

SILICON EPITAXIAL POWER TRANSISTORS

T-33-09

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

PNP complements are TIP42F, TIP42AF, TIP42BF and TIP42CF.

QUICK REFERENCE DATA

			TIP41F	AF	BF	CF
Collector-base voltage (open emitter)	V _{CBO}	max.	80	100	120	140
Collector-emitter voltage (open base)	V _{CEO}	max.	40	60	80	100
DC collector current	I _C	max.		6		A
Peak collector current	I _{CM}	max.		10		A
Total power dissipation up to T _H = 25 °C	P _{tot}	max.		32		W
Junction temperature	T _j	max.		150		°C
DC current gain I _C = 3 A; V _{CE} = 4 V	h _{FE}	min.		15		
		max.		75		

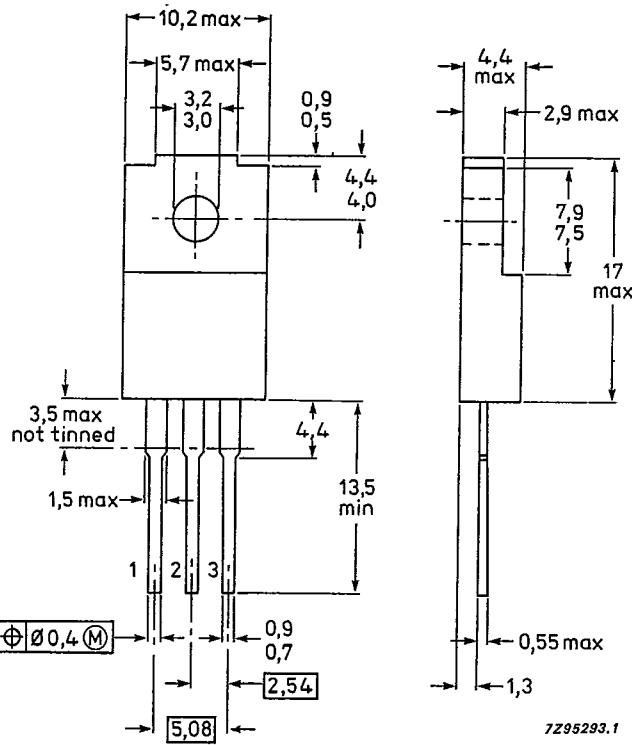
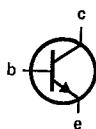
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT186.

Pinning

1 = base
2 = collector
3 = emitter



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RATINGS

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

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		TIP41F	AF	BF	CF	V
Collector-base voltage (open emitter)	V_{CBO}	max.	80	100	120	140
Collector-emitter voltage (open base)	V_{CEO}	max.	40	60	80	100
Emitter-base voltage (open collector)	V_{EBO}	max.			5	V
DC collector current	I_C	max.			6	A
Peak collector current	I_{CM}	max.			10	A
DC base current	I_B	max.			3	A
Total power dissipation up to $T_h = 25^\circ\text{C}$ (note 1)	P_{tot}	max.			20	W
up to $T_h = 25^\circ\text{C}$ (note 2)	P_{tot}	max.			32	W
Storage temperature range	T_{stg}				-65 to + 150	$^\circ\text{C}$
Junction temperature	T_j	max.			150	$^\circ\text{C}$

THERMAL RESISTANCE

From junction to internal heatsink	$R_{thj\cdot mb}$	=	1.6	K/W
From junction to external heatsink (note 1)	$R_{thj\cdot h}$	=	6.3	K/W
From junction to external heatsink (note 2)	$R_{thj\cdot h}$	=	3.9	K/W

INSULATION

Voltage allowed between all terminals and external heatsink, peak value	V_{insul}	max.	1000	V
Isolation capacitance from collector to external heatsink	C_{th}	typ.	12	pF

CHARACTERISTICS

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

		TIP41F	AF	BF	CF	
Collector cut-off currents $I_B = 0$; $V_{CE} = 30\text{ V}$	I_{CEO}	max.	0.2	0.2	—	mA
$I_B = 0$; $V_{CE} = 60\text{ V}$	I_{CEO}	max.	—	—	0.2	mA
$V_{BE} = 0$; $V_{CE} = V_{CEO\max}$	I_{CES}	max.		0.4		mA
Emitter cut-off current $I_C = 0$; $V_{EB} = 5\text{ V}$	I_{EBO}	max.		0.5		mA

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.

