

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.

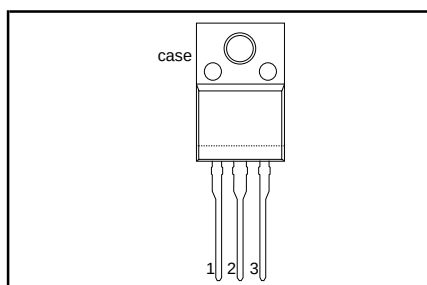
QUICK REFERENCE DATA

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)	$T_{hs} \leq 25\text{ }^{\circ}\text{C}$	-	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

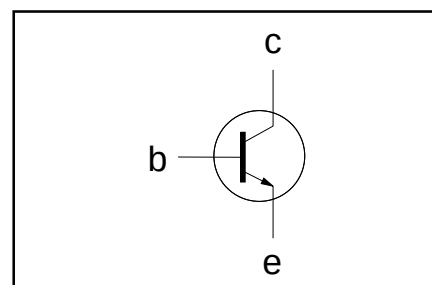
PINNING - SOT186A

PIN	DESCRIPTION
1	base
2	collector
3	emitter
case	isolated

PIN CONFIGURATION



SYMBOL



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)	$T_{hs} \leq 25\text{ }^{\circ}\text{C}$	-	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	$^{\circ}\text{C}$
T_j	Junction temperature		-	150	$^{\circ}\text{C}$

