

# BT151-650R

SCR, 12 A, 15mA, 650 V, SOT78

Rev. 05 — 27 February 2009

Product data sheet

## 1. Product profile

### 1.1 General description

Planar passivated SCR (Silicon Controlled Rectifier) in a SOT78 plastic package.

### 1.2 Features and benefits

- High reliability
- High surge current capability
- High thermal cycling performance

### 1.3 Applications

- Ignition circuits
- Motor control
- Protection Circuits
- Static switching

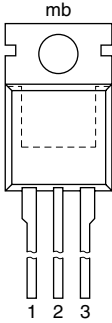

### 1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	-	650	V
$I_{\text{T(AV)}}$	average on-state current	half sine wave; $T_{\text{mb}} \leq 109\text{ °C}$ ; see <a href="#">Figure 3</a>	-	-	7.5	A
$I_{\text{T(RMS)}}$	RMS on-state current	half sine wave; $T_{\text{mb}} \leq 109\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	-	12	A
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_{\text{D}} = 12\text{ V}$ ; $T_{\text{j}} = 25\text{ °C}$ ; $I_{\text{T}} = 100\text{ mA}$ ; see <a href="#">Figure 8</a>	-	2	15	mA

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode		
2	A	anode		
3	G	gate		
mb	mb	anode		

**SOT78**  
(TO-220AB; SC-46)

## 3. Ordering information

**Table 3. Ordering information**

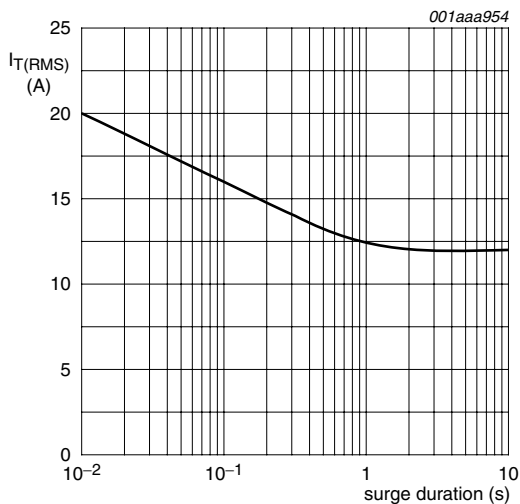
Type number	Package		Version
	Name	Description	
BT151-650R	TO-220AB; SC-46	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 4. Limiting values

**Table 4. Limiting values**

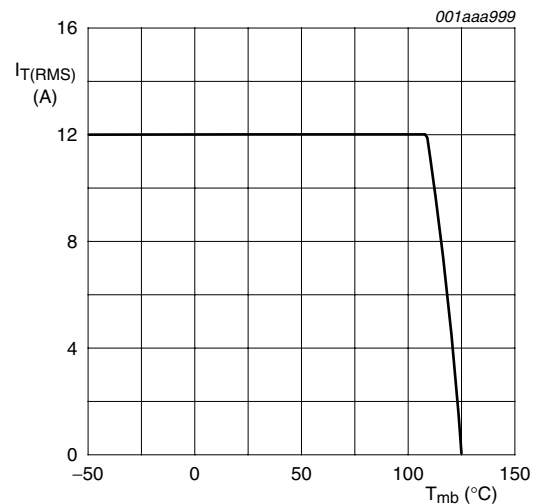
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	650	V
$V_{RRM}$	repetitive peak reverse voltage		-	650	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 3</a>	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	12	A
$di_T/dt$	rate of rise of on-state current	$I_T = 20\text{ A}$ ; $I_G = 50\text{ mA}$ ; $di_G/dt = 50\text{ mA}/\mu\text{s}$	-	50	A/ $\mu\text{s}$
$I_{GM}$	peak gate current		-	2	A
$P_{GM}$	peak gate power		-	5	W
$T_{stg}$	storage temperature		-40	150	$^{\circ}\text{C}$
$T_j$	junction temperature		-	125	$^{\circ}\text{C}$
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $t_p = 8.3\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$	-	132	A
		half sine wave; $t_p = 10\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	120	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	72	A <sup>2</sup> s
$P_{G(AV)}$	average gate power	over any 20 ms period	-	0.5	W
$V_{RGM}$	peak reverse gate voltage		-	5	V

