PHILIPS INTERNATIONAL 56E D 7110826 0042896 184 PHIN

T-33-31

SILICON DARLINGTON POWER TRANSISTORS

P-N-P 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. N-P-N complements are BD331, BD333, BD335 and BD337.

QUICK REFERENCE DATA

			BD332	334	336	338	
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 °C	P_{tot}	max.	60				W
Junction temperature	T_j	max.	150				°C
D.C. current gain $-I_C$ = 3,0 A; $-V_{CE}$ = 3 V	h_{FE}	>	750				

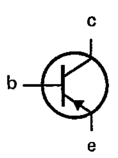
MECHANICAL DATA

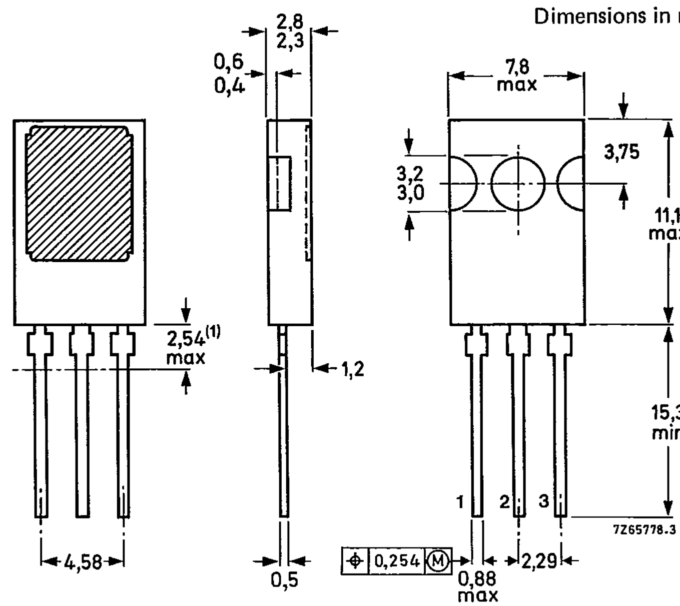
Dimensions in mm

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.

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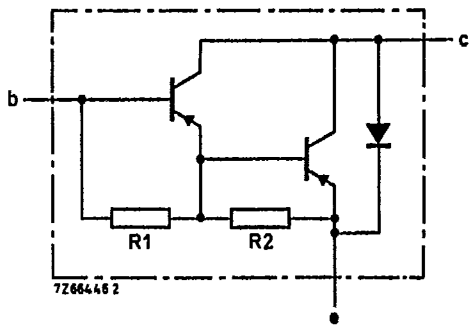

R1 typ. 4 kΩ
R2 typ. 80 Ω

Fig. 2 Circuit diagram.

RATINGS

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

			BD332	334	336	338	
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) $t_p \leq 10$ ms; $\delta < 0,1$	$-I_{CM}$	max.	10				A
Base current (d.c.)	$-I_B$	max.	150				mA
Total power dissipation up to $T_{mb} = 25$ °C	P_{tot}	max.	60				W
Storage temperature	T_{stg}		−65 to + 150				°C
Junction temperature *	T_j	max.	150				°C

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.

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CHARACTERISTICS

T_j = 25 °C unless otherwise specified

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
$I_B = 0; -V_{CE} = -½ V_{CEO}$	$-I_{CEO}$	<	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.	2700
$-I_C = 3$ A; $-V_{CE} = 3$ V	h_{FE}	>	750
$-I_C = 6$ A; $-V_{CE} = 3$ V	h_{FE}	typ.	400
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
Small signal current gain			
$-I_C = 3$ A; $-V_{CE} = 3$ V; f = 1 MHz	h_{fe}	>	10
Cut-off frequency			
$-I_C = 3$ A; $-V_{CE} = 3$ V	f_{hfe}	typ.	100 kHz
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
Second breakdown collector current non-repetitive; without heatsink			
$-V_{CE} = 60$ V; $t_p = 25$ ms	$-I_{(SB)}$	>	1 A
Switching times (see Figs 3 and 4)			
$-I_{Con} = 3$ 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.

