

SILICON EPITAXIAL BASE POWER TRANSISTORS

T-33-09

N-P-N silicon transistors in a plastic envelope intended for use in output stages of audio and television amplifier circuits where high peak powers can occur.

P-N-P complements are BD934; 936; 938; 940 and 942.

QUICK REFERENCE DATA

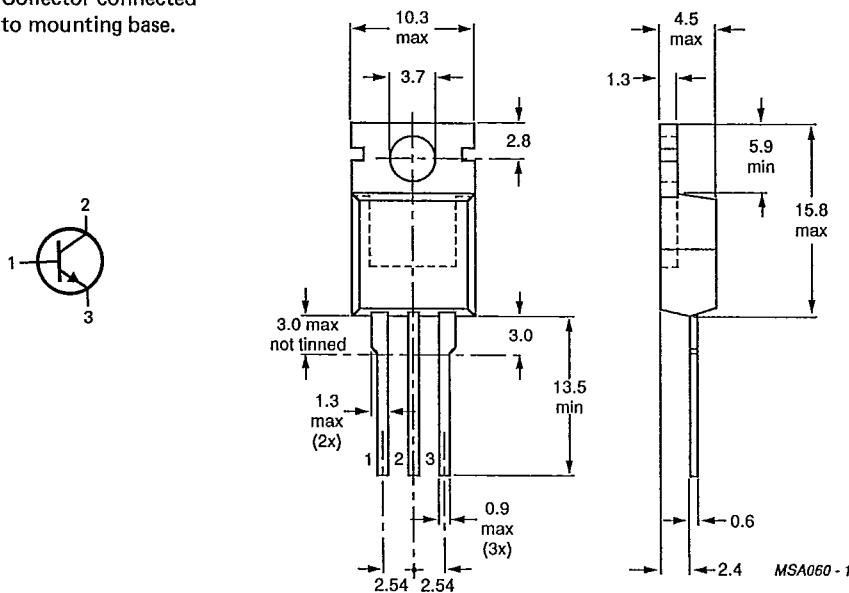
			BD933	935	937	939	941
Collector-base voltage	$V_{CBO}$	max.	45	60	100	120	140 V
Collector-emitter voltage	$V_{CEO}$	max.	45	60	80	100	120 V
Collector current (d.c.)	$I_C$	max.			3		A
Total power dissipation up to $T_{mb} = 25^\circ\text{C}$	$P_{tot}$	max.			30		W
Junction temperature	$T_j$	max.			150		$^\circ\text{C}$
D.C. current gain					40 to 250		
$I_C = 150\text{ mA}; V_{CE} = 2\text{ V}$	$h_{FE}$				40 to 250		
$I_C = 1\text{ A}; V_{CE} = 2\text{ V}$	$h_{FE}$	>			25		
Transition frequency					3		MHz
$I_C = 250\text{ mA}; V_{CE} = 10\text{ V}$	$f_T$	>			3		MHz

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220.

Collector connected to mounting base.



See also chapters Mounting instructions and Accessories.

BD933; 935  
BD937; 939  
BD941

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**RATINGS**

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

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		BD933	935	937	939	941	
Collector-base voltage (open emitter)	V <sub>CB0</sub>	max.	45	60	100	120	140 V
Collector-emitter voltage (open base)	V <sub>CE0</sub>	max.	45	60	80	100	120 V
Emitter-base voltage (open collector)	V <sub>EB0</sub>	max.			5		V
Collector current (d.c.)	I <sub>C</sub>	max.			3		A
Collector current (peak value)	I <sub>CM</sub>	max.			7		A
Base current (d.c.)	I <sub>B</sub>	max.			0,5		A
Total power dissipation up to T <sub>mb</sub> = 25 °C	P <sub>tot</sub>	max.			30		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>	=		4,17		K/W
From junction to ambient in free air	R <sub>th j-a</sub>	=		70		K/W

