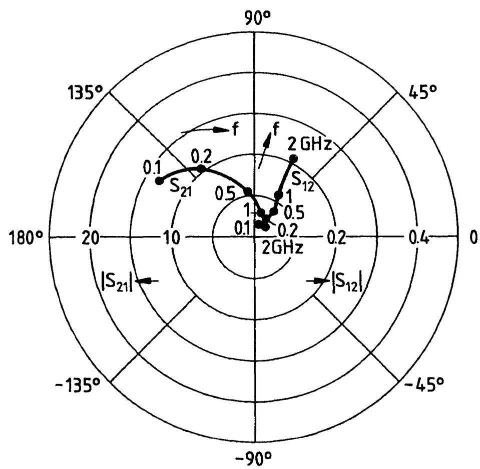
Common Emitter S Parameters
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.74	– 45	13.5	150	0.033	69	0.93	–21
0.2	0.64	– 81	10.5	129	0.052	57	0.73	–30
0.5	0.49	–132	5.6	101	0.078	53	0.50	–56
0.8	0.45	–158	3.7	86	0.097	57	0.41	–37
1.0	0.44	–169	3.0	79	0.113	61	0.39	–39
1.2	0.43	–179	2.6	73	0.127	64	0.38	–40
1.5	0.41	169	2.1	65	0.145	66	0.42	–45
2.0	0.40	160	1.7	54	0.194	71	0.44	–48

S_{11}, S_{22} = f (*f*), *Z*-plane
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



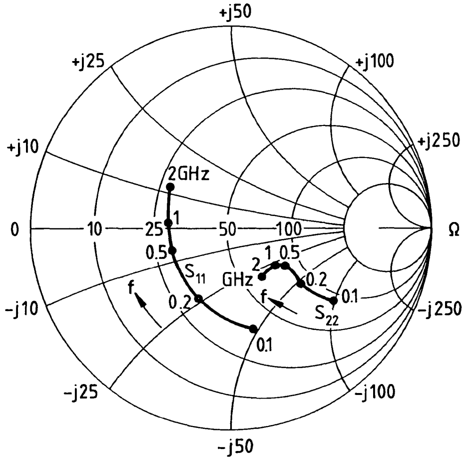
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



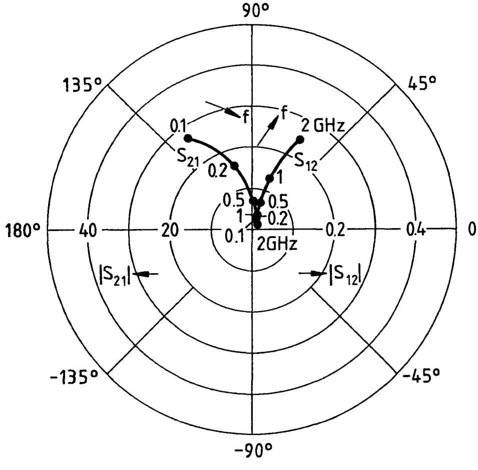
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.38	–105	27.6	125	0.021	64	0.69	–41
0.2	0.37	–138	16.5	107	0.032	66	0.41	–44
0.5	0.36	–170	7.2	90	0.066	73	0.26	–39
0.8	0.36	–178	4.6	80	0.101	74	0.21	–32
1.0	0.35	177	3.8	75	0.125	73	0.20	–40
1.2	0.34	173	3.2	71	0.147	72	0.20	–41
1.5	0.31	157	2.6	65	0.169	70	0.23	–43
2.0	0.30	152	2.1	55	0.228	69	0.28	–46

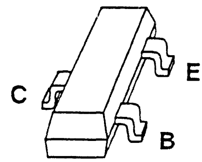
S_{11}, S_{22} = f (*f*), *Z*-plane
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω



- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 to 30 mA.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 93P	GG	Q 62702 – F1051	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	50	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

For detailed dimensions see chapter Package Outlines.
1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

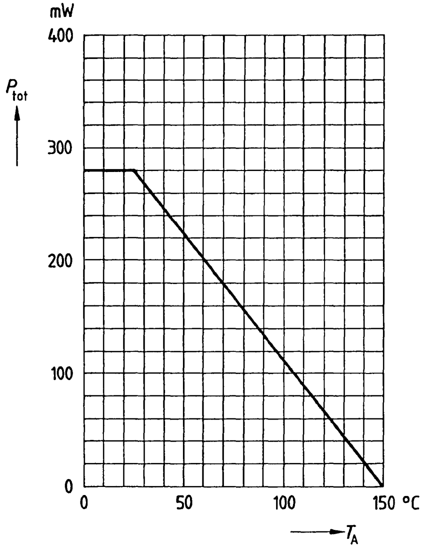
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 20 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 25 mA, V_{CE} = 5 V	h_{FE}	30	100	–	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	0.2	0.5	V

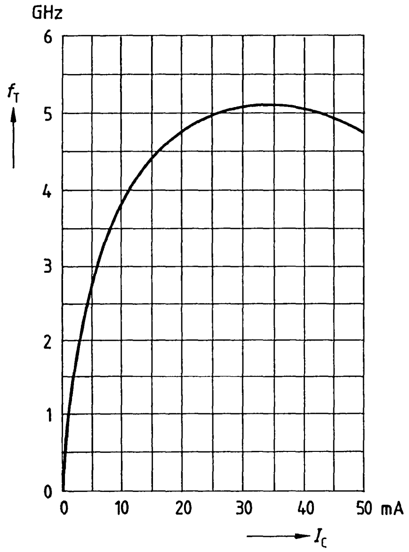
AC characteristics

Parameter	Symbol	Values min	Values typ	Values max	Unit
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 200$ MHz $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 200$ MHz	f_T	 – –	 5 4.7	 – –	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.6	0.75	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.28	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	2.1	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	0.9	–	pF
Noise figure $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 10$ MHz, $Z_S = 75\ \Omega$ $I_C = 5$ mA, $V_{CE} = 8$ V, $f = 500$ MHz, $Z_S = Z_{Sopt}$ $I_C = 10$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$	F	 – – –	 1.7 1.9 2.4	 – – –	dB
Power gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	13	–	dB
Transducer gain $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$	$\|S_{21e}\|^2$	–	15.8	–	dB
Linear output voltage two-tone intermodulation test $I_C = 25$ mA, $V_{CE} = 8$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	240	–	mV
Third order intercept point $I_C = 25$ mA, $V_{CE} = 8$ V, $f = 800$ MHz	IP_3	–	30.5	–	dBm

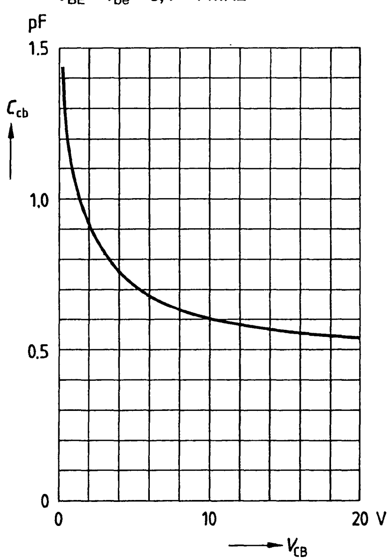
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



Common Emitter Noise Parameters

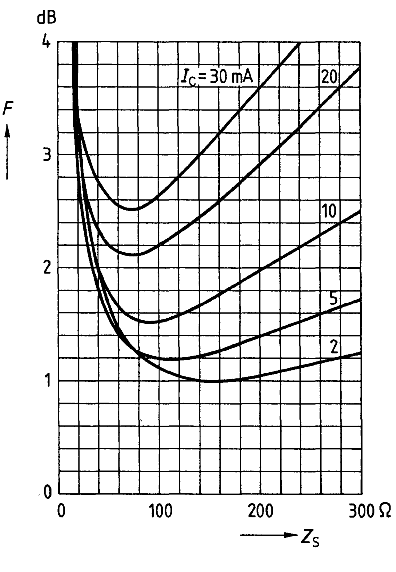
I_C = 2 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.0	–	(Z_S = 150 Ω)		–	–	1.6	–

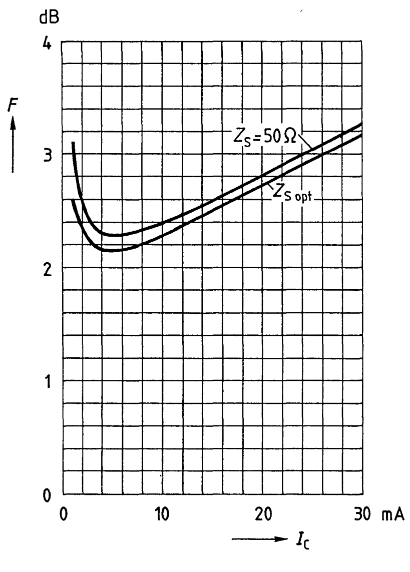
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.5	–	(Z_S = 90 Ω)		–	–	1.7	–
0.8	2.3	–	(Z_S = Z_{Sopt})		–	–	2.4	–

Noise figure F = f (Z_S)
V_{CE} = 8 V, f = 10 MHz



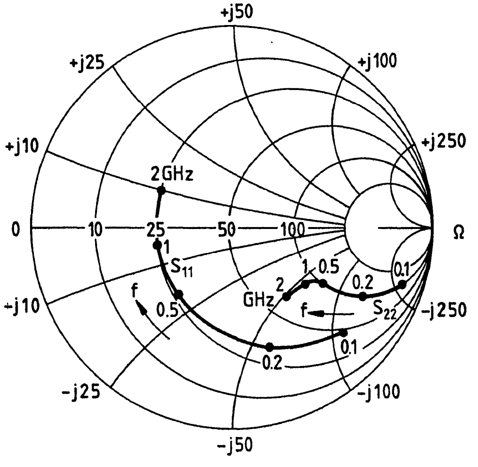
Noise figure F = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)



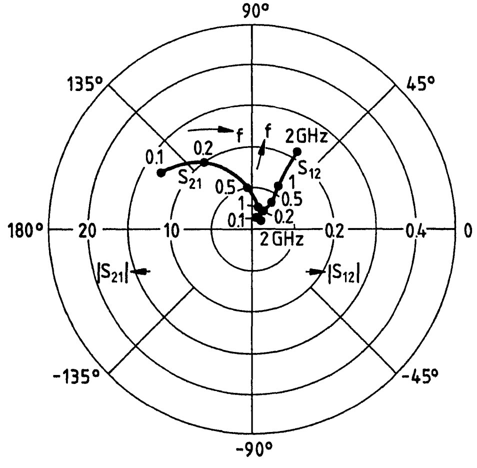
Common Emitter S Parameters
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.74	– 34	12.96	143	0.03	70	0.87	–14
0.3	0.51	– 92	7.50	113	0.06	55	0.65	–31
0.5	0.40	–125	5.13	97	0.08	55	0.54	–33
0.8	0.32	–157	3.35	78	0.10	57	0.48	–32
1.0	0.31	–171	2.71	72	0.12	59	0.48	–35
1.2	0.31	177	2.32	65	0.14	60	0.46	–38
1.4	0.31	166	2.05	59	0.16	62	0.45	–41
1.6	0.32	156	1.84	52	0.18	61	0.45	–46
1.8	0.33	146	1.64	47	0.20	61	0.45	–49
2.0	0.35	137	1.52	42	0.22	61	0.44	–52

$S_{11}, S_{22} = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



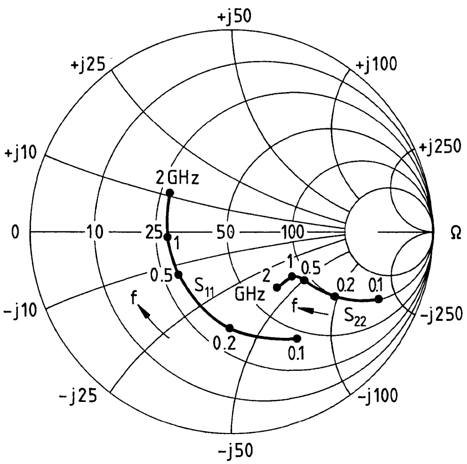
$S_{12}, S_{21} = f(f)$
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



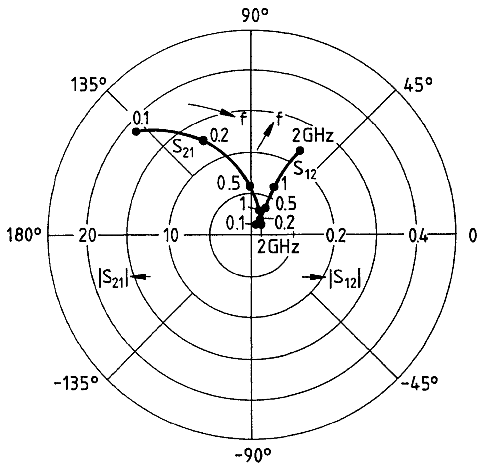
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.58	– 49	18.73	133	0.03	68	0.77	–19
0.3	0.37	–108	9.17	105	0.05	60	0.53	–32
0.5	0.30	–139	5.92	90	0.07	63	0.45	–32
0.8	0.25	–170	3.85	76	0.10	65	0.41	–31
1.0	0.25	180	3.09	70	0.13	65	0.40	–34
1.2	0.26	169	2.63	64	0.15	64	0.39	–37
1.4	0.26	160	2.33	58	0.17	64	0.38	–40
1.6	0.28	151	2.07	52	0.20	62	0.38	–44
1.8	0.29	142	1.84	48	0.22	61	0.38	–47
2.0	0.31	133	1.72	43	0.24	60	0.36	–49

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



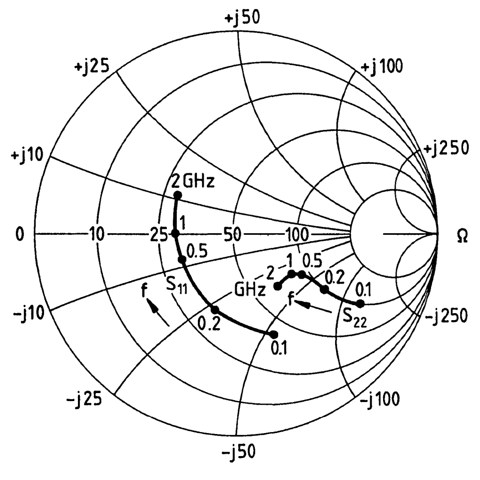
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



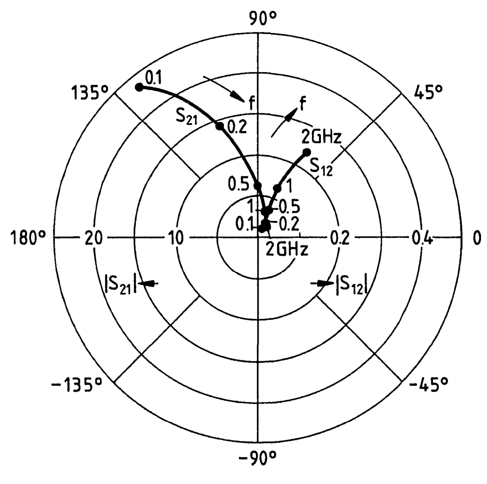
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.41	– 64	22.91	123	0.02	67	0.67	–22
0.3	0.28	–123	9.89	98	0.05	66	0.46	–30
0.5	0.25	–151	6.24	86	0.07	68	0.40	–30
0.8	0.23	–179	4.03	74	0.11	68	0.37	–28
1.0	0.23	172	3.22	69	0.13	68	0.37	–32
1.2	0.25	164	2.74	63	0.16	66	0.35	–35
1.4	0.25	155	2.41	57	0.18	66	0.35	–38
1.6	0.27	147	2.14	51	0.20	63	0.35	–43
1.8	0.28	139	1.92	47	0.23	61	0.35	–46
2.0	0.30	131	1.79	42	0.25	60	0.33	–48

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



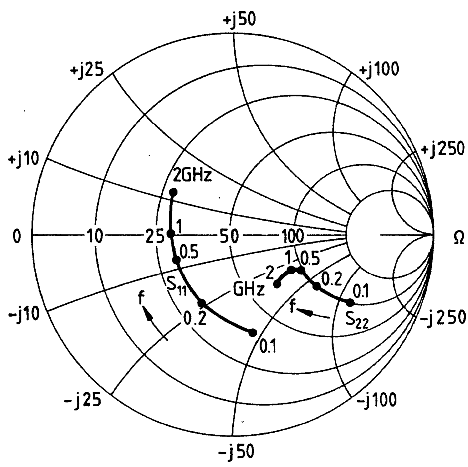
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



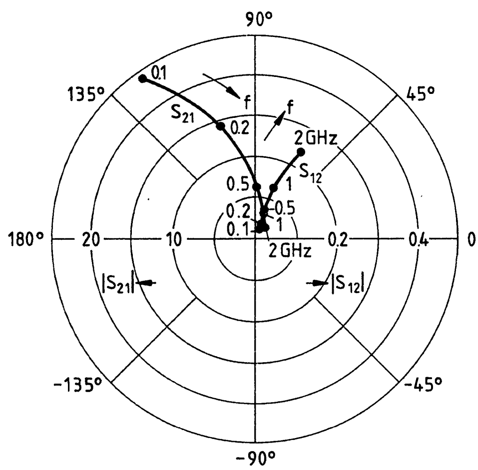
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.37	– 68	23.71	120	0.02	67	0.64	–22
0.3	0.26	–127	9.89	97	0.05	67	0.44	–29
0.5	0.24	–154	6.20	85	0.07	70	0.39	–28
0.8	0.22	179	3.98	73	0.11	69	0.37	–27
1.0	0.23	170	3.18	68	0.13	68	0.37	–31
1.2	0.24	162	2.71	62	0.16	66	0.36	–35
1.4	0.25	153	2.37	57	0.18	66	0.36	–37
1.6	0.27	146	2.11	51	0.20	63	0.35	–42
1.8	0.28	138	1.89	47	0.23	62	0.35	–46
2.0	0.30	130	1.77	42	0.25	60	0.34	–48

S_{11}, S_{22} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



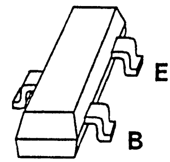
S_{12}, S_{21} = f (*f*)
I_C = 25 mA, V_{CE} = 8 V, Z_0 = 50 Ω



NPN Silicon RF Transistor

BFR 106

- For low-noise, high-gain amplifiers
- For linear broadband amplifiers
- Special application: antenna amplifiers



ESD: **E**lectrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 106	R7	Q 62702 – F1219	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	100	mA
Total power dissipation, $T_A \leq 45$ °C[2])	P_{tot}	350	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤300	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

DC characteristics

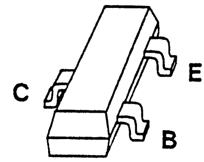
Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	100	nA
Emitter-base cutoff current V_{EB} = 2 V, I_C = 0	I_{EBO}	–	–	10	µA
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 30 mA, V_{CE} = 6 V	h_{FE}	 25 25	 – 90	 – –	–
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 30$ mA, $V_{CE} = 6$ V, $f = 200$ MHz	f_T	–	3.7	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	1	–	pF
Collector-emitter capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{ce}	–	0.3	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	4.5	–	pF
Output capacitance $V_{CE} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{obs}	–	1.3	–	pF
Noise figure $I_C = 30$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = Z_{Sopt}$	F	–	3.6	–	dB
Power gain $I_C = 30$ mA, $V_{CE} = 6$ V, $f = 800$ MHz, $Z_S = 50\ \Omega$, $Z_L = Z_{Lopt}$	G_{pe}	–	11.5	–	dB
Linear output voltage two-tone intermodulation test $I_C = 30$ mA, $V_{CE} = 6$ V, $d_{IM} = 60$ dB $f_1 = 806$ MHz, $f_2 = 810$ MHz, $Z_S = Z_L = 50\ \Omega$	$V_{o1} = V_{o2}$	–	250	–	mV

NPN Silicon RF Transistor **BFR 193**

- For low-noise, high-gain amplifiers up to 2 GHz.
- For linear broadband amplifiers.
- f_T = 8 GHz.
  F = 1.2 dB at 800 MHz.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFR 193	RC	Q 62702 – F1218	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-emitter voltage, $V_{BE} = 0$	V_{CES}	20	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	80	mA
Base current	I_B	10	mA
Total power dissipation, $T_A \leq 50$ °C[2]	P_{tot}	400	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1]	R_{thJA}	≤250	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

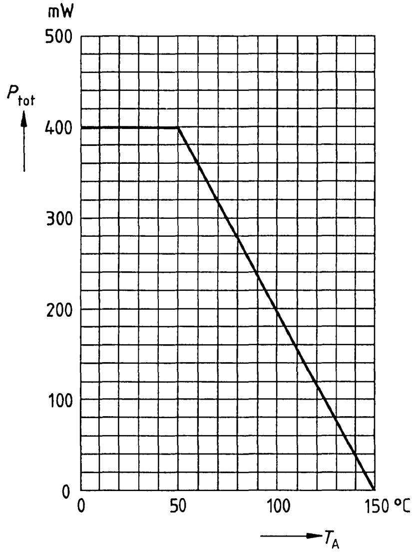
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EBO}	–	–	1	µA
DC current gain I_C = 5 mA, V_{CE} = 8 V I_C = 30 mA, V_{CE} = 8 V	h_{FE}	 – –	 90 100	 – –	– –
Collector-emitter saturation voltage I_C = 50 mA, I_B = 5 mA	V_{CEsat}	–	–	0.4	V

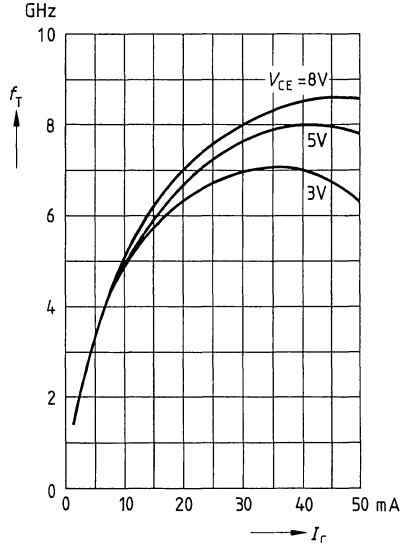
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 5 mA, V_{CE} = 8 V, f = 200 MHz I_C = 30 mA, V_{CE} = 8 V, f = 200 MHz	f_T	 – –	 3.5 7	 – –	GHz
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.66	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.24	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	2.2	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.9	–	pF
Noise figure I_C = 5 mA, V_{CE} = 8 V, f = 10 MHz, Z_S = 75 Ω I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = Z_{Sopt} I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_S = 50 Ω	F	 – – –	 0.8 1.7 2	 – – –	dB
Power gain I_C = 30 mA, V_{CE} = 8 V, f = 800 MHz, Z_S = 50 Ω, Z_L = Z_{Lopt}	G_{pe}	–	13.5	–	dB
Transducer gain I_C = 30 mA, V_{CE} = 8 V, f = 1 GHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	11.5	–	dB
Linear output voltage two-tone intermodulation test I_C = 40 mA, V_{CE} = 5 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_{o1} = V_{o2}	–	250	–	mV
Third order intercept point I_C = 40 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	31	–	dBm

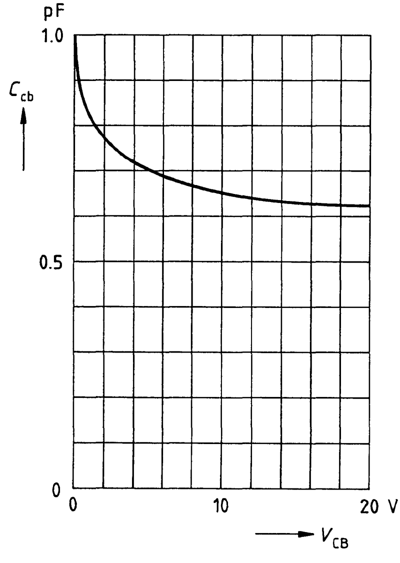
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
V_{CE} = 8 V, f = 200 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



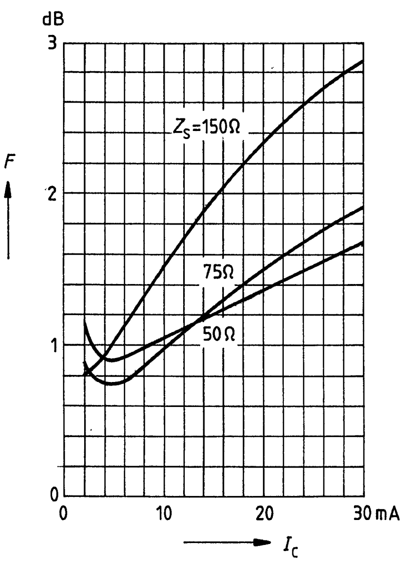
Common Emitter Noise Parameters
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1	–	(Z_S = 75 Ω)		–	–	1.05	–
0.8	1.25	13.5	–	–	–	–	1.35	12.4
2.0	2.4	7	–	–	–	–	–	–

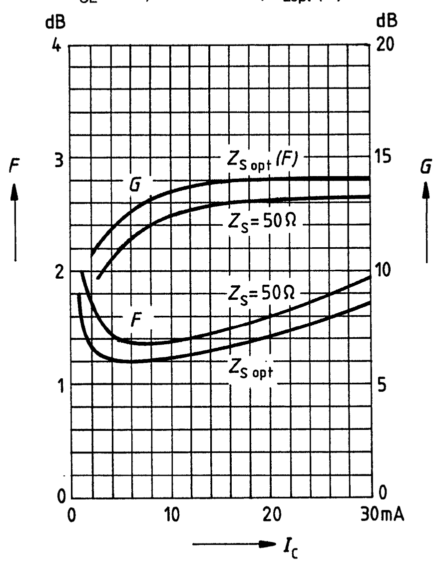
I_C = 30 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	F_{min}	G_p (F_{min})	Γ_{opt}		R_N	N	$F_{50\,\Omega}$	G_p ($F_{50\,\Omega}$)
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
0.01	1.65	–	(Z_S = 50 Ω)		–	–	1.65	–
0.8	1.7	14.2	–	–	–	–	1.95	13.3
2.0	2.7	7.5	–	–	–	–	–	–

Noise figure F = f (I_C)
V_{CE} = 8 V, f = 10 MHz

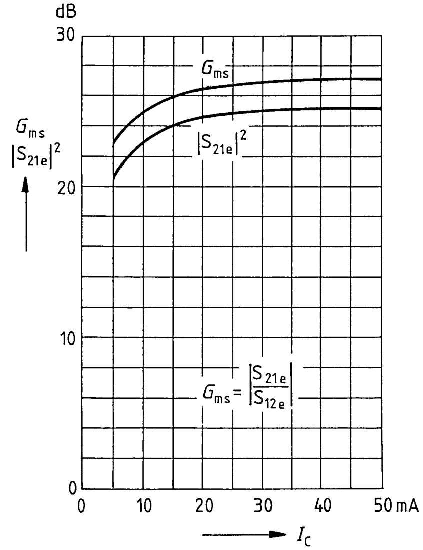


Noise figure F = f (I_C)
Power gain G = f (I_C)
V_{CE} = 8 V, f = 800 MHz, Z_{Lopt} (G)

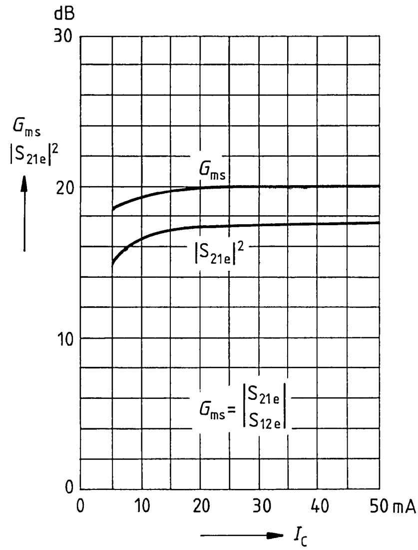


Common Emitter Power Gain

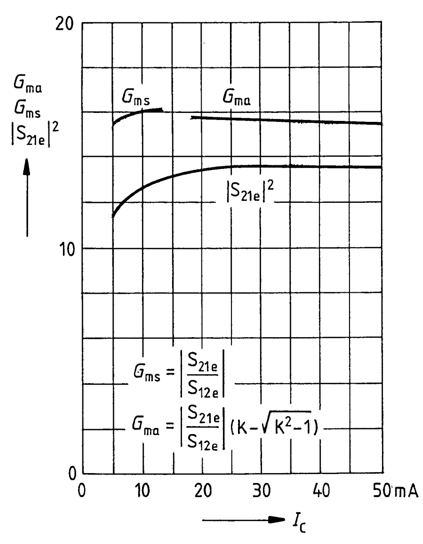
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 200$ MHz, $Z_0 = 50\ \Omega$



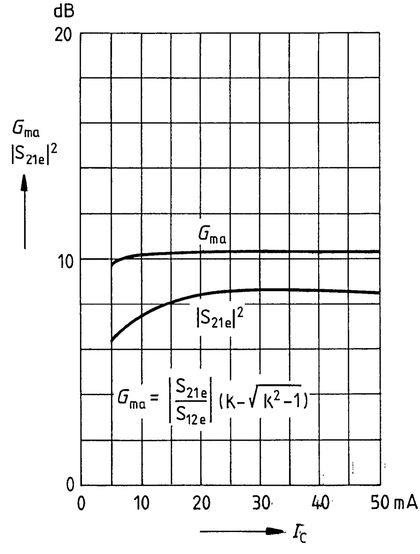
Power gain G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 500$ MHz, $Z_0 = 50\ \Omega$



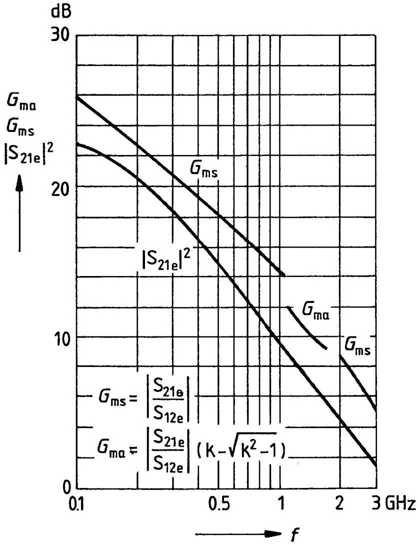
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 800$ MHz, $Z_0 = 50\ \Omega$



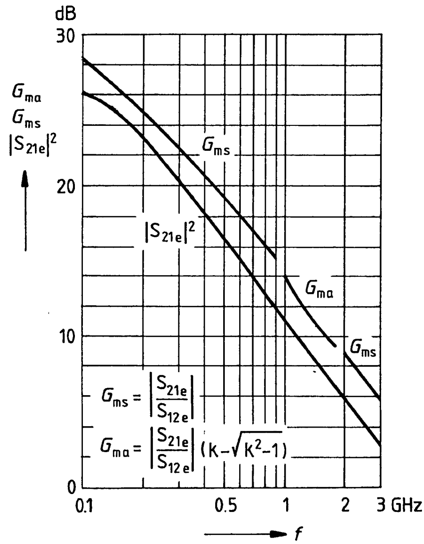
Power gain G_{ma}, $|S_{21e}|^2 = f(I_C)$
$V_{CE} = 8$ V, $f = 1.5$ GHz, $Z_0 = 50\ \Omega$



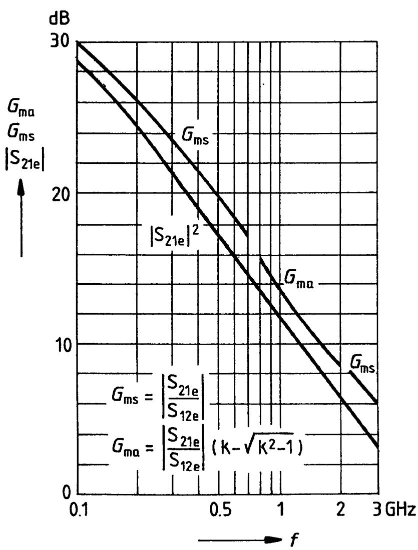
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 5$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



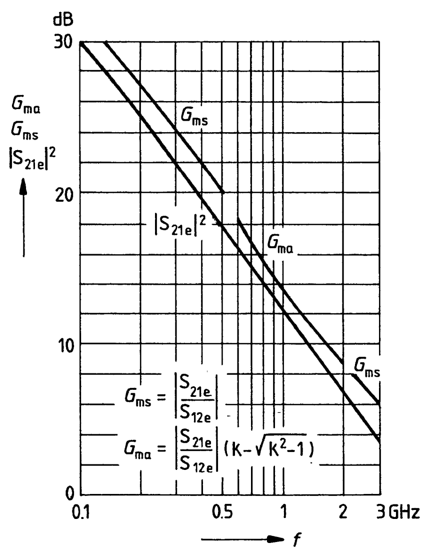
Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 10$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 20$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Power gain G_{ma}, G_{ms}, $|S_{21e}|^2 = f(f)$
$I_C = 40$ mA, $V_{CE} = 8$ V, $Z_0 = 50\ \Omega$



Common Emitter S Parameters
I_C = 10 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.594	– 64.8	20.60	137.8	0.031	64.3	0.770	– 31.2
0.15	0.530	– 87.0	16.80	125.1	0.039	59.3	0.643	– 38.6
0.20	0.484	–103.6	13.87	116.4	0.046	57.5	0.547	– 42.7
0.25	0.451	–116.9	11.67	109.8	0.051	57.1	0.478	– 44.9
0.30	0.431	–127.0	10.04	104.9	0.056	57.5	0.428	– 45.8
0.40	0.409	–142.4	7.80	97.5	0.066	59.4	0.363	– 46.2
0.50	0.397	–153.2	6.38	91.9	0.077	61.2	0.326	– 46.3
0.60	0.388	–161.6	5.38	87.3	0.087	62.7	0.302	– 46.3
0.70	0.386	–168.7	4.66	83.4	0.098	63.8	0.285	– 46.7
0.80	0.388	–174.1	4.13	79.7	0.109	64.5	0.275	– 47.2
0.90	0.390	–179.3	3.70	76.4	0.120	65.1	0.264	– 48.0
1.00	0.392	176.2	3.35	73.3	0.132	65.4	0.256	– 48.8
1.20	0.400	167.6	2.83	67.9	0.155	65.5	0.241	– 50.9
1.40	0.399	159.6	2.47	62.7	0.179	65.2	0.235	– 53.7
1.50	0.398	156.0	2.33	60.2	0.191	64.8	0.236	– 55.6
1.60	0.401	153.3	2.20	57.7	0.203	64.4	0.236	– 57.8
1.80	0.405	147.6	1.99	52.8	0.228	63.1	0.234	– 62.7
2.00	0.420	143.1	1.82	48.6	0.252	61.6	0.225	– 68.2
2.50	0.461	131.3	1.53	39.0	0.313	57.9	0.206	– 85.0
3.00	0.473	120.0	1.34	30.0	0.376	53.0	0.208	–100.0

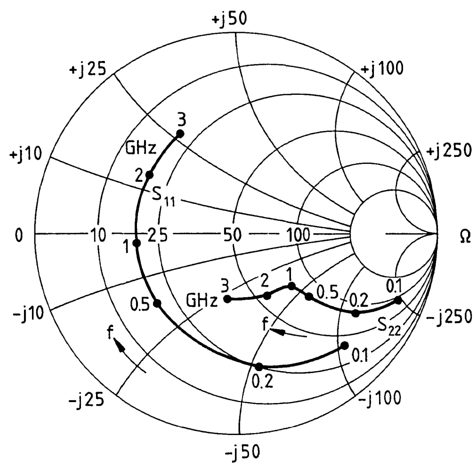
I_C = 30 mA, V_{CE} = 3 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.375	–101.9	29.20	122.8	0.023	65.8	0.564	– 46.0
0.15	0.355	–124.1	21.58	111.8	0.030	66.1	0.429	– 51.8
0.20	0.346	–138.3	16.90	105.0	0.036	67.9	0.348	– 54.0
0.25	0.340	–148.1	13.80	100.3	0.043	69.3	0.297	– 54.8
0.30	0.338	–155.1	11.65	96.7	0.049	70.5	0.261	– 54.6
0.40	0.338	–165.5	8.88	91.3	0.063	72.0	0.219	– 53.8
0.50	0.336	–172.6	7.19	87.2	0.077	72.7	0.196	– 53.3
0.60	0.334	–178.1	6.03	83.6	0.091	72.8	0.182	– 53.1
0.70	0.336	177.0	5.20	80.4	0.104	72.5	0.172	– 53.7
0.80	0.338	173.5	4.60	77.3	0.118	72.1	0.166	– 54.6
0.90	0.344	169.7	4.11	74.6	0.132	71.5	0.159	– 55.6
1.00	0.347	166.4	3.71	72.0	0.146	70.7	0.153	– 56.9
1.20	0.358	159.7	3.13	67.2	0.173	69.1	0.141	– 59.5
1.40	0.359	152.7	2.73	62.5	0.200	67.2	0.136	– 62.5
1.50	0.359	149.4	2.57	60.2	0.213	66.3	0.138	– 64.8
1.60	0.361	147.5	2.43	58.0	0.227	65.2	0.139	– 67.5
1.80	0.362	142.8	2.20	53.5	0.253	62.9	0.138	– 74.1
2.00	0.380	139.3	2.01	49.5	0.278	60.6	0.131	– 81.9
2.50	0.419	128.7	1.68	40.5	0.340	55.1	0.117	–105.4
3.00	0.431	118.8	1.47	31.6	0.398	49.3	0.125	–122.4

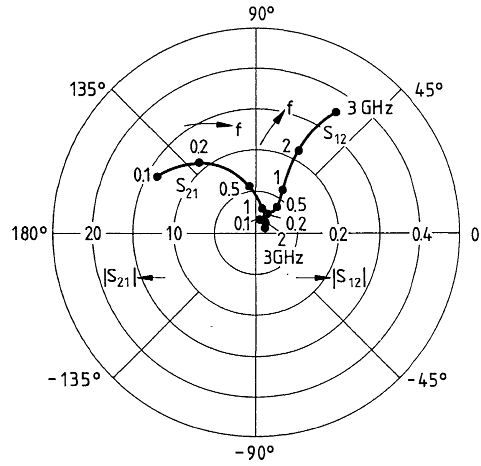
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.762	– 45.7	13.63	148.8	0.036	68.4	0.885	–20.5
0.15	0.698	– 64.3	12.06	136.9	0.048	61.1	0.798	–27.3
0.20	0.643	– 80.1	10.57	127.4	0.056	56.1	0.716	–32.0
0.25	0.597	– 93.2	9.26	119.9	0.063	53.0	0.649	–35.1
0.30	0.560	–104.4	8.18	113.8	0.068	51.1	0.594	–37.0
0.40	0.515	–122.1	6.56	104.5	0.076	49.6	0.516	–39.0
0.50	0.485	–135.6	5.44	97.5	0.083	50.0	0.468	–40.0
0.60	0.470	–146.3	4.65	91.7	0.090	51.3	0.436	–40.7
0.70	0.460	–155.3	4.06	86.8	0.097	52.7	0.415	–41.4
0.80	0.456	–162.4	3.60	82.5	0.104	54.1	0.399	–42.0
0.90	0.454	–169.4	3.24	78.4	0.112	55.6	0.386	–43.0
1.00	0.454	–175.5	2.94	74.7	0.120	57.0	0.375	–43.9
1.20	0.458	174.0	2.50	68.2	0.137	59.4	0.360	–46.3
1.40	0.461	164.5	2.18	62.4	0.155	61.1	0.351	–49.4
1.50	0.458	160.4	2.05	59.7	0.166	61.9	0.350	–51.1
1.60	0.461	156.9	1.95	56.9	0.176	62.3	0.351	–53.1
1.80	0.466	149.9	1.77	51.8	0.199	62.7	0.349	–57.4
2.00	0.479	143.8	1.62	46.9	0.221	62.4	0.341	–62.4
2.50	0.519	129.6	1.35	36.9	0.284	61.0	0.320	–77.1
3.00	0.539	117.5	1.18	27.5	0.353	57.1	0.324	–91.7

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



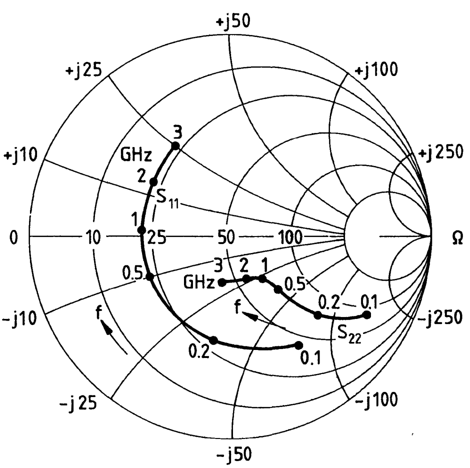
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



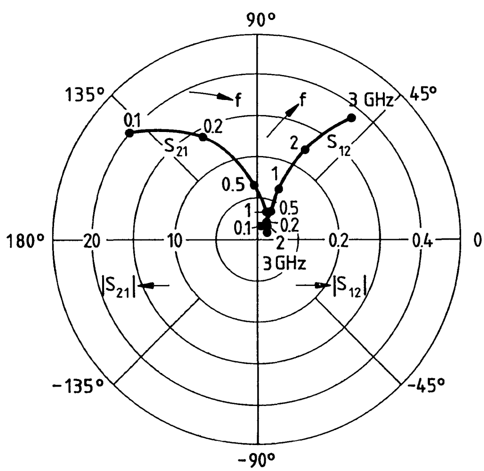
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.620	– 61.0	20.54	139.2	0.031	65.2	0.787	–29.7
0.15	0.547	– 82.5	16.91	126.6	0.040	60.0	0.664	–37.2
0.20	0.497	– 99.3	14.07	117.6	0.046	57.7	0.568	–41.4
0.25	0.459	–112.3	11.90	111.0	0.051	57.0	0.498	–43.6
0.30	0.434	–122.8	10.25	105.9	0.057	57.3	0.446	–44.7
0.40	0.407	–138.9	7.99	98.3	0.066	58.8	0.379	–45.4
0.50	0.390	–150.4	6.53	92.6	0.076	60.5	0.339	–45.4
0.60	0.384	–159.4	5.52	87.9	0.087	62.0	0.315	–45.4
0.70	0.379	–166.9	4.79	83.9	0.098	63.1	0.299	–45.7
0.80	0.379	–172.8	4.23	80.2	0.109	63.7	0.286	–46.1
0.90	0.382	–178.6	3.79	76.7	0.120	64.4	0.276	–46.8
1.00	0.385	176.2	3.44	73.5	0.131	64.7	0.267	–47.4
1.20	0.391	167.2	2.91	67.9	0.154	64.7	0.253	–49.5
1.40	0.393	158.5	2.53	62.7	0.177	64.4	0.245	–52.3
1.50	0.392	154.9	2.38	60.2	0.189	64.1	0.246	–53.9
1.60	0.395	152.0	2.26	57.6	0.201	63.6	0.246	–55.9
1.80	0.402	145.9	2.05	52.9	0.226	62.3	0.244	–60.5
2.00	0.415	140.9	1.87	48.4	0.249	60.8	0.236	–65.8
2.50	0.457	128.0	1.56	38.6	0.310	57.0	0.213	–81.2
3.00	0.477	117.6	1.37	29.3	0.370	52.1	0.217	–96.3

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



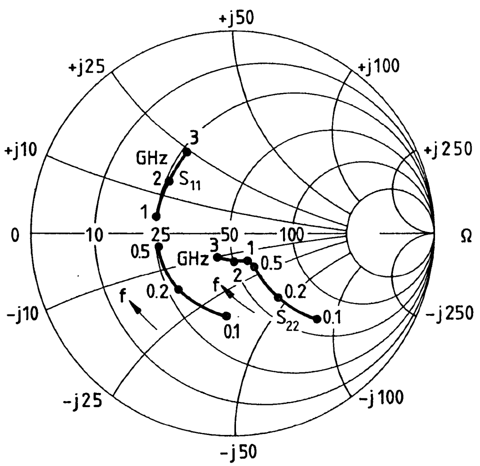
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



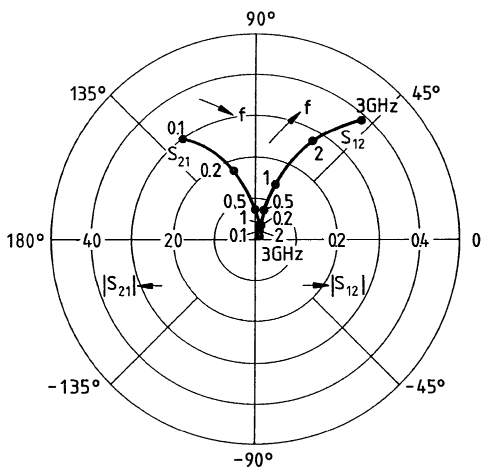
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.403	– 93.0	29.73	124.4	0.023	65.7	0.588	– 44.1
0.15	0.363	–115.9	22.16	113.1	0.030	65.3	0.452	– 50.1
0.20	0.346	–131.4	17.44	106.0	0.036	66.8	0.368	– 52.4
0.25	0.335	–142.0	14.29	101.2	0.043	68.3	0.314	– 53.1
0.30	0.327	–150.2	12.07	97.5	0.049	69.5	0.277	– 53.0
0.40	0.324	–161.7	9.21	92.0	0.063	70.9	0.232	– 52.1
0.50	0.319	–169.8	7.44	87.7	0.076	71.7	0.208	– 51.4
0.60	0.320	–176.2	6.25	84.1	0.090	72.0	0.194	– 51.2
0.70	0.321	178.8	5.40	80.8	0.104	71.8	0.184	– 51.6
0.80	0.323	174.5	4.76	77.8	0.117	71.3	0.176	– 52.1
0.90	0.327	170.2	4.25	74.9	0.131	70.7	0.170	– 53.0
1.00	0.332	166.2	3.85	72.2	0.144	70.0	0.163	– 53.9
1.20	0.340	158.8	3.25	67.3	0.171	68.4	0.152	– 56.4
1.40	0.346	151.3	2.83	62.6	0.197	66.5	0.145	– 59.5
1.50	0.344	148.5	2.66	60.4	0.211	65.6	0.147	– 61.2
1.60	0.347	146.0	2.52	58.1	0.224	64.4	0.148	– 63.6
1.80	0.351	141.1	2.28	53.7	0.250	62.1	0.147	– 69.5
2.00	0.367	137.1	2.08	49.4	0.275	59.8	0.140	– 77.0
2.50	0.408	125.9	1.74	40.4	0.335	54.3	0.120	– 98.2
3.00	0.431	116.6	1.52	31.1	0.392	48.5	0.129	–115.6

S_{11}, S_{22} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



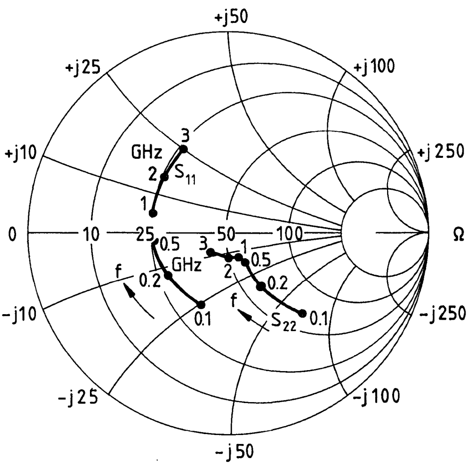
S_{12}, S_{21} = f (*f*)
I_C = 30 mA, V_{CE} = 5 V, Z_0 = 50 Ω



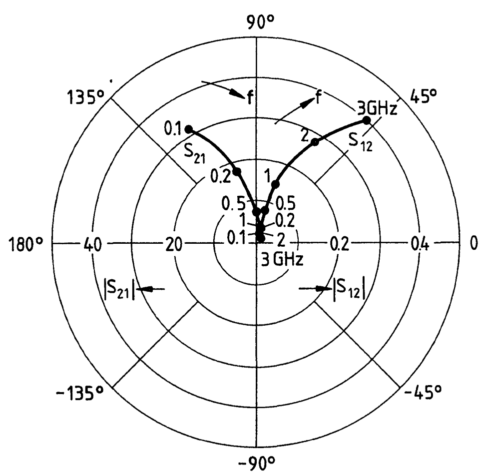
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.358	–106.3	31.26	120.1	0.022	66.9	0.518	– 48.1
0.15	0.337	–128.1	22.75	109.7	0.028	67.9	0.390	– 53.3
0.20	0.330	–141.8	17.72	103.3	0.035	69.9	0.314	– 54.9
0.25	0.325	–151.1	14.43	98.9	0.042	71.4	0.268	– 55.2
0.30	0.322	–158.2	12.16	95.5	0.049	72.4	0.236	– 54.8
0.40	0.322	–167.9	9.25	90.5	0.063	73.5	0.198	– 53.8
0.50	0.318	–174.8	7.46	86.4	0.077	73.7	0.178	– 53.0
0.60	0.321	179.8	6.25	83.0	0.091	73.7	0.166	– 52.9
0.70	0.322	175.0	5.40	79.9	0.106	73.2	0.158	– 53.6
0.80	0.325	171.4	4.76	77.0	0.120	72.4	0.152	– 54.2
0.90	0.330	167.4	4.25	74.2	0.134	71.7	0.146	– 55.4
1.00	0.335	163.9	3.84	71.5	0.148	70.8	0.140	– 56.6
1.20	0.344	156.8	3.24	66.8	0.175	68.9	0.130	– 59.5
1.40	0.348	149.6	2.82	62.1	0.202	66.8	0.124	– 63.0
1.50	0.346	146.7	2.65	59.9	0.216	65.7	0.125	– 64.8
1.60	0.349	144.6	2.51	57.6	0.230	64.4	0.127	– 67.4
1.80	0.355	140.0	2.27	53.3	0.256	62.0	0.128	– 73.9
2.00	0.368	135.9	2.08	49.1	0.281	59.5	0.121	– 82.5
2.50	0.411	125.0	1.73	40.0	0.341	53.8	0.105	–107.0
3.00	0.432	116.2	1.52	31.0	0.398	47.7	0.117	–124.8

S_{11}, S_{22} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



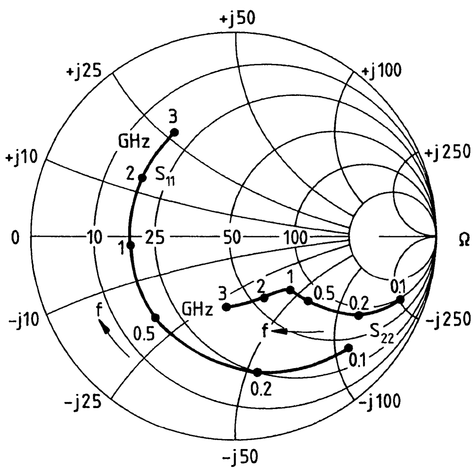
S_{12}, S_{21} = f (*f*)
I_C = 50 mA, V_{CE} = 5 V, Z_0 = 50 Ω



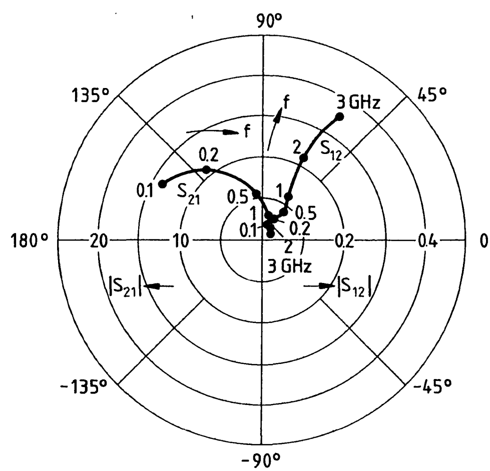
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.774	– 44.4	13.63	149.3	0.035	68.7	0.889	–20.0
0.15	0.709	– 62.6	12.11	137.5	0.047	61.5	0.804	–26.7
0.20	0.652	– 78.1	10.64	128.1	0.056	56.6	0.724	–31.3
0.25	0.602	– 91.0	9.35	120.6	0.062	53.3	0.657	–34.4
0.30	0.565	–102.0	8.26	114.5	0.067	51.3	0.602	–36.3
0.40	0.515	–119.9	6.65	105.1	0.075	49.9	0.525	–38.4
0.50	0.482	–133.3	5.52	98.0	0.082	50.1	0.476	–39.4
0.60	0.465	–144.3	4.72	92.3	0.089	51.3	0.444	–40.0
0.70	0.454	–153.5	4.12	87.4	0.096	52.8	0.422	–40.7
0.80	0.448	–160.9	3.66	83.0	0.103	54.1	0.407	–41.3
0.90	0.447	–167.9	3.29	78.9	0.111	55.6	0.394	–42.2
1.00	0.447	–174.3	2.99	75.2	0.119	57.0	0.382	–43.0
1.20	0.449	175.0	2.54	68.7	0.135	59.3	0.367	–45.3
1.40	0.450	165.4	2.22	62.9	0.154	61.0	0.358	–48.3
1.50	0.448	161.3	2.08	60.2	0.164	61.9	0.357	–50.0
1.60	0.453	157.5	1.98	57.4	0.174	62.3	0.357	–51.8
1.80	0.458	150.5	1.80	52.3	0.196	62.8	0.356	–56.1
2.00	0.468	144.4	1.64	47.4	0.219	62.5	0.347	–60.9
2.50	0.512	130.1	1.37	37.3	0.281	61.2	0.326	–75.2
3.00	0.529	117.9	1.20	28.0	0.348	57.5	0.329	–89.5

S_{11}, S_{22} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



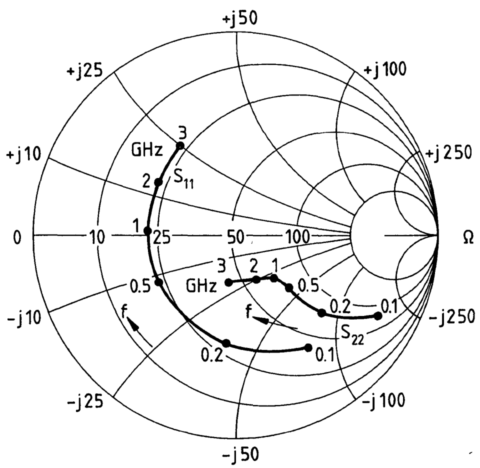
S_{12}, S_{21} = f (*f*)
I_C = 5 mA, V_{CE} = 8 V, Z_0 = 50 Ω



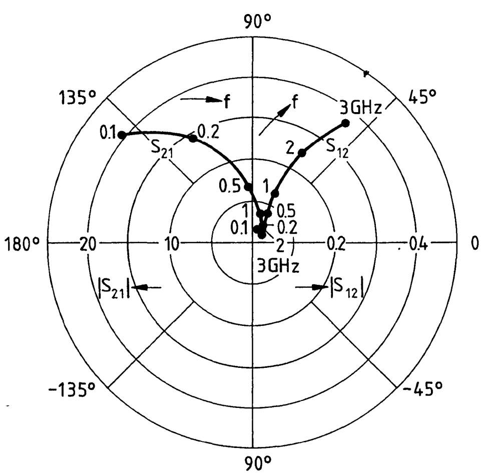
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.642	– 58.2	20.47	140.2	0.031	65.6	0.796	–28.8
0.15	0.564	– 79.1	16.98	127.6	0.040	60.3	0.676	–36.2
0.20	0.507	– 95.6	14.19	118.5	0.046	57.9	0.580	–40.4
0.25	0.466	–108.4	12.03	111.9	0.052	57.1	0.510	–42.7
0.30	0.437	–119.1	10.39	106.7	0.057	57.3	0.457	–43.8
0.40	0.405	–135.6	8.11	99.0	0.066	58.5	0.389	–44.5
0.50	0.384	–147.3	6.63	93.2	0.076	60.1	0.349	–44.6
0.60	0.375	–156.9	5.61	88.5	0.087	61.7	0.324	–44.5
0.70	0.371	–164.5	4.87	84.4	0.097	62.8	0.307	–44.8
0.80	0.369	–170.7	4.30	80.7	0.108	63.5	0.295	–45.2
0.90	0.371	–176.8	3.86	77.3	0.119	64.0	0.284	–45.8
1.00	0.372	177.7	3.50	74.0	0.130	64.4	0.275	–46.5
1.20	0.378	168.5	2.96	68.4	0.152	64.6	0.261	–48.4
1.40	0.383	159.6	2.58	63.2	0.175	64.2	0.252	–51.0
1.50	0.381	156.1	2.42	60.7	0.187	63.9	0.252	–52.6
1.60	0.385	152.9	2.30	58.2	0.199	63.4	0.253	–54.4
1.80	0.390	146.8	2.08	53.5	0.223	62.3	0.251	–58.9
2.00	0.404	141.7	1.90	48.9	0.246	60.8	0.242	–64.0
2.50	0.446	128.8	1.59	39.1	0.306	57.1	0.218	–78.8
3.00	0.466	117.9	1.39	29.8	0.366	52.4	0.220	–93.4

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



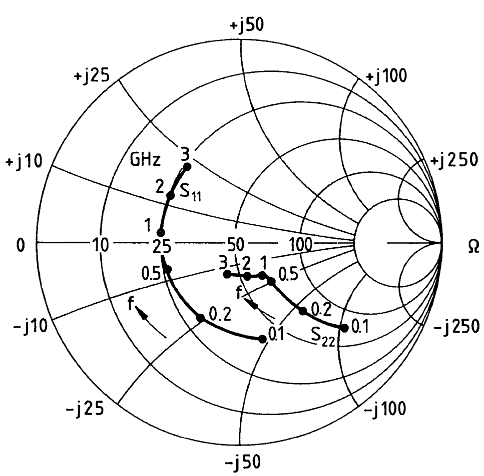
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω



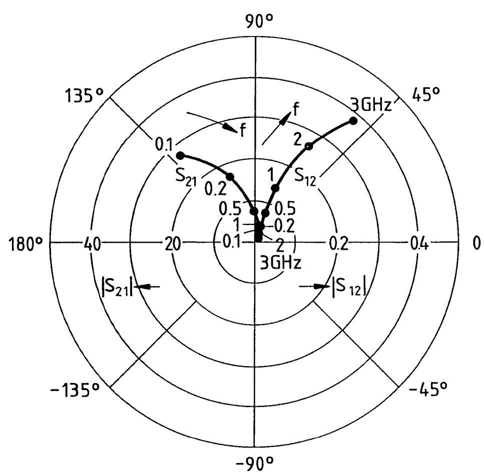
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.491	– 75.9	27.10	130.2	0.026	64.7	0.669	– 38.2
0.15	0.426	– 98.2	20.95	118.2	0.033	62.5	0.531	– 44.9
0.20	0.386	–114.3	16.78	110.4	0.039	63.0	0.440	– 47.8
0.25	0.358	–126.7	13.87	104.8	0.045	64.0	0.379	– 49.1
0.30	0.343	–136.0	11.79	100.7	0.051	65.2	0.336	– 49.3
0.40	0.329	–149.9	9.06	94.4	0.063	67.3	0.284	– 48.6
0.50	0.321	–159.5	7.35	89.8	0.075	68.5	0.255	– 48.1
0.60	0.314	–167.1	6.18	85.9	0.088	69.3	0.237	– 47.7
0.70	0.314	–173.5	5.34	82.5	0.100	69.6	0.224	– 47.9
0.80	0.316	–178.2	4.72	79.3	0.113	69.5	0.215	– 48.5
0.90	0.320	176.9	4.22	76.4	0.126	69.3	0.206	– 49.1
1.00	0.322	173.0	3.82	73.6	0.139	69.0	0.199	– 49.9
1.20	0.330	165.1	3.22	68.7	0.164	67.9	0.186	– 51.6
1.40	0.330	157.0	2.81	64.0	0.189	66.5	0.180	– 53.9
1.50	0.330	153.6	2.64	61.7	0.202	65.8	0.181	– 55.9
1.60	0.333	151.2	2.50	59.4	0.215	65.0	0.181	– 58.2
1.80	0.336	146.0	2.26	55.0	0.241	63.0	0.179	– 63.5
2.00	0.353	142.4	2.06	50.9	0.265	61.0	0.170	– 69.4
2.50	0.394	130.9	1.73	41.6	0.324	56.2	0.147	– 87.5
3.00	0.408	120.7	1.51	32.9	0.382	50.8	0.149	–102.8

S_{11}, S_{22} = f (f)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



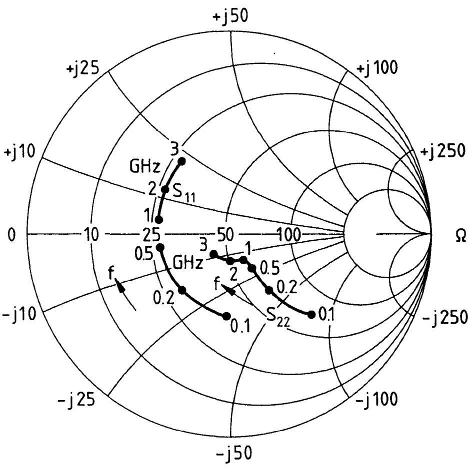
S_{12}, S_{21} = f (f)
I_C = 20 mA, V_{CE} = 8 V, Z_0 = 50 Ω



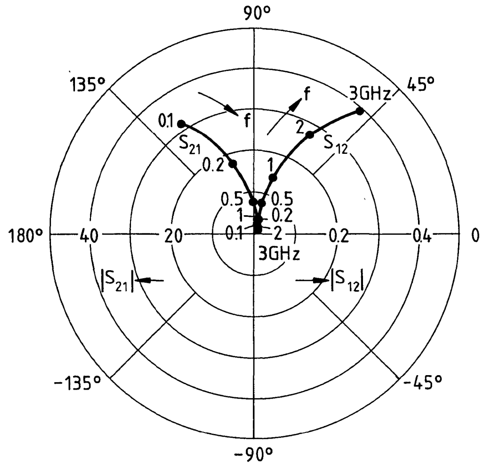
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.10	0.395	– 92.9	31.23	122.5	0.023	65.6	0.553	– 45.3
0.15	0.351	–115.2	23.03	111.6	0.029	66.2	0.422	– 50.5
0.20	0.327	–130.1	18.02	105.0	0.036	68.1	0.343	– 52.3
0.25	0.313	–141.2	14.70	100.3	0.042	69.6	0.293	– 52.7
0.30	0.306	–149.0	12.41	96.8	0.049	70.6	0.259	– 52.2
0.40	0.300	–160.6	9.46	91.6	0.062	72.3	0.219	– 50.9
0.50	0.297	–168.5	7.65	87.5	0.076	72.7	0.198	– 50.1
0.60	0.293	–174.7	6.42	84.1	0.090	72.9	0.184	– 49.7
0.70	0.295	179.9	5.54	81.0	0.104	72.6	0.175	– 50.1
0.80	0.296	176.0	4.89	78.1	0.117	72.1	0.169	– 50.9
0.90	0.302	172.1	4.37	75.3	0.131	71.4	0.161	– 51.7
1.00	0.306	168.5	3.95	72.8	0.145	70.8	0.155	– 52.8
1.20	0.314	161.3	3.33	68.3	0.172	69.1	0.143	– 54.8
1.40	0.318	153.8	2.90	63.7	0.198	67.2	0.139	– 57.5
1.50	0.315	150.5	2.73	61.5	0.211	66.2	0.140	– 59.6
1.60	0.317	148.7	2.58	59.3	0.225	65.2	0.141	– 62.3
1.80	0.321	143.9	2.33	54.9	0.251	62.9	0.139	– 68.5
2.00	0.337	140.9	2.13	51.0	0.275	60.6	0.131	– 75.8
2.50	0.378	129.8	1.78	42.0	0.335	55.2	0.112	– 98.3
3.00	0.392	120.2	1.56	33.3	0.392	49.4	0.117	–115.1

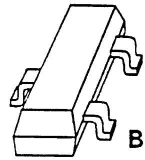
S_{11}, S_{22} = f (*f*)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



S_{12}, S_{21} = f (*f*)
I_C = 40 mA, V_{CE} = 8 V, Z_0 = 50 Ω



- For broadband amplifiers up to 1 GHz at collector currents from 1 to 20 mA.
- CECC-type available: CECC 50002/262.



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFS 17P	MC	Q 62702 – F940	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	2.5	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
Total power dissipation, $T_A \leq 25$ °C[2])	P_{tot}	280	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

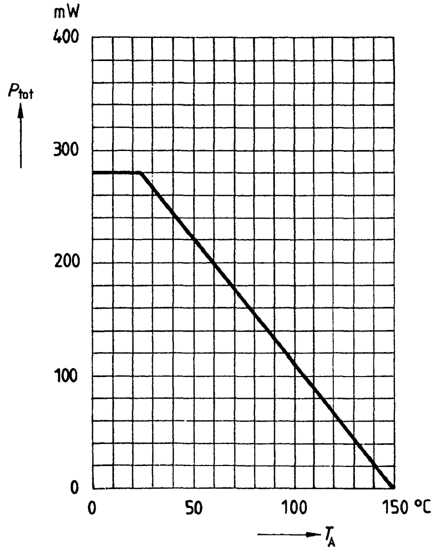
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 15 V, I_E = 0 V_{CB} = 25 V, I_E = 0	I_{CBO}	 – –	 – –	 0.05 10	µA
Emitter-base cutoff current V_{EB} = 2.5 V, I_C = 0	I_{EBO}	–	–	100	µA
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 25 mA, V_{CE} = 1 V	h_{FE}	 20 20	 – 70	 150 –	–
Collector-emitter saturation voltage I_C = 10 mA, I_B = 1 mA	V_{CEsat}	–	0.1	0.4	V

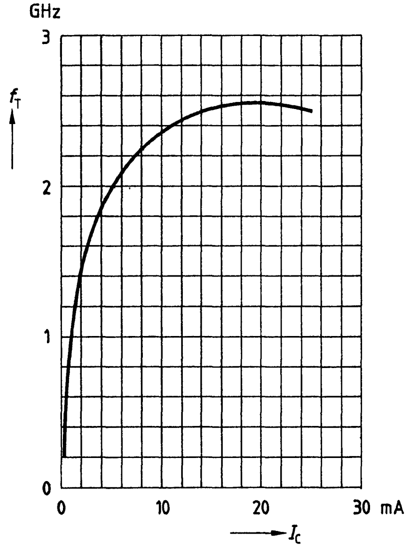
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency I_C = 2 mA, V_{CE} = 5 V, f = 200 MHz I_C = 25 mA, V_{CE} = 5 V, f = 200 MHz	f_T	 1 1.3	 1.4 2.5	 – –	GHz
Collector-base capacitance V_{CB} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.55	0.8	pF
Collector-emitter capacitance V_{CE} = 5 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.28	–	pF
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	1.2	–	pF
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	–	1.5	pF
Noise figure I_C = 2 mA, V_{CE} = 5 V, f = 800 MHz, Z_S = 50 Ω	F	–	3.5	5	dB
Transducer gain I_C = 20 mA, V_{CE} = 5 V, f = 500 MHz, Z_0 = 50 Ω	$\|S_{21e}\|^2$	–	12.7	–	dB
Linear output voltage two-tone intermodulation test I_C = 14 mA, V_{CE} = 5 V, d_{IM} = 60 dB f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	$V_{o1} = V_{o2}$	–	100	–	mV
Third order intercept point I_C = 14 mA, V_{CE} = 5 V, f = 800 MHz	IP_3	–	23	–	dBm

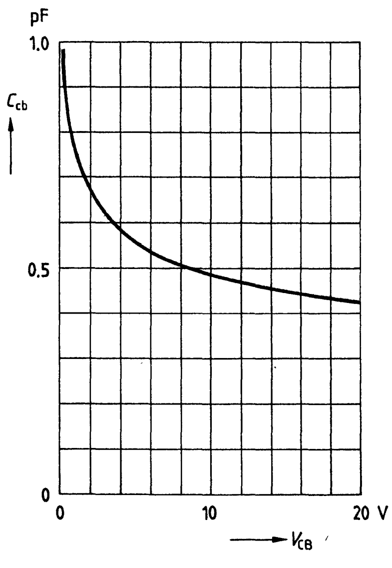
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 200$ MHz



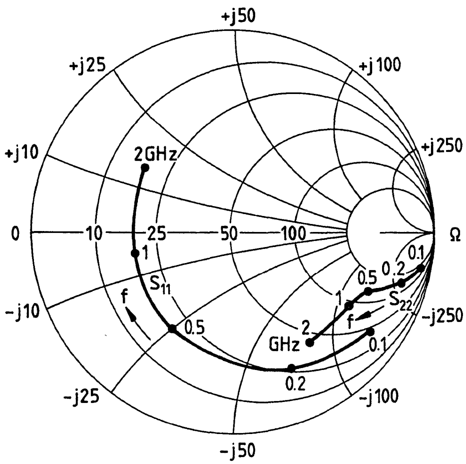
Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



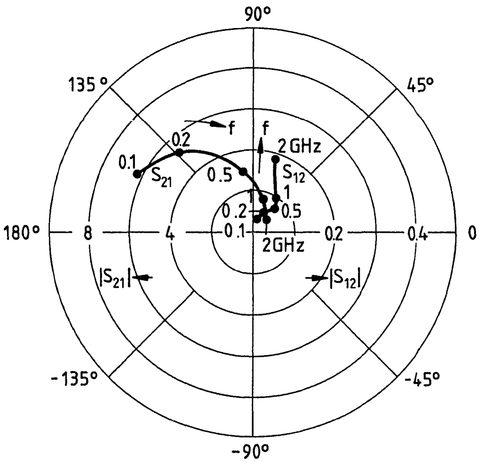
Common Emitter S Parameters
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.83	– 30	5.96	147	0.03	73	0.95	– 7
0.3	0.58	– 76	3.69	118	0.07	53	0.82	–19
0.5	0.45	–106	2.69	100	0.08	49	0.74	–21
0.8	0.35	–142	1.84	79	0.10	51	0.71	–27
1.0	0.34	–160	1.53	71	0.11	54	0.70	–31
1.2	0.34	–175	1.33	64	0.12	57	0.69	–35
1.5	0.36	165	1.13	52	0.14	62	0.67	–43
1.8	0.37	147	0.97	44	0.17	66	0.67	–50
2.0	0.41	137	0.91	39	0.19	68	0.67	–54

S_{11}, S_{22} = f (*f*)
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω



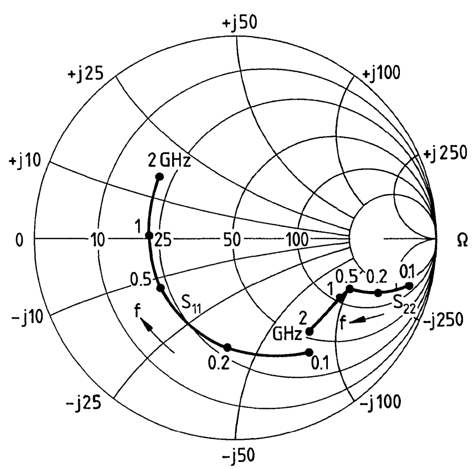
S_{12}, S_{21} = f (*f*)
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω



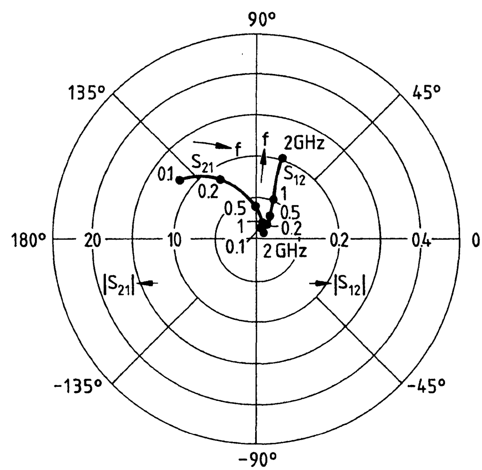
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.63	– 44	10.78	134	0.03	69	0.87	–11
0.3	0.38	– 98	5.37	107	0.05	57	0.70	–20
0.5	0.32	–130	3.59	92	0.07	60	0.64	–21
0.8	0.28	–161	2.39	74	0.09	63	0.62	–25
1.0	0.29	–177	1.94	68	0.11	65	0.62	–29
1.2	0.30	170	1.67	61	0.13	66	0.60	–33
1.5	0.33	155	1.40	50	0.15	67	0.59	–41
1.8	0.35	140	1.18	43	0.19	69	0.60	–47
2.0	0.39	132	1.11	38	0.21	69	0.59	–51

S_{11}, S_{22} = f (f)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



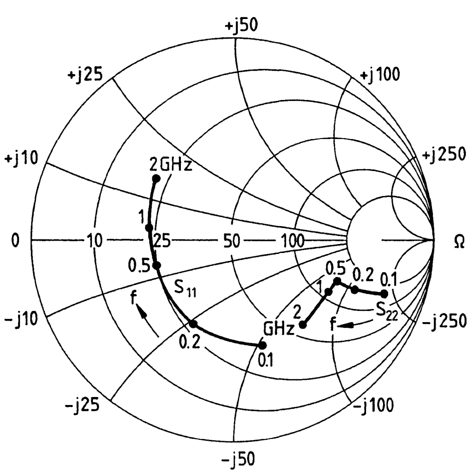
S_{12}, S_{21} = f (f)
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω



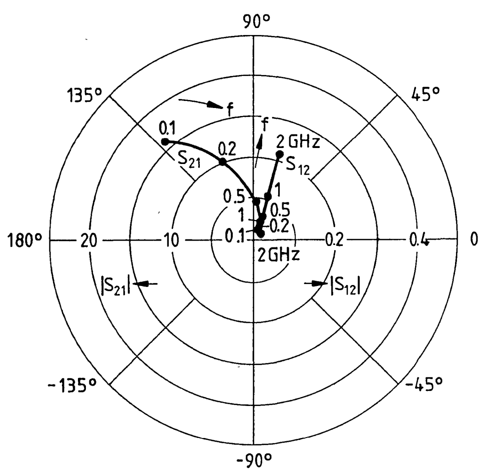
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.44	– 60	14.21	125	0.02	69	0.79	–14
0.3	0.29	–117	6.35	100	0.04	64	0.63	–19
0.5	0.27	–148	4.10	88	0.06	68	0.58	–19
0.8	0.26	–176	2.69	72	0.09	69	0.57	–23
1.0	0.28	173	2.18	66	0.12	70	0.57	–27
1.2	0.30	163	1.86	60	0.13	70	0.56	–31
1.5	0.32	150	1.55	49	0.16	69	0.55	–38
1.8	0.35	136	1.30	42	0.20	69	0.56	–45
2.0	0.38	128	1.22	37	0.22	69	0.56	–49

S_{11}, S_{22} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



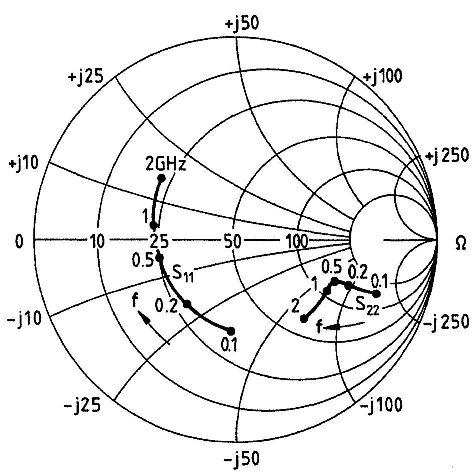
S_{12}, S_{21} = f (*f*)
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω



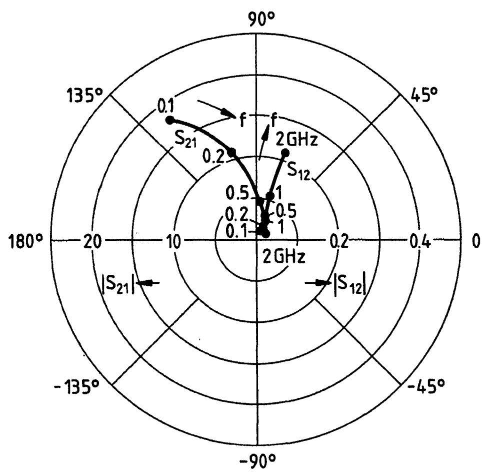
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.34	– 69	15.94	120	0.02	69	0.75	–15
0.3	0.26	–130	6.76	98	0.04	68	0.60	–19
0.5	0.26	–156	4.29	86	0.06	71	0.56	–19
0.8	0.26	179	2.80	70	0.09	71	0.55	–22
1.0	0.28	169	2.25	65	0.12	71	0.55	–27
1.2	0.30	160	1.92	59	0.14	71	0.55	–31
1.5	0.33	147	1.58	49	0.16	70	0.54	–38
1.8	0.36	135	1.34	41	0.20	70	0.54	–44
2.0	0.39	128	1.25	36	0.22	69	0.54	–48

S_{11}, S_{22} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



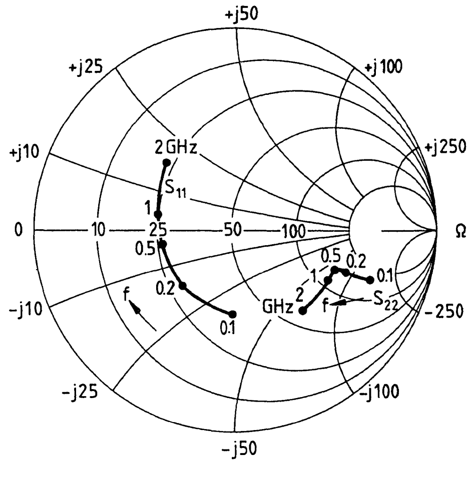
S_{12}, S_{21} = f (f)
I_C = 15 mA, V_{CE} = 5 V, Z_0 = 50 Ω



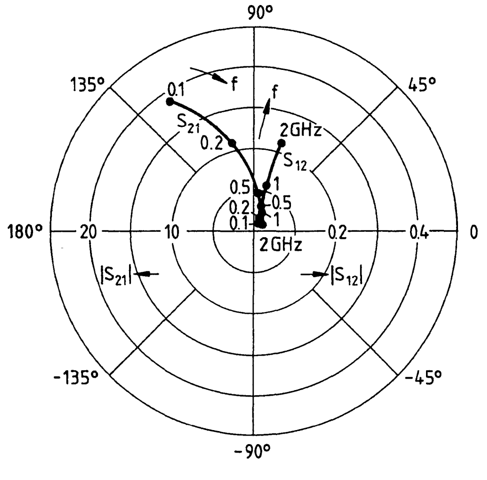
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	0.27	– 77	16.69	117	0.02	70	0.72	–14
0.3	0.25	–138	6.88	96	0.04	69	0.58	–17
0.5	0.26	–161	4.34	84	0.06	72	0.54	–18
0.8	0.27	175	2.82	69	0.09	71	0.54	–22
1.0	0.29	166	2.26	64	0.12	72	0.54	–26
1.2	0.31	157	1.93	58	0.14	71	0.53	–29
1.5	0.34	146	1.59	48	0.16	70	0.53	–37
1.8	0.36	133	1.34	40	0.20	70	0.54	–44
2.0	0.40	125	1.26	35	0.22	70	0.53	–47

S_{11}, S_{22} = f (*f*)
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω



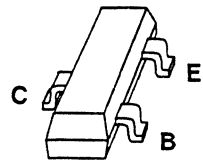
S_{12}, S_{21} = f (*f*)
I_C = 20 mA, V_{CE} = 5 V, Z_0 = 50 Ω



PNP Silicon RF Transistor

BFT 92

- For broadband amplifiers up to 2 GHz at collector currents up to 20 mA.
- Complementary type: BFR 92P (NPN).



ESD: Electrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFT 92	W 1	Q 62702 – F1062	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	15	V
Collector-base voltage	V_{CBO}	20	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	25	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	mA
Total power dissipation, $T_A \leq 60$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient [1])	R_{thJA}	≤440	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

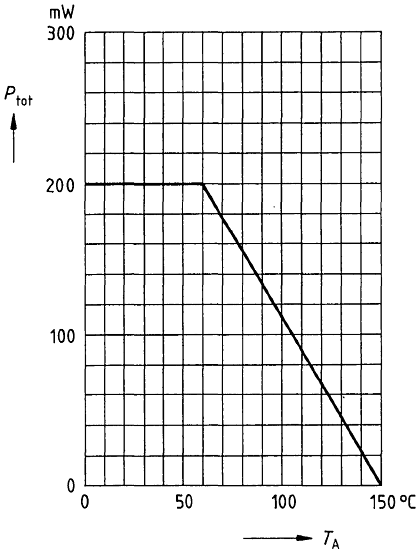
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	15	–	–	V
Collector-base cutoff current V_{CB} = 10 V, I_E = 0	I_{CBO}	–	–	50	nA
DC current gain I_C = 14 mA, V_{CE} = 10 V	h_{FE}	20	50	–	–

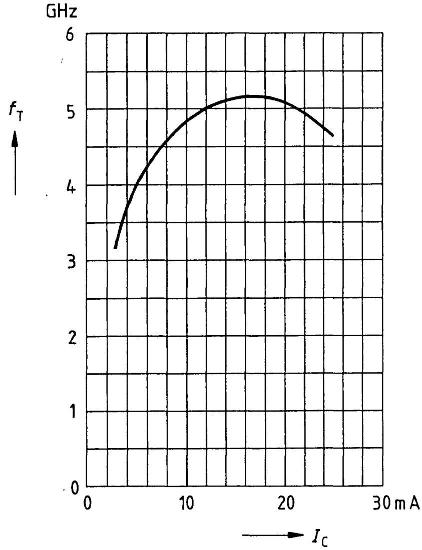
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 14$ mA, $V_{CE} = 10$ V, $f = 500$ MHz	f_T	–	5	–	GHz
Collector-base capacitance $V_{CB} = 10$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	0.6	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	0.8	–	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 10$ V, $f = 500$ MHz	F	–	2.4	–	dB
Power gain $I_C = 14$ mA, $V_{CE} = 10$ V, $f = 500$ MHz	G_{pe}	–	18	–	dB

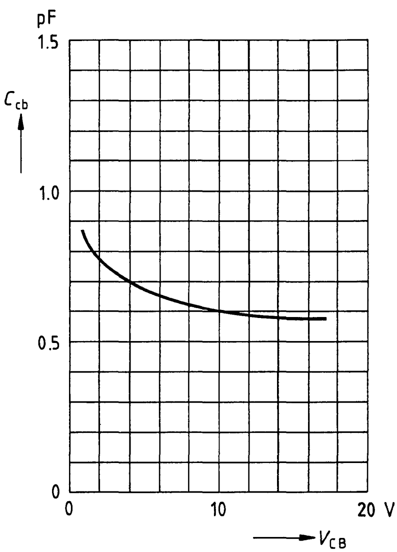
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



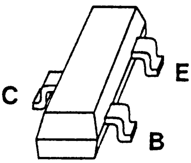
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 500$ MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



- For low-distortion broadband amplifiers up to 1 GHz at collector currents from 2 to 30 mA.
- Complementary type: BFR 93P (NPN).



