DISCRETE POWER DEVICES

DATABOOK

SGS ATES

DISCRETE POWER DEVICES
4th EDITION

DISCRETE POWER DEVICES
4th EDITION
ISSUED JUNE 1980

INTRODUCTION

This databook contains data sheets on the SGS-ATES range of discrete power devices for professional, industrial and consumer applications.
Selection guides are provided in the following pages to facilitate rapid identification of the most suitable device for the intended use.
The information on each product has been specially presented in order that the performance of the product can be readily evaluated within any required equipment design.

SGS-ATES GROUP OF COMPANIES

INTERNATIONAL HEADQUARTERS
SGS-ATES Componenti Elettronici SpA
Via C. Olivetti 2 - 20041 Agrate Brianza - Italy
Tel.: 039-65551
Telex: 330131-330141

BENELUX .
SGS-ATES Componenti Elettronici SpA
Benelux Sales Office
B-1180 Bruxelles
Winston Churchill Avenue, 122
Tel.: 02-3432439
Telex: 24149 B

DENMARK
SGS-ATES Scandinavia AB
Sales Office:
2730 Herlev
Herlev Torv 4
Tel.: 02-948533
Telex: 35280

EASTERN EUROPE
SGS-ATES Componenti Elettronici SpA
Export Sales Office
20041 Agrate Brianza - Italy
Via C. Olivetti, 2
Tel.: 039-6555287/6555207
Telex: 330131-330141

FINLAND
Sales Office:
SGS-ATES Scandinavia AB
02210 Esbo 21
Kääntöpiiri 2
Tel.: 90-881395/6
Telex: 123643

FRANCE
SGS-ATES France S.A.
75643 Paris Cedex 13
Résidence "Le Palatino"
17, Avenue de Choisy
Tel.: 5842730
Telex: 021-250938

GERMANY
SGS-ATES Deutschland Halbleiter
Bauelemente GmbH
8018 Grafing bei München
Haidling 17
Tel.: 08092-691
Telex: 05 27378
Sales Offices:
1000 Berlin 20
Gatower Strasse 185
Tel.: 030-3622031/2
Telex: 01 85418
3012 Langenhagen
Hubertusstrasse 7
Tel.: 0511-772075/7
Telex: 09 23195
8000 München 21
Landsbergerstrasse 289
Tel.: 089-582047/8
Telex: 05 215784
8500 Nürnberg 15
Parsifalstrasse 10
Tel.: 0911-49645/6
Telex: 0626243
7000 Stuttgart 80
Kalifenweg 45
Tel.: 0711-713091/2
Telex: 07 255545

HONG KONG
SGS-ATES Singapore (Pte) Ltd.
1329 Ocean Centre
Canton Road, Kowloon
Tel.: 3 - 662625
Telex: ESGIE HK 63906

ITALY
SGS-ATES Componenti Elettronici SpA
Direzione Commerciale Italia
20149 Milano
Via Correggio, 1/3
Tel.: 02-4695651
Sales Offices:
50127 Firenze
Via Giovanni Del Pian Dei Carpini 96/1
Tel.: 055-4377763
20149 Milano
Via Correggio 1/3
Tel.: 02-4695651
00199 Roma
Piazza Gondar 11
Tel.: 06-8392848/8312777
10121 Torino
Corso G. Ferraris, 26
Tel.: 011-531167

NORWAY
SGS-ATES Scandinavia AB
Sales Office:
Oslo 1
Stensberg gata 29
Tel.: 02-607222
Telex: 17472

SINGAPORE
SGS-ATES Singapore (Pte) Ltd.
Singapore 1231
Lorong 4 & 6 - Toa Payoh
Tel.: 2531411
Telex: ESGIES RS 21412

SWEDEN
SGS-ATES Scandinavia AB
19501 Märsta
Tingvallavaegen 9J
Tel.: 0760-40120
Telex: 042-10932

UNITED KINGDOM
SGS-ATES (United Kingdom) Ltd.
Aylesbury, Bucks
Planar House, Walton Street
Tel.: 0296-5977
Telex: 041-83245

U.S.A.
SGS-ATES Semiconductor Corporation
Waltham, MA 02154
240 Bear Hill Road
Tel.: (617) 890-6688
Telex: 923495 WHA
SGS-ATES Semiconductor Corporation
Mid-West Regional Office
Des Plaines, IL 60018
2340 Des Plaines Ave Suite 309
Tel.: (312) 296-4035
Telex: 282547

TABLE OF CONTENTS

ALPHA - NUMERICAL INDEX

ALPHA - NUMERICAL INDEX (continued)

SELECTION GUIDE BASED ON $I_{C\,(max)}$ and V_{CEO}

Collector-emitter voltage (V)

Collector current (A)

A \ V	22	30	32	40	45	50	60	70	75	80	90	100	110	120
1												2N5681 2N5679		2N5682 2N5680
				TIP29 TIP30			TIP29A TIP30A			TIP29B TIP30B		TIP29C TIP30C		
1.5														BSW67
					BD135 BD136		BD137 BD138			BD139 BD140				
2					BD375 BD376 BD233 BD234		BD377 BD378 BD235 BD236			BD379 BD380 BD237 BD238				
					BD239 BD240		BD239A BD240A			BD239B BD240B		BD239C BD240C		
							TIP110 TIP115			TIP111 TIP116		TIP112 TIP117		
3				2N3867 2N4234 2N4237			2N3868 2N4235 2N4238			2N4236 2N4239 2N6303				
							2N3418 2N3420			2N3419 2N3421				
					BD175 BD176		BD177 BD178			BD179 BD180				
				TIP31 TIP32	BD241 BD242		BD241A BD242A TIP31A TIP32A			BD241B BD242B TIP31B TIP32B		BD241C BD242C TIP31C TIP32C		
3.5														
4														
				2N4910 2N4898			2N4911 2N4899			2N4912 2N4900				
	BD433 BD434		BD435 BD436		BD437 BD438		BD439 BD440			BD441 BD442				
					2N6121 2N6124 BD675A BD676A		2N6122 2N6125 BD677 BD677A BD678 BD678A MJE700 MJE701 MJE800 MJE801			2N6123 2N6126 BD679 BD679A BD680 BD680A MJE702 MJE703 MJE802 MJE803		BD681 BD682		

125	140	150	160	170	180	200	250	300	325	350	375	400	450	V/W
						2N5415	2N3440 2N3440S	2N5416		2N3439				10
														30
		BSW68												5
														12.5
														25
														30
														50
														6
		BU125S				BUY49S								10
														15
						BU325								25
														30
														40
												BUX46		85
					BDW91 BDW92									10
														25
														36
														40

Power dissipation (W)

SELECTION GUIDE BASED ON $I_{C\,(max)}$ and V_{CEO} (continued)

Collector-emitter voltage (V)

Collector current (A)

A \ V	22	30	32	40	45	50	60	70	75	80	90	100	110	120
4				2N5190 2N5193 2N6034 2N6037			2N5191 2N5194 2N6035 2N6038			2N5192 2N5195 2N6036 2N6039				
5							BFX34 BSS44							
										2N5336 2N5337		2N5338 2N5339		
							2N4895 2N4896			2N4897				
										2N5151 2N5152 2N5153 2N5154				
										BUR10				
										BUX77 BUX78				
							TIP120 TIP125			TIP121 TIP126		TIP 122 TIP127		
6														
					BDW23 BDW24		BDW23A BDW24A			BDW23B BDW24B		BDW23C BDW24C		
				TIP41 TIP42	BD243 BD244		BD243A BD244A TIP41A TIP42A			BD243B BD244B TIP41B TIP42B		BD243C BD244C TIP41C TIP42C		
7							BU125 BUY68							BUY47
		2N6288 2N6111				2N6290 2N6109		2N6292 2N6107		2N5427 2N5428		2N5429 2N5430		

125	140	150	160	170	180	200	250	300	325	350	375	400	450	V / W
														40
														5
														6
														7
														11.7
														30
														40
														65
								2N6542				2N6543		100
														120
		BDW53S BDW54S												15
														50
	BDX53E BDX54E		BDX53F BDX54F							BU910		BU911 BUX82	BU912	60
										BUX97		BUX97A BU326S	BUX97B	60*
														65
								BU126			BU326		BU326A	75
				BUY48										10
														40
		BU407 BU407H BU407D BU409				BU406 BU406H BU406D BU408 BU408D								60

Power dissipation (W)

* at $T_{case} \leqslant 75\,^{\circ}C$

SELECTION GUIDE BASED ON $I_{C\,(max)}$ and V_{CEO} (continued)

Collector-emitter voltage (V)

Collector current (A)

A \ V	22	30	32	40	45	50	60	70	75	80	90	100	110	120
7														
							2N5871 2N5873			2N5872 2N5874				
8					BD533 BD534		BD535 BD536			BD537 BD538				
					BDX53 BDX54		BDX53A BDX54A			BDX53B BDX54B		BDX53C BDX54C		
					2N6386									
							TIP130 TIP135			TIP131 TIP136		TIP132 TIP137		
							MJ1000 MJ900			MJ1001 MJ901				
							2N6055 2N6053			2N6056 2N6054				
8.5														
10								2N4150						
														BUR12
							BDY92			BDY91		BDY90		
							2N6387			2N6388				
					BD663 BD664		BDX71	BDX73						
					BDW21 BDW22		BDW21A BDW22A			BDW21B BDW22B		BDW21C BDW22C		
					BDX85 BDX86		BDX85A BDX86A			BDX85B BDX86B		BDX85C BDX86C		
														BDX12

125	140	150	160	170	180	200	250	300	325	350	375	400	450	V/W
						BUY18S								**75**
						BU606 BU606D BU607 BU607D BU608 BU608D								**90**
														115
														50
		BU807				BU806								**60**
														65
														70
														90
														100
												BUX44		**120**
								2N6544				2N6545		**125**
														150
												BUX47		**107**
														8.75
														40
														60
														65
														75
						BUW66 BUW67								**90**
						BUY69C			BUY69B	BUW22 BUW24		BUY69A BUX80		**100**
	BDX11													**117**
									BUX43	BU920		BU921	BU922	**120**
												BUW25 BUW34 BUW35 BUW23 BUW32	BUW26 BUW36	**125**

Power dissipation (W)

SELECTION GUIDE BASED ON $I_{C\,(max)}$ and V_{CEO} (continued)

Collector-emitter voltage (V)

Collector current (A)

A \ V	22	30	32	40	45	50	60	70	75	80	90	100	110	120
10														2N6354
10							MJ3000 MJ2500 2N3713 2N3715 2N3789 2N3791 2N5875 2N5877			MJ3001 MJ2501 2N3714 2N3716 2N3790 2N3792 2N5876 2N5878				
12					BD705 BD706		BD707 BD708			BD709 BD710		BD711 BD712		
12					BDW93 BDW94		BDW93A BDW94A			BDW93B BDW94B		BDW93C BDW94C		
12					BDX87 BDX88		BDX87A BDX88A			BDX87B BDX88B		BDX87C BDX88C		
12							2N6057 2N6050			2N6058 2N6051		2N6059 2N6052		
15				2N6486 2N6489			2N6487 2N6490			2N6488 2N6491				
15					BD905 BD906		BD907 BD908			BD909 BD910		BD911 BD912		
15							2N3055 BDX10 BDX10C BDX18							
15				BDX13	BD181 BD142		BD182			BD183				
15														
15					BDW51 BDW52		BDW51A BDW52A			BDW51B BDW52B		BDW51C BDW52C		
15													2N6496	
15							MJ2955	BDX60						
15														
16				BDX75										
18														
20														
20									2N5039		2N5038			
20														
20														

125	140	150	160	170	180	200	250	300	325	350	375	400	450	V/W
														140
												BUX14		**150**
														75
														80
							BUX42							**120**
														150
														75
														90
														115
														117
						BUX41								**120**
												BUX48		**125**
														140
									BUX13	BU930		BU931	BU932	**150**
								2N6546				BUW44 BUW45 2N6547	BUW46	**175**
														75
			BUX41N											**120**
BUX40														**120**
														140
			BUX11N			BUX11	BUX12							**150**
						BUR11								**175**

Power dissipation (W)

SELECTION GUIDE BASED ON $I_{C\,(max)}$ and V_{CEO} (continued)

Collector-emitter voltage (V)

Collector current (A)

A \ V	22	30	32	40	45	50	60	70	75	80	90	100	110	120
25										BDY57				
30											2N5671			2N5672
														2N6033
40														
											2N6032			
50														
60														
70														

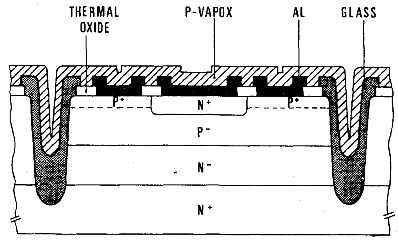
125	140	150	160	170	180	200	250	300	325	350	375	400	450	V / W
BUX10														150
BDY58														175
									BUR23			BUR24		250
														140
														140
						BUR21	BUR22							250
						BUX21	BUX22							350
														140
BUR20														250
BUX20														350
						BUR51	BUR52							350
BUR13														250
BUR50														350

Power dissipation (W)

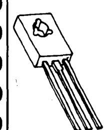
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES

EPITAXIAL BASE

NPN and PNP types
(perfect complementary pairs)
Medium V_{CEO} range (22 to 100 V)
Medium switching speed
Medium f_T (2 to 20 MHz)
High ruggedness
Monolithic Darlington capability

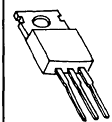


EPITAXIAL BASE -TO-126

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} A/V	V_{CE} sat max (V)	@ I_C/I_B (A/mA)	PACKAGE
BD175	BD176	45	45	3	30	40	0.15/2	0.8	1/100	(TO-126)
BD177	BD178	60	60	3	30	40	0.15/2	0.8	1/100	
BD179	BD180	80	80	3	30	40	0.15/2	0.8	1/100	
BD233	BD234	45	45	2	25	40	0.15/2	0.6	1/100	
BD235	BD236	60	60	2	25	40	0.15/2	0.6	1/100	
BD237	BD238	100	80	2	25	40	0.15/2	0.6	1/100	
BD433	BD434	22	22	4	36	50	2/1	0.5	2/200	
BD435	BD436	32	32	4	36	50	2/1	0.5	2/200	
BD437	BD438	45	45	4	36	40	2/1	0.6	2/200	
BD439	BD440	60	60	4	36	25	2/1	0.8	2/200	
BD441	BD442	80	80	4	36	15	2/1	0.8	2/200	
* BD675A	BD676A	45	45	4	40	750	2/3	2.8	2/8	
* BD677	BD678	60	60	4	40	750	1.5/3	2.5	1.5/6	
* BD677A	BD678A	60	60	4	40	750	2/3	2.8	2/8	
* BD679	BD680	80	80	4	40	750	1.5/3	2.5	1.5/6	
* BD679A	BD680A	80	80	4	40	750	2/3	2.8	2/8	
* BD681	BD682	100	100	4	40	750	1.5/3	2.5	1.5/6	
* MJE800	MJE700	60	60	4	40	750	1.5/3	2.5	1.5/30	
* MJE801	MJE701	60	60	4	40	750	2/3	2.8	2/40	
* MJE802	MJE702	80	80	4	40	750	1.5/3	2.5	1.5/30	
* MJE803	MJE703	80	80	4	40	750	2/3	2.8	2/40	
2N5190	2N5193	40	40	4	40	25	1.5/2	0.6	1.5/150	
2N5191	2N5194	60	60	4	40	25	1.5/2	0.6	1.5/150	
2N5192	2N5195	80	80	4	40	20	1.5/2	0.6	1.5/150	
* 2N6037	2N6034	40	40	4	40	750	2/3	2	2/8	
* 2N6038	2N6035	60	60	4	40	750	2/3	2	2/8	
* 2N6039	2N6036	80	80	4	40	750	2/3	2	2/8	

* Darlington types

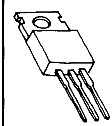
EPITAXIAL BASE - TO-220

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BD239	BD240	55	45	2	30	40	0.2/4	0.7	1/200	TO-220
BD239A	BD240A	70	60	2	30	40	0.2/4	0.7	1/200	
BD239B	BD240B	90	80	2	30	40	0.2/4	0.7	1/200	
BD239C	BD240C	115	100	2	30	40	0.2/4	0.7	1/200	
BD241	BD242	55	45	3	40	25	1/4	1.2	3/600	
BD241A	BD242A	70	60	3	40	25	1/4	1.2	3/600	
BD241B	BD242B	90	80	3	40	25	1/4	1.2	3/600	
BD241C	BD242C	115	100	3	40	25	1/4	1.2	3/600	
BD243	BD244	45	45	6	65	30	0.3/4	1.5	6/1000	
BD243A	BD244A	60	60	6	65	30	0.3/4	1.5	6/1000	
BD243B	BD244B	80	80	6	65	30	0.3/4	1.5	6/1000	
BD243C	BD244C	100	100	6	65	30	0.3/4	1.5	6/1000	
BD533	BD534	45	45	8	50	25	2/2	0.8	2/200	
BD535	BD536	60	60	8	50	25	2/2	0.8	2/200	
BD537	BD538	80	80	8	50	15	2/2	0.8	2/200	
BD663	BD664	45	45	10	75	20	2/2	1	3/300	
BD705	BD706	45	45	12	75	20	4/4	1	4/400	
BD707	BD708	60	60	12	75	15	4/4	1	4/400	
BD709	BD710	80	80	12	75	15	4/4	1	4/400	
BD711	BD712	100	100	12	75	15	4/4	1	4/400	
BD905	BD906	45	45	15	90	15	5/4	1	5/500	
BD907	BD908	60	60	15	90	15	5/4	1	5/500	
BD909	BD910	80	80	15	90	15	5/4	1	5/500	
BD911	BD912	100	100	15	90	15	5/4	1	5/500	
BDW23	BDW24	45	45	6	50	750	2/3	2	2/8	
* BDW23A	BDW24A	60	60	6	50	750	2/3	2	2/8	
* BDW23B	BDW24B	80	80	6	50	750	2/3	2	2/8	
* BDW23C	BDW24C	100	100	6	50	750	2/3	2	2/8	
* BDW93	BDW94	45	45	12	80	750	5/3	2	5/20	
* BDW93A	BDW94A	60	60	12	80	750	5/3	2	5/20	
* BDW93B	BDW94B	80	80	12	80	750	5/3	2	5/20	
* BDW93C	BDW94C	100	100	12	80	750	5/3	2	5/20	
* BDX53	BDX54	45	45	8	60	750	3/3	2	3/12	
* BDX53A	BDX54A	60	60	8	60	750	3/3	2	3/12	

* Darlington types

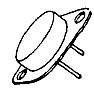
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES (continued)

EPITAXIAL BASE - TO-220 (continued)

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_c/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
* BDX53B	BDX54B	80	80	8	60	750	3/3	2	3/12	TO-220
* BDX53C	BDX54C	100	100	8	60	750	3/3	2	3/12	
* BDX53E	BDX54E	140	140	6	60	500	2/5	2	2/10	
* BDX53F	BDX54F	160	160	6	60	500	2/5	2	2/10	
TIP29	TIP30	40	40	1	30	40	0.2/4	0.7	1/125	
TIP29A	TIP30A	60	60	1	30	40	0.2/4	0.7	1/125	
TIP29B	TIP30B	80	80	1	30	40	0.2/4	0.7	1/125	
TIP29C	TIP30C	100	100	1	30	40	0.2/4	0.7	1/125	
TIP31	TIP32	40	40	3	40	25	1/4	1.2	3/375	
TIP31A	TIP32A	60	60	3	40	25	1/4	1.2	3/375	
TIP31B	TIP32B	80	80	3	40	25	1/4	1.2	3/375	
TIP31C	TIP32C	100	100	3	40	25	1/4	1.2	3/375	
TIP41	TIP42	40	40	6	65	30	0.3/4	1.5	6/600	
TIP41A	TIP42A	60	60	6	65	30	0.3/4	1.5	6/600	
TIP41B	TIP42B	80	80	6	65	30	0.3/4	1.5	6/600	
TIP41C	TIP42C	100	100	6	65	30	0.3/4	1.5	6/600	
* TIP110	TIP115	60	60	2	50	1000	1/4	2.5	2/8	
* TIP111	TIP116	80	80	2	50	1000	1/4	2.5	2/8	
* TIP112	TIP117	100	100	2	50	1000	1/4	2.5	2/8	
* TIP120	TIP125	60	60	5	65	1000	3/3	2	3/12	
* TIP121	TIP126	80	80	5	65	1000	3/3	2	3/12	
* TIP122	TIP127	100	100	5	65	1000	3/3	2	3/12	
* TIP130	TIP135	60	60	8	70	1000	4/4	2	4/16	
* TIP131	TIP136	80	80	8	70	1000	4/4	2	4/16	
* TIP132	TIP137	100	100	8	70	1000	4/4	2	4/16	
2N6121	2N6124	45	45	4	40	25	1.5/2	0.6	1.5/150	
2N6122	2N6125	60	60	4	40	25	1.5/2	0.6	1.5/150	
2N6123	2N6126	80	80	4	40	20	1.5/2	0.6	1.5/150	
2N6288	2N6111	40	30	7	40	30	4/3	1	3/300	
2N6290	2N6109	60	50	7	40	30	4/2.5	1	2.5/250	
2N6292	2N6107	80	70	7	40	30	4/2	1	2/200	
* 2N6386		40	40	8	65	1000	3/3	2	3/6	
* 2N6387		60	60	10	65	1000	5/3	2	5/10	
* 2N6388		80	80	10	65	1000	5/3	2	5/10	
2N6486	2N6489	50	40	15	75	20	5/4	1.3	5/500	
2N6487	2N6490	70	60	15	75	20	5/4	1.3	5/500	
2N6488	2N6491	90	80	15	75	20	5/4	1.3	5/500	

* Darlington types

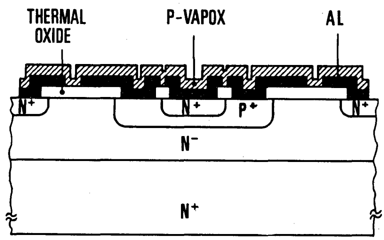
EPITAXIAL BASE TO-3

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BDW21	BDW22	45	45	10	90	15	4/4	1	4/400	TO-3
BDW21A	BDW22A	60	60	10	90	15	4/4	1	4/400	
BDW21B	BDW22B	80	80	10	90	15	4/4	1	4/400	
BDW21C	BDW22C	100	100	10	90	15	4/4	1	4/400	
BDW51	BDW52	45	45	15	125	20	5/4	1	5/500	
BDW51A	BDW52A	60	60	15	125	20	5/4	1	5/500	
BDW51B	BDW52B	80	80	15	125	20	5/4	1	5/500	
BDW51C	BDW52C	100	100	15	125	20	5/4	1	5/500	
° BDW91	BDW92	180	180	4	10	1000	2/5	2	2/4	
° BDX53S	BDX54S	150	150	6	15	500	2/5	2	2/8	
* BDX85	BDX86	45	45	10	100	1000	3/3	2	4/16	
* BDX85A	BDX86A	60	60	10	100	1000	3/3	2	4/16	
* BDX85B	BDX86B	80	80	10	100	1000	3/3	2	4/16	
* BDX85C	BDX86C	100	100	10	100	1000	3/3	2	4/16	
* BDX87	BDX88	45	45	12	120	1000	5/3	2	6/24	
* BDX87A	BDX88A	60	60	12	120	1000	5/3	2	6/24	
* BDX87B	BDX88B	80	80	12	120	1000	5/3	2	6/24	
* BDX87C	BDX88C	100	100	12	120	1000	5/3	2	6/24	
* MJ1000	MJ900	60	60	8	90	1000	3/3	2	3/12	
* MJ1001	MJ901	80	80	8	90	1000	3/3	2	3/12	
* MJ3000	MJ2500	60	60	10	150	1000	5/3	2	5/20	
* MJ3001	MJ2501	80	80	10	150	1000	5/3	2	5/20	
	MJ2955	100	60	15	150	20	4/4	1.1	4/400	
2N3055	BDX18	100	60	15	115	20	4/4	1	4/400	
2N3713	2N3789	80/60	60	10	150	15	3/2	1	5/500	
2N3714	2N3790	100/80	80	10	150	15	3/2	1	5/500	
2N3715	2N3791	80/60	60	10	150	30	3/2	0.8	5/500	
2N3716	2N3792	100/80	80	10	150	30	3/2	0.8	5/500	
2N5873	2N5871	60	60	7	115	35	0.5/4	1	4/400	
2N5874	2N5872	80	80	7	115	35	0.5/4	1	4/400	
2N5877	2N5875	60	60	10	150	20	4/4	1	5/500	
2N5878	2N5876	80	80	10	150	20	4/4	1	5/500	
* 2N6055	2N6053	60	60	8	100	750	4/3	2	4/16	
* 2N6056	2N6054	80	80	8	100	750	4/3	2	4/16	
* 2N6057	2N6050	60	60	12	150	750	6/3	2	6/24	
* 2N6058	2N6051	80	80	12	150	750	6/3	2	6/24	
* 2N6059	2N6052	100	100	12	150	750	6/3	2	6/24	

* Darlington types °TO-39

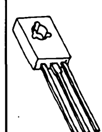
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES (continued)

EPITAXIAL PLANAR

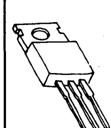


NPN and PNP types
Good voltage capability (V_{CES} up to 400 V)
Low saturation voltage
Low leakage
Very high f_T (up to 100 MHz)
Very high speed
Moderate ruggedness
Total base-collector passivation

EPITAXIAL PLANAR - TO-126

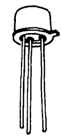
NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BD135	BD136	45	45	1.5	12.5	40	0.15/2	0.5	0.5/50	TO-126 
BD137	BD138	60	60	1.5	12.5	40	0.15/2	0.5	0.5/50	
BD139	BD140	80	80	1.5	12.5	40	0.15/2	0.5	0.5/50	
BD375	BD376	50	45	2	25	40	0.15/2	1	1/100	
BD377	BD378	75	60	2	25	40	0.15/2	1	1/100	
BD379	BD380	100	80	2	25	40	0.15/2	1	1/100	
BU325		200	200	3	25	30	0.5/5	1.5	0.5/50	

EPITAXIAL PLANAR - TO-220

NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BU406	400	200	7	60	10	5/1	1	5/500	TO-220 
BU406D	400	—	7	60	7.7	5/1	1	5/650	
BU406H	400	200	7	60	6.25	5/1	1	5/800	
BU407	330	150	7	60	10	5/1	1	5/500	
BU407D	330	—	7	60	7.7	5/1	1	5/650	
BU407H	330	150	7	60	6.25	5/1	1	5/800	
BU408	400	200	7	60	5	6/1	1	6/1200	
BU408D	400	—	7	60	5	6/1	1	6/1200	
BU409	250	150	7	60	7.5	3/1	1	3/400	
* BU806	400	200	8	60	100	5/1.5	1.5	5/50	
* BU807	330	150	8	60	100	5/1.5	1.5	5/50	

* Darlington types

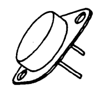
EPITAXIAL PLANAR - TO-39

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min @	I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V) @	I_C/I_B (A/mA)	PACKAGE
BFX34		100	60	5	5	40	2/2	1	5/500	TO-39
	BSS44	65	60	5	5	40	2/2	1	5/500	
BSW67		120	120	1.5	5	15	1/5	1	1/150	
BSW68		150	150	1.5	5	15	1/5	1	1/150	
BU125		130	60	7	10	15	5/2	1	5/500	
BU125S		250	150	3	10	30	0.25/3	1.5	0.5/50	
BUY47		150	120	7	10	15	5/5	1	5/500	
BUY48		200	170	7	10	15	5/5	1	5/500	
BUY49S		250	200	3	10	40	0.5/5	0.2	0.5/50	
BUY68		100	60	7	10	40	1/1	1	5/500	
2N3418		85	60	3	15 (*)	20	1/2	0.5	2/200	
2N3419		125	80	3	15 (*)	20	1/2	0.5	2/200	
2N3420		85	60	3	15 (*)	40	1/2	0.5	2/200	
2N3421		125	80	3	15 (*)	40	1/2	0.5	2/200	
2N3439		450	350	1	10	40	0.02/10	0.5	0.05/4	
2N3440		300	250	1	10	40	0.02/10	0.5	0.05/4	
	2N3867	40	40	3	6	25	2.5/3	0.5	0.5/50	
	2N3868	60	60	3	6	20	2.5/3	0.5	0.5/50	
2N4150		100	70	10	5	40	5/5	0.6	5/500	
	2N4234	40	40	3	6	30	0.25/1	0.6	1/125	
	2N4235	60	60	3	6	30	0.25/1	0.6	1/125	
	2N4236	80	80	3	6	30	0.25/1	0.6	1/125	
2N4237		50	40	3	6	30	0.25/1	0.6	1/100	
2N4238		80	60	3	6	30	0.25/1	0.6	1/100	
2N4239		100	80	3	6	30	0.25/1	0.6	1/100	
2N4895		120	60	5	7	40	2/2	1	5/500	
2N4896		120	60	5	7	100	2/2	1	5/500	
2N4897		150	80	5	7	40	2/2	1	5/500	
2N5152	2N5151	100	80	5	11.7	30	2.5/5	0.75	2.5/250	
2N5154	2N5153	100	80	5	11.7	70	2.5/5	0.75	2.5/250	
2N5336		80	80	5	6	20	5/2	1.2	5/500	
2N5337		80	80	5	6	40	5/2	1.2	5/500	
2N5338		100	100	5	6	20	5/2	1.2	5/500	
2N5339		100	100	5	6	40	5/2	1.2	5/500	
	2N5415	200	200	1	10	30	0.05/10	2.5	0.05/5	
	2N5416	350	300	1	10	30	0.05/10	2.5	0.05/5	
2N5681	2N5679	100	100	1	10	40	0.25/2	1	0.5/50	
2N5682	2N5680	120	120	1	10	40	0.25/2	1	0.5/50	
	2N6303	80	80	3	6	20	2.5/3	0.5	0.5/50	

* $I_C = 100\,°C$

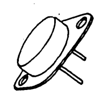
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES (continued)

EPITAXIAL PLANAR - TO-3

NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BU606	400	200	7	90	10	5/1	1	5/500	TO-3
BU606D	400	—	7	90	7.7	5/1	1	5/650	
BU607	330	200	7	90	10	5/1	1	5/500	
BU607D	330	—	7	90	7.7	5/1	1	5/650	
BU608	400	200	7	90	5	6/1	1	6/1200	
BU608D	400	—	7	90	5	6/1	1	6/1200	
* BUW66	400	200	10	90	40	10/2.5	1.5	5/50	
* BUW67	330	200	10	90	40	10/2.5	1.5	5/50	
BUY18S	400	200	7	50	20	1/5	1	5/500	

* Darlington types

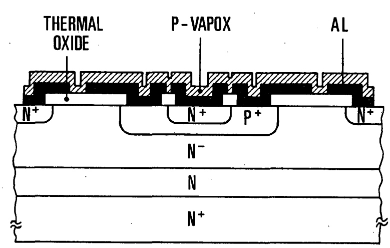
EPITAXIAL PLANAR - TO-66

NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BUR10		100	80	5	30	40	1/2	1	5/500	TO-66
• BUR11		300	200	20	175	15	10/5	0.8	10/1000	
° BUR12		200	120	10	40	80	1/5	0.5	5/500	
BUX77	BUX78	100	80	5	40	30	5/5	1	5/500	
2N4910	2N4898	40	40	4	25	20	0.5/1	0.6	1/100	
2N4911	2N4899	60	60	4	25	20	0.5/1	0.6	1/100	
2N4912	2N4900	80	80	4	25	20	0.5/1	0.6	1/100	
2N5427		80	80	7	40	20	5/2	1.2	7/700	
2N5428		80	80	7	40	40	5/2	1.2	7/700	
2N5429		100	100	7	40	20	5/2	1.2	7/700	
2N5430		100	100	7	40	40	5/2	1.2	7/700	

°TO-59 •TO-63

MULTIEPITAXIAL PLANAR

NPN and PNP types
I_C range up to 70 A
Good h_{FE} linearity
Very low leakage
High switching speed
High $E_{s/b}$ capability
Total base-collector passivation

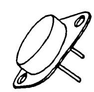


MULTIEPITAXIAL PLANAR - TO-220

NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
* BU910	400	350	6	60	20	4/1.8	1.8	2.5/50	TO-220
* BU911	450	400	6	60	20	4/1.8	1.8	2.5/50	
* BU912	500	450	6	60	20	4/1.8	1.8	2.0/50	

* Darlington types

MULTIEPITAXIAL PLANAR - TO-3

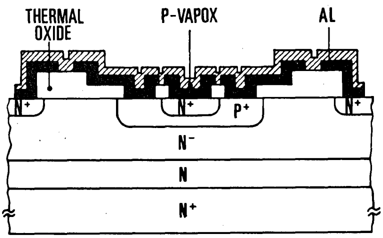
NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	$V_{CE\,sat}$ max (V)	@ I_C/I_B (A/A)	t_f (μs)	@ I_C/I_B (A/A)	PACKAGE
BDY57	120	80	25	175	1.4	10/1	2(*)	15/1.5	TO-3
BDY58	160	125	25	175	1.4	10/1	2(*)	15/1.5	
BDY90	120	100	10	60	1.5	10/1	0.2	5/0.5	
BDY91	100	80	10	60	1.5	10/1	0.2	5/0.5	
BDY92	80	60	10	60	1	10/1	0.2	5/0.5	
• BUR13	200	125	70	250	1.8	50/5	0.5	50/5	
BUR20	200	125	50	250	1.5	50/5	0.3	50/5	
BUR21	300	200	40	250	1.5	25/3	0.4	25/3	
BUR22	350	250	40	250	1.5	20/2.5	0.5	20/2.5	
BUR50	200	125	70	350	1.5	70/7	0.5	70/7	
BUR51	300	200	60	350	1.5	50/5	0.6	50/5	
BUR52	350	250	60	350	1.5	40/4	0.6	40/4	
BUX10	160	125	25	150	1.2	20/2	0.3	20/2	
BUX11	250	200	20	150	1.5	12/1.5	0.4	12/1.5	
BUX11N	220	160	20	150	1.5	15/1.88	0.5	15/1.88	
BUX12	300	250	20	150	1.5	10/1.25	0.5	10/1.25	
BUX20	160	125	50	350	1.2	50/5	0.3	50/5	
BUX21	250	200	40	350	1.5	25/3	0.4	25/3	
BUX22	300	250	40	350	1.5	20/2.5	0.5	20/2.5	
BUX40	160	125	20	120	1.6	15/1.88	0.4	15/1.88	
BUX41	250	200	15	120	1.6	8/1	0.8	8/1	
BUX41N	220	160	18	120	1.6	12/1.5	0.8	12/1.5	
BUX42	300	250	12	120	1.6	6/0.75	1.2	6/0.75	
2N5038	150	90	20	140	1	12/1.2	0.5	12/1.2	
2N5039	120	75	20	140	1	10/1	0.5	10/1	
2N5671	120	90	30	140	0.75	15/1.2	0.5	15/1.2	
2N5672	150	120	30	140	0.75	15/1.2	0.5	15/1.2	
2N6032	120	90	50	140	1.3	50/5	0.5	50/5	
2N6033	150	120	40	140	1	40/4	0.5	40/4	
2N6354	150	120	10	140	0.5	5/0.5	0.2	5/0.5	
2N6496	150	110	15	140	1	8/0.8	0.5	8/0.8	

* t_{off} • TO-63

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES (continued)

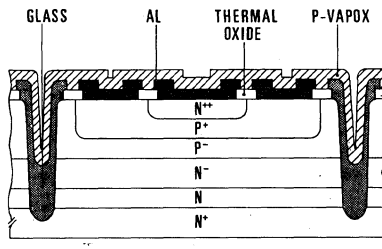
MULTIEPITAXIAL BIPLANAR®

NPN only
High voltage (V_{CES} = 400 to 800 V)
Low leakage
Good ruggedness
High switching speed
Total base-collector passivation
Very high stability at high temperature and high voltage

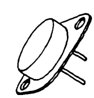


MULTIEPITAXIAL MESA

NPN and PNP types
High voltage (V_{CBO} up to 2000 V)
High power
Very good $I_{s/b}$ and $E_{s/b}$ performance
High switching speed
High f_T (20 MHz)
Good stability

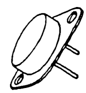


MULTIEPITAXIAL H.V. MESA AND BIPLANAR®- TO-3

	NPN	PNP	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
	BU126		750	300	6	75	10	2.5/10	5	4/1000	TO-3 
	BU326		800	375	6	75	10	2.5/10	3	4/1250	
	BU326A		900	400	6	75	3.2	4/3	1.5	2.5/500	
	BU326S		800	400	6	60(°)	3.5	4/5	1.5	2.5/500	
*	BU920		400	350	10	120	50	7/1.8	1.8	5/50	
*	BU921		450	400	10	120	50	7/1.8	1.8	5/50	
*	BU922		500	450	10	120	50	7/1.8	1.8	5/50	
*	BU930		400	350	15	150	40	10/1.8	1.8	8/100	
*	BU931		450	400	15	150	40	10/1.8	1.8	8/100	
*	BU932		500	450	15	150	40	10/1.8	1.8	8/150	
	BUR23		400	325	30	250	5	20/1.5	1.5	15/2000	
	BUR24		450	400	30	250	4	20/1.5	1.5	15/2500	
	BUW24	BUW22	450/400	350	10	100	10	1/5	1.5	2.5/500	
	BUW25	BUW23	600/450	400	10	125	15	1/5	1.5	4/1000	
	BUW26		800	450	10	125	15	1/5	1.5	4/1000	
	BUW34	BUW32	500	400	10	125	15	1/5	1.5	5/1000	
	BUW35		800	400	10	125	15	1/5	1.5	5/1000	
	BUW36		900	450	10	125	15	1/5	1.5	5/1000	

* Darlington types

MULTIEPITAXIAL H.V. MESA AND BIPLANAR® - TO-3 (continued)

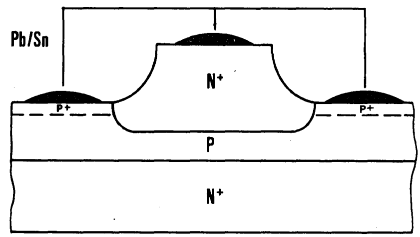
NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BUW44	500	400	15	175	6	6/1.5	3.0	10/2000	TO-3
BUW45	800	400	15	175	7	7/1.5	1.5	10/2000	
BUW46	900	450	15	175	7	7/1.5	1.5	10/2000	
BUX13	400	325	15	150	8	8/4	1.5	8/1600	
BUX14	450	400	10	150	8	6/4	1.6	6/1200	
BUX43	400	325	10	120	8	5/4	2	5/1000	
BUX44	450	400	8	120	8	4/4	1.5	4/800	
BUX46	850	400	3.5	85	5	3.5/5	1.5	2.5/500	
BUX47	850	400	8.5	107	3	9/3	1.5	6/1200	
BUX48	850	400	15	125	5	15/3	1.5	10/2000	
BUX80	800	400	10	100	5	5/1.5	1.5	5/1000	
BUX82	800	400	6	60	5	2.5/1.5	3	2.5/500	
BUX97	750	350	6	60 (°)	10	1/5	3	4/1250	
BUX97A	800	400	6	60 (°)	10	1/5	3	4/1250	
BUX97B	800	450	6	60 (°)	10	1/5	3.3	4/1250	
BUY69A	1000	400	10	100	15	2.5/10	3.3	8/2500	
BUY69B	800	325	10	100	15	2.5/10	3.3	8/2500	
BUY69C	500	200	10	100	15	2.5/10	1	8/2500	
2N6542	650	300	5	100	5	5/5	1	3/600	
2N6543	850	400	5	100	5	5/5	1.5	3/600	
2N6544	650	300	8	125	4	8/5	1.5	5/1000	
2N6545	850	400	8	125	4	8/5	1.5	5/1000	
2N6546	650	300	15	175	5	15/5	1.5	10/2000	
2N6547	850	400	15	175	5	15/5		10/2000	

(°) $T_C = 75\,°C$

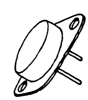
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES (continued)

HOMETAXIAL

Medium V_{CES} range (40 to 160V)
Low saturation voltage
Low f_T (0.8 MHz min)
Low switching speed
Very high ruggedness
Large safe operating area



HOMETAXIAL - TO-3

NPN	V_{CBO} (V)	V_{CEO} (V)	I_C (A)	P_{tot} (W)	h_{FE} min	@ I_C/V_{CE} (A/V)	$V_{CE\ sat}$ max (V)	@ I_C/I_B (A/mA)	PACKAGE
BD142	50	45	15	117	12	4/4	1.1	4/400	TO-3
BD181	55	45	15	117	20	3/4	1	3/300	
BD182	70	60	15	117	20	4/4	1	4/400	
BD183	85	80	15	117	20	3/4	1	3/300	
BDX10/2N3055H	100	60	15	115	20	4/4	1	4/400	
BDX10C/2N3055C	80	60	15	115	20	2/2	1	4/400	
BDX11/2N3442	160	140	10	117	20	3/4	1	3/300	
BDX12/2N4347	140	120	10	117	20	2/4	1	2/200	
BDX13/40251	50	40	15	117	15	8/4	1.5	8/800	
BDX60	100	70	15	150	20	5/4	1.5	8/1600	

CROSS REFERENCE GUIDE

TYPE	SGS-ATES NEAREST	PAGE
BD 135	BD 135	2
BD 136	BD 136	5
BD 137	BD 137	2
BD 138	BD 138	5
BD 139	BD 139	2
BD 140	BD 140	5
BD 142	BD 142	8
BD 165	BD 437	51
BD 166	BD 438	55
BD 167	BD 439	59
BD 168	BD 440	63
BD 169	BD 441	59
BD 170	BD 442	63
BD 175	BD 175	11
BD 176	BD 176	15
BD 177	BD 177	11
BD 178	BD 178	15
BD 179	BD 179	11
BD 180	BD 180	15
BD 181	BD 181	19
BD 182	BD 182	19
BD 183	BD 183	19
BD 185	BD 435	51
BD 186	BD 436	55
BD 187	BD 437	51
BD 188	BD 438	55
BD 189	BD 439	59
BD 190	BD 440	63
BD 195	BD 533	67
BD 196	BD 534	71
BD 197	BD 535	67
BD 198	BD 536	71
BD 199	BD 537	67
BD 200	BD 538	71
BD 201	BD 705	91

TYPE	SGS-ATES NEAREST	PAGE
BD 202	BD 706	96
BD 203	BD 707	91
BD 204	BD 708	96
BD 205	BD 905	101
BD 206	BD 906	105
BD 207	BD 907	101
BD 208	BD 908	105
BD 220	BD 537	67
BD 221	BD 533	67
BD 222	BD 535	67
BD 223	BD 538	71
BD 224	BD 534	71
BD 225	BD 536	71
BD 226	BD 375	43
BD 227	BD 376	47
BD 228	BD 377	43
BD 229	BD 378	47
BD 230	BD 379	43
BD 231	BD 380	47
BD 233	BD 233	23
BD 234	BD 234	27
BD 235	BD 235	23
BD 236	BD 236	27
BD 238	BD 238	27
BD 239	BD 239	31
BD 239A	BD 239A	31
BD 239B	BD 239B	31
BD 240	BD 240	33
BD 240A	BD 240A	33
BD 240B	BD 240B	33
BD 241	BD 241	35
BD 241A	BD 241A	35
BD 241B	BD 241B	35
BD 242	BD 242	37
BD 242A	BD 242A	37

TYPE	SGS-ATES NEAREST	PAGE
BD 242B	BD 242B	37
BD 243	BD 243	39
BD 243A	BD 243A	39
BD 243B	BD 243B	39
BD 243C	BD 243C	39
BD 244	BD 244	41
BD 244A	BD 244A	41
BD 244B	BD 244B	41
BD 244C	BD 244C	41
BD 245	BD 705	91
BD 245A	BD 707	91
BD 245B	BD 709	91
BD 245C	BD 711	91
BD 246	BD 706	96
BD 246A	BD 708	96
BD 246B	BD 710	96
BD 246C	BD 712	96
BD 253	BUW 24	380
BD 253A	BUW 25	384
BD 253B	BU 126	240
BD 253C	BU 326A	255
BD 262	BD 678	87
BD 262A	BD 680	87
BD 262B	BD 682	87
BD 263	BD 677	83
BD 263A	BD 679	83
BD 263B	BD 681	83
BD 264	BDW 24A	121
BD 264A	BDW 24B	121
BD 265	BDW 23A	117
BD 265A	BDW 23B	117
BD 266	BDX 54A	177
BD 266A	BDX 54B	177
BD 266B	BDX 54C	177
BD 267	BDX 53A	165

CROSS REFERENCE GUIDE (continued)

TYPE	SGS-ATES NEAREST	PAGE
BD 267A	BDX 53B	165
BD 267B	BDX 53C	165
BD 268	BDW 94A	148
BD 268A	BDW 94B	148
BD 269	BDW 93A	143
BD 269A	BDW 93B	143
BD 271	BD 533	67
BD 272	BD 534	71
BD 273	BD 535	67
BD 274	BD 536	71
BD 275	BD 537	67
BD 276	BD 538	71
BD 277	BD 664	79
BD 278	BD 663	75
BD 301	BD 533	67
BD 302	BD 534	71
BD 303	BD 535	67
BD 304	BD 536	71
BD 311	BDW 51A	125
BD 312	BDW 52A	130
BD 313	BDW 51B	125
BD 314	BDW 52B	130
BD 331	BDX 53A	165
BD 332	BDX 54A	177
BD 333	BDX 53B	165
BD 334	BDX 54B	177
BD 335	BDX 53C	165
BD 336	BDX 54C	177
BD 361	BD 433	51
BD 361A	BD 433	51
BD 362	BD 434	55
BD 362A	BD 434	55
BD 375	BD 375	43
BD 376	BD 376	47
BD 377	BD 377	43

TYPE	SGS-ATES NEAREST	PAGE
BD 378	BD 378	47
BD 379	BD 379	43
BD 380	BD 380	47
BD 433	BD 433	51
BD 434	BD 434	55
BD 435	BD 435	51
BD 436	BD 436	55
BD 437	BD 437	51
BD 438	BD 438	55
BD 439	BD 439	59
BD 440	BD 440	63
BD 441	BD 441	59
BD 442	BD 442	63
BD 533	BD 533	67
BD 534	BD 534	71
BD 535	BD 535	67
BD 536	BD 536	71
BD 537	BD 537	67
BD 538	BD 538	71
BD 539	BD 241	35
BD 539A	BD 241A	35
BD 539B	BD 241B	35
BD 539C	BD 241C	35
BD 540	BD 242	37
BD 540A	BD 242A	37
BD 540B	BD 242B	37
BD 540C	BD 242C	37
BD 543	BD 905	101
BD 543A	BD 907	101
BD 543B	BD 909	101
BD 544	BD 906	105
BD 544A	BD 908	105
BD 544B	BD 910	105
BD 561	BD 437	51
BD 562	BD 438	55

TYPE	SGS-ATES NEAREST	PAGE
BD 575	BD 533	67
BD 576	BD 534	71
BD 577	BD 535	67
BD 578	BD 536	71
BD 579	BD 537	67
BD 580	BD 538	71
BD 585	BD 533	67
BD 586	BD 534	71
BD 587	BD 535	67
BD 588	BD 536	71
BD 589	BD 537	67
BD 590	BD 538	71
BD 595	BD 705	91
BD 596	BD 706	96
BD 597	BD 707	91
BD 598	BD 708	96
BD 599	BD 709	91
BD 600	BD 710	96
BD 601	BD 711	91
BD 602	BD 712	96
BD 605	BD 905	101
BD 606	BD 906	105
BD 607	BD 907	101
BD 608	BD 908	105
BD 609	BD 909	101
BD 610	BD 910	105
BD 633	BD 533	67
BD 634	BD 534	71
BD 635	BD 535	67
BD 636	BD 536	71
BD 637	BD 537	67
BD 638	BD 538	71
BD 643	BDX 53	165
BD 644	BDX 54	177
BD 645	BDX 53A	165

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
BD 646	BDX 54A	177	BD 709	BD 709	91	BD 908	BD 908	105
BD 647	BDX 53B	165	BD 710	BD 710	96	BD 909	BD 909	101
BD 648	BDX 54B	177	BD 711	BD 711	91	BD 910	BD 910	105
BD 649	BDX 53C	165	BD 712	BD 712	96	BD 911	BD 911	101
BD 650	BDX 54C	177	BD 733	BD 533	67	BD 912	BD 912	105
BD 663	BD 663	75	BD 734	BD 534	71	BD 933	BD 239	31
BD 664	BD 664	79	BD 735	BD 533	67	BD 934	BD 240	33
BD 675A	BD 675A	83	BD 736	BD 534	71	BD 935	BD 239A	31
BD 676A	BD 676A	87	BD 737	BD 533	67	BD 936	BD 240A	33
BD 677	BD 677	83	BD 738	BD 534	71	BD 937	BD 239B	31
BD 677A	BD 677A	83	BD 795	BD 705	91	BD 938	BD 240B	33
BD 678	BD 678	87	BD 796	BD 706	96	BD 939	BD 239C	31
BD 678A	BD 678A	87	BD 797	BD 707	91	BD 940	BD 240C	33
BD 679	BD 679	83	BD 798	BD 708	96	BD 943	BD 533	67
BD 679A	BD 679A	83	BD 799	BD 709	91	BD 944	BD 534	71
BD 680	BD 680	87	BD 800	BD 710	96	BD 945	BD 535	67
BD 680A	BD 680A	87	BD 801	BD 711	91	BD 946	BD 534	71
BD 681	BD 681	83	BD 802	BD 712	96	BD 947	BD 533	67
BD 682	BD 682	87	BD 805	BD 905	101	BD 948	BD 534	71
BD 695A	BDX 53	165	BD 806	BD 906	105	BD 949	BD 241A	35
BD 696A	BDX 54	177	BD 807	BD 907	101	BD 950	BD 242A	37
BD 697	BDX 53A	165	BD 808	BD 908	105	BD 951	BD 241B	35
BD 697A	BDX 53A	165	BD 809	BD 909	101	BD 952	BD 242B	37
BD 698	BDX 54A	177	BD 810	BD 910	105	BD 953	BD 241C	35
BD 698A	BDX 54A	177	BD 895	BDW 93	143	BD 954	BD 242C	37
BD 699	BDX 53B	165	BD 896	BDW 94	148	BDT 62	BDW 94A	148
BD 699A	BDX 53B	165	BD 897	BDW 93A	143	BDT 62A	BDW 94B	148
BD 700	BDX 54B	177	BD 898	BDW 94A	148	BDT 62B	BDW 94C	148
BD 700A	BDX 54B	177	BD 899	BDW 93B	143	BDT 63	BDW 93A	143
BD 701	BDX 53C	165	BD 900	BDW 94B	148	BDT 63A	BDW 93B	143
BD 702	BDX 54C	177	BD 901	BDW 93C	143	BDT 63B	BDW 93C	143
BD 705	BD 705	91	BD 902	BDW 94C	148	BDT 91	BD 907	101
BD 706	BD 706	96	BD 905	BD 905	101	BDT 92	BD 908	105
BD 707	BD 707	91	BD 906	BD 906	105	BDT 93	BD 909	101
BD 708	BD 708	96	BD 907	BD 907	101	BDT 94	BD 910	105

CROSS REFERENCE GUIDE (continued)

TYPE	SGS-ATES NEAREST	PAGE
BDT 95	BD 911	101
BDT 96	BD 912	105
BDW 21	BDW 21	109
BDW 21A	BDW 21A	109
BDW 21B	BDW 21B	109
BDW 21C	BDW 21C	109
BDW 22	BDW 22	113
BDW 22A	BDW 22A	113
BDW 22B	BDW 22B	113
BDW 22C	BDW 22C	113
BDW 23	BDW 23	117
BDW 23A	BDW 23A	117
BDW 23B	BDW 23B	117
BDW 23C	BDW 23C	117
BDW 24	BDW 24	121
BDW 24A	BDW 24A	121
BDW 24B	BDW 24B	121
BDW 24C	BDW 24C	121
BDW 51	BDW 51	125
BDW 51A	BDW 51A	125
BDW 51B	BDW 51B	125
BDW 51C	BDW 51C	125
BDW 52	BDW 52	130
BDW 52A	BDW 52A	130
BDW 52B	BDW 52B	130
BDW 52C	BDW 52C	130
BDW 53	BDW 23	117
BDW 53A	BDW 23A	117
BDW 53B	BDW 23B	117
BDW 53C	BDW 23C	117
BDW 54	BDW 24	121
BDW 54A	BDW 24A	121
BDW 54B	BDW 24B	121
BDW 54C	BDW 24C	121
BDW 63	BDX 53	165

TYPE	SGS-ATES NEAREST	PAGE
BDW 63A	BDX 53A	165
BDW 63B	BDX 53B	165
BDW 63C	BDX 53C	165
BDW 64	BDX 54	177
BDW 64A	BDX 54A	177
BDW 64B	BDX 54B	177
BDW 64C	BDX 54C	177
BDW 73	BDW 93	143
BDW 73A	BDW 93A	143
BDW 73B	BDW 93B	143
BDW 73C	BDW 93C	143
BDW 74	BDW 94	148
BDW 74A	BDW 94A	148
BDW 74B	BDW 94B	148
BDW 74C	BDW 94C	148
BDW 91	BDW 91	135
BDW 92	BDW 92	139
BDW 93	BDW 93	143
BDW 93A	BDW 93A	143
BDW 93B	BDW 93B	143
BDW 93C	BDW 93C	143
BDW 94	BDW 94	148
BDW 94A	BDW 94A	148
BDW 94B	BDW 94B	148
BDW 94C	BDW 94C	148
BDX 10	BDX 10	153
BDX 10C	BDX 10C	153
BDX 11	BDX 11	157
BDX 12	BDX 12	157
BDX 13	BDX 13	161
BDX 18	BDX 18	163
BDX 33	BDX 53	165
BDX 33A	BDX 53A	165
BDX 33B	BDX 53B	165
BDX 33C	BDX 53C	165

TYPE	SGS-ATES NEAREST	PAGE
BDX 34	BDX 54	177
BDX 34A	BDX 54A	177
BDX 34B	BDX 54B	177
BDX 34C	BDX 54C	177
BDX 53	BDX 53	165
BDX 53A	BDX 53A	165
BDX 53B	BDX 53B	165
BDX 53C	BDX 53C	165
BDX 54	BDX 54	177
BDX 54A	BDX 54A	177
BDX 54B	BDX 54B	177
BDX 54C	BDX 54C	177
BDX 60	BDX 60	189
BDX 62	BDX 86A	200
BDX 62A	BDX 86B	200
BDX 62B	BDX 86C	200
BDX 63	BDX 85A	195
BDX 63A	BDX 85B	195
BDX 63B	BDX 85C	195
BDX 64	BDX 88A	210
BDX 64A	BDX 88B	210
BDX 64B	BDX 88C	210
BDX 65	BDX 87A	205
BDX 65A	BDX 87B	205
BDX 65B	BDX 87C	205
BDX 70	BDX 71	193
BDX 71	BDX 71	193
BDX 77	BD 709	91
BDX 78	BD 710	96
BDX 83	BDX 87	205
BDX 83A	BDX 87A	205
BDX 83B	BDX 87B	205
BDX 83C	BDX 87C	205
BDX 84	BDX 88	210
BDX 84A	BDX 88A	210

TYPE	SGS-ATES NEAREST	PAGE
BDX 84B	BDX 88B	210
BDX 84C	BDX 88C	210
BDX 85	BDX 85	195
BDX 85A	BDX 85A	195
BDX 85B	BDX 85B	195
BDX 85C	BDX 85C	195
BDX 86	BDX 86	200
BDX 86A	BDX 86A	200
BDX 86B	BDX 86B	200
BDX 86C	BDX 86C	200
BDX 87	BDX 87	205
BDX 87A	BDX 87A	205
BDX 87B	BDX 87B	205
BDX 87C	BDX 87C	205
BDX 88	BDX 88	210
BDX 88A	BDX 88A	210
BDX 88B	BDX 88B	210
BDX 88C	BDX 88C	210
BDX 91	BDW 21A	109
BDX 92	BDW 22A	113
BDX 93	BDW 21B	109
BDX 94	BDW 22B	113
BDX 95	BDW 21C	109
BDX 96	BDW 22C	113
BDY 57	BDY 57	215
BDY 58	BDY 58	215
BDY 90	BDY 90	218
BDY 91	BDY 91	218
BDY 92	BDY 92	218
BFX 34	BFX 34	220
BSS 44	BSS 44	224
BSW 67	BSW 67	228
BSW 68	BSW 68	228
BU 104	BU 606	285
BU 104D	BU 606D	290

TYPE	SGS-ATES NEAREST	PAGE
BU 104DP	BU 406D	270
BU 106	BU 607	285
BU 107	BU 607	285
BU 109	BU 607	285
BU 109D	BU 607D	290
BU 109DP	BU 407D	270
BU 110	BU 607	285
BU 111	BUW 24	380
BU 125	BU 125	232
BU 125S	BU 125S	236
BU 126	BU 126	240
BU 129	BU 606	285
BU 133	BU 126	240
BU 134	BUW 25	384
BU 137	BUY 69A	528
BU 310	BU 607	285
BU 311	BU 607	285
BU 312	BU 607	285
BU 322	BU 920	306
BU 322A	BU 922	306
BU 323	BU 930	312
BU 323A	BU 932	312
BU 326	BU 326S	260
BU 326A	BU 326A	255
BU 326S	BU 326S	260
BU 361	BUW 35	397
BU 406	BU 406	264
BU 406D	BU 406D	270
BU 406H	BU 406H	264
BU 407	BU 407	276
BU 407D	BU 407D	270
BU 407H	BU 407H	276
BU 408	BU 408	264
BU 408D	BU 408D	270
BU 409	BU 409	282

TYPE	SGS-ATES NEAREST	PAGE
BU 411	BU 607D	290
BU 412	BU 607D	290
BU 413	BU 607D	290
BU 606	BU 606	285
BU 606D	BU 606D	290
BU 607	BU 607	285
BU 607D	BU 607D	290
BU 608	BU 608	285
BU 608D	BU 608D	290
BU 806	BU 806	295
BU 807	BU 807	295
BU 910	BU 910	301
BU 911	BU 911	301
BU 912	BU 912	301
BU 920	BU 920	306
BU 921	BU 921	306
BU 922	BU 922	306
BU 930	BU 930	312
BU 931	BU 931	312
BU 932	BU 932	312
BUR 10	BUR 10	318
BUR 11	BUR 11	321
BUR 12	BUR 12	325
BUR 13	BUR 13	329
BUR 20	BUR 20	334
BUR 21	BUR 21	340
BUR 22	BUR 22	346
BUR 23	BUR 23	352
BUR 24	BUR 24	354
BUR 50	BUR 50	356
BUR 51	BUR 51	362
BUR 52	BUR 52	368
BUS 11	BUW 26	388
BUS 12	BUW 35	397
BUS 12A	BUW 36	397

CROSS REFERENCE GUIDE (continued)

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
BUS 13	BUX 48	490	BUX 16C	BUW 24	380	BUX 80	BUX 80	498
BUS 13A	BUW 46	402	BUX 17	BUX 41N	470	BUX 82	BUX 82	503
BUV 20	BUR 20	334	BUX 17A	BUX 42	476	BUX 97	BUX 97	508
BUV 21	BUR 21	340	BUX 17B	BUW 44	402	BUX 97A	BUX 97A	508
BUV 22	BUR 22	346	BUX 17C	BUW 44	402	BUX 97B	BUX 97B	508
BUV 23	BUR 23	352	BUX 18	BUX 41	464	BUY 18S	BUY 18S	512
BUV 24	BUR 24	354	BUX 18A	BUX 42	476	BUY 47	BUY 47	515
BUV 25	BUR 24	354	BUX 18B	BUW 35	397	BUY 48	BUY 48	515
BUW 24	BUW 24	380	BUX 18C	BUW 35	397	BUY 49S	BUY 49S	520
BUW 25	BUW 25	384	BUX 20	BUX 20	440	BUY 57	BUX 40	458
BUW 26	BUW 26	388	BUX 20S	BUX 20	440	BUY 58	BUX 41N	470
BUW 32	BUW 32	392	BUX 21	BUX 21	446	BUY 68	BUY 68	524
BUW 34	BUW 34	397	BUX 21S	BUX 21	446	BUY 69A	BUY 69A	528
BUW 35	BUW 35	397	BUX 22	BUX 22	452	BUY 69B	BUY 69B	528
BUW 36	BUW 36	397	BUX 23	BUR 23	352	BUY 69C	BUY 69C	528
BUW 44	BUW 44	402	BUX 24	BUR 24	354	MJ 424	BUW 35	397
BUW 45	BUW 45	402	BUX 25	BUR 24	354	MJ 425	BUW 35	397
BUW 46	BUW 46	402	BUX 28	BU 920	306	MJ 900	MJ 900	531
BUW 57	BUX 10	412	BUX 29	BU 921	306	MJ 901	MJ 901	531
BUW 58	BUX 11N	424	BUX 37	BU 931	312	MJ 1000	MJ 1000	531
BUW 66	BUW 66	407	BUX 40	BUX 40	458	MJ 1001	MJ 1001	531
BUW 67	BUW 67	407	BUX 40A	BUX 40	458	MJ 2500	MJ 2500	533
BUW 73	BUX 11	418	BUX 40S	BUX 40	458	MJ 2501	MJ 2501	533
BUX 10	BUX 10	412	BUX 41	BUX 41	464	MJ 2955	MJ 2955	535
BUX 10S	BUX 10	412	BUX 41N	BUX 41N	470	MJ 3000	MJ 3000	533
BUX 11	BUX 11	418	BUX 41S	BUX 41	464	MJ 3001	MJ 3001	533
BUX 11N	BUX 11N	424	BUX 42	BUX 42	476	MJ 3029	BUW 24	380
BUX 11S	BUX 11	418	BUX 43	BUX 43	482	MJ 3030	BUW 25	384
BUX 12	BUX 12	430	BUX 44	BUX 44	484	MJ 3040	BU 920	306
BUX 13	BUX 13	436	BUX 45	BUW 34	397	MJ 3041	BU 920	306
BUX 14	BUX 14	438	BUX 46	BUX 46	486	MJ 3042	BU 920	306
BUX 15	BUW 44	402	BUX 47	BUX 47	488	MJ 4030	BDX 87A	205
BUX 16	BUW 24	380	BUX 48	BUX 48	490	MJ 10000	BU 930	312
BUX 16A	BUW 24	380	BUX 77	BUX 77	496	MJ 10001	BU 931	312
BUX 16B	BUW 24	380	BUX 78	BUX 78	496	MJ 10002	BU 920	306

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
MJ 10003	BU 921	306	TIP 30	TIP 30	542	TIP 111	TIP 111	556
MJ 10012	BU 931	312	TIP 30A	TIP 30A	542	TIP 112	TIP 112	556
MJ 13014	BUW 34	397	TIP 30B	TIP 30B	542	TIP 115	TIP 115	558
MJ 13015	BUW 34	397	TIP 30C	TIP 30C	542	TIP 116	TIP 116	558
MJ 13330	BUX 41	464	TIP 31	TIP 31	544	TIP 117	TIP 117	558
MJ 13331	BUX 42	476	TIP 31A	TIP 31A	544	TIP 120	TIP 120	560
MJ 13332	BUR 23	352	TIP 31B	TIP 31B	544	TIP 121	TIP 121	560
MJ 13333	BUR 24	354	TIP 31C	TIP 31C	544	TIP 122	TIP 122	560
MJ 13334	BUR 24	354	TIP 32	TIP 32	546	TIP 125	TIP 125	562
MJE 341	BU 325	245	TIP 32A	TIP 32A	546	TIP 126	TIP 126	562
MJE 344	BU 325	245	TIP 32B	TIP 32B	546	TIP 127	TIP 127	562
MJE 700	MJE 700	537	TIP 32C	TIP 32C	546	TIP 130	TIP 130	564
MJE 701	MJE 701	537	TIP 41	TIP 41	548	TIP 131	TIP 131	564
MJE 702	MJE 702	537	TIP 41A	TIP 41A	548	TIP 132	TIP 132	564
MJE 703	MJE 703	537	TIP 41B	TIP 41B	548	TIP 135	TIP 135	566
MJE 800	MJE 800	537	TIP 41C	TIP 41C	548	TIP 136	TIP 136	566
MJE 801	MJE 801	537	TIP 42	TIP 42	550	TIP 137	TIP 137	566
MJE 802	MJE 802	537	TIP 42A	TIP 42A	550	TIP 150	BU 910	301
MJE 803	MJE 803	537	TIP 42B	TIP 42B	550	TIP 151	BU 910	301
SE 9300	BDW 93A	143	TIP 42C	TIP 42C	550	TIP 152	BU 911	301
SE 9301	BDW 93B	143	TIP 73	BD 905	101	TIP 660	BU 920	306
SE 9302	BDW 93C	143	TIP 73A	BD 907	101	TIP 661	BU 920	306
SE 9303	BDX 87A	205	TIP 73B	BD 909	101	TIP 662	BU 921	306
SE 9304	BDX 87B	205	TIP 73C	BD 911	101	2N 3055	2N 3055	568
SE 9305	BDX 87C	205	TIP 74	BD 906	105	2N 3055C	2N 3055C	153
SE 9400	BDW 94A	148	TIP 74A	BD 908	105	2N 3055E	2N 3055E	570
SE 9401	BDW 94B	148	TIP 74B	BD 910	105	2N 3055H	2N 3055H	153
SE 9402	BDW 94C	148	TIP 74C	BD 912	105	2N 3233	2N 3442	157
SE 9403	BDX 88A	210	TIP 100	BDX 53A	165	2N 3418	2N 3418	574
SE 9404	BDX 88B	210	TIP 101	BDX 53B	165	2N 3419	2N 3419	574
SE 9405	BDX 88C	210	TIP 102	BDX 53C	165	2N 3420	2N 3420	574
TIP 29	TIP 29	540	TIP 105	BDX 54A	177	2N 3421	2N 3421	574
TIP 29A	TIP 29A	540	TIP 106	BDX 54B	177	2N 3439	2N 3439	577
TIP 29B	TIP 29B	540	TIP 107	BDX 54C	177	2N 3440	2N 3440	577
TIP 29C	TIP 29C	540	TIP 110	TIP 110	556	2N 3442	2N 3442	157

CROSS REFERENCE GUIDE (continued)

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
2N 3445	BDW 51A	125	2N 4902	BDW 22A	113	2N 5339	2N 5339	633
2N 3446	BDW 51B	125	2N 4903	BDW 22B	113	2N 5490	BD 705	91
2N 3553	BUY 68	524	2N 4904	BDW 22	113	2N 5492	BD 707	91
2N 3554	BUY 68	524	2N 4905	BDW 22A	113	2N 5494	BD 705	91
2N 3713	2N 3713	581	2N 4906	BDW 22B	113	2N 5496	BD 709	91
2N 3714	2N 3714	581	2N 4910	2N 4910	610	2N 5671	2N 5671	645
2N 3715	2N 3715	581	2N 4911	2N 4911	610	2N 5672	2N 5672	645
2N 3716	2N 3716	581	2N 4912	2N 4912	610	2N 5681	BSW 67	228
2N 3719	BSS 44	224	2N 4913	BDW 21	109	2N 5682	BSW 67	228
2N 3720	BSS 44	224	2N 4914	BDW 21A	109	2N 5758	BDW 51C	125
2N 3789	2N 3789	585	2N 4915	BDW 21B	109	2N 5781	BSS 44	224
2N 3790	2N 3790	585	2N 5038	2N 5038	613	2N 5782	BSS 44	224
2N 3791	2N 3791	585	2N 5039	2N 5039	613	2N 5783	BSS 44	224
2N 3792	2N 3792	585	2N 5067	BDW 21	109	2N 5784	BUY 68	524
2N 3830	BUY 68	524	2N 5068	BDW 21A	109	2N 5785	BUY 68	524
2N 3831	BUY 68	524	2N 5069	BDW 21B	109	2N 5786	BUY 68	524
2N 3867	2N 3867	589	2N 5157	BUW 35	397	2N 5838	BUW 24	380
2N 3868	2N 3868	589	2N 5190	2N 5190	625	2N 5839	BUW 24	380
2N 3902	BUW 24	380	2N 5191	2N 5191	625	2N 5840	BUW 24	380
2N 3924	BUY 68	524	2N 5192	2N 5192	625	2N 5867	BDW 22A	113
2N 4150	2N 4150	594	2N 5193	2N 5193	629	2N 5868	BDW 22B	113
2N 4234	2N 4234	597	2N 5194	2N 5194	629	2N 5869	BDW 21A	109
2N 4235	2N 4235	597	2N 5195	2N 5195	629	2N 5870	BDW 21B	109
2N 4236	2N 4236	597	2N 5239	BUW 24	380	2N 5871	BDW 22A	113
2N 4237	2N 4237	600	2N 5240	BUW 24	380	2N 5872	BDW 22B	113
2N 4238	2N 4238	600	2N 5241	BUW 34	397	2N 5873	BDW 21A	109
2N 4239	2N 4239	600	2N 5294	BD 537	67	2N 5874	BDW 21B	109
2N 4347	2N 4347	157	2N 5296	BD 533	67	2N 5875	2N 5875	657
2N 4895	2N 4895	603	2N 5298	BD 535	67	2N 5876	2N 5876	657
2N 4896	2N 4896	603	2N 5333	BSS 44	224	2N 5877	2N 5877	662
2N 4897	2N 4897	603	2N 5334	BUY 68	524	2N 5878	2N 5878	662
2N 4898	2N 4898	607	2N 5335	BUY 47	515	2N 5879	BDW 52A	130
2N 4899	2N 4899	607	2N 5336	2N 5336	633	2N 5880	BDW 52B	130
2N 4900	2N 4900	607	2N 5337	2N 5337	633	2N 5881	BDW 51A	125
2N 4901	BDW 22	113	2N 5338	2N 5338	633	2N 5882	BDW 51B	125

TYPE	SGS-ATES NEAREST	PAGE
2N 6032	2N 6032	667
2N 6033	2N 6033	667
2N 6034	2N 6034	672
2N 6035	2N 6035	672
2N 6036	2N 6036	672
2N 6037	2N 6037	676
2N 6038	2N 6038	676
2N 6039	2N 6039	676
2N 6040	BDX 54A	177
2N 6041	BDX 54B	177
2N 6042	BDX 54C	177
2N 6043	BDX 53A	165
2N 6044	BDX 53B	165
2N 6045	BDX 53C	165
2N 6050	2N 6050	680
2N 6051	2N 6051	680
2N 6052	2N 6052	680
2N 6053	2N 6053	685
2N 6054	2N 6054	685
2N 6055	2N 6055	689
2N 6056	2N 6056	689
2N 6057	2N 6057	693
2N 6058	2N 6058	693
2N 6059	2N 6059	693
2N 6099	2N 6099	193
2N 6107	2N 6107	698
2N 6109	2N 6109	698
2N 6111	2N 6111	698
2N 6121	2N 6121	700
2N 6122	2N 6122	700
2N 6123	2N 6123	700
2N 6124	2N 6124	704
2N 6125	2N 6125	704
2N 6126	2N 6126	704
2N 6226	BDW 52C	130

TYPE	SGS-ATES NEAREST	PAGE
2N 6246	BDW 52A	130
2N 6247	BDW 52B	130
2N 6249	BUX 41	464
2N 6250	BUX 42	476
2N 6251	BUW 44	402
2N 6274	BUR 20	334
2N 6275	BUR 20	334
2N 6276	BUR 21	340
2N 6277	BUR 21	340
2N 6288	2N 6288	698
2N 6290	2N 6290	698
2N 6292	2N 6292	698
2N 6303	2N 6303	589
2N 6306	BUW 34	397
2N 6307	BUW 35	397
2N 6308	BUW 35	397
2N 6338	BUX 10	412
2N 6339	BUX 10	412
2N 6340	BUX 11N	424
2N 6341	BUX 11N	424
2N 6354	2N 6354	708
2N 6383	BDX 87	205
2N 6384	BDX 87A	205
2N 6385	BDX 87B	205
2N 6386	2N 6386	712
2N 6387	2N 6387	712
2N 6388	2N 6388	712
2N 6469	BDW 52	130
2N 6470	BDW 51	125
2N 6471	BDW 51A	125
2N 6472	BDW 51B	125
2N 6473	BD 711	91
2N 6475	BD 712	96
2N 6486	2N 6486	715
2N 6487	2N 6487	715

TYPE	SGS-ATES NEAREST	PAGE
2N 6488	2N 6488	715
2N 6489	2N 6489	718
2N 6490	2N 6490	718
2N 6491	2N 6491	718
2N 6496	2N 6496	613
2N 6510	BUW 25	384
2N 6511	BUW 34	397
2N 6512	BUW 34	397
2N 6513	BUW 34	397
2N 6514	BUW 34	397
2N 6531	BDX 53C	165
2N 6532	BDX 53C	165
2N 6542	2N 6542	721
2N 6543	2N 6543	721
2N 6544	2N 6544	724
2N 6545	2N 6545	724
2N 6546	2N 6546	727
2N 6547	2N 6547	727
2N 6569	BDW 51	125
2N 6573	BUW 44	402
2N 6574	2N 6546	727
2N 6575	BUW 45	402
2N 6594	BDW 52	130
2N 6648	BDX 88	210
2N 6649	BDX 88A	210
2N 6650	BDX 88B	210
2N 6666	BDX 54	177
2N 6667	BDX 54A	177
2N 6668	BDX 54B	177
40251	40251	161

ALPHABETICAL LIST OF SYMBOLS

B	Bandwidth
C_{CBO}	Collector-base capacitance (emitter open to a.c. and d.c.)
d	Distortion
$E_{s/b}$	Second breakdown energy (with base-emitter junction reverse biased)
f	Frequency
f_T	Transition frequency
G_v	Voltage gain
h_{fe}	Common emitter, small-signal value of the short-circuit forward current transfer ratio
h_{FE}	Common emitter, static value of the forward current transfer ratio
h_{FE1}/h_{FE2}	Common emitter, static value of the forward current transfer matched pair ratio
I_B	Base current
I_{B1}	Turn-on current
I_{B2}	Turn-off current
I_{BF}	Base forward current
I_{BFM}	Base forward peak current
I_{BM}	Base peak current
I_{BR}	Base reverse current
I_{BRM}	Base reverse peak current
I_C	Collector current
I_{CBO}	Collector cutoff current with emitter open
I_{CEO}	Collector cutoff current with base open
I_{CER}	Collector cutoff current with specified resistance between emitter and base
I_{CES}	Collector cutoff current with emitter short-circuited to base
I_{CEV}	Collector cutoff current with specified reverse voltage between emitter and base
I_{CM}	Collector peak current
I_d	Drain current
I_E	Emitter current

I_{EBO}	Emitter cutoff current with collector open
I_F	Continuous DC forward current
I_{FM}	Peak forward current
I_R	Continuous DC reverse current
$I_{s/b}$	Second breakdown collector current (with base-emitter junction forward biased)
P_o	Output power of a specified circuit
P_{tot}	Total power dissipation
R_{BB}	Base dropping resistance
R_{BE}	Resistance between base and emitter
R_{CC}	Collector dropping resistance
R_{EE}	Emitter dropping resistance
R_L	Load resistance
R_{th}	Thermal resistance
$R_{th\ j\text{-}amb}$	Thermal resistance junction-to-ambient
$R_{th\ j\text{-}case}$	Thermal resistance junction-to-case
t	Time
T_{amb}	Ambient temperature
T_{case}	Case temperature
t_f	Fall time
T_j	Junction temperature
t_{off}	Turn-off time
t_{on}	Turn-on time
t_r	Rise time
t_s	Storage time
T_{stg}	Storage temperature
V_{BE}	Base-emitter voltage
$V_{BE\ (sat)}$	Base-emitter saturation voltage
$V_{(BR)\ CBO}$	Collector-base breakdown voltage with emitter open
$V_{(BR)\ CEO}$	Collector-emitter breakdown voltage with base open

ALPHABETICAL LIST OF SYMBOLS (continued)

$V_{(BR)\,CER}$	Collector-emitter breakdown voltage with specified resistance
$V_{(BR)\,CES}$	Collector-emitter breakdown voltage with emitter short-circuited to base
$V_{(BR)\,CEV}$	Collector-emitter breakdown voltage with specified reverse voltage between emitter and base
$V_{(BR)\,EBO}$	Emitter-base breakdown voltage with collector open
V_{CB}	Collector-base voltage
V_{CBO}	Collector-base voltage with emitter open
V_{CE}	Collector-emitter voltage
V_{CEK}	Knee voltage at specified condition
V_{CEO}	Collector-emitter voltage with base open
$V_{CEO\,(sus)}$	Collector-emitter sustaining voltage with base open
V_{CER}	Collector-emitter voltage with specified resistance between emitter and base
$V_{CER\,(sus)}$	Collector-emitter sustaining voltage with specified resistance between emitter and base
$V_{CE\,(sat)}$	Collector-emitter saturation voltage
V_{CES}	Collector-emitter voltage with emitter short-circuited to base
V_{CEV}	Collector-emitter voltage with specified reverse voltage between emitter and base
$V_{CEV\,(sus)}$	Collector-emitter sustaining voltage with specified reverse voltage between emitter and base
$V_{CEX\,(sus)}$	Collector-emitter sustaining voltage with specified circuit between emitter and base
V_{EB}	Emitter-base voltage
V_{EBO}	Emitter-base voltage with collector open
V_F	Continuous DC forward voltage
V_i	Input voltage of a specified circuit
V_R	Continuous DC reverse voltage
V_{RM}	Peak reverse voltage
Z_{BE}	Impedance between base and emitter
Z_i	Input impedance

RATING SYSTEMS FOR ELECTRONIC DEVICES

A. DEFINITIONS OF TERMS USED

a. **Electronic device.** An electronic tube or valve, transistor or other semiconductor device.
Note: This definition excludes inductors, capacitors, resistors and similar components.

b. **Characteristic.** A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

c. **Bogey electronic device.** An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

d. **Rating.** A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determinated for specified values of environment and operation, and may be stated in any suitable terms.
Note: Limiting conditions may be either maxima or minima.

e. **Rating system.** The set of principles upon which ratings are established and which determines their interpretation.
Note: The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

B. ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.
The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

C. DESIGN - MAXIMUM RATING SYSTEM

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.
The equipment manufacturer should design so that, initially and throughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment, component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

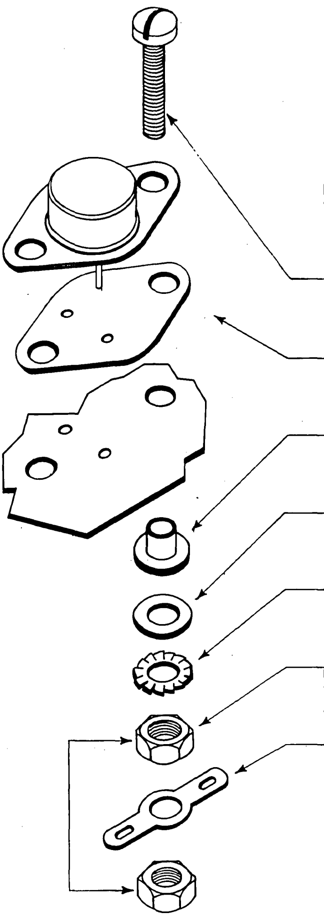
D. DESIGN - CENTRE RATING SYSTEM

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.
The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply-voltage.

The Absolute Maximum Rating System is commonly used for semiconductor devices.

ACCESSORIES AND MOUNTING INSTRUCTIONS

TO-3



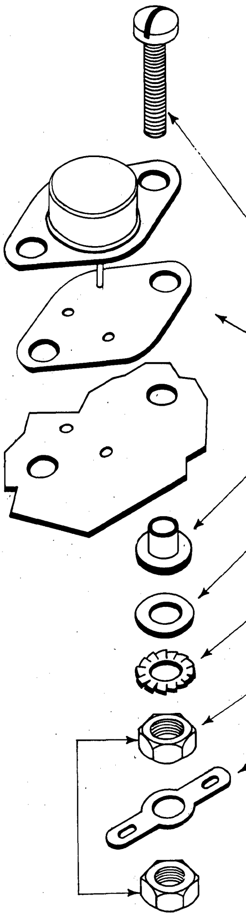
ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NR 021 D		M4 x 14 UNI 242	STEEL NICKEL PLATED	
MICA WASHER	1	* 495320-CT 2	* 495320-CT 2		MICA	XXXVIII
INSULATING BUSHES	2	DF 03 B	DF 03 B		NYLON	XXXIV
WASHERS	2	NR 024 A			STEEL NICKEL PLATED	XXXVII
LOCK WASHERS	2	NR 026 B		4 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	4	NR 022 D		M4 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 A			BRASS TIN PLATED	XXXVI

S-0375/2

* 495320-CT3 FOR MODIFIED TO-3 (see 2N6032 and 2N6033)

ACCESSORIES AND MOUNTING INSTRUCTIONS (continued)

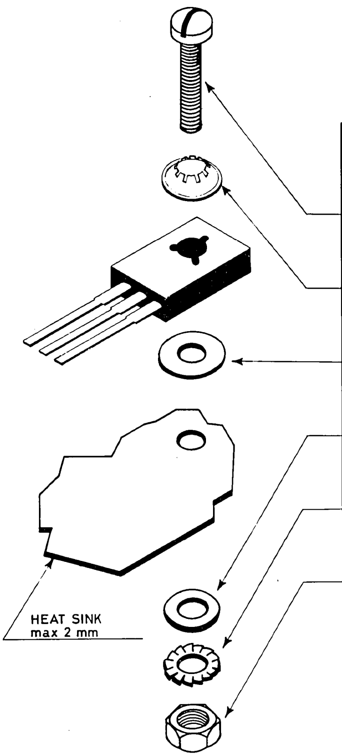
TO-66



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	ASSEMBLY NUMBER KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
MICA WASHER	1	DF 31 CTA	DF 31 CTA		MICA	XXXV
INSULATING BUSHES	2	DF 03 C	DF 03 C		NYLON	XXXIV
WASHERS	2	NR 024 B			STEEL NICKEL PLATED	XXXVII
LOCK WASHERS	2	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	4	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	XXXVI

S-03⁻ ⁵/2

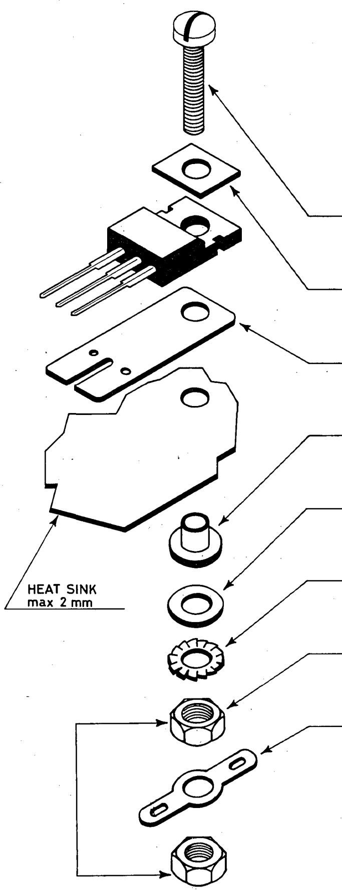
TO-126 (SOT-32)



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021C		M3 x 14 UNI 242	STEEL NICKEL PLATED	
LOCK WASHER	1	NR 026E			STEEL C72 UNI 3545	XXXVII
INSULATING BUSHE	1	DF 02 A	DF 02 A		MICA	XXXIV
WASHER	1	NR 024 B			STEEL NICKEL PLATED	XXXVII
LOCK WASHER	1	NR 026 A		3UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUT	1	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	

S-0340/2

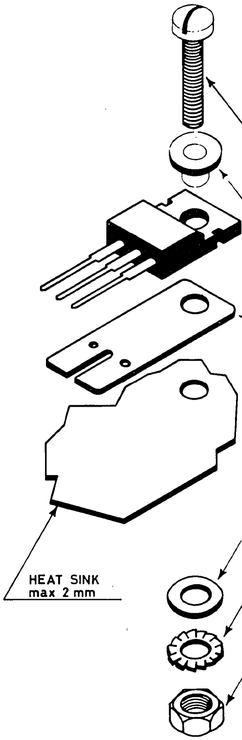
TO-220



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
RECTANGULAR WASHER	1	NR 231 CTB			STEEL NICKEL PLATED	XXXVIII
MICA WASHER	1	DF 103 CTC	DF 103 CTC		MICA	XXXVI
INSULATING BUSHE	1	DF 03 C	DF 03 C		NYLON	XXXIV
WASHER	1	NR 024 B			STEEL NICKEL PLATED	XXXVII
LOCK WASHER	1	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	XXXVI

S-0388/2

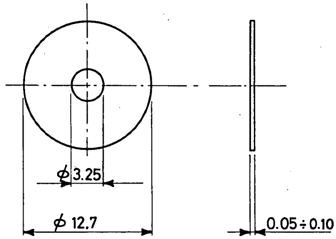
TO-220



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
INSULATING BUSHING	1	DF 03 D	DF 03 D		NYLON	XXXIV
MICA INSULATOR	1	DF 103 CTC	DF 103 CTC		MICA	XXXVI
METAL WASHER	1	NR 024 B			STEEL NICKEL PLATED	XXXVII
LOCK WASHER	1	NR 026 A		3UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3UNI 5590	STEEL NICKEL PLATED	

S-0389/2

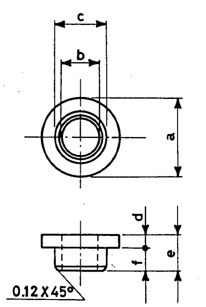
DF 02A



A-0025/1

TYPE	MATERIAL	NOTE
DF 02 A	MICA	

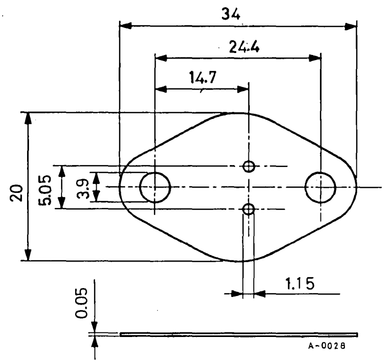
DF 03



A-0024/1

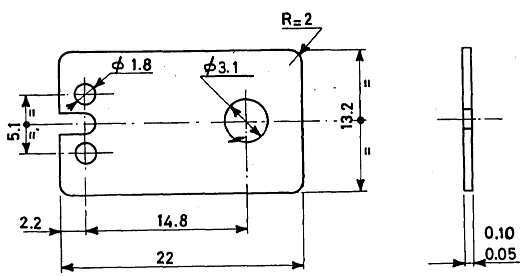
TYPE	MATERIAL	a	b	c	d	e	f	NOTE
DF 03 B	Nylon	8 max	4.1	5.6	1.1 max	1.6		
DF 03 C	Nylon	8 max	3.1	4.1	1.1 max	1.6		
DF 03 D	Nylon	5.5 max	3.1	3.88		1.8	1.2	

DF 31 CTA



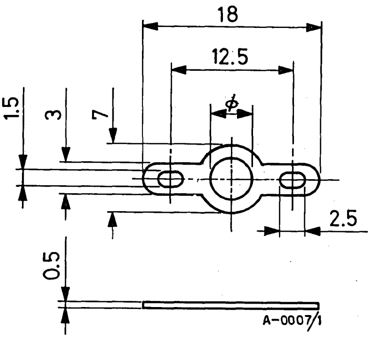
TYPE	MATERIAL	NOTE
DF 31CTA	Mica ASTM D351-57 T (V5)	–

DF 103 CTC



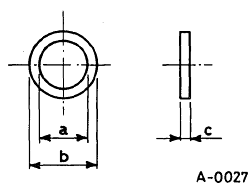
TYPE	MATERIAL	NOTE
DF 103 CTC	MICA	

NR 023



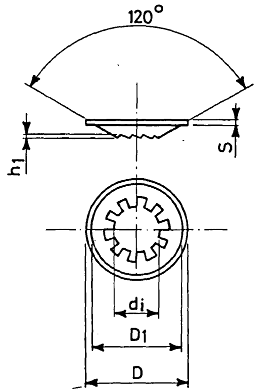
TYPE	MATERIAL	ϕ	NOTE
NR 023 A	Brass Tin plated	4.2	
NR 023 B	" "	3.2	

NR 024



TYPE	MATERIAL	a	b	c	NOTE
NR 024 A	Steel nickel plated	4,10	6,5	1	
NR 024B	" " "	3,10	5,3	1	

NR 026 E

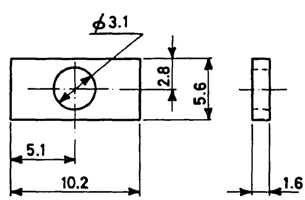


A-0022

TYPE	di max	di min	D max	D min	D1	S	h1	NOTE
NR 026E	3.3	3.1	7.1	6.8	5.2	0.4	0.8	

MATERIAL: Steel nickel plated

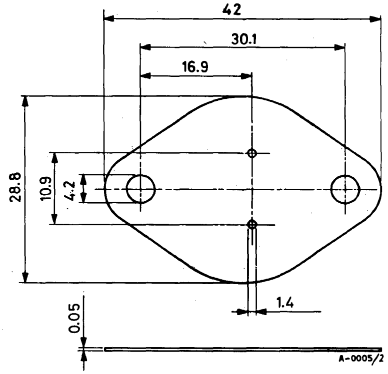
NR 231 CTB



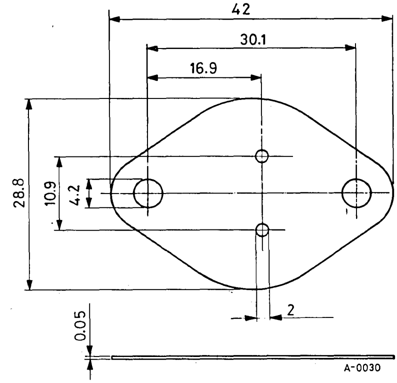
A-0023/2

TYPE	MATERIAL	NOTE
NR 231 CTB	Steel nickel plated	

495320 CT2



495320 CT3



DATA SHEETS

BD 135
BD 137
BD 139

EPITAXIAL PLANAR NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

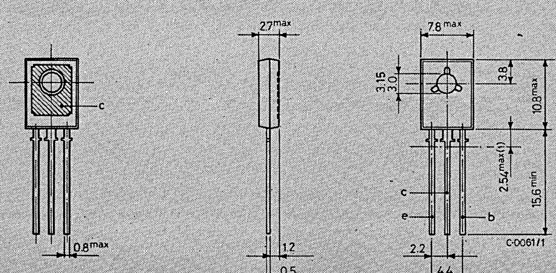
The BD 135, BD 137, BD 139 are silicon epitaxial planar transistors in Jedec TO-126 plastic package, designed for audio amplifiers and drivers utilizing complementary or quasi complementary circuits.
The complementary PNP types are the BD 136, BD 138 and BD 140 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 135	BD 137	BD 139
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		1.5A	
I_{CM}	Collector peak current		3A	
I_B	Base current		0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		12.5W	
	$T_{amb} \leq 25°C$		1.25W	
T_{stg}	Storage temperature		-55 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 10 °C/W

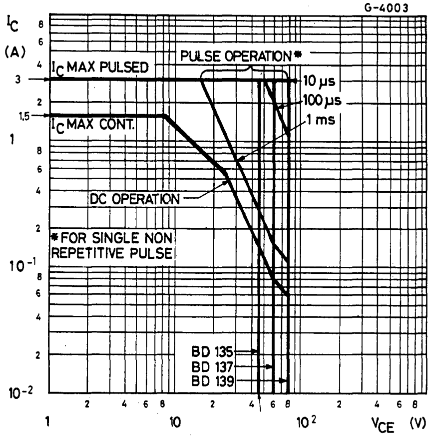
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 30V$			0.1	μA
		$T_{case} = 125°C$ $V_{CB} = 30V$			10	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			10	μA
$V_{CEO\ (sus)}$*	Collector emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$				
		for **BD135**	45			V
		for **BD137**	60			V
		for **BD139**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 500mA$ $I_B = 50mA$			0.5	V
V_{BE}*	Base-emitter on voltage	$I_C = 0.5A$ $V_{CE} = 2V$			1	V
h_{FE}*	DC current gain	$I_C = 5mA$ $V_{CE} = 2V$	25			–
		$I_C = 0.5A$ $V_{CE} = 2V$	25			–
		All types $I_C = 150mA$ $V_{CE} = 2V$				
		for **BD135**	40		250	–
		for **BD137, BD139**	40		160	–

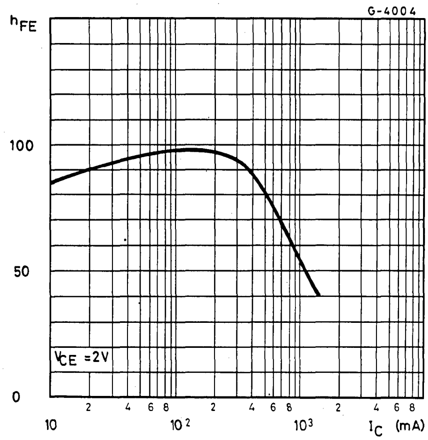
* Pulsed pulse duration = 300μsec, duty cycle ≤ 2%

Available in h_{FE} groups (I_C = 150mA; V_{CE} = 2V)	h_{FE} group	Min.	Max.
	6	40	100
	10	63	160
	16	100	250

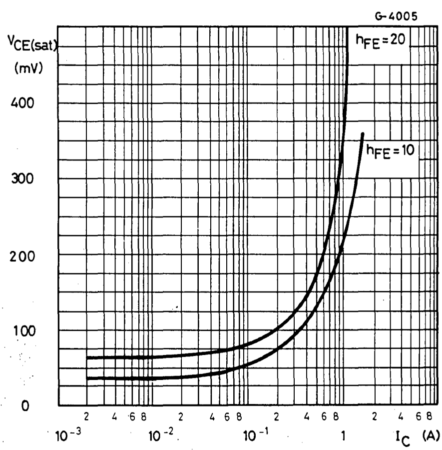
Safe operating areas



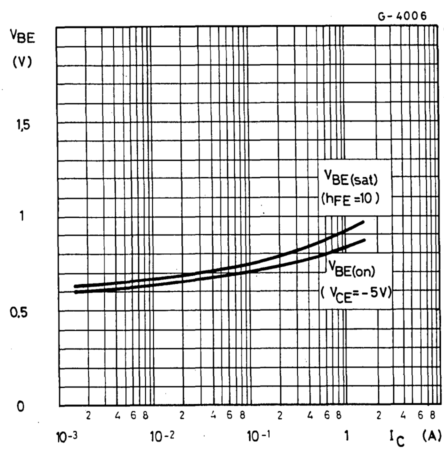
DC current gain



Collector-emitter saturation voltage



Base-emitter voltage



EPITAXIAL PLANAR PNP

BD 136
BD 138
BD 140

MEDIUM POWER GENERAL PURPOSE TRANSISTORS

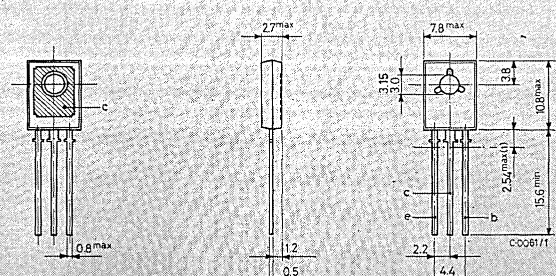
The BD 136, BD 138, BD 140 are silicon epitaxial planar PNP transistors in Jedec TO-126 plastic package, designed for audio amplifiers and drivers utilizing complementary or quasi-complementary circuits.
The complementary NPN types are respectively the BD 135, BD 137 and BD 139.

ABSOLUTE MAXIMUM RATINGS

		BD 136	BD 138	BD 140
V_{CBO}	Collector-base voltage ($I_E=0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C=0$)		-5V	
I_C	Collector current		-1.5A	
I_{CM}	Collector peak current		-3A	
I_B	Base current		-0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$		12.5W	
	$T_{amb} \leq 25\,°C$		1.25W	
T_{stg}	Storage temperature		-55 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

5/80

BD 136
BD 138
BD 140

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	10	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

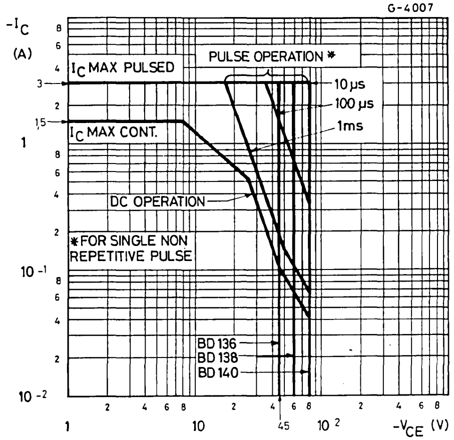
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=-30V			-0.1	μA
		T_{case}=125 °C V_{CB}=-30V			-10	μA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=-5V			-10	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =-30mA for **BD136** for **BD138** for **BD140**	 -45 -60 -80			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =-0.5A I_B =-0.05A			-0.5	V
V_{BE}*	Base-emitter voltage	I_C =-0.5A V_{CE}=-2V			-1	V
h_{FE}*	DC current gain	I_C =-5mA V_{CE}=-2V I_C =-0.5A V_{CE}=-2V All types I_C =-150mA V_{CE}=-2V for **BD136** for **BD138, BD140**	25 25 40 40		 250 160	— — — —

* Pulsed: pulse duration = 300μs, duty cycle ≤ 2%

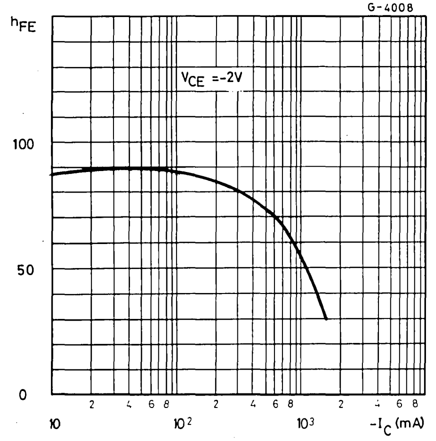
Available in h_{FE} groups (I_C=-0.15A V_{CE}=-2V)

		Min.	Max.
h_{FE} group	6	40	100
	10	63	160
	16	100	250

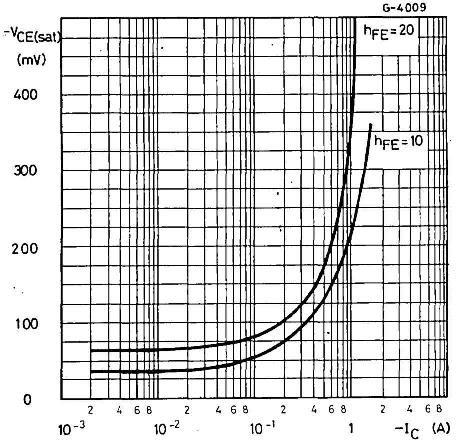
Safe operating areas



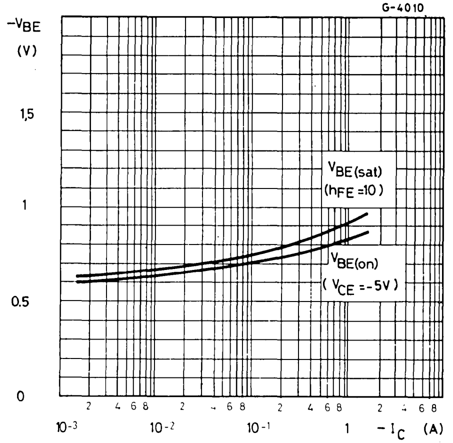
DC current gain



Collector-emitter saturation voltage



Base-emitter voltage



BD 142

SINGLE-DIFFUSED MESA NPN

AUDIO POWER AMPLIFIER

The BD 142 is a single-diffused mesa silicon NPN transistor in Jedec TO-3 metal case. It is intended for a wide variety of intermediate and high power applications and is particularly recommended as an audio power amplifier.

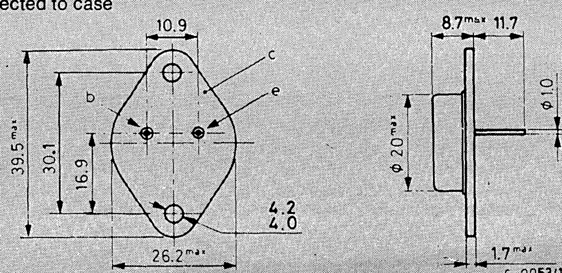
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	50	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	50	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	117	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

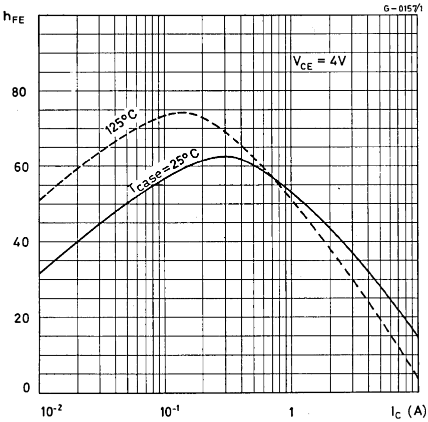
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

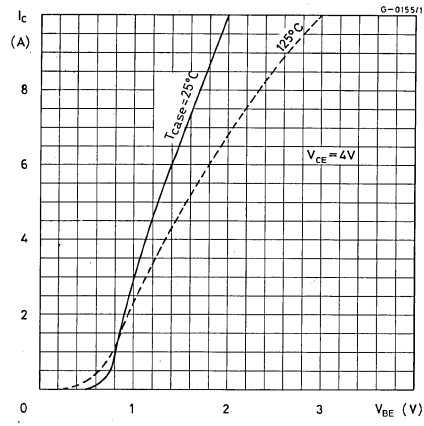
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current	V_{CE} = 40 V				2	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V				1	mA
V_{CEV}*	Collector-emitter voltage (V_{BE} = -1.5V)	I_C = 100mA		50			V
$V_{CEO\ (sus)}$*	Collector-emitter voltage (I_B = 0)	I_C = 200mA		45			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4 A	I_B = 0.4 A			1.1	V
V_{BE}*	Base-emitter voltage	I_C = 4 A	V_{CE} = 4 V			1.5	V
h_{FE}*	DC current gain Gr. 4	I_C = 500mA	V_{CE} = 4 V	20		50	—
	Gr. 5	I_C = 500mA	V_{CE} = 4 V	35		75	—
	Gr. 6	I_C = 500mA	V_{CE} = 4 V	60		145	—
	Gr. 7	I_C = 500mA	V_{CE} = 4 V	120		250	—
		I_C = 4 A	V_{CE} = 4 V	12	35	160	—
h_{FE_1}/h_{FE_2}	Matched pair	I_C = 500mA	V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 500mA	V_{CE} = 4 V	0.8			MHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 39 V		3			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

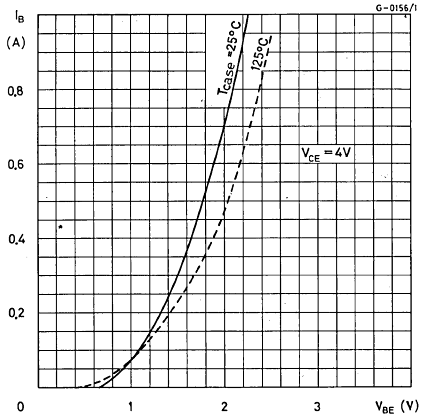
DC current gain



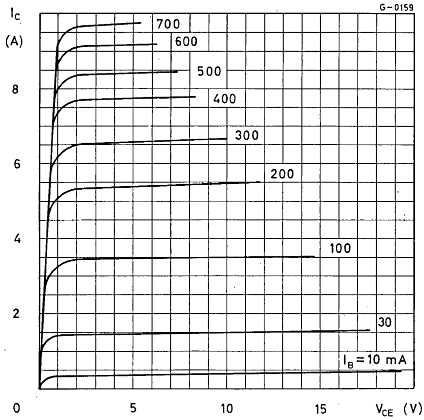
DC transconductance



Input characteristics



Output characteristics



EPITAXIAL-BASE NPN

BD 175
BD 177
BD 179

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

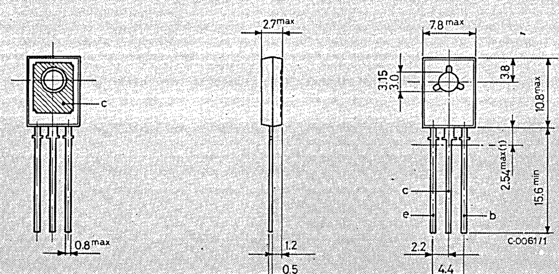
The BD 175, BD 177 and BD 179 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package intended for use in medium power linear and switching applications.
The complementart PNP types are the BD 176, BD 178 and BD 180.

ABSOLUTE MAXIMUM RATINGS

		BD 175	BD 177	BD 179
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		3A	
I_{CM}	Collector peak current		7A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		30W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

5/80

THERMAL DATA

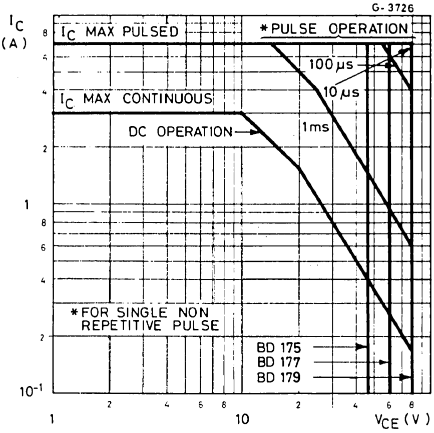
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.16	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

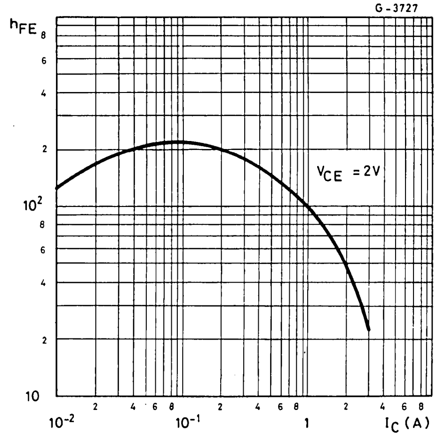
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD175** for **BD177** for **BD179**	$V_{CB} = 45V$ $V_{CB} = 60V$ $V_{CB} = 80V$			100 100 100	μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 100$ mA for **BD175** for **BD177** for **BD179**		 45 60 80			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 1A$	$I_B = 0.1A$			0.8	V
V_{BE}*	Base-emitter voltage	$I_C = 1A$	$V_{CE} = 2V$			1.3	V
h_{FE}*	DC current gain	$I_C = 150mA$ $I_C = 1A$	$V_{CE} = 2V$ $V_{CE} = 2V$	40 15			— —
f_T	Transistion frequency	$I_C = 250mA$	$V_{CE} = 10V$	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 1.5%

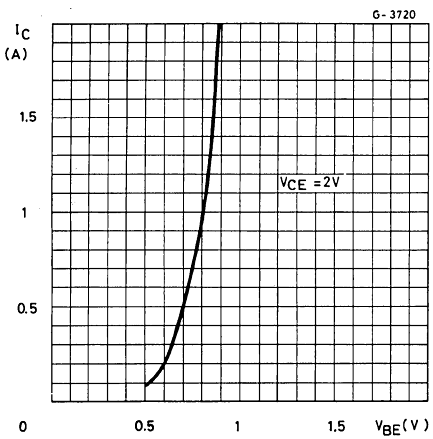
Safe operating areas



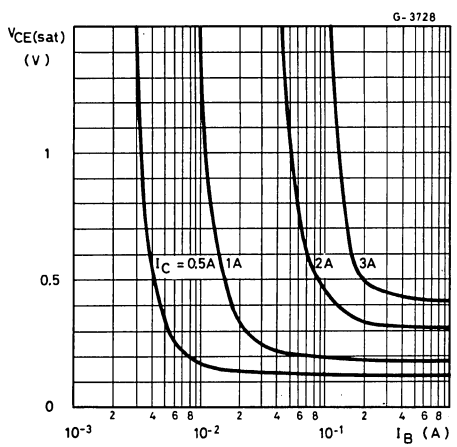
DC current gain



DC transconductance

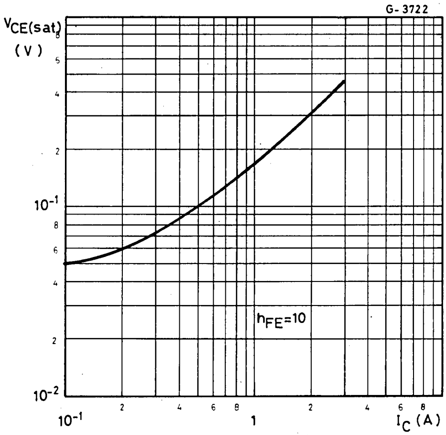


Collector-emitter saturation voltage

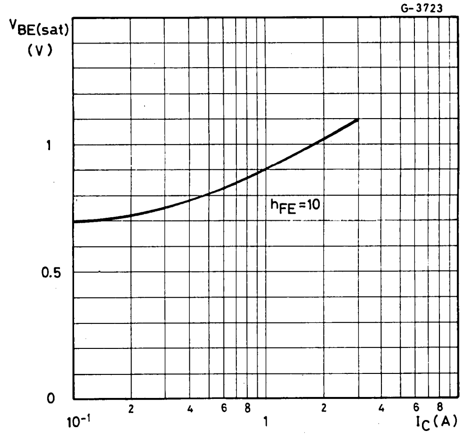


BD 175
BD 177
BD 179

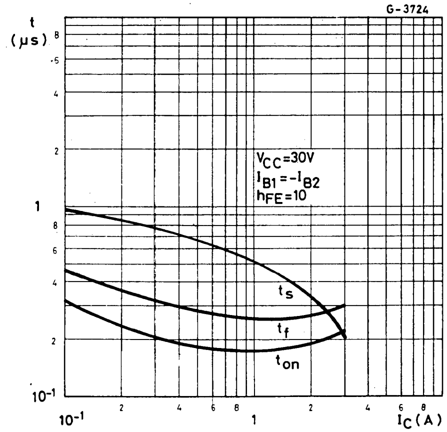
Collector-emitter saturation voltage



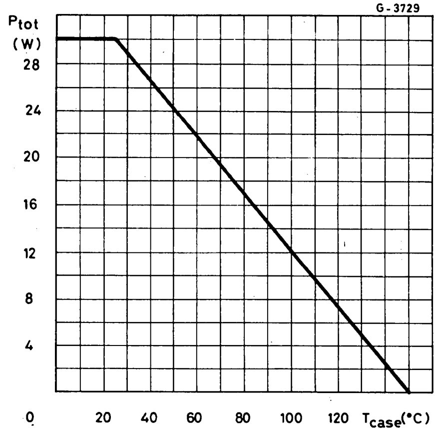
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



EPITAXIAL-BASE PNP

BD 176
BD 178
BD 180

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

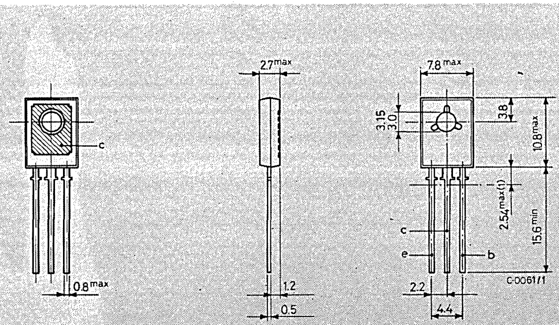
The BD 176, BD 178 and BD 180 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 175, BD 177 and BD 179.

ABSOLUTE MAXIMUM RATINGS

		BD 176	BD 178	BD 180
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V		
I_C	Collector current	-3A		
I_{CM}	Collector peak current	-7A		
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	30W		
T_{stg}	Storage temperature	-65 to 150°C		
T_j	Junction temperature	150°C		

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

5/80

THERMAL DATA

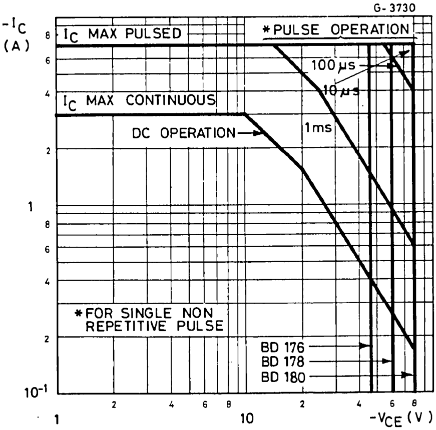
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.16 °C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

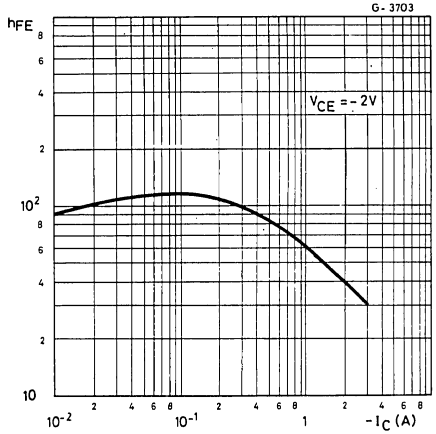
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD176** $V_{CB} = -45V$ for **BD178** $V_{CB} = -60V$ for **BD180** $V_{CB} = -80V$			-100 -100 -100	μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = -100$ mA for **BD176** for **BD178** for **BD180**	 -45 -60 -80			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -1A$ $I_B = -0.1A$			-0.8	V
V_{BE}*	Base-emitter voltage	$I_C = -1A$ $V_{CE} = -2V$			-1.3	V
h_{FE}*	DC current gain	$I_C = -150mA$ $V_{CE} = -2V$ $I_C = -1A$ $V_{CE} = -2V$	40 15			— —
f_T	Transistion frequency	$I_C = -250mA$ $V_{CE} = -10V$	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 1.5%

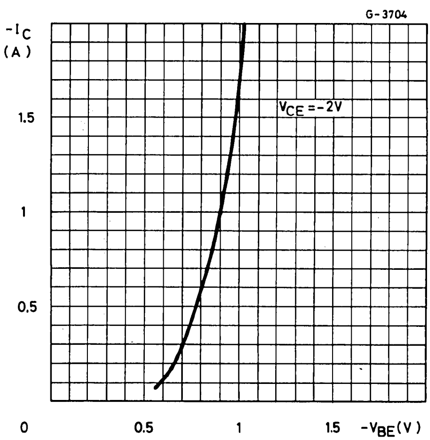
Safe operating areas



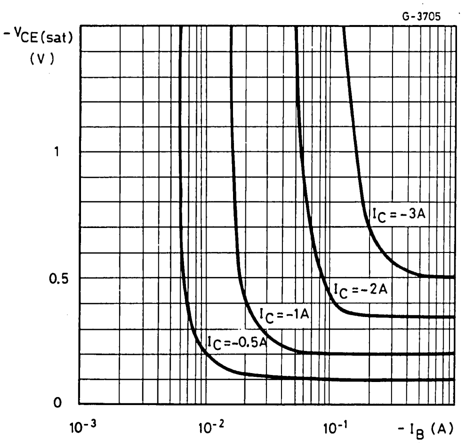
DC current gain



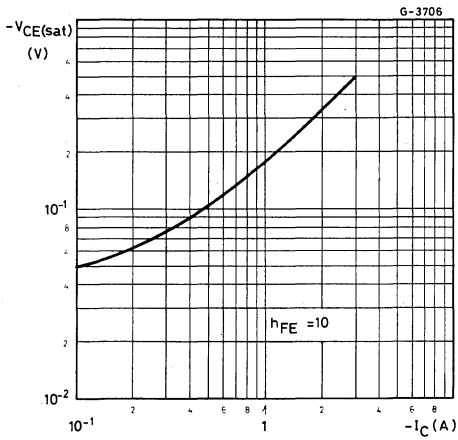
DC transconductance



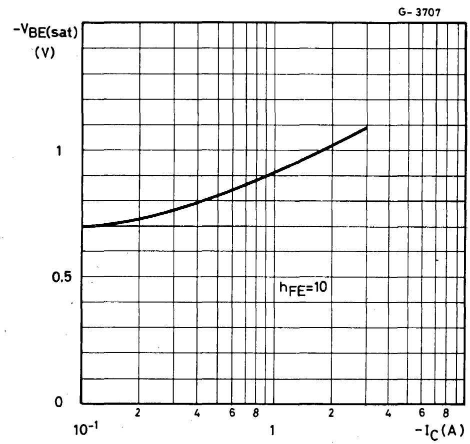
Collector-emitter saturation voltage



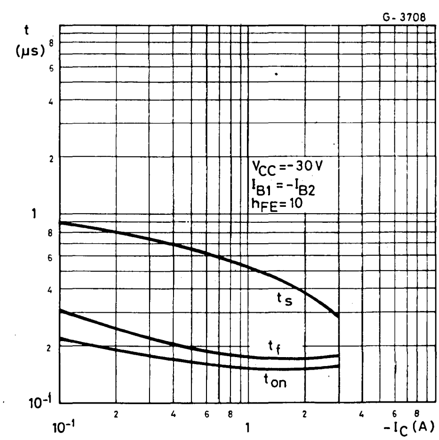
Collector-emitter saturation voltage



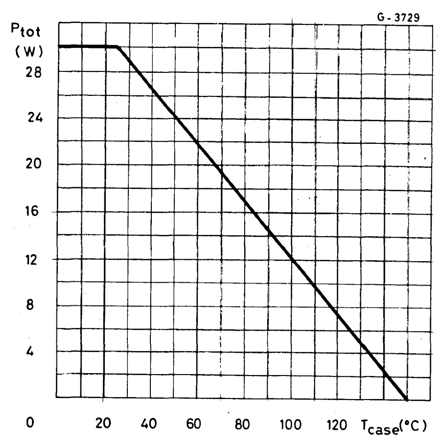
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



SINGLE-DIFFUSED MESA NPN

BD 181
BD 182
BD 183

HI-FI OUTPUT STAGES

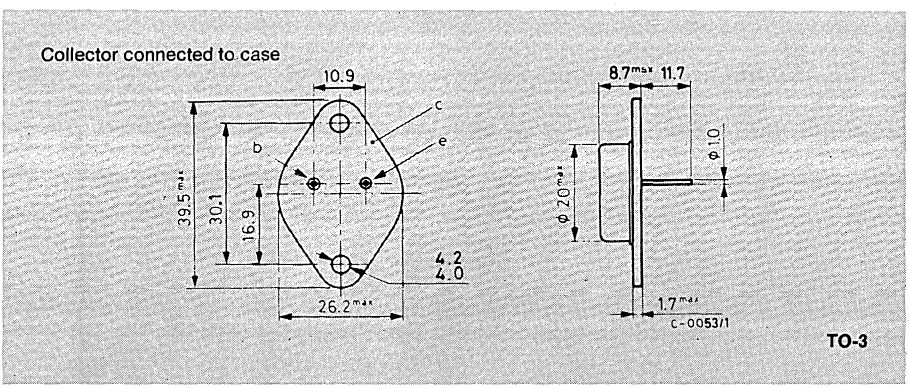
The BD 181, BD 182 and BD 183 are single diffused silicon NPN transistors in Jedec TO-3 metal case.

ABSOLUTE MAXIMUM RATINGS

		BD181	BD182	BD183
V_{CBO}	Collector-base voltage ($I_E = 0$)	55V	70V	85V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	55V	70V	85V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		7V	
I_C	Collector current		15A	
I_{BM}	Base peak current		7A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		117W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

BD 181
BD 182
BD 183

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

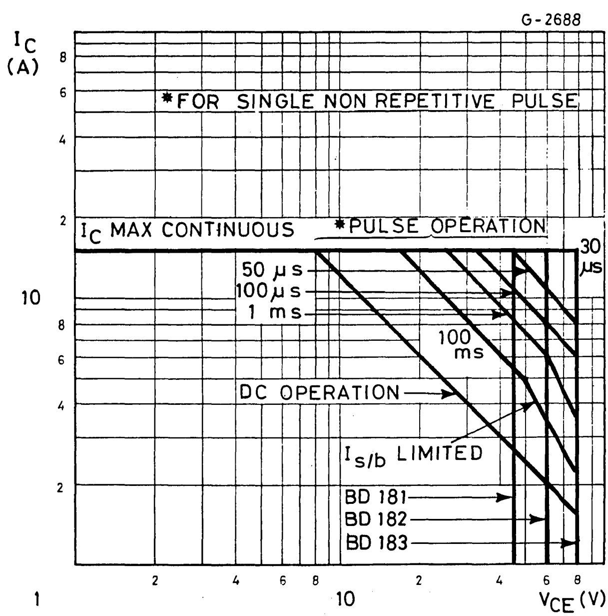
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD181** V_{CB} = 45 V for **BD182** V_{CB} = 60 V for **BD183** V_{CB} = 80 V			2 5 5	mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BD181** and **BD183** I_C = 3 A I_B = 0.3 A for **BD182** I_C = 4 A I_B = 0.4 A			1 1	V V
V_{BE}*	Base-emitter voltage	for **BD181** and **BD183** I_C = 3 A V_{CE} = 4 V for **BD182** I_C = 4 A V_{CE} = 4 V			1.5 1.5	V V
V_{CEK}*	Knee voltage	for **BD181** and **BD183** I_C = 3 A I_B = value for which I_C = 3.3A at V_{CE} = 1.5 V for **BD182** I_C = 4 A I_B = value for which I_C = 4.4A at V_{CE} = 1.5 V			1 1	V V
h_{FE}*	DC current gain	for **BD181** and **BD183** I_C = 3 A V_{CE} = 4 V for **BD182** I_C = 4 A V_{CE} = 4 V	20 20		70 70	— —

ELECTRICAL CHARACTERISTICS (continued)

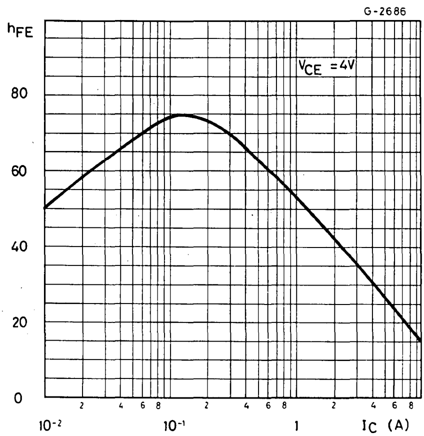
Parameter		Test conditions	Min.	Typ.	Max.	Unit
Linearity		$V_{CE} = 4$ V for **BD182** $\frac{h_{FE} \text{ at } I_C = 0.3\text{ A}}{h_{FE} \text{ at } I_C = 4\text{ A}}$		2.5	4	—
		for **BD181** and **BD183** $\frac{h_{FE} \text{ at } I_C = 0.3\text{ A}}{h_{FE} \text{ at } I_C = 3\text{ A}}$		2.5	3.5	—
h_{FE1}/h_{FE2}	Matched pair	for 2x**BD181** and 2x**BD183** $I_C = 3$ A $V_{CE} = 4$ V			1.3	—
		for 2 x **BD182** $I_C = 4$ A $V_{CE} = 4$ V			1.3	—
$f_{h_{fe}}$	Cutoff frequency	$I_C = 0.3$ A $V_{CE} = 4$ V	15			kHz
PRT	Power rating test	$I_C = 3$ A $V_{CE} = 39$ V	1			s

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

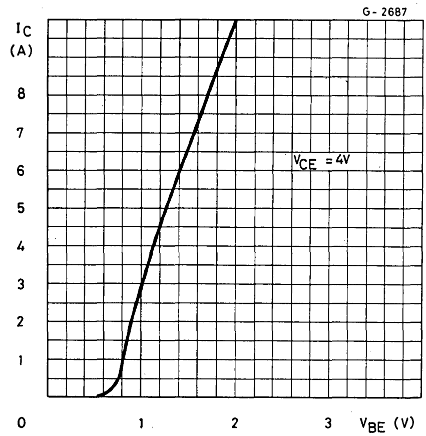
Safe operating areas



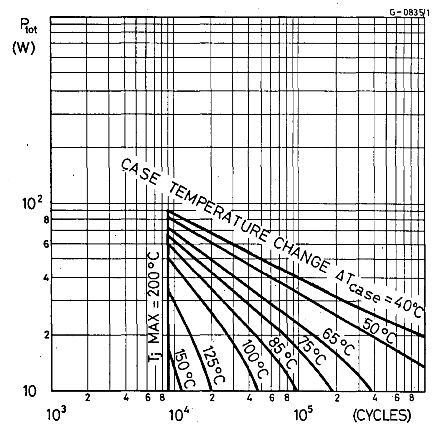
DC current gain



DC transconductance



Thermal-cycle rating chart



EPITAXIAL-BASE NPN

BD 233
BD 235
BD 237

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

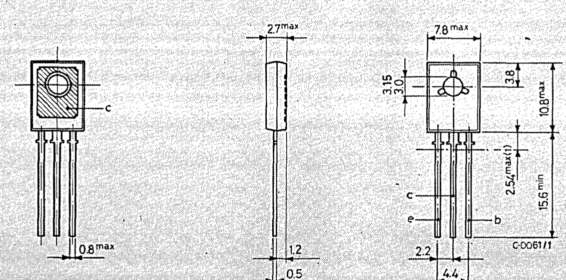
The BD 233, BD 235 and BD 237 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package intended for use in medium power linear and switching applications.
The complementary PNP types are the BD 234, BD 236 and BD 238 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 233	BD 235	BD 237
V_{CBO}	Collector-base voltage ($I_E=0$)	45V	60V	100V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	45V	60V	80V
V_{CER}	Collector-emitter voltage ($R_{BE}=1K\Omega$)	45V	60V	100V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		2A	
I_{CM}	Collector peak current		6A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		25W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



(1) Within this region the cross-section of the leads is uncontrolled.

TO-126 (SOT 32)

BD 233
BD 235
BD 237

THERMAL DATA

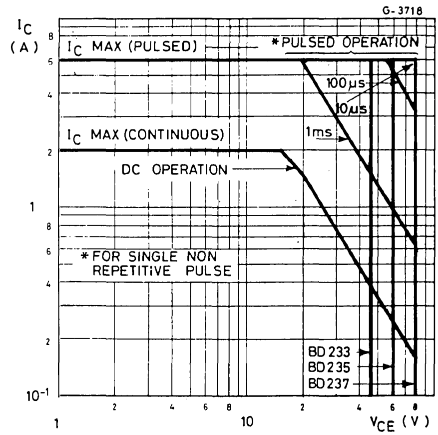
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

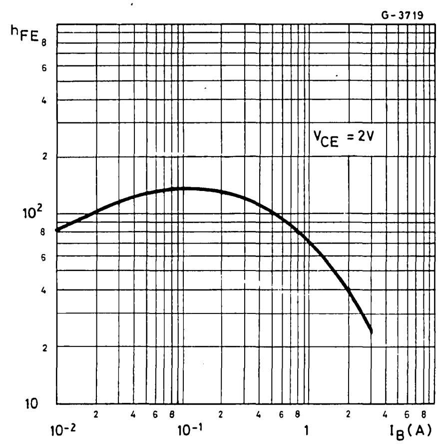
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD233** $V_{CB} = 45V$ for **BD235** $V_{CB} = 60V$ for **BD237** $V_{CB} = 100V$ $T_{case} = 150°C$ for **BD233** $V_{CB} = 45V$ for **BD235** $V_{CB} = 60V$ for **BD237** $V_{CB} = 100V$			100 100 100 2 2 2	μA μA μA mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 100$ mA for **BD233** for **BD235** for **BD237**	 45 60 80			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 1A$ $I_B = 0.1A$			0.6	V
V_{BE}*	Base-emitter voltage	$I_C = 1A$ $V_{CE} = 2V$			1.3	V
h_{FE}*	DC current gain	$I_C = 150mA$ $V_{CE} = 2V$ $I_C = 1A$ $V_{CE} = 2V$	40 25			– –
f_T	Transistion frequency	$I_C = 250mA$ $V_{CE} = 10V$	3			MHz
h_{FE1}/h_{FE2}*	Matched pairs BD233/BD234 BD235/BD236 BD237/BD238	$I_C = 150mA$ $V_{CE} = 2V$		1.6		–

* Pulsed: pulse duration = 300 μs, duty cycle ≤1.5%

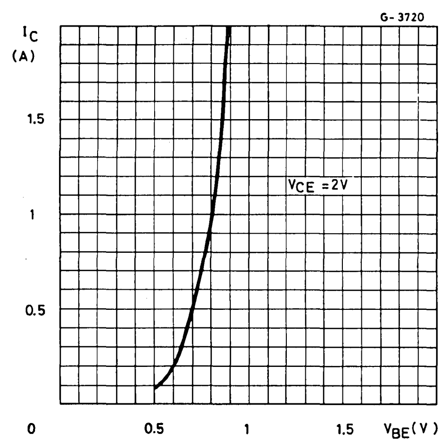
Safe operating areas



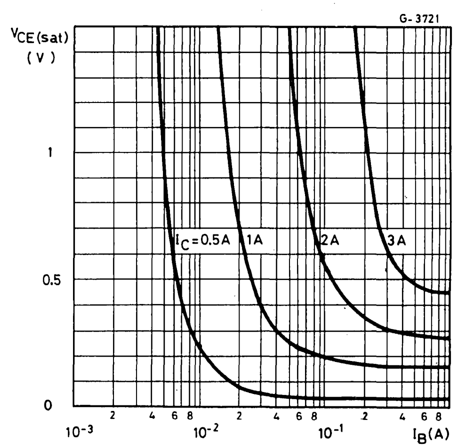
DC current gain



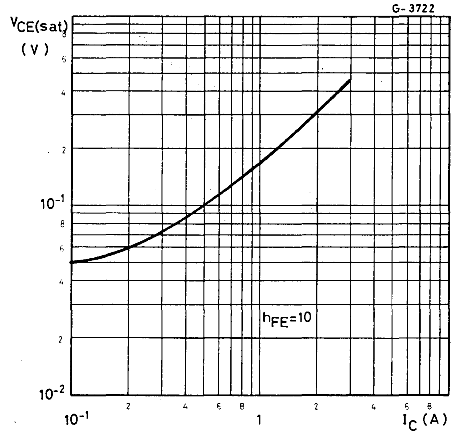
DC transconductance



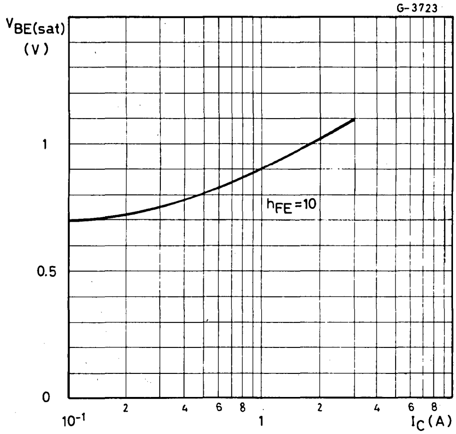
Collector-emitter saturation voltage



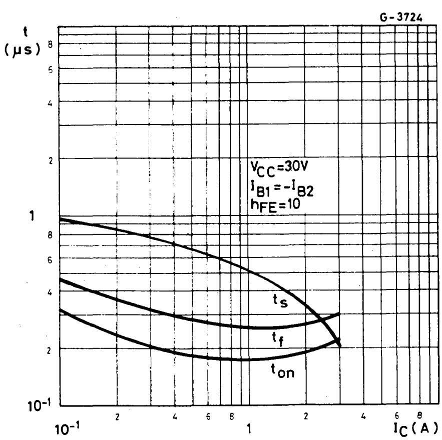
Collector-emitter saturation voltage



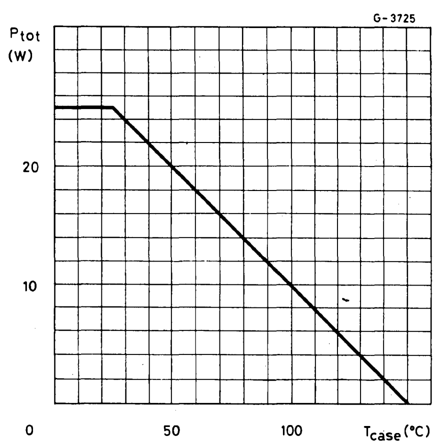
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



EPITAXIAL-BASE PNP

BD 234
BD 236
BD 238

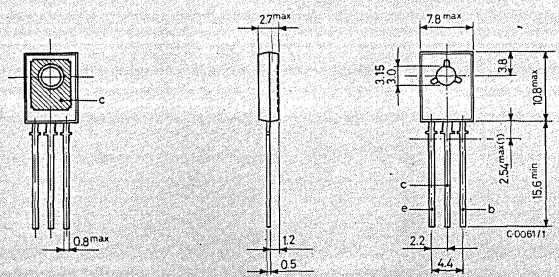
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 234, BD 236 and BD 238 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic-package intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 233, BD 235 and BD 237 respectively.

ABSOLUTE MAXIMUM RATINGS		BD234	BD236	BD238
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{CER}	Collector-emitter voltage ($R_{BE} = 1K\Omega$)	-45V	-60V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-2A	
I_{CM}	Collector peak current		-6A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		25W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

5/80

THERMAL DATA

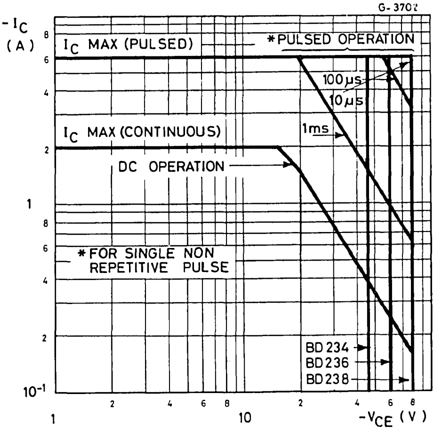
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

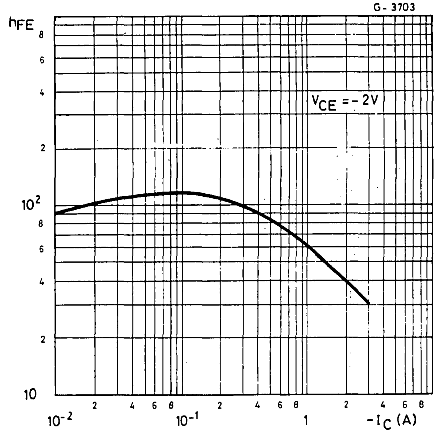
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD234** $V_{CB} = -45V$			-100	μA
		for **BD236** $V_{CB} = -60V$			-100	μA
		for **BD238** $V_{CB} = -100V$			-100	μA
		$T_{case} = 150°C$				
		for **BD234** $V_{CB} = -45V$			-2	mA
		for **BD236** $V_{CB} = -60V$			-2	mA
		for **BD238** $V_{CB} = -100V$			-2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -100$ mA				
		for **BD234**	-45			V
		for **BD236**	-60			V
		for **BD238**	-80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -1A$ $I_B = -0.1A$			-0.6	V
V_{BE}*	Base-emitter voltage	$I_C = -1A$ $V_{CE} = -2V$			-1.3	V
h_{FE}*	DC current gain	$I_C = -150mA$ $V_{CE} = -2V$	40			—
		$I_C = -1A$ $V_{CE} = -2V$	25			—
f_T	Transistion frequency	$I_C = -250mA$ $V_{CE} = -10V$	3			MHz
h_{FE1}/h_{FE2}*	Matched pairs BD233/BD234 BD235/BD236 BD237/BD238	$I_C = 150mA$ $V_{CE} = 2V$		1.6		—

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 1.5%

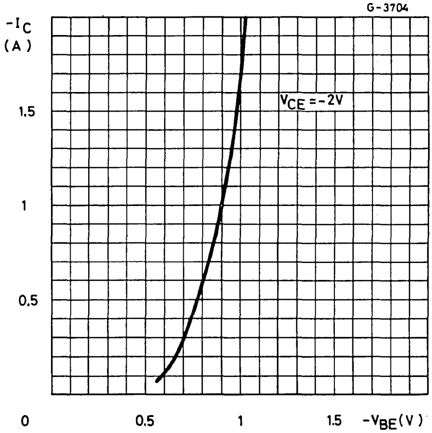
Safe operating areas



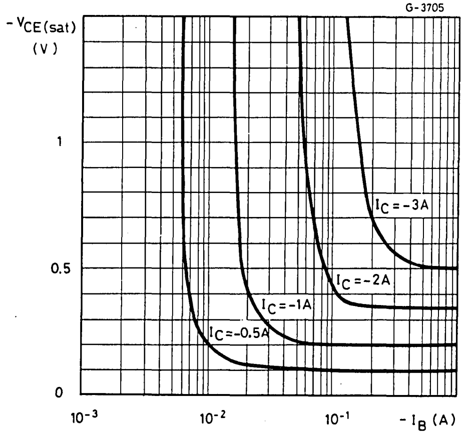
DC current gain



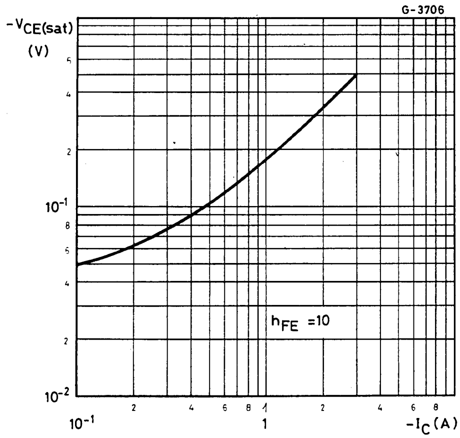
DC transconductance



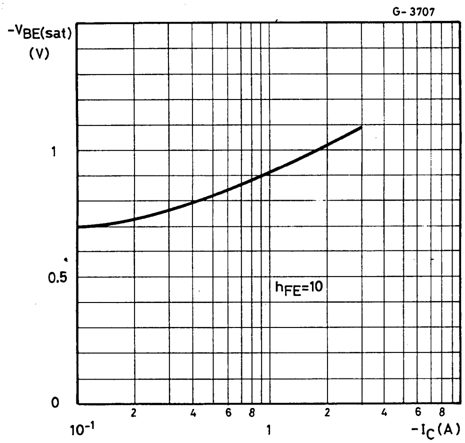
Collector-emitter saturation voltage



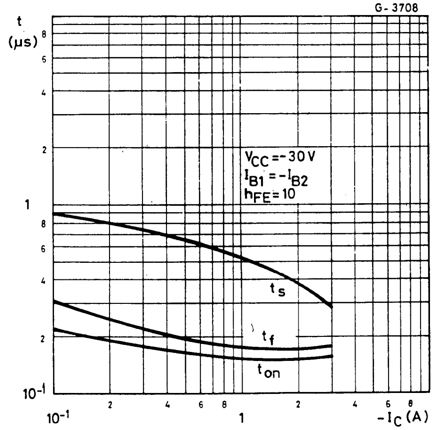
Collector-emitter saturation voltage



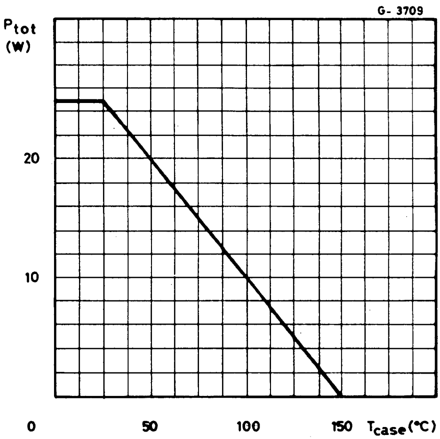
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



BD 239
BD 239A
BD 239B
BD 239C

EPITAXIAL-BASE NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 239, BD 239A, BD 239B and BD 239C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are BD 240, BD 240A, BD 240B and BD 240C respectively.

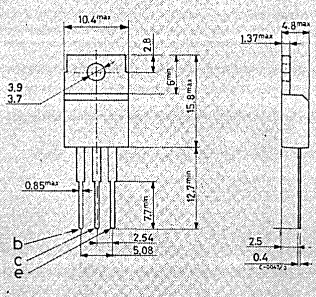
ABSOLUTE MAXIMUM RATINGS

		BD239	BD239A	BD239B	BD239C
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	55V	70V	90V	115V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	2A			
I_{CM}	Collector peak current	4A			
I_B	Base current	0.6A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	30W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.17	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 239** and **BD 239A** $V_{CE} = 30V$			0.3	mA
		for **BD 239B** and **BD 239C** $V_{CE} = 60V$			0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 239** $V_{CE} = 45V$			0.2	mA
		for **BD 239A** $V_{CE} = 60V$			0.2	mA
		for **BD 239B** $V_{CE} = 80V$			0.2	mA
		for **BD 239C** $V_{CE} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$				
		for **BD 239**	45			V
		for **BD 239A**	60			V
		for **BD 239B**	80			V
		for **BD 239C**	100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 1A$ $I_B = 0.2A$			0.7	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = 1A$ $V_{CE} = 4V$			1.3	V
h_{FE}*	DC current gain	$I_C = 0.2A$ $V_{CE} = 4V$	40			—
		$I_C = 1A$ $V_{CE} = 4V$	15			—
h_{fe}	Small signal current gain	$I_C = 0.2A$ $V_{CE} = 10V$ f = 1KHz	20			—
		$I_C = 0.2A$ $V_{CE} = 10V$ f = 1MHz	3			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BD 240
BD 240A
BD 240B
BD 240C

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

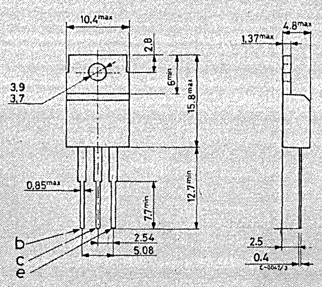
The BD 240, BD 240A, BD 240B and BD 240C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are BD 239, BD 239A, BD 239B and BD 239C respectively.

ABSOLUTE MAXIMUM RATINGS		BD240	BD240A	BD240B	BD240C
V_{CER}	Collector-emitter voltage (R_{BE} = 100Ω)	−55V	−70V	−90V	−115V
V_{CEO}	Collector-emitter voltage (I_B = 0)	−45V	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage (I_C = 0)	−5V			
I_C	Collector current	−2A			
I_{CM}	Collector peak current	−4A			
I_B	Base current	−0.6A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	30W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.17	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 240** and **BD 240A** $V_{CE} = -30V$			−0.3	mA
		for **BD 240B** and **BD 240C** $V_{CE} = -60V$			−0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 240** $V_{CE} = -45V$			−0.2	mA
		for **BD 240A** $V_{CE} = -60V$			−0.2	mA
		for **BD 240B** $V_{CE} = -80V$			−0.2	mA
		for **BD 240C** $V_{CE} = -100V$			−0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			−1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$				
		for **BD 240**	−45			V
		for **BD 240A**	−60			V
		for **BD 240B**	−80			V
		for **BD 240C**	−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -1A$ $I_B = -0.2A$			−0.7	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -1A$ $V_{CE} = -4V$			−1.3	V
h_{FE}*	DC current gain	$I_C = -0.2A$ $V_{CE} = -4V$	40			—
		$I_C = -1A$ $V_{CE} = -4V$	15			—
h_{fe}	Small signal current gain	$I_C = -0.2A$ $V_{CE} = -10V$ f = 1KHz	20			—
		$I_C = -0.2A$ $V_{CE} = -10V$ f = 1MHz	3			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

EPITAXIAL-BASE NPN

BD 241
BD 241A
BD 241B
BD 241C

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 241, BD 241A, BD 241B and BD 241C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the BD 242, BD 242A, BD 242B and BD 242C respectively.

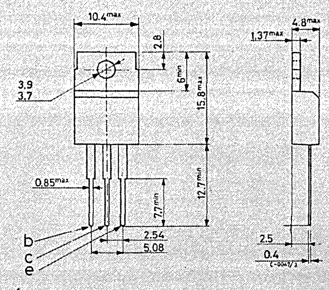
ABSOLUTE MAXIMUM RATINGS

		BD241	BD241A	BD241B	BD241C
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	55V	70V	90V	115V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	3A			
I_{CM}	Collector peak current	5A			
I_B	Base-current	1A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 3.13 °C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max 62.5 °C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 241** and **BD 241A** $V_{CE} = 30V$				0.3	mA
		for **BD 241B** and **BD 241C** $V_{CE} = 60V$				0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 241**	$V_{CE} = 45V$			0.2	mA
		for **BD 241A**	$V_{CE} = 60V$			0.2	mA
		for **BD 241B**	$V_{CE} = 80V$			0.2	mA
		for **BD 241C**	$V_{CE} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$					
		for **BD 241**		45			V
		for **BD 241A**		60			V
		for **BD 241B**		80			V
		for **BD 241C**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$	$I_B = 0.6A$			1.2	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = 3A$	$V_{CE} = 4V$			1.8	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE} = 4V$	25			—
		$I_C = 3A$	$V_{CE} = 4V$	10			—
h_{fe}	Small signal current gain	$I_C = 0.5A$ f = 1KHz	$V_{CE} = 10V$	20			—
		$I_C = 0.5A$ f = 1MHz	$V_{CE} = 10V$	3			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

EPITAXIAL-BASE PNP

BD 242
BD 242A
BD 242B
BD 242C

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 242, BD 242A, BD 242B and BD 242C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 241, BD 241A, BD 241B and BD 241C respectively.

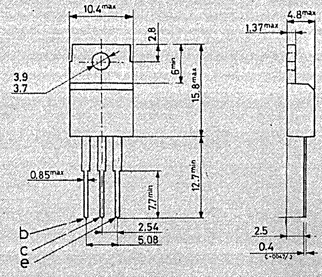
ABSOLUTE MAXIMUM RATINGS

		BD242	BD242A	BD242B	BD242C
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	–55V	–70V	–90V	–115V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	–45V	–60V	–80V	–100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	–5V			
I_C	Collector current	–3A			
I_{CM}	Collector peak current	–5A			
I_B	Base-current	–1A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	–65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BD 242
BD 242A
BD 242B
BD 242C

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.13	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 242** and **BD 242A** $V_{CE} = -30V$			–0.3	mA
		for **BD 242B** and **BD 242C** $V_{CE} = -60V$			–0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 242** $V_{CE} = -45V$			–0.2	mA
		for **BD 242A** $V_{CE} = -60V$			–0.2	mA
		for **BD 242B** $V_{CE} = -80V$			–0.2	mA
		for **BD 242C** $V_{CE} = -100V$			–0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			–1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$				
		for **BD 242**	–45			V
		for **BD 242A**	–60			V
		for **BD 242B**	–80			V
		for **BD 242C**	–100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -3A$ $I_B = -0.6A$			–1.2	V
V_{BE}*	Base-emitter voltage	$I_C = -3A$ $V_{CE} = -4V$			–1.8	V
h_{FE}*	DC current gain	$I_C = -1A$ $V_{CE} = -4V$	25			—
		$I_C = -3A$ $V_{CE} = -4V$	10			—
h_{fe}	Small signal current gain	$I_C = -0.5A$ $V_{CE} = -10V$ f = 1KHz	20			—
		$I_C = -0.5A$ $V_{CE} = -10V$ f = 1MHz	3			—

* Pulsed: pulse duration = 300μs, duty cycle $\leqslant$2%.

EPITAXIAL-BASE NPN

BD 243
BD 243A
BD 243B
BD 243C

POWER LINEAR AND SWITCHING APPLICATIONS

The BD 243, BD 243A, BD 243B and BD 243C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the BD 244, BD 244A, BD 244B and BD 244C respectively.

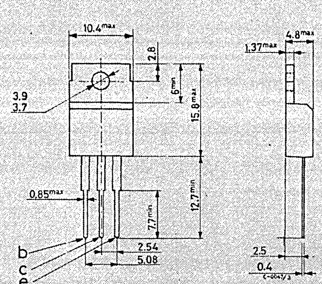
ABSOLUTE MAXIMUM RATINGS

		BD243	BD243A	BD243B	BD243C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	6A			
I_{CM}	Collector peak current	10A			
I_B	Base current	2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	65W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 243** and **BD 243A** $V_{CE} = 30V$ for **BD 243B** and **BD 243C** $V_{CE} = 60V$				 0.7 0.7	 mA mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 243** for **BD 243A** for **BD 243B** for **BD 243C**	$V_{CE} = 45V$ $V_{CE} = 60V$ $V_{CE} = 80V$ $V_{CE} = 100V$			0.4 0.4 0.4 0.4	mA mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$ for **BD 243** for **BD 243A** for **BD 243B** for **BD 243C**		 45 60 80 100			 V V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 6A$	$I_B = 1A$			1.5	V
V_{BE}*	Base-emitter voltage	$I_C = 6A$	$V_{CE} = 4V$			2	V
h_{FE}*	DC current gain	$I_C = 0.3A$ $I_C = 3A$	$V_{CE} = 4V$ $V_{CE} = 4V$	30 15			— —
h_{fe}	Small signal current gain	$I_C = 0.5A$ f = 1KHz $I_C = 0.50$ f = 1MHz	$V_{CE} = 10V$ $V_{CE} = 10V$	 20 3			 — —

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

EPITAXIAL-BASE PNP

BD 244
BD 244A
BD 244B
BD 244C

POWER LINEAR AND SWITCHING APPLICATIONS

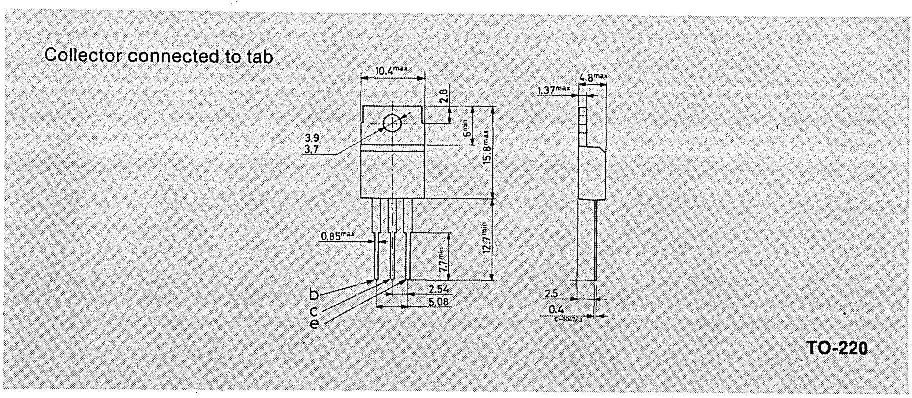
The BD 244, BD 244A, BD 244B and BD 244C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 243, BD 243A, BD 243B and BD 243C respectively.

ABSOLUTE MAXIMUM RATINGS

		BD244	BD244A	BD244B	BD244C
V_{CBO}	Collector-base voltage ($I_E = 0$)	–45V	–60V	–80V	–100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	–45V	–60V	–80V	–100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	–5V			
I_C	Collector current	–6A			
I_{CM}	Collector peak current	–10A			
I_B	Base current	–2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	65W			
T_{stg}	Storage temperature	–65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb.}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 244** and **BD 244A** $V_{CE} = -30V$			−0.7	mA
		for **BD 244B** and **BD 244C** $V_{CE} = -60V$			−0.7	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 244** $V_{CE} = -45V$			−0.4	mA
		for **BD 244A** $V_{CE} = -60V$			−0.4	mA
		for **BD 244B** $V_{CE} = -80V$			−0.4	mA
		for **BD 244C** $V_{CE} = -100V$			−0.4	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			−1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$				
		for **BD 244**	−45			V
		for **BD 244A**	−60			V
		for **BD 244B**	−80			V
		for **BD 244C**	−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -6A$ $I_B = -1A$			−1.5	V
V_{BE}*	Base-emitter voltage	$I_C = -6A$ $V_{CE} = -4V$			−2	V
h_{FE}*	DC current gain	$I_C = -0.3A$ $V_{CE} = -4V$	30			
		$I_C = -3A$ $V_{CE} = -4V$	15			
h_{fe}	Small signal current gain	$I_C = -0.5A$ $V_{CE} = -10V$ f = 1KHz	20			
		$I_C = -0.5A$ $V_{CE} = -10V$ f = 1MHz	3			

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%

EPITAXIAL PLANAR NPN

BD 375
BD 377
BD 379

MEDIUM POWER GENERAL PURPOSE TRANSISTORS

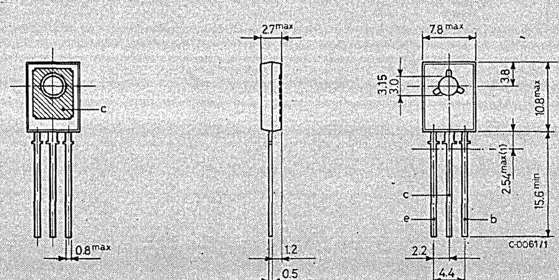
The BD 375, BD 377 and BD 379 are silicon epitaxial planar NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the BD 376, BD 378 and BD 380 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 375	BD 377	BD 379
V_{CBO}	Collector-base voltage ($I_E=0$)	50V	75V	100 V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		2A	
I_{CM}	Collector peak current (repetitive)		3A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$		25W	
T_{stg}	Storage temperature		-55 to 150 °C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

BD 375
BD 377
BD 379

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\,°C$ unless otherwise specified)

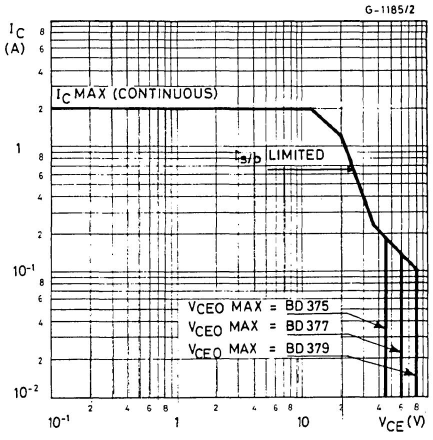
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E=0$)	for **BD375**					
		$V_{CB}=45V$				2	μA
		$V_{CB}=45V$	$T_{case}=150°C$			10	μA
		for **BD377**					
		$V_{CB}=60V$				2	μA
		$V_{CB}=60V$	$T_{case}=150°C$			10	μA
		for **BD379**					
		$V_{CB}=80V$				2	μA
		$V_{CB}=80V$	$T_{case}=150°C$			10	μA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=5V$				100	μA
V_{CBO}	Collector-base voltage ($I_E=0$)	$I_C=100\mu A$					
		for **BD375**		50			V
		for **BD377**		75			V
		for **BD379**		100			V
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	$I_C=100mA$					
		for **BD375**		45			V
		for **BD377**		60			V
		for **BD379**		80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C=1A$	$I_B=0.1A$			1	V
V_{BE}*	Base-emitter voltage	$I_C=1A$	$V_{CE}=2V$			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

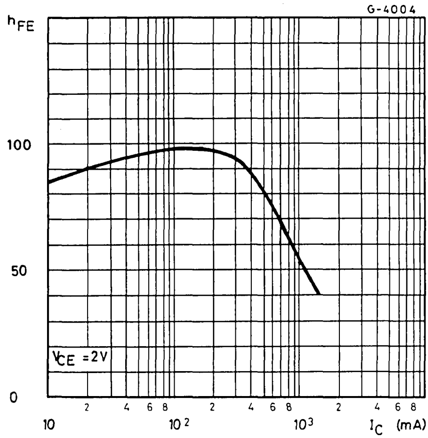
Parameter			Test conditions	Min. Typ. Max.	Unit
h_{FE}*	DC current gain	Gr. 6	I_C =0.15A V_{CE}=2V	40 100	–
		Gr.10	I_C =0.15A V_{CE}=2V	63 160	–
		Gr.16	I_C =0.15A V_{CE}=2V	100 250	–
		Gr.25	I_C =0.15A V_{CE}=2V	150 375	–
			I_C =1A V_{CE}=2V	20	–
t_{on}	Turn-on time		I_C =0.5A I_{B1} =0.05A V_{CC}=30V	50	ns
t_{off}	Turn-off time		I_C =0.5A V_{CC}=30V I_{B1} =-I_{B2} = 0.05A	500	ns

*Pulsed: pulse duration = 300 μs, duty cycle ≤ 2%

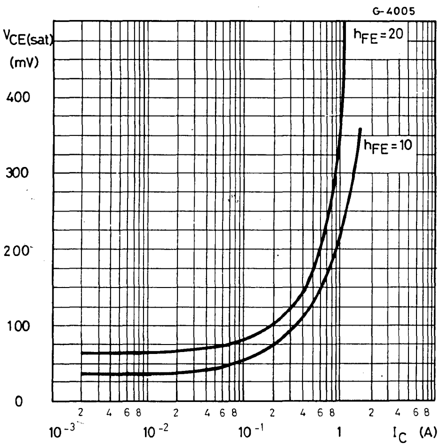
Safe operating area



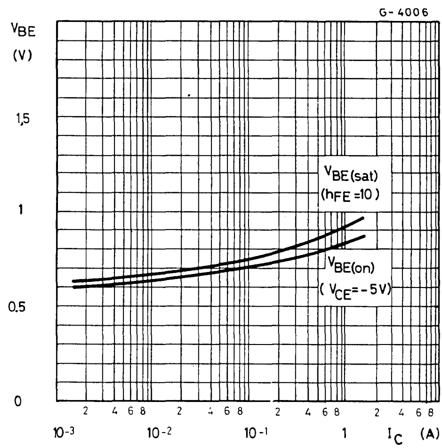
DC current gain



Collector-emitter saturation voltage



Base-emitter voltage



EPITAXIAL PLANAR PNP

BD 376
BD 378
BD 380

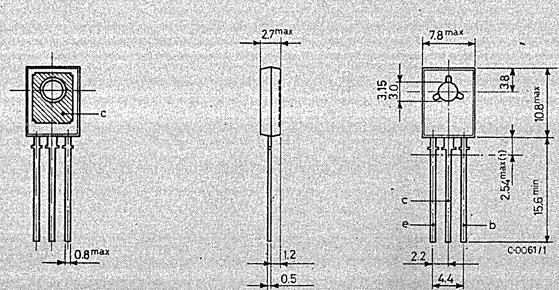
MEDIUM POWER GENERAL PURPOSE TRANSISTORS

The BD 376, BD 378 and BD 380 are silicon epitaxial planar PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 375, BD 377 and BD 379 respectively.