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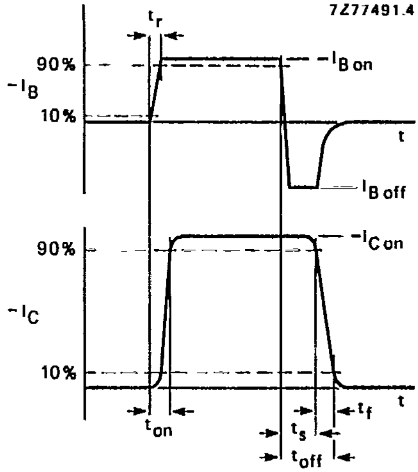
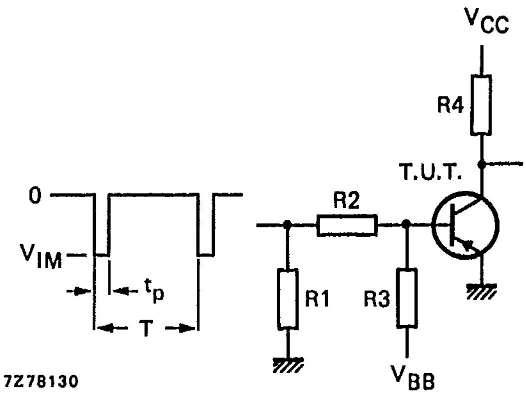


Fig. 3 Switching times waveforms.



$-V_{IM}$	=	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.

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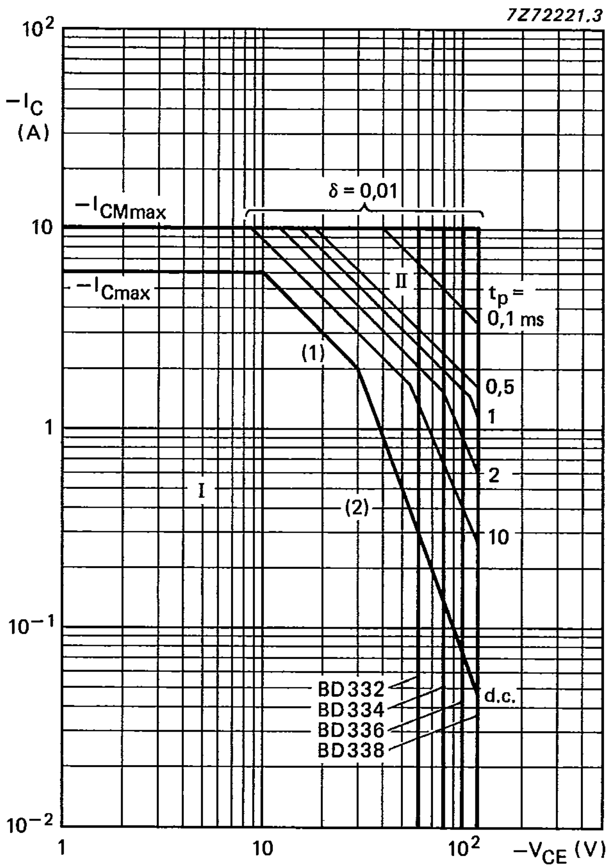

Fig. 5 Safe Operating Area with the transistor forward biased; T_{mb} = 25 °C.

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.

