

Silicon Diffused Power Transistor

BUT11AX

GENERAL DESCRIPTION

High-voltage, high-speed glass-passivated npn power transistor in a plastic full-pack envelope intended for use in converters, inverters, switching regulators, motor control systems, etc.

QUICK REFERENCE DATA

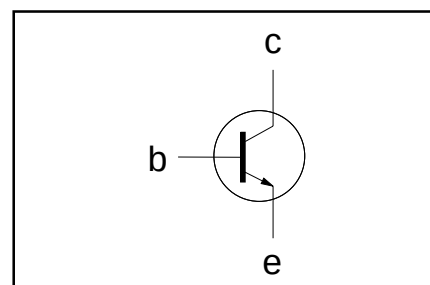
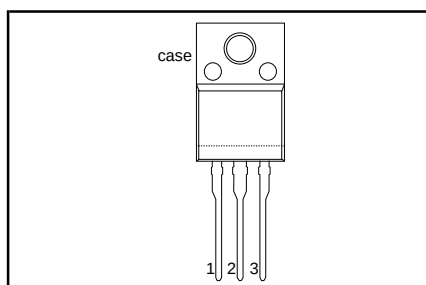
SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0\text{ V}$	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)	$T_{hs} \leq 25\text{ °C}$	-	5	A
I_{CM}	Collector current peak value		-	10	A
P_{tot}	Total power dissipation		-	32	W
V_{CESat}	Collector-emitter saturation voltage		-	1.5	V
I_{CSat}	Collector saturation current		2.5	-	A
t_f	Fall time		150	-	ns

PINNING - SOT186A

PIN CONFIGURATION

SYMBOL

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated



LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CESM}	Collector-emitter voltage peak value	$V_{BE} = 0\text{ V}$	-	1000	V
V_{CEO}	Collector-emitter voltage (open base)		-	450	V
I_C	Collector current (DC)	$T_{hs} \leq 25\text{ °C}$	-	5	A
I_{CM}	Collector current peak value		-	10	A
I_B	Base current (DC)		-	2	A
I_{BM}	Base current peak value		-	4	A
P_{tot}	Total power dissipation		-	32	W
T_{stg}	Storage temperature		-65	150	°C
T_j	Junction temperature		-	150	°C

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j-hs}$	Junction to heatsink	with heatsink compound	-	3.95	K/W
$R_{th\ j-a}$	Junction to ambient	in free air	55	-	K/W

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ISOLATION LIMITING VALUE & CHARACTERISTIC

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{isol}	R.M.S. isolation voltage from all three terminals to external heatsink	$f = 50\text{--}60\text{ Hz}$; sinusoidal waveform; $R.H. \leq 65\%$; clean and dustfree	-		2500	V
C_{isol}	Capacitance from T2 to external heatsink	$f = 1\text{ MHz}$	-	10	-	pF

STATIC CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CES}	Collector cut-off current ¹	$V_{BE} = 0\text{ V}$; $V_{CE} = V_{CESMmax}$	-	-	1.0	mA
I_{CES}		$V_{BE} = 0\text{ V}$; $V_{CE} = V_{CESMmax}$ $T_j = 125\text{ }^{\circ}\text{C}$	-	-	2.0	mA
I_{EBO}	Emitter cut-off current	$V_{EB} = 9\text{ V}$; $I_C = 0\text{ A}$	-	-	10	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	$I_B = 0\text{ A}$; $I_C = 100\text{ mA}$; $L = 25\text{ mH}$	450	-	-	V
V_{CEsat}	Collector-emitter saturation voltages	$I_C = 2.5\text{ A}$; $I_B = 0.5\text{ A}$	-	-	1.5	V
V_{BEsat}		$I_C = 2.5\text{ A}$; $I_B = 0.5\text{ A}$	-	-	1.3	V
h_{FE}	DC current gain	$I_C = 5\text{ mA}$; $V_{CE} = 5\text{ V}$	10	18	35	
h_{FE}		$I_C = 500\text{ mA}$; $V_{CE} = 5\text{ V}$	10	20	35	