ABSOLUTE MAXIMUM RATINGS		BD 376	BD 378	BD 380
V_{CBO}	Collector-base voltage ($I_E = 0$)	-50V	-75V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-2A	
I_{CM}	Collector peak current (repetitive)		-3A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$		25W	
T_{stg}	Storage temperature		-55 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

BD 376
BD 378
BD 380

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

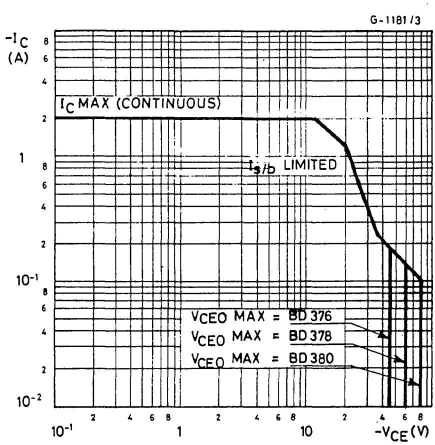
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	for **BD376**				
		V_{CB}=-45V			-2	μA
		V_{CB}=-45V T_{case}=150°C			-10	μA
		for **BD378**				
		V_{CB}=-60V			-2	μA
		V_{CB}=-60V T_{case}=150°C			-10	μA
		for **BD380**				
		V_{CB}=-80V			-2	μA
		V_{CB}=-80V T_{case}=150°C			-10	μA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=-5V			-100	μA
V_{CBO}	Collector-base voltage (I_E=0)	I_C =-100μA				
		for **BD376**	-50			V
		for **BD378**	-75			V
		for **BD380**	-100			V
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =-100mA				
		for **BD376**	-45			V
		for **BD378**	-60			V
		for **BD380**	-80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C =-1A I_B =-0.1A			-1	V
V_{BE}*	Base-emitter voltage	I_C =-1A V_{CE}=-2V			-1.5	V

ELECTRICAL CHARACTERISTICS (continued)

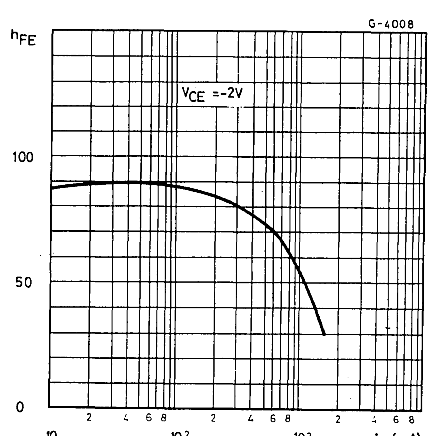
Parameter			Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	Gr. 6	I_C =-0.15A V_{CE}=-2V	40		100	–
		Gr.10	I_C =-0.15A V_{CE}=-2V	63		160	–
		Gr.16	I_C =-0.15A V_{CE}=-2V	100		250	–
		Gr.25	I_C =-0.15A V_{CE}=-2V	150		375	–
			I_C =-1A V_{CE}=-2V	20			–
t_{on}	Turn-on time		I_C =-0.5A I_{B1} =-0.05A V_{CC}=-30V		75		ns
t_{off}	Turn-off time		I_C =-0.5A V_{CC}=-30V I_{B1} =-I_{B2} = -0.05A		500		ns

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

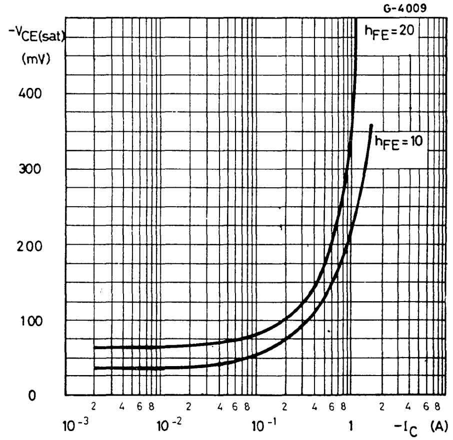
Safe operating area



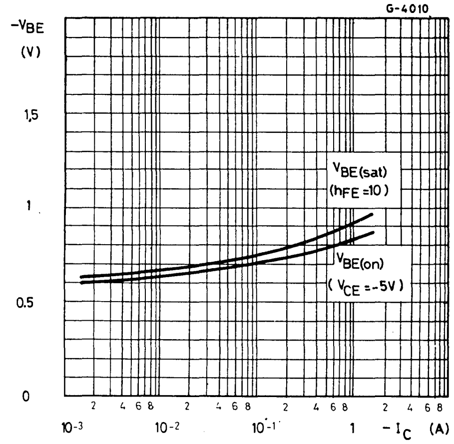
DC current gain



Collector-emitter saturation voltage



Base-emitter voltage



EPITAXIAL-BASE NPN

BD 433
BD 435
BD 437

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

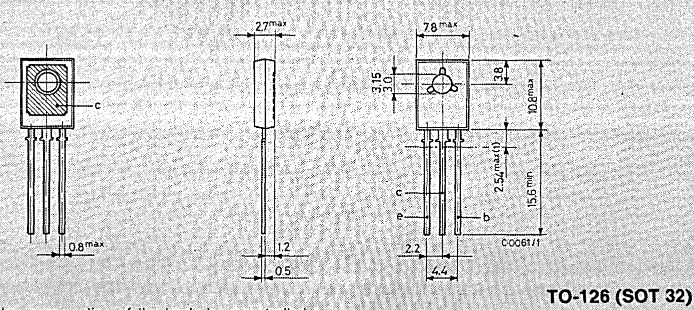
The BD 433, BD 435 and BD 437 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The BD 433 is especially suitable for use in car-radio output stages.
The complementary PNP types are the BD 434, BD 436 and BD 438 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 433	BD 435	BD 437
V_{CBO}	Collector-base voltage ($I_E = 0$)	22V	32V	45V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	22V	32V	45V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	22V	32V	45V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current ($t \leq 10ms$)		7A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		36 W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

BD 433
BD 435
BD 437

THERMAL DATA

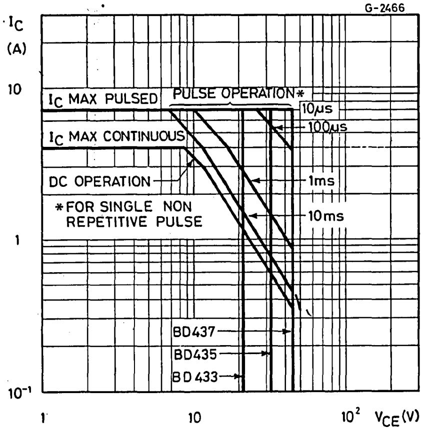
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

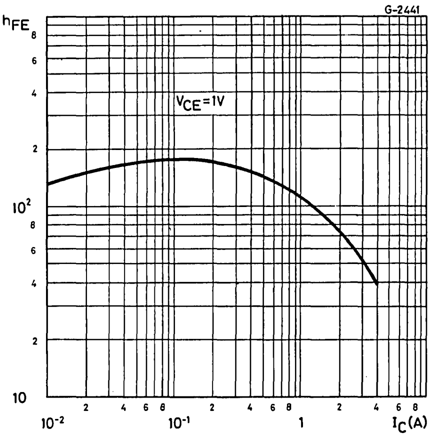
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD433**	$V_{CB} = 22V$			100	µA
		for **BD435**	$V_{CB} = 32V$			100	µA
		for **BD437**	$V_{CB} = 45V$			100	µA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD433**	$V_{CE} = 22V$			100	µA
		for **BD435**	$V_{CE} = 32V$			100	µA
		for **BD437**	$V_{CE} = 45V$			100	µA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
			for **BD433**	22			V
			for **BD435**	32			V
			for **BD437**	45			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 0.2A				
			for **BD433**		0.2	0.5	V
			for **BD435**		0.2	0.5	V
			for **BD437**		0.2	0.6	V
V_{BE}*	Base-emitter voltage	I_C = 10 mA	$V_{CE} = 5V$		0.58		V
		I_C = 2 A	$V_{CE} = 1V$				
			for **BD433**			1.1	V
			for **BD435**			1.1	V
			for **BD437**			1.2	V
h_{FE}*	DC current gain	I_C = 10 mA	$V_{CE} = 5V$				
			for **BD433**	40	130		—
			for **BD435**	40	130		—
			for **BD437**	30	130		—
		I_C = 500mA	$V_{CE} = 1V$	85	140		—
		I_C = 2 A	$V_{CE} = 1V$				
			for **BD433**	50			—
			for **BD435**	50			—
			for **BD437**	40			—
h_{FE_1}/h_{FE_2}*	Matched pair	I_C = 500mA	$V_{CE} = 1V$			1.4	—
f_T	Transition frequency	I_C = 250mA	$V_{CE} = 1V$	3			MHz

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

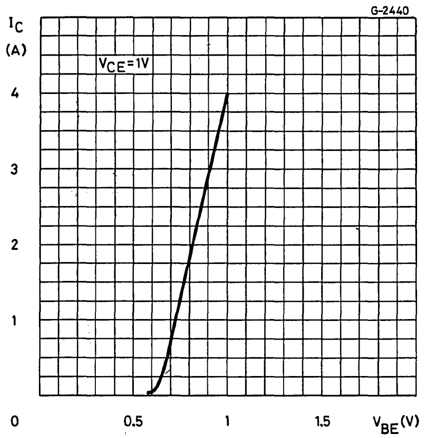
Safe operating areas



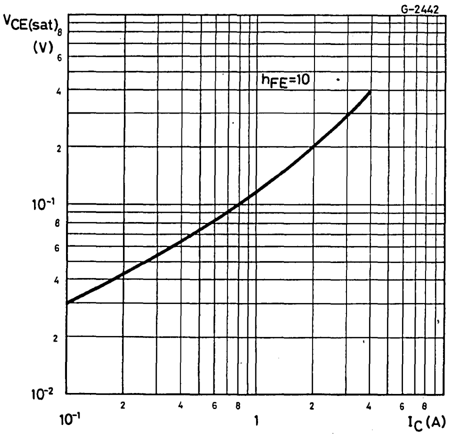
DC current gain



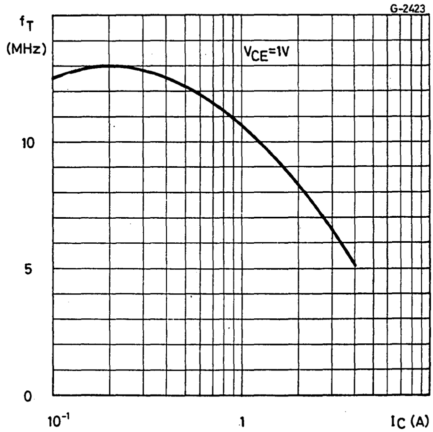
DC transconductance



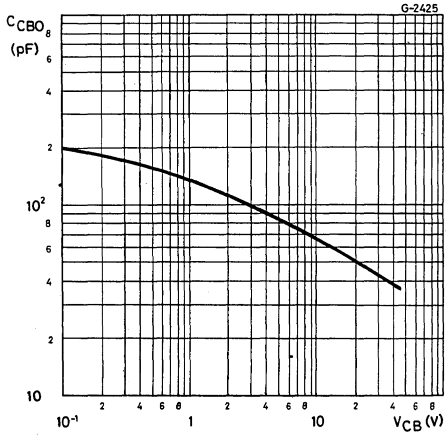
Collector-emitter saturation voltage



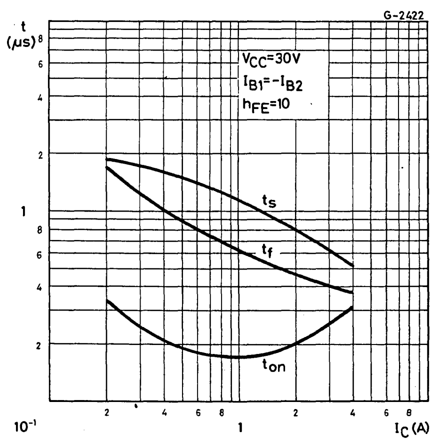
Transition frequency



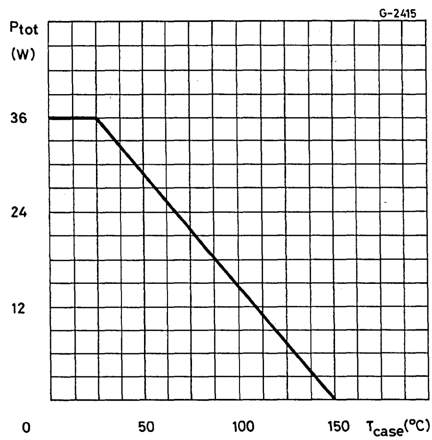
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

BD 434
BD 436
BD 438

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

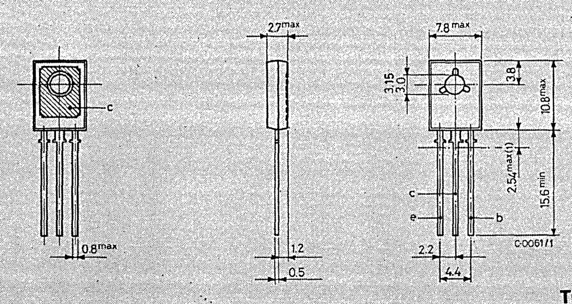
The BD 434, BD 436 and BD 438 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The BD 434 is especially suitable for use in car-radio output stages.
The complementary NPN types are the BD 433, BD 435 and BD 437 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 434	BD 436	BD 438
V_{CBO}	Collector-base voltage ($I_E = 0$)	-22V	-32V	-45V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-22V	-32V	-45V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-22V	-32V	-45V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current ($t \leq 10ms$)		-7A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		36 W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

BD 434
BD 436
BD 438

THERMAL DATA

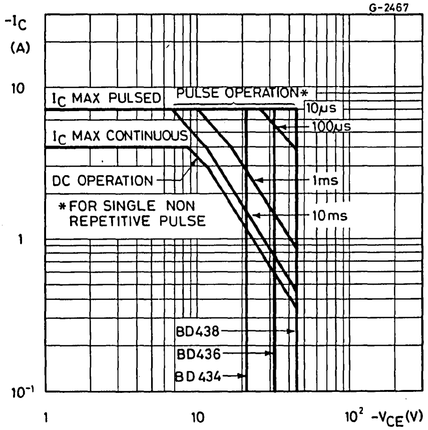
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

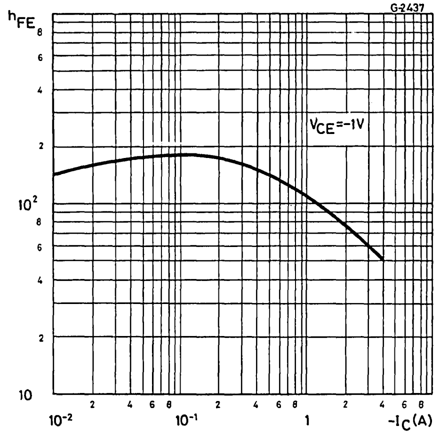
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0).	for **BD434** V_{CB} = -22V for **BD436** V_{CB} = -32V for **BD438** V_{CB} = -45V			-100 -100 -100	µA µA µA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD434** V_{CE} = -22V for **BD436** V_{CE} = -32V for **BD438** V_{CE} = -45V			-100 -100 -100	µA µA µA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100mA for **BD434** for **BD436** for **BD438**	-22 -32 -45			V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_B = -0.2A for **BD434** for **BD436** for **BD438**		 -0.2 -0.2 -0.2	 -0.5 -0.5 -0.6	 V V V
V_{BE}*	Base-emitter voltage	I_C = -10 mA V_{CE} = -5V I_C = -2 A V_{CE} = -1 V for **BD434** for **BD436** for **BD438**		-0.58	 -1.1 -1.1 -1.2	V V V V
h_{FE}*	DC current gain	I_C = -10mA V_{CE} = -5V for **BD434** for **BD436** for **BD438** I_C = -500mA V_{CE} = -1V I_C = -2 A V_{CE} = -1V for **BD434** for **BD436** for **BD438**	 40 40 30 85 50 50 40	 140 140 140 140		 — — — — — — —
h_{FE_1}/h_{FE_2}*	Matched pair	I_C = -500mA V_{CE} = - 1V			1.4	—
f_T	Transition frequency	I_C = -250mA V_{CE} = -1V	3			MHz

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

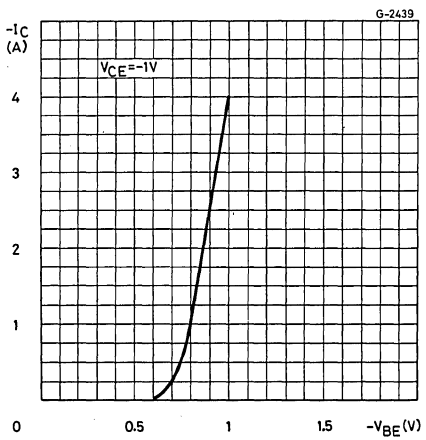
Safe operating areas



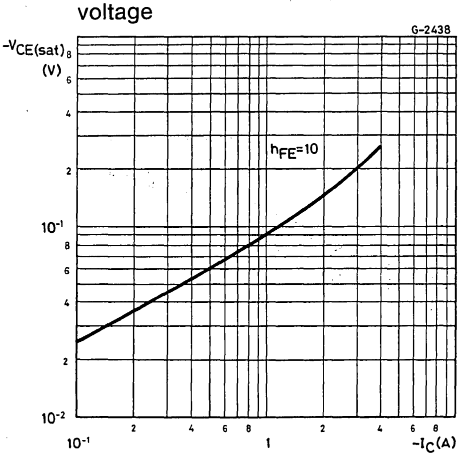
DC current gain



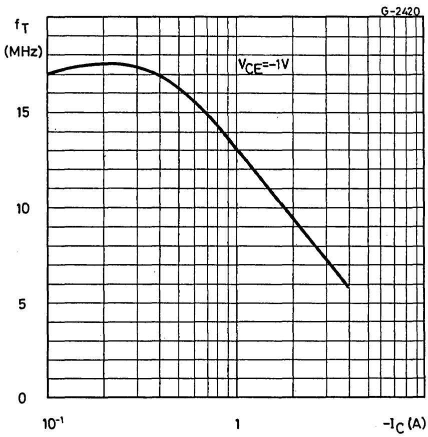
DC transconductance



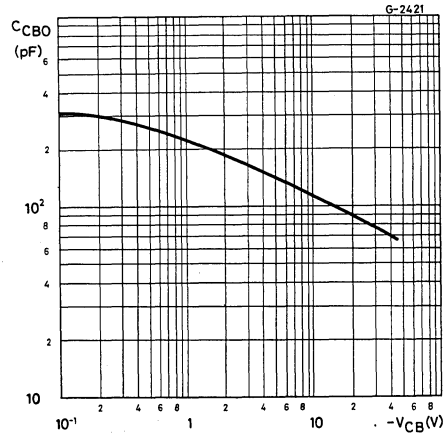
Collector-emitter saturation voltage



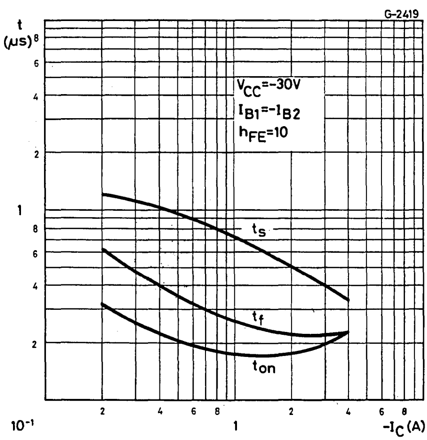
Transition frequency



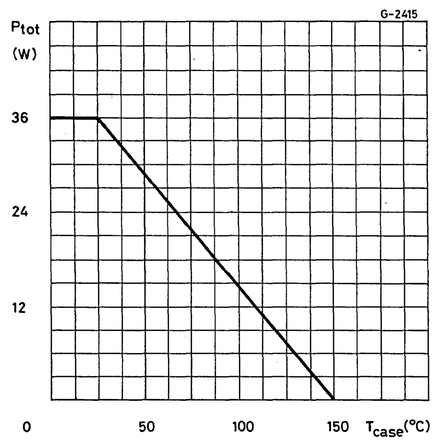
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BD 439
BD 441

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

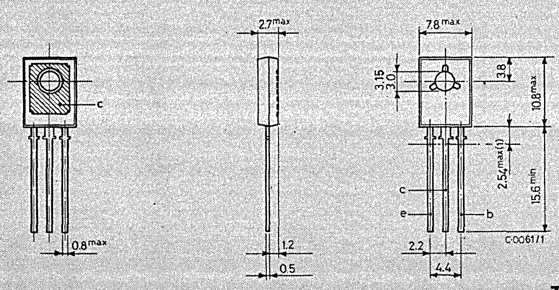
The BD 439 and BD 441 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package, intended for use in power linear and switching applications.
The complementary PNP types are the BD 440 and BD 442 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 439	BD 441
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	4A	
I_{CM}	Collector peak current ($t \leq 10ms$)	7A	
I_B	Base current	1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	36 W	
T_{stg}	Storage temperature	-65 to 150°C	
T_j	Junction temperature	150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

BD 439
BD 441

THERMAL DATA

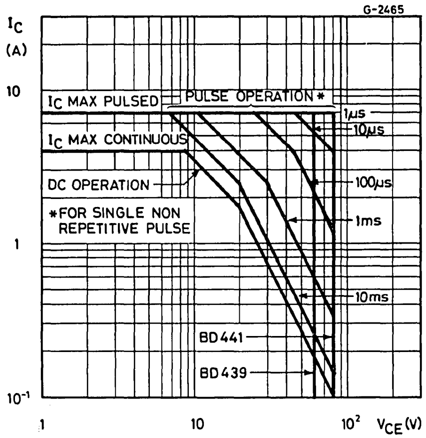
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

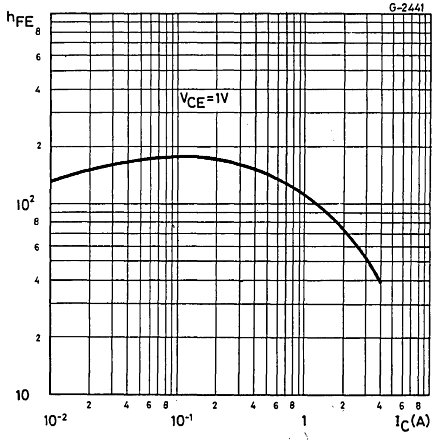
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD439** for **BD441**	V_{CB} = 60V V_{CB} = 80V			100 100	μA μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD439** for **BD441**	V_{CE} = 60V V_{CE} = 80V			100 100	μA μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	for **BD 439** for **BD 441**	60 80			V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 0.2A			0.8	V
V_{BE}*	Base-emitter voltage	I_C = 10 mA I_C = 2 A	V_{CE} = 5V V_{CE} = 1V		0.58	 1.5	V V
h_{FE}*	DC current gain	I_C = 10 mA	V_{CE} = 5V for **BD 439** for **BD 441**	 20 15	 130 130		 — —
		I_C = 500mA	V_{CE} = 1V for **BD 439** for **BD 441**	 40 40	 140 140		 — —
		I_C = 2 A	V_{CE} = 1V for **BD 439** for **BD 441**	 25 15			 — —
h_{FE_1}/h_{FE_2}*	Matched pair	I_C = 500mA	V_{CE} = 1V			1.4	—
f_T	Transition frequency	I_C = 250mA	V_{CE} = 1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

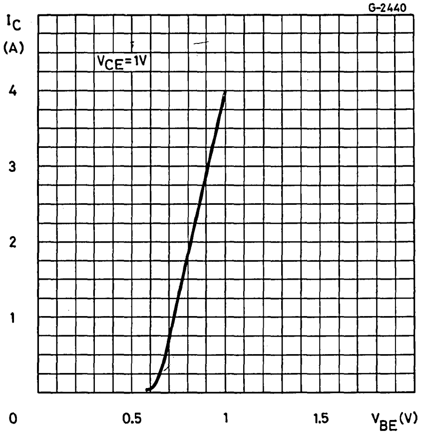
Safe operating areas



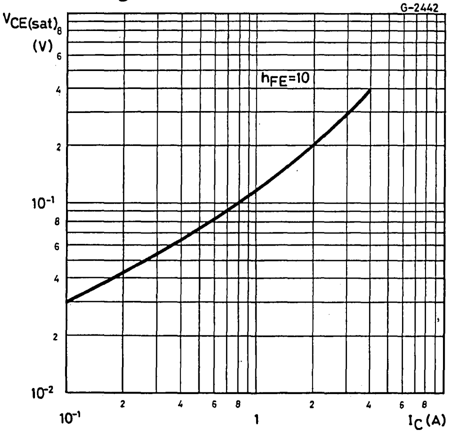
DC current gain



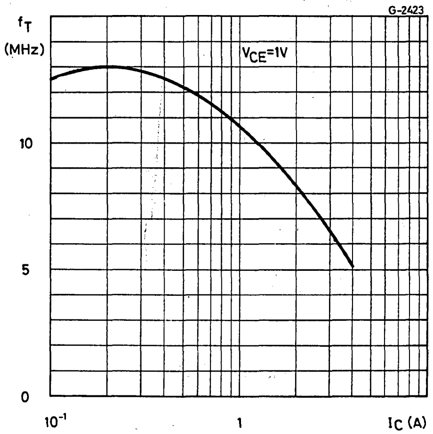
DC transconductance



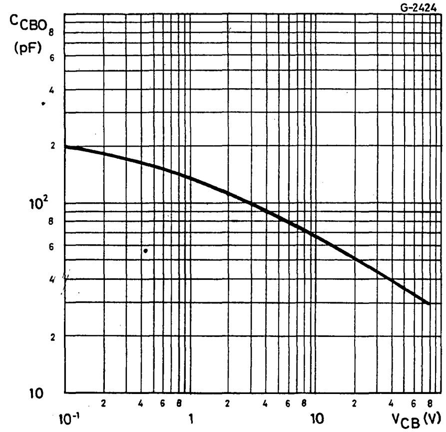
Collector-emitter saturation voltage



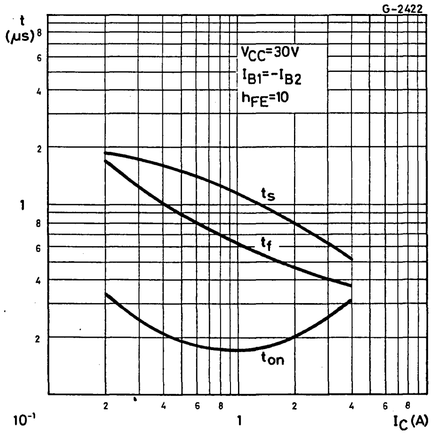
Transition frequency



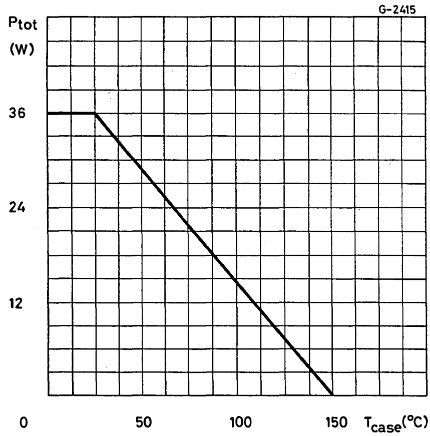
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD 440
BD 442

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

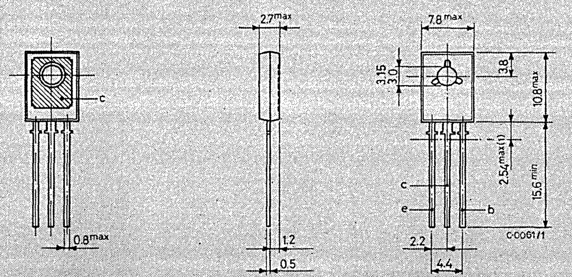
The BD 440 and BD 442 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package intended for use in power linear and switching applications.
The complementary NPN types are the BD439 and BD441 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 440	BD 442
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-4A	
I_{CM}	Collector peak current ($t \leq 10ms$)	-7A	
I_B	Base current	-1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	36 W	
T_{stg}	Storage temperature	-65 to 150°C	
T_j	Junction temperature	150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

BD 440
BD 442

THERMAL DATA

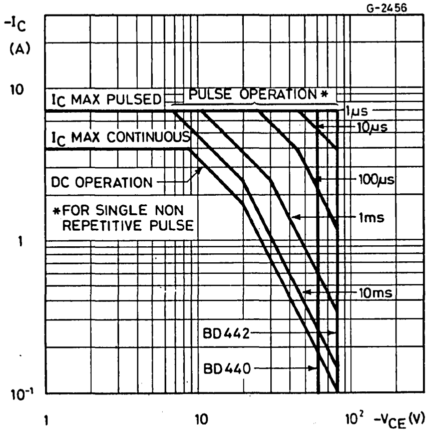
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

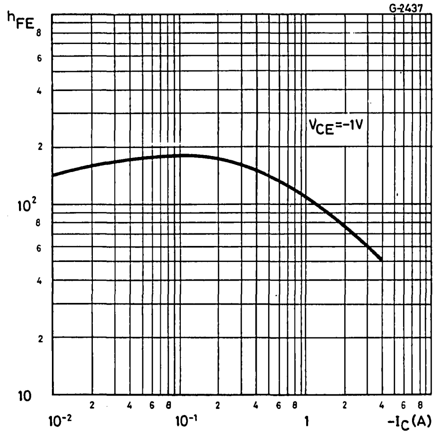
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD440** V_{CB} = -60V for **BD442** V_{CB} = -80V			-100 -100	μA μA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD440** V_{CE} = -60V for **BD442** V_{CE} = -80V			-100 -100	μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA for **BD 440** for **BD 442**	 -60 -80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_B = -0.2A			-0.8	V
V_{BE}*	Base-emitter voltage	I_C = -10mA V_{CE} = -5V I_C = -2 A V_{CE} = -1V		-0.58 	 -1.5	V V
h_{FE}*	DC current gain	I_C = -10mA V_{CE} = -5V for **BD 440** for **BD 442** I_C = -500mA V_{CE} = -1V for **BD 440** for **BD 442** I_C = -2 A V_{CE} = -1V for **BD 440** for **BD 442**	 20 15 40 40 25 15	 140 140 140 140 		 — — — — — —
h_{FE_1}/h_{FE_2}*	Matched pair	I_C = -500mA V_{CE} = -1V			1.4	—
f_T	Transition frequency	I_C = -250mA V_{CE} = -1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

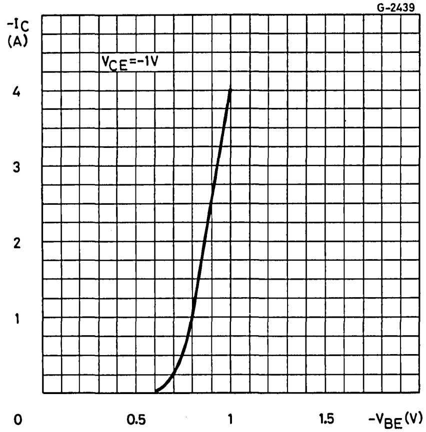
Safe operating areas



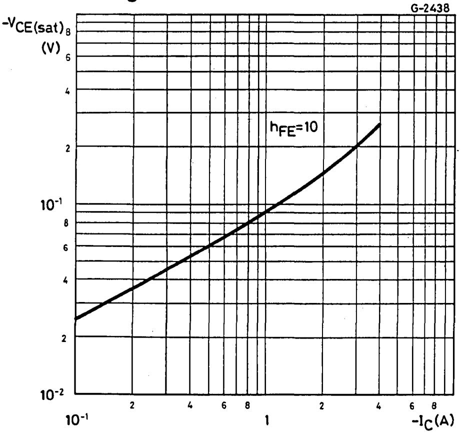
DC current gain



DC transconductance

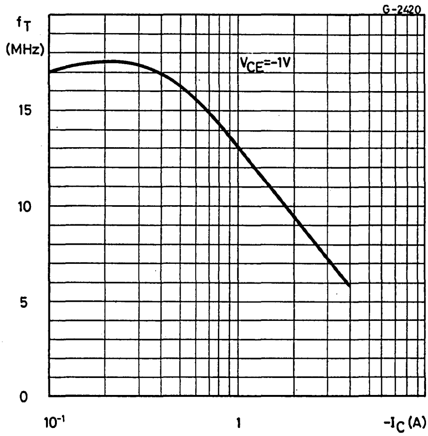


Collector-emitter saturation voltage

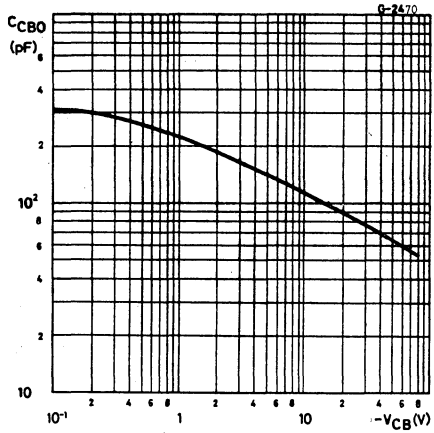


BD 440
BD 442

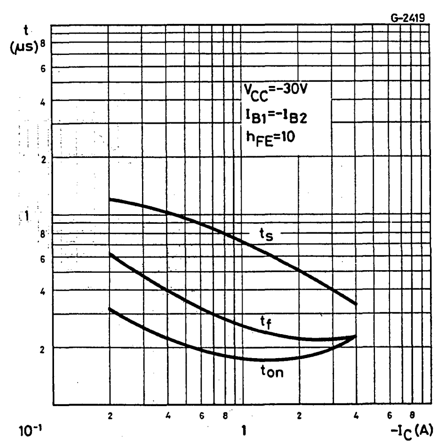
Transition frequency



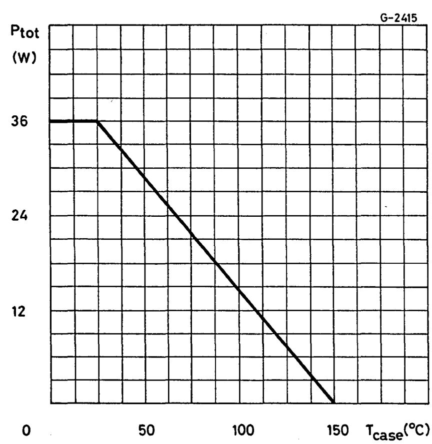
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BD 533
BD 535
BD 537

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 533, BD 535 and BD 537 are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the BD 534, BD 536 and BD 538 respectively.

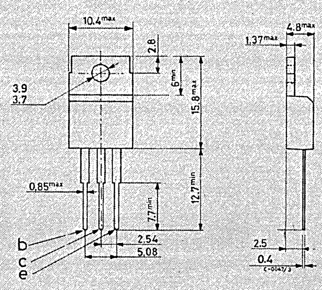
ABSOLUTE MAXIMUM RATINGS

		BD 533	BD 535	BD 537
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C, I_E	Collector and emitter current		8A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		50 W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

BD 533
BD 535
BD 537

THERMAL DATA

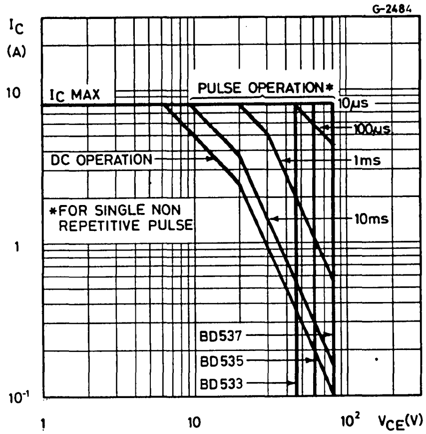
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

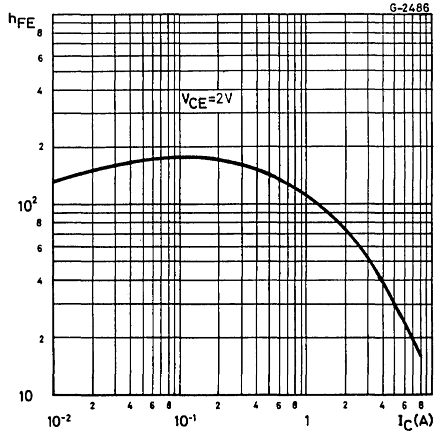
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD533** V_{CB} = 45V for **BD535** V_{CB} = 60V for **BD537** V_{CB} = 80V			100 100 100	μA μA μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD533** V_{CE} = 45V for **BD535** V_{CE} = 60V for **BD537** V_{CE} = 80V			100 100 100	μA μA μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **BD533** for **BD535** for **BD537**	45 60 80			V V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 2A I_B = 0.2A I_C = 6A I_B = 0.6A		 0.8	0.8 	V V
V_{BE}*	Base-emitter voltage	I_C = 2 A V_{CE} = 2 V			1.5	V
h_{FE}*	DC current gain	I_C = 10 mA V_{CE} = 5V for **BD533** for **BD535** for **BD537** I_C = 500mA V_{CE} = 2V I_C = 2 A V_{CE} = 2V for **BD533** for **BD535** for **BD537**	 20 20 15 40 25 25 15			 — — — — — — —
f_T	Transition frequency	I_C = 500mA V_{CE} = 1V	3	12		MHz
h_{FE} groups**:	J K L (only for BD533)	I_C = 2A V_{CE} = 2 V I_C = 3A V_{CE} = 2 V I_C = 2A V_{CE} = 2 V I_C = 3A V_{CE} = 2 V I_C = 2A V_{CE} = 2 V I_C = 3A V_{CE} = 2 V	30 15 40 20 60 30		75 100 150 	— — — — — —

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Only on request

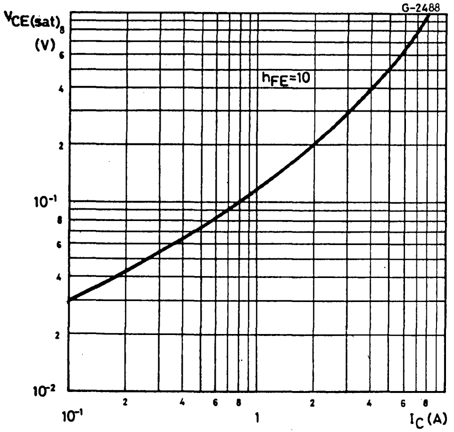
Safe operating areas



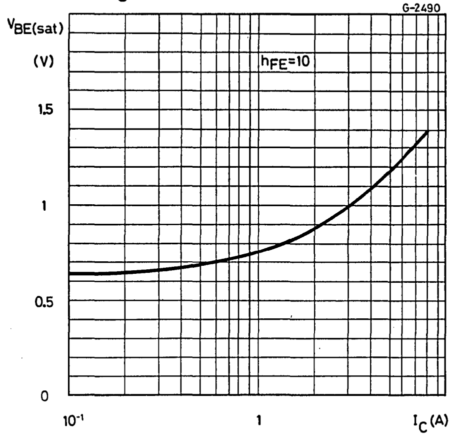
DC current gain



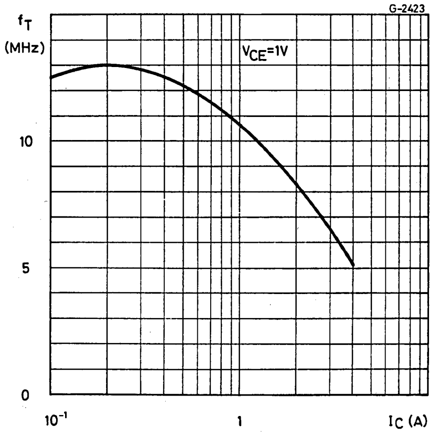
Collector-emitter saturation voltage



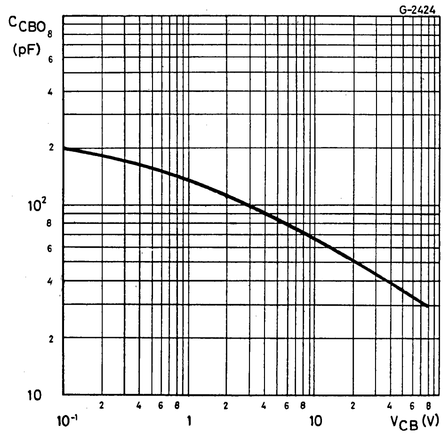
Base-emitter saturation voltage



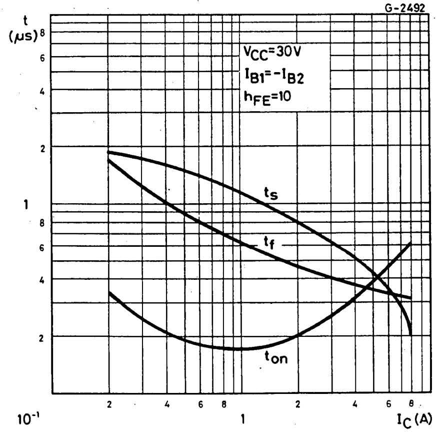
Transition frequency



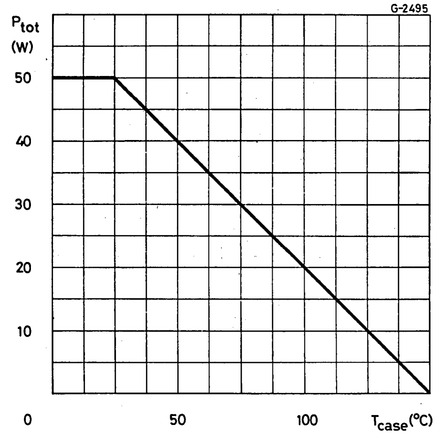
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

BD 534
BD 536
BD 538

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

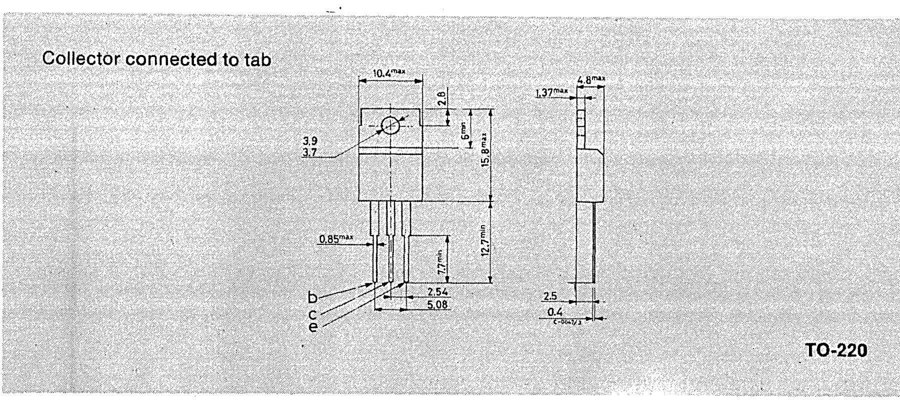
The BD 534, BD 536 and BD 538 are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the BD 533, BD 535 and BD 537 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD 534	BD 536	BD 538
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C, I_E	Collector and emitter current		-8A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		50 W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

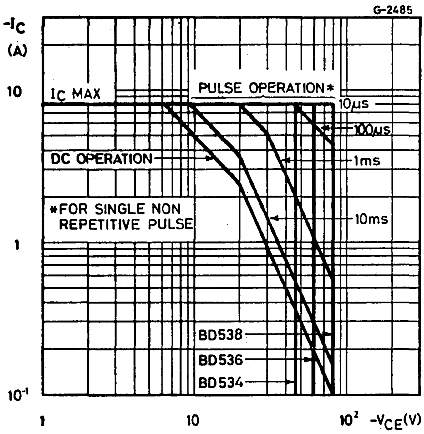
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

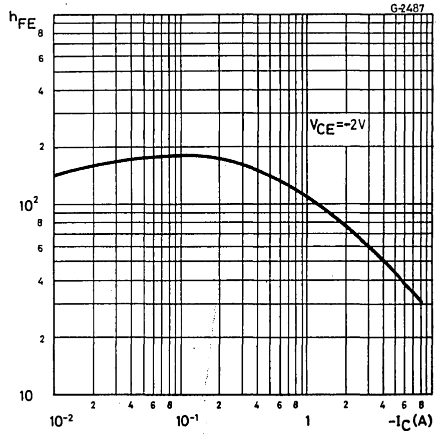
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD534**	V_{CB} = -45V			-100	μA
		for **BD536**	V_{CB} = -60V			-100	μA
		for **BD538**	V_{CB} = -80V			-100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD534**	V_{CE} = -45V			-100	μA
		for **BD536**	V_{CE} = -60V			-100	μA
		for **BD538**	V_{CE} = -80V			-100	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V				-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100mA	for **BD 534**	-45			V
			for **BD 536**	-60			V
			for **BD 538**	-80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A	I_B = -0.2A			-0.8	V
		I_C = -6A	I_B = -0.6A		-0.8		V
V_{BE}*	Base-emitter voltage	I_C = -2A	V_{CE} = -2 V			-1.5	V
h_{FE}*	DC current gain	I_C = -10 mA	V_{CE} = -5V				
			for **BD 534**	20			—
			for **BD 536**	20			—
			for **BD 538**	15			—
		I_C = -500mA	V_{CE} = -2V	40			—
		I_C = -2 A	V_{CE} = -2V				
			for **BD 534**	25			—
			for **BD 536**	25			—
			for **BD 538**	15			—
f_T	Transition frequency	I_C = -500mA	V_{CE} = -1V	3	16		MHz
h_{FE} groups**:	J	I_C = -2A	V_{CE} = -2 V	30		75	—
		I_C = -3A	V_{CE} = -2 V	15			—
	K	I_C = -2A	V_{CE} = -2 V	40		100	—
		I_C = -3A	V_{CE} = -2 V	20			—
	L (only for **BD534**)	I_C = -2A	V_{CE} = -2 V	60		150	—
		I_C = -3A	V_{CE} = -2 V	30			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Only on request

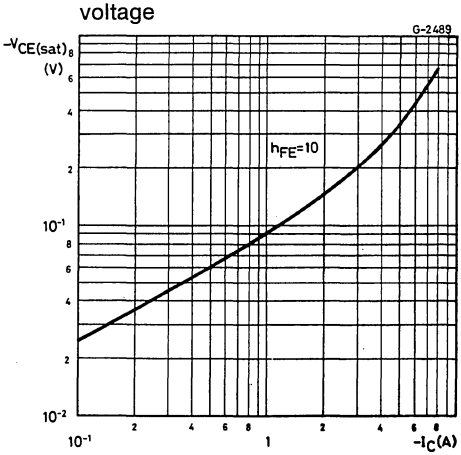
Safe operating areas



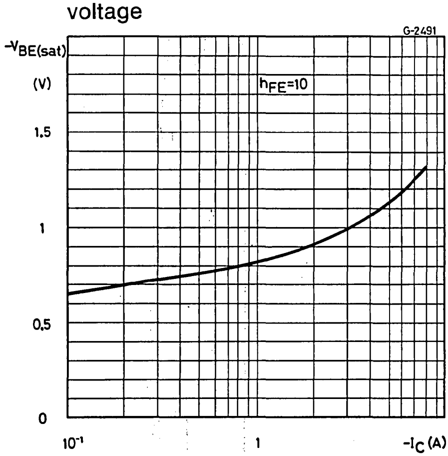
DC current gain



Collector-emitter saturation voltage

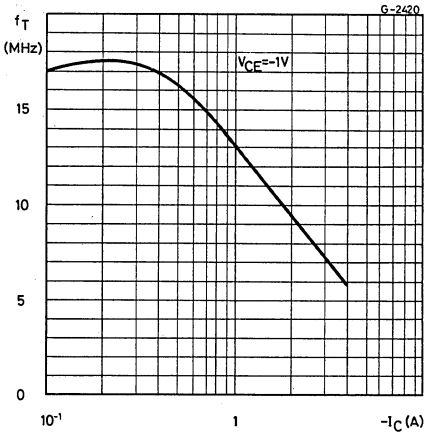


Base-emitter saturation voltage

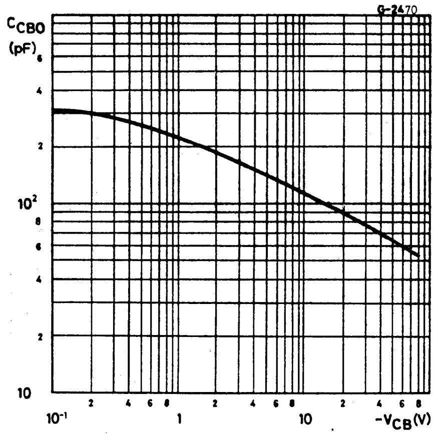


BD 534
BD 536
BD 538

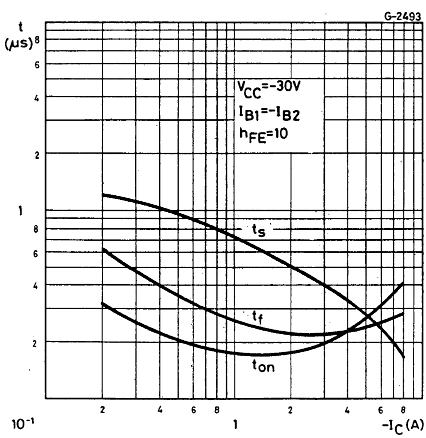
Transition frequency



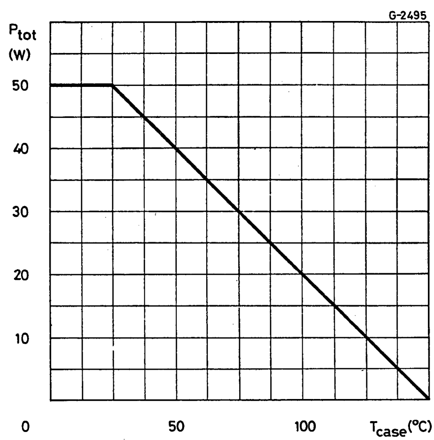
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BD 663

POWER LINEAR AND SWITCHING APPLICATIONS

The BD 663 is a silicon epitaxial-base NPN power transistor in Jedec TO-220 plastic package intended for use in power linear and switching applications.
The complementary PNP type is the BD 664.

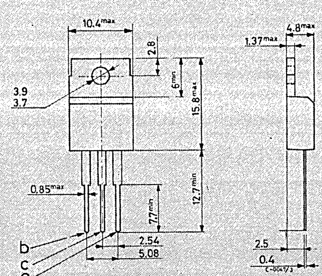
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	45	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	10	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	75	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

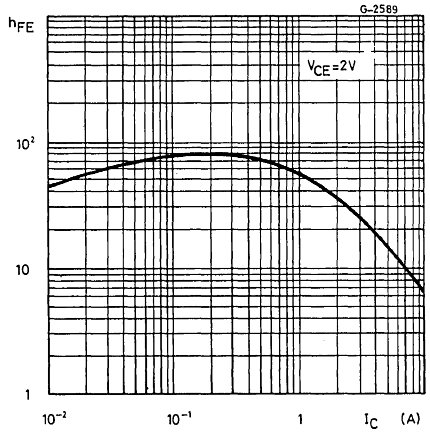
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

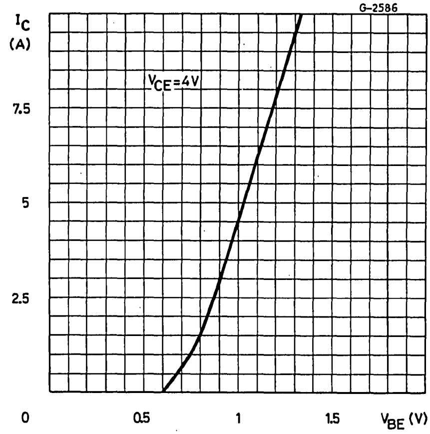
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	V_{CE} = 45 V				100	μA
I_{CEO}	Collector cutoff current ($I_C = 0$)	V_{CE} = 22 V				1	mA
I_{EBO}	Emitter cutoff current	V_{EB} = 5 V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA		45			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3 A I_C = 6 A	I_B = 0.3A I_B = 0.6A		 0.7	1 	V V
V_{BE}*	Base-emitter voltage	I_C = 4 A	V_{CE} = 4 V			1.5	V
h_{FE}*	DC current gain	I_C = 0.5A I_C = 2 A I_C = 3 A	V_{CE} = 2 V V_{CE} = 2 V V_{CE} = 2 V	40 20 15		400 250 150	— — —
f_T	Transition frequency	I_C = 0.5A	V_{CE} = 10V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

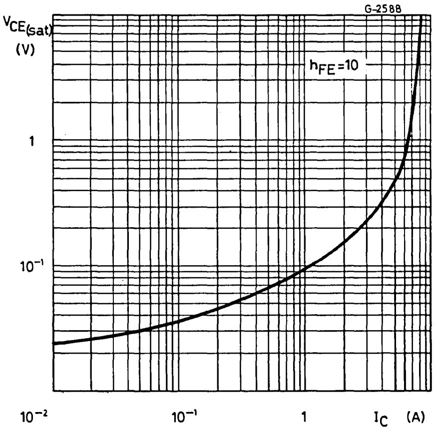
DC current gain



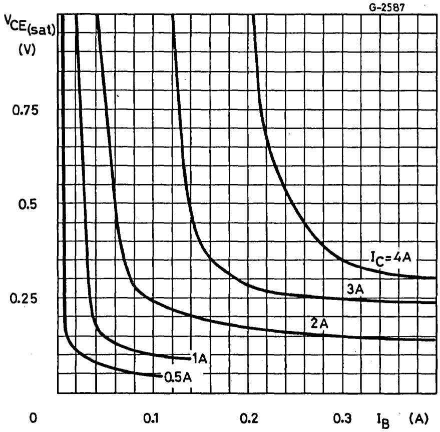
DC transconductance



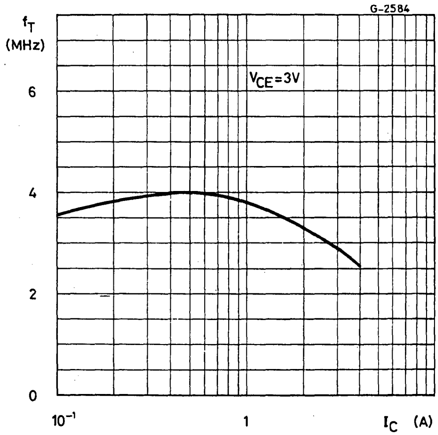
Collector-emitter saturation voltage



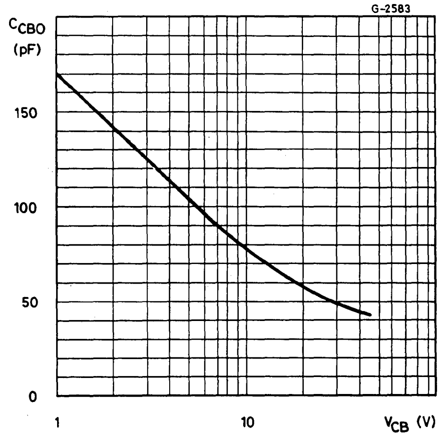
Collector-emitter saturation voltage



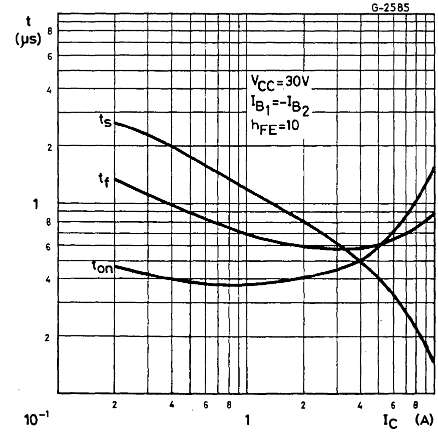
Transition frequency



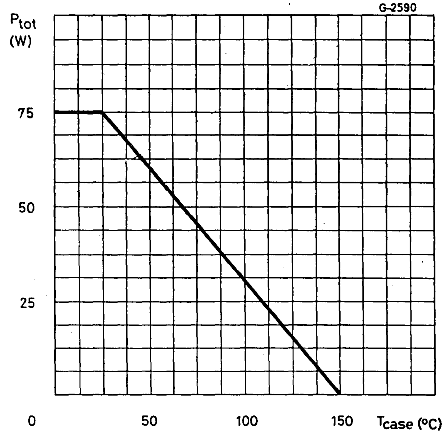
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

BD 664

POWER LINEAR AND SWITCHING APPLICATIONS

The BD 664 is a silicon epitaxial-base PNP power transistor in Jedec TO-220 plastic package intended for use in power linear and switching applications.
The complementary NPN type is the BD 663.

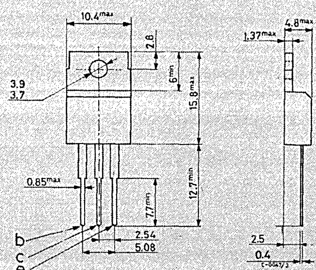
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-45	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	- 5	V
I_C	Collector current	-10	A
I_B	Base current	- 5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	75	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

BD 664

THERMAL DATA

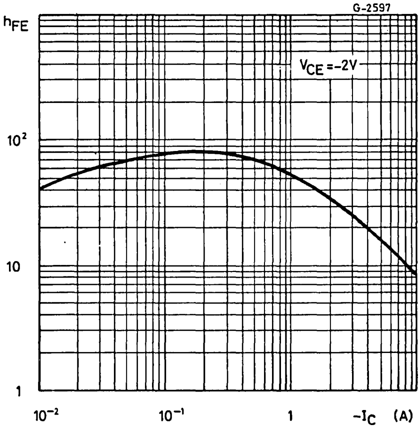
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

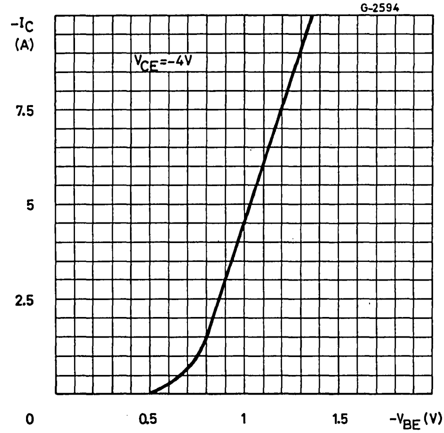
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = -45$ V			-100	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = -22$ V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5$ V			-1	mA
$V_{CEO\,(sus)}$*	Collector emitter sustaining voltage ($I_B = 0$)	$I_C = -100$mA	-45			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = -3$ A $\quad I_B = -0.3$A $I_C = -6$ A $\quad I_B = -0.6$A		 -0.6	-1	V V
V_{BE}*	Base-emitter voltage	$I_C = -4$ A $\quad V_{CE} = -4$ V			-1.5	V
h_{FE}	DC current gain	$I_C = -0.5$A $\quad V_{CE} = -2$ V $I_C = -2$ A $\quad V_{CE} = -2$ V $I_C = -3$ A $\quad V_{CE} = -2$ V	40 20 15		400 250 150	— — —
f_T	Transition frequency	$I_C = -0.5$A $\quad V_{CE} = -10$V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

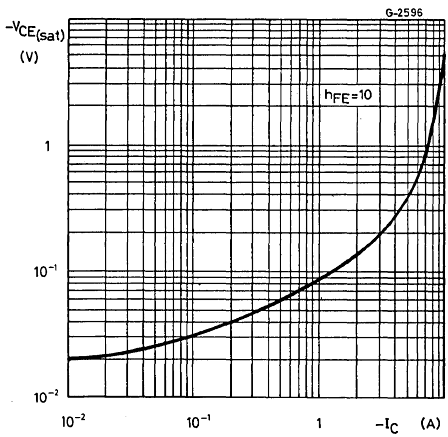
DC current gain



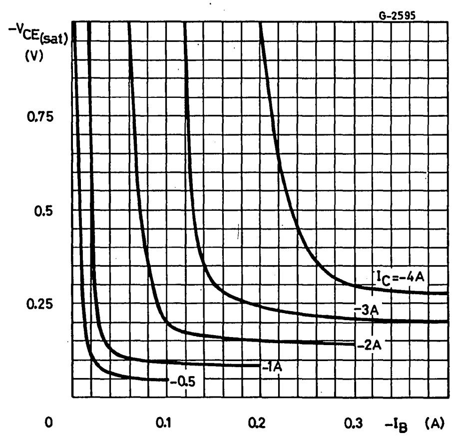
DC transconductance



Collector-emitter saturation voltage

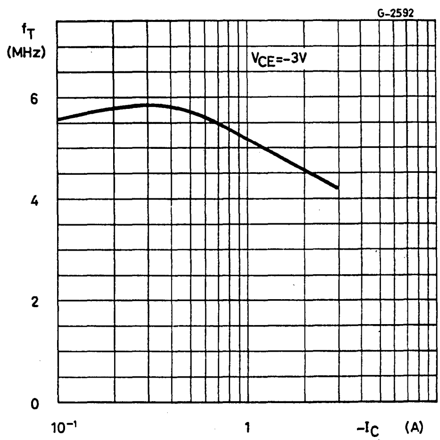


Collector-emitter saturation voltage

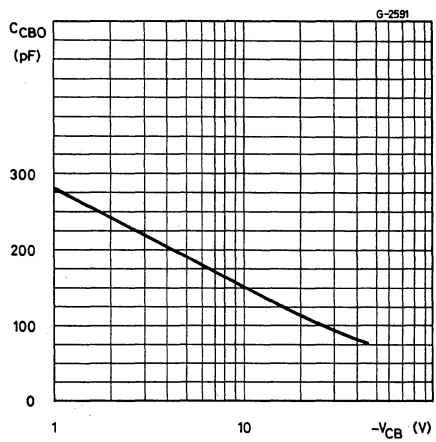


BD 664

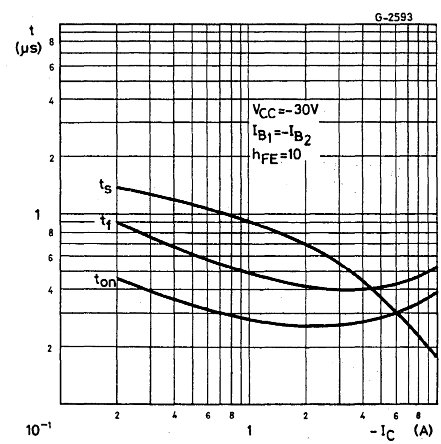
Transition frequency



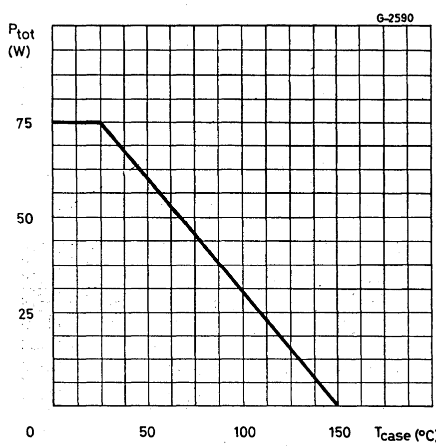
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD 675A BD 677
BD 677A BD 679
BD 679A BD 681

EPITAXIAL-BASE NPN

MEDIUM POWER DARLINGTONS

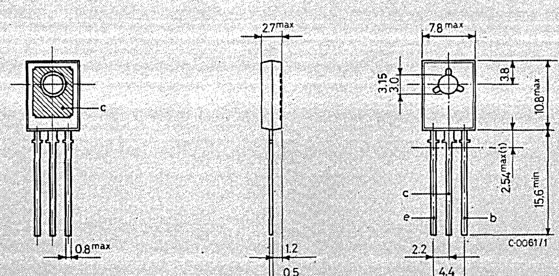
The BD 675A, BD 677, BD 677A, BD 679, BD 679A and BD 681 are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration and are mounted in Jedec TO-126 plastic package. They are intended for use in medium power linear and switching applications. The complementary PNP types are the BD 676A, BD 678, BD 678A, BD 680, BD 680A and BD 682 respectively.

ABSOLUTE MAXIMUM RATINGS

<table>
<tr><th></th><th></th><th>BD675A</th><th>BD677
BD677A</th><th>BD679
BD679A</th><th>BD681</th></tr>
<tr><td>V_{CBO}</td><td>Collector-base voltage ($I_E = 0$)</td><td>45V</td><td>60V</td><td>80V</td><td>100V</td></tr>
<tr><td>V_{CEO}</td><td>Collector-emitter voltage ($I_B = 0$)</td><td>45V</td><td>60V</td><td>80V</td><td>100V</td></tr>
<tr><td>V_{EBO}</td><td>Emitter-base voltage ($I_C = 0$)</td><td colspan="4">5V</td></tr>
<tr><td>I_C</td><td>Collector current</td><td colspan="4">4A</td></tr>
<tr><td>I_{CM}</td><td>Collector peak current (repetitive)</td><td colspan="4">6A</td></tr>
<tr><td>I_B</td><td>Base current</td><td colspan="4">100mA</td></tr>
<tr><td>P_{tot}</td><td>Total power dissipation at $T_{case} \leq 25°C$</td><td colspan="4">40W</td></tr>
<tr><td>T_{stg}</td><td>Storage temperature</td><td colspan="4">-65 to 150°C</td></tr>
<tr><td>T_j</td><td>Junction temperature</td><td colspan="4">150 °C</td></tr>
</table>

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

BD 675A BD 677
BD 677A BD 679
BD 679A BD 681

THERMAL DATA

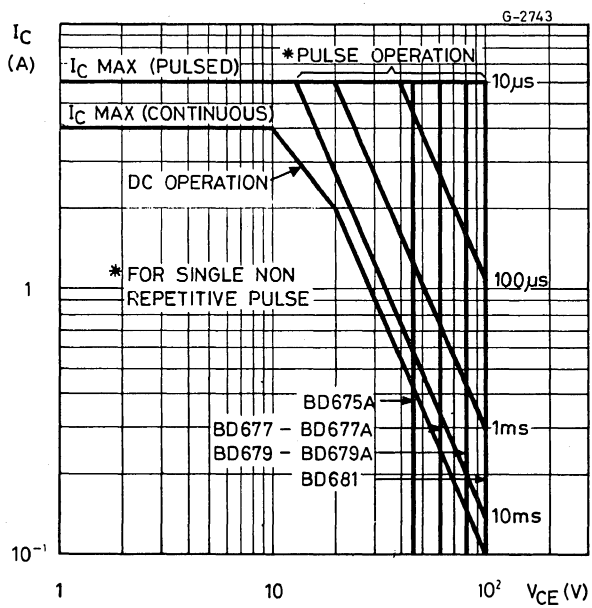
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

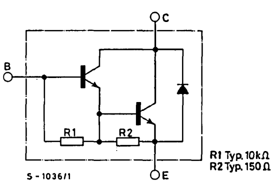
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD675A** V_{CB} = 45V			200	μA
		for **BD677/677A** V_{CB} = 60V			200	μA
		for **BD679/679A** V_{CB} = 80V			200	μA
		for **BD681** V_{CB} = 100V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BD675A** V_{CE} = 22V			500	μA
		for **BD677/677A** V_{CE} = 30V			500	μA
		for **BD679/679A** V_{CE} = 40V			500	μA
		for **BD681** V_{CE} = 50V			500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 50 mA				
		for **BD675A**	45			V
		for **BD677/677A**	60			V
		for **BD679/679A**	80			V
		for **BD681**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BD677/679/681**				
		I_C = 1.5A I_B = 6mA			2.5	V
		for **BD675A/677A/679A**				
		I_C = 2A I_B = 8mA			2.8	V
V_{BE}*	Base-emitter voltage	for **BD677/679/681**				
		I_C = 1.5A V_{CE} = 3V			2.5	V
		for **BD675A/677A/679A**				
		I_C = 2A V_{CE} = 3V			2.5	V
h_{FE}*	DC current gain	for **BD677/679/681**				
		I_C = 1.5A V_{CE} = 3V	750			—
		for **BD675A/677A/679A**				
		I_C = 2A V_{CE} = 3V	750			—
h_{fe}	Small signal current gain	I_C = 1.5A V_{CE} = 3V f = 1 MHz	1			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

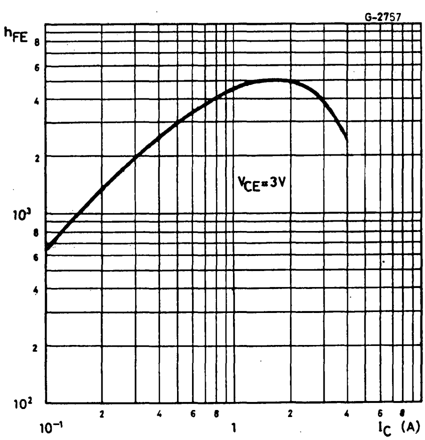
Safe operating areas



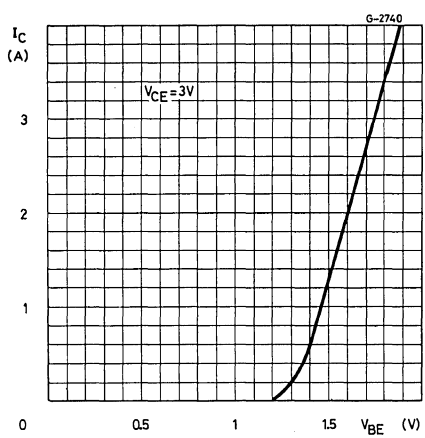
Internal circuit diagram



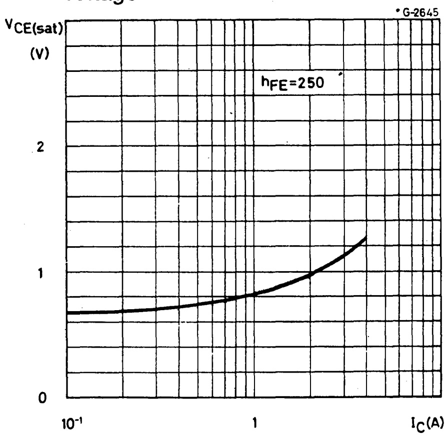
DC current gain



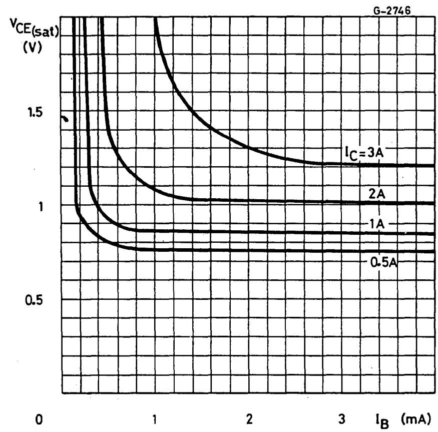
DC transconductance



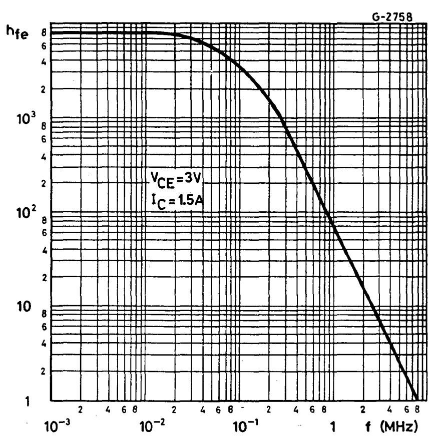
Collector-emitter saturation voltage



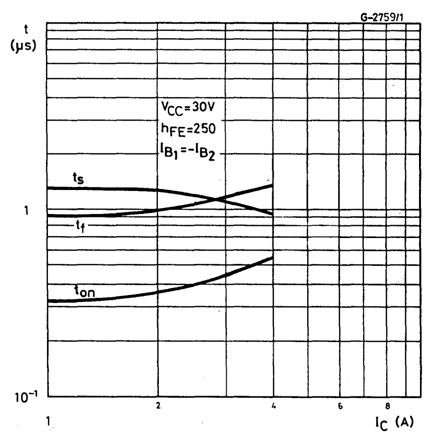
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



BD 676A BD 678
BD 678A BD 680
BD 680A BD 682

EPITAXIAL-BASE PNP

MEDIUM POWER DARLINGTONS

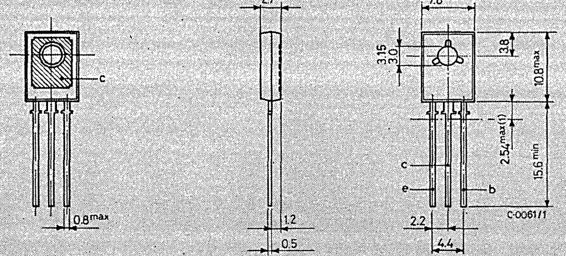
The BD 676A, BD 678, BD 678A, BD 680, BD 680A and BD 682 are silicon epitaxial-base PNP power transistors in monolithic Darlington configuration and are mounted in Jedec TO-126 plastic package. They are intended for use in medium power linear and switching applications. The complementary NPN types are the BD 675A, BD 677, BD 677A, BD 679, BD 679A and BD 681 respectively.

ABSOLUTE MAXIMUM RATINGS

		BD676A	BD678 BD678A	BD680 BD680A	BD682
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V		
I_C	Collector current		-4A		
I_{CM}	Collector peak current (repetitive)		-6A		
I_B	Base current		-100mA		
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		40W		
T_{stg}	Storage temperature		-65 to 150°C		
T_j	Junction temperature		150 °C		

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

THERMAL DATA

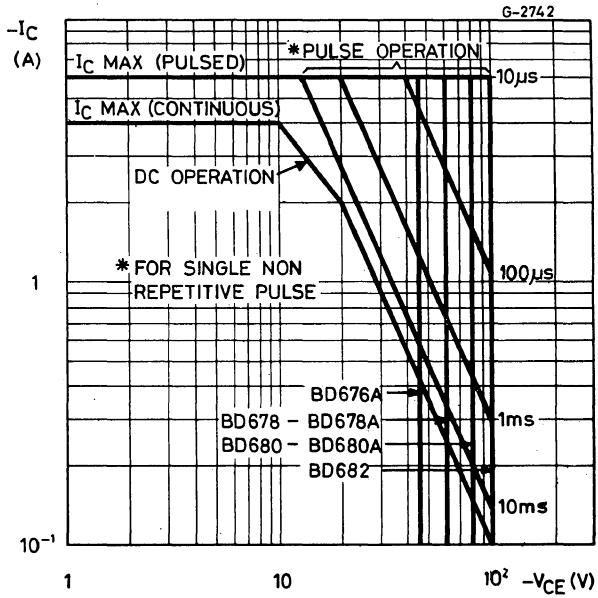
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

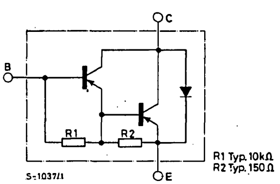
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD676A** V_{CB} = -45V for **BD678/678A** V_{CB} = -60V for **BD680/680A** V_{CB} = -80V for **BD682** V_{CB} = -100V			-200 -200 -200 -200	μA μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BD676A** V_{CE} = -22V for **BD678/678A** V_{CE} = -30V for **BD680/680A** V_{CE} = -40V for **BD682** V_{CE} = -50V			-500 -500 -500 -500	μA μA μA μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V			-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -50 mA for **BD676A** for **BD678/678A** for **BD680/680A** for **BD682**	 -45 -60 -80 -100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BD678/680/682** I_C = -1.5A I_B = -6mA for **BD676A/678A/680A** I_C = -2A I_B = -8mA			 -2.5 -2.8	 V V
V_{BE}*	Base-emitter voltage	for **BD678/680/682** I_C = -1.5A V_{CE} = -3V for **BD676A/678A/680A** I_C = -2A V_{CE} = -3V			 -2.5 -2.5	 V V
h_{FE}*	DC current gain	for **BD678/680/682** I_C = -1.5A V_{CE} = -3V for **BD676A/678A/680A** I_C = -2A V_{CE} = -3V	 750 750			 — —
h_{fe}	Small signal current gain	I_C = -1.5A V_{CE} = -3V f = 1 MHz	 1			 —

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

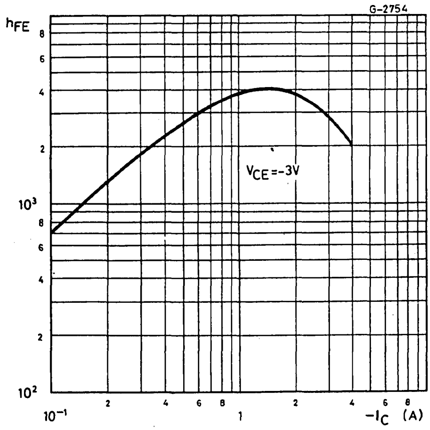
Safe operating areas



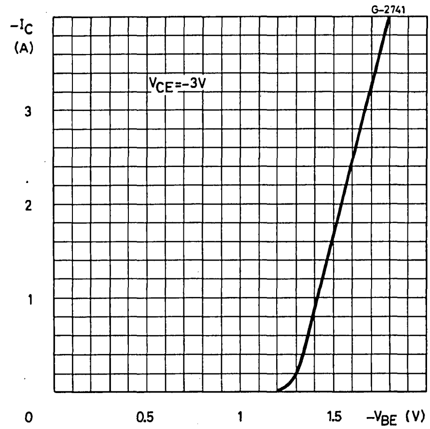
Internal circuit diagram



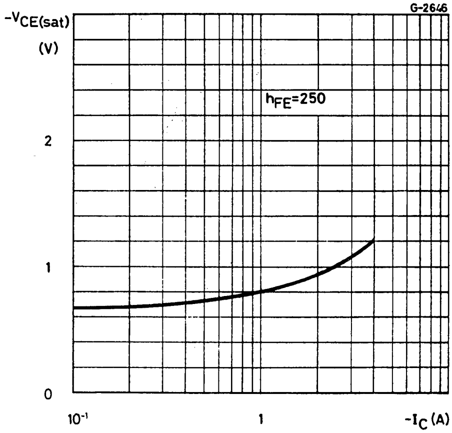
DC current gain



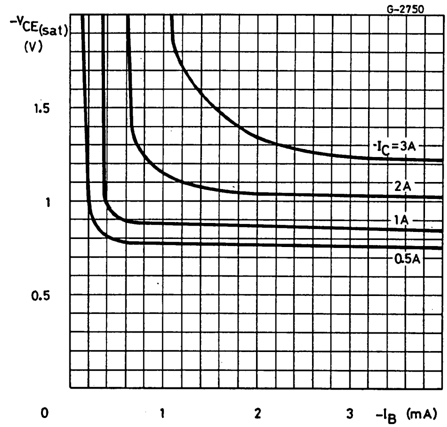
DC transconductance



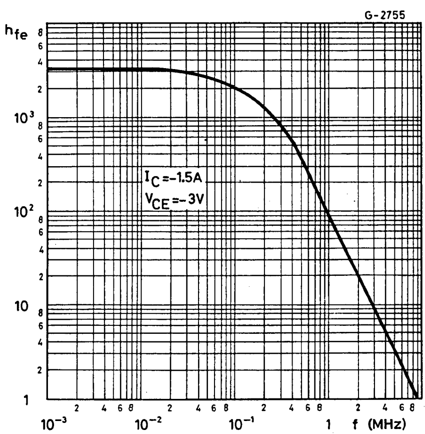
Collector-emitter saturation voltage



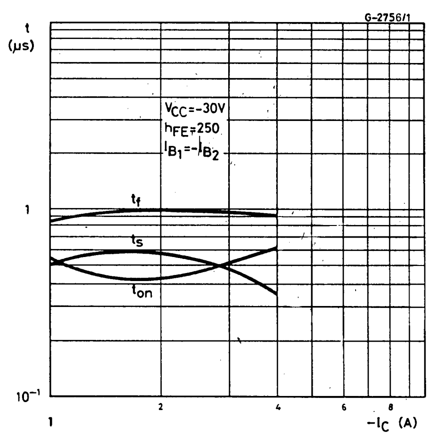
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE NPN

BD 705
BD 707
BD 709
BD 711

POWER LINEAR AND SWITCHING APPLICATIONS

The BD705, BD707, BD709 and BD711 are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package intended for use in power linear and switching applications.
The complementary PNP types are the BD706, BD708, BD710 and BD712 respectively.

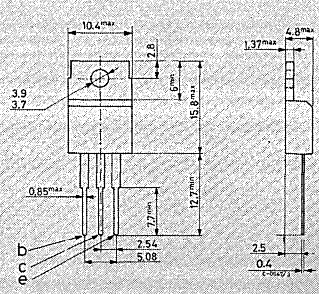
ABSOLUTE MAXIMUM RATINGS

		BD705	BD707	BD709	BD711
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	12A			
I_B	Base current	5A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	75W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

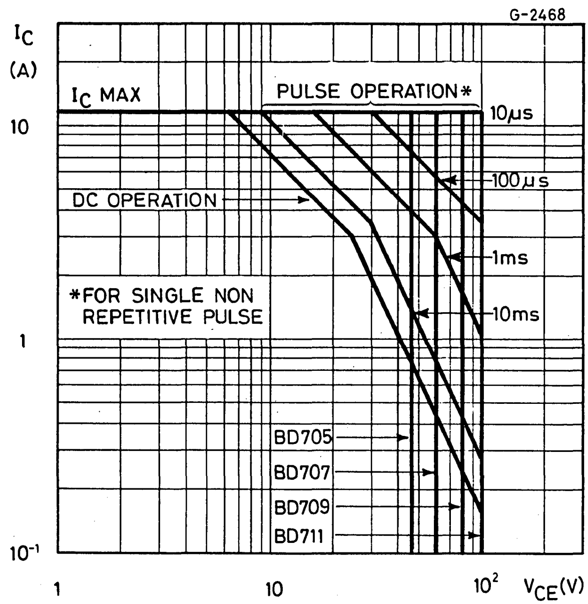
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD705**	V_{CB} = 45 V			100	μA
		for **BD707**	V_{CB} = 60 V			100	μA
		for **BD709**	V_{CB} = 80 V			100	μA
		for **BD711**	V_{CB} = 100 V			100	μA
		T_{case} = 150°C					
		for **BD705**	V_{CB} = 45 V			1	mA
		for **BD707**	V_{CB} = 60 V			1	mA
		for **BD709**	V_{CB} = 80 V			1	mA
		for **BD711**	V_{CB} = 100 V			1	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BD705**	V_{CE} = 22 V			1	mA
		for **BD707**	V_{CE} = 30 V			1	mA
		for **BD709**	V_{CE} = 40 V			1	mA
		for **BD711**	V_{CE} = 50 V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V				1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA					
			for **BD705**	45			V
			for **BD707**	60			V
			for **BD709**	80			V
			for **BD711**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4 A	I_B = 0.4 A			1	V
V_{CEK}*	Knee voltage	I_C = 3A	I_B = **		0.4		V
V_{BE}*	Base-emitter voltage	I_C = 4A	V_{CE} = 4V			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

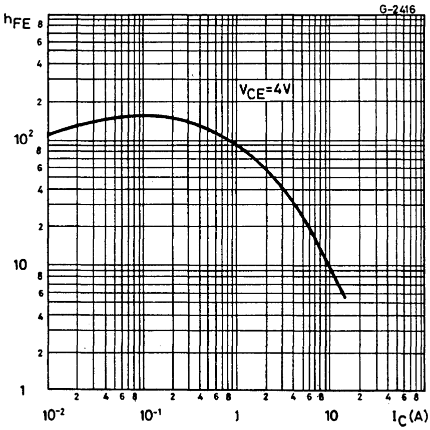
Parameter		Test conditions		Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 0.5A	V_{CE} = 2V	40	120	400	—
		I_C = 2A	V_{CE} = 2V				
			for **BD705**	30			—
			for **BD707**	30			—
			for **BD709**	30			—
		I_C = 4A	V_{CE} = 4V				
			for **BD705**	20	30	150	—
			for **BD707**	15		150	—
			for **BD709**	15		150	—
			for **BD711**	15		150	—
		I_C = 10A	V_{CE} = 4V				
			for **BD705**	5	10		—
			for **BD707**	5	10		—
			for **BD709**		8		—
			for **BD711**		8		—
f_T	Transition frequency	I_C = 300mA	V_{CE} = 3V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Value for which I_C = 3.3 A at V_{CE} = 2 V

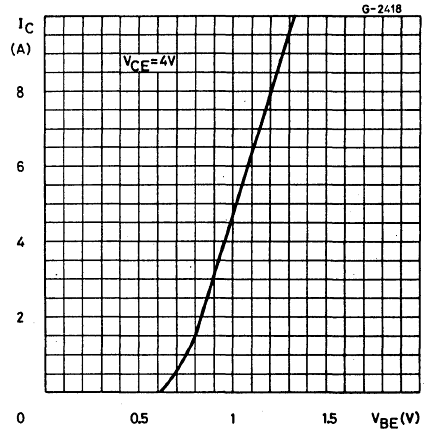
Safe operating areas



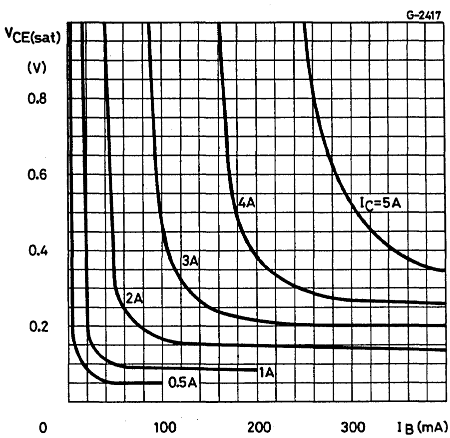
DC current gain



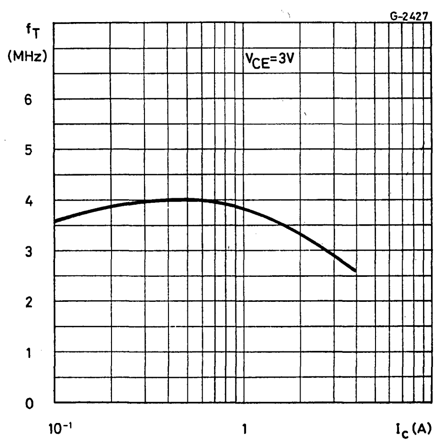
DC transconductance



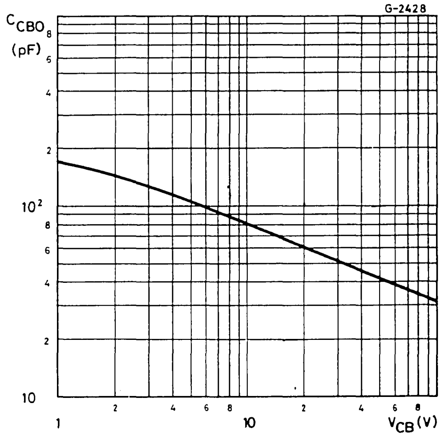
Collector-emitter saturation voltage



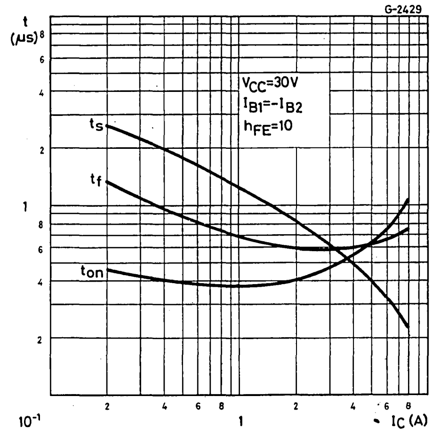
Transition frequency



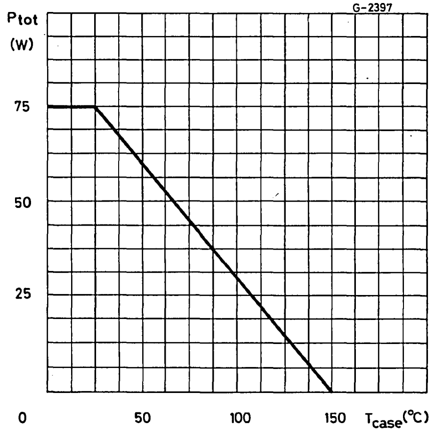
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD 706
BD 708
BD 710
BD 712

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

The BD706, BD708, BD710 and BD712 are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary NPN types are the BD705, BD707, BD709 and BD711 respectively.

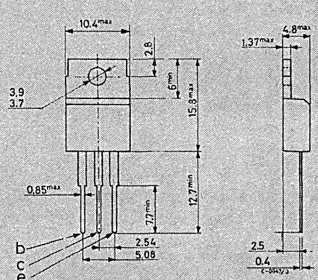
ABSOLUTE MAXIMUM RATINGS

		BD706	BD708	BD710	BD712
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-12A			
I_B	Base current	-5A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	75W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

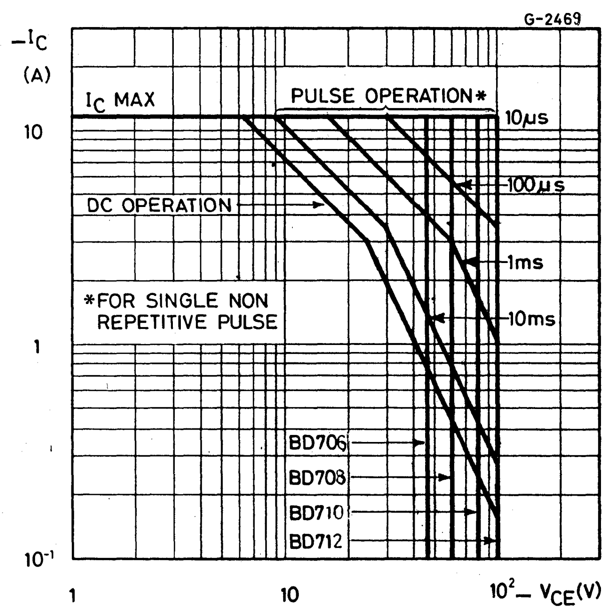
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD706**	V_{CB} = -45 V			-100	μA
		for **BD708**	V_{CB} = -60 V			-100	μA
		for **BD710**	V_{CB} = -80 V			-100	μA
		for **BD712**	V_{CB} = -100 V			-100	μA
		T_{case} = 150°C					
		for **BD706**	V_{CB} = -45 V			-1	mA
		for **BD708**	V_{CB} = -60 V			-1	mA
		for **BD710**	V_{CB} = -80 V			-1	mA
		for **BD712**	V_{CB} = -100 V			-1	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD706**	V_{CE} = -22 V			-1	mA
		for **BD708**	V_{CE} = -30 V			-1	mA
		for **BD710**	V_{CE} = -40 V			-1	mA
		for **BD712**	V_{CE} = -50 V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5 V				-1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA					
			for **BD706**	-45			V
			for **BD708**	-60			V
			for **BD710**	-80			V
			for **BD712**	-100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -4 A	I_B = -0.4 A			-1	V
V_{CEK}*	Knee voltage	I_C = -3A	I_B = **		-0.4		V
V_{BE}*	Base-emitter voltage	I_C = -4A	V_{CE} = -4V			-1.5	V

ELECTRICAL CHARACTERISTICS (continued)

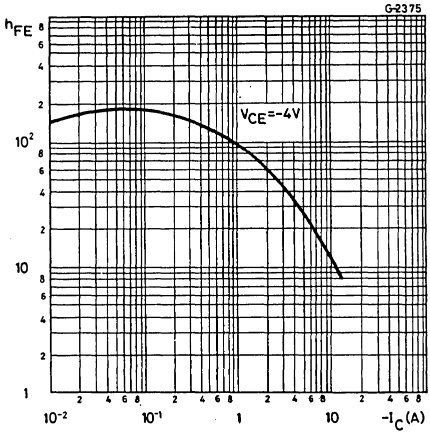
Parameter		Test conditions		Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = -0.5A	V_{CE} = -2V	40	120	400	—
		I_C = -2A	V_{CE} = -2V				
			for **BD706**	30			—
			for **BD708**	30			—
			for **BD710**	30			—
		I_C = -4A	V_{CE} = -4V				
			for **BD706**	20	30	150	—
			for **BD708**	15		150	—
			for **BD710**	15		150	—
			for **BD712**	15		150	—
		I_C = -10A	V_{CE} = -4V				
			for **BD706**	5	12		—
			for **BD708**	5	12		—
			for **BD710**		8		—
			for **BD712**		8		—
f_T	Transition frequency	I_C = -300mA	V_{CE} = -3V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Value for which I_C = -3.3 A at V_{CE} = -2 V

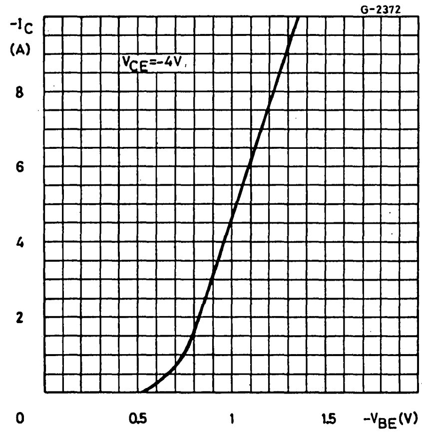
Safe operating areas



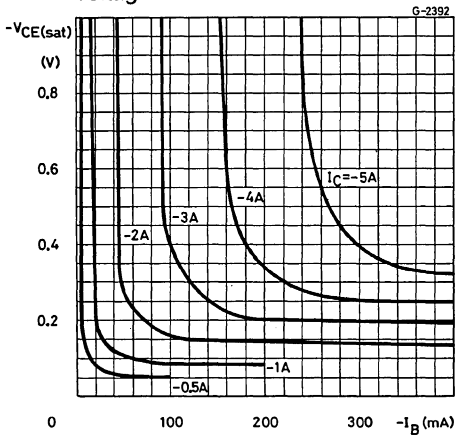
DC current gain



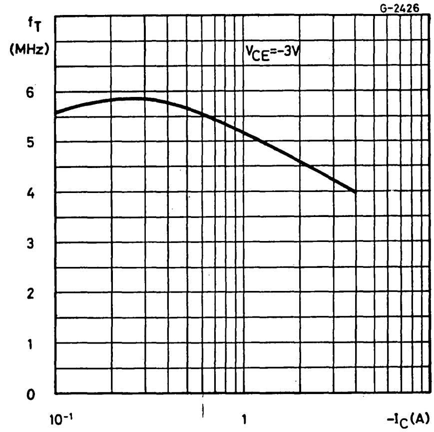
DC transconductance



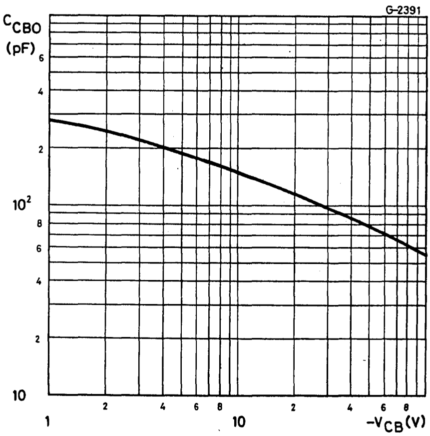
Collector-emitter saturation voltage



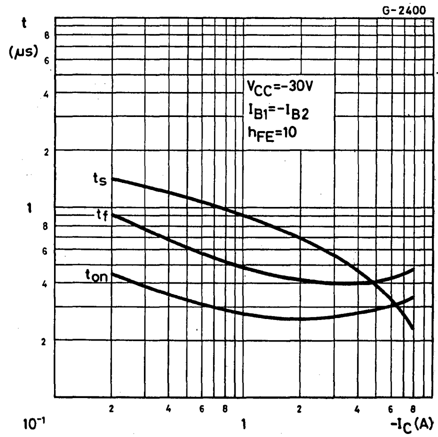
Transition frequency



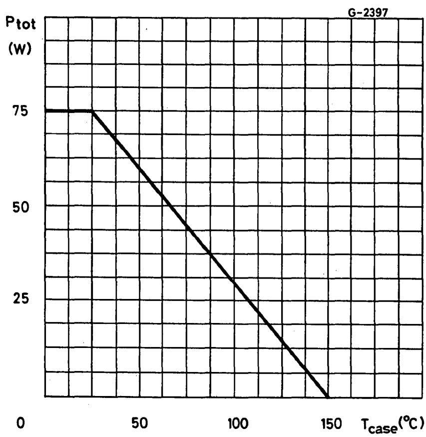
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BD 905
BD 907
BD 909
BD 911

POWER LINEAR AND SWITCHING APPLICATIONS

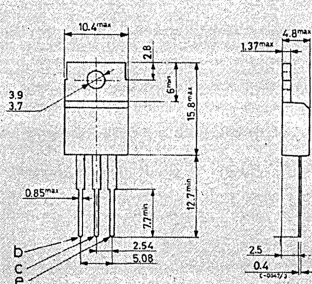
The BD 905, BD 907, BD 909, BD 911 are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications.
The complementary PNP types are the BD 906, BD 908, BD 910 and BD 912 respectively.

ABSOLUTE MAXIMUM RATINGS		BD905	BD907	BD909	BD911
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_E, I_C	Emitter and collector current	15A			
I_B	Base current	5A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	90W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

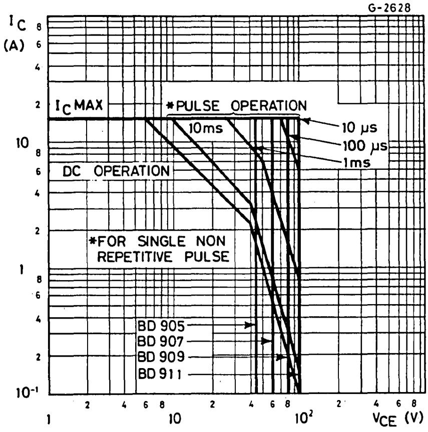
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

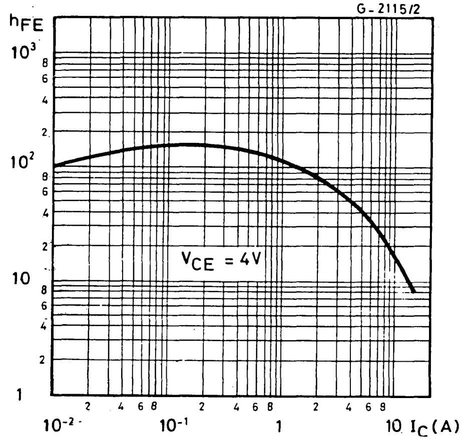
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD905**	V_{CB} = 45V			500	μA
		for **BD907**	V_{CB} = 60V			500	μA
		for **BD909**	V_{CB} = 80V			500	μA
		for **BD911**	V_{CB} = 100V			500	μA
		T_{case} = 150°C					
		for **BD905**	V_{CB} = 45V			5	mA
		for **BD907**	V_{CB} = 60V			5	mA
		for **BD909**	V_{CB} = 80V			5	mA
		for **BD911**	V_{CB} = 100V			5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD905**	V_{CE} = 30V			1	mA
		for **BD907**	V_{CE} = 30V			1	mA
		for **BD909**	V_{CE} = 40V			1	mA
		for **BD911**	V_{CE} = 50V			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
			for **BD905**	45			V
			for **BD907**	60			V
			for **BD909**	80			V
			for **BD911**	100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5A	I_B = 0.5A			1	V
		I_C = 10A	I_B = 2.5A			3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 10A	I_B = 2.5A			2.5	V
V_{BE}*	Base-emitter voltage	I_C = 5A	V_{CE} = 4V			1.5	V
h_{FE}*	DC current gain	I_C = 0.5A	V_{CE} = 4V	40		250	—
		I_C = 5A	V_{CE} = 4V	15		150	—
		I_C = 10A	V_{CE} = 4V	5			—
f_T	Transition frequency	I_C = 0.5A	V_{CE} = 4V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

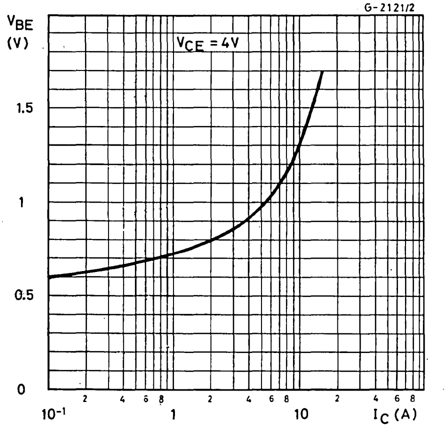
Safe operating areas



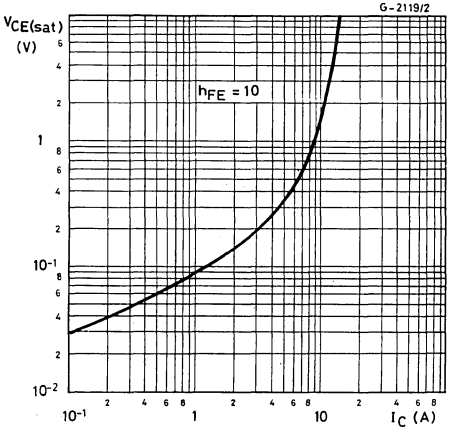
DC current gain



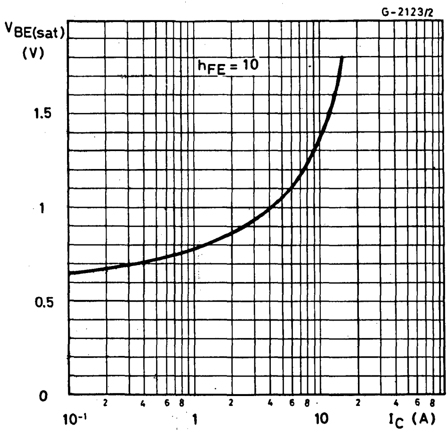
DC transconductance



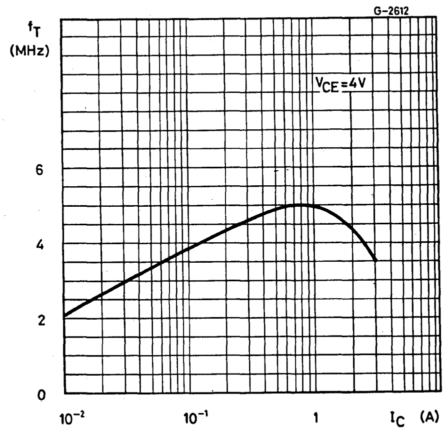
Collector-emitter saturation voltage



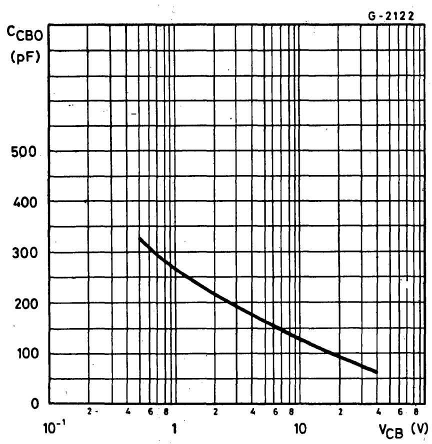
Base-emitter saturation voltage



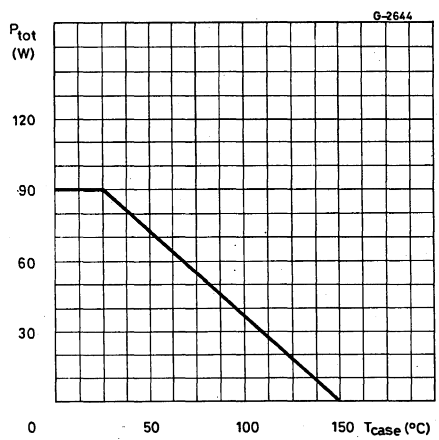
Transition frequency



Collector-base capacitance



Power rating chart



EPITAXIAL-BASE PNP

BD 906
BD 908
BD 910
BD 912

POWER LINEAR AND SWITCHING APPLICATIONS

The BD 906, BD 908, BD 910 and BD 912 are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package.
They are intended for use in power linear and switching applications.
The complementary NPN types are the BD 905, BD 907, BD 909 and BD 911 respectively.

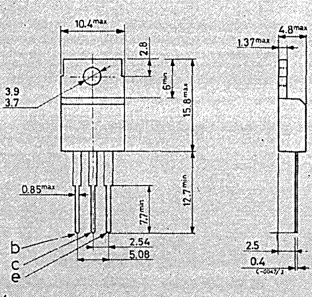
ABSOLUTE MAXIMUM RATINGS

		BD906	BD908	BD910	BD912
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_E, I_C	Emitter and collector current	-15A			
I_B	Base current	-5A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	90W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

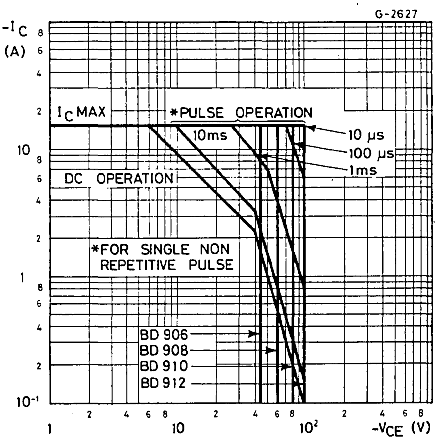
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

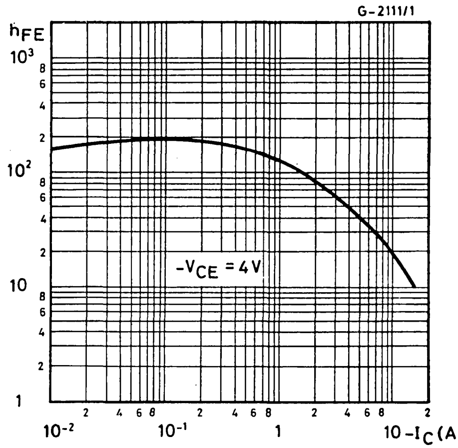
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD906**	V_{CB} = -45V			-500	μA
		for **BD908**	V_{CB} = -60V			-500	μA
		for **BD910**	V_{CB} = -80V			-500	μA
		for **BD912**	V_{CB} = -100V			-500	μA
		T_{case} = 150°C					
		for **BD906**	V_{CB} = -45V			-5	mA
		for **BD908**	V_{CB} = -60V			-5	mA
		for **BD910**	V_{CB} = -80V			-5	mA
		for **BD912**	V_{CB} = -100V			-5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD906**	V_{CE} = -30V			-1	mA
		for **BD908**	V_{CE} = -30V			-1	mA
		for **BD910**	V_{CE} = -40V			-1	mA
		for **BD912**	V_{CE} = -50V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V				-1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA					
			for **BD906**	-45			V
			for **BD908**	-60			V
			for **BD910**	-80			V
			for **BD912**	-100			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = -5A	I_B = -0.5A			-1	V
		I_C = -10A	I_B = -2.5A			-3	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = -10A	I_B = -2.5A			-2.5	V
V_{BE}*	Base-emitter voltage	I_C = -5A	V_{CE} = -4V			-1.5	V
h_{FE}*	DC current gain	I_C = -0.5A	V_{CE} = -4V	40		250	—
		I_C = -5A	V_{CE} = -4V	15		150	—
		I_C = -10A	V_{CE} = -4V	5			—
f_T	Transition frequency	I_C = -0.5A	V_{CE} = -4V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

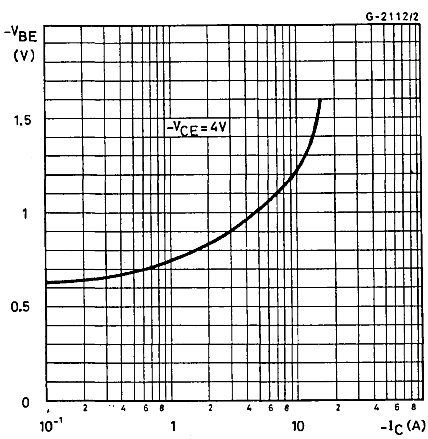
Safe operating areas



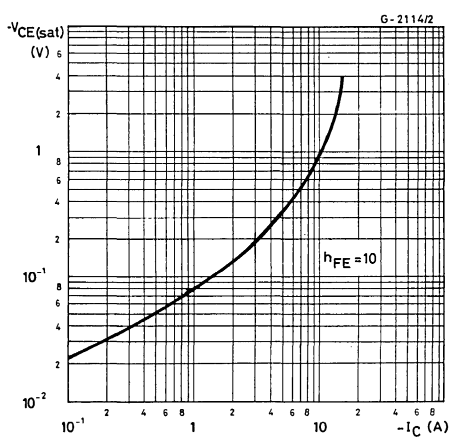
DC current gain



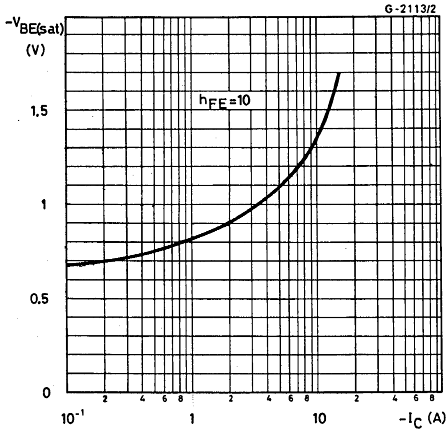
DC transconductance



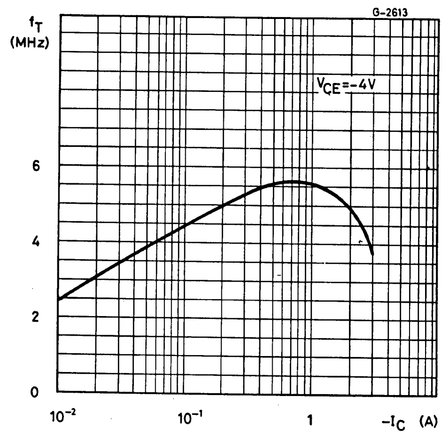
Collector-emitter saturation voltage



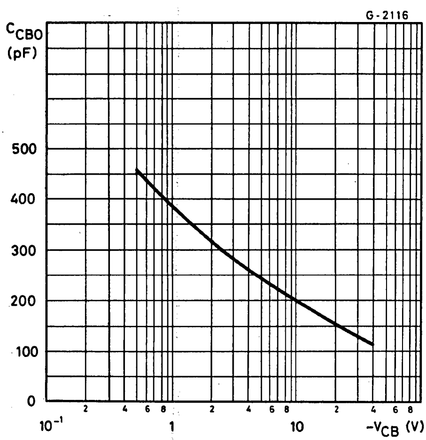
Base-emitter saturation voltage



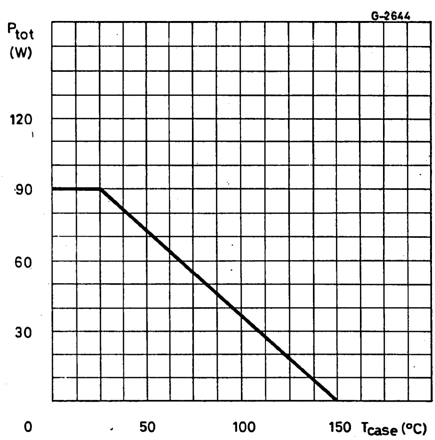
Transition frequency



Collector-base capacitance



Power rating chart



BDW 21
BDW 21A
BDW 21B
BDW 21C

EPITAXIAL-BASE NPN

POWER LINEAR AND SWITCHING APPLICATIONS

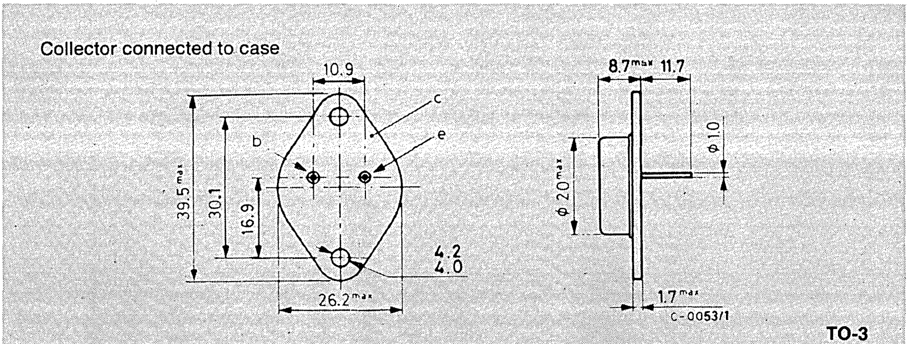
The BDW 21, BDW 21A, BDW 21B and BDW 21C are silicon epitaxial-base NPN power transistors in Jedec TO-3 metal case intended for use in power linear and switching applications.
The complementary PNP types are the BDW 22, BDW 22A, BDW 22B, and BDW 22C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDW21	BDW21A	BDW21B	BDW21C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	10A			
I_{CM}	Collector peak current	15A			
I_B	Base current	5A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	90W			
T_{stg}	Storage temperature	-65 to 200 °C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



TO-3

THERMAL DATA

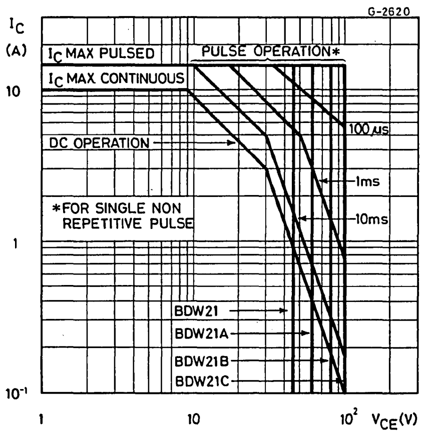
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.9	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

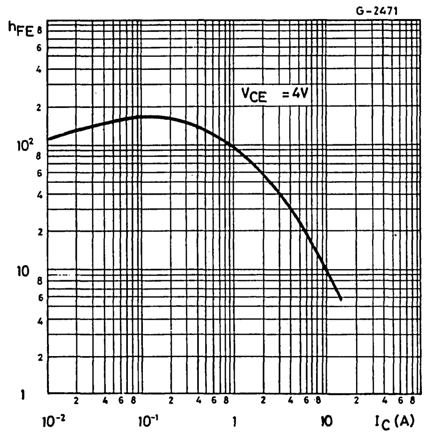
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($R_{BE} = 0$)	for **BDW21**	V_{CE} = 45V			100	μA
		for **BDW21A**	V_{CE} = 60V			100	μA
		for **BDW21B**	V_{CE} = 80V			100	μA
		for **BDW21C**	V_{CE} = 100V			100	μA
		T_{case} = 150 °C					
		for **BDW21**	V_{CE} = 45V			1	mA
		for **BDW21A**	V_{CE} = 60V			1	mA
		for **BDW21B**	V_{CE} = 80V			1	mA
		for **BDW21C**	V_{CE} = 100V			1	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDW21**	V_{CE} = 30V			0.5	mA
		for **BDW21A**	V_{CE} = 30V			0.5	mA
		for **BDW21B**	V_{CE} = 40V			0.5	mA
		for **BDW21C**	V_{CE} = 50V			0.5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
			for **BDW21**	45			V
			for **BDW21A**	60			V
			for **BDW21B**	80			V
			for **BDW21C**	100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4A	I_B = 0.4A			1	V
V_{CEK}	Knee voltage	I_C = 3A	I_B = **		0.4		V
V_{BE}*	Base-emitter voltage	I_C = 4A	V_{CE} = 4V			1.5	V
h_{FE}*	DC current gain	I_C = 0.5A	V_{CE} = 2V	40	120	400	—
		I_C = 2A	V_{CE} = 2V	30			—
		I_C = 4A	V_{CE} = 4V	15		150	—
		I_C = 10A	V_{CE} = 4V	5			—
f_T	Transition frequency	I_C = 300mA	V_{CE} = 3V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Value for which I_C = 3.3A at V_{CE} = 2 V

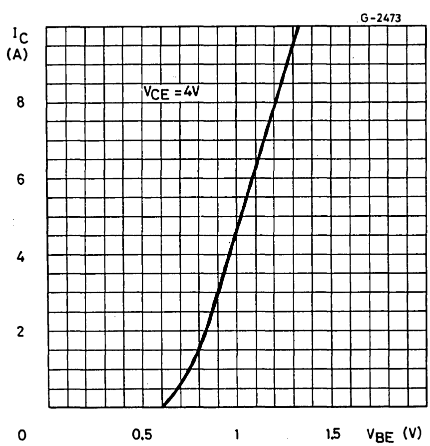
Safe operating areas



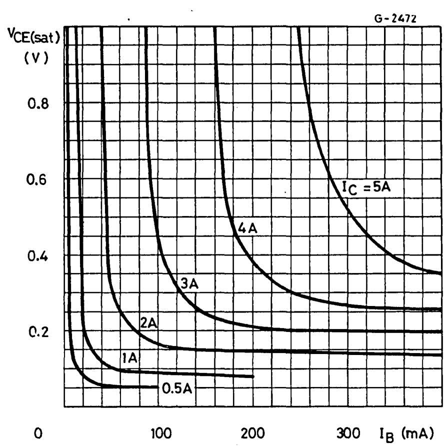
DC current gain



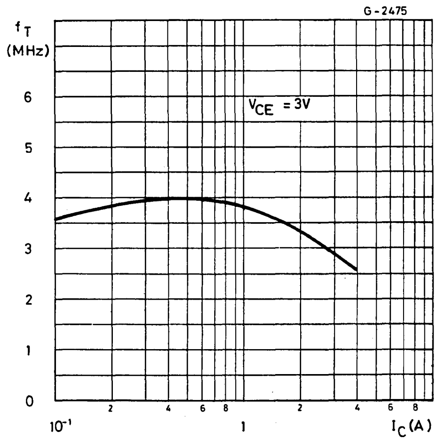
DC transconductance



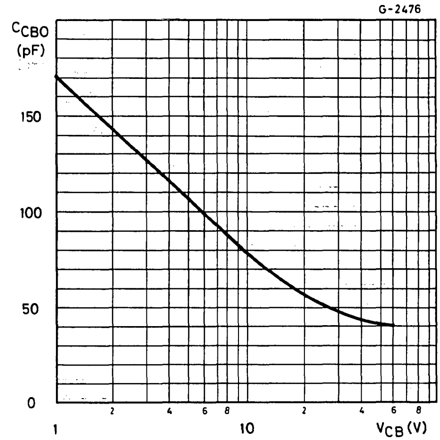
Collector-emitter saturation voltage



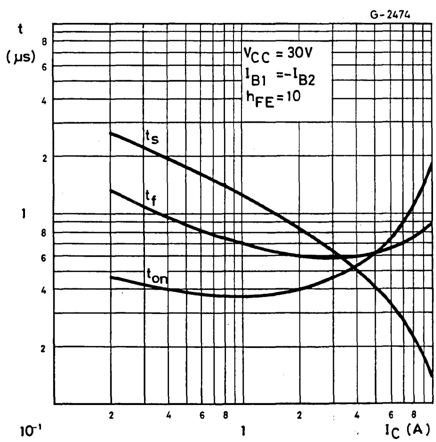
Transition frequency



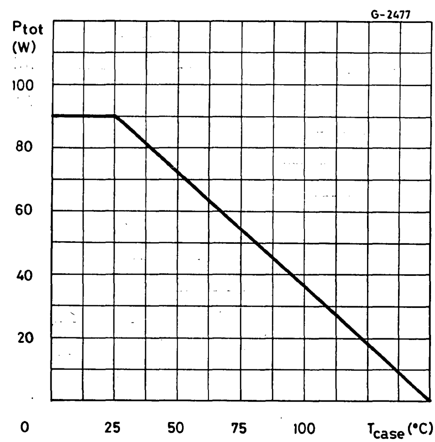
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDW 22
BDW 22A
BDW 22B
BDW 22C

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

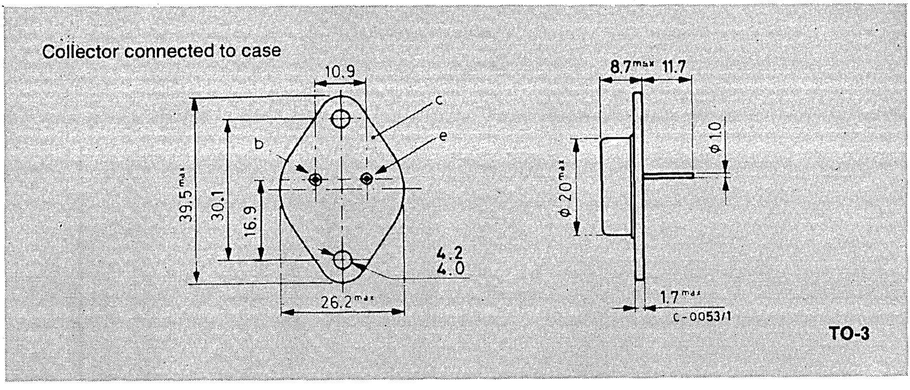
The BDW 22, BDW 22A, BDW 22B and BDW 22C are silicon epitaxial-base PNP power transistors in Jedec TO-3 metal case intended for use in power linear and switching applications.
The complementary NPN types are the BDW 21, BDW 21A, BDW 21B and BDW 21C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDW22	BDW22A	BDW22B	BDW22C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-10A			
I_{CM}	Collector peak current	-15A			
I_B	Base current	-5A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	90W			
T_{stg}	Storage temperature	-65 to 200 °C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

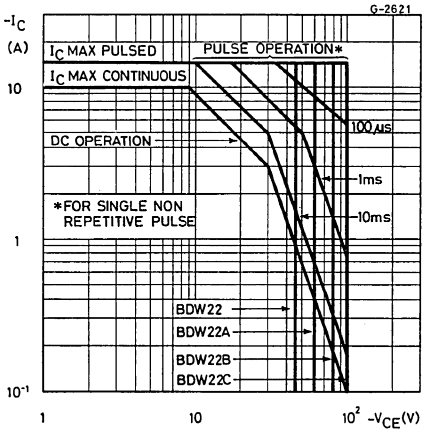
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.9	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

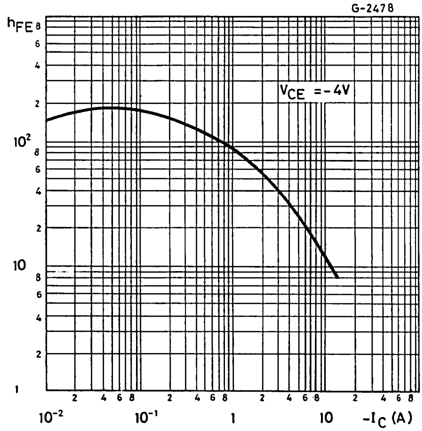
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector-cutoff current ($V_{BE}=0$)	for **BDW22**	V_{CE} = -45V			-100	μA
		for **BDW22A**	V_{CE} = -60V			-100	μA
		for **BDW22B**	V_{CE} = -80V			-100	μA
		for **BDW22C**	V_{CE} = -100V			-100	μA
		T_{case} = 150 °C					
		for **BDW22**	V_{CE} = -45V			-1	mA
		for **BDW22A**	V_{CE} = -60V			-1	mA
		for **BDW22B**	V_{CE} = -80V			-1	mA
		for **BDW22C**	V_{CE} = -100V			-1	mA
I_{CEO}	Collector-cutoff current ($I_B=0$)	for **BDW22**	V_{CE} = -30V			-0.5	mA
		for **BDW22A**	V_{CE} = -30V			-0.5	mA
		for **BDW22B**	V_{CE} = -40V			-0.5	mA
		for **BDW22C**	V_{CE} = -50V			-0.5	mA
I_{EBO}	Emitter-cutoff current ($I_C=0$)	V_{EB} = -5V				-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	I_C = -100mA					
			for **BDW22**	-45			V
			for **BDW22A**	-60			V
			for **BDW22B**	-80			V
			for **BDW22C**	-100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -4A	I_B = -0.4A			-1	V
V_{CEK}	Knee voltage	I_C = -3A	I_B = **		-0.4		V
V_{BE}*	Base-emitter voltage	I_C = -4A	V_{CE} = -4V			-1.5	V
h_{FE}*	DC current gain	I_C = -0.5A	V_{CE} = -2V	40	120	400	—
		I_C = -2A	V_{CE} = -2V	30			—
		I_C = -4A	V_{CE} = -4V	15		150	—
		I_C = -10A	V_{CE} = -4V	5			—
f_T	Transition frequency	I_C = -300mA	V_{CE} = -3V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
**Value for which I_C = -3.3 A at V_{CE} = -2V

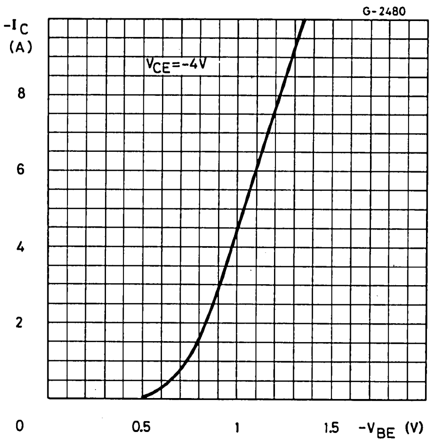
Safe operating areas



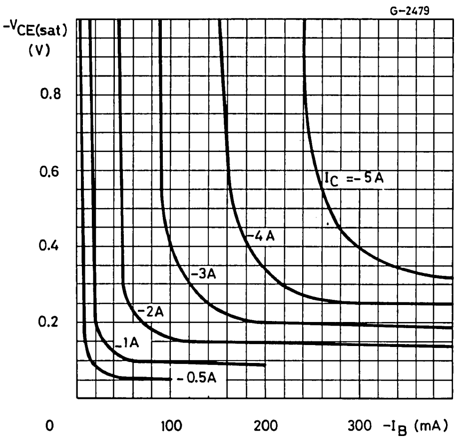
DC current gain



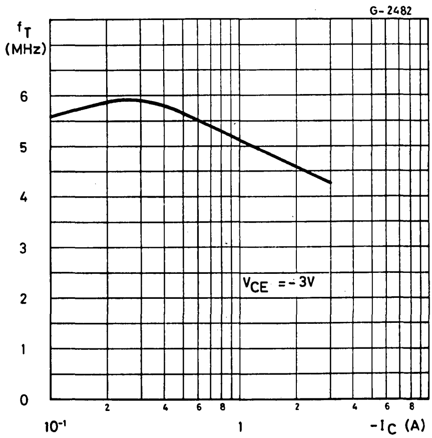
DC transconductance



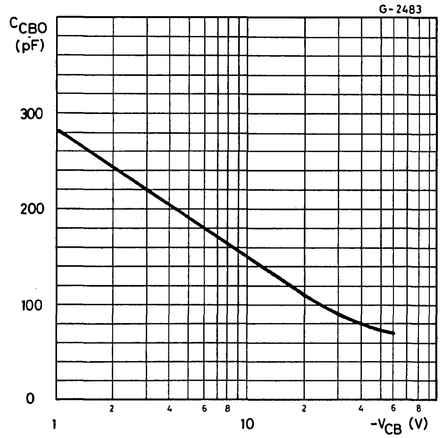
Collector-emitter saturation voltage



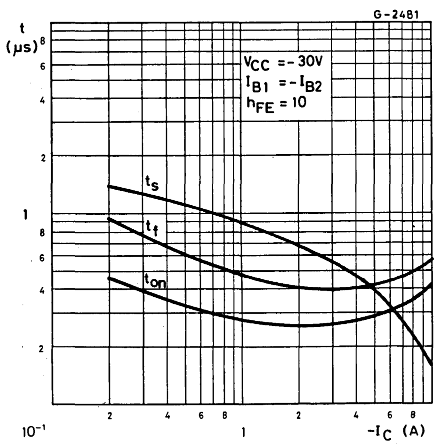
Transition frequency



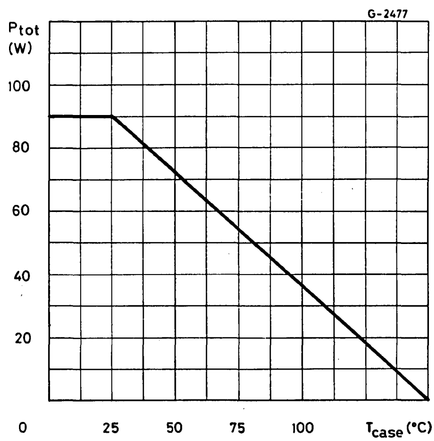
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDW 23
BDW 23A
BDW 23B
BDW 23C

EPITAXIAL-BASE NPN

POWER DARLINGTONS

The BDW 23, BDW 23A, BDW 23B and BDW 23C are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary PNP types are the BDW 24, BDW 24A, BDW 24B and BDW 24C respectively.

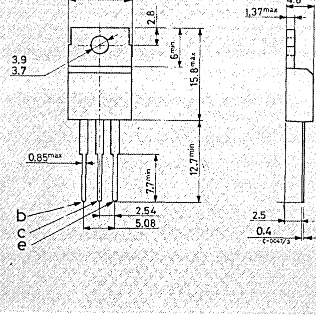
ABSOLUTE MAXIMUM RATINGS

		BDW23	BDW23A	BDW23B	BDW23C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	6A			
I_{CM}	Collector peak current (repetitive)	8A			
I_B	Base current	0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	50W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

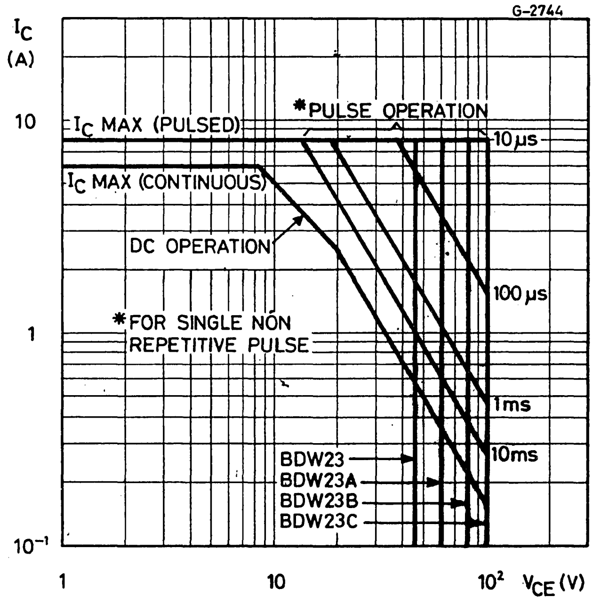
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

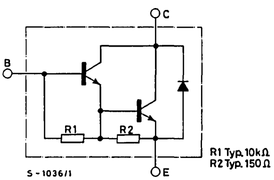
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW23**	V_{CB} = 45V			200	μA
		for **BDW23A**	V_{CB} = 60V			200	μA
		for **BDW23B**	V_{CB} = 80V			200	μA
		for **BDW23C**	V_{CB} = 100V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDW23**	V_{CE} = 22V			500	μA
		for **BDW23A**	V_{CE} = 30V			500	μA
		for **BDW23B**	V_{CE} = 40V			500	μA
		for **BDW23C**	V_{CE} = 50V			500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V				2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA					
			for **BDW23**	45			V
			for **BDW23A**	60			V
			for **BDW23B**	80			V
			for **BDW23C**	100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 8mA			2	V
		I_C = 6A	I_B = 60mA			3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2A	V_{CE} = 8mA			2.5	V
V_{BE}*	Base-emitter voltage	I_C = 1A	V_{CE} = 3V			2.5	V
		I_C = 6A	V_{CE} = 3V			3.0	V
h_{FE}*	DC current gain	I_C = 1A	V_{CE} = 3V	1000			—
		I_C = 2A	V_{CE} = 3V	750		20000	—
		I_C = 6A	V_{CE} = 3V	100			—
V_F*	Parallel-diode forward voltage	I_F = 2A				1.8	V

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

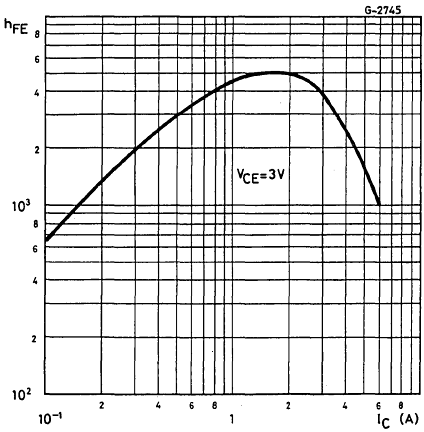
Safe operating areas



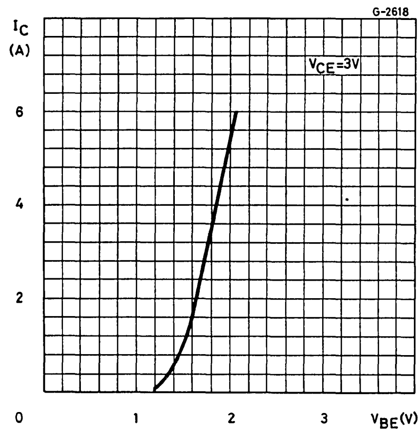
Internal circuit diagram



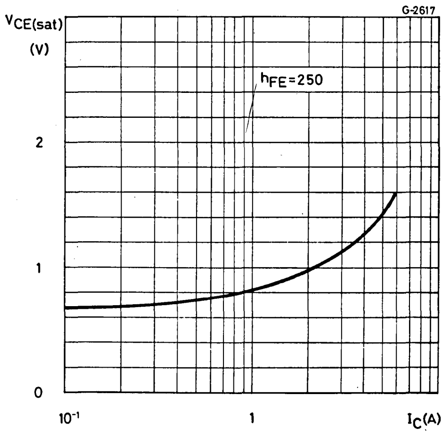
DC current gain



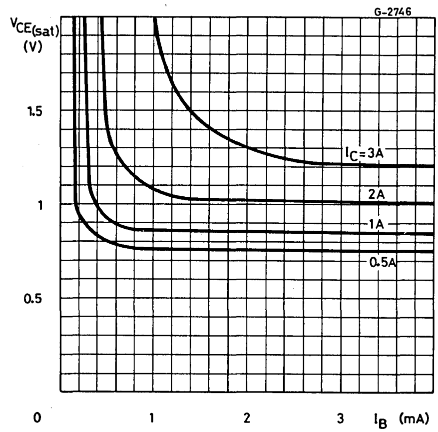
DC transconductance



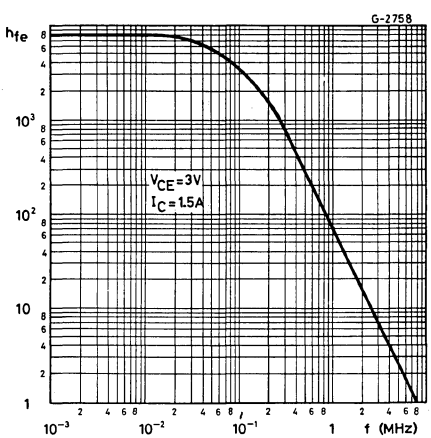
Collector-emitter saturation voltage



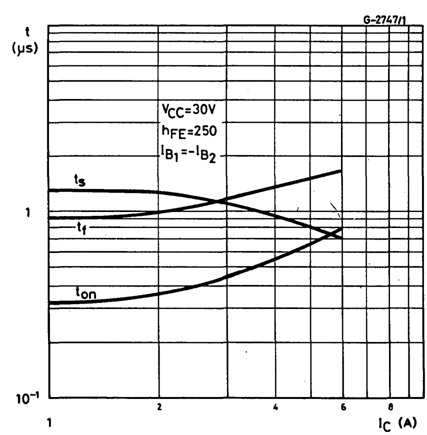
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDW 24
BDW 24A
BDW 24B
BDW 24C

POWER DARLINGTONS

The BDW 24, BDW 24A, BDW 24B, BDW 24C are silicon epitaxial-base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary NPN types are the BDW 23, BDW 23A, BDW 23B and BDW 23C respectively.

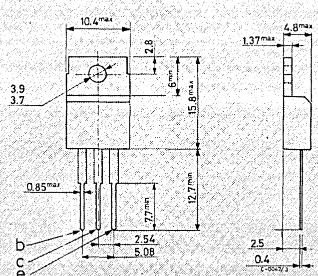
ABSOLUTE MAXIMUM RATINGS

		BDW24	BDW24A	BDW24B	BDW24C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-6A			
I_{CM}	Collector peak current (repetitive)	-8A			
I_B	Base current	-0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	50W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

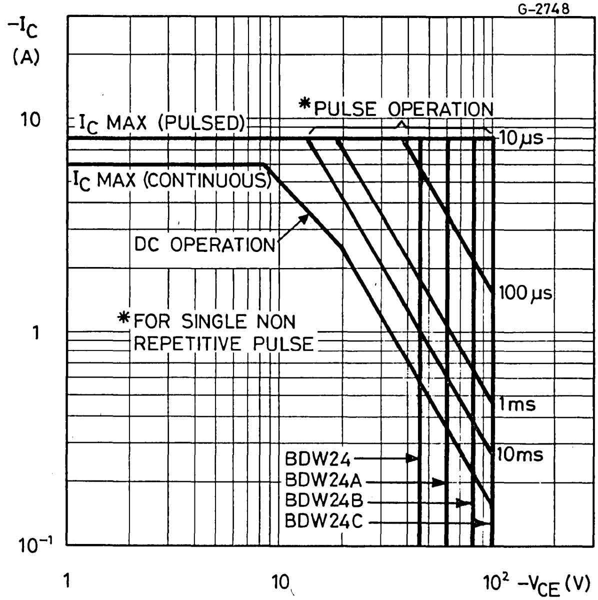
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

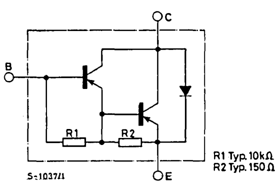
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW24**	V_{CB} = -45V			-200	μA
		for **BDW24A**	V_{CB} = -60V			-200	μA
		for **BDW24B**	V_{CB} = -80V			-200	μA
		for **BDW24C**	V_{CB} = -100V			-200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDW24**	V_{CE} = -22V			-500	μA
		for **BDW24A**	V_{CE} = -30V			-500	μA
		for **BDW24B**	V_{CE} = -40V			-500	μA
		for **BDW24C**	V_{CE} = -50V			-500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V				-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA					
			for **BDW24**	-45			V
			for **BDW24A**	-60			V
			for **BDW24B**	-80			V
			for **BDW24C**	-100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A	I_B = -8mA			-2	V
		I_C = -6A	I_B = -60mA			-3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -2A	I_B = -8mA			-2.5	V
V_{BE}*	Base-emitter voltage	I_C = -1A	V_{CE} = -3V			-2.5	V
		I_C = -6A	V_{CE} = -3V			-3.0	V
h_{FE}*	DC current gain	I_C = -1A	V_{CE} = -3V	1000			—
		I_C = -2A	V_{CE} = -3V	750		20000	—
		I_C = -6A	V_{CE} = -3V	100			—
V_F*	Parallel-diode forward voltage	I_F = 2A				1.8	V

* Pulsed: pulse duration = 300μs, duty cycle = 1.5%

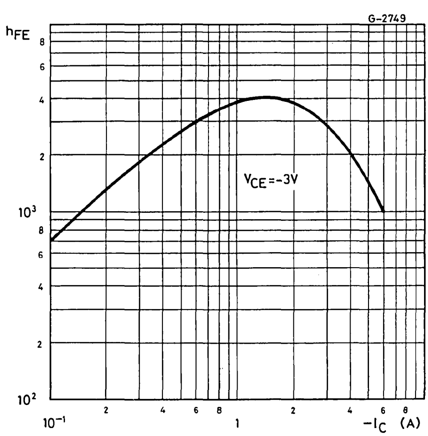
Safe operating areas



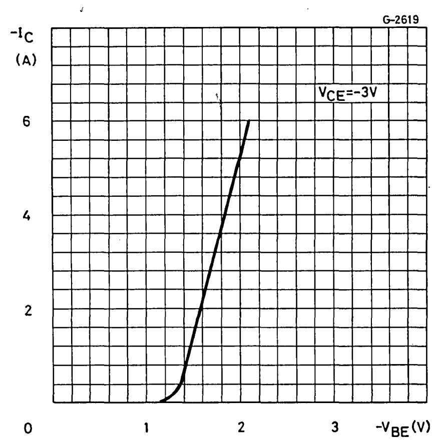
Internal circuit diagram



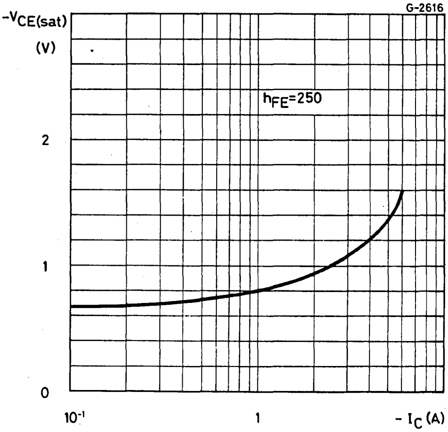
DC current gain



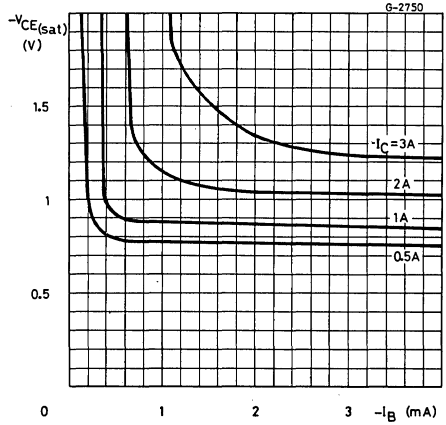
DC transconductance



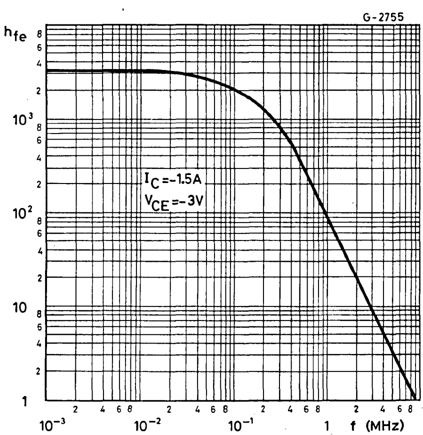
Collector-emitter saturation voltage



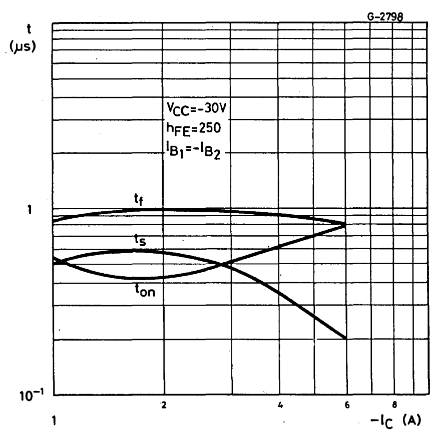
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDW 51
BDW 51A
BDW 51B
BDW 51C

POWER LINEAR AND SWITCHING APPLICATIONS

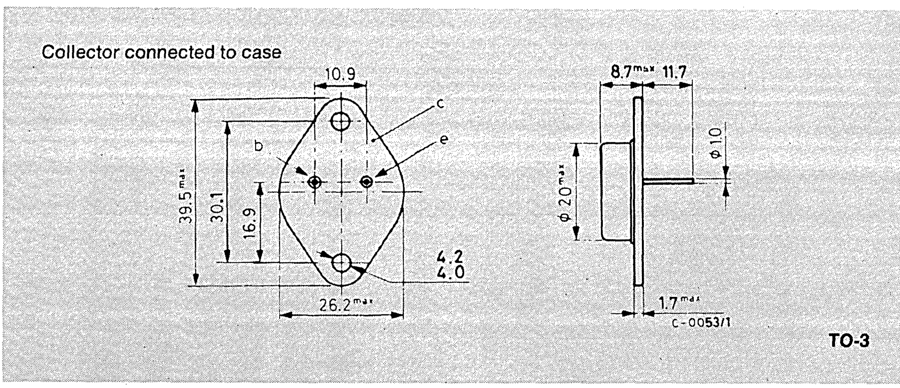
The BDW 51, BDW 51A, BDW 51B and BDW 51C are silicon epitaxial-base NPN power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the BDW 52, BDW 52A, BDW 52B and BDW 52C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDW51	BDW51A	BDW51B	BDW51C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	15A			
I_{CM}	Collector peak current (repetitive)	20A			
I_B	Base current	7A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	125W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

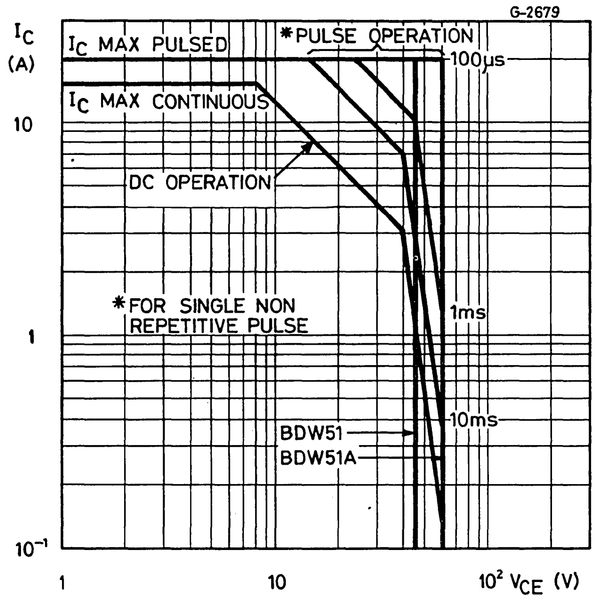
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

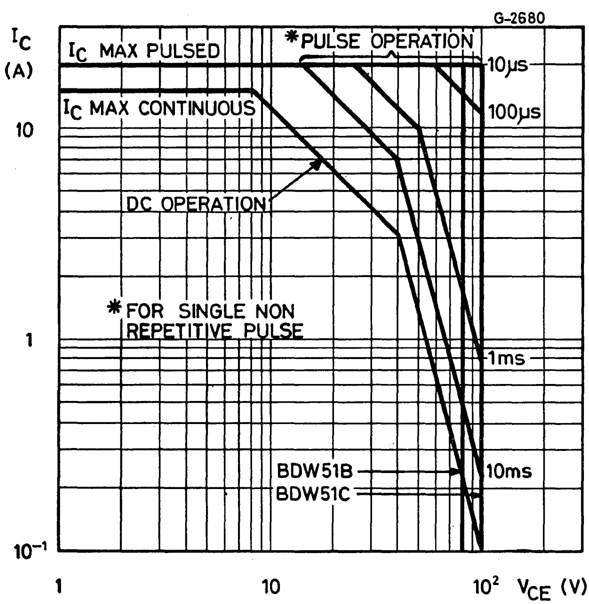
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW51** V_{CB} = 45V			500	μA
		for **BDW51A** V_{CB} = 60V			500	μA
		for **BDW51B** V_{CB} = 80V			500	μA
		for **BDW51C** V_{CB} = 100V			500	μA
		T_{case} = 150°C				
		for **BDW51** V_{CB} = 45V			5	mA
		for **BDW51A** V_{CB} = 60V			5	mA
		for **BDW51B** V_{CB} = 80V			5	mA
		for **BDW51C** V_{CB} = 100V			5	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDW51** V_{CE} = 22V			1	mA
		for **BDW51A** V_{CE} = 30V			1	mA
		for **BDW51B** V_{CE} = 40V			1	mA
		for **BDW51C** V_{CE} = 50V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA				
		for **BDW51**	45			V
		for **BDW51A**	60			V
		for **BDW51B**	80			V
		for **BDW51C**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5A I_B = 0.5A			1	V
		I_C = 10A I_B = 2.5A			3	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10A I_B = 2.5A			2.5	V
V_{BE}*	Base-emitter voltage	I_C = 5A V_{CE} = 4V			1.5	V
h_{FE}*	DC current gain	I_C = 5A V_{CE} = 4V	20		150	—
		I_C = 10A V_{CE} = 4V	5			—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 4V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

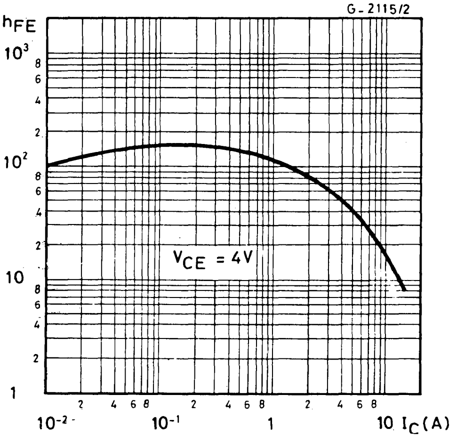
Safe operating areas
(for **BDW51** and **BDW51A**)



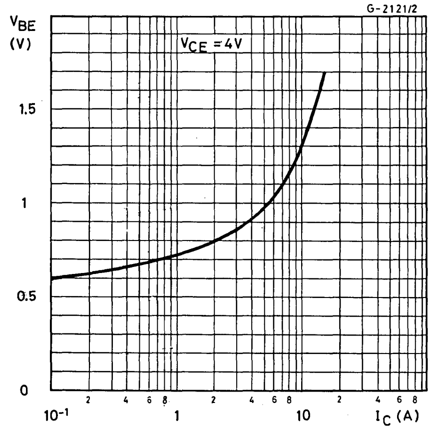
Safe operating areas
(for **BDW51B** and **BDW51C**)



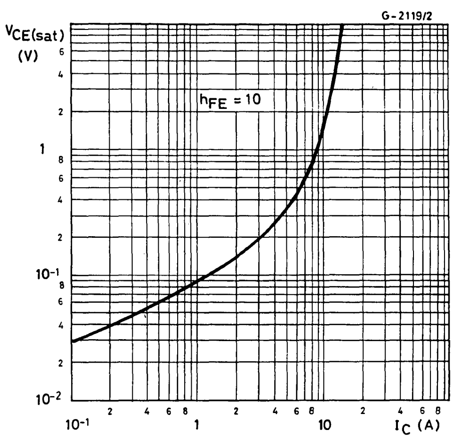
DC current gain



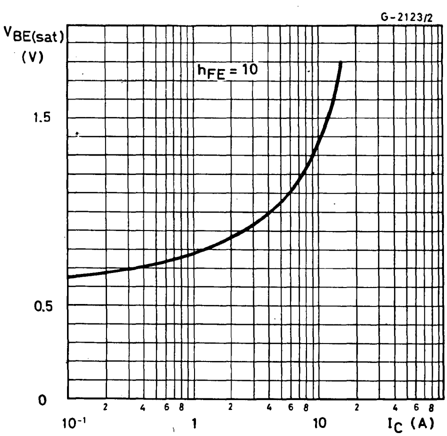
DC transconductance



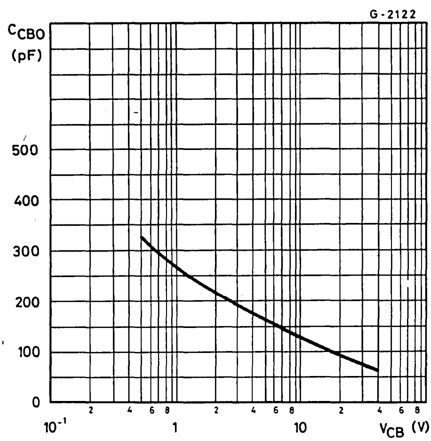
Collector-emitter saturation voltage



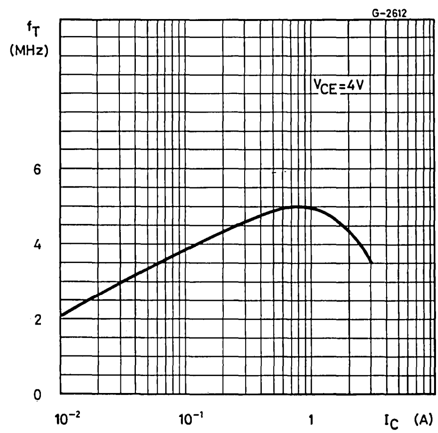
Base-emitter saturation voltage



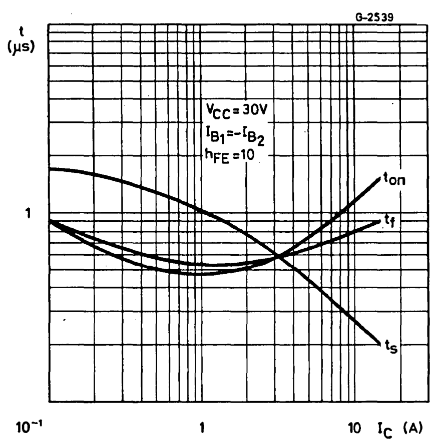
Collector-base capacitance



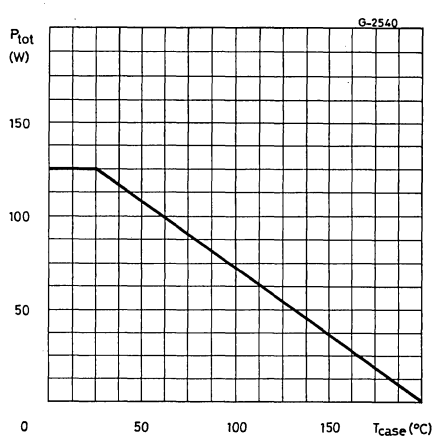
Transition frequency



Saturated switching characteristics



Power rating chart



BDW 52
BDW 52A
BDW 52B
BDW 52C

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

The BDW 52, BDW 52A, BDW 52B and BDW 52C are silicon epitaxial-base PNP power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the BDW 51, BDW 51A, BDW 51B and BDW 51C respectively.

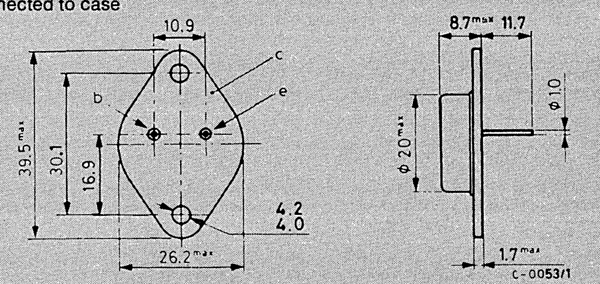
ABSOLUTE MAXIMUM RATINGS

		BDW52	BDW52A	BDW52B	BDW52C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-15A			
I_{CM}	Collector peak current	-20A			
I_B	Base current	-7A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	125W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

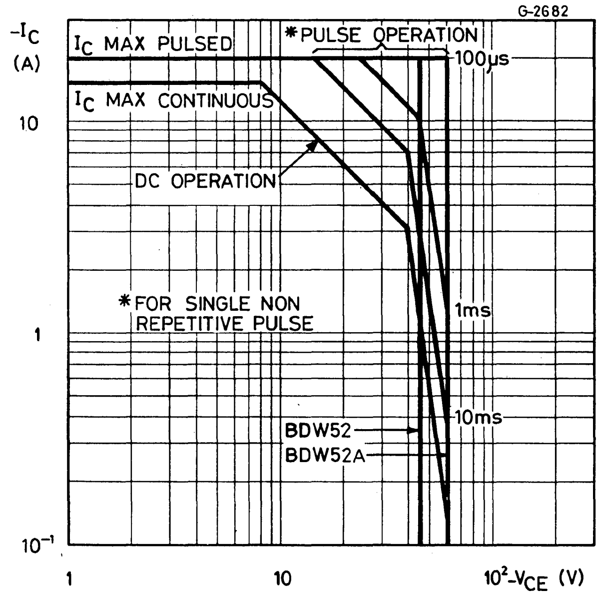
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

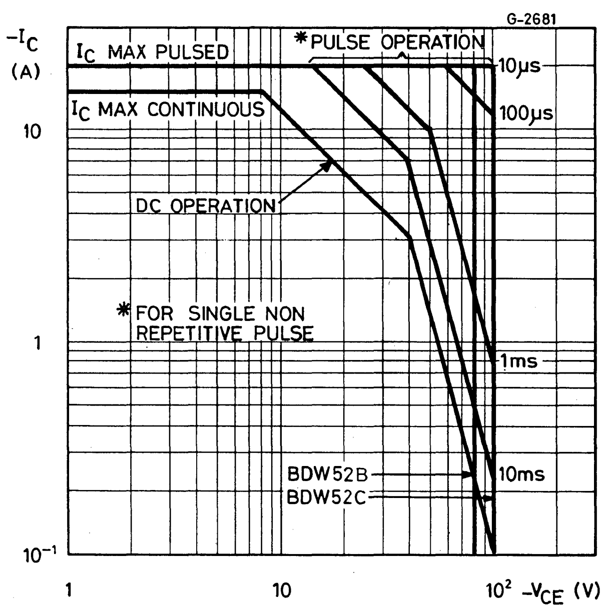
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW52**	V_{CB} = -45V			-500	μA
		for **BDW52A**	V_{CB} = -60V			-500	μA
		for **BDW52B**	V_{CB} = -80V			-500	μA
		for **BDW52C**	V_{CB} = -100V			-500	μA
		T_{case} = 150°C					
		for **BDW52**	V_{CB} = -45V			-5	mA
		for **BDW52A**	V_{CB} = -60V			-5	mA
		for **BDW52B**	V_{CB} = -80V			-5	mA
		for **BDW52C**	V_{CB} = -100V			-5	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDW52**	V_{CE} = -22V			-1	mA
		for **BDW52A**	V_{CE} = -30V			-1	mA
		for **BDW52B**	V_{CE} = -40V			-1	mA
		for **BDW52C**	V_{CE} = -50V			-1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V				-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA					
			for **BDW52**	-45			V
			for **BDW52A**	-60			V
			for **BDW52B**	-80			V
			for **BDW52C**	-100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -5A	I_B = -0.5A			-1	V
		I_C = -10A	I_B = -2.5A			-3	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = -10A	I_B = -2.5A			-2.5	V
V_{BE}*	Base-emitter voltage	I_C = -5A	V_{CE} = -4V			-1.5	V
h_{FE}*	DC current gain	I_C = -5A	V_{CE} = -4V	20		150	—
		I_C = -10A	V_{CE} = -4V	5			—
f_T	Transition frequency	I_C = -0.5A	V_{CE} = -4V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

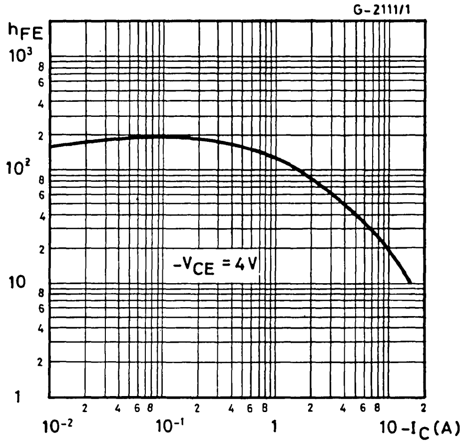
Safe operating areas
(for **BDW52** and **BDW52A**)



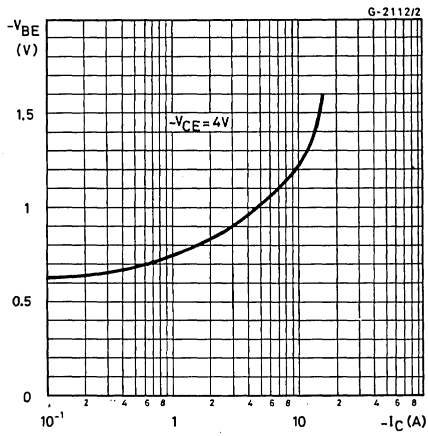
Safe operating areas
(for **BDW52B** and **BDW52C**)



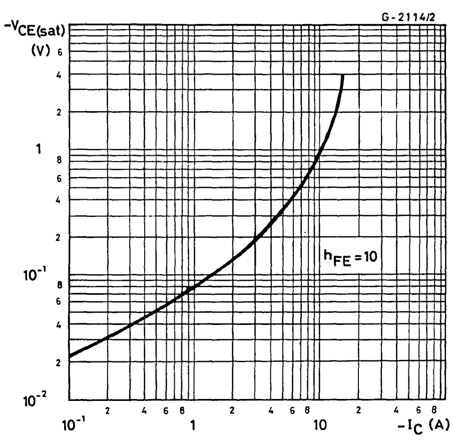
DC current gain



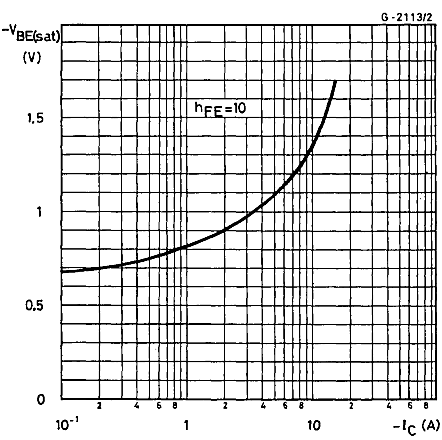
DC transconductance



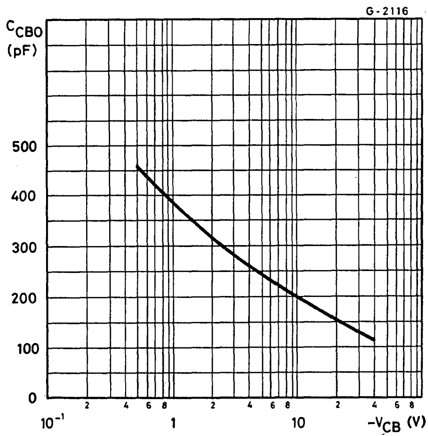
Collector-emitter saturation voltage



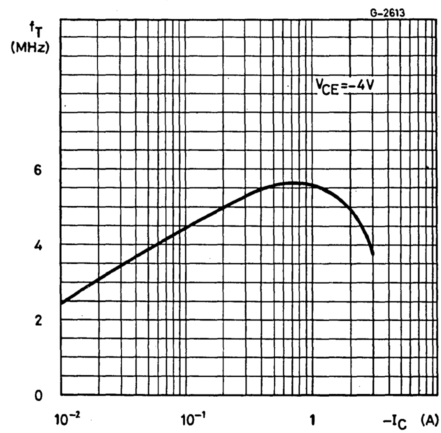
Base-emitter saturation voltage



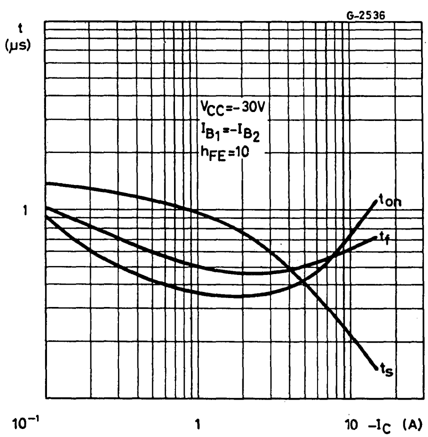
Collector-base capacitance



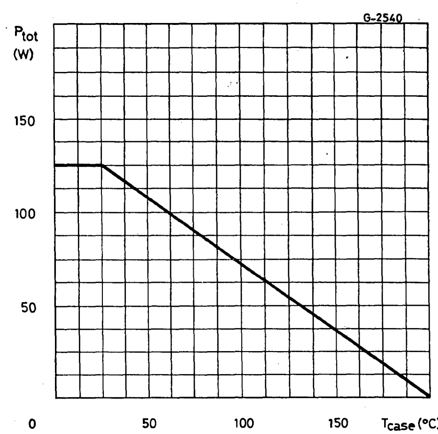
Transition frequency



Saturated switching characteristics



Power rating chart



BDW 91

EPITAXIAL-BASE NPN

MEDIUM POWER DARLINGTON

The BDW 91 is a silicon epitaxial base NPN transistor in monolithic Darlington configuration mounted in Jedec TO-39 metal case. It is intended for use in switching and linear applications. The complementary PNP type is the BDW92.

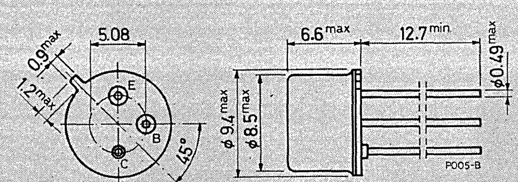
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	180	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	180	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	4	A
I_B	Base current	100	mA
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10	W
	$T_{amb} \leq 25°C$	1	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

BDW 91

THERMAL DATA

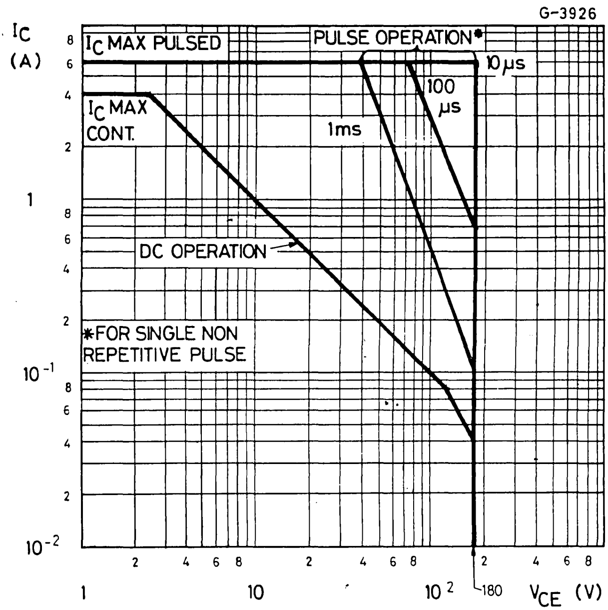
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

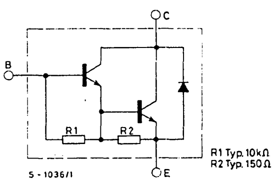
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 180V$			50	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 90V$			50	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{BE} = 6V$	0.4		2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 50$ mA	180			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 2A$ $I_B = 4mA$			2	V
V_{BE}*	Base-emitter voltage	$I_C = 2A$ $V_{CE} = 2V$			2.5	V
h_{FE}*	DC current gain	$I_C = 2A$ $V_{CE} = 5V$ $I_C = 50mA$ $V_{CE} = 5V$	1000 150	3000 300		— —
V_F*	Parallel diode forward voltage	$I_F = 2A$			2.5	V
h_{fe}	Small signal currente gain	$I_C = 0.5A$ $V_{CE} = 2V$ f = 1MHz		20		—

* Pulsed: pulse duration = 300 μsec, duty cycle = 1%

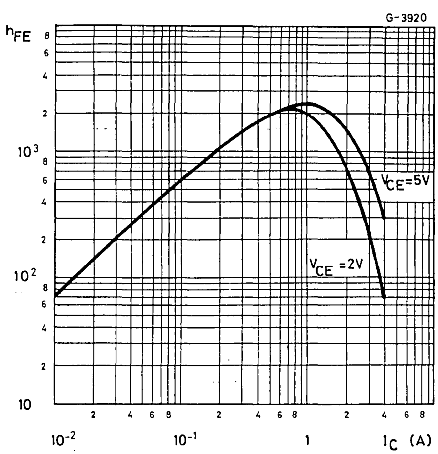
Safe operating areas



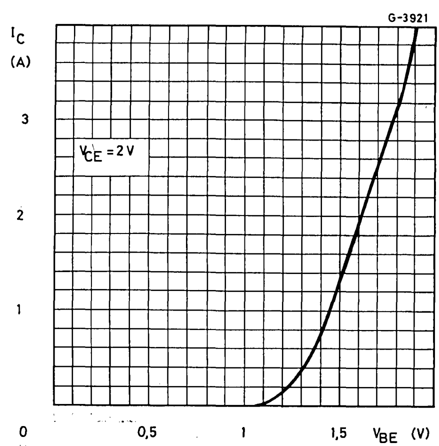
Internal circuit diagram



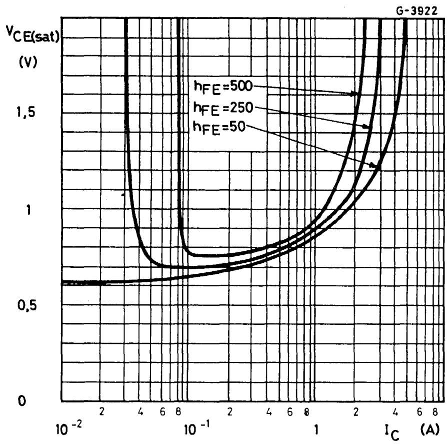
DC current gain



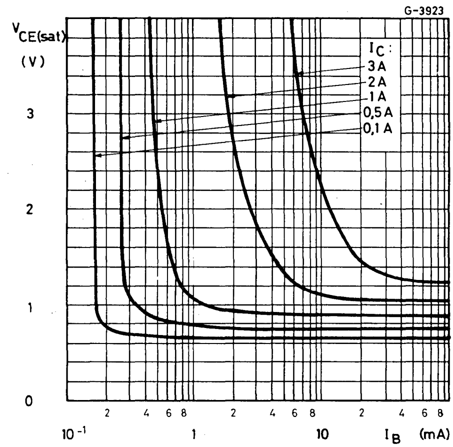
DC transconductance



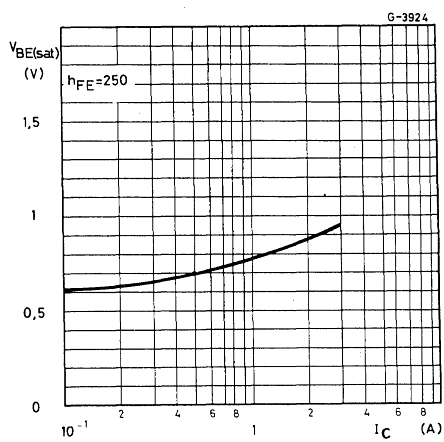
Collector-emitter saturation voltage



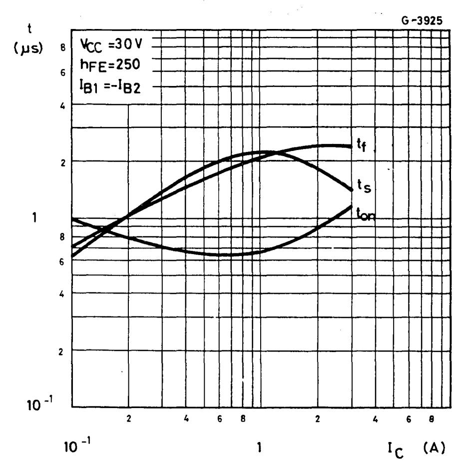
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE PNP

MEDIUM POWER DARLINGTON

The BDW 92 is a silicon epitaxial base PNP transistor in monolithic Darlington configuration mounted in Jedec TO-39 metal case. It is intended for use in switching and linear applications.
The complementary NPN type is the BDW91.

