SILICON EPITAXIAL POWER TRANSISTORS

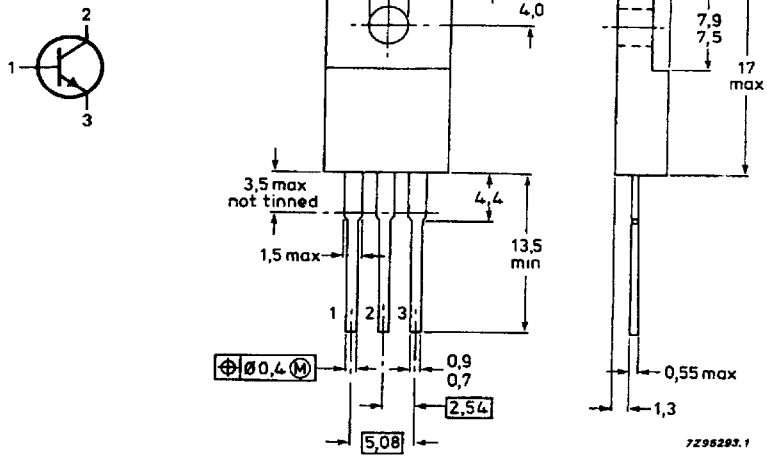
NPN silicon power transistors in a SOT186 envelope with an electrically insulated mounting base, intended for use in audio output stages, general purpose amplifier and high-speed switching applications.

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 °C	P_{tot}	max.	19	19	19	19	19	W
D.C. current gain I_C = 1 A; V_{CE} = 4 V	h_{FE}				15 to 75			
Transition frequency at f = 1 MHz I_C = 0,2 A; V_{CE} = 10 V	f_T	min.			3			MHz

Fig.1 SOT186. Dimensions in mm



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 °C (1)	P_{tot}	max.			14			W
up to T_h = 25 °C (2)	P_{tot}	max.			19			W
Storage temperature	T_{stg}				−65 to 150			°C
Junction temperature	T_j	max.			150			°C

THERMAL RESISTANCE

From junction to internal heatsink	$R_{th\ j\text{-}mb}$	=			4,17			K/W
From junction to external heatsink (1)	$R_{th\ j\text{-}h}$	=			9,17			K/W
From junction to external heatsink (2)	$R_{th\ j\text{-}h}$	=			6,67			K/W
From junction to ambient	$R_{th\ j\text{-}a}$	=			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	$C_{c\text{-}h}$	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.

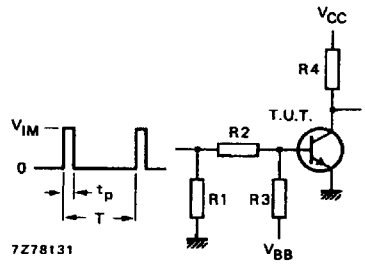
(3) Heatsink temperature T_h = 25 °C; relative humidity $R_H \leqslant 75\%$; atmospheric pressure p_{amb} = 1013 mbar.

CHARACTERISTICS

T_h = 25 °C unless otherwise specified

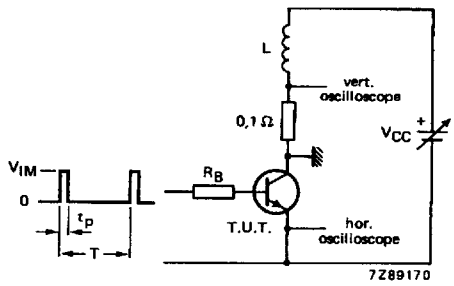
			TIP29F	29AF	29BF	29CF	29DF	
Collector cut-off currents								
I_B = 0; V_{CE} = 30 V	I_{CEO}	<	0,1	0,1	–	–	–	mA
I_B = 0; V_{CE} = 60 V	I_{CEO}	<	–	–	0,1	0,1	–	mA
I_B = 0; V_{CE} = 90 V	I_{CEO}	<	–	–	–	–	0,1	mA
V_{BE} = 0; V_{CE} = V_{CBO} max	I_{CES}	<	0,2	0,2	0,2	0,2	0,2	mA
Emitter cut-off current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



V_{CC} = 20 V
V_{IM} = 16 V
$-V_{BB}$ = 6,4 V
R1 = 82 Ω
R2 = 82 Ω
R3 = 82 Ω
R4 = 20 Ω
$t_r = t_f$ = 15 ns
t_p = 20 μs
T = 500 μs

Fig. 2 Switching times test circuit.