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DC current gain (note 1)					
$I_C = 0.3 \text{ A}; V_{CE} = 4 \text{ V}$	h_{FE}	min.	30	T-33-09	
$I_C = 3 \text{ A}; V_{CE} = 4 \text{ V}$	h_{FE}	min. max.	15 75		
Base-emitter voltage (note 2)					
$I_C = 6 \text{ A}; V_{CE} = 4 \text{ V}$	V_{BE}	max.	2	V	
Collector-emitter saturation voltage (note 1)					
$I_C = 6 \text{ A}; I_B = 0.6 \text{ A}$	V_{CEsat}	max.	1.5	V	
Collector-emitter breakdown voltage (note 1)					
$I_C = 30 \text{ mA}; I_B = 0$	$V_{(BR)CEO}$	max.	40	AF	TIP41F
Small-signal current transfer ratio			60	BF	
$I_C = 0.5 \text{ A}; V_{CE} = 10 \text{ V}; f = 1 \text{ kHz}$	$ h_{fe} $	min.	80	CF	
Transition frequency			100	V	
$I_C = 0.5 \text{ A}; V_{CE} = 10 \text{ V}; f = 1 \text{ kHz}$	f_T	min.			20
Turn-off breakdown energy with inductive load (Fig.4)					
$I_{Boff} = 0; I_{CC} = 2.5 \text{ V}$	$E_{(BR)}$	min.	62.5	MHz	
Switching times (Figs 2 and 3) (between 10% and 90% levels)					
$I_{Con} = 6 \text{ A}; I_{Bon} = -I_{Boff} = 0.6 \text{ A}$					
turn-on time	t_{on}	typ.	0.6	μs	
turn-off time	t_{off}	typ.	1	μs	

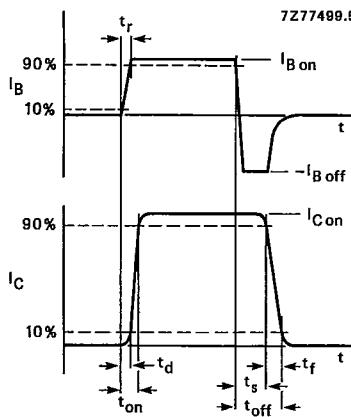


Fig.2 Switching times waveform.

Notes

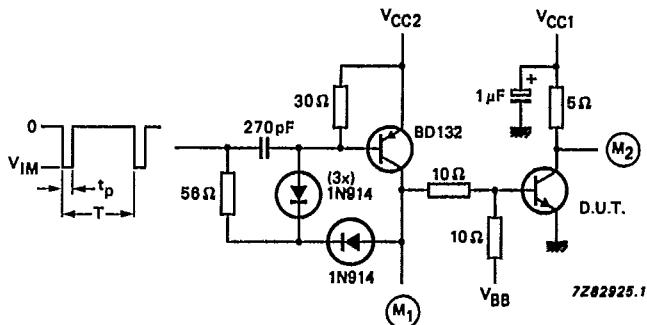
1. Measured under pulse conditions: t_p max. $300 \mu\text{s}$; δ max. 2%.
2. V_{BE} decreases by about 2.3 mV/K with increasing temperature.

TIP41F; 41AF
TIP41BF; 41CF

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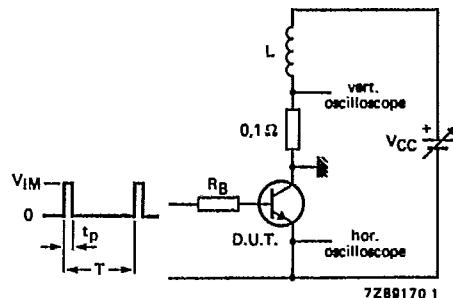
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$-V_{IM} = 10 \text{ V}$
 $V_{CC1} = 30 \text{ V}$
 $V_{CC2} = 16 \text{ V}$
 $-V_{BB} = 4 \text{ V}$
 $t_r = t_f = 15 \text{ ns}$
 $t_p = 20 \mu\text{s}$
 $\delta \text{ max. } 2\%$

Fig.3 Switching times test circuit.
Adjust V_{CC2} to give $M_1 = 14 \text{ V}$.

