

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 $T_{mb} = 25^\circ\text{C}$	P_{tot}	max.		60		W
Junction temperature	T_j	max.		150		$^\circ\text{C}$
D.C. current gain $-I_C = 3,0\text{ A}; -V_{CE} = 3\text{ V}$	h_{FE}	$>$		750		

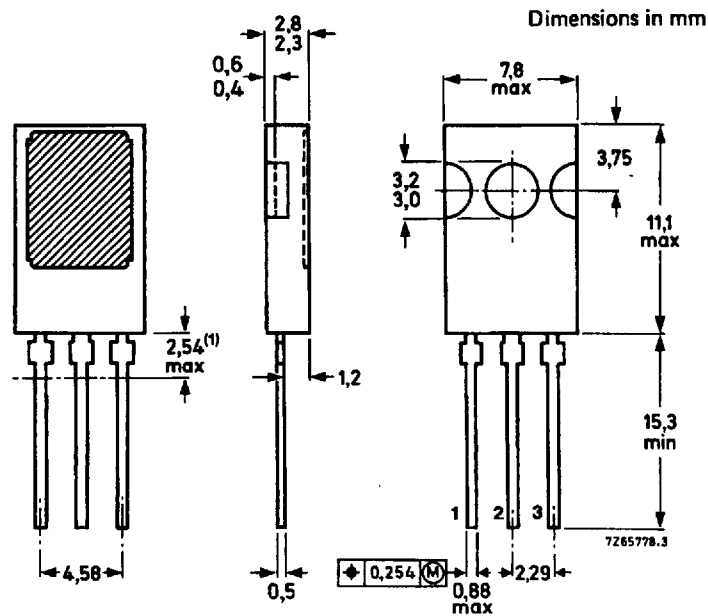
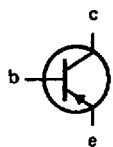
MECHANICAL DATA

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.

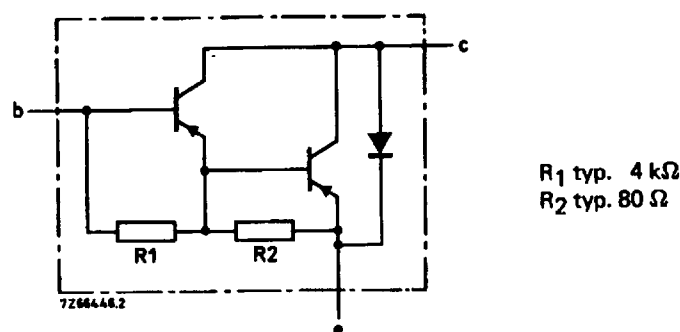


Fig. 2 Circuit diagram.

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

THERMAL RESISTANCE *

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

CHARACTERISTICS

 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

Collector cut-off current

 $I_E = 0; -V_{CB} = -V_{CBO\max}$ $-I_{CBO} < 0,1\text{ mA}$ $I_E = 0; -V_{CB} = -V_{CBO\max}; T_j = 150\text{ }^{\circ}\text{C}$ $-I_{CBO} < 1\text{ mA}$ $I_B = 0; -V_{CE} = -\frac{1}{2} V_{CEO}$ $-I_{CEO} < 0,2\text{ mA}$

Emitter cut-off current

 $I_C = 0; -V_{EB} = 5\text{ V}$ $-I_{EBO} < 5\text{ mA}$

D.C. current gain *

 $-I_C = 0,5\text{ A}; -V_{CE} = 3\text{ V}$ h_{FE} typ. 2700 $-I_C = 3\text{ A}; -V_{CE} = 3\text{ V}$ $h_{FE} > 750$ $-I_C = 6\text{ A}; -V_{CE} = 3\text{ V}$ h_{FE} typ. 400

