

BT151X series

Thyristors

Rev. 04 — 9 June 2004

Product data sheet

1. Product profile

1.1 General description

Passivated thyristors in a SOT186A full pack plastic package.

1.2 Features

- High thermal cycling performance
- High bidirectional blocking voltage capability
- Isolated mounting base.

1.3 Applications

- Motor control
- Industrial and domestic lighting, heating and static switching.

1.4 Quick reference data

- $V_{\text{DRM}}, V_{\text{RRM}} \leq 800 \text{ V}$ (BT151X-800)
- $V_{\text{DRM}}, V_{\text{RRM}} \leq 650 \text{ V}$ (BT151X-650)
- $V_{\text{DRM}}, V_{\text{RRM}} \leq 500 \text{ V}$ (BT151X-500)
- $I_{\text{T(RMS)}} \leq 12 \text{ A}$
- $I_{\text{T(AV)}} \leq 7.5 \text{ A}$
- $I_{\text{TSM}} \leq 120 \text{ A}$.

2. Pinning information

Table 1: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	cathode (k)		 <i>sym037</i>
2	anode (a)		
3	gate (g)		
mb	mounting base; isolated		

SOT186A (TO-220)

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3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
BT151X-500	-	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 'full pack'	SOT186A
BT151X-650			
BT151X-800			

