DATABOOK

DISCRETE POWER DEVICES
5th EDITION

SGS

DISCRETE POWER DEVICES
5th EDITION
ISSUED OCTOBER 1982

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.

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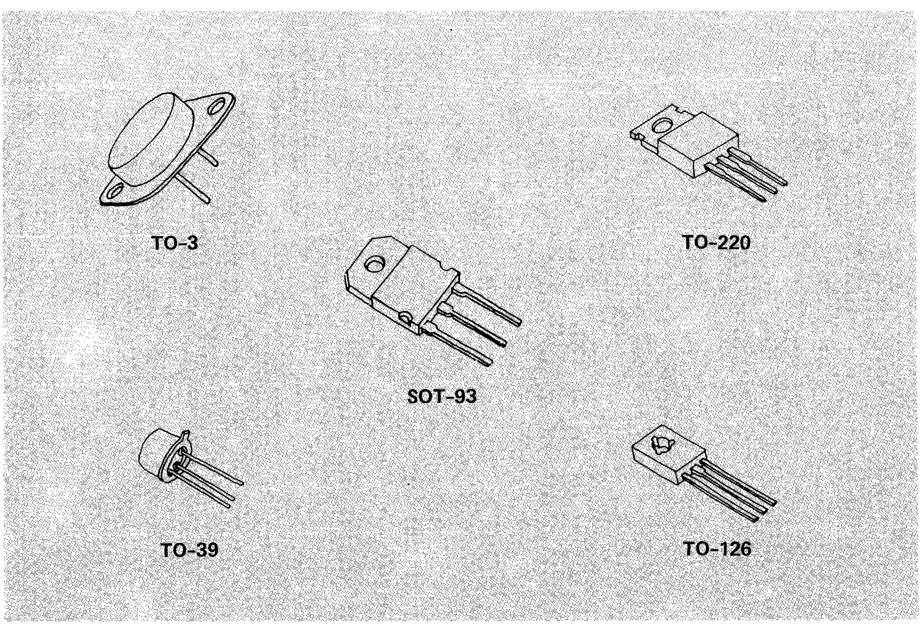
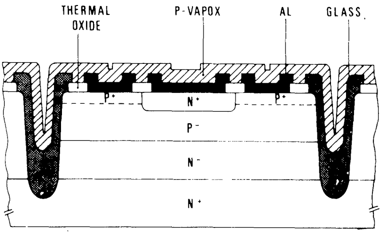
SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES

SGS power transistors cover a wide range of technologies optimized for almost every application.
These include epitaxial base (medium voltage, high ruggedness, general purpose) epitaxial planar (high speed with good voltage capability) multiepitaxial planar (high current switching) and multiepitaxial mesa (high voltage-high power switching).
A wide choice of packages are available.
In order to be easy to use following power transistor selector guides cover only a part of the complete range. Other voltage ratings and gain selections shown on the full data sheets are equally available.
Many older devices which are less popular for new designs are also in production. Your nearest SGS sales office or distributor has full details available on request.



EPITAXIAL BASE – I_{CM} 1 to 15A; V_{CEO} 22 to 180V

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



EPITAXIAL BASE

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
1	40	40	30	TO-220	**TIP29**	**TIP30**	15	1.0/4	0.70	1.0/125
1	60	60	30	TO-220	**TIP29A**	**TIP30A**	15	1.0/4	0.70	1.0/125
1	80	80	30	TO-220	**TIP29B**	**TIP30B**	15	1.0/4	0.70	1.0/125
1	100	100	30	TO-220	**TIP29C**	**TIP30C**	15	1.0/4	0.70	1.0/125
2	45	45	25	TO-126	**BD233**	**BD234**	25	1.0/2	0.60	1.0/100
2	55	45	30	TO-220	**BD239**	**BD240**	15	1.0/4	0.70	1.0/200
2	60	60	25	TO-126	**BD235**	**BD236**	25	1.0/2	0.60	1.0/100
2	70	60	30	TO-220	**BD239A**	**BD240A**	15	1.0/4	0.70	1.0/200
2	100	80	25	TO-126	**BD237**	**BD238**	25	1.0/2	0.60	1.0/100
2	90	80	30	TO-220	**BD239B**	**BD240B**	15	1.0/4	0.70	1.0/200
2	115	100	30	TO-220	**BD239C**	**BD240C**	15	1.0/4	0.70	1.0/200
* 2	60	60	50	TO-220	**TIP110**	**TIP115**	1000	1.0/4	2.50	2.0/8
* 2	80	80	50	TO-220	**TIP111**	**TIP116**	1000	1.0/4	2.50	2.0/8
* 2	100	100	50	TO-220	**TIP112**	**TIP117**	1000	1.0/4	2.50	2.0/8
3	45	45	30	TO-126	**BD175**	**BD176**	15	1.0/2	0.80	1.0/100
3	60	60	30	TO-126	**BD177**	**BD178**	15	1.0/2	0.80	1.0/100
3	80	80	30	TO-126	**BD179**	**BD180**	15	1.0/2	0.80	1.0/100
3	55	45	40	TO-220	**BD241**	**BD242**	25	1.0/4	1.20	3.0/600
3	40	40	40	TO-220	**TIP31**	**TIP32**	25	1.0/4	1.20	3.0/375
3	70	60	40	TO-220	**BD241A**	**BD242A**	25	1.0/4	1.20	3.0/600
3	60	60	40	TO-220	**TIP31A**	**TIP32A**	25	1.0/4	1.20	3.0/375
3	90	80	40	TO-220	**BD241B**	**BD242B**	25	1.0/4	1.20	3.0/600
3	80	80	40	TO-220	**TIP31B**	**TIP32B**	25	1.0/4	1.20	3.0/375
3	115	100	40	TO-220	**BD241C**	**BD242C**	25	1.0/4	1.20	3.0/600
3	100	100	40	TO-220	**TIP31C**	**TIP32C**	25	1.0/4	1.20	3.0/375

* Darlington types.

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES
(continued)

EPITAXIAL BASE (continued)

	I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
	4	40	40	40	TO-126	**2N5190**	**2N5193**	25	1.50/2	0.60	1.50/150
*	4	60	60	40	TO-126	**BD677**	**BD678**	750	1.50/3	2.50	1.50/6
*	4	80	80	40	TO-126	**BD679**	**BD680**	750	1.50/3	2.50	1.50/6
	4	80	80	40	TO-126	**2N5192**	**2N5195**	20	1.50/2	0.60	1.50/150
*	4	100	100	40	TO-126	**BD681**	**BD682**	750	1.50/3	2.50	1.50/6
	4	22	22	36	TO-126	**BD433**	**BD434**	50	2.0/1	0.50	2.0/200
	4	32	32	36	TO-126	**BD435**	**BD436**	50	2.0/1	0.50	2.0/200
	4	45	45	36	TO-126	**BD437**	**BD438**	40	2.0/1	0.60	2.0/200
*	4	45	45	40	TO-126	**BD675A**	**BD676A**	750	2.0/3	2.80	2.0/8
	4	45	45	50	TO-220	**BD533**	**BD534**	25	2.0/2	0.80	2.0/200
	4	60	60	36	TO-126	**BD439**	**BD440**	25	2.0/1	0.80	2.0/200
*	4	60	60	40	TO-126	**BD677A**	**BD678A**	750	2.0/3	2.80	2.0/8
	4	60	60	50	TO-220	**BD535**	**BD536**	25	2.0/2	0.80	2.0/200
	4	80	80	36	TO-126	**BD441**	**BD442**	15	2.0/1	0.80	2.0/200
*	4	80	80	40	TO-126	**BD679A**	**BD680A**	750	2.0/3	2.80	2.0/8
	4	80	80	50	TO-220	**BD537**	**BD538**	15	2.0/2	0.80	2.0/200
*	4	180	180	10	TO-39	**BDW91**	**BDW92**	1000	2.0/5	2.0	2.0/4
*	5	60	60	65	TO-220	**TIP120**	**TIP125**	1000	3.0/3	2.0	3.0/12
*	5	80	80	65	TO-220	**TIP121**	**TIP126**	1000	3.0/3	2.0	3.0/12
*	5	100	100	65	TO-220	**TIP122**	**TIP127**	1000	3.0/3	2.0	3.0/12
*	6	45	45	50	TO-220	**BDW23**	**BDW24**	750	2.0/3	2.0	2.0/8
*	6	60	60	50	TO-220	**BDW23A**	**BDW24A**	750	2.0/3	2.0	2.0/8
*	6	80	80	50	TO-220	**BDW23B**	**BDW24B**	750	2.0/3	2.0	2.0/8
*	6	100	100	50	TO-220	**BDW23C**	**BDW24C**	750	2.0/3	2.0	2.0/8
*	6	140	140	60	TO-220	**BDX53E**	**BDX54E**	500	2.0/5	2.0	2.0/10
*	6	150	150	15	TO-39	**BDX53S**	**BDX54S**	500	2.0/5	2.0	2.0/8
*	6	160	160	60	TO-220	**BDX53F**	**BDX54F**	500	2.0/5	2.0	2.0/10
	6	45	45	65	TO-220	**BD243**	**BD244**	15	3.0/4	1.50	6.0/1000
	6	40	40	65	TO-220	**TIP41**	**TIP42**	15	3.0/4	1.50	6.0/600
	6	60	60	65	TO-220	**BD243A**	**BD244A**	15	3.0/4	1.50	6.0/1000
	6	60	60	65	TO-220	**TIP41A**	**TIP42A**	15	3.0/4	1.50	6.0/600
	6	80	80	65	TO-220	**BD243B**	**BD244B**	15	3.0/4	1.50	6.0/1000
	6	80	80	65	TO-220	**TIP41B**	**TIP42B**	15	3.0/4	1.50	6.0/600
	6	100	100	65	TO-220	**BD243C**	**BD244C**	15	3.0/4	1.50	6.0/1000
	6	100	100	65	TO-220	**TIP41C**	**TIP42C**	15	3.0/4	1.50	6.0/600

* Darlington types.

EPITAXIAL BASE (continued)

	I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
	7	80	70	40	TO-220	**2N6292**	**2N6107**	30	4.0/2	1.0	2.0/200
	7	40	30	40	TO-220	**2N6288**	**2N6111**	30	4.0/3	1.0	3.0/300
*	8	40	40	65	TO-220	**2N6386**		1000	3.0/3	2.0	3.0/6
*	8	45	45	60	TO-220	**BDX53**	**BDX54**	750	3.0/3	2.0	3.0/12
*	8	60	60	60	TO-220	**BDX53A**	**BDX54A**	750	3.0/3	2.0	3.0/12
*	8	60	60	90	TO-3	**MJ1000**	**MJ900**	1000	3.0/3	2.0	3.0/12
*	8	80	80	60	TO-220	**BDX53B**	**BDX54B**	750	3.0/3	2.0	3.0/12
*	8	80	80	90	TO-3	**MJ1001**	**MJ901**	1000	3.0/3	2.0	3.0/12
*	8	100	100	60	TO-220	**BDX53C**	**BDX54C**	750	3.0/3	2.0	3.0/12
*	8	60	60	70	TO-220	**TIP130**	**TIP135**	1000	4.0/4	2.0	4.0/16
*	8	80	80	70	TO-220	**TIP131**	**TIP136**	1000	4.0/4	2.0	4.0/16
*	8	100	100	70	TO-220	**TIP132**	**TIP137**	1000	4.0/4	2.0	4.0/16
*	10	45	45	100	TO-3	**BDX85**	**BDX86**	1000	3.0/3	2.0	4.0/16
*	10	60	60	100	TO-3	**BDX85A**	**BDX86A**	1000	3.0/3	2.0	4.0/16
*	10	80	80	100	TO-3	**BDX85B**	**BDX86B**	1000	3.0/3	2.0	4.0/16
*	10	100	100	100	TO-3	**BDX85C**	**BDX86C**	1000	3.0/3	2.0	4.0/16
*	10	60	60	65	TO-220	**2N6387**		1000	5.0/3	2.0	5.0/10
*	10	60	60	150	TO-3	**MJ3000**	**MJ2500**	1000	5.0/3	2.0	5.0/20
	10	60	60	150	TO-3	**2N5877**	**2N5875**	20	4.0/4	1.0	5.0/500
	10	80	60	150	TO-3	**2N3715**	**2N3791**	30	3.0/2	0.80	5.0/500
*	10	80	80	65	TO-220	**2N6388**		1000	5.0/3	2.0	5.0/10
*	10	80	80	150	TO-3	**MJ3001**	**MJ2501**	1000	5.0/3	2.0	5.0/20
	10	80	80	150	TO-3	**2N5878**	**2N5876**	20	4.0/4	1.0	5.0/500
	10	100	80	150	TO-3	**2N3716**	**2N3792**	30	3.0/2	0.80	5.0/500
	12	45	45	75	TO-220	**BD705**	**BD706**	20	4.0/4	1.0	4.0/400
	12	60	60	75	TO-220	**BD707**	**BD708**	15	4.0/4	1.0	4.0/400
	12	80	80	75	TO-220	**BD709**	**BD710**	15	4.0/4	1.0	4.0/400
	12	100	100	75	TO-220	**BD711**	**BD712**	15	4.0/4	1.0	4.0/400
*	12	45	45	80	TO-220	**BDW93**	**BDW94**	750	5.0/3	2.0	5.0/20
*	12	60	60	80	TO-220	**BDW93A**	**BDW94A**	750	5.0/3	2.0	5.0/20
*	12	80	80	80	TO-220	**BDW93B**	**BDW94B**	750	5.0/3	2.0	5.0/20
*	12	100	100	80	TO-220	**BDW93C**	**BDW94C**	750	5.0/3	2.0	5.0/20
*	12	45	45	120	TO-3	**BDX87**	**BDX88**	1000	5.0/3	2.0	6.0/24
*	12	60	60	120	TO-3	**BDX87A**	**BDX88A**	1000	5.0/3	2.0	6.0/24

* Darlington types.

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES
(continued)

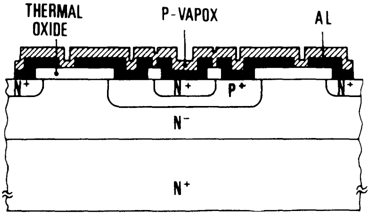
EPITAXIAL BASE (continued)

	I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
*	12	80	80	120	TO-3	**BDX87B**	**BDX88B**	1000	5.0/3	2.0	6.0/24
*	12	100	100	120	TO-3	**BDX87C**	**BDX88C**	1000	5.0/3	2.0	6.0/24
	15	100	60	115	TO-3	**2N3055E**	**MJ2955**	20	4.0/4	1.1	4.0/400
	15	45	45	90	TO-220	**BD905**	**BD906**	15	5.0/4	1.0	5.0/500
	15	45	45	125	TO-3	**BDW51**	**BDW52**	20	5.0/4	1.0	5.0/500
	15	60	60	90	TO-220	**BD907**	**BD908**	15	5.0/4	1.0	5.0/500
	15	60	60	125	TO-3	**BDW51A**	**BDW52A**	20	5.0/4	1.0	5.0/500
	15	80	80	90	TO-220	**BD909**	**BD910**	15	5.0/4	1.0	5.0/500
	15	80	80	125	TO-3	**BDW51B**	**BDW52B**	20	5.0/4	1.0	5.0/500
	15	100	100	90	TO-220	**BD911**	**BD912**	15	5.0/4	1.0	5.0/500
	15	100	100	125	TO-3	**BDW51C**	**BDW52C**	20	5.0/4	1.0	5.0/500

* Darlington types.

EPITAXIAL PLANAR – I_{CM} 0.5 to 2A; V_{CEO} 45 to 350V

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



EPITAXIAL PLANAR

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
0.5	300	300	20	TO-126	**MJE340**	**MJE350**	30	0.05/10	–	–
1	45	45	12	TO-126	**BD135**	**BD136**	40	0.15/2	0.5	0.50/50
1	60	60	12	TO-126	**BD137**	**BD138**	40	0.15/2	0.5	0.50/50
1	80	80	12	TO-126	**BD139**	**BD140**	40	0.15/2	0.5	0.50/50
1	120	120	10	TO-39	**2N5682**	**2N5680**	40	0.25/2	1.0	0.50/50
1	200	200	10	TO-39		**2N5415**	30	0.05/10	2.5	0.05/5
1	300	250	10	TO-39	**2N3440**		40	0.02/10	0.5	0.05/4
1	350	300	10	TO-39		**2N5416**	30	0.05/10	2.5	0.05/5
1	450	350	10	TO-39	**2N3439**		40	0.02/10	0.5	0.05/4
1.5	120	120	5	TO-39	**BSW67**		15	1.0/5	1.0	1.0/150
1.5	150	150	5	TO-39	**BSW68**		15	1.0/5	1.0	1.0/150
2	50	45	25	TO-126	**BD375**	**BD376**	40	0.15/2	1.0	1.0/100
2	75	60	25	TO-126	**BD377**	**BD378**	40	0.15/2	1.0	1.0/100
2	100	80	25	TO-126	**BD379**	**BD380**	40	0.15/2	1.0	1.0/100
3	250	150	10	TO-39	**BU125S**		30	0.25/3	1.5	0.50/50
3	200	200	25	TO-126	**BU325**		30	0.50/5	1.5	0.50/50
3	250	200	10	TO-39	**BUY49S**		40	0.50/5	0.2	0.50/50
3	40	40	6	TO-39		**2N4234**	30	0.25/1	0.6	1.0/125
5	100	60	5	TO-39	**BFX34**		40	2.0/2	1.0	5.0/500
5	65	60	5	TO-39		**BSS44**	40	2.0/2	1.0	5.0/500
5	150	80	7	TO-39	**2N4897**		40	2.0/2	1.0	5.0/500
5	100	80	11.7	TO-39	**2N5154**	**2N5153**	70	2.50/5	0.7	2.50/250
5	100	100	6	TO-39	**2N5338**		20	5.0/2	1.2	5.0/500
5	100	100	6	TO-39	**2N5339**		40	5.0/2	1.2	5.0/500
7	130	60	10	TO-39	**BU125**		15	5.0/2	1.0	5.0/500
7	100	60	10	TO-39	**BUY68**		40	1.0/1	1.0	5.0/500
7	150	120	10	TO-39	**BUY47**		15	5.0/5	1.0	5.0/500
7	330	–	60	TO-220	**BU407D**		8	5.0/1	1.0	5.0/650
7	330	150	60	TO-220	**BU407**		10	5.0/1	1.0	5.0/500
7	200	170	10	TO-39	**BUY48**		15	5.0/5	1.0	5.0/500
7	400	–	60	TO-220	**BU406D**		8	5.0/1	1.0	5.0/650
7	400	200	60	TO-220	**BU406**		10	5.0/1	1.0	5.0/500
7	400	200	50	TO-3	**BUY18S**		20	1.0/5	1.0	5.0/500
* 8	330	150	60	TO-220	**BU807**		100	5.0/2	1.5	5.0/50
* 8	400	200	60	TO-220	**BU806**		100	5.0/2	1.5	5.0/50

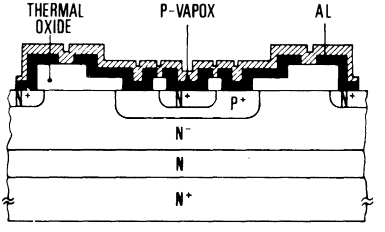
* Darlington types.

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES

(continued)

MULTIEPITAXIAL PLANAR – I_{CM} 1 to 70A; V_{CEO} 75 to 450V

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



MULTIEPITAXIAL PLANAR

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	h_{FE} min	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
1	350	250	40	TO-220	**TIP47**	10	1.0/10	1.0	1.0/200
1	400	300	40	TO-220	**TIP48**	10	1.0/10	1.0	1.0/200
1	450	350	40	TO-220	**TIP49**	10	1.0/10	1.0	1.0/200
1.5	700	400	40	TO-126	**MJE13003**	5	1.0/2	1.0	1.0/250
* 2.5	600	400	36	TO-126	**BU801**	100	1.0/3	2.2	1.0/15
* 6	400	350	60	TO-220	**BU910**	20	4.0/1.8	1.8	2.50/50
* 6	450	400	60	TO-220	**BU911**	20	4.0/1.8	1.8	2.50/50
* 6	500	450	60	TO-220	**BU912**	20	4.0/1.8	1.8	2.0/50
10	100	80	60	TO-3	**BDY91**	20	10.0/5	0.5	5.0/500
10	120	100	60	TO-3	**BDY90**	20	10.0/5	0.5	5.0/500
10	150	120	140	TO-3	**2N6354**	20	5.0/2	0.5	5.0/500
12	300	250	120	TO-3	**BUX42**	8	6.0/4	1.2	4.0/400
15	150	110	140	TO-3	**2N6496**	12	8.0/2	1.0	8.0/800
18	220	160	120	TO-3	**BUX41N**	8	12.0/4	1.2	8.0/800
15	250	200	120	TO-3	**BUX41**	8	8.0/4	1.2	5.0/500
20	120	75	140	TO-3	**2N5039**	20	10.0/5	1.0	10.0/1000
20	150	90	140	TO-3	**2N5038**	20	12.0/5	1.0	12.0/1200
20	160	125	120	TO-3	**BUX40**	8	15.0/4	1.2	10.0/1000
20	220	160	150	TO-3	**BUX11N**	10	15.0/4	0.6	8.0/800
20	250	200	150	TO-3	**BUX11**	10	12.0/4	0.6	6.0/600
20	300	250	150	TO-3	**BUX12**	10	10.0/4	1.0	5.0/500
25	120	80	175	TO-3	**BDY57**	20	10.0/4	1.4	10.0/1000
25	160	125	175	TO-3	**BDY58**	20	10.0/4	1.4	10.0/1000
25	160	125	150	TO-3	**BUX10**	10	20.0/4	0.6	10.0/1000

* Darlington types.

MULTIEPITAXIAL PLANAR (continued)

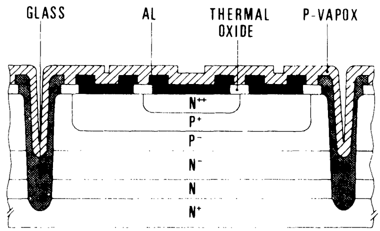
I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	@ h_{FE} min	I_C/V_{CE} (A/V)	@ V_{CEsat} max (V)	I_C/I_B (A/mA)
30	120	90	140	TO-3	**2N5671**	20	20.0/5	0.75	15.0/1200
30	150	120	140	TO-3	**2N5672**	20	20.0/5	0.75	15.0/1200
40	150	120	140	TO-3	**2N6033**	10	40.0/2	1.0	40.0/4000
40	250	200	250	TO-3	**BUV21**	10	25.0/4	0.6	12.0/1200
40	250	200	350	TO-3	**BUX21**	10	25.0/4	0.6	12.0/1200
40	300	250	250	TO-3	**BUV22**	10	20.0/4	1.0	10.0/1000
40	300	250	350	TO-3	**BUX22**	10	20.0/4	1.0	10.0/1000
50	120	90	140	TO-3	**2N6032**	10	50.0/2.6	1.3	50.0/5000
50	160	125	250	TO-3	**BUV20**	10	50.0/4	0.6	25.0/2500
50	160	125	350	TO-3	**BUX20**	10	50.0/4	0.6	25.0/2500
60	300	200	350	TO-3	**BUR51**	15	50.0/4	1.0	30.0/2000
60	350	250	350	TO-3	**BUR52**	15	40.0/4	1.8	25.0/2000
70	200	125	350	TO-3	**BUR50**	15	50.0/4	1.0	35.0/2000

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES

(continued)

MULTIEPITAXIAL MESA – I_{CM} 4 to 30A; V_{CEO} 325 to 600V

NPN and PNP types
High voltage (V_{CBO} up to 1000V)
High power
Very good $I_{s/b}$ and $E_{s/b}$ performance
High switching speed
High f_T (20 MHz)
Good stability



MULTIEPITAXIAL MESA

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min @	I_C/V_{CE} (A/V)	V_{CEsat} max(V) @	I_C/I_B (A/mA)
4	700	400	75	TO-220	**MJE13005**		10	1.0/5	0.6	2.0/500
6	800	375	75	TO-3	**BU326**		25•	1.00/5	1.5	2.50/500
6	800	375	113	SOT-93	**BU426**		25•	0.60/5	1.5	2.50/500
6	800	400	60°	TO-3	**BU326S**		3.5	4.0/5	1.5	2.50/500
6	900	400	75	TO-3	**BU326A**		25•	1.00/5	1.5	2.50/500
6	900	400	113	SOT-93	**BU426A**		25•	0.60/5	1.5	2.50/500
8	450	400	120	TO-3	**BUX44**		8	4.0/4	1.5	4.0/800
8	700	400	80	TO-220	**MJE13007**		8	2.0/5	1.5	5.0/1000
8	850	400	125	TO-3	**2N6545**		4	8.0/5	1.5	5.0/1000
8.5	850	400	107	TO-3	**BUX47**		3	9.0/3	1.5	6.0/1200
10	400	325	120	TO-3	**BUX43**		8	5.0/4	2.0	5.0/1000
10	800	325	100	TO-3	**BUY69B**		15	2.50/10	3.3	8.0/2500
10	500	400	125	TO-3	**BUW34**	**BUW32**	15	1.0/5	1.5	5.0/1000
10	800	400	125	TO-3	**BUW35**		15	1.0/5	1.5	5.0/1000
10	450	400	150	TO-3	**BUX14**		8	6.0/4	1.6	6.0/1200
10	800	400	100	TO-3	**BUX80**		5	5.0/1.5	1.5	5.0/1000
10	1000	400	100	TO-3	**BUY69A**		15	2.50/10	3.3	8.0/2500
10	900	450	125	TO-3	**BUW36**		15	1.0/5	1.5	5.0/1000
15	400	325	150	TO-3	**BUX13**		8	8.0/4	1.5	8.0/1600
* 15	400	350	150	TO-3	**BU930**		40	10.0/1.8	1.8	8.0/100
* 15	450	400	150	TO-3	**BU931**		40	10.0/1.8	1.8	8.0/100
15	500	400	175	TO-3	**BUW44**		6	6.0/1.5	3.0	10.0/2000
15	800	400	175	TO-3	**BUW45**		7	7.0/1.5	1.5	10.0/2000
15	850/450	400	175	TO-3	**BUX48**	**BUW42**	5	15.0/3	1.5	10.0/2000
15	850	400	175	TO-3	**2N6547**		5	15.0/5	1.5	10.0/2000
* 15	500	450	150	TO-3	**BU932**		40	10.0/1.8	1.8	8.0/150
15	900	450	175	TO-3	**BUW46**		7	7.0/1.5	1.5	10.0/2000
15	1000	450	175	TO-3	**BUX48A**		5	12.0/3	1.5	8.0/1600
15	500	500	350	TO-3	**BUX25**		8	8.0/4	1.0	8.0/1600
15	1000	600	175	TO-3	**BUX48B**		15	1.0/10	2.0	8.0/2500
20	450	400	350	TO-3	**BUX24**		8	12.0/4	1.0	12.0/2400
30	400	325	250	TO-3	**BUV23**		8	16.0/4	1.0	16.0/3200
30	400	325	350	TO-3	**BUX23**		8	16.0/4	1.0	16.0/3200
20	450	400	250	TO-3	**BUV24**		8	12.0/4	1.0	12.0/2400

* Darlington types, Multiepitaxial planar • Typical. ° T_C = 75°C.

Recent product introductions

EPITAXIAL BASE

	I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	PNP	h_{FE} min.	@ I_C/V_{CE} (A/V)	V_{CEsat} max. (V)	@ I_C/I_B (A/mA)
*	12	60	60	125	SOT-93	**BDV65**	**BDV64**	1000	5.0/4	2.0	5.0/20
*	12	80	80	125	SOT-93	**BDV65A**	**BDV64A**	1000	5.0/4	2.0	5.0/20
*	12	100	100	125	SOT-93	**BDV65B**	**BDV64B**	1000	5.0/4	2.0	5.0/20
*	16	60	60	150	TO-3	**MJ4030**	**MJ4033**	1000	10/3	4.0	16/80
*	16	80	80	150	TO-3	**MJ4031**	**MJ4034**	1000	10/3	4.0	16/80
*	16	100	100	150	TO-3	**MJ4032**	**MJ4035**	1000	10/3	4.0	16/80
*	30	60	60	200	TO-3	**MJ11012**	**MJ11011**	200	30/5	4.0	30/300
*	30	90	90	200	TO-3	**MJ11014**	**MJ11013**	200	30/5	4.0	30/300
*	30	120	120	200	TO-3	**MJ11016**	**MJ11015**	200	30/5	4.0	30/300
*	10	60	60	125	SOT-93	**TIP140**	**TIP145**	500	10/4	3.0	10/40
*	10	80	80	125	SOT-93	**TIP141**	**TIP146**	500	10/4	3.0	10/40
*	10	100	100	125	SOT-93	**TIP142**	**TIP147**	500	10/4	3.0	10/40
	20	60	60	160	TO-3	**2N6285**	**2N6282**	750	10/3	3.0	20/200
	20	80	80	160	TO-3	**2N6286**	**2N6283**	750	10/3	3.0	20/200
	20	100	100	160	TO-3	**2N6287**	**2N6284**	750	10/3	3.0	20/200

* Darlington types

MULTIEPITAXIAL PLANAR

	I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	h_{FE} min.	@ I_C/V_{CE} (A/V)	V_{CEsat} max. (V)	@ I_C/I_B (A/mA)
*	7	600	400	75	TO-220	**BU810**	10	7.0/3	2.0	2.0/20
*	28	600	400	175	TO-3	**BUT13**	30	10/5	5.0	28/5600
*	28	600	400	150	SOT-93	**BUT13P**	30	10/5	5.0	28/5600
	3	250	200	15	TO-126	**BUY49P**	40	0.5/5	0.2	0.5/50
*	20	400	350	175	TO-3	**MJ10004**	50	5.0/5	1.9	10/400
*	20	450	400	175	TO-3	**MJ10005**	50	5.0/5	1.9	10/400
*	20	400	350	150	SOT-93	**MJ10004P**	50	5.0/5	1.9	10/400
*	20	450	400	150	SOT-93	**MJ10005P**	50	5.0/5	1.9	10/400

* Darlington types

SELECTION GUIDES BASED ON TECHNOLOGY AND PACKAGES

(continued)

MULTIEPITAXIAL PLANAR (continued)

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	h_{FE} (min.)	@ I_C/V_{CE} (A/V)	V_{CEsat} max (V)	@ I_C/I_B (A/mA)
* 10	400	350	105	SOT-93	**BU920P**	50	7.0/1.8	1.8	5/50
* 10	450	400	105	SOT-93	**BU921P**	50	7.0/1.8	1.8	5/50
* 10	500	450	105	SOT-93	**BU922P**	50	7.0/1.8	1.8	5/50
4	40	30	30	TO-220	**D44C1**	25	1.0/1	0.5	1/100
4	55	45	30	TO-220	**D44C4**	25	1.0/1	0.5	1/100
4	70	60	30	TO-220	**D44C7**	25	1.0/1	0.5	1/100
4	90	80	30	TO-220	**D44C10**	25	1.0/1	0.5	1/100
10	–	30	50	TO-220	**D44H1**	20	4.0/1	1.0	8/800
10	–	45	50	TO-220	**D44H4**	20	4.0/1	1.0	8/800
10	–	60	50	TO-220	**D44H7**	20	4.0/1	1.0	8/800
10	–	80	50	TO-220	**D44H10**	20	4.0/1	1.0	8/800
4	200	125	31.25	TO-220	**D44Q1**	20	2.0/10	1.0	2/200
4	250	175	31.25	TO-220	**D44Q3**	20	2.0/10	1.0	2/200
4	300	225	31.25	TO-220	**D44Q5**	20	2.0/10	1.0	2/200
1	500	400	40	TO-220	**TIP50**	10	1.0/10	1.0	1/200
* 15	400	350	105	SOT-93	**BU930P**	40	10/1.8	1.8	8/100
* 15	450	400	105	SOT-93	**BU931P**	40	10/1.8	1.8	8/100
* 15	500	450	105	SOT-93	**BU932P**	53	8.0/1.8	1.8	8/150
7	140	90	50	TO-220	**2N6702**	20	5.0/2	1.5	7/700

* Darlington types

MULTIEPITAXIAL MESA

I_C (A)	V_{CBO} (V)	V_{CEO} (V)	P_{tot} (W)	Package	NPN	h_{FE} (min.)	@ I_C/V_{CE} (A/V)	V_{CEsat} max. (V)	@ I_C/I_B (A/mA)
5	850	400	850	TO-220	**BUV46**	5.0	3.5/5	1.5	2.5/500
9	850	400	120	SOT-93	**BUV47**	3.0	8.0/3	1.5	5.0/1000
9	1000	450	120	SOT-93	**BUV47A**	3.0	8.0/3	1.5	5.0/1000
5	850	400	100	SOT-93	**BUW11**	5.0	3.0/1.5	1.5	3.0/600
8	850	400	125	SOT-93	**BUW12**	5.0	6.0/1.5	1.5	6.0/1200
8	1000	450	125	SOT-93	**BUW12A**	5.0	6.0/1.5	1.5	6.0/1200
15	1000	700	175	TO-3	**BUX48C**	2.5	10/3	1.5	6.0/1500
2	800	400	40	TO-220	**BUX84**	50(°)	0.1/5	1.1	1.0/200
15	850	400	150	SOT-93	**BUV48**	5.0	15/5	1.5	10/2000
15	1000	450	150	SOT-93	**BUV48A**	5.0	12/5	1.5	8.0/1600
50	160	125	250	TO-3	**BUV20**	10	50/4	1.2	50/5000
40	250	200	250	TO-3	**BUV21**	10	25/4	1.5	25/3000
40	300	250	250	TO-3	**BUV22**	10	20/4	1.5	20/2500
30	400	325	250	TO-3	**BUV23**	8.0	16/4	1.0	16/3200
20	450	400	250	TO-3	**BUV24**	8.0	12/4	1.0	12/2400
15	500	500	250	TO-3	**BUV25**	8.0	8.0/4	1.0	8.0/1600
3	350	250	100	SOT-93	**TIP51**	10	3.0/10	1.5	3.0/600
3	400	300	100	SOT-93	**TIP52**	10	3.0/10	1.5	3.0/600
3	450	350	100	SOT-93	**TIP53**	10	3.0/10	1.5	3.0/600
3	500	400	100	SOT-93	**TIP54**	10	3.0/10	1.5	3.0/600

(°) Typical

CROSS REFERENCE GUIDE

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
BD 135	BD 135	*	BD 205	BD 905	120	BD 243	BD 243	74
BD 136	BD 136	*	BD 206	BD 906	124	BD 243A	BD 243A	74
BD 137	BD 137	*	BD 207	BD 907	120	BD 243B	BD 243B	74
BD 138	BD 138	*	BD 208	BD 908	124	BD 243C	BD 243C	74
BD 139	BD 139	*	BD 220	BD 537	94	BD 244	BD 244	76
BD 140	BD 140	*	BD 221	BD 533	94	BD 244A	BD 244A	76
BD 165	BD 437	78	BD 222	BD 535	94	BD 244B	BD 244B	76
BD 166	BD 438	82	BD 223	BD 538	98	BD 244C	BD 244C	76
BD 167	BD 439	86	BD 224	BD 534	98	BD 245	BD 705	110
BD 168	BD 440	90	BD 225	BD 536	98	BD 245A	BD 707	110
BD 169	BD 441	86	BD 226	BD 375	*	BD 245B	BD 709	110
BD 170	BD 442	90	BD 227	BD 376	*	BD 245C	BD 711	110
BD 175	BD 175	48	BD 228	BD 377	*	BD 246	BD 706	115
BD 176	BD 176	52	BD 229	BD 378	*	BD 246A	BD 708	115
BD 177	BD 177	48	BD 230	BD 379	*	BD 246B	BD 710	115
BD 178	BD 178	52	BD 231	BD 380	*	BD 246C	BD 712	115
BD 179	BD 179	48	BD 233	BD 233	56	BD 253	BUW 24	*
BD 180	BD 180	52	BD 234	BD 234	60	BD 253A	BUW 25	*
BD 181	BD 181	*	BD 235	BD 235	56	BD 253B	BU 136	*
BD 182	BD 182	*	BD 236	BD 236	60	BD 253C	BU 326A	240
BD 183	BD 183	*	BD 238	BD 238	60	BD 262	BD 678	106
BD 185	BD 435	78	BD 239	BD 239	64	BD 262A	BD 680	106
BD 186	BD 436	82	BD 239A	BD 239A	64	BD 262B	BD 682	106
BD 187	BD 437	78	BD 239B	BD 239B	64	BD 263	BD 677	102
BD 188	BD 438	82	BD 239C	BC 239C	64	BD 263A	BD 679	102
BD 189	BD 439	86	BD 240	BD 240	66	BD 263B	BD 681	102
BD 190	BD 440	90	BD 240A	BD 240A	66	BD 264	BDW 24A	*
BD 195	BD 533	94	BD 240B	BD 240B	66	BD 264A	BDW 24B	*
BD 196	BD 534	98	BD 240C	BD 240C	66	BD 265	BDW 23A	*
BD 197	BD 535	94	BD 241	BD 241	70	BD 265A	BDW 23B	*
BD 198	BD 536	98	BD 241A	BD 241A	70	BD 266	BDX 54A	173
BD 199	BD 537	94	BD 241B	BD 241B	70	BD 266A	BDX 54B	173
BD 200	BD 538	98	BD 241C	BD 241C	70	BD 266B	BDX 54C	173
BD 201	BD 705	110	BD 242	BD 242	72	BD 267	BDX 53A	161
BD 202	BD 706	115	BD 242A	BD 242A	72	BD 267A	BDX 53B	161
BD 203	BD 707	110	BD 242B	BD 242B	72	BD 267B	BDX 53C	161
BD 204	BD 708	115	BD 242C	BD 242C	72	BD 268	BDW 94A	156

* Data sheet available on request

CROSS REFERENCE GUIDE (continued)

TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE	TYPE	SGS-ATES NEAREST	PAGE
BD 268A	BDW 94B	156	BD 435	BD 435	78	BD 586	BD 534	98
BD 269	BDW 93A	151	BD 436	BD 436	82	BD 587	BD 535	94
BD 269A	BDW 93B	151	BD 437	BD 437	78	BD 588	BD 536	98
BD 271	BD 533	94	BD 438	BD 438	82	BD 589	BD 537	94
BD 272	BD 534	98	BD 439	BD 439	86	BD 590	BD 538	98
BD 273	BD 535	94	BD 440	BD 440	90	BD 595	BD 705	110
BD 274	BD 536	98	BD 441	BD 441	86	BD 596	BD 706	115
BD 275	BD 537	94	BD 442	BD 442	90	BD 597	BD 707	110
BD 276	BD 538	98	BD 533	BD 533	94	BD 598	BD 708	115
BD 277	BD 664	*	BD 534	BD 534	98	BD 599	BD 709	110
BD 278	BD 663	*	BD 535	BD 535	94	BD 600	BD 710	115
BD 301	BD 533	94	BD 536	BD 536	98	BD 601	BD 711	110
BD 302	BD 534	98	BD 537	BD 537	94	BD 602	BD 712	115
BD 303	BD 535	94	BD 538	BD 538	98	BD 605	BD 905	120
BD 304	BD 536	98	BD 539	BD 241	70	BD 606	BD 906	124
BD 311	BDW 51A	133	BD 539A	BD 241A	70	BD 607	BD 907	120
BD 312	BDW 52A	138	BD 539B	BD 241B	70	BD 608	BD 908	124
BD 313	BDW 51B	133	BD 539C	BD 241C	70	BD 609	BD 909	120
BD 314	BDW 52B	138	BD 540	BD 242	72	BD 610	BD 910	124
BD 331	BDX 53A	161	BD 540A	BD 242A	72	BD 633	BD 533	94
BD 332	BDX 54A	173	BD 540B	BD 242B	72	BD 634	BD 534	98
BD 333	BDX 53B	161	BD 540C	BD 242C	72	BD 635	BD 535	94
BD 334	BDX 54B	173	BD 543	BD 905	120	BD 636	BD 536	98
BD 335	BDX 53C	161	BD 543A	BD 907	120	BD 637	BD 537	94
BD 336	BDX 54C	173	BD 543B	BD 909	120	BD 638	BD 538	98
BD 361	BD 433	78	BD 544	BD 906	124	BD 643	BDX 53	161
BD 361A	BD 433	78	BD 544A	BD 908	124	BD 644	BDX 54	173
BD 362	BD 434	82	BD 544B	BD 910	124	BD 645	BDX 53A	161
BD 362A	BD 434	82	BD 561	BD 437	78	BD 646	BDX 54A	173
BD 375	BD 375	*	BD 562	BD 438	82	BD 647	BDX 53B	161
BD 376	BD 376	*	BD 575	BD 533	94	BD 648	BDX 54B	173
BD 377	BD 377	*	BD 576	BD 534	98	BD 649	BDX 53C	161
BD 378	BD 378	*	BD 577	BD 535	94	BD 650	BDX 54C	173
BD 379	BD 379	*	BD 578	BD 536	98	BD 663	BD 663	*
BD 380	BD 380	*	BD 579	BD 537	94	BD 664	BD 664	*
BD 433	BD 433	78	BD 580	BD 538	98	BD 675A	BD 675A	102
BD 434	BD 434	82	BD 585	BD 533	94	BD 676A	BD 676A	106

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BD 677	BD 677	102	BD 796	BD 706	115	BD 943	BD 533	94
BD 677A	BD 677A	102	BD 797	BD 707	110	BD 944	BD 534	98
BD 678	BD 678	106	BD 798	BD 708	115	BD 945	BD 535	94
BD 678A	BD 678A	106	BD 799	BD 709	110	BD 946	BD 534	98
BD 679	BD 679	102	BD 800	BD 710	115	BD 947	BD 533	94
BD 679A	BD 679A	102	BD 801	BD 711	110	BD 948	BD 534	98
BD 680	BD 680	106	BD 802	BD 712	115	BD 949	BD 241A	70
BD 680A	BD 680A	106	BD 805	BD 905	120	BD 950	BD 242A	72
BD 681	BD 681	102	BD 806	BD 906	124	BD 951	BD 241B	70
BD 682	BD 682	106	BD 807	BD 907	120	BD 952	BD 242B	72
BD 695A	BDX 53	161	BD 808	BD 908	124	BD 953	BD 241C	70
BD 696A	BDX 54	173	BD 809	BD 909	120	BD 954	BD 242C	72
BD 697	BDX 53A	161	BD 810	BD 910	124	BDT 62	BDW 94A	156
BD 697A	BDX 53A	161	BD 895	BDW 93	151	BDT 62A	BDW 94B	156
BD 698	BDX 54A	173	BD 896	BDW 94	156	BDT 62B	BDW 94C	156
BD 698A	BDX 54A	173	BD 897	BDW 93A	151	BDT 63	BDW 93A	151
BD 699	BDX 53B	161	BD 898	BDW 94A	151	BDT 63A	BDW 93B	151
BD 699A	BDX 53B	161	BD 899	BDW 93B	151	BDT 63B	BDW 93C	151
BD 700	BDX 54B	173	BD 900	BDW 94B	156	BDT 91	BD 907	120
BD 700A	BDX 54B	173	BD 901	BDW 93C	151	BDT 92	BD 908	124
BD 701	BDX 53C	161	BD 902	BDW 94C	156	BDT 93	BD 909	120
BD 702	BDX 54C	173	BD 905	BD 905	120	BDT 94	BD 910	124
BD 705	BD 705	110	BD 906	BD 906	124	BDT 95	BD 911	120
BD 706	BD 706	115	BD 907	BD 907	120	BDT 96	BD 912	124
BD 707	BD 707	110	BD 908	BD 908	124	BDV 64	BDV 64	128
BD 708	BD 708	115	BD 909	BD 909	120	BDV 64A	BDV 64A	128
BD 709	BD 709	110	BD 910	BD 910	124	BDV 64B	BDV 64B	128
BD 710	BD 710	115	BD 911	BD 911	120	BDV 65	BDV 65	128
BD 711	BD 711	110	BD 912	BD 912	124	BDV 65A	BDV 65A	128
BD 712	BD 712	115	BD 933	BD 239	64	BDV 65B	BDV 65B	128
BD 733	BD 533	94	BD 934	BD 240	66	BDW 21	BDW 21	*
BD 734	BD 534	98	BD 935	BD 239A	64	BDW 21A	BDW 21A	*
BD 735	BD 533	94	BD 936	BD 240A	66	BDW 21B	BDW 21B	*
BD 736	BD 534	98	BD 937	BD 239B	64	BDW 21C	BDW 21C	*
BD 737	BD 533	94	BD 938	BD 240B	66	BDW 22	BDW 22	*
BD 738	BD 534	98	BD 939	BD 239C	64	BDW 22A	BDW 22A	*
BD 795	BD 705	110	BD 940	BD 240C	66	BDW 22B	BDW 22B	*

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BDW 22C	BDW 22C	*	BDW 74	BDW 94	156	BDX 64A	BDX 88B	200
BDW 23	BDW 23	*	BDW 74A	BDW 94A	156	BDX 64B	BDX 88C	200
BDW 23A	BDW 23A	*	BDW 74B	BDW 94B	156	BDX 65	BDX 87A	195
BDW 23B	BDW 23B	*	BDW 74C	BDW 74C	156	BDX 65A	BDX 87B	195
BDW 23C	BDW 23C	*	BDW 91	BDW 91	143	BDX 65B	BDX 87C	195
BDW 24	BDW 24	*	BDW 92	BDW 92	147	BDX 70	BDX 71	*
BDW 24A	BDW 24A	*	BDW 93	BDW 93	151	BDX 77	BD 709	110
BDW 24B	BDW 24B	*	BDW 93A	BDW 93A	151	BDX 78	BD 710	115
BDW 24C	BDW 24C	*	BDW 93B	BDW 93B	151	BDX 83	BDX 87	195
BDW 51	BDW 51	133	BDW 93C	BDW 93C	151	BDX 83A	BDX 87A	195
BDW 51A	BDW 51A	133	BDW 94	BDW 94	156	BDX 83B	BDX 87B	195
BDW 51B	BDW 51B	133	BDW 94A	BDW 94A	156	BDX 83C	BDX 87C	195
BDW 51C	BDW 51C	133	BDW 94B	BDW 94B	156	BDX 84	BDX 88	200
BDW 52	BDW 52	138	BDW 94C	BDW 94C	156	BDX 84A	BDX 88A	200
BDW 52A	BDW 52A	138	BDX 33	BDX 53	161	BDX 84B	BDX 88B	200
BDW 52B	BDW 52B	138	BDX 33A	BDX 53A	161	BDX 84C	BDX 88C	200
BDW 52C	BDW 52C	138	BDX 33B	BDX 53B	161	BDX 85	BDX 85	185
BDW 53	BDW 23	*	BDX 33C	BDX 53C	161	BDX 85A	BDX 85A	185
BDW 53A	BDW 23A	*	BDX 34	BDX 54	173	BDX 85B	BDX 85B	185
BDW 53B	BDW 23B	*	BDX 34A	BDX 54A	173	BDX 85C	BDX 85C	185
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BDW 54A	BDW 24A	*	BDX 53	BDX 53	161	BDX 86B	BDX 86B	190
BDW 54B	BDW 24B	*	BDX 53A	BDX 53A	161	BDX 86C	BDX 86C	190
BDW 54C	BDW 24C	*	BDX 53B	BDX 53B	161	BDX 87	BDX 87	195
BDW 63	BDX 53	161	BDX 53C	BDX 53C	161	BDX 87A	BDX 87A	195
BDW 63A	BDX 53A	161	BDX 54	BDX 54	173	BDX 87B	BDX 87B	195
BDW 63B	BDX 53B	161	BDX 54A	BDX 54A	173	BDX 87C	BDX 87C	195
BDW 63C	BDX 53C	161	BDX 54B	BDX 54B	173	BDX 88	BDX 88	200
BDW 64	BDX 54	173	BDX 54C	BDX 54C	173	BDX 88A	BDX 88A	200
BDW 64A	BDX 54A	173	BDX 62	BDX 86A	190	BDX 88B	BDX 88B	200
BDW 64B	BDX 54B	173	BDX 62A	BDX 86B	190	BDX 88C	BDX 88C	200
BDW 64C	BDX 54C	173	BDX 62B	BDX 86C	190	BDX 91	BDW 21A	*
BDW 73	BDW 93	151	BDX 63	BDX 85A	185	BDX 92	BDW 22A	*
BDW 73A	BDW 93A	151	BDX 63A	BDX 85B	185	BDX 93	BDW 21B	*
BDW 73B	BDW 93B	151	BDX 63B	BDX 85C	185	BDX 94	BDW 22B	*
BDW 73C	BDW 93C	151	BDX 64	BDX 88A	200	BDX 95	BDW 21C	*

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BDX 96	BDW 22C	*	BU 361	BUW 35	359	BUR 21	BUV 21	335
BDY 57	BDY 57	205	BU 406	BU 406	249	BUR 22	BUV 22	335
BDY 58	BDY 58	205	BU 406D	BU 406D	255	BUR 23	BUV 23	338
BDY 90	BDY 90	208	BU 406H	BU 406H	249	BUR 24	BUV 24	338
BDY 91	BDY 91	208	BU 407	BU 407	261	BUR 50	BUR 50	301
BDY 92	BDY 92	208	BU 407D	BU 407D	255	BUR 51	BUR 51	307
BFX 34	BFX 34	210	BU 407H	BU 407H	261	BUR 53	BUR 52	313
BSS 44	BSS 44	214	BU 408	BU 408	249	BUS 12	BUW 35	359
BSW 67	BSW 67	218	BU 408D	BU 408D	255	BUW 12A	BUW 36	359
BSW 68	BSW 68	218	BU 411	BU 607D	*	BUS 13	BUX 48	449
BU 104	BU 606	*	BU 412	BU 607D	*	BUS 13A	BUW 46	366
BU 104D	BU 606D	*	BU 426	BU 426	267	BUT 13	BUT 13	319
BU 104DP	BU 406D	255	BU 426A	BU 426A	267	BUT 13P	BUT 13P	327
BU 106	BU 607	*	BU 606	BU 606	*	BUV 20	BUV 20	335
BU 107	BU 607	*	BU 606D	BU 606D	*	BUV 21	BUV 21	335
BU 109	BU 607	*	BU 607	BU 607	*	BUV 22	BUV 22	335
BU 109D	BU 607D	*	BU 607D	BU 607D	*	BUV 23	BUV 23	338
BU 109DP	BU 407D	255	BU 608	BU 608	*	BUV 24	BUV 24	338
BU 110	BU 607	*	BU 608D	BU 608D	*	BUV 25	BUV 25	338
BU 111	BUW 24	*	BU 807	BU 807	275	BUV 46	BUV 46	341
BU 125	BU 125	222	BU 810	BU 810	281	BUV 47	BUV 47	343
BU 125S	BUS 125S	226	BU 910	BU 910	285	BUV 47A	BUV 47A	343
BU 126	BU 126	*	BU 911	BU 911	285	BUV 48	BUV 48	346
BU 129	BU 606	*	BU 912	BU 912	285	BUV 48A	BUV 48A	346
BU 133	BU 126	*	BU 920	BU 920	*	BUW 11	BUW 11	348
BU 134	BUW 25	*	BU 920P	BU 920P	290	BUW 12	BUW 12	351
BU 137	BUY 69A	484	BU 921	BU 921	*	BUW 12A	BUW 12A	351
BU 310	BU 607	*	BU 921P	BU 921P	290	BUW 24	BUW 24	*
BU 311	BU 607	*	BU 922	BU 922	*	BUW 25	BUW 25	*
BU 312	BU 607	*	BU 922P	BU 922P	290	BUW 26	BUW 26	*
BU 322	BU 920	*	BU 930	BU 930	293	BUW 32	BUW 32	354
BU 322A	BU 922	*	BU 930P	BU 930P	299	BUW 34	BUW 34	359
BU 323	BU 930	293	BU 931	BU 931	293	BUW 35	BUW 35	359
BU 323A	BU 932	293	BU 931P	BU 931P	299	BUW 36	BUW 36	359
BU 326	BU 326S	245	BU 932	BU 932	293	BUW 42	BUW 42	364
BU 326A	BU 326A	240	BU 932P	BU 932P	299	BUW 44	BUW 44	366
BU 326S	BU 326S	245	BUR 20	BUV 20	335	BUW 45	BUW 45	366

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BUW 57	BUX 10	371	BUX 40	BUX 40	417	D44 C3	D44 C3	487
BUW 58	BUX 11N	383	BUX 40A	BUX 40	417	D44 C4	D44 C4	487
BUW 66	BUW 66	*	BUX 40S	BUX 40	417	D44 C5	D44 C5	487
BUW 67	BUW 67	*	BUX 41	BUX 41	423	D44 C6	D44 C6	487
BUW 73	BUX 11	377	BUX 41N	BUX 41N	429	D44 C7	D44 C7	487
BUX 10	BUX 10	371	BUX 41S	BUX 41	423	D44 C8	D44 C8	487
BUX 10S	BUX 10	371	BUX 42	BUX 42	435	D44 C9	D44 C9	487
BUX 11	BUX 11	377	BUX 43	BUX 43	441	D44 C10	D44 C10	487
BUX 11N	BUX 11N	383	BUX 44	BUX 44	443	D44 C11	D44 C11	487
BUX 11S	BUX 11	377	BUX 45	BUW 34	359	D44 C12	D44 C12	487
BUX 12	BUX 12	389	BUX 46	BUX 46	445	D44 H1	D44 H1	489
BUX 13	BUX 13	395	BUX 47	BUX 47	447	D44 H2	D44 H2	489
BUX 14	BUX 14	397	BUX 48	BUX 48	449	D44 H4	D44 H4	489
BUX 15	BUW 44	366	BUX 48A	BUX 48A	449	D44 H5	D44 H5	489
BUX 16	BUW 24	*	BUX 48B	BUX 48B	449	D44 H7	D44 H7	489
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BUX 16B	BUW 24	*	BUX 77	BUX 77	*	D44 H10	D44 H10	489
BUX 16C	BUW 24	*	BUX 78	BUX 78	*	D44 H11	D44 H11	489
BUX 17	BUX 41N	429	BUX 80	BUX 80	*	D44 Q1	D44 Q1	491
BUX 17A	BUX 42	435	BUX 82	BUX 82	*	D44 Q3	D44 Q3	491
BUX 17B	BUW 44	366	BUX 84	BUX 84	*	D44 Q5	D44 Q5	491
BUX 17C	BUW 44	366	BUX 97	BUX 97	*	MJ 424	BUW 35	359
BUX 18	BUX 41	423	BUX 97A	BUX 97A	*	MJ 425	BUW 35	359
BUX 18A	BUX 42	435	BUX 97B	BUX 97B	*	MJ 900	MJ 900	493
BUX 18B	BUW 35	359	BUY 18S	BUY 18S	466	MJ 901	MJ 901	493
BUX 18C	BUW 35	359	BUY 47	BUY 47	469	MJ 1000	MJ 1000	493
BUX 20	BUX 20	399	BUY 48	BUY 48	469	MJ 1001	MJ 1001	493
BUX 20S	BUX 20	399	BUY 49P	BUY 49P	474	MJ 2500	MJ 2500	495
BUX 21	BUX 21	405	BUY 49S	BUY 49S	476	MJ 2501	MJ 2501	495
BUX 21S	BUX 21	405	BUY 57	BUX 40	417	MJ 2955	MJ 2955	497
BUX 22	BUX 22	411	BUY 58	BUX 41N	429	MJ 3000	MJ 3000	495
BUX 23	BUV 23	338	BUY 68	BUY 68	480	MJ 3001	MJ 3001	495
BUX 24	BUV 24	338	BUY 69A	BUY 69A	484	MJ 3029	BUW 24	*
BUX 25	BUV 25	338	BUY 69B	BUY 69B	484	MJ 3030	BUW 25	*
BUX 28	BU 920	*	BUY 69C	BUY 69C	484	MJ 3040	BU 920P	290
BUX 29	BU 921	*	D44 C1	D44 C1	487	MJ 3041	BU 920P	290

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MJ 4030	MJ 4030	499
MJ 4031	MJ 4031	499
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MJ 4033	MJ 4033	499
MJ 4034	MJ 4034	499
MJ 4035	MJ 4035	499
MJ 10000	BU 930	293
MJ 10001	BU 931	293
MJ 10002	BU 920P	290
MJ 10003	BU 921P	290
MJ 10004	MJ 10004	501
MJ 10004P	MJ 10004P	501
MJ 10005	MJ 10005	501
MJ 10005P	MJ 10005P	501
MJ 11011	MJ 11011	504
MJ 11012	MJ 11012	504
MJ 11013	MJ 11013	504
MJ 11014	MJ 11014	504
MJ 11015	MJ 11015	504
MJ 11016	MJ 11016	504
MJ 10012	BU 931	293
MJ 13014	BUW 34	359
MJ 13015	BUW 34	359
MJ 13330	BUX 41	423
MJ 13331	BUX 42	435
MJ 13332	BUV 23	338
MJ 13333	BUV 24	338
MJ 13334	BUV 24	338
MJE 340	MJE 340	506
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MJE 700	MJE 700	508
MJE 701	MJE 701	508
MJE 702	MJE 702	508
MJE 703	MJE 703	508
MJE 800	MJE 800	508
MJE 801	MJE 801	508
MJE 802	MJE 802	508
MJE 803	MJE 803	508
MJE 13002	MJE 13002	511
MJE 13003	MJE 13003	511
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MJE 13007	MJE 13007	522
MJE 13007A	MJE 13007A	522
SE 9300	BDW 93A	151
SE 9301	BDW 93B	151
SE 9302	BDW 93C	151
SE 9303	BDX 87A	195
SE 9304	BDX 87B	195
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SE 9400	BDW 94A	156
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SE 9403	BDX 88A	200
SE 9404	BDX 88B	200
SE 9405	BDX 88C	200
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TIP 30A	TIP 30A	526
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TIP 30C	TIP 30C	526
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TIP 31A	TIP 31A	528
TIP 31B	TIP 31B	528
TIP 31C	TIP 31C	528
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TIP 32A	TIP 32A	530
TIP 32B	TIP 32B	530
TIP 32C	TIP 32C	530
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TIP 41A	TIP 41A	532
TIP 41B	TIP 41B	532
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TIP 42A	TIP 42A	534
TIP 42B	TIP 42B	534
TIP 42C	TIP 42C	534
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TIP 49	TIP 49	536
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TIP 52	TIP 52	542
TIP 53	TIP 53	542
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TIP 73A	BD 907	120
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TIP 100	BDX 53A	161
TIP 101	BDX 53B	161
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TIP 131	TIP 131	563
TIP 132	TIP 132	563
TIP 135	TIP 135	565
TIP 136	TIP 136	565
TIP 137	TIP 137	565
TIP 140	TIP 140	567
TIP 141	TIP 141	567
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TIP 145	TIP 145	567
TIP 146	TIP 146	567
TIP 147	TIP 147	567
TIP 150	BU 910	285
TIP 151	BU 910	285
TIP 152	BU 911	285
TIP 660	BU 920P	290
TIP 661	BU 920P	290
TIP 662	BU 921P	290
2N 3055E	2N 3055E	572
2N 3418	2N 3418	*
2N 3419	2N 3419	*
2N 3420	2N 3420	*
2N 3421	2N 3421	*
2N 3439	2N 3439	576
2N 3440	2N 3440	576
2N 3445	BDW 51A	133
2N 3446	BDW 51B	133
2N 3553	BUY 68	480
2N 3554	BUY 68	480
2N 3713	2N 3713	580
2N 3714	2N 3714	580
2N 3715	2N 3715	580
2N 3716	2N 3716	580
2N 3719	BSS 44	214
2N 3720	BSS 44	214
2N 3789	2N 3789	584
2N 3790	2N 3790	584
2N 3791	2N 3791	584
2N 3792	2N 3792	584
2N 3830	BUY 68	480
2N 3831	BUY 68	480
2N 3924	BUY 68	480
2N 4234	2N 4234	588
2N 4235	2N 4235	588
2N 4236	2N 4236	588
2N 4895	2N 4895	591
2N 4896	2N 4896	591
2N 4897	2N 4897	591
2N 5038	2N 5038	595
2N 5039	2N 5039	595
2N 5157	BUW 35	359
2N 5190	2N 5190	607
2N 5191	2N 5191	607
2N 5192	2N 5192	607
2N 5193	2N 5193	611
2N 5194	2N 5194	611
2N 5195	2N 5195	611
2N 5241	BUW 34	359
2N 5294	BD 537	94
2N 5296	BD 533	94
2N 5298	BD 535	94
2N 5333	BSS 44	214
2N 5334	BUY 68	480
2N 5335	BUY 47	469
2N 5336	2N 5336	615
2N 5337	2N 5337	615
2N 5338	2N 5338	615
2N 5339	2N 5339	615
2N 5490	BD 705	110
2N 5492	BD 707	110
2N 5494	BD 705	110
2N 5496	BD 709	110
2N 5671	2N 5671	624
2N 5672	2N 5672	624
2N 5681	BSW 67	218
2N 5682	BSW 67	218
2N 5758	BDW 51C	133
2N 5781	BSS 44	214
2N 5782	BSS 44	214
2N 5783	BSS 44	214
2N 5784	BUY 68	480
2N 5785	BUY 68	480
2N 5786	BUY 68	480
2N 5875	2N 5875	632
2N 5876	2N 5876	632
2N 5877	2N 5877	637
2N 5878	2N 5878	637
2N 5879	BDW 52A	138
2N 5880	BDW 52B	138
2N 5881	BDW 51A	133
2N 5882	BDW 51B	133
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2N 6033	2N 6033	642
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2N 6035	2N 6035	647
2N 6036	2N 6036	647
2N 6037	2N 6037	651
2N 6038	2N 6038	651
2N 6039	2N 6039	651
2N 6040	BDX 54A	173
2N 6041	BDX 54B	173
2N 6042	BDX 54C	173
2N 6043	BDX 53A	161
2N 6044	BDX 53B	161
2N 6045	BDX 53C	161

* Data sheet available on request

TYPE	SGS-ATES NEAREST	PAGE
2N 6050	2N 6050	655
2N 6051	2N 6051	655
2N 6052	2N 6052	655
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2N 6056	2N 6056	664
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2N 6109	2N 6109	673
2N 6111	2N 6111	673
2N 6121	2N 6121	675
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2N 6125	2N 6125	679
2N 6126	2N 6126	679
2N 6226	BDW 52C	138
2N 6246	BDW 52A	138
2N 6247	BDW 52B	138
2N 6249	BUX 41	423
2N 6250	BUX 42	435
2N 6251	BUW 44	366
2N 6274	BUV 20	335
2N 6275	BUV 20	335
2N 6276	BUV 21	335
2N 6277	BUV 21	335
2N 6282	2N 6282	683
2N 6283	2N 6283	683
2N 6284	2N 6284	683
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TYPE	SGS-ATES NEAREST	PAGE
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2N 6308	BUW 35	359
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2N 6339	BUX 10	371
2N 6340	BUX 11N	383
2N 6341	BUX 11N	383
2N 6354	2N 6354	685
2N 6383	BDX 87	195
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2N 6385	BDX 87B	195
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2N 6388	2N 6388	690
2N 6469	BDW 52	138
2N 6470	BDW 51	133
2N 6471	BDW 51A	133
2N 6472	BDW 51B	133
2N 6473	BD 711	110
2N 6475	BD 712	115
2N 6486	2N 6486	693
2N 6487	2N 6487	693
2N 6488	2N 6488	693
2N 6489	2N 6489	696
2N 6490	2N 6490	696
2N 6491	2N 6491	696
2N 6496	2N 6496	595
2N 6511	BUW 34	359
2N 6512	BUW 34	359
2N 6513	BUW 34	359
2N 6514	BUW 34	359
2N 6531	BDX 53C	161
2N 6532	BDX 53C	161
2N 6544	2N 6544	699
2N 6545	2N 6545	699
2N 6546	2N 6546	702
TYPE	SGS-ATES NEAREST	PAGE
2N 6547	2N 6547	702
2N 6569	BDW 51	133
2N 6573	BUW 44	366
2N 6574	2N 6546	702
2N 6575	BUW 45	366
2N 6594	BDW 52	138
2N 6648	BDX 88	200
2N 6649	BDX 88A	200
2N 6650	BDX 88B	200
2N 6666	BDX 54	173
2N 6667	BDX 54A	173
2N 6668	BDX 54B	173
2N 6702	2N 6702	705

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.

QUALITY

- 100% ELECTRICAL TESTING
- MARKING
- GROUP A ACCEPTANCE
- PACKING
- PACKING AND DOCUMENTATION ACCEPTANCE
- SHIPPING

GROUP A ACCEPTANCE

Sub-group	Parameters	Temp. °C	Insp. Level	Acceptablee quality level (AQL) Hermetic and molded packages
A1	Visual and Mechanical Inspection, Major Minor		I	0.25 1
*A2	Inoperative failure (electrical and mechanical)	25°C	II	0.15
A3	DC parameters	25°C	II	0.65
	h_{FE} ranges □			1
A4	AC parameters at 25°C and DC parameters at high temperature		S4	2.5

□ Applicable when h_{FE} is guaranteed as min and max

* Definition of electrical inoperative:

- open or short circuit
- $<$ 80% of guaranteed spec value for: BV_{CBO}, BV_{CEO}, BV_{CER}, BV_{CES}, BV_{CEV}, BV_{EBO}
- $>$ 200% of guaranteed spec value for: $V_{CE(sat)}$
- $>$ 200% of guaranteed spec value for: I_{CBO}, I_{CES}, I_{CEO}, I_{CEV} at 50% guaranteed BV value
- $>$ 150% of guaranteed max spec values for h_{FE}
- $<$ 50% of guaranteed min spec values for h_{FE}

For further information Quality and Reliability see the SGS SURE 3 programme.

PRECAUTIONS FOR PHYSICAL HANDLING OF POWER PLASTIC TRANSISTOR [TO-220, SOT-93, TO-126 (SOT-32)]

When mounting power transistors certain precautions must be taken in operations such as bending of leads, mounting of heatsink, soldering and removal of flux residue. If these operations are not carried out correctly, the device can be damaged or reliability compromised.

1. Bending and cutting leads

The bending or cutting of the leads requires the following precautions:

1.1. When bending the leads they must be clamped tightly between the package and the bending point to avoid strain on the package (in particular in the area where the leads enter the resin) (fig. 1). This also applies to cutting the leads (fig. 2).

1.2. The leads must be bent at a minimum distance of 3 mm from the package (fig. 3a).

1.3. The leads should not be bent at an angle of more than 90° and they must be bent only once (fig. 3b).

1.4. The leads must never be bent laterally (fig. 3c).

1.5. Check that the tool used to cut or form the leads does not damage them or ruin their surface finish.

Fig. 1 - Bending the leads

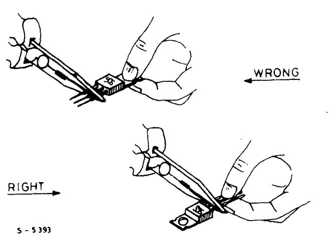


Fig. 2 - Lead forming or cutting mechanism

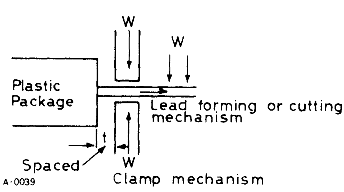
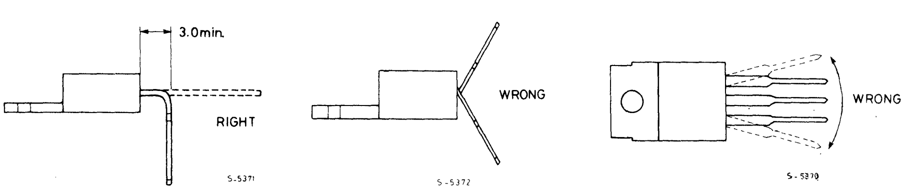


Fig. 3 - Angles for lead wire bending



a b c

2. Mounting on printed circuit

During mounting operations be careful not to apply stress to the power transistor.

2.1. Adhere strictly to the pin spacing of the transistor to avoid forcing the leads.

2.2. Leave a suitable space between printed circuit and transistor, if necessary use a spacer.

2.3. When fixing the device to the printed circuit do not put mechanical stress on the transistor. For this purpose the device should be soldered to the printed circuit board after the Transistor has been fixed to the heatsink and the heatsink to the printed circuit board.

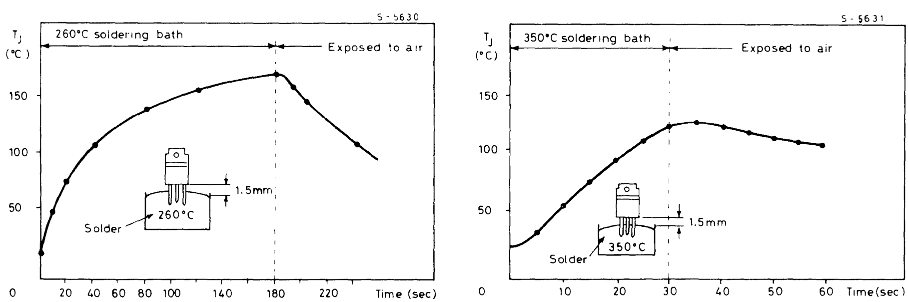
3. Soldering

In general a transistor should never be exposed to high temperature for any length of time. It is therefore preferable to use soldering methods where the transistor is exposed to the lowest possible temperatures for a short time.

3.1. Tolerable conditions are 260°C for 10 sec or 350°C for 3 sec. The graphs in fig. 4 give an idea of the excess junction temperature during the soldering process for a TO-220 (Versawatt). It is also important to use suitable fixes for the tin baths to avoid deterioration of the leads or of the package resin.

3.2. An excess of residual flux between the pins of the transistor or in contact with the resin can reduce the long-term reliability of the device. The solvent for removing excess flux must be chosen with care. The use of solvents derived from trichloroethylene is not recommended on plastic packages because the residue can cause corrosion.

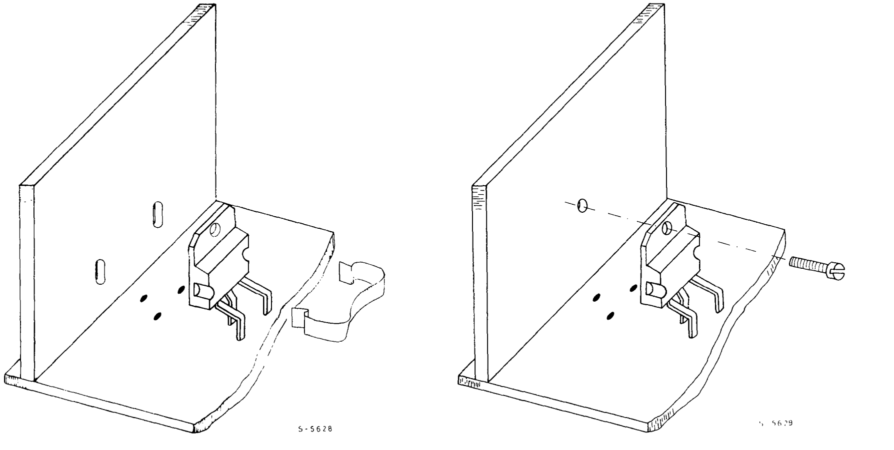
Fig. 4 – Junction temperatures during soldering



4. **Mounting at heatsink**
To exploit best the performance of power transistors a heatsink with R_{th} suitable for the power that the transistor will dissipate must be used.

4.1. The plastic packages used by SGS for its power transistors (SOT-32, SOT-93, Versawatt) provide for the use of a single screw to fix the package to the heatsink. A compression spring (clip) can be sufficient as an alternative (fig. 5).

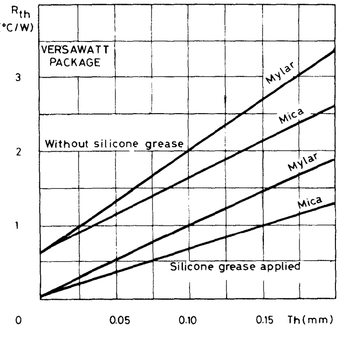
Fig. 5 – SOT-93 mounting examples



The screw should be properly tightened to ensure good contact between the back of the package and the heatsink but should not be too tight to avoid deformation of the copper part (tab) of the package causing breaking of the die or separation of the resin from the tab.

4.2. The contact R_{th} between device and heatsink can be improved by inserting a thin layer of silicone grease with fluidity sufficient to guarantee perfectly uniform distribution on the surface of the tab. The thermal resistance with and without silicone grease is given in fig. 6. An excessively thick layer or an excessive viscosity of the grease can degrade the R_{th}.

Fig. 6 – Contact thermal resistance vs. insulator thickness.

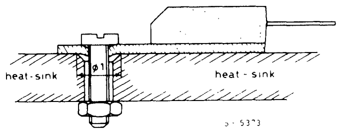


5. **Heatsink problems**
The most important aspect from the point of view of reliability of a power transistor is that the heatsink should be dimensioned to keep the T_j of the device as low as possible. From the mechanical point of view, however, the heatsink must be realized so that it does not damage the device.

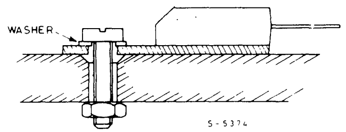
5.1. The planarity of the contact surface between device and heatsink must be < 25 μm for TO-220, SOT-93, TO-126 (SOT-32).

5.2. If self threading screws are used there must be an outlet for the material that is deformed during formation of the thread. The diameter ϕ 1 (fig. 7) must be large enough to avoid distortion of the

Fig. 7 – Device mounting



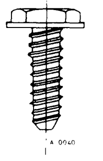
WRONG



RIGHT

tab during tightening. For this purpose it may be useful to insert a washer or use screws of the type shown in fig. 8 where the pressure on the tab is distributed on a much larger surface. Sometimes when the hole in the heatsink is formed with a punch, around the hole or hollow there may be a ring which is lower than the heatsink surface. This is dangerous because it may lead to distortion of the tab as mentioned before.

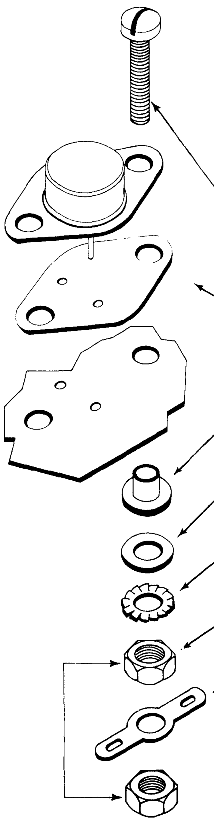
Fig. 8 – Suggested screw



5.3. A very serious problem is that of the rigidity between heatsink, device and printed circuit board. Once the device and the heatsink are mechanically connected, and the heatsink is fixed to the apparatus frame, the device and the PCB are bound together by the leads of the devices. A solution of this type is extremely dangerous.

ACCESSORIES AND MOUNTING INSTRUCTIONS

TO-3



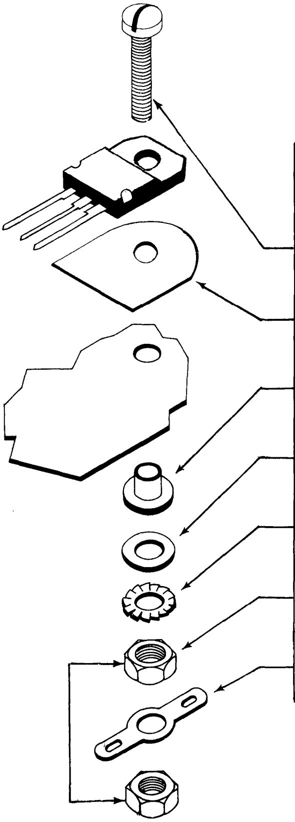
ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NOT AVAILABLE FROM SGS		
MICA WASHER	1	CDA 3126 A *	MICA	43
INSULATING BUSHES	2	CDA 3155 A	NYLON	44
WASHERS	2	NOT AVAILABLE FROM SGS		
LOCK WASHERS	2	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	4	NOT AVAILABLE FROM SGS		
SOLDER LUG	1	NOT AVAILABLE FROM SGS		

S-0375/3

* CDA 3126 B FOR MODIFIED TO-3 (see 2N6032 and 2N6033)

Maximum torque (applied to mounting flange)
Recommended: 0.55 Nm
Maximum: 1 Nm.

SOT-93

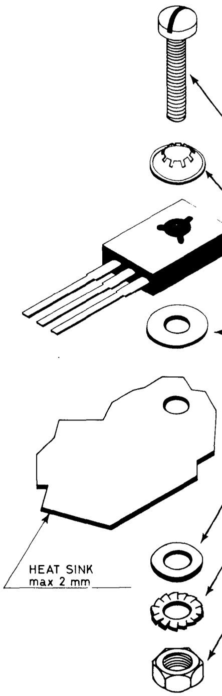


ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NOT AVAILABLE FROM SGS		
MICA WASHER	1	CDA 3154	MICA	44
INSULATING BUSHES	1	CDA 3155 C	NYLON	44
WASHERS	1	NOT AVAILABLE FROM SGS		
LOCK WASHERS	1	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	2	NOT AVAILABLE FROM SGS		
SOLDER LUG	1	NOT AVAILABLE FROM SGS		

S-5668

Maximum torque (applied to mounting flange)
Recommended: 0.55 Nm
Maximum: 1 Nm.

TO-126 (SOT-32)

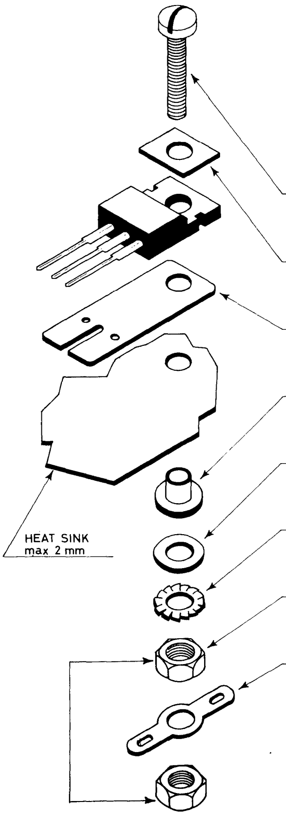


ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NOT AVAILABLE FROM SGS		
LOCK WASHER	1	CDA 3164	STEEL C 72 UNI 3545	46
MICA WASHER	1	CDA 3162	MICA	45
WASHER	1	NOT AVAILABLE FROM SGS		
LOCK WASHER	1	NOT AVAILABLE FROM SGS		
HEXAGON NUT	1	NOT AVAILABLE FROM SGS		

S-0340/3

Maximum torque (applied to mounting flange)
Recommended: 0.55 Nm
Maximum: 0.7 Nm.

TO-220



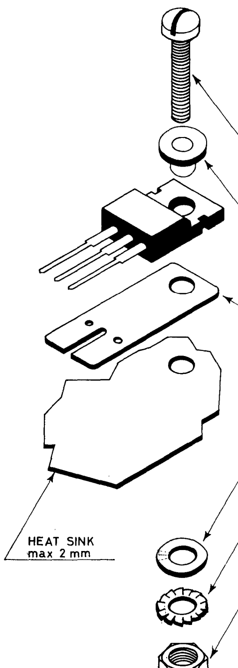
ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NOT AVAILABLE FROM SGS		
RECTANGULAR WASHER	1	CDA 3163		46
MICA WASHER	1	CDA 3159	MICA	45
INSULATING BUSHE	1	CDA 3155 B	NYLON	44
WASHER	1	NOT AVAILABLE FROM SGS		
LOCK WASHER	1	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	2	NOT AVAILABLE FROM SGS		
SOLDER LUG	1	NOT AVAILABLE FROM SGS		

S-0388/3

Maximum torque (applied to mounting flange)
Recommended: 0.55 Nm
Maximum: 0.7 Nm.

ACCESSORIES AND MOUNTING INSTRUCTIONS (continued)

TO-220

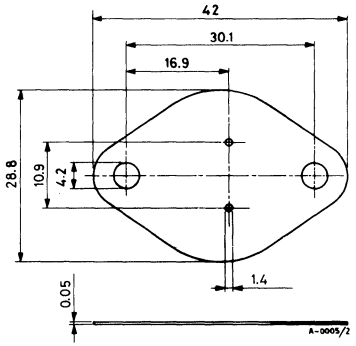


ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NOT AVAILABLE FROM SGS		
INSULATING BUSHING	1	CDA 3155B	NYLON	44
MICA INSULATOR	1	CDA 3159	MICA	45
METAL WASHER	1	NOT AVAILABLE FROM SGS		
LOCK WASHER	1	NOT AVAILABLE FROM SGS		
HEXAGON NUTS	2	NOT AVAILABLE FROM SGS		

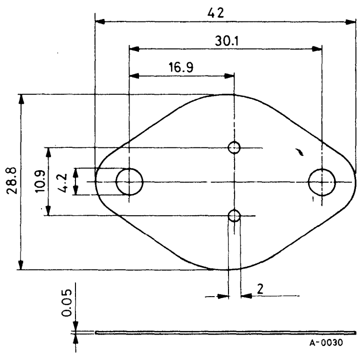
S-0389/3

Maximum torque (applied to mounting flange)
Recommended: 0.55 Nm
Maximum: 0.7 Nm.

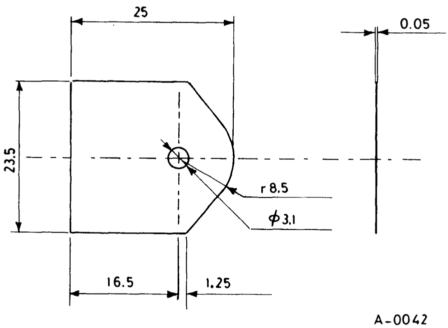
CDA 3126A



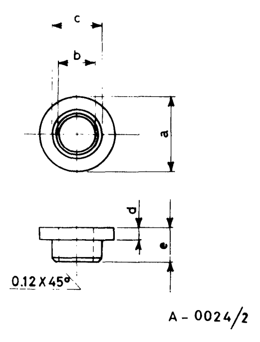
CDA 3126B



CDA 3154



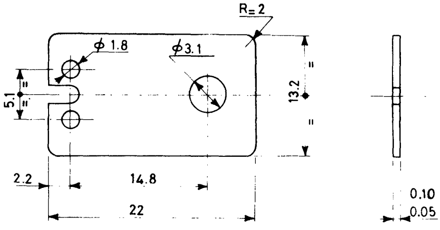
CDA 3155



Suffix	Package	a	b	c	d	e
A	TO-3	6.40 to 6.60	3.00 to 3.10	4.00 to 4.05	1.1 max	1.55 to 1.65
B	TO-220	5.30 to 5.50	3.00 to 3.10	3.83 to 3.88	0.60 to 0.65	1.70 to 1.80
C	SOT-93	6.40 to 6.60	3.00 to 3.10	4,00 to 4,05	1.3 to 1.4	2.7 to 2.9

Material: Nylon; Dimensions: mm.

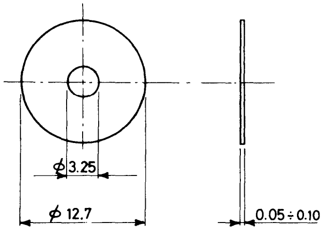
CDA 3159



A-0026/3

TYPE	MATERIAL	NOTE
CDA 3159	MICA	

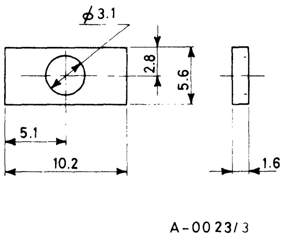
CDA 3162



A-0025/3

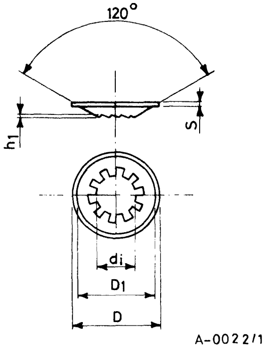
TYPE	MATERIAL	NOTE
CDA 3162	MICA	

CDA 3163



TYPE	MATERIAL	NOTE
CDA 3163	Steel nickel plated	

CDA 3164



TYPE	di max	di min	D max	D min	D1	S	h1	NOTE
CDA3164	3.3	3.1	7.1	6.8	5.2	0.4	0.8	

MATERIAL: Steel nickel plated

DATA SHEETS

BD175
BD177
BD179

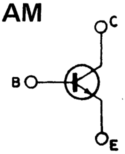
EPITAXIAL-BASE NPN

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.

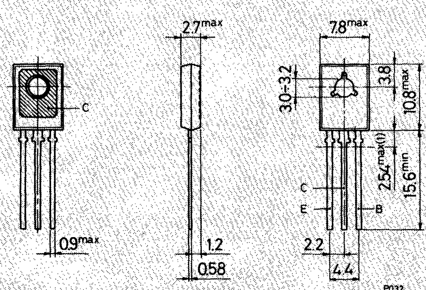
ABSOLUTE MAXIMUM RATINGS		BD 175	BD 177	BD 179
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		3A	
I_{CM}	Collector peak current		7A	
P_{tot}	Total power dissipation at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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

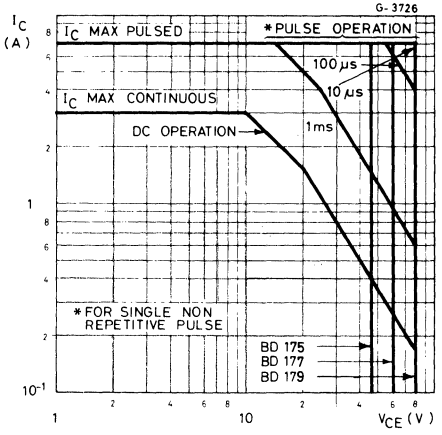
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.16	°C/W

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

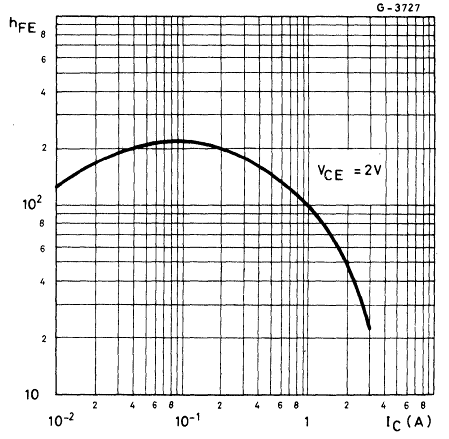
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD175** $V_{CB} = 45V$ for **BD177** $V_{CB} = 60V$ for **BD179** $V_{CB} = 80V$			100 100 100	μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter 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	$I_C = 150mA$ $V_{CE} = 2V$ $I_C = 1A$ $V_{CE} = 2V$	40 15			– –
f_T	Transistion frequency	$I_C = 250mA$ $V_{CE} = 10V$	3			MHz

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

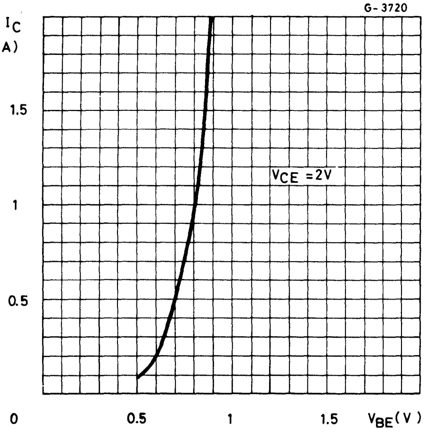
Safe operating areas



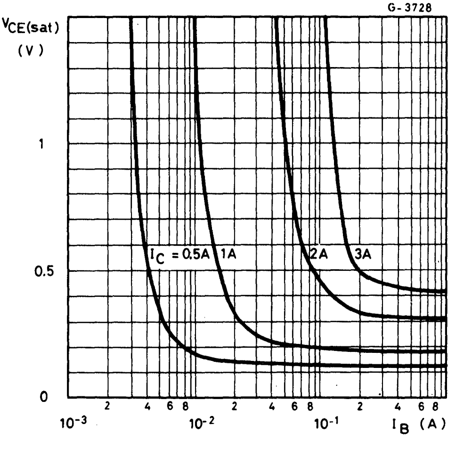
DC current gain



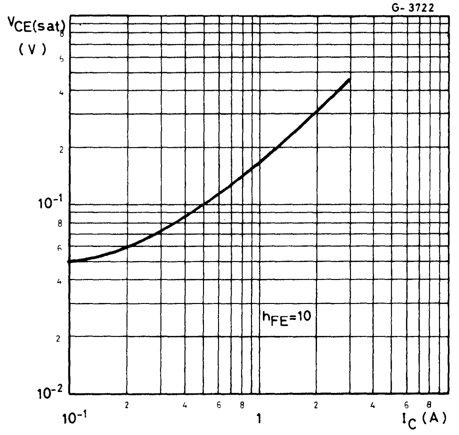
DC transconductance



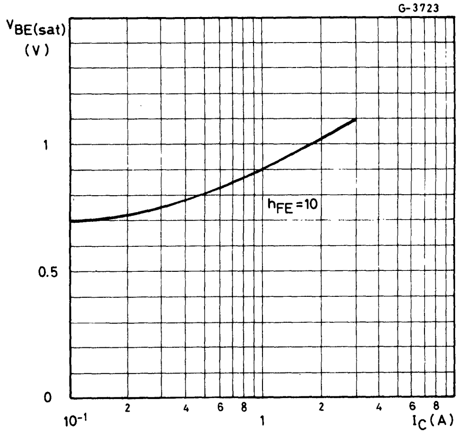
Collector-emitter saturation voltage



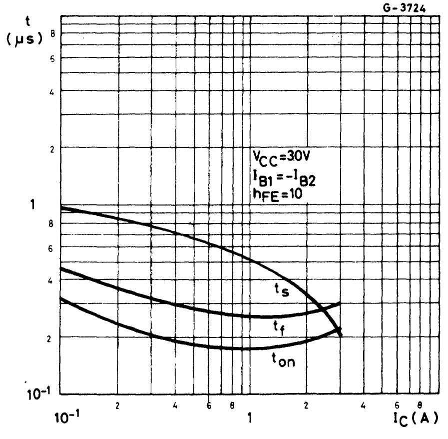
Collector-emitter saturation voltage



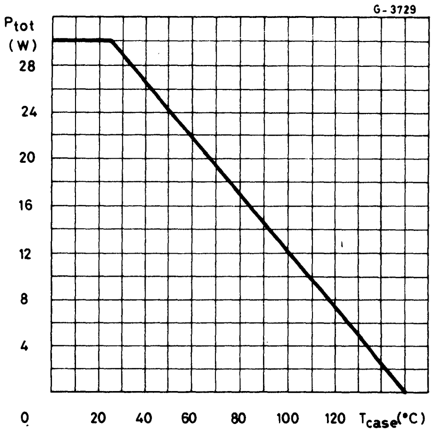
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



BD176
BD178
BD180

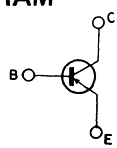
EPITAXIAL-BASE PNP

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.

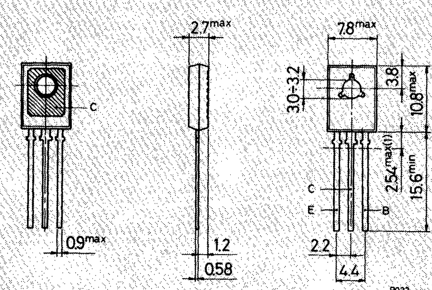
ABSOLUTE MAXIMUM RATINGS		BD 176	BD 178	BD 180
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-3A	
I_{CM}	Collector peak current		-7A	
P_{tot}	Total power dissipation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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

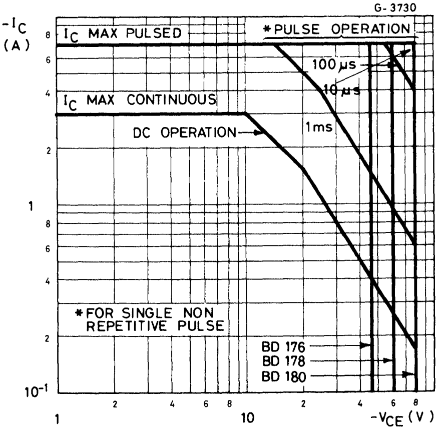
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4.16 °C/W

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

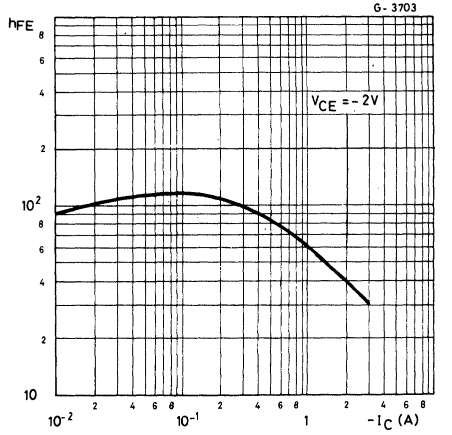
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E=0)	for **BD176** V_{CB}=-45V for **BD178** V_{CB}=-60V for **BD180** V_{CB}=-80V			-100 -100 -100	µA µA µA
I_{EBO}	Emitter cutoff current (I_C =0)	V_{EB}=-5V			-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	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%

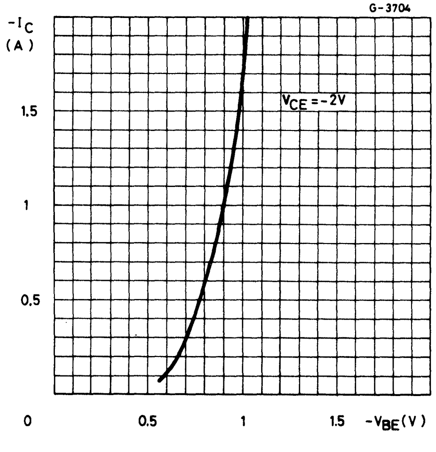
Safe operating areas



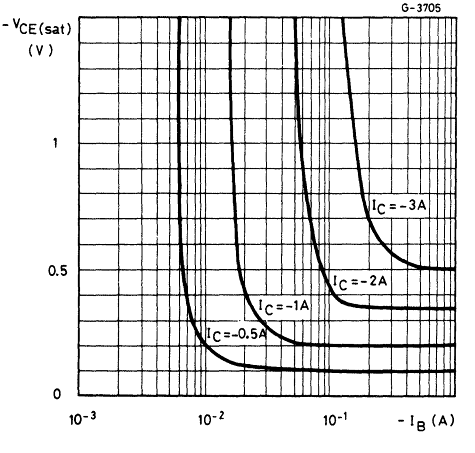
DC current gain



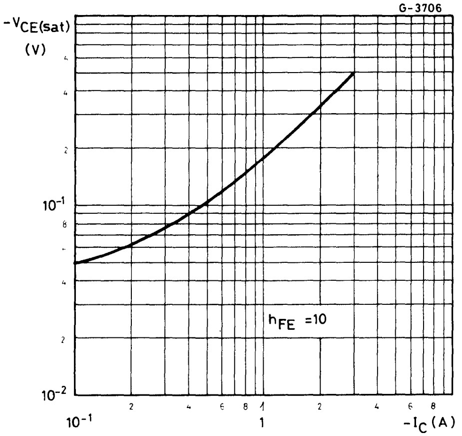
DC transconductance



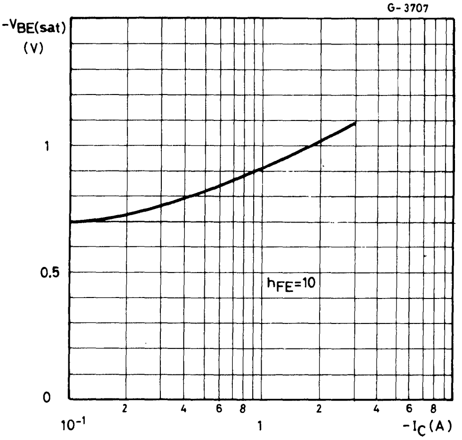
Collector-emitter saturation voltage



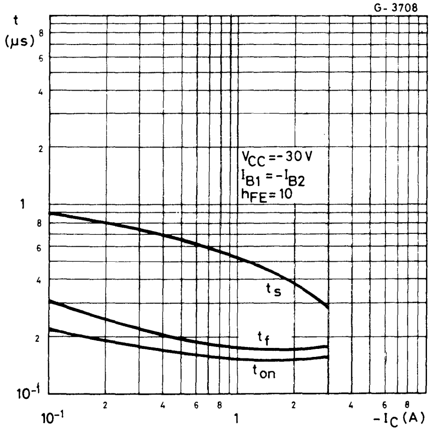
Collector-emitter saturation voltage



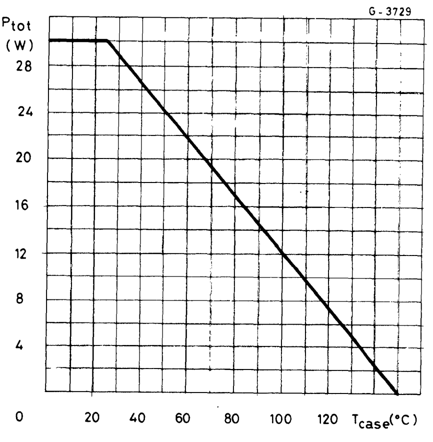
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



BD233
BD235
BD237

EPITAXIAL-BASE NPN

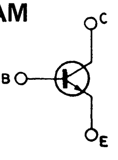
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

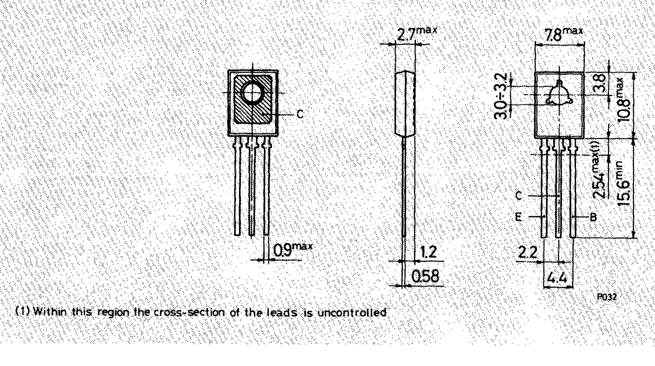
		BD 233	BD 235	BD 237
V_{CBO}	Collector-base voltage ($I_E=0$)	45V	60V	100V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	45V	60V	80V
V_{CER}	Collector-emitter voltage ($R_{BE}=1K\Omega$)	45V	60V	100V
V_{EBO}	Emitter-base voltage ($I_C=0$)		5V	
I_C	Collector current		2A	
I_{CM}	Collector peak current		6A	
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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



TO-126 (SOT-32)

THERMAL DATA

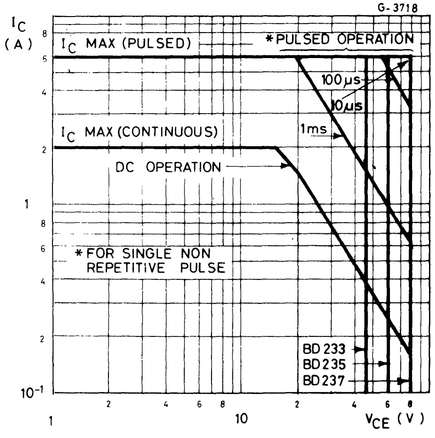
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W

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

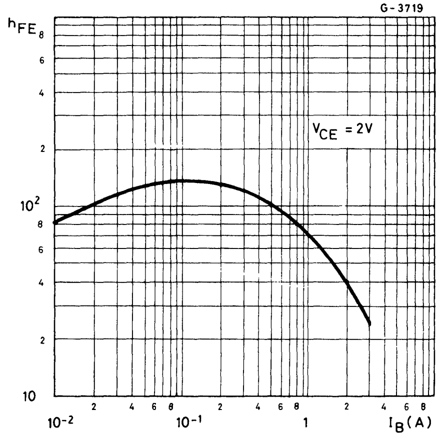
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD233** V_{CB} = 45V for **BD235** V_{CB} = 60V for **BD237** V_{CB} = 100V T_{case} = 150°C for **BD233** V_{CB} = 45V for **BD235** V_{CB} = 60V for **BD237** V_{CB} = 100V			100 100 100 2 2 2	μA μA μA mA 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%

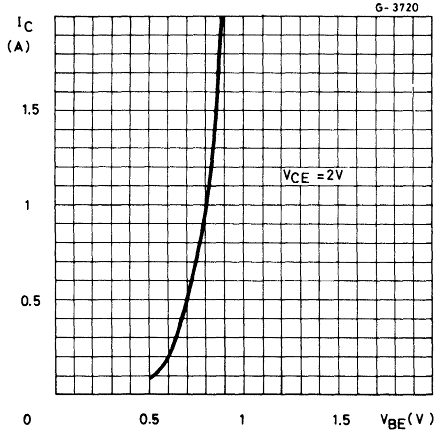
Safe operating areas



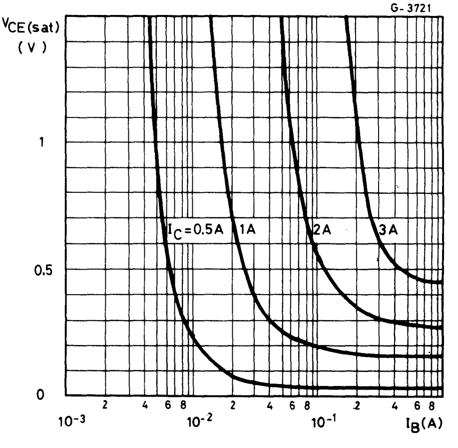
DC current gain



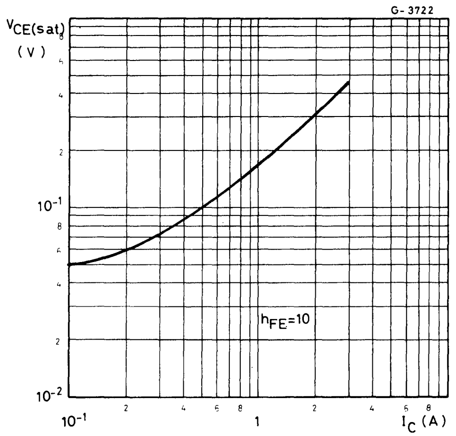
DC transconductance



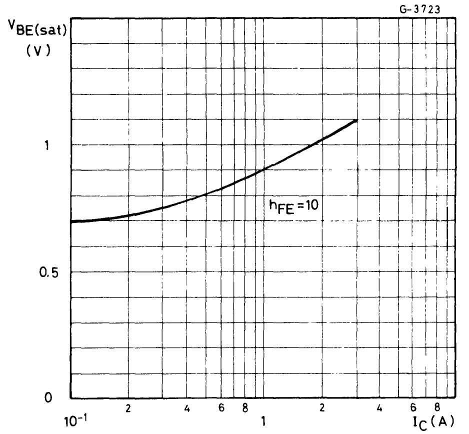
Collector-emitter saturation voltage



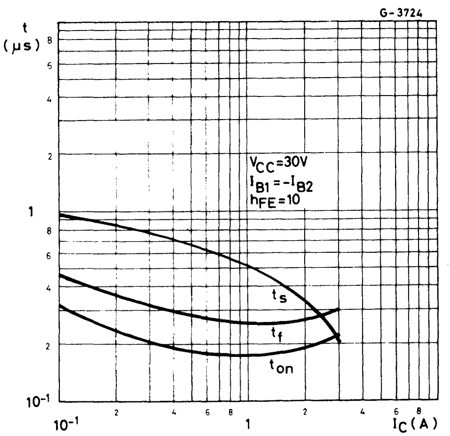
Collector-emitter saturation voltage



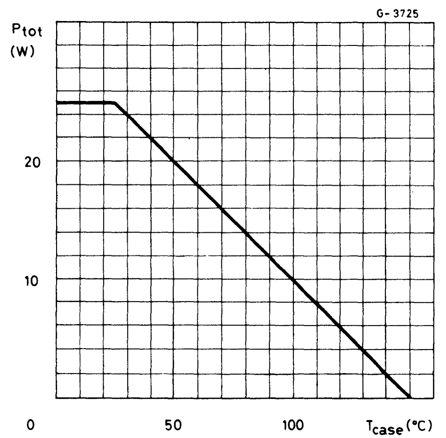
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



BD234
BD236
BD238

EPITAXIAL-BASE PNP

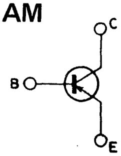
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

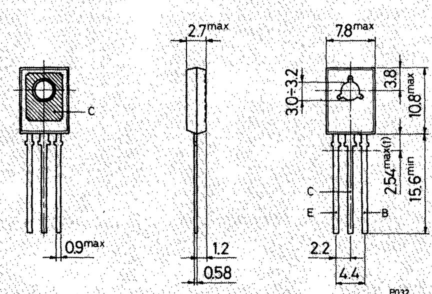
		BD234	BD236	BD238
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{CER}	Collector-emitter voltage ($R_{BE} = 1K\Omega$)	-45V	-60V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-2A	
I_{CM}	Collector 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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

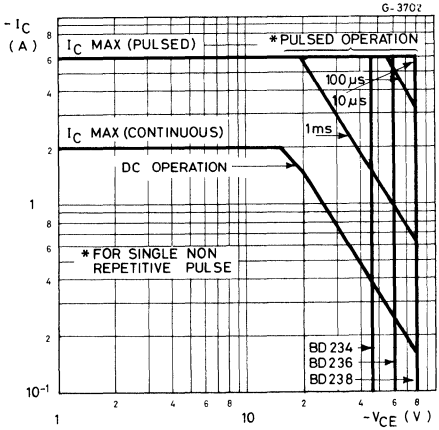
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W

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

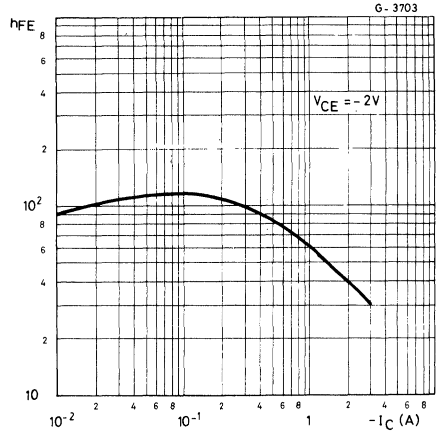
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD234** V_{CB}= -45V for **BD236** V_{CB}= -60V for **BD238** V_{CB}= -100V T_{case}= 150°C for **BD234** V_{CB}= -45V for **BD236** V_{CB}= -60V for **BD238** V_{CB}= -100V			-100 -100 -100 -2 -2 -2	µA µA 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_B=0)	I_C = -100 mA for **BD234** for **BD236** for **BD238**	 -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%

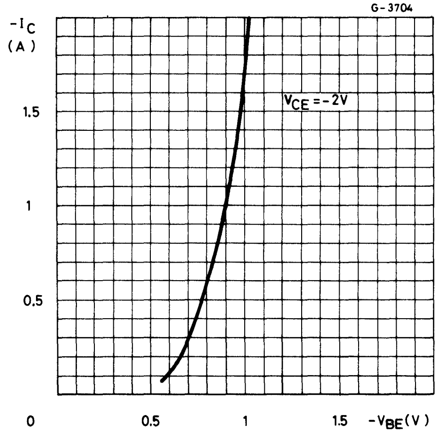
Safe operating areas



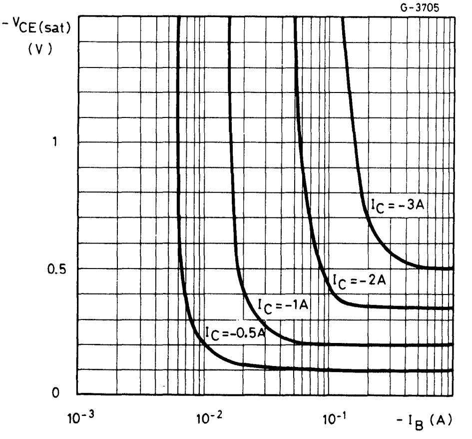
DC current gain



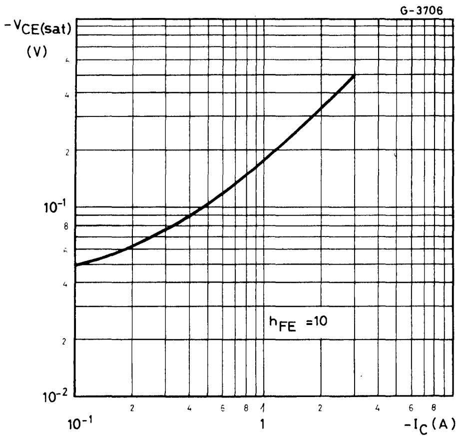
DC transconductance



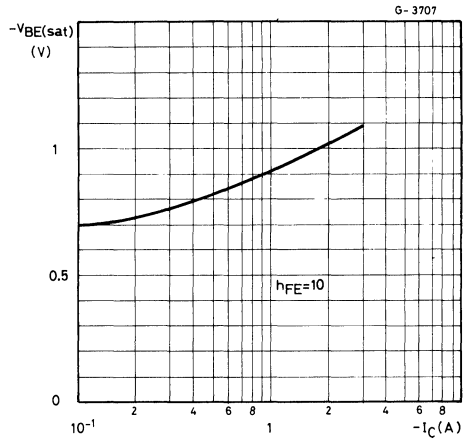
Collector-emitter saturation voltage



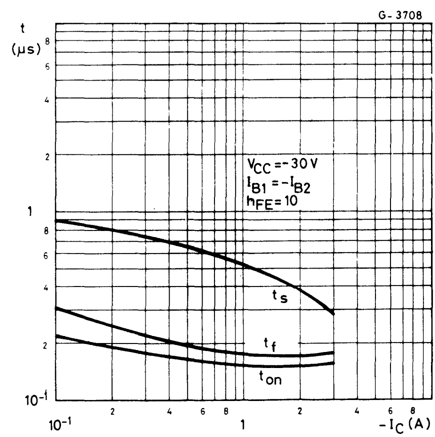
Collector-emitter saturation voltage



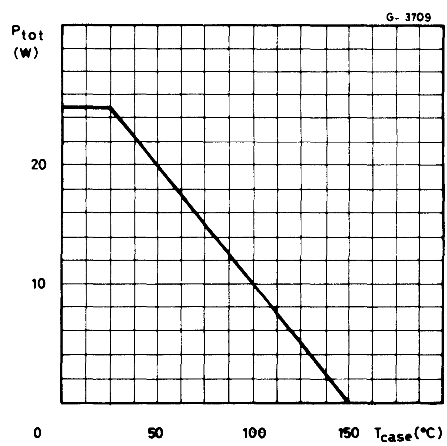
Base-emitter saturation voltage



Satured switching characteristics



Power derating chart



BD239
BD239A
BD239B
BD239C

EPITAXIAL-BASE NPN

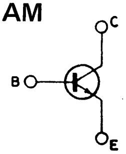
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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			

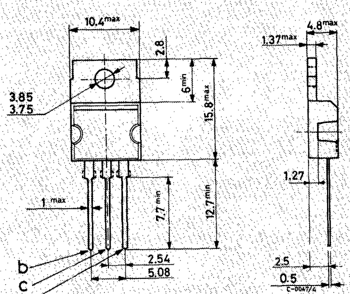
INTERNAL SCHEMATIC DIAGRAM



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 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 $\leq$2%.

BD240
BD240A
BD240B
BD240C

EPITAXIAL-BASE PNP

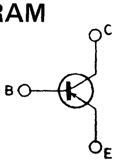
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

		BD 240	BD 240A	BD 240B	BD 240C
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			

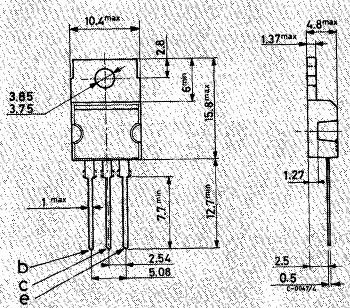
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

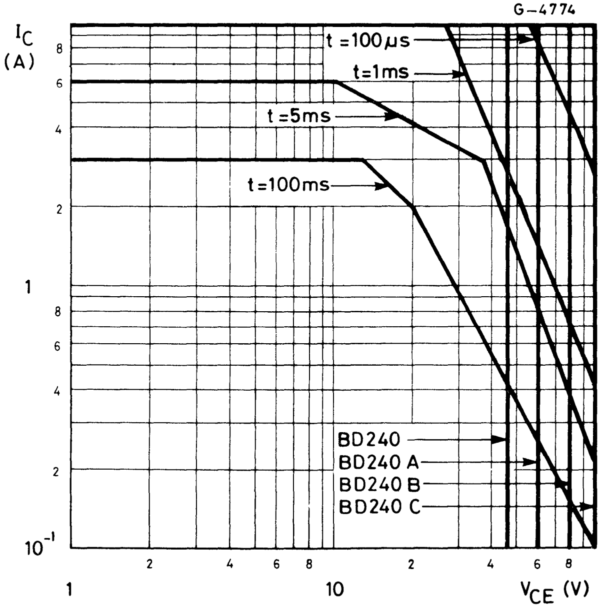
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	4.17	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max.	62.5	°C/W

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

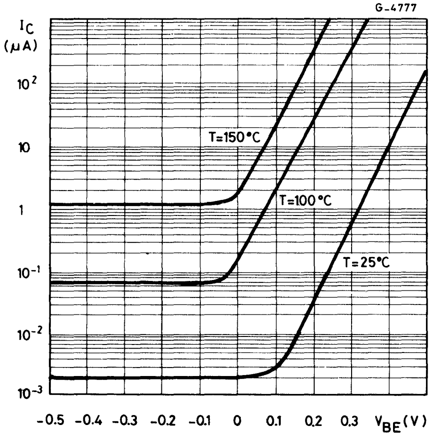
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD240** and **BD240A** V_{CE} = -30V			-0.3	mA
		for **BD240B** and **BD240C** V_{CE} = -60V			-0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD240** V_{CE} = -45V			-0.2	mA
		for **BD240A** V_{CE} = -60V			-0.2	mA
		for **BD240B** V_{CE} = -80V			-0.2	mA
		for **BD240C** 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 **BD240**	-45			V
		for **BD240A**	-60			V
		for **BD240B**	-80			V
		for **BD240C**	-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 = 300 μs, duty cycle $\leqslant$ 2%.

