

SILICON EPITAXIAL POWER TRANSISTORS

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

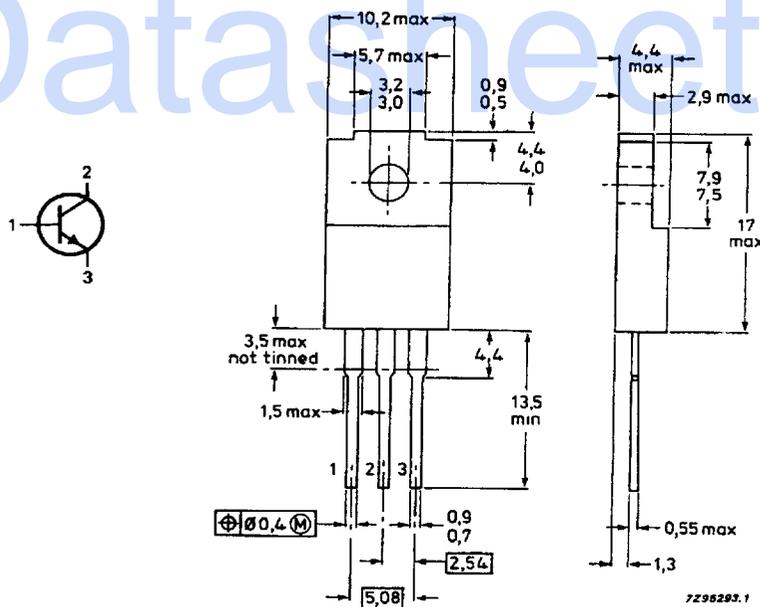
PNP complements are TIP30F, TIP30AF, TIP30BF, TIP30CF and TIP30DF.

QUICK REFERENCE DATA

		TIP29F	29AF	29BF	29CF	29DF
Collector-base voltage (open emitter)	V_{CBO} max.	80	100	120	140	160 V
Collector-emitter voltage (open base)	V_{CEO} max.	40	60	80	100	120 V
Emitter-base voltage (open collector)	V_{EBO} max.	5	5	5	5	5 V
Collector current d.c.	I_C max.	3	3	3	3	3 A
peak value	I_{CM} max.	7	7	7	7	7 A
Total power dissipation up to $T_h = 25^\circ\text{C}$	P_{tot} max.	19	19	19	19	19 W
D.C. current gain $I_C = 1\text{ A}; V_{CE} = 4\text{ V}$	h_{FE}	15 to 75				
Transition frequency at $f = 1\text{ MHz}$ $I_C = 0,2\text{ A}; V_{CE} = 10\text{ V}$	f_T min.	3			MHz	

Fig.1 SOT186.

Dimensions in mm



**TIP29F
TIP29AF; TIP29BF
TIP29CF; TIP29DF**

RATINGS

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

		TIP29F	29AF	29BF	29CF	29DF
Collector-base voltage (open emitter)	V_{CBO} max.	80	100	120	140	160 V
Collector-emitter voltage (open base)	V_{CEO} max.	40	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.			0,4		A
Total power dissipation up to $T_h = 25^\circ\text{C}$ (1)	P_{tot} max.			14		W
up to $T_h = 25^\circ\text{C}$ (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 envelope.

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

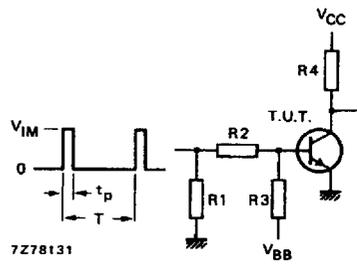
(3) Heatsink temperature $T_h = 25^\circ\text{C}$; relative humidity $R_H \leq 75\%$; atmospheric pressure $P_{amb} = 1013$ mbar.