**CHARACTERISTICS**

T<sub>j</sub> = 25 °C unless otherwise specified

Collector cut-off current							
I <sub>E</sub> = 0; V <sub>CB</sub> = V <sub>CB0max</sub>	I <sub>CB0</sub>	<		50		μA	
I <sub>E</sub> = 0; V <sub>CB</sub> = V <sub>CB0max</sub> ; T <sub>j</sub> = 150 °C	I <sub>CB0</sub>	<		1		mA	
I <sub>E</sub> = 0; V <sub>CE</sub> = V <sub>CE0max</sub>	I <sub>CE0</sub>	<		0,1		mA	
Emitter cut-off current							
I <sub>C</sub> = 0; V <sub>EB</sub> = 5 V	I <sub>EB0</sub>	<		0,2		mA	
D.C. current gain *							
I <sub>C</sub> = 150 mA; V <sub>CE</sub> = 2 V	h <sub>FE</sub>			40 to 250			
I <sub>C</sub> = 1 A; V <sub>CE</sub> = 2 V	h <sub>FE</sub>	>		25			
Base-emitter voltage **							
I <sub>C</sub> = 1 A; V <sub>CE</sub> = 2 V	V <sub>BE</sub>	<		1,3		V	
Collector-emitter saturation voltage *							
I <sub>C</sub> = 1 A; I <sub>B</sub> = 0,1 A	V <sub>CEsat</sub>	<		0,6		V	
Transition frequency at f = 1 MHz							
I <sub>C</sub> = 250 mA; V <sub>CE</sub> = 10 V	f <sub>T</sub>	>		3		MHz	
Switching times							
I <sub>Con</sub> = 1 A; I <sub>Bon</sub> = -I <sub>Boff</sub> = 0,1 A	t <sub>on</sub>	typ		0,4		μs	
turn-on time		<		1		μs	
Turn-off time	t <sub>off</sub>	typ.		1,5		μs	
		<		3		μs	
Second-breakdown collector current							
V <sub>CE</sub> = 40 V; t <sub>p</sub> = 0,1 s; non-repetitive	I <sub>(SB)</sub>	>		0,75		A	

\* Measured under pulse conditions: t<sub>p</sub> < 300 μs; δ < 2%.

\*\* V<sub>BE</sub> decreases by about 2,3 mV/K with increasing temperature.

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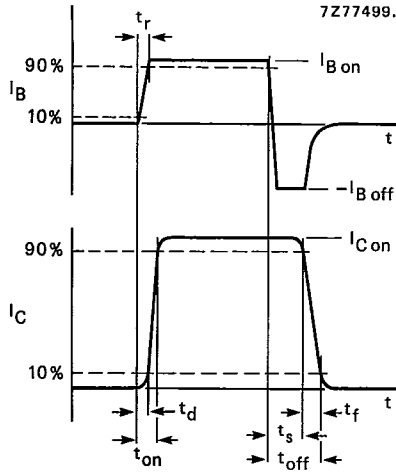


Fig. 2 Switching times waveforms.

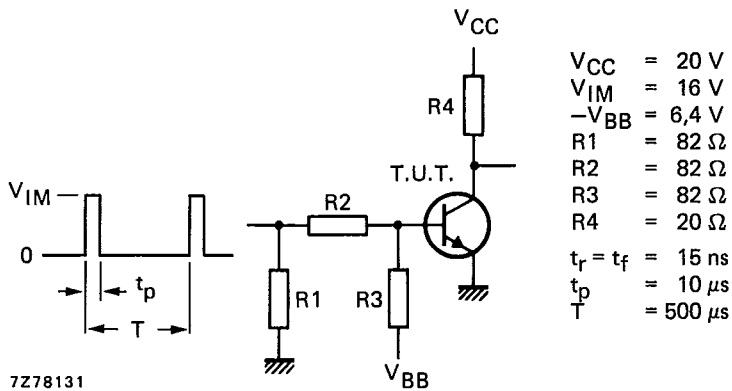


Fig. 3 Switching times test circuit.