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

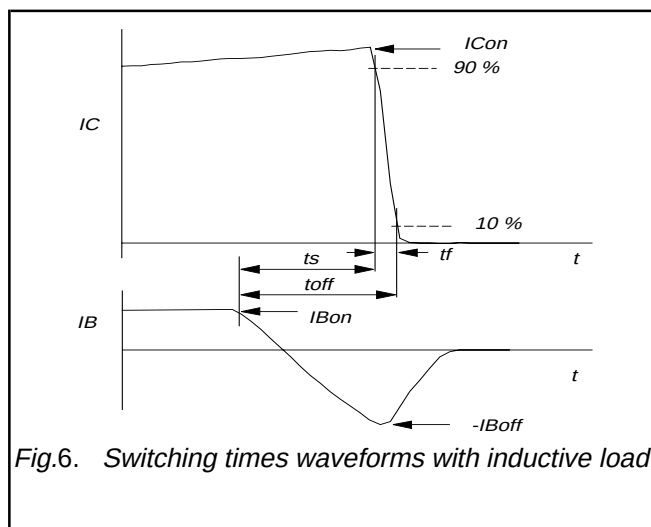
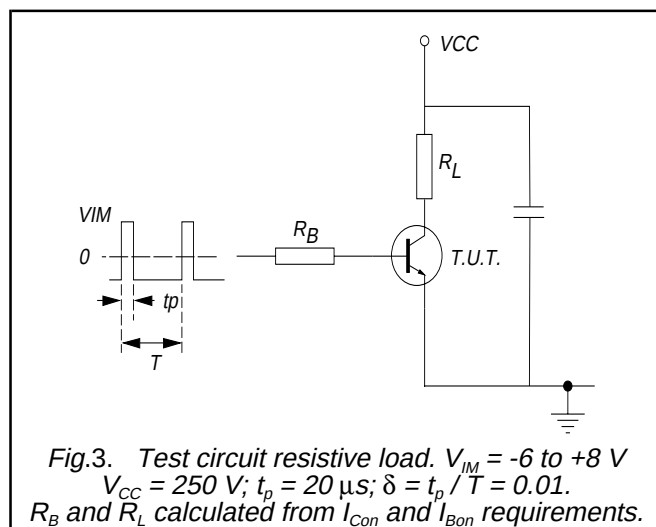
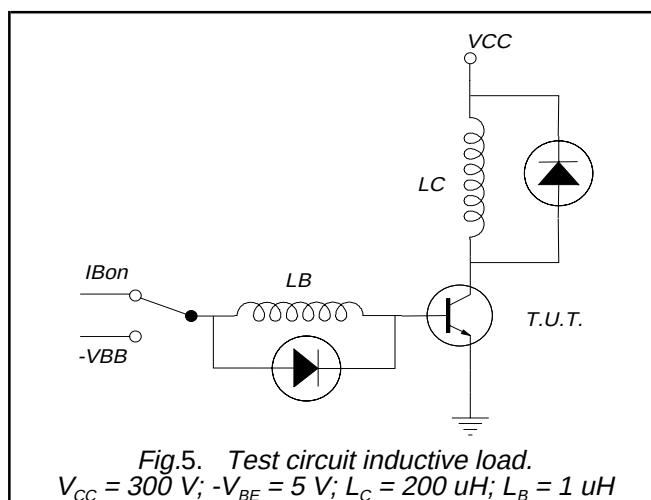
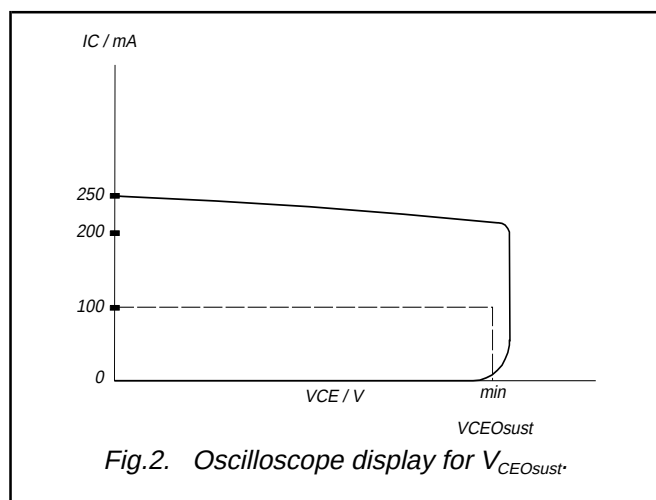
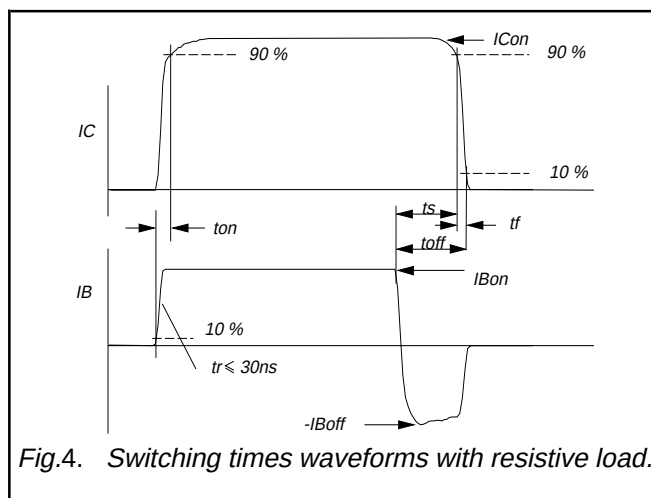
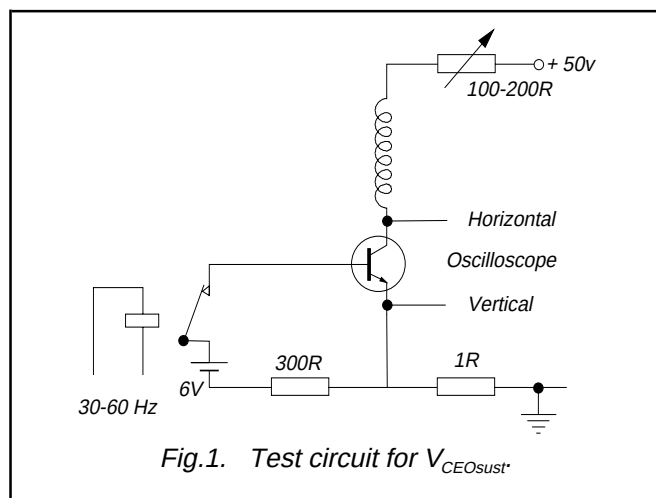
 $T_{hs} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

