

NPN silicon power transistor in a SOT186 envelope with an electrically insulated mounting base, intended for use in audio output stages and for general purpose amplifier applications.

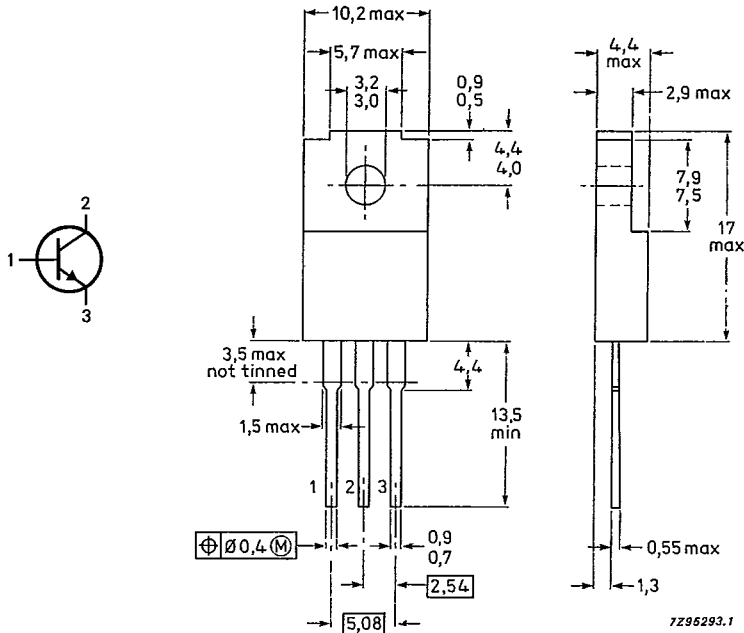
PNP complements are BD934F, BD936F, BD938F, BD940F and BD942F.

**QUICK REFERENCE DATA**

			BD933F	935F	937F	939F	941F
Collector-base voltage (open emitter)	$V_{CBO}$	max.	45	60	100	120	140 V
Collector-emitter voltage (open base)	$V_{CEO}$	max.	45	60	80	100	120 V
Emitter-base voltage (open collector)	$V_{EBO}$	max.			5		V
Collector current d.c.	$I_C$	max.			3		A
peak value	$I_{CM}$	max.			7		A
Total power dissipation up to $T_h = 25\text{ }^\circ\text{C}$	$P_{tot}$	max.			19		W
D.C. current gain $I_C = 1\text{ A}; V_{CE} = 2\text{ V}$	$h_{FE}$	min.			25		
Transition frequency at $f = 1\text{ MHz}$ $I_C = 250\text{ mA}; V_{CE} = 10\text{ V}$	$f_T$	min.			3		MHz

Fig.1 SOT186.

Dimensions in mm



7296293.1

**RATINGS**

T-33-07

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

		BD933F	935F	937F	939F	941F	
Collector-base voltage (open emitter)	$V_{CBO}$	max. 45	60	100	120	140	V
Collector-emitter voltage (open base)	$V_{CEO}$	max. 45	60	80	100	120	V
Emitter-base voltage (open collector)	$V_{EBO}$	max.		5			V
Collector current d.c.	$I_C$	max.		3			A
peak value	$I_{CM}$	max.		7			A
Base current (d.c.)	$I_B$	max.		0,5			A
Total power dissipation up to $T_h = 25\text{ }^\circ\text{C}$ (1)	$P_{tot}$	max.		14			W
up to $T_h = 25\text{ }^\circ\text{C}$ (2)	$P_{tot}$	max.		19			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 internal heatsink	$R_{thj-mb}$	=		4,17			K/W
From junction to external heatsink (1)	$R_{thj-h}$	=		9,17			K/W
From junction to external heatsink (2)	$R_{thj-h}$	=		6,67			K/W
From junction to ambient	$R_{thj-a}$	=		55			K/W

**INSULATION**

Voltage allowed between all terminals and external heatsink, peak value (3)	$V_{insul}$	max.		1000			V
Insulation capacitance between collector and external heatsink	$C_{c-h}$	typ.		12			pF

- (1) Mounted without heatsink compound and  $30 \pm 5$  newtons pressure on centre of envelope.
- (2) Mounted with heatsink compound and  $30 \pm 5$  newtons pressure on centre of envelope.
- (3) Heatsink temperature  $T_h = 25\text{ }^\circ\text{C}$ ; relative humidity  $R_H < 75\%$ ; atmospheric pressure  $P_{amb} = 1013$  mbar.