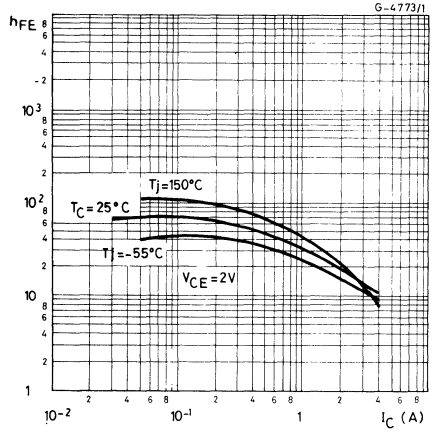
Safe operating areas



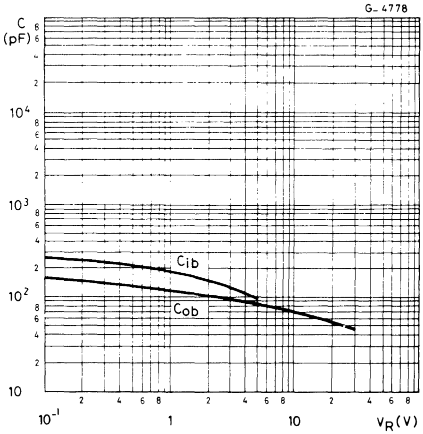
Collector cutoff current



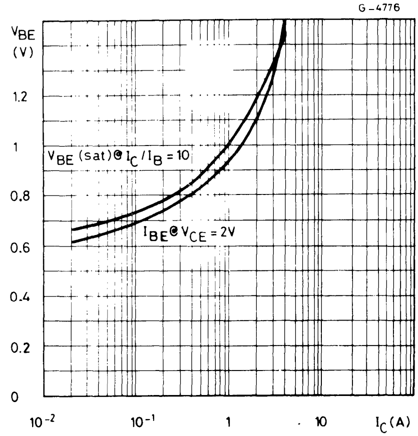
DC current gain



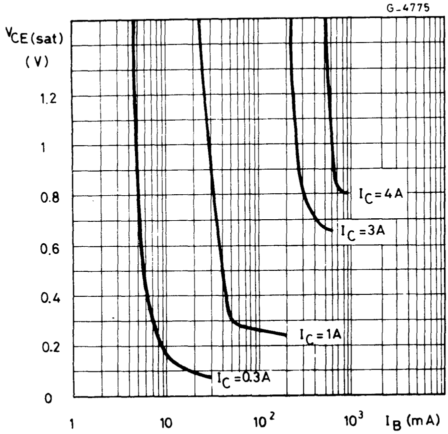
Input and output capacitance



Base-emitter voltage



Collector-emitter saturation voltage



SGS

BD241
BD241A
BD241B
BD241C

EPITAXIAL-BASE NPN

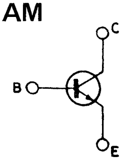
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

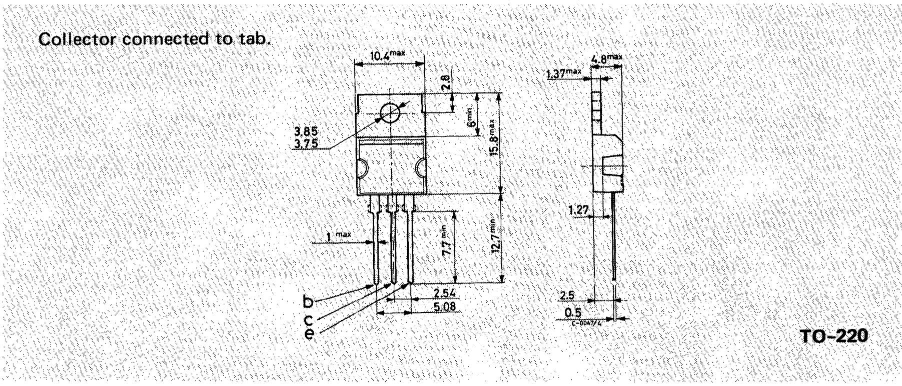
		BD241	BD241A	BD241B	BD241C
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	55V	70V	90V	115V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	3A			
I_{CM}	Collector peak current	5A			
I_B	Base-current	1A			
P_{tot}	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			

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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 for **BD 241B** and **BD 241C** V_{CE} = 60V			 0.3 0.3	 mA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD 241** V_{CE} = 45V for **BD 241A** V_{CE} = 60V for **BD 241B** V_{CE} = 80V for **BD 241C** 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 **BD 241** for **BD 241A** for **BD 241B** for **BD 241C**	 45 60 80 100			 V V V 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 I_C = 3A V_{CE} = 4V	25 10			— —
h_{fe}	Small signal current gain	I_C = 0.5A V_{CE} = 10V f = 1KHz I_C = 0.5A V_{CE} = 10V f = 1MHz	 20 3			 — —

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

SGS

BD242
BD242A
BD242B
BD242C

EPITAXIAL-BASE PNP

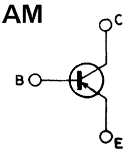
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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			

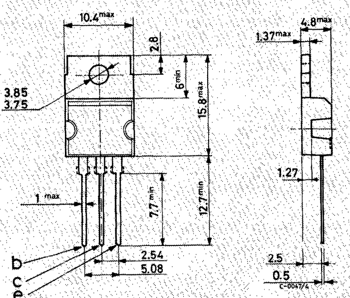
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

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 for **BD 242B** and **BD 242C** V_{CE} = –60V			–0.3 –0.3	mA mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD 242** V_{CE} = –45V for **BD 242A** V_{CE} = –60V for **BD 242B** V_{CE} = –80V for **BD 242C** 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 **BD 242** for **BD 242A** for **BD 242B** for **BD 242C**	 –45 –60 –80 –100			 V V V 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 I_C = –3A V_{CE} = –4V	25 10			— —
h_{fe}	Small signal current gain	I_C = –0.5A V_{CE} = –10V f = 1KHz I_C = –0.5A V_{CE} = –10V f = 1MHz	 20 3			 — —

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

BD243
BD243A
BD243B
BD243C

EPITAXIAL-BASE NPN

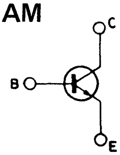
POWER LINEAR AND SWITCHING APPLICATIONS

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			

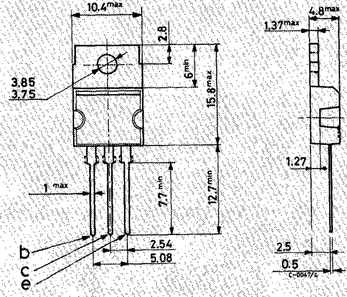
INTERNAL SCHEMATIC DIAGRAM



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 **BD 243** and **BD 243A** V_{CE} = 30V			0.7	mA
		for **BD 243B** and **BD 243C** V_{CE} = 60V			0.7	mA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD 243** V_{CE} = 45V			0.4	mA
		for **BD 243A** V_{CE} = 60V			0.4	mA
		for **BD 243B** V_{CE} = 80V			0.4	mA
		for **BD 243C** 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 243**	45			V
		for **BD 243A**	60			V
		for **BD 243B**	80			V
		for **BD 243C**	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 = 0.50 V_{CE} = 10V f = 1MHz	3			—

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

BD244
BD244A
BD244B
BD244C

EPITAXIAL-BASE PNP

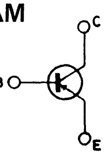
POWER LINEAR AND SWITCHING APPLICATIONS

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			

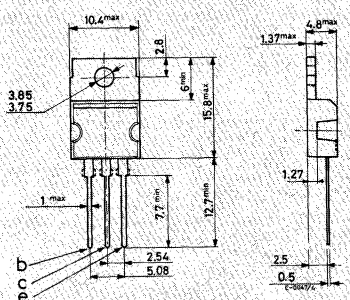
INTERNAL SCHEMATIC DIAGRAM



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 **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 ≤2%

BD433
BD435
BD437

EPITAXIAL-BASE NPN

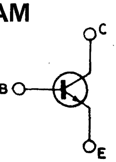
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

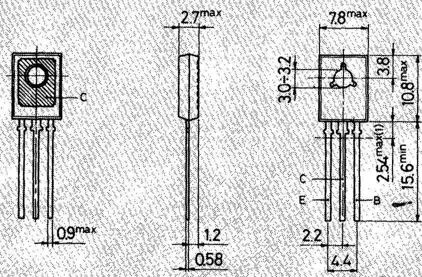
		BD 433	BD 435	BD 437
V_{CBO}	Collector-base voltage ($I_E = 0$)	22V	32V	45V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	22V	32V	45V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	22V	32V	45V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current ($t \leq 10ms$)		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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

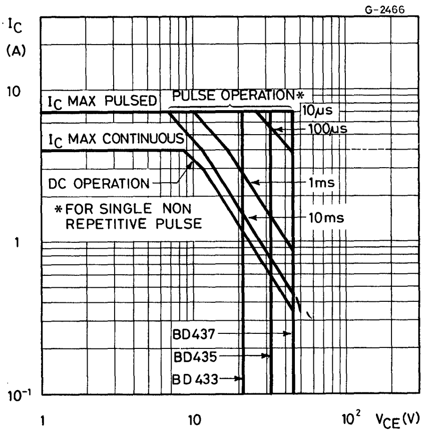
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

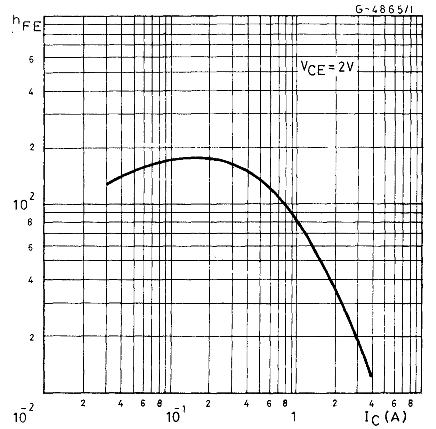
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD433** V_{CB} = 22V for **BD435** V_{CB} = 32V for **BD437** V_{CB} = 45V			100 100 100	μA μA μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD433** V_{CE} = 22V for **BD435** V_{CE} = 32V for **BD437** 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 **BD433** for **BD435** for **BD437**	 22 32 45			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A I_B = 0.2A for **BD433** for **BD435** for **BD437**		 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} = 1V for **BD433** for **BD435** for **BD437**		0.58	 1.1 1.1 1.2	V V V V
h_{FE}*	DC current gain	I_C = 10 mA V_{CE} = 5V for **BD433** for **BD435** for **BD437** I_C = 500mA V_{CE} = 1V I_C = 2 A V_{CE} = 1V for **BD433** for **BD435** for **BD437**	 40 40 30 85 50 50 40	 130 130 130 140		 — — — — — — —
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%

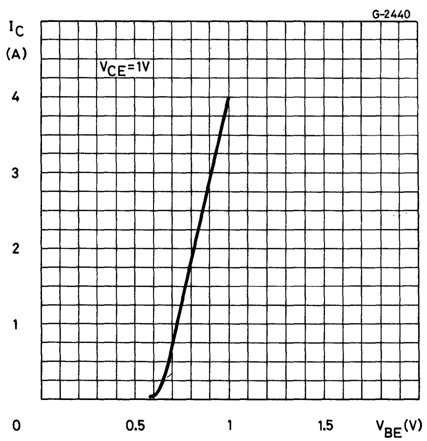
Safe operating areas



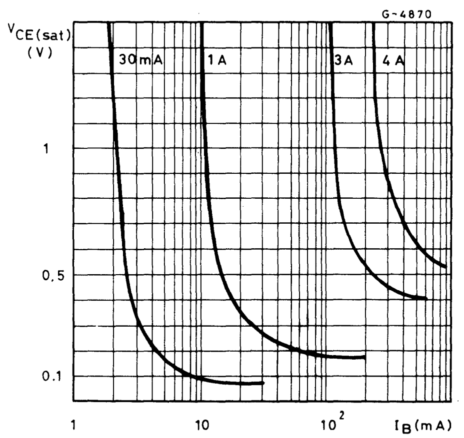
DC current gain



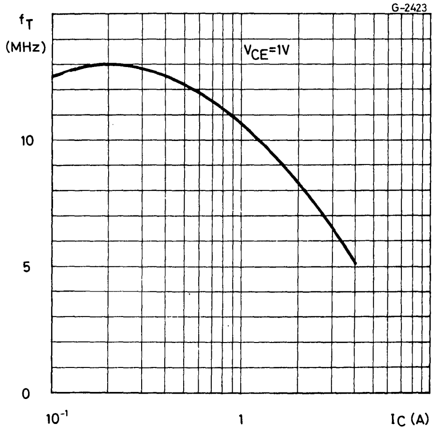
DC transconductance



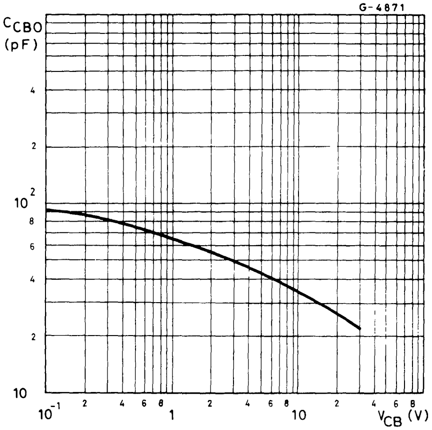
Collector-emitter saturation voltage



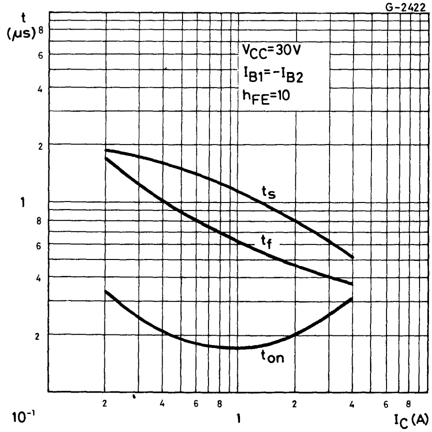
Transition frequency



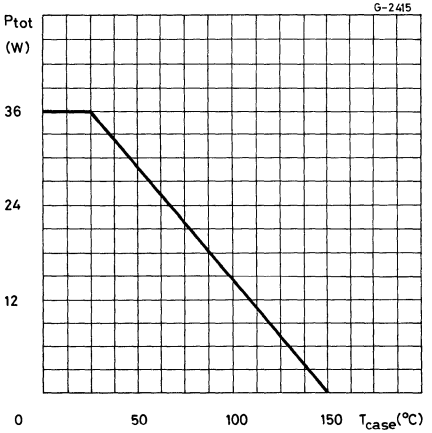
Collector-base capacitance



Saturated switching characteristics



Power rating chart



SGS BD434 BD436 BD438

EPITAXIAL-BASE PNP

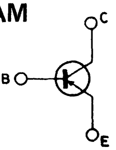
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

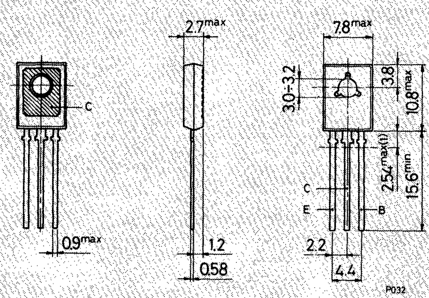
		BD 434	BD 436	BD 438
V_{CBO}	Collector-base voltage ($I_E = 0$)	-22V	-32V	-45V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-22V	-32V	-45V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-22V	-32V	-45V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

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

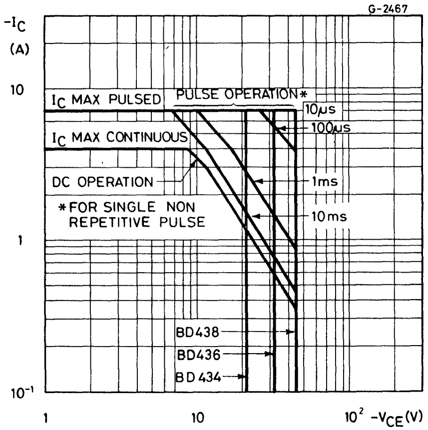
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0).	for **BD434** V_{CB} = -22V			-100	μA
		for **BD436** V_{CB} = -32V			-100	μA
		for **BD438** V_{CB} = -45V			-100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD434** V_{CE} = -22V			-100	μA
		for **BD436** V_{CE} = -32V			-100	μA
		for **BD438** 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 **BD434**	-22			V
		for **BD436**	-32			V
		for **BD438**	-45			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A I_B = -0.2A				
		for **BD434**		-0.2	-0.5	V
		for **BD436**		-0.2	-0.5	V
		for **BD438**		-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} = -1 V				
		for **BD434**			-1.1	V
		for **BD436**			-1.1	V
		for **BD438**			-1.2	V
h_{FE} *	DC current gain	I_C = -10mA V_{CE} = -5V				
		for **BD434**	40	140		—
		for **BD436**	40	140		—
		for **BD438**	30	140		—
		I_C = -500mA V_{CE} = -1V	85	140		—
		I_C = -2 A V_{CE} = -1V				
		for **BD434**	50			—
		for **BD436**	50			—
		for **BD438**	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

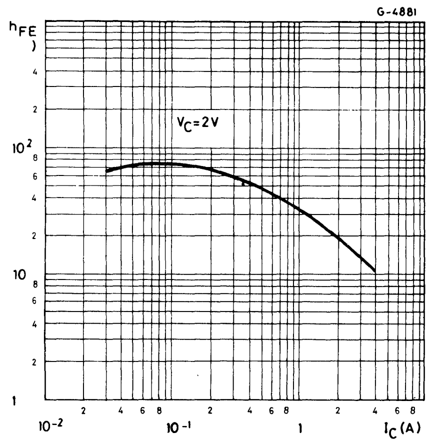
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BD434
BD436
BD438

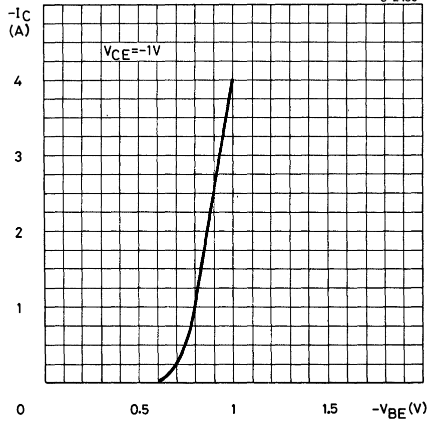
Safe operating areas



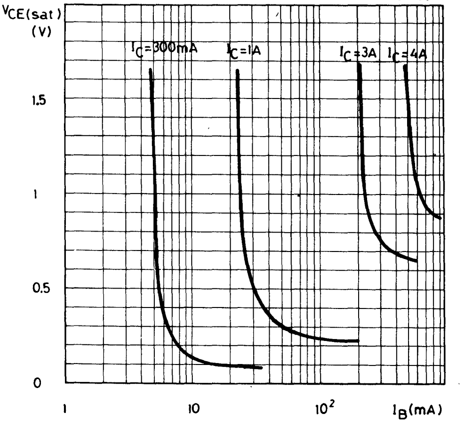
DC current gain



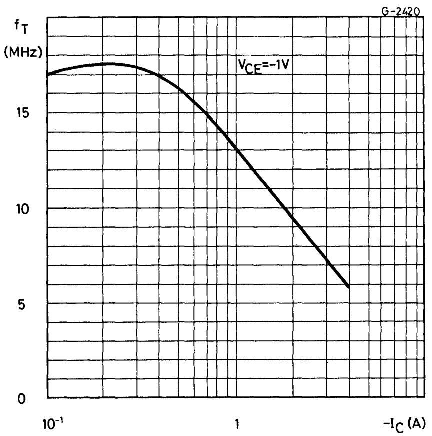
DC transconductance



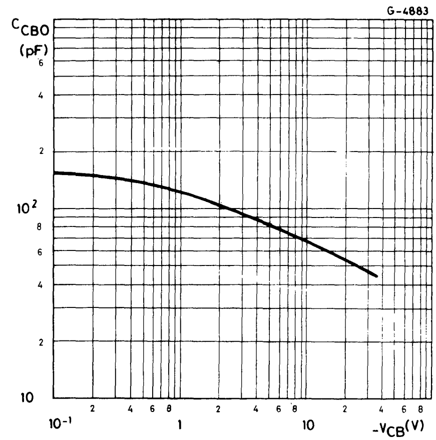
Collector-emitter saturation voltage



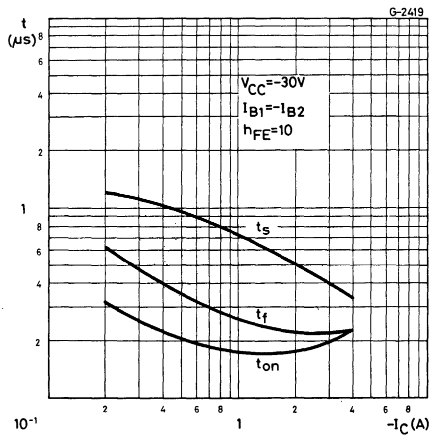
Transition frequency



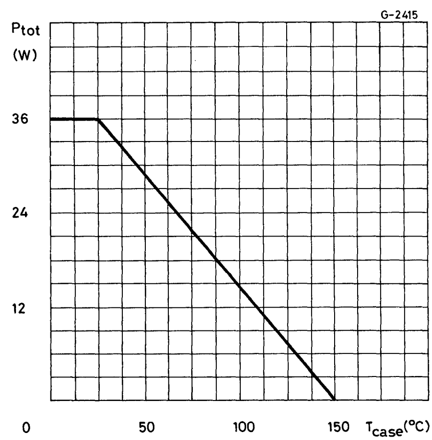
Collector-base capacitance



Saturated switching characteristics



Power rating chart



SGS

BD439
BD441

EPITAXIAL-BASE NPN

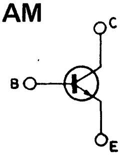
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

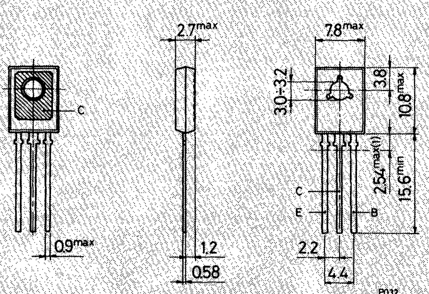
		BD 439	BD 441
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	
I_C	Collector current	4A	
I_{CM}	Collector peak current ($t \leq 10ms$)	7A	
I_B	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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

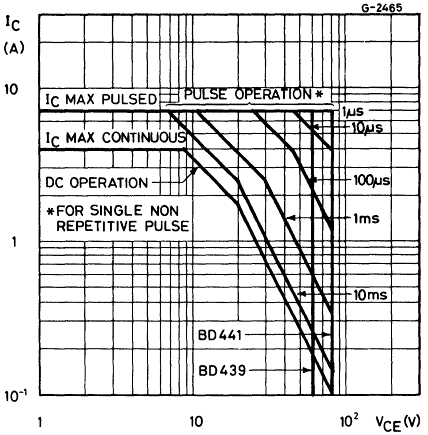
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

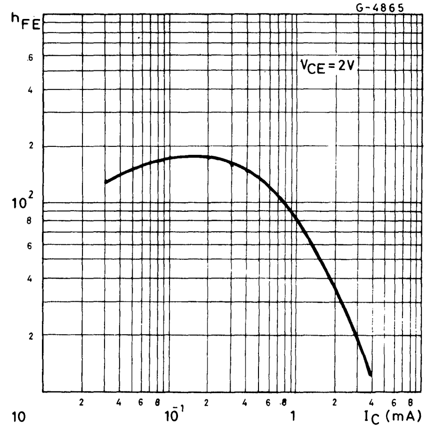
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD439** for **BD441**	V_{CB} = 60V V_{CB} = 80V			100 100	μA μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD439** for **BD441**	V_{CE} = 60V V_{CE} = 80V			100 100	μA μA
I_{EBO}	Emitter cutoff current (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%

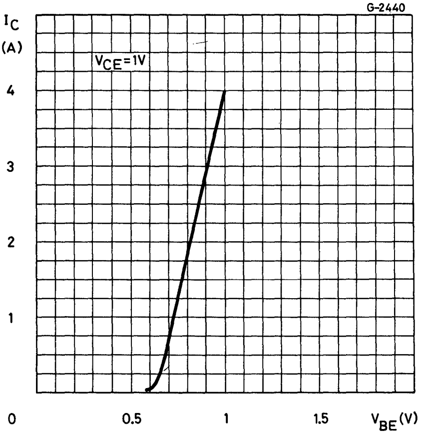
Safe operating areas



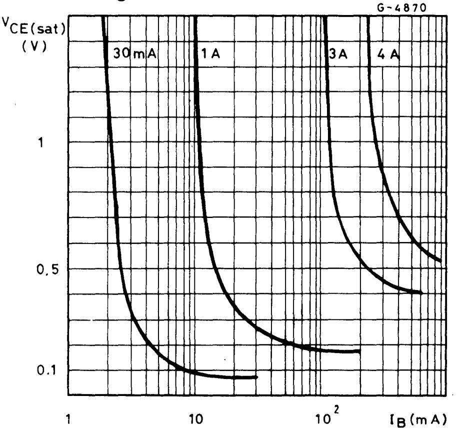
DC current gain



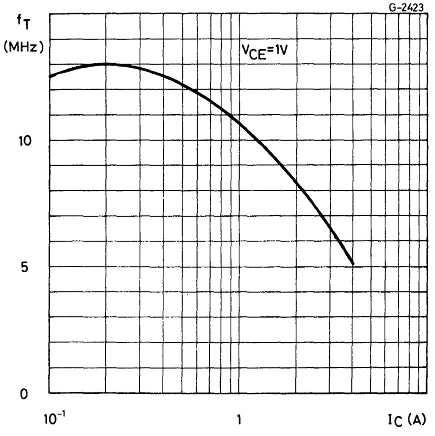
DC transconductance



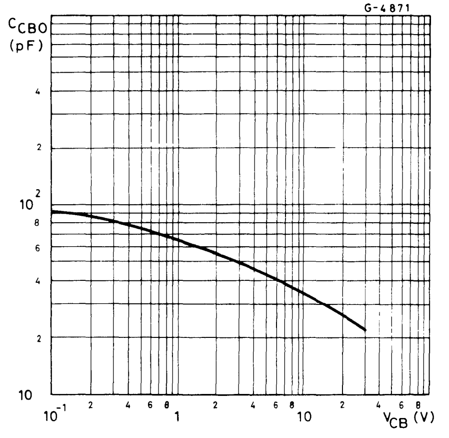
Collector-emitter saturation voltage



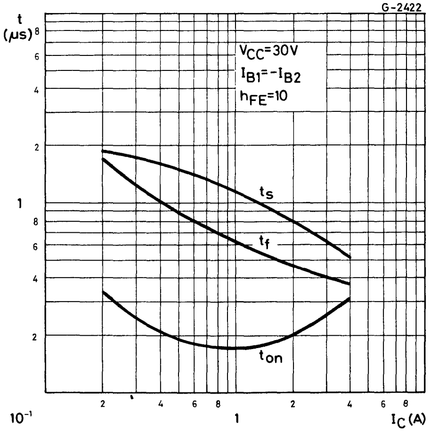
Transition frequency



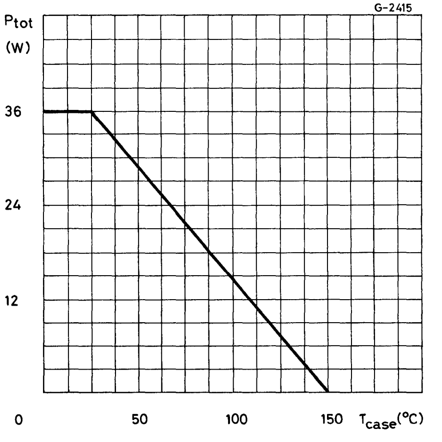
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD440
BD442

EPITAXIAL-BASE PNP

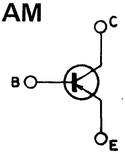
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

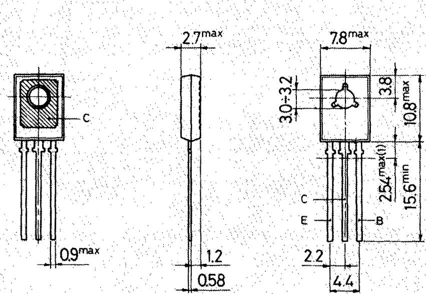
		BD 440	BD 442
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-4A	
I_{CM}	Collector peak current ($t \leq 10ms$)	-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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

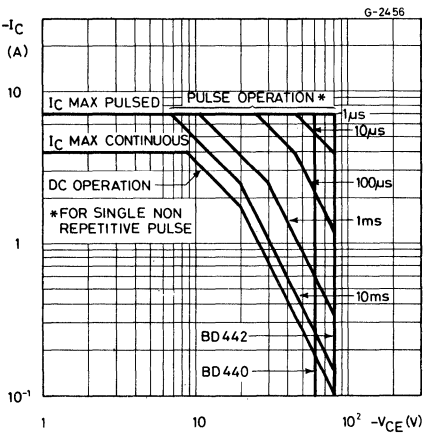
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

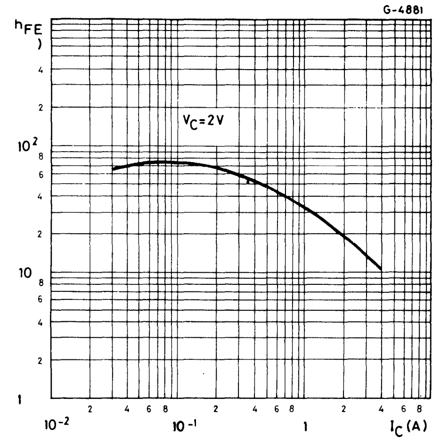
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD440** V_{CB} = -60V for **BD442** V_{CB} = -80V			-100 -100	μA μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD440** V_{CE} = -60V for **BD442** V_{CE} = -80V			-100 -100	μA μA
I_{EBO}	Emitter cutoff 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%

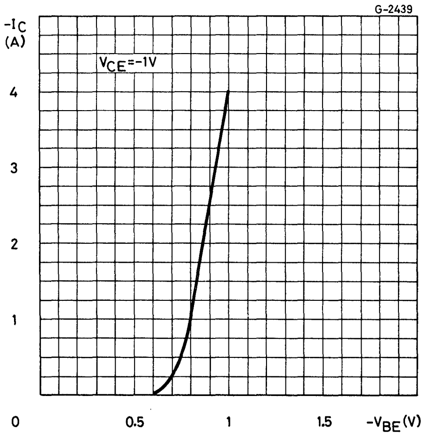
Safe operating areas



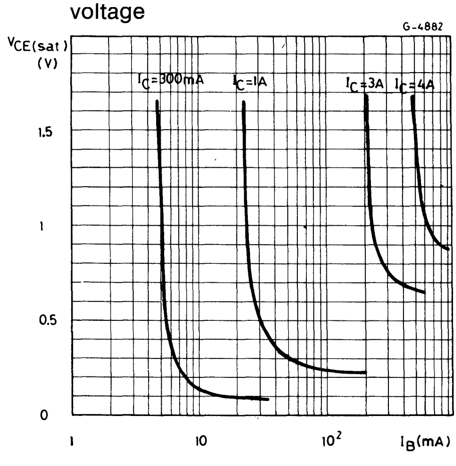
DC current gain



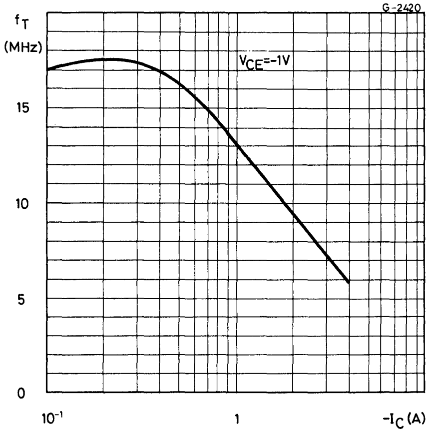
DC transconductance



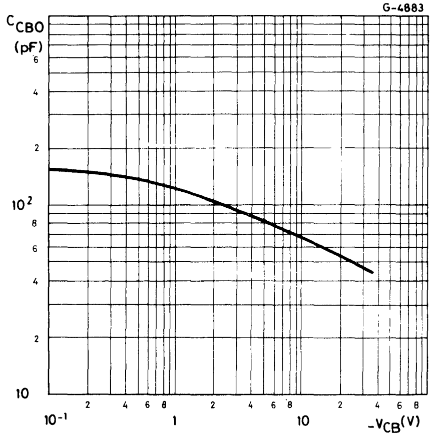
Collector-emitter saturation voltage



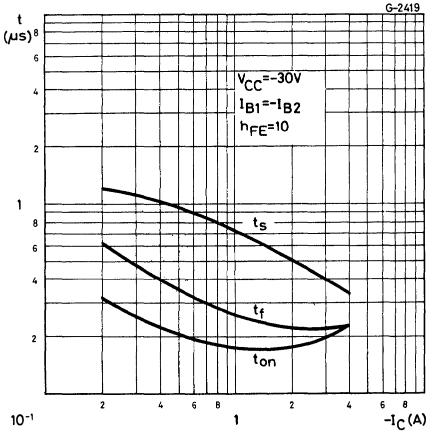
Transition frequency



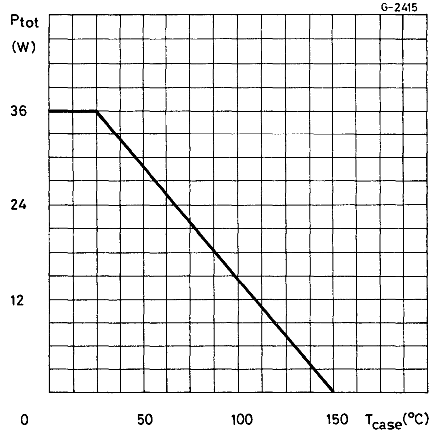
Collector-base capacitance



Saturated switching characteristics



Power rating chart



SGS BD533 BD535 BD537

EPITAXIAL-BASE NPN

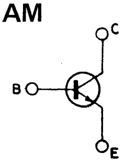
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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		

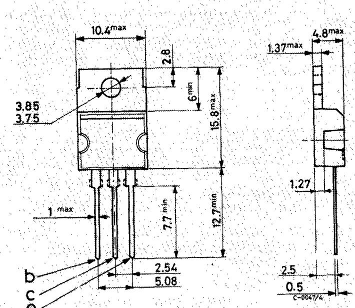
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

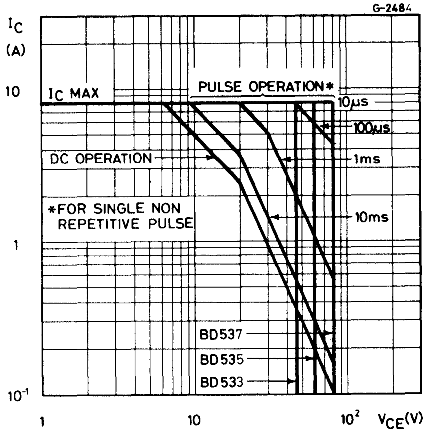
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

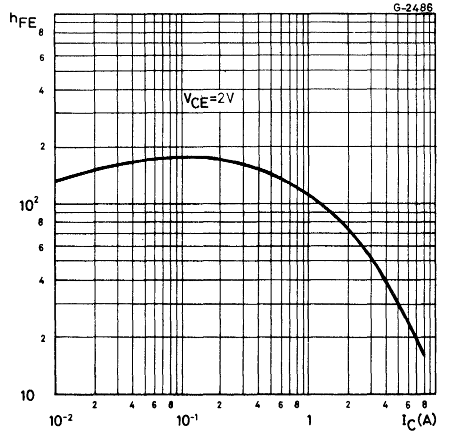
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD533**	V_{CB} = 45V			100	μA
		for **BD535**	V_{CB} = 60V			100	μA
		for **BD537**	V_{CB} = 80V			100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD533**	V_{CE} = 45V			100	μA
		for **BD535**	V_{CE} = 60V			100	μA
		for **BD537**	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 **BD533**	45			V
			for **BD535**	60			V
			for **BD537**	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 = 2 A	V_{CE} = 2 V			1.5	V
h_{FE}*	DC current gain	I_C = 10 mA	V_{CE} = 5V				
			for **BD533**	20			—
			for **BD535**	20			—
			for **BD537**	15			—
		I_C = 500mA	V_{CE} = 2V	40			—
		I_C = 2 A	V_{CE} = 2V				
			for **BD533**	25			—
			for **BD535**	25			—
			for **BD537**	15			—
f_T	Transition frequency	I_C = 500mA	V_{CE} = 1V	3	12		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			—

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

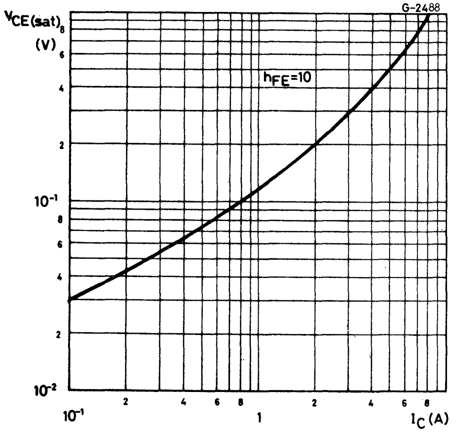
Safe operating areas



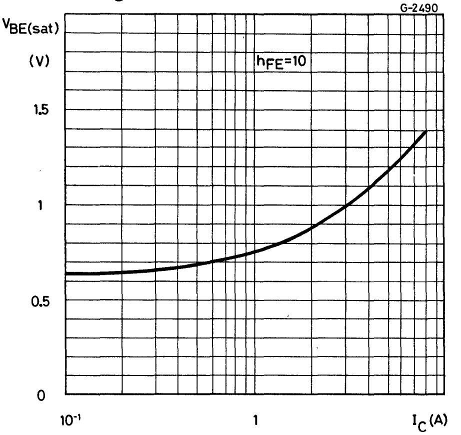
DC current gain



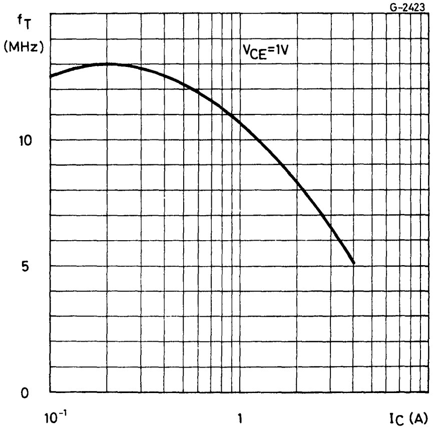
Collector-emitter saturation voltage



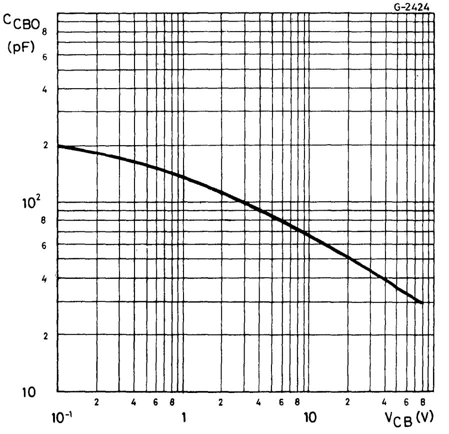
Base-emitter saturation voltage



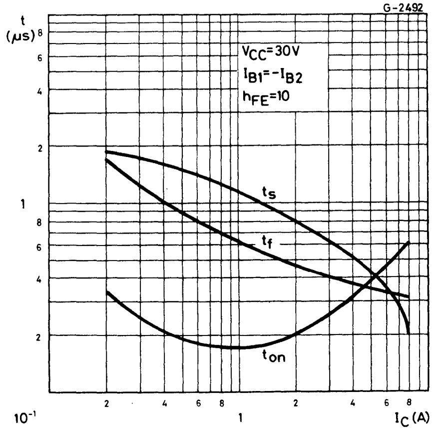
Transition frequency



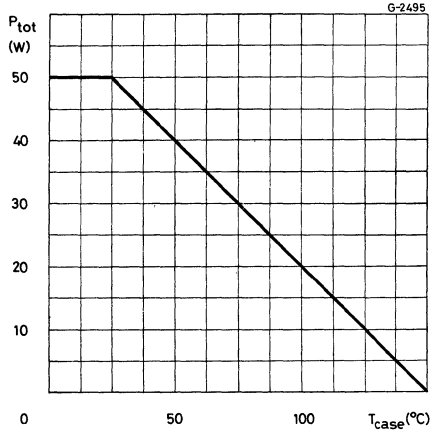
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD534
BD536
BD538

EPITAXIAL-BASE PNP

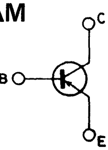
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

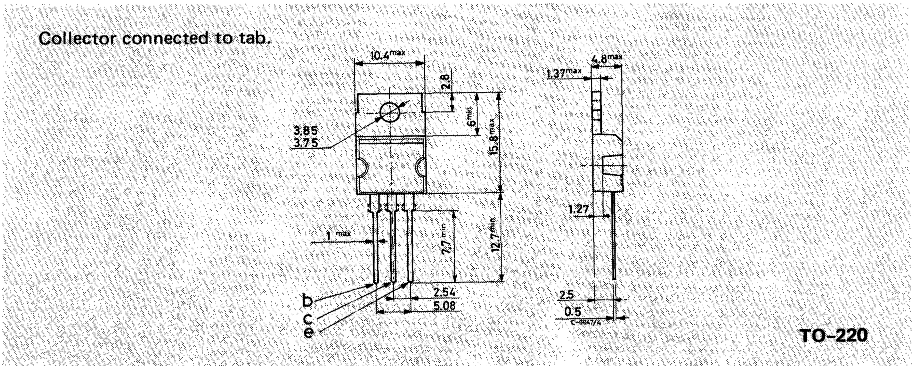
		BD 534	BD 536	BD 538
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V		
I_C, I_E	Collector and emitter current	-8A		
I_B	Base 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		

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

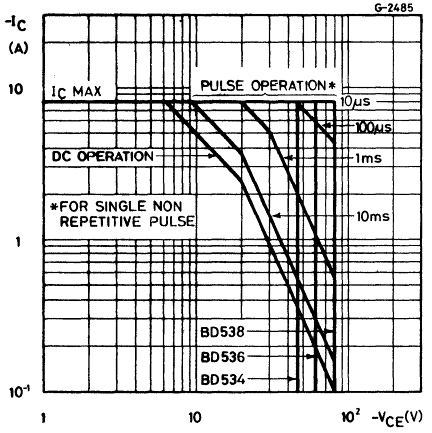
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

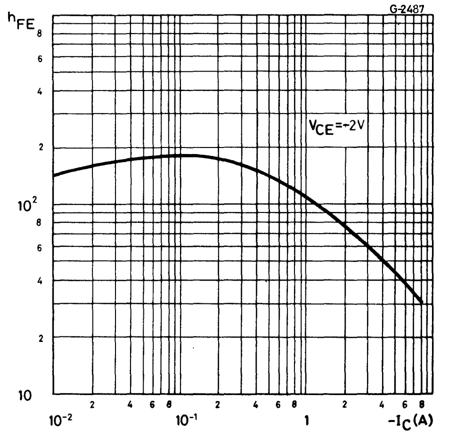
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD534**	V_{CB} = -45V			-100	μA
		for **BD536**	V_{CB} = -60V			-100	μA
		for **BD538**	V_{CB} = -80V			-100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD534**	V_{CE} = -45V			-100	μA
		for **BD536**	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			—

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

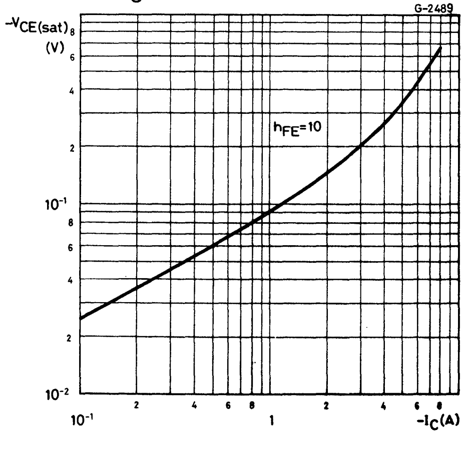
Safe operating areas



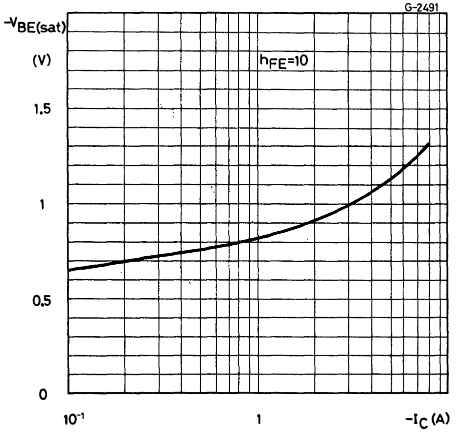
DC current gain



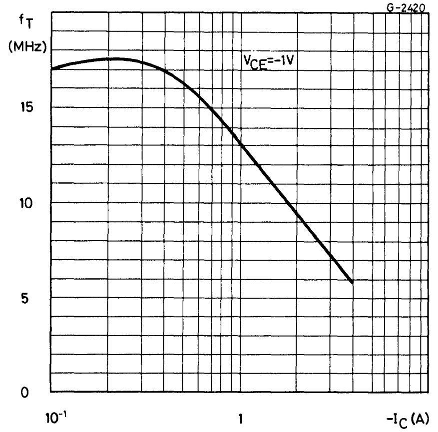
Collector-emitter saturation voltage



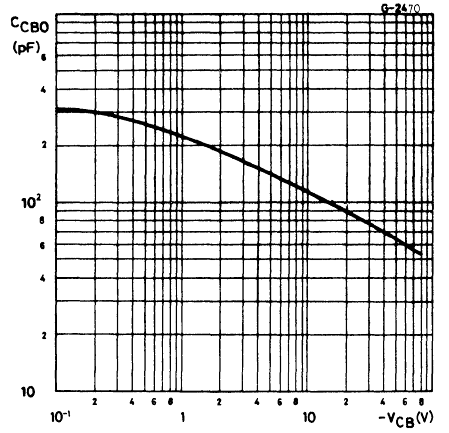
Base-emitter saturation voltage



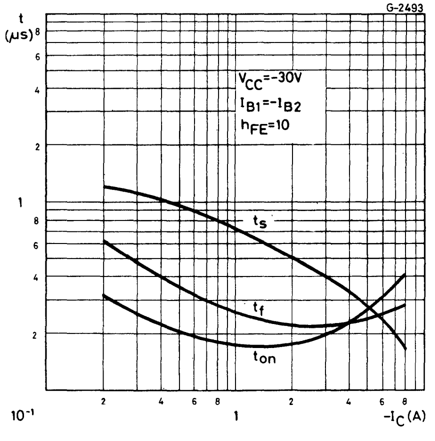
Transition frequency



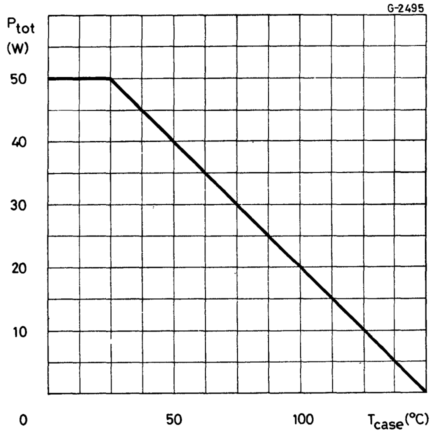
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD675A
BD677/A
BD679/A
BD681

EPITAXIAL-BASE NPN

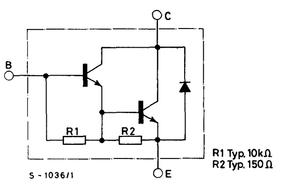
MEDIUM POWER DARLINGTONS

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

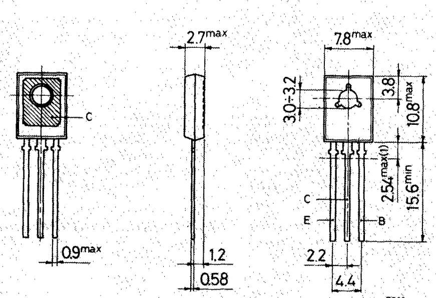
		BD675A	BD677 BD677A	BD679 BD679A	BD681
V_{CBO}	Collector-base voltage ($I_E = 0$)	45V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	4A			
I_{CM}	Collector peak current (repetitive)	6A			
I_B	Base current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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

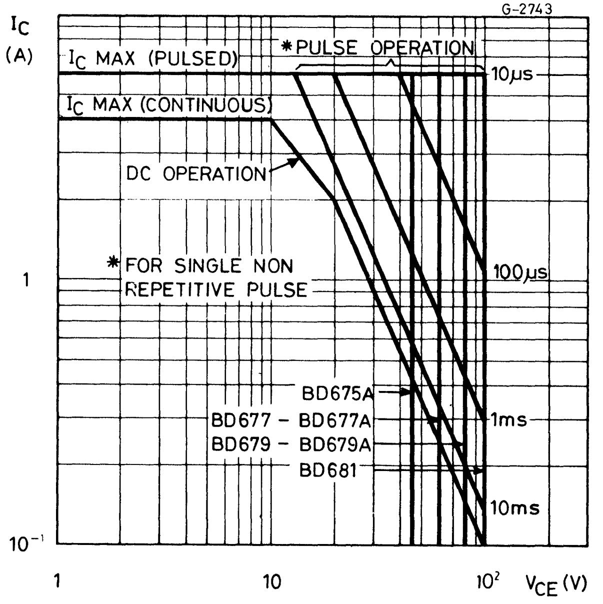
$R_{th\ j-case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

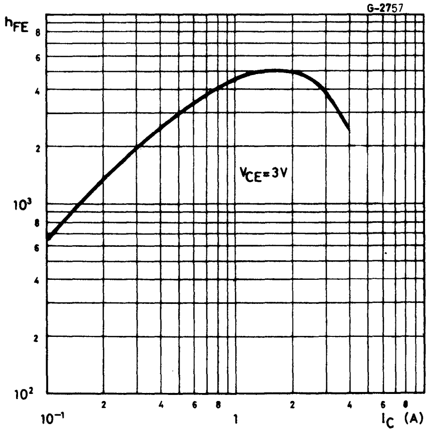
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD675A** V_{CB} = 45V for **BD677/677A** V_{CB} = 60V for **BD679/679A** V_{CB} = 80V for **BD681** V_{CB} = 100V			200 100 200 200	μA μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BD675A** V_{CE} = 22V for **BD677/677A** V_{CE} = 30V for **BD679/679A** V_{CE} = 40V for **BD681** V_{CE} = 50V			500 100 500 500	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 **BD675A** for **BD677/677A** for **BD679/679A** for **BD681**	 45 60 80 100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BD677/679/681** I_C = 4 A I_B = 40 mA for **BD675A/677A/679A** I_C = 2A I_B = 8mA			 2.7 2.8	 V V
V_{BE}*	Base-emitter voltage	for **BD677/679/681** I_C = 1.5A V_{CE} = 3V for **BD675A/677A/679A** I_C = 2A V_{CE} = 3V			 2.5 2.5	 V V
h_{FE}*	DC current gain	for **BD677/679/681** I_C = 4 A V_{CE} = 3V for **BD675A/677A/679A** I_C = 2A V_{CE} = 3V	 110 750			 — —
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%

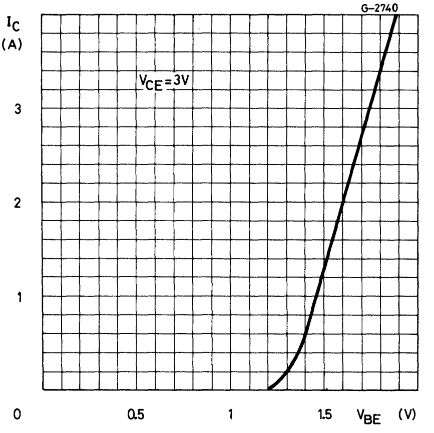
Safe operating areas



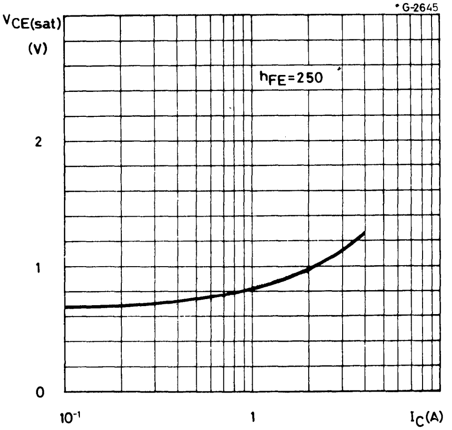
DC current gain



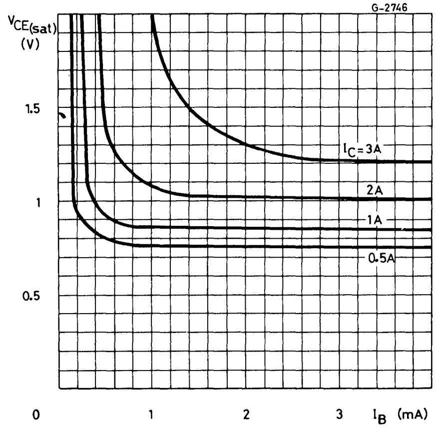
DC transconductance



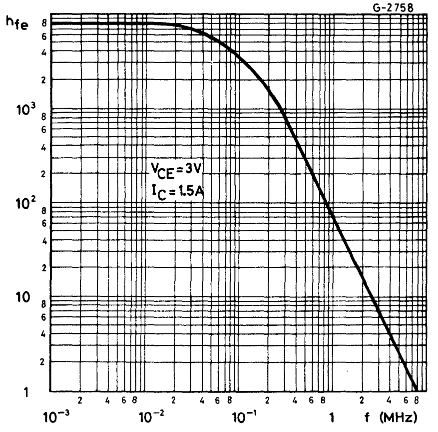
Collector-emitter saturation voltage



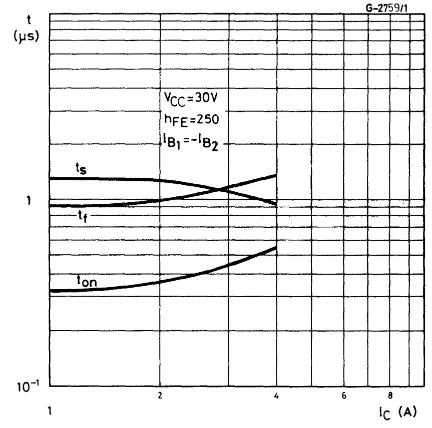
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



SGS

BD676A
BD678/A
BD680/A
BD682

EPITAXIAL-BASE PNP

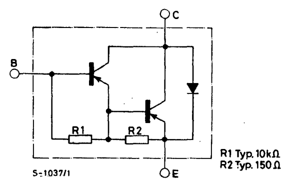
MEDIUM POWER DARLINGTONS

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

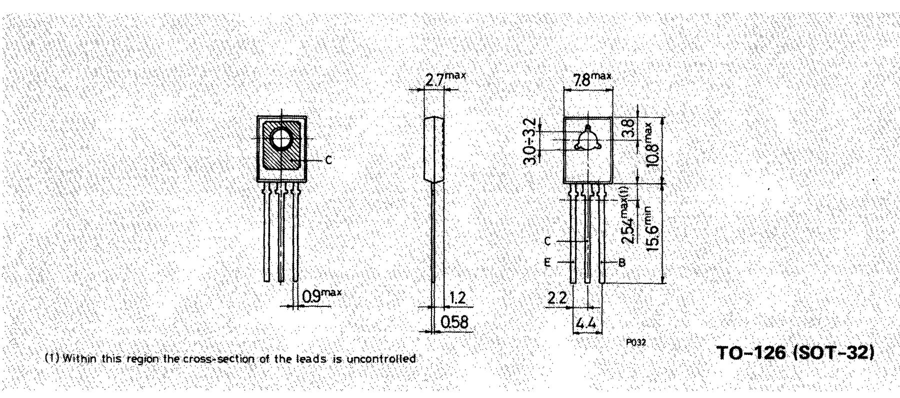
		BD676A	BD678 BD678A	BD680 BD680A	BD682
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-4A			
I_{CM}	Collector peak current (repetitive)	-6A			
I_B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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

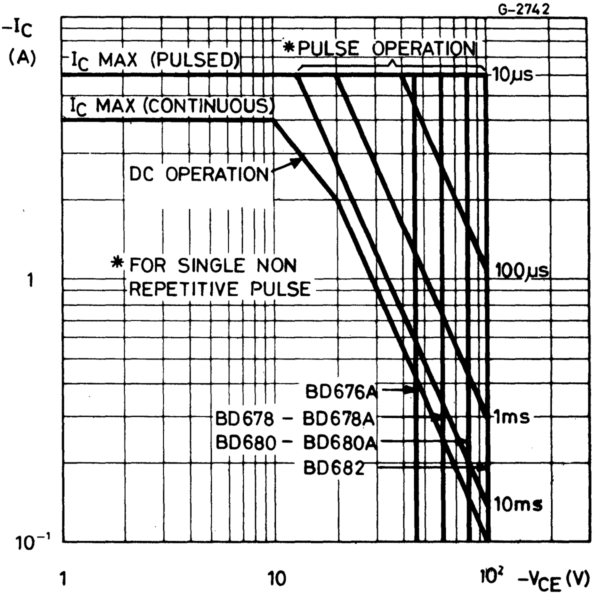
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

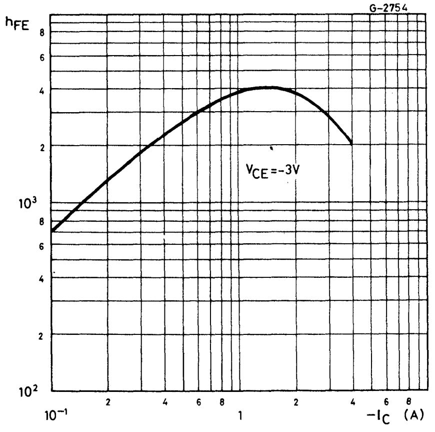
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD676A** V_{CB} = -45V for **BD678/678A** V_{CB} = -60V for **BD680/680A** V_{CB} = -80V for **BD682** V_{CB} = -100V			-200 -100 -200 -200	μA μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BD676A** V_{CE} = -22V for **BD678/678A** V_{CE} = -30V for **BD680/680A** V_{CE} = -40V for **BD682** V_{CE} = -50V			-500 -100 -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 **BD676 A** 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 = -4A I_B = -40 mA for **BD676A/678A/680A** I_C = -2A I_B = -8mA			 -2.7 -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 = -4A V_{CE} = -3V for **BD676A/678A/680A** I_C = -2A V_{CE} = -3V	 110 750			 — —
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%

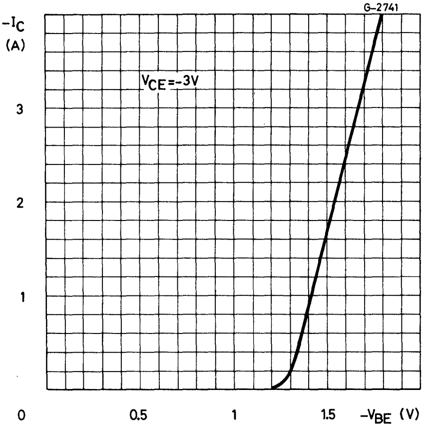
Safe operating areas



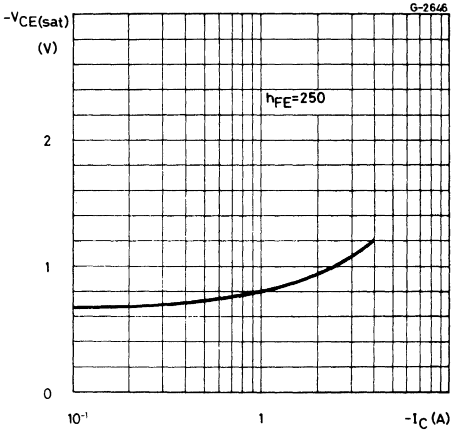
DC current gain



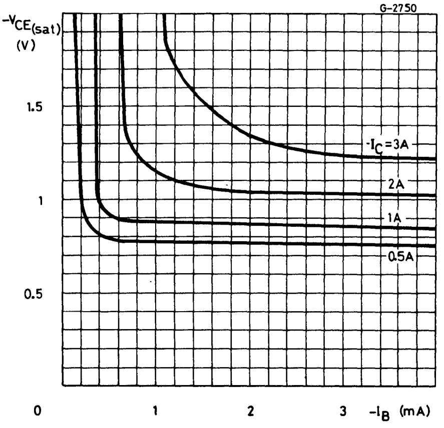
DC transconductance



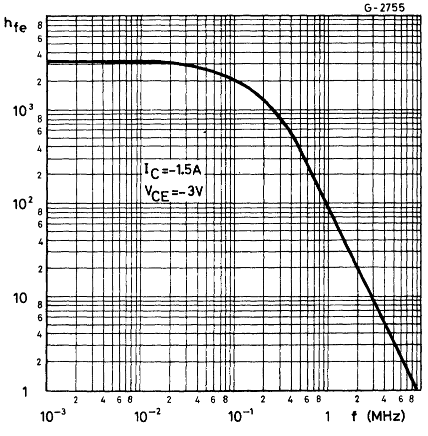
Collector-emitter saturation voltage



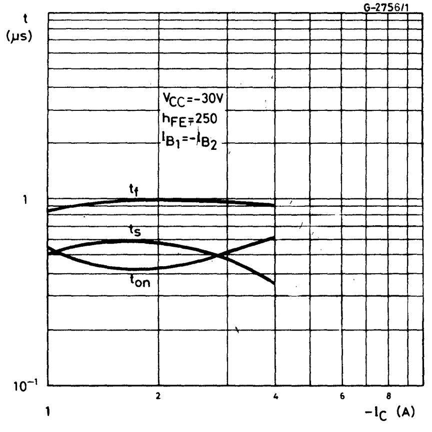
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



BD705
BD707
BD709
BD711

EPITAXIAL-BASE NPN

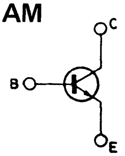
POWER LINEAR AND SWITCHING APPLICATIONS

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			

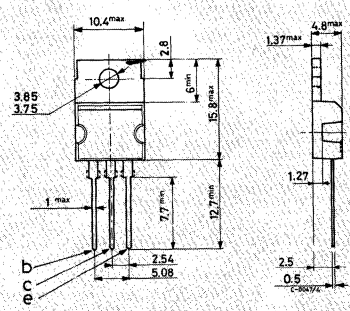
INTERNAL SCHEMATIC DIAGRAM



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)

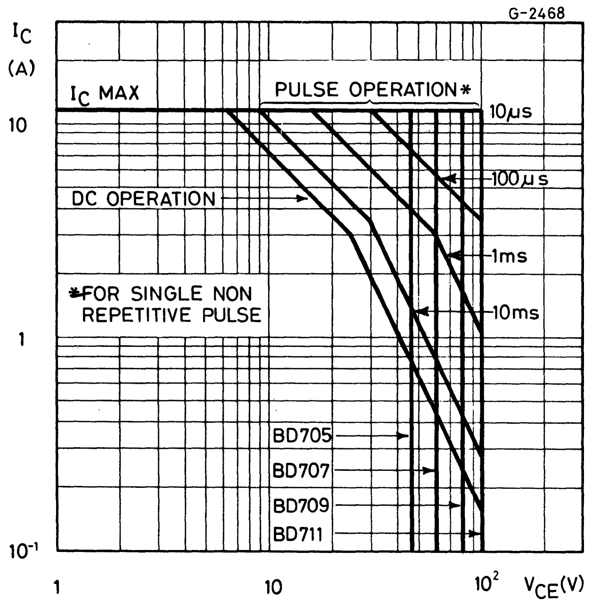
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD705**	V_{CB} = 45 V			100	μA
		for **BD707**	V_{CB} = 60 V			100	μA
		for **BD709**	V_{CB} = 80 V			100	μA
		for **BD711**	V_{CB} = 100 V			100	μA
		T_{case} = 150°C					
		for **BD705**	V_{CB} = 45 V			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)

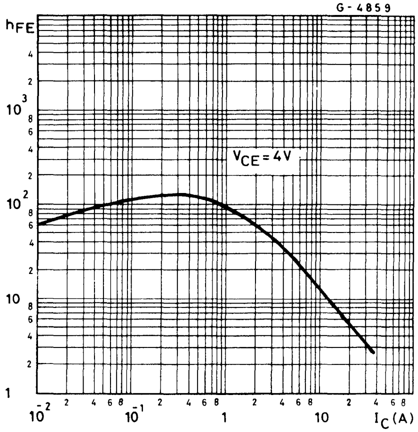
Parameter		Test conditions		Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 0.5A	V_{CE} = 2V	40	120	400	—
		I_C = 2A	V_{CE} = 2V				
			for **BD705**	30			—
			for **BD707**	30			—
			for **BD709**	30			—
		I_C = 4A	V_{CE} = 4V				
			for **BD705**	20	30	150	—
			for **BD707**	15		150	—
			for **BD709**	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

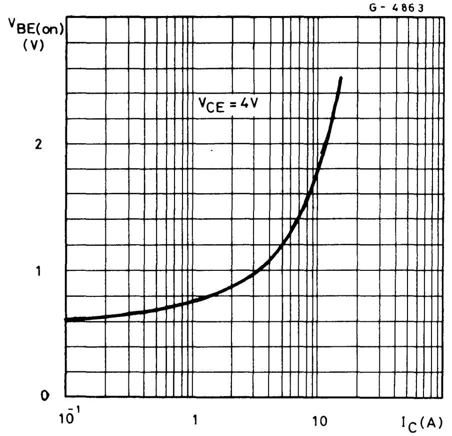
Safe operating areas



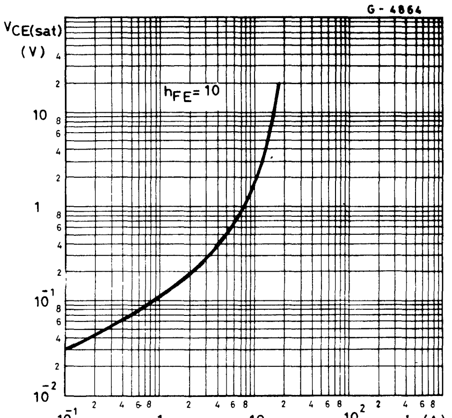
DC current gain



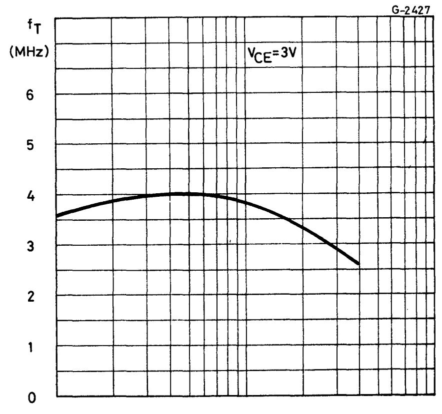
DC transconductance



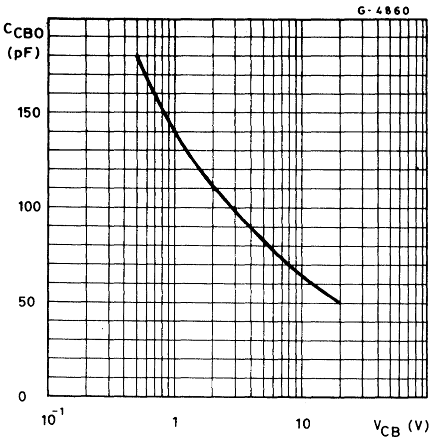
Collector-emitter saturation voltage



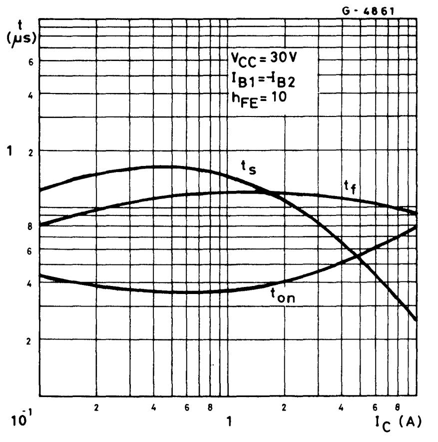
Transition frequency



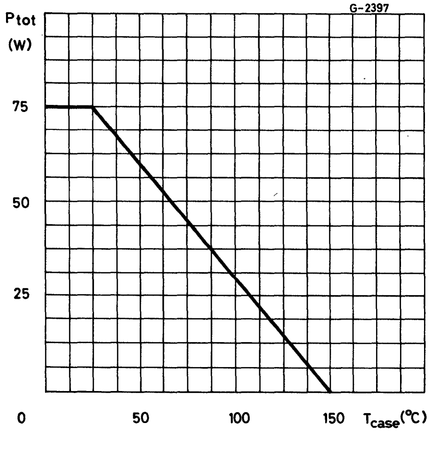
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

BD706
BD708
BD710
BD712

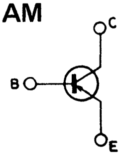
POWER LINEAR AND SWITCHING APPLICATIONS

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			

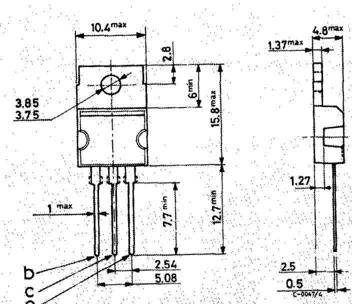
INTERNAL SCHEMATIC DIAGRAM



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)

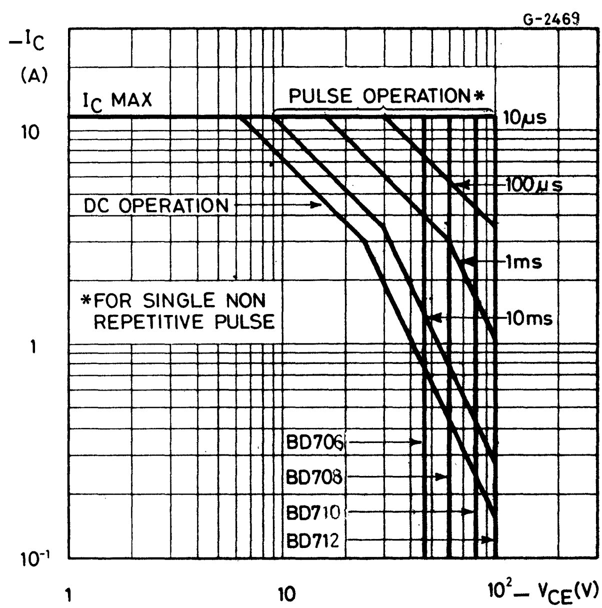
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD706**	V_{CB} = -45 V			-100	μA
		for **BD708**	V_{CB} = -60 V			-100	μA
		for **BD710**	V_{CB} = -80 V			-100	μA
		for **BD712**	V_{CB} = -100 V			-100	μA
		T_{case} = 150°C					
		for **BD706**	V_{CB} = -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)

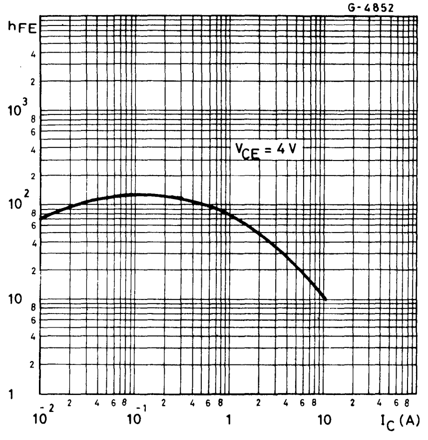
Parameter		Test conditions		Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = -0.5A	V_{CE} = -2V	40	120	400	—
		I_C = -2A	V_{CE} = -2V				
			for **BD706**	30			—
			for **BD708**	30			—
			for **BD710**	30			—
		I_C = -4A	V_{CE} = -4V				
			for **BD706**	20	30	150	—
			for **BD708**	15		150	—
			for **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

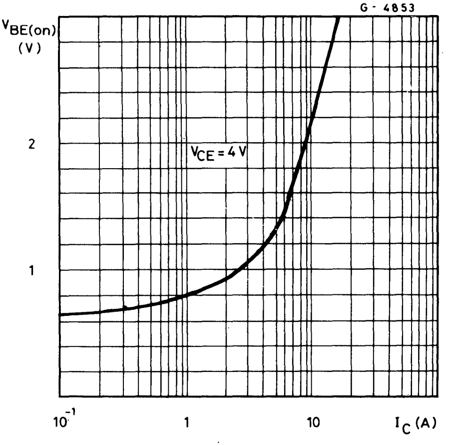
Safe operating areas



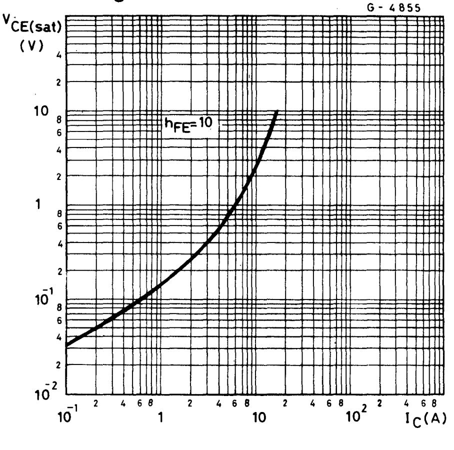
DC current gain



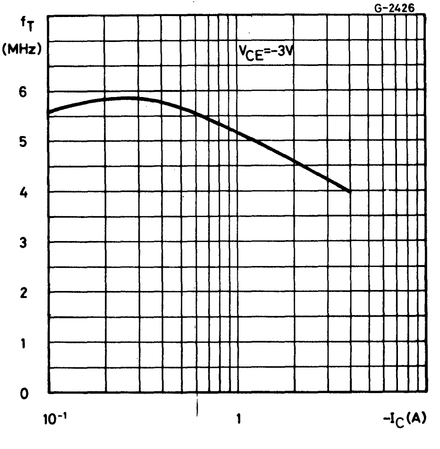
DC transconductance



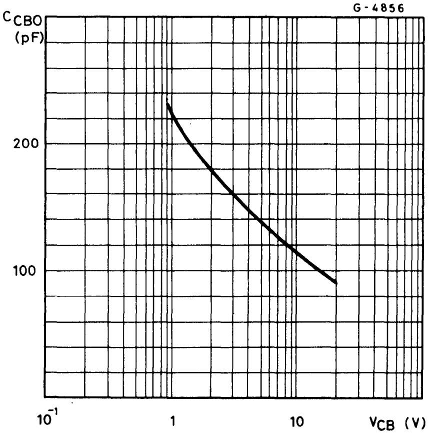
Collector-emitter saturation voltage



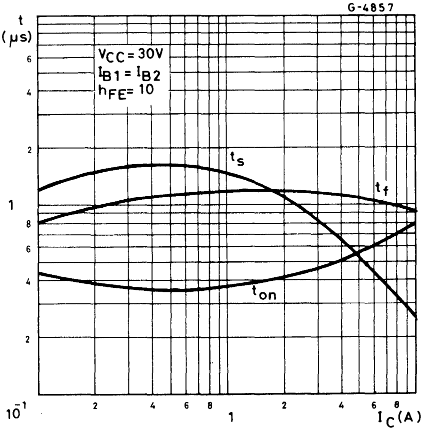
Transition frequency



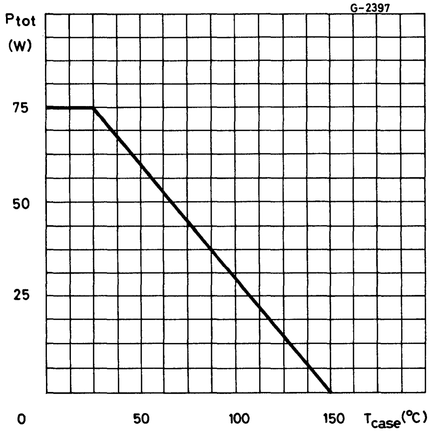
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BD905
BD907
BD909
BD911

EPITAXIAL-BASE NPN

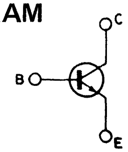
POWER LINEAR AND SWITCHING APPLICATIONS

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 $T_{case} \leq 25°C$	90W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

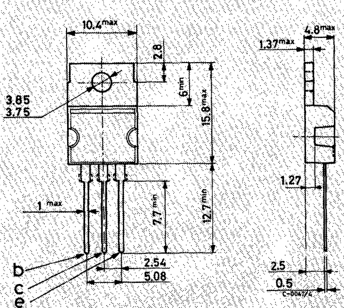
INTERNAL SCHEMATIC DIAGRAM



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

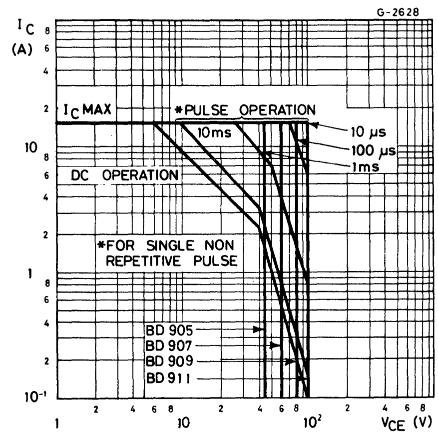
ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

	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

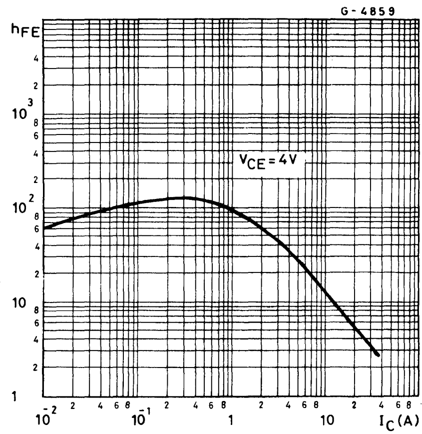
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

BD905
BD907
BD909
BD911

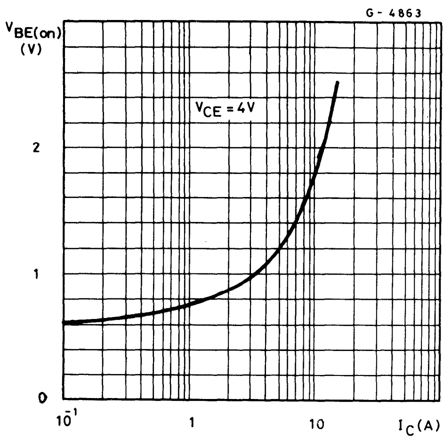
Safe operating areas



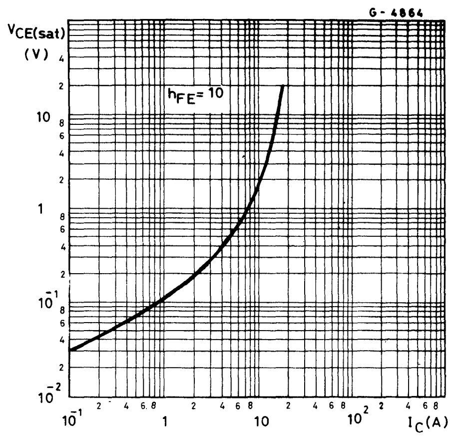
DC current gain



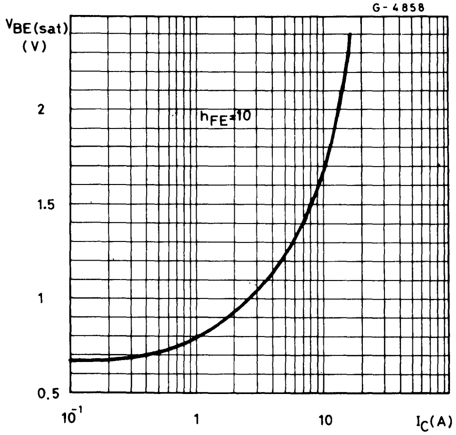
DC transconductance



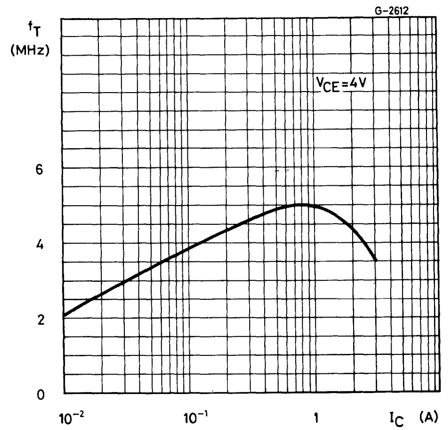
Collector-emitter saturation voltage



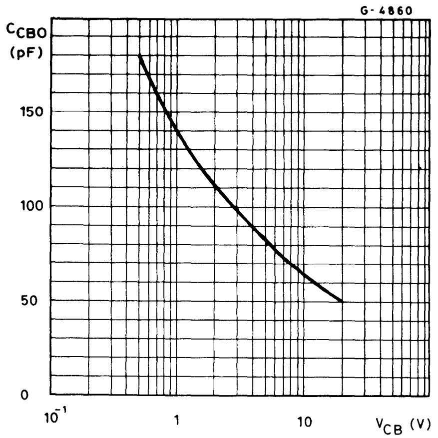
Base-emitter saturation voltage



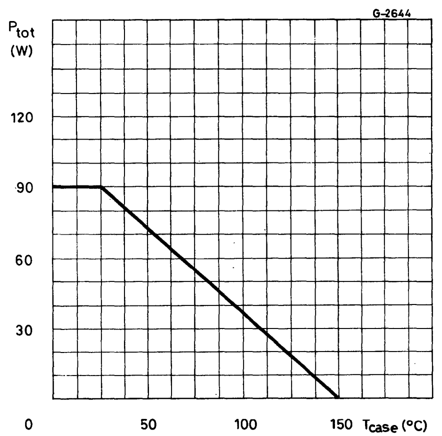
Transition frequency



Collector-base capacitance



Power rating chart



BD906
BD908
BD910
BD912

EPITAXIAL-BASE PNP

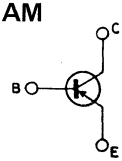
POWER LINEAR AND SWITCHING APPLICATIONS

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			

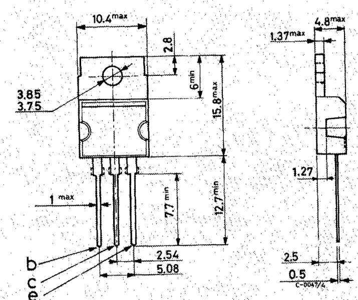
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

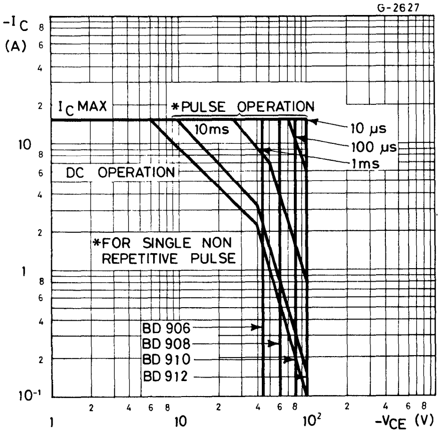
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

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

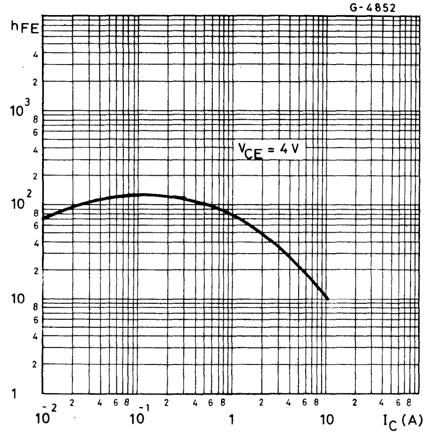
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD906**	V_{CB} = -45V			-500	μA
		for **BD908**	V_{CB} = -60V			-500	μA
		for **BD910**	V_{CB} = -80V			-500	μA
		for **BD912**	V_{CB} = -100V			-500	μA
		T_{case} = 150°C					
		for **BD906**	V_{CB} = -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%

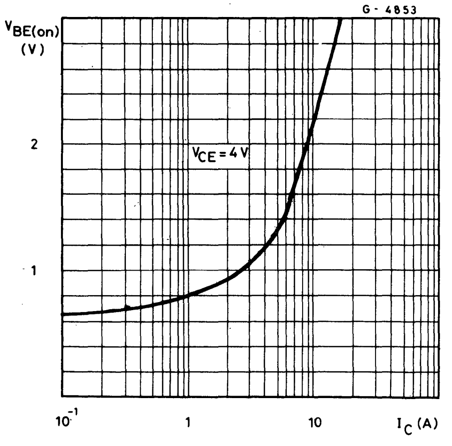
Safe operating areas



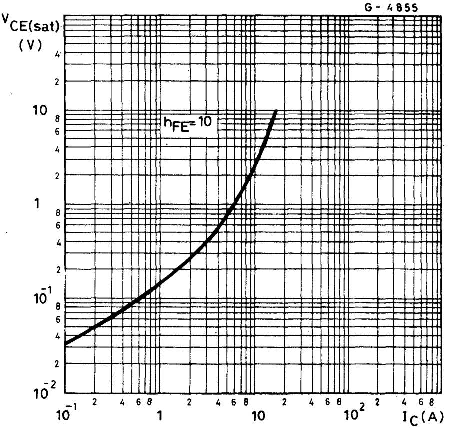
DC current gain



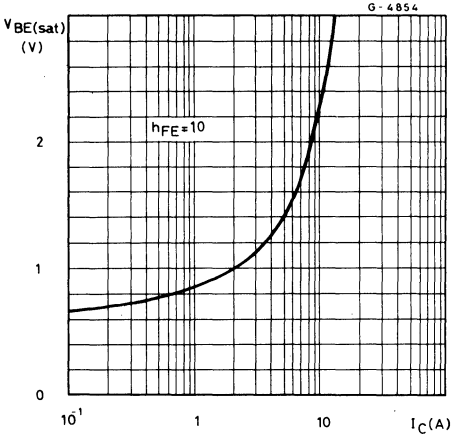
DC transconductance



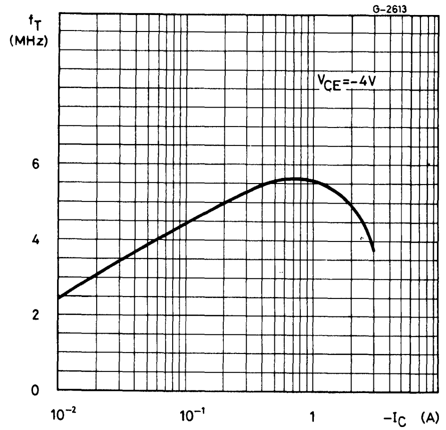
Collector-emitter saturation voltage



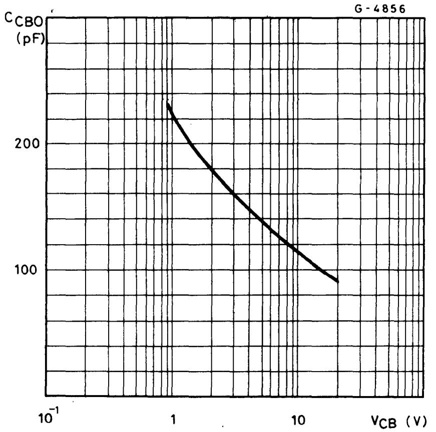
Base-emitter saturation voltage



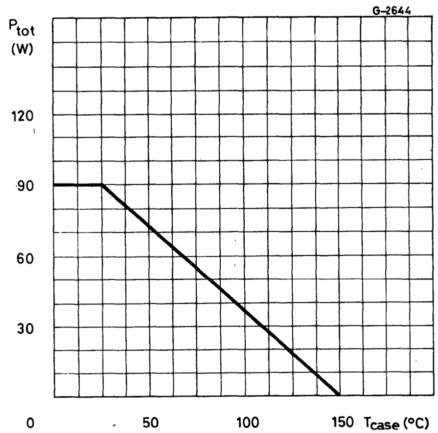
Transition frequency



Collector-base capacitance



Power rating chart



SGS

BDV64 / BDV65
BDV64A / BDV65A
BDV64B / BDV65B

EPITAXIAL-BASE NPN/PNP

POWER DARLINGTONS

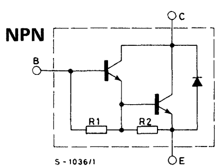
The BDV65, BDV65A, BDV65B, are silicon epitaxial-base NPN transistors in monolithic Darlington configuration and are mounted in SOT-93 plastic package. They are intended for use in power linear and switching applications.
The complementary PNP types are BDV64, BDV64A, BDV64B respectively.

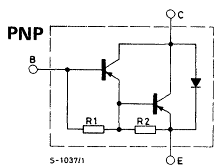
ABSOLUTE MAXIMUM RATINGS

		* PNP NPN	BDV64 BDV65	BDV64A BDV65A	BDV64B BDV65B
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 (repetitive)			20A	
I_B	Base current			0.5A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$			125W	
T_{stg}	Storage temperature			-65 to 150°C	
T_j	Junction temperature			150°C	

* For PNP types voltage and current values are negative

INTERNAL SCHEMATIC DIAGRAMS

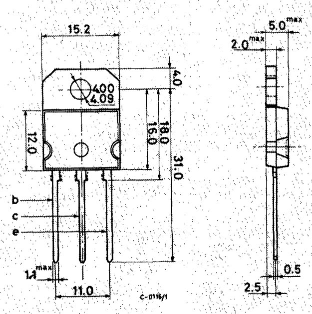




MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

$R_{th\ j-case}$	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 ($I_E = 0$)	for **BDV64/5** V_{CB} = 60V			400	μA
		for **BDV64A/5A** V_{CB} = 80V			400	μA
		for **BDV64B/5B** V_{CB} = 100V			400	μA
		T_{case} = 150°C				
		for **BDV64/65** V_{CB} = 30V			2	mA
		for **BDV64A/5A** V_{CB} = 40V			2	mA
		for **BDV64B/5B** V_{CB} = 50V			2	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDV64/65** V_{CE} = 30V			1	mA
		for **BDV64A/5A** V_{CE} = 40V			1	mA
		for **BDV64B/5B** V_{CE} = 50V			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EBO} = 5V			5	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 30mA				
		for **BDV64/65**	60			V
		for **BDV64A/5A**	80			V
		for **BDV64B/5B**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5A I_B = 20mA			2	V
V_{BE}*	Base-emitter voltage	I_C = 5A V_{CE} = 4V			2.5	V
h_{FE}*	DC current gain	I_C = 1A V_{CE} = 4V		2500		–
		I_C = 5A V_{CE} = 4V	1000			–
		I_C = 10A V_{CE} = 4V		500		–
V_F	Parallel diode forward voltage	I_F = 5A		1.2		V

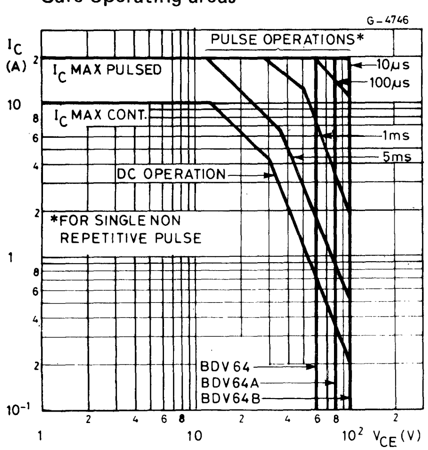
ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions		Min.	Typ.	Max.	Unit
h_{fe}	Small signal current gain	$I_C = 5A$ $f = 1$ MHz	$V_{CE} = 4V$		60		–
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $f = 1$ MHz	$I_E = 0$		100		pF
t_{on}	Turn-on time	$I_C = 5A$ $I_{B2} = 20A$	$I_{B1} = 20mA$ $V_{CC} = 16V$		0.5		μs
t_s	Storage time				1.1 1.3	**	μs μs
t_f	Fall time				2.5 1.0	**	μs μs

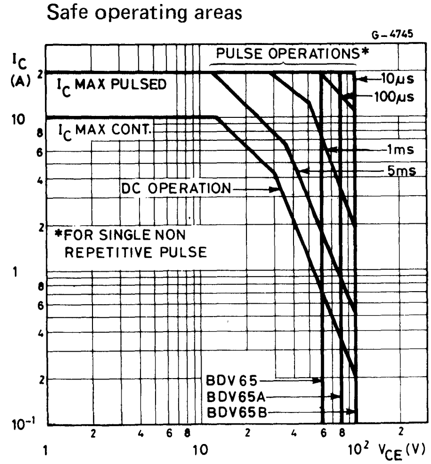
* Pulsed: pulse duration = 300 μs duty cycle = 1.5%
** For PNP types

For PNP types voltage and current values are negative

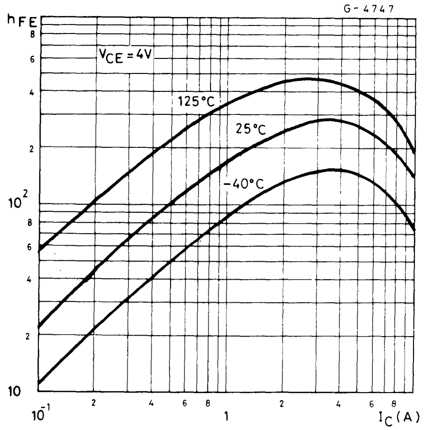
Safe operating areas



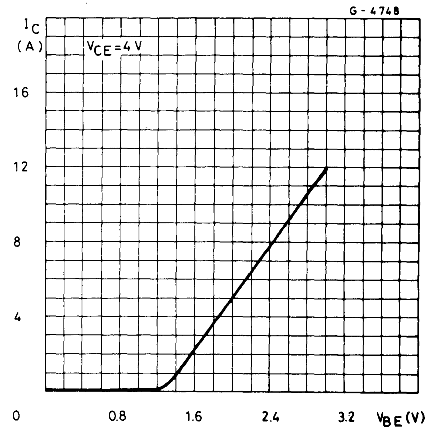
Safe operating areas



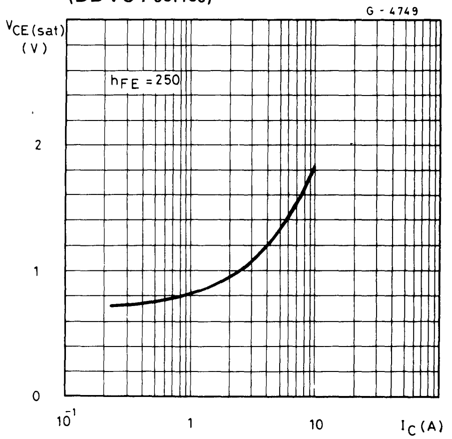
DC current gain (BDV64 series)



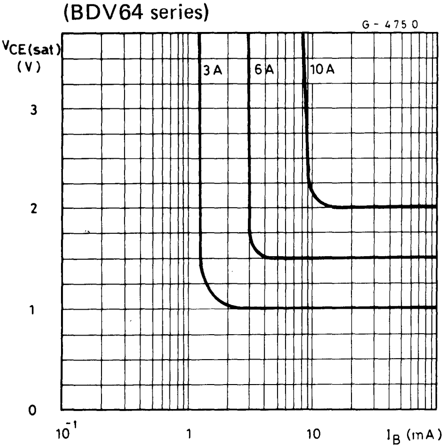
DC transconductance (BDV64 series)



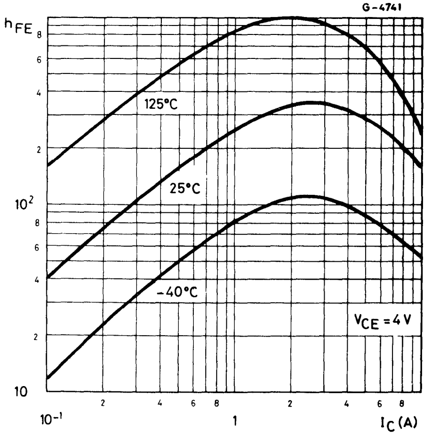
Collector-emitter saturation voltage (BDV64 series)



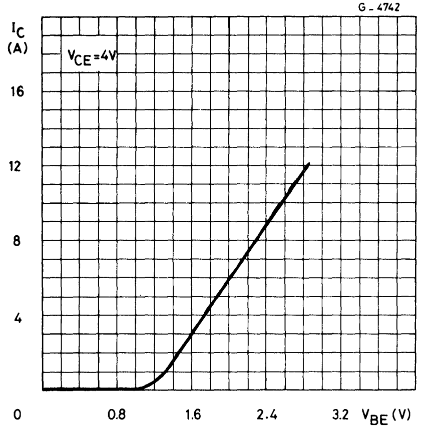
Collector-emitter saturation voltage (BDV64 series)



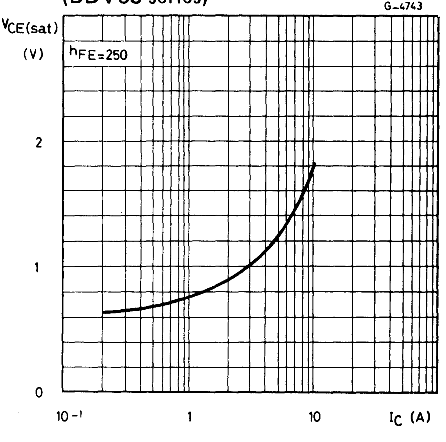
DC current gain (BDV65 series)



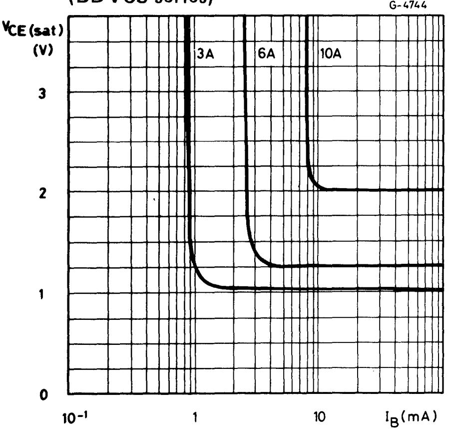
DC transconductance (BDV65 series)



Collector-emitter saturation voltage (BDV65 series)



Collector-emitter saturation voltage (BDV65 series)



EPITAXIAL-BASE NPN

BDW51
BDW51A
BDW51B
BDW51C

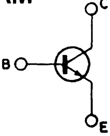
POWER LINEAR AND SWITCHING APPLICATIONS

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			

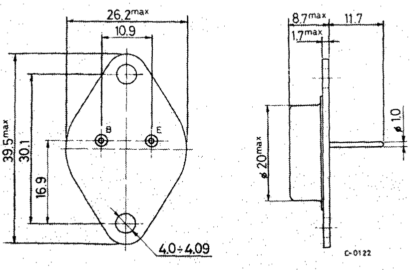
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

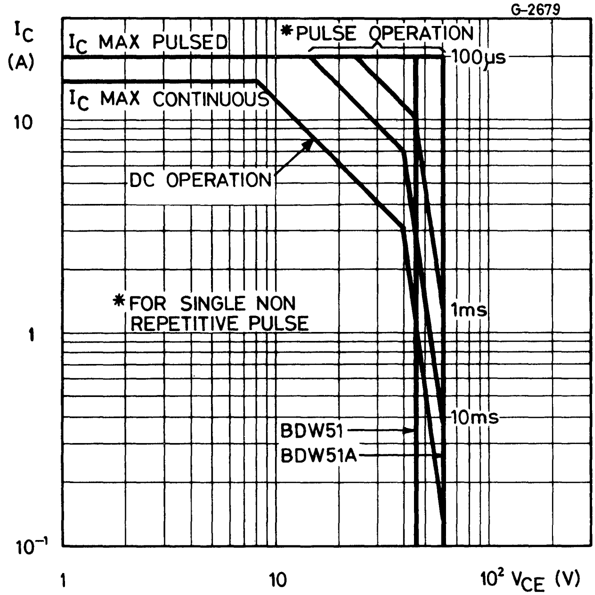
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

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

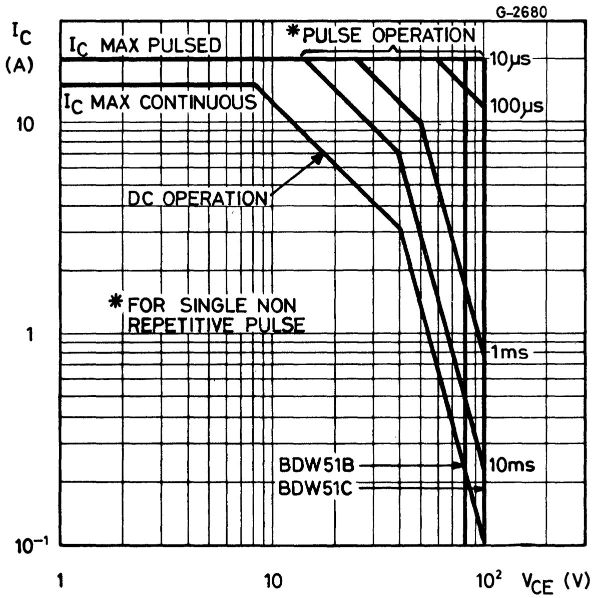
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW51**	V_{CB} = 45V			500	μA
		for **BDW51A**	V_{CB} = 60V			500	μA
		for **BDW51B**	V_{CB} = 80V			500	μA
		for **BDW51C**	V_{CB} = 100V			500	μA
		T_{case} = 150°C					
		for **BDW51**	V_{CB} = 45V			5	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%

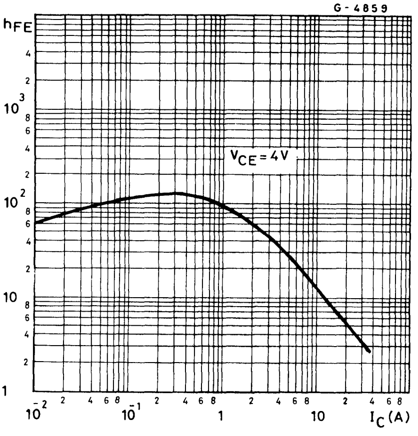
Safe operating areas
(for **BDW51** and **BDW51A**)



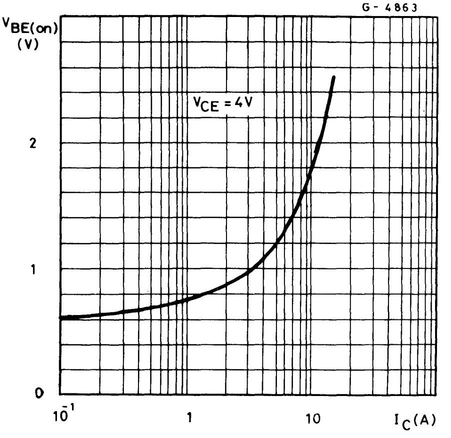
Safe operating areas
(for **BDW51B** and **BDW51C**)



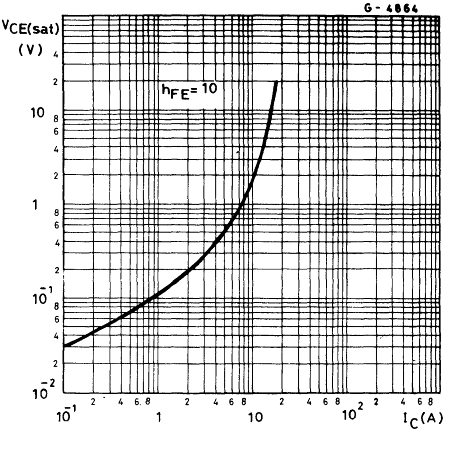
DC current gain



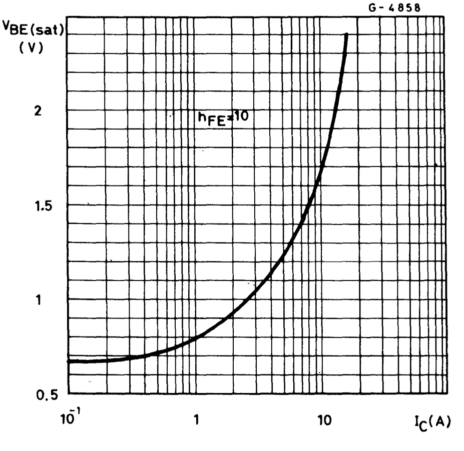
DC transconductance



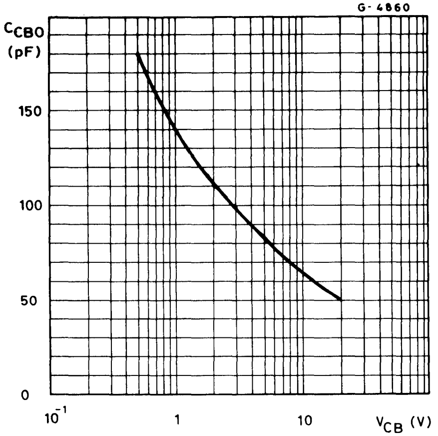
Collector-emitter saturation voltage



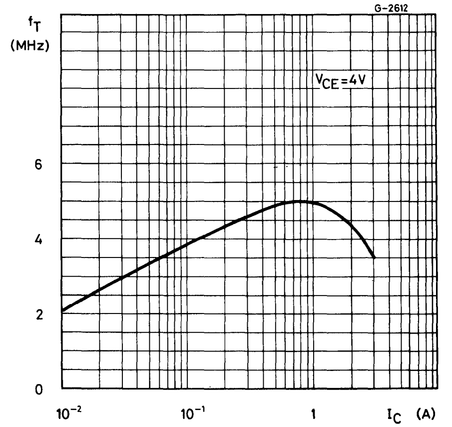
Base-emitter saturation voltage



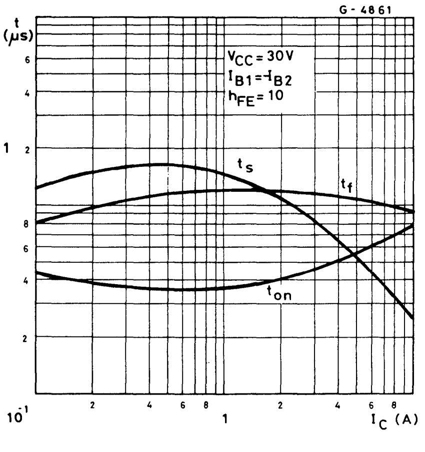
Collector-base capacitance



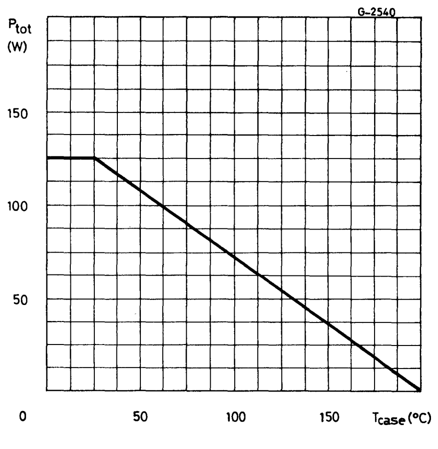
Transition frequency



Saturated switching characteristics



Power rating chart



BDW52
BDW52A
BDW52B
BDW52C

EPITAXIAL-BASE PNP

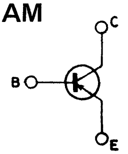
POWER LINEAR AND SWITCHING APPLICATIONS

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			

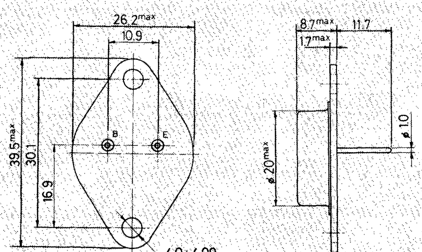
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

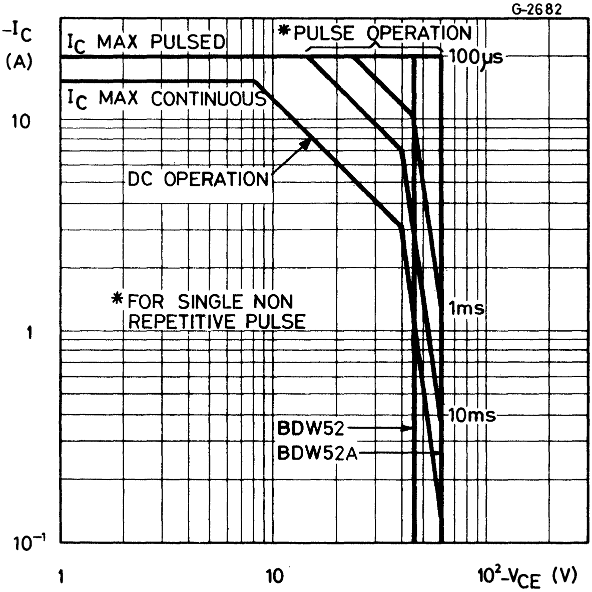
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

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

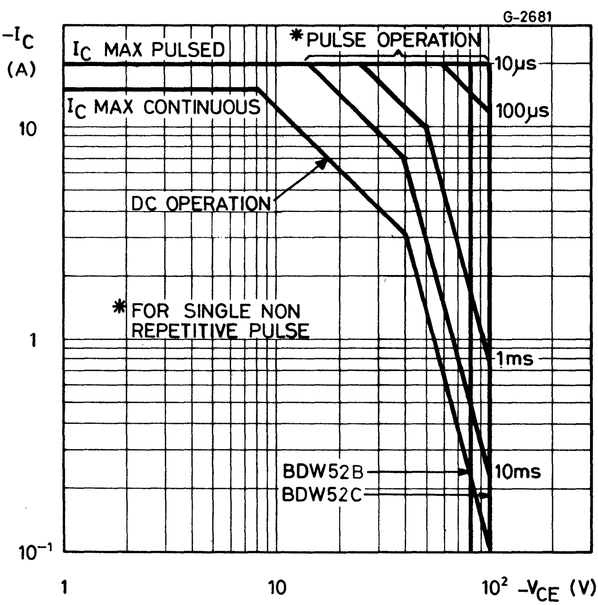
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDW52**	V_{CB} = -45V			-500	μA
		for **BDW52A**	V_{CB} = -60V			-500	μA
		for **BDW52B**	V_{CB} = -80V			-500	μA
		for **BDW52C**	V_{CB} = -100V			-500	μA
		T_{case} = 150°C					
		for **BDW52**	V_{CB} = -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%

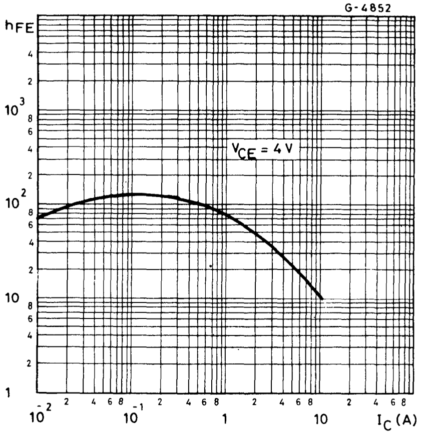
Safe operating areas
(for **BDW52** and **BDW52A**)



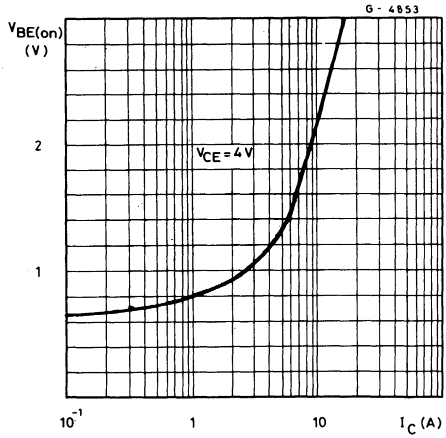
Safe operating areas
(for **BDW52B** and **BDW52C**)



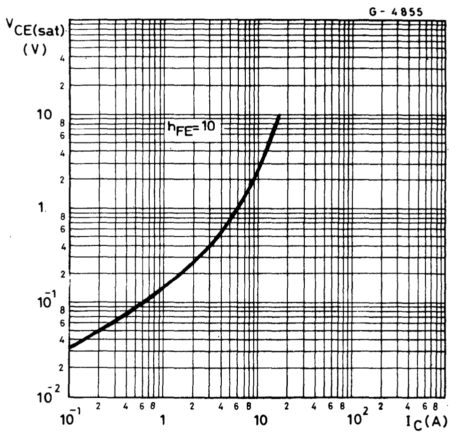
DC current gain



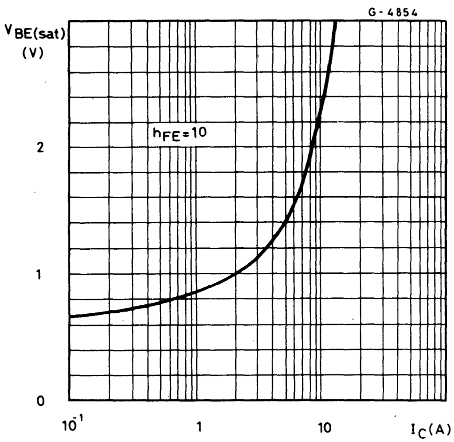
DC transconductance



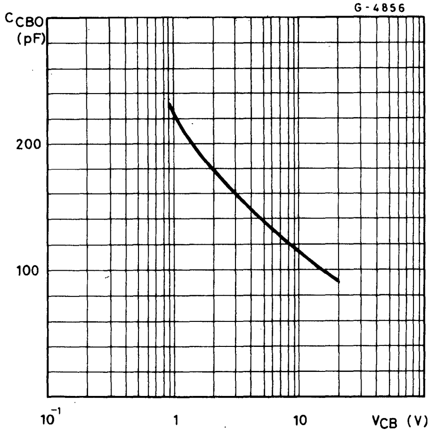
Collector-emitter saturation voltage



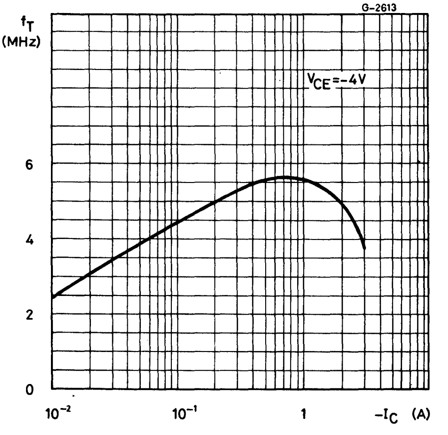
Base-emitter saturation voltage



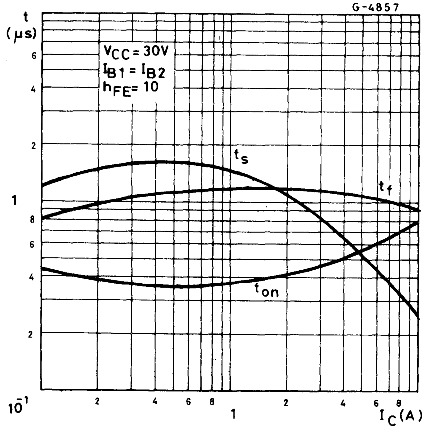
Collector-base capacitance



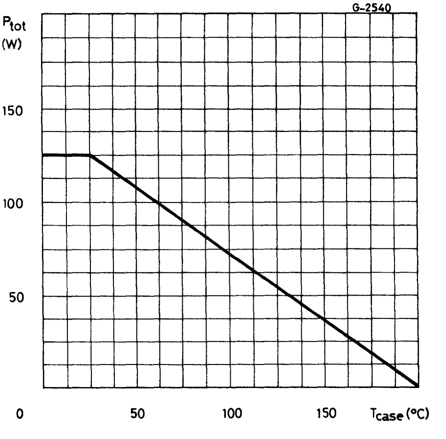
Transition frequency



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

SGS **BDW91**

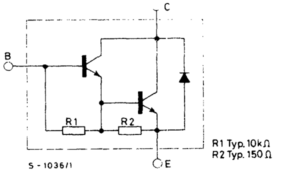
MEDIUM POWER DARLINGTON

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

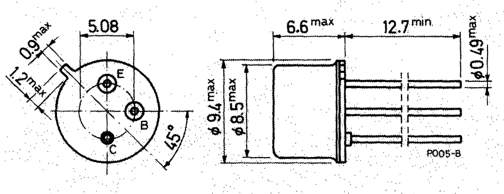
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

5/80

THERMAL DATA

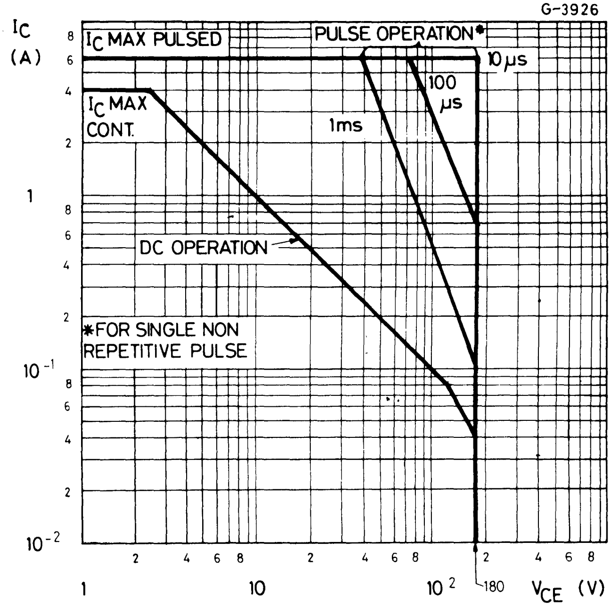
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

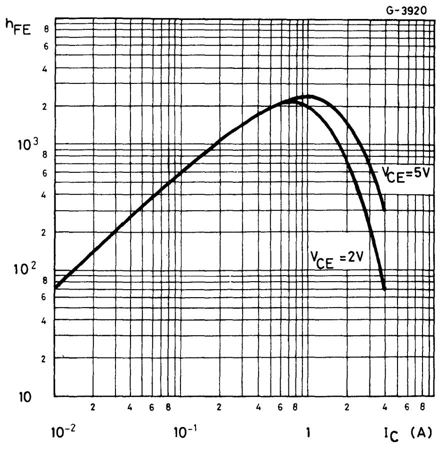
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 180V$				50	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 90V$				50	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{BE} = 6V$		0.4		2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining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

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

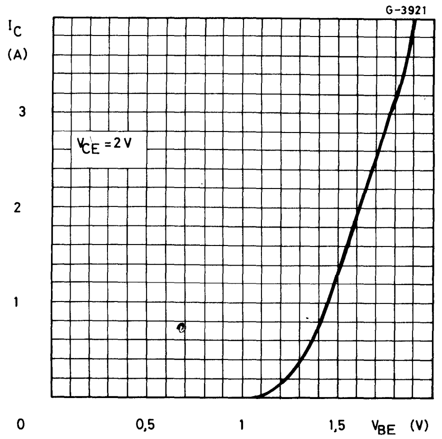
Safe operating areas



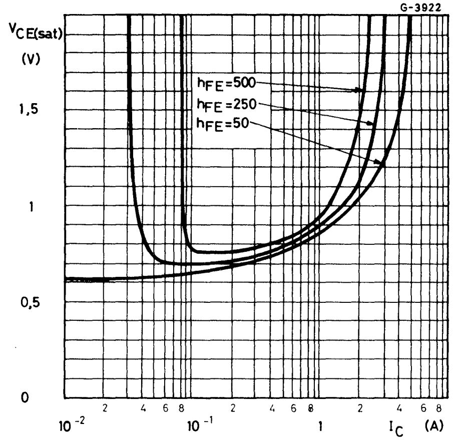
DC current gain



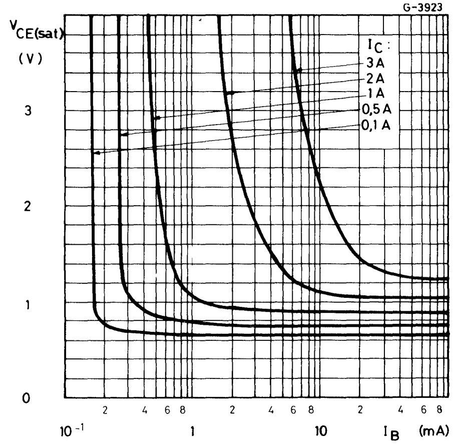
DC transconductance



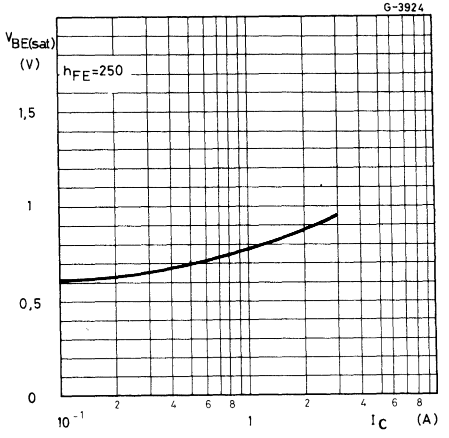
Collector-emitter saturation voltage



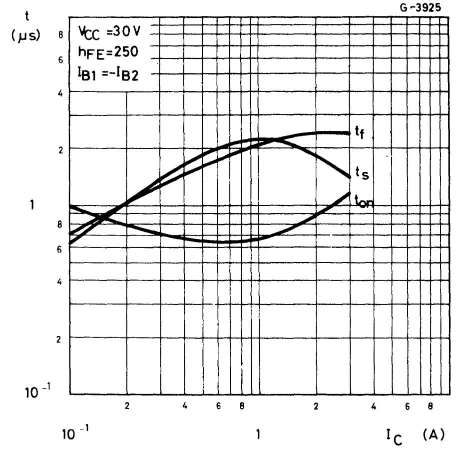
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDW92

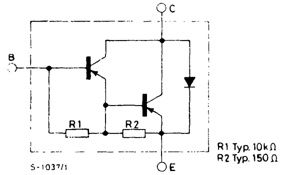
MEDIUM POWER DARLINGTON

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

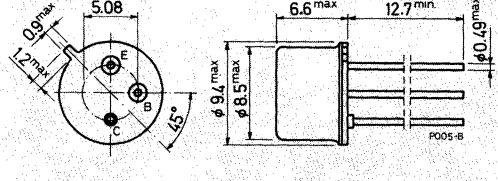
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

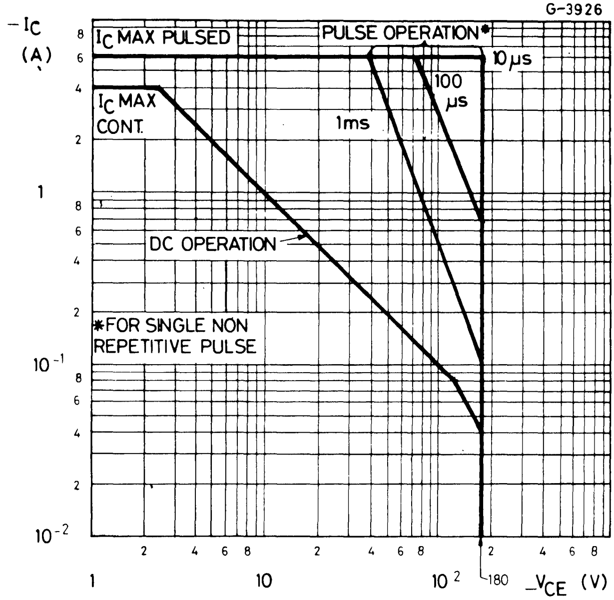
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

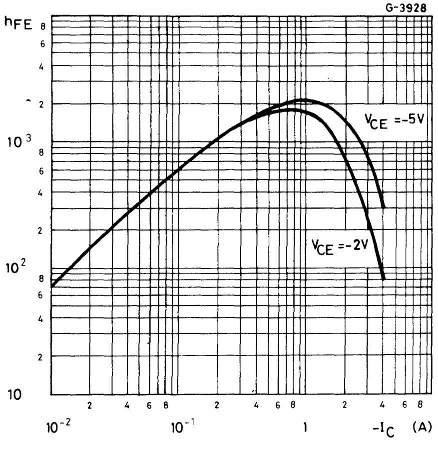
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB}=-180V			-50	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE}=-90V			-50	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{BE}= -6V	-0.4		-2	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	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%

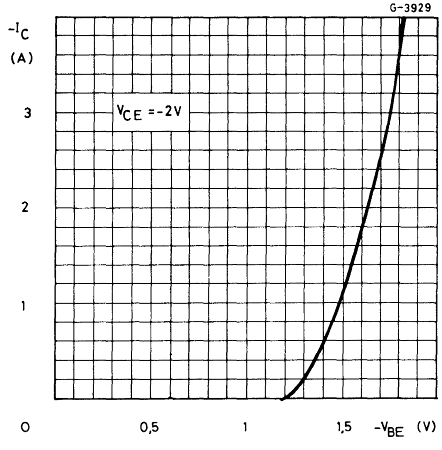
Safe operating areas



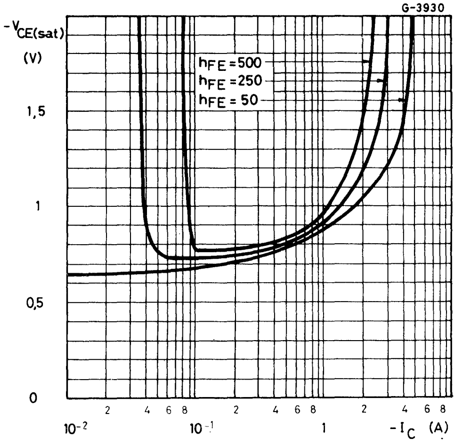
DC current gain



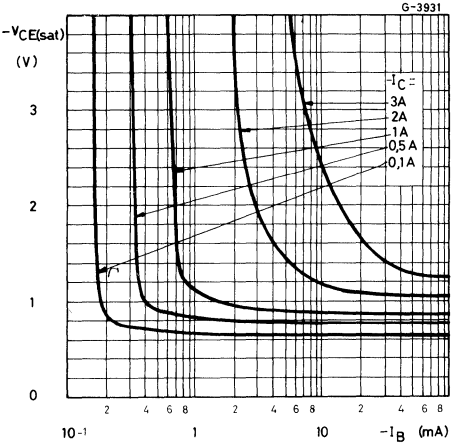
DC transconductance



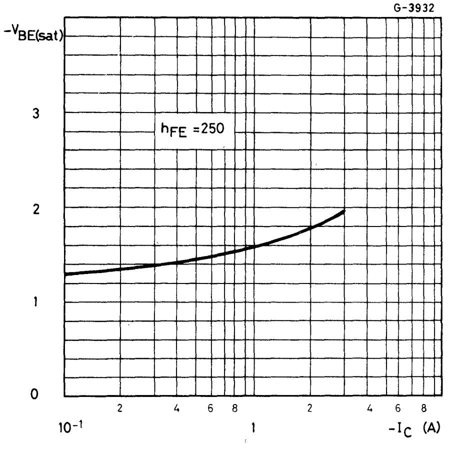
Collector-emitter saturation voltage



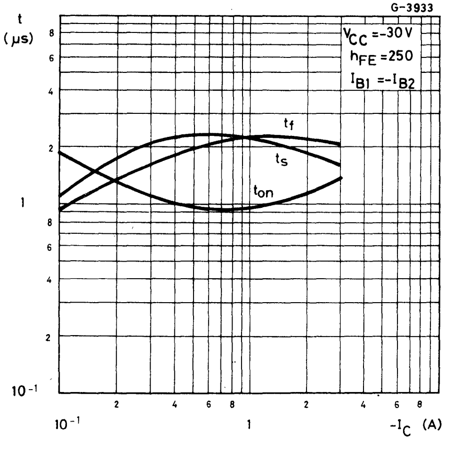
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDW93
BDW93A
BDW93B
BDW93C

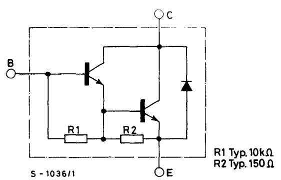
POWER DARLINGTONS

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			

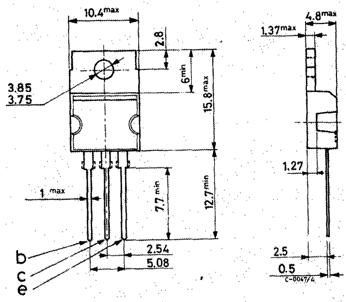
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

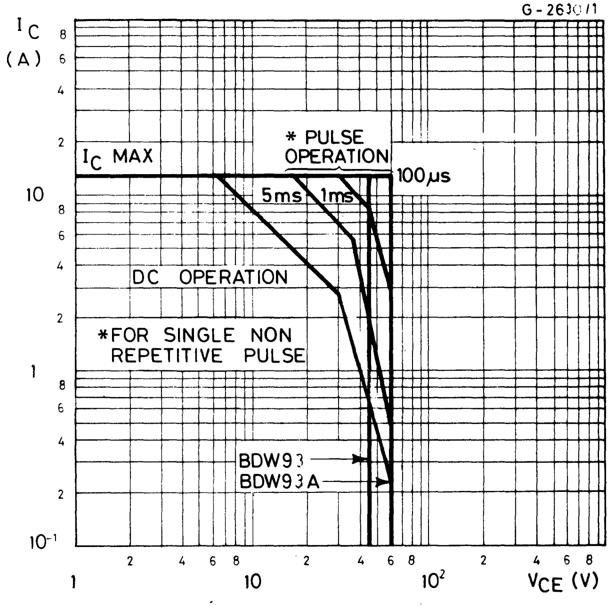
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W

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

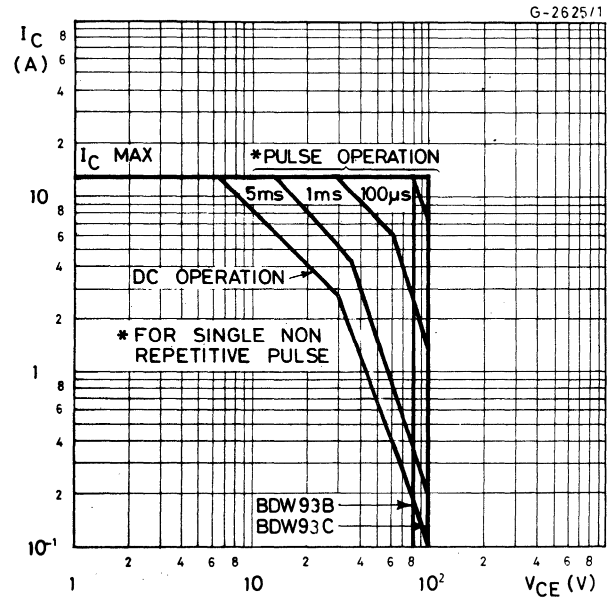
Parameter		Test conditions	Min.	Typ.	Max.	Unit.
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDW93** V_{CB} = 45V			100	μA
		for **BDW93A** V_{CB} = 60V			100	μA
		for **BDW93B** V_{CB} = 80V			100	μA
		for **BDW93C** V_{CB} = 100V			100	μA
		T_{case} = 150°C				
		for **BDW93** V_{CB} = 45V			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%

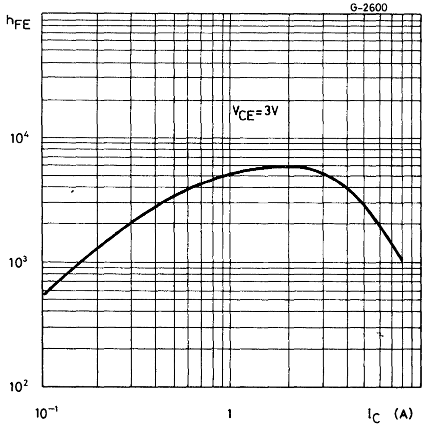
Safe operating areas
(for **BDW93** and **BDW93A**)



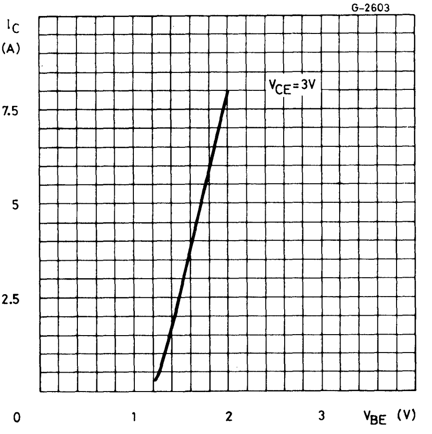
Safe operating areas
(for **BDW93B** and **BDW93C**)



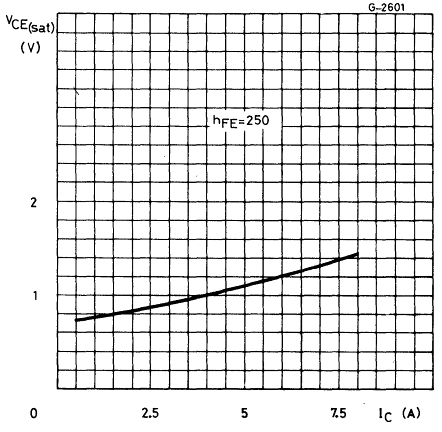
DC current gain



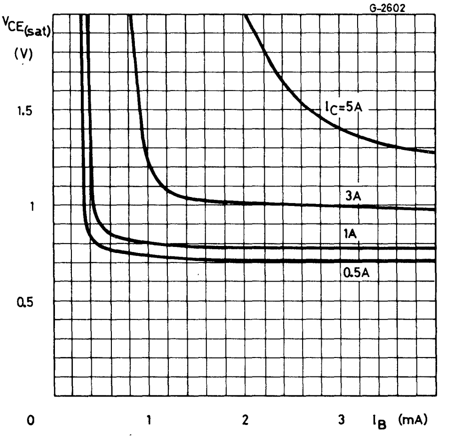
DC transconductance



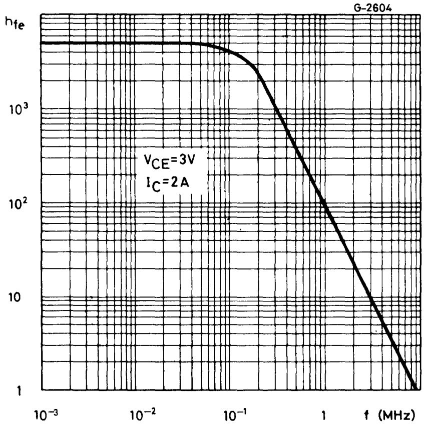
Collector-emitter saturation voltage



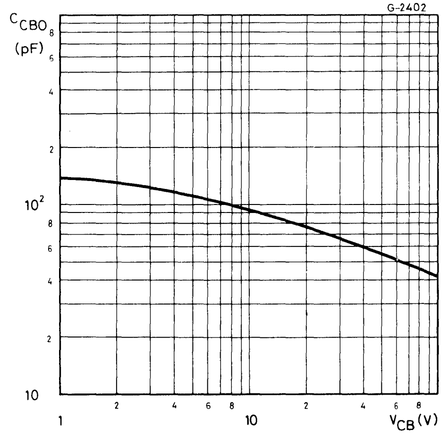
Collector-emitter saturation voltage



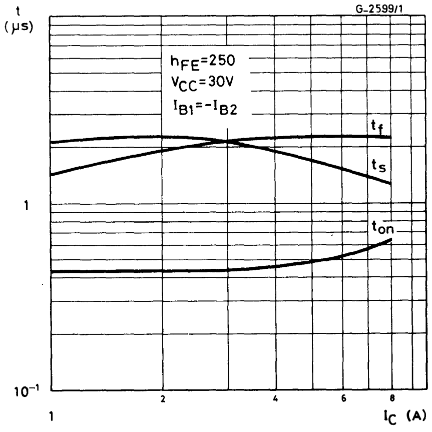
Small signal current gain



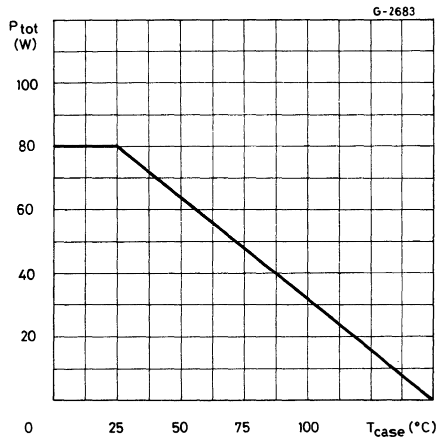
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDW94
BDW94A
BDW94B
BDW94C

EPITAXIAL-BASE PNP

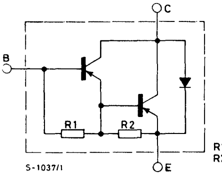
POWER DARLINGTONS

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 $T_{case} \leq 25°C$	80W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

INTERNAL SCHEMATIC DIAGRAM

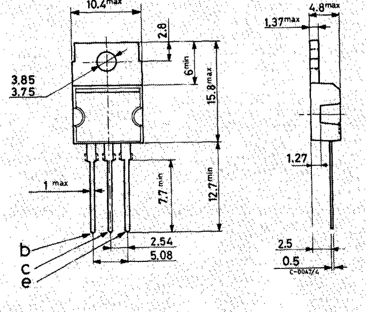


R1 Typ. 10kΩ
R2 Typ. 150Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

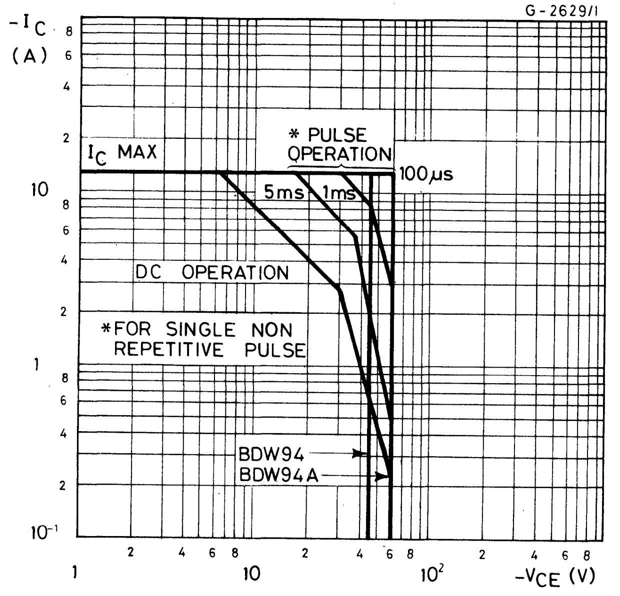
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.56	°C/W

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

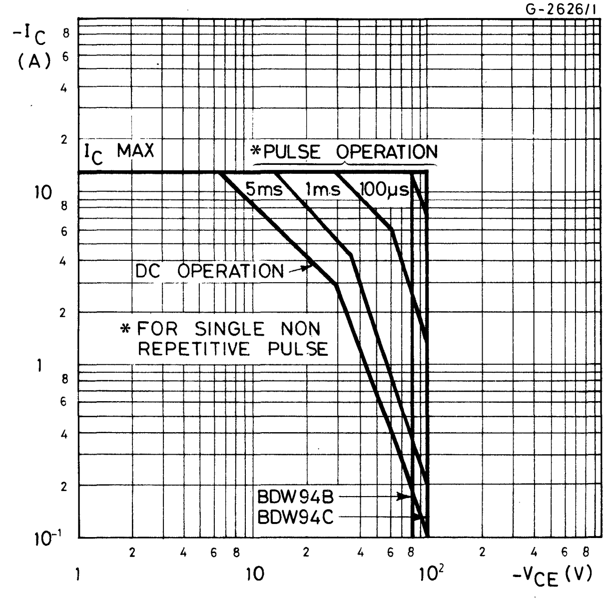
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDW94** V_{CB} = -45V for **BDW94A** V_{CB} = -60V for **BDW94B** V_{CB} = -80V for **BDW94C** V_{CB} = -100V T_{case} = 150°C for **BDW94** V_{CB} = -45V for **BDW94A** V_{CB} = -60V for **BDW94B** V_{CB}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

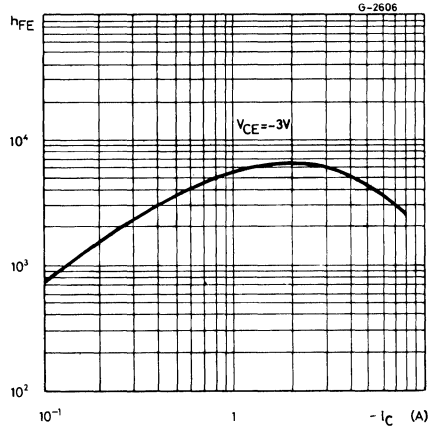
Safe operating areas
(for **BDW94** and **BDW94A**)



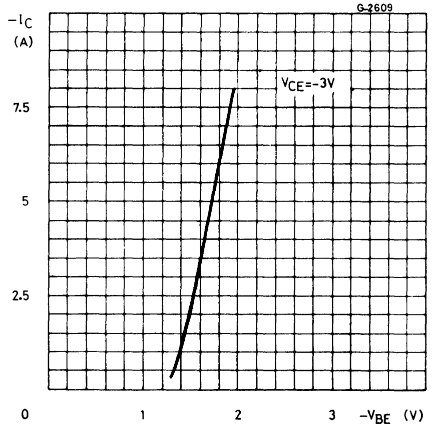
Safe operating areas
(for **BDW94B** and **BDW94C**)



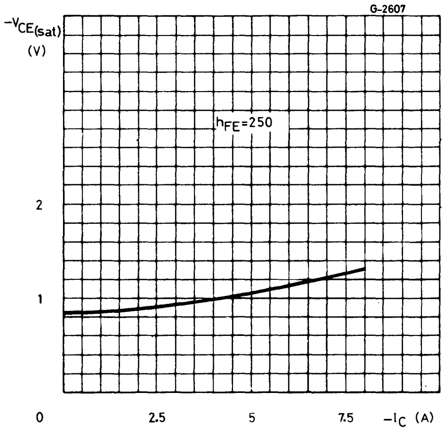
DC current gain



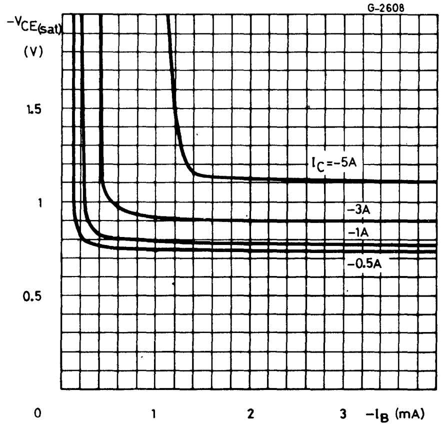
DC transconductance



Collector-emitter saturation voltage



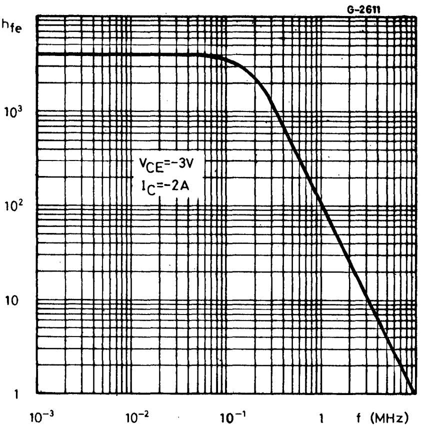
Collector-emitter saturation voltage



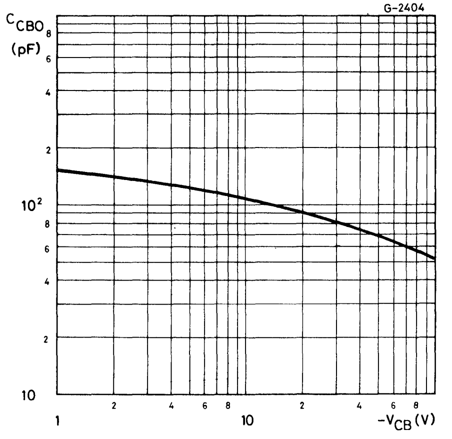
SGS

BDW94
BDW94A
BDW94B
BDW94C

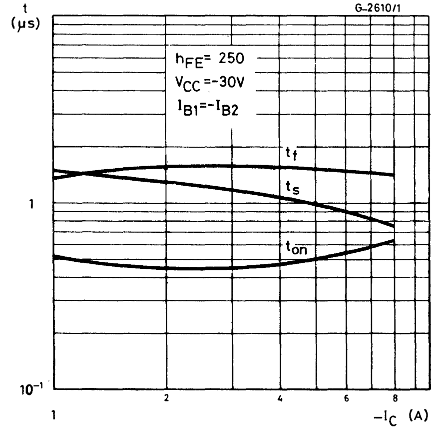
Small signal current gain



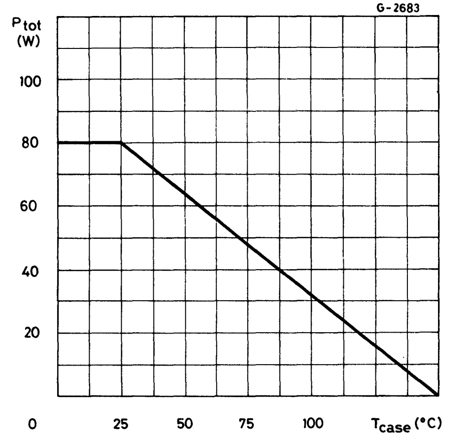
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BDX53
BDX53A
BDX53B
BDX53C

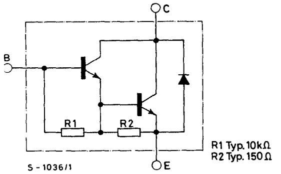
POWER DARLINGTONS

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			

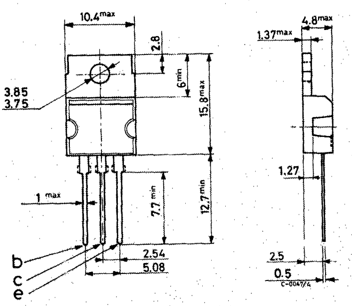
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

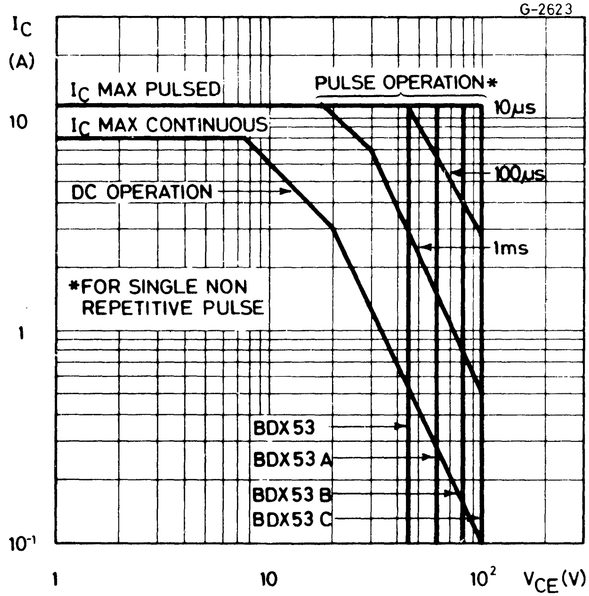
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