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)				
t_f	Turn-off storage time				
t_f	Turn-off fall time	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	1.5	-	μs
t_s	Switching times (inductive load)				
t_f	Turn-off storage time				
t_f	Turn-off fall time	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	150	-	ns
t_s	Switching times (inductive load)				
t_f	Turn-off storage time				
t_f	Turn-off fall time	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	1.8	-	μs
t_s	Switching times (inductive load)				
t_f	Turn-off storage time				
t_f	Turn-off fall time	$I_{Con} = 2.5\text{ A}$; $I_{Bon} = 0.5\text{ A}$; $L_B = 1\text{ }\mu\text{H}$; $-V_{BB} = 5\text{ V}$; $T_j = 100\text{ }^{\circ}\text{C}$	170	-	ns
t_s	Switching times (inductive load)				
t_f	Turn-off storage time				

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

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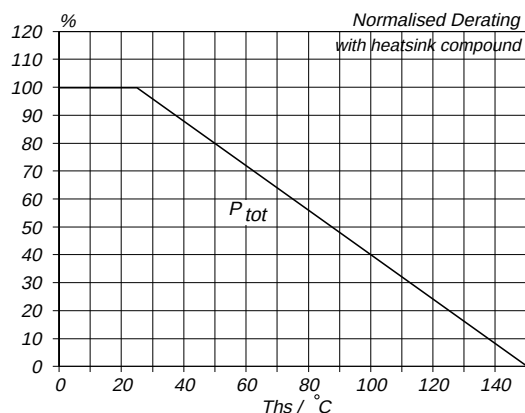


Fig.7. Normalised power derating and second breakdown curves.