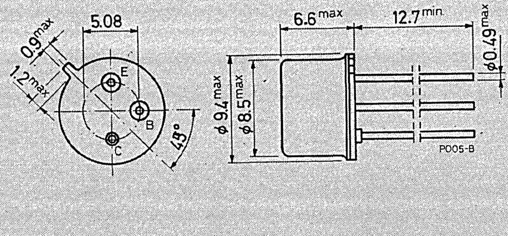
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-180	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-180	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-6	V
I_C	Collector current	-4	A
I_B	Base current	-100	mA
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10	W
	$T_{amb} \leq 25°C$	1	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

BDW 92

THERMAL DATA

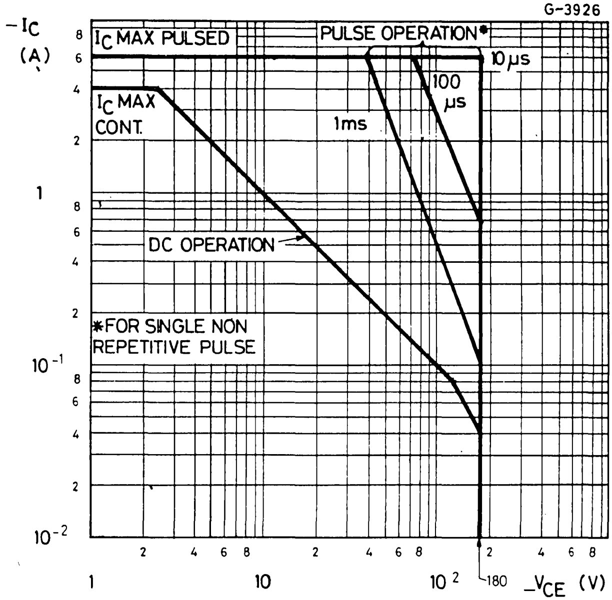
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

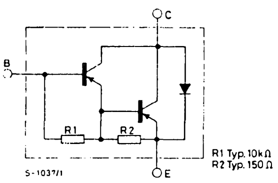
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -180V			-50	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = -90V			-50	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{BE} = -6V	-0.4		-2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C = -50 mA	-180			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_B = -4mA			-2	V
V_{BE}*	Base-emitter voltage	I_C = -2A V_{CE} = -2V			-2.5	V
h_{FE}*	DC current gain	I_C = -2A V_{CE} = -5V I_C = -50mA V_{CE} = -5V	1000 150	3000 300		— —
V_F*	Parallel diode forward voltage	I_F = -2A			-2.5	V
h_{fe}	Small signal current gain	I_C = -0.5A V_{CE} = -2V f = 1MHz		20		—

* Pulsed: pulse duration = 300μs, duty cycle = 1%

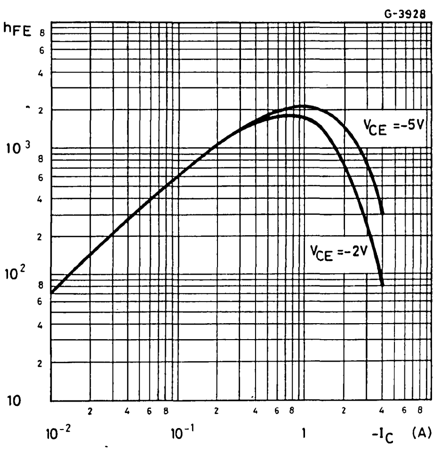
Safe operating areas



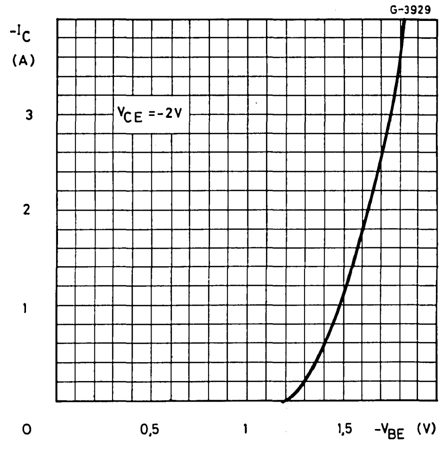
Internal circuit diagram



DC current gain

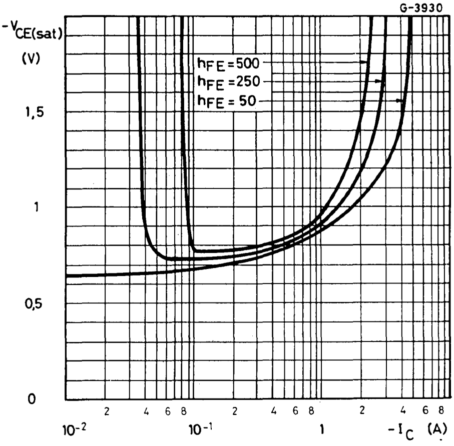


DC transconductance

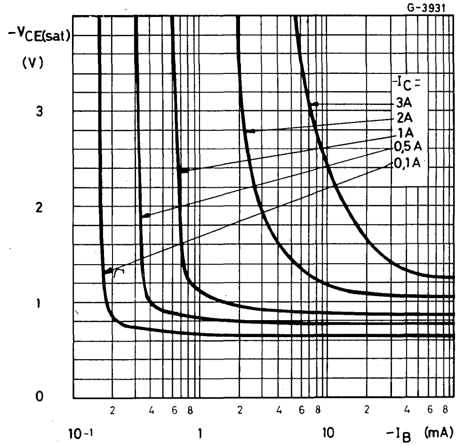


BDW 92

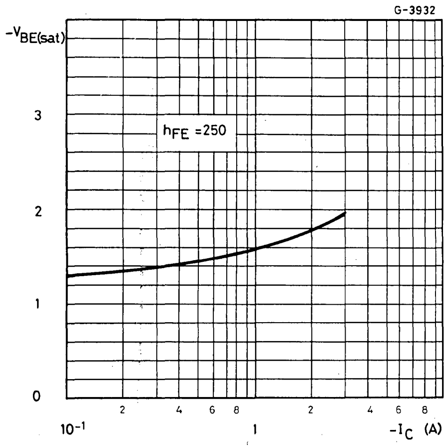
Collector-emitter saturation voltage



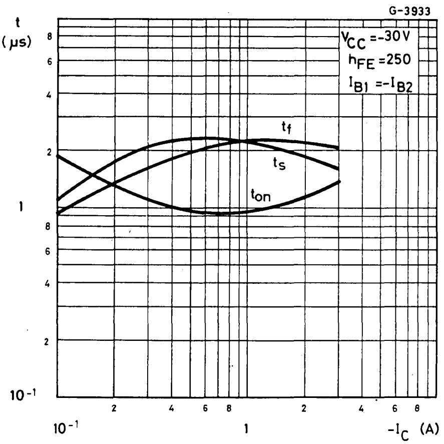
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDW 93
BDW 93A
BDW 93B
BDW 93C

POWER DARLINGTONS

The BDW 93, BDW 93A, BDW 93B and BDW 93C are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications. The complementary PNP types are the BDW 94, BDW 94A, BDW 94B and BDW 94C respectively.

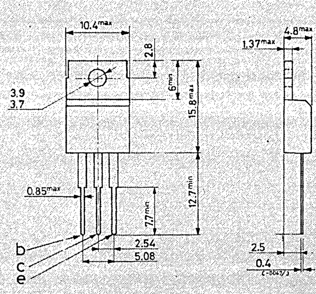
ABSOLUTE MAXIMUM RATINGS

		BDW93	BDW93A	BDW93B	BDW93C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
I_C	Collector current	12A			
I_{CM}	Collector peak current	15A			
I_B	Base current	0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	80W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

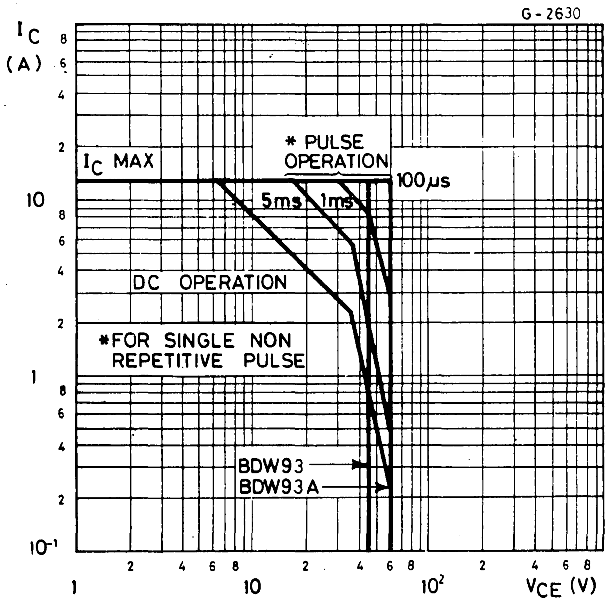
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

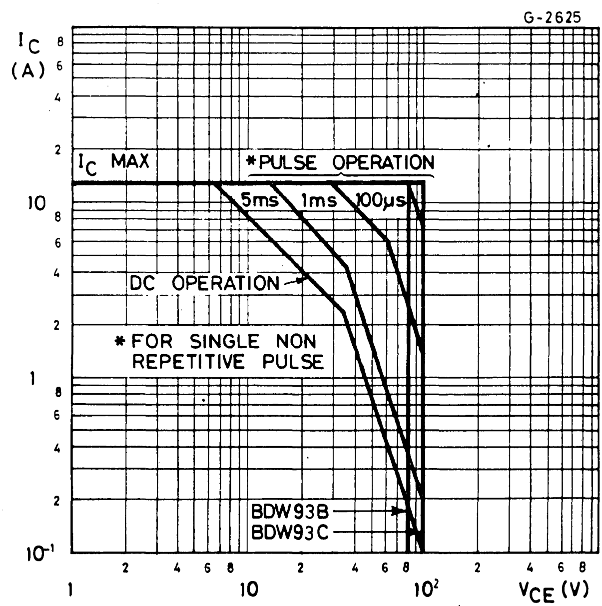
Parameter		Test conditions		Min.	Typ.	Max.	Unit.
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDW93**	V_{CB} = 45V			100	μA
		for **BDW93A**	V_{CB} = 60V			100	μA
		for **BDW93B**	V_{CB} = 80V			100	μA
		for **BDW93C**	V_{CB} = 100V			100	μA
		T_{case} = 150°C					
		for **BDW93**	V_{CB} = 45V			5	mA
		for **BDW93A**	V_{CB} = 60V			5	mA
		for **BDW93B**	V_{CB} = 80V			5	mA
		for **BDW93C**	V_{CB} = 100V			5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDW93**	V_{CE} = 40V			1	mA
		for **BDW93A**	V_{CE} = 60V			1	mA
		for **BDW93B**	V_{CE} = 80V			1	mA
		for **BDW93C**	V_{CE} = 80V			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
		for **BDW93**		45			V
		for **BDW93A**		60			V
		for **BDW93B**		80			V
		for **BDW93C**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5A	I_B = 20mA			2	V
		I_C = 10A	I_B = 100mA			3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 5A	I_B = 20mA			2.5	V
		I_C = 10A	I_B = 100mA			4	V
h_{FE}*	DC current gain	I_C = 3A	V_{CE} = 3V	1000			—
		I_C = 5A	V_{CE} = 3V	750		20000	—
		I_C = 10A	V_{CE} = 3V	100			—
V_F*	Parallel-diode forward voltage	I_F = 5A			1.3	2	V
		I_F = 10A			1.8	4	V
h_{fe}	Small signal current gain	I_C = 1A	V_{CE} = 10V				
		f = 1 MHz		20			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

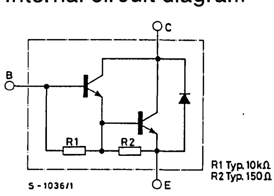
Safe operating areas
(for **BDW93** and **BDW93A**)



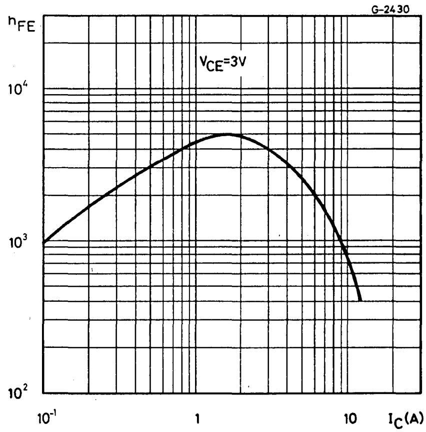
Safe operating areas
(for **BDW93B** and **BDW93C**)



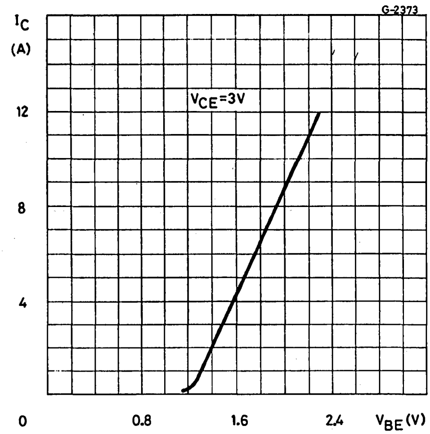
Internal circuit diagram



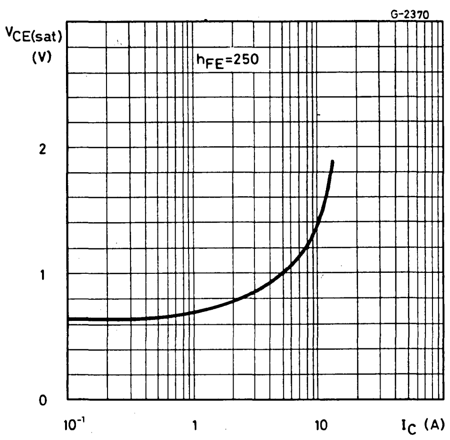
DC current gain



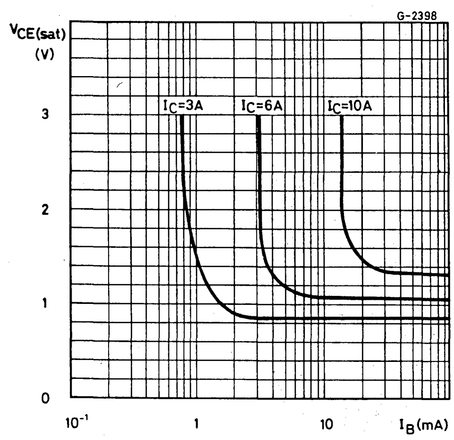
DC transconductance



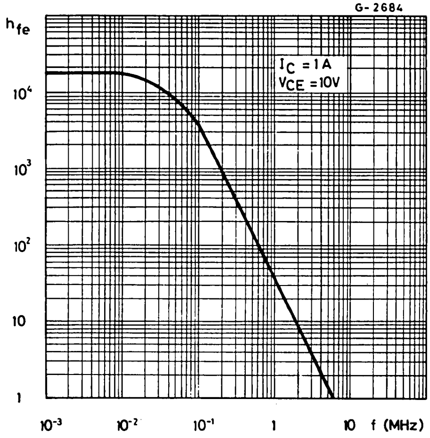
Collector-emitter saturation voltage



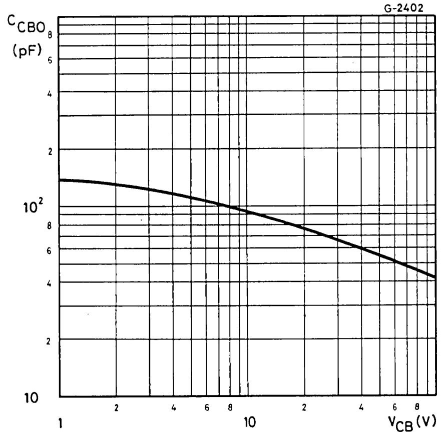
Collector-emitter saturation voltage



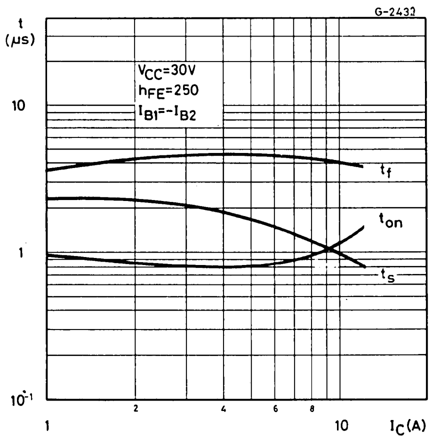
Small signal current gain



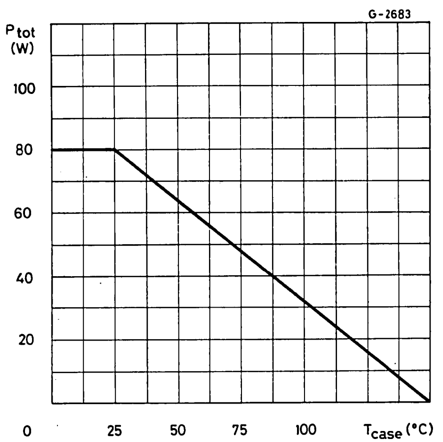
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDW 94
BDW 94A
BDW 94B
BDW 94C

EPITAXIAL-BASE PNP

POWER DARLINGTONS

The BDW 94, BDW 94A, BDW 94B and BDW 94C are silicon epitaxial-base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications. The complementary NPN types are the BDW 93, BDW 93A, BDW 93B and BDW 93C respectively.

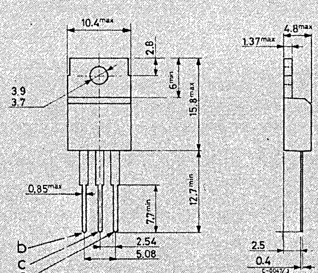
ABSOLUTE MAXIMUM RATINGS

		BDW94	BDW94A	BDW94B	BDW94C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
I_C	Collector current	-12A			
I_{CM}	Collector peak current	-15A			
I_B	Base current	-0.2A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	80W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

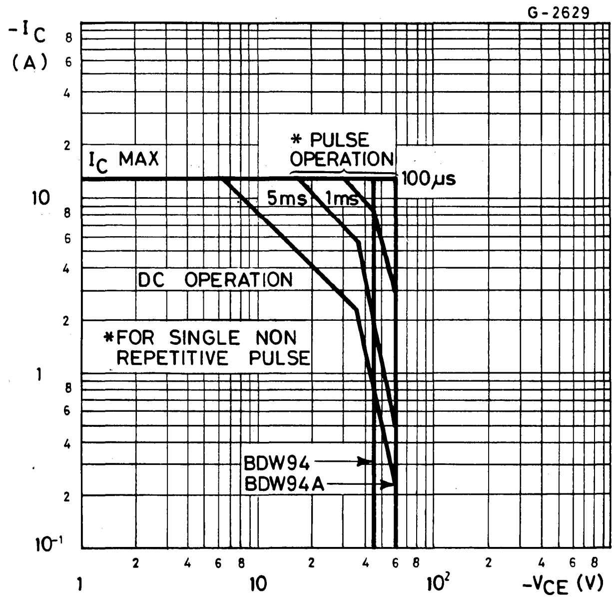
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

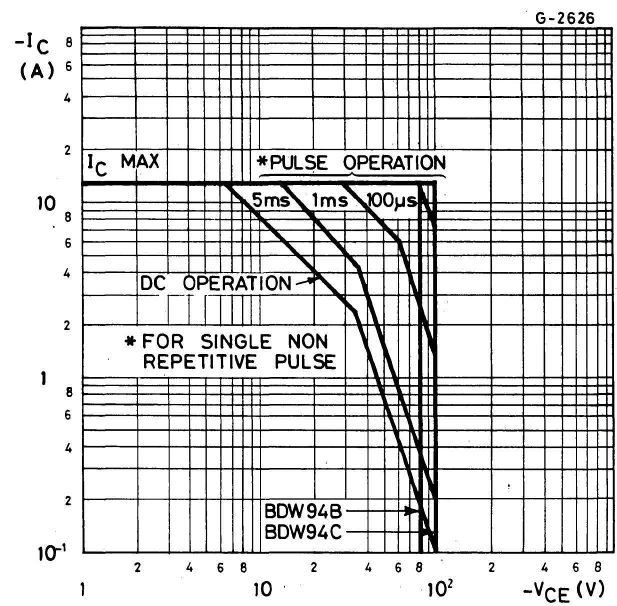
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDW94**	V_{CB} = -45V			-100	μA
		for **BDW94A**	V_{CB} = -60V			-100	μA
		for **BDW94B**	V_{CB} = -80V			-100	μA
		for **BDW94C**	V_{CB} = -100V			-100	μA
		T_{case} = 150°C					
		for **BDW94**	V_{CB} = -45V			-5	mA
		for **BDW94A**	V_{CB} = -60V			-5	mA
		for **BDW94B**	V_{CB} = -80V			-5	mA
		for **BDW94C**	V_{CB} = -100V			-5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDW94**	V_{CE} = -40V			-1	mA
		for **BDW94A**	V_{CE} = -60V			-1	mA
		for **BDW94B**	V_{CE} = -80V			-1	mA
		for **BDW94C**	V_{CE} = -80V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V				-2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA					
		for **BDW94**		-45			V
		for **BDW94A**		-60			V
		for **BDW94B**		-80			V
		for **BDW94C**		-100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -5A	I_B = -20mA			-2	V
		I_C = -10A	I_B = -100mA			-3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -5A	I_B = -20mA			-2.5	V
		I_C = -10A	I_B = -100mA			-4	V
h_{FE}*	DC current gain	I_C = -3A	V_{CE} = -3V	1000			—
		I_C = -5A	V_{CE} = -3V	750		20000	—
		I_C = -10A	V_{CE} = -3V	100			—
V_F*	Parallel-diode forward voltage	I_F = 5A			1.3	2	V
		I_F = 10A			1.8	4	V
h_{fe}	Small signal current gain	I_C = -1A	V_{CE} = -10V				
		f = 1 MHz		20			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

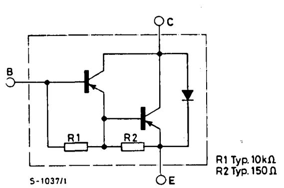
Safe operating areas
(for **BDW94** and **BDW94A**)



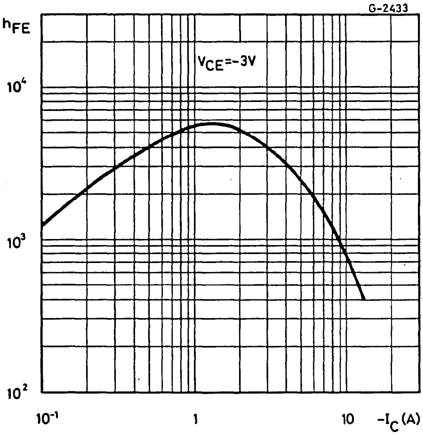
Safe operating areas
(for **BDW94B** and **BDW94C**)



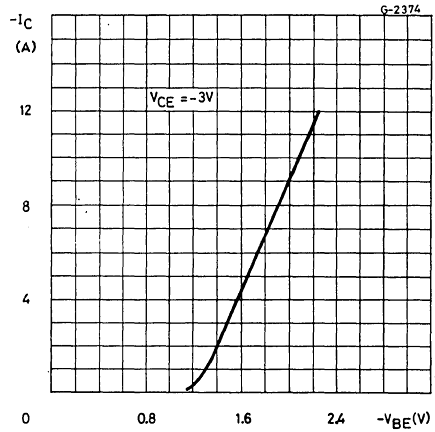
Internal circuit diagram



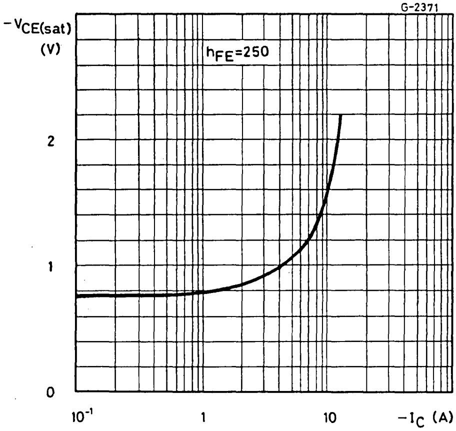
DC current gain



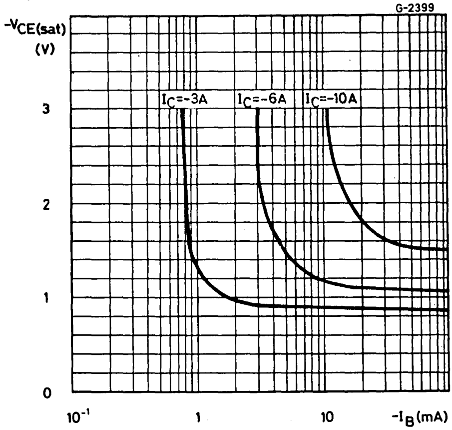
DC transconductance



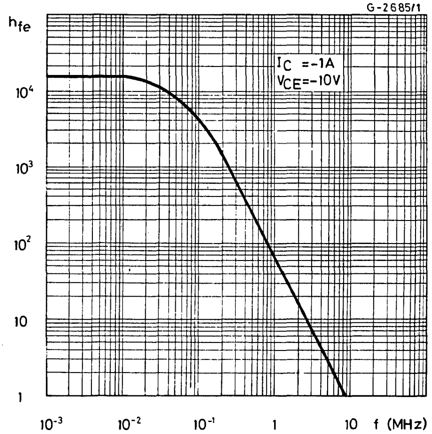
Collector-emitter saturation voltage



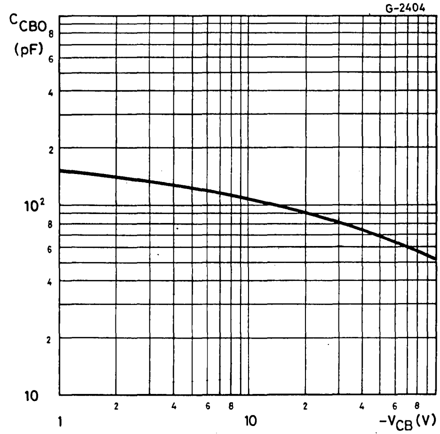
Collector-emitter saturation voltage



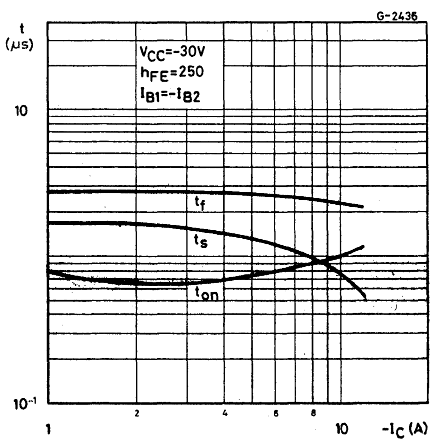
Small signal current gain



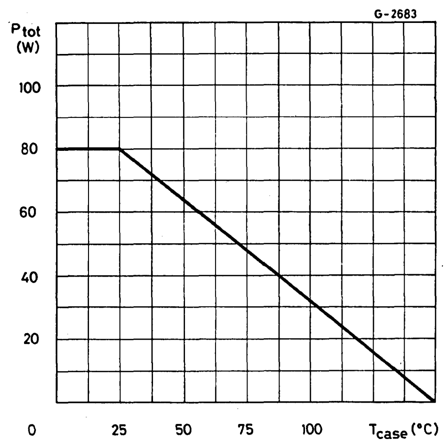
Collector-base capacitance



Saturated switching characteristics



Power rating chart



HOMETAXIAL* NPN

BDX 10 /2N 3055H
BDX 10C/2N 3055C

POWER LINEAR AND SWITCHING APPLICATIONS

The BDX 10/2N 3055H and the BDX 10C/2N 3055C are single diffused «hometaxial*» silicon NPN transistors in Jedec TO-3 metal case. They are useful for power switching circuits, series and shunt regulator output stages and high fidelity amplifiers.
Designed to assure freedom from second breakdown at maximum ratings.

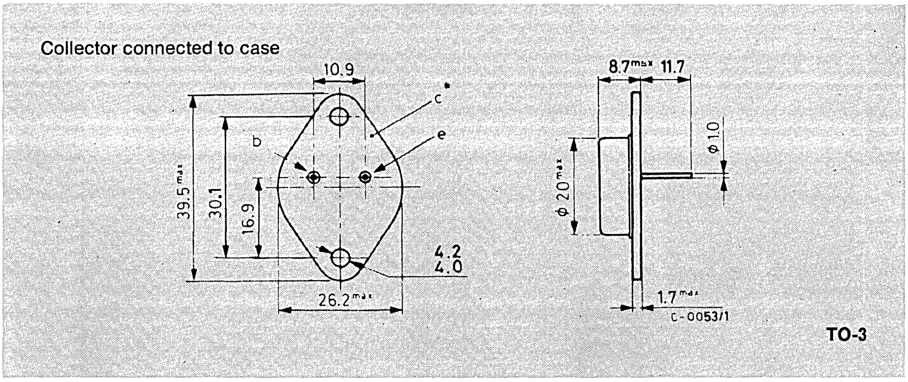
* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

ABSOLUTE MAXIMUM RATINGS

		BDX10C 2N3055C	BDX10 2N3055H
V_{CBO}	Collector-base voltage ($I_E = 0$)	80V	100V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	70V	90V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	—	70V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	15A	
I_B	Base current	7A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	115W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

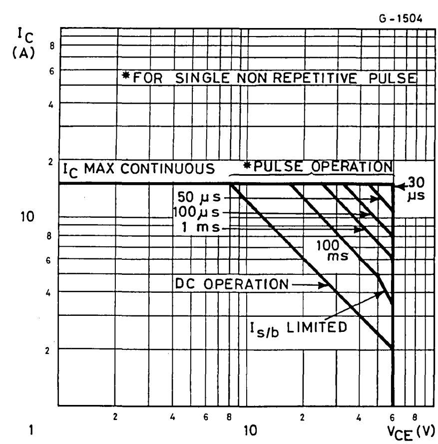
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **BDX10/2N 3055H**				
		V_{CE} = 100V			5	mA
		V_{CE} = 100V T_{case} = 150°C			30	mA
		for **BDX10C/2N 3055C**				
		V_{CE} = 80V			5	mA
		V_{CE} = 80V T_{case} = 150°C			30	mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			1	mA
$V_{CEV\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V)	I_C = 100mA				
		for **BDX10/2N 3055H**	90			V
		for **BDX10C/2N 3055C**	70			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100Ω)	for **BDX10/2N 3055H** I_C = 200mA	70			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA	60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_B = 400mA			1	V
		for **BDX10/2N 3055H**				
		I_C = 10A I_B = 3.3A			3	V
V_{BE}*	Base-emitter voltage	I_C = 4 A V_{CE} = 4 V			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

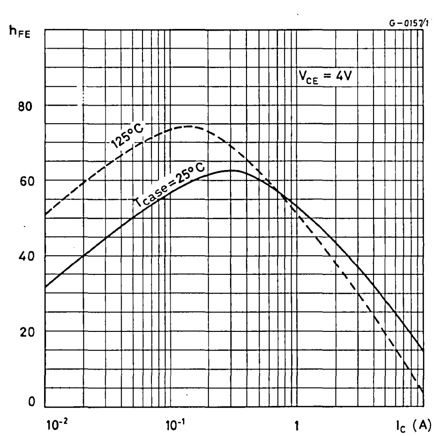
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	for **BDX10/2N 3055H**				
	Gr. 4	I_C = 500mA V_{CE} = 4 V	20		50	—
	Gr. 5	I_C = 500mA V_{CE} = 4 V	35		75	—
	Gr. 6	I_C = 500mA V_{CE} = 4 V	60		145	—
	Gr. 7	I_C = 500mA V_{CE} = 4 V	120		250	—
		I_C = 4 A V_{CE} = 4 V	20		70	—
		I_C = 10 A V_{CE} = 4 V	5			—
		for **BDX10C/2N 3055C**				
		I_C = 500mA V_{CE} = 4 V	20		250	—
		I_C = 2 A V_{CE} = 2 V	20		160	—
		I_C = 4 A V_{CE} = 4 V	12			—
h_{FE1}/h_{FE2}	Matched pair	I_C = 500mA V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	800			kHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 60 V	1.95			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1 s, non repetitive pulse

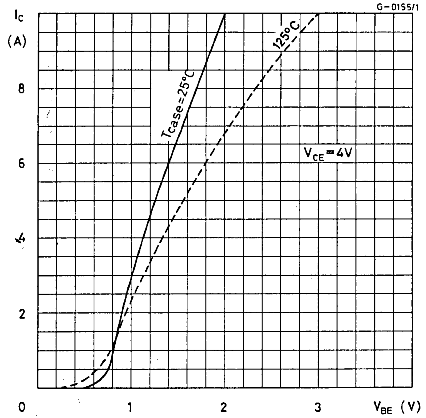
Safe operating areas



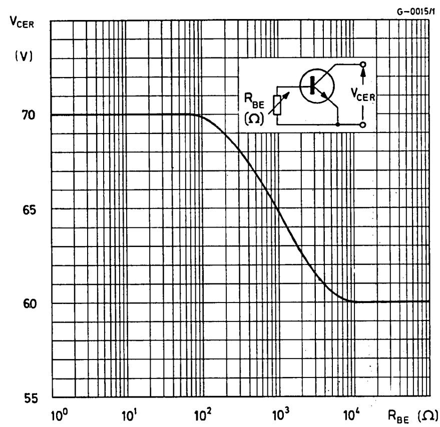
DC current gain



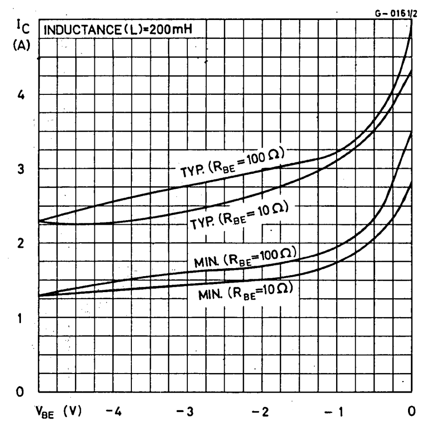
DC transconductance



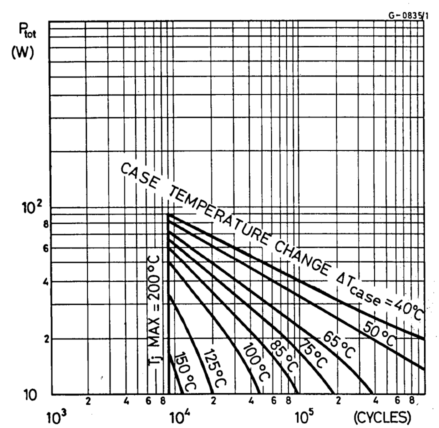
Collector-emitter breakdown voltage



Reverse-bias second breakdown characteristics



Thermal-cycle rating chart



BDX 11 / 2N 3442
BDX 12 / 2N 4347

HOMETAXIAL* NPN

HIGH POWER, HIGH VOLTAGE APPLICATIONS

The BDX11/2N 3442 and BDX12/2N 4347 are high voltage, «hometaxial*» NPN transistors in Jedec TO-3 metal case. They are intended for use as power switches, regulators, dc-dc converters, inverters and audio amplifiers.

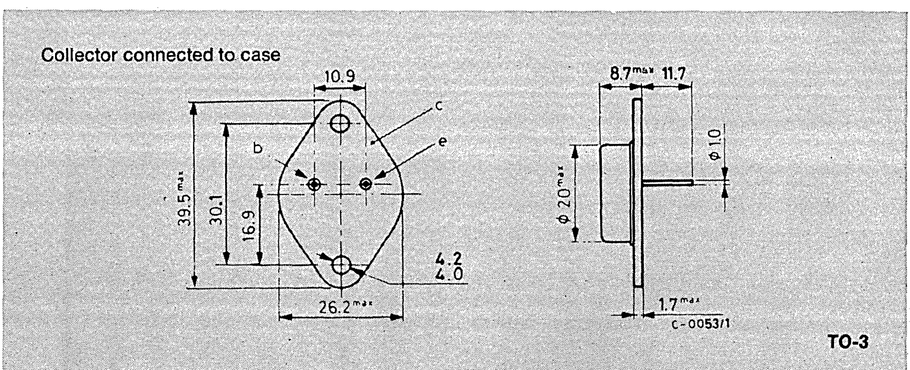
*Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

ABSOLUTE MAXIMUM RATINGS

		BDX 12 2N 4347	BDX 11 2N 3442
V_{CBO}	Collector-base voltage ($I_E = 0$)	140V	160V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	140V	160V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	130V	150V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120V	140V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	10A	
I_{CM}	Collector peak current (repetitive)	15A	
I_B	Base current	7A	
P_{tot}	Total power dissipation $T_{case} \leq 25°C$ for **BDX11/2N3442**	117W	
	for **BDX12/2N4347**	100W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	**BDX11/2N 3442**	max	1.5	°C/W
		BDX12/2N 4347	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

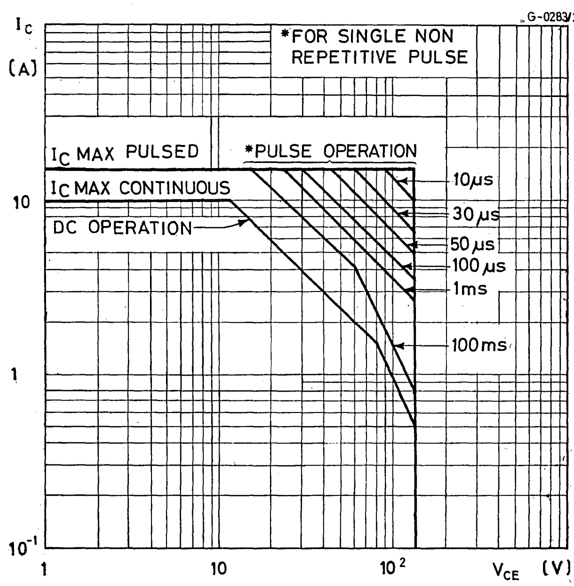
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0) (for **BDX11/2N 3442**)	V_{CB} = 140 V			1	mA
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **BDX11/2N 3442**				
		V_{CE} = 140 V			1	mA
		V_{CE} = 140 V T_{case} = 150°C			10	mA
		for **BDX12/2N 4347**				
		V_{CE} = 120 V			2	mA
		V_{CE} = 120 V T_{case} = 150°C			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CEV\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V)	I_C = 100mA				
		for **BDX11/2N 3442**	160			V
		for **BDX12/2N 4347**	140			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100 Ω)	I_C = 100mA				
		for **BDX11/2N 3442**	150			V
		for **BDX12/2N 4347**	130			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA				
		for **BDX11/2N 3442**	140			V
		for **BDX12/2N 4347**	120			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BDX11/2N 3442**				
		I_C = 3 A I_B = 0.3 A			1	V
		for **BDX12/2N 4347**				
		I_C = 2 A I_B = 0.2 A			1	V
V_{BE}*	Base-emitter voltage	for **BDX11/2N 3442**				
		I_C = 3 A V_{CE} = 4 V			1.7	V
		for **BDX12/2N 4347**				
		I_C = 2 A V_{CE} = 4 V			2	V

ELECTRICAL CHARACTERISTICS (continued)

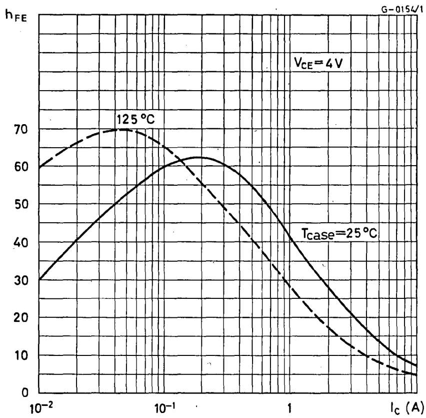
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	for **BDX11/2N 3442**				
	Gr. 4	I_C = 0.5 A V_{CE} = 4 V	20		50	—
	Gr. 5	I_C = 0.5 A V_{CE} = 4 V	35		75	—
	Gr. 6	I_C = 0.5 A V_{CE} = 4 V	60		145	—
	Gr. 7	I_C = 0.5 A V_{CE} = 4 V	120		250	—
		I_C = 3 A V_{CE} = 4 V	20		70	—
		for **BDX12/2N 4347**				
		I_C = 2 A V_{CE} = 4 V	20		70	—
h_{FE1}/h_{FE2}*	Matched pair (for **BDX11/2N 3442**)	I_C = 0.5 A V_{CE} = 4 V			1.6	—
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 78 V **BDX11/2N 3442**	1.5			A
		V_{CE} = 67 V **BDX12/2N 4347**	1.5			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5 %
** Pulsed: 1s, non repetitive pulse

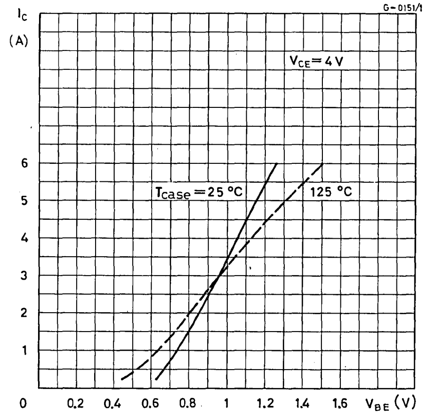
Safe operating areas
(for **BDX11/2N 3442** only)



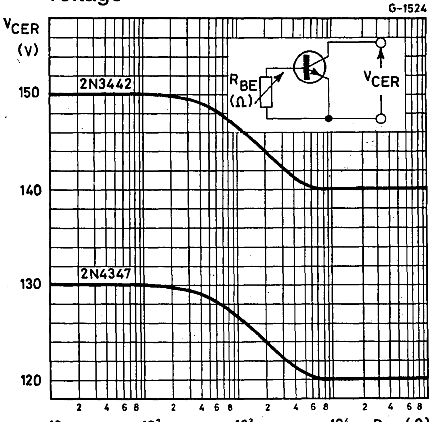
DC current gain



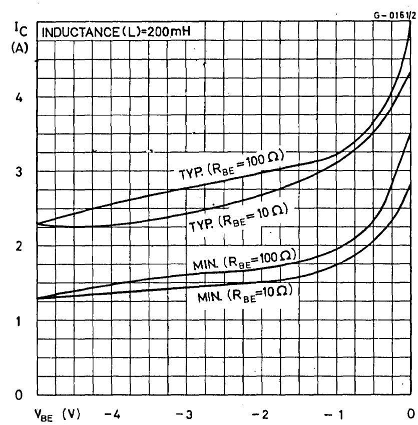
DC transconductance



Collector-emitter breakdown voltage



Reverse-bias second breakdown characteristics



BDX 13
40251

HOMETAXIAL* NPN

HIGH CURRENT POWER APPLICATIONS

The BDX 13/40251 is a single diffused «hometaxial» silicon NPN transistor in Jedec TO-3 metal case. It is intended for a wide variety of high power applications **because of very low collector saturation voltage up to 8 A.**

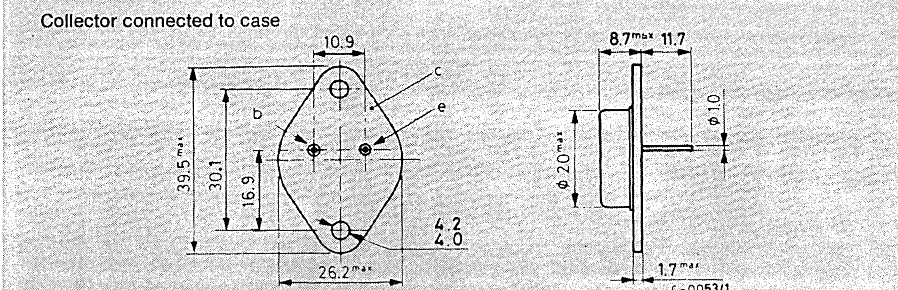
* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	50	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	50	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	117	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



TO-3

6/77

BDX 13
40251

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 40 V V_{CE} = 40 V T_{case} = 150°C			2 10	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			10	mA
$V_{CBO\ (sus)}$*	Collector-base sustaining voltage (I_E = 0)	I_C = 100 mA	50			V
$V_{CEV\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V)	I_C = 100 mA	50			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200 mA	40			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 8 A I_B = 0.8 A			1.5	V
V_{BE}*	Base-emitter voltage	I_C = 8 A V_{CE} = 4 V			2.2	V
h_{FE}*	DC current gain Gr. 4 Gr. 5 Gr. 6 Gr. 7	 I_C = 500mA V_{CE} = 4 V I_C = 500mA V_{CE} = 4 V I_C = 500mA V_{CE} = 4 V I_C = 500mA V_{CE} = 4 V I_C = 8 A V_{CE} = 4 V	 20 35 60 120 15		 50 75 145 250 60	 — — — — —
h_{FE1}/h_{FE2}*	Matched pair	I_C = 500mA V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	0.8			MHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 39 V	3			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

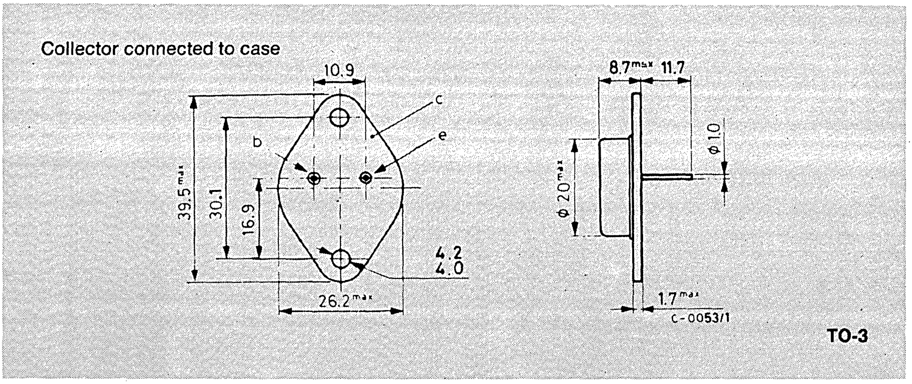
The BDX 18 is a silicon epitaxial-base PNP power transistor in Jedec TO-3 metal case. It is intended for power switching circuits, series and shunt regulators, output stages and hi-fi amplifiers.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-100	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = 1.5$ V)	-90	V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\ \Omega$)	-70	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-7	V
I_C	Collector current	-15	A
I_B	Base current	-7	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	117	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



BDX 18

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = 1.5 V)	V_{CE} = -90 V V_{CE} = -60 V T_{case} = 150°C			-5 -10	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = -30 V			-0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{BE} = 7 V			-5	mA
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = 1.5 V, R_{BE} = 100 Ω)	I_C = -100 mA	-90			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100 Ω)	I_C = -200 mA	-70			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -200 mA	-60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -4 A I_B = -0.4 A			-1.1	V
V_{BE}*	Base-emitter voltage	I_C = -4 A V_{CE} = -4 V			-1.8	V
h_{FE}*	DC current gain	I_C = -4 A V_{CE} = -4 V	20		70	—
f_T	Transition frequency	I_C = -1 A V_{CE} = -10 V	4			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

For characteristic curves see the BDW52 series

EPITAXIAL-BASE NPN

BDX 53
BDX 53A
BDX 53B
BDX 53C

POWER DARLINGTONS

The BDX 53, BDX 53A, BDX 53B and BDX 53C are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package, intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary PNP types are the BDX 54, BDX 54A, BDX 54B and BDX 54C respectively.

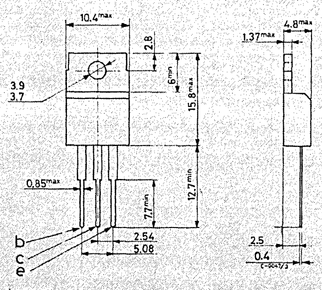
ABSOLUTE MAXIMUM RATINGS

		BDX53	BDX53A	BDX53B	BDX53C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	8A			
I_{CM}	Collector peak current (repetitive)	12A			
I_B	Base current	0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	60W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

BDX 53
BDX 53A
BDX 53B
BDX 53C

THERMAL DATA

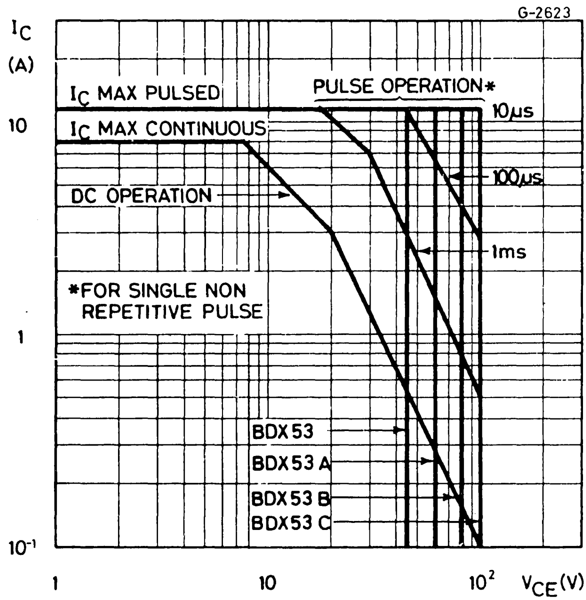
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

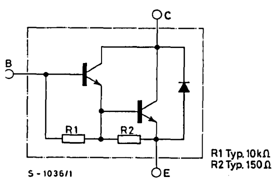
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX53**	V_{CB} = 45V			200	μA
		for **BDX53A**	V_{CB} = 60V			200	μA
		for **BDX53B**	V_{CB} = 80V			200	μA
		for **BDX53C**	V_{CB} = 100V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX53**	V_{CE} = 22V			500	μA
		for **BDX53A**	V_{CE} = 30V			500	μA
		for **BDX53B**	V_{CE} = 40V			500	μA
		for **BDX53C**	V_{CE} = 50V			500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V				2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA					
			for **BDX53**	45			V
			for **BDX53A**	60			V
			for **BDX53B**	80			V
			for **BDX53C**	100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3A	I_B = 12mA			2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 3A	I_B = 12mA			2.5	V
h_{FE}*	DC current gain	I_C = 3A	V_{CE} = 3V	750			—
V_F	Parallel-diode forward voltage	I_F = 3A				1.8	V
		I_F = 8A			2.5		V

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

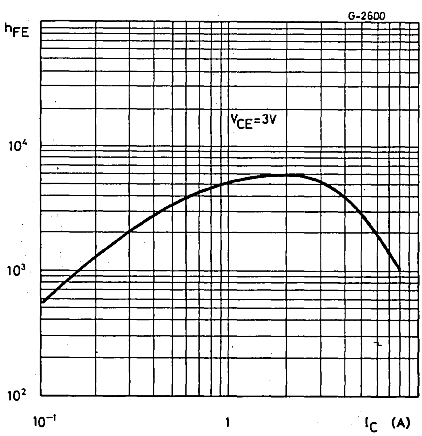
Safe operating areas



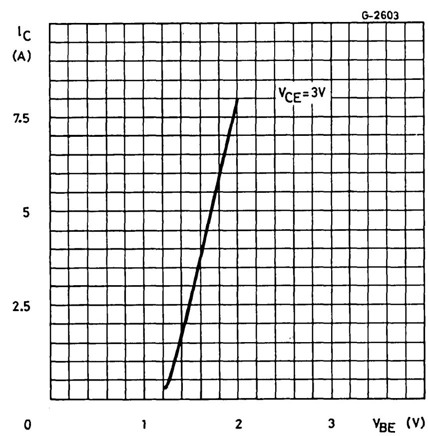
Internal circuit diagram



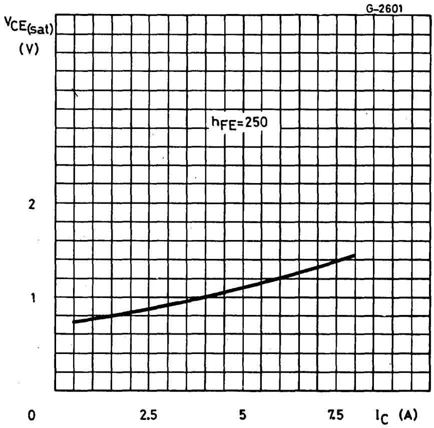
DC current gain



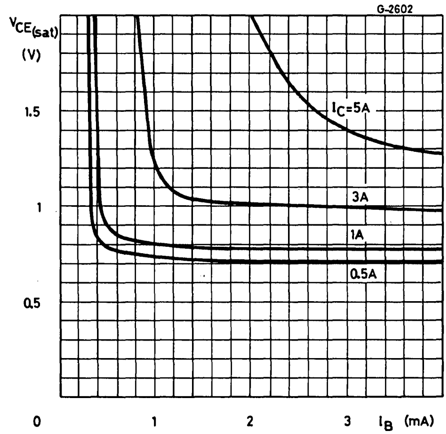
DC transconductance



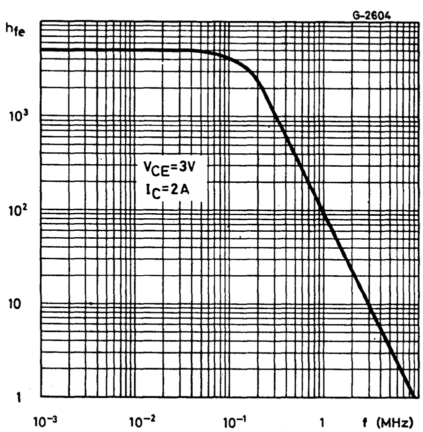
Collector-emitter saturation voltage



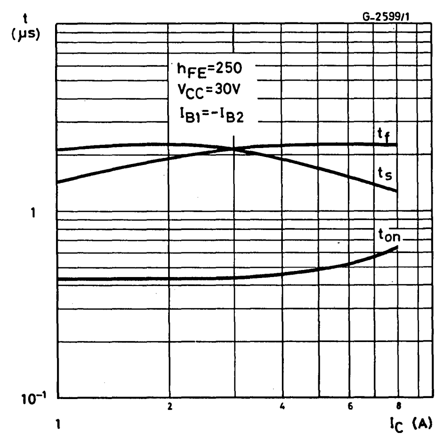
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDX 53E
BDX 53F

PRELIMINARY DATA

POWER DARLINGTONS

The BDX 53E, BDX 53F are silicon epitaxial base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications.
The complementary PNP types are the BDX 54E and BDX 54F respectively.

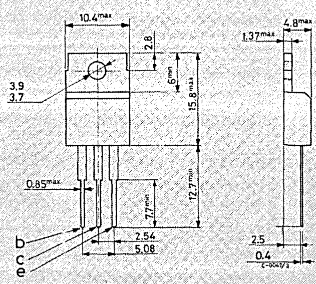
ABSOLUTE MAXIMUM RATINGS

		BDX53E	BDX53F
V_{CBO}	Collector-base voltage ($I_E = 0$)	140V	160V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	140V	160V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	8A	
I_{CM}	Collector peak current	12A	
I_B	Base current	0.2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	60W	
T_{stg}	Storage temperature	-65 to 150°C	
T_j	Junction temperature	150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BDX 53E
BDX 53F

THERMAL DATA

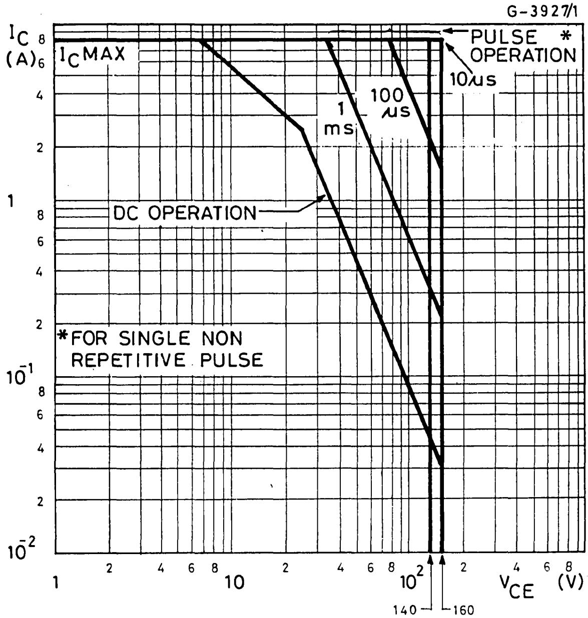
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

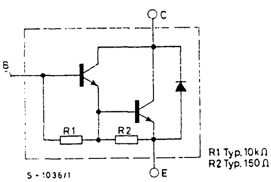
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDX53E** $V_{CE} = 70V$ for **BDX53F** $V_{CE} = 80V$			0.5 0.5	mA mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDX53E** $V_{CB} = 140V$ for **BDX53F** $V_{CB} = 160V$			0.2 0.2	mA mA
I_{EBO}	Emitter cutoff current ($I_E = 0$)	$V_{EB} = 5V$			5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 50\ mA$ for **BDX53E** for **BDX53F**	 140 160			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 2A$ $I_B = 10mA$			2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 2A$ $I_B = 10mA$			2.5	V
h_{FE}*	DC current gain	$I_C = 2A$ $V_{CE} = 5V$ $I_C = 3A$ $V_{CE} = 5V$	500 150			– –
V_F*	Parallel diode forward voltage	$I_F = 2A$			2.5	V
h_{fe}	Small signal currente gain	$I_C = 0.5A$ $V_{CE} = 2V$ $f = 1MHz$		20		–

* Pulsed: pulse duration = 300 µs, duty cycle = 1%

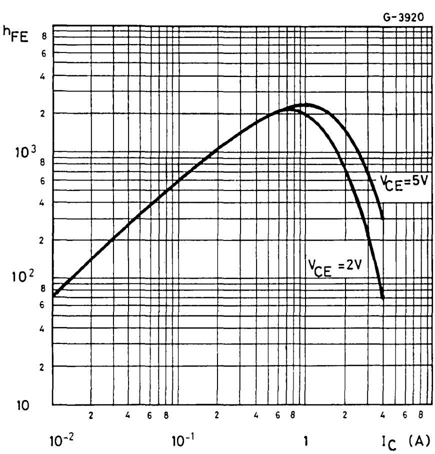
Safe operating areas



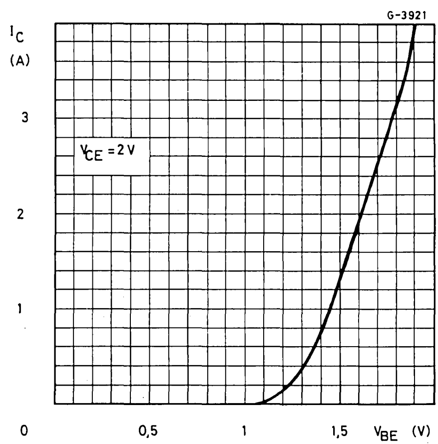
Internal circuit diagram



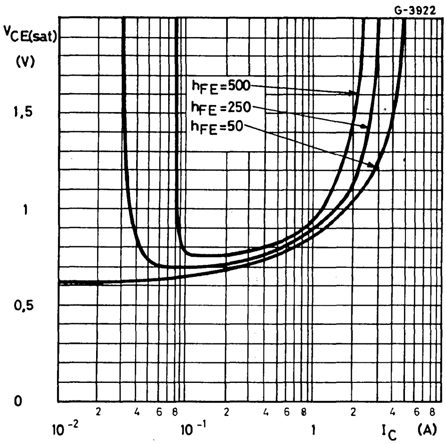
DC current gain



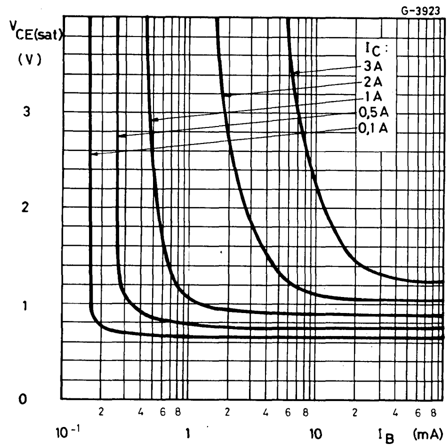
DC transconductance



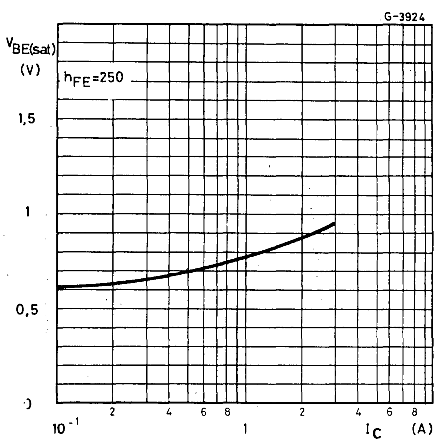
Collector-emitter saturation voltage



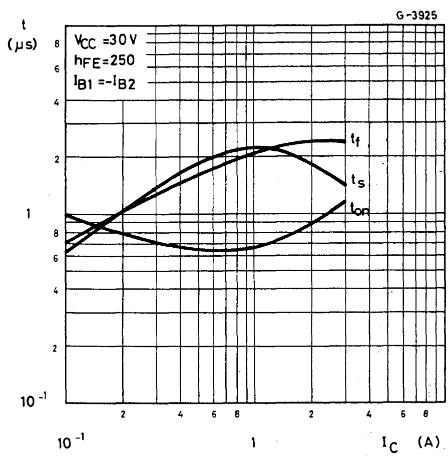
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



BDX 53S

EPITAXIAL-BASE NPN

PRELIMINARY DATA

MEDIUM POWER DARLINGTON

The BDX53S is a silicon epitaxial-base NPN transistor in monolithic Darlington configuration and is mounted in Jedec TO-39 metal case.
It is intended for use in medium in power linear and switching applications.
The complementary PNP type is the BDX54S

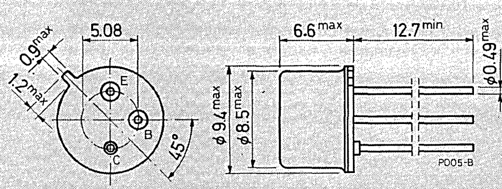
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	150	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	10	A
I_B	Base current	0.2	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	15	W
	$T_{amb} \leq 25°C$	1	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

BDX 53S

THERMAL DATA

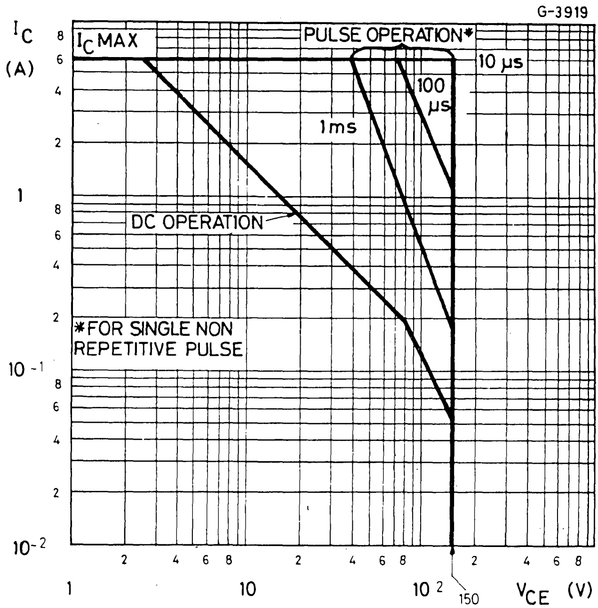
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	11.66	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

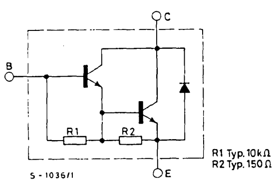
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 150V$ $T_{case} = 125°C$ $V_{CB} = 150V$			0.2 2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 75V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 50\ mA$	150			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 2A$ $I_B = 8mA$			2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 2A$ $I_B = 8mA$			2.5	V
h_{FE}*	DC current gain	$I_C = 100mA$ $V_{CE} = 5V$ $I_C = 2A$ $V_{CE} = 5V$	100 500			— —
V_F*	Parallel diode forward voltage	$I_F = 2A$			2.5	V
h_{fe}	Small signal currente gain	$I_C = 0.5A$ $V_{CE} = 2V$ $f = 1MHz$		20		—

* Pulsed: pulse duration = 300 μs, duty cycle = 1%

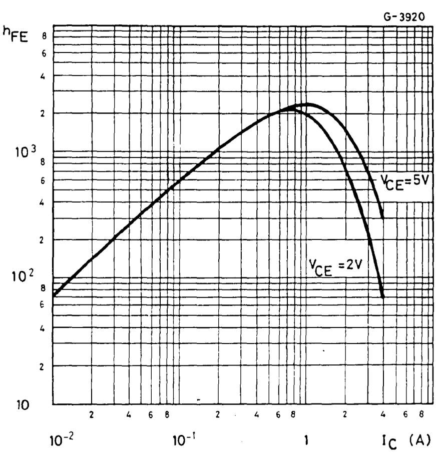
Safe operating area



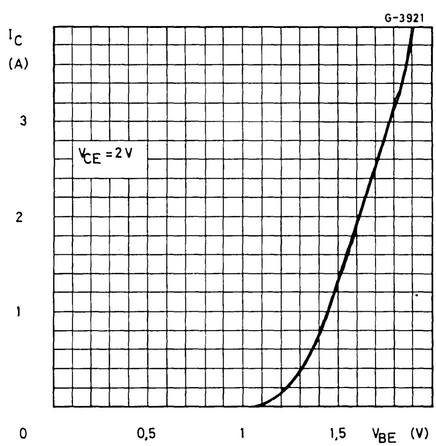
Internal circuit diagram



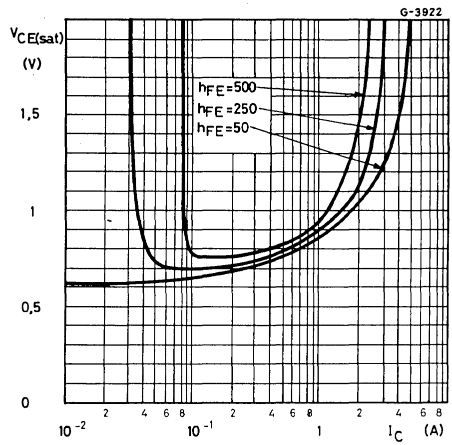
DC current gain



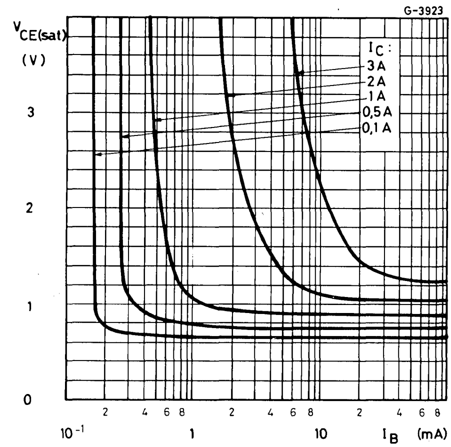
DC transconductance



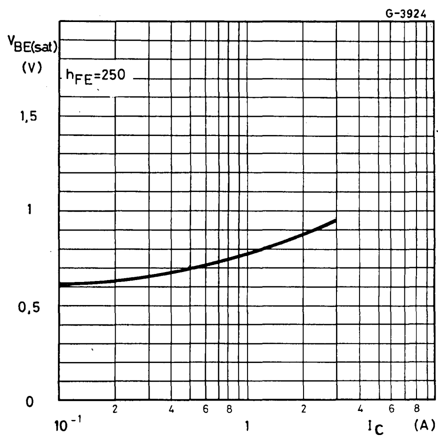
Collector-emitter saturation voltage



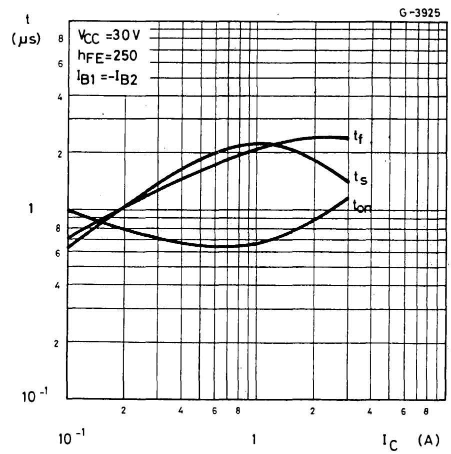
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDX 54
BDX 54A
BDX 54B
BDX 54C

POWER DARLINGTONS

The BDX 54, BDX 54A, BDX 54B and BDX 54C are silicon epitaxial-base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package, intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary NPN types are the BDX 53, BDX 53A, BDX 53B and BDX 53C respectively.

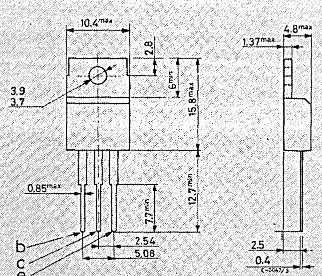
ABSOLUTE MAXIMUM RATINGS

		BDX54	BDX54A	BDX54B	BDX54C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-8A			
I_{CM}	Collector peak current (repetitive)	-12A			
I_B	Base current	-0.2A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	60W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

BDX 54
BDX 54A
BDX 54B
BDX 54C

THERMAL DATA

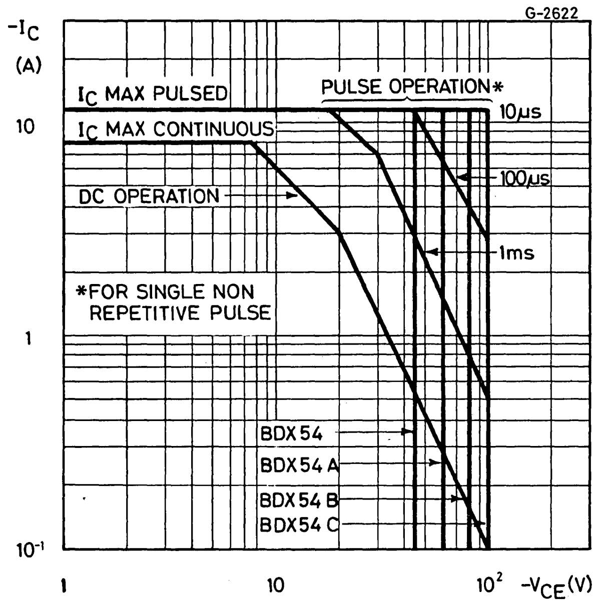
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

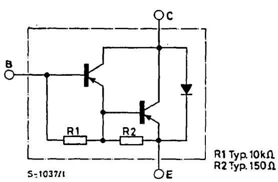
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX54**	V_{CB} = -45V			-200	μA
		for **BDX54A**	V_{CB} = -60V			-200	μA
		for **BDX54B**	V_{CB} = -80V			-200	μA
		for **BDX54C**	V_{CB} = -100V			-200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX54**	V_{CE} = -22V			-500	μA
		for **BDX54A**	V_{CE} = -30V			-500	μA
		for **BDX54B**	V_{CE} = -40V			-500	μA
		for **BDX54C**	V_{CE} = -50V			-500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V				-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA					
			for **BDX54**	-45			V
			for **BDX54A**	-60			V
			for **BDX54B**	-80			V
			for **BDX54C**	-100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -3A	I_B = -12mA			-2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -3A	V_{CE} = -12mA			-2.5	V
h_{FE}*	DC current gain	I_C = -3A	V_{CE} = -3V	750			—
V_F	Parallel-diode forward voltage	I_F = 3A				1.8	V
		I_F = 8A			2.5		V

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

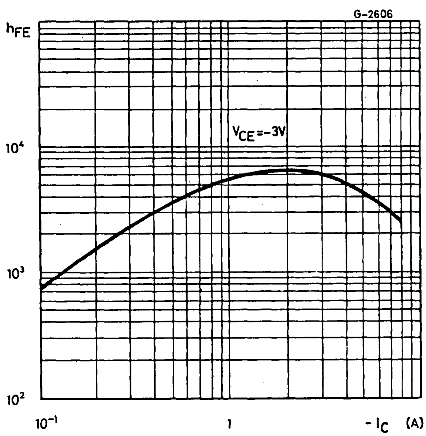
Safe operating areas



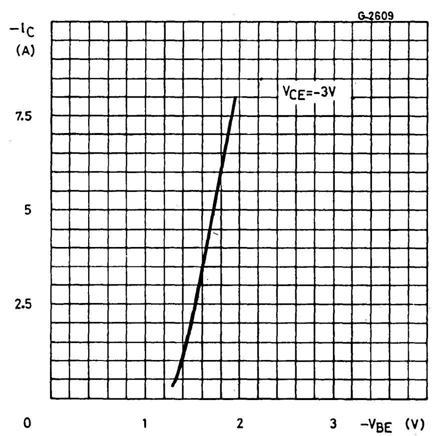
Internal circuit diagram



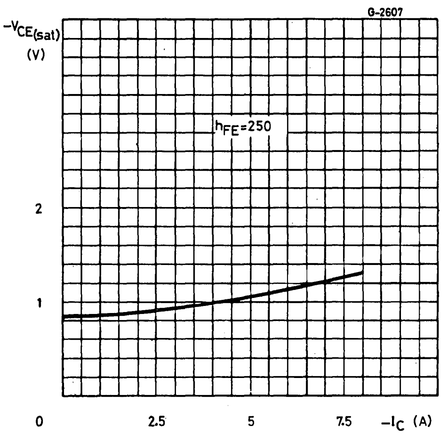
DC current gain



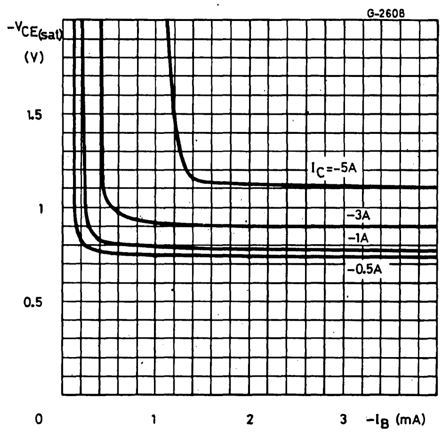
DC transconductance



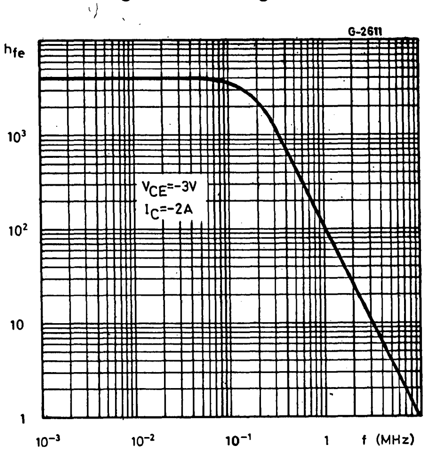
Collector-emitter saturation voltage



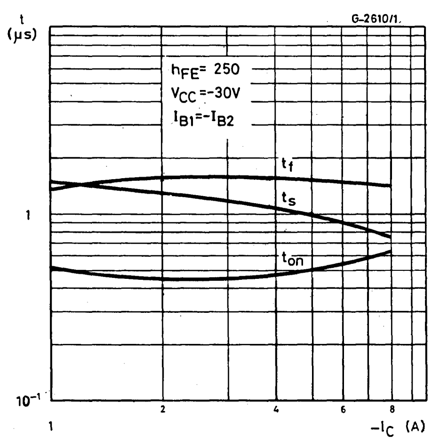
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDX 54E
BDX 54F

PRELIMINARY DATA

POWER DARLINGTONS

The BDX 54E, BDX 54F are silicon epitaxial base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in power linear and switching applications. The complementary NPN types are the BDX 53E and BDX 53F respectively.

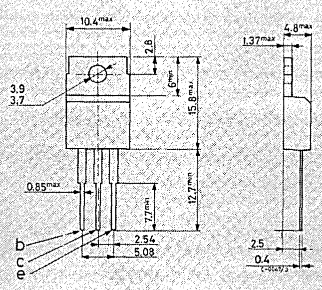
ABSOLUTE MAXIMUM RATINGS

		BDX54E	BDX54F
V_{CBO}	Collector-base voltage ($I_E = 0$)	-140V	-160V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-140V	-160V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-8A	
I_{CM}	Collector peak current	-12A	
I_B	Base current	-0.2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	60W	
T_{stg}	Storage temperature	-65 to 150°C	
T_j	Junction temperature	150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BDX 54E
BDX 54F

THERMAL DATA

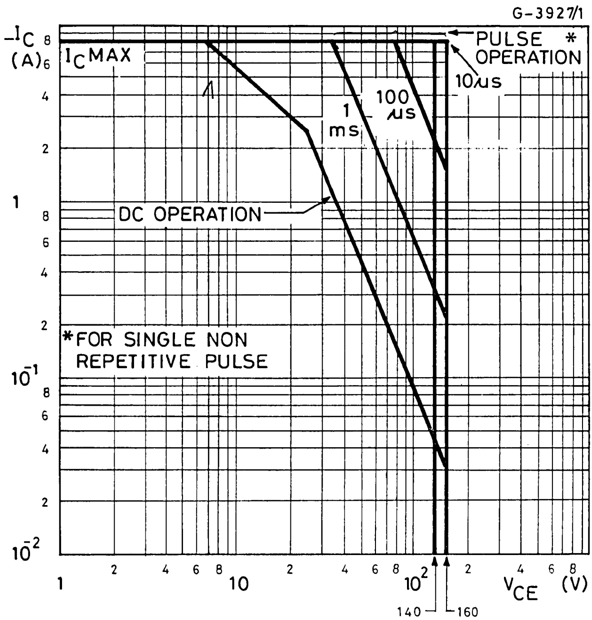
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

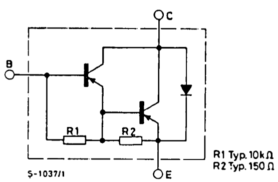
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDX54E** V_{CE} = -70V for **BDX54F** V_{CE} = -80V			-0.5 -0.5	mA mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDX54E** V_{CB} = -140V for **BDX54F** V_{CB} = -160V			-0.2 -0.2	mA mA
I_{EBO}	Emitter cutoff current ($I_E = 0$)	V_{EB} = -5V			-5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -50 mA for **BDX54E** for **BDX54F**	 -140 -160			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_B = -10mA			-2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -2A I_B = -10mA			-2.5	V
h_{FE}*	DC current gain	I_C = -2A V_{CE} = -5V I_C = -3A V_{CE} = -5V	500 150			— —
V_F*	Parallel diode forward voltage	I_F = 2A			-2.5	V
h_{fe}	Small signal currente gain	I_C = -0.5A V_{CE} = -2V f = 1MHz		20		—

* Pulsed: pulse duration = 300 µs, duty cycle = 1%

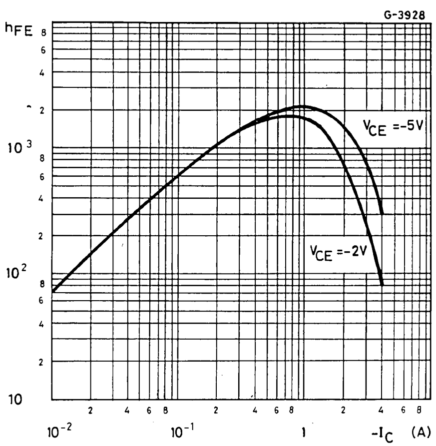
Safe operating areas



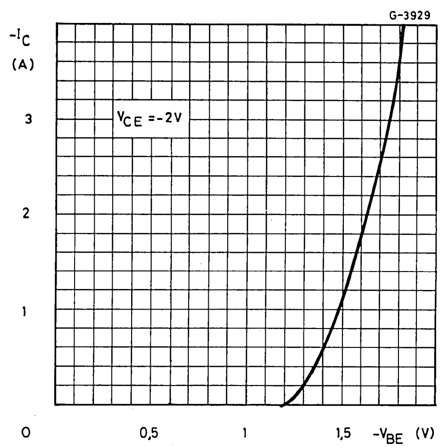
Internal circuit diagram



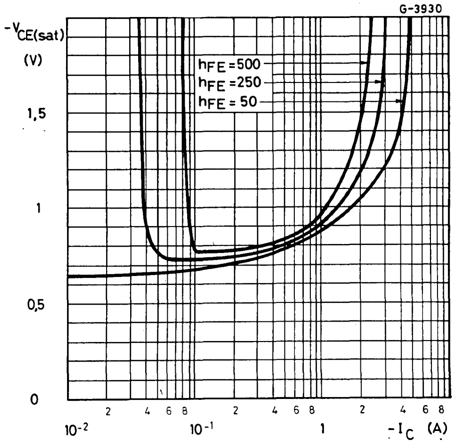
DC current gain



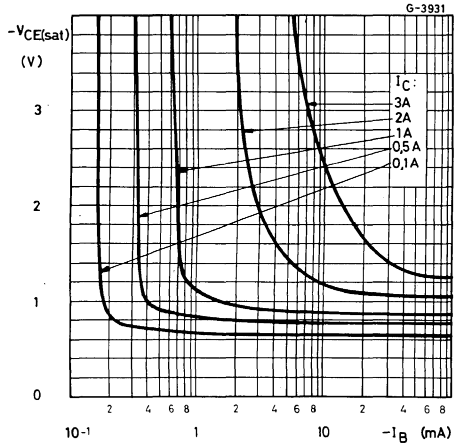
DC transconductance



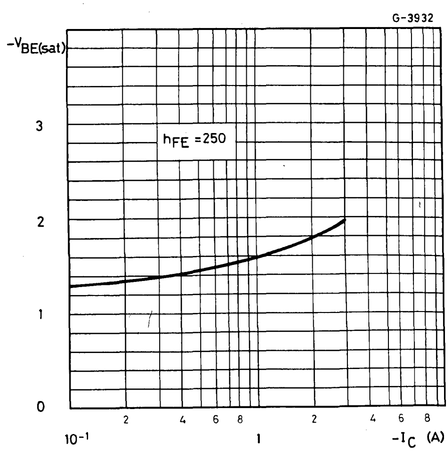
Collector-emitter saturation voltage



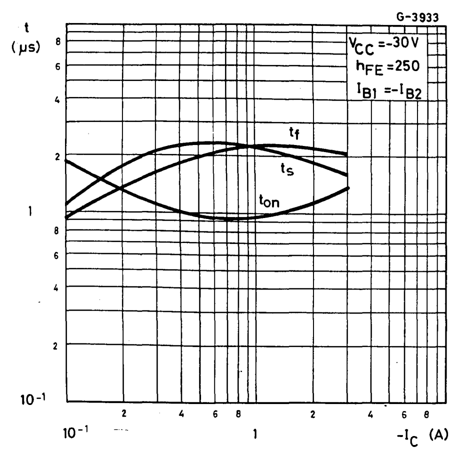
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



BDX 54S

EPITAXIAL-BASE PNP

PRELIMINARY DATA

MEDIUM POWER DARLINGTON

The BDX 54S is a silicon epitaxial-base PNP transistor in monolithic Darlington configuration and is mounted in Jedec TO-39 metal case.
It is intended for use in medium power linear and switching applications.
The complementary NPN type is the BDX 53S.

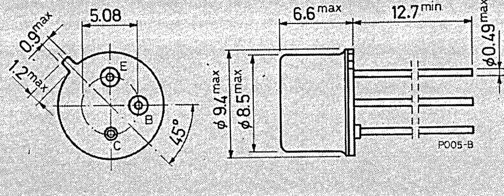
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-150	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5	V
I_C	Collector current	-6	A
I_{CM}	Collector peak current	-10	A
I_B	Base current	-0.2	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	15	W
	$T_{amb} \leq 25°C$	1	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

BDX 54S

THERMAL DATA

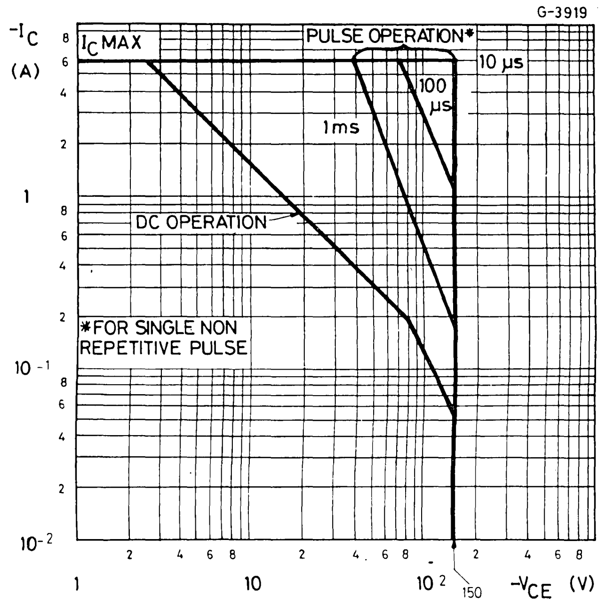
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	11.66	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

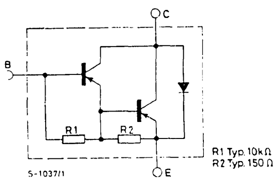
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB}=-150V T_{case}= 125°C V_{CB}=-150V			-0.2 -2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE}=-75V			-0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB}=-5V			-5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C =-50 mA	-150			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =-2A I_B =-8mA			-2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C =-2A I_B =-8mA			-2.5	V
h_{FE}*	DC current gain	I_C =-100mA V_{CE}=-5V I_C =-2A V_{CE}=-5V	100 500			— —
V_F*	Parallel diode forward voltage	I_F =-2A			-2.5	V
h_{fe}	Small signal currente gain	I_C =-0.5A V_{CE}=-2V f = 1MHz		20		—

* Pulsed: pulse duration = 300 µs, duty cycle = 1%

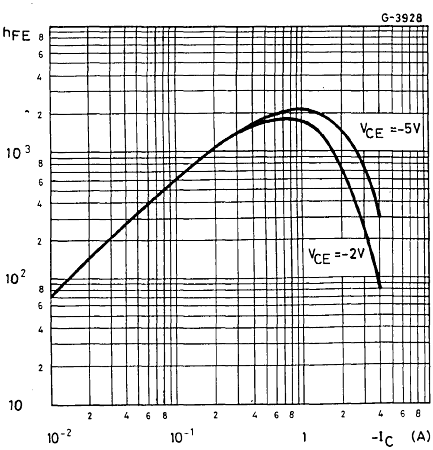
Safe operating area



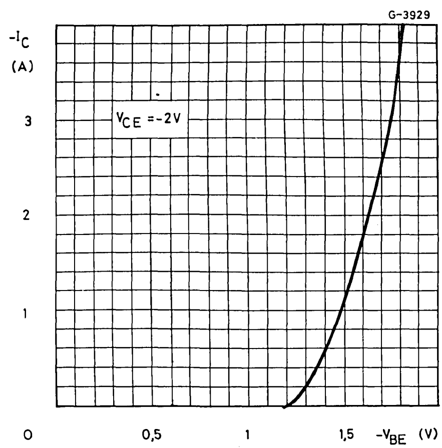
Internal circuit diagram



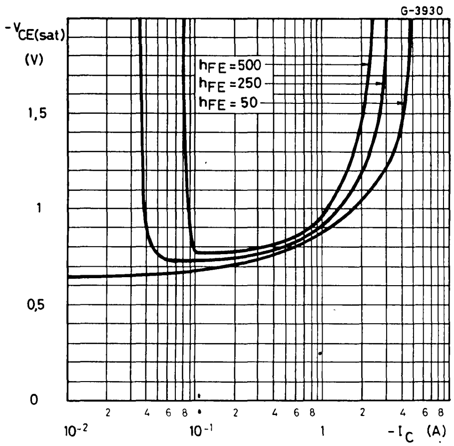
DC current gain



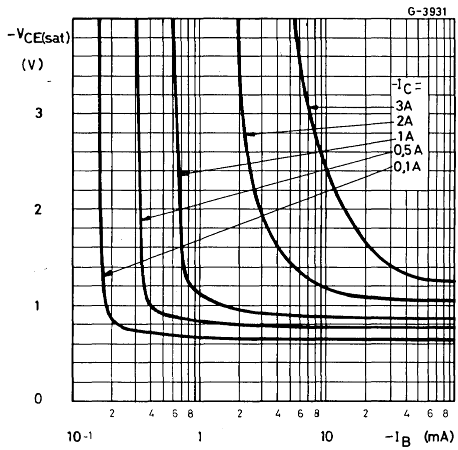
DC transconductance



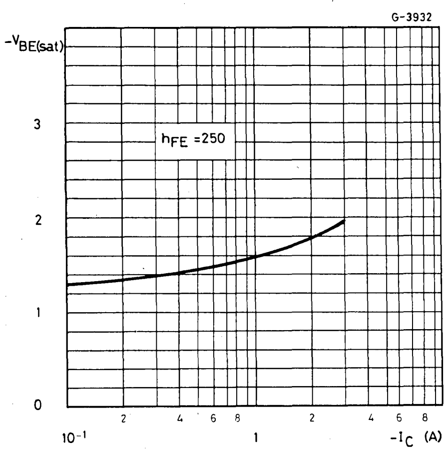
Collector-emitter saturation voltage



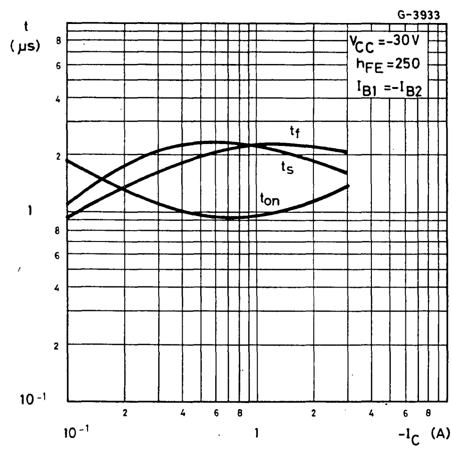
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



HOMETAXIAL* NPN

BDX 60

HIGH CURRENT, HIGH POWER APPLICATIONS

The BDX 60 is a single diffused «hometaxial*» silicon NPN transistor in Jedec TO-3 metal case, with high gain, low saturation voltage at high collector current (up to 15 A) and high breakdown voltage. It is intended for a wide variety of high-power applications. **Designed to assure freedom from second breakdown at maximum ratings.**

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

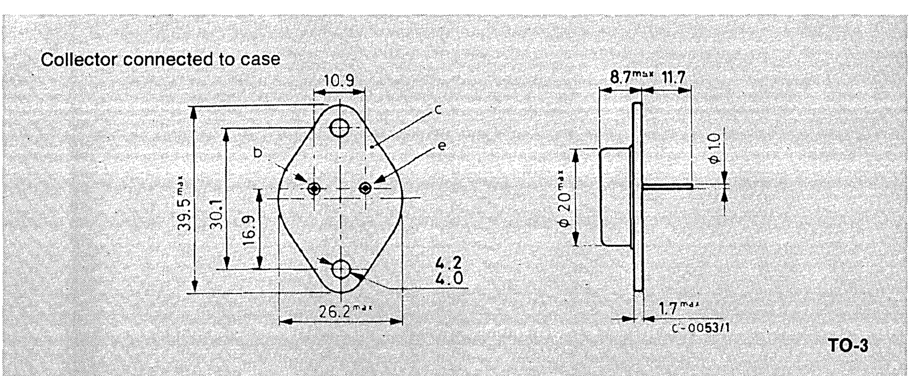
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage (I_E = 0)	100	V
V_{CEV}	Collector-emitter voltage (V_{BE} = -1.5 V)	90	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leqslant 100\ \Omega$)	80	V
V_{CEO}	Collector-emitter voltage (I_B = 0)	70	V
V_{EBO}	Emitter-base voltage (I_C = 0)	7	V
I_C*	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

* The emitter current may reach 30 A peak with collector-base junction short-circuited

MECHANICAL DATA

Dimensions in mm



6/77

BDX 60

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

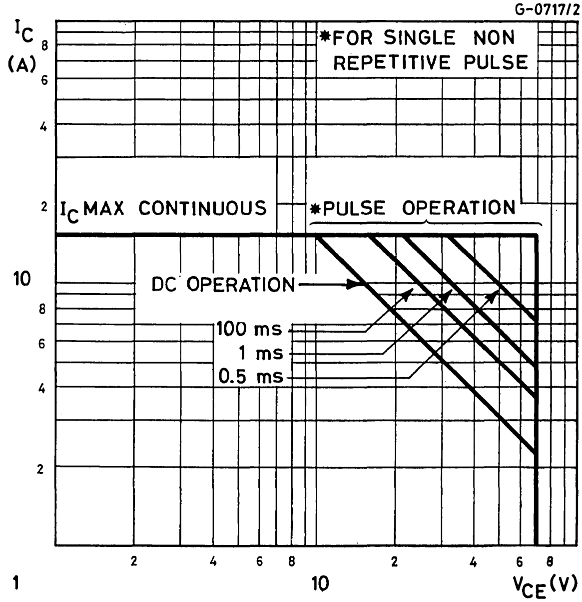
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 100 V				5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V				1	mA
$V_{CEV\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5 V)	I_C = 100 mA		90			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100 Ω)	I_C = 200 mA		80			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200 mA		70			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_C = 8 A I_C = 15 A	I_B = 0.4 A I_B = 1.6 A I_B = 3 A			0.5 1.5 4	V V V
V_{BE}*	Base-emitter voltage	I_C = 4 A	V_{CE} = 4 V			1.2	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 4 A I_C = 8 A I_C = 15 A	I_B = 0.4 A I_B = 1.6 A I_B = 3 A			1.6 3 5.5	V V V
h_{FE}*	DC current gain	I_C = 0.5 A I_C = 5 A I_C = 8 A	V_{CE} = 4 V V_{CE} = 4 V V_{CE} = 4 V	30 20 10		250 70	— — —
h_{FE1}/h_{FE2}	Matched pair	I_C = 0.5 A	V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A	V_{CE} = 4 V	0.8			MHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 70 V		2.14			A

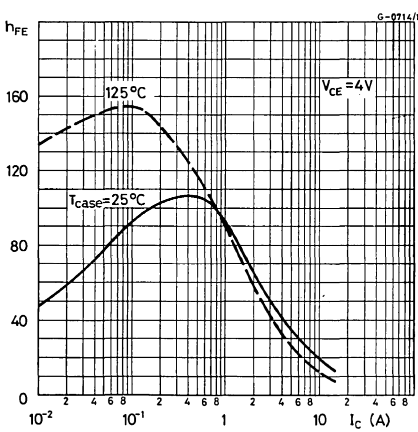
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

** Pulsed: 1s, non repetitive pulse

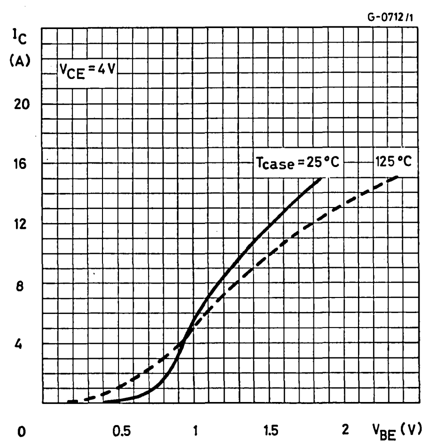
Safe operating areas



DC current gain

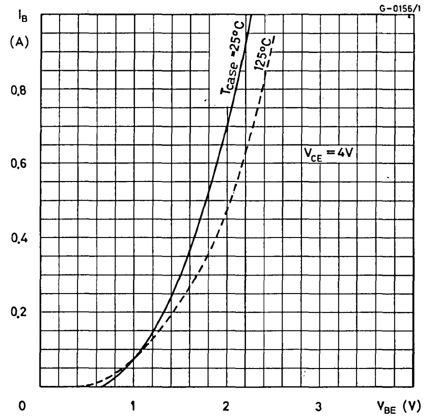


DC transconductance

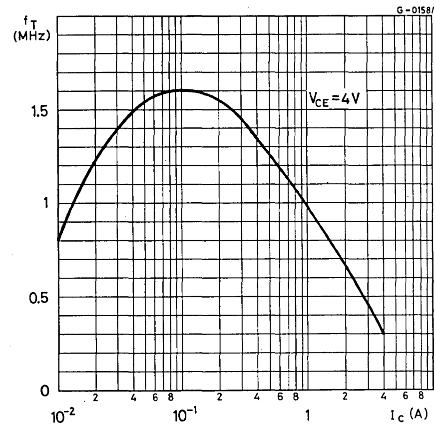


BDX 60

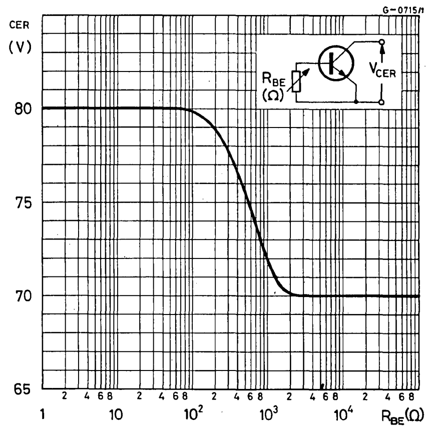
Input characteristics



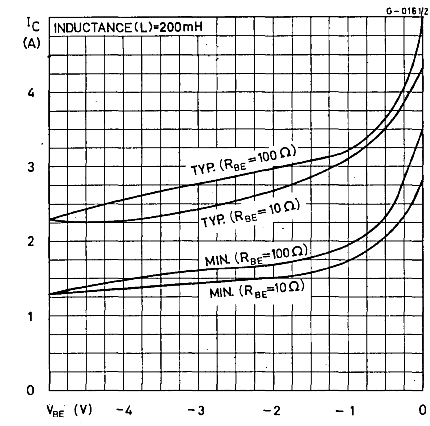
Transition frequency



Collector-emitter breakdown voltage



Reverse-bias second breakdown voltage



SINGLE DIFFUSED NPN

BDX 71
2N 6099

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BDX 71/2N 6099, are single diffused silicon NPN transistors in Jedec TO-220 plastic package. All types are intended for a wide variety of medium power switching and linear applications, such as series and shunt regulators, solenoid drivers, motor-speed controllers and driver and output stages of high-fidelity amplifiers.

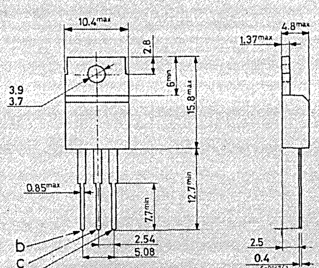
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	70	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\Omega$)	65	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8	V
I_C	Collector current	10	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1.8	W
	$T_{case} \leq 25°C$	75	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BDX 71
2N 6099

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67 °C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70 °C/W

ELECTRICAL CHARACTERISTICS (T_{case}= 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE}=-1.5V)	V_{CE}=65V V_{CE}=65V T_{case}=150°C			2 10	mA mA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=50V			2	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=8V			1	mA
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100Ω)	I_C =200mA	65			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C =200mA	60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =10A I_B =2A			2.5	V
V_{BE}*	Base-emitter voltage	I_C =4A V_{CE}=4V			1.7	V
h_{FE}*	DC current gain	I_C = 4A V_{CE}=4V I_C =10A V_{CE}=4V	20 5		80	– –
h_{fe}	Small signal current gain	I_C =500mA V_{CE}=4V f =1 kHz	15			–

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

EPITAXIAL-BASE NPN

BDX 85
BDX 85A
BDX 85B
BDX 85C

POWER DARLINGTONS

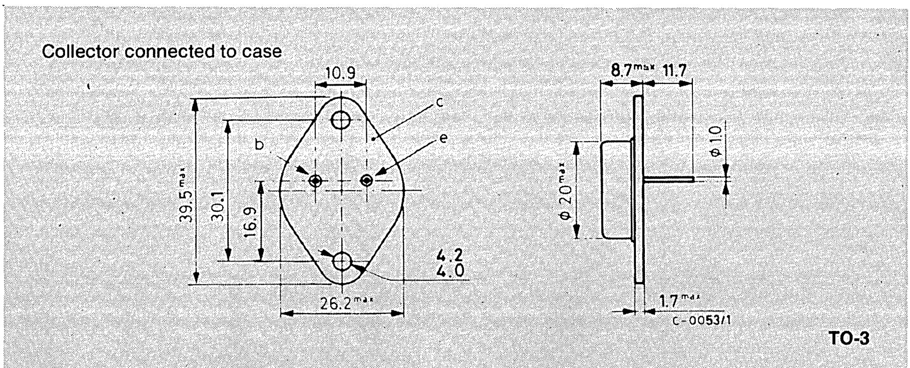
The BDX 85, BDX 85A, BDX 85B and BDX 85C are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the BDX 86, BDX 86A, BDX 86B and BDX 86C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDX85	BDX85A	BDX85B	BDX85C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	10A			
I_{CM}	Collector peak current (repetitive)	15A			
I_B	Base current	0.1A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

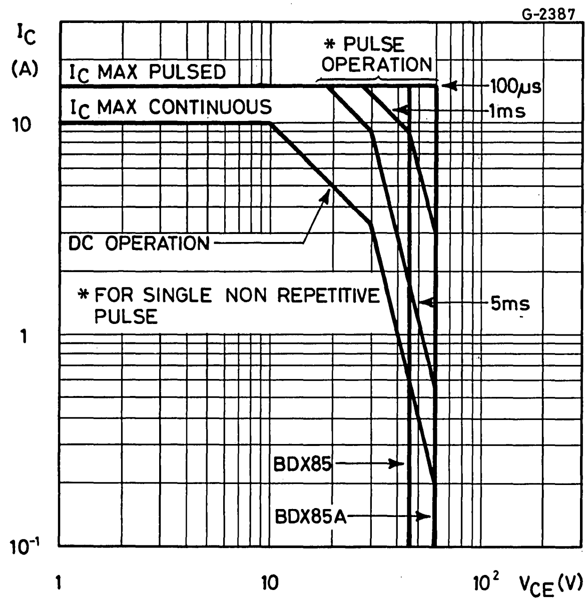
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

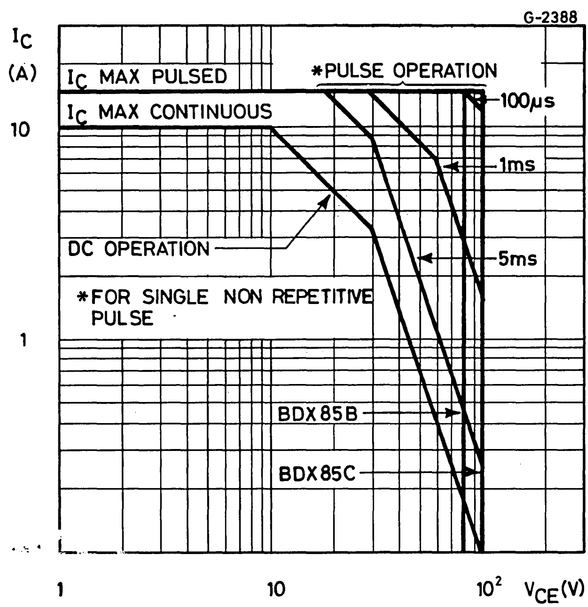
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX85** V_{CB} = 45 V for **BDX85A** V_{CB} = 60 V for **BDX85B** V_{CB} = 80 V for **BDX85C** V_{CB} = 100 V T_{case} = 150°C for **BDX85** V_{CB} = 45 V for **BDX85A** V_{CB} = 60 V for **BDX85B** V_{CB} = 80 V for **BDX85C** V_{CB} = 100 V			500 500 500 500 5 5 5 5	μA μA μA μA mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX85** V_{CE} = 22 V for **BDX85A** V_{CE} = 30 V for **BDX85B** V_{CE} = 40 V for **BDX85C** V_{CE} = 50 V			1 1 1 1	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA for **BDX85** for **BDX85A** for **BDX85B** for **BDX85C**	 45 60 80 100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4A I_B = 16 mA I_C = 8A I_B = 40 mA			2 4	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 8A I_B = 80 mA			4	V
V_{BE}*	Base-emitter voltage	I_C = 4A V_{CE} = 3V			2.8	V
h_{FE}*	DC current gain	I_C = 3A V_{CE} = 3V I_C = 4A V_{CE} = 3V I_C = 8A V_{CE} = 4V	1000 750 200		 18000 	— — —
V_F	Parallel-diode forward voltage	I_F = 3A I_F = 8A		 2.5	1.8 	V V
h_{fe}	Small signal current gain	I_C = 3A V_{CE} = 3V f = 1 MHz		 10		 —

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

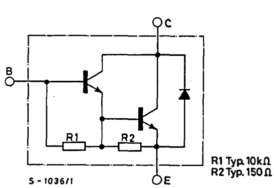
Safe operating areas
(for **BDX85** and **BDX85A**)



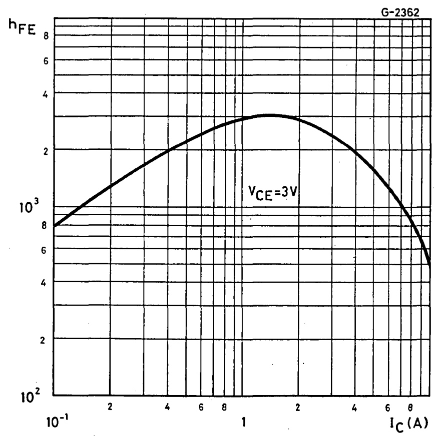
Safe operating areas
(for **BDX85B** and **BDX85C**)



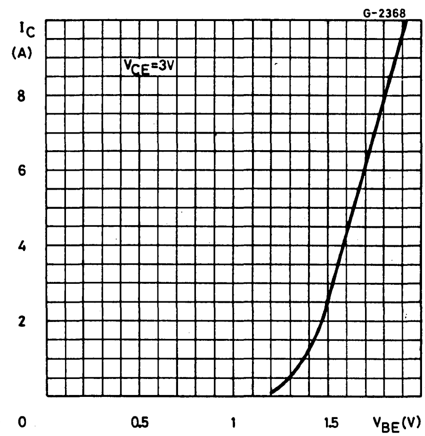
Internal circuit diagram



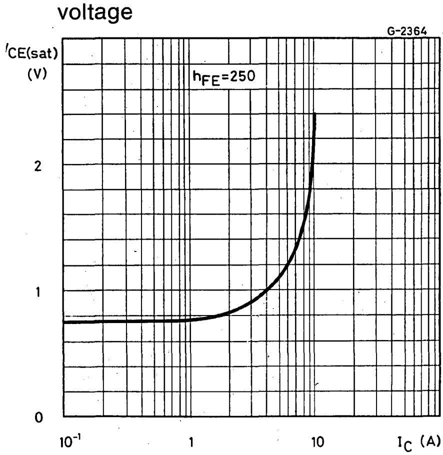
DC current gain



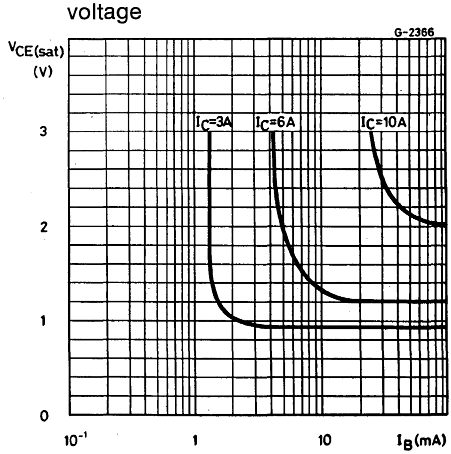
DC transconductance



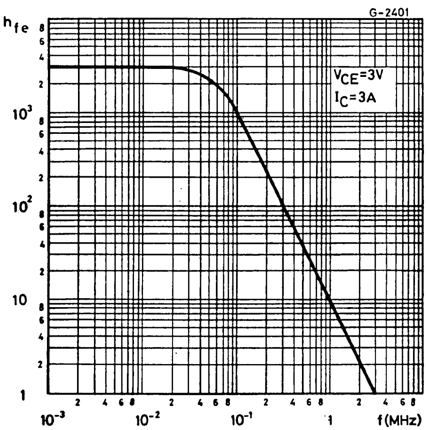
Collector-emitter saturation voltage



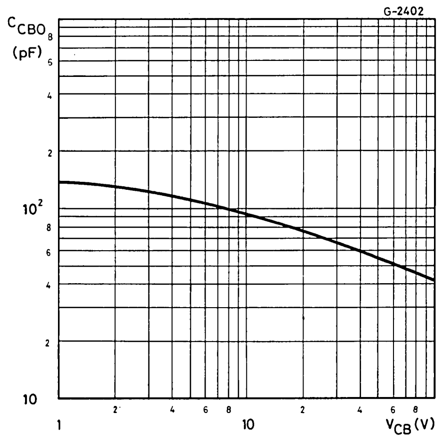
Collector-emitter saturation voltage



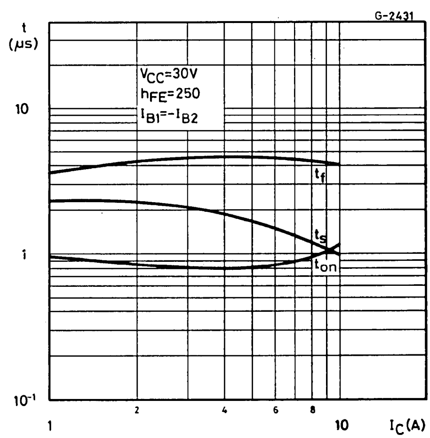
Small signal current gain



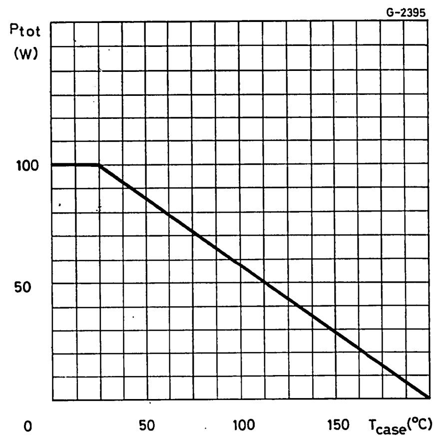
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDX 86
BDX 86A
BDX 86B
BDX 86C

EPITAXIAL-BASE PNP

POWER DARLINGTONS

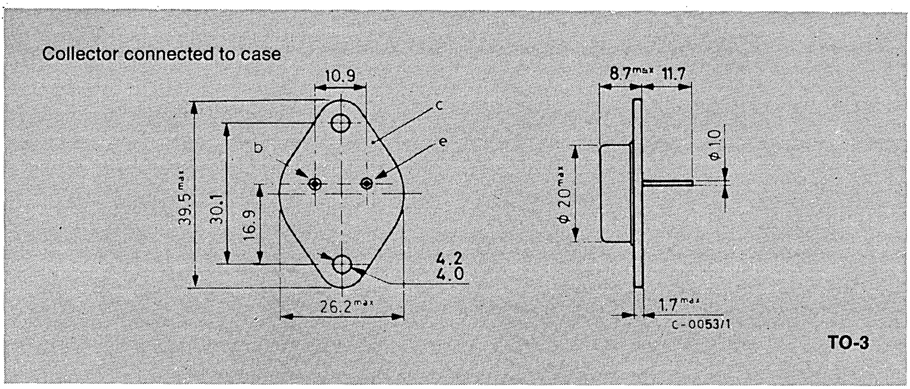
The BDX 86, BDX 86A, BDX 86B and BDX 86C are silicon epitaxial-base PNP power transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the BDX 85, BDX 85A, BDX 85B and BDX 85C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDX86	BDX86A	BDX86B	BDX86C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-10A			
I_{CM}	Collector peak current (repetitive)	-15A			
I_B	Base current	-0.1A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

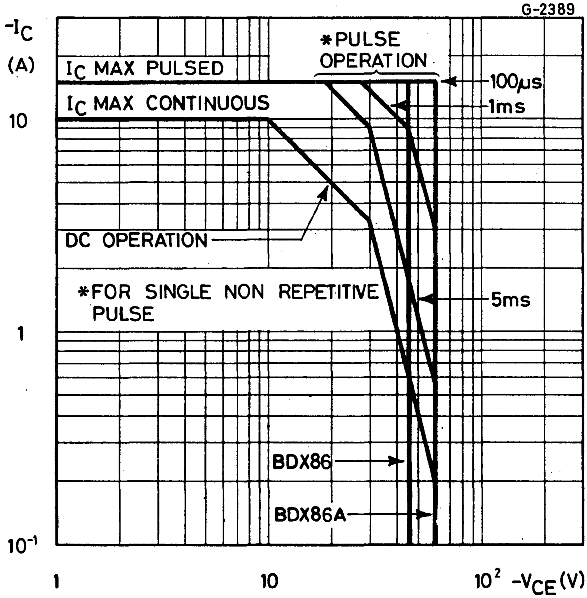
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

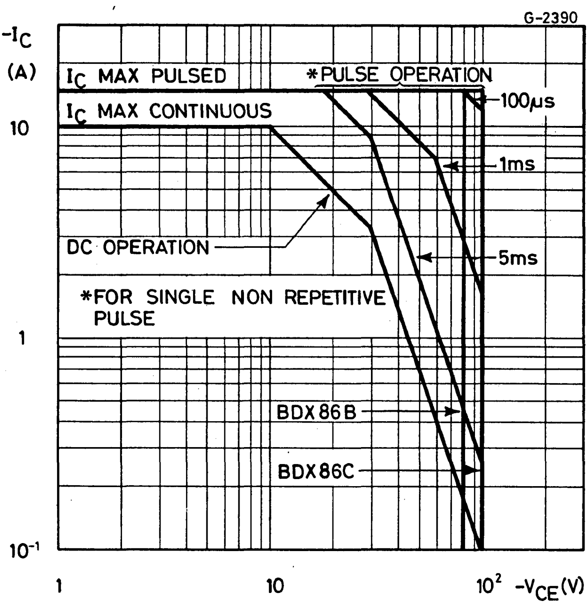
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX86** V_{CB} = -45 V for **BDX86A** V_{CB} = -60 V for **BDX86B** V_{CB} = -80 V for **BDX86C** V_{CB} = -100 V T_{case} = 150°C for **BDX86** V_{CB} = -45 V for **BDX86A** V_{CB} = -60 V for **BDX86B** V_{CB} = -80 V for **BDX86C** V_{CB} = -100 V			-500 -500 -500 -500 -5 -5 -5 -5	μA μA μA μA mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX86** V_{CE} = -22 V for **BDX86A** V_{CE} = -30 V for **BDX86B** V_{CE} = -40 V for **BDX86C** V_{CE} = -50 V			-1 -1 -1 -1	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V			-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA for **BDX86** for **BDX86A** for **BDX86B** for **BDX86C**	 -45 -60 -80 -100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -4A I_B = -16 mA I_C = -8A I_B = -40 mA			-2 -4	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = -8A I_B = -80 mA			-4	V
V_{BE}*	Base-emitter voltage	I_C = -4A V_{CE} = -3V			-2.8	V
h_{FE}*	DC current gain	I_C = -3A V_{CE} = -3V I_C = -4A V_{CE} = -3V I_C = -8A V_{CE} = -4V	1000 750 200		 18000 	— — —
V_F	Parallel-diode forward voltage	I_F = 3A I_F = 8A		 2.5	1.8 	V V
h_{fe}	Small signal current gain	I_C = -3A V_{CE} = -3V f = 1 MHz		 10		 —

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

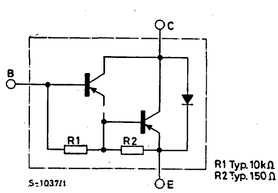
Safe operating areas
(for **BDX86** and **BDX86A**)



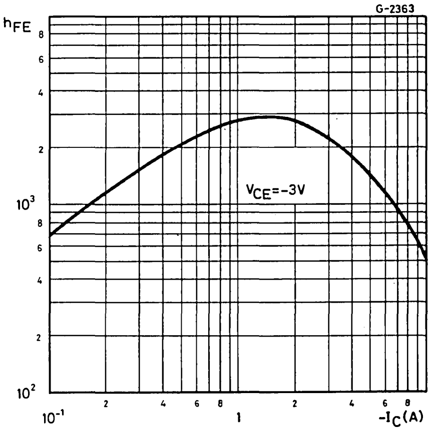
Safe operating areas
(for **BDX86B** and **BDX86C**)



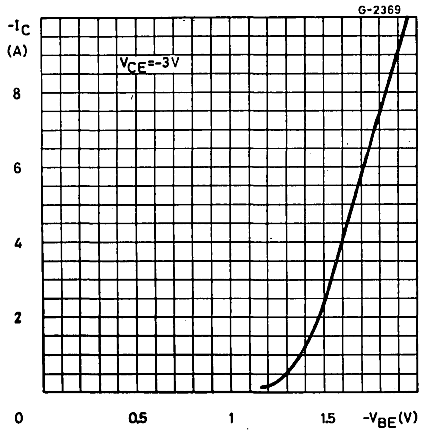
Internal circuit diagram



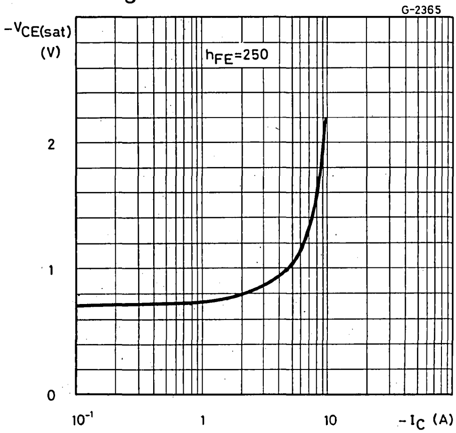
DC current gain



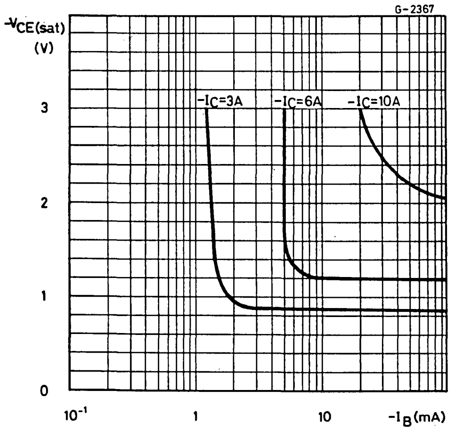
DC transconductance



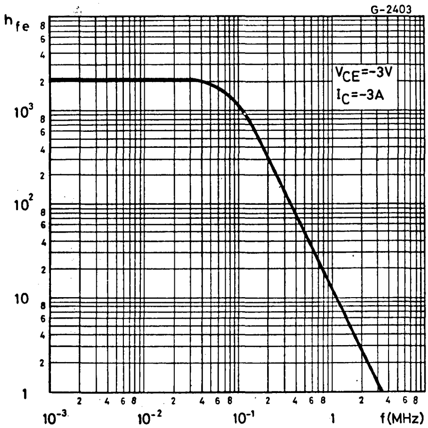
Collector-emitter saturation voltage



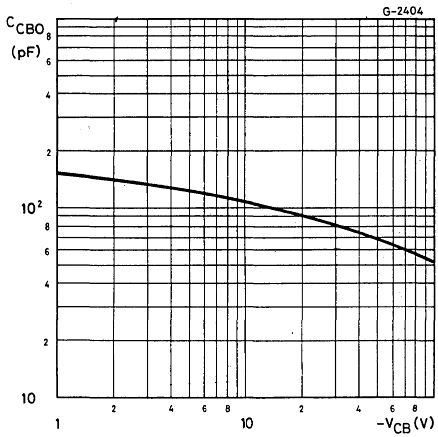
Collector-emitter saturation voltage



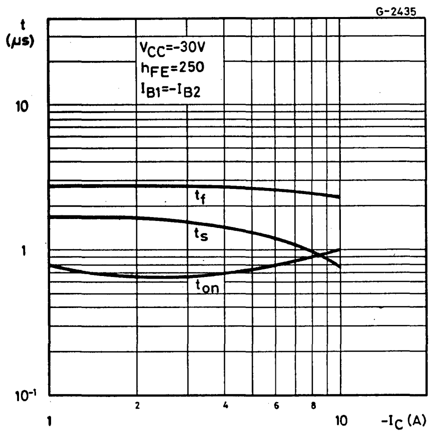
Small signal current gain



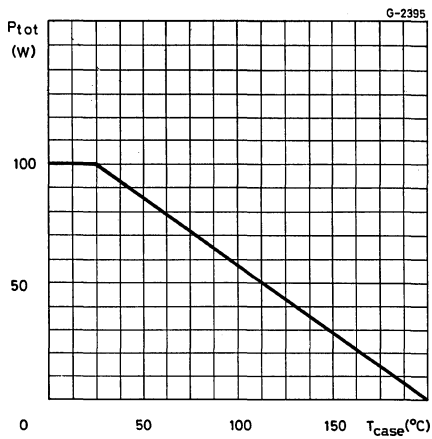
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BDX 87
BDX 87A
BDX 87B
BDX 87C

POWER DARLINGTONS

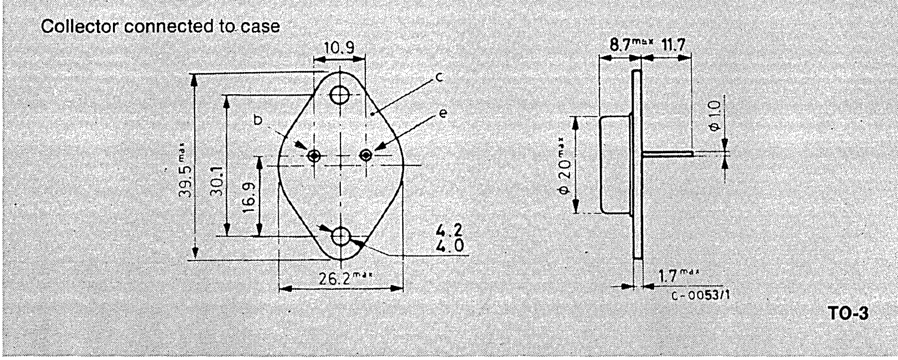
The BDX 87, BDX 87A, BDX 87B and BDX 87C are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the BDX 88, BDX 88A, BDX 88B and BDX 88C respectively.

ABSOLUTE MAXIMUM RATINGS

		BDX87	BDX87A	BDX87B	BDX87C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	12A			
I_{CM}	Collector peak current (repetitive)	18A			
I_B	Base current	0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	120W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm



TO-3

THERMAL DATA

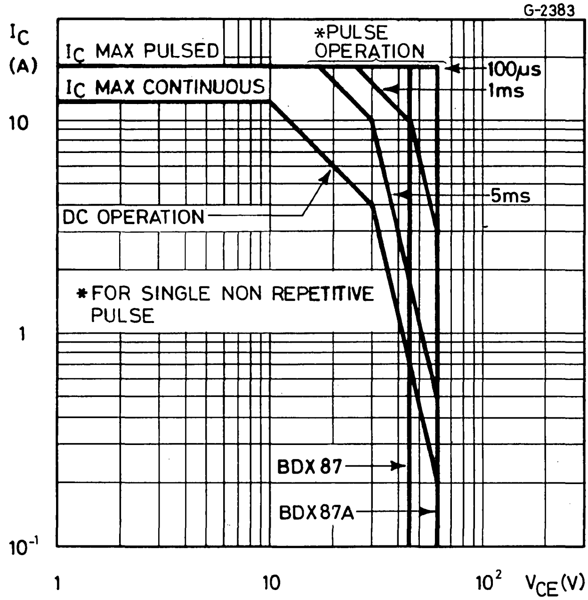
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.45	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

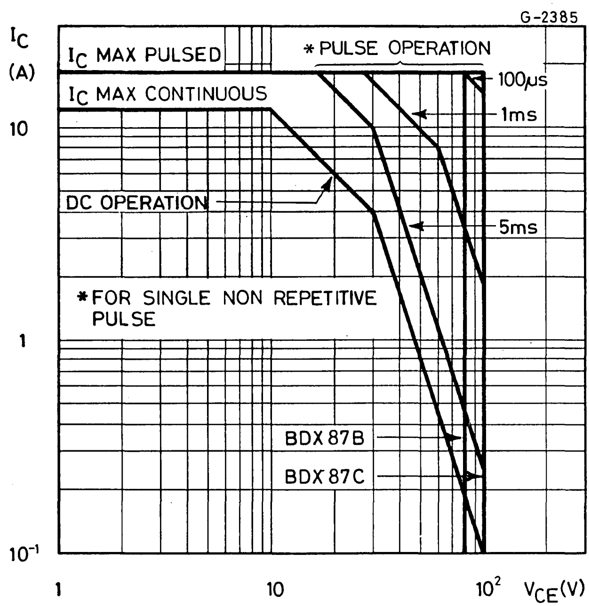
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX87** V_{CB} = 45 V for **BDX87A** V_{CB} = 60 V for **BDX87B** V_{CB} = 80 V for **BDX87C** V_{CB} = 100 V T_{case} = 150°C for **BDX87** V_{CB} = 45 V for **BDX87A** V_{CB} = 60 V for **BDX87B** V_{CB} = 80 V for **BDX87C** V_{CB} = 100 V			500 500 500 500 5 5 5 5	μA μA μA μA mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX87** V_{CE} = 22 V for **BDX87A** V_{CE} = 30 V for **BDX87B** V_{CE} = 40 V for **BDX87C** V_{CE} = 50 V			1 1 1 1	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V			2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA for **BDX87** for **BDX87A** for **BDX87B** for **BDX87C**	 45 60 80 100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 6A I_B = 24 mA I_C = 12A I_B = 120 mA			2 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 12A I_B = 120 mA			4	V
V_{BE}*	Base-emitter voltage	I_C = 6A V_{CE} = 3V			2.8	V
h_{FE}*	DC current gain	I_C = 5A V_{CE} = 3V I_C = 6A V_{CE} = 3V I_C = 12A V_{CE} = 3V	1000 750 100		 18000 	— — —
V_F	Parallel-diode forward voltage	I_F = 3A I_F = 8A		 2.5	1.8 	V V
h_{fe}	Small signal current gain	I_C =5A V_{CE} = 3V f = 1 MHz		 25		—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

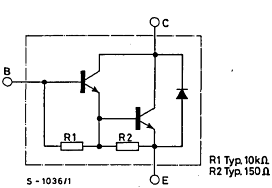
Safe operating areas
(for **BDX87** and **BDX87A**)



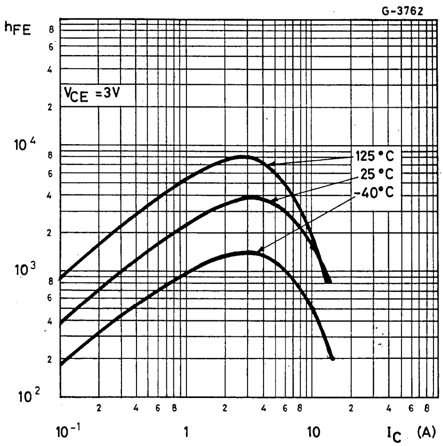
Safe operating areas
(for **BDX87B** and **BDX87C**)



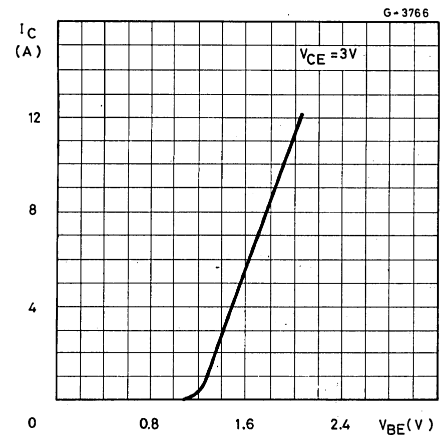
Internal circuit diagram



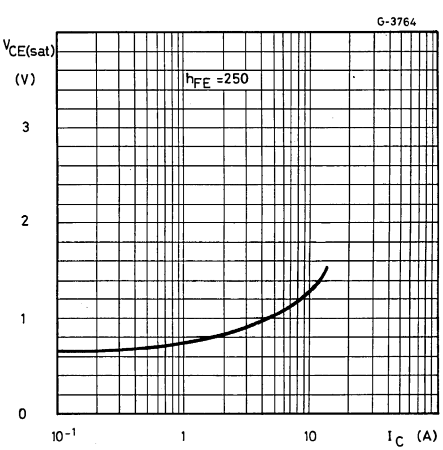
DC current gain



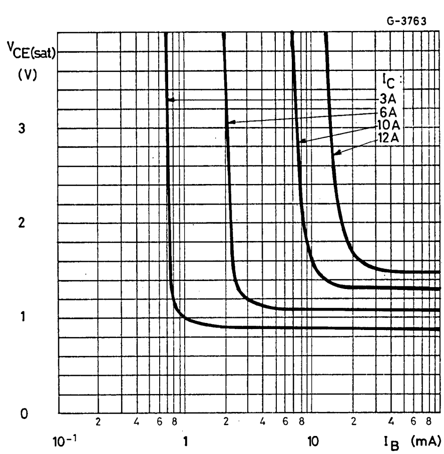
DC transconductance



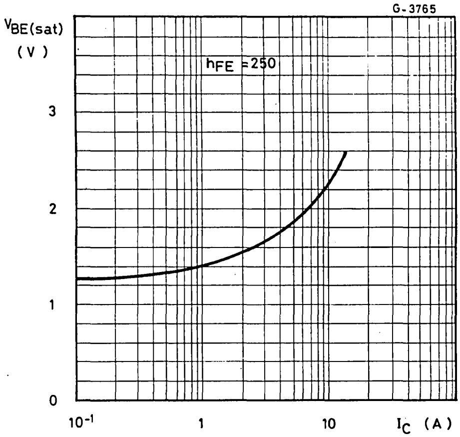
Collector-emitter saturation voltage



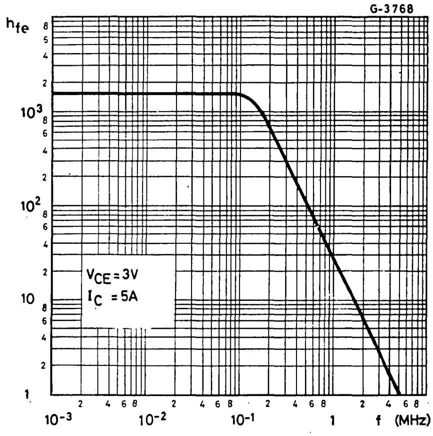
Collector-emitter saturation voltage



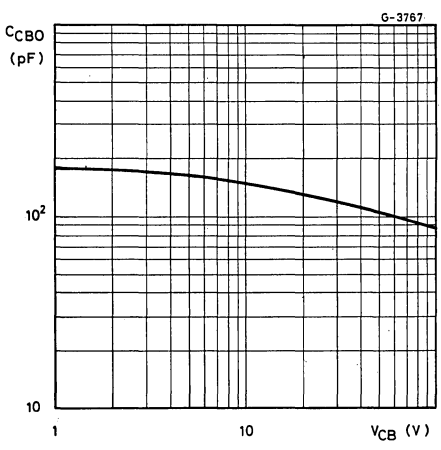
Base-emitter saturation voltage



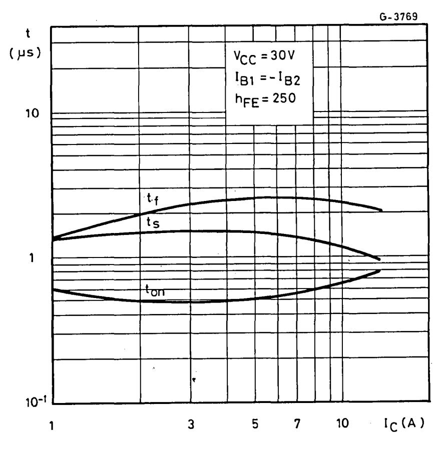
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BDX 88
BDX 88A
BDX 88B
BDX 88C

EPITAXIAL-BASE PNP

POWER DARLINGTONS

The BDX 88, BDX 88A, BDX 88B and BDX 88C are silicon epitaxial-base PNP power transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the BDX 87, BDX 87A, BDX 87B and BDX 87C respectively.

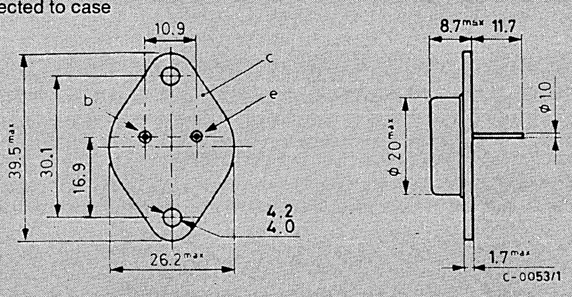
ABSOLUTE MAXIMUM RATINGS

		BDX88	BDX88A	BDX88B	BDX88C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-12A			
I_{CM}	Collector peak current (repetitive)	-18A			
I_B	Base current	-0.2A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	120W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

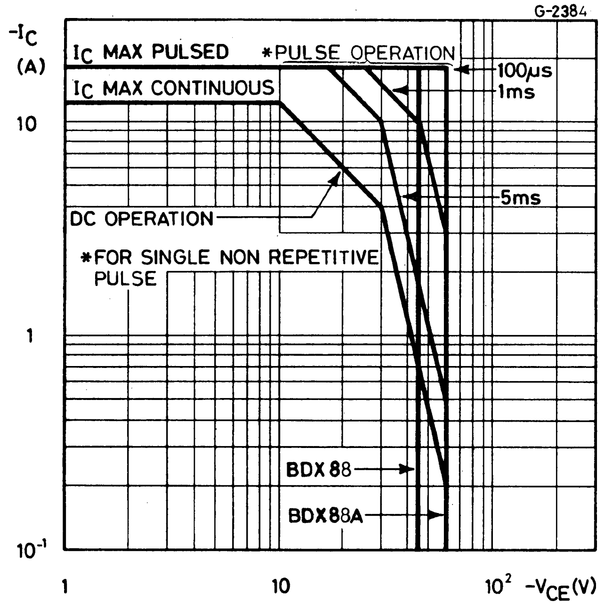
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.45	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

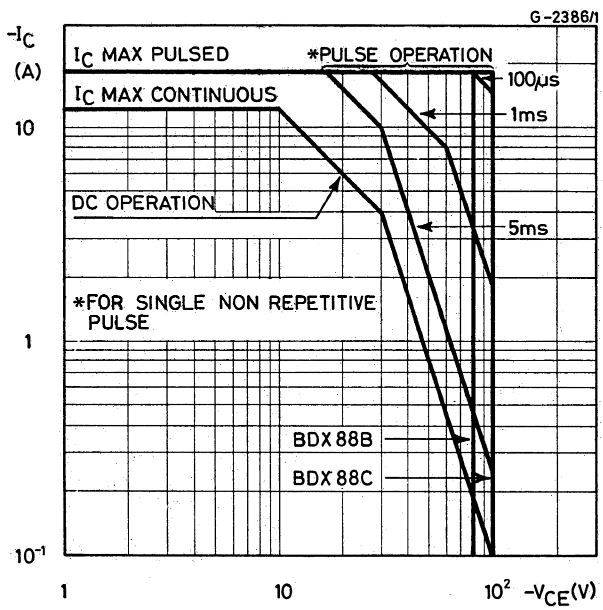
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX88** V_{CB} = -45 V for **BDX88A** V_{CB} = -60 V for **BDX88B** V_{CB} = -80 V for **BDX88C** V_{CB} = -100 V T_{case} = 150°C for **BDX88** V_{CB} = -45 V for **BDX88A** V_{CB} = -60 V for **BDX88B** V_{CB} = -80 V for **BDX88C** V_{CB} = -100 V			-500 -500 -500 -500 -5 -5 -5 -5	µA µA µA µA mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX88** V_{CE} = -22 V for **BDX88A** V_{CE} = -30 V for **BDX88B** V_{CE} = -40 V for **BDX88C** V_{CE} = -50 V			-1 -1 -1 -1	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V			-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA for **BDX88** for **BDX88A** for **BDX88B** for **BDX88C**	 -45 -60 -80 -100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -6A I_B = -24 mA I_C = -12A I_B = -120 mA			-2 -3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = -12A I_B = -120 mA			-4	V
V_{BE}*	Base-emitter voltage	I_C = -6A V_{CE} = -3V			-2.8	V
h_{FE}*	DC current gain	I_C = -5A V_{CE} = -3V I_C = -6A V_{CE} = -3V I_C = -12A V_{CE} = -3V	1000 750 100		 18000 	— — —
V_F	Parallel-diode forward voltage	I_F = 3A I_F = 8A		 2.5	1.8 	V V
h_{fe}	Small signal current gain	I_C = -5A V_{CE} = -3V f = 1 MHz		35		—

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

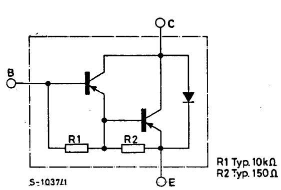
Safe operating areas
(for **BDX88** and **BDX88A**)



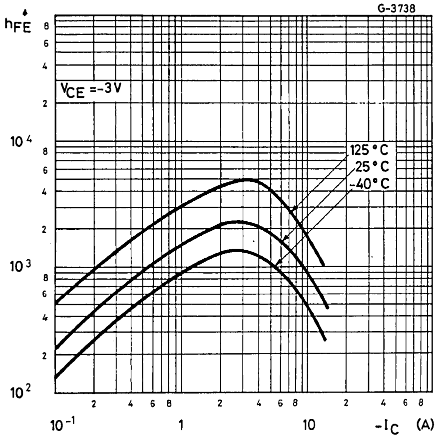
Safe operating areas
(for **BDX88B** and **BDX88C**)



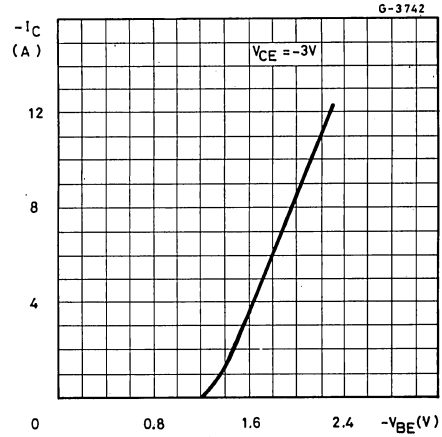
Internal circuit diagram



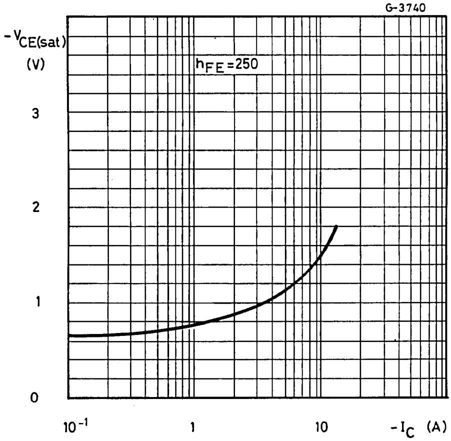
DC current gain



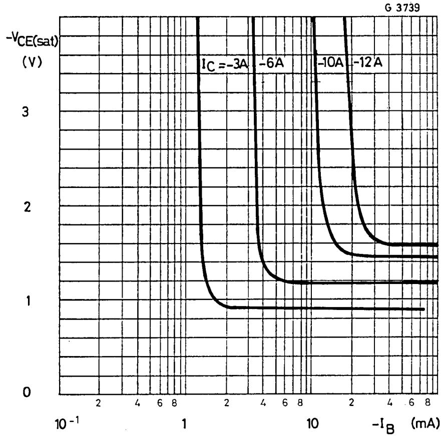
DC transconductance



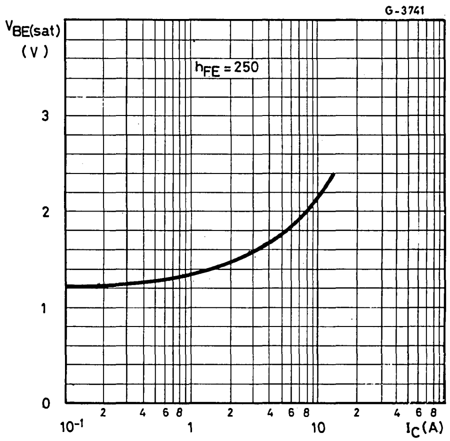
Collector-emitter saturation voltage



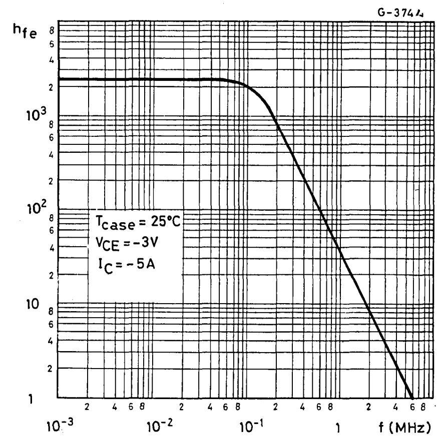
Collector-emitter saturation voltage



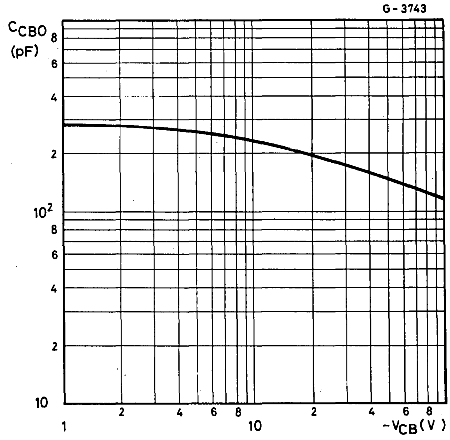
Base-emitter saturation voltage



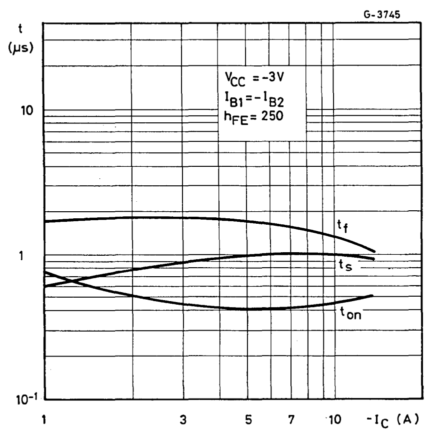
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



MULTIEPITAXIAL PLANAR NPN

BDY 57
BDY 58

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTORS

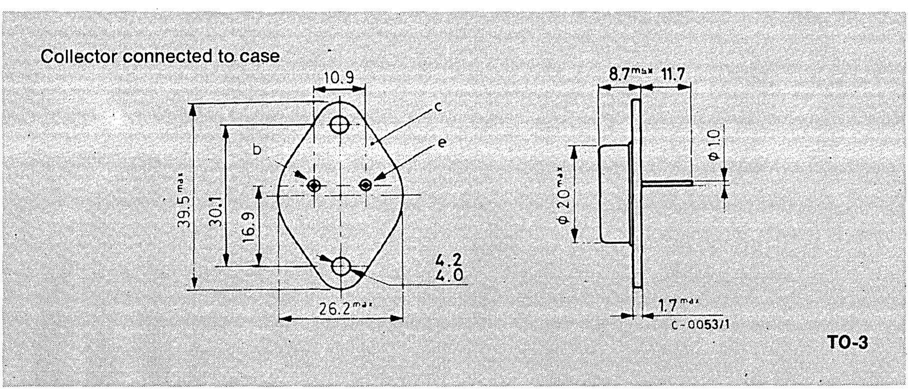
The BDY 57 and BDY 58 are silicon multiepitaxial planar NPN transistors in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

<table>
<tr><th></th><th></th><th>BDY 57</th><th>BDY 58</th></tr>
<tr><td>V_{CBO}</td><td>Collector-base voltage ($I_E = 0$)</td><td>120V</td><td>160V</td></tr>
<tr><td>V_{CEO}</td><td>Collector-emitter voltage ($I_B = 0$)</td><td>80V</td><td>125V</td></tr>
<tr><td>V_{EBO}</td><td>Emitter-base voltage ($I_C = 0$)</td><td colspan="2">10V</td></tr>
<tr><td>I_C</td><td>Collector current</td><td colspan="2">25A</td></tr>
<tr><td>I_B</td><td>Base current</td><td colspan="2">6A</td></tr>
<tr><td>P_{tot}</td><td>Total power dissipation at $T_{case} \leq 25°C$</td><td colspan="2">175W</td></tr>
<tr><td>T_{stg}</td><td>Storage temperature</td><td colspan="2">−65 to 200°C</td></tr>
<tr><td>T_j</td><td>Junction temperature</td><td colspan="2">200°C</td></tr>
</table>

MECHANICAL DATA

Dimensions in mm



BDY 57
BDY 58

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 120V			1	mA
I_{CER}	Collector cutoff current	V_{CE} = 80V R_{BE} = 10Ω T_{case} = 100°C			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 10V			0.5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA for **BDY 57** for **BDY 58**	 80 125			 V V
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage	I_C = 5mA for **BDY 57** for **BDY 58**	 120 160			 V V
$V_{(BR)\ EBO}$*	Emitter-base breakdown voltage (I_C = 0)	I_E = 5mA	10			V
$V_{CE\ sat}$*	Collector-emitter saturation voltage	I_C = 10A I_B = 1A		0.5	1.4	V
$V_{BE\ sat}$*	Base-emitter saturation voltage	I_C = 10A I_B = 1A		1.4	2	V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	$I_C = 10A$ $V_{CE} = 4V$	20		60	—
		$I_C = 20A$ $V_{CE} = 4V$		15		—
		$T_{case} = -30°C$ $I_C = 10A$ $V_{CE} = 4V$	10			—
f_T	Transition frequency	$I_C = 1A$ $V_{CE} = 15V$ $f = 10MHz$	7			MHz
t_{on}	Turn-on time	$I_C = 15A$ $I_{B1} = 1.5A$			1	μs
t_{off}	Turn-off time	$I_C = 15A$ $I_{B1} = -I_{B2} = 1.5A$			2	μs
	Clamped $E_{s/b}$ Collector current	$V_{(clamp)} = 125V$ $L = 500\mu H$	15			A

* Pulsed: pulse duration = $300\mu s$, duty cycle $\leqslant 2\%$.

BDY 90
BDY 91
BDY 92

MULTIEPITAXIAL PLANAR NPN

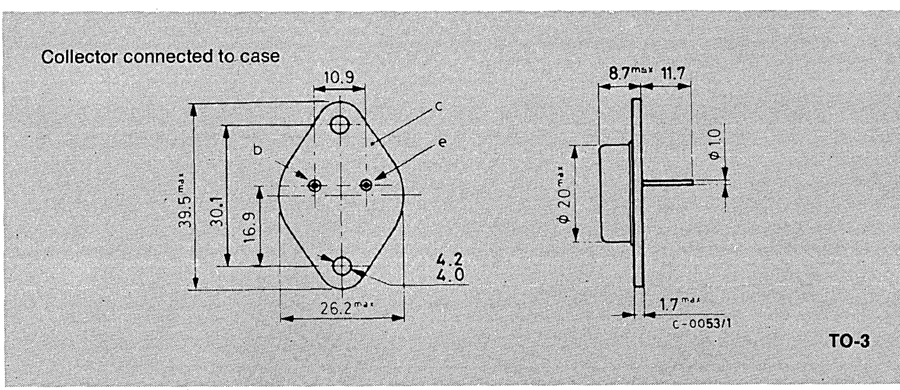
HIGH CURRENT, HIGH SPEED TRANSISTORS

The BDY 90, BDY 91, BDY 92 are silicon multiepitaxial planar NPN transistors in Jedec TO-3 metal case intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS		BDY 90	BDY 91	BDY 92
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	100V	80V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1{,}5V$)	120V	100V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	100V	80V	60V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		10A	
I_{CM}	Collector peak current		15A	
I_B	Base current		2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		60W	
T_{stg}	Storage temperature		–65 to 175°C	
T_j	Junction temperature		175°C	

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = V_{CBO}$ max				1	mA
I_{CEV}	Collector cutoff current ($V_{BE} = -1.5V$)	$V_{CE} = V_{CEV}$ max				1	mA
		$T_{case} = 150°C$ $V_{CE} = V_{CEV}$ max				3	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 6V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$					
		for **BDY 90**		120			V
		for **BDY 91**		100			V
		for **BDY 92**		80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$	$I_B = 0.5A$			0.5	V
		$I_C = 10A$	$I_B = 1A$				
		for **BDY 90, BDY 91**				1.5	V
		for **BDY 92**				1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 5A$	$I_B = 0.5A$			1.2	V
		$I_C = 10A$	$I_B = 1A$			1.5	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE} = 2V$	35			—
		$I_C = 5A$	$V_{CE} = 5V$	30		120	—
		$I_C = 10A$	$V_{CE} = 5V$	20			—
f_t	Transition frequency	$I_C = 0.5A$ $f = 5MHz$	$V_{CE} = 5V$		70		MHz
t_{on}	Turn-on time	$I_C = 5A$ $V_{CC} = 30V$	$I_{B1} = 0.5A$			0.35	μs
t_s	Storage time	$I_C = 5A$ $V_{CC} = 30V$	$I_{B1} = -I_{B2} = 0.5A$			1.3	μs
t_f	Fall time					0.2	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BFX 34

EPITAXIAL PLANAR NPN

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

The BFX 34 is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case, intended for high current applications.
Very low saturation voltage and high speed at high current levels make it ideal for power drivers, power amplifiers, switching power supplies relay drivers, inverters.

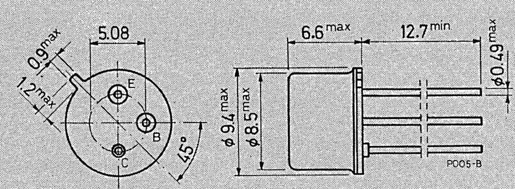
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	120	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leqslant 25°C$	0.87	W
	$T_{case} \leqslant 25°C$	5	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

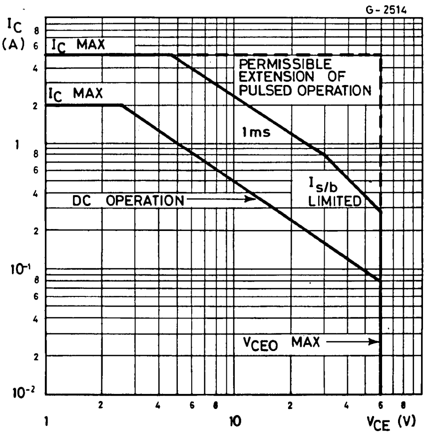
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 60V		0.02	10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 4V		0.05	10	μA
$V_{(BR)\,CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 5mA	120			V
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	60			V
V_{EBO}*	Emitter-base voltage (I_C =0)	I_E = 1 mA	6			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 5A I_B = 0.5A		0.4	1	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 5A I_B = 0.5A		1.3	1.6	V
h_{FE}*	DC current gain	I_C = 1A V_{CE} = 2V I_C = 1.5A V_{CE} = 0.6V I_C = 2A V_{CE} = 2V	 40	100 75 80	 150	— — —
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 5 V f = 20 MHz	70	100		MHz
C_{EBO}	Emitter-base capacitance	I_C = 0 V_{EB} = 0.5V f = 1 MHz		300	500	pF
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10V f = 1 MHz		40	100	pF
t_{on}	Turn-on time	I_C = 5 A V_{CC} = 20 V I_{B1} = $-I_{B2}$ = 0.5 A		0.25	0.6	μs
t_{off}	Turn-off time			0.6	1.2	μs

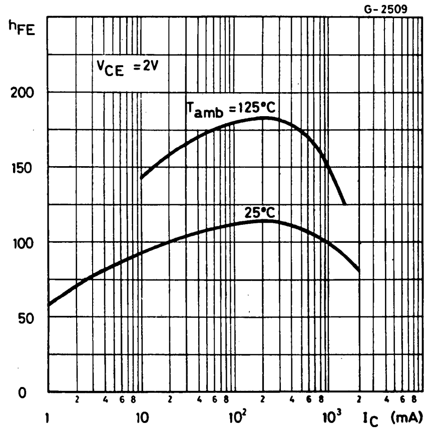
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BFX 34

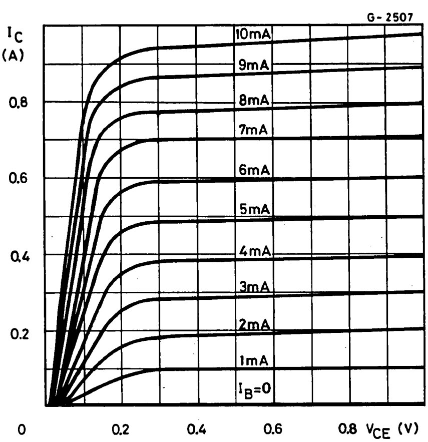
Safe operating areas



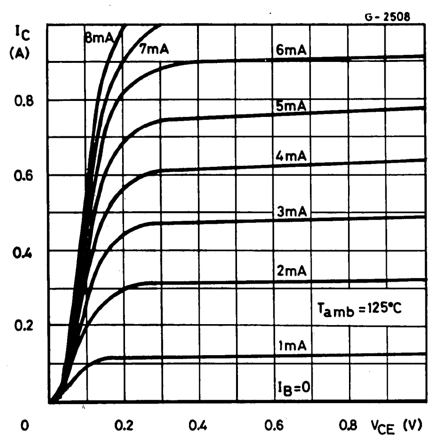
DC current gain



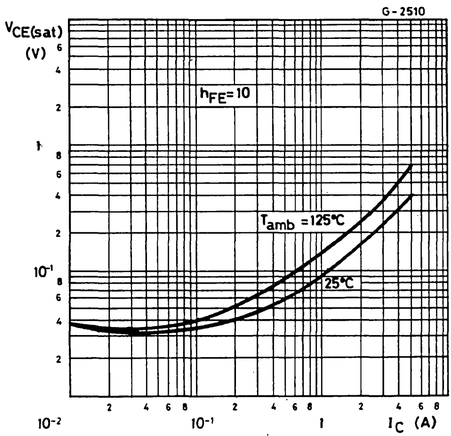
Output characteristics



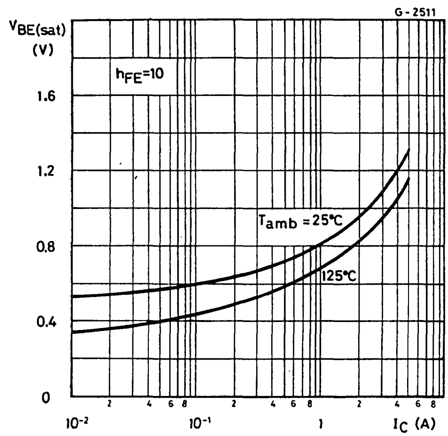
Output characteristics



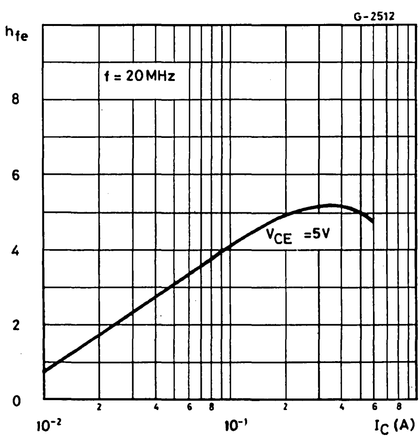
Collector-emitter saturation voltage



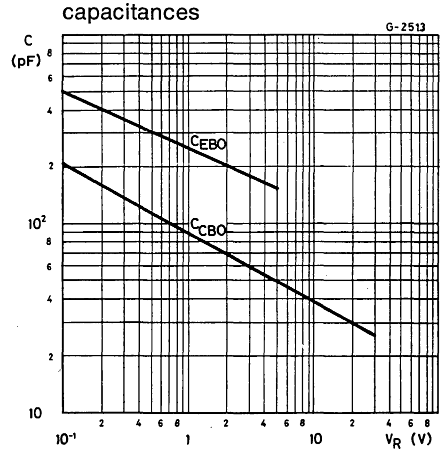
Base-emitter saturation voltage



Small signal current gain



Emitter-base and collector-base capacitances



BSS 44

EPITAXIAL PLANAR PNP

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

The BSS 44 is a silicon epitaxial planar PNP transistor in Jedec TO-39 metal case. It is used for high-current switching and power amplifier applications up to 5A.

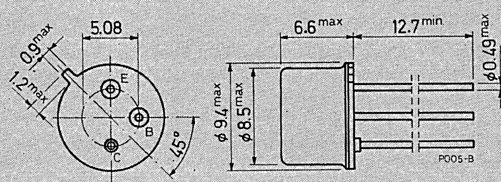
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-65	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-6	V
I_C	Collector current	-5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	0.87	W
	$T_{case} \leq 25°C$	5	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

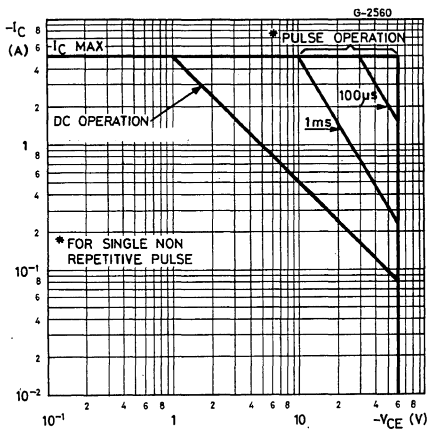
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = -60V				-0.5	μA
$V_{(BR)\ CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = -1 mA		-65			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -50 mA		-60			V
V_{EBO}*	**Emitter-base voltage (I_C =0)**	I_E = -1 mA		-6			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -0.5A I_C = -5A	I_B = -50mA I_B = -0.5A		-0.1 -0.4	 -1	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -0.5A I_C = -5A	I_B = -50mA I_B = -0.5A		-0.8 -1.1	 -1.6	V V
h_{FE}*	DC current gain	I_C = -0.5A I_C = -2A I_C = -5A	V_{CE} = -2V V_{CE} = -2V V_{CE} = -2V	30 40	 70 45		— — —
f_T	Transition frequency	I_C = -0.5A	V_{CE} = -5V		80		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 f = 1 MHz	V_{CB} = -10 V			100	pF
t_{on}	Turn-on time	I_C = -0.5A I_{B1} = $-I_{B2}$ = -50mA	V_{CC} = -20V		0.065		μs
t_{off}	Turn-off time				0.45		μs

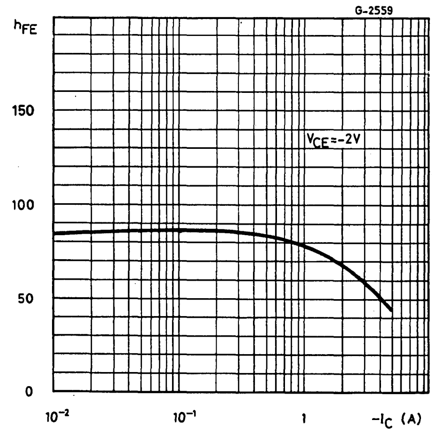
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BSS 44

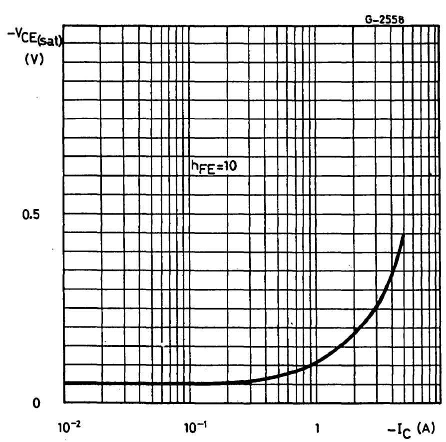
Safe operating areas



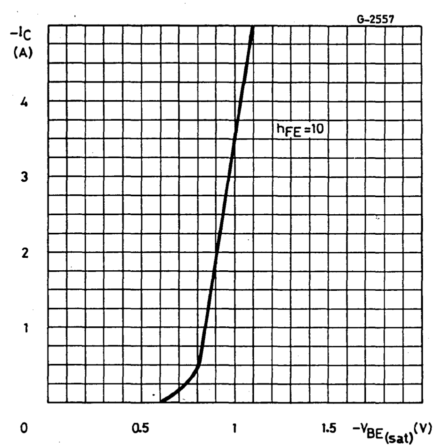
DC current gain



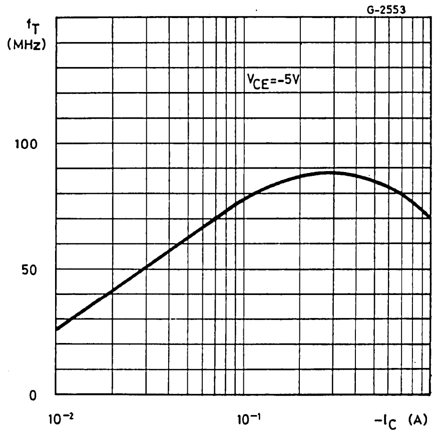
Collector-emitter saturation voltage



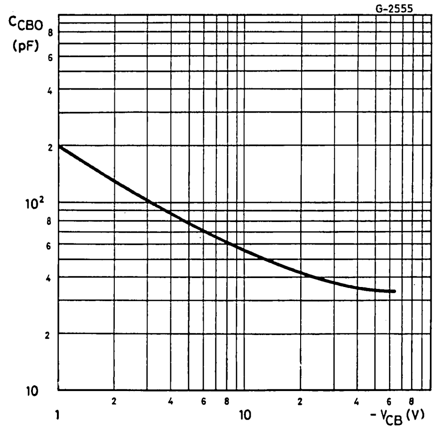
Base-emitter saturation voltage



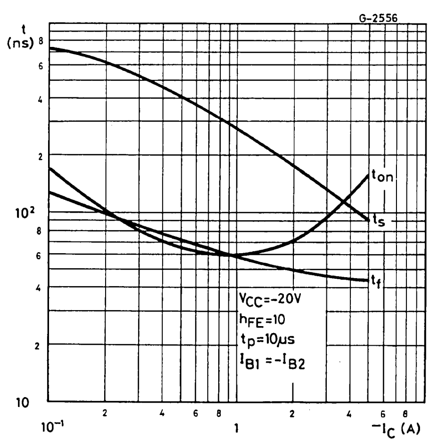
Transition frequency



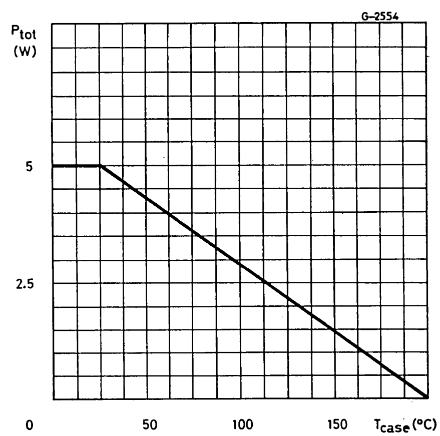
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BSW 67
BSW 68

EPITAXIAL PLANAR NPN

HIGH VOLTAGE SWITCH

The BSW 67 and BSW 68 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case. They are intended for high voltage inductive load switching applications.

