SILICON EPITAXIAL POWER TRANSISTORS

NPN silicon power transistors in a SOT186 envelope with an electrically insulated mounting base.

They are intended for use in audio amplifier output stages, general purpose amplifiers, and high-speed switching applications.

PNP complements are TIP32F, TIP32AF, TIP32BF, TIP32CF and TIP32DF.

QUICK REFERENCE DATA

			TIP31F	31AF	31BF	31CF	31DF	
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
DC collector current	I_C	max.			3			A
Peak collector current	I_{CM}	max.			5			A
DC current gain I_C = 3 A; V_{CE} = 4 V	h_{FE}	min.			10			
Small-signal current gain at f = 1 MHz I_C = 0.5 A; V_{CE} = 10 V	h_{fe}	min.			3			

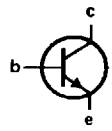
MECHANICAL DATA

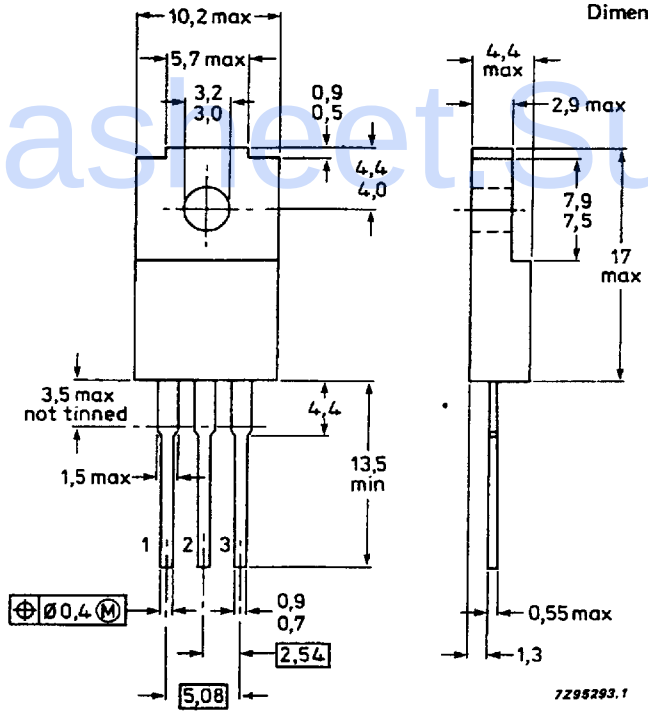
Dimensions in mm

Fig.1 SOT186.

Pinning

1 = base
2 = collector
3 = emitter





RATINGS

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

			TIP31F	31AF	31BF	31CF	31DF	
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
DC collector current	I_C	max.			3			A
Peak collector current	I_{CM}	max.			5			A
DC base current	I_B	max.			1			A
Total power dissipation up to T_h = 25 °C (note 1)	P_{tot}	max.			15			W
up to T_h = 25 °C (note 2)	P_{tot}	max.			22			W
Storage temperature range	T_{stg}				−65 to 150			°C
Junction temperature	T_j	max.			150			°C

THERMAL RESISTANCE

From junction to internal heatsink	$R_{th\ j\text{-}mb}$	=	3.12	K/W
From junction to external heatsink (note 1)	$R_{th\ j\text{-}h}$	=	8.12	K/W
From junction to external heatsink (note 2)	$R_{th\ j\text{-}h}$	=	5.62	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 (note 3)	V_{insul}	max.	1000	V
Insulation capacitance between collector and external heatsink	$C_{c\text{-}h}$	typ.	12	pF

Notes

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 °C; relative humidity $R_H \leqslant 75\%$; atmospheric pressure P_{amb} = 1013 mbar.

