

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 $T_{mb} = 25\text{ }^\circ\text{C}$	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				

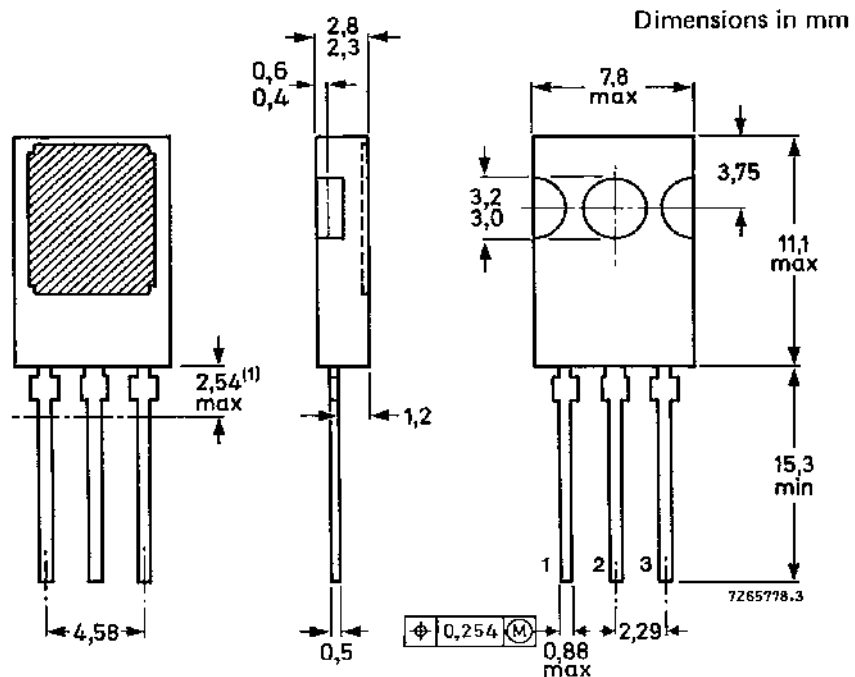
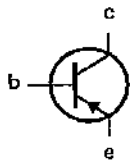
MECHANICAL DATA

Fig. 1 SOT-82.

Collector connected to metal part of mounting surface.

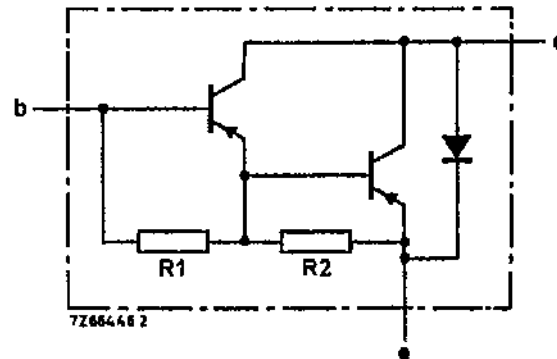
Pinning

- 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.



T-33-31

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 ≤ 10 ms; δ ≤ 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-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

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

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Collector cut-off current

$I_E = 0; -V_{CB} = -V_{CB0\text{max}} \quad -I_{CBO} < 0,1 \text{ mA}$

$I_E = 0; -V_{CB} = -V_{CB0\text{max}}; T_j = 150^\circ\text{C} \quad -I_{CBO} < 1 \text{ mA}$

$I_B = 0; -V_{CE} = -\frac{1}{2} V_{CEO} \quad -I_{CEO} < 0,2 \text{ mA}$

Emitter cut-off current

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

D.C. current gain *

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

$-I_C = 3 \text{ A}; -V_{CE} = 3 \text{ V} \quad h_{FE} > 750$

$-I_C = 6 \text{ A}; -V_{CE} = 3 \text{ V} \quad h_{FE} \text{ typ. } 400$

Base-emitter voltage **

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

Collector-emitter saturation voltage

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

Small signal current gain

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

Cut-off frequency

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

Diode, forward voltage

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

D.C. current gain ratio of

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

Second breakdown collector current

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

Switching times (see Figs 3 and 4)

$-I_{Con} = 3 \text{ A}; -I_{Bon} = I_{Boff} = 12 \text{ mA} \quad t_{on} \text{ typ. } 1 \mu\text{s}$

