

## SILICON DARLINGTON POWER TRANSISTORS

NPN epitaxial base transistors in monolithic Darlington circuit for audio output stages and general purpose amplifier and switching applications. TO-220 plastic envelope. PNP complements are BDT64; BDT64A; BDT64B and BDT64C.

### QUICK REFERENCE DATA

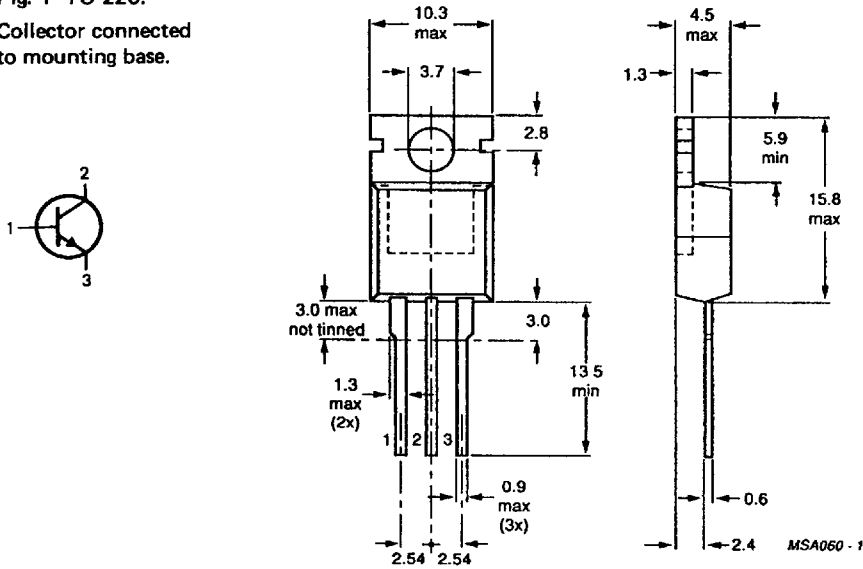
			BDT65	65A	65B	65C
Collector-base voltage (open emitter)	$V_{CBO}$	max.	60	80	100	120 V
Collector-emitter voltage (open base)	$V_{CEO}$	max.	60	80	100	120 V
Emitter-base voltage (open collector)	$V_{EBO}$	max.	5	5	5	5 V
Collector current (d.c.)	$I_C$	max.	12			A
Total power dissipation up to $T_{mb} = 25\text{ }^\circ\text{C}$	$P_{tot}$	max.	125			W
Junction temperature	$T_j$	max.	150			$^\circ\text{C}$
D.C. current gain $I_C = 5\text{ A}; V_{CE} = 4\text{ V}$	$h_{FE}$	>	1000			

### MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220.

Collector connected to mounting base.



See also chapters Mounting instructions and Accessories.

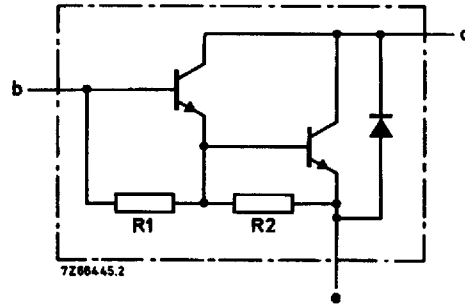


Fig. 2 Circuit diagram. R1 typ. 5 k $\Omega$ ; R2 typ. 80  $\Omega$ .

**RATINGS**

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

			BDT65	65A	65B	65C
Collector-base voltage (open emitter)	V <sub>CBO</sub>	max.	60	80	100	120 V
Collector-emitter voltage (open base)	V <sub>CEO</sub>	max.	60	80	100	120 V
Emitter-base voltage (open collector)	V <sub>EBO</sub>	max.	5	5	5	5 V
Collector current (d.c.)	I <sub>C</sub>	max.		12		A
Collector current (peak value)	I <sub>CM</sub>	max.		20		A
Base current (d.c.)	I <sub>B</sub>	max.		500		mA
Total power dissipation up to T <sub>mb</sub> = 25 °C	P <sub>tot</sub>	max.		125		W
Storage temperature	T <sub>stg</sub>		-65 to + 150			°C
Junction temperature	T <sub>j</sub>	max.		150		°C