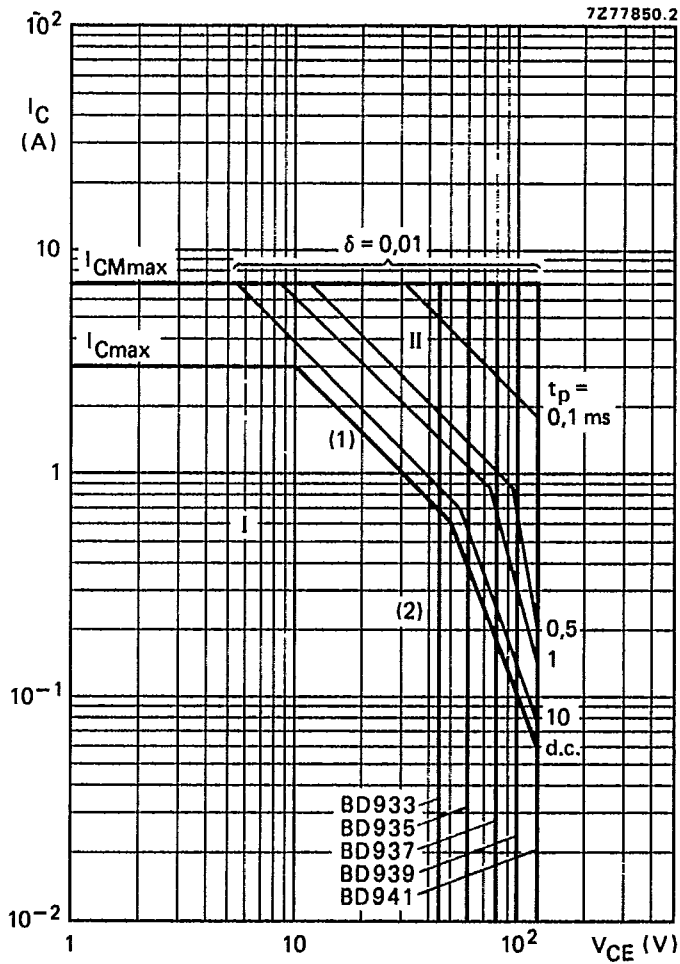


Fig. 4 Safe Operating Area,  $T_{mb} = 25^{\circ}\text{C}$ .

- 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.

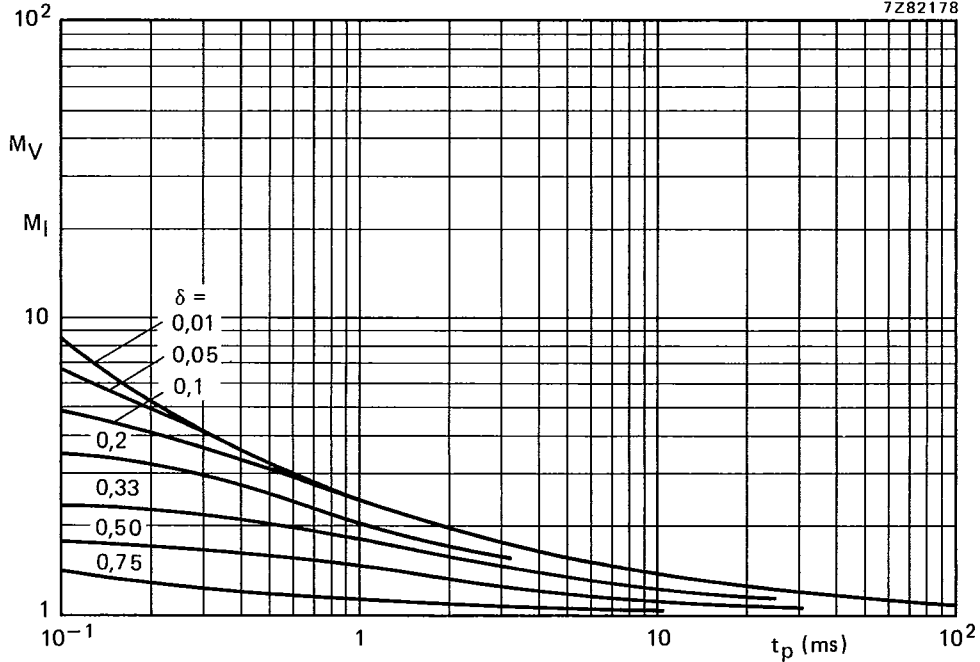


Fig. 5 Second-breakdown voltage multiplying factor at the  $I_{Cmax}$  level and second-breakdown current multiplying factor at the  $V_{CE0max}$  level.