$\text{turn-on time} \quad < 2 \mu\text{s}$

$\text{turn-off time} \quad t_{off} \text{ typ. } 5 \mu\text{s}$

$< 10 \mu\text{s}$

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

BD331; 333
BD335; 337

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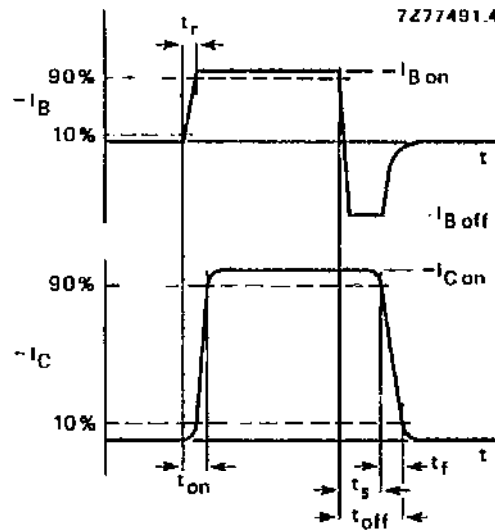
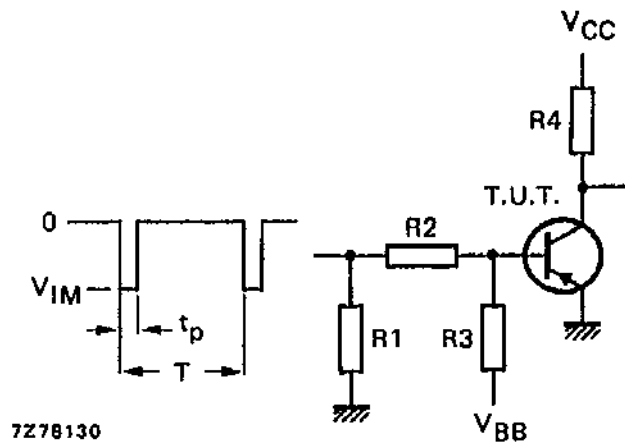


Fig. 3 Switching times waveforms.



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

Fig. 4 Switching times test circuit.

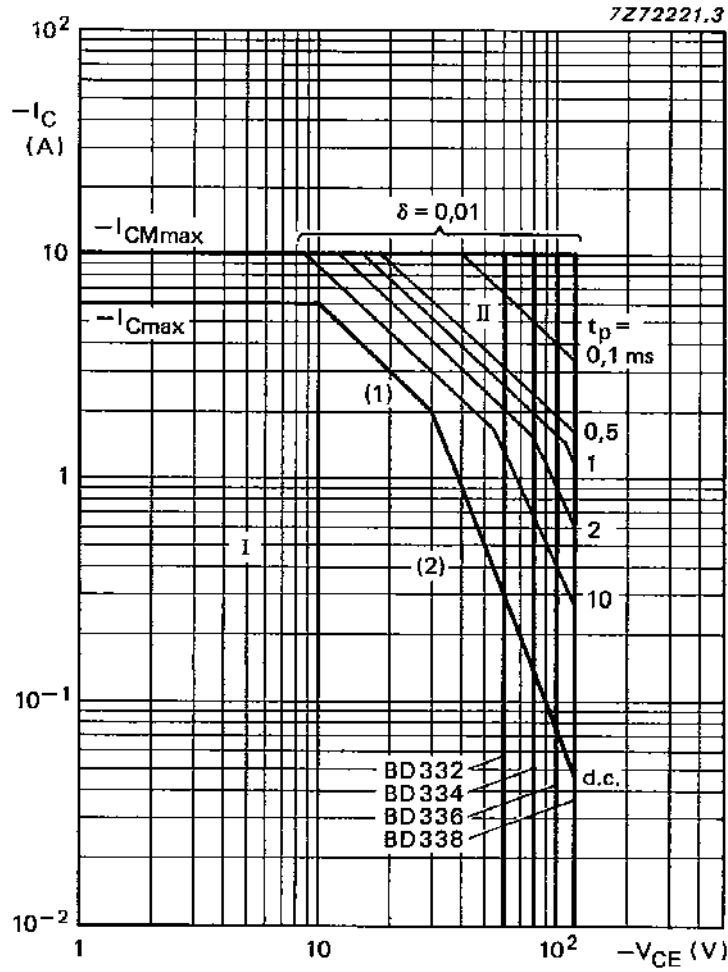


Fig. 5 Safe Operating Area with the transistor forward biased; $T_{mb} = 25\text{ }^{\circ}\text{C}$.

