

SILICON EPITAXIAL-BASE POWER TRANSISTORS

PNP transistors in a plastic envelope. With their npn complements BD201, BD203, and BDX77, they are primarily intended for use in hi-fi equipment delivering an output of 15 to 25 W into a 4 Ω or 8 Ω load.

QUICK REFERENCE DATA

			BD202	BD204	BDX78
Collector-emitter voltage (open base)	$-V_{CE0}$	max.	45	60	80 V
Collector current (DC)	$-I_C$	max.		8	A
Total power dissipation up to $T_{mb} = 25^\circ\text{C}$	P_{tot}	max.		60	W
Cut-off frequency $-I_C = 0.3\text{ A}; -V_{CE} = 3\text{ V}$	f_{hfe}	min.		25	kHz

MECHANICAL DATA

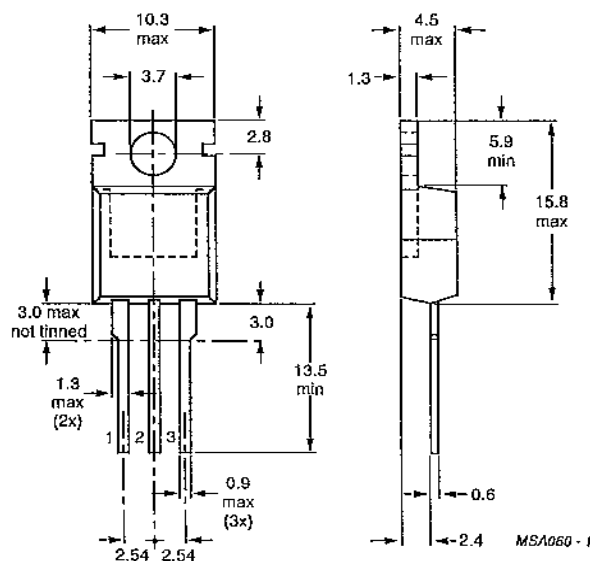
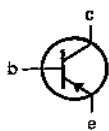
Dimensions in mm

Fig.1 TO-220.

Collector connected
to mounting base.

Pinning

- 1 = base
2 = collector
3 = emitter



See also chapters Mounting Instructions and Accessories.

RATINGS

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

			BD202	BD204	BDX78	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Emitter-base voltage (open collector)	$-V_{EBO}$	max.	5	5	5	V
Collector current (DC)	$-I_C$	max.		8		A
Collector current (peak value; t_p max. 10 ms)	$-I_{CM}$	max.		12		A
Collector current (non-repetitive peak value, t_p max. 2 ms)	$-I_{CSM}$	max.		25		A
Base current (DC)	$-I_B$	max.		3		A
Total power dissipation up to $T_{mb} = 25^\circ\text{C}$	P_{tot}	max.		60		W
Storage temperature range	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	$R_{th\ j-a}$	=		70		K/W

CHARACTERISTICS

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

Collector cut-off current

 $I_B = 0; -V_{CE} = 30\text{ V}$ $I_E = 0; -V_{CB} = 40\text{ V}; T_j = 150^\circ\text{C}$

$-I_{CEO}$	max.	0.2	mA
$-I_{CBO}$	max.	1	mA

Emitter cut-off current

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

$-I_{EBO}$	max.	0.5	mA
------------	------	-----	----

Collector-emitter breakdown voltage

 $I_C = 0.2\text{ A}; I_B = 0$ $I_C = 0.2\text{ A}; I_B = 0$ $I_C = 0.2\text{ A}; I_B = 0$

$-V_{(BR)CEO}$	min.	45	V
$-V_{(BR)CEO}$	min.	60	V
$-V_{(BR)CEO}$	min.	80	V

Base-emitter voltage (note 1)

 $-I_C = 3\text{ A}; -V_{CE} = 2\text{ V}$

$-V_{BE}$	max.	1.5	V
-----------	------	-----	---

Knee voltage (note 1)

 $-I_C = 3\text{ A}; -I_B = \text{value at which}$ $-I_C = 3.3\text{ A at } -V_{CE} = 2\text{ V}$

$-V_{CEK}$	typ.	1	V
------------	------	---	---

Saturation voltages (note 1)

 $-I_C = 3\text{ A}; -I_B = 0.3\text{ A}$ $-I_C = 6\text{ A}; -I_B = 0.6\text{ A}$