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
BFT 93	X1	Q 62702 – F1063	SOT-23

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CEO}	12	V
Collector-base voltage	V_{CBO}	15	V
Emitter-base voltage	V_{EBO}	2	V
Collector current	I_C	35	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	50	mA
Total power dissipation, $T_A \leq 60$ °C[2])	P_{tot}	200	mW
Junction temperature	T_j	150	°C
Ambient temperature range	T_A	–65 ... +150	°C
Storage temperature range	T_{stg}	–65 ... +150	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤440	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

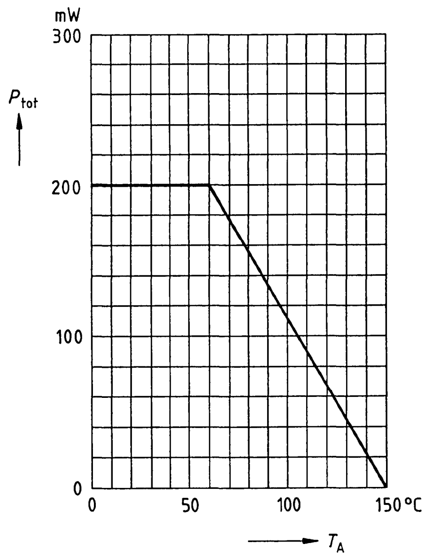
DC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	12	–	–	V
Collector-base cutoff current V_{CB} = 5 V, I_E = 0	I_{CBO}	–	–	50	nA
DC current gain I_C = 30 mA, V_{CE} = 5 V	h_{FE}	20	50	–	–

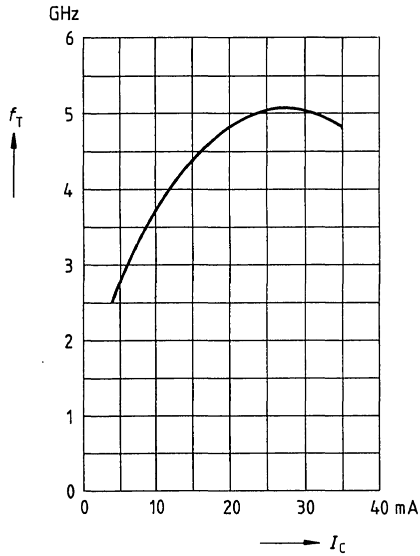
AC characteristics

Parameter	Symbol	Values			Unit
		min	typ	max	
Transition frequency $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 500$ MHz	f_T	–	5	–	GHz
Collector-base capacitance $V_{CB} = 5$ V, $V_{BE} = v_{be} = 0$, $f = 1$ MHz	C_{cb}	–	1	–	pF
Input capacitance $V_{EB} = 0.5$ V, $I_C = i_c = 0$, $f = 1$ MHz	C_{ibo}	–	1.8	–	pF
Noise figure $I_C = 2$ mA, $V_{CE} = 5$ V, $f = 500$ MHz, $Z_S = Z_{Sopt}$	F	–	2.4	–	dB
Power gain $I_C = 30$ mA, $V_{CE} = 5$ V, $f = 500$ MHz, $Z_S = Z_{Sopt}$, $Z_L = Z_{Lopt}$	G_{pe}	–	16.5	–	dB

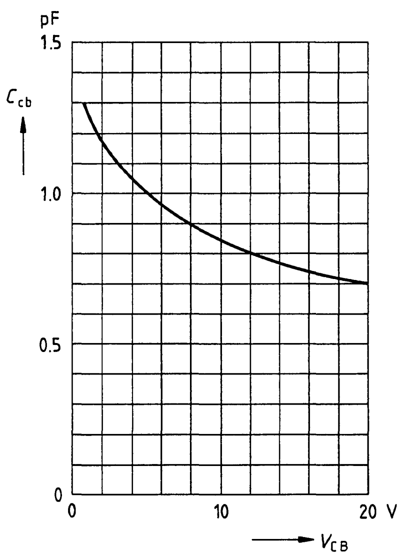
Total power dissipation $P_{tot} = f(T_A)$
Package mounted on alumina



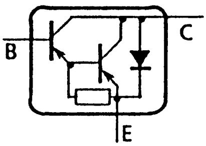
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 500$ MHz

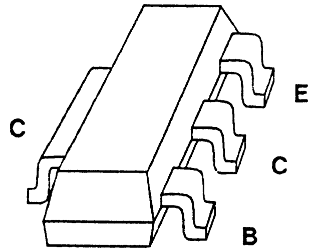


Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, $f = 1$ MHz



- High collector current
- Low collector -emitter saturation voltage
- Complementary types: BSP 60...BSP 62 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
BSP 50	BSP 50	Q62702 - P1163	SOT-223
BSP 51	BSP 51	Q62702 - P1164	SOT-223
BSP 52	BSP 52	Q62702 - P1165	SOT-223

Maximum Ratings

Parameter	Symbol	BSP50	BSP51	BSP52	Unit
Collector-emitter voltage	V_{CER}	45	60	80	V
Collector-base voltage	V_{CBO}	60	80	100	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		1		A
Peak collector current	I_{CM}		2		A
Base current	I_B		0.1		A
Total power dissipation, $T_A \leq 25°C$ [1]	P_{tot}		1.5		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}	-65	to	+ 150	°C

Thermal Resistance

Junction - ambient [1]	R_{thJA}	≤ 83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage 1) $I_C = 10$mA, $R_{BE} = 4.5$MΩ	BSP 50	$V_{(BR)CER}$	45	-	-	V
	BSP 51		60	-	-	V
	BSP 52		80	-	-	V
Collector-base breakdown voltage $I_C = 100$µA, $I_B = 0$	BSP 50	$V_{(BR)CBO}$	60	-	-	V
	BSP 51		80	-	-	V
	BSP 52		100	-	-	V
Emitter-base breakdown voltage $I_E = 100$µA, $I_B = 0$		$V_{(BR)EBO}$	5	-	-	V
Collector-emitter cutoff current $V_{CE} = V_{CERmax}, V_{BE} = 0$		I_{CES}	-	-	10	µA
Emitter-base cutoff current $V_{EB} = 4$ V, $I_C = 0$		I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 150$ mA, $V_{CE} = 10$ V		h_{FE}	1000	-	-	-
$I_C = 500$ mA, $V_{CE} = 10$ V			2000	-	-	-
Collector-emitter saturation voltage 2) $I_C = 500$ mA, $I_B = 0.5$ mA		V_{CEsat}	-	-	1.3	V
$I_C = 1$ A, $I_B = 1$ mA			-	-	1.8	V
Base-emitter saturation voltage 2) $I_C = 500$ mA, $I_B = 0.5$ mA		V_{BEsat}	-	-	1.9	V
$I_C = 1$ A, $I_B = 1$ mA			-	-	2.2	V
AC Characteristics						
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 100$ MHz		f_T	-	200	-	MHz
Switching times $I_C = 500$ mA, $I_{B1} = I_{B2} = 0.5$ mA (see Fig. 2 and 3)		t_{on}	-	400	-	ns
		t_{off}	-	1500	-	ns

1) Compare R_{BE} for thermal stability
2) Pulse test conditions: $t \leqq 300$µs; $D = 2\%$

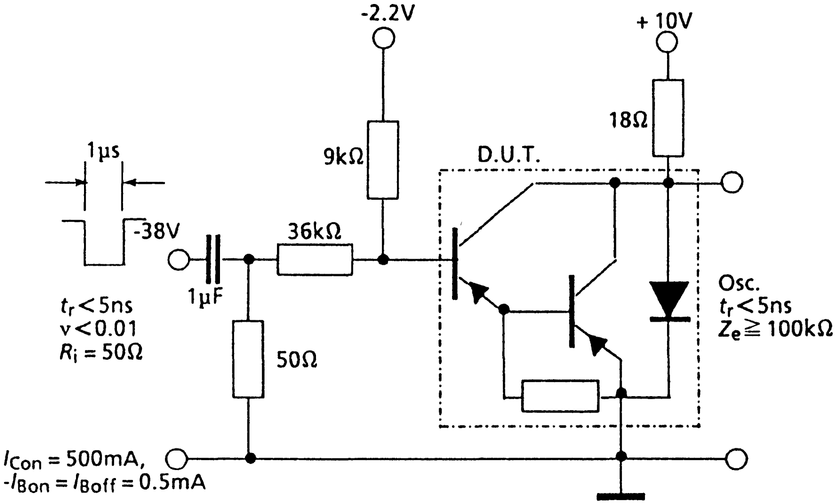


Fig.2 Switching time test circuit

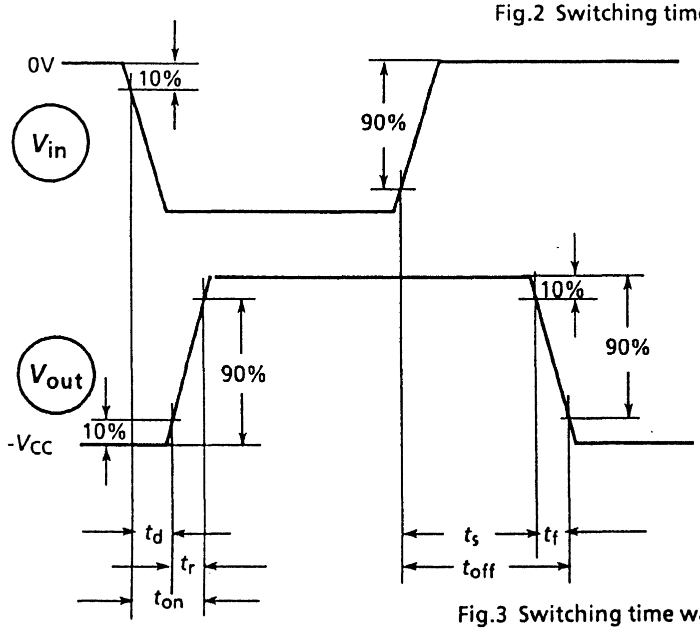
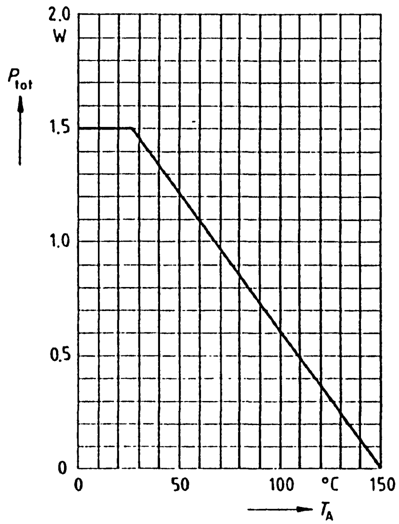
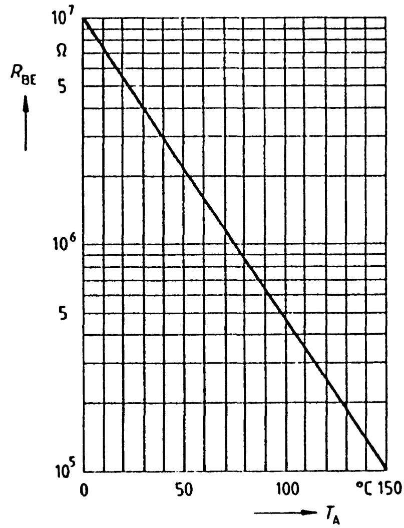


Fig.3 Switching time waveform

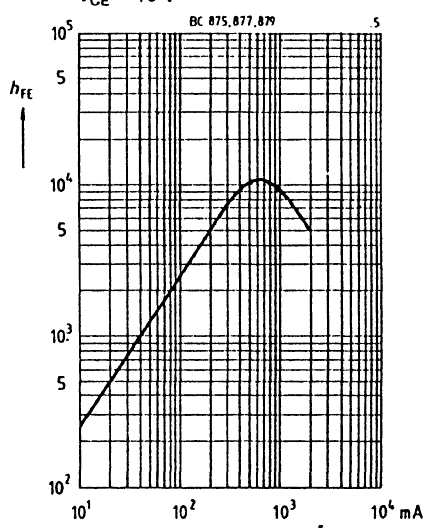
Total power dissipation $P_{tot} = f(T_A)$



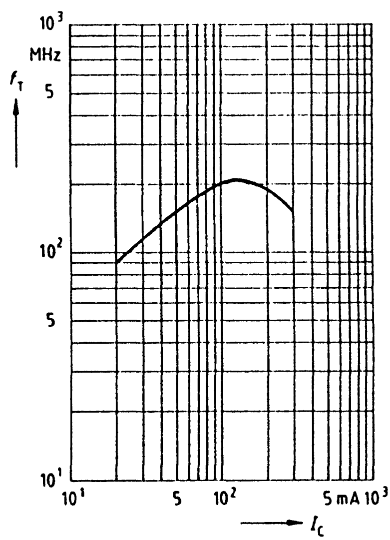
External resistance $R_{BE} = f(T_A)$*
$V_{CB} = V_{CE\,max}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V

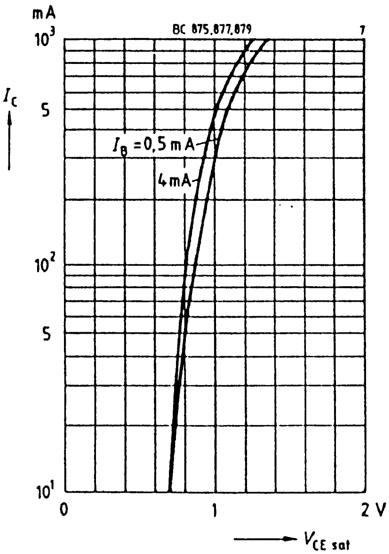


Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V

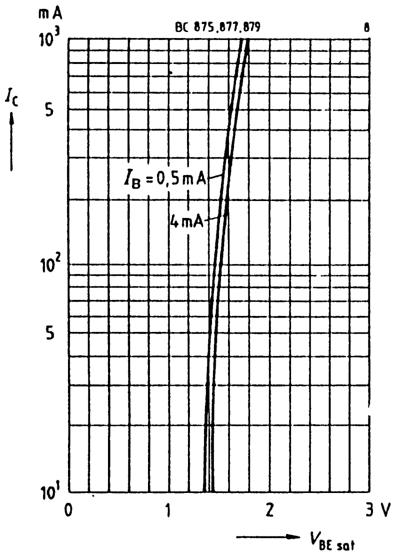


*$R_{BE\,max}$ for thermal stability

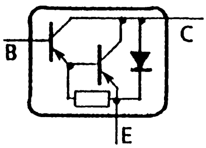
Base-emitter saturation voltage
$I_C = f(V_{BE\,sat})$, I_B-parameter

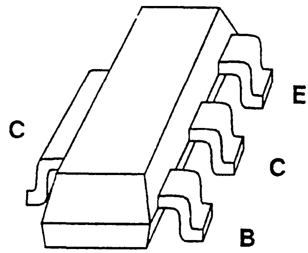


Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$, I_B-parameter



- High collector current
- Low collector -emitter saturation voltage
- Complementary types: BSP 50...BSP 52 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
BSP 60	BSP 60	Q62702 - P1166	SOT-223
BSP 61	BSP 61	Q62702 - P1167	SOT-223
BSP 62	BSP 62	Q62702 - P1168	SOT-223

Maximum Ratings

Parameter	Symbol	BSP60	BSP61	BSP62	Unit
Collector-emitter voltage	V_{CER}	45	60	80	V
Collector-base voltage	V_{CBO}	60	80	100	V
Emitter-base voltage	V_{EBO}	5	5	5	V
Collector current	I_C		1		A
Peak collector current	I_{CM}		2		A
Base current	I_B		0.1		A
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}		1.5		W
Junction temperature	T_j		150		°C
Storage temperature range	T_{stg}	-65	to	+ 150	°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage 1) $I_C = 10mA$, $R_{BE} = 4.5M\Omega$	BSP 60	$V_{(BR)CER}$	45	-	-	V
	BSP 61		60	-	-	V
	BSP 62		80	-	-	V
Collector-base breakdown voltage $I_C = 100\mu A$, $I_B = 0$	BSP 60	$V_{(BR)CBO}$	60	-	-	V
	BSP 61		80	-	-	V
	BSP 62		100	-	-	V
Emitter-base breakdown voltage $I_E = 100\mu A$, $I_B = 0$		$V_{(BR)EBO}$	5	-	-	V
Collector-emitter cutoff current $V_{CE} = V_{CERmax}, V_{BE} = 0$		I_{CES}	-	-	10	µA
Emitter-base cutoff current $V_{EB} = 4$ V, $I_C = 0$		I_{EBO}	-	-	10	µA
DC current gain 1) $I_C = 150$ mA, $V_{CE} = 10$ V		h_{FE}	1000	-	-	-
$I_C = 500$ mA, $V_{CE} = 10$ V			2000	-	-	-
Collector-emitter saturation voltage 2) $I_C = 500$ mA, $I_B = 0,5$ mA		V_{CEsat}	-	-	1.3	V
$I_C = 1$ A, $I_B = 1$ mA			-	-	1.8	V
Base-emitter saturation voltage 2) $I_C = 500$ mA, $I_C = 0,5$ mA		V_{BEsat}	-	-	1.9	V
$I_C = 1$ A, $I_B = 1$ mA			-	-	2.2	V
AC Characteristics						
Transition frequency $I_C = 100$ mA, $V_{CE} = 5$ V, $f = 100$ MHz		f_T	-	200	-	MHz
Switching times $I_C = 500$ mA, $I_{B1} = I_{B2} = 0.5$ mA (see Fig. 2 and 3)		t_{on}	-	400	-	ns
		t_{off}	-	1500	-	ns

1) Compare R_{BE} for thermal stability
2) Pulse test conditions: $t \leqq 300\mu s$; D = 2%

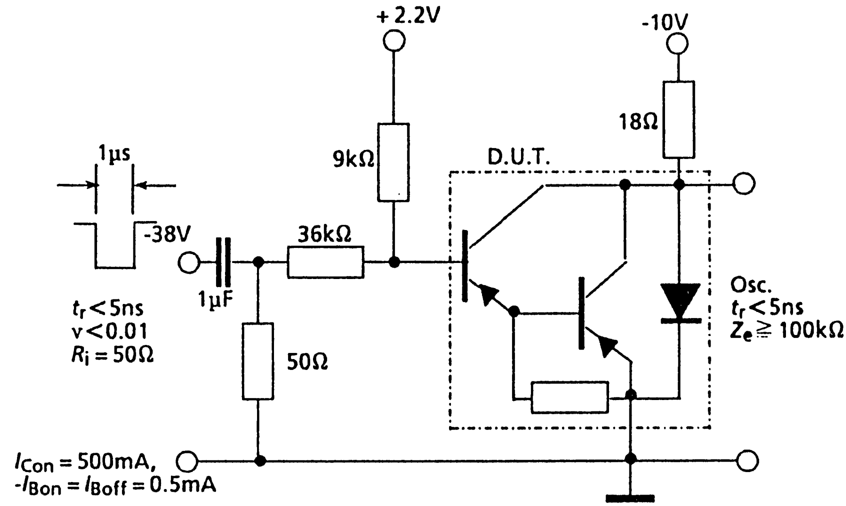


Fig.2 Switching time test circuit

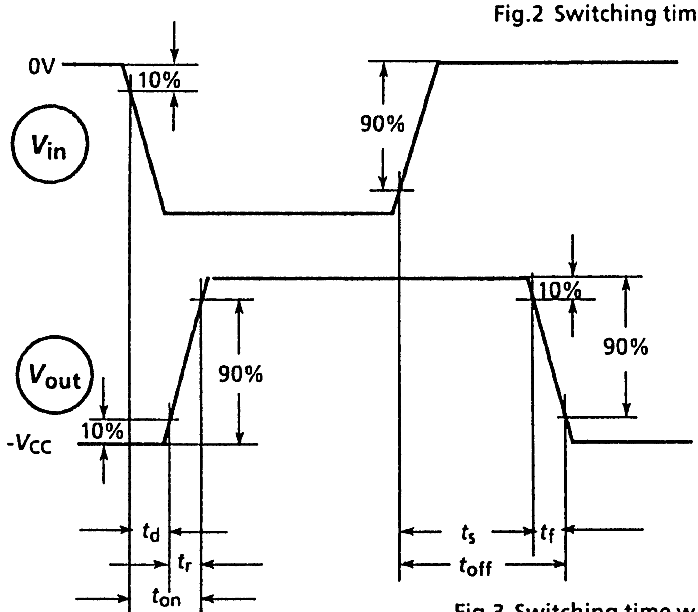
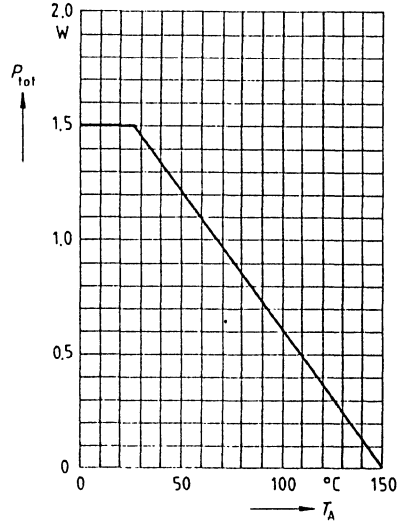
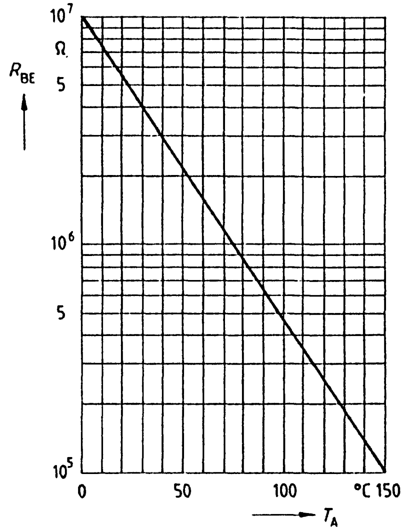


Fig.3 Switching time waveform

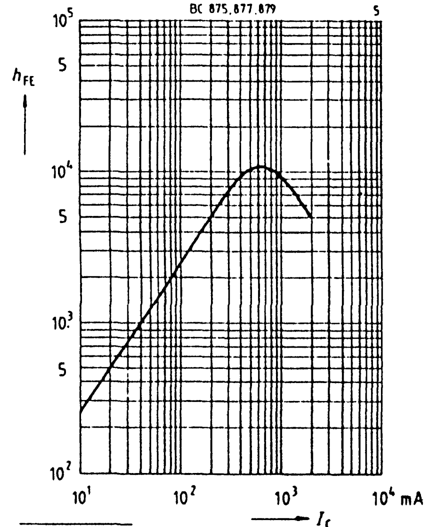
Total power dissipation $P_{tot} = f(T_A)$



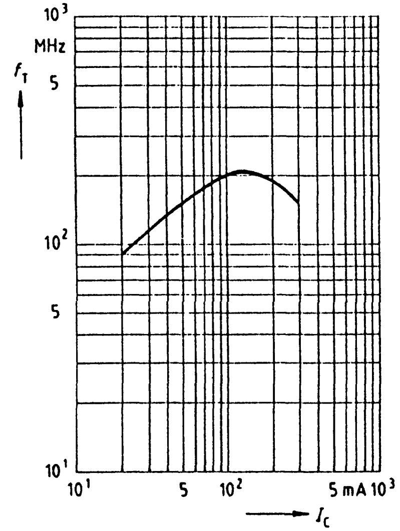
External resistance $R_{BE} = f(T_A)$*
$V_{CB} = V_{CE\,max}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V

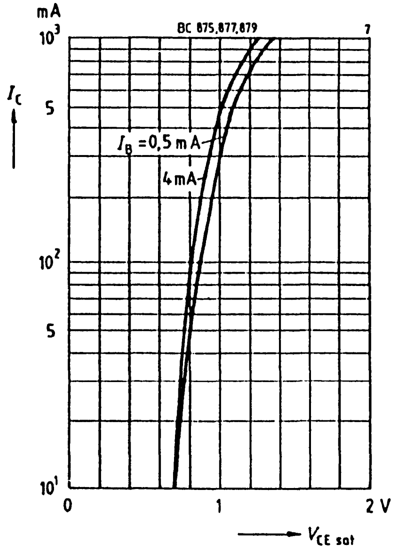


Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V

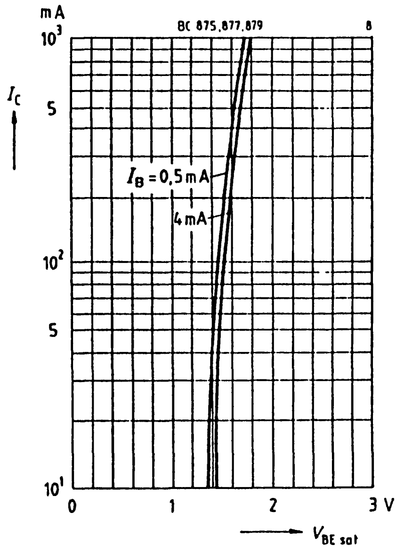


*$R_{BE\,max}$ for thermal stability

Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$, I_B-parameter

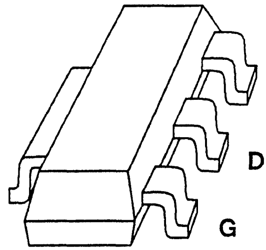


Base-emitter saturation voltage
$I_C = f(V_{BE\,sat})$, I_B-parameter



Preliminary Data

- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 240V
- Continuous drain current I_D = 0.29A
- Drain-source on-resistance $R_{DS(on)}$ = 8.0Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 88	BSP 88	Q67000-S070	SOT 223

Maximum Ratings

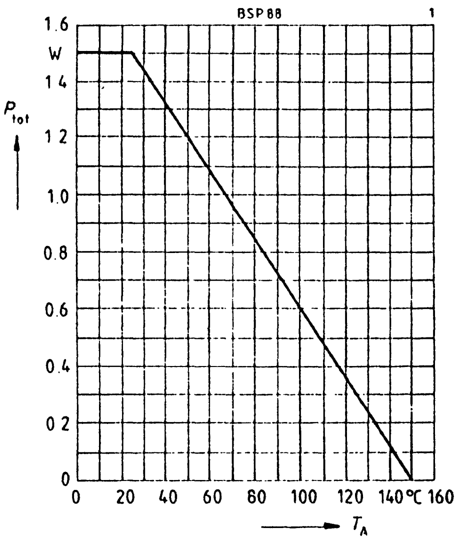
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	240	V	-
Drain-gate voltage	V_{DGR}	240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.29	A	T_A =29°C
Pulsed drain current	I_{Dpuls}	1.16	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1

Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

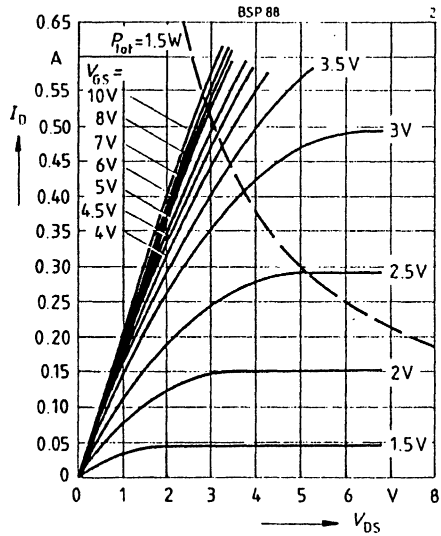
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	240	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.6	0.8	1.2	V	V_{DS} = V_{GS} ; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	1.0	20.0	µA	T_j =25°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	10.0	200	µA	T_j =125°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	-	100	nA	T_j =25°C; V_{DS} =100V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	6.0	8.0	Ω	V_{GS} =4.5V I_D =0.29A
	$R_{DS(on)}$	-	-	6.0	Ω	V_{GS} =10V I_D =0.29A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.14	0.32	-	S	V_{DS} ≥2* I_D * $R_{DSon\,max}$ I_D =0.29A
Input capacitance	C_{iss}	-	90	140	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	20	30		
Reverse transfer capacitance	C_{rss}	-	6	9		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.28A R_{GS} =50Ω
	t_r	-	10	15		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	30	40		
	t_f	-	25	30		
Reverse diode						
Continuous source current	I_S	-	-	0.29	A	
Pulsed source current	I_{SM}	-	-	1.16	A	
Diode forward on-voltage	V_{SD}	-	1.0	1.3	V	V_{GS} =0V I_F =0.58A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

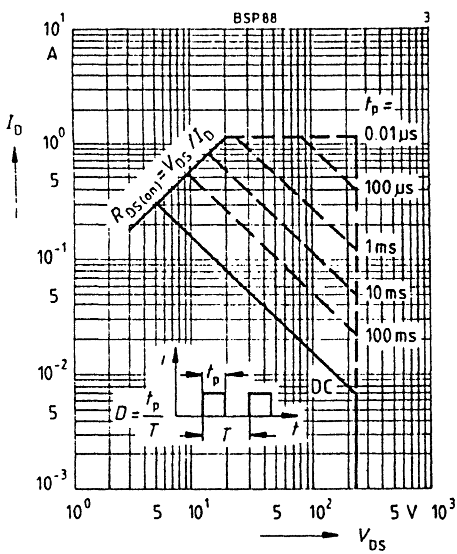
Permissible power dissipation $P_{tot} = f(T_A)$



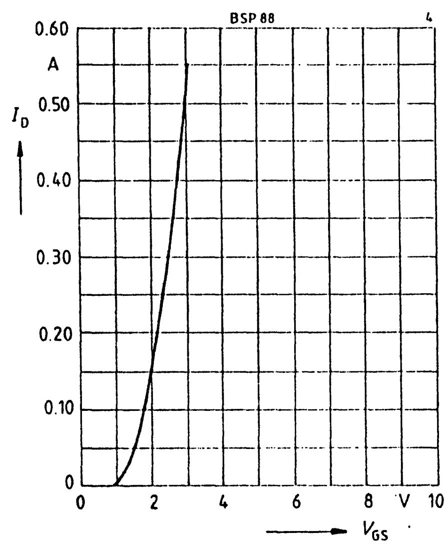
Typ. output characteristics $I_D = f(V_{DS})$



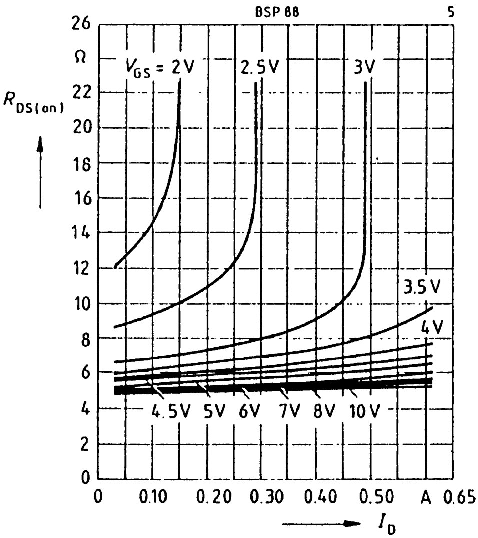
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



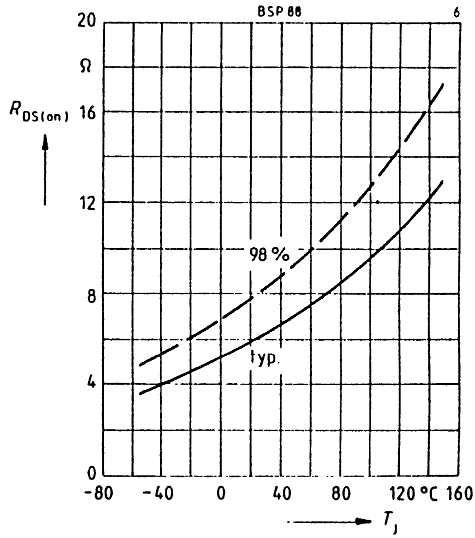
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



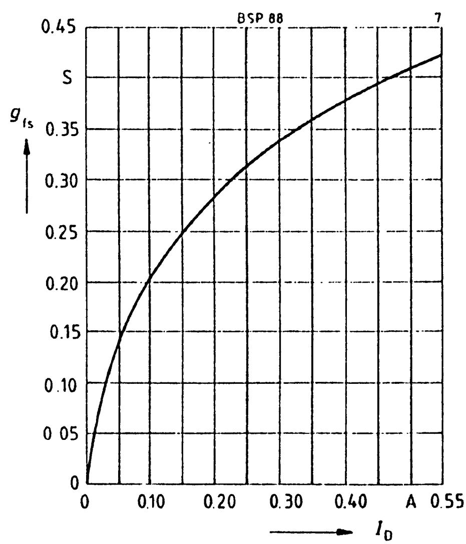
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25\ °C$



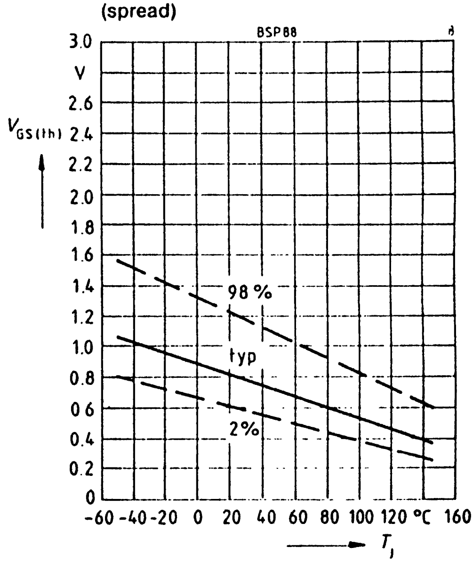
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 4.5$ V, $I_D = 0.29$ A, (spread)



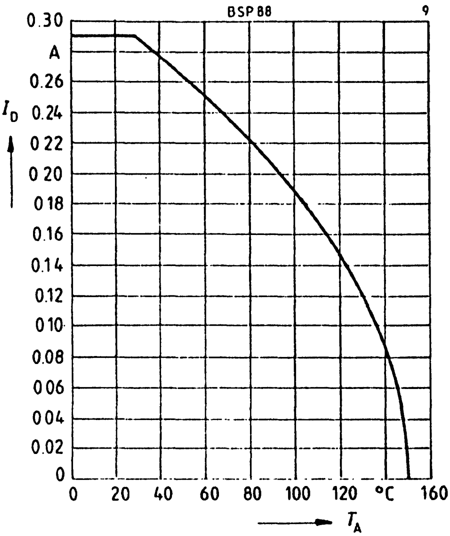
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25\ °C$



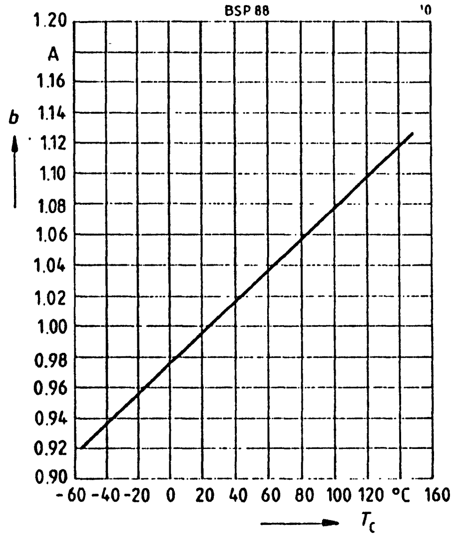
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



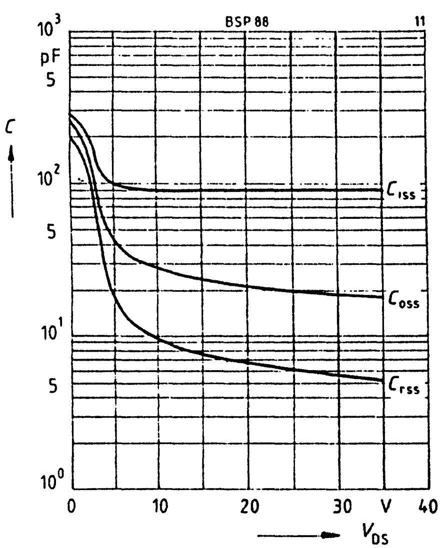
Continuous drain current $I_D = f(T_A)$



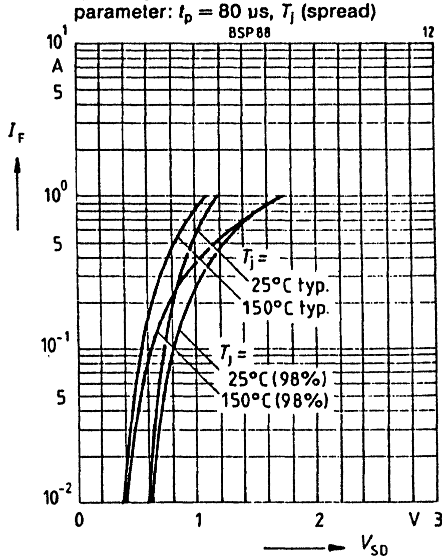
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



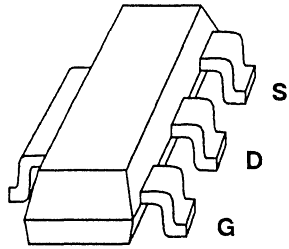
Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)



Preliminary Data



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 240V
- Continuous drain current I_D = 0.34A
- Drain-source on-resistance $R_{DS(on)}$ = 6.0Ω
- Total power dissipation P_D = 1.5W

Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 89	BSP 89	Q67002-S652	SOT 223

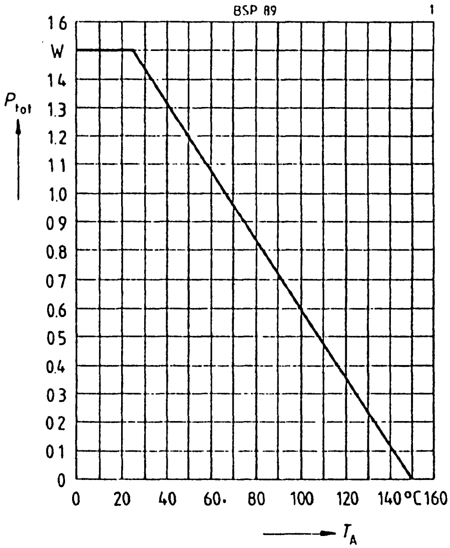
Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	240	V	-
Drain-gate voltage	V_{DGR}	240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.34	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	1.36	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

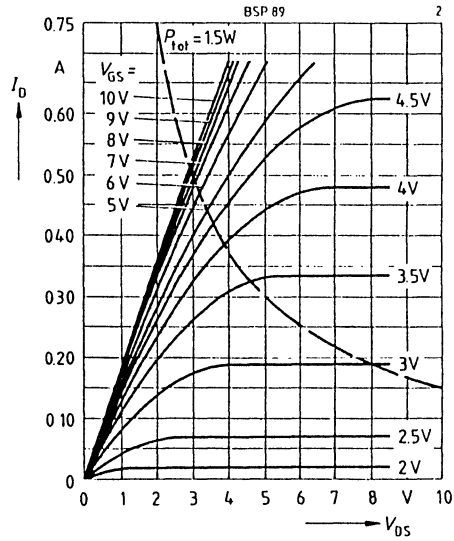
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	240	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.5	2.0	V	V_{DS} = V_{GS} ; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	4.0	60.0	µA	T_j =25°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	8.0	200	µA	T_j =125°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	-	200	nA	T_j =25°C; V_{DS} =60V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	5.5	6.0	Ω	V_{GS} =10V I_D =0.34A
	$R_{DS(on)}$	-	9.0	10.0	Ω	V_{GS} =4.5V I_D =0.34A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.14	0.29	-	S	V_{DS} ≥2* I_D * $R_{DSon\,max}$ I_D =0.34A
Input capacitance	C_{iss}	-	90	140	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	20	30		
Reverse transfer capacitance	C_{rss}	-	6	9		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.28A R_{GS} =50Ω
	t_r	-	8	12		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	25	30		
	t_f	-	22	28		
Reverse diode						
Continuous source current	I_S	-	-	0.34	A	
Pulsed source current	I_{SM}	-	-	1.36	A	
Diode forward on-voltage	V_{SD}	-	1.1	1.4	V	V_{GS} =0V I_F =0.68A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =100V, I_F = I_{DR} dI_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} dI_F /dt = 100A/µs

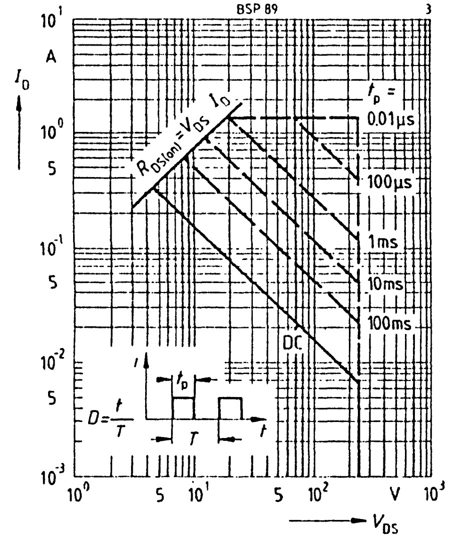
Permissible power dissipation $P_{tot} = f(T_A)$



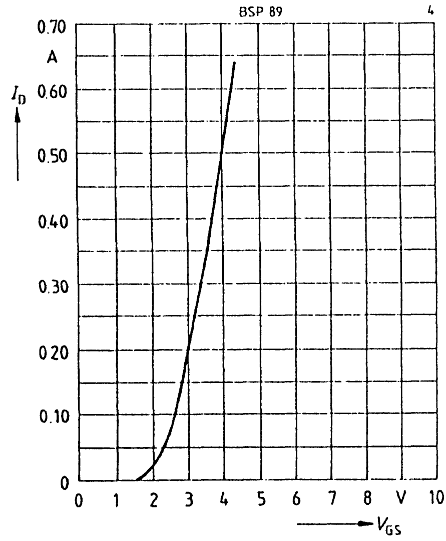
Typ. output characteristics $I_D = f(V_{DS})$



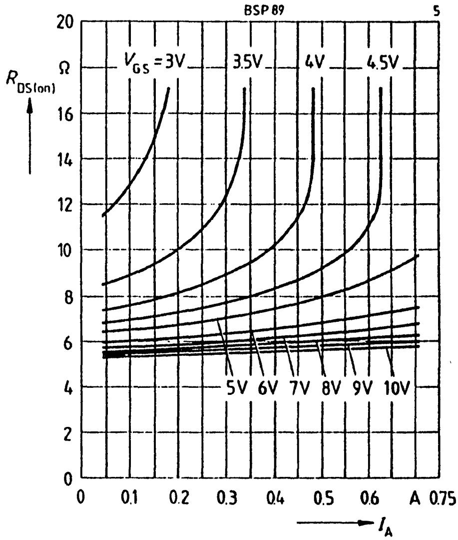
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



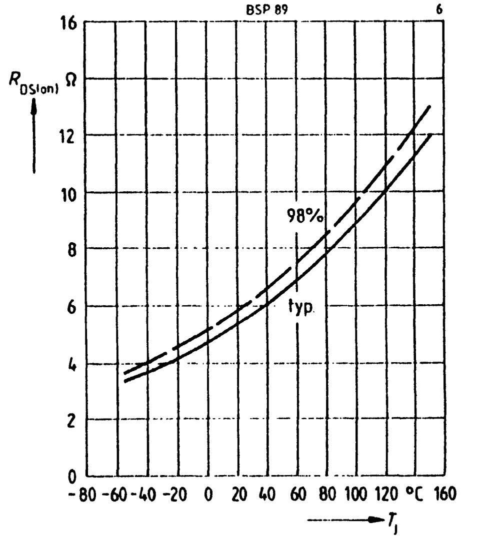
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



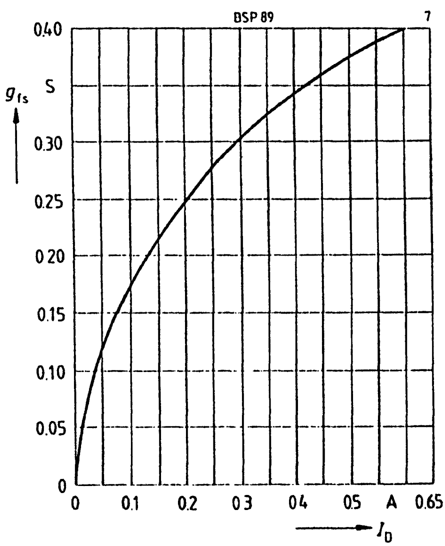
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25$ °C



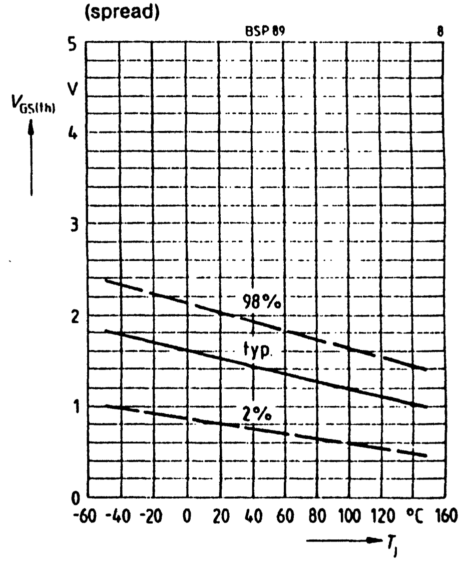
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 10$ V, $I_D = 0.34$ A, (spread)



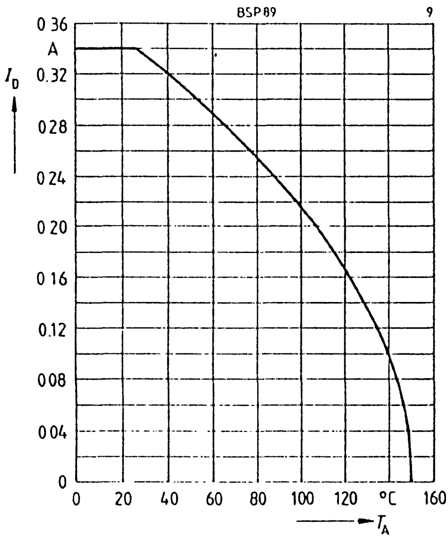
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



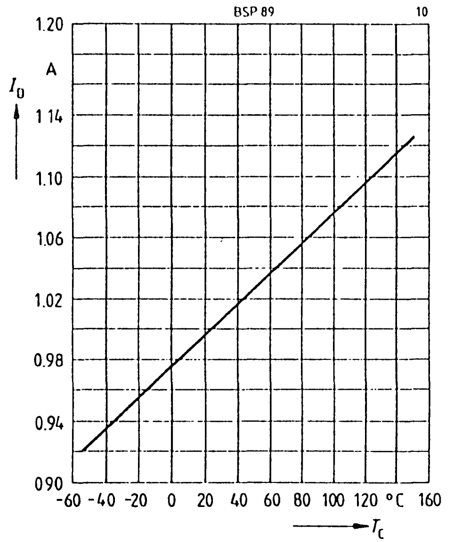
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



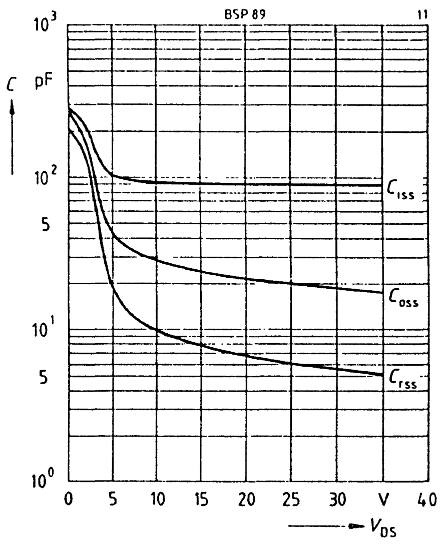
Continuous drain current $I_D = f(T_A)$



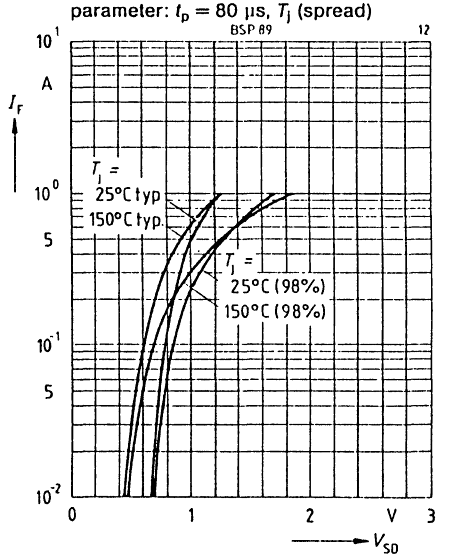
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

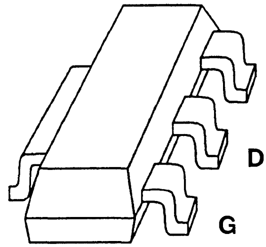


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)



Preliminary Data

- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = -240V
- Continuous drain current I_D = -0.18A
- Drain-source on-resistance $R_{DS(on)}$ = 20Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 92	BSP 92	Q62702-S653	SOT 223

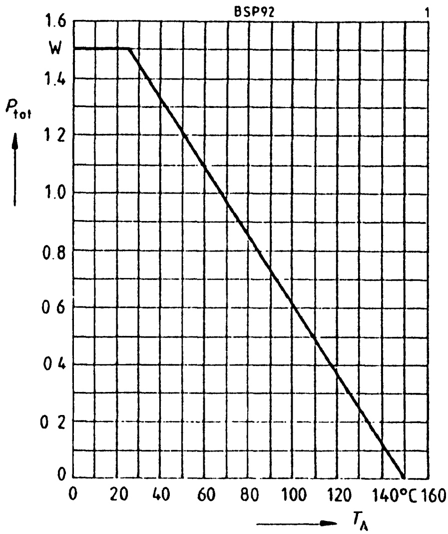
Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	-240	V	-
Drain-gate voltage	V_{DGR}	-240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	-0.18	A	T_A =33°C
Pulsed drain current	I_{Dpuls}	-0.72	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

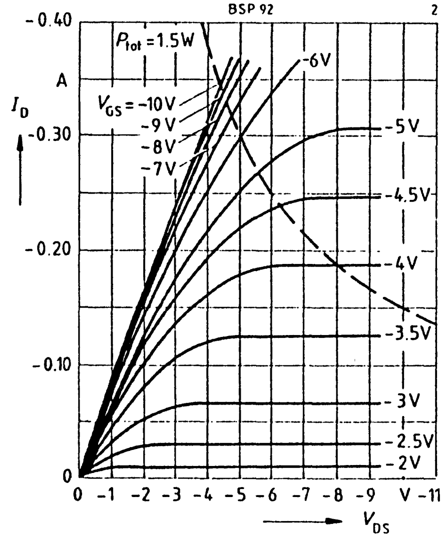
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	-240	-	-	V	V_{GS} =0V I_D =-0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-0.8	-1.5	-2.0	V	V_{DS}= V_{GS} ; I_D =-1mA
Zero gate voltage drain current	I_{DSS}	-	-4.0	-60.0	µA	T_j =25°C; V_{DS} =-240V V_{GS} =0V
	I_{DSS}	-	-8.0	-200	µA	T_j =125°C; V_{DS} =-240V V_{GS} =0V
	I_{DSS}	-	-	-200	nA	T_j =25°C; V_{DS} =-60V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	-10.0	-100	nA	V_{GS} =-20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	12.0	20.0	Ω	V_{GS} =-10V I_D =-0.18A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.06	0.13	-	S	V_{DS} ≥2* I_D * $R_{DSon\ max}$ I_D =-0.18A
Input capacitance	C_{iss}	-	70	105	pF	V_{GS} =0V V_{DS} =-25V f =1MHz
Output capacitance	C_{oss}	-	20	30		
Reverse transfer capacitance	C_{rss}	-	8	12		
Turn-on time t_{on}	$t_{d(on)}$	-	8	12	ns	V_{CC} =-30V V_{GS} =-10V I_D =-0.25A R_{GS} =50Ω
(t_{on} =$t_{d(on)}$ +t_r)	t_r	-	30	45		
Turn-off time t_{off}	$t_{d(off)}$	-	15	20		
(t_{off} =$t_{d(off)}$ +t_f)	t_f	-	30	40		
Reverse diode						
Continuous source current	I_S	-	-	-0.18	A	
Pulsed source current	I_{SM}	-	-	-0.72	A	
Diode forward on-voltage	V_{SD}	-	-0.9	-1.2	V	V_{GS} =0V I_F =-0.36A

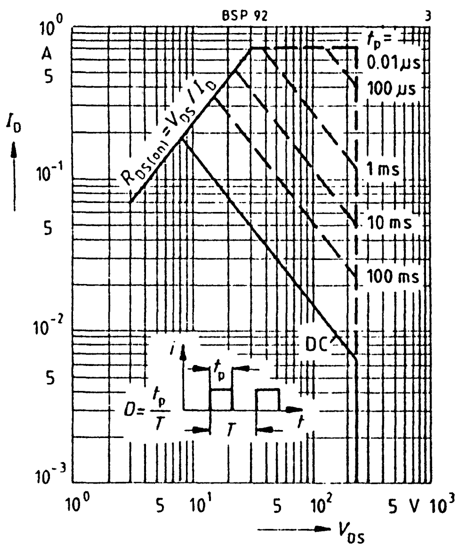
Permissible power dissipation $P_{tot} = f(T_A)$



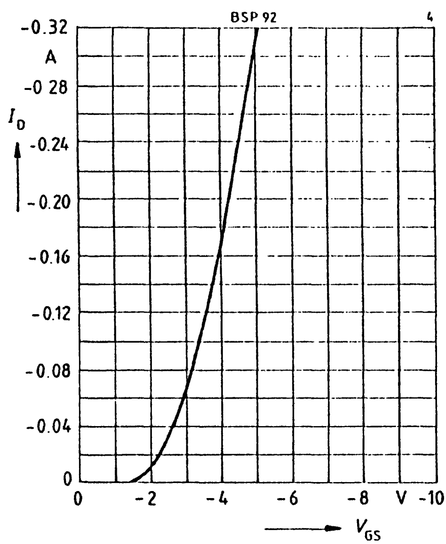
Typ. output characteristics $I_D = f(V_{DS})$



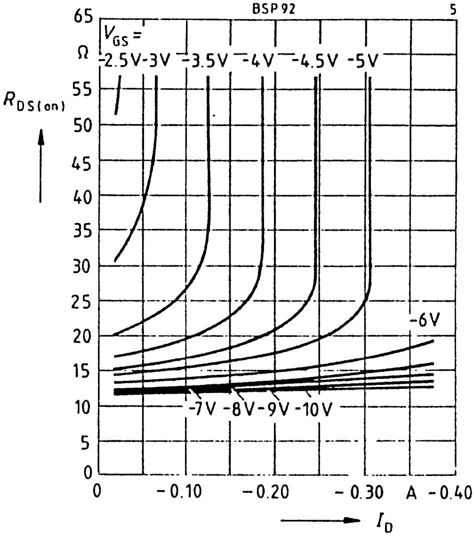
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



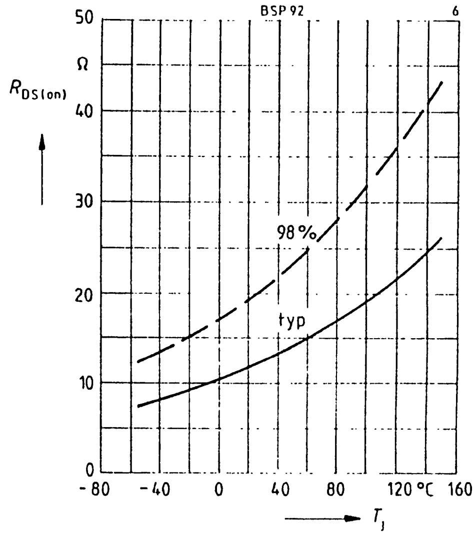
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



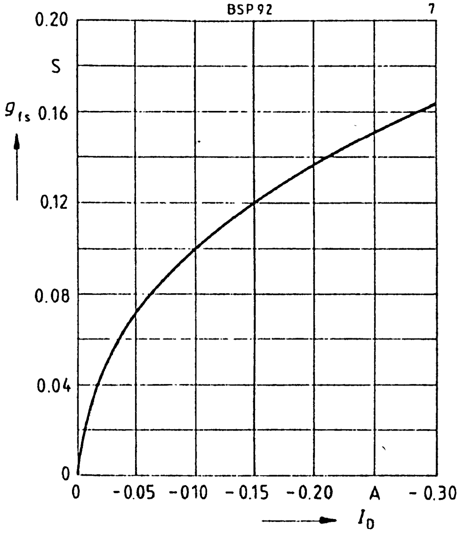
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25\ °C$



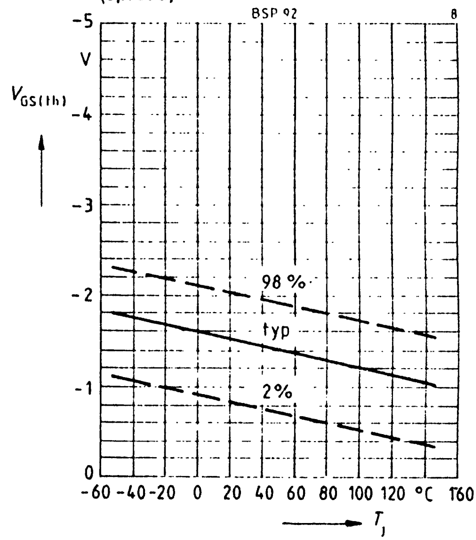
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: V_{GS} = 10 V, I_D = 0.18 A, (spread)



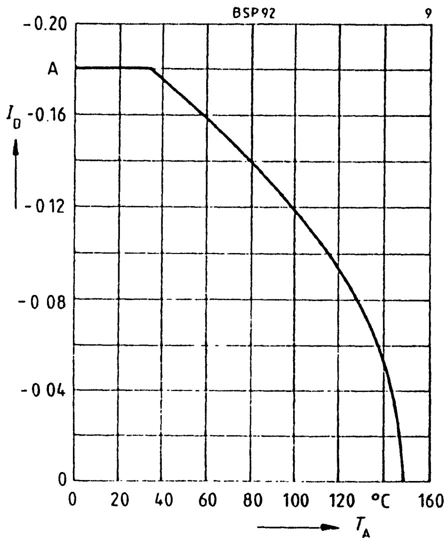
Typ. transconductance $g_{fs} = f(I_D)$
parameter: V_{DS} = 25 V, t_p = 80 µs, $T_j = 25\ °C$



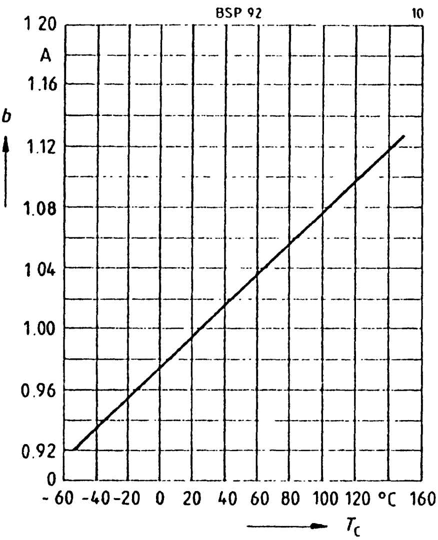
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, I_D = 1 mA
(spread)



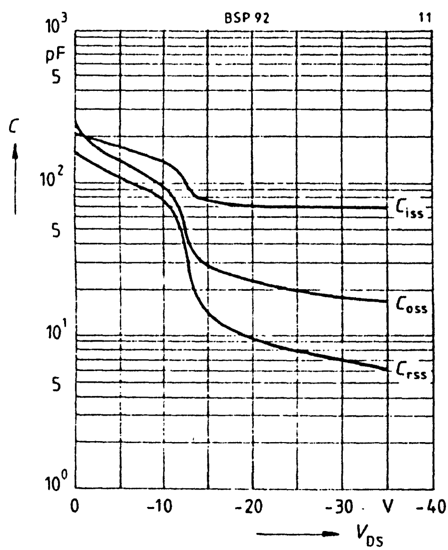
Continuous drain current $I_D = f(T_A)$



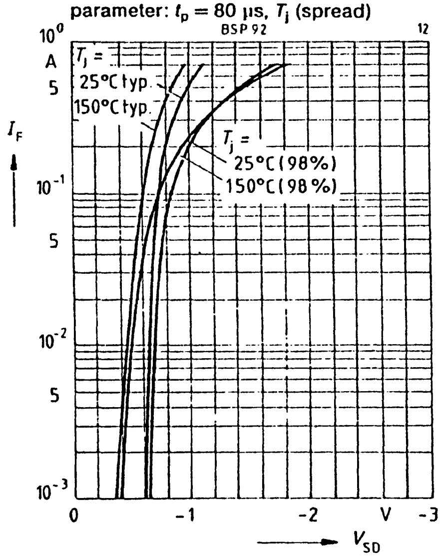
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



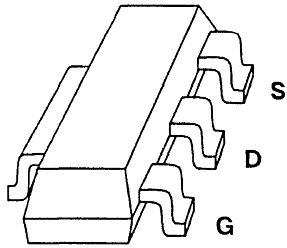
Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)



Preliminary Data



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 600V
- Continuous drain current I_D = .110A
- Drain-source on-resistance $R_{DS(on)}$ = 45Ω
- Total power dissipation P_D = 1.5W

Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 125	BSP 125	Q62702-S654	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	600	V	-
Drain-gate voltage	V_{DGR}	600	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.110	A	T_A =39°C
Pulsed drain current	I_{Dpuls}	0.44	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

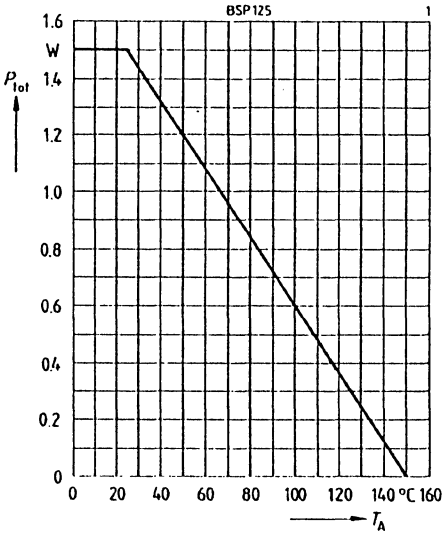
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	600	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	1.5	2.0	2.5	V	V_{DS} = V_{GS} ; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	10.0	100	nA	T_j =25°C; V_{DS} =600V V_{GS} =0V
	I_{DSS}	-	8.0	50.0	µA	T_j =125°C; V_{DS} =600V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	30.0	45.0	Ω	V_{GS} =10V I_D =0.11A

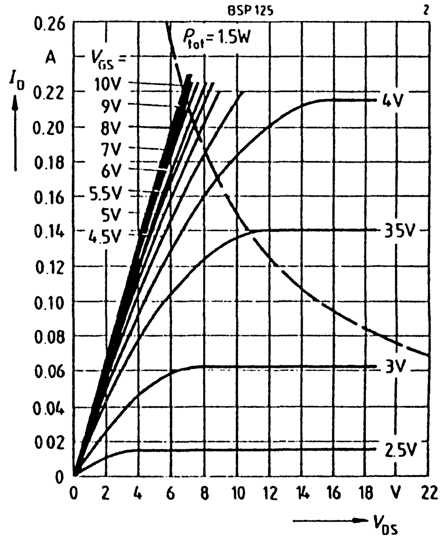
Dynamic characteristics

Description	Symbol	min.	typ.	max.	Unit	Condition
Forward transconductance	g_{fs}	0.06	0.15	-	S	V_{DS} ≥2* I_D * $R_{DSon\,max}$ I_D =0.11A
Input capacitance	C_{iss}	-	110	170	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	10	15		
Reverse transfer capacitance	C_{rss}	-	6	10		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.21A R_{GS} =50Ω
	t_r	-	10	15		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	18	25		
	t_f	-	20	25		
Reverse diode						
Continuous source current	I_S	-	-	0.11	A	
Pulsed source current	I_{SM}	-	-	0.44	A	
Diode forward on-voltage	V_{SD}	-	1.0	1.4	V	V_{GS} =0V I_F =0.22A

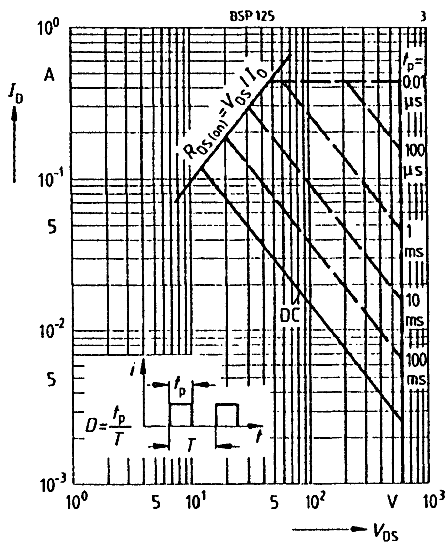
Permissible power dissipation $P_{tot} = f(T_A)$



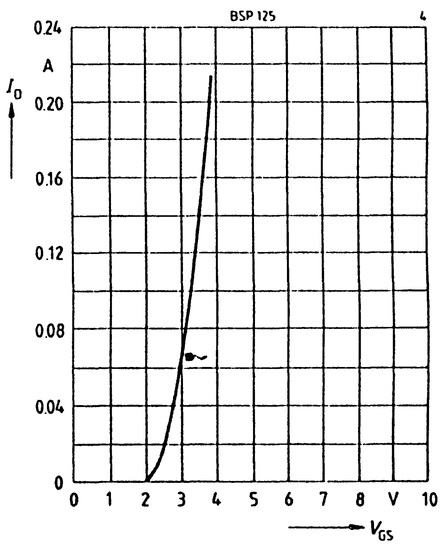
Typ. output characteristics $I_D = f(V_{DS})$



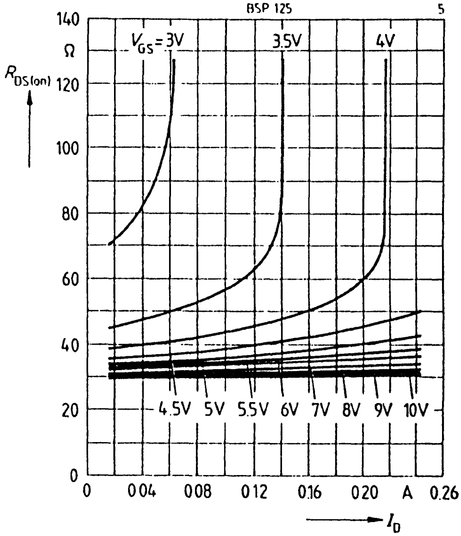
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



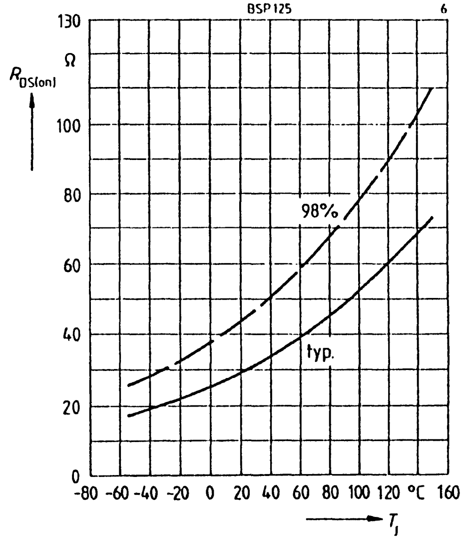
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



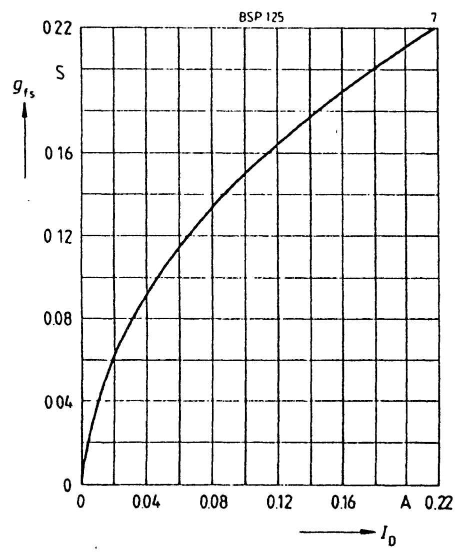
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25$ °C



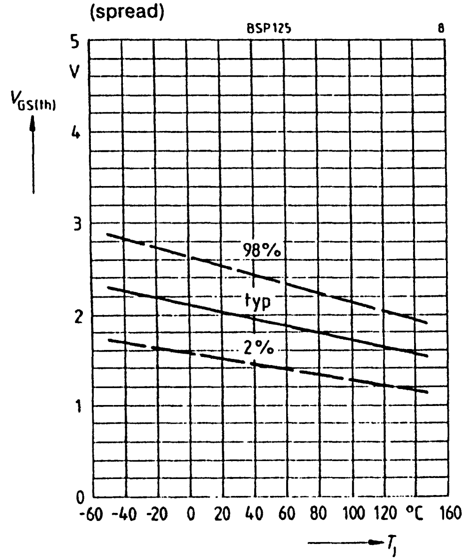
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 10$ V, $I_D = 0.11$ A, (spread)



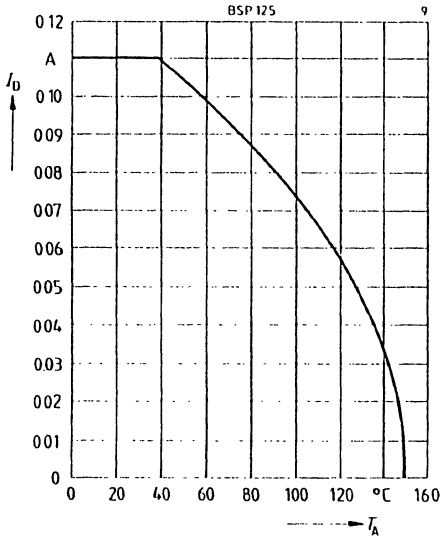
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



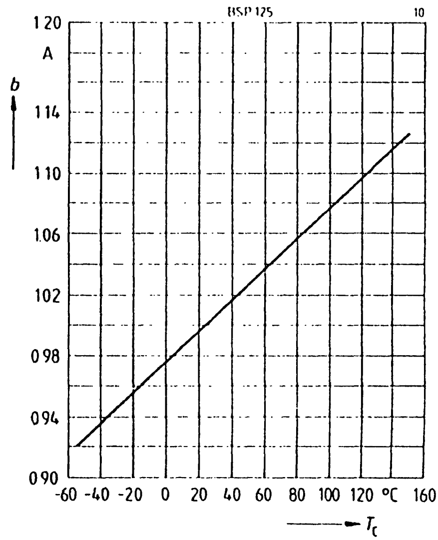
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



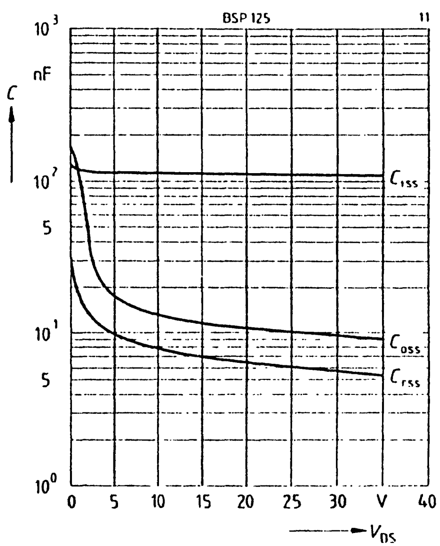
Continuous drain current $I_D = f(T_A)$



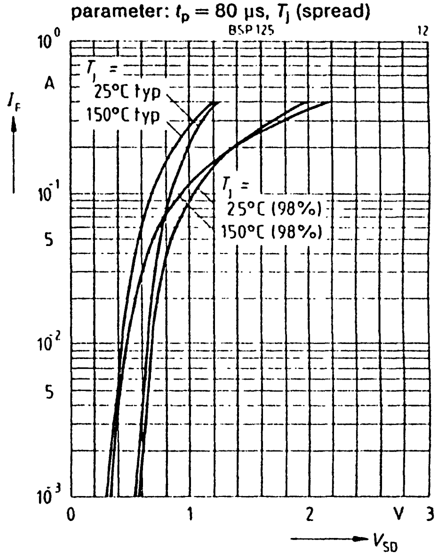
Drain-source breakdown voltage
$V_{(BR)DSS}\ (T_j) = b \times V_{(BR)DSS}\ (25\ °C)$



Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz

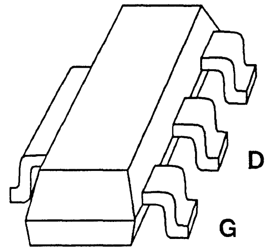


Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80\ \mu s$, T_j (spread)



Preliminary Data

- SIPMOS - depletion mode
- Drain-source voltage V_{DS} = 240V
- Continuous drain current I_D = 0.19A
- Drain-source on-resistance $R_{DS(on)}$ = 20Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 129	BSP 129	Q62702-S510	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	240	V	-
Drain-gate voltage	V_{DGR}	240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.19	A	T_A =29°C
Pulsed drain current	I_{Dpuls}	0.57	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

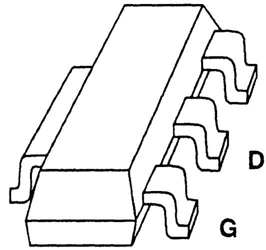
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	240	-	-	V	V_{GS} =-3V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-1.8	-	-0.7	V	V_{DS} = 3V; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	-	100	nA	T_j =25°C; V_{DS} =240V V_{GS} =-3V
	I_{DSS}	-	-	200	µA	T_j =125°C; V_{DS} =240V V_{GS} =-3V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	9.5	20	Ω	V_{GS} =0V I_D =.014A

Dynamic characteristics

Description	Symbol	min.	typ.	max.	Unit	Condition
Forward transconductance	g_{fs}	0.14	0.2	-	S	$V_{DS} \geq 2 * I_D * R_{DSon\,max}$ I_D =0.25A
Input capacitance	C_{iss}	-	110	-	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	20	-		
Reverse transfer capacitance	C_{rss}	-	5	-		
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	10	-	ns	V_{CC} =30V V_{GS} =-2V...+5V I_D =0.25A R_{GS} =50Ω
	t_r	-	15	-		
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	80	-		
	t_f	-	150	-		
Reverse diode						
Continuous source current	I_S	-	-	0.15	A	
Pulsed source current	I_{SM}	-	-	0.45	A	
Diode forward on-voltage	V_{SD}	-	0.7	1.4	V	V_{GS} =0V I_F =0.3A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

Preliminary Data



- SIPMOS - depletion mode
- Drain-source voltage V_{DS} = 600V
- Continuous drain current I_D = 0.100A
- Drain-source on-resistance $R_{DS(on)}$ = 60Ω
- Total power dissipation P_D = 1.5W

Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 135	BSP 135	Q62702-S655	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	600	V	-
Drain-gate voltage	V_{DGR}	600	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.100	A	T_A =27°C
Pulsed drain current	I_{Dpuls}	0.30	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

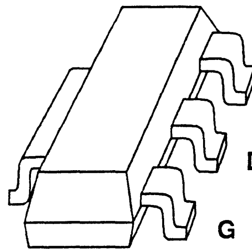
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSV}$	600	-	-	V	V_{GS} =-3V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-1.8	-1.2	-0.7	V	V_{DS} = 3V; I_D =1mA
Zero gate voltage drain current	I_{DSV}	-	-	100	nA	T_j =25°C; V_{DS} =600V V_{GS} =-3V
	I_{DSV}	-	-	200	µA	T_j =125°C; V_{DS} =600V V_{GS} =-3V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	45.0	60.0	Ω	V_{GS} =0V I_D =10mA

Description	Symbol	min.	typ.	max.	Unit	Condition
Dynamic characteristics						
Forward transconductance	g_{fs}	0.01	0.04	-	S	$V_{DS} \geq 2 * I_D * R_{DSon\,max}$ I_D =10mA
Input capacitance	C_{iss}	-	110	-	pF	V_{GS} =-3V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	20	-		
Reverse transfer capacitance	C_{rss}	-	5	-		
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	10	-	ns	V_{CC} =30V V_{GS} =-3V...+5V I_D =0.2A R_{GS} =50Ω
	t_r	-	10	-		
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	15	-		
	t_f	-	25	-		
Reverse diode						
Continuous source current	I_S	-	-	0.100	A	
Pulsed source current	I_{SM}	-	-	0.300	A	
Diode forward on-voltage	V_{SD}	-	0.90	1.30	V	V_{GS} =0V I_F =0.2A
Reverse recovery time	t_{rr}	-	-	-	µs	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

Preliminary Data

- SIPMOS - depletion mode
- Drain-source voltage V_{DS} = 200V
- Continuous drain current I_D = .44A
- Drain-source on-resistance $R_{DS(on)}$ = 3.5Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 149	BSP 149	Q67000-S071	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	200	V	-
Drain-gate voltage	V_{DGR}	200	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.44	A	T_A =28°C
Pulsed drain current	I_{Dpuls}	1.32	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

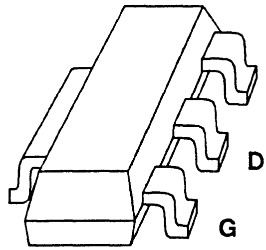
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSV}$	200	-	-	V	V_{GS} =-3V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-1.8	-	-0.7	V	V_{DS} = 3V; I_D =1mA
Zero gate voltage drain current	I_{DSV}	-	-	0.2	µA	T_j =25°C; V_{DS} =200V V_{GS} =-3V
	I_{DSV}	-	-	200	µA	T_j =125°C; V_{DS} =200V V_{GS} =-3V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	3.0	3.5	Ω	V_{GS} =0V I_D =30mA

Dynamic characteristics

Description	Symbol	min.	typ.	max.	Unit	Condition
Forward transconductance	g_{fs}	0.4	1.0	-	S	V_{DS} ≥2* I_D * $R_{DSon\,max}$ I_D =0.44A
Input capacitance	C_{iss}	-	400	-	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	50	-		
Reverse transfer capacitance	C_{rss}	-	15	-		
Turn-on time t_{on} (t_{on} =$t_{d(on)}$ +t_r)	$t_{d(on)}$	-	15	-	ns	V_{CC} =30V V_{GS} =-2V...+5V I_D =0.29A R_{GS} =50Ω
	t_r	-	10	-		
Turn-off time t_{off} (t_{off} =$t_{d(off)}$ +t_f)	$t_{d(off)}$	-	100	-		
	t_f	-	40	-		
Reverse diode						
Continuous source current	I_S	-	-	0.44	A	
Pulsed source current	I_{SM}	-	-	1.32	A	
Diode forward on-voltage	V_{SD}	-	0.9	1.2	V	V_{GS} =0V I_F =0.88A
Reverse recovery time	t_{rr}	-	-	-	µs	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

Preliminary Data

- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 50V
- Continuous drain current I_D = 1.7A
- Drain-source on-resistance $R_{DS(on)}$ = .3Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 295	BSP 295	Q67000-S066	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	50	V	-
Drain-gate voltage	V_{DGR}	50	V	R_{GS} =20 kΩ
Continuous drain current	I_D	1.7	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	6.8	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

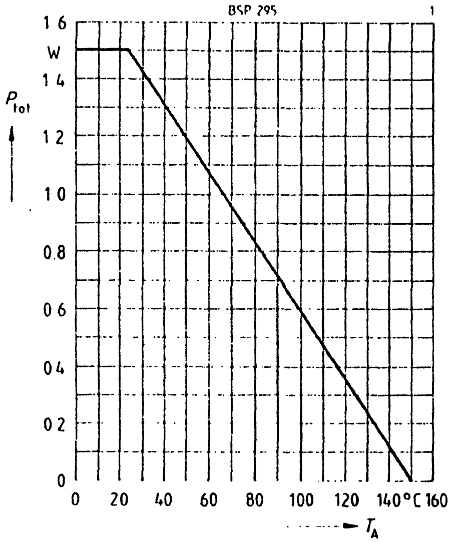
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	50	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.2	2.0	V	$V_{DS} = V_{GS}$; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	0.1	1.0	µA	T_j =25°C; V_{DS} =50V V_{GS} =0V
	I_{DSS}	-	8.0	50.0	µA	T_j =125°C; V_{DS} =50V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	0.2	0.3	Ω	V_{GS} =10V I_D =1.7A
	$R_{DS(on)}$	-	0.4	0.5	Ω	V_{GS} =4.5V I_D =1.7A