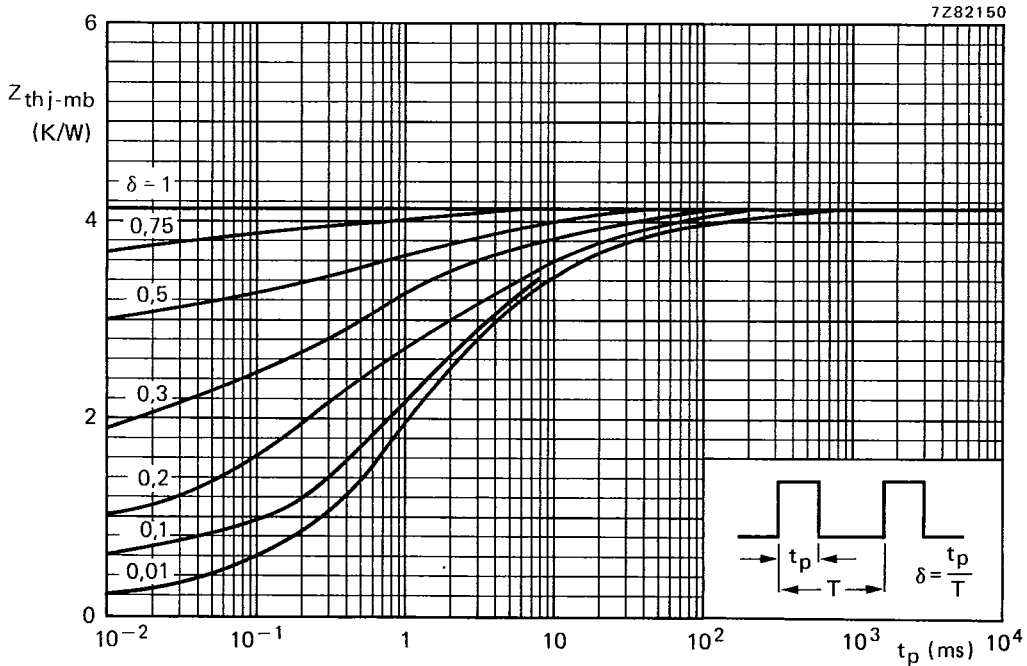


Fig. 6 Pulse power rating chart.

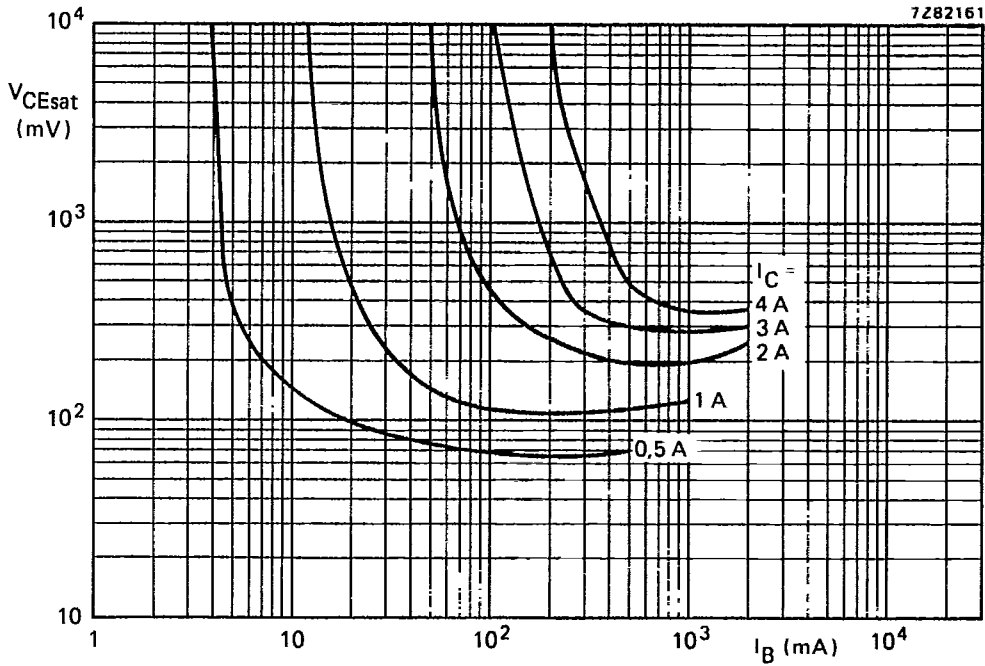


Fig. 7 Typical collector-emitter saturation voltage as a function of base current with collector current as a parameter.