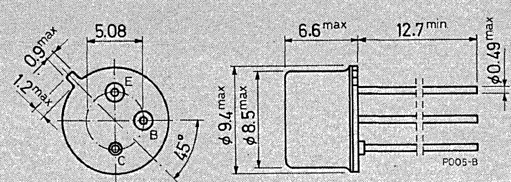
ABSOLUTE MAXIMUM RATINGS

		BSW 67	BSW 68
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	150V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120V	150V
I_C	Collector current	1.5A	
I_{CM}	Collector peak current	2A	
P_{tot}	Total power dissipation at $T_{amb} \leqslant 45°C$	0.7W	
	$T_{case} \leqslant 25°C$	5W	
	$T_{case} \leqslant 100°C$	2.85W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

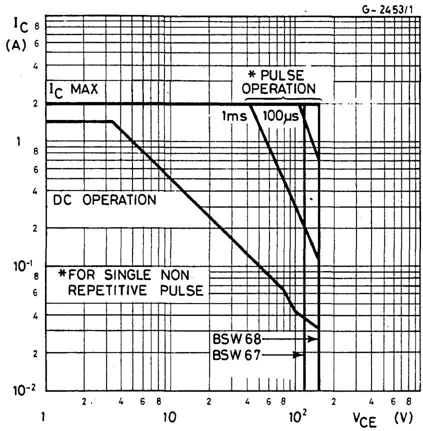
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	220	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

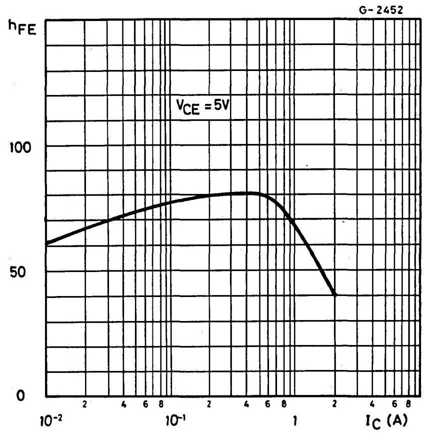
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BSW 67**				
		V_{CB} = 60 V			100	nA
		V_{CB} = 60 V T_{case} = 150°C			50	μA
		for **BSW 68**				
		V_{CB} = 75 V			100	nA
		V_{CB} = 75 V T_{case} = 150°C			50	μA
$V_{(BR)\ CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = 100 μA				
		for **BSW 67**	120			V
		for **BSW 68**	150			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA				
		for **BSW 67**	120			V
		for **BSW 68**	150			V
V_{EBO}*	**Emitter-base voltage (I_C =0)**	I_E = 100 μA	6			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 0.1 A I_B = 0.01 A			0.15	V
		I_C = 0.5 A I_B = 0.05 A			0.5	V
		I_C = 1 A I_B = 0.15 A			1	V
$V_{BE\ (sat)}$*	Base-emitter voltage	I_C = 0.1 A I_B = 0.01 A			0.9	V
		I_C = 0.5 A I_B = 0.05 A			1.1	V
		I_C = 1 A I_B = 0.15 A			1.2	V
h_{FE}*	DC current gain	I_C = 0.1 A V_{CE} = 5 V	40			—
		I_C = 0.5 A V_{CE} = 5 V	30			—
		I_C = 1 A V_{CE} = 5 V	15			—
f_T	Transition frequency	I_C = 100mA V_{CE} = 20 V		80		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V; f = 1 MHz			35	pF
t_{on}	Turn-on time	I_C = 0.5 A V_{CC} = 20 V; I_{B1} = $-I_{B2}$ = 0.05 A		0.3		μs
t_{off}	Turn-off time			1		μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

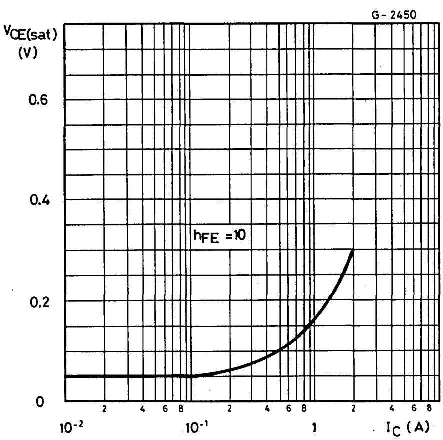
Safe operating areas



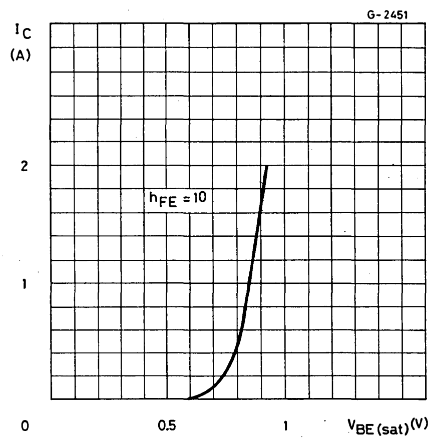
DC current gain



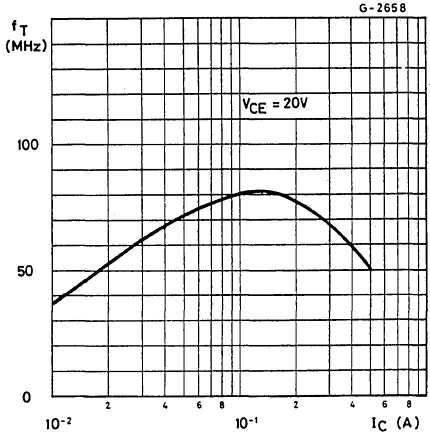
Collector-emitter saturation voltage



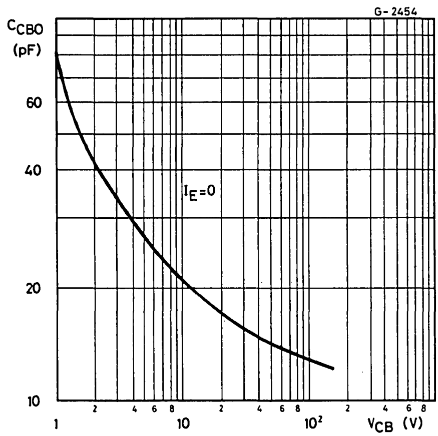
Base-emitter saturation voltage



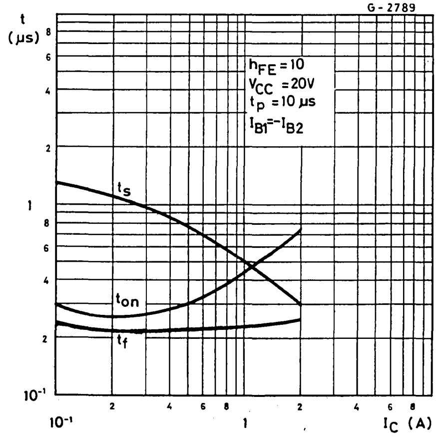
Transition frequency



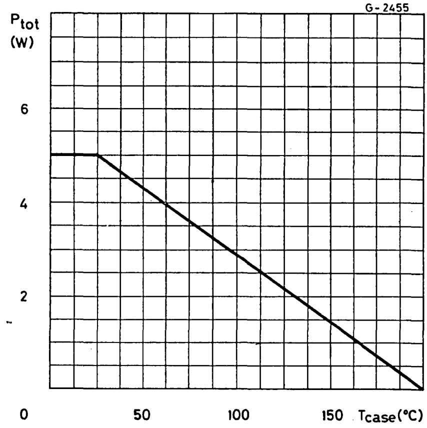
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU 125

EPITAXIAL PLANAR NPN

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

The BU 125 is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case. It is used in TV horizontal output and general purpose applications.

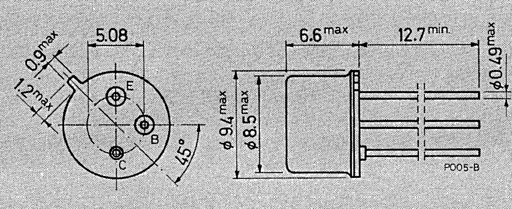
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	130	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1	W
	$T_{case} \leq 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

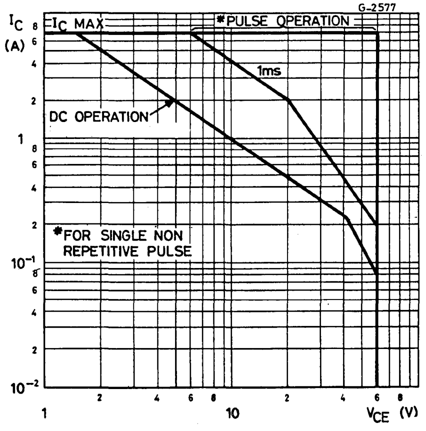
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 100 V			0.02	10	μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 1 mA		130			V
$V_{(BR)\ CES}$*	Collector-emitter breakdown voltage (V_{BE} = 0)	I_C = 1 mA		130			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 50 mA		60			V
V_{EBO}*	**Emitter-base voltage (I_C =0)**	I_E = 1 mA		5			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1 A I_C = 5 A	I_B = 0.1 A I_B = 0.5 A			0.25 1.2	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 1 A I_C = 5A	I_B = 0.1 A I_B = 0.5 A		0.9 1.3	1 1.6	V V
h_{FE}*	DC current gain	I_C = 0.1 A I_C = 5 A	V_{CE} = 2 V V_{CE} = 2 V	40 15	155 60		— —
f_T	Transition frequency	I_C = 0.5 A	V_{CE} = 5 V	50			MHz
C_{CBO}	Collector-base capacitance	I_E = 0 f = 1 MHz	V_{CB} = 10 V			80	pF
t_{off}	Turn-off time	I_C = 5 A I_{B1} = $-I_{B2}$ = 0.5 A	V_{CC} = 20 V			0.65	μs

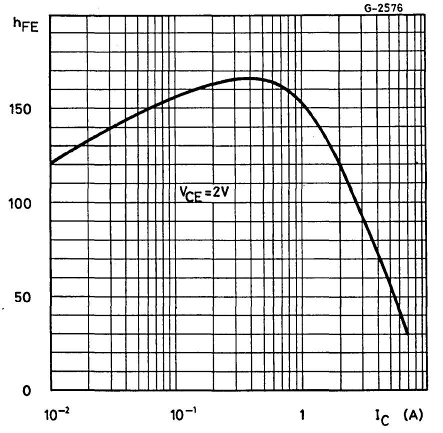
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BU 125

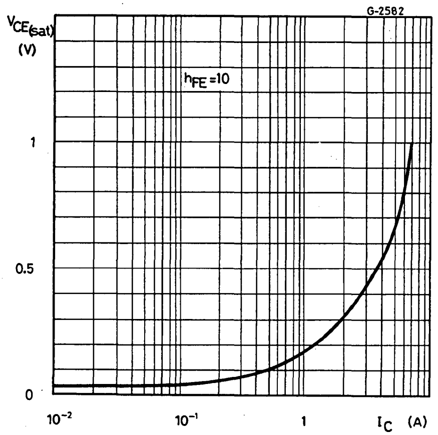
Safe operating areas



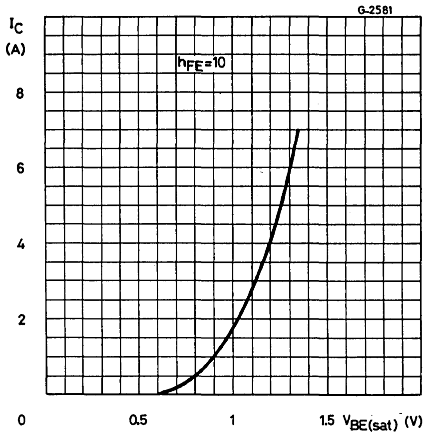
DC current gain



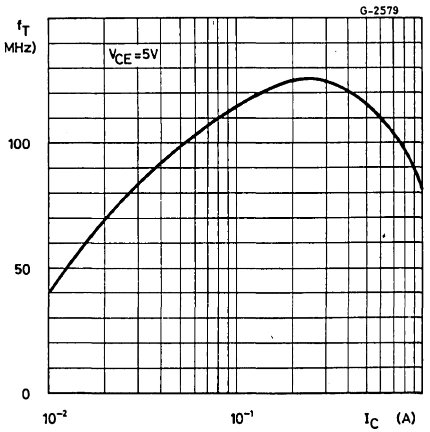
Collector-emitter saturation voltage



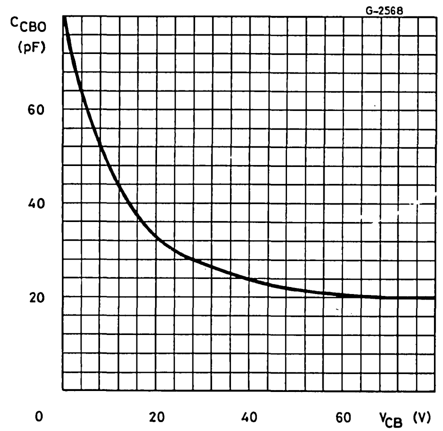
Base-emitter saturation voltage



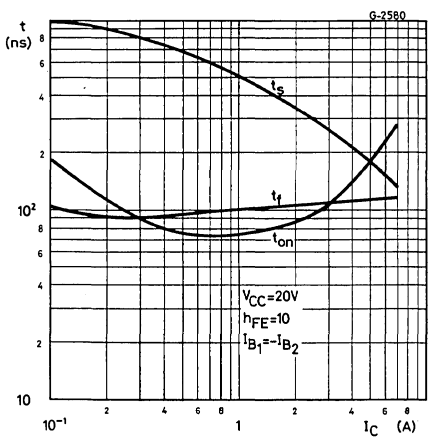
Transition frequency



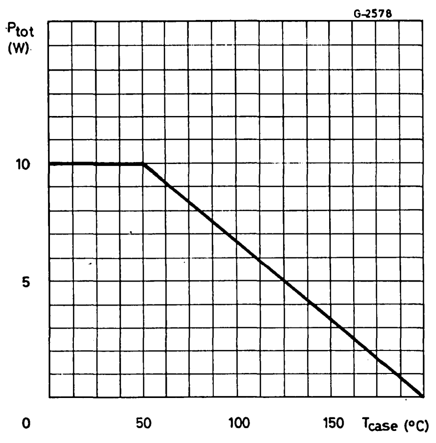
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU 125S

EPITAXIAL PLANAR NPN

HIGH VOLTAGE POWER AMPLIFIER

The BU 125S is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case. It is intended for general purpose, linear and switching applications.

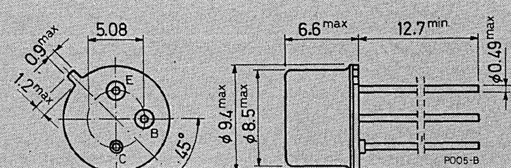
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	3	A
I_{CM}	Collector peak current (repetitive)	5	A
I_B	Base current	0.5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1	W
	$T_{case} \leq 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

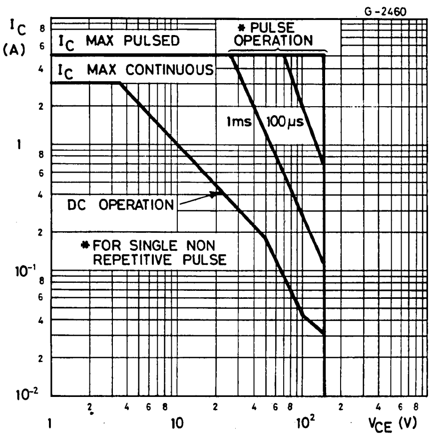
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 200 V			10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6 V			1	mA
V_{CBO}	Collector-base voltage (I_E = 0)	I_C = 1mA	250			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 20 mA	150			V
$V_{CE\ (sat)}$	Collector-emitter saturation voltage	I_C = 500mA I_B = 50mA			1.5	V
h_{FE}	DC current gain	I_C = 5 mA V_{CE} = 10V I_C = 250mA V_{CE} = 3V	30 30			— —
f_T	Transition frequency	I_C = 100mA V_{CE} = 10V	15			MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 20 V f = 1 MHz			35	pF
t_{on}	Turn-on time	I_C = 0.5 A V_{CC} = 20 V I_{B1} = $-I_{B2}$ = 0.05 A		0.3		μs
t_{off}	Turn-off time			1		μs

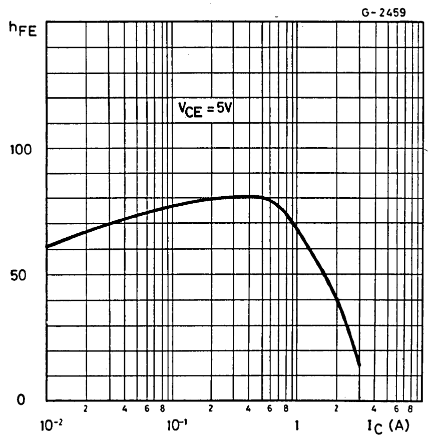
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BU 125S

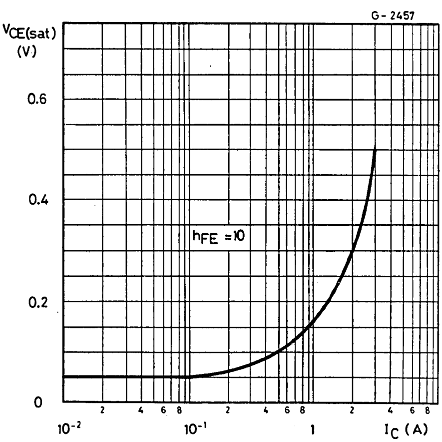
Safe operating areas



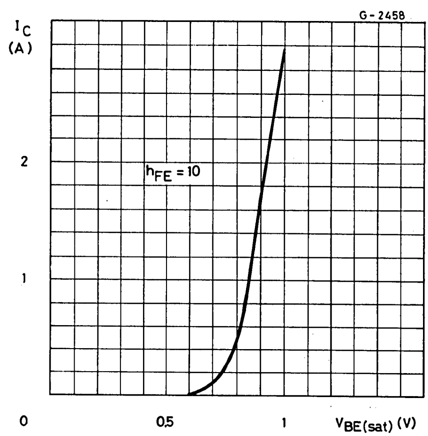
DC current gain



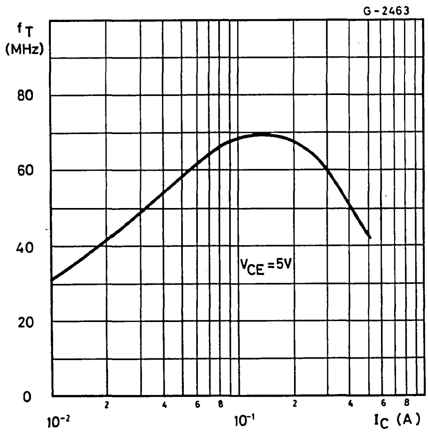
Collector-emitter saturation voltage



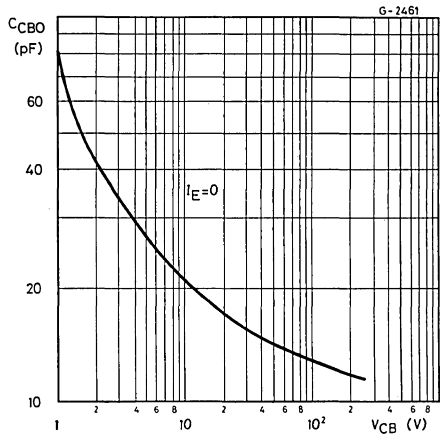
Base-emitter saturation voltage



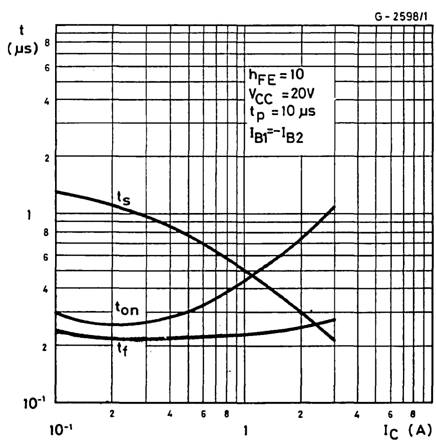
Transition frequency



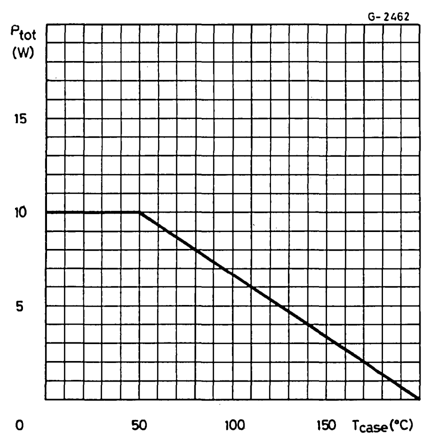
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU 126

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BU 126 is a silicon multiepitaxial NPN transistor in Jedec TO-3 metal case particularly intended for switch-mode TV supply system.

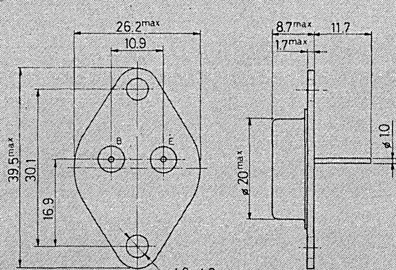
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	750	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	300	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	6	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	8	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	75	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.33	°C/W

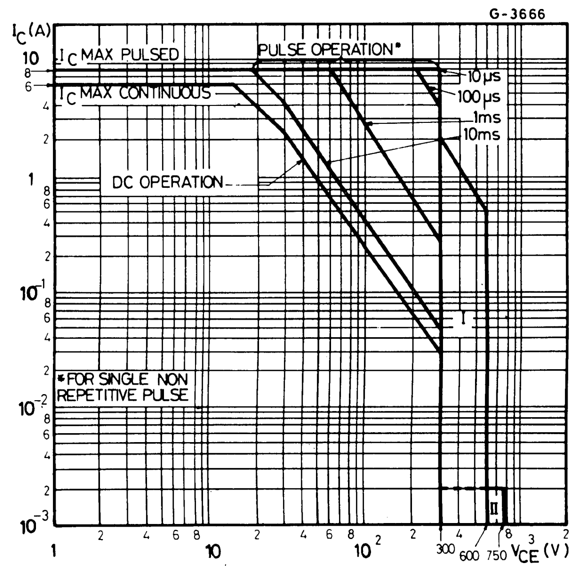
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min. Typ. Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=750V T_{case}=125°C V_{CE}=750V	0.5 2	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=6V	5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =100mA	300	V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =4A I_B =1A	5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =4A I_B =1A	1.5V	V
h_{FE}*	DC current gain	I_C =2.5A V_{CE}=10V	10	–
t_{on}	Turn-on time	I_C =2.5A V_{CC}=250V I_{B1} =0.5A	0.2	μs
t_s	Storage time	I_C =2.5A V_{CC} =250A I_{B1} =0,5A I_{B2} =-1A	1	μs
t_f	Fall time		0.15	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BU 126

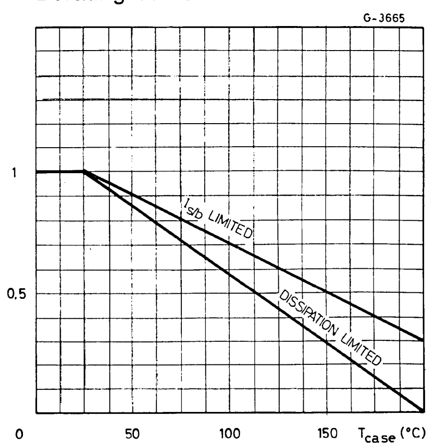
Safe operating areas



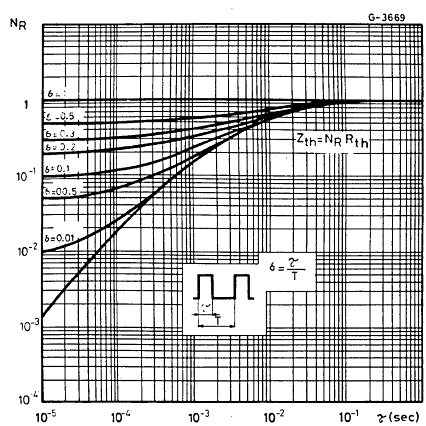
I— Area of permissible operation during turn-on provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6\ \mu s$

II—Area of permissible operation with $V_{BE} \leq 0$ and $t_p \leq 2$ ms

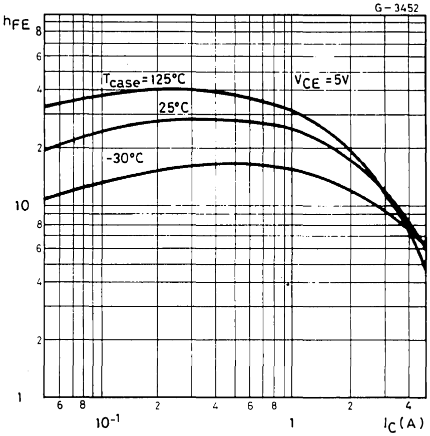
Derating curves



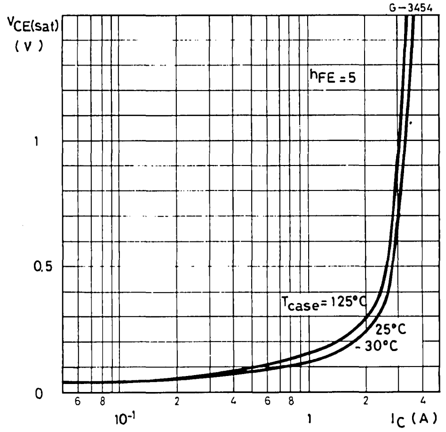
Transient thermal response



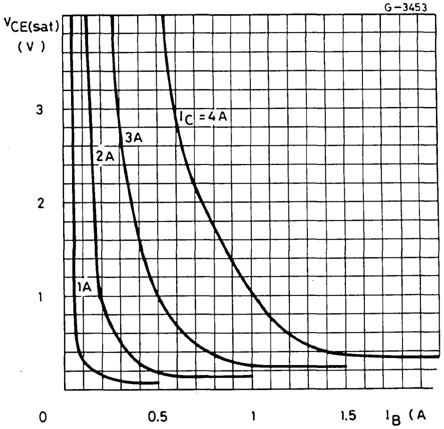
DC current gain



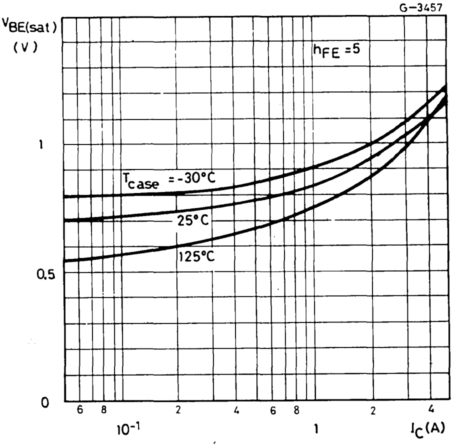
Collector-emitter saturation voltage



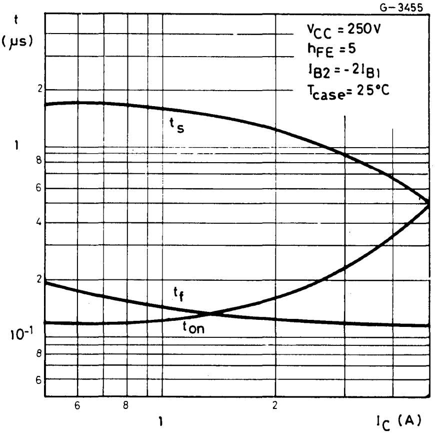
Collector-emitter saturation voltage



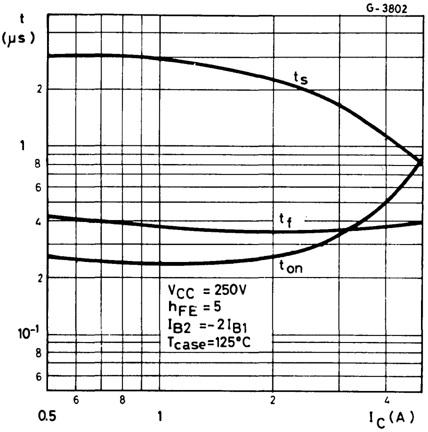
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



BU 325

EPITAXIAL PLANAR NPN

HIGH VOLTAGE SWITCH

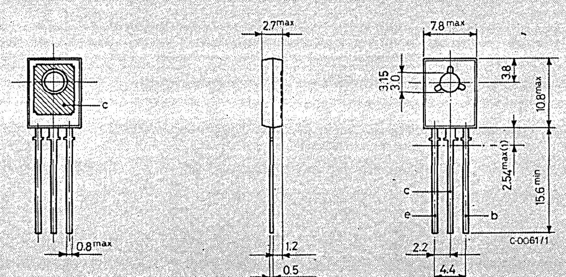
The BU 325 is a silicon planar epitaxial NPN transistor in Jedec TO-126 plastic case. It is intended for high voltage, high current linear and switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	3	A
I_B	Base current	1	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25\,°C$	1.25	W
	$T_{case} \leq 25\,°C$	25	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

BU 325

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-amb.	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

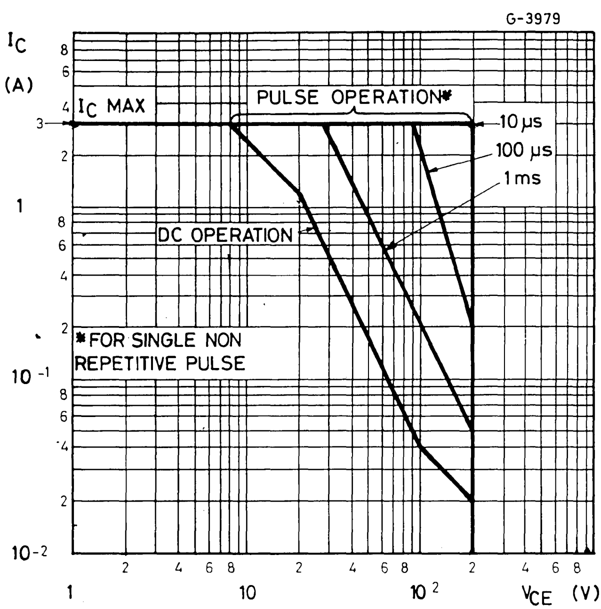
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=200V			100	μA
V_{CBO}	Collector base breakdown voltage (I_E=0)	I_C =100μA	200			V
$V_{CEO\ (sus)}$ *	Collector-emitter sustaining voltage (I_B = 0)	I_C =10mA	200			V
V_{EBO}*	Emitter-base voltage (I_C=0)	I_E =1mA	5			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =150mA I_B =15mA I_C =500mA I_B =50mA		0.06 0.10	1.0 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =150mA I_B =15mA I_C =500mA I_B =50mA		0.73 0.80	1.0 1.2	V V
h_{FE}*	DC current gain	I_C =50mA V_{CE}=5V I_C =150mA V_{CE}=5V I_C =500mA V_{CE}=5V	30 30 30		200 200 200	— — —

ELECTRICAL CHARACTERISTICS (continued)

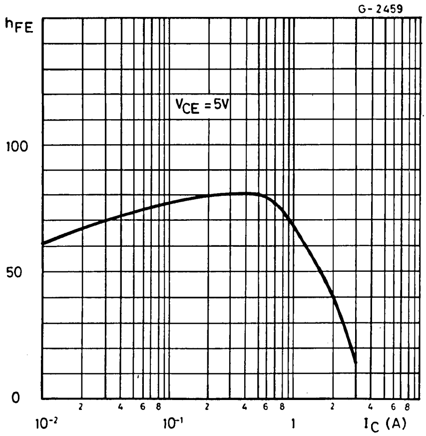
Parameter		Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C =500mA V_{CE}=5V	40	MHz
C_{CBO}	Collector-base capacitance	I_E =0 V_{CB}=10V f =1MHz	50	pF
t_{on}	Turn-on time	I_C =0.5A I_{B1} =50mA V_{CC}=20V	0.3	µs
t_{off}	Turn-off time	I_C =0.5A I_{B1} =-I_{B2} =50mA V_{CC}=20V	1	µs

* Pulsed: pulse duration =300 µs, duty cycle =1.5%

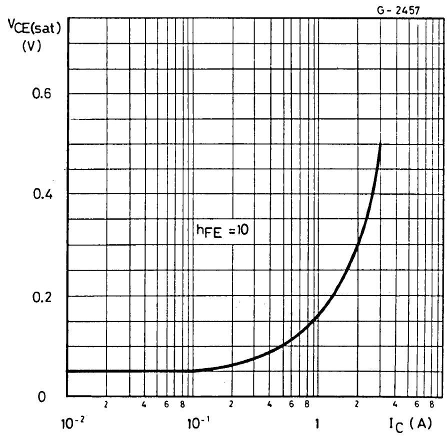
Safe operating areas



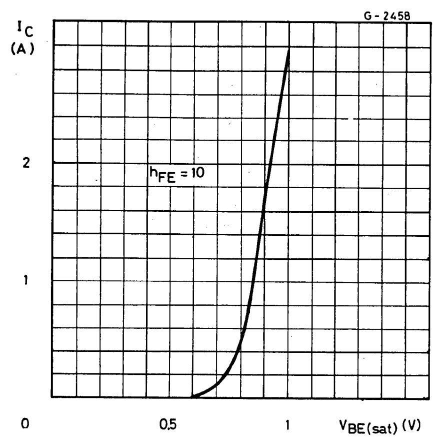
DC current gain



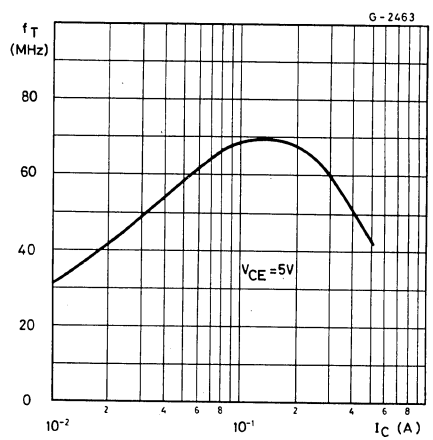
Collector-emitter saturation voltage



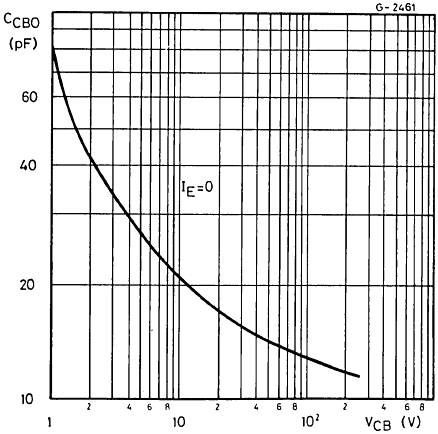
Base-emitter saturation voltage



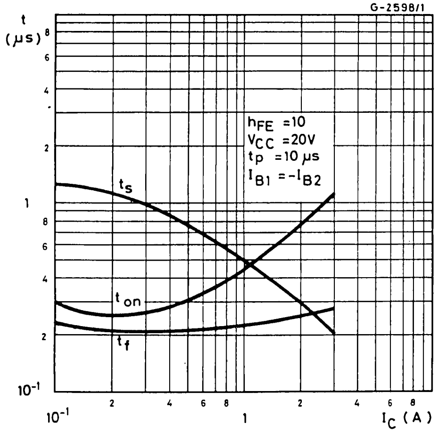
Transition frequency



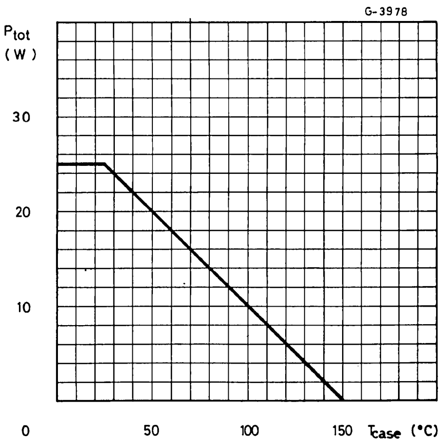
Collector-emitter saturation voltage



Saturated switching characteristics



Power rating chart



BU 326

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BU 326 is a silicon multiepitaxial mesa NPN transistor in a Jedec TO-3 metal case particularly intended for switch-mode CTV supply system.

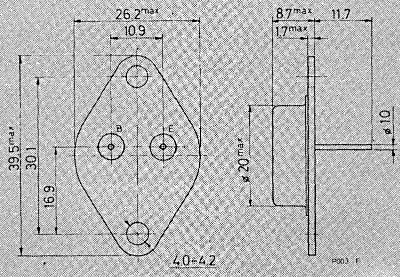
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	800	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	375	V
V_{EBO}	Base-emitter voltage ($I_C=0$)	10	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	8	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	75	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.33	°C/W

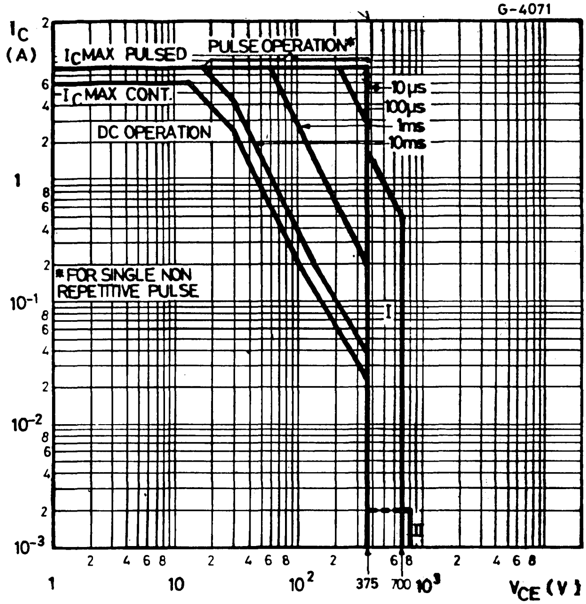
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=800V V_{CE}=800V T_{case}=125 °C			1 2	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=10V			10	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C =100mA	325			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =2.5A I_B =0.5A I_C =4A I_B =1.25A			1.5 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =2.5A I_B =0.5A I_C =4A I_B =1.25A			1.4 1.6	V V
h_{FE}*	DC current gain	I_C =1A V_{CE}=5V		25		—
t_{on}	Turn-on time	I_C =2.5A I_{B1} =0.5A V_{CC}=250V			0.5	µs
t_s	Storage time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			3.5	µs
t_f	Fall time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			0.5	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

BU 326

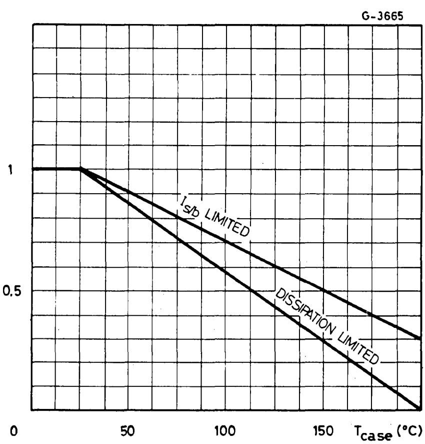
Safe operating areas



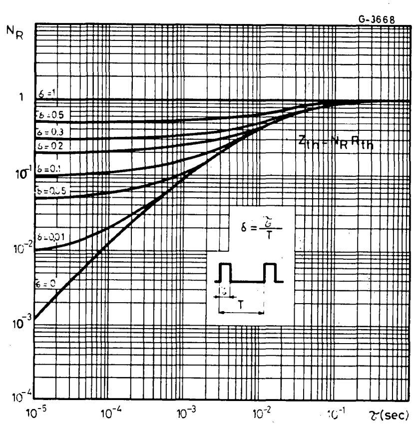
I — Area of permissible operation during turn-on provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0.6$ μs

II— Area of permissible operation with $V_{BE} \leq 0$ and $t_p \leq 2$ μs

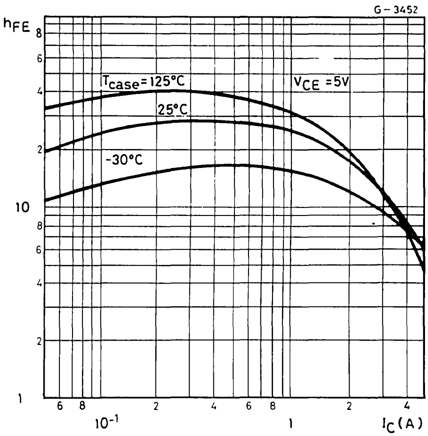
Derating curves



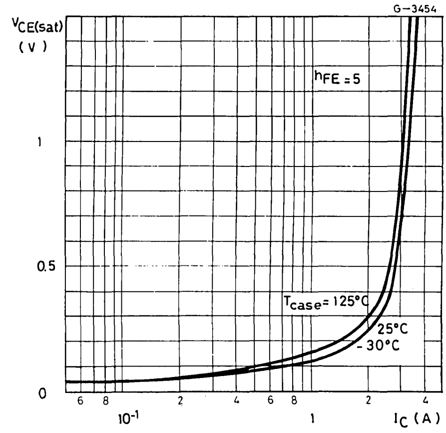
Thermal transient response



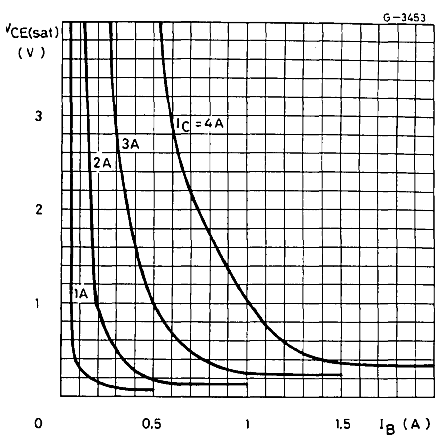
DC current gain



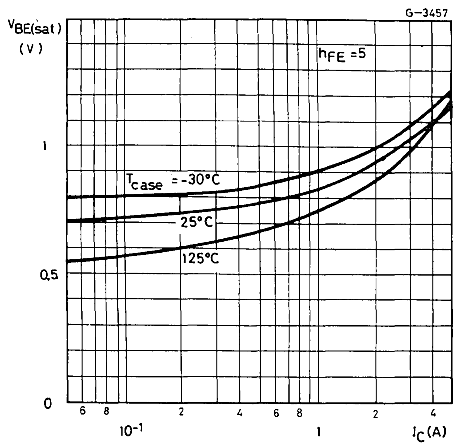
Collector-emitter saturation voltage



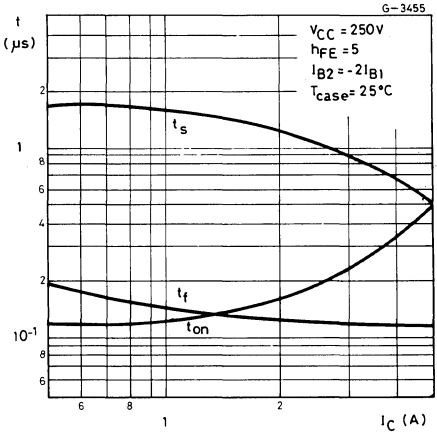
Collector-emitter saturation voltage



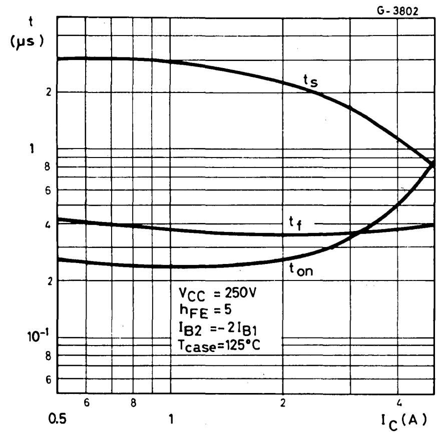
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



BU 326A

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BU 326A is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case particularly intended for switch-mode CTV supply system.

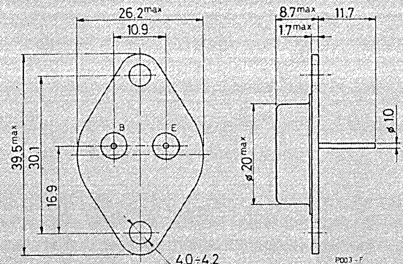
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	900	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	10	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	8	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	75	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

5/80

BU 326A

THERMAL DATA

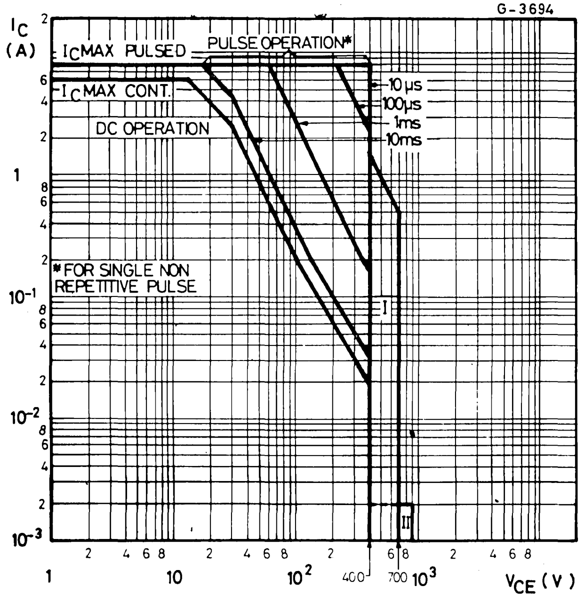
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.33	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=900V V_{CE}=900V T_{case}=125 °C			1 2	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=10V			10	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C =100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =2.5A I_B =0.5A I_C =4A I_B =1.25A			1.5 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =2.5A I_B =0.5A I_C =4A I_B =1.25A			1.4 1.6	V V
h_{FE}*	DC current gain	I_C =1A V_{CE}=5V		25		—
t_{on}	Turn-on time	I_C =2.5A I_{B1} =0.5A V_{CC}=250V			0.5	µs
t_s	Storage time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			3.5	µs
t_f	Fall time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			0.5	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

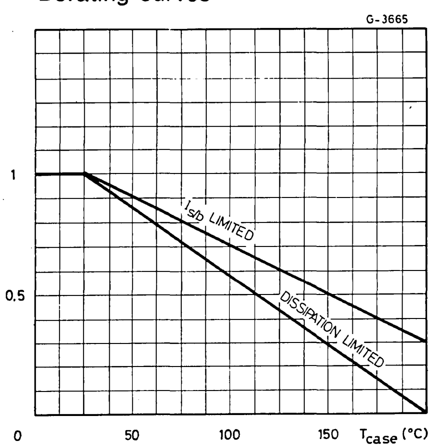
Safe operating areas



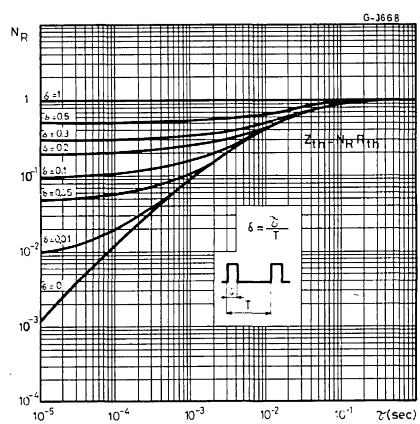
I — Area of permissible operation during turn-on provided $R_{BE}=100\Omega$ and $t_p \leq 0.6$ µs

II— Area of permissible operation with $V_{BE} \leq 0$ and $t_p \leq 2$ µs

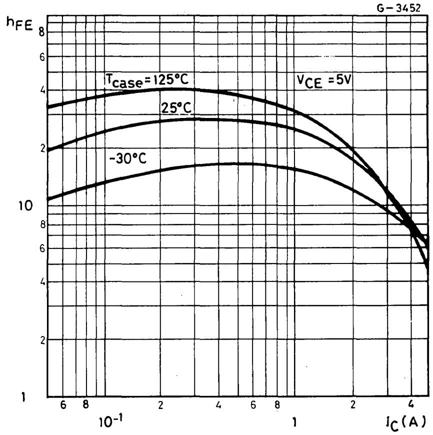
Derating curves



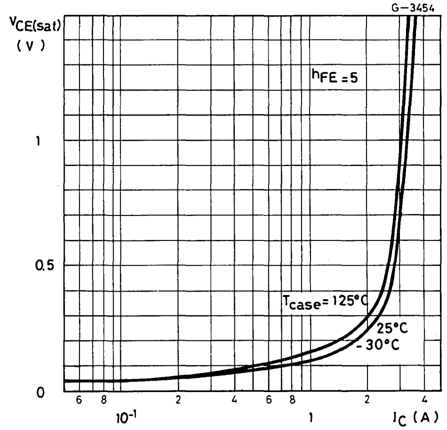
Thermal transient response



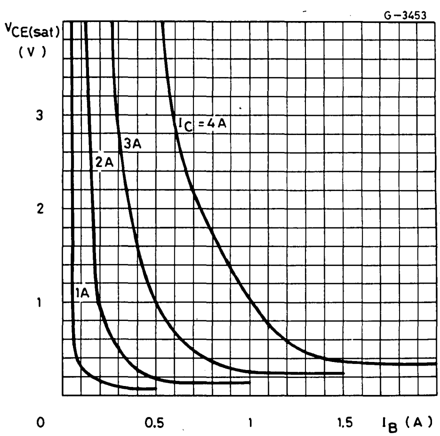
DC current gain



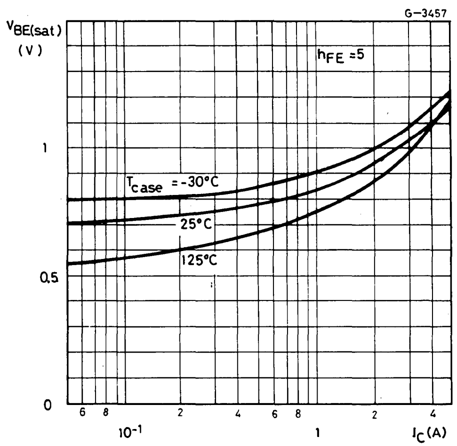
Collector-emitter saturation voltage



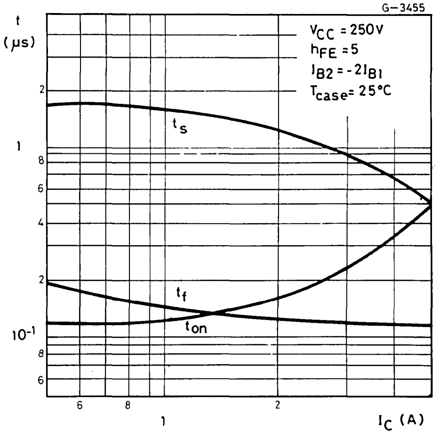
Collector-emitter saturation voltage



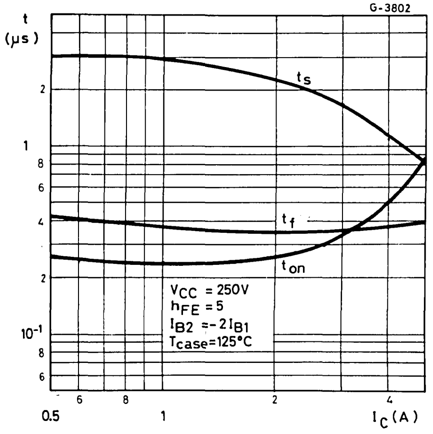
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



BU 326S

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BU 326S is a silicon multiepitaxial NPN transistor in Jedec TO-3 metal case, particularly intended for switch-mode CTV applications.

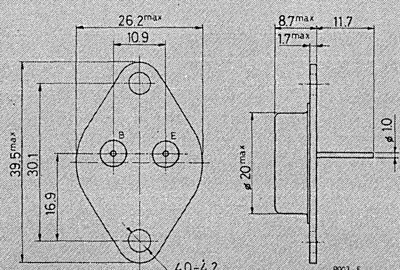
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	8	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 75°C$	60	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W

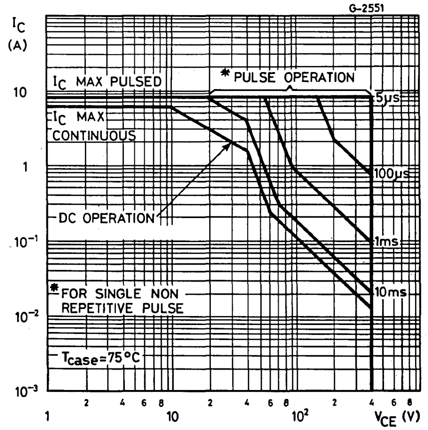
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	V_{CE} = 800 V V_{CE} = 800 V T_{case} = 150°C			1 3	mA mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	V_{EB} = 7 V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	I_C = 100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2.5A I_B = 0.5A I_C = 4A I_B = 1.25A			1.5 3	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_B = 0.5A I_C = 4A I_B = 1.25A			1.4 1.8	V V
h_{FE}*	DC current gain	I_C = 4 A V_{CE} = 5V	3.5		10	—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V		20		MHz
t_{on}	Turn-on time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A		0.3		μs
t_s	Storage time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A I_{B2} = -1A		1.8		μs
t_f	Fall time			0.3		μs

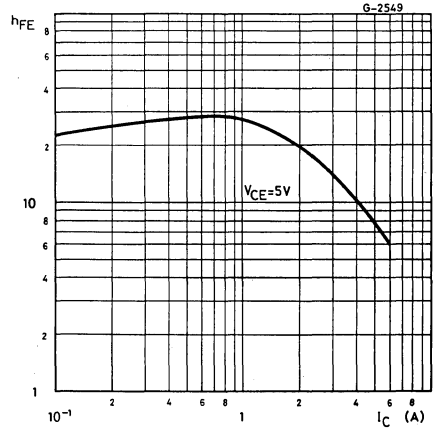
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BU 326S

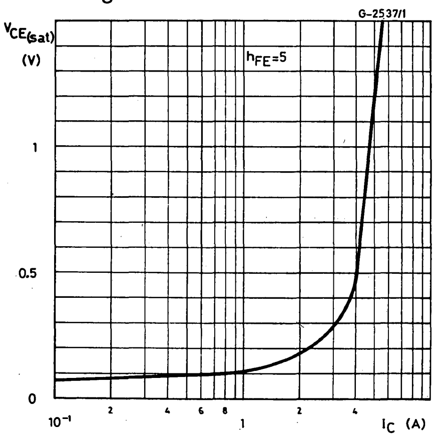
Safe operating areas



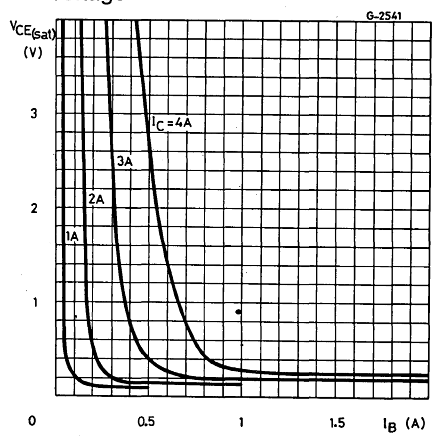
DC current gain



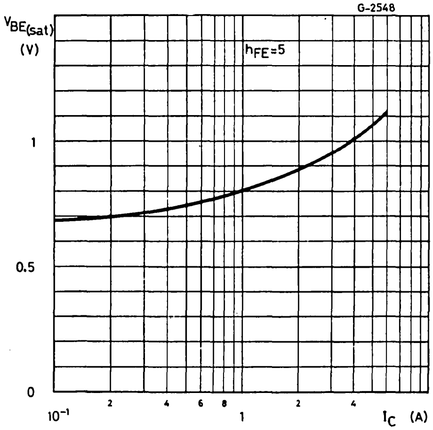
Collector-emitter saturation voltage



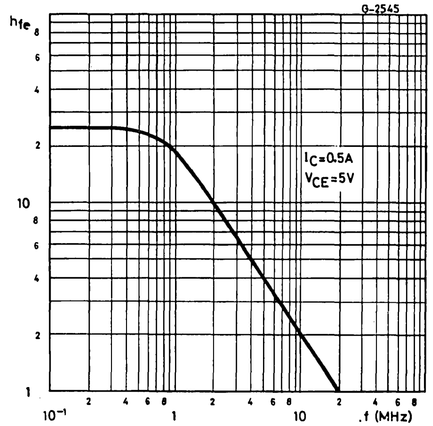
Collector-emitter saturation voltage



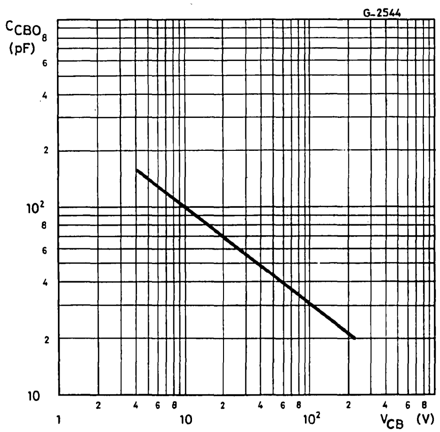
Base-emitter saturation voltage



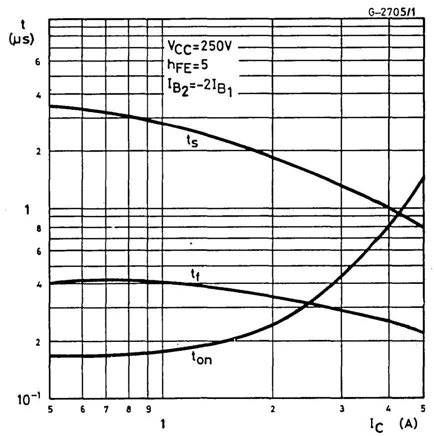
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BU 406
BU 406H
BU 408

EPITAXIAL PLANAR NPN

HORIZONTAL TV DEFLECTORS

The BU 406, BU 406H and BU 408 are silicon epitaxial planar NPN transistors in Jedec TO-220 plastic package. They are fast switching, high voltage devices for use in horizontal deflection output stages of large screen MTV receivers with 110° CRT.

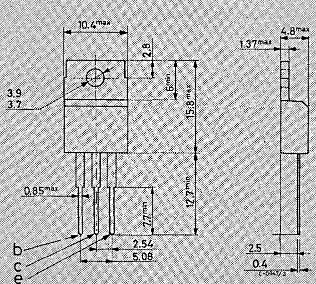
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	400	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_{CM}	Collector peak current (repetitive)	10	A
I_{CM}	Collector peak current (t = 10 ms)	15	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	60	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

6/77

THERMAL DATA

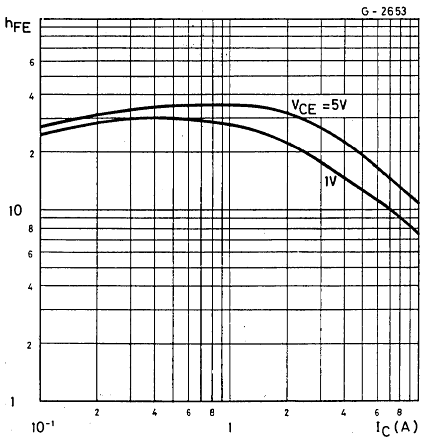
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

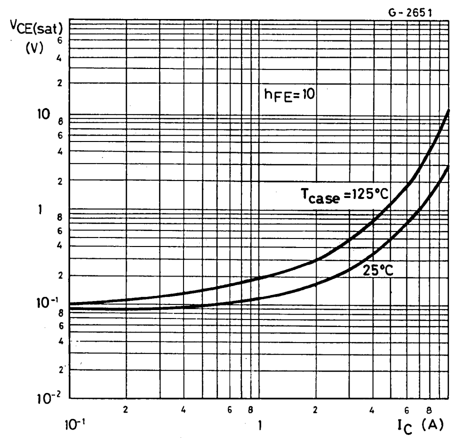
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	V_{CE} = 400 V			5	mA
		V_{CE} = 250 V			100	μA
		V_{CE} = 250 V T_{case} = 150°C			1	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	V_{EB} = 6 V			1	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BU406**				
		I_C = 5 A I_B = 0.5 A			1	V
		for **BU406H**				
		I_C = 5 A I_B = 0.8 A			1	V
		for **BU408**				
		I_C = 6 A I_B = 1.2 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BU406**				
		I_C = 5 A I_B = 0.5 A			1.2	V
		for **BU406H**				
		I_C = 5 A I_B = 0.8 A			1.2	V
		for **BU408**				
		I_C = 6 A I_B = 1.2 A			1.5	V
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 10 V	10			MHz
t_{off}**	Turn-off time	for **BU406**				
		I_C = 5 A $I_{B\ end}$ = 0.5A			0.75	μs
		for **BU406H**				
		I_C = 5 A $I_{B\ end}$ = 0.8A			0.4	μs
		for **BU408**				
		I_C = 6 A $I_{B\ end}$ = 1.2A			0.4	μs
$I_{s/b}$	Second breakdown collector current	V_{CE} = 40 V t = 10ms	4			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** See test circuit

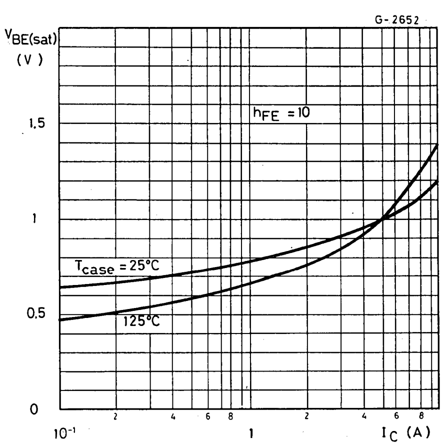
DC current gain



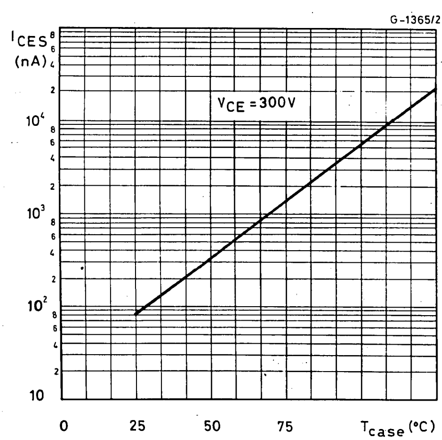
Collector-emitter saturation voltage



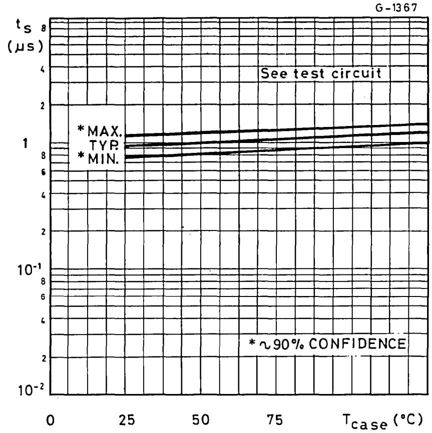
Base-emitter saturation voltage



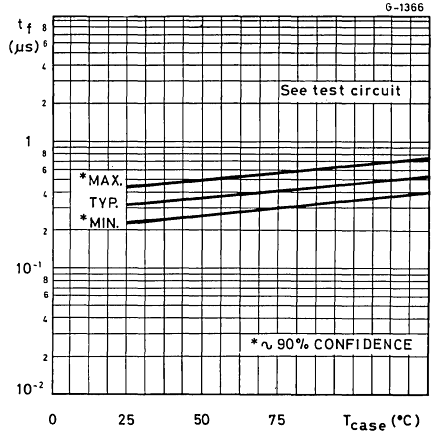
Collector cutoff current



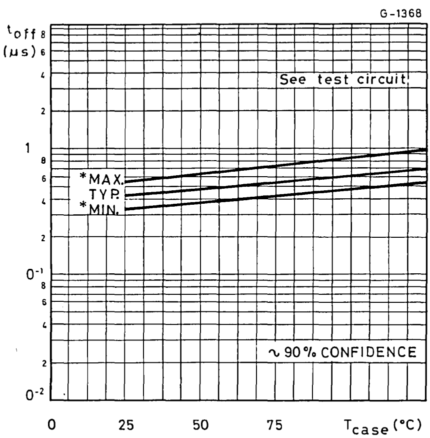
Storage time



Fall time

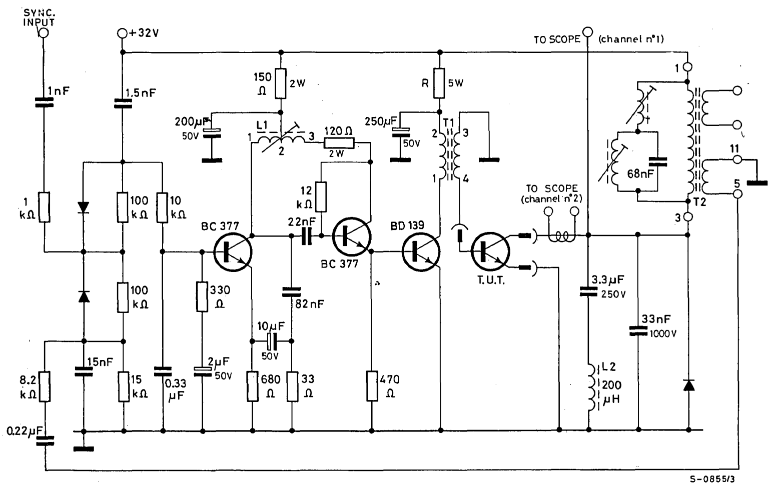


Turn-off time



SWITCHING TIMES

Test circuit (fall, storage and turn-off time)



L1 Horizontal hold coil:Pins 1-2=75 turns Ø 0.2 mm; R=1.5 Ω; L min = 0.62 mH
Pins 2-3=293 turns Ø 0.2 mm; R=4.8 Ω; L max = 4.1 mH Core=siferrit B62120 25×4×2

L2 Horizontal yoke=200 μH

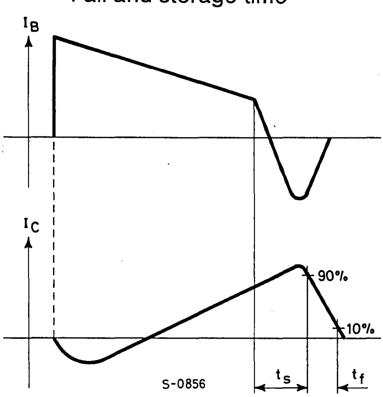
T1 Driver transformer: Pins 1-2=125 turns Ø 0.2 mm;
Pins 3-4=25 turns Ø 0.4 mm; Gap =0.12 mm; Core=3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

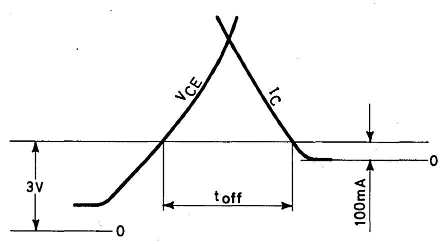
R = 330 Ω for BU406
R = 220 Ω for BU406H
R = 180 Ω for BU408

Waveforms

Fall and storage time



Turn-off time

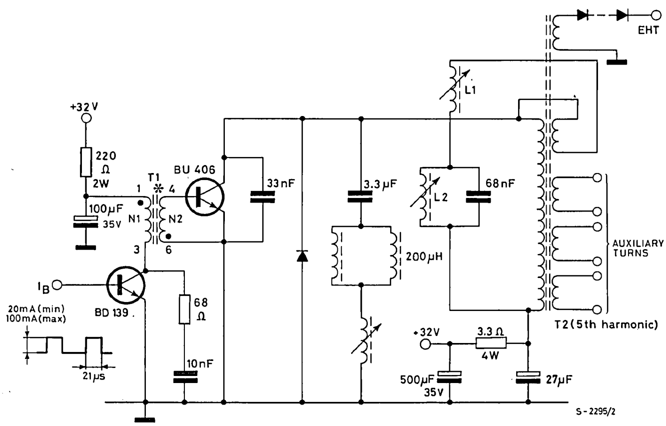


Turn-off time is the time for the collector current I_C to decrease to 100 mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

BU 406 - application circuit for 17" to 24" - 110° - 28 mm neck picture tubes



*N1=125 turns ⌀ 0.3mm ; N2=25 turns ⌀ 0.6mm ; GAP=0.12mm ; CORE=DOUBLE E 19x5x8 mm;FERRITE 3E1 TYPE

BU 406D
BU 407D
BU 408D

EPITAXIAL PLANAR NPN

HORIZONTAL TV DEFLECTORS

The BU 406D, BU 407D and BU 408D are silicon planar epitaxial NPN transistors with integrated damper diode, in Jedec TO-220 plastic package. They are fast switching, high voltage devices for use in horizontal deflection output stages of MTV receivers with 110° CRT.
The BU 406D and BU 408D are primarily intended for large screen, while the BU 407D is for medium and small screens.

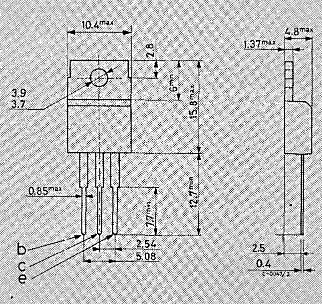
ABSOLUTE MAXIMUM RATINGS

		BU406D	BU407D	BU408D
V_{CBO}	Collector-base voltage ($I_E = 0$)	400V	330V	400V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400V	330V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		7A	
I_{CM}	Collector peak current (repetitive)		10A	
I_{CM}	Collector peak current (t = 10 ms)		15A	
I_B	Base current		4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		60W	
T_{stg}	Storage temperature		-65 to 150 °C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

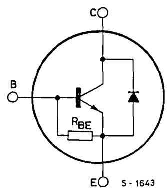
Dimensions in mm

Collector connected to tab



TO-220

INTERNAL SCHEMATIC DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

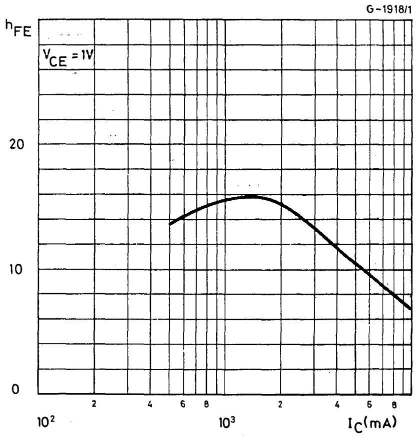
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	for **BU406D** and **BU408D** V_{CE} = 400 V for **BU407D** V_{CE} = 330 V			15 15	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6 V			400	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BU406D** and **BU407D** I_C = 5 A I_B = 0.65 A for **BU408D** I_C = 6 A I_B = 1.2 A			1 1	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BU406D** and **BU407D** I_C = 5 A I_B = 0.65 A for **BU408D** I_C = 6 A I_B = 1.2 A			1.3 1.5	V V
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 10 V	10			MHz
t_{off}	Turn-off time	for **BU406D** and **BU407D** I_C = 5 A $I_{B\ end}$ = 0.65 A for **BU408D** I_C = 6 A $I_{B\ end}$ = 1.2A			0.75 0.5	μs μs
$I_{s/b}$	Second breakdown collector current	V_{CE} = 40 V t = 10 ms		4		A
V_F	Diode forward voltage	I_F = 5 A			1.5	V

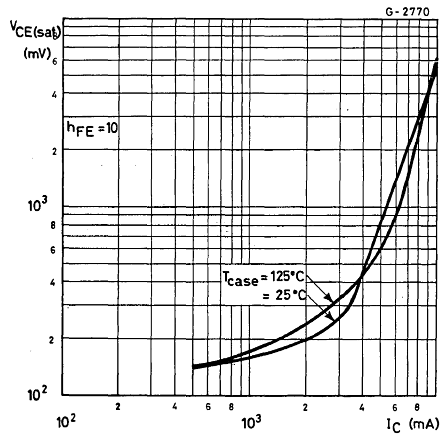
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BU 406D
BU 407D
BU 408D

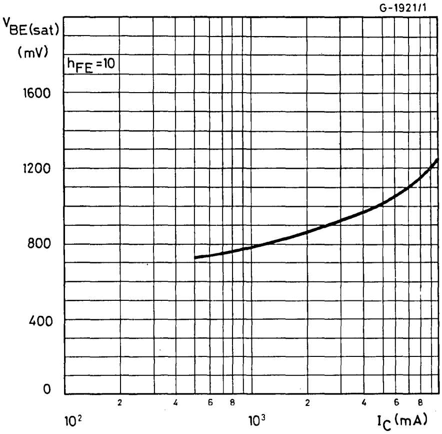
DC current gain



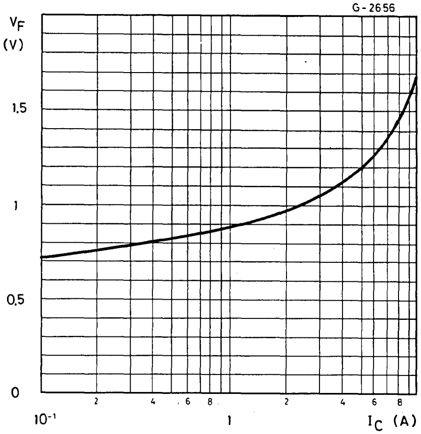
Collector-emitter saturation voltage



Base-emitter saturation voltage

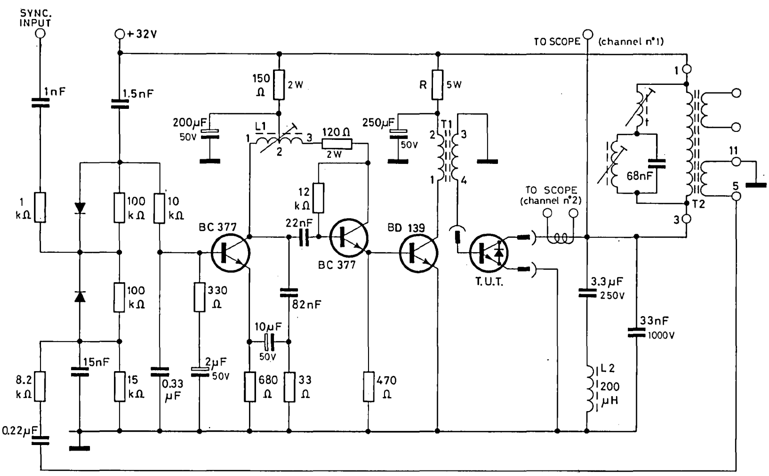


Forward voltage



SWITCHING TIMES

Test circuit (fall, storage and turn-off time)



S-2297/1

L1 Horizontal hold coil: Pins 1–2=75 turns Ø 0.2 mm; R=1.5 Ω; L min = 0.62 mH
Pins 2–3=293 turns Ø 0.2 mm; R=4.8 Ω; L max= 4.1 mH Core=siferrit B62120 25×4×2

L2 Horizontal yoke=200 µH

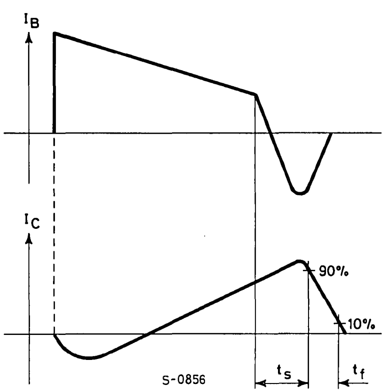
T1 Driver transformer: Pins 1–2=125 turns Ø 0.2 mm;
Pins 3–4=25 turns Ø 0.4 mm; Gap =0.12 mm; Core=3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

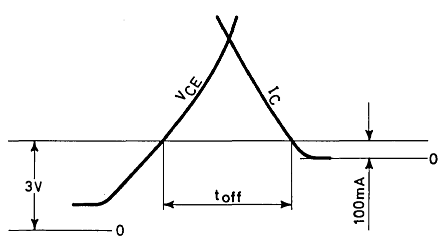
R = 270 Ω for BU406D and BU407D
R = 180 Ω for BU408D

Waveforms

Fall and storage time



Turn-off time



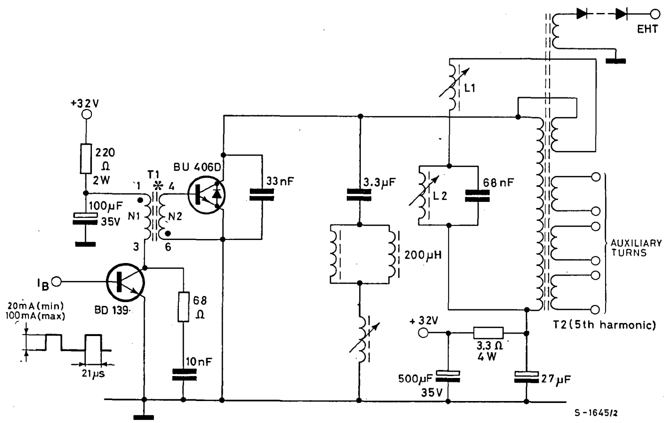
Turn-off time is the time for the collector current I_C to decrease to 100 mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

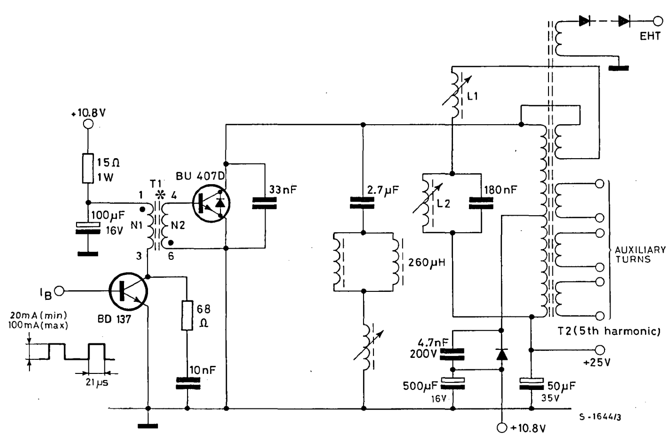
Two examples are given of the BU 406D and BU 407D in conventional MTV horizontal deflection circuits.

BU 406D - application circuit for 17" to 24" - 110° - 28 mm neck picture tubes



*N1=125 turns ∅ 0.3mm; N2=25 turns ∅ 0.6mm; GAP=0.12mm; CORE=DOUBLE E 19x5x8 mm; FERRITE 3E1 TYPE

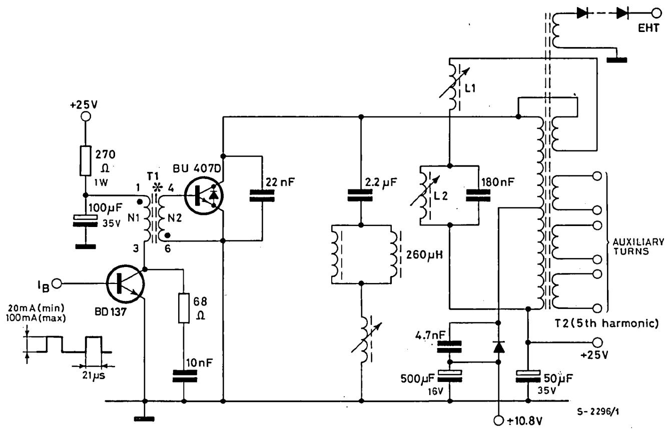
BU 407D - application circuit for 12" to 17" - 110° - 20 mm neck picture tubes
(driver supply voltage = 10.8 V)



*N1= 90 turns ∅ 0.3mm; N2=30 turns ∅ 0.6mm; GAP=0.12mm; CORE=DOUBLE E 19x5x8 mm; FERRITE 3E1 TYPE

APPLICATION INFORMATION (continued)

BU 407D - application circuit for 12" to 17" - 110° - 20 mm neck picture tubes
(driver supply voltage = 25 V)



*N1=125 turns ∅ 0.3mm ; N2=25 turns ∅ 0.6mm ; GAP=0.12mm ; CORE=DOUBLE E 19x5x8 mm;FERRITE 3E1 TYPE

BU 407
BU 407H

EPITAXIAL PLANAR NPN

HORIZONTAL TV DEFLECTORS

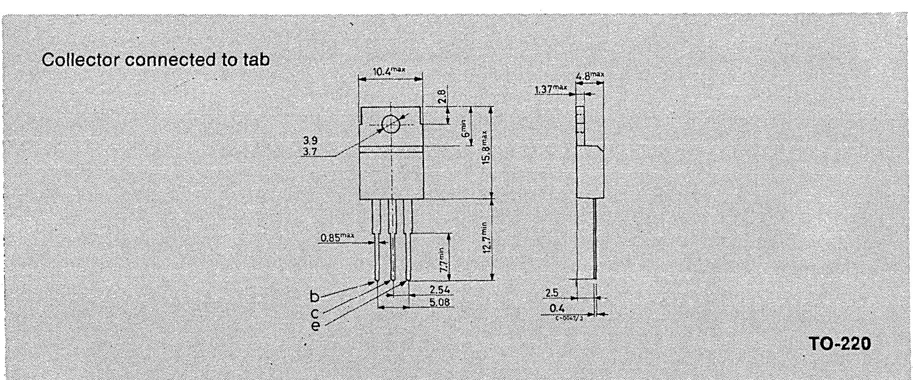
The BU 407 and BU 407H are silicon epitaxial planar NPN transistors in Jedec TO-220 plastic package.
They are fast switching, high voltage devices for use in horizontal deflection output stages of medium and small screens MTV receivers with 110° CRT.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	330	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	330	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_{CM}	Collector peak current (repetitive)	10	A
I_{CM}	Collector peak current (t = 10 ms)	15	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	60	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

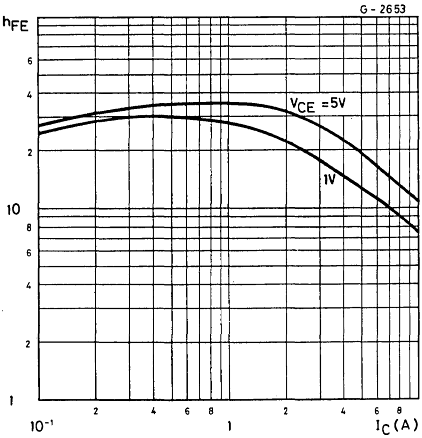
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	V_{CE} = 330V V_{CE} = 200V V_{CE} = 200V	 T_{case} = 150°C			5 100 1	mA μA mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	V_{EB} = 6 V				1	mA
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **BU407** I_C = 5 A for **BU407H** I_C = 5 A	 I_B = 0.5A I_B = 0.8A			 1 1	 V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	for **BU407** I_C = 5 A for **BU407H** I_C = 5 A	 I_B = 0.5A I_B = 0.8A			 1.2 1.2	 V V
f_T	Transition frequency	I_C = 0.5 A	V_{CE} = 10 V	10			MHz
t_{off}**	Turn-off time	for **BU407** I_C = 5 A for **BU407H** I_C = 5 A	 $I_{B\,end}$ = 0.5A $I_{B\,end}$ = 0.8A			 0.75 0.4	 μs μs
$I_{s/b}$	Second breakdown collector current	V_{CE} = 40 V	t = 10ms	4			A

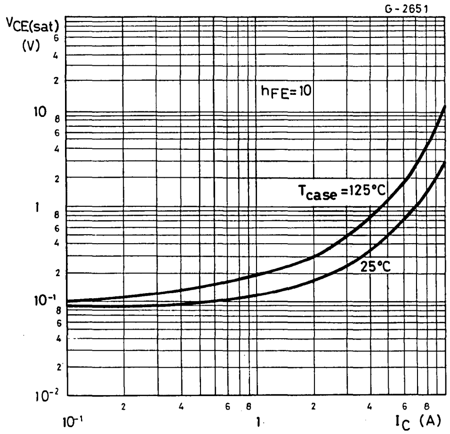
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** See test circuit

BU 407
BU 407H

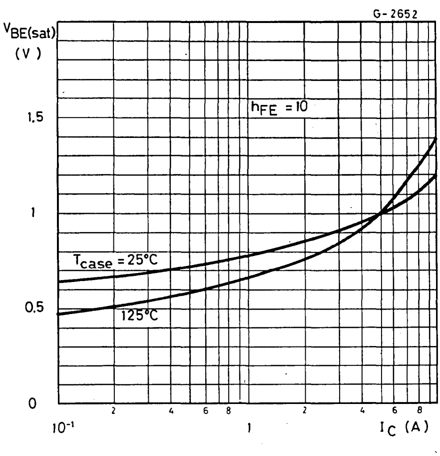
DC current gain



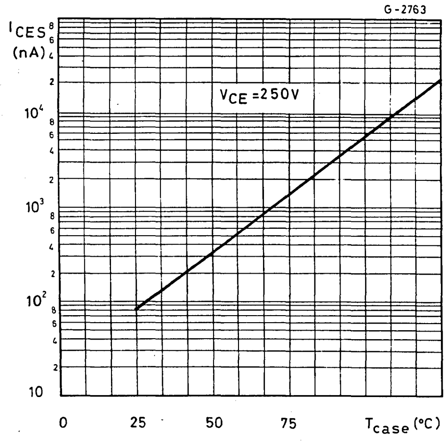
Collector-emitter saturation voltage



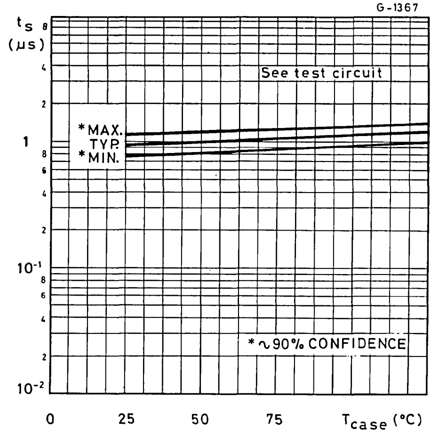
Base-emitter saturation voltage



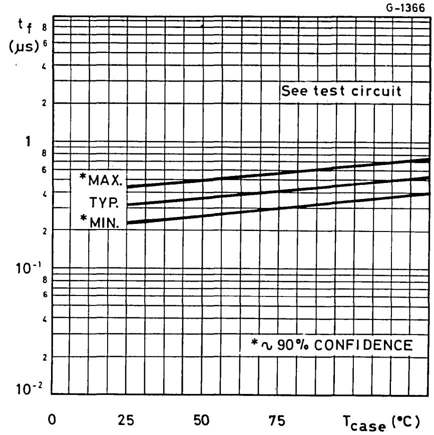
Collector cutoff current



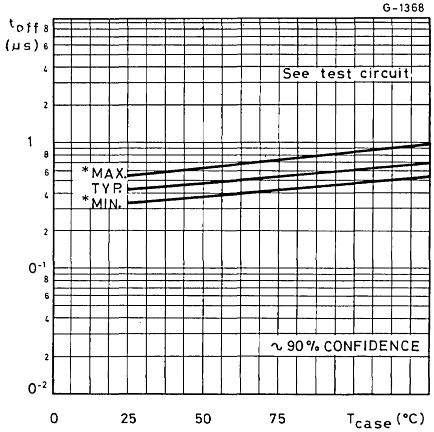
Storage time



Fall time

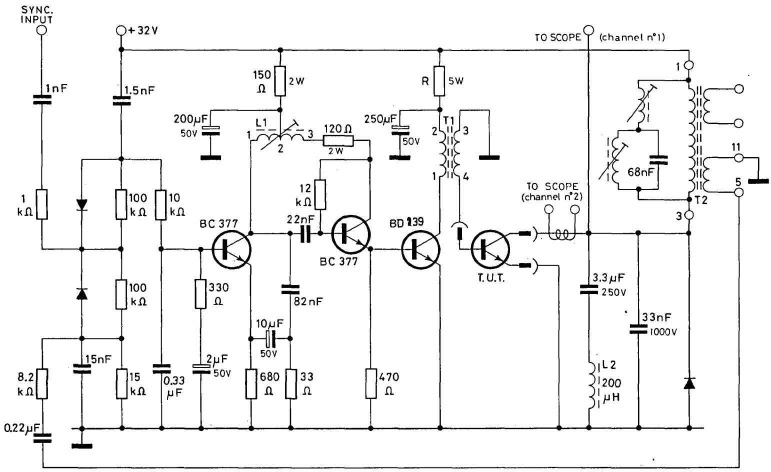


Turn-off time



SWITCHING TIMES

Test circuit (fall, storage and turn-off time)



S-2291/2

L1 Horizontal hold coil: Pins 1–2=75 turns ∅ 0.2 mm; R=1.5 Ω; L min = 0.62 mH
Pins 2–3=293 turns ∅ 0.2 mm; R=4.8 Ω; L max = 4.1 mH Core = siferrit B62120 25×4×2

L2 Horizontal yoke = 200 µH

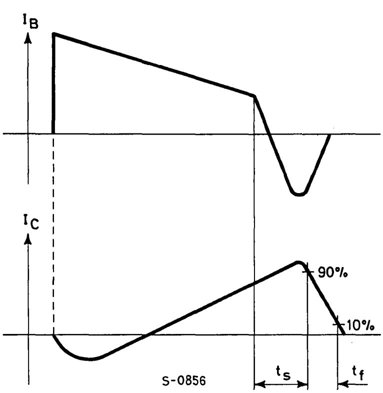
T1 Driver transformer: Pins 1–2=125 turns ∅ 0.2 mm;
Pins 3–4=25 turns ∅ 0.4 mm; Gap = 0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

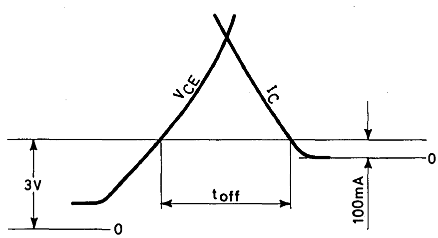
R = 330 Ω for BU407
R = 220 Ω for BU407H

Waveforms

Fall and storage time



Turn-off time



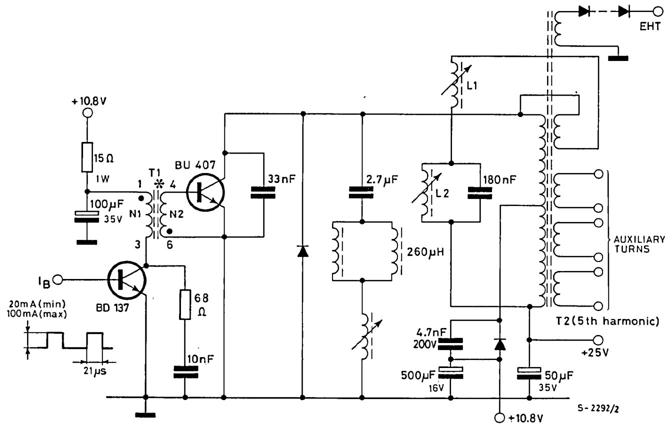
Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

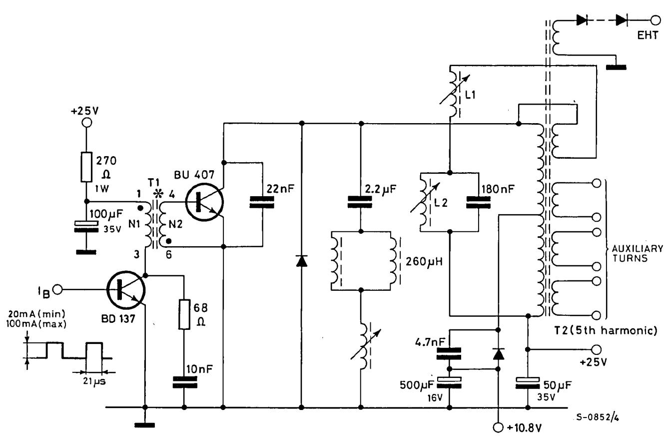
Two examples are given of the BU407 in conventional MTV horizontal deflection circuits

BU 407 - application circuit for 12" to 17" - 110° - 20 mm neck picture tubes
(driver supply voltage = 10.8V)



✻N1=125 turns ∅ 0.3mm; N2=30 turns ∅ 0.6mm; GAP=0.12mm; CORE=DOUBLE E 19x5x8 mm;FERRITE 3E1TYPE

BU 407 - application circuit for 12" to 17" - 110° - 20 mm neck picture tubes
(driver supply voltage = 25 V)



✻N1=125 turns ∅ 0.3mm; N2=25 turns ∅ 0.6mm; GAP=0.12mm; CORE=DOUBLE E 19x5x8 mm;FERRITE 3E1TYPE

BU 409

EPITAXIAL PLANAR NPN

LINEAR AND SWITCHING APPLICATIONS

The BU 409 is a silicon epitaxial planar NPN transistor in Jedec TO-220 plastic package. It is intended for general purpose linear and switching applications.

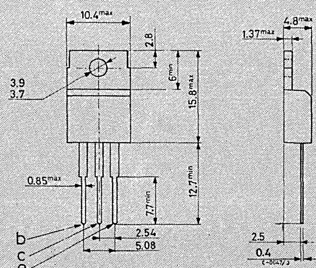
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_B	Base current	1	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	60	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

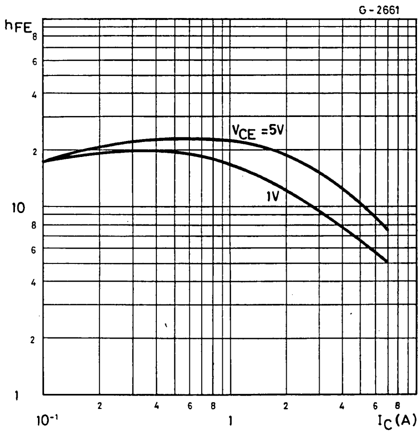
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

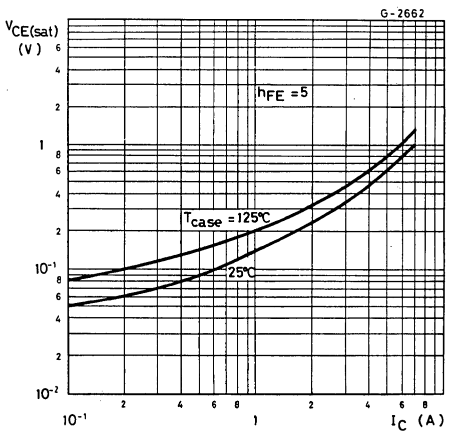
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = 250 V				5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 6 V				1	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3 A	I_B = 0.4 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 3 A	I_B = 0.4 A			1.25	V
h_{FE}*	DC current gain	I_C = 3 A	V_{CE} = 1 V	7.5			—
f_T	Transition frequency	I_C = 500mA	V_{CE} = 10 V	10			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

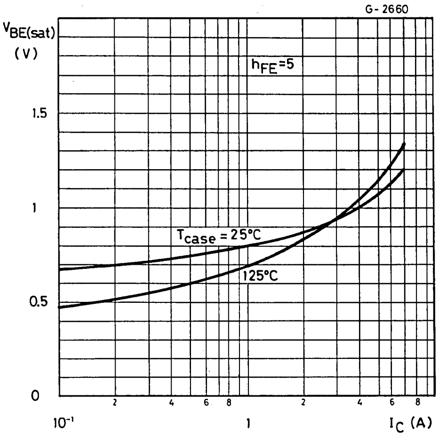
DC current gain



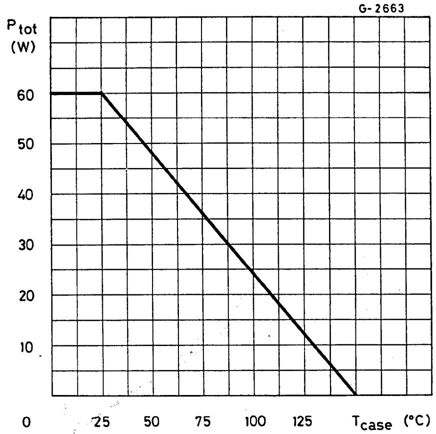
Collector-emitter saturation voltage



Base-emitter saturation voltage



Power rating chart



EPITAXIAL PLANAR NPN

BU 606
BU 607
BU 608

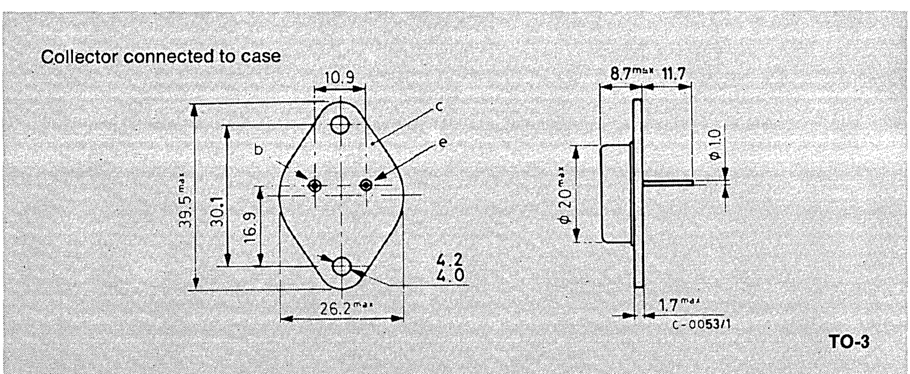
HORIZONTAL TV DEFLECTORS

The BU 606, BU 607 and BU 608 are silicon epitaxial planar NPN transistors in Jedec TO-3 metal case. They are fast switching, high voltage devices for use in horizontal deflection output stages of MTV receivers with 110° CRT. The BU 606 and BU 608 are primarily intended for large screen, while the BU 607 is for medium and small screens.

ABSOLUTE MAXIMUM RATINGS		BU606	BU607	BU608
V_{CBO}	Collector-base voltage ($I_E = 0$)	400V	330V	400V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400V	330V	400V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		200V	
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		7A	
I_{CM}	Collector peak current (repetitive)		10A	
I_{CM}	Collector peak current (t = 10 ms)		15A	
I_B	Base current		4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		90W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

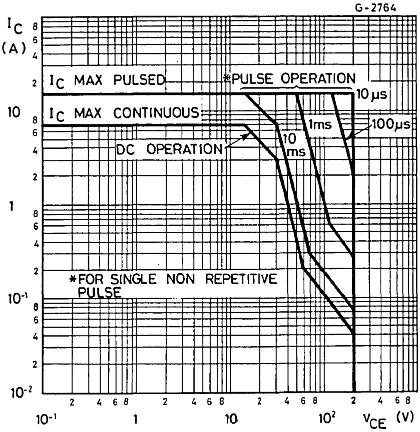
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.9	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

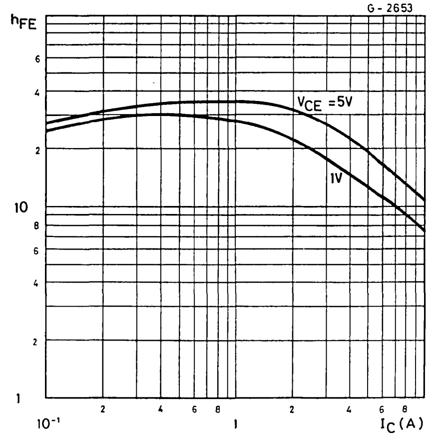
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	for **BU606** and **BU608** V_{CE} = 400V for **BU607** V_{CE} = 330V			 5 5	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			1	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BU606** and **BU607** I_C = 5A I_B = 0.5A for **BU608** I_C = 6A I_B = 1.2A			 1 1	 V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BU606** and **BU607** I_C = 5A I_B = 0.5A for **BU608** I_C = 6A I_B = 1.2A			 1.2 1.5	 V V
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V	10			MHz
t_{off}**	Turn-off time	for **BU606** and **BU607** I_C = 5A $I_{B\ end}$ = 0.5A for **BU608** I_C = 6A $I_{B\ end}$ = 1.2A			 0.75 0.4	 µs µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
** See test circuit

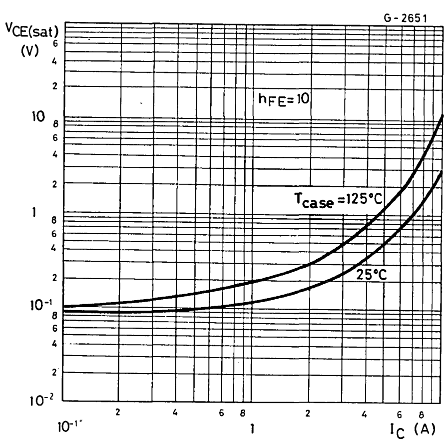
Safe operating areas



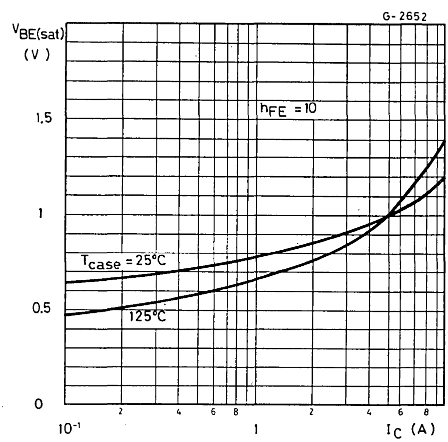
DC current gain



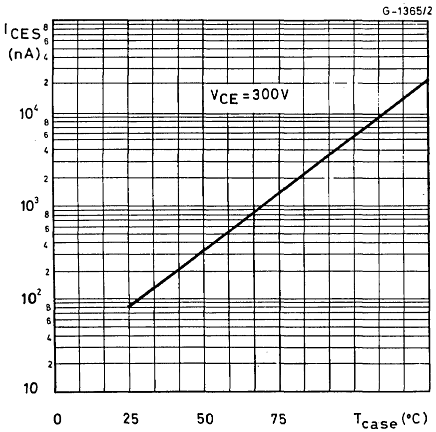
Collector-emitter saturation voltage



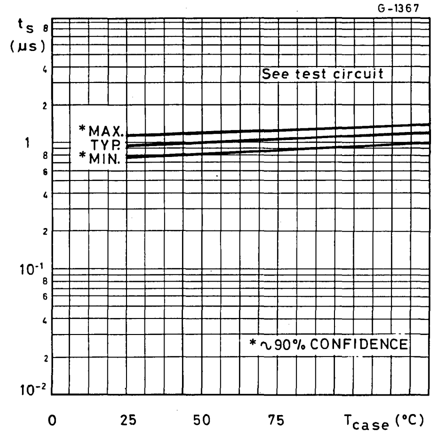
Base-emitter saturation voltage



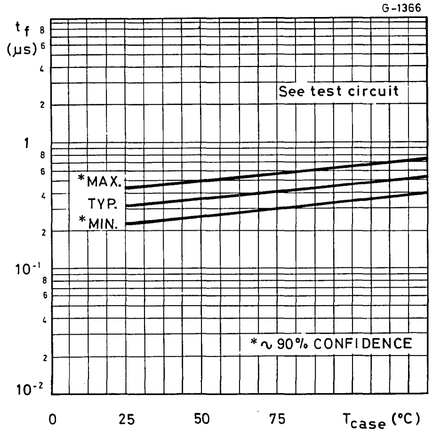
Collector cutoff current



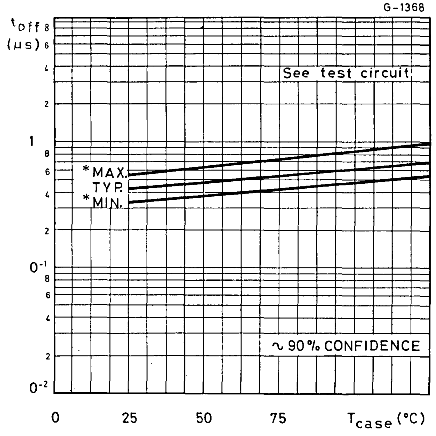
Storage time



Fall time

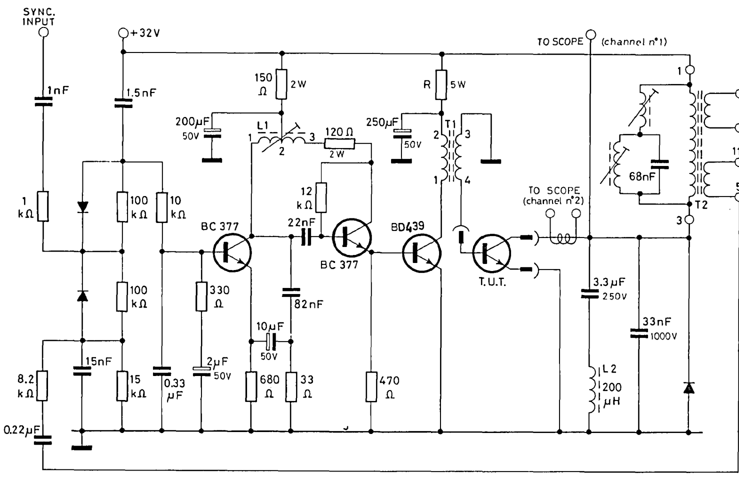


Turn-off time



SWITCHING TIMES

Test circuit (fall, storage and turn-off time)



L1 Horizontal hold coil: Pins 1-2=75 turns Ø 0.2 mm; R=1.5 Ω; L min = 0.62 mH
Pins 2-3=293 turns Ø 0.2 mm; R=4.8 Ω; L max = 4.1 mH Core=siferrit B 62120 25×4×2

L2 Horizontal yoke=200 μH

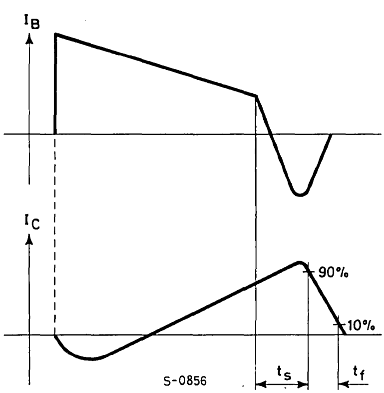
T1 Driver transformer: Pins 1-2=125 turns Ø 0.2 mm;
Pins 3-4=25 turns Ø 0.4 mm; Gap =0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

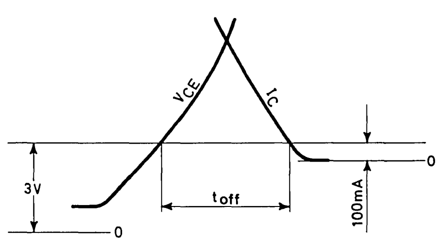
R = 330 Ω for BU 606 and BU607
R = 180 Ω for BU 608

Waveforms

Fall and storage time



Turn-off time



Turn-off time is the time for the collector current I_C to decrease to 100 mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

BU 606D
BU 607D
BU 608D

EPITAXIAL PLANAR NPN

HORIZONTAL TV DEFLECTORS

The BU 606D, BU 607D and BU 608D are silicon epitaxial planar NPN transistors with integrated damper diode, in Jedec TO-3 metal case. They are fast switching, high voltage devices for use in horizontal deflection output stages of MTV receivers with 110° CRT. The BU 606D and BU 608D are primarily intended for large screen, while the BU 607D is for medium and small screens.

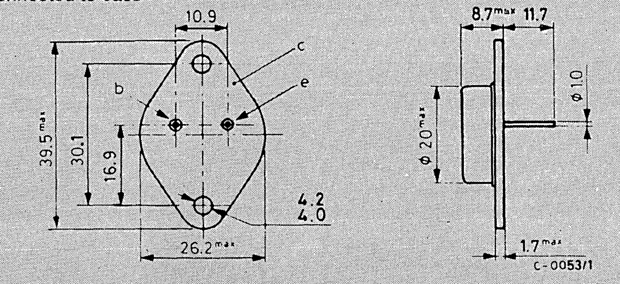
ABSOLUTE MAXIMUM RATINGS

		BU606D	BU607D	BU608D
V_{CBO}	Collector-base voltage ($I_E = 0$)	400V	330V	400V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400V	330V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		7A	
I_{CM}	Collector peak current (repetitive)		10A	
I_{CM}	Collector peak current (t = 10 ms)		15A	
I_B	Base current		4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		90W	
T_{stg}	Storage temperature		-65 to 175 °C	
T_j	Junction temperature		175 °C	

MECHANICAL DATA

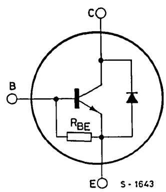
Dimensions in mm

Collector connected to case



TO-3

INTERNAL SCHEMATIC DIAGRAM



THERMAL DATA

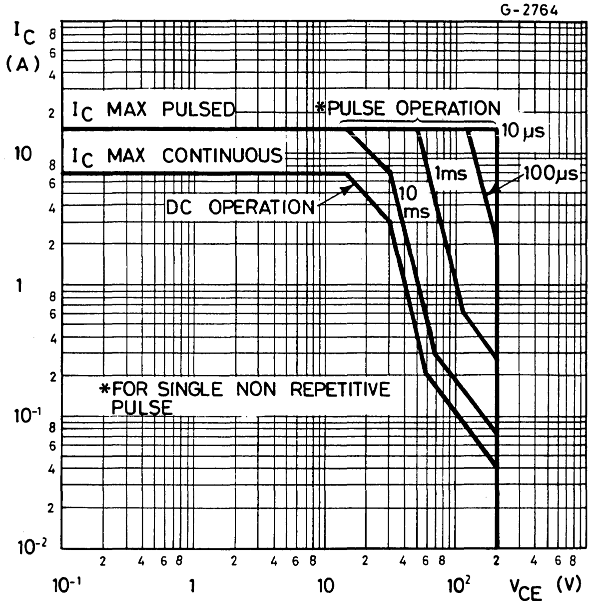
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.9	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

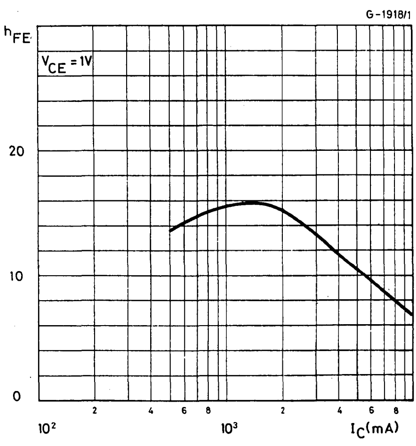
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	for **BU606D** and **BU608D** V_{CE} = 400V for **BU607D** V_{CE} = 330V			 5 5	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			400	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BU606D** and **BU607D** I_C = 5A I_B = 0.65A for **BU608D** I_C = 6A I_B = 1.2A			 1 1	 V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BU606D** and **BU607D** I_C = 5A I_B = 0.65A for **BU608D** I_C = 6A I_B = 1.2A			 1.3 1.5	 V V
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V	10			MHz
t_{off}**	Turn-off time	for **BU606D** and **BU607D** I_C = 5A I_{Bend} = 0.65A for **BU608D** I_C = 6A I_{Bend} = 1.2A			 0.75 0.5	 µs µs
V_F	Diode forward voltage	I_F = 5 A			1.5	V

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
** See test circuit

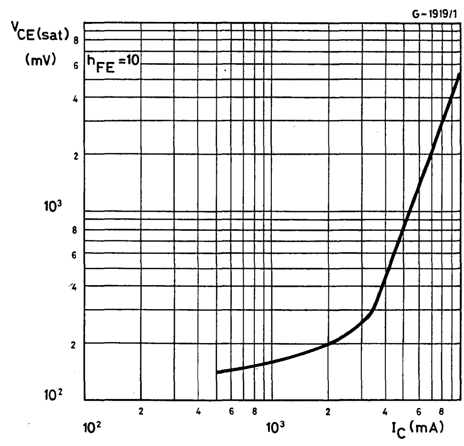
Safe operating areas



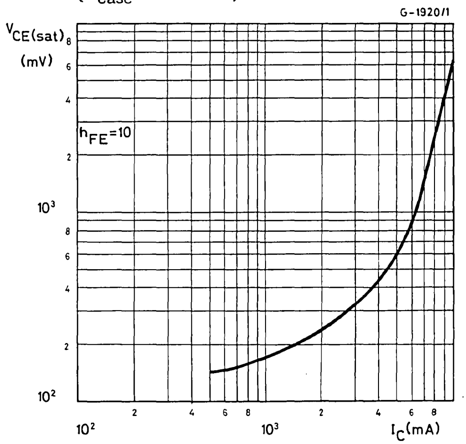
DC current gain



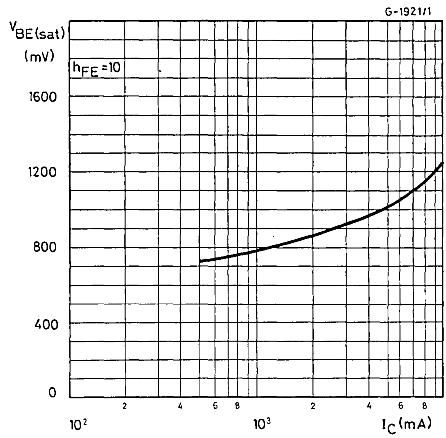
Collector-emitter saturation voltage



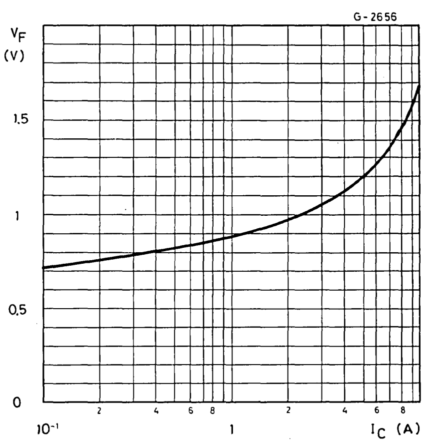
Collector-emitter saturation voltage (T_{case} = 125°C)



Base-emitter saturation voltage

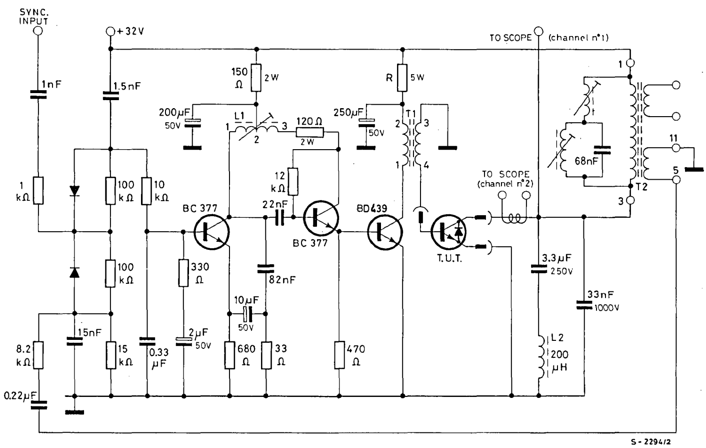


Forward voltage



SWITCHING TIMES

Test circuit (fall. storage and turn-off time)



L1 Horizontal hold coil: Pins 1-2=75 turns ∅ 0.2 mm; R=1.5 Ω; L min = 0.62 mH; Pins 2-3=293 turns ∅ 0.2 mm; R=4.8 Ω; L max = 4.1 mH; Core = siferrit B62120 25×4×2

L2 Horizontal yoke = 200 μH

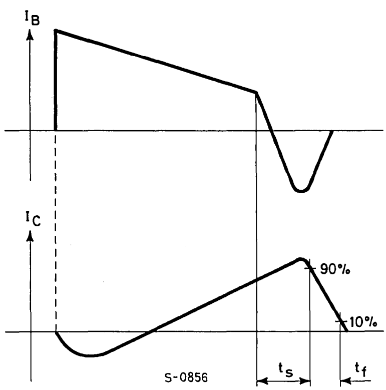
T1 Driver transformer: Pins 1-2=125 turns ∅ 0.2 mm; Pins 3-4=25 turns ∅ 0.4 mm; Gap = 0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

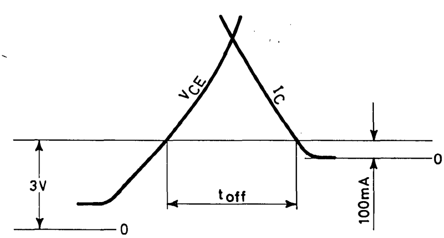
R = 270 Ω for BU 606D and BU 607D
R = 180 Ω for BU 608D

Waveforms

Fall and storage time



Turn-off time



Turn-off time is the time for the collector current I_C to decrease to 100 mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

EPITAXIAL PLANAR NPN

BU 806
BU 807

FAST SWITCHING DARLINGTON TRANSISTORS

The BU 806 and BU 807 are silicon epitaxial planar NPN power Darlington transistors with integrated base-emitter speed-up diode, mounted in Jedec TO-220 plastic package. They are high voltage, high current devices for fast switching applications. In particular they can be used in horizontal output stages of 110° CRT video displays. The BU 806 is primarily intended for large screeen, while the BU 807 is for medium and small screens.

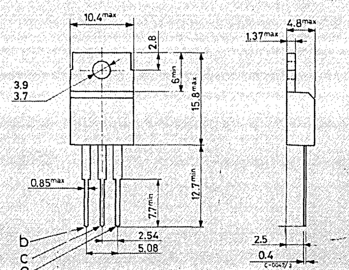
ABSOLUTE MAXIMUM RATINGS

		BU 806	BU 807
V_{CBO}	Collector-base voltage ($I_E=0$)	400V	330V
V_{CEV}	Collector-emitter voltage (V_{BE}=-6V)	400V	330V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	200V	150V
V_{EBO}	Emitter-base voltage ($I_C=0$)	6V	
I_C	Collector current	8A	
I_{CM}	Collector peak current	15A	
I_{DM}	Damper diode peak forward current	10A	
I_B	Base current	2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$°C	60W	
T_{stg}	Storage temperature	-65 to 150°C	
T_j	Junction temperature	150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BU 806
BU 807

THERMAL DATA

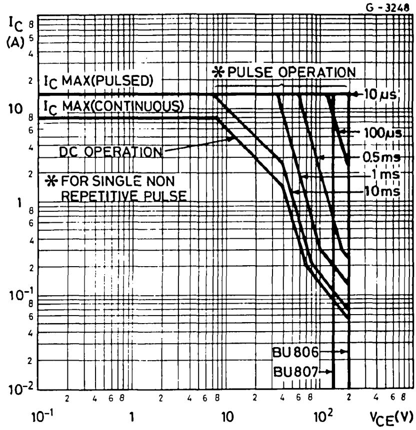
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}case}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

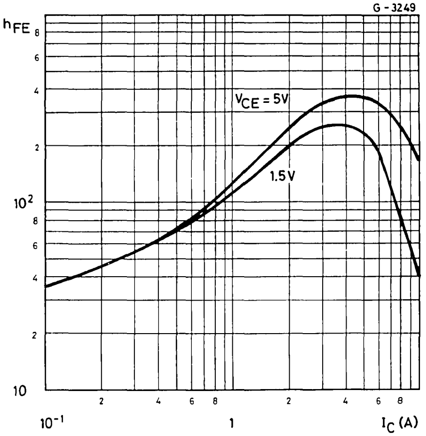
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BU807** $V_{CE}=330V$ for **BU806** $V_{CE}=400V$			100 100	μA μA
I_{CEV}	Collector cutoff current ($V_{BE}=-6V$)	for **BU807** $V_{CE}=330V$ for **BU806** $V_{CE}=400V$			100 100	μA μA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=6V$			3	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	$I_C=100mA$ for **BU807** for **BU806**	 150 200			 V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C=5A$ $I_B=50mA$			1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C=5A$ $I_B=50mA$			2.4	V
V_F*	Damper diode forward voltage	$I_F=4A$			2	V
t_{off}**	Turn-off time	$I_C=5A$ $I_{B1}=50mA$		0.4	1	μs
t_{on}	Turn-on time	**RESISTIVE LOAD**		0.35		μs
t_s	Storage time	$I_C=5A$ $I_{B1}=50mA$ $I_{B2}=-500mA$ $V_{CC}=100V$		0.55		μs
t_f	Fall time			0.2		μs

* Pulsed: pulse duration = 300μs, duty cycle = 1,5%
** See test circuit

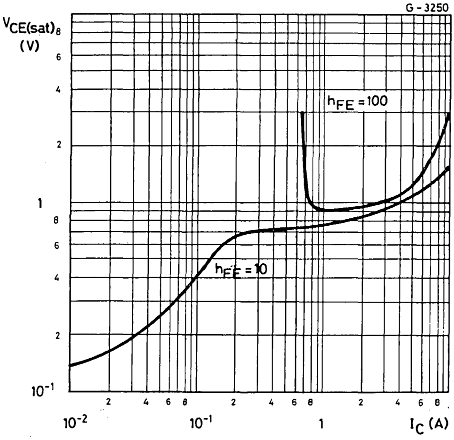
Safe operating areas



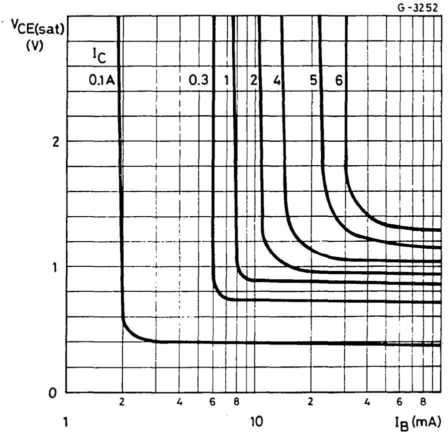
DC current gain



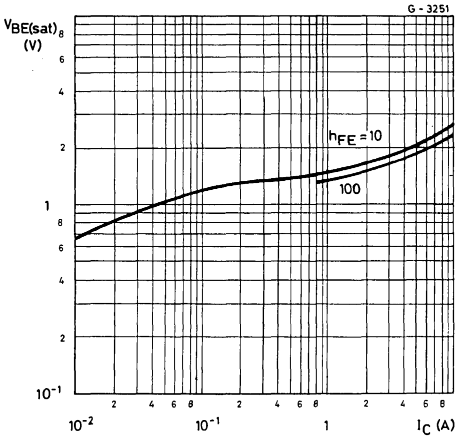
Collector-emitter saturation voltage



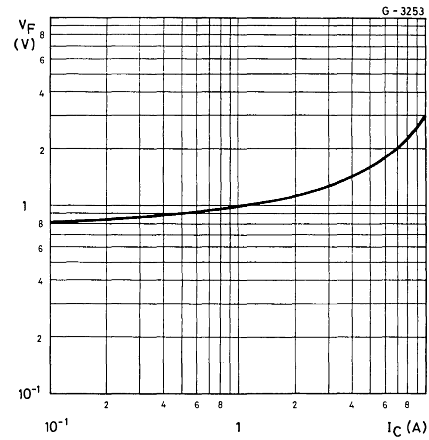
Collector-emitter saturation voltage



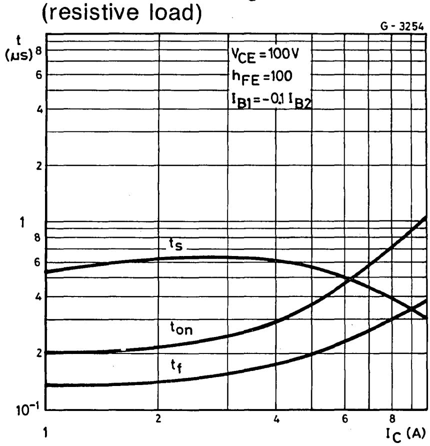
Base-emitter saturation voltage



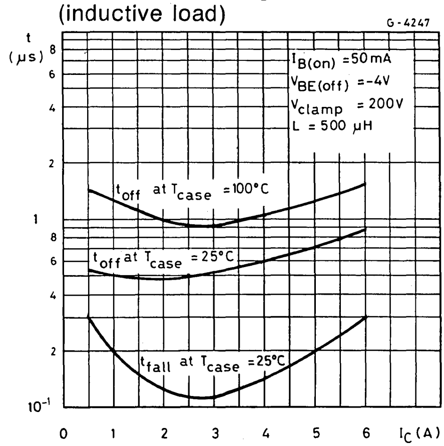
Damper diode



Saturated switching characteristics (resistive load)

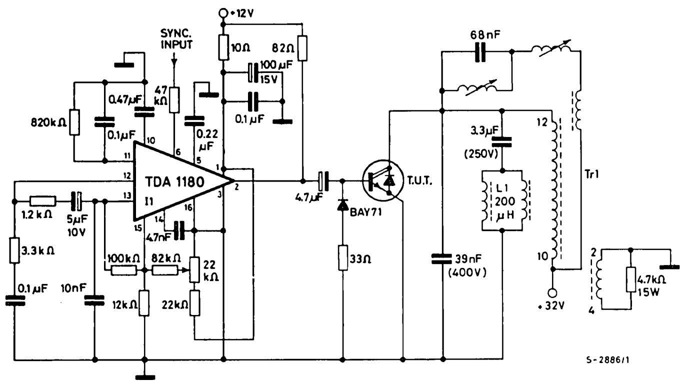


Saturated switching characteristics (inductive load)



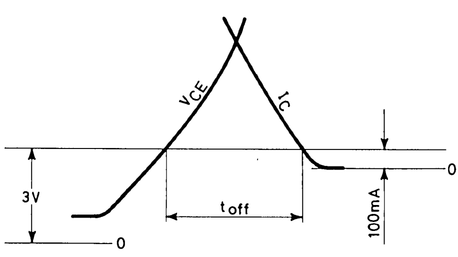
HORIZONTAL DEFLECTION TURN-OFF TIME

Test circuit



L1 = Horizontal yoke = 200 µH
Tr1 = EHT Transformer SAREAtype 900914 or equivalent
I1 = Horizontal oscillator linear I.C. TDA 1180

Turn-off time waveform

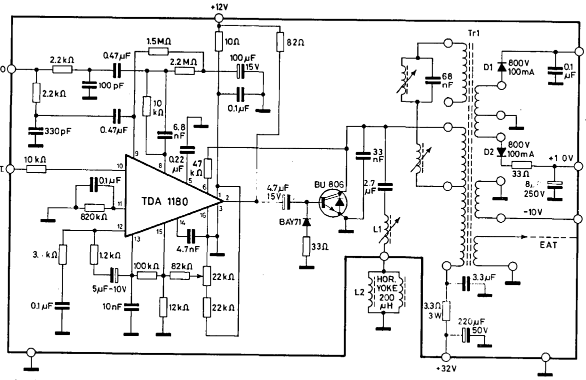


Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

Horizontal deflection circuit using the darlington BU 806 directly driven by the TDA 1180 (B & W TV set: large screen solution)

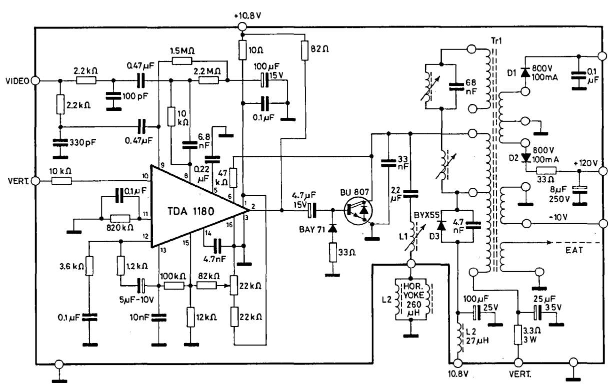


L1 = Linearity inductance RL 33 INELCO

S - 2887/1

L_l = Linearity inductance $19 \div 39 \mu H$

Horizontal deflection circuit using the darlington BU 807 directly driven by the TDA 1180 (B & W TV set: small screen solution).



L1 = Linearity inductance RL 46 INELCO

S - 2888/1

L_l = Linearity inductance $37 \div 67 \mu H$

MULTIEPITAXIAL PLANAR NPN

BU 910
BU 911
BU 912

PRELIMINARY DATA

HIGH VOLTAGE POWER DARLINGTON

The BU 910, BU 911 and BU 912 are high voltage, silicon NPN transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, designed for applications such as electronic ignition, DC and AC motor controls, solenoid drivers, etc.

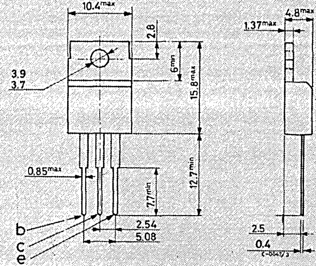
ABSOLUTE MAXIMUM RATINGS

		BU 910	BU 911	BU 912
V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	400V	450V	500V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	350V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		6A	
I_{CM}	Collector peak current		10A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		60W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

BU 910
BU 911
BU 912

THERMAL DATA

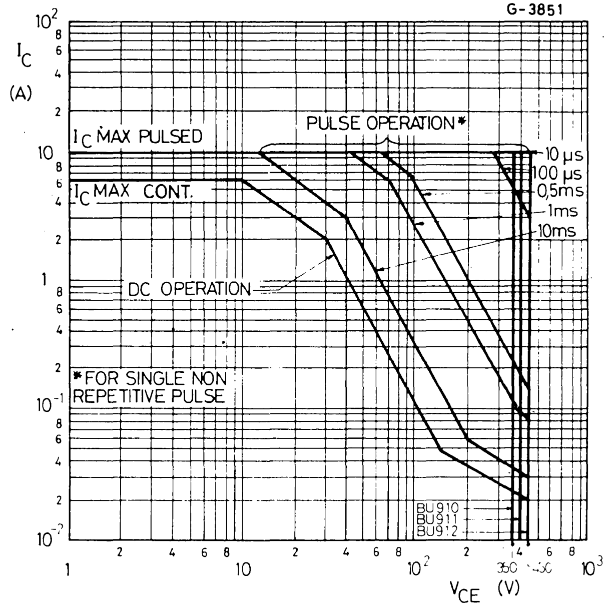
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

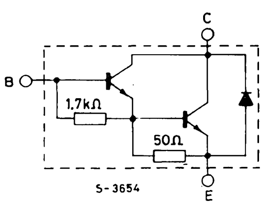
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BU910** V_{CE}=400V			1	mA
		for **BU911** V_{CE}=450V			1	mA
		for **BU912** V_{CE}=500V			1	mA
		T_{case} = 125°C				
		for **BU910** V_{CE}=400V			5	mA
		for **BU911** V_{CE}=450V			5	mA
		for **BU912** V_{CE}=500V			5	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BU910** V_{CE}=350V			1	mA
		for **BU911** V_{CE}=400V			1	mA
		for **BU912** V_{CE}=450V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB}=5V			5	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C = 100 mA				
		for **BU910**	350			V
		for **BU911**	400			V
		for **BU912**	450			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **BU910** and **BU911** I_C = 2.5A I_B = 50mA			1.8	V
		for **BU912** I_C = 2A I_B = 50mA			1.8	V
		All types I_C = 4A I_B = 200mA			1.8	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	for **BU910** and **BU911** I_C = 2.5A I_B = 50mA			2.2	V
		for **BU912** I_C = 2A I_B = 50mA			2.2	V
		All types I_C = 4A I_B = 200mA			2.5	V
V_F	Diode forward voltage	I_F = 4A			2.5	V

*Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

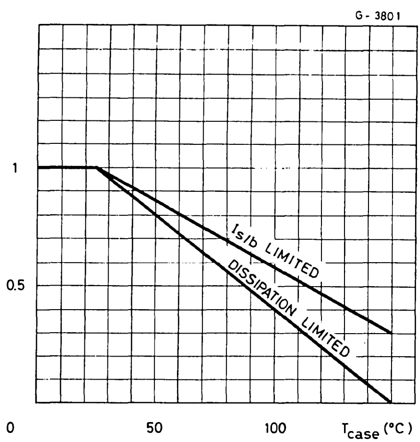
Safe operating areas



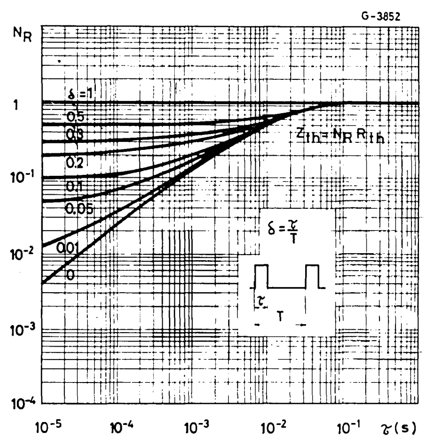
Internal circuit diagram



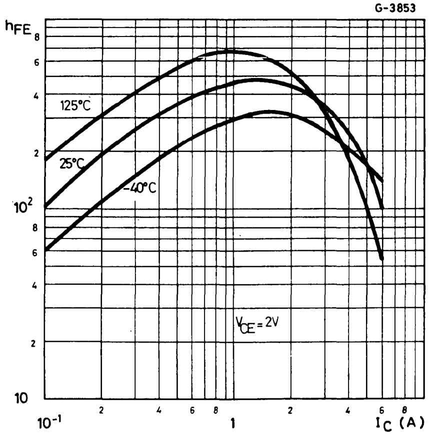
Derating curves



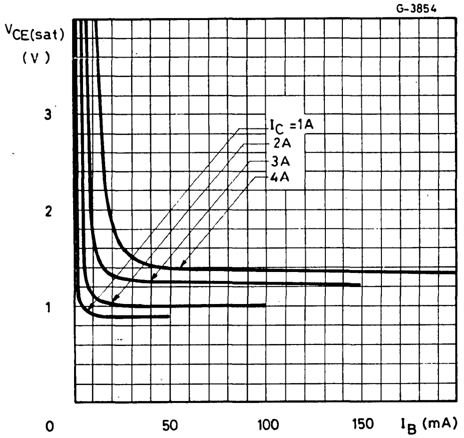
Thermal transient response



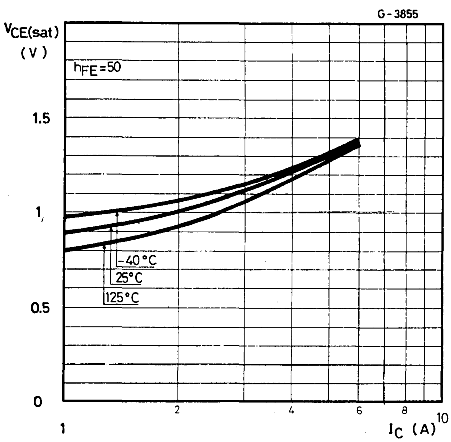
DC current gain



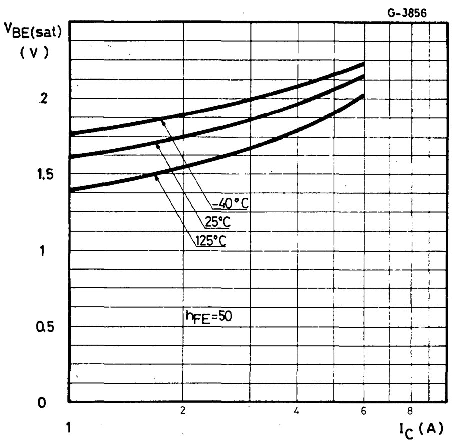
Collector-emitter saturation voltage



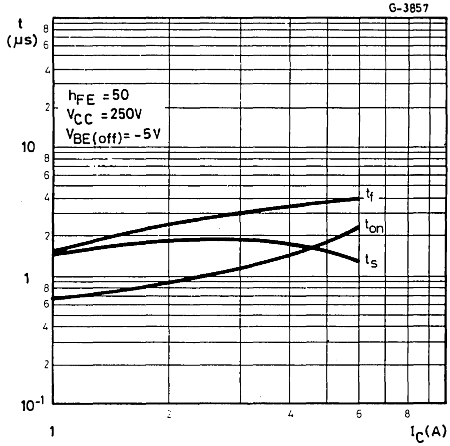
Collector-emitter saturation voltage



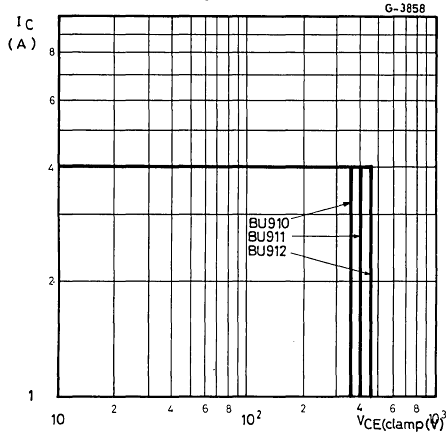
Base-Emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

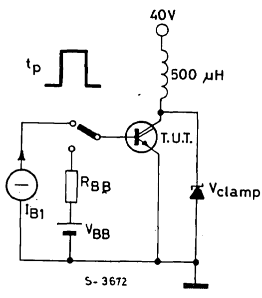
TEST CONDITIONS:

$5V > |-V_{BB}| > 0V$

$I_C / I_B = 50$

t_p = adjusted for nominal I_C.

$R_{BB} = 1\,\Omega$



BU 920
BU 921
BU 922

MULTIEPITAXIAL MESA NPN

PRELIMINARY DATA

HIGH VOLTAGE POWER DARLINGTON

The BU 920, BU 921 and BU 922 are high voltage, high current silicon NPN transistors in monolithic Darlington configuration in Jedec TO-3 metal case, specially intended for automotive ignition applications and inverter circuits for motor controls.

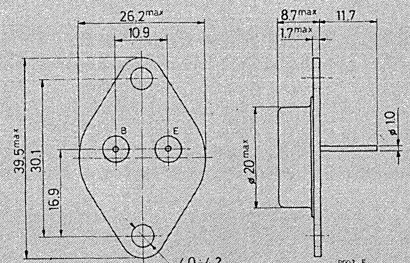
ABSOLUTE MAXIMUM RATINGS

		BU 920	BU 921	BU 922
V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	400V	450V	500V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	350V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		10A	
I_{CM}	Collector peak current		15A	
I_B	Base current		5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		120W	
T_{stg}	Storage temperature		-65 to 175°C	
T_j	Junction temperature		175°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	°C/W

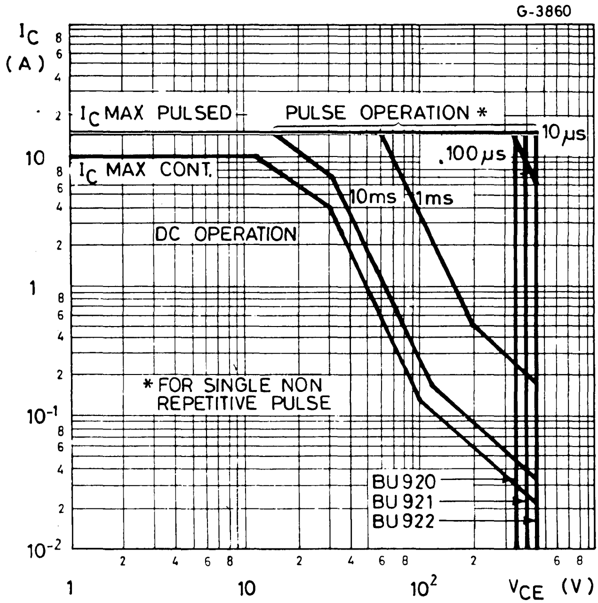
ELECTRICAL CHARACTERISTICS (T_{case}= 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	for **BU920** V_{CE}=400V			1	mA
		for **BU921** V_{CE}=450V			1	mA
		for **BU922** V_{CE}=500V			1	mA
		T_{case}= 150°C				
		for **BU920** V_{CE}=400V			5	mA
		for **BU921** V_{CE}=450V			5	mA
		for **BU922** V_{CE}=500V			5	mA
I_{CEO}	Collector cutoff current (I_C=0	for **BU920** V_{CE}=350V			1	mA
		for **BU921** V_{CE}=400V			1	mA
		for **BU922** V_{CE}=450V			1	mA
I_{EBO}	Emitter cutoff current (I_C =0)	V_{EB}=5V			50	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =100 mA				
		for **BU920**	350			V
		for **BU921**	400			V
		for **BU922**	450			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =5A I_B =50mA			1.8	V
		I_C =7A I_B =140mA			1.8	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C =5A I_B =50mA			2.2	V
		I_C =7A I_B =140mA			2.5	V
V_F*	Diode forward voltage	I_F =7A			2.5	V
	Functional test (see test circuit figg. 1 and 2)	for **BU920**				
		V_{CE}=350V L = 7mH	7			A
		for **BU921** and **BU922**				
		V_{CE}=400 L = 7mH	7			A

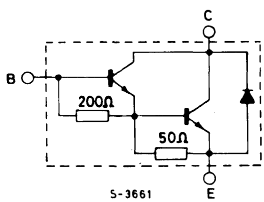
* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

BU 920
BU 921
BU 922

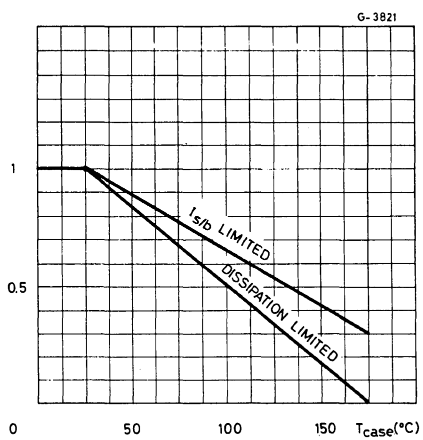
Safe operating areas



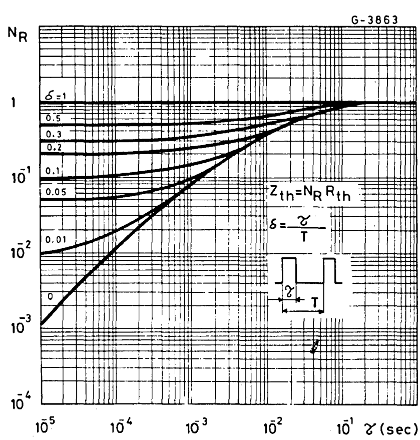
Internal circuit diagram



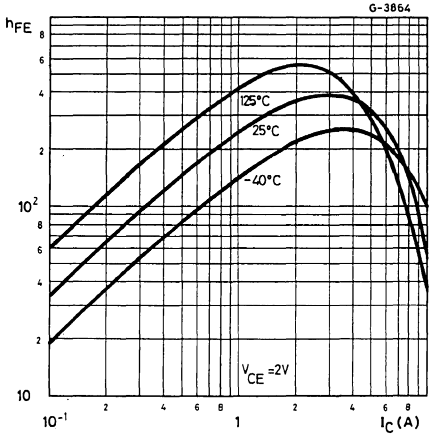
Derating curves



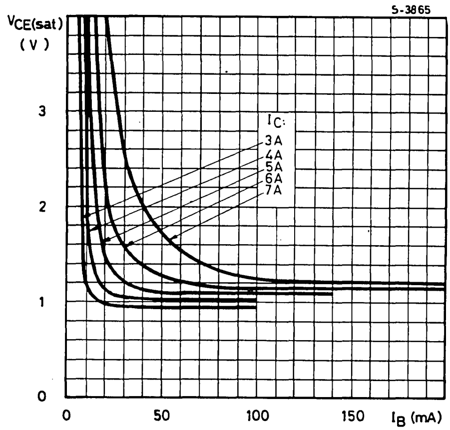
Thermal transient response



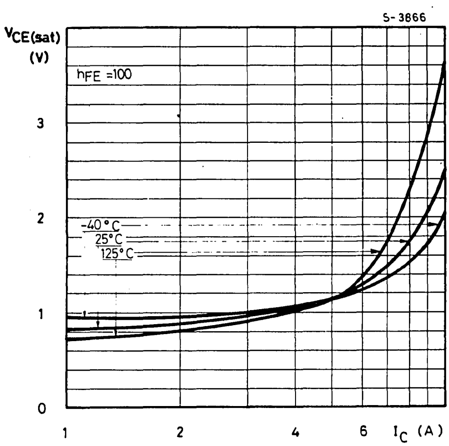
DC current gain



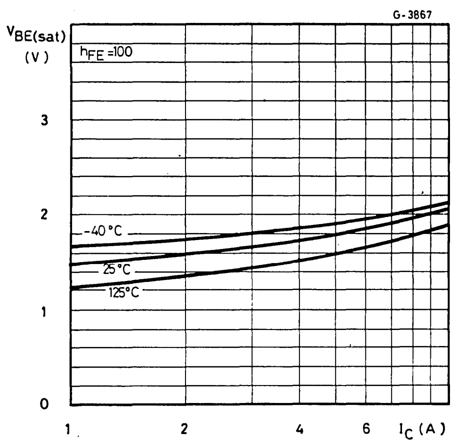
Collector-emitter saturation voltage



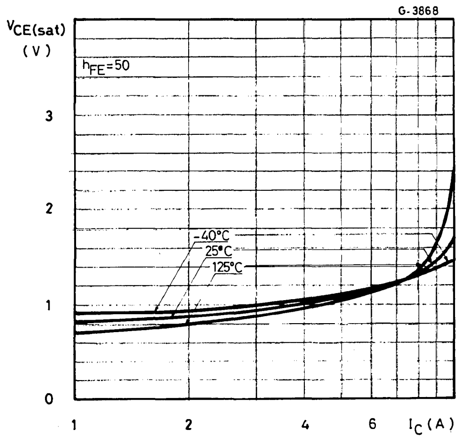
Collector-emitter saturation voltage



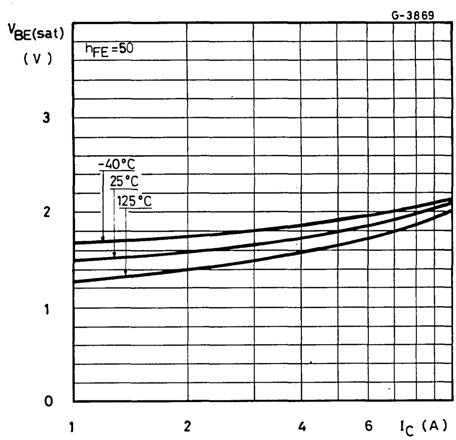
Base-emitter saturation voltage



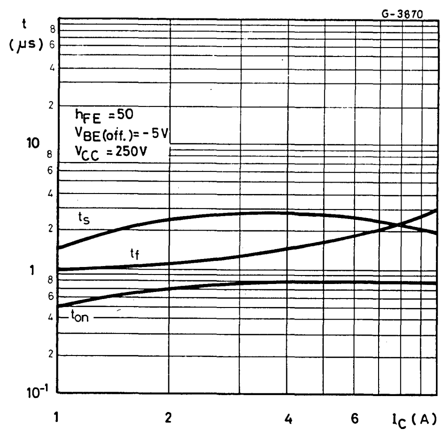
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristcs



Clamped reverse bias safe operating areas

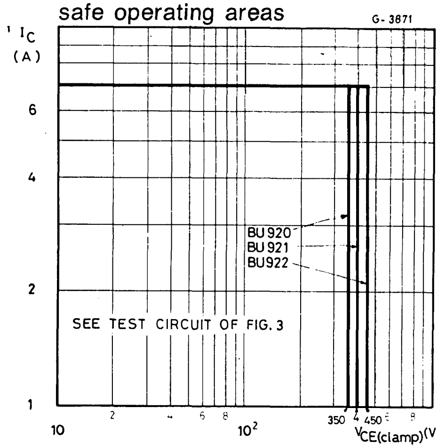


Fig. 1 — Functional test circuit

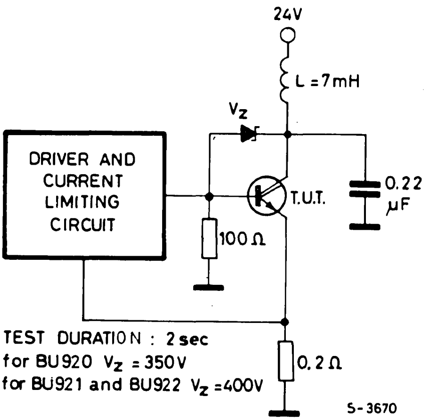


Fig. 2 — Functional test waveforms

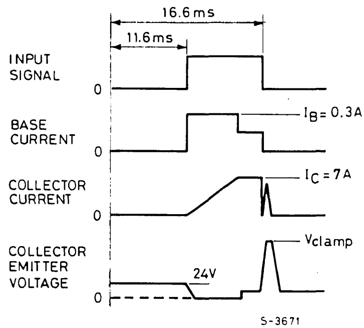
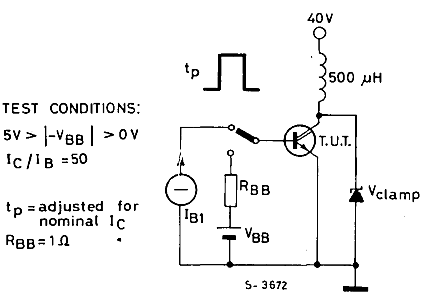


Fig. 3 — Clamped $E_{s/b}$ test circuit



BU 930
BU 931
BU 932

MULTIEPITAXIAL MESA NPN

PRELIMINARY DATA

HIGH VOLTAGE POWER DARLINGTON

The BU 930, BU 931 and BU 932 are high voltage, high current silicon NPN transistor in monolithic Darlington configuration in Jedec TO-3 metal case specially intended for automative ignition applications and inverter circuits for motor controls.

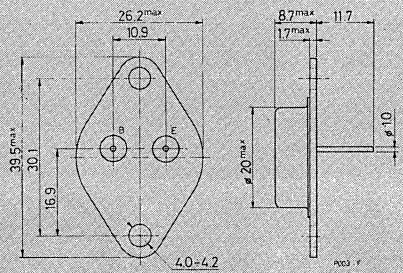
ABSOLUTE MAXIMUM RATINGS

		BU930	BU931	BU932
V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	400V	450V	500V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	350V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		15A	
I_{CM}	Collector peak current		20A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		150W	
T_{stg}	Storage temperature		-65 to 175°C	
T_j	Junction temperature		175°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25$ °C unless otherwise specified)

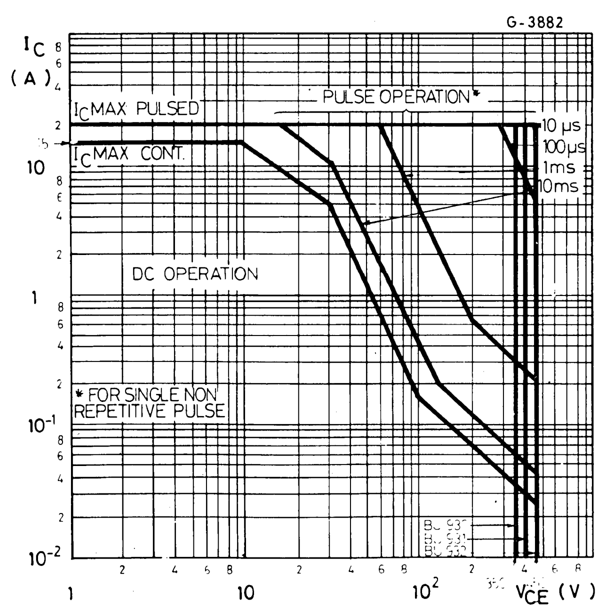
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($I_E = 0$)	for **BU930**	$V_{CE} = 400V$			1	mA
		for **BU931**	$V_{CE} = 450V$			1	mA
		for **BU932**	$V_{CE} = 500V$			1	mA
		$T_{case} = 150$ °C					
		for **BU930**	$V_{CE} = 400V$			5	mA
		for **BU931**	$V_{CE} = 450V$			5	mA
		for **BU932**	$V_{CE} = 500V$			5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BU930**	$V_{CE} = 350V$			1	mA
		for **BU931**	$V_{CE} = 400V$			1	mA
		for **BU932**	$V_{CE} = 450V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				50	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	$I_C = 100mA$					
		for **BU930**		350			V
		for **BU931**		400			V
		for **BU932**		450			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BU930** and **BU931**					
		$I_C = 7A$	$I_B = 70mA$			1.6	V
		$I_C = 8A$	$I_B = 100mA$			1.8	V
		$I_C = 10A$	$I_B = 250mA$			1.8	V
		for **BU932**					
		$I_C = 8A$	$I_B = 150mA$			1.8	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BU930** and **BU931**					
		$I_C = 8A$	$I_B = 100mA$			2.2	V
		$I_C = 10A$	$I_B = 250mA$			2.5	V
		for **BU932**					
		$I_C = 8A$	$I_B = 150mA$			2.2	V

ELECTRICAL CHARACTERISTICS (continued)

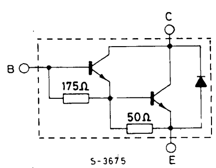
Parameter		Test conditions	Min. Typ. Max.	Unit
V_F*	Diode forward voltage	I_F =10A	2.5	V
	Functional test (see test circuit figg. 2 and 3)	for **BU930** V_{CE}=350V L=7mH for **BU931** and **BU932** V_{CE}=400V L=7mH	8 8	A A

* Pulsed: pulse duration =300 µs, duty cycle =1.5%

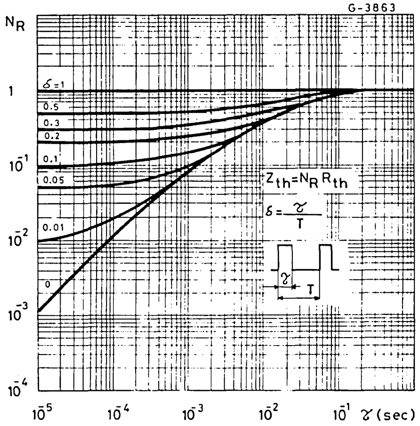
Safe operating areas



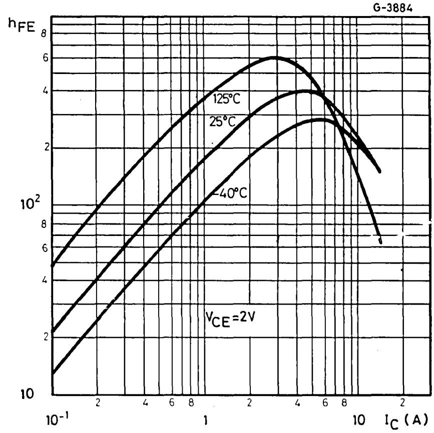
Internal circuit diagram



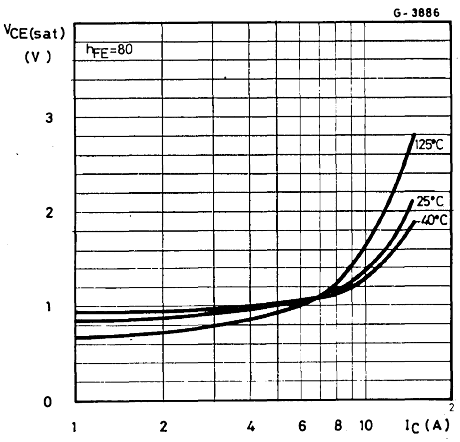
Thermal transient response



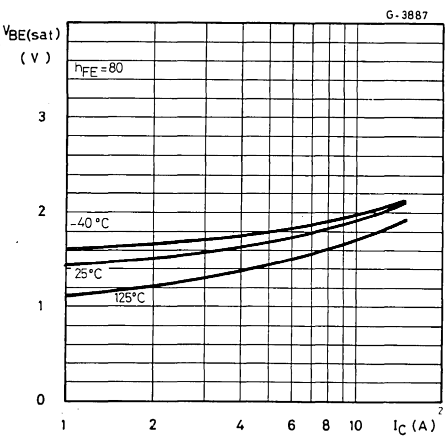
DC current gain



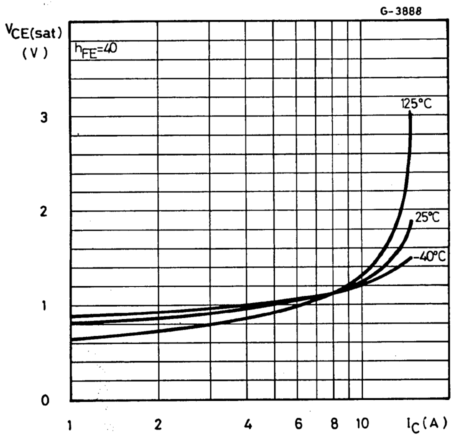
Collector-emitter saturation voltage



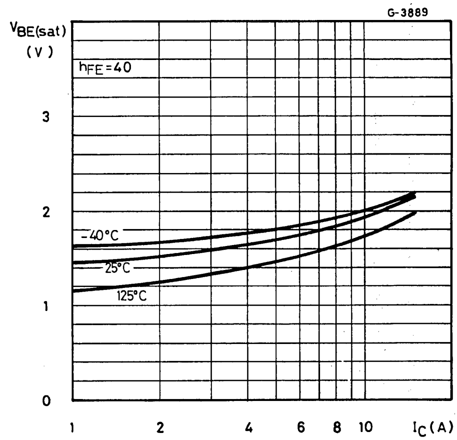
Base-emitter saturation voltage



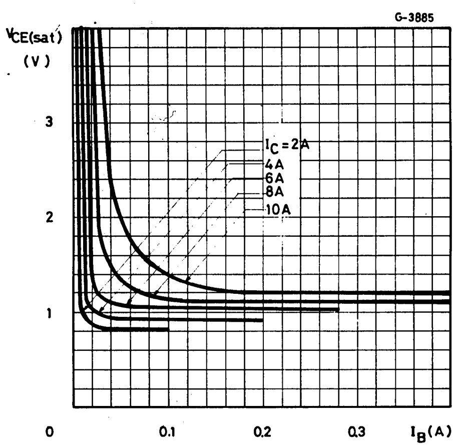
Collector-emitter saturation voltage



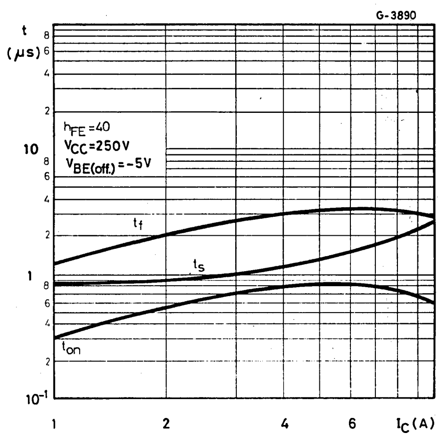
Base-emitter saturation voltage



Collector-emitter saturation voltage



Saturated switching characteristics



BU 930
BU 931
BU 932

Clamped reverse bias safe operating areas

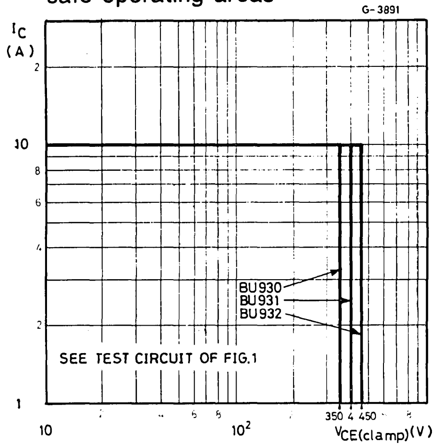


Fig. 1 – Clamped $E_{s/b}$ test circuit

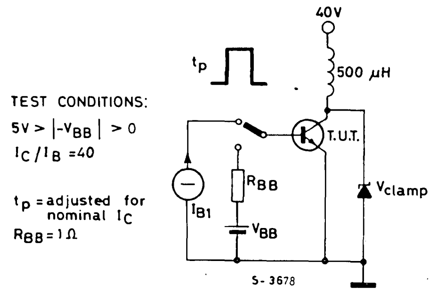


Fig. 2 – Functional test circuit

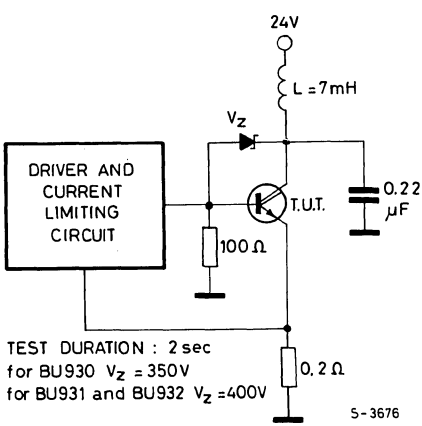
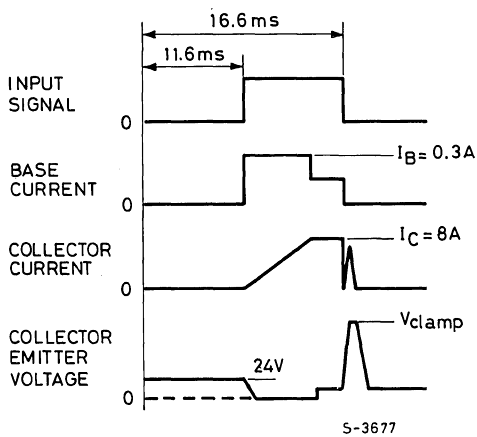


Fig. 3 – Functional test waveforms



BUR 10

EPITAXIAL PLANAR NPN

MEDIUM POWER TRANSISTOR

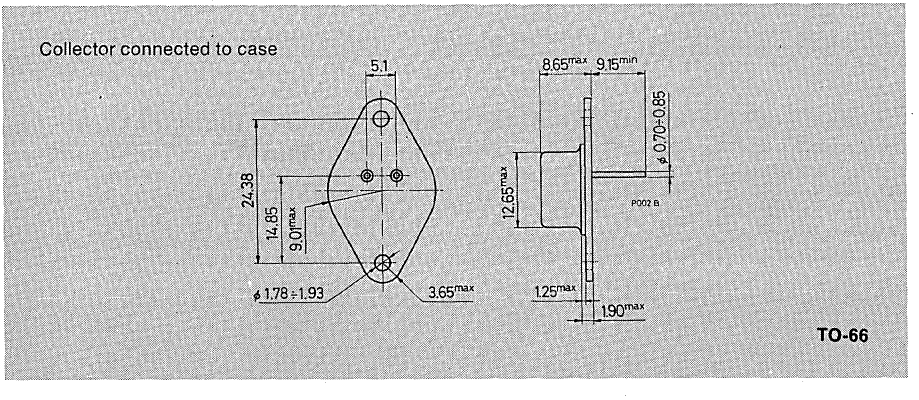
The BUR 10 is a silicon epitaxial planar NPN transistor in Jedec TO-66 metal case designed for power amplifiers and switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	100	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	80	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	8	V
I_C	Collector current	5	A
I_B	Base current	0.5	A
P_{tot}	Total power dissipation at $T_{case} \leq 100°C$	30	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.33	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=60V			0.1	μA
I_{CEV}	Collector cutoff current (V_{EB}=0.5V)	V_{CE}=100V T_{case}=150 °C V_{CE}=60V			10 50	μA μA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=50			1	μA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V V_{EB}=8V			0.1 10	μA μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =50mA	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =1A I_B =100mA I_C =5A I_B =0.5A			0.25 1	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =1A I_B =100mA			1.2	V
V_{BE}*	Base-emitter voltage	I_C =1A V_{CE}=2V			1.2	V
h_{FE}*	DC current gain	I_C =10mA V_{CE}=2V I_C =1A V_{CE}=2V I_C =5A V_{CE}=5V T_{case}=-55 °C I_C =1A V_{CE}=2V	30 40 15 10		 120	— — — —
C_{CBO}	Collector-base capacitance	I_E =0 V_{CB}=10V f =1MHz		125		pF

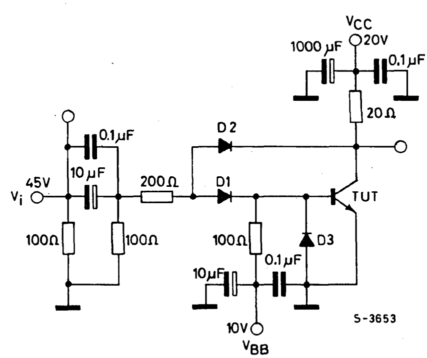
BUR 10

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C =0.5A V_{CE}=10V f =10MHz	50	MHz
t_{on}	Turn-on time	(see test circuit)	80	ns
t_s	Storage time		60	ns
t_f	Fall time		80	ns

* Pulsed: pulse duration =300 μs, duty cycle ≤2%

Test circuit



Test conditions: I_C=1 A; V_{BB}=-10V; V_I =+45V; V_{CC}≃20V
V_I characteristics: t_p=10 μs; t_r ≤ 15 ns; t_f ≤15 ns; duty cycle ≤ 2%

EPITAXIAL PLANAR NPN

BUR 11

HIGH VOLTAGE SWITCHING TRANSISTOR

The BUR 11 is a silicon epitaxial planar transistor in Jedec TO-63 metal case designed for high power switching applications. This device has been qualified by the European Space Agency (E.S.A.) to be used in switching equipment for space applications.

