PHILIPS INTERNATIONAL 56E D ■ 7110826 0042886 235 ■PHIN
T-33-29

SILICON DARLINGTON POWER TRANSISTORS

N-P-N epitaxial base transistors in monolithic Darlington circuit for audio output stages and general amplifier and switching applications; plastic SOT-82 envelope for clip mounting; can also be soldered or adhesive mounted into a hybrid circuit. P-N-P complements are BD332, BD334, BD336 and BD338.

QUICK REFERENCE DATA

			BD331	333	335	337	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	100	120	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	80	100	120	V
Collector-current (d.c.)	I_C	max.	6				A
Base current (d.c.)	I_B	max.	150				mA
Total power dissipation up to $T_{mb} = 25\ ^oC$	P_{tot}	max.	60				W
Junction temperature	T_j	max.	150				^oC
D.C. current gain $I_C = 3{,}0$ A; $V_{CE} = 3$ V	h_{FE}	>	750				

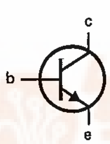
MECHANICAL DATA

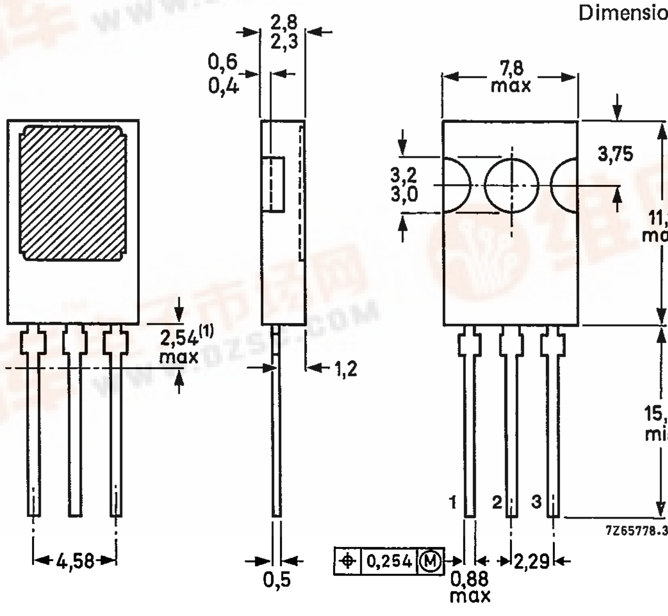
Dimensions in mm

Fig. 1 SOT-82.

Collector connected to metal part of mounting surface

Pinning
1 = base
2 = collector
3 = emitter

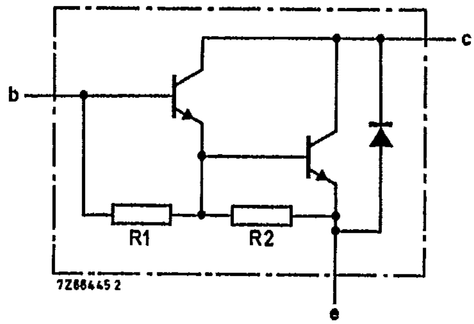




(1) Within this region the cross-section of the leads is uncontrolled.

See also chapters Mounting Instructions and Accessories.

PHILIPS INTERNATIONAL 56E D 7110826 0042887 171 PHIN
T-33-29



R_1 typ. 4 kΩ
R_2 typ. 100 Ω

Fig. 2 Circuit diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

			BD331	333	335	337	
Collector-base voltage (open emitter)	V_{CBO}	max.	60	80	100	120	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	80	100	120	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	5	5	5	V
Collector current (d.c.)	I_C	max.	6				A
Collector current (peak value) $t_p \leqslant 10$ ms; $\delta \leqslant 0{,}1$	I_{CM}	max.	10				A
Base current (d.c.)	I_B	max.	150				mA
Total power dissipation up to $T_{mb} = 25\ ^oC$	P_{tot}	max.	60				W
Storage temperature	T_{stg}		−65 to + 150				^oC
Junction temperature *	T_j	max.	150				^oC

THERMAL RESISTANCE *

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,08	K/W
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	100	K/W

* Based on maximum average junction temperature in line with common industrial practice. The resulting higher junction temperature of the output transistor part is taken into account.