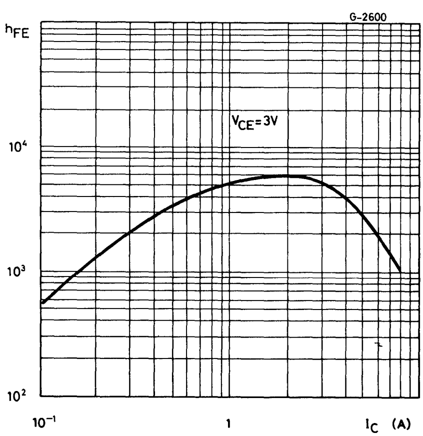
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX53**	V_{CB} = 45V			200	μA
		for **BDX53A**	V_{CB} = 60V			200	μA
		for **BDX53B**	V_{CB} = 80V			200	μA
		for **BDX53C**	V_{CB} = 100V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX53**	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	2.5	V
		I_F = 8A			2.5		V

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

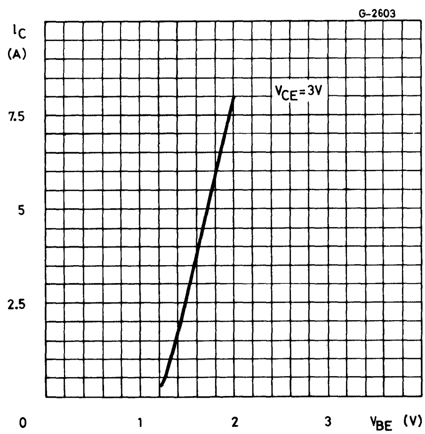
Safe operating areas



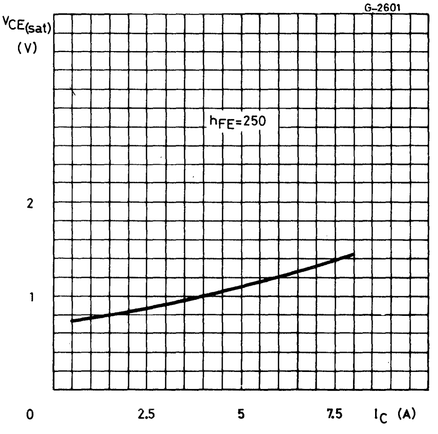
DC current gain



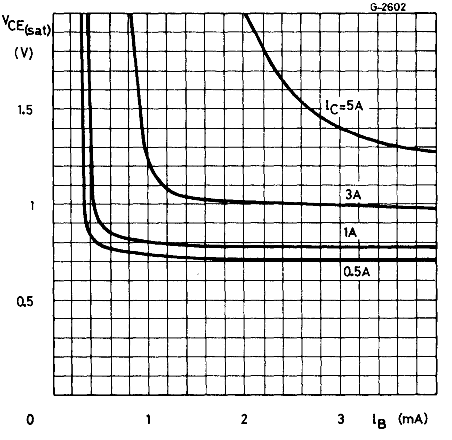
DC transconductance



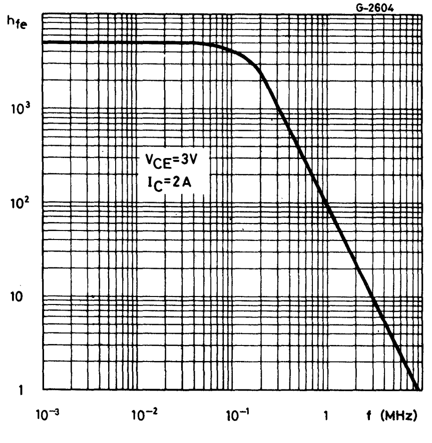
Collector-emitter saturation voltage



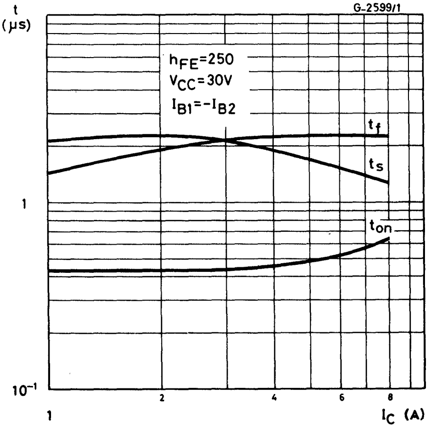
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



BDX53E
BDX53F

EPITAXIAL-BASE NPN

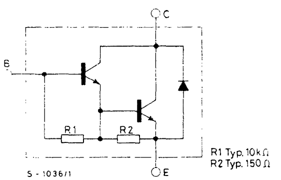
POWER DARLINGTONS

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	

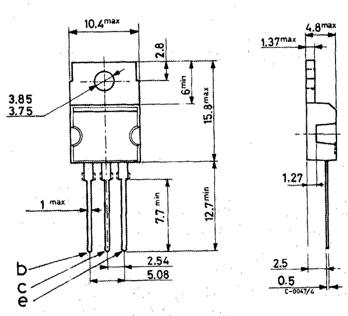
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

5/80

BDX53E
BDX53F

THERMAL DATA

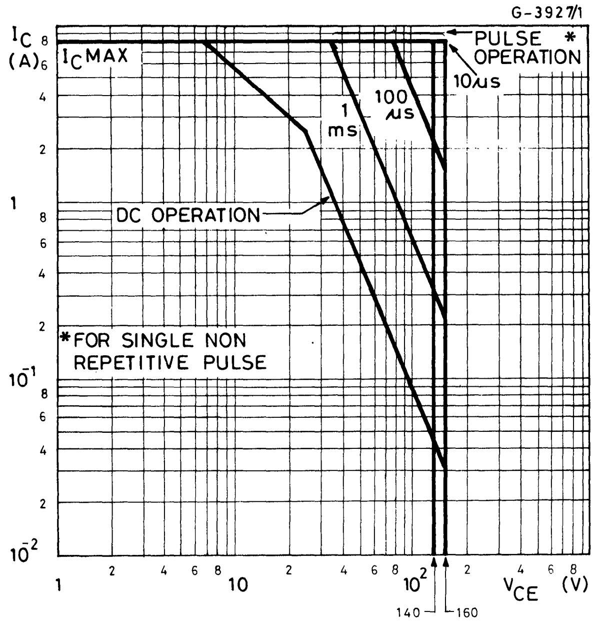
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

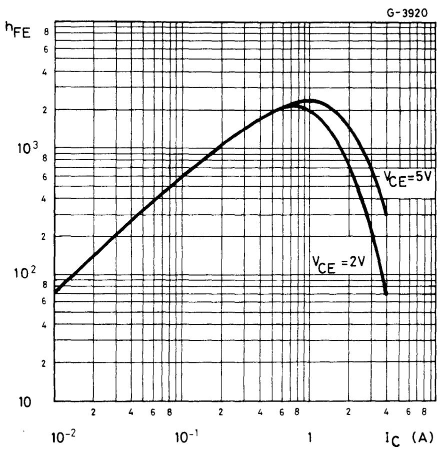
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDX53E** V_{CE} = 70V for **BDX53F** V_{CE} = 80V			0.5 0.5	mA mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDX53E** V_{CB} = 140V for **BDX53F** V_{CB} = 160V			0.2 0.2	mA mA
I_{EBO}	Emitter cutoff 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%

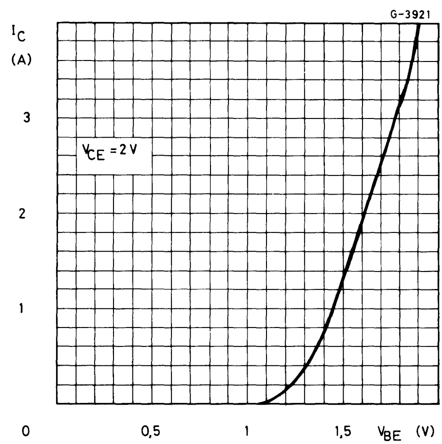
Safe operating areas



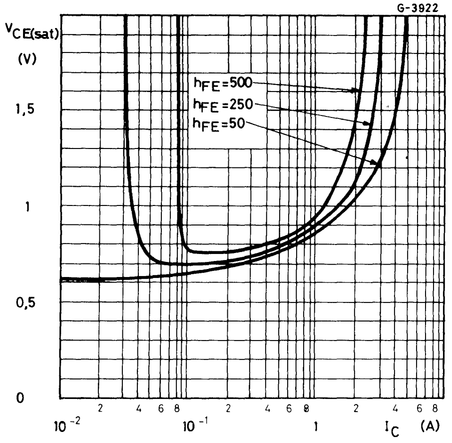
DC current gain



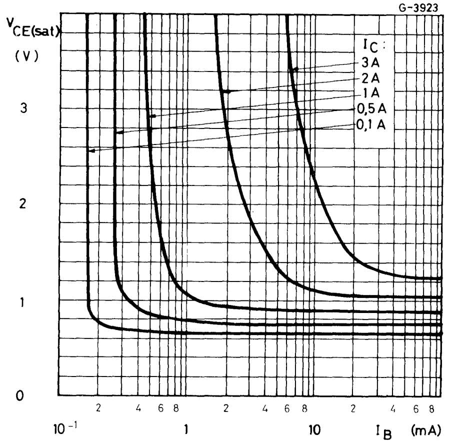
DC transconductance



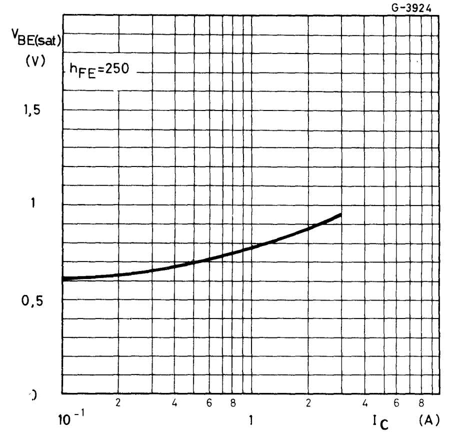
Collector-emitter saturation voltage



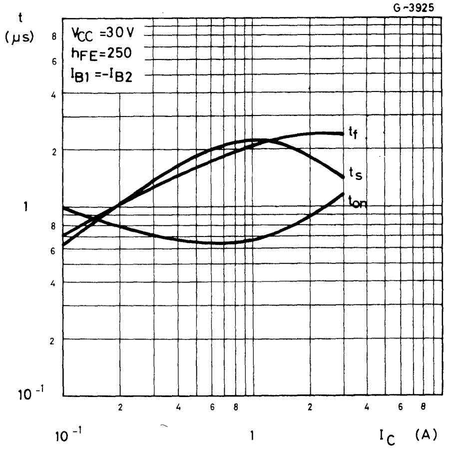
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDX53S

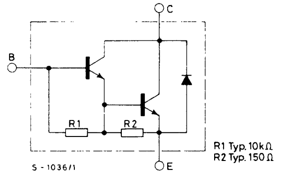
MEDIUM POWER DARLINGTON

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

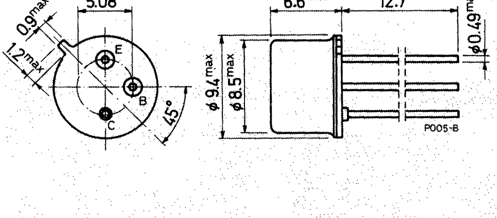
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

BDX53S

THERMAL DATA

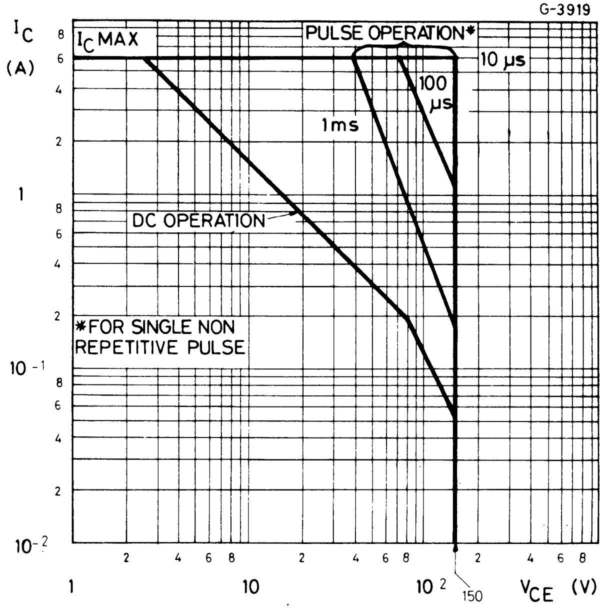
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	11.66	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

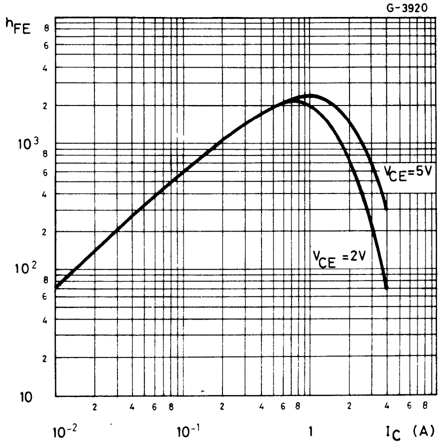
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 150V$ $T_{case} = 125°C$ $V_{CB} = 150V$			0.2 2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 75V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			5	mA
$V_{CEO\ (sus)}$*	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%

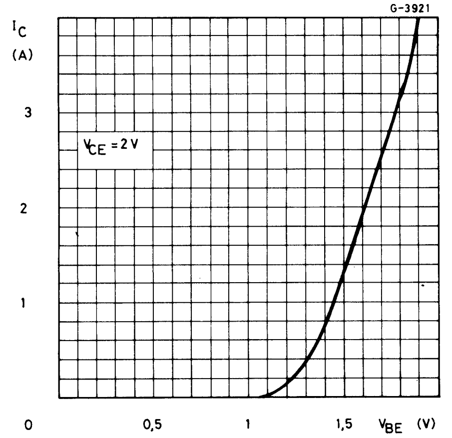
Safe operating area



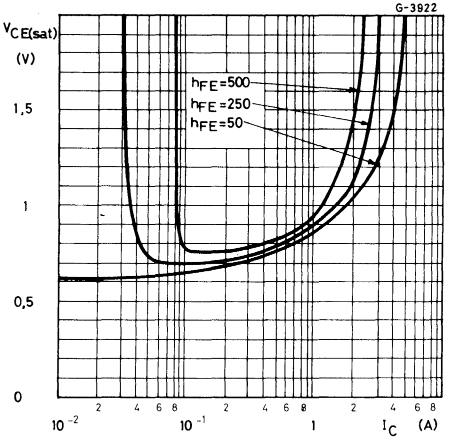
DC current gain



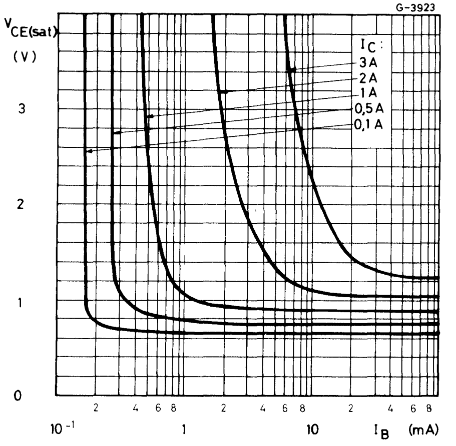
DC transconductance



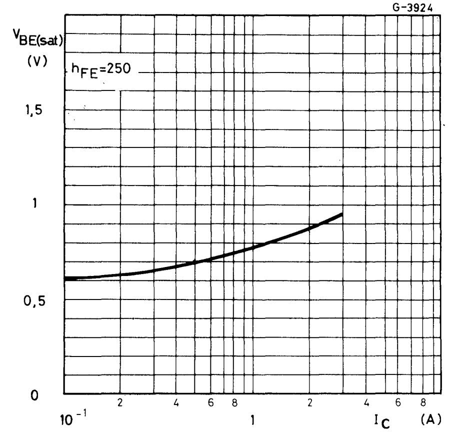
Collector-emitter saturation voltage



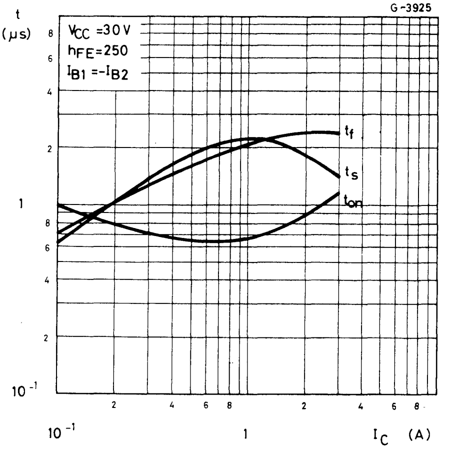
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



BDX54
BDX54A
BDX54B
BDX54C

EPITAXIAL-BASE PNP

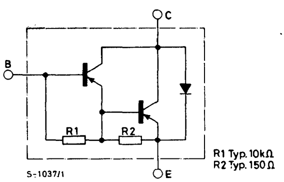
POWER DARLINGTONS

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 $T_{case} \leq 25°C$	60W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150 °C			

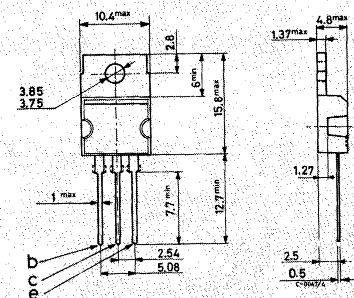
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

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THERMAL DATA

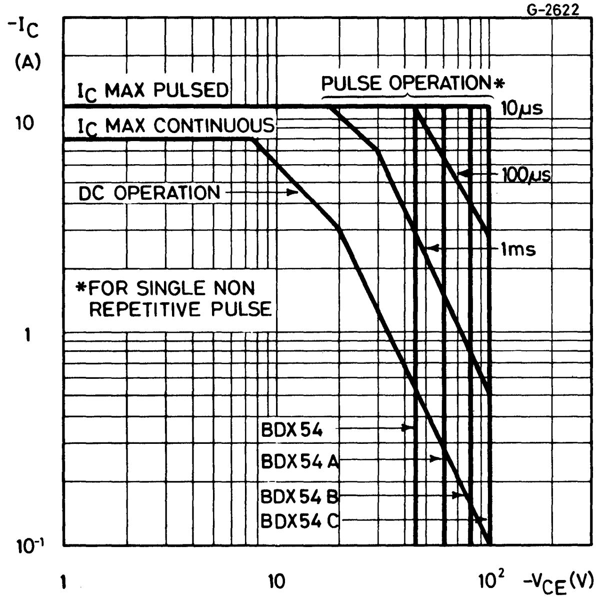
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

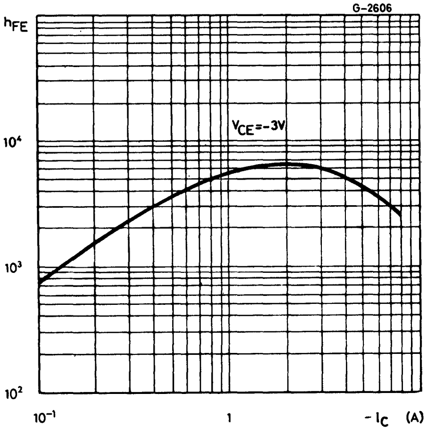
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX54** for **BDX54A** for **BDX54B** for **BDX54C**	V_{CB} = -45V V_{CB} = -60V V_{CB} = -80V V_{CB} = -100V			-200 -200 -200 -200	μA μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX54** for **BDX54A** for **BDX54B** for **BDX54C**	V_{CE} = -22V V_{CE} = -30V V_{CE} = -40V 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 = -100 mA	for **BDX54** for **BDX54A** for **BDX54B** for **BDX54C**	-45 -60 -80 -100			V V V 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 I_F = 8A			1.8 2.5	2.5	V V

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

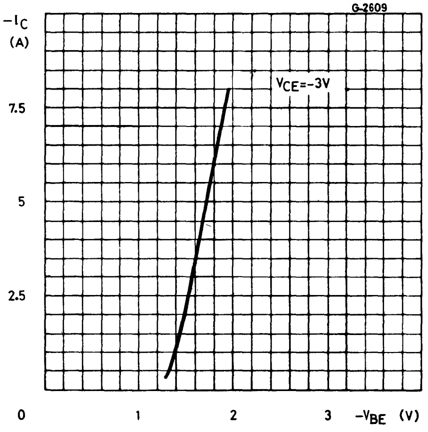
Safe operating areas



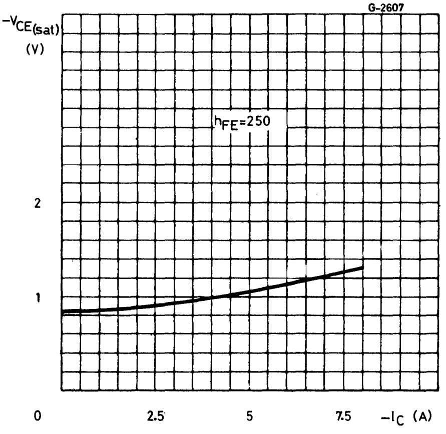
DC current gain



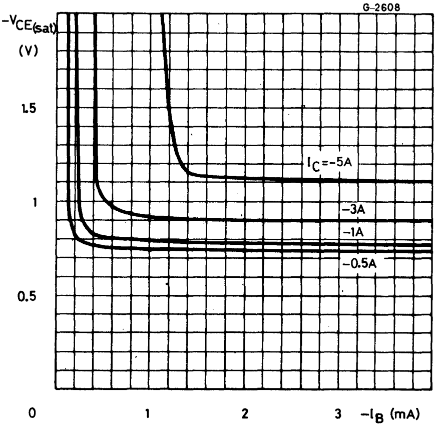
DC transconductance



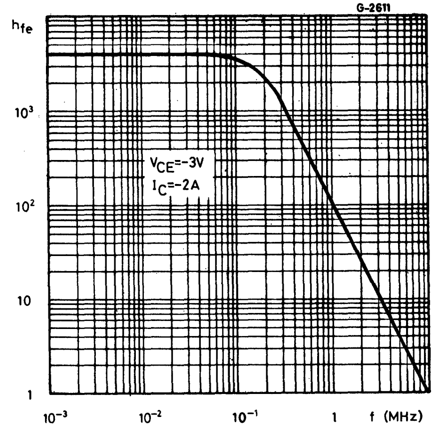
Collector-emitter saturation voltage



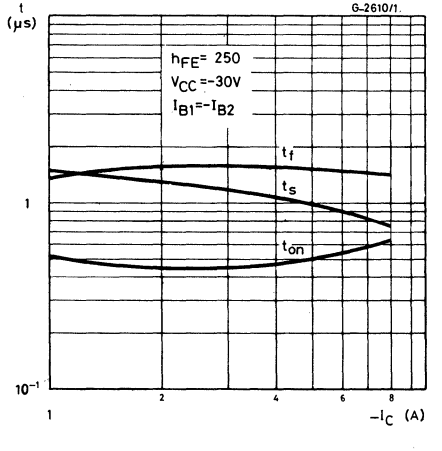
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDX54E
BDX54F

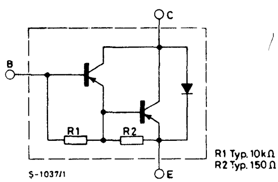
POWER DARLINGTONS

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	

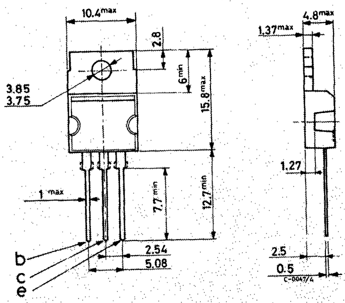
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

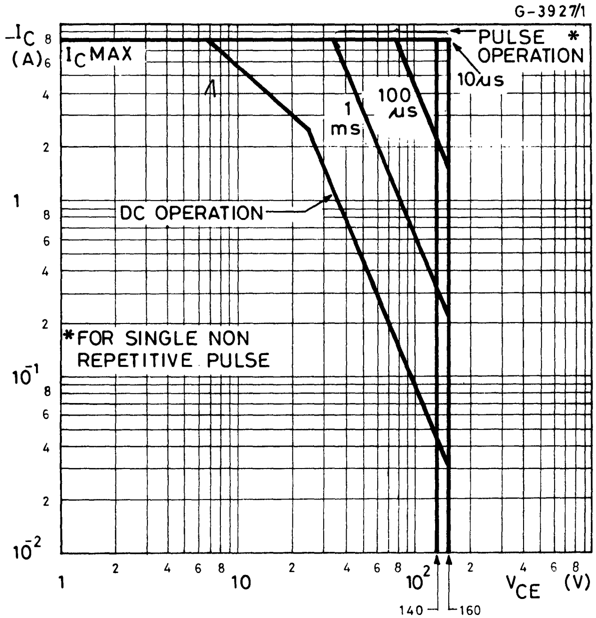
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

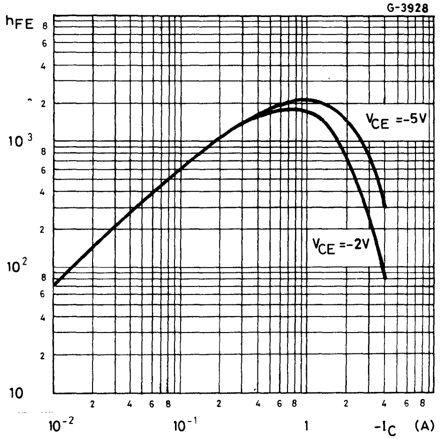
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX54E** V_{CE} = -70V for **BDX54F** V_{CE} = -80V			-0.5 -0.5	mA mA
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX54E** V_{CB} = -140V for **BDX54F** V_{CB} = -160V			-0.2 -0.2	mA mA
I_{EBO}	Emitter 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%

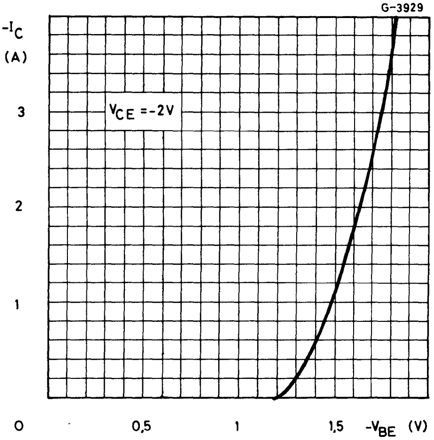
Safe operating areas



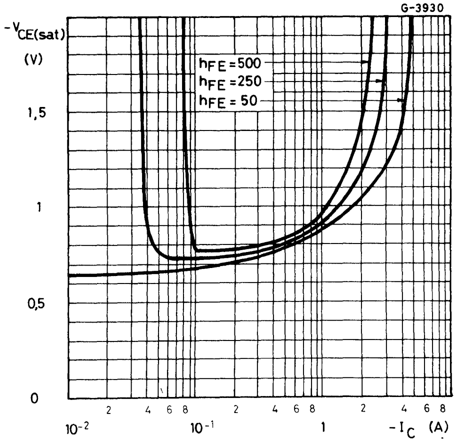
DC current gain



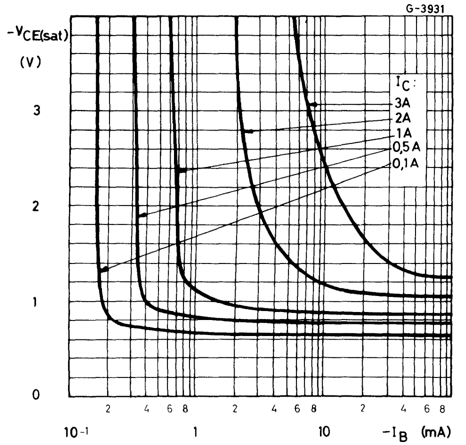
DC transconductance



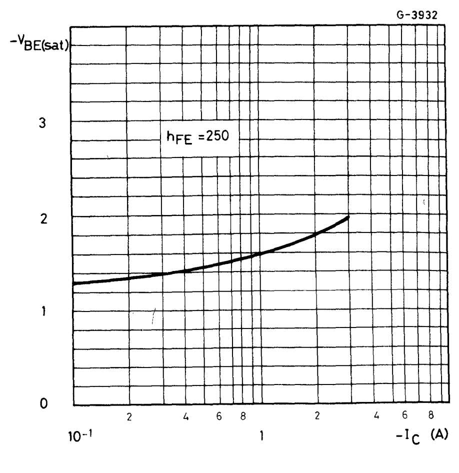
Collector-emitter saturation voltage



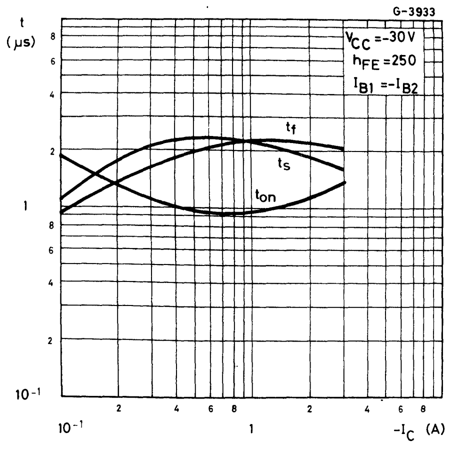
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE PNP

BDX54S

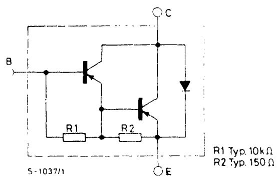
MEDIUM POWER DARLINGTON

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

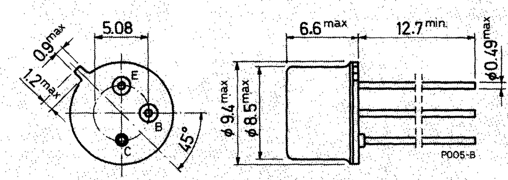
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

SGS **BDX54S**

THERMAL DATA

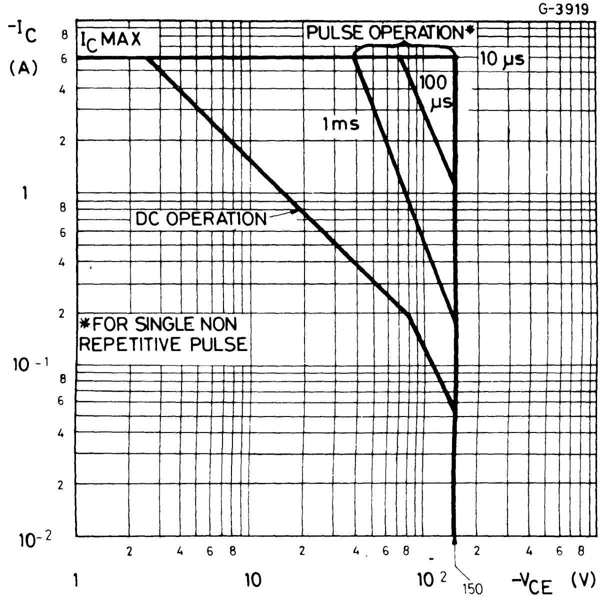
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	11.66	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

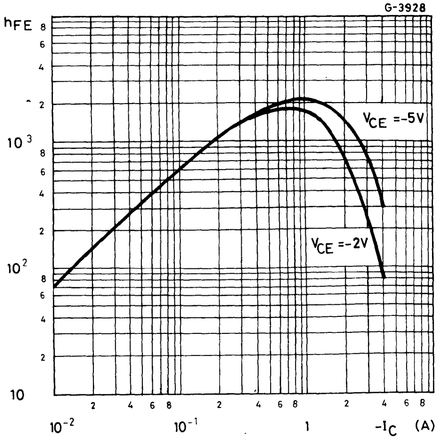
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -150V T_{case} = 125°C V_{CB} = -150V			-0.2 -2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = -75V			-0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V			-5	mA
$V_{CEO\ (sus)}$*	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%

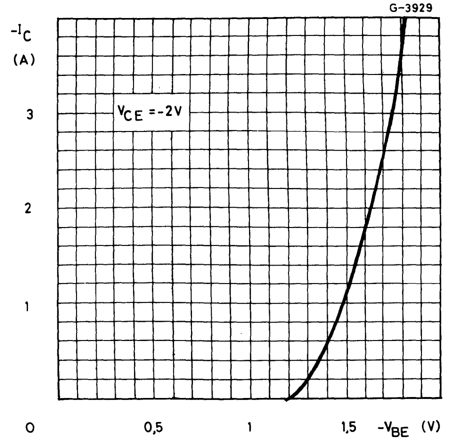
Safe operating area



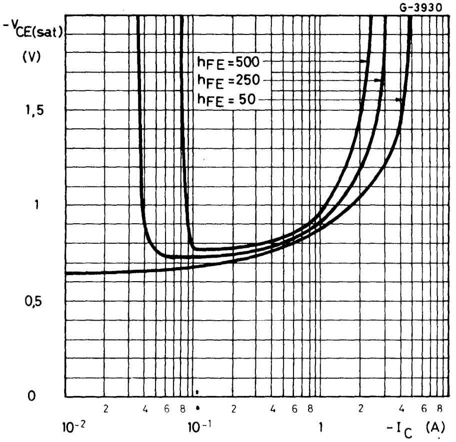
DC current gain



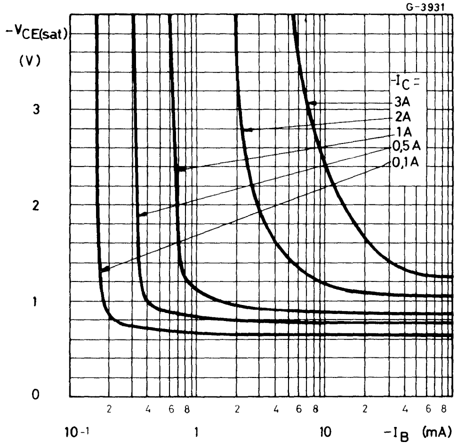
DC transconductance



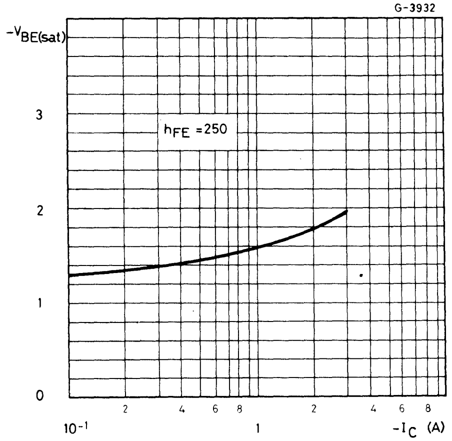
Collector-emitter saturation voltage



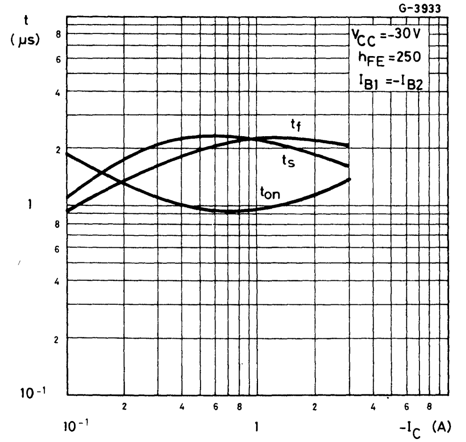
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



EPITAXIAL-BASE NPN

BDX85
BDX85A
BDX85B
BDX85C

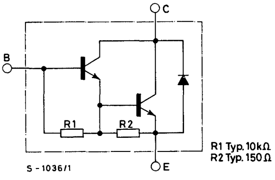
POWER DARLINGTONS

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			

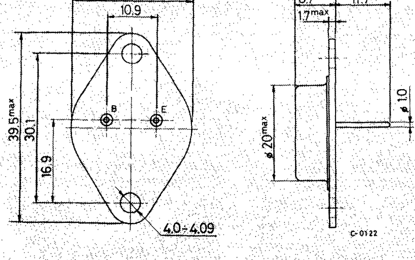
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

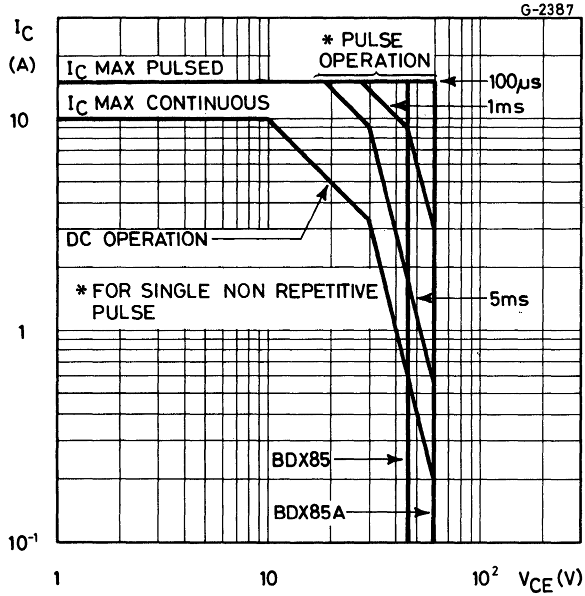
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

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

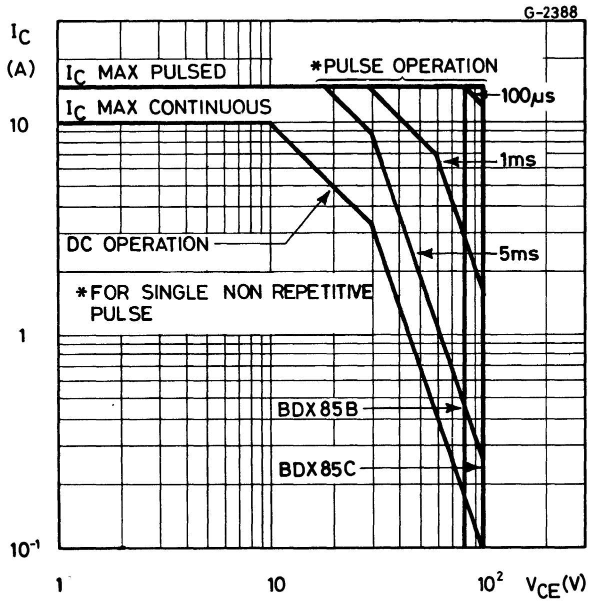
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX85** V_{CB} = 45 V for **BDX85A** V_{CB} = 60 V for **BDX85B** V_{CB} = 80 V for **BDX85C** V_{CB} = 100 V T_{case} = 150°C for **BDX85** V_{CB} = 45 V for **BDX85A** V_{CB} = 60 V for **BDX85B** 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%

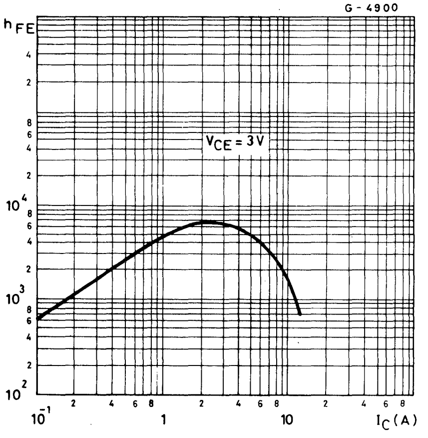
Safe operating areas
(for **BDX85** and **BDX85A**)



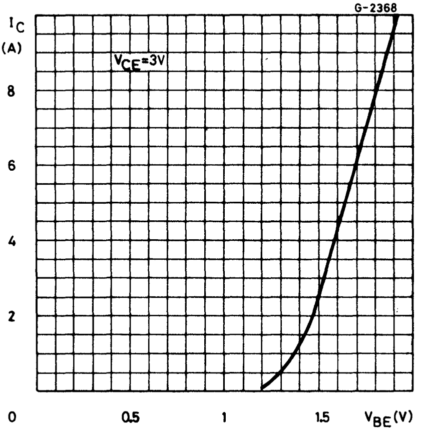
Safe operating areas
(for **BDX85B** and **BDX85C**)



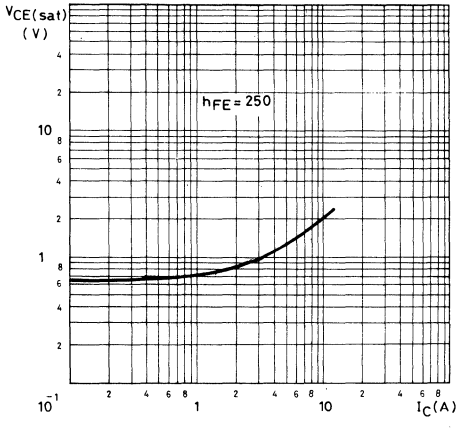
DC current gain



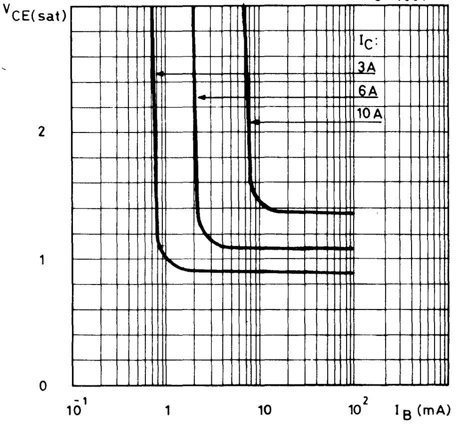
DC transconductance



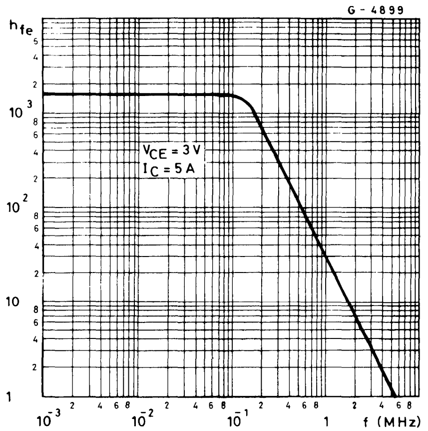
Collector-emitter saturation voltage



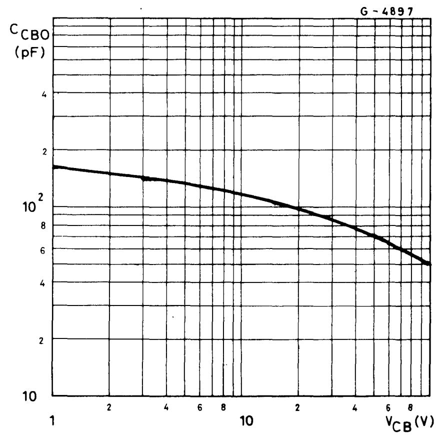
Collector-emitter saturation voltage



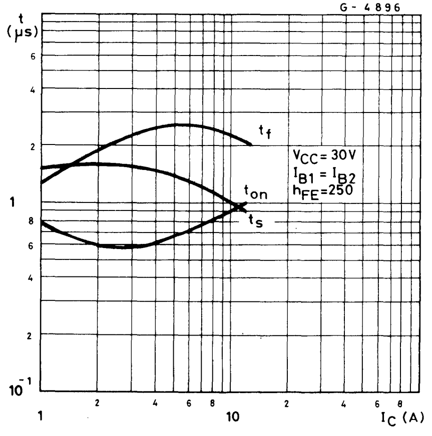
Small signal current gain



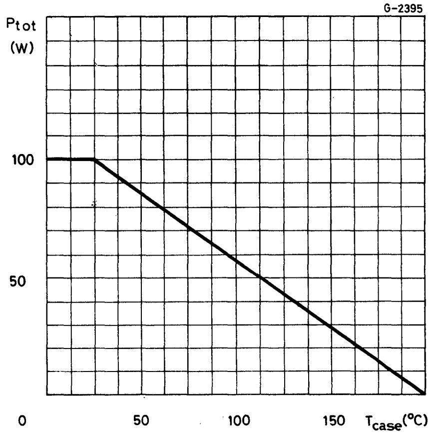
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BDX86
BDX86A
BDX86B
BDX86C

EPITAXIAL-BASE PNP

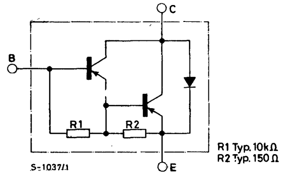
POWER DARLINGTONS

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

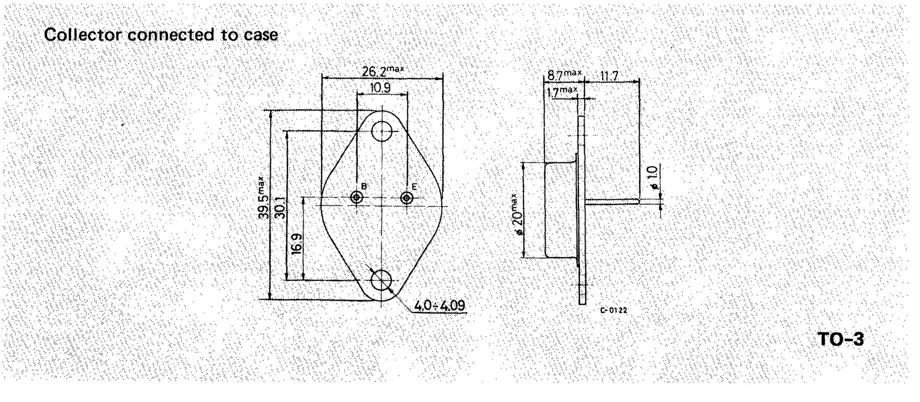
		BDX86	BDX86A	BDX86B	BDX86C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-10A			
I_{CM}	Collector peak current (repetitive)	-15A			
I_B	Base current	-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			

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

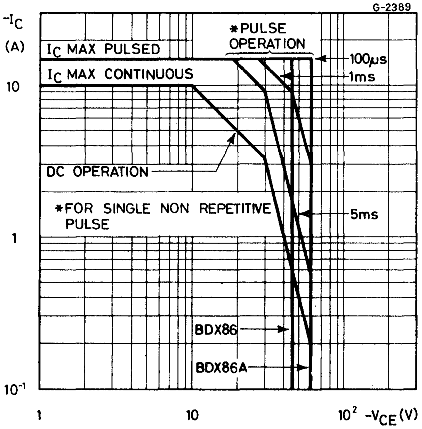
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

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

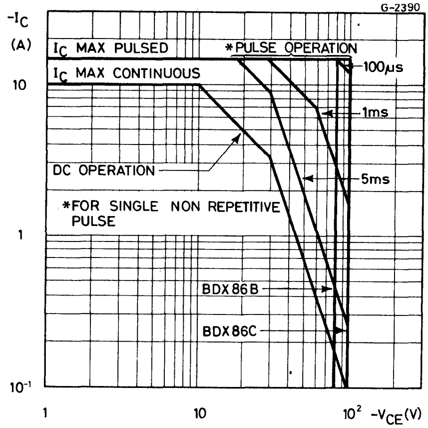
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX86** V_{CB} = -45 V for **BDX86A** V_{CB} = -60 V for **BDX86B** V_{CB} = -80 V for **BDX86C** V_{CB} = -100 V T_{case} = 150°C for **BDX86** V_{CB} = -45 V for **BDX86A** V_{CB} = -60 V for **BDX86B** V_{CB} = -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%

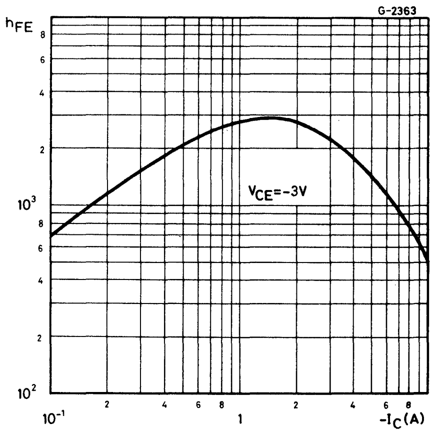
Safe operating areas
(for **BDX86** and **BDX86A**)



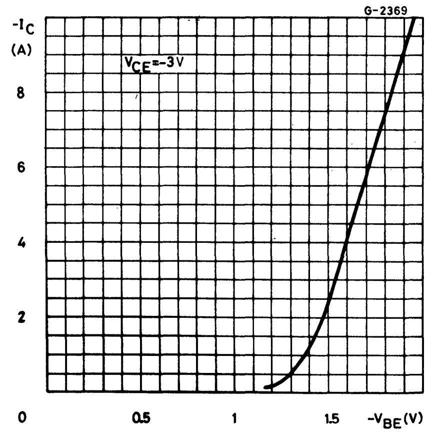
Safe operating areas
(for **BDX86B** and **BDX86C**)



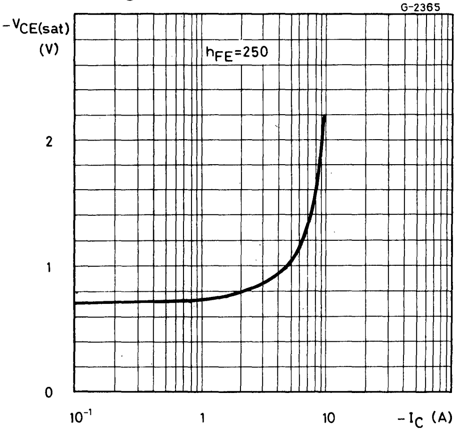
DC current gain



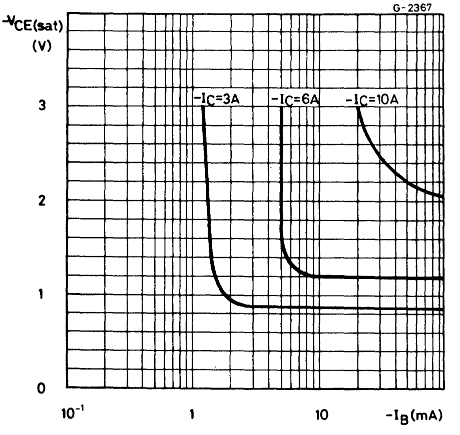
DC transconductance



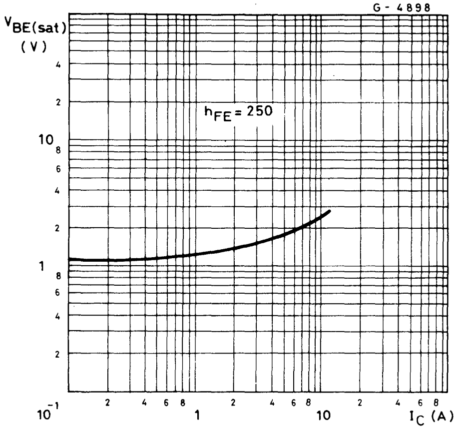
Collector-emitter saturation voltage



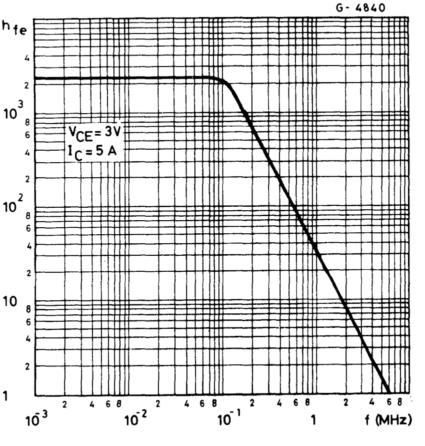
Collector-emitter saturation voltage



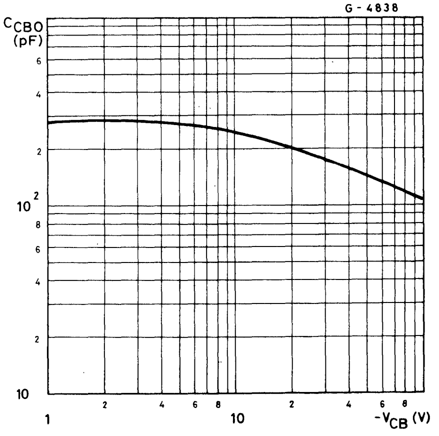
Base-emitter saturation voltage



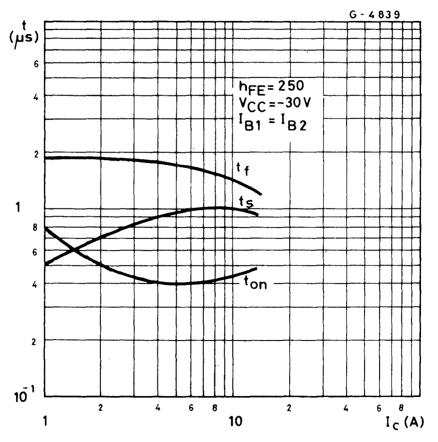
Small signal current gain



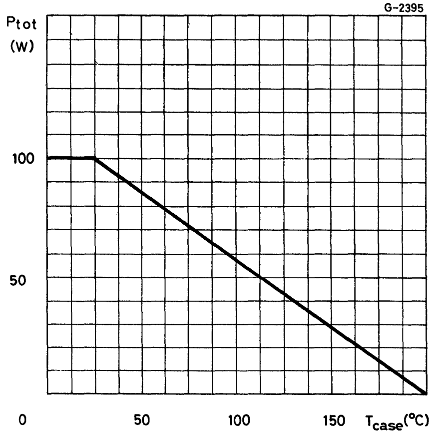
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

BDX87
BDX87A
BDX87B
BDX87C

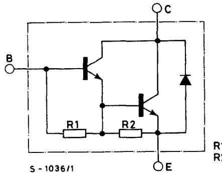
POWER DARLINGTONS

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			

INTERNAL SCHEMATIC DIAGRAM

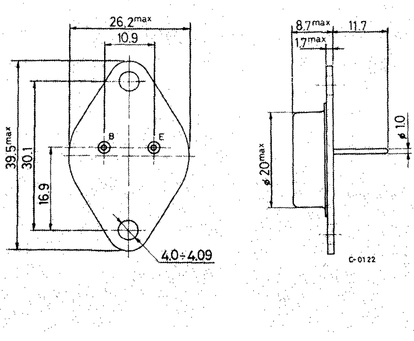


R1 Typ. 10kΩ
R2 Typ. 150Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

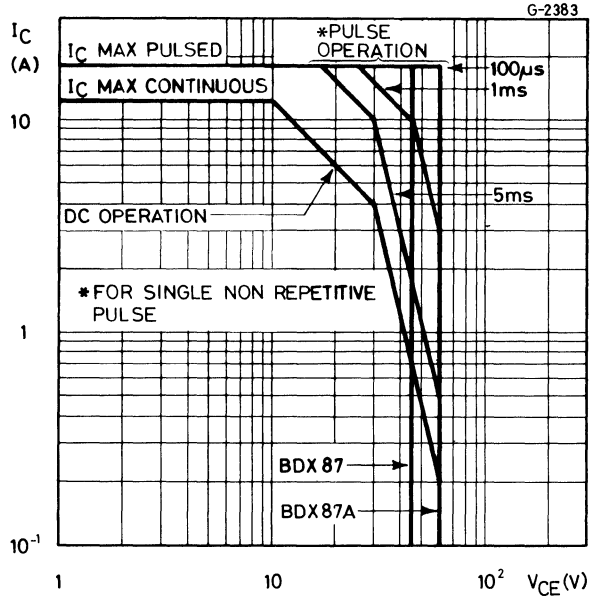
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.45	°C/W

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

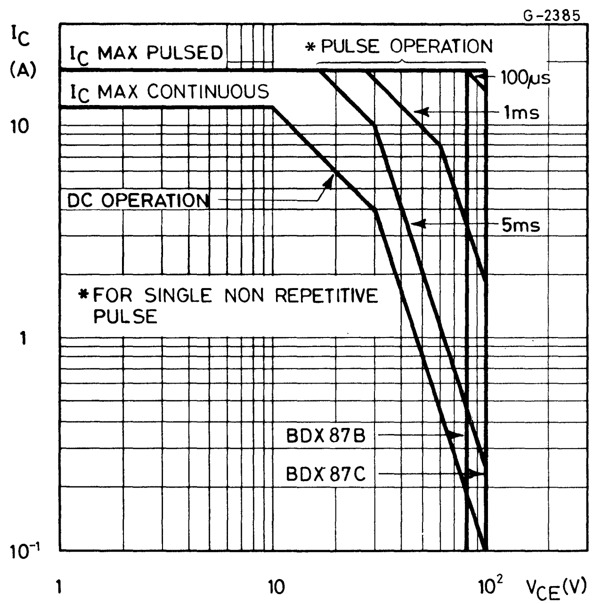
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX87** V_{CB} = 45 V for **BDX87A** V_{CB} = 60 V for **BDX87B** V_{CB} = 80 V for **BDX87C** V_{CB} = 100 V T_{case} = 150°C for **BDX87** V_{CB} = 45 V for **BDX87A** V_{CB} = 60 V for **BDX87B** V_{CB} = 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%

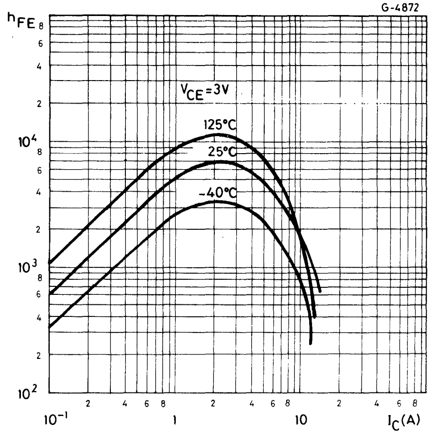
Safe operating areas
(for **BDX87** and **BDX87A**)



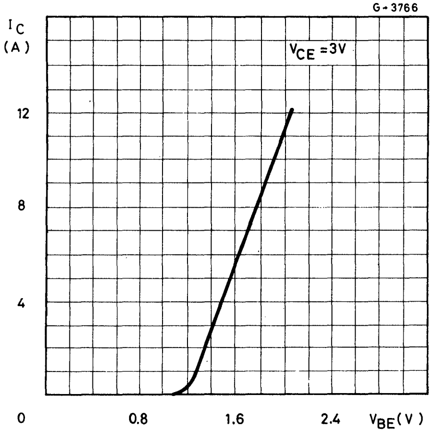
Safe operating areas
(for **BDX87B** and **BDX87C**)



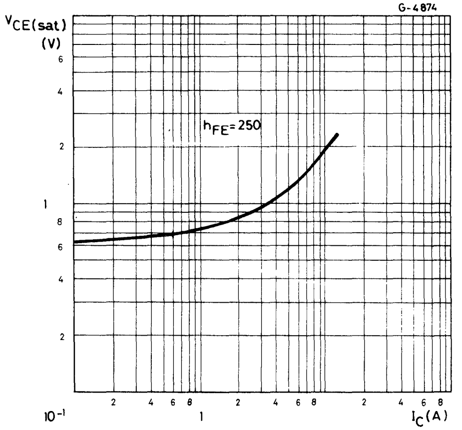
DC current gain



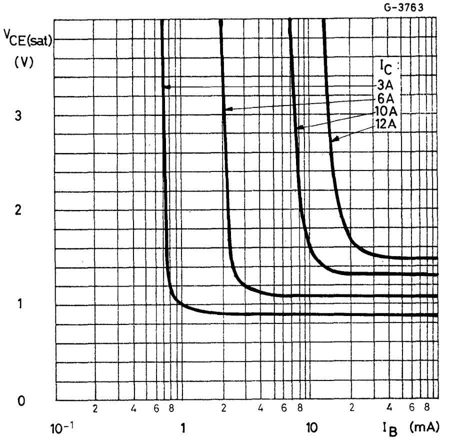
DC transconductance



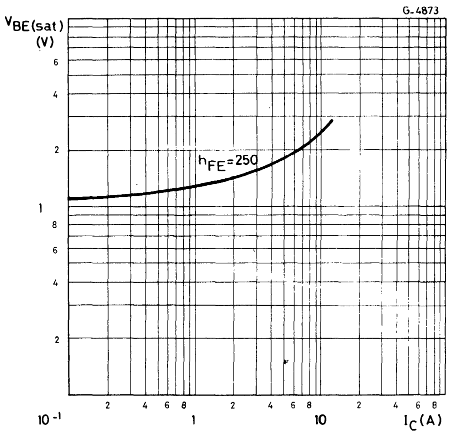
Collector-emitter saturation voltage



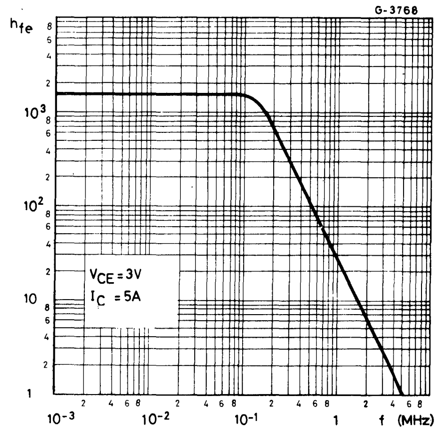
Collector-emitter saturation voltage



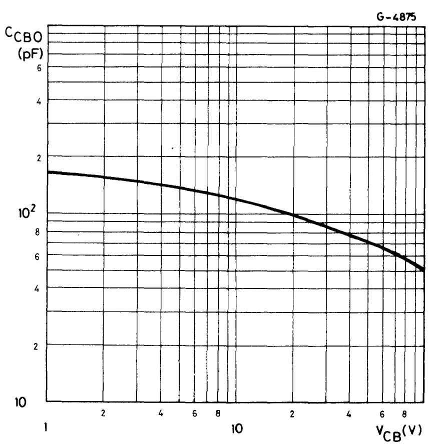
Base-emitter saturation voltage



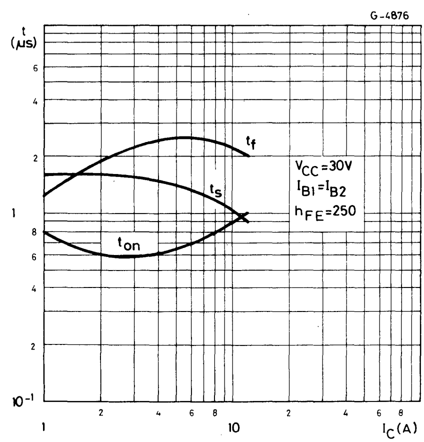
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



BDX88
BDX88A
BDX88B
BDX88C

EPITAXIAL-BASE PNP

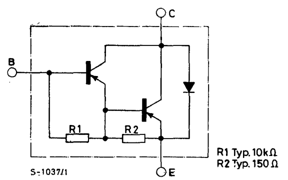
POWER DARLINGTONS

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

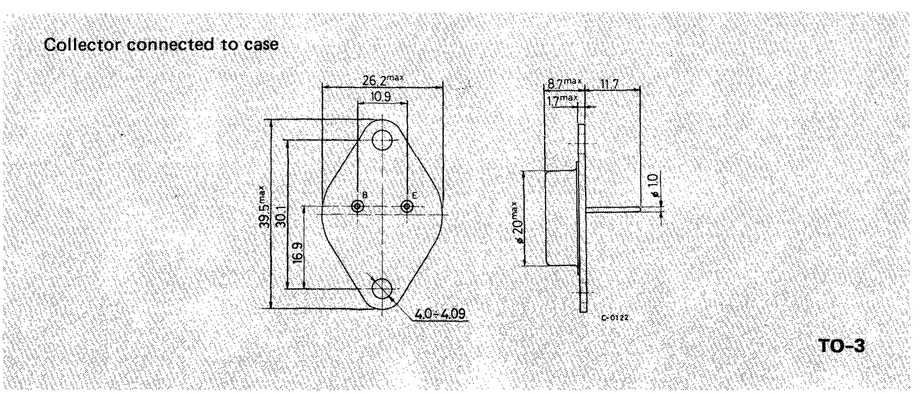
		BDX88	BDX88A	BDX88B	BDX88C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45V	-60V	-80V	-100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45V	-60V	-80V	-100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V			
I_C	Collector current	-12A			
I_{CM}	Collector peak current (repetitive)	-18A			
I_B	Base current	-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			

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



BDX88
BDX88A
BDX88B
BDX88C

THERMAL DATA

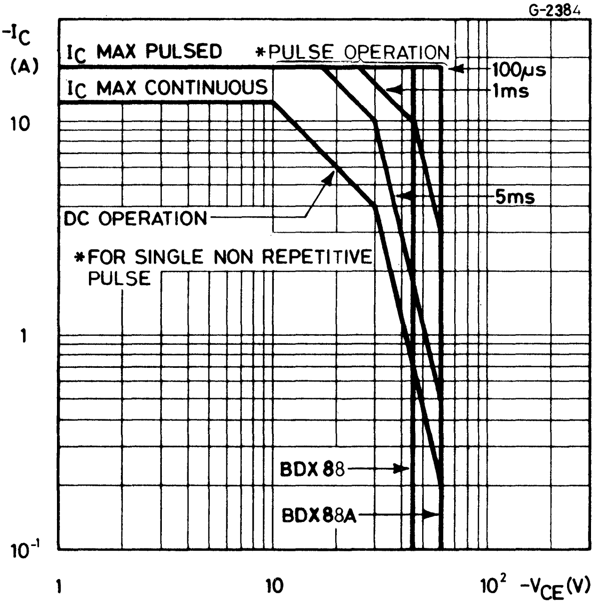
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.45	°C/W

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

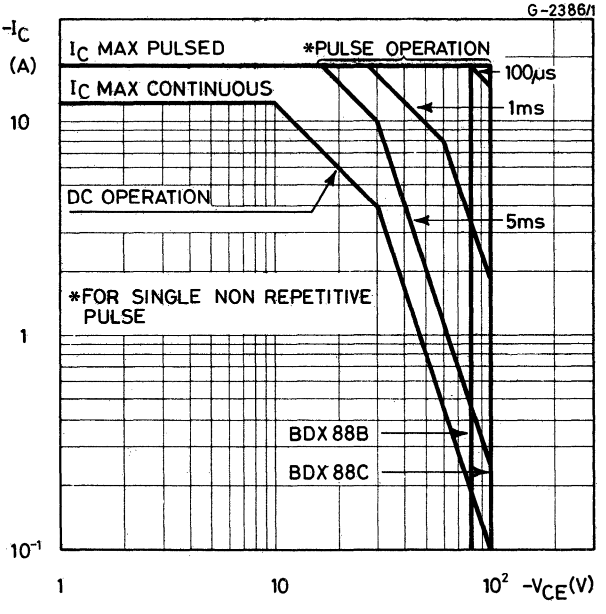
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX88** V_{CB} = -45 V			-500	μA
		for **BDX88A** V_{CB} = -60 V			-500	μA
		for **BDX88B** V_{CB} = -80 V			-500	μA
		for **BDX88C** V_{CB} = -100 V			-500	μA
		T_{case} = 150°C				
		for **BDX88** V_{CB} = -45 V			-5	mA
		for **BDX88A** V_{CB} = -60 V			-5	mA
		for **BDX88B** V_{CB} = -80 V			-5	mA
		for **BDX88C** V_{CB} = -100 V			-5	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX88** V_{CE} = -22 V			-1	mA
		for **BDX88A** V_{CE} = -30 V			-1	mA
		for **BDX88B** V_{CE} = -40 V			-1	mA
		for **BDX88C** V_{CE} = -50 V			-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 **BDX88**	-45			V
		for **BDX88A**	-60			V
		for **BDX88B**	-80			V
		for **BDX88C**	-100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -6A I_B = -24 mA			-2	V
		I_C = -12A I_B = -120 mA			-3	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	1000			—
		I_C = -6A V_{CE} = -3V	750		18000	—
		I_C = -12A V_{CE} = -3V	100			—
V_F	Parallel-diode forward voltage	I_F = 3A			1.8	V
		I_F = 8A		2.5		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%

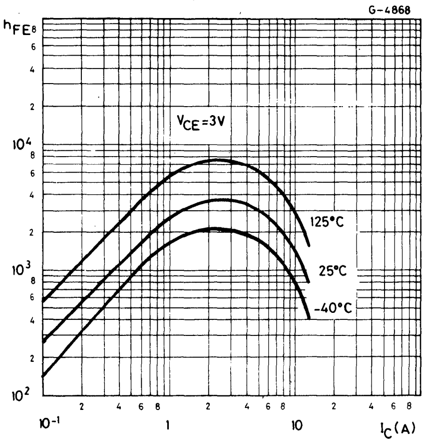
Safe operating areas
(for **BDX88** and **BDX88A**)



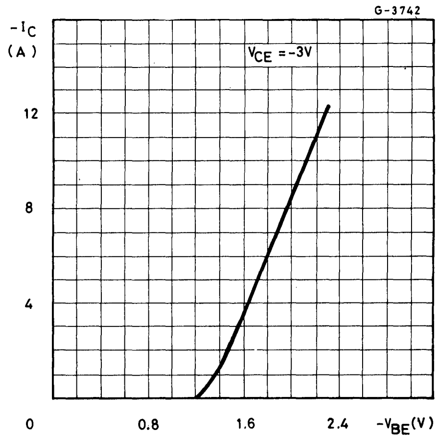
Safe operating areas
(for **BDX88B** and **BDX88C**)



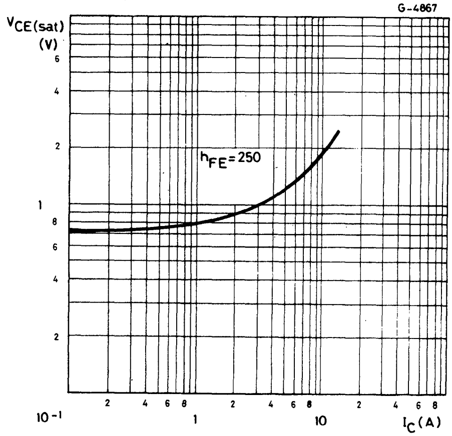
DC current gain



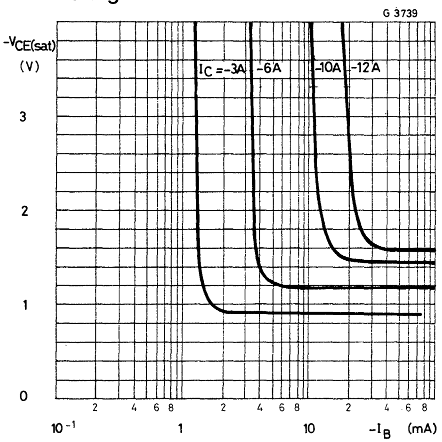
DC transconductance



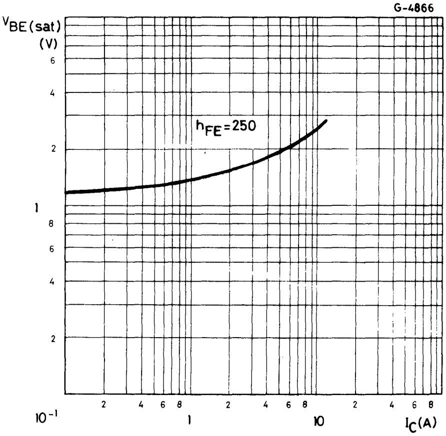
Collector-emitter saturation voltage



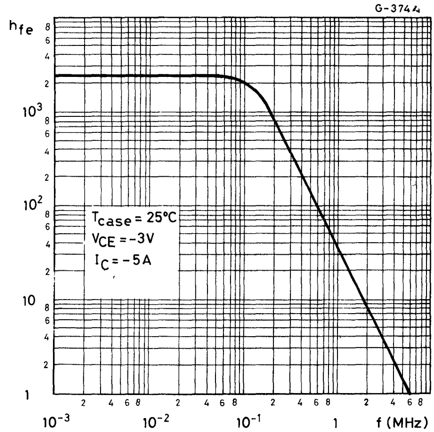
Collector-emitter saturation voltage



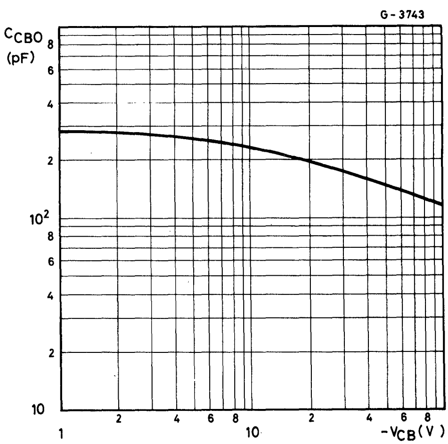
Base-emitter saturation voltage



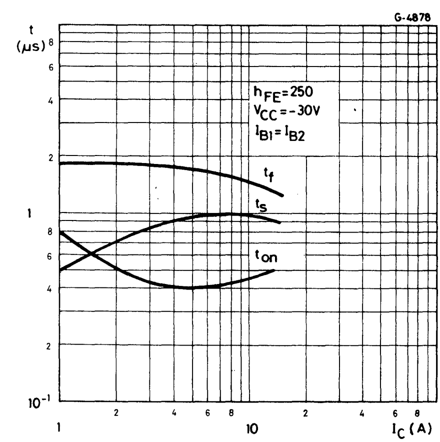
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



MULTIEPITAXIAL PLANAR NPN

BDY57
BDY58

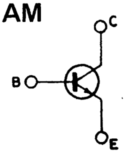
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTORS

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

		BDY 57	BDY 58
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	160V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	80V	125V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	10V	
I_C	Collector current	25A	
I_B	Base current	6A	
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	

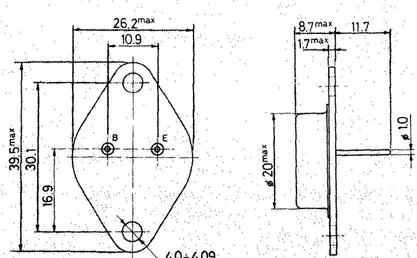
INTERNAL SCHEMATIC DIAGRAM



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_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 120V$			1	mA
I_{CER}	Collector cutoff current	$V_{CE} = 80V$ $R_{BE} = 10\Omega$ $T_{case} = 100°C$			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 $\leq 2\%$.

BDY90
BDY91
BDY92

MULTIEPITAXIAL PLANAR NPN

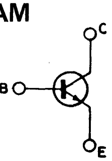
HIGH CURRENT, HIGH SPEED TRANSISTORS

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

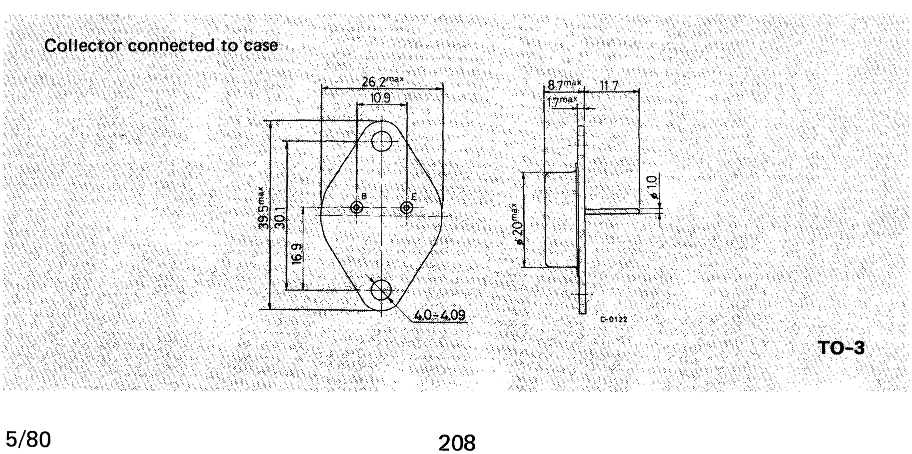
		BDY 90	BDY 91	BDY 92
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	100V	80V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1{,}5V$)	120V	100V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	100V	80V	60V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		6V	
I_C	Collector current		10A	
I_{CM}	Collector peak 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	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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	$I_C = 0.5A$ $V_{CE} = 5V$ $f = 5MHz$		70		MHz
t_{on}	Turn-on time	$I_C = 5A$ $I_{B1} = 0.5A$ $V_{CC} = 30V$			0.35	μs
t_s	Storage time	$I_C = 5A$ $I_{B1} = -I_{B2} = 0.5A$ $V_{CC} = 30V$			1.3	μs
t_f	Fall time				0.2	μs

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

SGS **BFX34**

EPITAXIAL PLANAR NPN

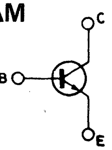
HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

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

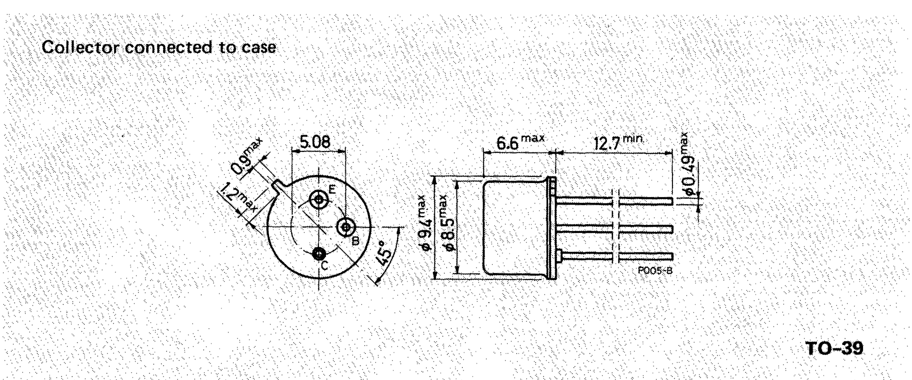
V_{CBO}	Collector-base voltage ($I_E = 0$)	120	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	0.87	W
	$T_{case} \leq 25°C$	5	W
T_{stg}	Storage temperature	-65 to 200	°C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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



TO-39

THERMAL DATA

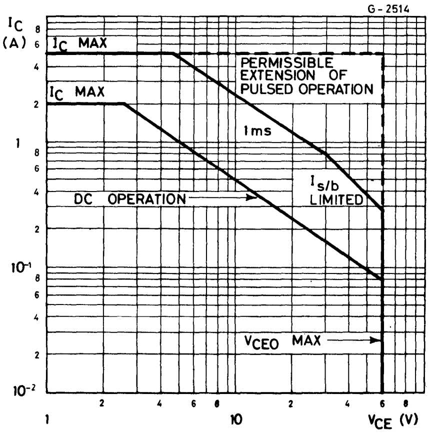
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

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

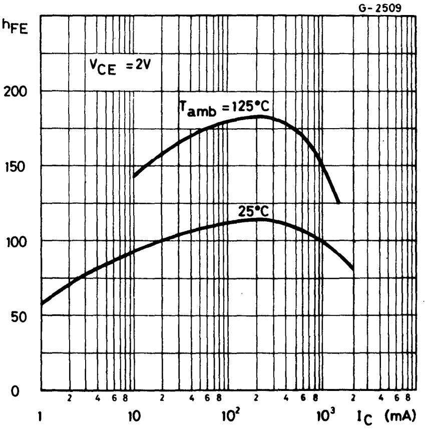
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 60V		0.02	10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 4V		0.05	10	μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 5mA	120			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining 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%

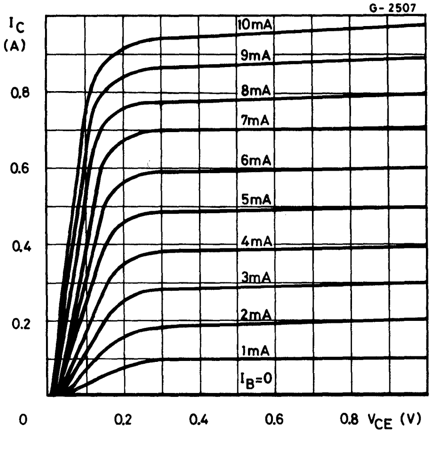
Safe operating areas



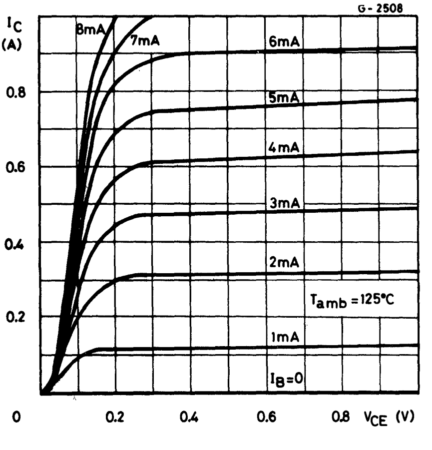
DC current gain



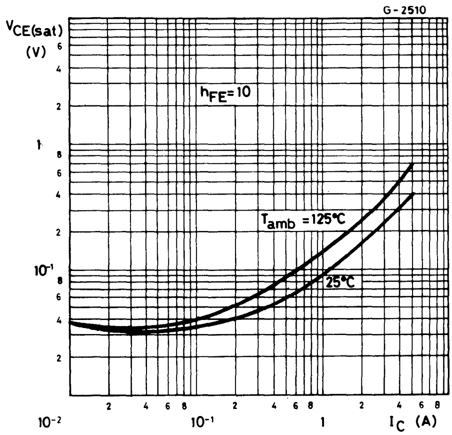
Output characteristics



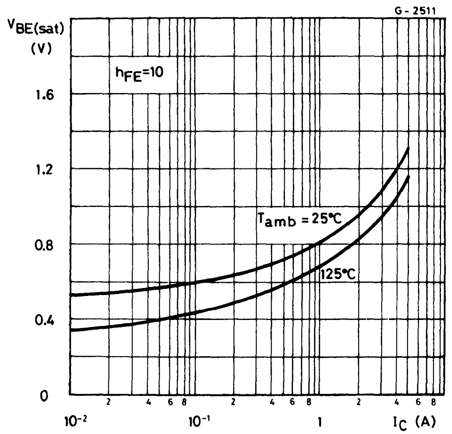
Output characteristics



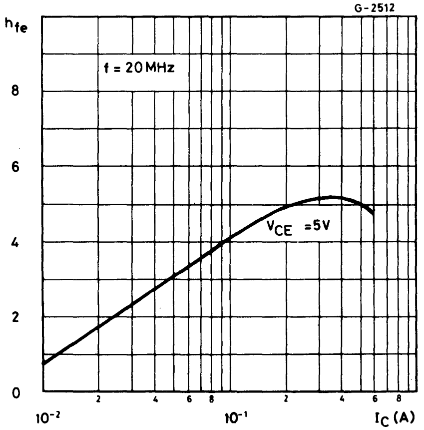
Collector-emitter saturation voltage



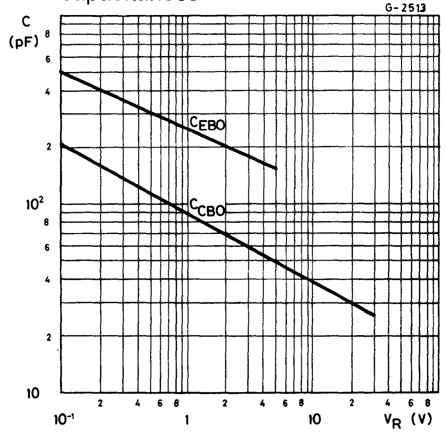
Base-emitter saturation voltage



Small signal current gain



Emitter-base and collector-base capacitances



BSS44

EPITAXIAL PLANAR PNP

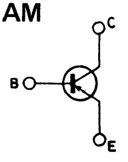
HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

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

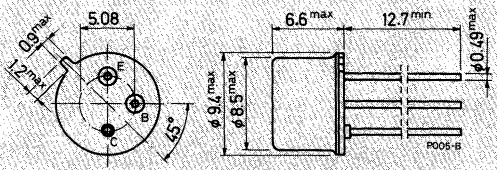
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

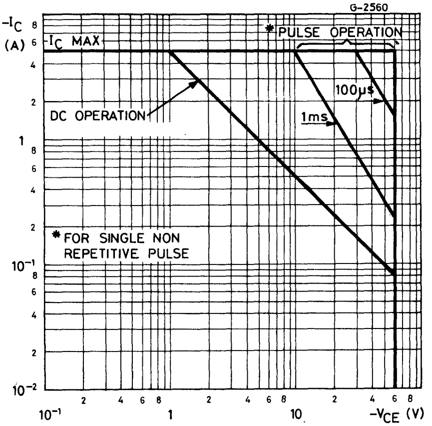
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

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

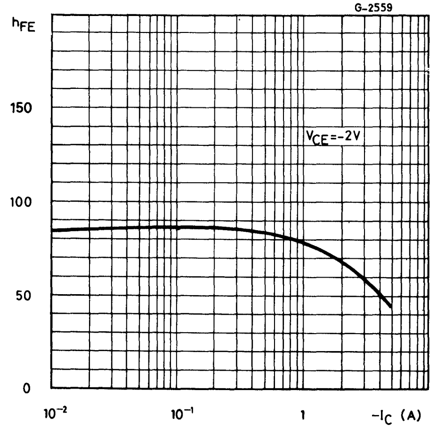
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = -60V			-0.5	μA
$V_{(BR)\ CBO}$	Collector-base breakdown voltage (I_E = 0)	I_C = -1 mA	-65			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -50 mA	-60			V
V_{EBO}*	**Emitter-base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

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

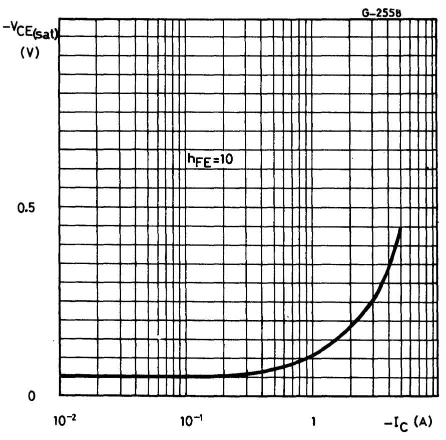
Safe operating areas



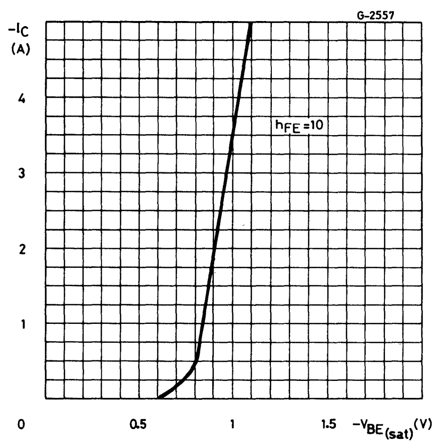
DC current gain



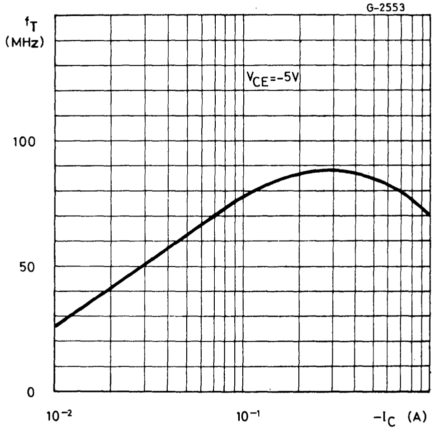
Collector-emitter saturation voltage



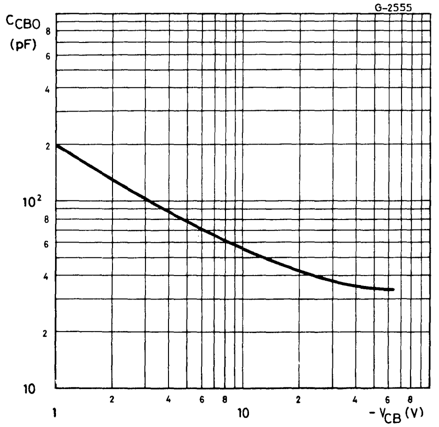
Base-emitter saturation voltage



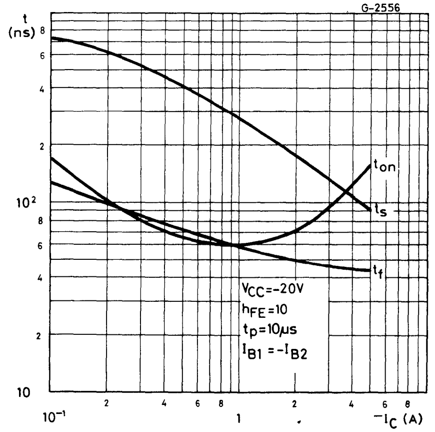
Transition frequency



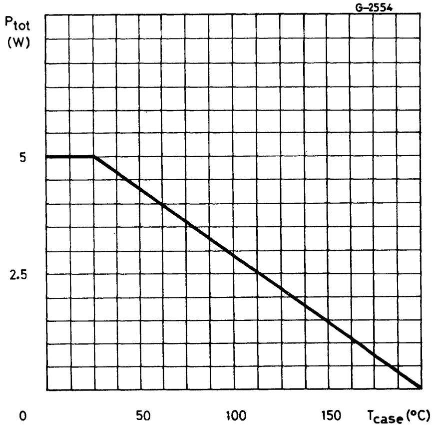
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BSW67
BSW68

EPITAXIAL PLANAR NPN

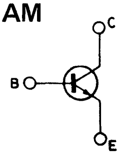
HIGH VOLTAGE SWITCH

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 $T_{amb} \leq 45°C$	0.7W	
	$T_{case} \leq 25°C$	5W	
	$T_{case} \leq 100°C$	2.85W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

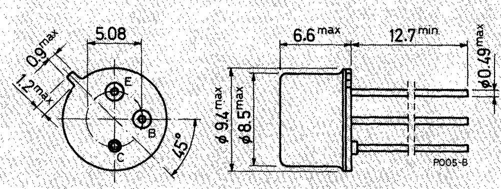
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

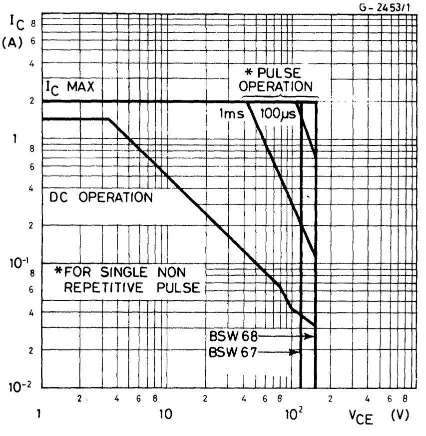
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	220	°C/W

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

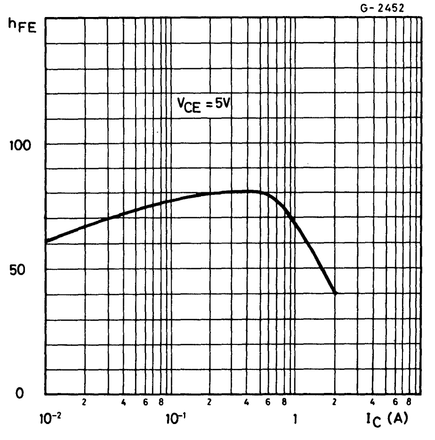
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BSW 67**				
		V_{CB} = 60 V			100	nA
		V_{CB} = 60 V T_{case} = 150°C			50	μA
		for **BSW 68**				
		V_{CB} = 75 V			100	nA
		V_{CB} = 75 V T_{case} = 150°C			50	μA
$V_{(BR)\ CBO}$	Collector-base breakdown 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%

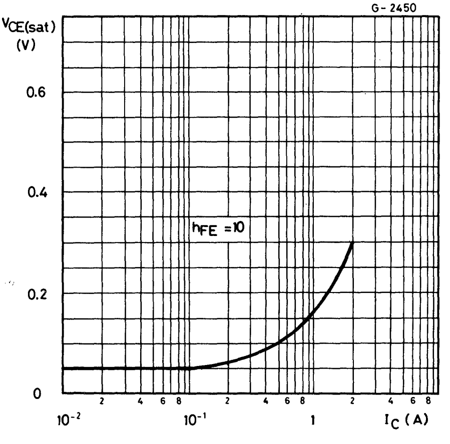
Safe operating areas



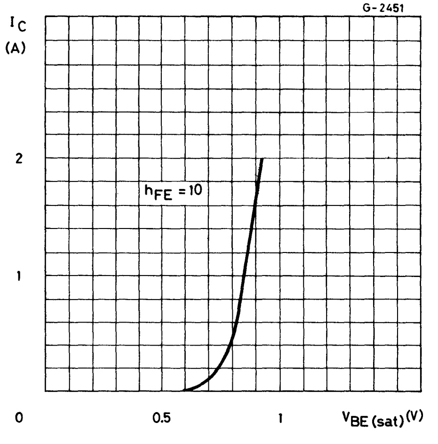
DC current gain



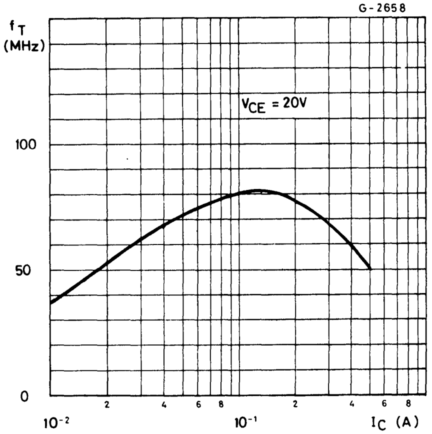
Collector-emitter saturation voltage



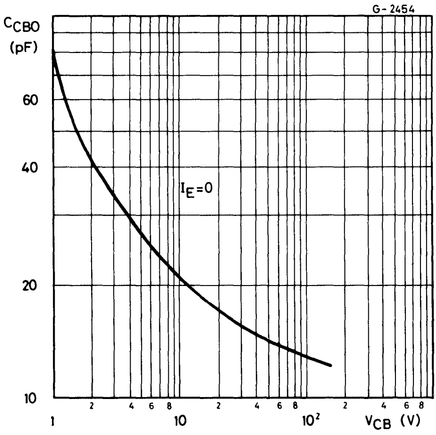
Base-emitter saturation voltage



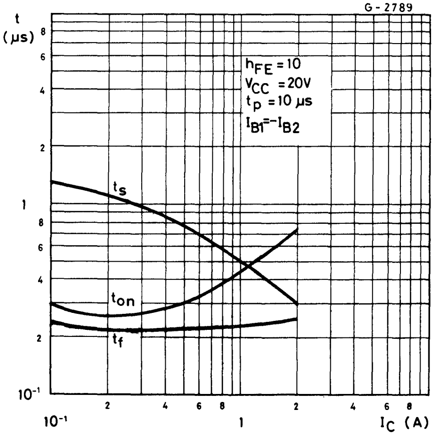
Transition frequency



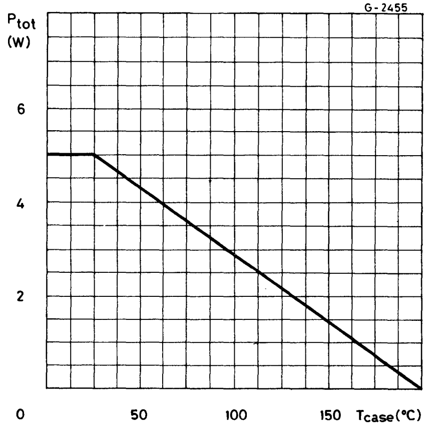
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU125

EPITAXIAL PLANAR NPN

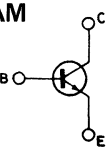
HIGH CURRENT,GENERAL PURPOSE TRANSISTOR

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 $T_{amb} \leqslant 25°C$	1	W
	$T_{case} \leqslant 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

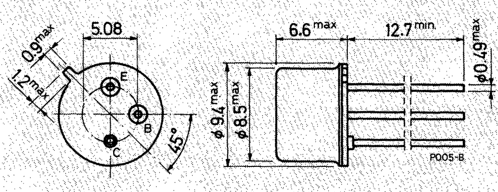
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

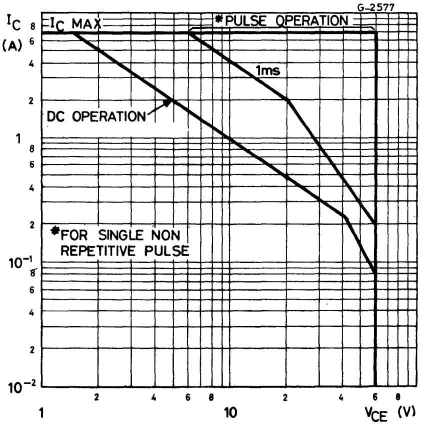
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

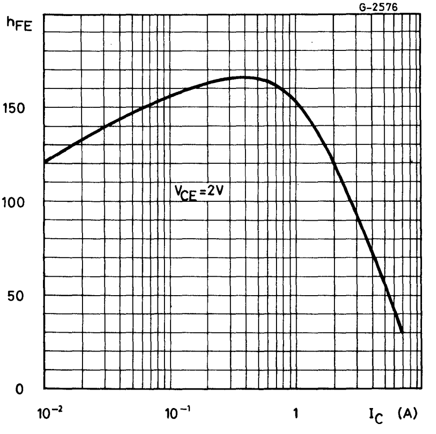
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 100 V		0.02	10	μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 1 mA	130			V
$V_{(BR)\ CES}$*	Collector-emitter breakdown voltage (V_{BE} = 0)	I_C = 1 mA	130			V
$V_{CEO\ (sus)}$*	Collector-emitter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

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

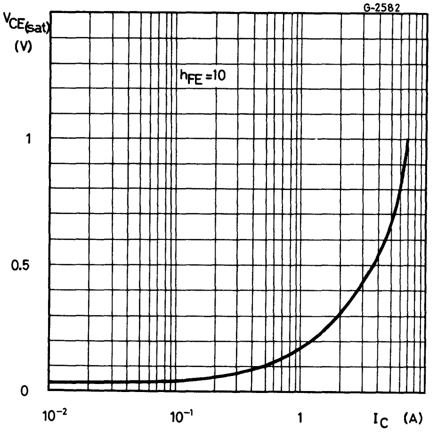
Safe operating areas



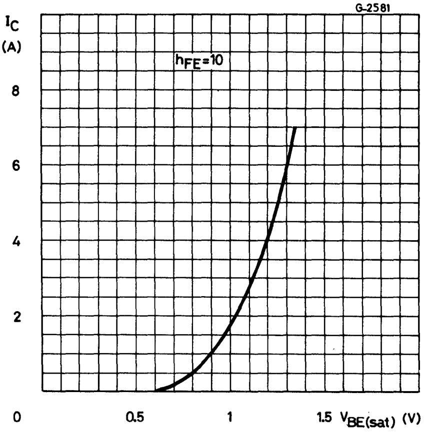
DC current gain



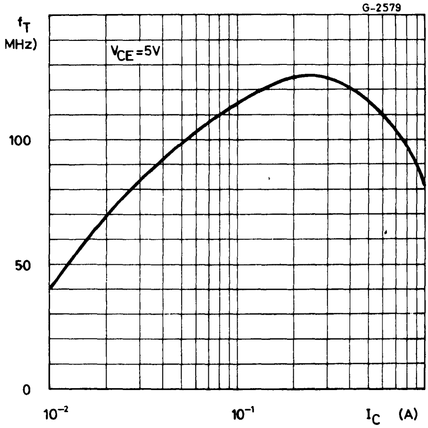
Collector-emitter saturation voltage



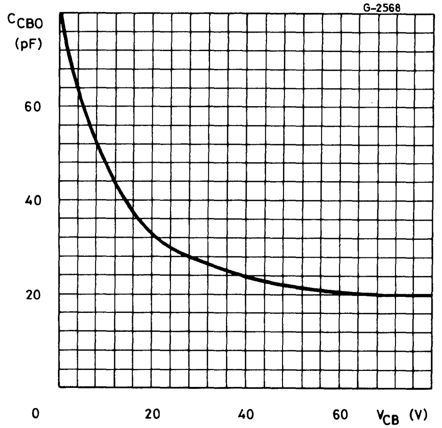
Base-emitter saturation voltage



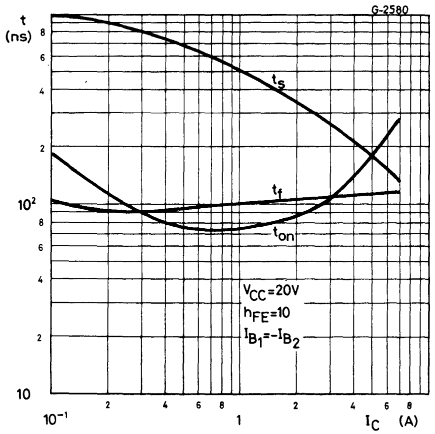
Transition frequency



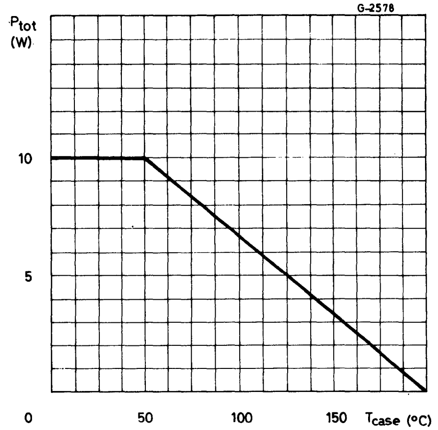
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU125S

EPITAXIAL PLANAR NPN

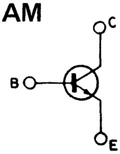
HIGH VOLTAGE POWER AMPLIFIER

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 $T_{amb} \leqslant 25°C$	1	W
	$T_{case} \leqslant 50°C$	10	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

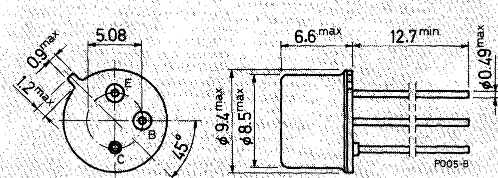
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

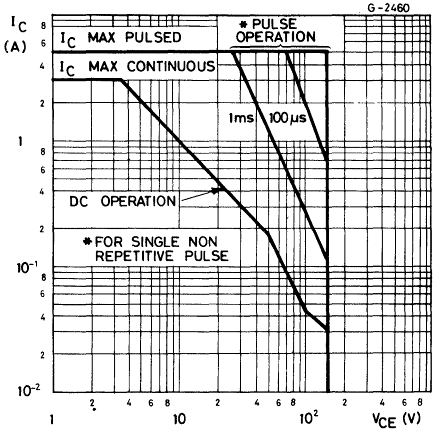
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

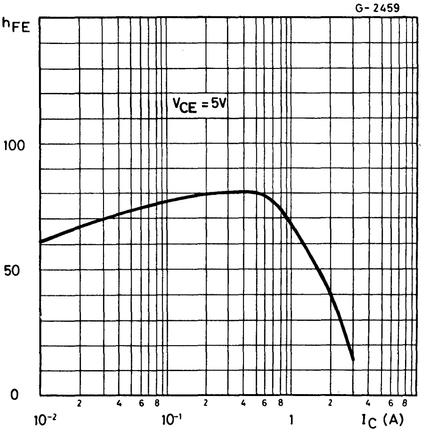
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 200 V			10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6 V			1	mA
V_{CBO}	Collector-base voltage (I_E = 0)	I_C = 1mA	250			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 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%

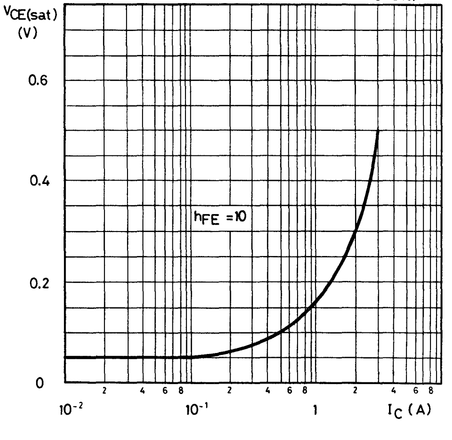
Safe operating areas



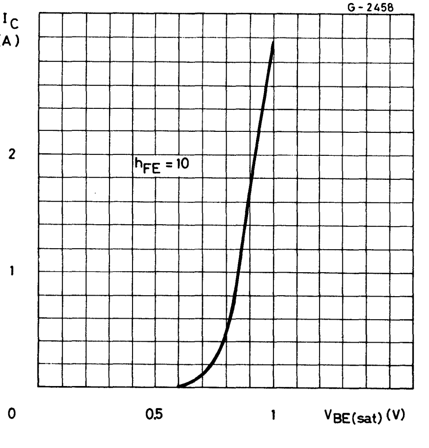
DC current gain



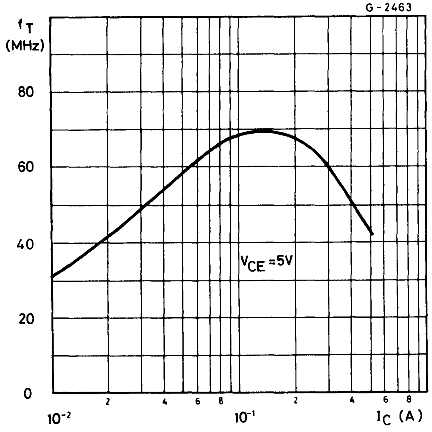
Collector-emitter saturation voltage



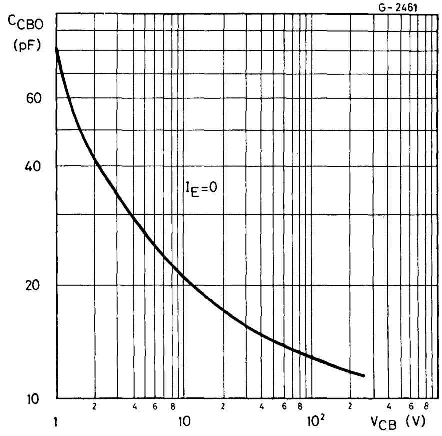
Base-emitter saturation voltage



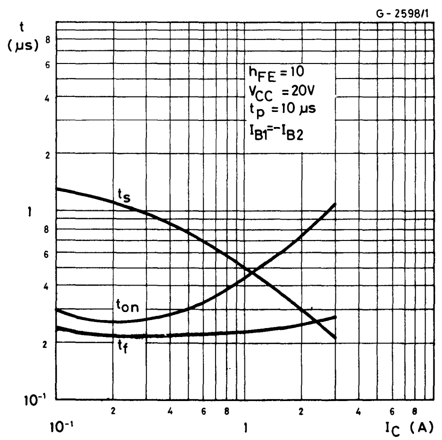
Transition frequency



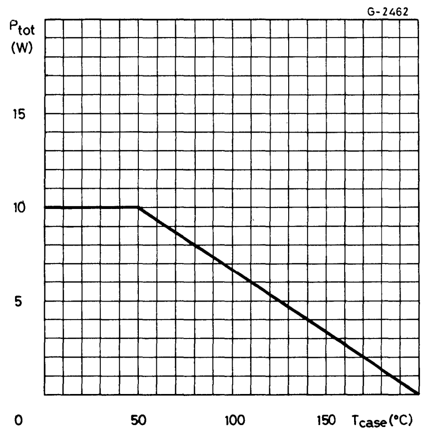
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BU325

EPITAXIAL PLANAR NPN

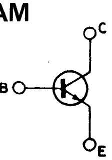
HIGH VOLTAGE SWITCH

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

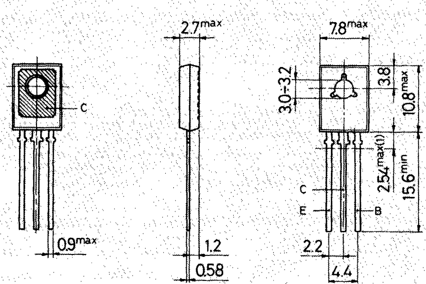
V_{CBO}	Collector-base voltage ($I_E = 0$)	200	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	3	A
I_B	Base current	1	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25\,°C$	1.25	W
	$T_{case} \leq 25\,°C$	25	W
T_{stg}	Storage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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

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)

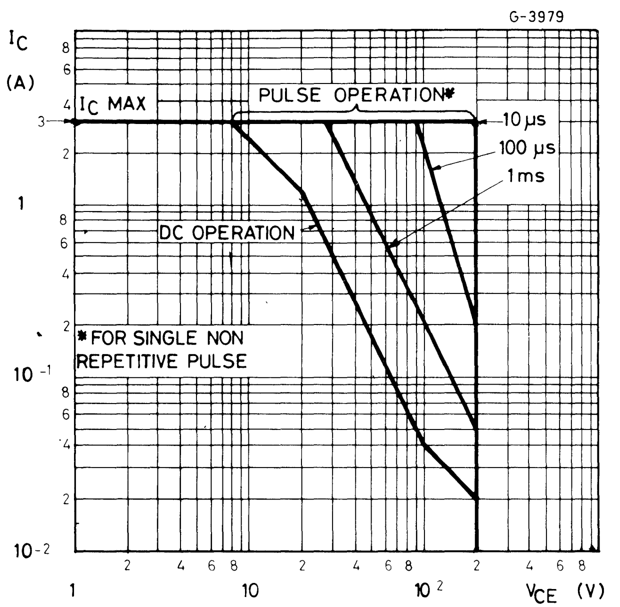
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 200$ V			100	µA
V_{CBO}	Collector base breakdown voltage ($I_E = 0$)	$I_C = 100$ µA	200			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 10$ mA	200			V
V_{EBO}*	Emitter-base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

ELECTRICAL CHARACTERISTICS (continued)

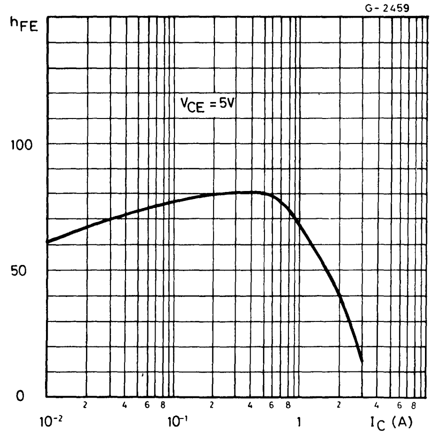
Parameter		Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C =500mA V_{CE}=5V	40	MHz
C_{CBO}	Collector-base capacitance	I_E =0 V_{CB}=10V f =1MHz	50	pF
t_{on}	Turn-on time	I_C =0.5A I_{B1} =50mA V_{CC}=20V	0.3	μs
t_{off}	Turn-off time	I_C =0.5A I_{B1} =-I_{B2} =50mA V_{CC}=20V	1	μs

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

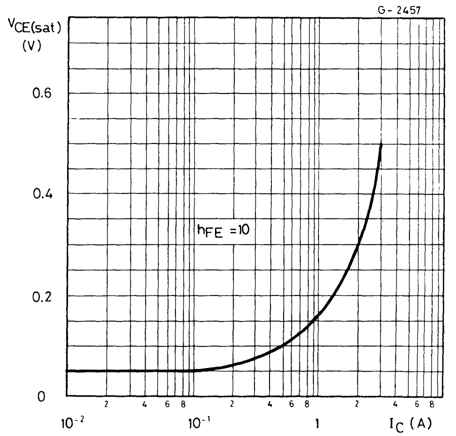
Safe operating areas



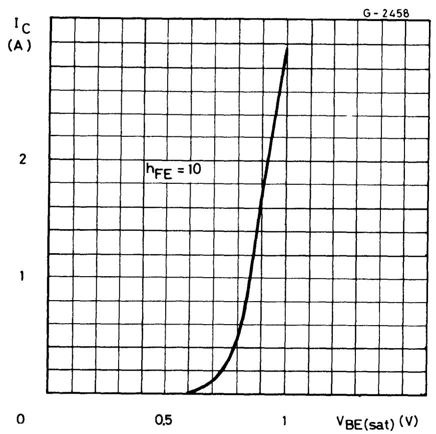
DC current gain



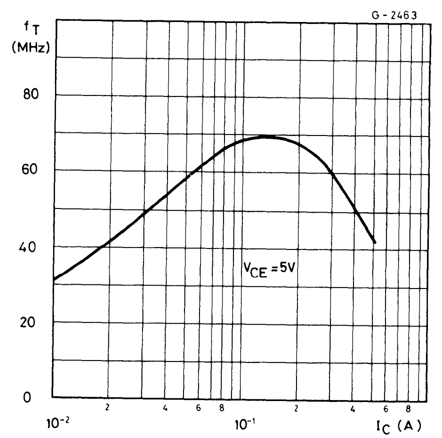
Collector-emitter saturation voltage



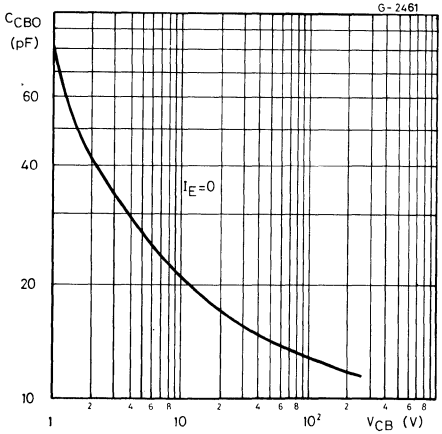
Base-emitter saturation voltage



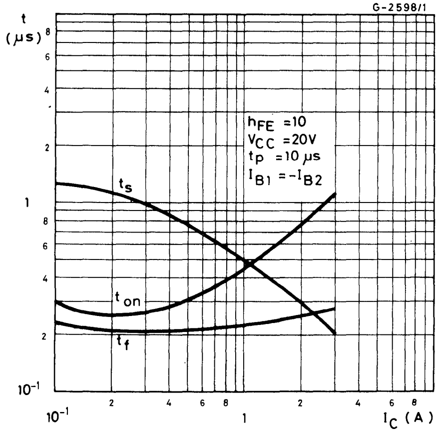
Transition frequency



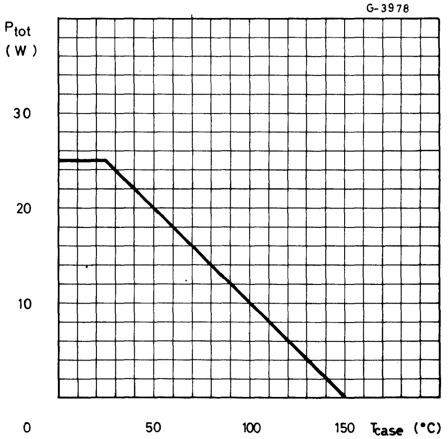
Collector-emitter saturation voltage



Saturated switching characteristics



Power rating chart



MULTIEPITAXIAL MESA NPN

BU326

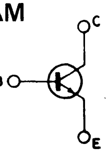
HIGH VOLTAGE POWER SWITCH

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

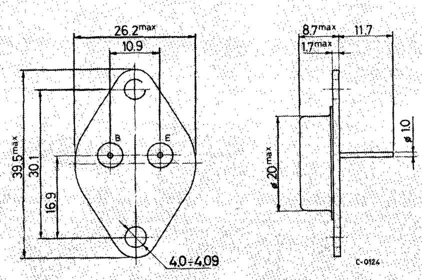
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

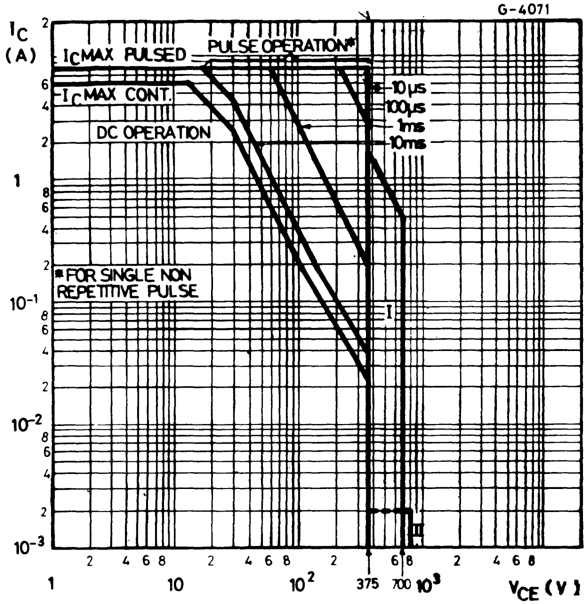
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.33	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	$V_{CE}=800V$ $V_{CE}=800V$ $T_{case}=125\,°C$			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%

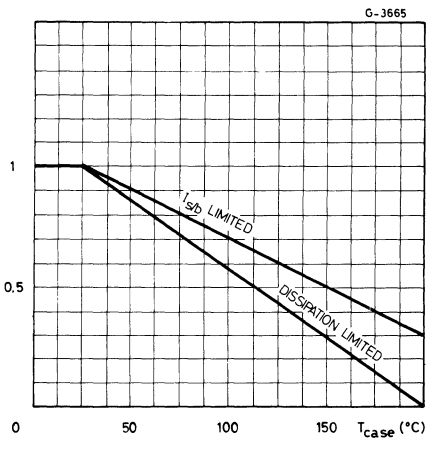
Safe operating areas



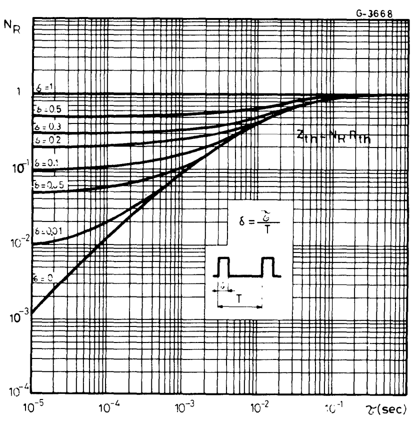
I — Area of permissible operation during turn-on provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0.6$ µs

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

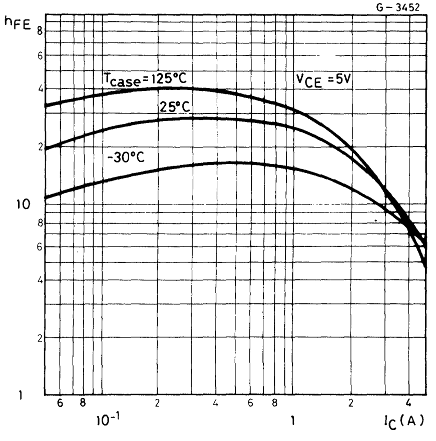
Derating curves



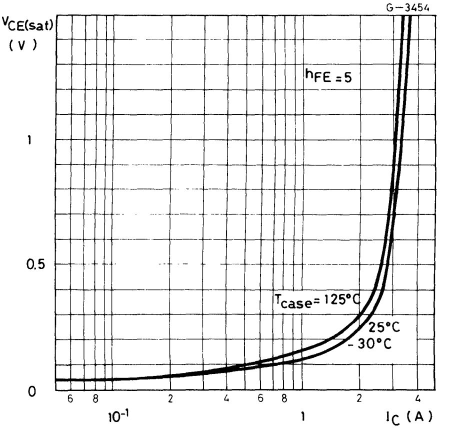
Thermal transient response



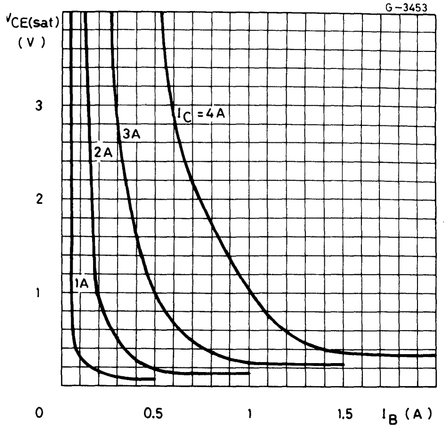
DC current gain



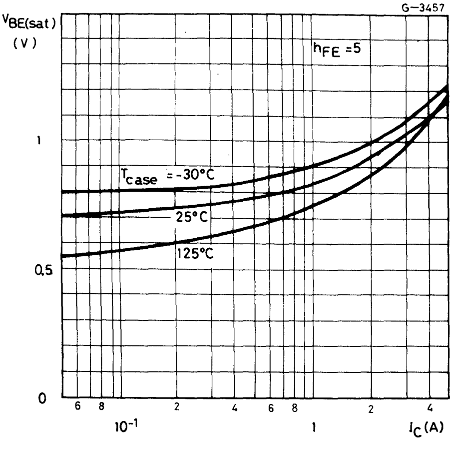
Collector-emitter saturation voltage



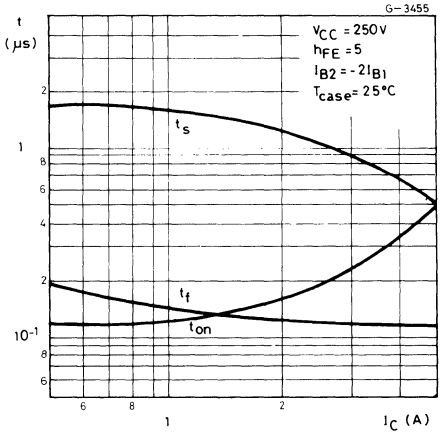
Collector-emitter saturation voltage



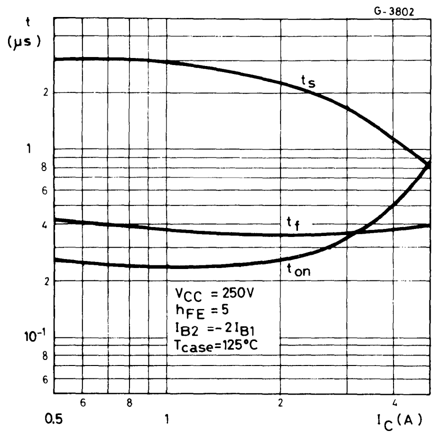
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



BU326A

MULTIEPITAXIAL MESA NPN

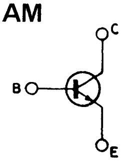
HIGH VOLTAGE POWER SWITCH

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

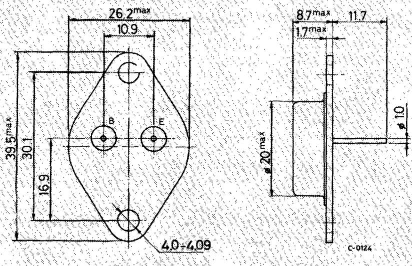
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

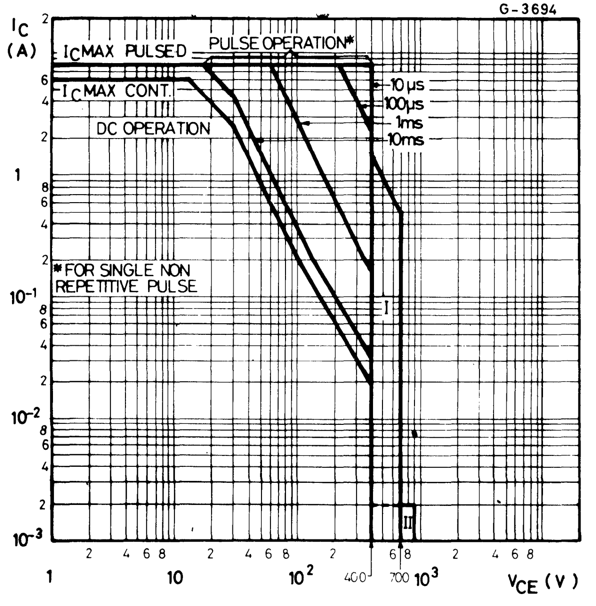
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.33	°C/W

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}=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%

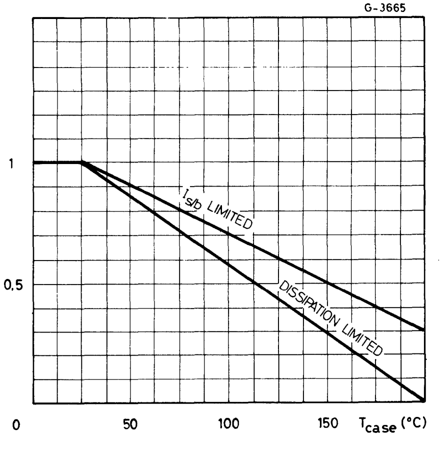
Safe operating areas



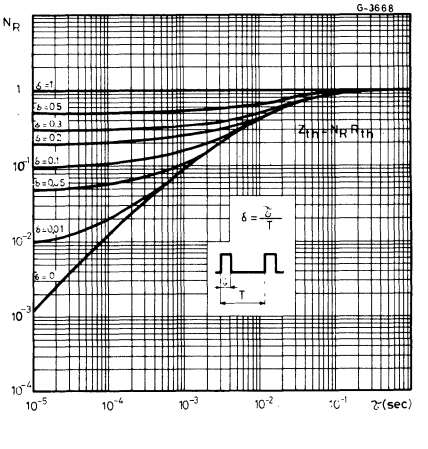
I — Area of permissible operation during turn – on provided $R_{BE} = 100\Omega$ and $t_p \leq 0.6\ \mu s$

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

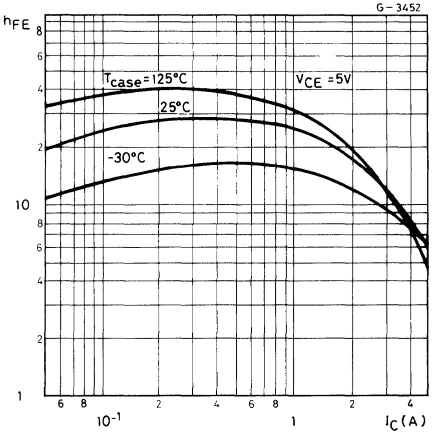
Derating curves



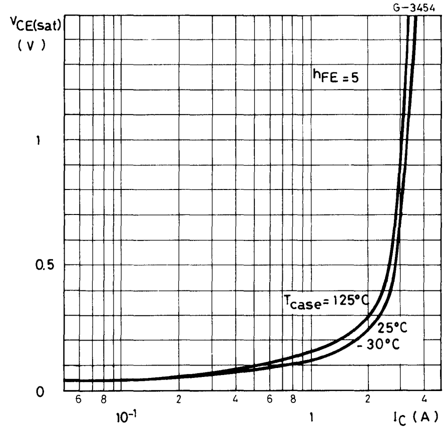
Thermal transient response



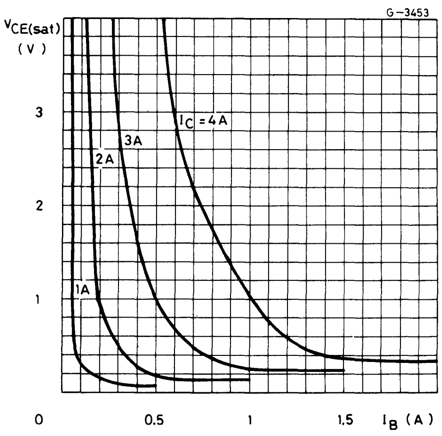
DC current gain



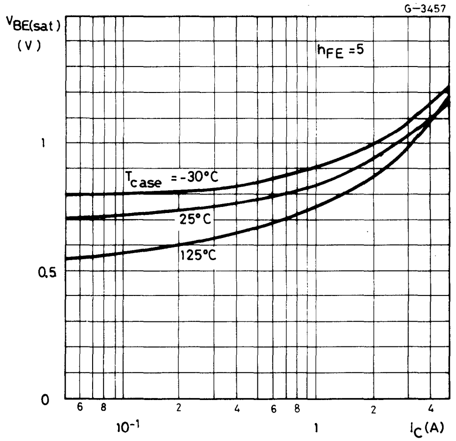
Collector-emitter saturation voltage



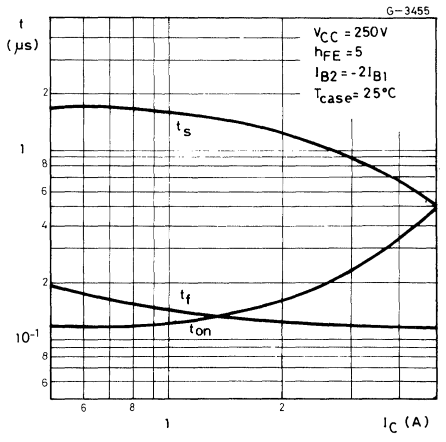
Collector-emitter saturation voltage



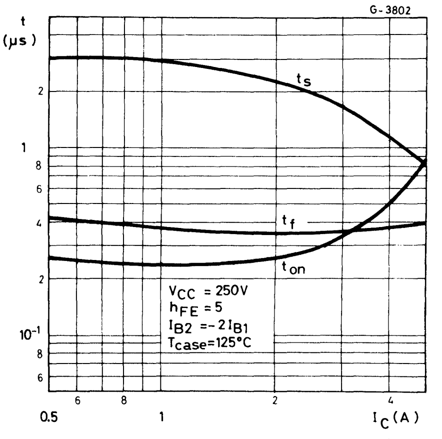
Base-emitter saturation voltage



Saturated switching characteristics



Saturated switching characteristics



BU326S

MULTIEPITAXIAL MESA NPN

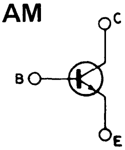
HIGH VOLTAGE POWER SWITCH

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 $T_{case} \leqslant 75°C$	60	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

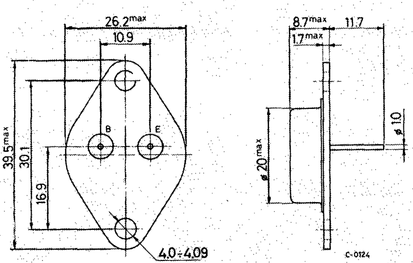
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

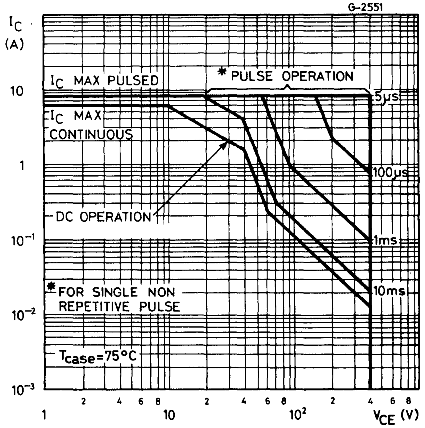
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W

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

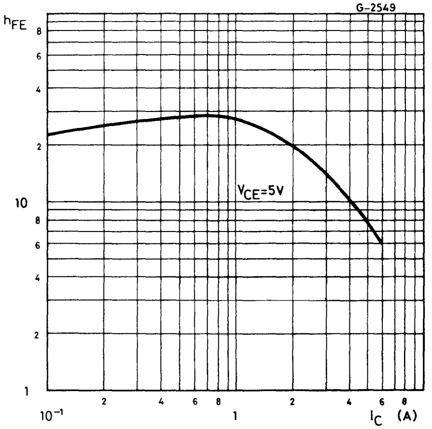
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	V_{CE} = 800 V V_{CE} = 800 V T_{case} = 150°C			1 3	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 7 V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100mA	400			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%

