

PHILIPS INTERNATIONAL 56E D 7110826 0043052 592 PHIN
SILICON EPITAXIAL POWER TRANSISTORS T-33-07

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.

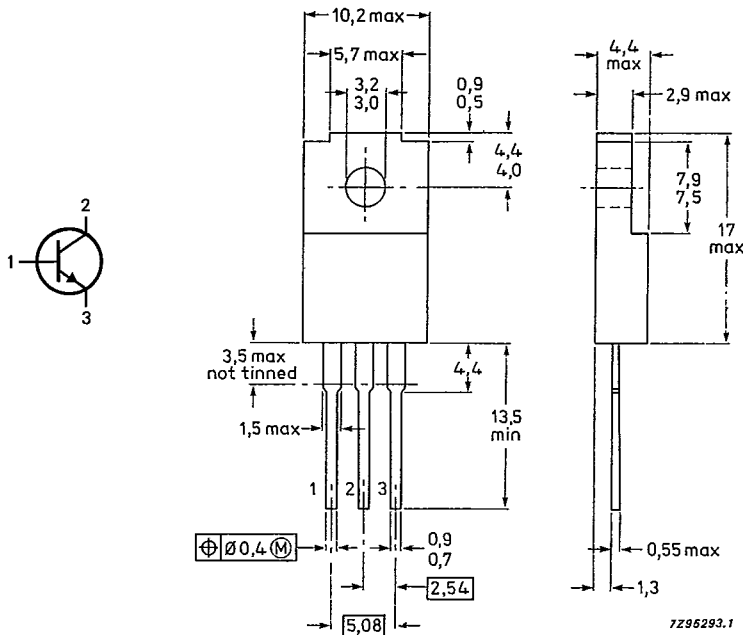
PNP complements are BD934F, BD936F, BD938F, BD940F and BD942F.

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 $T_h = 25^\circ\text{C}$	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



RATINGS

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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	$R_{th\ j-mb}$	=		4,17		K/W
From junction to external heatsink (1)	$R_{th\ j-h}$	=		9,17		K/W
From junction to external heatsink (2)	$R_{th\ j-h}$	=		6,67		K/W
From junction to ambient	$R_{th\ j-a}$	=		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 ± 5 newtons pressure on centre of envelope.

(2) Mounted with heatsink compound and 30 ± 5 newtons pressure on centre of envelope.

(3) Heatsink temperature $T_h = 25\text{ }^{\circ}\text{C}$; relative humidity $R_H \leq 75\%$; atmospheric pressure
 $P_{amb} = 1013\text{ mbar}$.

CHARACTERISTICS

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

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Collector cut-off currents

 $I_E = 0; V_{CB} = V_{CB0\text{max}}$ $I_E = 0; V_{CB} = V_{CB0\text{max}}; T_h = 150^\circ\text{C}$ $I_E = 0; V_{CE} = V_{CE0\text{max}}$ $I_{CBO} < 0,1 \text{ mA}$ $I_{CBO} < 3 \text{ mA}$ $I_{CEO} < 0,5 \text{ mA}$

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)

 $I_C = 1 \text{ A}; I_B = 0,1 \text{ A}$ $V_{CE\text{sat}} < 0,6 \text{ V}$ 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

 $I_C = 1 \text{ A}; I_{B\text{on}} = -I_{B\text{off}} = 0,1 \text{ A}$

turn-on time

 $t_{\text{on}} \begin{matrix} \text{typ.} & 0,4 \mu\text{s} \\ < & 1 \mu\text{s} \end{matrix}$

turn-off time

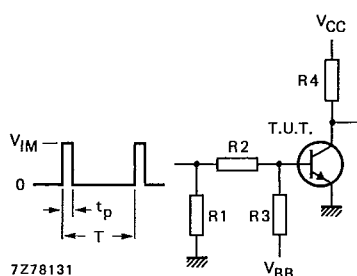
 $t_{\text{off}} \begin{matrix} \text{typ.} & 1,5 \mu\text{s} \\ < & 3 \mu\text{s} \end{matrix}$  $V_{CC} = 20 \text{ V}$ $V_{IM} = 16 \text{ V}$ $-V_{BB} = 6,4 \text{ V}$ $R1 = 82 \Omega$ $R2 = 82 \Omega$ $R3 = 82 \Omega$ $R4 = 20 \Omega$ $t_r = t_f = 15 \text{ ns}$ $t_p = 10 \mu\text{s}$ $T = 500 \mu\text{s}$

Fig. 2 Switching times test circuit.