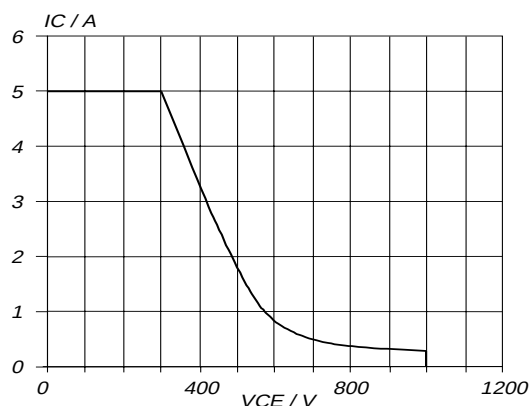


Fig.8. Reverse bias safe operating area. $T_j \leq T_{jmax}$

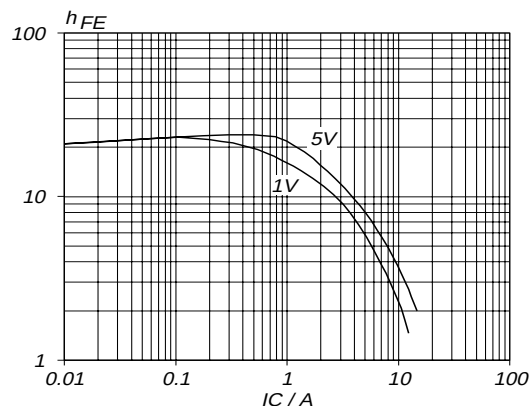


Fig.9. Typical DC current gain.
 $h_{FE} = f(I_C)$; parameter V_{CE}

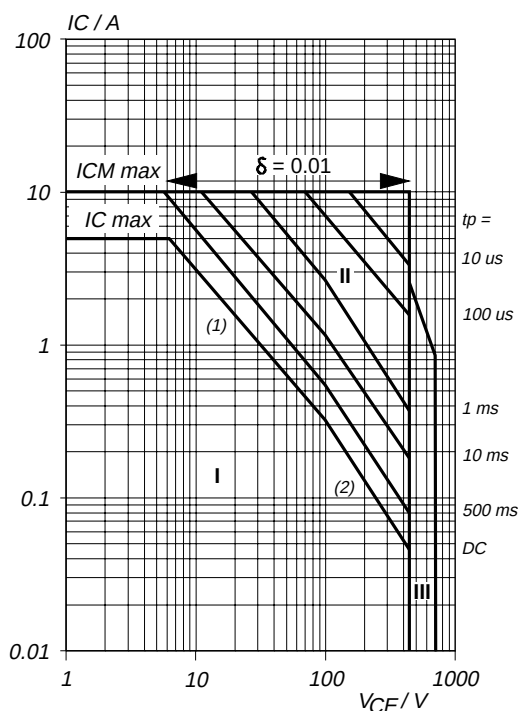


Fig.10. Forward bias safe operating area. $T_{hs} \leq 25^\circ\text{C}$

- (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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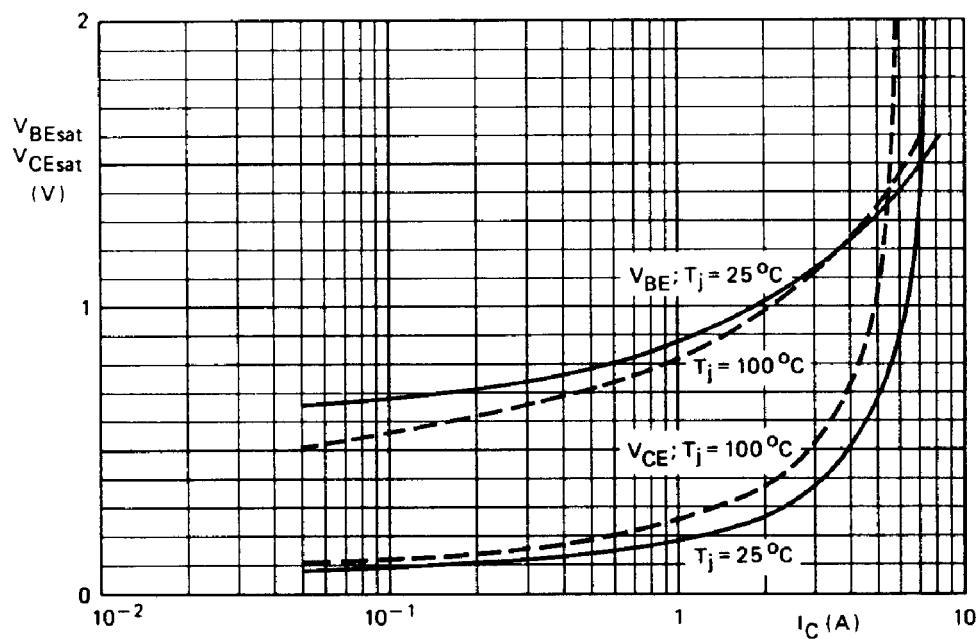


Fig.11. Typical base-emitter and collector-emitter saturation voltages.