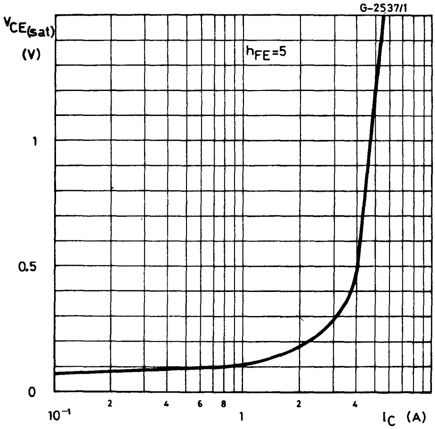
Safe operating areas



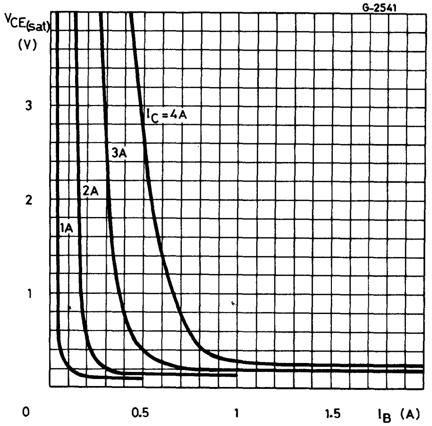
DC current gain



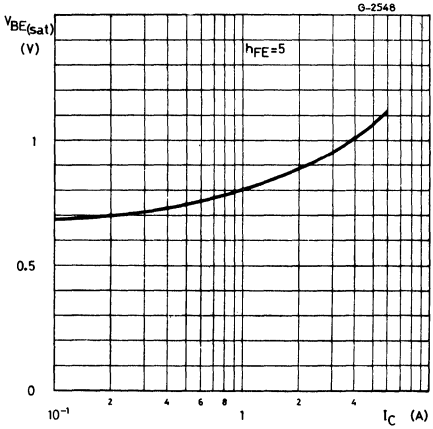
Collector-emitter saturation voltage



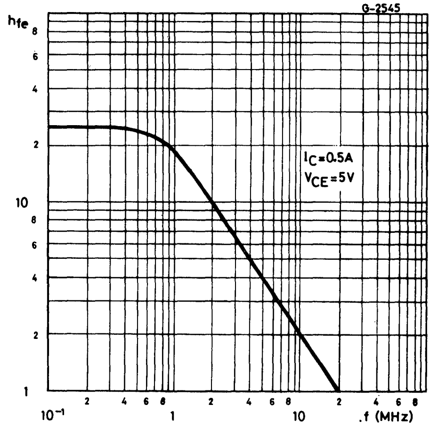
Collector-emitter saturation voltage



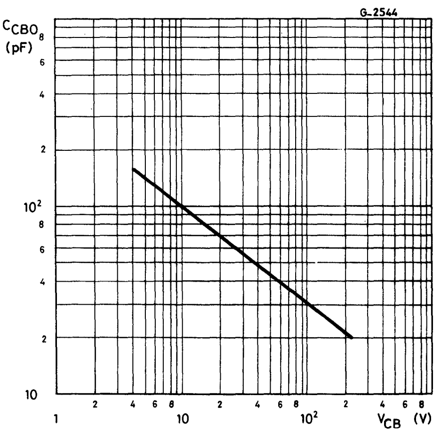
Base-emitter saturation voltage



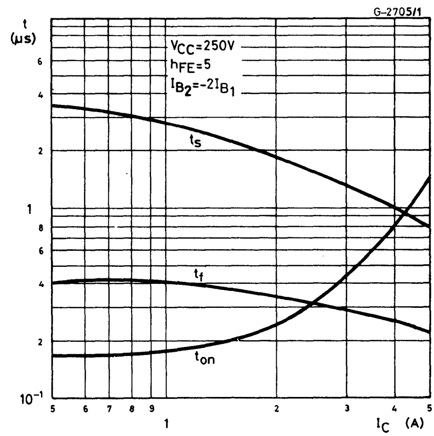
Small signal current gain



Collector-base capacitance



Saturated switching characteristics



EPITAXIAL PLANAR NPN

BU406
BU406H
BU408

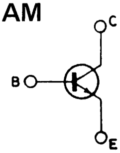
HORIZONTAL TV DEFLECTORS

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 $T_{case} \leqslant 25$ °C	60	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

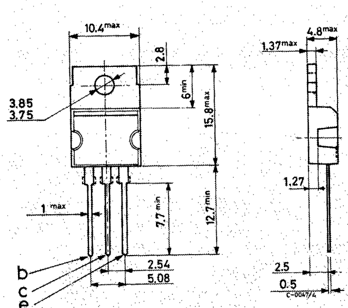
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

SGS

BU406
BU406H
BU408

THERMAL DATA

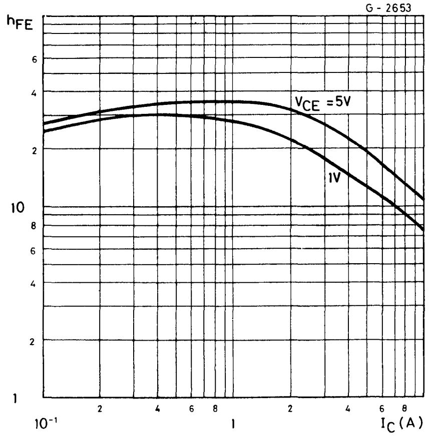
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

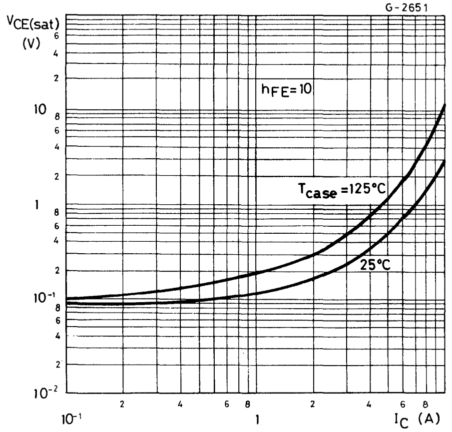
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	V_{CE} = 400 V				5	mA
		V_{CE} = 250 V				100	μA
		V_{CE} = 250 V	T_{case} = 150°C			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 6 V				1	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	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

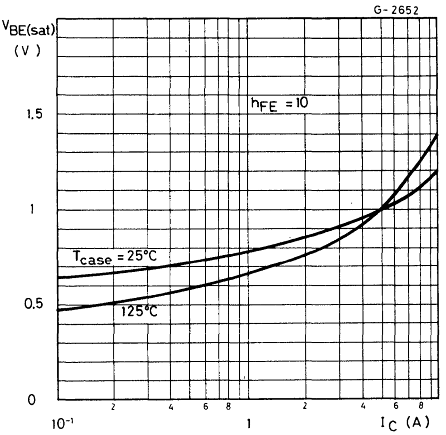
DC current gain



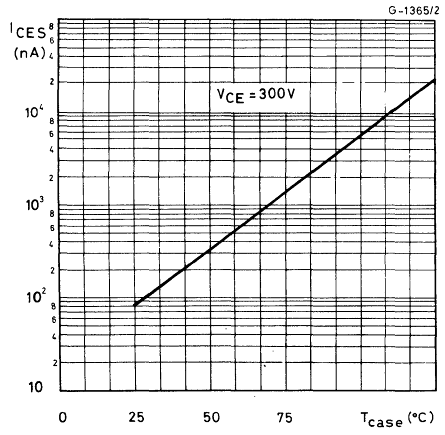
Collector-emitter saturation voltage



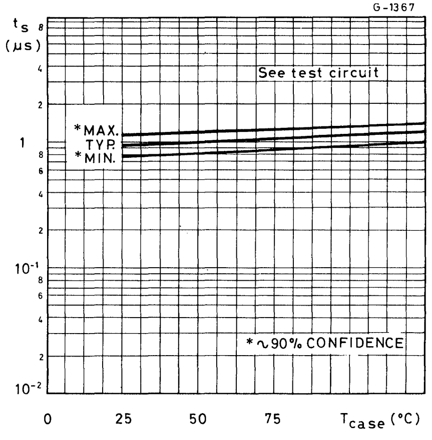
Base-emitter saturation voltage



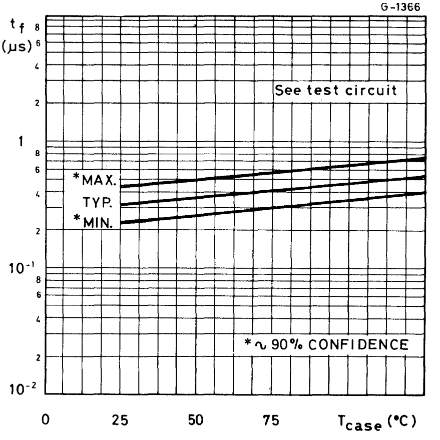
Collector cutoff current



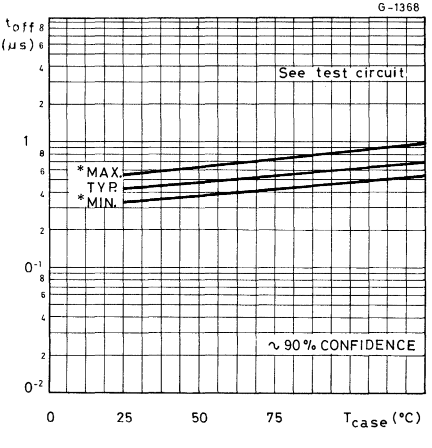
Storage time



Fall time

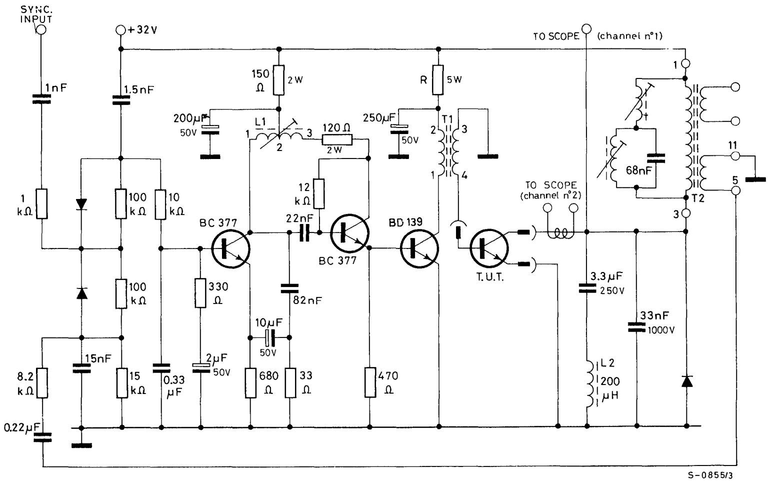


Turn-off time



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 B 62120 25×4×2

L2 Horizontal yoke=200 μH

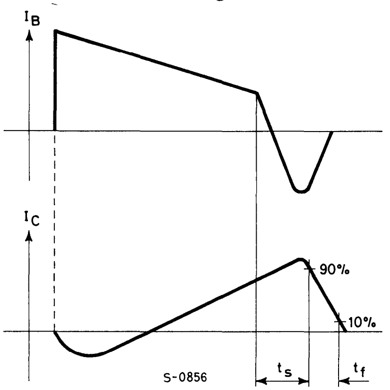
T1 Driver transformer: Pins 1–2=125 turns Ø 0.2 mm;
Pins 3–4=25 turns Ø 0.4 mm; Gap = 0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

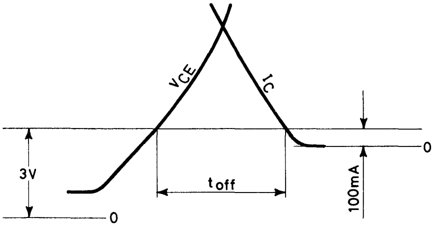
R = 330 Ω for BU406
R = 220 Ω for BU406H
R = 180 Ω for BU408

Waveforms

Fall and storage time



Turn-off time

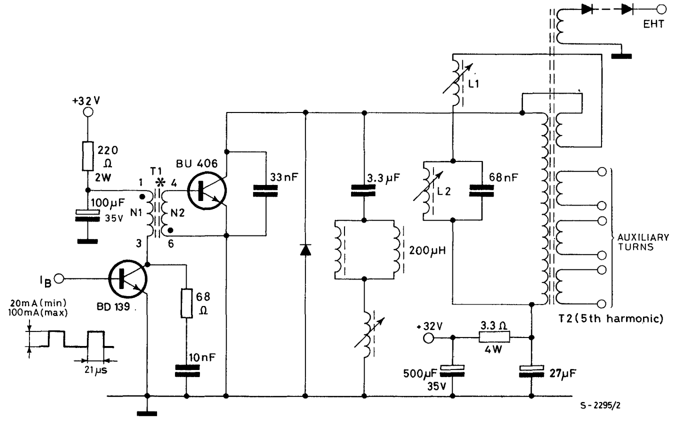


Turn-off time is the time for the collector current I_C to decrease to 100 mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

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

EPITAXIAL PLANAR NPN

SGS

BU406D
BU407D
BU408D

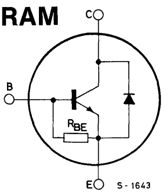
HORIZONTAL TV DEFLECTORS

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	

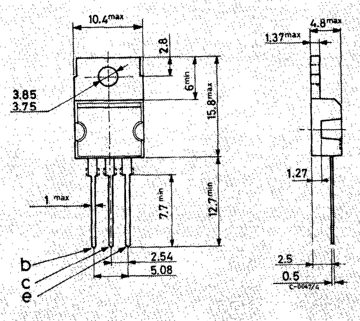
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

6/77

BU406D
BU407D
BU408D

THERMAL DATA

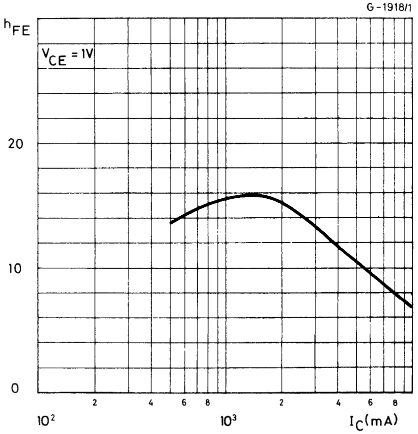
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

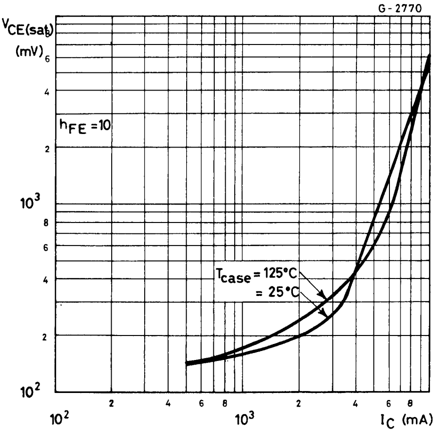
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current ($V_{BE} = -1.5V$)	for **BU406D** and **BU408D** $V_{CE} = 400$ V for **BU407D** $V_{CE} = 330$ V			 15 15	 mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 6$ V			400	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation 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 $I_{B\ end} = 1.2$ A			 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%

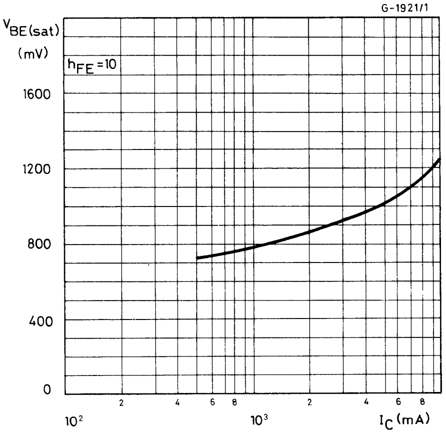
DC current gain



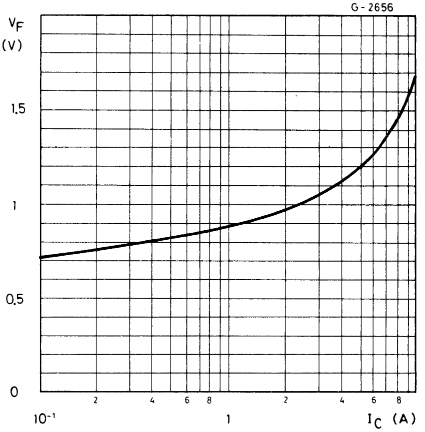
Collector-emitter saturation voltage



Base-emitter saturation voltage

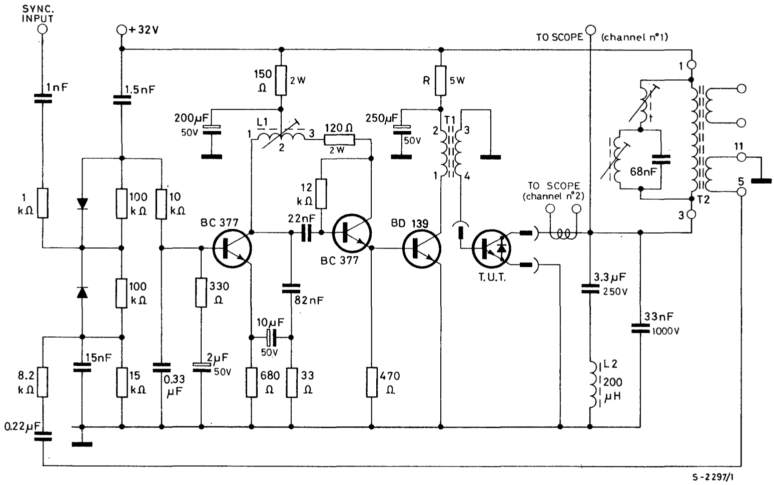


Forward voltage



SWITCHING TIMES

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



L1 Horizontal hold coil: Pins 1-2=75 turns 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

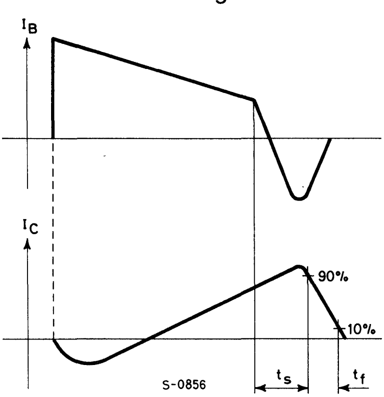
T1 Driver transformer: Pins 1-2=125 turns Ø 0.2 mm;
Pins 3-4=25 turns Ø 0.4 mm; Gap = 0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

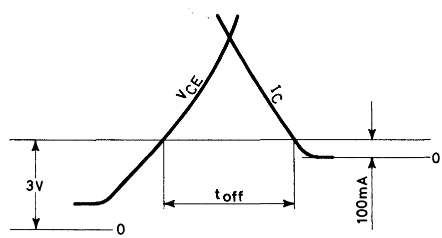
R = 270 Ω for BU406D and BU407D
R = 180 Ω for BU408D

Waveforms

Fall and storage time



Turn-off time



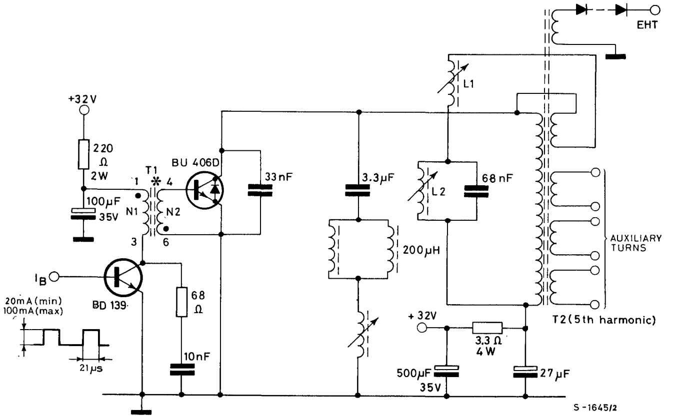
Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

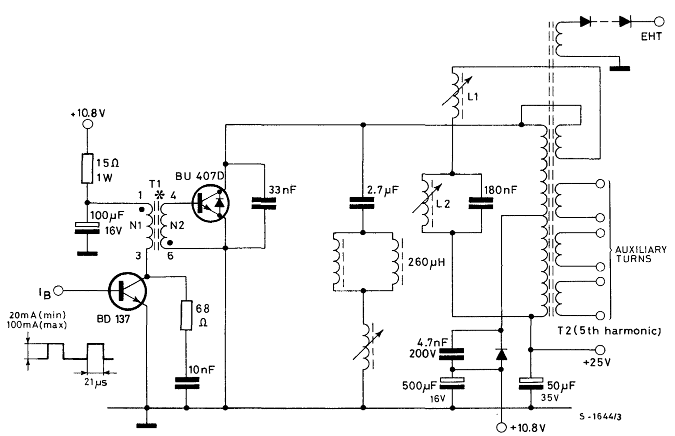
Two examples are given of the BU 406D and BU 407D in conventional MTV horizontal deflection circuits.

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

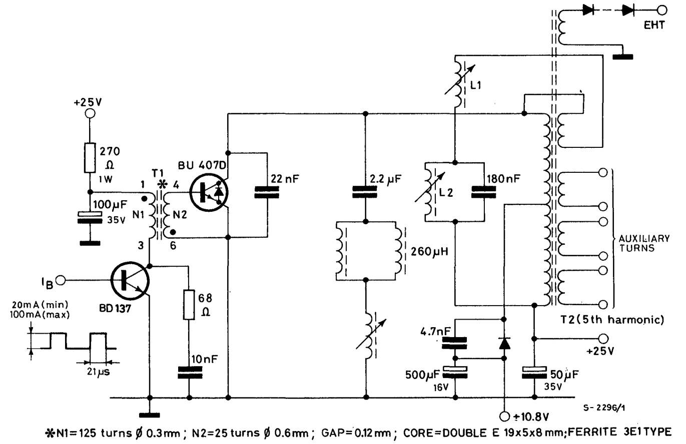
BU 407D - application circuit for 12" to 17" - 110° - 20 mm neck picture tubes (driver supply voltage = 10.8 V)



*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

BU407
BU407H

EPITAXIAL PLANAR NPN

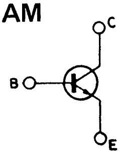
HORIZONTAL TV DEFLECTORS

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

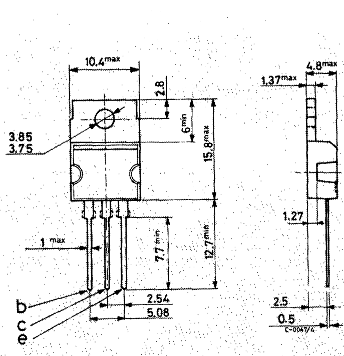
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

BU407
BU407H

THERMAL DATA

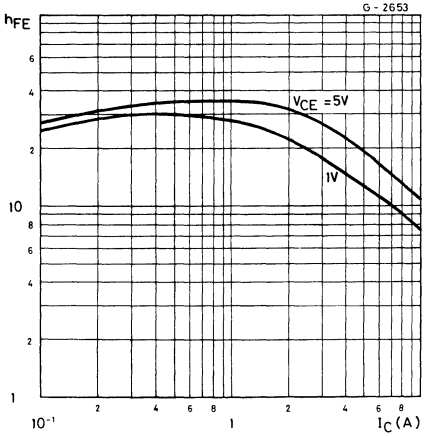
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

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

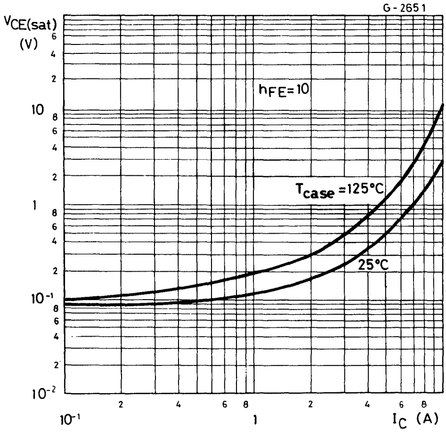
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 330V$ $V_{CE} = 200V$ $V_{CE} = 200V$ $T_{case} = 150°C$			5 100 1	mA μA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 6\ V$			1	mA
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BU407** $I_C = 5\ A$ $I_B = 0.5A$ for **BU407H** $I_C = 5\ A$ $I_B = 0.8A$			 1 1	 V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	for **BU407** $I_C = 5\ A$ $I_B = 0.5A$ for **BU407H** $I_C = 5\ A$ $I_B = 0.8A$			 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** $I_C = 5\ A$ $I_{B\ end} = 0.5A$ for **BU407H** $I_C = 5\ A$ $I_{B\ end} = 0.8A$			 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

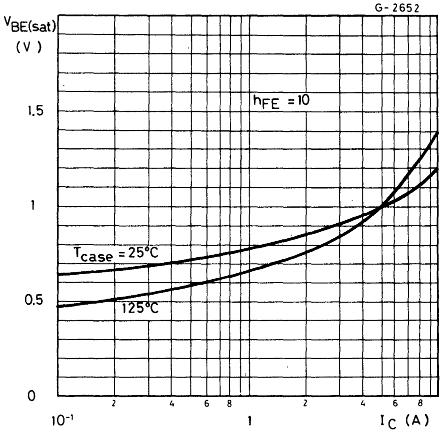
DC current gain



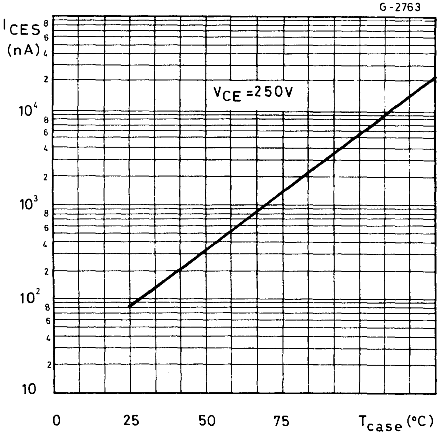
Collector-emitter saturation voltage



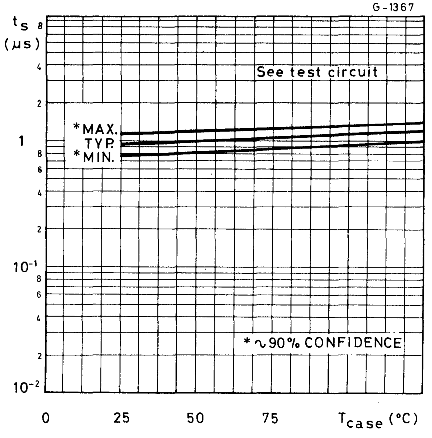
Base-emitter saturation voltage



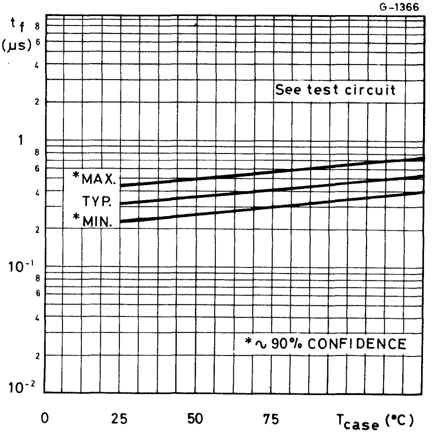
Collector cutoff current



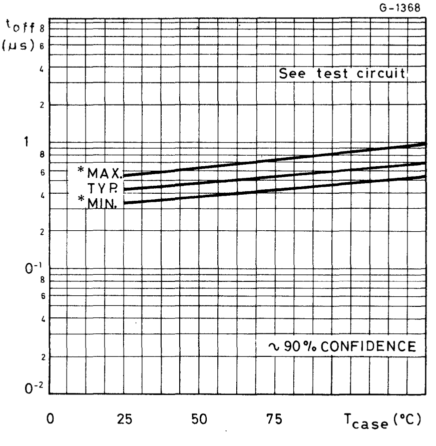
Storage time



Fall time

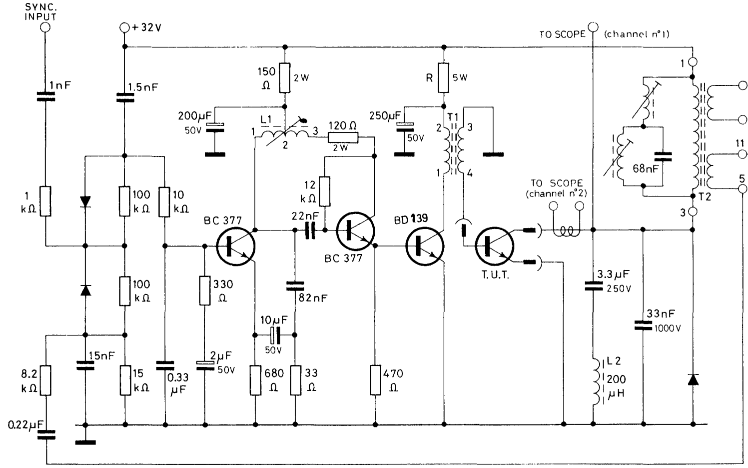


Turn-off time



SWITCHING TIMES

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



S-2291/2

L1 Horizontal hold coil: Pins 1-2=75 turns 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

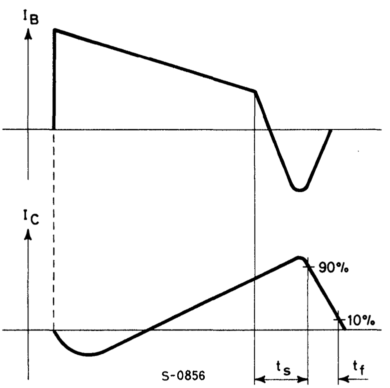
T1 Driver transformer: Pins 1-2=125 turns Ø 0.2 mm;
Pins 3-4=25 turns Ø 0.4 mm; Gap = 0.12 mm; Core = 3E3 double E 19×15×5

T2 EHT transformer manufacturer ARCO type 249.065/035

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

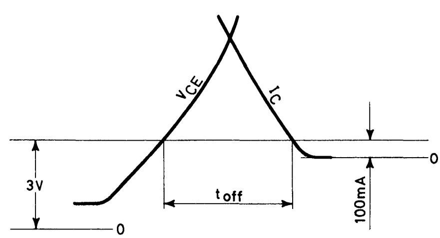
Waveforms

Fall and storage time



S-0856

Turn-off time



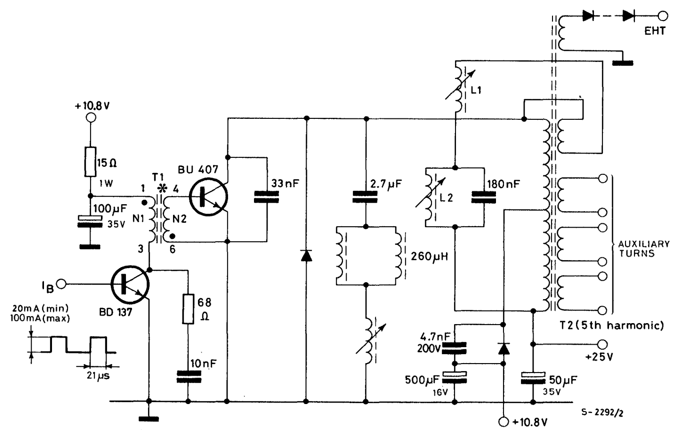
Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

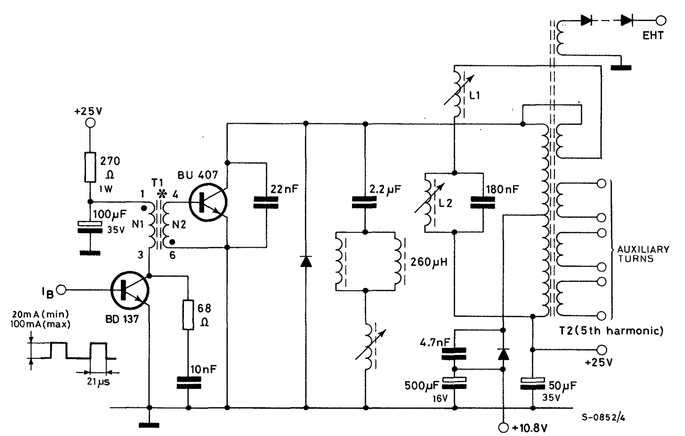
Two examples are given of the BU407 in conventional MTV horizontal deflection circuits

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

MULTIEPITAXIAL MESA NPN

BU426
BU426A

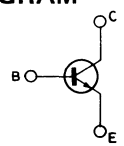
HIGH VOLTAGE POWER SWITCH

The BU426 and BU426A are silicon multiepitaxial mesa NPN transistors in SOT-93 plastic package, particularly intended for switch-mode CTV supply systems.

ABSOLUTE MAXIMUM RATINGS

		BU426	BU426A
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800 V	900V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	375V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	10V	
I_C	Collector-current	6A	
I_{CM}	Collector-peak current ($t_p = 2ms$)	8A	
I_B	Base current	3A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	113W	
T_{stg}	Storage temperature	-65°C to 150°C	
T_j	Junction temperature	150°C	

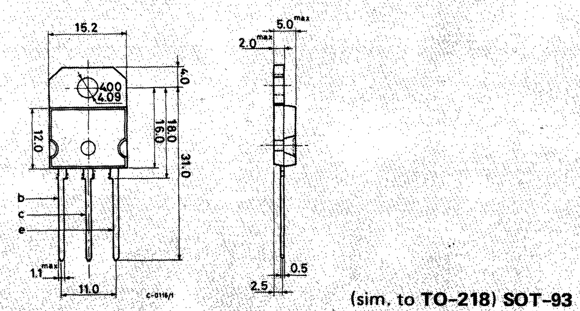
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

10/82

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)

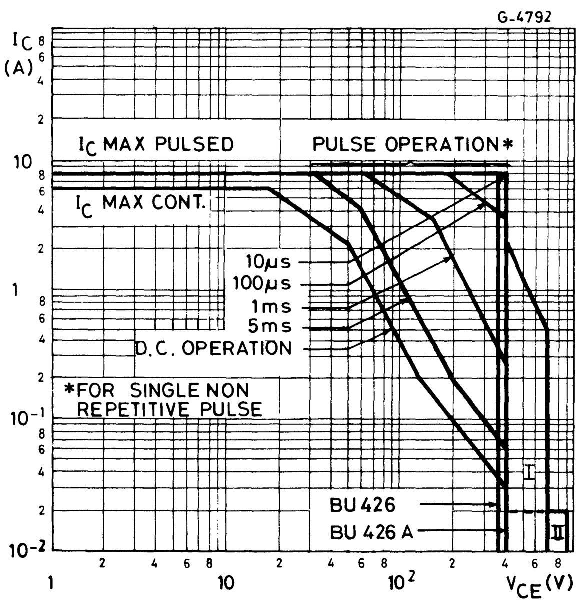
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BU426** V_{CE} = 800V for **BU426A** V_{CE} = 900V T_{case} = 125°C for **BU426** V_{CE} = 800V for **BU426A** V_{CE} = 900V			1 1 2 2	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 10V			10	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	for **BU426** I_C = 100mA for **BU426A** I_C = 100mA	375 400			V 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 = 0.6A V_{CE} = 5V		30	60	V
t_{on}	Turn-on time	I_C = 2.5A I_{B1} = 0.5A V_{CC} = 250V		0.25	0.5	μs

ELECTRICAL CHARACTERISTIC (Continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time	$I_C = 2.5A$ $I_{B1} = 0.5A$ $I_{B2} = -1A$ $V_{CC} = 250V$		2.5	3.5	μs
t_f	Fall time			0.2	0.5	μs
t_f	Fall time	$I_C = 2.5A$ $I_{B1} = 0.5A$ $I_{B2} = -1A$ $V_{CC} = 250V$ $T_{case} = 100°C$			0.75	μs

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

Safe operating areas



I = Area of permissible operation driving turn-on provided $R_{BE} = 100\Omega$ and $t_p \leqslant 0.6$ μs.
II = Area of permissible operation with $V_{BE} \leqslant 0$; $t_p \leqslant 2$ μs.

SGS **BU801**

EPITAXIAL PLANAR NPN

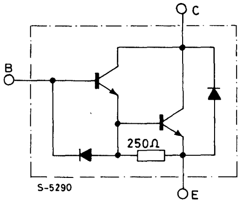
HIGH VOLTAGE FAST DARLINGTON

The BU801 is a silicon epitaxial planar NPN Darlington transistor with integrated base-emitter speed-up diode, mounted in Jedec TO-126 plastic package. It is particularly suitable as output stage in medium power and driver stage in high power, fast switching applications.

ABSOLUTE MAXIMUM RATINGS

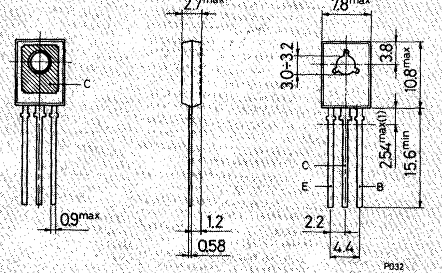
V_{CBO}	Collector-base voltage ($I_E = 0$)	600	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C, I_E	Collector and emitter currents	3	A
I_B	Base current	1	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	40	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°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}= 600V				200	μA
I_{CEO}	Collector-cutoff current (I_B= 0)	V_{CE}= 400V				1	mA
I_{EBO} *	Emitter cutoff current (I_C= 0)	V_{EB}= 7V				100	mA
$V_{CEO(sus)}$ *	Collector-emitter sustaining voltage	I_C= 10 mA		400			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C= 200 mA I_C= 1A I_C= 2A	I_B= 2 mA I_B= 20 mA I_B= 200 mA		1.0 1.2 1.8	1.5 2.0 3.0	V V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C= 200 mA I_C= 1A I_C= 2A	I_B= 2 mA I_B= 20 mA I_B= 200 mA			2 2.5 3	V V V
h_{FE} *	DC current gain	I_C= 200 mA	V_{CE}= 3V	100			–
V_F *	Diode forward voltage	I_F= 1A				4	V

RESISTIVE SWITCHING TIMES

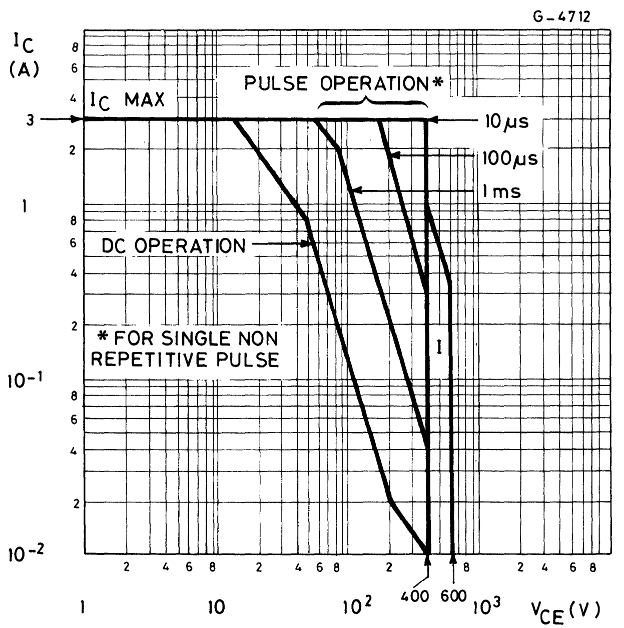
t_{on}	Turn-on time	V_{CC}= 250V I_C= 200 mA I_{B_1}= 2 mA $V_{BE\,off}$= -5V	0.17	0.8	μs
t_s	Storage time		0.37	1	μs
t_f	Fall time		0.13	0.5	μs

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time	V_{CC} = 250V I_C = 1A I_{B1} = 20 mA $V_{BE\,off}$ = -5V		0.18	0.8	μs
t_s	Storage time			0.38	1	μs
t_f	Fall time			0.09	0.5	μs
INDUCTIVE SWITCHING TIMES						
t_s	Storage time	V_{Clamp} = 250V I_C = 200 mA I_{B1} = 2 mA V_{BEoff} = -5V		0.35	1	μs
t_f	Fall time			0.09	0.4	μs
t_s	Storage time	V_{Clamp} = 250V I_C = 1A I_{B1} = 20 mA V_{BEoff} = -5V		0.5	1	μs
t_f	Fall time			0.06	0.4	μs

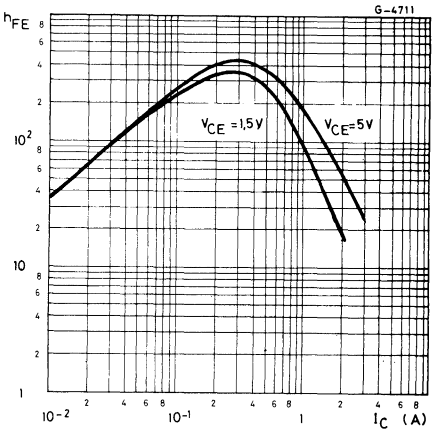
* Pulsed: Pulse duration = 300 μs, duty cycle = 1.5%

Safe operating areas

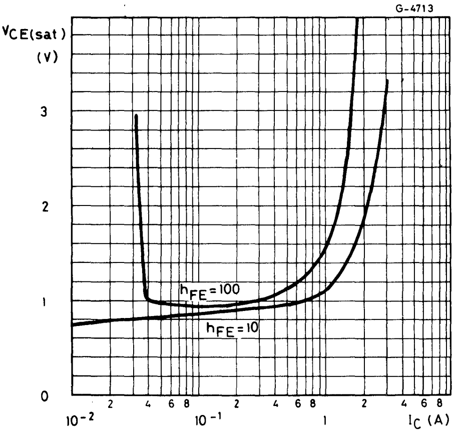


I = Area of permissible operation during turn-on with $t_p \leq 1\ \mu s$.

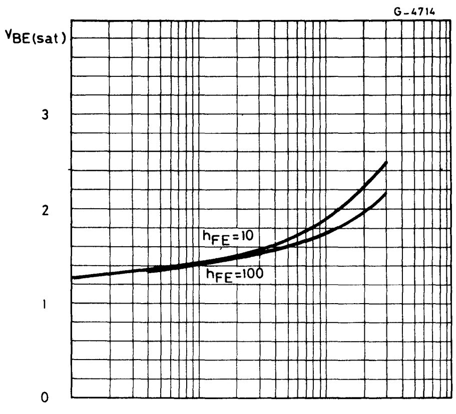
DC current gain



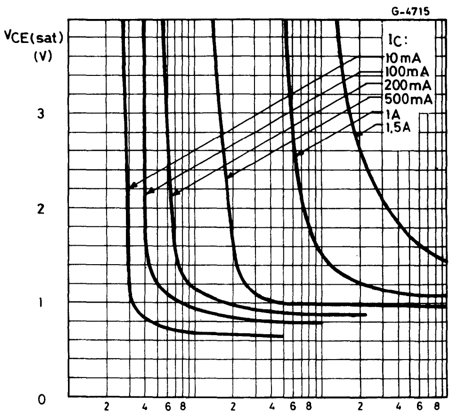
Collector-emitter saturation voltage



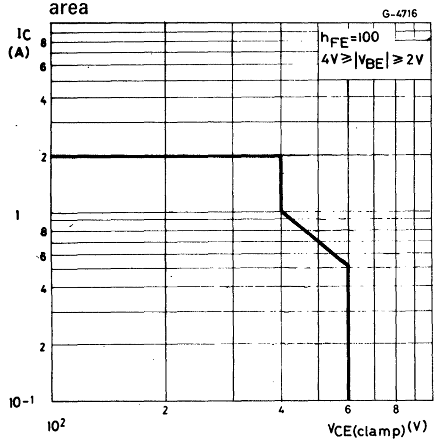
Base-emitter saturation voltage



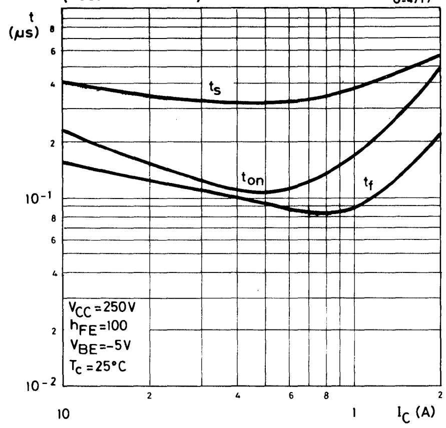
Collector-emitter saturation voltage



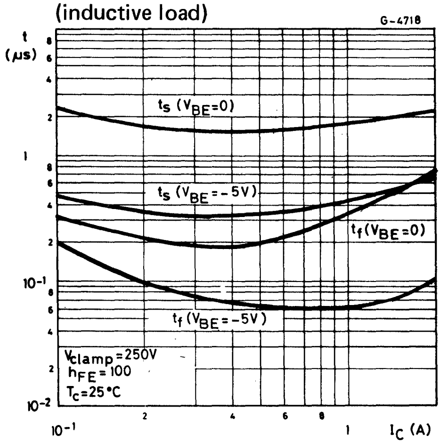
Clamped reverse bias safe operating area



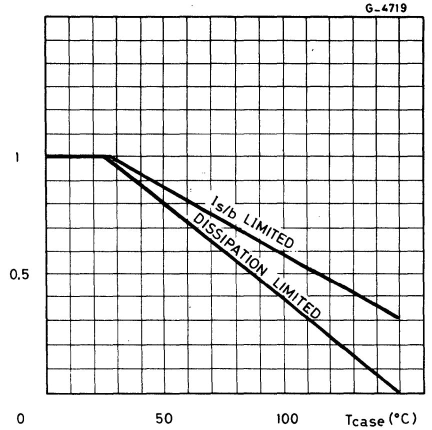
Saturated switching characteristics (resistive load)



Saturated switching characteristics (inductive load)



Derating curves



EPITAXIAL PLANAR NPN

SGS **BU806 BU807**

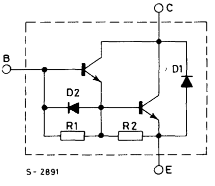
FAST SWITCHING DARLINGTON TRANSISTORS

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	

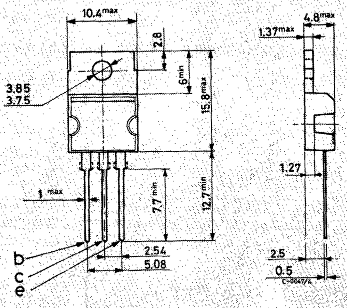
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

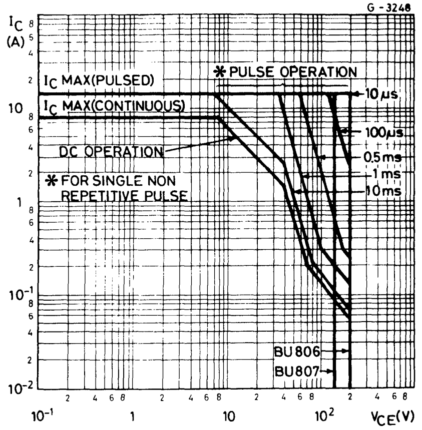
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}case}$	Thermal resistance junction-ambient	max	70	°C/W

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

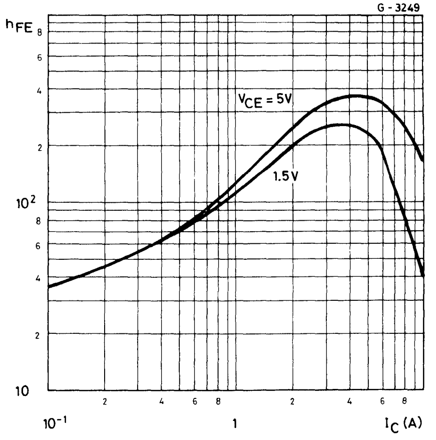
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	for **BU807** V_{CE}=330V for **BU806** V_{CE}=400V			100 100	µA µA
I_{CEV}	Collector cutoff current (V_{BE}=-6V)	for **BU807** V_{CE}=330V for **BU806** V_{CE}=400V			100 100	µA µA
I_{EBO}	Emitter cutoff current (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

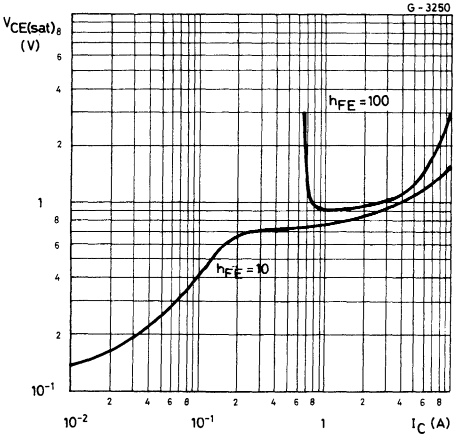
Safe operating areas



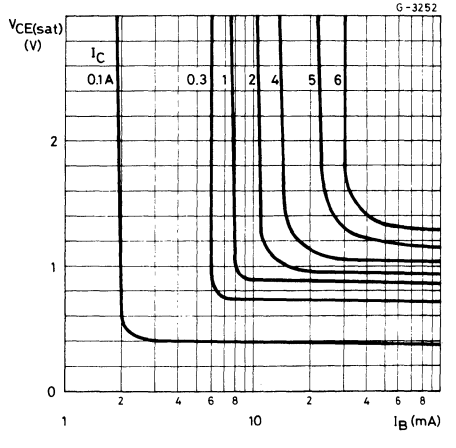
DC current gain



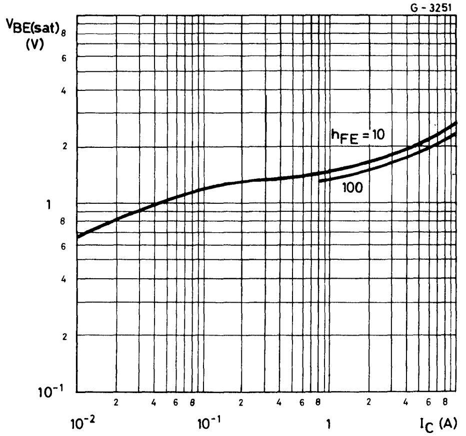
Collector-emitter saturation voltage



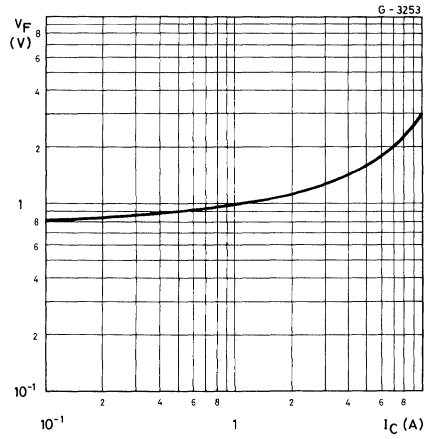
Collector-emitter saturation voltage



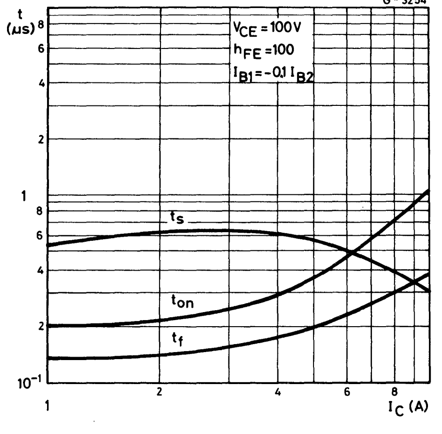
Base-emitter saturation voltage



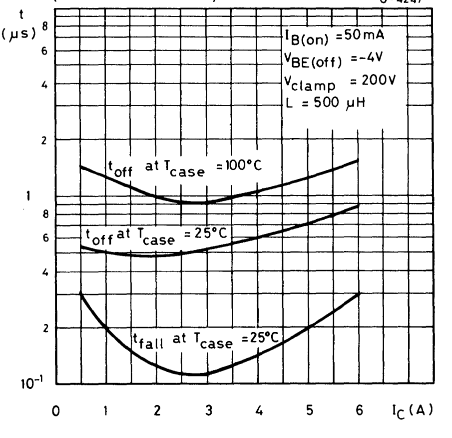
Damper diode



Saturated switching characteristics (resistive load)

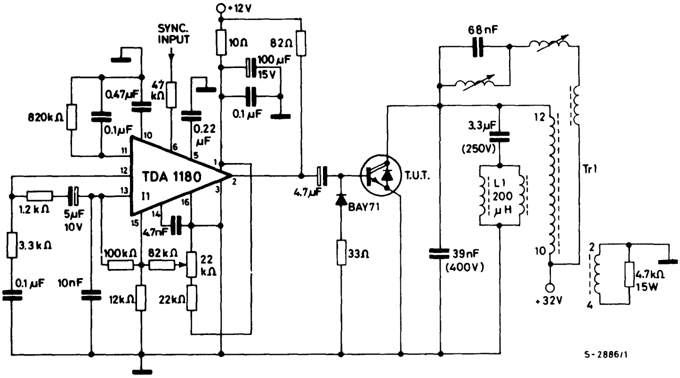


Saturated switching characteristics (inductive load)



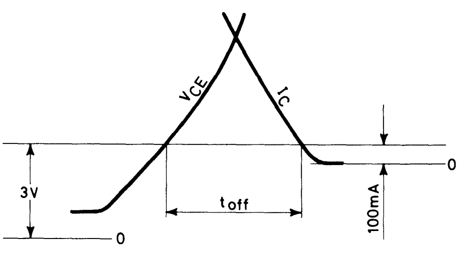
HORIZONTAL DEFLECTION TURN-OFF TIME

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

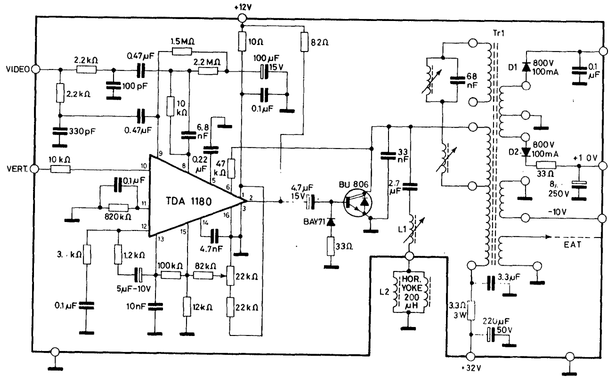


Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

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)

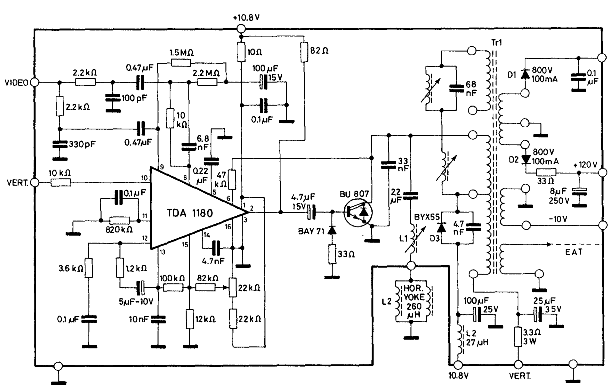


L1 = Linearity inductance RL 33 INELCO

S-2887/1

L_l = Linearity inductance 19÷39μH

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÷67μH

SGS **BU810**

EPITAXIAL PLANAR NPN

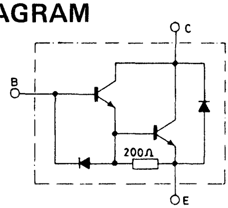
MEDIUM POWER FAST SWITCHING

The BU810 is a silicon epitaxial planar NPN Darlington transistor with integrated base-emitter speed-up diode, mounted in Jedec TO-220 plastic package. It is particularly suitable as output stage in medium power, fast switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	600	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	7	A
I_{CM}	Collector peak current	10	A
I_B	Base current	2	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	75	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

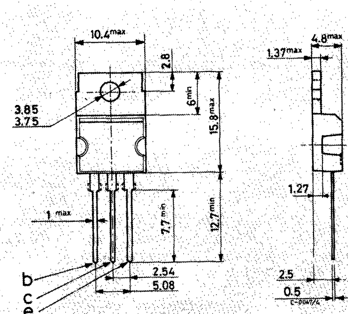
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

$R_{th\ j-case}$	Thermal resistance junction-case	max.	1.66	°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} = 600V			200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 400V			1	mA
I_{EBO} *	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			150	mA
$V_{CEO(sus)}$ *	Collector-emitter sustaining voltage	I_C = 100mA	400			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C = 2A I_B = 20mA I_C = 4A I_B = 200mA I_C = 7A I_B = 0.7A			2 2.5 3	V V V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C = 2A I_B = 20mA I_C = 4A I_B = 200mA			2.2 3	V V
V_F *	Diode forward voltage	I_F = 7A			3	V

RESISTIVE SWITCHING TIMES

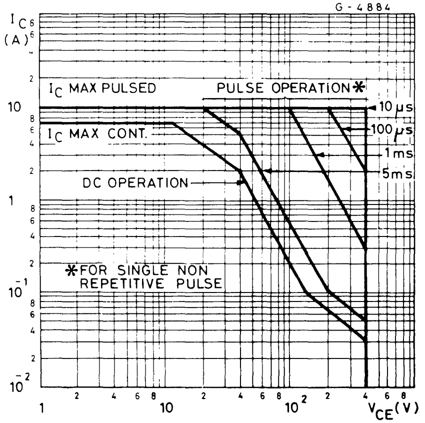
t_{on}	Turn-on time	V_{CC} = 250V I_C = 2A I_{B1} = 20mA $V_{BE(off)}$ = -5V			0.6	μs
t_s	Storage time				1.5	μs
t_f	Fall time				0.5	μs

INDUCTIVE SWITCHING TIMES

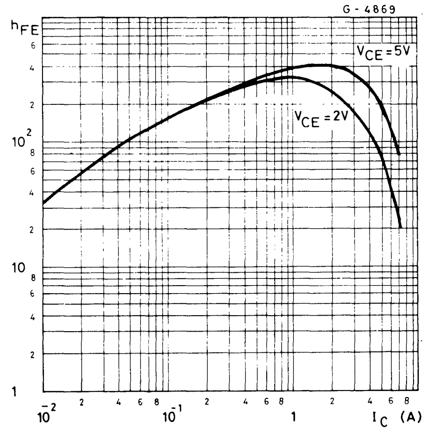
t_s	Storage time	V_{Clamp} = 250V I_C = 7A I_{B1} = 0.7A $V_{BE(off)}$ = -5V			1.5	μs
t_f	Fall time				0.4	μs
t_s	Storage time				1.5	μs
t_f	Fall time				0.7	μs

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

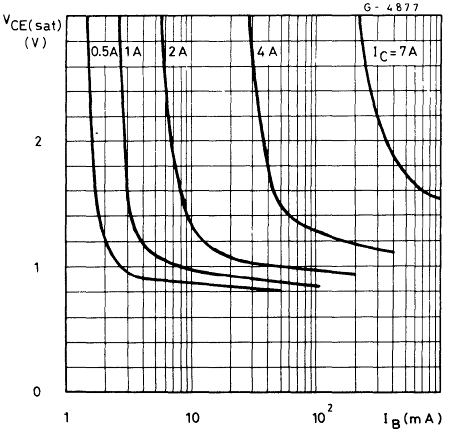
Safe operating areas



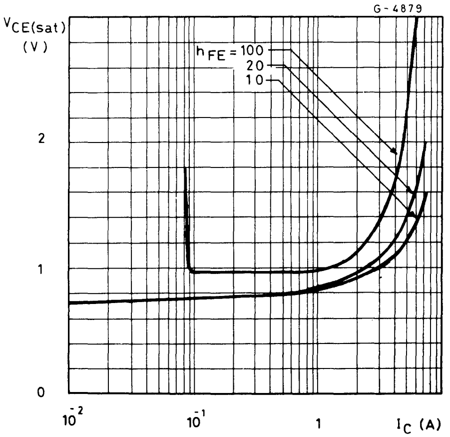
DC current gain



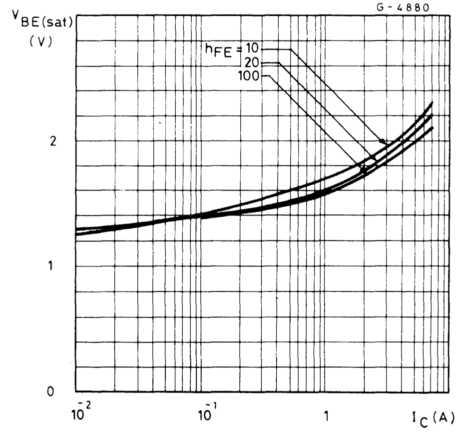
Collector-emitter saturation voltage



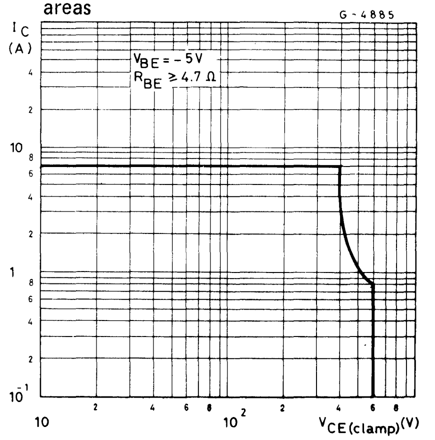
Collector-emitter saturation voltage



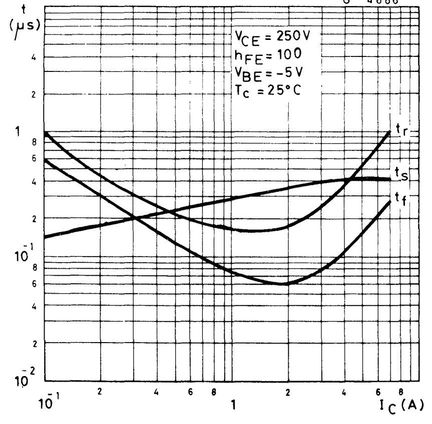
Base-emitter saturation voltage



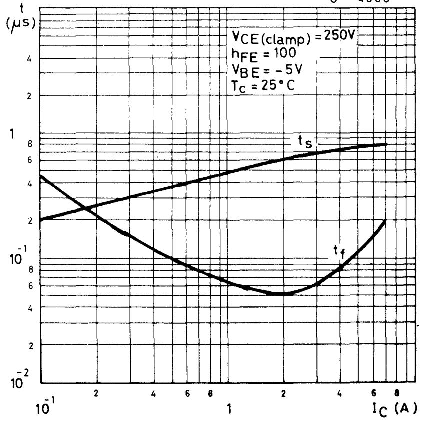
Clampled reverse bias safe operating areas



Saturated switching characteristics (resistive load)



Saturated switching characteristics



MULTIEPITAXIAL PLANAR NPN

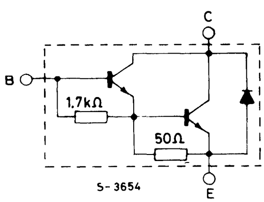
BU910
BU911
BU912

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	

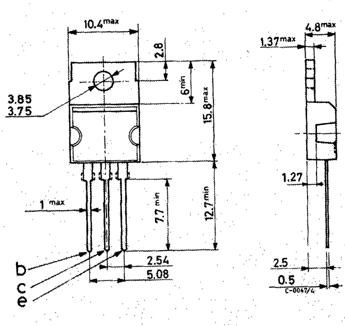
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

5/80

THERMAL DATA

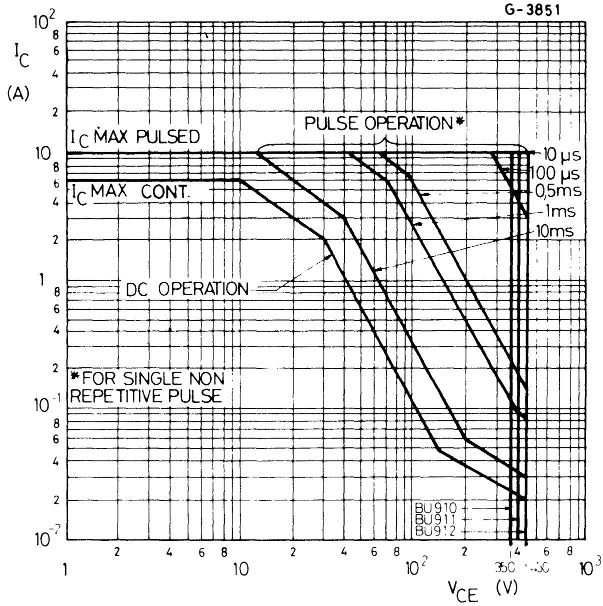
$R_{th\ j-case}$	Thermal resistance junction-case	max	2.08	°C/W

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

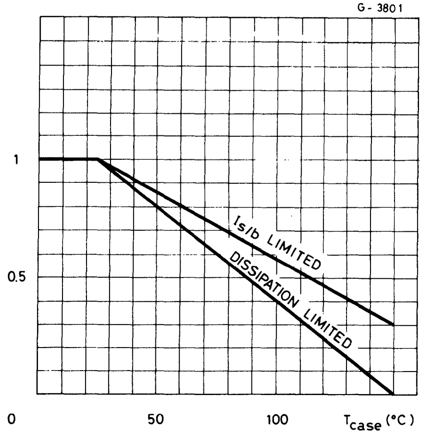
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}= 0)	for **BU910** V_{CE}=400V			1	mA
		for **BU911** V_{CE}=450V			1	mA
		for **BU912** V_{CE}=500V			1	mA
		T_{case}= 125°C				
		for **BU910** V_{CE}=400V			5	mA
		for **BU911** V_{CE}=450V			5	mA
		for **BU912** 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%

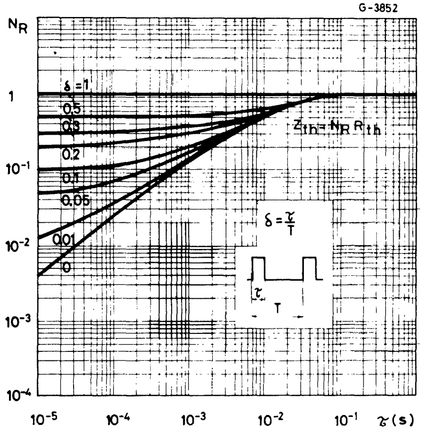
Safe operating areas



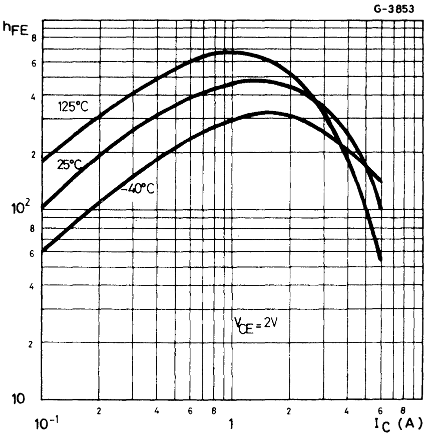
Derating curves



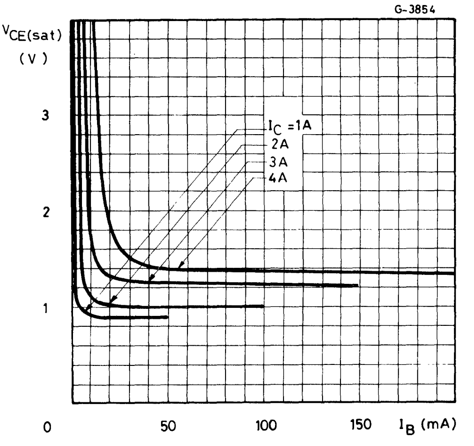
Thermal transient response



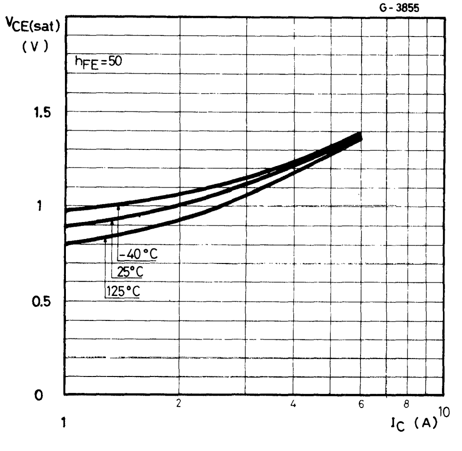
DC current gain



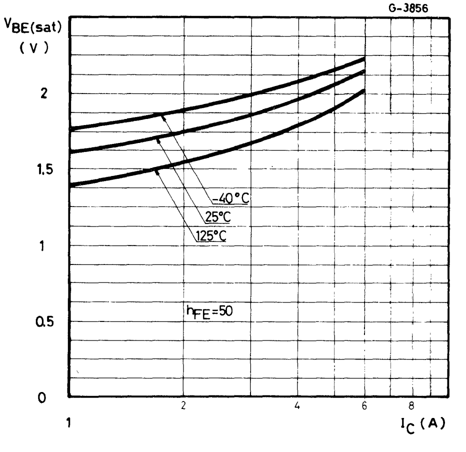
Collector-emitter saturation voltage



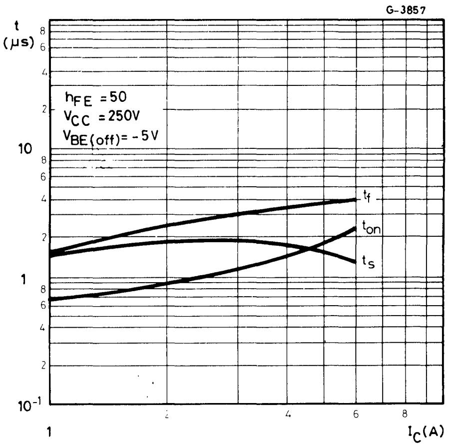
Collector-emitter saturation voltage



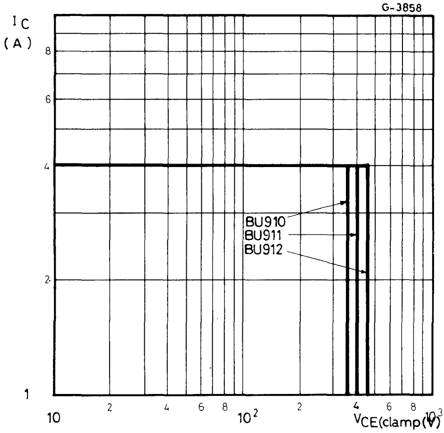
Base-Emitter saturation voltage



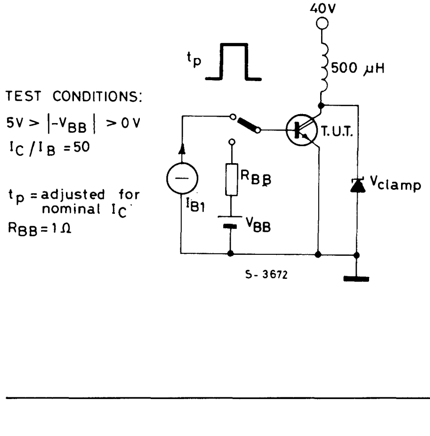
Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit



SGS

BU920P
BU921P
BU922P

MULTIEPITAXIAL PLANAR NPN

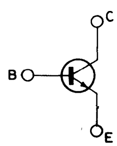
HIGH VOLTAGE POWER DARLINGTON

The BU920P, BU921P, BU922P are high voltage high current silicon NPN transistors in monolithic Darlington configuration in SOT-93 plastic package, specially intended for automotive ignition applications and invert circuits for motor controls.

ABSOLUTE MAXIMUM RATINGS

		BU920P	BU921P	BU922P
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 $T_{case} \leq 25°C$		105W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

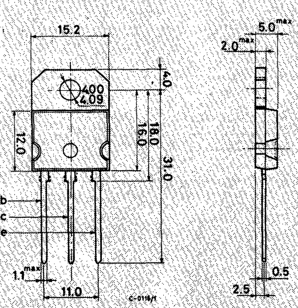
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

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)

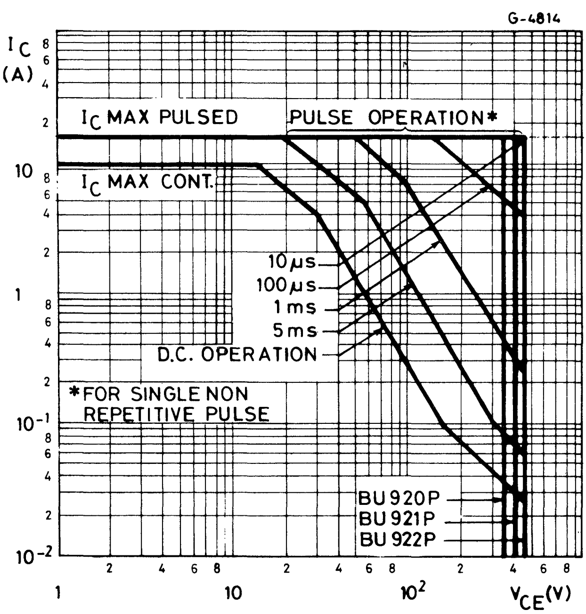
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BU920P** V_{CE} = 400V			1	mA
		for **BU921P** V_{CE} = 450V			1	mA
		for **BU922P** V_{CE} = 500V			1	mA
		T_{case} = 150°C				
		for **BU920P** V_{CE} = 400V			5	mA
		for **BU921P** V_{CE} = 450V			5	mA
		for **BU922P** V_{CE} = 500V			5	mA
I_{CEO}	Collector cutoff current (I_C = 0)	for **BU920P** V_{CE} = 350V			1	mA
		for **BU921P** V_{CE} = 400V			1	mA
		for **BU922P** V_{CE} = 450V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			20	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA for **BU920P**	350			V
		for **BU921P**	400			V
		for **BU922P**	450			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
$V_{CE(sat)}$ *	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

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

Safe operating areas



MULTIEPITAXIAL PLANAR NPN

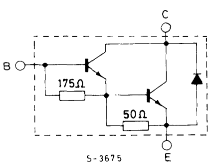
BU930
BU931
BU932

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	

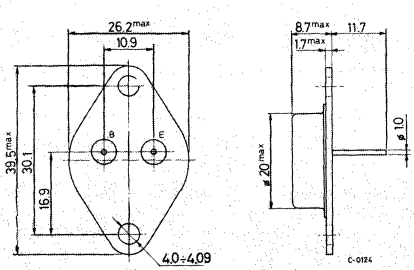
INTERNAL SCHEMATIC DIAGRAM



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)

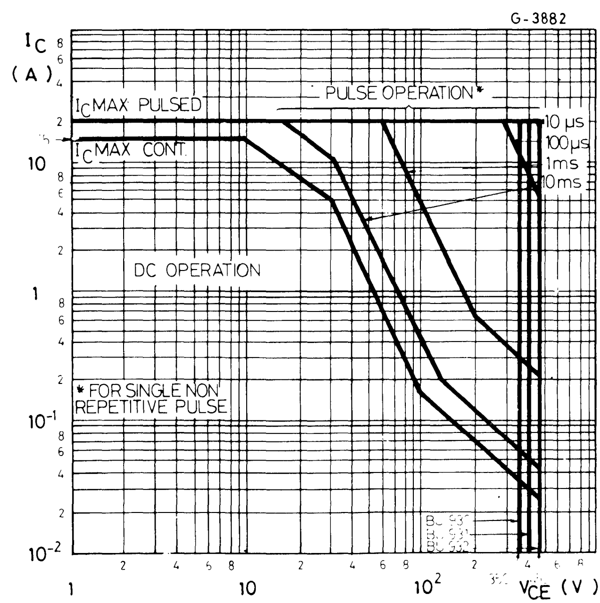
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BU930**	$V_{CE}=400V$			1	mA
		for **BU931**	$V_{CE}=450V$			1	mA
		for **BU932**	$V_{CE}=500V$			1	mA
		$T_{case}=150\,°C$					
		for **BU930**	$V_{CE}=400V$			5	mA
		for **BU931**	$V_{CE}=450V$			5	mA
		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)

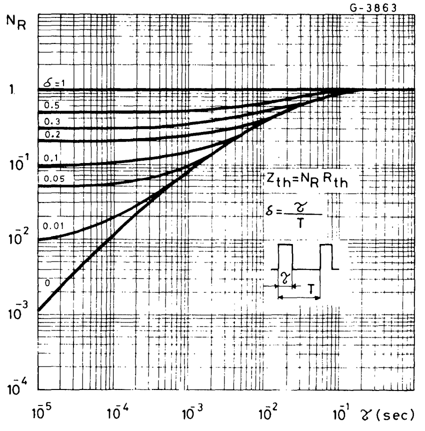
Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_F*	Diode forward voltage	I_F =10A			2.5	V
	Functional test (see test circuit figg. 2 and 3)	for **BU930** V_{CE}=350V L=7mH	8			A
		for **BU931** and **BU932** V_{CE}=400V L=7mH	8			A

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

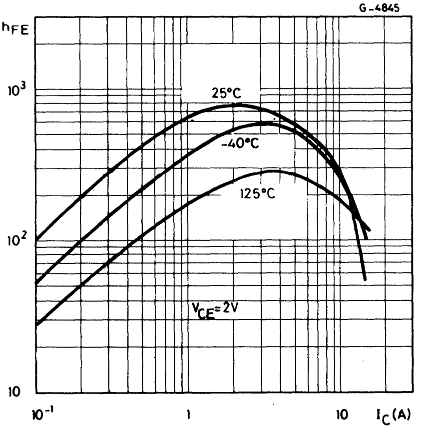
Safe operating areas



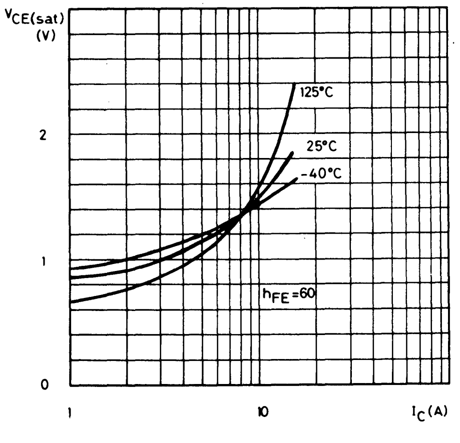
Thermal transient response



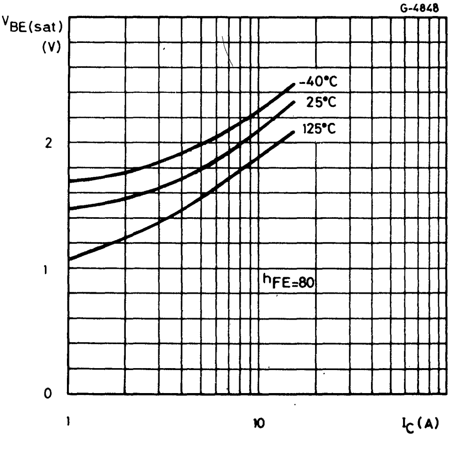
DC current gain



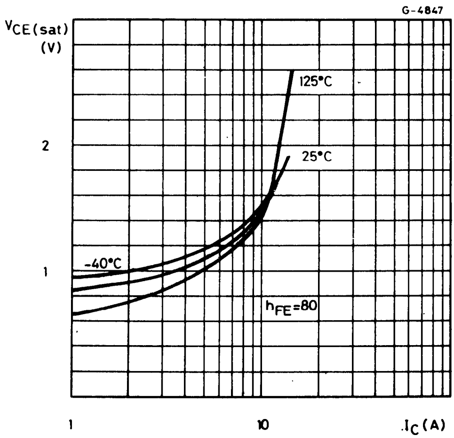
Collector-emitter saturation voltage



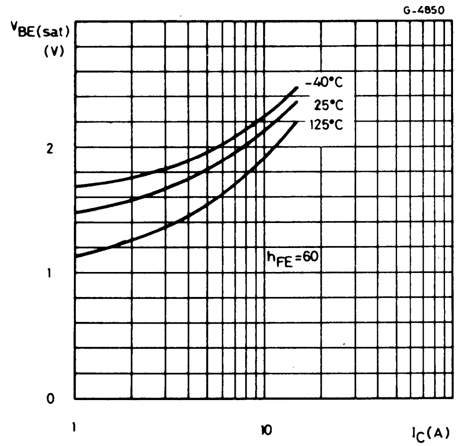
Base-emitter saturation voltage



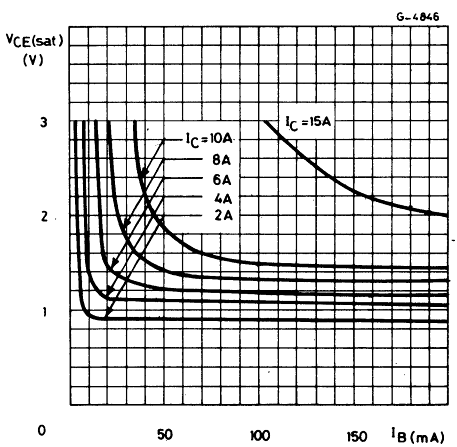
Collector-emitter saturation voltage



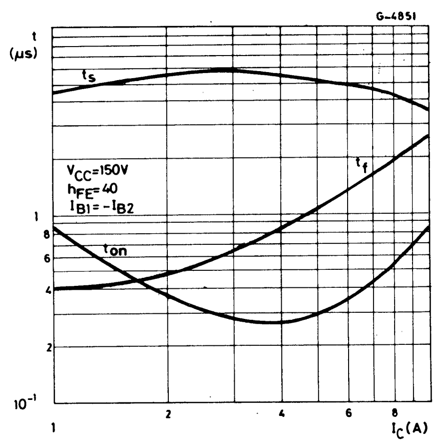
Base-emitter saturation voltage



Collector-emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas

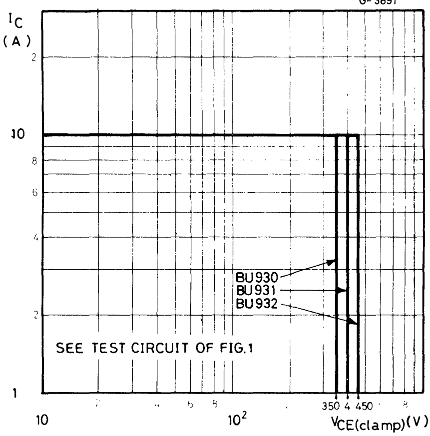


Fig. 1 — Clamped $E_{s/b}$ test circuit

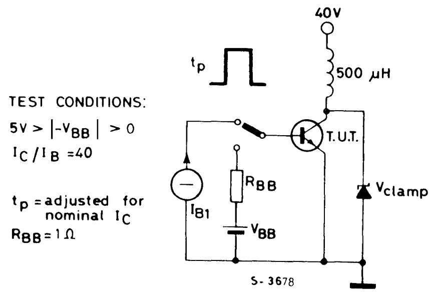


Fig. 2 — Functional test circuit

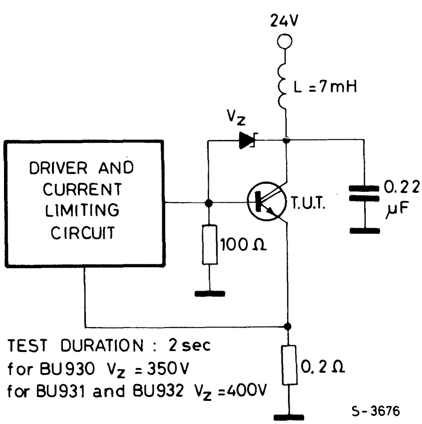
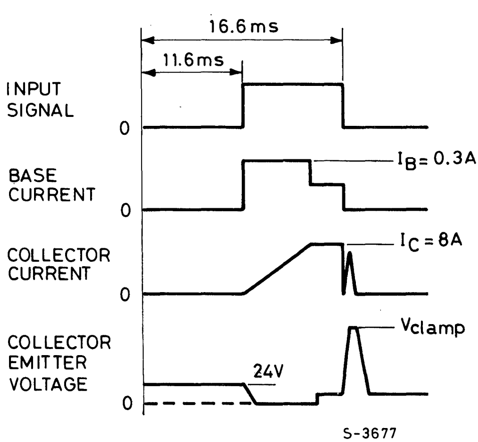


Fig. 3 — Functional test waveforms



MULTIEPITAXIAL PLANAR NPN

BU930P
BU931P
BU932P

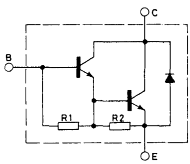
AUTOMOTIVE IGNITION DARLINGTON

The BU930P, BU931P and BU932P are high voltage silicon NPN Darlington transistors in SOT-93 specially intended for automotive ignition application and inverter circuits for motor controls.

ABSOLUTE MAXIMUM RATINGS

		BU930P	BU931P	BU932P
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 $T_{case} \leqslant 25°C$		105W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

INTERNAL SCHEMATIC DIAGRAM

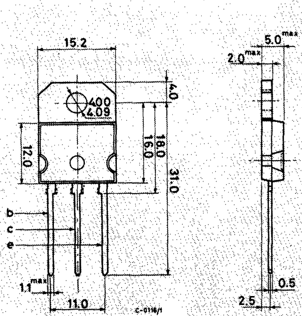


R1 Typ. 175Ω
R2 Typ. 50Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

BU930P
BU931P
BU932P

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 ($V_{BE} = 0$)	for **BU930P** $V_{CE} = 400V$ for **BU931P** $V_{CE} = 450V$ for **BU932P** $V_{CE} = 500V$ $T_{case} = 150°C$ for **BU930P** $V_{CE} = 400V$ for **BU931P** $V_{CE} = 450V$ for **BU932P** $V_{CE} = 500V$			1 1 1 5 5 5	mA mA mA mA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BU930P** $V_{CE} = 350V$ for **BU931P** $V_{CE} = 400V$ for **BU932P** $V_{CE} = 450V$			1 1 1	mA mA 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 **BU930P** for **BU931P** for **BU932P**	 350 400 450			 V V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **BU930P** and **BU931P** $I_C = 7A$ $I_B = 70mA$ $I_C = 8A$ $I_B = 100mA$ $I_C = 10A$ $I_B = 250mA$ for **BU932P** $I_C = 8A$ $I_B = 150mA$			 1.6 1.8 1.8 1.8	 V V V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	for **BU930P** and **BU931P** $I_C = 8A$ $I_B = 100mA$ $I_C = 10A$ $I_B = 250mA$ for **BU932P** $I_C = 8A$ $I_B = 150mA$			 2.2 2.5 2.2	 V V V
V_F*	Diode forward voltage	$I_F = 10A$			2.5	V

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

MULTIEPITAXIAL PLANAR NPN

SGS **BUR50**

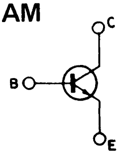
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

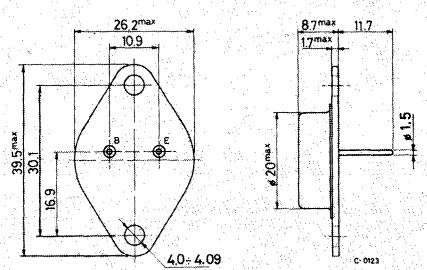
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

BUR50

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)

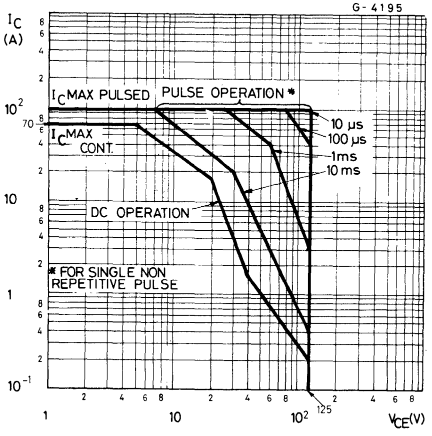
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 200V$ $V_{CB} = 200V$ $T_{case} = 125\,°C$			0.2 2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 125V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			0.2	mA
$V_{CEO\,(sus)}$*	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	$I_C = 35A$ $I_B = 2A$ $I_C = 70A$ $I_B = 7A$		 0.8	1 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 35A$ $I_B = 2A$ $I_C = 70A$ $I_B = 7A$		 1.6	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

ELECTRICAL CHARACTERISTICS (continued)

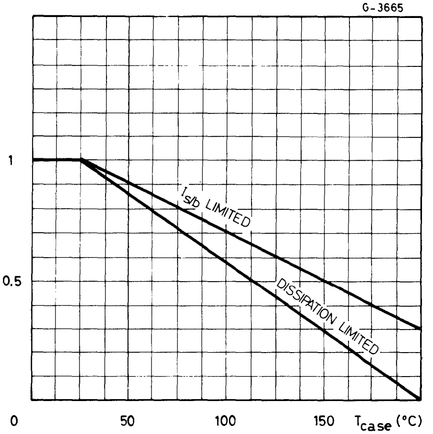
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =70A I_{B1} =7A V_{CC}=60V		0.5	1.2	µs
t_s	Storage time (fig. 2)	I_C =70A I_{B1} =7A I_{B2} =-7A V_{CC}=60V		0.82	2	µs
t_f	Fall time (fig. 2)			0.1	0.5	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=125V L =500µH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

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

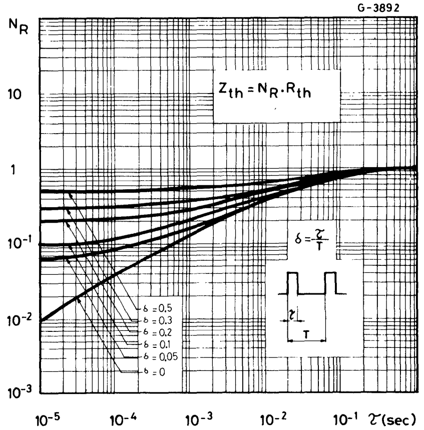
Safe operating areas



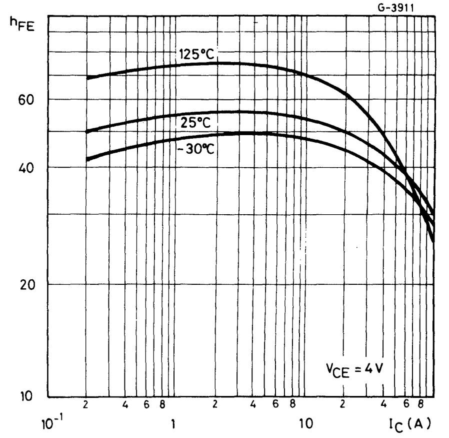
Derating curves



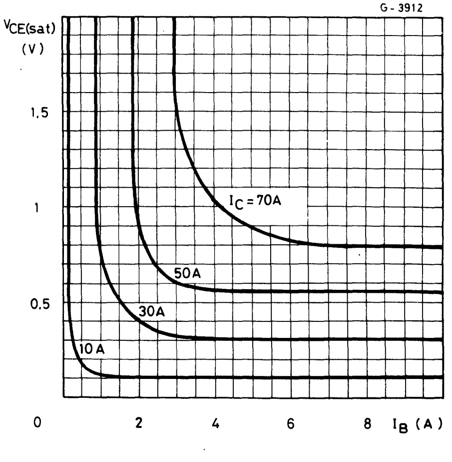
Thermal transient response



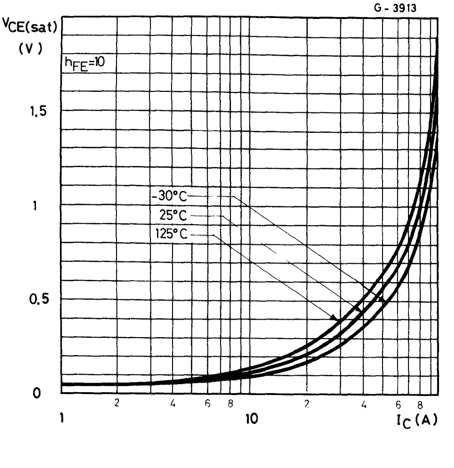
DC current gain



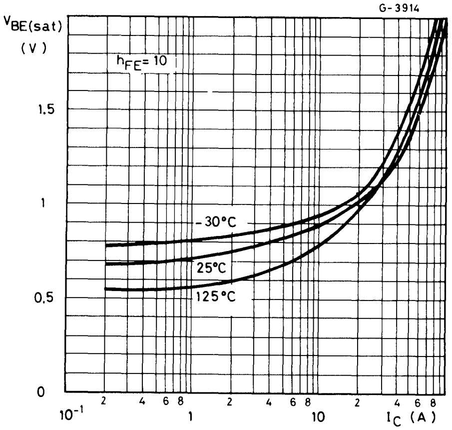
Collector-emitter saturation voltage



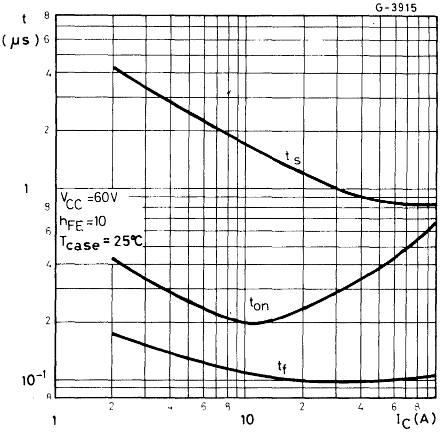
Collector-emitter saturation voltage



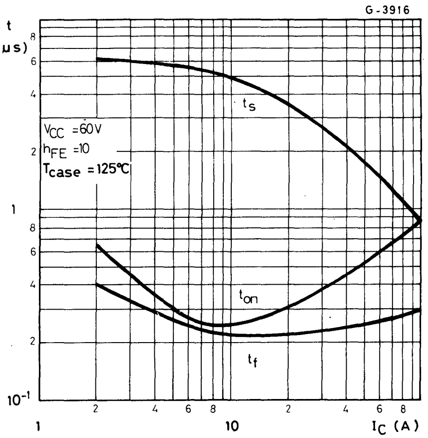
Base-emitter saturation voltage



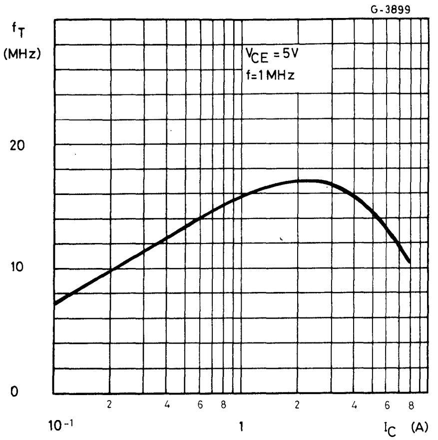
Saturated switching characteristics



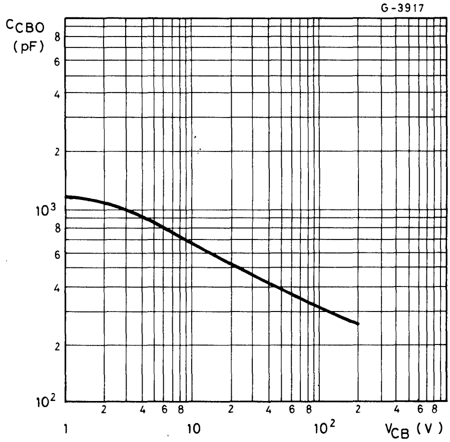
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

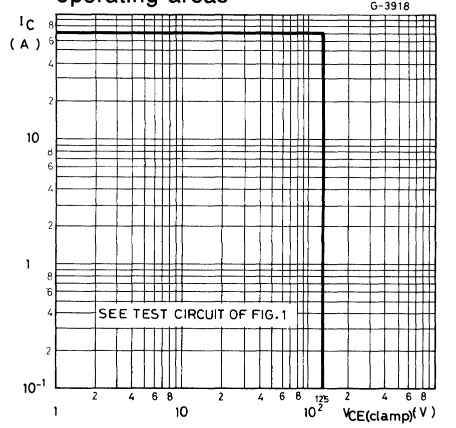


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

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

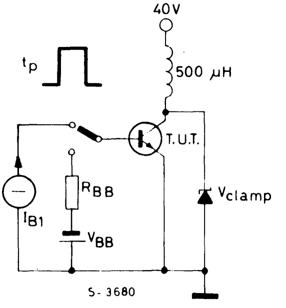


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 60 V

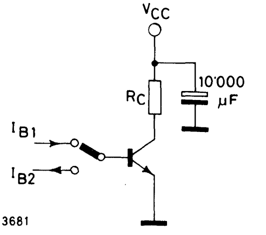
$$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUR51

MULTIEPITAXIAL PLANAR NPN

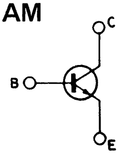
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

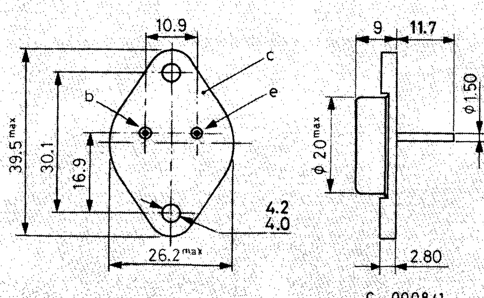
INTERNAL SCHEMATIC DIAGRAM



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)

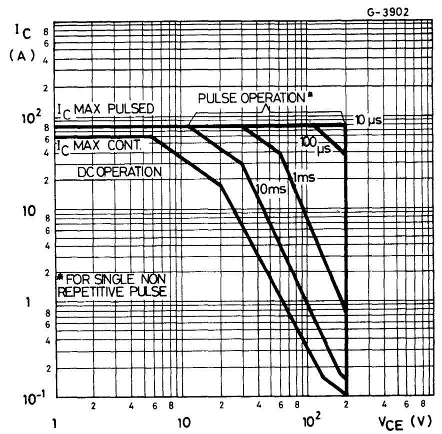
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 300V$ $V_{CB} = 300V$ $T_{case} = 125\ °C$			0.2 2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 200V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			0.2	mA
$V_{CEO\ (sus)}$*	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

ELECTRICAL CHARACTERISTICS (continued)

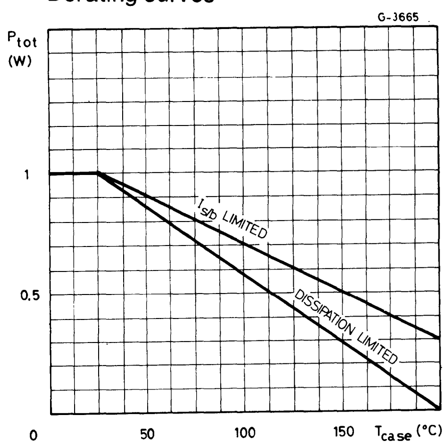
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =50A I_{B1} =5A V_{CC}=100V		0.35	1	µs
t_s	Storage time (fig. 2)	I_C =50A I_{B1} =5A I_{B2} =-5A V_{CC}=100V		0.9	2	µs
t_f	Fall time (fig. 2)			0.24	0.6	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500µH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

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

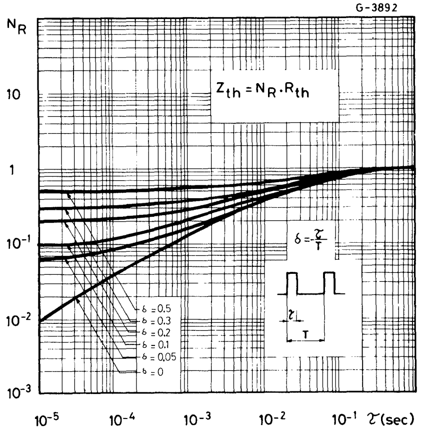
Safe operating areas



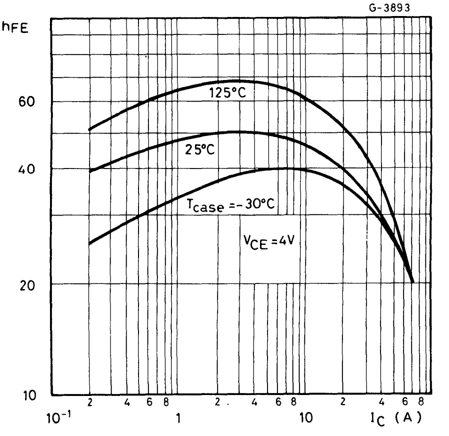
Derating curves



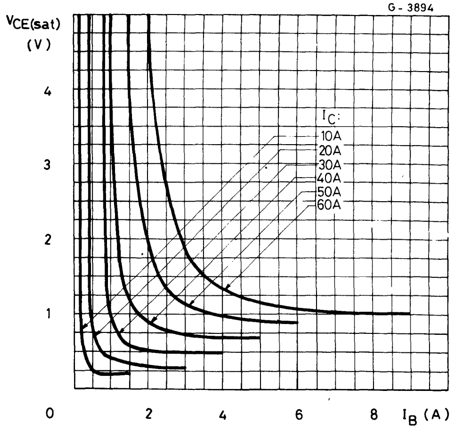
Thermal transient response



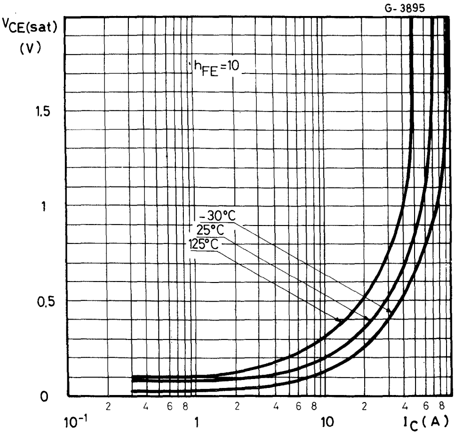
DC current gain



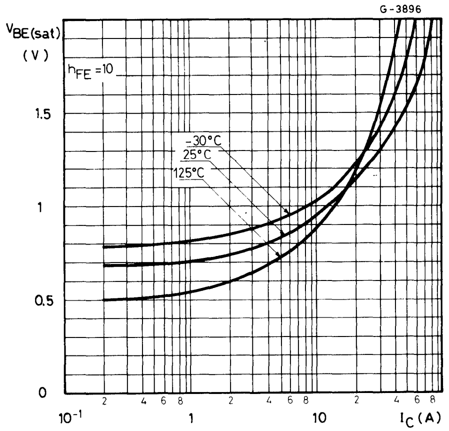
Collector-emitter saturation voltage



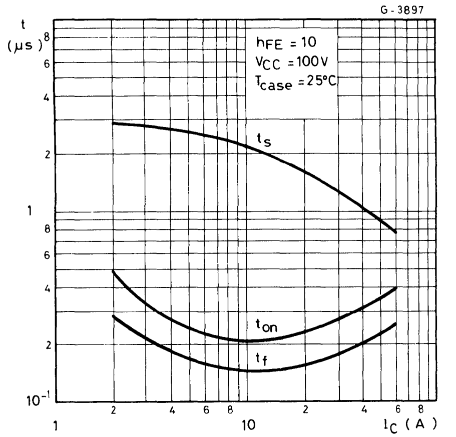
Collector-emitter saturation voltage



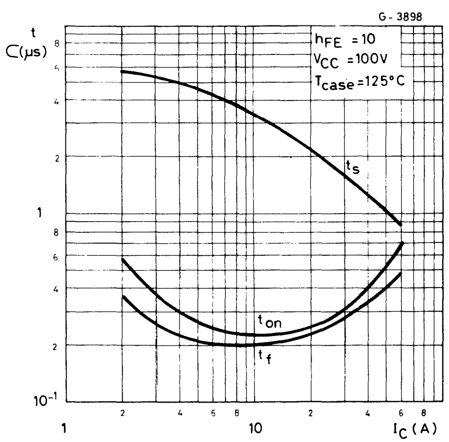
Base-emitter saturation voltage



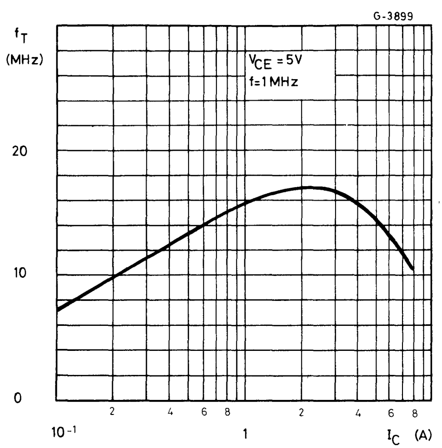
Saturated switching characteristics



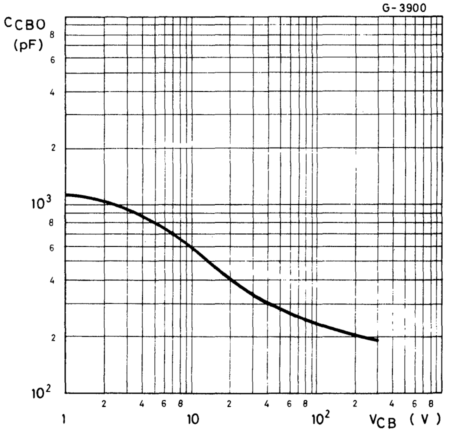
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

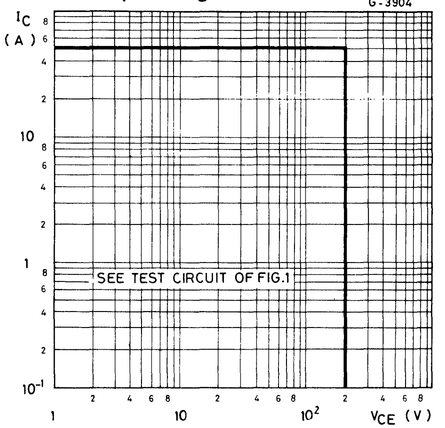


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C/I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

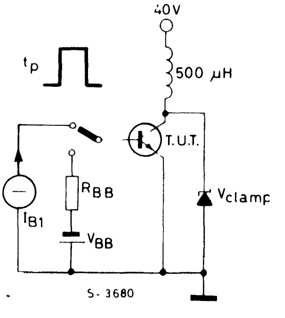


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 100V$

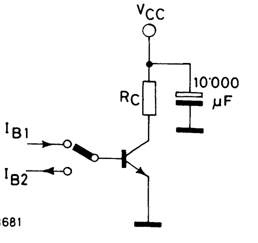
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 μs

$t_r, t_f \leq 50ns$

duty cycle = 1%



MULTIEPITAXIAL PLANAR NPN

BUR52

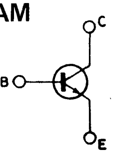
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

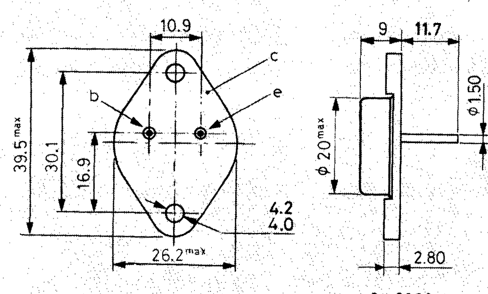
INTERNAL SCHEMATIC DIAGRAM



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)

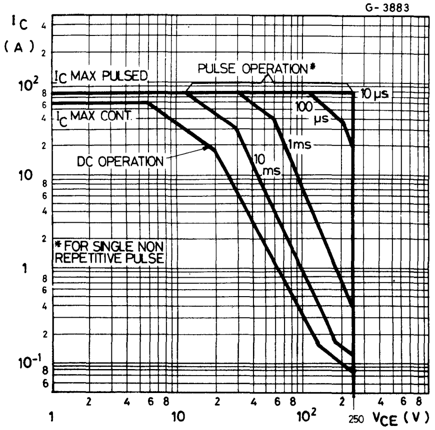
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 350V$ $V_{CB} = 350V$ $T_{case} = 125\,°C$			0.2 2	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 250V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 7V$			0.2	mA
$V_{CEO\,(sus)}$*	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

ELECTRICAL CHARACTERISTICS (continued)

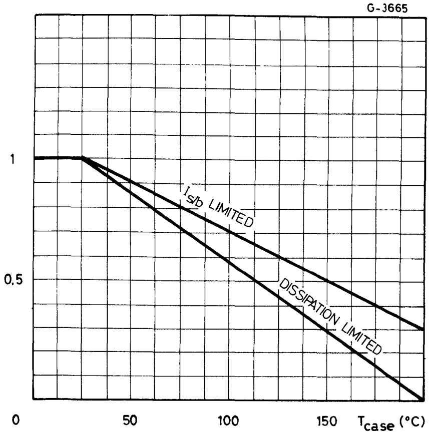
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time (fig. 2)	I_C =40A I_{B1} =4A I_{B2} =-4A V_{CC}=100V		1.2	2	µs
t_f	Fall time (fig. 2)			0.20	0.6	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500µH	40			A

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

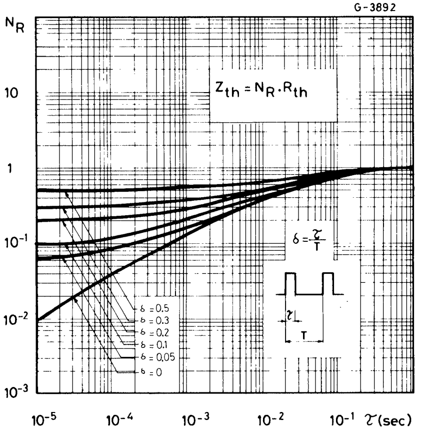
Safe operating areas



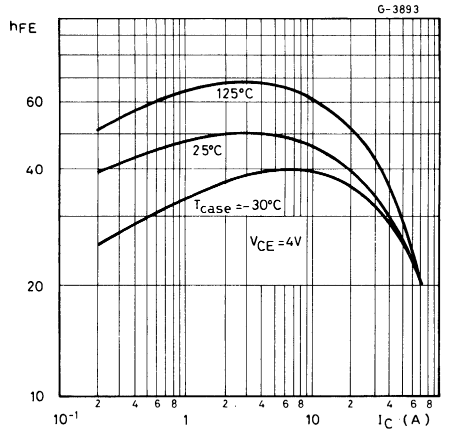
Derating curves



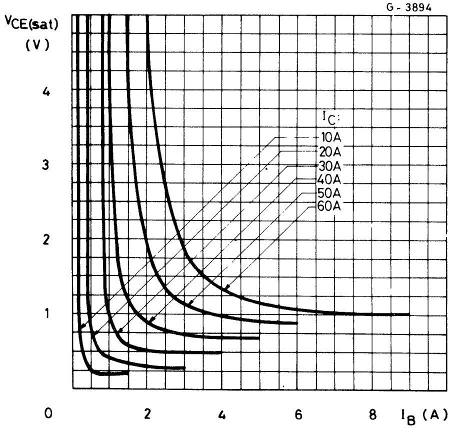
Thermal transient response



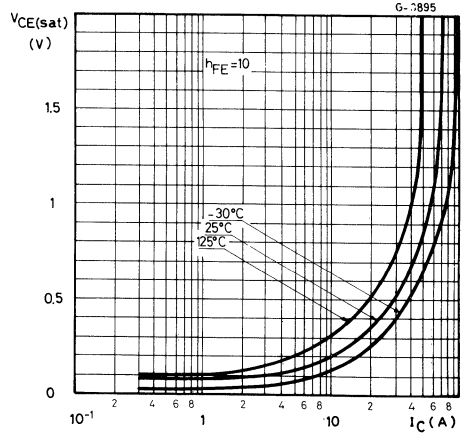
DC current gain



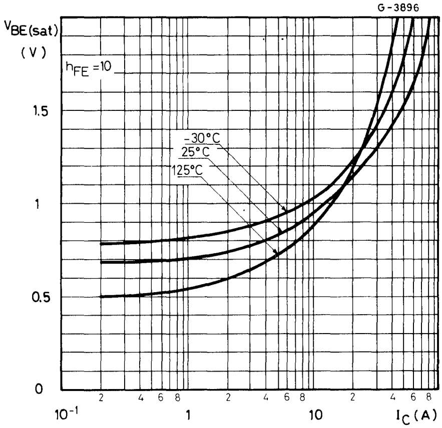
Collector-emitter saturation voltage



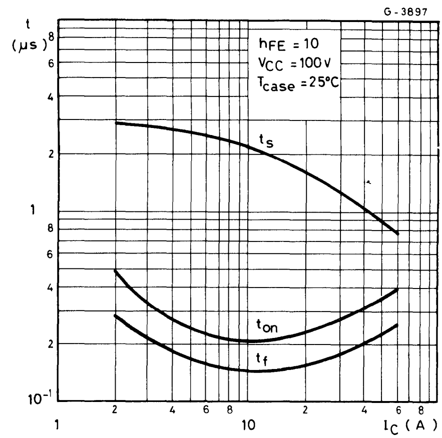
Collector-emitter saturation voltage



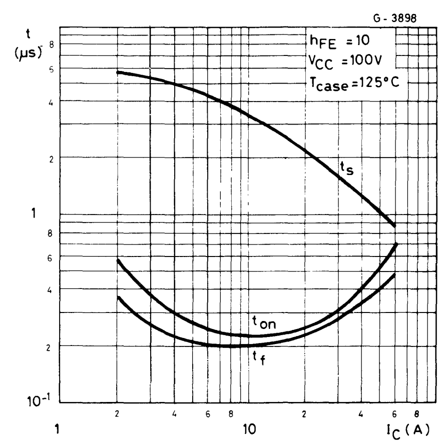
Base-emitter saturation voltage



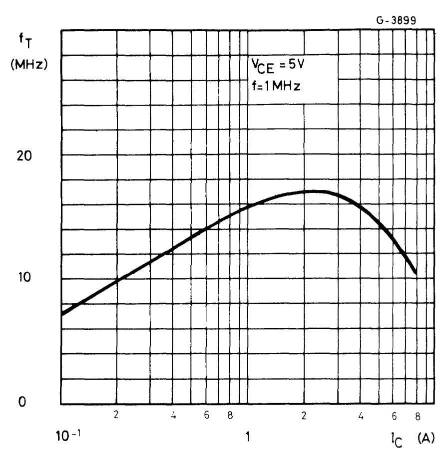
Saturated switching characteristics



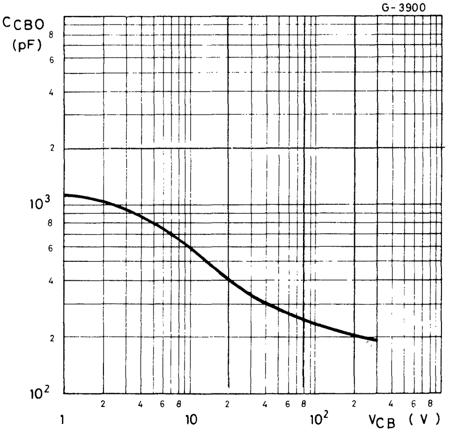
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

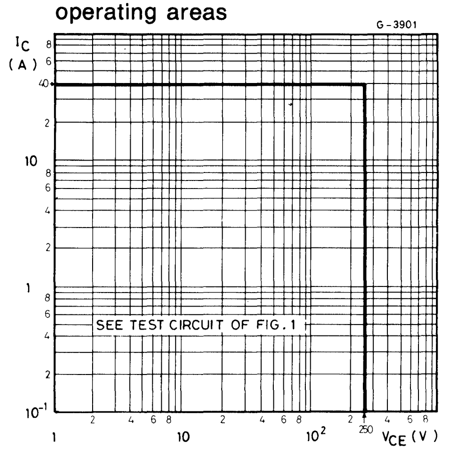


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

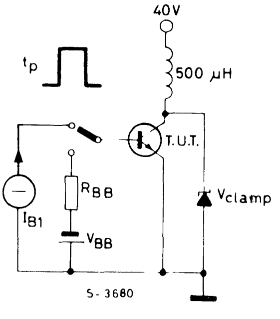


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 100V

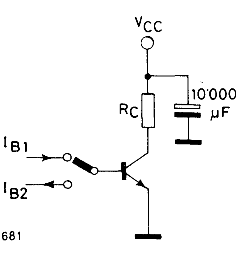
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



EPITAXIAL PLANAR NPN

SGS **BUT13**

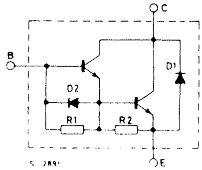
HIGH VOLTAGE, HIGH POWER, FAST SWITCHING

The BUT13 is a silicon epitaxial planar NPN Darlington transistor with integrated base-emitter speed-up diode, mounted in jedec TO-3 metal case. It is particularly suitable as output stage in high power, fast switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	600	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	28	A
I_{CM}	Collector peak current ($t_p = 10ms$)	35	A
I_B	Base current	6	A
P_{tot}	Total power dissipation $T_{case} \leqslant 25°C$	175	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

INTERNAL SCHEMATIC DIAGRAM

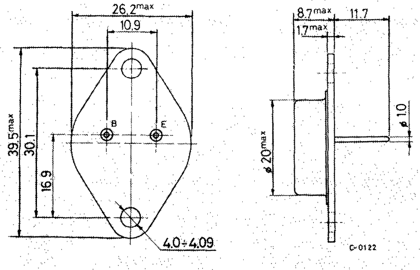


R1 = 100Ω
R2 = 350Ω

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_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 600V V_{CE} = 600V T_{case} = 100°C			100 2	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} = 2V			175	mA
$V_{CEO(sus)}$*	Collector cutoff sustaining voltage	I_C = 100mA	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10A I_B = 0.5A I_C = 18A I_B = 1.8A I_C = 22A I_B = 2.2A I_C = 28A I_B = 5.6A			2 2.5 3 5	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10A I_B = 0.5A I_C = 18A I_B = 1.8A I_C = 22A I_B = 2.2A			2.5 3 3.3	V V V
h_{FE}	DC current gain	I_C = 10A V_{CE} = 5V I_C = 18A V_{CE} = 5V	30 20			V V
V_F	Diode forward voltage	I_F = 22A			4	V

RESISTIVE SWITCHING TIMES

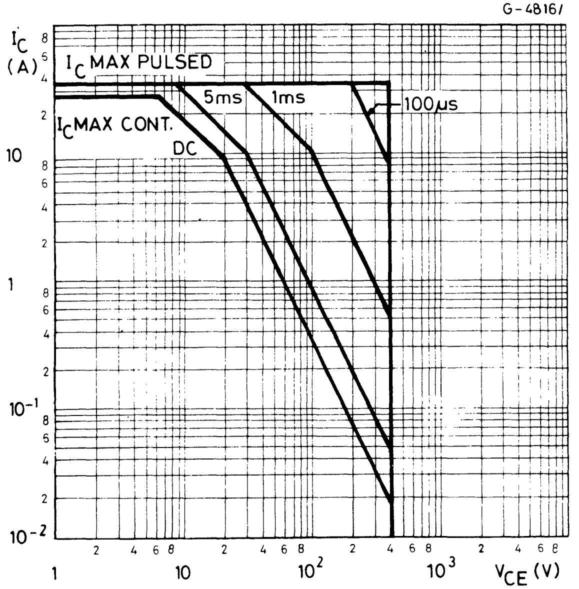
t_{on}	Turn-on time	V_{CC} = 250V I_C = 10A I_{B1} = 0.5A $V_{BE(off)}$ = -5V		0.35	0.6	μs
t_s	Storage time			0.8	1.5	μs
t_f	Fall time			0.25	0.6	μs

ELECTRICAL CHARACTERISTICS (continued)

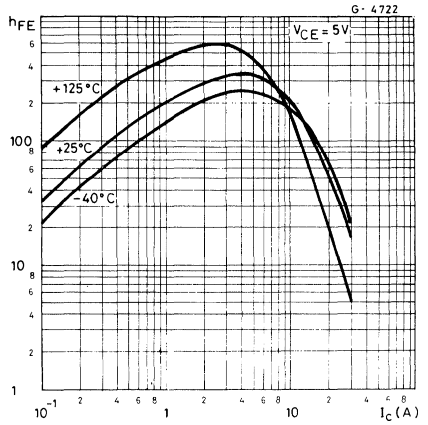
Parameter		Test conditions	Min.	Typ.	Max.	Unit
INDUCTIVE SWITCHING TIMES						
t_s	Storage time	$V_{Clamp} = 250V$ $I_C = 10A$ I_{B1} 0.5A; $V_{BE(off)} = -5V$		0.8	1.5	μs
t_f	Fall time			0.08	0.5	μs
t_s	Storage time	$V_{Clamp} = 250V$ $I_C = 20A$ $I_{B1} = 2A$; $V_{BE(off)} = 5V$		0.8	1.5	μs
t_f	Fall time			0.35	0.7	μs

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

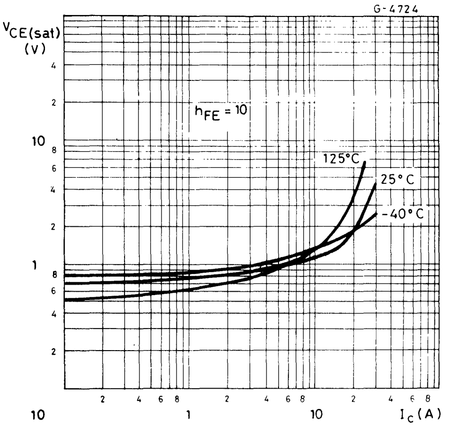
Safe operating areas



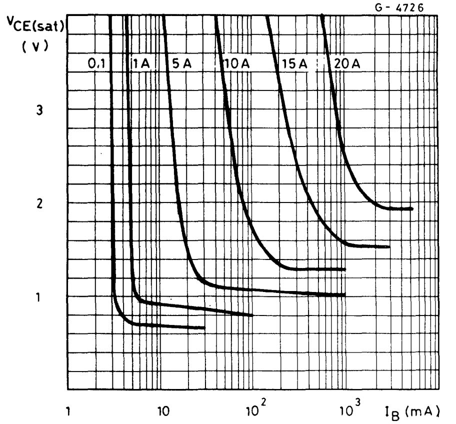
DC current gain



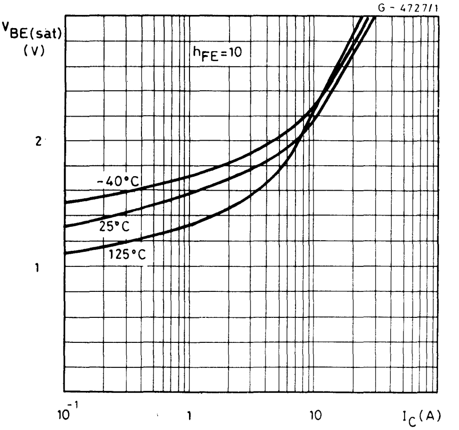
Collector-emitter saturation voltage



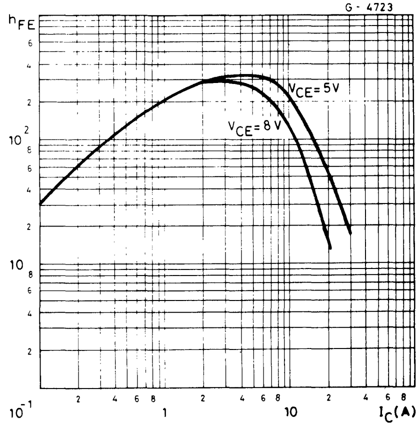
Collector-emitter saturation voltage



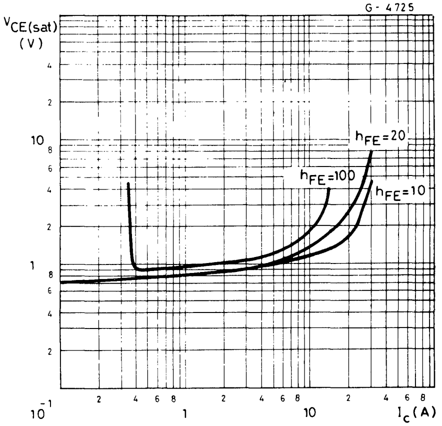
Base-emitter saturation voltage



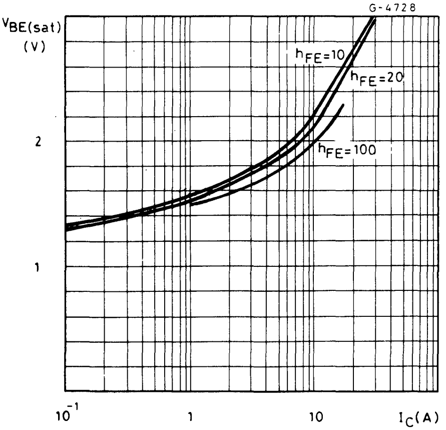
DC current gain



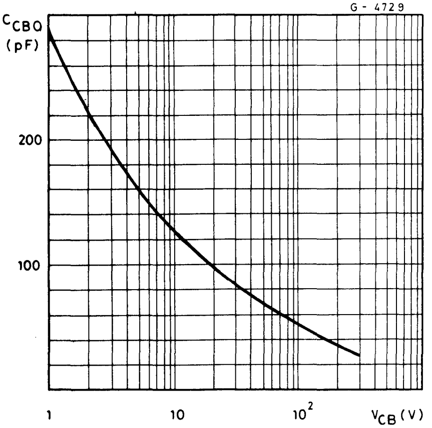
Collector-emitter saturation voltage



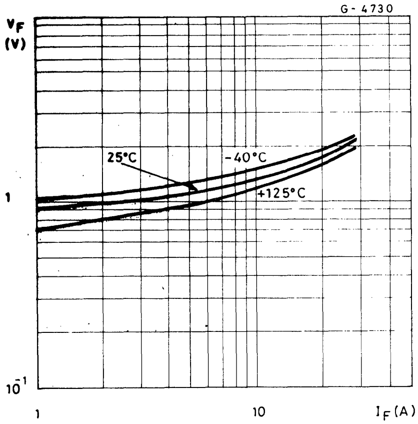
Base-emitter saturation voltage



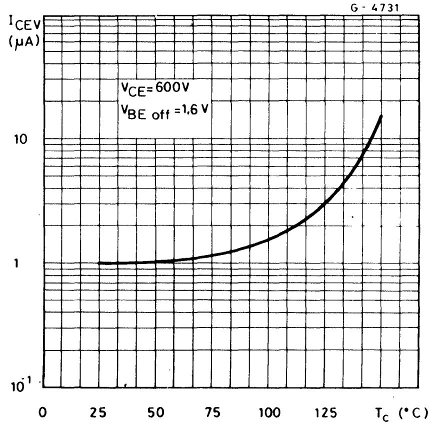
Collector base capacitance



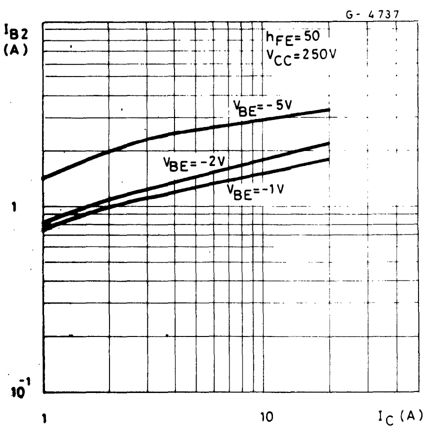
Diode forward voltage



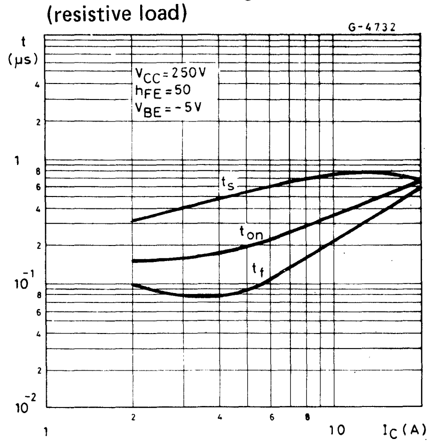
Collector cutoff current



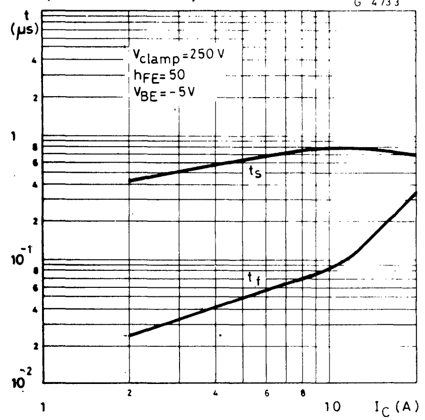
Reverse peak current



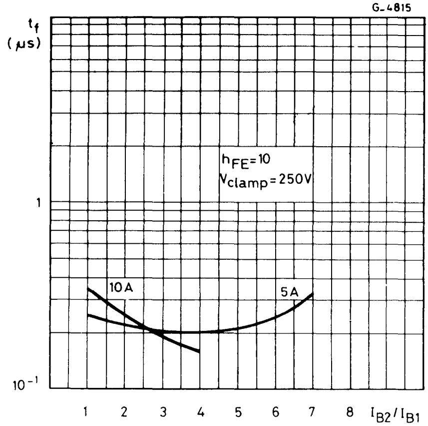
Saturated switching characteristics (resistive load)



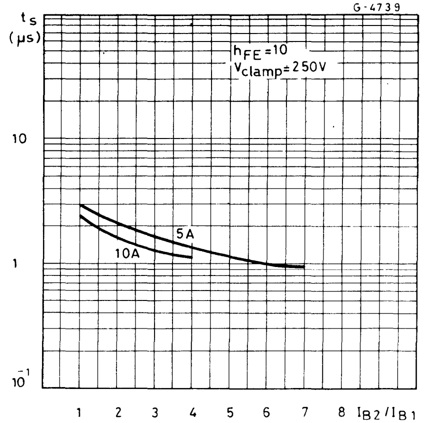
Saturated switching characteristics (inductive load)