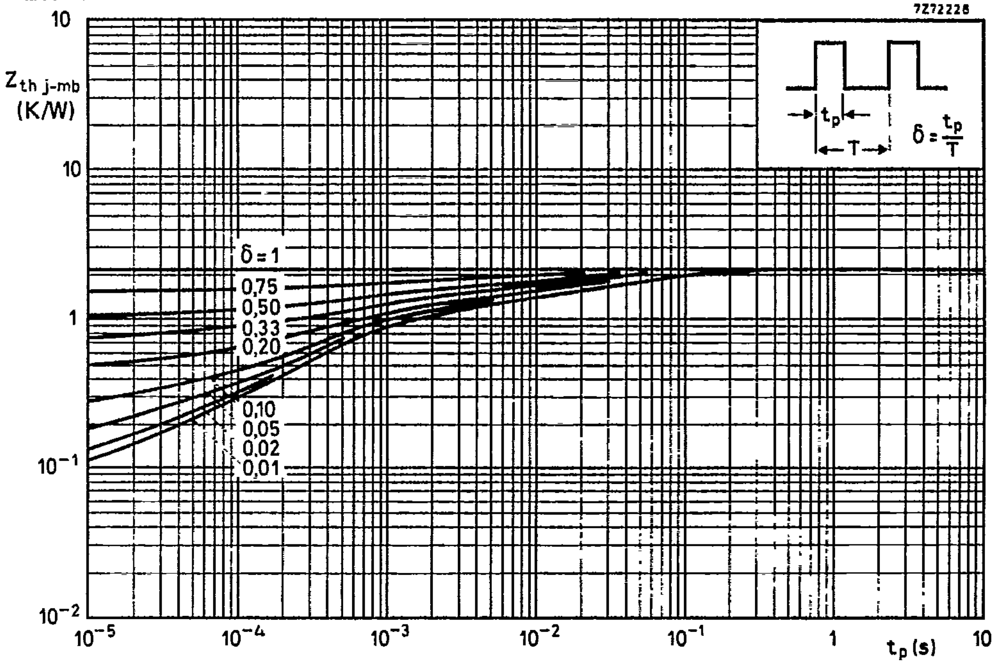

Fig. 6 Pulse power rating chart.

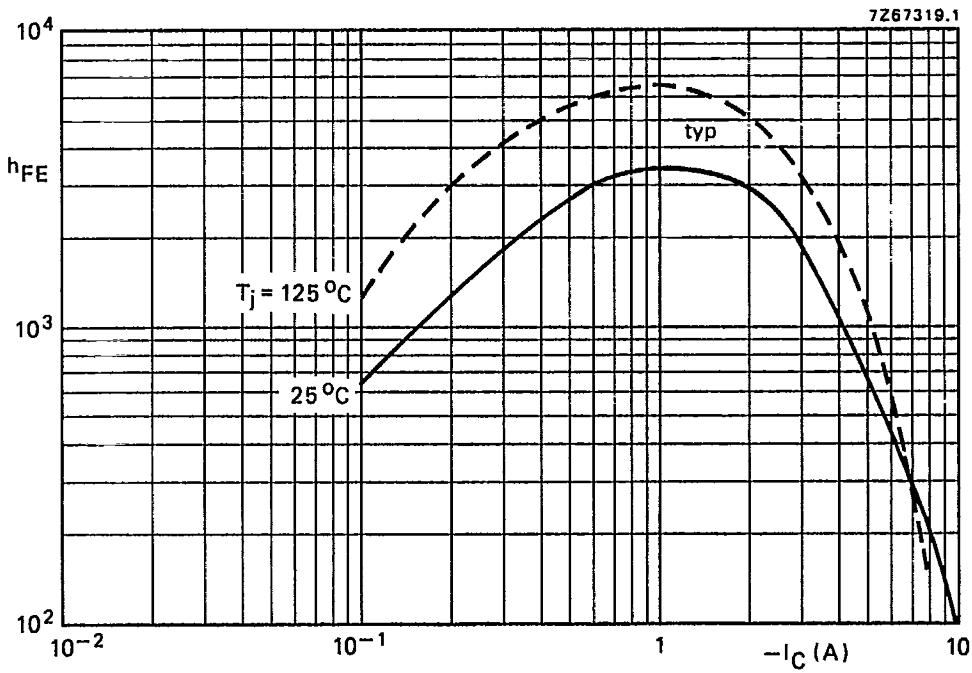

Fig. 7 D.C. current gain at $-V_{CE} = 3$ V.