- 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.

BD332; 334
BD336; 338

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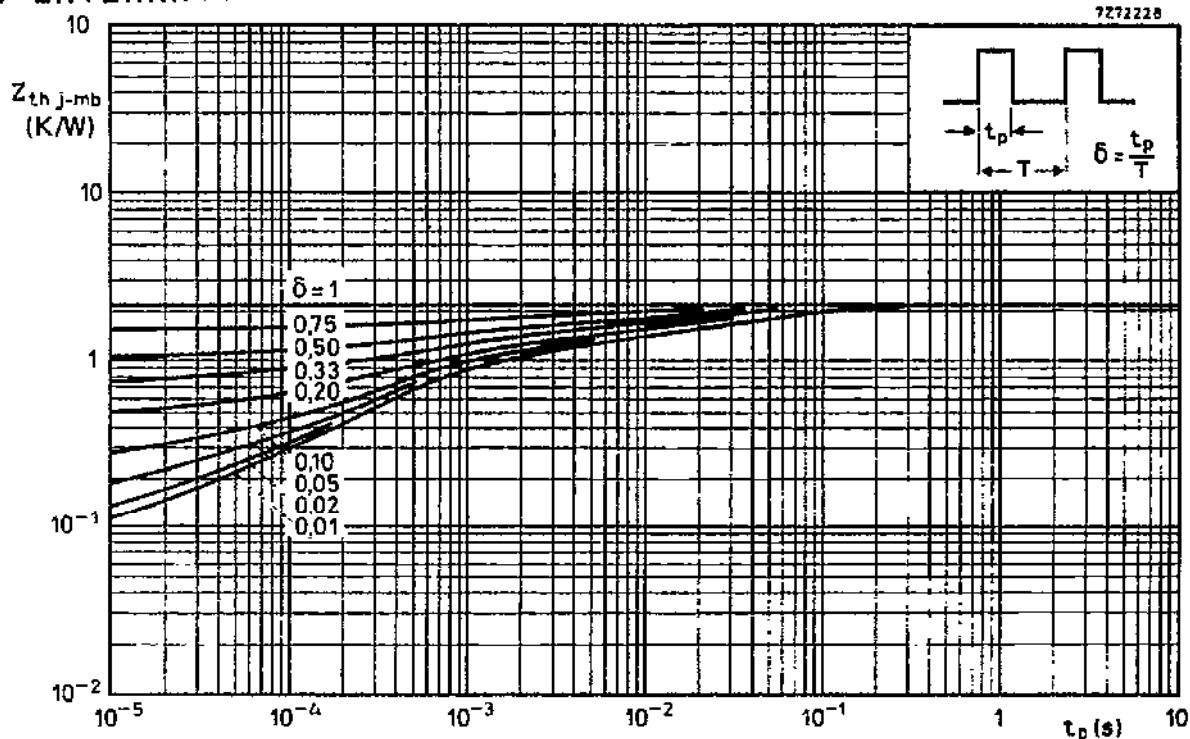


Fig. 6 Pulse power rating chart.