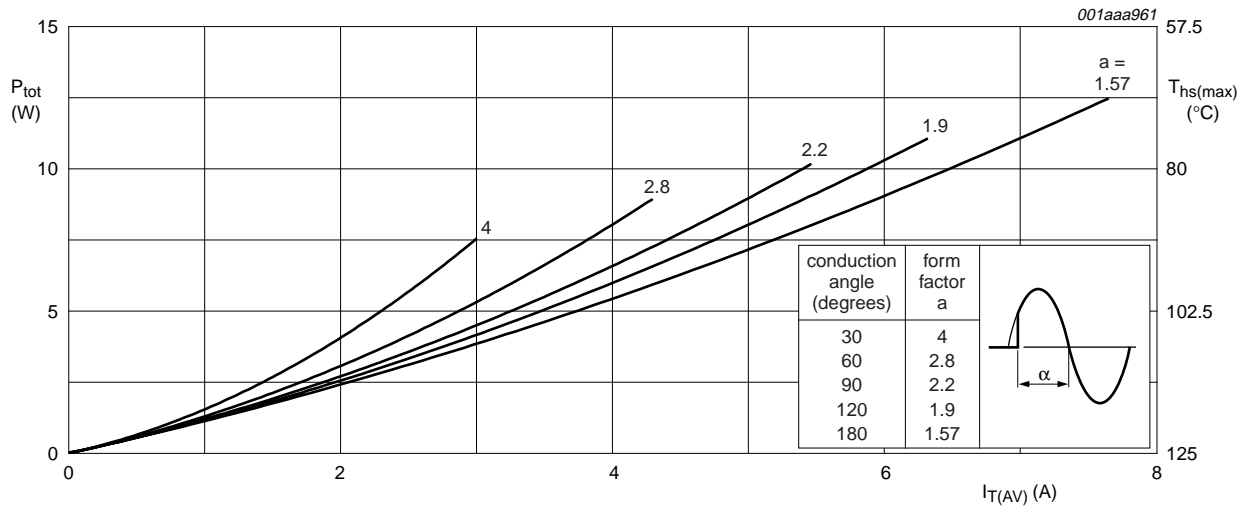
4. Limiting values

Table 3: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

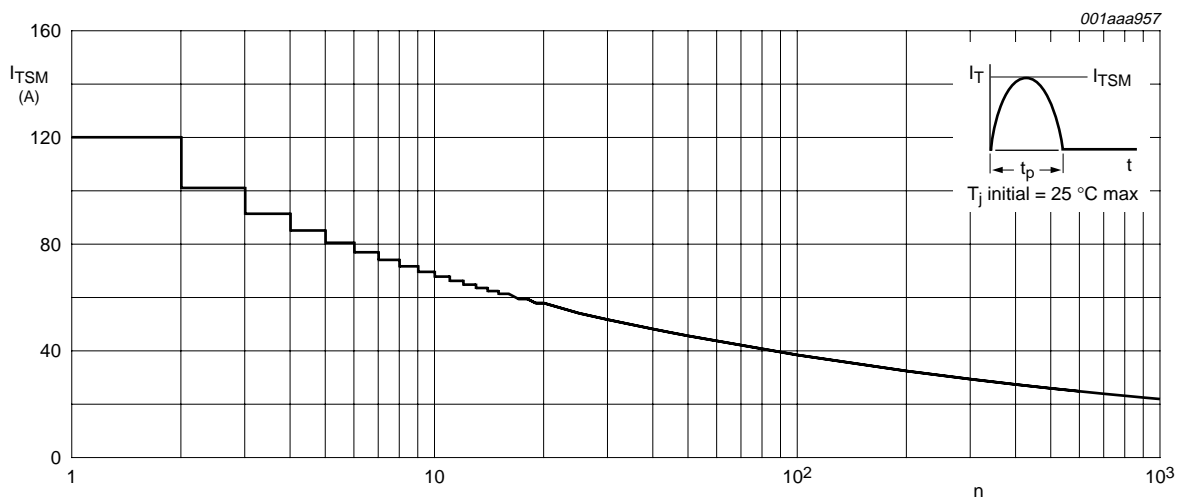
Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DRM}, V_{RRM}	repetitive peak off-state voltage					
		BT151X-500	[1]	-	500	V
		BT151X-650	[1]	-	650	V
		BT151X-800		-	800	V
$I_{T(AV)}$	average on-state current	half sinewave; $T_{hs} \leq 69\text{ °C}$; Figure 1	-	7.5	A	
$I_{T(RMS)}$	RMS on-state current	all conduction angles; Figure 4 and Figure 5	-	12	A	
I_{TSM}	non-repetitive peak on-state current	half sinewave; $T_j = 25\text{ °C}$ prior to surge; Figure 2 and Figure 3				
		$t = 10\text{ ms}$	-	120	A	
		$t = 8.3\text{ ms}$	-	132	A	
I^2t	I^2t for fusing	$t = 10\text{ ms}$	-	72	A^2s	
di_T/dt	repetitive rate of rise of on-state current after triggering	$I_{TM} = 20\text{ A}$; $I_G = 50\text{ mA}$; $dI_G/dt = 50\text{ mA}/\mu s$	-	50	$A/\mu s$	
I_{GM}	peak gate current		-	2	A	
V_{RGM}	peak reverse gate voltage		-	5	V	
P_{GM}	peak gate power		-	5	W	
$P_{G(AV)}$	average gate power	over any 20 ms period	-	0.5	W	
T_{stg}	storage temperature		-40	+150	$^{\circ}C$	
T_j	junction temperature		-	125	$^{\circ}C$	

[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the thyristor may switch to the on-state. The rate of rise of current should not exceed 15 A/ μs .



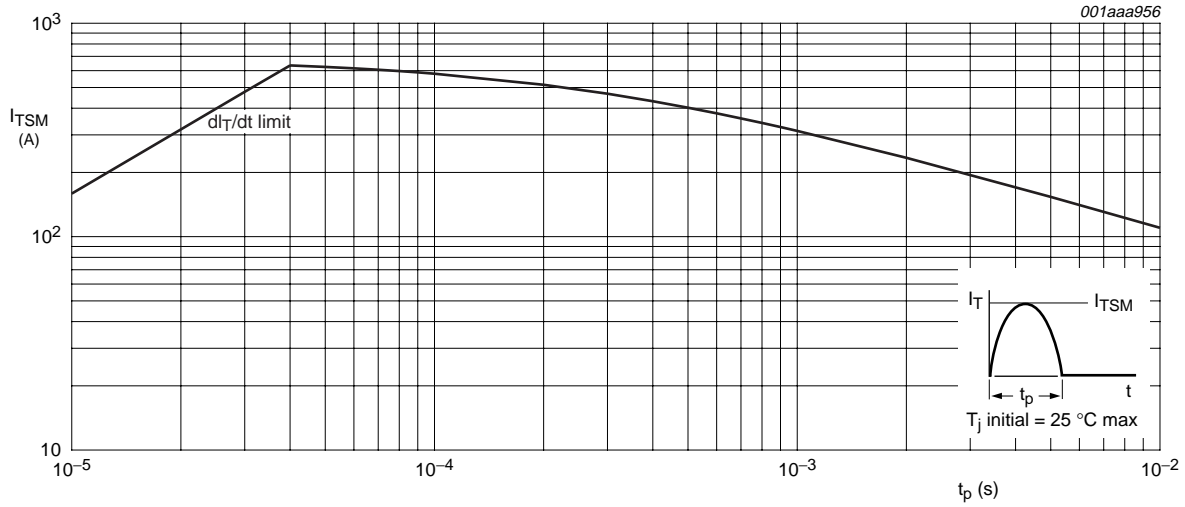
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$.