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

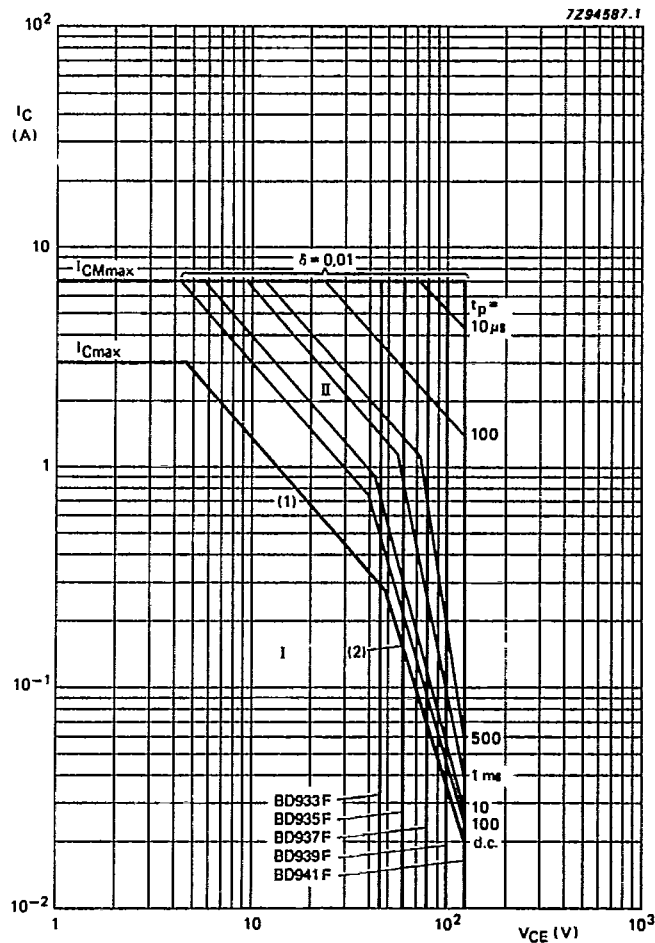


Fig. 4 Safe Operating Area, $T_{amb} = 25\text{ }^{\circ}\text{C}$.

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

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

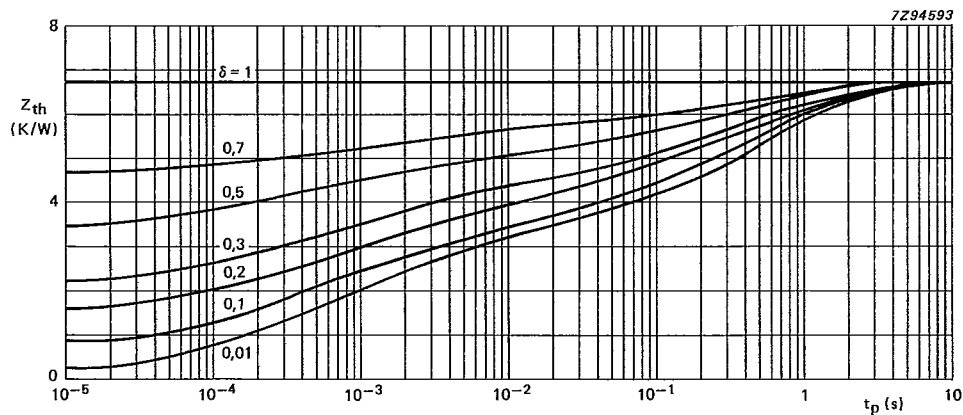


Fig. 5 Pulse power rating chart; mounted *with* heatsink compound and 30 ± 5 Newton pressure on the envelope.