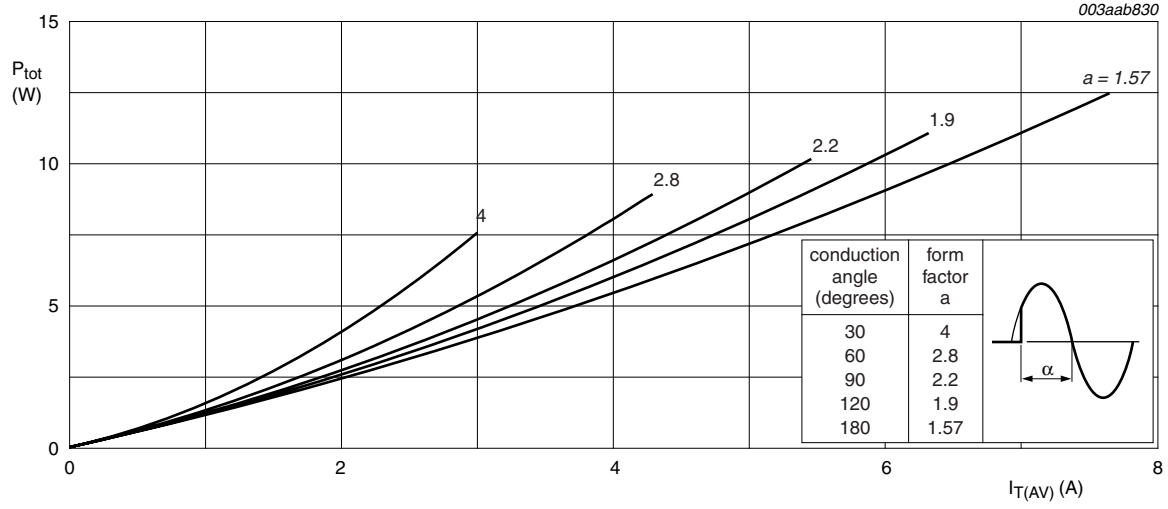


$f = 50\text{ Hz}; T_{mb} = 109\text{ }^{\circ}\text{C}$

**Fig 1. RMS on-state current as a function of surge duration; maximum values**

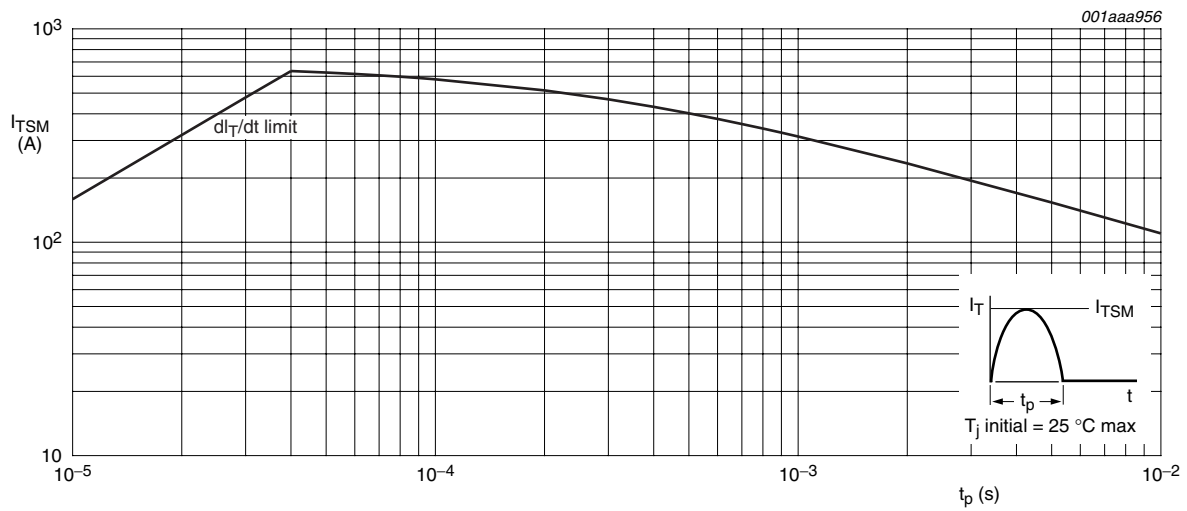


**Fig 2. RMS on-state current as a function of mounting base temperature; maximum values**



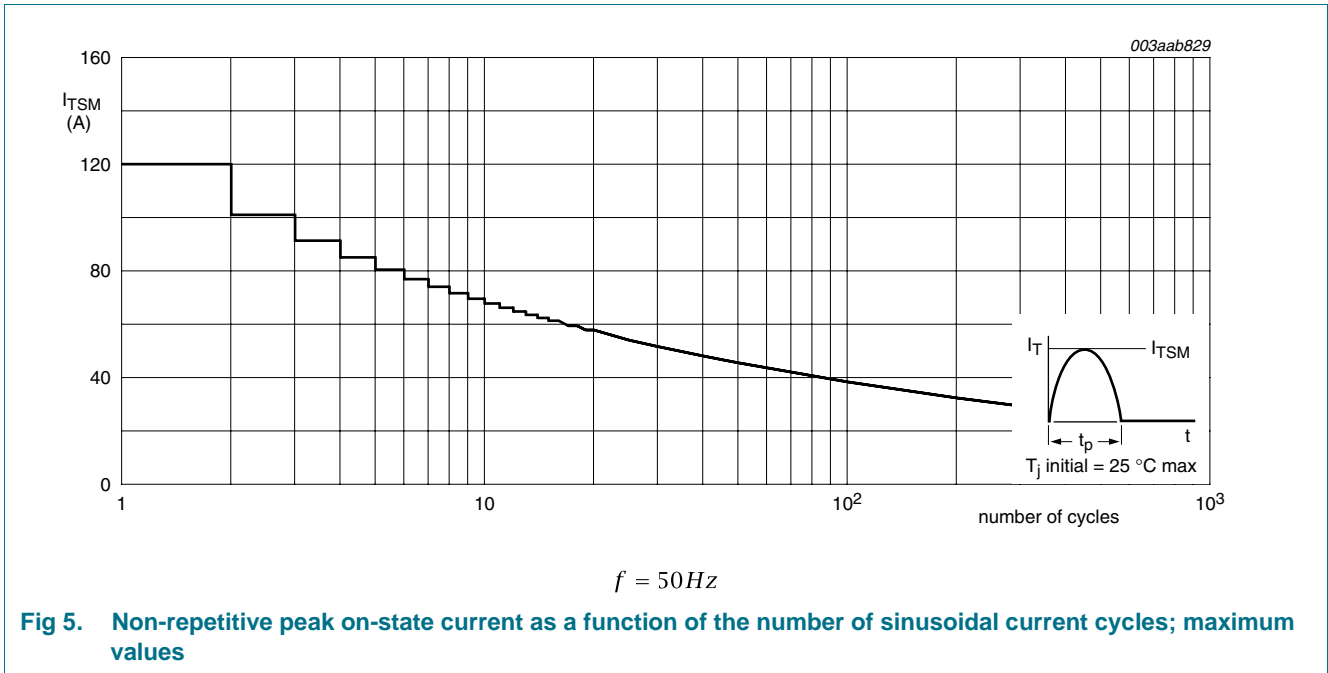