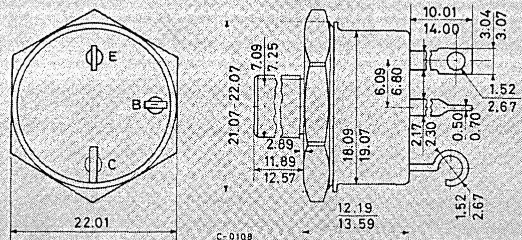
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	20	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	175	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 63

BUR 11

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

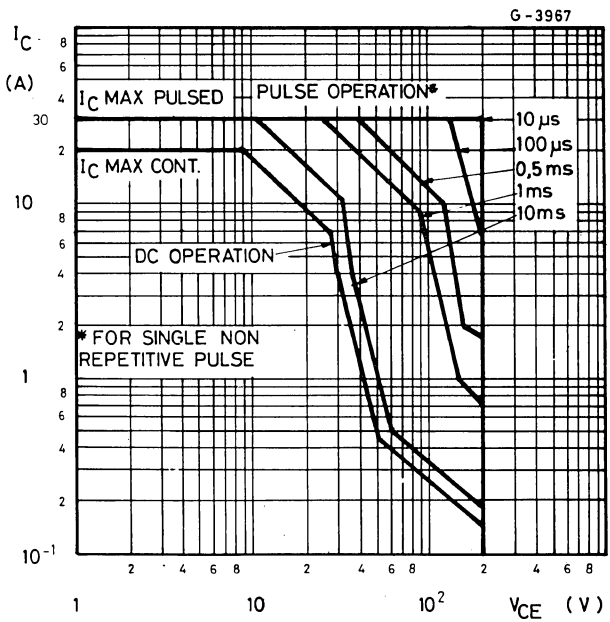
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	T_{case}=150 °C V_{CB}=240V				100	μA
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=240V				1	μA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V				0.2	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =100mA		200			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =10A	I_B =1A			0.8	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =10A	I_B =1A			1.4	V
h_{FE}*	DC current gain	I_C =10A I_C =5A	V_{CE}=5V V_{CE}=5V	15 20			— —
C_{CBO}	Collector-base capacitance	I_E =0 f =1MHz	V_{CE}=10V			250	pF
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V	t = 1 sec	4			A

ELECTRICAL CHARACTERISTICS (continued)

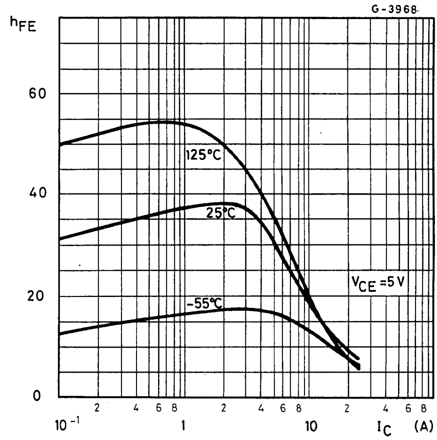
Parameter		Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time	I_C =10A I_{B1} =2A V_{CC}=100V	0.5	µs
t_s	Storage time	I_C =10 I_{B1}=-I_{B2}=2A V_{CC}=100V	1	µs
t_f	Fall time		0.3	µs

* Pulsed: pulse duration =300 µsec duty cycle ≤2%

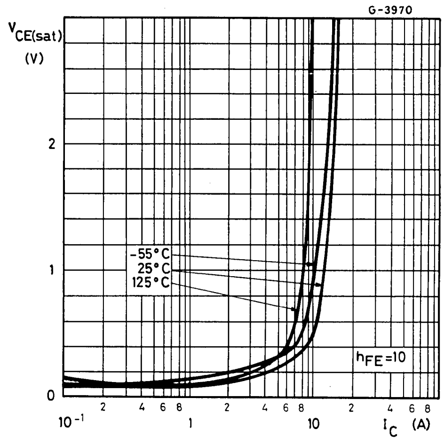
Safe operating areas



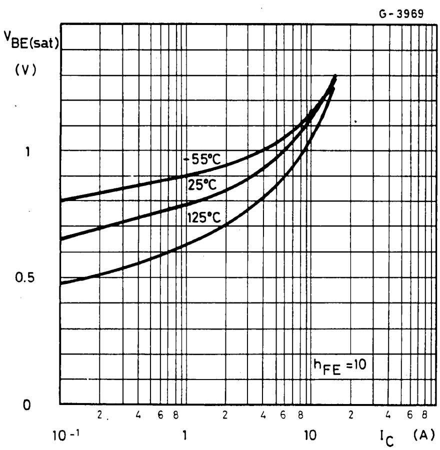
DC current gain



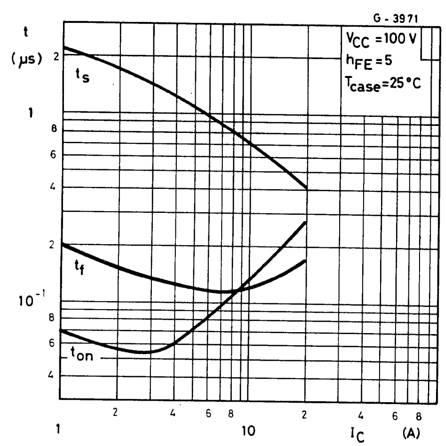
Collector-emitter saturation voltage



Base-emitter saturation voltage



Switching times



BUR 12

EPITAXIAL PLANAR NPN

MEDIUM POWER SWITCH

The BUR 12 is a silicon epitaxial planar transistor in Jedec TO-59 metal case. This device has been qualified by the European Space Agency (E.S.A.) to be used in medium power switching equipment for space applications.

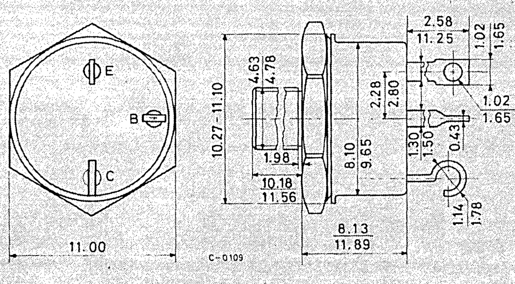
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	120	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	6	V
I_C	Collector current	10	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	40	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector isolated from the case



TO-59

5/80

BUR 12

THERMAL DATA

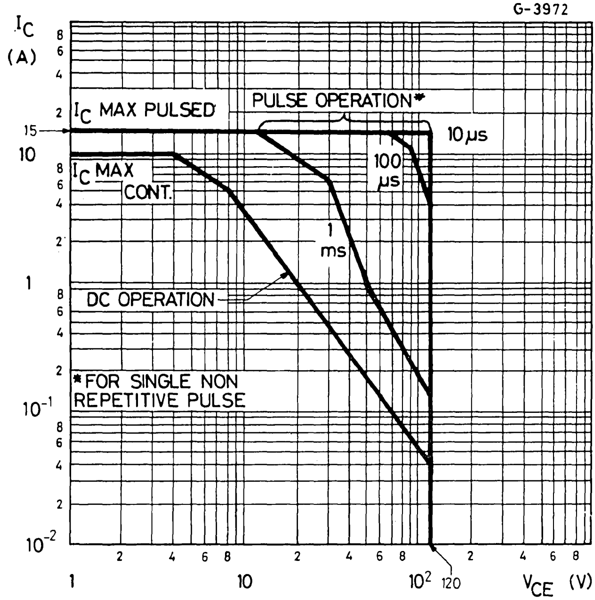
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.37	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

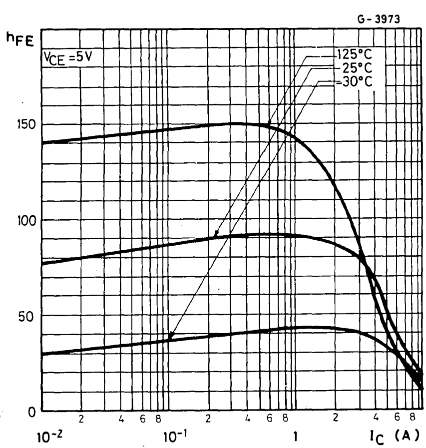
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=150V			1	μA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =50mA	120			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =5A I_B =0.5A			0.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =5A I_B =0.5A			1.4	V
h_{FE}*	DC current gain	I_C =1A V_{CE}=5V I_C =5A V_{CE}=5V	80 40		140	– –
C_{CBO}	Collector-base capacitance	I_E=0 V_{CE}=10V f =1MHz			150	pF
$I_{s/b}$	Second breakdown collector current	V_{CE}=13V t = 0.5s	2			A
t_{on}	Turn-on time	I_C =1A I_{B1} =0.1A V_{CC}=20V			200	ns
t_s	Storage time	I_C =1A I_{B1}=-I_{B2}=0.1A V_{CC}=20V			2	μs
t_f	Fall time				150	ns

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 2%

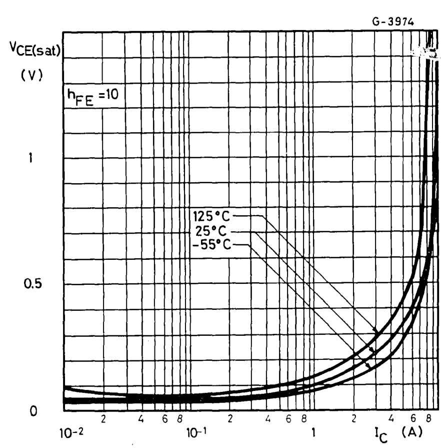
Safe operating areas



DC current gain

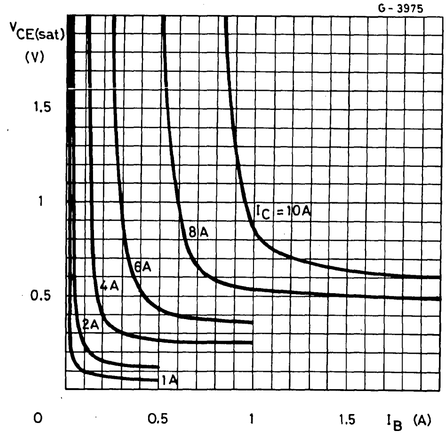


Collector-emitter saturation voltage

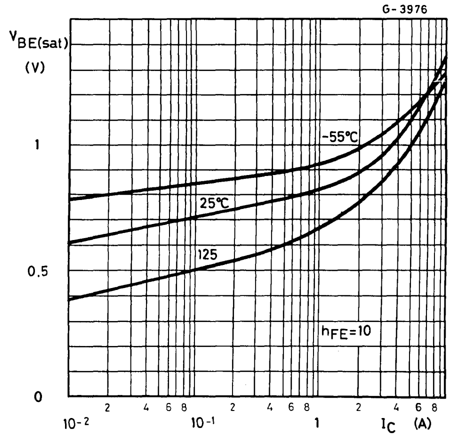


BUR 12

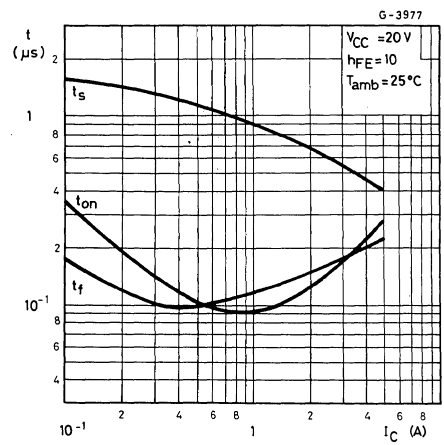
Collector-emitter saturation voltage



Base-emitter saturation voltage



Switching times



BUR 13

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

The BUR 13 is a silicon multipitaxial planar NPN transistor in Jedec TO-63 metal case, intended for use in switching and linear applications in military and industrial equipment.

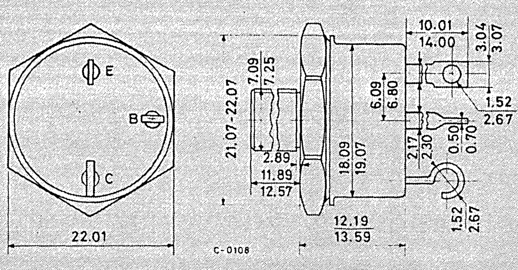
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	8	V
I_C	Collector current	70	A
I_{CM}	Collector peak current (t_p=10 ms)	100	A
I_B	Base current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	250	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 63

BUR 13

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

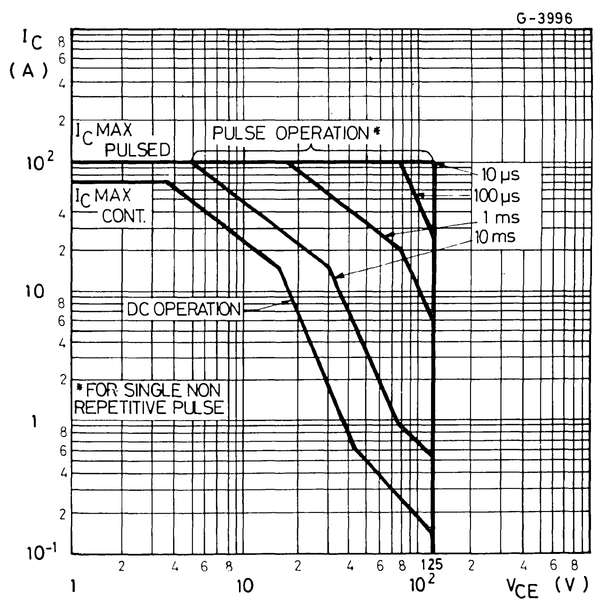
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CBO} = 200V$				
		$T_{case} = 25°C$			200	µA
		$T_{case} = 150°C$			800	µA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			500	µA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 100mA$	125			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 15A$ $I_B = 0.75A$			0.7	V
		$I_C = 25A$ $I_B = 1.25A$			1.2	V
		$I_C = 40A$ $I_B = 4A$			1.5	V
		$I_C = 50A$ $I_B = 5A$			1.8	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 25A$ $I_B = 1.25A$			1.5	V
		$I_C = 50A$ $I_B = 5A$			2.5	V
h_{FE}*	DC current gain	$I_C = 25A$ $V_{CE} = 5V$	20		100	—
		$I_C = 50A$ $V_{CE} = 5V$	15			—
f_T	Transition frequency	$I_C = 1A$ $V_{CE} = 5V$ f = 1 MHz	15	40		MHz
t_{on}	Turn-on time	$I_C = 50A$ $I_{B1} = 5A$ $V_{CC} = 30V$		0.6	1	µs

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min. Typ. Max.	Unit
t_s	Storage time	I_C =50A I_{B1} =-I_{B2} =5A V_{CC}=30V	0.5 1.5	μs
t_f	Fall time		0.1 0.5	μs
$I_{s/b}$	Second breakdown collector current	V_{CE}=16V t =1s	15.6	A
	Unclamped $E_{s/b}$ Collector current	R_{BE}=20Ω V_{BE}=-4V L =50μH	25	A

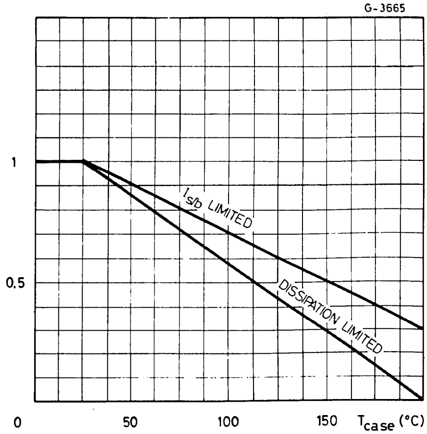
* Pulsed: pulse duration =300 μs, duty cycle =1%

Safe operating areas

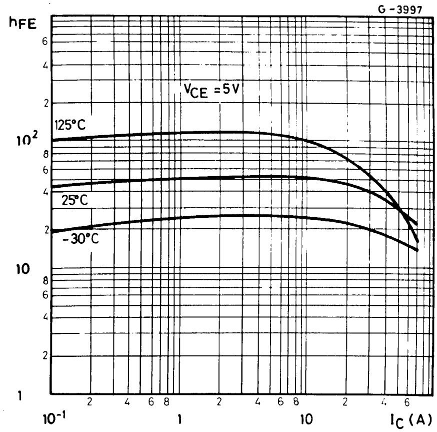


BUR 13

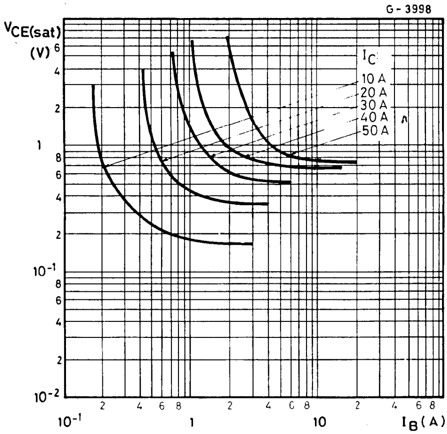
Derating curves



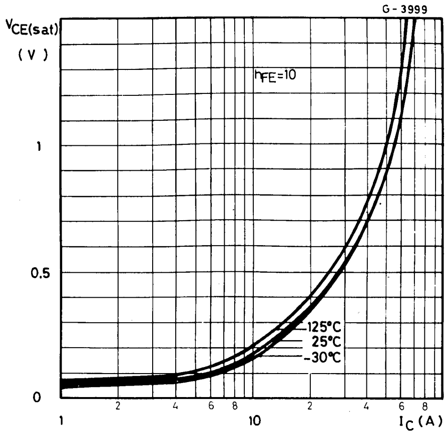
DC current gain



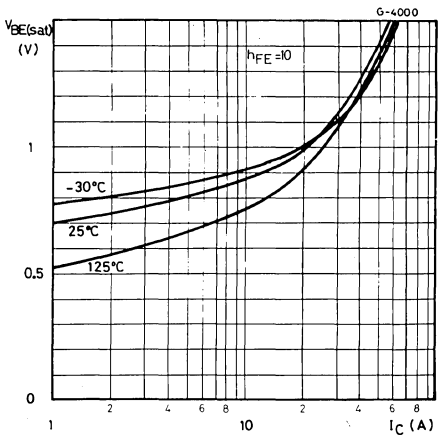
Collector-emitter saturation voltage



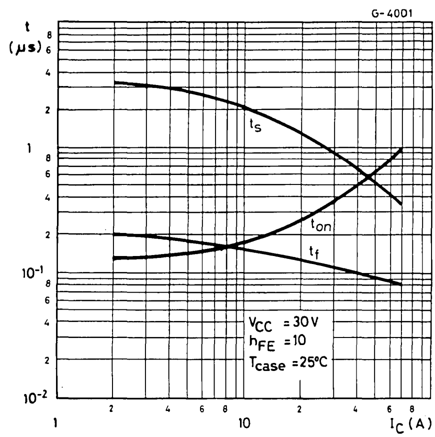
Collector-emitter saturation voltage



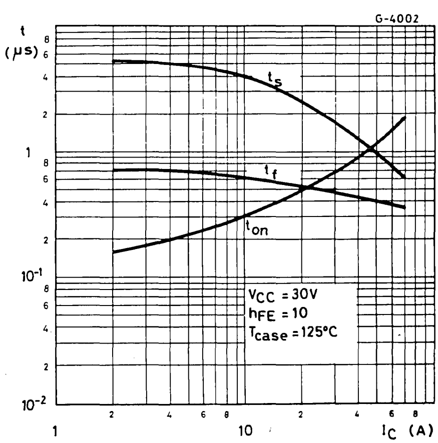
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



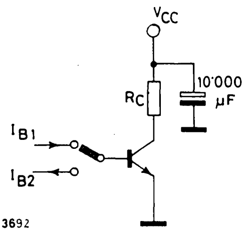
Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 30V

$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE
pulse width = 10 μs
$t_r, t_f \leq$ 50ns
duty cycle = 1%



S-3692

BUR 20

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

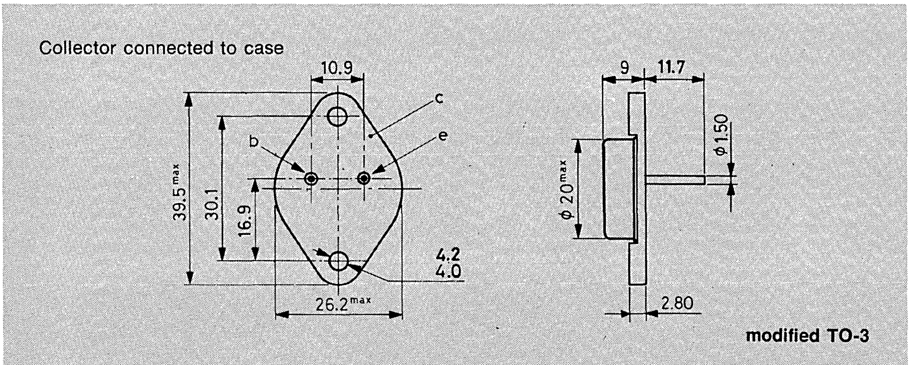
The BUR 20 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	200	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	50	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	75	A
I_B	Base current	15	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	250	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\,°C$ unless otherwise specified)

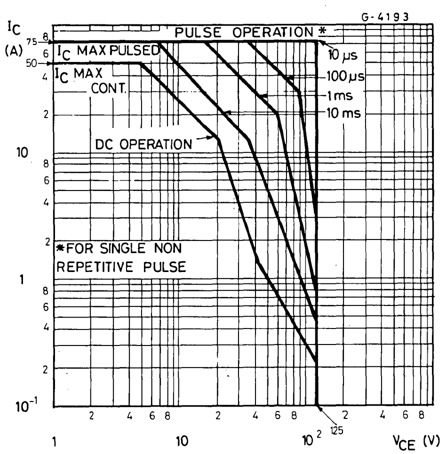
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 125V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 200V$ $V_{BE} = -1.5V$ $V_{CE} = 200V$ $V_{BE} = -1.5V$ $T_{case} = 125\,°C$			0.5 6	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\ (sus)}$	*Collector-emitter sustaining voltage	$I_C = 200mA$	125			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 25A$ $I_B = 2A$ $I_C = 50A$ $I_B = 5A$			1 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 25A$ $I_B = 2A$ $I_C = 50A$ $I_B = 5A$			2.0 2.5	V V
h_{FE}*	DC current gain	$I_C = 25A$ $V_{CE} = 2V$ $I_C = 50A$ $V_{CE} = 4V$	15 10		60	– –
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 20V$ $t = 1s$	12.5			A

ELECTRICAL CHARACTERISTICS (continued)

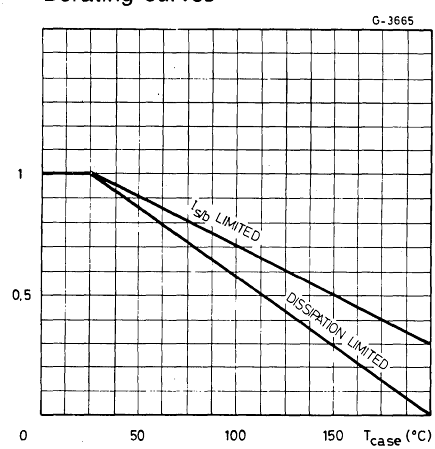
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
f_T	Transition frequency	I_C = 1A V_{CE} = 15V f = 10MHz	10	24		MHz
t_{on}	Turn-on time (fig. 2)	I_C = 50A I_{B1} = 5A V_{CC} = 60V		0.45	1.5	μs
t_s	Storage time (fig. 2)	I_C = 50A I_{B1} = 5A I_{B2} = -5A V_{CC} = 60V		0.65	1.2	μs
t_f	Fall time (fig. 2)			0.12	0.3	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp} = 125V L = 500μH	50			A

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 2%

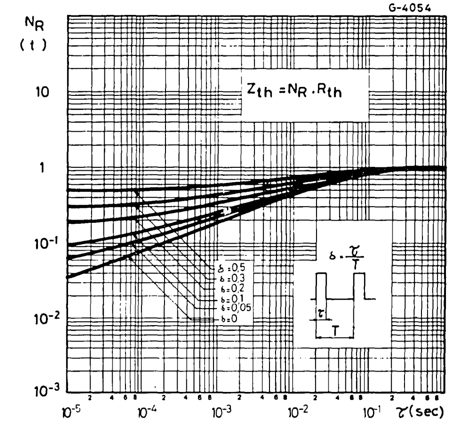
Safe operating areas



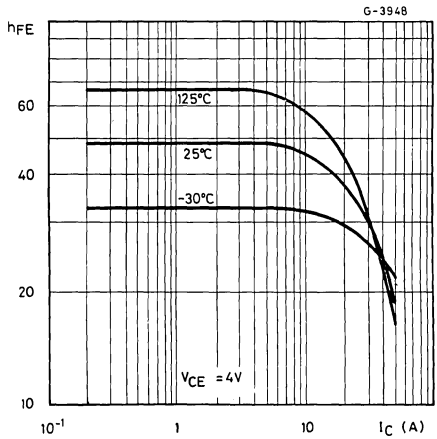
Derating curves



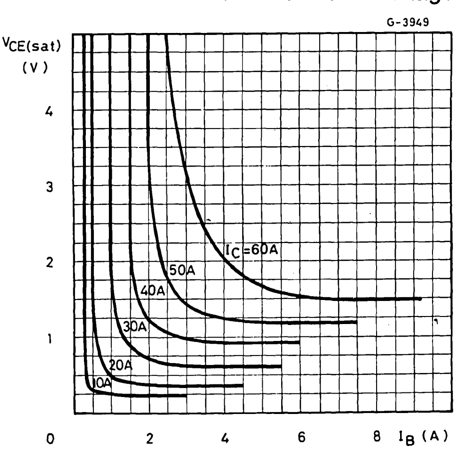
Thermal transient response



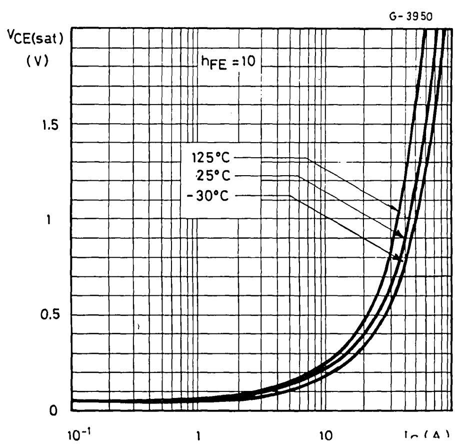
DC current gain



Collector-emitter saturation voltage

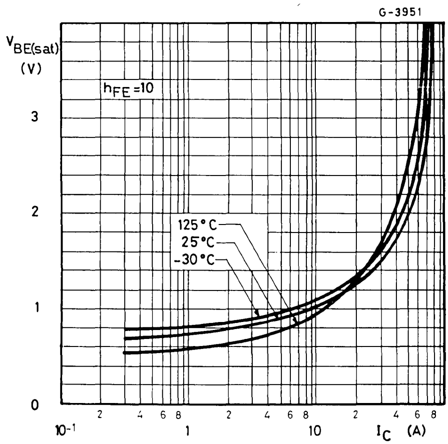


Collector-emitter saturation voltage

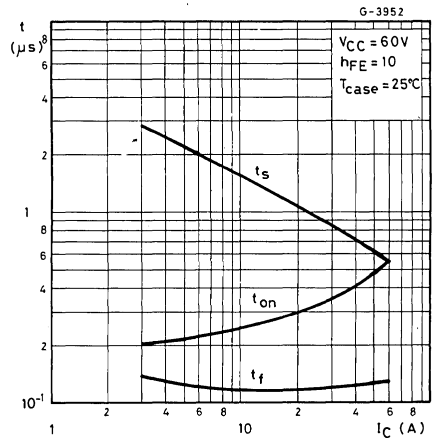


BUR 20

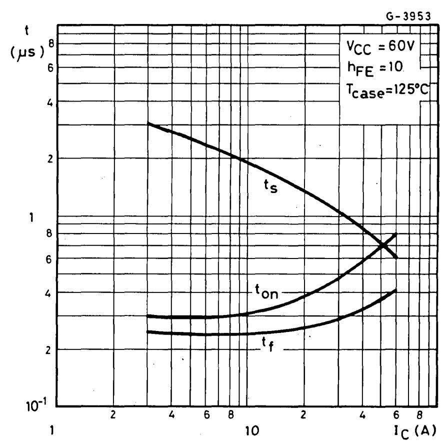
Base-emitter saturation voltage



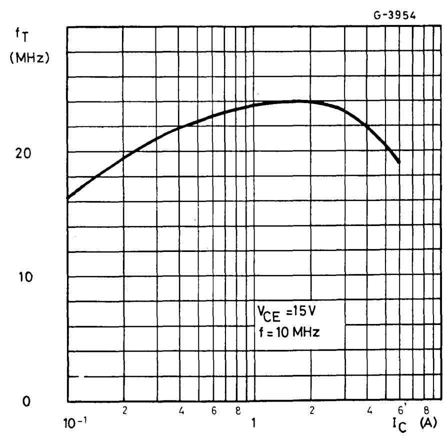
Saturated switching characteristics



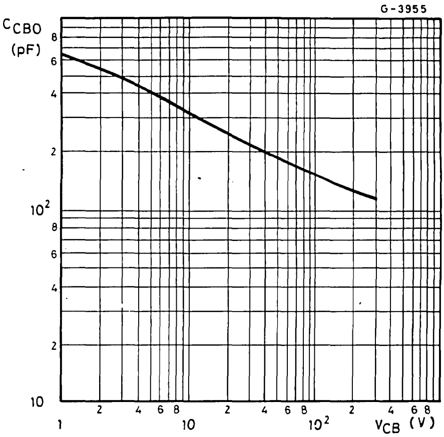
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias areas safe operating

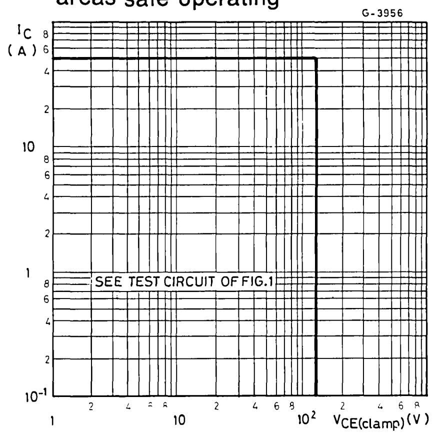


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

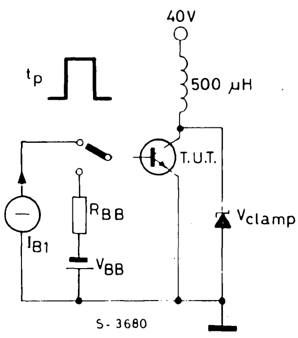


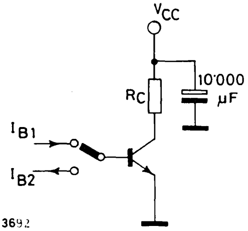
Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 60 V

$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE
pulse width = 10 μs
$t_r, t_f \leq$ 50ns
duty cycle = 1%



BUR 21

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

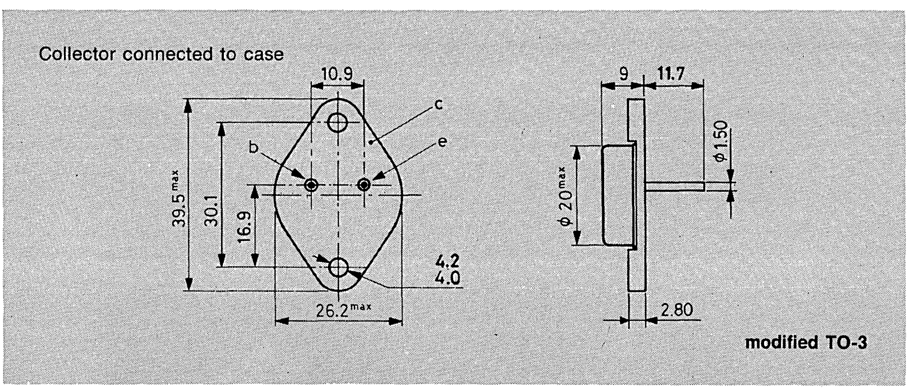
The BUR 21 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	300	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=-1.5V$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	40	A
I_{CM}	Collector peak current ($t_p=10$ ms)	50	A
I_B	Base current	8	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	250	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



BUR 21

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 200V$				1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 300V$ $V_{CE} = 300V$ $T_{case} = 125°C$	$V_{BE} = -1.5V$ $V_{BE} = -1.5V$			0.5 6	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$				1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$		200			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 12A$ $I_C = 25A$ $I_C = 30A$	$I_B = 1.2A$ $I_B = 3A$ $I_B = 5A$		0.3 0.7 0.9	0.6 1.5 1.5	V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 25A$ $I_C = 30A$	$I_B = 3A$ $I_B = 5A$		1.5	1.8 2.2	V V
h_{FE}*	DC current gain	$I_C = 12A$ $I_C = 25A$	$V_{CE} = 2V$ $V_{CE} = 4V$	15 10		60	— —
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 140V$ $V_{CE} = 20V$	$t = 1s$ $t = 1s$	0.15 12.5			A A
f_T	Transition frequency	$V_{CE} = 15V$ $f = 10MHz$	$I_C = 1A$	10	20		MHz

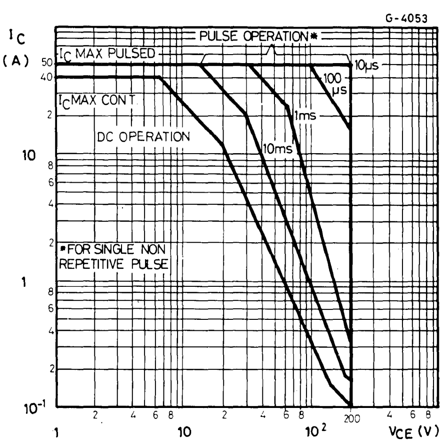
BUR 21

ELECTRICAL CHARACTERISTICS (continued)

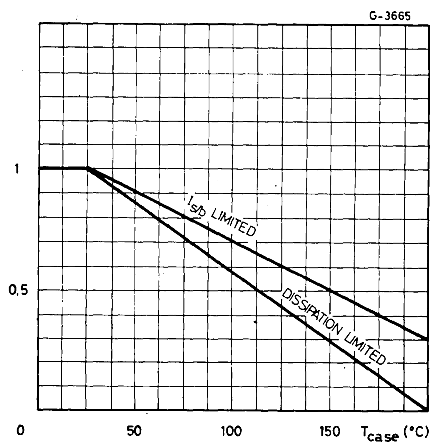
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =25A I_{B1} =3A V_{CC}=100V		0.25	1	µs
t_s	Storage time (fig. 2)	I_C =25A I_{B1} =3A I_{B2} =-3A V_{CC}=100V		1	1.8	µs
t_f	Fall time (fig. 2)			0.2	0.4	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500µH	30			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

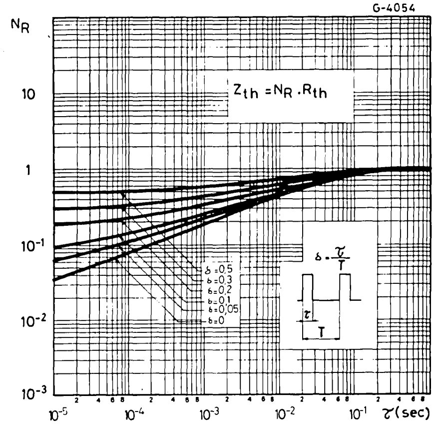
Safe operating areas



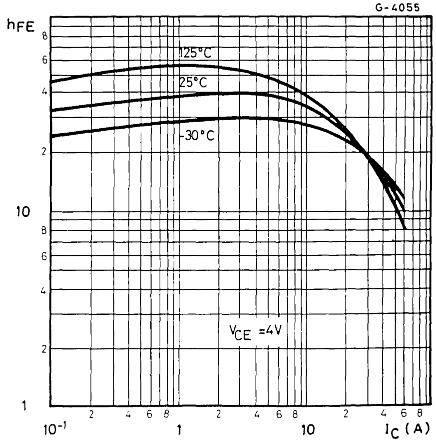
Derating curves



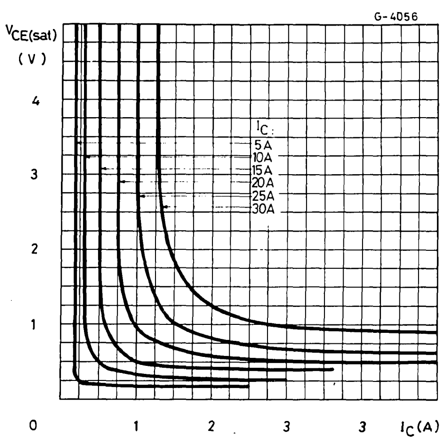
Thermal transient response



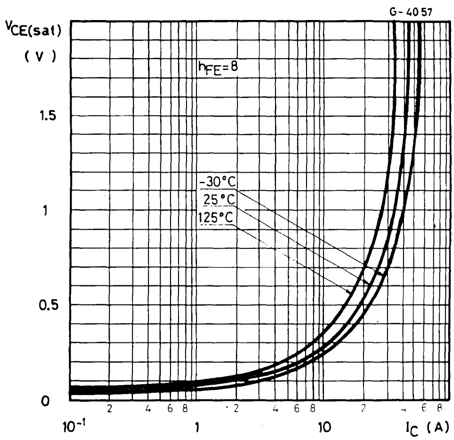
DC current gain



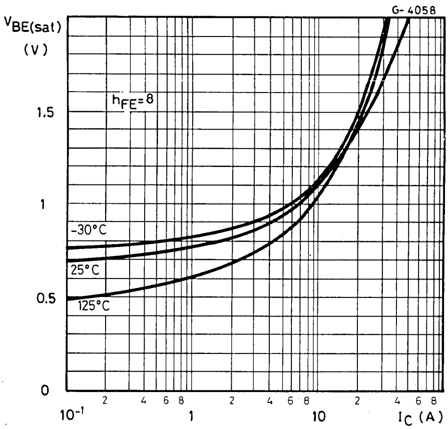
Collector-emitter saturation voltage



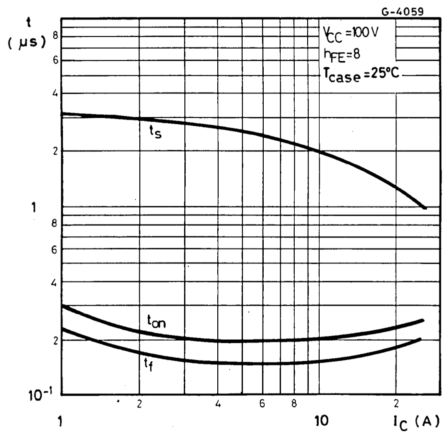
Collector-emitter saturation voltage



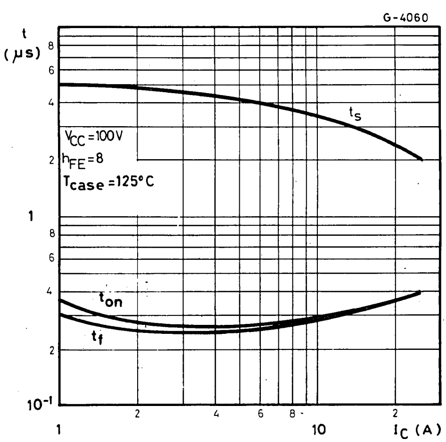
Base-emitter saturation voltage



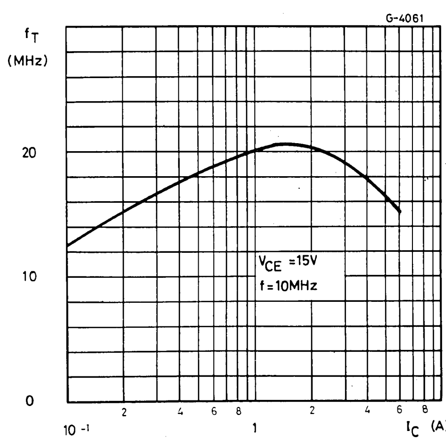
Saturated switching characteristics



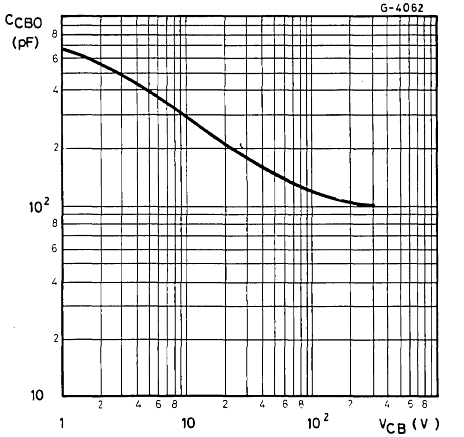
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

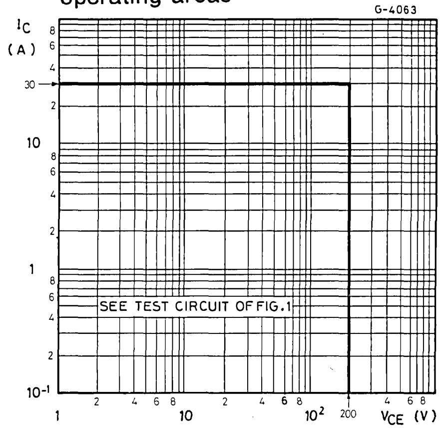


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7\,V \geq |-V_{BB}| \geq 2\,V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

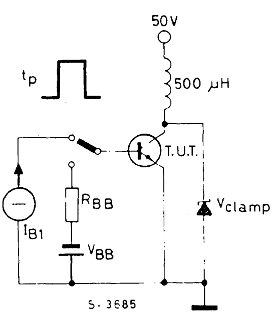


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 100V$

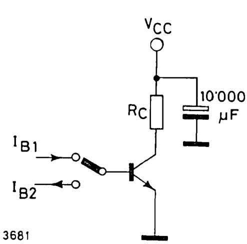
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq 50ns$

duty cycle = 1%



BUR 22

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

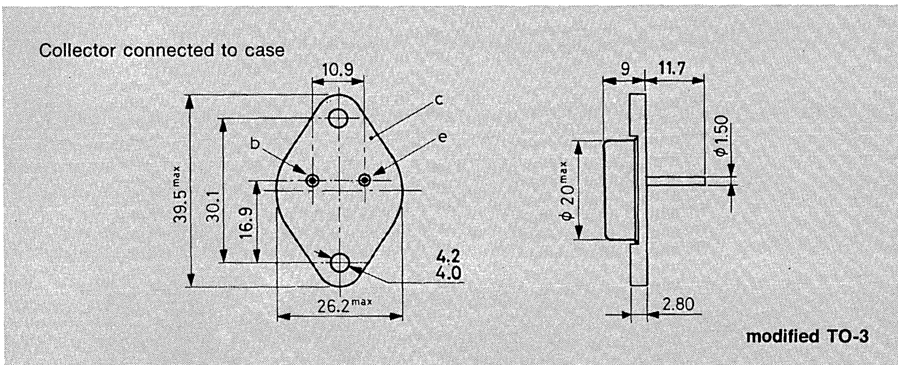
The BUR 22 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	350	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=-1.5V$)	350	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	250	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	40	A
I_{CM}	Collector peak current ($t_p=10$ ms)	50	A
I_B	Base current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	250	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=250V			1	mA
I_{CEX}	Collector cutoff current	V_{CE}=350V V_{BE}=-1.5V V_{CE}=350V V_{BE}=-1.5V T_{case}=125 °C			0.5 6	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	250			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =10A I_B =1A I_C =20A I_B =2.5A I_C =25A I_B =4A		0.3 0.5 0.7	1 1.5 1.5	V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =20A I_B =2.5A I_C =25A I_B =4A		1.4	1.8 2.2	V V
h_{FE}*	DC current gain	I_C =10A V_{CE}=4V I_C =20A V_{CE}=4V	15 10		60	– –
$I_{s/b}$	Second breakdown collector current	V_{CE}=140V t =1s V_{CE}=20V t =1s	0.15 12.5			A A
f_T	Transition frequency	V_{CE}=15V I_C =1A f =10MHz	10	20		MHz

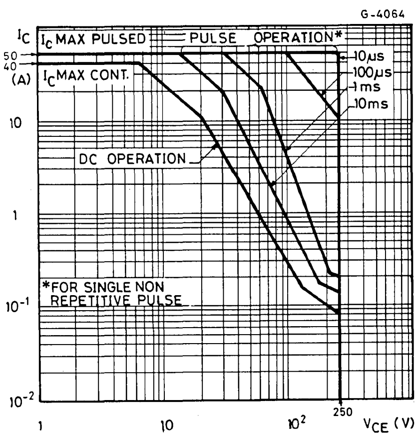
BUR 22

ELECTRICAL CHARACTERISTICS (continued)

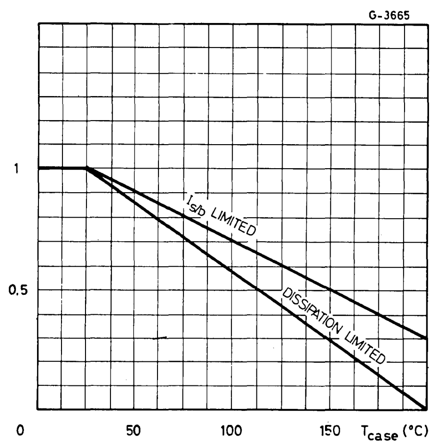
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =20A I_B =2.5A V_{CC}=100V		0.25	1	µs
t_s	Storage time (fig. 2)	I_C =20A I_{B1} =2.5A I_{B2} =-2.5A V_{CC}=100V		1.25	2	µs
t_f	Fall time (fig. 2)			0.18	0.5	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L=500µH	25			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

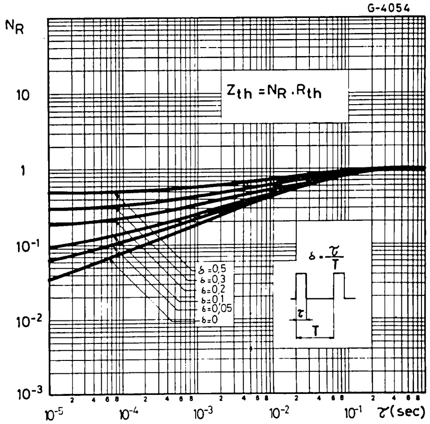
Safe operating areas



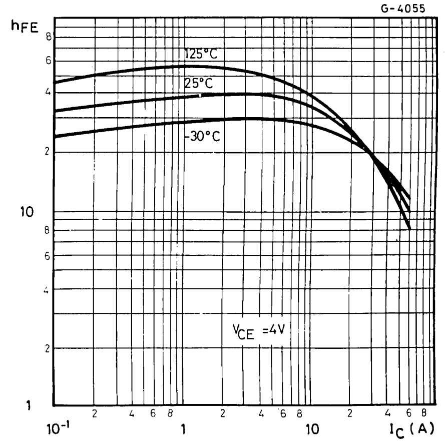
Derating curves



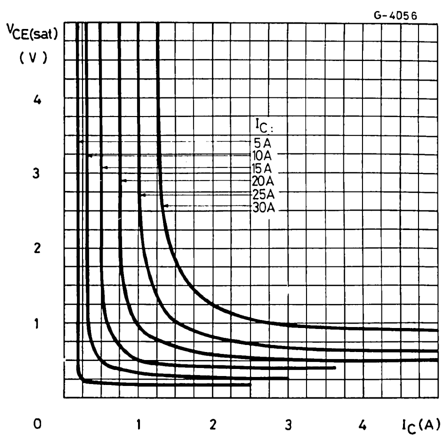
Thermal transient response



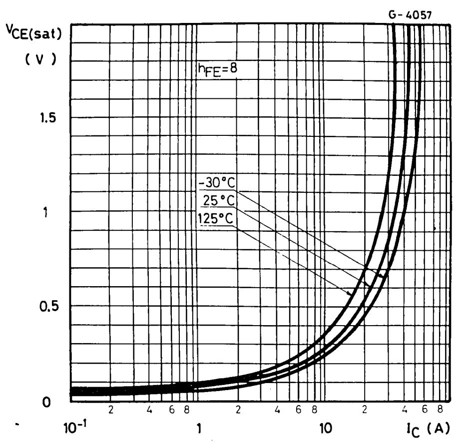
DC current gain



Collector-emitter saturation voltage

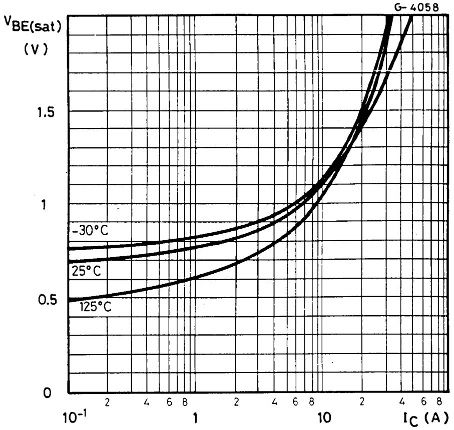


Collector-emitter saturation voltage

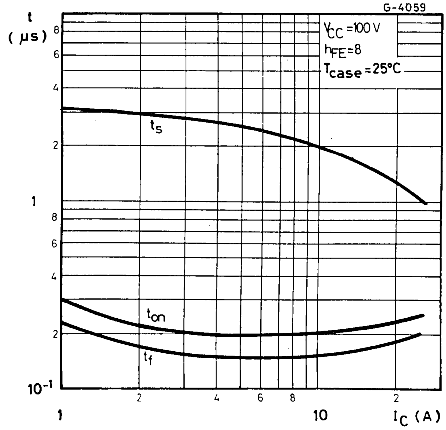


BUR 22

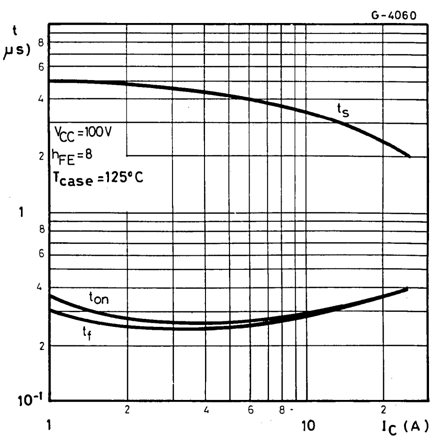
Base-emitter saturation voltage



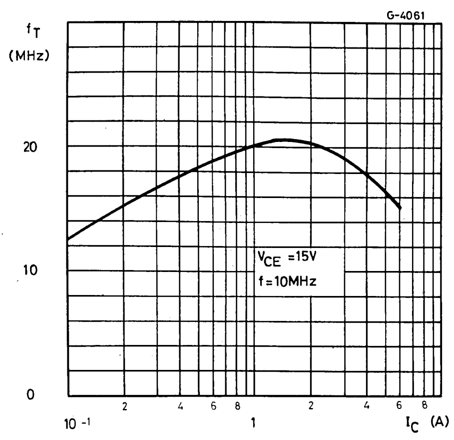
Saturated switching characteristics



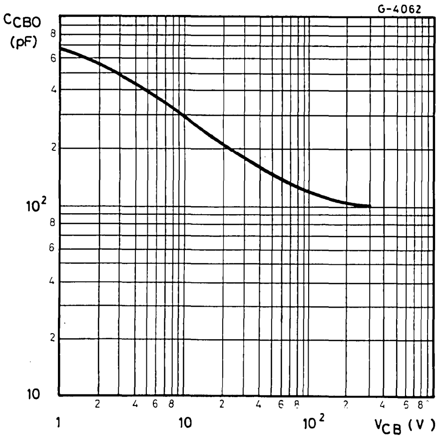
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

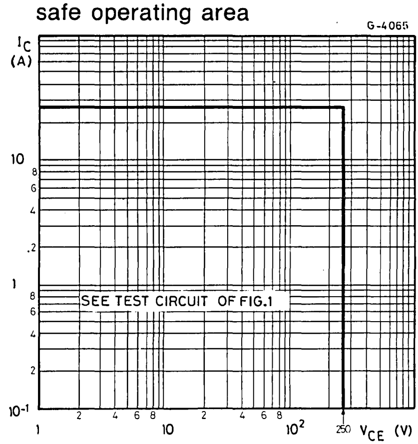


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C/I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

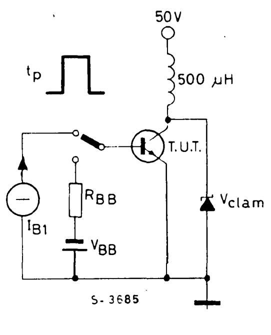


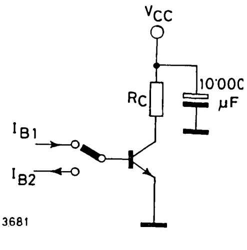
Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 100V$

$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE
pulse width = 10 µs
$t_r, t_f \leq 50ns$
duty cycle = 1%



BUR 23

MULTIEPITAXIAL MESA NPN

PRELIMINARY DATA

HIGH VOLTAGE POWER SWITCH

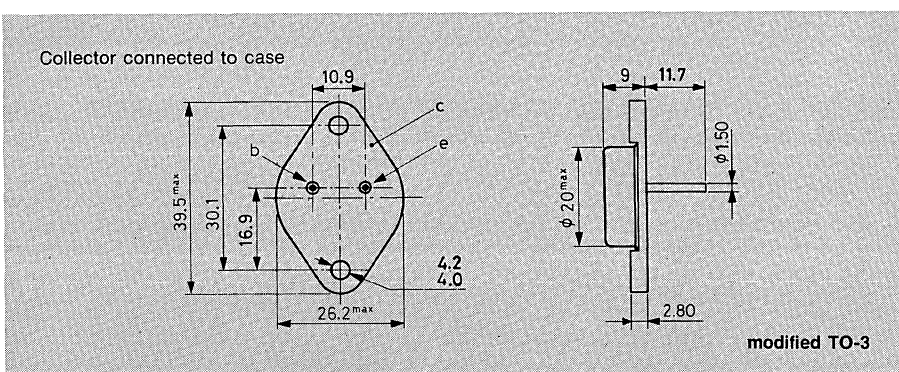
The BUR 23 is a silicon multiepitaxial mesa NPN transistor in modified Jedec TO-3 metal case, intended for use in power switching applications in military and industrial equipments.

ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	400	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	325	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	30	A
I_{CM}	Collector peak current ($t_p \leq 10ms$)	40	A
I_B	Base current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	250	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 400V$ $V_{CE} = 400V$ $T_{case} = 125°C$			500 3	μA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 325V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$	325			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 20A$ $I_B = 4A$ $I_C = 15A$ $I_B = 2A$			1.5 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 20A$ $I_B = 4A$			1.6	V
t_{on}	Turn-on time	$I_C = 20A$ $V_{CC} = 250V$ $I_{B1} = -I_{B2} = 4A$			0.75	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUR 24

MULTIEPITAXIAL MESA NPN

PRELIMINARY DATA

HIGH VOLTAGE POWER SWITCH

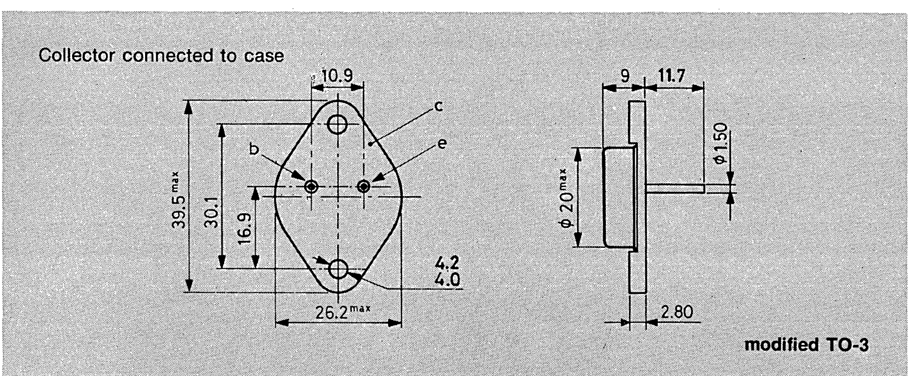
The BUR 24 is a silicon multiepitaxial mesa NPN transistor in modified Jedec TO-3 metal case, intended for use in power switching applications in military and industrial equipments.

ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	450	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	30	A
I_{CM}	Collector peak current ($t_p \leq 10ms$)	40	A
I_B	Base current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	250	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.7	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 450V$ $V_{CE} = 450V$ $T_{case} = 125°C$			500 3	μA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 400V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 20A$ $I_B = 5A$ $I_C = 15A$ $I_B = 2.5A$			1.5 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 20A$ $I_B = 5A$			1.8	V
t_{on}	Turn-on time	$I_C = 20A$ $V_{CC} = 250V$ $I_{B1} = -I_{B2} = 5A$			0.7	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUR 50

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

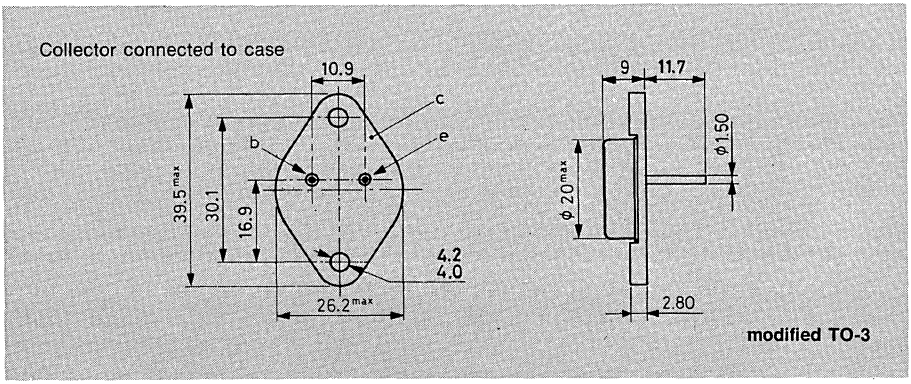
The BUR 50 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	10	V
I_C	Collector current	70	A
I_{CM}	Collector peak current ($t_p=10$ ms)	100	A
I_B	Base current	20	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

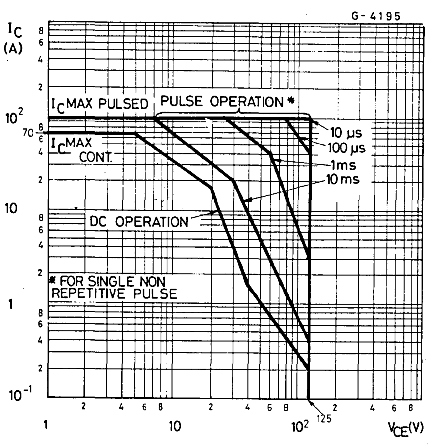
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=200V V_{CB}=200V T_{case}=125 °C				0.2 2	mA mA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=125V				1	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=7V				0.2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA		125			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =10mA		10			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =35A I_C =70A	I_B =2A I_B =7A		 0.8	1 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =35A I_C =70A	I_B =2A I_B =7A		 1.6	1.8 2	V V
h_{FE}*	DC current gain	I_C =5A I_C =50A	V_{CE}=4V V_{CE}=4V	20 15		100	– –
$I_{s/b}$	Second breakdown collector current	V_{CE}=20V	t = 1s	17.5			A
f_T	Transition frequency	I_C =1A f =1MHz	V_{CE}= 5V	10	16		MHz

ELECTRICAL CHARACTERISTICS (continued)

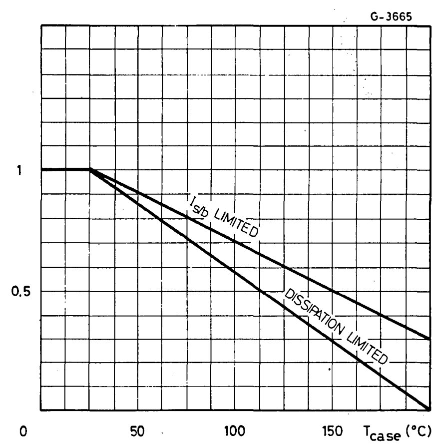
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =70A I_{B1} =7A V_{CC}=60V		0.5	1.2	µs
t_s	Storage time (fig. 2)	I_C =70A I_{B1} =7A I_{B2} =-7A V_{CC}=60V		0.82	2	µs
t_f	Fall time (fig. 2)			0.1	0.5	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=125V L =500µH	70			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

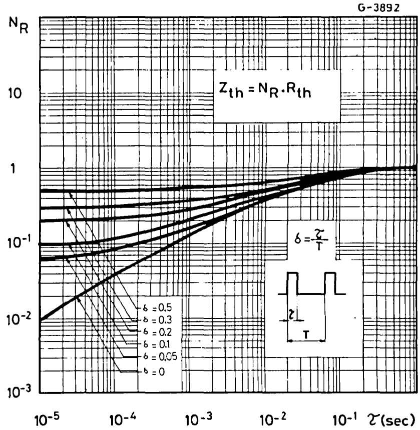
Safe operating areas



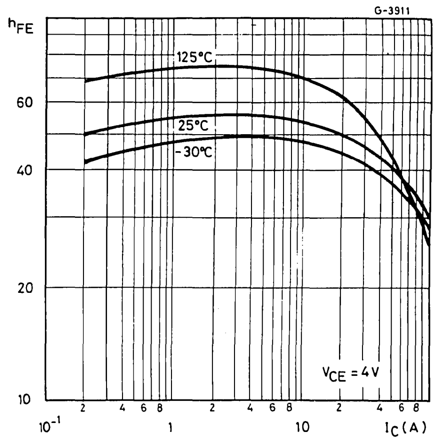
Derating curves



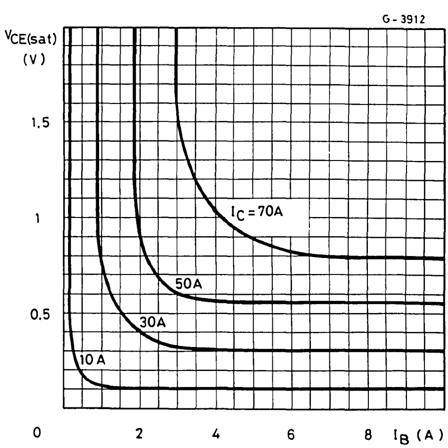
Thermal transient response



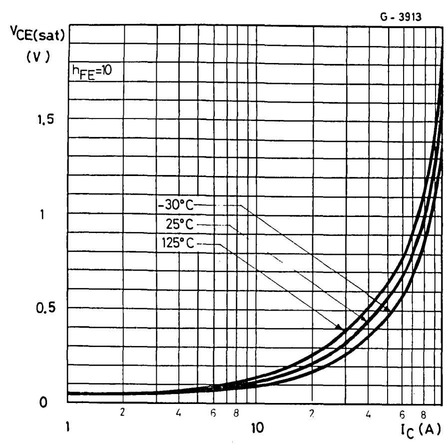
DC current gain



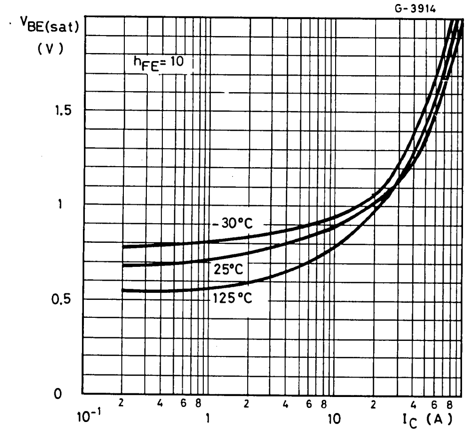
Collector-emitter saturation voltage



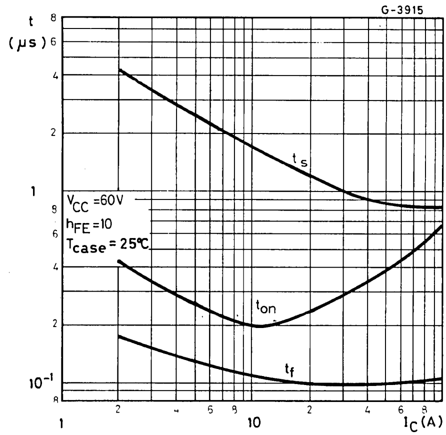
Collector-emitter saturation voltage



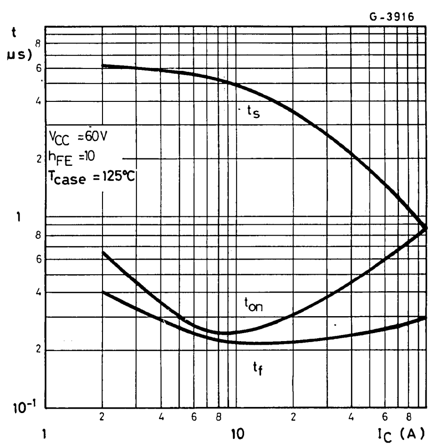
Base-emitter saturation voltage



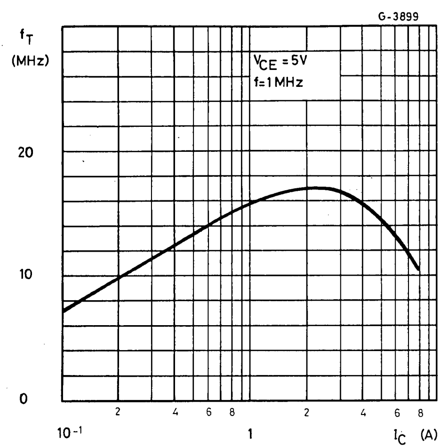
Saturated switching characteristics



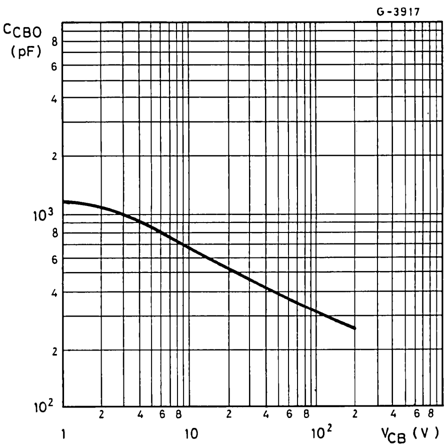
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

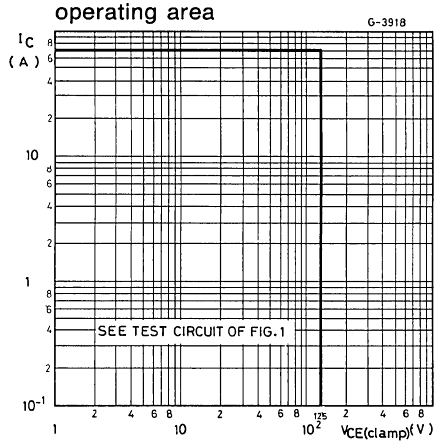


Fig. 1 – Clamped $E_{s/b}$ test circuit

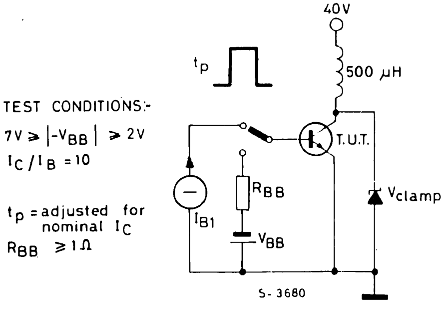
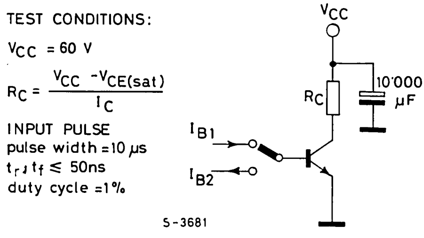


Fig. 2 – Switching times test circuit (resistive load)



BUR 51

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

The BUR 51 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

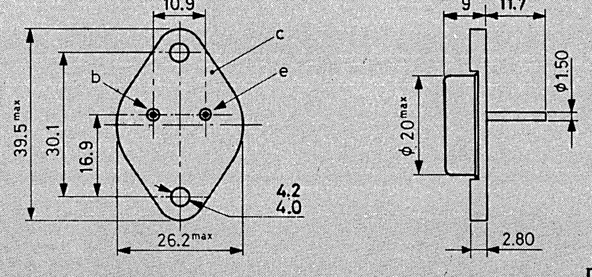
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	10	V
I_C	Collector current	60	A
I_{CM}	Collector peak current ($t_p=10$ ms)	80	A
I_B	Base current	16	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



modified TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=300V V_{CB}=300V T_{case}=125 °C			0.2 2	mA mA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=200V			1	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=7V			0.2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	200			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =10mA	10			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =30A I_B =2A I_C =50A I_B =5A		 0.9	1 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =30A I_B =2A I_C =50A I_B =5A		 1.55	1.8 2	V V
h_{FE}*	DC current gain	I_C =5A V_{CE}=4V I_C =50A V_{CE}=4V	20 15		100	— —
$I_{s/b}$	Second breakdown collector current	V_{CE}=20V t = 1s	17.5			A
f_T	Transition frequency	I_C =1A V_{CE}=5V f =1MHz	10	16		MHz

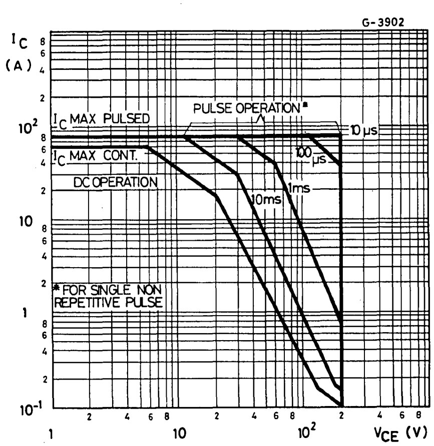
BUR 51

ELECTRICAL CHARACTERISTICS (continued)

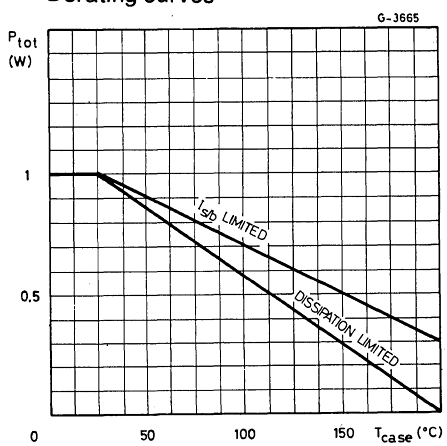
	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =50A I_{B1} =5A V_{CC}=100V	0.35 1	µs
t_s	Storage time (fig. 2)	I_C =50A I_{B1} =5A I_{B2} =-5A V_{CC}=100V	0.9 2	µs
t_f	Fall time (fig. 2)		0.24 0.6	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500µH	50	A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

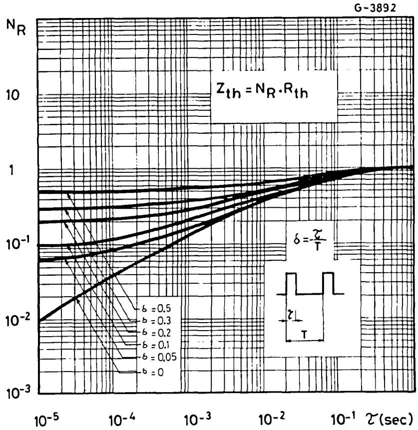
Safe operating areas



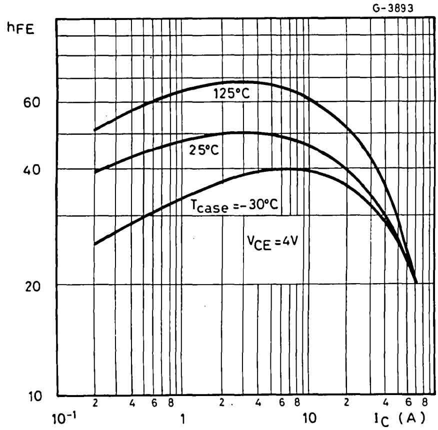
Derating curves



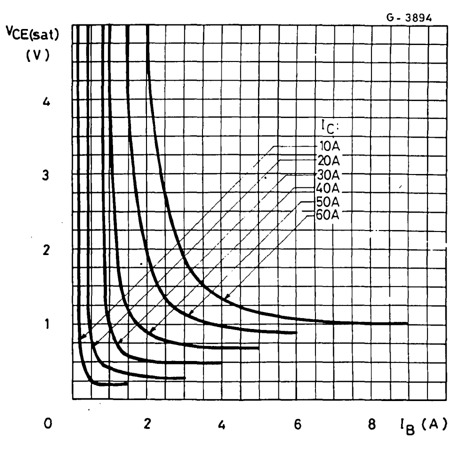
Thermal transient response



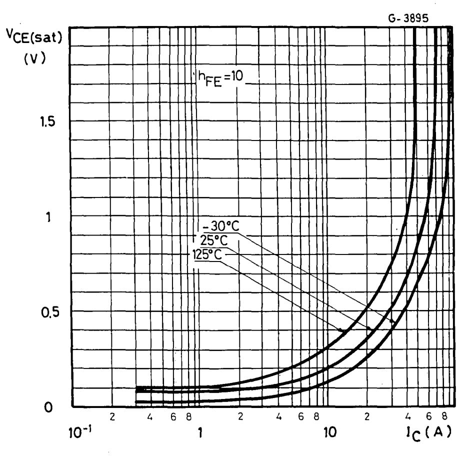
DC current gain



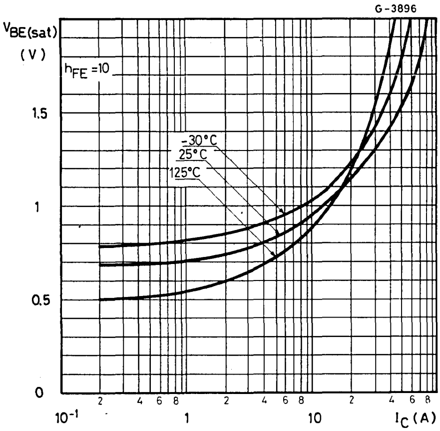
Collector-emitter saturation voltage



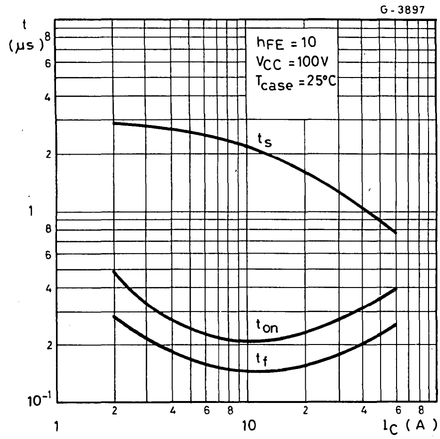
Collector-emitter saturation voltage



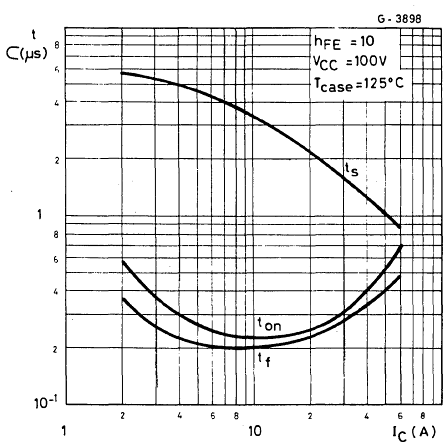
Base-emitter saturation voltage



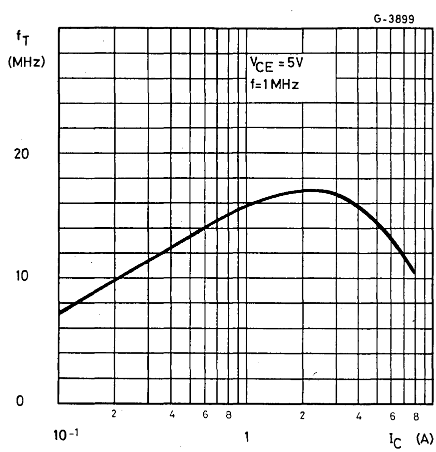
Saturated switching characteristics



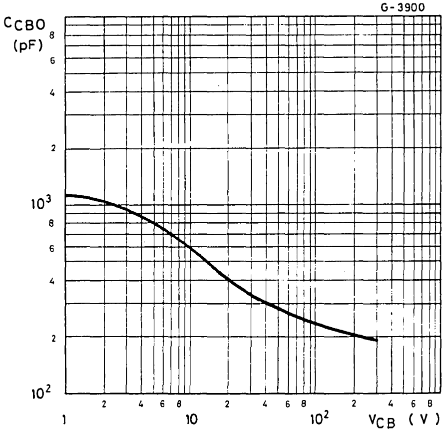
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

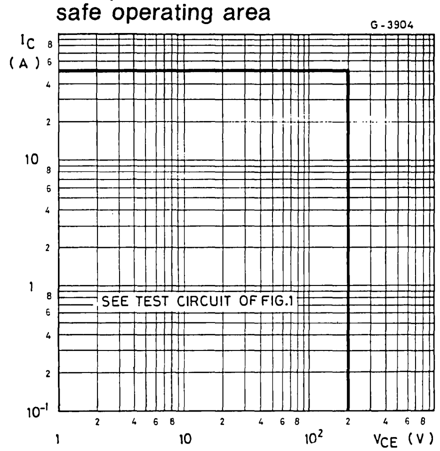


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

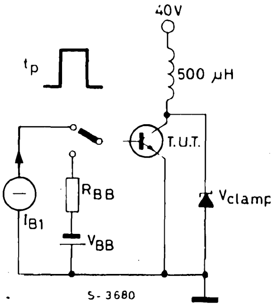


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 100V

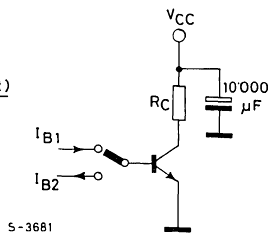
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUR 52

MULTIEPITAXIAL PLANAR NPN

PRELIMINARY DATA

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

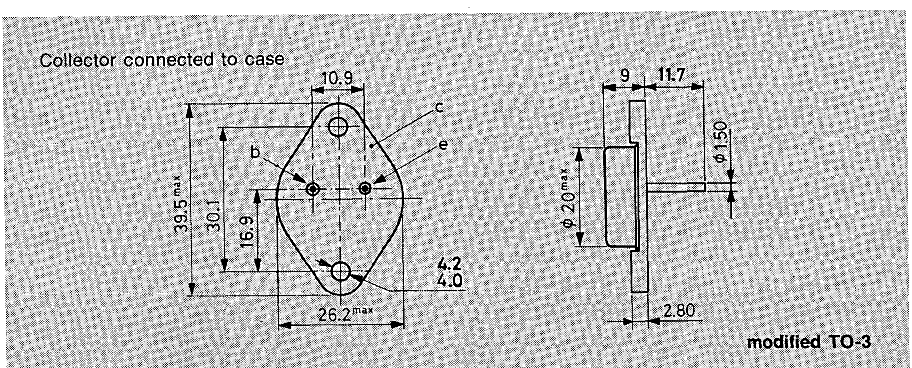
The BUR 52 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	350	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	250	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	10	V
I_C	Collector current	60	A
I_{CM}	Collector peak current (t_p=10 ms)	80	A
I_B	Base current	16	A
P_{tot}	Total power dissipation at $T_{case}\leq 25\,°C$	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	V_{CB}=350V V_{CB}=350V T_{case}=125 °C			0.2 2	mA mA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=250V			1	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=7V			0.2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	250			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =10mA	10			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =25A I_B =2A I_C =40A I_B =4A		 0.70	1 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =25A I_B =2A I_C =40A I_B =4A		 1.5	1.8 2	V V
h_{FE}*	DC current gain	I_C =5A V_{CE}=4V I_C =40A V_{CE}=4V	20 15		100	— —
$I_{s/b}$	Second breakdown collector current	V_{CE}=20V t =1s	17.5			A
f_T	Transition frequency	I_C =1A V_{CE}=5V f =1MHz	10	16		MHz
t_{on}	Turn-on time (fig. 2)	I_C =40A I_{B1} =4A V_{CC}=100V		0.3	1	μs

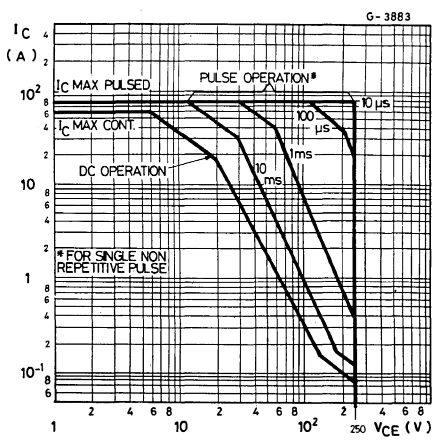
BUR 52

ELECTRICAL CHARACTERISTICS (continued)

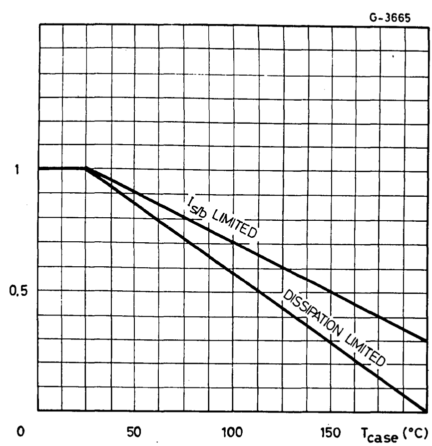
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time (fig. 2)	I_C =40A I_{B1} =4A I_{B2} =–4A V_{CC}=100V		1.2	2	µs
t_f	Fall time (fig. 2)			0.20	0.6	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500µH	40			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

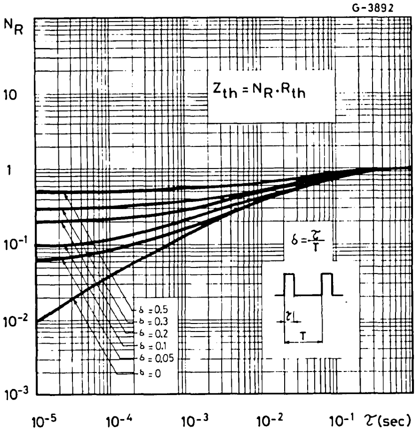
Safe operating areas



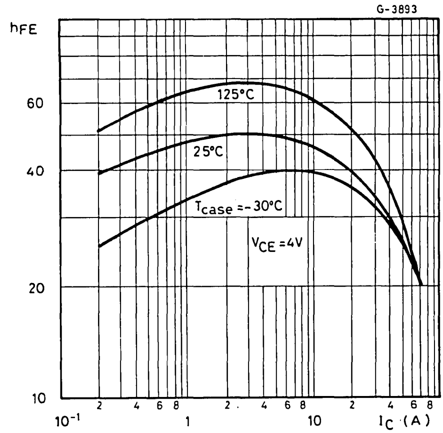
Derating curves



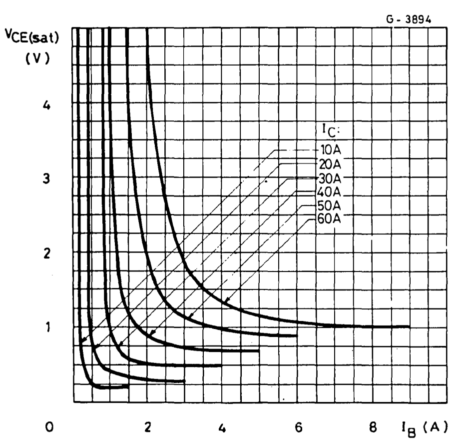
Thermal transient response



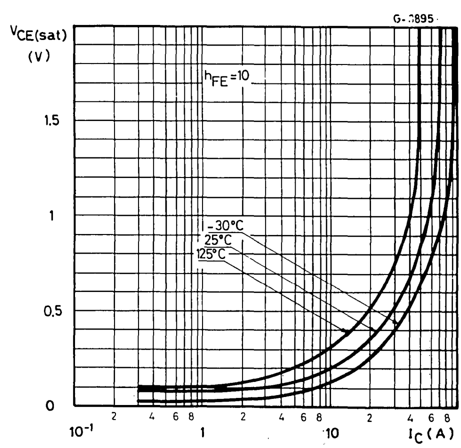
DC current gain



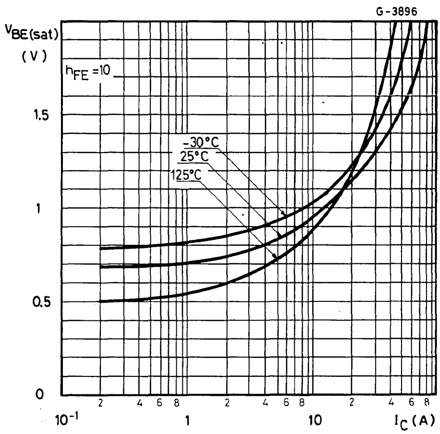
Collector-emitter saturation voltage



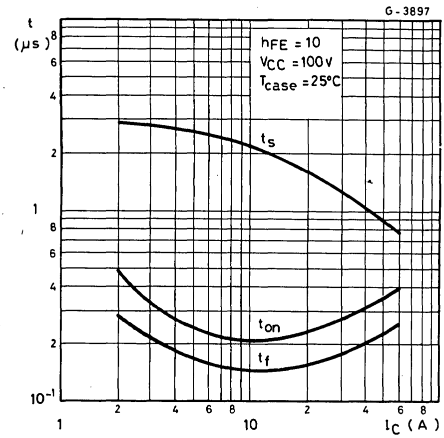
Collector-emitter saturation voltage



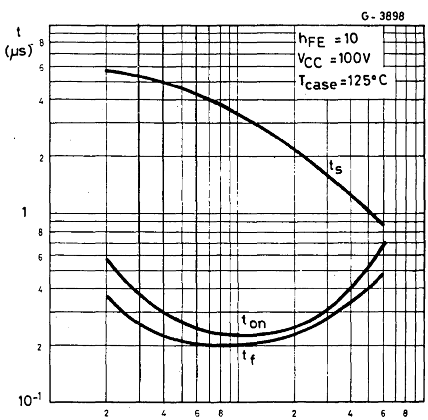
Base-emitter saturation voltage



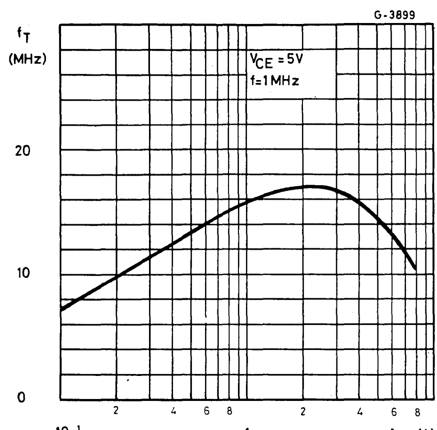
Saturated switching characteristics



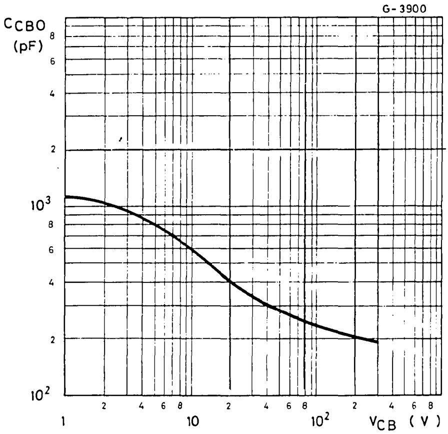
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

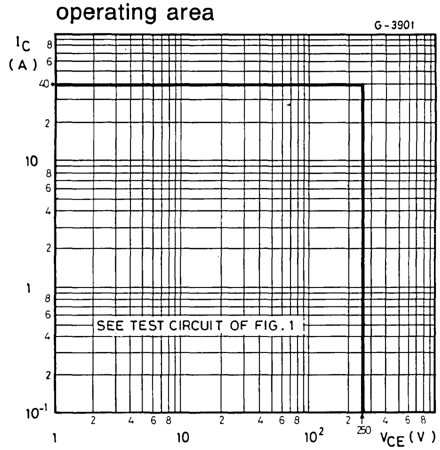


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\,\Omega$

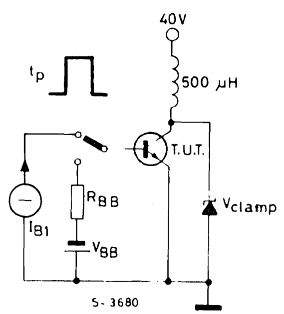


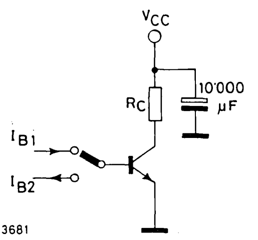
Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 100V$

$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE
pulse width = 10 µs
$t_r, t_f \leq$ 50ns
duty cycle = 1%



BUW 22
BUW 23

MULTIEPITAXIAL MESA PNP

PRELIMINARY DATA

HIGH VOLTAGE POWER SWITCH

The BUW 22, BUW23 are silicon multiepitaxial mesa PNP transistors in Jedec TO-3 metal case, particularly intended for high voltage, fast switching applications. The complementary NPN types are the BUW 24 and BUW 25 respectively.

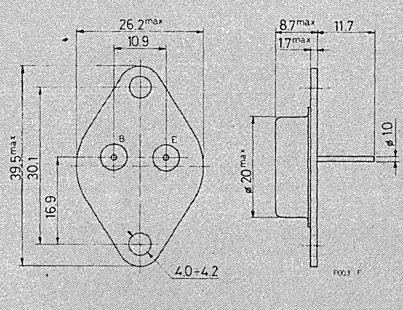
ABSOLUTE MAXIMUM RATINGS

		BUW 22	BUW 23
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-400V	-450V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-350V	-400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-10A	
I_B	Base current	-4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W	125W
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case for BUW 22	max	1.75 °C/W
$R_{th\ j\text{-}case}$	Thermal resistance junction-case for BUW 23	max	1.4 °C/W

ELECTRICAL CHARACTERISTICS (T_{case}= 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}= 0)	for **BUW22** V_{CE}=-400V for **BUW23** V_{CE}=-450V			-500 -500	μA μA
I_{CES}	Collector cutoff current (V_{BE}=0)	T_{case}=125°C for **BUW22** V_{CE}=-400V for **BUW23** V_{CE}=-450V			 -3 -3	 mA mA
I_{EBO}	Emitter cutoff current (I_C =0)	V_{EB}=-5V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =-100 mA for **BUW22** for **BUW23**	 -350 -400			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BUW22** I_C =-2.5A I_B =-0.5A for **BUW23** I_C =-3A I_B =-0.6A I_C =-4A I_B =-1.A			-1.5 -1.5 -1.5	V V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BUW22** I_C =-2.5A I_B =-0.5A for **BUW23** I_C =-3A I_B =-0.6A I_C =-4A I_B =-1A			-1.4 -1.3 -1,5	V V V
h_{FE}*	DC current gain	I_C =-1A V_{CE}=-5V for **BUW22** for **BUW23**	 10 15			 – –

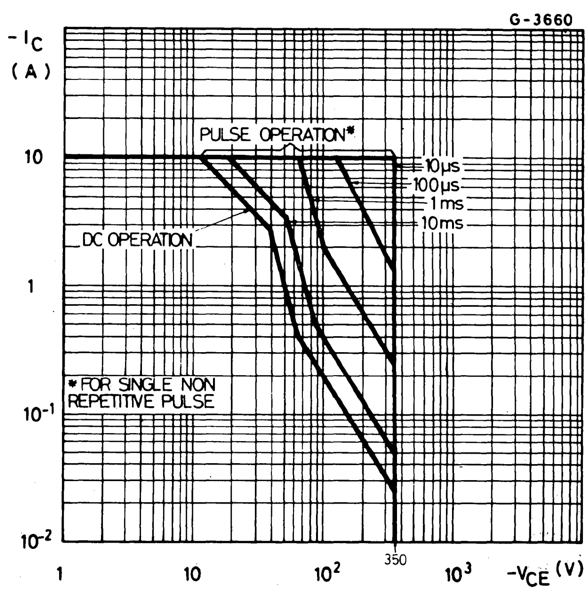
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

ELECTRICAL CHARACTERISTICS (continued)

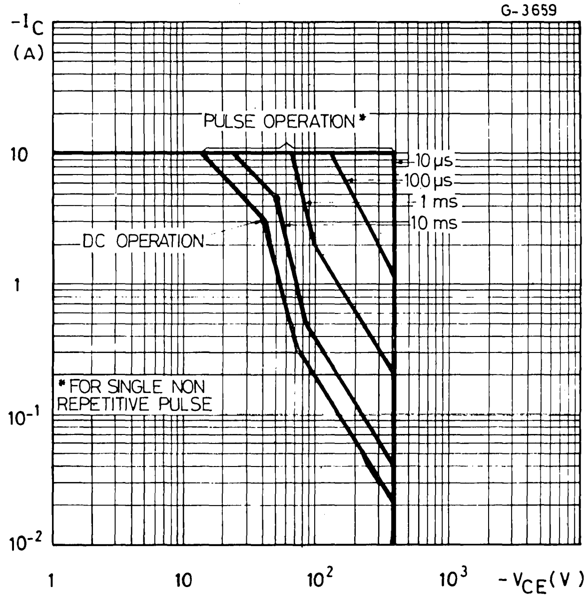
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Tur-on time	for **BUW22** I_C = -2.5A I_{B1} = -0.5A V_{CC} = -250V		0.25		μs
		for **BUW23** I_C = -3A I_{B1} = -0.6A V_{CC} = -250V			0.5	μs
t_s	Storage time	for **BUW22** I_C = -2.5A V_{CC} = -250V I_{B1} = -0.5A I_{B2} = 1.25A		1		μs
t_f	Fall time			0.3		μs
t_s	Storage time	for **BUW23** I_C = -3A V_{CC} = -250V I_{B1} = -0.6A I_{B2} = 1.5A			2	μs
t_f	Fall time				0.8	μs

*Pulsed: pulse duration = 300μs, duty cycle = 1.5%

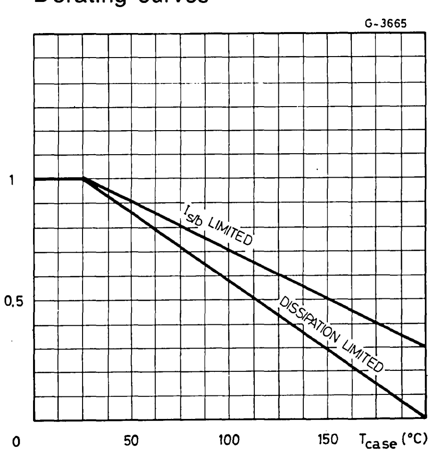
Safe operating areas (for BUW22)



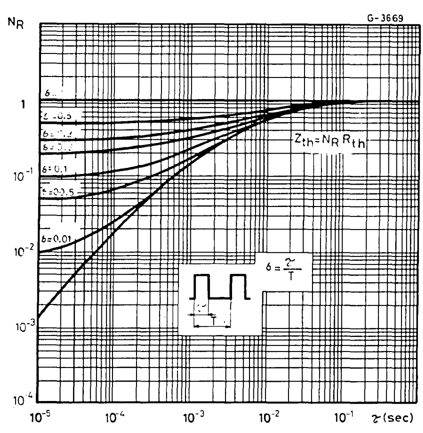
Safe operating areas
(for BUW23)



Derating curves

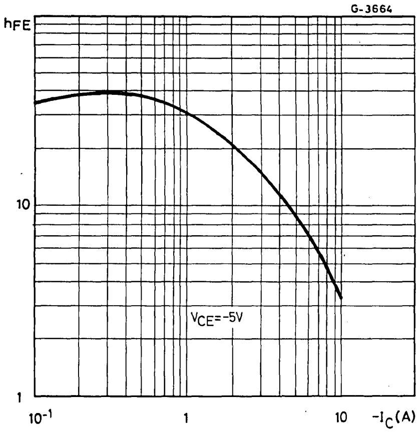


Transient thermal response

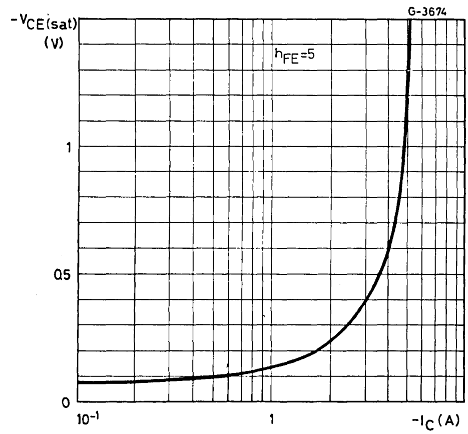


BUW 22
BUW 23

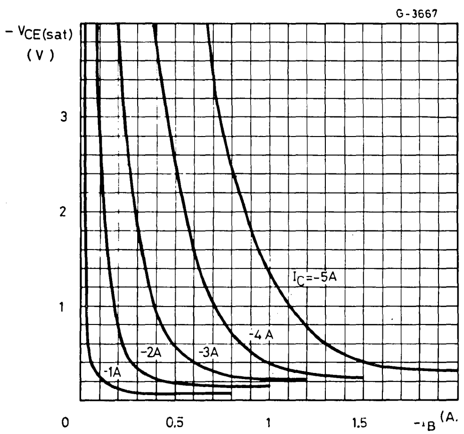
DC current gain



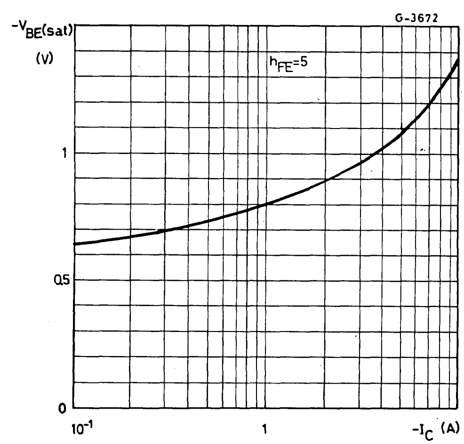
Collector-emitter saturation voltage



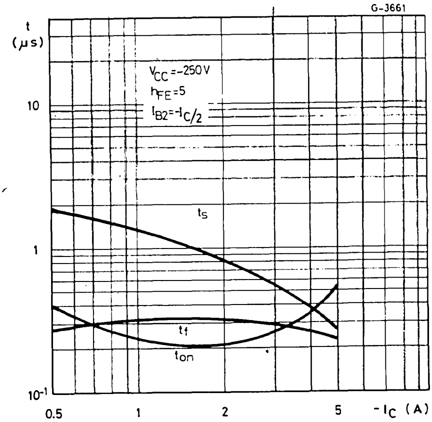
Collector-emitter saturation voltage



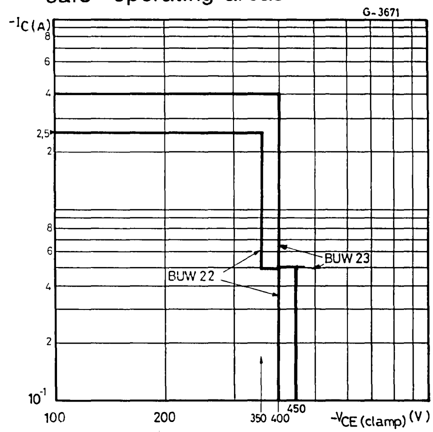
Base-emitter saturation voltage



Satured switching characteristics

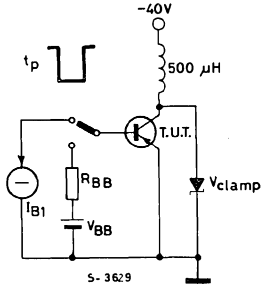


Clamped reverse bias
safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:
$5V \geq |-V_{BB}| > 2V$
$I_C / I_B = 5$
$2I_{B1} > |-I_{B2}| > I_{B1}$
t_p = adjusted for nominal I_C
R_{BB} = adjusted for I_{B2}



BUW 24

MULTIEPITAXIAL BIPLANAR NPN

HIGH VOLTAGE POWER SWITCH

The BUW 24 is a silicon multiepitaxial biplanar® NPN transistor in Jedec TO-3 metal case, particularly intended for high voltage, fast switching and industrial applications.
The complementary PNP type is the BUW 22.

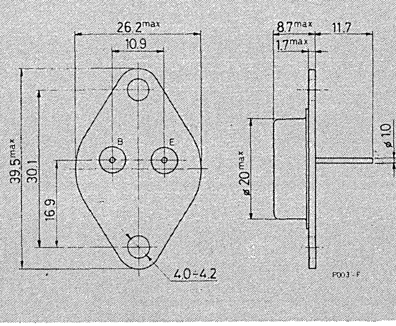
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	450	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	350	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	10	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	100	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

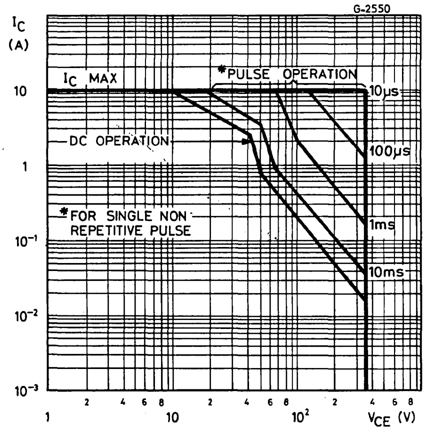
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 450$ V $V_{CE} = 450$ V $T_{case} = 150°C$			500 2.5	μA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5$ V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA	350			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2.5A I_B = 0.5A			1.5	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_B = 0.5A			1.4	V
h_{FE}*	DC current gain	I_C = 1 A V_{CE} = 5V	10		80	—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V		20		MHz
t_{on}	Turn-on time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A		0.3		μs
t_s	Storage time	I_C = 2.5A V_{CC} = 250V I_{B1} = 0.5A I_{B2} = -1.25A		1.8		μs
t_f	Fall time			0.3		μs

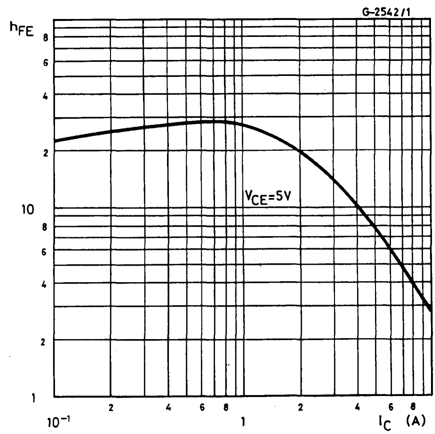
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BUW 24

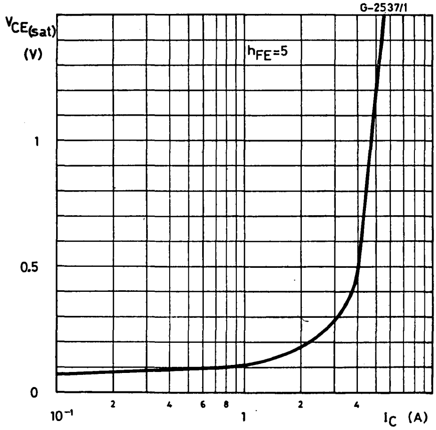
Safe operating areas



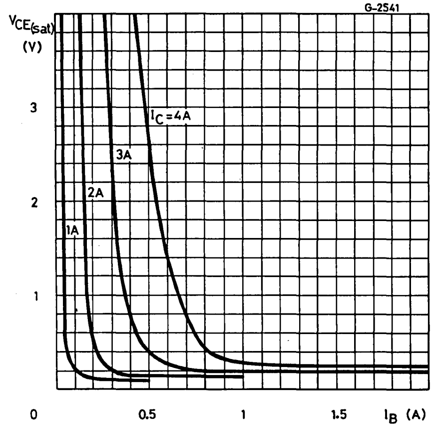
DC current gain



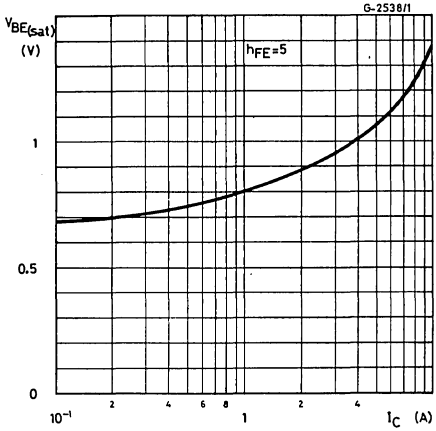
Collector-emitter saturation voltage



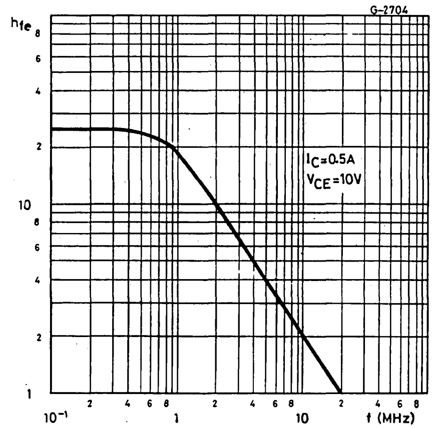
Collector-emitter saturation voltage



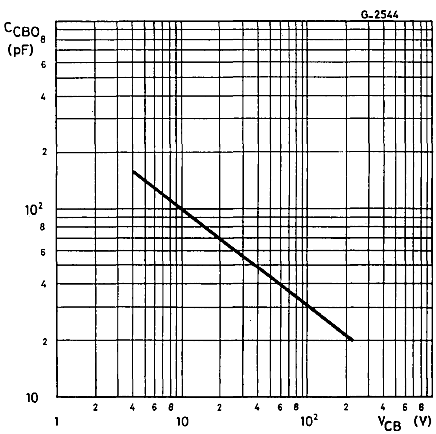
Base-emitter saturation voltage



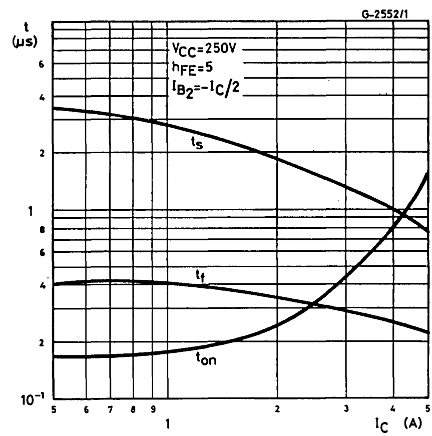
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BUW 25

MULTIEPITAXIAL BIPLANAR NPN

HIGH VOLTAGE POWER SWITCH

The BUW 25 is a silicon multiepitaxial biplanar® NPN transistor in Jedec TO-3 metal case. It is particularly intended for high voltage, fast switching and industrial applications. The complementary PNP type is the BUW 23.

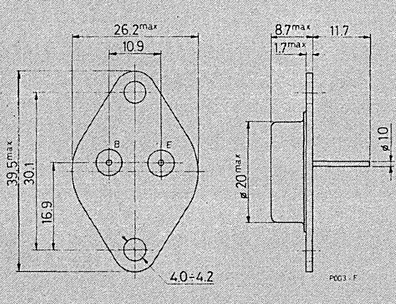
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	600	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8	V
I_C	Collector current	10	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	125	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

6/77

THERMAL DATA

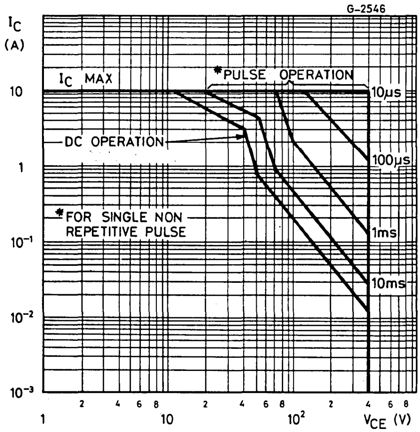
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

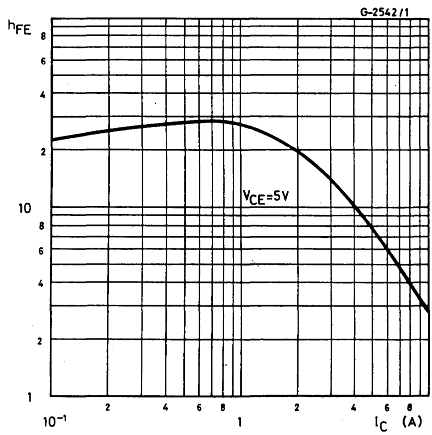
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 600$ V $V_{CE} = 600$ V $T_{case} = 150°C$			500 2.5	μA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 400$ V			100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 8V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100$ mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 3$ A $I_B = 0.6A$ $I_C = 4$ A $I_B = 1$ A			1.5 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 3$ A $I_B = 0.6A$ $I_C = 4$ A $I_B = 1$ A			1.3 1.5	V V
h_{FE}*	DC current gain	$I_C = 1$ A $V_{CE} = 5$ V $I_C = 8$ A $V_{CE} = 5$ V	15	 4	40	— —
f_T	Transition frequency	$I_C = 0.5$ A $V_{CE} = 10$ V		20		MHz
t_{on}	Turn-on time	$I_C = 3$ A $V_{CC} = 250$ V $I_{B1} = 0.6$ A		0.3	0.5	μs
t_s	Storage time	$I_C = 3$ A $V_{CC} = 250$ V $I_{B1} = 0.6$ A $I_{B2} = -1.5$ A		1.2	2	μs
t_f	Fall time			0.3	0.5	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

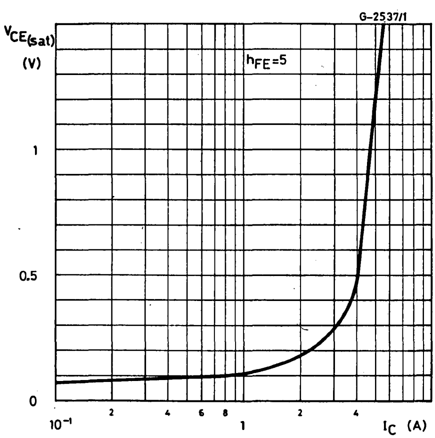
Safe operating areas



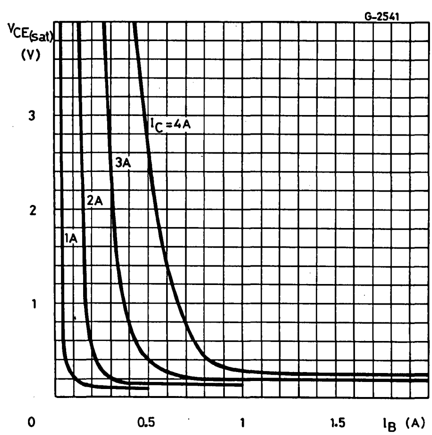
DC current gain



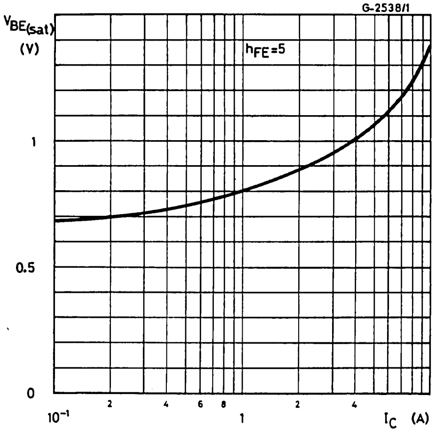
Collector-emitter saturation voltage



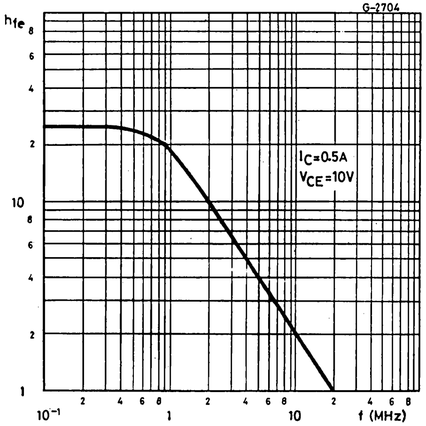
Collector-emitter saturation voltage



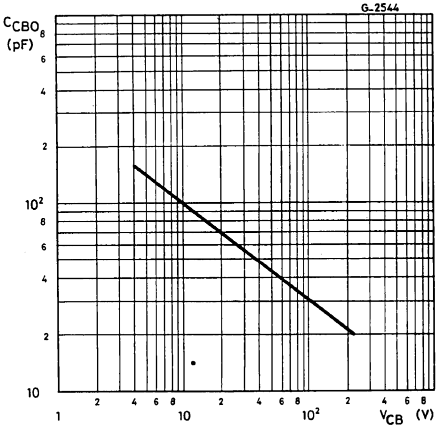
Base-emitter saturation voltage



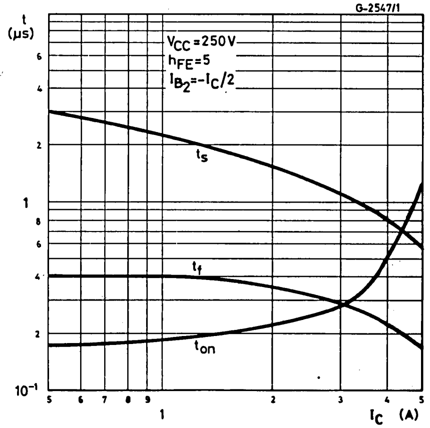
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BUW 26

MULTIEPITAXIAL BIPLANAR NPN

HIGH VOLTAGE POWER SWITCH

The BUW 26 is a silicon multiepitaxial biplanar® NPN transistor in Jedec TO-3 metal case. It is particularly intended for high voltage, fast switching and industrial applications.

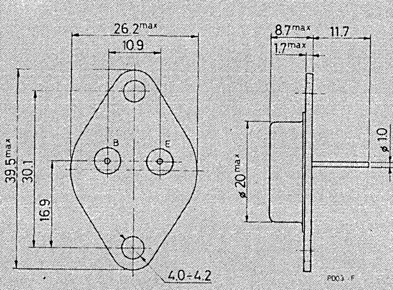
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	450	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8	V
I_C	Collector current	10	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	125	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

6/77

THERMAL DATA

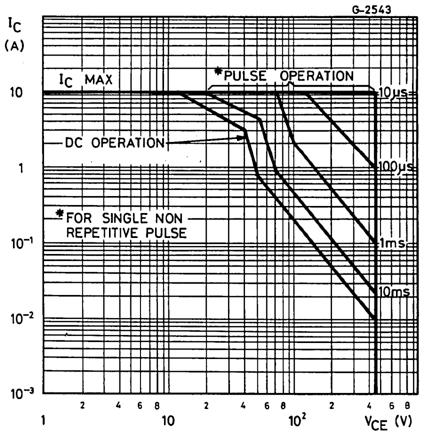
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

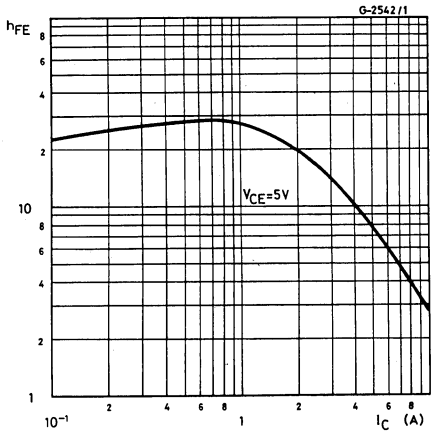
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	V_{CE} = 800 V V_{CE} = 800 V T_{case} = 150°C			500 1	μA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 450 V			100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 8V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA	450			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3 A I_B = 0.6A I_C = 4 A I_B = 1 A			1.5 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 3 A I_B = 0.6A I_C = 4 A I_B = 1 A			1.3 1.5	V V
h_{FE}*	DC current gain	I_C = 1 A V_{CE} = 5 V I_C = 8 A V_{CE} = 5 V	15	 4	40	— —
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 10 V		20		MHz
t_{on}	Turn-on time	I_C = 3 A V_{CC} = 250 V I_{B1} = 0.6 A		0.3	0.5	μs
t_s	Storage time	I_C = 3 A V_{CC} = 250 V I_{B1} = 0.6 A I_{B2} = -1.5 A		1.2	2	μs
t_f	Fall time			0.3	0.5	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

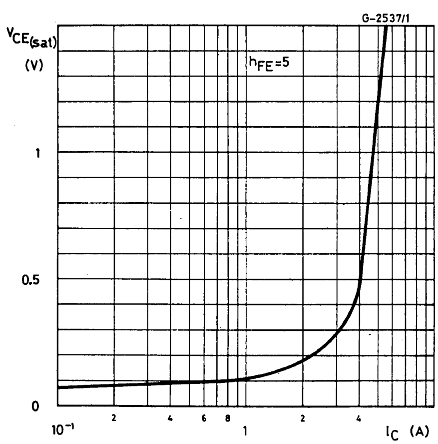
Safe operating areas



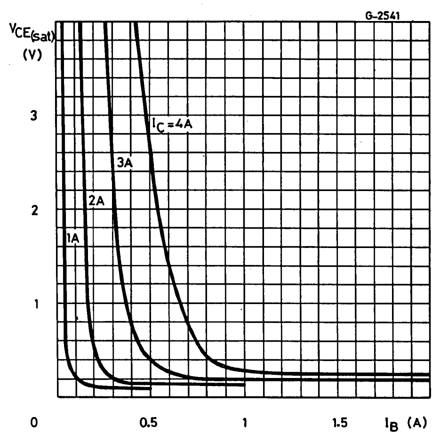
DC current gain



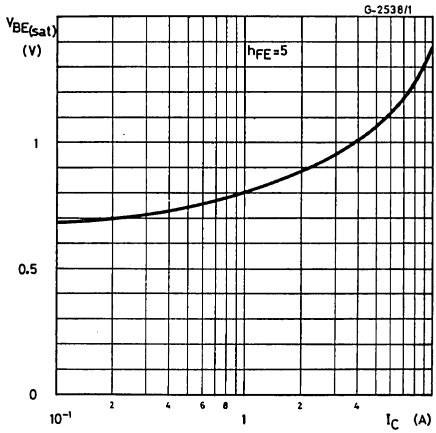
Collector-emitter saturation voltage



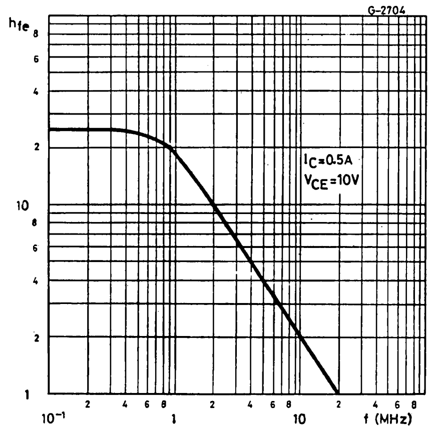
Collector-emitter saturation voltage



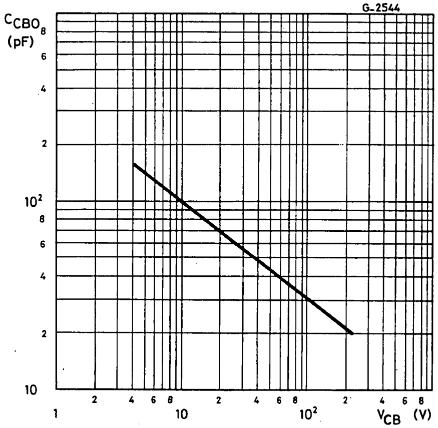
Base-emitter saturation voltage



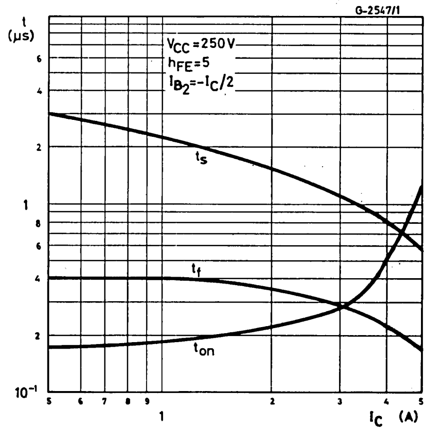
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BUW 32

MULTIEPITAXIAL MESA PNP

PRELIMINARY DATA

HIGH VOLTAGE POWER SWITCH

The BUW 32 is a silicon multipitaxial mesa PNP transistor in Jedec TO-3 metal case. It is intended for high voltage, fast switching and industrial applications. The complementary NPN type is the BUW 35.

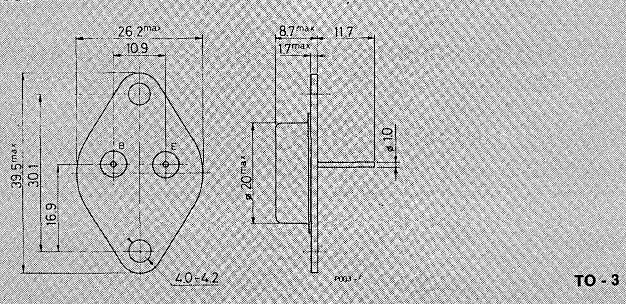
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	-450	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	-400	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	-7	V
I_C	Collector current	-10	A
I_B	Base current	-5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	125	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



THERMAL DATA

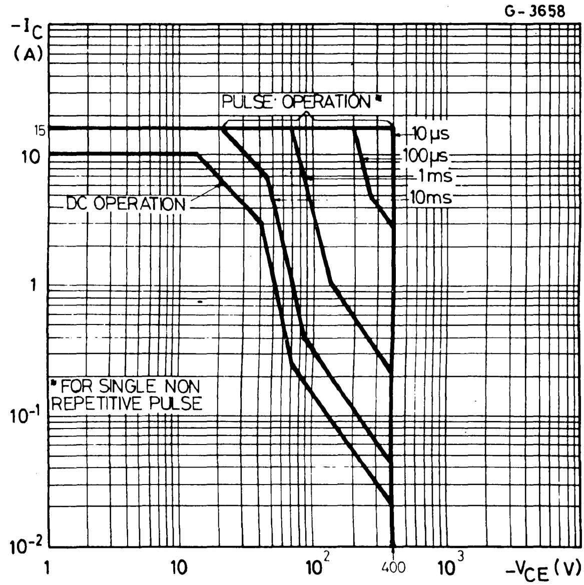
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

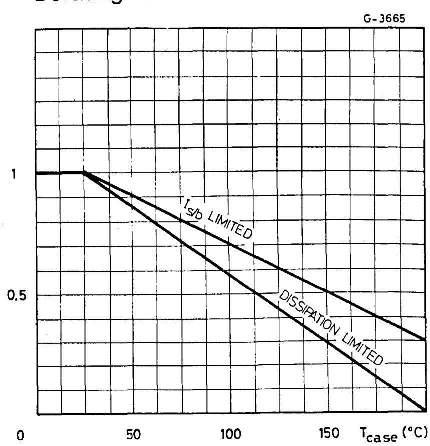
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=-450V			-500	µA
I_{CES}	Collector cutoff current (I_C=0)	V_{CE}=-450V T_{case}=125°C			-3	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=-7V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =-100mA	-400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =-5A I_B =-1A			-1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =-5A I_B =-1A			-1.5	V
h_{FE}*	DC current gain	I_C =-1A V_{CE}=-5V	15			–
t_{on}	Turn-on time	I_C =-5A I_B =-1A V_{CC}=-250V			0.75	µs
t_s	Storage time	I_C =-5A V_{CC}=-250V I_{B1} =-1A I_{B2} =2A			3	µs
t_f	Fall time				0.8	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

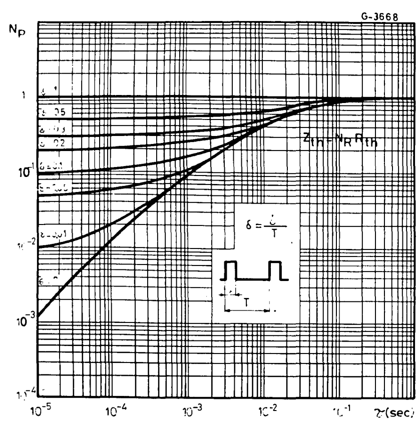
Safe operating areas



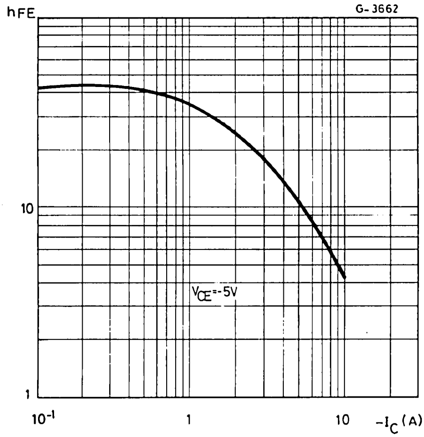
Derating curves



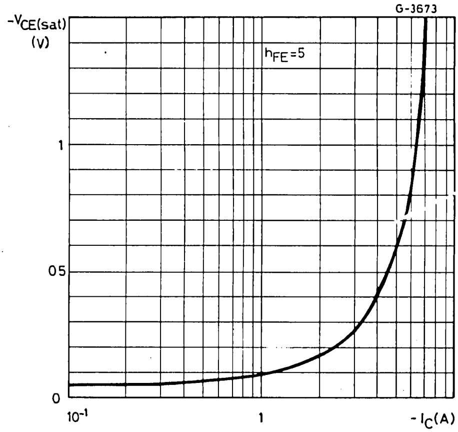
Transient thermal response



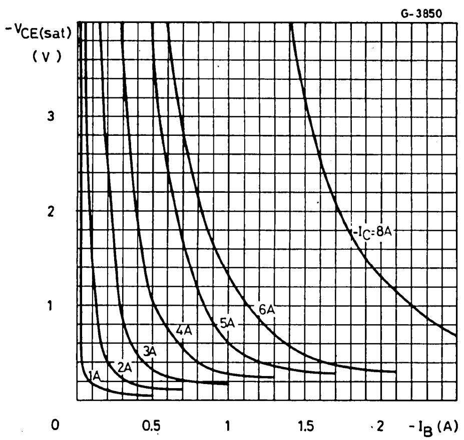
DC current gain



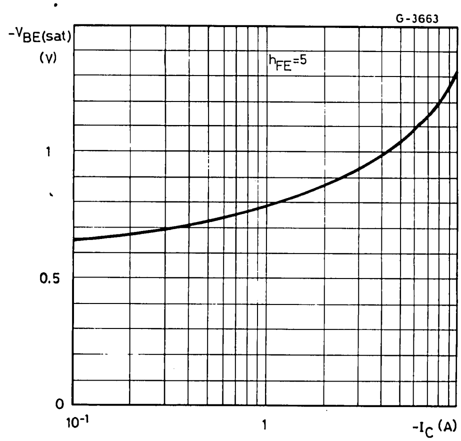
Collector-emitter saturation voltage



Collector-emitter saturation voltage

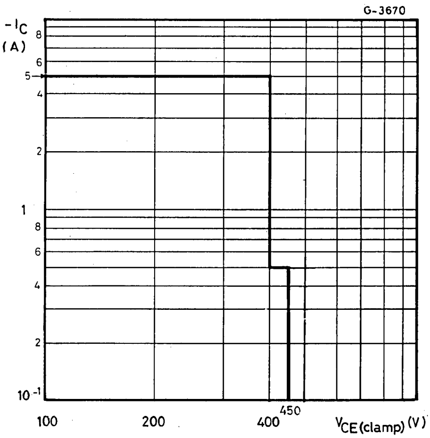


Base-emitter saturation voltage

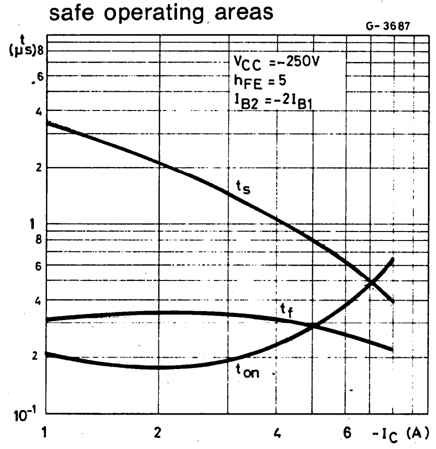


BUW 32

Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

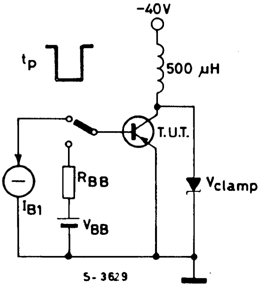
$5V \geq |-V_{BB}| > 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUW 34, BUW 35 and BUW 36 are silicon multiepitaxial mesa NPN transistors in Jedec TO-3 metal case. They are intended for high voltage, fast switching applications.

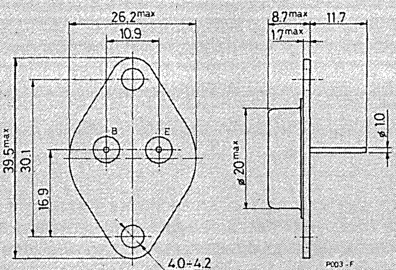
ABSOLUTE MAXIMUM RATINGS

		BUW34	BUW35	BUW36
V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	500V	800V	900V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	400V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C=0$)		7V	
I_C	Collector current		10A	
I_{CM}	Collector peak current		15A	
I_B	Base current		5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		125W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

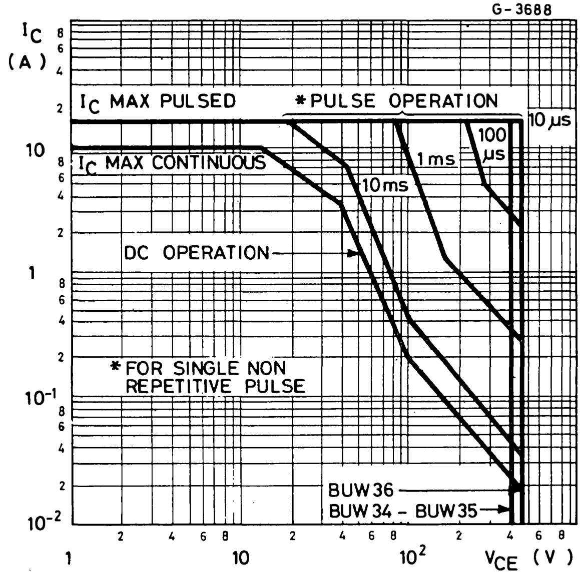
$R_{th\ j-case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

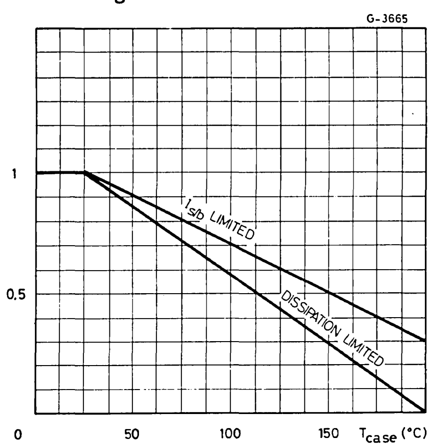
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BUW34**	$V_{CE}=500V$			500	µA
		for **BUW35**	$V_{CE}=800V$			500	µA
		for **BUW36**	$V_{CE}=900V$			500	µA
		$T_{case}=125°C$					
		for **BUW34**	$V_{CE}=500V$			3	mA
		for **BUW35**	$V_{CE}=800V$			3	mA
		for **BUW36**	$V_{CE}=900V$			3	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=7V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	$I_C = 100mA$					
		for **BUW34**		400			V
		for **BUW35**		400			V
		for **BUW36**		450			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	All types	$I_C = 5A$, $I_B = 1A$			1.5	V
		for **BUW35**	$I_C = 8A$, $I_B = 2.5A$			1.5	V
		for **BUW36**	$I_C = 8A$, $I_B = 2.5A$			3	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	All types	$I_C = 5A$, $I_B = 1A$			1.5	V
		for **BUW35**	$I_C = 8A$, $I_B = 2.5A$			1.8	V
		for **BUW36**	$I_C = 8A$, $I_B = 2.5A$			1.8	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE}=5V$	15			–
t_{on}	Turn-on time	$I_C = 5A$, $I_{B1} = 1A$	$V_{CC}=250V$			0.75	µs
t_s	Storage time	$I_C = 5A$, $I_{B1} = 1A$	$V_{CC}=250V$, $I_{B2} = -1A$			3	µs
t_f	Fall time					0.8	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

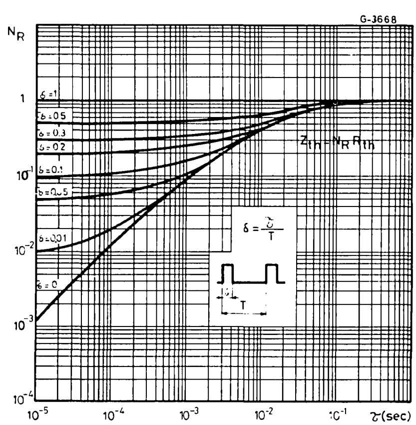
Safe operating areas



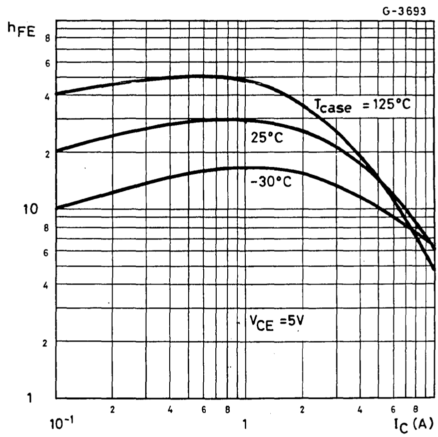
Derating curves



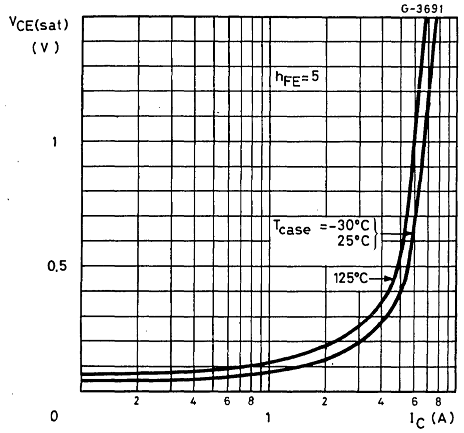
Transient thermal response



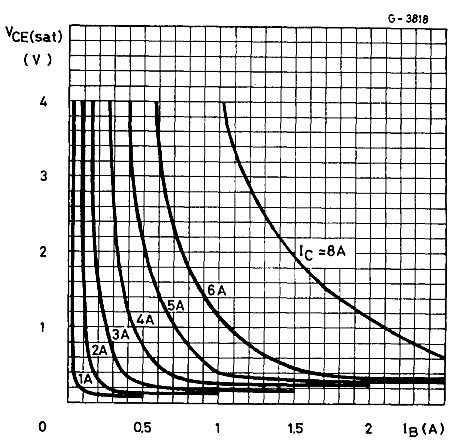
DC current gain



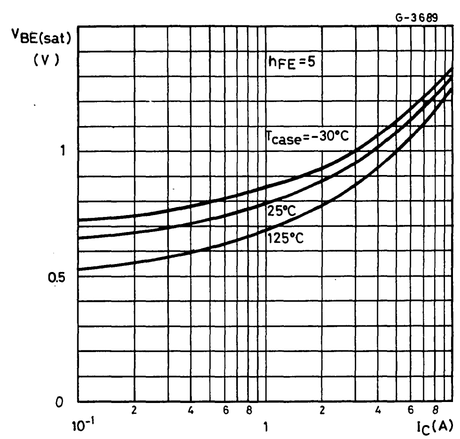
Collector-emitter saturation voltage



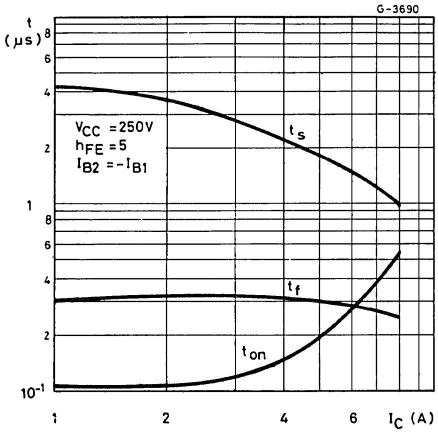
Collector-emitter saturation voltage



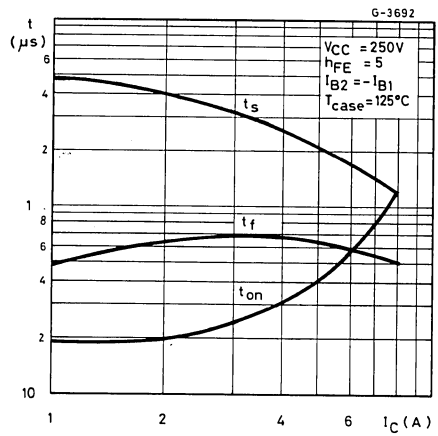
Base-emitter saturation voltage



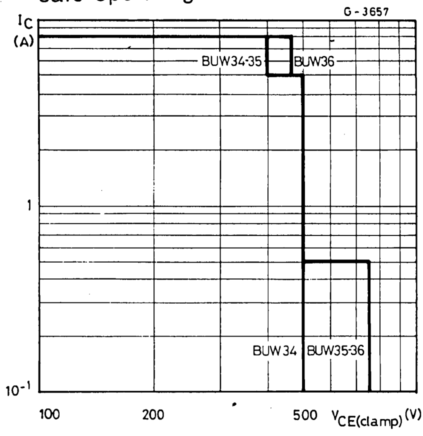
Saturated switching characteristics



Saturated switching characteristics

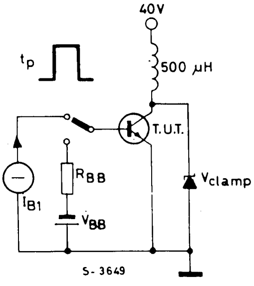


Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:
5V ≥ $|-V_{BB}|$ ≥ 2V
I_C / I_B =5
$2I_{B1} > |-I_{B2}| > I_{B1}$
t_p = adjusted for nominal I_C
R_{BB} = adjusted for I_{B2}



BUW 44
BUW 45
BUW 46

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE, HIGH CURRENT POWER SWITCH

The BUW 44, BUW 45 and BUW 46 are multiepitaxial mesa NPN transistors in Jedec TO-3 metal case, intended in fast switching applications for high output powers.

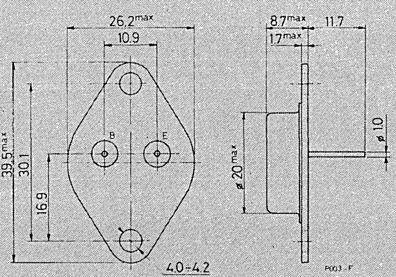
ABSOLUTE MAXIMUM RATINGS

		BUW44	BUW45	BUW46
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	500V	800V	900V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		7V	
I_C	Collector current		15A	
I_{CM}	Collector peak current		30A	
I_B	Base current		10A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		175W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

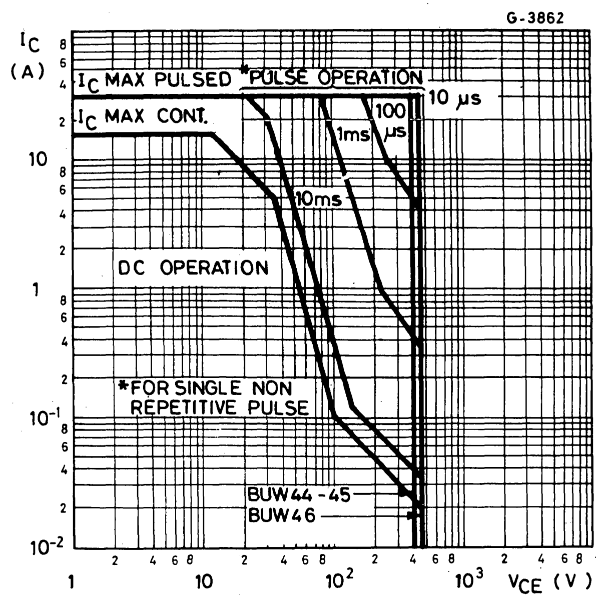
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BUW44** $V_{CE} = 500V$			500	µA
		for **BUW45** $V_{CE} = 800V$			500	µA
		for **BUW46** $V_{CE} = 900V$			500	µA
		$T_{case} = 125°C$				
		for **BUW44** $V_{CE} = 500V$			3	mA
		for **BUW45** $V_{CE} = 800V$			3	mA
		for **BUW46** $V_{CE} = 900V$			3	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 100mA$				
		for **BUW44**	400			V
		for **BUW45**	400			V
		for **BUW46**	450			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BUW44**				
		$I_C = 10A$ $I_B = 2A$			3	V
		$I_C = 6A$ $I_B = 1A$			1.5	V
		for **BUW45** and **BUW46**				
		$I_C = 10A$ $I_B = 2A$			1.5	V
		$I_C = 7A$ $I_B = 1A$			1.5	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BUW44**				
		$I_C = 10A$ $I_B = 2A$			1.8	V
		$I_C = 6A$ $I_B = 1A$			1.4	V
		for **BUW45** and **BUW46**				
		$I_C = 10A$ $I_B = 2A$			1.8	V
		$I_C = 7A$ $I_B = 1A$			1.4	V

ELECTRICAL CHARACTERISTICS (continued)

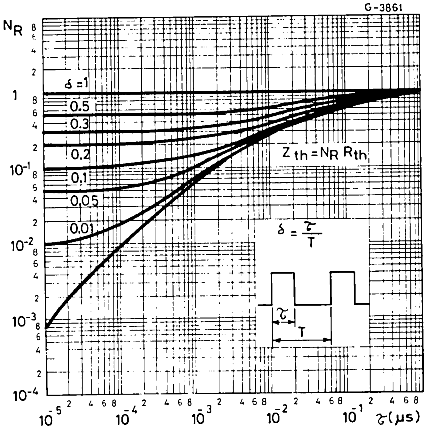
	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time	I_C = 10A I_{B1} = 2A V_{CC} = 250V	0.75	µs
t_s	Storage time	I_C = 10A I_{B1} = 2A I_{B2} = -2A V_{CC} = 250V	3	µs
t_f	Fall time		0.8	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

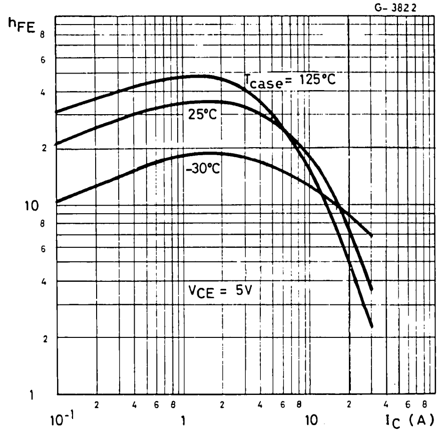
Safe operating areas



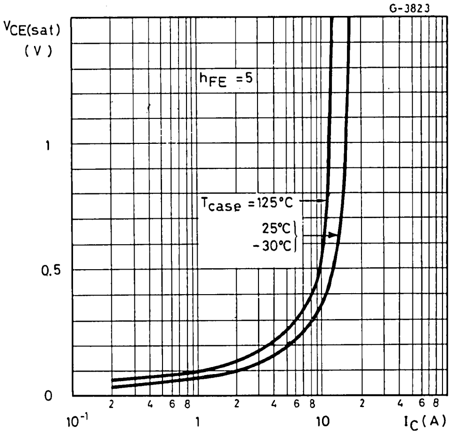
Thermal transient response



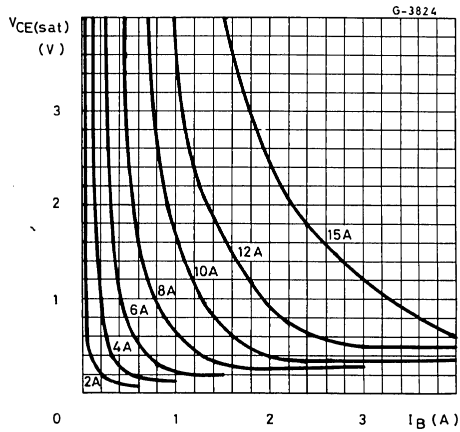
DC current gain



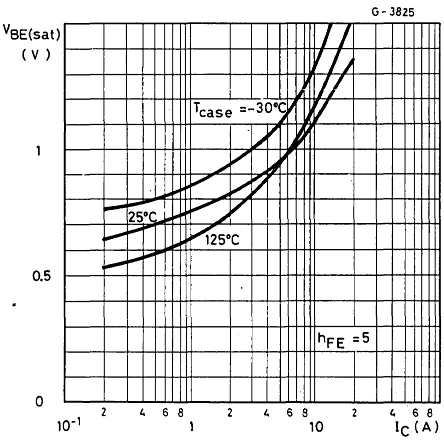
Collector-emitter saturation voltage



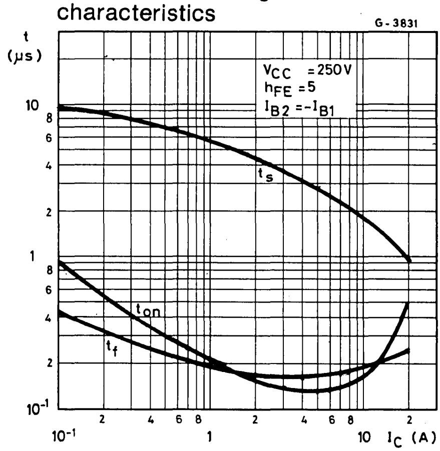
Collector-emitter saturation voltage



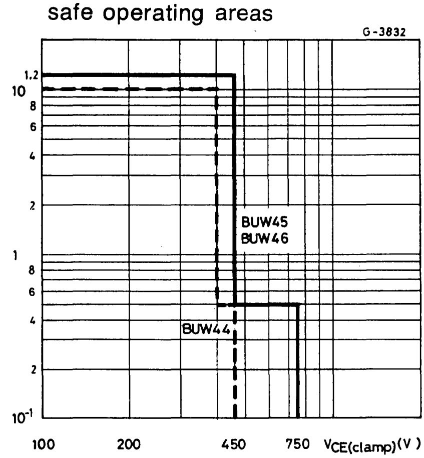
Base-emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

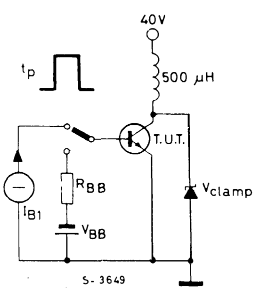
$5V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



EPITAXIAL PLANAR NPN

BUW 66
BUW 67

FAST SWITCHING DARLINGTON TRANSISTORS

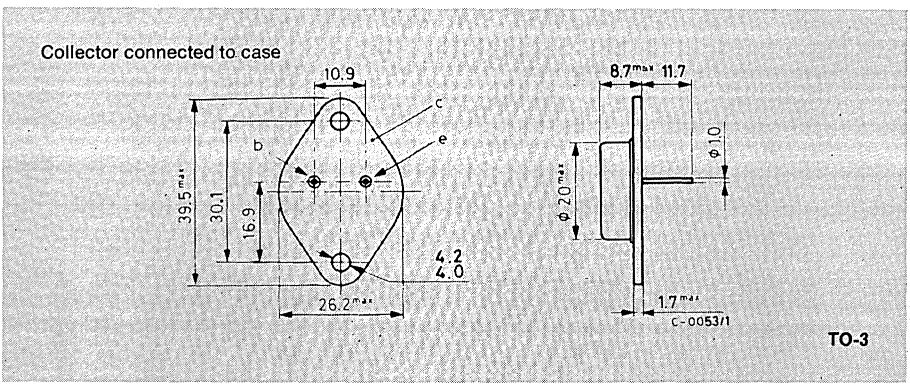
The BUW 66 and BUW 67 are silicon epitaxial planar NPN transistors in monolithic Darlington configuration in Jedec TO-3 metal case.
They are particularly intended for high voltage, high current fast switching applications.

ABSOLUTE MAXIMUM RATINGS

		BUW66	BUW67
V_{CBO}	Collector-base voltage ($I_E = 0$)	400V	330V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -6V$)	400V	330V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200V	200V
V_{EBO}	Emitter-base voltage	6V	
I_C	Collector current	10A	
I_{CM}	Collector peak current	15A	
I_{FM}	Parallel-diode forward peak current	10A	
I_B	Base current	2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	90W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm



5/80

BUW 66
BUW 67

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.9	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

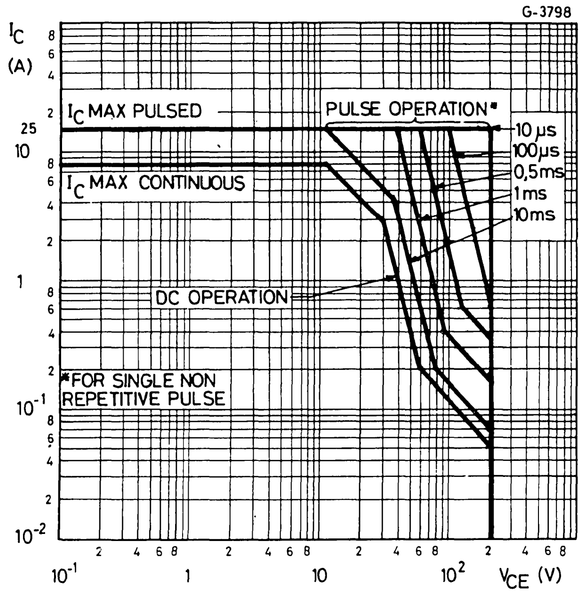
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BUW66** $V_{CE}=400V$ for **BUW67** $V_{CE}=330V$			100 100	μA μA
I_{CEV}	Collector cutoff current ($V_{BE}=-6V$)	for **BUW66** $V_{CE}=400V$ for **BUW67** $V_{CE}=330V$			100 100	μA μA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=6V$			3	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	$I_C=100mA$	200			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C=5A$ $I_B=50mA$ $I_C=10A$ $I_B=250mA$			1.5 2.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C=5A$ $I_B=50mA$ $I_C=10A$ $I_B=250mA$			2.4 3	V V
V_F*	Parallel diode forward voltage	$I_F=5A$			2	V
t_{on}**	Turn-on time	$I_C=5A$ $I_{B1}=50mA$ $V_{CC}=100V$		0.35	0.8	μs
t_s**	Storage time	$I_C=5A$ $I_{B1}=50mA$ $I_{B2}=-500mA$ $V_{CC}=100V$		0.55	1.5	μs
t_f**	Fall time			0.2	0.7	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

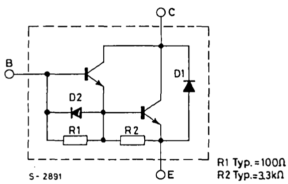
** Resistive load.