V_{IM} = 12 V
R_B = 270 Ω
L = 20 mH
I_C = 1,8 A
t_p = 1 ms
δ = 1 %

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

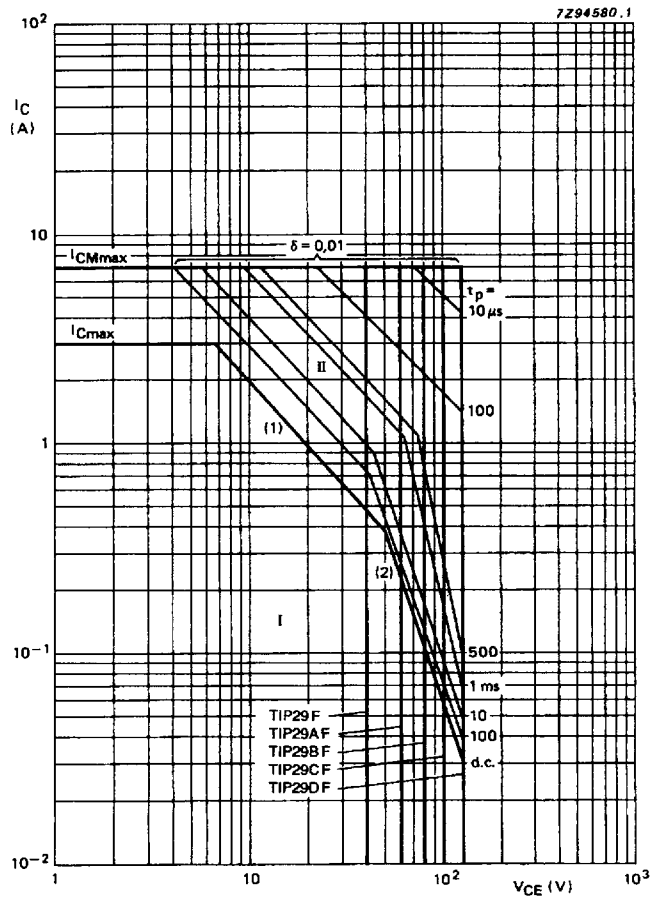


Fig. 4 Safe Operating Area, T_{mb} = 25 °C.

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.

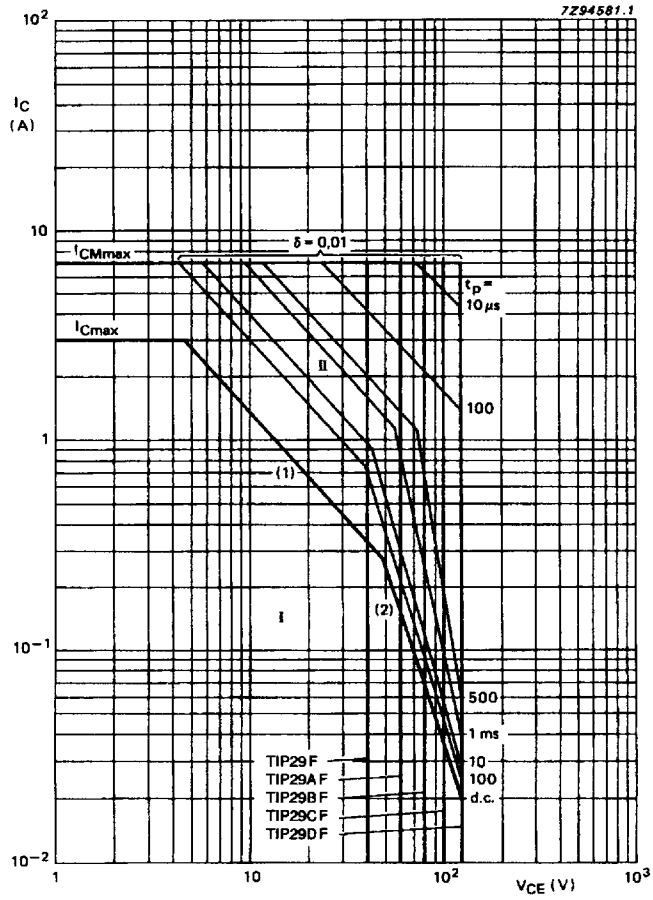


Fig. 5 Safe Operating Area, T_{mb} = 25 °C.

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.