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$

Fig 3. Total power dissipation as a function of average on-state current; maximum values



$t_p = 10 \text{ ms}$

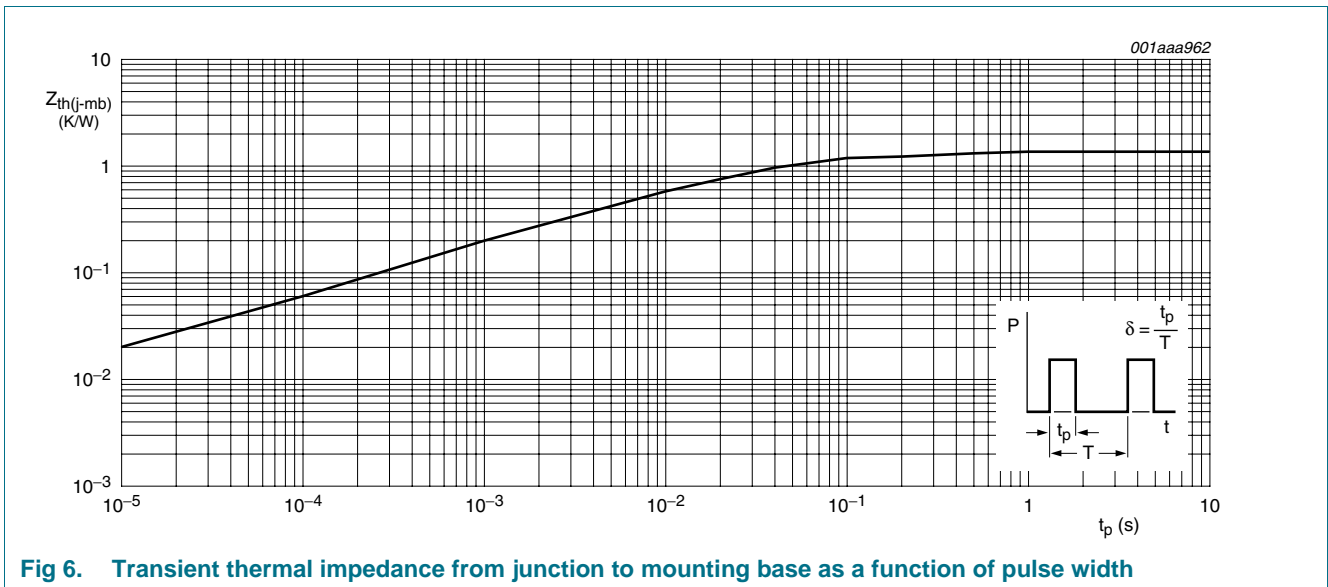
Fig 4. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values