Base-emitter voltage **

 $-I_C = 3\text{ A}; -V_{CE} = 3\text{ V}$ $-V_{BE} < 2,5\text{ V}$

Collector-emitter saturation voltage

 $-I_C = 3\text{ A}; -I_B = 12\text{ mA}$ $-V_{CEsat} < 2\text{ V}$

Small signal current gain

 $-I_C = 3\text{ A}; -V_{CE} = 3\text{ V}; f = 1\text{ MHz}$ $h_{fe} > 10$

Cut-off frequency

 $-I_C = 3\text{ A}; -V_{CE} = 3\text{ V}$ f_{hfe} typ. 100 kHz

Diode, forward voltage

 $I_F = 3\text{ A}$ V_F typ. 1,8 V

D.C. current gain ratio of

complementary matched pairs

 $-I_C = 3\text{ A}; -V_{CE} = 3\text{ V}$ $h_{FE1}/h_{FE2} < 2,5$

Second breakdown collector current

non-repetitive; without heatsink

 $-V_{CE} = 60\text{ V}; t_p = 25\text{ ms}$ $-I_{(SB)} > 1\text{ A}$

Switching times (see Figs 3 and 4)

 $-I_{Con} = 3\text{ A}; -I_{Bon} = I_{Boff} = 12\text{ mA}$
turn-on time t_{on} typ. 1 μs $< 2\text{ }\mu\text{s}$

turn-off time

 t_{off} typ. 5 μs $< 10\text{ }\mu\text{s}$ * Measured under pulse conditions: $t_p < 300\text{ }\mu\text{s}$, $\delta < 2\%$.** V_{BE} decreases by about 3,8 mV/K with increasing temperature.

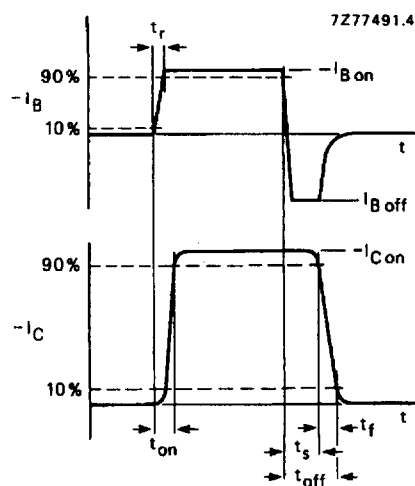


Fig. 3 Switching times waveforms.

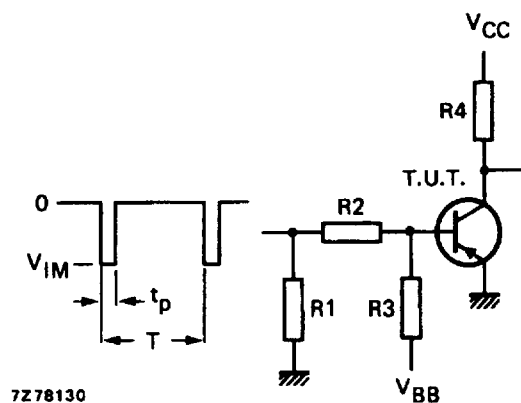


Fig. 4 Switching times test circuit.

$-V_{IM}$	$= 10 \text{ V}$
$-V_{CC}$	$= 10 \text{ V}$
V_{BB}	$= 4 \text{ V}$
$R1$	$= 56 \text{ } \Omega$
$R2$	$= 410 \text{ } \Omega$
$R3$	$= 560 \text{ } \Omega$
$R4$	$= 3 \text{ } \Omega$
$t_r = t_f$	$= 15 \text{ ns}$
t_p	$= 10 \text{ } \mu\text{s}$
T	$= 500 \text{ } \mu\text{s}$