Fig 1. Total power dissipation as a function of average on-state current; maximum values.



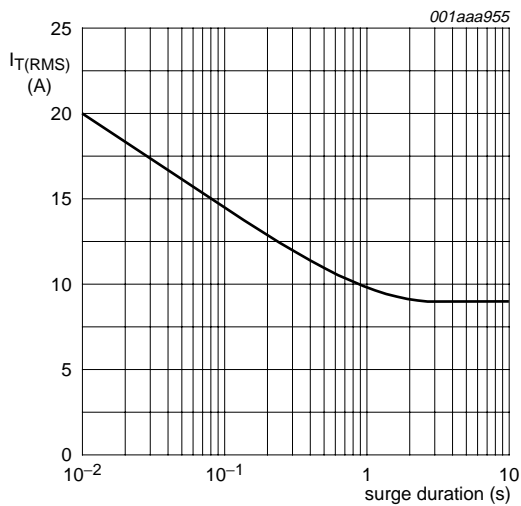
f = 50 Hz.

Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values.



$t_p \leq 10 \text{ ms.}$

Fig 3. Non-repetitive peak on-state current as a function of pulse width; maximum values.



$f = 50 \text{ Hz; } T_{hs} \leq 87 \text{ °C.}$

Fig 4. RMS on-state current as a function of surge duration; maximum values.