$-V_{CEsat}$	max.	1	V
$-V_{CEsat}$	max.	1.5	V
$-V_{BEsat}$	max.	2	V

DC current gain (note 1)

 $-I_C = 3\text{ A}; -V_{CE} = 2\text{ V}$ $-I_C = 2\text{ A}; -V_{CE} = 2\text{ V}$ $-I_C = 1\text{ A}; -V_{CE} = 2\text{ V}$

BD202

BD204

BDX78

h_{FE}	min.	30	
h_{FE}	min.	30	
h_{FE}	min.	30	

Note

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

PHILIPS INTERNATIONAL

56E D

7110826 0042818 794 PHIN

Cut-off frequency

 $-I_C = 0.3 \text{ A}; -V_{CE} = 3 \text{ V}$ f_{hfe} min. 25 kHzTransition frequency at $f = 1 \text{ MHz}$ $-I_C = 0.3 \text{ A}; -V_{CE} = 3 \text{ V}$ f_T min. 7 MHz

DC current gain ratio of matched complementary pairs

 $-I_C = 1 \text{ A}; -V_{CE} = 2 \text{ V}$ h_{FE1}/h_{FE2} max. 2.5

Forward bias second breakdown collector current

 $V_{CE} = 40 \text{ V}; t_p = 0.1 \text{ s}$ I_{SB} min. 1.5 A

Switching times

 $-I_{Con} = 2 \text{ A}; -I_{Bon} = I_{Boff} = 0.2 \text{ A}$

turn-on time

 t_{on} max. 1 μs

turn-off time

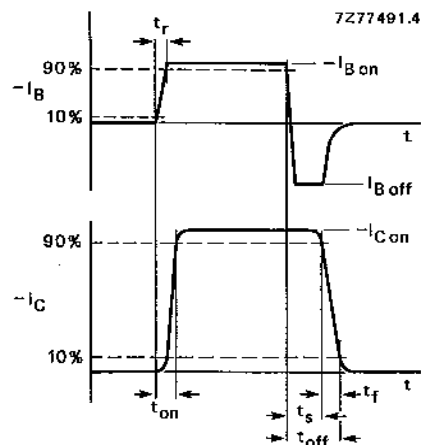
 t_{off} max. 2 μs 

Fig. 2 Switching times waveforms.

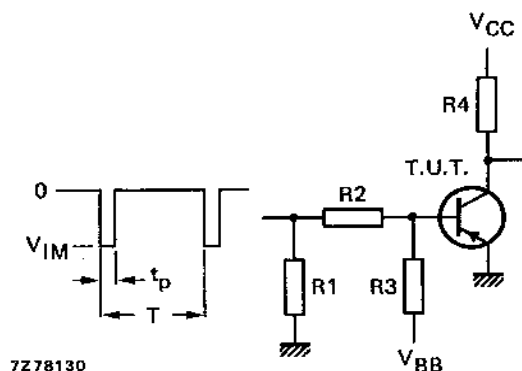


Fig. 3 Switching times test circuit.

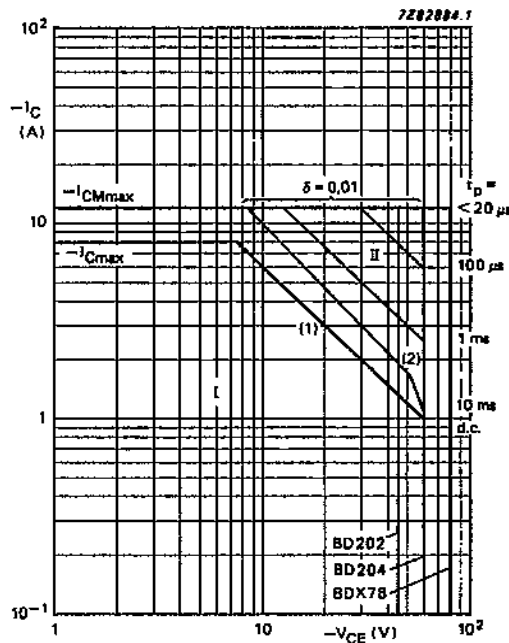
 $-V_{IM} = 15 \text{ V}$ $R3 = 22 \Omega$ $-V_{CC} = 20 \text{ V}$ $R4 = 10 \Omega$ $+V_{BB} = 4 \text{ V}$ $t_r = t_f = 15 \text{ ns}$ $R1 = 56 \Omega$ $t_p = 10 \mu\text{s}$ $R2 = 33 \Omega$ $T = 500 \mu\text{s}$