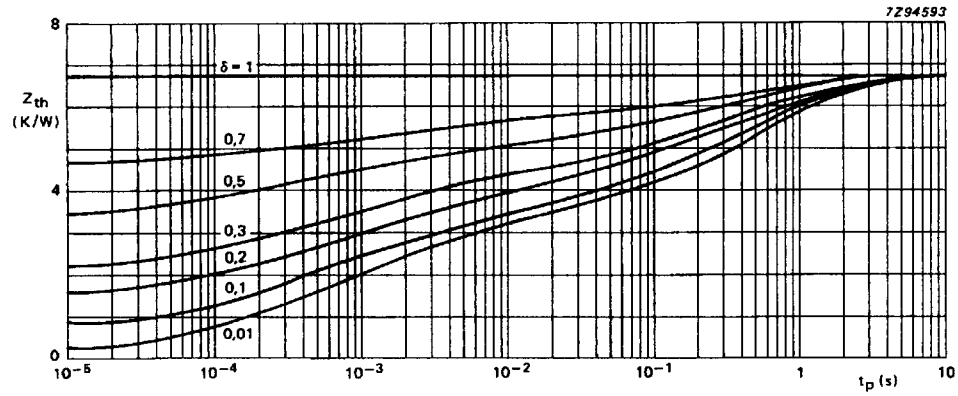


Fig. 6 Pulse power rating chart; mounted *with* heatsink compound and 30 ± 5 Newton pressure on the envelope.

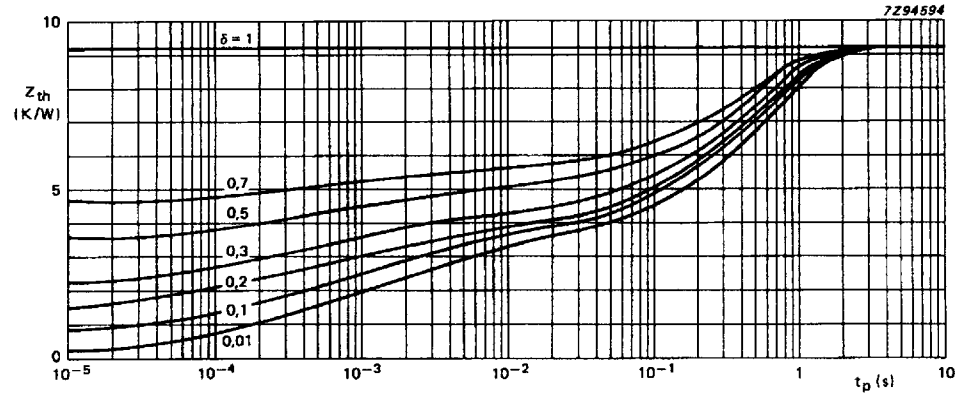


Fig. 7 Pulse power rating chart; mounted *without* heatsink compound and 30 ± 5 Newton pressure on the envelope.

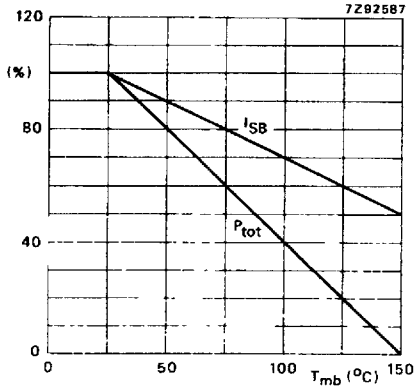


Fig. 8 Total power dissipation and second-breakdown current derating curve.

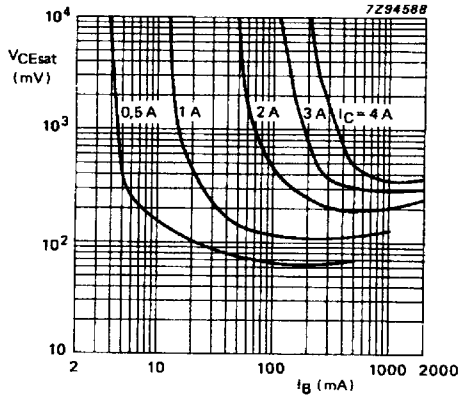


Fig. 9 Collector-emitter saturation voltage; typical values.

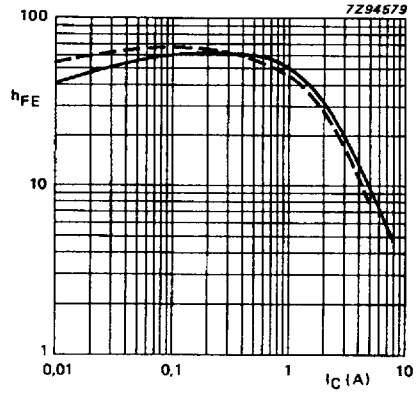


Fig. 10 D.C. current gain; V_{CE} = 4 V; typical values;
—— T_j = 25 °C; – – – – T_j = 125 °C.