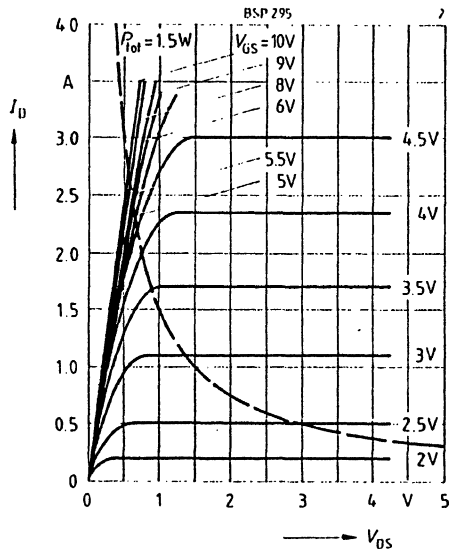
Dynamic characteristics

Description	Symbol	min.	typ.	max.	Unit	Condition
Forward transconductance	g_{fs}	0.5	1.4	-	S	$V_{DS} \geq 2 * I_D * R_{DSon\,max}$ I_D =1.7A
Input capacitance	C_{iss}	-	370	550	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	110	170		
Reverse transfer capacitance	C_{rss}	-	40	60		
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	8	12	ns	V_{CC} =30V V_{GS} =10V I_D =0.29A R_{GS} =50Ω
	t_r	-	15	25		
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	100	150		
	t_f	-	75	110		
Reverse diode						
Continuous source current	I_S	-	-	1.7	A	
Pulsed source current	I_{SM}	-	-	6.8	A	
Diode forward on-voltage	V_{SD}	-	1.0	1.5	V	V_{GS} =0V I_F =3.4A
Reverse recovery time	t_{rr}	-	-	-	µs	V_R =100V, $I_F = I_{DR}$ di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, $I_F = I_{DR}$ di_F /dt = 100A/µs

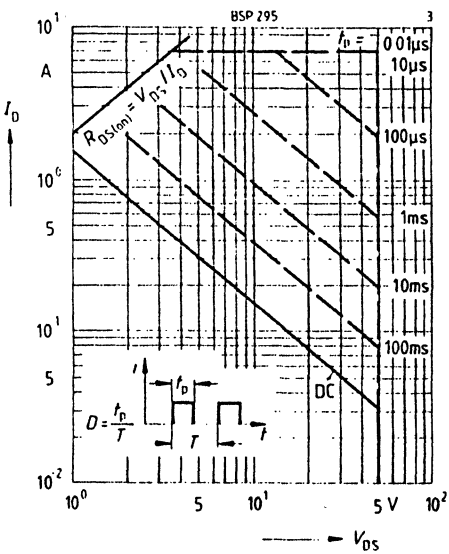
Permissible power dissipation $P_{tot} = f(T_A)$



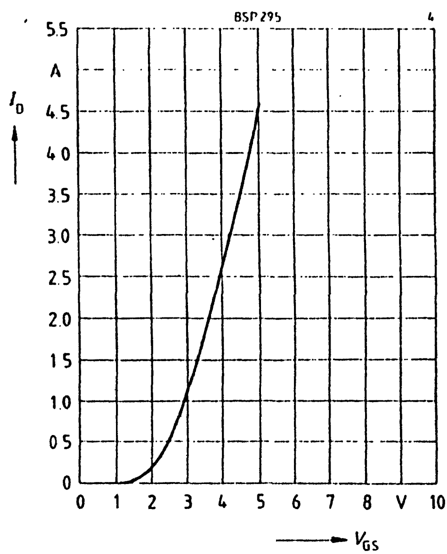
Typ. output characteristics $I_D = f(V_{DS})$



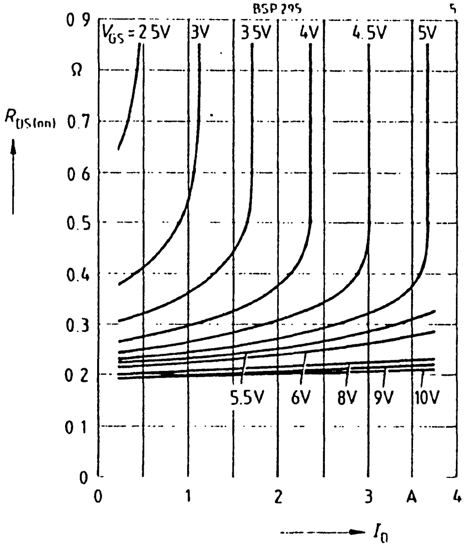
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



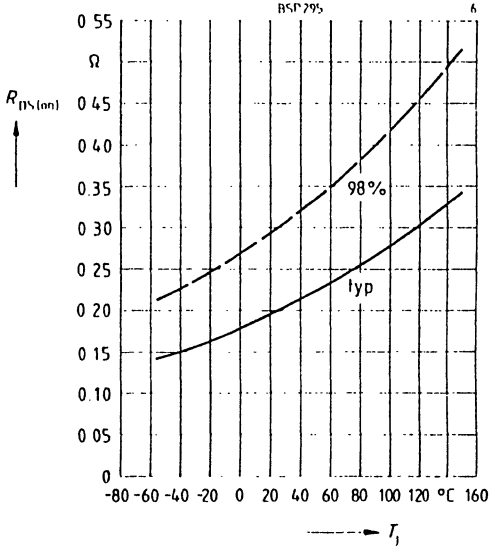
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



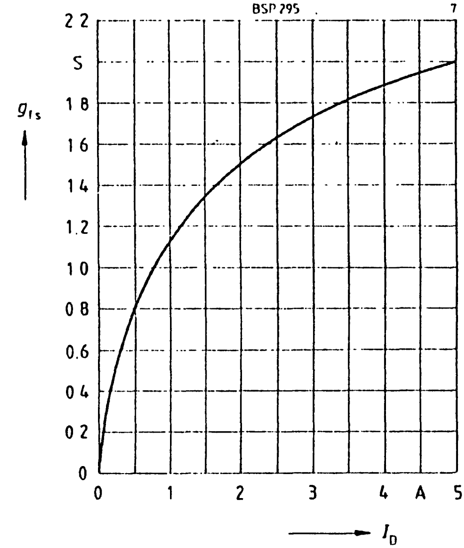
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25$ °C



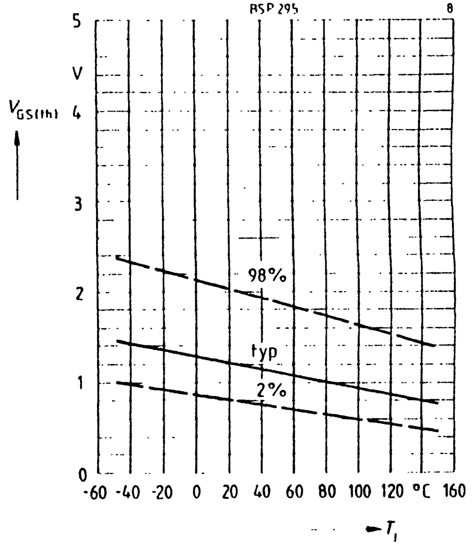
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 10$ V, $I_D = 1.7$ A, (spread)



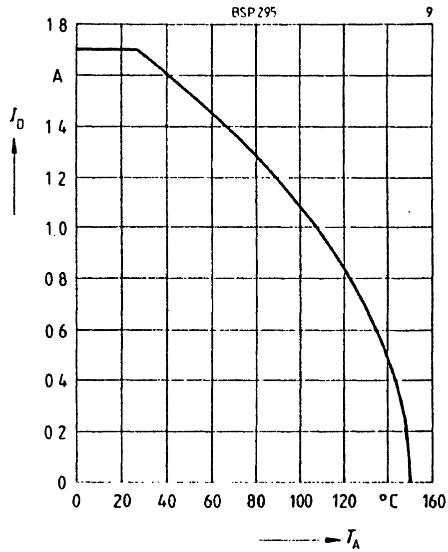
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



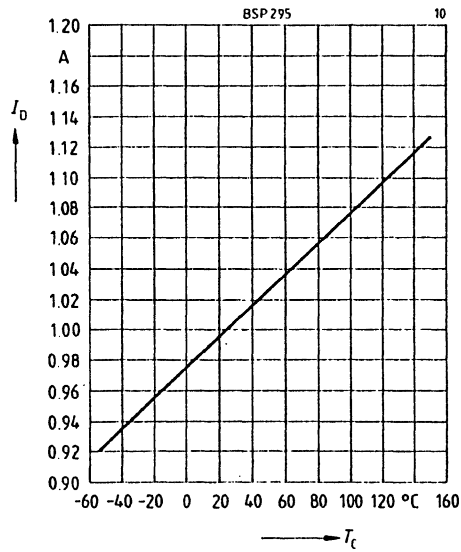
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



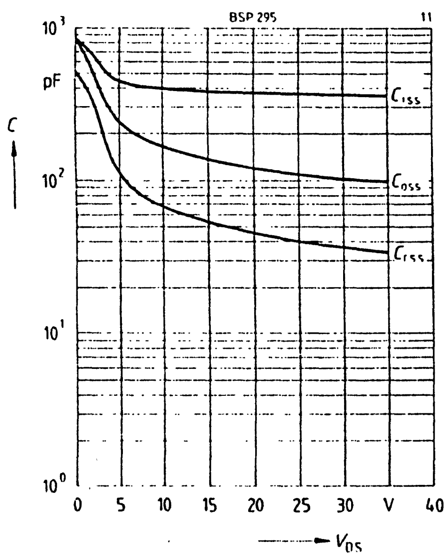
Continuous drain current $I_D = f(T_A)$



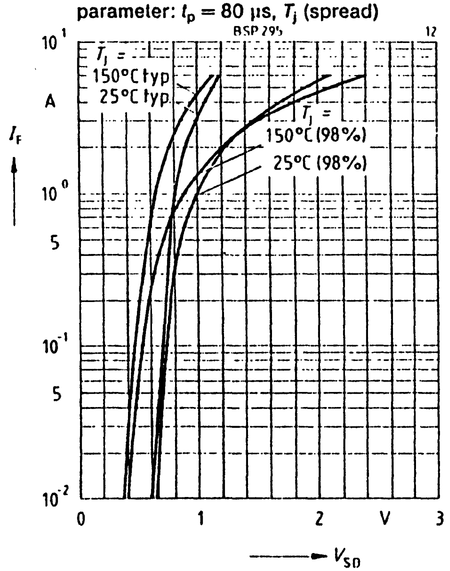
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)

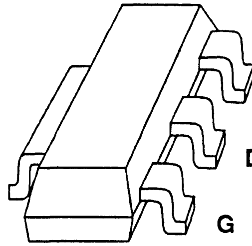


Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)





- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 100V
- Continuous drain current I_D = 1.0A
- Drain-source on-resistance $R_{DS(on)}$ = 0.8Ω
- Total power dissipation P_D = 1.5W

Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 296	BSP 296	Q67000-S067	SOT 223

Maximum Ratings

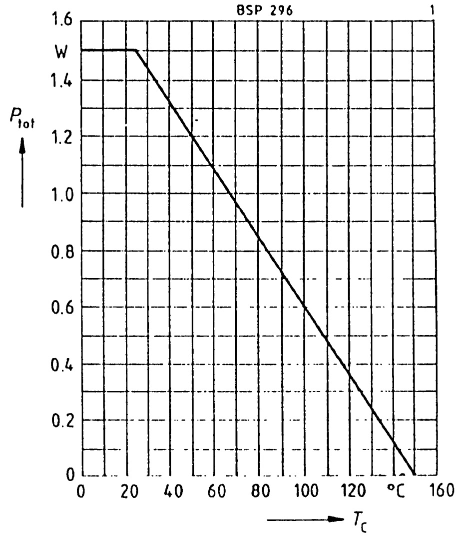
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	100	V	-
Drain-gate voltage	V_{DGR}	100	V	R_{GS} =20 kΩ
Continuous drain current	I_D	1.0	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	4.0	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

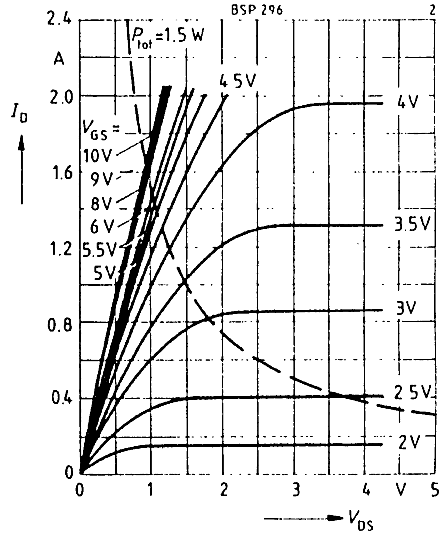
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.2	2.0	V	V_{DS} = V_{GS} ; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	0.1	1.0	µA	T_j =25°C; V_{DS} =100V V_{GS} =0V
	I_{DSS}	-	8.0	50.0	µA	T_j =125°C; V_{DS} =100V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	0.55	0.8	Ω	V_{GS} =10V I_D =1.0A
	$R_{DS(on)}$	-	0.95	1.4	Ω	V_{GS} =4.5V I_D =1.0A

Description	Symbol	min.	typ.	max.	Unit	Condition
Dynamic characteristics						
Forward transconductance	g_{fs}	0.5	1.1	-	S	V_{DS} ≥2* I_D * $R_{DSon\,max}$ I_D =1.0A
Input capacitance	C_{iss}	-	400	600	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	65	100		
Reverse transfer capacitance	C_{rss}	-	20	30		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	7	10	ns	V_{CC} =30V V_{GS} =10V I_D =0.29A R_{GS} =50Ω
	t_r	-	10	15		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	100	150		
	t_f	-	50	75		
Reverse diode						
Continuous source current	I_S	-	-	1.0	A	
Pulsed source current	I_{SM}	-	-	4.0	A	
Diode forward on-voltage	V_{SD}	-	0.9	1.3	V	V_{GS} =0V I_F =2.0A
Reverse recovery time	t_{rr}	-	-	-	µs	V_R =100V, I_F = I_{DR} dI_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} dI_F /dt = 100A/µs

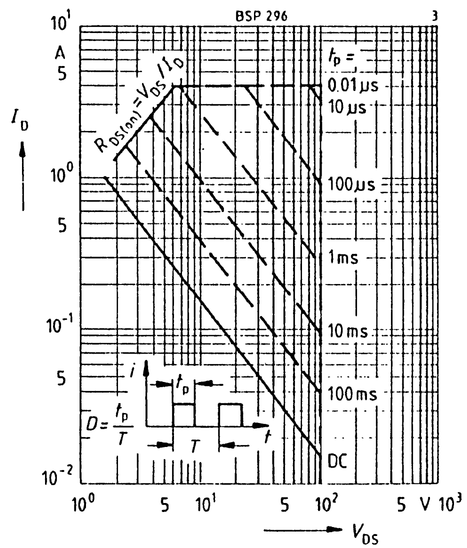
Permissible power dissipation $P_{tot} = f(T_A)$



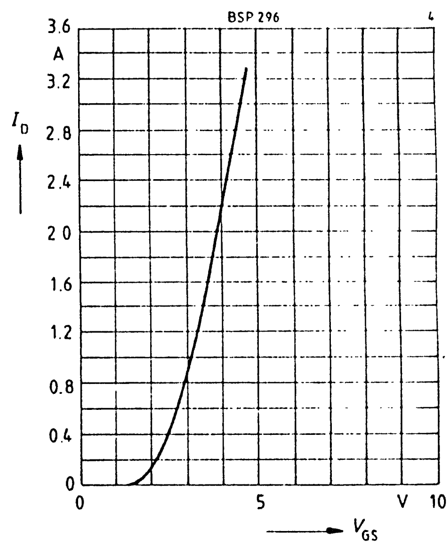
Typ. output characteristics $I_D = f(V_{DS})$



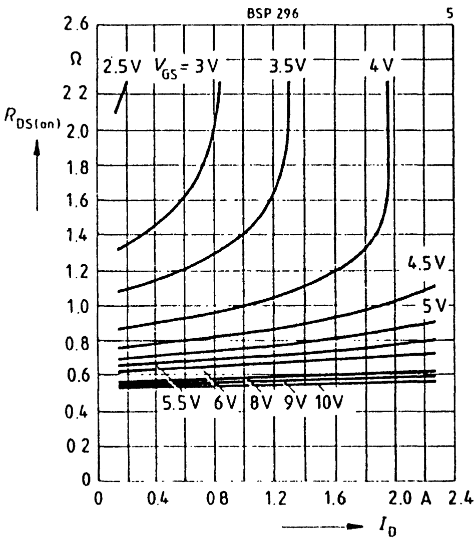
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



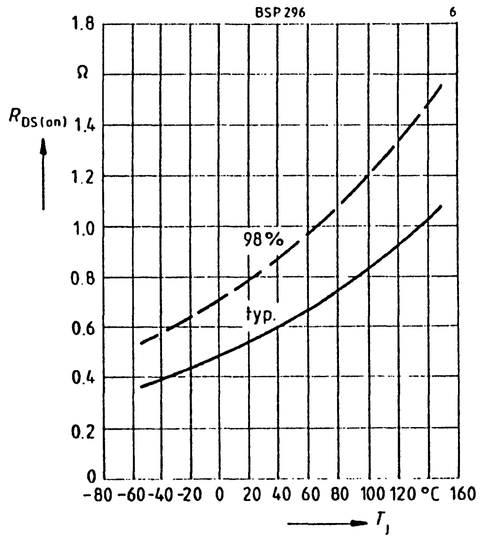
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



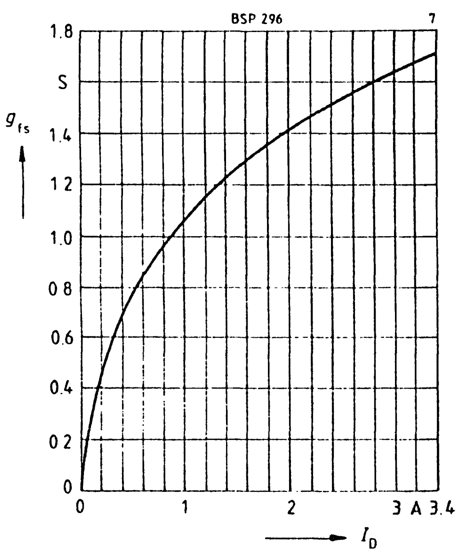
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25$ °C



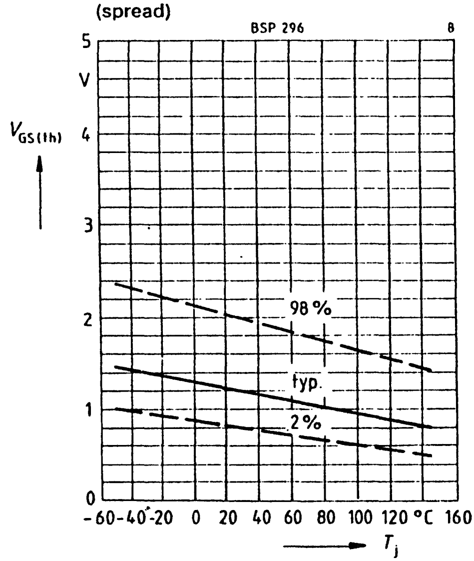
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 10$ V, $I_D = 1.0$ A, (spread)



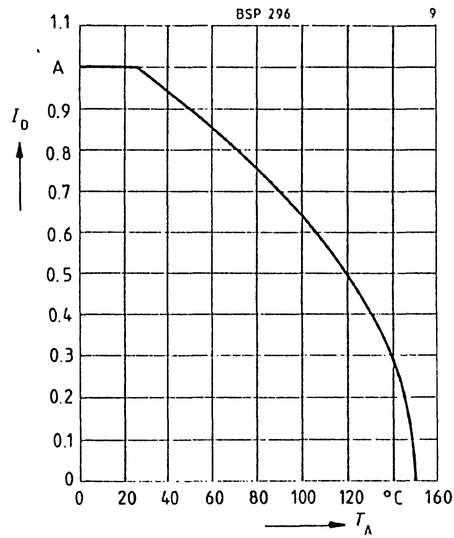
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



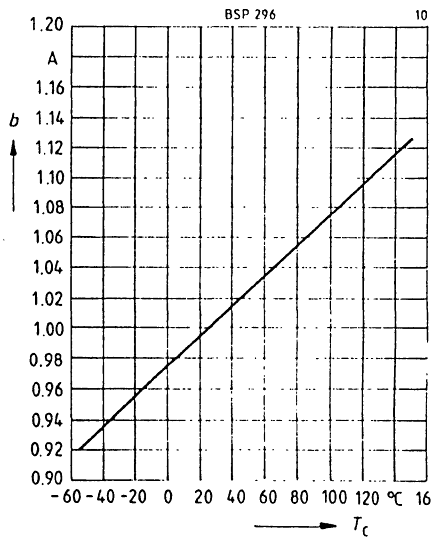
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



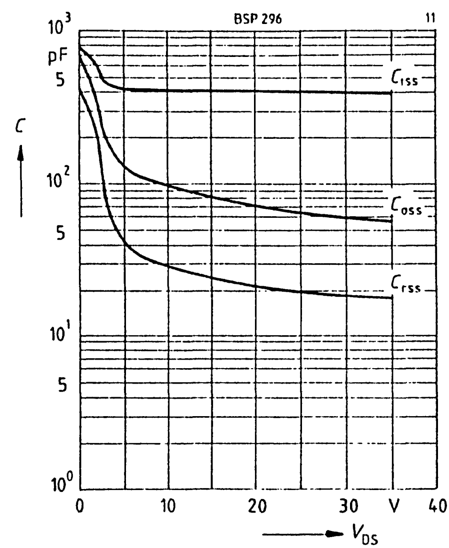
Continuous drain current $I_D = f(T_A)$



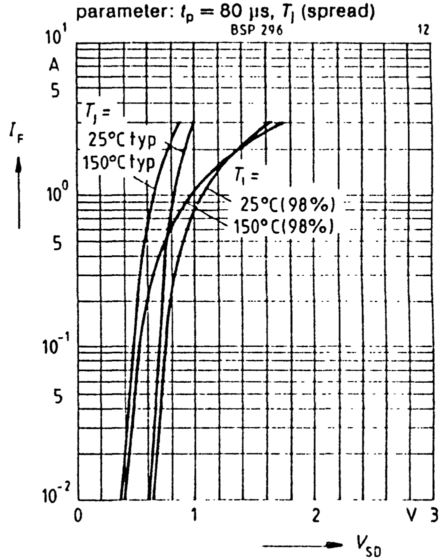
Drain-source breakdown voltage
$V_{(BR)DSS}(T_j) = b \times V_{(BR)DSS}$ (25 °C)



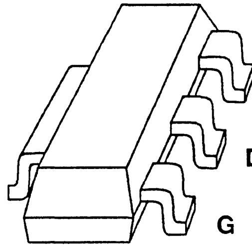
Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 200V
- Continuous drain current I_D = 0.6A
- Drain-source on-resistance $R_{DS(on)}$ = 2.0Ω
- Total power dissipation P_D = 1.5W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 297	BSP 297	Q67000-S068	SOT 223

Maximum Ratings

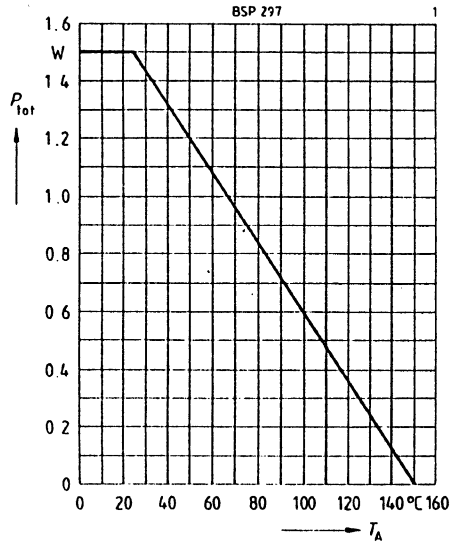
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	200	V	-
Drain-gate voltage	V_{DGR}	200	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.6	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	2.4	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side				

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

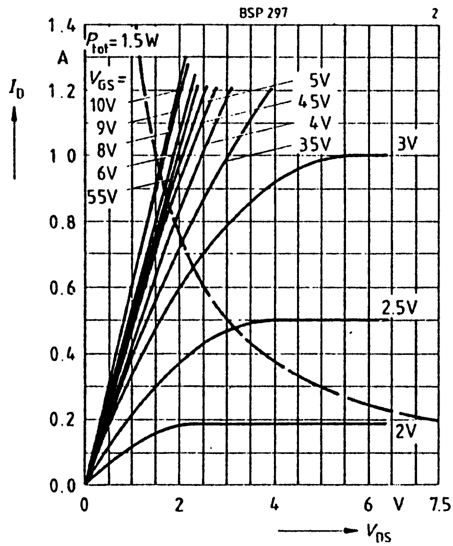
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	200	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.2	2.0	V	$V_{DS}=V_{GS}$; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	0.1	1.0	µA	T_j =25°C; V_{DS} =200V V_{GS} =0V
	I_{DSS}	-	8.0	50.0	µA	T_j =125°C; V_{DS} =130V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	1.6	2.0	Ω	V_{GS} =10V I_D =0.6A
	$R_{DS(on)}$	-	2.0	3.3	Ω	V_{GS} =4.5V I_D =0.6A

Description	Symbol	min.	typ.	max.	Unit	Condition
Dynamic characteristics						
Forward transconductance	g_{fs}	0.5	0.9	-	S	$V_{DS}\geq 2*I_D*R_{DSon\,max}$ I_D =0.6A
Input capacitance	C_{iss}	-	420	630	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	40	60		
Reverse transfer capacitance	C_{rss}	-	10	15		
Turn-on time t_{on} ($t_{on}=t_{d(on)}+t_r$)	$t_{d(on)}$	-	8	15	ns	V_{CC} =30V V_{GS} =10V I_D =0.29A R_{GS} =50Ω
	t_r	-	10	15		
Turn-off time t_{off} ($t_{off}=t_{d(off)}+t_f$)	$t_{d(off)}$	-	100	150		
	t_f	-	40	60		
Reverse diode						
Continuous source current	I_S	-	-	0.6	A	
Pulsed source current	I_{SM}	-	-	2.4	A	
Diode forward on-voltage	V_{SD}	-	0.85	1.1	V	V_{GS} =0V I_F =1.2A
Reverse recovery time	t_{rr}	-	-	-	µs	V_R =100V, $I_F=I_{DR}$ dI_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, $I_F=I_{DR}$ dI_F /dt = 100A/µs

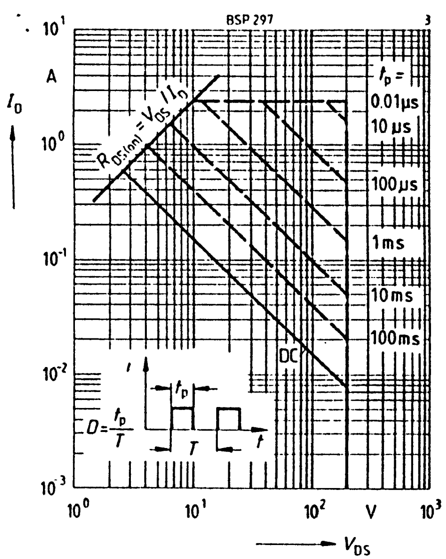
Permissible power dissipation $P_{tot} = f(T_A)$



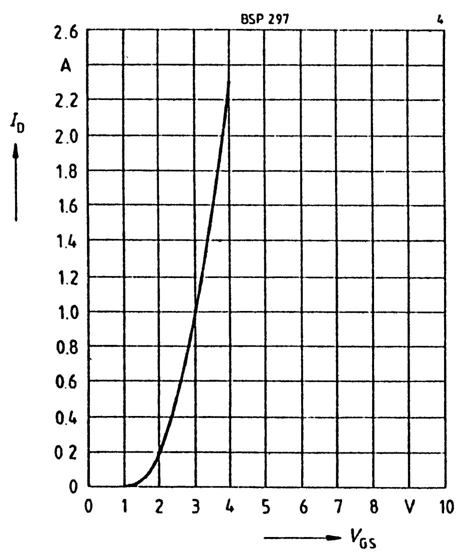
Typ. output characteristics $I_D = f(V_{DS})$



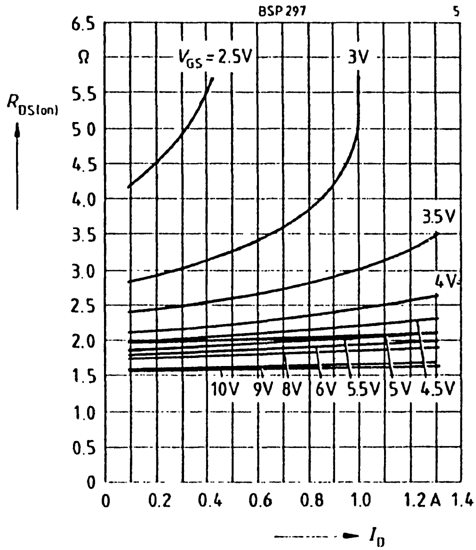
Permissible operating area $I_D = f(V_{DS})$
parameter: $D = 0.01$, $T_C = 25$ °C



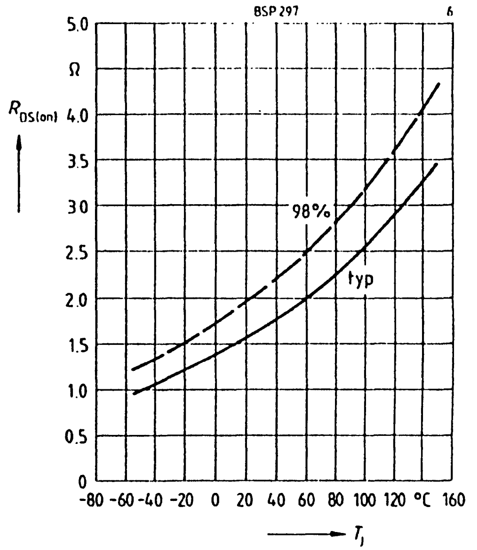
Typ. transfer characteristic $I_D = f(V_{GS})$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



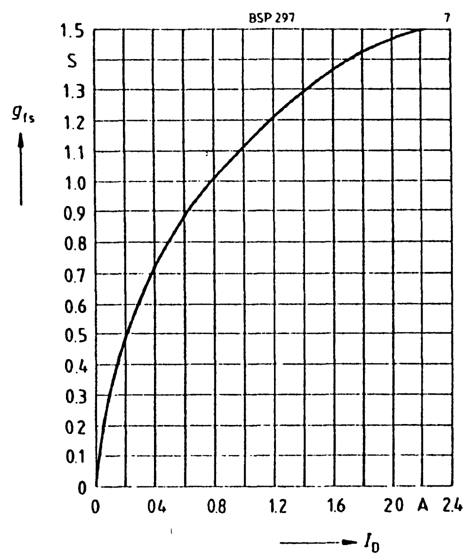
Typ. drain-source on-state resistance
$R_{DS(on)} = f(I_D)$
parameter: V_{GS}, $T_j = 25$ °C



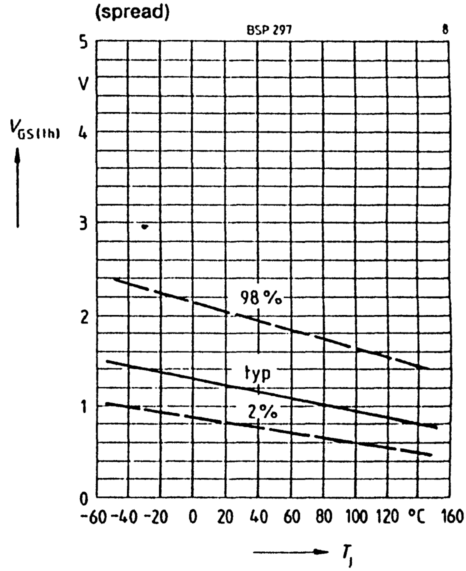
Drain-source on-state resistance
$R_{DS(on)} = f(T_j)$
parameter: $V_{GS} = 10$ V, $I_D = 0.6$ A, (spread)



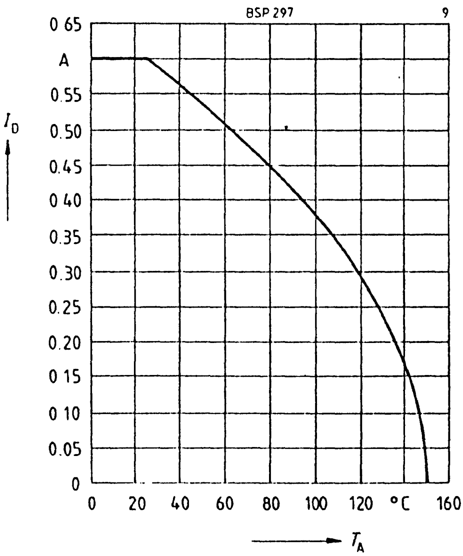
Typ. transconductance $g_{fs} = f(I_D)$
parameter: $V_{DS} = 25$ V, $t_p = 80$ µs, $T_j = 25$ °C



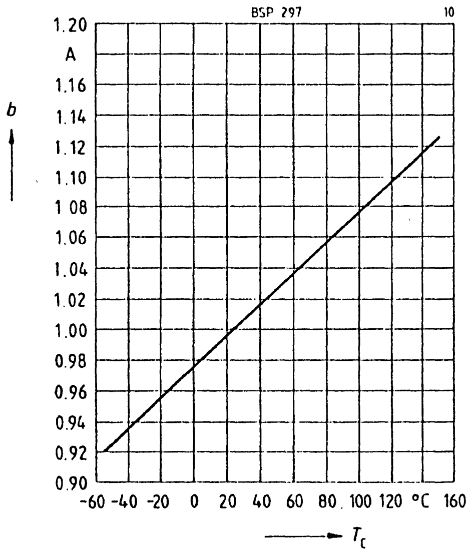
Gate threshold voltage $V_{GS(th)} = f(T_j)$
parameter: $V_{GS} = V_{DS}$, $I_D = 1$ mA
(spread)



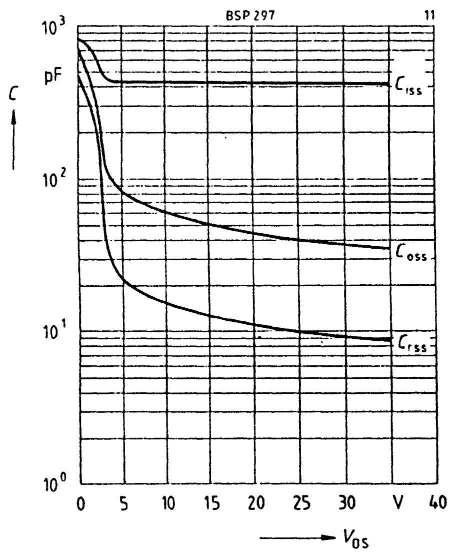
Continuous drain current $I_D = f(T_A)$



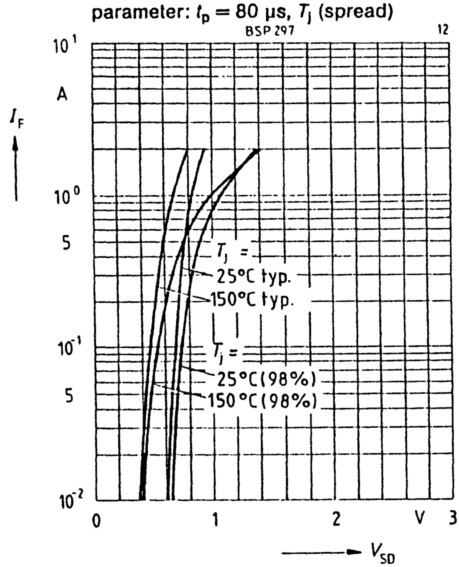
Drain-source breakdown voltage
$V_{(BR)DSS}\ (T_j) = b \times V_{(BR)DSS}\ (25\ °C)$

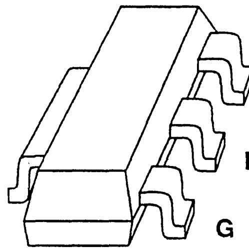


Typ. capacitance $C = f(V_{DS})$
parameter: $V_{GS} = 0$, $f = 1$ MHz



Forward characteristics of reverse diode
$I_F = f(V_{SD})$
parameter: $t_p = 80$ µs, T_j (spread)





- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = -50V
- Continuous drain current I_D = -1.0A
- Drain-source on-resistance $R_{DS(on)}$ = .95Ω
- Total power dissipation P_{tot} = 1.5W

Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSP 315	BSP 315	Q67000-S027	SOT 223

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	-50	V	-
Drain-gate voltage	V_{DGR}	-50	V	R_{GS} =20 kΩ
Continuous drain current	I_D	-1.0	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	-4.0	A	T_A =25°C
Gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_{tot}	1.5	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤83.3	K/W	
Chip - substrate rear side	$R_{th\ JSR}$	≤10		

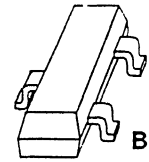
Electrical Characteristics
at T_j =25°C, unless otherwise specified.

Parameter	Symbol	Value			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	-50	-	-	V	V_{GS} =0 I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-0.8	-1.2	-2.0	V	V_{GS} = V_{DS} I_D =1 mA
Zero gate voltage drain current	I_{DSS}	-	-0.1 -8	-1 -50	μA μA	T_j =25°C T_j =125°C V_{GS} =0 V_{DS} =-50V
Gate-source leakage current	I_{GSS}	-	-10	-100	nA	V_{GS} =-20V, V_{DS} =0
Drain-source on-state resistance	$R_{DS(on)}$	-	-	.95	Ω	V_{GS} =-10V I_D =-1.0A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.25	.5	-	S	V_{DS} =-25V I_D =-1.0A
Input capacitance	C_{iss}	-	400	-	pF	V_{GS} =0 V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	50	-		
Reverse transfer capacitance	C_{oss}	-	15	-		
Turn-on time t_{on} (t_{on} =$t_{d(on)}$ +t_r)	$t_{d(on)}$	-	15	20	ns	V_{CC} =-30V V_{GS} =-10V I_D =-0.29A R_{GS} =50Ω
	t_r	-	10	15		
Turn-off time t_{off} (t_{off} =$t_{d(off)}$ +t_f)	$t_{d(off)}$	-	100	130		
	t_f	-	40	55		
Reverse diode						
Continuous reverse drain current	I_S	-	-1.0	-	A	T_C =25°C
Pulsed reverse drain current	I_{SM}	-	-4.0	-	A	
Diode forward on-voltage	V_{SD}	-	-1	-1.5	V	T_j =25°C, V_{GS} =0 I_F =-2.0A

NPN Silicon Switching Transistors

BSS 79
BSS 81

- High DC current gain
- Low collector-emitter saturation voltage
- Complementary types: BSS 80, BSS 82 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
BSS 79 B	CE	Q62702–S403	Q62702–S503	SOT 23
BSS 79 C	CF	Q62702–S402	Q62702–S501	SOT 23
BSS 81 B	CD	Q62702–S420	Q62702–S555	SOT 23
BSS 81 C	CG	Q62702–S419	Q62702–S559	SOT 23

Maximum ratings

Parameter	Symbol	BSS 79	BSS 81	Unit
Collector-emitter voltage	V_{CEO}	40	35	V
Collector-base voltage	V_{CBO}	75		V
Emitter-base voltage	V_{EBO}	6		V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

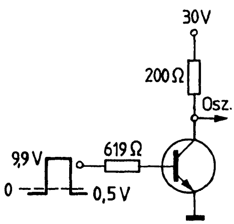
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BSS 79		40	–	–	V
BSS 81		35	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	75	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 60$ V		–	–	10	nA
$V_{CB} = 60$ V, $T_A = 150\,°C$		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	10	nA
DC current gain	h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 10$ V					
BSS 79 B/81 B		20	–	–	–
BSS 79 C/81 C		35	–	–	–
$I_C =$ 1 mA, $V_{CE} = 10$ V					
BSS 79 B/81 B		25	–	–	–
BSS 79 C/81 C		50	–	–	–
$I_C =$ 10 mA, $V_{CE} = 10$ V[1]					
BSS 79 B/81 B		35	–	–	–
BSS 79 C/81 C		75	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1]					
BSS 79 B/81 B		40	–	120	–
BSS 79 C/81 C		100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1]					
BSS 79 B/81 B		25	–	–	–
BSS 79 C/81 C		40	–	–	–
Collector-emitter saturation voltage[1]	V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	1,3	V
Base-emitter saturation voltage[1]	V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	1,2	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	2,0	V

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

AC chararacteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	f_T	–	250	–	MHz
Open-circuit output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	6	–	pF
V_{CC} = 30 V, I_C = 150 mA, $I_{B1} = I_{B2}$ = 15 mA, V_{BE} = 0,5 V					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	25	ns
Storage time	t_{stg}	–	–	250	ns
Fall time	t_f	–	–	60	ns

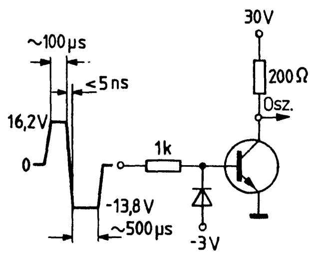
Test circuits

Delay and rise time

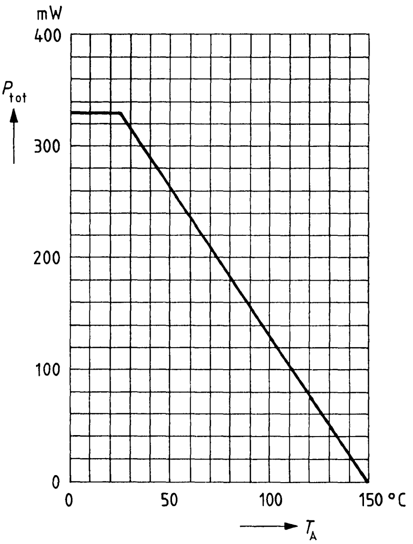


Oscilloscope: R > 100 kΩ
C < 12 pF
t_r < 5 ns

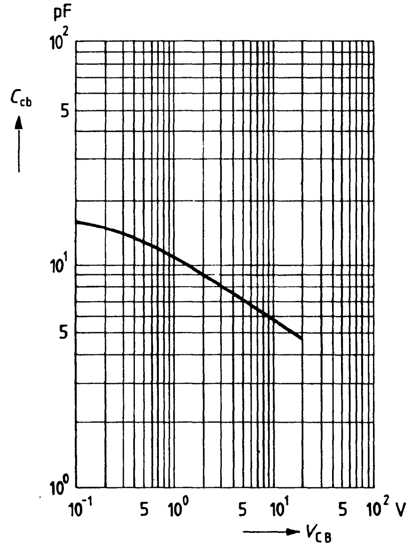
Storage and fall time



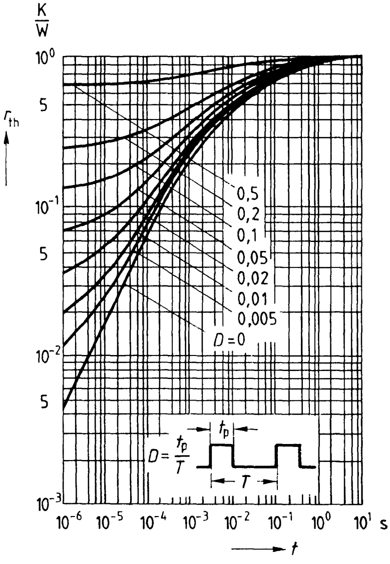
Total power dissipation $P_{tot} = f(T_A)$



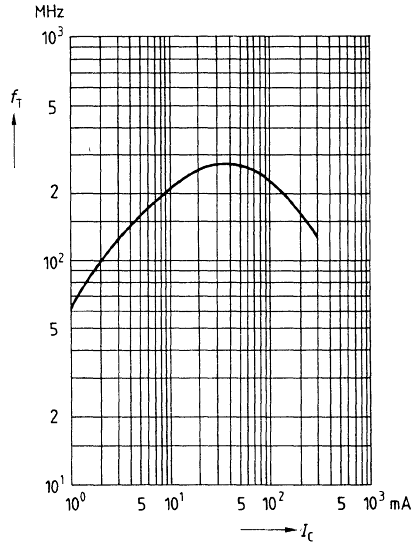
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



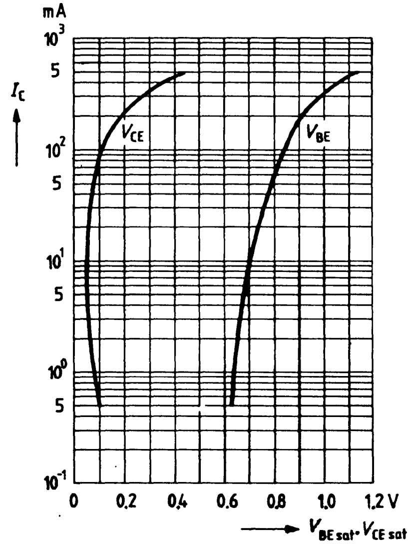
Pulse handling capability $r_{th} = f(t)$
(standardized)



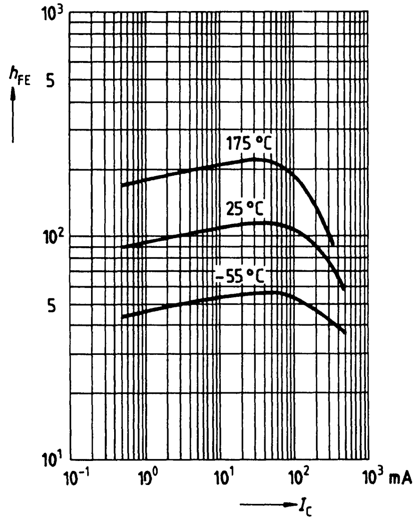
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V



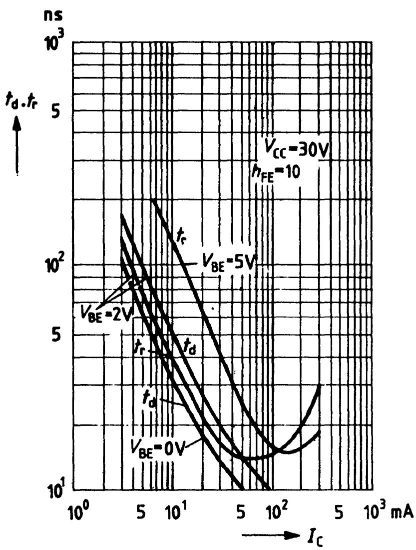
Saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$ $V_{CE\,sat} = f(I_C)$



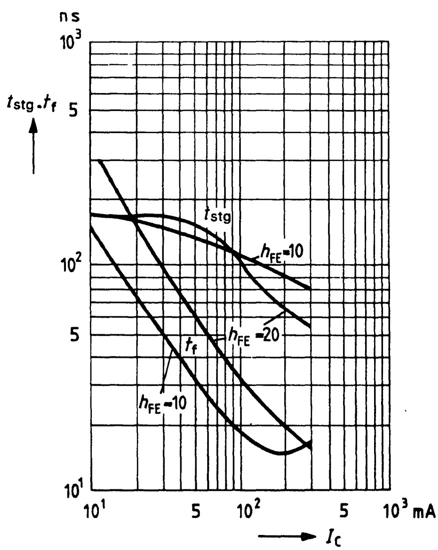
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10\ V$



Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



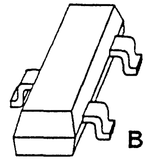
Storage time $t_{stg} = f(I_C)$
Fall time $t_f = f(I_C)$



PNP Silicon Switching Transistors

BSS 80
BSS 82

- High DC current gain
- Low collector-emitter saturation voltage
- Complementary types: BSS 79, BSS 81 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
BSS 80 B	CH	Q62702–S398	Q62702–S557	SOT 23
BSS 80 C	CJ	Q62702–S399	Q62702–S492	SOT 23
BSS 82 B	CL	Q62702–S409	Q62702–S560	SOT 23
BSS 82 C	CM	Q62702–S408	Q62702–S482	SOT 23

Maximum ratings

Parameter	Symbol	BSS 80	BSS 82	Unit
Collector-emitter voltage	V_{CEO}	40	60	V
Collector-base voltage	V_{CBO}	60		V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	800		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

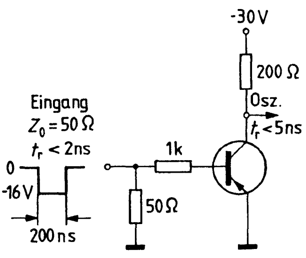
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)\,CEO}$				
BSS 80		40	–	–	V
BSS 82		60	–	–	V
Collector-base breakdown voltage $I_C = 10\,\mu A$	$V_{(BR)\,CBO}$	60	–	–	V
Emitter-base breakdown voltage $I_E = 10\,\mu A$	$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 50$ V		–	–	10	nA
$V_{CB} = 50$ V, $T_A = 150\,°C$		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	10	nA
DC current gain	h_{FE}				
$I_C = 100\,\mu A$, $V_{CE} = 10$ V					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		75	–	–	–
$I_C =$ 1 mA, $V_{CE} = 10$ V					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		100	–	–	–
$I_C =$ 10 mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		100	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	120	–
BSS 80 C/82 C		100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1])					
BSS 80 B/82 B		40	–	–	–
BSS 80 C/82 C		50	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	0,4	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	1,6	V
Base-emitter saturation voltage[1])	V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA		–	–	1,3	V
$I_C = 500$ mA, $I_B = 50$ mA		–	–	2,6	V

[1]) Pulse test: $t \leq 300\,\mu s$, D = 2%.

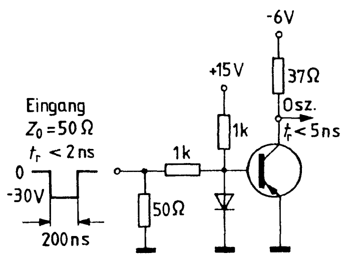
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	–	250	–	MHz
Open-circuit output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	6	–	pF
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 150$ mA					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	40	ns
$V_{CC} = 6$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA					
Storage time	t_{stg}	–	–	80	ns
Fall time	t_f	–	–	30	ns

Test circuits

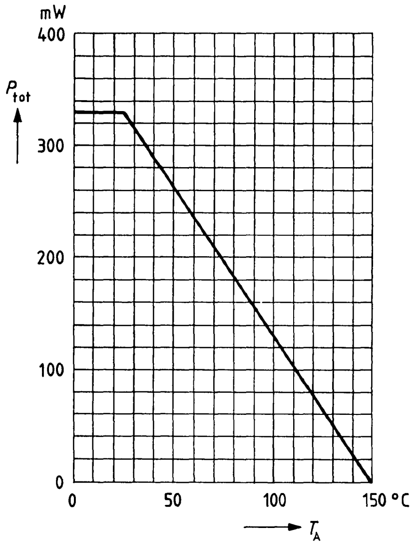
Delay and rise time



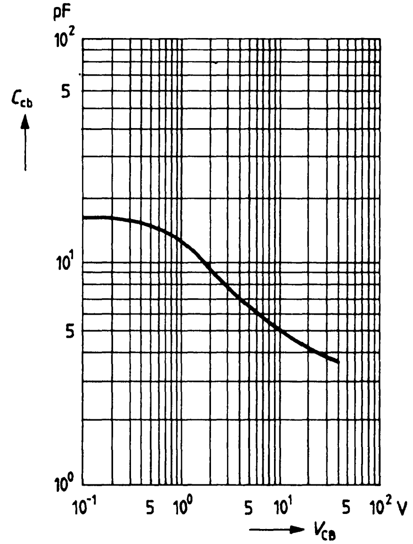
Storage and fall time



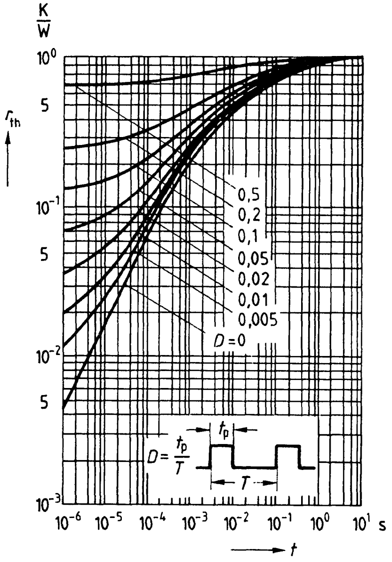
Total power dissipation $P_{tot} = f(T_A)$



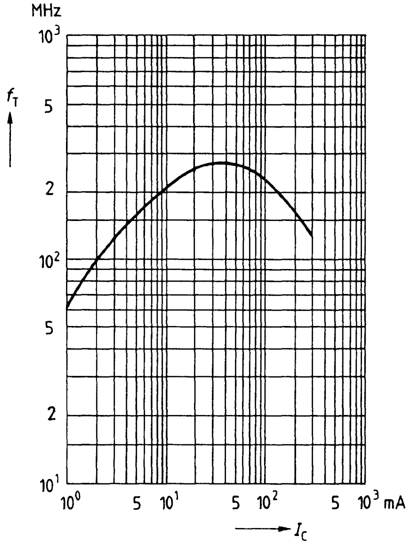
Collector-base capacitance $C_{cb} = f(V_{CB})$
$f = 1$ MHz



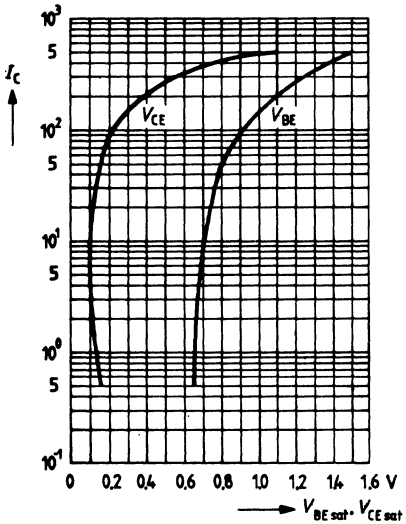
Pulse handling capability $r_{th} = f(t)$
(standardized)



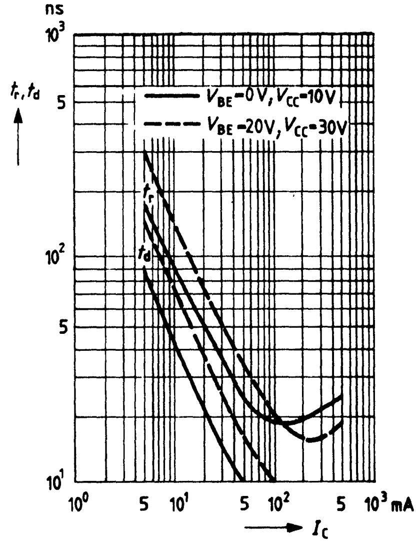
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V



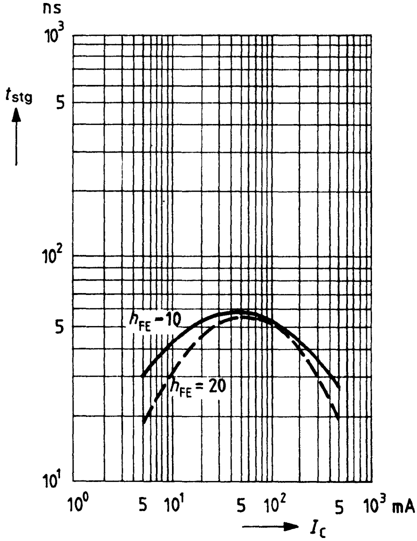
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$



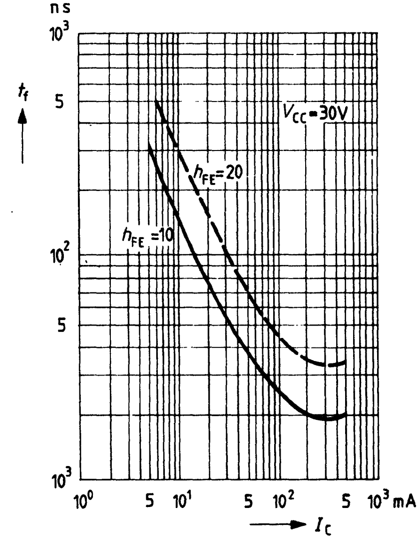
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



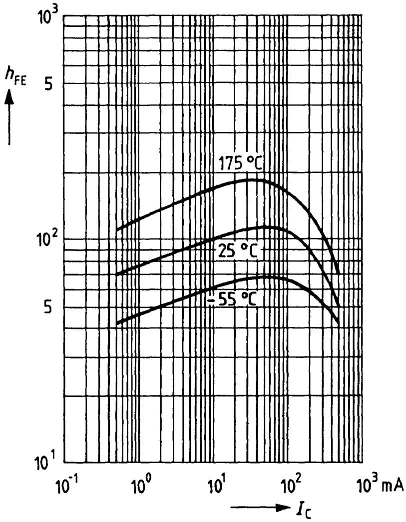
Storage time $t_{stg} = f(I_C)$



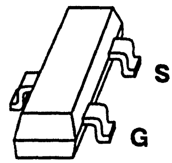
Fall time $t_f = f(I_C)$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10\ V$



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = -50V
- Continuous drain current I_D = -0.13A
- Drain-source on-resistance $R_{DS(on)}$ = 10.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 84	SP	Q62702-S568	SOT 23

Maximum Ratings

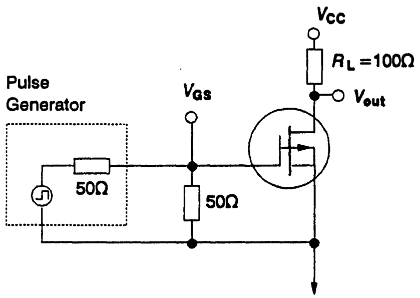
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	-50	V	-
Drain-gate voltage	V_{DGR}	-50	V	R_{GS} =20 kΩ
Continuous drain current	I_D	-0.13	A	T_A =30°C
Pulsed drain current	I_{Dpuls}	-0.52	A	T_A =25°C
Peak gate-source voltage	V_{GS}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	Mounted on
Chip - substrate rear side	$R_{th\ JSR}$	≤285		Ceramic substrate 2.5cm²

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

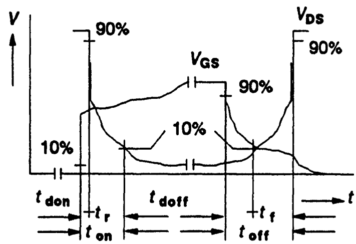
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	-50	-	-	V	V_{GS} =0V I_D =-0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-0.8	-1.5	-2.0	V	V_{DS} = V_{GS} ; I_D =-1mA
Zero gate voltage drain current	I_{DSS}	-	-1.0	-15.0	µA	T_j =25°C; V_{DS} =-50V V_{GS} =0V
	I_{DSS}	-	-2.0	-60.0	µA	T_j =125°C; V_{DS} =-50V V_{GS} =0V
	I_{DSS}	-	-	0.1	µA	T_j =25°C; V_{DS} =-25V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	-1.0	-10.0	nA	V_{GS} =-20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	5.0	10.0	Ω	V_{GS} =-10V I_D =0.13A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.05	0.08	-	S	V_{DS} =-25V I_D =-0.13A
Input capacitance	C_{iss}	-	30	45	pF	V_{GS} =0V V_{DS} =-25V f =1MHz
Output capacitance	C_{oss}	-	17	25		
Reverse transfer capacitance	C_{rss}	-	8	12		
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	8	12	ns	V_{CC} =-30V V_{GS} =-10V I_D =-0.27A R_{GS} =50Ω
	t_r	-	35	50		
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	8	10		
	t_f	-	20	25		
Reverse diode						
Continuous source current	I_S	-	-	-0.13	A	
Pulsed source current	I_{SM}	-	-	-0.52	A	
Diode forward on-voltage	V_{SD}	-	-0.9	-1.2	V	V_{GS} =0V I_F =-0.26A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =-30V, I_F = I_{DR} di_F /dt = -100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =-30V, I_F = I_{DR} di_F /dt = -100A/µs

Switching Time Measurement

Test circuit

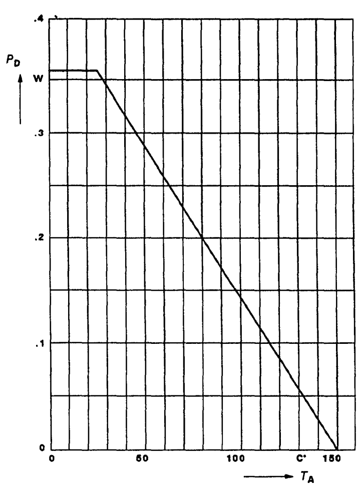


Switching times



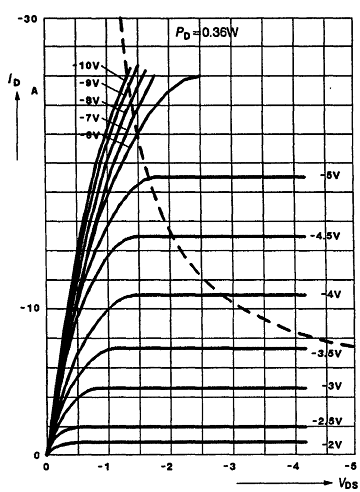
Permissible power dissipation versus temperature

$P_D = f T_A$
X Axis: T_A / °C
Y Axis: P_D / W



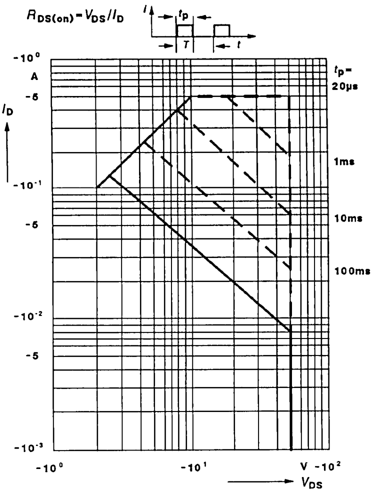
Typical output characteristic

$I_D = f V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



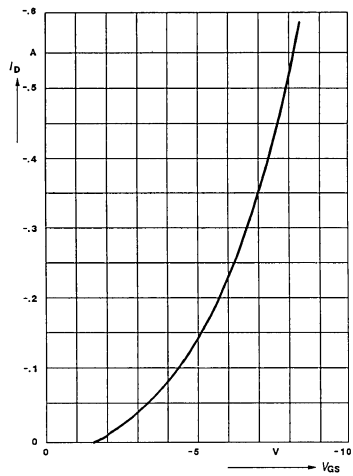
Safe operating area

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p / T$; $T_C = 25°C$



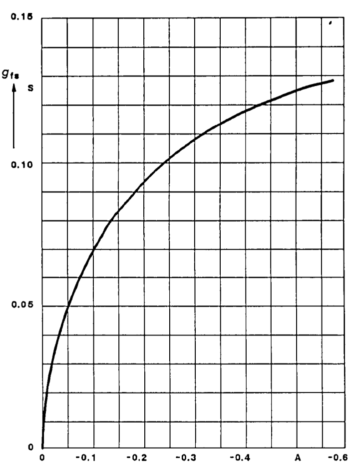
Typical transfer characteristic

$I_D = f\,V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = -25V; t_p = 80µs; T_j = 25°C



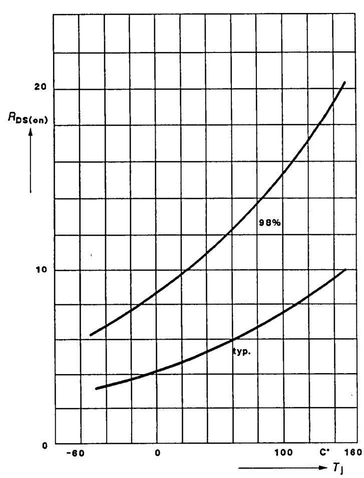
Typical transconductance

$g_{fs} = f\,I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: V_{DS} = -25V; t_p = 80µs; T_j = 25°C



Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = -10V; I_D = -0.13A



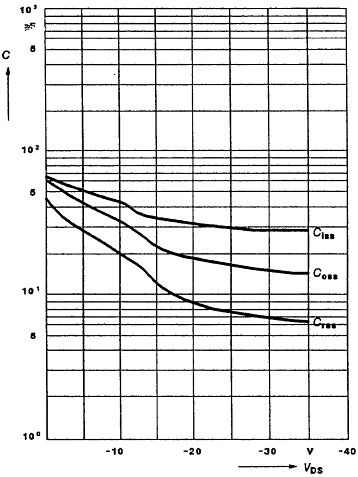
Typical capacitances

$C = f\,V_{DS}$

X Axis: V_{DS} / V

Y Axis: C / pF

Parameter: V_{GS} =0; f =1MHz

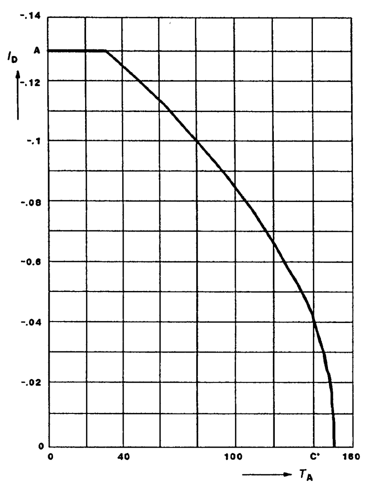


Drain current

$I_D = f\,T_A$

X Axis: T_A / °C

Y Axis: I_D / A



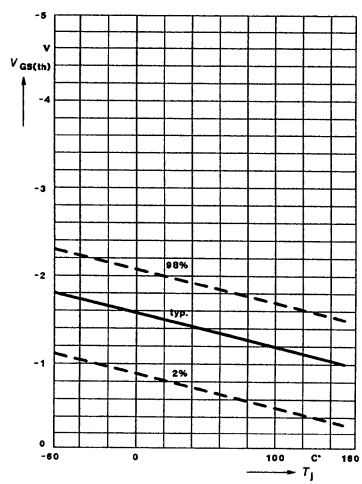
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$

X Axis: T_j / °C

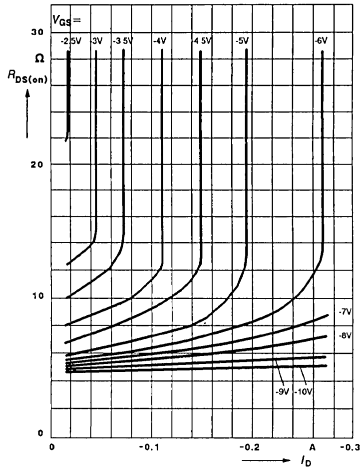
Y Axis: V_{GSth} / V

Parameter: V_{GS} = V_{DS} ; I_D = -1mA



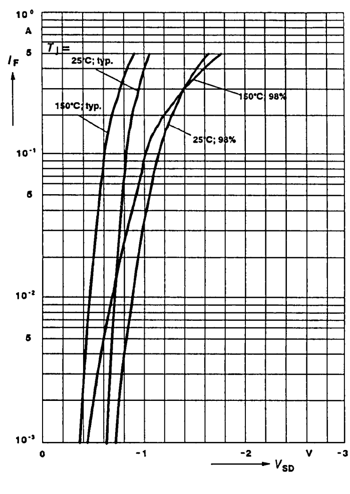
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; T_j = 25°C

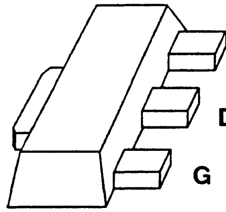


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 240V
- Continuous drain current I_D = 0.29A
- Drain-source on-resistance $R_{DS(on)}$ = 6.0Ω
- Total power dissipation P_D = 1.0W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
BSS 87	KA	Q62702-S506	SOT 89

Maximum Ratings

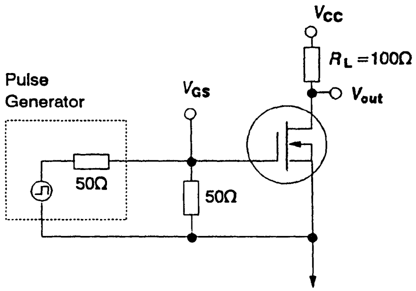
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	240	V	-
Drain-gate voltage	V_{DGR}	240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.29	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	1.16	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.0	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤125	K/W	

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

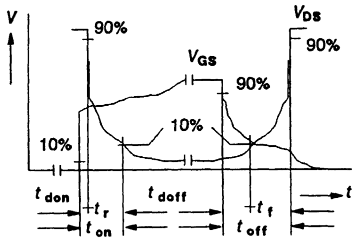
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	240	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.5	2.0	V	V_{DS} = V_{GS}; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	4.0	60.0	µA	T_j =25°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	8.0	200	µA	T_j =125°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	-	200	nA	T_j =25°C; V_{DS} =60V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	4.0 5.7	6.0 10.0	Ω Ω	V_{GS} =10V I_D =0.29A V_{GS} =4.5V I_D =0.29A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.14	0.29	-	S	V_{DS} =25V I_D =0.29A
Input capacitance	C_{iss}	-	90	140	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	20	30		
Reverse transfer capacitance	C_{rss}	-	6.0	9.0		
Turn-on time t_{on}	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.28A R_{GS} =50Ω
(t_{on} = $t_{d(on)}$ + t_r)	t_r	-	8	12		
Turn-off time t_{off}	$t_{d(off)}$	-	25	30		
(t_{off} = $t_{d(off)}$ + t_f)	t_f	-	22	28		
Reverse diode						
Continuous source current	I_S	-	-	0.29	A	
Pulsed source current	I_{SM}	-	-	1.16	A	
Diode forward on-voltage	V_{SD}	-	0.85	1.4	V	V_{GS} =0V I_F =0.58A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs

Switching Time Measurement

Test circuit

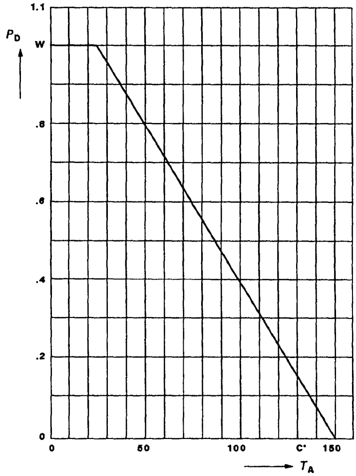


Switching times



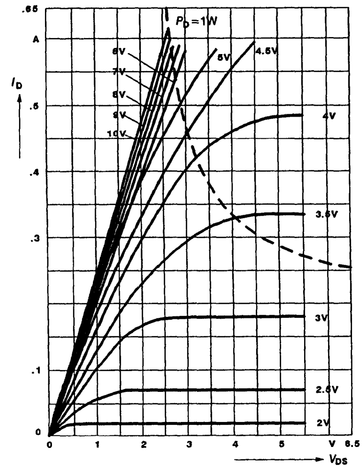
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



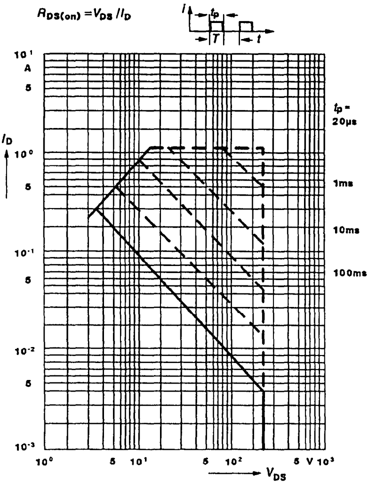
Typical output characteristic

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



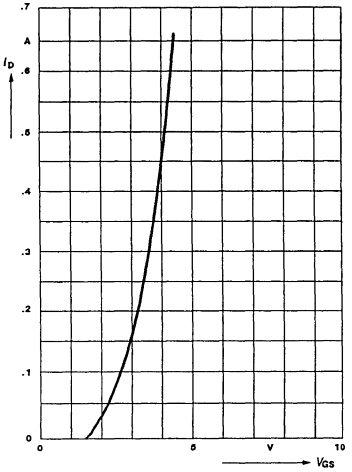
Safe operating area

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p\,/T$; $T_C = 25°C$



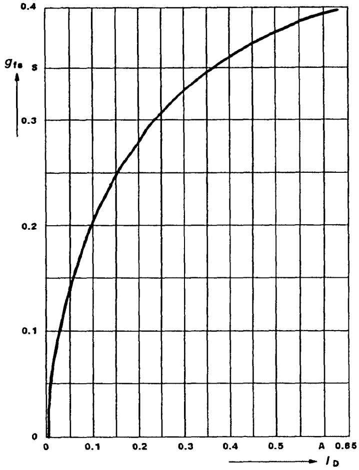
Typical transfer characteristic

$I_D = f\,V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: $V_{DS} = 25V$; $t_p = 80\mu s$; $T_j = 25°C$



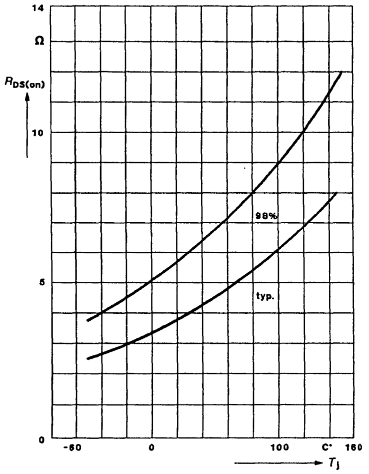
Typical transconductance

$g_{fs} = f\,I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: $V_{DS} = 25V$; $t_p = 80\mu s$; $T_j = 25°C$



Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: $V_{GS} = 10V$; $I_D = 0.29A$



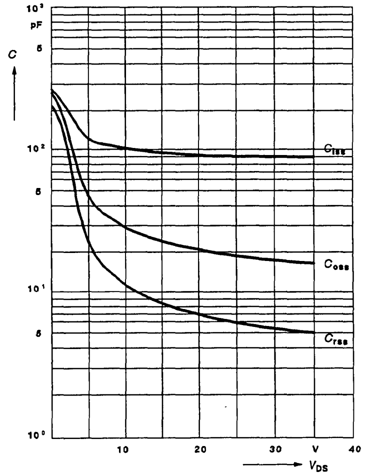
Typical capacitances

$C = f\,V_{DS}$

X Axis: V_{DS} / V

Y Axis: C / pF

Parameter: $V_{GS} = 0$; $f = 1$MHz

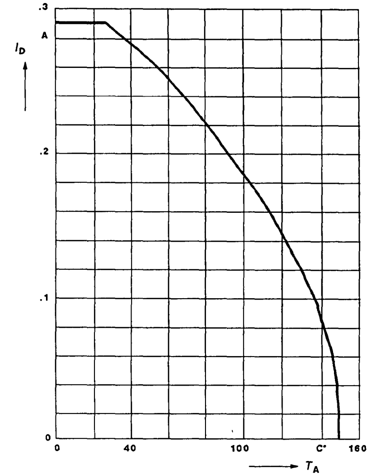


Drain current

$I_D = f\,T_A$

X Axis: T_A / °C

Y Axis: I_D / A



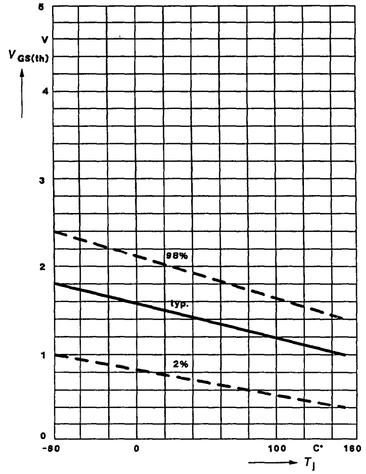
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$

X Axis: T_j / °C

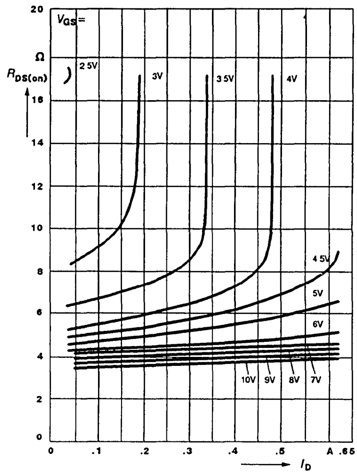
Y Axis: V_{GSth} / V

Parameter: $V_{GS} = V_{DS}$; $I_D = 1$mA



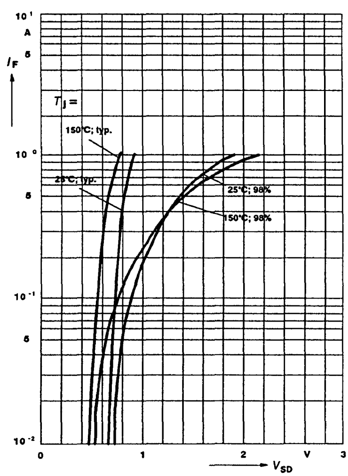
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; $T_j = 25°C$

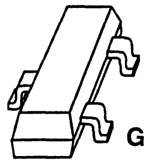


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80 μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 100V
- Continuous drain current I_D = 0.17A
- Drain-source on-resistance $R_{DS(on)}$ = 6.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 119	SH	Q62702-S631	SOT 23

Maximum Ratings

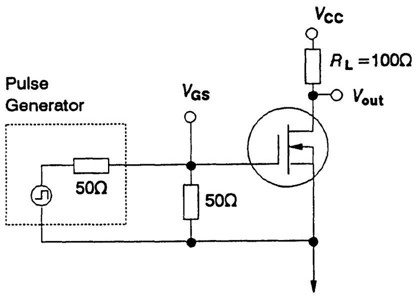
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	100	V	-
Drain-gate voltage	V_{DGR}	100	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.17	A	T_A =28°C
Pulsed drain current	I_{Dpuls}	0.68	A	T_C =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	
Chip - substrate rear side Ceramic substrate 15mm x 16.7mm x 0.7mm	$R_{th\ JSR}$	≤285		

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

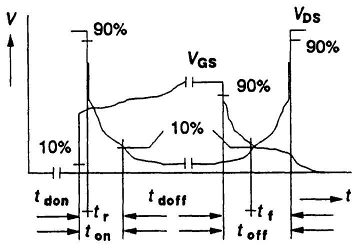
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	1.6	2.0	2.6	V	V_{DS} = V_{GS}; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	-	0.5	μA	T_j =25°C; V_{DS} =100V V_{GS} =0V
	I_{DSS}	-	-	5.0	μA	T_j =125°C; V_{DS} =100V V_{GS} =0V
	I_{DSS}	-	-	100	nA	T_j =25°C; V_{DS} =60V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	3.2	6.0	Ω	V_{GS} =10V I_D =0.17A
		-	4.7	10.0	Ω	V_{GS} =4.5V I_D =0.17A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.10	0.20	-	S	V_{DS} =25V I_D =0.17A
Input capacitance	C_{iss}	-	40	60	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	10	15		
Reverse transfer capacitance	C_{rss}	-	4.0	6.0		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.28A R_{GS} =50Ω
	t_r	-	8	12		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	12	16		
	t_f	-	17	22		
Reverse diode						
Continuous source current	I_S	-	-	0.17	A	
Pulsed source current	I_{SM}	-	-	0.68	A	
Diode forward on-voltage	V_{SD}	-	0.85	1.4	V	V_{GS} =0V I_F =0.34A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =30V, I_F = I_{DR} di_F /dt = 100A/μs
Reverse recovery charge	Q_{rr}	-	-	-	μC	V_R =30V, I_F = I_{DR} di_F /dt = 100A/μs

Switching Time Measurement

Test circuit

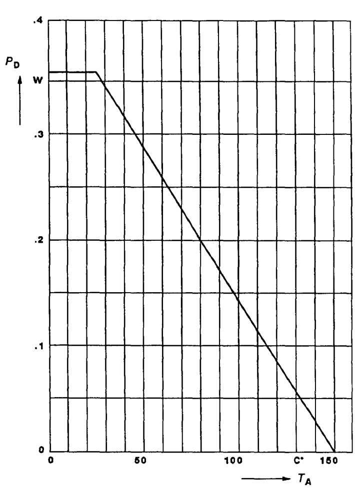


Switching times



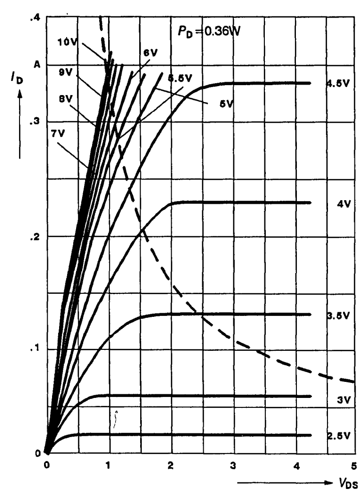
Permissible power dissipation versus temperature