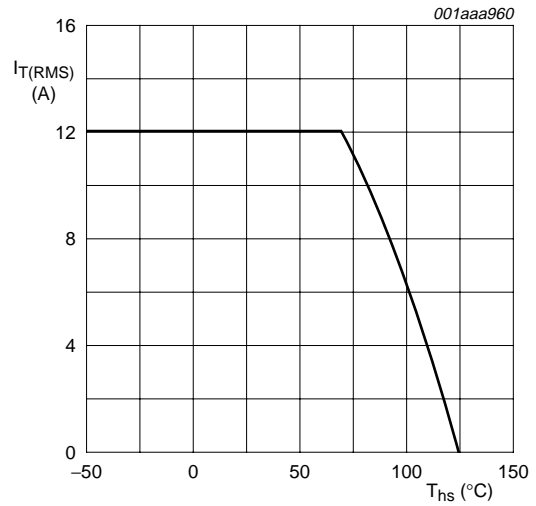
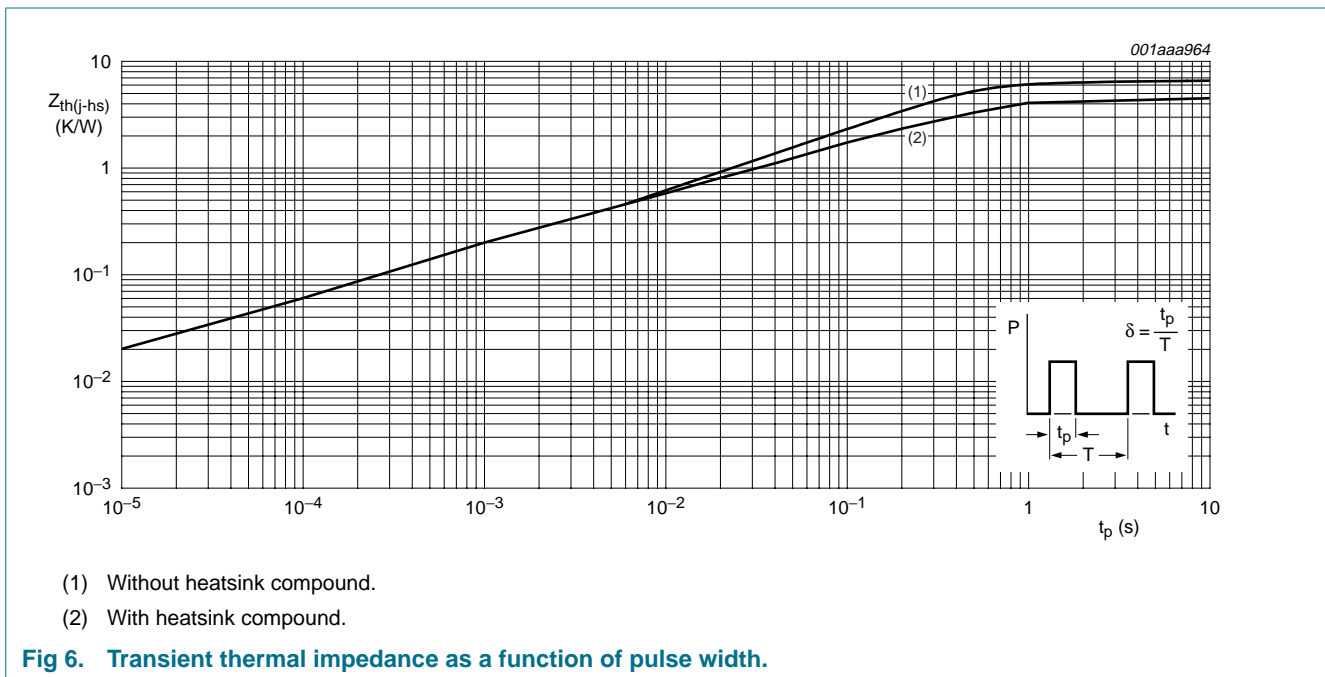


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values.

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Typ	Max	Unit
$R_{th(j-hs)}$	thermal resistance from junction to heatsink	Figure 6			
		with heatsink compound	-	4.5	K/W
		without heatsink compound	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	55	-	K/W



6. Isolation characteristics

Table 5: Isolation limiting values and characteristics

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

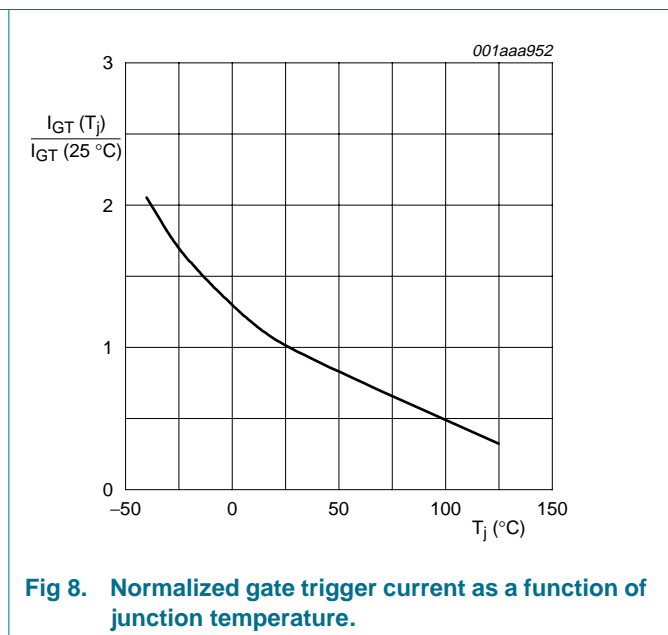
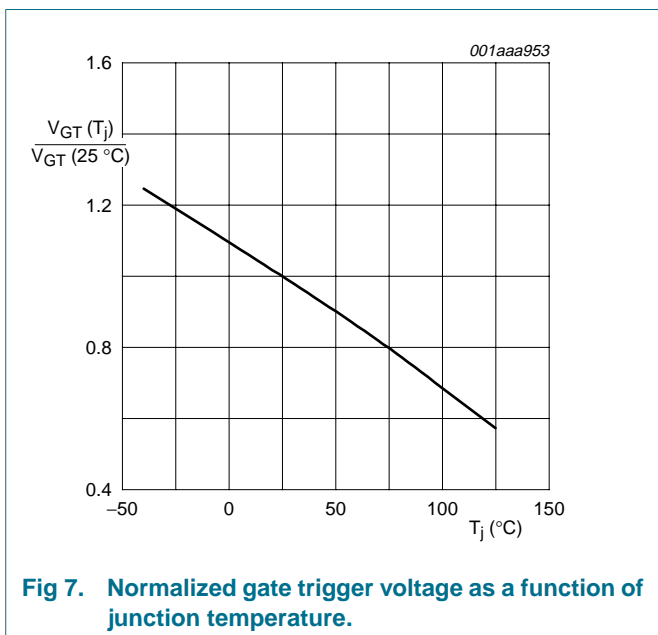
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{isol}	RMS isolation voltage from all three terminals to external heatsink	$f = 50$ to 60 Hz; sinusoidal waveform; R.H. $\leq 65\%$; clean and dust free	-	2500	V
C_{isol}	capacitance from pin 2 to external heatsink	$f = 1$ MHz	10	-	pF