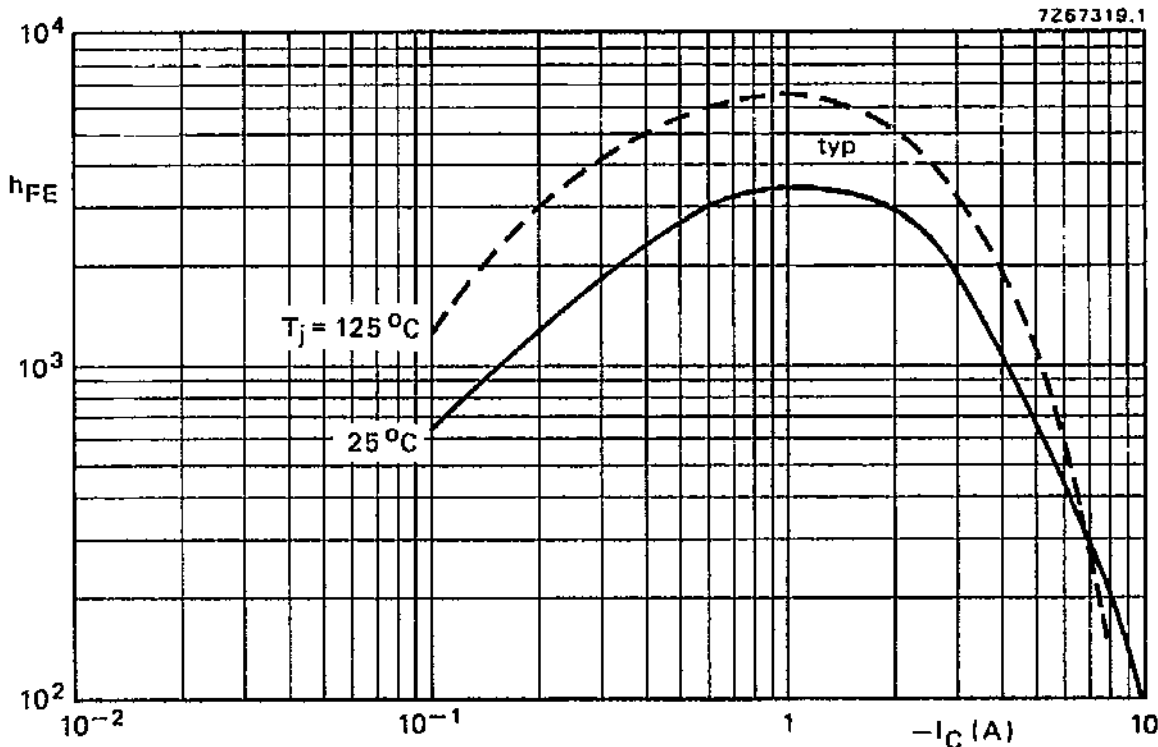


Fig. 7 D.C. current gain at $-V_{CE} = 3\text{ V}$.