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

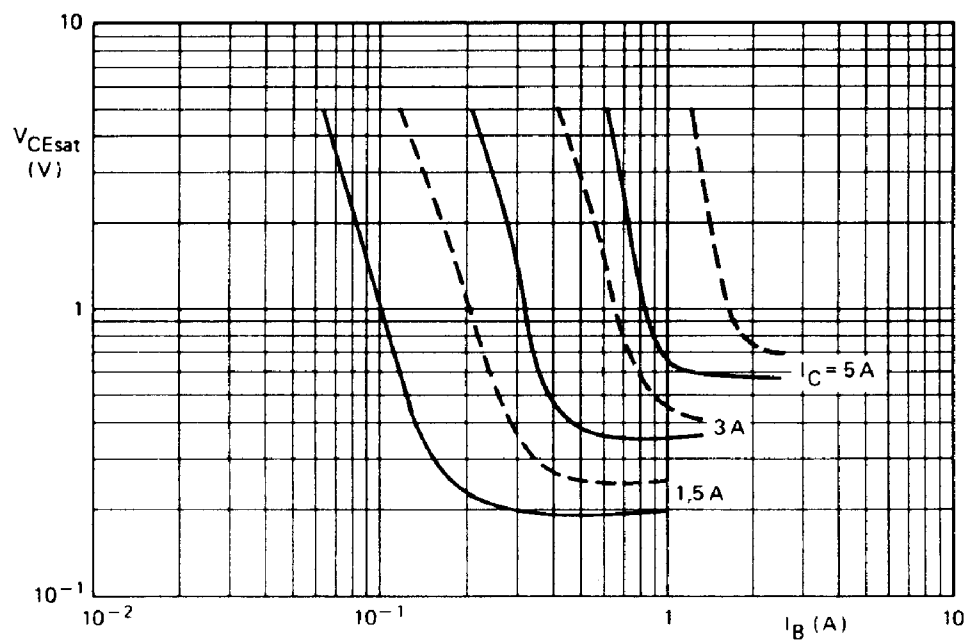


Fig.12. Collector-emitter saturation voltage. Solid lines = typ values, dotted lines = max values. $V_{CEsat} = f(I_B)$; parameter I_C

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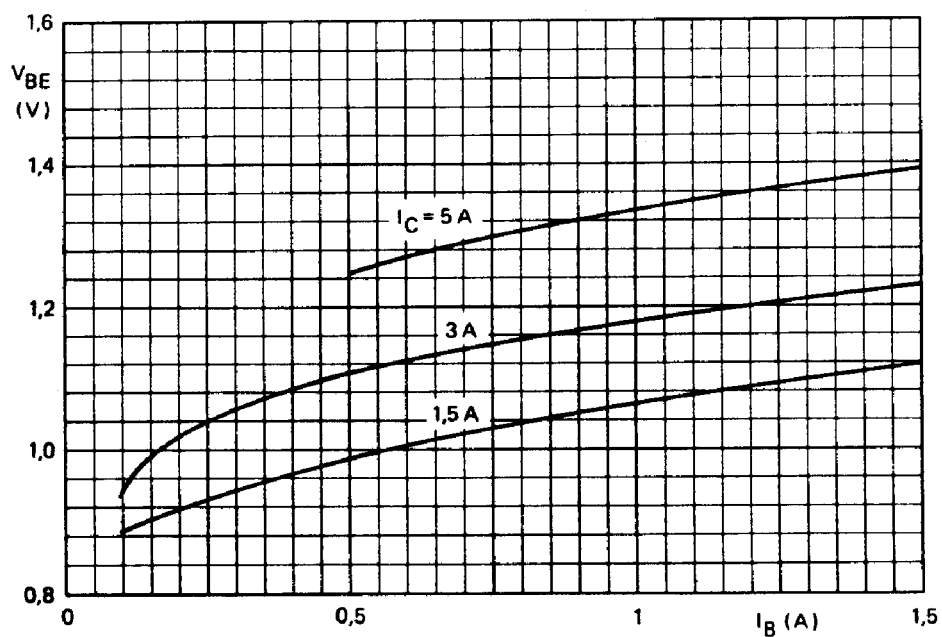


Fig.13. Typical base-emitter saturation voltage.