BD202
BD204
BDX78

PHILIPS INTERNATIONAL

56E D 7110826 0042819 620 PHIN

T-33-21



- I Region of permissible DC operation.
- II Permissible extension for repetitive pulse operation.
- (1) $P_{tot \max}$ and $P_{peak \max}$ lines.
- (2) Second-breakdown limits.

Fig.4 Safe operating area; $T_{mb} = 25^\circ\text{C}$.

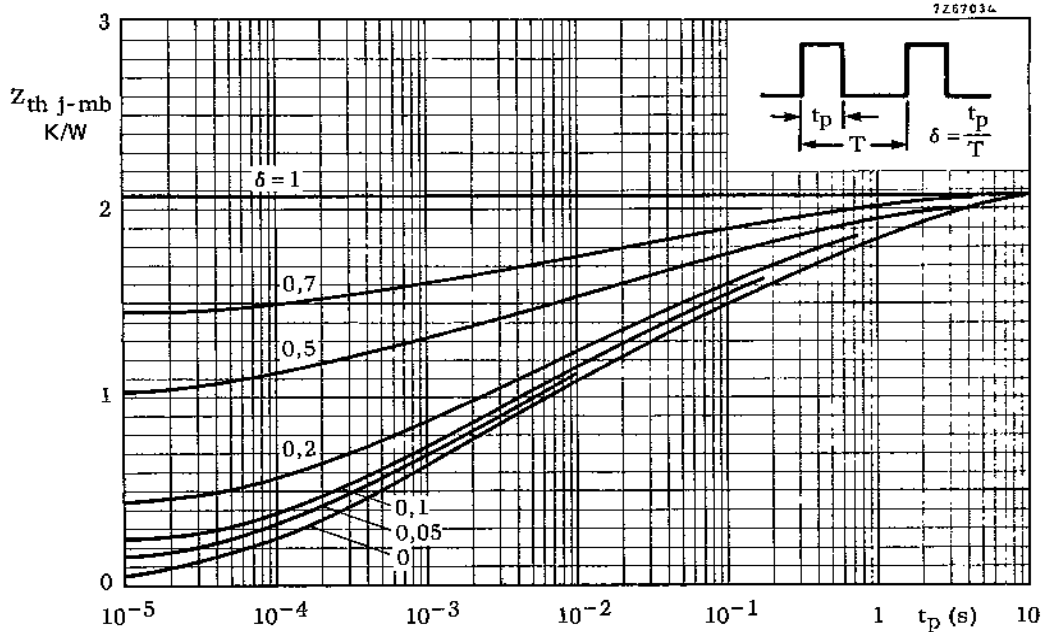
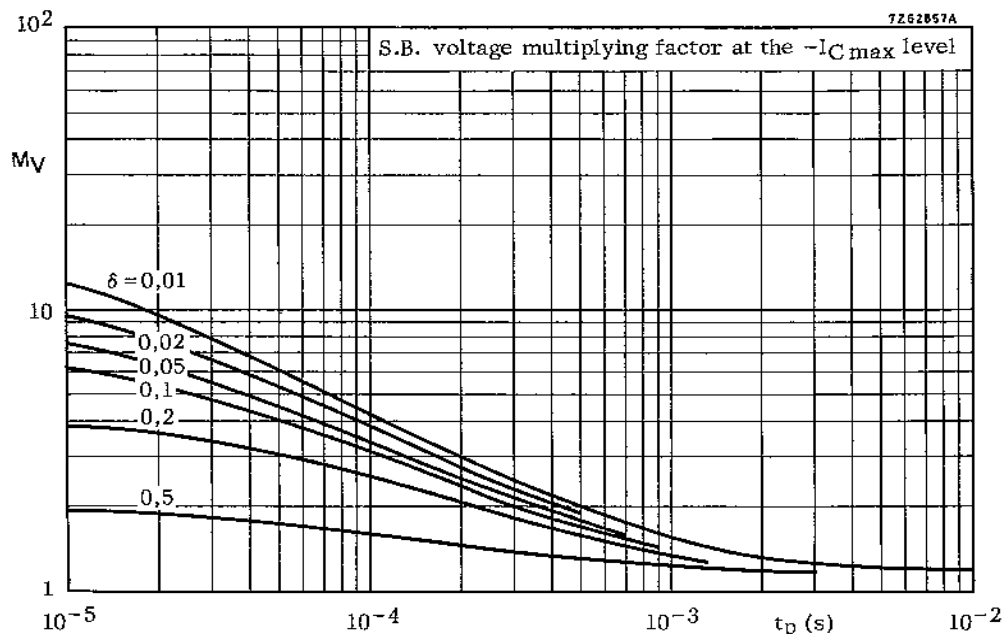