CHARACTERISTICS

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

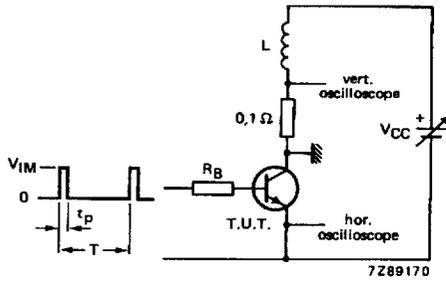
		TIP29F	29AF	29BF	29CF	29DF
Collector cut-off currents						
$I_B = 0; V_{CE} = 30\text{ V}$	I_{CEO}	< 0,1	0,1	—	—	— mA
$I_B = 0; V_{CE} = 60\text{ V}$	I_{CEO}	< —	—	0,1	0,1	— mA
$I_B = 0; V_{CE} = 90\text{ V}$	I_{CEO}	< —	—	—	—	0,1 mA
$V_{BE} = 0; V_{CE} = V_{CBO\text{ max}}$	I_{CES}	< 0,2	0,2	0,2	0,2	0,2 mA
Emitter cut-off current						
$I_C = 0; V_{EB} = 5\text{ V}$	I_{EBO}	< 0,2	0,2	0,2	0,2	0,2 mA
Collector-emitter breakdown voltages (1)						
$I_B = 0; I_C = 30\text{ mA}$	$V_{(BR)CEO}$	> 40	60	80	100	120 V
D.C. current gain (1)						
$I_C = 0,2\text{ A}; V_{CE} = 4\text{ V}$	h_{FE}	>		40		
$I_C = 1\text{ A}; V_{CE} = 4\text{ V}$	h_{FE}	>		15 to 75		
Base-emitter voltages (1)+(2)						
$I_C = 1\text{ A}; V_{CE} = 4\text{ V}$	V_{BE}	<		1,3		
Collector-emitter saturation voltage (1)						
$I_C = 1\text{ A}; I_B = 0,125\text{ A}$	V_{CEsat}	<		0,7		V
Transition frequency at $f = 1\text{ MHz}$						
$I_C = 0,2\text{ A}; V_{CE} = 10\text{ V}$	f_T	>		3		MHz
Small-signal current gain						
$I_C = 0,2\text{ A}; V_{CE} = 10\text{ V}$						
at 1 kHz	h_{fe}	>		20		
at 1 MHz	h_{fe}	>		3		
Turn-off breakdown energy with inductive load (see Fig. 3)						
$I_C = 1,8\text{ A}; L = 20\text{ mH}$	$E_{(BR)}$	>		32		mJ
Switching times (see Fig. 2)						
$I_C = 1\text{ A}; I_{Bon} = -I_{Boff} = 0,1\text{ A}$						
turn-on time	t_{on}	typ.		0,3		μs
turn-off time	t_{off}	typ.		1		μs

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



$V_{CC} = 20 \text{ V}$
 $V_{IM} = 16 \text{ V}$
 $-V_{BB} = 6,4 \text{ V}$
 $R1 = 82 \Omega$
 $R2 = 82 \Omega$
 $R3 = 82 \Omega$
 $R4 = 20 \Omega$
 $t_r = t_f = 15 \text{ ns}$
 $t_p = 20 \mu\text{s}$
 $T = 500 \mu\text{s}$

Fig. 2 Switching times test circuit.



$V_{IM} = 12 \text{ V}$
 $R_B = 270 \Omega$
 $L = 20 \text{ mH}$
 $I_C = 1,8 \text{ A}$
 $t_p = 1 \text{ ms}$
 $\delta = 1 \%$

Fig. 3 Test circuit for turn-off breakdown energy.