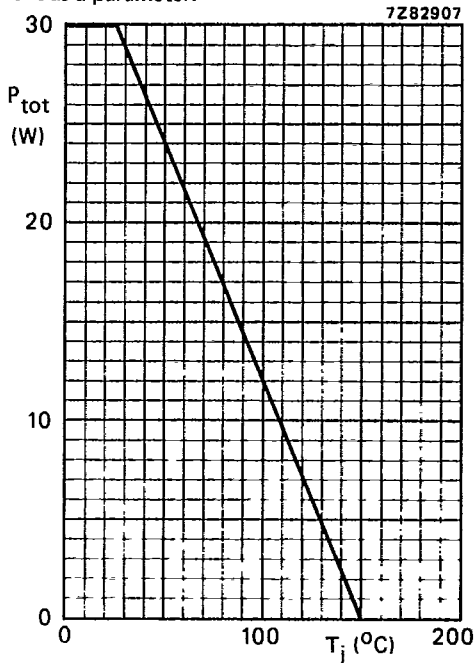


Fig. 8 Power derating curve.

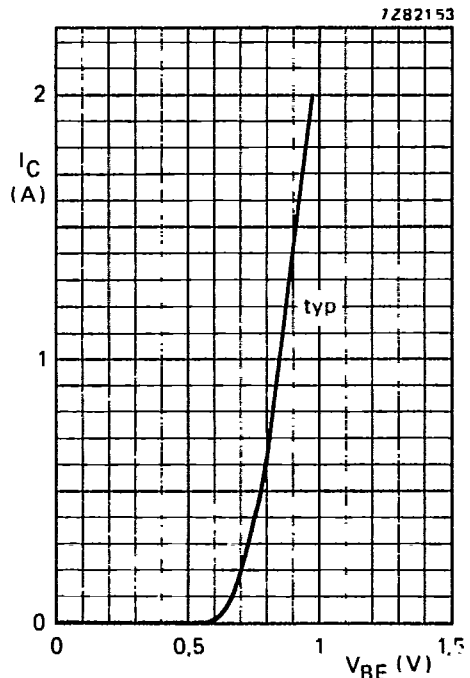


Fig. 9  $V_{CE} = 2$  V;  $T_j = 25^{\circ}C$ .

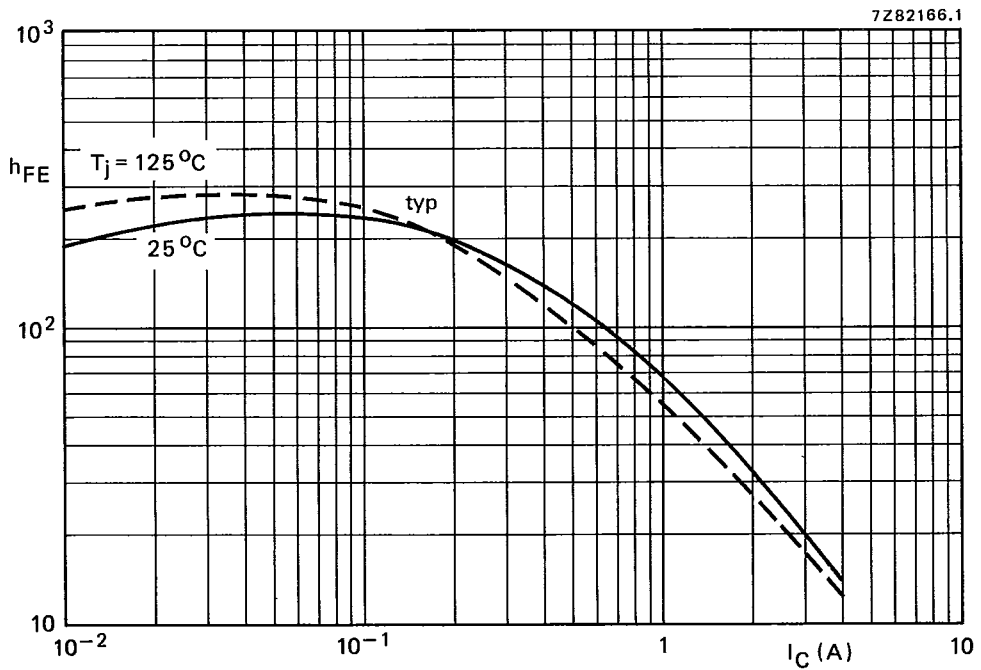


Fig. 10 Typical static forward current transfer ratio as a function of the collector current.  $V_{CE} = 2\text{ V}$