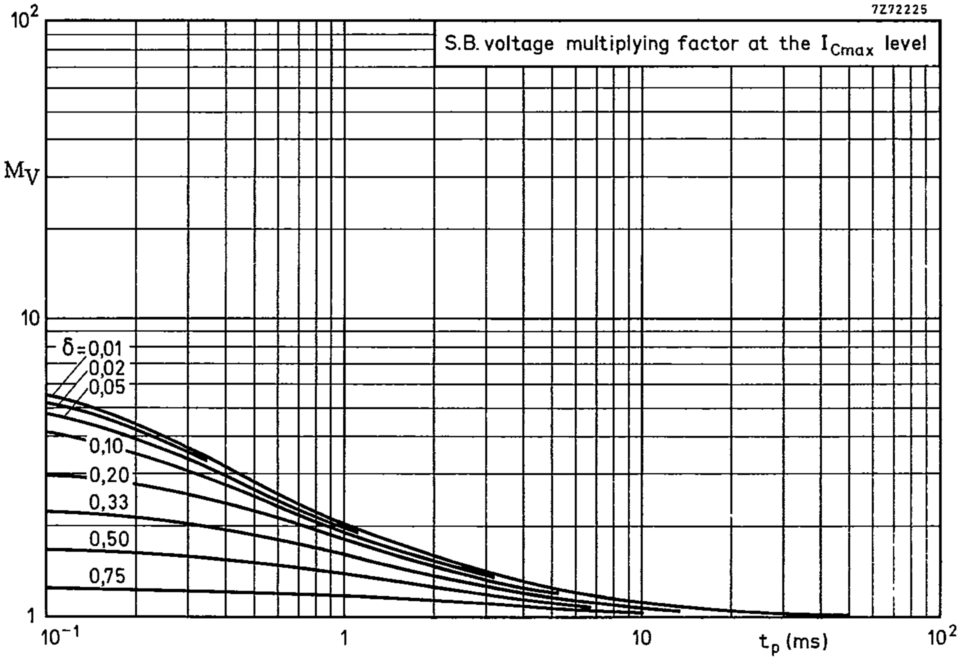

Fig. 8 Second breakdown voltage multiplying factor at the I_{Cmax} level.