BUW 66
BUW 67

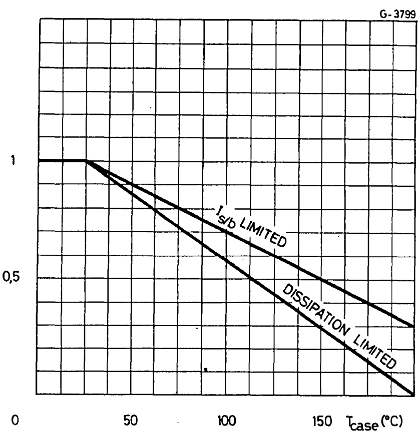
Safe operating areas



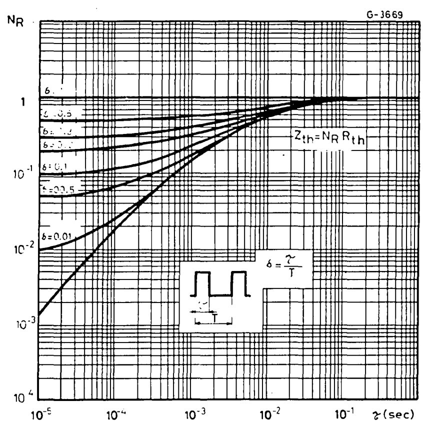
Internal circuit diagram



Derating curves

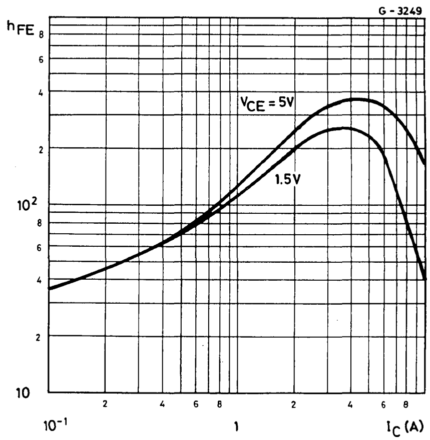


Transient thermal response

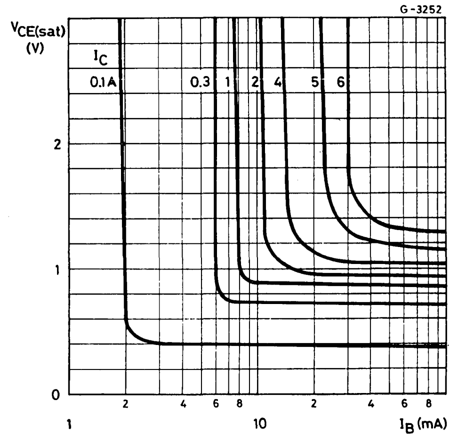


BUW 66
BUW 67

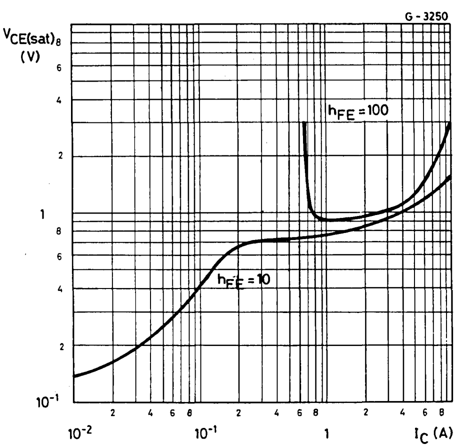
DC current gain



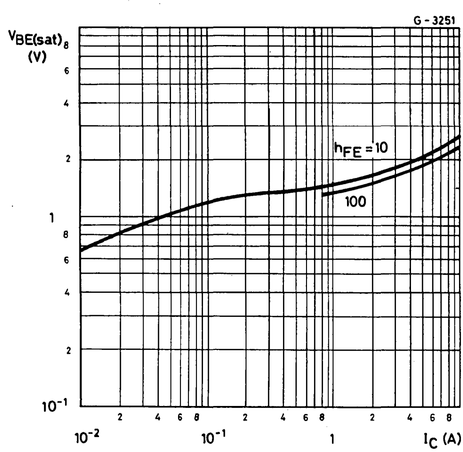
Collector-emitter saturation voltage



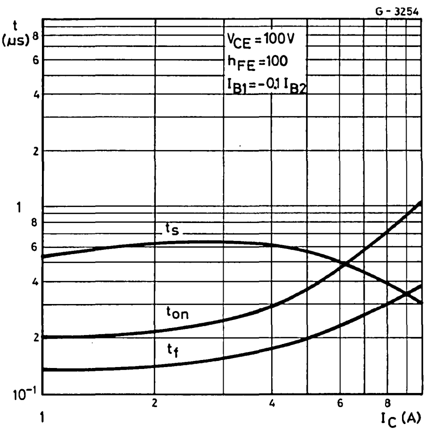
Collector-emitter saturation voltage



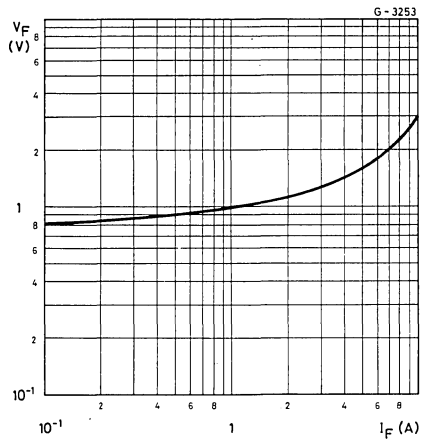
Base-emitter saturation voltage



Saturated switching characteristics



Forward voltage



BUX 10

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

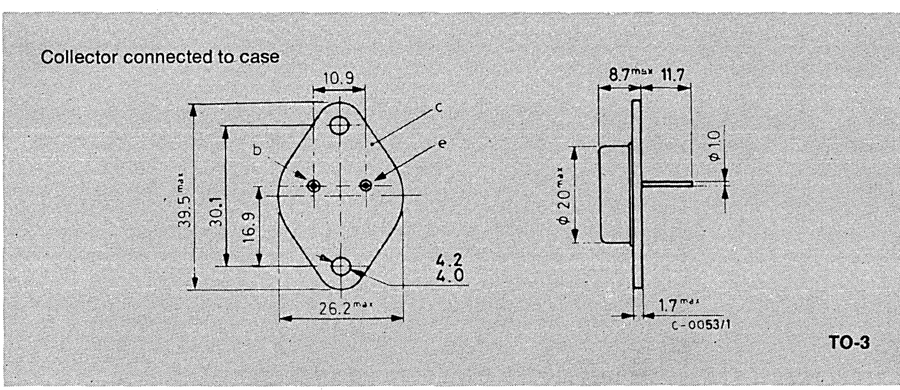
The BUX 10 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	160	V
V_{CEX}	Collector-emitter voltage (V_{BE}=-1.5V)	160	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	25	A
I_{CM}	Collector peak current (t_p=10 ms)	30	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

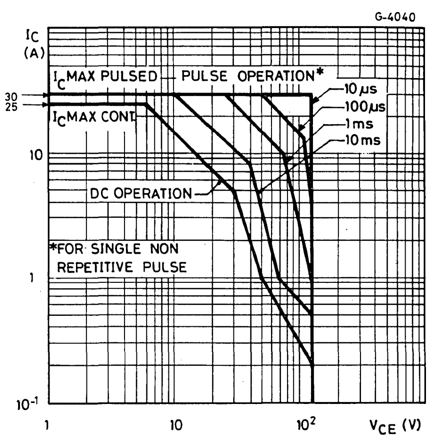
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=100V			1.5	mA
I_{CEX}	Collector cutoff current	V_{CE}=160V V_{BE}=-1.5V T_{case}=125°C V_{CE}=160V V_{BE}=-1.5V			1.5 6	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	125			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =10A I_B =1A I_C =20A I_B =2A		0.3 0.7	0.6 1.2	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =20A I_B =2A		1.6	2	V
h_{FE}*	DC current gain	I_C =10A V_{CE}=2V I_C =20A V_{CE}=4V	20 10		60	— —
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V t =1s V_{CE}=48V t =1s	5 1			A A
f_T	Transition frequency	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

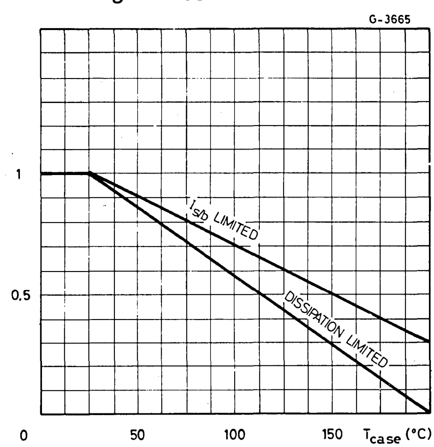
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =20A I_{B1} =2A V_{CC}=30V		0.5	1.5	µs
t_s	Storage time (fig. 2)	I_C =20A I_{B1}=-I_{B2}=2A V_{CC}=30V		0.6	1.2	µs
t_f	Fall time (fig. 2)			0.15	0.3	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=125V L=500µH	20			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

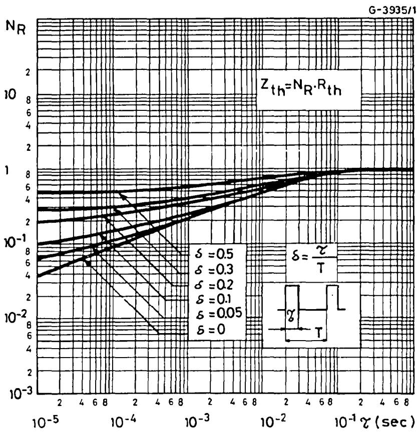
Safe operating areas



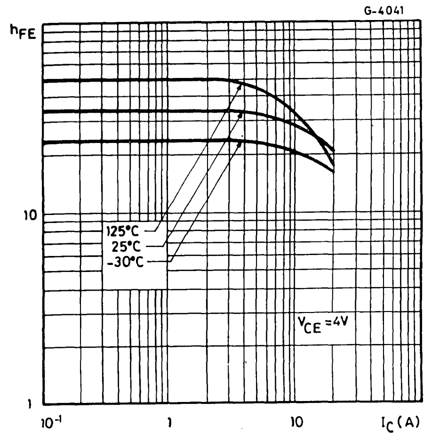
Derating curves



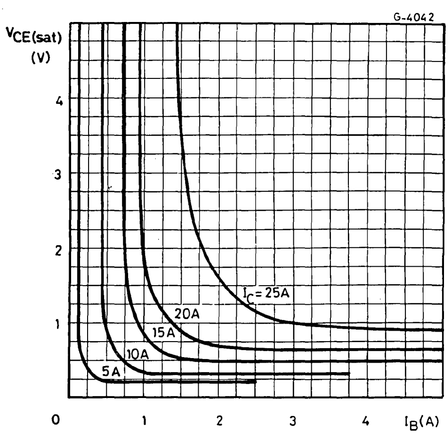
Thermal transient response



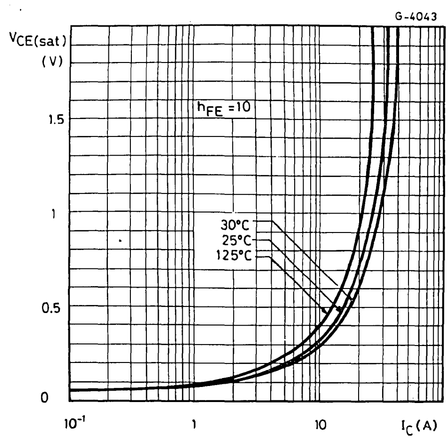
DC current gain



Collector-emitter saturation voltage

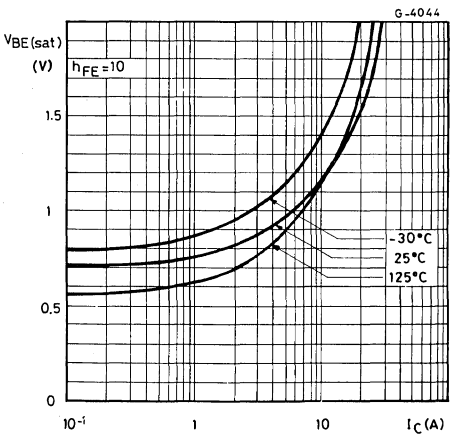


Collector-emitter saturation voltage

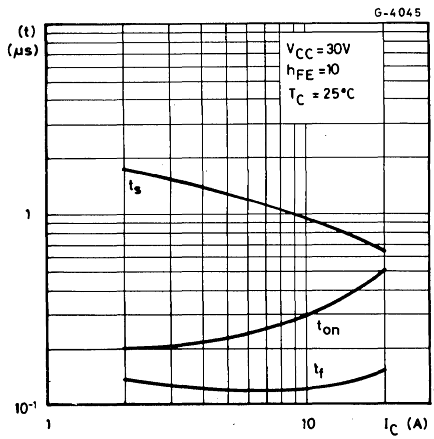


BUX 10

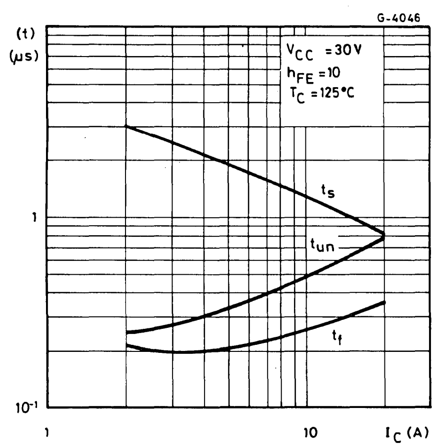
Base-emitter saturation voltage



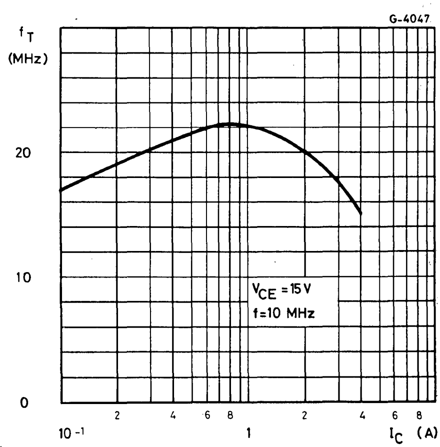
Saturated switching characteristics



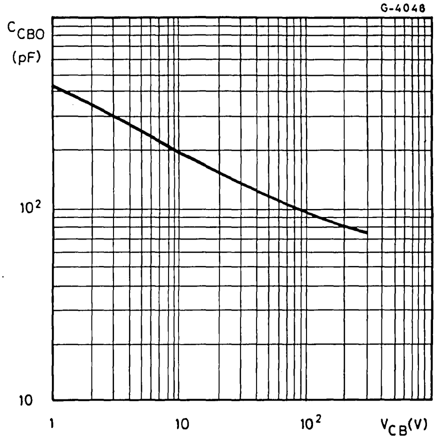
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

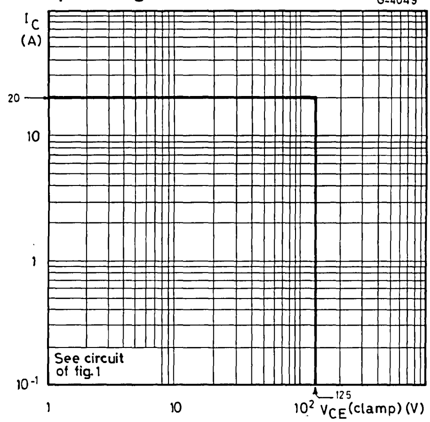


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

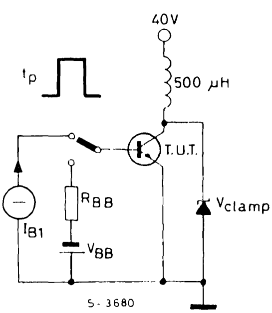


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 30V

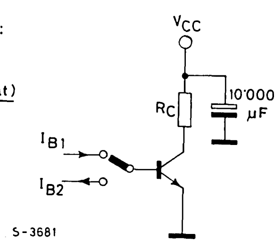
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 11

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

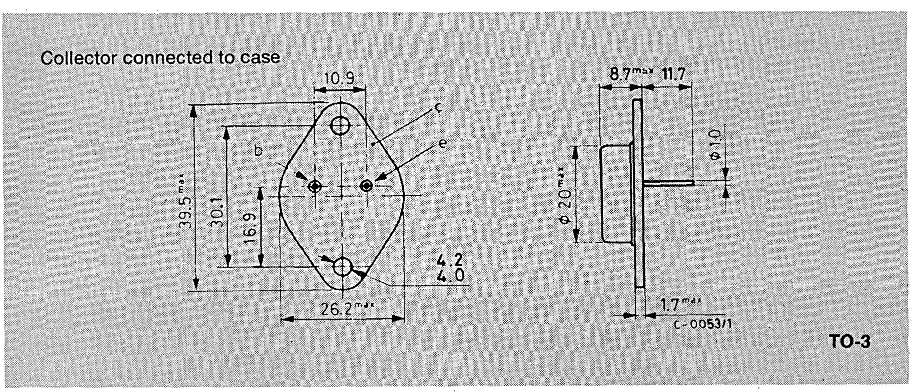
The BUX 11 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	20	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	25	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 1.17 °C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

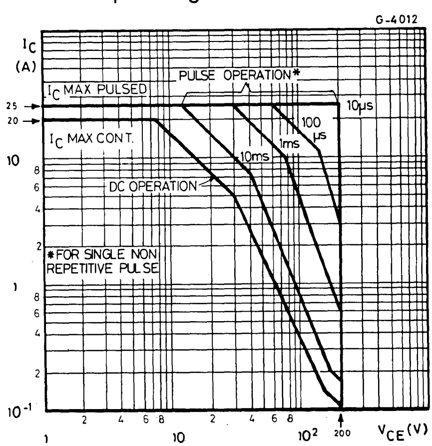
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=160V			1.5	mA
I_{CEX}	Collector cutoff current	V_{CE}=250V V_{BE}=-1.5V			1.5	mA
		V_{CE}=250V V_{BE}=-1.5V T_{case}=125°C			6	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	200			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =6A I_B =0.6A		0.3	0.6	V
		I_C =12A I_B =1.5A		0.6	1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =12A I_B =1.5A		1.3	1.5	V
h_{FE}*	DC current gain	I_C =6A V_{CE}=2V	20		60	—
		I_C =12A V_{CE}=4V	10			—
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V t = 1s	5			A
		V_{CE}=140V t = 1s	0.15			A
f_T	Transition frequency	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

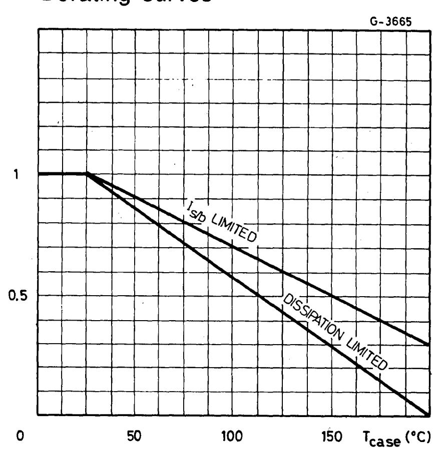
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =12A I_{B1} =1.5A V_{CC}=150V		0.3	1	μs
t_s	Storage time (fig. 2)	I_C =12A I_{B1} =1.5A I_{B2} =-1.5A V_{CC}=150V		1.2	1.8	μs
t_f	Fall time (fig. 2)	I_C =12A I_{B1} =1.5A I_{B2} =-1.5A V_{CC}=150V		0.24	0.4	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500μH	12			A

* Pulsed: pulse duration =300 μs, duty cycle ≤2%

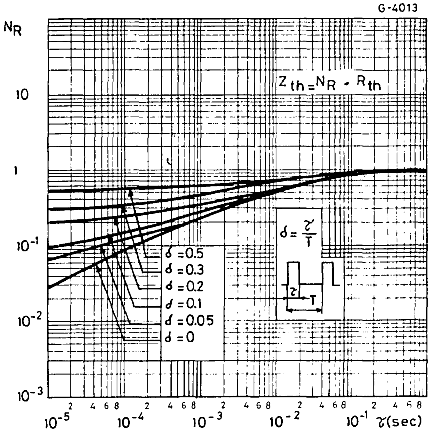
Safe operating areas



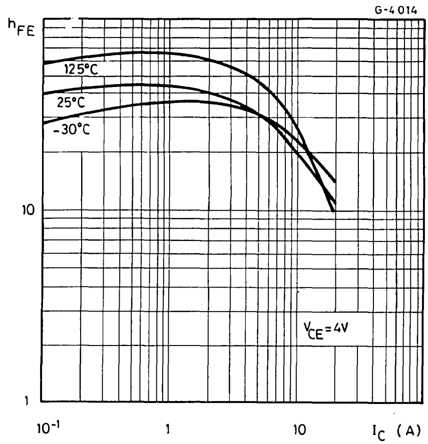
Derating curves



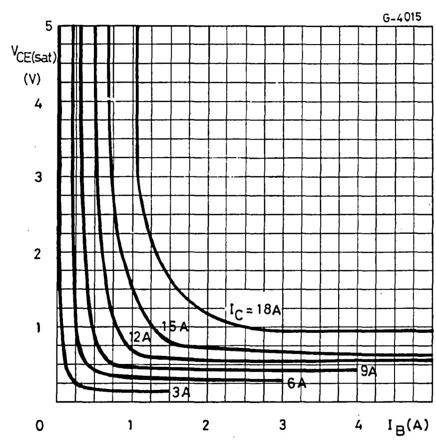
Thermal transient response



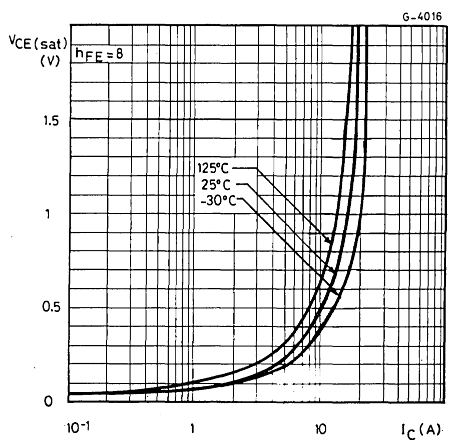
DC current gain



Collector-emitter saturation voltage

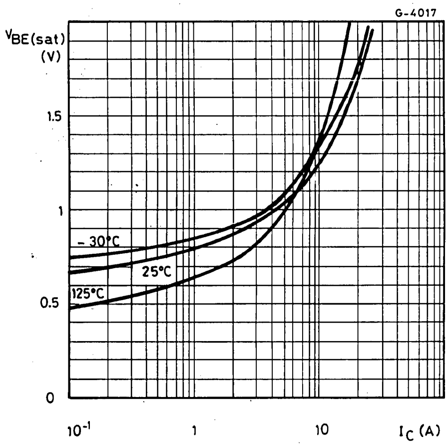


Collector-emitter saturation voltage

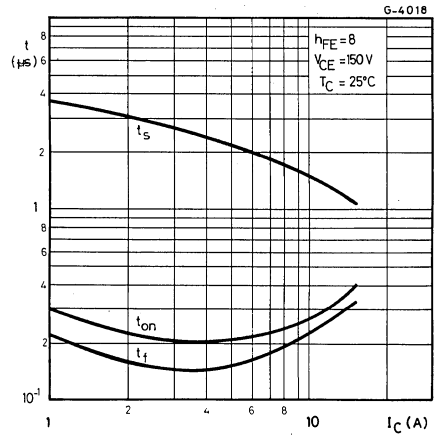


BUX 11

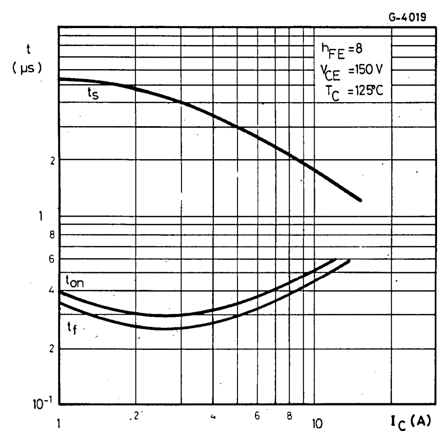
Base-emitter saturation voltage



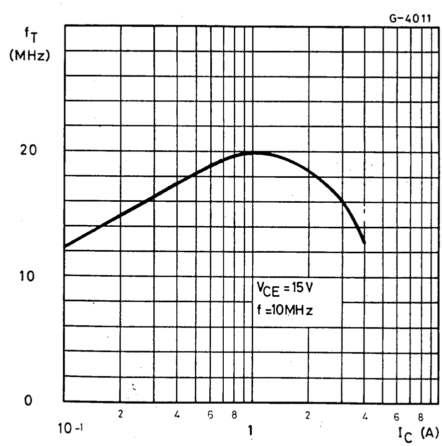
Saturated switching characteristics



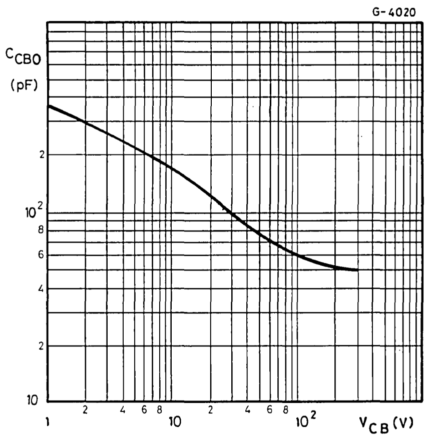
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

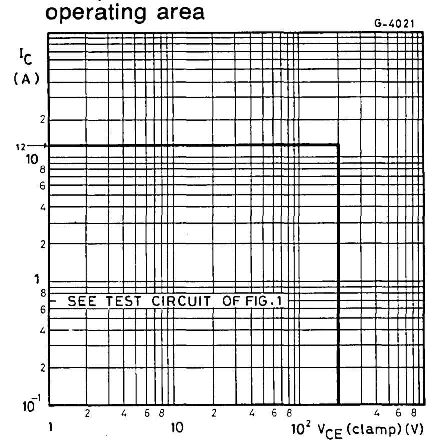


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\,\Omega$

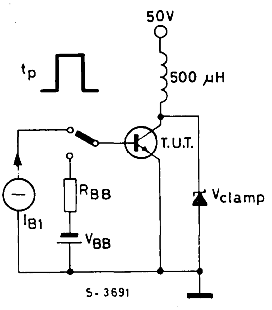


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 150V$

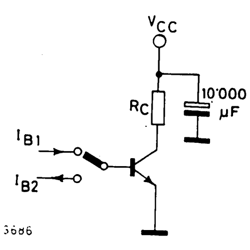
$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq 50ns$

duty cycle = 1%



BUX 11N

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

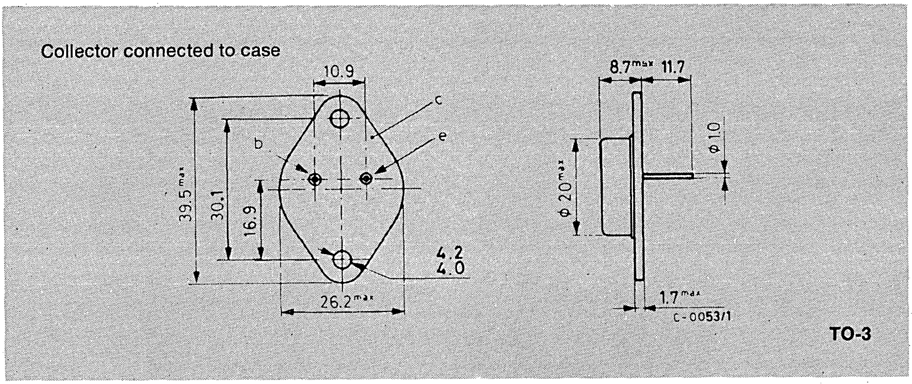
The BUX 11N is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	220	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	220	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	160	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	20	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	25	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 130V$			1.5	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 220V$ $V_{BE} = -1.5V$ $V_{CE} = 220V$ $V_{BE} = -1.5V$ $T_{case} = 125°C$			1.5 6	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$ $L = 25\ mH$	160			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 8A$ $I_B = 0.8A$ $I_C = 15A$ $I_B = 1.88A$		0.3 0.6	0.6 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 15A$ $I_B = 1.88A$		1.4	1.8	V
h_{FE}*	DC current gain	$I_C = 8A$ $V_{CE} = 2V$ $I_C = 15A$ $V_{CE} = 4V$	20 10		60	– –
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 30V$ $t = 1s$ $V_{CE} = 140V$ $t = 1s$	5 0.15			A A
f_T	Transition frequency	$V_{CE} = 15V$ $I_C = 1A$ $f = 10MHz$	8			MHz

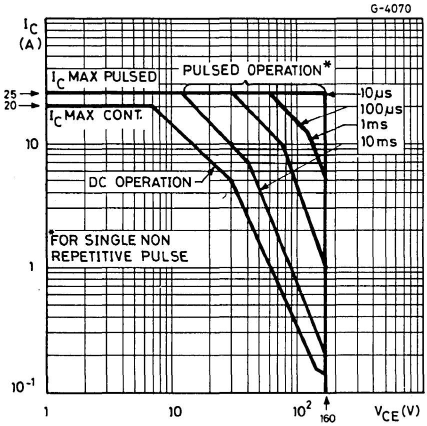
BUX 11N

ELECTRICAL CHARACTERISTICS (continued)

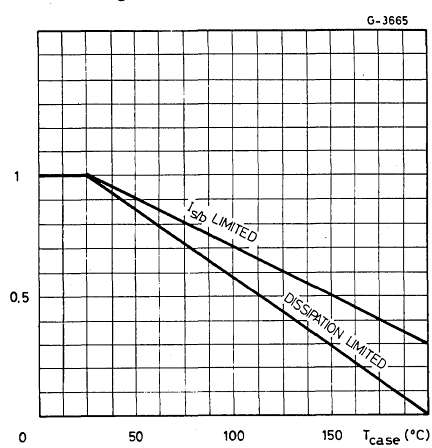
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	$I_C = 15A$ $I_{B1} = 1.88A$ $V_{CC} = 30V$		0.4	1.5	μs
t_s	Storage time (fig. 2)	$I_C = 15A$ $I_{B1} = -I_{B2} = 1.88A$ $V_{CC} = 30V$		0.75	1.5	μs
t_f	Fall time (fig. 2)			0.14	0.5	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	$V_{clamp} = 160V$ $L = 500μH$	15			A

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 2%

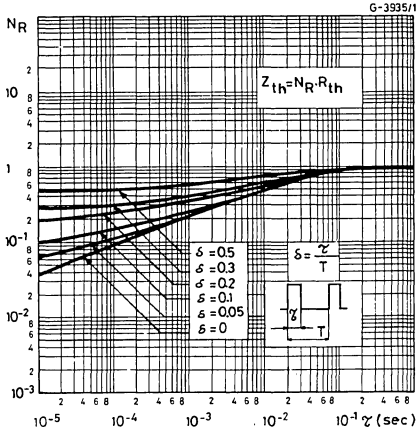
Safe operating areas



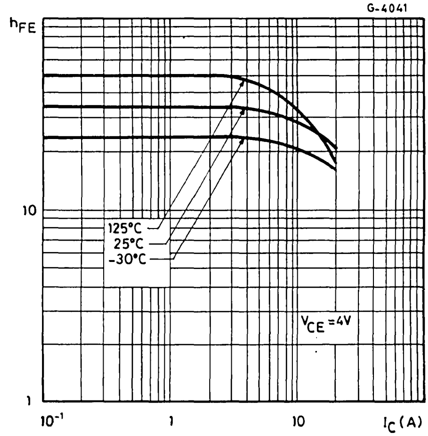
Derating curves



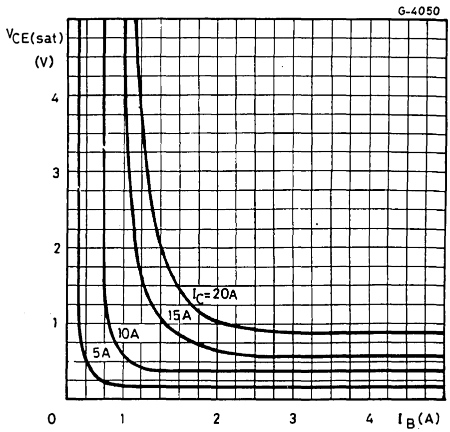
Thermal transient response



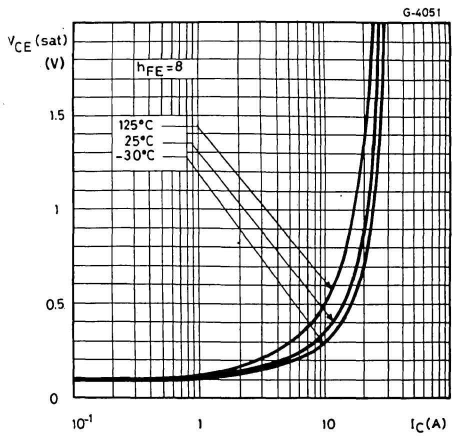
DC current gain



Collector-emitter saturation voltage

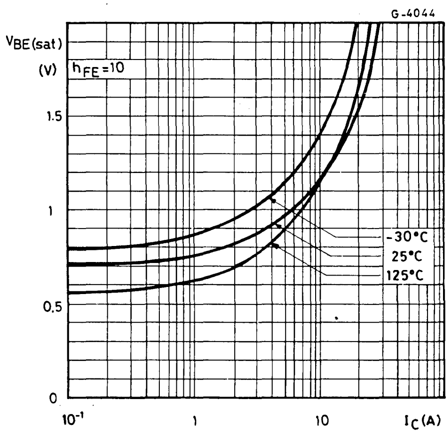


Collector-emitter saturation voltage

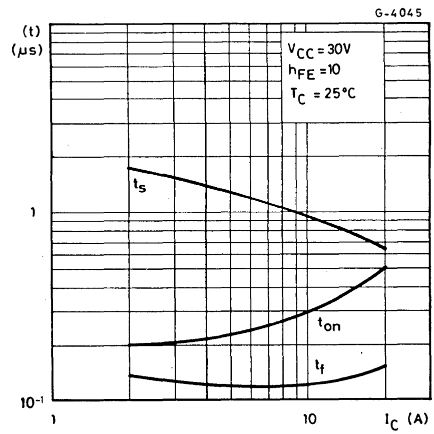


BUX 11N

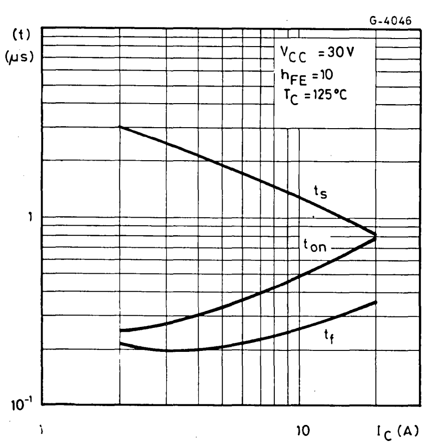
Base-emitter saturation voltage



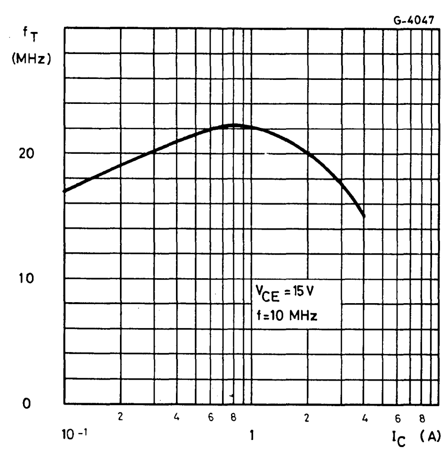
Saturated switching characteristics



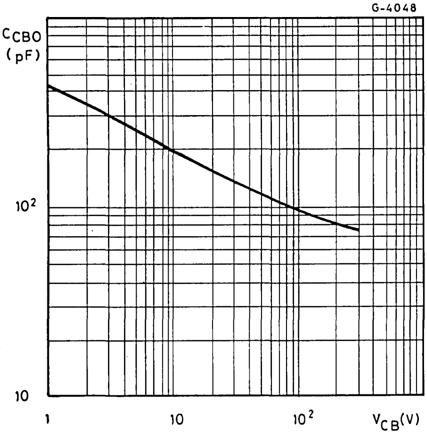
Saturated switching characteristics



Transition frequency



Collector base capacitance



Clamped reverse bias safe operating areas

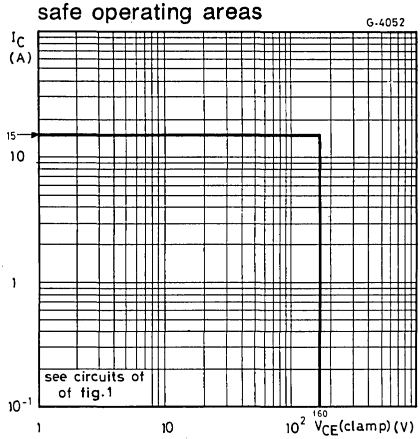


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:
$7V \geq |-V_{BB}| \geq 2V$
$I_C / I_B = 8$

t_p = adjusted for nominal I_C
$R_{BB} \geq 1\,\Omega$

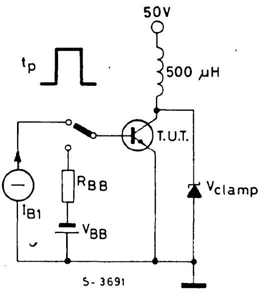
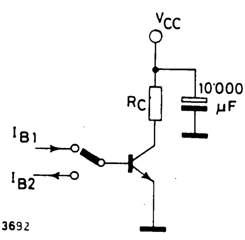


Fig. 2 — Switching times test circuit (Resistive load)

TEST CONDITIONS:
V_{CC} = 30 V

$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE
pulse width = 10 μs
$t_r, t_f \leq$ 50ns
duty cycle = 1 %



BUX 12

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

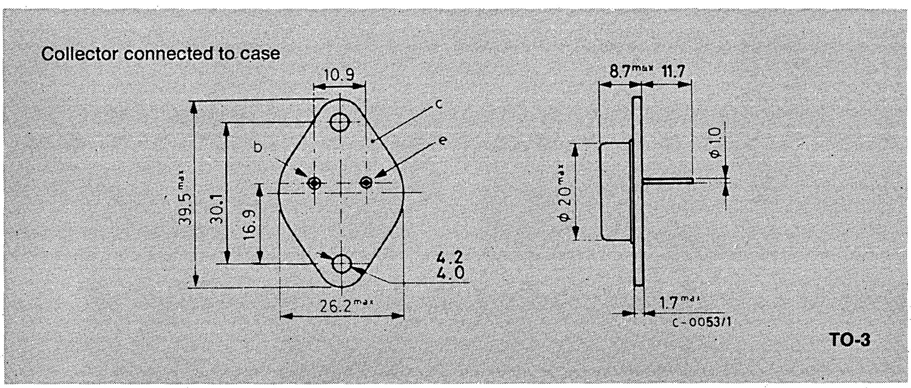
The BUX 12 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	300	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	250	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	20	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	25	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

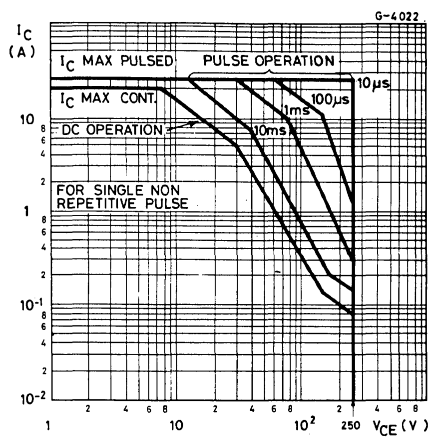
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=200V			1.5	mA
I_{CEX}	Collector cutoff current	V_{CE}=300V V_{BE}=-1.5V			1.5	mA
		T_{case}=125°C V_{CE}=300V V_{BE}=-1.5V			6	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	250			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =5A I_B =0.5A		0.22	1	V
		I_C =10A I_B =1.25A		0.5	1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =10A I_B =1.25A		1.23	1.5	V
h_{FE}*	DC current gain	I_C =5A V_{CE}=4V	20		60	—
		I_C =10A V_{CE}=4V	10			—
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V t =1s	5			A
		V_{CE}=140V t =1s	0.15			A
f_T	Transition frequency	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

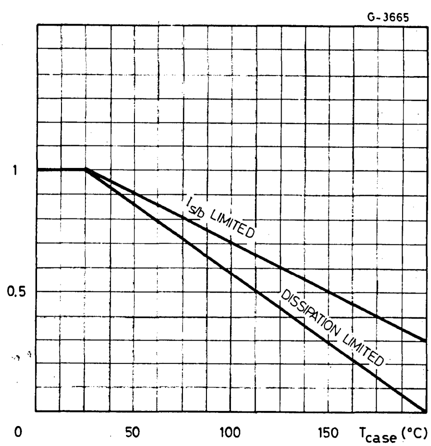
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =10A I_{B1} =1.25A V_{CC}=150V		0.28	1	μs
t_s	Storage time (fig. 2)	I_C =10A I_{B1} =1.25A I_{B2} =-1.25A V_{CC}=150V		1.45	2	μs
t_f	Fall time (fig. 2)	I_C =10A I_{B1} =1.25A I_{B2} =-1.25A V_{CC}=150V		0.23	0.5	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500μH	10			A

* Pulsed: pulse duration =300 μs, duty cycle ≤2%

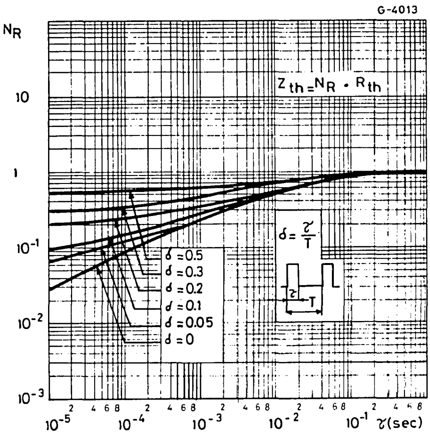
Safe operating areas



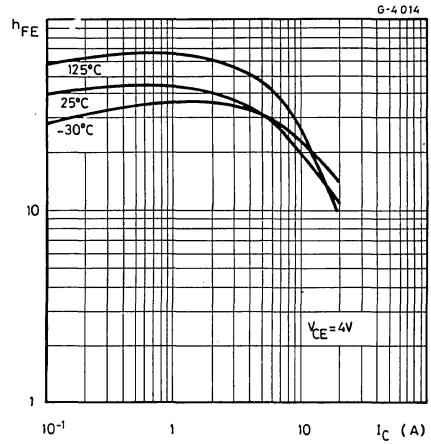
Derating curves



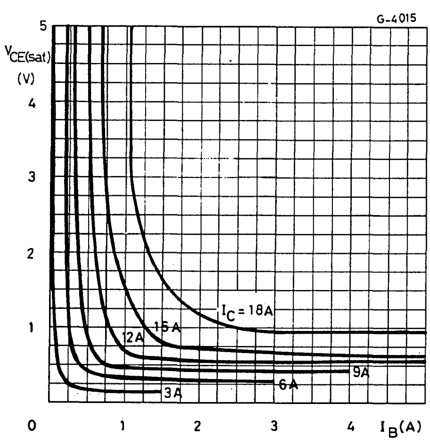
Thermal transient response



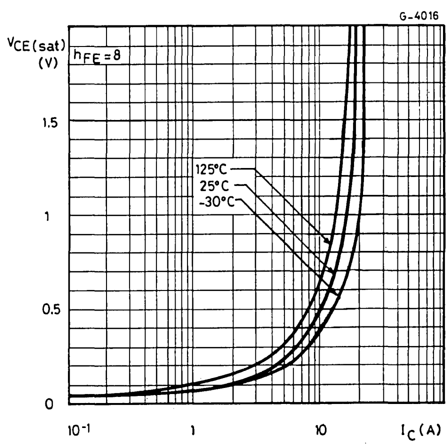
DC current gain



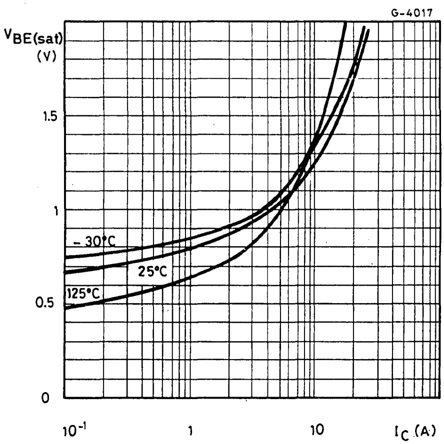
Collector-emitter saturation voltage



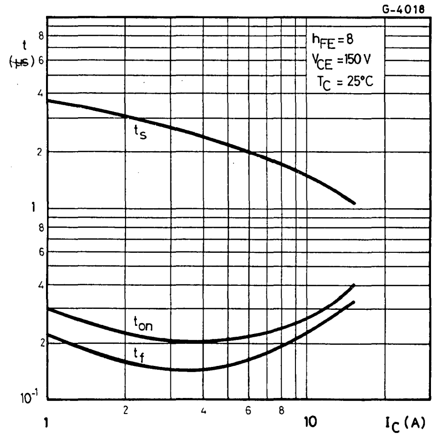
Collector-emitter saturation voltage



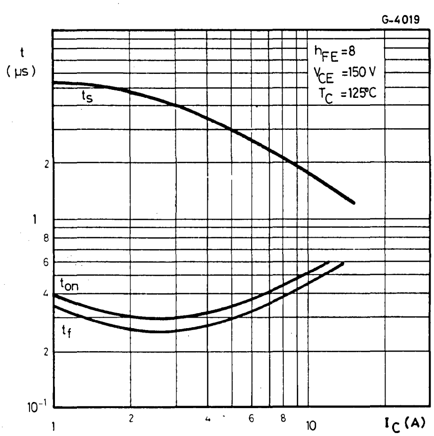
Base-emitter saturation voltage



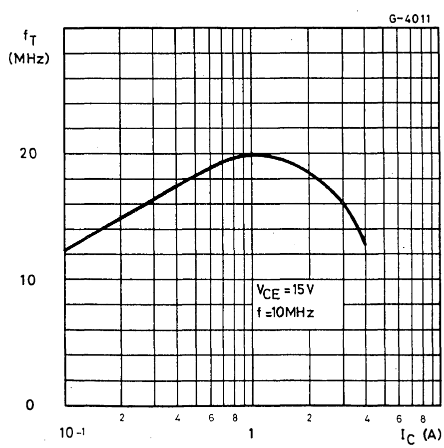
Saturated switching characteristics



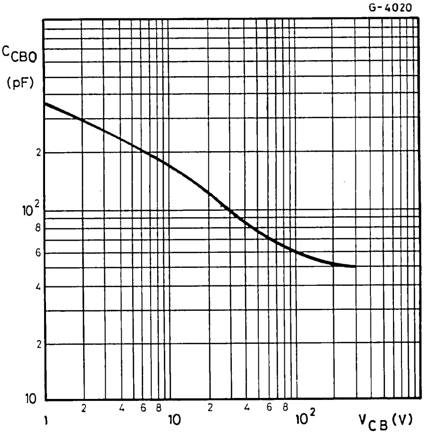
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

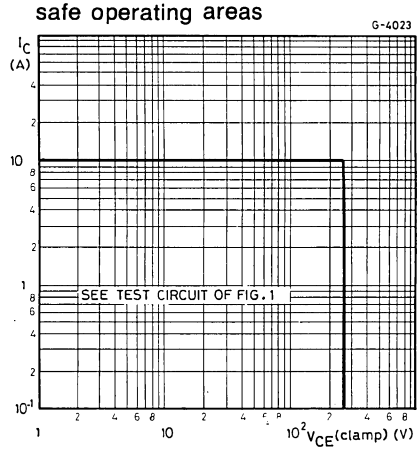


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\,\Omega$

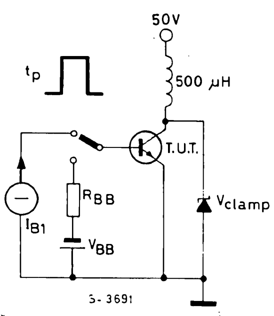


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 150V$

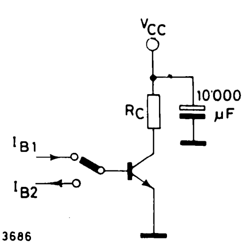
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq 50ns$

duty cycle = 1%



BUX 13

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 13 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications.

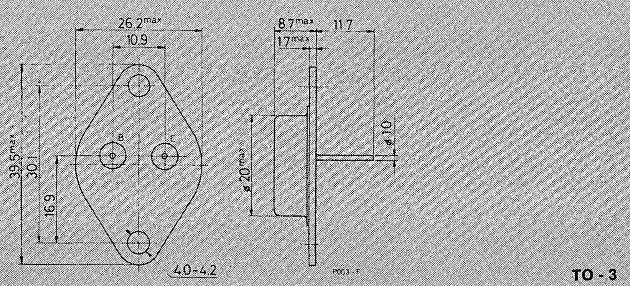
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	400	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leqslant 100\Omega$)	390	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	325	V
V_{EBO}	Base-emitter voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_{CM}	Collector peak current ($t_p \leqslant 10ms$)	20	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	150	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 400V V_{CE} = 400V T_{case} = 125°C			1.5 6	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 260V			1.5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	325			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4A I_B = 0.8A I_C = 8A I_B = 1.6A			0.8 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 8A I_B = 1.6A			1.5	V
h_{FE}*	DC current gain	I_C = 4A V_{CE} = 4V I_C = 8A V_{CE} = 4V	15 8		60	— —
f_T	Transition frequency	I_C = 1A V_{CE} = 15V f = 10MHz	8			MHz
t_{on}	Turn-on time	I_C = 8A I_{B1} = 1.6A V_{CC} = 150V			1.2	μs
t_s	Storage time	I_C = 8A $I_{B1} = -I_{B2}$ = 1.6A V_{CC} = 150V			2.5	μs
t_f	Fall time				1	μs

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

BUX 14

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 14 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications

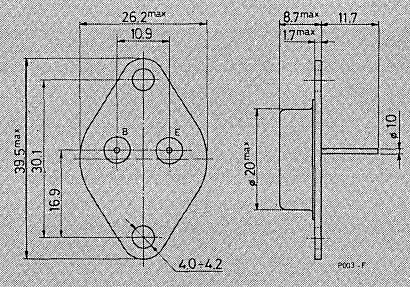
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	450	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\Omega$)	440	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Base-emitter voltage ($I_C = 0$)	7	V
I_C	Collector current	10	A
I_{CM}	Collector peak current ($t_p \leq 10ms$)	15	A
I_B	Base current	2	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150	W
T_{stg}	Storage temperature	−65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 450V V_{CE} = 450V T_{case} = 125°C			1.5 6	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 320V			1.5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3A I_B = 0.6A I_C = 6A I_B = 1.2A			0.6 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 6A I_B = 1.2A			1.5	V
h_{FE}*	DC current gain	I_C = 3A V_{CE} = 4V I_C = 6A V_{CE} = 4V	15 8		60	— —
f_T	Transition frequency	I_C = 1A V_{CE} = 15V f = 10MHz	8			MHz
t_{on}	Turn-on time	I_C = 6A I_{B1} = 1.2A V_{CC} = 150V			1.4	μs
t_s	Storage time	I_C = 6A $I_{B1} = -I_{B2}$ = 1.2A V_{CC} = 150V			3	μs
t_f	Fall time				1.2	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUX 20

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

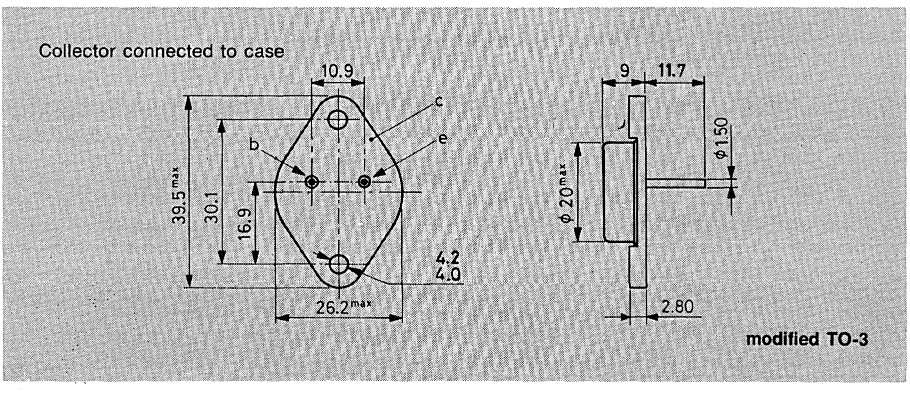
The BUX 20 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	160	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=$ -1.5 V)	160	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	50	A
I_{CM}	Collector peak current ($t_p=10$ ms)	60	A
I_B	Base current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

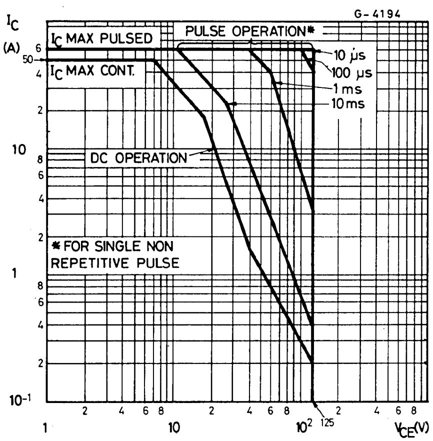
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=100V			3	mA
I_{CEX}	Collector cutoff current	V_{CE}=160V V_{BE}=-1.5V T_{case}=125 °C V_{CE}=160V V_{BE}=-1.5V			3 12	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	125			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C =25A I_B =2.5A I_C =50A I_B =5A		0.3 0.55	0.6 1.2	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =50A I_B =5A		1.35	2	V
h_{FE}*	DC current gain	I_C =25A V_{CE}=2V I_C =50A V_{CE}=4V	20 10		60	— —
$I_{s/b}$	Second breakdown collector current	V_{CE}=40V t = 1s V_{CE}=20V t = 1s	1.5 17.5			A A
f_T	Transition frequency	V_{CE}=15V I_C =2A f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

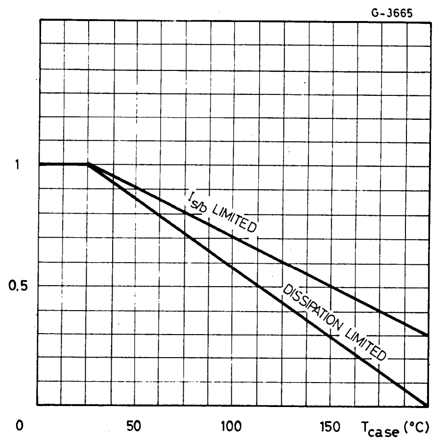
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =50A I_{B1} =5A V_{CC}=60V		0.4	1.5	µs
t_s	Storage time (fig. 2)	I_C =50A I_{B1} =5A I_{B2} =-5A V_{CC}=60V		0.85	1.2	µs
t_f	Fall time (fig. 2)			0.1	0.3	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=125V L=500µH	50			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

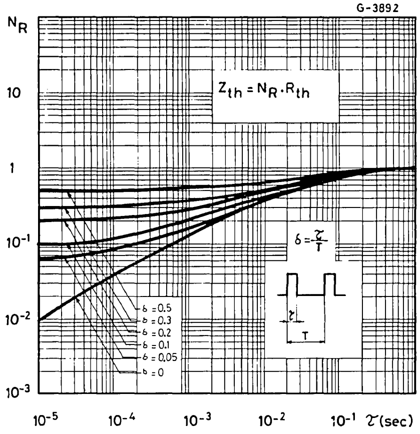
Safe operating areas



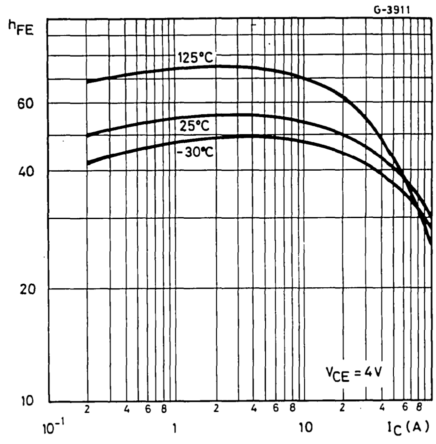
Derating curves



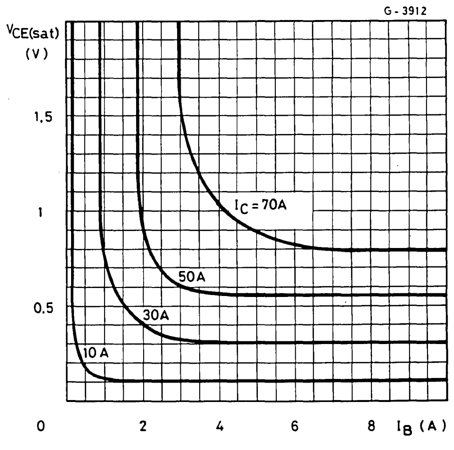
Thermal transient response



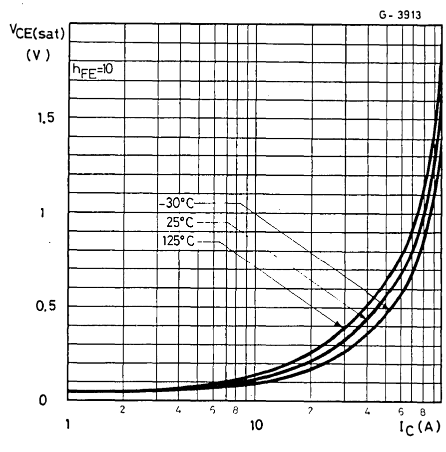
DC current gain



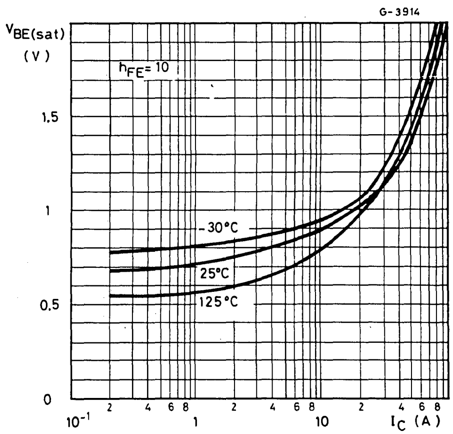
Collector-emitter saturation voltage



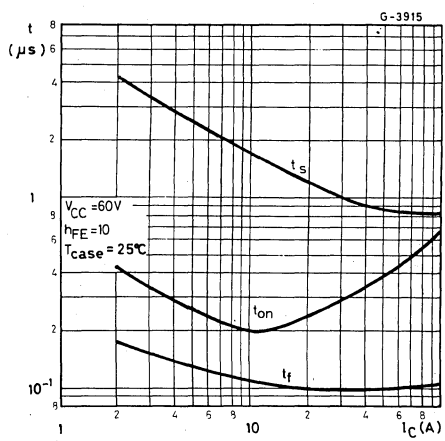
Collector-emitter saturation voltage



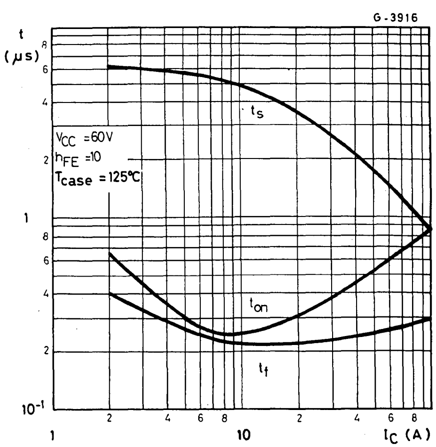
Base-emitter saturation voltage



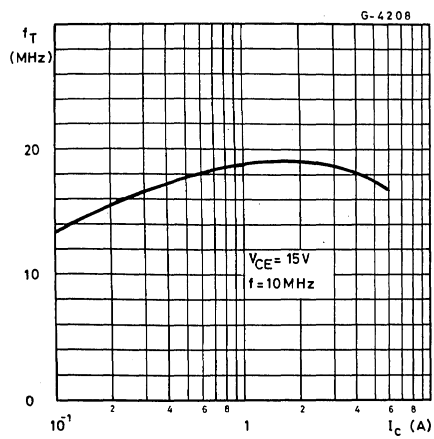
Saturated switching characteristics



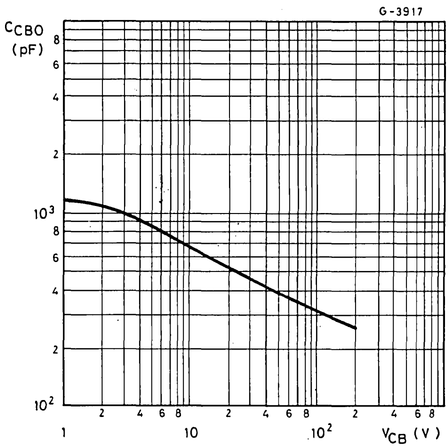
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

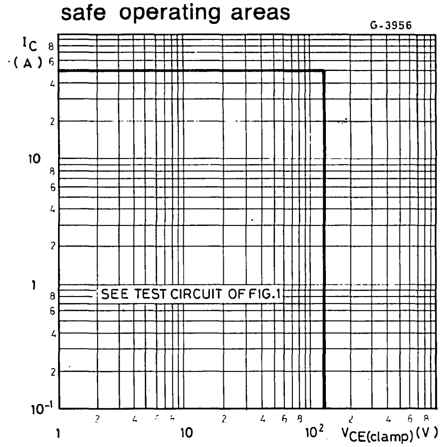


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

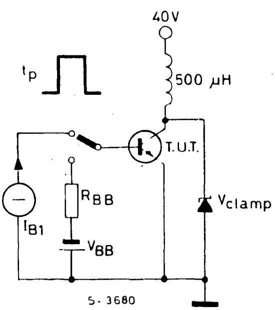


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 60 V

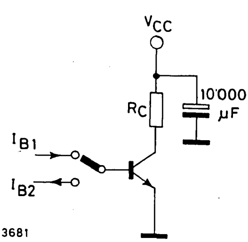
$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 21

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

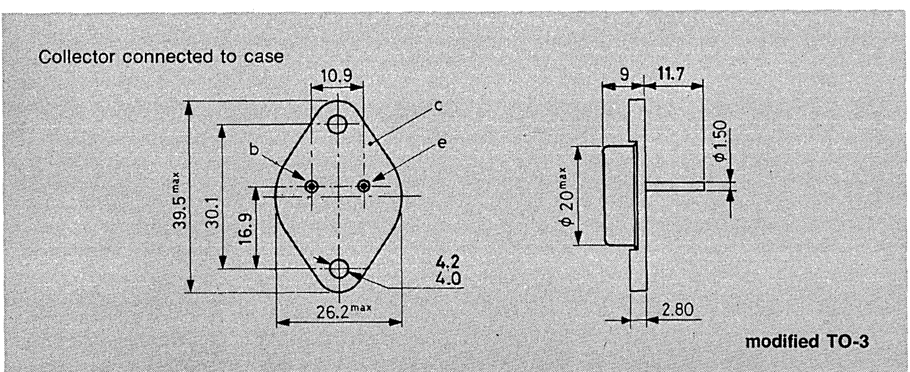
The BUX 21 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEX}	Collector-emitter voltage ($V_{EB} = -1.5V$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	40	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	50	A
I_B	Base current	8	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

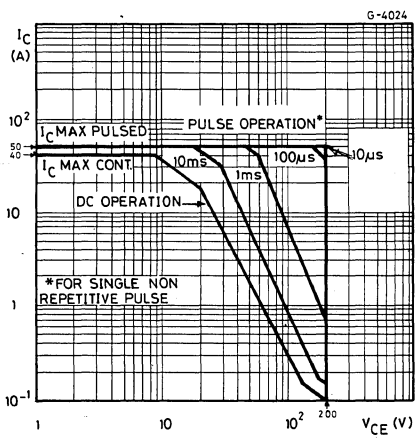
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=160V			3	mA
I_{CEX}	Collector cutoff current	V_{CE}=250V V_{BE}=-1.5V T_{case}=125 °C V_{CE}=250V V_{BE}=-1.5V			3 12	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$ *	Collector-emitter sustaining voltage	I_C =200mA	200			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\ (sat)}$ *	Collector-emitter saturation voltage	I_C =12A I_B =1.2A I_C =25A I_B =3A		0.22 0.4	0.6 1.5	V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C =25A I_B =3A		1.2	1.5	V
h_{FE} *	DC current gain	I_C =12 V_{CE}=2V I_C =25 V_{CE}=4V	20 10		60	— —
$I_{s/b}$	Second breakdown collector current	V_{CE}=140V t =1s V_{CE}=20V t =1s	0.15 17.5			A A
f_T	Transition frequency	V_{CE}=15V I_C =2 f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

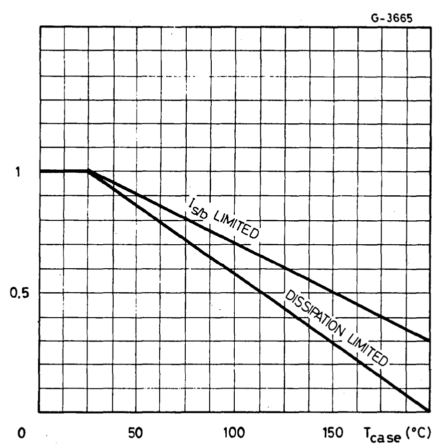
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =25A I_{B1} =3A V_{CC}=100V		0.24	1.2	μs
t_s	Storage time (fig. 2)	I_C =25A I_{B1} =3A I_{B2} =-3A V_{CC}=100V		1.3	1.8	μs
t_f	Fall time (fig. 2)			0.18	0.4	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500μH	30			A

* Pulsed: pulse duration =300 μs, duty cycle ≤2%

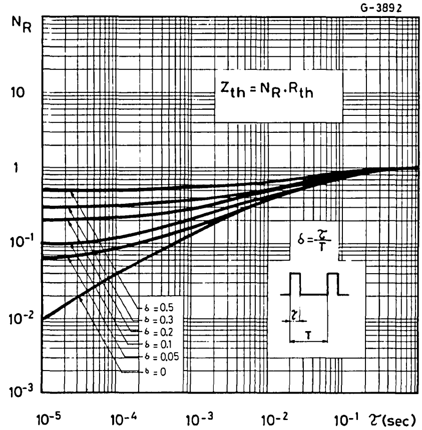
Safe operating areas



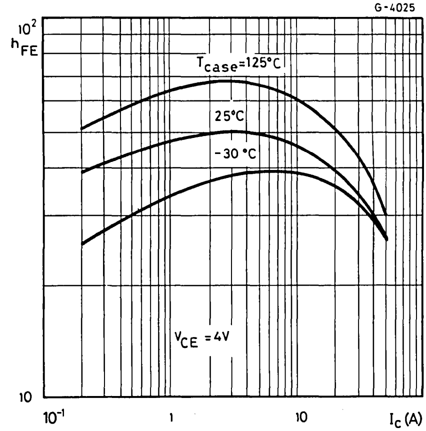
Derating curves



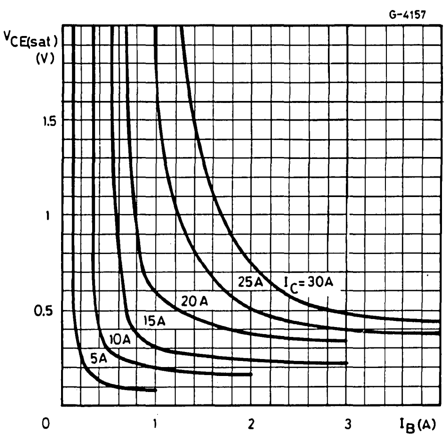
Thermal transient response



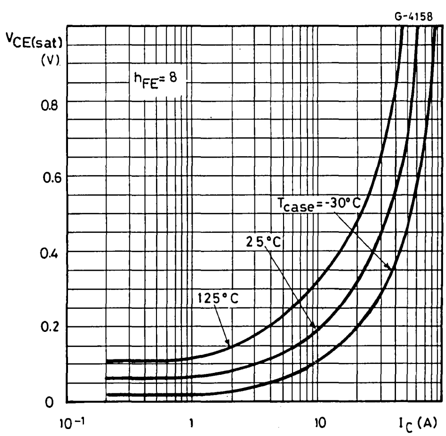
DC current gain



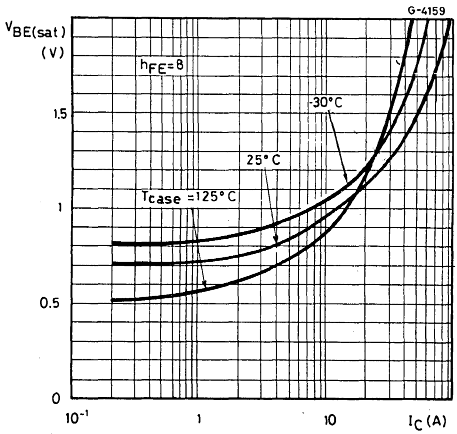
Collector-emitter saturation voltage



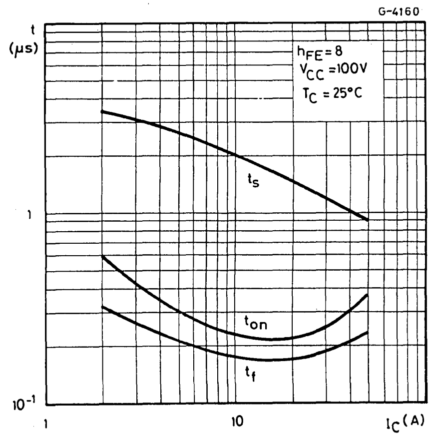
Collector-emitter saturation voltage



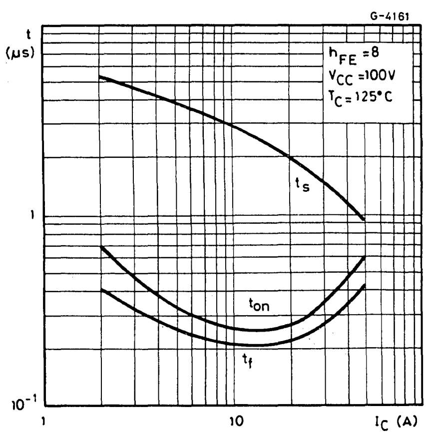
Base-emitter saturation voltage



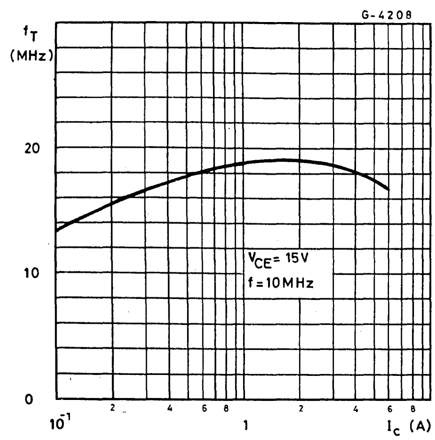
Saturated switching characteristics



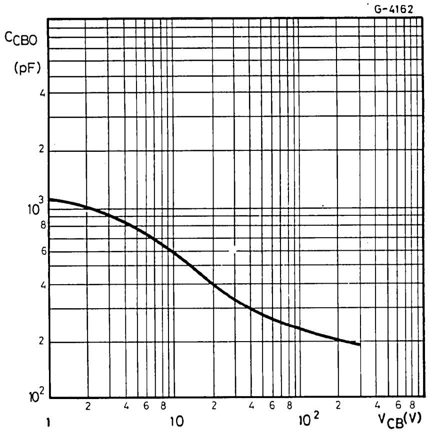
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

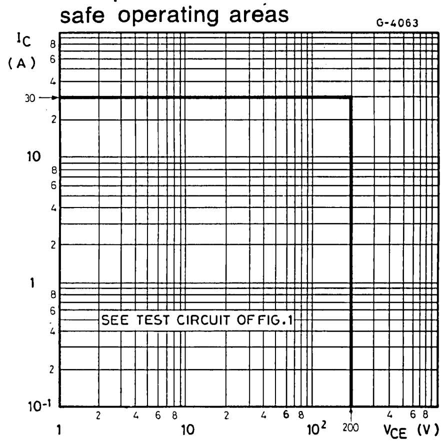


Fig. 1 – Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

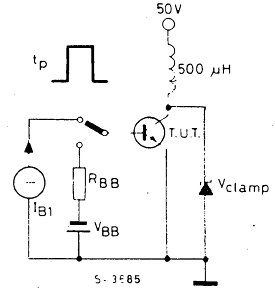


Fig. 2 – Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 100V

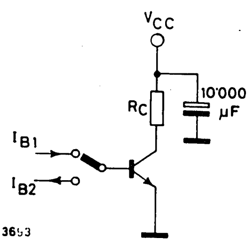
$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE

pulse width = 5μs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 22

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

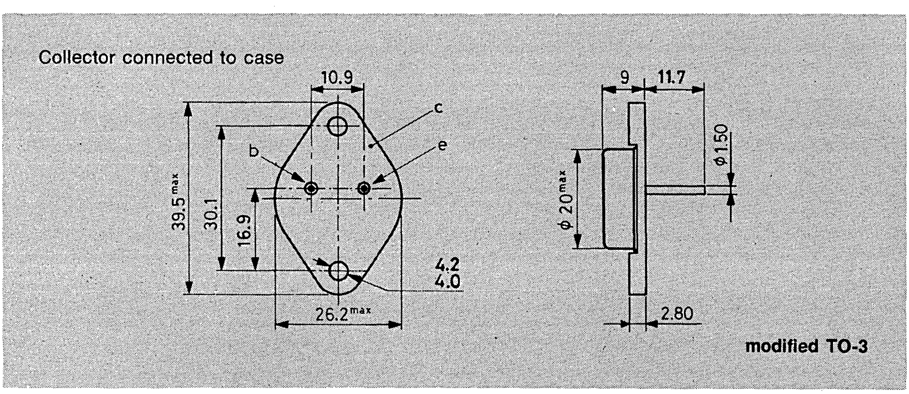
The BUX 22 is a silicon multiepitaxial planar NPN transistor in modified Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	300	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=-1.5V$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	250	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	40	A
I_{CM}	Collector peak current ($t_p=10$ ms)	50	A
I_B	Base current	8	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	350	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.5	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case}=25\,°C$ unless otherwise specified)

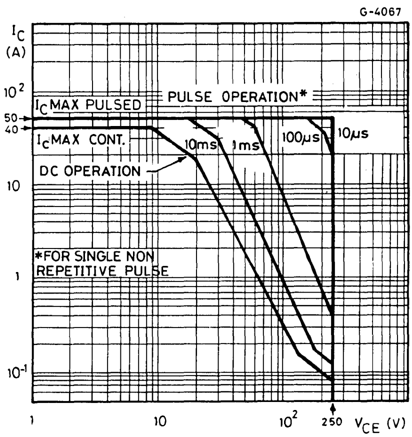
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B=0$)	$V_{CE}=200V$			3	mA
I_{CEX}	Collector cutoff current	$V_{CE}=300V$ $V_{BE}=-1.5V$			3	mA
		$T_{case}=125\,°C$ $V_{CE}=300V$ $V_{BE}=-1.5V$			12	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C=200mA$	250			V
V_{EBO}	Emitter-base voltage ($I_C=0$)	$I_E=50mA$	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C=10A$ $I_B=1A$		0.2	1	V
		$I_C=20A$ $I_B=2.5A$		0.32	1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C=20A$ $I_B=2.5A$		1.1	1.5	V
h_{FE}*	DC current gain	$I_C=10A$ $V_{CE}=4V$	20		60	—
		$I_C=20A$ $V_{CE}=4V$	10			—
$I_{s/b}$	Second breakdown collector current	$V_{CE}=140V$ $t=1s$	0.15			A
		$V_{CE}=20V$ $t=1s$	17.5			A
f_T	Transition frequency	$I_C=2A$ $V_{CE}=15V$ $f=10MHz$	10			MHz

ELECTRICAL CHARACTERISTICS (continued)

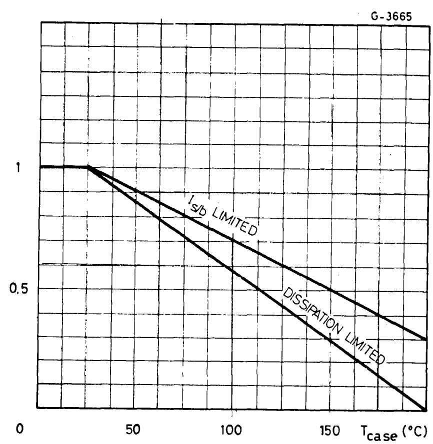
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =20A I_{B1} =2.5A V_{CC}=100V		0.22	1.3	µs
t_s	Storage time (fig. 2)	I_C =20A I_{B1} =2.5A I_{B2} =-2.5A V_{CC}=100V		1.5	2	µs
t_f	Fall time (fig. 2)	I_C =20A I_{B1} =2.5A I_{B2} =-2.5A V_{CC}=100V		0.17	0.5	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L=500µH	25			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

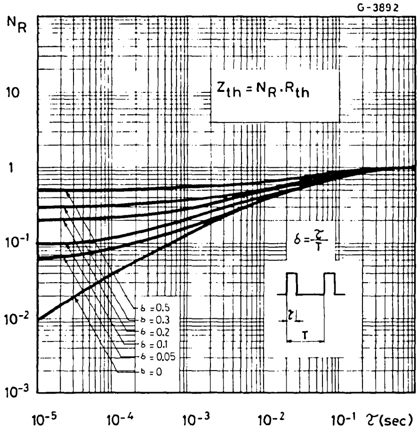
Safe operating areas



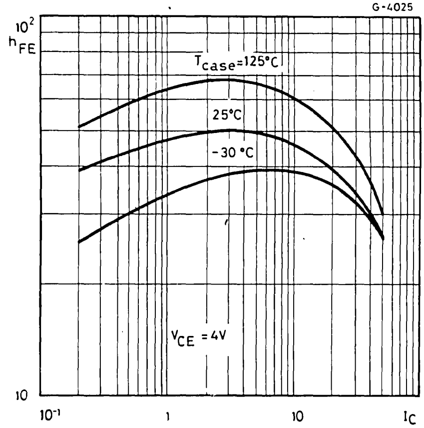
Derating curves



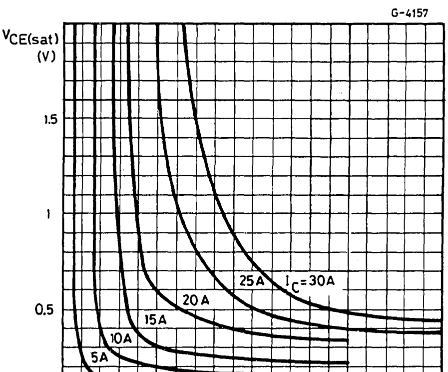
Thermal transient response



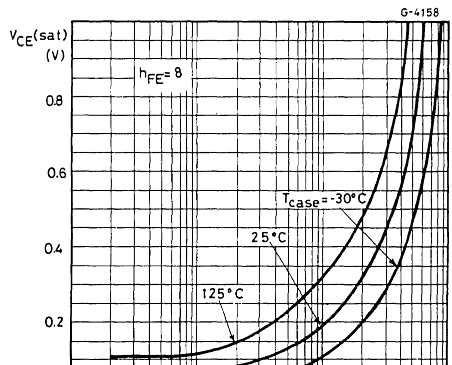
DC current gain



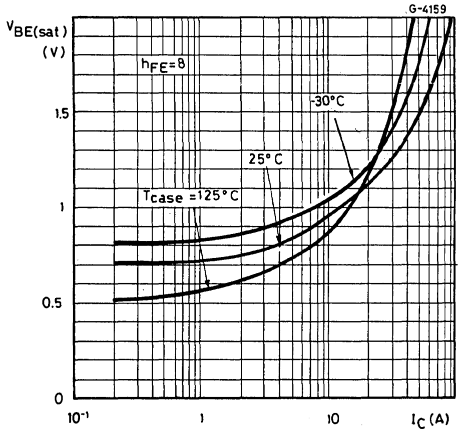
Collector-emitter saturation voltage



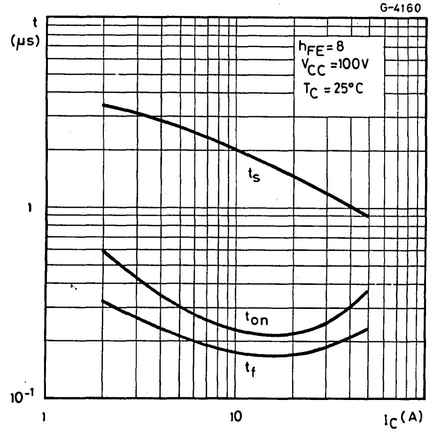
Collector-emitter saturation voltage



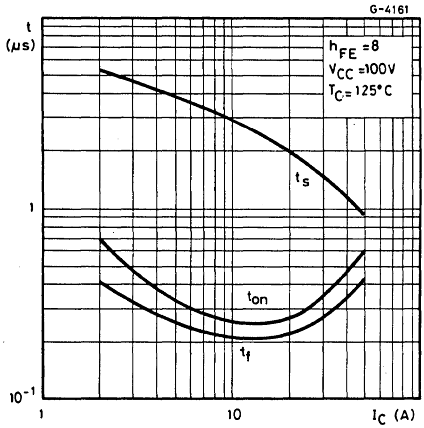
Base-emitter saturation voltage



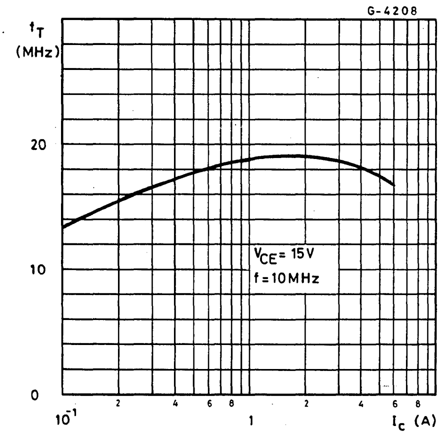
Saturated switching characteristics



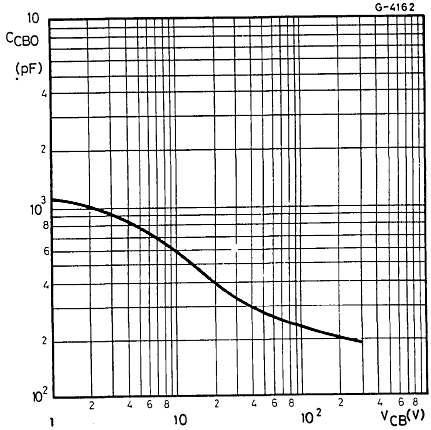
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

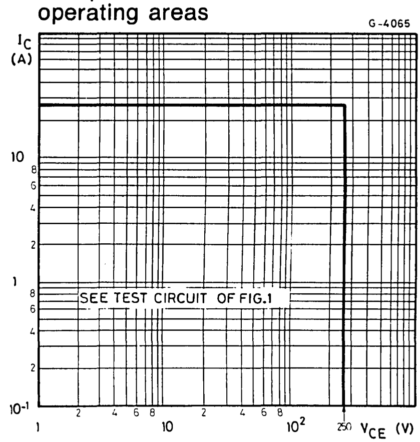


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

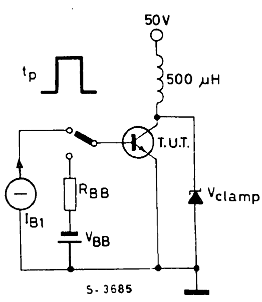


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 100V

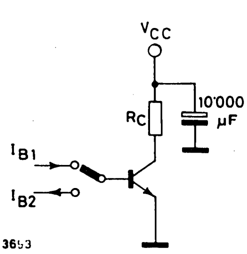
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 5μs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 40

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

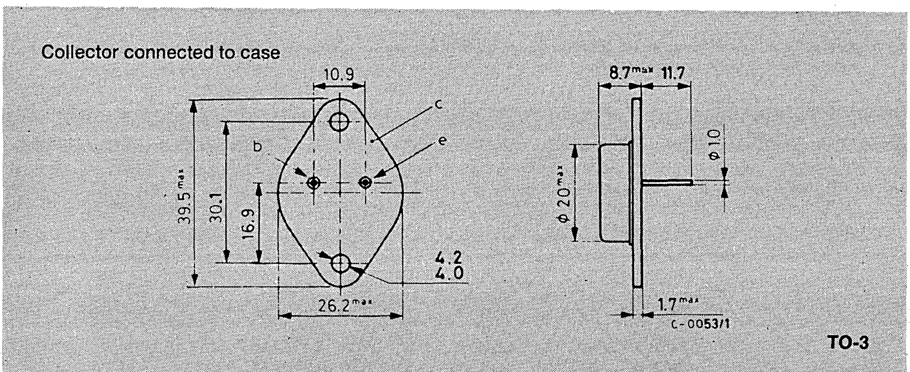
The BUX 40 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	160	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	160	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	20	A
I_{CM}	Collector peak current ($t_p = 10ms$)	28	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	120	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

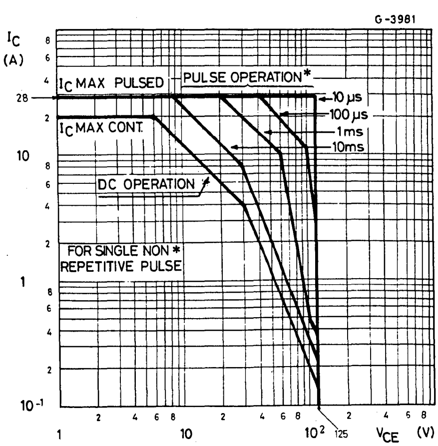
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 100V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 160V$ $V_{BE} = -1.5V$ $T_{case} = 125°C$ $V_{CE} = 160V$ $V_{BE} = -1.5V$			1 5	mA mA
I_{EBO}	Emitter-cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	125			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 1A$ $I_C = 15A$ $I_B = 1.88\ A$		0.6 0.9	1.2 1.6	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 15A$ $I_B = 1.88A$		1.7	2	V
h_{FE}*	DC current gain	$I_C = 10A$ $V_{CE} = 4V$ $I_C = 15A$ $V_{CE} = 4V$	15 8		45	— —
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 30V$ $t = 1\ s$ $V_{CE} = 50V$ $t = 1\ s$	4 1			A A
f_T	Transition frequency	$I_C = 1A$ $V_{CE} = 15V$ $f = 10MHz$	8			MHz

* Pulsed: pulse duration = 300 μs, duty cycle ≤ 2%.

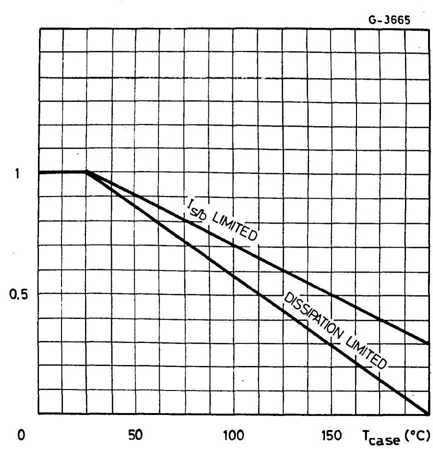
ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time (see fig. 2)	I_C =15A I_{B1}=1.88A V_{CC}=30V	0.35 1.2	μs
t_s	Storage time (see fig. 2)	I_C =15A I_{B1}=-I_{B2}=1.88A V_{CC}=30V	0.85 1	μs
t_f	Fall time (see fig. 2)		0.14 0.4	μs
	Clamped $E_{s/b}$ Collector current (see fig. 1)	V_{CLAMP}=125V L=500μH	15	A

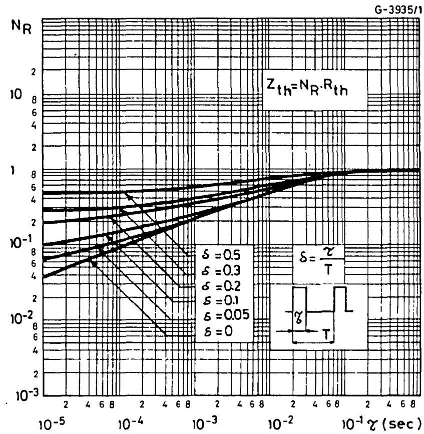
Safe operating areas



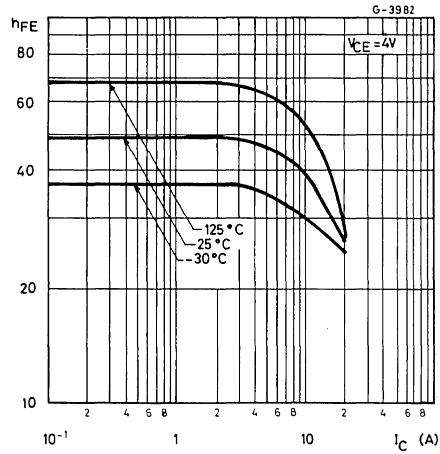
Derating curves



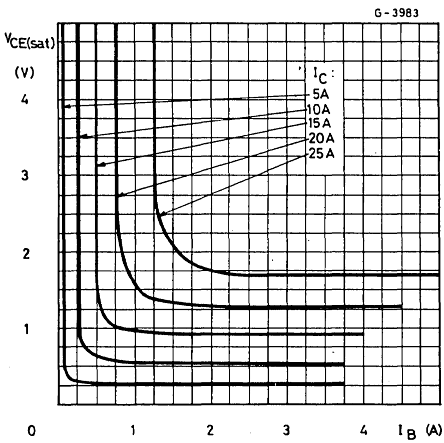
Thermal transient response



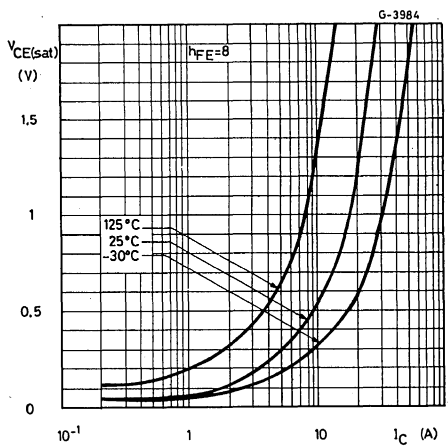
DC current gain



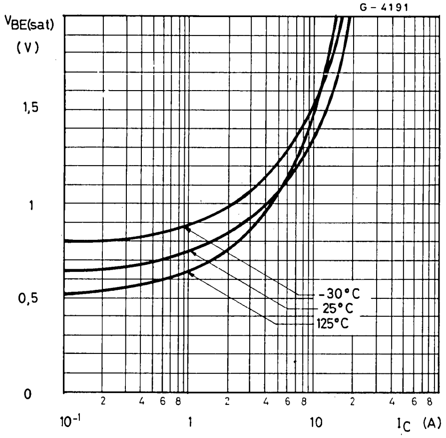
Collector-emitter saturation voltage



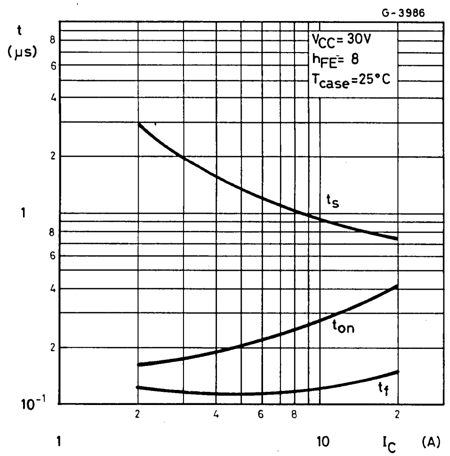
Collector-emitter saturation voltage



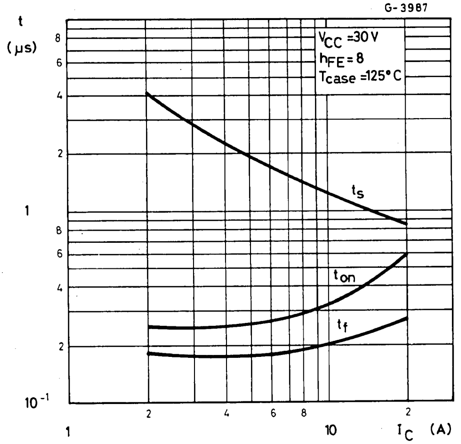
Base-emitter saturation voltage



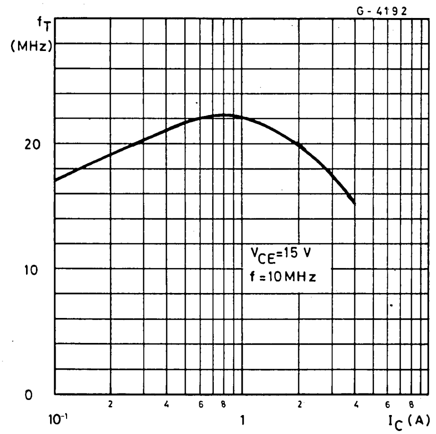
Saturated switching characteristics



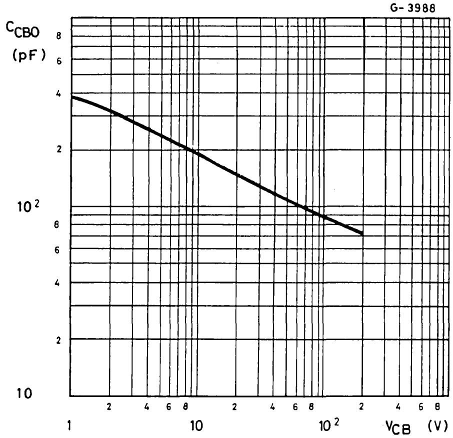
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

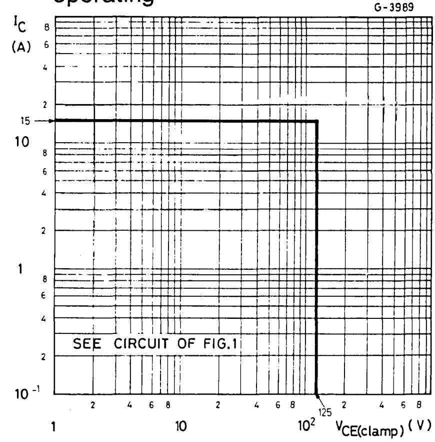


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\,\Omega$

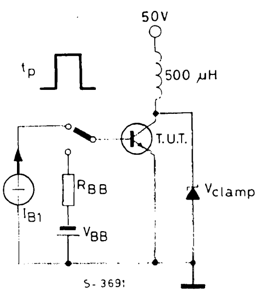


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 30V

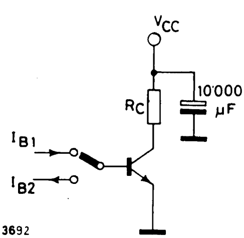
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 41

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

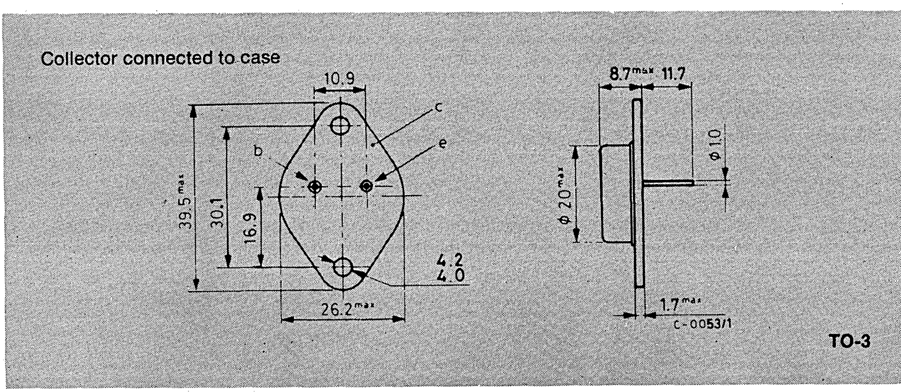
The BUX 41 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	20	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	120	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

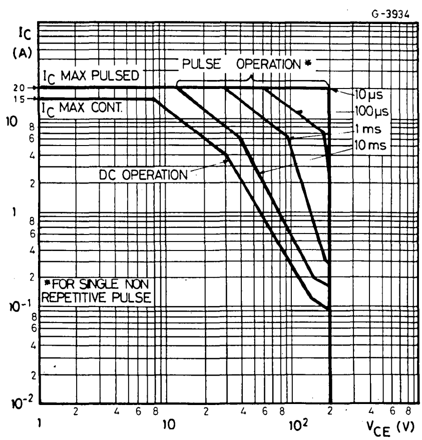
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=160V			1	mA
I_{CEX}	Collector cutoff current	V_{CE}=250V V_{BE}=-1.5V T_{case}=125°C V_{CE}=250V V_{BE}=-1.5V			1 5	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	200			V
V_{EBO}	Emitter-base voltage (I_C=0)	I_E =50mA	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =5A I_B =0.5A I_C =8A I_B =1A		0.38 0.6	1.2 1.6	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =8A I_B =1A		1.35	2	V
h_{FE}*	DC current gain	I_C =5A V_{CE}=4V I_C =8A V_{CE}=4V	15 8		45	– –
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V t =1s V_{CE}=135V t =1s	4 0.15			A A
f_t	Transition frequency	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

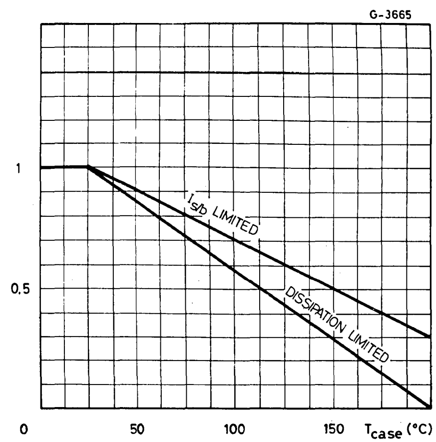
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C = 8A I_{B1} = 1A V_{CC} = 150V		0.28	1	µs
t_s	Storage time (fig. 2)	I_C = 8A* I_{B1} = 1A I_{B2} = -1A V_{CC} = 150V		1.2	1.7	µs
t_f	Fall time (fig. 2)			0.25	0.8	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp} = 200V L = 500µH	8			A

* Pulsed: pulse duration = 300 µs, duty cycle ≤ 2%

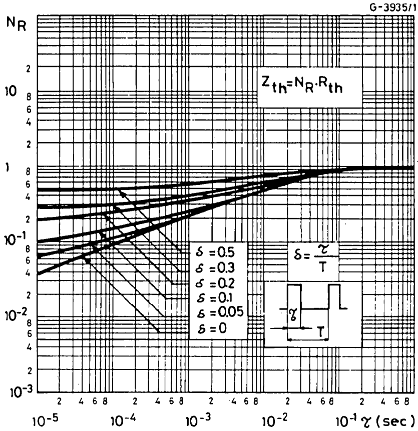
Safe operating areas



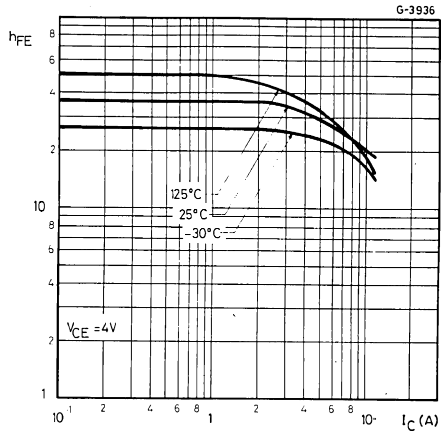
Derating curves



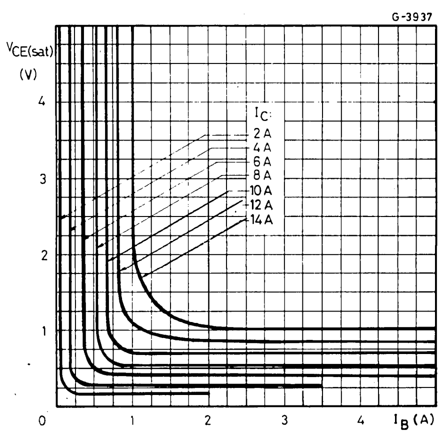
Thermal transient response



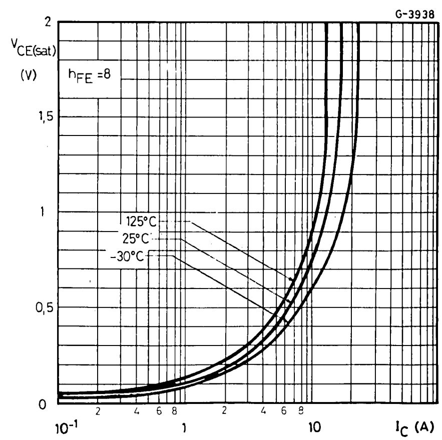
DC current gain



Collector-emitter saturation voltage

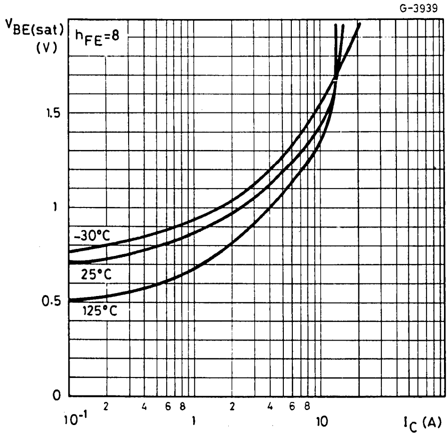


Collector-emitter saturation voltage

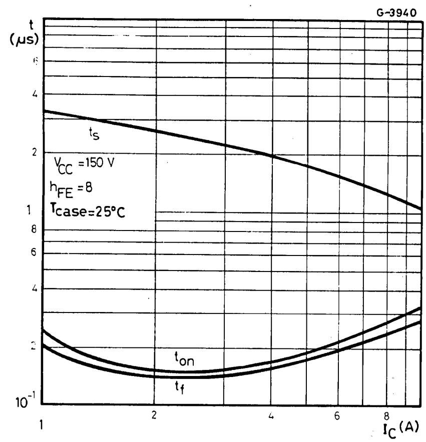


BUX 41

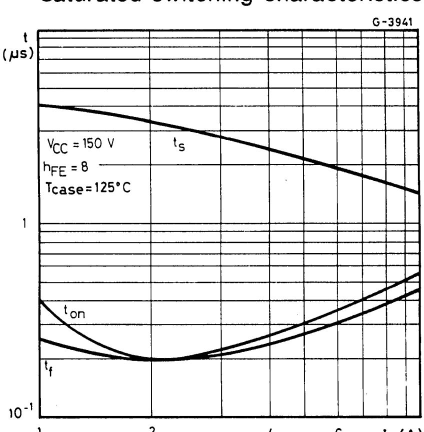
Base-emitter saturation voltage



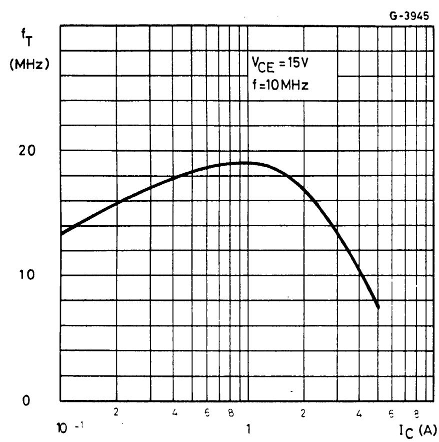
Saturated switching characteristics



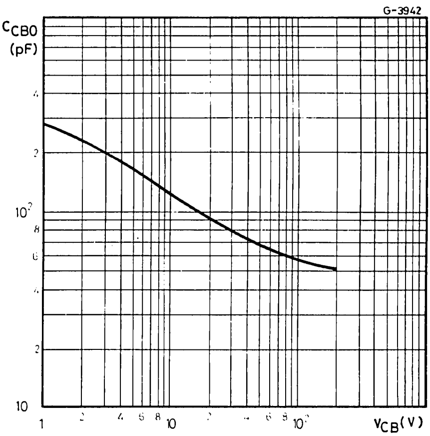
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

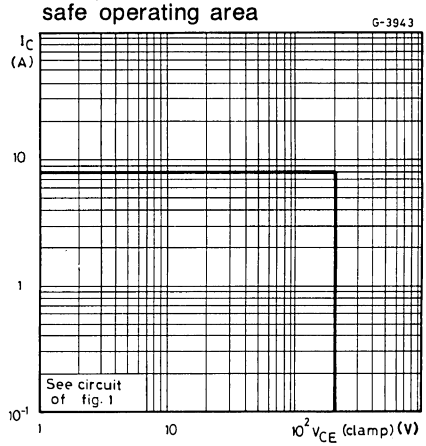


Fig. 1 – Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

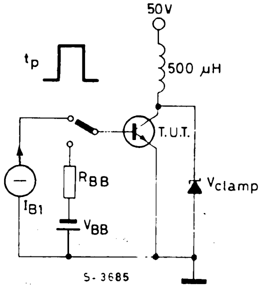


Fig. 2 – Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 150V

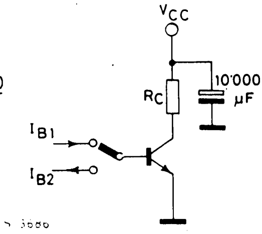
$R_C = \dfrac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX 41N

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

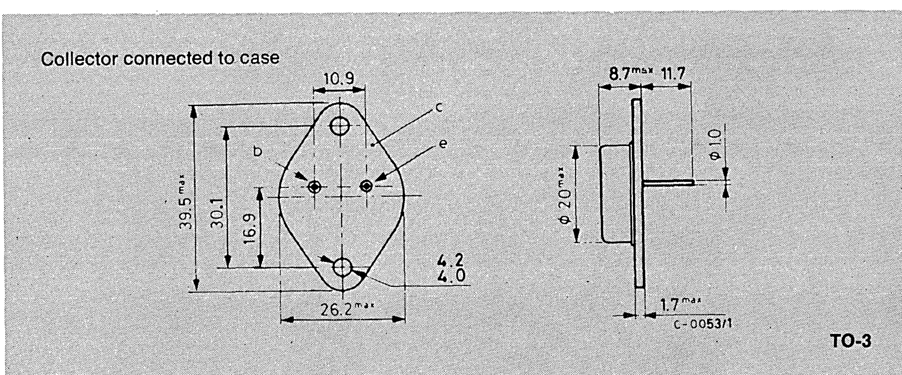
The BUX 41 N is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	220	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	220	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	160	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	18	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	25	A
I_B	Base current	3.6	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	120	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

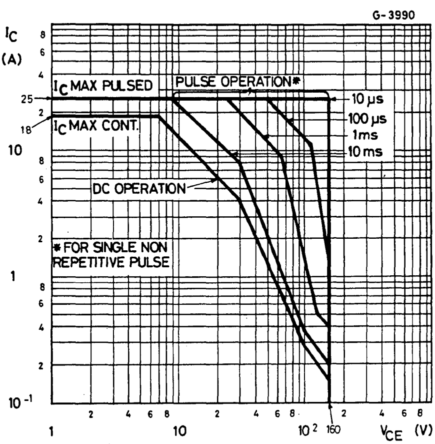
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=130V			1	mA
I_{CEX}	Collector cutoff current	V_{CE}=220V V_{BE}=-1.5V			1	mA
		T_{case}=125°C V_{CE}=220V V_{BE}=-1.5V			5	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	I_C =200mA	160			V
V_{EBO}	Emitter-base voltage (I_C= 0)	I_E =50mA	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =8A I_B =0.8A		0.5	1.2	V
		I_C =12A I_B =1.5A		0.75	1.6	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =12A I_B =1.5A		1.5	2	V
h_{FE}*	DC current gain	I_C =8A V_{CE}=4V	15		45	—
		I_C =12A V_{CE}=4V	8			—
$I_{s/b}$	Second breakdown collector current	V_{CE}=30V t =1s	4			A
		V_{CE}=100V t =1s	0.27			A
f_T	Transition frequency	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

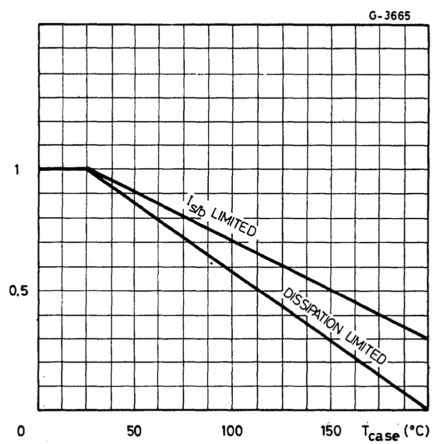
	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =12A I_{B1} =1.5A V_{CC}=30V	0.35 1.3	μs
t_s	Storage time (fig. 2)	I_C =12A I_{B1}=-I_{B2}=1.5 A V_{CC}=30V	0.85 1.5	μs
t_f	Fall time (fig. 2)		0.14 0.8	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{CLAMP}=160V L =500μH	12	A

* Pulsed: pulse duration =300 μs, duty cycle ≤2%

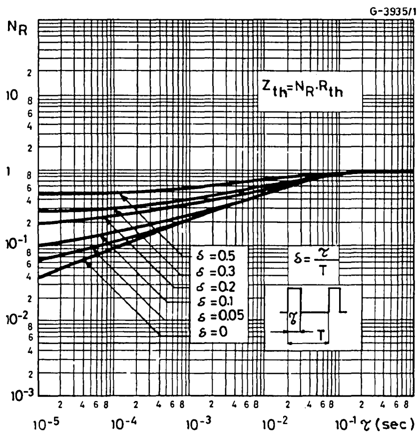
Safe operating areas



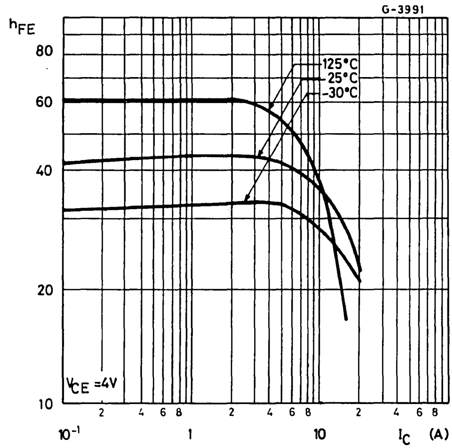
Derating curves



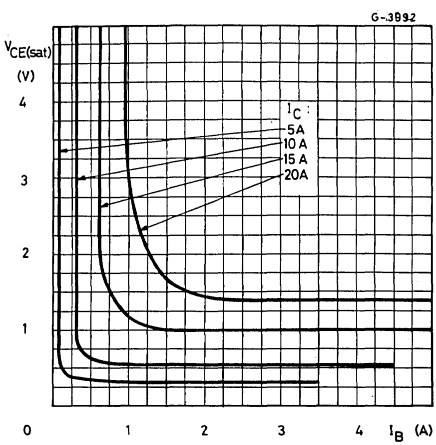
Thermal transient response



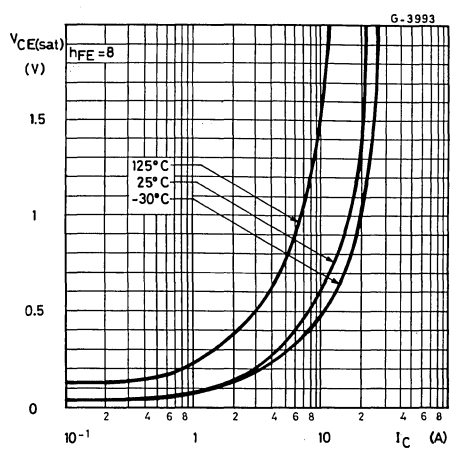
DC current gain



Collector-emitter saturation voltage

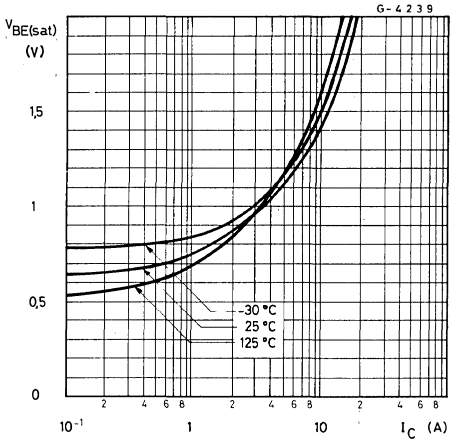


Collector-emitter saturation voltage

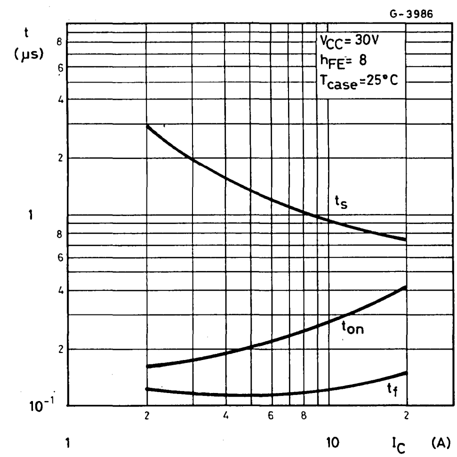


BUX 41N

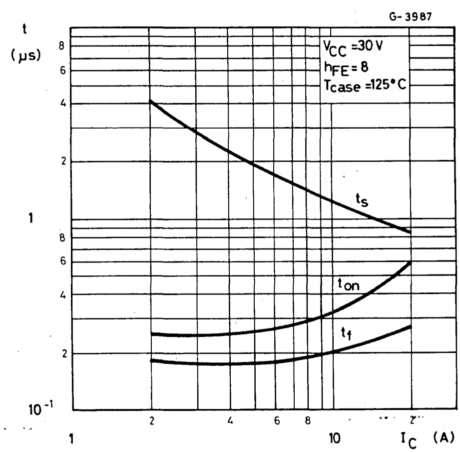
Base-emitter saturation voltage



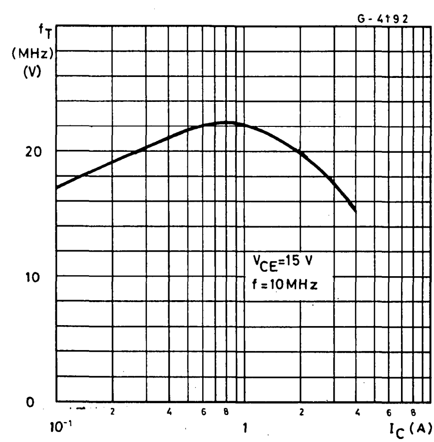
Saturated switching characteristics



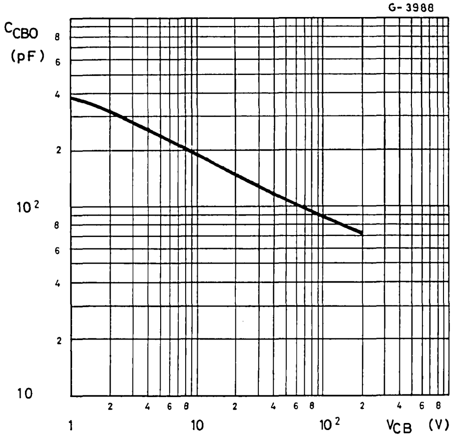
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

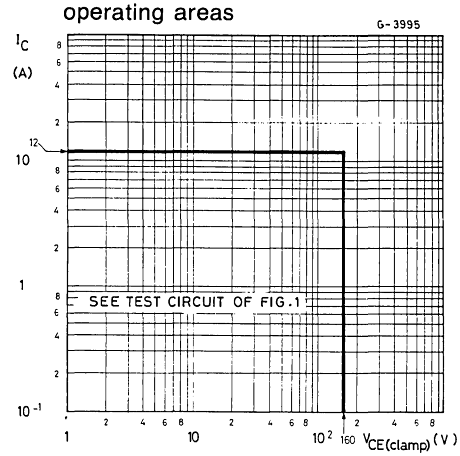


Fig. 1 — Clamped $E_{s/b}$ test circuit

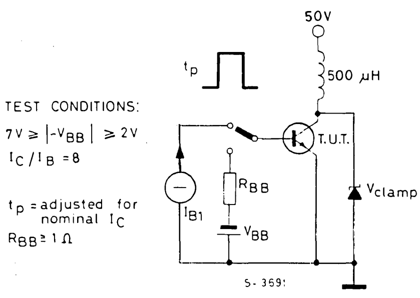
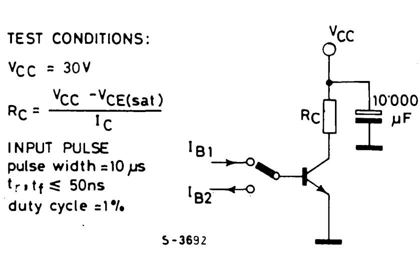


Fig. 2 — Switching times test circuit (resistive load)



BUX 42

MULTIEPITAXIAL PLANAR NPN

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

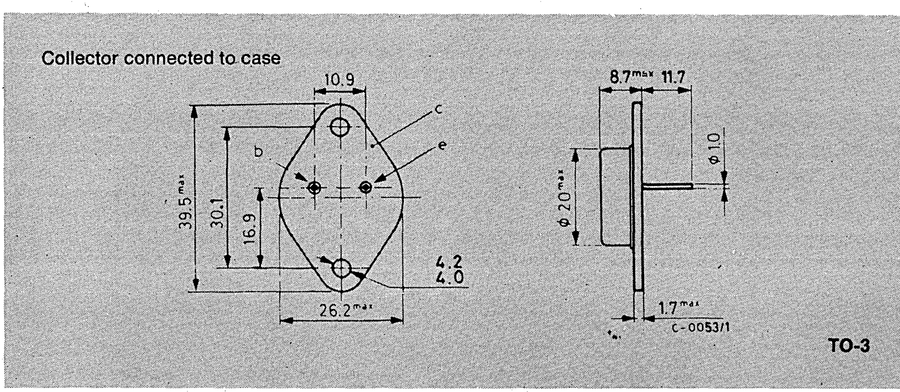
The BUX 42 is a silicon multiepitaxial planar NPN transistor in Jedec TO-3 metal case, intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E=0$)	300	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=-1.5V$)	300	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	250	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	12	A
I_{CM}	Collector peak current ($t_p=10$ ms)	15	A
I_B	Base current	2.4	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	120	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\,°C$ unless otherwise specified)

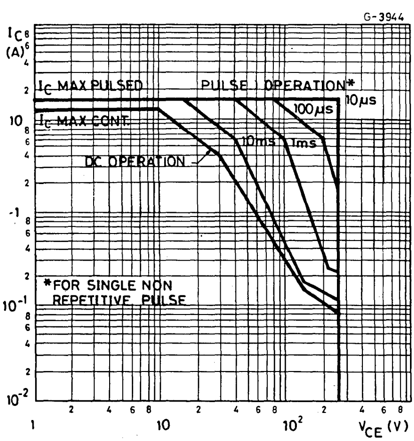
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 200V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 300V$ $V_{BE} = -1.5V$			1	mA
		$T_{case} = 125\,°C$ $V_{CE} = 300V$ $V_{BE} = -1.5V$			5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	250			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 4A$ $I_B = 0.4A$		0.33	1.2	V
		$I_C = 6A$ $I_B = 0.75A$		0.45	1.6	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 6A$ $I_B = 0.75A$		1.23	2	V
h_{FE}*	DC current gain	$I_C = 4A$ $V_{CE} = 4V$	15		45	—
		$I_C = 6A$ $V_{CE} = 4V$	8			—
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 135V$ $t = 1s$	0.15			A
		$V_{CE} = 30V$ $t = 1s$	4			A
f_T	Transition frequency	$I_C = 1A$ $V_{CE} = 15V$ $f = 10MHz$	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

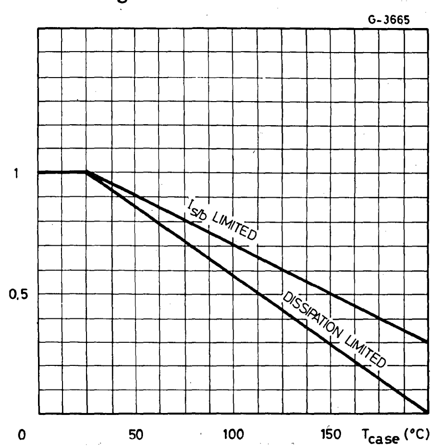
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =6A I_{B1} =0.75A V_{CC}=150V		0.23	1	µs
t_s	Storage time (fig. 2)	I_C =6A I_{B1} =0.75A I_{B2} =-0.75A V_{CC}=150V		1.5	2	µs
t_f	Fall time (fig. 2)			0.2	1.2	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500µH	6			A

* Pulsed: pulse duration =300 µs, duty cycle ≤2%

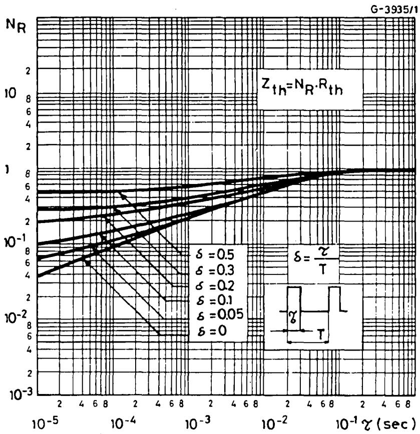
Safe operating areas



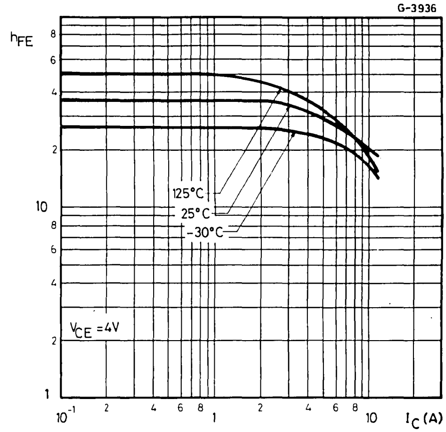
Derating curves



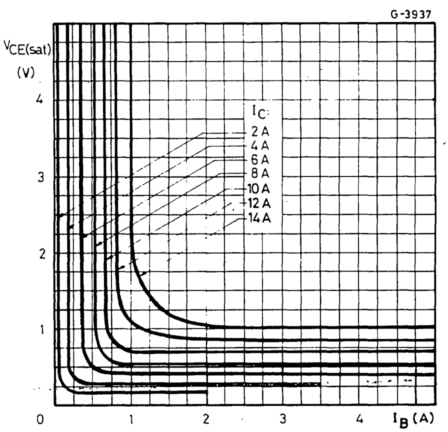
Thermal transient response



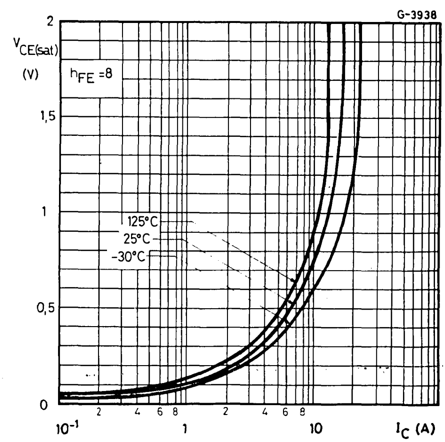
DC current gain



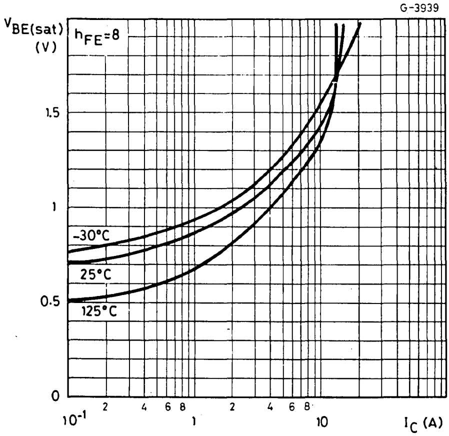
Collector-emitter saturation voltage



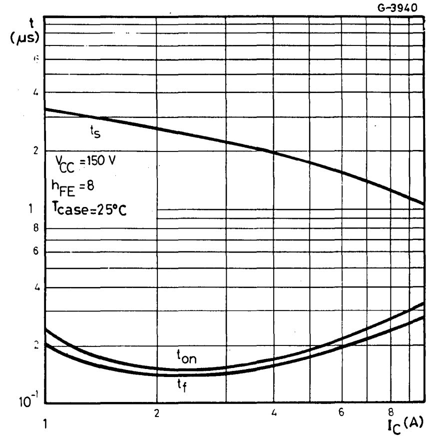
Collector-emitter saturation voltage



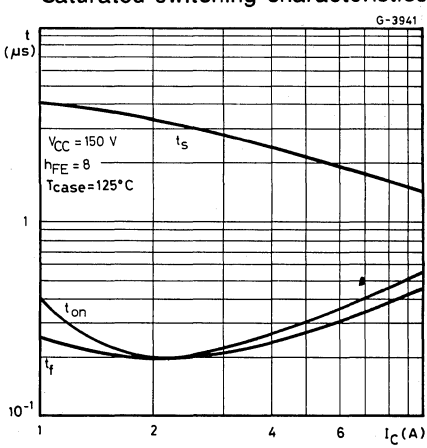
Base-emitter saturation voltage



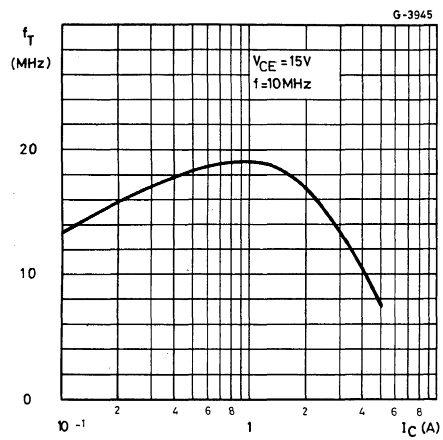
Saturated switching characteristics



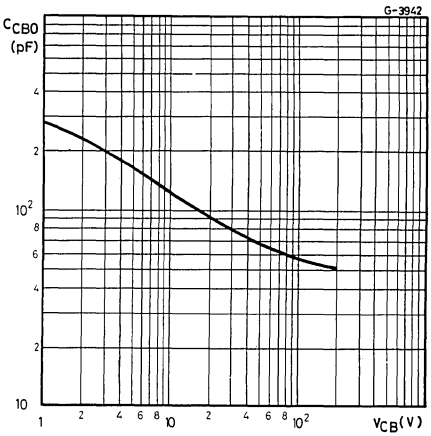
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

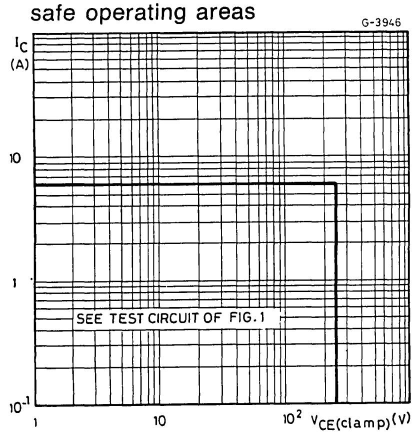


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

$7V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

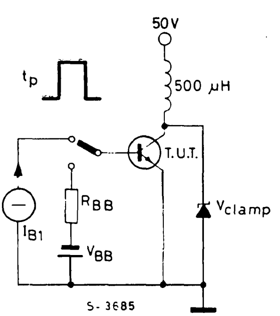


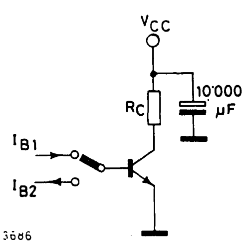
Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 150V

$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE
pulse width = 10 µs
$t_r, t_f \leq$ 50ns
duty cycle = 1%



BUX 43

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 43 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications.

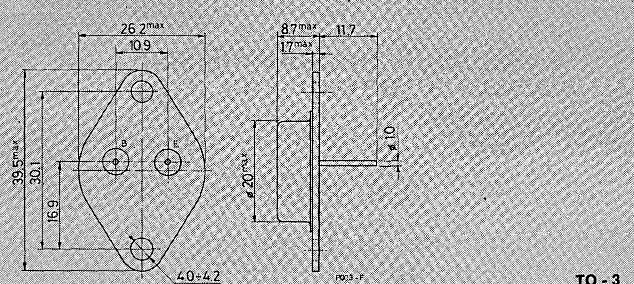
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	400	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leqslant 100\Omega$)	360	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	325	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	10	A
I_{CM}	Collector peak current ($t_p \leqslant 10ms$)	12	A
I_B	Base current	2	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	120	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 400V V_{CE} = 400V T_{case} = 125°C			1 5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 260V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	325			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3A I_B = 0.375A I_C = 5A I_B = 1A			1 1.6	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 5A I_B = 1A			2	V
h_{FE}*	DC current gain	I_C = 3A V_{CE} = 4V I_C = 5A V_{CE} = 4V	15 8		60	— —
f_T	Transition frequency	I_C = 1A V_{CE} = 15V f = 10MHz	8			MHz
t_{on}	Turn-on time	I_C = 5A I_{B1} = 1A V_{CC} = 150V			1	μs
t_s	Storage time	I_C = 5A $I_{B1} = -I_{B2}$ = 1A V_{CC} = 150V			2.2	μs
t_f	Fall time				1.2	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUX 44

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 44 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications.

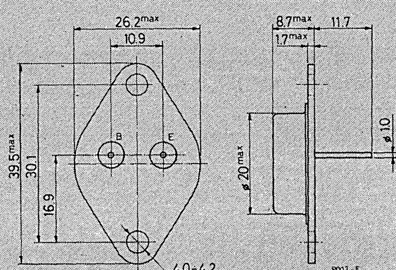
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	450	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\Omega$)	440	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	8	A
I_{CM}	Collector peak current ($t_p \leq 10$ms)	10	A
I_B	Base current	1.6	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	120	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.46	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 450V V_{CE} = 450V T_{case} = 125°C			1 5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 320V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A I_B = 0.25A I_C = 4A I_B = 0.8A			1 2	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 4A I_B = 0.8A			2	V
h_{FE}*	DC current gain	I_C = 2A V_{CE} = 4V I_C = 4A V_{CE} = 4V	15 8		45	— —
f_T	Transition frequency	I_C = 1A V_{CE} = 15V f = 10MHz	8			MHz
t_{on}	Turn-on time	I_C = 4A I_B = 0.8A V_{CC} = 150V			1	μs
t_s	Storage time	I_C = 4A $I_{B1} = -I_{B2}$ = 0.8A V_{CC} = 150V			2.5	μs
t_f	Fall time				1.2	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUX 46

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 46 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications.

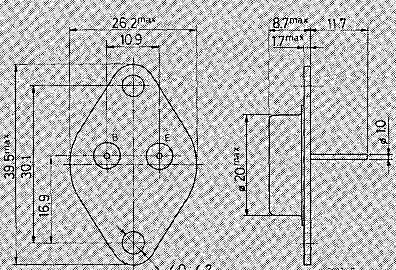
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 10\Omega$)	850	V
V_{CEO}	collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	5	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	85	W
T_{stg}	Storage temperature	–65 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 850V V_{CE} = 850V T_{case} = 125°C			100 1	μA mA
I_{CER}	Collector cutoff current ($R_{BE} \leqslant 10\Omega$)	V_{CE} = 850V V_{CE} = 850V T_{case} = 125°C			300 2	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2.5A I_B = 0.5A I_C = 3.5A I_B = 0.7A			1.5 5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_B = 0.5A			1.3	V
t_{on}	Turn-on time	I_C = 2.5A V_{CC} = 150V $I_{B1} = -I_{B2}$ = 0.5A			1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUX 47

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 47 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended for high voltage, fast switching applications.

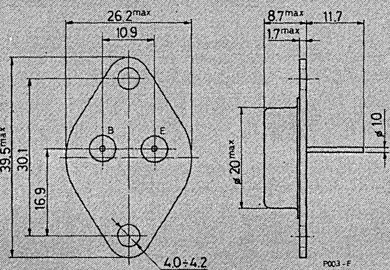
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 10\Omega$)	850	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	8.5	A
I_{CM}	Collector peak current ($t_p \leq 10$ ms)	12	A
I_B	Base current	3	A
I_{BM}	Base peak current ($t_p \leq 10$ms)	6	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	107	W
T_{stg}	Storage temperature	–65 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 850V$ $V_{CE} = 850V$ $T_{case} = 125°C$			150 1.5	μA mA
I_{CER}	Collector cutoff current ($R_{BE} \leqslant 10\Omega$)	$V_{CE} = 850V$ $V_{CE} = 850V$ $T_{case} = 125°C$			400 3	μA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$	400			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 6A$ $I_B = 1.2A$ $I_C = 9A$ $I_B = 3A$			1.5 3	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 6A$ $I_B = 1.2A$			1.6	V
t_{on}	Turn-on time	$I_C = 6A$ $V_{CC} = 150V$ $I_{B1} = -I_{B2} = 1.2A$			1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

BUX 48

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE, HIGH CURRENT POWER SWITCH

The BUX 48 is a multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, intended in fast switching applications for high output powers.

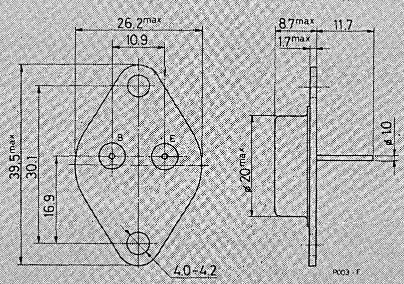
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	850	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 10\Omega$)	850	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	15	A
I_{CM}	Collector peak current ($t_p \leq 5$ms)	30	A
I_{CP}	Collector peak current non repetitive ($t_p \leq 20\mu$s)	55	A
I_B	Base current	4	A
I_{BM}	Base peak current ($t_p \leq 5$ms)	20	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$°C	125	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

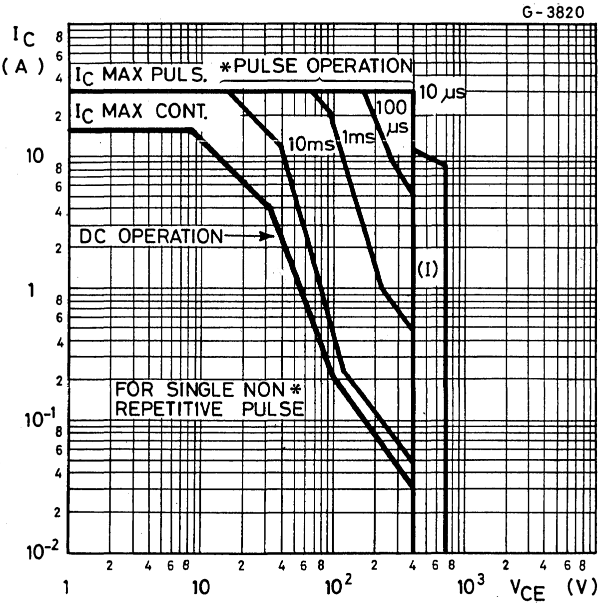
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.2	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	$V_{CE}=850V$			200	μA
		$T_{case}=125°C$ $V_{CE}=850V$			2	mA
I_{CER}	Collector cutoff current ($R_{BE}<10\Omega$)	$V_{CE}=850V$			500	μA
		$T_{case}=125°C$ $V_{CE}=850V$			4	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=7V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C=100mA$	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C=10A$ $I_B=2A$			1.5	V
		$I_C=15A$ $I_B=3A$			5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C=10A$ $I_{B1}=2A$			1.6	V
RESISTIVE SWITCHING TIMES						
t_{on}	Turn-on time	$V_{CC}=150V$ $I_C=10A$ $I_{B1}=-I_{B2}=2A$			1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs
INDUCTIVE SWITCHING TIMES						
t_s	Storage time	$V_{clamp}=300V$ $I_C=10A$ $I_{B1}=2A$ $-V_B=5V$ $L_B=3\mu H$ $L_C=1.5mH$ $T_C=100°C$			5	μs
t_f	Fall time				0.8	μs

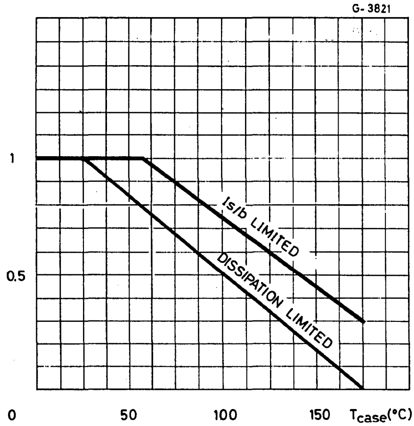
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

Safe operating areas

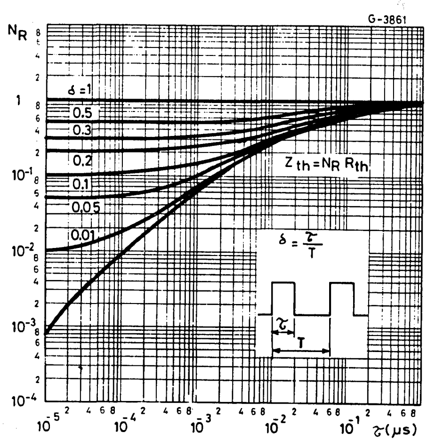


I – Area of permissible operation during turn-on provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.25\ \mu s$

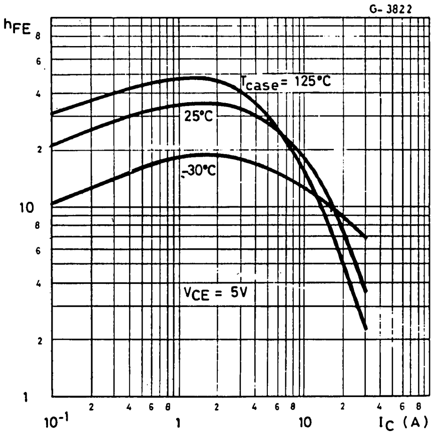
Derating curves



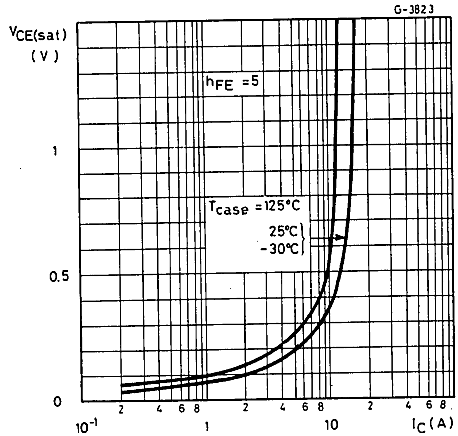
Thermal transient response



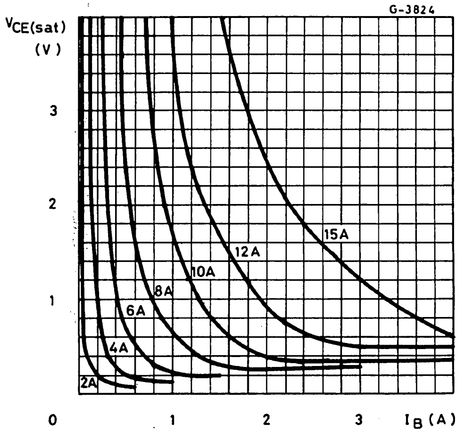
DC current gain



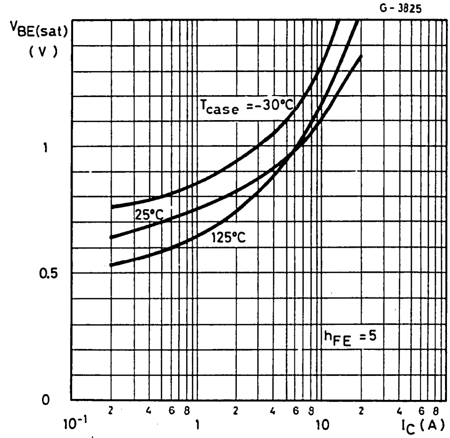
Collector-emitter saturation voltage



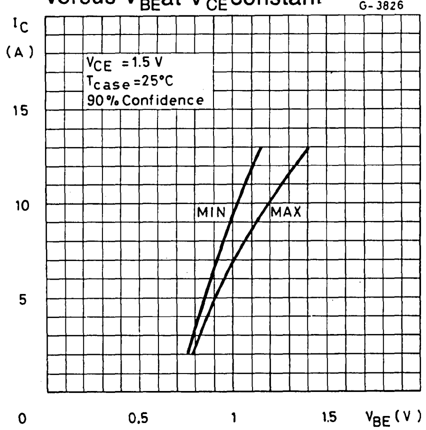
Collector-emitter saturation voltage



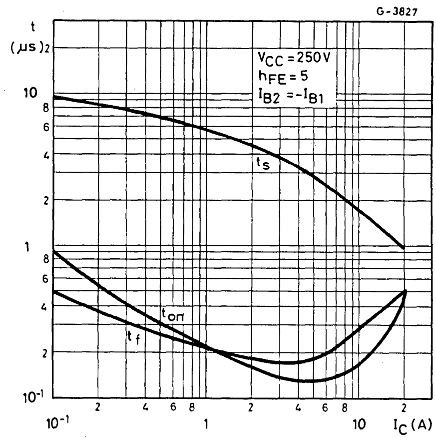
Base-emitter saturation voltage



Extreme characteristics Ic versus V_{BE} at V_{CE} constant*

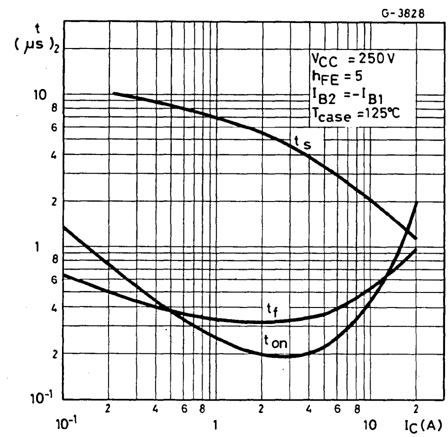


Saturated switching characteristics

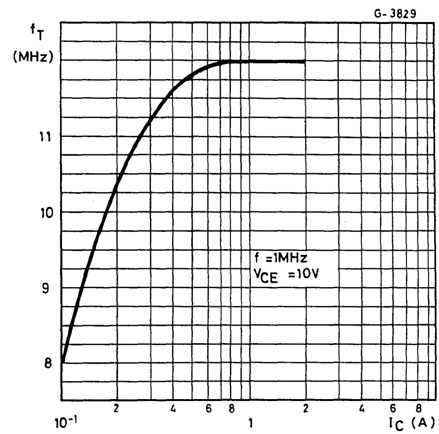


* These values can be used to determine the collector current dispersion with «paralleled» transistors.

Saturated switching characteristics



Transition frequency



Clamped reverse bias safe operating areas

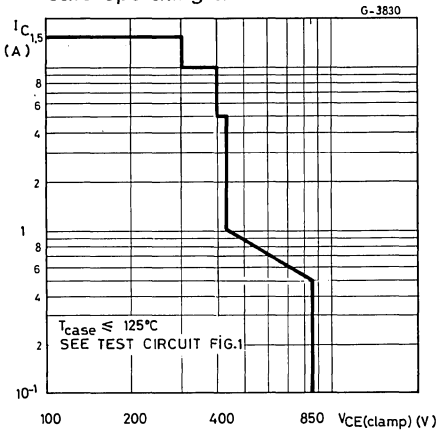


Fig. 1 — Clamped $E_{s/b}$ test circuit

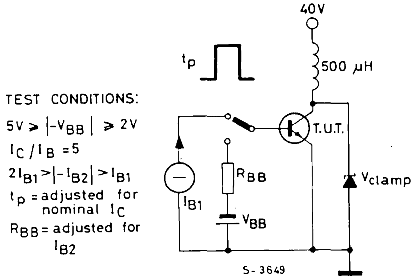
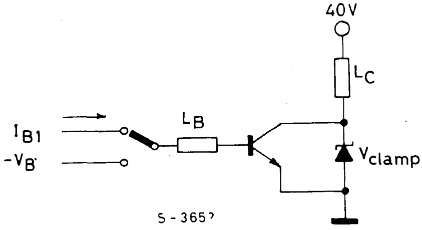


Fig. 2 — Switching times test circuit inductive load



BUX 77
BUX 78

EPITAXIAL PLANAR NPN/PNP

FAST SWITCHING APPLICATIONS

The BUX 77 and BUX 78 are silicon epitaxial planar transistors in Jedec TO-66 metal case.
They are particularly intended for fast switching applications in military and space equipments.

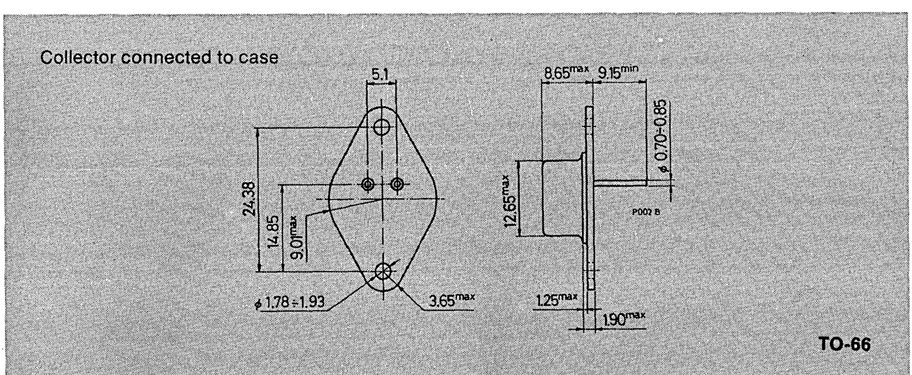
ABSOLUTE MAXIMUM RATINGS

		NPN	BUX 77	
		PNP°	BUX 78	
V_{CBO}	Collector-base voltage ($I_E = 0$)		100	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		80	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6	V
I_C	Collector current		5	A
I_B	Base current		0.8	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		40	W
T_{stg}	Storage temperature		-65 to 200	°C
T_j	Junction temperature		200	°C

° For PNP devices voltage and current values are negative

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.4	°C/W

ELECTRICAL CHARACTERISTICS° (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CE} = 80 V V_{CE} = 80 V T_{case} = 150°C			0.5 150	μA μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = 60 V			10	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 4 V			0.5	μA
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	I_C = 2 mA	100			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 50 mA	80			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	I_E = 1 mA	6			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 0.5 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 5 A I_B = 0.5 A			1.3	V
h_{FE}*	DC current gain	I_C = 0.5 A V_{CE} = 5 V I_C = 2 A V_{CE} = 5 V I_C = 5 A V_{CE} = 5 V T_{case} = -40°C I_C = 1 A V_{CE} = 5 V	70 50 30 25	 120		— — — —
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 5 V f = 20 MHz	2.5			MHz
t_{on}	Turn-on time	I_C = 5 A V_{CC} = 40 V I_{B1} = $-I_{B2}$ = 0.5 A			0.3	μs
t_r	Rise time				0.2	μs
t_s	Storage time				0.5	μs
t_f	Fall time				0.2	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
° For PNP devices voltage and current values are negative

BUX 80

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUX 80 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, particularly intended for converters, inverters, switching regulators and motor control systems applications.

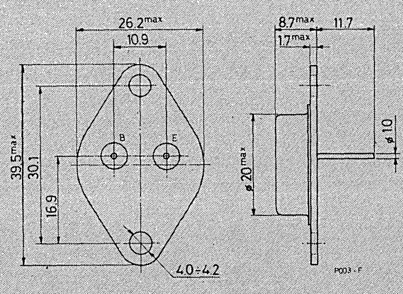
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	800	V
V_{CER}	Collector-emitter voltage ($R_{BE}=50\Omega$)	500	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	10	V
I_C	Collector current	10	A
I_{CM}	Collector peak current	15	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 40°C$	100	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.1	°C/W

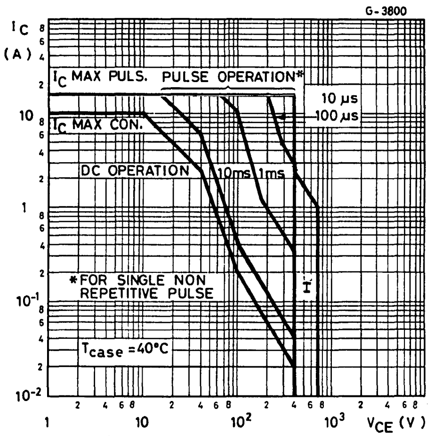
ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	$V_{CE}=800V$ $V_{CE}=800V$ $T_{case}=125°C$			1 3	mA mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=10V$			10	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	I_C =100mA	400			V
$V_{CER(sus)}$*	Collector-emitter sustaining voltage ($R_{BE}=50\Omega$)	I_C =100mA	500			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =5A I_B =1A I_C =8A I_B =2.5A			1.5 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =5A I_B =1A I_C =8A I_B =2.5A			1.4 1.8	V V
h_{FE}*	DC current gain	I_C =1,2A V_{CE}=5V		30		—
t_{on}	Turn-on time	I_C =5A I_{B1} =1A V_{CC}=250V			0.5	µs
t_s	Storage time	I_C =5A I_{B1} =1A I_{B2} =-2A V_{CC}=250V			3.5	µs
t_f	Fall time	I_C =5A I_{B1} =1A I_{B2} =-2A V_{CC}=-250V			0.5	µs

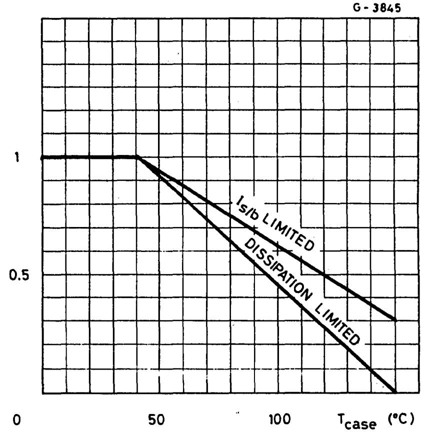
* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

BUX 80

Safe operating areas

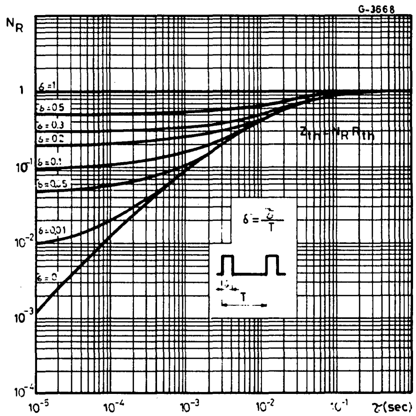


Derating curves

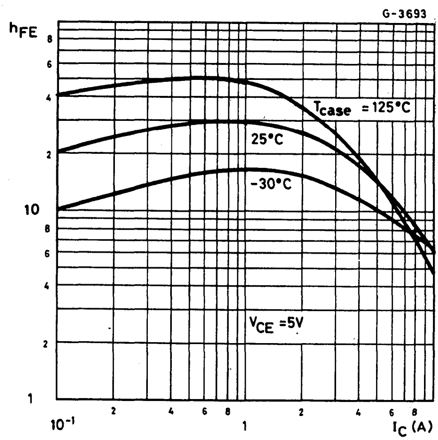


I — Area of permissible operation during Turn-on provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0,6\mu s$

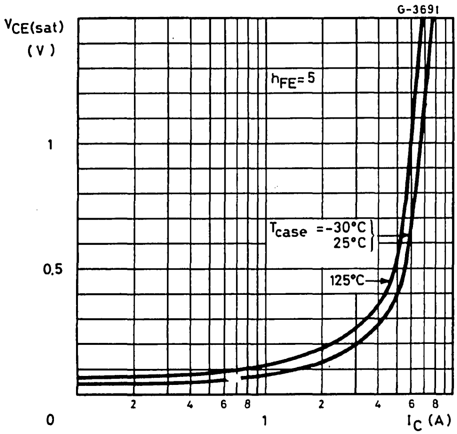
Transient thermal response



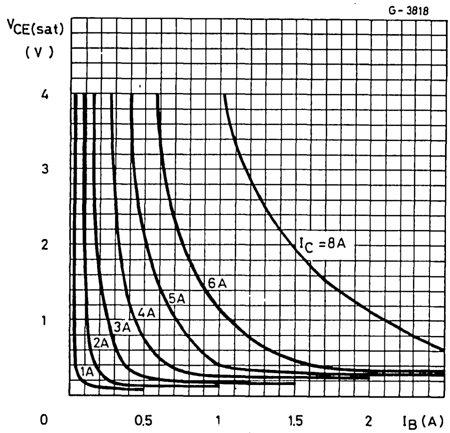
DC current gain



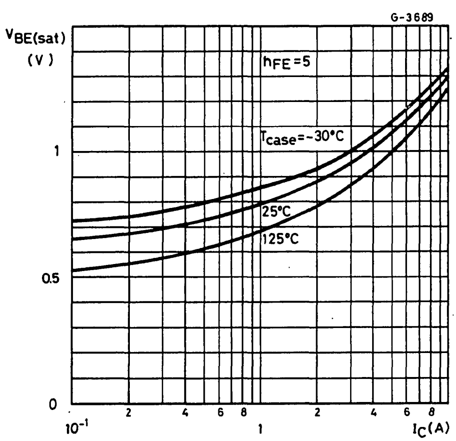
Collector-emitter saturation voltage



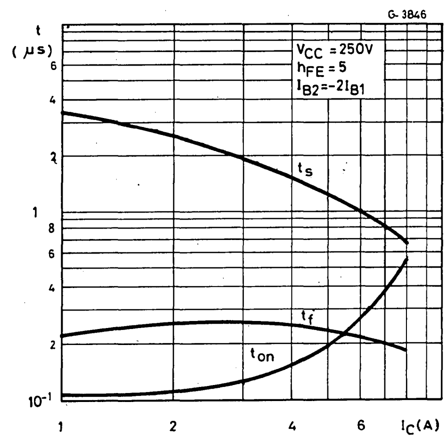
Collector-emitter saturation voltage



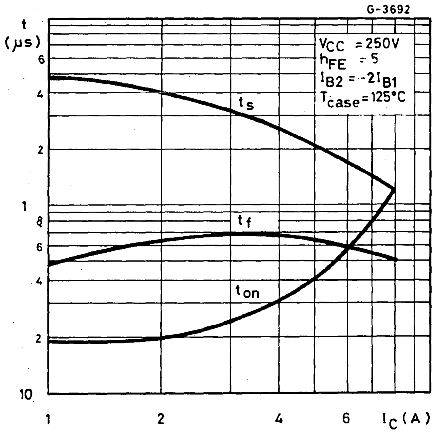
Base-emitter saturation voltage



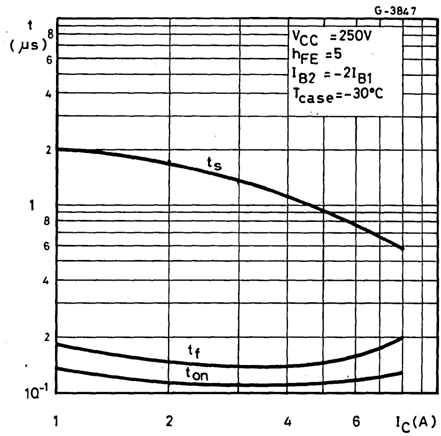
Saturated switching characteristics



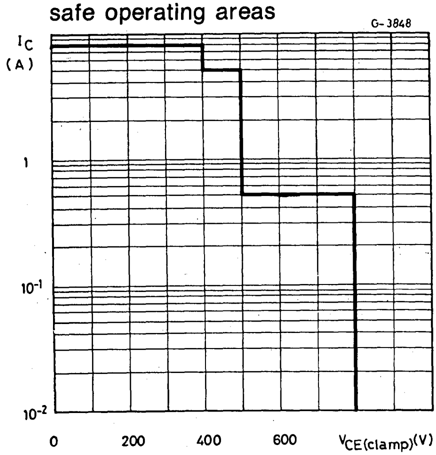
Saturated switching characteristics



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

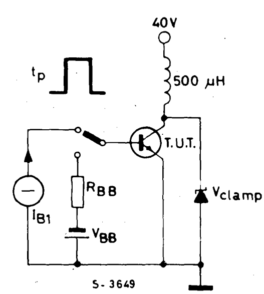
$5V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



MULTIEPITAXIAL MESA NPN

BUX 82

HIGH VOLTAGE POWER SWITCH

The BUX 82 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-3 metal case, particularly intended for converters, inverters, switching regulators and motor control systems applications.

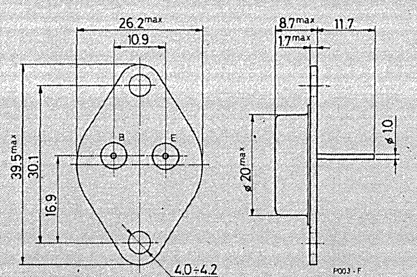
ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	10	V
I_C	Collector current	6	A
I_{CM}	Collector peak current	8	A
I_B	Base current	3	A
P_{tot}	Total power dissipation at $T_{case} \leq 50°C$	60	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

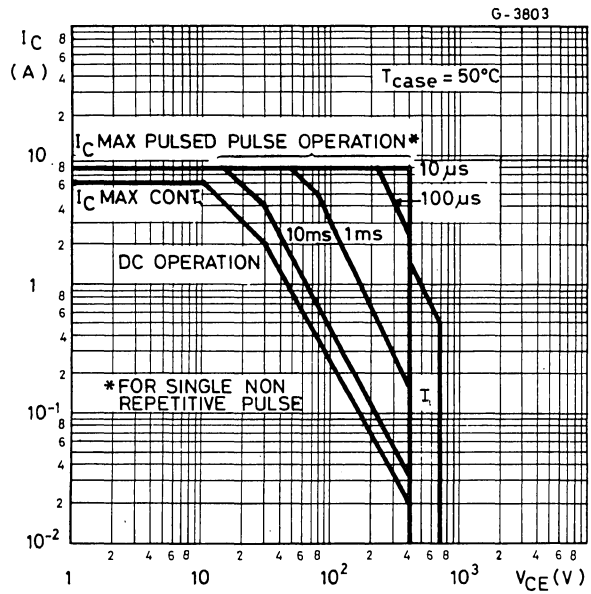
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 1.65 °C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	$V_{CE}=800V$			1	mA
I_{CES}	Collector cutoff current ($V_{BE}=0$)	$V_{CE}=800V$ $T_{case}=125°C$			2	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=10V$			10	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	I_C =100mA	400			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =2.5A I_B =0.5A			1.5	V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =4A I_B =1.25A			3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C =2.5A I_B =0.5A			1.4	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =4A I_B =1.25A			1.6	V
h_{FE}*	DC current gain	I_C =0.6A V_{CE}=5V		30		—
t_{on}	Turn-on time	I_C =2.5A I_{B1} =0.5A V_{CC}=250V			0.5	µs
t_s	Storage time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			3.5	µs
t_f	Fall time	I_C =2.5A I_{B1} =0.5A I_{B2} =-1A V_{CC}=250V			0.5	µs

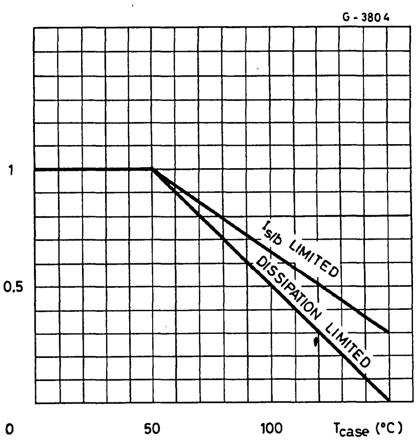
* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

Safe operating areas

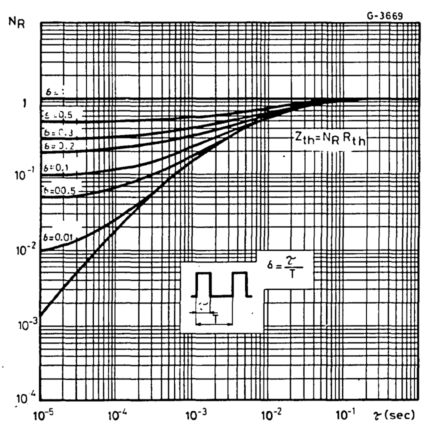


I— Area of permissible operation during turn-on provided $R_{BE} \leq 100\ \Omega$ and $t_p \leq 0.6\ \mu s$

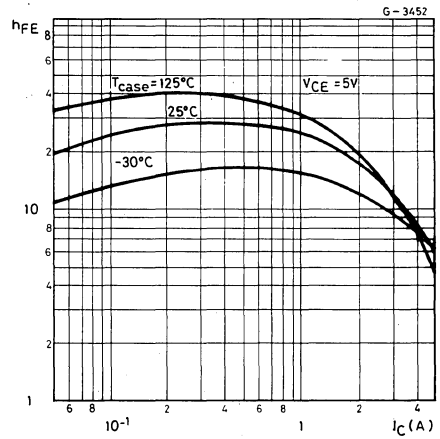
Derating curves



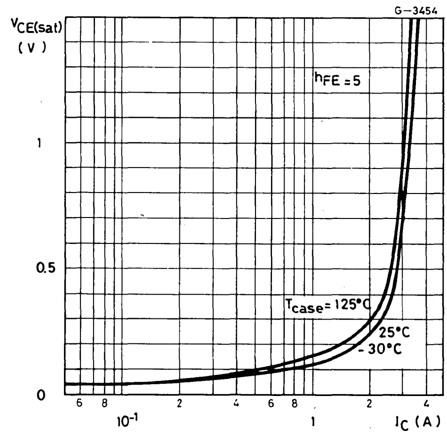
Transient thermal response



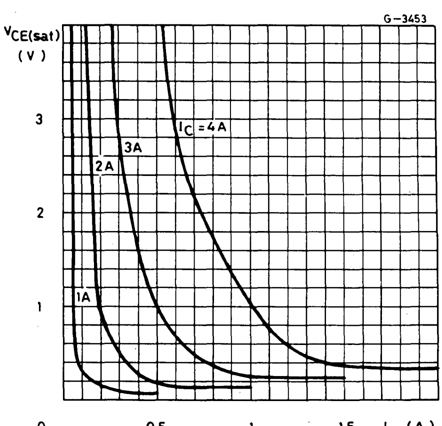
DC current gain



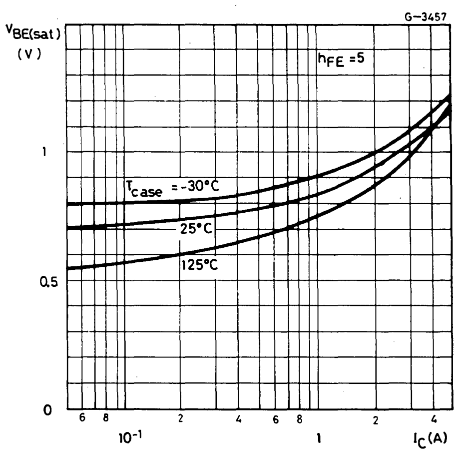
Collector-emitter saturation voltage



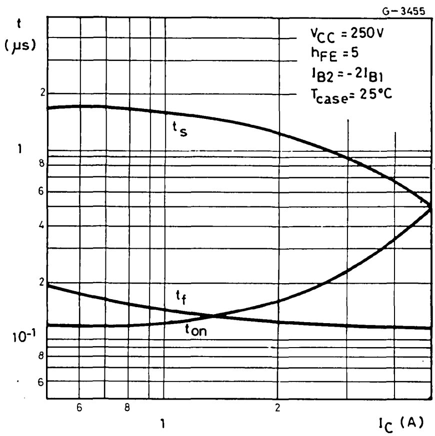
Collector-emitter saturation voltage



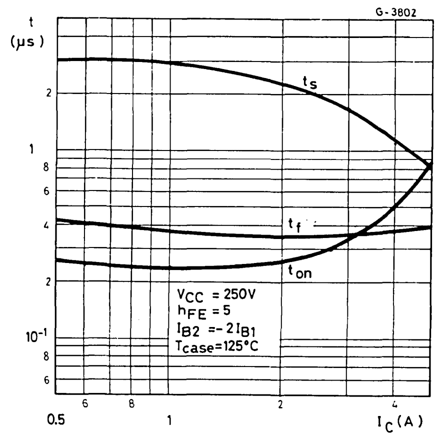
Base-emitter saturation voltage



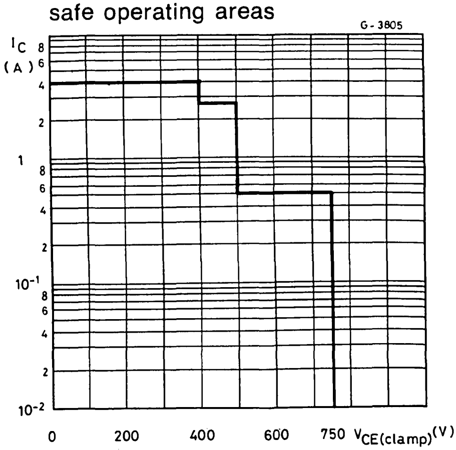
Saturated switching characteristics



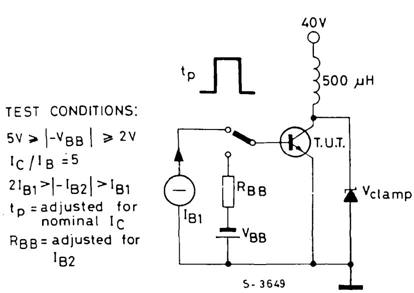
Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit



BUX 97
BUX 97A
BUX 97B

MULTIEPITAXIAL BIPLANAR NPN

HIGH VOLTAGE POWER SWITCH

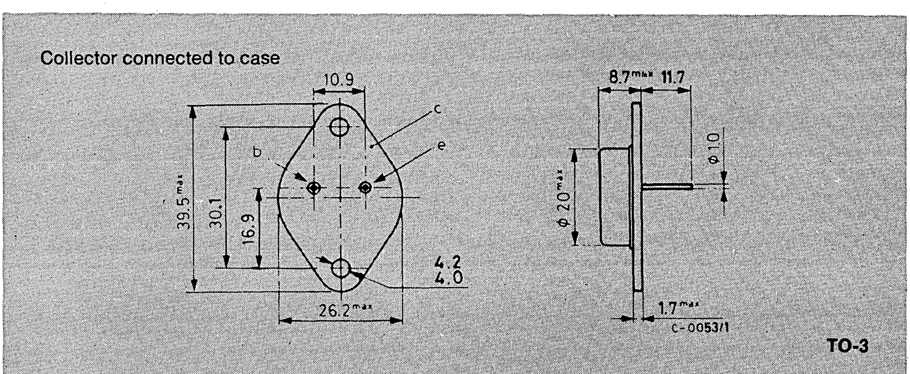
The BUX 97, BUX 97A and BUX 97B are silicon multiepitaxial biplanar® NPN transistors in Jedec TO-3 metal case. They are intended for high voltage, fast switching and industrial applications.

ABSOLUTE MAXIMUM RATINGS

		BUX97	BUX97A	BUX97B
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	750V	800V	800V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	350V	400V	450V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		7V	
I_C	Collector current		6A	
I_{CM}	Collector peak current		8A	
I_{BM}	Base peak current		3A	
P_{tot}	Total power dissipation at $T_{case} \leq 75°C$		60W	
T_{stg}	Storage temperature		-65 to 175 °C	
T_j	Junction temperature		175 °C	

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

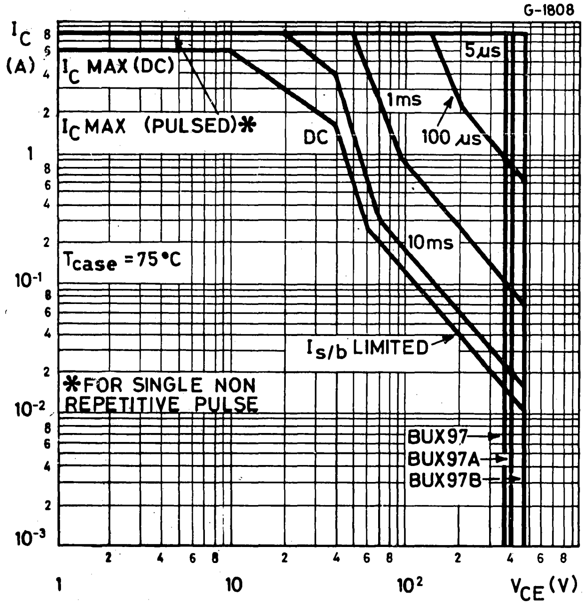
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

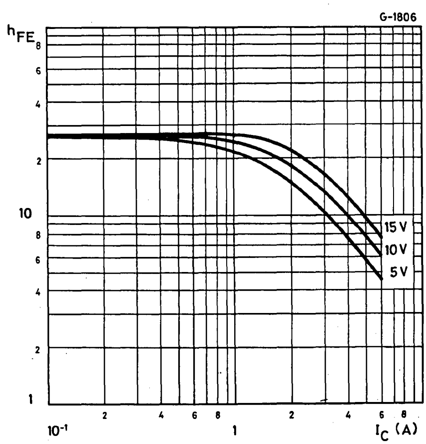
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ max			1	mA
		T_{case} = 150°C $V_{CE} = V_{CES}$ max			3	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA for **BUX 97**	350			V
		for **BUX 97A**	400			V
		for **BUX 97B**	450			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1 A I_B = 0.2A		0.2	1	V
		I_C = 4 A I_B = 1.25A		0.8	3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 1 A I_B = 0.2A			1.3	V
		I_C = 4 A I_B = 1.25A			1.8	V
h_{FE}*	DC current gain	I_C = 1 A V_{CE} = 5V	10		70	—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V		20		MHz
t_{on}	Turn-on time	I_C = 4 A V_{CC} = 100V I_{B1} = 1.25A		0.6		μs
t_s	Storage time	I_C = 4A V_{CC} = 100V $I_{B1} = -I_{B2}$ = 1.25A		2		μs
t_f	Fall time			0.5		μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

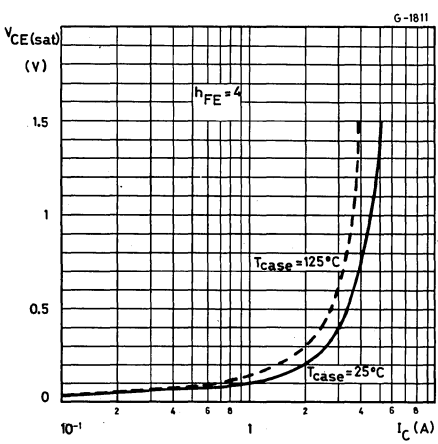
Safe operating areas



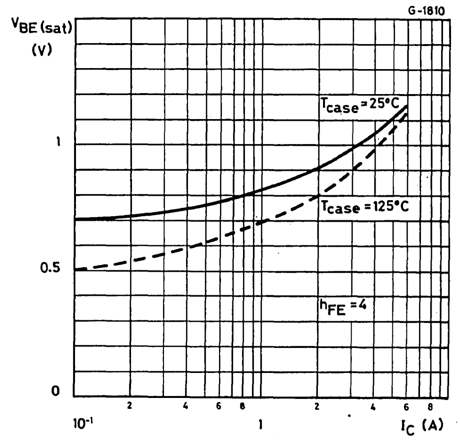
DC current gain



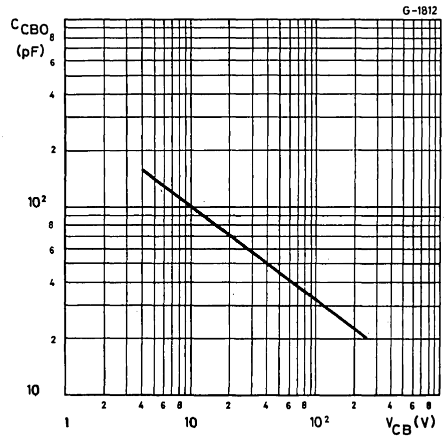
Collector-emitter saturation voltage



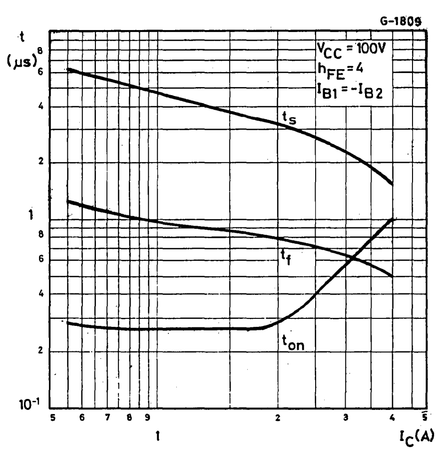
Base-emitter saturation voltage



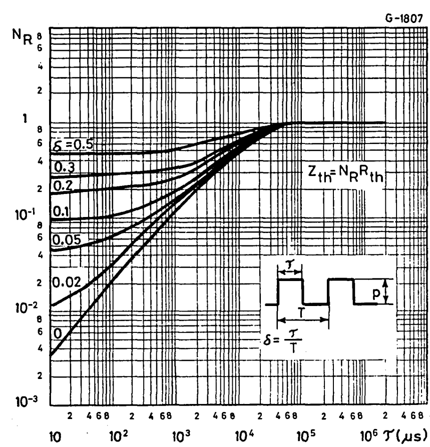
Collector-base capacitance



Saturated switching characteristics



Thermal response



BUY 18S

EPITAXIAL PLANAR NPN

FAST SWITCHING HIGH VOLTAGE POWER

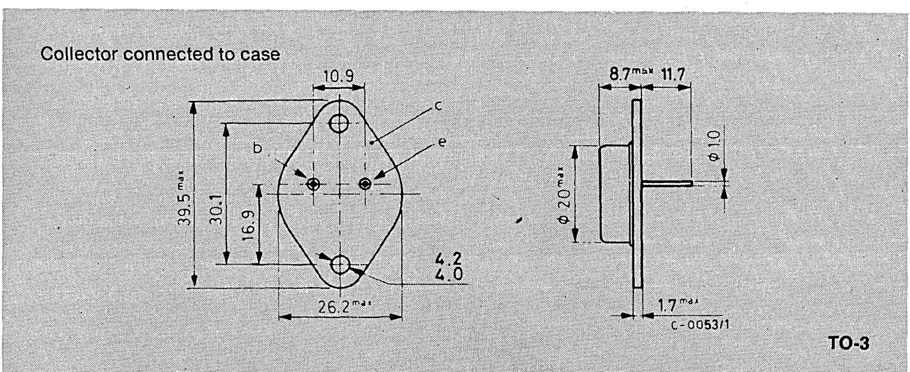
The BUY 18S is a silicon planar epitaxial NPN transistor in Jedec TO-3 metal case. It is intended for high-voltage switching power applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	400	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_{CM}	Collector peak current (repetitive)	10	A
I_{CM}	Collector peak current ($t \leqslant 10$ ms)	15	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 75$ °C	50	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2	°C/W

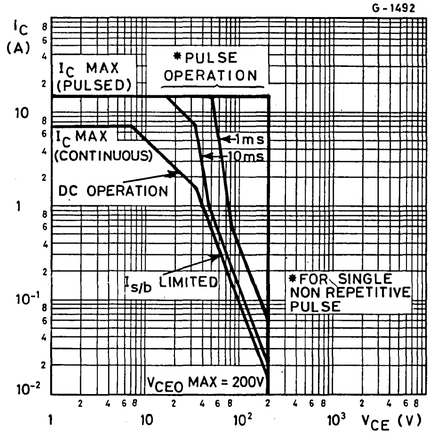
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = 200V V_{CB} = 200V T_{case} = 100°C			10 2	μA mA
$V_{(BR)\,CBO}$*	Collector-base breakdown voltage ($I_E = 0$)	I_C = 5 mA	400			V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	I_E = 1 mA	6			V
$V_{CEO\,(SUS)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 20 mA	200			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 5A I_B = 0.5A I_C = 7A I_B = 0.7A		 1	1	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 5A I_B = 0.5A I_C = 7A I_B = 0.7A			1.4 1.6	V V
h_{FE}*	DC current gain	I_C = 1A V_{CE} = 5V	20	35		—
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 10V		30		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 50V f = 1 MHz		55		pF
t_{on}	Turn-on time	I_C = 5A I_{B1} = 0.5A			1	μs
t_{off}	Turn-off time	I_C = 5A I_{B1} = $-I_{B2}$ = 0.5A		0.3	1	μs
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 40V	1			A

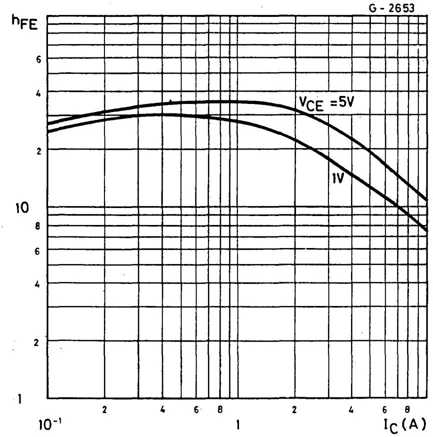
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5 %
** Pulsed: 1s, non repetitive pulse

BUY 18S

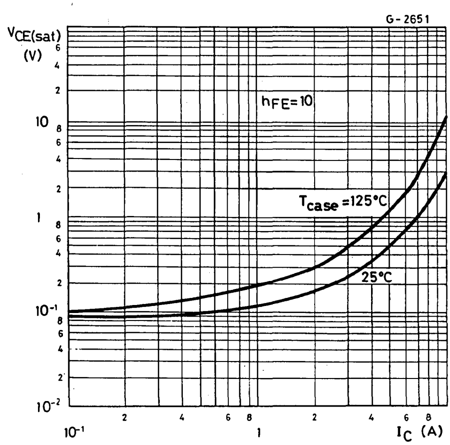
Safe operating areas



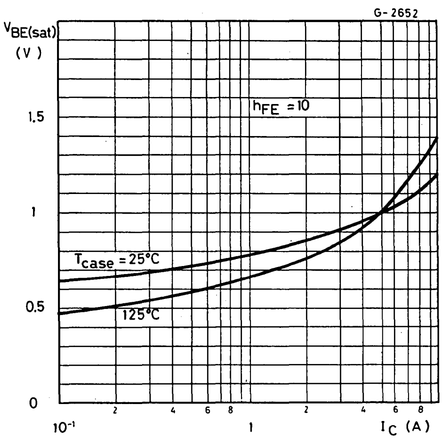
DC current gain



Collector-emitter saturation voltage



Base-emitter saturation voltage



EPITAXIAL PLANAR NPN

BUY 47
BUY 48

HIGH VOLTAGE, HIGH CURRENT SWITCH

The BUY 47 and BUY 48 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case. They are used in high-voltage, high-current switching applications up to 7 A.