## 5. Thermal characteristics

**Table 5. Thermal characteristics**

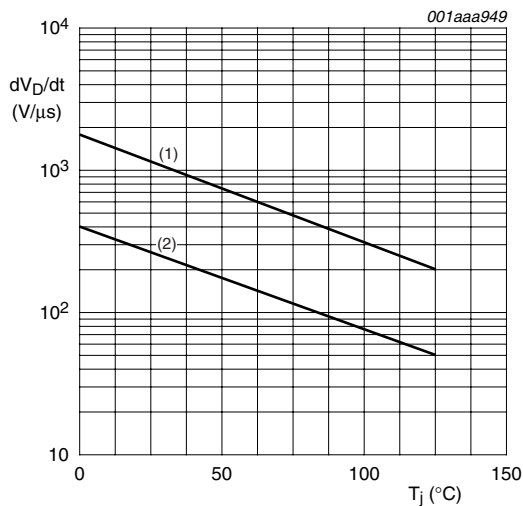
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 6</a>	-	-	1.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air		-	60	-	K/W



## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; $I_T = 100\text{ mA}$ ; see <a href="#">Figure 8</a>	-	2	15	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	10	40	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	7	20	mA
$V_T$	on-state voltage	$I_T = 23\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	1.4	1.75	V
$V_{GT}$	gate trigger voltage	$I_T = 100\text{ mA}$ ; $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	0.6	1.5	V
		$I_T = 100\text{ mA}$ ; $V_D = 650\text{ V}$ ; $T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 650\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
$I_R$	reverse current	$V_R = 650\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 435\text{ V}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; gate open circuit	50	130	-	V/ $\mu$ s
		$V_{DM} = 435\text{ V}$ ; $T_j = 125\text{ °C}$ ; $R_{GK} = 100\text{ }\Omega$ ; exponential waveform; see <a href="#">Figure 7</a>	200	1000	-	V/ $\mu$ s
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 40\text{ A}$ ; $V_D = 650\text{ V}$ ; $I_G = 100\text{ mA}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ °C}$	-	2	-	$\mu$ s
$t_q$	commutated turn-off time	$V_{DM} = 435\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{TM} = 20\text{ A}$ ; $V_R = 25\text{ V}$ ; $(dI_T/dt)_M = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 50\text{ V}/\mu\text{s}$ ; $R_{GK} = 100\text{ }\Omega$	-	70	-	$\mu$ s