$P_D = f\, T_A$
X Axis: T_A / °C
Y Axis: P_D / W



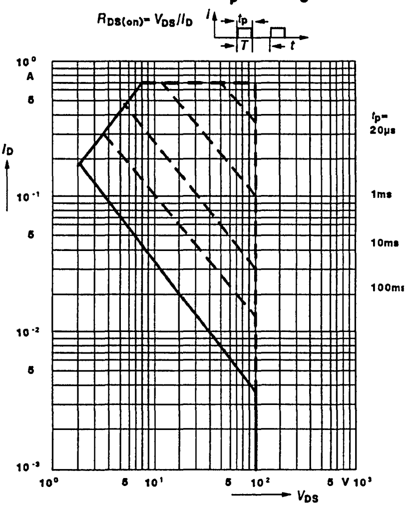
Typical output characteristic

$I_D = f\, V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



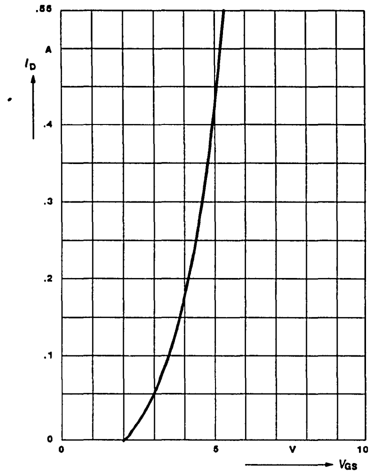
Safe operating area

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p$ / T; $T_C = 25°C$



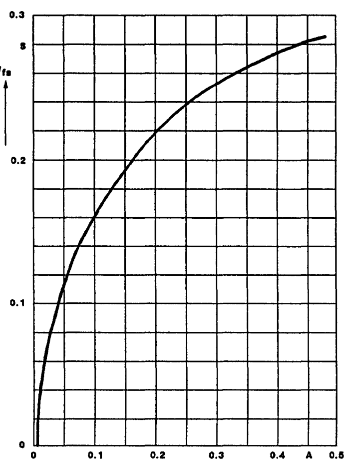
Typical transfer characteristic

$I_D = f\,V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



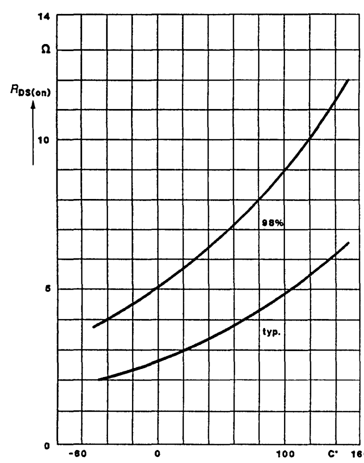
Typical transconductance

$g_{fs} = f\,I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



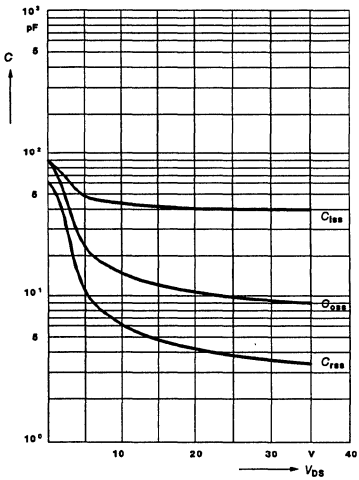
Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = 10V; I_D = 0.17A



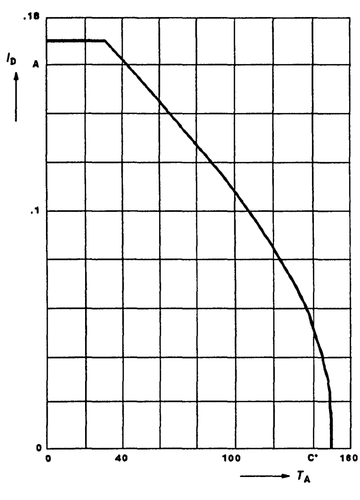
Typical capacitances

$C = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: C / pF
Parameter: V_{GS} =0; f =1MHz



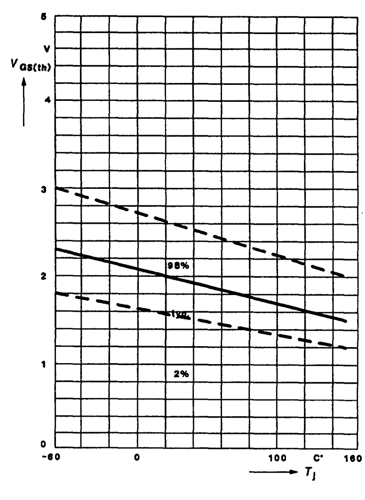
Drain current

$I_D = f\,T_A$
X Axis: T_A / °C
Y Axis: I_D / A



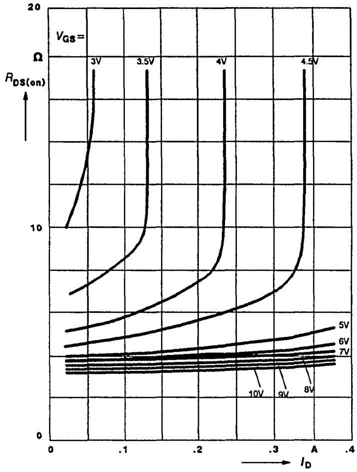
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: $V_{GS} = V_{DS}$; I_D = 1mA



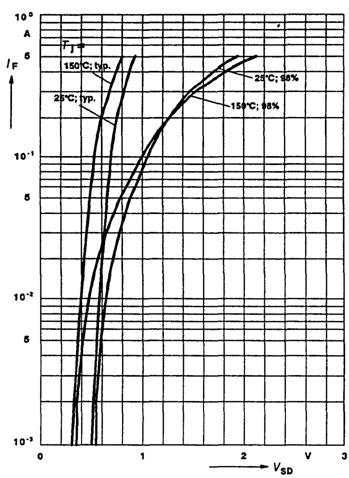
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; $T_j = 25°C$

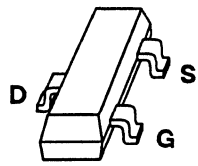


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p =80μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 100V
- Continuous drain current I_D = 0.17A
- Drain-source on-resistance $R_{DS(on)}$ = 6.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 123	SA	Q62702-S512	SOT 23

Maximum Ratings

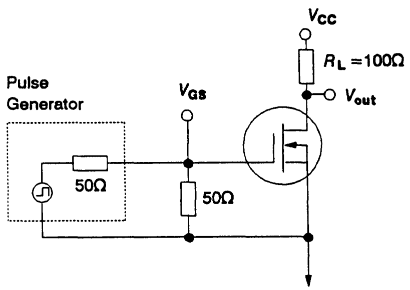
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	100	V	-
Drain-gate voltage	V_{DGR}	100	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.17	A	T_A =28°C
Pulsed drain current	I_{Dpuls}	0.68	A	T_A =25°C
Peak gate-source voltage	V_{GS}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	Mounted on
Chip - substrate rear side	$R_{th\ JSR}$	≤285		Ceramic substrate 2.5cm²

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

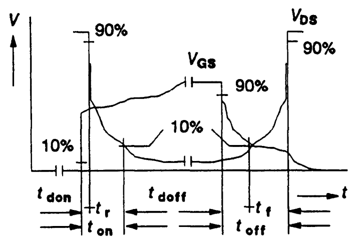
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	100	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.5	2.0	V	V_{DS} = V_{GS}; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	0.1	1.0	μA	T_j =25°C; V_{DS} =100V V_{GS} =0V
	I_{DSS}	-	2.0	60.0	μA	T_j =125°C; V_{DS} =100V V_{GS} =0V
	I_{DSS}	-	-	10.0	nA	T_j =25°C; V_{DS} =20V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	50.0	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	3.0 4.1	6.0 10.0	Ω Ω	V_{GS} =10V I_D =0.17A V_{GS} =4.5V I_D =0.17A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.08	0.17	-	S	V_{DS} =25V I_D =0.17A
Input capacitance	C_{iss}	-	40	60	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	10	15		
Reverse transfer capacitance	C_{rss}	-	4.0	6.0		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.28A R_{GS} =50Ω
	t_r	-	8	12		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	12	16		
	t_f	-	17	22		
Reverse diode						
Continuous source current	I_S	-	-	0.17	A	
Pulsed source current	I_{SM}	-	-	0.68	A	
Diode forward on-voltage	V_{SD}	-	0.85	1.3	V	V_{GS} =0V I_F =0.34A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =30V, I_F = I_{DR} di_F /dt = 100A/μs
Reverse recovery charge	Q_{rr}	-	-	-	μC	V_R =30V, I_F = I_{DR} di_F /dt = 100A/μs

Switching Time Measurement

Test circuit

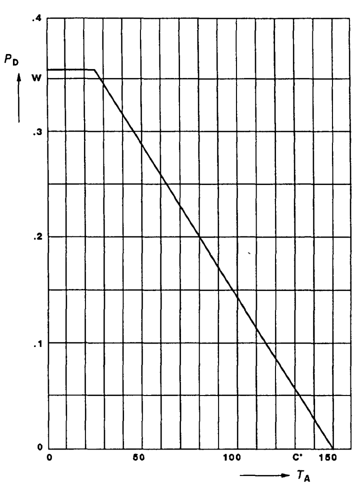


Switching times



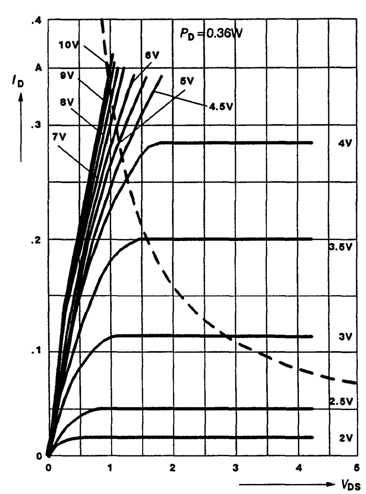
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



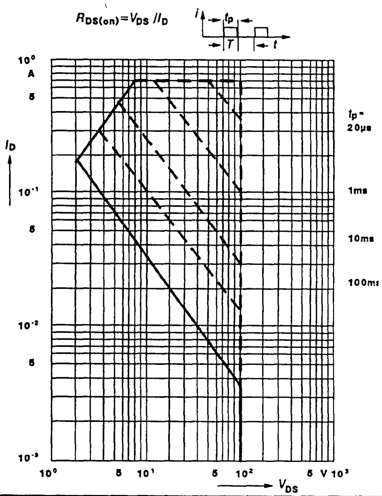
Typical output characteristic

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



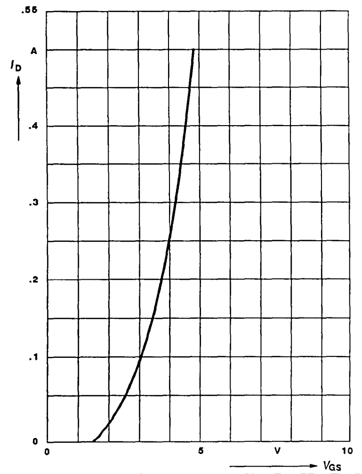
Safe operating area

$I_D = f V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p$ / T; T_C = 25°C



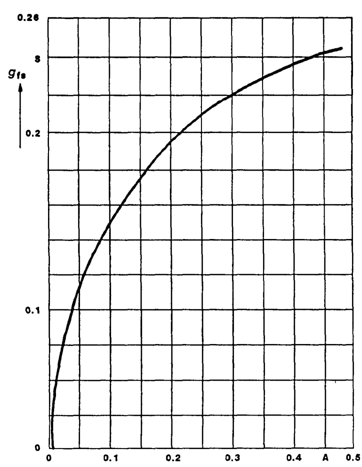
Typical transfer characteristic

$I_D = f V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



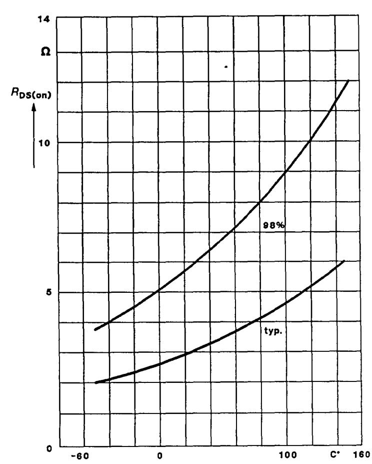
Typical transconductance

$g_{fs} = f I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



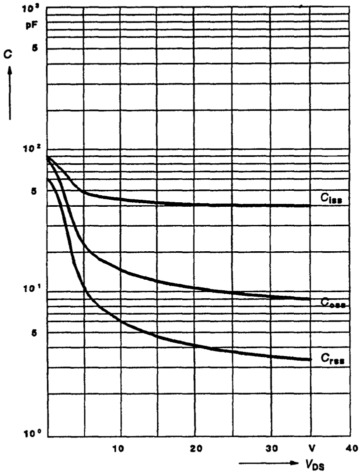
Drain to source on resistance (spread)

$R_{DSon} = f T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = 10V; I_D = 0.17A



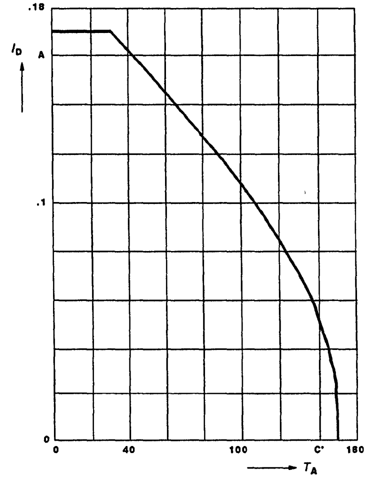
Typical capacitances

$C = f\ V_{DS}$
X Axis: V_{DS} / V
Y Axis: C / pF
Parameter: $V_{GS} = 0$; $f = 1$MHz



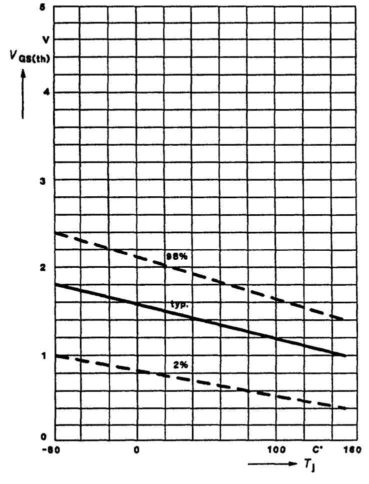
Drain current

$I_D = f\ T_A$
X Axis: T_A / °C
Y Axis: I_D / A



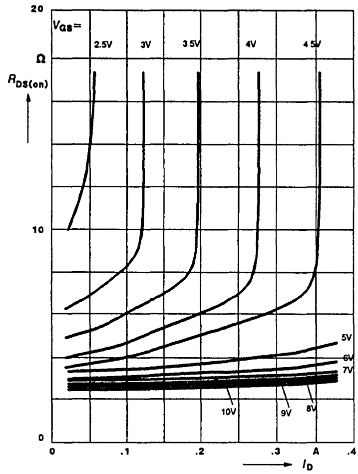
Gate threshhold voltage (spread)

$V_{GSth} = f\ T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: $V_{GS} = V_{DS}$; $I_D = 1$mA



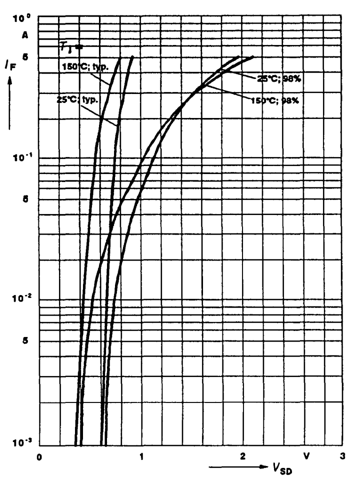
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; $T_j = 25°C$

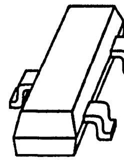


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80µs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 240V
- Continuous drain current I_D = 0.10A
- Drain-source on-resistance $R_{DS(on)}$ = 16.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 131	SR	Q62702-S565	SOT 23

Maximum Ratings

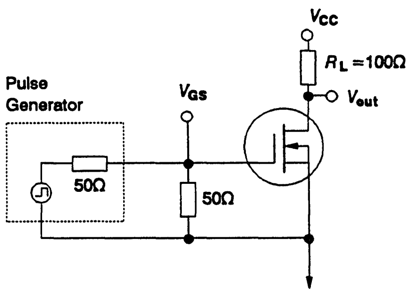
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	240	V	-
Drain-gate voltage	V_{DGR}	240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.10	A	T_A =26°C
Pulsed drain current	I_{Dpuls}	0.40	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	
Chip - substrate rear side Ceramic substrate 25mm x 25mm x 0.7mm	$R_{th\ JSR}$	≤285		

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

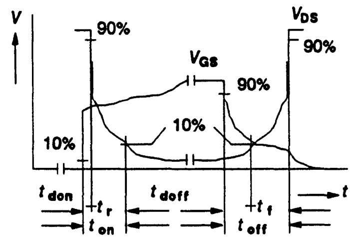
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	240	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.4	2.0	V	V_{DS} = V_{GS}; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	1.0	15.0	µA	T_j =25°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	2.0	60.0	µA	T_j =125°C; V_{DS} =240V V_{GS} =0V
	I_{DSS}	-	-	30.0	nA	T_j =25°C; V_{DS} =130V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	1.0	10.0	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	12.0 15.0	16.0 26.0	Ω Ω	V_{GS} =10V I_D =0.1A V_{GS} =4.5V I_D =0.1A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.06	0.14	-	S	V_{DS} =25V I_D =0.1A
Input capacitance	C_{iss}	-	60	90	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	8	12		
Reverse transfer capacitance	C_{rss}	-	2.5	5.0		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.26A R_{GS} =50Ω
	t_r	-	8	12		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	12	16		
	t_f	-	15	20		
Reverse diode						
Continuous source current	I_S	-	-	0.10	A	
Pulsed source current	I_{SM}	-	-	0.40	A	
Diode forward on-voltage	V_{SD}	-	0.8	1.2	V	V_{GS} =0V I_F =0.2A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs

Switching Time Measurement

Test circuit

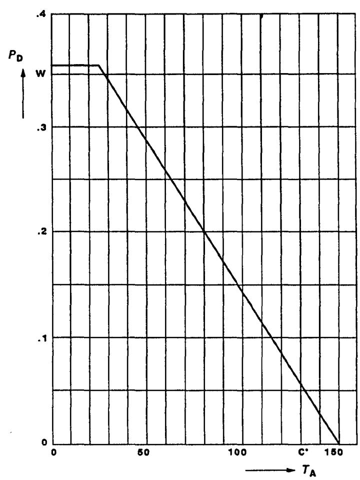


Switching times



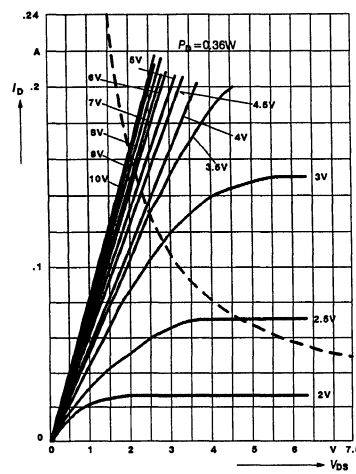
Permissible power dissipation versus temperature

$P_D = f\, T_A$
X Axis: T_A / °C
Y Axis: P_D / W



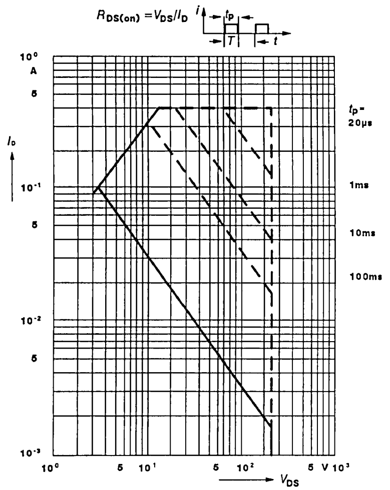
Typical output characteristic

$I_D = f\, V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



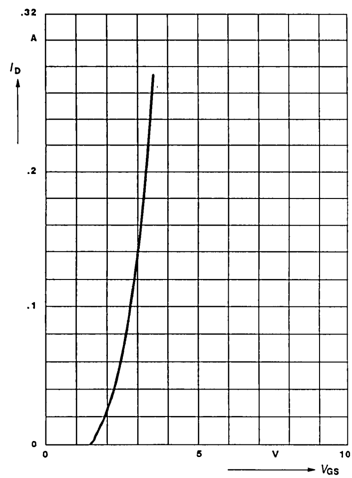
Safe operating range

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: D = 0.01, $D = t_p$ / T; T_C = 25°C



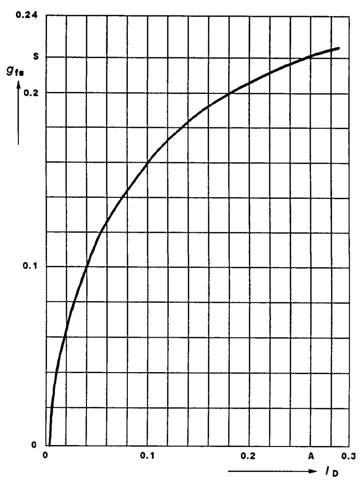
Typical transfer characteristic

$I_D = f\,V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



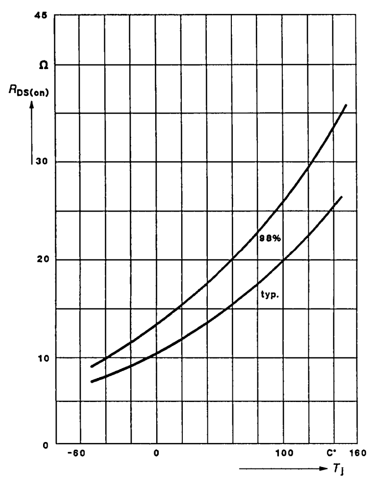
Typical transconductance

$g_{fs} = f\,I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: V_{DS} = 25V; t_p = 80µs; T_j = 25°C



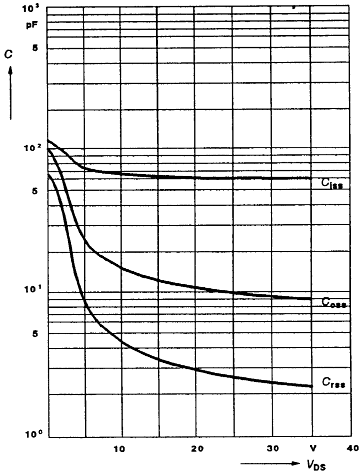
Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = 10V; I_D = 0.1A



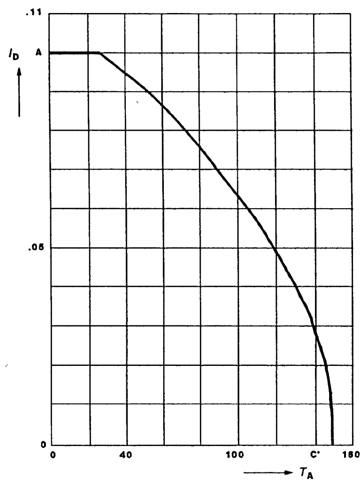
Typical capacitances

$C = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: C / pF
Parameter: $V_{GS} = 0$; $f = 1$MHz



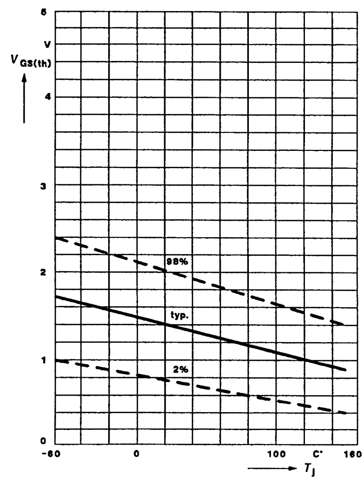
Drain current

$I_D = f\,T_A$
X Axis: T_A / °C
Y Axis: I_D / A



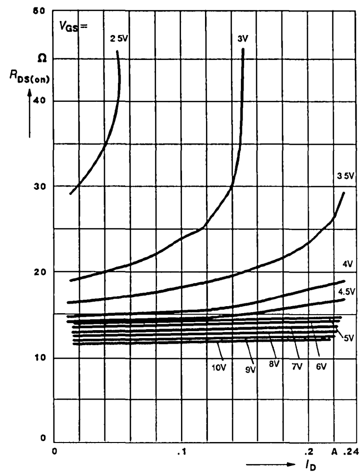
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: $V_{GS} = V_{DS}$; $I_D = 1$mA



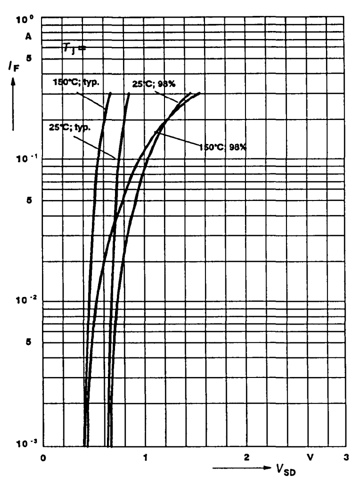
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; $T_j = 25°C$

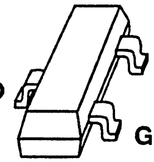


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 50V
- Continuous drain current I_D = 0.22A
- Drain-source on-resistance $R_{DS(on)}$ = 3.5Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 138	SS	Q62702-S566	SOT 23

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	50	V	-
Drain-gate voltage	V_{DGR}	50	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.22	A	T_A =31°C
Pulsed drain current	I_{Dpuls}	0.88	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1

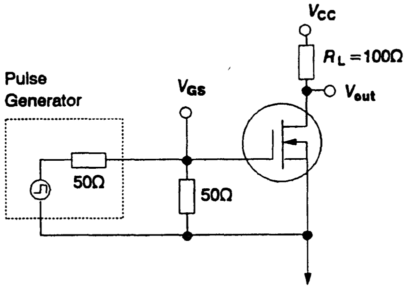
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	
Chip - substrate rear side Ceramic substrate 25mm x 25mm x 0.7mm	$R_{th\ JSR}$	≤285		

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

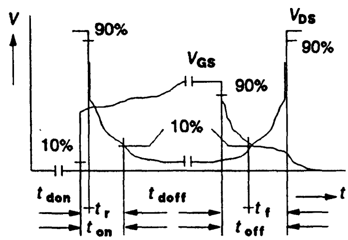
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	50	-	-	V	V_{GS} =0V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.2	1.6	V	V_{DS} = V_{GS}; I_D =1mA
Zero gate voltage drain current	I_{DSS}	-	-	0.5	µA	T_j =25°C; V_{DS} =50V V_{GS} =0V
	I_{DSS}	-	-	5.0	µA	T_j =125°C; V_{DS} =50V V_{GS} =0V
	I_{DSS}	-	-	100	nA	T_j =25°C; V_{DS} =30V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	1.8 2.8	3.5 5.8	Ω Ω	V_{GS} =10V I_D =0.22A V_{GS} =4.5V I_D =0.22A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.12	0.20	-	S	V_{DS} =25V I_D =0.22A
Input capacitance	C_{iss}	-	40	60	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	15	25		
Reverse transfer capacitance	C_{rss}	-	5	10		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =0.29A R_{GS} =50Ω
	t_r	-	8	12		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	12	16		
	t_f	-	17	22		
Reverse diode						
Continuous source current	I_S	-	-	0.22	A	
Pulsed source current	I_{SM}	-	-	0.88	A	
Diode forward on-voltage	V_{SD}	-	0.9	1.4	V	V_{GS} =0V I_F =0.44A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =30V, I_F = I_{DR} di_F /dt = 100A/µs

Switching Time Measurement

Test circuit

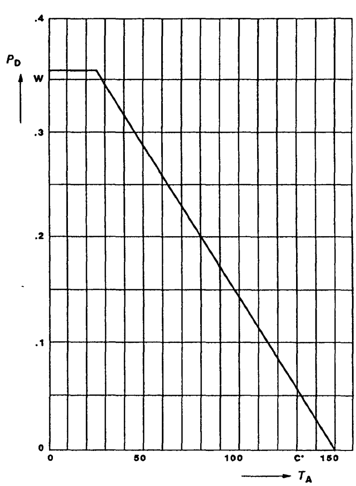


Switching times



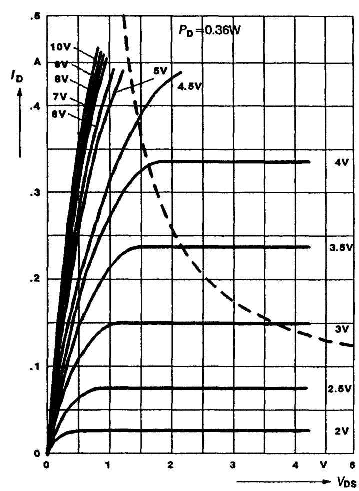
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



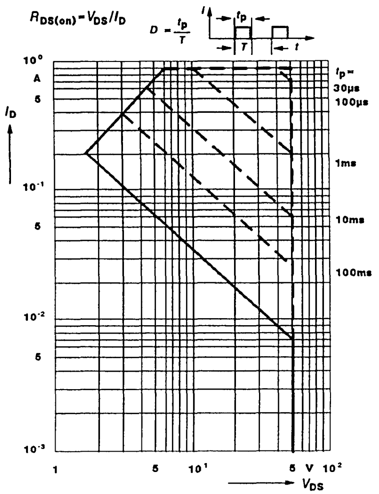
Typical output characteristic

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



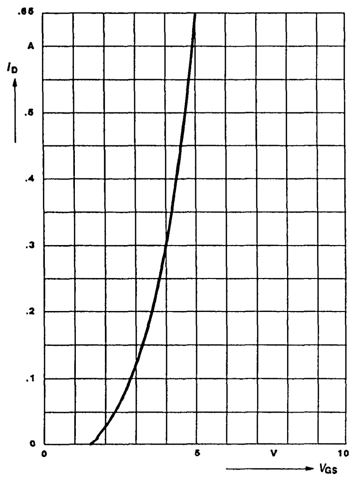
Safe operating area

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p / T$; $T_C = 25°C$



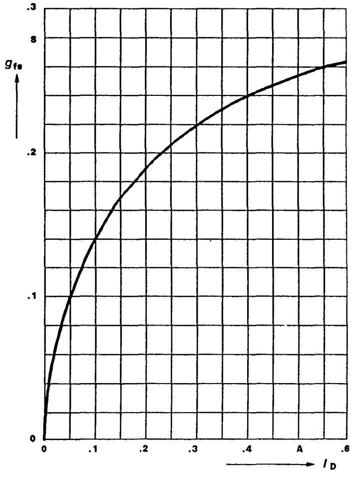
Typical transfer characteristic

$I_D = f\,V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: $V_{DS} = 25V$; $t_p = 80\mu s$; $T_j = 25°C$



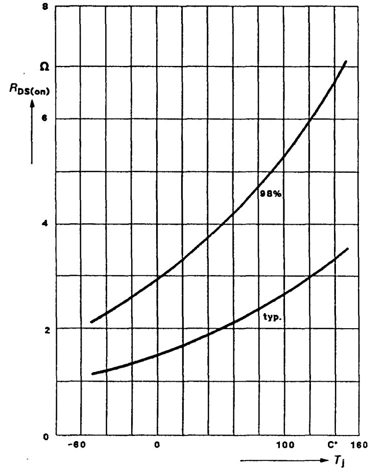
Typical transconductance

$g_{fs} = f\,I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: $V_{DS} = 25V$; $t_p = 80\mu s$; $T_j = 25°C$



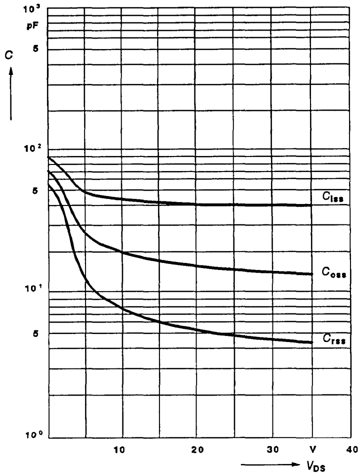
Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: $V_{GS} = 10V$; $I_D = 0.22A$



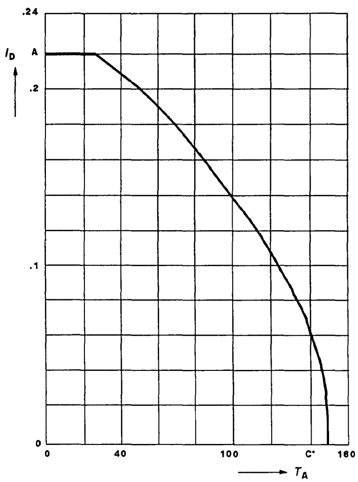
Typical capacitances

$C = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: C / pF
Parameter: V_{GS} =0; f =1MHz



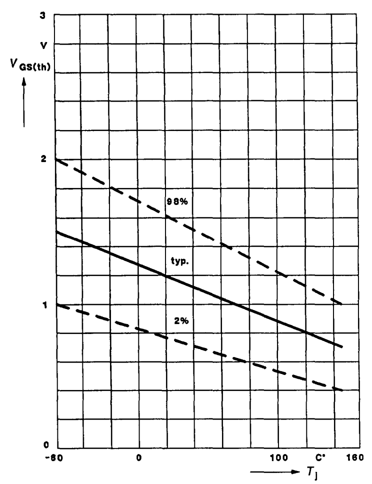
Drain current

$I_D = f\,T_A$
X Axis: T_A / °C
Y Axis: I_D / A



Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: $V_{GS} = V_{DS}$; I_D = 1mA



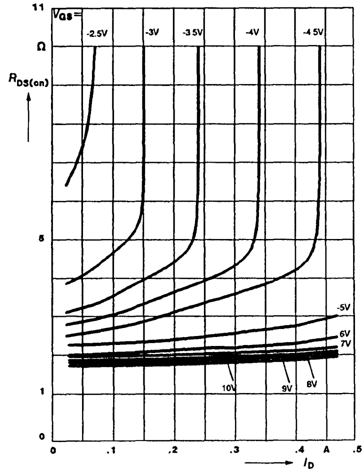
Typical drain-source on-state resistance

$R_{DSon} = f\,I_D$

X Axis: I_D / A

Y Axis: R_{DSon} / Ω

Parameter: V_{GS} ; T_j = 25°C



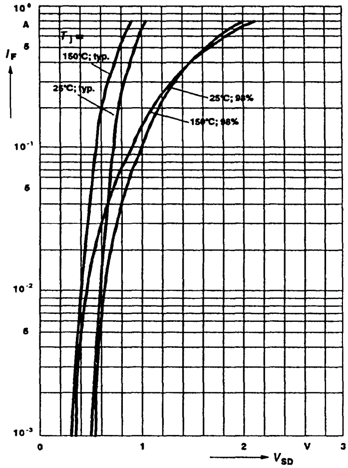
Typical reverse diode forward voltage (spread)

$I_F = f\,V_{SD}$

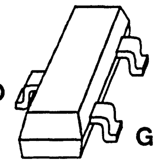
X Axis: V_{SD} / V

Y Axis: I_F / A

Parameter: t_p =80µs; T_j



- SIPMOS - depletion mode
- Drain-source voltage V_{DS} = 250V
- Continuous drain current I_D = 0.04A
- Drain-source on-resistance $R_{DS(on)}$ = 100Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 139	ST	Q62702-S612	SOT 23

Maximum Ratings

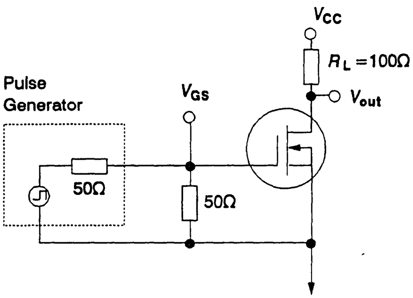
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	250	V	-
Drain-gate voltage	V_{DGR}	250	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.04	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	0.12	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	
Chip - substrate rear side Ceramic substrate 25mm x 25mm x 0.7mm	$R_{th\ JSR}$	≤285		

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

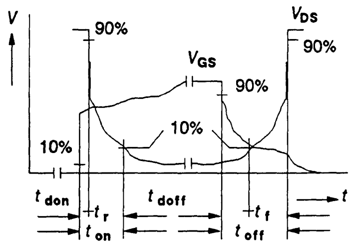
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSV}$	250	-	-	V	V_{GS} =-3V I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-1.8	-1.0	-0.7	V	V_{DS} = 3V; I_D =1mA
Zero gate voltage drain current	I_{DSV}	-	-	100	nA	T_j =25°C; V_{DS} =250V V_{GS} =-3V
	I_{DSV}	-	-	200	µA	T_j =125°C; V_{DS} =250V V_{GS} =-3V
	I_{DSV}	-	-	-	-	T_j =25°C; V_{DS} =-V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	10.0	100	nA	V_{GS} =±20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	-	100	Ω	V_{GS} =0V I_D =14mA
Dynamic characteristics						
Forward transconductance	g_{fs}	0.05	0.07	-	S	V_{DS} =25V I_D =0.04A
Input capacitance	C_{iss}	-	50	-	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	10	-		
Reverse transfer capacitance	C_{rss}	-	3	-		
Turn-on time t_{on} ($t_{on} = t_{d(on)} + t_r$)	$t_{d(on)}$	-	10	-	ns	V_{CC} =30V V_{GS} =-2V...+5V I_D =0.15A R_{GS} =50Ω
	t_r	-	20	-		
Turn-off time t_{off} ($t_{off} = t_{d(off)} + t_f$)	$t_{d(off)}$	-	70	-		
	t_f	-	120	-		
Reverse diode						
Continuous source current	I_S	-	-	0.04	A	
Pulsed source current	I_{SM}	-	-	0.12	A	
Diode forward on-voltage	V_{SD}	-	0.9	1.2	V	V_{GS} =0V I_F =0.08A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

Switching Time Measurement

Test circuit

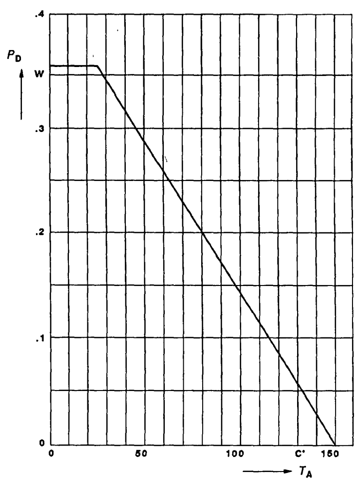


Switching times



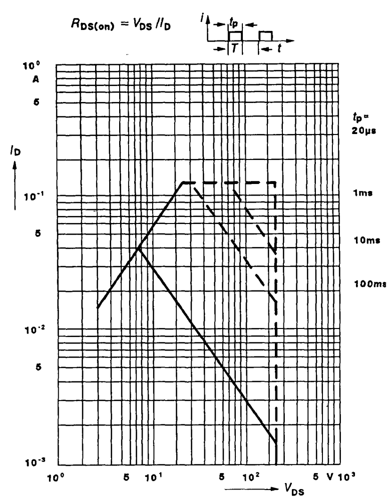
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



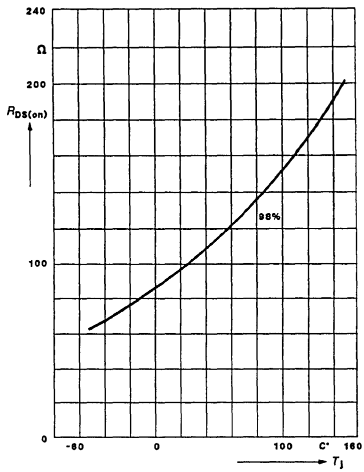
Safe operating area

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p$ /T; $T_C = 25°C$



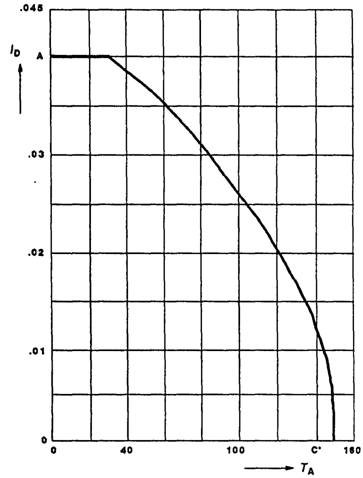
Drain to source on resistance (spread)

$R_{DSon} = f\,T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} =0; I_D =14mA



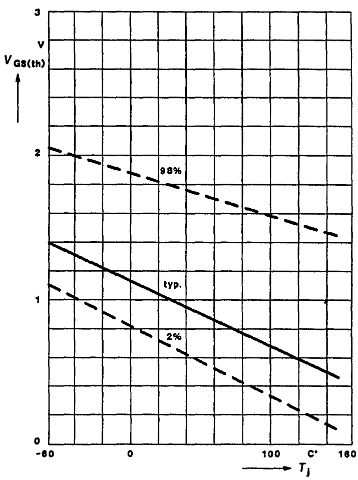
Drain current

$I_D = f\,T_A$
X Axis: T_A / °C
Y Axis: I_D / A



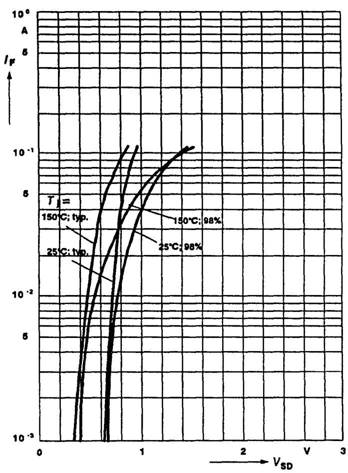
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: V_{GS} = 3V; I_D = 1mA

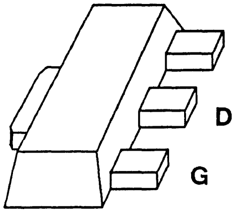


Typical reverse diode forward voltage (spread)

$I_F = f\,V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p =80μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = -240V
- Continuous drain current I_D = -0.15A
- Drain-source on-resistance $R_{DS(on)}$ = 20.0Ω
- Total power dissipation P_D = 1.0W



Type	Marking	Ordering code for versions on 8 mm-tape	Package
BSS 192	KB	Q62702-S602	SOT 89

Maximum Ratings

Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	-240	V	-
Drain-gate voltage	V_{DGR}	-240	V	R_{GS} =20 kΩ
Continuous drain current	I_D	-0.15	A	T_A =23°C
Pulsed drain current	I_{Dpuls}	-.6	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	1.0	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤125	K/W	

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

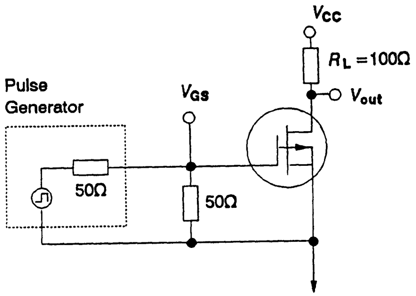
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	-240	-	-	V	V_{GS} =0V I_D =-0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-0.8	-1.5	-2.0	V	V_{DS} = V_{GS}; I_D =-1mA
Zero gate voltage drain current	I_{DSS}	-	-4.0	-60.0	μA	T_j =25°C; V_{DS} =-240V V_{GS} =0V
	I_{DSS}	-	-8.0	-200	μA	T_j =125°C; V_{DS} =-240V V_{GS} =0V
	I_{DSS}	-	-	-0.2	μA	T_j =25°C; V_{DS} =-60V V_{GS} =0V
Gate-source leakage current	I_{GSS}	-	-10.0	-100	nA	V_{GS} =-20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	-	10.0	20.0	Ω	V_{GS} =-10V I_D =-0.15A

Dynamic characteristics

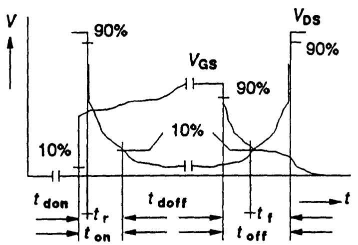
Description	Symbol	min.	typ.	max.	Unit	Condition
Forward transconductance	g_{fs}	0.06	0.12	-	S	V_{DS} =-25V I_D =-0.15A
Input capacitance	C_{iss}	-	70	105	pF	V_{GS} =0V V_{DS} =-25V f =1MHz
Output capacitance	C_{oss}	-	20	30		
Reverse transfer capacitance	C_{rss}	-	8.0	12.0		
Turn-on time t_{on}	$t_{d(on)}$	-	8	12	ns	V_{CC} =-30V V_{GS} =-10V I_D =-0.25A R_{GS} =50Ω
(t_{on} = $t_{d(on)}$ + t_r)	t_r	-	30	45		
Turn-off time t_{off}	$t_{d(off)}$	-	15	20		
(t_{off} = $t_{d(off)}$ + t_f)	t_f	-	30	45		
Reverse diode						
Continuous source current	I_S	-	-	-0.15	A	
Pulsed source current	I_{SM}	-	-	-0.60	A	
Diode forward on-voltage	V_{SD}	-	-0.85	-1.2	V	V_{GS} =0V I_F =-0.3A
Reverse recovery time	t_{rr}	-	130	-	ns	V_R =-100V, I_F =0.5A di_F /dt = -100A/μs
Reverse recovery charge	Q_{rr}	-	300	-	nC	V_R =-100V, I_F =0.5A di_F /dt = -100A/μs

Switching Time Measurement

Test circuit

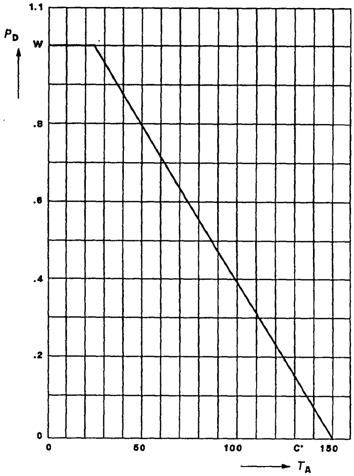


Switching times



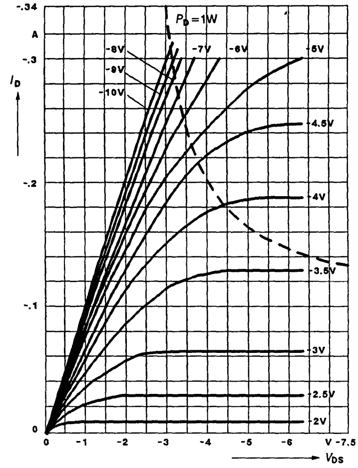
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



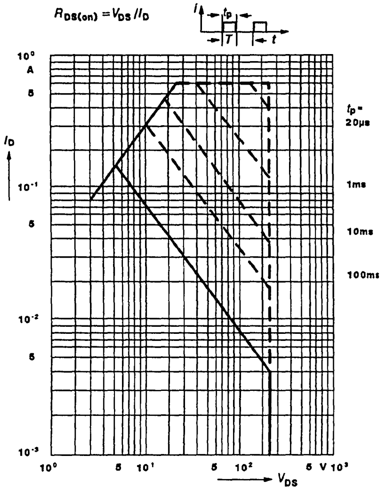
Typical output characteristic

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



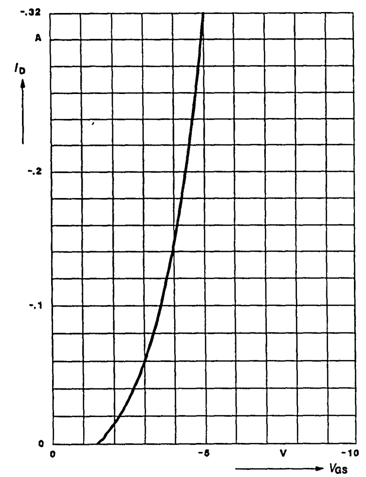
Safe operating area

$I_D = f V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p / T$; $T_C = 25°C$



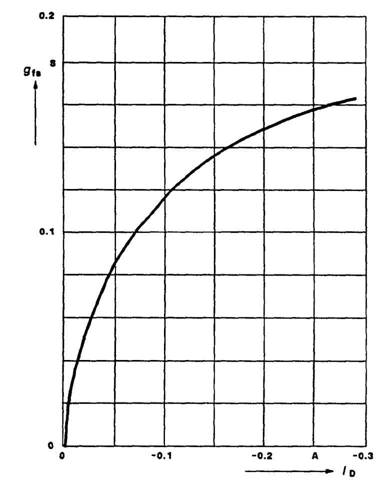
Typical transfer characteristic

$I_D = f V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = -25V; t_p = 80µs; T_j = 25°C



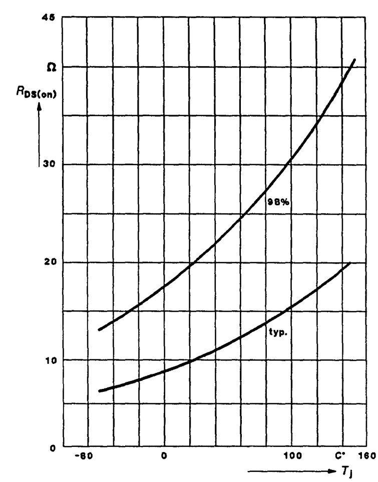
Typical transconductance

$g_{fs} = f I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: V_{DS} = -25V; t_p = 80µs; T_j = 25°C



Drain to source on resistance (spread)

$R_{DSon} = f T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = -10V; I_D = -0.15A



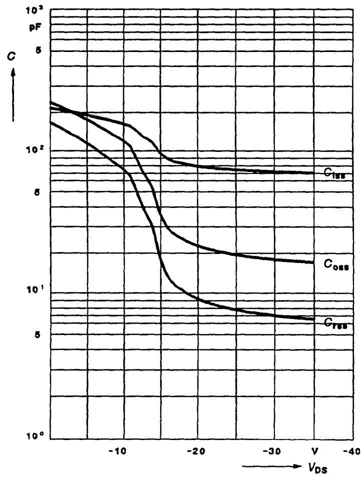
Typical capacitances

$C = f\,V_{DS}$

X Axis: V_{DS} / V

Y Axis: C / pF

Parameter: $V_{GS} = 0$; f = 1MHz

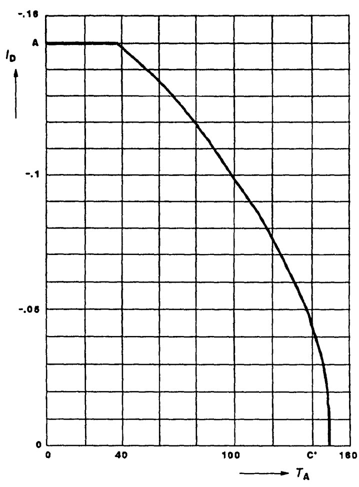


Drain current

$I_D = f\,T_A$

X Axis: T_A / °C

Y Axis: I_D / A



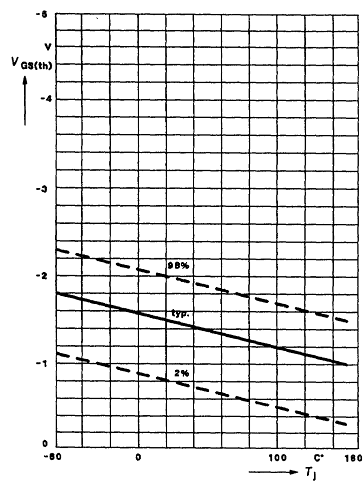
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$

X Axis: T_j / °C

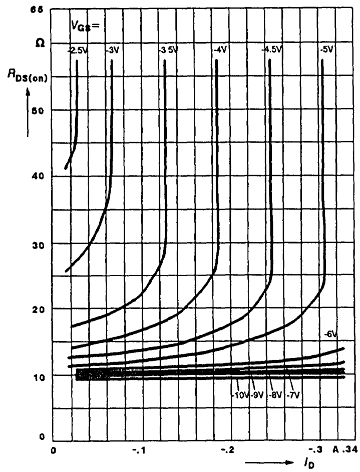
Y Axis: V_{GSth} / V

Parameter: $V_{GS} = V_{DS}$; I_D = -1mA



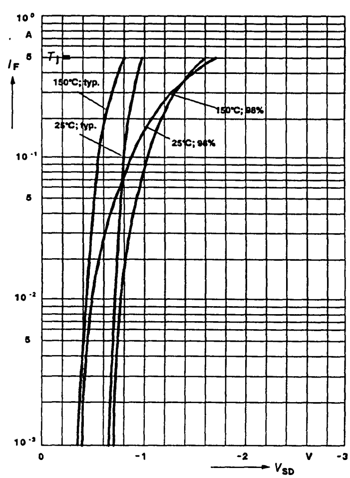
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; $T_j = 25°C$

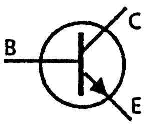


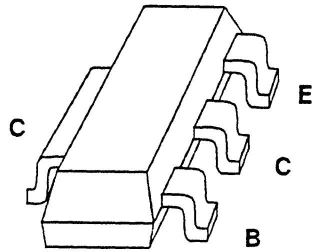
Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80µs; T_j



- High DC current gain: 0.1 to 500 mA
- Low collector -emitter saturation voltage
- Complementary types: PZT 2907 (PNP)
  PZT 2907A (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
PZT 2222	ZT 2222	Q62702 - Z2026	SOT-223
PZT 2222A	ZT 2222A	Q62702 - Z2027	SOT-223

Maximum Ratings

Parameter	Symbol	PZT 2222	PZT 2222A	Unit
Collector-emitter voltage	V_{CEO}	30	40	V
Collector-base voltage	V_{CBO}	60	75	V
Emitter-base voltage	V_{EBO}	5	6	V
Collector current	I_C	600		mA
Total power dissipation, $T_A \leq 25°C$[1])	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction -ambient [1])	R_{thJA}	≤83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm. Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines.

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				V
$I_C = 10$ mA, $I_B = 0$	PZT 2222		30	-	-	
	PZT 2222A		40	-	-	
Collector-base breakdown voltage		$V_{(BR)CBO}$				V
$I_C = 10$ µA, $I_B = 0$	PZT 2222		60	-	-	
	PZT 2222A		75	-	-	
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
$I_E = 10$ µA, $I_E = 0$	PZT 2222		5	-	-	V
	PZT 2222A		6	-	-	
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 50$ V, $I_E = 0$	PZT 2222		-	-	20	nA
	PZT 2222A		-	-	10	nA
$V_{CB} = 50$ V, $I_E = 0$, $T_A = 150$ °C	PZT 2222		-	-	20	µA
	PZT 2222A		-	-	10	µA
Emitter-base cutoff current		I_{EBO}				nA
$V_{EB} = 3$ V, $I_C = 0$			-	-	10	
Collector-emitter cutoff current		I_{CEV}				nA
$V_{CE} = 30$ V, $-V_{BE} = 0.5$ V			-	-	50	
Emitter-base cutoff current		I_{EBV}				nA
$V_{CE} = 30$ V, $-V_{BE} = 0.5$ V			-	-	50	
DC current gain 1)		h_{FE}				
$I_C = 0.1$ mA, $V_{CE} = 10$ V			35	-	-	-
$I_C = 1$ mA, $V_{CE} = 10$ V			50	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V			75	-	-	-
$I_C = 150$ mA, $V_{CE} = 10$ V			100	-	300	-
$I_C = 500$ mA, $V_{CE} = 10$ V	PZT 2222		30	-	-	-
	PZT 2222A		40	-	-	-
Collector-emitter saturation voltage 1)		V_{CEsat}				V
$I_C = 150$ mA, $I_B = 15$ mA	PZT 2222		-	-	0.4	
	PZT 2222A		-	-	0.3	
$I_C = 500$ mA, $I_B = 50$ mA	PZT 2222		-	-	1.6	
	PZT 2222A		-	-	1.0	
Base-emitter saturation voltage 1)		V_{BEsat}				V
$I_C = 150$ mA, $I_B = 15$ mA	PZT 2222		-	-	1.3	
	PZT2222A		-	-	1.2	
$I_C = 500$ mA, $I_B = 50$ mA	PZT 2222		-	-	2.6	
	PZT2222A			-	2.0	

1) Pulse test conditions: t ≦ 300µs; D = 2%

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	f_T	300	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	8	pF
Input capacitance V_{EB} = 2 V, f = 1 MHz	C_{ibo}	–	–	25	pF
Input impedance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{ie}	 2 0.25	 – –	 8 1.25	kΩ
Voltage feedback ratio I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{re}	 – –	 – –	 8 4	$\times 10^{-4}$
Small-signal current gain I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{fe}	 50 75	 – –	 300 375	–
Output admittance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{oe}	 5 25	 – –	 35 200	µS
Collector-base time constant I_E = 20 mA, V_{CB} = 20 V, f = 31.8 MHz	$rb'C_c$	–	–	150	ps
Noise figure I_C = 100 µA, V_{CE} = 10 V, R_S = 1 kΩ, f = 1 kHz	NF	–	–	4	dB
Switching times V_{CC} = 30 V, V_{BE} = 0.5 V, I_C = 150 mA, I_{B1} = 15 mA	 t_d t_r	 – –	 – –	 10 25	 ns ns
Switching times V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA	t_s t_f	– –	– –	225 60	ns ns

Turn-on time (see Fig.2) when switched to I_{Con} = 150mA; I_{Bon} = 15mA

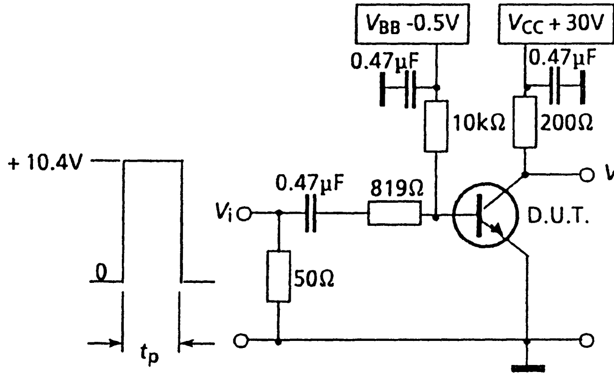


Fig.2 Input waveform and test circuit for determining delay, rise and turn-on time

Turn-off time (see Fig.3) when switched to I_{Con} = 150mA; I_{Bon} = 15mA to cut-off with -I_{Boff} = 15mA

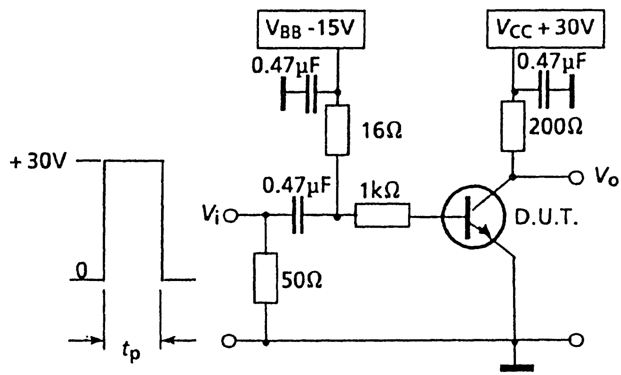


Fig.3 Input waveform and test circuit for determining storage, fall and turn-off time

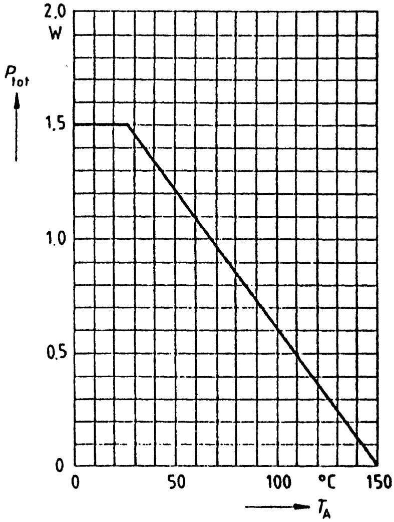
Pulse generator (see Fig.2 and 3)

frequency	f = 150Hz
pulse duration	t_p = 200ns
rise time	$t_r \leqq$ 2ns
output impedance	Z_o = 50Ω

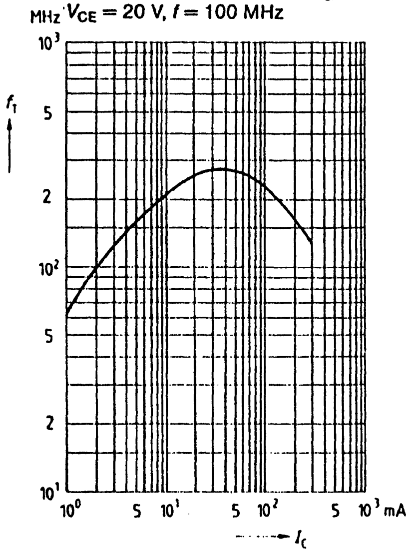
Oscilloscope (see Fig.2 and 3)

rise time	$t_r \leqq$ 5ns
output impedance	Z_i = 10MΩ

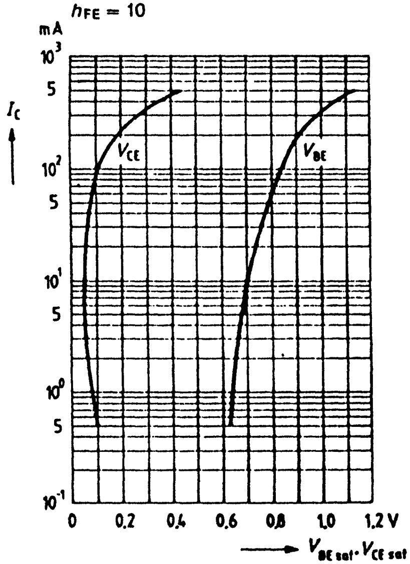
Total power dissipation $P_{tot} = f(T_A)$



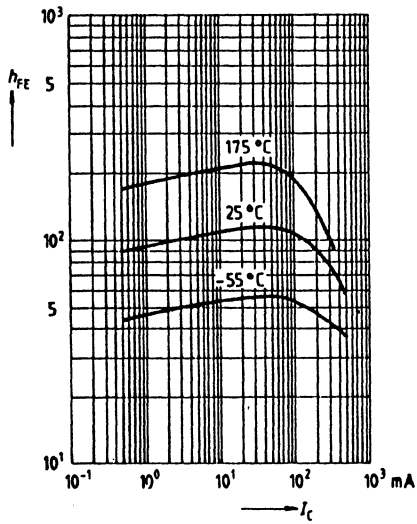
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V, $f = 100$ MHz



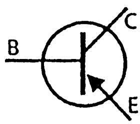
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$

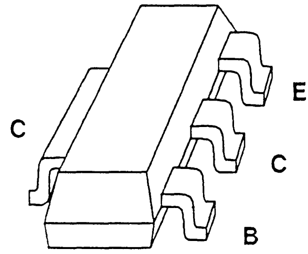


DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



- High DC current gain: 0.1 to 500 mA
- Low collector -emitter saturation voltage
- Complementary types: PZT 2222 (NPN)
  PZT 2222A (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
PZT 2907	ZT 2907	Q62702 - Z2028	SOT-223
PZT 2907A	ZT 2907A	Q62702 - Z2025	SOT-223

Maximum Ratings

Parameter	Symbol	PZT 2907	PZT 2907A	Unit
Collector-emitter voltage	V_{CEO}	40	60	V
Collector-base voltage	V_{CBO}	60	60	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	600		mA
Total power dissipation, $T_A \leq 25\,°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1,5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 10$ mA, $I_B = 0$	PZT 2907		40	-	-	V
	PZT 2907A		60	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 10$ µA, $I_B = 0$	PZT 2907		60	-	-	V
	PZT 2907A		60	-	-	V
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
$I_E = 10$ µA, $I_E = 0$			5	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 50$ V, $I_E = 0$	PZT 2907		-	-	20	nA
	PZT 2907A		-	-	10	nA
$V_{CB} = 50$ V, $I_E = 0$, $T_A = 150$ °C	PZT 2907		-	-	20	µA
	PZT 2907A		-	-	10	µA
Emitter-base cutoff current		I_{EBO}				
$V_{EB} = 3$ V, $I_C = 0$			-	-	10	nA
Collector-emitter cutoff current		I_{CEV}				
$V_{CE} = 30$ V, + $V_{BE} = 0.5$ V			-	-	50	nA
Collector-base cutoff current		I_{EBV}				
$V_{CE} = 30$ V, + $V_{BE} = 0.5$ V			-	-	50	nA
DC current gain 1)		h_{FE}				
$I_C = 0.1$ mA, $V_{CE} = 10$ V	PZT 2907		35	-	-	-
	PZT 2907A		75	-	-	-
$I_C = 1$ mA, $V_{CE} = 10$ V	PZT 2907		50	-	-	-
	PZT 2907A		100	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V	PZT 2907		75	-	-	-
	PZT 2907A		100	-	-	-
$I_C = 150$ mA, $V_{CE} = 10$ V	PZT 2907		100	-	300	-
	PZT 2907A		100	-	300	-
$I_C = 500$ mA, $V_{CE} = 10$ V	PZT 2907		30	-	-	-
	PZT 2907A		50	-	-	-
Collector-emitter saturation voltage 1)		V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA			-	-	0.4	V
$I_C = 500$ mA, $I_B = 50$ mA			-	-	1.6	V
Base-emitter saturation voltage 1)		V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA			-	-	1.3	V
$I_C = 500$ mA, $I_B = 50$ mA			-	-	2.6	V

1) Pulse test conditions: t ≦ 300µs; D = 2%

AC Characteristics

Transition frequency $I_C = 20$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	200	-	-	MHz
Collector-base capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	-	-	8	pF
Input capacitance $V_{EB} = 0.5$ V, $f = 1$ MHz	C_{ib}	-	-	30	pF
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 15$ mA (see Fig.2)					
Delay time	t_d	-	-	10	ns
Rise time	t_r	-	-	40	ns
$V_{CC} = 6$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA (see Fig.3)					
Storage time	t_{stg}	-	-	80	ns
Fall time	t_f	-	-	30	ns

Turn-on time (see Fig.2)

when switched to $-I_{Con}$ = 150mA; $-I_{Bon}$ = 15mA

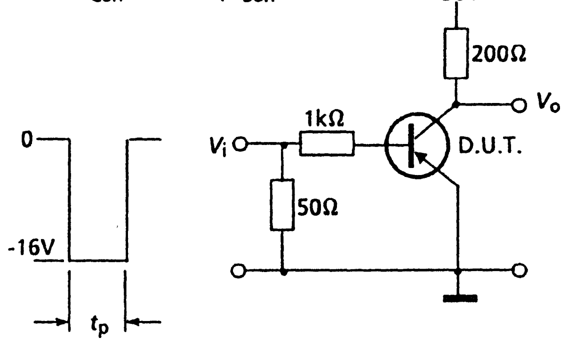


Fig.2 Input waveform and test circuit for determining delay,rise and turn-on time

Turn-off time (see Fig.3)

when switched to $-I_{Con}$ = 150mA; $-I_{Bon}$ = 15mA
to cut-off with $+I_{Boff}$ = 15mA

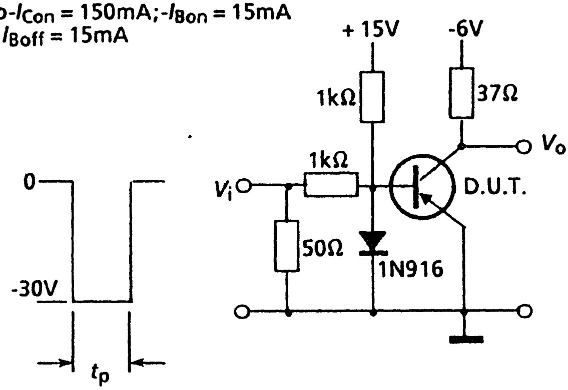


Fig.3 Input waveform and test circuit for determining storage,fall and turn-off time

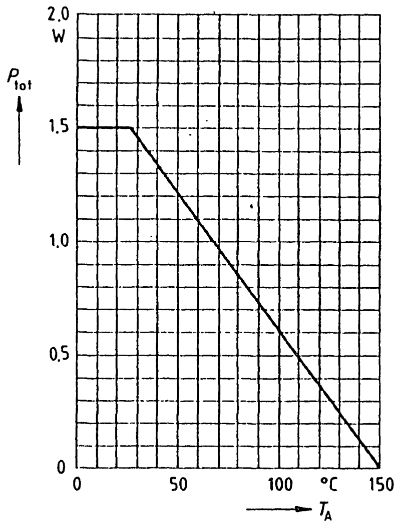
Pulse generator (see Fig.2 and 3)

frequency	f = 150Hz
pulse duration	t_P = 200ns
rise time	$t_r \leqq$ 2ns
output impedance	Z_o = 50Ω

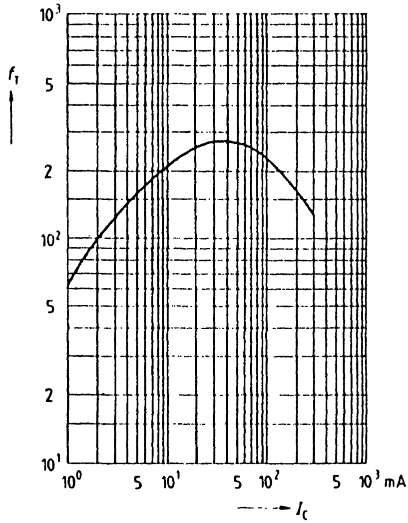
Oscilloscope (see Fig.2 and 3)

rise time	$t_r \leqq$ 5ns
output impedance	Z_i = 10MΩ

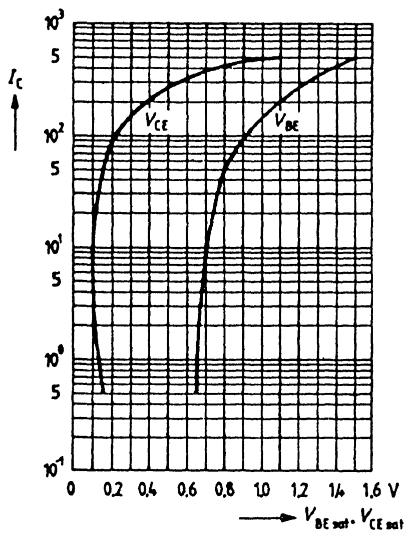
Total power dissipation $P_{tot} = f(T_A)$



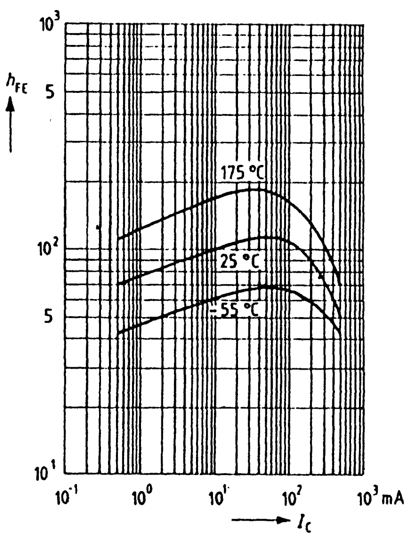
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V, f = 100 MHz



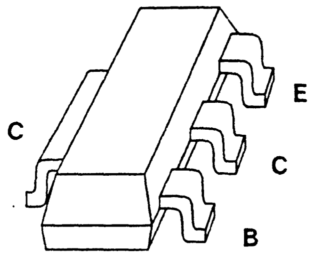
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
h_{FE} = 10

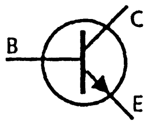


DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



- High DC current gain 0.1 to 100 mA
- Low collector -emitter saturation voltage
- Complementary type: PZT 3906 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
PZT 3904	ZT 3904	Q62702 - Z2029	SOT-223

Maximum Ratings

Parameter	Symbol	PZT 3904	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	60	V
Emitter-base voltage	V_{EBO}	6	V
Collector current	I_C	200	mA
Total power dissipation, $T_A \leq 25°C$ [1])	P_{tot}	1.5	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction - ambient [1])	R_{thJA}	$\leq$83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values min.	typ.	max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	40	-	-	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_B = 0$	$V_{(BR)CBO}$	60	-	-	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	6	-	-	V
Collector-base cutoff current $V_{CB} = 30$ V, $I_E = 0$	I_{CBO}	-	-	50	nA
Collector -emitter cutoff current $V_{CE} = 30$ V,$-V_{BE} = 0{,}5$ V	I_{CEV}	-	-	50	nA
Base-emitter cutoff current $V_{CE} = 30$ V,$-V_{BE} = 0{,}5$ V	I_{BEV}	-	-	50	nA
DC current gain 1) $I_C = 0.1$ mA, $V_{CE} = 1$ V $I_C = 1$ mA, $V_{CE} = 1$ V $I_C = 10$ mA, $V_{CE} = 1$ V $I_C = 50$ mA, $V_{CE} = 1$ V $I_C = 100$ mA, $V_{CE} = 1$ V	h_{FE}	 40 70 100 60 30	 - - - - -	 - - 300 - -	 - - - - -
Collector-emitter saturation voltage 1) $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA,$I_B = 5$ mA	V_{CEsat}	 - -	 - -	 0.2 0.3	 V V
Base-emitter saturation voltage 1) $I_C = 10$ mA, $I_C = 1$ mA $I_C = 50$ mA,$I_C = 5$ mA	V_{BEsat}	 - -	 - -	 0.85 0.95	 V V

1) Pulse test conditions: $t \leqq 300$µs; $D = 2\%$

AC Characteristics

Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	300	-	-	MHz
Collector-base cpacitance $V_{CB} = 5$ V,$f = 1$ MHz	C_{ob}	-	-	4	pF
Input capacitance $V_{EB} = 0.5$ V,$f = 1$ MHz	C_{ib}	-	-	8	pF
Noise figure $I_C = 100$ µA,$V_{CE} = 5$ V,$R_S = 1$kΩ, $f = 10$ Hz to 15.7 kHz	F	-	-	5	dB
Input impedance $I_C = 1$ mA,$V_{CE} = 10$ V, $f = 1$ kHz	h_{11e}	1	-	10	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 1$ mA,$V_{CE} = 10$ V, $f = 1$ kHz	h_{12e}	0.5	-	8	10^{-4}
Short-circuit forward current transfer ratio $I_C = 1$ mA,$V_{CE} = 10$ V, $f = 1$ kHz	h_{21e}	100	-	400	-
Open circuit output admittance $I_C = 1$ mA,$V_{CE} = 10$ V, $f = 1$ kHz	h_{22e}	1	-	40	µS
$V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = 1$ mA $V_{BE(off)} = 0.5$ V Delay time Rise time $V_{CC} = 3$ V,$I_C = 10$ mA, $I_{B1} = I_{B2} = 1$ mA Storage time Fall time	 t_d t_r t_{stg} t_f	 - - - -	 - - - -	 35 35 200 50	 ns ns ns ns

Switching times

Turn-on time (see Figs 2 and 3) when switched from
$-V_{BEoff} = 0.5V$ to $I_{Con} = 10mA; I_{Bon} = 1mA$

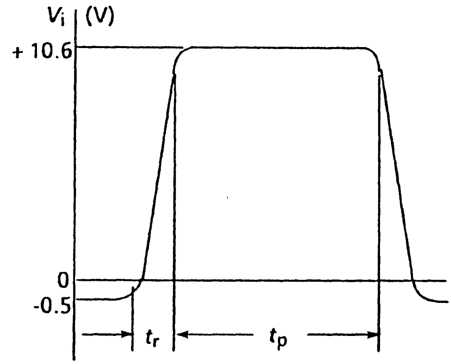


Fig.2 Input waveform; $t_r < 1ns$; $t_p = 300ns$
$\delta = 0.02$

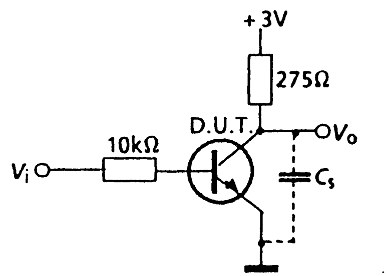


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4pF$;
scope impedance = 10MΩ

Turn-off time (see Figs 4 and 5)
$I_{Con} = 10mA; I_{Bon} = -I_{Boff} = 1mA$

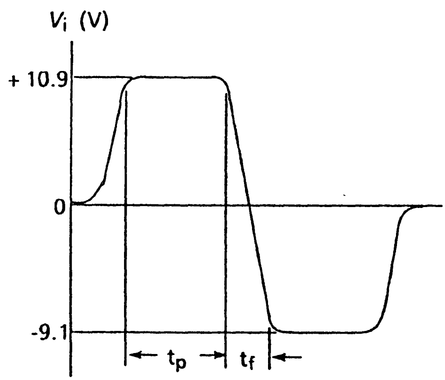


Fig.4 Input waveform; $t_f < 1ns$;
$10\mu s < t_p < = 500\mu s; \delta = 0.02$

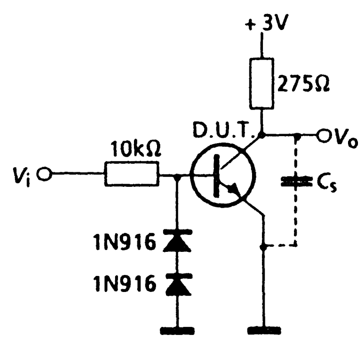
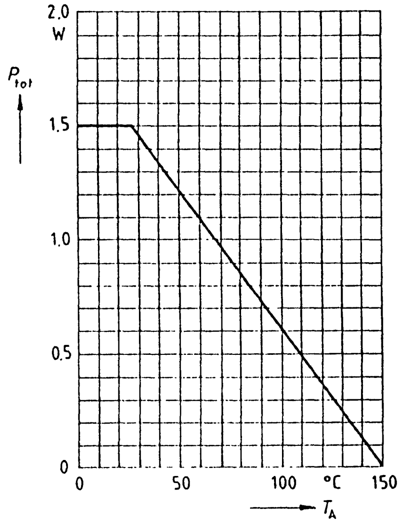
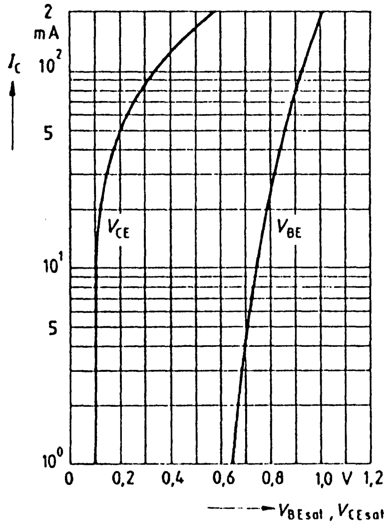


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4pF$;
scope impedance = 10MΩ

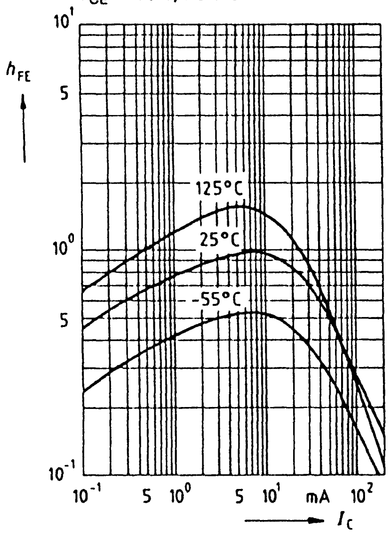
Total power dissipation $P_{tot} = f(T_A)$



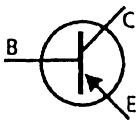
Saturation voltage $I_C = f(V_{BE\ sat}, V_{CE\ sat})$
$h_{FE} = 10$

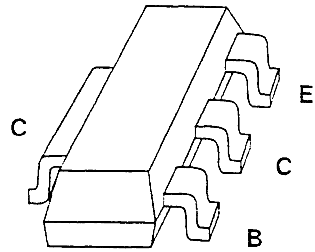


DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V, normalized



- High DC current gain 0.1 to 100 mA
- Low collector -emitter saturation voltage
- Complementary type: PZT 3904 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
PZT 3906	ZT 3906	Q62702 - Z2030	SOT-223

Maximum Ratings

Parameter	Symbol	PZT 3906	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	200	mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	-65 to +150	°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min $6cm^2$
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1$ mA, $I_B = 0$	$V_{(BR)CEO}$	40	-	-	V
Collector-base breakdown voltage $I_C = 10$ µA, $I_B = 0$	$V_{(BR)CBO}$	40	-	-	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	5	-	-	V
Collector-base cutoff current $V_{CB} = 30$ V, $I_E = 0$	I_{CBO}	-	-	50	nA
Collector-emitter cutoff current $V_{CE} = 30$ V, + $V_{BE} = 0.5$ V	I_{CEV}	-	-	50	nA
Collector-base cutoff current $V_{CE} = 30$ V; + $V_{BE} = 0.5$ V	I_{BEV}	-	-	50	nA
DC current gain 1) $I_C = 0.1$ mA, $V_{CE} = 1$ V $I_C = 1$ mA, $V_{CE} = 1$ V $I_C = 10$ mA, $V_{CE} = 1$ V $I_C = 50$ mA, $V_{CE} = 1$ V $I_C = 100$ mA, $V_{CE} = 1$ V	h_{FE}	 60 80 100 60 30	 - - - - -	 - - 300 - -	 - - - - -
Collector-emitter saturation voltage 1) $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	 - -	 - -	 0.25 0.4	 V V
Base-emitter saturation voltage 1) $I_C = 10$ mA, $I_C = 1$ mA $I_C = 50$ mA, $I_C = 5$ mA	V_{BEsat}	 - -	 - -	 0.85 0.95	 V V

1) Pulse test conditions: $t \leqq 300$µs; D = 2%

AC Characteristics

Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	250	-	-	MHz
Collector-base capacitance $V_{CB} = 5$ V, $f = 1$ MHz	C_{ob}	-	-	4.5	pF
Input capacitance $V_{EB} = 0.5$ V, $f = 1$ MHz	C_{ib}	-	-	10	pF
Noise figure $I_C = 100$ µA, $V_{CE} = 5$ V, $R_S = 1$ kΩ, $f = 10$ Hz to 15.7 kHz	F	-	-	4	dB
Input impedance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{11e}	2	-	12	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{12e}	0.1	-	10	10^{-4}
Short-circuit forward current transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{21e}	100	-	400	-
Open circuit output admittance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{22e}	3	-	60	µS
$V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = 1$ mA $V_{BE(off)} = 0.5$ V Delay time Rise time $V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = I_{B2} = 1$ mA Storage time Fall time	 t_d t_r t_{stg} t_f	 - - - -	 - - - -	 35 35 225 75	 ns ns ns ns

Switching times

Turn-on time (see Figs 2 and 3) when switched from
$+V_{BEoff} = 0.5V$ to $-I_{Con} = 10mA; -I_{Bon} = 1mA$