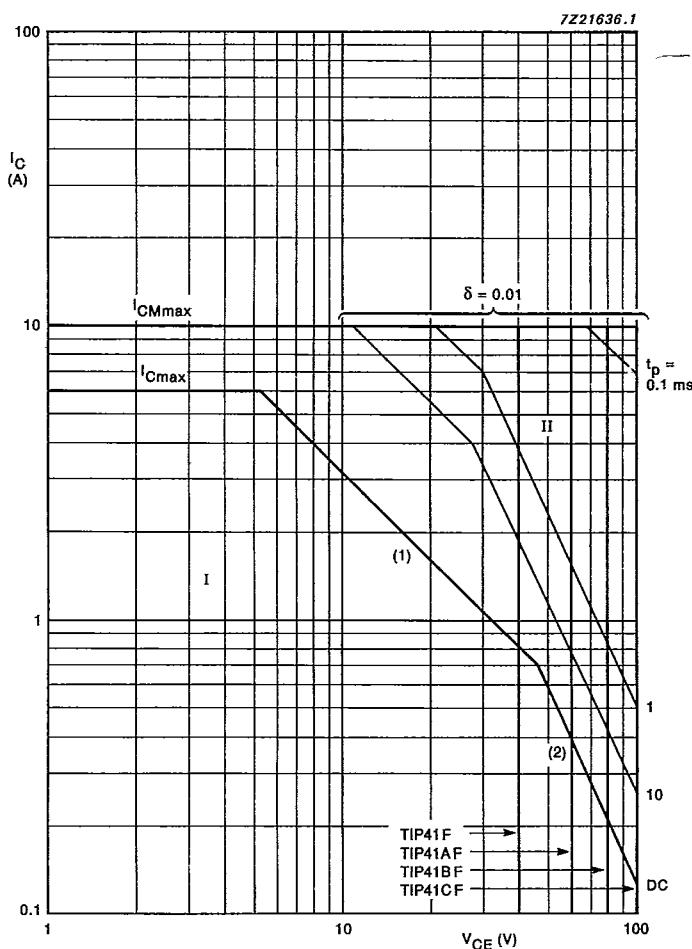


$V_{IM} = 12 \text{ V}$
 $R_B = 270 \Omega$
 $L = 20 \text{ mH}$
 $I_{CC} = 2.5 \text{ A}$
 $\delta \text{ max. } 1\%$
 $t_p = 1 \text{ ms}$

Fig.4 Test circuit for turn-off breakdown energy.

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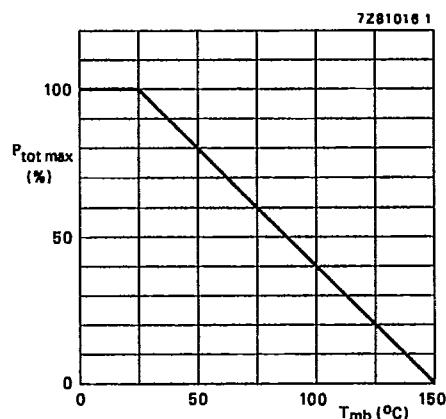
- I Region of permissible DC operation.
- II Permissible extension for repetitive pulse operation.
- (1) $P_{\text{tot max}}$ and $P_{\text{peak max}}$ lines.
- (2) Second-breakdown limits.

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

TIP41F; 41AF
TIP41BF; 41CF

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Fig.6 Total power dissipation.

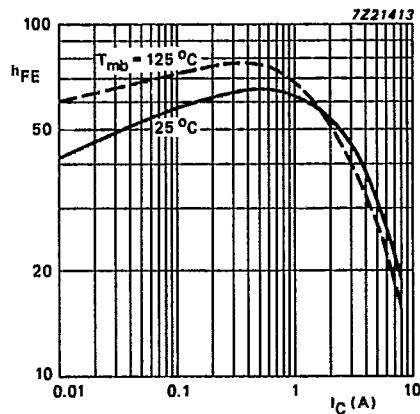


Fig.7 DC current gain; V_{CE} = 4 V; typical values.

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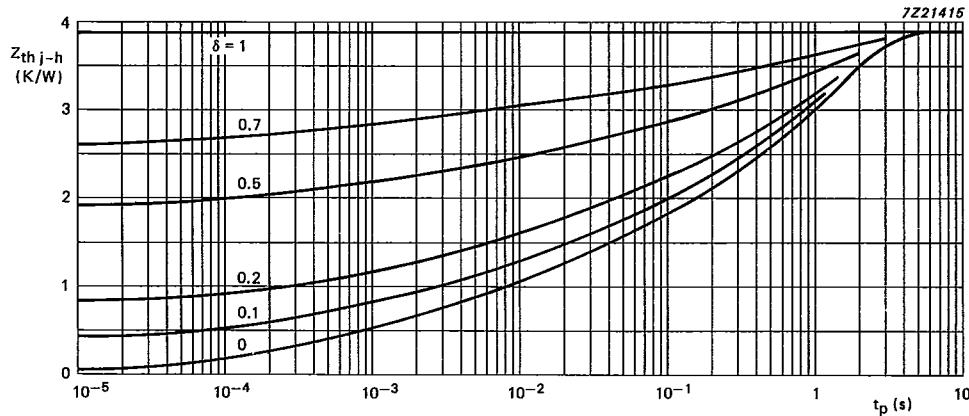
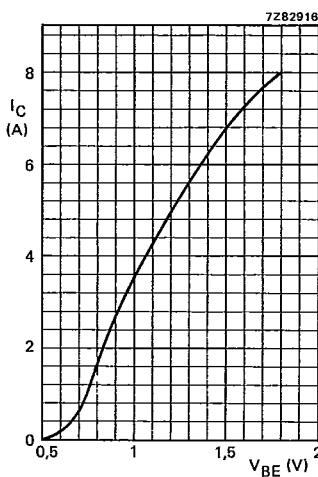


Fig.8 Pulse power rating chart.

Fig.9 Typical collector current.
 $V_{CE} = 4$ V; $T_j = 25$ °C.