Fig. 5 Pulse power rating chart.

Fig. 6 S.B. voltage multiplying factor at the $-I_{C\ max}$ level.

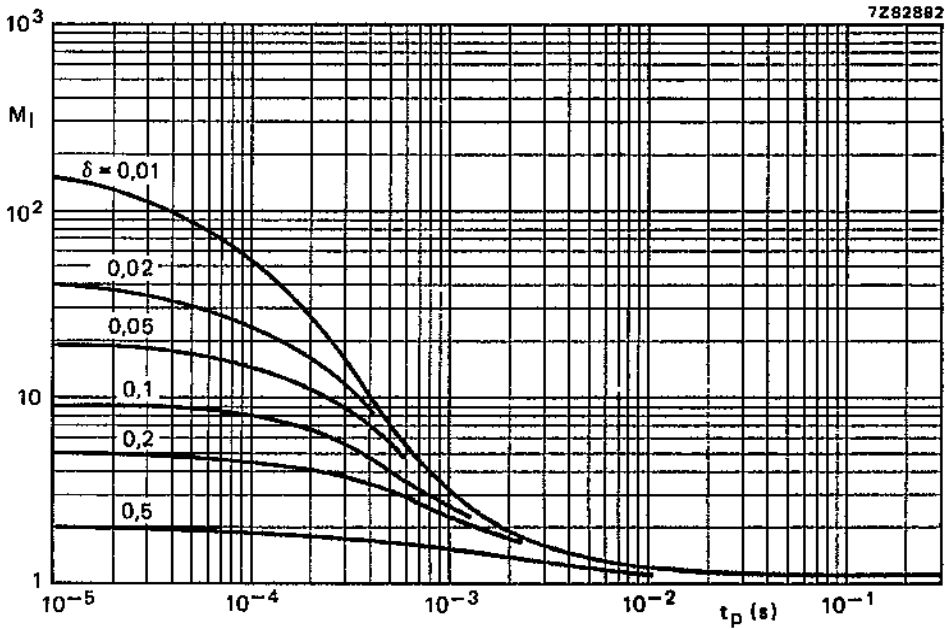


Fig. 7 S.B. current multiplying factor at the $-V_{CEmax}$ level.