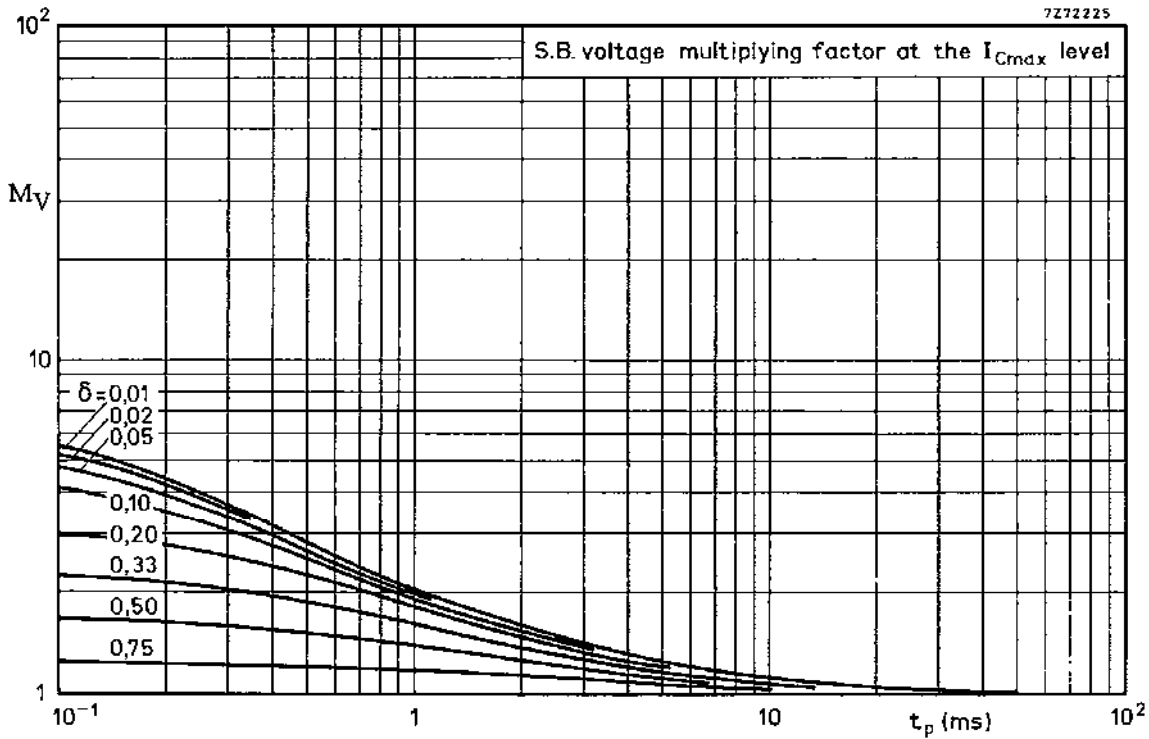


Fig. 8 Second breakdown voltage multiplying factor at the I_{Cmax} level.

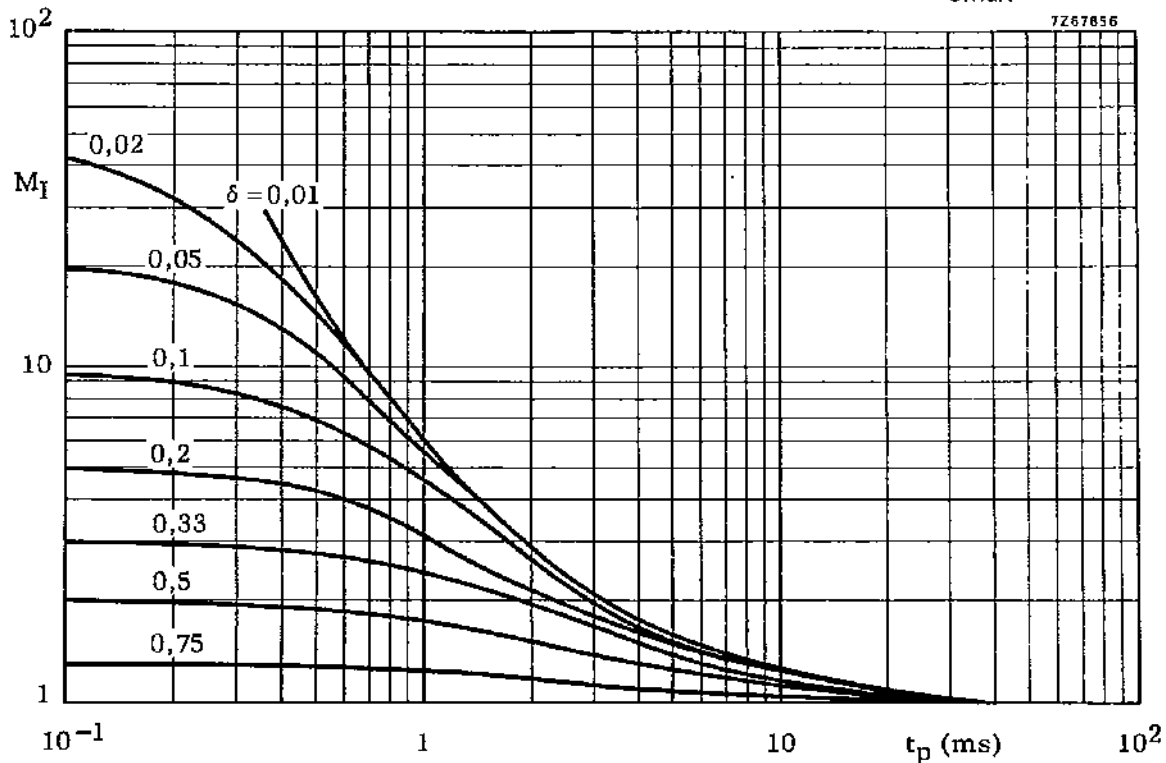


Fig. 9 Second breakdown current multiplying factor at the V_{CE0max} level.