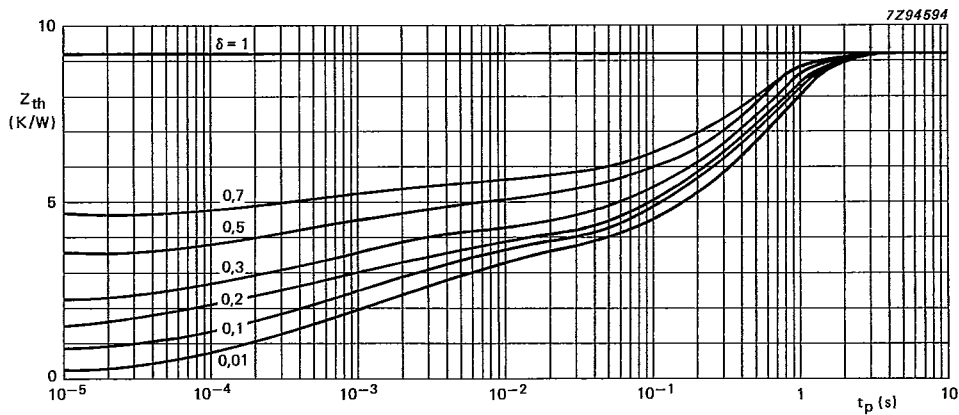


Fig. 6 Pulse power rating chart; mounted *without* heatsink compound and 30 ± 5 Newton pressure on the envelope.

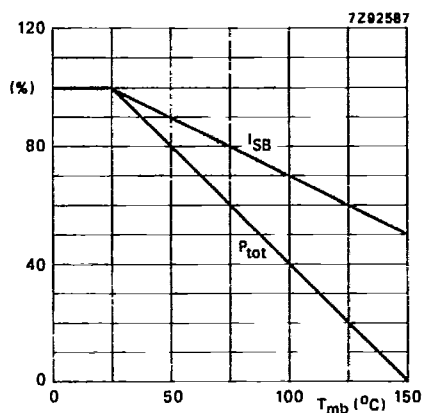


Fig. 7 Total power dissipation and second-breakdown current derating curve.

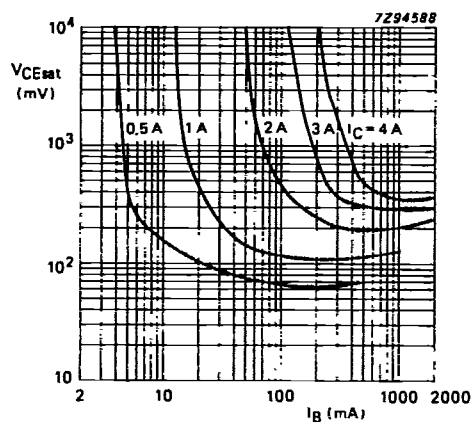


Fig. 8 Collector-emitter saturation voltage; typical values.

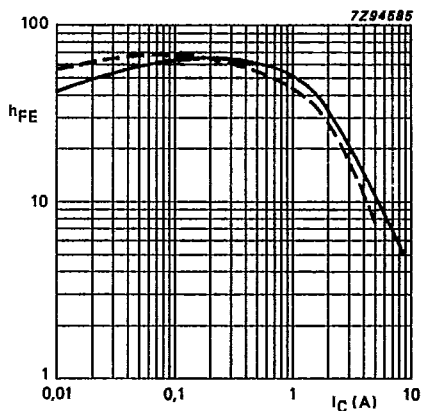


Fig. 9 D.C. current gain; $V_{CE} = 2 \text{ V}$; typical values;
— $T_j = 25 \text{ }^\circ\text{C}$; - - - $T_j = 125 \text{ }^\circ\text{C}$.

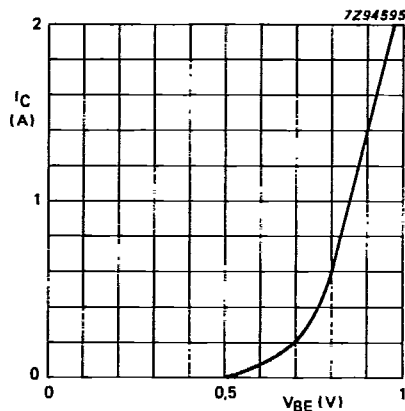


Fig. 10 $V_{CE} = 2 \text{ V}$; typical values.