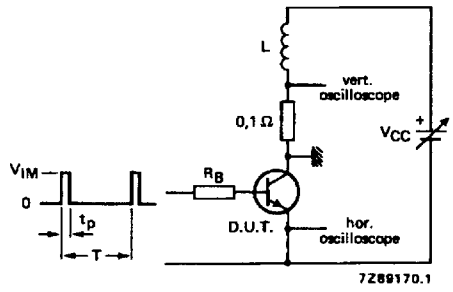
CHARACTERISTICS

T_h = 25 °C unless otherwise specified

			TIP31F	31AF	31BF	31CF	31DF	
Collector cut-off current								
I_B = 0; V_{CE} = 30 V	I_{CEO}	max.	0.1	0.1	–	–	–	mA
I_B = 0; V_{CE} = 60 V	I_{CEO}	max.	–	–	0.1	0.1	–	mA
I_B = 0; V_{CE} = 90 V	I_{CEO}	max.	–	–	–	–	0.1	mA
V_{BE} = 0; V_{CE} = V_{CBO}max	I_{CES}	max.	0.2	0.2	0.2	0.2	0.2	mA
Emitter cut-off current								
I_C = 0; V_{EB} = 5 V	I_{EBO}	max.	0.2	0.2	0.2	0.2	0.2	mA
DC current gain (note 1)								
I_C = 1 A; V_{CE} = 4 V	h_{FE}	min.	25	25	25	25	25	
I_C = 3 A, V_{CE} = 4 V	h_{FE}	min.	10	10	10	10	5	
		max.	50	50	50	50	–	
Collector-emitter breakdown voltage (note 1)								
I_B = 0; I_C = 30 mA	$V_{(BR)CEO}$	min.	40	60	80	100	120	V
Collector-emitter saturation voltage (note 1)								
I_C = 3 A; I_B = 375 mA	V_{CEsat}	max.	1.2	1.2	1.2	1.2	–	V
I_C = 3 A, I_B = 750 mA	V_{CEsat}	max.	–	–	–	–	2.5	V
Base-emitter voltages (notes 1 and 2)								
I_C = 3 A; V_{CE} = 4 V	V_{BE}	max.			1.8			V
Small-signal current gain								
I_C = 0.5 A; V_{CE} = 10 V								
at 1 kHz	h_{fe}	min.			20			
at 1 MHz	h_{fe}	min.			3			
Turn-off breakdown energy with inductive load (see Fig.3)								
I_C = 1.8 A; L = 20 mH	$E_{(BR)}$	min.			32			mJ
Switching times (see Fig.2)								
I_C = 1 A; $I_{B\,on}$ = $-I_{B\,off}$ = 0.1 A								
turn-on time	t_{on}	typ.			0.3			μs
turn-off time	t_{off}	typ.			1			μs

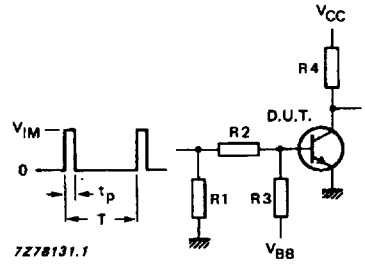
Notes

1. Measured under pulse conditions: t_p = 300 μs; δ = 2%.
2. V_{BE} decreases by about 2.3 mV/K with increasing temperature.



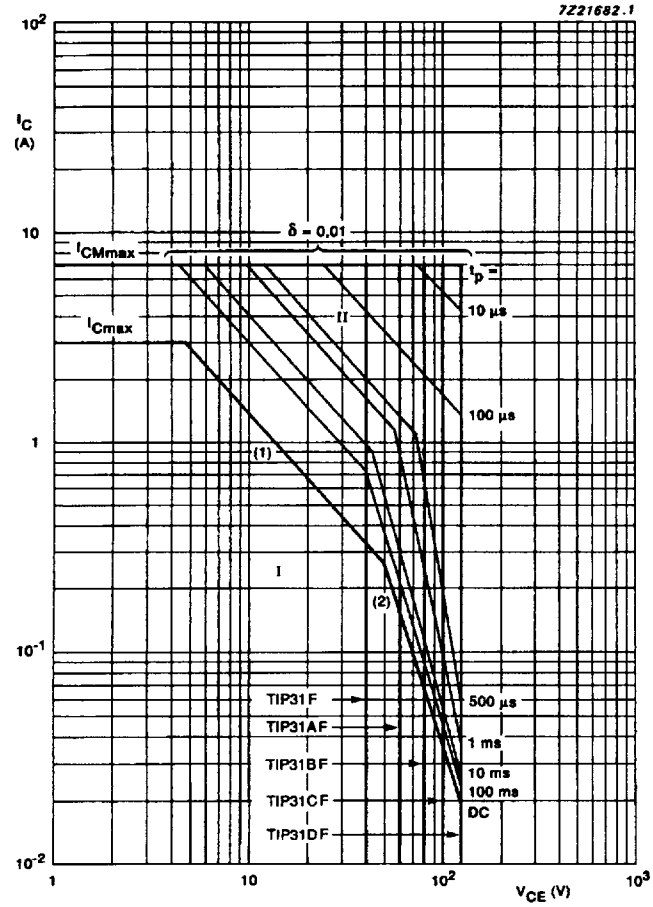
V_{CC} = 20 V
V_{IM} = 30 V
$-V_{BB}$ = 3 V
R_1 = 56 Ω
R_2 = 150 Ω
R_3 = 33 Ω
R_4 = 20 Ω
$t_r = t_f$ = 15 ns
t_p = 20 μs
T = 500 μs