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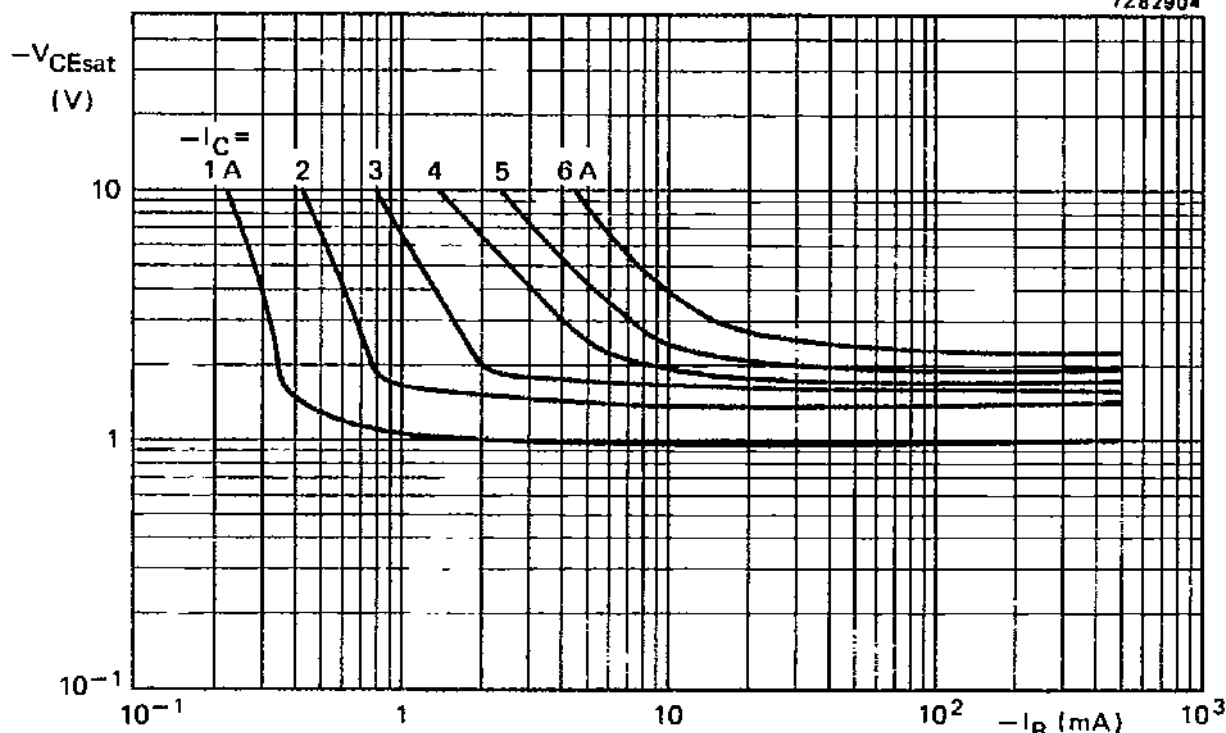


Fig. 10 Typical values collector-emitter saturation voltage. $T_j = 25^\circ\text{C}$.