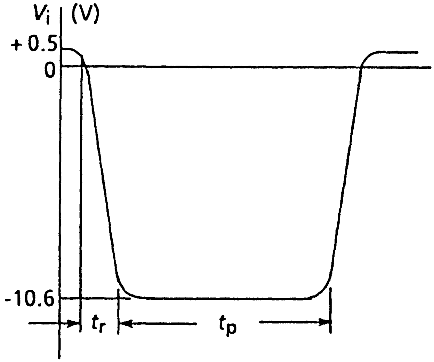


Fig.2 Input waveform; $t_r < 1ns$; $t_p = 300ns$
$\delta = 0.02$

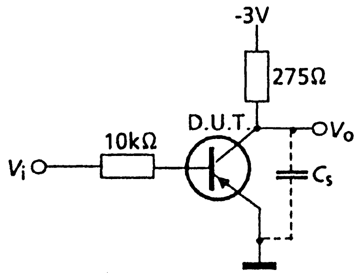


Fig. 3 Delay and rise time test circuit; total shunt capacitance of test jig and connectors $C_s < 4pF$;
scope impedance = 10MΩ

Turn-off time (see Figs 4 and 5)
$-I_{Con} = 10mA; -I_{Bon} = I_{Boff} = 1mA$

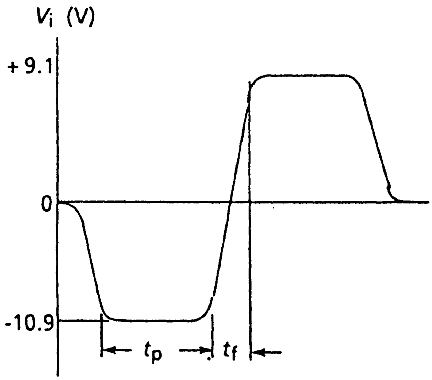


Fig.4 Input waveform; $t_f < 1ns$;
$10\mu s < t_p <= 500\mu s; \delta = 0.02$

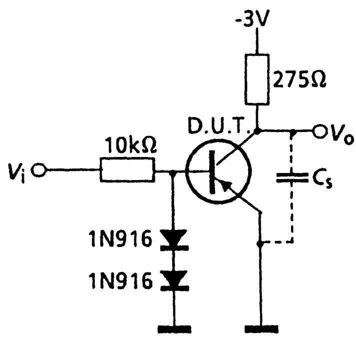
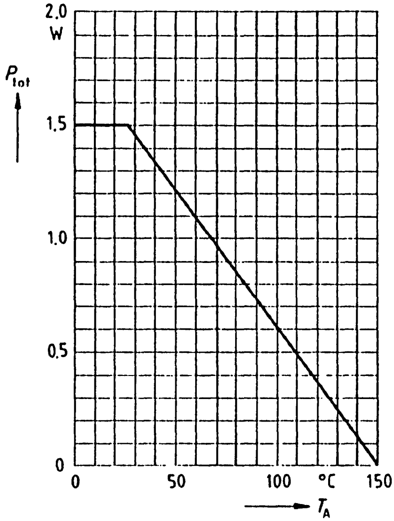
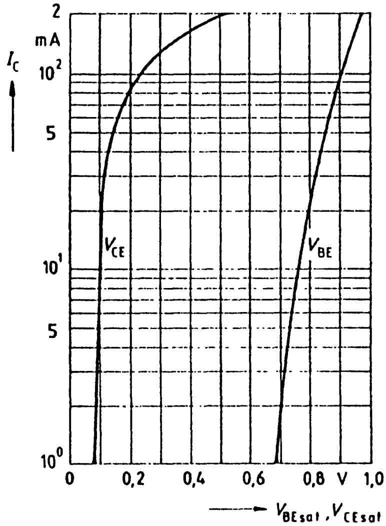


Fig. 5 Storage and fall time test circuit; total shunt capacitance of test jig and connectors $C_s < 4pF$;
scope impedance = 10MΩ

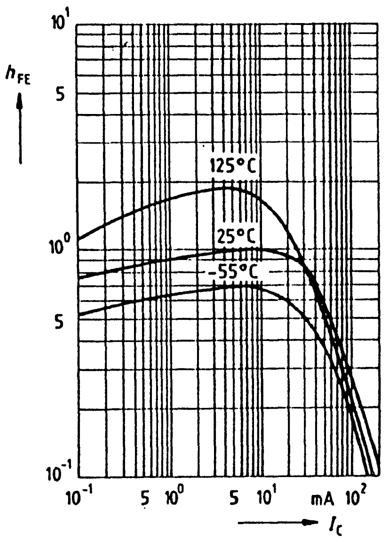
Total power dissipation $P_{tot} = f(T_A)$



Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$

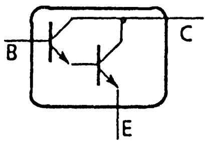


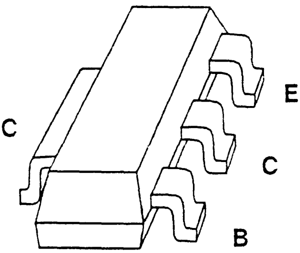
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V, normalized



NPN Silicon Darlington Transistors — PZTA 13; PZTA 14

- For general AF applications
- High collector current
- High current gain
- Complementary types: PZTA 63 / 64 (PNP)





Type	Marking	Ordering code (12-mm tape)	Package*
PZTA 13	PZTA 13	Q62702 - Z2033	SOT-223
PZTA 14	PZTA 14	Q62702 - Z2034	SOT-223

Maximum Ratings

Parameter	Symbol	PZTA 13	PZTA 14	Unit
Collector-emitter voltage	V_{CES}	30	30	V
Collector-base voltage	V_{CBO}	30	30	V
Emitter-base voltage	V_{EBO}	10		V
Collector current	I_C	300		mA
Peak collector current	I_{CM}	500		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

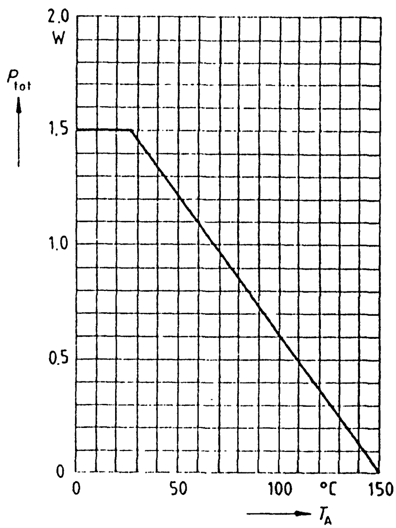
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

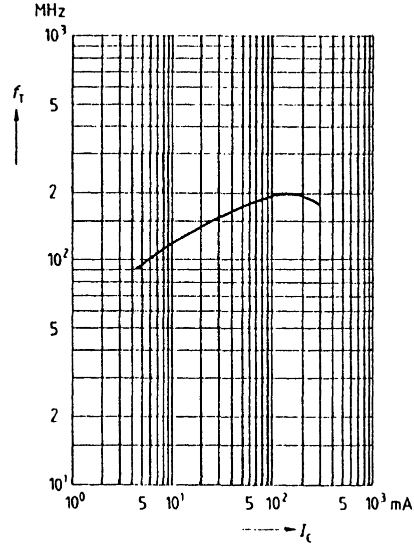
Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 100$ µA	$V_{(BR)CES}$	30	-	-	V
Collector-base breakdown voltage $I_C = 100$ µA, $I_B = 0$	$V_{(BR)CBO}$	30	-	-	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	10	-	-	V
Collector-base cutoff current $V_{CE} = 30$ V, $I_E = 0$ $V_{CE} = 30$ V, $I_E = 0, T_A = 150$°C	I_{CBO}	-	-	100 10	nA µA
Emitter-base cutoff current $V_{EB} = 10$ V, $I_C = 0$	I_{EBO}	-	-	100	nA
DC current gain $I_C = 10$ mA, $V_{CE} = 5$ V PZTA 13 PZTA 14 $I_C = 100$ mA, $V_{CE} = 5$ V PZTA 13 PZTA 14	h_{FE}	5000 10000 10000 20000	- - - -	- - - -	- - - -
Collector-emitter saturation voltage $I_C = 100$ mA, $I_B = 0.1$ mA	V_{CEsat}	-	-	1.5	V
Base-emitter saturation voltage $I_C = 100$ mA, $I_B = 0.1$mA	V_{BEsat}	-	-	2.0	V
AC Characteristics					
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	125	-	-	MHz

1) Pulse test conditions $t \leq 300$µs, D = 2 %

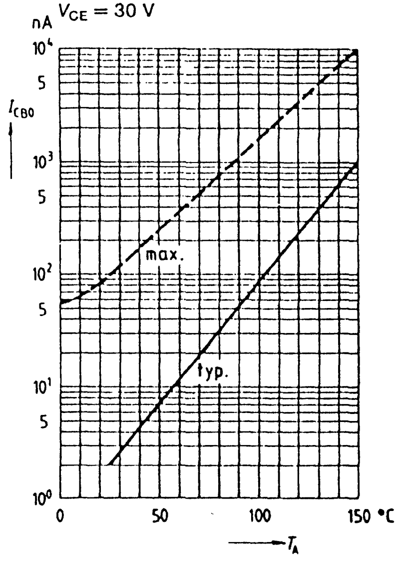
Total power dissipation $P_{tot} = f(T_A)$



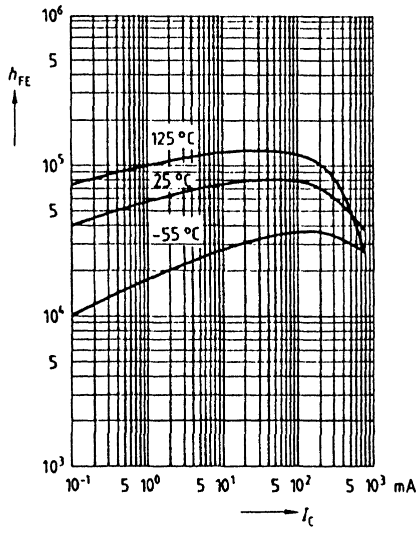
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



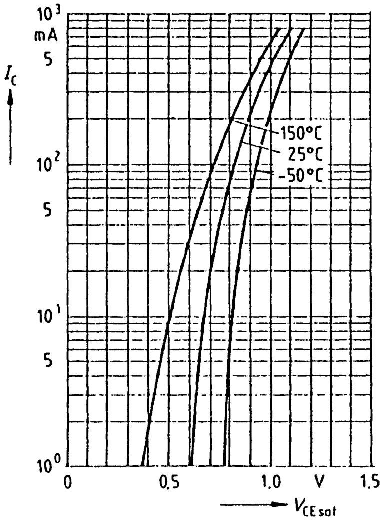
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CE} = 30$ V



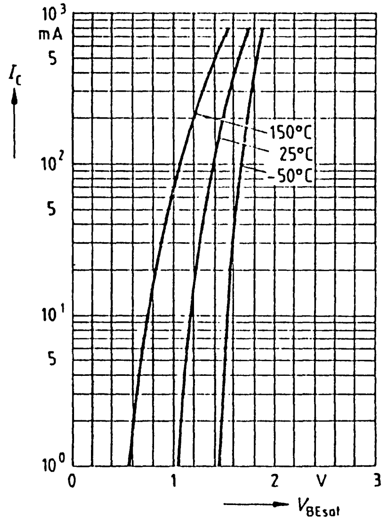
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



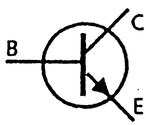
Base-emitter saturation voltage $I_c = f(V_{BE\,sat})$
$h_{FE} = 1000$

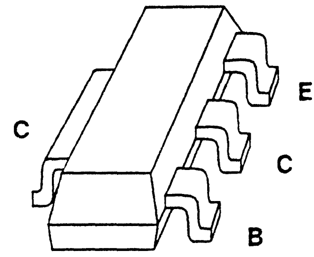


Collector-emitter saturation voltage
$I_c = f(V_{CE\,sat})$
$h_{FE} = 1000$



- High breakdown voltage
- Low collector -emitter saturation voltage
- Complementary types: PZTA 92/93 (PNP)





Type	Marking	Ordering code (12–mm tape)	Package*
PZTA 42	PZTA 42	Q62702 - Z2035	SOT-223
PZTA 43	PZTA 43	Q62702 - Z2036	SOT-223

Maximum Ratings

Parameter	Symbol	PZTA 42	PZTA 43	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	6	6	V
Collector current	I_C	500		mA
Base current	I_B	100		mA
Total power dissipation, $T_A \leq 25°C$ [1]	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient [1]	R_{thJA}	$\leq$83.3	K/W

[1]) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

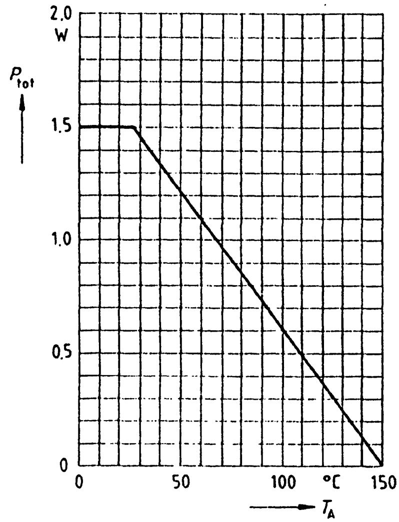
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

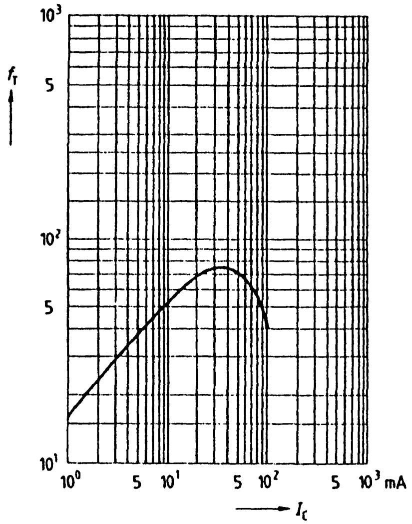
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 1$ mA, $I_B = 0$	PZTA 42		300	-	-	V
	PZTA 43		200	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100$ µA, $I_B = 0$	PZTA 42		300	-	-	V
	PZTA 43		200	-	-	V
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
$I_E = 100$ µA, $I_C = 0$			6	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 160$ V	PZTA 42		-	-	100	nA
$V_{CB} = 200$ V	PZTA 43		-	-	100	nA
$V_{CB} = 160$ V, $T_A = 150$°C	PZTA 42		-		20	µA
$V_{CB} = 200$ V, $T_A = 150$°C	PZTA 43		-		20	µA
Emitter-base cutoff current		I_{EBO}				
$V_{EB} = 3$ V, $I_C = 0$			-	-	100	nA
DC current gain 1)		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V			40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V			40	-	-	-
Collector-emitter saturation voltage 1)		V_{CEsat}				
$I_C = 20$ mA, $I_B = 2$ mA	PZTA 42		-	-	0.5	V
	PZTA 43		-	-	0.4	V
Base-emitter saturation voltage		V_{BEsat}				
$I_C = 20$ mA, $I_B = 2$ mA			-	-	0.9	V
AC Characteristics						
Transition frequency		f_T				
$I_C = 20$ mA, $V_{CE} = 10$ V, $f = 100$ MHz			-	70	-	MHz
Collector-base capacitance		C_{ob}				
$V_{CB} = 20$ V, $f = 1$ MHz	PZTA 42		-	-	3	pF
	PZTA 43		-	-	4	pF

1) Pulse test conditions: t ≦ 300µs; D = 2%

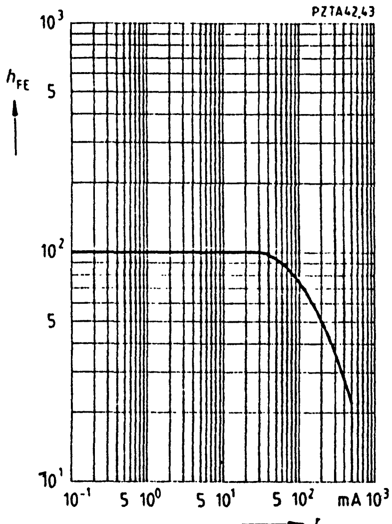
Total power dissipation $P_{tot} = f(T_A)$



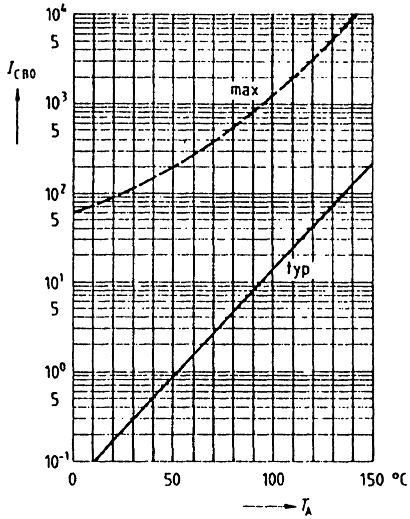
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



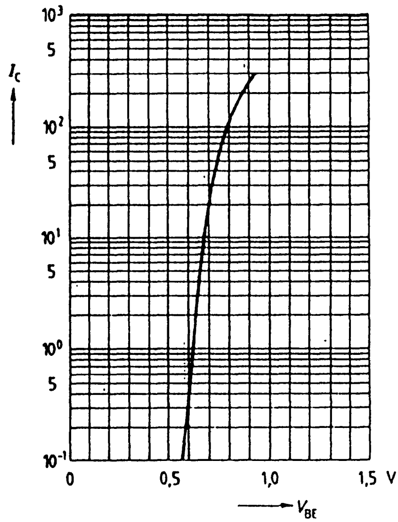
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



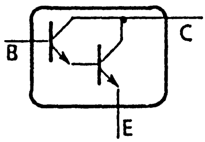
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 160$ V

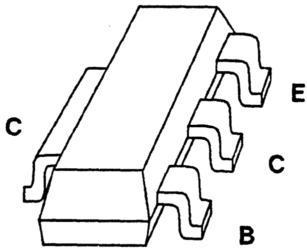


Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



- For general AF applications
- High collector current
- High current gain
- Complementary types: PZTA 13 / 14 (NPN)





Type	Marking	Ordering code (12–mm tape)	Package*
PZTA 63	PZTA 63	Q62702 - Z2031	SOT-223
PZTA 64	PZTA 64	Q62702 - Z2032	SOT-223

Maximum Ratings

Parameter	Symbol	PZTA 63	PZTA 64	Unit
Collector-emitter voltage	V_{CES}	30	30	V
Collector-base voltage	V_{CBO}	30	30	V
Emitter-base voltage	V_{EBO}	10		V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	≤ 83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

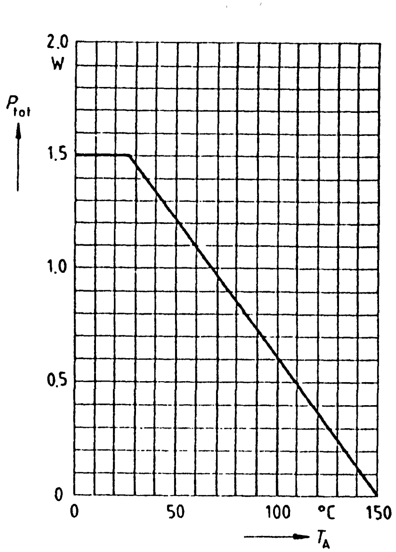
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

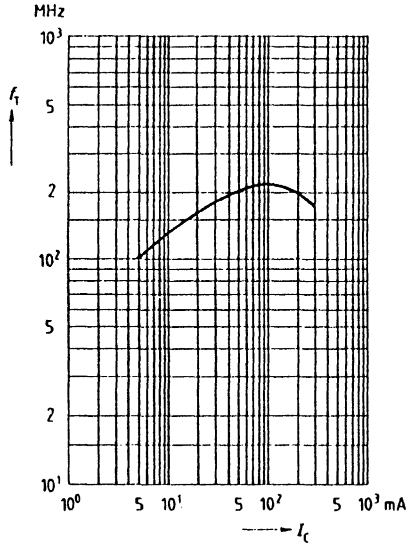
Parameter	Symbol	Values min.	typ.	max.	Unit
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 100$ µA	$V_{(BR)CES}$	30	-	-	V
Collector-base breakdown voltage $I_C = 100$ µA, $I_B = 0$	$V_{(BR)CBO}$	30	-	-	V
Emitter-base breakdown voltage $I_E = 10$ µA, $I_C = 0$	$V_{(BR)EBO}$	10	-	-	V
Collector-base cutoff current $V_{CE} = 30$ V, $I_E = 0$ $V_{CE} = 30$ V, $I_E = 0, T_A = 150$°C	I_{CBO}	-	-	100 10	nA µA
Emitter-base cutoff current $V_{EB} = 10$ V, $I_C = 0$	I_{EBO}	-	-	100	nA
DC current gain $I_C = 10$ mA, $V_{CE} = 5$ V PZTA63 PZTA64 $I_C = 100$ mA, $V_{CE} = 5$ V PZTA63 PZTA64	h_{FE}	5000 10000 10000 20000	- - - -	- - - -	- - - -
Collector-emitter saturation voltage $I_C = 100$ mA, $I_B = 0.1$ mA	V_{CEsat}	-	-	1.5	V
Base-emitter saturation voltage $I_C = 100$ mA, $I_B = 0.1$ mA	V_{BEsat}	-	-	2.0	V
AC Characteristics					
Transition frequency $I_C = 50$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	125	-	-	MHz

1) Pulse test conditions t ≦ 300µs, D = 2 %

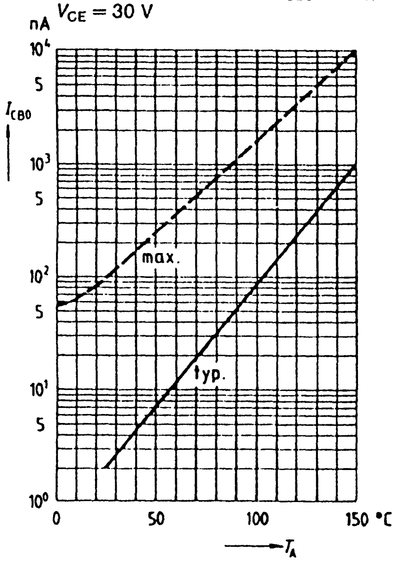
Total power dissipation $P_{tot} = f(T_A)$



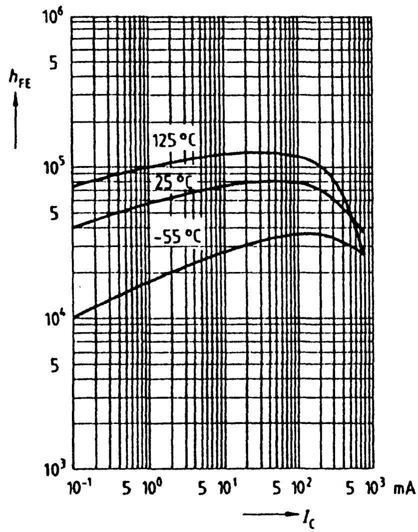
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



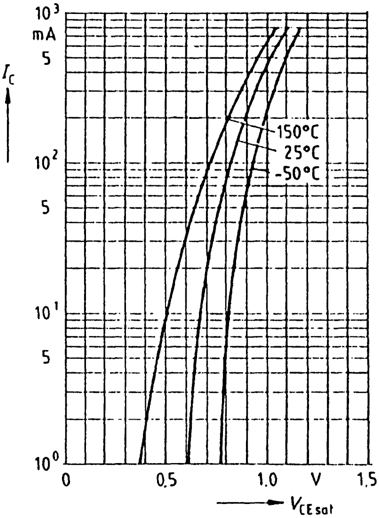
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CE} = 30$ V



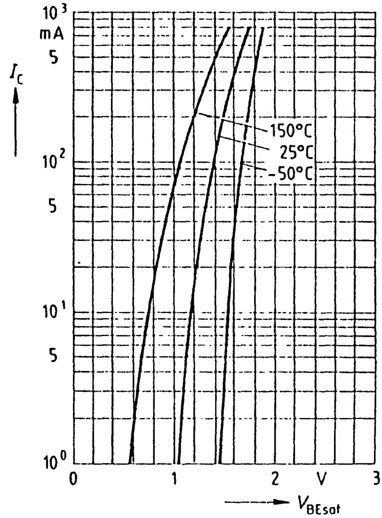
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



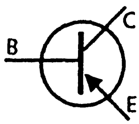
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 100$

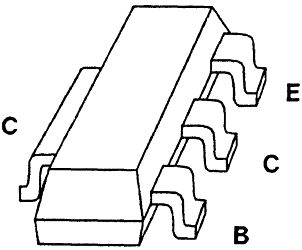


Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



- High breakdown voltage
- Low collector -emitter saturation voltage
- Complementary types: PZTA 42/43 (NPN)





Type	Marking	Ordering code (12-mm tape)	Package*
PZTA 92	PZTA 92	Q62702 - Z2037	SOT-223
PZTA 93	PZTA 93	Q62702 - Z2038	SOT-223

Maximum Ratings

Parameter	Symbol	PZTA 92	PZTA 93	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	5	5	V
Collector current	I_C	500		mA
Base current	I_B	100		mA
Total power dissipation, $T_A \leq 25°C$ 1)	P_{tot}	1.5		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	-65 to +150		°C

Thermal Resistance

Junction - ambient 1)	R_{thJA}	$\leq$83.3	K/W

1) Package mounted on an epoxy printed circuit board 40mm x 40mm x 1.5mm
Mounting pad for the collector lead min 6cm²

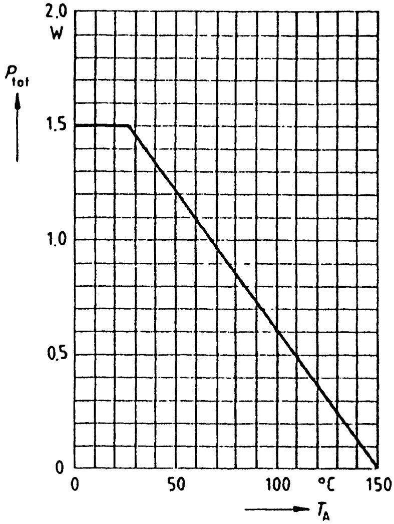
*) For detailed dimensions see chapter Package Outlines

Characteristics
at $T_A = 25$ °C, unless otherwise specified.

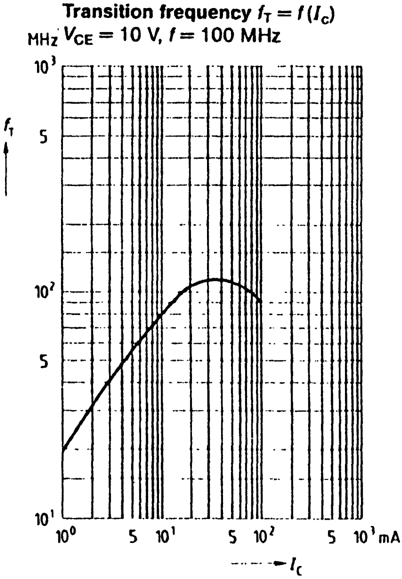
Parameter		Symbol	Values min.	typ.	max.	Unit
DC Characteristics						
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 1$ mA, $I_B = 0$	PZTA 92		300	-	-	V
	PZTA 93		200	-	-	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100$ µA, $I_B = 0$	PZTA 92		300	-	-	V
	PZTA 93		200	-	-	V
Emitter-base breakdown voltage		$V_{(BR)EBO}$				
$I_E = 100$ µA, $I_C = 0$			5	-	-	V
Collector-base cutoff current		I_{CBO}				
$V_{CB} = 160$ V	PZTA 92		-	-	250	nA
$V_{CB} = 200$ V	PZTA 93		-	-	250	nA
$V_{CB} = 160$ V, $T_A = 150$°C	PZTA 92		-		20	µA
$V_{CB} = 200$ V, $T_A = 150$°C	PZTA 93		-		20	µA
Emitter-base cutoff current		I_{EBO}				
$V_{EB} = 3$ V, $I_C = 0$			-	-	100	nA
DC current gain 1)		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	-	-	-
$I_C = 10$ mA, $V_{CE} = 10$ V			40	-	-	-
$I_C = 30$ mA, $V_{CE} = 10$ V			25	-	-	-
Collector-emitter saturation voltage 1)		V_{CEsat}				
$I_C = 20$ mA, $I_B = 2$ mA	PZTA 92		-	-	0.5	V
	PZTA 93				0.4	V
Base-emitter saturation voltage 1)		V_{BEsat}				
$I_C = 20$ mA, $I_B = 2$ mA			-	-	0.9	V
AC Characteristics						
Transition frequency		f_T				
$I_C = 20$ mA, $V_{CE} = 10$ V, $f = 100$ MHz			-	100	-	MHz
Collector-base capacitance		C_{ob}				
$V_{CB} = 20$ V, $f = 1$ MHz	PZTA 92		-	-	6	pF
	PZTA 93		-	-	8	pF

1) Pulse test conditions: $t \leqq 300$µs; D = 2%

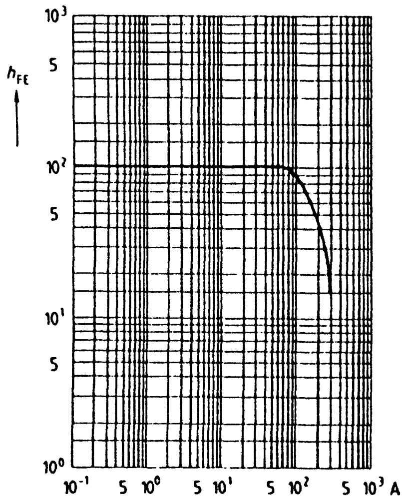
Total power dissipation $P_{tot} = f(T_A)$



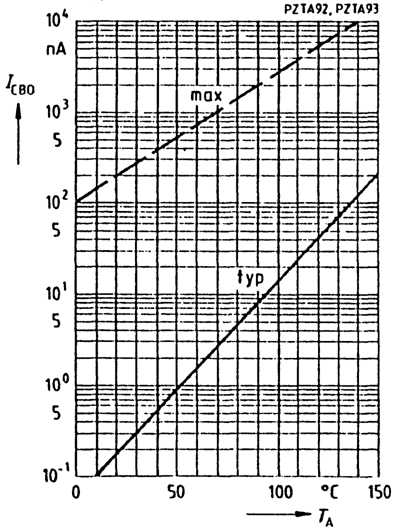
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz



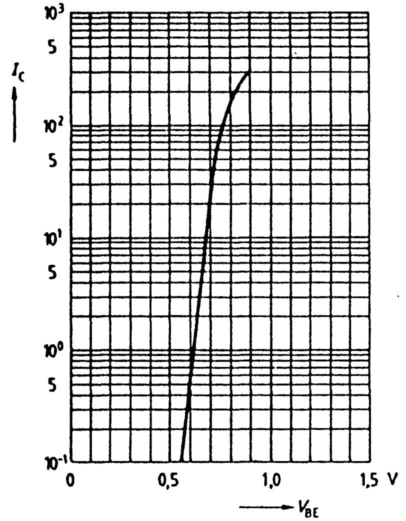
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



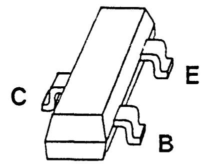
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 160$ V



Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



- High DC current gain 0.1 to 500 mA
- Low collector-emitter saturation voltage
- Complementary types: SMBT 2907, SMBT 2907 A (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBT 2222	S1B	Q68000–A4335	Q68000–A6481	SOT 23
SMBT 2222 A	S1P	Q68000–A4334	Q68000–A6473	SOT 23

Maximum ratings

Parameter	Symbol	SMBT 2222	SMBT 2222 A	Unit
Collector-emitter voltage	V_{CEO}	30	40	V
Collector-base voltage	V_{CBO}	60	75	V
Emitter-base voltage	V_{EBO}	5	6	V
Collector current	I_C	600		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \dots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	SMBT 2222		30	–	–	V
	SMBT 2222 A		40	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10$ µA	SMBT 2222		60	–	–	V
	SMBT 2222 A		75	–	–	V
Emitter-base breakdown voltage		$V_{(BR)\,EBO}$				
$I_E = 10$ µA	SMBT 2222		5	–	–	V
	SMBT 2222 A		6	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 50$ V	SMBT 2222		–	–	10	nA
$V_{CB} = 60$ V	SMBT 2222 A		–	–	10	nA
$V_{CB} = 50$ V, $T_A = 150\,°C$	SMBT 2222		–	–	10	µA
$V_{CB} = 60$ V, $T_A = 150\,°C$	SMBT 2222 A		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	10	nA
DC current gain		h_{FE}				
$I_C = 100$ µA, $V_{CE} = 10$ V			35	–	–	–
$I_C = 1$ mA, $V_{CE} = 10$ V			50	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]			75	–	–	–
$I_C = 150$ mA, $V_{CE} = 1$ V[1]			50	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1]			100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1]	SMBT 2222		30	–	–	–
	SMBT 2222 A		40	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V, $T_A = 55\,°C$	SMBT 2222 A		35	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA	SMBT 2222		–	–	0,4	V
	SMBT 2222 A		–	–	0,3	V
$I_C = 500$ mA, $I_B = 50$ mA	SMBT 2222		–	–	1,6	V
	SMBT 2222 A		–	–	1,0	V
Base-emitter saturation voltage[1]		V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA	SMBT 2222		–	–	1,3	V
	SMBT 2222 A		0,6	–	1,2	V
$I_C = 500$ mA, $I_B = 50$ mA	SMBT 2222		–	–	2,6	V
	SMBT 2222 A		–	–	2,0	V

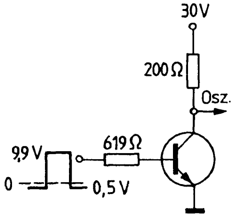
[1]) Pulse test: $t \leq 300$ µs, D = 2%.

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz SMBT 2222 SMBT 2222 A	f_T	 250 300	 – –	 – –	 MHz MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{ob}	–	–	8	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz SMBT 2222 SMBT 2222 A	C_{ib}	 – –	 – –	 30 25	 pF pF
Short-circuit input impedance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{11e}	 2 0,25	 – –	 8 1,25	 kΩ kΩ
Open-circuit reverse voltage transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{12e}	 – –	 – –	 8,0 4,0	 10^{-4} 10^{-4}
Short-circuit forward current transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{21e}	 50 75	 – –	 300 375	 – –
Open-circuit output admittance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 I_C = 10 mA, V_{CE} = 10 V, f = 1 kHz SMBT 2222 A	h_{22e}	 5 25	 – –	 35 200	 µS µS
Collector-base time constant I_E = 20 mA, V_{CB} = 10 V, f = 31,8 MHz SMBT 2222 A	$r_b'C_C$	–	–	150	ps
Noise figure I_C = 100 µA, V_{CE} = 10 V, R_S = 1 kΩ f = 1 kHz SMBT 2222 A	F	–	–	4,0	dB

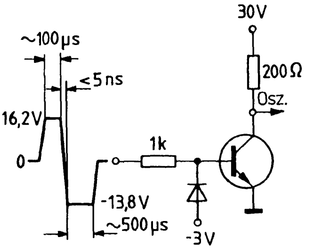
AC characteristics	Symbol	min	typ	max	Unit
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 15$ mA $V_{BE(off)} = 0{,}5$ V					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	25	ns
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA					
Storage time	t_{stg}	–	–	225	ns
Fall time	t_f	–	–	60	ns

Test circuits

Delay and rise time

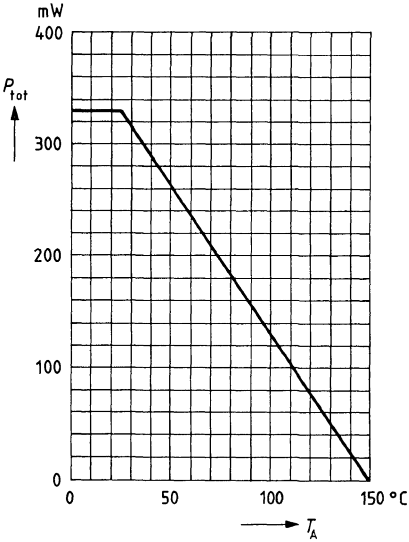


Storage and fall time

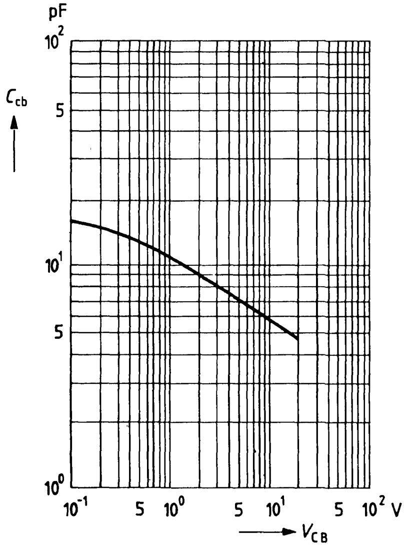


Oscilloscope: $R > 100$ kΩ
$C < 12$ pF
$t_r < 5$ ns

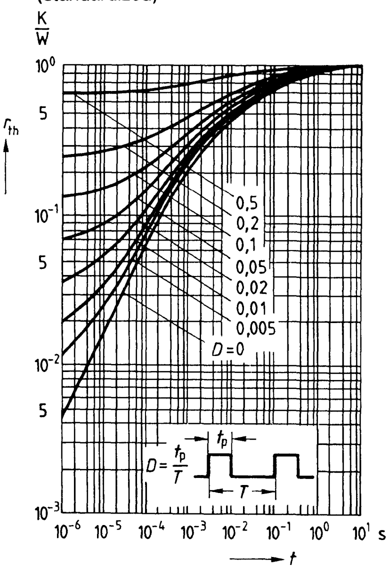
Total power dissipation $P_{tot} = f(T_A)$



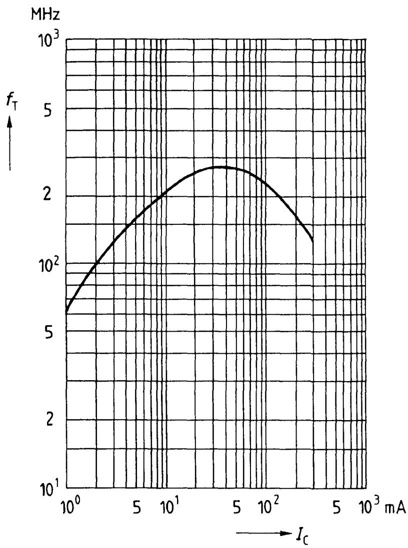
Collector-base capacitance
$C_{cb} = f(V_{CB})$
$f = 1$ MHz



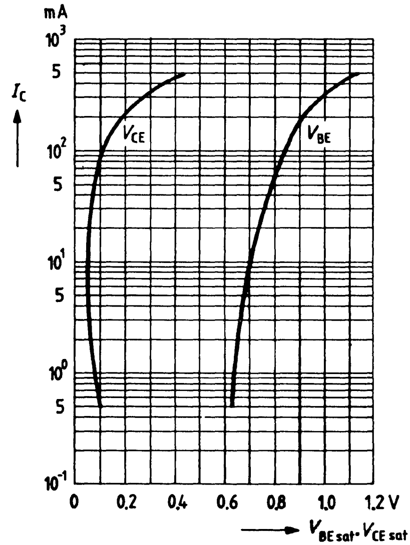
Pulse handling capability $r_{th} = f(t)$
(standardized)



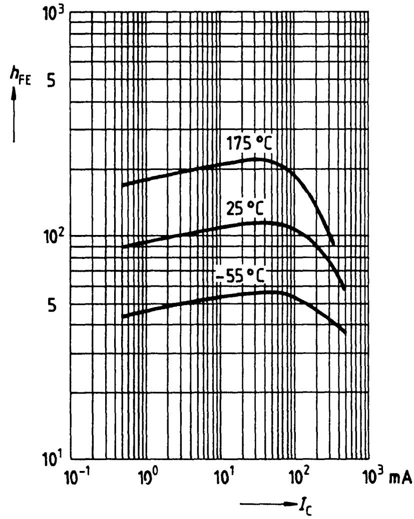
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V



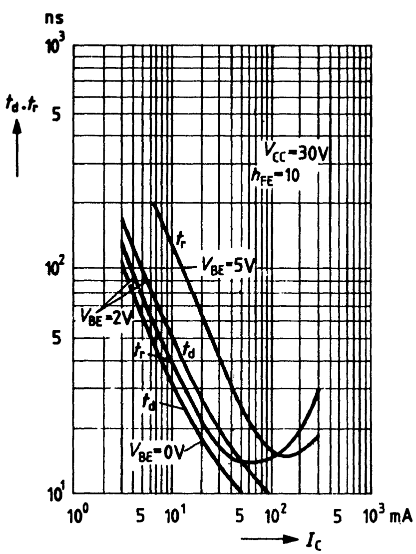
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$



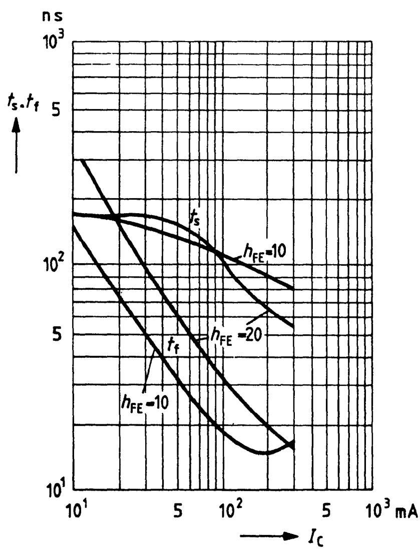
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



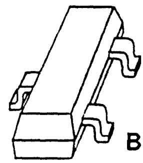
Storage time $t_{stg} = f(I_C)$
Fall time $t_f = f(I_C)$



PNP Silicon Switching Transistors

SMBT 2907
SMBT 2907 A

- High DC current gain: 0.1 to 500 mA
- Low collector-emitter saturation voltage
- Complementary types: SMBT 2222, SMBT 2222 A (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBT 2907	S2B	Q68000–A4336	Q68000–A6501	SOT 23
SMBT 2907 A	S2F	Q68000–A4337	Q68000–A6474	SOT 23

Maximum ratings

Parameter	Symbol	SMBT 2907	SMBT 2907 A	Unit
Collector-emitter voltage	V_{CEO}	40	60	V
Collector-base voltage	V_{CBO}	60		V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	600		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

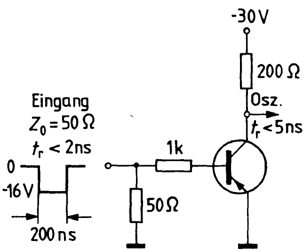
DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)\,CEO}$				
$I_C = 10$ mA	SMBT 2907		40	–	–	V
	SMBT 2907 A		60	–	–	V
Collector-base breakdown voltage		$V_{(BR)\,CBO}$				
$I_C = 10\ \mu A$	SMBT 2907		60	–	–	V
	SMBT 2907 A		60	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$		$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 50$ V	SMBT 2907		–	–	20	nA
$V_{CB} = 50$ V	SMBT 2907 A		–	–	10	nA
$V_{CB} = 50$ V, $T_A = 150\,°C$	SMBT 2907		–	–	20	µA
$V_{CB} = 50$ V, $T_A = 150\,°C$	SMBT 2907 A		–	–	10	µA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	10	nA
DC current gain		h_{FE}				
$I_C = 100\ \mu A$, $V_{CE} = 10$ V	SMBT 2907		35	–	–	–
	SMBT 2907 A		75	–	–	–
$I_C = 1$ mA, $V_{CE} = 10$ V	SMBT 2907		50	–	–	–
	SMBT 2907 A		100	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1]	SMBT 2907		75	–	–	–
	SMBT 2907 A		100	–	–	–
$I_C = 150$ mA, $V_{CE} = 10$ V[1]	SMBT 2907		100	–	300	–
	SMBT 2907 A		100	–	300	–
$I_C = 500$ mA, $V_{CE} = 10$ V[1]	SMBT 2907		30	–	–	–
	SMBT 2907 A		50	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
$I_C = 150$ mA, $I_B = 15$ mA			–	–	0,4	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	1,6	V
Base-emitter saturation voltage[1]		V_{BEsat}				
$I_C = 150$ mA, $I_B = 15$ mA			–	–	1,3	V
$I_C = 500$ mA, $I_B = 50$ mA			–	–	2,6	V

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

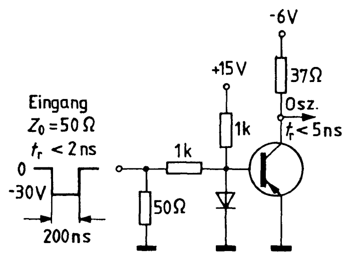
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	200	–	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	–	8	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	–	30	pF
$V_{CC} = 30$ V, $I_C = 150$ mA, $I_{B1} = 15$ mA					
Delay time	t_d	–	–	10	ns
Rise time	t_r	–	–	40	ns
$V_{CC} = 6$ V, $I_C = 150$ mA, $I_{B1} = I_{B2} = 15$ mA					
Storage time	t_{stg}	–	–	80	ns
Fall time	t_f	–	–	30	ns

Test circuits

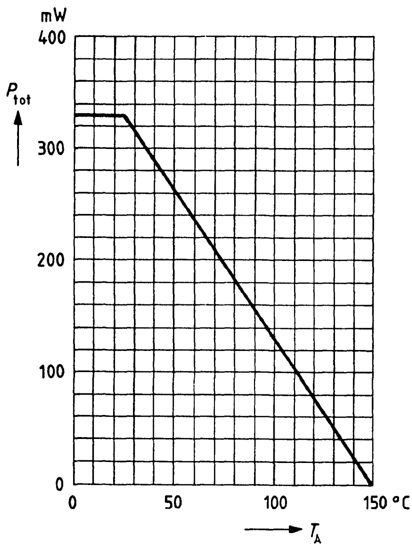
Delay and rise time



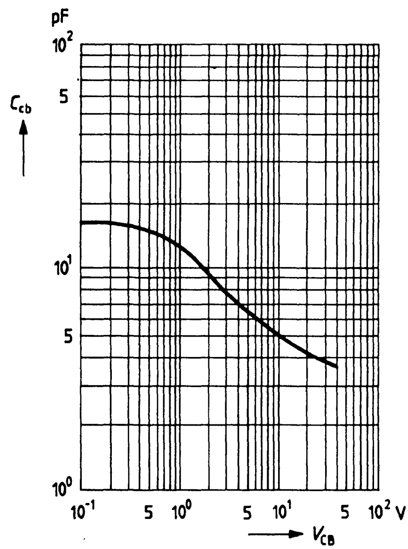
Storage and fall time



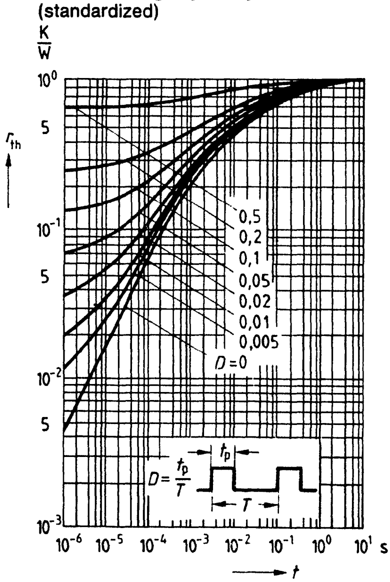
Total power dissipation $P_{tot} = f(T_A)$



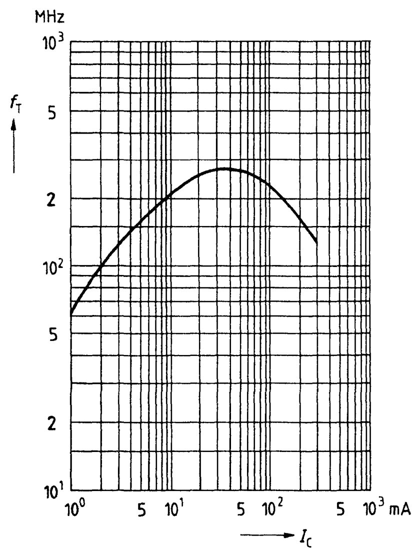
Collector-base capacitance
$C_{cb} = f(V_{CB})$
$f = 1$ MHz



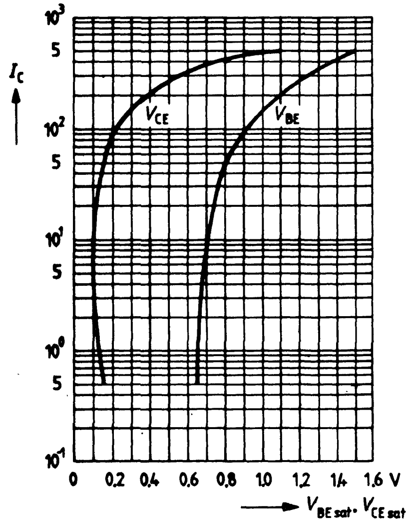
Pulse handling capability $r_{th} = f(t)$
(standardized)



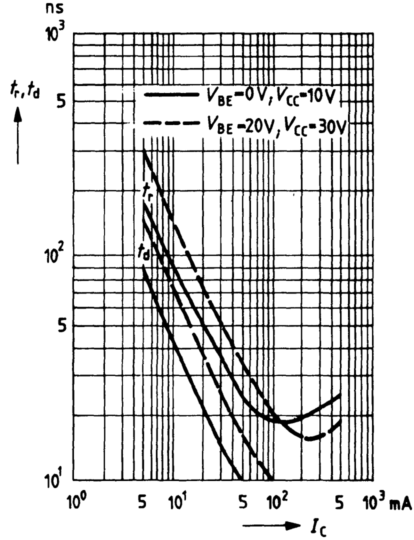
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V



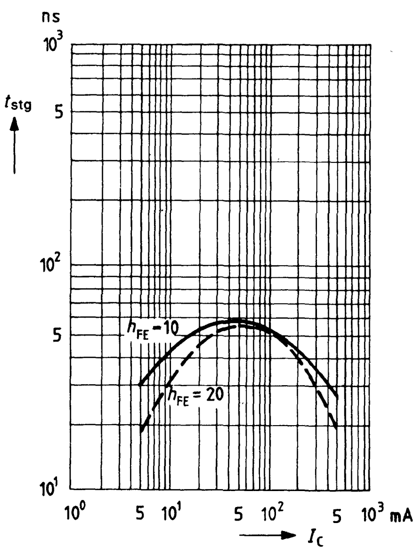
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$



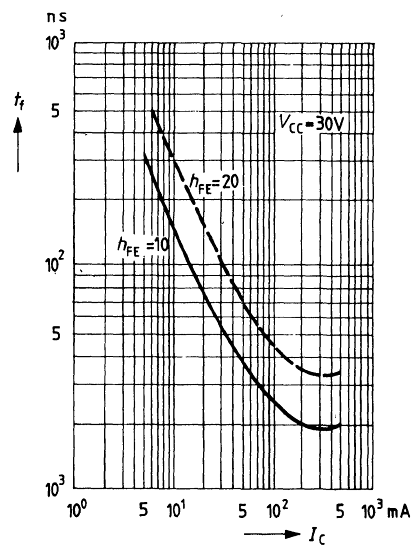
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$
$h_{FE} = 10$



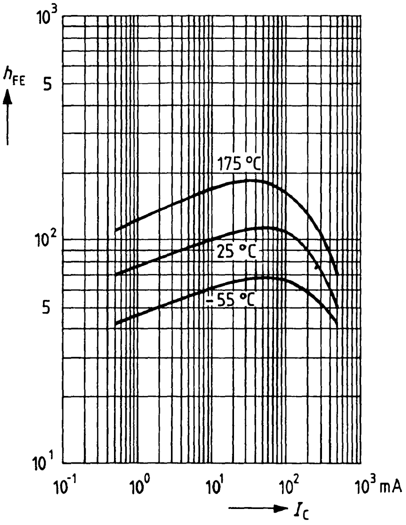
Storage time $t_{stg} = f(I_C)$



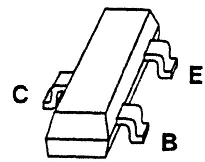
Fall time $t_f = f(I_C)$



DC current gain $h_{FE} = f(I_C)$



- High DC current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage
- Complementary type: SMBT 3906 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBT 3904	S1A	Q68000–A4340	Q68000–A4416	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	60	V
Emitter-base voltage	V_{EBO}	6	V
Collector current	I_C	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

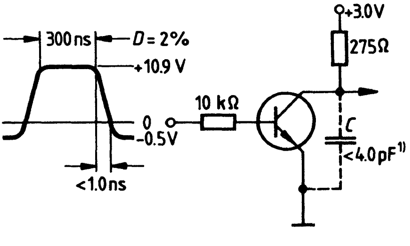
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)\,CBO}$	60	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current $V_{CB} = 30$ V	I_{CBO}	–	–	50	nA
DC current gain $I_C = 100$ µA, $V_{CE} = 1$ V $I_C = 1$ mA, $V_{CE} = 1$ V $I_C = 10$ mA, $V_{CE} = 1$ V[1] $I_C = 50$ mA, $V_{CE} = 1$ V[1] $I_C = 100$ mA, $V_{CE} = 1$ V[1]	h_{FE}	 40 70 100 60 30	 – – – – –	 – – 300 – –	 – – – – –
Collector-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA, $I_B = 5$ mA	V_{CEsat}	 – –	 – –	 0,2 0,3	 V V
Base-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA $I_C = 50$ mA, $I_B = 5$ mA	V_{BEsat}	 0,65 –	 – –	 0,85 0,95	 V V

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

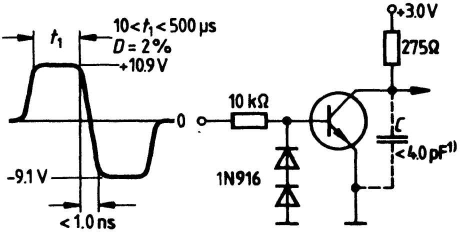
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	300	–	–	MHz
Output capacitance $V_{CB} = 5$ V, $f = 1$ MHz	C_{ob}	–	–	4	pF
Input capacitance $V_{EB} = 0{,}5$ V, $f = 1$ MHz	C_{ib}	–	–	8	pF
Input impedance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{11e}	1	–	10	kΩ
Open-circuit reverse voltage transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{12e}	0,5	–	8	10^{-4}
Short-circuit forward current transfer ratio $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{21e}	100	–	400	–
Open-circuit output admittance $I_C = 1$ mA, $V_{CE} = 10$ V, $f = 1$ kHz	h_{22e}	1	–	40	µS
Noise figure $I_C = 100$ µA, $V_{CE} = 5$ V, $R_S = 1$ kΩ $f = 1$ kHz	F	–	–	5	dB
$V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = 1$ mA $V_{BE(off)} = 0{,}5$ V Delay time Rise time $V_{CC} = 3$ V, $I_C = 10$ mA, $I_{B1} = I_{B2} = 1$ mA Storage time Fall time	 t_d t_r t_{stg} t_f	 – – – –	 – – – –	 35 35 200 50	 ns ns ns ns

Test circuits

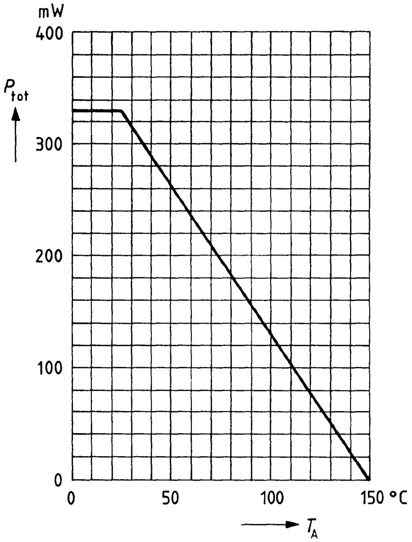
Delay and rise time



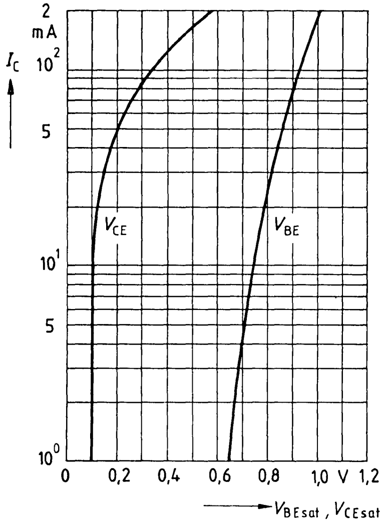
Storage and fall time



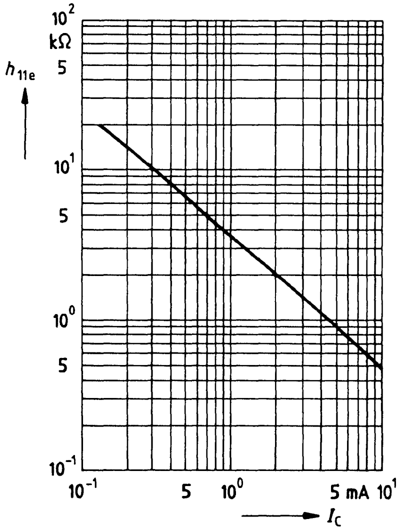
Total power dissipation $P_{tot} = f(T_A)$



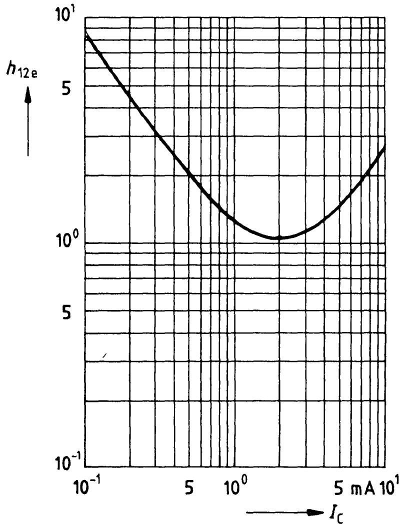
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



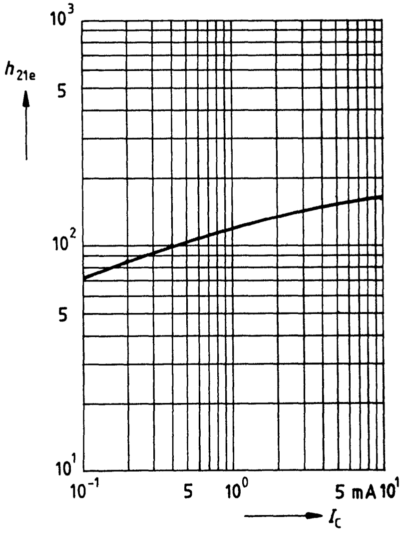
Input impedance
$h_{11e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ kHz



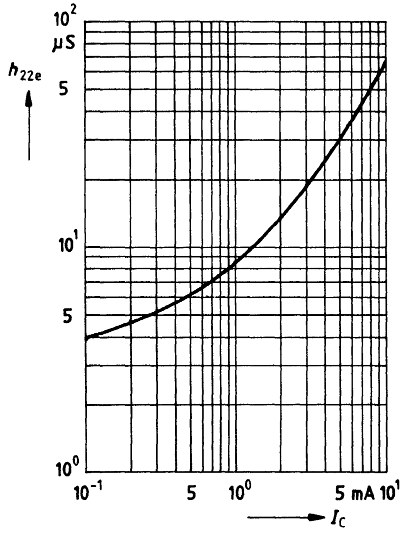
Open-circuit reverse voltage transfer ratio $h_{12e} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ kHz



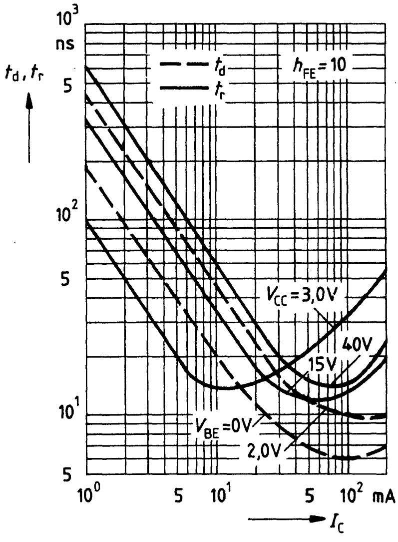
Short-circuit forward current transfer ratio $h_{21e} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



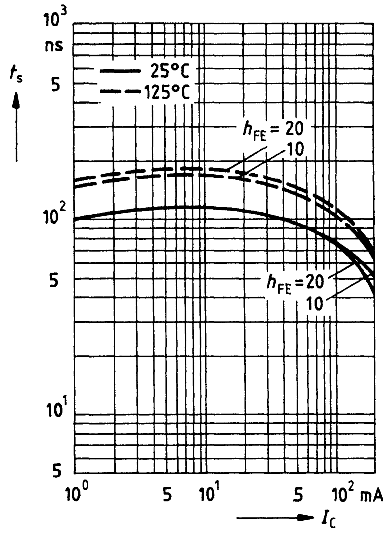
Open-circuit output admittance $h_{22e} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



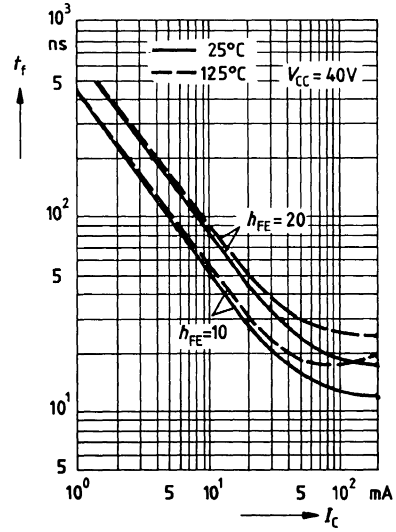
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



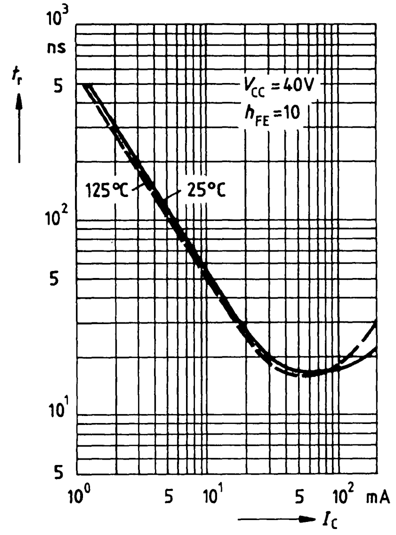
Storage time $t_{stg} = f(I_C)$



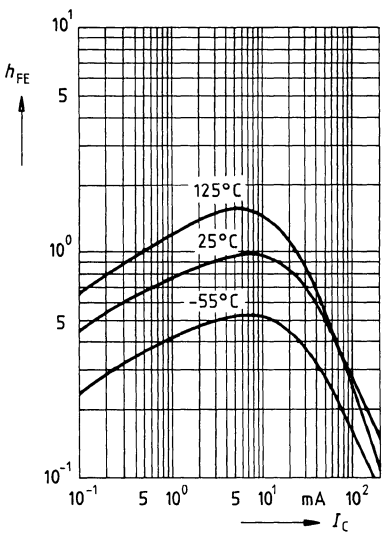
Fall time $t_f = f(I_C)$



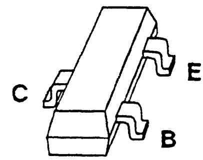
Rise time $t_r = f(I_C)$



DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



- High DC current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage
- Complementary type: SMBT 3904 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBT 3906	S2A	Q68000–A4341	Q68000–A4417	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CE0}	40	V
Collector-base voltage	V_{CB0}	40	V
Emitter-base voltage	V_{EB0}	5	V
Collector current	I_C	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction-ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

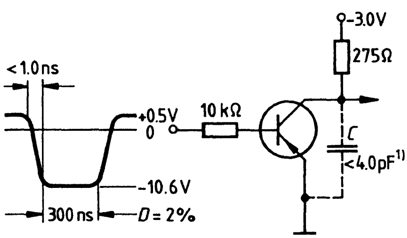
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	40	–	–	V
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)\,CBO}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current $V_{CB} = 30$ V	I_{CBO}	–	–	50	nA
DC current gain	h_{FE}				
$I_C = 100$ µA, $V_{CE} = 1$ V		60	–	–	–
$I_C = 1$ mA, $V_{CE} = 1$ V		80	–	–	–
$I_C = 10$ mA, $V_{CE} = 1$ V[1]		100	–	300	–
$I_C = 50$ mA, $V_{CE} = 1$ V[1]		60	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V[1]		30	–	–	–
Collector-emitter saturation voltage[1]	V_{CEsat}				
$I_C = 10$ mA, $I_B = 1$ mA		–	–	0,25	V
$I_C = 50$ mA, $I_B = 5$ mA		–	–	0,4	V
Base-emitter saturation voltage[1]	V_{BEsat}				
$I_C = 10$ mA, $I_B = 1$ mA		0,65	–	0,85	V
$I_C = 50$ mA, $I_B = 5$ mA		–	–	0,95	V

[1]) Pulse test: $t \leq 300$ µs, D = 2%.

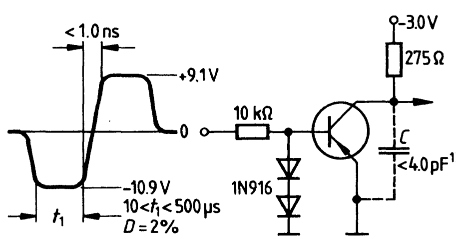
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	250	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{ob}	–	–	4,5	pF
Input capacitance V_{EB} = 0,5 V, f = 1 MHz	C_{ib}	–	–	10	pF
Short-circuit input impedance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{11e}	2	–	12	kΩ
Open-circuit reverse voltage transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{12e}	0,1	–	10	10^{-4}
Short-circuit forward current transfer ratio I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{21e}	100	–	400	–
Open-circuit output admittance I_C = 1 mA, V_{CE} = 10 V, f = 1 kHz	h_{22e}	3	–	60	µS
Noise figure I_C = 100 µA, V_{CE} = 5 V, R_S = 1 kΩ f = 1 kHz	F	–	–	4	dB
V_{CC} = 3 V, I_C = 10 mA, I_{B1} = 1 mA $V_{BE\,(off)}$ = 0,5 Vdc Delay time Rise time V_{CC} = 3 V, I_C = 10 mA, I_{B1} = I_{B2} = 1 mA Storage time Fall time	 t_d t_r t_{stg} t_f	 – – – –	 – – – –	 35 35 225 75	 ns ns ns ns

Test circuits

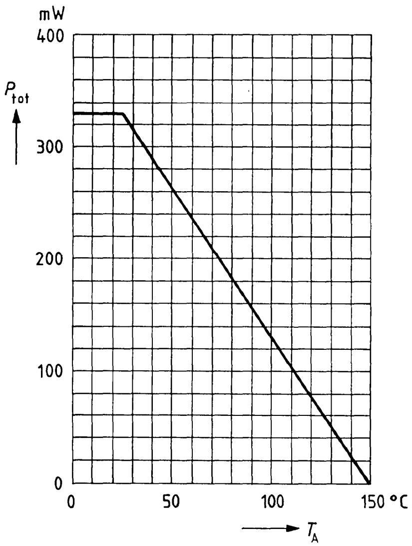
Delay and rise time



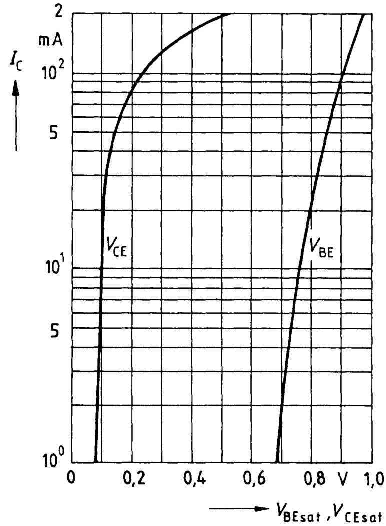
Storage and fall time



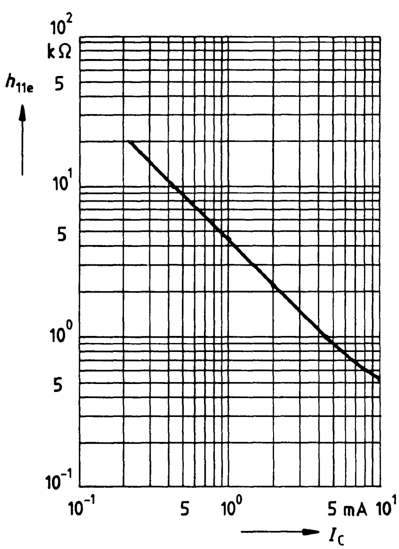
Total power dissipation $P_{tot} = f(T_A)$



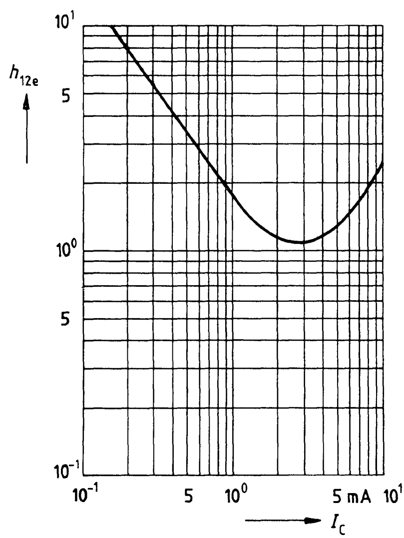
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



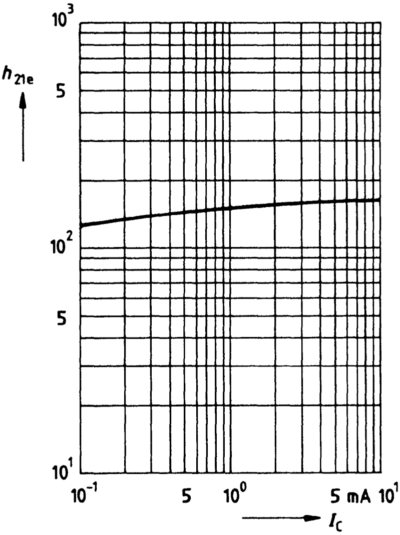
Short-circuit input impedance $h_{11e} = f(I_C)$
V_{CE} = 10 V, f = 1 kHz



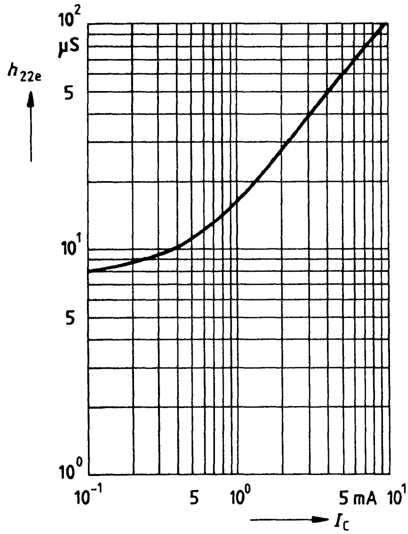
Open-circuit reverse voltage transfer ratio $h_{12e} = f(I_C)$



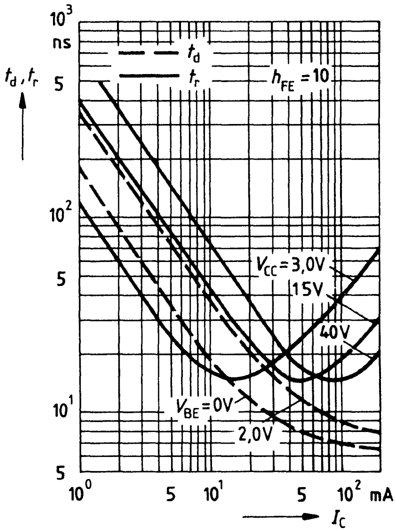
Short-circuit forward current transfer ratio $h_{21e} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



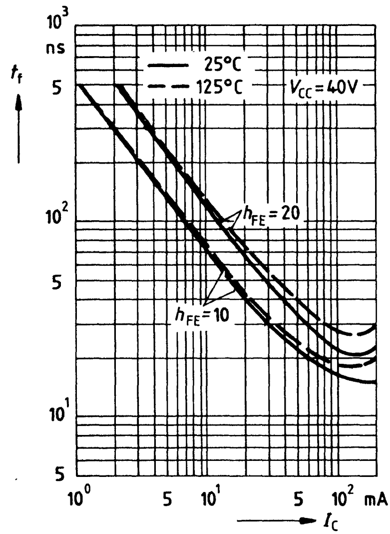
Open-circuit output admittance $h_{22e} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



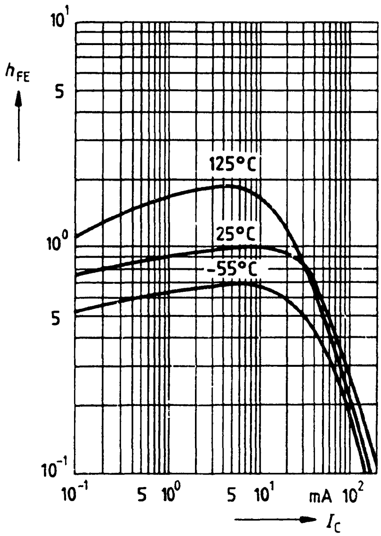
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



Fall time $t_f = f(I_C)$

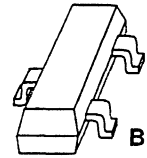


DC current gain $h_{FE} = f(I_C)$



NPN Silicon Switching Transistor

- High current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT 4124	SCZ	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	200	mA
Total power dissipation T_A = 25 °C	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

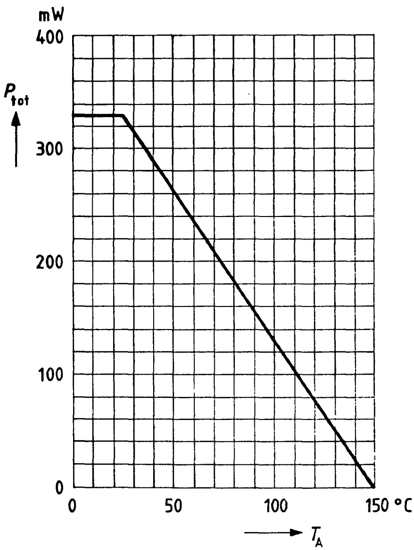
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics		min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	25	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	30	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	50	nA
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 50 mA, V_{CE} = 1 V	h_{FE}	 120 60	 – –	 360 	 – –
Collector-emitter saturation voltage[1]) I_C = 50 mA; I_B = 5 mA	V_{CEsat}	–	–	0.3	V
Base-emitter saturation voltage[1]) I_C = 50 mA; I_B = 5 mA	V_{BEsat}	–	–	0.95	V

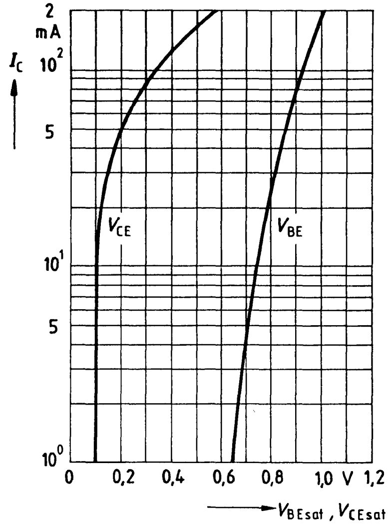
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	300	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{obo}	–	–	4	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	8	pF
Small-signal current gain I_C = 1 mA; V_{CE} = 5 V, f = 1 kHz	h_{fe}	120	–	480	–
Noise figure I_C = 0.1 mA, V_{CE} = 5 V, f = 10 Hz to 15 kHz R_S = 1 kΩ	NF	–	–	5	dB

[1]) Pulse test: $t \leq$ 300 µs, $D \leq$ 2 %

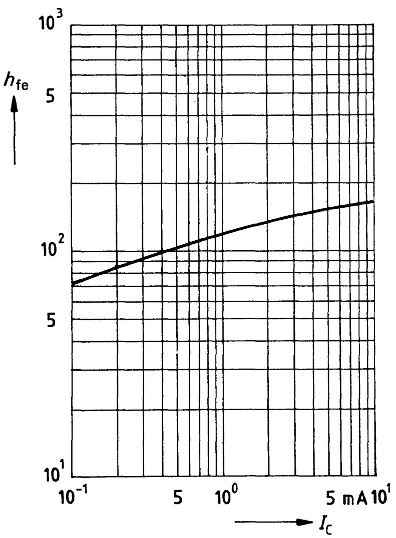
Total power dissipation $P_{tot} = f(T_A)$



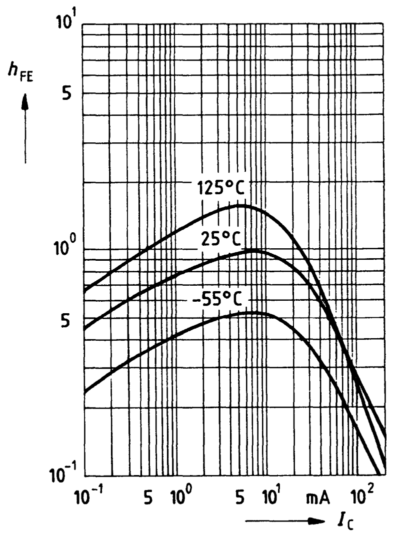
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



Small-signal current gain $h_{fe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz

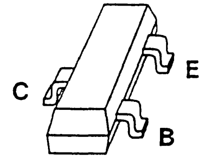


DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V (standardized)



PNP Silicon Switching Transistor — SMBT 4126

- High current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT 4126	SC3	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	25	V
Collector-base voltage	V_{CBO}	25	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	200	mA
Total power dissipation T_A = 25 °C	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–65...+150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

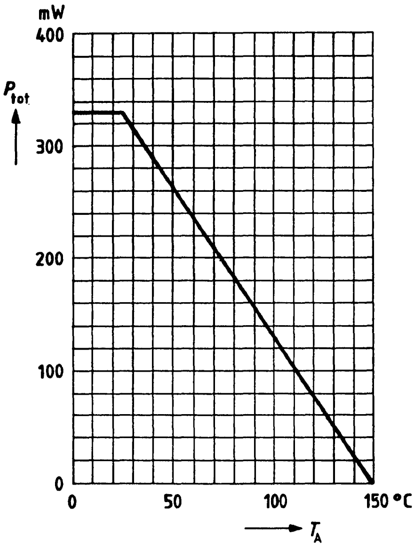
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	25	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	25	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	4	–	–	V
Collector cutoff current V_{CB} = 20 V, I_E = 0	I_{CBO}	–	–	50	nA
Emitter cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	50	nA
DC current gain I_C = 2 mA, V_{CE} = 1 V I_C = 50 mA, V_{CE} = 1 V	h_{FE}	 120 60		 360	 – –
Collector-emitter saturation voltage[1] I_C = 50 mA; I_B = 5 mA	V_{CEsat}	–	–	0.4	V
Base-emitter saturation voltage[1] I_C = 50 mA; I_B = 5 mA	V_{BEsat}	–	–	0.95	V

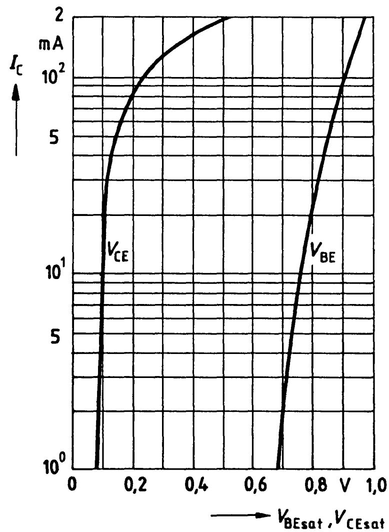
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	250	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{obo}	–	–	4.5	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	10	pF
Small-signal current gain I_C = 1 mA; V_{CE} = 5 V, f = 1 kHz	h_{fe}	120	–	480	–
Noise figure I_C = 0.1 mA, V_{CE} = 5 V, f = 10 Hz to 15 kHz R_S = 1 kΩ	NF	–	–	4	dB

[1]) Pulse test: $t \leq$ 300 µs, $D \leq$ 2 %

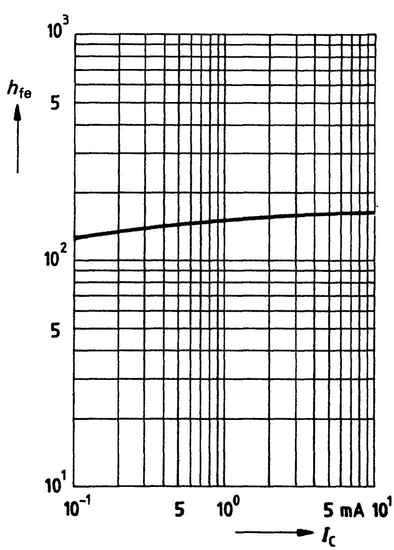
Total power dissipation $P_{tot} = f(T_A)$



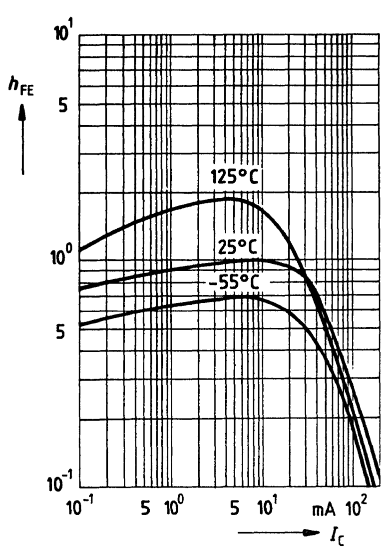
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



Small-signal current gain $h_{fe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