DYNAMIC CHARACTERISTICS

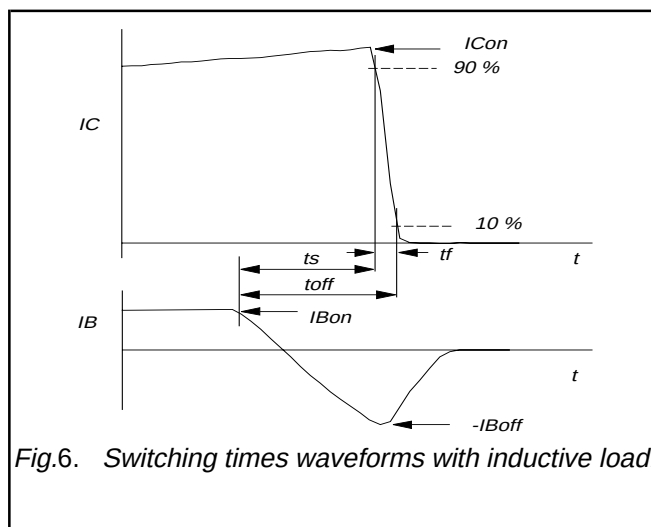
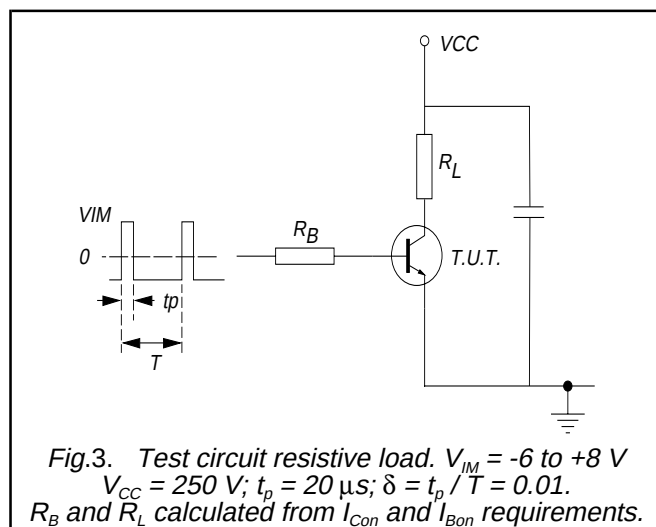
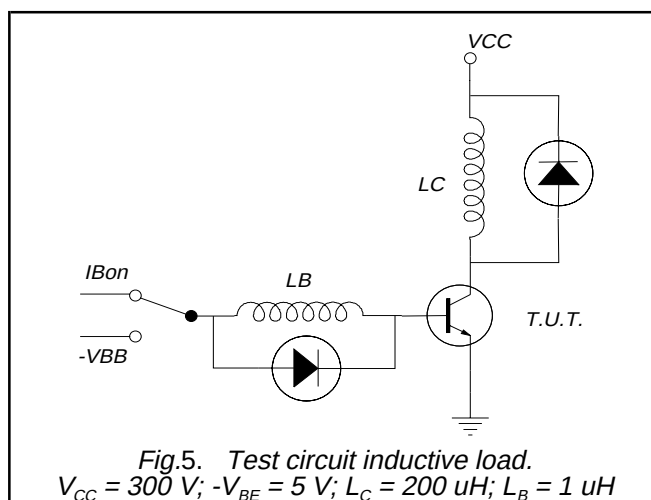
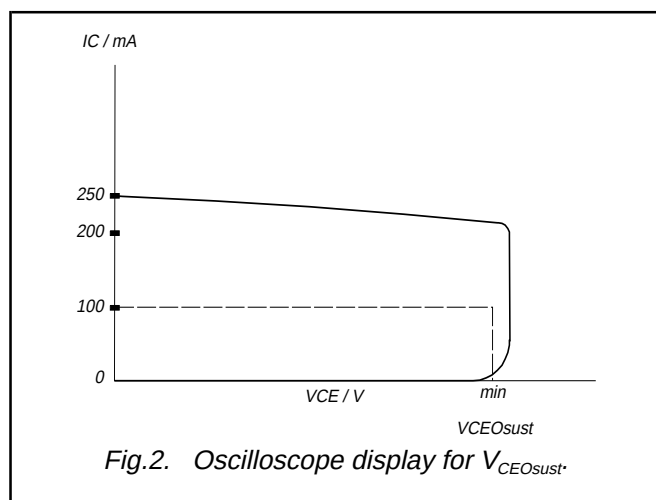
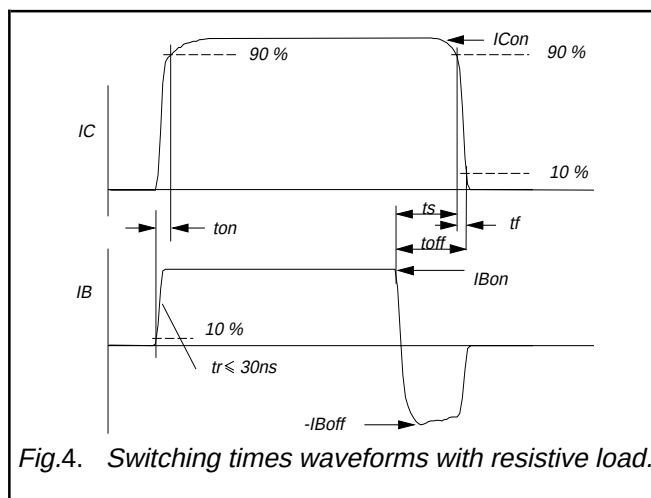
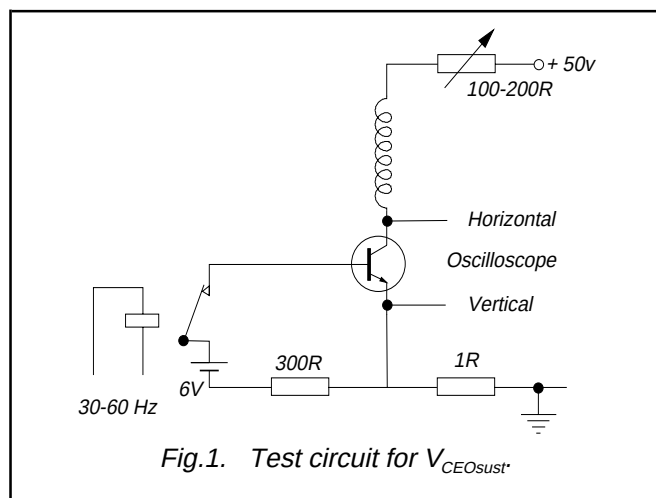
 $T_{hs} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
t_{on}	Switching times (resistive load)	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = -I_{Boff} = 0.5\text{ A}$	0.6	-	μs
t_s	Turn-on time				
t_f	Turn-off storage time				
t_f	Turn-off fall time	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$	0.6	-	μs
t_s	Switching times (inductive load)	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	1.5	-	μs
t_s	Turn-off storage time				
t_f	Turn-off fall time				
t_s	Switching times (inductive load)	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	1.8	-	μs
t_s	Turn-off storage time				
t_f	Turn-off fall time				