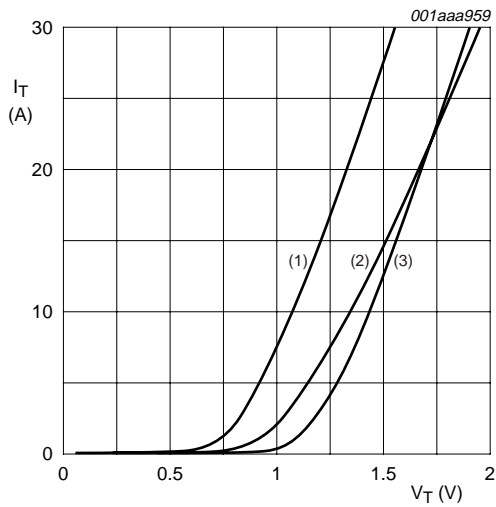
7. Characteristics

Table 6: Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 8	-	2	15	mA
I_L	latching current	$V_D = 12\text{ V}$; $I_{GT} = 0.1\text{ A}$; Figure 10	-	10	40	mA
I_H	holding current	$V_D = 12\text{ V}$; $I_{GT} = 0.1\text{ A}$; Figure 11	-	7	20	mA
V_T	on-state voltage	$I_T = 23\text{ A}$; Figure 9	-	1.4	1.75	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 7	-	0.6	1.5	V
		$V_D = V_{DRM(max)}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ }^\circ\text{C}$	0.25	0.4	-	V
I_D, I_R	off-state leakage current	$V_D = V_{DRM(max)}$; $V_R = V_{RRM(max)}$; $T_j = 125\text{ }^\circ\text{C}$	-	0.1	0.5	mA
Dynamic characteristics						
dV_D/dt	critical rate of rise of off-state voltage	$V_{DM} = 67\% V_{DRM(max)}$; $T_j = 125\text{ }^\circ\text{C}$; exponential waveform; Figure 12				
		gate open circuit	50	130	-	V/ μs
		$R_{GK} = 100\ \Omega$	200	1000	-	V/ μs
t_{gt}	gate controlled turn-on time	$I_{TM} = 40\text{ A}$; $V_D = V_{DRM(max)}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	μs
t_q	circuit commuted turn-on time	$V_D = 67\% V_{DRM(max)}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{TM} = 20\text{ A}$; $V_R = 25\text{ V}$; $dI_{TM}/dt = 30\text{ A}/\mu\text{s}$; $dV_D/dt = 50\text{ V}/\mu\text{s}$; $R_{GK} = 100\ \Omega$	-	70	-	μs





$V_O = 1.06\text{ V}$.

$R_S = 0.0304\ \Omega$.