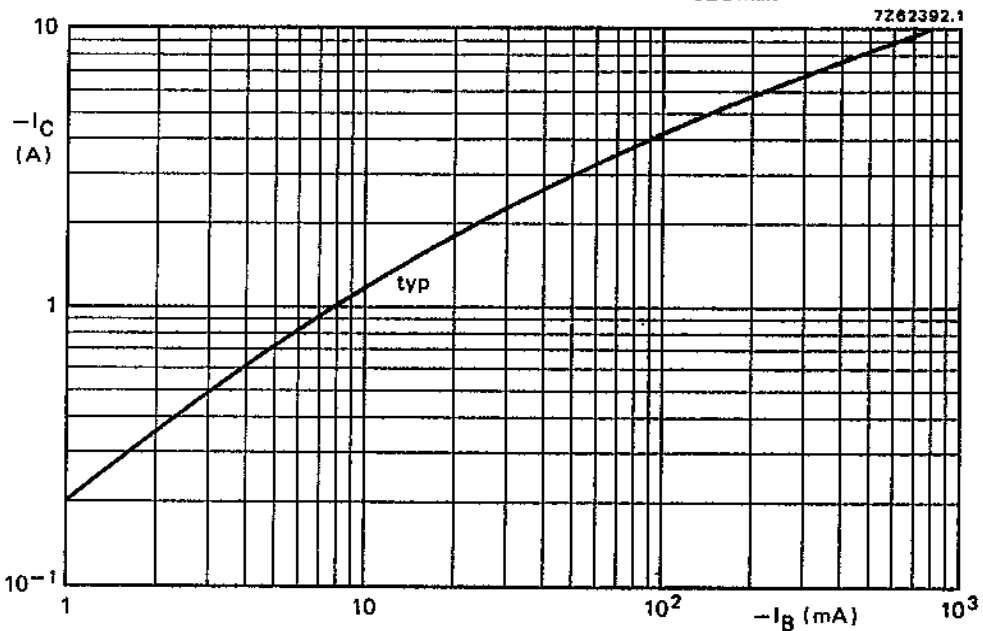
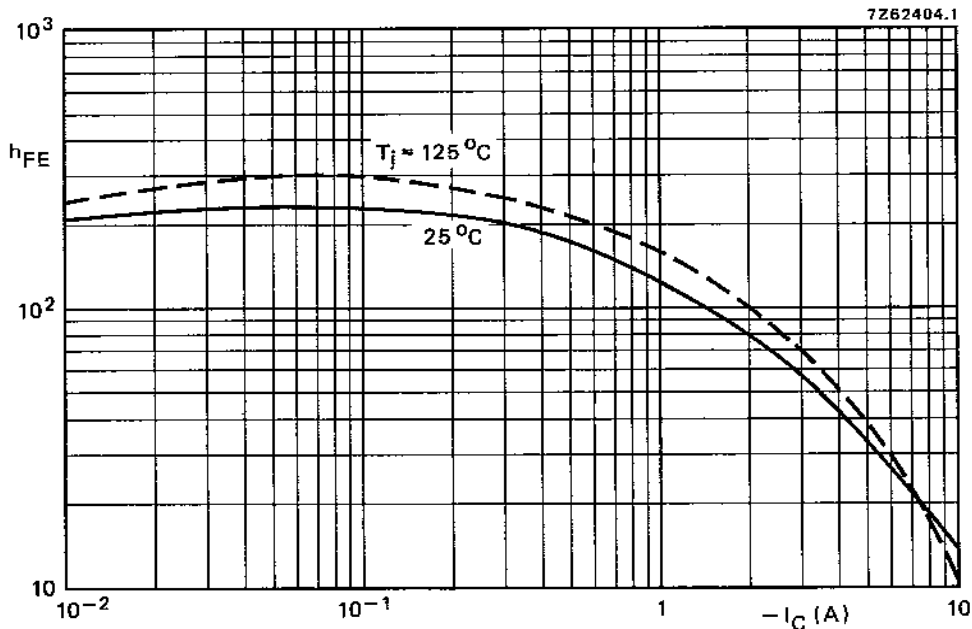
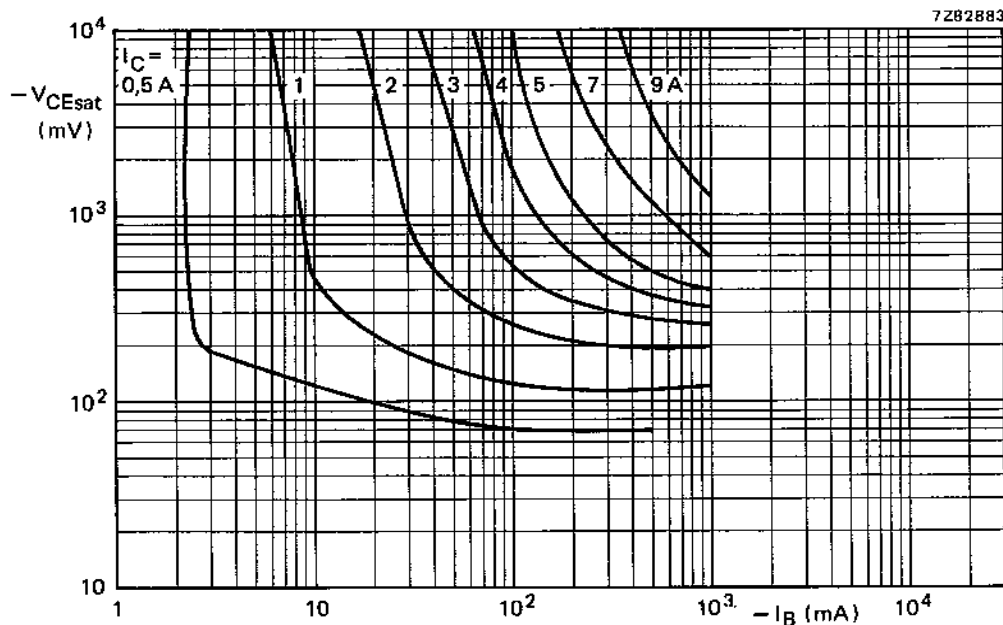