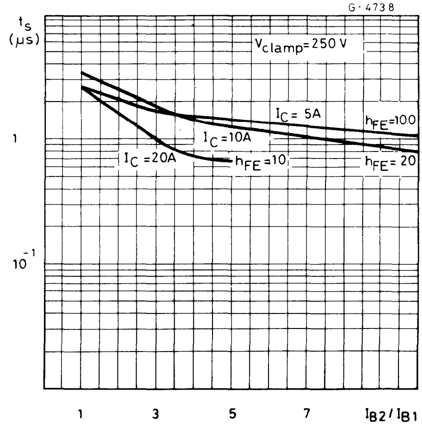
Fall time



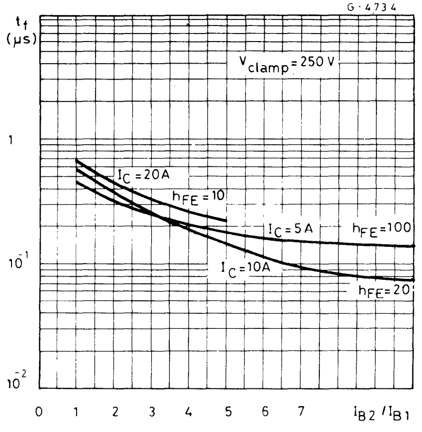
Storage time



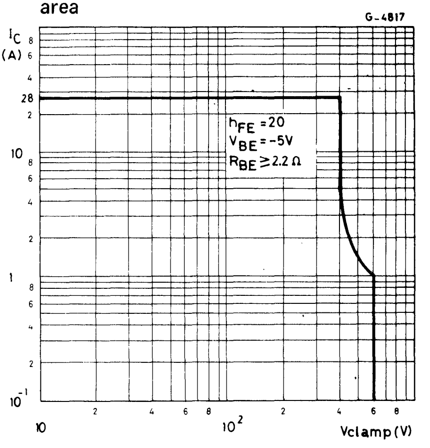
Storage time



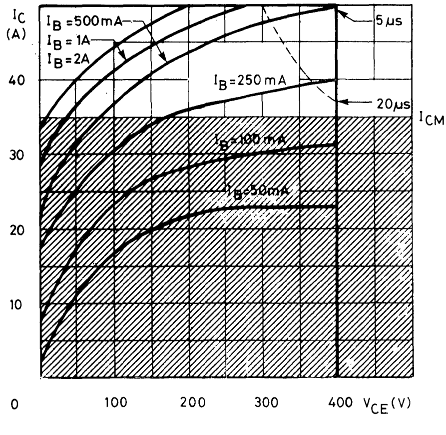
Fall time



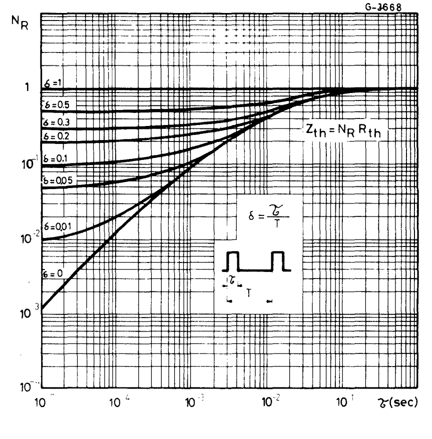
Clamped reverse bias safe operating area



Overload safe operating areas



Thermal transient response



EPITAXIAL PLANAR NPN

BUT13P

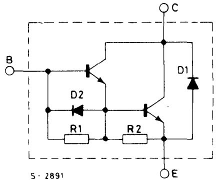
HIGH VOLTAGE, HIGH POWER, FAST SWITCHING

The BUT13P is a silicon epitaxial planar NPN Darlington transistor with integrated base-emitter speed-up diode, mounted in SOT-93 plastic package.
It is particularly suitable as output stage in high power, fast switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	600	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	28	A
I_{CM}	Collector peak current ($t_p = 10$ ms)	35	A
I_B	Base current	6	A
P_{tot}	Total power dissipation $T_{case} \leqslant 25°C$	150	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

INTERNAL SCHEMATIC DIAGRAM

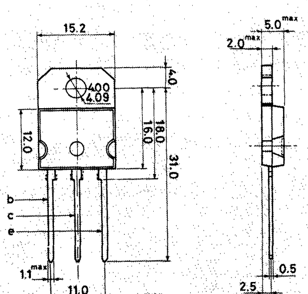


R1 TYP. 100Ω
R2 TYP. 350Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

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

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

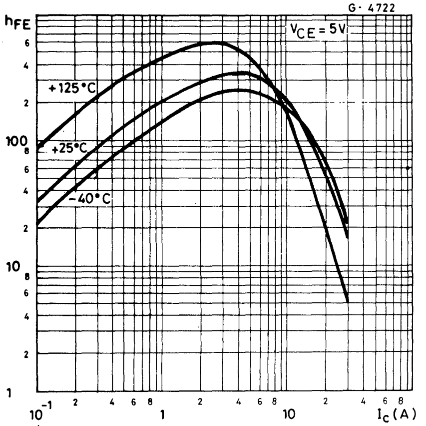
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}*	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 600V V_{CE} = 600V (T_C = 100°C)				100 2	μA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 400V				1	mA
I_{EBO}*	Emitter cutoff current (I_C = 0)	V_{EB} = 2V				175	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100 mA		400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10A I_C = 18A I_C = 22A I_C = 28A	I_B = 0.5A I_B = 1.8A I_B = 2.2A I_B = 5.6A			2 2.5 3 5	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10A I_C = 18A I_C = 22A	I_B = 0.5A I_B = 1.8A I_B = 2.2A			2.5 3 3.3	V V V
h_{FE}	DC Current gain	I_C = 10A I_C = 18A	V_{CE} = 5V V_{CE} = 5V	30 20			– –
V_F	Diode forward voltage	I_F = 22A				4	V

ELECTRICAL CHARACTERISTICS (continued)

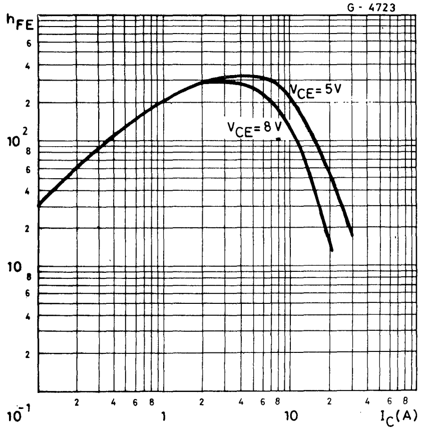
Parameter		Test conditions	Min.	Typ.	Max.	Unit
RESISTIVE SWITCHING TIMES						
t_{on}	Turn-on time	V_{CC} = 250V I_C = 10A I_{B1} = 0.5A $V_{BE(off)}$ = -5V		0.35	0.6	μs
t_s	Storage time			0.8	1.5	μs
t_f	Fall time			0.25	0.6	μs
INDUCTIVE SWITCHING TIMES						
t_s	Storage time	V_{Clamp} = 250V I_C = 10A I_{B1} = 0.5A $V_{BE(off)}$ = -5V		0.8	1.5	μs
t_f	Fall time			0.08	0.5	μs
t_s	Storage time	V_{Clamp} = 250V I_C = 20A I_{B1} = 2A $V_{BE(off)}$ = -5V		0.8	1.5	μs
t_f	Fall time			0.35	0.7	μs

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

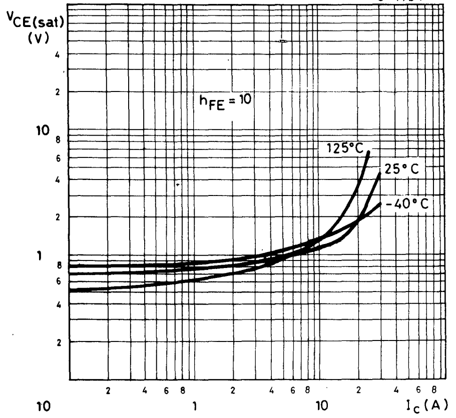
DC current gain



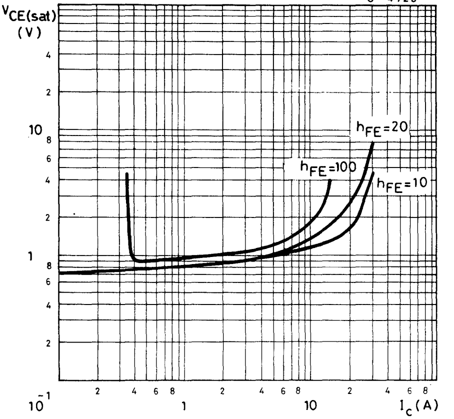
DC current gain



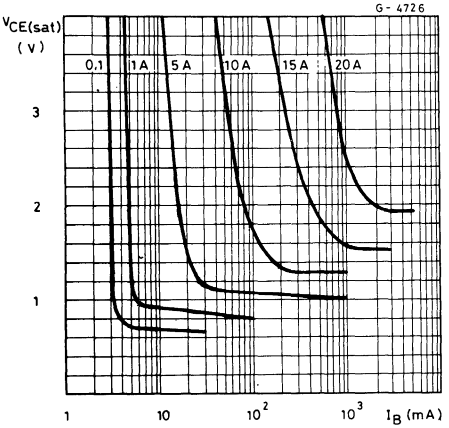
Collector-emitter saturation voltage



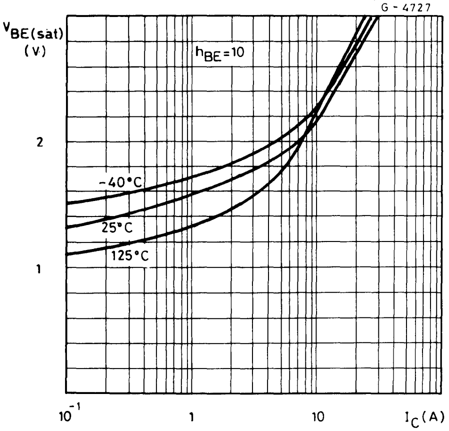
Collector-emitter saturation voltage



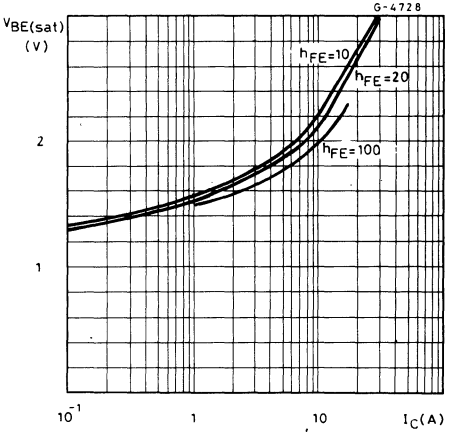
Collector-emitter saturation voltage



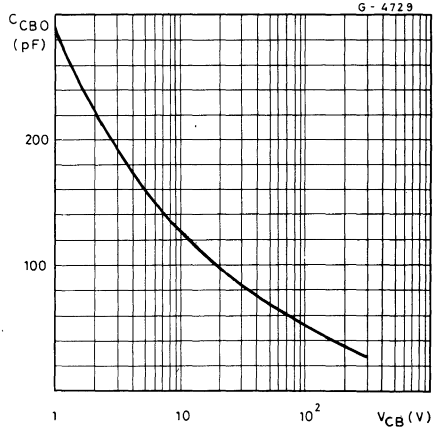
Base-emitter saturation voltage



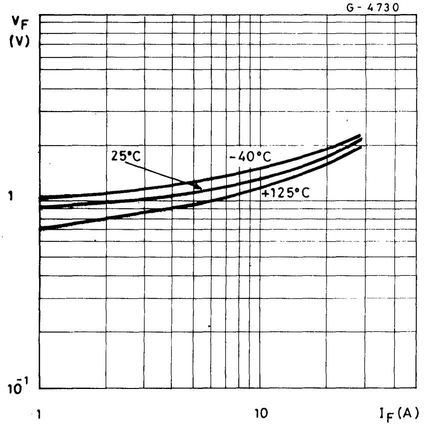
Base-emitter saturation voltage



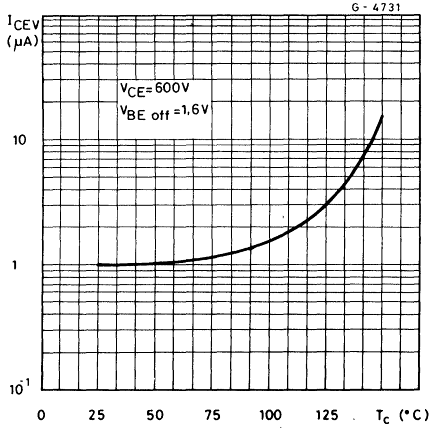
Collector-base capacitance



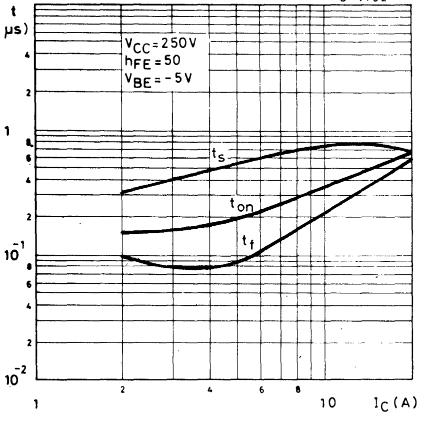
Forward voltage



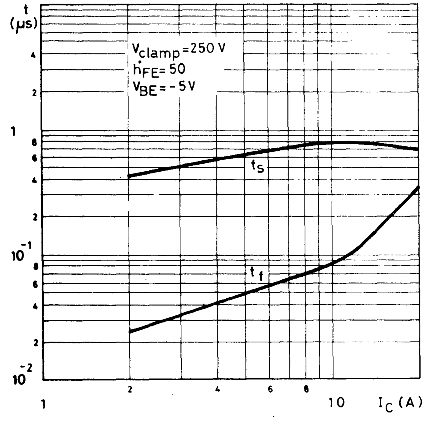
I_{CEV} Temperature



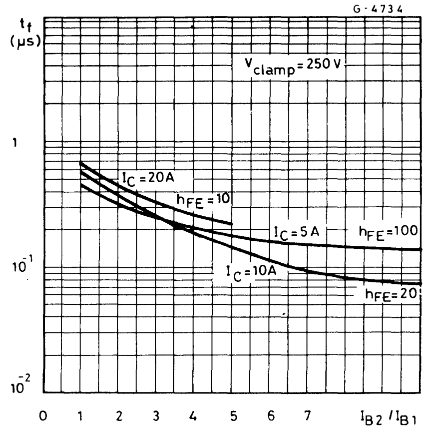
Saturated switching characteristics (resistive)



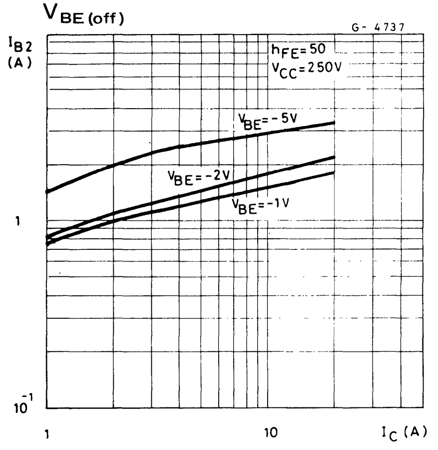
Saturated switching characteristics (inductive)



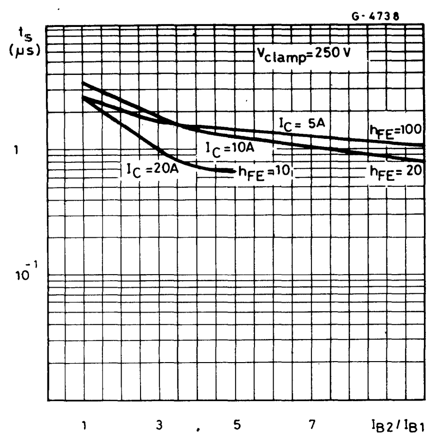
Fall time (resistive)



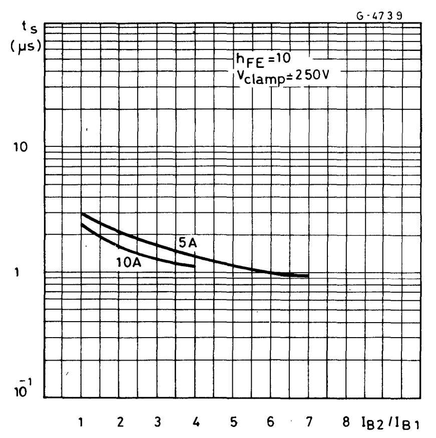
Reverse base current vs. I_C and $V_{BE(off)}$



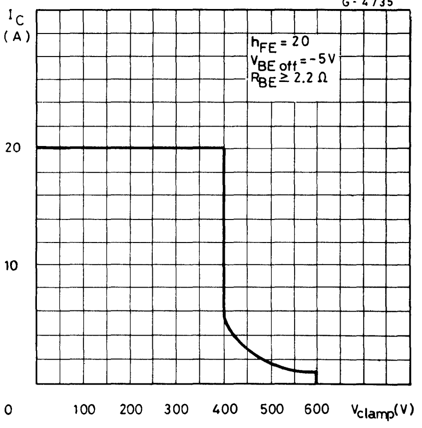
Storage time (inductive)



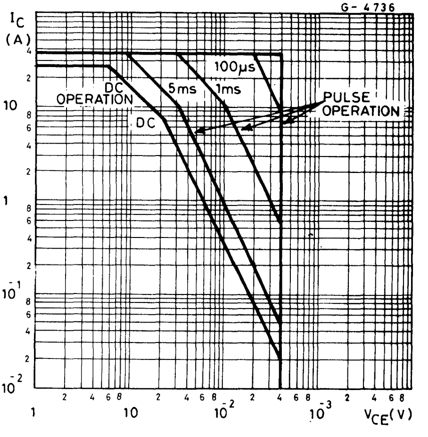
Storage time (inductive)



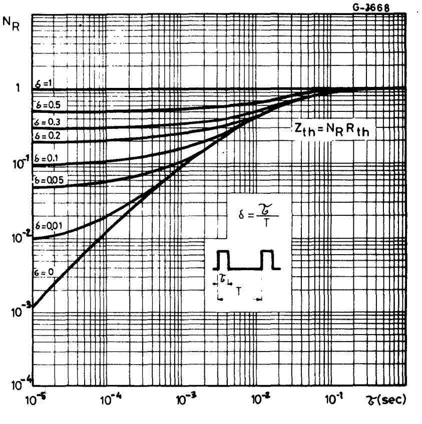
Clamped reverse bias safe operating areas



Safe operating areas



Thermal transient response



MULTIEPITAXIAL PLANAR NPN

SGS **BUV20 BUV21 BUV22**

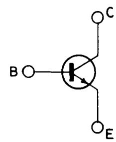
HIGH CURRENT POWER SWITCH

The BUV20, BUV21 and BUV22 are 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

		BUV20	BUV21	BUV22
V_{CBO}	Collector-base voltage ($I_E = 0$)	160V	250V	300V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	150V	240V	290V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	160V	250V	300V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	125V	200V	250V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	7V	7V
I_C	Collector current	50A	40A	40A
I_{CM}	Collector peak current	60A	50A	50A
I_B	Base current	10A	8A	8A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		250W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

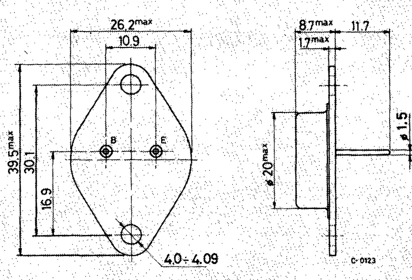
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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 ($I_B = 0$)	for **BUV20** $V_{CE} = 100V$ for **BUV21** $V_{CE} = 160V$ for **BUV22** $V_{CE} = 200V$			3 3 3	mA mA mA
I_{CEX}	Collector cutoff current ($V_{BE} = -1.5A$)	$V_{CE} = V_{CEX}$ for **BUV20** for **BUV21** for **BUV22** at $T_{case} = 125°C$ for **BUV20** for **BUV21** for **BUV22**			 3 3 3 12 12 12	 mA mA mA mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 200mA$ L = 25mH for **BUV20** for **BUV21** for **BUV22**	 125 200 250			 V V V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BUV20** $I_C = 25A$ $I_B = 2.5A$ $I_C = 50A$ $I_B = 5A$ for **BUV21** $I_C = 12A$ $I_B = 1.2A$ $I_C = 25A$ $I_B = 3A$ for **BUV22** $I_C = 10A$ $I_B = 1A$ $I_C = 20A$ $I_B = 2.5A$		 0.3 0.7 0.2 0.9 0.2 0.5	 0.6 1.2 0.6 1.5 1 1.5	 V V V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BUV20** $I_C = 50A$ $I_B = 5A$ for **BUV21** $I_C = 25A$ $I_B = 3A$ for **BUV22** $I_C = 40A$ $I_B = 4A$		 1.4 1.2 1.2	 2 1.5 1.5	 V V V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	for **BUV20**				
		$V_{CE} = 2V$ $I_C = 25A$	20		60	–
		$V_{CE} = 4V$ $I_C = 50A$	10			–
		for **BUV21**				
		$V_{CE} = 2V$ $I_C = 12A$	20		60	–
		$V_{CE} = 4V$ $I_B = 25A$	10			–
		for **BUV22**				
		$V_{CE} = 4V$ $I_C = 10A$	20		60	–
		$V_{CE} = 4V$ $I_C = 20A$	10			–
f_T	Transition frequency	$V_{CE} = 15V$ $I_C = 2A$ $f = 10MHz$	8			MHz
t_{on}	Turn-on time	for **BUV20**				
		$I_C = 50A$ $I_B = 5A$			1.5	μs
		for **BUV21**				
		$I_C = 25A$ $I_B = 3A$			1.2	μs
		for **BUV22**				
		$I_C = 20A$ $I_B = 2.5A$			1.3	μs
t_f	Fall time	for **BUV20**				
		$I_C = 50A$ $I_{B1} = -I_{B2} = 5A$			0.3	μs
		for **BUV21**				
		$I_C = 25A$ $I_{B1} = -I_{B2} = 3A$			0.4	μs
		for **BUV22**				
		$I_C = 20A$ $I_{B1} = -I_{B2} = 2.5A$			0.5	μs
t_s	Storage time	for **BUV20**				
		$I_C = 50A$ $I_{B1} = -I_{B2} = 5A$			1.2	μs
		for **BUV21**				
		$I_C = 25A$ $I_{B1} = -I_{B2} = 3A$			1.8	μs
		for **BUV22**				
		$I_C = 20A$ $I_{B1} = -I_{B2} = 2.5A$			2	μs

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

SGS BUV23 BUV24 BUV25

MULTIEPITAXIAL MESA NPN

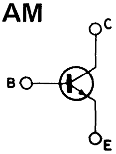
POWER SWITCH

The BUV23, BUV24 and BUV25 are silicon multiepitaxial mesa NPN transistors in Jedec TO-3 metal case, intended for use in power switching applications in military and industrial equipments.

ABSOLUTE MAXIMUM RATINGS

		BUV23	BUV24	BUV25
V_{CBO}	Collector-base voltate ($I_E = 0$)	400V	450V	500V
V_{CER}	Collector-emitter voltage ($R_{BE} = 100\Omega$)	390V	440V	500V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400V	450V	500V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	325V	400V	500V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	7V	7V
I_C	Collector current	30A	20A	15A
I_{CM}	Collector peak current ($t_p = 10ms.$)	40A	30A	20A
I_B	Base current	6A	4A	3A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		250W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

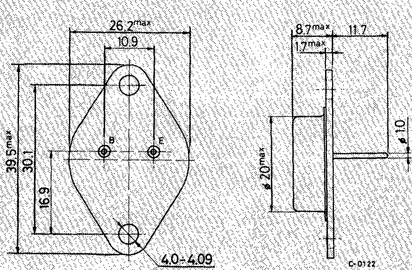
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j-case}$	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 ($I_B = 0$)	$V_{CE} = 260V$	for **BUV23**			3	mA
		$V_{CE} = 320V$	for **BUV24**			3	mA
		$V_{CE} = 400V$	for **BUV25**			3	mA
I_{CEX}	Collector cutoff current ($V_{BE} = -1.5V$)	$V_{CE} = V_{CEX}$				3	mA
		$T_{case} = 125°C$ $V_{CE} = V_{CEX}$				12	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BUV23**					
		$I_C = 8A$	$I_B = 1.6A$		0.2	0.8	V
		$I_C = 16A$	$I_B = 3.2A$		0.35	1	V
		for **BUV24**					
		$I_C = 6A$	$I_B = 1.2A$		0.15	0.6	V
		$I_C = 12A$	$I_B = 2.4A$		0.3	1	V
		for **BUV25**					
		$I_C = 4A$	$I_B = 0.8A$		0.2	0.6	V
		$I_C = 8A$	$I_B = 1.6A$		0.6	1	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BUV23**					
		$I_C = 16A$	$I_B = 3.2A$		1.15	1.5	V
		for **BUV24**					
		$I_C = 12A$	$I_B = 2.4A$		1	1.15	V
		for **BUV25**					
		$I_C = 8A$	$I_B = 1.6A$		1.2	1.5	V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	$L = 25mH$				
			for **BUV23**	325			V
			for **BUV24**	400			V
			for **BUV25**	500			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 50mA$		7			V
h_{FE}*	DC current gain	$V_{CE} = 4V$	for **BUV23**				
		$I_C = 8A$		15		60	–
		$I_C = 16A$		8			–
		$V_{CE} = 4V$	for **BUV24**				
		$I_C = 6A$		15		60	–
		$I_C = 12A$		8			–
		$V_{CE} = 4V$	for **BUV25**				
		$I_C = 4A$		15		60	–
		$I_C = 8A$		8			–

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
f_T	Transition frequency	$V_{CE} = 15V$ $I_C = 2A$ $f = 10MHz$	8			MHz
t_{on}	Turn-on time	for **BUV23** $I_C = 16A$ $I_B = 3.2A$		0.55	1.3	μs
		for **BUV24** $I_C = 12A$ $I_B = 2.4A$		0.6	1.6	μs
		for **BUV25** $I_C = 8A$ $I_B = 1.6A$		0.9	1.8	μs
t_f	Fall time	for **BUV23** $I_C = 16A$; $I_{B1} = -I_{B2} = 3.2A$		0.26	1.2	μs
		for **BUV24** $I_C = 12A$; $I_{B1} = -I_{B2} = 2.4A$		0.6	1.4	μs
		for **BUV25** $I_C = 8A$; $I_{B1} = -I_{B2} = 1.6A$		0.9	1.6	μs
t_s	Storage time	for **BUV23** $I_C = 16A$; $I_{B1} = -I_{B2} = 3.2A$		1.7	2.5	μs
		for **BUV24** $I_C = 12A$; $I_{B1} = -I_{B2} = 2.4A$		1.5	3	μs
		for **BUV25** $I_C = 8A$; $I_{B1} = -I_{B2} = 1.6A$		3.5	5	μs

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

SGS **BUV46**

MULTIEPITAXIAL MESA NPN

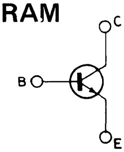
HIGH VOLTAGE POWER SWITCH

The BUV46 is a silicon multiepitaxial mesa NPN transistor in Jedec TO-220 plastic package, intended for high voltage, fast switching applications.

ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850	V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -2.5V$)	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 $T_{case} \leqslant 25°C$	85	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

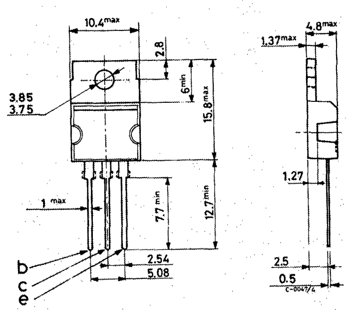
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

10/82

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.76	°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} = 10Ω)	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_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-time	I_C = 2.5A V_{CC} = 150V I_{B1} = $-I_{B2}$ = 0.5 A			1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs

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

MULTIEPITAXIAL MESA NPN

BUV47
BUV47A

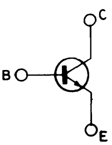
HIGH VOLTAGE POWER SWITCH

The BUV47 is silicon multiepitaxial mesa NPN transistor in SOT-93 plastic package. It is intended for high voltage, fast switching and industrial applications.

ABSOLUTE MAXIMUM RATINGS

		BUV47	BUV47A
V_{CBO}	Collector-base voltage ($I_E = 0$)	850V	1000V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400V	450V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	
I_C	Collector current	9A	
I_{CM}	Collector peark current ($t_p < 5ms.$)	15A	
I_B	Base current	3A	
I_{BM}	Base peak current ($t_p < 5ms.$)	6A	
P_{tot}	Total power dissipation at $T_{case} < 25°C$	120W	
T_{stg}	Storage temperature	-65 to 175°C	
T_j	Junction temperature	175°C	

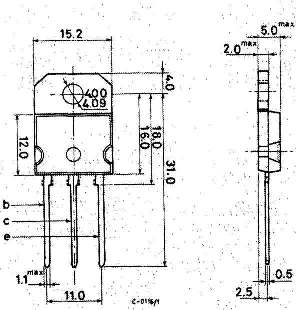
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

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)

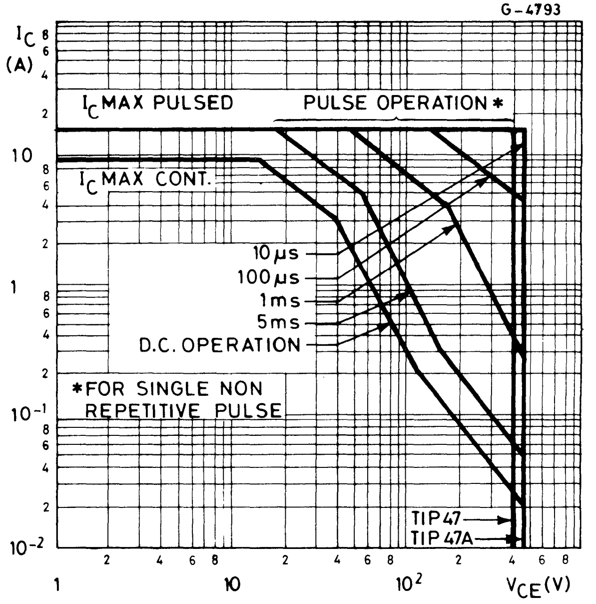
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = -2.5V)	$V_{CE} = V_{CBO}$ $V_{CE} = V_{CBO}$ T_{case} = 125°C			0.15 1.5	mA mA
I_{CER}	Collector cutoff current (R_{BE} = 10Ω)	$V_{CE} = V_{CBO}$ $V_{CE} = V_{CBO}$ T_{case} = 125°C			0.4 3	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
V_{EBO}	Emitter-base voltage (I_C = 0)	I_E = 0.05A	7		30	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 0.2A L = 25mH for **BUV47A**	400 450			V 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			1.6	V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time	**Resistive load** $I_C = 5A$ $I_{B1} = 1A$ $I_{B2} = -1A$ $V_{CC} = 150V$			1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.8	μs
t_f	Fall time	**Inductive load** $I_C = 5A$ $I_{B1} = 1A$ $V_{BE} = -5V$ $V_{CC} = 300V$ $L = 3\mu H$ $T_j = 100°C$			0.5	μs

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

Safe operating areas



SGS **BUV48**
BUV48A

MULTIEPITAXIAL MESA NPN

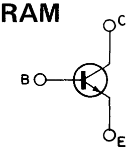
HIGH VOLTAGE FAST SWITCHING

The BUV48 is silicon multiepitaxial mesa NPN transistor in SOT-93 plastic package. It is intended for high voltage, high current, fast switching and industrial applications.

ABSOLUTE MAXIMUM RATINGS

		BUV48	BIV48A
V_{CBO}	Collector-base voltage ($I_E = 0$)	850V	1000V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	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	4A	
I_{BM}	Base peak current	20A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	150W	
T_{stg}	Storage temperature	175°C	
T_j	Junction temperature	-65 to 175°C	

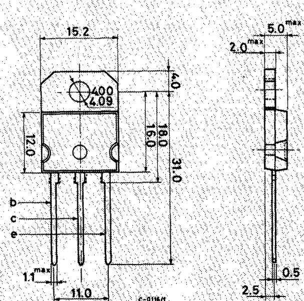
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

$R_{th\ j-case}$	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_{CEX}	Collector cutoff current (V_{BE} = 2.5V)	$V_{CE} = V_{CBO}$ $V_{CE} = V_{CBO}$ T_{case} = 125°C			0.2 2	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
I_{CER}	Collector cutoff current (R_{BE} = 10Ω)	$V_{CE} = V_{CBO}$ $V_{CE} = V_{CBO}$ T_{case} = 125°C			0.5 4	mA mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200mA L = 25mH for **BUV48** for **BUV48A**	 400 450			 V V
V_{EBO}	Emitter-base voltage (I_C = 0)	I_E = 0.05A	7		30	V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 10A I_B = 2A for **BUV48** I_C = 8A I_B = 1.6A for **BUV48A** I_C = 15A I_B = 3A for **BUV48** I_C = 12A I_B = 2.4A for **BUV48A**			1.5 1.5 5 5	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 10A I_B = 2A for **BUV48** I_C = 8A I_B = 1.6A for **BUV48A**			1.6 1.6	V V
t_{on}	Turn-on time	V_{CC} = 150V V_{BE} = -6V R_{B2} = 1.5; I_C = 10A (BUV48) I_C = 8A (BUV48A) $I_{B1} = -I_{B2}$ = 2A (BUV48) $I_{B1} = -I_{B2}$ = 1.6A (BUV48A)		0.55	1	μs
t_s	Storage time			1.5	3	μs
t_f	Fall time			0.3	0.8	μs

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

SGS

BUW11

MULTIEPITAXIAL MESA NPN

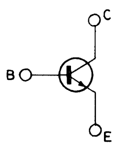
HIGH VOLTAGE POWER SWITCH

The BUW11 is silicon multiepitaxial mesa NPN transistors in SOT-93 plastic package. It is intended for high voltage, fast switching industrial applications.

ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
I_C	Collector current	5	A
I_{CM}	Collector peak current ($t_p \leqslant 2$ ms.)	10	A
I_B	Base current	2	A
I_{BM}	Base peak current ($t_p \leqslant 2$ ms.)	3	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	100	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

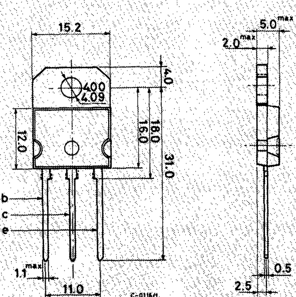
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

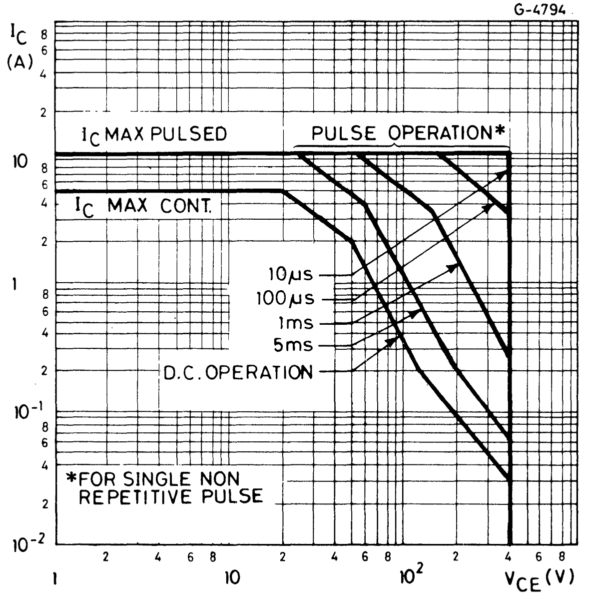
$R_{th\ j-case}$	Thermal resistance junction-case	max.	1.5	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	$V_{CE} = 850V$ $V_{CE} = 850V$ $T_j = 125°C$			1 2	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 9V$			10	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 100mA$ $L = 25mH$	400			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 3A$ $I_B = 0.6A$			1.5	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 3A$ $I_B = 0.6A$			1.4	V
t_{on}	Turn-on time	$I_C = 3A$ $I_{B1} = 0.6A$ $I_{B2} = -0.6A$			1	μs
t_s	Storage time				4	μs
t_f	Fall time				0.8	μs

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

Safe operating areas



BUW12
BUW12A

MULTIEPITAXIAL MESA NPN

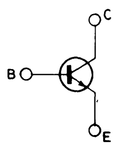
HIGH VOLTAGE POWER SWITCH

The BUW12 and BUW12A are silicon multiepitaxial mesa NPN transistors in SOT-93 plastic package, particularly intended for high voltage, fast switching industrial applications.

ABSOLUTE MAXIMUM RATING

		BUW12	BUW12A
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850V	1000V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400V	450V
I_C	Collector current	8A	
I_{CM}	Collector peak current ($t_p \leqslant 2ms$)	20A	
I_B	Base current	4A	
I_{BM}	Base peak current ($t_p \leqslant 2ms$)	6A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	125W	
T_{stg}	Storage temperature	-65 to 175°C	
T_j	Junction temperature	175°C	

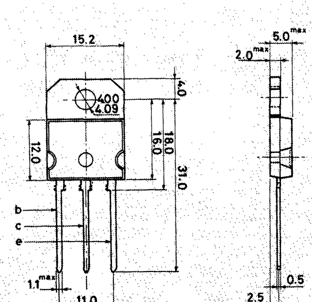
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

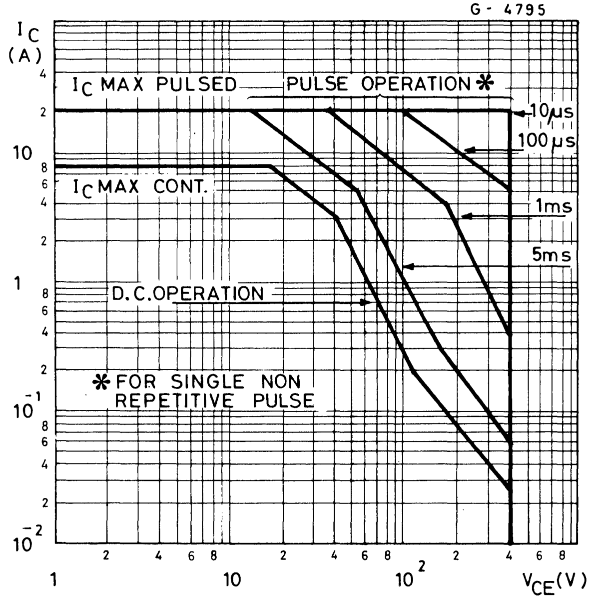
$R_{th\ j-case}$	Thermal resistance junction-case	max.	1.2	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_j = 125°C			1 3	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 9V			10	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA L = 25mH	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 6A I_B = 1.2A			1.5	V
$V_{BE(sat)}$*	Base emitter saturation voltage	I_C = 6A I_B = 1.2A			1.5	V
t_{on}	Turn-on time	I_C = 6A I_{B1} = 1.2A I_{B2} = 1.2A			1	μs
t_s	Storage time				4	μs
t_f	Fall time				0.8	μs

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

Safe operating areas



MULTIEPITAXIAL MESA PNP

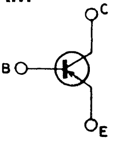
HIGH VOLTAGE POWER SWITCH

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

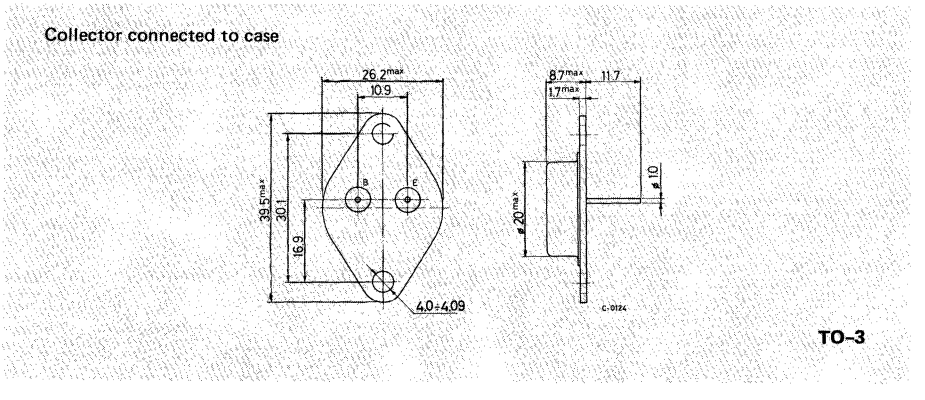
V_{CES}	Collector-emitter voltage ($V_{BE}=0$)	-450	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	-400	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	-7	V
I_C	Collector current	-10	A
I_B	Base current	-5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	125	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

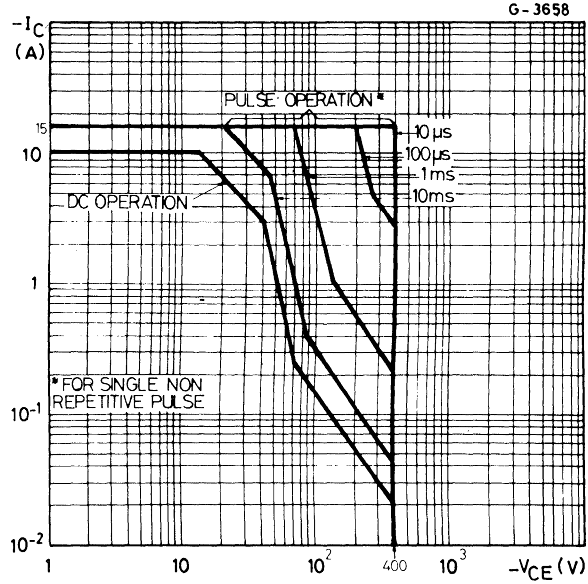
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

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

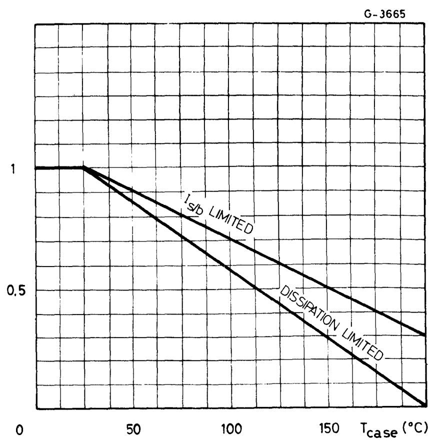
Parameter		Test conditions	Min. Typ. Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	V_{CE}=-450V	-500	μA
I_{CES}	Collector cutoff current ($I_C=0$)	V_{CE}=-450V T_{case}=125°C	-3	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	V_{EB}=-7V	-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B=0$)	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%

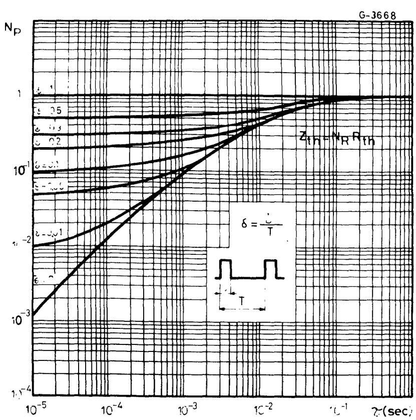
Safe operating areas



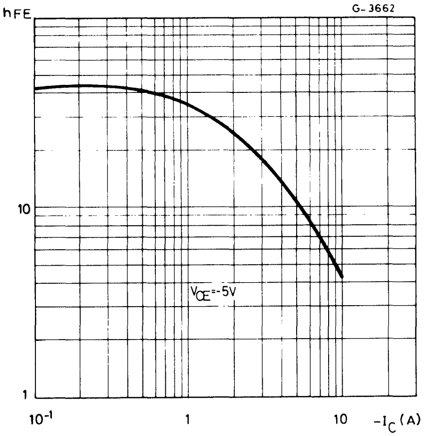
Derating curves



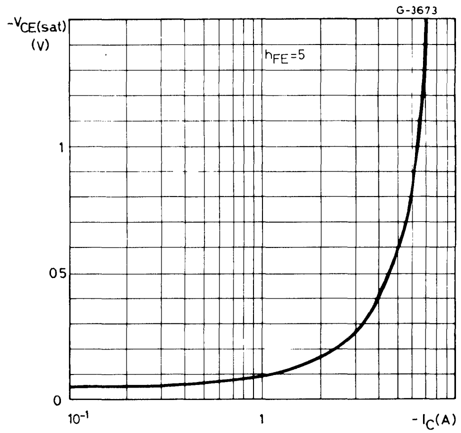
Transient thermal response



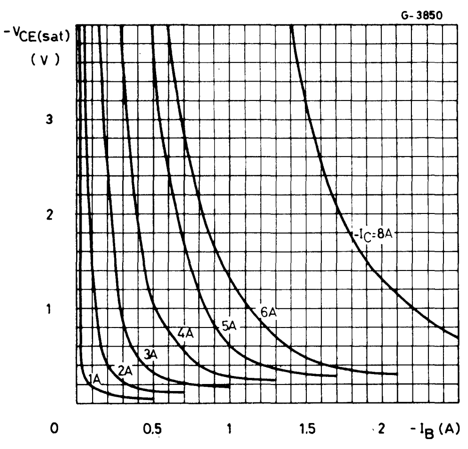
DC current gain



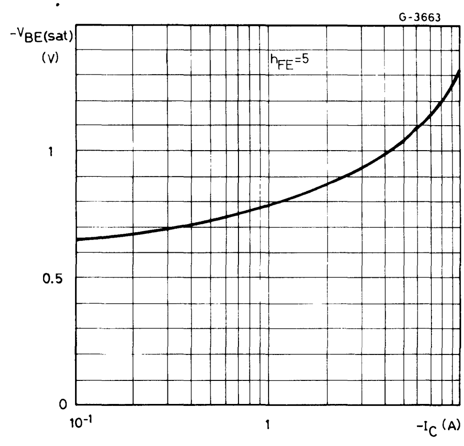
Collector-emitter saturation voltage



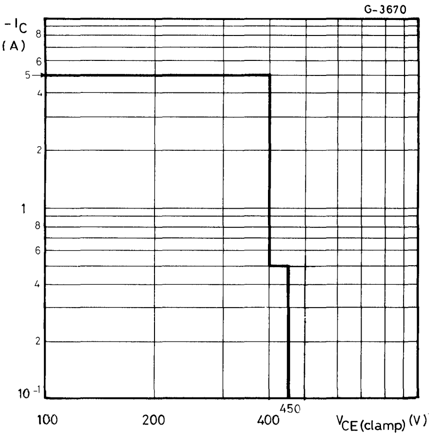
Collector-emitter saturation voltage



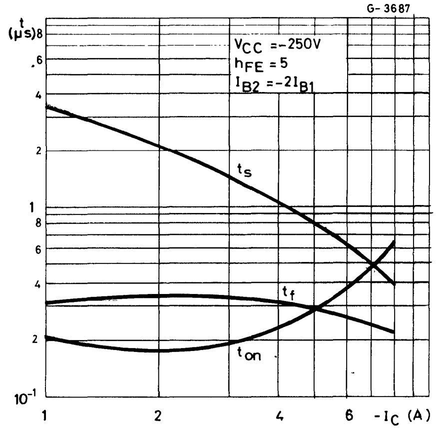
Base-emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

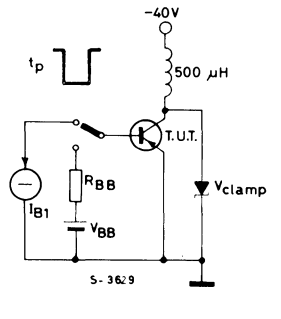
$5V \geq |-V_{BB}| > 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



MULTIEPITAXIAL MESA NPN

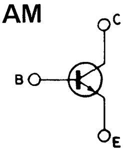
BUW34
BUW35
BUW36

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	

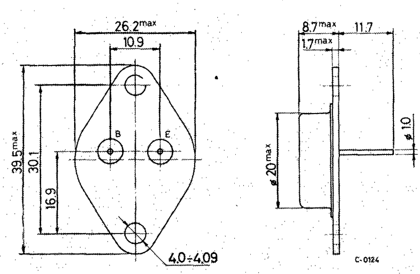
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

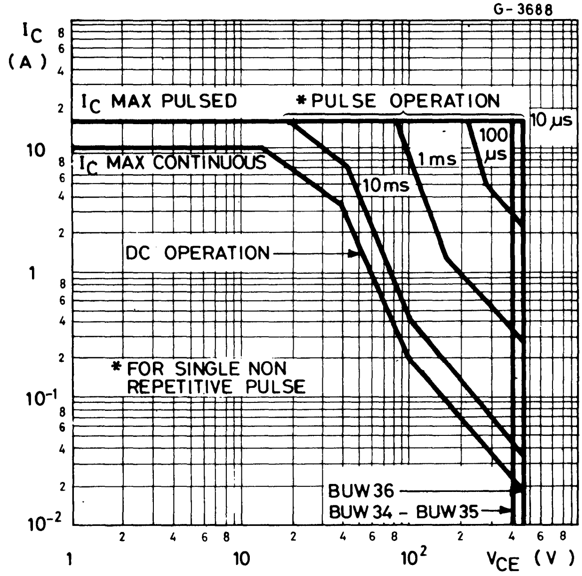
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.4	°C/W

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

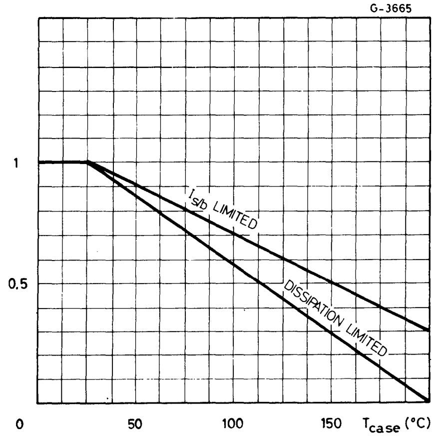
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BUW34** $V_{CE}=500V$ for **BUW35** $V_{CE}=800V$ for **BUW36** $V_{CE}=900V$ $T_{case}=125°C$ for **BUW34** $V_{CE}=500V$ for **BUW35** $V_{CE}=800V$ for **BUW36** $V_{CE}=900V$			500 500 500 3 3 3	µA µA µA mA mA 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** for **BUW35** for **BUW36**	 400 400 450			 V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	All types I_C =5A I_B =1A for **BUW35** I_C =8A I_B =2.5A for **BUW36** I_C =8A I_B =2.5A			1.5 1.5 3	V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	All types I_C =5A I_B =1A for **BUW35** I_C =8A I_B =2.5A for **BUW36** I_C =8A I_B =2.5A			1.5 1.8 1.8	V V V
h_{FE}*	DC current gain	I_C =1A V_{CE}=5V	15			—
t_{on}	Turn-on time	I_C =5A V_{CC}=250V I_{B1} =1A			0.75	µs
t_s	Storage time	I_C =5A V_{CC}=250V I_{B1} =1A I_{B2} =-1A			3	µs
t_f	Fall time				0.8	µs

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

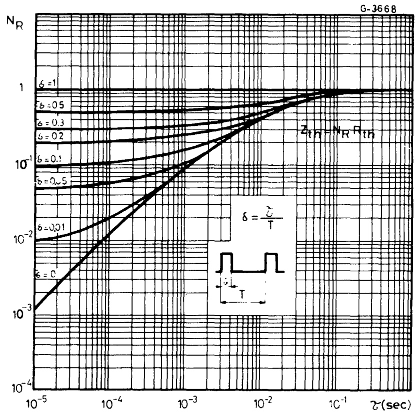
Safe operating areas



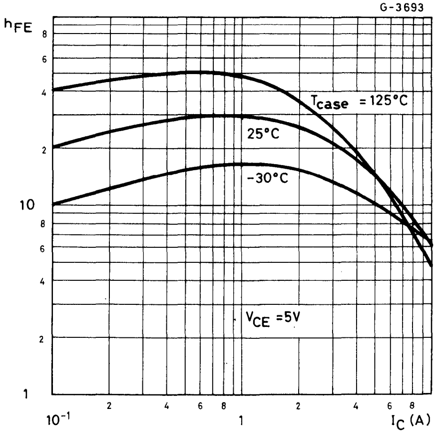
Derating curves



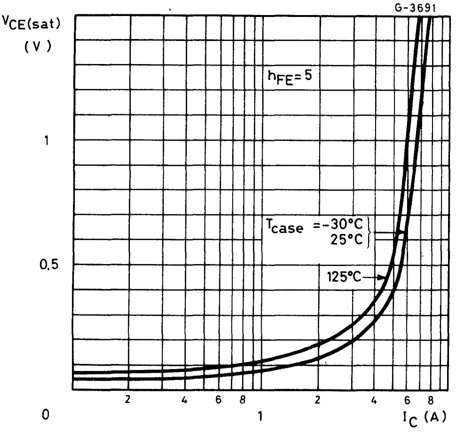
Transient thermal response



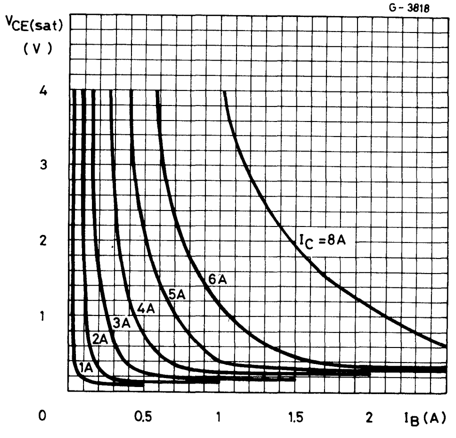
DC current gain



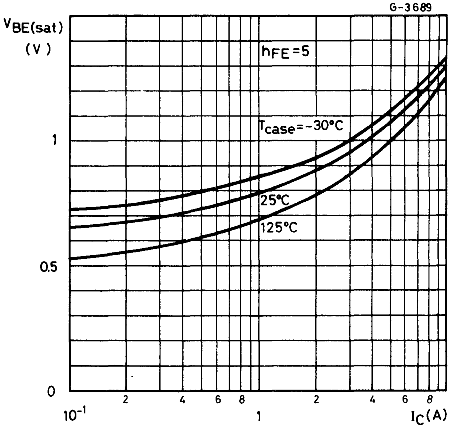
Collector-emitter saturation voltage



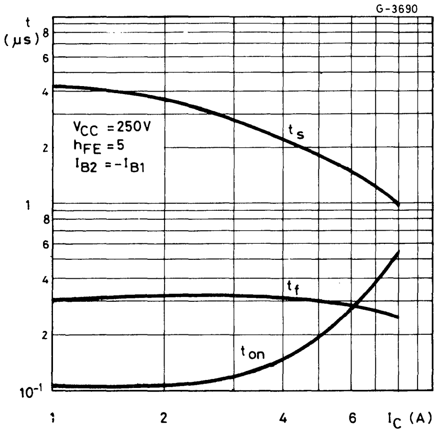
Collector-emitter saturation voltage



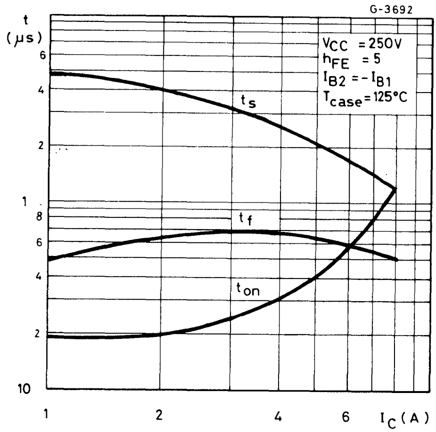
Base-emitter saturation voltage



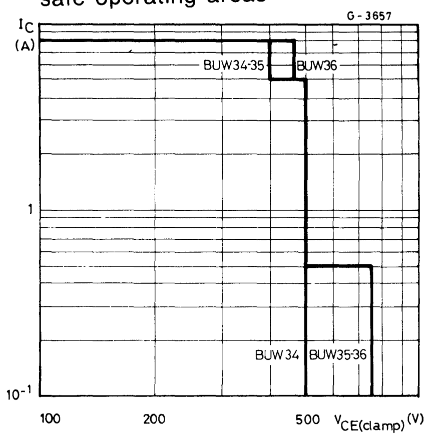
Saturated switching characteristics



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

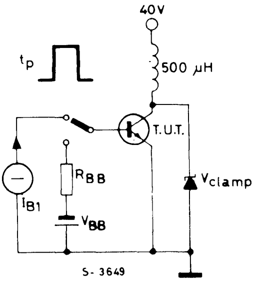
$5V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



BUW42

MULTIEPITAXIAL MESA PNP

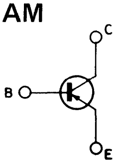
HIGH VOLTAGE POWER SWITCH

The BUW42 is a silicon multiepitaxial mesa PNP transistor in Jedec TO-3 metal case, intended in fast switching applications for high output powers. The complementary NPN types are the 2N6547 and the BUX48.

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	-15	A
I_{CM}	Collector peak current	--30	A
I_B	Base current	-10	A
P_{tot}	Total power dissipation $T_{case} \leqslant 25°C$	150	W
T_{stg}	Storage temperature	-65 to 175	°C
T_j	Junction temperature	175	°C

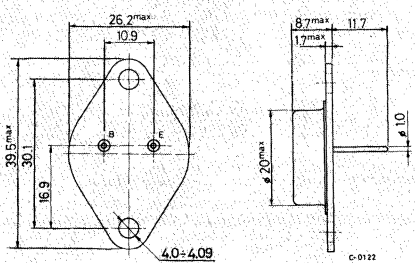
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j-case}$	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 ($V_{BE} = 0$)	$V_{CE} = -450V$ $V_{CE} = -450V$ $T_{case} = 100°C$			-1 -4	mA 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	$I_C = -10A$ $I_B = -2A$ $I_C = -15A$ $I_B = -3A$ $T_{case} = 100°C$ $I_C = -10A$ $I_B = -2A$			-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
h_{FE} *	DC current gain	$I_C = -5A$ $V_{CE} = -2V$ $I_C = -10A$ $V_{CE} = -2V$	12 6		60 30	– –
t_{on}	Turn-on time	**Resistive load** $V_{CC} = -250V$ $I_C = -10A$ $I_{B1} = -I_B = -2A$			1	μs
t_s	Storage time				4	μs
t_f	Fall time				0.7	μs

* Pulsed: pulse duration = 200 μs, duty cycle = 1.5%.

BUW44 BUW45 BUW46

MULTIEPITAXIAL MESA NPN

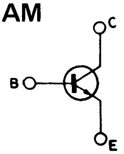
HIGH VOLTAGE, HIGH CURRENT POWER SWITCH

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	

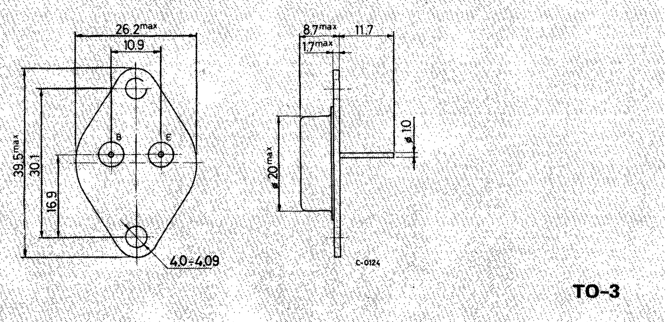
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



THERMAL DATA

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

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

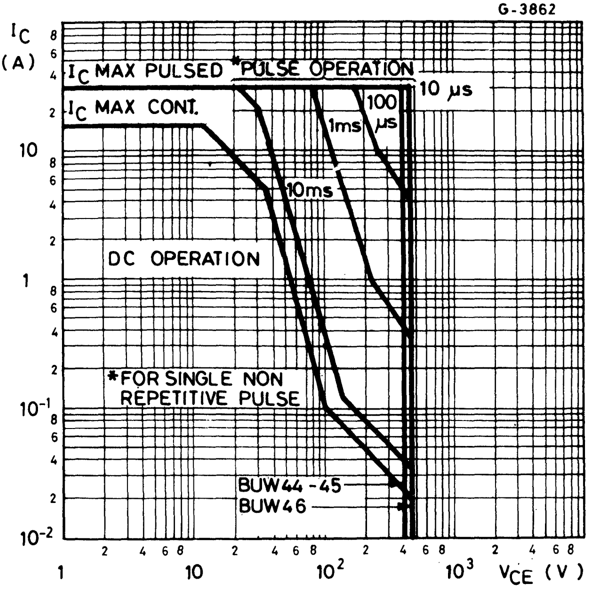
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE}=0$)	for **BUW44** $V_{CE}=500V$ for **BUW45** $V_{CE}=800V$ for **BUW46** $V_{CE}=900V$ $T_{case}=125°C$ for **BUW44** $V_{CE}=500V$ for **BUW45** $V_{CE}=800V$ for **BUW46** $V_{CE}=900V$			500 500 500 3 3 3	µA µA µA mA mA 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** for **BUW45** for **BUW46**	 400 400 450			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	for **BUW44** $I_C=10A$ $I_B=2A$ $I_C=6A$ $I_B=1A$ for **BUW45** and **BUW46** $I_C=10A$ $I_B=2A$ $I_C=7A$ $I_B=1A$			 3 1.5 1.5 1.5	 V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	for **BUW44** $I_C=10A$ $I_B=2A$ $I_C=6A$ $I_B=1A$ for **BUW45** and **BUW46** $I_C=10A$ $I_B=2A$ $I_C=7A$ $I_B=1A$			 1.8 1.4 1.8 1.4	 V V V V

ELECTRICAL CHARACTERISTICS (continued)

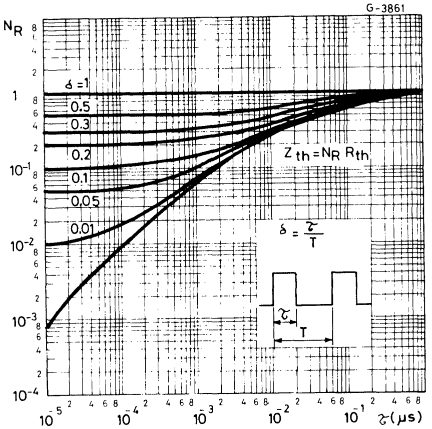
Parameter		Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time	I_C = 10A I_{B1} = 2A V_{CC} = 250V	0.75	μs
t_s	Storage time	I_C = 10A I_{B1} = 2A I_{B2} = -2A V_{CC} = 250V	3	μs
t_f	Fall time		0.8	μs

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

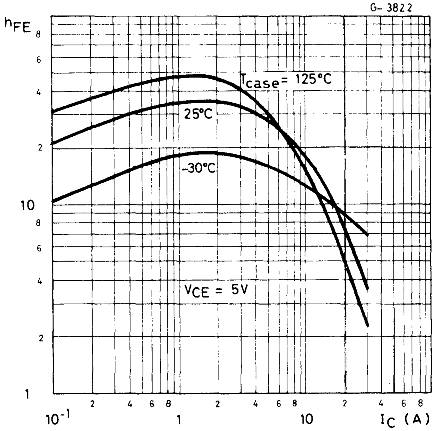
Safe operating areas



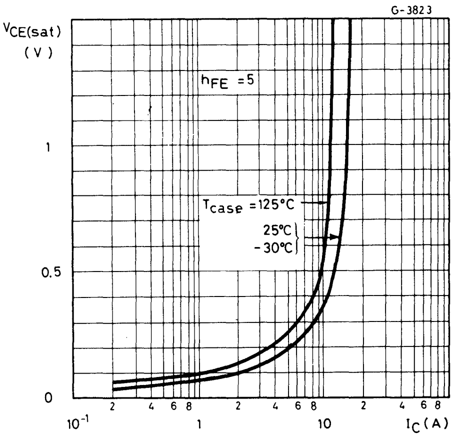
Thermal transient response



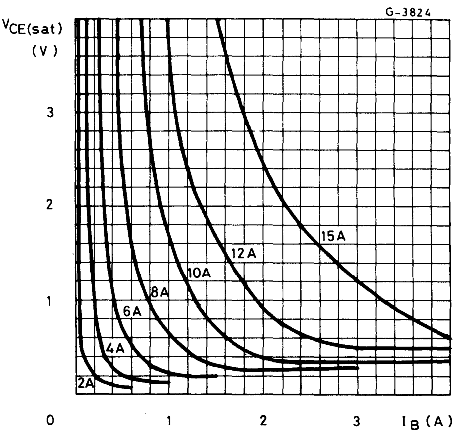
DC current gain



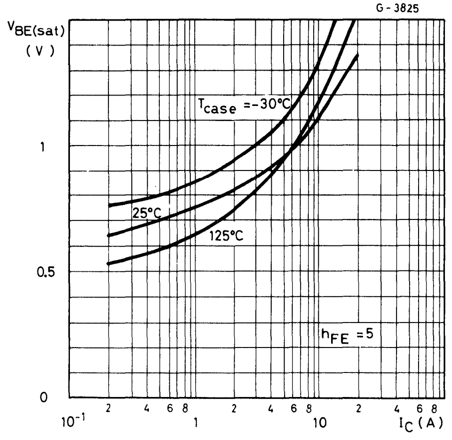
Collector-emitter saturation voltage



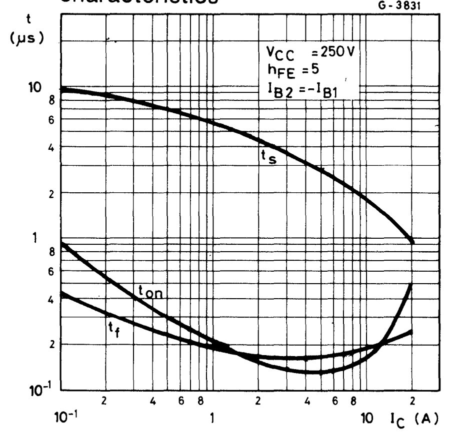
Collector-emitter saturation voltage



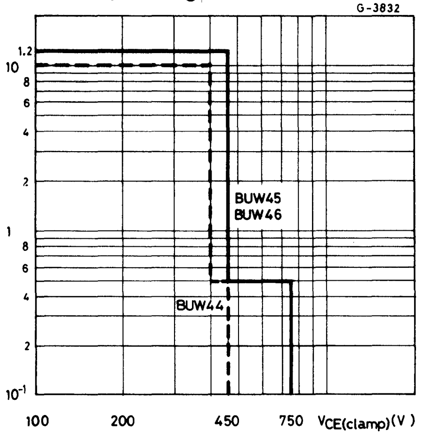
Base-emitter saturation voltage



Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

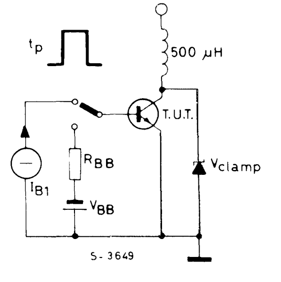
$5V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 5$

$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

R_{BB} = adjusted for I_{B2}



SGS	**BUX10**

MULTIEPITAXIAL PLANAR NPN

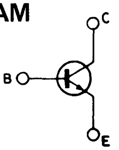
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

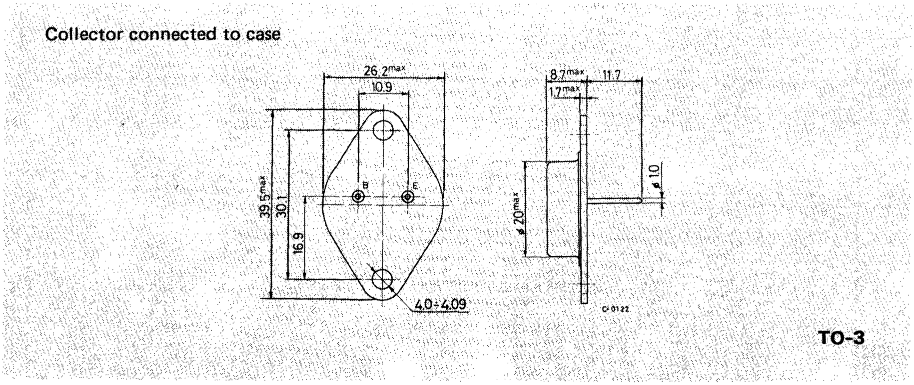
V_{CBO}	Collector-base voltage ($I_E=0$)	160	V
V_{CEX}	Collector-emitter voltage (V_{BE}=-1.5V)	160	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	25	A
I_{CM}	Collector peak current (t_p=10 ms)	30	A
I_B	Base current	5	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

INTERNAL SCHEMATIC DIAGRAM



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)

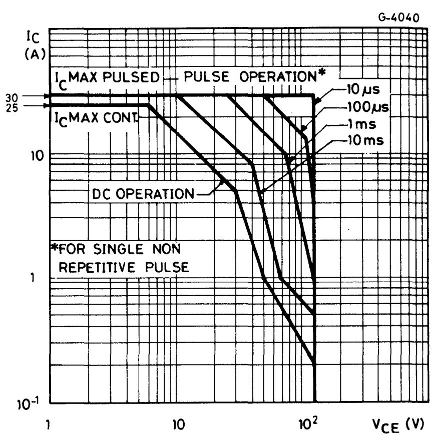
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 100V			1.5	mA
I_{CEX}	Collector cutoff current	V_{CE} = 160V V_{BE} = -1.5V T_{case} = 125 °C V_{CE} = 160V V_{BE} = -1.5V			1.5 6	mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO\ (sus)}$	*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)

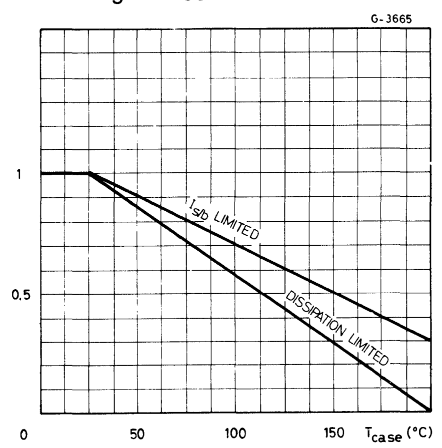
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	$I_C = 20A$ $I_{B1} = 2A$ $V_{CC} = 30V$		0.5	1.5	µs
t_s	Storage time (fig. 2)	$I_C = 20A$ $I_{B1} = -I_{B2} = 2A$ $V_{CC} = 30V$		0.6	1.2	µs
t_f	Fall time (fig. 2)			0.15	0.3	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	$V_{clamp} = 125V$ $L = 500\mu H$	20			A

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

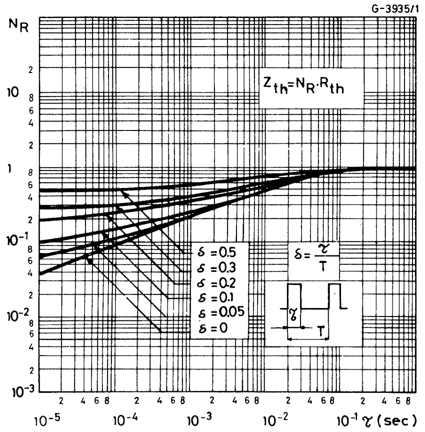
Safe operating areas



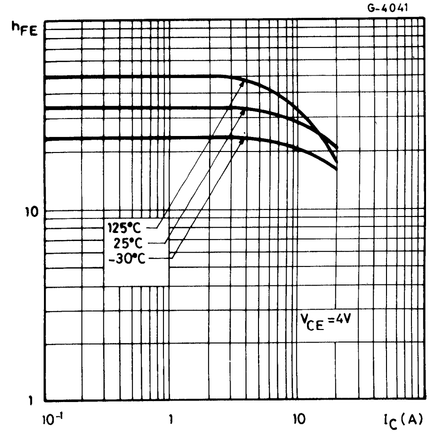
Derating curves



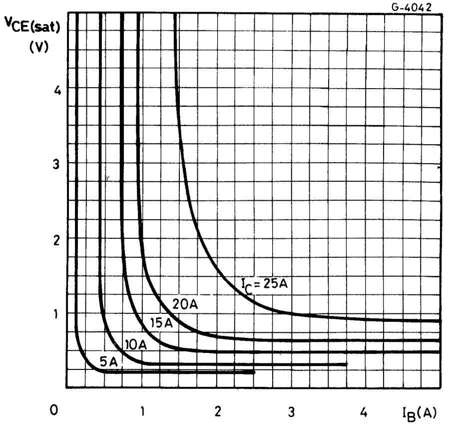
Thermal transient response



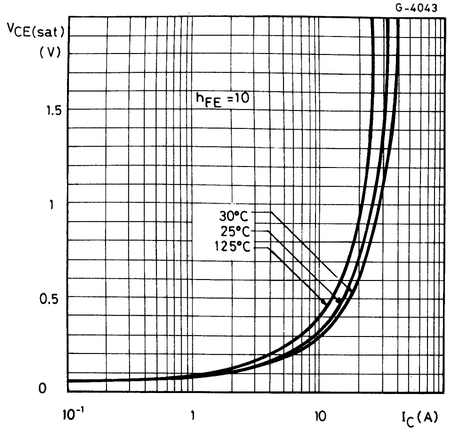
DC current gain



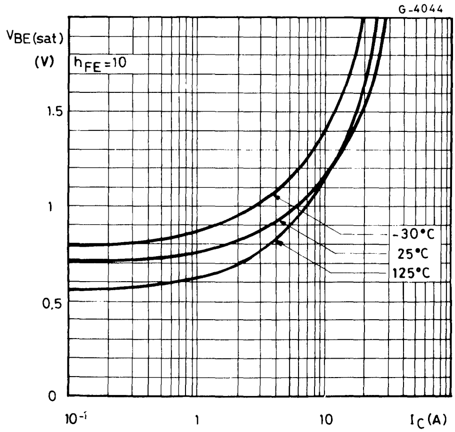
Collector-emitter saturation voltage



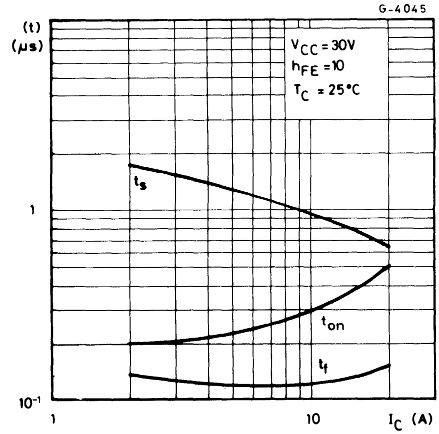
Collector-emitter saturation voltage



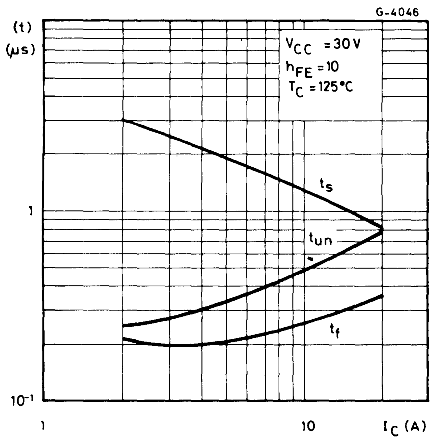
Base-emitter saturation voltage



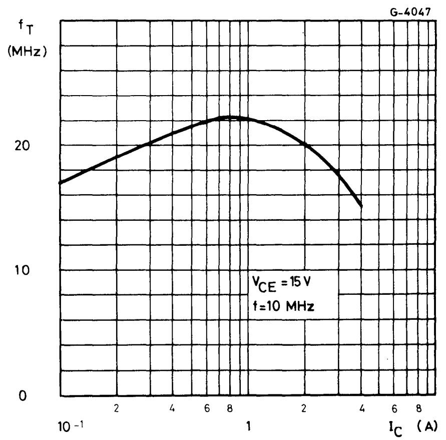
Saturated switching characteristics



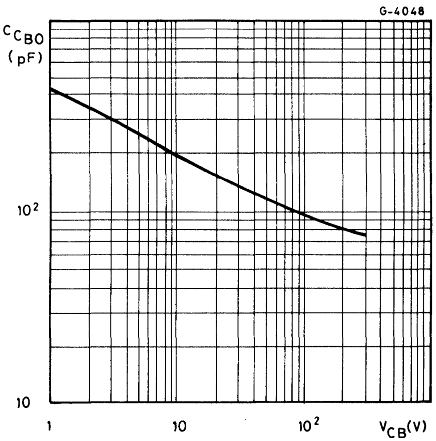
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

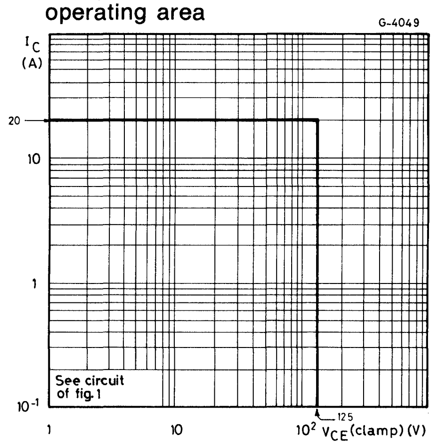


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 10$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

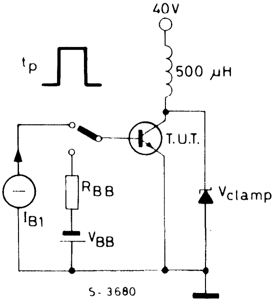


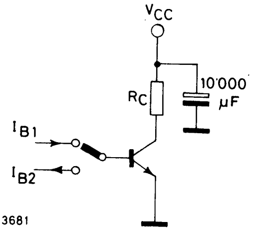
Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 30V$

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

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



MULTIEPITAXIAL PLANAR NPN

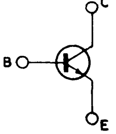
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

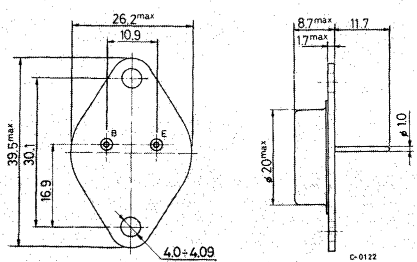
INTERNAL SCHEMATIC DIAGRAM



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)

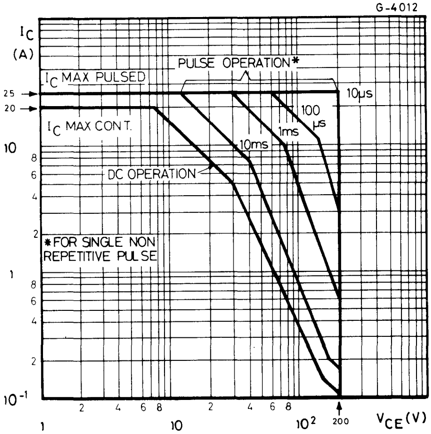
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=160V			1.5	mA
I_{CEX}	Collector cutoff current	V_{CE}=250V V_{BE}=-1.5V V_{CE}=250V V_{BE}=-1.5V T_{case}=125°C			1.5 6	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$	*Collector-emitter sustaining voltage	I_C =200mA	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 I_C =12A I_B =1.5A		0.3 0.6	0.6 1.5	V 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 I_C =12A 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	I_C =1A V_{CE}=15V f =10MHz	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

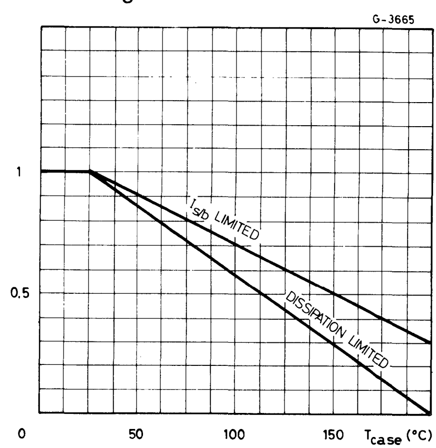
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =12A I_{B1} =1.5A V_{CC}=150V		0.3	1	μs
t_s	Storage time (fig. 2)	I_C =12A I_{B1} =1.5A I_{B2} =-1.5A V_{CC}=150V		1.2	1.8	μs
t_f	Fall time (fig. 2)	I_C =12A I_{B1} =1.5A I_{B2} =-1.5A V_{CC}=150V		0.24	0.4	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500μH	12			A

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

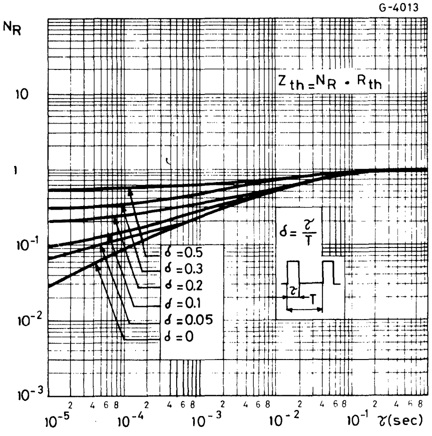
Safe operating areas



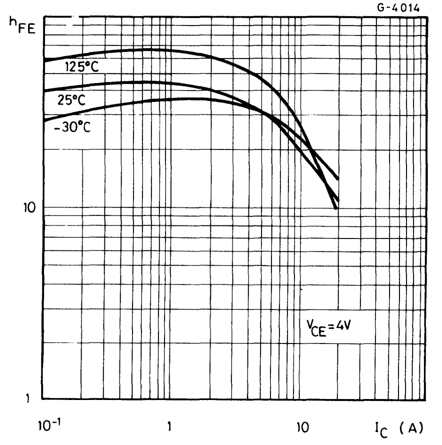
Derating curves



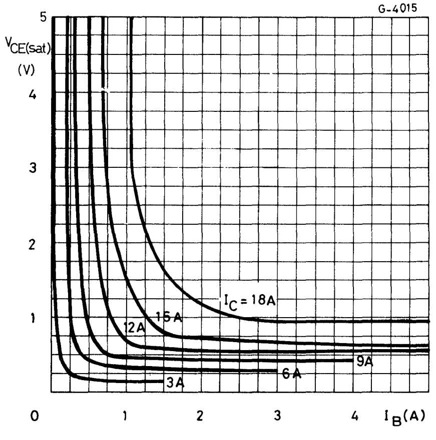
Thermal transient response



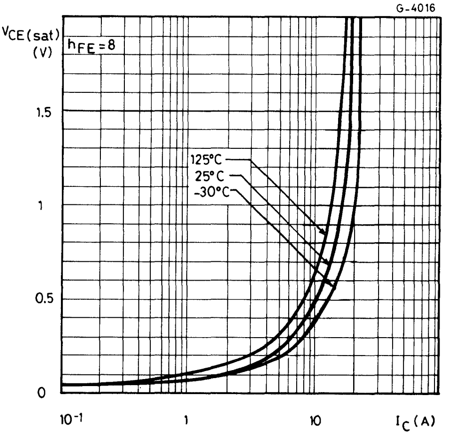
DC current gain



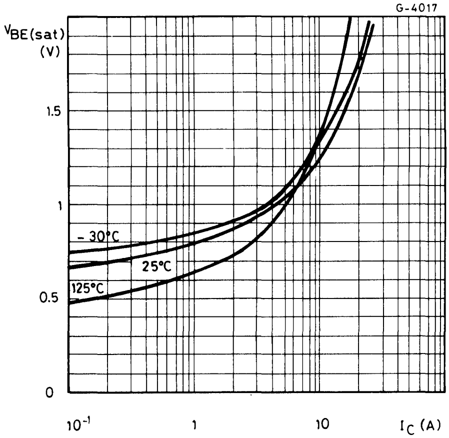
Collector-emitter saturation voltage



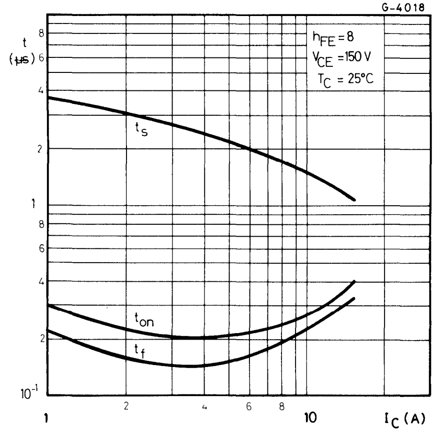
Collector-emitter saturation voltage



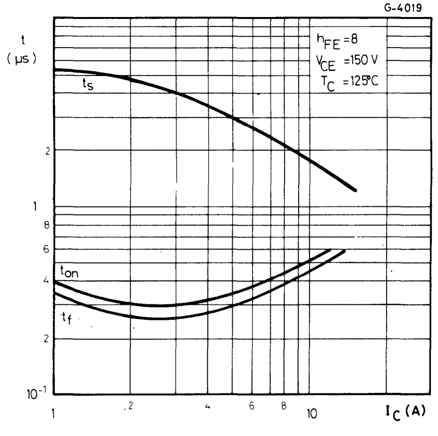
Base-emitter saturation voltage



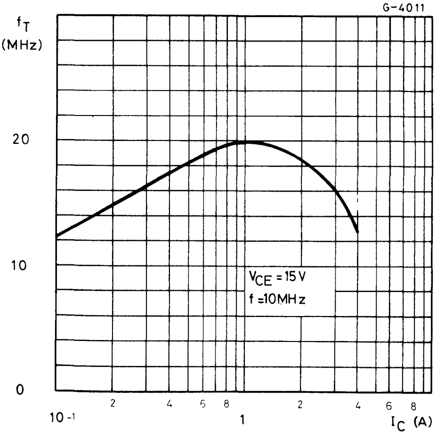
Saturated switching characteristics



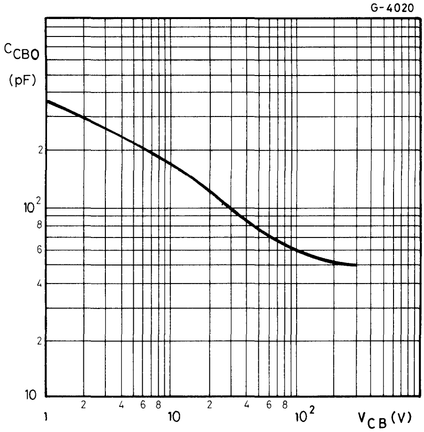
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

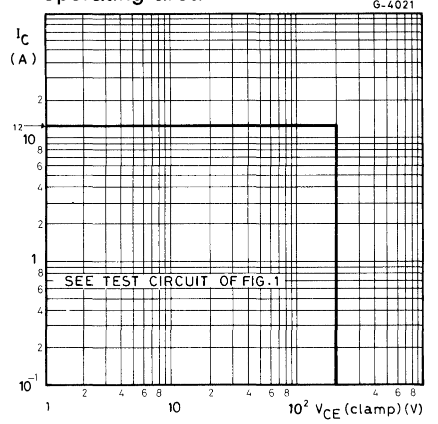


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

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

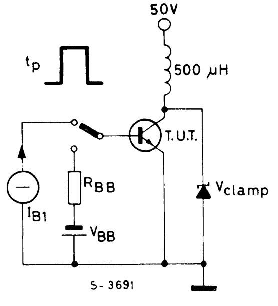


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 150V$

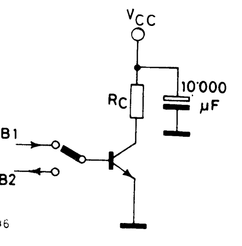
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



BUX11N

MULTIEPITAXIAL PLANAR NPN

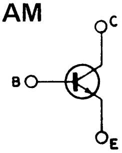
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

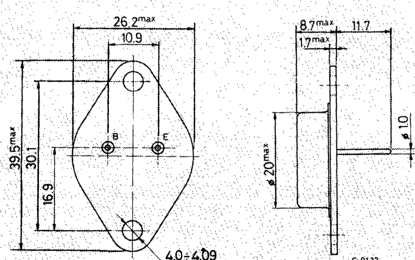
INTERNAL SCHEMATIC DIAGRAM



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)

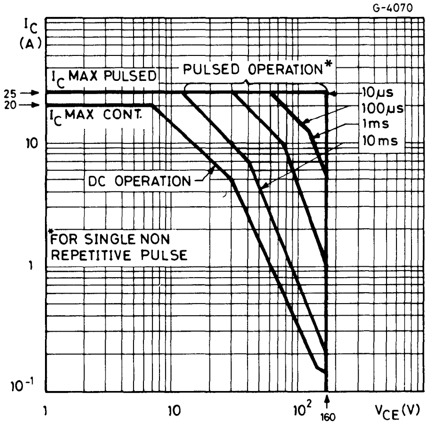
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 130V$			1.5	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 220V$ $V_{BE} = -1.5V$ $V_{CE} = 220V$ $V_{BE} = -1.5V$ $T_{case} = 125°C$			1.5 6	mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			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

ELECTRICAL CHARACTERISTICS (continued)

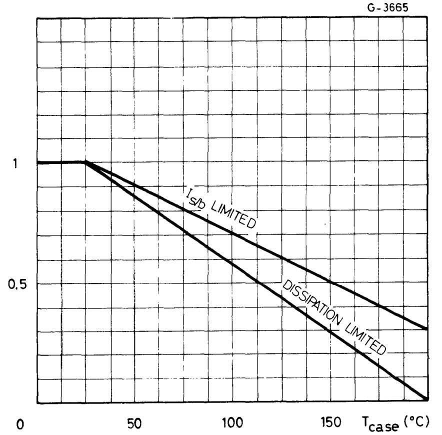
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C = 15A I_{B1} = 1.88A V_{CC} = 30V		0.4	1.5	μs
t_s	Storage time (fig. 2)	I_C = 15A I_{B1} = -I_{B2} = 1.88A V_{CC} = 30V		0.75	1.5	μs
t_f	Fall time (fig. 2)	I_C = 15A I_{B1} = -I_{B2} = 1.88A V_{CC} = 30V		0.14	0.5	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp} = 160V L = 500μH	15			A

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

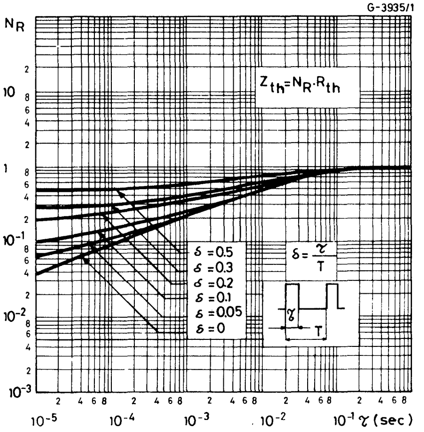
Safe operating areas



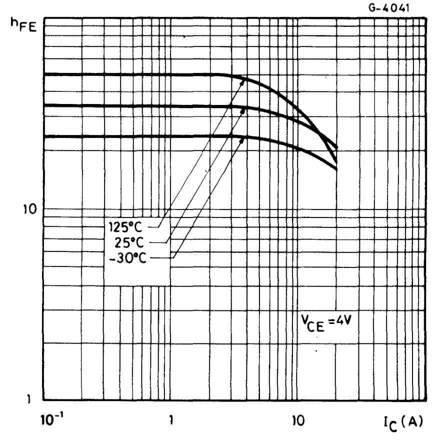
Derating curves



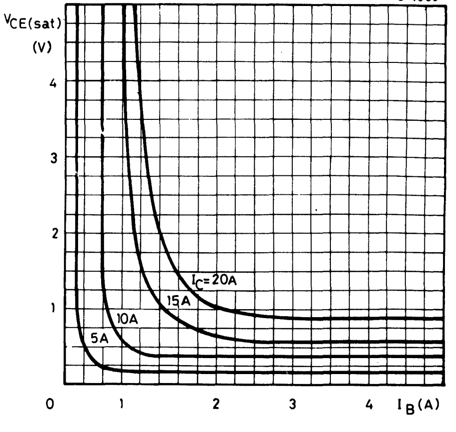
Thermal transient response



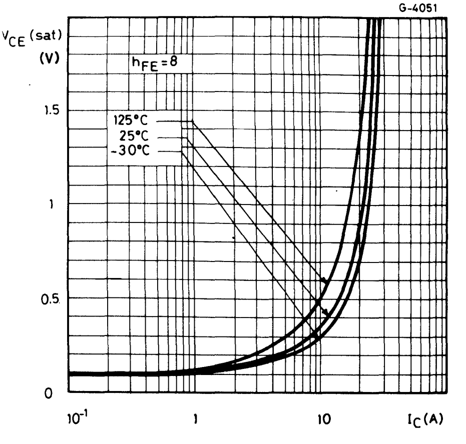
DC current gain



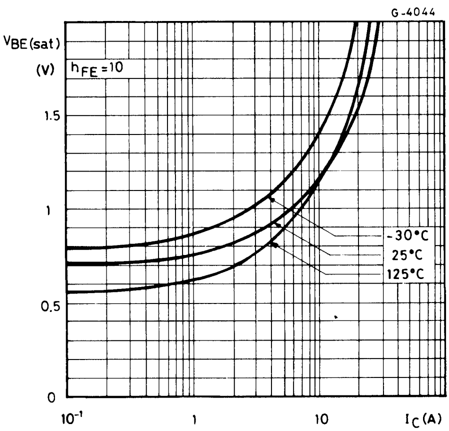
Collector-emitter saturation voltage



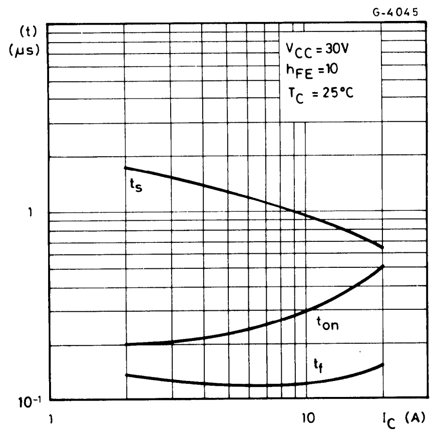
Collector-emitter saturation voltage



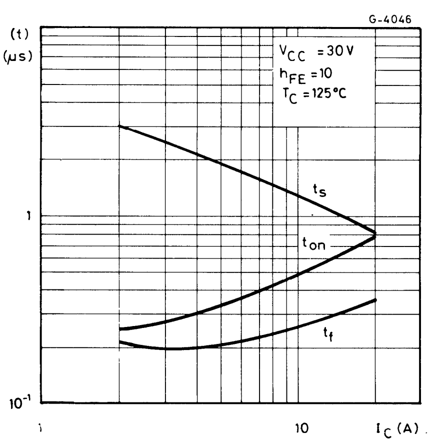
Base-emitter saturation voltage



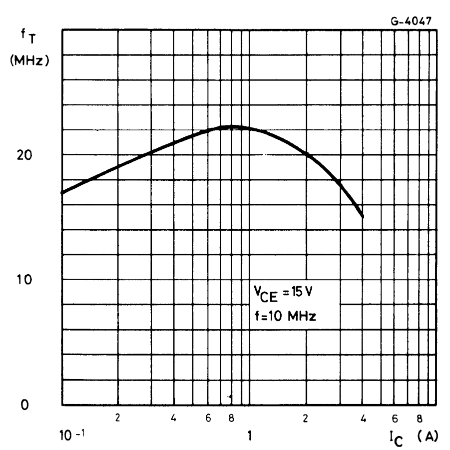
Saturated switching characteristics



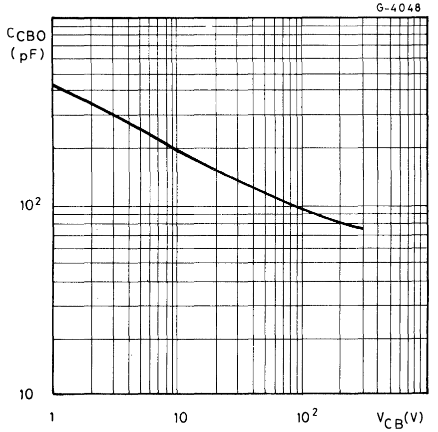
Saturated switching characteristics



Transition frequency



Collector base capacitance



Clamped reverse bias safe operating areas

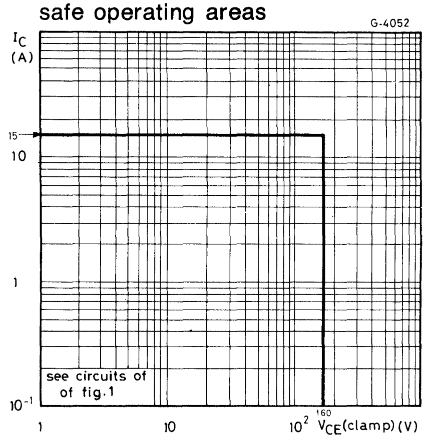


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

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

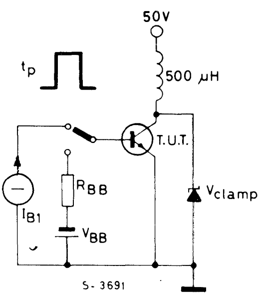


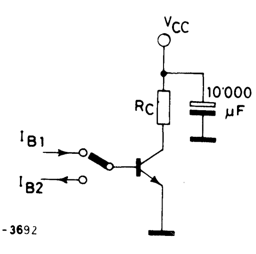
Fig. 2 — Switching times test circuit (Resistive load)

TEST CONDITIONS:

$V_{CC} = 30V$

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

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



BUX12

MULTIEPITAXIAL PLANAR NPN

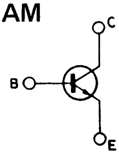
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

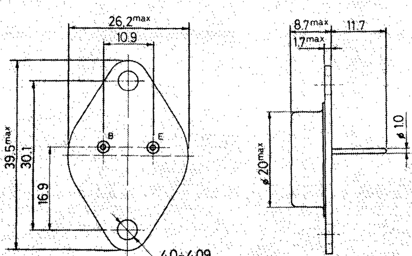
INTERNAL SCHEMATIC DIAGRAM



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)

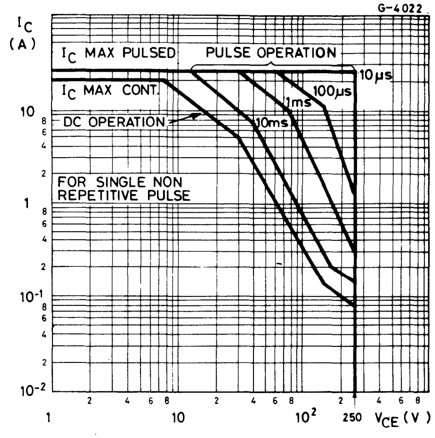
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B=0$)	$V_{CE}=200V$			1.5	mA
I_{CEX}	Collector cutoff current	$V_{CE}=300V$ $V_{BE}=-1.5V$			1.5	mA
		$T_{case}=125$ °C $V_{CE}=300V$ $V_{BE}=-1.5V$			6	mA
I_{EBO}	Emitter cutoff current ($I_C=0$)	$V_{EB}=5V$			1	mA
$V_{CEO(sus)}$*	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)

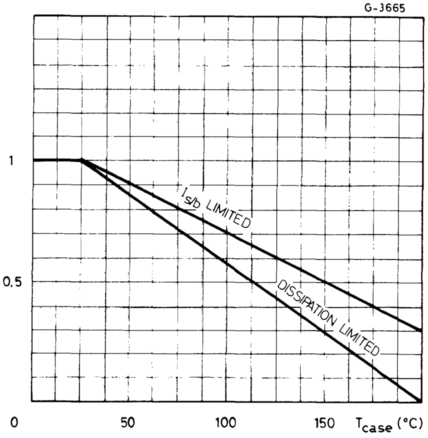
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =10A I_{B1} =1.25A V_{CC}=150V		0.28	1	μs
t_s	Storage time (fig. 2)	I_C =10A I_{B1} =1.25A I_{B2} =-1.25A V_{CC}=150V		1.45	2	μs
t_f	Fall time (fig. 2)			0.23	0.5	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500μH	10			A

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

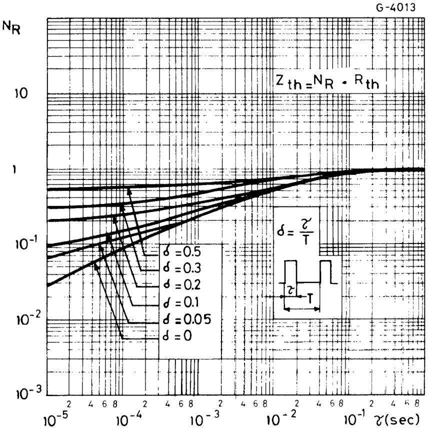
Safe operating areas



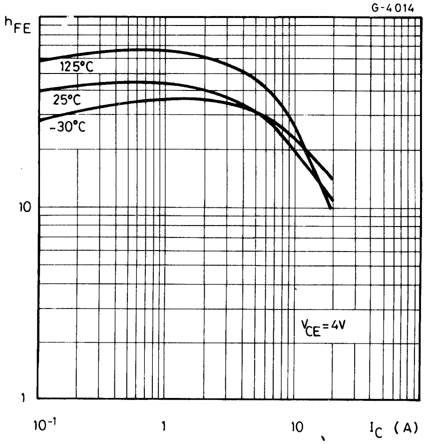
Derating curves



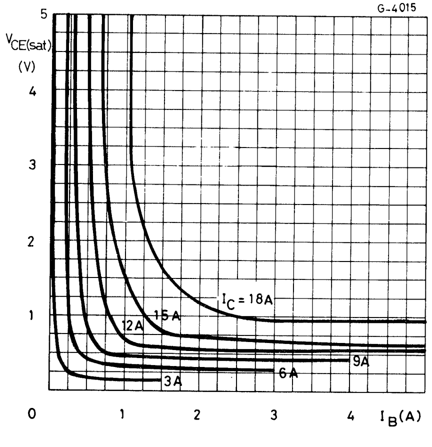
Thermal transient response



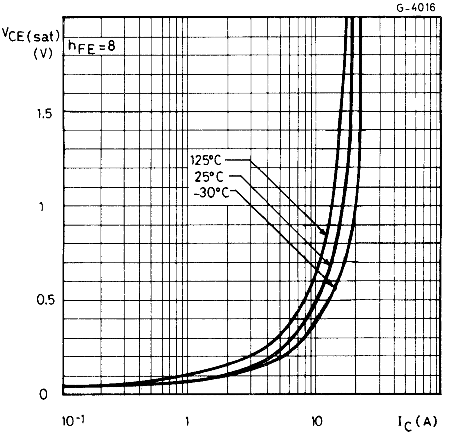
DC current gain



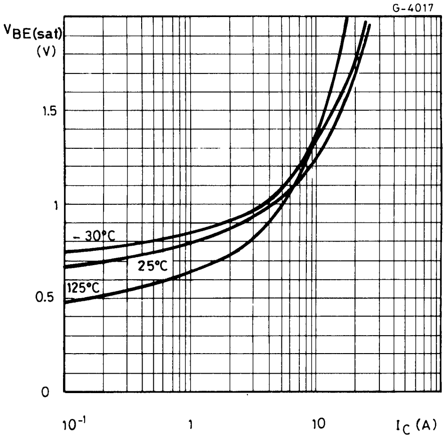
Collector-emitter saturation voltage



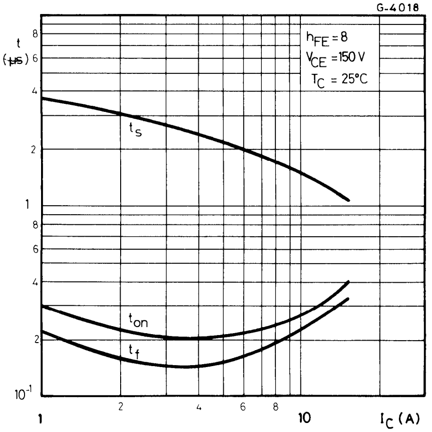
Collector-emitter saturation voltage



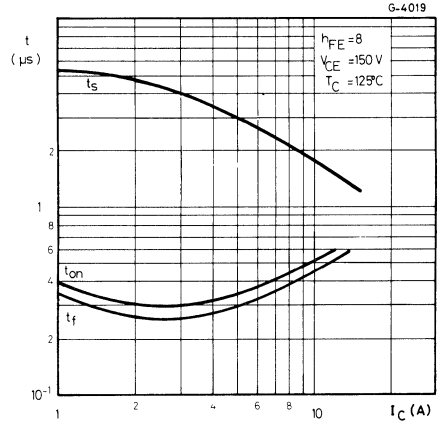
Base-emitter saturation voltage



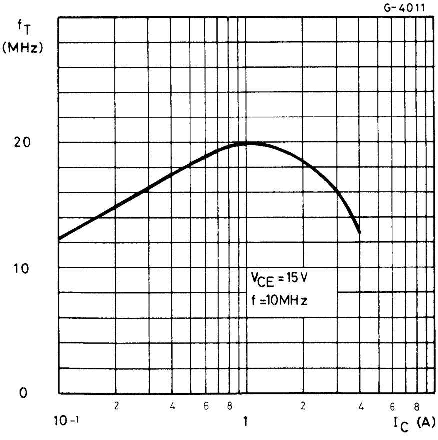
Saturated switching characteristics



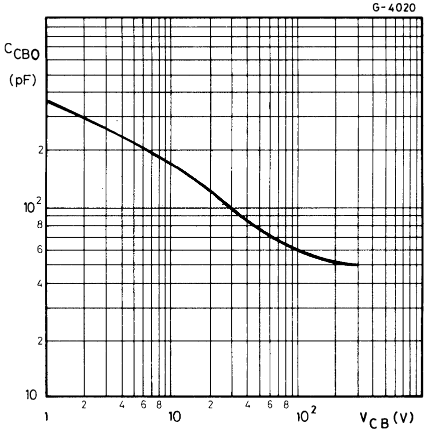
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

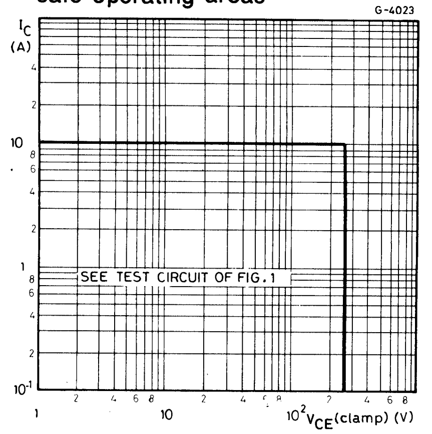


Fig. 1 – Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

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

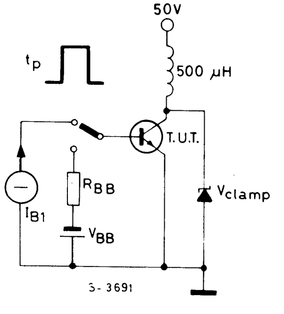


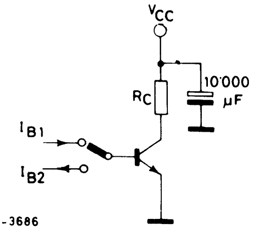
Fig. 2 – Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 150V$

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

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



MULTIEPITAXIAL MESA NPN

SGS **BUX13**

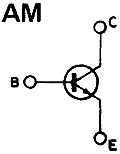
HIGH VOLTAGE POWER SWITCH

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 ($R_{BE} \leq 100\Omega$)	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 ($t_p \leq 10ms$)	20	A
I_B	Base current	3	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

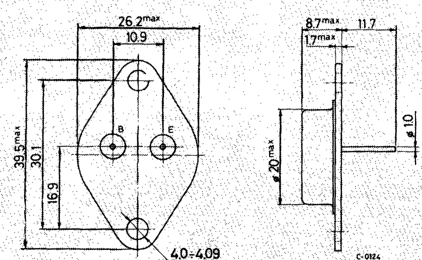
INTERNAL SCHEMATIC DIAGRAM



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} = 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 ≤2%.

MULTIEPITAXIAL MESA NPN

BUX14

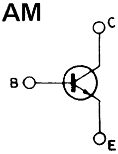
HIGH VOLTAGE POWER SWITCH

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 ($R_{BE} \leqslant 100\Omega$)	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 ($t_p \leqslant 10ms$)	15	A
I_B	Base current	2	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

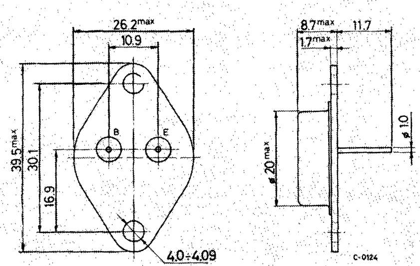
INTERNAL SCHEMATIC DIAGRAM



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	1.17	°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%.

MULTIEPITAXIAL PLANAR NPN

BUX20

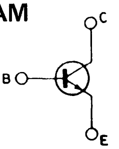
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

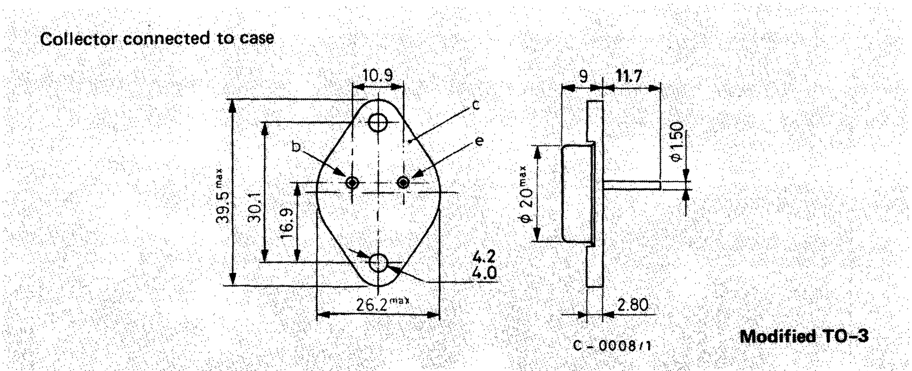
V_{CBO}	Collector-base voltage ($I_E=0$)	160	V
V_{CEX}	Collector-emitter voltage ($V_{BE}=$ -1.5 V)	160	V
V_{CEO}	Collector-emitter voltage ($I_B=0$)	125	V
V_{EBO}	Emitter-base voltage ($I_C=0$)	7	V
I_C	Collector current	50	A
I_{CM}	Collector peak current ($t_p=10$ ms)	60	A
I_B	Base current	10	A
P_{tot}	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

INTERNAL SCHEMATIC DIAGRAM



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)

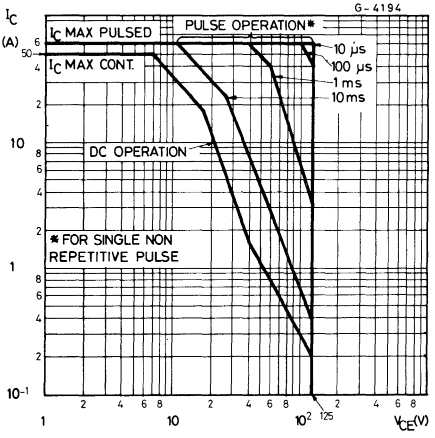
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 100V$			3	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 160V$ $V_{BE} = -1.5V$			3	mA
		$T_{case} = 125°C$ $V_{CE} = 160V$ $V_{BE} = -1.5V$			12	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	125			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 25A$ $I_B = 2.5A$		0.3	0.6	V
		$I_C = 50A$ $I_B = 5A$		0.55	1.2	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 50A$ $I_B = 5A$		1.35	2	V
h_{FE}*	DC current gain	$I_C = 25A$ $V_{CE} = 2V$	20		60	—
		$I_C = 50A$ $V_{CE} = 4V$	10			—
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 40V$ $t = 1s$	1.5			A
		$V_{CE} = 20V$ $t = 1s$	17.5			A
f_T	Transition frequency	$V_{CE} = 15V$ $I_C = 2A$ $f = 10MHz$	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

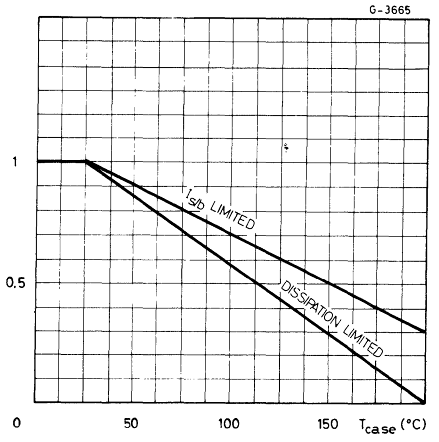
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =50A I_{B1} =5A V_{CC}=60V		0.4	1.5	μs
t_s	Storage time (fig. 2)	I_C =50A I_{B1} =5A I_{B2} =-5A V_{CC}=60V		0.85	1.2	μs
t_f	Fall time (fig. 2)			0.1	0.3	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=125V L =500μH	50			A

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

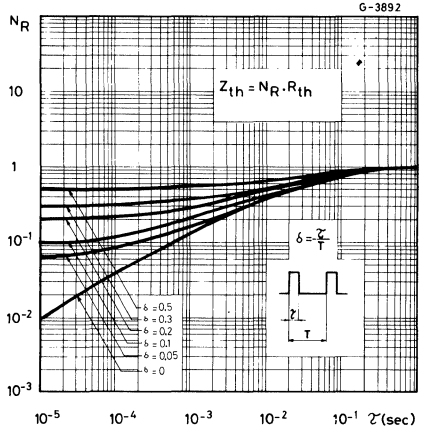
Safe operating areas



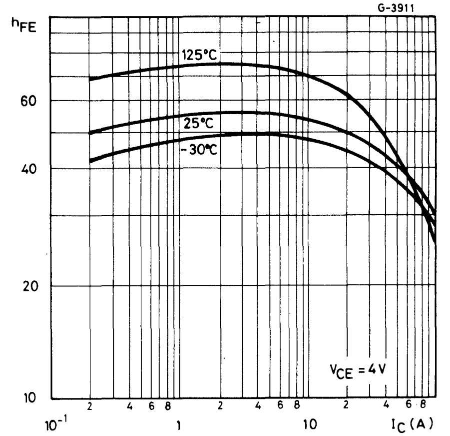
Derating curves



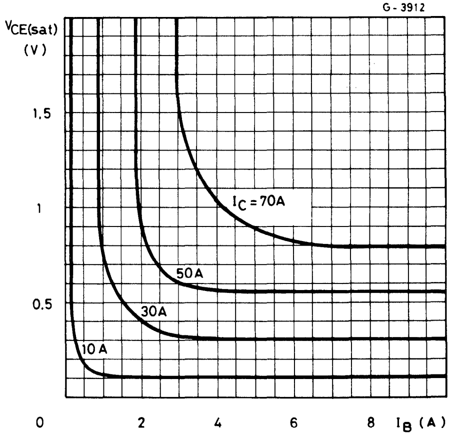
Thermal transient response



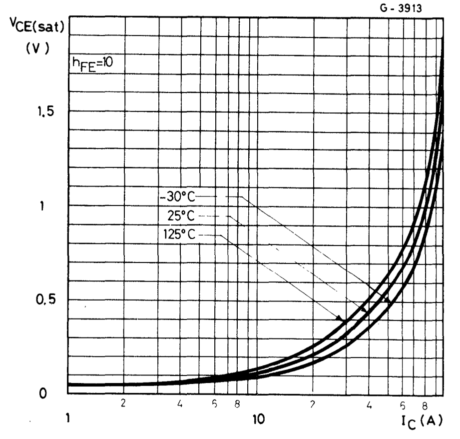
DC current gain



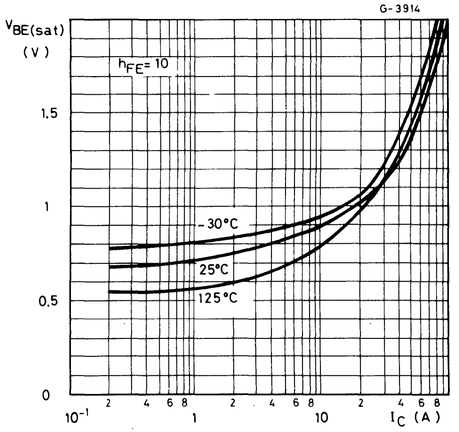
Collector-emitter saturation voltage



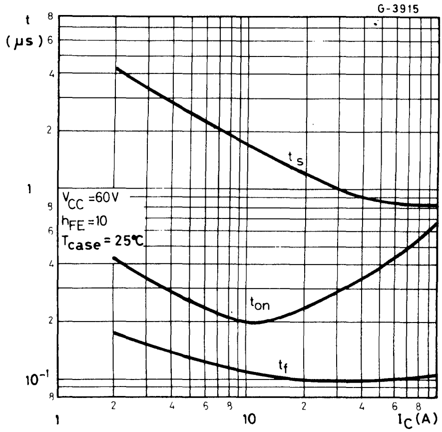
Collector-emitter saturation voltage



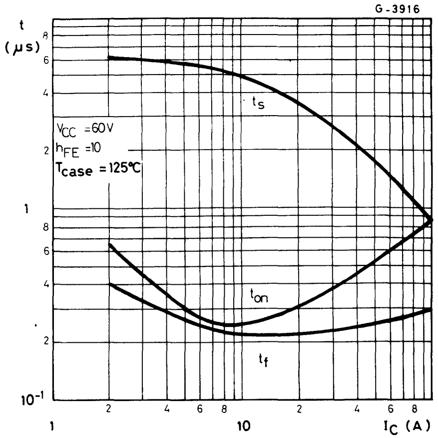
Base-emitter saturation voltage



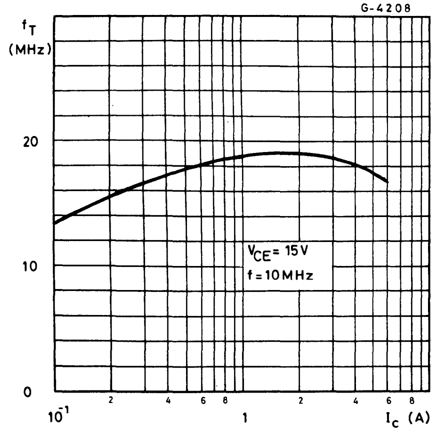
Saturated switching characteristics



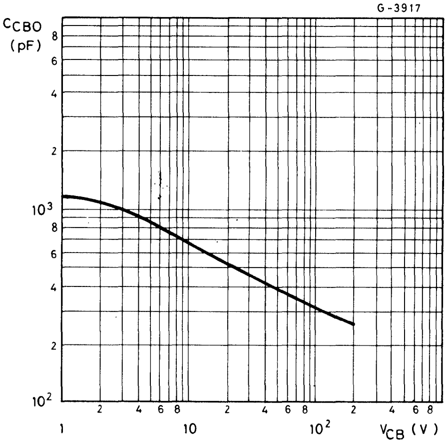
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

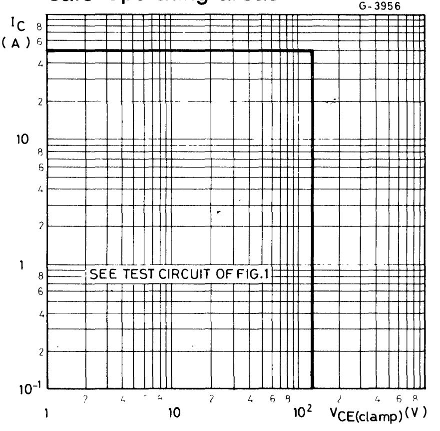


Fig. 1 – Clamped $E_{s/b}$ test circuit

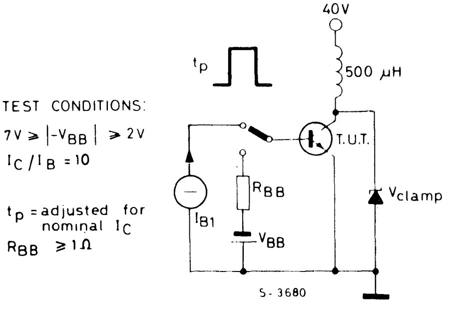
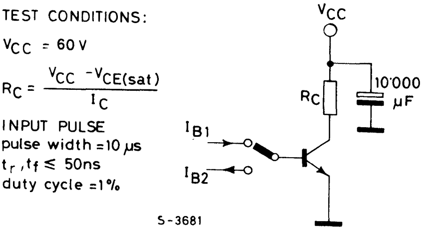


Fig. 2 – Switching times test circuit (resistive load)



MULTIEPITAXIAL PLANAR NPN

BUX21

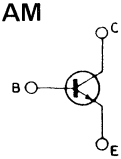
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

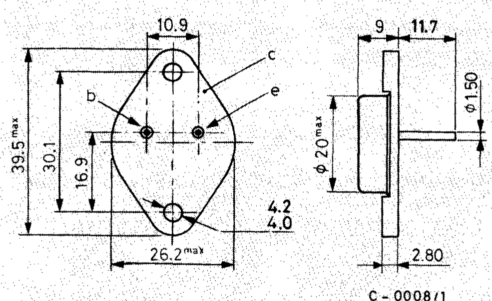
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



Modified TO-3

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)

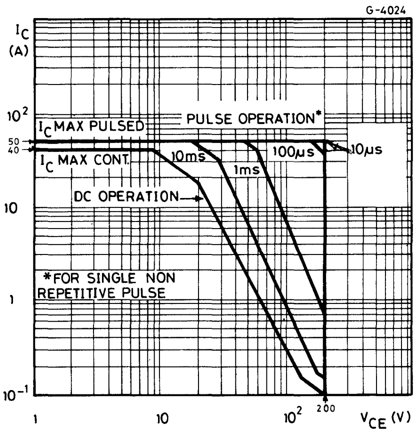
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 160V$			3	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 250V$ $V_{BE} = -1.5V$			3	mA
		$T_{case} = 125\,°C$ $V_{CE} = 250V$ $V_{BE} = -1.5V$			12	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	200			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 12A$ $I_B = 1.2A$		0.22	0.6	V
		$I_C = 25A$ $I_B = 3A$		0.4	1.5	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 25A$ $I_B = 3A$		1.2	1.5	V
h_{FE}*	DC current gain	$I_C = 12$ $V_{CE} = 2V$	20		60	—
		$I_C = 25$ $V_{CE} = 4V$	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	$V_{CE} = 15V$ $I_C = 2$ $f = 10MHz$	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

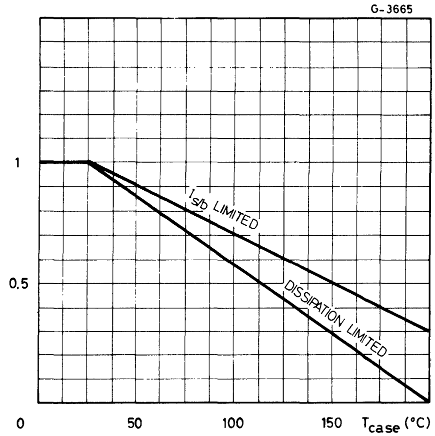
	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =25A I_{B1} =3A V_{CC}=100V	0.24 1.2	µs
t_s	Storage time (fig. 2)	I_C =25A I_{B1} =3A I_{B2} =-3A V_{CC}=100V	1.3 1.8	µs
t_f	Fall time (fig. 2)		0.18 0.4	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500µH	30	A

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

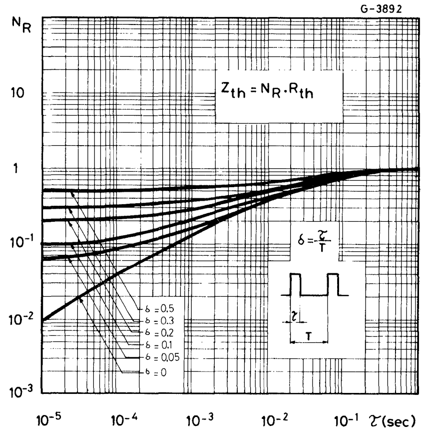
Safe operating areas



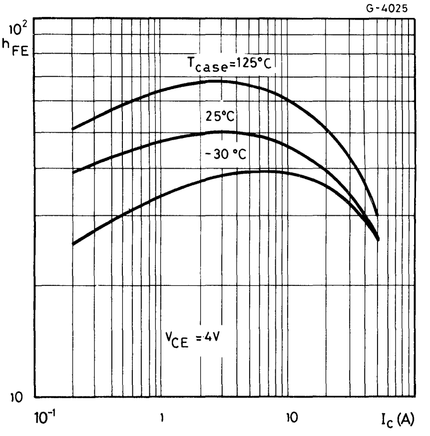
Derating curves



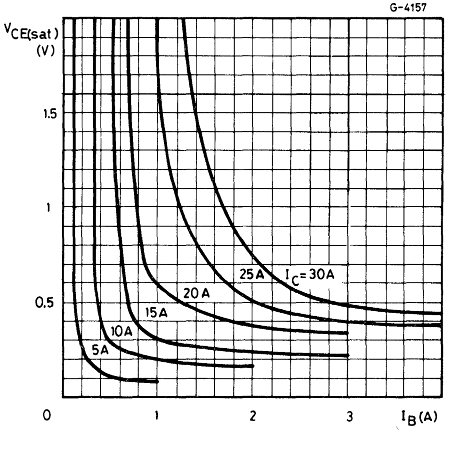
Thermal transient response



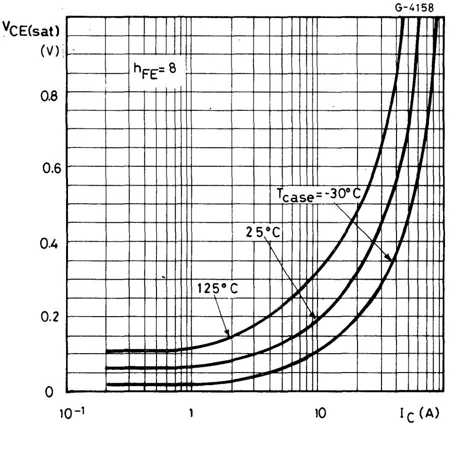
DC current gain



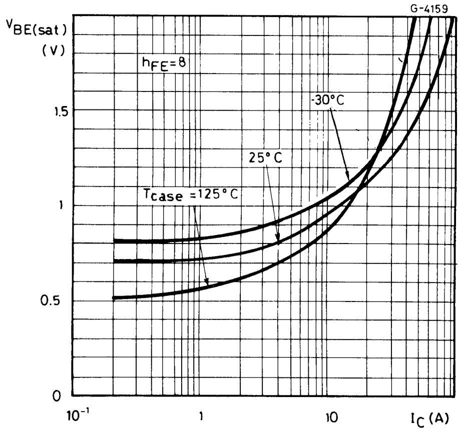
Collector-emitter saturation voltage



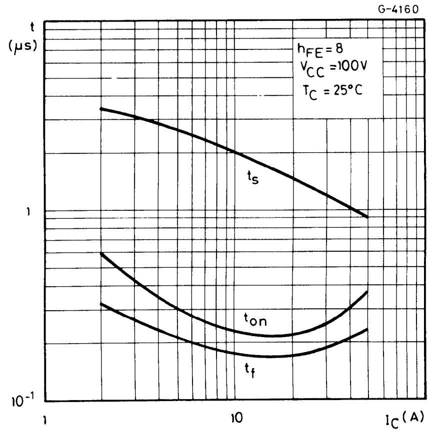
Collector-emitter saturation voltage



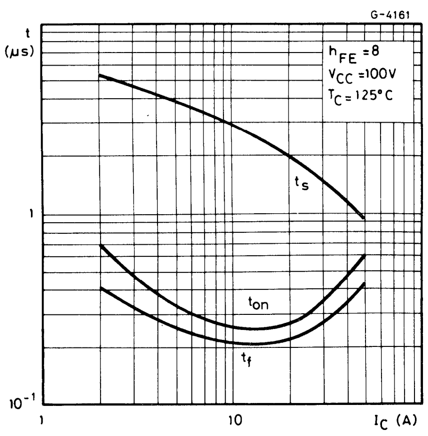
Base-emitter saturation voltage



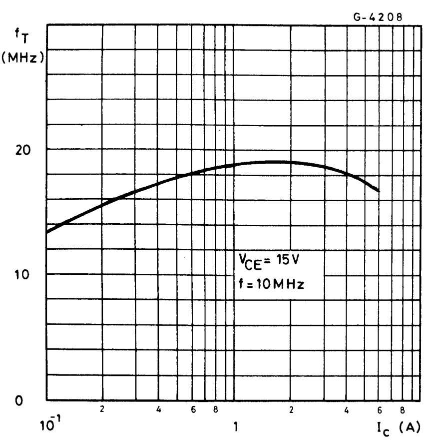
Saturated switching characteristics



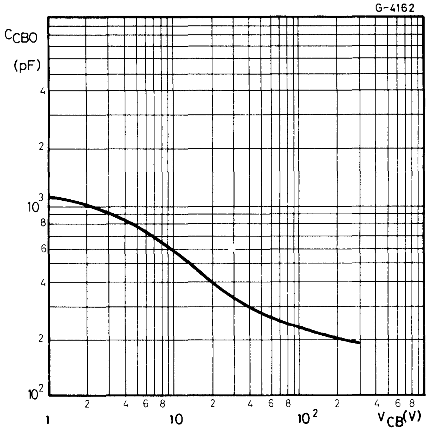
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

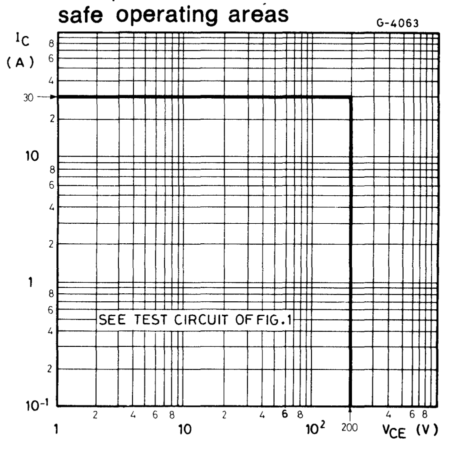


Fig. 1 – Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:
$7\,V \geq |-V_{BB}| \geq 2\,V$
$I_C/I_B = 8$
t_p = adjusted for nominal I_C
$R_{BB} \geq 1\Omega$

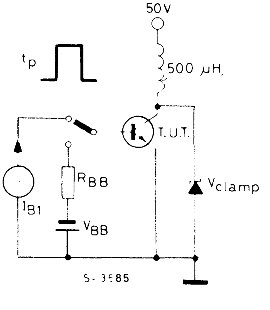
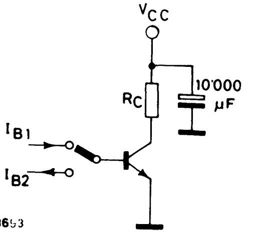


Fig. 2 – Switching times test circuit (resistive load)

TEST CONDITIONS:
V_{CC} = 100V
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$
INPUT PULSE
pulse width = 5μs
$t_r, t_f \leq$ 50ns
duty cycle = 1%



MULTIEPITAXIAL PLANAR NPN

SGS **BUX22**

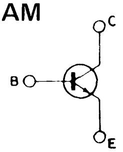
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

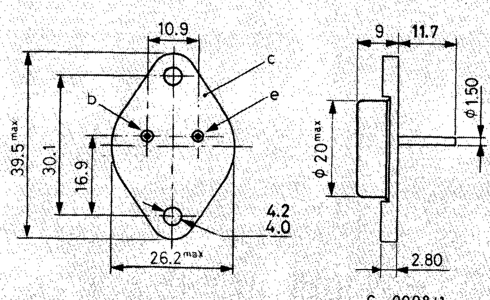
INTERNAL SCHEMATIC DIAGRAM



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)