**THERMAL RESISTANCE**

From junction to mounting base	R <sub>th j-mb</sub> =		1		K/W
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**CHARACTERISTICS** $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified

Collector cut-off current

$V_{CB} = V_{CB0max}; I_E = 0$

$I_{CBO} < 0,4\text{ mA}$

$V_{CB} = \frac{1}{2}V_{CB0max}; I_E = 0; T_j = 150\text{ }^\circ\text{C}$

$I_{CBO} < 2\text{ mA}$

$I_B = 0; V_{CE} = \frac{1}{2}V_{CE0max}$

$I_{CEO} < 0,2\text{ mA}$

Emitter cut-off current

$I_C = 0; V_{EB} = 5\text{ V}$

$I_{EBO} < 5\text{ mA}$

D.C. current gain\*

$I_C = 1\text{ A}; V_{CE} = 4\text{ V}$

$h_{FE} \text{ typ. } 1500$

$I_C = 5\text{ A}; V_{CE} = 4\text{ V}$

$h_{FE} > 1000$

$I_C = 12\text{ A}; V_{CE} = 4\text{ V}$

$h_{FE} \text{ typ. } 1000$

Base-emitter voltage

$I_C = 5\text{ A}; V_{CE} = 4\text{ V}$

$V_{BE} < 2,5\text{ V}$

Collector-emitter saturation voltage\*

$I_C = 5\text{ A}; I_B = 20\text{ mA}$

$V_{CEsat} < 2\text{ V}$

$I_C = 10\text{ A}; I_B = 100\text{ mA}$

$V_{CEsat} < 3\text{ V}$

Diode, forward voltage

$I_F = 5\text{ A}$

$V_F < 2\text{ V}$

$I_F = 12\text{ A}$

$V_F \text{ typ. } 2\text{ V}$

Collector capacitance at  $f = 1\text{ MHz}$ 

$V_{CB} = 10\text{ V}; I_E = I_e = 0$

$C_c \text{ typ. } 200\text{ pF}$

Second-breakdown collector current

non-repetitive; without heatsink

$V_{CE} = 60\text{ V}; t_p = 0,1\text{ s}$

$I_{SB} > 2\text{ A}$

Turn-off breakdown energy with inductive load;

$-I_{Boff} = 0; I_{CM} = 6,3\text{ A}$

$L = 5\text{ mH}$  (see Fig. 3)

$E_{(BR)} > 100\text{ mJ}$

Switching times (see Figs 4 and 5)

$I_{Con} = 5\text{ A}; I_{Bon} = -I_{Boff} = 20\text{ mA}$

turn-on time

$t_{on} \text{ typ. } 1\text{ }\mu\text{s}$   
 $< 2,5\text{ }\mu\text{s}$

turn-off time

$t_{off} \text{ typ. } 6,0\text{ }\mu\text{s}$   
 $< 10\text{ }\mu\text{s}$

Small-signal current gain

$I_C = 5\text{ A}; V_{CE} = 3\text{ V}; f = 1\text{ MHz}$

$h_{fe} > 10$

\* Measured under pulse conditions  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta < 2\%$ .

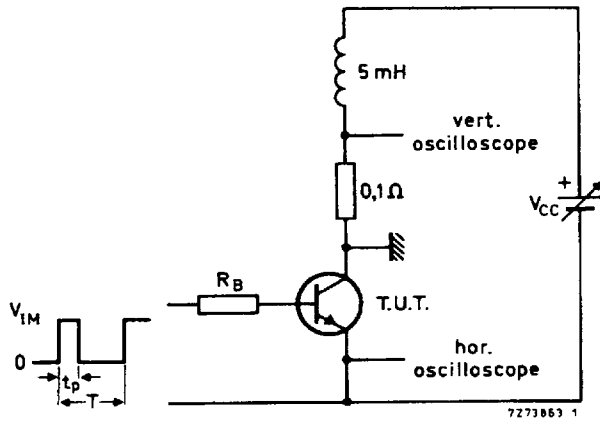


Fig. 3 Test circuit for turn-off breakdown energy.  
 $V_{IM} = 12 \text{ V}$ ;  $R_B = 270 \Omega$ ;  
 $t_p = 1 \text{ ms}$ ;  $\delta = 1\%$ .