PHILIPS INTERNATIONAL 56E D 7110826 0042888 008 PHIN

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

T-33-29

Collector cut-off current			
$I_E = 0$; $V_{CB} = V_{CBOmax}$	I_{CBO}	<	0,1 mA
$I_E = 0$; $V_{CB} = V_{CBOmax}$; T_j = 150 °C	I_{CBO}	<	1 mA
$I_B = 0$; $V_{CE} = ½ V_{CEOmax}$	I_{CEO}	<	0,2 mA
Emitter cut-off current			
$I_C = 0$; V_{EB} = 5 V	I_{EBO}	<	5 mA
D.C. current gain *			
I_C = 0,5 A; V_{CE} = 3 V	h_{FE}	typ.	1900
I_C = 3 A; V_{CE} = 3 V	h_{FE}	>	750
I_C = 6 A; V_{CE} = 3 V	h_{FE}	typ.	3000
Base-emitter voltage **			
I_C = 3 A; V_{CE} = 3 V	V_{BE}	<	2,5 V
Collector-emitter saturation voltage			
I_C = 3 A; I_B = 12 mA	V_{CEsat}	<	2 V
Cut-off frequency			
I_C = 3 A; V_{CE} = 3 V	f_{hfe}	typ.	50 kHz
Turn-off breakdown energy with inductive load (see Fig. 12)			
$-I_{Boff} = 0$; I_{Con} = 4,5 A	$E_{(BR)}$	>	50 mJ
Diode forward voltage			
I_F = 3 A	V_F	typ.	1,8 V
D.C. current gain ratio of complementary matched pairs			
I_C = 3 A; V_{CE} = 3 V	h_{FE1}/h_{FE2}	<	2,5
Small signal current gain			
I_C = 3 A; V_{CE} = 3 V; f = 1 MHz	h_{fe}	>	10
Second-breakdown collector current			
V_{CE} = 60 V; t_p = 25 ms	$I_{(SB)}$	>	1 A
Switching times (between 10% and 90% levels)			
I_{Con} = 3 A; $I_{Bon} = -I_{Boff}$ = 12 mA			
Turn-on time	t_{on}	typ.	1 μs
		<	2 μs
Turn-off time	t_{off}	typ.	5 μs
		<	10 μs

* Measured under pulse conditions: $t_p < 300$ μs, $\delta < 2\%$.

** V_{BE} decreases by about 3,8 mV/K with increasing temperature.

PHILIPS INTERNATIONAL 56E D 7110826 0042889 T44 PHIN

T-33-29

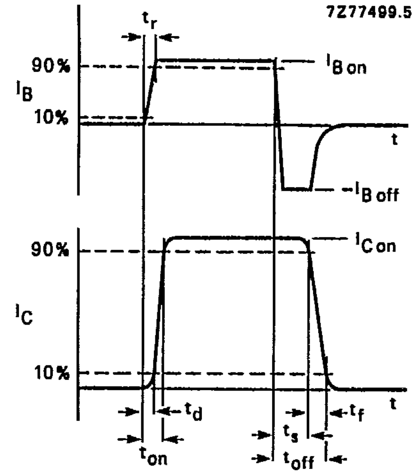
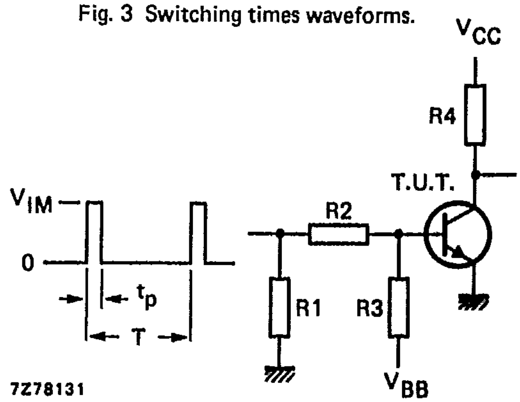
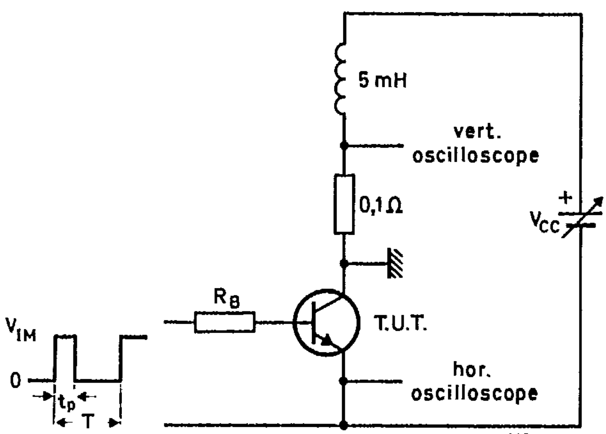


Fig. 3 Switching times waveforms.