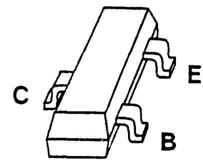
DC current gain $h_{FE} = f(I_C)$
(standardized), V_{CE} = 1 V



PNP Silicon Transistors

SMBT 5086
SMBT 5087

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage
- Low noise between 30 Hz and 15 kHz



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT 5086	S2P	upon request	upon request	SOT 23
SMBT 5087	S2O	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	50	V
Collector-base voltage	V_{CBO}	50	V
Emitter-base voltage	V_{EBO}	3	V
Collector current	I_C	50	mA
Total power dissipation T_A = 25 °C	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

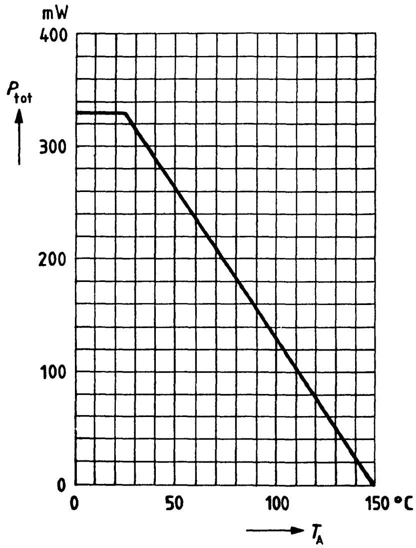
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA		$V_{(BR)CEO}$	50	–	–	V
Collector-base breakdown voltage I_C = 100 μA		$V_{(BR)CBO}$	50	–	–	V
Emitter-base breakdown voltage I_E = 10 μA		$V_{(BR)EBO}$	3	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 10 V, I_E = 0			–	–	10	nA
V_{CB} = 35 V, I_E = 0			–	–	50	nA
V_{CB} = 35 V, I_E = 0, T_A = 150 °C			–	–	20	μA
DC current gain		h_{FE}				
I_C = 100 μA, V_{CE} = 5 V	SMBT 5086		150	–	500	–
	SMBT 5087		250	–	800	–
I_C = 1 mA, V_{CE} = 5 V	SMBT 5086		150	–	–	–
	SMBT 5087		250	–	–	–
I_C = 10 mA, V_{CE} = 5 V	SMBT 5086		150	–	–	–
	SMBT 5087		250	–	–	–
Collector-emitter saturation voltage[1]) I_C = 10 mA; I_B = 1 mA		V_{CEsat}	–	–	0.3	V
Base-emitter saturation voltage[1]) I_C = 10 mA; I_B = 1 mA		V_{BEsat}	–	–	0.85	V

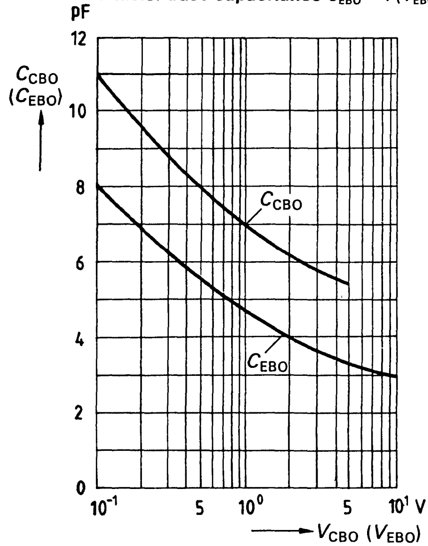
AC characteristics		Symbol	min	typ	max	Unit
Transition frequency I_C = 0.5 mA, V_{CE} = 5 V, f = 100 MHz		f_T	40	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz		C_{obo}	–	–	4	pF
Small-signal current gain		h_{fe}				
I_C = 1 mA; V_{CE} = 5 V, f = 1 kHz	SMBT 5086		150	–	600	–
I_C = 1 mA; V_{CE} = 5 V, f = 1 kHz	SMBT 5087		250	–	900	–
Noise figure		NF				
I_C = 100 μA, V_{CE} = 5 V, f = 1 kHz, R_S = 3 kΩ	SMBT 5086		–	–	3	dB
	SMBT 5087		–	–	2	dB
I_C = 2 mA, V_{CE} = 5 V, f = 10 Hz to 15 kHz, R_S = 10 kΩ	SMBT 5086		–	–	3	dB
	SMBT 5087		–	–	2	dB

[1]) Pulse test: $t \leq$ 300 μs, $D \leq$ 2%

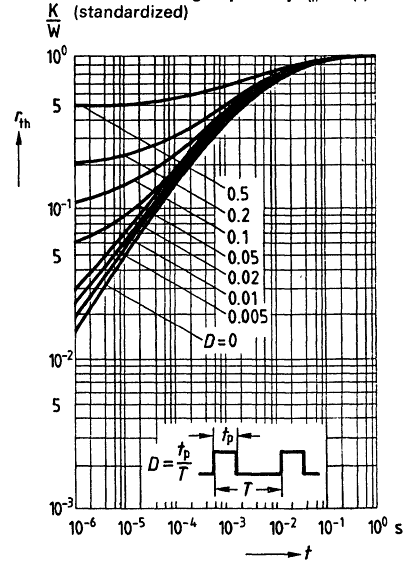
Total power dissipation $P_{tot} = f(T_A)$



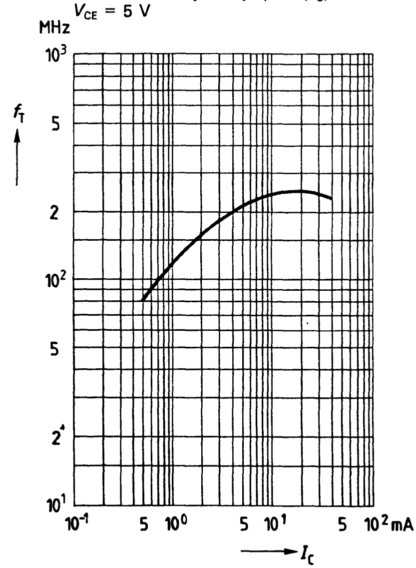
Collector-base capacitance $C_{CBO} = f(V_{CBO})$
Emitter-base capacitance $C_{EBO} = f(V_{EBO})$



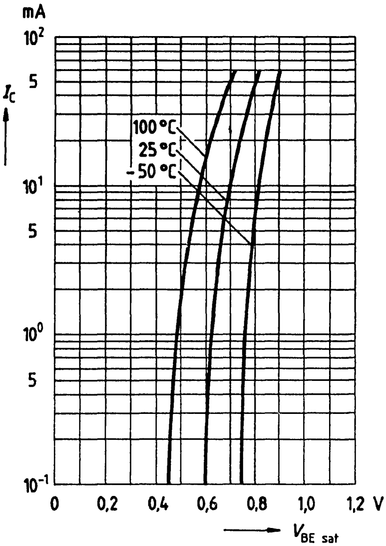
Pulse handling capability $r_{th} = f(t)$
(standardized)



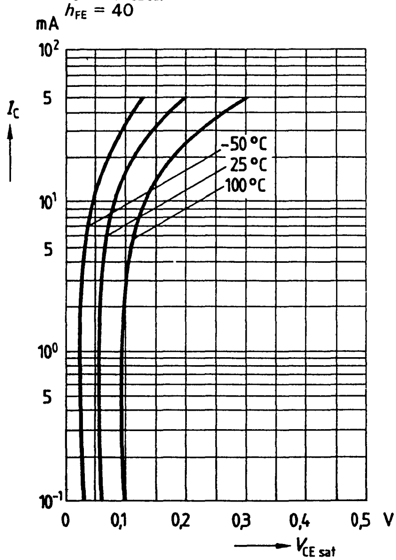
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



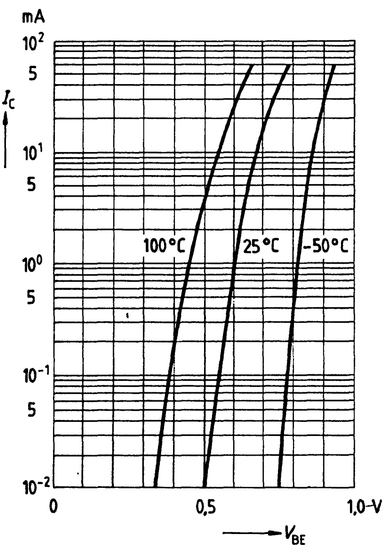
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 40$



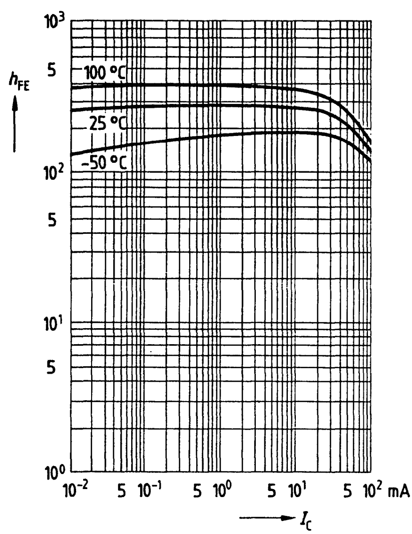
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 40$



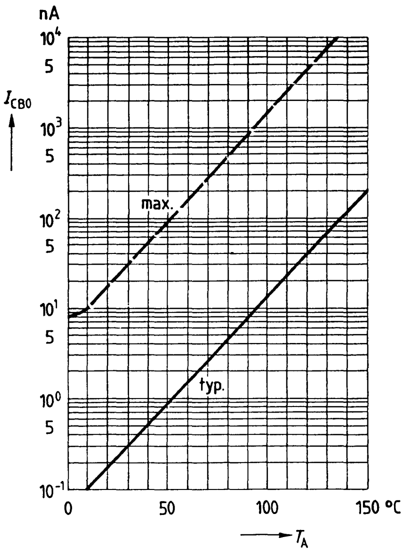
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



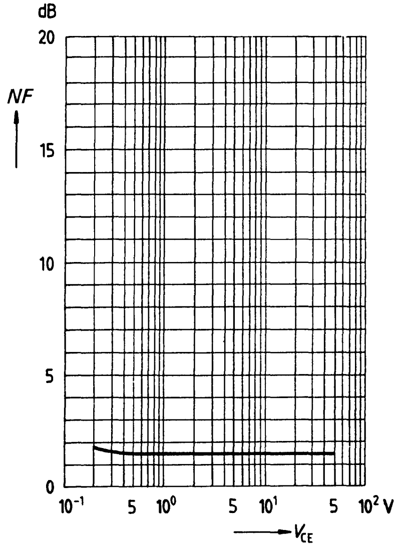
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



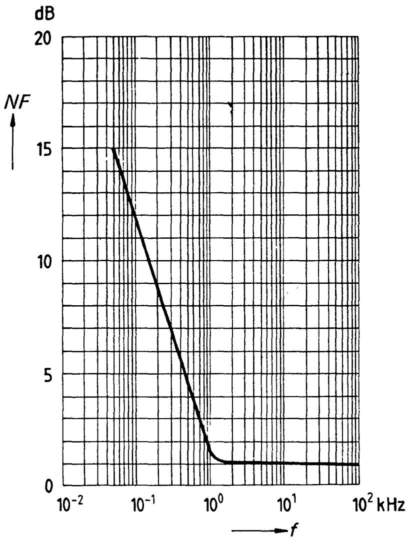
Collector cutoff current $I_{CBO} = f(T_A)$



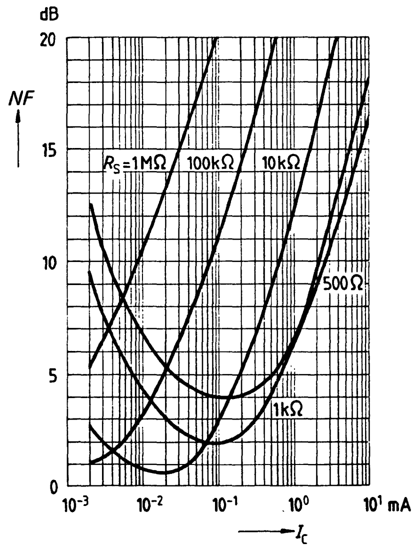
Noise figure $NF = f(V_{CE})$
I_C = 0.2 mA, R_S = 2 kΩ, f = 1 kHz



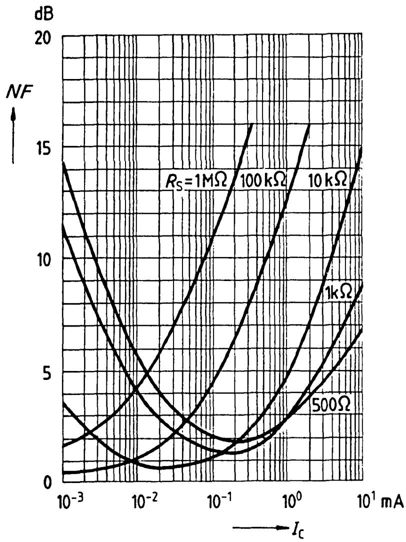
Noise figure $NF = f(f)$
I_C = 0.2 mA, R_S = 2 kΩ, V_{CE} = 5 V



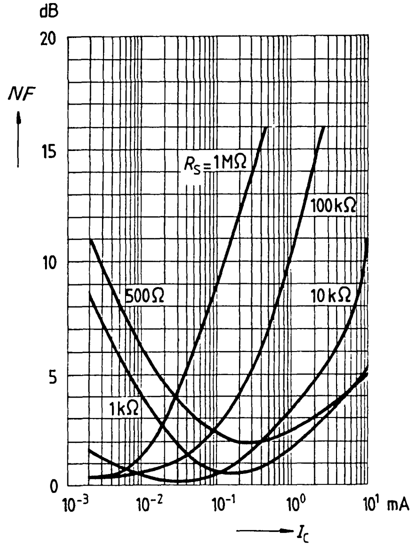
Noise figure $NF = f(I_C)$
V_{CE} = 5 V, f = 120 Hz



Noise figure $NF = f(I_C)$
V_{CE} = 5 V, f = 1 kHz

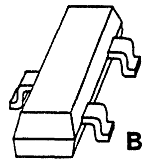


Noise figure $NF = f(I_C)$
V_{CE} = 5 V, f = 10 kHz



NPN Silicon Darlington Transistor — SMBT 6427

- For general amplifier applications
- High collector current
- High current gain



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT 6427	S1V	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	12	V
Collector current	I_C	500	mA
Peak collector current	I_{CM}	800	mA
Total power dissipation T_A = 25 °C	P_{tot}	360	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350	K/W

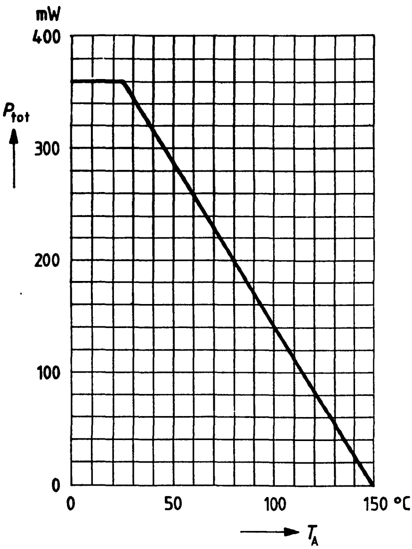
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	40	–	–	V
Collector-base breakdown voltage I_C = 100 µA	$V_{(BR)CBO}$	40	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	12	–	–	V
Collector cutoff current V_{CB} = 30 V, I_E = 0 V_{CB} = 30 V, I_E = 0, T_A = 150 °C	I_{CBO}	 – –	 – –	 50 10	 nA µA
Collector cutoff current V_{CE} = 30 V, I_B = 0	I_{CEO}	–	–	1	µA
Emitter cutoff current V_{EB} = 10 V, I_C = 0	I_{EBO}	–	–	50	nA
DC current gain I_C = 10 mA, V_{CE} = 5 V I_C = 100 mA, V_{CE} = 5 V I_C = 500 mA, V_{CE} = 5 V	h_{FE}	 10 000 20 000 14 000		 100 000 200 000 140 000	 – –
Collector-emitter saturation voltage[1]) I_C = 50 mA; I_B = 0.5 mA I_C = 500 mA; I_B = 0.5 mA	V_{CEsat}	 – –	 – –	 1.2 1.5	 V V
Base-emitter saturation voltage[1]) I_C = 500 mA; I_B = 0.5 mA	V_{BEsat}	–	–	2.0	V
Base-emitter voltage I_C = 50 mA; V_{CE} = 5 V	$V_{BE(on)}$	–	–	1.75	V

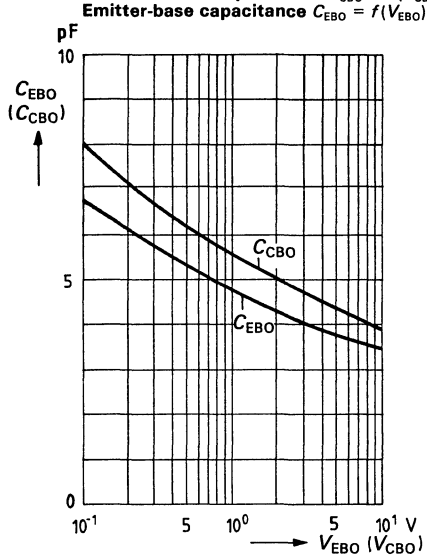
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 5V, f = 100 MHz	f_T	130	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	7	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	25	pF
Noise figure I_C = 1 mA, V_{CE} = 5 V, R_S = 100 kΩ f = 1 kHz to 15 kHz	NF	–	–	10	dB

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2$ %

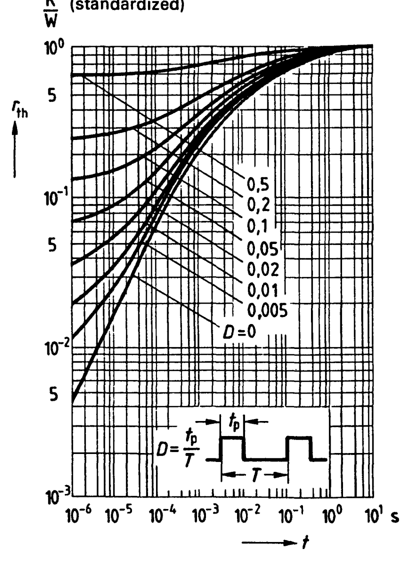
Total power dissipation $P_{tot} = f(T_A)$



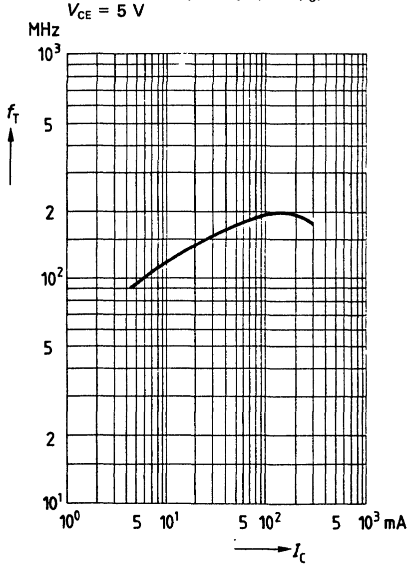
Collector-base capacitance $C_{CBO} = f(V_{CBO})$
Emitter-base capacitance $C_{EBO} = f(V_{EBO})$



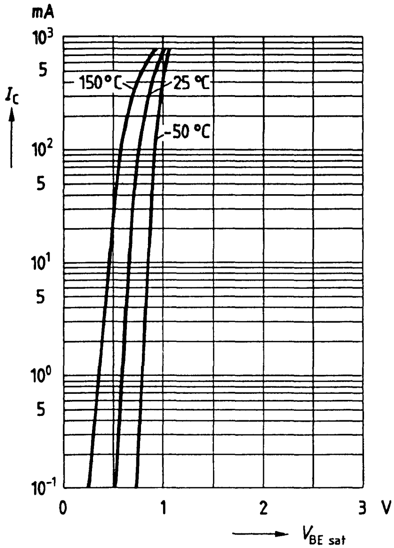
Pulse handling capability $r_{th} = f(t)$
(standardized)



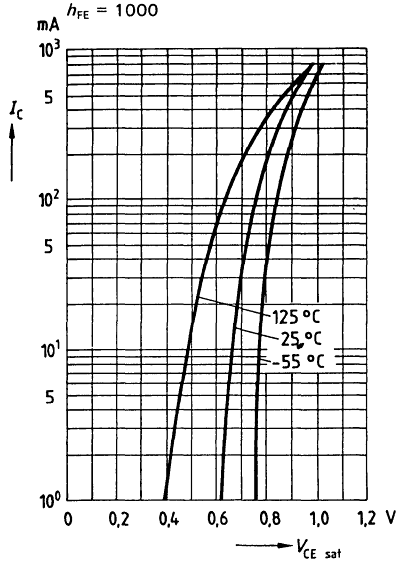
Transition frequency $f_T = f(I_C)$
V_{CE} = 5 V



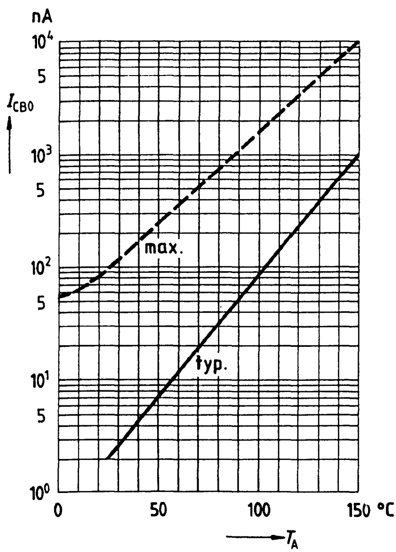
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



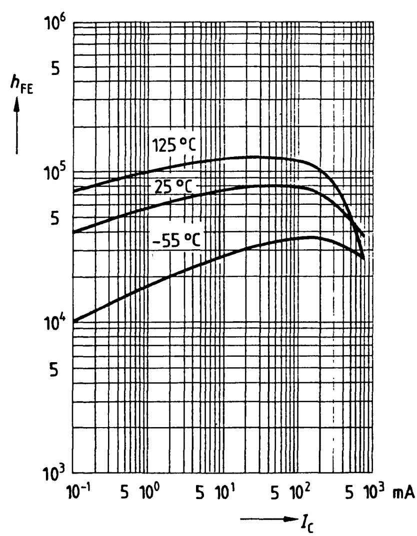
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



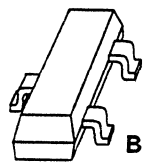
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



NPN Silicon Transistors

SMBT 6428
SMBT 6429

- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT 6428	S1K	upon request	upon request	SOT 23
SMBT 6429	S1L	upon request	upon request	SOT 23

Maximum ratings

Parameter	Symbol	SMBT 6428	SMBT 6429	Unit
Collector-emitter voltage	V_{CEO}	50	45	V
Collector-base voltage	V_{CBO}	60	55	V
Emitter-base voltage	V_{EBO}	6		V
Collector current	I_C	200		mA
Total power dissipation T_A = 25 °C	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	–65...+150		°C
Thermal resistance				
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

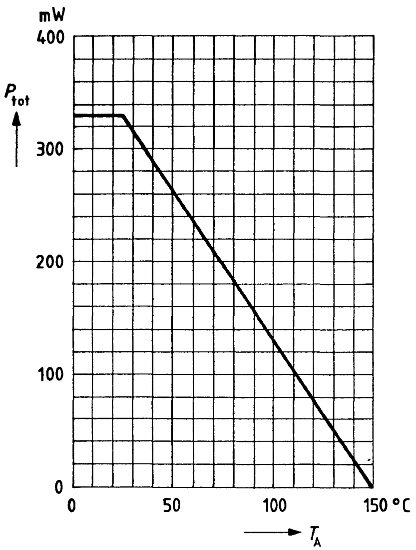
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
I_C = 1 mA	SMBT 6428		50	–	–	V
	SMBT 6429		45	–	–	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
I_C = 10 µA	SMBT 6428		60	–	–	V
	SMBT 6429		55	–	–	V
Emitter-base breakdown voltage I_E = 1 µA		$V_{(BR)EBO}$	6	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 30 V, I_E = 0			–	–	10	nA
V_{CB} = 30 V, I_E = 0, T_A = 150 °C			–	–	10	µA
Collector cutoff current V_{CE} = 30 V, I_B = 0		I_{CEO}	–	–	100	nA
Emitter cutoff current V_{EB} = 5 V, I_C = 0		I_{EBO}	–	–	10	nA
DC current gain		h_{FE}				
I_C = 10 µA, V_{CE} = 5 V	SMBT 6428		250			–
	SMBT 6429		500			–
I_C = 100 µA, V_{CE} = 5 V	SMBT 6428		250		650	–
	SMBT 6429		500		1250	–
I_C = 1 mA, V_{CE} = 5 V	SMBT 6428		250			–
	SMBT 6429		500			–
I_C = 10 mA, V_{CE} = 5 V	SMBT 6428		250			–
	SMBT 6429		500			–
Collector-emitter saturation voltage[1])		V_{CEsat}				
I_C = 10 mA; I_B = 0.5 mA			–	–	0.2	V
I_C = 100 mA; I_B = 5 mA			–	–	0.6	V
Base-emitter voltage I_C = 1 mA; V_{CE} = 5 V		$V_{BE(on)}$	0.56	–	0.66	V

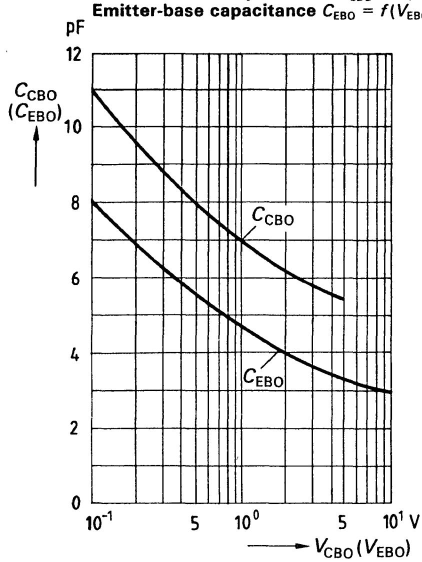
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 5 mA, V_{CE} = 5 V, f = 100 MHz	f_T	100	–	700	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	3	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	15	pF

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2$%

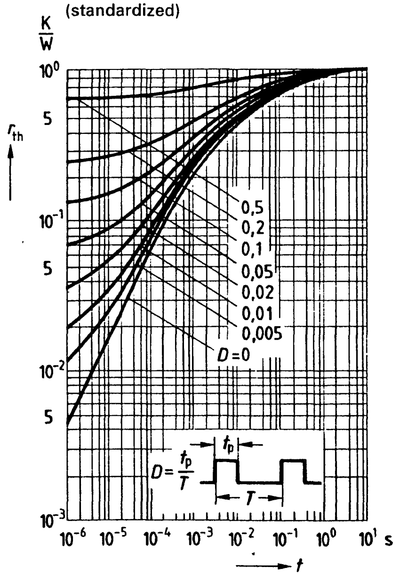
Total power dissipation $P_{tot} = f(T_A)$



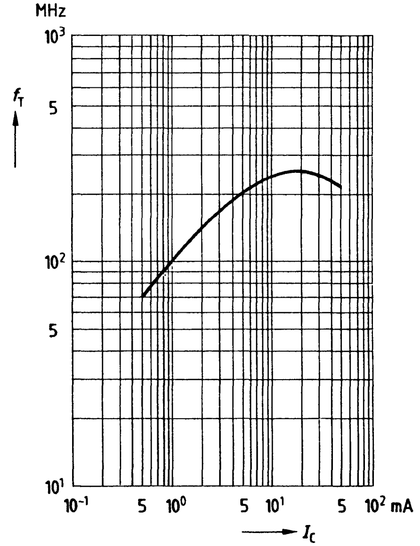
Collector-base capacitance $C_{CBO} = f(V_{CBO})$
Emitter-base capacitance $C_{EBO} = f(V_{EBO})$



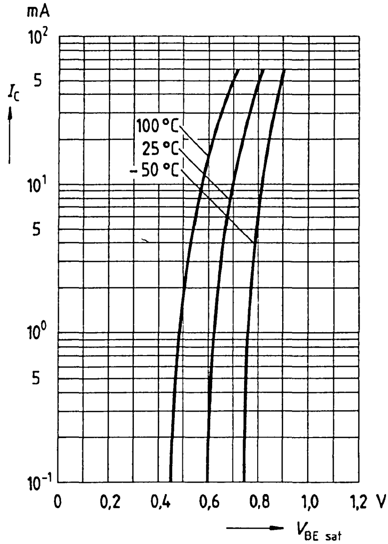
Pulse handling capability $r_{th} = f(t)$
(standardized)



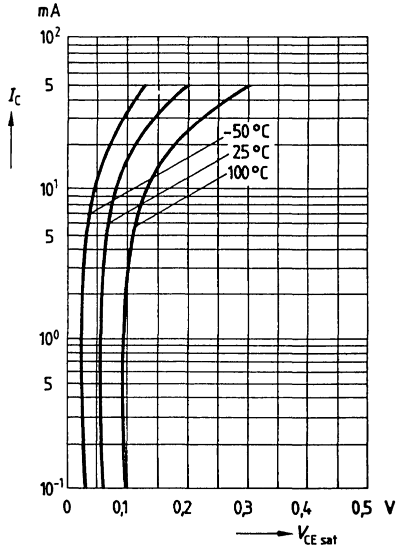
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



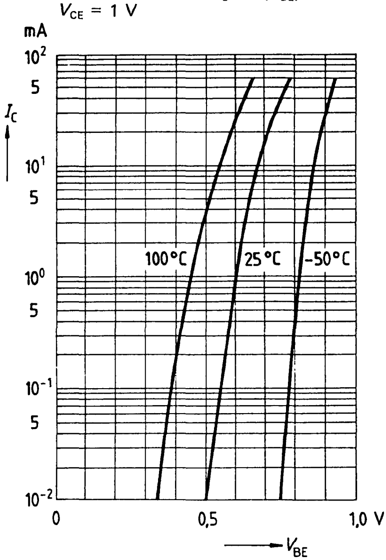
Base-emitter saturation voltage
$I_C = f(V_{BE\,sat})$
$h_{FE} = 40$



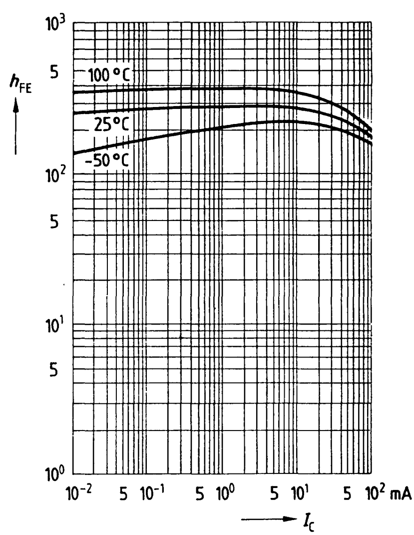
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 40$



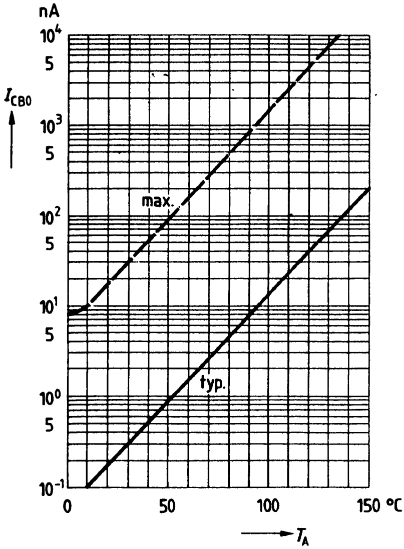
Collector current $I_C = f(V_{BE})$
$V_{CE} = 1$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V

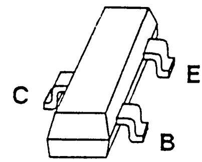


Collector cutoff current $I_{CBO} = f(T_A)$



NPN Silicon AF Transistors

- High break down voltage
- Low collector-emitter saturation voltage
- Complementary types: SMBTA 55, SMBTA 56 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 05	S1H	Q68000–A6402	Q68000–A3430	SOT 23
SMBTA 06	S1G	Q68000–A6403	Q68000–A3428	SOT 23

Maximum ratings

Parameter	Symbol	SMBTA 05	SMBTA 06	Unit
Collector-emitter voltage	V_{CEO}	60	80	V
Collector-base voltage	V_{CBO}	60	80	V
Emitter-base voltage	V_{EBO}	4		V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

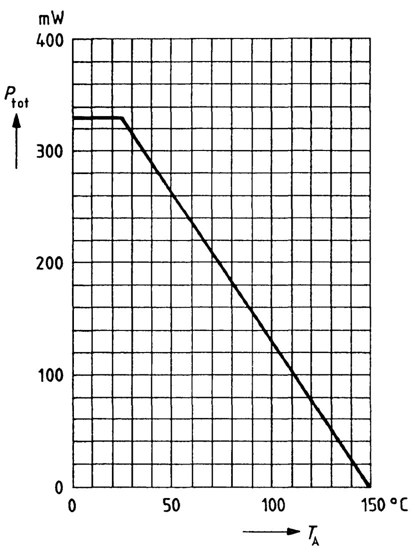
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

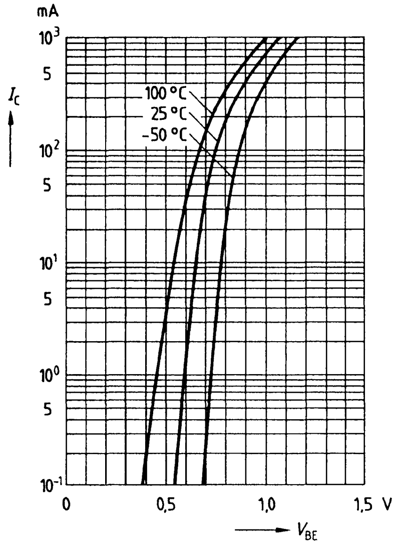
DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
$I_C = 1$ mA	SMBTA 05		60	–	–	V
	SMBTA 06		80	–	–	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
$I_C = 100$ µA	SMBTA 05		60	–	–	V
	SMBTA 06		80	–	–	V
Emitter-base breakdown voltage $I_E = 10$ µA		$V_{(BR)EBO}$	4	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 60$ V	SMBTA 05		–	–	100	nA
$V_{CB} = 80$ V	SMBTA 06		–	–	100	nA
$V_{CB} = 60$ V, $T_A = 150\,°C$	SMBTA 05		–	–	20	µA
$V_{CB} = 80$ V, $T_A = 150\,°C$	SMBTA 06		–	–	20	µA
Collector cutoff current $V_{CE} = 60$ V		I_{CEO}	–	–	100	nA
DC current gain[1]		h_{FE}				
$I_C = 10$ mA, $V_{CE} = 1$ V			50	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V			50	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 10$ mA		V_{CEsat}	–	–	0,25	V
Base-emitter saturation voltage[1] $I_C = 100$ mA, $V_{CE} = 1$ V		V_{BEsat}	–	–	1,2	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	12	–	pF

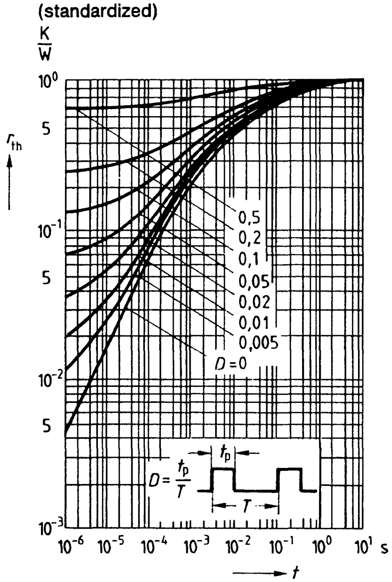
Total power dissipation $P_{tot} = f(T_A)$



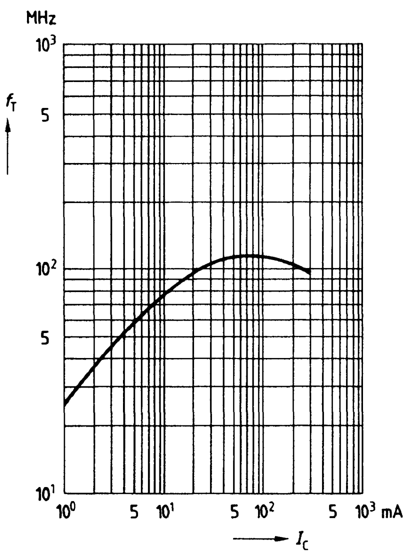
Collector current $I_C = f(V_{BE\,sat})$



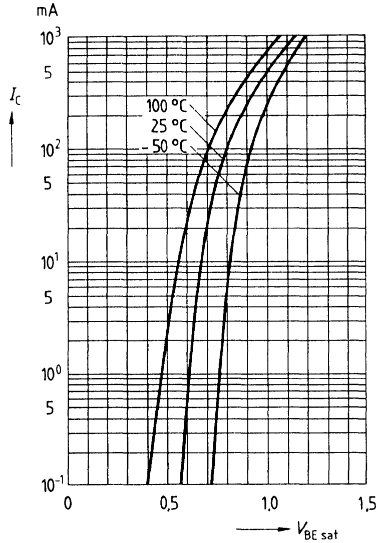
Pulse handling capability $r_{th} = f(t)$
(standardized)



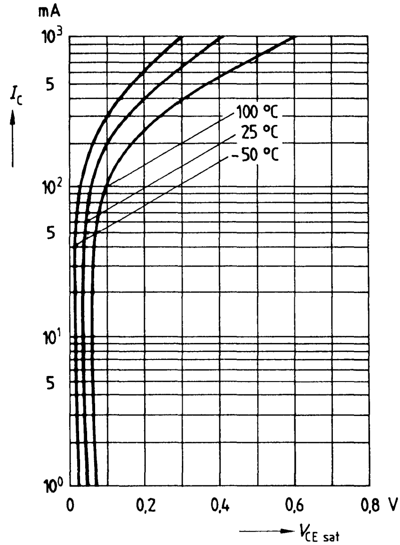
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\,V$



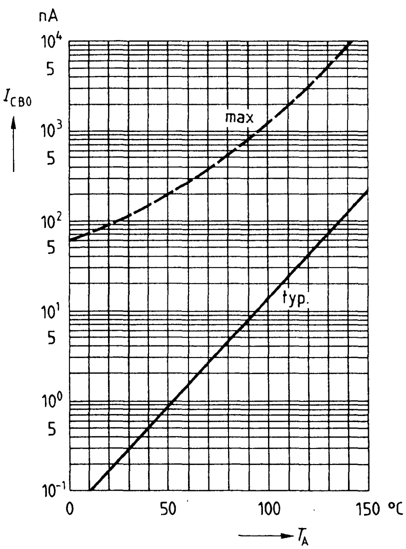
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 10$



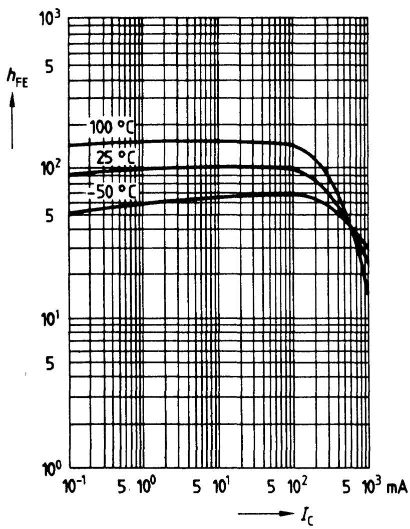
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 10$



Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



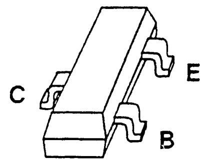
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN Silicon Darlington Transistors

SMBTA 13
SMBTA 14

- High DC current gain
- High collector current
- Collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 13	S1M	Q68000–A4331	Q68000–A6475	SOT 23
SMBTA 14	S1N	Q68000–A4332	Q68000–A6476	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	30	V
Collector-base voltage	V_{CBO}	30	V
Emitter-base voltage	V_{EBO}	10	V
Collector current	I_C	300	mA
Peak collector current	I_{CM}	500	mA
Base current	I_B	100	mA
Peak base current	I_{BM}	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \cdots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

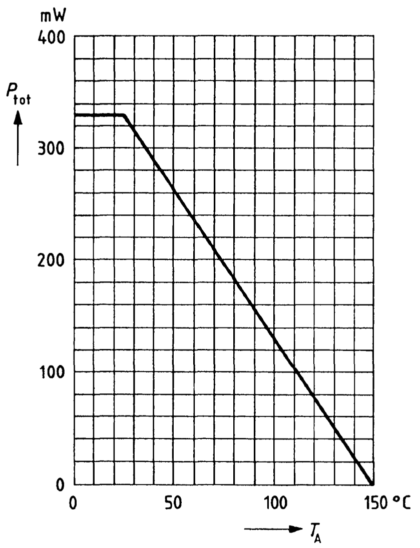
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

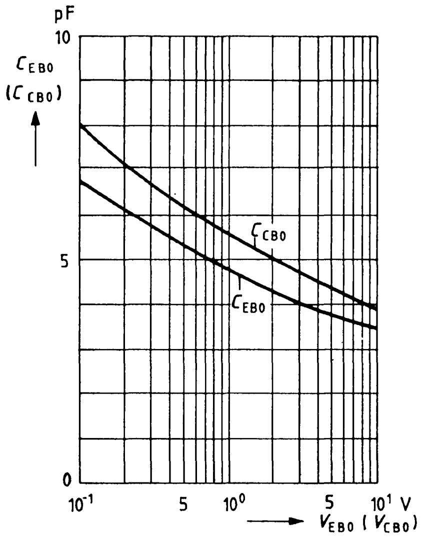
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CE0}$	30	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CB0}$	30	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EB0}$	10	–	–	V
Collector cutoff current $V_{CB} = 30\ V$	I_{CB0}	–	–	100	nA
Emitter cutoff current $V_{EB} = 10\ V$	I_{EB0}	–	–	100	nA
DC current gain $I_C = 10\ mA$, $V_{CE} = 5\ V$[1]	h_{FE}				
SMBTA 13		5000	–	–	–
SMBTA 14		10000	–	–	–
$I_C = 100\ mA$, $V_{CE} = 5\ V$[1]					
SMBTA 13		10000	–	–	–
SMBTA 14		20000	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100\ mA$, $I_B = 0{,}1\ mA$	V_{CEsat}	–	–	1,5	V
Base-emitter saturation voltage[1] $I_C = 100\ mA$, $I_B = 0{,}1\ mA$	V_{BEsat}	–	–	2	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50\ mA$, $V_{CE} = 5\ V$, $f = 20\ MHz$	f_T	125	–	–	MHz

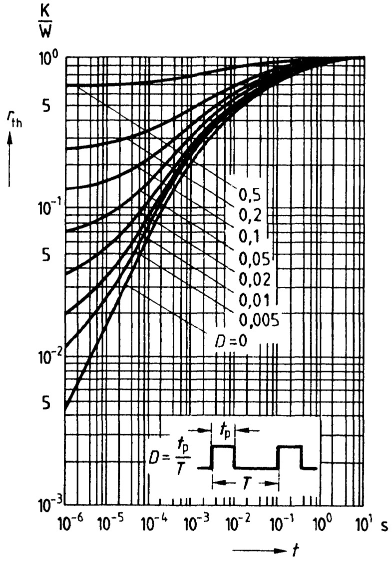
Total power dissipation $P_{tot} = f(T_A)$



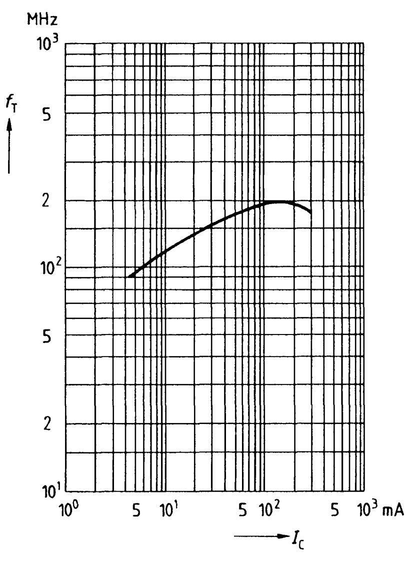
Capacitance $C_{CB0} = f(V_{CB0})$
$C_{EB0} = f(V_{EB0})$
$f = 1$ MHz



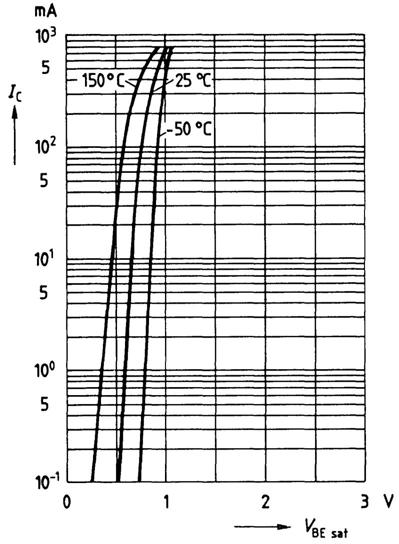
Pulse handling capability $r_{th} = f(t)$
(standardized)



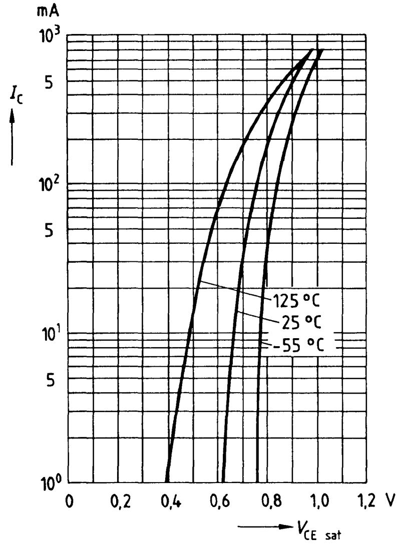
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 20$ MHz



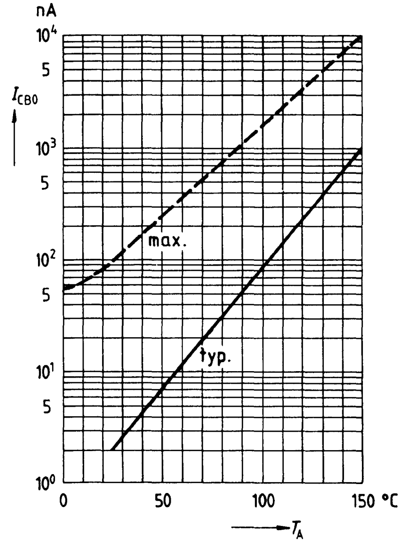
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 1000$



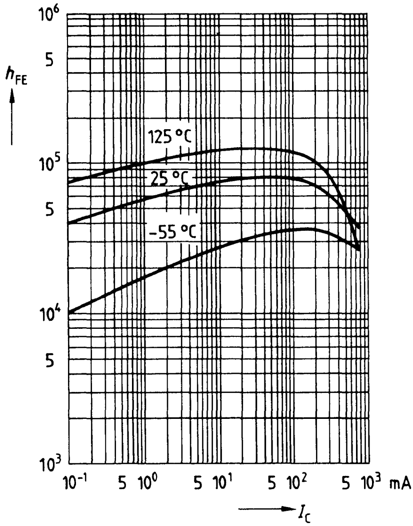
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 1000$



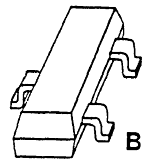
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30\ V$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5\ V$



- High DC current gain
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 20	S1C	Q68000–A4333	Q68000–A6477	SOT 23

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	100	mA
Peak collector current	I_{CM}	200	mA
Peak base current	I_{BM}	200	mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	$-65 \dots +150$	°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

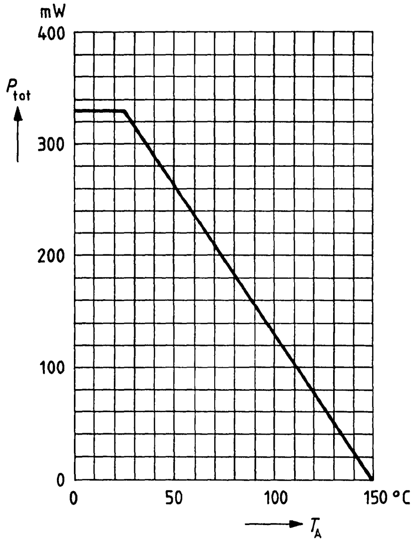
Electrical characteristics

at $T_A = 25\,°C$, unless otherwise specified

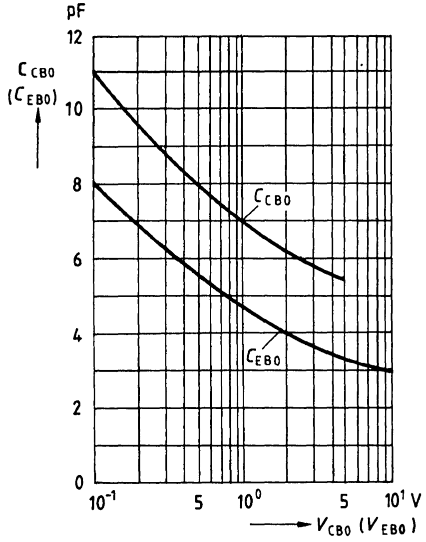
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$	40	–	–	V
Emitter-base breakdown voltage $I_E = 100$ µA	$V_{(BR)\,EBO}$	4	–	–	V
Collector cutoff current $V_{CB} = 30$ V $V_{CB} = 30$ V, $T_A = 150\,°C$	I_{CBO}	 – –	 – –	 100 20	 nA µA
Emitter cutoff current $V_{EB} = 4$ V	I_{EBO}	–	–	20	nA
DC current gain $I_C = 5$ mA, $V_{CE} = 10$ V	h_{FE}	40	–	400	–
Collector-emitter saturation voltage[1] $I_C = 10$ mA, $I_B = 1$ mA	V_{CEsat}	–	–	0,25	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 100$ MHz	f_T	125	–	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	–	4	pF

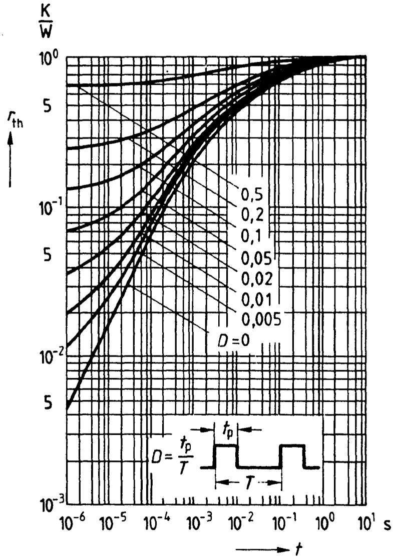
Total power dissipation $P_{tot} = f(T_A)$



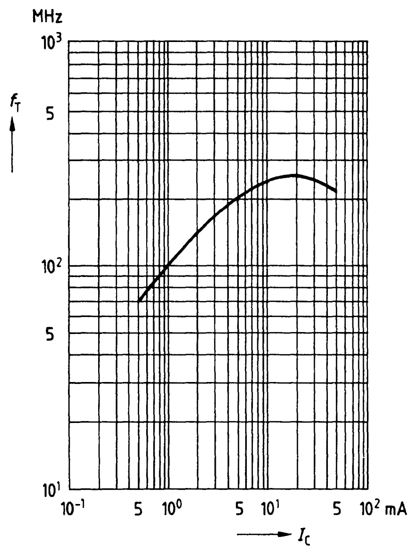
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$
$f = 1$ MHz



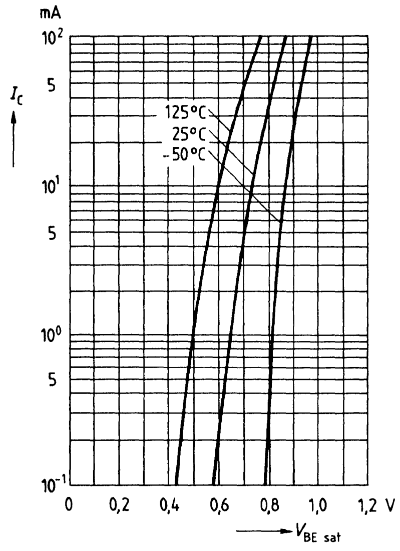
Pulse handling capability $r_{th} = f(t)$
(standardized)



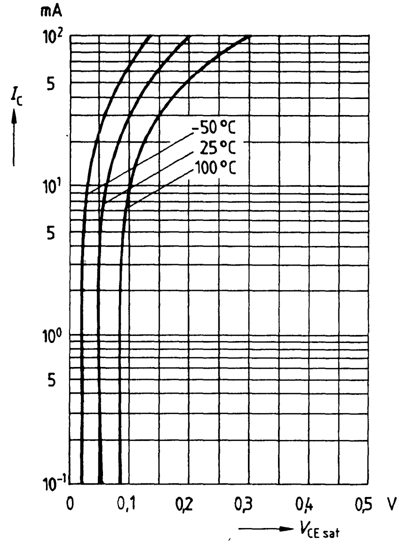
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V, $f = 100$ MHz



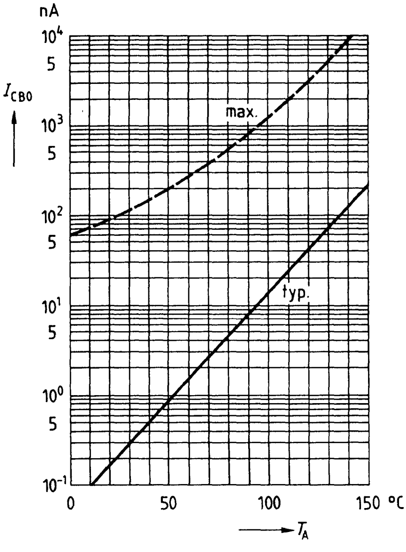
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 20$



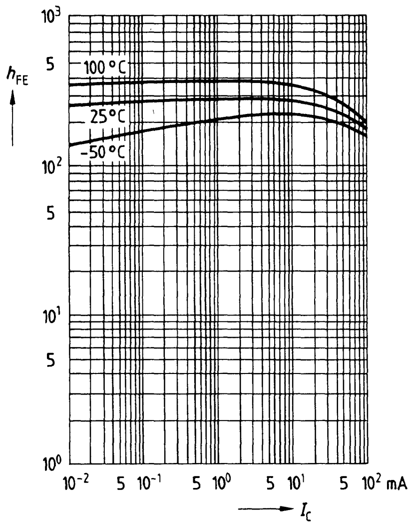
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 20$



Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 30$ V



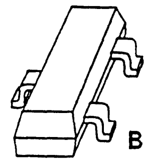
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



NPN Silicon Transistors for High Voltages

SMBTA 42
SMBTA 43

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: SMBTA 92, SMBTA 93 (PNP)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 42	S1D	Q68000–A4329	Q68000–A6478	SOT 23
SMBTA 43	S1E	Q68000–A4330	Q68000–A6482	SOT 23

Maximum ratings

Parameter	Symbol	SMBTA 42	SMBTA 43	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	6		V
Collector current	I_C	500		mA
Base current	I_B	100		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

Electrical characteristics

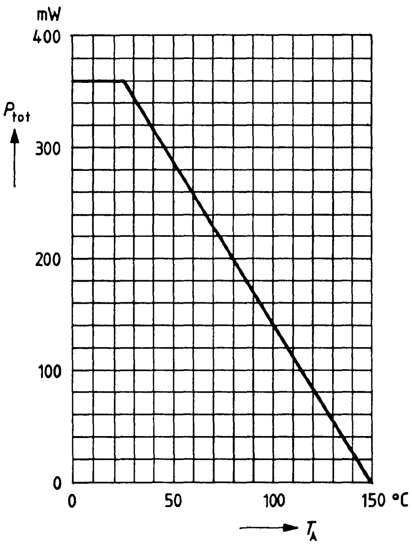
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA		$V_{(BR)\,CEO}$				
	SMBTA 42		300	–	–	V
	SMBTA 43		200	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$		$V_{(BR)\,CBO}$				
	SMBTA 42		300	–	–	V
	SMBTA 43		200	–	–	V
Emitter-base breakdown voltage $I_E = 100\ \mu A$		$V_{(BR)\,EBO}$	6	–	–	V
Collector cutoff current		I_{CBO}				
$V_{CB} = 200$ V	SMBTA 42		–	–	100	nA
$V_{CB} = 160$ V	SMBTA 43		–	–	100	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$	SMBTA 42		–	–	20	μA
$V_{CB} = 160$ V, $T_A = 150\,°C$	SMBTA 43		–	–	20	μA
Emitter cutoff current $V_{EB} = 3$ V		I_{EBO}	–	–	100	nA
DC current gain		h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V			25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V¹)			40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V¹)	SMBTA 42		40	–	–	–
	SMBTA 43		40	–	–	–
Collector-emitter saturation voltage¹) $I_C = 20$ mA, $I_B = 2$ mA		V_{CEsat}				
	SMBTA 42		–	–	0,5	V
	SMBTA 43		–	–	0,4	V
Base-emitter saturation voltage¹) $I_C = 20$ mA, $I_B = 2$ mA		V_{BEsat}	–	–	0,9	V

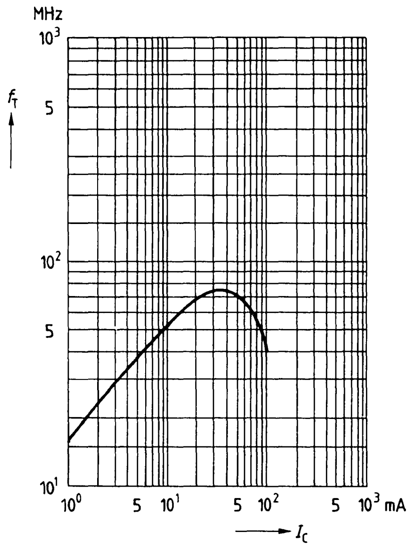
AC characteristics		Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz		f_T	50	–	–	MHz
Output capacitance $V_{CB} = 20$ V, $f = 1$ MHz		C_{ob}				
	SMBTA 42		–	–	3	pF
	SMBTA 43		–	–	4	pF

¹) Pulse test: $t \leq 300\ \mu s$, D = 2%.

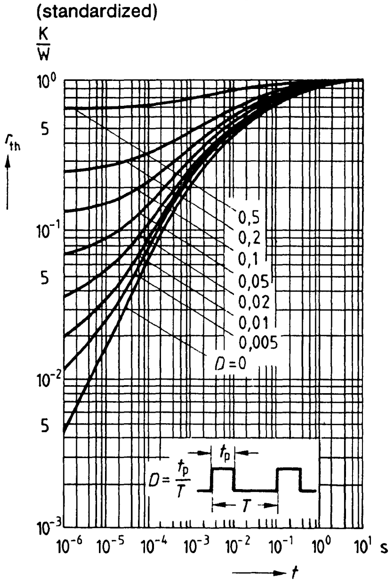
Total power dissipation $P_{tot} = f(T_A)$



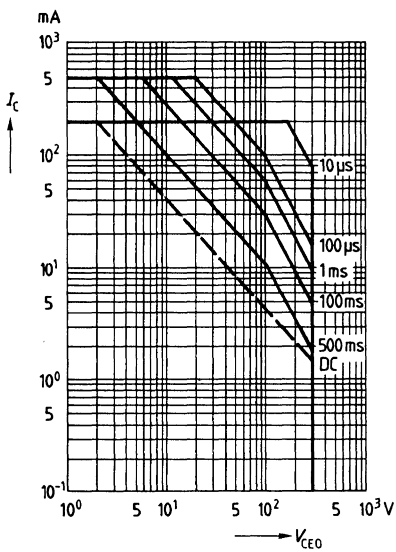
Transition frequency $f_T = f(I_C)$
$V_{CE} = 10$ V, $f = 100$ MHz



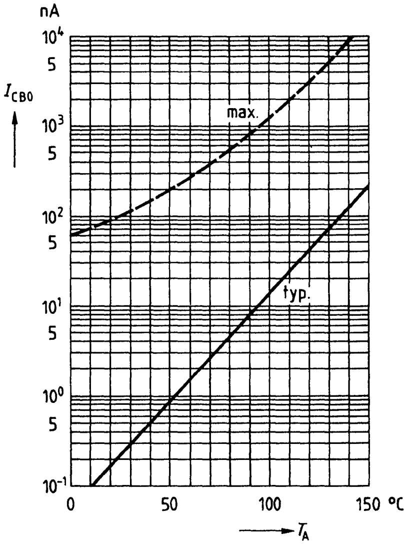
Pulse handling capability $r_{th} = f(t)$
(standardized)



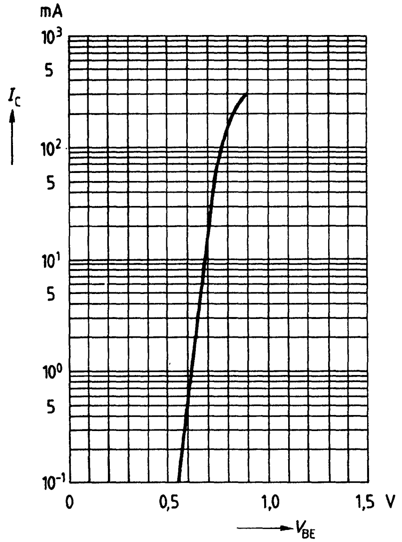
Operating range $I_C = f(V_{CE0})$
$T_A = 25\,°C$, $D = 0$



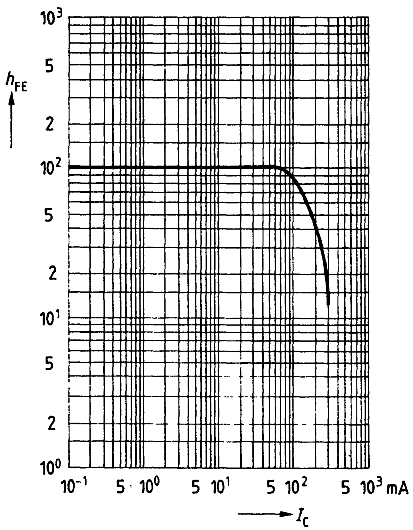
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = 160$ V



Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



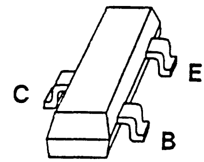
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP Silicon AF Transistors

SMBTA 55
SMBTA 56

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: SMBTA 05, SMBTA 06 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 55	S2H	Q68000–A7420	Q68000–A3386	SOT 23
SMBTA 56	S2G	Q68000–A7421	Q68000–A2882	SOT 23

Maximum ratings

Parameter	Symbol	SMBTA 55	SMBTA 56	Unit
Collector-emitter voltage	V_{CEO}	60	80	V
Collector-base voltage	V_{CBO}	60	80	V
Emitter-base voltage	V_{EBO}	4		V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	1		A
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	330		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance Junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375		K/W

Electrical characteristics

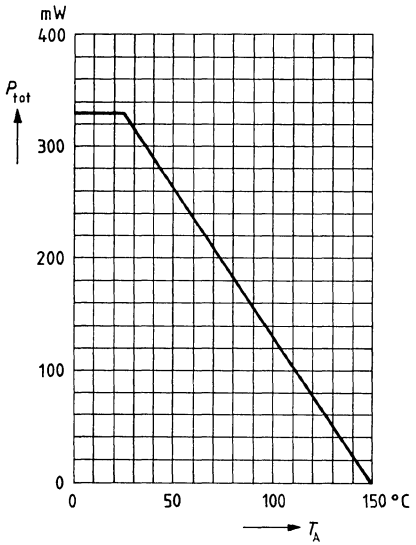
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CE0}$				
SMBTA 55		60	–	–	V
SMBTA 56		80	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$	$V_{(BR)\,CB0}$				
SMBTA 55		60	–	–	V
SMBTA 56		80	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EB0}$	4	–	–	V
Collector cutoff current	I_{CB0}				
$V_{CB} = 60$ V SMBTA 55		–	–	100	nA
$V_{CB} = 80$ V SMBTA 56		–	–	100	nA
$V_{CB} = 60$ V, $T_A = 150\,°C$ SMBTA 55		–	–	20	µA
$V_{CB} = 80$ V, $T_A = 150\,°C$ SMBTA 56		–	–	20	µA
Collector cutoff current $V_{CE} = 60$ V	I_{CE0}	–	–	100	nA
DC current gain[1]	h_{FE}				
$I_C = 10$ mA, $V_{CE} = 1$ V		50	–	–	–
$I_C = 100$ mA, $V_{CE} = 1$ V		50	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100$ mA, $I_B = 10$ mA	$V_{CE(sat)}$	–	–	0,25	V
Base-emitter saturation voltage[1] $I_C = 100$ mA, $V_{CE} = 1$ V	$V_{BE(sat)}$	–	–	1,2	V

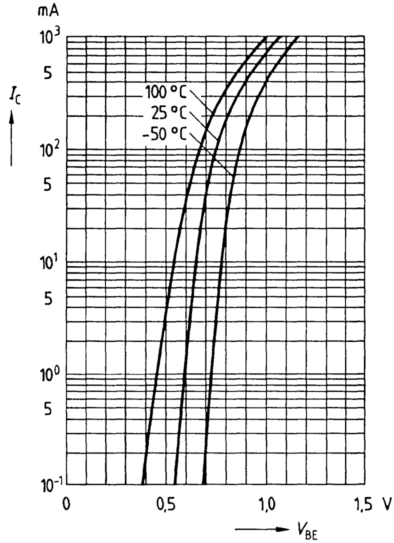
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 20$ mA, $V_{CE} = 5$ V, $f = 20$ MHz	f_T	–	100	–	MHz
Output capacitance $V_{CB} = 10$ V, $f = 1$ MHz	C_{ob}	–	12	–	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

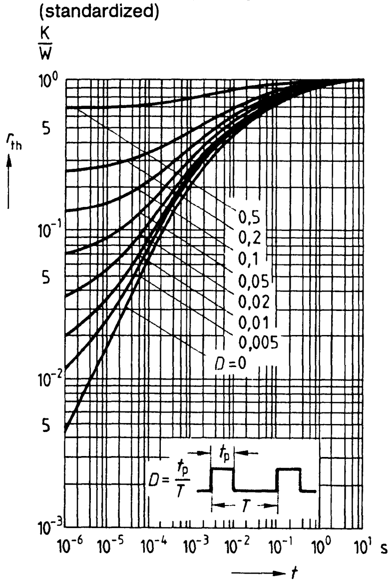
Total power dissipation $P_{tot} = f(T_A)$



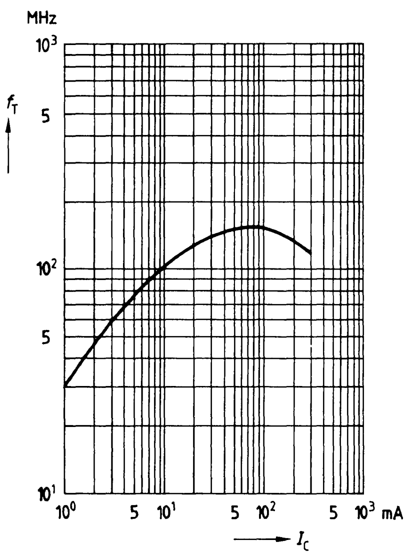
Collector current $I_C = f(V_{BE\,sat})$
$V_{CE} = 1\ V$



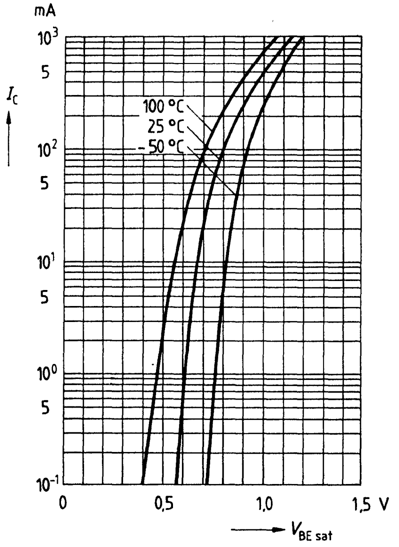
Pulse handling capability $r_{th} = f(t)$
(standardized)



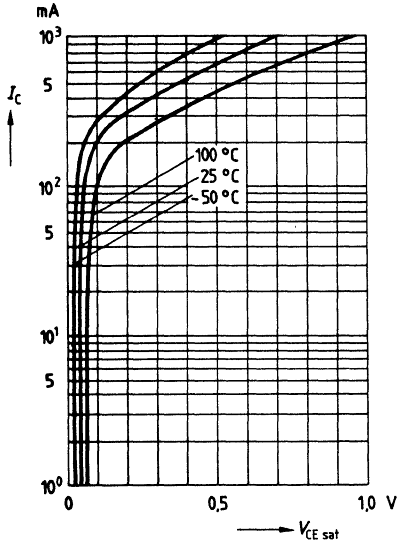
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5\ V$



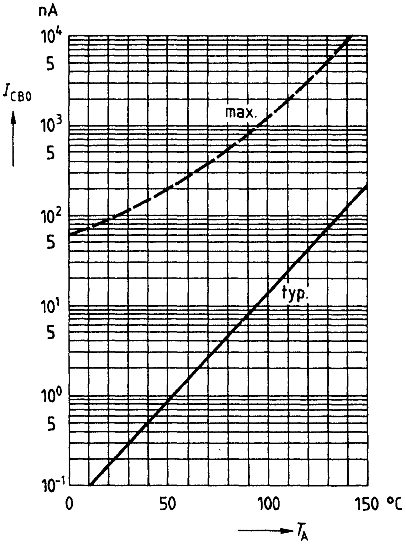
Base-emitter saturation voltage $V_{BE\,sat} = f(I_C)$
$h_{FE} = 10$



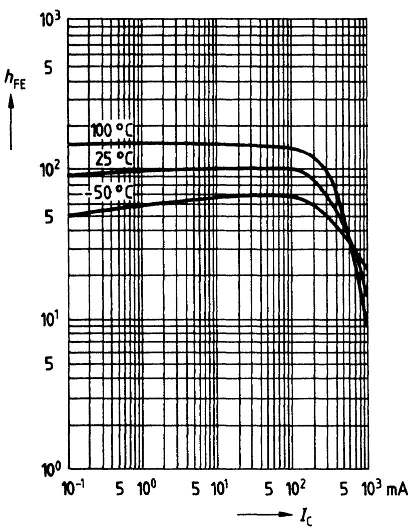
Collector-emitter saturation voltage
$V_{CE\,sat} = f(I_C)$
$h_{FE} = 10$



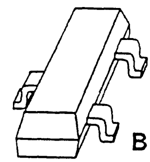
Collector cutoff current $I_{CB0} = f(T_A)$
$V_{CB} = V_{CE\,max}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 1$ V



- High collector current
- High DC current gain



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 63	S2U	Q68000–A6419	Q68000–A2625	SOT 23
SMBTA 64	S2V	Q68000–A6420	Q68000–A2485	SOT 23

Maximum ratings

Parameter	Symbol	SMBTA 63	SMBTA 64	Unit
Collector-emitter voltage	V_{CEO}	30	30	V
Collector-base voltage	V_{CBO}	30	30	V
Emitter-base voltage	V_{EBO}	10	10	V
Collector current	I_C	500		mA
Peak collector current	I_{CM}	800		mA
Base current	I_B	100		mA
Peak base current	I_{BM}	200		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

Electrical characteristics

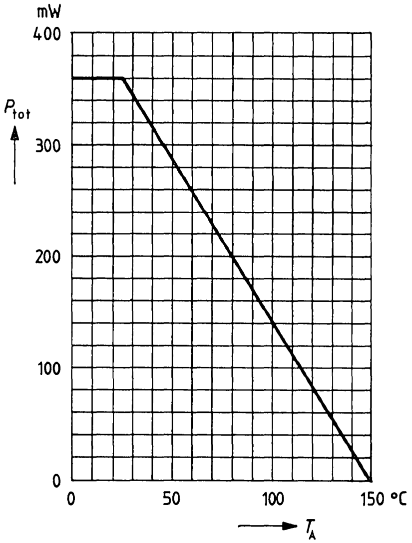
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CEO}$	30	–	–	V
Collector-base breakdown voltage $I_C = 10\ \mu A$	$V_{(BR)\,CBO}$	30	–	–	V
Emitter-base breakdown voltage $I_E = 10\ \mu A$	$V_{(BR)\,EBO}$	10	–	–	V
Collector cutoff current $V_{CB} = 30\ V$	I_{CBO}	–	–	100	nA
Emitter cutoff current $V_{EB} = 10\ V$	I_{EBO}	–	–	100	nA
DC current gain[1] $I_C = 10\ mA$, $V_{CE} = 5\ V$	h_{FE}				
SMBTA 63		5000	–	–	–
SMBTA 64		10000	–	–	–
$I_C = 100\ mA$, $V_{CE} = 5\ V$					
SMBTA 63		10000	–	–	–
SMBTA 64		20000	–	–	–
Collector-emitter saturation voltage[1] $I_C = 100\ mA$, $I_B = 0{,}1\ mA$	V_{CEsat}	–	–	1,5	V
Base-emitter saturation voltage[1] $I_C = 100\ mA$, $I_B = 0{,}1\ mA$	V_{BEsat}	–	–	2	V

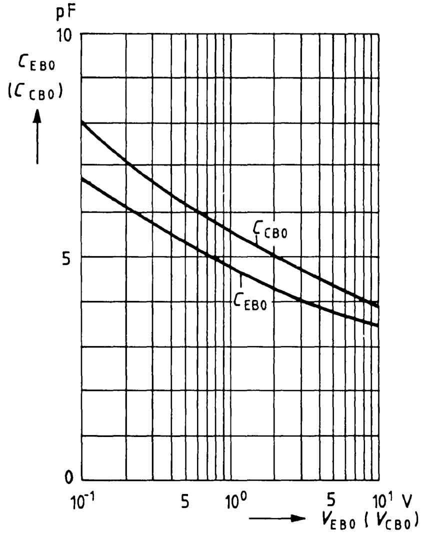
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 50\ mA$, $V_{CE} = 5\ V$, $f = 20\ MHz$	f_T	125	–	–	MHz

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

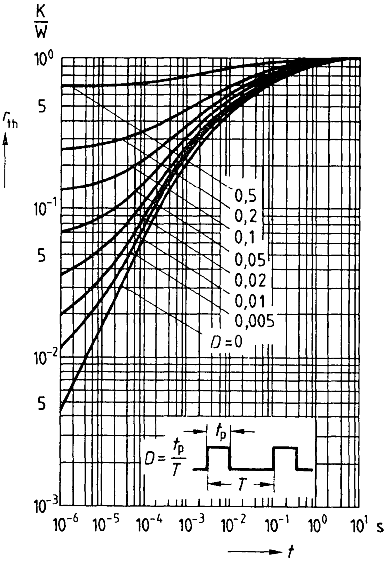
Total power dissipation $P_{tot} = f(T_A)$



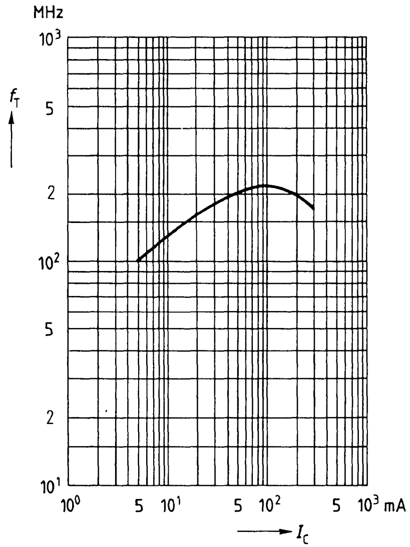
Collector-base capacitance $C_{CB0} = f(V_{CB0})$
Emitter-base capacitance $C_{EB0} = f(V_{EB0})$
$f = 1$ MHz



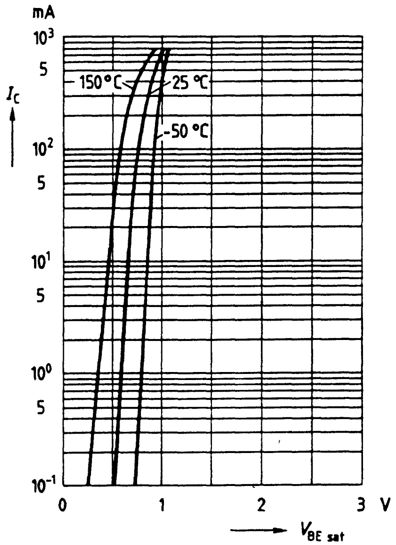
Pulse handling capability $r_{th} = f(t)$
(standardized)



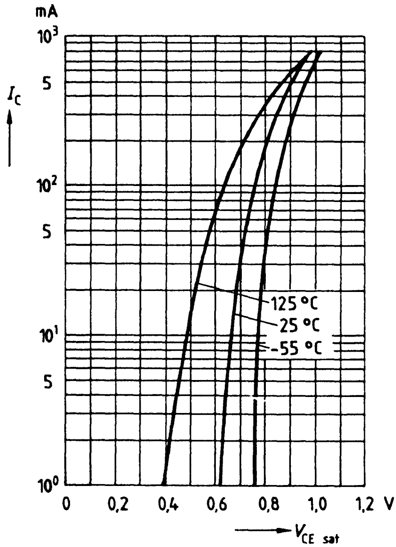
Transition frequency $f_T = f(I_C)$
$V_{CE} = 5$ V



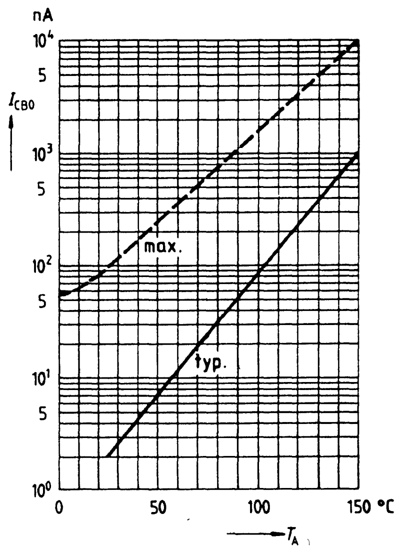
Base-emitter saturation voltage $I_C = f(V_{BE\,sat})$
$h_{FE} = 1000$



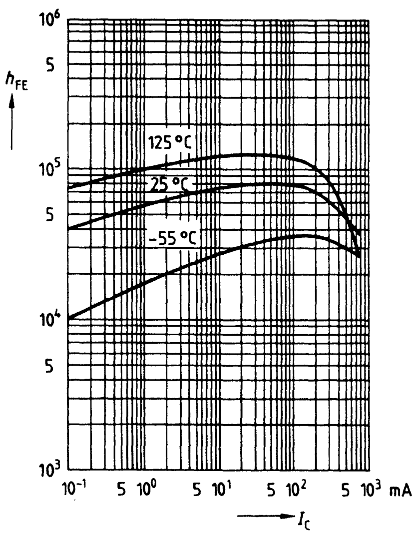
Collector-emitter saturation voltage
$I_C = f(V_{CE\,sat})$
$h_{FE} = 1000$



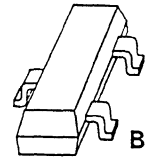
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = V_{CE\,max}$



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 5$ V



- For AF input stages and driver applications
- High current gain
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SMBT A 70	S2C	upon request	upon request	SOT 23

Maximum ratings

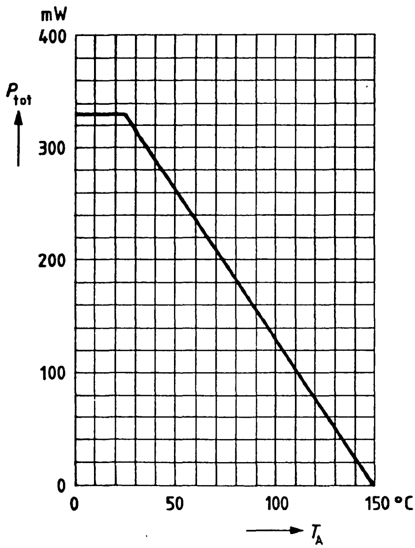
Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Emitter-base voltage	V_{EBO}	4	V
Collector current	I_C	100	mA
Peak collector current	I_{CM}	200	mA
Peak base current	I_{BM}	100	mA
Total power dissipation T_A = 25 °C	P_{tot}	330	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 375	K/W

Electrical Characteristics
at T_A = 25 °C, unless otherwise specified

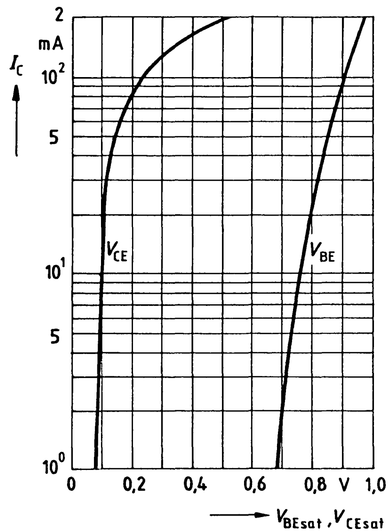
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	40	–	–	V
Emitter-base breakdown voltage I_E = 100 µA	$V_{(BR)EBO}$	4	–	–	V
Collector cutoff current V_{CB} = 30 V, I_E = 0 V_{CB} = 30 V, I_E = 0, T_A = 150 °C	I_{CBO}	 – –	 – –	 100 20	 nA µA
Emitter cutoff current V_{EB} = 4 V, I_C = 0	I_{EBO}	–	–	20	nA
DC current gain I_C = 5 mA, V_{CE} = 10 V	h_{FE}	40	–	400	–
Collector-emitter saturation voltage[1]) I_C = 10 mA; I_B = 1 mA	V_{CEsat}	–	–	0.25	V

AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 5 mA, V_{CE} = 10 V, f = 100 MHz	f_T	125	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	4	pF

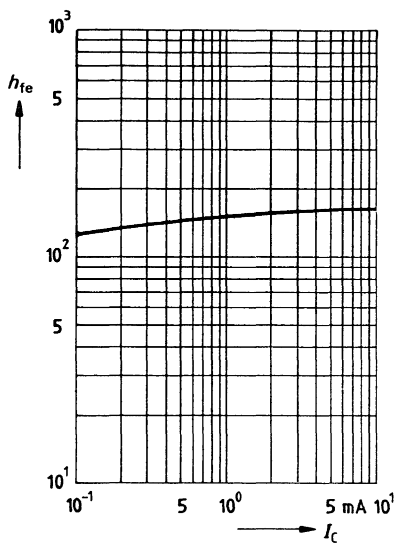
Total power dissipation $P_{tot} = f(T_A)$



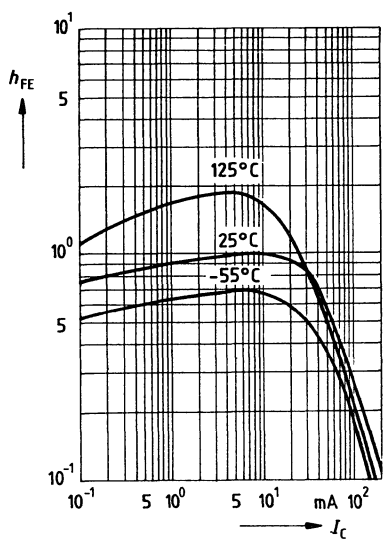
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



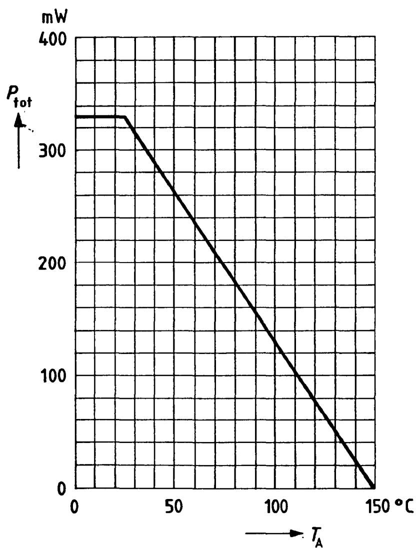
Small-signal current gain $h_{fe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



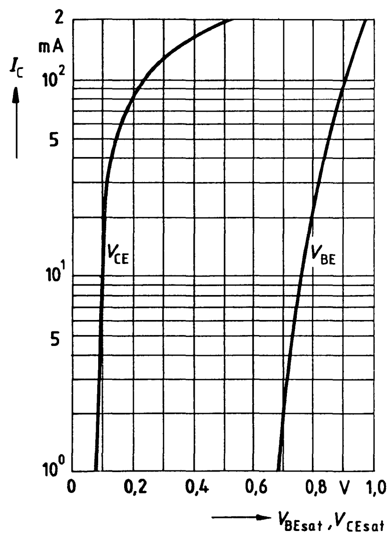
DC current gain $h_{FE} = f(I_C)$
(standardized), V_{CE} = 1 V



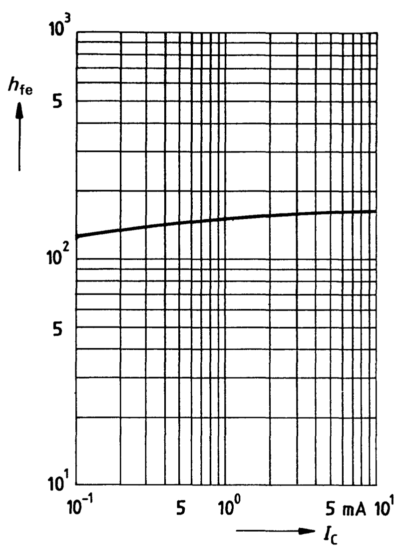
Total power dissipation $P_{tot} = f(T_A)$



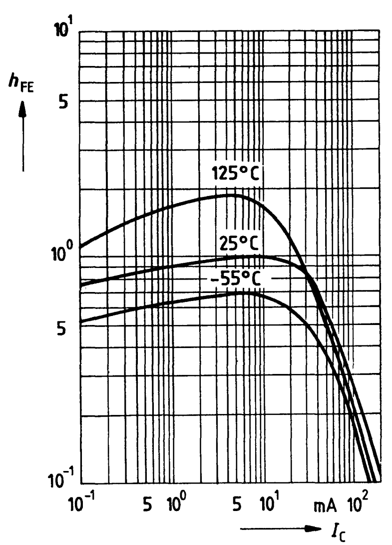
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



Small-signal current gain $h_{fe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



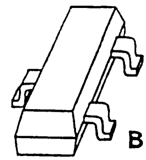
DC current gain $h_{FE} = f(I_C)$
(standardized), V_{CE} = 1 V



PNP Silicon Transistors for High Voltages

SMBTA 92
SMBTA 93

- High breakdown voltage
- Low collector-emitter saturation voltage
- Complementary types: SMBTA 42, SMBTA 43 (NPN)



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
SMBTA 92	S2D	Q68000–A4338	Q68000–A6479	SOT 23
SMBTA 93	S2E	Q68000–A4339	Q68000–A6483	SOT 23

Maximum ratings

Parameter	Symbol	SMBTA 92	SMBTA 93	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	500		mA
Base current	I_B	100		mA
Total power dissipation $T_A = 25\,°C$	P_{tot}	360		mW
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	$-65 \cdots +150$		°C
Thermal resistance junction - ambient package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 350		K/W

Electrical characteristics

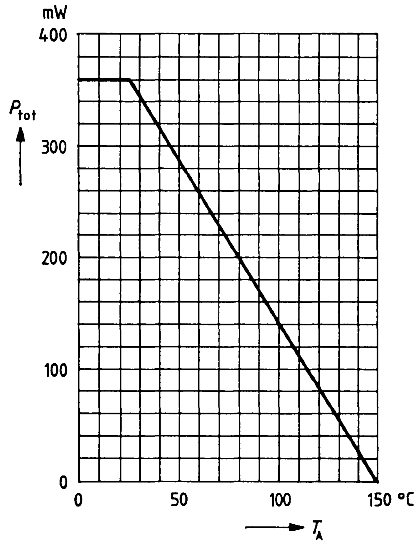
at $T_A = 25\,°C$, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)\,CEO}$				
SMBTA 92		300	–	–	V
SMBTA 93		200	–	–	V
Collector-base breakdown voltage $I_C = 100\ \mu A$	$V_{(BR)\,CBO}$				
SMBTA 92		300	–	–	V
SMBTA 93		200	–	–	V
Emitter-base breakdown voltage $I_E = 100\ \mu A$	$V_{(BR)\,EBO}$	5	–	–	V
Collector cutoff current	I_{CBO}				
$V_{CB} = 200$ V SMBTA 92		–	–	250	nA
$V_{CB} = 160$ V SMBTA 93		–	–	250	nA
$V_{CB} = 200$ V, $T_A = 150\,°C$ SMBTA 92		–	–	20	µA
$V_{CB} = 160$ V, $T_A = 150\,°C$ SMBTA 93		–	–	20	µA
Emitter cutoff current $V_{EB} = 3$ V	I_{EBO}	–	–	100	nA
DC current gain	h_{FE}				
$I_C = 1$ mA, $V_{CE} = 10$ V		25	–	–	–
$I_C = 10$ mA, $V_{CE} = 10$ V[1])		40	–	–	–
$I_C = 30$ mA, $V_{CE} = 10$ V[1]) SMBTA 92		25	–	–	–
SMBTA 93		25	–	–	–
Collector-emitter saturation voltage[1]) $I_C = 20$ mA, $I_B = 2$ mA	V_{CEsat}				
SMBTA 92		–	–	0,5	V
SMBTA 93		–	–	0,4	V
Base-emitter saturation voltage[1]) $I_C = 20$ mA, $I_B = 2$ mA	V_{BEsat}	–	–	0,9	V

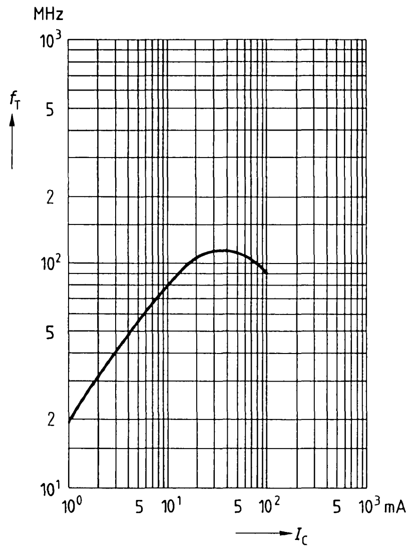
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency $I_C = 10$ mA, $V_{CE} = 20$ V, $f = 100$ MHz	f_T	50	–	–	MHz
Output capacitance $V_{CB} = 20$ V, $f = 1$ MHz	C_{ob}				
SMBTA 92		–	–	6	pF
SMBTA 93		–	–	8	pF

[1]) Pulse test: $t \leq 300\ \mu s$, D = 2%.