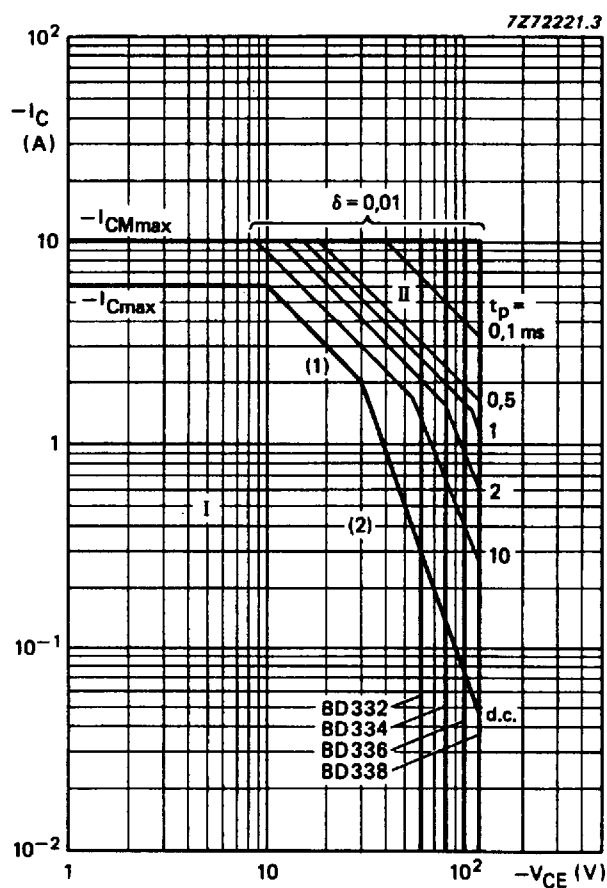


Fig. 5 Safe Operating Area with the transistor forward biased; $T_{mb} = 25\ ^\circ C$.

- 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.

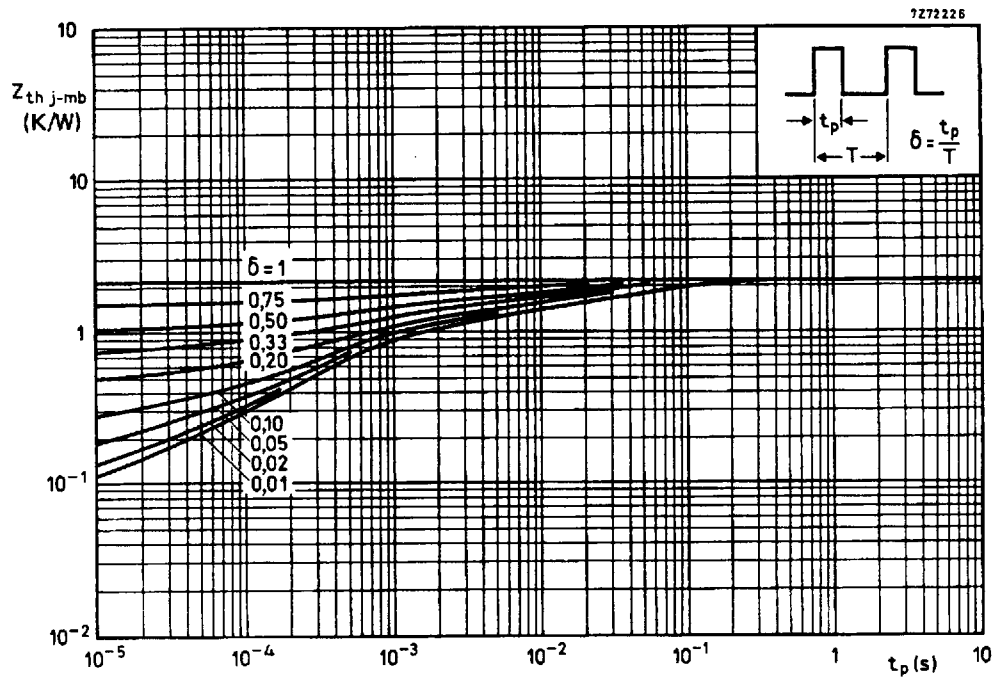


Fig. 6 Pulse power rating chart.