Fig. 8 Typical collector current as a function of base current. $-V_{CE} = 2$ V; $T_J = 25$ °C.

Fig. 9 Typical forward current transfer ratio at $-V_{CE} = 2$ V.Fig. 10 Typical collector-emitter saturation voltage. $T_j = 25^\circ\text{C}$.

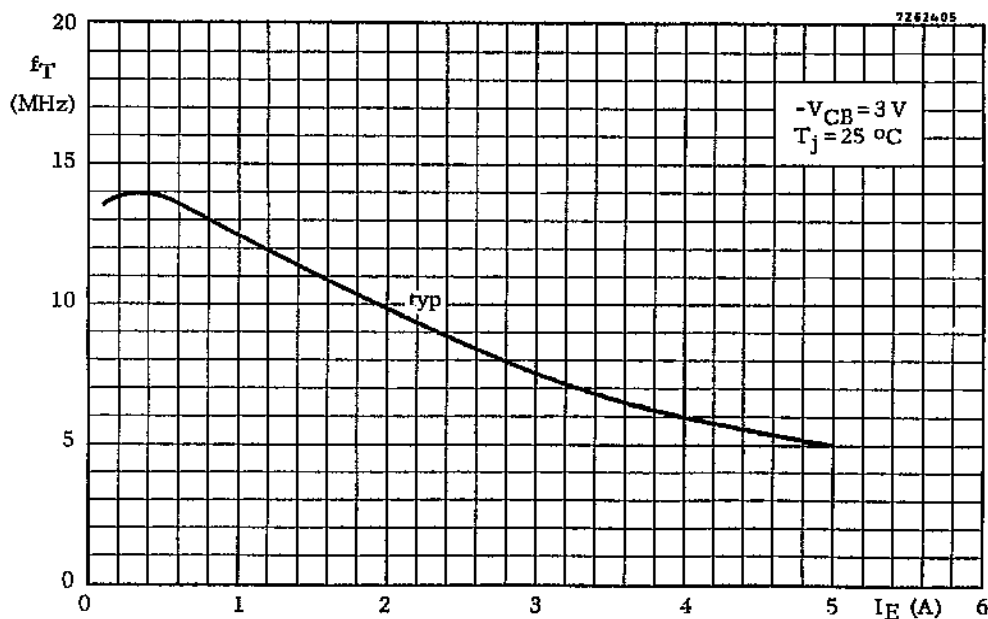


Fig. 11 Typical transition frequency.

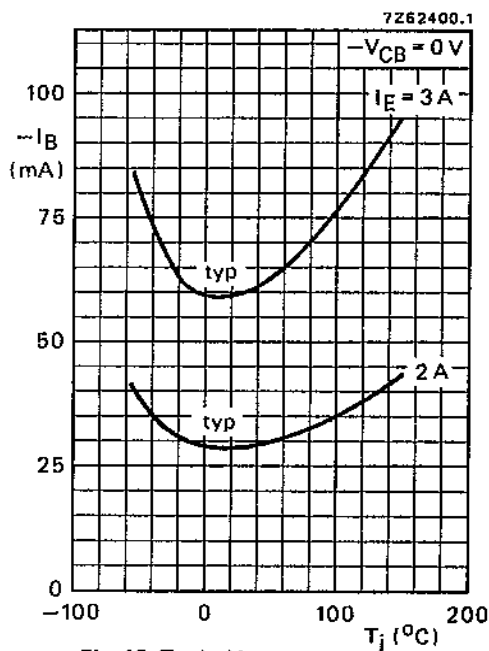


Fig. 12 Typical base current.