V_{IM}	=	10 V
V_{CC}	=	10 V
$-V_{BB}$	=	4 V
R1	=	56 Ω
R2	=	410 Ω
R3	=	560 Ω
R4	=	3 Ω
$t_r = t_f$	=	15 ns
t_p	=	10 μs
T	=	500 μs

Fig. 4 Switching times test circuit.



V_{IM}	=	12 V
R_B	=	270 Ω
I_C	=	4,5 A
δ	=	1 %
t_p	=	1 ms

Fig. 5 Test circuit for turn-off breakdown energy.

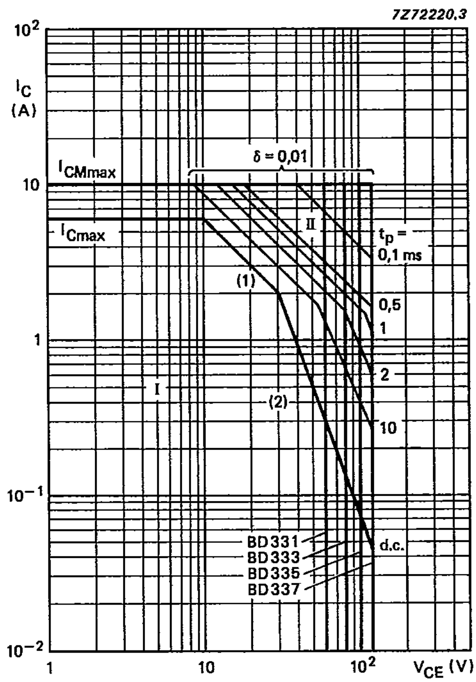


Fig. 6 Safe Operating Area, $T_{mb} \leq 25\ ^{o}C$.

I Region of permissible d.c. operation.
II Permissible extension for repetitive pulse operation.

(1) $P_{tot\ max}$ and $P_{peak\ max}$ lines.
(2) Second-breakdown limits.

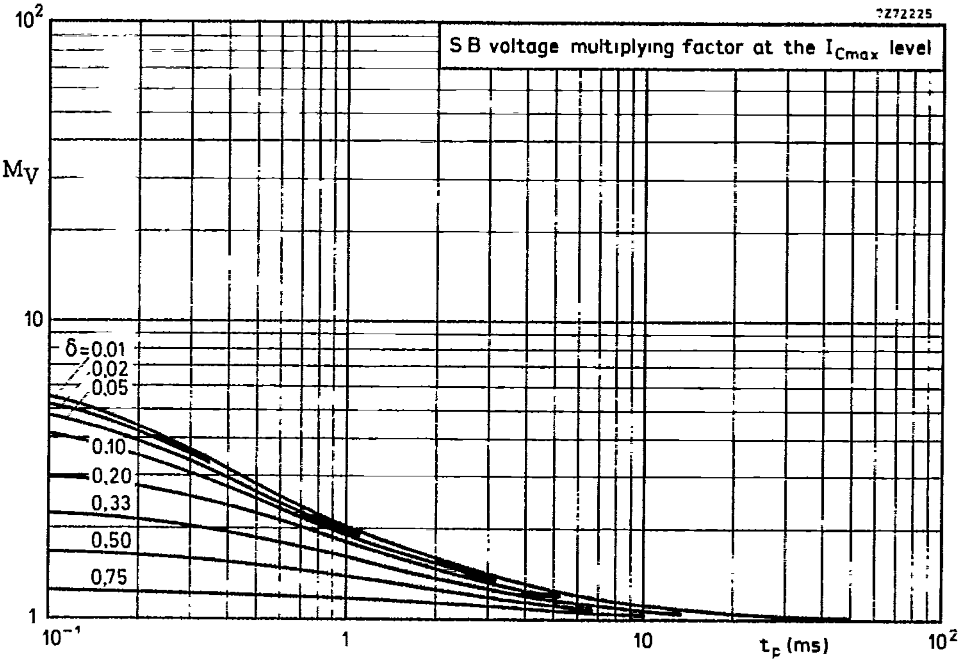


Fig. 7 Second breakdown voltage multiplying factor at I_{Cmax} level.