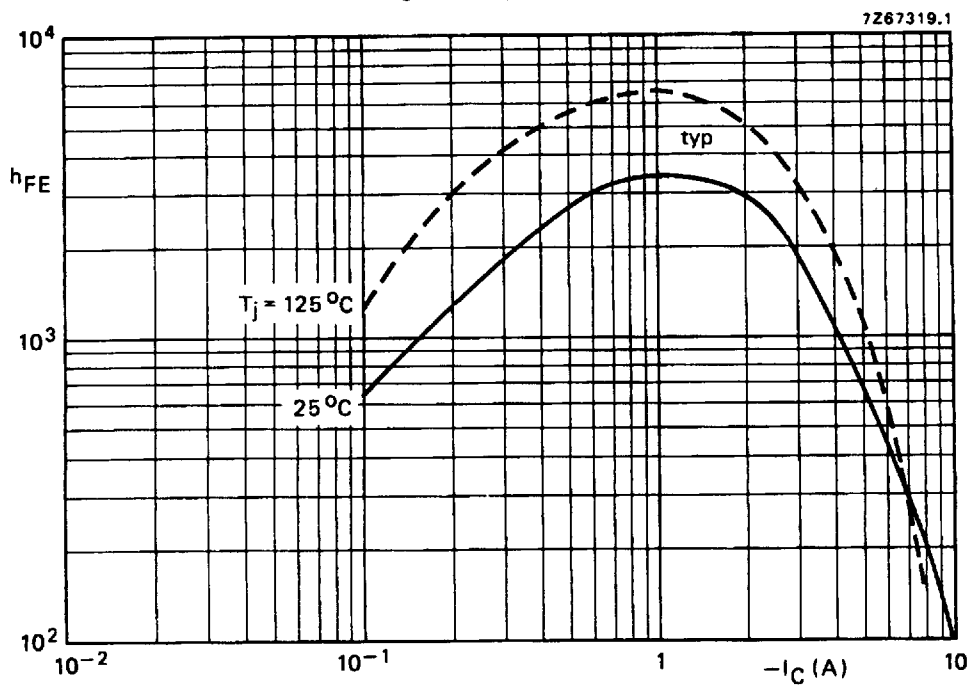
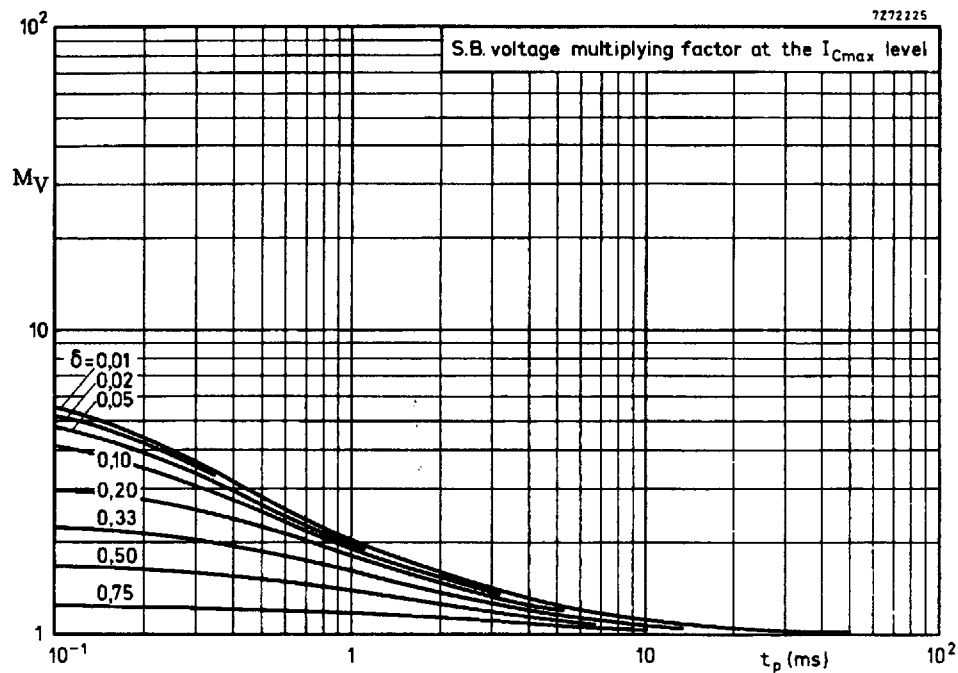
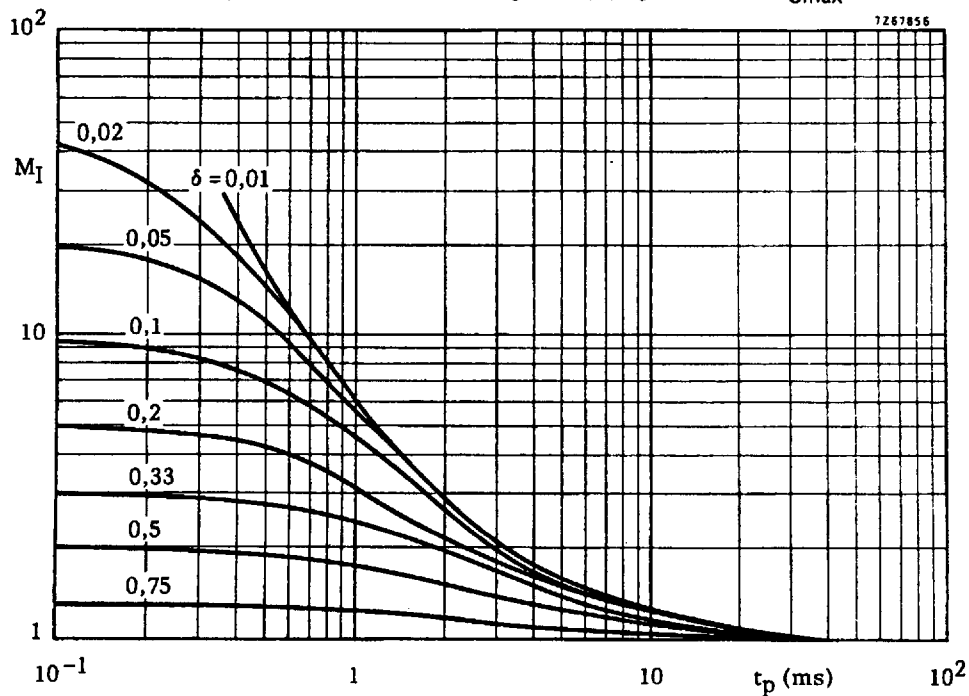