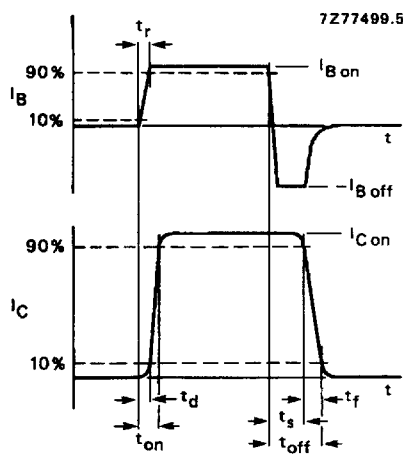
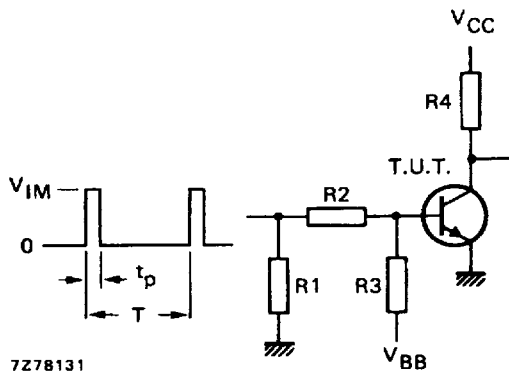


Fig. 4 Switching times waveforms.



$V_{CC} = 30 \text{ V}$   
 $V_{IM} = 15 \text{ V}$   
 $-V_{BB} = 4 \text{ V}$   
 $R1 = 56 \Omega$   
 $R2 = 410 \Omega$   
 $R3 = 560 \Omega$   
 $R4 = 6 \Omega$   
 $t_r = t_f = 15 \text{ ns}$   
 $t_p = 10 \mu\text{s}$   
 $T = 500 \mu\text{s}$

Fig. 5 Switching times test circuit.

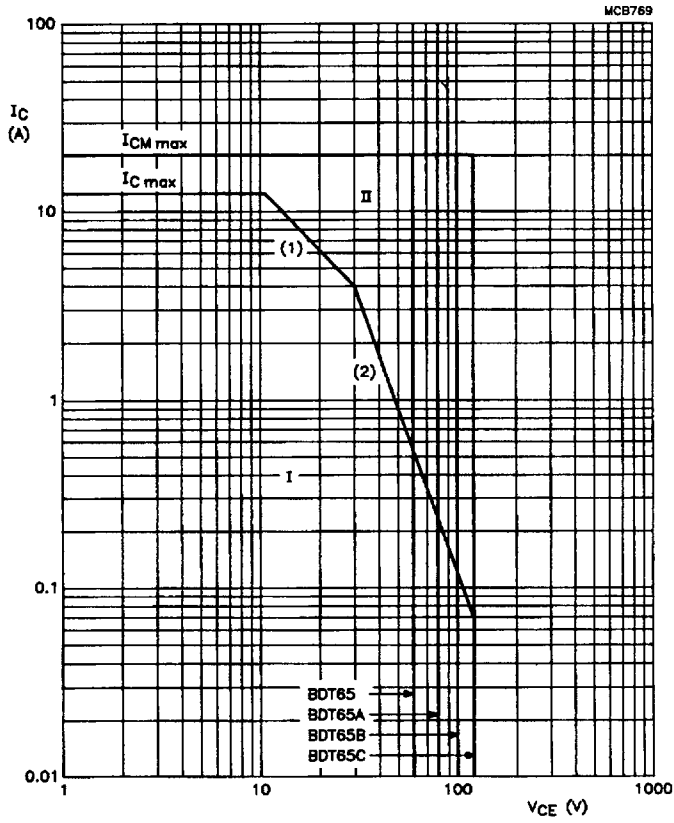


Fig. 6 Safe Operating Area;  $T_{mb} = 25\text{ }^{\circ}\text{C}$ .

- 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.