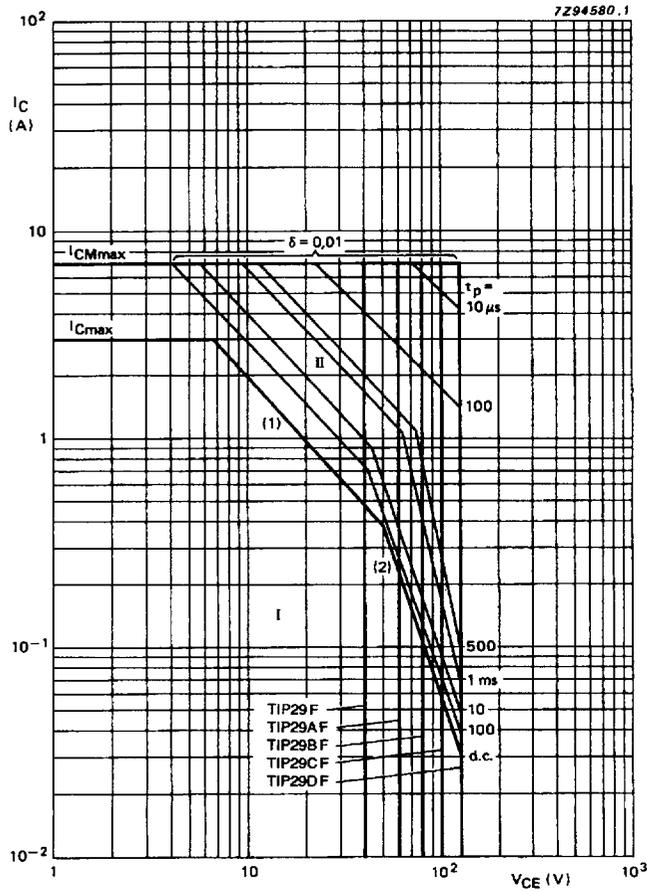


Fig. 4 Safe Operating Area, $T_{mb} = 25^{\circ}\text{C}$.

- 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.

Mounted *with* heatsink compound and 30 ± 5 Newton pressure on the centre of the envelope.

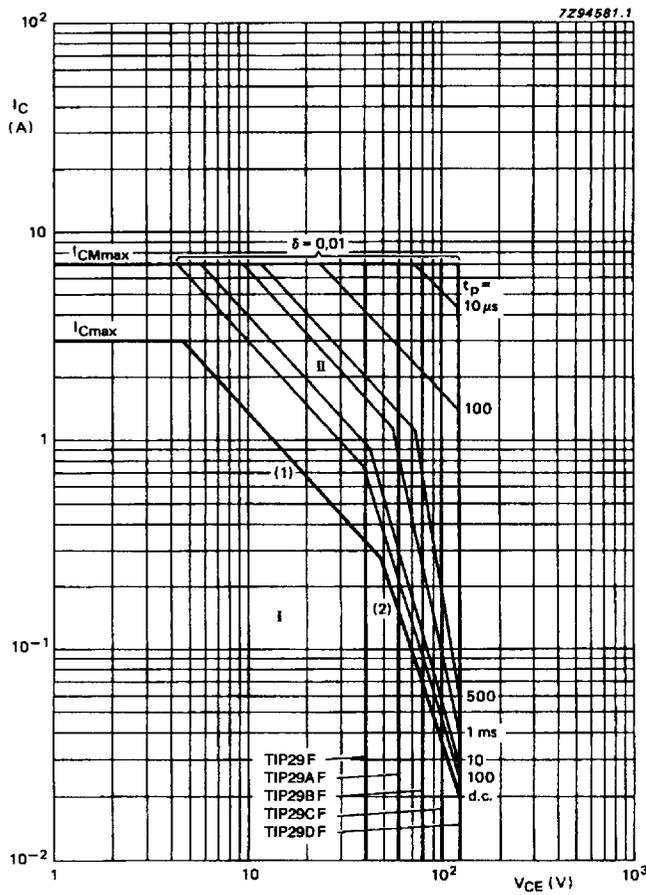


Fig. 5 Safe Operating Area, $T_{mb} = 25^{\circ}\text{C}$.

- 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.