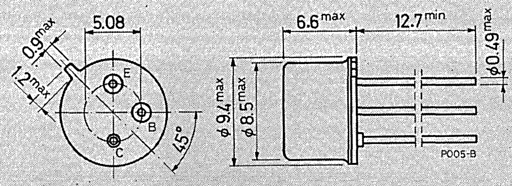
ABSOLUTE MAXIMUM RATINGS

		BUY 47	BUY 48
V_{CBO}	Collector-base voltage ($I_E = 0$)	150V	200V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120V	170V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6V	
I_C	Collector current	7A	
I_{CM}	Collector peak current (repetitive)	10A	
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1W	
	$T_{case} \leq 50°C$	10W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

6/77

BUY 47
BUY 48

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

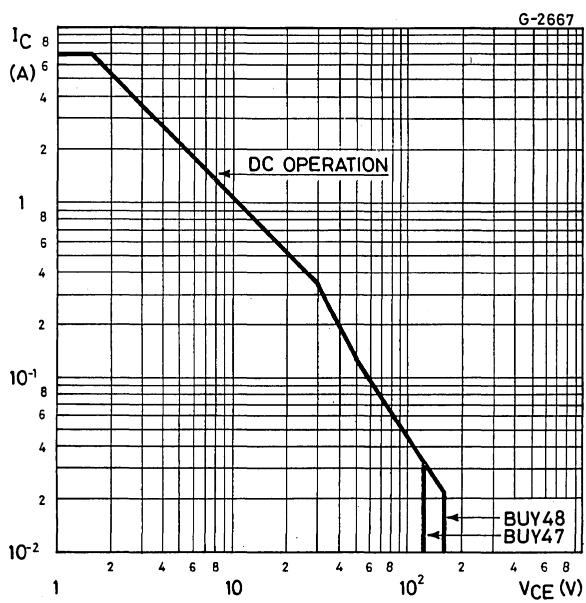
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BUY 47**					
		V_{CB} = 80 V				10	μA
		V_{CB} = 80 V	T_{case} = 125°C			1	mA
		for **BUY 48**					
		V_{CB} = 100 V				10	μA
		V_{CB} = 100 V	T_{case} = 125°C			1	mA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 1 mA	for **BUY 47**	150			V
			for **BUY 48**	200			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 20 mA	for **BUY 47**	120			V
			for **BUY 48**	170			V
V_{EBO}*	**Emitter-base voltage (I_C = 0)**	I_E = 1 mA		6			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 0.5 A	I_B = 50 mA		0.05		V
		I_C = 2 A	I_B = 0.2 A			0.45	V
		I_C = 5 A	I_B = 0.5 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 0.5 A	I_B = 50 mA		0.8		V
		I_C = 2 A	I_B = 0.2 A			1.1	V
		I_C = 5 A	I_B = 0.5 A			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

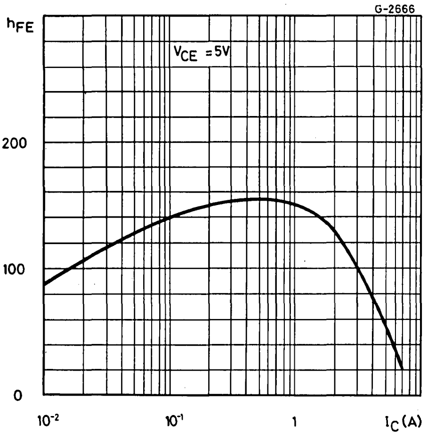
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 50 mA V_{CE} = 5 V		130		—
		I_C = 0.5 A V_{CE} = 5 V	40	150		—
		I_C = 2 A V_{CE} = 5 V	40	130		—
		I_C = 5 A V_{CE} = 5 V	15	45		—
f_T	Transition frequency	I_C = 100mA V_{CE} = 10 V		90		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 50 V f = 1 MHz		45	80	pF
t_{on}	Turn-on time	I_C = 5 A V_{CC} = 40 V I_{B1} = $-I_{B2}$ = 0.5 A			1	μs
t_{off}	Turn-off time				2	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

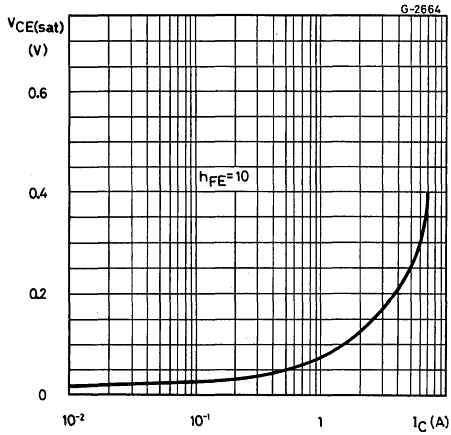
Safe operating areas



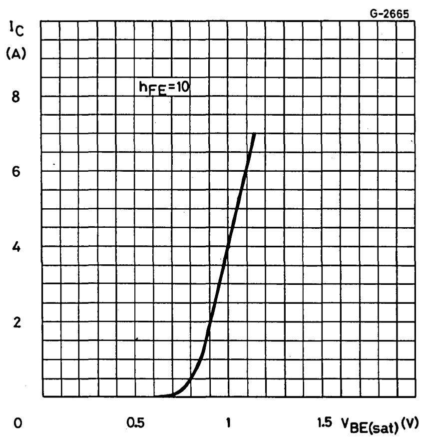
DC current gain



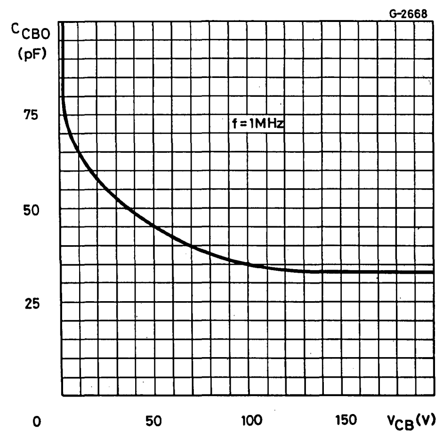
Collector-emitter saturation voltage



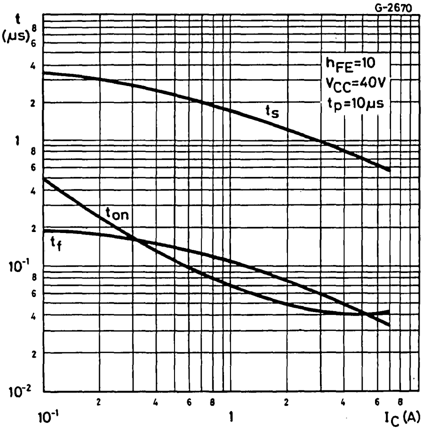
Base-emitter saturation voltage



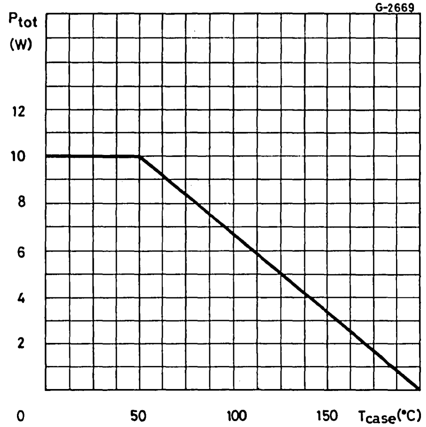
Collector-base capacitance



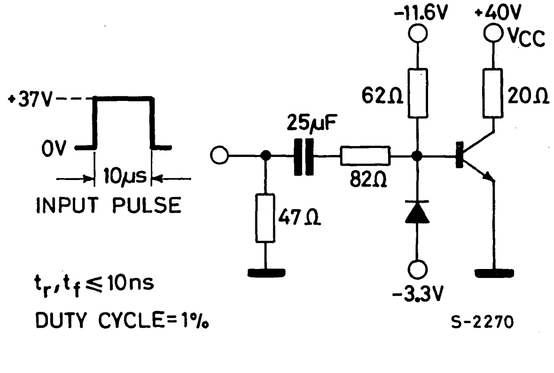
Saturated switching characteristics



Power rating chart



Switching time test circuit



BUY 49S

EPITAXIAL PLANAR NPN

HIGH VOLTAGE, MEDIUM CURRENT SWITCH

The BUY 49S is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case. It is used in high-voltage, high-current switching applications up to 3A.

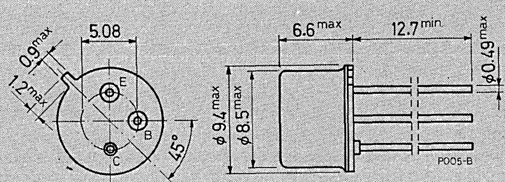
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	3	A
I_{CM}	Collector peak current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1	W
	$T_{case} \leq 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

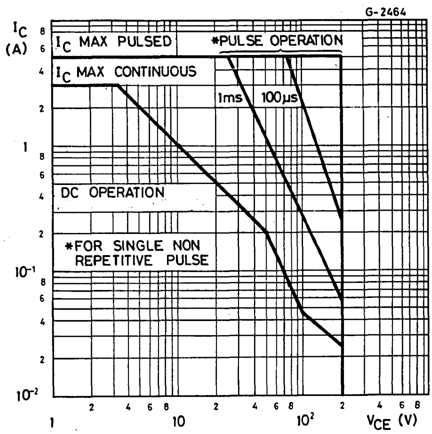
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 200 V V_{CB} = 200 V T_{case} = 150°C			0.1 50	μA μA
$V_{(BR)\,CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 100 μA	250			V
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 20 mA	200			V
V_{EBO}*	Emitter-base voltage (I_C =0)	I_E = 1 mA	6			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 0.5 A I_B = 50 mA			0.2	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 0.5 A I_B = 50 mA			1.1	V
h_{FE}*	DC current gain	I_C = 20 mA V_{CE} = 5 V I_C = 0.5 A V_{CE} = 5 V I_C = 20 mA V_{CE} = 2 V T_{case} = -55°C	40 40 16	 80		— — —
f_T	Transition frequency	I_C = 100mA V_{CE} = 10 V	50			MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz			30	pF
t_{on}	Turn-on time	I_C = 0.5 A V_{CC} = 20 V I_{B1} = $-I_{B2}$ = 50 mA		0.3		μs
t_{off}	Turn-off time			1		μs
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 50 V	0.2			A

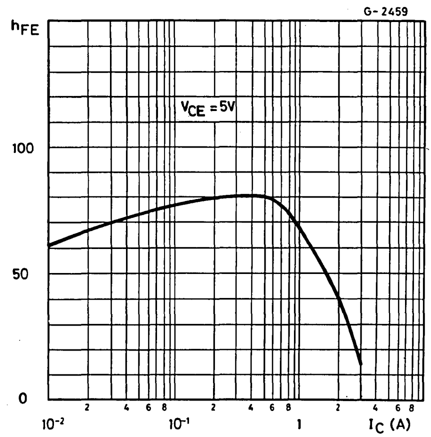
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

BUY 49S

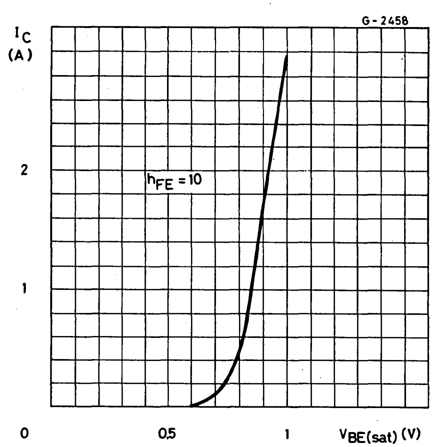
Safe operating areas



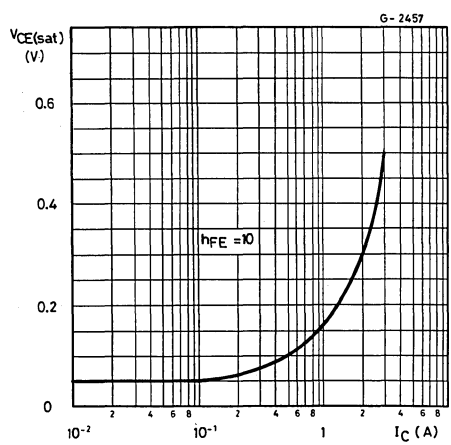
DC current gain



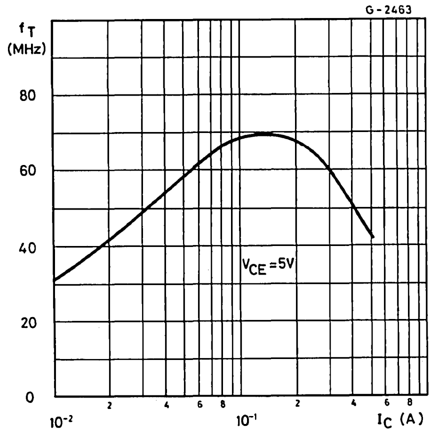
DC transconductance



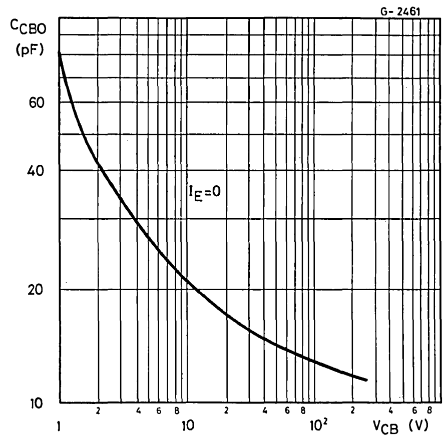
Collector-emitter saturation voltage



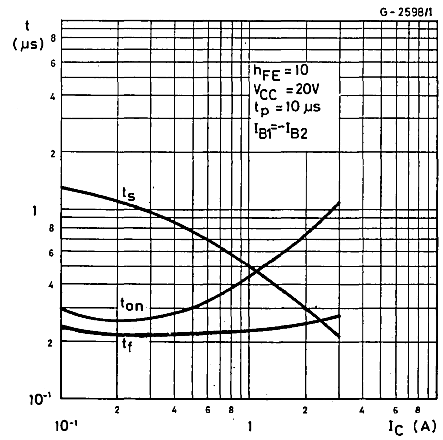
Transition frequency



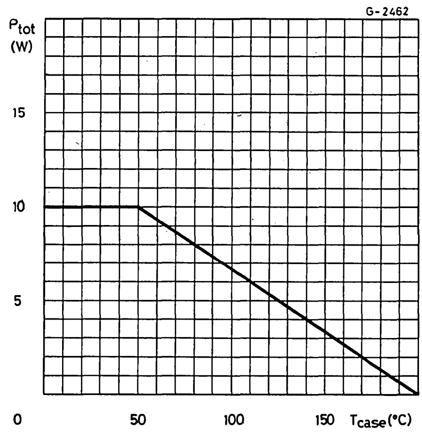
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BUY 68

EPITAXIAL PLANAR NPN

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

The BUY 68 is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case. It is used for high-current switching applications and in power amplifiers. The BUY 68 is available in 3 h_{FE} gain bands.

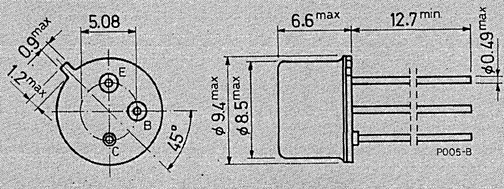
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
V_{CER}	Collector-emitter voltage ($R_{BE}^{\bullet} \leq 10\ \Omega$)	80	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
P_{tot}	Total power dissipation at $T_{amb} \leqslant 25°C$	1	W
	$T_{case} \leqslant 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

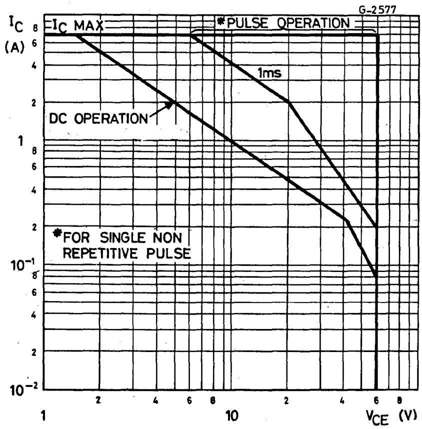
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 60$ V				1	μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 1$ mA		100			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage ($R_{BE} = 10\ \Omega$)	$I_C = 50$ mA		80			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 50$ mA		60			V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	$I_E = 1$ mA		6			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 2$ A $I_C = 5$ A	$I_B = 0.2$ A $I_B = 0.5$ A			0.6 1	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 2$ A $I_C = 5$ A	$I_B = 0.2$ A $I_B = 0.5$ A		1 1.2	1.3 1.6	V V
h_{FE}*	DC current gain	$I_C = 0.1$ A	$V_{CE} = 1$ V	40	130		—
			Group 6	40	70		—
			Group 10	63	110		—
			Group 16	100	170		—
		$I_C = 1$ A	$V_{CE} = 1$ V	40	130	250	—
			Group 6	40	70	100	—
			Group 10	63	110	160	—
			Group 16	100	170	250	—
f_T	Transition frequency	$I_C = 0.5$ A	$V_{CE} = 5$ V	50			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $f = 1$ MHz	$V_{CB} = 10$ V			80	pF
t_{on}	Turn-on time	$I_C = 5$ A $I_{B1} = -I_{B2} = 0.5$ A	$V_{CC} = 20$ V			0.35	μs
t_{off}	Turn-off time					0.75	μs

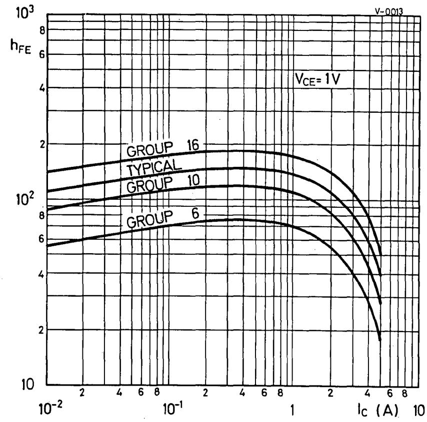
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BUY 68

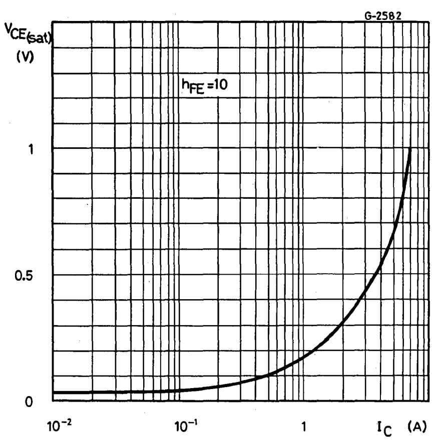
Safe operating areas



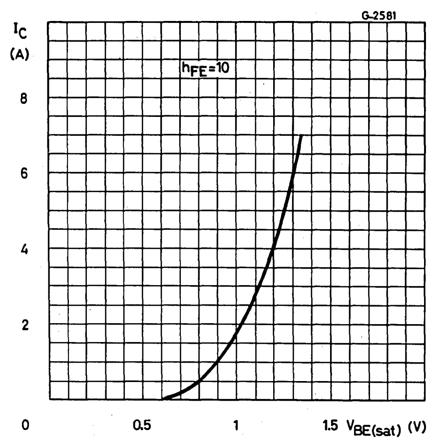
DC current gain



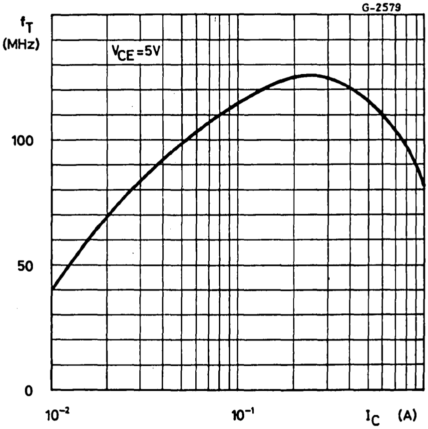
Collector-emitter saturation voltage



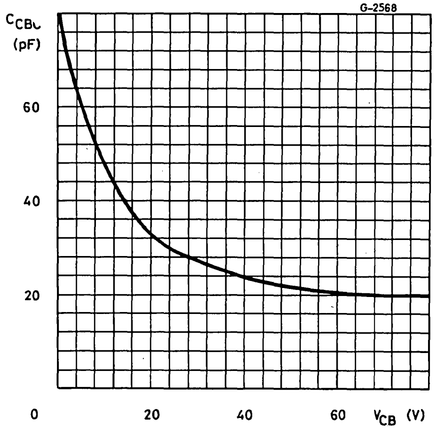
Base-emitter saturation voltage



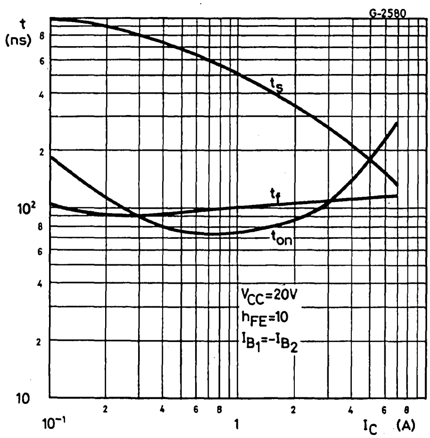
Transition frequency



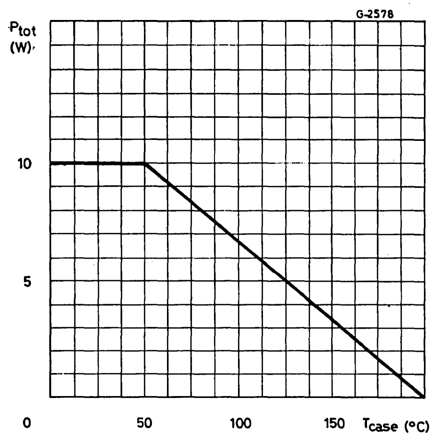
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BUY 69A
BUY 69B
BUY 69C

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The BUY 69A, BUY 69B, and BUY 69C are silicon multiepitaxial mesa NPN transistors in Jedec TO-3 metal case. They are intended for horizontal deflection output stage of CTV receivers and high voltage, fast switching and industrial applications.

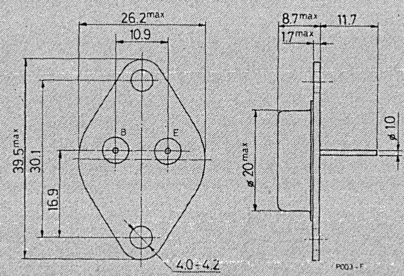
ABSOLUTE MAXIMUM RATINGS

		BUY 69A	BUY 69B	BUY 69C
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	1000V	800V	500V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400V	325V	200V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		8V	
I_C	Collector current		10A	
I_{CM}	Collector peak current ($t_p \leq 10ms$)		15A	
I_B	Base current		3A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$		100W	
T_{stg}	Storage temperature		−65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BUY69A** V_{CE} = 1000V for **BUY69B** V_{CE} = 800V for **BUY69C** V_{CE} = 500V			1 1 1	mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 8V			1	mA
V_{CBO}	Collector-base voltage (I_E = 0)	for **BUY69A** I_C = 1mA for **BUY69B** I_C = 1mA for **BUY69C** I_C = 1mA	1000 800 500			V V V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **BUY69A** for **BUY69B** for **BUY69C**	 400 325 200			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 8A I_B = 2.5A			3.3	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 8A I_B = 2.5A			2.2	V
h_{FE}*	DC current gain	I_C = 2.5A V_{CE} = 10V	15			—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V		10		MHz
$I_{S/b}$**	Second breakdown collector current	V_{CE} = 25V	4			A
t_{on}	Turn-on time	I_C = 5A V_{CE} = 250V I_{B1} = 1A		0.2		μs

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time	$I_C = 5A$ $V_{CE} = 250V$ $I_{B1} = -I_{B2} = 1A$		1.7		μs
t_f	Fall time			0.3		μs
t_f	Fall time	$I_C = 8A$ $V_{CE} = 40V$ $I_{B1} = -I_{B2} = 2.5A$			1	μs

* Pulsed: pulse duration = 300μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

For characteristics curves see the BUW 34/5/6 series.

EPITAXIAL-BASE NPN/PNP

MJ 900
MJ 901
MJ 1000
MJ 1001

COMPLEMENTARY POWER DARLINGTONS

The MJ 900, MJ 901, MJ 1000 and MJ 1001 are silicon epitaxial-base transistors in monolithic Darlington configuration, and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The PNP types are the MJ 900 and MJ 901 and their complementary NPN types are the MJ 1000 and MJ 1001 respectively.

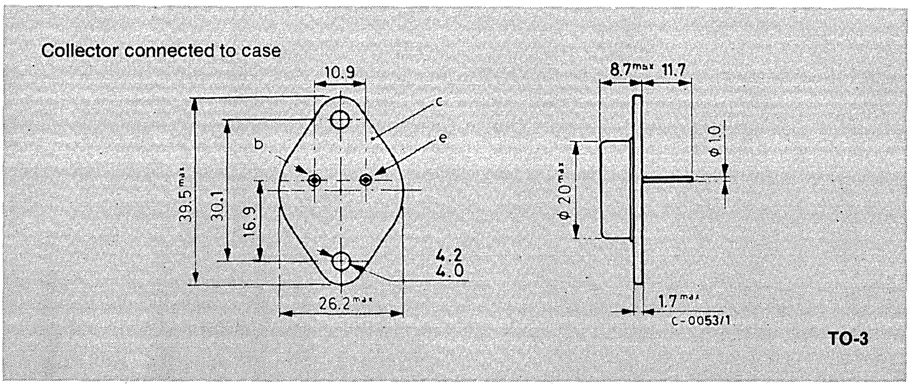
ABSOLUTE MAXIMUM RATINGS

		PNP°	MJ 900	MJ 901
		NPN	MJ1000	MJ1001
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		8A	
I_B	Base current		0.1A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C		90W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

° For PNP types voltage and current values are negative

MECHANICAL DATA

Dimensions in mm



TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.94	°C/W

ELECTRICAL CHARACTERISTICS ° (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current ($R_{BE} = 1k\Omega$)	for **MJ900** and **MJ1000** V_{CE} = 60 V for **MJ901** and **MJ1001** V_{CE} = 80 V T_{case} = 150°C for **MJ900** and **MJ1000** V_{CE} = 60 V for **MJ901** and **MJ1001** V_{CE} = 80 V			1 1 5 5	mA mA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **MJ900** and **MJ1000** V_{CE} = 30 V for **MJ901** and **MJ1001** V_{CE} = 40 V			0.5 0.5	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5 V			2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA for **MJ900** and **MJ1000** for **MJ901** and **MJ1001**	60 80			V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 3 A I_B = 12mA I_C = 8 A I_B = 40mA			2 4	V V
V_{BE}*	Base-emitter voltage	I_C = 3 A V_{CE} = 3 V			2.5	V
h_{FE}*	DC current gain	I_C = 3 A V_{CE} = 3 V I_C = 4 A V_{CE} = 3 V	1000 750			— —

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
° For PNP types current and voltage values are negative

For characteristic curves see the 2N 6053/55 series

MJ 2500
MJ 2501
MJ 3000
MJ 3001

EPITAXIAL-BASE NPN/PNP

COMPLEMENTARY POWER DARLINGTONS

The MJ 2500, MJ 2501, MJ 3000 and MJ 3001 are silicon epitaxial-base transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The PNP types are the MJ 2500 and MJ 2501 and the ir complementary NPN types are the MJ 3000 and MJ 3001 respectively.

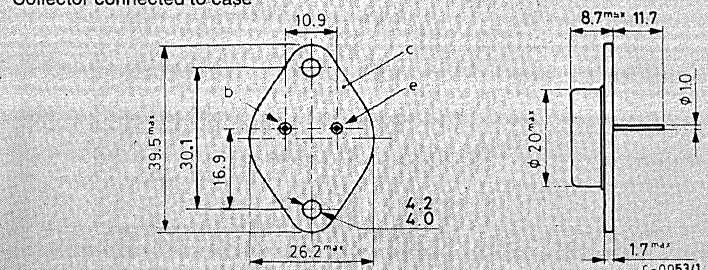
ABSOLUTE MAXIMUM RATINGS

		PNP°	MJ2500	MJ2501
		NPN	MJ3000	MJ3001
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		10A	
I_B	Base current		0.2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		150W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

° For PNP types voltage and current values are negative

MECHANICAL DATA

Dimensions in mm



TO-3

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS ° (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector cutoff current ($R_{BE} = 1k\Omega$)	for **MJ2500** and **MJ3000** V_{CE} = 60 V for **MJ2501** and **MJ3001** V_{CE} = 80 V T_{case} = 150°C for **MJ2500** and **MJ3000** V_{CE} = 60 V for **MJ2501** and **MJ3001** V_{CE} = 80 V			 1 1 5 5	 mA mA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **MJ2500** and **MJ3000** V_{CE} = 30 V for **MJ2501** and **MJ3001** V_{CE} = 40 V			 1 1	 mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5 V			2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA for **MJ2500** and **MJ3000** for **MJ2501** and **MJ3001**	 60 80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 20mA I_C = 10 A I_B = 50mA			2 4	V V
V_{BE}*	Base-emitter voltage	I_C = 5 A V_{CE} = 3 V			3	V
h_{FE}*	DC current gain	I_C = 5 A V_{CE} = 3 V	1000			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
° For PNP types current and voltage values are negative
For characteristic curves see the 2N6050 / 57 series

MJ 2955

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

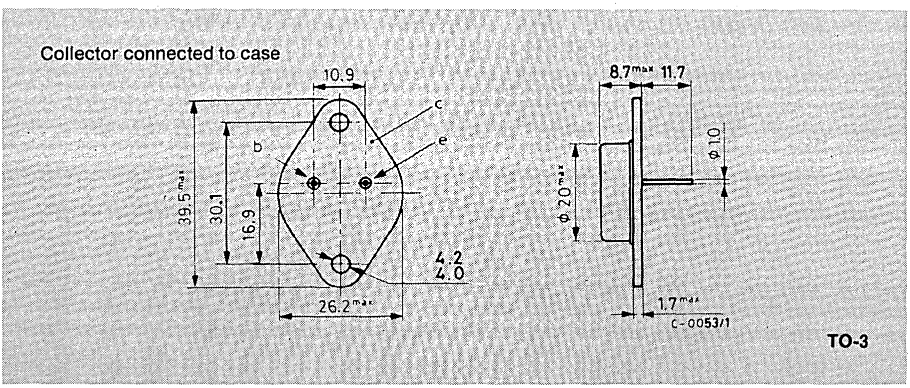
The MJ 2955 is a silicon epitaxial-base PNP power transistor in Jedec TO-3 metal case. It is intended for power switching circuits, series and shunt regulators, output stages and hi-fi amplifiers.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-100	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leqslant 100\ \Omega$)	-70	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-7	V
I_C	Collector current	-15	A
I_B	Base current	-7	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25\ °C$	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



6/77

MJ 2955

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = 1.5V)	V_{CE} = -100V V_{CE} = -100V T_{case} = 150°C			-1 -5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = -30 V			-0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{BE} = 7 V			-5	mA
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100 Ω)	I_C = -200mA	-70			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -200mA	-60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -4 A I_B = -0.4A I_C = -10 A I_B = -3.3A			-1.1 -3	V V
V_{BE}*	Base-emitter voltage	I_C = -4 A V_{CE} = -4 V			-1.8	V
h_{FE}*	DC current gain	I_C = -4 A V_{CE} = -4 V I_C = -10 A V_{CE} = -4 V	20 5		70	— —
f_T	Transition frequency	I_C = -0.5A V_{CE} = -10V	4			MHz

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
For characteristic curves see the 2N 5875 series

EPITAXIAL-BASE NPN/PNP

MJE 700/MJE 800
MJE 701/MJE 801
MJE 702/MJE 802
MJE 703/MJE 803

MEDIUM POWER DARLINGTONS

The MJE 700, MJE 701, MJE 702, MJE 703, MJE 800, MJE 801, MJE 802 and MJE 803 are silicon epitaxial-base power transistors in monolithic Darlington configuration and are mounted in Jedec TO-126 plastic package.
They are intended for use in medium power linear and switching applications.
The PNP types are the MJE 700, MJE 701, MJE 702 and MJE 703 and their complementary NPN types are the MJE 800, MJE 801, MJE 802 and MJE 803.

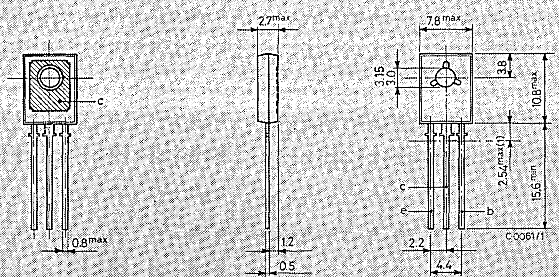
ABSOLUTE MAXIMUM RATINGS

		PNP°	MJE700 MJE701	MJE702 MJE703
		NPN	MJE800 MJE801	MJE802 MJE803
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_B	Base current		0.1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		40W	
T_{stg}	Storage temperature		-65 to 150 °C	
T_j	Junction temperature		150 °C	

° For PNP devices voltage and current values are negative

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.13	°C/W

ELECTRICAL CHARACTERISTICS ° (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **MJE 700, MJE 800,**	**MJE 701, MJE 801**				
		V_{CB} = 60 V				200	μA
		V_{CB} = 60 V	T_{case} = 100°C			2	mA
		for **MJE 702, MJE 802,**	**MJE 703, MJE 803**				
		V_{CB} = 80 V				200	μA
		V_{CB} = 80 V	T_{case} = 100°C			2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **MJE 700, MJE 800,**	**MJE 701, MJE 801**				
		V_{CE} = 30 V				500	μA
		for **MJE 702, MJE 802,**	**MJE 703, MJE 803**				
		V_{CE} = 40 V				500	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5 V				2	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	for **MJE 700, MJE 800,**	**MJE 701, MJE 801**				
		I_C = 50 mA		60			V
		for **MJE 702, MJE 802,**	**MJE 703, MJE 803**				
		I_C = 50 mA		80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **MJE 700, MJE 800,**	**MJE 702, MJE 802**				
		I_C = 1.5 A	I_B = 30mA			2.5	V
		for **MJE 701, MJE 801,**	**MJE 703, MJE 803**				
		I_C = 2 A	I_B = 40mA			2.8	V

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{BE}*	Base-emitter voltage	for **MJE 700, MJE 702, MJE 800, MJE 802** I_C = 1.5 A V_{CE} = 3 V			2.5	V
		for **MJE 701, MJE 703, MJE 801, MJE 803** I_C = 2 A V_{CE} = 3 V			2.5	V
h_{FE}*	DC current gain	for **MJE 700, MJE 702, MJE 800, MJE 802** I_C = 1.5 A V_{CE} = 3 V	750			—
		for **MJE 701, MJE 703, MJE 801, MJE 803** I_C = 2 A V_{CE} = 3 V	750			—
h_{fe}	Small signal current gain	I_C = 1.5 A V_{CE} = 3 V f = 1 MHz	1			—

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
° For PNP devices voltage and current values are negative
For characteristic curves see the 2N 6034/2N 6039 series

TIP 29
TIP 29A
TIP 29B
TIP 29C

EPITAXIAL-BASE NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The TIP 29, TIP 29A, TIP 29B and TIP 29C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the TIP 30, TIP 30A, TIP 30B and TIP 30C.

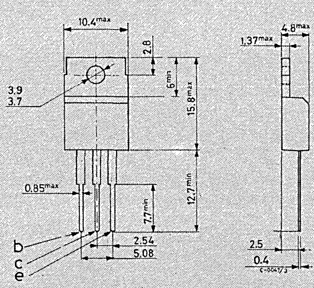
ABSOLUTE MAXIMUM RATINGS

		TIP 29	TIP 29A	TIP 29B	TIP 29C
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	1A			
I_{CM}	Collector peak current	3A			
I_B	Base current	0.4A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	30W			
	$T_{amb} \leqslant 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.17	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **TIP 29** and **TIP 29A** V_{CE} = 30V for **TIP 29B** and **TIP 29C** V_{CE} = 60V			0.3 0.3	mA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **TIP 29** V_{CE} = 40V for **TIP 29A** V_{CE} = 60V for **TIP 29B** V_{CE} = 80V for **TIP 29C** V_{CE} = 100V			0.2 0.2 0.2 0.2	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 30mA for **TIP 29** for **TIP 29A** for **TIP 29B** for **TIP 29C**	 40 60 80 100			 V V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1A I_B = 125mA			0.7	V
$V_{BE\ (on)}$*	Base-emitter voltage	I_C = 1A V_{CE} = 4V			1.3	V
h_{FE}*	DC current gain	I_C = 0.2A V_{CE} = 4V I_C = 1A V_{CE} = 4V	40 15		 75	— —
h_{fe}	Small signal current gain	I_C = 0.2A V_{CE} = 10V f = 1KHz I_C = 0.2A V_{CE} = 10V f = 1MHz	 20 3			 — —

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

TIP 30
TIP 30A
TIP 30B
TIP 30C

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The TIP 30, TIP 30A, TIP 30B and TIP 30C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the TIP 29, TIP 29A, TIP 29B and TIP 29C respectively.

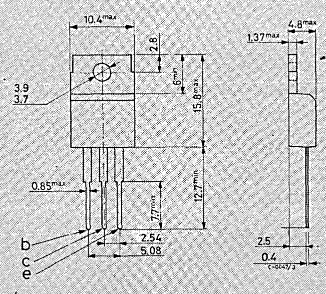
ABSOLUTE MAXIMUM RATINGS

		TIP 30	TIP 30A	TIP 30B	TIP 30C
V_{CBO}	Collector-base voltage ($I_E = 0$)	−40V	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−40V	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	−5V			
I_C	Collector current	−1A			
I_{CM}	Collector peak current	−3A			
I_B	Base current	−0.4A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	30W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.17	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector-cutoff current (I_B = 0)	for **TIP 30** and **TIP 30A** V_{CE} = −30V for **TIP 30B** and **TIP 30C** V_{CE} = −60V			 −0.3 −0.3	 mA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **TIP 30** V_{CE} = −40V for **TIP 30A** V_{CE} = −60V for **TIP 30B** V_{CE} = −80V for **TIP 30C** V_{CE} = −100V			−0.2 −0.2 −0.2 −0.2	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = −5V			−1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = −30mA for **TIP 30** for **TIP 30A** for **TIP 30B** for **TIP 30C**	 −40 −60 −80 −100			 V V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = −1A; I_B = −125mA			−0.7	V
$V_{BE\ (on)}$*	Base-emitter voltage	I_C = −1A V_{CE} = −4V			−1.3	V
h_{FE}*	DC current gain	I_C = −0.2A V_{CE} = −4V I_C = −1A V_{CE} = −4V	40 15		 75	— —
h_{fe}	Small signal current gain	I_C = −0.2A V_{CE} = −10V f = 1KHz I_C = −0.2A V_{CE} = −10V f = 1MHz	 20 3			 — —

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

TIP 31
TIP 31A
TIP 31B
TIP 31C

EPITAXIAL-BASE NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The TIP 31, TIP 31A, TIP 31B and TIP 31C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the TIP 32, TIP 32A, TIP 32B and TIP 32C.

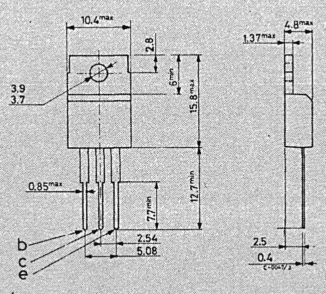
ABSOLUTE MAXIMUM RATINGS

		TIP 31	TIP 31A	TIP 31B	TIP 31C
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	3A			
I_{CM}	Collector peak current	5A			
I_B	Base-current	1A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 31** and **TIP 31A**					
		$V_{CE} = 30V$				0.3	mA
		for **TIP 31B** and **TIP 31C**					
		$V_{CE} = 60V$				0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP 31**	$V_{CE} = 40V$			0.2	mA
		for **TIP 31A**	$V_{CE} = 60V$			0.2	mA
		for **TIP 31B**	$V_{CE} = 80V$			0.2	mA
		for **TIP 31C**	$V_{CE} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$					
		for **TIP 31**		40			V
		for **TIP 31A**		60			V
		for **TIP 31B**		80			V
		for **TIP 31C**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$	$I_B = 375mA$			1.2	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = 3A$	$V_{CE} = 4V$			1.8	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE} = 4V$	25			—
		$I_C = 3A$	$V_{CE} = 4V$	10		50	—
h_{fe}	Small signal current gain	$I_C = 0.5A$ $f = 1KHz$	$V_{CE} = 10V$	20			—
		$I_C = 0.5A$ $f = 1MHz$	$V_{CE} = 10V$	3			—

* Pulsed: pulse duration = 300μs, duty cycle $\leqslant$2%.

TIP 32
TIP 32A
TIP 32B
TIP 32C

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The TIP 32, TIP 32A, TIP 32B and TIP 32C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the TIP 31, TIP 31A, TIP 31B and TIP 31C.

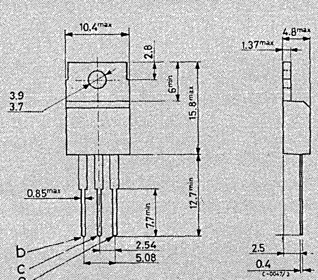
ABSOLUTE MAXIMUM RATINGS

		TIP 32	TIP 32A	TIP 32B	TIP 32C
V_{CBO}	Collector-base voltage ($I_C = 0$)	−40V	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−40V	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	−5V			
I_C	Collector current	−3A			
I_{CM}	Collector peak current	−5A			
I_B	Base-current	−1A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	40W			
	$T_{amb} \leqslant 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 32** and **TIP 32A** $V_{CE} = -30V$				−0.3	mA
		for **TIP 32B** and **TIP 32C** $V_{CE} = -60V$				−0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP 32**	$V_{CE} = -40V$			−0.2	mA
		for **TIP 32A**	$V_{CE} = -60V$			−0.2	mA
		for **TIP 32B**	$V_{CE} = -80V$			−0.2	mA
		for **TIP 32C**	$V_{CE} = -100V$			−0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$				−1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$					
		for **TIP 32**		−40			V
		for **TIP 32A**		−60			V
		for **TIP 32B**		−80			V
		for **TIP 32C**		−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -3A$	$I_B = -375mA$			−1.2	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -3A$	$V_{CE} = -4V$			−1.8	V
h_{FE}	DC current gain	$I_C = -1A$	$V_{CE} = -4V$	25			—
		$I_C = -3A$	$V_{CE} = -4V$	10		50	—
h_{fe}	Small signal current gain	$I_C = -0.5A$ f = 1KHz	$V_{CE} = -10V$	20			—
		$I_C = -0.5A$ f = 1MHz	$V_{CE} = -10V$	3			—

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

TIP 41
TIP 41A
TIP 41B
TIP 41C

EPITAXIAL-BASE NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The TIP 41, TIP 41A, TIP 41B, and TIP 41C are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package intended for use in medium power linear and switching applications.
The complementary PNP types are the TIP 42, TIP 42A, TIP 42B and TIP 42C respectively.

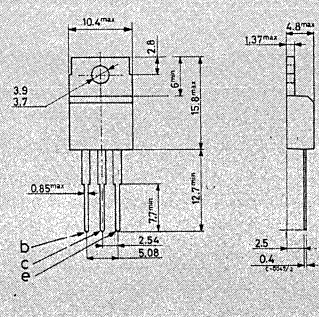
ABSOLUTE MAXIMUM RATINGS

		TIP41	TIP41A	TIP41B	TIP41C
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	6A			
I_{CM}	Collector peak current	10A			
I_B	Base current	3A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	65W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	–65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP41** and **TIP41A** $V_{CE} = 30V$			0.7	mA
		for **TIP41B** and **TIP41C** $V_{CE} = 60V$			0.7	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP41** $V_{CE} = 40V$			0.4	mA
		for **TIP41A** $V_{CE} = 60V$			0.4	mA
		for **TIP41B** $V_{CE} = 80V$			0.4	mA
		for **TIP41C** $V_{CE} = 100V$			0.4	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$				
		for **TIP41**	40			V
		for **TIP41A**	60			V
		for **TIP41B**	80			V
		for **TIP41C**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 6A$ $I_B = 0.6A$			1.5	V
V_{BE}*	Base-emitter voltage	$I_C = 6A$ $V_{CE} = 4V$			2	V
h_{FE}*	DC current gain	$I_C = 0.3A$ $V_{CE} = 4V$	30			—
		$I_C = 3A$ $V_{CE} = 4V$	15		75	—
h_{fe}	Small signal current gain	$I_C = 0.5A$ $V_{CE} = 10V$				
		f = 1KHz	20			—
		f = 1MHz	3			—

* Pulsed: pulse duration = 300μs, duty cycle ≤ 2%

TIP 42
TIP 42A
TIP 42B
TIP 42C

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

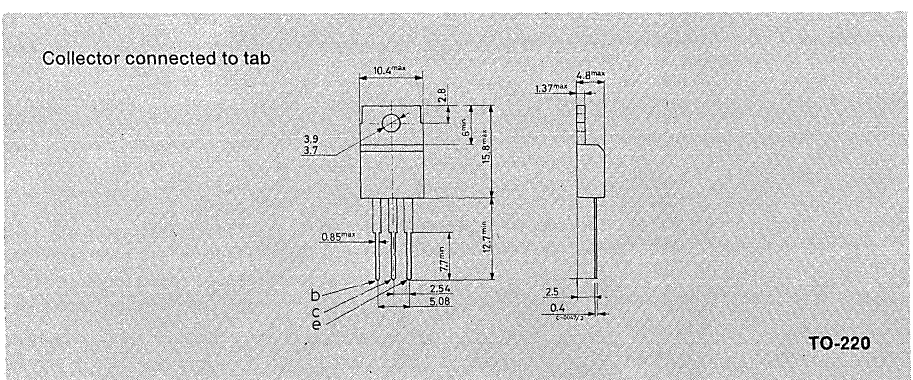
The TIP 42, TIP 42A, TIP 42B and TIP 42C are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the TIP 41, TIP 41A, TIP 41B and TIP 41C respectively.

ABSOLUTE MAXIMUM RATINGS

		TIP 42	TIP 42A	TIP 42B	TIP 42C
V_{CBO}	Collector-base voltage ($I_E = 0$)	−40V	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−40V	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	−5V			
I_C	Collector current	−6A			
I_{CM}	Collector peak current	−10A			
I_B	Base current	−3A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	65W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 42** and **TIP 42A** $V_{CE} = -30V$			−0.7	mA
		for **TIP 42B** and **TIP 42C** $V_{CE} = -60V$			−0.7	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP 42** $V_{CE} = -40V$			−0.4	mA
		for **TIP 42A** $V_{CE} = -60V$			−0.4	mA
		for **TIP 42B** $V_{CE} = -80V$			−0.4	mA
		for **TIP 42C** $V_{CE} = -100V$			−0.4	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			−1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$ for **TIP 42**	−40			V
		for **TIP 42A**	−60			V
		for **TIP 42B**	−80			V
		for **TIP 42C**	−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -6A$ $I_B = -0.6A$			−1.5	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -6A$ $V_{CE} = -4V$			−2	V
h_{FE}*	DC current gain	$I_C = -0.3A$ $V_{CE} = -4V$	30			—
		$I_C = -3A$ $V_{CE} = -4V$	15		75	—
h_{fe}	Small signal current gain	$I_C = -0.5A$ $V_{CE} = -10V$ f = 1KHz	20			—
		$I_C = -0.5A$ $V_{CE} = -10V$ f = 1MHz	3			—

* Pulsed: pulse duration = 300μs, duty cycle $\leqslant$2%.

TIP 100
TIP 101
TIP 102

EPITAXIAL-BASE NPN

POWER DARLINGTONS

The TIP 100, TIP 101 and TIP 102 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration mounted in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary PNP types are the TIP 105, TIP 106 and TIP 107 respectively.

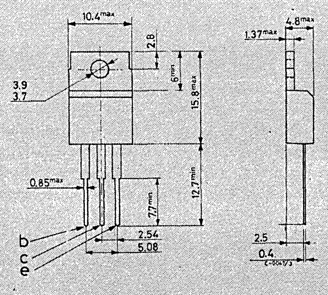
ABSOLUTE MAXIMUM RATINGS

		TIP 100	TIP 101	TIP 102
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		8A	
I_{CM}	Collector peak current		15A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		80W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 100** for **TIP 101** for **TIP 102**	$V_{CE} = 30V$ $V_{CE} = 40V$ $V_{CE} = 50V$			50 50 50	μA μA μA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 100** for **TIP 101** for **TIP 102**	$V_{CB} = 60V$ $V_{CB} = 80V$ $V_{CB} = 100V$			50 50 50	μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				8	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$ for **TIP 100** for **TIP 101** for **TIP 102**		 60 80 100			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$ $I_C = 8A$	$I_B = 6mA$ $I_B = 80mA$			2 2.5	V V
V_{BE}*	Base-emitter voltage	$I_C = 8A$	$V_{CE} = 4V$			2.8	V
h_{FE}*	DC current gain	$I_C = 3A$ $I_C = 8A$	$V_{CE} = 4V$ $V_{CE} = 4V$	1000 200		20000	— —
V_F*	Forward voltage of commutation diode ($I_B = 0$)	$I_F = -I_C = 10A$				2.8	V

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

TIP 105
TIP 106
TIP 107

EPITAXIAL-BASE PNP

POWER DARLINGTONS

The TIP 105, TIP 106 and TIP 107 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration mounted in Jedec TO-220 plastic package intended for use in power linear and switching applications.
The complementary NPN types are the TIP 100, TIP 101 and TIP 102 respectively.

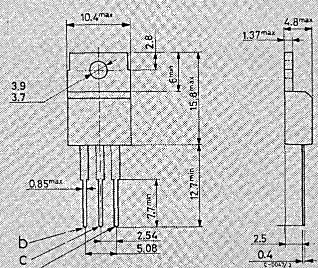
ABSOLUTE MAXIMUM RATINGS

		TIP 105	TIP 106	TIP 107
V_{CBO}	Collector-base voltage ($I_E = 0$)	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		−5V	
I_C	Collector current		−8A	
I_{CM}	Collector peak current		−15A	
I_B	Base current		−1A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		80W	
	$T_{amb} \leqslant 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 105**	$V_{CE} = -30V$			−50	μA
		for **TIP 106**	$V_{CE} = -40V$			−50	μA
		for **TIP 107**	$V_{CE} = -50V$			−50	μA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 105**	$V_{CB} = -60V$			−50	μA
		for **TIP 106**	$V_{CB} = -80V$			−50	μA
		for **TIP 107**	$V_{CB} = -100V$			−50	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$				−8	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$					
		for **TIP 105**		−60			V
		for **TIP 106**		−80			V
		for **TIP 107**		−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -3A$	$I_B = -6mA$			−2	V
		$I_C = -8A$	$I_B = -80mA$			−2.5	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -8A$	$V_{CE} = -4V$			−2.8	V
h_{FE}*	DC current gain	$I_C = -3A$	$V_{CE} = -4V$	1000		20000	—
		$I_C = -8A$	$V_{CE} = -4V$	200			—
V_F*	Forward voltage of commutation diode ($I_B = 0$)	$I_F = -I_C = 10A$				2.8	V

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

TIP 110
TIP 111
TIP 112

EPITAXIAL-BASE NPN

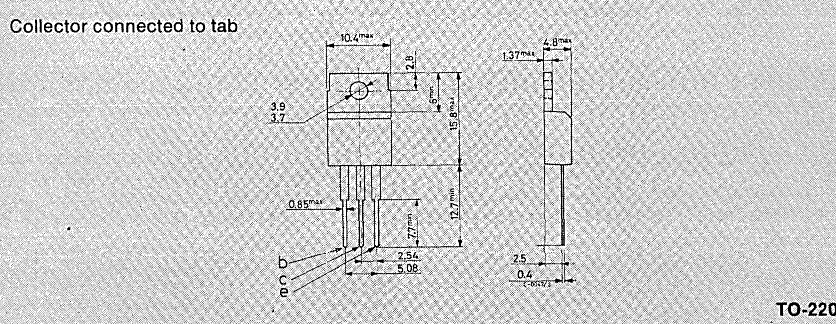
POWER DARLINGTONS

The TIP 110, TIP 111 and TIP 112 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the TIP 115, TIP 116 and TIP 117 respectively.

ABSOLUTE MAXIMUM RATINGS		TIP 110	TIP 111	TIP 112
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		2A	
I_{CM}	Collector peak current		4A	
I_B	Base current		50mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		50W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **TIP 110** for **TIP 111** for **TIP 112**	V_{CE} = 30V V_{CE} = 40V V_{CE} = 50V			2 2 2	mA mA mA
I_{CBO}	Collector cutoff current (I_E = 0)	for **TIP 110** for **TIP 111** for **TIP 112**	V_{CB} = 60V V_{CB} = 80V V_{CB} = 100V			1 1 1	mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V				2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C = 30mA for **TIP 110** for **TIP 111** for **TIP 112**		 60 80 100			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 8mA			2.5	V
$V_{BE\ (on)}$*	Base-emitter voltage	I_C = 2A	V_{CE} = 4V			2.8	V
h_{FE}*	DC current gain	I_C = 1A I_C = 2A	V_{CE} = 4V V_{CE} = 4V	1000 500			— —

* Pulsed: pulse duration = 300μs, duty cycle $\leqslant$2%.

TIP 115
TIP 116
TIP 117

EPITAXIAL-BASE PNP

POWER DARLINGTONS

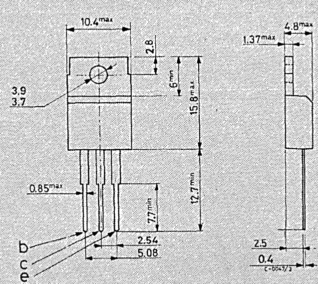
The TIP 115, TIP 116 and TIP 117 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the TIP 110, TIP 111 and TIP 112 respectively.

ABSOLUTE MAXIMUM RATINGS		TIP 115	TIP 116	TIP 117
V_{CBO}	Collector-base voltage ($I_E = 0$)	$-60V$	$-80V$	$-100V$
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	$-60V$	$-80V$	$-100V$
V_{EBO}	Emitter-base voltage ($I_C = 0$)		$-5V$	
I_C	Collector current		$-2A$	
I_{CM}	Collector peak current		$-4A$	
I_B	Base current		$-50mA$	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		50W	
	$T_{amb} \leqslant 25°C$		2W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 115**	$V_{CE} = -30V$			−2	mA
		for **TIP 116**	$V_{CE} = -40V$			−2	mA
		for **TIP 117**	$V_{CE} = -50V$			−2	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 115**	$V_{CB} = -60V$			−1	mA
		for **TIP 116**	$V_{CB} = -80V$			−1	mA
		for **TIP 117**	$V_{CB} = -100V$			−1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$				−2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$					
		for **TIP 115**		−60			V
		for **TIP 116**		−80			V
		for **TIP 117**		−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -2A$	$I_B = -8mA$			−2,5	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -2A$	$V_{CE} = -4V$			−2.8	V
h_{FE}*	DC current gain	$I_C = -1A$	$V_{CE} = -4V$	1000			—
		$I_C = -2A$	$V_{CE} = -4V$	500			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

TIP 120
TIP 121
TIP 122

EPITAXIAL-BASE NPN

POWER DARLINGTONS

The TIP 120, TIP 121 and TIP 122 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary PNP types are the TIP 125, TIP 126 and TIP 127 respectively.

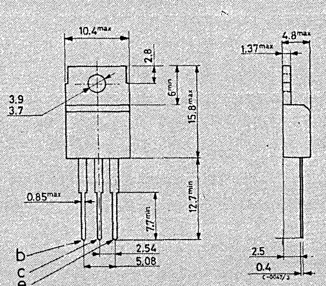
ABSOLUTE MAXIMUM RATINGS

		TIP 120	TIP 121	TIP 122
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		5A	
I_{CM}	Collector peak current		8A	
I_B	Base current		0.1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		65W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 120**	$V_{CE} = 30V$			0.5	mA
		for **TIP 121**	$V_{CE} = 40V$			0.5	mA
		for **TIP 122**	$V_{CE} = 50V$			0.5	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 120**	$V_{CB} = 60V$			0.2	mA
		for **TIP 121**	$V_{CB} = 80V$			0.2	mA
		for **TIP 122**	$V_{CB} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$					
		for **TIP 120**		60			V
		for **TIP 121**		80			V
		for **TIP 122**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$	$I_B = 12mA$			2	V
		$I_C = 5A$	$I_B = 20mA$			4	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = 3A$	$V_{CE} = 3V$			2.5	V
h_{FE}*	DC current gain	$I_C = 0.5A$	$V_{CE} = 3V$	1000			—
		$I_C = 3A$	$V_{CE} = 3V$	1000			—

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

TIP 125
TIP 126
TIP 127

EPITAXIAL-BASE PNP

POWER DARLINGTONS

The TIP 125, TIP 126 and TIP 127 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary NPN types are the TIP 120, TIP 121 and TIP 122 respectively.

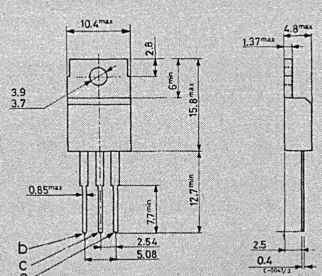
ABSOLUTE MAXIMUM RATINGS

		TIP 125	TIP 126	TIP 127
V_{CBO}	Collector-base voltage ($I_E = 0$)	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		−5V	
I_C	Collector current		−5A	
I_{CM}	Collector peak current		−8A	
I_B	Base current		−0.1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		65W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 125**	$V_{CE} = -30V$			−0.5	mA
		for **TIP 126**	$V_{CE} = -40V$			−0.5	mA
		for **TIP 127**	$V_{CE} = -50V$			−0.5	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 125**	$V_{CB} = -60V$			−0.2	mA
		for **TIP 126**	$V_{CB} = -80V$			−0.2	mA
		for **TIP 127**	$V_{CB} = -100V$			−0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$				−2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -30mA$					
		for **TIP 125**		−60			V
		for **TIP 126**		−80			V
		for **TIP 127**		−100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -3A$	$I_B = -12mA$			−2	V
		$I_C = -5A$	$I_B = -20mA$			−4	V
$V_{BE\ (on)}$*	Base-emitter voltage	$I_C = -3A$	$V_{CE} = -3V$			−2.5	V
h_{FE}*	DC current gain	$I_C = -0.5A$	$V_{CE} = -3V$	1000			—
		$I_C = -3A$	$V_{CE} = -3V$	1000			—

*Pulsed: pulse duration = 300μs, duty cycle ≤ 2%.

TIP 130
TIP 131
TIP 132

EPITAXIAL-BASE NPN

POWER DARLINGTONS

The TIP130, TIP131 and TIP 132 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration mounted in Jedec T0-220 plastic package intended for use in power linear and switching applications.
The complementary PNP types are the TIP 135, TIP 136 and TIP 137 respectively.

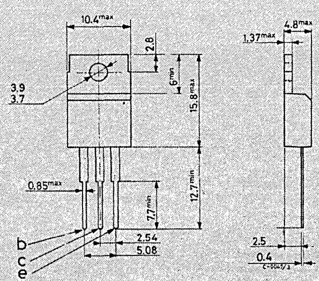
ABSOLUTE MAXIMUM RATINGS

		TIP 130	TIP 131	TIP 132
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		8A	
I_{CM}	Collector peak current		12A	
I_B	Base current		0.3A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		70W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		–65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.78	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 130** for **TIP 131** for **TIP 132**	$V_{CE} = 30V$ $V_{CE} = 40V$ $V_{CE} = 50V$			0.5 0.5 0.5	mA mA mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 130** for **TIP 131** for **TIP 132**	$V_{CB} = 60V$ $V_{CB} = 80V$ $V_{CB} = 100V$			0.2 0.2 0.2	mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$ for **TIP 130** for **TIP 131** for **TIP 132**		 60 80 100			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 4A$ $I_C = 6A$	$I_B = 16mA$ $I_B = 30mA$			2 3	V V
V_{BE}*	Base-emitter voltage	$I_C = 4A$	$V_{CE} = 4V$			2.5	V
h_{FE}*	DC current gain	$I_C = 1A$ $I_C = 4A$	$V_{CE} = 4V$ $V_{CE} = 4V$	500 1000		 15000	— —

* Pulsed: pulse duration = 300μs, duty cycle ≤2%

TIP 135
TIP 136
TIP 137

EPITAXIAL-BASE PNP

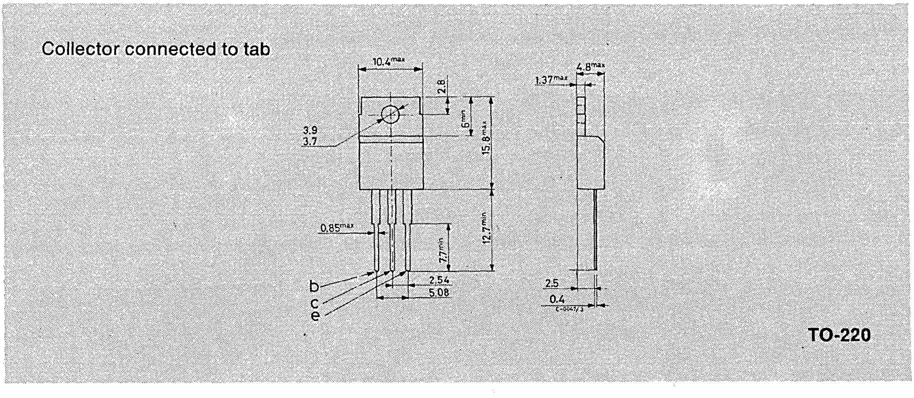
The TIP 135, TIP 136 and TIP 137 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary NPN types are the TIP 130, TIP 131 and TIP 132 respectively.

ABSOLUTE MAXIMUM RATINGS

		TIP 135	TIP 136	TIP 137
V_{CBO}	Collector-base voltage ($I_E = 0$)	−60V	−80V	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−60V	−80V	−100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		−5V	
I_C	Collector current		−8A	
I_{CM}	Collector peak current		−12A	
I_B	Base current		−0.3A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		70W	
	$T_{amb} \leq 25°C$		2W	
T_{stg}	Storage temperature		−65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.78	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **TIP 135** for **TIP 136** for **TIP 137**	V_{CE} = −30V V_{CE} = −40V V_{CE} = −50V			−0.5 −0.5 −0.5	mA mA mA
I_{CBO}	Collector cutoff current (I_E = 0)	for **TIP 135** for **TIP 136** for **TIP 137**	V_{CB} = −60V V_{CB} = −80V V_{CB} = −100V			−0.2 −0.2 −0.2	mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = −5V				−5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C = −30mA for **TIP 135** for **TIP 136** for **TIP 137**		 −60 −80 −100			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = −4A I_C = −6A	I_B = −16mA I_B = −30mA			−2 −3	V V
$V_{BE\ (on)}$*	Base-emitter voltage	I_C = −4A	V_{CE} = −4V			−2.5	V
h_{FE}*	DC current gain	I_C = −1A I_C = −4A	V_{CE} = −4V V_{CE} = −4V	500 1000		 15000	— —

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

2N 3055

SINGLE-DIFFUSED MESA NPN

POWER LINEAR AND SWITCHING APPLICATIONS

The 2N 3055 is a silicon single-diffused mesa NPN transistor in Jedec TO-3 metal case. It is intended for power switching circuits, series and shunt regulators output stages and high fidelity amplifiers.

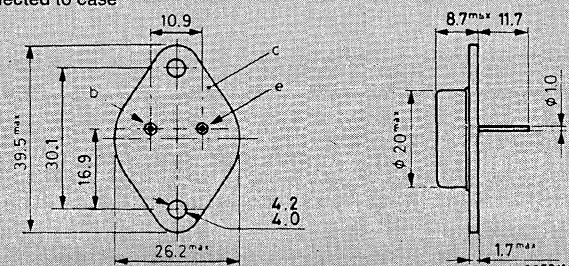
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	70	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	115	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 100 V V_{CE} = 100 V T_{case} = 150°C			5 30	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30 V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CER\ (sus)}$*	Collector-emitter sust. voltage (R_{BE} = 100Ω)	I_C = 200 mA	70			V
$V_{CEO\ (sus)}$*	Collector-emitter sust. voltage (I_B = 0)	I_C = 200 mA	60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_B = 400mA I_C = 10 A I_B = 3.3A			1 3	V V
V_{BE}*	Base-emitter voltage	I_C = 4 A V_{CE} = 4 V			1.5	V
h_{FE}*	DC current gain Group 4 Group 5 Group 6 Group 7	 I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 4 A V_{CE} = 4 V I_C = 10 A V_{CE} = 4 V	 20 35 60 120 20 5		 50 75 145 250 70 	 — — — — — —
h_{FE1}/h_{FE2}*	Matched pair	I_C = 0.5 A V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	0.8			MHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 40 V	2.87			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

2N 3055E

EPITAXIAL-BASE NPN

POWER LINEAR AND SWITCHING APPLICATIONS

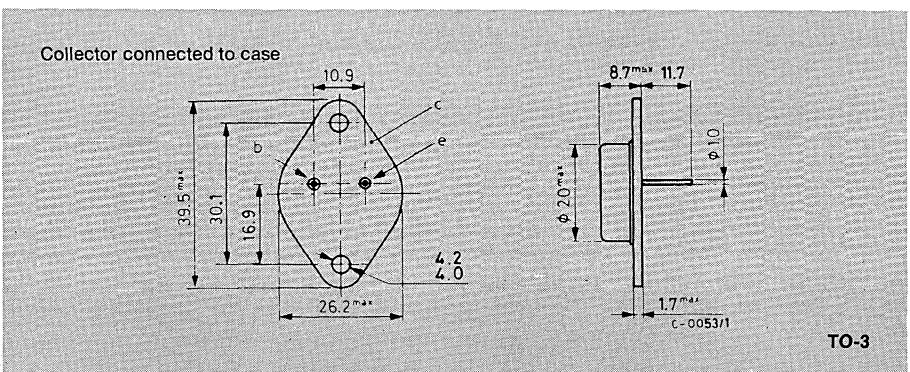
The 2N 3055E is a silicon epitaxial-base NPN transistor in Jedec TO-3 metal case. It is intended for power switching circuits, series and shunt regulators, output stages and high fidelity amplifiers.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	70	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	115	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

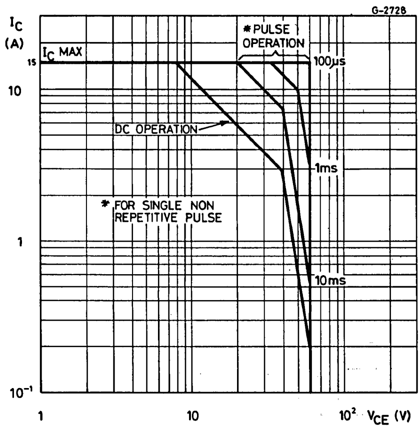
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

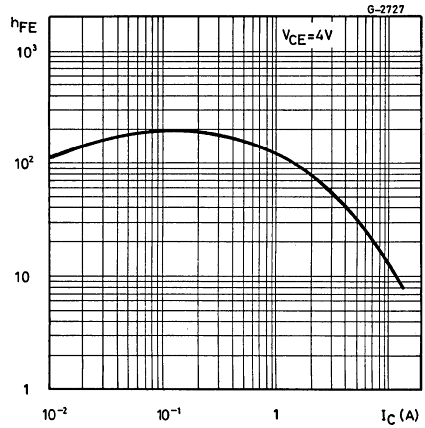
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 100 V V_{CE} = 100 V T_{case} = 150°C			1 5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30 V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CER\ (sus)}$*	Collector-emitter sust. voltage (R_{BE} = 100Ω)	I_C = 200 mA	70			V
$V_{CEO\ (sus)}$*	Collector-emitter sust. voltage (I_B = 0)	I_C = 200 mA	60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_B = 400mA I_C = 10 A I_B = 3.3A			1 3	V V
V_{BE}*	Base-emitter voltage	I_C = 4 A V_{CE} = 4 V			1.5	V
h_{FE}*	DC current gain Group 4 Group 5 Group 6 Group 7	 I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 0.5 A V_{CE} = 4 V I_C = 4 A V_{CE} = 4 V I_C = 10 A V_{CE} = 4 V	 20 35 60 120 20 5		 50 75 145 250 70	 — — — — — —
h_{FE1}/h_{FE2}*	Matched pair	I_C = 0.5 A V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	2.5			MHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 40 V	2.87			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

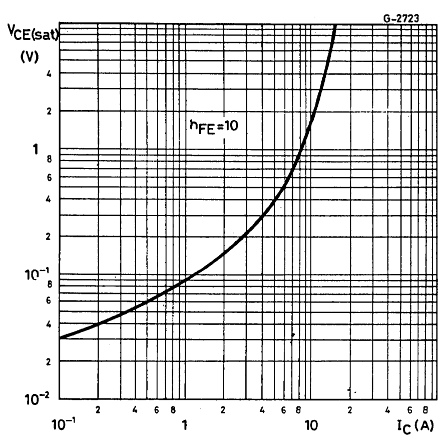
Safe operating areas



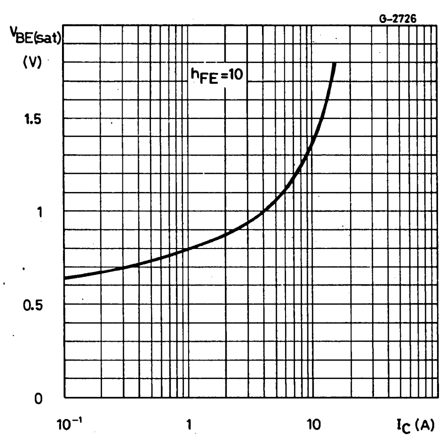
DC current gain



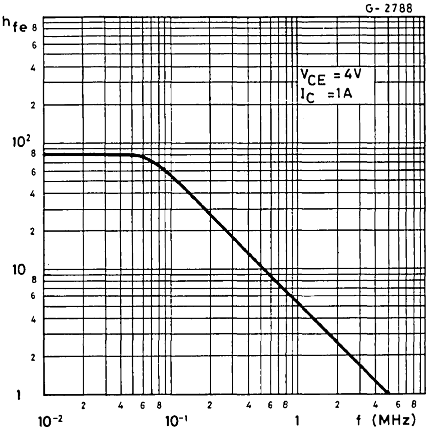
Collector-emitter saturation voltage



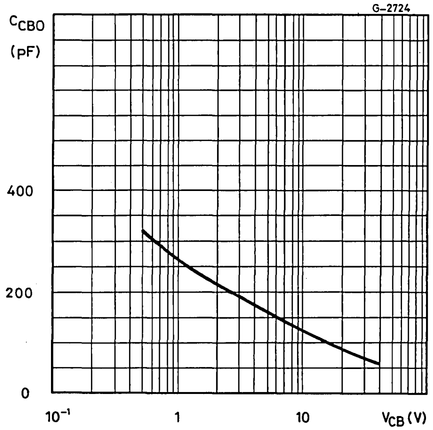
Base-emitter saturation voltage



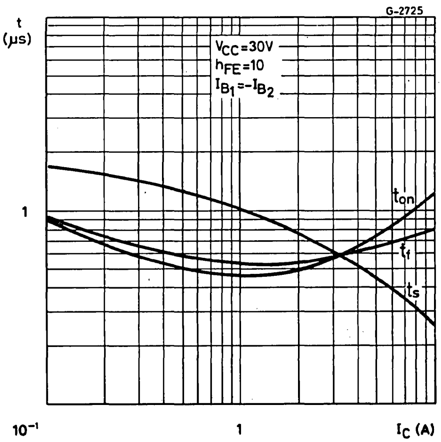
Small signal current gain



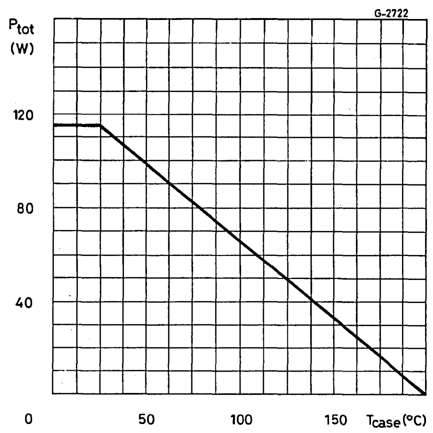
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 3418
2N 3419
2N 3420
2N 3421

EPITAXIAL PLANAR NPN

HIGH FREQUENCY MEDIUM POWER TRANSISTORS

The 2N3418, 2N3419, 2N3420 and 2N3421 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case.
They are intended for driver circuits, switching and amplifier applications.

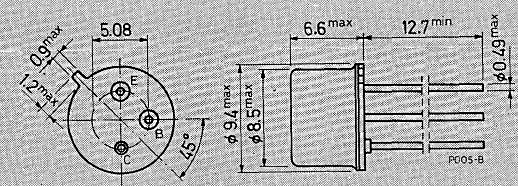
ABSOLUTE MAXIMUM RATINGS

		2N3418 2N3420	2N3419 2N3421
V_{CBO}	Collector-base voltage ($I_E = 0$)	85V	125V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8V	
I_C	Collector current	3A	
I_{CM}	Collector peak current	5A	
I_B	Base current	1A	
P_{tot}	Total power dissipation at $T_{case} \leq 100°C$	15W	
	$T_{amb} \leq 25°C$	1W	
T_{stg}	Storage temperature	–65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	6.7	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = –0.5V)	for **2N3418** and **2N3420** V_{CE} = 80V			0.5	μA
		for **2N3419** and **2N3421** V_{CE} = 120V			0.5	μA
		T_{case} = 150°C for **2N3418** and **2N3420** V_{CE} = 80V			50	μA
		for **2N3419** and **2N3421** V_{CE} = 120V			50	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V			0.5	μA
		V_{EB} = 8V			10	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 50mA for **2N3418** and **2N3420**	60			V
		for **2N3419** and **2N3421**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1A I_B = 100mA			0.25	V
		I_C = 2A I_B = 200mA			0.5	V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_B = 100mA I_C = 1A			1.2	V
		I_B = 200mA I_C = 2A			1.4	V
h_{FE}*	DC current gain	I_C = 100mA V_{CE} = 2V				
		for **2N3418** and **2N3419**	20			—
		for **2N3420** and **2N3421**	40			—
		I_C = 1A V_{CE} = 2V				
		for **2N3418** and **2N3419**	20		60	—
		for **2N3420** and **2N3421**	40		120	—
		I_C = 2A V_{CE} = 2V				
		for **2N3418** and **2N3419**	15			—
		for **2N3420** and **2N3421**	30			—
		I_C = 5A V_{CE} = 5V				
		for **2N3418** and **2N3419**	10			—
		for **2N3420** and **2N3421**	15			—
		T_{case} = –55°C all types I_C = 1A V_{CE} = 2V	10			—
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10V f = 1MHz			150	pF
f_T	Transition frequency	I_C = 100mA V_{CE} = 10V f = 20MHz	40			MHz
t_{on}	Turn on time	I_C = 1A I_{B1} = $-I_{B2}$ = 100mA V_{CC} = 30V		165	300	ns
t_{off}	Turn off time			540	1200	ns
t_{on}	Turn on time	I_C = 2A I_{B1} = $-I_{B2}$ = 200mA V_{CC} = 30V		200		ns
t_{off}	Turn off time			350		ns

* Pulsed pulse duration = 300 μs, duty cycle $\leqslant$2%

EPITAXIAL PLANAR NPN

2N 3439
2N 3440

HIGH VOLTAGE TRANSISTORS

The 2N3439, 2N3440 are high voltage silicon epitaxial planar transistors designed for use in consumer and industrial line-operated applications. These devices are particularly suited as drivers in high-voltage low current inverters, switching and series regulators.

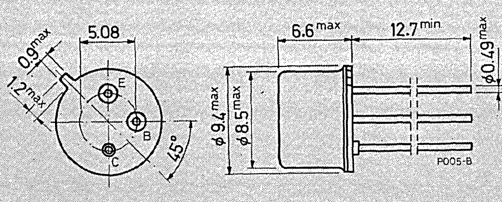
ABSOLUTE MAXIMUM RATINGS

		2N3439	2N3440
V_{CBO}	Collector-base voltage ($I_E = 0$)	450V	300V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	350V	250V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	1A	
I_B	Base current	0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10W	
	$T_{amb} \leq 50°C$	1W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

2N 3439
2N 3440

THERMAL DATA

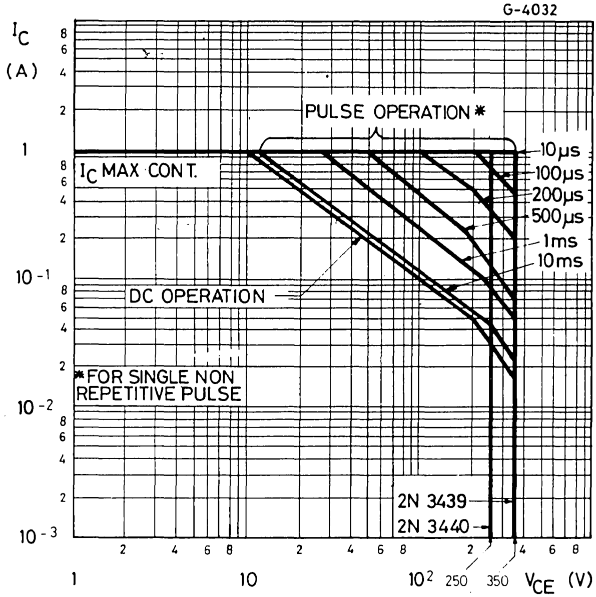
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	150	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

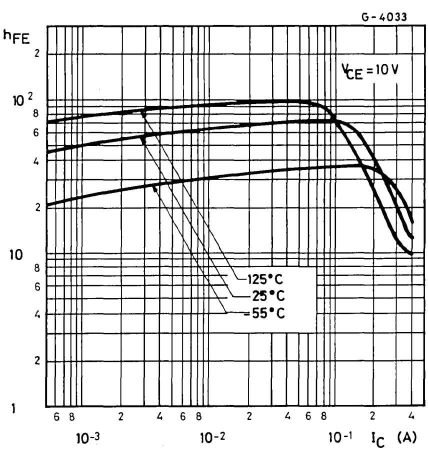
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N3439** $V_{CB} = 360V$ for **2N3440** $V_{CB} = 250V$			20 20	µA µA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N3439** $V_{CE} = 300V$ for **2N3440** $V_{CE} = 200V$			20 50	µA µA
I_{CEX}	Collector cutoff current ($V_{BE} = -1,5V$)	for **2N3439** $V_{CE} = 450V$ for **2N3440** $V_{CE} = 300V$			500 500	µA µA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 6V$			20	µA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 50mA$ for **2N3439** for **2N3440**	 350 250			 V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 50mA$ $I_B = 4mA$			0.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 50mA$ $I_B = 4mA$			1.3	V
C_{ob}	Output capacitance	$V_{CB} = 10V$, f = 1MHz			10	pF
h_{FE}*	DC current gain	$I_C = 20mA$ $V_{CE} = 10V$ for **2N3439** $I_C = 2mA$ $V_{CE} = 10V$	40 30		160	– –
h_{fe}	Small signal current gain	$I_C = 5mA$ $V_{CE} = 10V$ f = 1KHz	25			–
f_T	Transition frequency	$I_C = 10mA$ $V_{CE} = 10V$ f = 5MHz	15			MHz

* Pulsed: pulse duration = 300 µs, duty cycle ≤ 2%

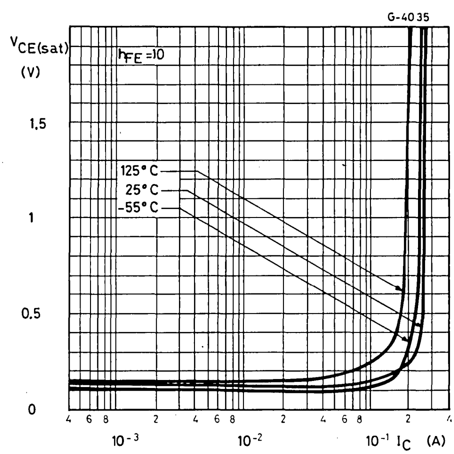
Safe operating areas



DC current gain

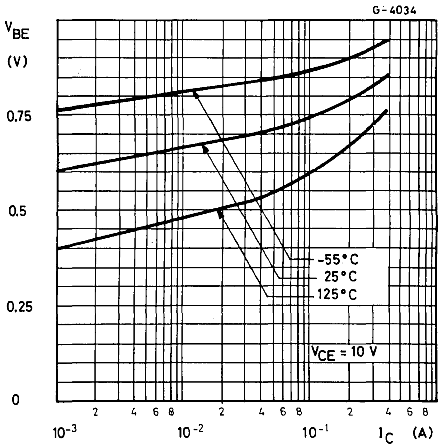


Collector-emitter saturation voltage

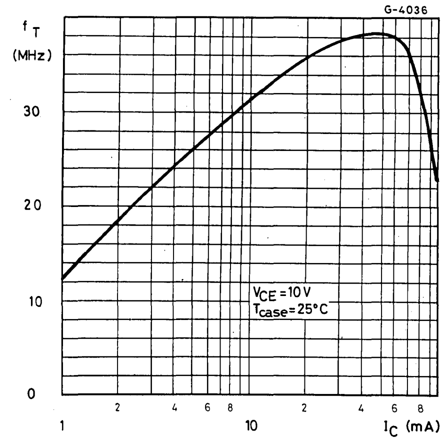


2N 3439
2N 3440

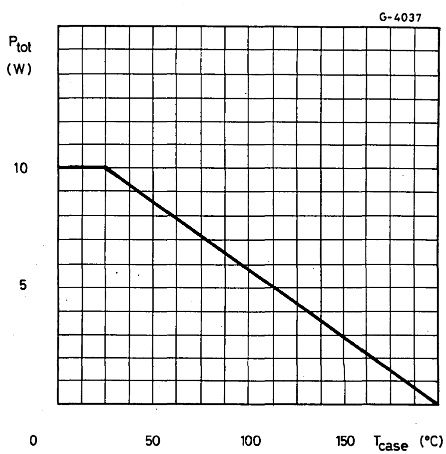
Base emitter voltage



Transition frequency



Power rating chart



EPITAXIAL-BASE NPN

2N 3713
2N 3714
2N 3715
2N 3716

POWER LINEAR AND SWITCHING APPLICATIONS

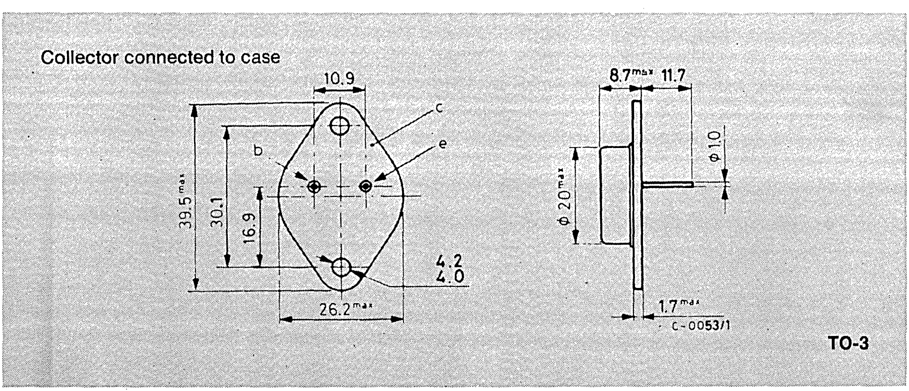
The 2N 3713, 2N 3714, 2N 3715 and 2N 3716 are silicon epitaxial-base NPN power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the 2N 3789, 2N 3790, 2N 3791 and 2N 3792 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N3713 2N3715	2N3714 2N3716
V_{CBO}	Collector-base voltage ($I_E = 0$)	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	10A	
I_B	Base current	4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

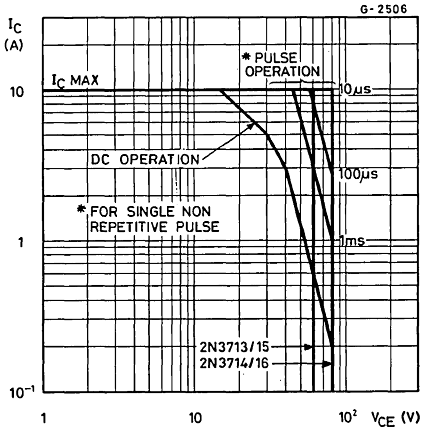
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

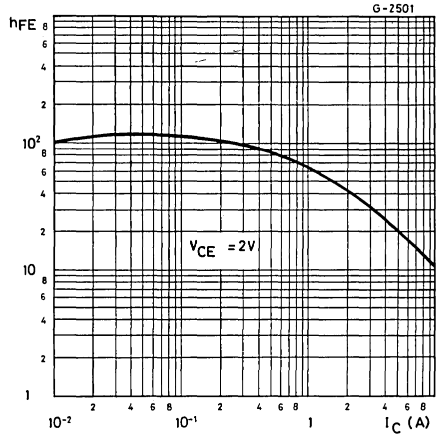
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 80 V for **2N3713** and **2N3715**			1	mA
		V_{CE} = 100 V for **2N3714** and **2N3716**			1	mA
		T_{case} = 150 °C V_{CE} = 60 V for **2N3713** and **2N3715**			10	mA
		V_{CE} = 80 V for **2N3714** and **2N3716**			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200 mA for **2N3713** and **2N3715**	60			V
		for **2N3714** and **2N3716**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 0.5A for **2N3713** and **2N3714**			1	V
		for **2N3715** and **2N3716**			0.8	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 5 A I_B = 0.5A for **2N3713** and **2N3714**			2	V
		for **2N3715** and **2N3716**			1.5	V
V_{BE}*	Base-emitter voltage	I_C = 3 A V_{CE} = 2 V			1.5	V
h_{FE}*	DC current gain	I_C = 1 A V_{CE} = 2 V for **2N3713** and **2N3714**	25		90	—
		for **2N3715** and **2N3716**	50		150	—
		I_C = 3 A V_{CE} = 2 V for **2N3713** and **2N3714**	15			—
		for **2N3715** and **2N3716**	30		120	—
		I_C = 10 A V_{CE} = 4 V	5			—
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 10 V	4			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

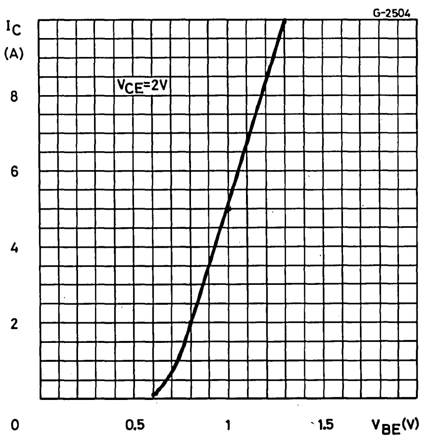
Safe operating areas



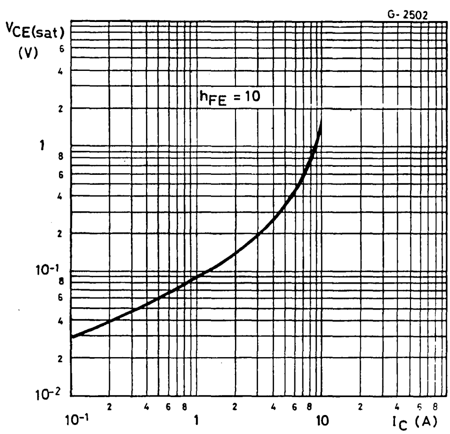
DC current gain



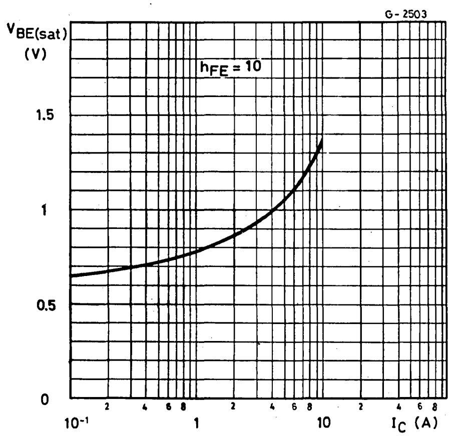
DC transconductance



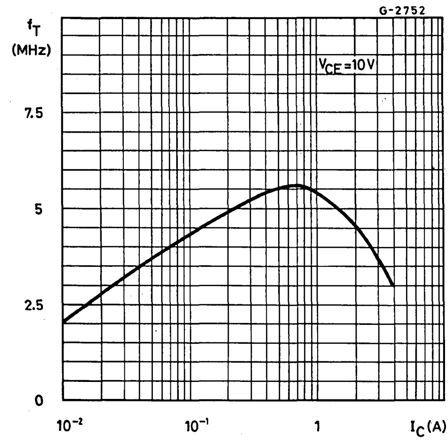
Collector-emitter saturation voltage



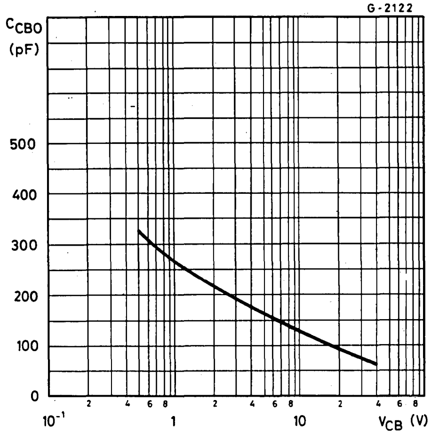
Base-emitter saturation voltage



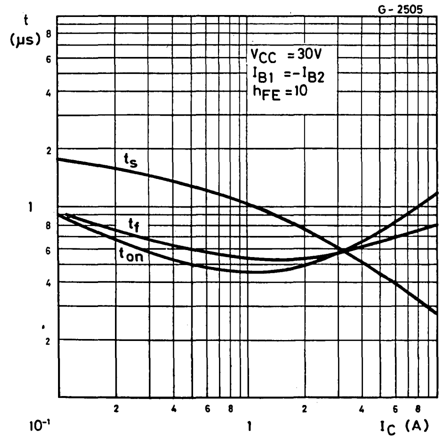
Transition frequency



Collector-base capacitance



Saturated switching characteristics



EPITAXIAL-BASE PNP

2N 3789
2N 3790
2N 3791
2N 3792

POWER LINEAR AND SWITCHING APPLICATIONS

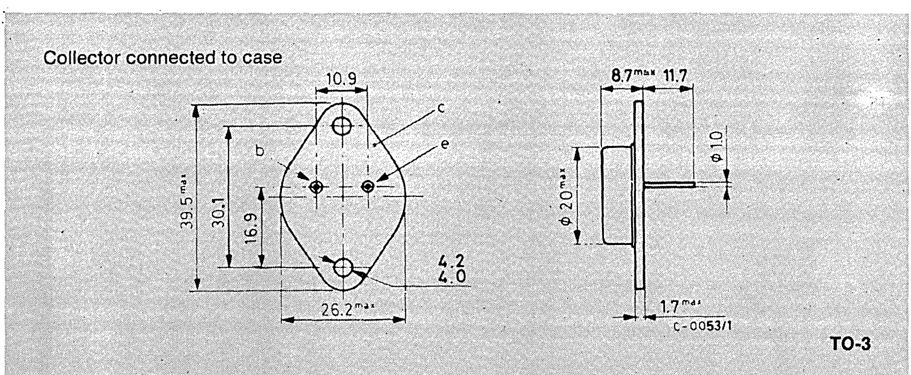
The 2N 3789, 2N 3790, 2N 3791 and 2N 3792 are silicon epitaxial-base PNP power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the 2N 3713, 2N 3714, 2N 3715 and 2N 3716 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N3789 2N3791	2N3790 2N3792
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-7V	
I_C	Collector current	-10A	
I_B	Base current	-4A	
P_{tot}	Total power dissipation $T_{case} \leqslant 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



THERMAL DATA

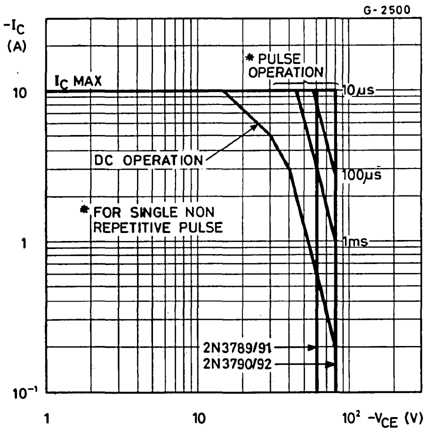
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

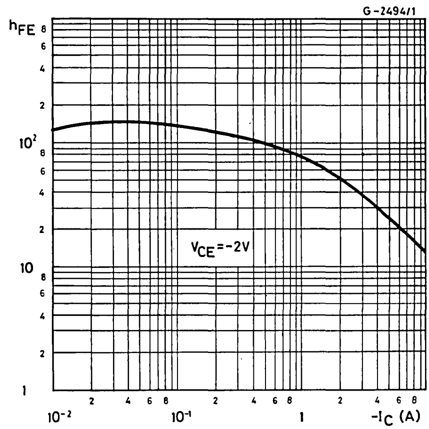
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector-emitter cutoff current (V_{BE} = 1.5 V)	V_{CE} = -60 V for **2N3789** and **2N3791**			-1	mA
		V_{CE} = -80 V for **2N3790** and **2N3792**			-1	mA
		T_{case} = 150 °C V_{CE} = -60 V for **2N3789** and **2N3791**			-5	mA
		V_{CE} = -80 V for **2N3790** and **2N3792**			-5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -7 V			-5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -200 mA for **2N3789** and **2N3791**	-60			V
		for **2N3790** and **2N3792**	-80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -4 A I_B = -0.4A for **2N3789** and **2N3790**			-1	V
		I_C = -5 A I_B = -0.5A for **2N3791** and **2N3792**			-1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -4 A I_B = -0.4A for **2N3789** and **2N3790**			-2	V
		I_C = -5 A I_B = -0.5A for **2N3791** and **2N3792**			-1.5	V
h_{FE}*	DC current gain	I_C = -1 A V_{CE} = -2 V for **2N3789** and **2N3790**	25		90	—
		for **2N3791** and **2N3792**	50		150	—
		I_C = -3 A V_{CE} = -2 V for **2N3789** and **2N3790**	15			—
		for **2N3791** and **2N3792**	30		120	—
		I_C = -10A V_{CE} = -4 V	5			—
f_T	Transition frequency	I_C = -0.5A V_{CE} = -10 V	4			MHz

* Pulsed: pulse duration = 300 μs, duty cycle =

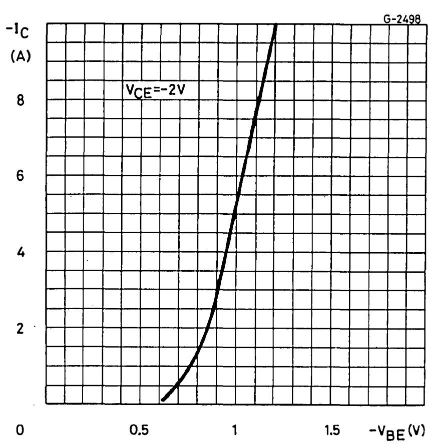
Safe operating areas



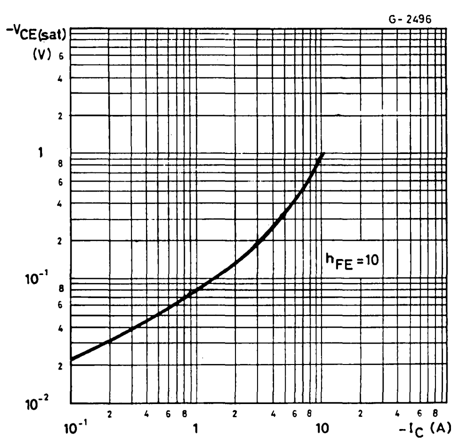
DC current gain



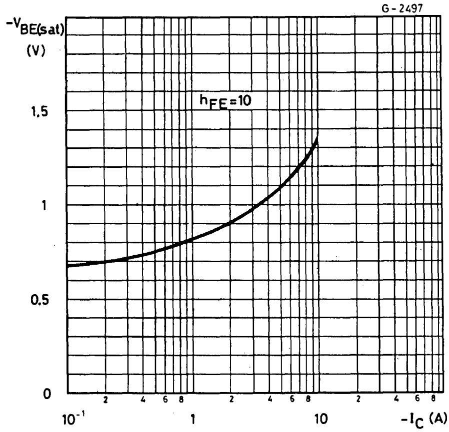
DC transconductance



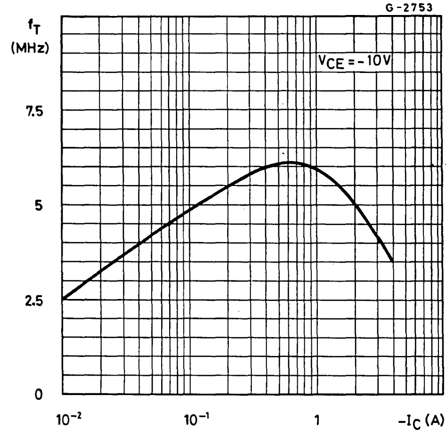
Collector-emitter saturation voltage



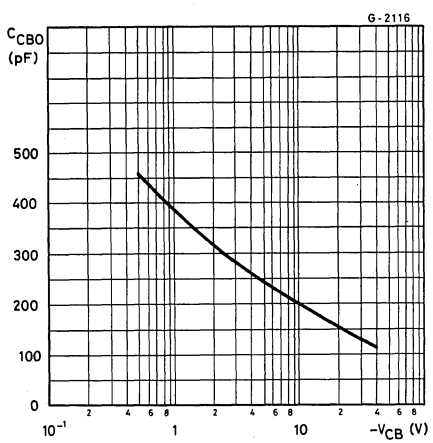
Base-emitter saturation voltage



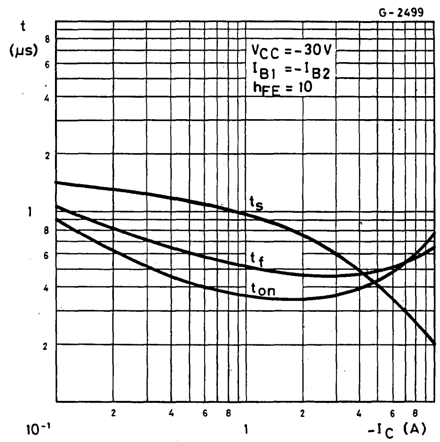
Transition frequency



Collector-base capacitance



Saturated switching characteristics



2N 3867
2N 3868
2N 6303

EPITAXIAL PLANAR PNP

GENERAL PURPOSE TRANSISTORS

The 2N 3867, 2N 3868 and 2N 6303 are silicon epitaxial planar PNP transistors in Jedec TO-39 metal case.
They are intended for switching and power amplifier applications up to 3A.

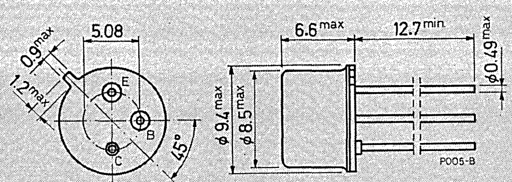
ABSOLUTE MAXIMUM RATINGS

		2N3867	2N3868	2N6303
V_{CBO}	Collector-base voltage ($I_E = 0$)	-40V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-40V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-4V	
I_C	Collector current		-3A	
I_{CM}	Collector peak current		-10A	
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$		1W	
	$T_{case} \leq 25°C$		6W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

2N 3867
2N 3868
2N 6303

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	29	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

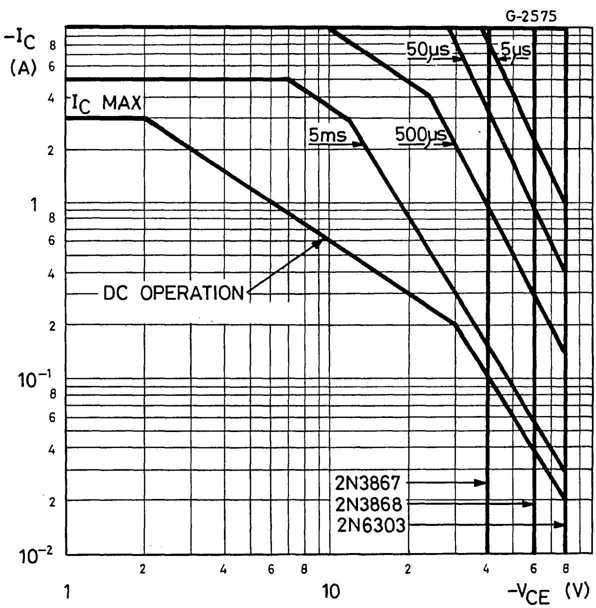
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current ($V_{BE} = 2V$)	for **2N3867** V_{CE} = -40 V for **2N3868** V_{CE} = -60 V for **2N6303** V_{CE} = -80 V			-1 -1 -1	μA μA μA
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = V_{CE}$ max T_{case} = 150 °C			-150	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_E = 0$)	I_C = -20 mA for **2N3867** for **2N3868** for **2N6303**	 -40 -60 -80			 V V V
V_{CBO}	Collector-base voltage ($I_E = 0$)	I_C = -0.1 mA for **2N3867** for **2N3868** for **2N6303**	 -40 -60 -80			 V V V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	I_E = -0.1 mA	-4			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -0.5A I_B = -0.05A I_C = -1.5A I_B = -0.15A I_C = -2.5A I_B = -0.25A			-0.5 -0.75 -1.3	V V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -0.5A I_B = -0.05A I_C = -1.5A I_B = -0.15A I_C = -2.5A I_B = -0.25A			-1 -1.4 -2	V V V
h_{FE}*	DC current gain	I_C = -0.5A V_{CE} = -1V for **2N3867** for **2N3868** and **2N6303** I_C = -1.5A V_{CE} = -2V for **2N3867** for **2N3868** and **2N6303** I_C = -2.5A V_{CE} = -3V for **2N3867** for **2N3868** and **2N6303** I_C = -3A V_{CE} = -5V for **2N3867**	 50 35 40 30 25 20 20		 200 150	 — — — — — — —

ELECTRICAL CHARACTERISTICS (continued)

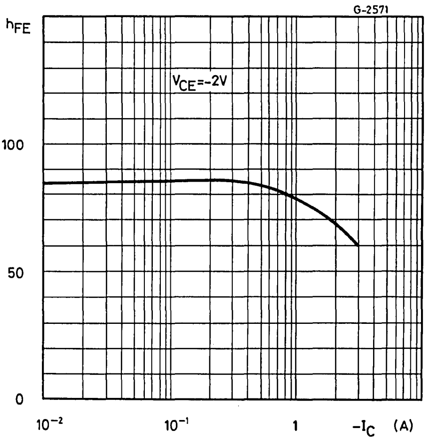
Parameter		Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C = -0.1A V_{CE} = -5V	60	MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = -10V f = 0.1 MHz	120	pF
t_{on}	Turn-on time	I_C = -1.5A V_{CC} = -30V I_{B1} = -0.15A	100	ns
t_s	Storage time	I_C = -1.5A V_{CC} = -30V I_{B1} = $-I_{B2}$ = -0.15A	325	ns
t_f	Fall time		75	ns

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

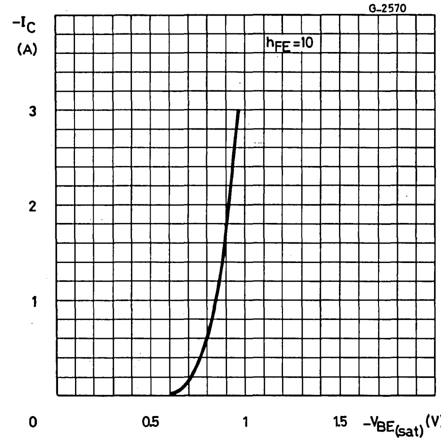
Safe operating areas



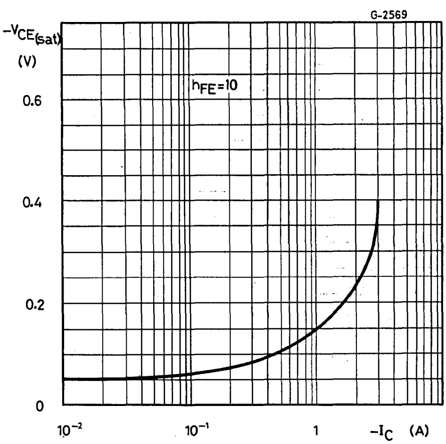
DC current gain



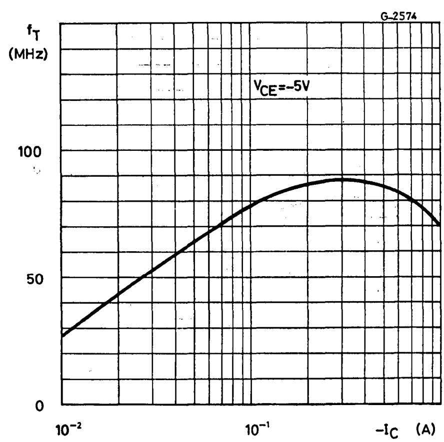
DC transconductance



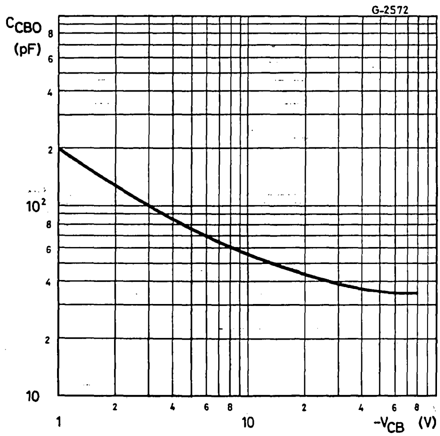
Collector-emitter saturation voltage



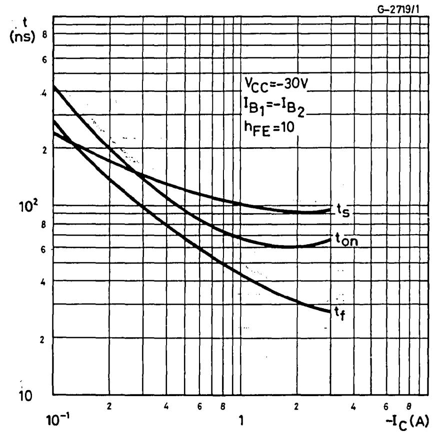
Transition frequency



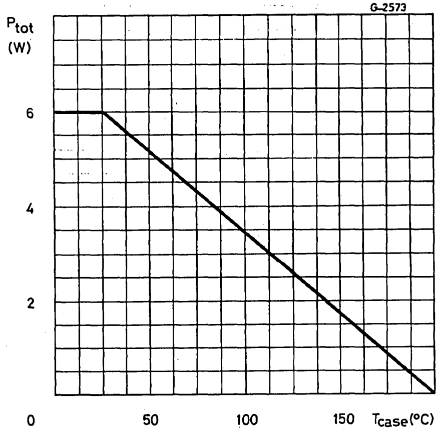
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 4150

EPITAXIAL PLANAR NPN

HIGH SPEED POWER TRANSISTORS

The 2N4150 is a silicon epitaxial planar NPN transistor in Jedec TO-39 metal case, with very low saturation voltage and high gain, particularly intended as driver in power switching applications.

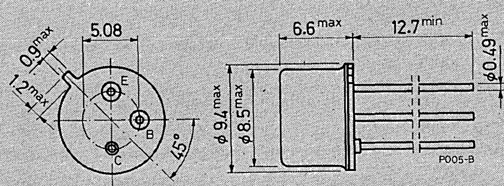
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	70	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_{CM}	Collector peak current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 100°C$	5	W
	$T_{amb} \leq 25°C$	1.5	W
T_{stg}	Storage temperature	–65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	20	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	117	°C/W

ELECTRICAL CHARACTERISTICS (at $T_{case}=25°C$ unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 80V$				0.1	μA
I_{CEV}	Collector cutoff current ($V_{EB}=0{,}5V$)	$V_{CE} = 100V$				10	μA
		$T_{case} = 150°C$ $V_{CE} = 80V$				100	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 60V$				10	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				0.1	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$		70			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$	$I_B = 0.5A$			0.6	V
		$I_C = 10A$	$I_B = 1A$			2.5	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 5A$	$I_B = 0.5A$			1.5	V
		$I_C = 10A$	$I_B = 1A$			2.5	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE} = 5V$	50		120	—
		$I_C = 5A$	$V_{CE} = 5V$	40			—
		$I_C = 10A$	$V_{CE} = 5V$	10			—
		$T_{case} = -55°C$ $I_C = 5A$	$V_{CE} = 5V$	20			—

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{fe}	Small signal current gain	$I_C = 50mA$ $V_{CE} = 5V$ $f = 1KHz$	40		160	—
f_T	Transition frequency	$I_C = 0.2A$ $V_{CE} = 10V$ $f = 10MHz$	15		75	MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10V$ $f = 1MHz$			350	pF
t_r	Rise time	$I_C = 5A$ $V_{CC} = 20V$ $I_{B1} = -I_{B2} = 0.5A$			0.5	μs
t_d	Delay time				50	ns
t_s	Storage time				1.5	μs
t_f	Fall time				0.5	μs

* Pulsed: pulse duration = $300\mu s$, duty cycle $\leqslant 2\%$.

EPITAXIAL PLANAR PNP

2N 4234
2N 4235
2N 4236

MEDIUM POWER GENERAL PURPOSE TRANSISTORS

The 2N4234, 2N4235 and 2N4236 are silicon epitaxial planar PNP transistors in Jedec TO-39 metal case.
They are intended for use in switching and amplifier applications.
The complementary NPN types are the 2N4237, 2N4238 and 2N4239 respectively.

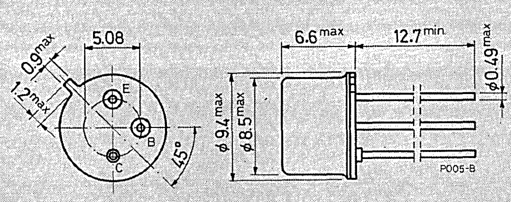
ABSOLUTE MAXIMUM RATINGS

		2N4234	2N4235	2N4236
V_{CBO}	Collector-base voltage ($I_E = 0$)	–40V	–60V	–80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	–40V	–60V	–80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		–7V	
I_C	Collector current		–3A	
I_B	Base current		–0.2A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		6W	
	$T_{amb} \leqslant 25°C$		1W	
T_{stg}	Storage temperature		–65 to 200°C	
T_j	Junction temperature		200°	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

2N 4234
2N 4235
2N 4236

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	29	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **2N4234**	V_{CE} = –40V			–0.1	mA
		for **2N4235**	V_{CE} = –60V			–0.1	mA
		for **2N4236**	V_{CE} = –80V			–0.1	mA
I_{CEV}	Collector cutoff current (V_{BE} = 1.5)	for **2N4234**	V_{CE} = –40V			–0.1	mA
		for **2N4235**	V_{CE} = –60V			–0.1	mA
		for **2N4236**	V_{CE} = –80V			–0.1	mA
		T_{case} = 150°C					
		for **2N4234**	V_{CE} = –30V			–1	mA
		for **2N4235**	V_{CE} = –40V			–1	mA
		for **2N4236**	V_{CE} = –60V			–1	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N4234**	V_{CE} = –30V			–1	mA
		for **2N4235**	V_{CE} = –40V			–1	mA
		for **2N4236**	V_{CE} = –60V			–1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{BE} = 7V				–0.5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = –100mA					
		for **2N4234**		–40			V
		for **2N4235**		–60			V
		for **2N4236**		–80			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = -1A$	$I_B = -100\,mA$			−0.6	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = -1A$	$I_B = -100mA$			−1.5	V
V_{BE}*	Base-emitter voltage	$I_C = -0.25A$	$V_{CE} = -1V$			−1.0	V
h_{FE}*	DC current gain	$I_C = -100mA$	$V_{CE} = -1V$	40			—
		$I_C = -250mA$	$V_{CE} = -1V$	30		150	—
		$I_C = -500mA$	$V_{CE} = -1V$	20			—
		$I_C = -1A$	$V_{CE} = -1V$	10			—
f_T	Transition frequency	$I_C = -100mA$ f = 1MHz	$V_{CE} = -10V$	3			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ f = 100KHz	$V_{CB} = -10V$			100	pF
h_{fe}	Small signal current gain	$I_C = -50mA$ f = 1KHz	$V_{CE} = -10V$	25			—

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%

2N 4237
2N 4238
2N 4239

EPITAXIAL PLANAR NPN

MEDIUM POWER GENERAL PURPOSE TRANSISTORS

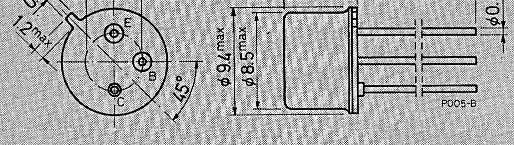
The 2N4237, 2N4238 and 2N4239 are silicon epitaxial planar transistors in Jedec TO-39 metal case.
They are intended for use in switching and amplifier applications.
The complementary PNP types are the 2N4234, 2N4235 and 2N4236 respectively.

ABSOLUTE MAXIMUM RATINGS		**2N4237**	**2N4238**	**2N4239**
V_{CBO}	Collector-base voltage ($I_E = 0$)	50V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6V		
I_C	Collector current	3A		
I_B	Base current	0.5A		
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	6W		
T_{stg}	Storage temperature	–65 to 200°C		
T_j	Junction temperature	200°C		

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal data resistance junction-case	max	29	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N4237**	$V_{CB} = 50V$			0.1	mA
		for **2N4238**	$V_{CB} = 80V$			0.1	mA
		for **2N4239**	$V_{CB} = 100V$			0.1	mA
I_{CEV}	Collector cutoff current ($V_{BE} = -1.5V$)	for **2N4237**	$V_{CE} = 45V$			0.1	mA
		for **2N4238**	$V_{CE} = 75V$			0.1	mA
		for **2N4239**	$V_{CE} = 90V$			0.1	mA
		$T_{case} = 150°C$					
		for **2N4237**	$V_{CE} = 30V$			1	mA
		for **2N4238**	$V_{CE} = 50V$			1	mA
		for **2N4239**	$V_{CE} = 70V$			1	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N4237**	$V_{CE} = 40V$			0.7	mA
		for **2N4238**	$V_{CE} = 60V$			0.7	mA
		for **2N4239**	$V_{CE} = 80V$			0.7	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 6V$				0.5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$					
		for **2N4237**		40			V
		for **2N4238**		60			V
		for **2N4239**		80			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CE\ (sat)}$*	Collector-emitter saturationvoltage	$I_C = 500mA$ $I_C = 1A$	$I_B = 50mA$ $I_B = 0.1A$			0.3 0.6	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 1A$	$I_B = 0.1A$			1.5	V
V_{BE}*	Base-emitter voltage	$I_C = 250mA$	$V_{CE} = 1V$			1	V
h_{FE}*	DC current gain	$I_C = 50mA$ $I_C = 250mA$ $I_C = 500mA$ $I_C = 1A$	$V_{CE} = 1V$ $V_{CE} = 1V$ $V_{CE} = 1V$ $V_{CE} = 1V$	30 30 30 15		 150 	— — — —
f_T	Transition frequency	$I_C = 100mA$ $f = 1MHz$	$V_{CE} = 10V$	2			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $f = 100KHz$	$V_{CB} = 10V$			100	pF
h_{fe}	Small signal current gain	$I_C = 100mA$ $f = 1KHz$	$V_{CE} = 10V$	30			—

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

EPITAXIAL PLANAR NPN

2N 4895
2N 4896
2N 4897

HIGH CURRENT, FAST SWITCHING APPLICATIONS

The 2N 4895, 2N 4896 and 2N 4897 are silicon expitaxial planar NPN transistors in Jedec TO-39 metal case.
They are intended for high current, fast switching applications and for power amplifiers.

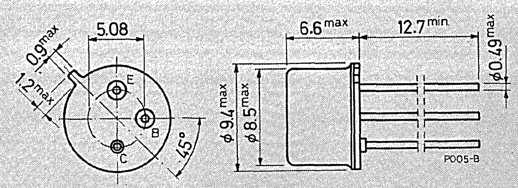
ABSOLUTE MAXIMUM RATINGS

		2N4895	2N4896	2N4897
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	120V	150V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		5A	
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$		1W	
	$T_{case} \leq 25°C$		7W	
	$T_{case} \leq 100°C$		4W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

6/77

THERMAL DATA

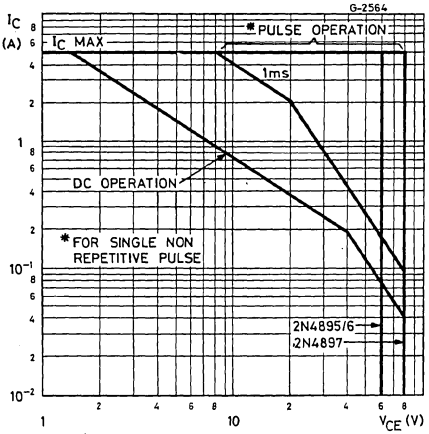
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

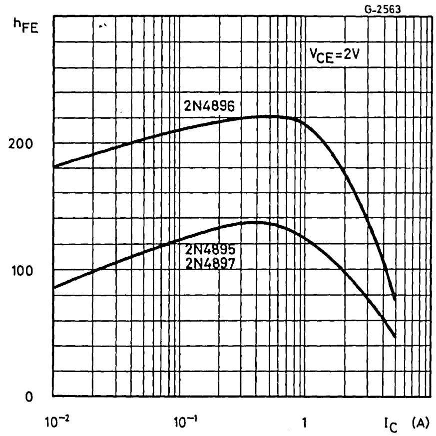
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **2N4895** and **2N4896**				
		V_{CE} = 120V			1	mA
		V_{CE} = 60V			1	μA
		V_{CE} = 60V T_{case} = 150°C			100	μA
		for **2N4897**				
		V_{CE} = 150V			1	mA
		V_{CE} = 100V			1	μA
		V_{CE} = 100V T_{case} = 150°C			100	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6 V			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 50 mA				
		for **2N4895** and **2N4896**	60			V
		for **2N4897**	80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 0.5 A			1	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 5 A I_B = 0.5 A			1.6	V
h_{FE}*	DC current gain	I_C = 2 A V_{CE} = 2 V				
		for **2N4895** and **2N4897**	40		120	—
		for **2N4896**	100		300	—
		I_C = 2 A V_{CE} = 2 V T_{case} = -55°C				
		for **2N4895** and **2N4897**	15			—
		for **2N4896**	35			—
f_T	Transition frequency	I_C = 0.5A V_{CE} = 5 V				
		for **2N4895** and **2N4897**	50			MHz
		for **2N4896**	80			MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz			80	pF
t_{on}	Turn-on time	I_C = 5 A V_{CC} = 20V I_{B1} = 0.5 A			0.35	μs
t_s	Storage time	I_C = 5 A V_{CC} = 20V I_{B1} = $-I_{B2}$ = 0.5A			0.35	μs
t_f	Fall time				0.3	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

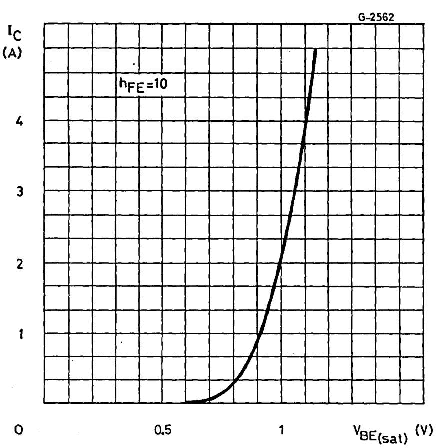
Safe operating areas



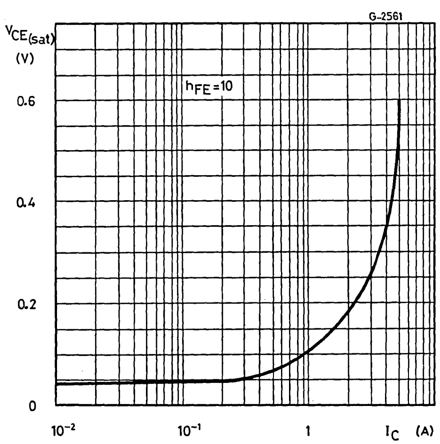
DC current gain



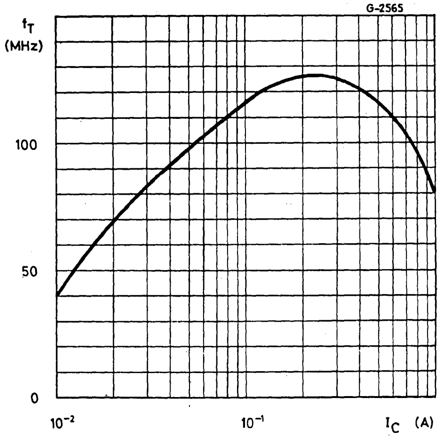
DC transconductance



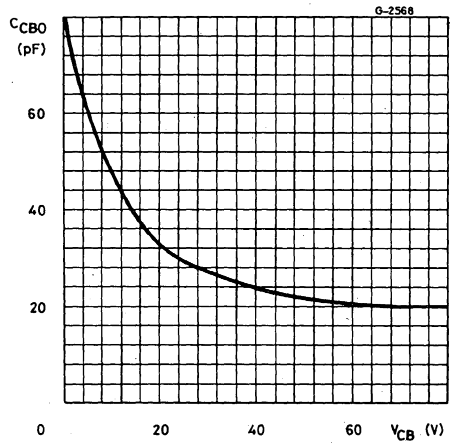
Collector-emitter saturation voltage



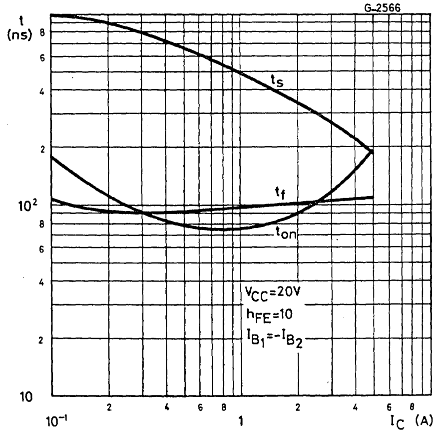
Transition frequency



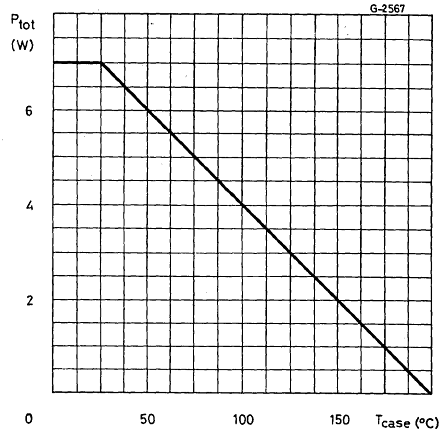
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL PLANAR PNP

2N 4898
2N 4899
2N 4900

MEDIUM POWER GENERAL PURPOSE TRANSISTORS

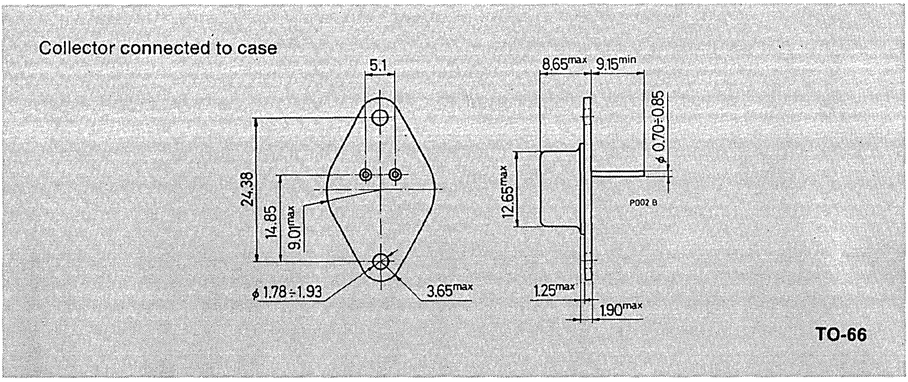
The 2N4898, 2N4899 and 2N4900 are silicon epitaxial planar PNP transistors in Jedec TO-66 metal case.
They are intended for use in switching and amplifier applications.
The complementary NPN types are the 2N4910, 2N4911 and 2N4912 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N4898	2N4899	2N4900
V_{CBO}	Collector-base voltage ($I_E = 0$)	−40V	−60V	−80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−40V	−60V	−80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		−5V	
I_C	Collector current		−4A	
I_B	Base current		−1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		25W	
T_{stg}	Storage temperature		−65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm



5/80

2N 4898
2N 4899
2N 4900

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	7	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E =0)	for **2N4898** V_{CB} = –40V			–0.1	mA
		for **2N4899** V_{CB} = –60V			–0.1	mA
		for **2N4900** V_{CB} = –80V			–0.1	mA
I_{CEV}	Collector cutoff current (V_{BE} = 1.5V)	for **2N4898** V_{CE} = –40V			–0.1	mA
		for **2N4899** V_{CE} = –60V			–0.1	mA
		for **2N4900** V_{CE} = –80V			–0.1	mA
		T_{case} = 150°C				
		for **2N4898** V_{CE} = –40V			–1	mA
		for **2N4899** V_{CE} = –60V			–1	mA
		for **2N4900** V_{CE} = –80V			–1	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N4898** V_{CE} = –20V			–0.5	mA
		for **2N4899** V_{CE} = –30V			–0.5	mA
		for **2N4900** V_{CE} = –40V			–0.5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{BE} = 5.0V			–1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = –0.1A				
		for **2N4898**	–40			V
		for **2N4899**	–60			V
		for **2N4900**	–80			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = -1A$	$I_B = -0.1A$			–0.6	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = -1A$	$I_B = -0.1A$			–1.3	V
V_{BE}*	Base-emitter voltage	$I_C = -1A$	$V_{CE} = -1V$			–1.3	V
h_{FE}*	DC current gain	$I_C = -50mA$	$V_{CE} = -1V$	40			—
		$I_C = -500mA$	$V_{CE} = -1V$	20		100	—
		$I_C = -1A$	$V_{CE} = -1V$	10			—
f_T	Transition frequency	$I_C = -250mA$ $f = 1MHz$	$V_{CE} = -10V$	3			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $f = 100KHz$	$V_{CB} = -10V$			100	pF
h_{fe}	Small signal current gain	$I_C = -250mA$ $f = 1KHz$	$V_{CE} = -10V$	25			—

* Pulsed: pulse duration = 300 μs, duty cycle $\leqslant$2%.

2N 4910
2N 4911
2N 4912

EPITAXIAL PLANAR NPN

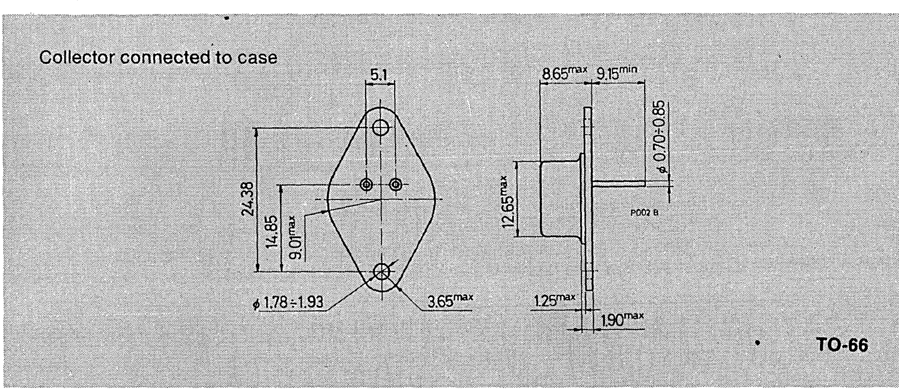
MEDIUM POWER GENERAL PURPOSE TRANSISTORS

The 2N4910, 2N4911 and 2N4912 are silicon epitaxial planar NPN transistors in Jedec TO-66 metal case.
They are intended for use in switching and amplifier applications.
The complementary PNP types are the 2N4898, 2N4899 and 2N4900 respectively.

ABSOLUTE MAXIMUM RATINGS		2N4910	2N4911	2N4912
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		25W	
T_{stg}	Storage temperature		−65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	7	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N4910**	V_{CB} = 40V			0.1	mA
		for **2N4911**	V_{CB} = 60V			0.1	mA
		for **2N4912**	V_{CB} = 80V			0.1	mA
I_{CEV}	Collector cutoff current (V_{BE} = –1.5V)	for **2N4910**	V_{CE} = 40V			0.1	mA
		for **2N4911**	V_{CE} = 60V			0.1	mA
		for **2N4912**	V_{CE} = 80V			0.1	mA
		T_{case} = 150°C					
		for **2N4910**	V_{CE} = 40V			1	mA
		for **2N4911**	V_{CE} = 60V			1	mA
		for **2N4912**	V_{CE} = 80V			1	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N4910**	V_{CE} = 20V			0.5	mA
		for **2N4911**	V_{CE} = 30V			0.5	mA
		for **2N4912**	V_{CE} = 40V			0.5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{BE} = –5.0V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 0.1A					
		for **2N4910**		40			V
		for **2N4911**		60			V
		for **2N4912**		80			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 1A$	$I_B = 0.1A$			0.6	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 1A$	$I_B = 0.1A$			1.3	V
V_{BE}*	Base-emitter voltage	$I_C = 1A$	$V_{CE} = 1V$			1.3	V
h_{FE}*	DC current gain	$I_C = 50mA$ $I_C = 500mA$ $I_C = 1A$	$V_{CE} = 1V$ $V_{CE} = 1V$ $V_{CE} = 1V$	40 20 10		 100 	— — —
f_T	Transition frequency	$I_C = 250mA$ $f = 1MHz$	$V_{CE} = 10V$	3			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $f = 100KHz$	$V_{CB} = 10V$			100	pF
h_{fe}	Small signal current gain	$I_C = 250mA$ $f = 1KHz$	$V_{CE} = 10V$	25			—

* Pulsed: pulse duration = 300μs, duty cycle $\leqslant$2%.

MULTIEPITAXIAL PLANAR NPN

2N 5038
2N 5039
2N 6496

HIGH CURRENT POWER SWITCH

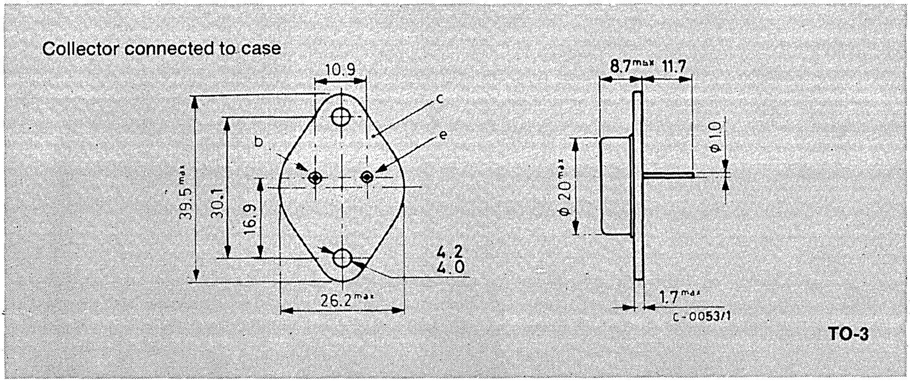
The 2N 5038, 2N 5039 and 2N 6496 are silicon planar multiepitaxial NPN transistors in Jedec TO-3 metal case.
They are especially intended for high current and fast switching applications.

ABSOLUTE MAXIMUM RATINGS

		2N5038	2N5039	2N6496
V_{CBO}	Collector-base voltage ($I_E = 0$)	150V	120V	150V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V, R_{BE} = 100\Omega$)	150V	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$)	110V	95V	130V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90V	75V	110V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	7V	7V
I_C	Collector current	20A	20A	15A
I_{CM}	Collector peak current	30A	30A	—
I_B	Base current		5A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25\ °C$		140W	
T_{stg}	Storage temperature		-65 to 200 °C	
T_j	Junction temperature		200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

2N 5038
2N 5039
2N 6496

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5038**				
		V_{CE} = 140 V			50	mA
		V_{CE} = 100V T_{case} = 150°C			10	mA
		for **2N5039**				
		V_{CE} = 110V			50	mA
		V_{CE} = 85V T_{case} = 150°C			10	mA
		for **2N6496**				
		V_{CE} = 130V			20	mA
		V_{CE} = 130V T_{case} = 150°C			25	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N5038**				
		V_{CE} = 70 V			20	mA
		for **2N5039**				
		V_{CE} = 55 V			20	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			50	mA
		V_{EB} = 5 V				
		for **2N5038**			5	mA
		for **2N5039**			15	mA
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V, R_{BE} = 100Ω)	I_C = 200 mA				
		for **2N5038**	150			V
		for **2N5039**	120			V
		for **2N6496**	150			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 50 Ω)	I_C = 200mA				
		for **2N5038**	110			V
		for **2N5039**	95			V
		for **2N6496**	130			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA				
		for **2N5038**	90			V
		for **2N5039**	75			V
		for **2N6496**	110			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **2N5038**				
		I_C = 12 A I_B = 1.2 A			1	V
		I_C = 20 A I_B = 5 A			2.5	V
		for **2N5039**				
		I_C = 10 A I_B = 1 A			1	V
		I_C = 20 A I_B = 5 A			2.5	V
		for **2N6496**				
		I_C = 8 A I_B = 0.8 A			1	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	for **2N5038** and **2N5039**				
		I_C = 20 A I_B = 5 A			3.3	V
		for **2N6496**				
		I_C = 8 A I_B = 0.8 A			2	V
V_{BE}*	Base-emitter voltage	for **2N5038**				
		I_C = 12 A V_{CE} = 5 V			1.8	V
		for **2N5039**				
		I_C = 10 A V_{CE} = 5 V			1.8	V
		for **2N6496**				
		I_C = 8 A V_{CE} = 2 V			1.6	V
h_{FE}*	DC current gain	for **2N5038**				
		I_C = 2 A V_{CE} = 5 V	50		250	—
		I_C = 12 A V_{CE} = 5 V	20		100	—
		for **2N5039**				
		I_C = 2 A V_{CE} = 5 V	30		250	—
		I_C = 10 A V_{CE} = 5 V	20		100	—
		for **2N6496**				
		I_C = 8 A V_{CE} = 2 V	12		100	—
h_{fe}	Small signal current gain	I_C = 2 A V_{CE} = 10 V f = 5 MHz	12			—
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz			300	pF
t_r	Rise time	for **2N5038** I_C = 12 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 1.2 A			0.5	µs
t_s	Storage time	for **2N5039** I_C = 10 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 1 A			1.5	µs
t_f	Fall time	for **2N6496** I_C = 8 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 0.8 A			0.5	µs

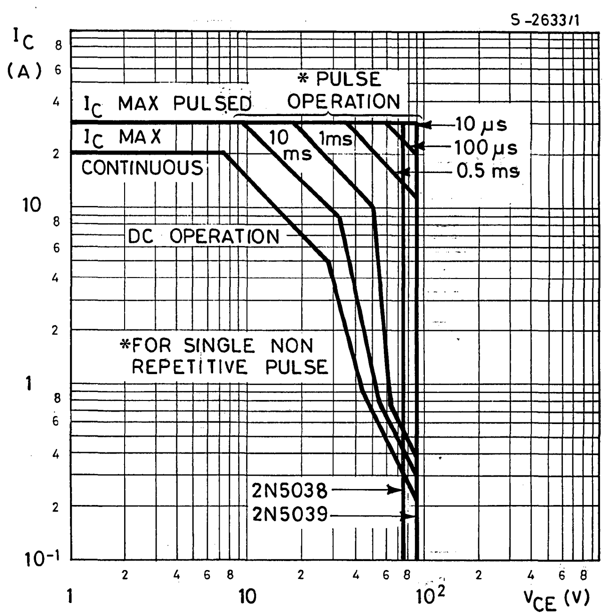
2N 5038
2N 5039
2N 6496

ELECTRICAL CHARACTERISTICS (continued)

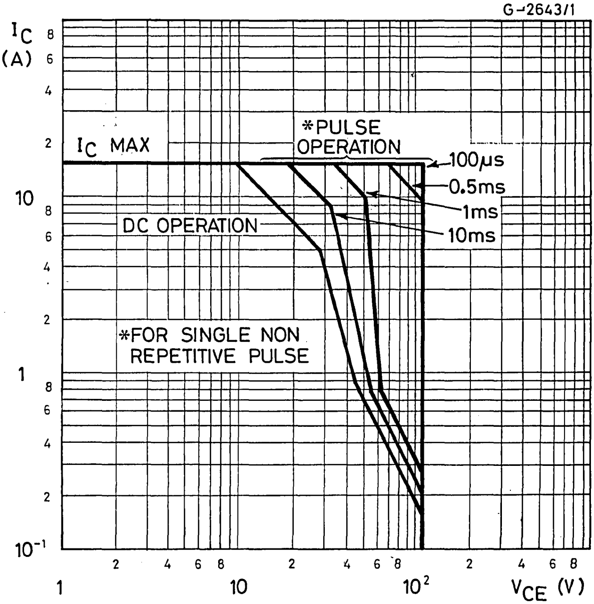
Parameter		Test conditions		Min. Typ. Max.	Unit
$I_{s/b}$**	Second breakdown collector current	$V_{CE} = 28$ V $V_{CE} = 45$ V		5 0.9	A A
$E_{s/b}$	Second breakdown energy	$V_{BE} = -4$ V $L = 180$ μH	$R_{BE} = 20\ \Omega$ for **2N5038** for **2N5039** for **2N6496**	 13 13 5.7	 mJ mJ mJ

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1 s non repetitive pulse

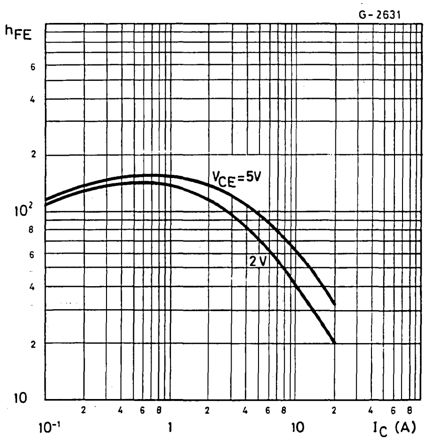
Safe operating areas (for **2N5038** and **2N5039**)



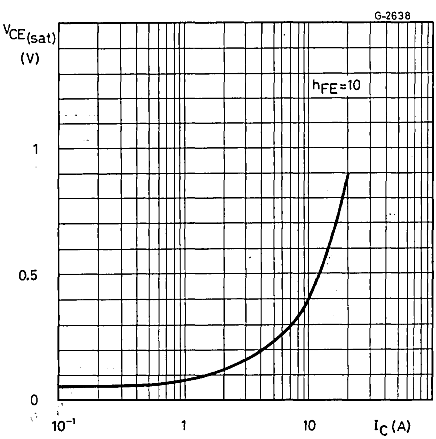
Safe operating areas (for **2N6496**)



DC current gain

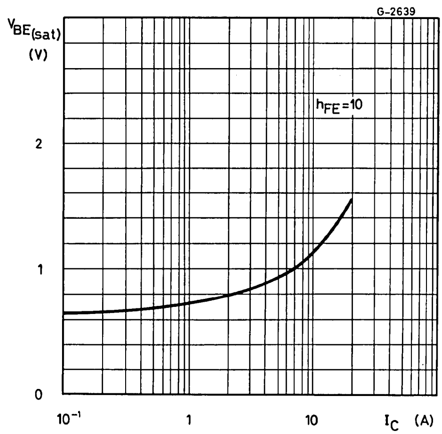


Collector-emitter saturation voltage

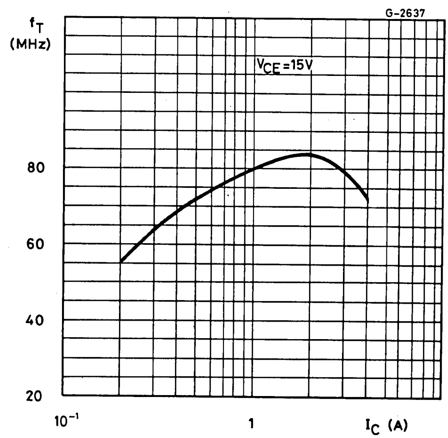


2N 5038
2N 5039
2N 6496

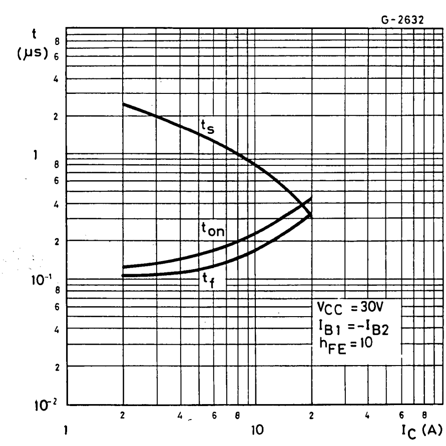
Base-emitter saturation voltage



Transition frequency



Saturated switching characteristics



EPITAXIAL PLANAR PNP

2N 5151
2N 5153

HIGH SPEED MEDIUM VOLTAGE SWITCHES

The 2N5151 and 2N5153 are silicon epitaxial planar PNP transistors in Jedec TO-39 metal case intended for use in switching applications.
The complementary NPN types are the 2N5152 and 2N5154 respectively.

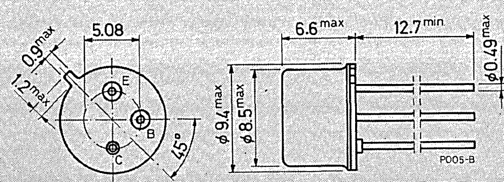
ABSOLUTE MAXIMUM RATINGS

		2N5151 | 2N5153
V_{CBO}	Collector-base voltage ($I_E = 0$)	−100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	−80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	−5.5V
I_C	Collector current	−5A
I_{CM}	Collector peak current	−10A
I_B	Base current	−2.5A
P_{tot}	Total power dissipation at $T_{case} \leq 50°C$	10W
	$T_{case} \leq 100°C$	6.7W
	$T_{amb} \leq 25°C$	1W
T_{stg}	Storage temperature	−65 to 200°C
T_j	Junction temperature	200°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

2N 5151
2N 5153

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = –60V V_{CE} = –100V				–1 –1	μA mA
I_{CEV}	Collector cutoff current (V_{BE} = 2V)	V_{CE} = –60V T_{case} = 150°C				–500	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = –40V				–50	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = –4V V_{EB} = –5.5V				–1 –1	μA mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = –100mA		–80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = –2.5A I_C = –5A	I_B = –250mA I_B = –500mA			–0.75 –1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = –2.5A I_C = –5A	I_B = –250mA I_B = –500mA			–1.45 –2.2	V V
V_{BE}*	Base-emitter voltage	I_C = –2.5A	V_{CE} = –5V			–1.45	V
h_{FE}*	DC current gain	for **2N5151**					
		I_C = –50mA	V_{CE} = –5V	20			—
		I_C = –2.5A	V_{CE} = –5V	30		90	—
		I_C = –5A	V_{CE} = –5V	20			—
		T_{case} = –55°C					
		I_C = –2.5A	V_{CE} = –5V	15			—
		for **2N5153**					
		I_C = –50mA	V_{CE} = –5V	50			—
		I_C = –2.5A	V_{CE} = –5V	70		200	—
		I_C = –5A	V_{CE} = –5V	40			—
		T_{case} = –55°C					
		I_C = –2.5A	V_{CE} = –5V	35			—

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = -10V$ $f = 1MHz$			250	pF
h_{fe}	Small signal current gain	$I_C = -0.1A$ $V_{CE} = -5V$ $f = 1KHz$ for **2N5151** for **2N5153**	 20 50			 — —
		$I_C = -0.5A$ $V_{CE} = -5V$ $f = 20MHz$ for **2N5151** for **2N5153**	 3 3.5			 — —
t_{on}	Turn-on time	$I_C = -5A$ $I_{B1} = -0.5A$ $V_{CC} = -30V$		0.5		μs
t_{off}	Turn-off time	$I_C = -5A$ $I_{B1} = -I_{B2} = -0.5A$ $V_{CC} = -30V$		1.3		μs

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

2N 5152 2N 5154

EPITAXIAL PLANAR NPN

HIGH SPEED MEDIUM VOLTAGE SWITCHES

The 2N5152 and 2N5154 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case intended for use in switching applications.
The complementary PNP types are the 2N5151 and 2N5153 respectively.

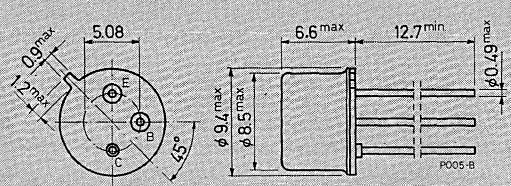
ABSOLUTE MAXIMUM RATINGS

		2N5152 | 2N5154
V_{CBO}	Collector-base voltage ($I_E = 0$)	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6V
I_C	Collector current	2A
I_{CM}	Collector peak current	10A
I_B	Base current	1A
P_{tot}	Total power dissipation at $T_{case} \leqslant 50°C$	10W
	$T_{case} \leqslant 100°C$	6.7W
	$T_{amb} \leqslant 25°C$	1W
T_{stg}	Storage temperature	–65 to 200°C
T_j	Junction temperature	200°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 60V V_{CE} = 100V				1 1	μA mA
I_{CEV}	Collector cutoff current (V_{BE} = –2V)	V_{CE} = 60V T_{case} = 150°C				500	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 40V				50	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V V_{EB} = 6V				1 1	μA mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA		80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 2.5A I_C = 5A	I_B = 250mA I_B = 500mA			0.75 1.5	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_C = 5A	I_B = 250mA I_B = 500mA			1.45 2.2	V V
V_{BE}*	Base-emitter voltage	I_C = 2.5A	V_{CE} = 5V			1.45	V
h_{FE}*	DC current gain	for **2N5152**					
		I_C = 50mA	V_{CE} = 5V	20			—
		I_C = 2.5A	V_{CE} = 5V	30		90	—
		I_C = 5A	V_{CE} = 5V	20			—
		T_{case} = –55°C					
		I_C = 2.5A	V_{CE} = 5V	15			—
		for **2N5154**					
		I_C = 50mA	V_{CE} = 5V	50			—
		I_C = 2.5A	V_{CE} = 5V	70		200	—
		I_C = 5A	V_{CE} = 5V	40			—
		T_{case} = –55°C					
		I_C = 2.5A	V_{CE} = 5V	35			—

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min. Typ. Max.	Unit
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10V$ $f = 1MHz$	250	pF
h_{fe}	Small signal current gain	$I_C = 0.1A$ $V_{CE} = 5V$ $f = 1KHz$ for **2N5152** for **2N5154** $I_C = 0.5A$ $V_{CE} = 5V$ $f = 20MHz$ for **2N5152** for **2N5154**	 20 50 3 3.5	 — — — —
t_{on}	Turn on time	$I_C = 5A$ $I_{B1} = 0.5A$ $V_{CC} = 30V$	0.5	μs
t_{off}	Turn off time	$I_C = 5A$ $I_{B1} = -I_{B2} = 0.5A$ $V_{CC} = 30V$	1.3	μs

* Pulsed: pulse duration = $300\mu s$, duty cycle $\leqslant 2\%$.

EPITAXIAL-BASE NPN

2N 5190
2N 5191
2N 5192

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

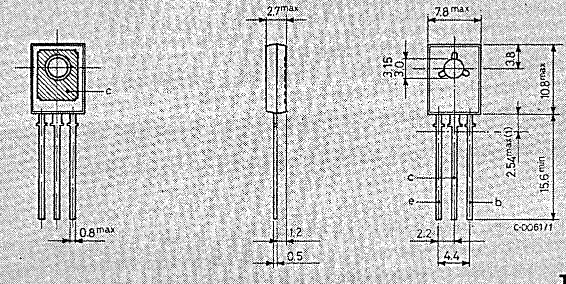
The 2N 5190, 2N 5191, 2N 5192 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the 2N 5193, 2N 5194 and 2N 5195 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N5190	2N5191	2N5192
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current ($t \leq 10$ ms)		7A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

2N 5190
2N 5191
2N 5192

THERMAL DATA

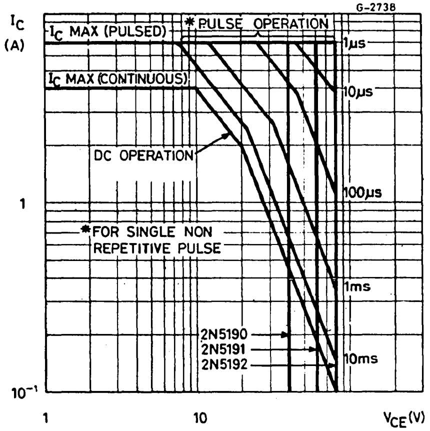
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

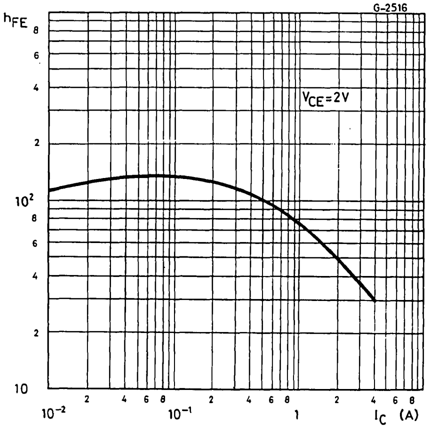
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5190**	V_{CB} = 40V			100	μA
		for **2N5191**	V_{CB} = 60V			100	μA
		for **2N5192**	V_{CB} = 80V			100	μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5V)	for **2N5190**	V_{CE} = 40V			100	μA
		for **2N5191**	V_{CE} = 60V			100	μA
		for **2N5192**	V_{CE} = 80V			100	μA
		T_{case} = 125°C					
		for **2N5190**	V_{CE} = 40V			2	mA
		for **2N5191**	V_{CE} = 60V			2	mA
		for **2N5192**	V_{CE} = 80V			2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5190**	V_{CE} = 40V			1	mA
		for **2N5191**	V_{CE} = 60V			1	mA
		for **2N5192**	V_{CE} = 80V			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
			for **2N5190**	40			V
			for **2N5191**	60			V
			for **2N5192**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1.5A	I_B = 0.15A			0.6	V
		I_C = 4A	I_B = 1A			1.4	V
V_{BE}*	Base-emitter voltage	I_C = 1.5A	V_{CE} = 2V			1.2	V
h_{FE}*	DC current gain	I_C = 1.5A	V_{CE} = 2V				
			for **2N5190**	25		100	—
			for **2N5191**	25		100	—
			for **2N5192**	20		80	—
		I_C = 4A	V_{CE} = 2V				
			for **2N5190**	10			—
			for **2N5191**	10			—
			for **2N5192**	7			—
f_T	Transition frequency	I_C = 1A	V_{CE} = 10V	2			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

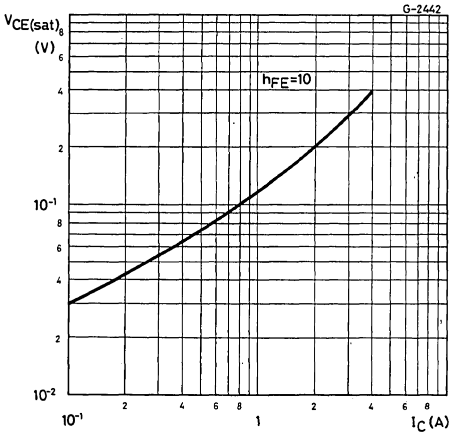
Safe operating areas



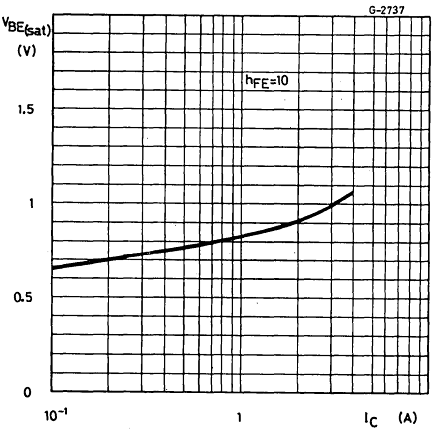
DC current gain



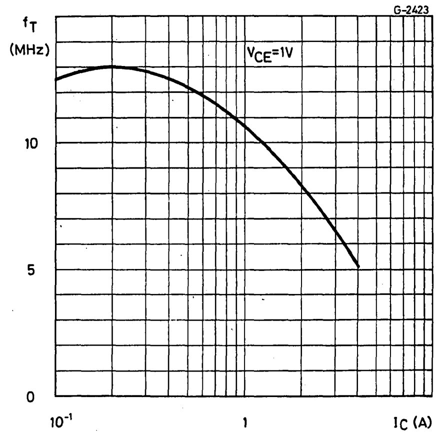
Collector-emitter saturation voltage



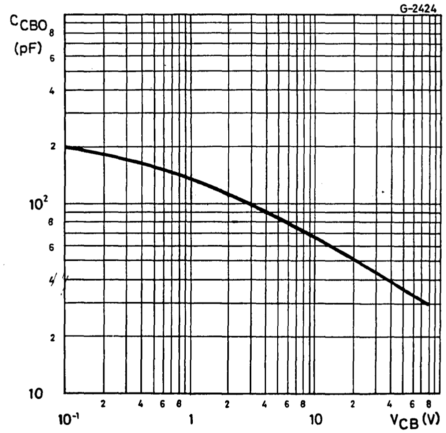
Base-emitter saturation voltage



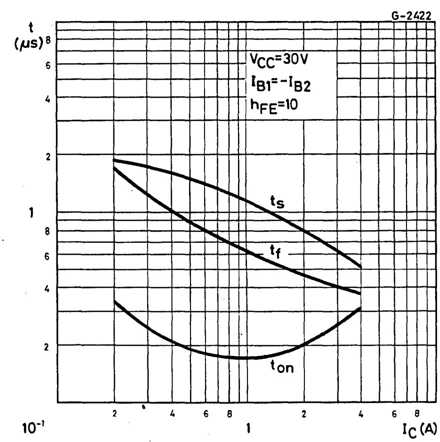
Transition frequency



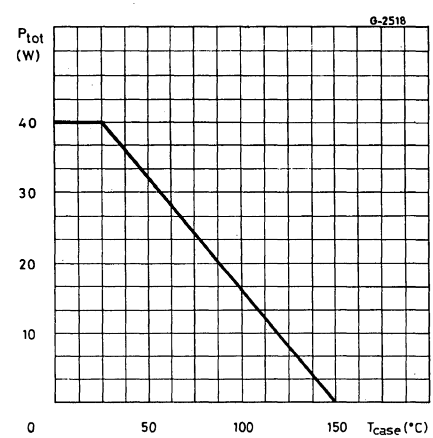
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

2N 5193
2N 5194
2N 5195

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

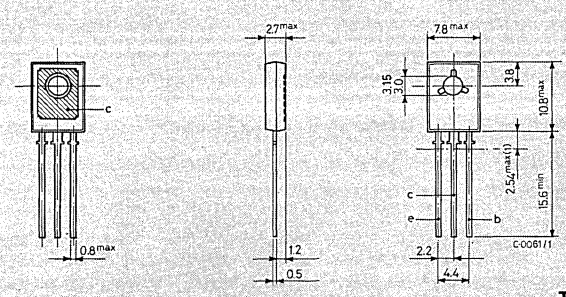
The 2N 5193, 2N 5194, 2N 5195 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the 2N 5190, 2N 5191, 2N 5192 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N5193	2N5194	2N5195
V_{CBO}	Collector-base voltage ($I_E = 0$)	-40V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-40V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current ($t \leqslant 10$ ms)		-7A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

THERMAL DATA

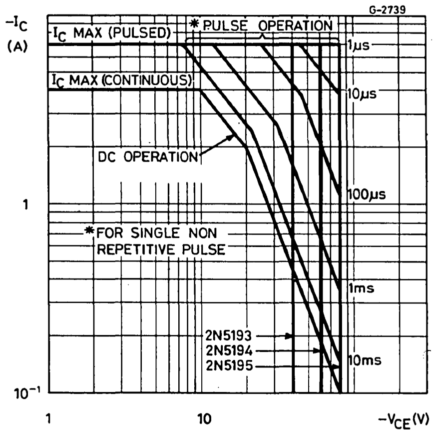
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

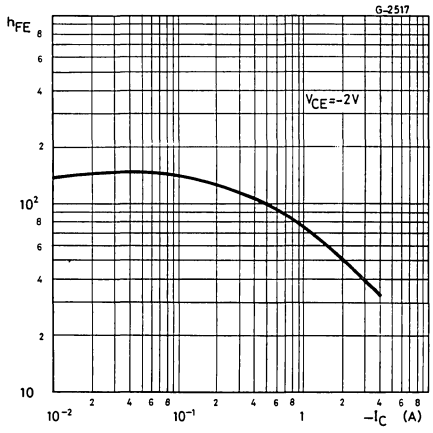
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5193**	V_{CB} = -40V			-100	μA
		for **2N5194**	V_{CB} = -60V			-100	μA
		for **2N5195**	V_{CB} = -80V			-100	μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5)	for **2N5193**	V_{CE} = -40V			-100	μA
		for **2N5194**	V_{CE} = -60V			-100	μA
		for **2N5195**	V_{CE} = -80V			-100	μA
		T_{case} = 125°C					
		for **2N5193**	V_{CE} = -40V			-2	mA
		for **2N5194**	V_{CE} = -60V			-2	mA
		for **2N5195**	V_{CE} = -80V			-2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5193**	V_{CE} = -40V			-1	mA
		for **2N5194**	V_{CE} = -60V			-1	mA
		for **2N5195**	V_{CE} = -80V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V				-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA					
			for **2N5193**	-40			V
			for **2N5194**	-60			V
			for **2N5195**	-80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -1.5A	I_B = -0.15A			-0.6	V
		I_C = -4A	I_B = -1A			-1.2	V
V_{BE}*	Base-emitter voltage	I_C = -1.5A	V_{CE} = -2V			-1.2	V
h_{FE}*	DC current gain	I_C = -1.5A	V_{CE} = -2V				
			for **2N5193**	25		100	—
			for **2N5194**	25		100	—
			for **2N5195**	20		80	—
		I_C = -4A	V_{CE} = -2V				
			for **2N5193**	10			—
			for **2N5194**	10			—
			for **2N5195**	7			—
f_T	Transition frequency	I_C = -1A	V_{CE} = -10V	2			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

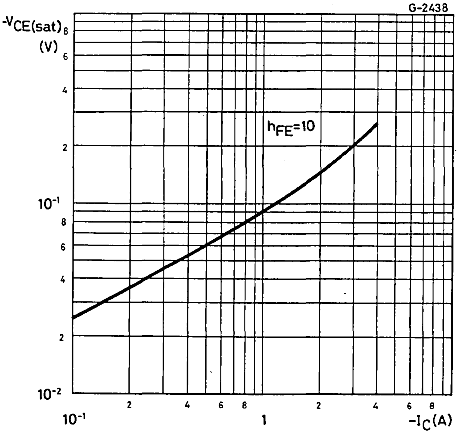
Safe operating areas



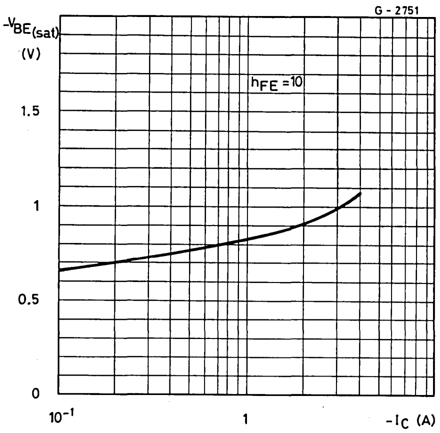
DC current gain



Collector-emitter saturation voltage

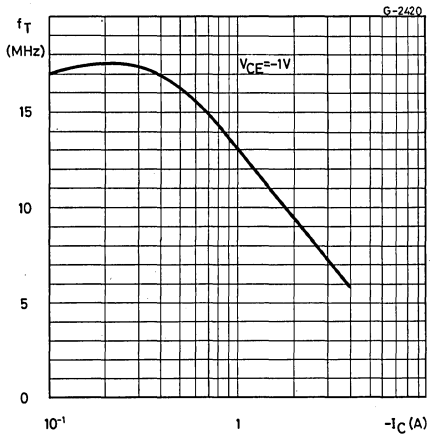


Base-emitter saturation voltage

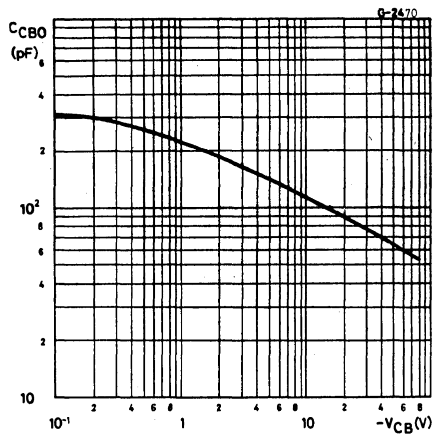


2N 5193
2N 5194
2N 5195

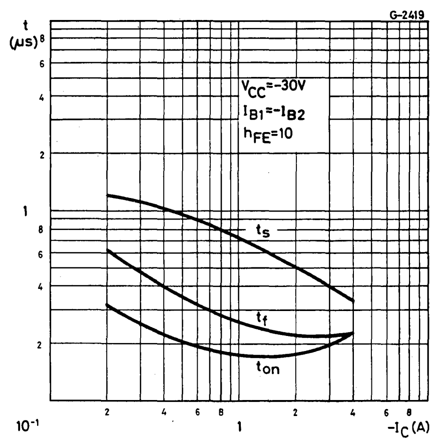
Transition frequency



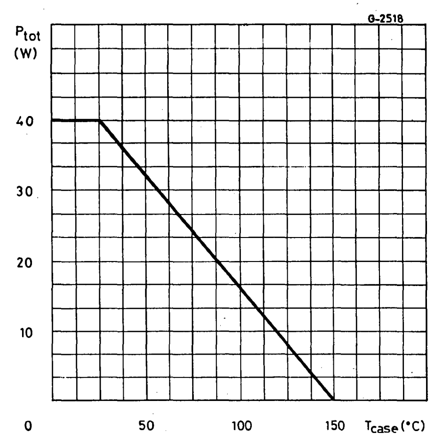
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL PLANAR NPN

2N 5336
2N 5337
2N 5338
2N 5339

HIGH CURRENT FAST SWITCHING APPLICATIONS

The 2N 5336, 2N 5337, 2N 5338 and 2N 5339 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case.
They are intended for high current switching applications up to 5A.