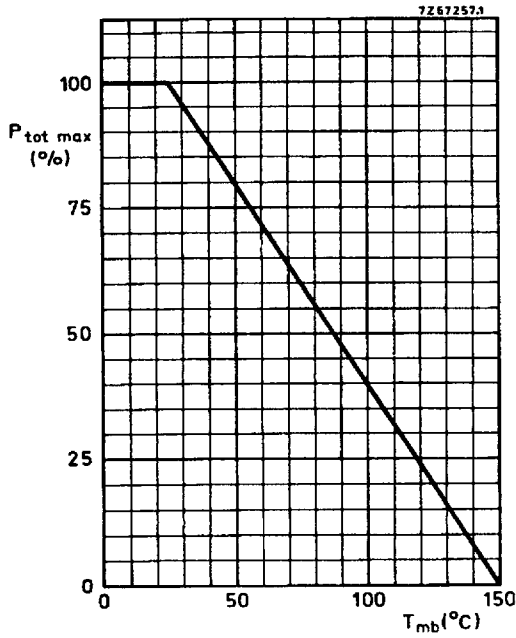


Fig. 7 Power derating curve.

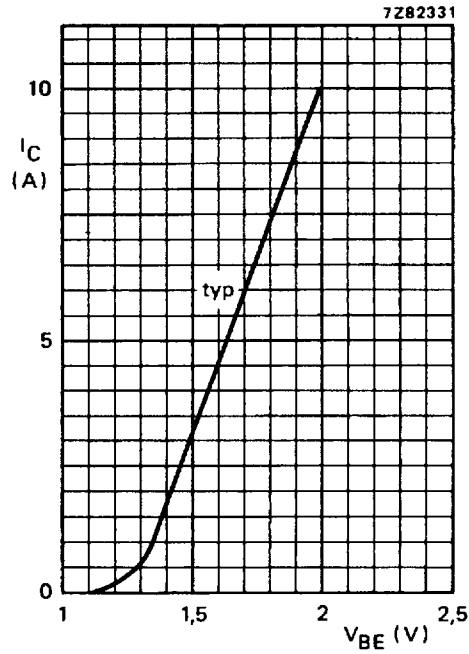


Fig. 8 Base-emitter voltage as a function of collector current.  $V_{CE} = 3\text{ V}$ ;  $T_{amb} = 25\text{ }^\circ\text{C}$ .

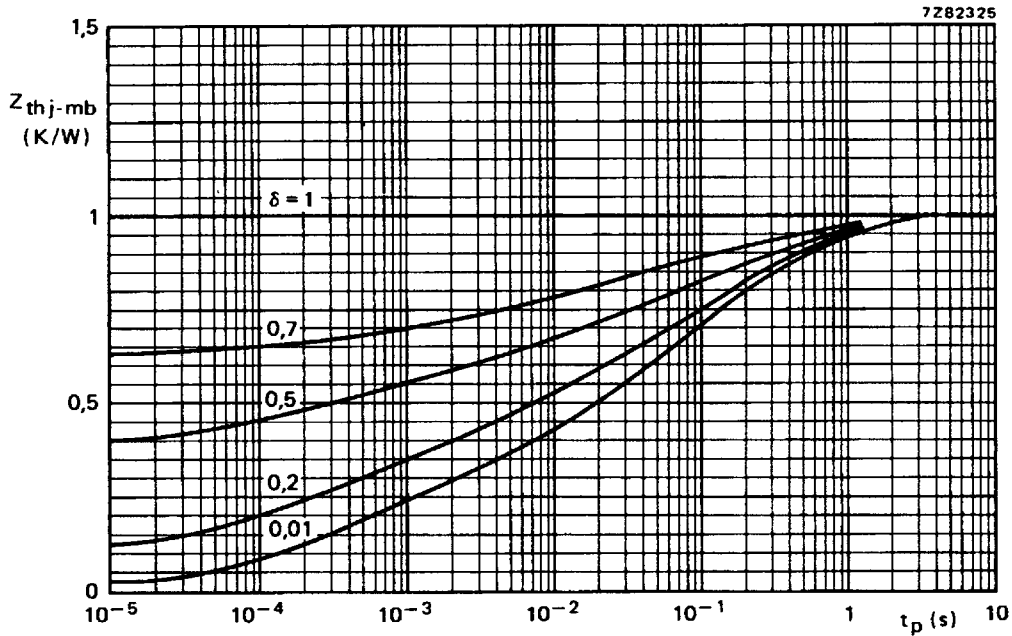


Fig. 9 Pulse power rating chart.