## CHARACTERISTICS

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

T-33-07

Collector cut-off currents

 $I_E = 0; V_{CB} = V_{CB0max}$  $I_{CBO} < 0,1\text{ mA}$  $I_E = 0; V_{CB} = V_{CB0max}; T_h = 150\text{ }^\circ\text{C}$  $I_{CBO} < 3\text{ mA}$  $I_E = 0; V_{CE} = V_{CEOmax}$  $I_{CEO} < 0,5\text{ mA}$ 

Emitter cut-off current

 $I_C = 0; V_{EB} = 5\text{ V}$  $I_{EBO} < 1\text{ mA}$ 

D.C. current gain (1)

 $I_C = 1\text{ A}; V_{CE} = 2\text{ V}$  $h_{FE} > 25$  $I_C = 150\text{ mA}; V_{CE} = 2\text{ V}$  $h_{FE} 40\text{ to }250$ 

Base-emitter voltage (1)+(2)

 $I_C = 1\text{ A}; V_{CE} = 2\text{ V}$  $V_{BE} < 1,3\text{ V}$ 

Collector-emitter saturation voltage (1)

 $I_C = 1\text{ A}; I_B = 0,1\text{ A}$  $V_{CEsat} < 0,6\text{ V}$ Transition frequency at  $f = 1\text{ MHz}$  $I_C = 250\text{ mA}; V_{CE} = 10\text{ V}$  $f_T > 3\text{ MHz}$ 

Second-breakdown collector current

 $V_{CE} = 40\text{ V}; t_p = 1\text{ s};$ 

non-repetitive, without heatsink

 $I_{SB} > 475\text{ mA}$ 

Switching times

 $I_C = 1\text{ A}; I_{B0n} = -I_{B0ff} = 0,1\text{ A}$ 

turn-on time

 $t_{0n}$  typ.  $0,4\text{ }\mu\text{s}$   
<  $1\text{ }\mu\text{s}$ 

turn-off time

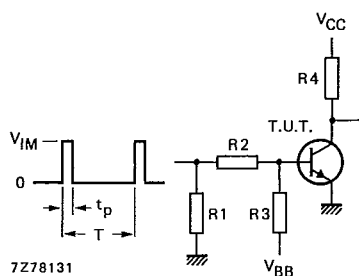
 $t_{0ff}$  typ.  $1,5\text{ }\mu\text{s}$   
<  $3\text{ }\mu\text{s}$  $V_{CC} = 20\text{ V}$  $V_{IM} = 16\text{ V}$  $-V_{BB} = 6,4\text{ V}$  $R1 = 82\text{ }\Omega$  $R2 = 82\text{ }\Omega$  $R3 = 82\text{ }\Omega$  $R4 = 20\text{ }\Omega$  $t_r = t_f = 15\text{ ns}$  $t_p = 10\text{ }\mu\text{s}$  $T = 500\text{ }\mu\text{s}$ 

Fig. 2 Switching times test circuit.

(1) Measured under pulse conditions:  $t_p = 300\text{ }\mu\text{s}$ ;  $\delta = 0,02$ .(2)  $V_{BE}$  decreases by about  $2,3\text{ mV/K}$  with increasing temperature.