- (1) $T_j = 125^\circ\text{C}$; typical values.
- (2) $T_j = 125^\circ\text{C}$; maximum values.
- (3) $T_j = 25^\circ\text{C}$; maximum values.

Fig 9. On-state current characteristics.

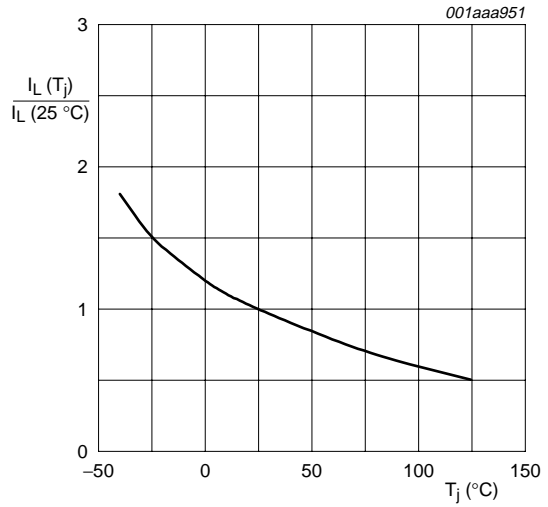


Fig 10. Normalized latching current as a function of junction temperature.

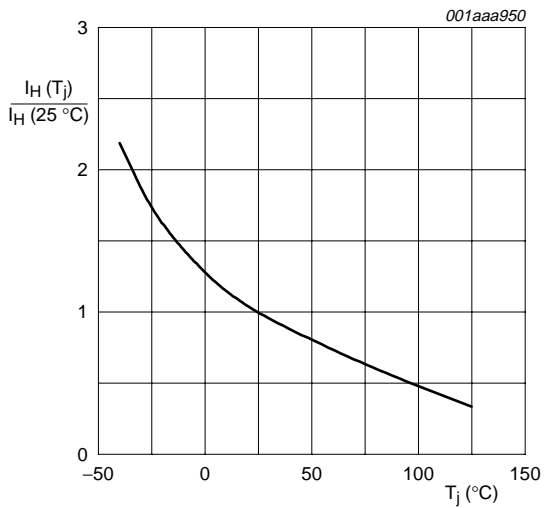
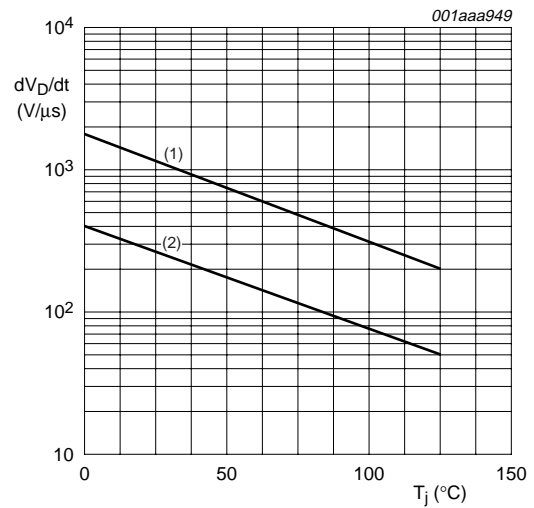


Fig 11. Normalized holding current as a function of junction temperature.



- (1) $R_{GK} = 100\ \Omega$.
- (2) Gate open circuit.

Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values.

8. Package information

Epoxy meets requirements of UL94 V-0 at $\frac{1}{8}$ inch.

9. Package outline

Plastic single-ended package; isolated heatsink mounted;
1 mounting hole; 3 lead TO-220 'full pack'