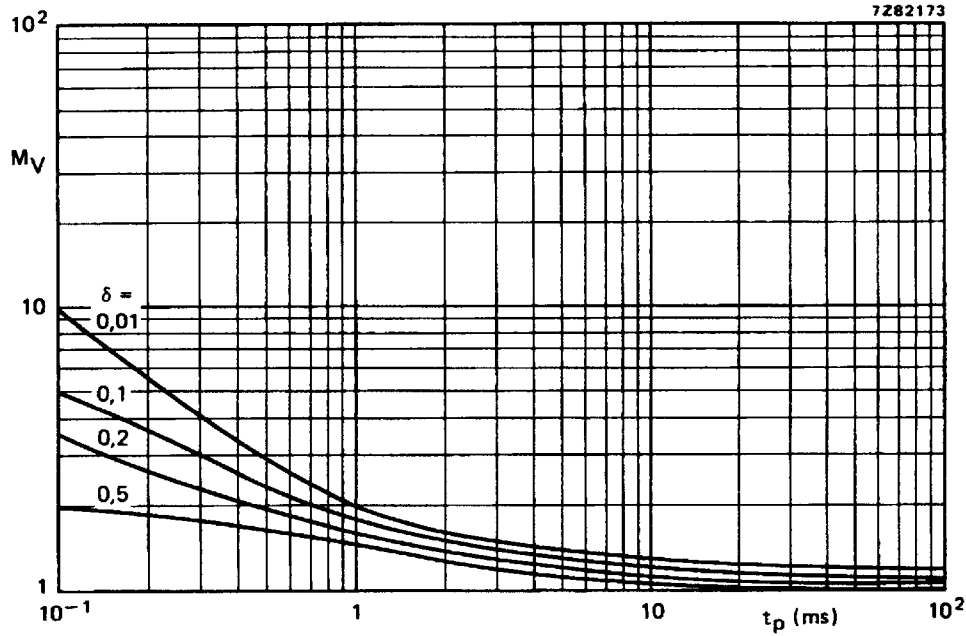


Fig. 10 S.B. voltage multiplying factor at the  $I_{Cmax}$  level.

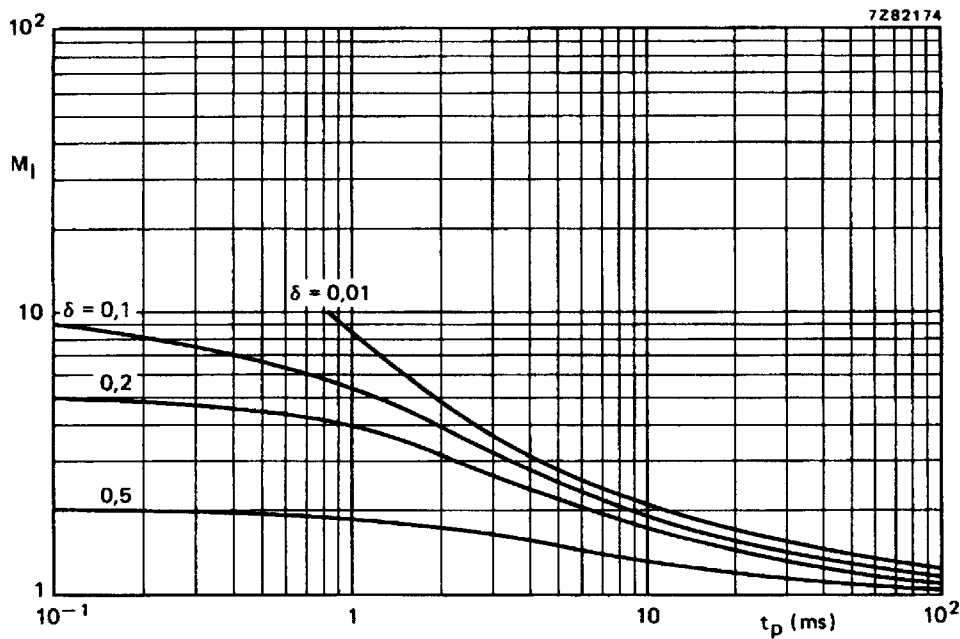


Fig. 11 S.B. current multiplying factor at the  $V_{CFQmax}$  level.