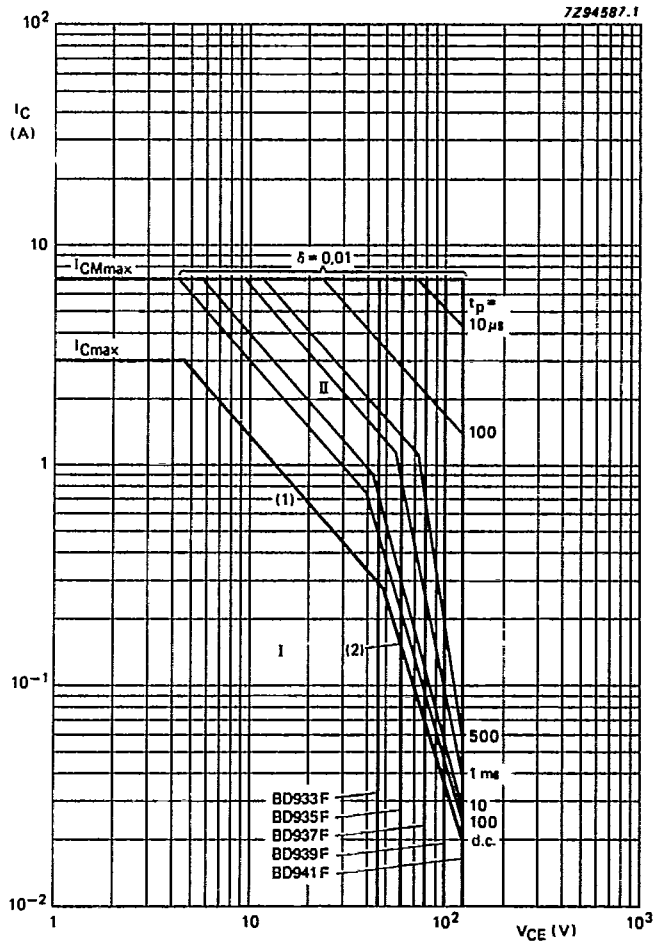


Fig. 4 Safe Operating Area,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

- 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.

Mounted *without* heatsink compound and  $30 \pm 5$  Newton pressure on the centre of the envelope.

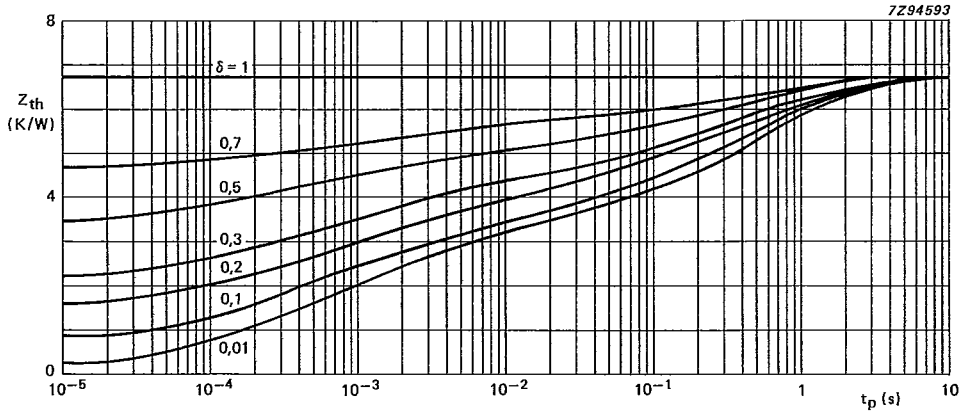


Fig. 5 Pulse power rating chart; mounted *with* heatsink compound and  $30 \pm 5$  Newton pressure on the envelope.