¹ Measured with half sine-wave voltage (curve tracer).

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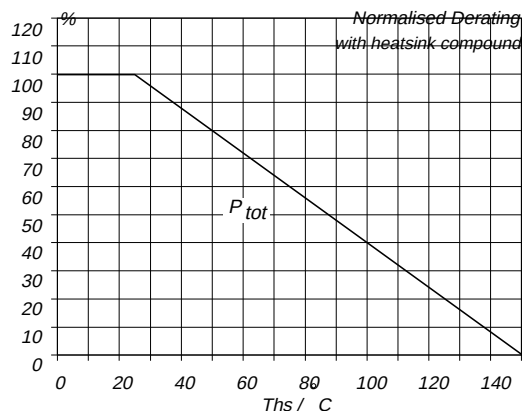


Fig.7. Normalised power derating and second breakdown curves.

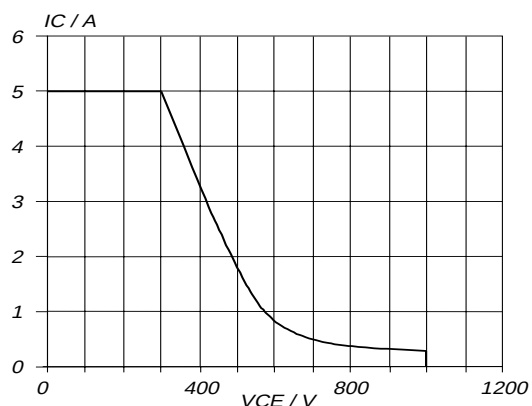


Fig.8. Reverse bias safe operating area. $T_j \leq T_{jmax}$

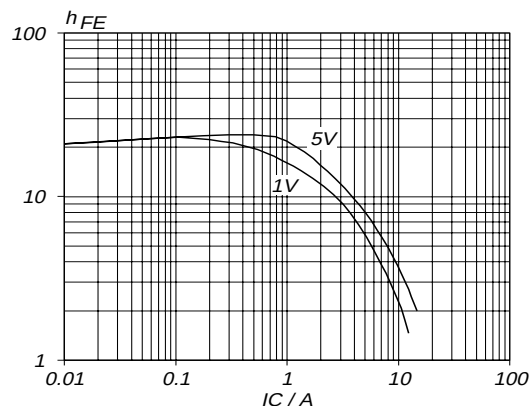


Fig.9. Typical DC current gain.
 $h_{FE} = f(I_C)$; parameter V_{CE}

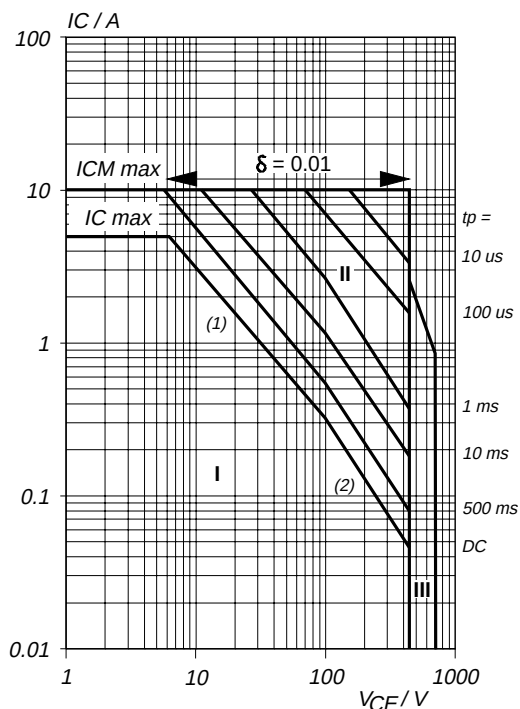


Fig.10. Forward bias safe operating area. $T_{hs} \leq 25^\circ\text{C}$

- (1) P_{tot} max and P_{tot} peak max lines.
 - (2) Second breakdown limits.
 - I Region of permissible DC operation.
 - II Extension for repetitive pulse operation.
 - III Extension during turn-on in single transistor converters provided that $R_{BE} \leq 100 \Omega$ and $t_p \leq 0.6 \mu\text{s}$.
- NB: Mounted with heatsink compound and 30 ± 5 newton force on the centre of the envelope.