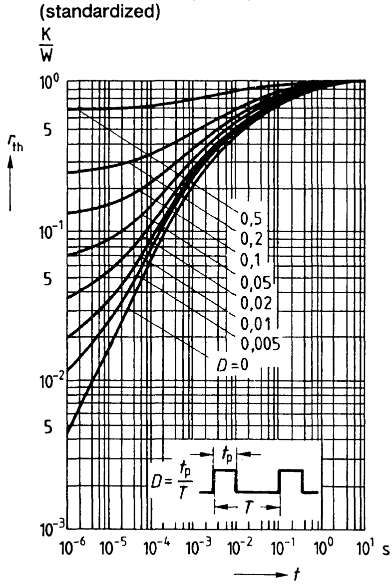
Total power dissipation $P_{tot} = f(T_A)$



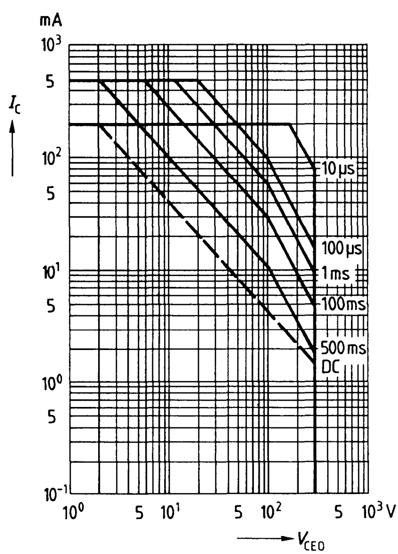
Transition frequency $f_T = f(I_C)$
$V_{CE} = 20$ V, $f = 100$ MHz



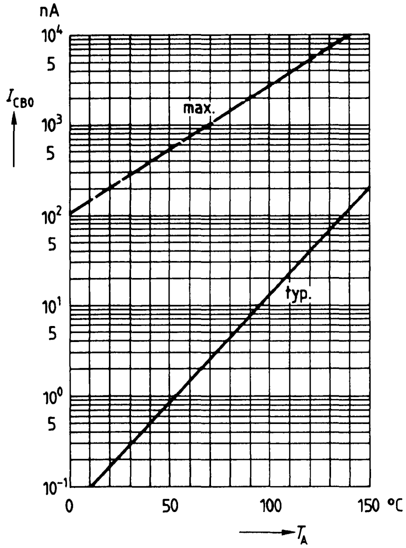
Pulse handling capability $r_{th} = f(t)$
(standardized)



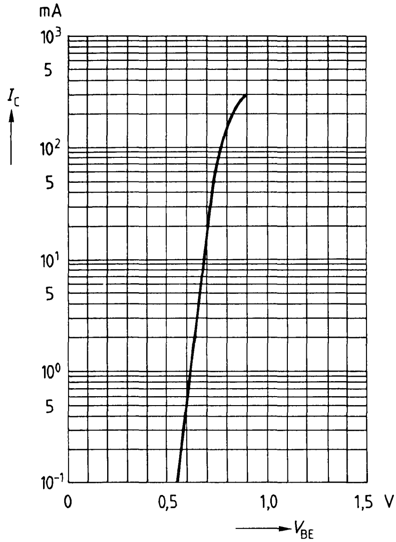
Operating range $I_C = f(V_{CE0})$
$T_A = 25\,°C$, $D = 0$



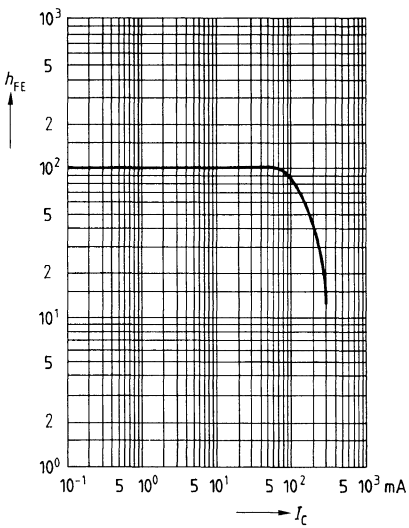
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 160$ V



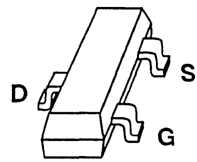
Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = 60V
- Continuous drain current I_D = 0.19A
- Drain-source on-resistance $R_{DS(on)}$ = 5.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
SN 7002	SG	Q67000-S063	SOT 23

Maximum Ratings

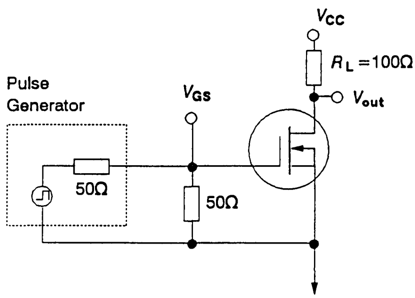
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	60	V	
Drain-gate voltage	V_{DGR}	60	V	R_{GS} =20 kΩ
Continuous drain current	I_D	0.19	A	T_A =25°C
Pulsed drain current	I_{Dpuls}	0.76	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	Mounted on
Chip - substrate rear side	$R_{th\ JSR}$	≤285		Ceramic substrate 2.5cm²

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

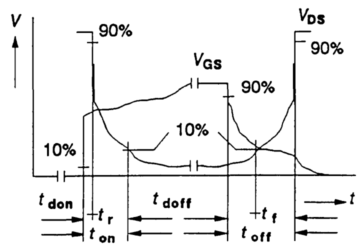
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	60	-	-	V	V_{GS} =0 I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	0.8	1.4	2.0	V	V_{GS} = V_{DS} I_D =1 mA
Zero gate voltage drain current	I_{DSS}	-	0.1	1.0	µA	T_j =25°C V_{GS} =0 V_{DS} =60V
Gate-source leakage current	I_{GSS}	-	1.0	10	nA	V_{GS} =20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	2.0 3.0	5.0 7.5	Ω Ω	V_{GS} =10V I_D =0.5A V_{GS} =4.5V I_D =0.05A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.1	0.18	-	S	$V_{DS} \geq 2 * I_D * R_{DS(on)max}$ I_D =0.2A
Input capacitance	C_{iss}	-	40	60	pF	V_{GS} =0V V_{DS} =25V f =1MHz
Output capacitance	C_{oss}	-	15	25		
Reverse transfer capacitance	C_{rss}	-	5	10		
Turn-on time t_{on}	$t_{d(on)}$	-	5	8	ns	V_{CC} =30V V_{GS} =10V I_D =-0.29A R_{GS} =50Ω
($t_{on} = t_{d(on)} + t_r$)	t_r	-	8	12		
Turn-off time t_{off}	$t_{d(off)}$	-	12	16		
($t_{off} = t_{d(off)} + t_f$)	t_f	-	17	22		
Reverse diode						
Continuous source current	I_S	-	-	0.19	A	
Pulsed source current	I_{SM}	-	-	0.76	A	
Diode forward on-voltage	V_{SD}	-	0.85	1.2	V	V_{GS} =0V I_F =0.28A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R =100V, I_F = I_{DR} di_F /dt = 100A/µs

Switching Time Measurement

Test circuit

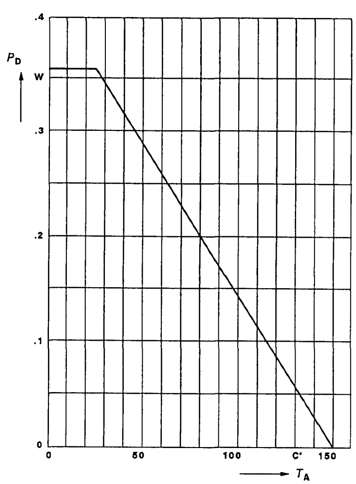


Switching times



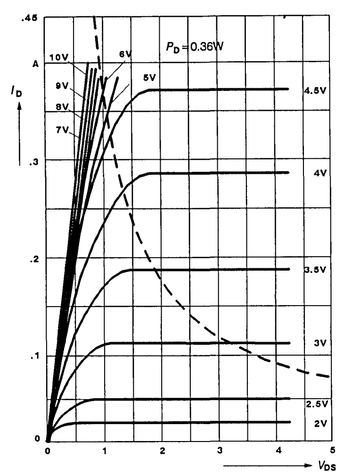
Permissible power dissipation versus temperature

$P_D = f\ T_A$
X Axis: T_A / °C
Y Axis: P_D / W



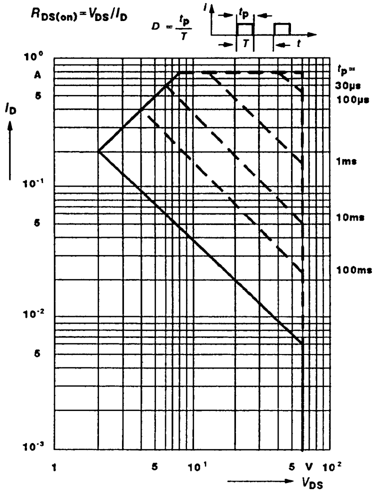
Typical output characteristic

$I_D = f\ V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



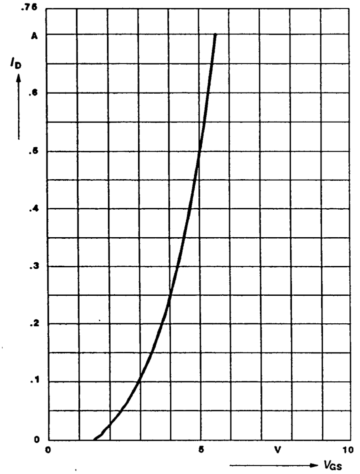
Safe operating area

$I_D = f\, V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: $D = 0.01$, $D = t_p / T$; $T_C = 25°C$



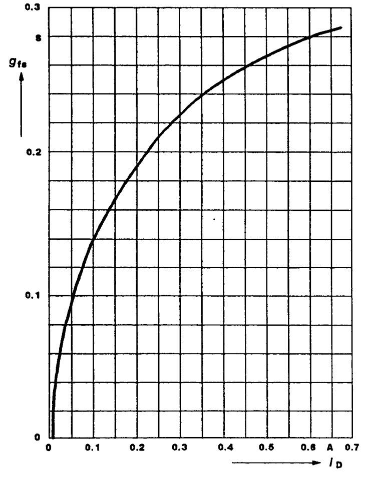
Typical transfer characteristic

$I_D = f\, V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: $V_{DS} = 25V$; $t_p = 80\mu s$; $T_j = 25°C$



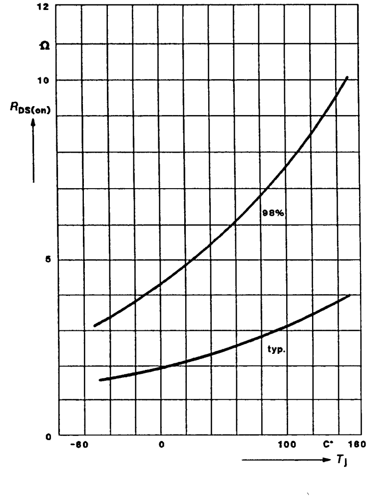
Typical transconductance

$g_{fs} = f\, I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: $V_{DS} \geq 2 * I_D * R_{DSon\,max}$; $t_p = 80\mu s$;
$T_j = 25°C$



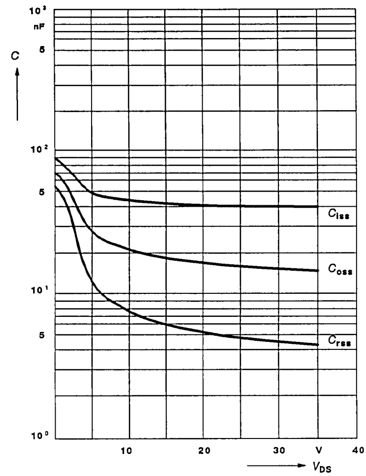
Drain to source on resistance (spread)

$R_{DSon} = f\, T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: $V_{GS} = 10V$; $I_D = 0.5A$



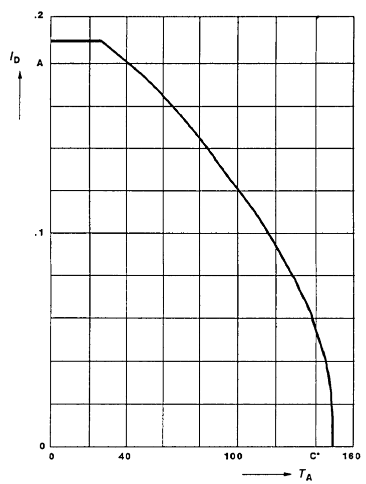
Typical capacitances

$C = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: C / nF
Parameter: V_{GS} =0; f = 1MHz



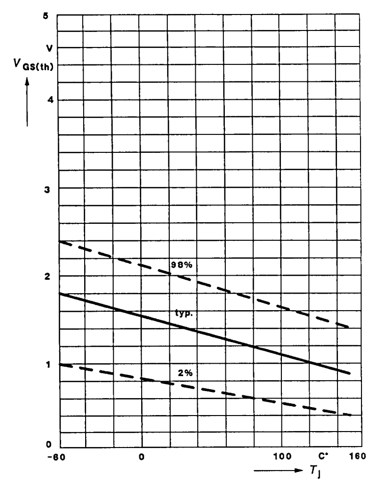
Drain current

$I_D = f\,T_A$
X Axis: T_A / °C
Y Axis: I_D / A



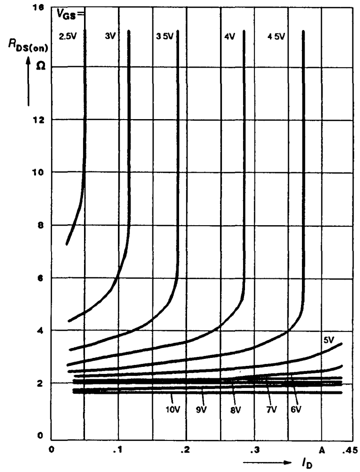
Gate threshhold voltage (spread)

$V_{GSth} = f\,T_j$
X Axis: T_j / °C
Y Axis: V_{GSth} / V
Parameter: $V_{GS} = V_{DS}$; I_D = 1mA



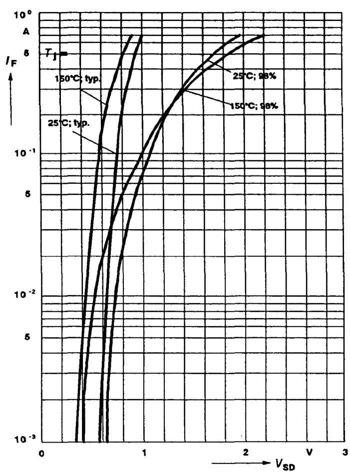
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; T_j = 25°C

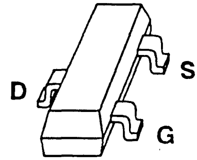


Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80μs; T_j



- SIPMOS - enhancement mode
- Drain-source voltage V_{DS} = -60V
- Continuous drain current I_D = -0.13A
- Drain-source on-resistance $R_{DS(on)}$ = 10.0Ω
- Total power dissipation P_D = 0.36W



Type	Marking	Ordering code for versions on 12 mm-tape	Package
SP 0610T	SF	Q67000-S065	SOT 23

Maximum Ratings

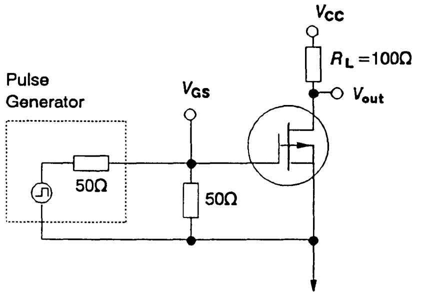
Parameter	Symbol	Ratings	Unit	Conditions
Drain-source voltage	V_{DS}	-60	V	-
Drain-gate voltage	V_{DGR}	-60	V	R_{GS} =20 kΩ
Continuous drain current	I_D	-0.13	A	T_A =36°C
Pulsed drain current	I_{Dpuls}	-0.52	A	T_A =25°C
Peak gate-source voltage	V_{gs}	±20	V	aperiodic
Power dissipation	P_D	0.36	W	T_A =25°C
Operating and storage temperature range	T_j T_{stg}	-55...+150	°C	-
Climatic category		55...150...56		DIN IEC 68 part 1
Thermal resistance				
Chip - air	R_{thJA}	≤350	K/W	Mounted on Ceramic substrate 2.5cm²
Chip - substrate rear side	$R_{th\ JSR}$	≤285		

Electrical Characteristics
at T_j =25°C, unless otherwise specified.

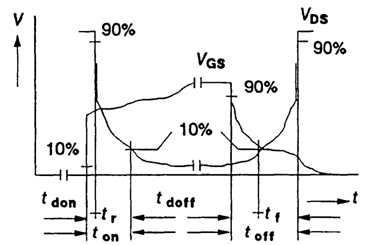
Description	Symbol	Characteristics			Unit	Condition
		min.	typ.	max.		
Static characteristics						
Drain-source breakdown voltage	$V_{(BR)DSS}$	-60	-	-	V	V_{GS} =0 I_D =0.25 mA
Gate threshold voltage	$V_{GS(th)}$	-1.0	-1.5	-2.0	V	V_{DS} = V_{GS} I_D =1 mA
Zero gate voltage drain current	I_{DSS}	-	-0.1	-1.0	µA	T_j =25°C V_{DS} = -60V V_{GS} = 0V
Gate-source leakage current	I_{GSS}	-	-1.0	-10	nA	V_{GS} =-20V, V_{DS} =0V
Drain-source on-state resistance	$R_{DS(on)}$	- -	6.0 9.0	10.0 12.5	Ω Ω	V_{GS} = -10V I_D = -0.2A V_{GS} = -4.5V I_D = 0.025A
Dynamic characteristics						
Forward transconductance	g_{fs}	0.06	0.075	-	S	V_{DS} ≥2 * I_D * $R_{DS(on)max}$ I_D = -0.5A
Input capacitance	C_{iss}	-	30	45	pF	V_{GS} =0V V_{DS} = -25V f =1MHz
Output capacitance	C_{oss}	-	17	25		
Reverse transfer capacitance	C_{rss}	-	8	12		
Turn-on time t_{on} (t_{on} = $t_{d(on)}$ + t_r)	$t_{d(on)}$	-	8	12	ns	V_{CC} =-30V V_{GS} =-10V I_D =-0.27A R_{GS} =50Ω
	t_r	-	35	50		
Turn-off time t_{off} (t_{off} = $t_{d(off)}$ + t_f)	$t_{d(off)}$	-	8	10		
	t_f	-	20	25		
Reverse diode						
Continuous source current	I_S	-	-	-0.12	A	
Pulsed source current	I_{SM}	-	-	-0.48	A	
Diode forward on-voltage	V_{SD}	-	-0.85	-1.2	V	V_{GS} =0V I_F = -0.18A
Reverse recovery time	t_{rr}	-	-	-	ns	V_R = -30V, I_F = I_{DR} di_F /dt = -100A/µs
Reverse recovery charge	Q_{rr}	-	-	-	µC	V_R = -30V, I_F = I_{DR} di_F /dt = -100A/µs

Switching Time Measurement

Test circuit

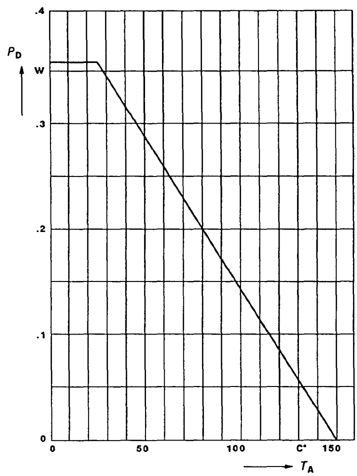


Switching times



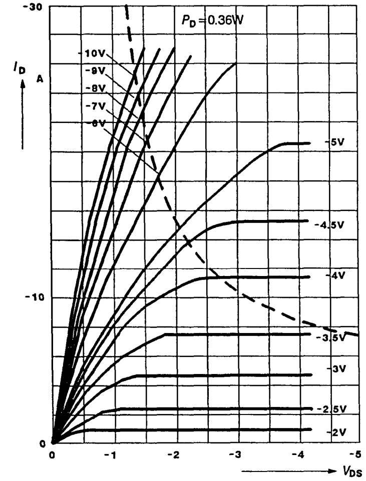
Permissible power dissipation versus temperature

$P_D = f\,T_A$
X Axis: T_A / °C
Y Axis: P_D / W



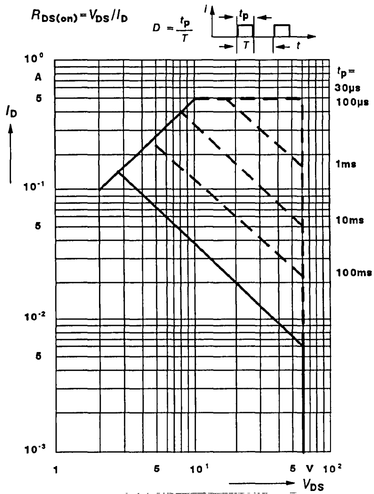
Typical output characteristic

$I_D = f\,V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A



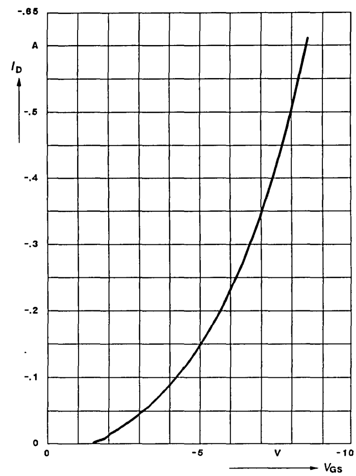
Safe operating area

$I_D = f V_{DS}$
X Axis: V_{DS} / V
Y Axis: I_D / A
Parameter: D = 0.01, $D = t_p / T$; T_C = 25°C



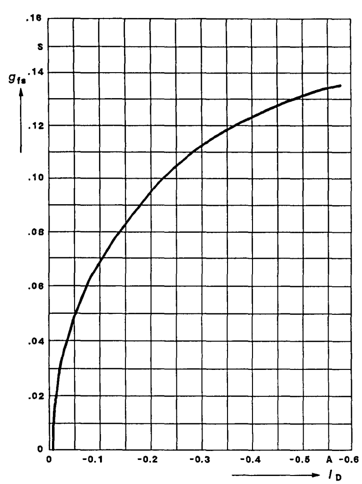
Typical transfer characteristic

$I_D = f V_{GS}$
X Axis: V_{GS} / V
Y Axis: I_D / A
Parameter: V_{DS} = -25V; t_p = 80µs; T_j = 25°C



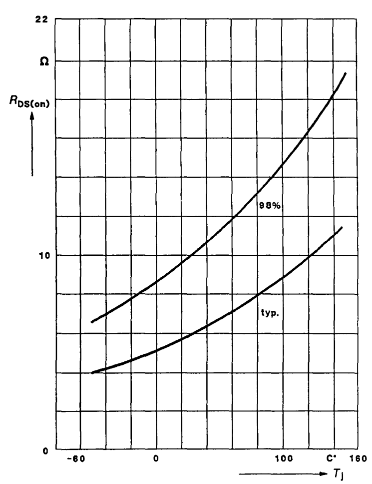
Typical transconductance

$g_{fs} = f I_D$
X Axis: I_D / A
Y Axis: g_{fs} / S
Parameter: $V_{DS} \geq 2 * I_D * R_{DSon\,max}$; t_p = 80µs;
T_j = 25°C



Drain to source on resistance (spread)

$R_{DSon} = f T_j$
X Axis: T_j / °C
Y Axis: R_{DSon} / Ω
Parameter: V_{GS} = -10V; I_D = 0.2A



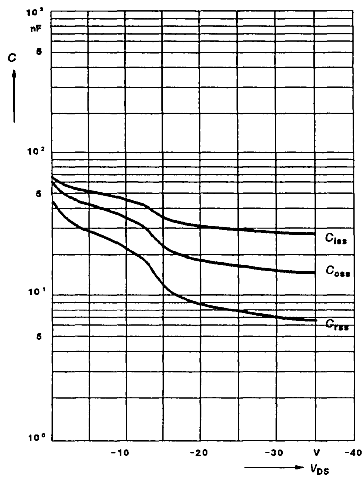
Typical capacitances

$C = f\, V_{DS}$

X Axis: V_{DS} / V

Y Axis: C / nF

Parameter: V_{GS} =0; f =1MHz

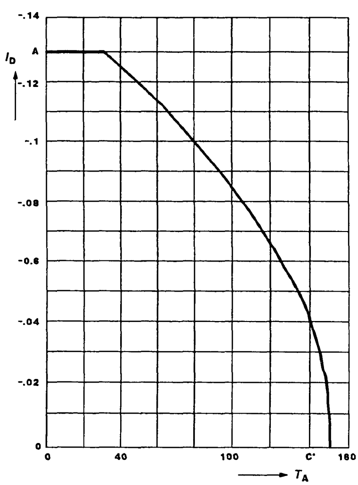


Drain current

$I_D = f\, T_A$

X Axis: T_A /°C

Y Axis: I_D /A



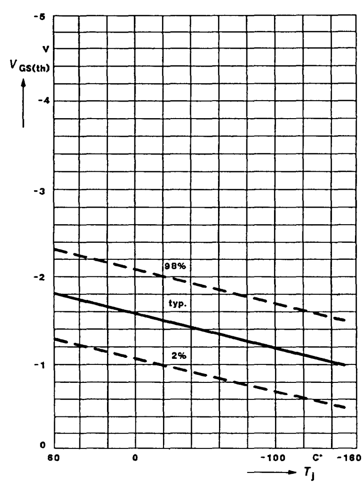
Gate threshhold voltage (spread)

$V_{GSth} = f\, T_j$

X Axis: T_j /°C

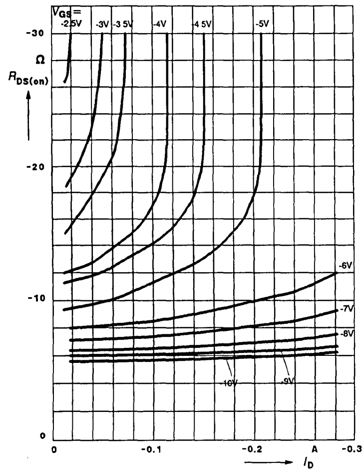
Y Axis: V_{GSth} /V

Parameter: $V_{GS} = V_{DS}$; I_D = -1mA



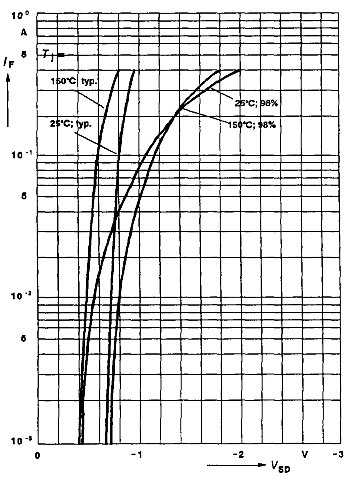
Typical drain-source on-state resistance

$R_{DSon} = f\, I_D$
X Axis: I_D / A
Y Axis: R_{DSon} / Ω
Parameter: V_{GS}; T_j = 25°C



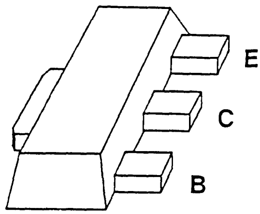
Typical reverse diode forward voltage (spread)

$I_F = f\, V_{SD}$
X Axis: V_{SD} / V
Y Axis: I_F / A
Parameter: t_p = 80μs; T_j



NPN Silicon Switching Transistor
SXT 2222 A

- High current gain: 0.1 to 500 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT 2222 A	S2P	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	75	V
Emitter-base voltage	V_{EBO}	6	V
Collector current	I_C	600	mA
Total power dissipation T_A = 25 °C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics
at T_A = 25 °C, unless otherwise specified

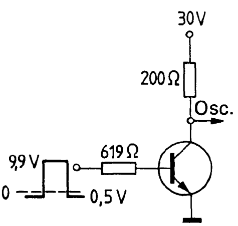
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	40	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	75	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	6	–	–	V
Collector cutoff current V_{CE} = 60 V, I_E = 0 V_{CE} = 60 V, I_E = 0, T_A = 125 °C	I_{CBO}	 – –	 – –	 10 10	 nA µA
Collector cutoff current V_{CE} = 30 V, V_{BE} = 0.5 V	I_{CEX}	–	–	10	nA
Emitter cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	10	nA
Base cutoff current V_{CE} = 30 V, V_{BE} = –3 V	I_{BL}	–	–	20	nA
DC current gain I_C = 100 µA, V_{CE} = 10 V I_C = 1 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V, T_A = –55 °C I_C = 150 mA, V_{CE} = 10 V I_C = 150 mA, V_{CE} = 1 V I_C = 500 mA, V_{CE} = 10 V	h_{FE}	 35 50 75 35 100 50 40	 – – – – – – –	 – – – – 300 – –	 – – – – – – –
Collector-emitter saturation voltage[1]) I_C = 150 mA; I_B = 15 mA I_C = 500 mA; I_B = 50 mA	V_{CEsat}	 – –	 – –	 0.3 1.0	 V V
Base-emitter saturation voltage[1]) I_C = 150 mA; I_B = 15 mA I_C = 500 mA; I_B = 50 mA	V_{BEsat}	 0.6 –	 – –	 1.2 2.0	 V V

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2$ %

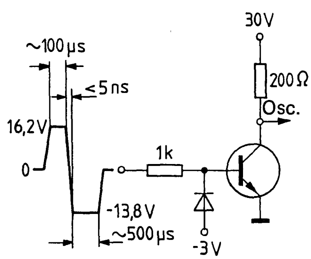
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	f_T	300	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	8	pF
Input capacitance V_{EB} = 2 V, f = 1 MHz	C_{ibo}	–	–	25	pF
Input impedance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{ie}	 2 0.25	 – –	 8 1.25	kΩ
Voltage feedback ratio I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{re}	 – –	 – –	 8 4	$\times 10^{-4}$
Small-signal current gain I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{fe}	 50 75	 – –	 300 375	–
Output admittance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz I_C = 10 mA; V_{CE} = 10 V, f = 1 kHz	h_{oe}	 5 25	 – –	 35 200	µS
Collector-base time constant I_E = 20 mA, V_{CB} = 20 V, f = 31.8 MHz	$rb'C_c$	–	–	150	ps
Noise figure I_C = 100 µA, V_{CE} = 10 V, R_S = 1 kΩ, f = 1 kHz	NF	–	–	4	dB
Switching times V_{CC} = 30 V, V_{BE} = 0.5 V, I_C = 150 mA, I_{B1} = 15 mA	 t_d t_r	 – –	 – –	 10 25	 ns ns
Switching times V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA	t_s t_f	– –	– –	225 60	ns ns

Test circuits

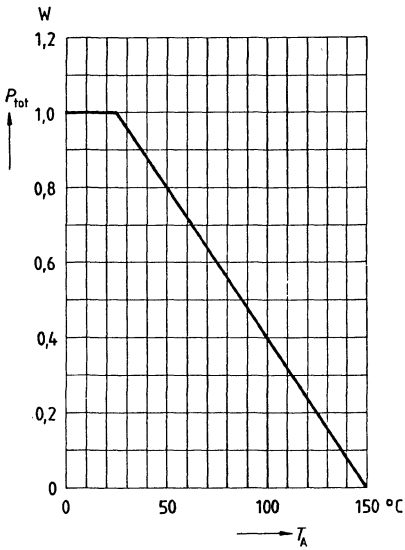
Delay and rise time



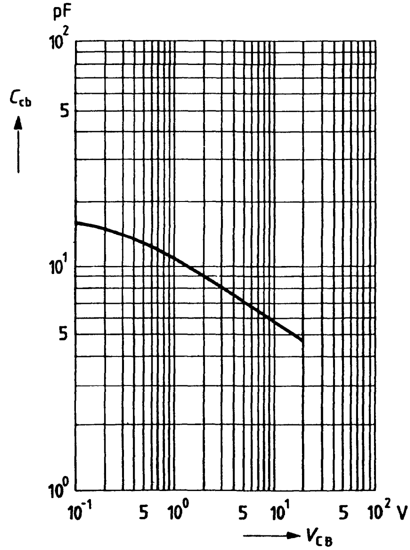
Storage and fall time



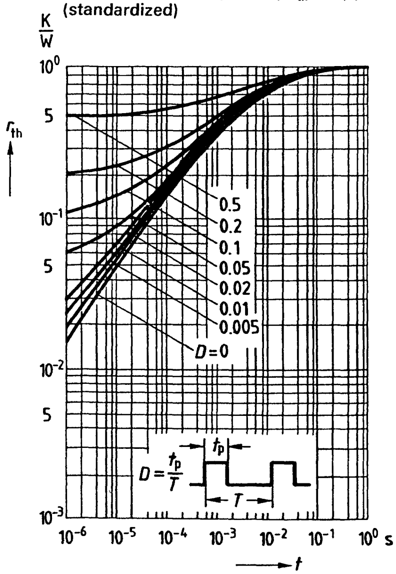
Total power dissipation $P_{tot} = f(T_A)$



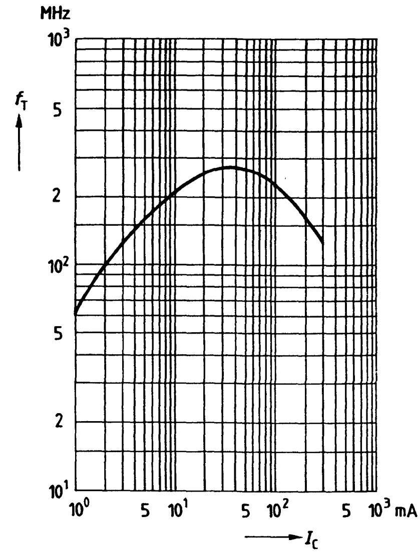
Collector-base capacitance
$C_{cb} = f(V_{CB})$
f = 1 MHz



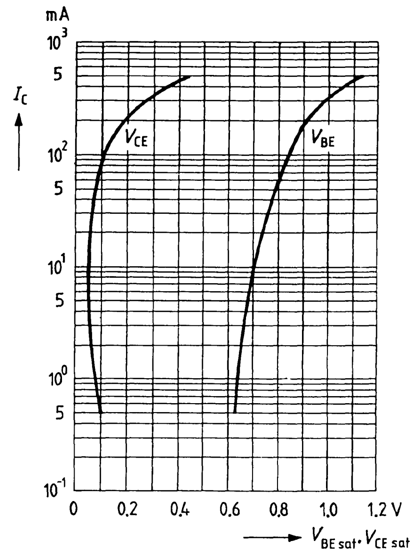
Pulse handling capability $r_{th} = f(t)$
(standardized)



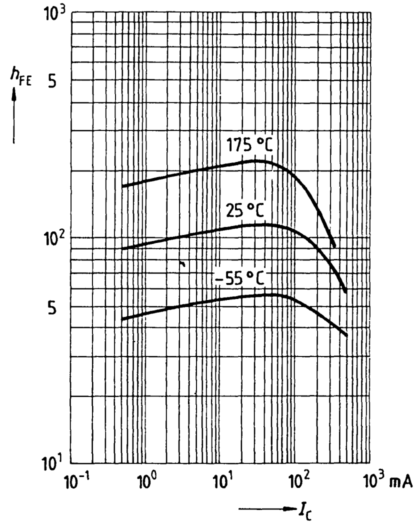
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V



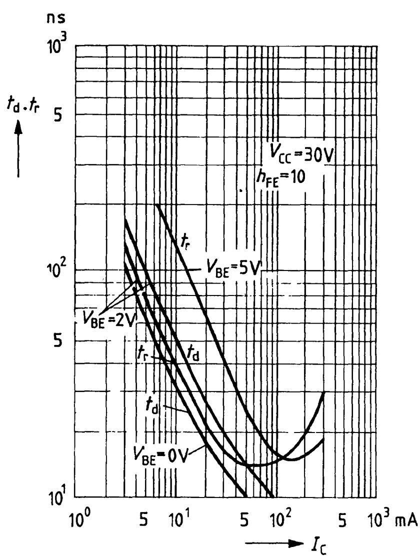
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$



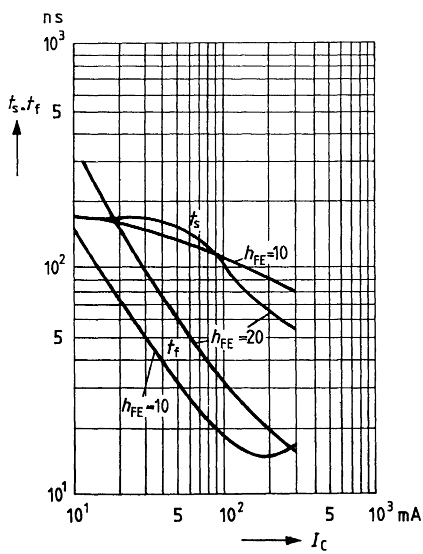
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$

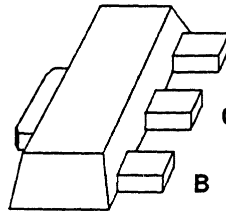


Storage time $t_s = f(I_C)$
Fall time $t_f = f(I_C)$



PNP Silicon Switching Transistor **SXT 2907 A**

- High current gain: 0.1 to 500 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT 2907 A	S2F	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	60	V
Collector-base voltage	V_{CBO}	60	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	600	mA
Total power dissipation T_A = 25 °C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics
at T_A = 25 °C, unless otherwise specified

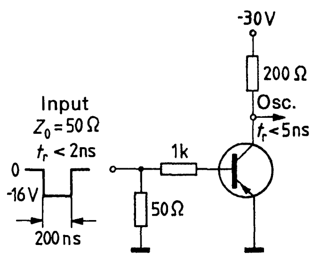
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	60	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	60	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current V_{CB} = 60 V, I_E = 0 V_{CB} = 60 V, I_E = 0, T_A = 125°C	I_{CBO}	 – –	 – –	 10 10	 nA µA
Collector cutoff current V_{CE} = 30 V, V_{BE} = 0.5 V	I_{CEX}	–	–	50	nA
Emitter cutoff current V_{EB} = 3 V, I_C = 0	I_{EBO}	–	–	10	nA
Base cutoff current V_{CE} = 30 V, V_{BE} = 3 V	I_{BL}	–	–	50	nA
DC current gain I_C = 100 µA, V_{CE} = 10 V I_C = 1 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 150 mA, V_{CE} = 10 V I_C = 500 mA, V_{CE} = 10 V	h_{FE}	 75 100 100 100 50	 – – – – –	 – – – 300 –	 – – – – –
Collector-emitter saturation voltage[1]) I_C = 150 mA; I_B = 15 mA I_C = 500 mA; I_B = 50 mA	V_{CEsat}	 – –	 – –	 0.4 1.6	 V V
Base-emitter saturation voltage[1]) I_C = 150 mA; I_B = 15 mA I_C = 500 mA; I_B = 50 mA	V_{BEsat}	 – –	 – –	 1.3 2.0	 V V

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2$ %

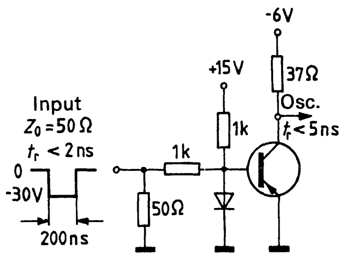
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	f_T	200	–	–	MHz
Output capacitance V_{CB} = 10 V, f = 1 MHz	C_{obo}	–	–	8	pF
Input capacitance V_{EB} = 2 V, f = 1 MHz	C_{ibo}	–	–	30	pF
Switching times V_{CC} = 30 V, V_{BE} = 0.5 V, I_C = 150 mA, I_{B1} = 15 mA	 t_d t_r	 – –	 – –	 10 40	 ns ns
Switching times V_{CC} = 6 V, I_C = 150 mA, $I_{B1}=I_{B2}$=15 mA	t_s t_f	– –	– –	80 30	ns ns

Test circuits

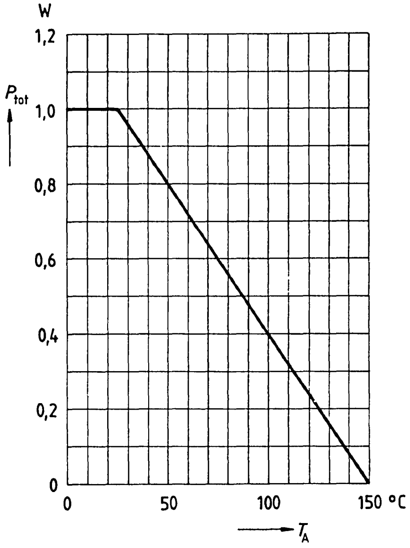
Delay and rise time



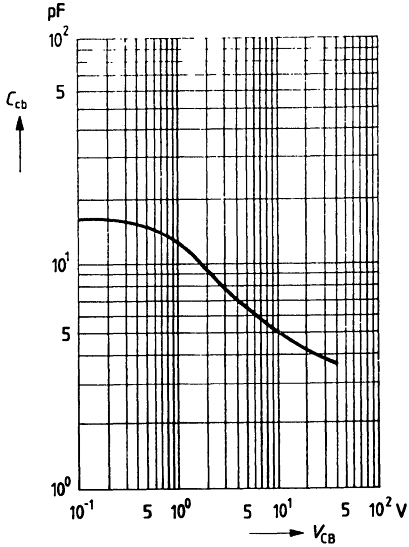
Storage and fall time



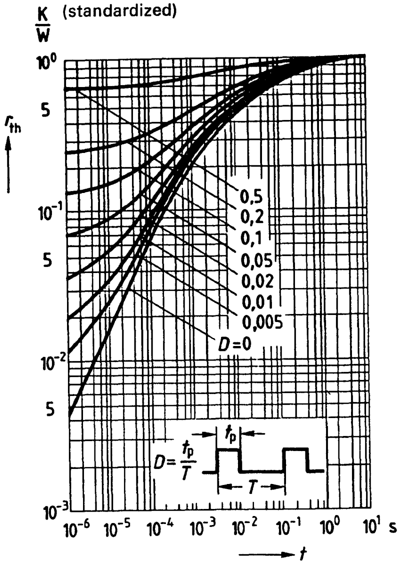
Total power dissipation $P_{tot} = f(T_A)$



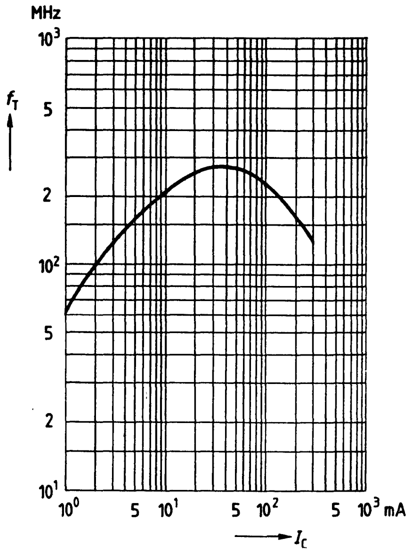
Collector-base capacitance
$C_{cb} = f(V_{CB})$
f = 1 MHz



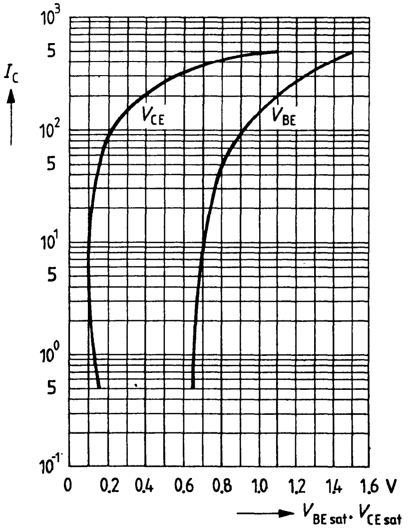
Pulse handling capability $r_{th} = f(t)$
(standardized)



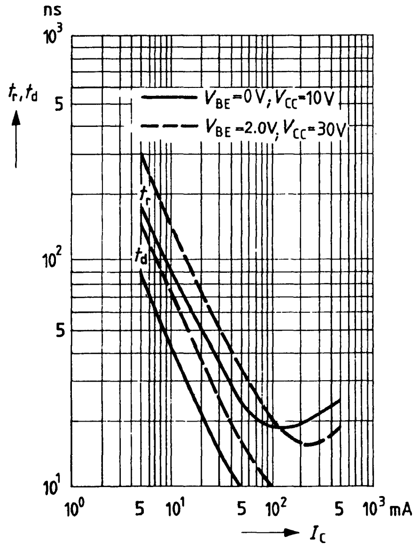
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V



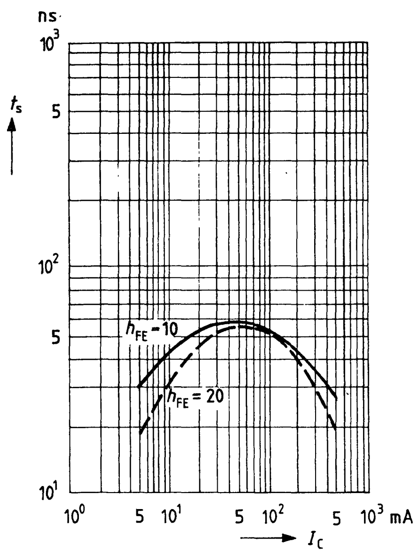
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$
$h_{FE} = 10$



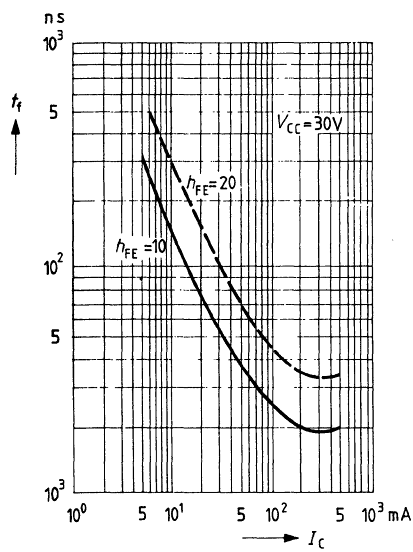
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$
$h_{FE} = 10$



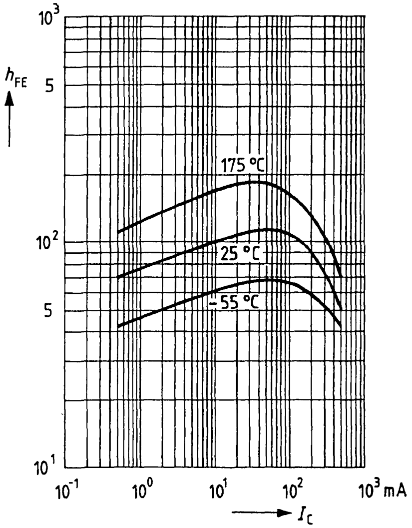
Storage time $t_s = f(I_C)$



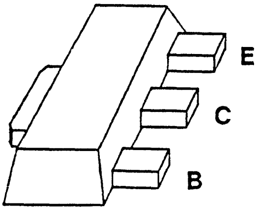
Fall time $t_f = f(I_C)$



DC current gain $h_{FE} = f(I_C)$



- High current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT 3904	S1A	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	60	V
Emitter-base voltage	V_{EBO}	6	V
Collector current	I_C	200	mA
Total power dissipation T_A = 25 °C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	–65...+150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics
at T_A = 25 °C, unless otherwise specified

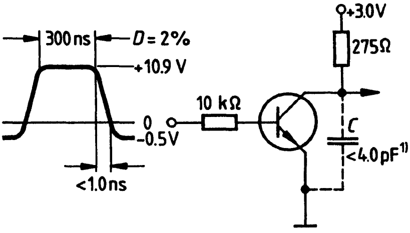
DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	40	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	60	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	6	–	–	V
Base cutoff current V_{CE} = 30 V, V_{BE} = – 3 V	I_{BL}	–	–	50	nA
Collector cutoff current V_{CE} = 30 V, V_{BE} = 3 V	I_{CEX}	–	–	50	nA
DC current gain I_C = 100 µA, V_{CE} = 1 V I_C = 1 mA, V_{CE} = 1 V I_C = 10 mA, V_{CE} = 1 V I_C = 50 mA, V_{CE} = 1 V I_C = 100 mA, V_{CE} = 1 V	h_{FE}	 40 70 100 60 30	 – – – – –	 – – 300 – –	 – – – – –
Collector-emitter saturation voltage[1]) I_C = 10 mA; I_B = 1 mA I_C = 50 mA; I_B = 5 mA	V_{CEsat}	 – –	 – –	 0.2 0.3	 V V
Base-emitter saturation voltage[1]) I_C = 10 mA; I_B = 1 mA I_C = 50 mA; I_B = 5 mA	V_{BEsat}	 0.65 –	 – –	 0.85 0.95	 V V

[1]) Pulse test: $t \leq$ 300 µs, $D \leq$ 2 %

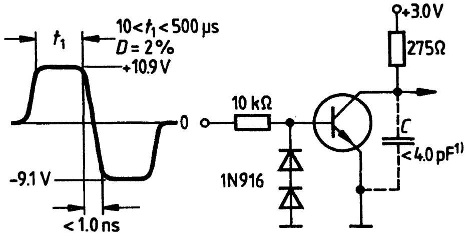
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	300	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{obo}	–	–	4	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	8	pF
Input impedance I_{CE} = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{ie}	1	–	10	kΩ
Voltage feedback ratio I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{re}	0.5	–	8	$\times 10^{-4}$
Small-signal current gain I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{fe}	100	–	400	–
Output admittance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{oe}	1	–	40	µS
Noise figure I_C = 0.1 mA, V_{CE} = 5 V, f = 10 Hz to 15 kHz R_S = 1 kΩ	NF	–	–	5	dB
Switching times V_{CC} = 3 V, V_{BE} = 0.5 V, I_C = 10 mA, I_{B1} = 1 mA	t_d t_r	– –	– –	35 35	ns ns
Switching times V_{CC} = 3 V, I_C = 10 mA, I_{B1} = I_{B2} = 1 mA	t_s t_f	– –	– –	200 50	ns ns

Test circuits

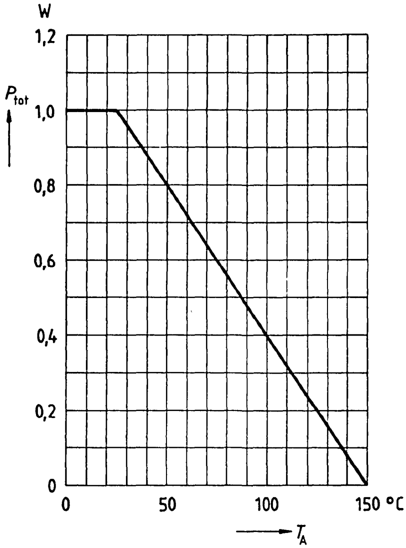
Delay and rise time



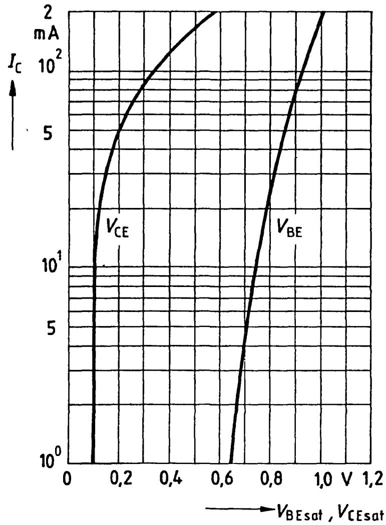
Storage and fall time



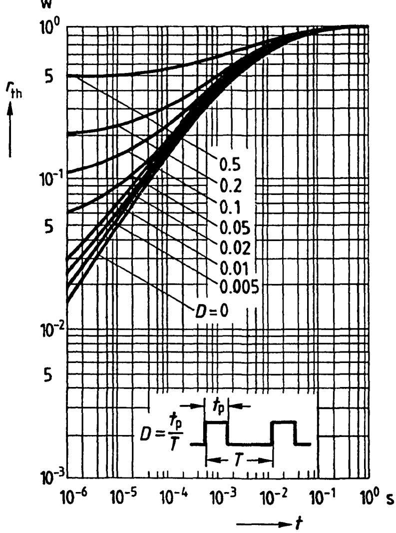
Total power dissipation $P_{tot} = f(T_A)$



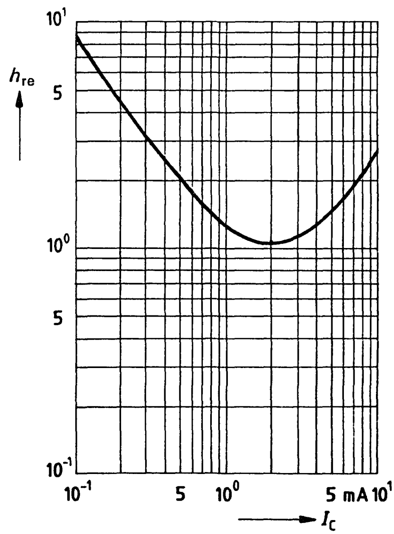
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



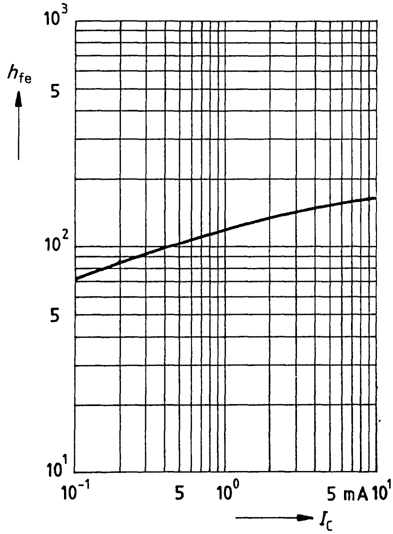
Pulse handling capability $r_{th} = f(t)$
(standardized)



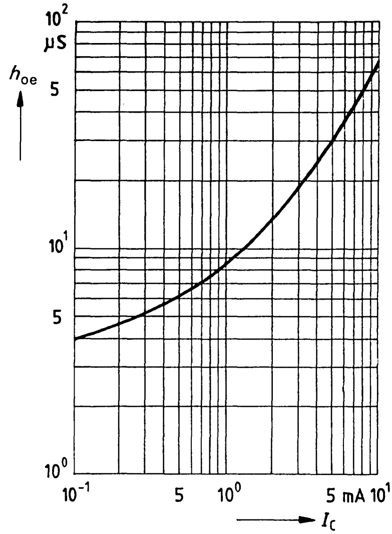
Voltage feedback ratio $h_{re} = f(I_C)$
V_{CE} = 10 V, f = 1 kHz



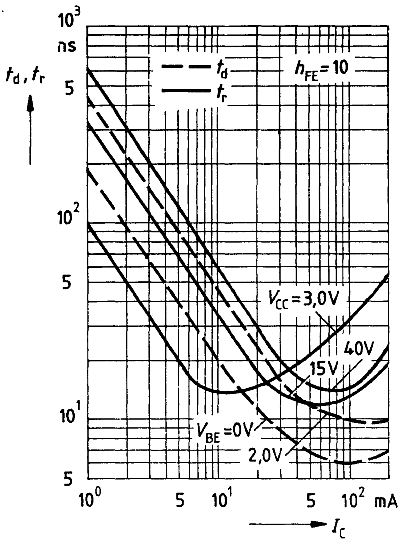
Small-signal current gain $h_{fe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



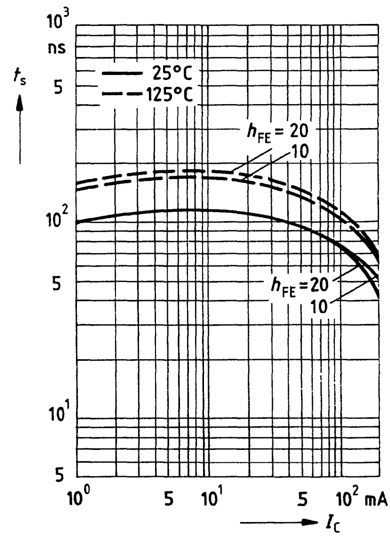
Output admittance $h_{oe} = f(I_C)$
V_{CE} = 10 V, f = 1 MHz



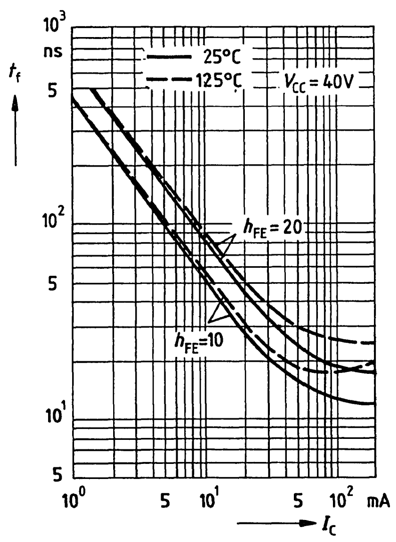
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



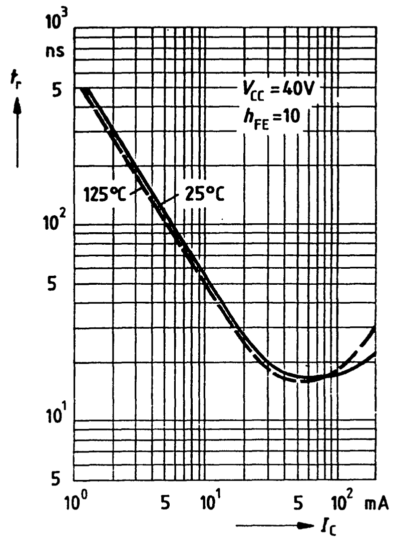
Storage time $t_s = f(I_C)$



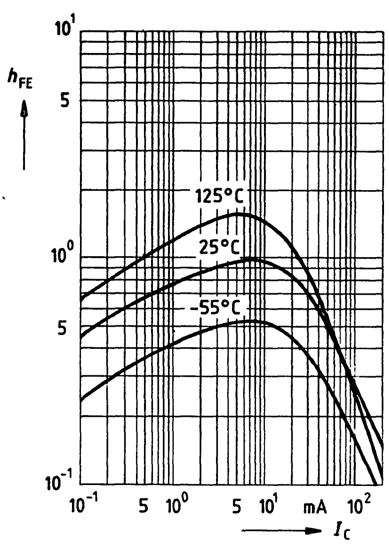
Fall time $t_f = f(I_C)$



Rise time $t_r = f(I_C)$

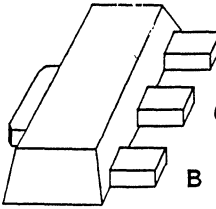


DC current gain $h_{FE} = f(I_C)$
V_{CE} = 1 V (standardized)



PNP Silicon Switching Transistor SXT 3906

- High current gain: 0.1 to 100 mA
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT 3906	S2A	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	Ratings	Unit
Collector-emitter voltage	V_{CEO}	40	V
Collector-base voltage	V_{CBO}	40	V
Emitter-base voltage	V_{EBO}	5	V
Collector current	I_C	200	mA
Total power dissipation T_A = 25 °C	P_{tot}	1	W
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	– 65...+ 150	°C
Thermal resistance			
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125	K/W

Electrical characteristics

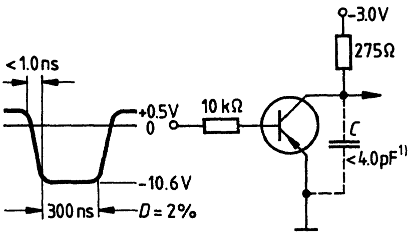
at T_A = 25 °C, unless otherwise specified

DC characteristics	Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	40	–	–	V
Collector-base breakdown voltage I_C = 10 µA	$V_{(BR)CBO}$	40	–	–	V
Emitter-base breakdown voltage I_E = 10 µA	$V_{(BR)EBO}$	5	–	–	V
Base cutoff current V_{CE} = 30 V, V_{BE} = 3 V	I_{BL}	–	–	50	nA
Collector cutoff current V_{CE} = 30 V, V_{BE} = –3 V	I_{CEX}	–	–	50	nA
DC current gain	h_{FE}				
I_C = 100 µA, V_{CE} = 1 V		60	–	–	–
I_C = 1 mA, V_{CE} = 1 V		80	–	–	–
I_C = 10 mA, V_{CE} = 1 V		100	–	300	–
I_C = 50 mA, V_{CE} = 1 V		60	–	–	–
I_C = 100 mA, V_{CE} = 1 V		30	–	–	–
Collector-emitter saturation voltage[1])	V_{CEsat}				
I_C = 10 mA; I_B = 1 mA		–	–	0.25	V
I_C = 50 mA; I_B = 5 mA		–	–	0.4	V
Base-emitter saturation voltage[1])	V_{BEsat}				
I_C = 10 mA; I_B = 1 mA		0.65	–	0.85	V
I_C = 50 mA; I_B = 5 mA		–	–	0.95	V

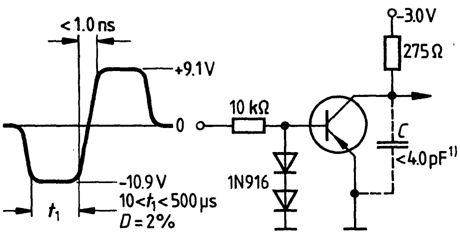
AC characteristics	Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	f_T	250	–	–	MHz
Output capacitance V_{CB} = 5 V, f = 1 MHz	C_{obo}	–	–	4.5	pF
Input capacitance V_{EB} = 0.5 V, f = 1 MHz	C_{ibo}	–	–	10	pF
Input impedance I_{CE} = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{ie}	2	–	12	kΩ
Voltage feedback ratio I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{re}	0.1	–	10	$\times 10^{-4}$
Small-signal current gain I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{fe}	100	–	400	–
Output admittance I_C = 1 mA; V_{CE} = 10 V, f = 1 kHz	h_{oe}	3	–	60	μS
Noise figure I_C = 0.1 mA, V_{CE} = 5 V, f = 10 Hz to 15 kHz, R_S = 1 kΩ	NF	–	–	4	dB
Switching times V_{CC} = 3 V, V_{BE} = 0.5 V, I_C = 10 mA, I_{B1} = 1 mA	t_d t_r	– –	– –	35 35	ns ns
Switching times V_{CC} = 3 V, I_C = 10 mA, I_{B1} = 1 mA	t_s t_f	– –	– –	225 75	ns ns

Test circuits

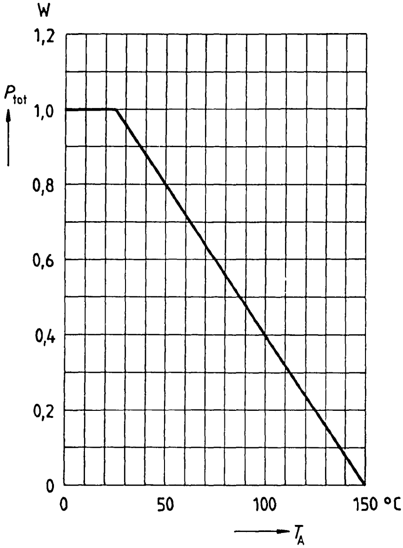
Delay and rise time



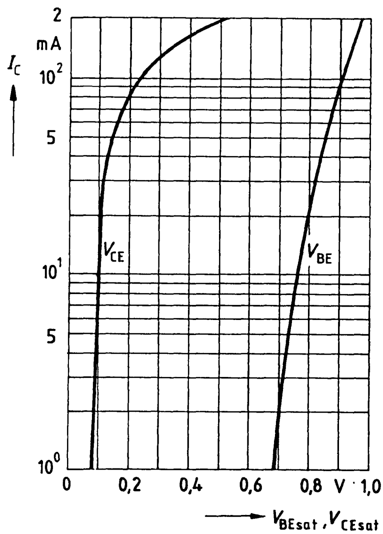
Storage and fall time



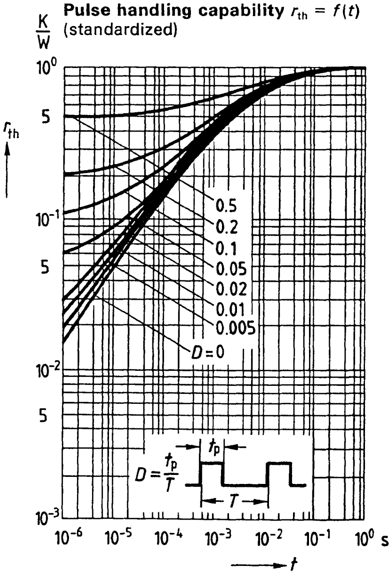
Total power dissipation $P_{tot} = f(T_A)$



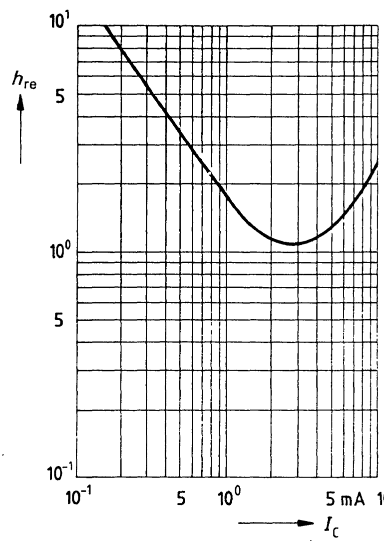
Saturation voltage $I_C = f(V_{BE\,sat}, V_{CE\,sat})$



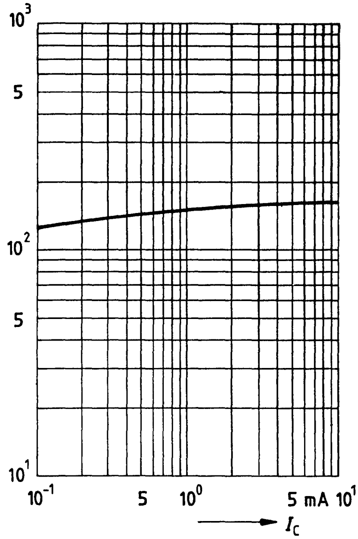
Pulse handling capability $r_{th} = f(t)$
(standardized)



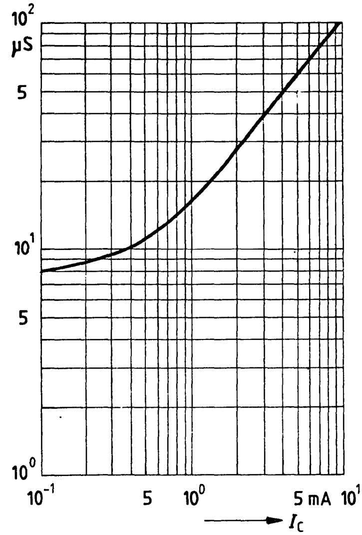
Voltage feedback ratio $h_{re} = f(I_C)$



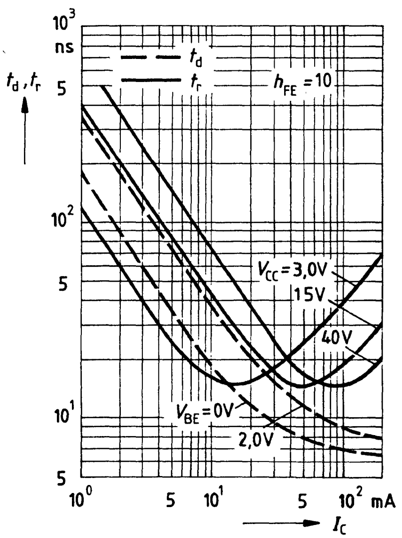
Small-signal current gain $h_{fe} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ MHz



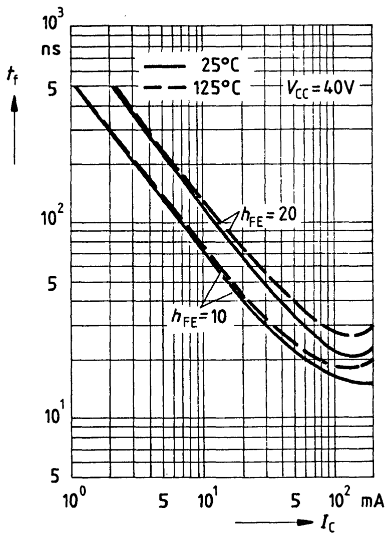
Output admittance $h_{oe} = f(I_C)$
$V_{CE} = 10$ V, $f = 1$ MHz



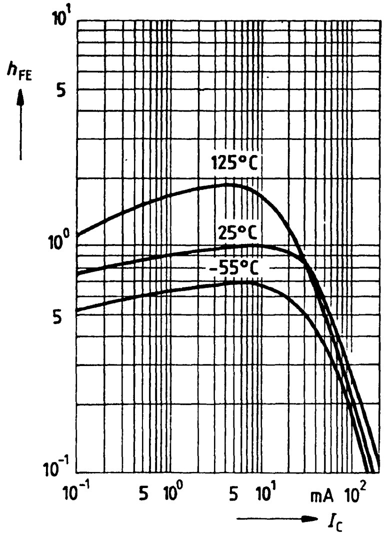
Delay time $t_d = f(I_C)$
Rise time $t_r = f(I_C)$



Fall time $t_f = f(I_C)$



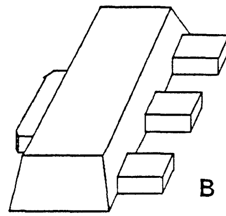
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 1 V (standardized)



NPN Silicon High Voltage Transistors

SXT A 42
SXT A 43

- High breakdown voltage
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT A 42	S1D	upon request	upon request	SOT 89
SXT A 43	S1E	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	SXT A 42	SXT A 43	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	6		V
Collector current	I_C	500		mA
Total power dissipation T_A = 25 °C	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	– 65...+150		°C
Thermal resistance				
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

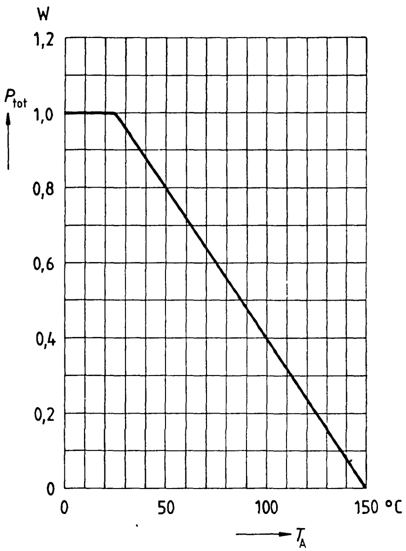
Electrical characteristics
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
I_C = 1 mA	SXT A 42		300	–	–	V
	SXT A 43		200	–	–	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
I_C = 100 µA	SXT A 42		300	–	–	V
	SXT A 43		200	–	–	V
Emitter-base breakdown voltage I_E = 100 µA		$V_{(BR)EBO}$	6	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 200 V, I_E = 0	SXT A 42		–	–	100	nA
V_{CB} = 160 V, I_E = 0	SXT A 43		–	–	100	nA
V_{CB} = 200 V, I_E = 0, T_A = 125 °C	SXT A 42		–	–	10	µA
V_{CB} = 160 V, I_E = 0, T_A = 125 °C	SXT A 43		–	–	10	µA
Emitter cutoff current V_{EB} = 6 V, I_C = 0		I_{EBO}	–	–	100	nA
DC current gain		h_{FE}				
I_C = 1 mA, V_{CE} = 10 V			25	–	–	–
I_C = 10 mA, V_{CE} = 10 V			40	–	–	–
I_C = 30 mA, V_{CE} = 10 V	SXT A 42		40	–	–	–
	SXT A 43		40	–	–	–
Collector-emitter saturation voltage[1]		V_{CEsat}				
I_C = 20 mA; I_B = 2 mA	SXT A 42		–	–	0.5	V
	SXT A 43		–	–	0.4	V
Base-emitter saturation voltage[1] I_C = 20 mA; I_B = 2 mA		V_{BEsat}	–	–	0.9	V

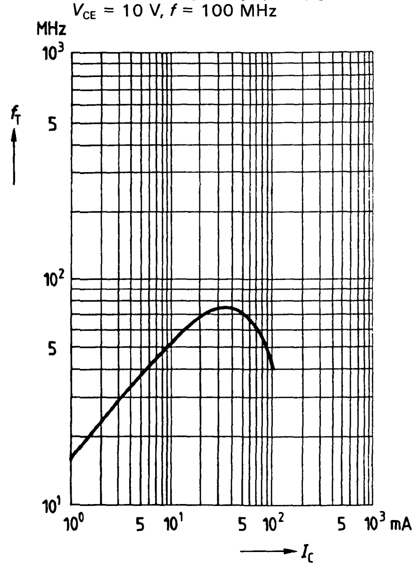
AC characteristics		Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz		f_T	50	–	–	MHz
Output capacitance		C_{obo}				
V_{CB} = 20 V, f = 1 MHz	SXT A 42		–	–	3	pF
	SXT A 43		–	–	4	pF