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

Fig 7. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values

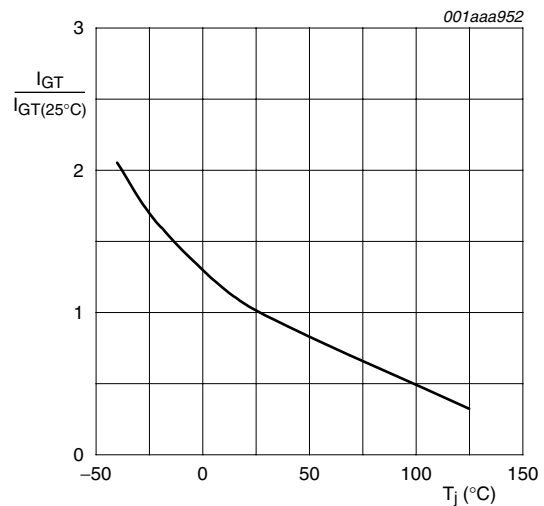


Fig 8. Normalized gate trigger current as a function of junction temperature

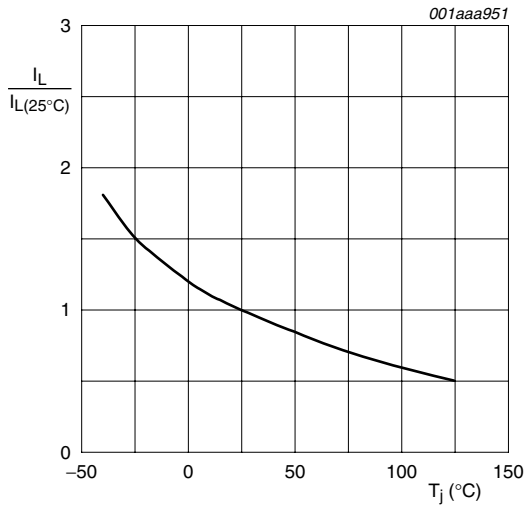


Fig 9. Normalized latching current as a function of junction temperature

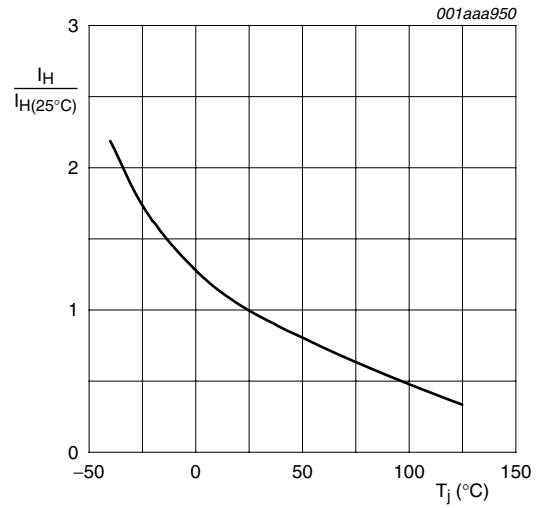
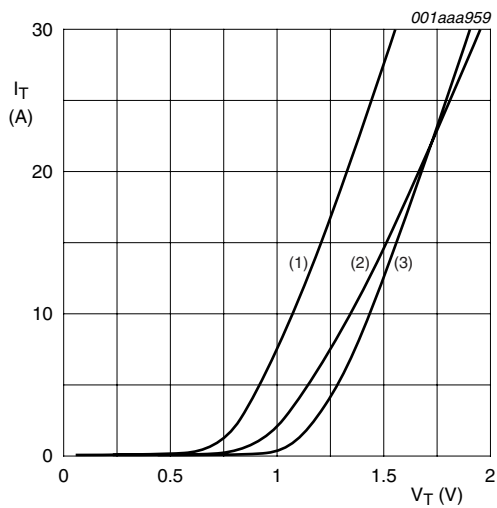


Fig 10. Normalized holding current as a function of junction temperature



$V_0 = 1.06 \text{ V}; R_s = 0.0304 \Omega$   
 (1)  $T_j = 150^\circ\text{C}$ ; typical values  
 (2)  $T_j = 150^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25^\circ\text{C}$ ; maximum values