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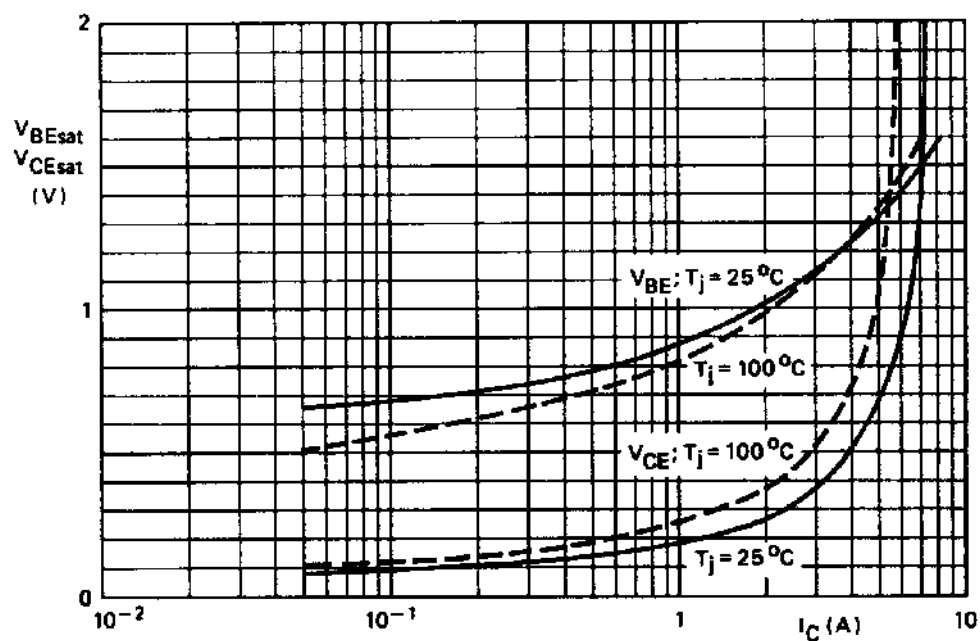


Fig.11. Typical base-emitter and collector-emitter saturation voltages.

$$V_{BEsat} = f(I_C); V_{CEsat} = f(I_C); I_C/I_B = 5$$

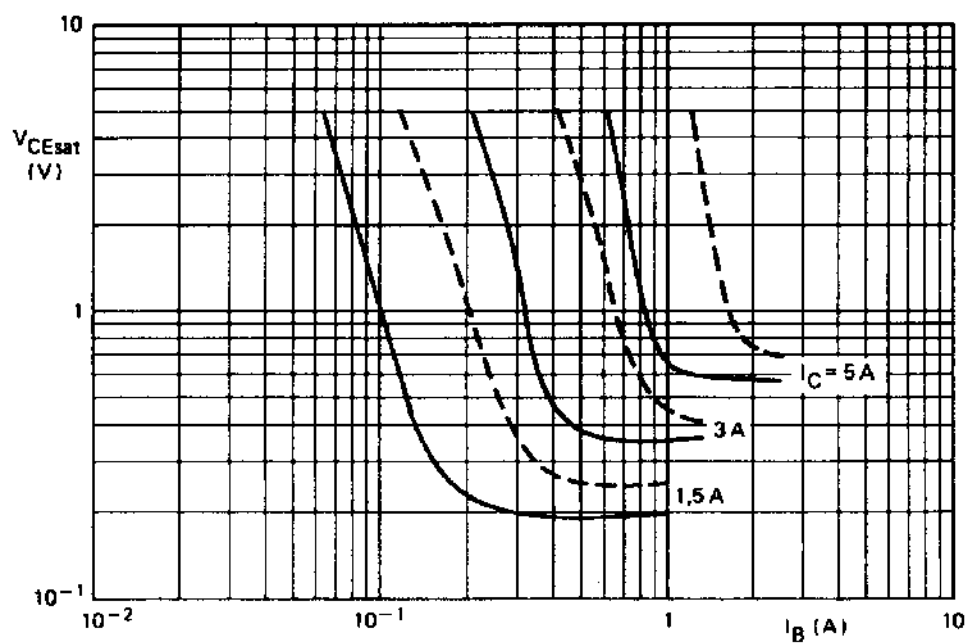


Fig.12. Collector-emitter saturation voltage. Solid lines = typ values, dotted lines = max values. $V_{CEsat} = f(I_B)$; parameter I_C