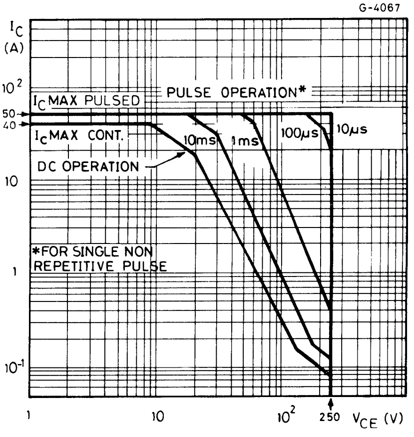
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=200V			3	mA
I_{CEX}	Collector cutoff current	V_{CE}=300V V_{BE}=-1.5V			3	mA
		T_{case}=125 °C V_{CE}=300V V_{BE}=-1.5V			12	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter 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)

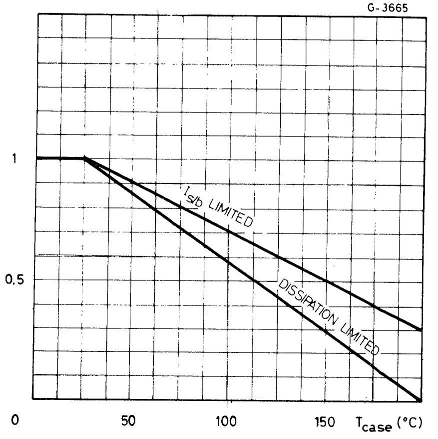
	Parameter	Test conditions	Min. Typ. Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =20A I_{B1} =2.5A V_{CC}=100V	0.22 1.3	µs
t_s	Storage time (fig. 2)	I_C =20A I_{B1} =2.5A I_{B2} =-2.5A V_{CC}=100V	1.5 2	µs
t_f	Fall time (fig. 2)		0.17 0.5	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500µH	25	A

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

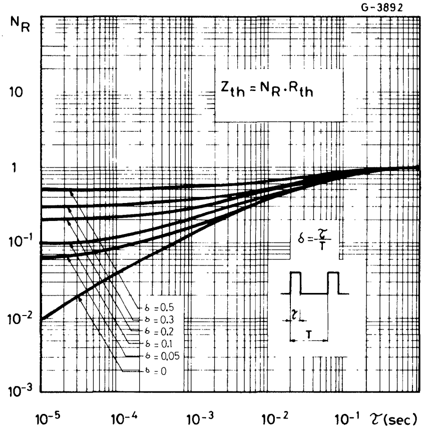
Safe operating areas



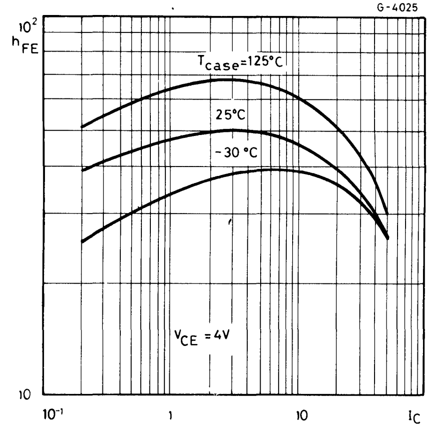
Derating curves



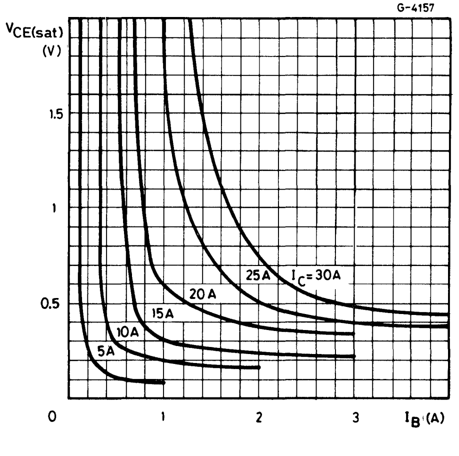
Thermal transient response



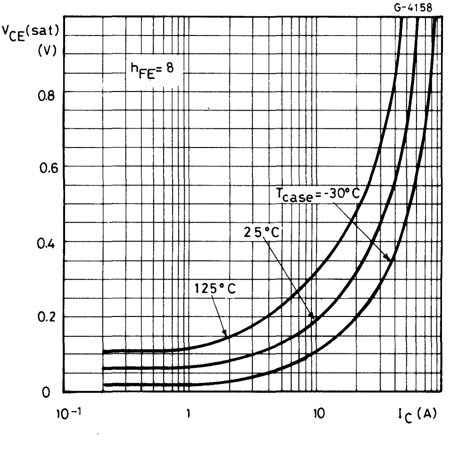
DC current gain



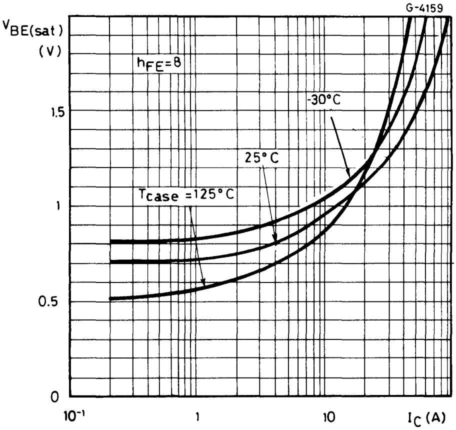
Collector-emitter saturation voltage



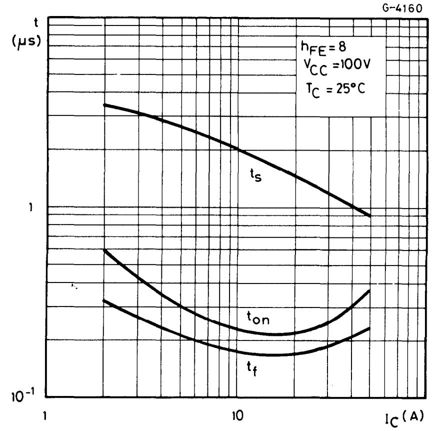
Collector-emitter saturation voltage



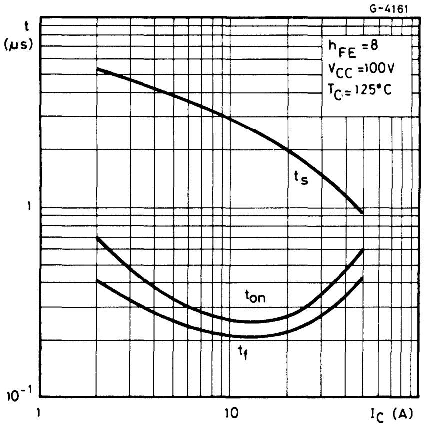
Base-emitter saturation voltage



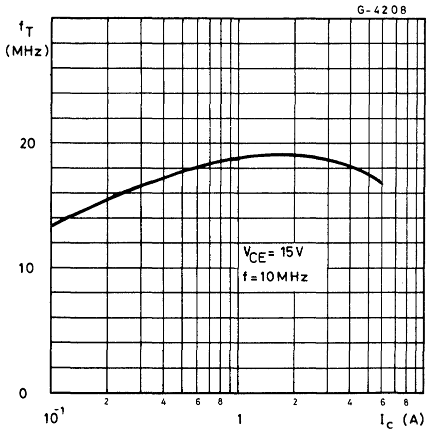
Saturated switching characteristics



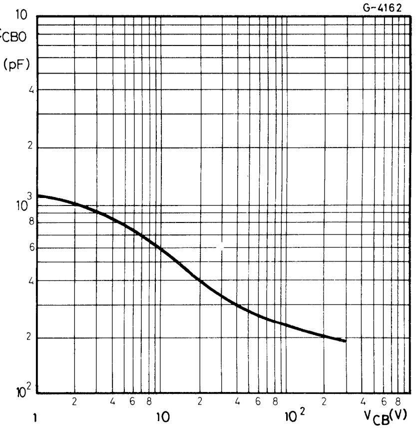
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

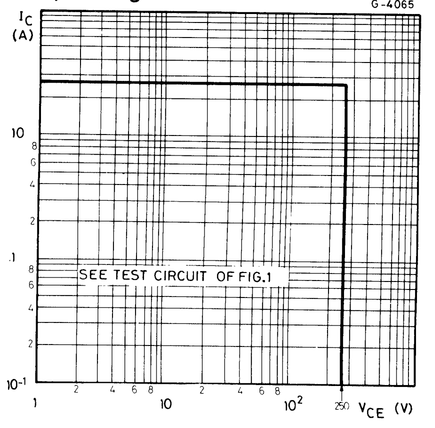


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

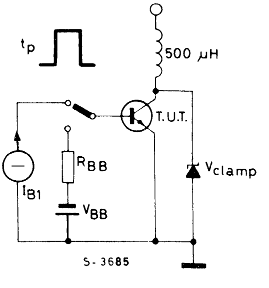


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

$V_{CC} = 100V$

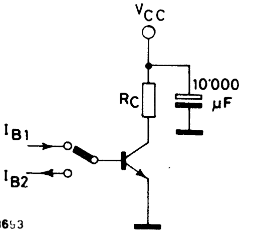
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 5μs

$t_r, t_f \leq 50ns$

duty cycle = 1%



BUX40

MULTIEPITAXIAL PLANAR NPN

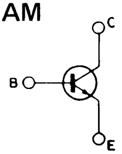
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

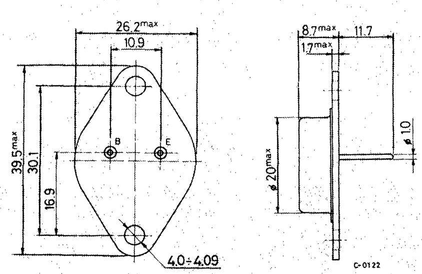
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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)

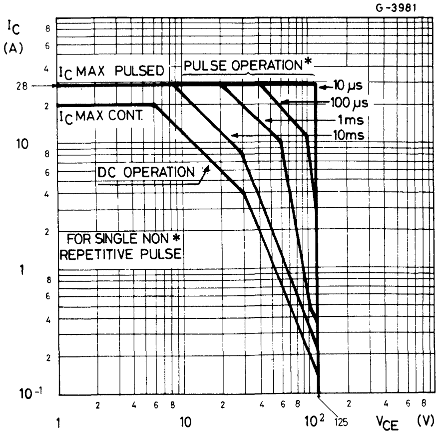
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 100V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 160V$ $V_{BE} = -1.5V$			1	mA
		$T_{case} = 125°C$ $V_{CE} = 160V$ $V_{BE} = -1.5V$			5	mA
I_{EBO}	Emitter-cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	125			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 1A$		0.6	1.2	V
		$I_C = 15A$ $I_B = 1.88\ A$		0.9	1.6	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 15A$ $I_B = 1.88A$		1.7	2	V
h_{FE}*	DC current gain	$I_C = 10A$ $V_{CE} = 4V$	15		45	—
		$I_C = 15A$ $V_{CE} = 4V$	8			—
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 30V$ $t = 1\ s$	4			A
		$V_{CE} = 50V$ $t = 1\ s$	1			A
f_T	Transition frequency	$I_C = 1A$ $V_{CE} = 15V$ $f = 10MHz$	8			MHz

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

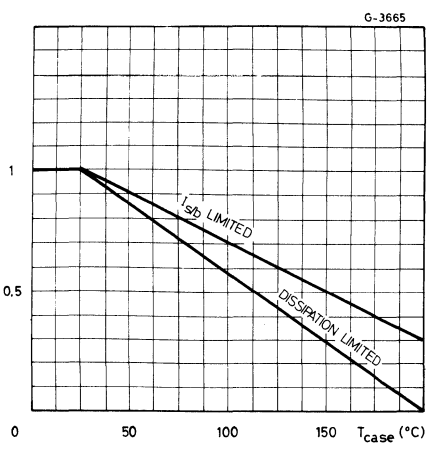
ELECTRICAL CHARACTERISTICS (continued)

	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

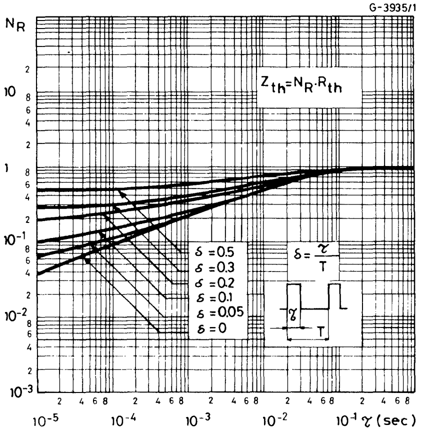
Safe operating areas



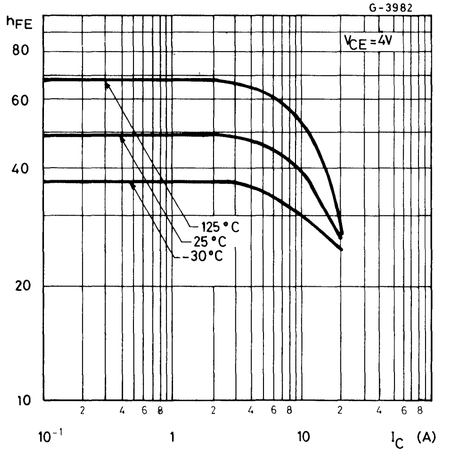
Derating curves



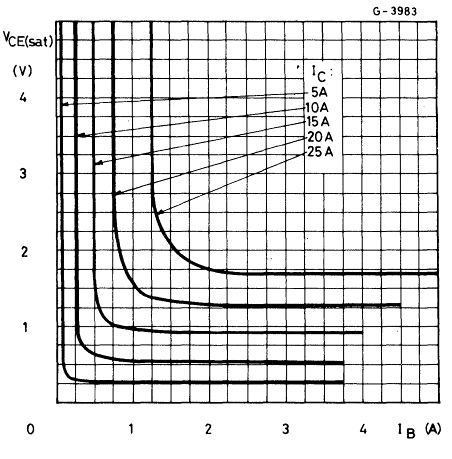
Thermal transient response



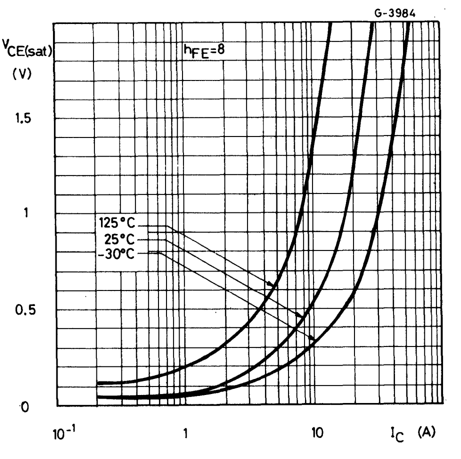
DC current gain



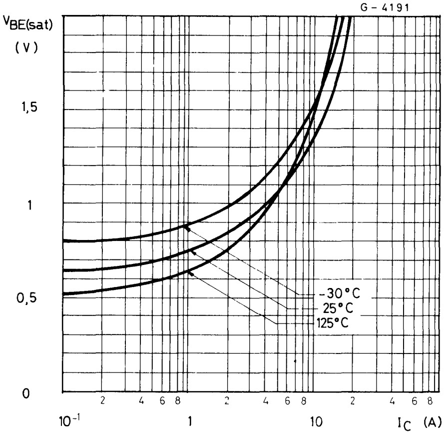
Collector-emitter saturation voltage



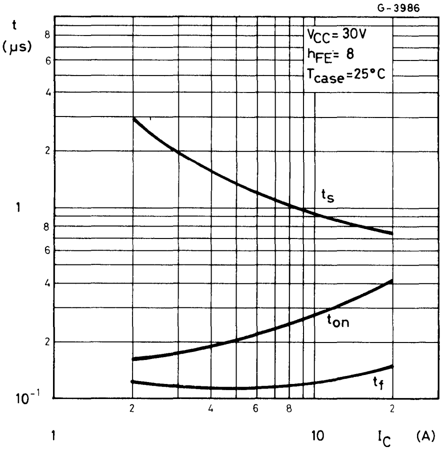
Collector-emitter saturation voltage



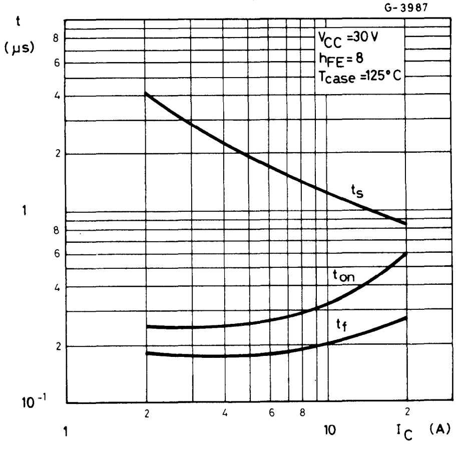
Base-emitter saturation voltage



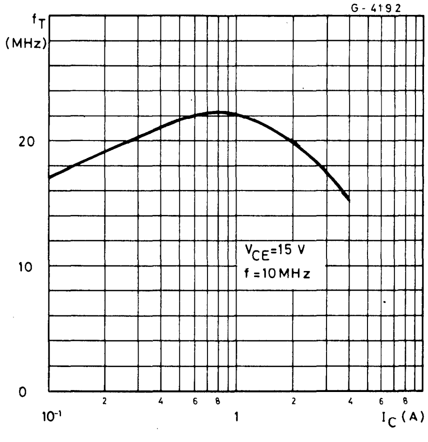
Saturated switching characteristics



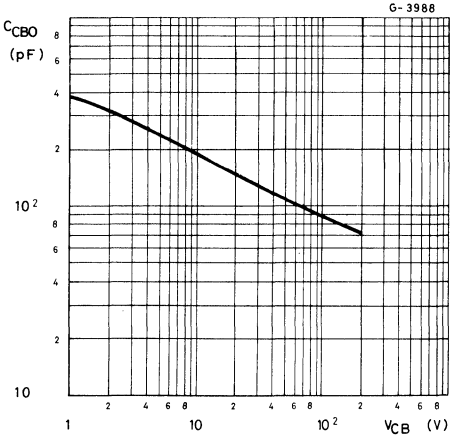
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

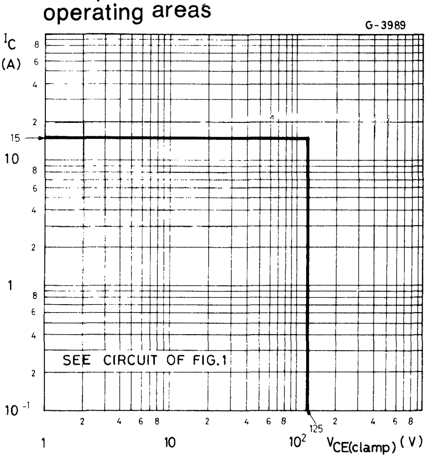


Fig. 1 – Clamped $E_{s/b}$ test circuit

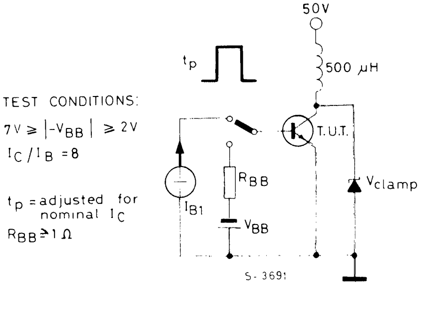
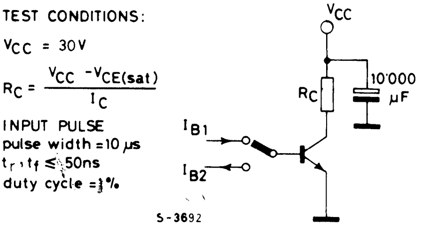


Fig. 2 – Switching times test circuit (resistive load)



BUX41

MULTIEPITAXIAL PLANAR NPN

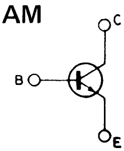
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

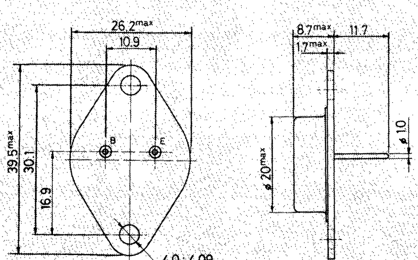
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

SGS **BUX41**

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)

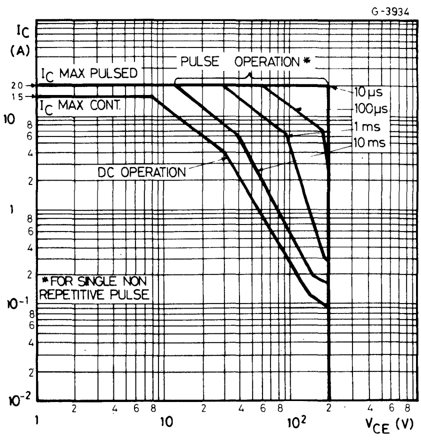
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 160V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 250V$ $V_{BE} = -1.5V$			1	mA
		$T_{case} = 125\,°C$ $V_{CE} = 250V$ $V_{BE} = -1.5V$			5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	$I_C = 200mA$	200			V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_E = 50mA$	7			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$ $I_B = 0.5A$		0.38	1.2	V
		$I_C = 8A$ $I_B = 1A$		0.6	1.6	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 8A$ $I_B = 1A$		1.35	2	V
h_{FE}*	DC current gain	$I_C = 5A$ $V_{CE} = 4V$	15		45	—
		$I_C = 8A$ $V_{CE} = 4V$	8			—
$I_{s/b}$	Second breakdown collector current	$V_{CE} = 30V$ $t = 1s$	4			A
		$V_{CE} = 135V$ $t = 1s$	0.15			A
f_t	Transition frequency	$I_C = 1A$ $V_{CE} = 15V$ $f = 10MHz$	8			MHz

ELECTRICAL CHARACTERISTICS (continued)

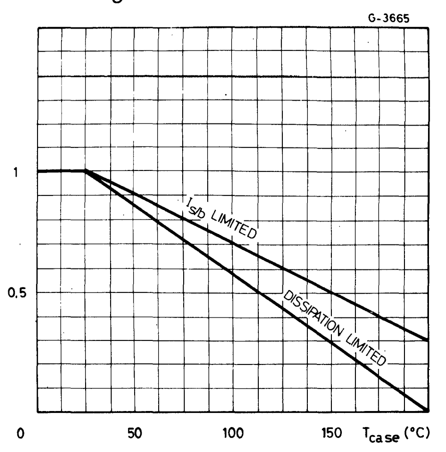
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =8A I_{B1} =1A V_{CC}=150V		0.28	1	μs
t_s	Storage time (fig. 2)	I_C =8A* I_{B1} =1A I_{B2} =-1A V_{CC}=150V		1.2	1.7	μs
t_f	Fall time (fig. 2)	I_C =8A* I_{B1} =1A I_{B2} =-1A V_{CC}=150V		0.25	0.8	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=200V L =500μH	8			A

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

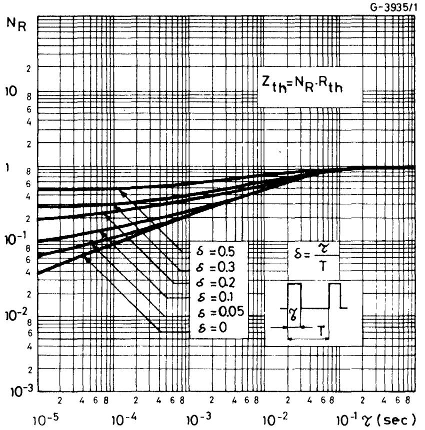
Safe operating areas



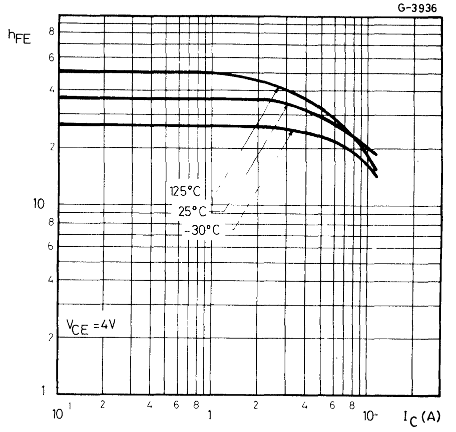
Derating curves



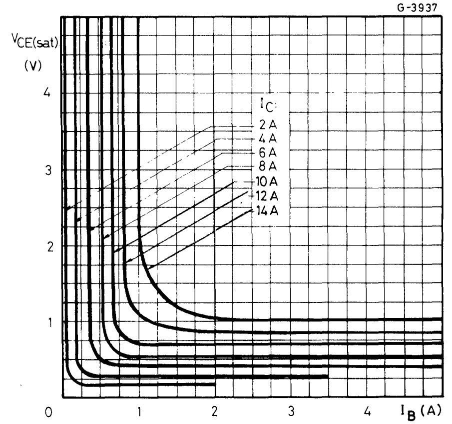
Thermal transient response



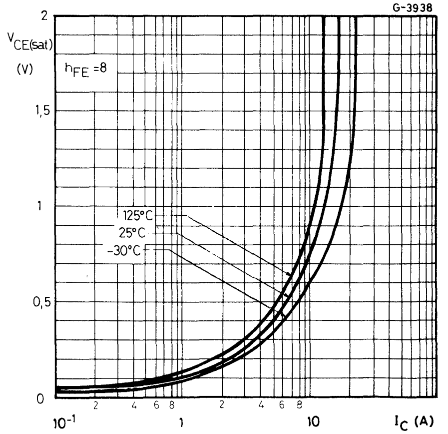
DC current gain



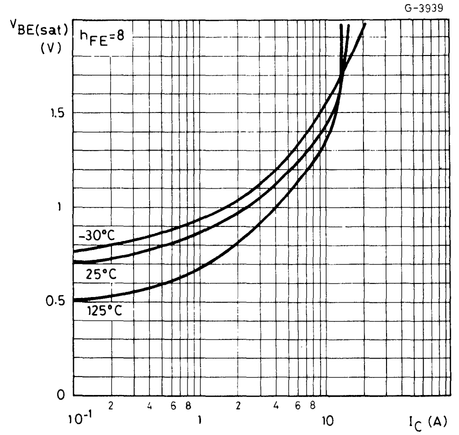
Collector-emitter saturation voltage



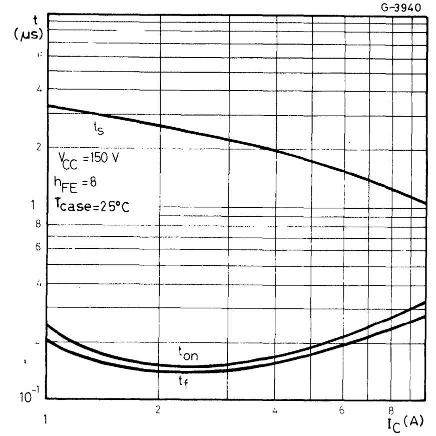
Collector-emitter saturation voltage



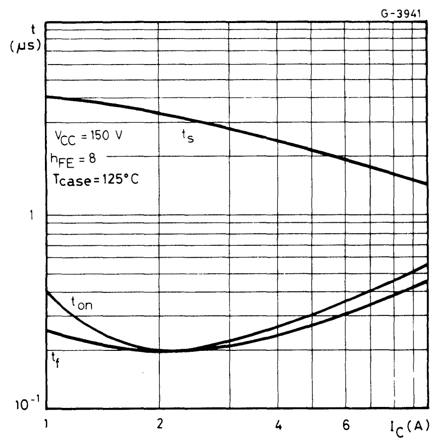
Base-emitter saturation voltage



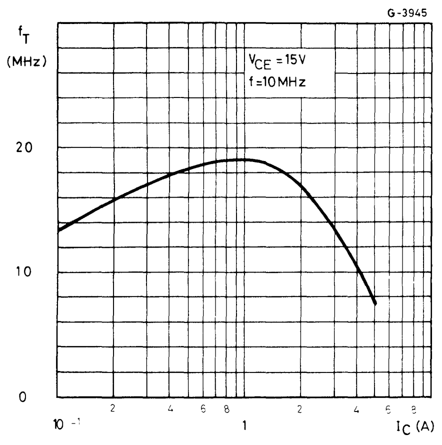
Saturated switching characteristics



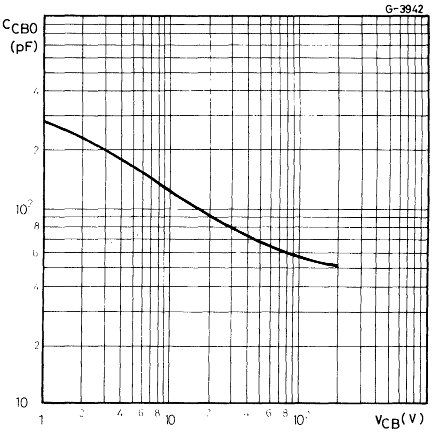
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating area

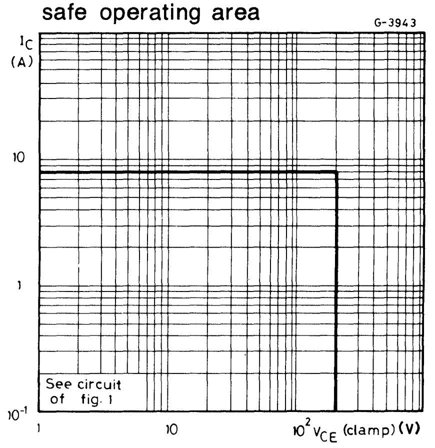


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:
$7V \geq |-V_{BB}| \geq 2V$
$I_C / I_B = 8$

t_p = adjusted for nominal I_C
$R_{BB} \geq 1\Omega$

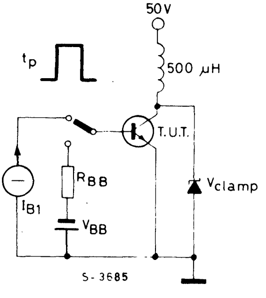
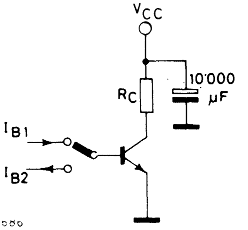


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:
V_{CC} = 150 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%



BUX41N

MULTIEPITAXIAL PLANAR NPN

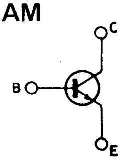
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

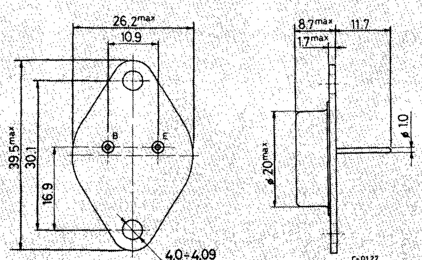
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

SGS BUX41N

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)

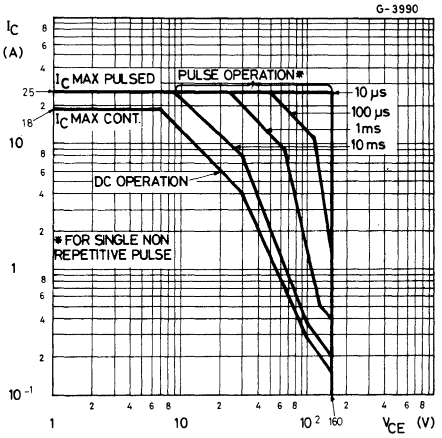
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	V_{CE}=130V			1	mA
I_{CEX}	Collector cutoff current	V_{CE}=220V V_{BE}=-1.5V			1	mA
		T_{case}=125 °C V_{CE}=220V V_{BE}=-1.5V			5	mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=5V			1	mA
$V_{CEO\ (sus)}$*	Collector-emitter 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)

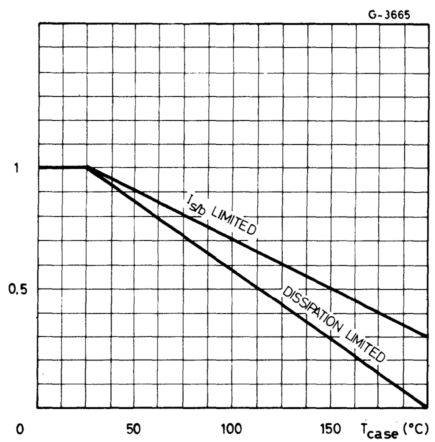
Parameter		Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =12A I_{B1} =1.5A V_{CC}=30V		0.35	1.3	µs
t_s	Storage time (fig. 2)	I_C =12A I_{B1}=-I_{B2}=1.5 A V_{CC}=30V		0.85	1.5	µs
t_f	Fall time (fig. 2)			0.14	0.8	µs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{CLAMP}=160V L =500µH	12			A

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

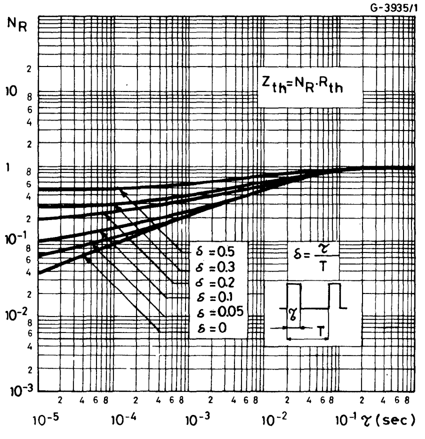
Safe operating areas



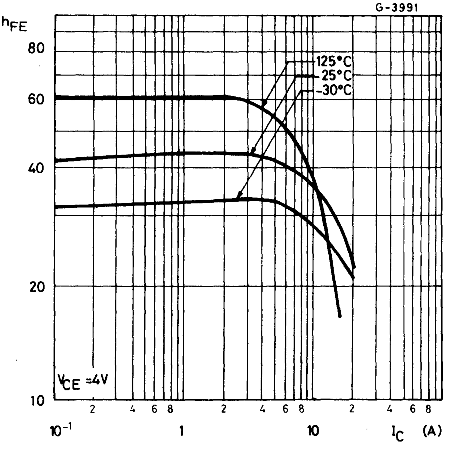
Derating curves



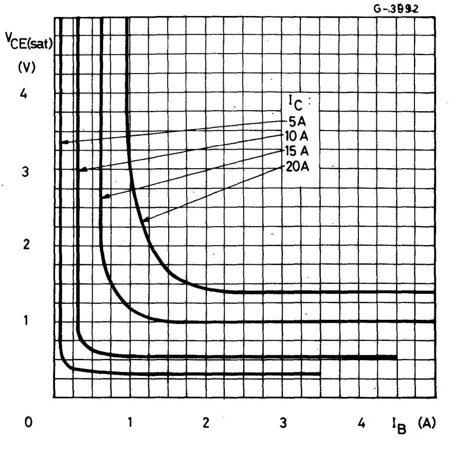
Thermal transient response



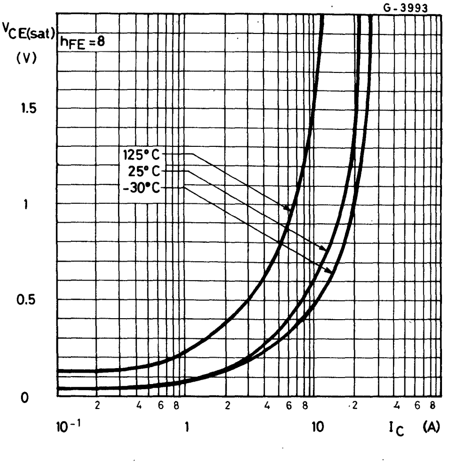
DC current gain



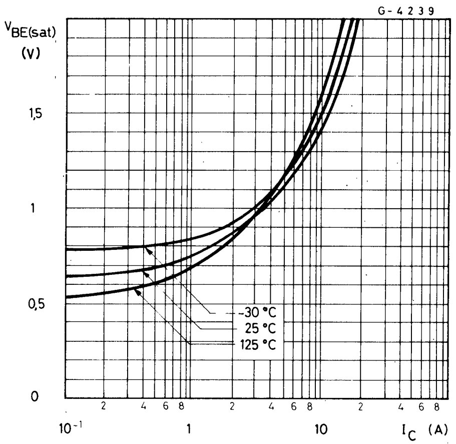
Collector-emitter saturation voltage



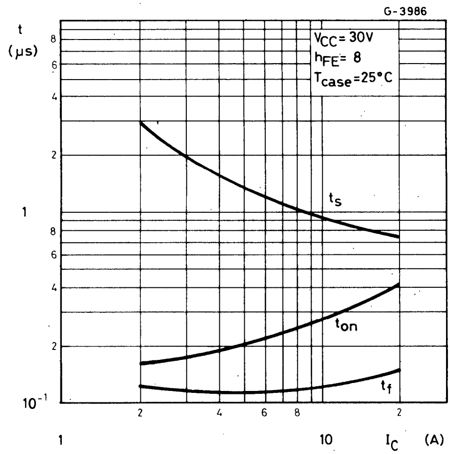
Collector-emitter saturation voltage



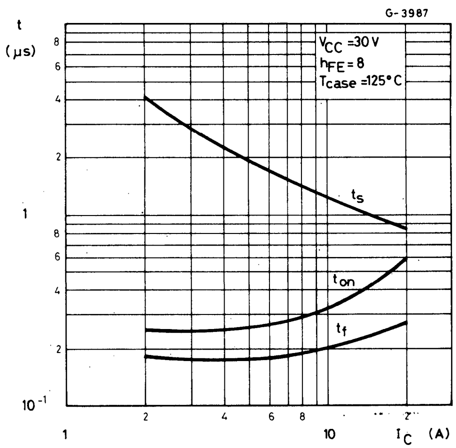
Base-emitter saturation voltage



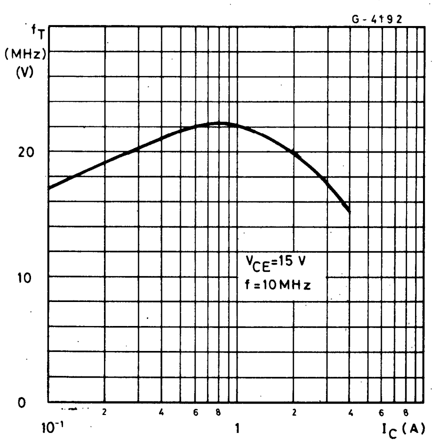
Saturated switching characteristics



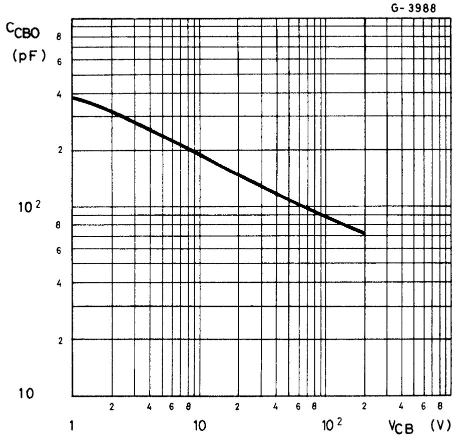
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

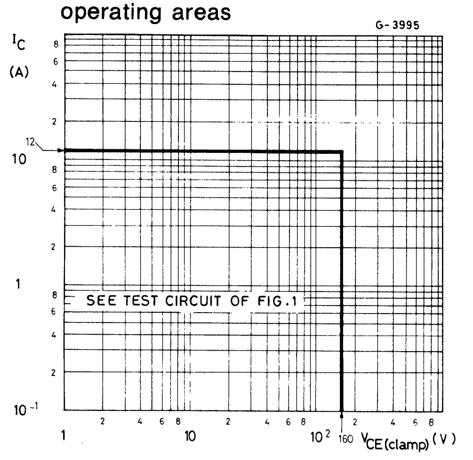


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C / I_B = 8$

t_p = adjusted for nominal I_C

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

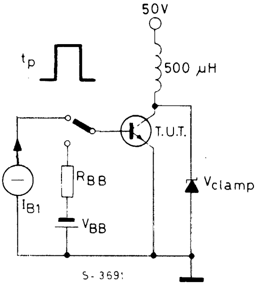


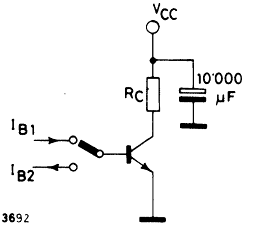
Fig. 2 — Switching times test circuit (resistive load)

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%



SGS BUX42

MULTIEPITAXIAL PLANAR NPN

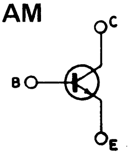
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTOR

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

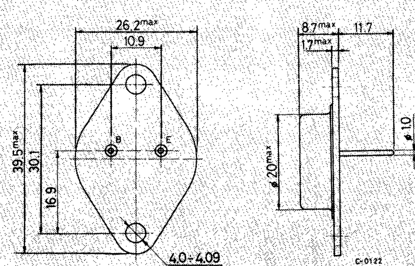
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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)

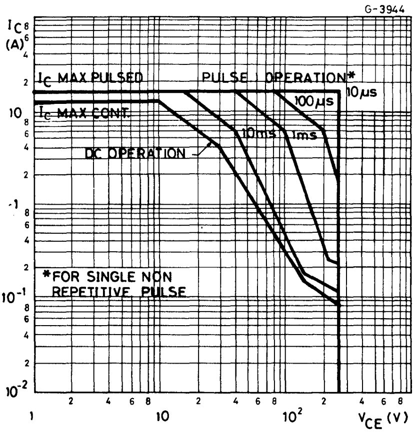
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 200V$			1	mA
I_{CEX}	Collector cutoff current	$V_{CE} = 300V$ $V_{BE} = -1.5V$			1	mA
		$T_{case} = 125\,°C$ $V_{CE} = 300V$ $V_{BE} = -1.5V$			5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			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)

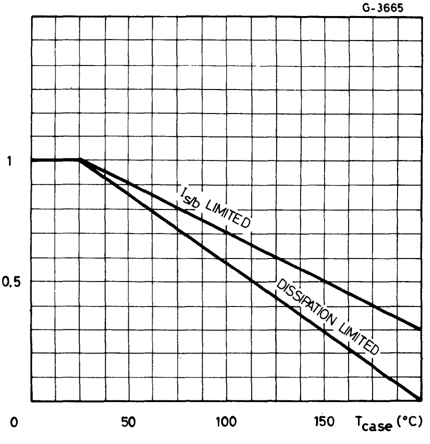
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_{on}	Turn-on time (fig. 2)	I_C =6A I_{B1} =0.75A V_{CC}=150V		0.23	1	μs
t_s	Storage time (fig. 2)	I_C =6A I_{B1} =0.75A I_{B2} =-0.75A V_{CC}=150V		1.5	2	μs
t_f	Fall time (fig. 2)			0.2	1.2	μs
	Clamped $E_{s/b}$ Collector current (fig. 1)	V_{clamp}=250V L =500μH	6			A

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

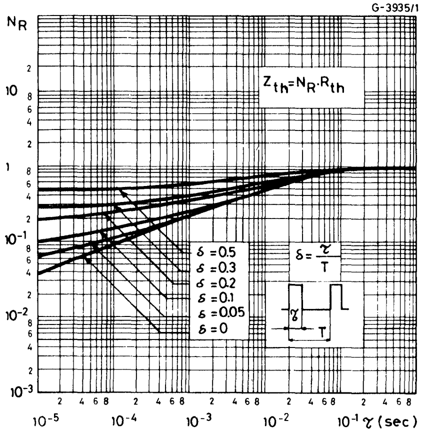
Safe operating areas



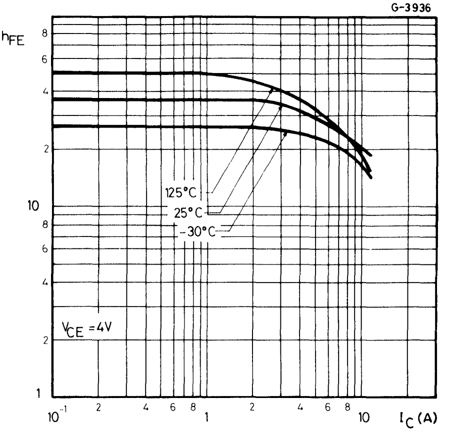
Derating curves



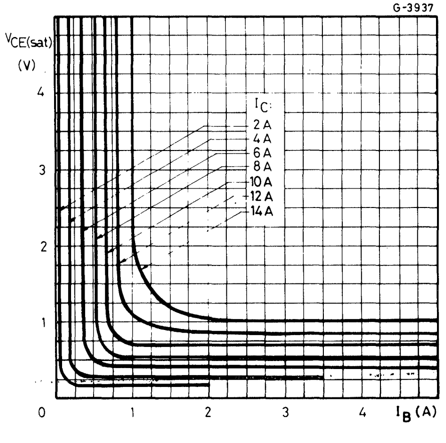
Thermal transient response



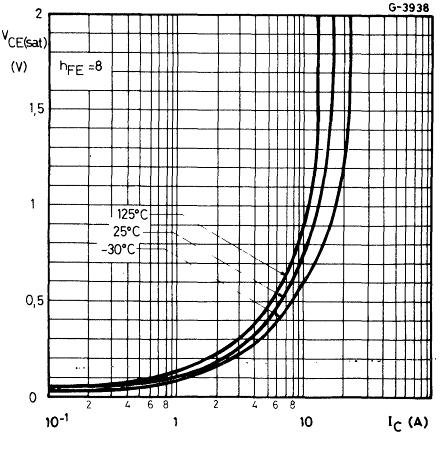
DC current gain



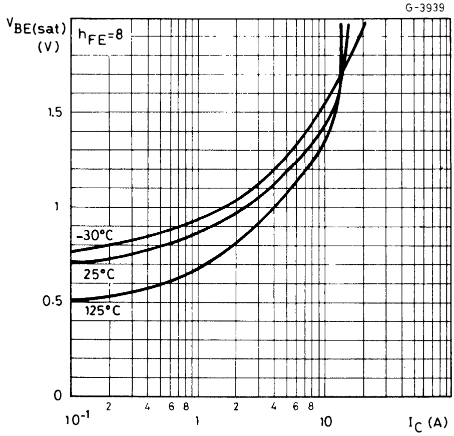
Collector-emitter saturation voltage



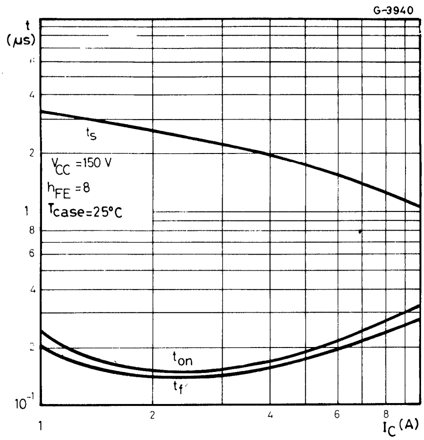
Collector-emitter saturation voltage



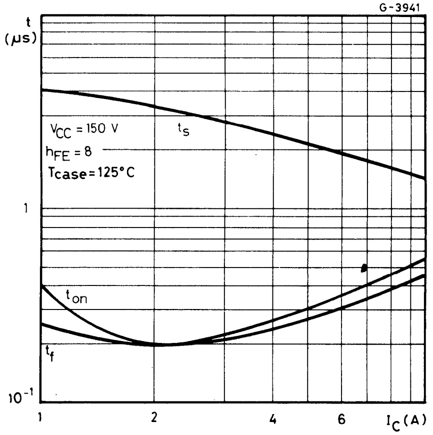
Base-emitter saturation voltage



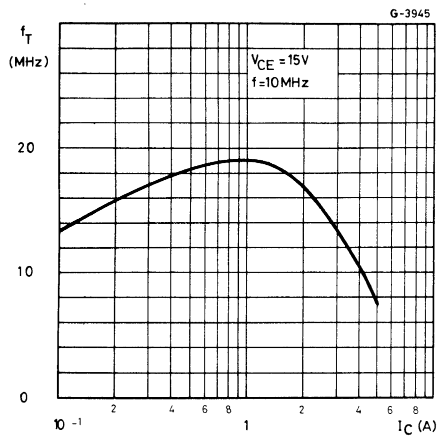
Saturated switching characteristics



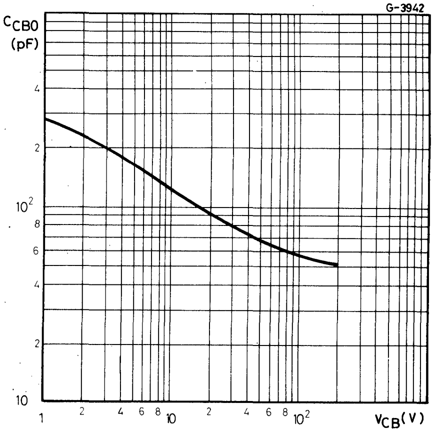
Saturated switching characteristics



Transition frequency



Collector-base capacitance



Clamped reverse bias safe operating areas

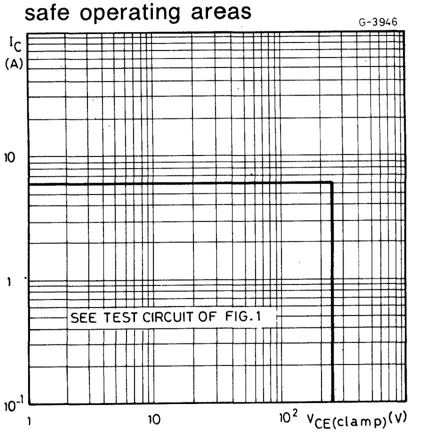


Fig. 1 — Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

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

$I_C/I_B = 8$

t_p = adjusted for nominal I_C

$R_{BB} \geq 1\Omega$

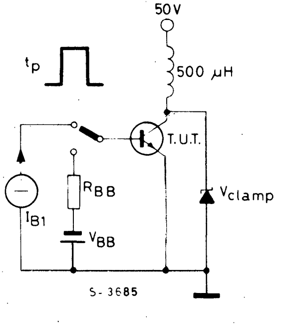


Fig. 2 — Switching times test circuit (resistive load)

TEST CONDITIONS:

V_{CC} = 150 V

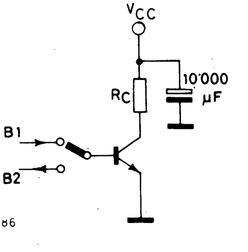
$R_C = \frac{V_{CC} - V_{CE(sat)}}{I_C}$

INPUT PULSE

pulse width = 10 µs

$t_r, t_f \leq$ 50ns

duty cycle = 1%



MULTIEPITAXIAL MESA NPN

BUX43

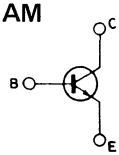
HIGH VOLTAGE POWER SWITCH

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 ($t_p \leqslant 10$ms)	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

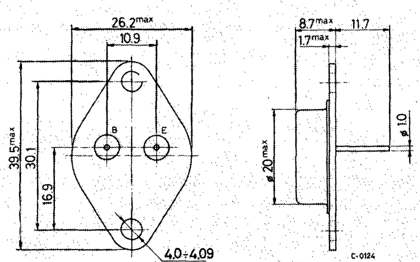
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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%.

BUX44

MULTIEPITAXIAL MESA NPN

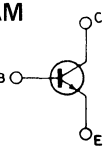
HIGH VOLTAGE POWER SWITCH

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 ($R_{BE} \leqslant 100\Omega$)	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 ($t_p \leqslant 10ms$)	10	A
I_B	Base current	1.6	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

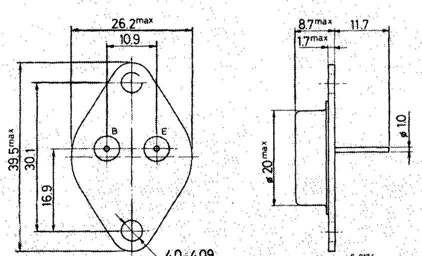
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

SGS **BUX44**

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%.

MULTIEPITAXIAL MESA NPN

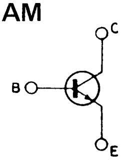
HIGH VOLTAGE POWER SWITCH

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 ($R_{BE} \leqslant 10\Omega$)	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 $T_{case} \leqslant 25°C$	85	W
T_{stg}	Storage temperature	–65 to 175	°C
T_j	Junction temperature	175	°C

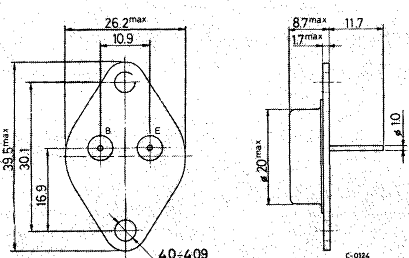
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

SGS BUX46

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 ($R_{BE} \leq 10\Omega$)	$V_{CE} = 850V$ $V_{CE} = 850V$ $T_{case} = 125°C$			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 = $300\mu s$, duty cycle $\leq 2\%$.

MULTIEPITAXIAL MESA NPN

SGS **BUX47**

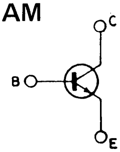
HIGH VOLTAGE POWER SWITCH

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 ($R_{BE} \leqslant 10\Omega$)	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 ($t_p \leqslant 10\,ms$)	12	A
I_B	Base current	3	A
I_{BM}	Base peak current ($t_p \leqslant 10\,ms$)	6	A
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	107	W
T_{stg}	Storage temperature	–65 to 175	°C
T_j	Junction temperature	175	°C

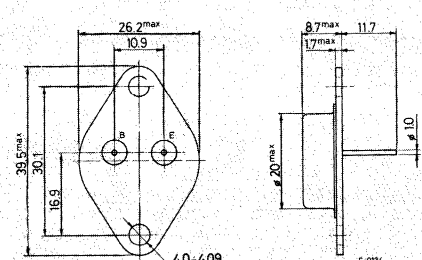
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

SGS **BUX47**

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%.

MULTIEPITAXIAL MESA NPN

SGS BUX48 BUX48A BUX48B BUX48C

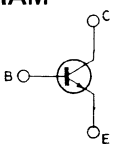
VERY HIGH VOLTAGE POWER SWITCH

The BUX48 series are multiepitaxial mesa NPN transistors in a Jedec TO-3 metal case, particularly intended for switching and industrial applications from single and three-phase mains operation.

ABSOLUTE MAXIMUM RATINGS

		BUX48	BUX48A	BUX48B	BUX48C
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	850V	1000V	1000V	1000V
V_{CER}	Collector-emitter voltage ($R_{BE} = 10\Omega$)	850V	1000V	1000V	1000V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400V	450V	600V	700V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V			
I_C	Collector current	15A			
I_{CM}	Collector peak current ($t_p \leqslant 5ms$)	30A			
I_{CP}	Collector peak current non repetitive ($t_p \leqslant 20\ \mu s$)	55A			
I_B	Base current	4A			
I_{BM}	Base peak current ($t_p \leqslant 5ms$)	20A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	175W			
T_{stg}	Storage temperature	-65 to 200°C			
T_j	Junction temperature	200°C			

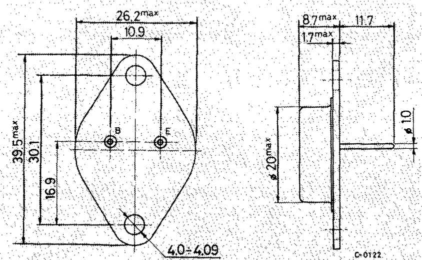
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

BUX48
BUX48A
BUX48B
BUX48C

THERMAL DATA

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

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

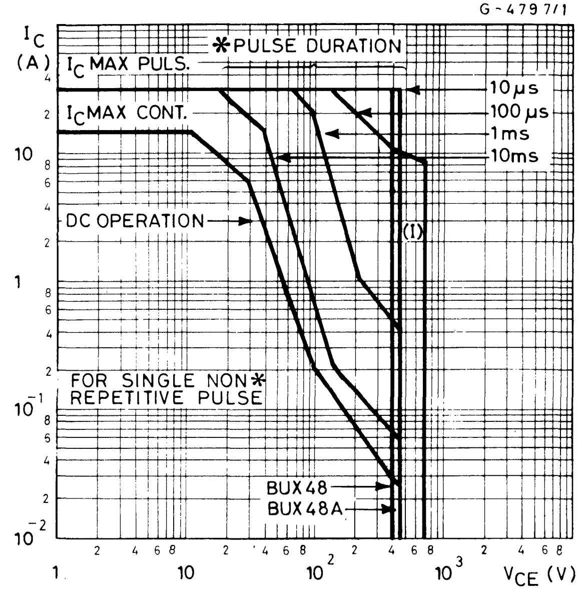
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BUX48** and **BUX48A**				
		$V_{CE} = V_{CES}$			200	μA
		$T_{case} = 125°C$				
		$V_{CE} = V_{CES}$			2	mA
		for **BUX48B** and **BUX48C**				
		$V_{CE} = V_{CES}$			500	μA
		$T_{case} = 125°C$				
		$V_{CE} = V_{CES}$			3	mA
I_{CER}	Collector cutoff current ($R_{BE} = 10\Omega$)	$V_{CE} = V_{CES}$			500	μA
		$T_{case} = 125°C$				
		$V_{CE} = V_{CES}$			4	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BUX48B**				
		$V_{CE} = V_{CEO}$			1	mA
		for **BUX48C**				
		$V_{CE} = V_{CEO}$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	for **BUX48** $I_C = 200mA$	400			V
		for **BUX48A** $I_C = 200mA$	450			V
		for **BUX48B** $I_C = 100mA$	600			V
		for **BUX48C** $I_C = 100mA$	700			V
$V_{CER(sus)}$*	Collector-emitter sustaining voltage ($R_{BE} = 10\Omega$)	for **BUX48B** and **BUX48C**				
		$L = 2mH$ $V_{Clamp} = 1000V$				
		$I_C = 0.5A$	1000			V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	for **BUX48**				
		$I_C = 10A$ $I_B = 2A$			1.5	V
		$I_C = 15A$ $I_B = 3A$			5	V
		for **BUX48A**				
		$I_C = 8A$ $I_B = 1.6A$			1.5	V
		$I_C = 12A$ $I_B = 2.4A$			5	V
		for **BUX48B** and **BUX48C**				
		$I_C = 6A$ $I_B = 1.5A$			1.5	V
		$I_C = 8A$ $I_B = 2.5A$			2	V
		$I_C = 10A$ $I_B = 4A$			3	V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	for **BUX48**				
		$I_C = 10A$ $I_B = 2A$			1.6	V
		for **BUX48A**				
		$I_C = 8A$ $I_B = 1.6A$			1.6	V
		for **BUX48B** and **BUX48C**				
		$I_C = 6A$ $I_B = 1.5A$			1.6	V
		$I_C = 10A$ $I_B = 4A$			2	V
t_{on}	Turn-on time (resistive load)	for **BUX48**				
		$V_{CC} = 150V$ $I_C = 10A$				
		$I_{B1} = -I_{B2} = 2A$			1	μs
		for **BUX48A**				
		$V_{CC} = 150V$ $I_C = 8A$				
		$I_{B1} = -I_{B2} = 1.6A$			1	μs
		for **BUX48B** and **BUX48C**				
		$V_{CC} = 250V$ $I_C = 6A$				
		$I_{B1} = -I_{B2} = 1.5A$		0.500	1	μs
t_s	Storage time (resistive load)	for **BUX48**				
		$V_{CC} = 150V$ $I_C = 10A$				
		$I_{B1} = -I_{B2} = 2A$			3	μs
		for **BUX48A**				
		$V_{CC} = 150V$ $I_C = 8A$				
		$I_{B1} = -I_{B2} = 1.6A$			3	μs
		for **BUX48B** and **BUX48C**				
		$V_{CC} = 250V$ $I_C = 6A$				
		$I_{B1} = -I_{B2} = 1.5A$		1.5	3	μs
t_f	Fall time (resistive load)	for **BUX48**				
		$V_{CC} = 150V$ $I_C = 10A$				
		$I_{B1} = -I_{B2} = 2A$			0.8	μs
		for **BUX48A**				
		$V_{CC} = 150V$ $I_C = 8A$				
		$I_{B1} = -I_{B2} = 1.6A$			0.8	μs
		for **BUX48B** and **BUX48C**				
		$V_{CC} = 250V$ $I_C = 6A$				
		$I_{B1} = -I_{B2} = 1.5A$		0.200	0.8	μs

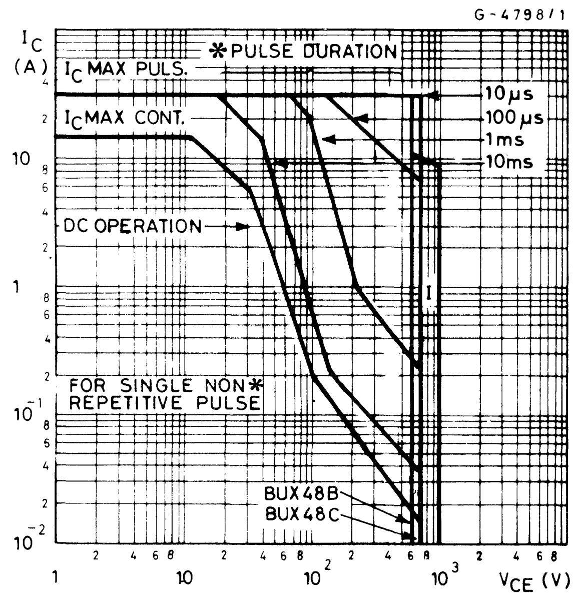
* Pulsed: pulse duration = 300 μs, duty cyle -1.5%.

Safe operating areas



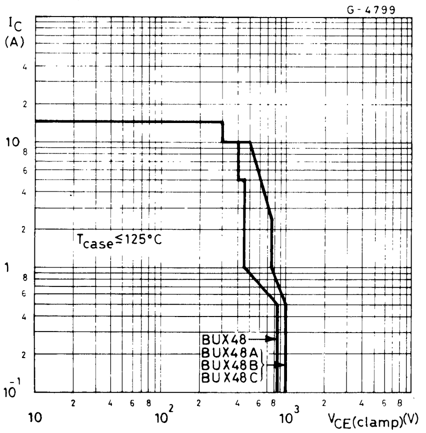
I - Area of permissible operation during turn-on provided $R_{BE} \leqslant 100\Omega$ and $t_p \leqslant 0.25\ \mu s$

Safe operating areas

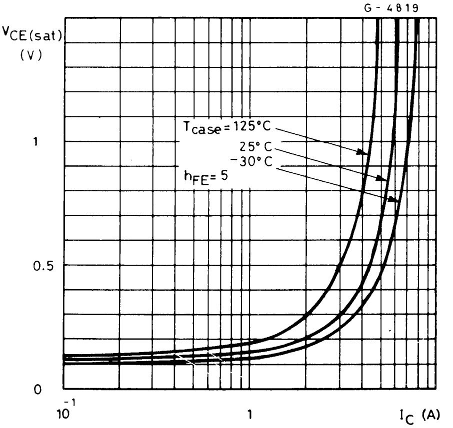


I - Area of permissible operation during turn-on provided $R_{BE} \leqslant 100\Omega$ and $t_p \leqslant 0,25\ \mu s$

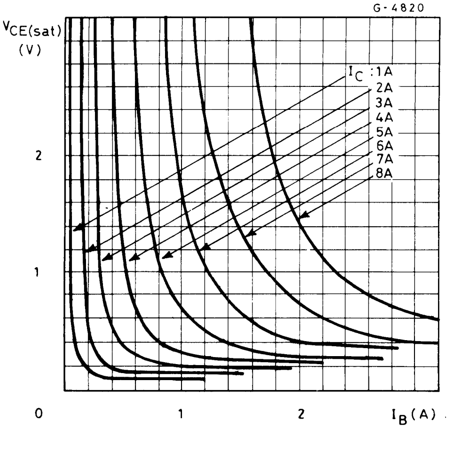
Clamped reverse bias safe operating areas



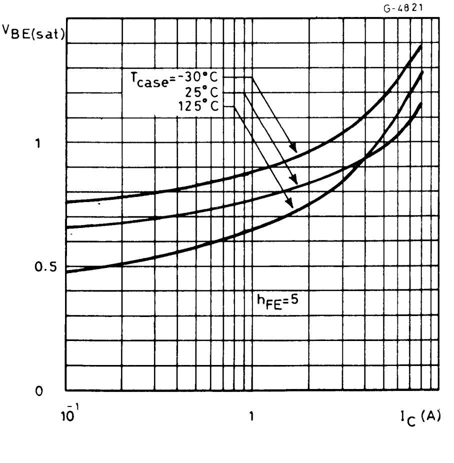
Collector-emitter saturation voltage



Collector-emitter saturation voltage

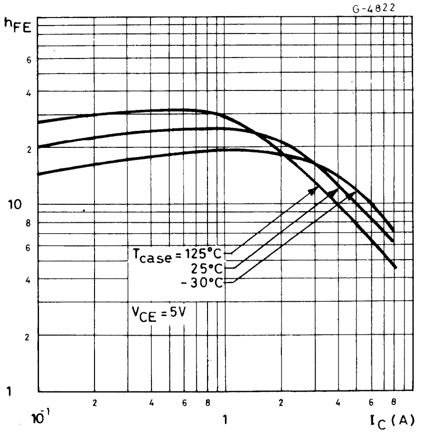


Base-emitter saturation voltage

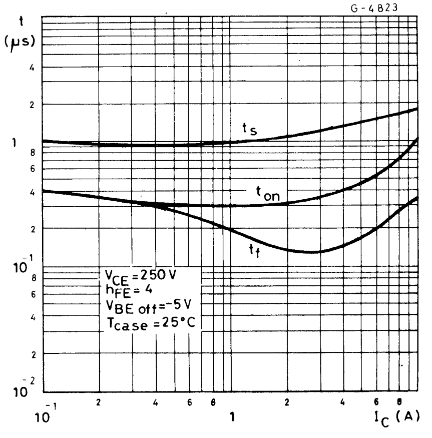


BUX48
BUX48A
BUX48B
BUX48C

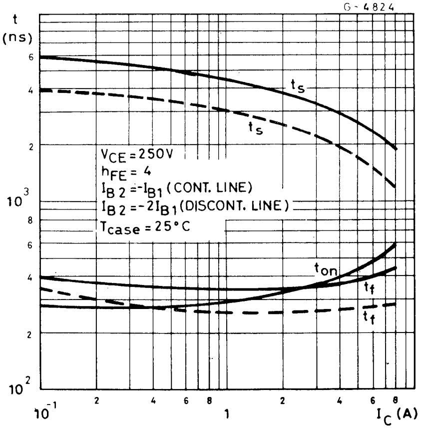
DC current gain



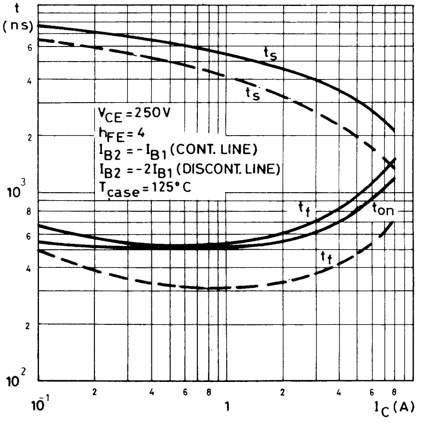
Saturated switching characteristics



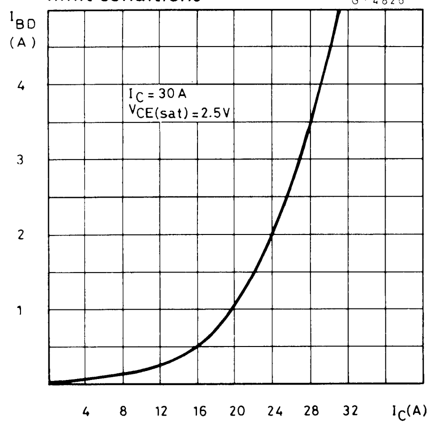
Saturated switching characteristics



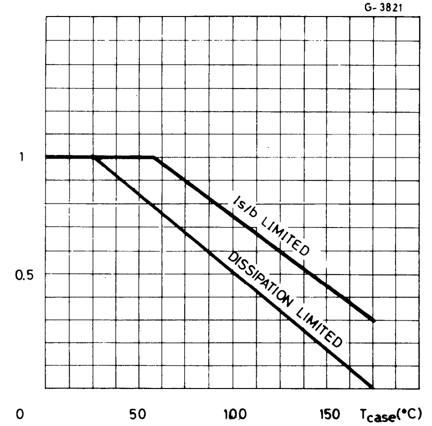
Saturated switching characteristics



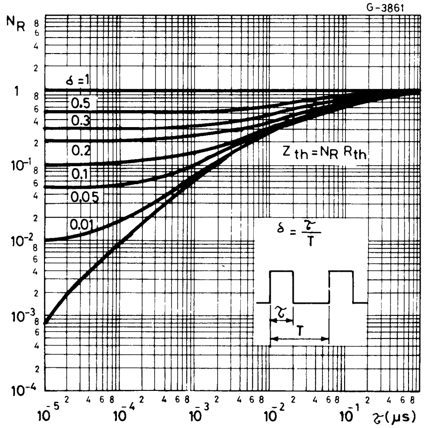
Maximum base current I_{BD} to drive the discrete Darlington in saturated limit conditions



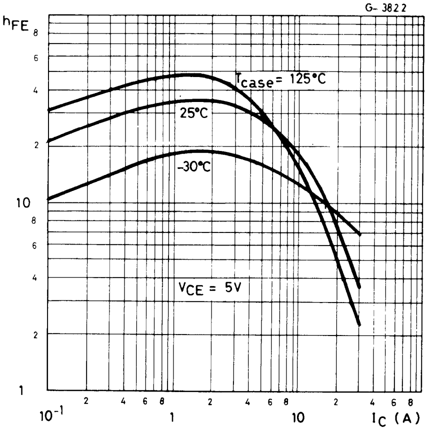
Derating curves



Thermal transient response

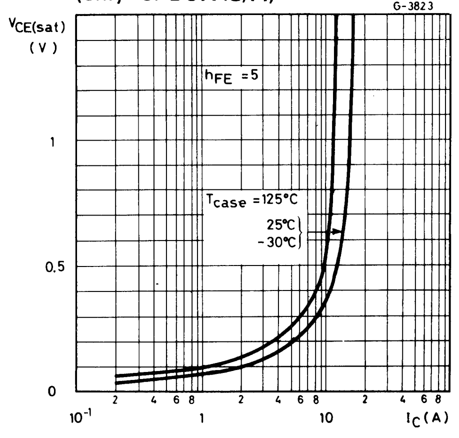


DC current gain (only for BUX48/A)

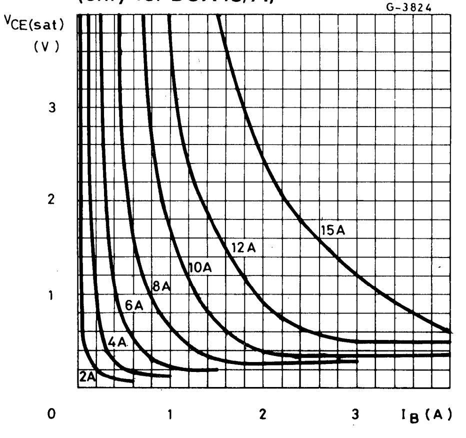


BUX48
BUX48A
BUX48B
BUX48C

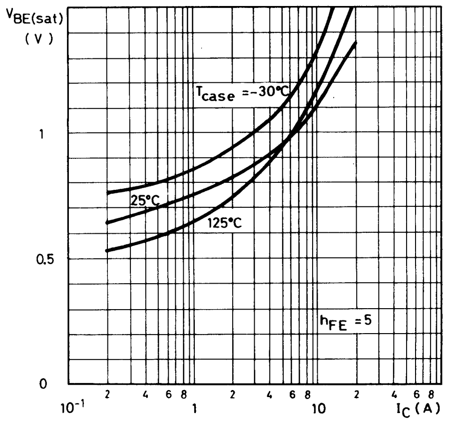
Collector-emitter saturation voltage (only for BUX48/A)



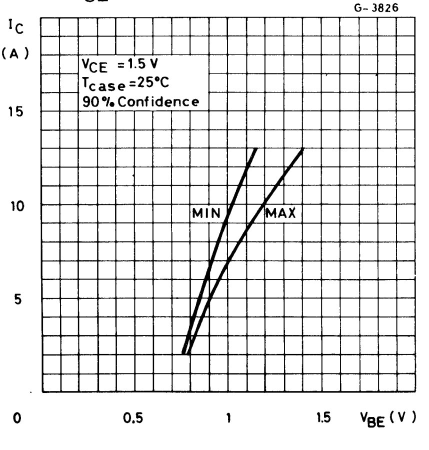
Collector-emitter saturation voltage (only for BUX48/A)



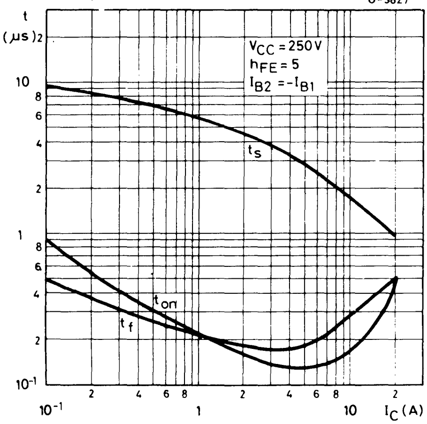
Base-emitter saturation voltage (only for BUX48/A)



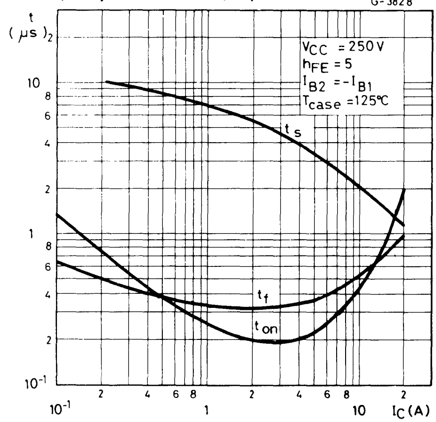
Extreme characteristics I_C vs. V_{BE} at V_{CE} constant (only for BUX48/A)



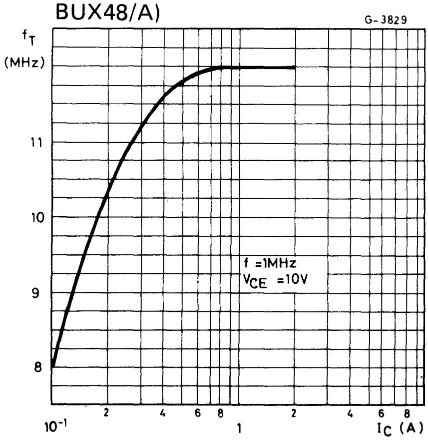
Saturated switching characteristics (only for BUX48/A)



Saturated switching characteristics (only for BUX48/A)



Transition frequency (only for BUX48/A)



Clamped $E_{s/b}$ test circuit

TEST CONDITIONS:

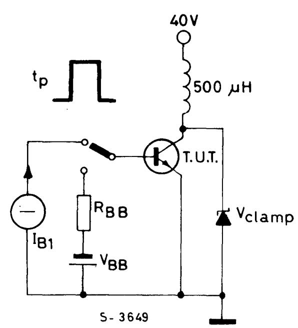
$5V \geq |-V_{BB}| \geq 2V$

$I_C / I_B = 5$

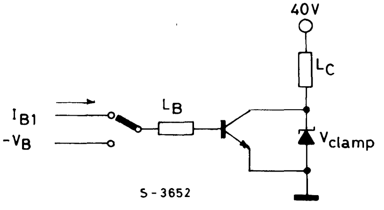
$2I_{B1} > |-I_{B2}| > I_{B1}$

t_p = adjusted for nominal I_C

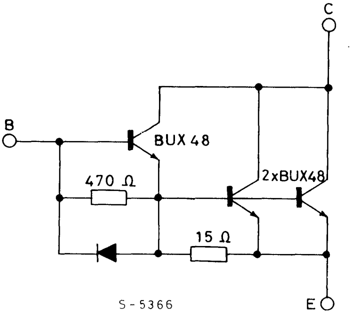
R_{BB} = adjusted for I_{B2}



Switching times test circuit inductive load



Discrete Darlington configuration using BUX48 series devices



Switchable power at 30A:18KVA

BUX80

MULTIEPITAXIAL MESA NPN

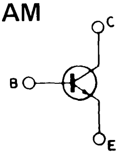
HIGH VOLTAGE POWER SWITCH

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

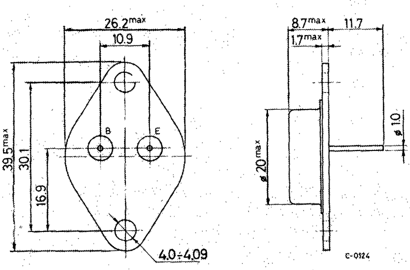
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

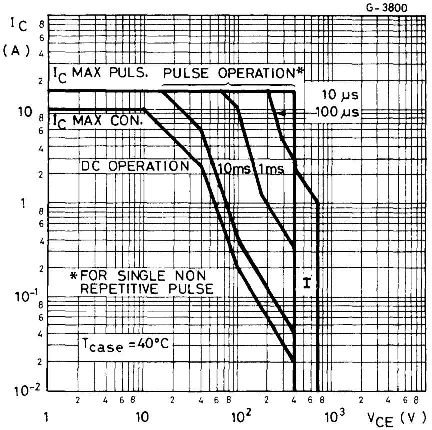
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.1	°C/W

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

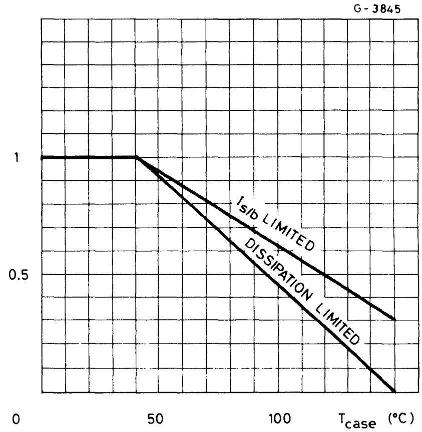
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE}=0)	V_{CE}=800V V_{CE}=800V T_{case}=125°C			1 3	mA mA
I_{EBO}	Emitter cutoff current (I_C=0)	V_{EB}=10V			10	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B=0)	I_C =100mA	400			V
$V_{CER(sus)}$*	Collector-emitter sustaining voltage (R_{BE}=50Ω)	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%

Safe operating areas

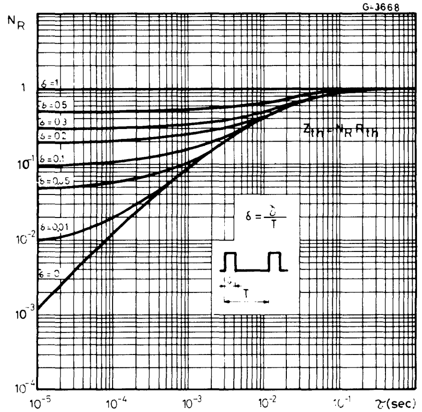


Derating curves

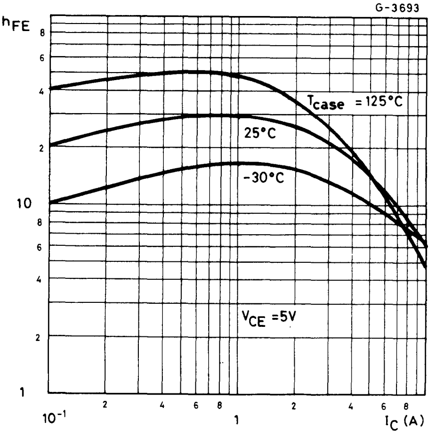


I — Area of permissible operation during Turn-on provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0{,}6\mu s$

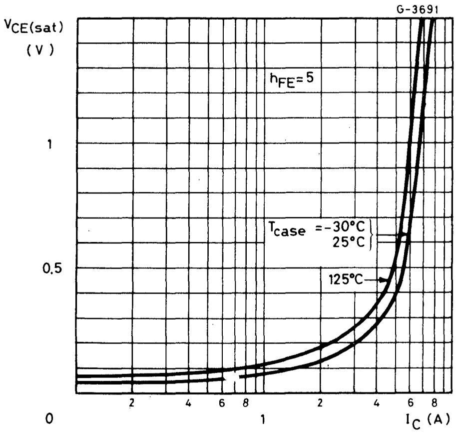
Transient thermal response



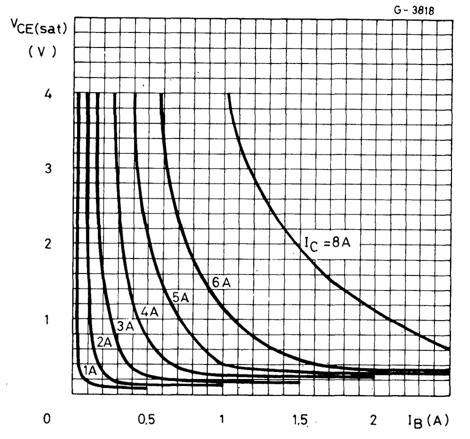
DC current gain



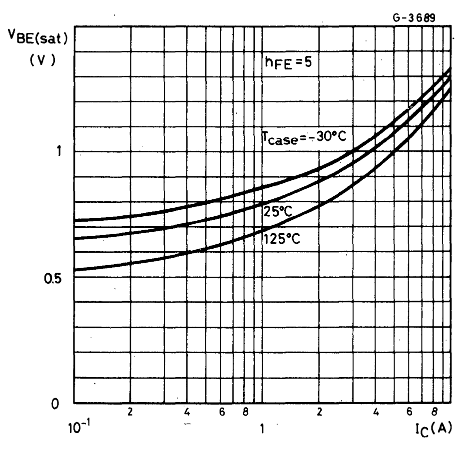
Collector-emitter saturation voltage



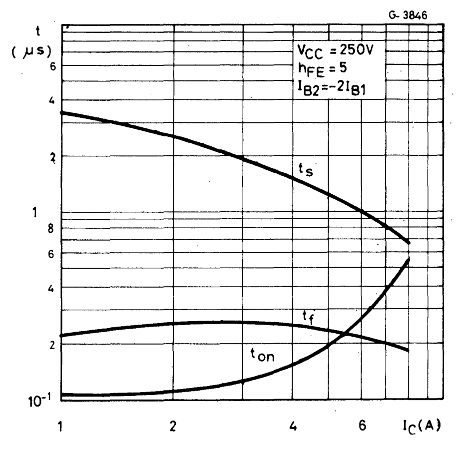
Collector-emitter saturation voltage



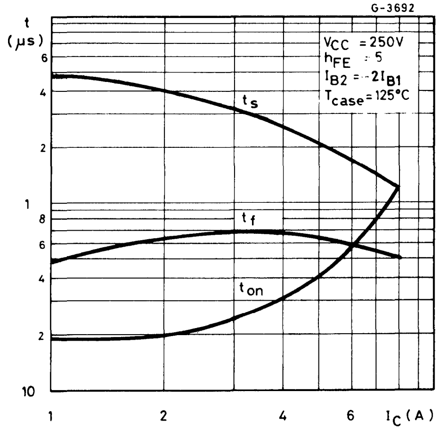
Base-emitter saturation voltage



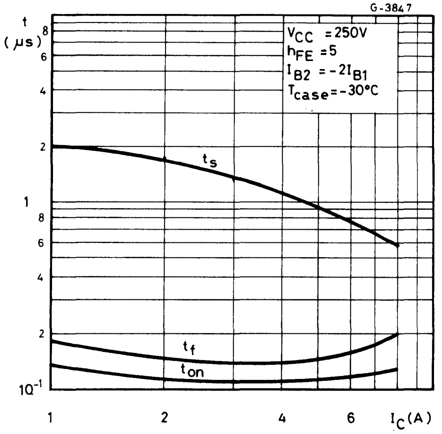
Saturated switching characteristics



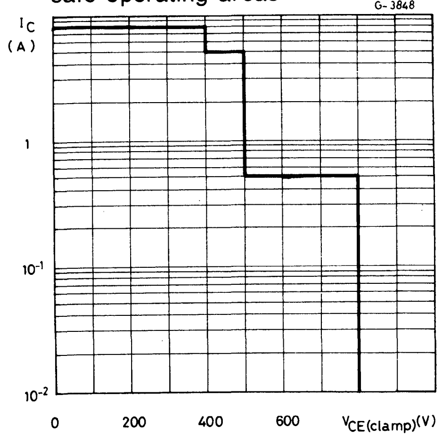
Saturated switching characteristics



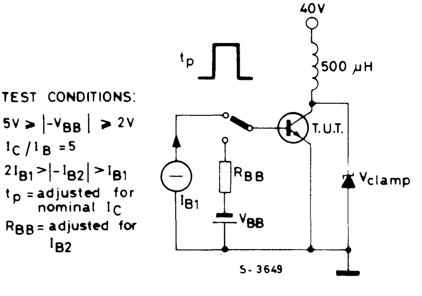
Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit



SGS **BUX84**

MULTIEPITAXIAL MESA NPN

ADVANCE DATA

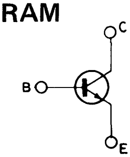
HIGH VOLTAGE SWITCH

The BUX84, is a multiepitaxial mesa NPN transistor, intended for use in converters inverters, switching regulators, motor control systems and switching applications.
It is mounted in Jedec TO-220 plastic package.

ABSOLUTE MAXIMUM RATINGS

V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	800	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	400	V
I_C	Collector current	2	A
I_{CM}	Collector peak current	3	A
I_B	Base current	0.75	A
I_{BM}	Base peak current	1	A
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

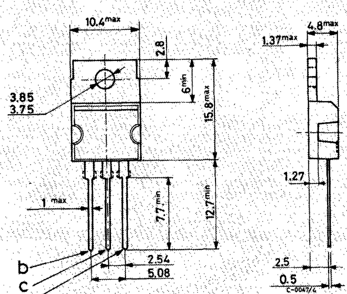
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

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

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = V_{CES}$ $V_{CE} = V_{CES}$ T_j = 125°C			200 1.5	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA I_B = 0 L = 25mH	400			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 0.3A I_B = 30mA I_C = 1A I_B = 0.2A			1.5 3	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 1A I_B = 0.2A			1.1	V
h_{FE}*	DC current gain	V_{CE} = 5V I_C = 0.1A		50		—
t_{on}	Turn-on time	I_C = 1A V_{CC} = 250V I_B = 0.2A $-I_B$ = 0.4A		300	500	ns
t_s	Storage time			1	3.5	μs
t_f	Fall time			0.1	1.4	μs

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

BUY18S

EPITAXIAL PLANAR NPN

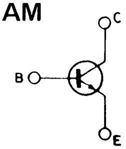
FAST SWITCHING HIGH VOLTAGE POWER

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

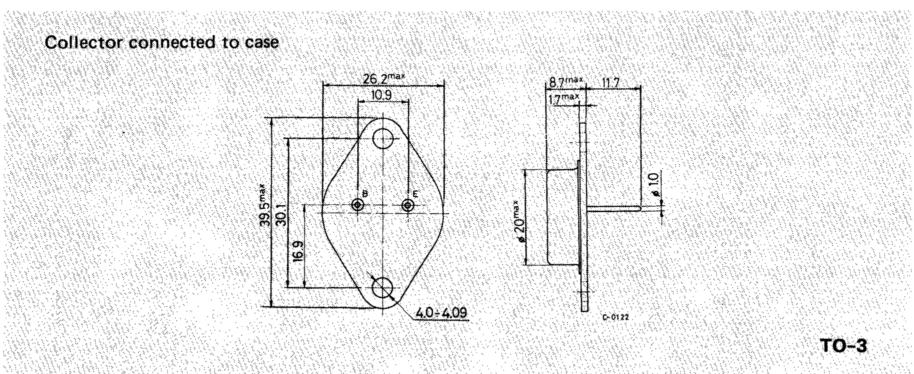
V_{CBO}	Collector-base voltage ($I_E = 0$)	400	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_{CM}	Collector peak current (repetitive)	10	A
I_{CM}	Collector peak current ($t \leqslant 10$ ms)	15	A
I_B	Base current	4	A
P_{tot}	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

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2	°C/W

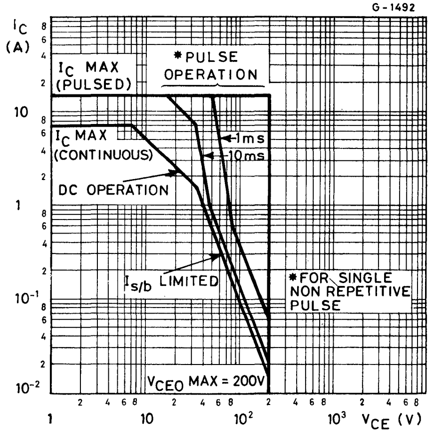
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

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

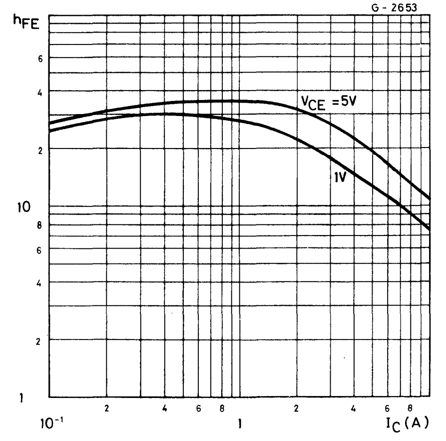
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5 %
** Pulsed: 1s, non repetitive pulse

SGS **BUY18S**

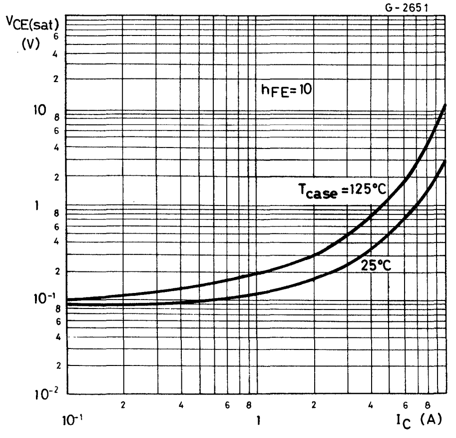
Safe operating areas



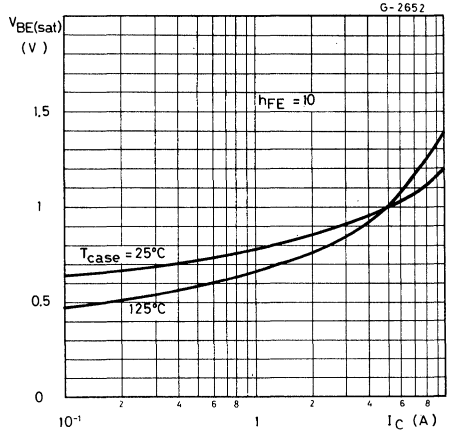
DC current gain



Collector-emitter saturation voltage



Base-emitter saturation voltage



BUY47
BUY48

EPITAXIAL PLANAR NPN

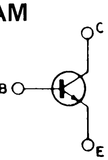
HIGH VOLTAGE, HIGH CURRENT SWITCH

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	

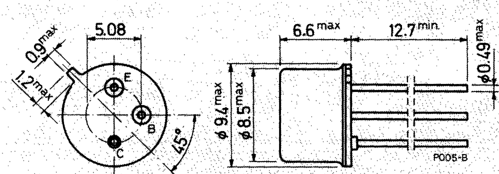
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

BUY47
BUY48

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)

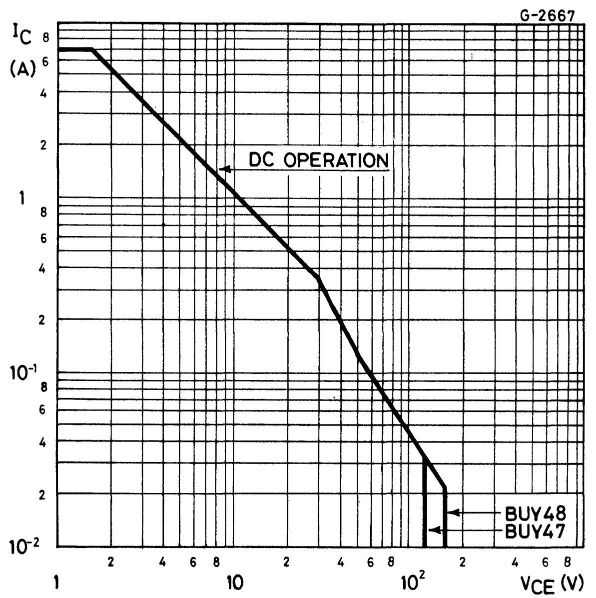
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BUY 47**					
		V_{CB} = 80 V				10	μA
		V_{CB} = 80 V	T_{case} = 125°C			1	mA
		for **BUY 48**					
		V_{CB} = 100 V				10	μA
		V_{CB} = 100 V	T_{case} = 125°C			1	mA
$V_{(BR)\ CBO}$*	Collector-base breakdown 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)

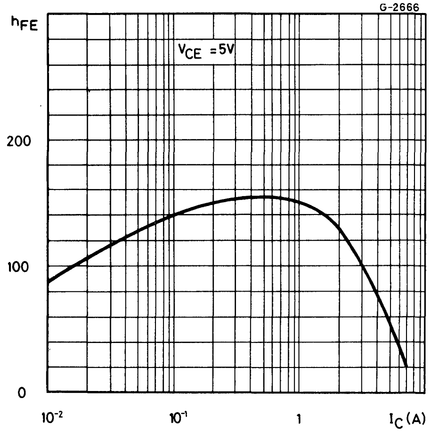
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 50 mA V_{CE} = 5 V		130		—
		I_C = 0.5 A V_{CE} = 5 V	40	150		—
		I_C = 2 A V_{CE} = 5 V	40	130		—
		I_C = 5 A V_{CE} = 5 V	15	45		—
f_T	Transition frequency	I_C = 100mA V_{CE} = 10 V		90		MHz
C_{CBO}	Collector-base capacitance	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%

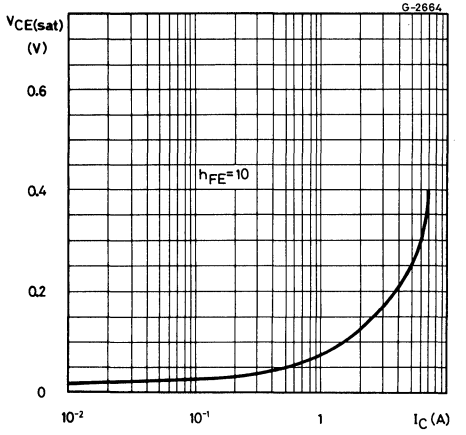
Safe operating areas



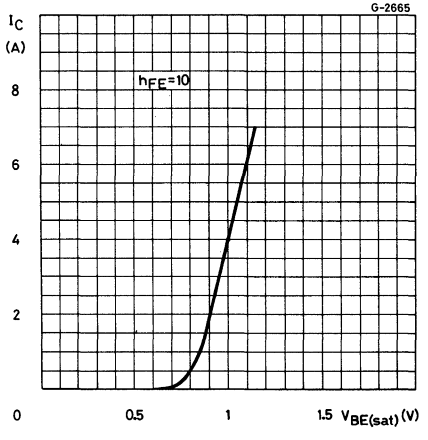
DC current gain



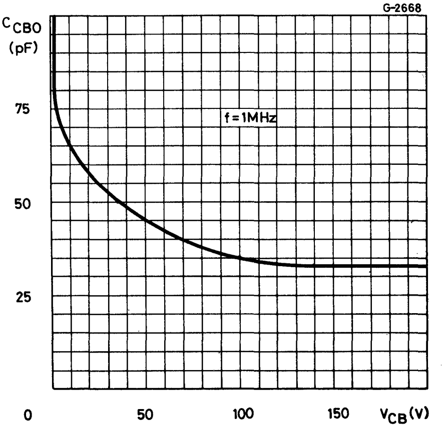
Collector-emitter saturation voltage



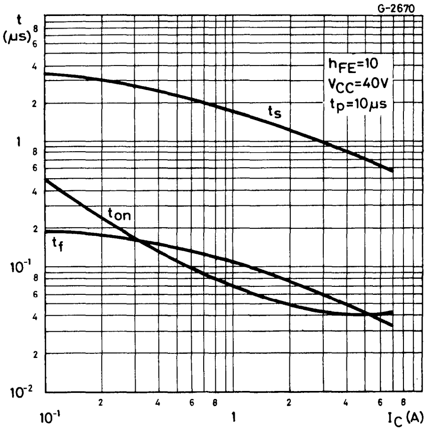
Base-emitter saturation voltage



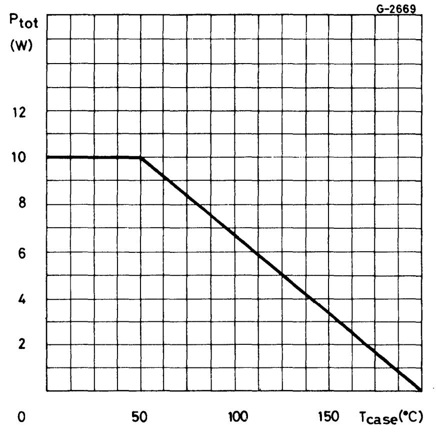
Collector-base capacitance



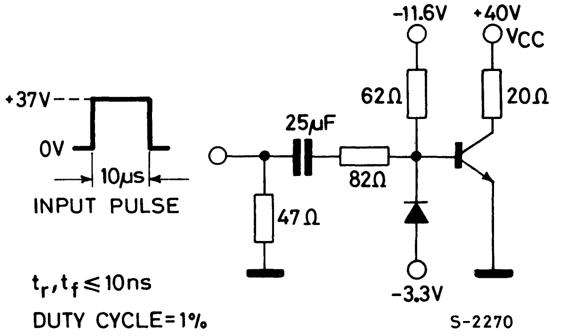
Saturated switching characteristics



Power rating chart



Switching time test circuit



SGS **BUY49P**

EPITAXIAL PLANAR NPN

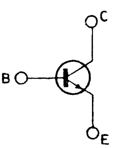
HIGH VOLTAGE, MEDIUM CURRENT SWITCH

The BUY49P is a silicon epitaxial planar NPN transistor in Jedec TO-126 plastic package. It is used in high-current switching applications up to 3A.

ABSOLUTE MAXIMUM RATINGS

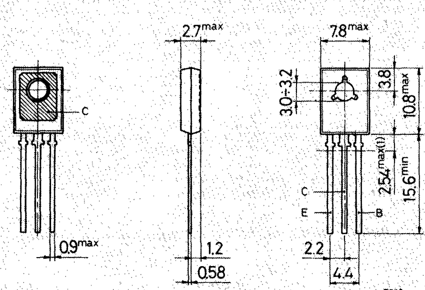
V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	3	A
I_{CM}	Collector peak current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	15	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	8.33	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 200V$			0.1	μA
V_{CBO}*	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 100\ \mu A$	250			V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 20mA$	200			V
V_{EBO} *	Emitter-base voltage ($I_C = 0$)	$I_E = 1mA$	6			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	$I_C = 0.5A$ $I_B = 50mA$			0.2	V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	$I_C = 0.5A$ $I_B = 50mA$			1.1	V
h_{FE} *	DC current gain	$I_C = 20mA$ $V_{CE} = 2V$	30			–
		$I_C = 20mA$ $V_{CE} = 5V$	40		120	–
		$I_C = 0.5A$ $V_{CE} = 5V$	40			–
		$I_C = 20mA$ $V_{CE} = 2V$ $T_{case} = -55°C$	16			–
f_T	Transition frequency	$I_C = 100mA$ $V_{CE} = 10V$	30			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10V$ f = 1MHz			50	pF
t_{on}	Turn-on time	$I_C = 0.5A$ $V_{CC} = 20V$			0.8	μs
t_{off}	Turn-off time	$I_{B1} = -I_{B2} = 50mA$			2.5	μs

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

BUY49S

EPITAXIAL PLANAR NPN

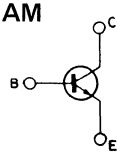
HIGH VOLTAGE, MEDIUM CURRENT SWITCH

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

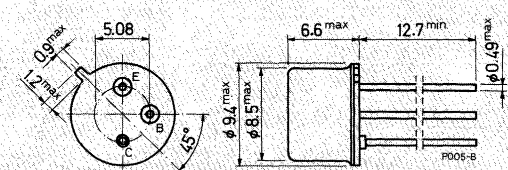
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

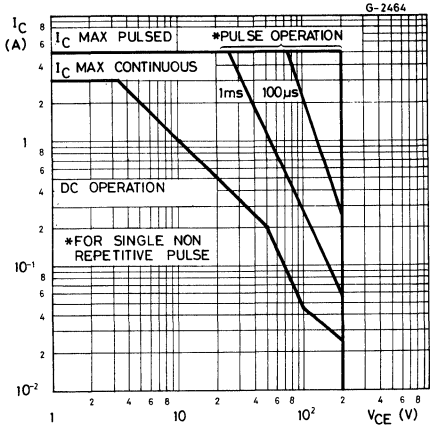
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

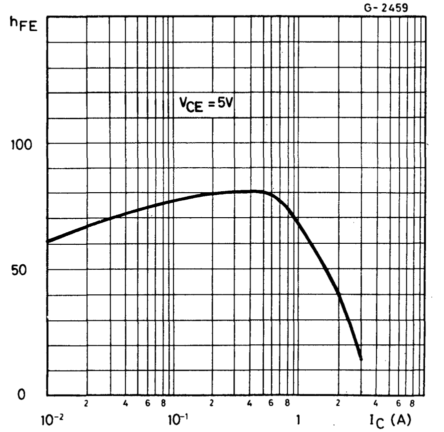
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 200 V V_{CB} = 200 V T_{case} = 150 °C			0.1 50	μA μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 100 μA	250			V
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 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

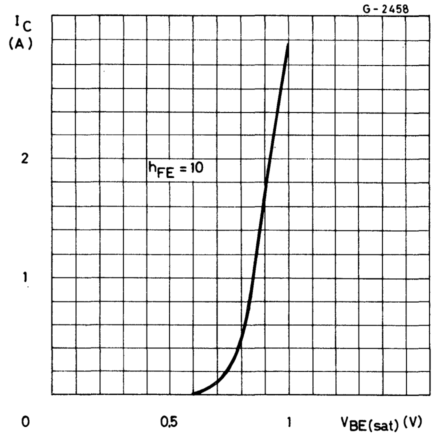
Safe operating areas



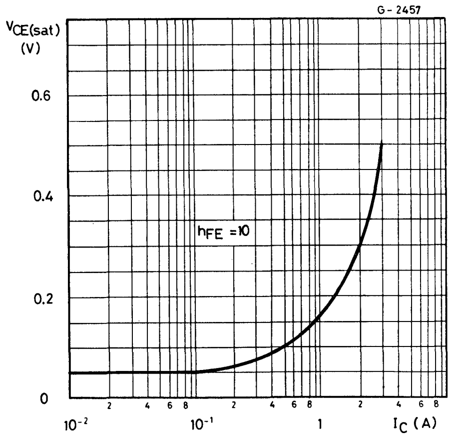
DC current gain



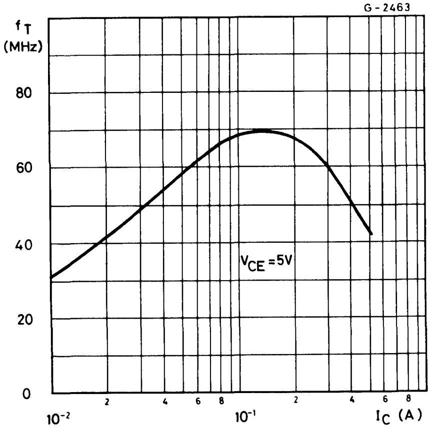
DC transconductance



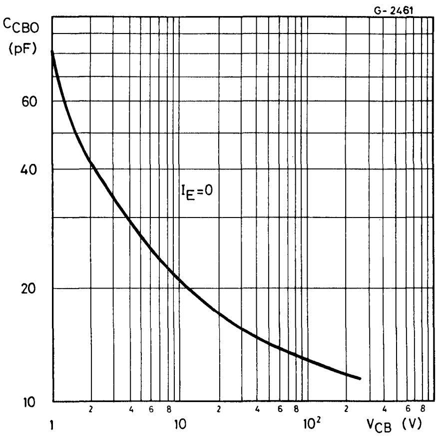
Collector-emitter saturation voltage



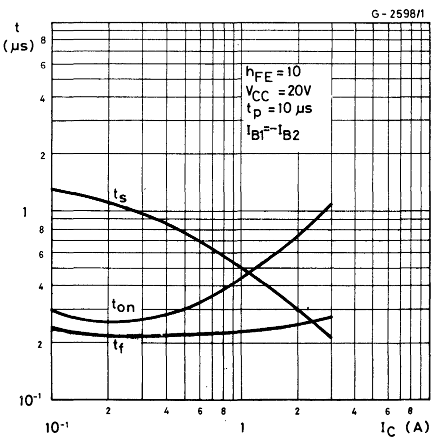
Transition frequency



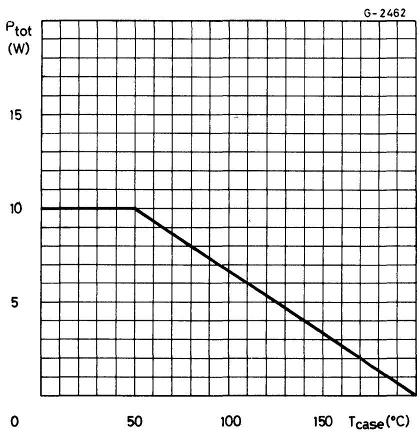
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BUY68

EPITAXIAL PLANAR NPN

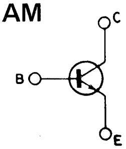
HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

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 ($R_{BE} \leq 10\ \Omega$)	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

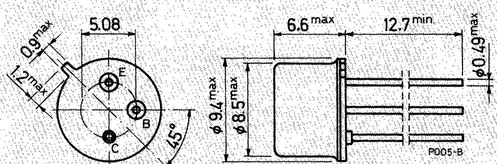
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

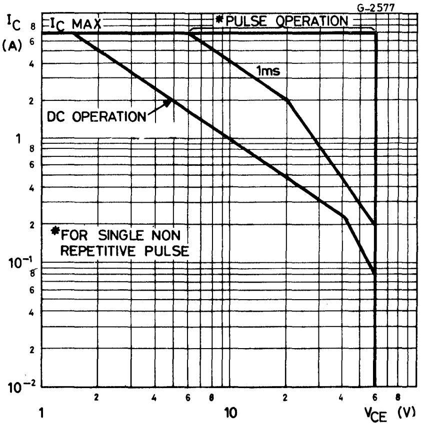
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

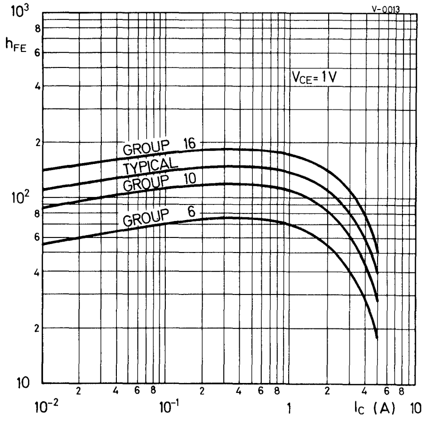
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 60 V			1	μA
$V_{(BR)\ CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 1 mA	100			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE} = 10 Ω)	I_C = 50 mA	80			V
$V_{CEO\ (sus)}$*	Collector-emitter 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_B = 0.2 A			0.6	V
		I_C = 5 A I_B = 0.5 A			1	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2 A I_B = 0.2 A		1	1.3	V
		I_C = 5 A I_B = 0.5 A		1.2	1.6	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 V_{CB} = 10 V f = 1 MHz			80	pF
t_{on}	Turn-on time	I_C = 5 A V_{CC} = 20 V I_{B1} = $-I_{B2}$ = 0.5 A			0.35	μs
t_{off}	Turn-off time				0.75	μs

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

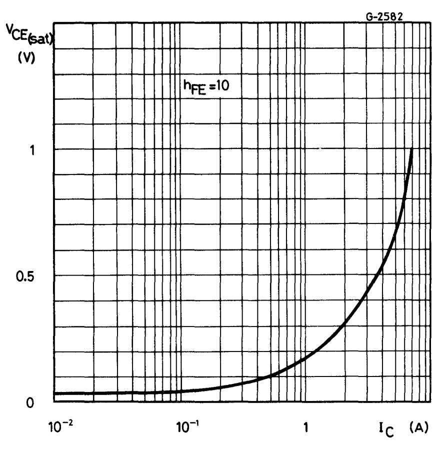
Safe operating areas



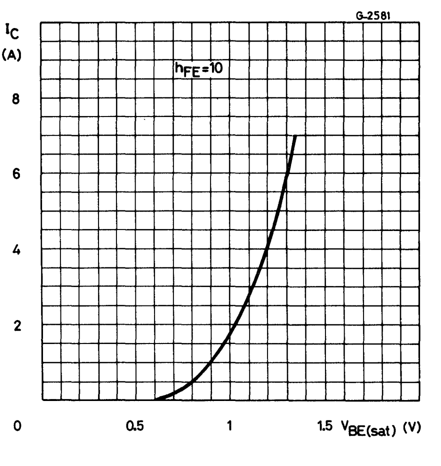
DC current gain



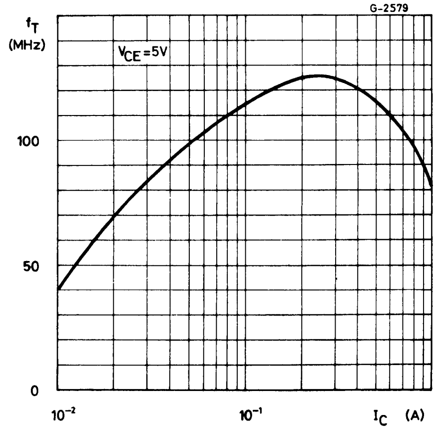
Collector-emitter saturation voltage



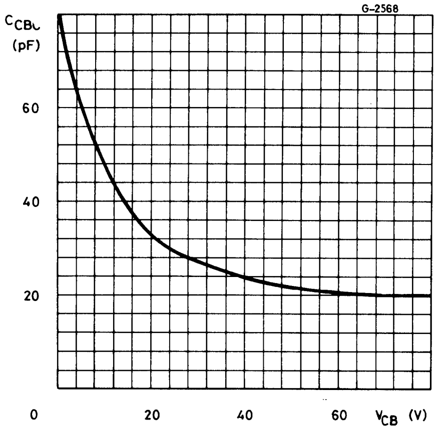
Base-emitter saturation voltage



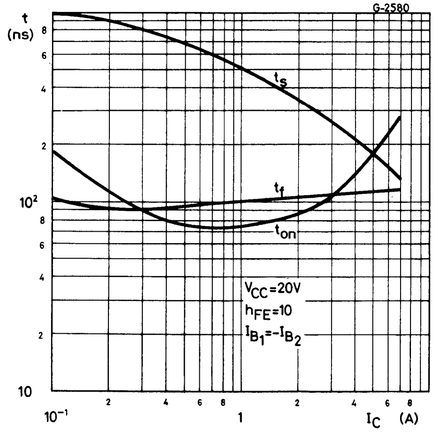
Transition frequency



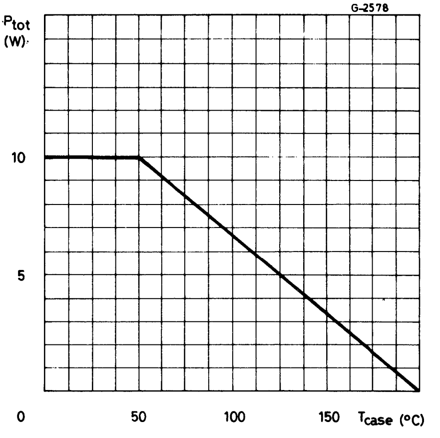
Collector-base capacitance



Saturated switching characteristics



Power rating chart



BUY69A
BUY69B
BUY69C

MULTIEPITAXIAL MESA NPN

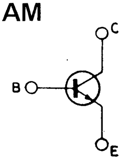
HIGH VOLTAGE POWER SWITCH

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	

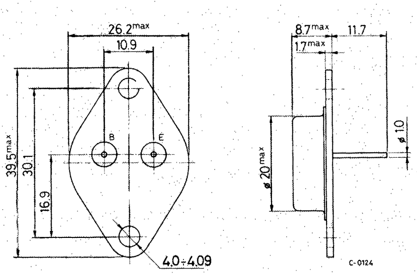
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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: 1 s, non repetitive pulse

For characteristics curves see the BUW 34/5/6 series.

MULTIEPITAXIAL PLANAR NPN

D44C1 / 2 / 3
D44C4 / 5 / 6
D44C7 / 8 / 9
D44C10 / 11 / 12

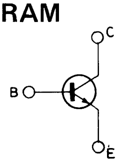
LINEAR AND SWITCHING APPLICATIONS

The D44C1 to D44C12 are silicon multiepitaxial planar transistors in TO-220 plastic package intended for linear and switching applications.

ABSOLUTE MAXIMUM RATINGS

		D44C 1/2/3	D44C 4/5/6	D44C 7/8/9	D44C 10/11/12
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	40V	55V	70V	90V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	30V	45V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V	5V	5V	5V
I_C	Collector current	4A			
I_{CM}	Collector peak current ($t_p = 10ms$)	6A			
P_{tot}	Total power dissipation $T_{case} \leq 25°C$	30W			
	$T_{amb} \leq 25°C$	1,67W			
T_{stg}	Storage temperature	-55 to 150°C			
T_j	Junction temperature	150°C			

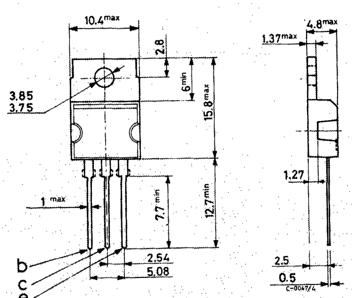
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

10/82

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction–case	max.	4.2	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction–ambient	max.	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} = Rated V_{CES}			10	μA
I_{EBO} *	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			100	μA
$V_{CEO(sus)}$*	Collector–emitter sustaining voltage	I_C = 100mA for **D44C1-2-3** for **D44C4-5-6** for **D44C7-8-9** for **D44C10-11-12**	 30 45 60 80			 V V V V
$V_{CE(sat)}$*	Collector–emitter saturation voltage	I_C = 1A I_B = 50mA for **D44C2-3-5-6-8-9-11-12** I_C = 1A I_B = 0.1A for **D44C1-4-7-10**			 0.5 0.5	 V V
$V_{BE(sat)}$*	Base–emitter saturation voltage	I_C = 1A I_B = 100mA			1.3	V
h_{FE} *	DC current gain	I_C = 0.2A V_{CE} = 1V I_C = 2A V_{CE} = 1V for **D44C3-6-9-12** I_C = 0.2A V_{CE} = 1V I_C = 1A V_{CE} = 1V for **D44C2-5-8-11** I_C = 0.2A V_{CE} = 1V I_C = 1A V_{CE} = 1V for **D44C1-4-7-10**	40 20 100 20 25 10		120 220	– –

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

D44H1 / D44H2
D44H4 / D44H5
D44H7 / D44H8
D44H10 / D44H11

MULTIEPITAXIAL PLANAR NPN

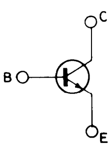
SWITCHING APPLICATIONS GENERAL PURPOSE

The D44H series are silicon multiepitaxial planar transistors and are mounted in Jedec TO-220 plastic package.
They are intended for various switching and general purpose applications.

ABSOLUTE MAXIMUM RATINGS

		D44H1/2	D44H4/5	D44H7/8	D44H10/11
V_{CEO}	Collector-emitter voltate ($I_B = 0$)	30V	45V	60V	80V
V_{EBO}	Emitter base voltage ($I_C = 0$)	5V			
I_C	Collector current	10A			
I_{CM}	Collector peak current	20A			
P_{tot}	Total power dissipation $T_{case} \leqslant 25°C$	50W			
T_{stg}	Storage temperature	-55 to 150°C			
T_j	Junction temperature	150°C			

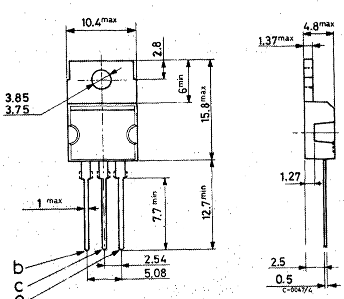
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

$R_{th\ j-case}$	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} = Rated V_{CEO}			10	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = Rated V_{EBO}			100	μA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage	I_C = 100mA for **D44H1/2** for **D44H4/5** for **D44H7/8** for **D44H10/11**	30 45 60 80			V V V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 8A I_B = 0.4A for **D44H2/5/8/11** I_C = 8A I_B = 0.8A for **D44H1/4/7/10**			 1 1	 V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 8A I_B = 0.8A			1.5	V
h_{FE} *	DC current gain	V_{CE} = 1V I_C = 2A for **D44H1/4/7/10** for **D44H2/5/8/11** V_{CE} = 1V I_C = 4A for **D44H1/4/7/10** for **D44H2/5/8/11**	 35 60 20 40			 — — — —

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

MULTIEPITAXIAL PLANAR NPN

SGS

D44Q1
D44Q3
D44Q5

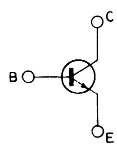
LINEAR AND SWITCHING APPLICATIONS

The D44Q1, D44Q3 and D44Q5 are silicon multiepitaxial planar transistors in TO-220 plastic package intended for linear and switching applications.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter		D44Q1	D44Q3	D44Q5
V_{CBO}	Collector-base voltage ($I_E = 0$)		200V	250V	300V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		125V	175V	225V
V_{EBO}	Emitter-base voltage ($I_B = 0$)		7V	7V	7V
I_C	Collector current			4A	
P_{tot}	Total power dissipation	$T_{case} \leqslant 25°C$		31.25W	
		$T_{amb} \leqslant 25°C$		1.67W	
T_{stg}	Storage temperature			-55 to 150°C	
T_j	Junction temperature			150°C	

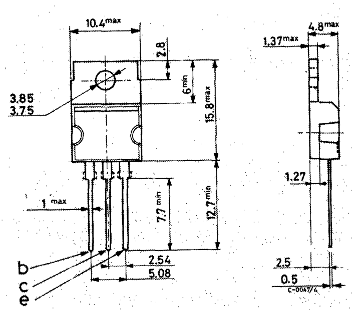
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

10/82

D44Q1
D44Q3
D44Q5

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction–case	max.	4	°C/W
$R_{th\ j\text{-}amb.}$	Thermal resistance junction–ambient	max.	75	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	Rated V_{CEO}			10	μA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	$I_C = 10mA$				
		for **D44Q1**	125			V
		for **D44Q3**	175			V
		for **D44Q5**	225			V
$V_{CE(sat)}$*	Collector–emitter saturation voltage	$I_C = 2A$ $I_B = 0.2A$			1	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 2A$ $I_B = 0.2A$			1.3	V
h_{FE}*	DC current gain	$I_C = 0.2A$ $V_{CE} = 10V$	30			–
		$I_C = 2A$ $V_{CE} = 10V$	20			–
f_T	Transition frequency	$I_C = 100mA$ $V_{CE} = 10V$		20		MHz
C_{CBO}	Collector base capacitance	$V_{CB} = 10V$ $f = 1MHz$		32		pF
t_{on}	Turn-in time	$V_{CC} = 50V$ $I_C = 1A$ $I_{B1} = -I_{B2} = 0.1A$			0.4	μs
t_s	Storage time				2	μs
t_f	Fall time				1.7	μs

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

EPITAXIAL-BASE NPN/PNP

MJ900
MJ901
MJ1000
MJ1001

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

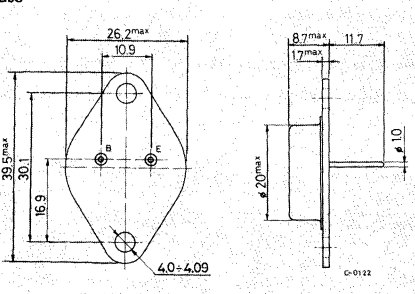
		PNP°	MJ 900	MJ 901
		NPN	MJ1000	MJ1001
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		8A	
I_B	Base current		0.1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25\ °C$		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

Collector connected to case



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} = 1kΩ)	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

EPITAXIAL-BASE NPN/PNP

MJ2500
MJ2501
MJ3000
MJ3001

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

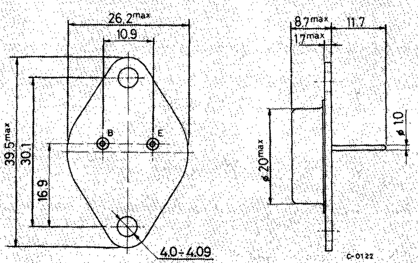
		PNP°	MJ2500	MJ2501
		NPN	MJ3000	MJ3001
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		10A	
I_B	Base current		0.2A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °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

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_{CER}	Collector cutoff current ($R_{BE} = 1k\Omega$)	for **MJ2500** and **MJ3000**				
		V_{CE} = 60 V			1	mA
		for **MJ2501** and **MJ3001**				
		V_{CE} = 80 V			1	mA
		T_{case} = 150°C				
		for **MJ2500** and **MJ3000**				
		V_{CE} = 60 V			5	mA
		for **MJ2501** and **MJ3001**				
		V_{CE} = 80 V			5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **MJ2500** and **MJ3000**				
		V_{CE} = 30 V			1	mA
		for **MJ2501** and **MJ3001**				
		V_{CE} = 40 V			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 = 100mA				
		for **MJ2500** and **MJ3000**	60			V
		for **MJ2501** and **MJ3001**	80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 5 A I_B = 20mA			2	V
		I_C = 10 A I_B = 50mA			4	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

MJ2955

EPITAXIAL-BASE PNP

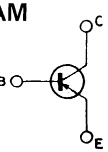
POWER LINEAR AND SWITCHING APPLICATIONS

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

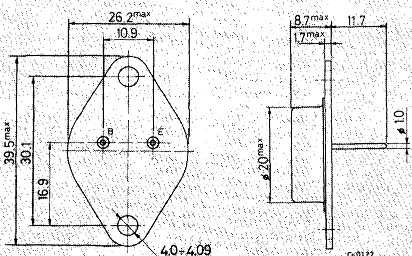
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

MJ2955

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

MJ4030 / MJ4033
MJ4031 / MJ4034
MJ4032 / MJ4035

GENERAL PURPOSE

The MJ4030/31/32/33/34/35 are medium-power silicon Darlington in Jedec TO-3 metal case, intended for use in general purpose and amplifier applications.

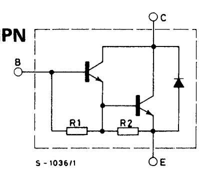
ABSOLUTE MAXIMUM RATINGS

		NPN / PNP*	MJ4030 / MJ4033	MJ4031 / MJ4034	MJ4032 / MJ4035
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			16A	
I_B	Base current			0.5A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$			150W	
T_{stg}	Storage temperature			-65 to 200°C	
T_j	Junction temperature			200°C	

* For NPN types voltage and current values are negative

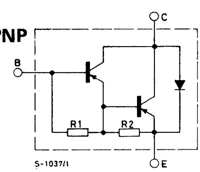
INTERNAL SCHEMATIC DIAGRAMS

NPN



R1 ≅ 5 KΩ
R2 ≅ 50Ω

PNP

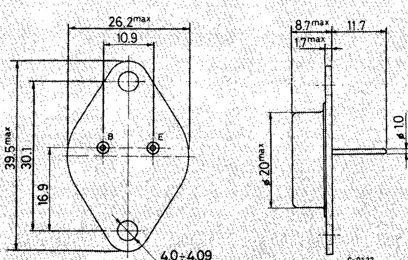


R1 ≅ 5 KΩ
R2 ≅ 50Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j-case}$	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 ($I_B = 0$)	$V_{CE} = 30V$ $I_B = 0$ **MJ4030/33**			3	mA
		$V_{CE} = 40V$ $I_B = 0$ **MJ4031/34**			3	mA
		$V_{CE} = 50V$ $I_B = 0$ **MJ4032/35**			3	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{BE} = 5V$ $I_C = 0$			5	mA
I_{CER}	Collector cutoff current ($R_{BE} = 1K\Omega$)	for **MJ4030/33** $V_{CB} = 60V$			1	mA
		for **MJ4031/34** $V_{CB} = 80V$			1	mA
		for **MJ4032/35** $V_{CB} = 100V$			1	mA
		$T_{case} = 150°C$				
		for **MJ4030/33** $V_{CB} = 60V$			5	mA
		for **MJ4031/34** $V_{CB} = 80V$			5	mA
		for **MJ4032/35** $V_{CB} = 100V$			5	mA
$V_{(BR)CEO}$*	Collector-emitter Breakdown voltage	$I_C = 100mA$ $I_B = 0$				
		for **MJ4030/33**	60			V
		for **MJ4031/33**	80			V
		for **MJ4032/35**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 40mA$			2.5	V
		$I_C = 16A$ $I_B = 80mA$			4	V
V_{BE}*	Base-emitter voltage	$I_C = 10A$ $V_{CE} = 3V$			3	V
h_{FE}*	DC Current gain	$I_C = 10A$ $V_{CE} = 3V$	1000			–

* Pulsed: pulse duration =300 μs, duty cycles ≤ 2%.
For PNP types voltage and current values are negative.

MJ10004 / 5
MJ10004P / 5P

EPITAXIAL PLANAR NPN

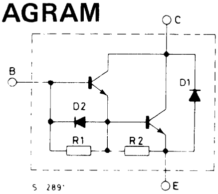
HIGH POWER FAST SWITCHING

The MJ10004/10005 are silicon darlington transistors with integrated base-emitter speed-up diode, mounted in Jedec TO-3 metal case designed for high-power, fast switching applications. The MJ10004P and MJ10005P are mounted in SOT-93 case similar to TO-218.

ABSOLUTE MAXIMUM RATINGS

		MJ10004/5	MJ1004P/5P
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	350V	400V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -5V$)	400V	450V
V_{CEV}	Collector-emitter voltage ($V_{BE} = 1{,}5V$)	450V	500V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8V	
I_C	Collector current	20A	
I_{CM}	Collector peak current	30A	
I_B	Base current	2.5A	
I_{BM}	Base peak current	5A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	TO-3 175W	SOT-93 150W
T_{stg}	Storage temperature	-65 to 200°C	-65 to 175°C
T_j	Junction temperature	200°C	175°C

INTERNAL SCHEMATIC DIAGRAM

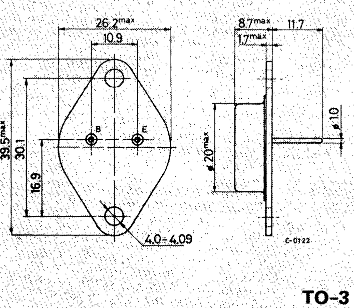


R1 Typ. 100Ω
R2 Typ. 350Ω

MECHANICAL DATA

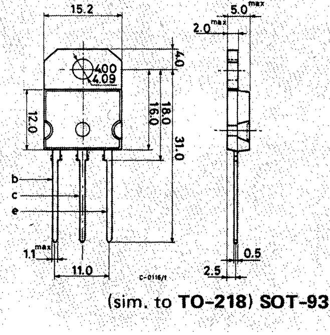
Dimensions in mm

Collector connected to case



TO-3

Collector connected to tab.



(sim. to TO-218) SOT-93

10/82

THERMAL DATA

$R_{th\ j-case}$	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_{CER}	Collector cutoff current (R_{BE} = 50Ω)	V_{CE} = Rated V_{CEV} T_{case} = 100°C			5	mA
I_{CEV}	Collector cutoff current (V_{BE} = 1.5V)	V_{CEV} = Rated Value			0.25	mA
		V_{CEV} = Rated Value T_{case} = 150°C			5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 2V			175	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage I_B = 0)	I_C = 250mA V_{Clamp} = Rated V_{CEO}				
		for **MJ10004**	350			V
		for **MJ10005**	400			V
$V_{CEX(sus)}$*	Collector-emitter sustaining voltage (V_{BE} = -5V)	I_C = 2A V_{Clamp} = Rated V_{CEX} T_{case} = 100°C				
		for **MJ10004**	400			V
		for **MJ10005**	450			V
		I_C = 10A T_{case} = 100°C V_{Clamp} = Rated V_{CEX}				
		for **MJ10004**	275			V
		for **MJ10005**	325			V
$V_{CE(sat)}$ *	Collector-emitter saturation voltage	I_C = 10A I_B = 400mA			1.9	V
		I_C = 20A I_B = 2A			(°)3	V
		I_C = 10A I_B = 400mA T_{case} = 100°C			2.5	V
$V_{BE(sat)}$ *	Base-emitter saturation voltage	I_C = 10A I_B = 400mA			2.5	V
		I_C = 10A I_B = 400mA T_{case} = 100°C			2.5	V

(o) For MJ10004P/5P = 5V max.

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = 5A V_{CE} = 5V I_C = 10A V_{CE} = 5V	50 40		600 400	– —
V_f*	Diode forward voltage	I_F = 10A		3	5	V
h_{fe}	Small-signal current gain	I_C = 1A V_{CE} = 10V f_{test} = 1MHz	10			—
C_{ob}	Output capacitance	V_{CB} = 10V I_E = 0 f_{test} = 100MHz	100		325	pF
t_{on}	Turn-on time	V_{CC} = 250V I_C = 10A I_{B1} = -I_{B2} = 400mA $V_{BE(off)}$ = 5V t_p = 50μs duty cycle -2%		0.22	0.8	μs
t_r	Rise time			0.6	1.5	μs
t_f	Fall time			0.15	0.5	μs

*Pulsed: pulse duration = 300 μ duty cycle = 1.5%.

MJ11011/MJ11012
MJ11013/MJ11014
MJ11015/MJ11016

EPITAXIAL-BASE NPN/PNP

GENERAL PURPOSE

The MJ11011/12/13/14/15/16 are silicon transistors in Darlington configuration in Jedec TO-3 metal-case. Intended for general purpose and amplifier applications.