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2\%$

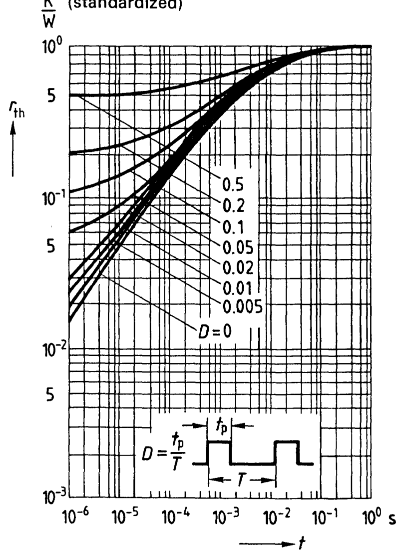
Total power dissipation $P_{tot} = f(T_A)$



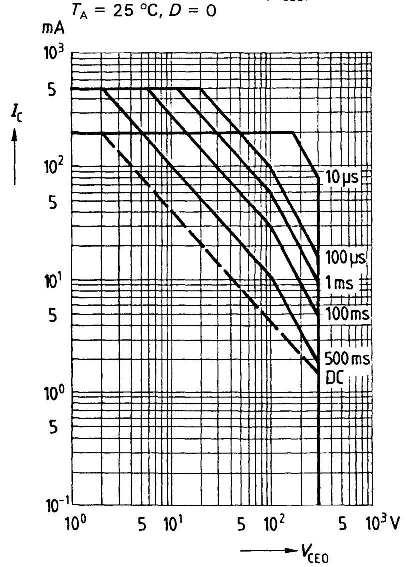
Transition frequency $f_T = f(I_C)$
V_{CE} = 10 V, f = 100 MHz



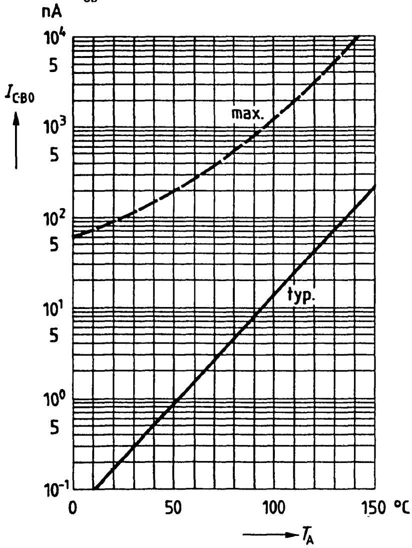
Pulse handling capability $r_{th} = f(t)$
(standardized)



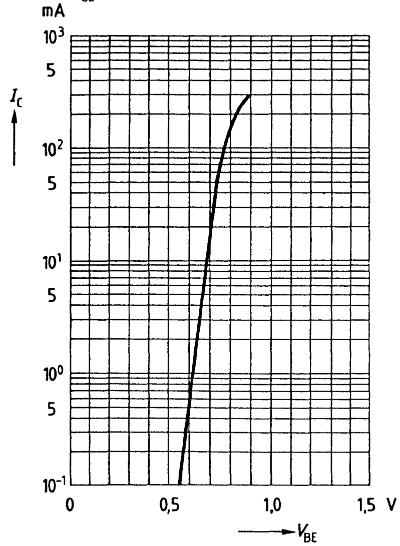
Operating range $I_C = f(V_{CEO})$
T_A = 25 °C, D = 0



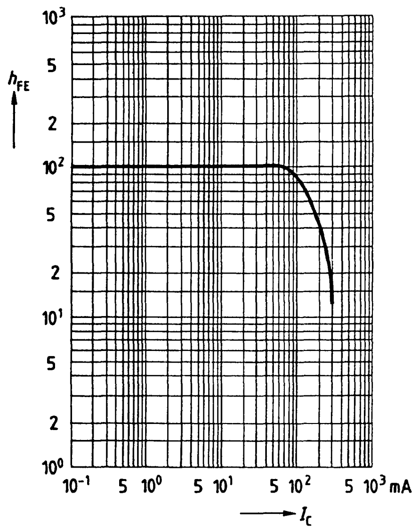
Collector cutoff current $I_{CBO} = f(T_A)$
$V_{CB} = 160$ V



Collector current $I_C = f(V_{BE})$
$V_{CE} = 10$ V



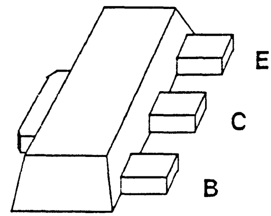
DC current gain $h_{FE} = f(I_C)$
$V_{CE} = 10$ V



PNP Silicon High-Voltage Transistors

SXT A 92
SXT A 93

- High breakdown voltage
- Low collector-emitter saturation voltage



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8-mm tape	Package
SXT A 92	S2D	upon request	upon request	SOT 89
SXT A 93	S2E	upon request	upon request	SOT 89

Maximum ratings

Parameter	Symbol	SXT A 92	SXT A 93	Unit
Collector-emitter voltage	V_{CEO}	300	200	V
Collector-base voltage	V_{CBO}	300	200	V
Emitter-base voltage	V_{EBO}	5		V
Collector current	I_C	500		mA
Total power dissipation T_A = 25 °C	P_{tot}	1		W
Junction temperature	T_j	150		°C
Storage temperature range	T_{stg}	–65...+150		°C
Thermal resistance				
Junction-ambient Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{thJA}	≤ 125		K/W

Electrical characteristics

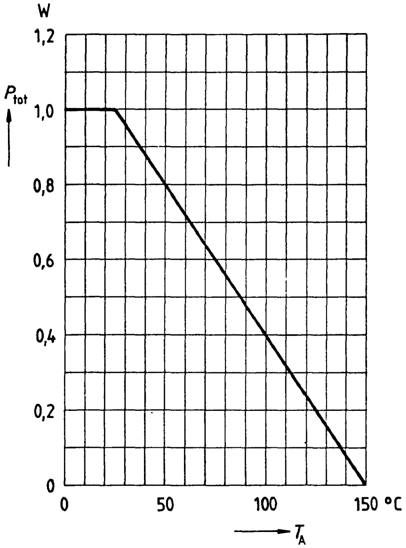
at T_A = 25 °C, unless otherwise specified

DC characteristics		Symbol	min	typ	max	Unit
Collector-emitter breakdown voltage		$V_{(BR)CEO}$				
I_C = 1 mA	SXT A 92		300	–	–	V
	SXT A 93		200	–	–	V
Collector-base breakdown voltage		$V_{(BR)CBO}$				
I_C = 100 µA	SXT A 92		300	–	–	V
	SXT A 93		200	–	–	V
Emitter-base breakdown voltage I_E = 100 µA		$V_{(BR)EBO}$	5	–	–	V
Collector cutoff current		I_{CBO}				
V_{CB} = 200 V, I_E = 0	SXT A 92		–	–	250	nA
V_{CB} = 160 V, I_E = 0	SXT A 93		–	–	250	nA
V_{CB} = 200 V, I_E = 0, T_A = 125 °C	SXT A 92		–	–	20	µA
V_{CB} = 160 V, I_E = 0, T_A = 25 °C	SXT A 93		–	–	20	µA
Emitter cutoff current V_{EB} = 4 V, I_C = 0		I_{EBO}	–	–	100	nA
DC current gain		h_{FE}				
I_C = 1 mA, V_{CE} = 10 V			25	–	–	–
I_C = 10 mA, V_{CE} = 10 V			40	–	–	–
I_C = 30 mA, V_{CE} = 10 V	SXT A 92		25	–	–	–
	SXT A 93		25	–	–	–
Collector-emitter saturation voltage[1])		V_{CEsat}				
I_C = 20 mA; I_B = 2 mA	SXT A 92		–	–	0.5	V
	SXT A 93		–	–	0.4	V
Base-emitter saturation voltage[1]) I_C = 20 mA; I_B = 2 mA		V_{BEsat}	–	–	0.9	V

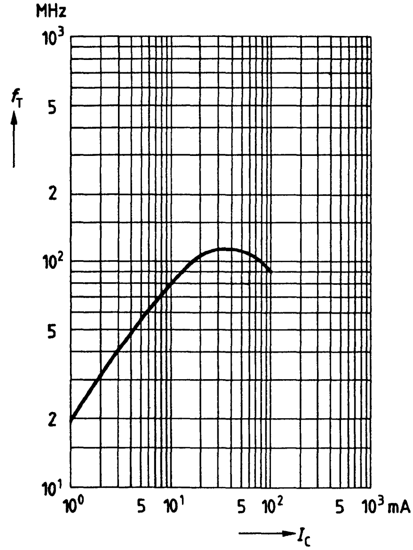
AC characteristics		Symbol	min	typ	max	Unit
Transition frequency I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz		f_T	50	–	–	MHz
Output capacitance		C_{obo}				
V_{CB} = 20 V, f = 1 MHz	SXT A 92		–	–	6	pF
	SXT A 93		–	–	8	pF

[1]) Pulse test: $t \leq 300$ µs, $D \leq 2$ %

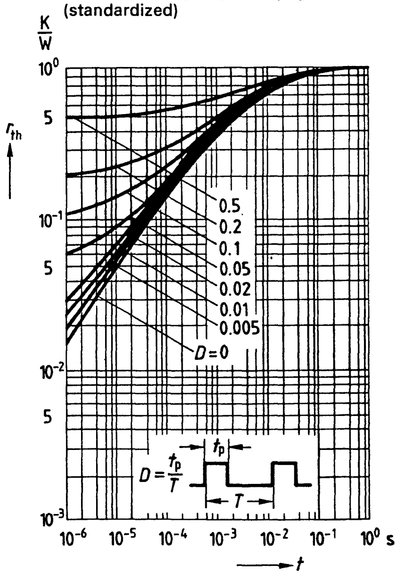
Total power dissipation $P_{tot} = f(T_A)$



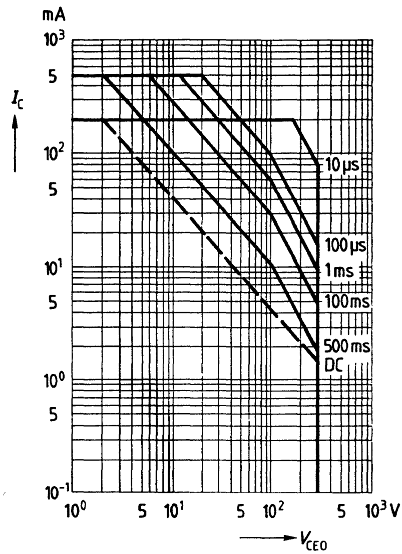
Transition frequency $f_T = f(I_C)$
V_{CE} = 20 V, f = 100 MHz



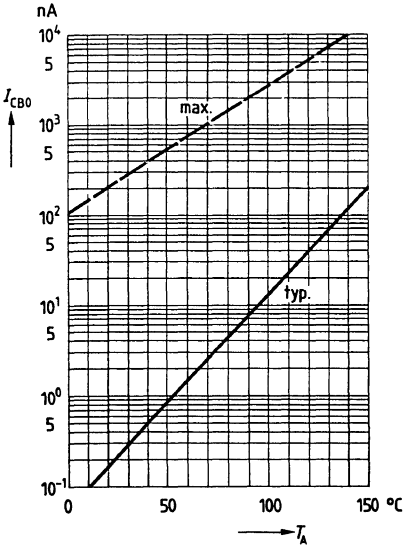
Pulse handling capability $r_{th} = f(t)$
(standardized)



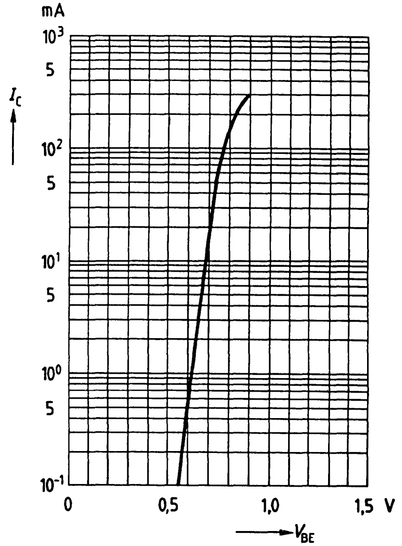
Operating range $I_C = f(V_{CEO})$
T_A = 25 ° C, D = 0



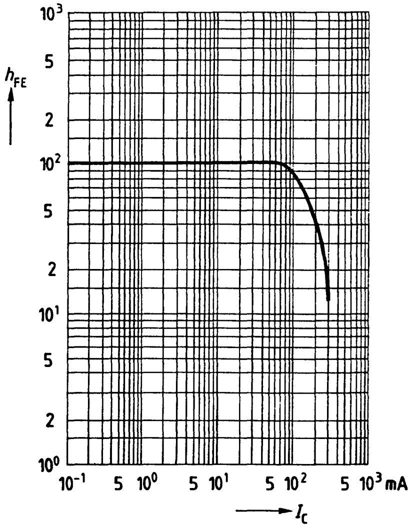
Collector cutoff current $I_{CBO} = f(T_A)$
V_{CB} = 160 V



Collector current $I_C = f(V_{BE})$
V_{CE} = 10 V



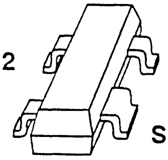
DC current gain $h_{FE} = f(I_C)$
V_{CE} = 10 V



GaAs FETs

GaAs-FET

- N-channel dual-gate GaAs MES FET
- Depletion mode transistor for tuned small-signal applications up to 2 GHz, e. g. VHF, UHF, Sat-TV tuners
- Low noise
- High gain
- Low input capacitance



ESD: Electro**s**tatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
CF 739	MS	Q 62702 – F1215	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	10	V
Gate 1-source voltage	$-V_{G1S}$	6	V
Gate 2-source voltage	$-V_{G2S}$	6	V
Drain current	I_D	80	mA
Gate 1-source peak current	$+I_{G1SM}$	1	mA
Gate 2-source peak current	$+I_{G2SM}$	1	mA
Total power dissipation, $T_A \leq 42$ °C[2])	P_{tot}	240	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–55 ... +125	°C

Thermal Resistance

Junction – ambient[1])	R_{thJA}	≤450	K/W

1) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.

Electrical Characteristics

at T_A = 25 °C, unless otherwise specified.

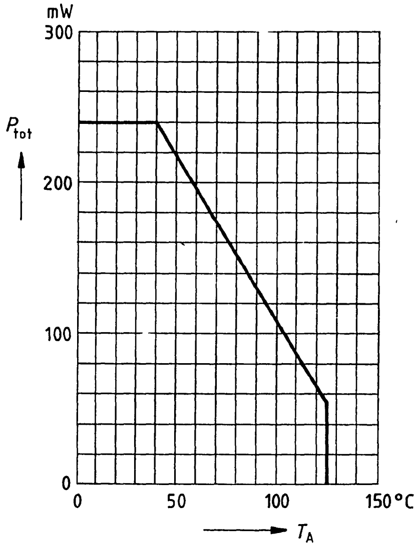
DC characteristics

Parameter	Symbol	Values min	typ	max	Unit
Drain-source breakdown voltage $I_D = 100\ \mu A$, $-V_{G1S} = -V_{G2S} = 4\ V$	$V_{(BR)DS}$	10	–	–	V
Gate 1 leakage current $-V_{G1S} = 5\ V$, $V_{G2S} = V_{DS} = 0$	$-I_{G1SS}$	–	–	20	µA
Gate 2 leakage current $-V_{G2S} = 5\ V$, $V_{G1S} = V_{DS} = 0$	$-I_{G2SS}$	–	–	20	µA
Drain current $V_{G1S} = 0$, $V_{G2S} = 0$, $V_{DS} = 3\ V$	I_{DSS}	10	–	80	mA
Gate 1-source pinch-off voltage $V_{G2S} = 0$, $V_{DS} = 5\ V$, $I_D = 200\ \mu A$	$-V_{G1S(P)}$	–	–	4.5	V
Gate 2-source pinch-off voltage $V_{G1S} = 0$, $V_{DS} = 5\ V$, $I_D = 200\ \mu A$	$-V_{G2S(P)}$	–	–	4.5	V

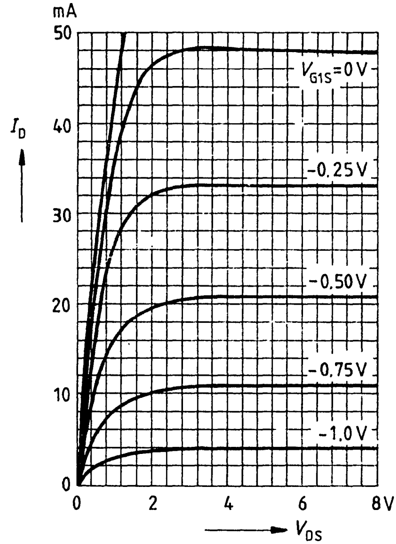
AC characteristics

Parameter	Symbol	min	typ	max	Unit
Forward transconductance $V_{DS} = 5\ V$, $V_{G2S} = 2\ V$, $I_D = 10\ mA$, $f = 1\ kHz$	g_{fs}	–	25	–	mS
Gate 1 input capacitance $V_{G2S} = 2\ V$, $V_{DS} = 5\ V$, $I_D = 10\ mA$, $f = 1\ MHz$	C_{g1ss}	–	0.95	–	pF
Output capacitance $V_{G2S} = 2\ V$, $V_{DS} = 5\ V$, $I_D = 10\ mA$, $f = 1\ MHz$	C_{dss}	–	0.5	–	pF
Noise figure $V_{G2S} = 2\ V$, $V_{DS} = 5\ V$, $I_D = 10\ mA$, $f = 1.75\ GHz$	F	–	1.8	–	dB
Power gain $V_{G2S} = 2\ V$, $V_{DS} = 5\ V$, $I_D = 10\ mA$, $f = 1.75\ GHz$	G_{ps}	–	17	–	dB

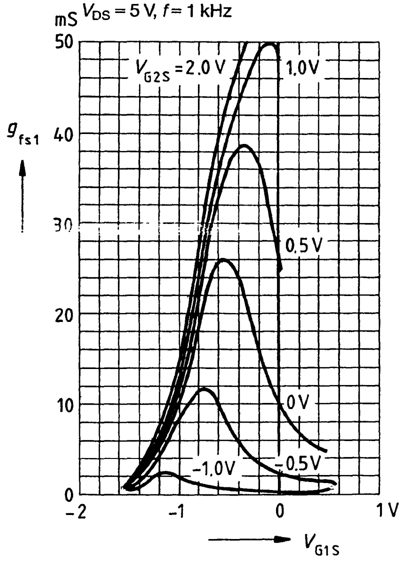
Total power dissipation $P_{tot} = f(T_A)$
package mounted on alumina



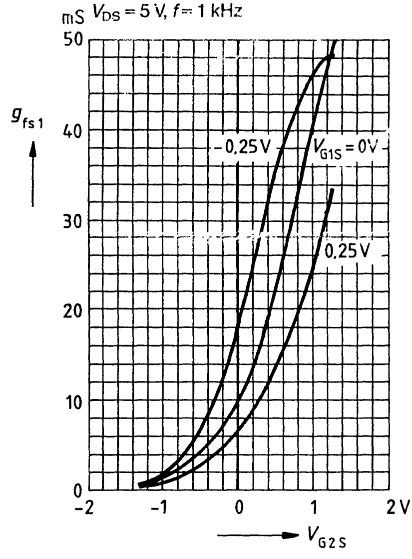
Output characteristics $I_D = f(V_{DS})$
$V_{G2S} = 2$ V



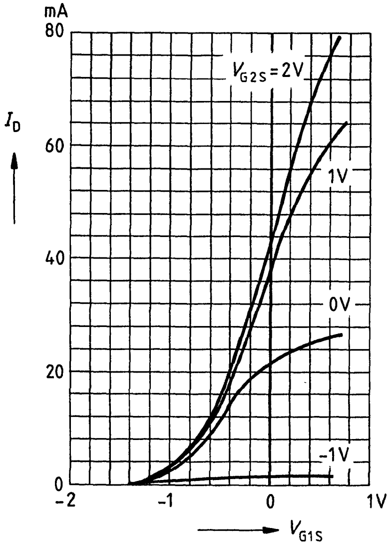
Gate 1 forward transconductance
$g_{fs1} = f(V_{G1S})$
$V_{DS} = 5$ V, $f = 1$ kHz



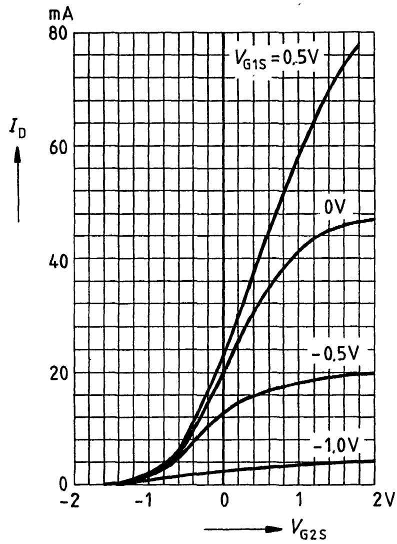
Gate 1 forward transconductance
$g_{fs1} = f(V_{G2S})$
$V_{DS} = 5$ V, $f = 1$ kHz



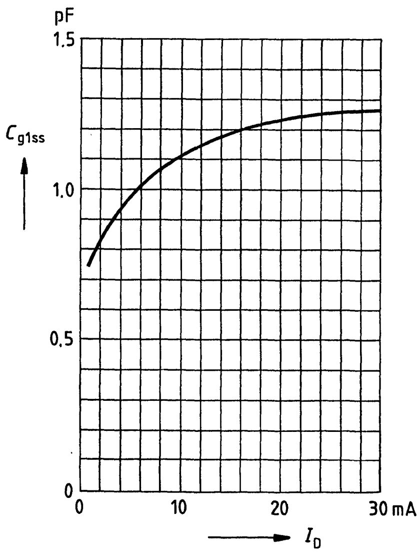
Drain current $I_D = f(V_{G1S})$
$V_{DS} = 5\ V$



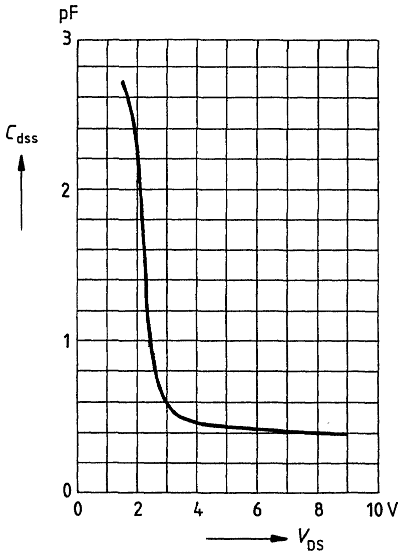
Drain current $I_D = f(V_{G2S})$
$V_{DS} = 5\ V$



Gate 1 input capacitance $C_{g1ss} = f(I_D)$
$V_{G2S} = 2\ V$, $V_{DS} = 5\ V$, $f = 0.1 - 1\ GHz$

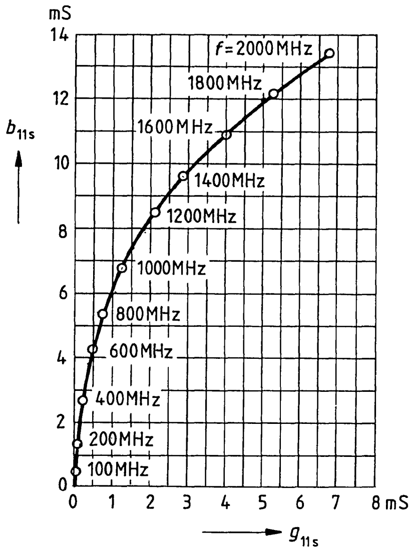


Output capacitance $C_{dss} = f(V_{DS})$
$V_{G2S} = 2\ V$, $I_D = 10\ mA$, $f = 0.1 - 1\ GHz$

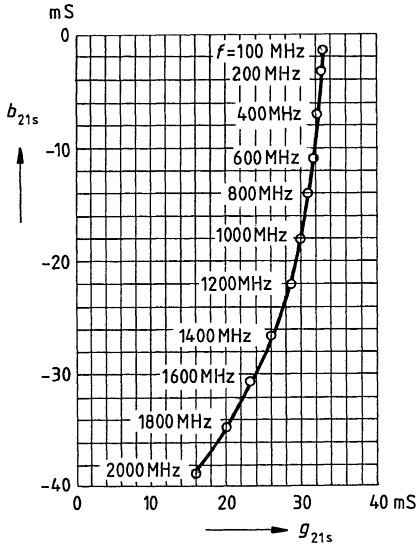


Common Source Admittance Parameters, G_2 RF grounded

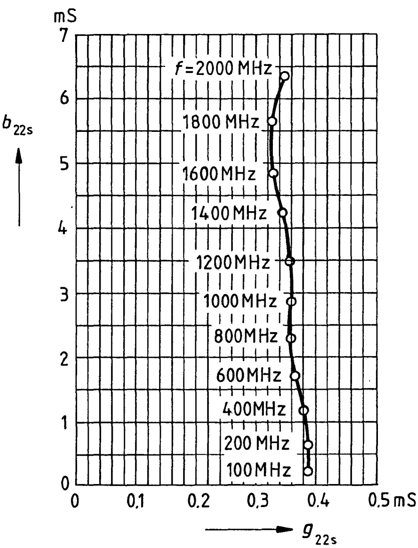
Gate 1 input admittance y_{11s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA



Gate 1 forward transfer admittance y_{21s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA

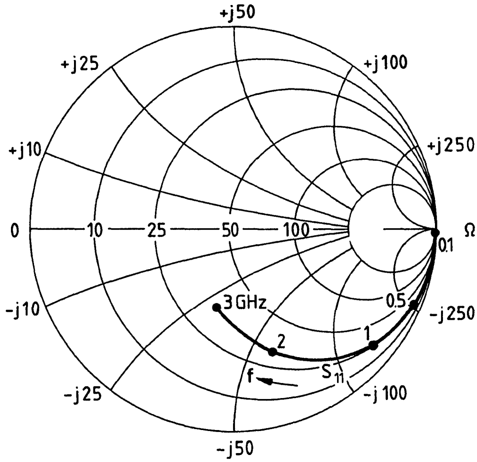


Output admittance y_{22s}
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA

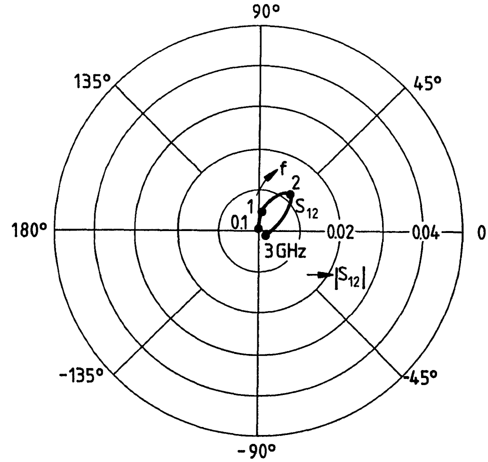


Common Source S Parameters, G_2 RF grounded

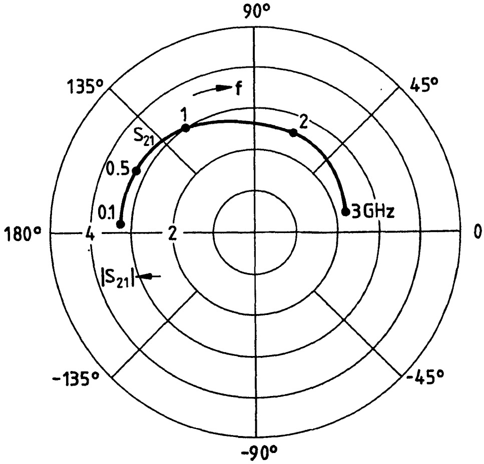
S_{11} = f (*f*), *Z*-plane
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



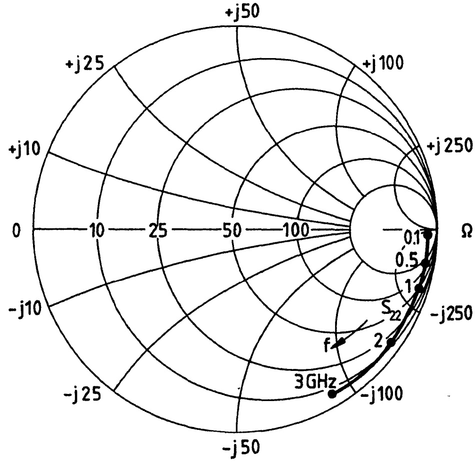
S_{12} = f (*f*)
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



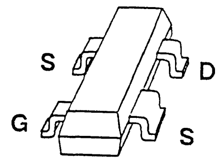
S_{21} = f (*f*)
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



S_{22} = f (*f*), *Z*-plane
V_{DS} = 5 V, V_{G2S} = 2 V, I_D = 10 mA, Z_0 = 50 Ω



- Low noise (F_{min} = 1.4 dB at 4 GHz)
- High gain (11.5 dB typ. at 4 GHz)
- For oscillators up to 12 GHz
- For amplifiers up to 6 GHz
- Ion-implanted planar structure
- Chip all gold metallization
- Chip nitride passivation



ESD: Electrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code (tape and reel)	Package
CFY 30	A2	Q 62703 – F97	SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain voltage	V_{DS}	5	V
Drain-gate voltage	V_{DG}	7	V
Gate-source voltage	V_{GS}	–4 ... +0.5	V
Drain current	I_D	80	mA
Total power dissipation, $T_c \leq 90$ °C	P_{tot}	250	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–40 ... +150	°C

Thermal Resistance

Channel – case	R_{thchC}	≤240	K/W

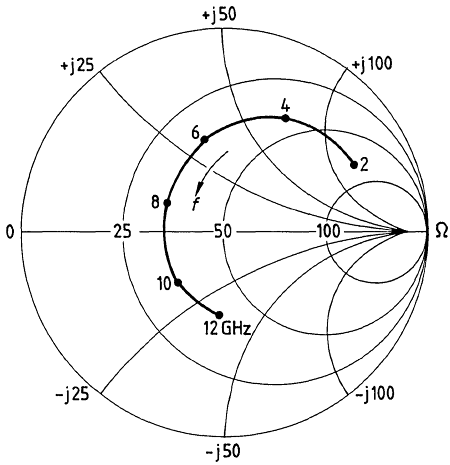
Electrical Characteristics
at T_A = 25 °C.

Parameter	Symbol	Values min	Values typ	Values max	Unit
Drain-source saturation current V_{DS} = 3.5 V, V_{GS} = 0	I_{DSS}	20	50	80	mA
Pinch-off voltage I_D = 1 mA, V_{DS} = 3.5 V	V_P	–0.5	–1.3	–4.0	V
Transconductance I_D = 15 mA, V_{DS} = 3.5 V	g_m	20	30	–	mS
Gate leakage current I_D = 15 mA, V_{DS} = 3.5 V	I_G	–	0.1	2.0	µA
Noise figure	F				dB
I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz		–	1.4	1.6	
f = 6 GHz		–	2.0	–	
Associated gain	G_a				dB
I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz		10	11.5	–	
f = 6 GHz		–	8.9	–	
Maximum available gain I_D = 15 mA, V_{DS} = 3.5 V, f = 6 GHz	*MAG*	–	11.2	–	dB
Maximum stable gain I_D = 15 mA, V_{DS} = 3.5 V, f = 4 GHz	*MSG*	–	14.4	–	dB
Power output at 1 dB compression I_D = 30 mA, V_{DS} = 4 V, f = 6 GHz	P_{1dB}	–	16	–	dBm

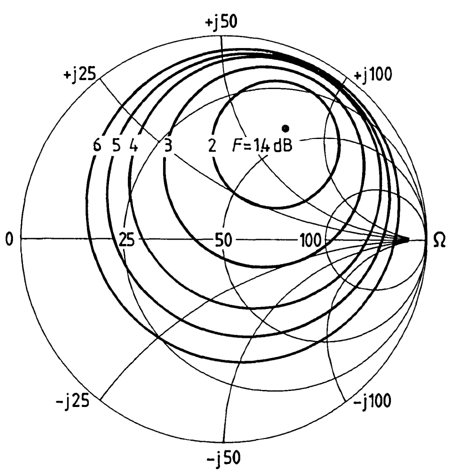
Common Source Noise Parameters
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

f	F_{min}	G_a	Γ_{opt}		R_N	N	$F_{50\Omega}$	$G_{(F50\Omega)}$
GHz	dB	dB	MAG	ANG	Ω	–	dB	dB
2	1.0	15.5	0.72	27	49	0.17	2.9	10.0
4	1.4	11.5	0.64	61	29	0.17	2.7	9.3
6	2.0	8.9	0.46	101	19	0.30	2.8	7.5
8	2.5	7.1	0.31	153	9	0.31	2.8	6.4
10	3.0	5.8	0.34	–133	14	0.38	3.4	4.2
12	3.5	5.0	0.41	– 93	28	0.42	4.1	2.9

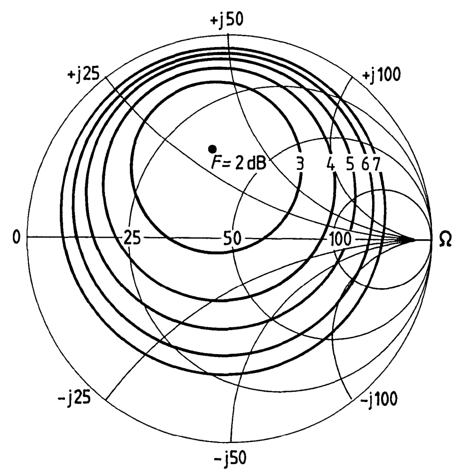
Source impedance for min. noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V



Circles of constant noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V, $f = 4$ GHz

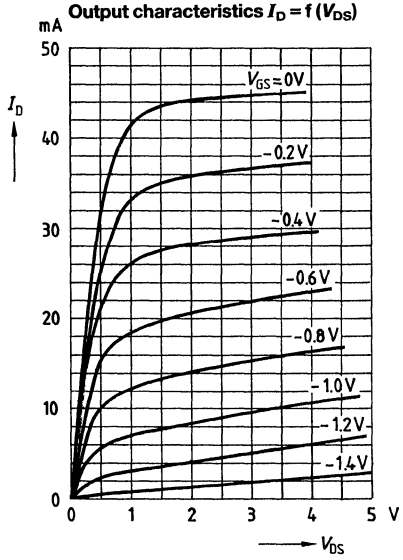


Circles of constant noise figure
$I_D = 15$ mA, $V_{DS} = 3.5$ V, $f = 6$ GHz

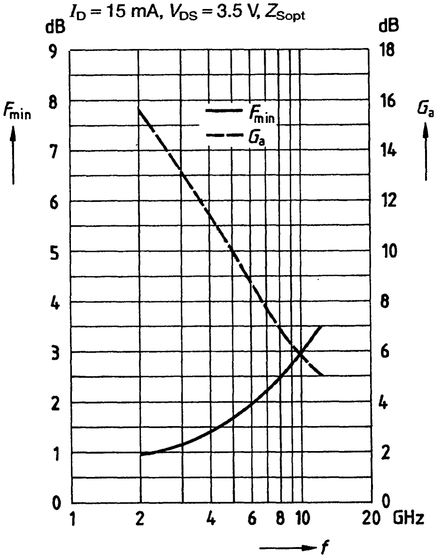


Characteristics at T_A = 25 °C

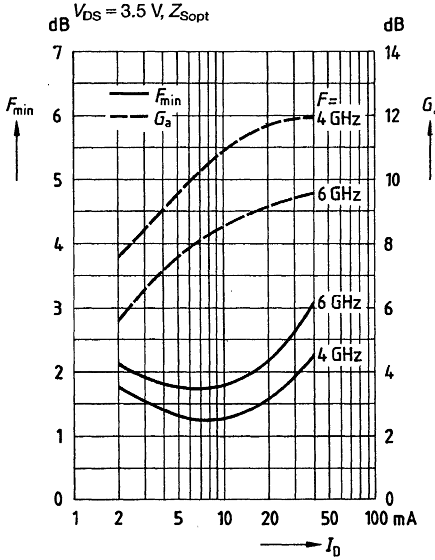
Output characteristics I_D = f (V_{DS})



Minimum noise figure F_{min} = f (*f*)
Associated gain G_a = f (*f*)
I_D = 15 mA, V_{DS} = 3.5 V, Z_{Sopt}



Minimum noise figure F_{min} = f (I_D)
Associated gain G_a = f (I_D)
V_{DS} = 3.5 V, Z_{Sopt}



Common Source S Parameters
I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

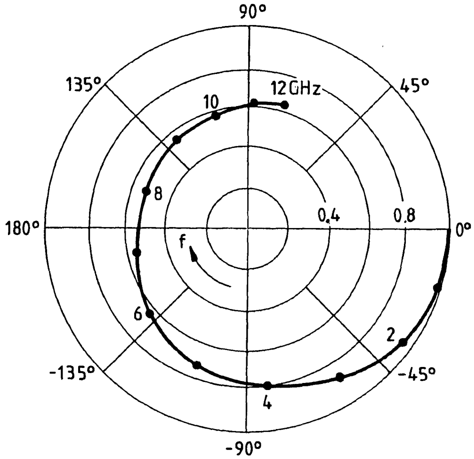
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 1	2.43	178	0.003	87	0.70	– 1
0.2	1.00	– 3	2.43	176	0.005	86	0.70	– 3
0.4	1.00	– 6	2.43	171	0.010	23	0.69	– 5
0.6	1.00	– 10	2.43	167	0.015	81	0.69	– 8
0.8	0.99	– 14	2.43	162	0.020	78	0.68	– 11
1.0	0.99	– 17	2.43	158	0.025	75	0.68	– 13
1.2	0.98	– 21	2.43	154	0.030	72	0.67	– 15
1.4	0.98	– 25	2.44	150	0.035	69	0.67	– 18
1.6	0.97	– 28	2.44	145	0.040	66	0.66	– 20
1.8	0.97	– 32	2.45	141	0.045	63	0.66	– 23
2.0	0.96	– 36	2.45	137	0.050	60	0.65	– 26
2.2	0.95	– 38	2.46	133	0.054	58	0.64	– 28
2.4	0.93	– 44	2.47	129	0.058	55	0.64	– 30
2.6	0.92	– 49	2.48	124	0.062	53	0.63	– 32
2.8	0.90	– 53	2.49	120	0.066	50	0.62	– 35
3.0	0.88	– 58	2.50	116	0.070	48	0.61	– 38
3.2	0.87	– 62	2.50	111	0.074	45	0.60	– 41
3.4	0.85	– 67	2.50	107	0.078	42	0.59	– 44
3.6	0.83	– 72	2.50	102	0.082	39	0.57	– 47
3.8	0.82	– 77	2.50	98	0.086	36	0.55	– 51
4.0	0.80	– 82	2.50	93	0.090	32	0.54	– 54
4.2	0.79	– 87	2.50	88	0.094	29	0.52	– 58
4.4	0.77	– 92	2.51	83	0.097	25	0.50	– 61
4.6	0.76	– 98	2.50	78	0.100	22	0.48	– 64
4.8	0.74	–104	2.49	73	0.103	18	0.46	– 67
5.0	0.72	–110	2.47	68	0.106	15	0.45	– 70
5.2	0.70	–115	2.45	64	0.108	12	0.43	– 73
5.4	0.68	–121	2.43	59	0.110	9	0.42	– 76
5.6	0.66	–127	2.41	54	0.112	6	0.40	– 80
5.8	0.65	–133	2.39	50	0.113	3	0.38	– 84
6.0	0.63	–139	2.36	45	0.114	0	0.36	– 88
6.2	0.62	–144	2.33	41	0.114	– 3	0.33	– 93
6.4	0.60	–150	2.30	37	0.115	– 6	0.31	– 98
6.6	0.59	–156	2.27	32	0.115	– 9	0.29	–104
6.8	0.57	–162	2.24	27	0.116	–11	0.27	–110
7.0	0.56	–168	2.21	22	0.116	–14	0.25	–116
7.2	0.55	–174	2.19	17	0.116	–17	0.24	–122
7.4	0.54	179	2.16	12	0.116	–20	0.23	–129
7.6	0.54	172	2.14	8	0.116	–22	0.21	–137
7.8	0.53	166	2.11	3	0.116	–25	0.20	–145
8.0	0.53	160	2.08	– 2	0.115	–27	0.19	–154
8.2	0.54	153	2.04	– 7	0.114	–30	0.18	–163
8.4	0.54	147	2.00	–11	0.113	–32	0.18	–173
8.6	0.55	141	1.96	–16	0.112	–34	0.17	179
8.8	0.55	135	1.92	–21	0.111	–37	0.18	171

I_D = 15 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

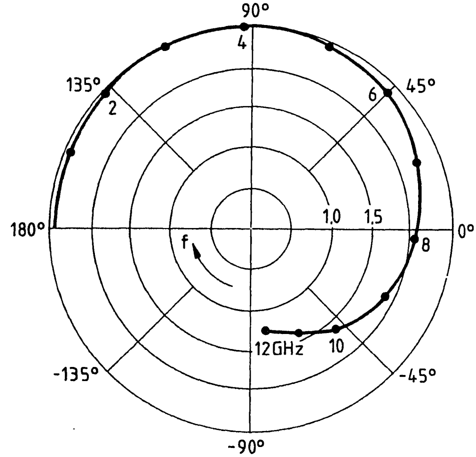
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
9.0	0.55	129	1.88	–25	0.110	–39	0.18	163
9.2	0.56	124	1.83	–30	0.109	–42	0.19	155
9.4	0.56	119	1.78	–35	0.108	–44	0.20	148
9.6	0.57	114	1.72	–40	0.107	–46	0.21	141
9.8	0.57	110	1.66	–44	0.105	–48	0.22	134
10.0	0.58	106	1.61	–48	0.104	–50	0.23	128
10.2	0.58	102	1.56	–52	0.103	–51	0.25	123
10.4	0.59	98	1.51	–56	0.102	–53	0.26	118
10.6	0.59	94	1.46	–59	0.101	–54	0.28	113
10.8	0.60	91	1.42	–62	0.101	–56	0.29	108
11.0	0.60	88	1.38	–65	0.100	–57	0.30	104
11.2	0.61	85	1.35	–69	0.099	–58	0.32	100
11.4	0.61	82	1.32	–72	0.099	–59	0.33	96
11.6	0.62	79	1.30	–75	0.098	–60	0.34	93
11.8	0.62	77	1.27	–78	0.097	–62	0.35	89
12.0	0.62	74	1.25	–81	0.096	–63	0.36	85

$I_D = 15$ mA, $V_{DS} = 3.5$ V, $Z_0 = 50\ \Omega$

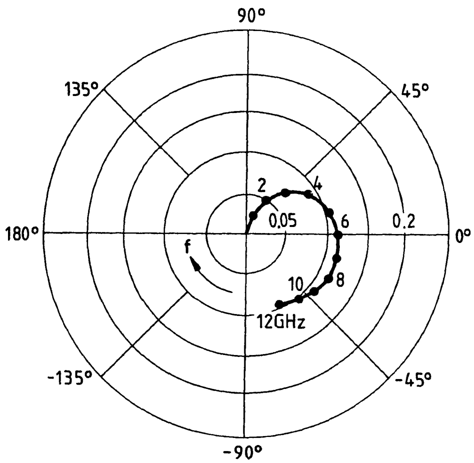
$S_{11} = f(f)$



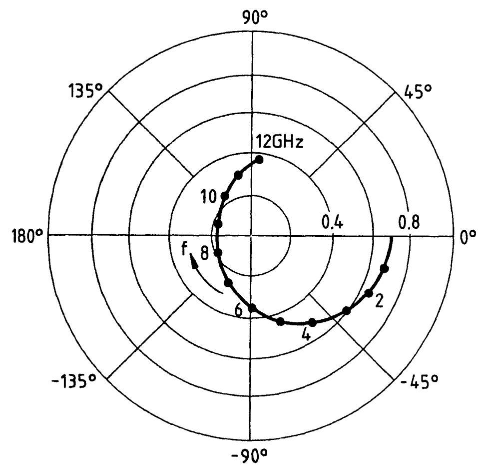
$S_{12} = f(f)$



$S_{21} = f(f)$



$S_{22} = f(f)$



Common Source S Parameters

I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

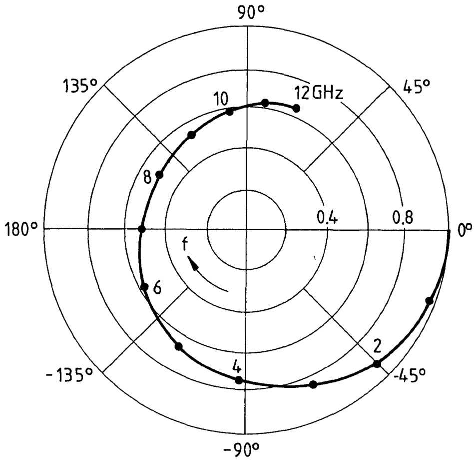
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.1	1.00	– 2	3.23	178	0.002	85	0.71	– 1
0.2	1.00	– 4	3.22	176	0.004	82	0.71	– 3
0.4	1.00	– 8	3.21	171	0.009	79	0.70	– 6
0.6	0.99	– 12	3.20	167	0.013	76	0.69	– 9
0.8	0.99	– 16	3.19	162	0.017	73	0.69	– 11
1.0	0.98	– 20	3.18	157	0.021	73	0.68	– 14
1.2	0.97	– 24	3.18	153	0.025	70	0.67	– 16
1.4	0.96	– 28	3.18	148	0.030	67	0.67	– 19
1.6	0.95	– 32	3.17	143	0.034	65	0.66	– 21
1.8	0.94	– 38	3.17	139	0.038	63	0.66	– 24
2.0	0.92	– 40	3.17	135	0.042	61	0.65	– 26
2.2	0.91	– 44	3.17	131	0.046	58	0.64	– 28
2.4	0.90	– 48	3.17	127	0.051	56	0.63	– 31
2.6	0.89	– 53	3.17	123	0.055	53	0.62	– 33
2.8	0.87	– 58	3.17	119	0.059	50	0.61	– 36
3.0	0.85	– 63	3.17	114	0.063	48	0.60	– 39
3.2	0.83	– 68	3.16	109	0.067	45	0.58	– 42
3.4	0.81	– 73	3.14	104	0.070	42	0.56	– 45
3.6	0.79	– 79	3.12	99	0.073	40	0.55	– 48
3.8	0.77	– 85	3.10	94	0.076	37	0.54	– 51
4.0	0.75	– 91	3.08	88	0.079	34	0.52	– 54
4.2	0.73	– 96	3.06	83	0.082	31	0.51	– 57
4.4	0.71	–102	3.04	78	0.084	28	0.50	– 60
4.6	0.69	–108	3.02	73	0.087	24	0.48	– 63
4.8	0.67	–114	3.00	68	0.089	21	0.47	– 66
5.0	0.65	–120	2.98	63	0.091	18	0.45	– 70
5.2	0.63	–126	2.95	58	0.092	15	0.43	– 73
5.4	0.62	–132	2.91	54	0.093	12	0.41	– 77
5.6	0.60	–138	2.87	49	0.094	10	0.38	– 81
5.8	0.59	–144	2.82	44	0.095	7	0.36	– 85
6.0	0.57	–150	2.77	40	0.096	4	0.34	– 89
6.2	0.56	–156	2.73	35	0.097	2	0.32	– 94
6.4	0.54	–162	2.68	31	0.097	– 1	0.30	– 99
6.6	0.53	–168	2.63	27	0.098	– 4	0.29	–104
6.8	0.52	–174	2.58	22	0.098	– 6	0.27	–109
7.0	0.51	179	2.54	18	0.099	– 9	0.26	–115
7.2	0.51	173	2.50	14	0.099	–11	0.24	–121
7.4	0.51	166	2.46	9	0.099	–13	0.22	–127
7.6	0.50	160	2.43	5	0.099	–16	0.21	–134
7.8	0.50	153	2.40	0	0.099	–18	0.19	–141
8.0	0.50	147	2.36	– 4	0.099	–20	0.18	–148
8.2	0.51	141	2.31	– 8	0.099	–22	0.17	–156
8.4	0.51	135	2.26	–13	0.099	–24	0.16	–164
8.6	0.52	130	2.21	–17	0.099	–27	0.16	–174
8.8	0.52	125	2.15	–22	0.099	–29	0.16	176

I_D = 30 mA, V_{DS} = 3.5 V, Z_0 = 50 Ω

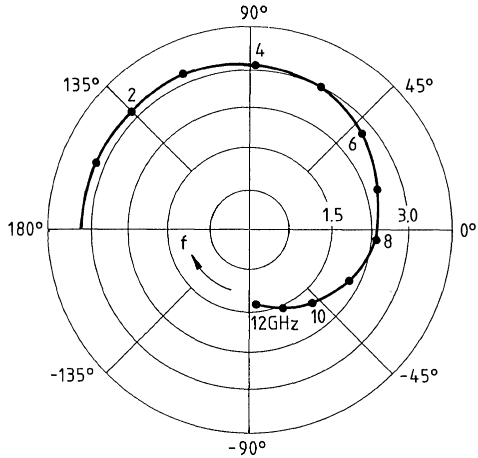
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
9.0	0.53	120	2.09	–26	0.099	–31	0.16	167
9.2	0.54	115	2.04	–30	0.099	–33	0.17	158
9.4	0.55	111	1.98	–35	0.099	–35	0.18	150
9.6	0.55	107	1.93	–39	0.099	–37	0.19	142
9.8	0.56	103	1.87	–43	0.099	–39	0.21	135
10.0	0.57	99	1.82	–47	0.099	–41	0.22	128
10.2	0.58	95	1.76	–51	0.100	–42	0.23	123
10.4	0.59	91	1.71	–54	0.100	–44	0.25	118
10.6	0.60	88	1.65	–58	0.100	–45	0.26	114
10.8	0.60	85	1.60	–62	0.101	–47	0.27	109
11.0	0.61	82	1.55	–65	0.101	–48	0.29	104
11.2	0.61	79	1.51	–69	0.102	–49	0.30	100
11.4	0.61	76	1.47	–72	0.102	–51	0.31	96
11.6	0.62	73	1.44	–75	0.103	–52	0.32	92
11.8	0.62	71	1.41	–78	0.103	–53	0.33	89
12.0	0.62	68	1.38	–82	0.104	–55	0.34	85

$I_D = 30$ mA, $V_{DS} = 3.5$ V, $Z_0 = 50\ \Omega$

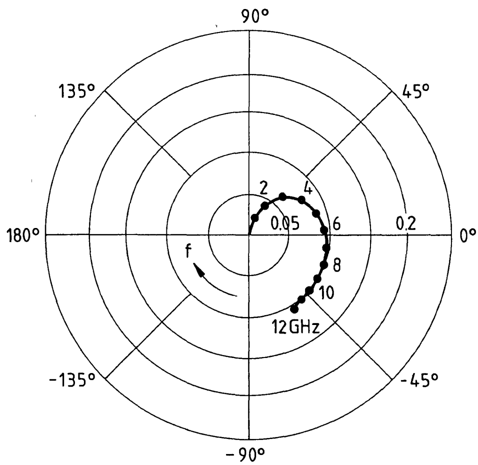
$S_{11} = f(f)$



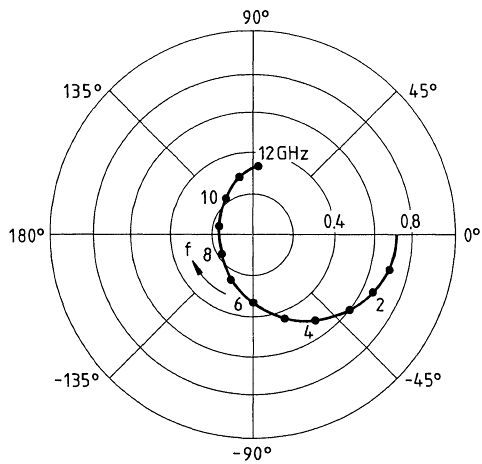
$S_{12} = f(f)$



$S_{21} = f(f)$



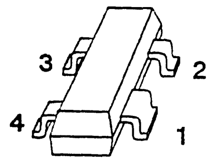
$S_{22} = f(f)$



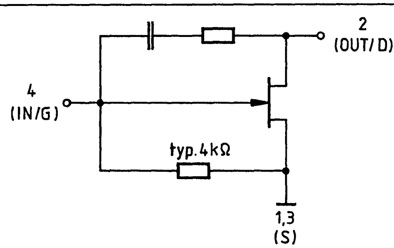
GaAs MMICs

GaAs-MMIC

- Single-stage, monolithic microwave IC (MMIC amplifier)
- Cascadable 50 Ω gain block
- Application range: 100 MHz to 3 GHz
- Third order intercept point 30 dBm typical at 1.8 GHz
- Gain: 8.5 dB typical at 1.8 GHz
- Low noise figure: 3.0 dB typical at 1.8 GHz
- Gain control dynamic range 20 dB
- Ion-implanted planar structure
- Chip all gold metallization
- Chip nitride passivation



ESD: Electrostatic **d**ischarge sensitive device, observe handling precautions!

Type	Marking	Ordering code	Circuit diagram	Package
CGY 50	G2	Q 68000 – A8370		SOT-143

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain voltage (DC)	V_D	5.5	V
Peak drain voltage (DC + RF)	V_{Dp}	7.5	V
Current control gate voltage	V_G	–3 ... 0	V
Drain gate voltage	V_{DG}	7.5	V
Input power	P_{IN}	16	dBm
Total power dissipation, $T_C \leq 100$ °C	P_{tot}	400	mW
Channel temperature	T_{ch}	150	°C
Storage temperature range	T_{stg}	–40 ... +150	°C

Thermal Resistance

Channel – case [1]	R_{thchC}	≤125	K/W

Note: Exceeding any of the maximum ratings may cause permanent damage to the device. Appropriate handling is required to protect the electrostatic-sensitive MMIC against degradation due to excess voltage or excess current spikes. Proper ground connection of leads 1 and 3 (with minimum inductance) is required to achieve the guaranteed RF performance, stable operating conditions and adequate cooling.

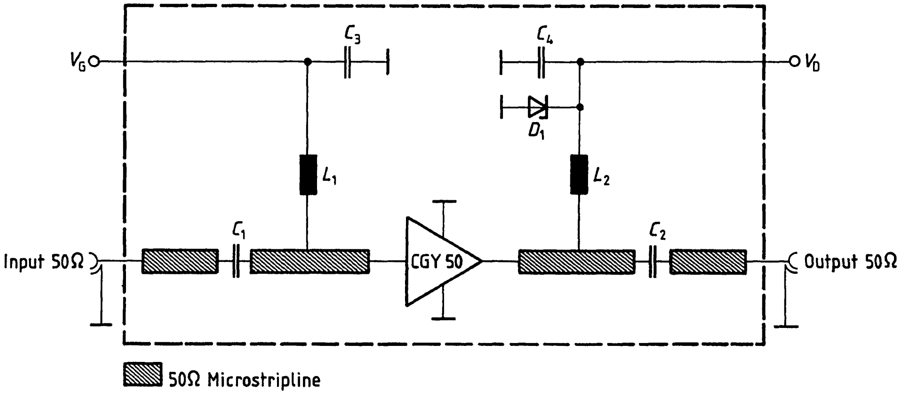
1) For application circuit see page 937.

DC Characteristics
at T_A = 25 °C, V_G = 0 V, V_D = 4.5 V, R_S = R_L = 50 Ω, unless otherwise specified,
(for application circuit see next page).

Parameter	Symbol	Values			Unit
		min	typ	max	
Drain current	I_D	–	60	80	mA
Power gain f = 200 MHz f = 1800 MHz	G	 – 7.5	 10.0 8.5	 – –	dB
Gain flatness f = 200 to 1000 MHz f = 800 to 1800 MHz	ΔG	 – –	 0.4 1.1	 – 2	dB
Noise figure f = 200 to 1800 MHz	F	–	3.0	4.0	dB
Input return loss f = 200 to 1800 MHz	RL_{IN}	9.5	12	–	dB
Output return loss f = 200 to 1800 MHz	RL_{OUT}	9.5	12	–	dB
Third order intercept point, two-tone intermodulation test f_1 = 806 MHz, f_2 = 810 MHz, P_0 = 10 dBm (both carriers)	IP_3	29	31	–	dBm
1 dB gain compression f = 200 to 1800 MHz	P_{1dB}	–	16	–	dBm
Gain control dynamic range f = 200 to 1800 MHz	ΔG	–	20	–	dB

Application Circuit

f = 800 to 1800 MHz

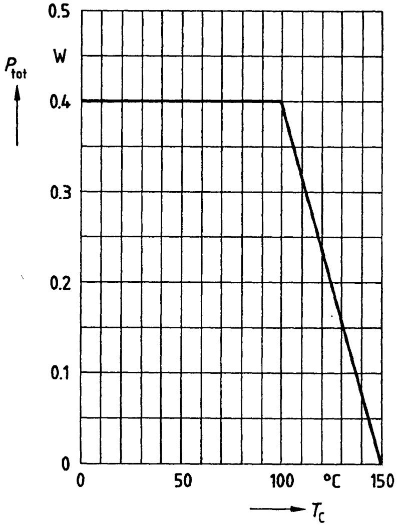


Summary of components

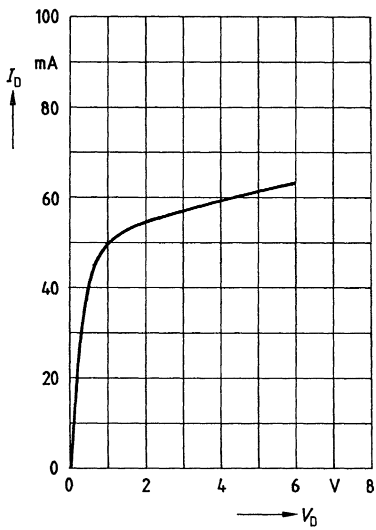
C_1, C_2 C_3, C_4	Chip capacitors 100 pF Chip capacitors 1 nF
L_1, L_2	Discrete inductor 1 µH or printed microstripline inductor
D_1	Z diode 5.6 V (type BZW 22 C5V6)

Note: Operating conditions for $P_{IN\ max}$: $R_G = R_L = 50\ \Omega$, $C_{1\ max}$ = 220 pF, V_D = 4.5 V; V_G current limited <2 mA.

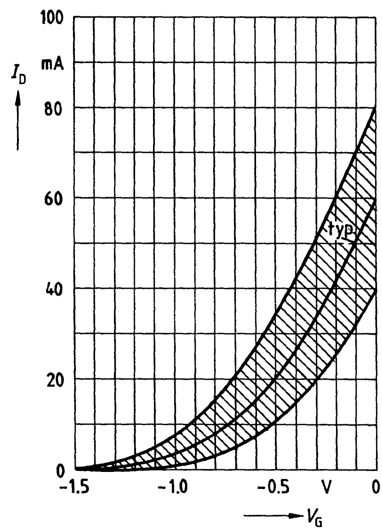
Total power dissipation $P_{tot} = f(T_C)$



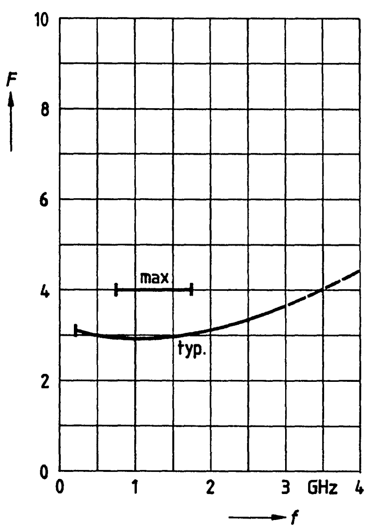
Drain current $I_D = f(V_D)$
$V_G = 0$ V



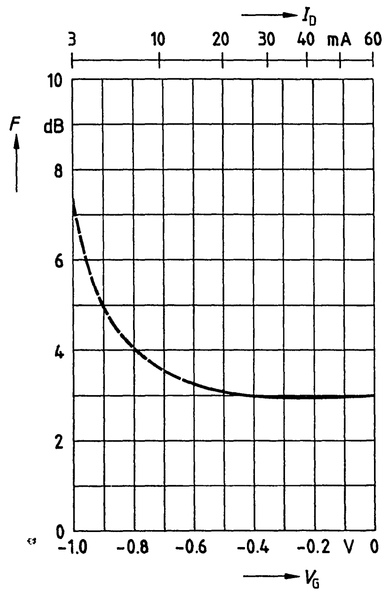
Drain current $I_D = f(V_G)$
$V_D = 4.5$ V



Noise figure $F = f(f)$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$

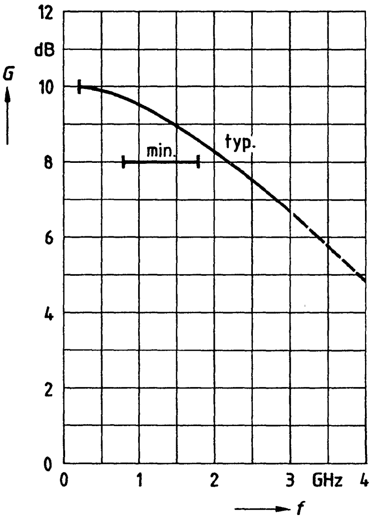


Noise figure $F = f(V_G)$[1])
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$
$f = 200$ to 1800 MHz

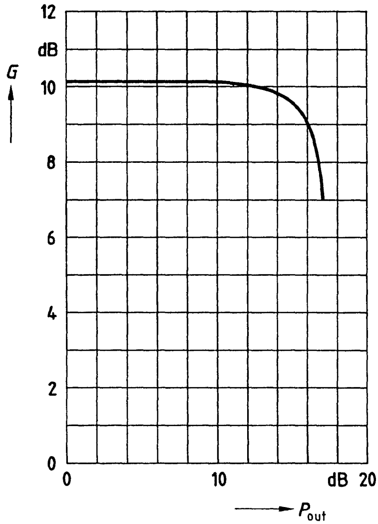


1) See next page.

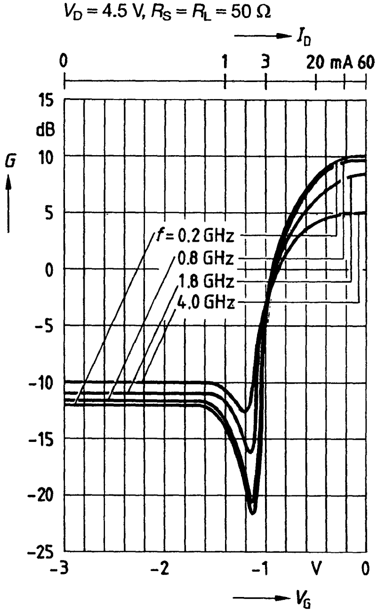
Power gain $G = f(f)$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$



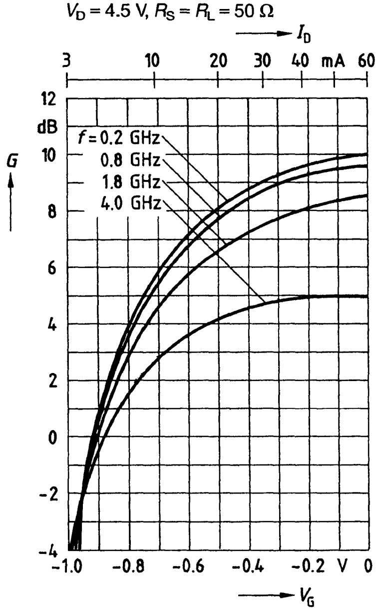
Power gain $G = f(P_{out})$
$V_D = 4.5$ V, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$
$f = 800$ MHz



Power gain $G = f(V_G)$[1]
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$

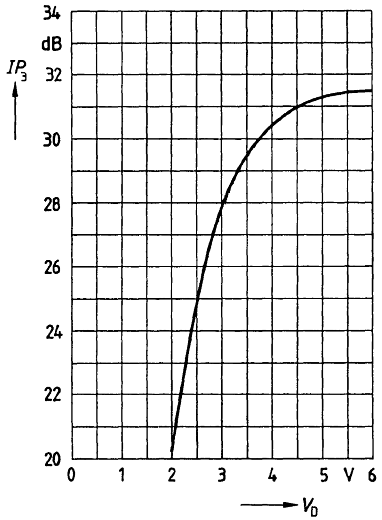


Power gain $G = f(V_G)$[1]
$V_D = 4.5$ V, $R_S = R_L = 50\ \Omega$



1) The gate voltage V_G refers to a typical drain current I_{DSS} of 60 mA with the supplementary information of the I_D values.

Third order intercept point $IP_3 = f(V_D)$
$f = 800$ MHz, $V_G = 0$ V, $R_S = R_L = 50\ \Omega$



The intermodulation ratio d_{IM} can easily be determined.

$d_{IM} = 2\,(IP_3 - P_0)$

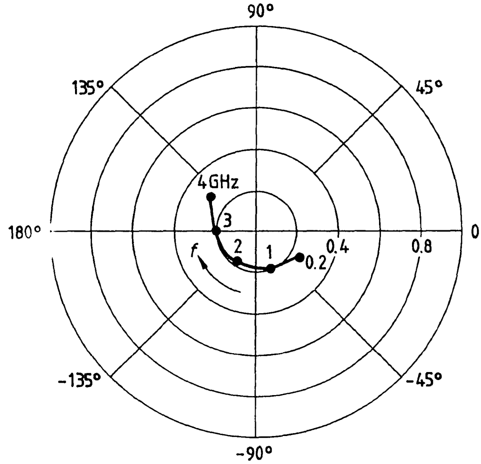
IP_3 = Intercept point
d_{IM} = Intermodulation ratio
P_0 = Power level of each carrier in dBm

S Parameters
$V_D = 4.5$ V, $V_G = 0$ V, $Z_0 = 50\ \Omega$

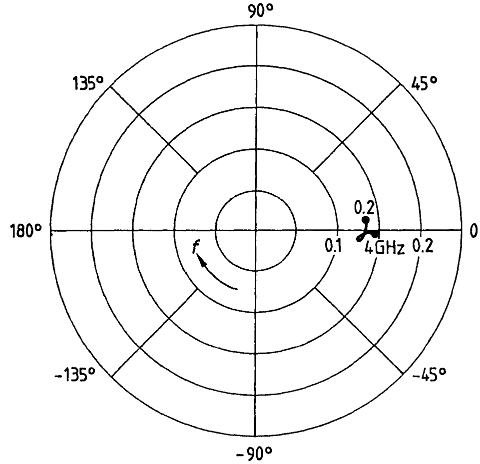
f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
0.2	0.25	– 31	3.30	164	0.14	5.0	0.05	–144
0.4	0.27	– 34	3.20	158	0.14	0.0	0.05	–133
0.6	0.21	– 44	3.17	150	0.13	–2.0	0.08	105
0.8	0.20	– 54	3.09	142	0.13	–3.0	0.01	91
1.0	0.19	– 65	3.00	134	0.13	–4.0	0.12	81
1.2	0.18	– 77	2.90	126	0.13	–5.0	0.14	74
1.4	0.18	– 93	2.81	118	0.13	–5.0	0.16	68
1.6	0.17	–103	2.70	111	0.13	–6.0	0.17	62
1.8	0.17	–119	2.60	103	0.13	–5.0	0.18	56
2.0	0.17	–130	2.50	96	0.12	–5.0	0.19	51
2.2	0.18	–141	2.42	94	0.12	–4.0	0.20	46
2.4	0.18	–152	2.33	83	0.12	–4.0	0.21	42
2.6	0.19	–163	2.24	77	0.12	–3.0	0.21	39
2.8	0.20	–172	2.16	71	0.13	–3.0	0.21	36
3.0	0.21	179	2.07	65	0.13	–2.0	0.21	33
3.2	0.22	172	2.01	60	0.13	–2.0	0.21	30
3.4	0.23	162	1.94	54	0.13	–2.0	0.21	29
3.6	0.24	153	1.87	49	0.14	–1.0	0.21	28
3.8	0.26	148	1.81	43	0.14	–1.0	0.21	27
4.0	0.28	142	1.75	38	0.15	–1.0	0.20	27

S Parameters
$V_D = 4.5\ V$, $V_G = 0\ V$, $Z_0 = 50\ \Omega$

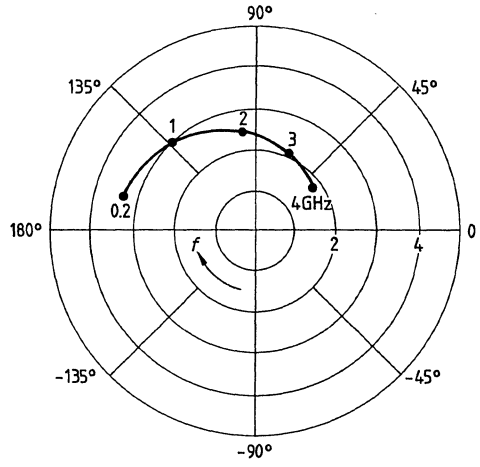
S_{11}



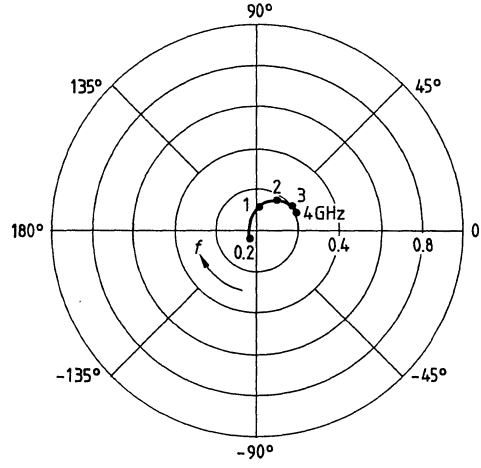
S_{12}



S_{21}



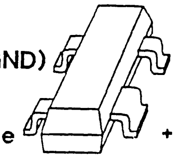
S_{22}



Sensors

GaAs Hall Sensor

- For digital speed and position measurement
- High sensitivity and operating temperature
- Low offset voltage
- Low *TC* of sensitivity and internal resistance



Type	Marking	Ordering code for versions in bulk	Ordering code for versions on 8 mm-tape	Package
S KSY 13	S13	Q62705–K142	–	SOT 143

Maximum ratings

Parameter	Symbol	Ratings	Unit
Control current	I_{1max}	7	mA
Operating temperature range	T_A	$-40 \cdots +150$	°C
Storage temperature range	T_{stg}	$-50 \cdots +160$	°C
Thermal resistance package mounted on alumina 15 mm × 16.7 mm × 0.7 mm	R_{th}	≈ 375	K/W

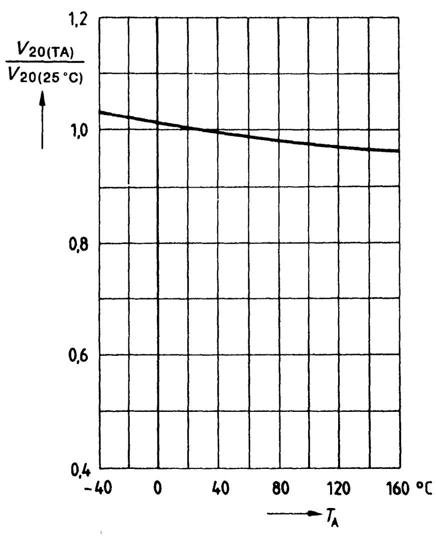
S Preferred type

Electrical characteristics

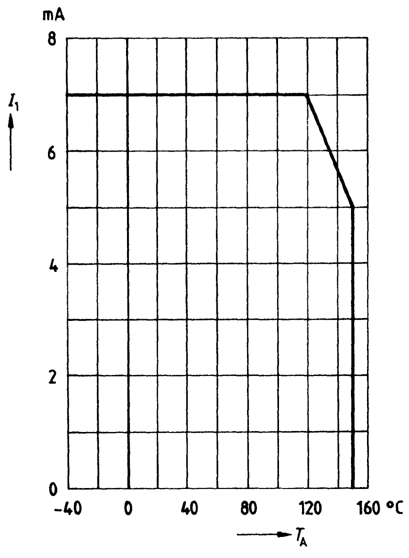
at $T_A = 25\,°C$, unless otherwise specified

Characteristics	Symbol	Ratings	Unit
Rated control current	I_{1N}	5	mA
Open-circuit Hall voltage $I_{1N} = 5$ mA, $B = 0{,}1$ T	V_{20}	95…145	mV
Ohmic offset voltage[1] $I_{1N} = 5$ mA, $B = 0$	V_{RO}	$\leq \pm 30$	mV
Internal resistance at the control side at the Hall side	 R_{10} R_{20}	 900 … 1200 900 … 1200	 Ω Ω
Temperature coefficient of V_{20} $I_{1N} = 5$ mA, $B = 0{,}2$ T	TC_{V20}	$\approx -0{,}05$	%/K
Temperature coefficient of R_{10}, R_{20} $I_1 = 1$ mA, $B = 0{,}2$ T	$TC_{R10/R20}$	$\approx 0{,}08$	%/K

Open-circuit Hall voltage
$\frac{V_{20(TA)}}{V_{20(25\,°C)}} = f(T_A)$



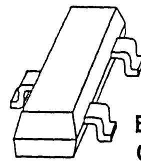
Max. control current $I_1 = f(T_A)$



[1]) Grouping upon request.

NPN silicon planar epitaxial sensors

- Suitable for measuring, controlling and regulating air, non-aggressive gases and liquids
- To be used as element for temperature compensation
- High reliability due to multilayer gold contacts



Type	Marking		Package
S KTY 13 A	TA	Q62705–K13	SOT 23
KTY 13 B	TB	Q62705–K14	
KTY 13 C	TC	Q62705–K15	
KTY 13 D	TD	Q62705–K16	

Maximum ratings

Parameter	Symbol	Ratings	Unit
Max. DC control current	I	3	mA
Peak current $t = 10$ ms	$\hat{I}$	7	mA
Ambient temperature range	T_A	$-50 \cdots +150$	°C
Storage temperature range	T_{stg}	$-50 \cdots +160$	°C

Electrical characteristics

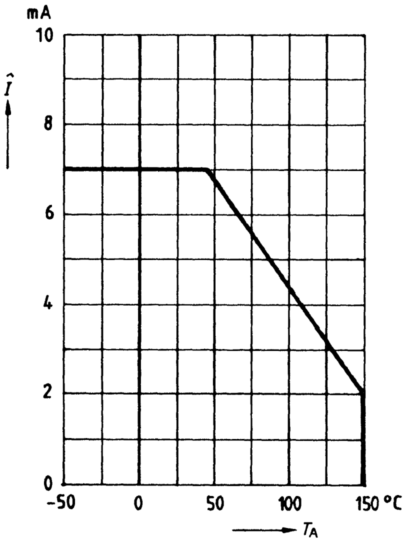
at $T_A = 25\,°C$, unless otherwise specified

		Symbol	min	typ	max	Unit
Basic resistance[1])		R_{25}				
$I_N = 1$ mA	KTY 13 A		1980	2000	2020	Ω
	KTY 13 B		1960	2000	2040	Ω
	KTY 13 C		1900	2000	2100	Ω
	KTY 13 D		1800	2000	2200	Ω
Tolerance of basic resistance R_{25}		$R_{25\text{-tol}}$				
$R_{25} = 2000\ \Omega$, $I_N = 1$ mA	KTY 13 A		–	± 1	–	%
	KTY 13 B		–	± 2	–	%
	KTY 13 C		–	± 5	–	%
	KTY 13 D		–	±10	–	%
Resistance unbalance at polarity change		M				
$I_N = 3$ mA			–	≤ 0,3	–	%
$I_N = 1$ mA			–	≤ 0,1	–	%
Thermal time constant 63% value in still medium						
in air		τ_{Air}	–	7	–	s
in oil		τ_{Oil}	–	1	–	s

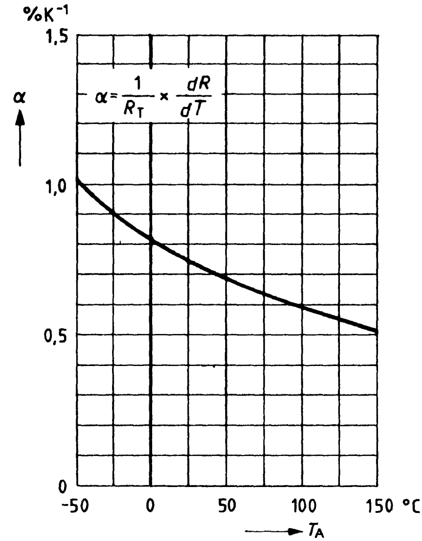
[1]) An operating current of 0.1 mA is recommended for precision measurements, as the inherent temperature rise is negligible and the unbalance decreases.

S Preferred type

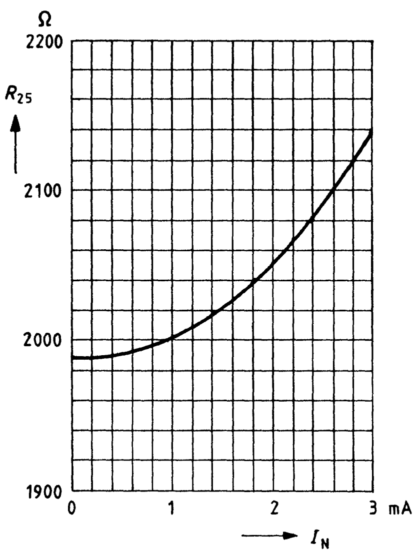
Limited charging current versus ambient temperature $\hat{I} = f(T_A)$
Parameter: air, $t \leq 10$ ms



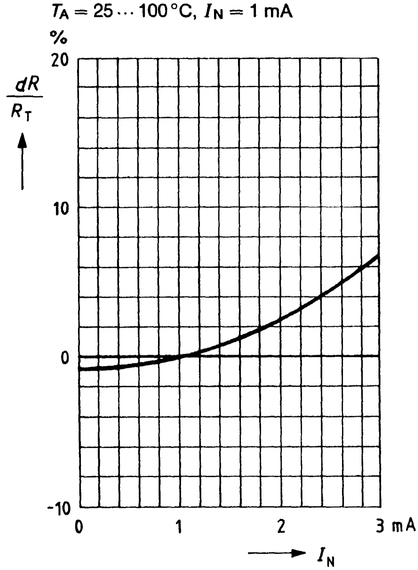
Temperature coefficient versus ambient temperature $\alpha = f(T_A)$



Sensor resistance
$R_{25} = f(I_N)$



Sensor resistance $\frac{dR}{R_T} = f(I_N)$
$T_A = 25 \cdots 100\,°C$, $I_N = 1$ mA



Analytic expression of the regression parabola for the median temperature factor ($I_N = 1$ mA)

$$k_T = \frac{R_T}{R_{25}} = [1 + \alpha(\Delta T) + \beta(\Delta T)^2]$$

Analytic expression for calculating the sensor temperature

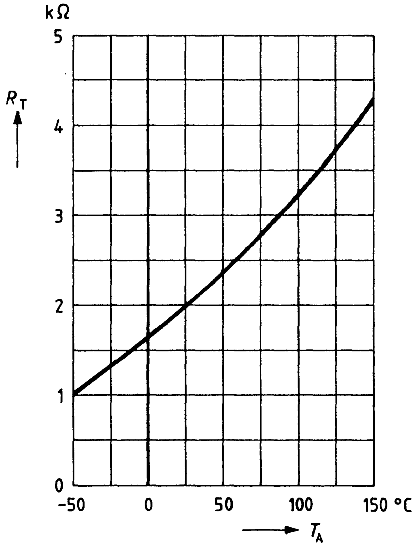
$$T(°C) = 25 + \frac{\sqrt{\alpha^2 - 4\beta + 4\beta \cdot k_T} - \alpha}{2\beta}$$

α = 7,64 · 10^{-3} (K^{-1})
β = 1,66 · 10^{-5} (K^{-1})
R_{25} = resistance value at T_A = 25 °C (e.g. 2000 Ω)
R_T = resistance value at temperature T (°C)
T_A = ambient temperature
ΔT = temperature difference between T_{25} and T
T = temperature ≈ sensor package temperature ≈ ambient temperature

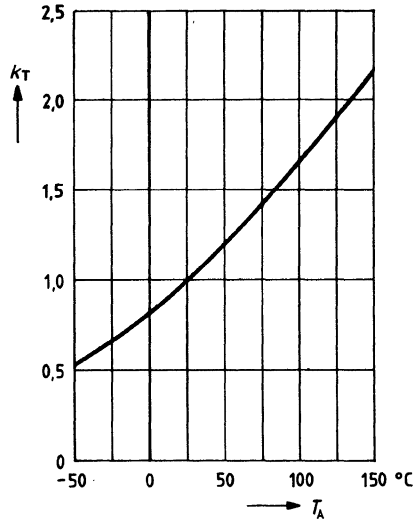
Tolerance of the temperature factor

Temperature T	Temperature factor k_T
+ 150 °C	2,214
+ 125 °C	1,93
+ 100 °C	1,666
+ 75 °C	1,423
+ 50 °C	1,201
+ 25 °C	1,000
0 °C	0,819
− 25 °C	0,659
− 50 °C	0,52

Sensor resistance
$R_T = f(T_A)$
$I_N = 1$ mA



Temperature factor
$k_T = \frac{R_T}{R_{25}} = f(T_A)$



Siemens Components, Inc.
Special Products Division
186 Wood Avenue South
Iselin, New Jersey 08830
Telephone (800) 888-7730
Fax (908) 632-2830
Telex 844891

Order Number B123-B6253-X-X-7600

CP4 20M 5/90 Printed in U.S.A.