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.



I Region of permissible DC 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 newtons pressure on the centre of the envelope.

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

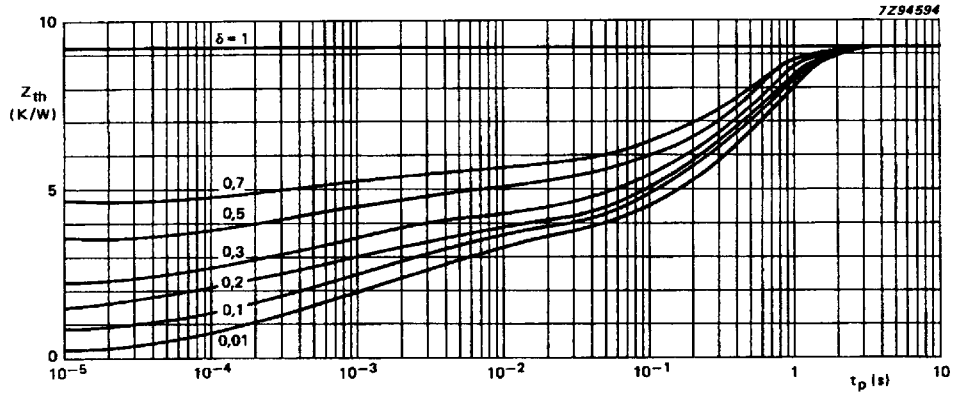


Fig.5 Pulse power rating chart; mounted without heatsink compound and 30 ± 5 newtons pressure on the envelope.

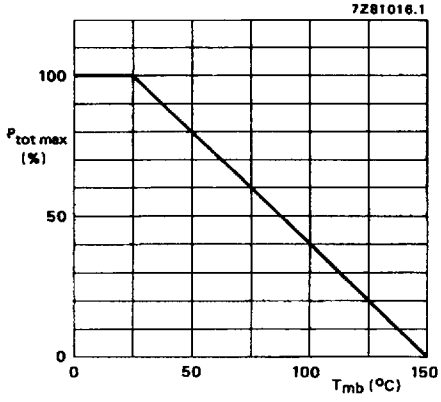


Fig.6 Total power dissipation.

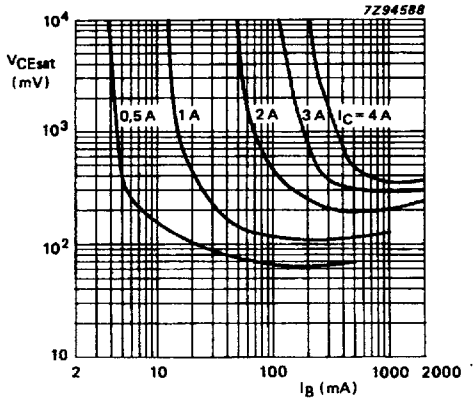


Fig.7 Typical collector-emitter saturation voltage; T_j = 25 °C.

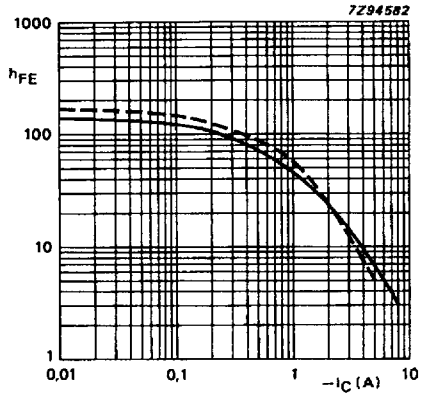


Fig.8 Typical DC current gain; V_{CE} = 4 V; T_j = 25 °C.