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

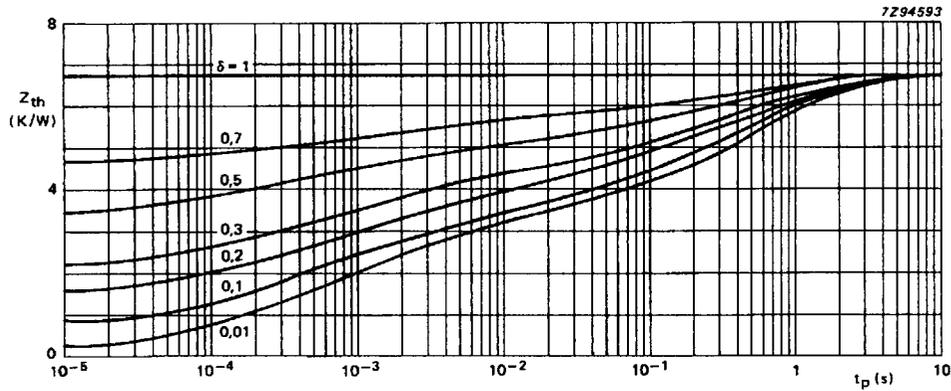


Fig. 6 Pulse power rating chart; mounted *with* heatsink compound and 30 ± 5 Newton pressure on the envelope.

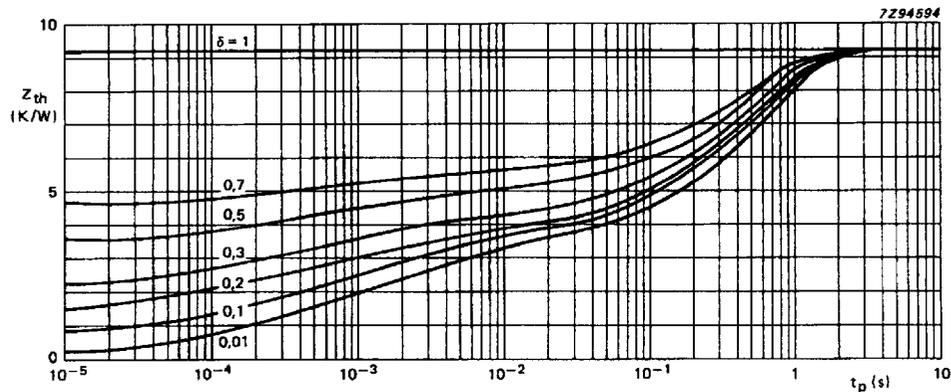


Fig. 7 Pulse power rating chart; mounted *without* heatsink compound and 30 ± 5 Newton pressure on the envelope.

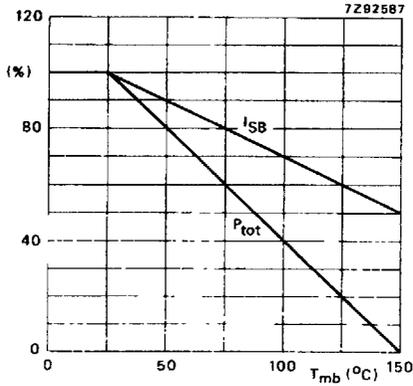


Fig. 8 Total power dissipation and second-breakdown current derating curve.

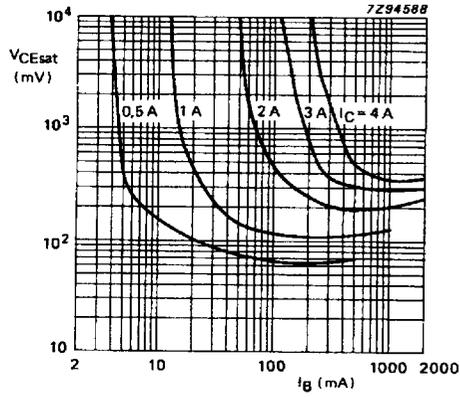


Fig. 9 Collector-emitter saturation voltage; typical values.

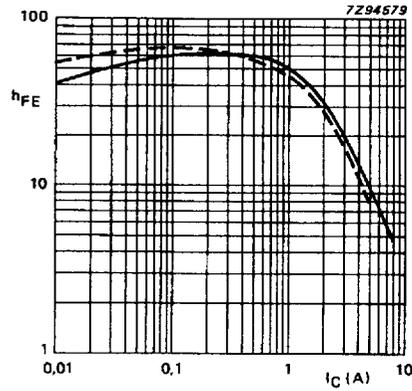


Fig. 10 D.C. current gain; $V_{CE} = 4 \text{ V}$; typical values;
 — $T_j = 25 \text{ }^\circ\text{C}$; - - - $T_j = 125 \text{ }^\circ\text{C}$.