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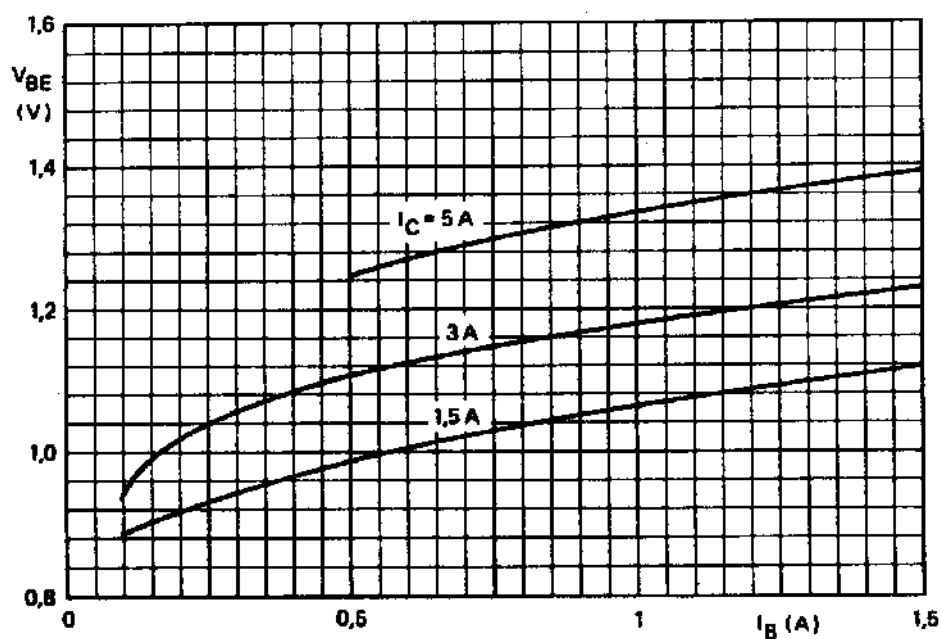


Fig.13. Typical base-emitter saturation voltage.
 $V_{BEsat} = f(I_B)$; parameter I_C