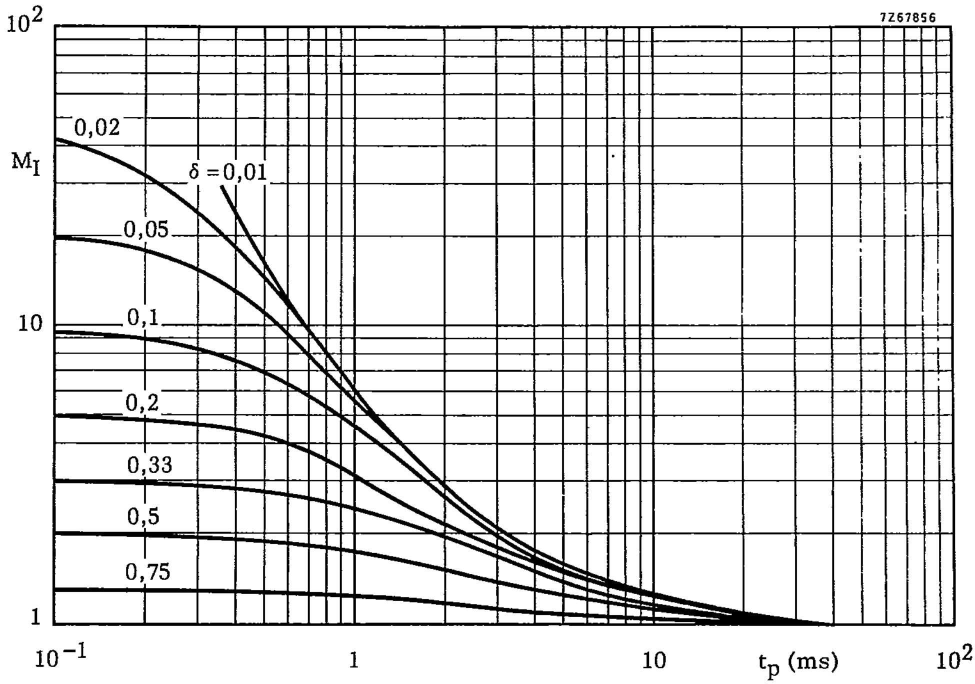

Fig. 9 Second breakdown current multiplying factor at the V_{CEOmax} level.

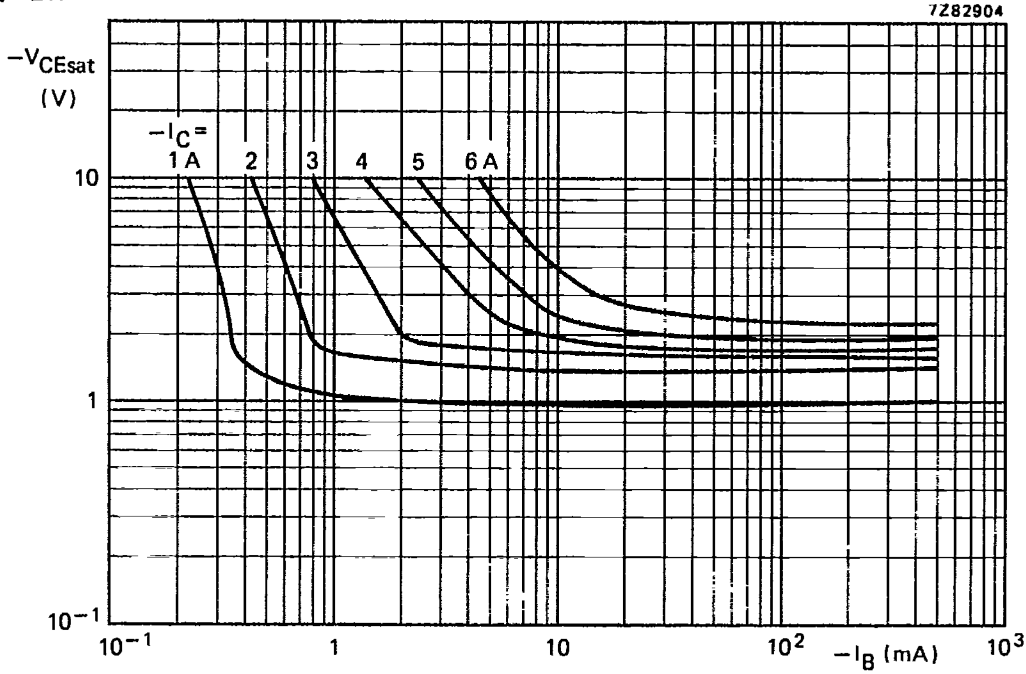

Fig. 10 Typical values collector-emitter saturation voltage. $T_j = 25\ ^oC$.