Fig 11. On-state current as a function of on-state voltage

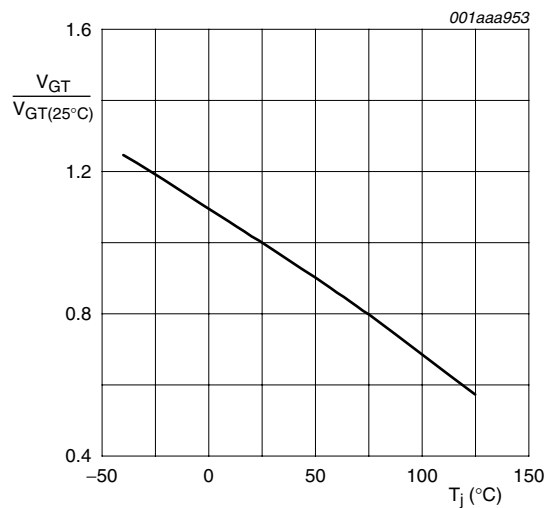


Fig 12. Normalized gate trigger voltage as a function of junction temperature

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

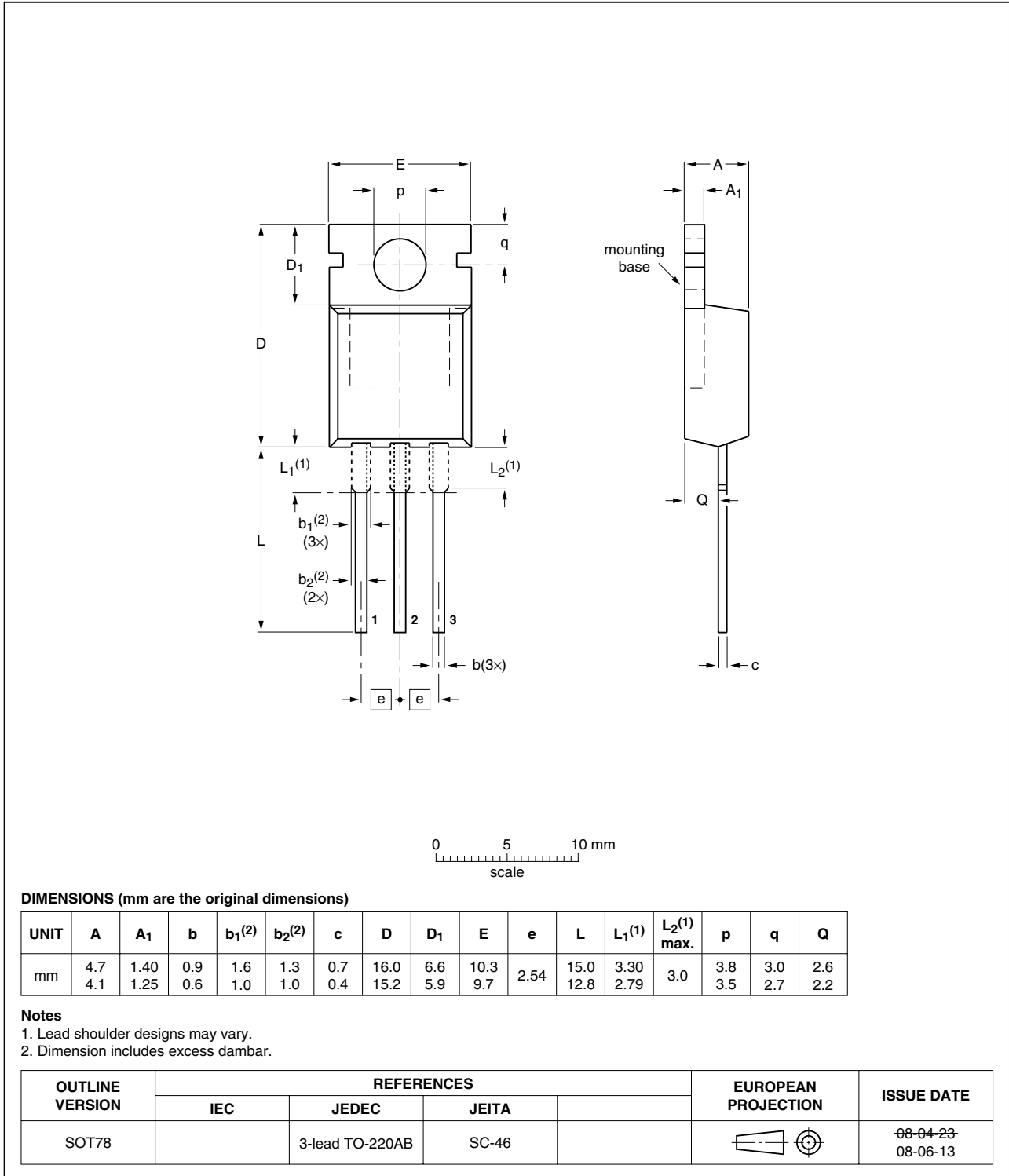


Fig 13. Package outline SOT78 (TO-220AB)



## 8. Revision history

**Table 7. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT151-650R_5	20090227	Product data sheet	-	BT151_SER_L_R_4
Modifications:	<ul style="list-style-type: none"> <li>• Package outline updated.</li> <li>• Type number BT151-650R separated from data sheet BT151_SER_L_R_4.</li> </ul>			
BT151_SER_L_R_4	20061023	Product data sheet	-	BT151_SERIES_3
BT151_SERIES_3 (9397 750 13159)	20040607	Product specification	-	BT151_SERIES_2
BT151_SERIES_2	19990601	Product specification	-	BT151_SERIES_1
BT151_SERIES_1	19970901	Product specification	-	-

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Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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