SOT186A

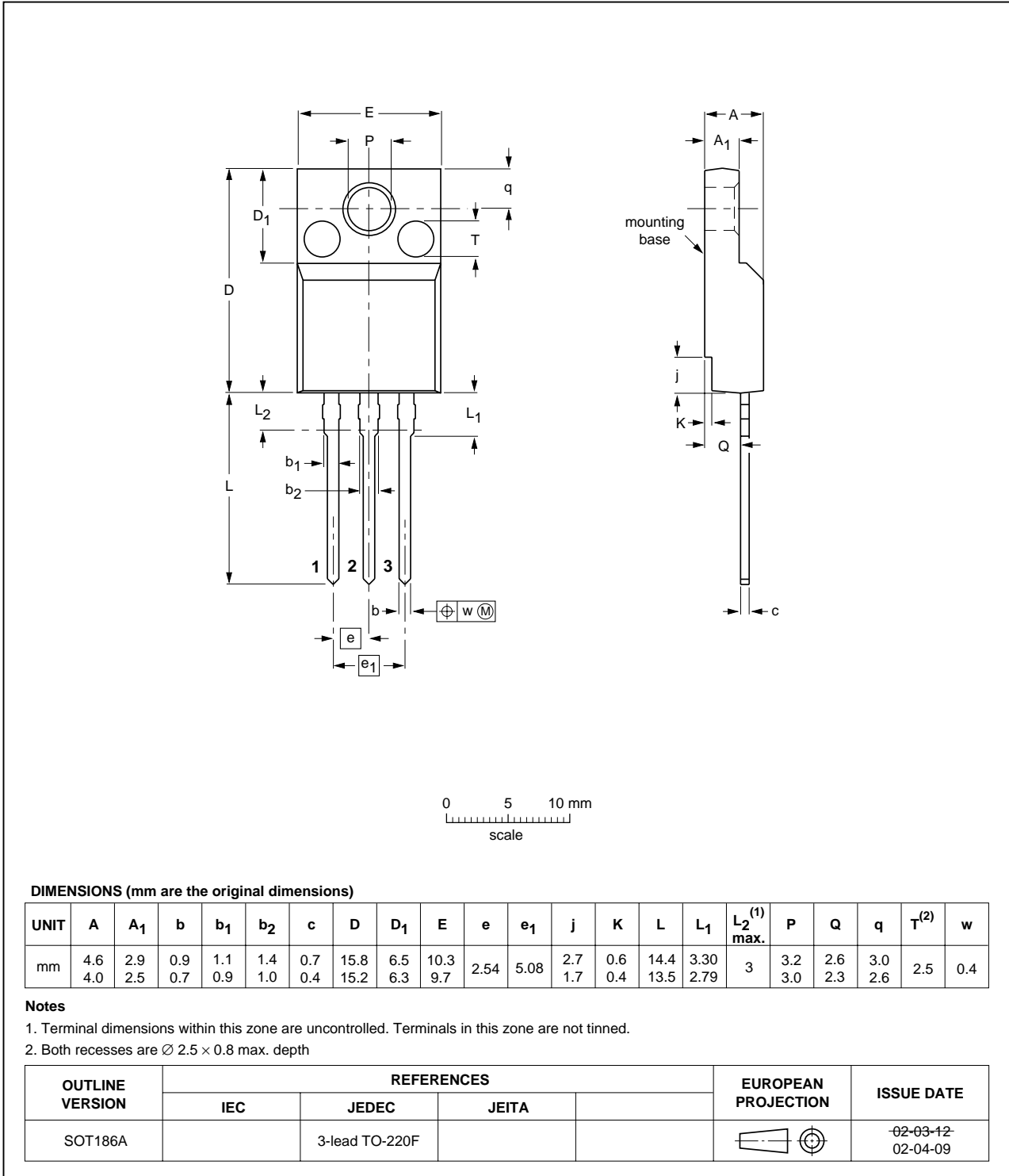


Fig 13. Package outline.

10. Revision history

Table 7: Revision history

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
BT151X_SERIES_4	20040609	Product specification	-	9397 750 13162	BT151X_SERIES_3
Modifications:	<ul style="list-style-type: none">The format of this specification has be redesigned to comply with Philips Semiconductors' new presentation and information standard				
BT151X_SERIES_3	20030901	Product specification	-	-	BT151X_SERIES_2
BT151X_SERIES_2	19990601	Product specification	-	-	BT151X_SERIES_1
BT151X_SERIES_1	19970901	Product specification	-	-	-

11. Data sheet status

Level	Data sheet status ^[1]	Product status ^[2] ^[3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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 the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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