Fig. 7 D.C. current gain at $-V_{CE} = 3\text{ V}$.

Fig. 8 Second breakdown voltage multiplying factor at the I_{Cmax} level.Fig. 9 Second breakdown current multiplying factor at the V_{CEOmax} level.

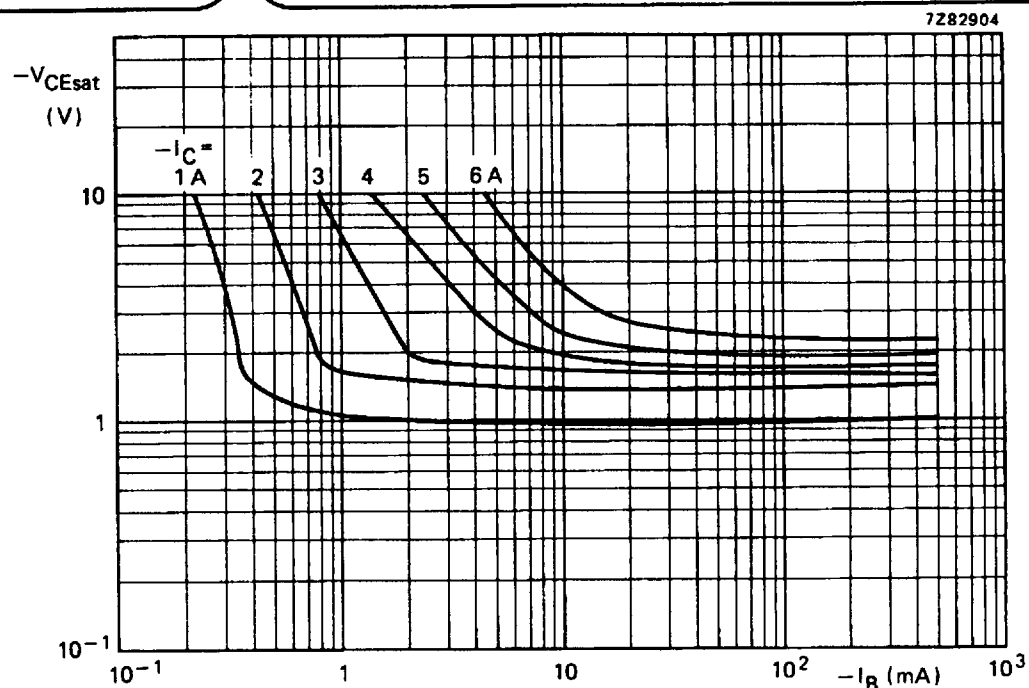


Fig. 10 Typical values collector-emitter saturation voltage. $T_j = 25^\circ\text{C}$.