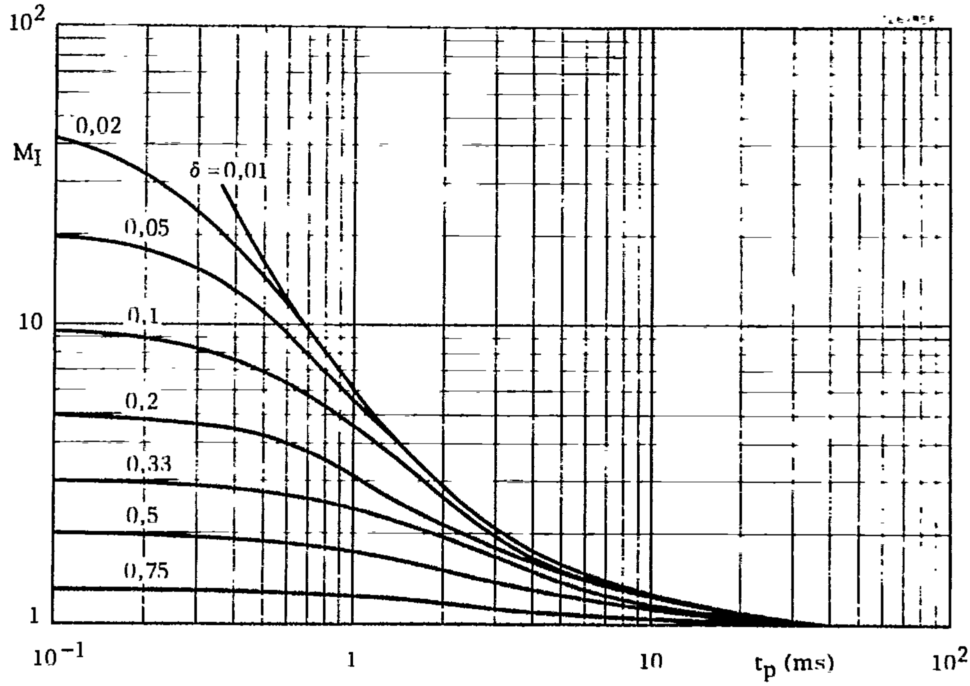


Fig. 8 Second breakdown current multiplying factor at V_{CEOmax} level.

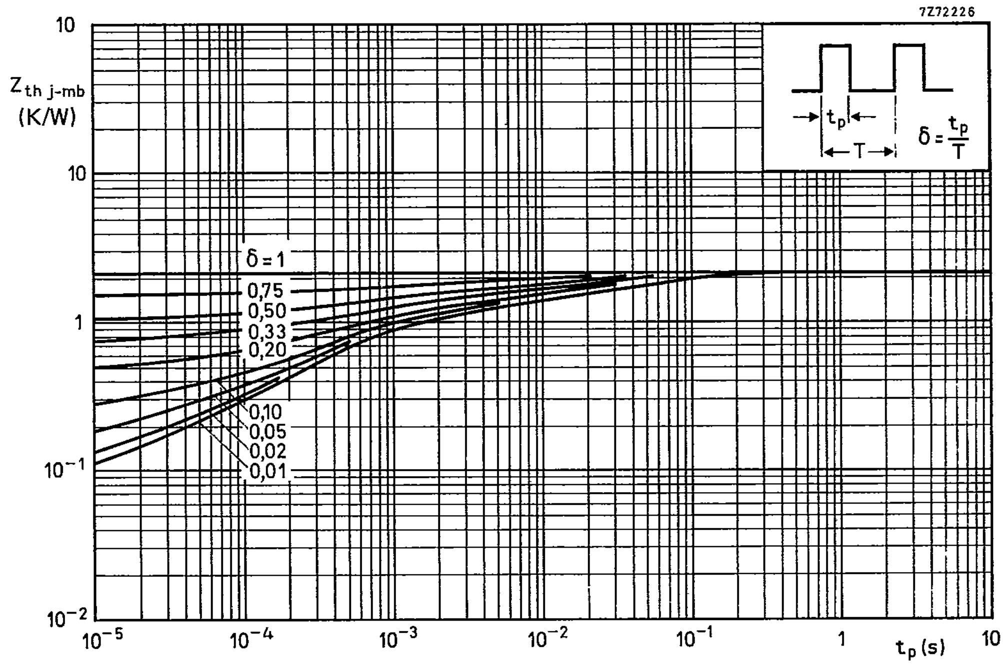


Fig. 9 Pulse power rating chart.