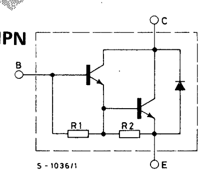
ABSOLUTE MAXIMUM RATINGS

		PNP* / NPN	MJ11011 / MJ11012	MJ11013 / MJ11014	MJ11015 / MJ11016
V_{CBO}	Collector-base voltage ($I_E = 0$)		60V	90V	120V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		60V	90V	120V
V_{EBO}	Base-emitter voltage ($I_C = 0$)			5V	
I_C	Collector current			30A	
I_B	Base current			1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$			200W	
T_{stg}	Storage temperature			-65 to 200°C	
T_j	Junction temperature			200°C	

* For PNP types voltage and current values are negative

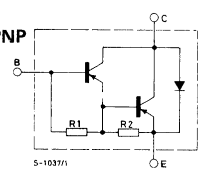
INTERNAL SCHEMATIC DIAGRAMS

NPN



R1 ≅ 8KΩ
R2 ≅ 60Ω

PNP

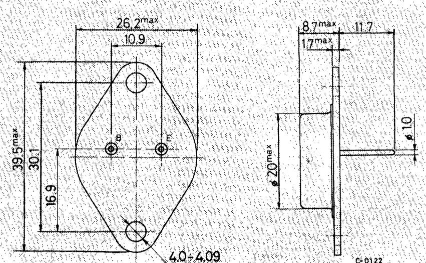


R1 ≅ 8KΩ
R2 ≅ 60Ω

MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	0.87	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = 50V$			1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{BE} = 5V$			5	mA
I_{CER}	Collector cutoff current ($R_{BE} = 1K\Omega$)	for **MJ11011/12** $V_{CE} = 60V$			1	mA
		for **MJ11013/14** $V_{CE} = 90V$			1	mA
		for **MJ11015/16** $V_{CE} = 120V$			1	mA
		$T_{case} = 150°C$				
		for **MJ11011/12** $V_{CE} = 60V$			5	mA
		for **MJ11013/14** $V_{CE} = 90V$			5	mA
		for **MJ11015/16** $V_{CE} = 120V$			5	mA
$V_{(BR)CEO}$*	Collector emitter breakdown voltage	$I_C = 100mA$ $I_B = 0$				
		for **MJ11011/12**	60			V
		for **MJ11013/14**	90			V
		for **MJ11015/16**	120			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 20A$ $I_B = 200mA$			3	V
		$I_C = 30A$ $I_B = 300mA$			4	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 20A$ $I_B = 200mA$			3.5	V
		$I_C = 30A$ $I_B = 300mA$			5	V
h_{FE}*	DC current gain	$I_C = 20A$ $V_{CE} = 5V$	1000			—
		$I_C = 30A$ $V_{CE} = 5V$	200			—
h_{fe}	Small signal current gain	$I_C = 10A$ $V_{CE} = 3V$ f = 1MHz	4			

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

For PNP devices voltage and current values are negative.

MJE340 MJE350

EPITAXIAL PLANAR NPN / PNP

HIGH VOLTAGE POWER TRANSISTOR

The MJE340/MJE350 are silicon epitaxial planar transistors in jedec TO-126 plastic package intended for use in medium power linear and switching applications.

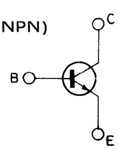
ABSOLUTE MAXIMUM RATINGS

V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	3	V
I_C	Collector current	0.5	A
P_{tot}	Total power dissipation at $T_{case} \geq 25°C$	20.8	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

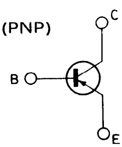
For PNP types voltage and current values are negative

INTERNAL SCHEMATIC DIAGRAMS

MJE340 (NPN)

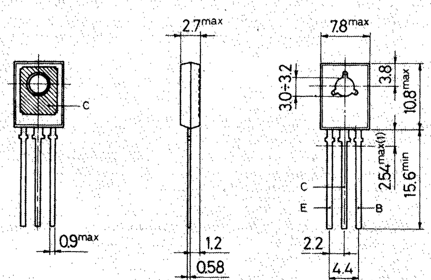


MJE350 (PNP)



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

$R_{th\ j-case}$	Thermal resistance junction-case	max.	6.0	°C/W

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_B = 0$)	$V_{CB} = 300V$			100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 3V$			100	μA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 1mA$	300			V
h_{FE}	DC current gain	$I_C = 50mA$ $V_{CE} = 10V$	30		240	–

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

For PNP types voltage and current values are negative.

MJE700 / MJE800
MJE701 / MJE801
MJE702 / MJE802
MJE703 / MJE803

EPITAXIAL-BASE NPN/PNP

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.

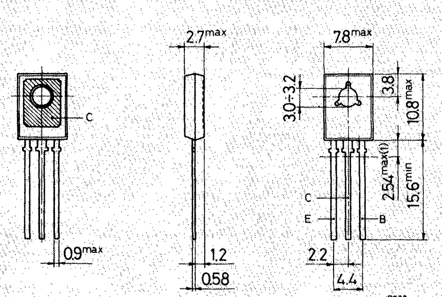
ABSOLUTE MAXIMUM RATINGS

		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



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

TO-126 (SOT-32)

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				100	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				100	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 = 4 A	I_B = 40mA			2.7	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 for **MJE 701, MJE 703,** **MJE 801, MJE 803** I_C = 2 A V_{CE} = 3 V			 2.5 2.5	 V V
h_{FE}*	DC current gain	for **MJE 700, MJE 702,** **MJE 800, MJE 802** I_C = 4 A V_{CE} = 3 V for **MJE 701, MJE 703,** **MJE 801, MJE 803** I_C = 2 A V_{CE} = 3 V	 110 750			 — —
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

MULTIEPITAXIAL BIPLANAR NPN

MJE13002
MJE13003

LINEAR AND SWITCHING APPLICATIONS

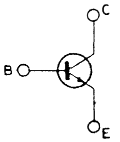
The MJE13002 and MJE13003 are silicon multiepitaxial biplanar transistors in TO-126 plastic package intended for linear and switching applications.

ABSOLUTE MAXIMUM RATINGS

		MJE13002	MJE13003
V_{CBO}	Collector-base voltage ($I_E = 0$)	600V	700V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	9V	
I_C	Collector current	1.5V	
$I_{CM\,(*)}$	Collector peak current	3A	
I_B	Base current	0.75A	
$I_{BM\,(*)}$	Base peak current	1.5A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	40W	
	$T_{amb} \leqslant 25°C$	1.4W	
T_j, T_{stg}	Junction, Storage temperature	-65 to 150°C	

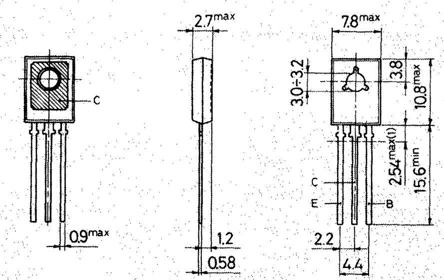
* Pulse width = 5msec., duty cycle $\leqslant$ 10%.

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

SGS MJE13002 MJE13003

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.	89	°C/W

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

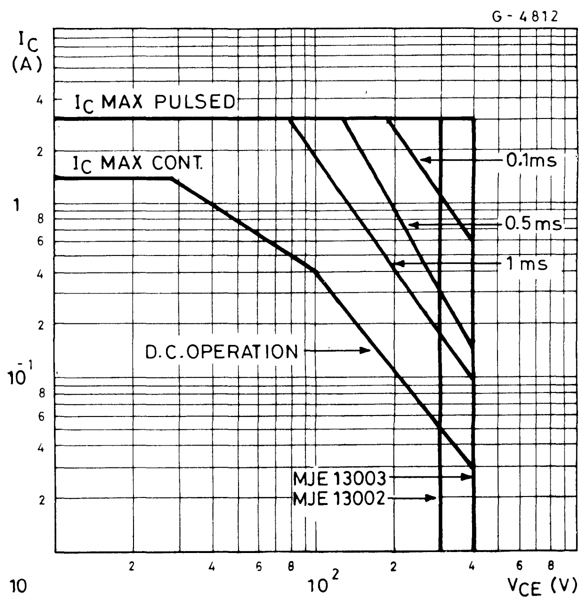
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **MJE13002** V_{CES} = 600V for **MJE13003** V_{CES} = 700V T_{case} = 100°C for **MJE13002** V_{CES} = 600V for **MJE13003** V_{CES} = 700V			1 1 5 5	mA mA mA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 9V			1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	I_C = 10mA for **MJE13002** for **MJE13003**	300 400			V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 0.5A I_B = 0.1A I_C = 1A I_B = 0.25A I_C = 1.5A I_B = 0.5A I_C = 1A I_B = 0.25A T_{case} = 100°C			0.5 1 3 1	V V V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 0.5A I_B = 0.1A I_C = 1A I_B = 0.25A I_C = 1A I_B = 0.25A T_{case} = 100°C			1 1.2 1.1	V V V
h_{FE}*	DC current gain	I_C = 0.5A V_{CE} = 2V I_C = 1A V_{CE} = 2V	8 5		40 25	– –
f_T	Transition frequency	V_{CE} = 10V f = 1MHz I_C = 100mA	5	10		MHz
C_{CBO}	Collector-base capacitance	V_{CB} = 10V		30		pF

ELECTRICAL CHARACTERISTICS (continued)

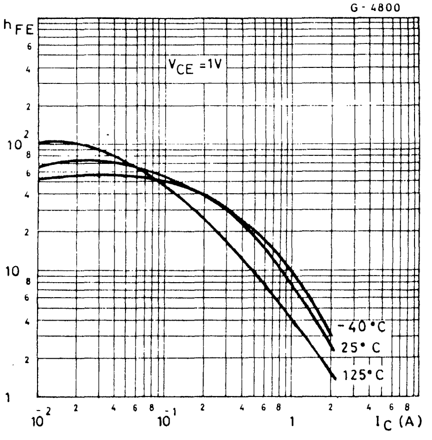
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_r	Rise time	**Resistive load** $V_{CC} = 125V$ $I_C = 1A$ $I_{B1} = -I_{B2} = 0.2A$		0.24	1	µs
t_s	Storage time			1.7	4	µs
t_f	Fall time			0.5	1	µs
t_{sv}	Voltage storage time	**Inductive load** $I_C = 1A$ $I_{B1} = 0.2A$ $V_{BE(off)} = 5V$ $L = 50mH$ $V_{Clamp} = 300V$		0.8	4	µs
t_c	Commutation time			0.1	0.75	µs

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

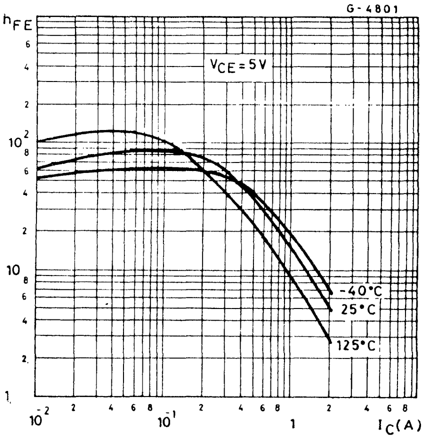
Safe operating areas



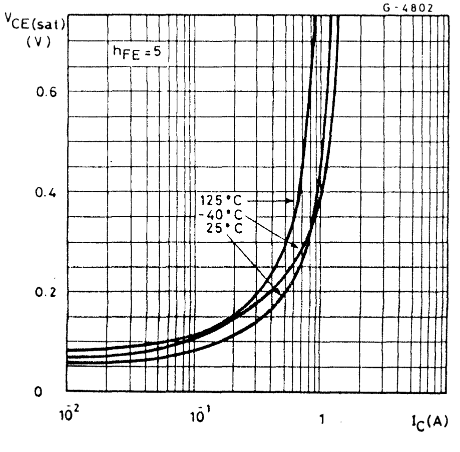
DC current gain



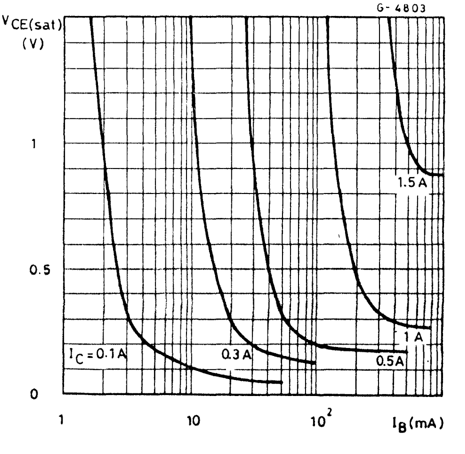
DC current gain



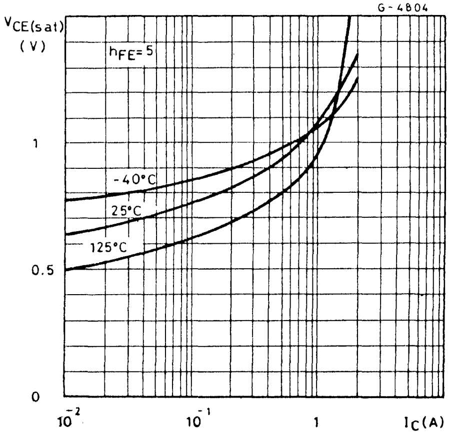
Collector-emitter saturation voltage



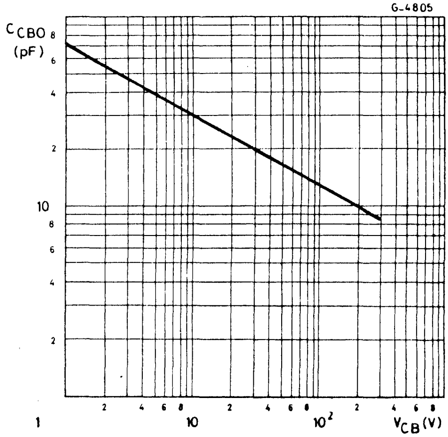
Collector-emitter saturation voltage



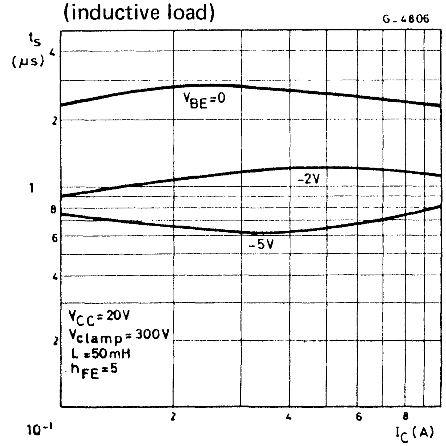
Base-emitter saturation voltage



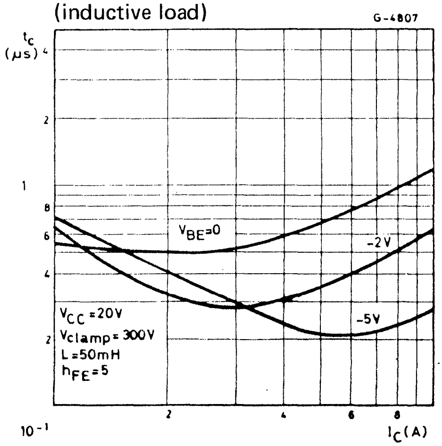
Collector-base capacitance



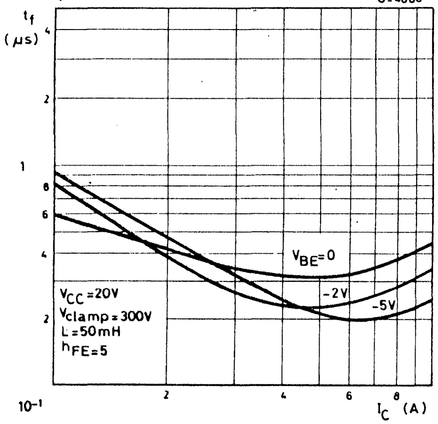
Saturated switching characteristics (inductive load)



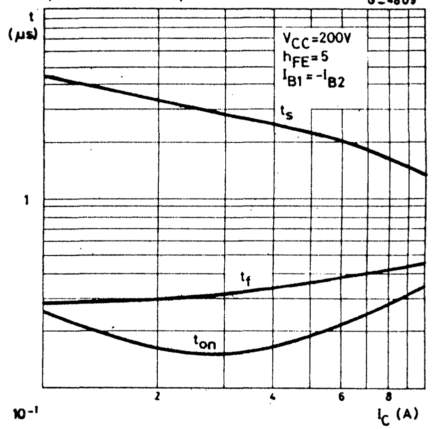
Saturated switching characteristics (inductive load)



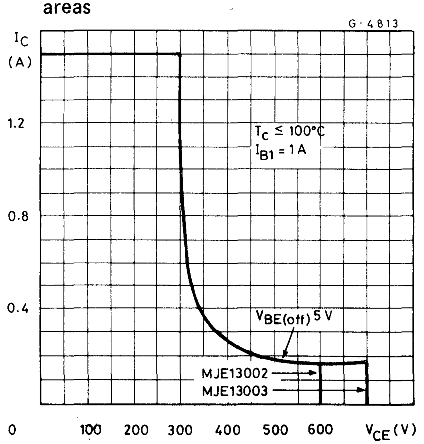
Saturated switching characteristics (inductive load)



Saturated switching characteristics (resistive load)



Clamped reverse bias safe operating areas



MJE13004
MJE13005

MULTIEPITAXIAL MESA NPN

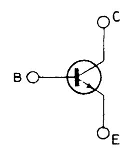
HIGH VOLTAGE POWER SWITCH

The MJE13004/13005 are silicon multiepitaxial mesa NPN transistors in Jedec TO-220 plastic package particularly intended for switch-mode applications.

ABSOLUTE MAXIMUM RATINGS

		MJE13004	MJE13005
V_{CEV}	Collector-emitter voltage	600V	700V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V
V_{EBO}	Emitter-base ($I_C = 0$)	9V	
I_C	Collector current	4A	
I_{CM}	Collector peak current	8A	
I_B	Base current	2A	
I_{BM}	Base peak current	4A	
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	

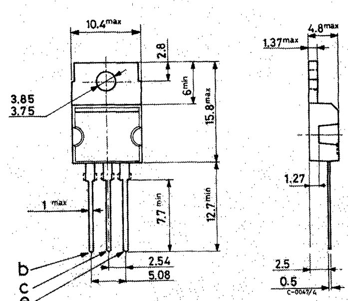
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

THERMAL DATA

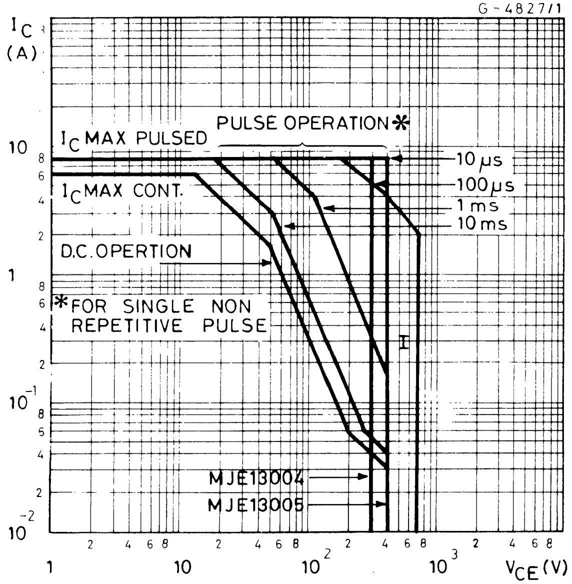
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max.	1.67	°C/W

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	for **MJE13004**				
		V_{CE} = 600V			1	mA
		V_{CE} = 600V T_{case} = 100°C			5	mA
		for **MJE13005**				
		V_{CE} = 700V			1	mA
		V_{CE} = 700V T_{case} = 100°C			5	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 = 10mA for **MJE13004**	300			V
		for **MJE13005**	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 1A I_B = 0.2A			0.5	V
		I_C = 2A I_B = 0.5A			0.6	V
		I_C = 4A I_B = 1A			1	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 1A I_B = 0.2A			1.2	V
		I_C = 2A I_B = 0.5A			1.6	V
h_{FE}	DC current gain	I_C = 1A V_{CE} = 5V	10	30	60	–
		I_C = 2A V_{CE} = 5V	8		40	–
t_{on}	Turn-on time	I_C = 2A I_{B1} = $-I_{B2}$ = 0.4A V_{CC} = 250V			0.8	μs
t_s	Storage time				4	μs
t_f	Fall time				0.9	μs

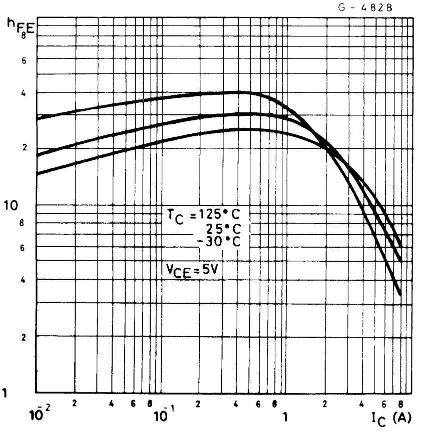
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%.

Safe operating areas

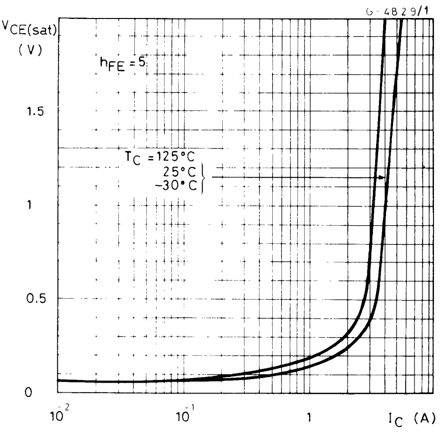


I – Area of permissible operation during turn-on provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0.25\ \mu s$.

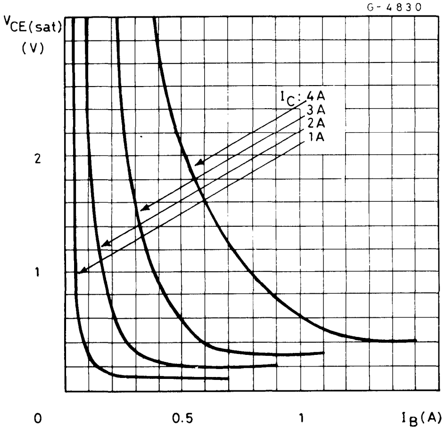
DC current gain



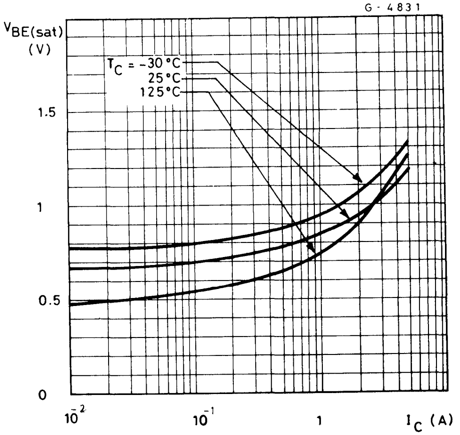
Collector-emitter saturation voltage



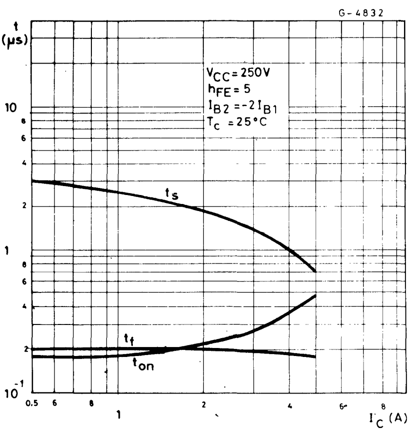
Collector-emitter saturation voltage



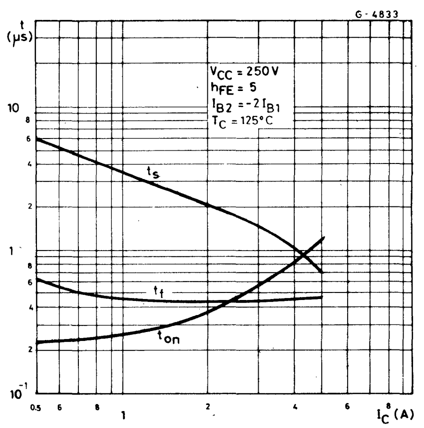
Base-emitter saturation voltage



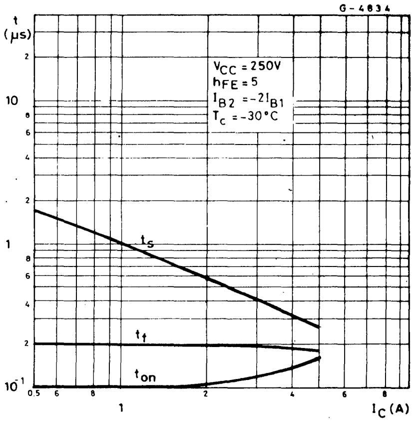
Saturated switching characteristics



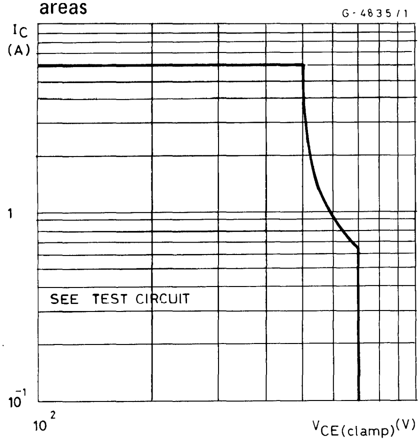
Saturated switching characteristics



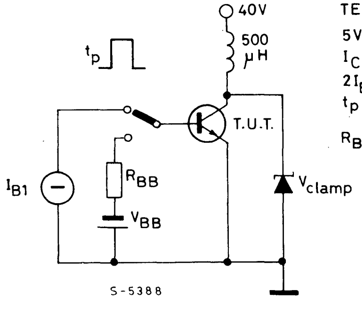
Saturated switching characteristics



Clamped reverse bias safe operating areas



Clamped $E_{s/b}$ test circuit



TEST CONDITIONS ;
$5V \geq |-V_{BB}| \geq 2V$
$I_C / I_B \geq 4$
$2I_{B1} \geq |-I_{B2}| \geq I_{B1}$
t_p = adjusted for nominal I_C
R_{BB} = adjusted for I_{B2}

MJE13006
MJE13007
MJE13007A

MULTIEPITAXIAL MESA NPN

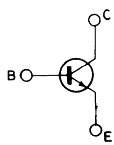
MOTOR CONTROL, SWITCH REGULATORS

The MJE13006, MJE13007 and MJE13007A are silicon multiepitaxial mesa NPN transistors. They are mounted in Jedec TO-220 plastic package, intended for use in motor controls, switching regulator's etc.

ABSOLUTE MAXIMUM RATINGS

		MJE13006	MJE13007	MJE13007A
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	300V	400V	400V
V_{CEV}	Collector-emitter voltage	600V	700V	850V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		9V	
I_C	Collector current		8A	
I_{CM}	Collector peak current		16A	
I_B	Base current		4A	
I_{BM}	Base peak current		8A	
I_E	Emitter current		12A	
I_{EM}	Emitter peak current		24A	
P_{tot}	Total power dissipation at T_{case} -25°C		80W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

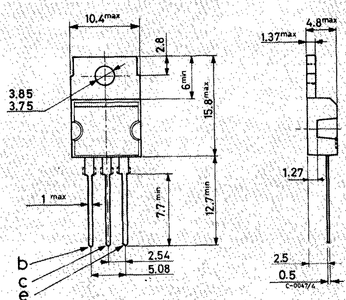
INTERNAL SCHEMATIC DIAGRAMS



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

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

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 9V$ $I_C = 0$			1	mA
I_{CEV}	Collector cutoff current	V_{CEV} = Rated value $V_{BE(off)} = 1.5V$			1	mA
		V_{CEV} = Rated value $V_{BE(off)} = 1.5V$ $T_{case} = 100°C$			5	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	$I_C = 10mA$ $I_B = 0$ for **MJE13006**	300			V
		for **MJE13007/13007A**	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 2A$ $I_B = 0.4A$			1	V
		$I_C = 5A$ $I_B = 1A$			1.5	V
		$I_C = 8A$ $I_B = 2A$			3	V
		$I_C = 5A$ $I_B = 1A$ $T_{case} = 100°C$			2	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 2A$ $I_B = 0.4A$			1.2	V
		$I_C = 5A$ $I_B = 1A$			1.6	V
		$I_C = 5A$ $I_B = 1A$ $T_{case} = 100°C$			1.5	V
h_{FE}*	DC current gain	$I_C = 2A$ $V_{CE} = 5V$	8		40	–
		$I_C = 5A$ $V_{CE} = 5V$	6		30	–
f_T	Transition frequency	$I_C = 500mA$ $V_{CE} = 10V$ $f = 1MHz$	4			MHz
C_{ob}	Output capacitance	$V_{CB} = 10V$ $I_E = 0$ $f = 0.1MHz$		110		pF
t_{on}	Turn-on time	$V_{CC} = 125V$ $I_C = 5A$ $I_{B1} = I_{B2} = 1A$ $t_p = 25\mu s$ Duty Cycle ≤ 1%			1.1	μs
t_s	Storage time				3	μs
t_f	Fall time				0.7	μs

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

TIP29
TIP29A
TIP29B
TIP29C

EPITAXIAL-BASE NPN

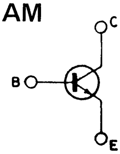
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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 $T_{case} \leq 25°C$	30W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

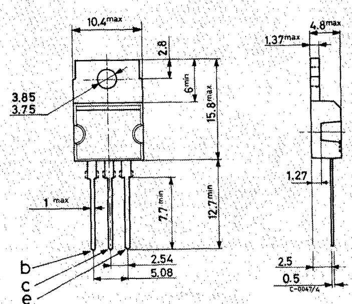
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

SGS

TIP29
TIP29A
TIP29B
TIP29C

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** $V_{CE} = 30V$			0.3	mA
		for **TIP 29B** and **TIP 29C** $V_{CE} = 60V$			0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP 29** $V_{CE} = 40V$			0.2	mA
		for **TIP 29A** $V_{CE} = 60V$			0.2	mA
		for **TIP 29B** $V_{CE} = 80V$			0.2	mA
		for **TIP 29C** $V_{CE} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$			1	mA
$V_{CE0\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$				
		for **TIP 29**	40			V
		for **TIP 29A**	60			V
		for **TIP 29B**	80			V
		for **TIP 29C**	100			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	$I_C = 0.2A$ $V_{CE} = 4V$	40			—
		$I_C = 1A$ $V_{CE} = 4V$	15		75	—
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 $\leq$2%.

TIP30
TIP30A
TIP30B
TIP30C

EPITAXIAL-BASE PNP

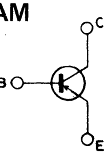
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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			

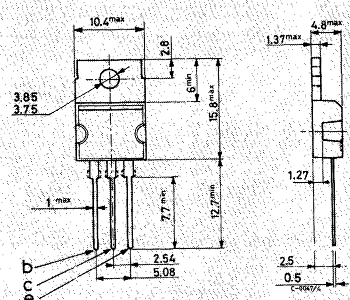
INTERNAL SCHEMATIC DIAGRAM



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 30** and **TIP 30A** $V_{CE} = -30V$			−0.3	mA
		for **TIP 30B** and **TIP 30C** $V_{CE} = -60V$			−0.3	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **TIP 30** $V_{CE} = -40V$			−0.2	mA
		for **TIP 30A** $V_{CE} = -60V$			−0.2	mA
		for **TIP 30B** $V_{CE} = -80V$			−0.2	mA
		for **TIP 30C** $V_{CE} = -100V$			−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 30**	−40			V
		for **TIP 30A**	−60			V
		for **TIP 30B**	−80			V
		for **TIP 30C**	−100			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	$I_C = -0.2A$ $V_{CE} = -4V$	40			—
		$I_C = -1A$ $V_{CE} = -4V$	15		75	—
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%.

TIP31
TIP31A
TIP31B
TIP31C

EPITAXIAL-BASE NPN

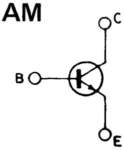
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

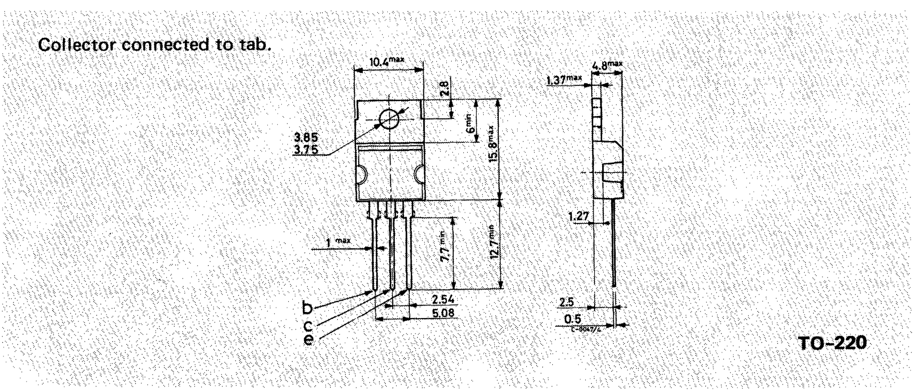
		TIP 31	TIP 31A	TIP 31B	TIP 31C
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	3A			
I_{CM}	Collector peak current	5A			
I_B	Base-current	1A			
P_{tot}	Total 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			

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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	$I_C = 0.5A$ $V_{CE} = 10V$ f = 1KHz	20			—
		$I_C = 0.5A$ $V_{CE} = 10V$ f = 1MHz	3			—

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

TIP32
TIP32A
TIP32B
TIP32C

EPITAXIAL-BASE PNP

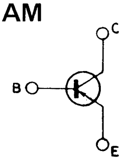
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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 $T_{case} \leq 25°C$	40W			
	$T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	−65 to 150°C			
T_j	Junction temperature	150°C			

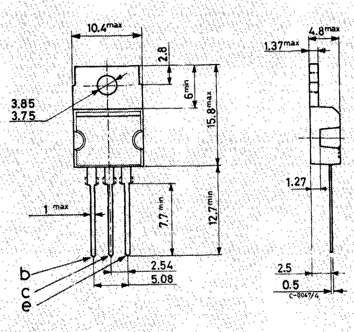
INTERNAL SCHEMATIC DIAGRAM



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 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	$I_C = -0.5A$ $V_{CE} = -10V$ f = 1KHz	20			—
		$I_C = -0.5A$ $V_{CE} = -10V$ f = 1MHz	3			—

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

SGS **TIP41 TIP41A TIP41B TIP41C**

EPITAXIAL-BASE NPN

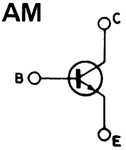
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

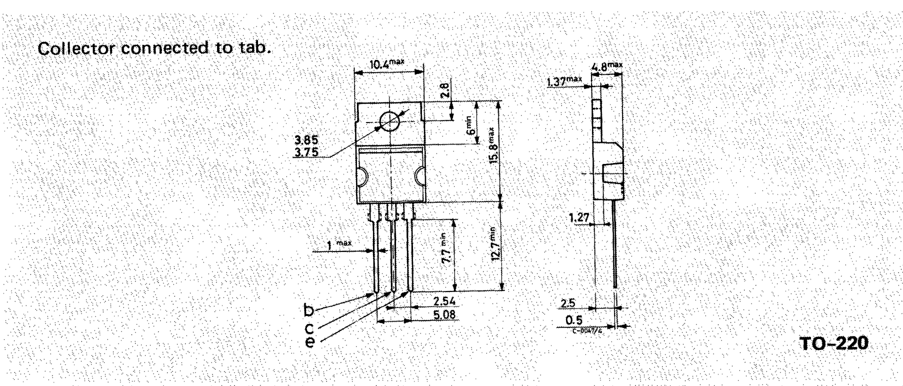
		TIP41	TIP41A	TIP41B	TIP41C
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V	100V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	6A			
I_{CM}	Collector peak current	10A			
I_B	Base current	3A			
P_{tot}	Total power 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			

INTERNAL SCHEMATIC DIAGRAM



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 **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%

TIP42
TIP42A
TIP42B
TIP42C

EPITAXIAL-BASE PNP

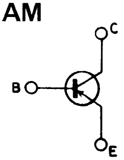
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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			

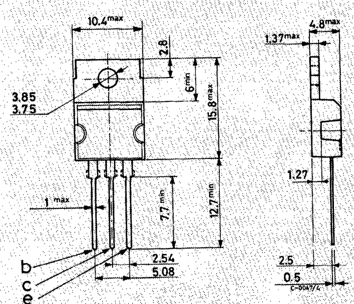
INTERNAL SCHEMATIC DIAGRAM



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 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	$I_C = -0.5A$ f = 1KHz	$V_{CE} = -10V$	20			—
		$I_C = -0.5A$ f = 1MHz	$V_{CE} = -10V$	3			—

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

SGS

TIP47
TIP48
TIP49
TIP50

MULTIEPITAXIAL PLANAR NPN

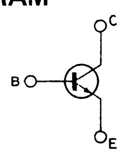
LINEAR AND SWITCHING APPLICATIONS

The TIP47 to TIP50 are silicon multiepitaxial planar transistors in TO-220 plastic package intended for linear and switching applications.

ABSOLUTE MAXIMUM RATINGS

		TIP47	TIP48	TIP49	TIP50
V_{CBO}	Collector base voltage ($I_E = 0$)	350V	400V	450V	500V
V_{CEO}	Collector emitter voltage ($I_B = 0$)	250V	300V	350V	400V
V_{EBO}	Emitter base voltage ($I_C = 0$)	5V			
I_C	Collector current	1A			
I_{CM}	Collector peak current	2A			
I_B	Base current	0.6A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	40W			
P_{tot}	Total power dissipation at $T_{amb} \leq 25°C$	2W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

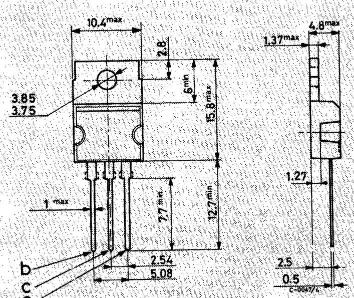
INTERNAL SCHEMATIC DIAGRAM



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.	62.5	°C/W

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

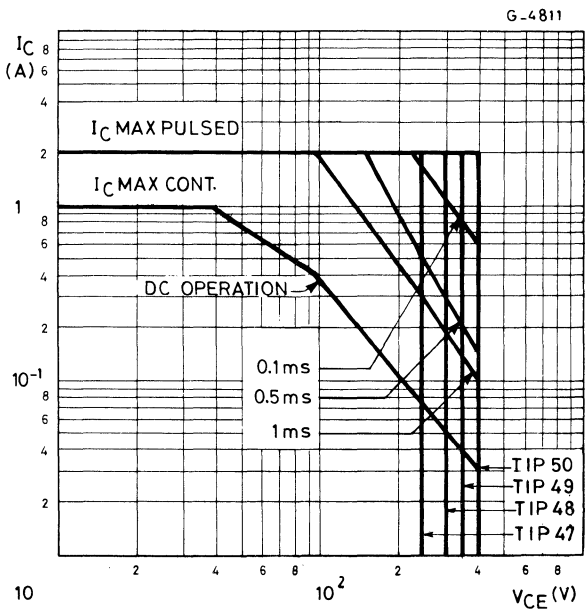
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **TIP47**	V_{CE} = 350V			1	mA
		for **TIP48**	V_{CE} = 400V			1	mA
		for **TIP49**	V_{CE} = 450V			1	mA
		for **TIP50**	V_{CE} = 500V			1	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **TIP47**	V_{CE} = 150V			1	mA
		for **TIP48**	V_{CE} = 200V			1	mA
		for **TIP49**	V_{CE} = 250V			1	mA
		for **TIP50**	V_{CE} = 300V			1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V				1	mA
$V_{CEO(sus)}$*	Collector emitter sustaining voltage	I_C = 30mA	for **TIP47**	250			V
			for **TIP48**	300			V
			for **TIP49**	350			V
			for **TIP50**	400			V
$V_{CE(sat)}$*	Collector emitter saturation voltage	I_C = 1A	I_B = 0.2A			1	V
$V_{BE(on)}$*	Base emitter on voltage	I_C = 1A	V_{CE} = 10V			1.5	V

ELECTRICAL CHARACTERISTICS (continued)

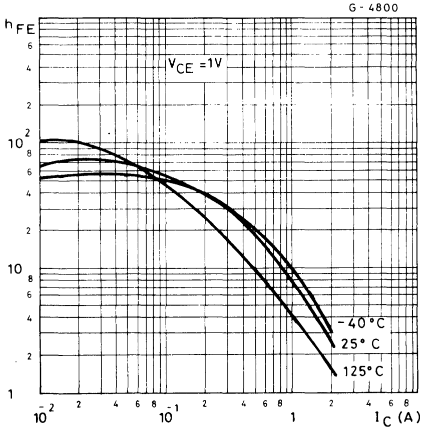
Parameter		Test conditions		Min.	Typ.	Max.	Unit
h_{FE} *	DC current gain	$I_C = 0.3A$	$V_{CE} = 10V$	30		150	–
		$I_C = 1A$	$V_{CE} = 10V$	10			–
f_T	Transition frequency	$V_{CE} = 10V$ $f = 2MHz$	$I_C = 0.2A$	10			MHz
h_{fe}	Small signal current gain	$V_{CE} = 10V$ $f = 1KHz$	$I_C = 0.2$	25			–

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

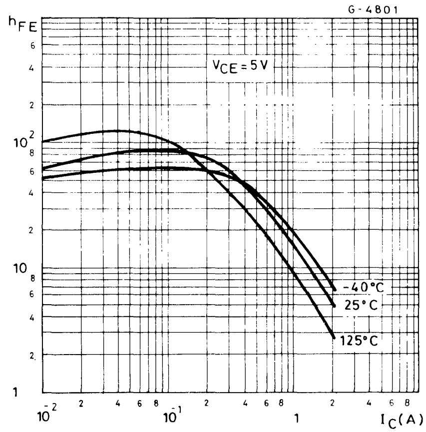
Safe operating areas



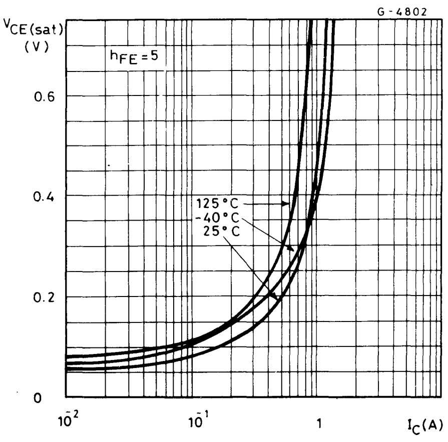
DC current gain



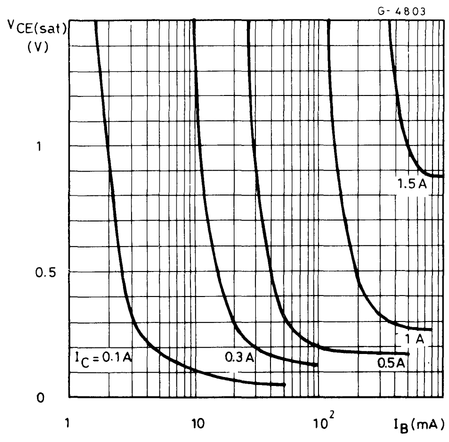
DC current gain



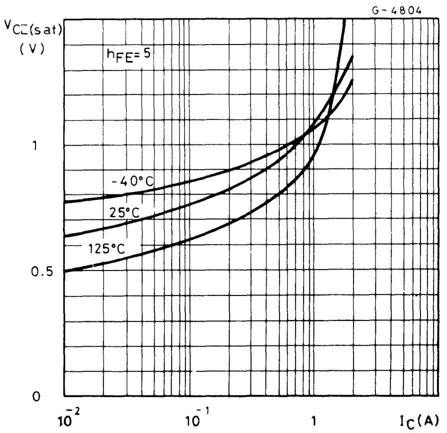
Collector-emitter saturation voltage



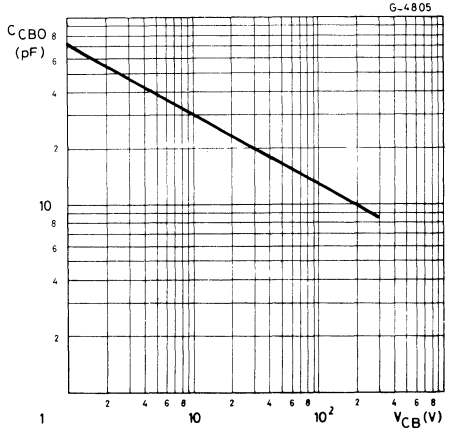
Collector-emitter saturation voltage



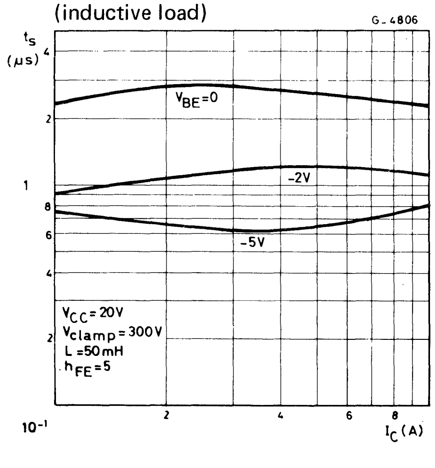
Base-emitter saturation voltage



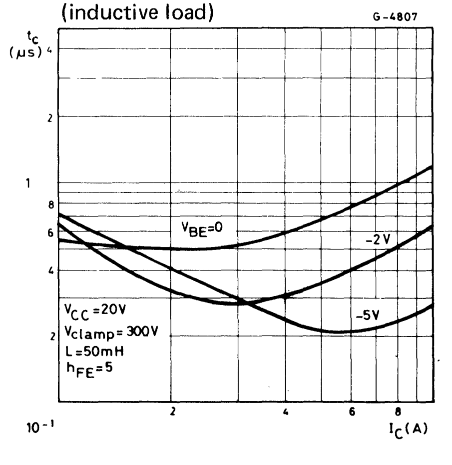
Collector-base capacitance



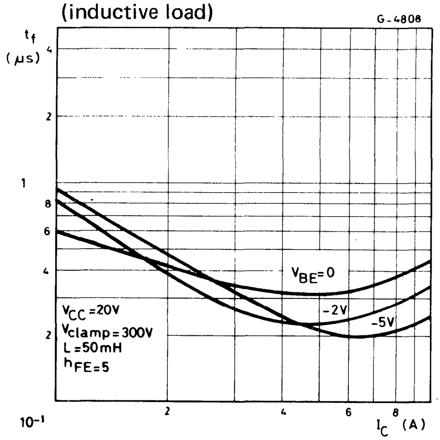
Saturated switching characteristics (inductive load)



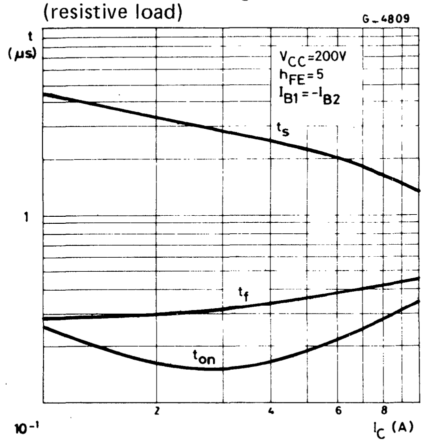
Saturated switching characteristics (inductive load)



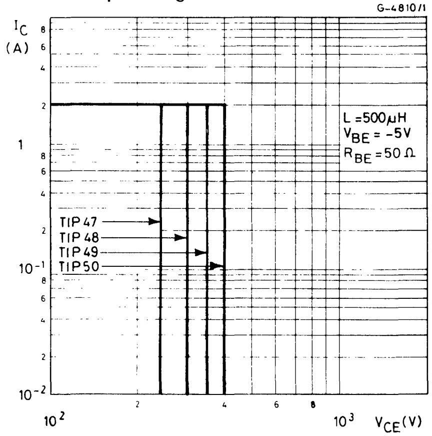
Saturated switching characteristics (inductive load)



Saturated switching characteristics (resistive load)



Clampled reverse bias safe operating areas



SGS

TIP51
TIP52
TIP53
TIP54

MULTIEPITAXIAL MESA NPN

ADVANCE DATA

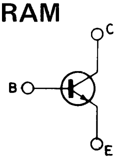
HIGH VOLTAGE POWER SWITCH

The TIP51, TIP52, TIP53, TIP54 are silicon multiepitaxial mesa NPN transistors in SOT-93 plastic package.
They are intended for high voltage, fast switching industrial and consumer applications.

ABSOLUTE MAXIMUM RATINGS

		TIP51	TIP52	TIP53	TIP54
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	350V	400V	450V	500V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	250V	300V	350V	400V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5V			
I_C	Collector current	3V			
I_{CM}	Collector peak current	5A			
I_B	Base current	0.6A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$	100W			
T_{stg}	Storage temperature	-65 to 150°C			
T_j	Junction temperature	150°C			

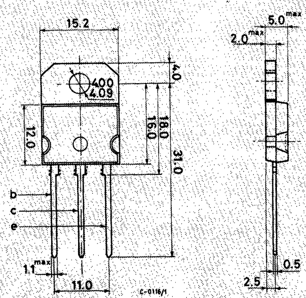
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

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

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

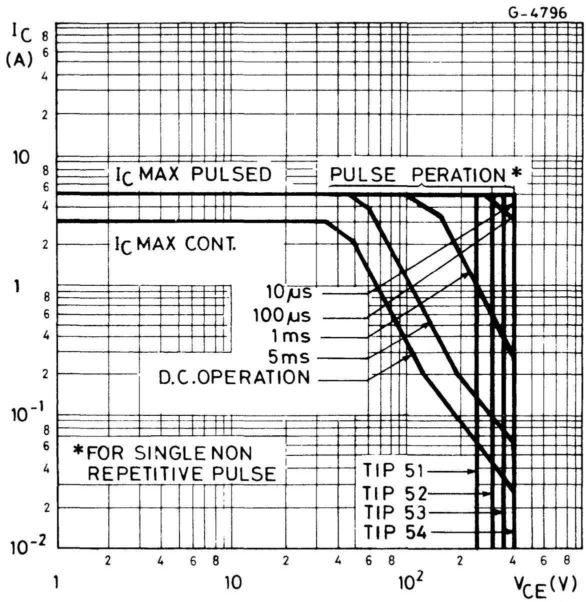
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector-cutoff current (V_{BE} = 0)	for **TIP51**	V_{CE} = 350V			1	mA
		for **TIP52**	V_{CE} = 400V			1	mA
		for **TIP53**	V_{CE} = 450V			1	mA
		for **TIP54**	V_{CE} = 500V			1	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **TIP51**	V_{CE} = 150V			1	mA
		for **TIP52**	V_{CE} = 200V			1	mA
		for **TIP53**	V_{CE} = 250V			1	mA
		for **TIP54**	V_{CE} = 300V			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 = 30mA	for **TIP51**	250			V
			for **TIP52**	300			V
			for **TIP53**	350			V
			for **TIP54**	400			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 3A	I_B = 0.6A			1.5	V
V_{BE}*	Base-emitter	I_C = 3A	V_{CE} = 10V			1.5	V
h_{FE}*	DC current gain	I_C = 0.3A	V_{CE} = 10V	30		150	–
		I_C = 3A	V_{CE} = 10V	10			
h_{fe}	Small signal current gain	I_C=0.2A; V_{CE}=10V; f=1KHz		30			–
		I_C=0.2A; V_{CE}=10V; f=1MHz		2.5			–

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$E_{s/b}$	Second breakdown Un clamped energy	$V_{BE} = 20V$ $R_{BE} = 100\Omega$ $L = 30mH$	100			mJ
t_{on}	Turn-on time	$I_C = 1A$ $I_{B1} = 100mA$ $V_{CC} = 200V$		0.2		μs
t_{off}	Turn-off time	$I_C = 1A$ $I_{B1} = -I_{B2} = 100mA$ $V_{CC} = 200V$		2		μs

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

Safe operating areas



EPITAXIAL-BASE NPN

TIP100
TIP101
TIP102

POWER DARLINGTONS

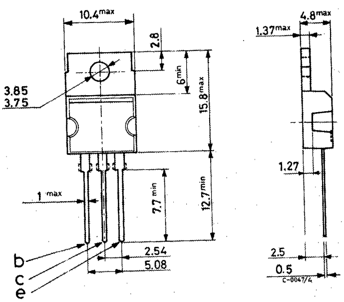
The TIP 100, TIP 101 and TIP 102 are silicon epitaxial-base NPN transistors in monolithic Darlington configuration mounted in Jedec TO-220 plastic package, intended for use in power linear and switching applications.
The complementary PNP types are the TIP 105, TIP 106 and TIP 107 respectively.

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**	$V_{CE} = 30V$			50	μA
		for **TIP 101**	$V_{CE} = 40V$			50	μA
		for **TIP 102**	$V_{CE} = 50V$			50	μA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 100**	$V_{CB} = 60V$			50	μA
		for **TIP 101**	$V_{CB} = 80V$			50	μA
		for **TIP 102**	$V_{CB} = 100V$			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 100**		60			V
		for **TIP 101**		80			V
		for **TIP 102**		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}*	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 $\leq$2%.

EPITAXIAL-BASE PNP

SGS

TIP105
TIP106
TIP107

POWER DARLINGTONS

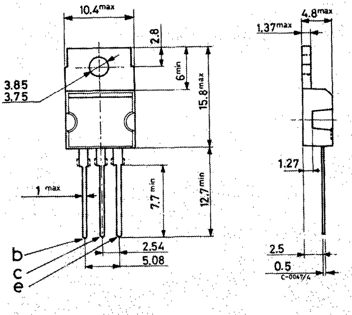
The TIP 105, TIP 106 and TIP 107 are silicon epitaxial-base PNP transistors in monolithic Darlington configuration mounted in Jedec TO-220 plastic package intended for use in power linear and switching applications.
The complementary NPN types are the TIP 100, TIP 101 and TIP 102 respectively.

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 $T_{case} \leq 25°C$		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 105** for **TIP 106** for **TIP 107**	$V_{CE} = -30V$ $V_{CE} = -40V$ $V_{CE} = -50V$			−50 −50 −50	μA μA μA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 105** for **TIP 106** for **TIP 107**	$V_{CB} = -60V$ $V_{CB} = -80V$ $V_{CB} = -100V$			−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 105** for **TIP 106** for **TIP 107**		 −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
$V_{BE\ (on)}$*	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%.

EPITAXIAL-BASE NPN

SGS **TIP110 TIP111 TIP112**

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.

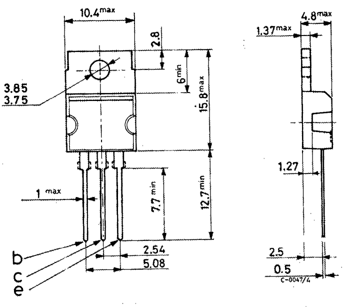
ABSOLUTE MAXIMUM RATINGS

		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

Collector connected to tab.



TO-220

5/80

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**	$V_{CE} = 30V$			2	mA
		for **TIP 111**	$V_{CE} = 40V$			2	mA
		for **TIP 112**	$V_{CE} = 50V$			2	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 110**	$V_{CB} = 60V$			1	mA
		for **TIP 111**	$V_{CB} = 80V$			1	mA
		for **TIP 112**	$V_{CB} = 100V$			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 110**		60			V
		for **TIP 111**		80			V
		for **TIP 112**		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 $\leqslant$2%.

EPITAXIAL-BASE PNP

TIP115
TIP116
TIP117

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.

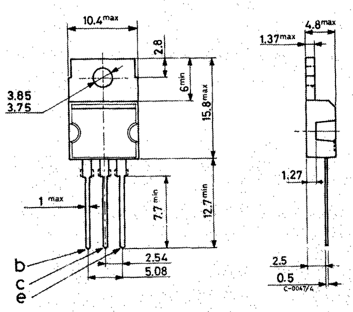
ABSOLUTE MAXIMUM RATINGS

		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 $T_{case} \leq 25°C$		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

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%.

EPITAXIAL-BASE NPN

TIP120
TIP121
TIP122

POWER DARLINGTONS

The TIP 120, TIP 121 and TIP 122 are silicon epitáxial-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.

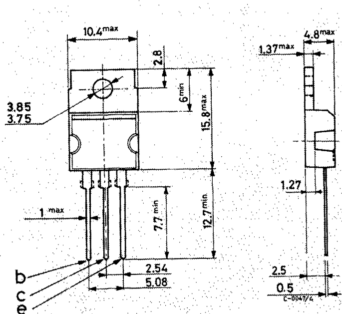
ABSOLUTE MAXIMUM RATINGS

		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

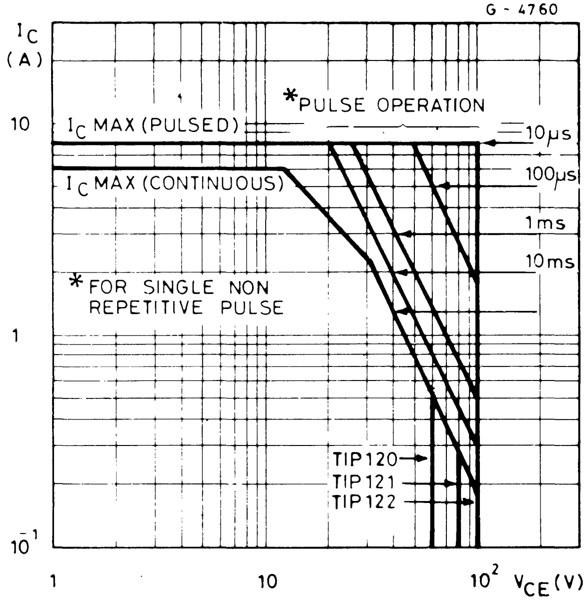
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

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

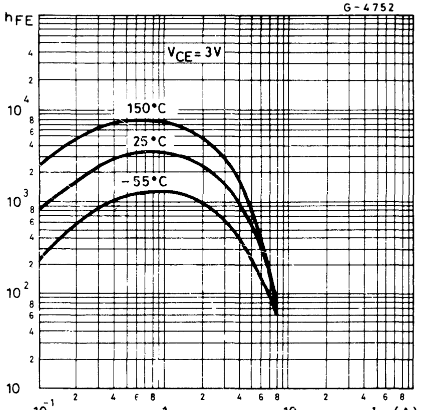
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 120**	$V_{CE} = 30V$			0.5	mA
		for **TIP 121**	$V_{CE} = 40V$			0.5	mA
		for **TIP 122**	$V_{CE} = 50V$			0.5	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 120**	$V_{CB} = 60V$			0.2	mA
		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%.

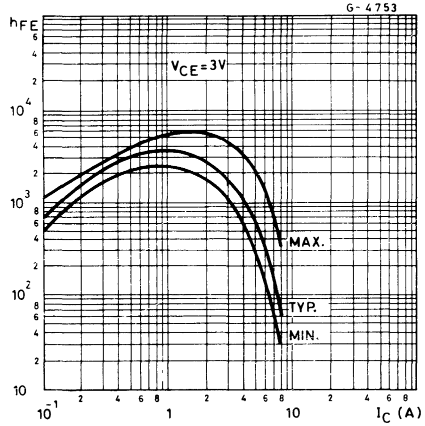
Safe operating areas



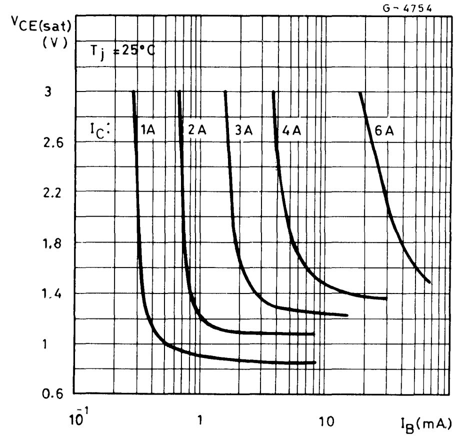
DC current gain



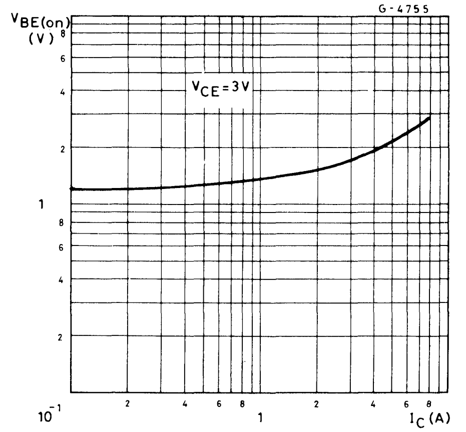
DC current gain



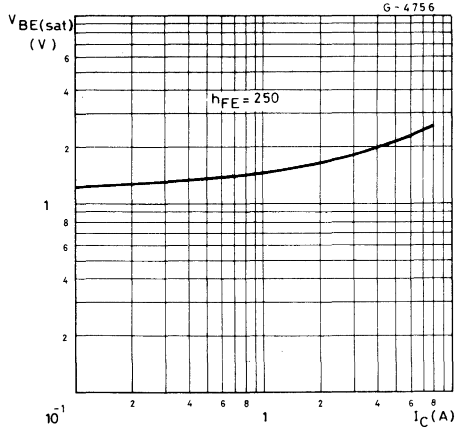
Collector-emitter saturation voltage



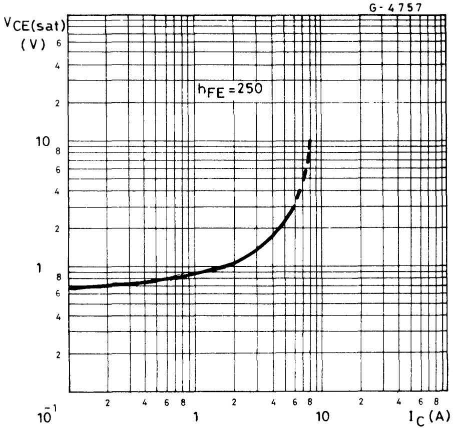
Base-emitter voltage



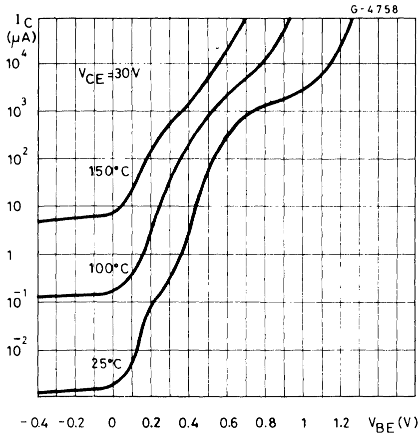
Base-emitter saturation voltage



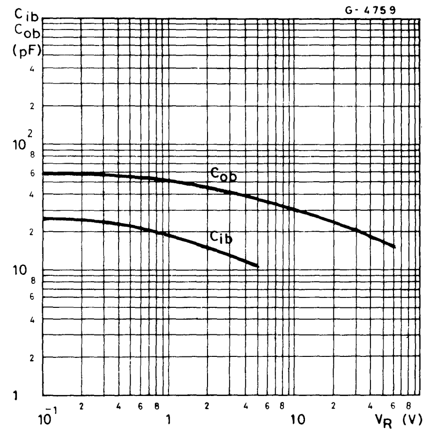
Collector-emitter saturation voltage



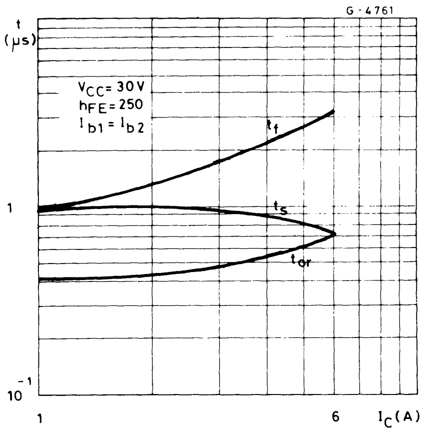
Collector cutoff current



Collector base capacitance



Saturated switching characteristics



TIP125 TIP126 TIP127

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.

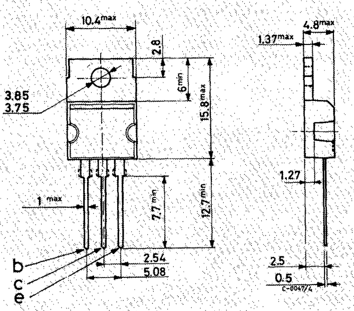
ABSOLUTE MAXIMUM RATINGS

		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 $T_{case} \leqslant 25°C$		65W	
	$T_{amb} \leqslant 25°C$		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

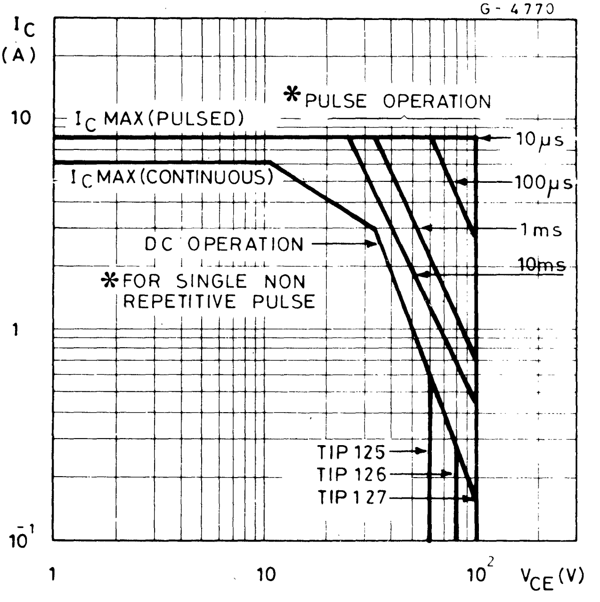
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.92	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	62.5	°C/W

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

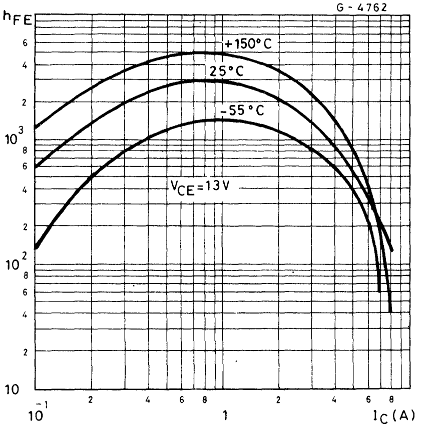
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP 125**	$V_{CE} = -30V$			−0.5	mA
		for **TIP 126**	$V_{CE} = -40V$			−0.5	mA
		for **TIP 127**	$V_{CE} = -50V$			−0.5	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 125**	$V_{CB} = -60V$			−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%.

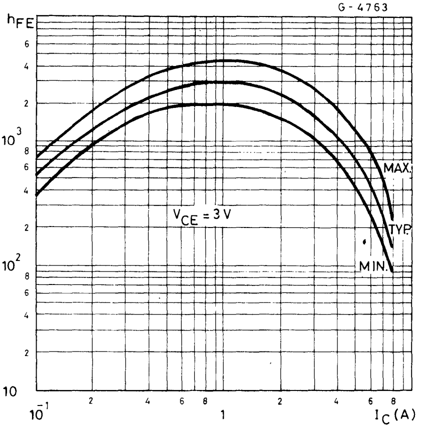
Safe operating areas



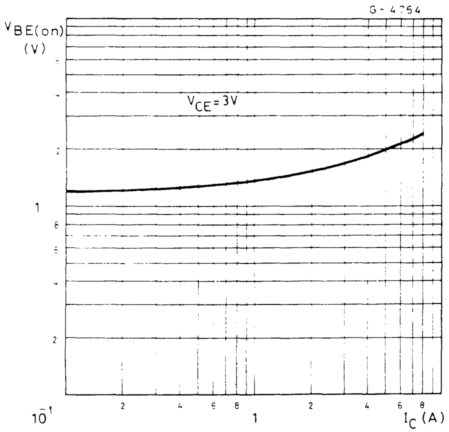
DC current gain



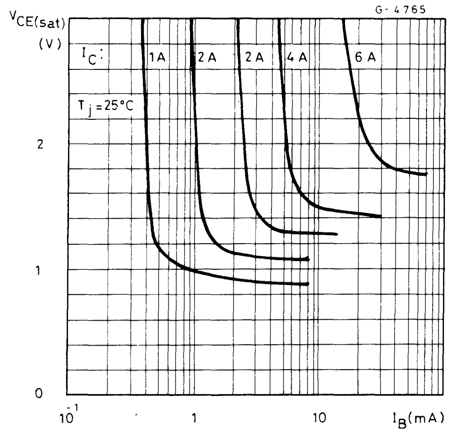
DC current gain



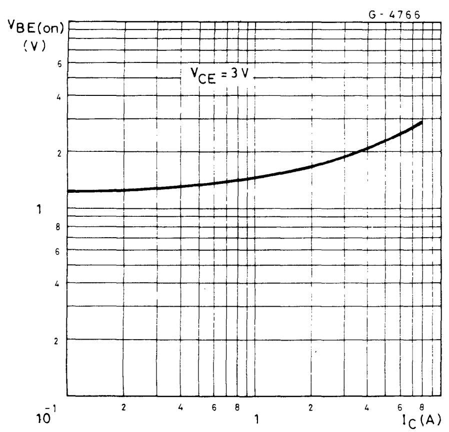
Base-emitter voltage



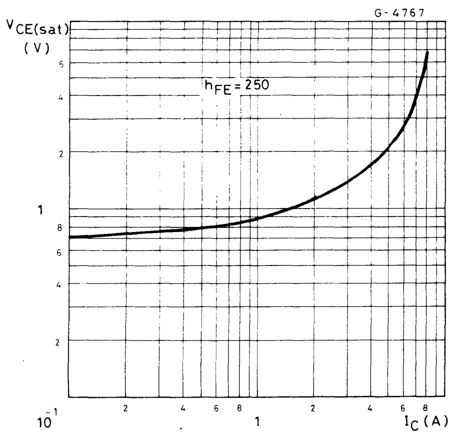
Collector-emitter saturation voltage



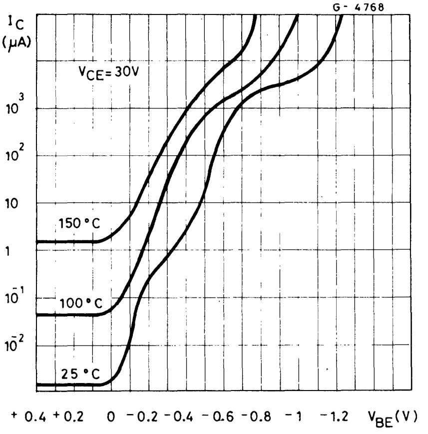
Base-emitter saturation voltage



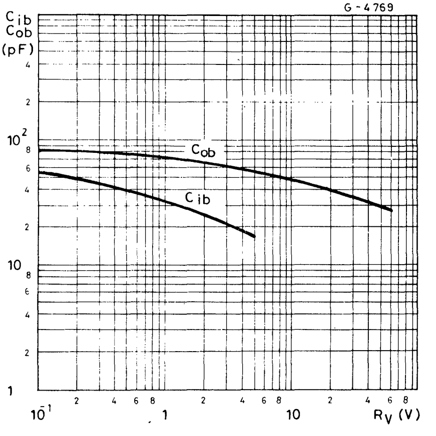
Collector-emitter saturation voltage



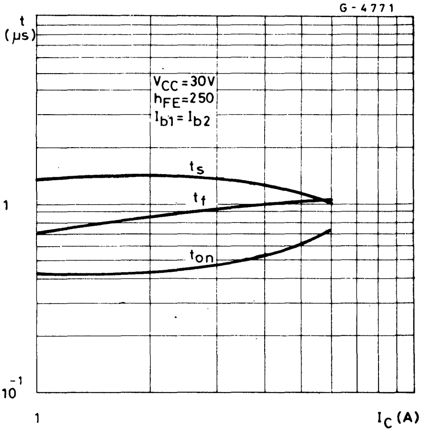
Collector cutoff current



Collector base capacitance



Saturated switching characteristics



EPITAXIAL-BASE NPN

TIP130
TIP131
TIP132

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.

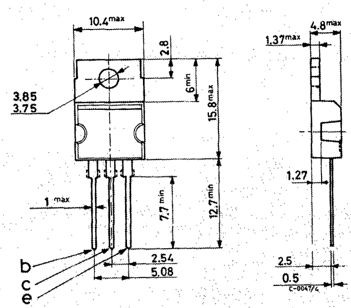
ABSOLUTE MAXIMUM RATINGS

		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**	$V_{CE} = 30V$			0.5	mA
		for **TIP 131**	$V_{CE} = 40V$			0.5	mA
		for **TIP 132**	$V_{CE} = 50V$			0.5	mA
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP 130**	$V_{CB} = 60V$			0.2	mA
		for **TIP 131**	$V_{CB} = 80V$			0.2	mA
		for **TIP 132**	$V_{CB} = 100V$			0.2	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				5	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 30mA$					
		for **TIP 130**		60			V
		for **TIP 131**		80			V
		for **TIP 132**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = 4A$	$I_B = 16mA$			2	V
		$I_C = 6A$	$I_B = 30mA$			3	V
V_{BE}*	Base-emitter voltage	$I_C = 4A$	$V_{CE} = 4V$			2.5	V
h_{FE}*	DC current gain	$I_C = 1A$	$V_{CE} = 4V$	500			—
		$I_C = 4A$	$V_{CE} = 4V$	1000		15000	—

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

SGS

TIP135
TIP136
TIP137

EPITAXIAL-BASE PNP

POWER DARLINGTONS

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.

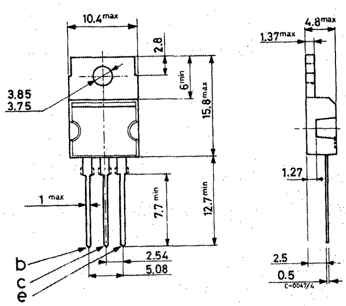
ABSOLUTE MAXIMUM RATINGS

		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

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 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%.

EPITAXIAL-BASE NPN/PNP

TIP140 / TIP145
TIP141 / TIP146
TIP142 / TIP147

POWER DARLINGTONS

The TIP140, TIP141, TIP142 are silicon epitaxial base NPN transistors in monolithic Darlington configuration and are mounted in SOT-93 plastic package. They are intended for use in power linear and switching applications.
The complementary PNP types are TIP145, TIP146, TIP147 respectively.

ABSOLUTE MAXIMUM RATINGS

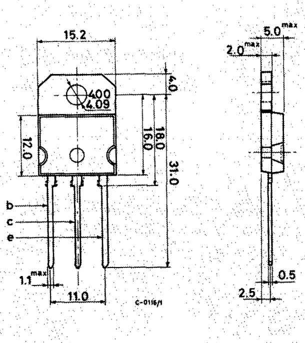
	NPN *PNP	TIP140 TIP145	TIP141 TIP146	TIP142 TIP147
V_{CBO}	Collector-base voltage ($I_E = 0$)	60V	80V	100V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60V	80V	100V
V_{EBO}	Emitter base voltage ($I_C = 0$)		5V	
I_C	Collector current		10A	
I_{CM}	Collector peak current (repetitive)		20A	
I_B	Base current		0.5A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25°C$		125W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

* For PNP types voltage and current values are negative.

MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



(sim. to **TO-218**) **SOT-93**

THERMAL DATA

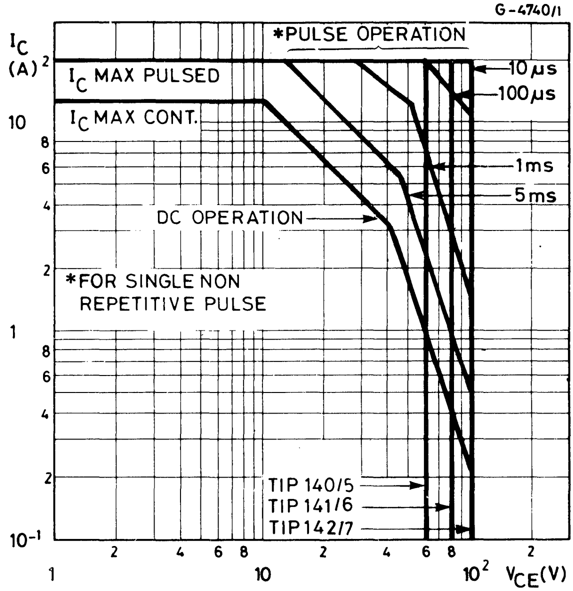
$R_{th\ j-case}$	Thermal resistance junction-case	max	1	°C/W

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

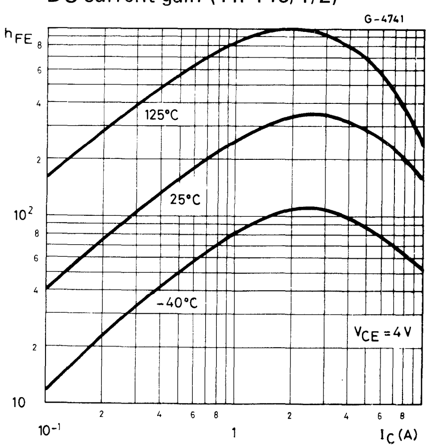
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **TIP140/5** V_{CB} = 60V for **TIP141/6** V_{CB} = 80V for **TIP142/7** V_{CB} = 100V			1 1 1	mA mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **TIP140/5** V_{CB} = 30V for **TIP141/6** V_{CE} = 40V for **TIP142/7** V_{CE} = 50V			2 2 2	mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EBO} = 5V			2	mA
$V_{CEO\,(sus)}$*	Collector emitter sustaining voltage ($I_B = 0$)	I_C = 30 mA for **TIP140/5** for **TIP141/6** for **TIP142/7**	60 80 100			V V V
$V_{CE\,(sat)}$*	Collector--emitter saturation voltage	I_C = 5A I_B = 10 mA I_C = 10A I_B = 40 mA			2 3	V V
V_{BE}*	Base-emitter voltage	I_C = 10A V_{CE} = 4V			3	V
h_{FE}*	DC current gain	I_C = 5A V_{CE} = 4V I_C = 10A V_{CE} = 4V	1000 500			– –
t_{on}	Turn-on time	I_C = 10A I_{B1} = 40 mA I_{B2} = -40 mA R_L = 3Ω		0.9		μs
t_{off}	Turn-off time			4		μs

* Pulsed: pulse duration = 200 μs, duty cycle = 1.5%.
For PNP devices voltage and current values are negative

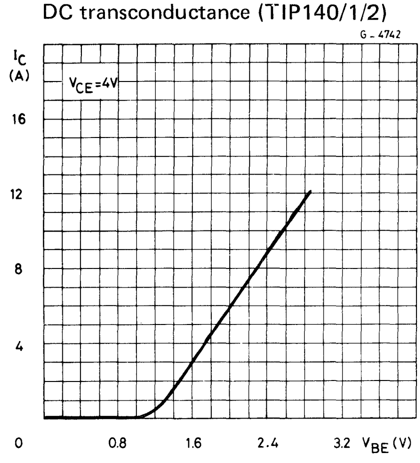
Safe operating areas



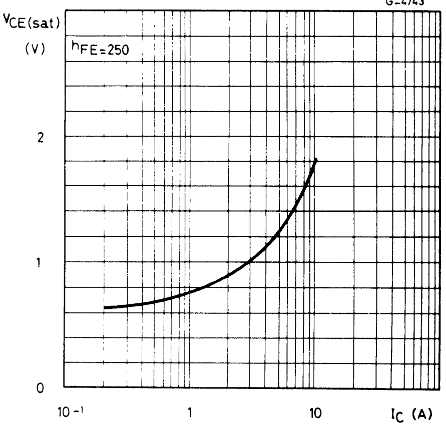
DC current gain (TIP140/1/2)



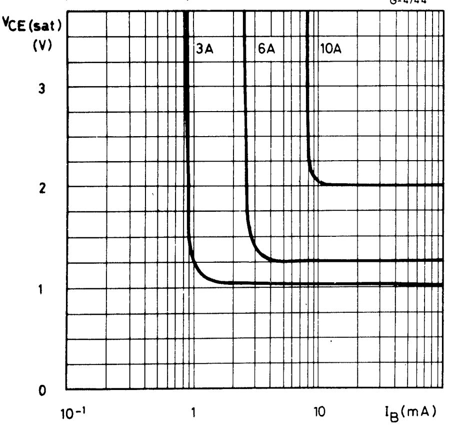
DC transconductance (TIP140/1/2)



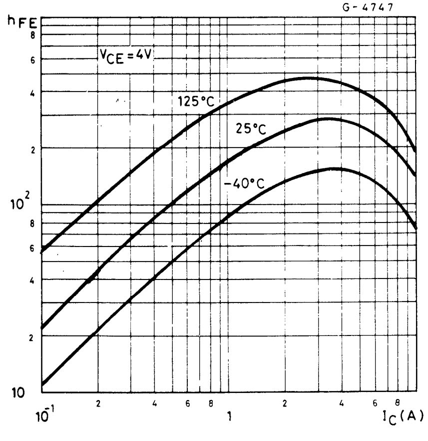
Collector-emitter saturation voltage (TIP140/1/2)



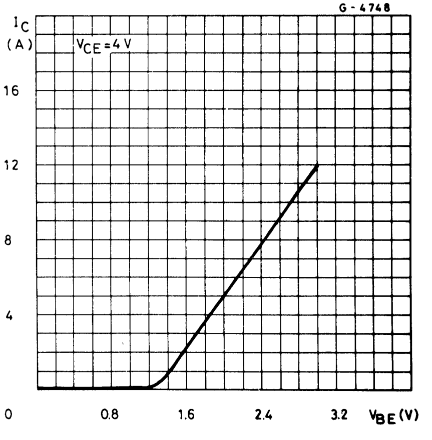
Collector-emitter saturation voltage (TIP140/1/2)



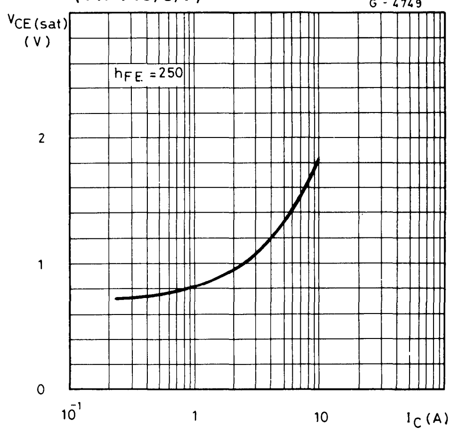
DC current gain (TIP145/6/7)



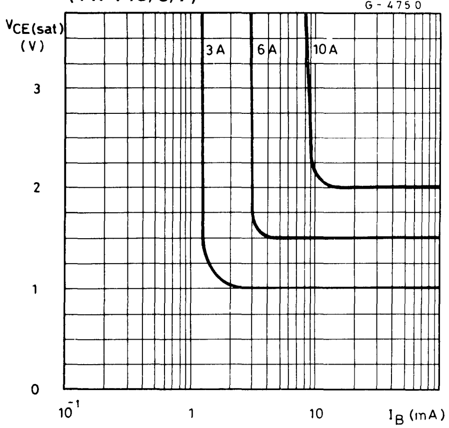
DC transconductance (TIP145/6/7)



Collector-emitter saturation voltage (TIP145/6/7)



Collector-emitter saturation voltage (TIP145/6/7)



2N3055E

EPITAXIAL-BASE NPN

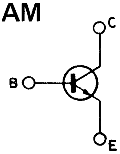
POWER LINEAR AND SWITCHING APPLICATIONS

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

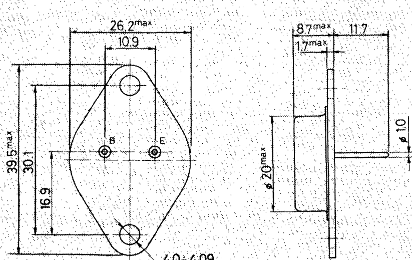
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

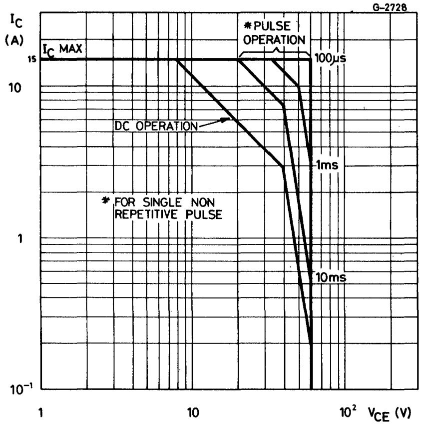
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

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

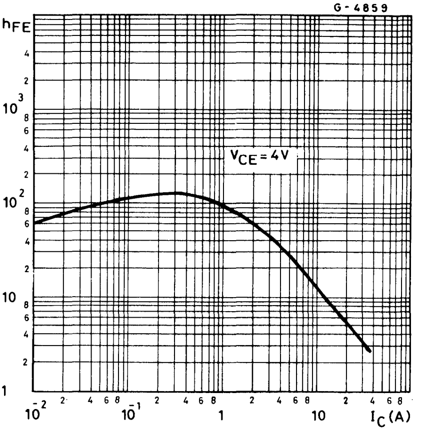
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 100 V V_{CE} = 100 V T_{case} = 150°C			1 5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30 V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CER\ (sus)}$*	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

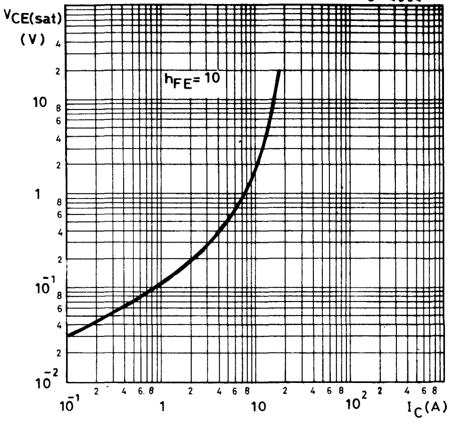
Safe operating areas



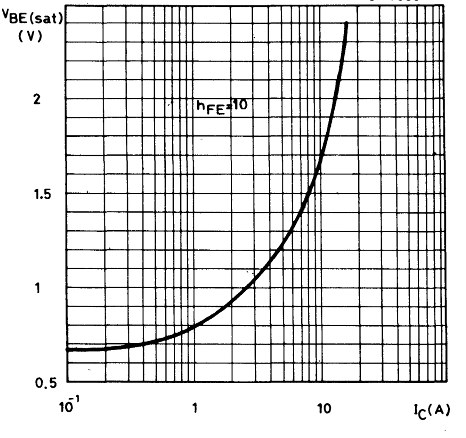
DC current gain



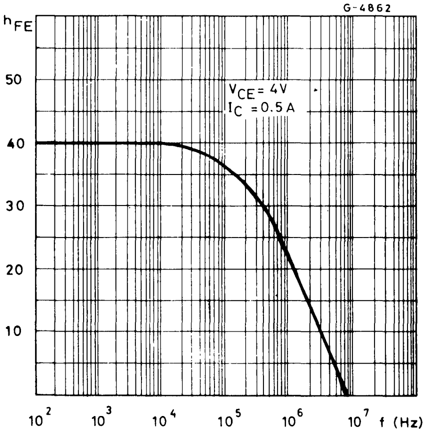
Collector-emitter saturation voltage



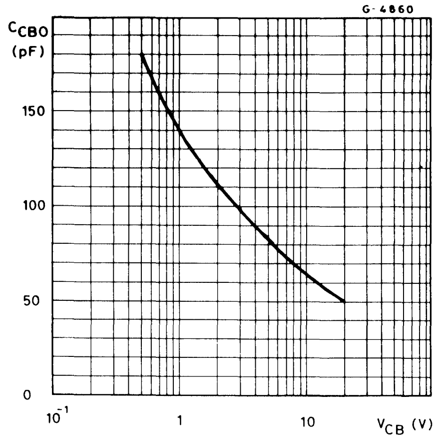
Base-emitter saturation voltage



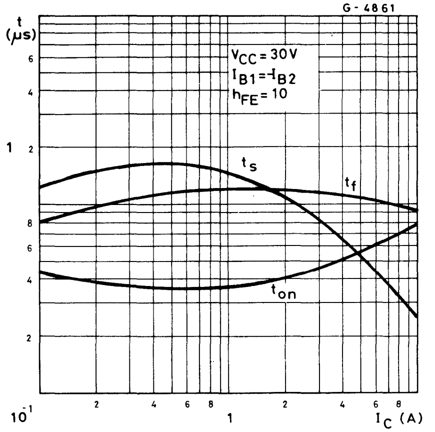
Small signal current gain



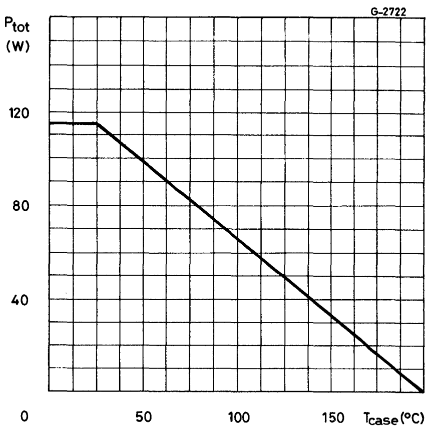
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N3439
2N3440

EPITAXIAL PLANAR NPN

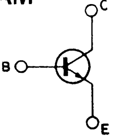
HIGH VOLTAGE TRANSISTORS

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	

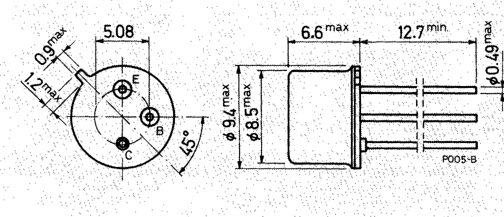
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

THERMAL DATA

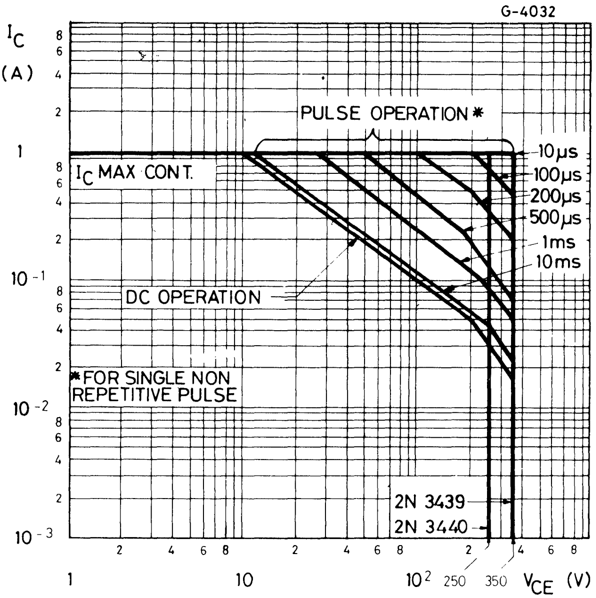
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	17.5 °C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	150 °C/W

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

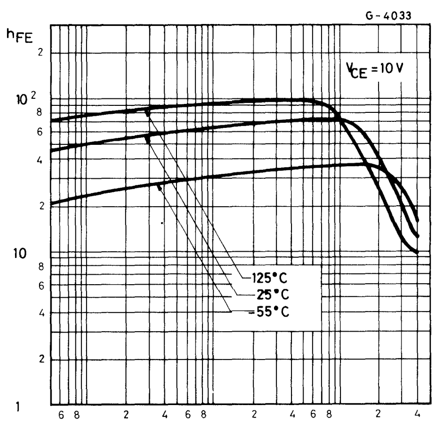
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N3439** $V_{CB} = 360V$ for **2N3440** $V_{CB} = 250V$			20 20	μA μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N3439** $V_{CE} = 300V$ for **2N3440** $V_{CE} = 200V$			20 50	μA μA
I_{CEX}	Collector 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 $= 300\,\mu s$, duty cycle $\leq 2\%$

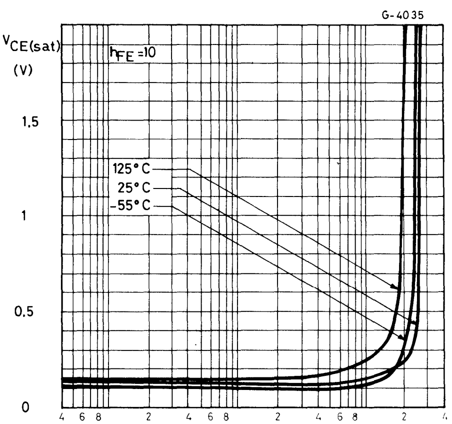
Safe operating areas



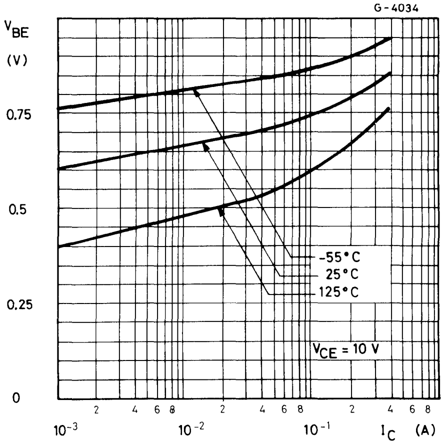
DC current gain



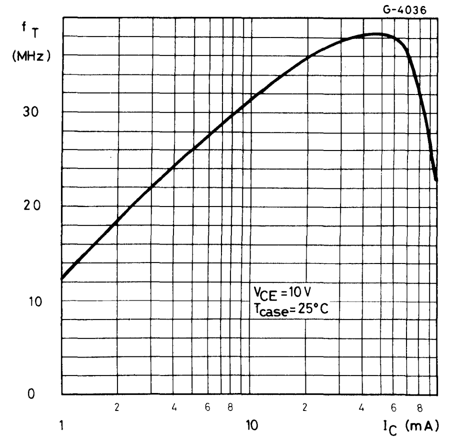
Collector-emitter saturation voltage



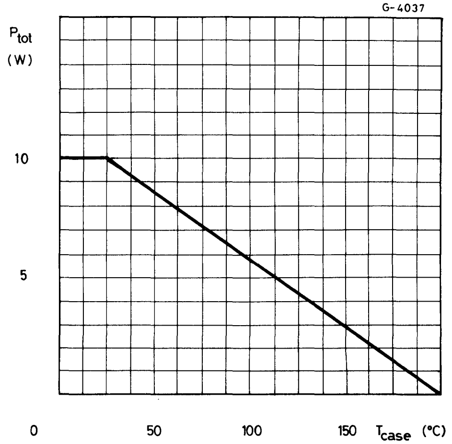
Base emitter voltage



Transition frequency



Power rating chart



2N3713
2N3714
2N3715
2N3716

EPITAXIAL-BASE NPN

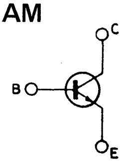
POWER LINEAR AND SWITCHING APPLICATIONS

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	

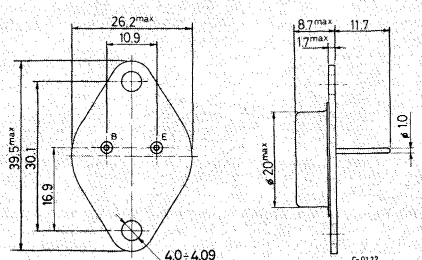
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

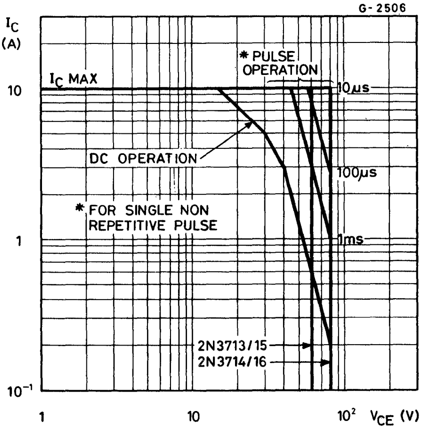
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

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

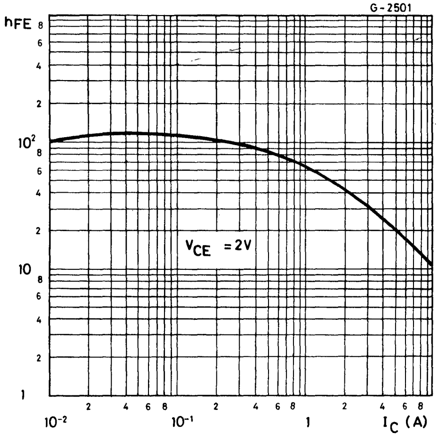
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 80 V for **2N3713** and **2N3715**			1	mA
		V_{CE} = 100 V for **2N3714** and **2N3716**			1	mA
		T_{case} = 150 °C				
		V_{CE} = 60 V for **2N3713** and **2N3715**			10	mA
		V_{CE} = 80 V for **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%

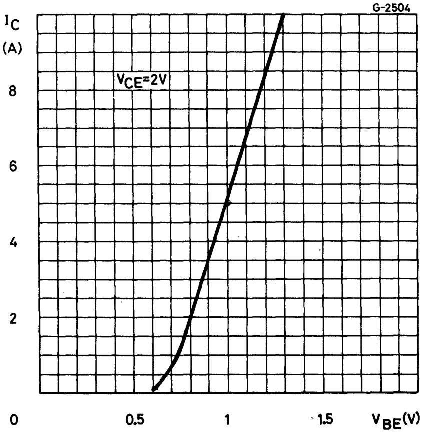
Safe operating areas



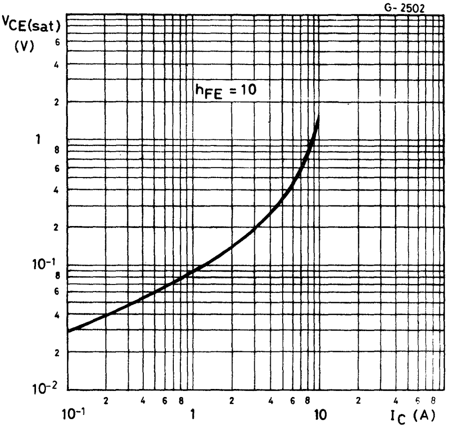
DC current gain



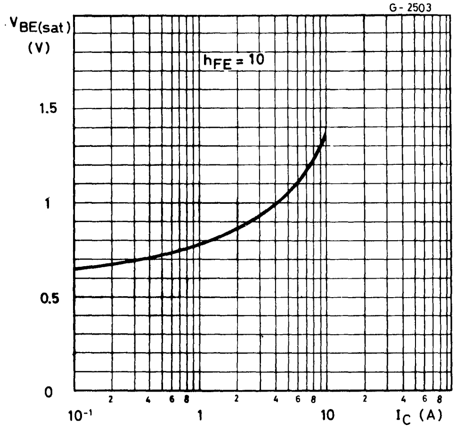
DC transconductance



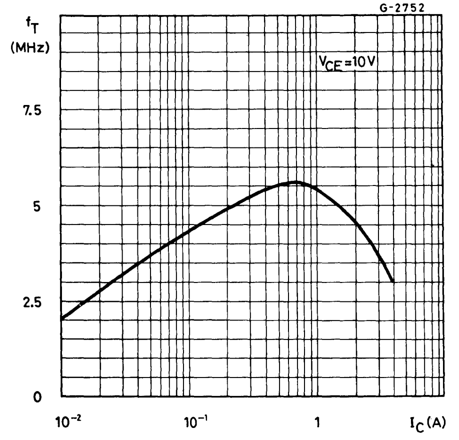
Collector-emitter saturation voltage



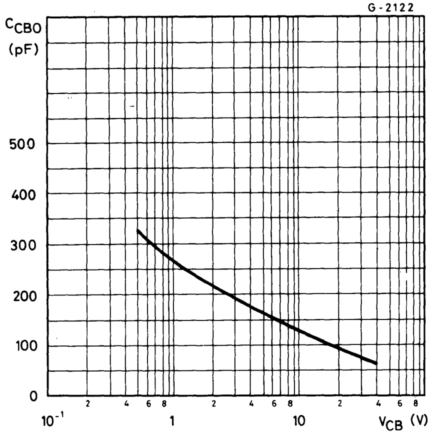
Base-emitter saturation voltage



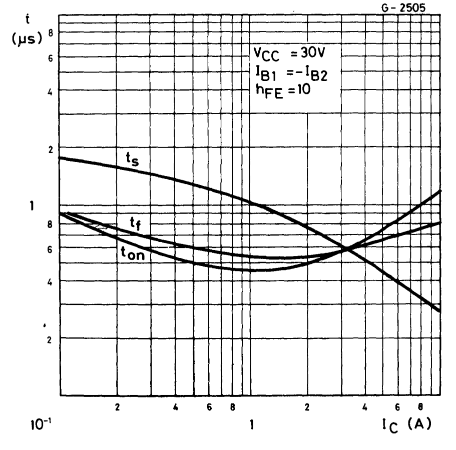
Transition frequency



Collector-base capacitance



Saturated switching characteristics



2N3789
2N3790
2N3791
2N3792

EPITAXIAL-BASE PNP

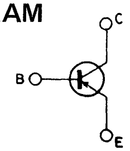
POWER LINEAR AND SWITCHING APPLICATIONS

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 $T_{case} \leq 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200 °C	

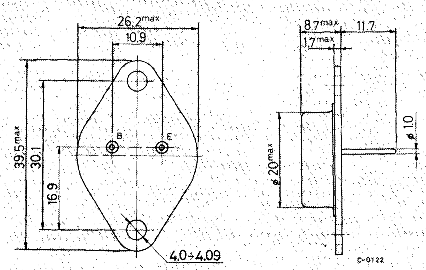
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

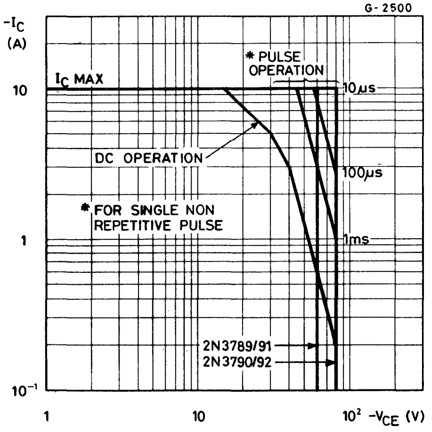
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

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

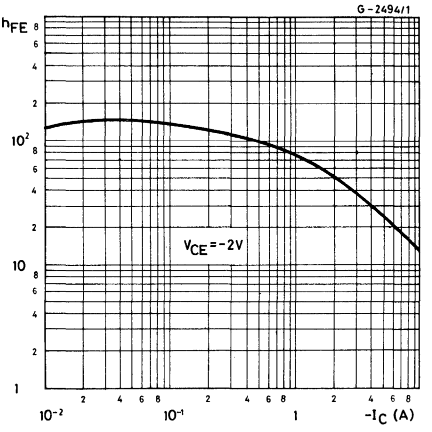
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector-emitter cutoff current (V_{BE} = 1.5 V)	V_{CE} = -60 V for **2N3789** and **2N3791**			-1	mA
		V_{CE} = -80 V for **2N3790** and **2N3792**			-1	mA
		T_{case} = 150 °C V_{CE} = -60 V for **2N3789** and **2N3791**			-5	mA
		V_{CE} = -80 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 = 1.5%

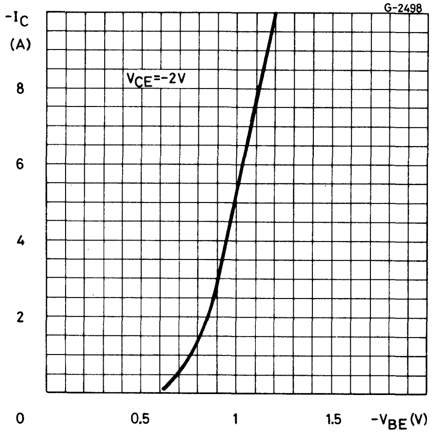
Safe operating areas



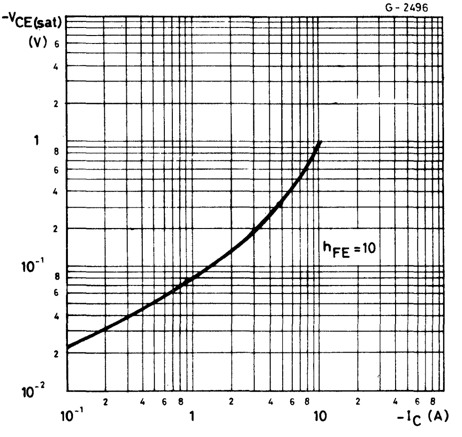
DC current gain



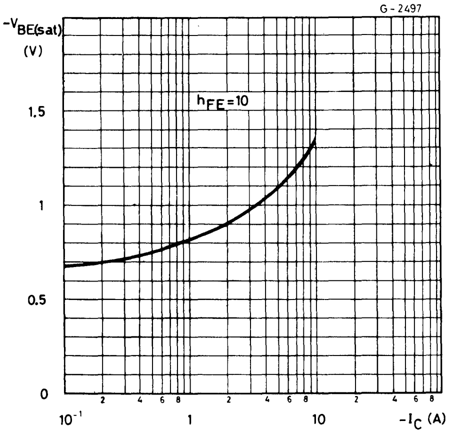
DC transconductance



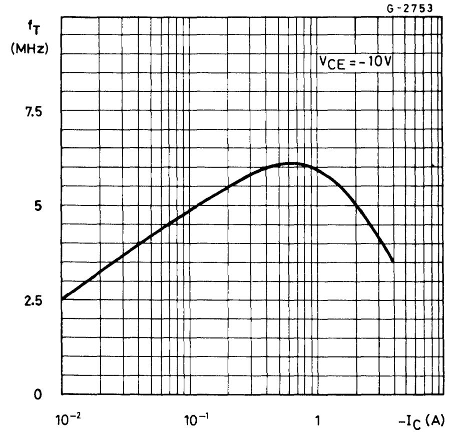
Collector-emitter saturation voltage



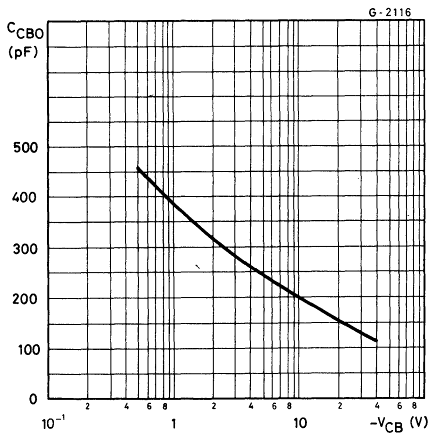
Base-emitter saturation voltage



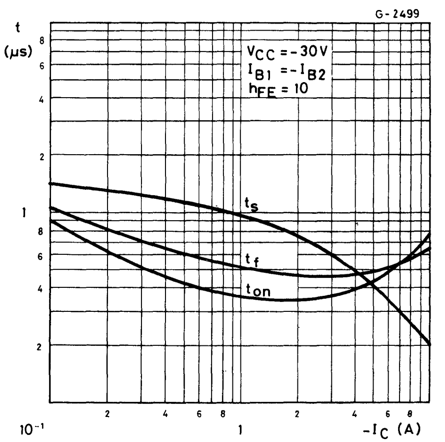
Transition frequency



Collector-base capacitance



Saturated switching characteristics



SGS

2N4234
2N4235
2N4236

EPITAXIAL PLANAR PNP

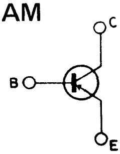
MEDIUM POWER GENERAL PURPOSE TRANSISTORS

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 $T_{case} \leq 25°C$		6W	
	$T_{amb} \leq 25°C$		1W	
T_{stg}	Storage temperature		−65 to 200°C	
T_j	Junction temperature		200°	

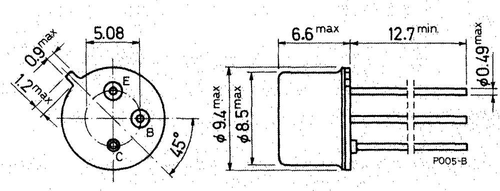
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

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	$I_C = -100mA$ $V_{CE} = -10V$ f = 1MHz	3			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = -10V$ f = 100KHz			100	pF
h_{fe}	Small signal current gain	$I_C = -50mA$ $V_{CE} = -10V$ f = 1KHz	25			—

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

EPITAXIAL PLANAR NPN

2N4895
2N4896
2N4897

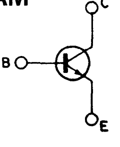
HIGH CURRENT, FAST SWITCHING APPLICATIONS

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	

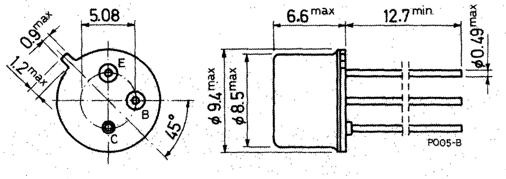
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

SGS

2N4895
2N4896
2N4897

THERMAL DATA

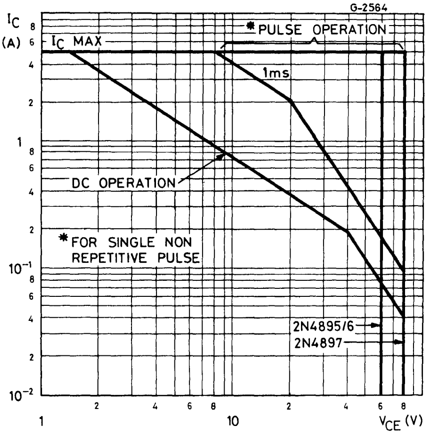
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

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

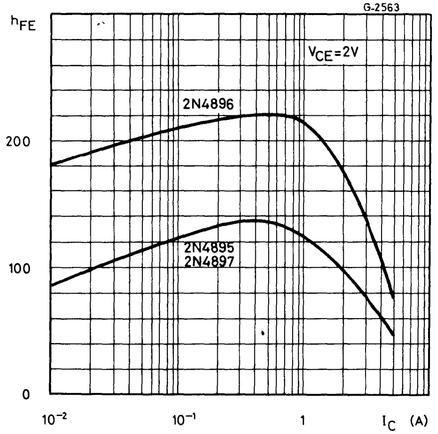
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **2N4895** and **2N4896**				
		V_{CE} = 120V			1	mA
		V_{CE} = 60V			1	μA
		V_{CE} = 60V T_{case} = 150°C			100	μA
		for **2N4897**				
		V_{CE} = 150V			1	mA
		V_{CE} = 100V			1	μA
		V_{CE} = 100V T_{case} = 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%

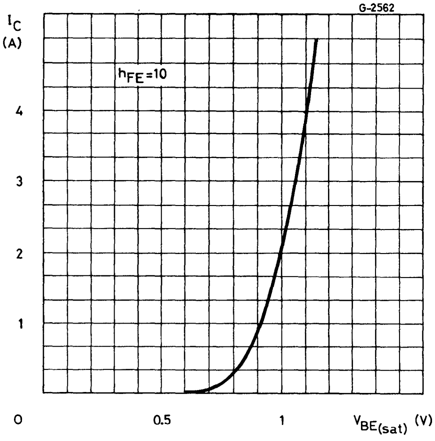
Safe operating areas



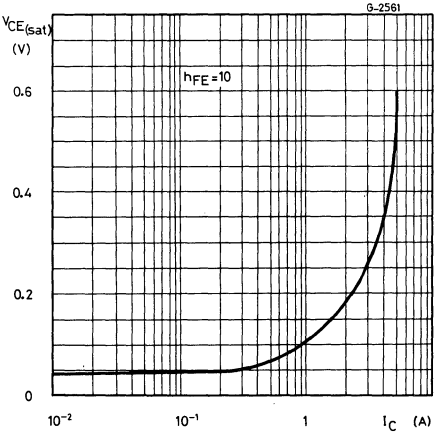
DC current gain



DC transconductance



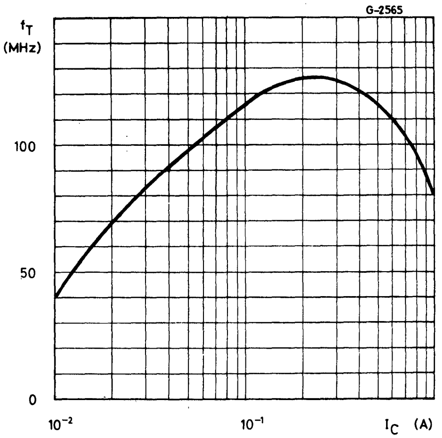
Collector-emitter saturation voltage



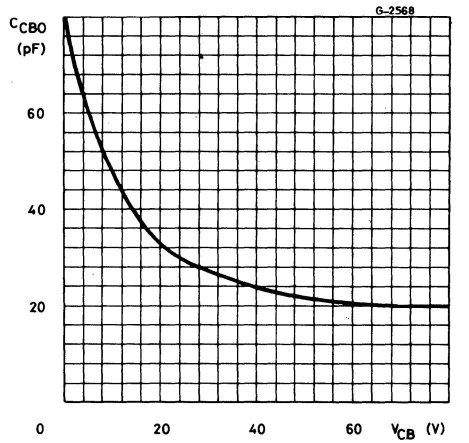
SGS

2N4895
2N4896
2N4897

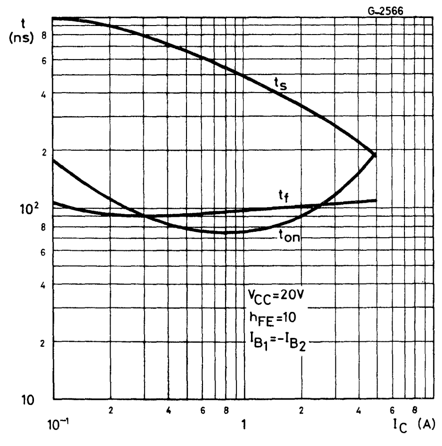
Transition frequency



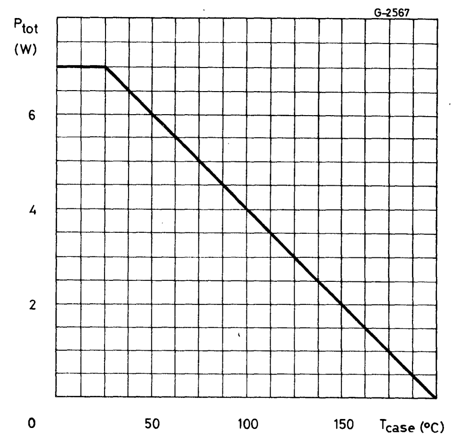
Collector-base capacitance



Saturated switching characteristics



Power rating chart



MULTIEPITAXIAL PLANAR NPN

2N5038
2N5039
2N6496

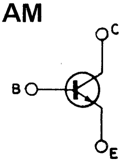
HIGH CURRENT POWER SWITCH

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

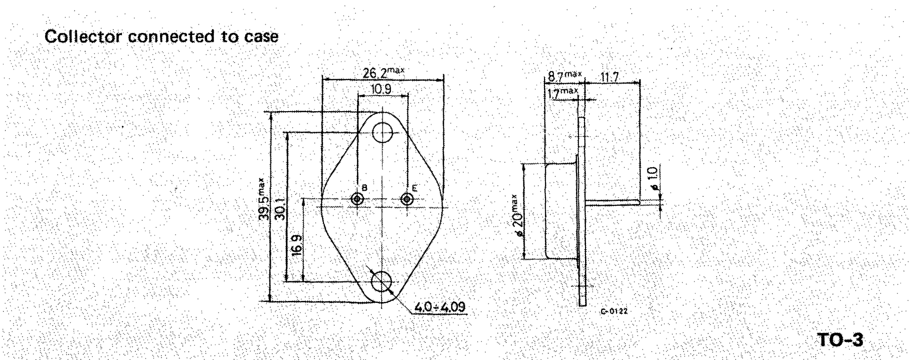
		2N5038	2N5039	2N6496
V_{CBO}	Collector-base voltage ($I_E = 0$)	150V	120V	150V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5V, R_{BE} = 100\Omega$)	150V	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 50\ \Omega$)	110V	95V	130V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90V	75V	110V
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 $T_{case} \leq 25\ °C$	140W		
T_{stg}	Storage temperature	-65 to 200 °C		
T_j	Junction temperature	200 °C		

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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)

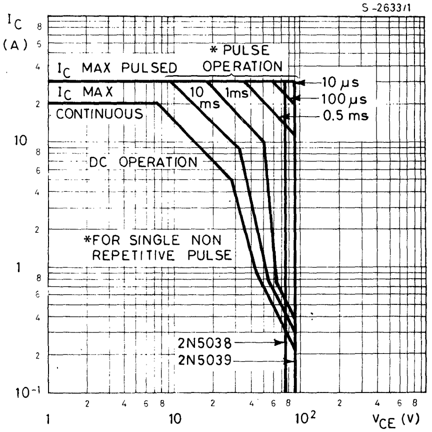
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **2N5038**				
		I_C = 12 A I_B = 1.2 A			1	V
		I_C = 20 A I_B = 5 A			2.5	V
		for **2N5039**				
		I_C = 10 A I_B = 1 A			1	V
		I_C = 20 A I_B = 5 A			2.5	V
		for **2N6496**				
		I_C = 8 A 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

ELECTRICAL CHARACTERISTICS (continued)

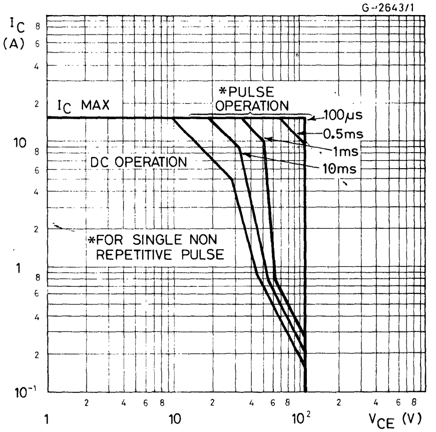
Parameter		Test conditions	Min. Typ. Max.	Unit
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 28 V V_{CE} = 45 V	5 0.9	A A
$E_{s/b}$	Second breakdown energy	V_{BE} = -4 V R_{BE} = 20 Ω L = 180 μH for **2N5038** for **2N5039** for **2N6496**	 13 13 5.7	 mJ mJ mJ

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

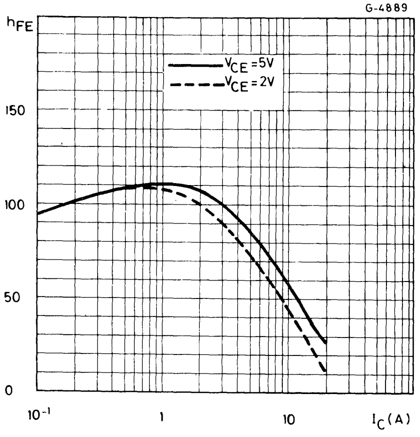
Safe operating areas
(for **2N5038** and **2N5039**)



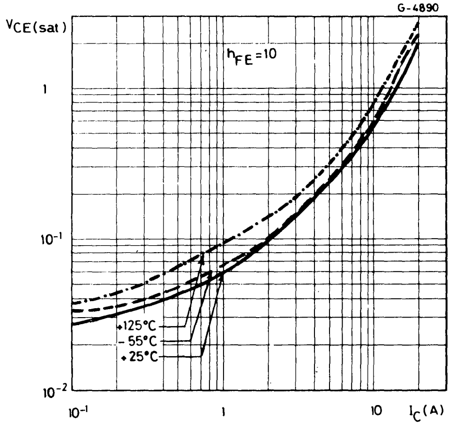
Safe operating areas
(for **2N6496**)



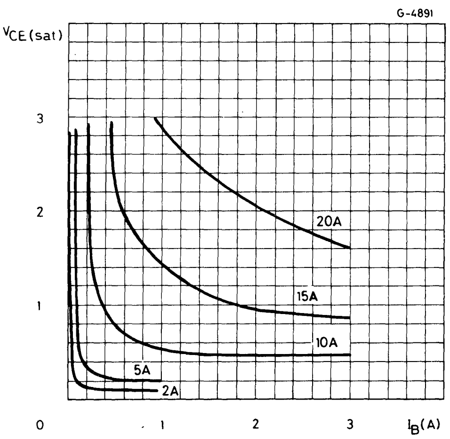
DC current gain



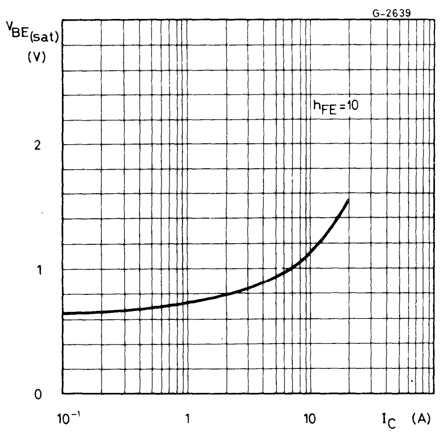
Collector-emitter saturation voltage



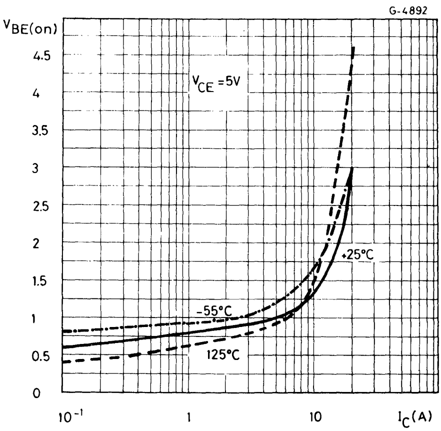
Collector-emitter saturation voltage



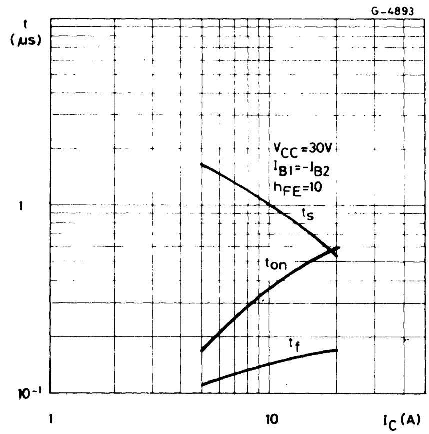
Base-emitter saturation voltage



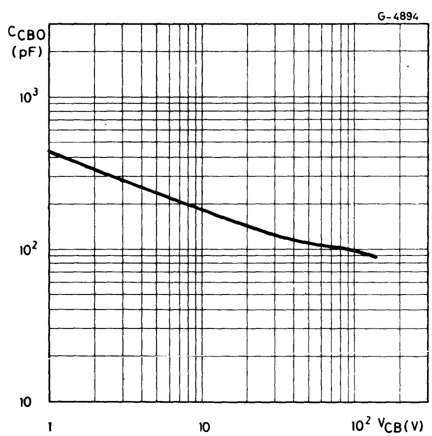
$V_{BE(on)}$ vs. collector current



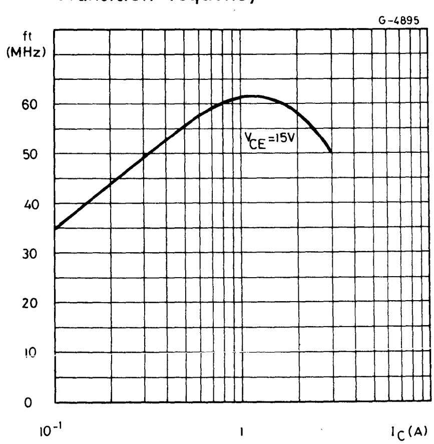
Saturated switching characteristics



Collector-base capacitance



Transition frequency



EPITAXIAL PLANAR PNP

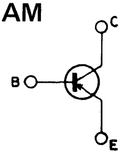
2N5151
2N5153

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

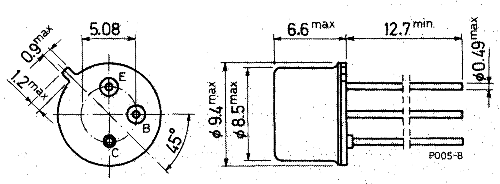
INTERNAL SCHEMATIC DIAGRAM



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_{CES}	Collector cutoff current (V_{BE} = 0)	$V_{CE} = -60V$				–1	μA
		$V_{CE} = -100V$				–1	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)	$V_{EB} = -4V$				–1	μA
		$V_{EB} = -5.5V$				–1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	$I_C = -100mA$		–80			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -2.5A$	$I_B = -250mA$			–0.75	V
		$I_C = -5A$	$I_B = -500mA$			–1.5	V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	$I_C = -2.5A$	$I_B = -250mA$			–1.45	V
		$I_C = -5A$	$I_B = -500mA$			–2.2	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** $I_C = -0.5A$ $V_{CE} = -5V$ $f = 20MHz$ for **2N5151** for **2N5153**	 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 = 300μs, duty cycle $\leqslant$2%.

SGS **2N5152** **2N5154**

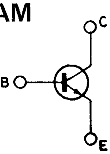
EPITAXIAL PLANAR NPN

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 $T_{case} \leq 50°C$	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

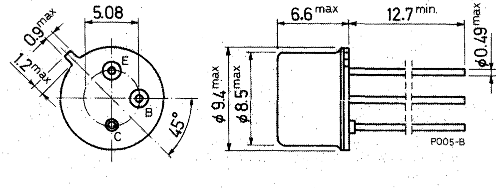
INTERNAL SCHEMATIC DIAGRAM



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_{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_B = 250mA I_C = 5A I_B = 500mA			0.75 1.5	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 2.5A I_B = 250mA I_C = 5A 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**	20			—
		for **2N5154**	50			—
		$I_C = 0.5A$ $V_{CE} = 5V$ $f = 20MHz$				
		for **2N5152**	3			—
		for **2N5154**	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 $\leqslant$2%.