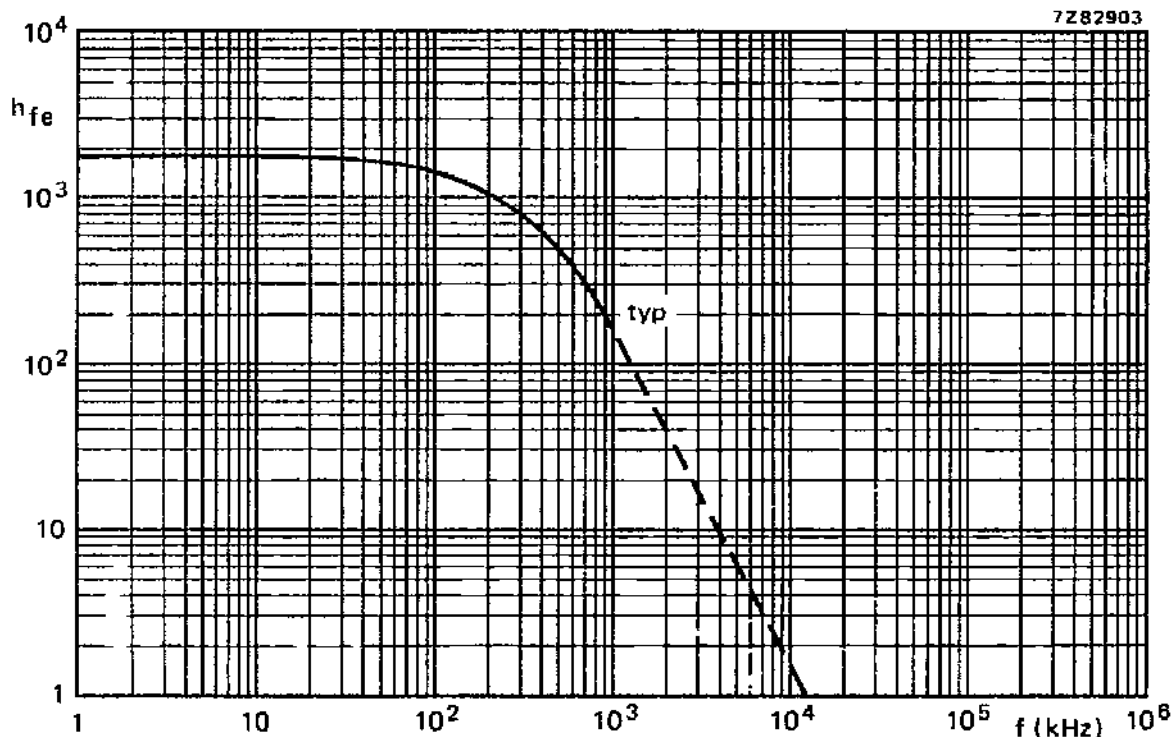


Fig. 11 Small signal current gain. $-I_C = 3\text{ A}$; $-V_{CE} = 3\text{ V}$.

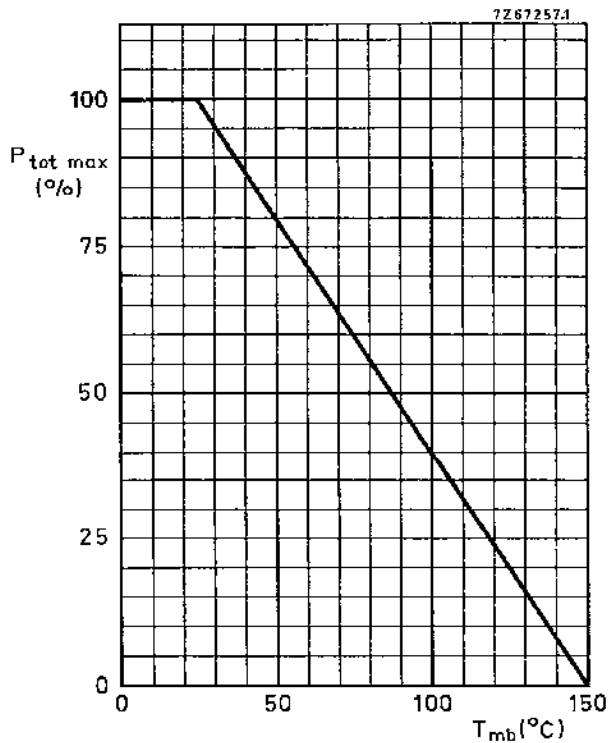


Fig. 12 Power derating curve.

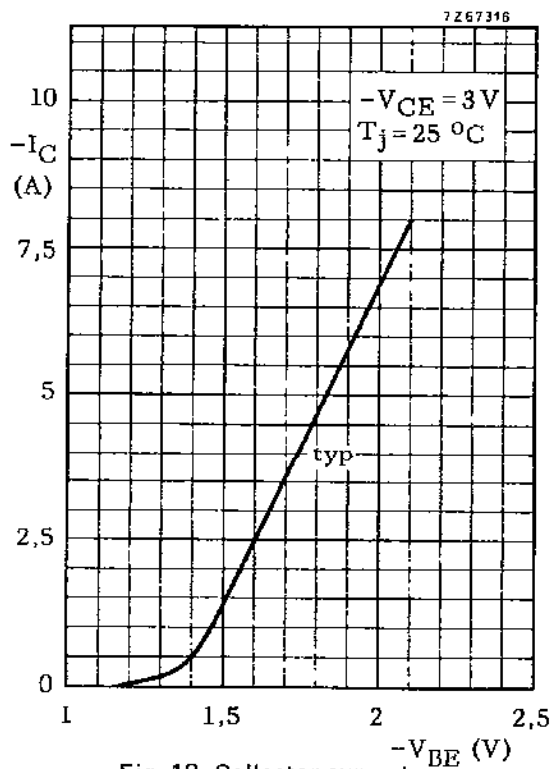


Fig. 13 Collector current.