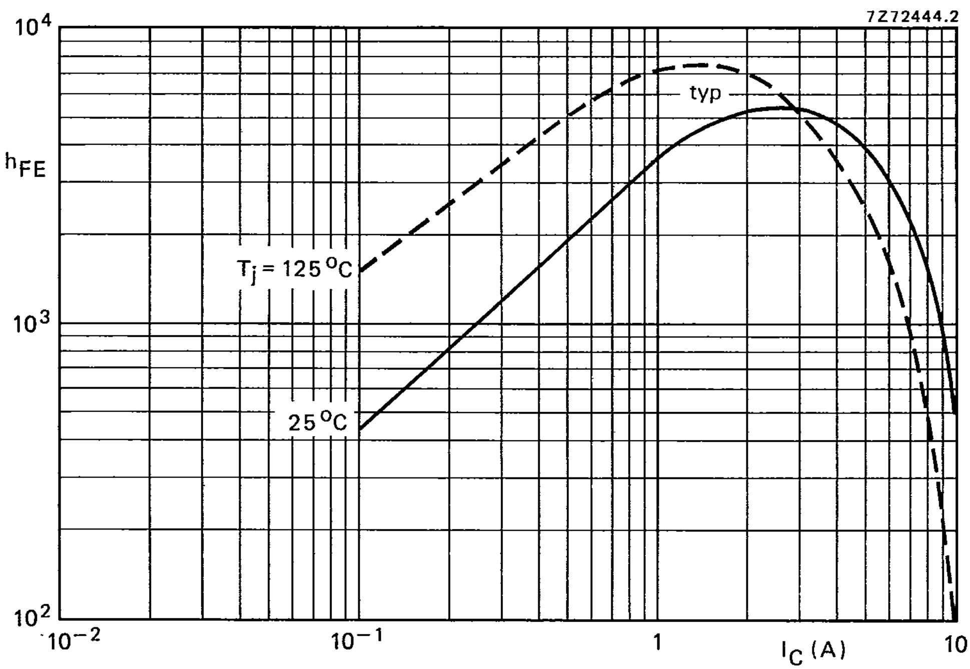


Fig. 10 D.C. current gain. V_{CE} = 3 V.

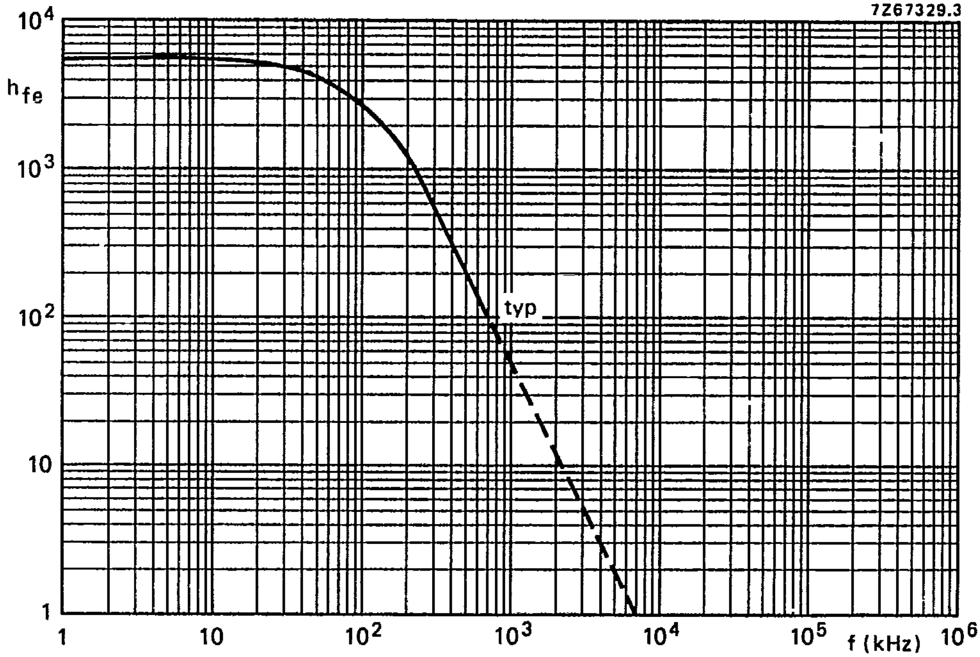


Fig. 11 Small signal current gain at I_C = 3 A; V_{CE} = 3 V.