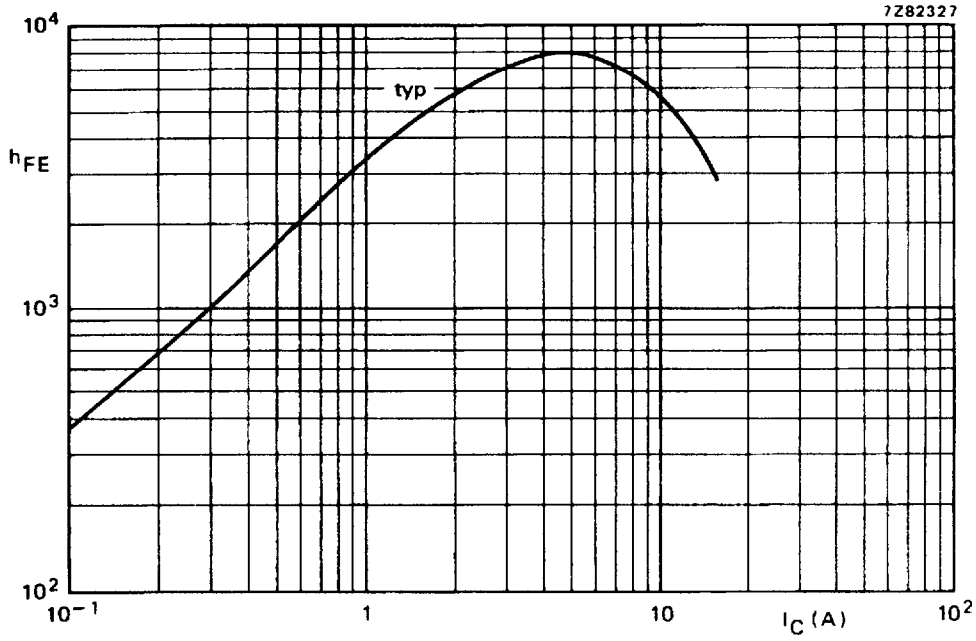


Fig. 12 Typical d.c. current gain as a function of collector current;  $V_{CE} = 3\text{ V}$ ;  $T_j = 25\text{ }^\circ\text{C}$ .

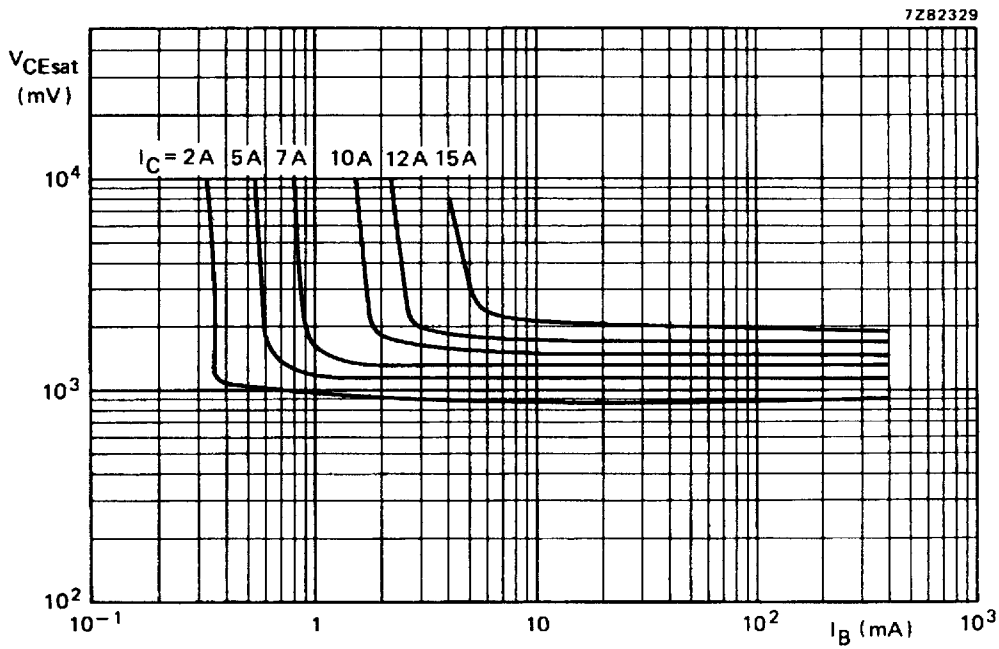


Fig. 13 Typical collector-emitter saturation voltages.