EPITAXIAL-BASE NPN

SGS **2N5190 2N5191 2N5192**

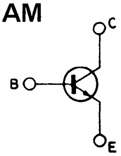
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

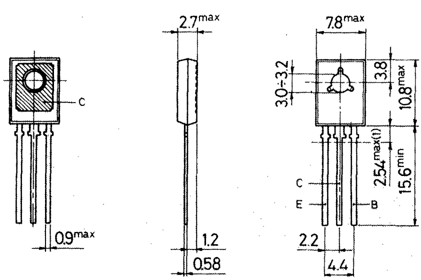
		2N5190	2N5191	2N5192
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current ($t \leq 10$ ms)		7A	
I_B	Base current		1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

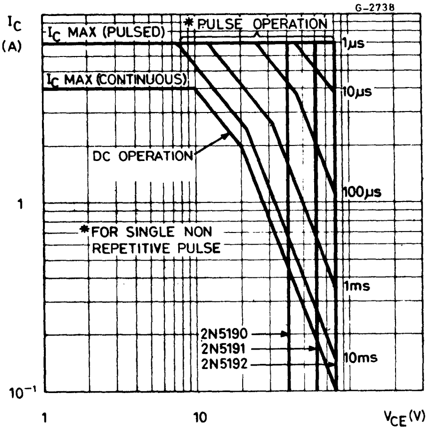
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

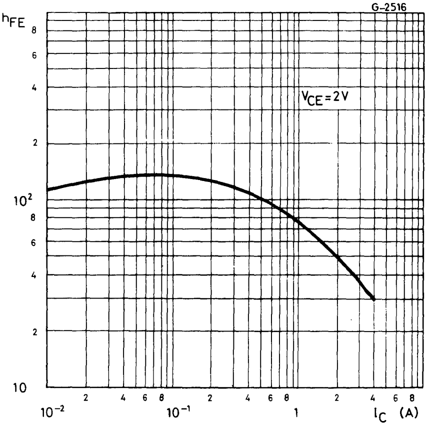
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5190**	V_{CB} = 40V			100	μA
		for **2N5191**	V_{CB} = 60V			100	μA
		for **2N5192**	V_{CB} = 80V			100	μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5V)	for **2N5190**	V_{CE} = 40V			100	μA
		for **2N5191**	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%

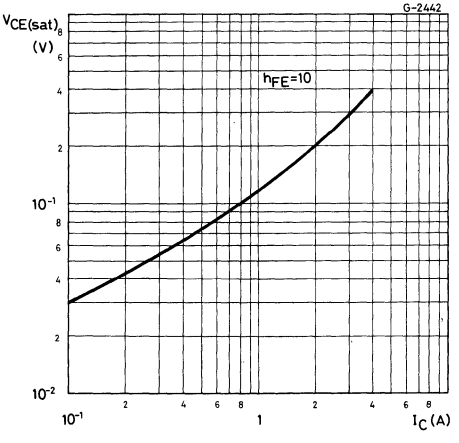
Safe operating areas



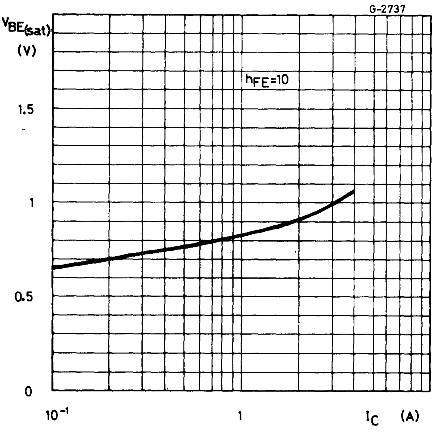
DC current gain



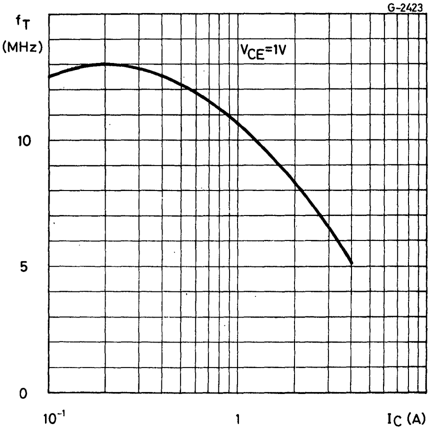
Collector-emitter saturation voltage



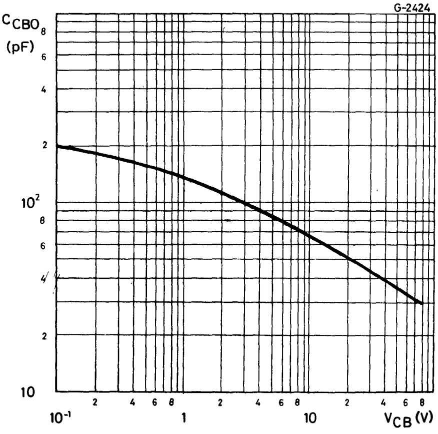
Base-emitter saturation voltage



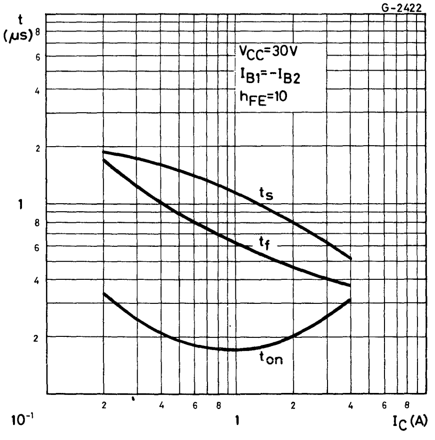
Transition frequency



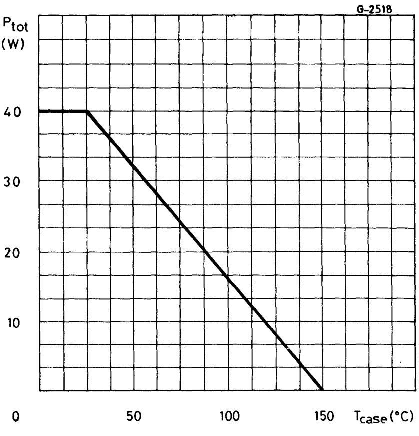
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

2N5193
2N5194
2N5195

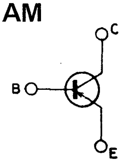
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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

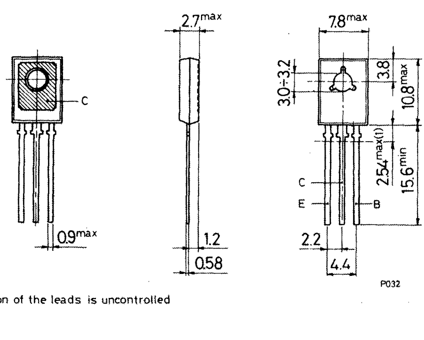
		2N5193	2N5194	2N5195
V_{CBO}	Collector-base voltage ($I_E = 0$)	-40V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-40V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current ($t \leq 10$ ms)		-7A	
I_B	Base current		-1A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

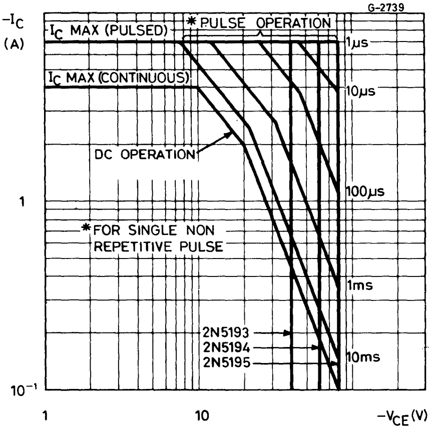
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

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

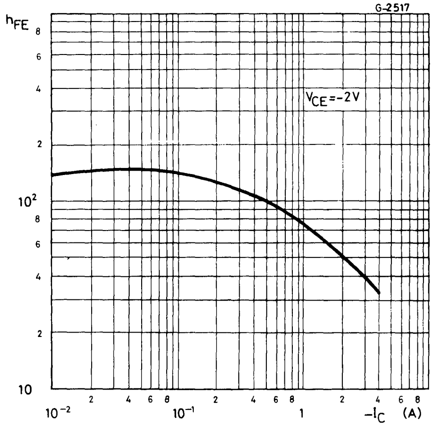
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5193**	V_{CB} = -40V			-100	μA
		for **2N5194**	V_{CB} = -60V			-100	μA
		for **2N5195**	V_{CB} = -80V			-100	μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5)	for **2N5193**	V_{CE} = -40V			-100	μA
		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%

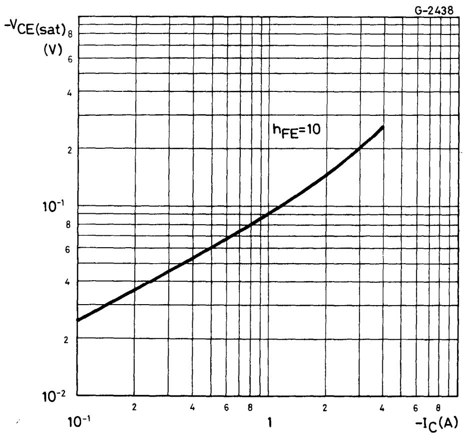
Safe operating areas



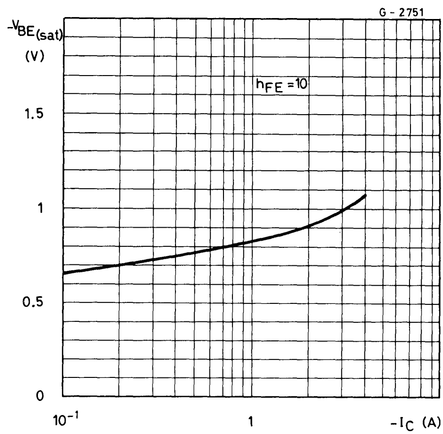
DC current gain



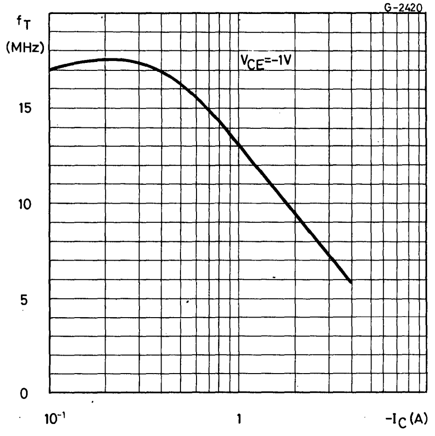
Collector-emitter saturation voltage



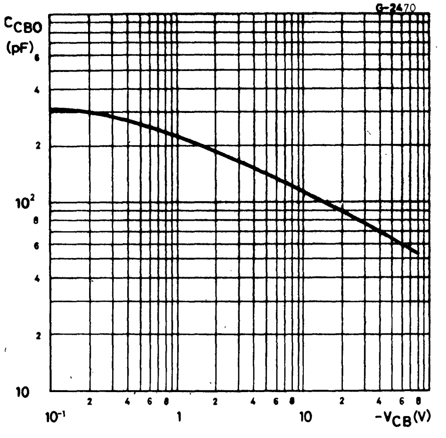
Base-emitter saturation voltage



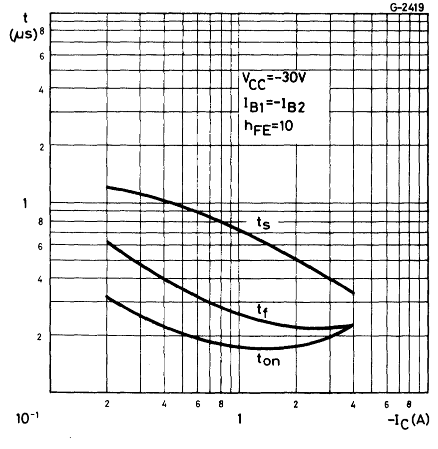
Transition frequency



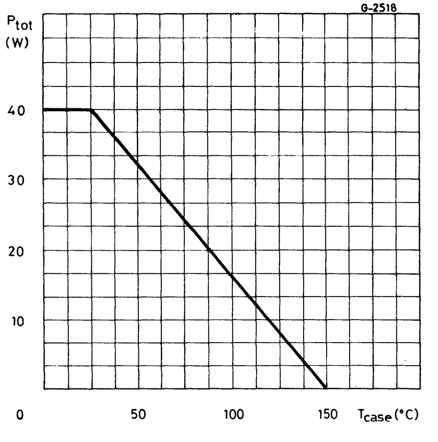
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL PLANAR NPN

2N5336
2N5337
2N5338
2N5339

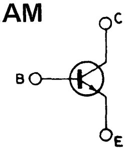
HIGH CURRENT FAST SWITCHING APPLICATIONS

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	

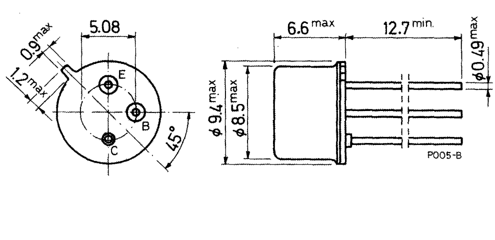
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-39

SGS 2N5336 2N5337 2N5338 2N5339

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)

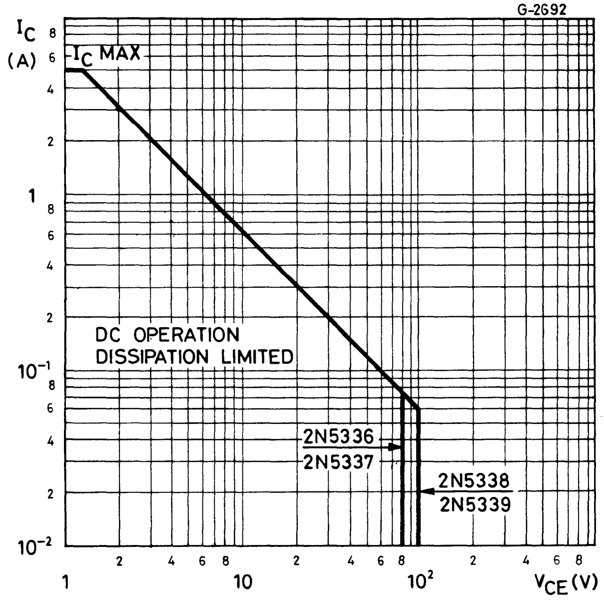
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5336** and **2N5337** V_{CB} = 80 V for **2N5338** and **2N5339** V_{CB} = 100 V			 10 10	 μA μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5336** and **2N5337** V_{CE} = 75 V for **2N5338** 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)

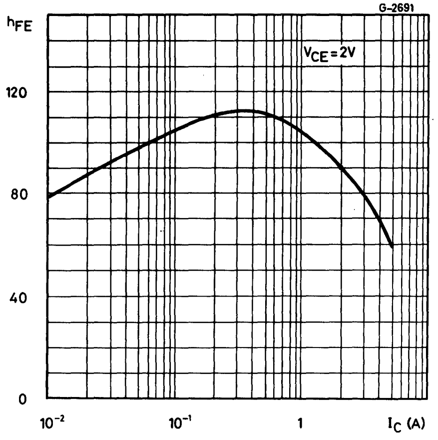
	Parameter	Test conditions	Min. Typ. Max.	Unit
f_T	Transition frequency	I_C = 0.5A V_{CE} = 10 V	30	MHz
C_{CBO}	Collector-base capacitance	V_{CB} = 10V I_E = 0 f = 0.1 MHz	250	pF
t_{on}	Turn-on time	I_C = 2 A V_{CC} = 40V I_{B1} = 0.2 A	200	ns
t_s	Storage time	I_C = 2 A V_{CC} = 40V I_{B1} = $-I_{B2}$ = 0.2 A	2	µs
t_f	Fall time		200	ns

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

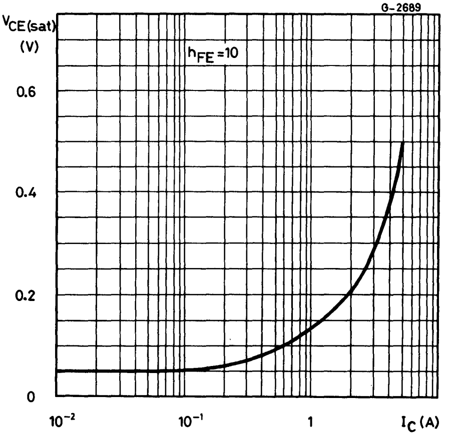
Safe operating areas



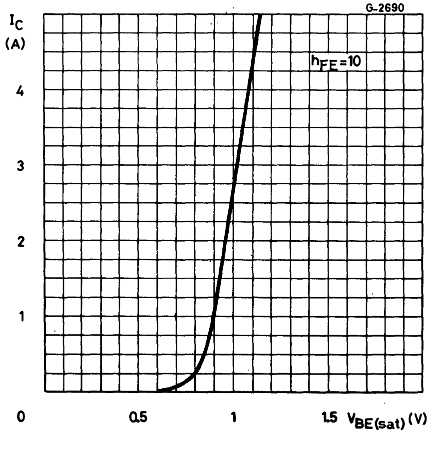
DC current gain



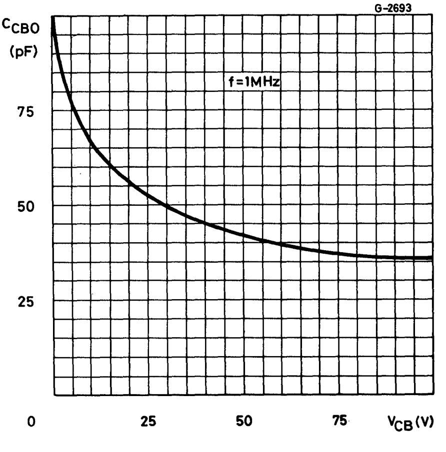
Collector-emitter saturation voltage



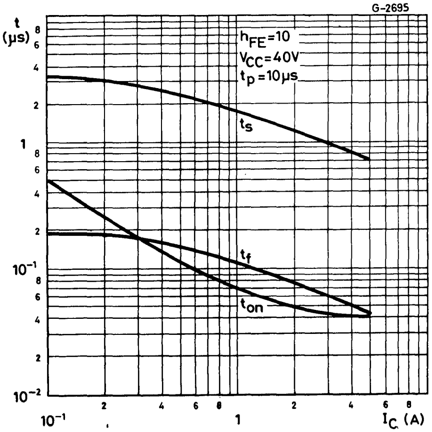
Base-emitter saturation voltage



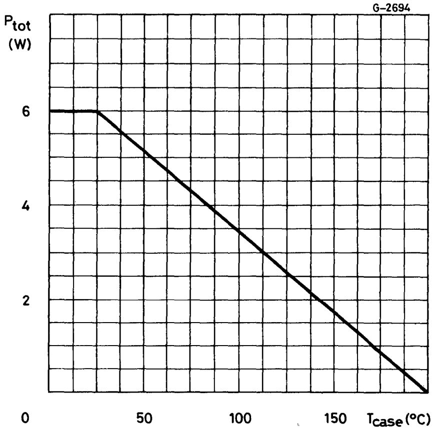
Collector-base capacitance



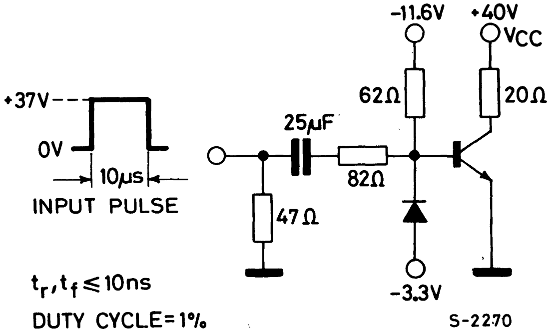
Saturated switching characteristics



Power rating chart



Switching time test circuit



2N5415
2N5416

EPITAXIAL PLANAR PNP

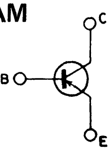
HIGH VOLTAGE TRANSISTORS

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	

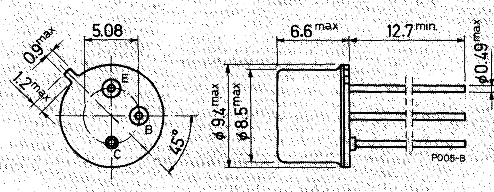
INTERNAL SCHEMATIC DIAGRAM



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 ($R_{BE} = 50\Omega$)	$I_C = -50mA$ 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

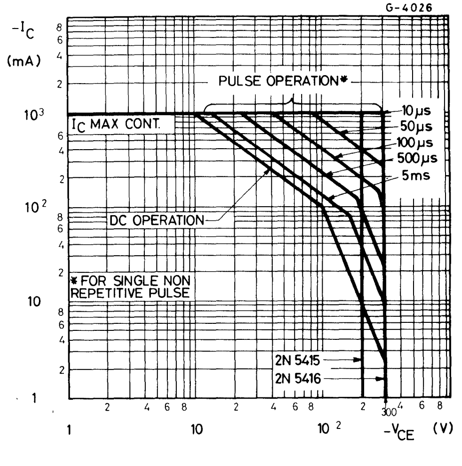
SGS 2N5415 2N5416

ELECTRICAL CHARACTERISTICS (continued)

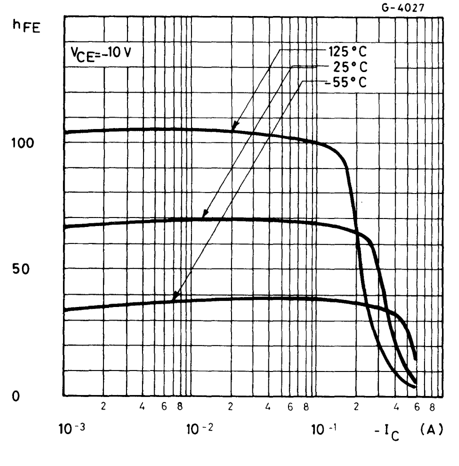
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C =-50mA V_{CE}=-10V for **2N5415** for **2N5416**	 30 30		 150 120	 — —
h_{fe}	Small signal current gain	I_C =-5mA V_{CE}=-10V f = 1KHz	25			—
f_T	Transition frequency	I_C =-10mA V_{CE}=-10V f = 5MHz	15			MHz
C_{CBO}	Collector-base capacitance	I_E =0 V_{CB}=-10V f = 1MHz			25	pF

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

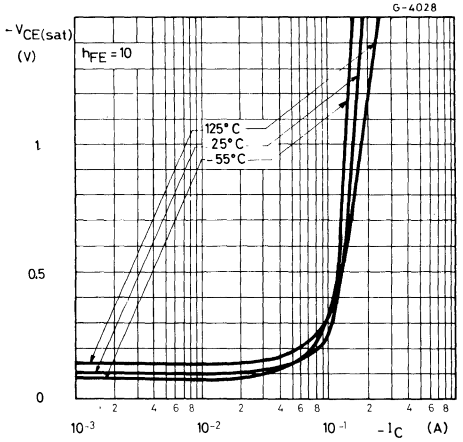
Safe operating areas



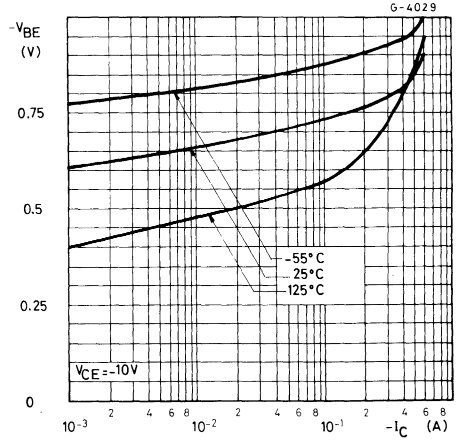
DC current gain



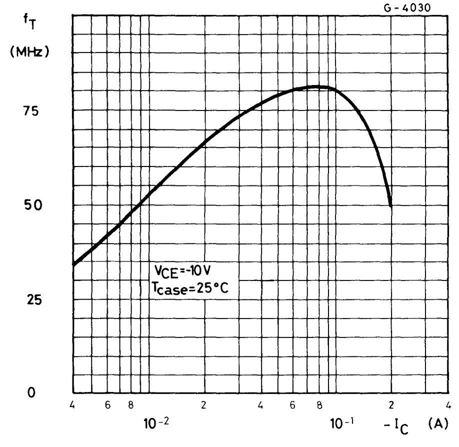
Collector-emitter saturation voltage



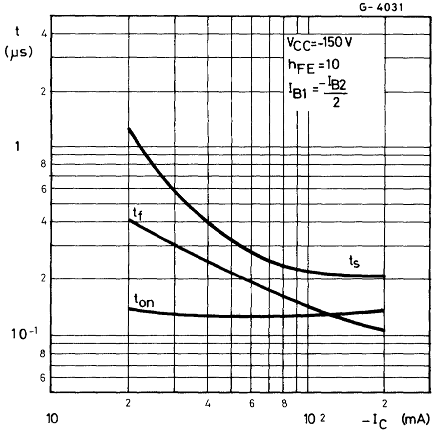
Base-emitter voltage



Transition frequency



Switching times



2N5671
2N5672

MULTIEPITAXIAL PLANAR NPN

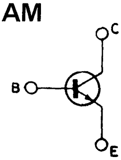
HIGH CURRENT FAST SWITCHING APPLICATIONS

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 Ω)	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq$ 50 Ω)	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	

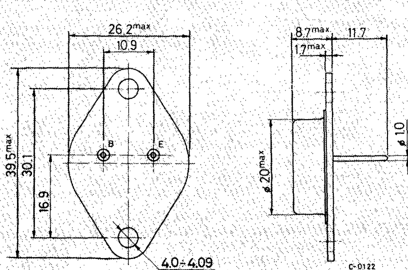
INTERNAL SCHEMATIC DIAGRAM



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)

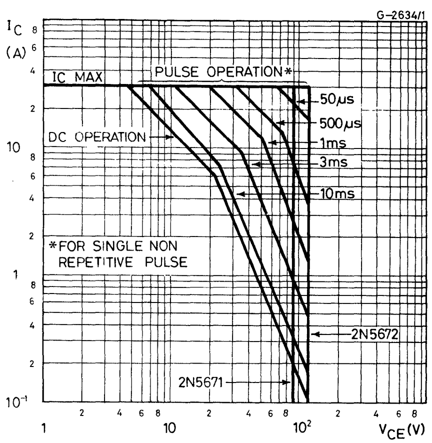
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5671** V_{CE} = 110 V for **2N5672** V_{CE} = 135 V V_{CE} = 100V T_{case} = 150°C for **2N5671** for **2N5672**			12 10 15 10	mA mA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 80 V			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 V_{CE} = 2 V I_C = 20 A V_{CE} = 5 V	20 20		100	— —
f_T	Transition frequency	I_C = 2 A V_{CE} = 10 V	50			MHz

ELECTRICAL CHARACTERISTICS (continued)

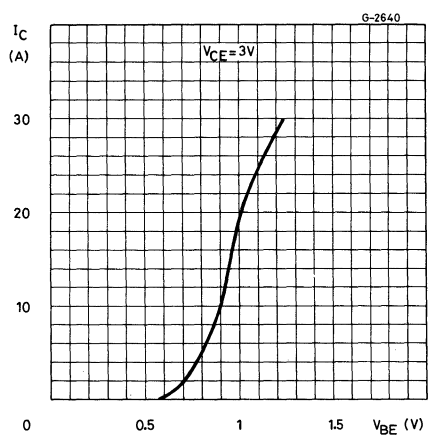
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10\ V$ $f = 1\ MHz$			900	pF
t_{on}	Turn-on time	$I_C = 15\ A$ $V_{CC} = 30\ V$ $I_{B1} = -I_{B2} = 1.2A$			0.5	μs
t_s	Storage time				1.5	μs
t_f	Fall time				0.5	μs
$I_{s/b}$**	Second breakdown collector current	$V_{CE} = 24\ V$ $V_{CE} = 45\ V$	5.8 0.9			A A
$E_{s/b}$	Second breakdown energy	$V_{BE} = -4\ V$, $R_{BE} = 20\ \Omega$ $L = 180\ \mu H$	20			mJ

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

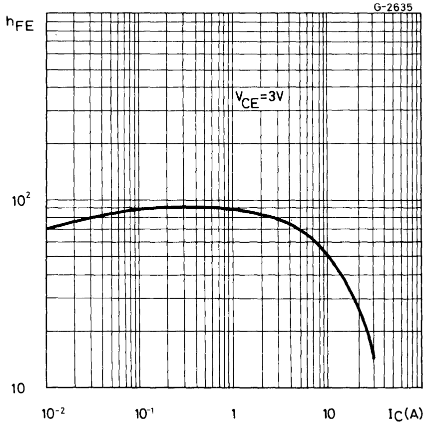
Safe operating areas



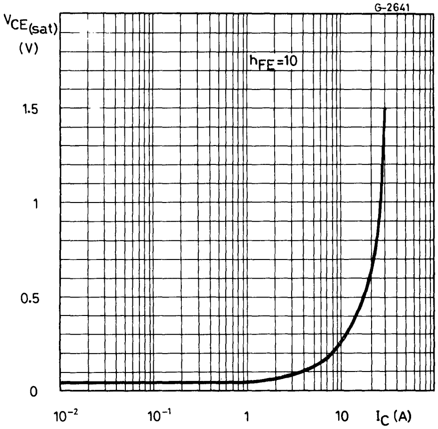
DC transconductance



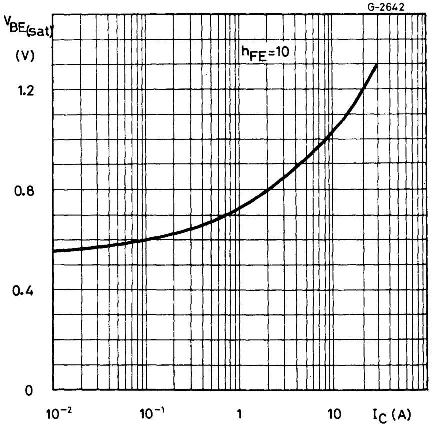
DC current gain



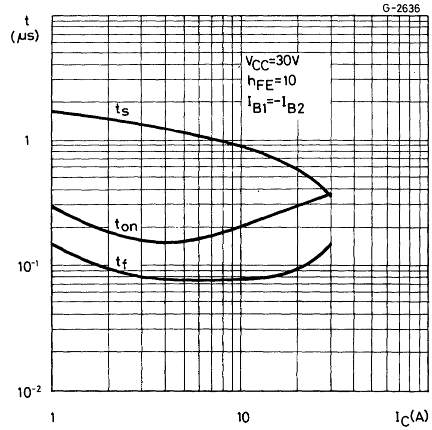
Collector-emitter saturation voltage



Base-emitter saturation voltage



Saturated switching characteristics



2N5679
2N5680

EPITAXIAL PLANAR PNP

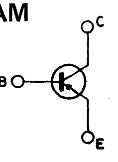
PNP SILICON TRANSISTORS

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	

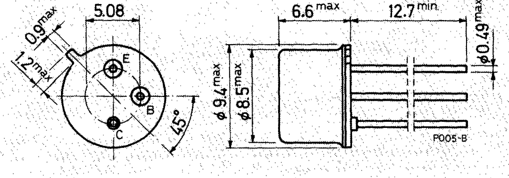
INTERNAL SCHEMATIC DIAGRAM



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	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%.

2N5681
2N5682

EPITAXIAL PLANAR NPN

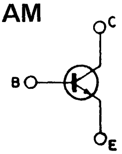
GENERAL PURPOSE TRANSISTORS

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	

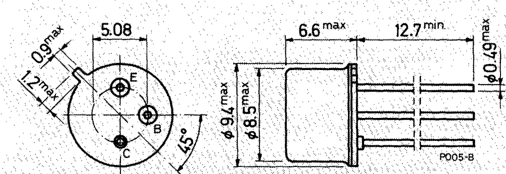
INTERNAL SCHEMATIC DIAGRAM



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	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%.

2N5875
2N5876

EPITAXIAL-BASE PNP

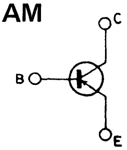
SILICON HIGH POWER TRANSISTORS

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	

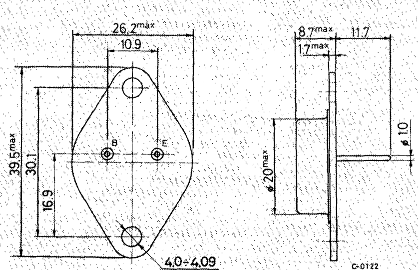
INTERNAL SCHEMATIC DIAGRAM



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)

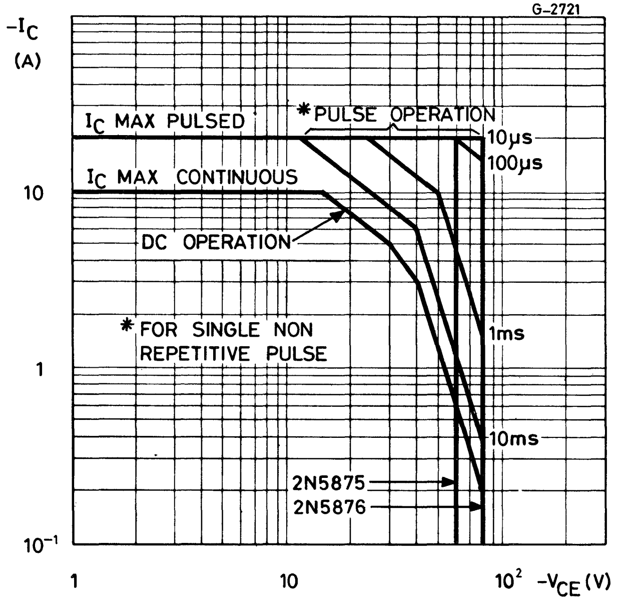
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N5875** $V_{CB} = -60V$ for **2N5876** $V_{CB} = -80V$			-0.5 -0.5	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N5875** $V_{CE} = -30V$ for **2N5876** $V_{CE} = -40V$			-1 -1	mA mA
I_{CEX}	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)

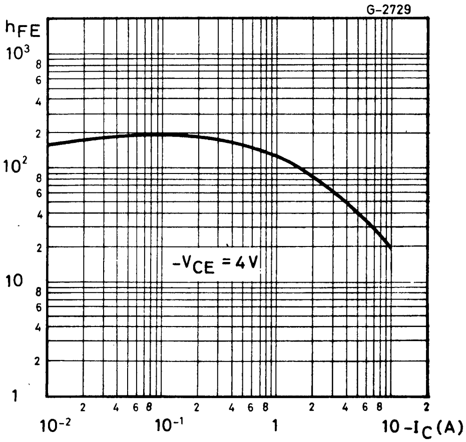
Parameter		Test conditions	Min.	Typ.	Max.	Unit
h_{FE}*	DC current gain	I_C = -4A V_{CE} = -4V I_C = -10A V_{CE} = -4V	20 4		100	— —
f_T	Transition frequency	I_C = -0.5A V_{CE} = -10V	4			MHz
C_{CBO}	Collector-base capacitance	V_{CB} = -10V f = 1 MHz I_E = 0			500	pF
t_r	Rise time	I_C = -4A V_{CC} = -30V 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%

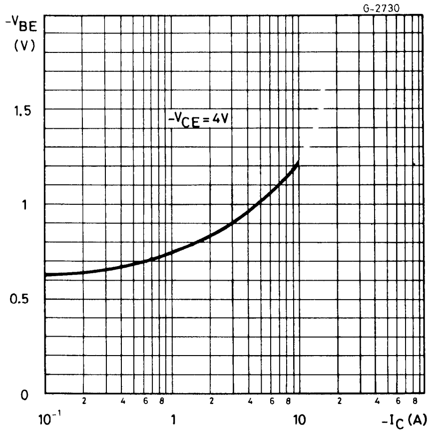
Safe operating areas



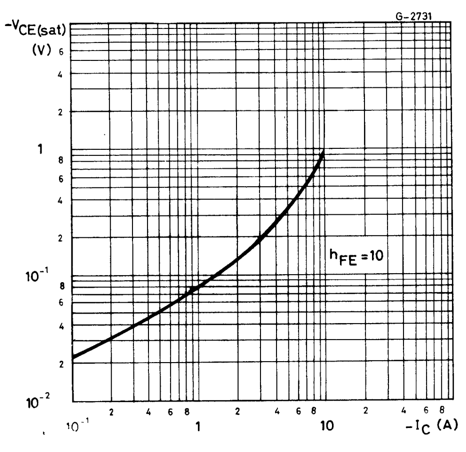
DC current gain



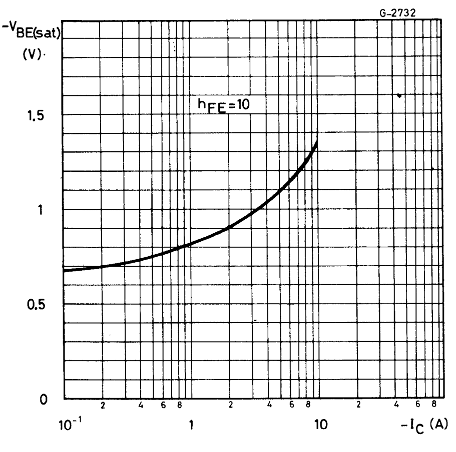
DC transconductance



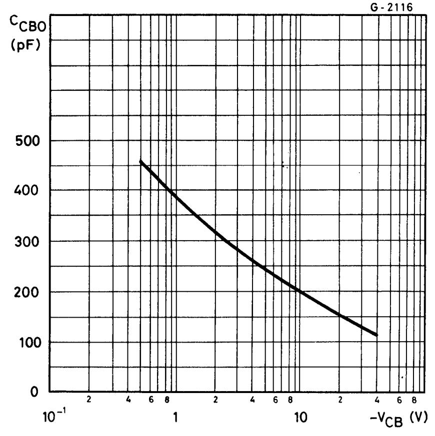
Collector-emitter saturation voltage



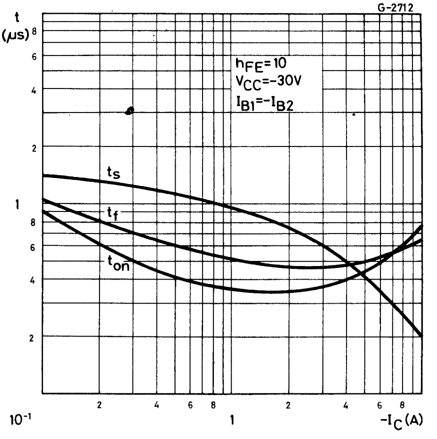
Base-emitter saturation voltage



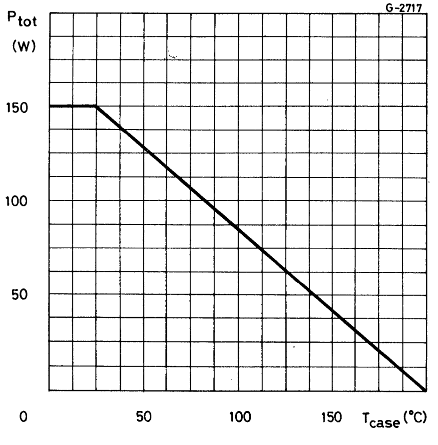
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN

2N5877
2N5878

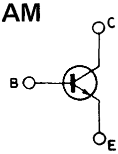
SILICON HIGH POWER TRANSISTORS

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

		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 $T_{case} \leqslant 25°C$	150W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

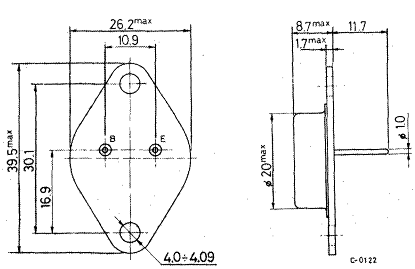
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

2N5877
2N5878

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)

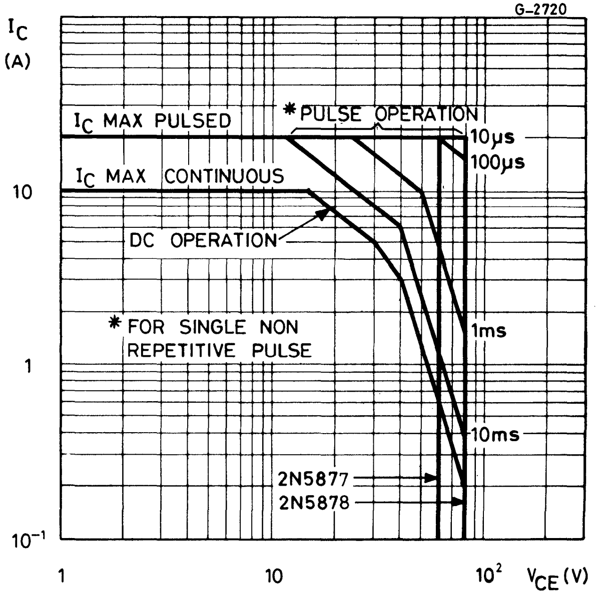
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **2N5877** V_{CB} = 60V for **2N5878** V_{CB} = 80V			0.5 0.5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N5877** V_{CE} = 30V for **2N5878** V_{CE} = 40V			1 1	mA mA
I_{CEX}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N5877** V_{CE} = 60V for **2N5878** V_{CE} = 80V T_{case} = 150 °C for **2N5877** V_{CE} = 60V for **2N5878** 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_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			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%

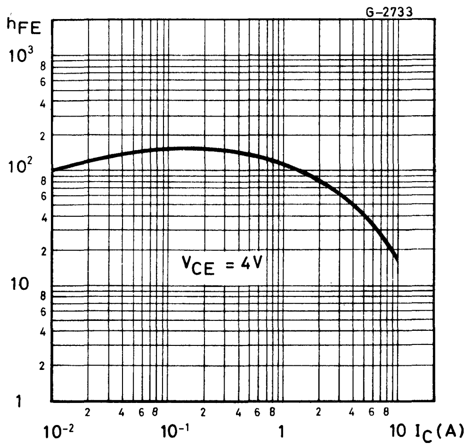
Safe operating areas



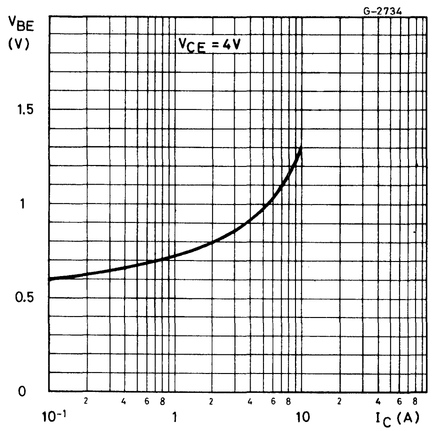
SGS

2N5877
2N5878

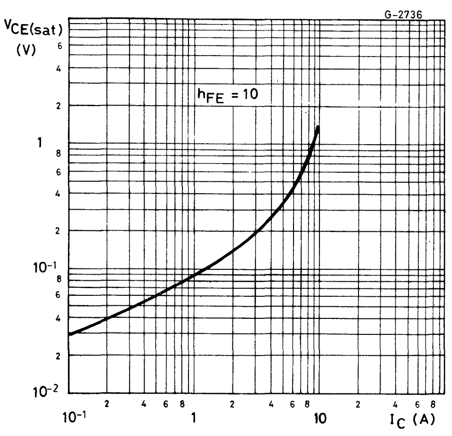
DC current gain



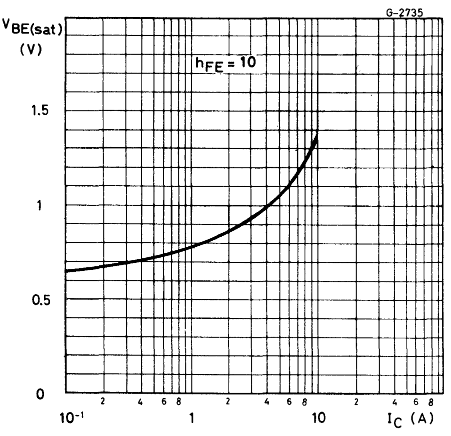
DC transconductance



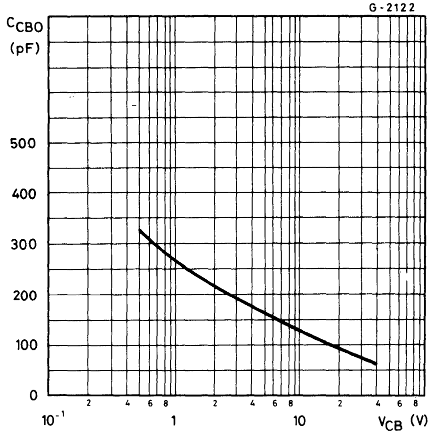
Collector-emitter saturation voltage



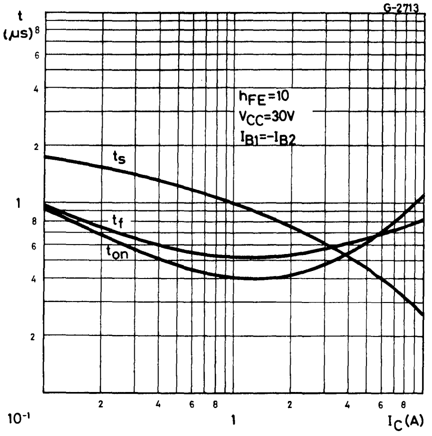
Base-emitter saturation voltage



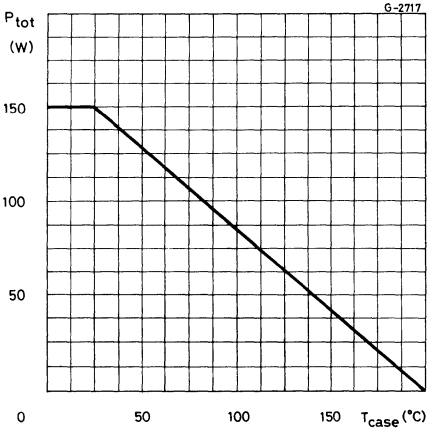
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N6032
2N6033

MULTIEPITAXIAL PLANAR NPN

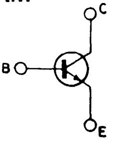
HIGH CURRENT, HIGH SPEED, HIGH POWER TRANSISTORS

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

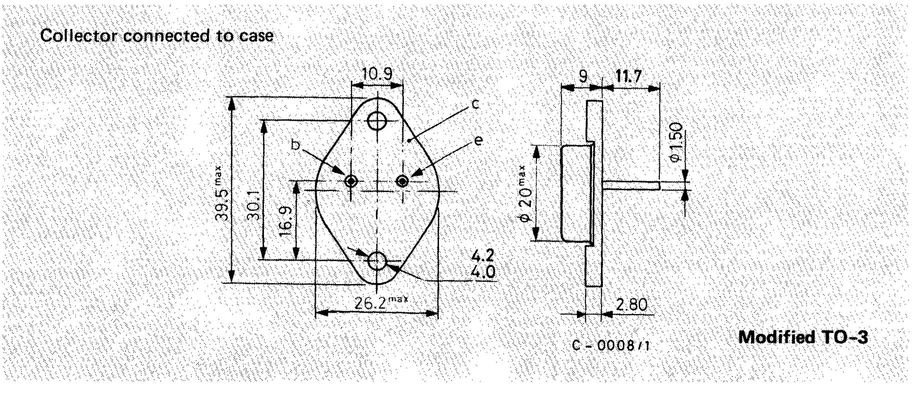
		2N6032	2N6033
V_{CBO}	Collector-base voltage ($I_E = 0$)	120V	150V
V_{CEX}	Collector-emitter voltage ($V_{BE} = -1.5$ V, $R_{BE} = 50\ \Omega$)	120V	150V
V_{CER}	Collector-emitter voltage ($R_{BE} = 50\ \Omega$)	110V	140V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90	120V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7V	7V
I_C	Collector current	50A	40A
I_B	Base current	10A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	140W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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)

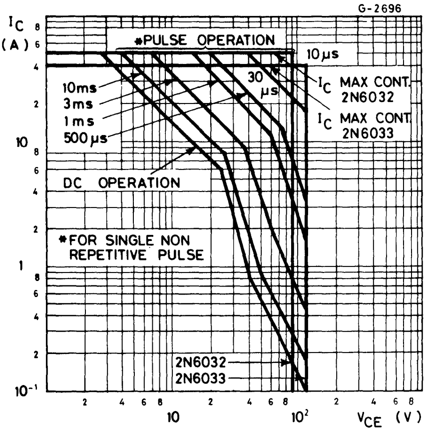
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N6032**				
		V_{CE} = 110V			12	mA
		V_{CE} = 100V T_{case} = 150°C			15	mA
		for **2N6033**				
		V_{CE} = 135V			10	mA
		V_{CE} = 100V T_{case} = 150°C			10	mA
I_{CEO}	Collector cutoff current (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, L=2mH)	I_C = 200 mA				
		for **2N6032**	120			V
		for **2N6033**	150			V
$V_{CER\ (sus)}$*	Collector-emitter sustaining voltage (R_{BE}=50Ω, L=15mH)	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)

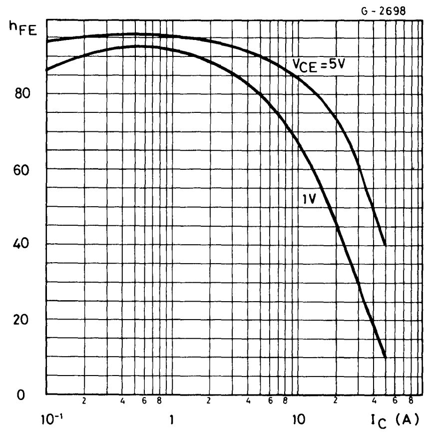
Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_{BE}*	Base-emitter voltage	for **2N6032** I_C = 50 A V_{CE} = 2 V			2	V
		for **2N6033** I_C = 40 A V_{CE} = 2 V			2	V
h_{FE}*	DC current gain	for **2N6032** I_C = 50 A V_{CE} = 2.6 V	10		50	—
		for **2N6033** I_C = 40 A V_{CE} = 2 V	10		50	—
h_{fe}	Small-signall 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

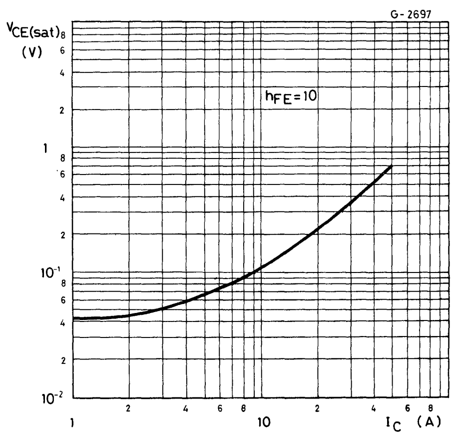
Safe operating areas



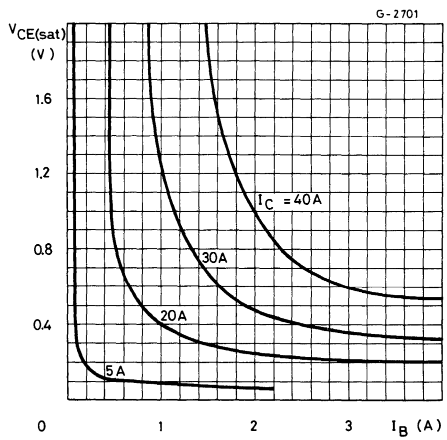
DC current gain



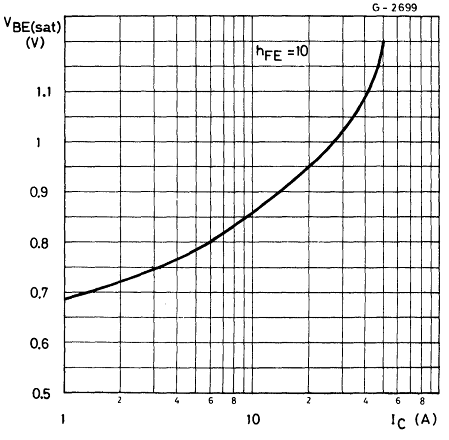
Collector-emitter saturation voltage



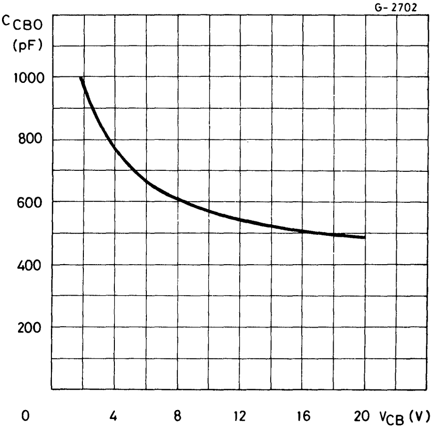
Collector-emitter saturation voltage



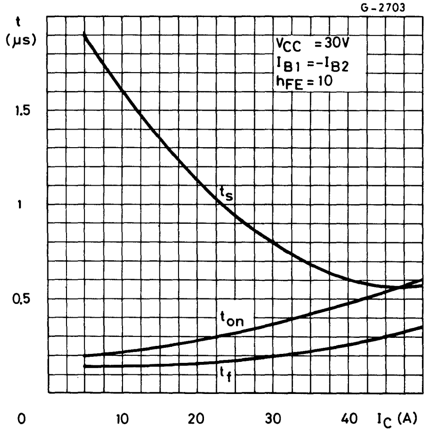
Base-emitter saturation voltage



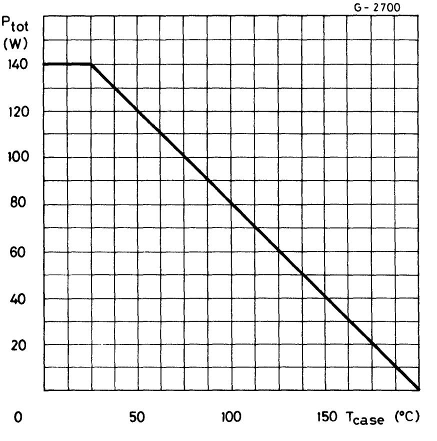
Collector-base capacitance



Saturated switching characteristics



Power rating chart



2N6034
2N6035
2N6036

EPITAXIAL-BASE PNP

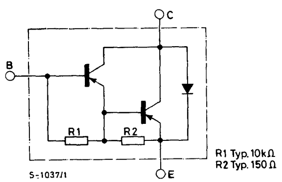
MEDIUM POWER DARLINGTONS

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

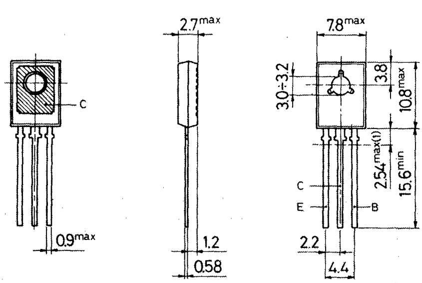
		2N6034	2N6035	2N6036
V_{CBO}	Collector-base voltage ($I_E = 0$)	-40V	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-40V	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5V	
I_C	Collector current		-4A	
I_{CM}	Collector peak current		-8A	
I_B	Base current		-100mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

THERMAL DATA

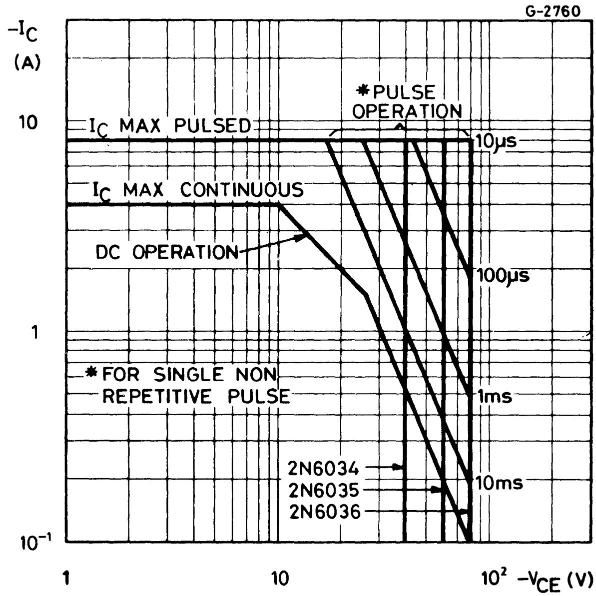
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	83.3	°C/W

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

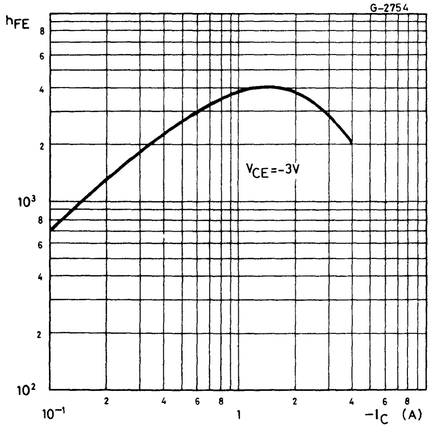
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6034**	V_{CB} = -40V			-500	μA
		for **2N6035**	V_{CB} = -60V			-500	μA
		for **2N6036**	V_{CB} = -80V			-500	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6034**	V_{CE} = -20V			-500	μA
		for **2N6035**	V_{CE} = -30V			-500	μA
		for **2N6036**	V_{CE} = -40V			-500	A
I_{CEX}	Collector cutoff current (V_{EB} = -1.5V)	for **2N6034**	V_{CE} = -40V			-0.5	mA
		for **2N6035**	V_{CE} = -60V			-0.5	mA
		for **2N6036**	V_{CE} = -80V			-0.5	mA
		T_{case} = 125 °C					
		for **2N6034**	V_{CE} = -40V			-2	mA
		for **2N6035**	V_{CE} = -60V			2	mA
		for **2N6036**	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 **2N6034**	-40			V
			for **2N6035**	-60			V
			for **2N6036**	-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 = -0.75 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%

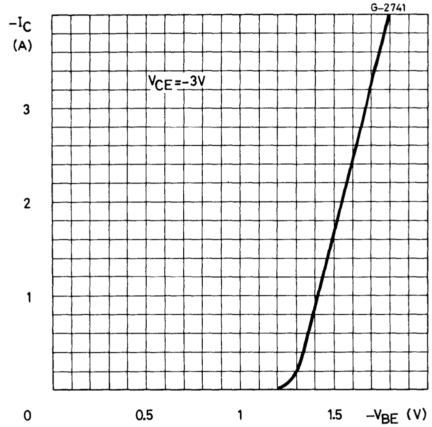
Safe operating areas



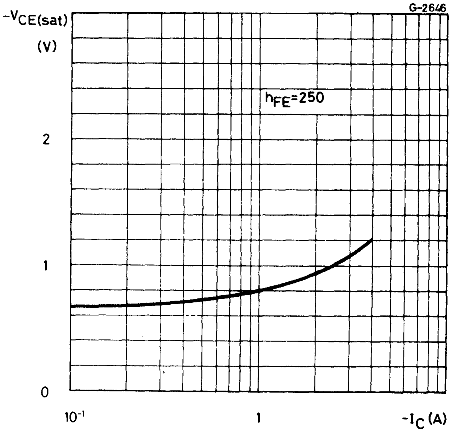
DC current gain



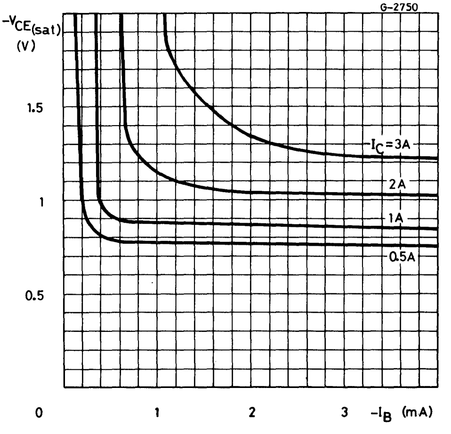
DC transconductance



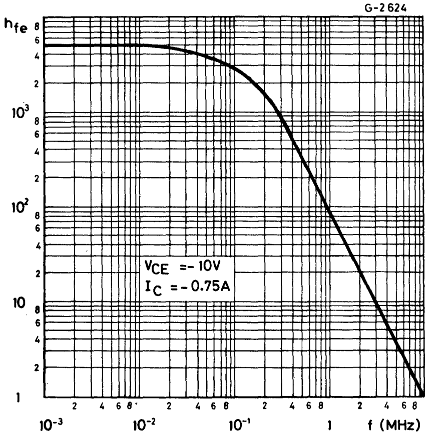
Collector-emitter saturation voltage



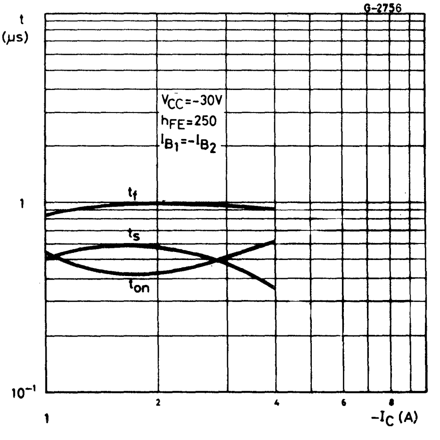
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



EPITAXIAL-BASE NPN

2N6037
2N6038
2N6039

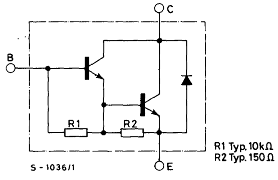
MEDIUM POWER DARLINGTONS

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

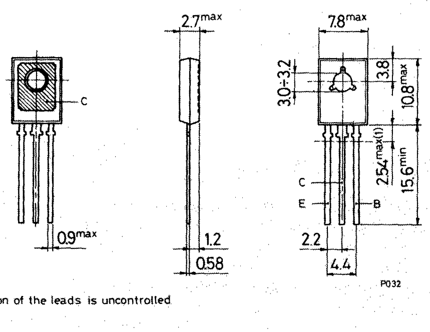
		2N6037	2N6038	2N6039
V_{CBO}	Collector-base voltage ($I_E = 0$)	40V	60V	80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40V	60V	80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5V	
I_C	Collector current		4A	
I_{CM}	Collector peak current		8A	
I_B	Base current		100mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150°C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



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

TO-126 (SOT-32)

SGS **2N6037 2N6038 2N6039**

THERMAL DATA

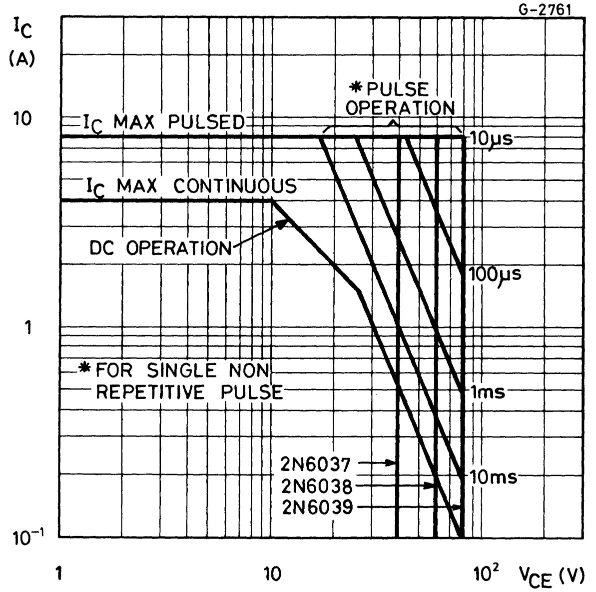
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	83.3	°C/W

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

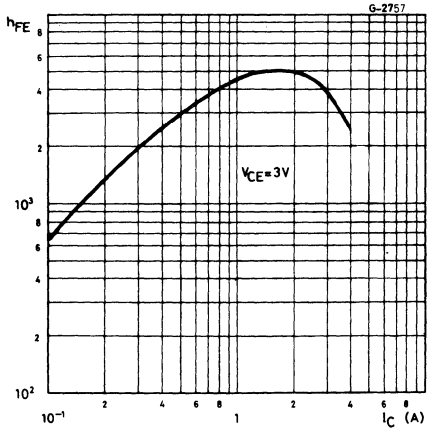
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6037** V_{CB} = 40V for **2N6038** V_{CB} = 60V for **2N6039** V_{CB} = 80V			500 500 500	μA μA μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6037** V_{CE} = 20V for **2N6038** V_{CE} = 30V for **2N6039** V_{CE} = 40V			500 500 500	μA μA μA
I_{CEX}	Collector cutoff current (V_{EB} = 1.5V)	for **2N6037** V_{CE} = 40V for **2N6038** V_{CE} = 60V for **2N6039** V_{CE} = 80V T_{case} = 125 °C for **2N6037** V_{CE} = 40V for **2N6038** V_{CE} = 60V for **2N6039** 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 **2N6037** for **2N6038** for **2N6039**	 40 60 80			 V V V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 2A I_B = 8mA I_C = 4A 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 V_{CE} = 3V I_C = 2A V_{CE} = 3V I_C = 4A V_{CE} = 3V	500 750 100		 15000 	— — —
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%

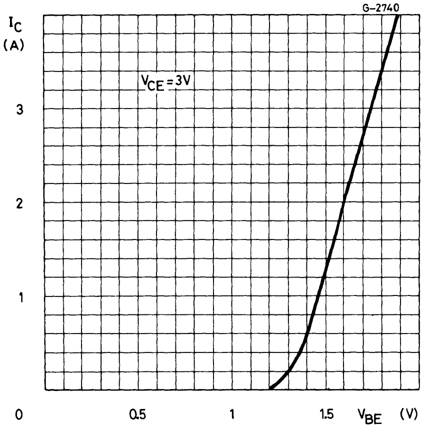
Safe operating areas



DC current gain

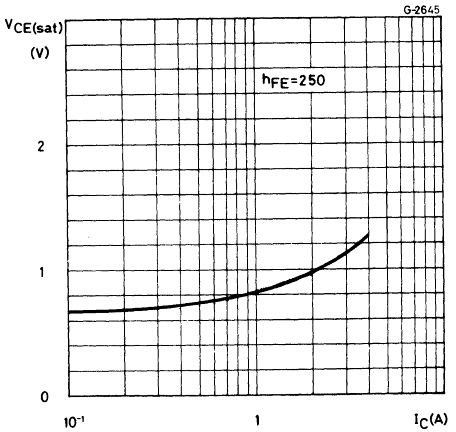


DC transconductance

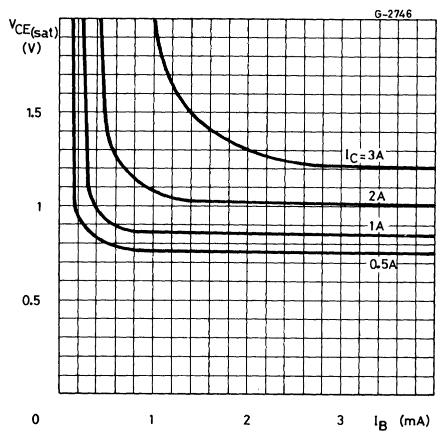


2N6037
2N6038
2N6039

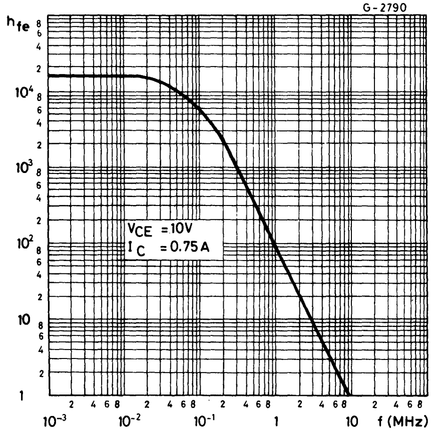
Collector-emitter saturation voltage



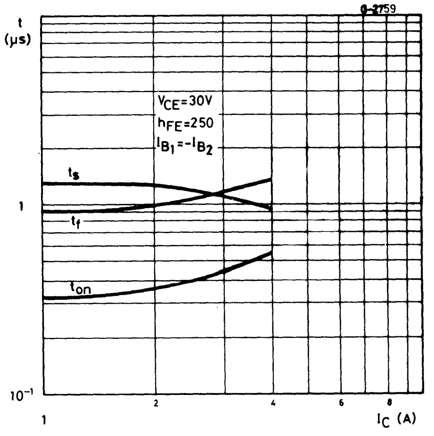
Collector-emitter saturation voltage



Small signal current gain



Saturated switching characteristics



2N6050
2N6051
2N6052

EPITAXIAL-BASE PNP

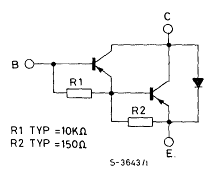
POWER DARLINGTONS

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	

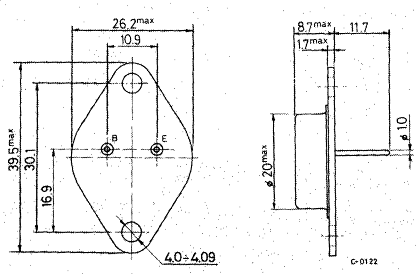
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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SGS 2N6050 2N6051 2N6052

THERMAL DATA

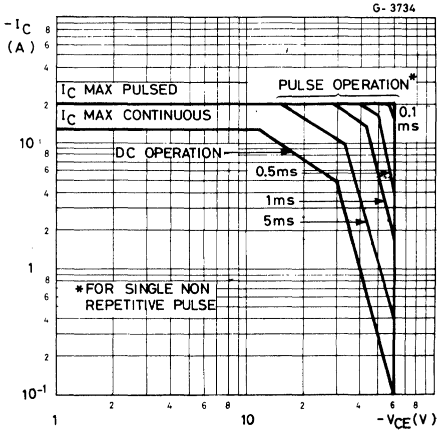
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

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

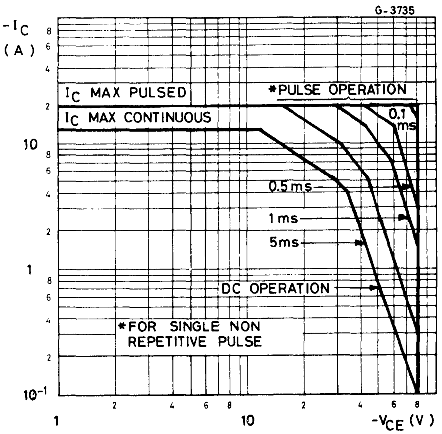
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6050** V_{CE} = -30V for **2N6051** V_{CE} = -40V for **2N6052** V_{CE} = -50V			-1 -1 -1	mA mA mA
I_{CEX}	Collector cutoff current (V_{EB} = -1.5V)	for **2N6050** V_{CE} = -60V for **2N6051** V_{CE} = -80V 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%

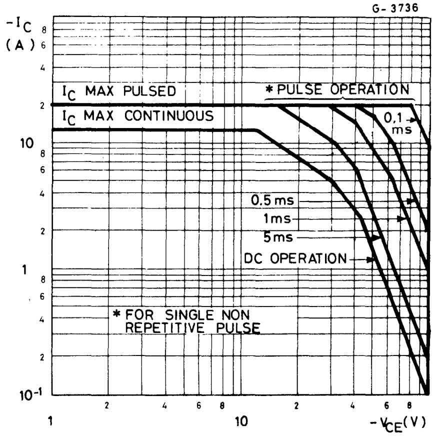
Safe operating areas for 2N6050



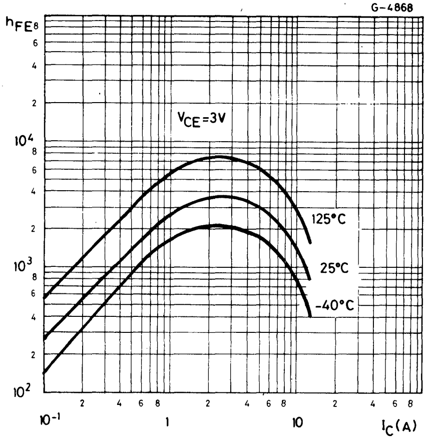
Safe operating areas for 2N6051



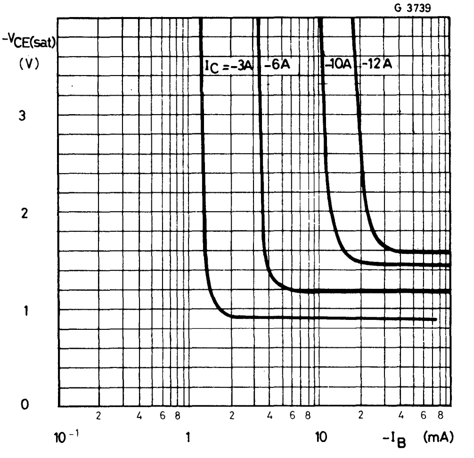
Safe operating areas for 2N6052



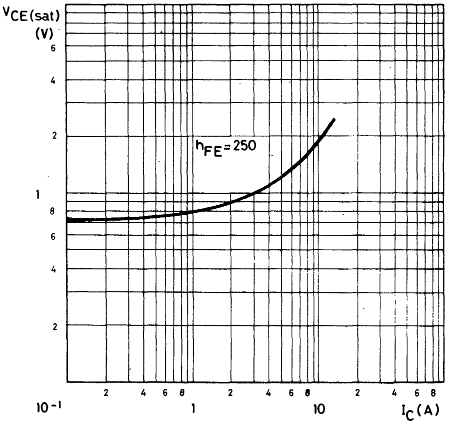
DC current gain



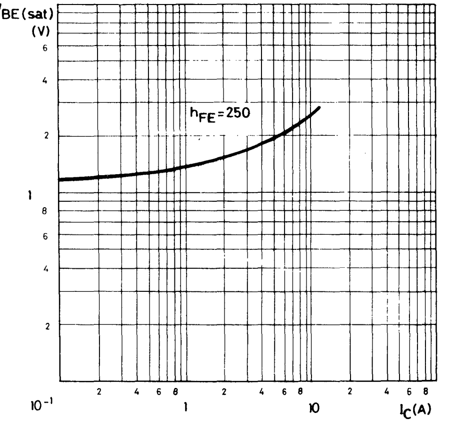
Collector-emitter saturation voltage



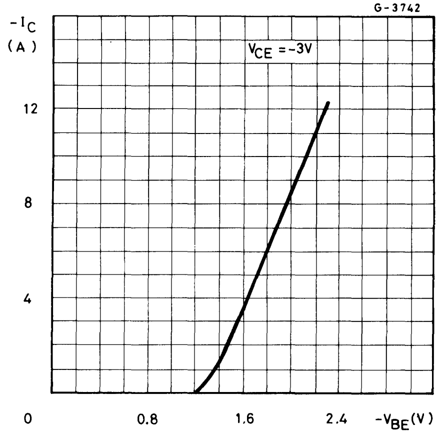
Collector-emitter saturation voltage



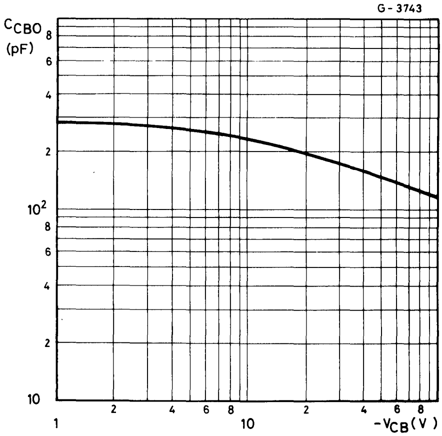
Base-emitter saturation voltage



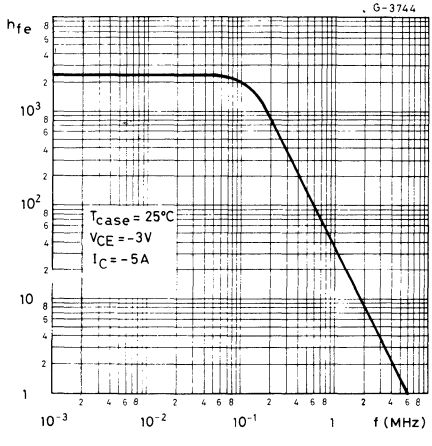
DC transconductance



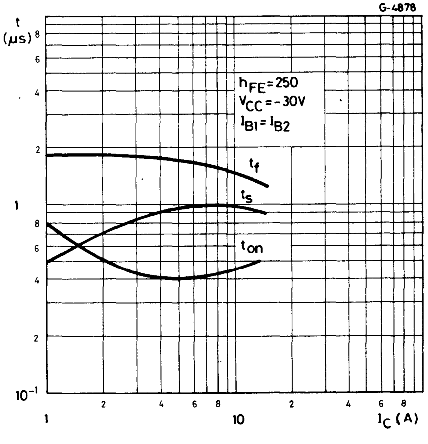
Collector-base capacitance



Small signal current gain



Saturated switching characteristics



SGS **2N6053 2N6054**

EPITAXIAL-BASE PNP

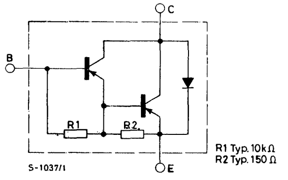
POWER DARLINGTONS

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

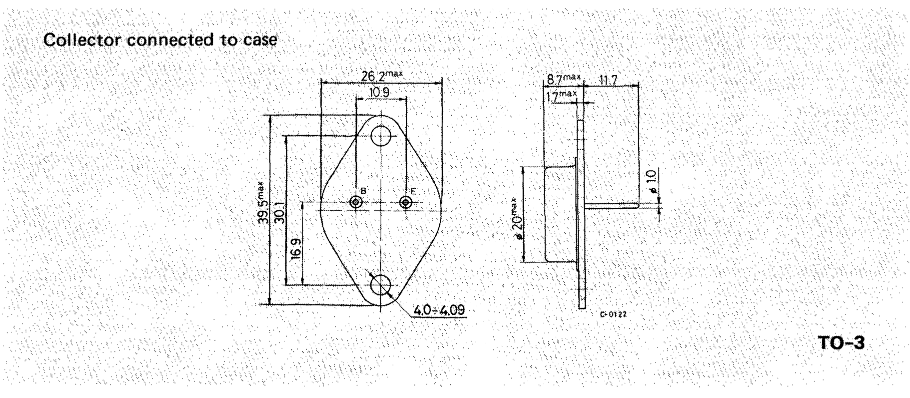
		2N6053	2N6054
V_{CBO}	Collector-base voltage ($I_E = 0$)	-60V	-80V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60V	-80V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5V	
I_C	Collector current	-8A	
I_{CM}	Collector peak current	-16A	
I_B	Base current	-120mA	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	100W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm



THERMAL DATA

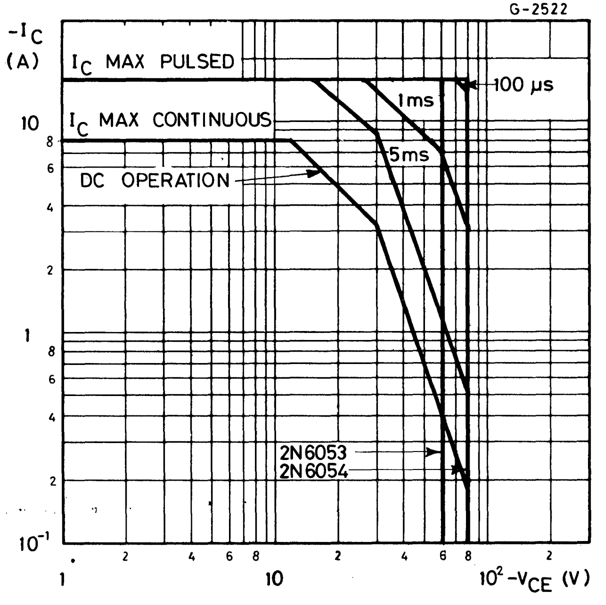
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.75	°C/W

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

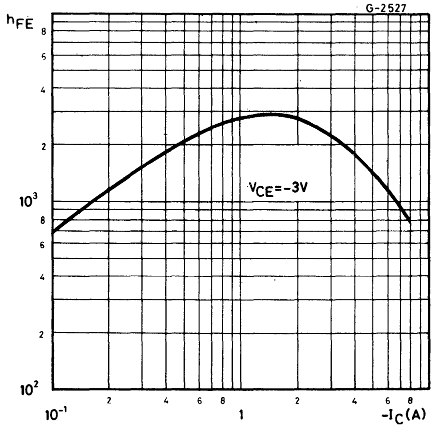
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = 1.5V)	for **2N6053** V_{CE} = -60V for **2N6054** V_{CE} = -80V T_{case} = 150 °C for **2N6053** V_{CE} = -60V for **2N6054** V_{CE} = -80V			-500 -500 -5 -5	μA μA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	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%

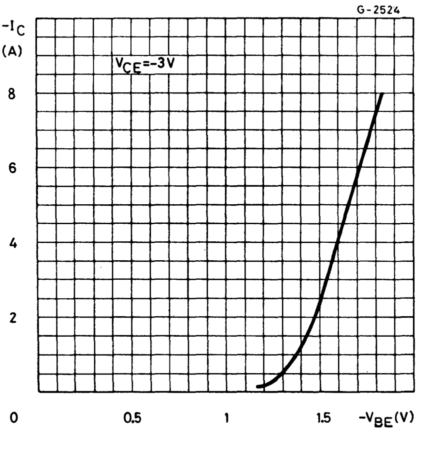
Safe operating areas



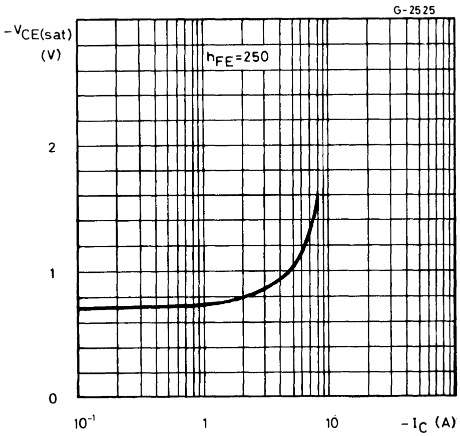
DC current gain



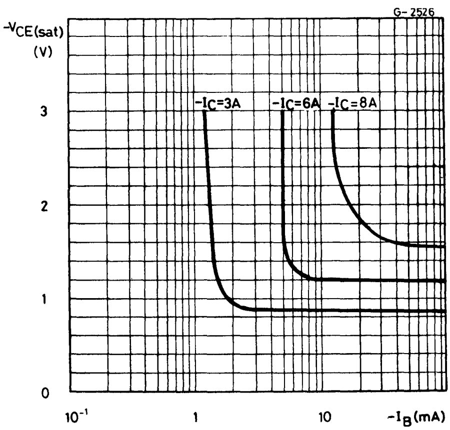
DC transconductance



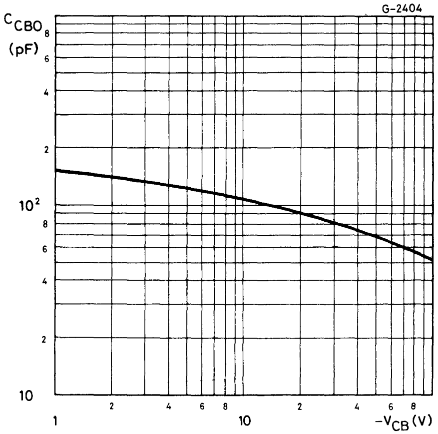
Collector-emitter saturation voltage



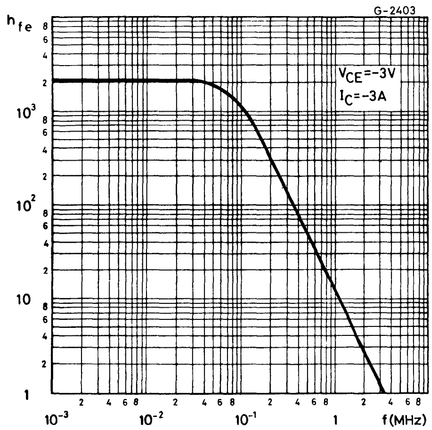
Collector-emitter saturation voltage



Collector-base capacitance



Small signal current gain



2N6055
2N6056

EPITAXIAL-BASE NPN

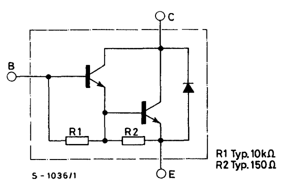
POWER DARLINGTONS

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 $T_{case} \leqslant 25°C$	100W	
T_{stg}	Storage temperature	-65 to 200°C	
T_j	Junction temperature	200°C	

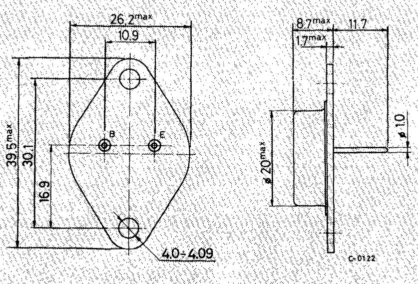
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

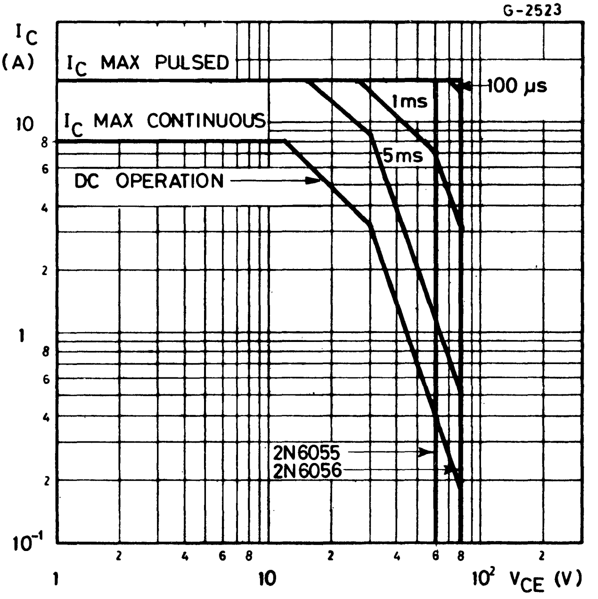
$R_{th\ j-case}$	Thermal resistance junction-case	max	1.75	°C/W

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

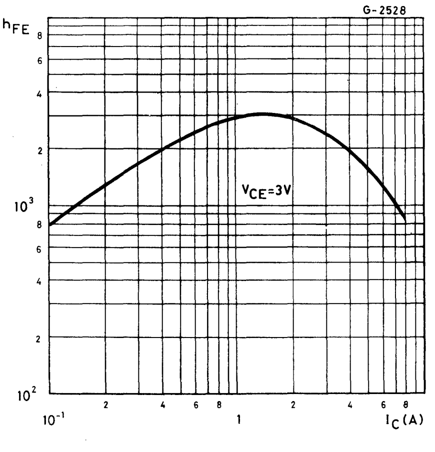
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Collector cutoff current (V_{BE} = -1.5V)	for **2N6055** V_{CE} = 60V for **2N6056** V_{CE} = 80V T_{case} = 150 °C for **2N6055** V_{CE} = 60V for **2N6056** V_{CE} = 80V			500 500 5 5	μA μA mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **2N6055** 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%

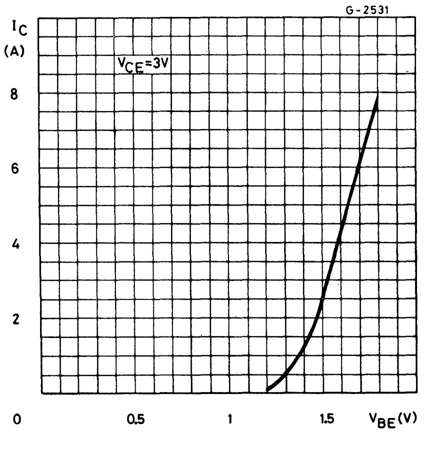
Safe operating areas



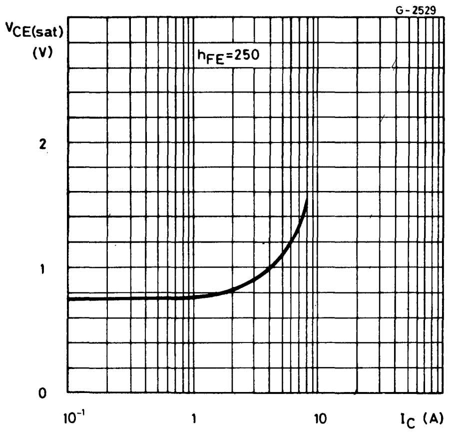
DC current gain



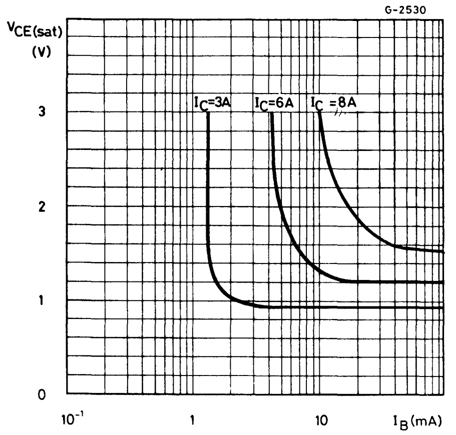
DC transconductance



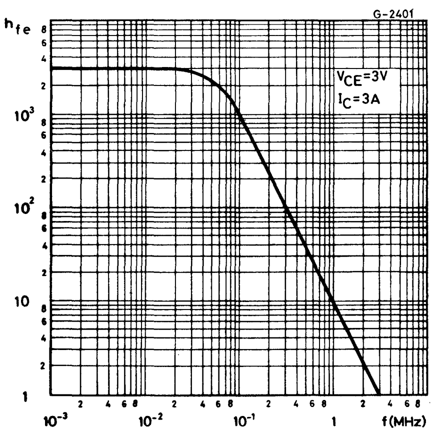
Collector-emitter saturation voltage



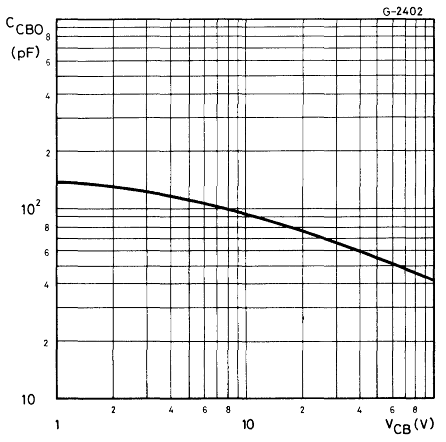
Collector-emitter saturation voltage



Small signal current gain



Collector-base capacitance



2N6057
2N6058
2N6059

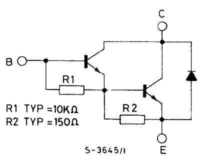
EPITAXIAL-BASE NPN

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	

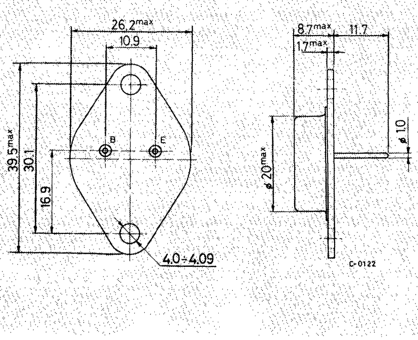
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

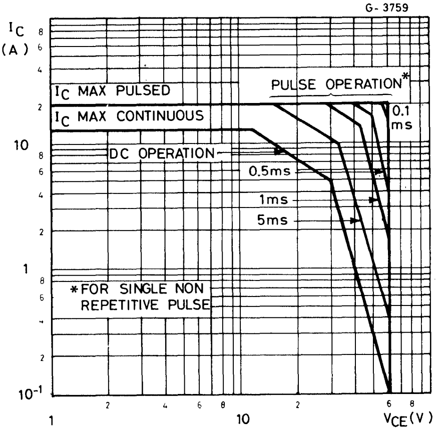
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.17	°C/W

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

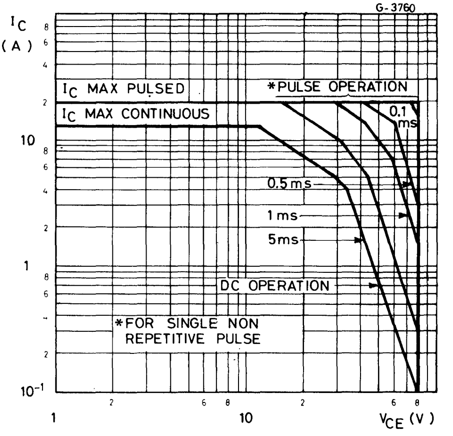
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEO}	Collector cutoff current (I_B=0)	for **2N6057**	V_{CE}=30V			1	mA
		for **2N6058**	V_{CE}=40V			1	mA
		for **2N6059**	V_{CE}=50V			1	mA
I_{CEX}	Collector cutoff current (V_{BE}=0)	for **2N6057**	V_{CE}=60V			0.5	mA
		for **2N6058**	V_{CE}=80V			0.5	mA
		for **2N6059**	V_{CE}=100V			0.5	mA
		T_{case}=150°C					
		for **2N6057**	V_{CE}=60V			5	mA
		for **2N6058**	V_{CE}=80V			5	mA
		for **2N6059**	V_{CE}=100V			5	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**		60			V
		for **2N6058**		80			V
		for **2N6059**		100			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C =6A	I_B =24mA			2	V
		I_C =12A	I_B =120mA			3	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	750		18000	—
		I_C =12A	V_{CE}=3V	100			—
h_{fe}	Small signal current gain	I_C =5A, f =1MHz	V_{CE}=3V	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%

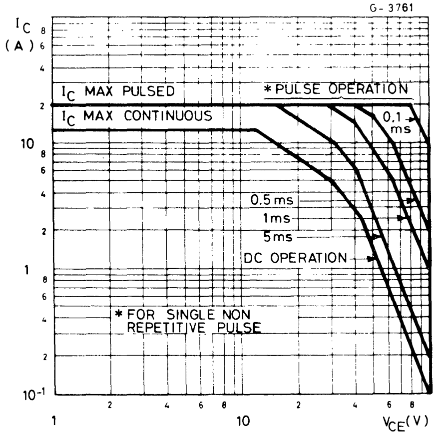
Safe operating areas for 2N6057



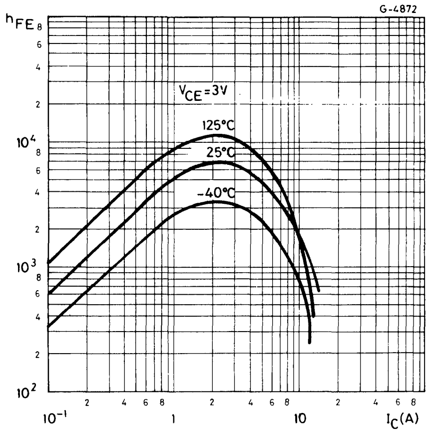
Safe operating areas for 2N6058



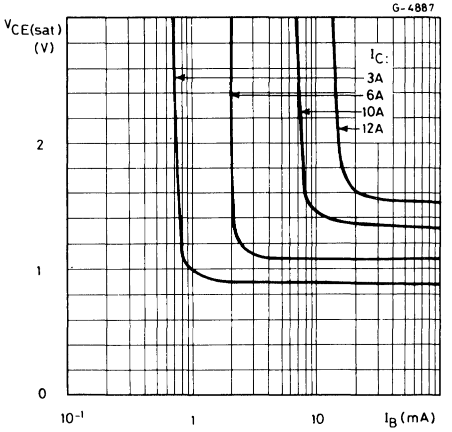
Safe operating areas for 2N6059



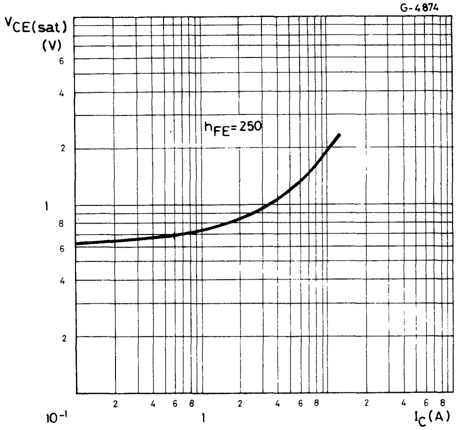
DC current gain



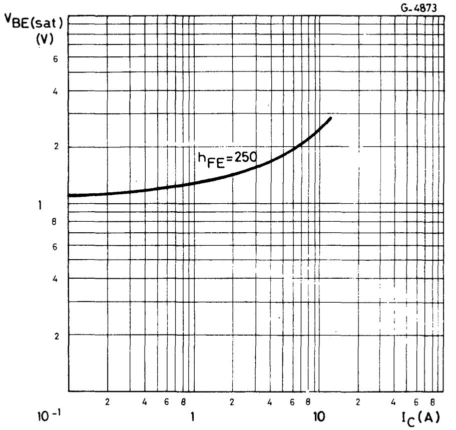
Collector-emitter saturation voltage



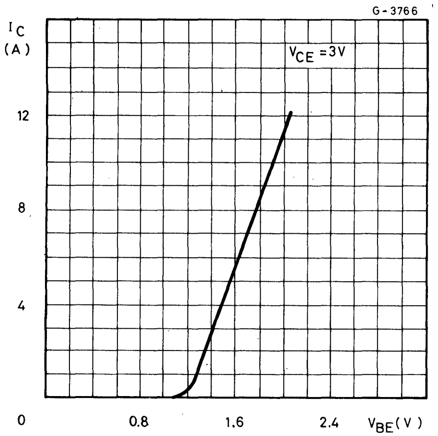
Collector-emitter saturation voltage



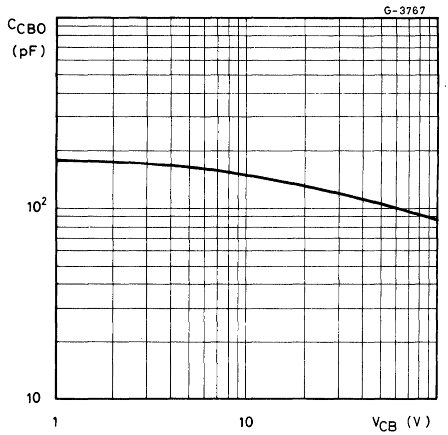
Base-emitter saturation voltage



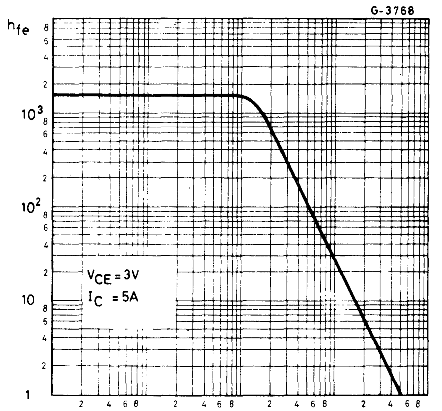
DC transconductance



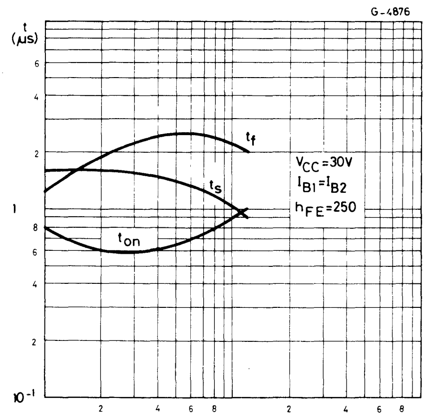
Collector-emitter saturation voltage



Small signal current gian



Saturated switching characteristics



2N6107 / 2N6292
2N6109 / 2N6290
2N6111 / 2N6288

EPITAXIAL-BASE NPN/PNP

GENERAL PURPOSE COMPLEMENTARY PAIRS

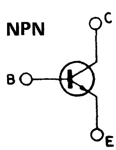
The 2N 6107, 2N 6109, 2N 6111, 2N 6288, 2N 6290 and 2N 6292 are epitaxial-base silicon transistors in Jedec TO-220 plastic package. They are intended for a wide variety of medium power switching and linear applications.
The PNP types are the 2N 6107, 2N 6109, 2N 6111 and their complementary NPN types are the 2N 6292, 2N 6290 and 2N 6288 respectively.

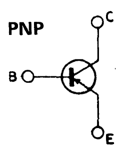
ABSOLUTE MAXIMUM RATINGS

		2N6107	2N6109	2N6111
	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 $T_{case} \leq 25$ °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

INTERNAL SCHEMATIC DIAGRAMS

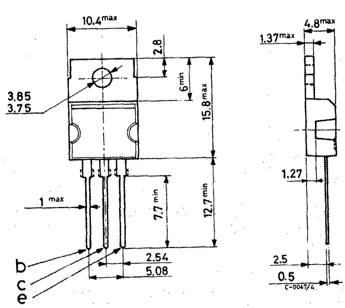
NPN


PNP


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 / 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

2N6121
2N6122
2N6123

EPITAXIAL-BASE NPN

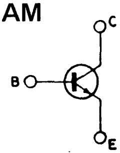
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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 $T_{case} \leq 25°C$		40W	
T_{stg}	Storage temperature		-65 to 150°C	
T_j	Junction temperature		150 °C	

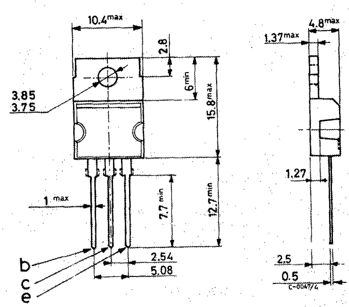
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

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2N6121
2N6122
2N6123

THERMAL DATA

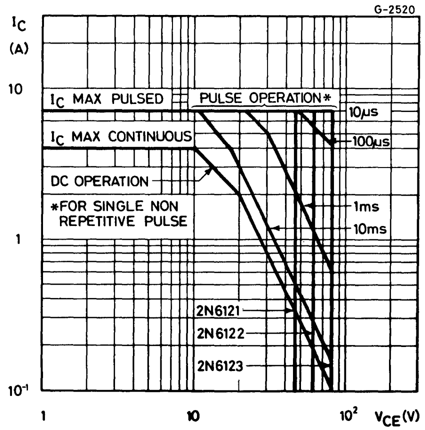
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance juntion-ambient	max	70	°C/W

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

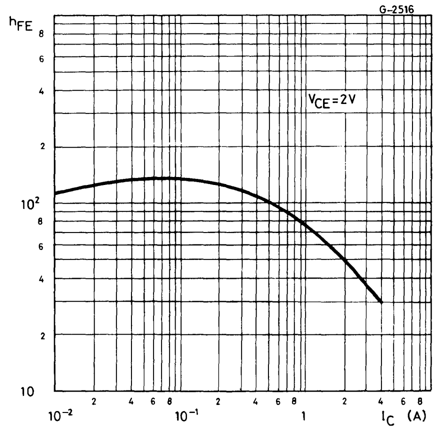
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6121**	V_{CB} = 45 V			100	μA
		for **2N6122**	V_{CB} = 60 V			100	μA
		for **2N6123**	V_{CB} = 80 V			100	μA
I_{CEX}	Collector cutoff current (V_{BE} = -1.5V)	for **2N6121**	V_{CE} = 45 V			100	μA
		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%

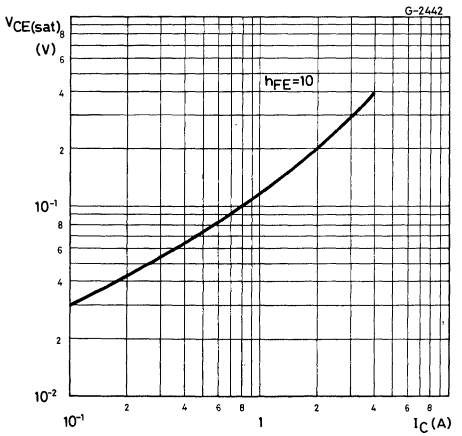
Safe operating areas



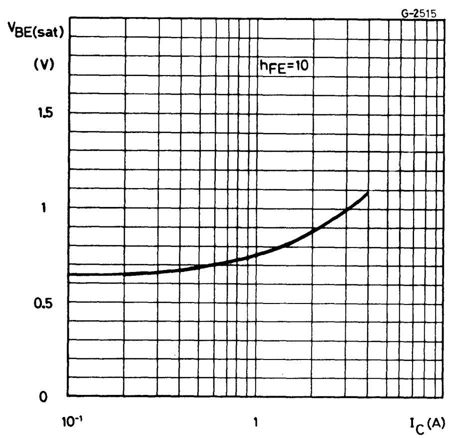
DC current gain



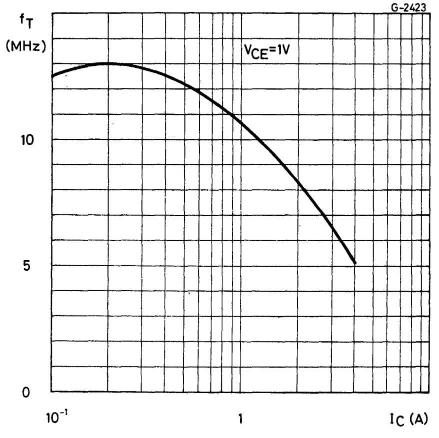
Collector-emitter saturation voltage



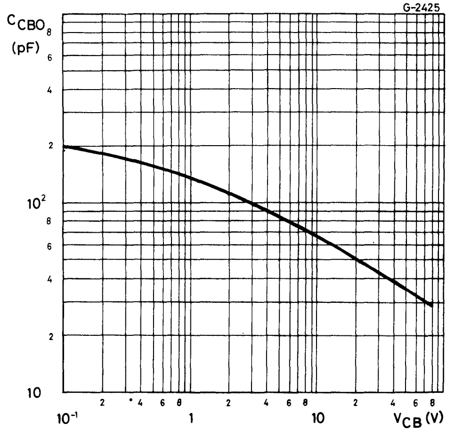
Base-emitter saturation voltage



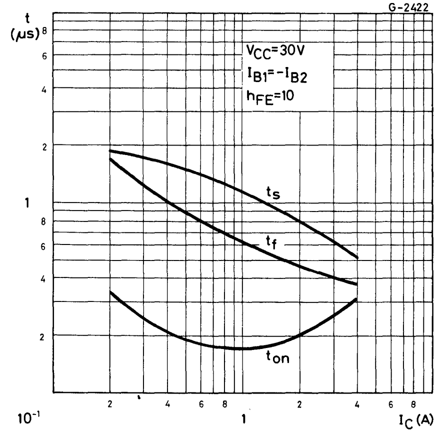
Transition frequency



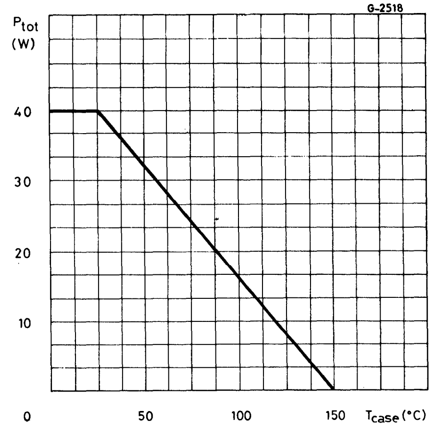
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE PNP

2N6124
2N6125
2N6126

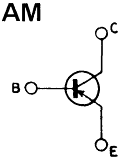
MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

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	

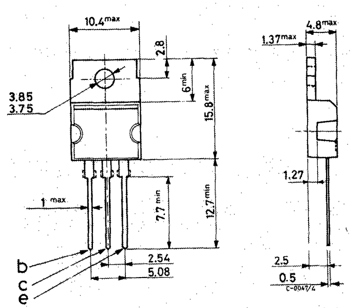
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

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2N6124
2N6125
2N6126

THERMAL DATA

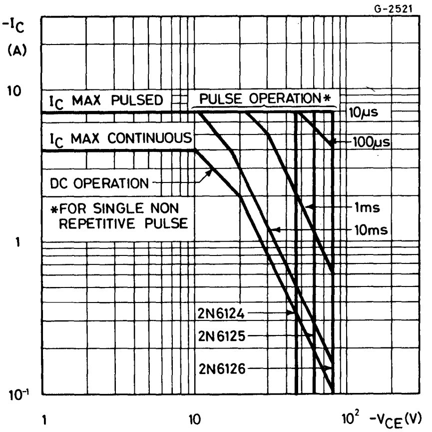
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance juntion-ambient	max	70	°C/W

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

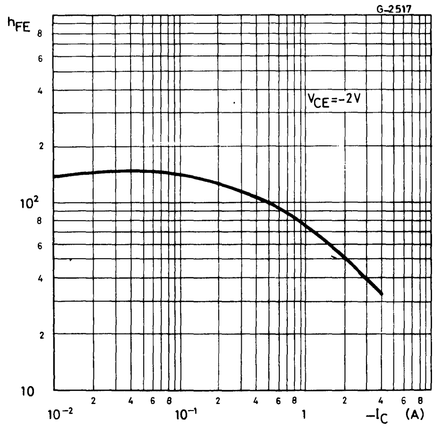
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **2N6124**	V_{CB} = -45 V			-100	µA
		for **2N6125**	V_{CB} = -60 V			-100	µA
		for **2N6126**	V_{CB} = -80 V			-100	µA
I_{CEX}	Collector cutoff current ($V_{BE} = 1.5V$)	for **2N6124**	V_{CE} = -45 V			-100	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%

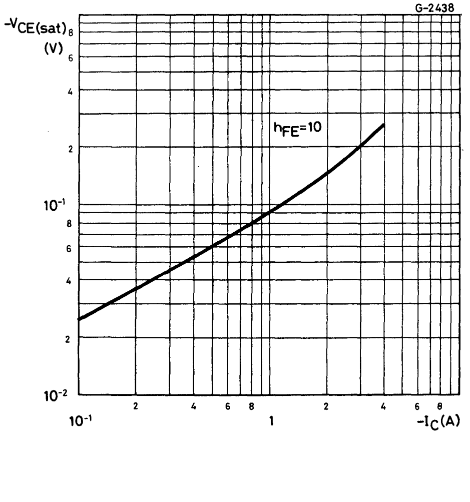
Safe operating areas



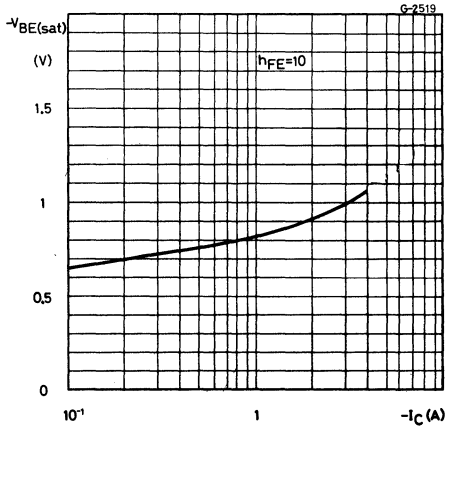
DC current gain



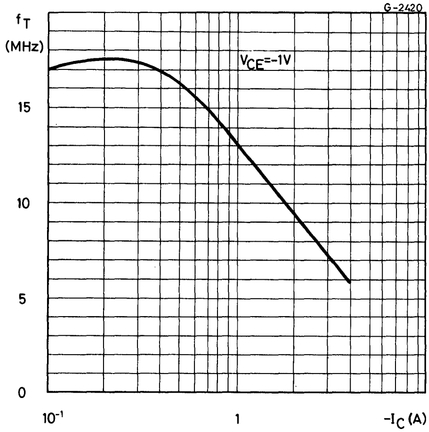
Collector-emitter saturation voltage



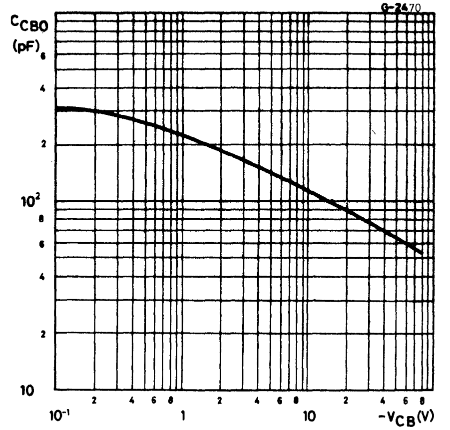
Base-emitter saturation voltage



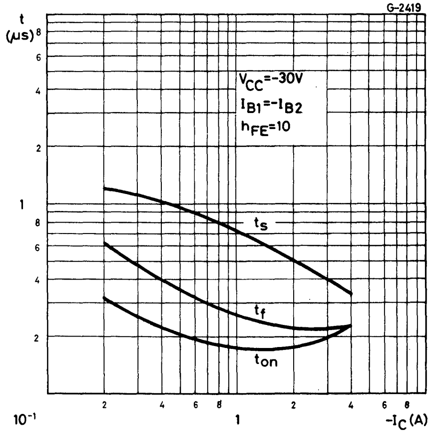
Transition frequency



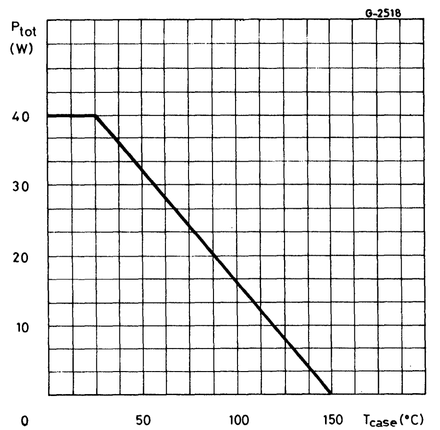
Collector-base capacitance



Saturated switching characteristics



Power rating chart



EPITAXIAL-BASE NPN/PNP

GENERAL PURPOSE AMPLIFIER AND SWITCHING APPLICATIONS

The 2N6282, 2N6283 and 2N6284 NPN types and the complementary types are mounted in jedec TO-3 metal case, intended for use in general-purpose amplifier and low-frequency switching applications. The complementary PNP types are 2N6285, 2N6286 and 2N6287.

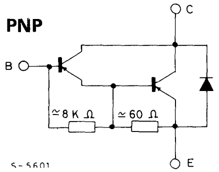
ABSOLUTE MAXIMUM RATINGS

	NPN / * PNP	2N6282 / 2N6285	2N6283 / 2N6286	2N6284 / 2N6287
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		20A	
I_{CM}	Collector peak current ($t_p = 10ms$)		40A	
I_B	Base current		0.5A	
P_{tot}	Total power dissipation at $T_{case} \geq 25°C$		160W	
T_{stg}	Storage temperature		-65 to 200°C	
T_j	Junction temperature		200°C	

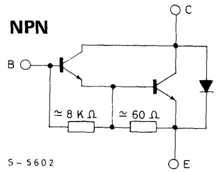
* For PNP types voltage and current values are negative

INTERNAL SCHEMATIC DIAGRAMS

PNP



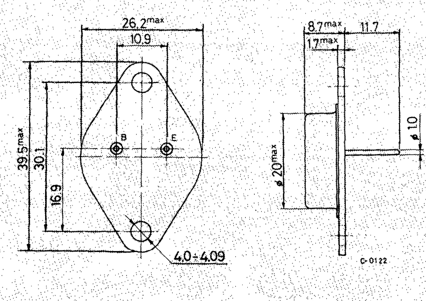
NPN



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

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THERMAL DATA

$R_{th\ j-case}$	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_{CEO}	Collector cutoff current ($I_B = 0$)	for **2N6282/85** $V_{CE} = 30V$ for **2N6283/86** $V_{CE} = 40V$ for **2N6284/87** $V_{CE} = 50V$			1 1 1	mA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{BE} = 5V$			2	mA
I_{CEX}	Collector cutoff current (V_{BE} = 1,5V)	V_{CE} = Rated V_{CBO} V_{CE} = Rated V_{CBO} T_{case} = 150°C			0.5 5	mA mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage	$I_C = 0.1A$ $I_B = 0$ for **2N6282/85** for **2N6283/86** for **2N6284/87**	 60 80 100			 V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 40mA$ $I_C = 20A$ $I_B = 200mA$			2 3	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 20A$ $I_B = 200mA$			4	V
$V_{BE(on)}$*	Base-emitter voltage	$I_C = 10A$ $V_{CE} = 3V$			2.8	V
h_{FE}*	DC current gain	$I_C = 10A$ $V_{CE} = 3V$ $I_C = 20A$ $V_{CE} = 3V$	750 100		18000	–
C_{CBO}	Collector-base capacitance	$V_{CB} = 10V$ $I_E = 0$ f = 0.1MHz for **2N6282/6283/6284** for **2N6285/6286/6287**			 400 600	 pF pF
h_{fe}	Small signal current gain	$I_C = 10A$ $V_{CE} = 3V$ f = 1KHz	300			–

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

For PNP types voltage and current values are negative

MULTIEPITAXIAL PLANAR NPN

2N6354

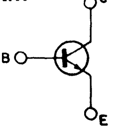
HIGH SPEED SWITCHING APPLICATIONS

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 $T_{case} \leqslant 25$ °C	140	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

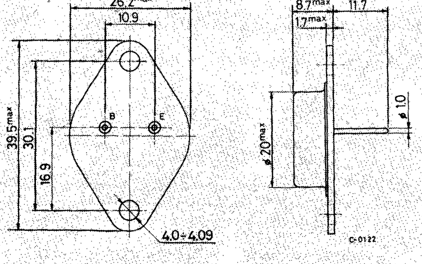
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to case



TO-3

THERMAL DATA

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

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

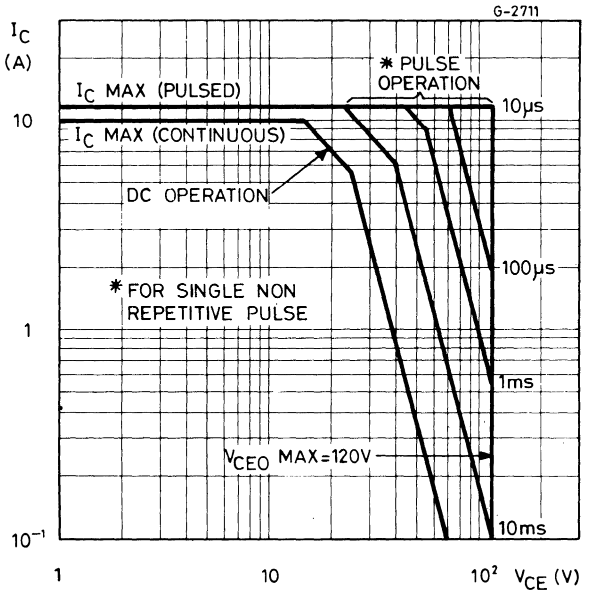
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = 150 V			5	mA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	V_{CE} = 140 V V_{CE} = 140 V T_{case} = 150°C			10 20	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = 100 V			20	mA
I_{EBO}	Emitter 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)

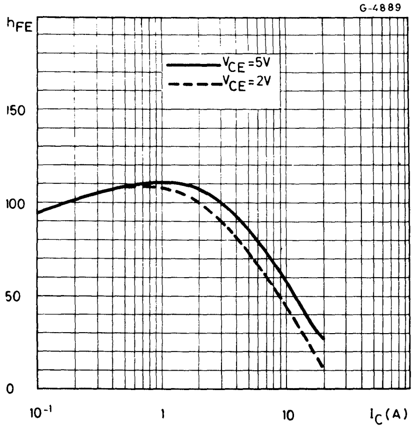
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t_s	Storage time	$I_C = 5$ A $V_{CC} = 30$ V $I_{B1} = -I_{B2} = 0.5$A			1	μs
t_f	Fall time	$I_C = 5$ A $V_{CC} = 30$ V $I_{B1} = -I_{B2} = 0.5$A			0.2	μs
$I_{s/b}$**	Second breakdown collector current	$V_{CE} = 25$ V	5.5			A
$E_{s/b}$	Second breakdown energy	$I_C = 5$ A $V_{EB} = 1$ V $R_{BE} = 50\ \Omega$ L = 25 μH	0.3			mJ

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

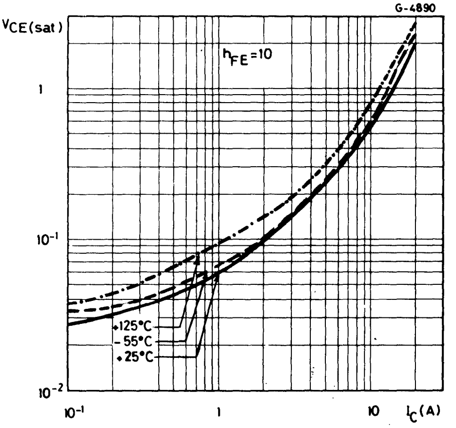
Safe operating areas



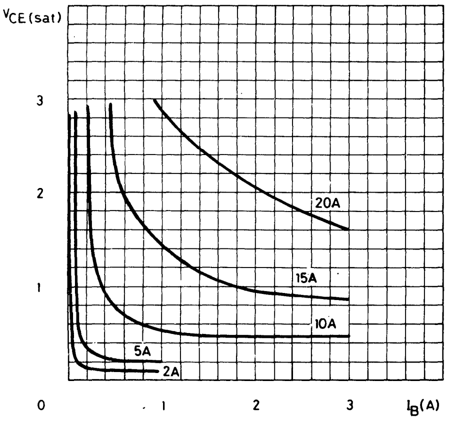
DC current gain



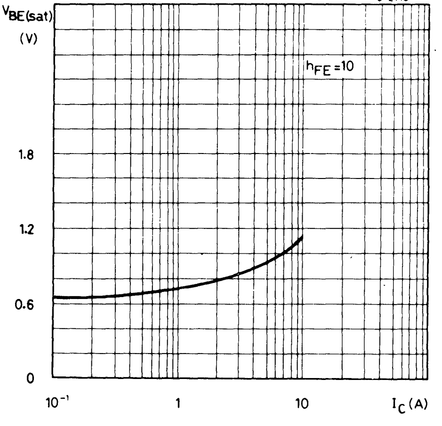
Collector-emitter saturation voltage



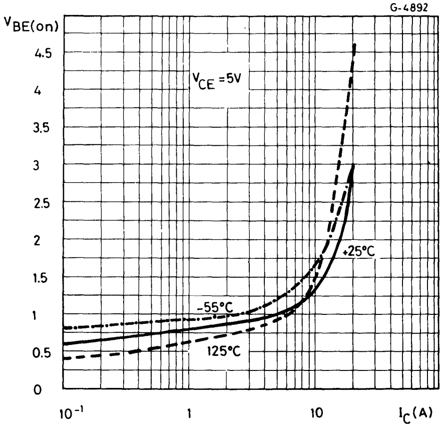
Collector-emitter saturation voltage



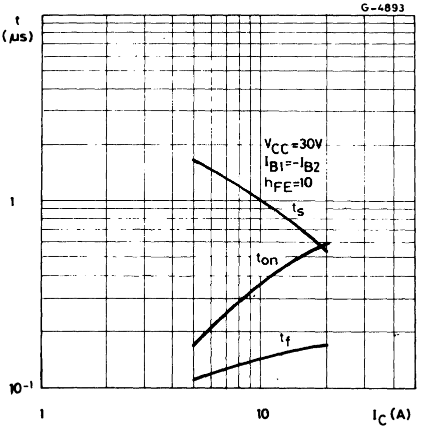
Base-emitter saturation voltage



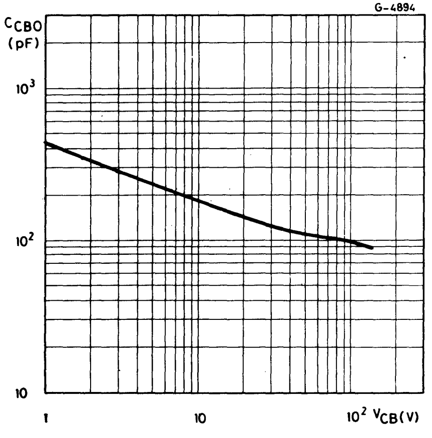
$V_{BE(on)}$ vs. collector current



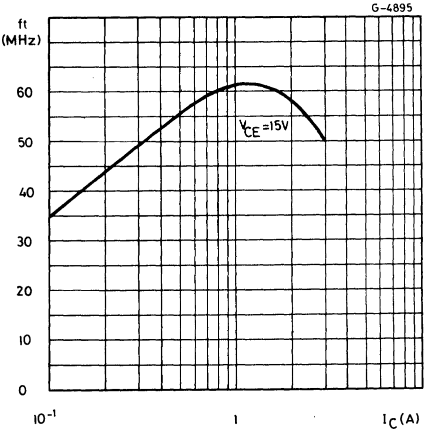
Saturated switching characteristics



Collector-base capacitance



Transition frequency



2N6386
2N6387
2N6388

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.

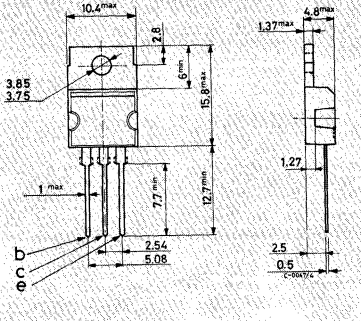
ABSOLUTE MAXIMUM RATINGS

		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			2.8	V
		for **2N6387** and **2N6388**				
		I_C = 5 A V_{CE} = 3 V			2.8	V
		for **2N6386**				
		I_C = 8 A V_{CE} = 3 V			4.5	V
		for **2N6387** and **2N6388**				
		I_C = 10 A V_{CE} = 3 V			4.5	V
h_{FE}*	DC current gain	for **2N6386**				
		I_C = 3 A V_{CE} = 3 V	1000		20000	—
		for **2N6387** and **2N6388**				
		I_C = 5 A V_{CE} = 3 V	1000		20000	—
		for **2N6386**				
		I_C = 8 A V_{CE} = 3 V	100			—
		for **2N6387** and **2N6388**				
		I_C = 10 A V_{CE} = 3 V	100			—
h_{fe}	Small signal current gain	I_C = 1 A				
		V_{CE} = 10 V f = 1 MHz	20			—
		V_{CE} = 10 V f = 1 kHz	1000			—
V_F*	Paralled-diode forward voltage	for **2N6386**				
		I_F = 8 A			4	V
		for **2N6387** and **2N6388**				
		I_F = 10 A			4	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

2N6486
2N6487
2N6488

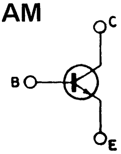
POWER LINEAR AND SWITCHING APPLICATIONS

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	

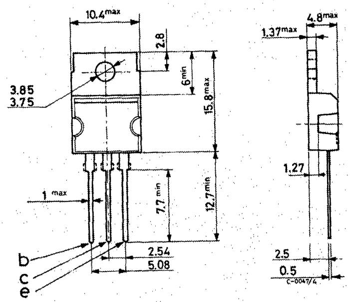
INTERNAL SCHEMATIC DIAGRAM



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 **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%.

2N6489
2N6490
2N6491

EPITAXIAL-BASE PNP

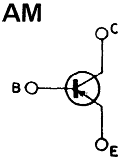
POWER LINEAR AND SWITCHING APPLICATIONS

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	

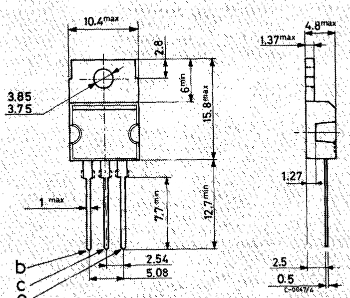
INTERNAL SCHEMATIC DIAGRAM



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

2N6544
2N6545

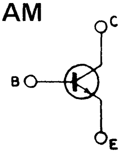
HIGH VOLTAGE POWER SWITCH

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 $T_{case} \leq 25°C$	125W	
T_{stg}	Storage temperature	−65 to 200°C	
T_j	Junction temperature	200°C	

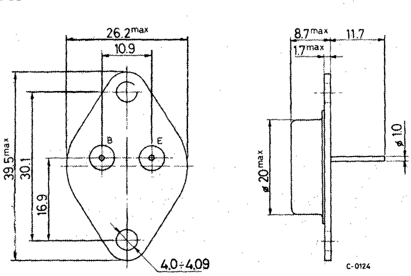
INTERNAL SCHEMATIC DIAGRAM



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.	1.4	°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			0.5	mA
		for **2N6545** V_{CE} = 850V			0.5	mA
		T_{case} = 100°C				
		for **2N6544** V_{CE} = 650V			2.5	mA
		for **2N6545** V_{CE} = 850V			2.5	mA
I_{CER}	Collector cutoff current (R_{BE} = 50Ω)	T_{case} = 100°C				
		for **2N6544** V_{CE} = 650V			3	mA
		for **2N6545** V_{CE} = 850V			3	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**	300			V
		for **2N6545**	400			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**	350			V
		for **2N6545**	450			V
		V_{clamp} = rated $V_{CEO\ (sus)}$−100V I_C = 8A				
		for **2N6544**	200			V
		for **2N6545**	300			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	$I_C = 2.5A$ $V_{CE} = 3V$ $I_C = 5A$ $V_{CE} = 3V$	12 7		60 35	— —
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 5A$ $I_B = 1A$ $I_C = 8A$ $I_B = 2A$ $T_{case} = 100°C$ $I_C = 5A$ $I_B = 1A$			1.5 5 2.5	V V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 5A$ $I_B = 1A$ $T_{case} = 100°C$ $I_C = 5A$ $I_B = 1A$			1.6 1.6	V 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**			1	μs
t_s	Storage time	$I_C = 5A$ $V_C = 250V$ $I_{B1} = -I_{B2} = 1A$			4	μs
t_f	Fall time				1	μs
t_s	Storage time	**INDUCTIVE LOAD** $I_C = 5A$ (pk) $I_{B1} = 1A$ $V_{BE} = -5V$ $L = 180\mu H$			4	μs
t_f	Fall time	$T_{case} = 100°C$ for **2N6544** $V_{clamp} = 350V$ for **2N6545** $V_{clamp} = 450V$			0.9	μs

* Pulsed: pulse duration = $300\mu s$, duty cycle = 1.5%.

For characteristic curves see the BUW 35 type.

2N6546
2N6547

MULTIEPITAXIAL MESA NPN

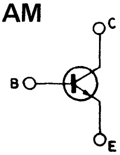
HIGH VOLTAGE, HIGH CURRENT POWER SWITCH

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

		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	

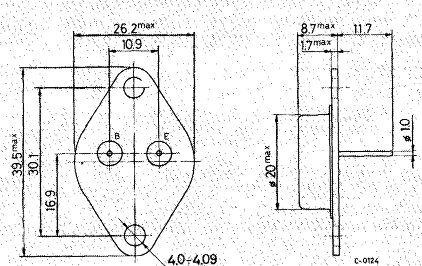
INTERNAL SCHEMATIC DIAGRAM



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 **2N6546** V_{CE} = 650V			1	mA
		for **2N6547** V_{CE} = 850V			1	mA
		T_{case} = 100°C				
		for **2N6546** V_{CE} = 650V			4	mA
		for **2N6547** V_{CE} = 850V			4	mA
I_{CER}	Collector cutoff current (R_{BE} = 50Ω)	T_{case} = 100°C				
		for **2N6546** V_{CE} = 650V			5	mA
		for **2N6547** V_{CE} = 850V			5	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**	300			V
		for **2N6547**	400			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**	350			V
		for **2N6547**	450			V
		V_{clamp} = rated $V_{CEO\ (sus)}$−100V, I_C = 15A				
		for **2N6546**	200			V
		for **2N6547**	300			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	$I_C = 5A$ $V_{CE} = 2V$	12		60	—
		$I_C = 10A$ $V_{CE} = 2V$	6		30	—
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	$I_C = 10A$ $I_B = 2A$			1.5	V
		$I_C = 15A$ $I_B = 3A$			5	V
		$T_{case} = 100°C$ $I_C = 10A$ $I_B = 2A$			2.5	V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	$I_C = 10A$ $I_B = 2A$			1.6	V
		$T_{case} = 100°C$ $I_C = 10A$ $I_B = 2A$			1.6	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**			1	μs
t_s	Storage time	$V_{CC} = 250V$ $I_C = 10A$ $I_{B1} = -I_{B2} = 2A$			4	μs
t_f	Fall time				0.7	μs
t_s	Storage time	**INDUCTIVE LOAD** $I_C = 10A$ (pk) $I_{B1} = 2A$ $V_{BE} = -5V$ $L = 180\mu H$			5	μs
t_f	Fall time	$T_{case} = 100°C$ for **2N6546** $V_{clamp} = 350V$ for **2N6547** $V_{clamp} = 450V$			1.5	μs

* Pulsed: pulse duration = $300\mu s$, duty cycle = 1.5%.

For characteristic curves see the BUW 45 type.

MULTIEPITAXIAL PLANAR NPN

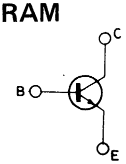
SWITCHING AND GENERAL PURPOSE

The 2N6702 is a silicon multiepitaxial planar NPN transistor and is mounted in Jedec TO-220 plastic package.
It is intended for various switching and general purpose applications.

ABSOLUTE MAXIMUM RATINGS

V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	140	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	90	V
V_{EBO}	Emitter-base voltate ($I_C = 0$)	7	V
I_C	Collector current	7	A
I_{CM}	Collector peak current	10	A
I_B	Base current	5	A
P_{tot}	Total power dissipation ($T_{case} \leq 25°C$)	50	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

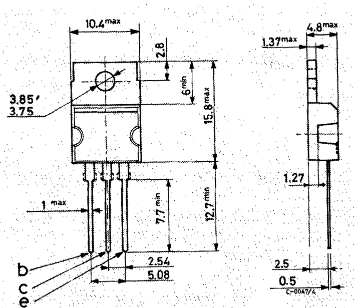
INTERNAL SCHEMATIC DIAGRAM



MECHANICAL DATA

Dimensions in mm

Collector connected to tab.



TO-220

10/82

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_{CEV}	Collector cutoff current (V_{BE} =-1.5V)	V_{CE} = 140V V_{CE} = 140V at T_{case} = 125°C			100 1	μA mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			100	μA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100mA	90			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5A; I_B = 0.5A I_C = 7A; I_B = 0.7A			0.8 1.5	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 5A; I_B = 0.5A			1.5	V
h_{FE}*	DC current gain	I_C = 0.2A; V_{CE} = 2V I_C = 5A; V_{CE} = 2V	30 20			– –
h_{fe}	Small signal current gain	I_C = 0.5A; V_{CE} = 10V f = 5MHz	4		40	–
f_T	Transition frequency	I_C = 0.5A; V_{CE} = 10V f = 5MHz	20		200	MHz
C_{CBO}	Collector base capacitance	I_E = 0; V_{CB} = 10V f = 100KHz	50		150	pF
$I_{s/b}$	Second breakdown	V_{CE} = 20V; t = 100 ms	2.5			A
t_d	Delay time	I_C = 5A; I_{B1} = 0.5A V_{CC} = 70V			0.1	μs
t_r	Rise time				0.25	μs
t_s	Storage time	I_C = 5A; I_{B1} = $-I_{B2}$ = 0.5A V_{CC} = 70V			1	μs
t_r	Fall time				0.5	μs

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

DESIGN AND TECHNICAL 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.

DN328 – OPTIMUM BASE DRIVE VERSUS COLLECTOR CURRENT WAVEFORM

Improving the switching behaviour of power devices for both triangular and trapezoidal collector current waveforms.

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.

TN146 – USING THE L200 ADJUSTABLE VOLTAGE AND CURRENT REGULATOR

Description and applications of the L200, versatile variable regulator (2.85 to 36V, 2A max.)

TN150 – 40 INDUSTRIAL APPLICATION IDEAS

Industrial applications for linear integrated circuits and power transistors.

All these Design and Technical Notes can be obtained free of charge from the SGS-ATES sales network.

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