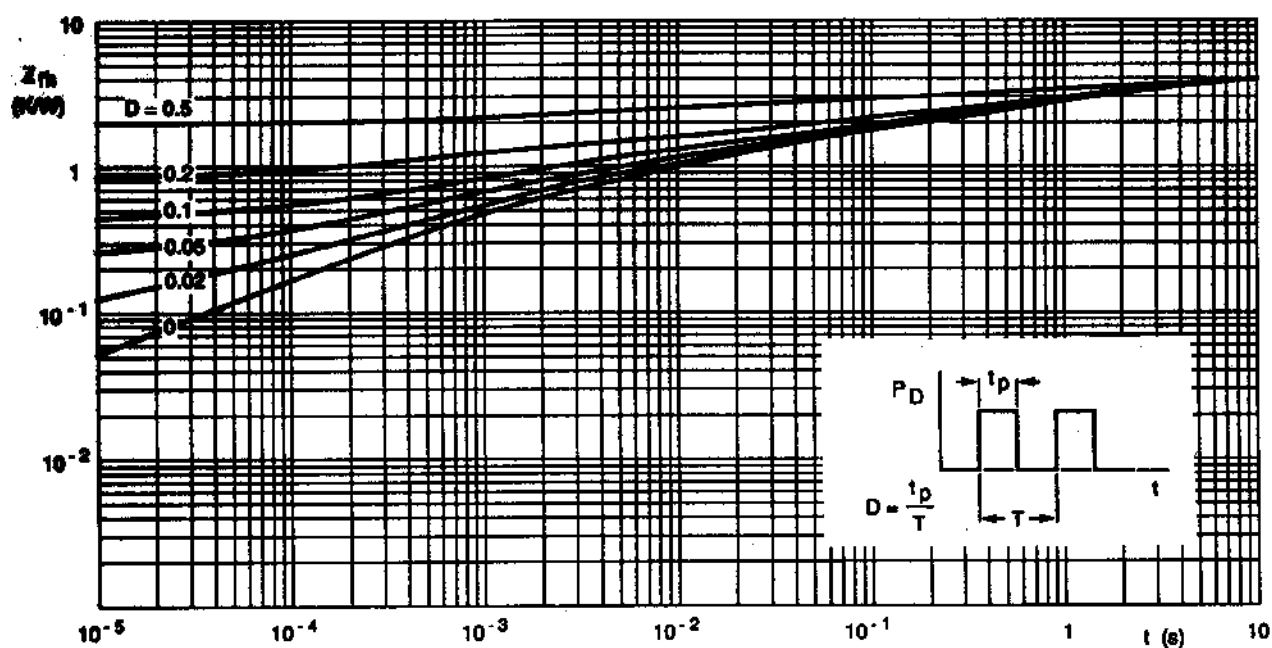


Fig.14. Transient thermal impedance.
 $Z_{thj-hs} = f(t)$; parameter $D = t_p/T$

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MECHANICAL DATA

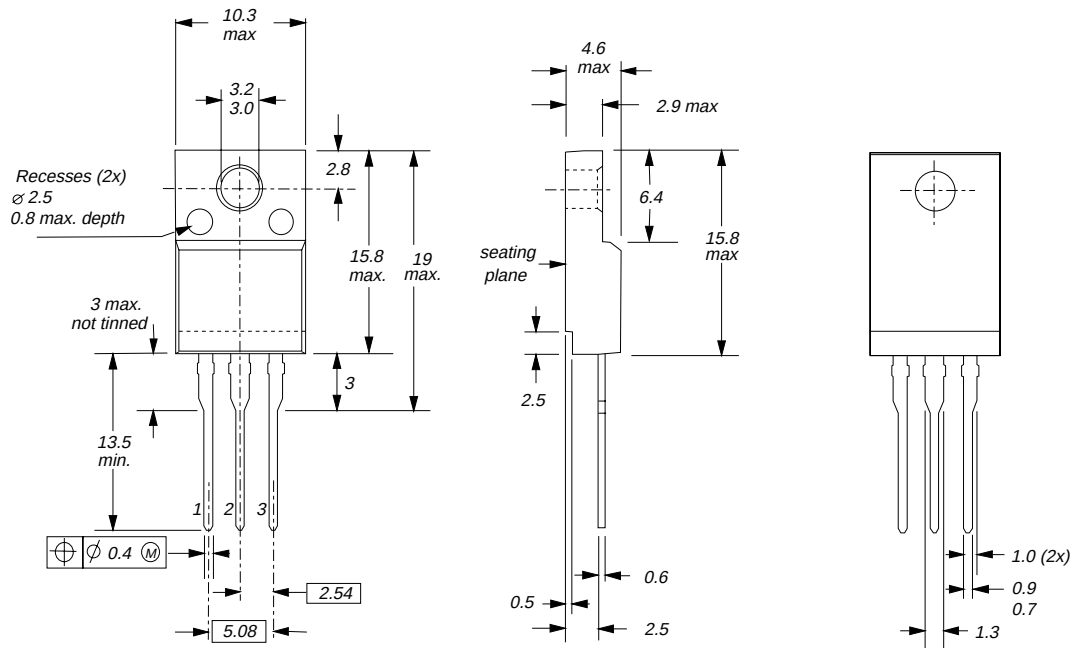
*Dimensions in mm**Net Mass: 2 g*

Fig.15. SOT186A; The seating plane is electrically isolated from all terminals.

Notes

1. Refer to mounting instructions for F-pack envelopes.
2. Epoxy meets UL94 V0 at 1/8".