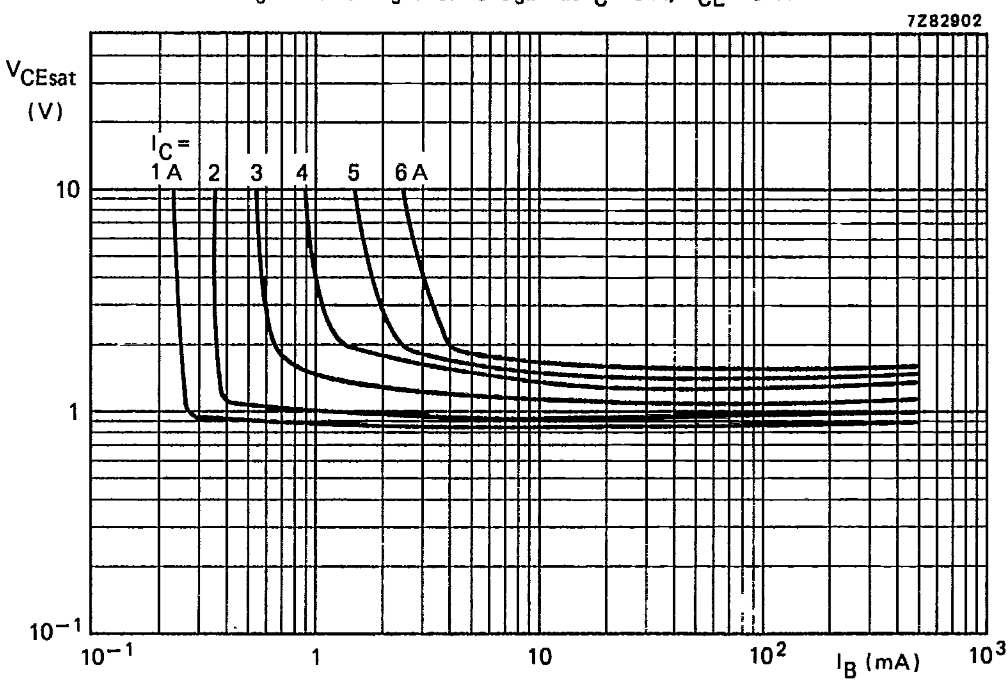


Fig. 12 Typical values collector-emitter saturation. T_j = 25 °C.

T-33-29

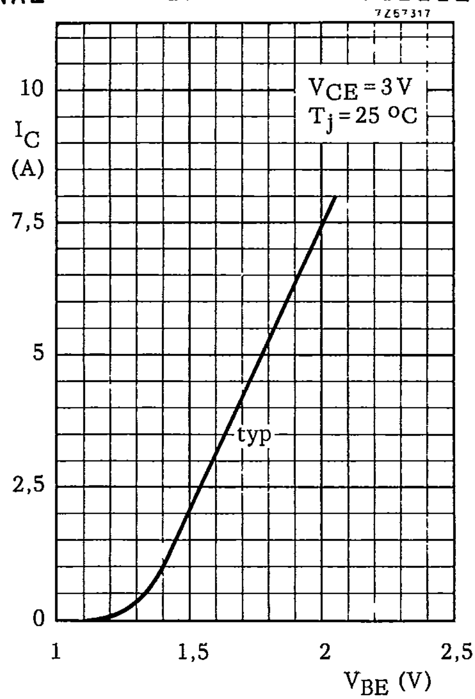


Fig. 13 Collector current.

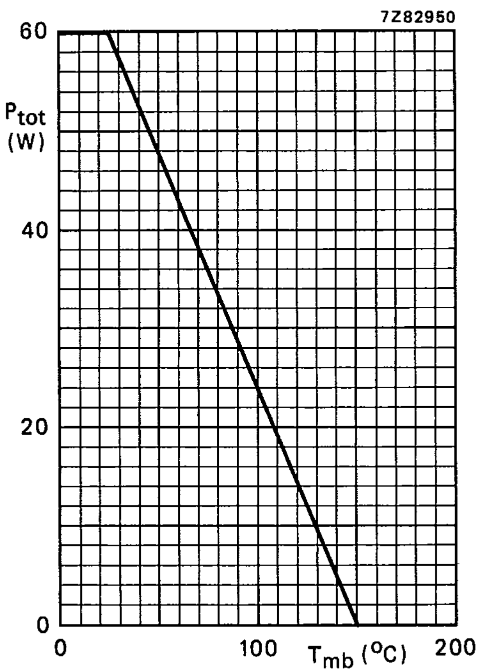


Fig. 14 Power derating curve.