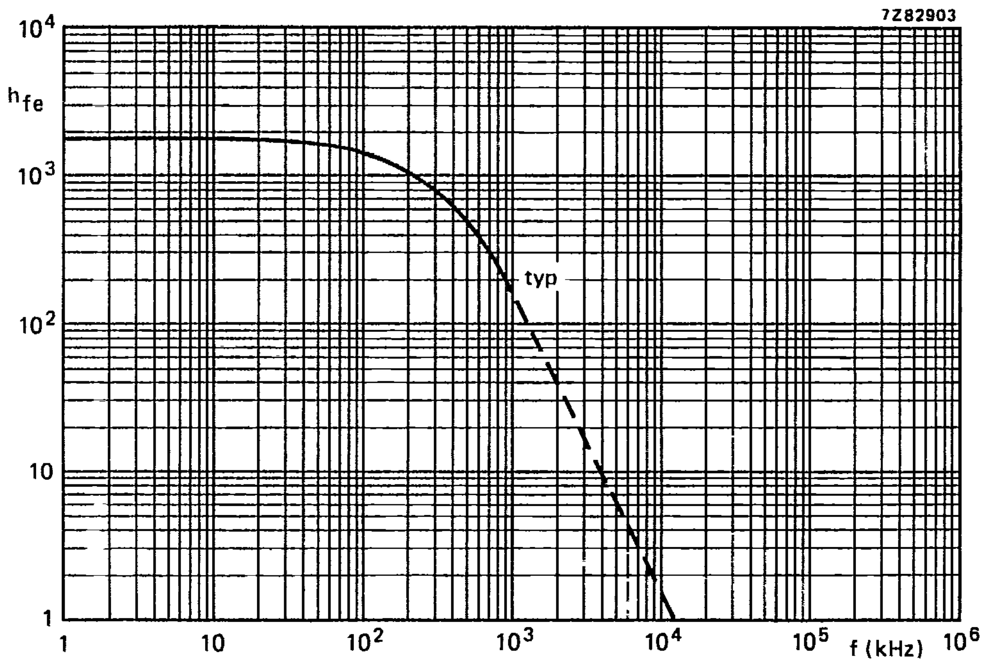

Fig. 11 Small signal current gain. $-I_C = 3$ A; $-V_{CE} = 3$ V.

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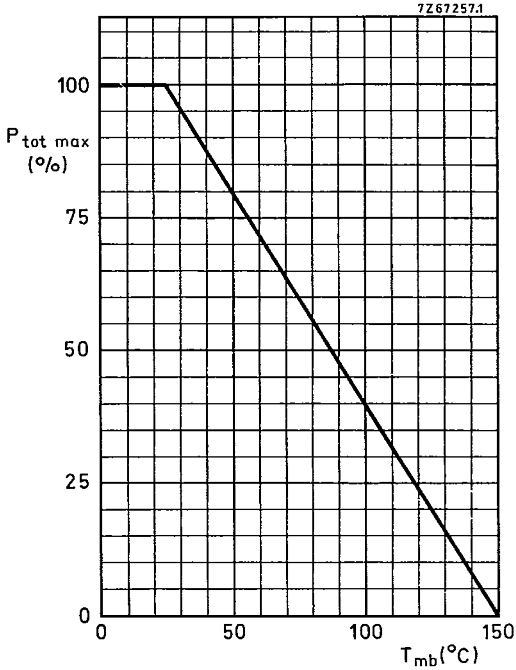

Fig. 12 Power derating curve.

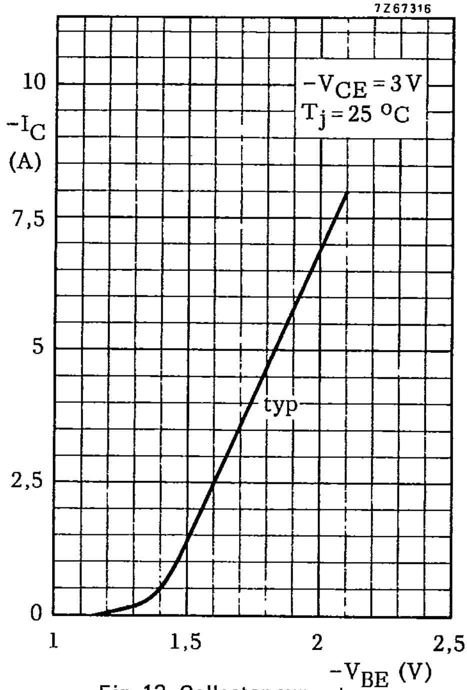

Fig. 13 Collector current.