$$V_{BEsat} = f(I_B); \text{ parameter } I_C$$

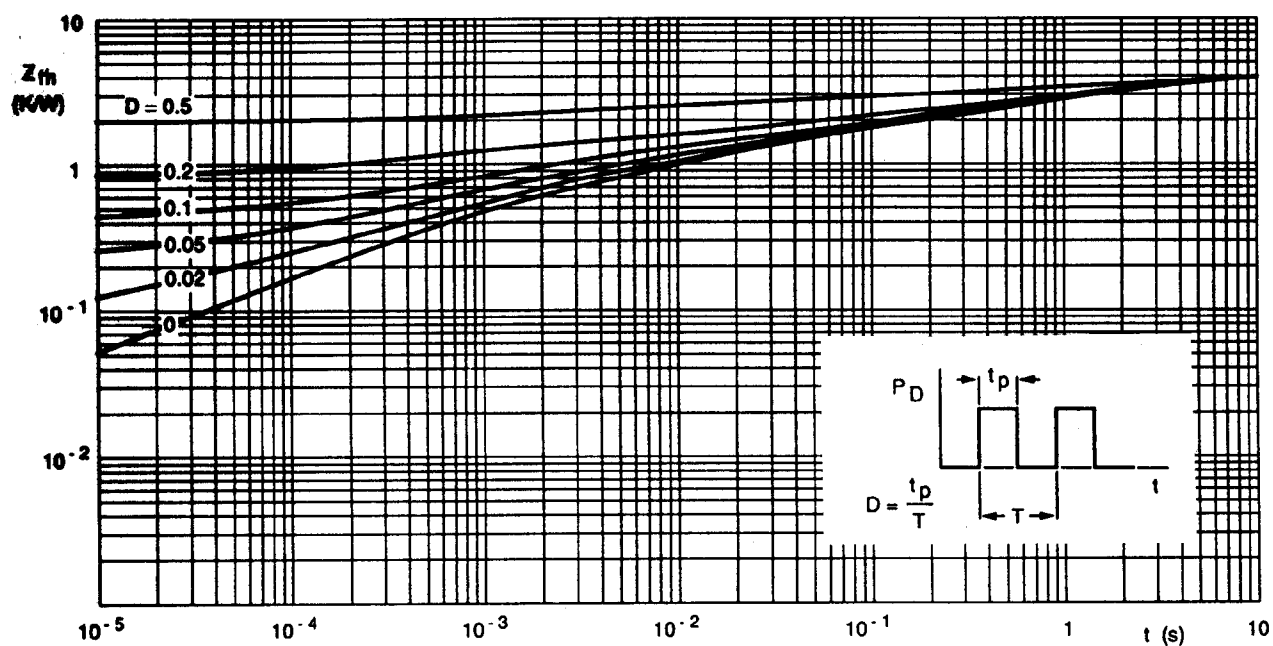


Fig.14. Transient thermal impedance.

$$Z_{thj-hs} = f(t); \text{ parameter } D = t_p/T$$

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MECHANICAL DATA

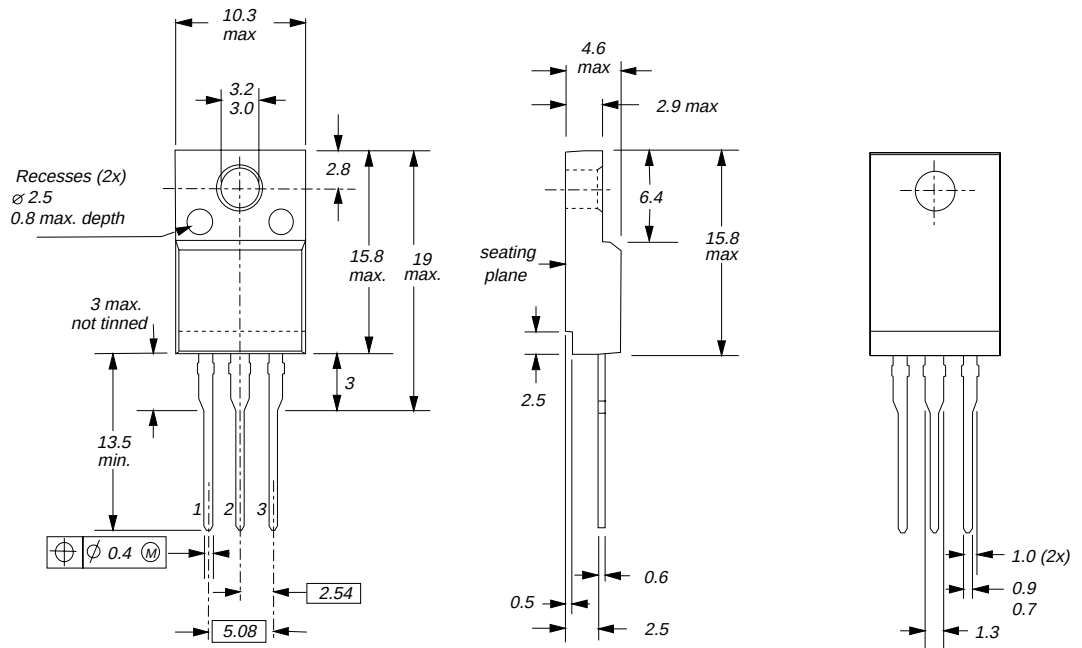
*Dimensions in mm**Net Mass: 2 g*

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".

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	
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