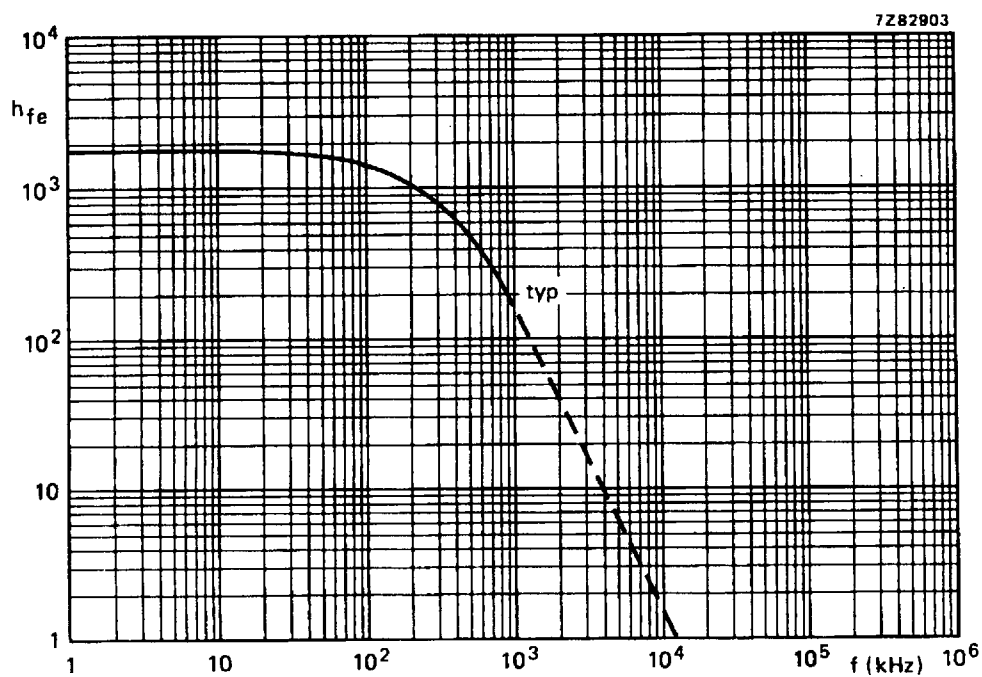


Fig. 11 Small signal current gain. $-I_C = 3\text{ A}$; $-V_{CE} = 3\text{ V}$.

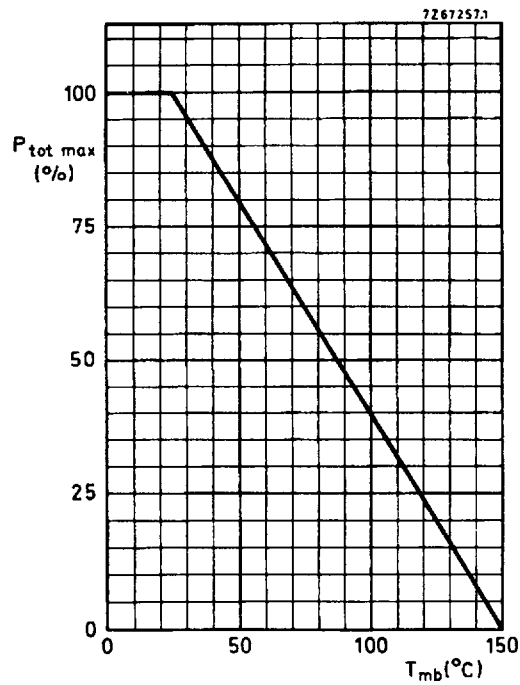


Fig. 12 Power derating curve.

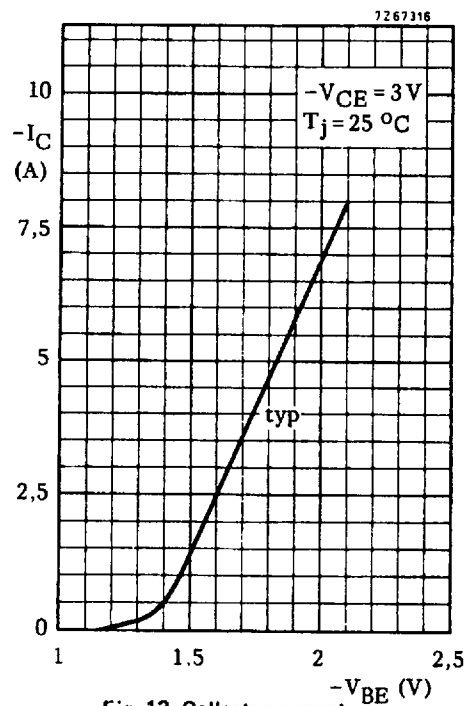


Fig. 13 Collector current.