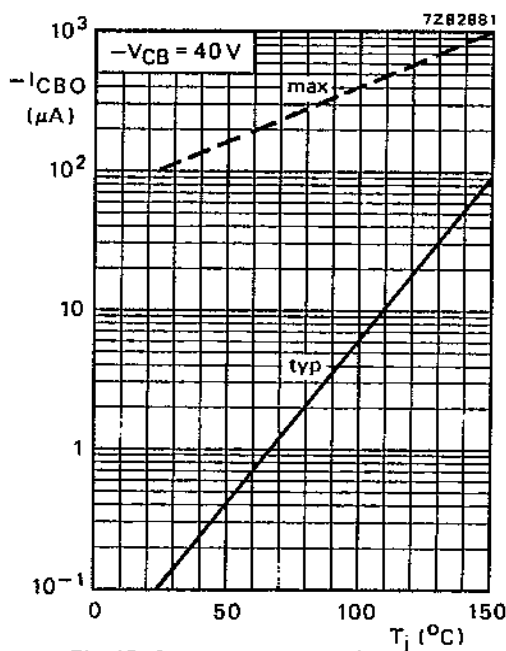


Fig. 13 Collector-base cut-off current.

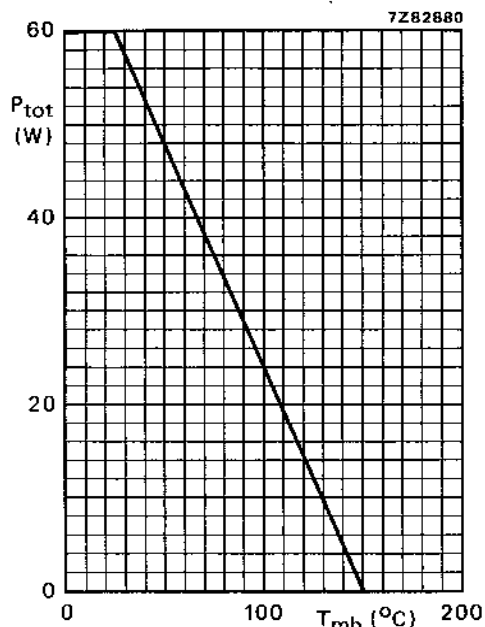


Fig. 14 Total power dissipation.

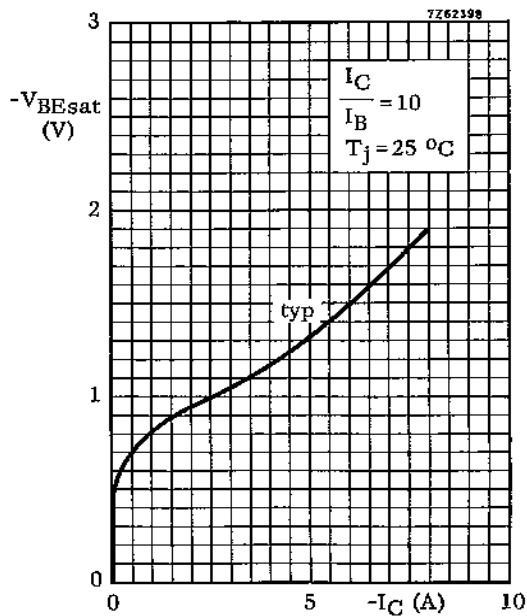


Fig. 15 Base-emitter saturation voltage.

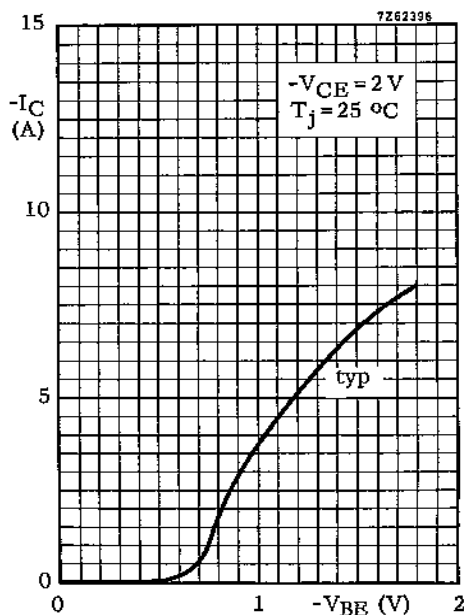


Fig. 16 Typical collector current.