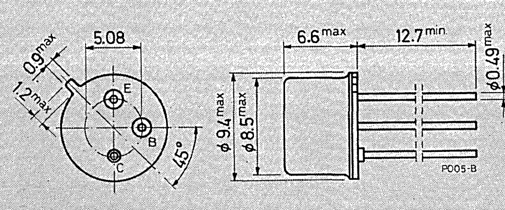
ABSOLUTE MAXIMUM RATINGS

		2N5336 2N5337	2N5338 2N5339
V_{CBO}	Collector-base voltage ($I_E = 0$)	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6V	
I_C	Collector current	5A	
I_{CM}	Collector peak current	7A	
I_B	Base current	1A	
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	1W	
	$T_{case} \leq 25°C$	6W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	29.2	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

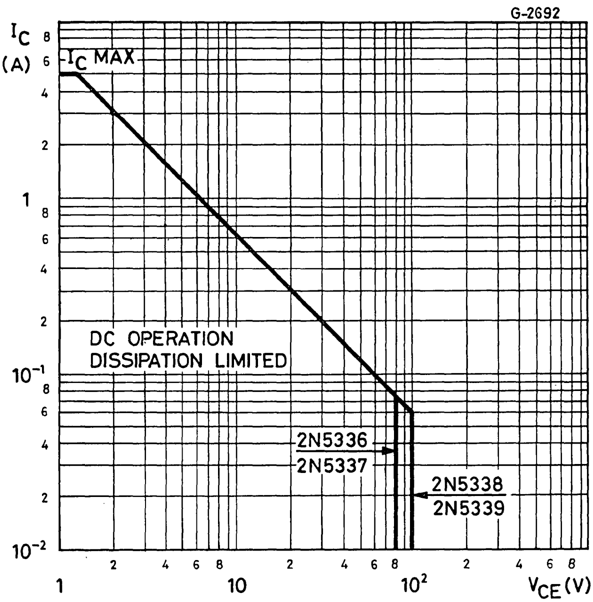
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5336** and **2N5337** V_{CB} = 80 V for **2N5338** and **2N5339** V_{CB} = 100 V			10 10	µA µA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5336** and **2N5337** V_{CE} = 75 V for **2N5338** and **2N5339** V_{CE} = 90 V			100 100	µA µA
I_{CEX}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5336** and **2N5337** V_{CE} = 75 V V_{CE} = 75 V T_{case} = 150°C for **2N5338** and **2N5339** V_{CE} = 90 V V_{CE} = 90 V T_{case} = 150°C			10 1 10 1	µA mA µA mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 50 mA for **2N5336** and **2N5337** for **2N5338** and **2N5339**	80 100			V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2 A I_B = 0.2 A I_C = 5 A I_B = 0.5 A			0.7 1.2	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2 A I_B = 0.2 A I_C = 5 A I_B = 0.5 A			1.2 1.8	V V
h_{FE}*	DC current gain	I_C = 0.5 A V_{CE} = 2 V for **2N5336** and **2N5338** for **2N5337** and **2N5339** I_C = 2 A V_{CE} = 2 V for **2N5336** and **2N5338** for **2N5337** and **2N5339** I_C = 5 A V_{CE} = 2 V for **2N5336** and **2N5338** for **2N5337** and **2N5339**	 30 60 30 60 20 40		 120 240	 — — — — — —

ELECTRICAL CHARACTERISTICS (continued)

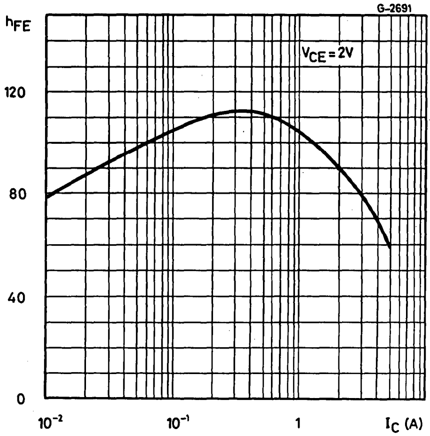
Parameter		Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10 V	30	MHz
C_{CBO}	Collector-base capacitance	V_{CB} = 10V I_E = 0 f = 0.1 MHz	250	pF
t_{on}	Turn-on time	I_C = 2 A V_{CC} = 40V I_{B1} = 0.2 A	200	ns
t_s	Storage time	I_C = 2 A V_{CC} = 40V I_{B1} = $-I_{B2}$ = 0.2 A	2	μs
t_f	Fall time		200	ns

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

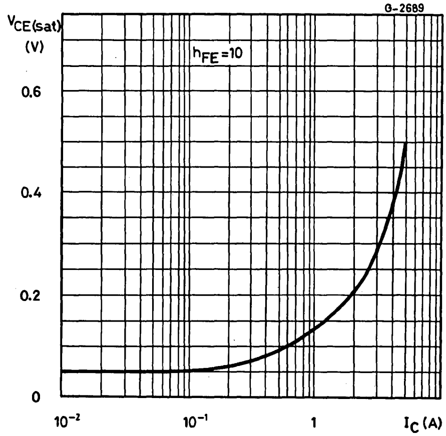
Safe operating areas



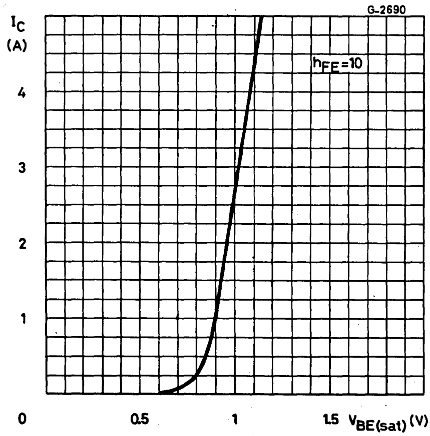
DC current gain



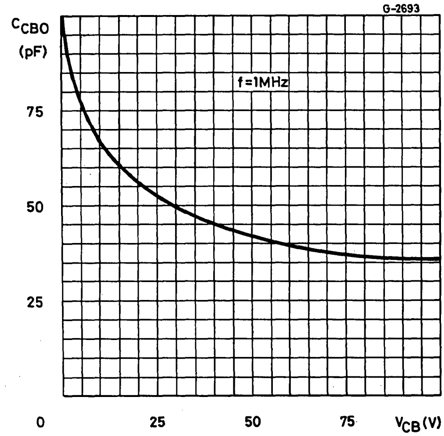
Collector-emitter saturation voltage



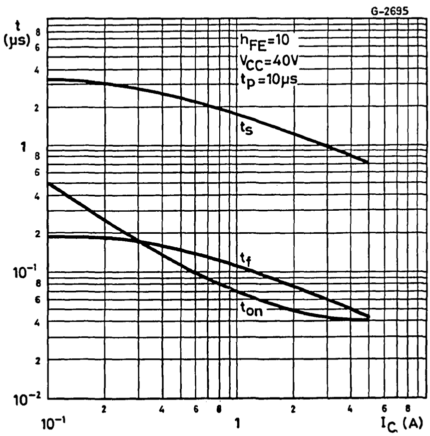
Base-emitter saturation voltage



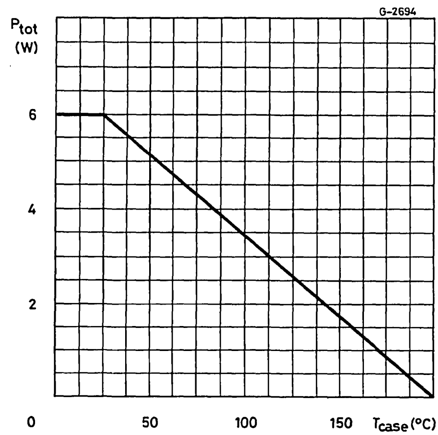
Collector-base capacitance



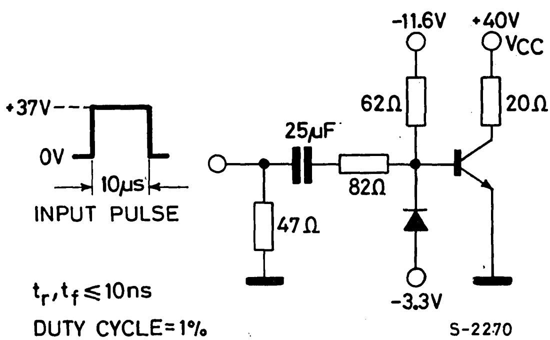
Saturated switching characteristics



Power rating chart



Switching time test circuit



2N 5415
2N 5416

EPITAXIAL PLANAR PNP

HIGH VOLTAGE TRANSISTORS

The 2N5415, 2N5416 are high voltage silicon epitaxial planar transistors designed for use in consumer and industrial line-operated applications. These devices are particularly suited as drivers in high-voltage low current inverters, switching and series regulators.

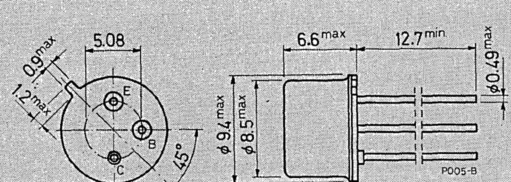
ABSOLUTE MAXIMUM RATINGS

		2N5415	2N5416
V_{CBO}	Collector-base voltage ($I_E = 0$)	-200V	-350V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-200V	-300V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-4V	-6V
I_C	Collector current	-1A	
I_B	Base current	-0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10W	
	$T_{amb} \leq 50°C$	1W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	150	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

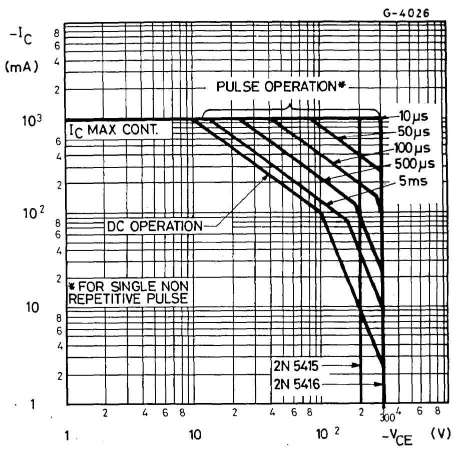
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	for **2N5415** V_{CB}=-175V for **2N5416** V_{CB}=-280V			-50 -50	μA μA
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=-150V			-50	μA
I_{EBO}	Emitter cutoff current (I_C=0)	for **2N5415** V_{EB}=-4V for **2N5416** V_{EB}=-6V			-20 -20	μA μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =-10mA for **2N5415** for **2N5416**	 -200 -300			 V V
V_{CER}*	Collector-emitter sustaining voltage (R_{BE}=50Ω)	I_C =-50mA for **2N5416**	 -350			 V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =-50mA I_B =-5mA			-2.5	V
V_{BE} *	Base-emitter voltage	I_C =-50mA V_{CE}=-10V			-1.5	V

ELECTRICAL CHARACTERISTICS (continued)

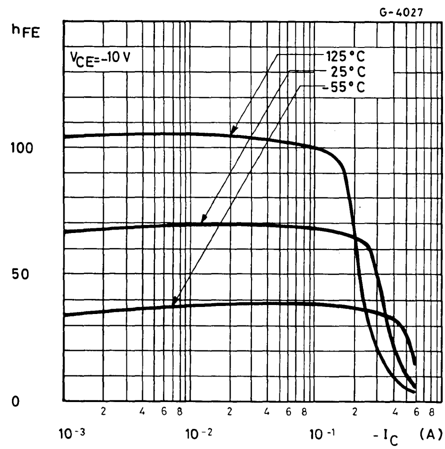
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C =-50mA V_{CE}=-10V for **2N5415** for **2N5416**	 30 30		 150 120	 – –
h_{fe}	Small signal current gain	I_C =-5mA V_{CE}=-10V f = 1KHz	25			–
f_T	Transition frequency	I_C =-10mA V_{CE}=-10V f = 5MHz	15			MHz
C_{CBO}	Collector-base capacitance	I_E =0 V_{CB}=-10V f = 1MHz			25	pF

* Pulsed: pulse duration = 300 µs, duty cycle ≤ 2%

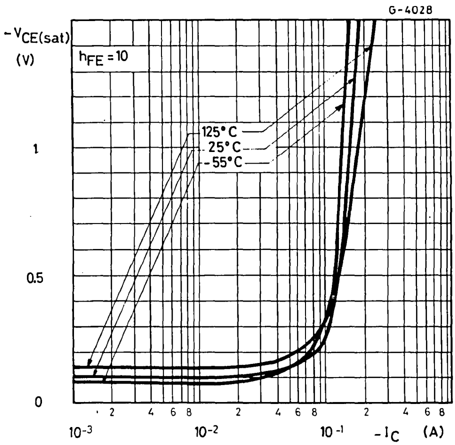
Safe operating areas



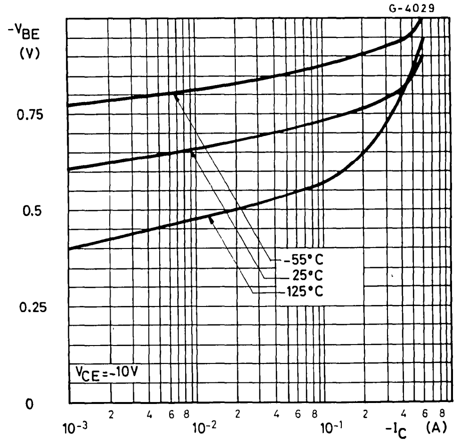
DC current gain



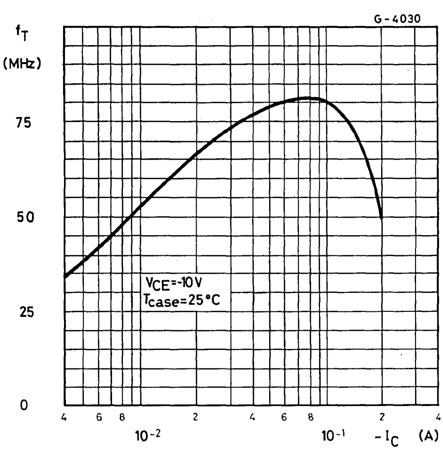
Collector-emitter saturation voltage



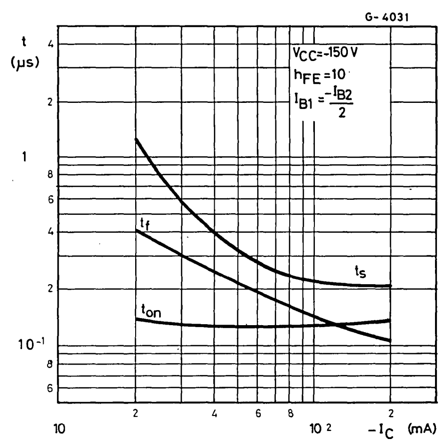
Base-emitter voltage



Transition frequency



Switching times



2N 5427
2N 5428
2N 5429
2N 5430

EPITAXIAL PLANAR NPN

MEDIUM POWER APPLICATIONS

The 2N5427, 2N5428, 2N5429 and 2N5430 are silicon epitaxial planar NPN transistors in Jedec TO-66 metal case.
They are intended for use in switching and wide band amplifier applications.

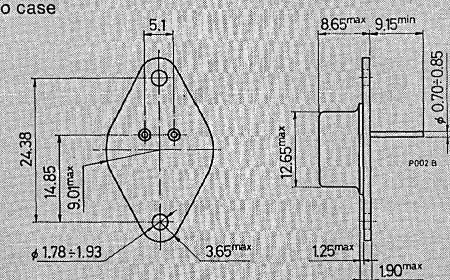
ABSOLUTE MAXIMUM RATINGS

		2N5427 2N5428	2N5429 2N5430
V_{CBO}	Collector-base voltage ($I_E = 0$)	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6V	
I_C	Collector current	7A	
I_B	Base current	1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40W	
T_{stg}	Storage temperature	–65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-66

5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.37	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5427** and **2N5428** V_{CB} = 80V for **2N5429** and **2N5430** V_{CB} = 100V				10 10	μA μA
I_{CEV}	Collector cutoff current (V_{BE} = –1,5V)	for **2N5427** and **2N5428** V_{CE} = 75V for **2N5429**and **2N5430** V_{CE} = 90V T_{case} = 150°C for **2N5427** and **2N5428** V_{CE} = 75V for **2N5429** and **2N5430** V_{CE} = 90V				10 10 1 1	μA μA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5427** and **2N5428** V_{CE} = 75V for **2N5429** and **2N5430** V_{CE} = 90V				100 100	μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 6V				100	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 50mA for **2N5427** and **2N5428** for **2N5429** and **2N5430**		 80 100			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A I_C = 7A	I_B = 0.2A I_B = 0.7A			0.7 1.2	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2A I_C = 7A	I_B = 0.2A I_B = 0.7A			1.2 2	V V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	$I_C = 500mA$ $V_{CE} = 2V$				
		for **2N5427** and **2N5429**	30			—
		for **2N5428** and **2N5430**	60			—
		$I_C = 2A$ $V_{CE} = 2V$				
		for **2N5427** and **2N5429**	30		120	—
		for **2N5428** and **2N5430**	60		240	—
		$I_C = 5A$ $V_{CE} = 2V$				
		for **2N5427** and **2N5429**	20			—
		for **2N5428** and **2N5430**	40			—
f_T	Transition frequency	$I_C = 500mA$ $V_{CE} = 10V$ $f = 10MHz$	30			MHz
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $I_E = 0$ $f = 100KHz$			250	pF
t_d	Delay time	$I_C = 2A$ $I_{B1} = 0.2A$ $V_{CC} = 40V$			100	ns
t_r	Rise time				100	ns
t_s	Storage time	$I_C = 2A$ $I_{B1} = -I_{B2} = 0.2A$ $V_{CC} = 40V$			2	μs
t_f	Fall time				200	ns

* Pulsed: pulse duration = $300\mu s$, duty cycle $\leqslant 2\%$.

MULTIEPITAXIAL PLANAR NPN

2N 5671
2N 5672

HIGH CURRENT FAST SWITCHING APPLICATIONS

The 2N 5671 and 2N 5672 are silicon multiepitaxial planar NPN transistors in Jedec TO-3 metal case.
They are especially intended for high current, fast switching industrial applications.

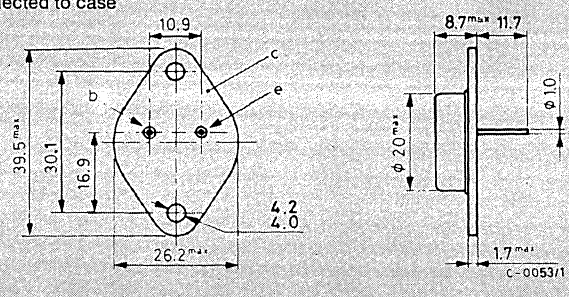
ABSOLUTE MAXIMUM RATINGS

		2N5671	2N5672
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	150V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5$ V, $R_{BE} = 50\ \Omega$)	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$)	110V	140V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90V	120V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	30A	
I_B	Base current	10A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	140W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

6/77

2N 5671
2N 5672

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

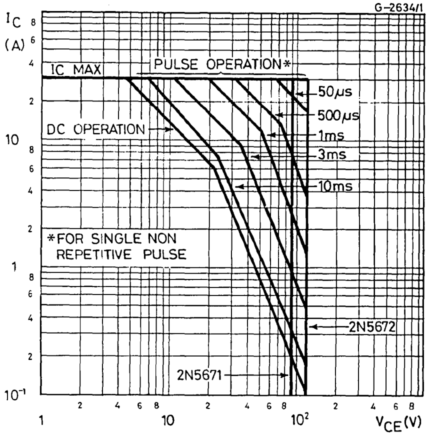
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5671** for **2N5672** V_{CE} = 100V	V_{CE} = 110 V V_{CE} = 135 V T_{case} = 150°C for **2N5671** for **2N5672**			12 10 15 10	mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 80 V				10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V				10	mA
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V, R_{BE} = 50Ω)	I_C = 200 mA	for **2N5671** for **2N5672**	120 150			V V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 50 Ω)	I_C = 200mA	for **2N5671** for **2N5672**	110 140			V V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA	for **2N5671** for **2N5672**	90 120			V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 15 A	I_B = 1.2 A			0.75	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 15 A	I_B = 1.2 A			1.5	V
V_{BE}*	Base-emitter voltage	I_C = 15 A	V_{CE} = 5 V			1.6	V
h_{FE}*	DC current gain	I_C = 15 A I_C = 20 A	V_{CE} = 2 V V_{CE} = 5 V	20 20		100	— —
f_T	Transition frequency	I_C = 2 A	V_{CE} = 10 V	50			MHz

ELECTRICAL CHARACTERISTICS (continued)

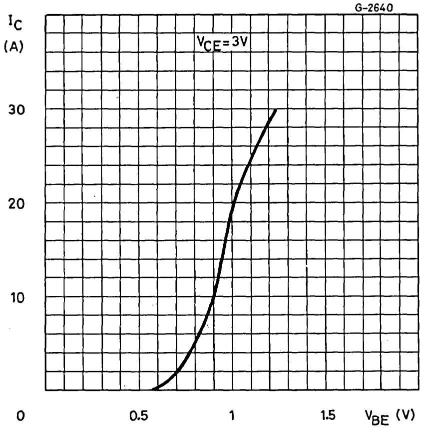
Parameter		Test conditions	Min.	Typ.	Max.	Unit
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10$ V f = 1 MHz			900	pF
t_{on}	Turn-on time	$I_C = 15$ A $V_{CC} = 30$ V $I_{B1} = -I_{B2} = 1.2$A			0.5	µs
t_s	Storage time				1.5	µs
t_f	Fall time				0.5	µs
$I_{s/b}$**	Second breakdown collector current	$V_{CE} = 24$ V $V_{CE} = 45$ V	5.8 0.9			A A
$E_{s/b}$	Second breakdown energy	$V_{BE} = -4$ V, $R_{BE} = 20\ \Omega$ L = 180 µH	20			mJ

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
** Pulsed: 1 s, non repetitive pulse

Safe operating areas

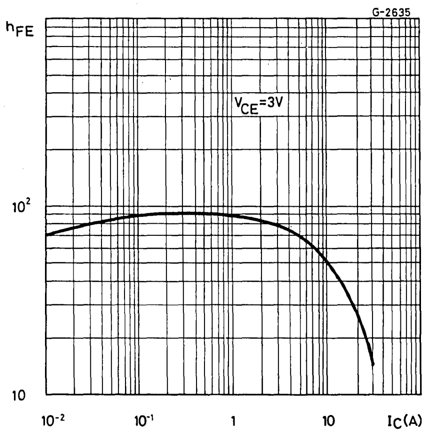


DC transconductance

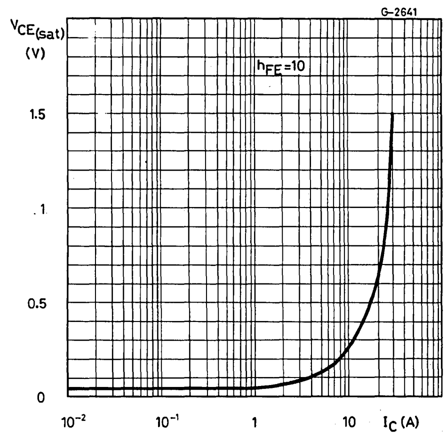


2N 5671
2N 5672

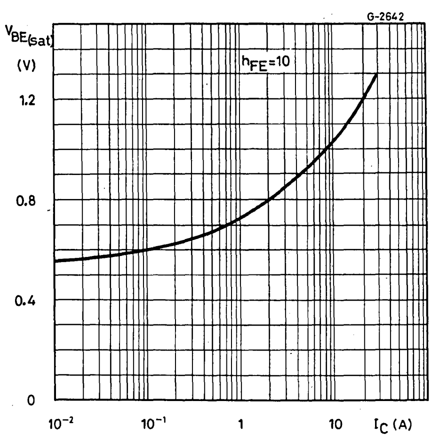
DC current gain



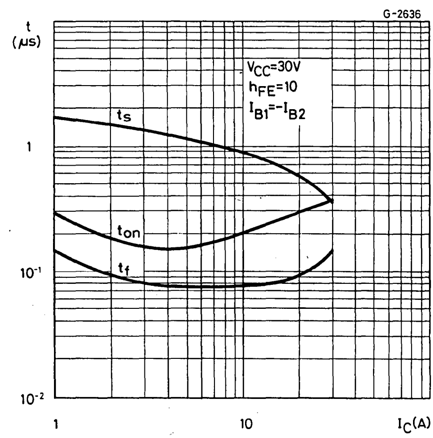
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL PLANAR PNP

2N 5679
2N 5680

PNP SILICON TRANSISTORS

The 2N5679 and 2N5680 are silicon epitaxial planar PNP transistors in Jedec TO-39 metal case intended for use as drivers for high power transistors in general purpose, amplifier and switching circuit.
The complementary NPN types are the 2N5681 and 2N5682 respectively.

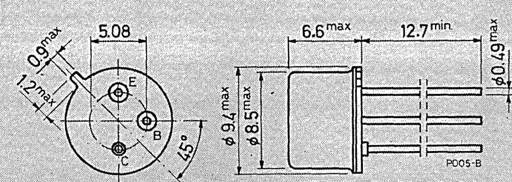
ABSOLUTE MAXIMUM RATINGS

		2N5679	2N5680
V_{CBO}	Collector-base voltage ($I_E = 0$)	$-100V$	$-120V$
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	$-100V$	$-120V$
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$-4V$	
I_C	Collector current	$-1A$	
I_B	Base current	$-0.5A$	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10W	
	$T_{amb} \leq 25°C$	1W	
T_{stg}	Storage temperature	-65 to $200°C$	
T_j	Junction temperature	$200°C$	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

2N 5679
2N 5680

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5679** $V_{CB} = -100V$ for **2N5680** $V_{CB} = -120V$			–1 –1	μA μA
I_{CEV}	Collector cutoff current ($V_{BE} = 1.5$)	for **2N5679** $V_{CE} = -100V$ for **2N5680** $V_{CE} = -120V$ $T_{case} = 150°C$ for **2N5679** $V_{CE} = -100V$ for **2N5680** $V_{CE} = -120V$			–1 –1 –1 –1	μA μA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5679** $V_{CE} = -70V$ for **2N5680** $V_{CE} = -80V$			–10 –10	μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -4V$			–1	μA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -10mA$ for **2N5679** for **2N5680**	 –100 –120			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -250mA$ $I_B = -25mA$ $I_C = -500mA$ $I_B = -50mA$ $I_C = -1A$ $I_B = -200mA$			–0.6 –1 –2	V V V
V_{BE}*	Base-emitter voltage	$I_C = -250mA$ $V_{CE} = -2V$			–1	V
h_{FE}*	DC current gain	$I_C = -250mA$ $V_{CE} = -2V$ $I_C = -1A$ $V_{CE} = -2V$	40 5		150	— —
f_T	Transition frequency	$I_C = -100mA$ $V_{CE} = -10V$ $f = 10MHz$	30			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = -20V$ $f = 1MHz$			50	pF
h_{fe}	Small signal current gain	$I_C = -0.2A$ $V_{CE} = -1.5V$ $f = 1KHz$	40			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

EPITAXIAL PLANAR NPN

2N 5681
2N 5682

PRELIMINARY DATA

GENERAL PURPOSE TRANSISTORS

The 2N5681 and 2N5682 are silicon epitaxial planar NPN transistors in Jedec TO-39 metal case intended for use as drivers for high power transistors in general purpose amplifier and switching circuits.
The complementary PNP types are the 2N5679 and 2N5680 respectively.

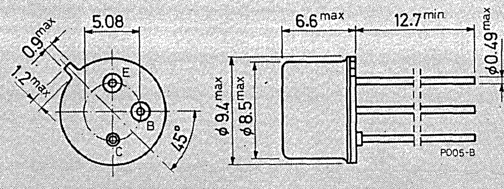
ABSOLUTE MAXIMUM RATINGS

		2N5681	2N5682
V_{CBO}	Collector-base voltage ($I_E = 0$)	100V	120V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	100V	120V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	4V	
I_C	Collector current	1A	
I_B	Base current	0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	10W	
	$T_{amb} \leq 25°C$	1W	
T_{stg}	Storage temperature	–65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

2N 5681
2N 5682

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5681** $V_{CB} = 100V$ for **2N5682** $V_{CB} = 120V$			1 1	µA µA
I_{CEV}	Collector cutoff current ($V_{BE} = -1.5V$)	for **2N5681** $V_{CE} = 100V$ for **2N5682** $V_{CE} = 120V$ $T_{case} = 150°C$ for **2N5681** $V_{CE} = 100V$ for **2N5682** $V_{CE} = 120V$			1 1 1 1	µA µA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5681** $V_{CE} = 70V$ for **2N5682** $V_{CE} = 80V$			10 10	µA µA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 4V$			1	µA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 10mA$ for **2N5681** for **2N5682**	 100 120			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 250mA$ $I_B = 25mA$ $I_C = 500mA$ $I_B = 50mA$ $I_C = 1A$ $I_B = 200mA$			0.6 1 2	V V V
V_{BE}*	Base-emitter voltage	$I_C = 250mA$ $V_{CE} = 2V$			1	V
h_{FE}*	DC current gain	$I_C = 250mA$ $V_{CE} = 2V$ $I_C = 1A$ $V_{CE} = 2V$	40 5		150	— —
f_T	Transition frequency	$I_C = 100mA$ $V_{CE} = 10V$ $f = 10MHz$	30			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 20V$ $f = 1MHz$			50	pF
h_{fe}	Small signal current gain	$I_C = 0.2A$ $V_{CE} = 1.5V$ $f = 1KHz$	40			—

* Pulsed: pulse duration = 300µs, duty cycle ≤2%.

EPITAXIAL-BASE PNP

2N 5871
2N 5872

POWER LINEAR AND SWITCHING APPLICATIONS

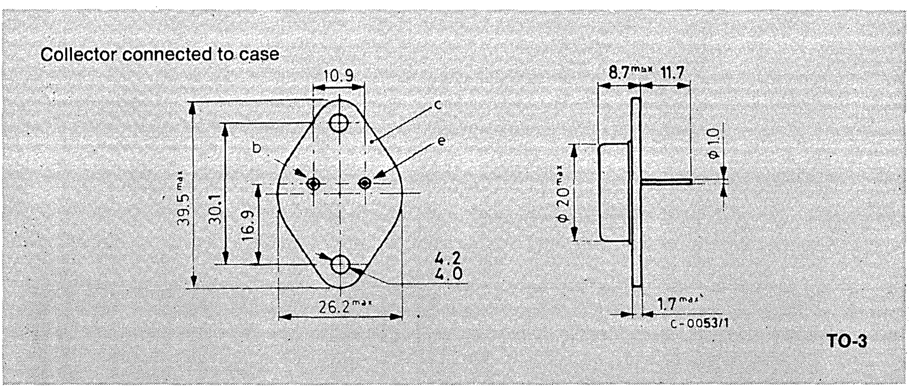
The 2N5871 and 2N5872 are silicon epitaxial-base PNP power transistors in Jedec TO-3 metal case, intended for use in linear and switching applications. The complementary NPN types are the 2N5873 and 2N5874 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N5871	2N5872
V_{CBO}	Collector-base voltage ($I_E = 0$)	–60V	–80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	–60V	–80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	–5V	
I_C	Collector current	–7A	
I_{CM}	Collector peak current	–15A	
I_B	Base current	–2A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	115W	
T_{stg}	Storage temperature	–65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm



2N 5871
2N 5872

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction case	max	1.52	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5871** for **2N5872**	$V_{CB} = -60V$ $V_{CB} = -80V$			–0.25 –0.25	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5871** for **2N5872**	$V_{CE} = -30V$ $V_{CE} = -40V$			–0.5 –0.5	mA mA
I_{CEV}	Collector cutoff current ($V_{BE} = 1.5V$)	for **2N5871** for **2N5872** T_{case} = 150°C for **2N5871** for **2N5872**	$V_{CE} = -60V$ $V_{CE} = -80V$ $V_{CE} = -60V$ $V_{CE} = -80V$			–0.25 –0.25 –2 –2	mA mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$				–1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -100mA$ for **2N5871** for **2N5872**		 –60 –80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -4A$ $I_C = -7A$	$I_B = -0.4A$ $I_B = -1.75A$			–1 –2	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = -7A$	$I_B = -1.75A$			–2.5	V
V_{BE}*	Base-emitter voltage	$I_C = -2.5A$	$V_{CE} = -4V$			–1.5	V
h_{FE}*	DC current gain	$I_C = -0.5A$ $I_C = -2.5A$ $I_C = -7A$	$V_{CE} = -4V$ $V_{CE} = -4V$ $V_{CE} = -4V$	35 20 4		 100 	— — —
h_{fe}	Small signal current gain	$I_C = -0.5A$ f = 1KHz	$V_{CE} = -4V$	20			—
f_T	Transition frequency	$I_C = -0.25A$	$V_{CE} = -10V$	4			MHz

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%

For characteristics curves see the BDW22 series.

EPITAXIAL-BASE NPN

2N 5873
2N 5874

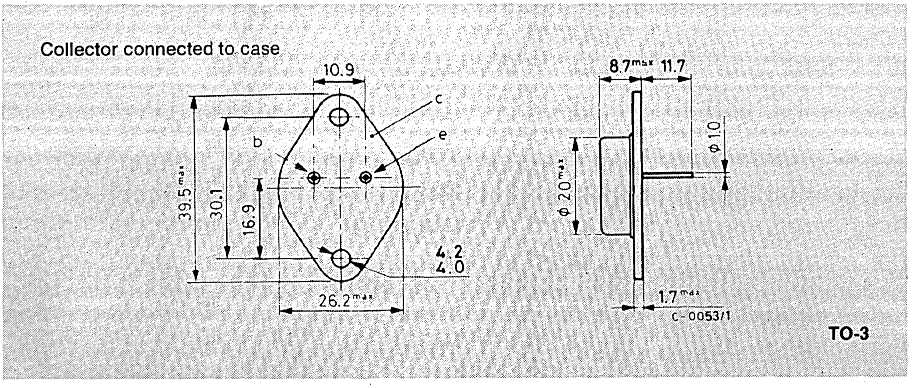
POWER LINEAR AND SWITCHING APPLICATIONS

The 2N5873 and 2N5874 are silicon epitaxial-base NPN power transistors in Jedec TO-3 metal case, intended for use in power linear and switching applications.
The complementary PNP types are the 2N5871 and 2N5872 respectively.

ABSOLUTE MAXIMUM RATINGS		2N5873	2N5874
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	7A	
I_{CM}	Collector peak current	15A	
I_B	Base current	2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	115W	
T_{stg}	Storage temperature	–65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm



2N 5873
2N 5874

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.52	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5873**	$V_{CB} = 60V$			0.25	mA
		for **2N5874**	$V_{CB} = 80V$			0.25	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5873**	$V_{CE} = 30V$			0.5	mA
		for **2N5874**	$V_{CE} = 40V$			0.5	mA
I_{CEV}	Collector cutoff current ($V_{BE} = -1.5V$)	for **2N5873**	$V_{CE} = 60V$			0.25	mA
		for **2N5874**	$V_{CE} = 80V$			0.25	mA
		$T_{case} = 150°C$					
		for **2N5873**	$V_{CE} = 60V$			2	mA
		for **2N5874**	$V_{CE} = 80V$			2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100mA$					
		for **2N5873**		60			V
		for **2N5874**		80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 4A$	$I_B = 0.4A$			1	V
		$I_C = 7A$	$I_B = 1.75A$			2	V
V_{BE}*	Base-emitter voltage	$I_C = 2.5A$	$V_{CE} = 4V$			1.5	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = 7A$	$I_B = 1.75A$			2.5	V
h_{FE}*	DC current gain	$I_C = 0.5A$	$V_{CE} = 4V$	35			—
		$I_C = 2.5A$	$V_{CE} = 4V$	20		100	—
		$I_C = 7A$	$V_{CE} = 4V$	4			—
h_{fe}	Small signal current gain	$I_C = 0.5A$ f = 1KHz	$V_{CE} = 4V$	20			—
f_T	Transition frequency	$I_C = 0.25A$	$V_{CE} = 10V$	4			MHz

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

For characteristics curves see the, BDW 21 series.

EPITAXIAL-BASE PNP

2N 5875
2N 5876

SILICON HIGH POWER TRANSISTORS

The 2N 5875 and 2N 5876 are silicon epitaxial-base PNP power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications. The complementary NPN types are the 2N 5877 and 2N 5878 respectively.

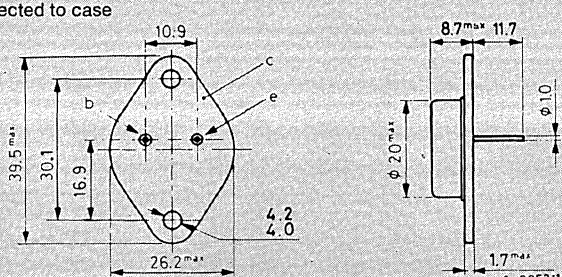
ABSOLUTE MAXIMUM RATINGS

		2N5875	2N5876
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-10A	
I_{CM}	Collector peak current	-20A	
I_B	Base current	-4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

2N 5875
2N 5876

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

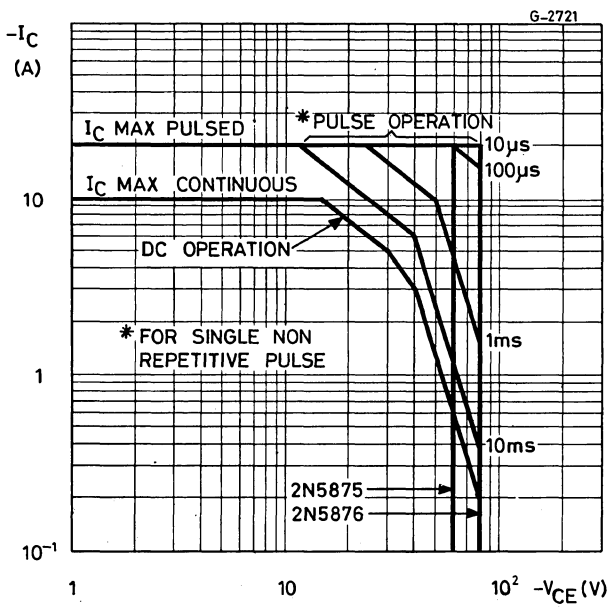
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **2N5875** V_{CB} = -60V for **2N5876** V_{CB} = -80V			-0.5 -0.5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N5875** V_{CE} = -30V for **2N5876** V_{CE} = -40V			-1 -1	mA mA
I_{CEX}	Collector cutoff current (V_{BE} = 1.5 V)	for **2N5875** V_{CE} = -60V for **2N5876** V_{CE} = -80V T_{case} = 150 °C for **2N5875** V_{CE} = -60V for **2N5876** V_{CE} = -80V			-0.5 -0.5 -5 -5	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5 V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -200 mA for **2N5875** for **2N5876**	 -60 -80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -5 A I_B = -0.5A I_C = -10A I_B = -2.5A			-1 -3	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = -10A I_C = -2.5A			-2.5	V
V_{BE}*	Base-emitter voltage	I_C = -4A V_{CE} = -4V			-1.5	V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = -4A V_{CE} = -4V I_C = -10A V_{CE} = -4V	20 4		100	— —
f_T	Transition frequency	I_C = -0.5A V_{CE} = -10V	4			MHz
C_{CBO}	Collector-base capacitance	V_{CB} = -10V f = 1 MHz I_E = 0			500	pF
t_r	Rise time	I_C = -4A V_{CC} = -30V I_{B1} = -0.4A			0.7	μs
t_s	Storage time	I_C = -4A V_{CC} = -30V I_{B1} = $-I_{B2}$ = -0.4A			1	μs
t_f	Fall time				0.8	μs

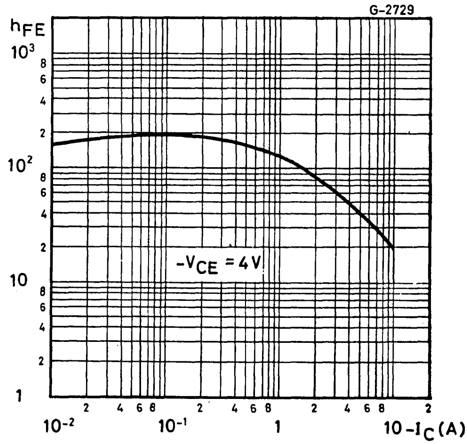
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

Safe operating areas

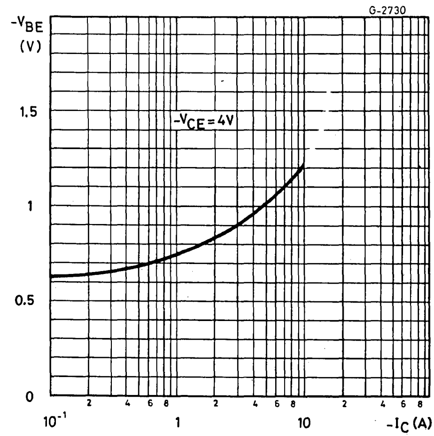


2N 5875
2N 5876

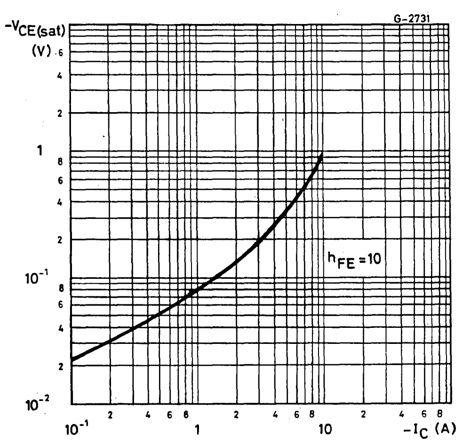
DC current gain



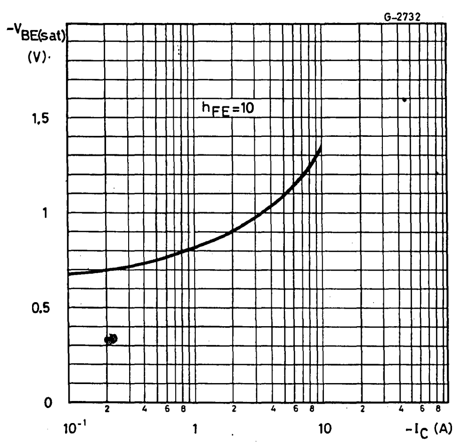
DC transconductance



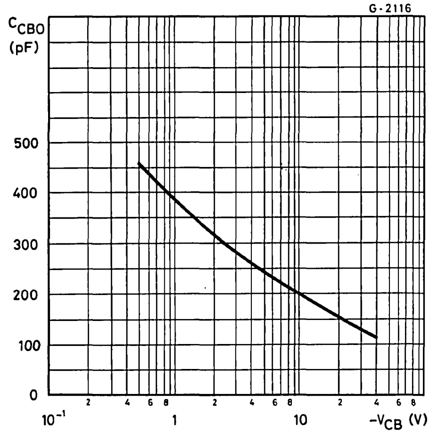
Collector-emitter saturation voltage



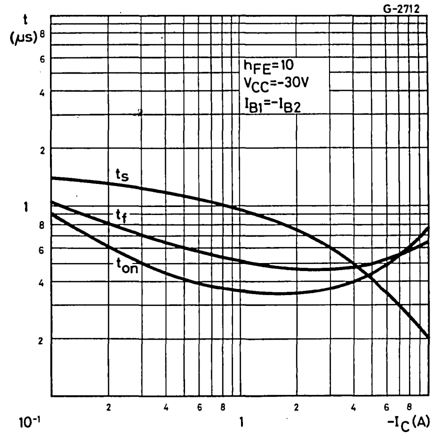
Base-emitter saturation voltage



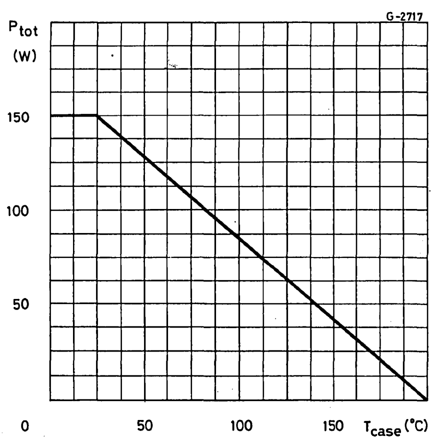
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 5877
2N 5878

EPITAXIAL-BASE NPN

SILICON HIGH POWER TRANSISTORS

The 2N 5877 and 2N 5878 are silicon epitaxial-base NPN power transistors in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the 2N 5875 and 2N 5876 respectively.

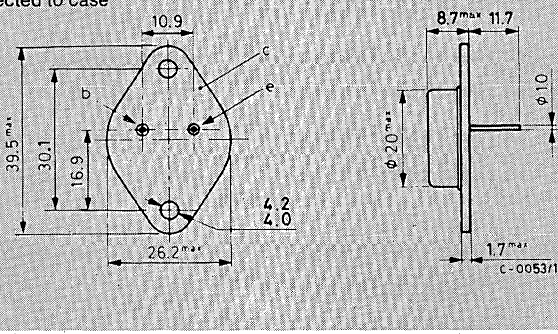
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	2N5877	2N5878
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	10A	
I_{CM}	Collector peak current	20A	
I_B	Base current	4A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

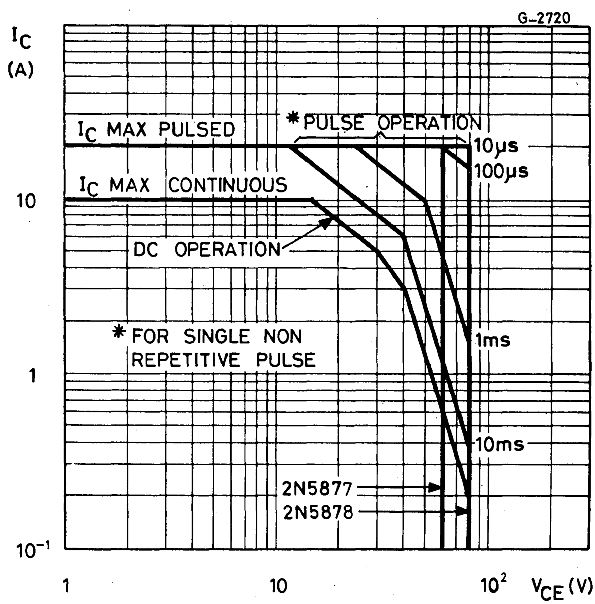
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **2N5877** for **2N5878**	V_{CB} = 60V V_{CB} = 80V			0.5 0.5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N5877** for **2N5878**	V_{CE} = 30V V_{CE} = 40V			1 1	mA mA
I_{CEX}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5877** for **2N5878** T_{case} = 150 °C for **2N5877** for **2N5878**	V_{CE} = 60V V_{CE} = 80V V_{CE} = 60V V_{CE} = 80V			0.5 0.5 5 5	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200 mA	for **2N5877** for **2N5878**	60 80			V V
$V_{CE\ (sat)}$*	Collector emitter saturation voltage	I_C = 5 A I_C = 10A	I_B = 0.5A I_B = 2.5A			1 3	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 10A	I_C = 2.5A			2.5	V
V_{BE}*	Base-emitter voltage	I_C = 4A	V_{CE} = 4V			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

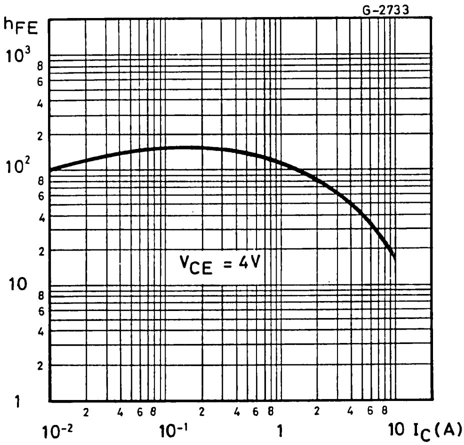
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 4A V_{CE} = 4V I_C = 10A V_{CE} = 4V	20 4		100	— —
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10V	4			MHz
C_{CBO}	Collector-base capacitance	V_{CB} = 10V f = 1 MHz I_E = 0			300	pF
t_r	Rise time	I_C = 4A V_{CC} = 30V I_{B1} = 0.4A			0.7	µs
t_s	Storage time	I_C = 4A V_{CC} = 30V I_{B1} = $-I_{B2}$ = 0.4A			1	µs
t_f	Fall time				0.8	µs

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%

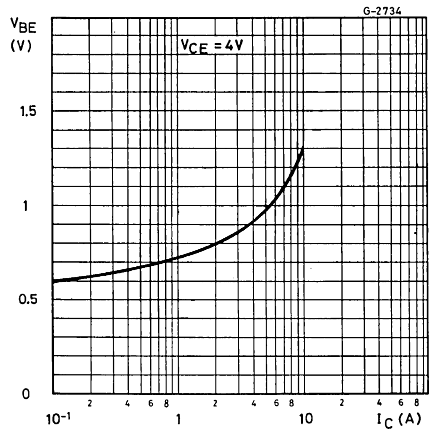
Safe operating areas



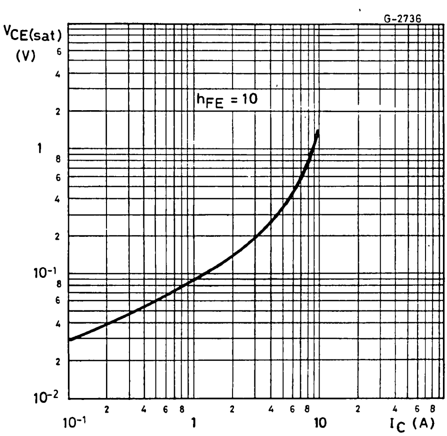
DC current gain



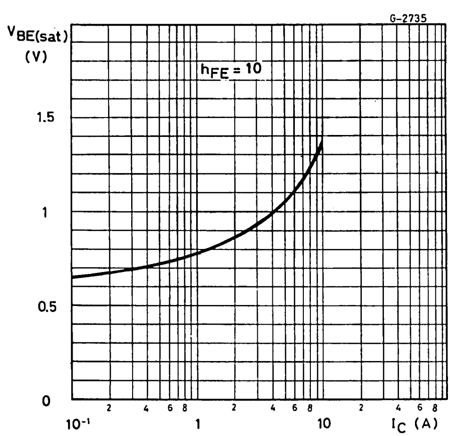
DC transconductance



Collector-emitter saturation voltage

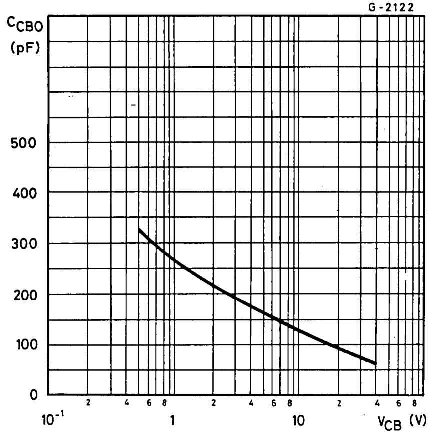


Base-emitter saturation voltage

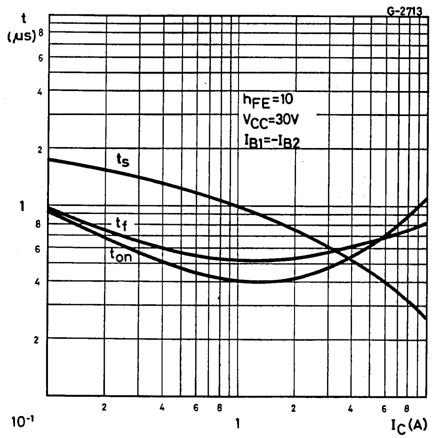


2N 5877
2N 5878

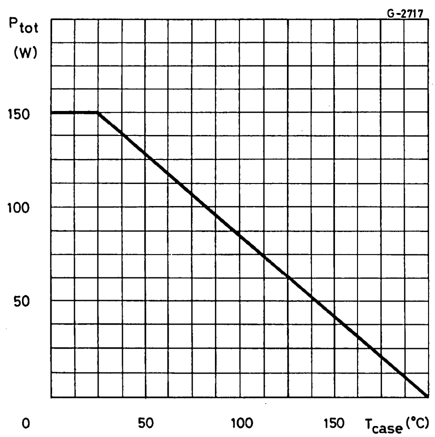
Collector-base capacitance



Saturated switching characteristics



Power rating chart



MULTIEPITAXIAL PLANAR NPN

2N 6032
2N 6033

HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTORS

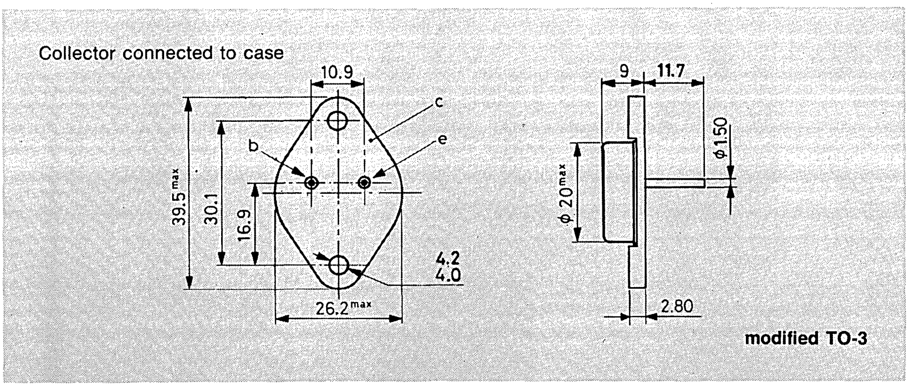
The 2N 6032 and 2N 6033 are silicon multiepitaxial planar NPN transistors in modified Jedec TO-3 metal case.
They have high current, high power handling capability, fast switching speed and are intended for use in switching and linear applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

		2N6032	2N6033
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	150V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5$ V, $R_{BE} = 50\ \Omega$)	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} = 50\ \Omega$)	110V	140V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90	120V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	7V
I_C	Collector current	50A	40A
I_B	Base current	10A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	140W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



6/77

2N 6032
2N 6033

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N6032**				
		V_{CE} = 110V			12	mA
		V_{CE} = 100V T_{case} = 150°C			15	mA
		for **2N6033**				
		V_{CE} = 135V			10	mA
		V_{CE} = 100V T_{case} = 150°C			10	mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 80 V			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			10	mA
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5V, R_{BE} = 50Ω)	I_C = 200 mA				
		for **2N6032**	120			V
		for **2N6033**	150			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 50 Ω)	I_C = 200mA				
		for **2N6032**	110			V
		for **2N6033**	140			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA				
		for **2N6032**	90			V
		for **2N6033**	120			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **2N6032**				
		I_C = 50 A I_B = 5 A			1.3	V
		for **2N6033**				
		I_C = 40 A I_B = 4 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **2N6032**				
		I_C = 50 A I_B = 5 A			2	V
		for **2N6033**				
		I_C = 40 A I_B = 4 A			2	V

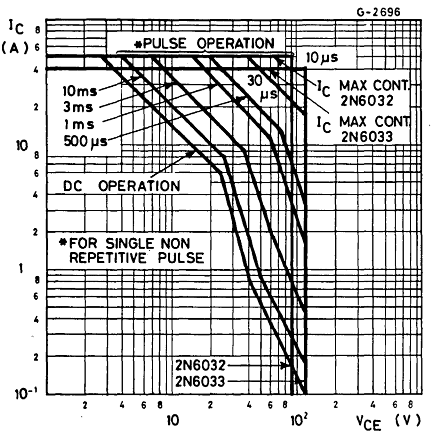
ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_{BE}*	Base-emitter voltage	for **2N6032** I_C = 50 A V_{CE} = 2 V			2	V
		for **2N6033** I_C = 40 A V_{CE} = 2 V			2	V
h_{FE}*	DC current gain	for **2N6032** I_C = 50 A V_{CE} = 2.6 V	10		50	—
		for **2N6033** I_C = 40 A V_{CE} = 2 V	10		50	—
h_{fe}	Small-signall current gain	I_C = 2 A V_{CE} = 10 V f = 5 MHz	10			—
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz			800	pF
t_r	Rise time	for **2N6032** I_C = 50 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 5A for **2N6033** I_C = 40 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 4A			1	μs
t_s	Storage time				1.5	μs
t_f	Fall time				0.5	μs
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 24 V	5.8			A
		V_{CE} = 40 V	0.9			A
$E_{s/b}$	Second breakdown energy	V_{BE} = -4 V, R_{BE} = 5 Ω L = 310 μH	62			mJ

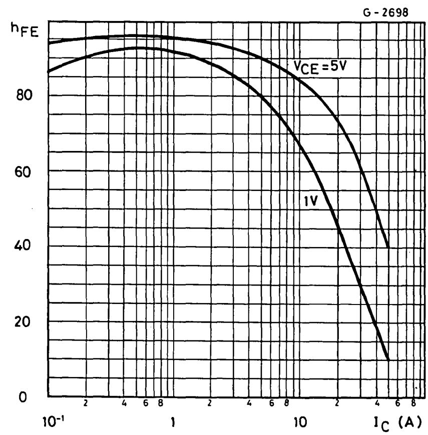
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1 s non repetitive pulse

2N 6032
2N 6033

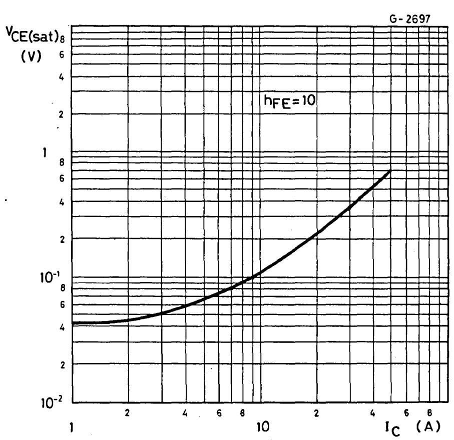
Safe operating areas



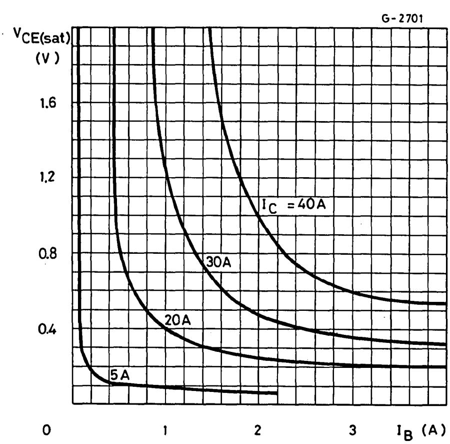
DC current gain



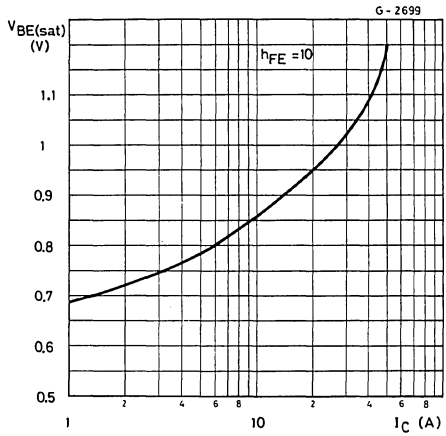
Collector-emitter saturation voltage



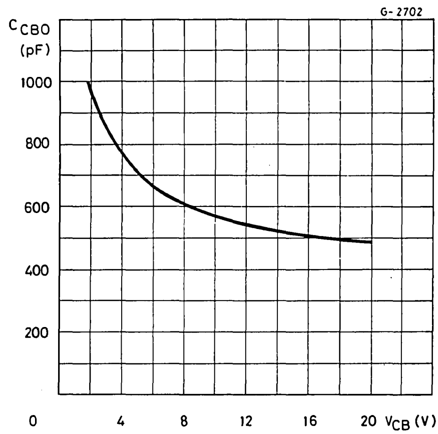
Collector-emitter saturation voltage



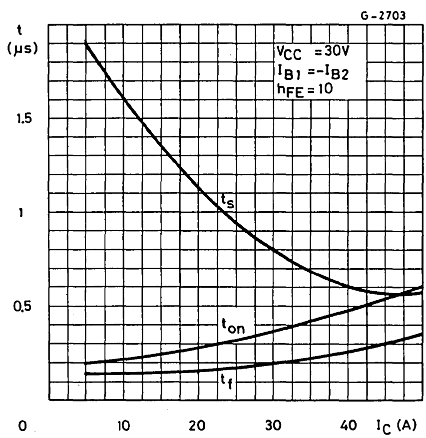
Base-emitter saturation voltage



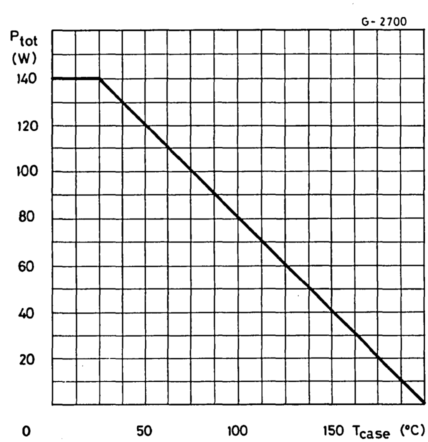
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 6034
2N 6035
2N 6036

EPITAXIAL-BASE PNP

MEDIUM POWER DARLINGTONS

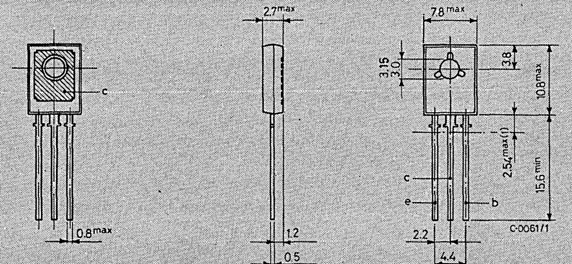
The 2N 6034, 2N 6035 and 2N 6036 are silicon epitaxial-base PNP power transistors in monolithic Darlington configuration and are mounted in Jedec TO-126 plastic package. They are intended for use in medium power linear and switching applications.
The complementary NPN types are the 2N 6037, 2N 6038 and 2N 6039 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6034	2N6035	2N6036
V_{CBO}	Collector-base voltage ($I_E = 0$)	-40V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-40V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current		-8A	
I_B	Base current		-100mA	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	83.3	°C/W

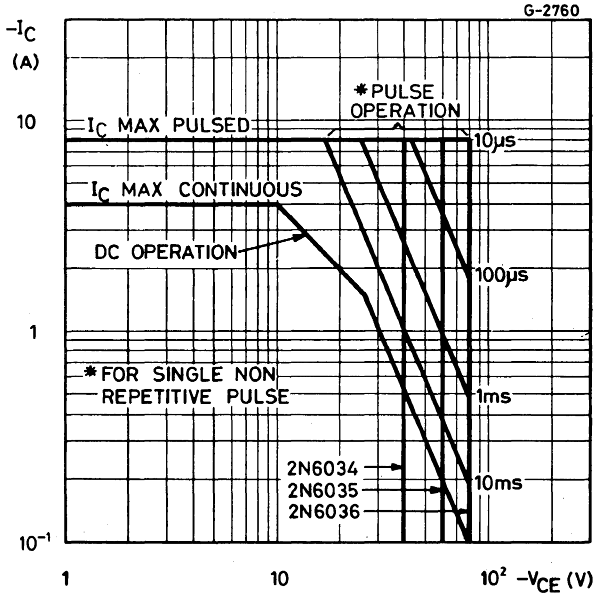
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6034** for **2N6035** for **2N6036**	V_{CB} = -40V V_{CB} = -60V V_{CB} = -80V			-500 -500 -500	μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6034** for **2N6035** for **2N6036**	V_{CE} = -20V V_{CE} = -30V V_{CE} = -40V			-500 -500 -500	μA μA A
I_{CEX}	Collector cutoff current (V_{EB} = -1.5V)	for **2N6034** for **2N6035** for **2N6036** T_{case} = 125 °C for **2N6034** for **2N6035** for **2N6036**	V_{CE} = -40V V_{CE} = -60V V_{CE} = -80V V_{CE} = -40V V_{CE} = -60V V_{CE} = -80V			-0.5 -0.5 -0.5 -2 2 -2	mA mA mA mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V				-2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100mA	for **2N6034** for **2N6035** for **2N6036**	-40 -60 -80			V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_C = -4A	I_B = -8mA I_B = -40mA			-2 -3	V V
V_{BE}*	Base-emitter voltage	I_C = -2A	V_{CE} = -3V			-2.8	V
h_{FE}*	DC current gain	I_C = -0.5A I_C = -2A I_C = -4A	V_{CE} = -3V V_{CE} = -3V V_{CE} = -3V	500 750 100		 15000 	— — —
h_{fe}	Small signal current gain	I_C = -0.75 f = 1 MHz	V_{CE} = -10V	1			—
C_{CBO}	Collector-base capacitance	V_{CB} = -10V f = 1 MHz	I_E = 0			200	pF

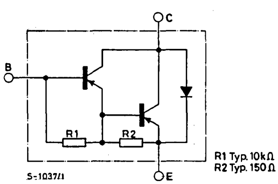
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

2N 6034
2N 6035
2N 6036

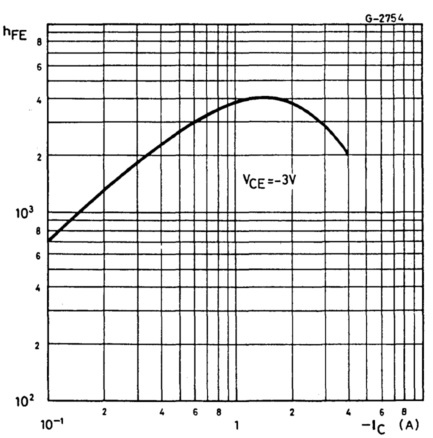
Safe operating areas



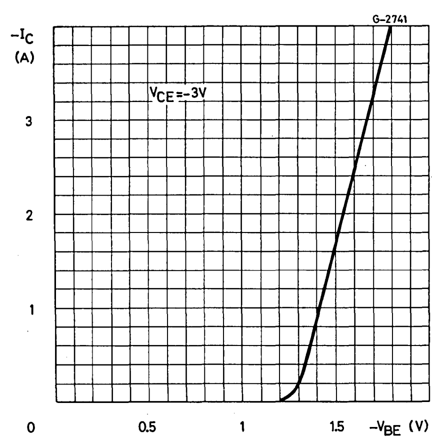
Internal circuit diagram



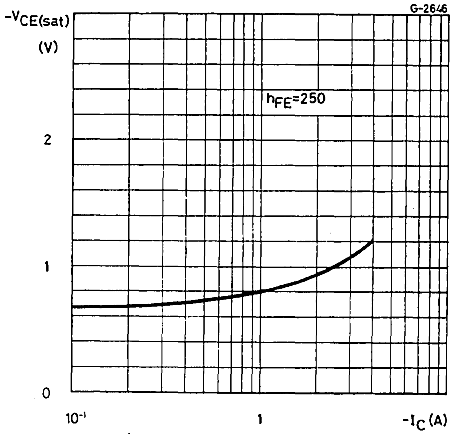
DC current gain



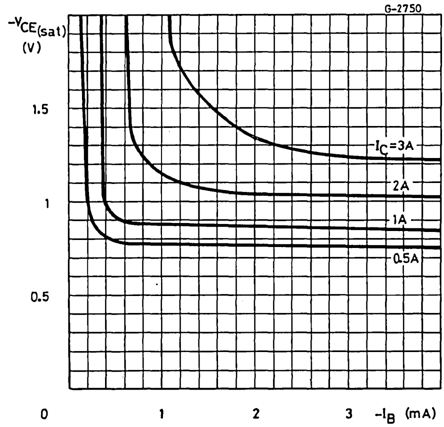
DC transconductance



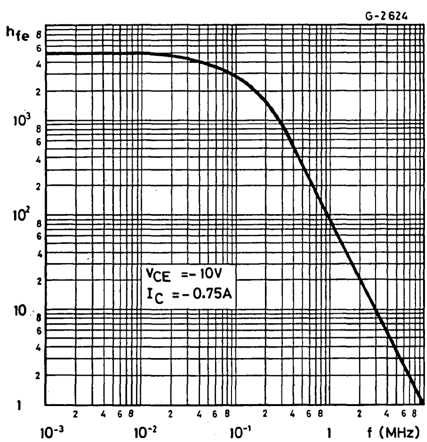
Collector-emitter saturation voltage



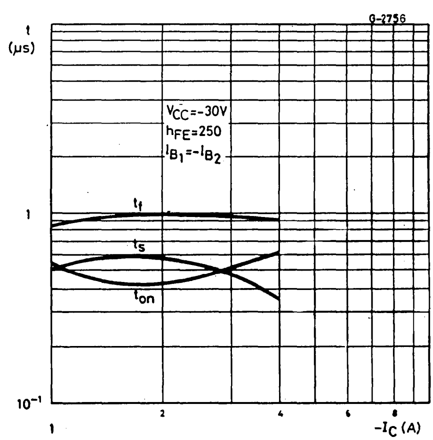
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



2N 6037
2N 6038
2N 6039

EPITAXIAL-BASE NPN

MEDIUM POWER DARLINGTONS

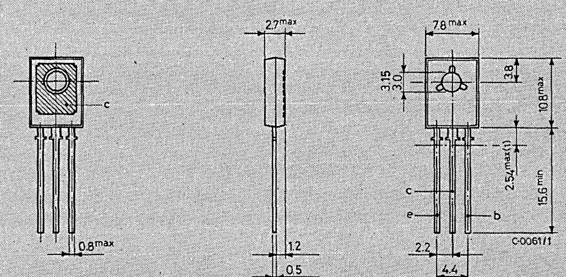
The 2N 6037, 2N 6038 and 2N 6039 are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration and are mounted in Jedec TO-126 plastic package. They are intended for use in medium power linear and switching applications.
The complementary PNP types are the 2N 6034, 2N 6035 and 2N 6036 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6037	2N6038	2N6039
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current		8A	
I_B	Base current		100mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

THERMAL DATA

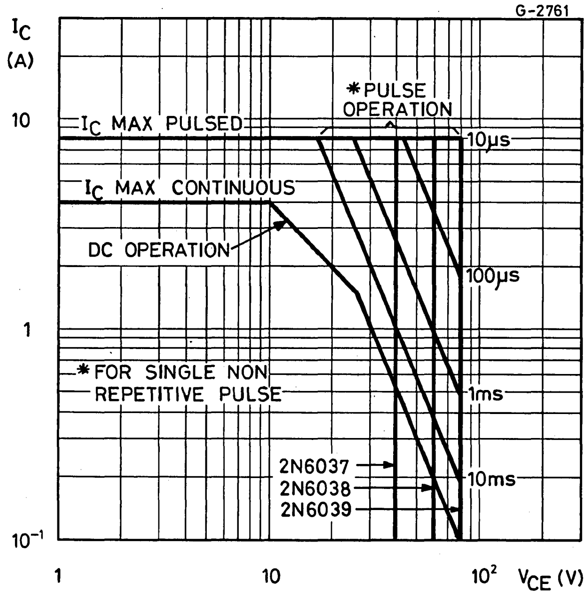
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	83.3	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

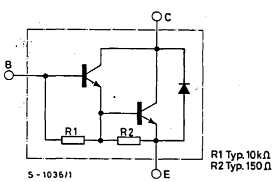
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6037**	V_{CB} = 40V			500	μA
		for **2N6038**	V_{CB} = 60V			500	μA
		for **2N6039**	V_{CB} = 80V			500	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6037**	V_{CE} = 20V			500	μA
		for **2N6038**	V_{CE} = 30V			500	μA
		for **2N6039**	V_{CE} = 40V			500	μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5V)	for **2N6037**	V_{CE} = 40V			0.5	mA
		for **2N6038**	V_{CE} = 60V			0.5	mA
		for **2N6039**	V_{CE} = 80V			0.5	mA
		T_{case} = 125 °C					
		for **2N6037**	V_{CE} = 40V			2	mA
		for **2N6038**	V_{CE} = 60V			2	mA
		for **2N6039**	V_{CE} = 80V			2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA					
			for **2N6037**	40			V
			for **2N6038**	60			V
			for **2N6039**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 8mA			2	V
		I_C = 4A	I_B = 40mA			3	V
V_{BE}*	Base-emitter voltage	I_C = 2A	V_{CE} = 3V			2.8	V
h_{FE}*	DC current gain	I_C = 0.5A	V_{CE} = 3V	500			—
		I_C = 2A	V_{CE} = 3V	750		15000	—
		I_C = 4A	V_{CE} = 3V	100			—
h_{fe}	Small signal current gain	I_C = 0.75A	V_{CE} = 10V				
		f = 1 MHz		1			—
C_{CBO}	Collector-base capacitance	V_{CB} = 10V					
		f = 1 MHz	I_E = 0			100	pF

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

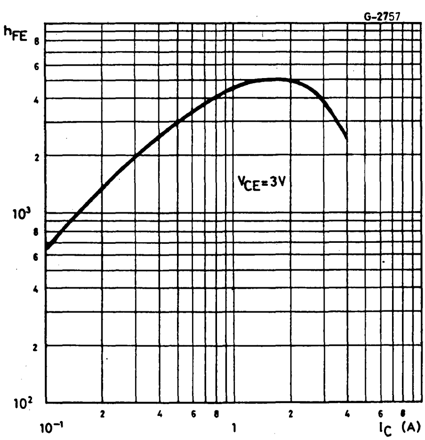
Safe operating areas



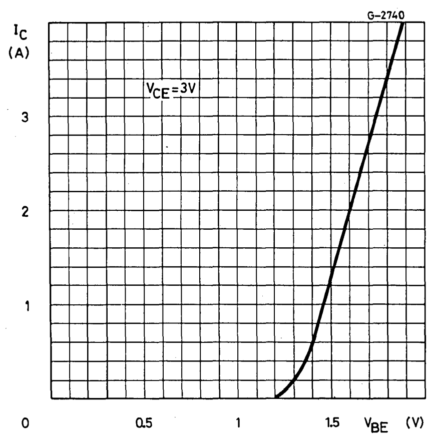
Internal circuit diagram



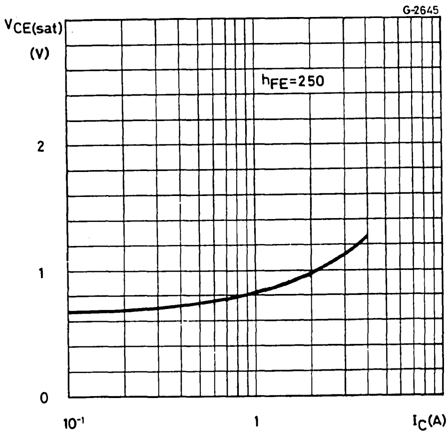
DC current gain



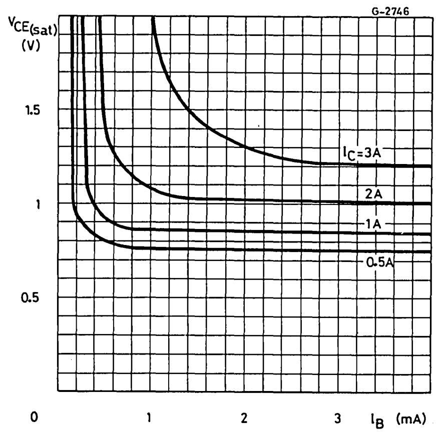
DC transconductance



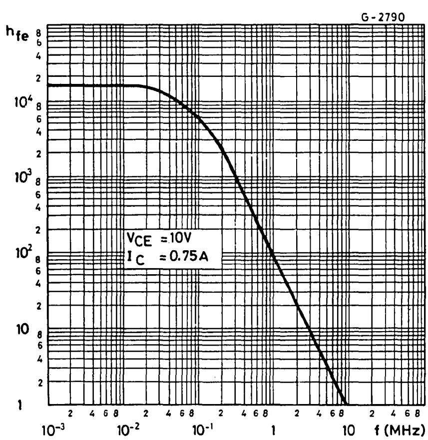
Collector-emitter saturation voltage



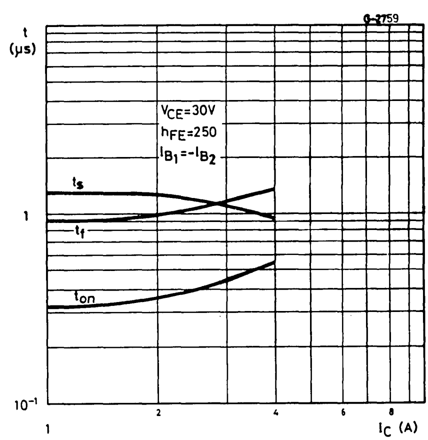
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



2N 6050
2N 6051
2N 6052

EPITAXIAL-BASE PNP

POWER DARLINGTONS

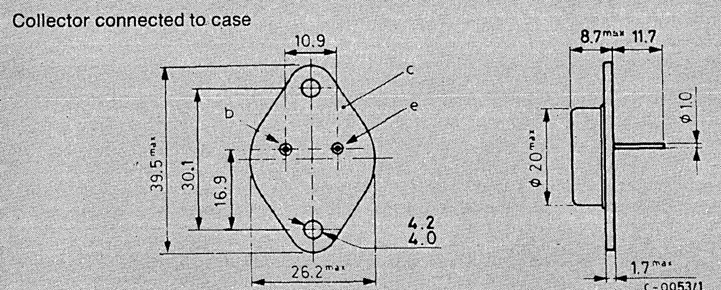
The 2N 6050, 2N 6051 and 2N 6052 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the 2N 6057, 2N 6058 and 2N 6059 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6050	2N6051	2N6052
V_{CBO}	Collector-base voltage ($I_E=0$)	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C=0$)		-5V	
I_C	Collector current		-12A	
I_{CM}	Collector peak current		-20A	
I_B	Base current		-0.2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		150W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm



TO-3

THERMAL DATA

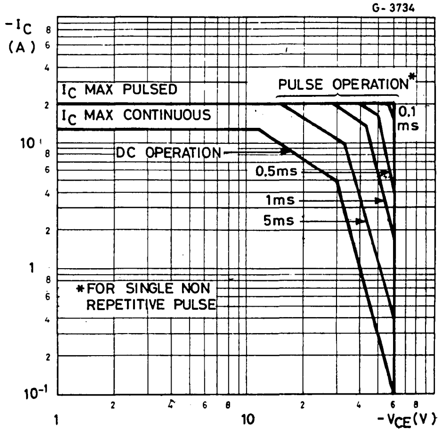
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

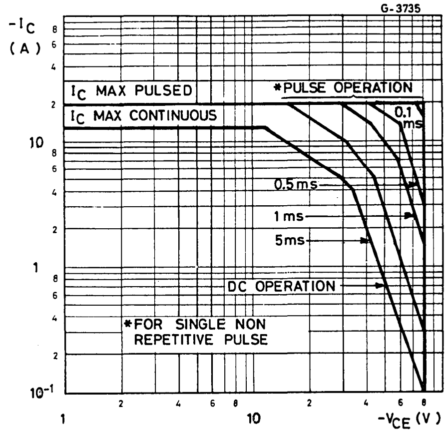
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6050** V_{CE} = -30V for **2N6051** V_{CE} = -40V for **2N6052** V_{CE} = -50V			-1 -1 -1	mA mA mA
I_{CEX}	Collector cutoff current (V_{EB} = -1.5V)	for **2N6050** V_{CE} = -60V for **2N6051** V_{CE} = -80V for **2N6052** V_{CE} = -100V T_{case} = 150 °C for **2N6050** V_{CE} = -60V for **2N6051** V_{CE} = -80V for **2N6052** V_{CE} = -100V			-0.5 -0.5 -0.5 -5 -5 -5	mA mA mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V			-2	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100mA for **2N6050** for **2N6051** for **2N6052**	 -60 -80 -100			 V V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = -6 A I_B = -24mA I_C = -12A I_B = -120mA			-2 -3	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = -12A I_B = -120mA			-4	V
V_{BE}*	Base-emitter voltage	I_C = -6A V_{CE} = -3V			-2.8	V
h_{FE}*	DC current gain	I_C = -6A V_{CE} = -3V I_C = -12A V_{CE} = -3V	750 100		18000	— —
h_{fe}	Small signal current gain	I_C = -5A V_{CE} = -3V f = 1 MHz	 4			 —
C_{CBO}	Collector-base capacitance	V_{CB} = -10V f = 1 MHz I_E = 0			500	pF

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

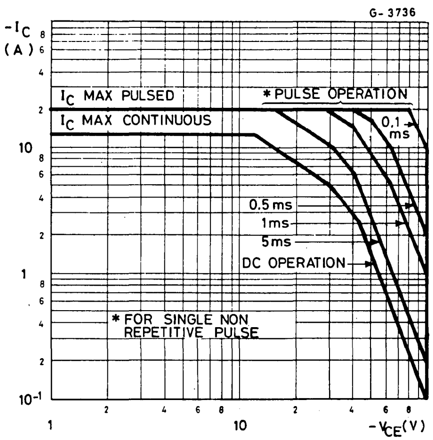
Safe operating areas for 2N6050



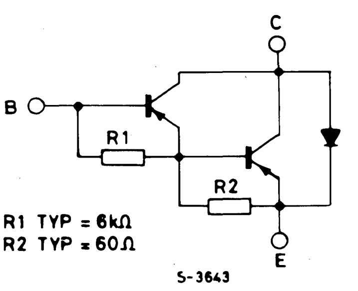
Safe operating areas for 2N6051



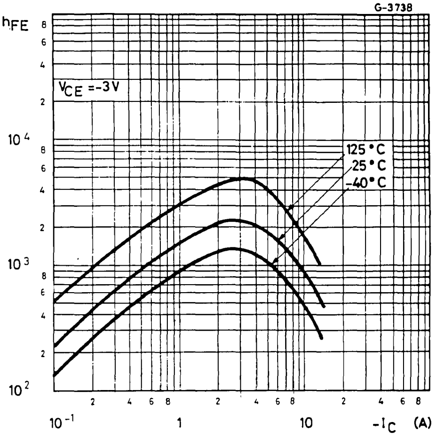
Safe operating areas for 2N6052



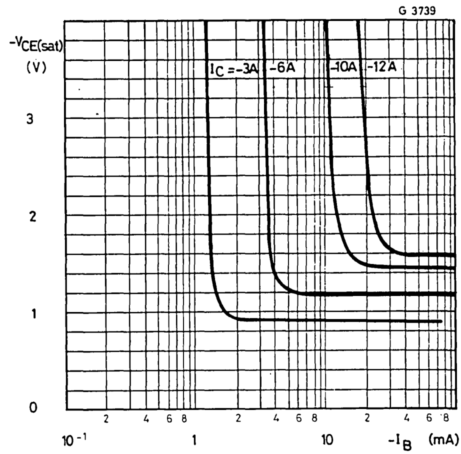
Internal circuit diagram



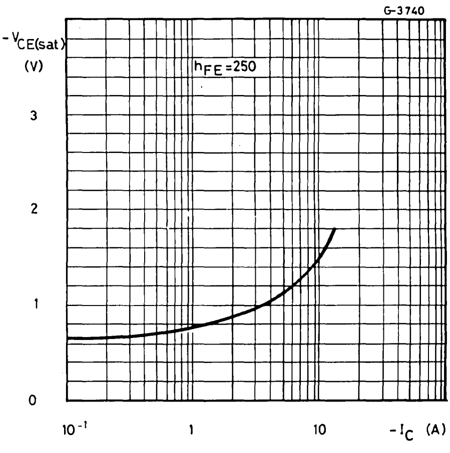
DC current gain



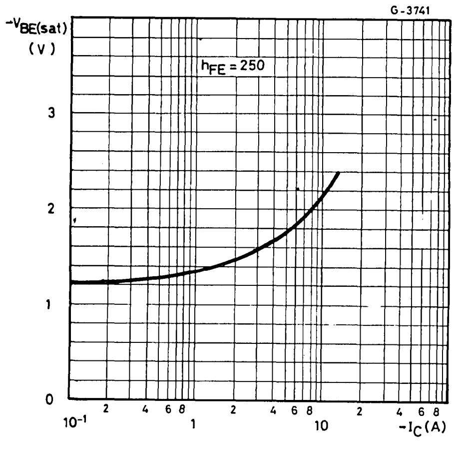
Collector-emitter saturation voltage



Collector-emitter saturation voltage

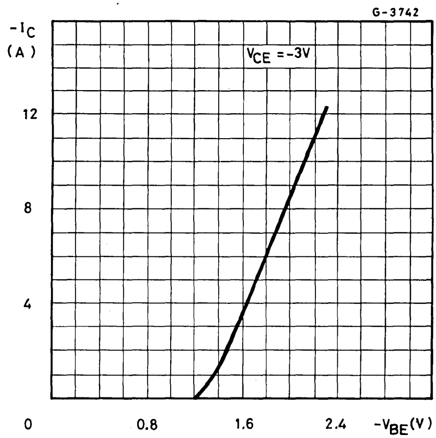


Base-emitter saturation voltage

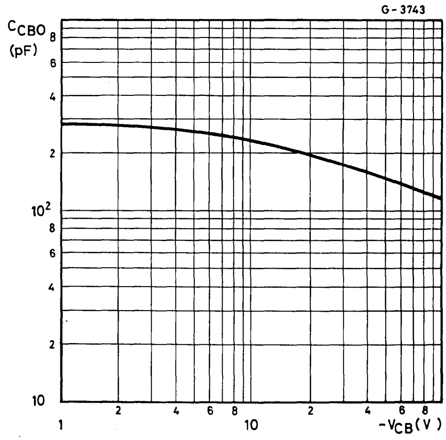


2N 6050
2N 6051
2N 6052

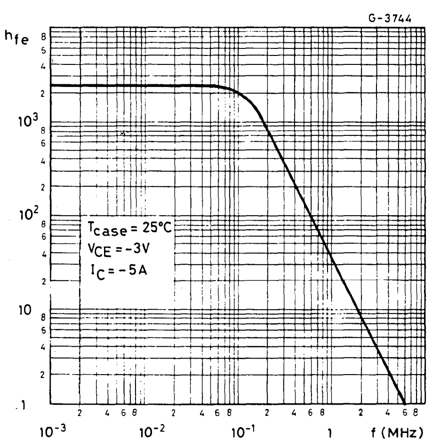
DC transconductance



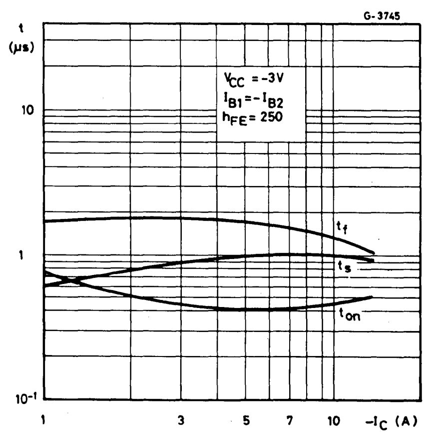
Collector-base capacitance



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE PNP

2N 6053
2N 6054

POWER DARLINGTONS

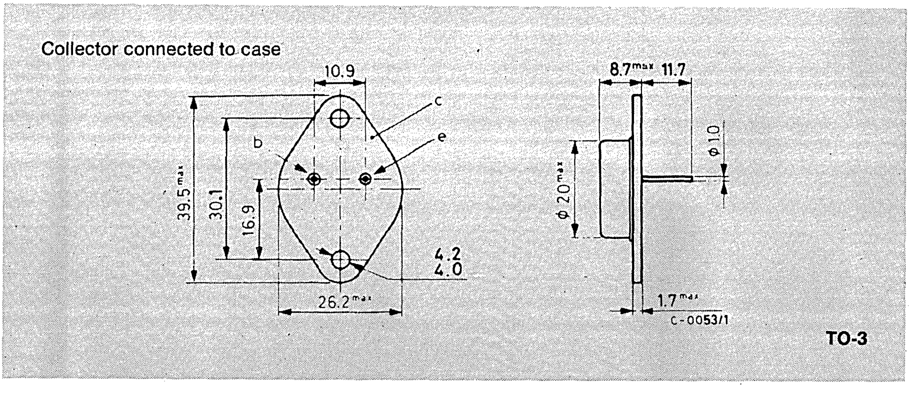
The 2N 6053 and 2N 6054 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary NPN types are the 2N 6055 and 2N 6056 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6053	2N6054
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-8A	
I_{CM}	Collector peak current	-16A	
I_B	Base current	-120mA	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	100W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm



2N 6053
2N 6054

THERMAL DATA

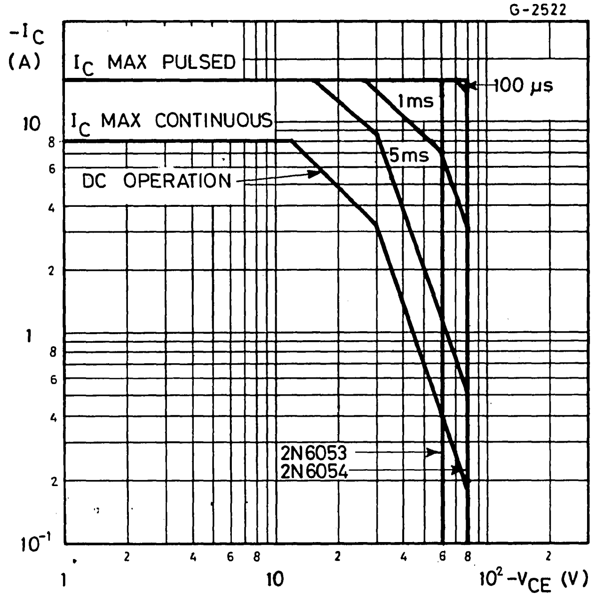
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS ($T_{case} = 25°C$ unless otherwise specified)

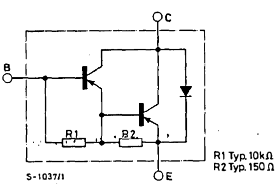
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current ($V_{BE} = 1.5V$)	for **2N6053** $V_{CE} = -60V$ for **2N6054** $V_{CE} = -80V$ $T_{case} = 150\ °C$ for **2N6053** $V_{CE} = -60V$ for **2N6054** $V_{CE} = -80V$			-500 -500 -5 -5	μA μA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N6053** $V_{CE} = -30V$ for **2N6054** $V_{CE} = -40V$			-0.5 -0.5	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -5V$			-2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = -100mA$ for **2N6053** for **2N6054**	 -60 -80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -4A$ $I_B = -16mA$ $I_C = -8A$ $I_B = -80mA$			-2 -3	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = -8A$ $I_B = -80mA$			-4	V
V_{BE}*	Base-emitter voltage	$I_C = -4A$ $V_{CE} = -3V$			-2.8	V
h_{FE}*	DC current gain	$I_C = -4A$ $V_{CE} = -3V$ $I_C = -8A$ $V_{CE} = -3V$	750 100		18000	— —
h_{fe}	Small signal current gain	$I_C = -3A$ $V_{CE} = -3V$ $f = 1\ MHz$	4			—
C_{CBO}	Collector-base capacitance	$V_{CB} = -10V$ $f = 1\ MHz$ $I_E = 0$			300	pF

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

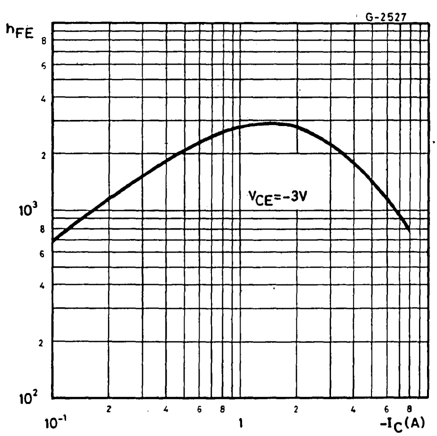
Safe operating areas



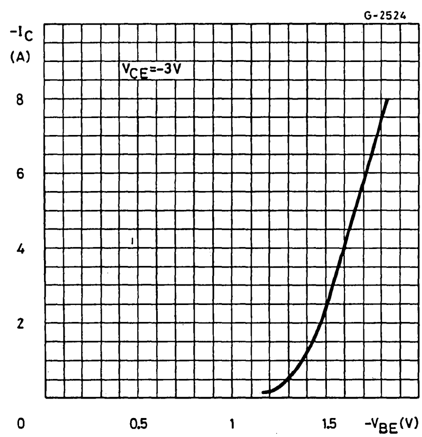
Internal circuit diagram



DC current gain

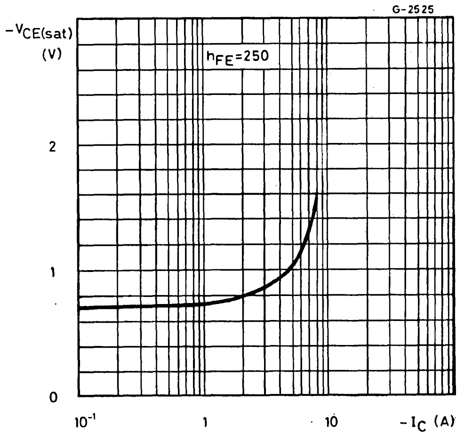


DC transconductance

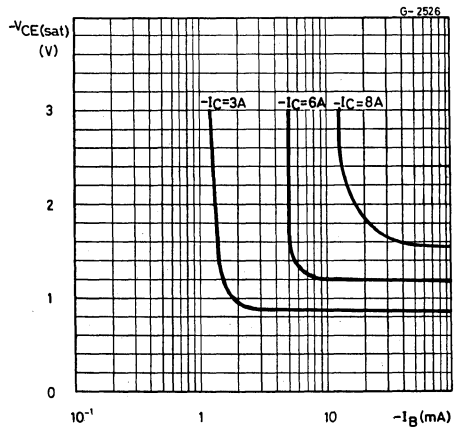


2N 6053
2N 6054

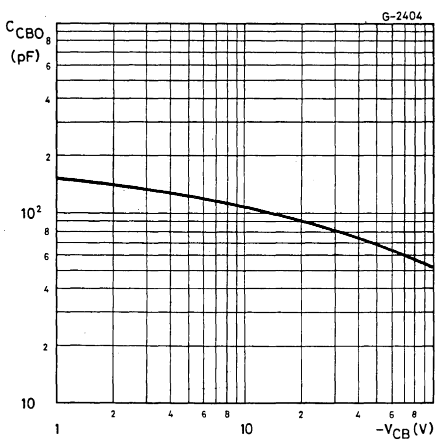
Collector-emitter saturation voltage



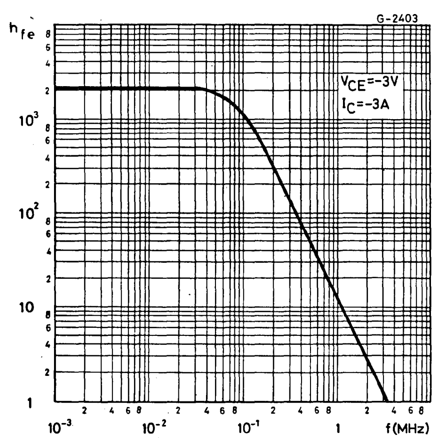
Collector-emitter saturation voltage



Collector-base capacitance



Small signal current gain



EPITAXIAL-BASE NPN

2N 6055
2N 6056

POWER DARLINGTONS

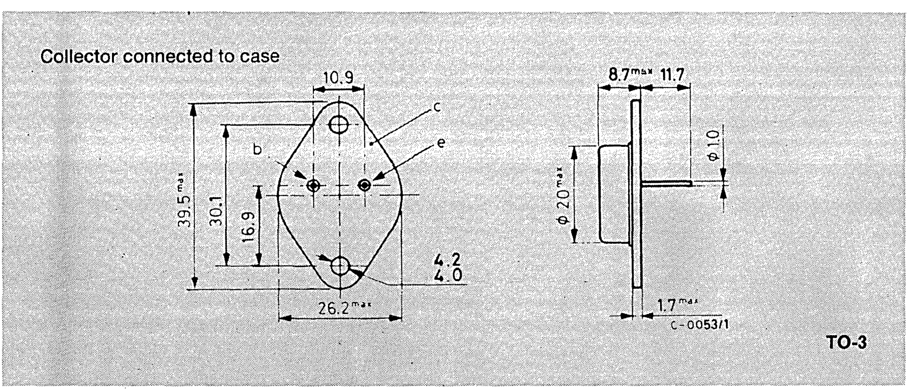
The 2N 6055 and 2N 6056 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case intended for use in power linear and switching applications.
The complementary PNP types are the 2N 6053 and 2N 6054 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6055	2N6056
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	8A	
I_{CM}	Collector peak current	16A	
I_B	Base current	120mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm



6/77

2N 6055
2N 6056

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

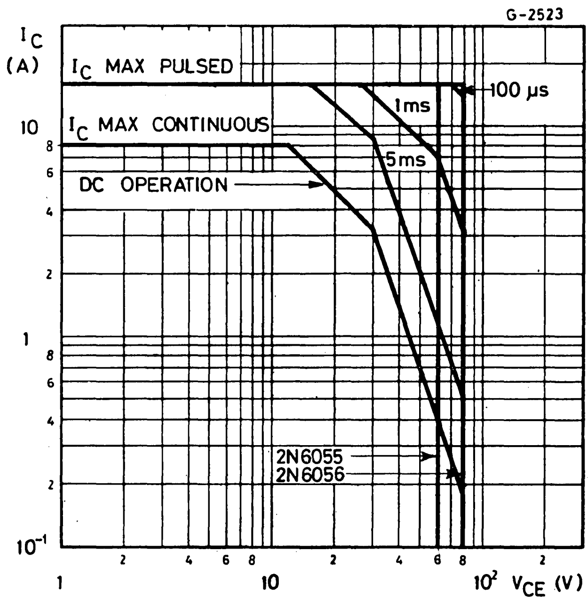
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

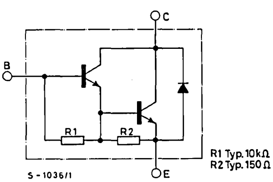
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = -1.5V)	for **2N6055** V_{CE} = 60V for **2N6056** V_{CE} = 80V T_{case} = 150 °C for **2N6055** V_{CE} = 60V for **2N6056** V_{CE} = 80V			500 500 5 5	μA μA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6055** V_{CE} = 30V for **2N6056** V_{CE} = 40V			0.5 0.5	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **2N6055** for **2N6056**	 60 80			 V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4A I_B = 16mA I_C = 8A I_B = 80mA			2 3	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 8A I_B = 80mA			4	V
V_{BE}*	Base-emitter voltage	I_C = 4A V_{CE} = 3V			2.8	V
h_{FE}*	DC current gain	I_C = 4A V_{CE} = 3V I_C = 8A V_{CE} = 3V	750 100		18000	—
h_{fe}	Small signal current gain	I_C = 3A V_{CE} = 3V f = 1 MHz	4			—
C_{CBO}	Collector-base capacitance	V_{CB} = 10V f = 1 MHz I_E = 0			200	pF

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

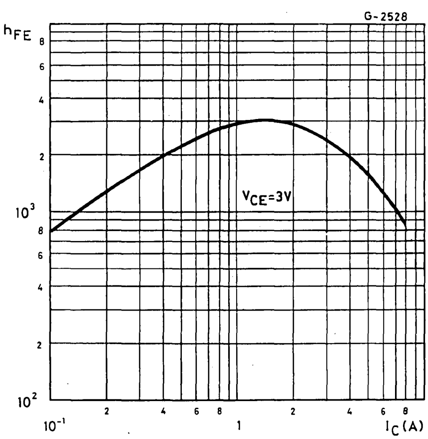
2N 6055
2N 6056

Safe operating areas

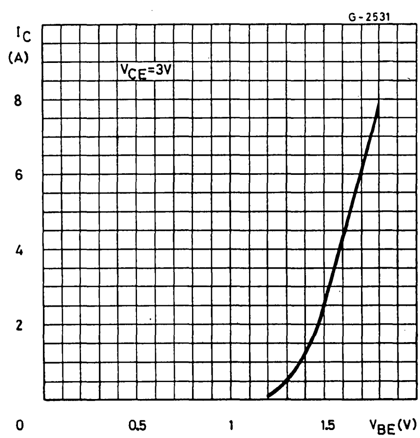




DC current gain

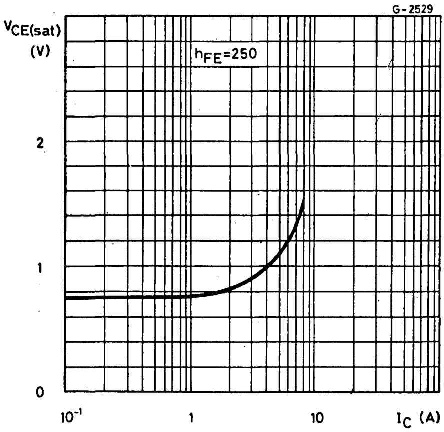


DC transconductance

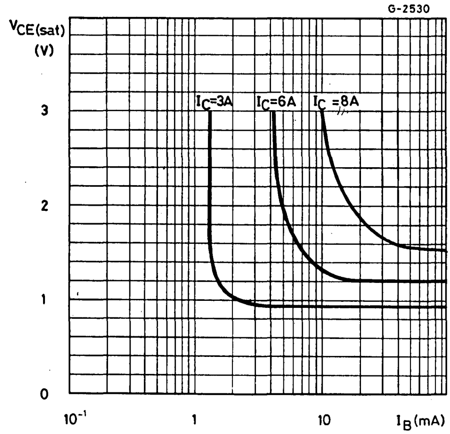


2N 6055
2N 6056

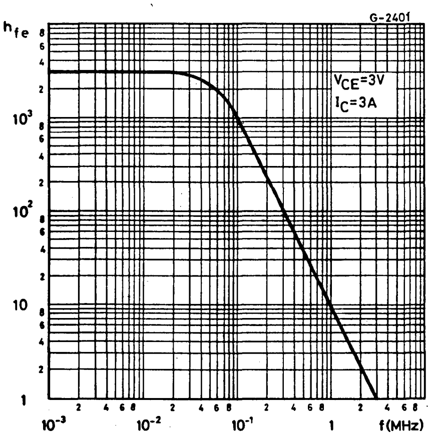
Collector-emitter saturation voltage



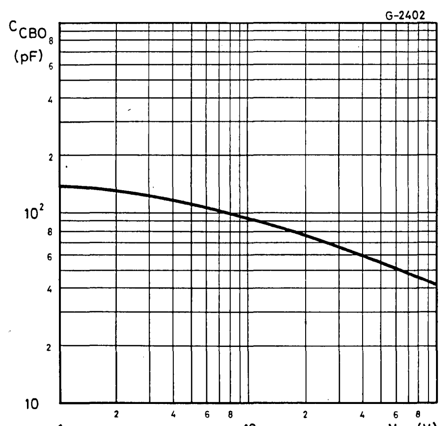
Collector-emitter saturation voltage



Small signal current gain



Collector-base capacitance



EPITAXIAL-BASE NPN

2N 6057
2N 6058
2N 6059

POWER DARLINGTONS

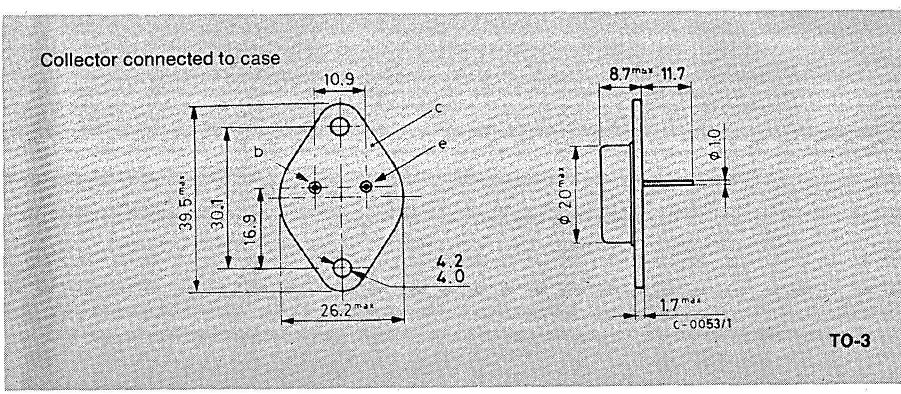
The 2N 6057, 2N 6058 and 2N 6059 are silicon epitaxial-base NPN transistor in monolithic Darlington configuration and are mounted in Jedec TO-3 metal case. They are intended for use in power linear and switching applications.
The complementary PNP types are the 2N 6050, 2N 6051 and 2N 6052 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6057	2N6058	2N6059
V_{CBO}	Collector-base voltage ($I_E=0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		12A	
I_{CM}	Collector peak current		20A	
I_B	Base current		0.2A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$		150W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

MECHANICAL DATA

Dimensions in mm



2N 6057
2N 6058
2N 6059

THERMAL DATA

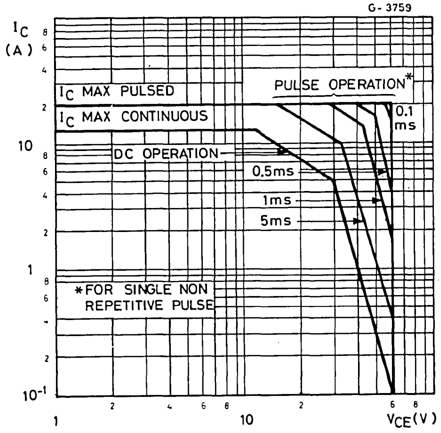
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max 1.17 °C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

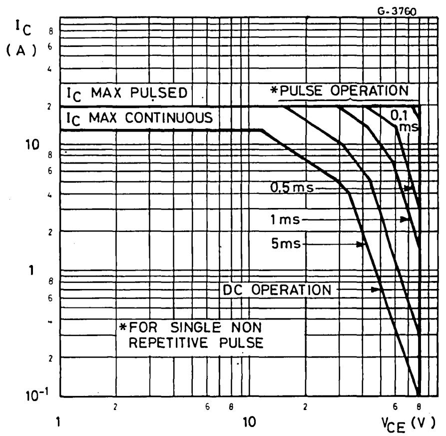
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	for **2N6057** V_{CE}=30V for **2N6058** V_{CE}=40V for **2N6059** * V_{CE}=50V			1 1 1	mA mA mA
I_{CEX}	Collector cutoff current (V_{BE}=0)	for **2N6057** V_{CE}=60V for **2N6058** V_{CE}=80V for **2N6059** V_{CE}=100V T_{case}=150 °C for **2N6057** V_{CE}=60V for **2N6058** V_{CE}=80V for **2N6059** V_{CE}=100V			0.5 0.5 0.5 5 5 5	mA mA mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C =100mA for **2N6057** for **2N6058** for **2N6059**	 60 80 100			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =6A I_B =24mA I_C =12A I_B =120mA			2 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C =12A I_B =120mA			4	V
V_{BE}*	Base-emitter voltage	I_C =6A V_{CE}=3V			2.8	V
h_{FE}*	DC current gain	I_C =6A V_{CE}=3V I_C =12A V_{CE}=3V	750 100		18000	— —
h_{fe}	Small signal current gain	I_C =5A V_{CE}=3V f =1MHz	4			—
C_{CBO}	Collector-base capacitance	V_{CB}=10V f =1MHz I_E =0			300	pF

* Pulsed: pulse duration =300 µs, duty cycle ≤1.5%

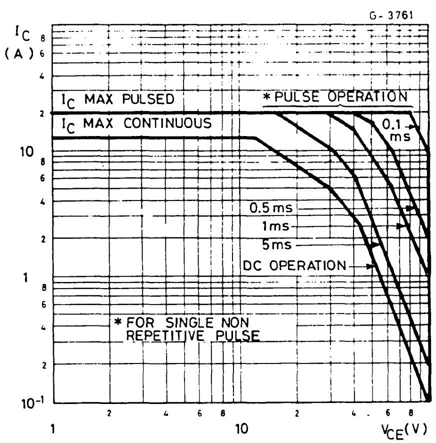
Safe operating areas for 2N6057



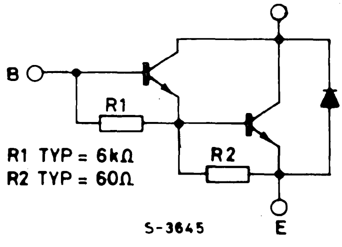
Safe operating areas for 2N6058



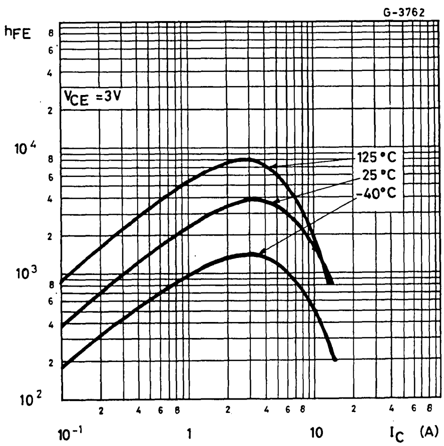
Safe operating areas for 2N6059



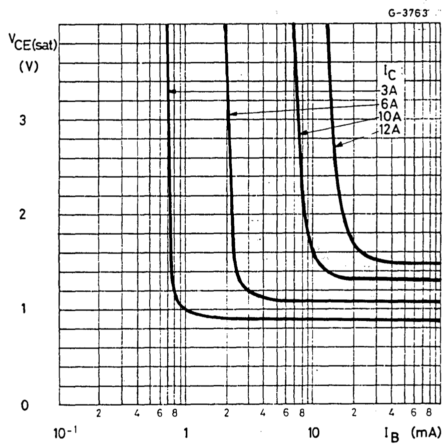
Internal circuit diagram



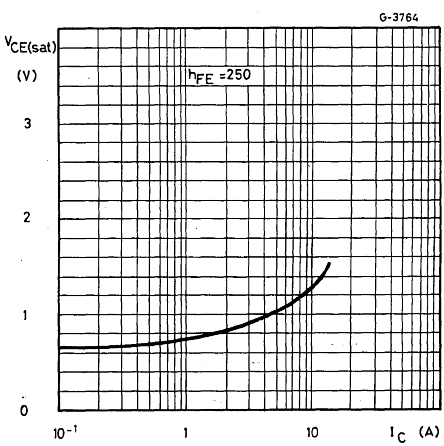
DC current gain



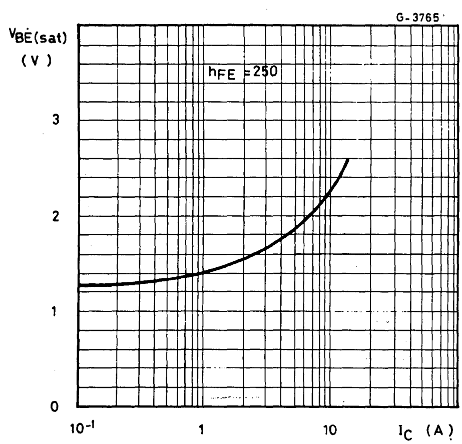
Collector-emitter saturation voltage



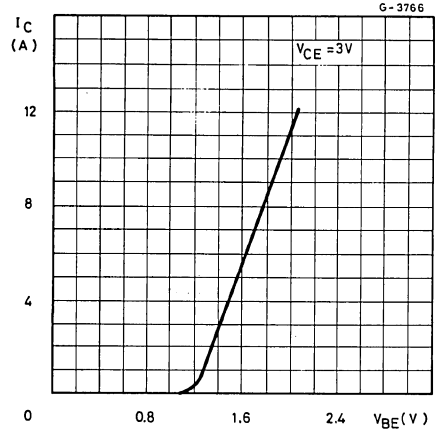
Collector-emitter saturation voltage



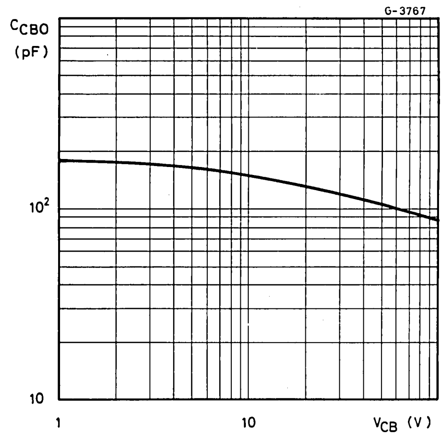
Base-emitter saturation voltage



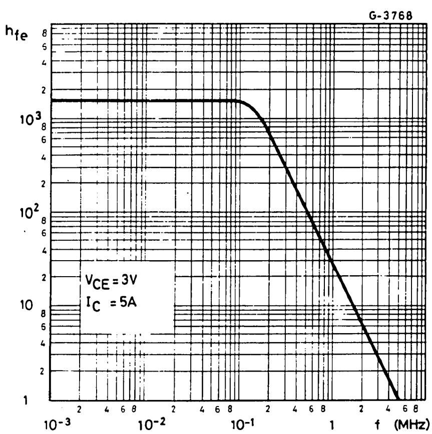
DC transconductance



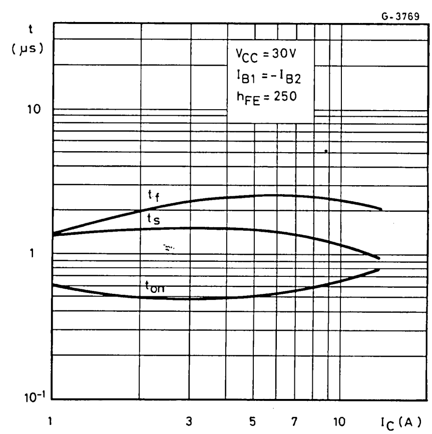
Collector-emitter saturation voltage



Small signal current gian



Saturated switching characteristics



2N 6107/2N 6292
2N 6109/2N 6290
2N 6111/2N 6288

EPITAXIAL-BASE NPN/PNP

GENERAL PURPOSE COMPLEMENTARY PAIRS

The 2N 6107, 2N 6109, 2N 6111, 2N 6288, 2N 6290 and 2N 6292 are epitaxial-base silicon transistors in Jedec TO-220 plastic package. They are intended for a wide variety of medium power switching and linear applications.
The PNP types are the 2N 6107, 2N 6109, 2N 6111 and their complementary NPN types are the 2N 6292, 2N 6290 and 2N 6288 respectively.

ABSOLUTE MAXIMUM RATINGS

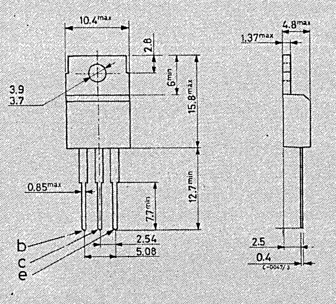
		PNP°	2N6107	2N6109	2N6111
		NPN	2N6292	2N6290	2N6288
V_{CBO}	Collector-base voltage ($I_E = 0$)		80V	60V	40V
V_{CEX}	Collector-emitter voltage ($R_{BE} = 100\Omega$)		80V	60V	40V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		70V	50V	30V
V_{EBO}	Emitter-base voltage ($I_C = 0$)			5V	
I_C	Collector current			7A	
I_B	Base current			3A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C			40W	
T_{stg}	Storage temperature			-65 to 150 °C	
T_j	Junction temperature			150 °C	

° For PNP devices voltage and current values are negative

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.125	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS° (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions V_{CE}(V)	I_C(A)	I_B(A)	2N6111 / 2N6288 Min.	Max.	2N6109 / 2N6290 Min.	Max.	2N6107 / 2N6292 Min.	Max.	Unit
					PNP: 2N6111		2N6109		2N6107		PNP
					NPN: 2N6288		2N6290		2N6292		NPN
I_{CEX}	(V_{EB} = 1.5 V)	80								0.1	mA
		60						0.1			mA
		40				0.1					mA
	T_{case} = 150 °C	70								2	mA
		50						2			mA
		30				2					mA
I_{CEO}	(I_B = 0)	60								1	mA
		40						1			mA
		20				1					mA
I_{EBO}	(V_{EB} = 5 V)		0			1		1		1	mA
$V_{CER\ (sus)}$*	(R_{BE} = 100Ω)		0.1		40		60		80		V
$V_{CEO\ (sus)}$*			0.1	0	30		50		70		V
$V_{CE\ (sat)}$*			2	0.2						1	V
			2.5	0.25				1			V
			3	0.3		1					V
			7	3		3.5		3.5		3.5	V
V_{BE}*		4	2							1.5	V
		4	2.5					1.5			V
		4	3			1.5					V
		4	7			3		3		3	V
h_{FE}*		4	2						30	150	—
		4	2.5				30	150			—
		4	3		30	150					—
		4	7		2.3		2.3		2.3		—
h_{fe}	(f = 50 kHz)	4	0.5		20		20		20		—
f_T	PNP types	4	0.5		10		10		10		MHz
	NPN types	4	0.5		4		4		4		MHz
C_{CBO}	(f = 1MHz, V_{CB} = 10V)					250		250		250	pF

* Pulsed: pulse duration = 300 µs, duty cycle = 1.5%
° For PNP devices voltage and current values are negative
For characteristic curves see the BD 533 (NPN) and BD 534 (PNP) series

2N 6121
2N 6122
2N 6123

EPITAXIAL-BASE NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The 2N 6121, 2N 6122 and 2N 6123 are silicon epitaxial-base NPN power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are the 2N 6124, 2N 6125 and 6126 respectively.

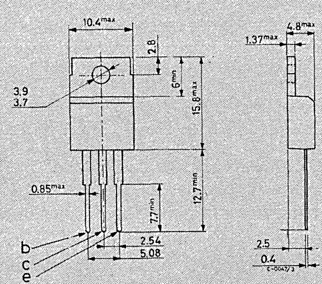
ABSOLUTE MAXIMUM RATINGS

		2N6121	2N6122	2N6123
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current		7A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

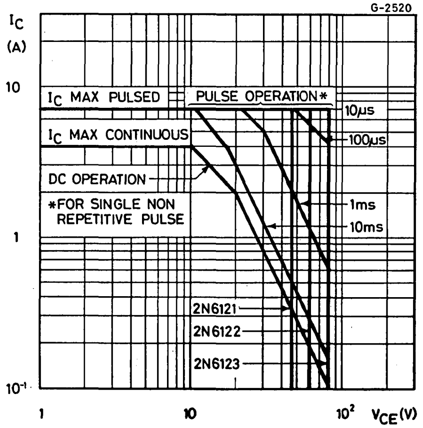
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance juntion-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

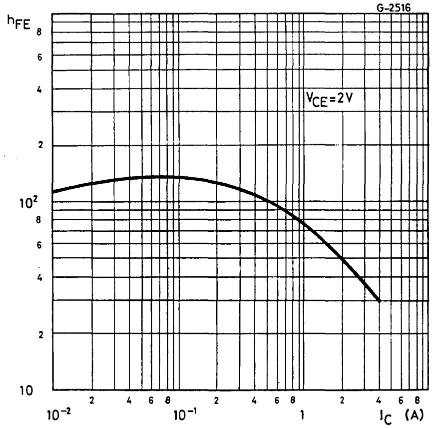
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6121**	V_{CB} = 45 V			100	μA
		for **2N6122**	V_{CB} = 60 V			100	μA
		for **2N6123**	V_{CB} = 80 V			100	μA
I_{CEX}	Collector cutoff current (V_{BE} = -1.5V)	for **2N6121**	V_{CE} = 45 V			100	μA
		for **2N6122**	V_{CE} = 60 V			100	μA
		for **2N6123**	V_{CE} = 80 V			100	μA
		T_{case} = 125 °C					
		for **2N6121**	V_{CE} = 45 V			2	mA
		for **2N6122**	V_{CE} = 60 V			2	mA
		for **2N6123**	V_{CE} = 80 V			2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N6121**	V_{CE} = 45 V			1	mA
		for **2N6122**	V_{CE} = 60 V			1	mA
		for **2N6123**	V_{CE} = 80 V			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5 V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100 mA					
			for **2N6121**	45			V
			for **2N6122**	60			V
			for **2N6123**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1.5A	I_B = 0.15A			0.6	V
		I_C = 4 A	I_B = 1A			1.4	V
V_{BE}*	Base-emitter voltage	I_C = 1.5 A	V_{CE} = 2 V			1.2	V
h_{FE}*	DC current gain	I_C = 1.5 A	V_{CE} = 2 V				
			for **2N6121**	25		100	—
			for **2N6122**	25		100	—
			for **2N6123**	20		80	—
		I_C = 4 A	V_{CE} = 2 V				
			for **2N6121**	10			—
			for **2N6122**	10			—
			for **2N6123**	7			—
h_{fe}	Small signal current gain	I_C = 1 A	V_{CE} = 4 V				
		f = 1 MHz		2.5			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

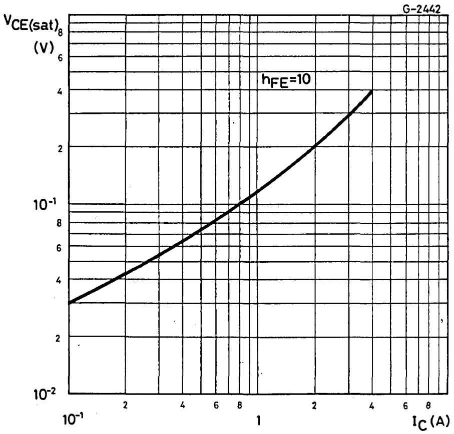
Safe operating areas



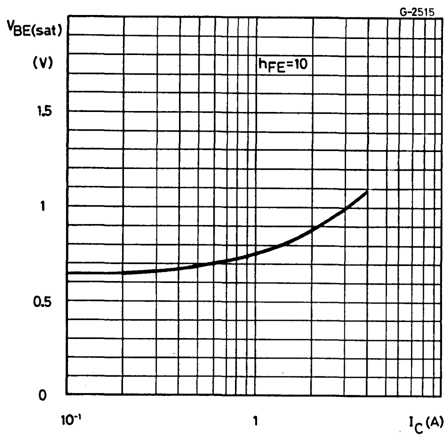
DC current gain



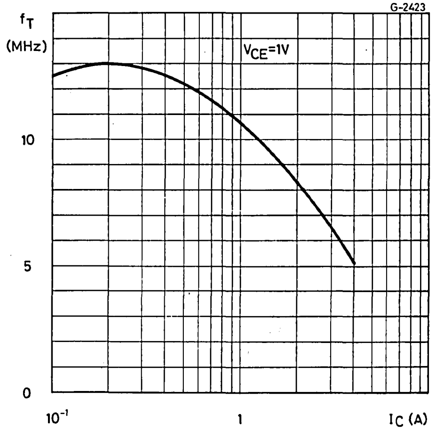
Collector-emitter saturation voltage



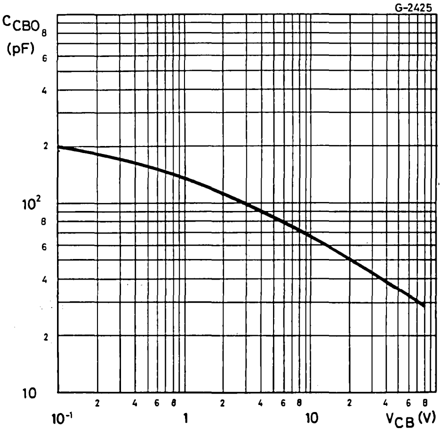
Base-emitter saturation voltage



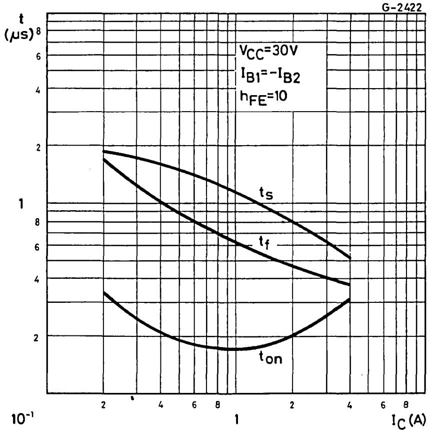
Transition frequency



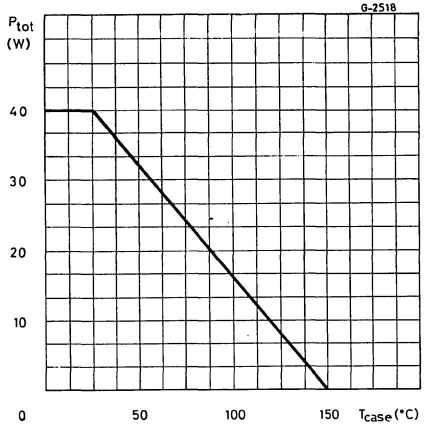
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 6124
2N 6125
2N 6126

EPITAXIAL-BASE PNP

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The 2N 6124, 2N 6125 and 2N 6126 are silicon epitaxial-base PNP power transistors in Jedec TO-220 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are the 2N 6121, 2N 6122 and 2N 6123 respectively.

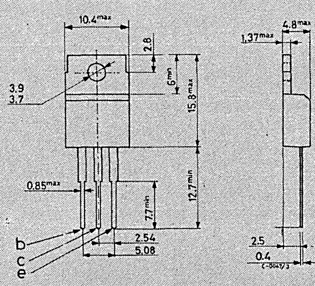
ABSOLUTE MAXIMUM RATINGS

		2N6124	2N6125	2N6126
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current		-7A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

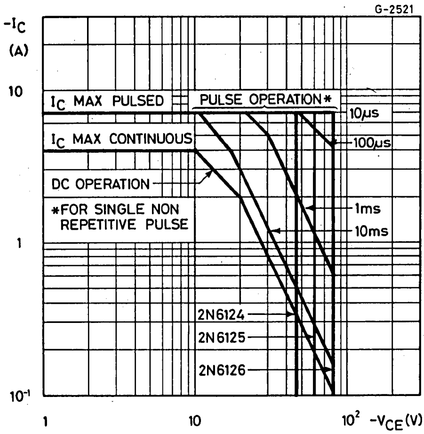
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance juntion-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

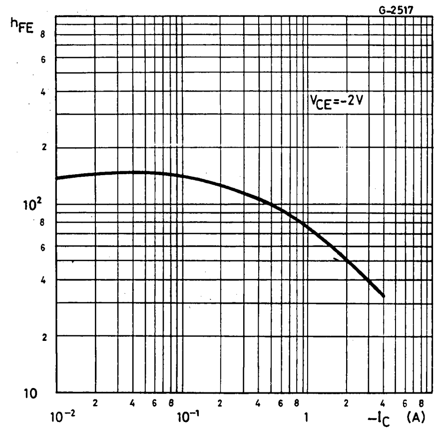
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6124**	V_{CB} = -45 V			-100	μA
		for **2N6125**	V_{CB} = -60 V			-100	μA
		for **2N6126**	V_{CB} = -80 V			-100	μA
I_{CEX}	Collector cutoff current (V_{BE} = 1.5V)	for **2N6124**	V_{CE} = -45 V			-100	μA
		for **2N6125**	V_{CE} = -60 V			-100	μA
		for **2N6126**	V_{CE} = -80 V			-100	μA
		T_{case} = 125 °C					
		for **2N6124**	V_{CE} = -45 V			-2	mA
		for **2N6125**	V_{CE} = -60 V			-2	mA
		for **2N6126**	V_{CE} = -80 V			-2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N6124**	V_{CE} = -45 V			-1	mA
		for **2N6125**	V_{CE} = -60 V			-1	mA
		for **2N6126**	V_{CE} = -80 V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5 V				-1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100 mA					
			for **2N6124**	-45			V
			for **2N6125**	-60			V
			for **2N6126**	-80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = -1.5A	I_B = -0.15A			-0.6	V
		I_C = -4 A	I_B = -1A			-1.4	V
V_{BE}*	Base-emitter voltage	I_C = -1.5A	V_{CE} = -2 V			-1.2	V
h_{FE}*	DC current gain	I_C = -1.5A	V_{CE} = -2 V				
			for **2N6124**	25		100	—
			for **2N6125**	25		100	—
			for **2N6126**	20		80	—
		I_C = -4A	V_{CE} = -2 V				
			for **2N6124**	10			—
			for **2N6125**	10			—
			for **2N6126**	7			—
h_{fe}	Small signal current gain	I_C = -1 A, f = 1 MHz	V_{CE} = -4 V	2.5			—

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

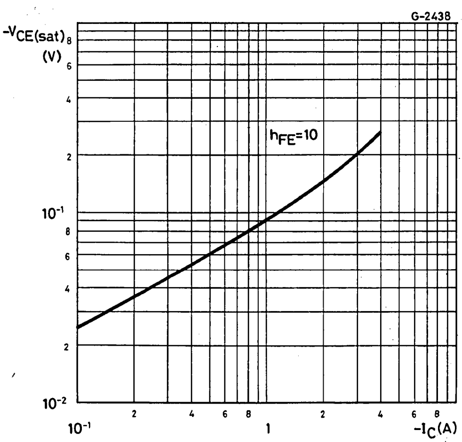
Safe operating areas



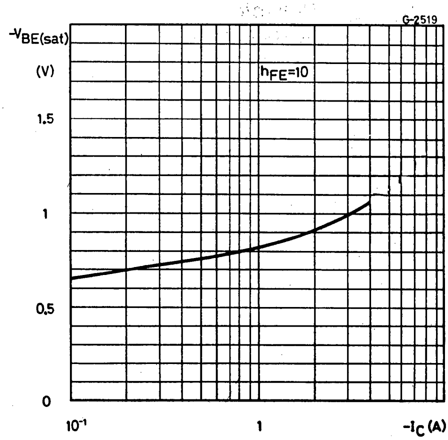
DC current gain



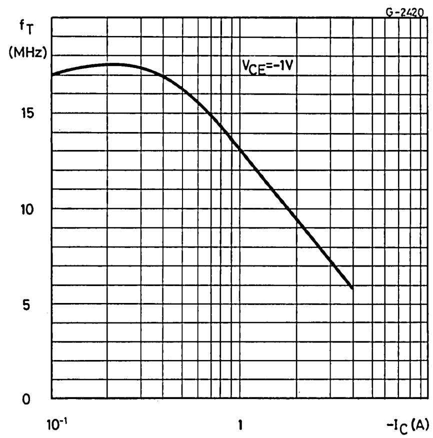
Collector-emitter saturation voltage



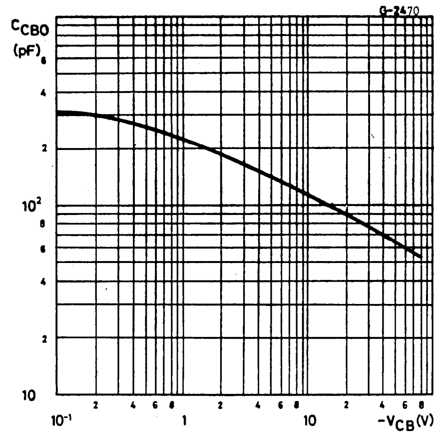
Base-emitter saturation voltage



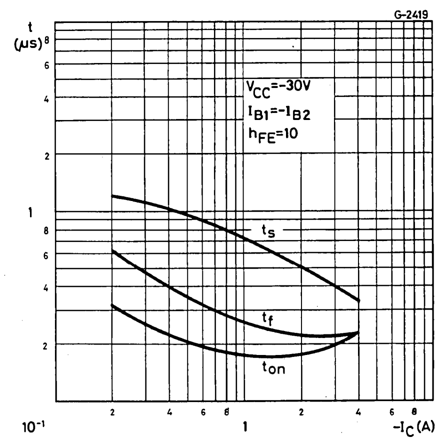
Transition frequency



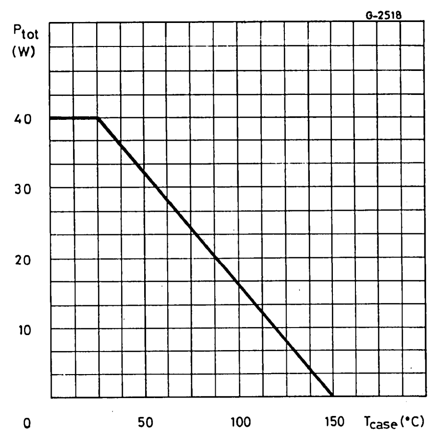
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N 6354

MULTIEPITAXIAL PLANAR NPN

HIGH SPEED SWITCHING APPLICATIONS

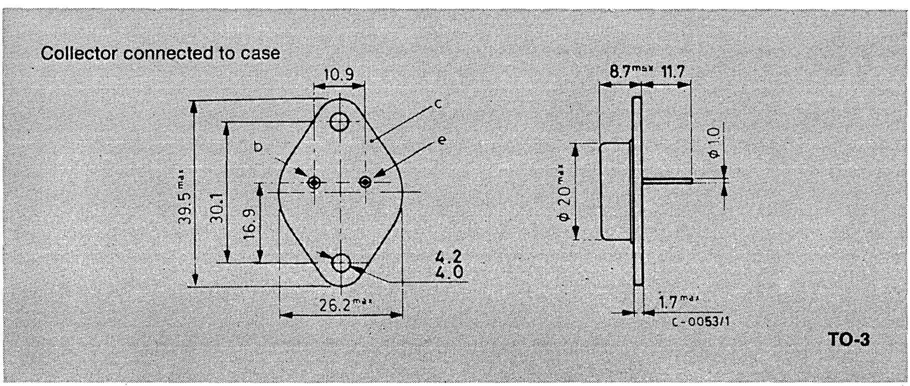
The 2N 6354 is a silicon planar multiepitaxial NPN transistor in Jedec TO-3 metal case. It is intended for use in high speed switching applications in military and industrial equipment.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	150	V
V_{CEX}	Collector-emitter voltage ($R_{BE} = 500\Omega$)	130	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6.5	V
I_C	Collector current	10	A
I_{CM}	Collector peak current	12	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	140	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



6/77

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.25	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

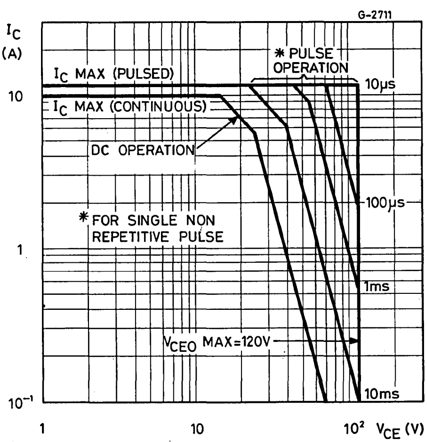
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} =$ 150 V			5	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} =$ 140 V $V_{CE} =$ 140 V $T_{case} = 150$°C			10 20	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} =$ 100 V			20	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} =$ 6.5 V			5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 200 mA	120			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage ($R_{BE} = 100\Omega$)	I_C = 200 mA	130			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 10 A I_B = 1 A I_C = 5 A I_B = 0.5 A			1 0.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 10 A I_B = 1 A I_C = 5 A I_B = 0.5 A			2 1.3	V V
h_{FE}*	DC current gain	I_C = 5 A $V_{CE} =$ 2 V I_C = 10 A $V_{CE} =$ 2 V	20 10		150 100	— —
h_{fe}	Small signal current gain	I_C = 1 A $V_{CE} =$ 10 V f = 10 MHz	8			—
C_{CBO}	Collector-base capacitance	I_E = 0 $V_{CB} =$ 10 V f = 1 MHz			300	pF
t_r	Rise time	I_C = 5 A $V_{CC} =$ 30 V $I_{B1} = -I_{B2}$ = 0.5A I_C = 10 A $V_{CC} =$ 30 V $I_{B1} = -I_{B2}$ = 1A			0.3 1	µs µs

ELECTRICAL CHARACTERISTICS (continued)

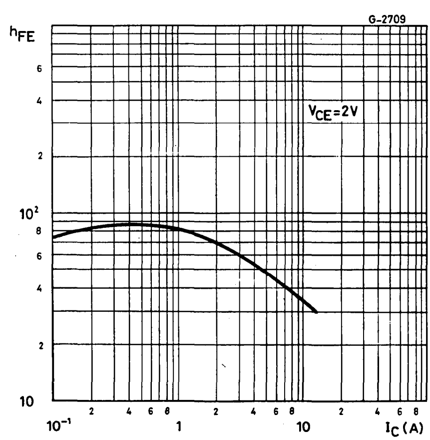
Parameter		Test conditions	Min. Typ. Max.	Unit
t_s	Storage time	I_C = 5 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 0.5A	1	μs
t_f	Fall time	I_C = 5 A V_{CC} = 30 V I_{B1} = $-I_{B2}$ = 0.5A	0.2	μs
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 25 V	5.5	A
$E_{s/b}$	Second breakdown energy	I_C = 5 A V_{EB} = 1 V R_{BE} = 50 Ω L = 25 μH	0.3	mJ

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1 s, non repetitive pulse

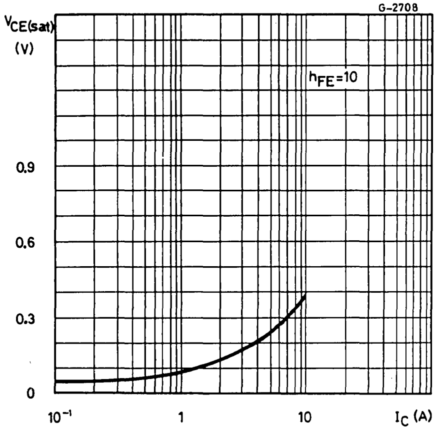
Safe operating areas



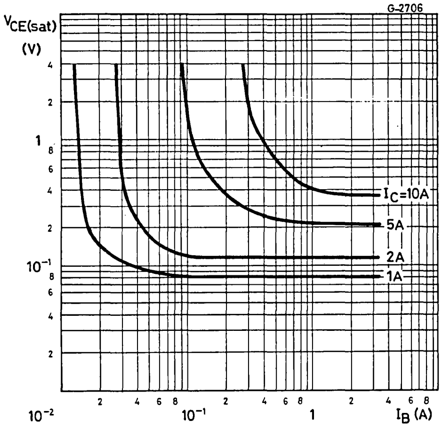
DC current gain



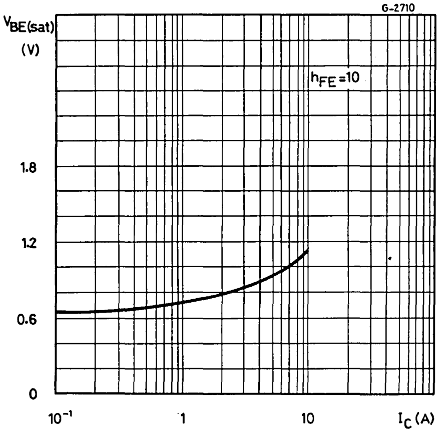
Collector-emitter saturation voltage



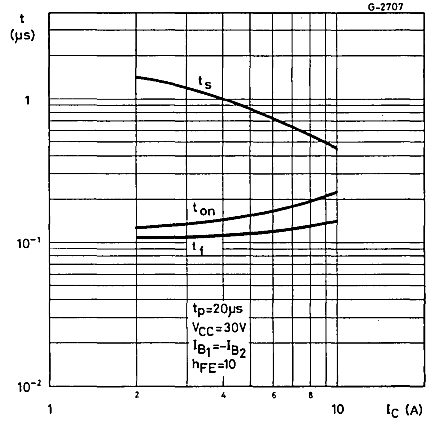
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



2N 6386
2N 6387
2N 6388

EPITAXIAL-BASE NPN

POWER DARLINGTON TRANSISTORS

The 2N 6386, 2N 6387 and 2N 6388 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in Jedec TO-220 plastic package. They are intended for use in low and medium frequency power applications.

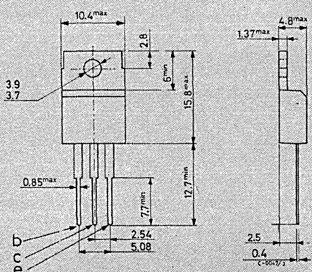
ABSOLUTE MAXIMUM RATINGS

		2N6386	2N6387	2N6388
V_{CBO}	Collector-base voltage ($I_B = 0$)	40V	60V	80V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	40V	60V	80V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 100\Omega$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	5V	5V
I_C	Collector current	8A	10A	10A
I_{CM}	Collector peak current		15A	
I_B	Base current		250mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C		65W	
T_{stg}	Storage temperature		-65 to 150 °C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 40 V for **2N6386**			0.3	mA
		V_{CE} = 60V for **2N6387**			0.3	mA
		V_{CE} = 80 V for **2N6388**			0.3	mA
		T_{case} = 125°C				
		V_{CE} = 40 V for **2N6386**			3	mA
		V_{CE} = 60 V for **2N6387**			3	mA
		V_{CE} = 80 V for **2N6388**			3	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = 40 V for **2N6386**			1	mA
		V_{CE} = 60 V for **2N6387**			1	mA
		V_{CE} = 80 V for **2N6388**			1	mA
I_{EBO}	Emitter-base current ($I_C = 0$)	V_{EB} = 5 V			5	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 200 mA				
		for **2N6386**	40			V
		for **2N6387**	60			V
		for **2N6388**	80			V
$V_{CER\,(sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100 Ω)	I_C = 200 mA				
		for **2N6386**	40			V
		for **2N6387**	60			V
		for **2N6388**	80			V
$V_{CEV\,(sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -1.5 V)	I_C = 200 mA				
		for **2N6386**	40			V
		for **2N6387**	60			V
		for **2N6388**	80			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **2N6386**				
		I_C = 3 A I_B = 6 mA			2	V
		for **2N6387** and **2N6388**				
		I_C = 5 A I_B = 10mA			2	V
		for **2N6386**				
		I_C = 8 A I_B = 80mA			3	V
		for **2N6387** and **2N6388**				
		I_C = 10 A I_B = 100mA			3	V

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{BE}*	Base-emitter voltage	for **2N6386** I_C = 3 A V_{CE} = 3 V for **2N6387** and **2N6388** I_C = 5 A V_{CE} = 3 V for **2N6386** I_C = 8 A V_{CE} = 3 V for **2N6387** and **2N6388** I_C = 10 A V_{CE} = 3 V			 2.8 2.8 4.5 4.5	 V V V V
h_{FE}*	DC current gain	for **2N6386** I_C = 3 A V_{CE} = 3 V for **2N6387** and **2N6388** I_C = 5 A V_{CE} = 3 V for **2N6386** I_C = 8 A V_{CE} = 3 V for **2N6387** and **2N6388** I_C = 10 A V_{CE} = 3 V	 1000 1000 100 100		 20000 20000	 — — — —
h_{fe}	Small signal current gain	I_C = 1 A V_{CE} = 10 V f = 1 MHz V_{CE} = 10 V f = 1 kHz	 20 1000			 — —
V_F*	Paralled-diode forward voltage	for **2N6386** I_F = 8 A for **2N6387** and **2N6388** I_F = 10 A			 4 4	 V V
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V f = 1 MHz			200	pF
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 25 V	2.6			A
$E_{s/b}$	Second breakdown energy	L = 12 mH R_{BE} = 100Ω V_{BE} = -1.5 V I_C = 4.5 A	120			mJ

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s non repetitive pulse

EPITAXIAL-BASE NPN

2N 6486
2N 6487
2N 6488

POWER LINEAR AND SWITCHING APPLICATIONS

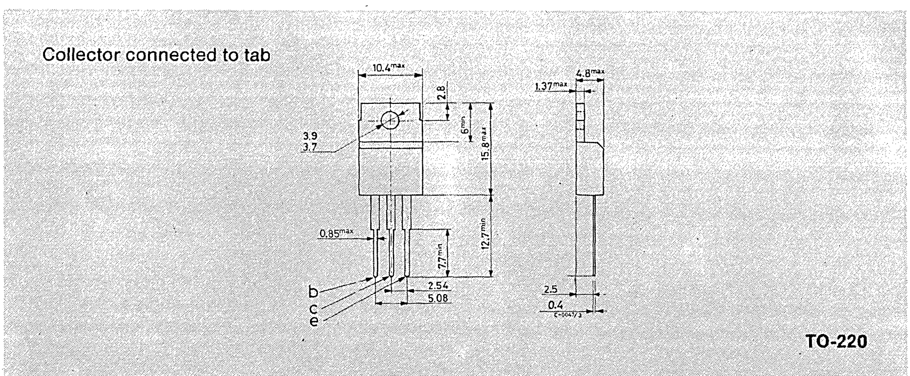
The 2N6486, 2N6487 and 2N6488 are silicon epitaxial-base NPN transistors mounted in Jedec TO-220 plastic package.
They are intended for use in power linear and switching applications.
The complementary PNP types are the 2N6489, 2N6490 and 2N6491 respectively.

ABSOLUTE MAXIMUM RATINGS

		2N6486	2N6487	2N6488
V_{CBO}	Collector-base voltage ($I_E = 0$)	50V	70V	90V
V_{CEX}	Collector-base voltage ($V_{BE} = 1.5V$; $R_{BE} = 100\Omega$)	50V	70V	90V
V_{CEO}	Collector-base voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector-current		15A	
I_B	Base-current		5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		75W	
	$T_{amb} \leq 25°C$		1.8W	
T_{stg}	Storage temperature		–65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm



5/80

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector-cutoff current ($I_B = 0$)	for **2N6486**	$V_{CE} = 20V$			1	mA
		for **2N6487**	$V_{CE} = 30V$			1	mA
		for **2N6488**	$V_{CE} = 40V$			1	mA
I_{CEX}	Collector-cutoff current ($V_{BE}=-1.5V$ $R_{BE} = 100\Omega$)	for **2N6486**	$V_{CE} = 45V$			0.5	mA
		for **2N6487**	$V_{CE} = 65V$			0.5	mA
		for **2N6488**	$V_{CE} = 85V$			0.5	mA
		$T_{case} = 150°C$					
		for **2N6486**	$V_{CE} = 40V$			5	mA
		for **2N6487**	$V_{CE} = 60V$			5	mA
		for **2N6488**	$V_{CE} = 80V$			5	mA
I_{CER}	Collector-cutoff current ($R_{BE}=100\Omega$)	for **2N6486**	$V_{CE} = 35V$			0.5	mA
		for **2N6487**	$V_{CE} = 55V$			0.5	mA
		for **2N6488**	$V_{CE} = 75V$			0.5	mA
I_{EBO}	Emitter-cutoff current ($I_C = 0$)	$V_{BE} = 5V$				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 200mA$					
		for **2N6486**		40			V
		for **2N6487**		60			V
		for **2N6488**		80			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage ($R_{BE} = 100\Omega$)	$I_C = 200mA$					
		for **2N6486**		45			V
		for **2N6487**		65			V
		for **2N6488**		85			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CEX\,(sus)}$*	Collector-emitter sustaining voltage ($V_{BE} = -1.5V$; $R_{BE} = 100\Omega$)	$I_C = 200mA$					
		for **2N6486**		50			V
		for **2N6487**		70			V
		for **2N6488**		90			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$	$I_B = 0.5A$			1.3	V
		$I_C = 15A$	$I_B = 5A$			3.5	V
V_{BE}*	Base-emitter voltage	$I_C = 5A$	$V_{CE} = 4V$			1.3	V
		$I_C = 15A$	$V_{CE} = 4V$			3.5	V
h_{FE}*	DC current gain	$I_C = 5A$	$V_{CE} = 4V$	20		150	—
		$I_C = 15A$	$V_{CE} = 4V$	5			—
h_{fe}	Small signal current gain	$I_C = 1A$, $f = 1MHz$	$V_{CE} = 4V$	5			—
		$I_C = 1A$, $f = 1KHz$	$V_{CE} = 4V$	25			—

* Pulsed: pulse duration = 300μs, duty cycle $\leq$2%.

2N 6489
2N 6490
2N 6491

EPITAXIAL-BASE PNP

POWER LINEAR AND SWITCHING APPLICATIONS

The 2N6489, 2N6490 and 2N6491 are silicon epitaxial-base PNP transistors mounted in Jedec TO-220 plastic package.
They are intended for use in power linear and switching applications.
The complementary NPN types are the 2N6486, 2N6487 and 2N6488 respectively.

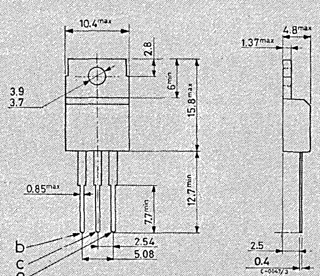
ABSOLUTE MAXIMUM RATINGS

		2N6489	2N6490	2N6491
V_{CBO}	Collector-base voltage ($I_E = 0$)	–50V	–70V	–90V
V_{CEX}	Collector-base voltage ($V_{BE} = 1.5V$; $R_{BE} = 100\Omega$)	–50V	–70V	–90V
V_{CEO}	Collector-base voltage ($I_B = 0$)	–40V	–60V	–80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		–5V	
I_C	Collector-current		–15A	
I_B	Base-current		–5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		75W	
	$T_{amb} \leq 25°C$		1.8W	
T_{stg}	Storage temperature		–65 to 150°C	
T_j	Junction temperature		150°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector-cutoff current (I_B = 0)	for **2N6489**	V_{CE} = –20V			–1	mA
		for **2N6490**	V_{CE} = –30V			–1	mA
		for **2N6491**	V_{CE} = –40V			–1	mA
I_{CEX}	Collector-cutoff current (V_{BE} = 1.5V R_{BE} = 100Ω)	for **2N6489**	V_{CE} = –45V			–0.5	mA
		for **2N6490**	V_{CE} = –65V			–0.5	mA
		for **2N6491**	V_{CE} = –85V			–0.5	mA
		T_{case} = 150°C					
		for **2N6489**	V_{CE} = –40V			–5	mA
		for **2N6490**	V_{CE} = –60V			–5	mA
		for **2N6491**	V_{CE} = –80V			–5	mA
I_{CER}	Collector cutoff current(R_{BE}=100Ω)	for **2N6489**	V_{CE} = –35V			–0.5	mA
		for **2N6490**	V_{CE} = –55V			–0.5	mA
		for **2N6491**	V_{CE} = –75V			–0.5	mA
I_{EBO}	Emitter-cutoff current	V_{BE} = –5V				–1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B= 0)	I_C = –200mA					
		for **2N6489**		–40			V
		for **2N6490**		–60			V
		for **2N6491**		–80			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 100Ω)	I_C = –200mA					
		for **2N6489**		–45			V
		for **2N6490**		–65			V
		for **2N6491**		–85			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (V_{BE} = 1.5V; R_{BE} = 100Ω)	I_C = –200mA					
		for **2N6489**		–50			V
		for **2N6490**		–70			V
		for **2N6491**		–90			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = –5A;	I_B = –0.5A			–1.3	V
		I_C = –15A;	I_B = –5A			–3.5	V
V_{BE}*	Base-emitter voltage	I_C = –5A	V_{CE} = –4V			–1.3	V
		I_C = –15A	V_{CE} = –4V			–3.5	V
h_{FE}*	DC current gain	I_C = –5A	V_{CE} = –4V	20		150	—
		I_C = –15A	V_{CE} = –4V	5			—
h_{fe}	Small signal emitter gain	I_C = –1A, f = 1MHz	V_{CE} = –4V	5			—
		I_C = –1A, f = 1KHz	V_{CE} = –4V	25			—

* Pulsed: pulse duration = 300μs, duty cycle ≤2%.

MULTIEPITAXIAL MESA NPN

2N 6542
2N 6543

HIGH VOLTAGE POWER SWITCH

The 2N6542 and 2N6543 are silicon multiepitaxial mesa NPN transistors in Jedec TO-3 metal case. They are intended for high voltage, fast switching applications.

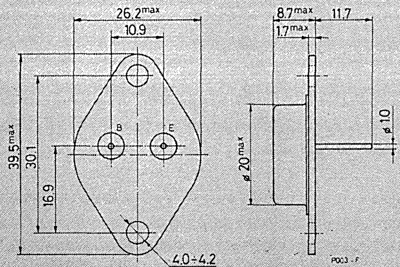
ABSOLUTE MAXIMUM RATINGS

		2N6542	2N6543
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	650V	850V
V_{CEX}	(Clamped) Collector-emitter voltage ($V_{BE} = -5V$)	350V	450V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	9V	
I_C	Collector current	5A	
I_{CM}	Collector peak current (t = 10ms)	10A	
I_B	Base current	5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W	
T_{stg}	Storage temperature	−65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

2N 6542
2N 6543

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Tests conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **2N6542** V_{CE} = 650V for **2N6543** V_{CE} = 850V T_{case} = 100°C for **2N6542** V_{CE} = 650V for **2N6543** V_{CE} = 850V			0.5 0.5 3 3	mA mA mA mA
I_{CER}	Collector cutoff current (R_{BE} = 50Ω)	T_{case} = 100°C for **2N6542** V_{CE} = 650V for **2N6543** V_{CE} = 850V			 3 3	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 9V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **2N6542** for **2N6543**	 300 400			 V V
$V_{CEX\ (sus)}$	Collector-emitter sustaining voltage (clamped $E_{s/b}$)	I_C/I_B = 5A L = 180μH V_{BE} = −5V T_{case} = 100°C V_{clamp} = rated $V_{CEX\ (sus)}$ I_C = 2.6A for **2N6542** for **2N6543** V_{clamp} = rated $V_{CEO\ (sus)}$−100V I_C = 5A for **2N6542** for **2N6543**	 350 450 200 300			 V V V V
$I_{s/b}$	Second breakdown collector current	t = 1 s (non repetitive) V_{CE} = 100V	0.2			A
$E_{s/b}$	Second breakdown energy	L = 40μH V_{BE} = −4V R_{BE} = 50Ω	180			μJ

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Tests conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	$I_C = 1.5A$ $V_{CE} = 2V$ $I_C = 3A$ $V_{CE} = 2V$	12 7		60 35	— —
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$ $I_B = 0.6A$ $I_C = 5A$ $I_B = 1A$ $T_{case} = 100°C$ $I_C = 3A$ $I_B = 0.6A$			1 5 2	V V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 3A$ $I_B = 0.6A$ $T_{case} = 100°C$ $I_C = 3A$ $I_B = 0.6A$			1.4 1.4	V V
f_T	Transition frequency	$I_C = 0.2A$ $V_{CE} = 10V$ $f = 1MHz$	6		24	MHz
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $I_E = 0$ $f = 1MHz$			110	pF
t_{on}	Turn-on time	**RESISTIVE LOAD** $I_C = 3A$ $V_{CC} = 250V$ $I_{B1} = -I_{B2} = 0.6A$			0.75	μs
t_s	Storage time				4	μs
t_f	Fall time				0.8	μs
t_s	Storage time	**INDUCTIVE LOAD** $I_C = 3A(pk)$ $I_{B1} = 0.6A$ $V_{BE} = -5V$ $L = 180\mu H$ $T_{case} = 100°C$ for **2N6542** $V_{clamp} = 350V$ for **2N6543** $V_{clamp} = 450V$			4	μs
t_f	Fall time				0.8	μs

* Pulsed: pulse duration = 300μs, duty cycle = 1.5 %.
For characteristic curves see the BUW 25 type.

2N 6544
2N 6545

MULTIEPITAXIAL MESA NPN

HIGH VOLTAGE POWER SWITCH

The 2N6544 and 2N6545 are multiepitaxial mesa NPN transistors in Jedec TO-3 metal case. They are intended for high voltage, fast switching applications.

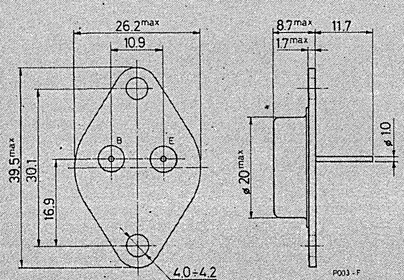
ABSOLUTE MAXIMUM RATINGS

		2N6544	2N6545
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	650V	850V
V_{CEX}	(Clamped) Collector-emitter voltage ($V_{BE} = -5V$)	350V	450V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	9V	
I_C	Collector current	8A	
I_{CM}	Collector peak current ($t_p = 10ms$)	16A	
I_B	Base current	8A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	125W	
T_{stg}	Storage temperature	−65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **2N6544** V_{CE} = 650V for **2N6545** V_{CE} = 850V T_{case} = 100°C for **2N6544** V_{CE} = 650V for **2N6545** V_{CE} = 850V			0.5 0.5 2.5 2.5	mA mA mA mA
I_{CER}	Collector cutoff current (R_{BE} = 50Ω)	T_{case} = 100°C for **2N6544** V_{CE} = 650V for **2N6545** V_{CE} = 850V			 3 3	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 9V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **2N6544** for **2N6545**	 300 400			 V V
$V_{CEX\ (sus)}$	Collector-emitter sustaining voltage (clamped $E_{s/b}$)	I_C/I_B = 5 L = 180μH V_{BE} = −5V T_{case} = 100°C V_{clamp} = rated $V_{CEX\ (sus)}$ I_C = 4.5A for **2N6544** for **2N6545** V_{clamp} = rated $V_{CEO\ (sus)}$−100V I_C = 8A for **2N6544** for **2N6545**	 350 450 200 300			 V V V V
$I_{s/b}$	Second breakdown collector current	t = 1 s (non repetitive) V_{CE} = 100V	0.2			A
$E_{s/b}$	Second breakdown energy	L = 40μH V_{BE} = −4V R_{BE} = 50Ω	500			μJ

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	$I_C = 2.5A$ $V_{CE} = 3V$	12		60	—
		$I_C = 5A$ $V_{CE} = 3V$	7		35	—
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$ $I_B = 1A$			1.5	V
		$I_C = 8A$ $I_B = 2A$			5	V
		$T_{case} = 100°C$ $I_C = 5A$ $I_B = 1A$			2.5	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 5A$ $I_B = 1A$			1.6	V
		$T_{case} = 100°C$ $I_C = 5A$ $I_B = 1A$			1.6	V
f_T	Transition frequency	$I_C = 0.3A$ $V_{CE} = 10V$ $f = 1MHz$	6		24	MHz
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $I_E = 0$ $f = 1MHz$			200	pF
t_{on}	Turn-on time	**RESISTIVE LOAD** $I_C = 5A$ $V_C = 250V$ $I_{B1} = -I_{B2} = 1A$			1	μs
t_s	Storage time				4	μs
t_f	Fall time				1	μs
t_s	Storage time	**INDUCTIVE LOAD** $I_C = 5A$ (pk) $I_{B1} = 1A$ $V_{BE} = -5V$ $L = 180\mu H$ $T_{case} = 100°C$ for **2N6544** $V_{clamp} = 350V$ for **2N6545** $V_{clamp} = 450V$			4	μs
t_f	Fall time				0.9	μs

* Pulsed: pulse duration = $300\mu s$, duty cycle = 1.5 %.

For characteristic curves see the BUW 35 type.

MULTIEPITAXIAL MESA NPN

2N 6546
2N 6547

HIGH VOLTAGE, HIGH CURRENT POWER SWITCH

The 2N6546 and 2N6547 are multiepitaxial mesa NPN transistors in Jedec TO-3 metal case, intended in fast switching applications for high output power.

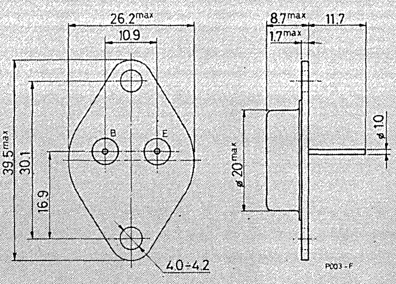
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	2N6546	2N6547
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	650V	850V
V_{CEX}	(Clamped) Collector-emitter voltage ($V_{BE} = -5V$)	350V	450V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	9V	
I_C	Collector current	15A	
I_{CM}	Collector peak current	30A	
I_B	Base current	10A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	175W	
T_{stg}	Storage temperature	−65 to 200°C	
T_j	Junction temperature	200°C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO - 3

5/80

2N 6546
2N 6547

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **2N6546** V_{CE} = 650V for **2N6547** V_{CE} = 850V T_{case} = 100°C for **2N6546** V_{CE} = 650V for **2N6547** V_{CE} = 850V			1 1 4 4	mA mA mA mA
I_{CER}	Collector cutoff current (R_{BE} = 50Ω)	T_{case} = 100°C for **2N6546** V_{CE} = 650V for **2N6547** V_{CE} = 850V			 5 5	 mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 9V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **2N6546** for **2N6547**	 300 400			 V V
$V_{CEX\ (sus)}$*	Collector-emitter sustaining voltage (clamped $E_{S/B}$)	I_C/I_B = 5 L = 180μH V_{BE} = −5V T_{case} = 100°C V_{clamp} = rated $V_{CEX\ (sus)}$ I_C = 8A for **2N6546** for **2N6547** V_{clamp} = rated $V_{CEO\ (sus)}$−100V I_C = 15A for **2N6546** for **2N6547**	 350 450 200 300			 V V V V
$I_{s/b}$	Second breakdown collector current	t = 1 s (non repetitive) V_{CE} = 100V	 0.2			 A
$E_{s/b}$	Second breakdown energy	L = 40μH V_{BE} = −4V R_{BE} = 50Ω	2			mJ

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	$I_C = 5A$ $V_{CE} = 2V$ $I_C = 10A$ $V_{CE} = 2V$	12 6		60 30	— —
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 2A$ $I_C = 15A$ $I_B = 3A$ $T_{case} = 100°C$ $I_C = 10A$ $I_B = 2A$			1.5 5 2.5	V V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 10A$ $I_B = 2A$ $T_{case} = 100°C$ $I_C = 10A$ $I_B = 2A$			1.6 1.6	V V
f_T	Transition frequency	$I_C = 0.5A$ $V_{CE} = 10V$ $f = 1MHz$	6		24	MHz
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $I_E = 0$ $f = 1MHz$			360	pF
t_{on}	Turn-on time	**RESISTIVE LOAD** $V_{CC} = 250V$ $I_C = 10A$ $I_{B1} = -I_{B2} = 2A$			1	μs
t_s	Storage time				4	μs
t_f	Fall time				0.7	μs
t_s	Storage time	**INDUCTIVE LOAD** $I_C = 10A$ (pk) $I_{B1} = 2A$ $V_{BE} = -5V$ $L = 180\mu H$ $T_{case} = 100°C$ for **2N6546** $V_{clamp} = 350V$ for **2N6547** $V_{clamp} = 450V$			5	μs
t_f	Fall time				1.5	μs

* Pulsed: pulse duration = 300μs, duty cycle = 1.5%.

For characteristic curves see the BUW 45 type.

DESIGN NOTES APPLICABLE TO POWER DEVICES

DN300 — HORIZONTAL DEFLECTION IN B / W TV SETS USING THE SGS-ATES DARLINGTONS BU806 / 7

Horizontal deflection circuits for B / W receivers using the BU806 and BU807 darlingtons driven by the TDA1180. A short reliability report on the TO-220 plastic package is included.

DN306 — PARALLEL CONNECTION OF HIGH VOLTAGE TRANSISTORS

Connecting high-voltage transistors in parallel; obtaining good performance and reliable operation.

DN307 — AUDIO AMPLIFIERS

Audio amplifiers with output powers of 35W, 50W and 75W using complementary power transistors. Full constructional details are provided.

DN308 — DRIVING CIRCUITS FOR SGS-ATES SWITCHING TRANSISTORS

Driving circuits which optimize the switching efficiency of power stages. This consideration is of particular importance when the duty cycle or switching frequency is variable.

DN323 — BUW34 AND BUW44 HIGH VOLTAGE TRANSISTOR APPLICATIONS: 400W AND 600W SWITCH-MODE MAINS ISOLATED SUPPLIES

The design of two switch-mode regulated supplies: 24V / 400W and 24V / 600W. Details of the performance and construction are included.

DN327 — POWER TRANSISTOR SELECTOR FOR SWITCH-MODE AND LINEAR USE

SGS-ATES power technologies for different applications. Includes a summary of the product range.

DN328 — OPTIMUM BASE DRIVE VERSUS COLLECTOR CURRENT WAVEFORM

Improving the switching behaviour of power devices for both triangular and trapezoidal collector current wareforms.

DN329 — POWER TRANSISTOR TECHNOLOGY FOR SWITCH-MODE USE

The latest SGS-ATES technologies for switch-mode application devices.

DN335 — REVERSE SECONDARY BREAKDOWN

A description of the phenomenon and power transistor ratings for both clamped and unclamped $E_{s/b}$ stresses.

DN336 — DIRECT SECONDARY BREAKDOWN

A description of the $I_{s/b}$ rating in power transistors and how to obtain reliable operation in repetitive pulse conditions.

DN337 — COMPLEMENTARY PAIRS IN SWITCHING APPLICATIONS

The advantages of complementary transistors in circuit design. Includes an application example: a 720W switch-mode converter in bridge configuration.

DN338 — SGS-ATES TRANSISTORS IN VOLTAGE CONVERTERS

A summary of power stage configurations. Lists the significant characteristics of SGS-ATES power devices in each application.

DN339 — RELIABILITY OF MULTIEPITAXIAL PLANAR TRNASISTORS

The results of reliability tests performed on SGS-ATES multiepitaxial planar power transistors.

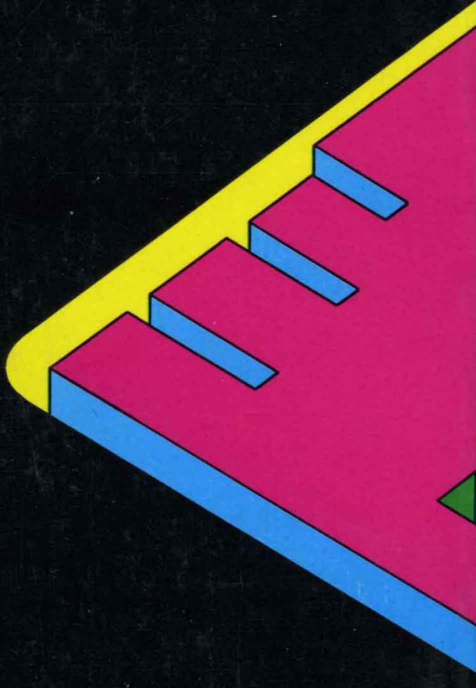
DN369 — HIGH CURRENT TRANSISTOR APPLICATIONS

The application of high current transistors (BUR51 and BUX41) in DC motor speed control for machine tools.

All these Design Notes can be obtained free of charge from the SGS-ATES sales network.

SGS-ATES GROUP OF COMPANIES
Italy – France – Germany – Singapore – Sweden – United Kingdom – U.S.A.

Garzanti s.p.a. - Cernusco s./N.



Suggested price
U.S. $ 8
(including tax)

ORDER CODE: DAPWR/4