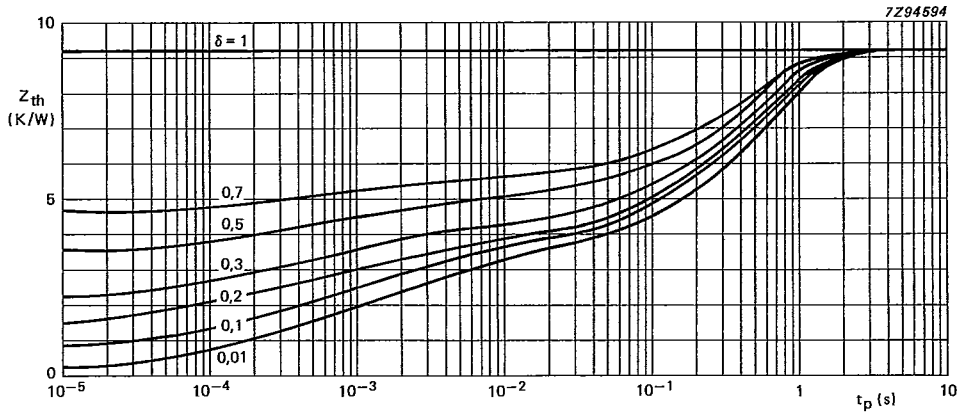


Fig. 6 Pulse power rating chart; mounted *without* heatsink compound and  $30 \pm 5$  Newton pressure on the envelope.

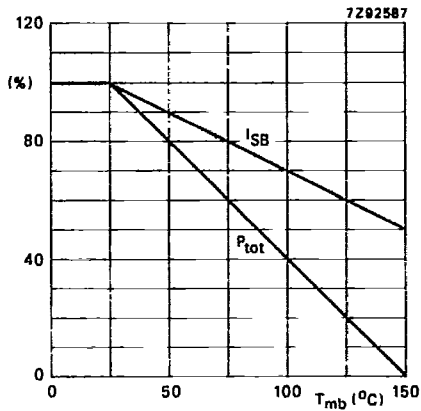


Fig. 7 Total power dissipation and second-breakdown current derating curve.

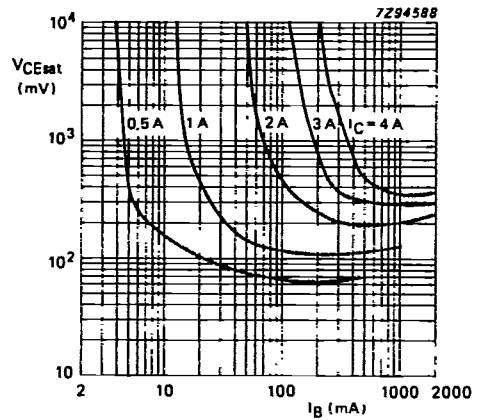


Fig. 8 Collector-emitter saturation voltage; typical values.

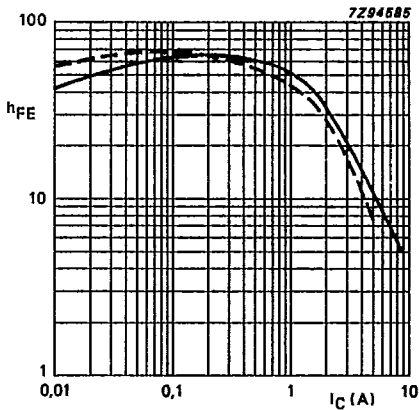


Fig. 9 D.C. current gain;  $V_{CE} = 2\text{ V}$ ; typical values;  
 —  $T_j = 25\text{ }^\circ\text{C}$ ; - - -  $T_j = 125\text{ }^\circ\text{C}$ .

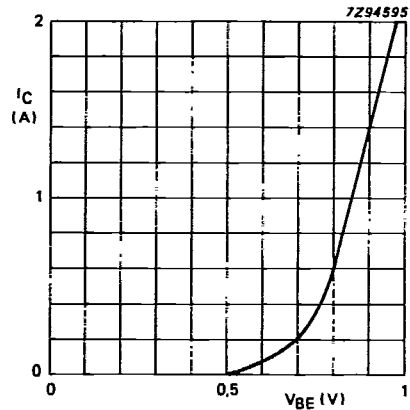


Fig. 10  $V_{CE} = 2\text{ V}$ ; typical values.