

BT151-650L

SCR, 12 A, 5 mA, 650 V, SOT78

Rev. 05 — 2 March 2009

Product data sheet

1. Product profile

1.1 General description

Planar passivated SCR 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

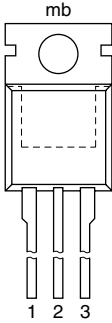

1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{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 Figure 3	-	-	7.5	A
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 109\text{ °C}$; see Figure 1 ; see Figure 2	-	-	12	A
Static characteristics						
I_{GT}	gate trigger current	$V_{\text{D}} = 12\text{ V}$; $T_{\text{j}} = 25\text{ °C}$; $I_{\text{T}} = 100\text{ mA}$; see Figure 8	-	2	5	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

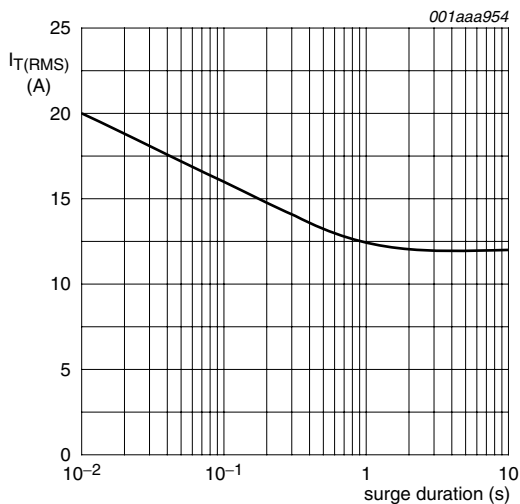
Type number	Package		Version
	Name	Description	
BT151-650L	TO-220AB; SC-46	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

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 Figure 3	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$; see Figure 1 ; see Figure 2	-	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/ μs
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 Figure 4 ; see Figure 5	-	120	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; sine-wave pulse	-	72	A ² 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

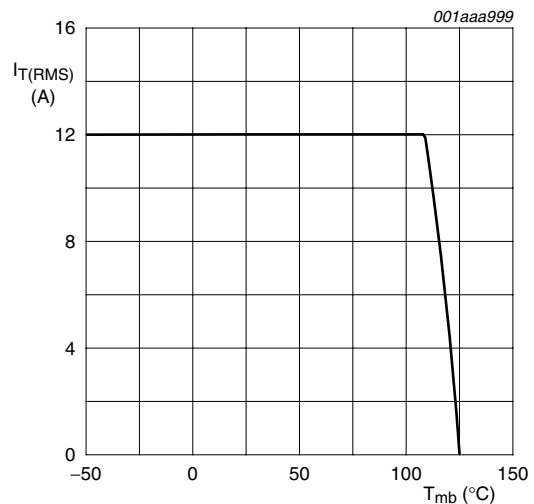
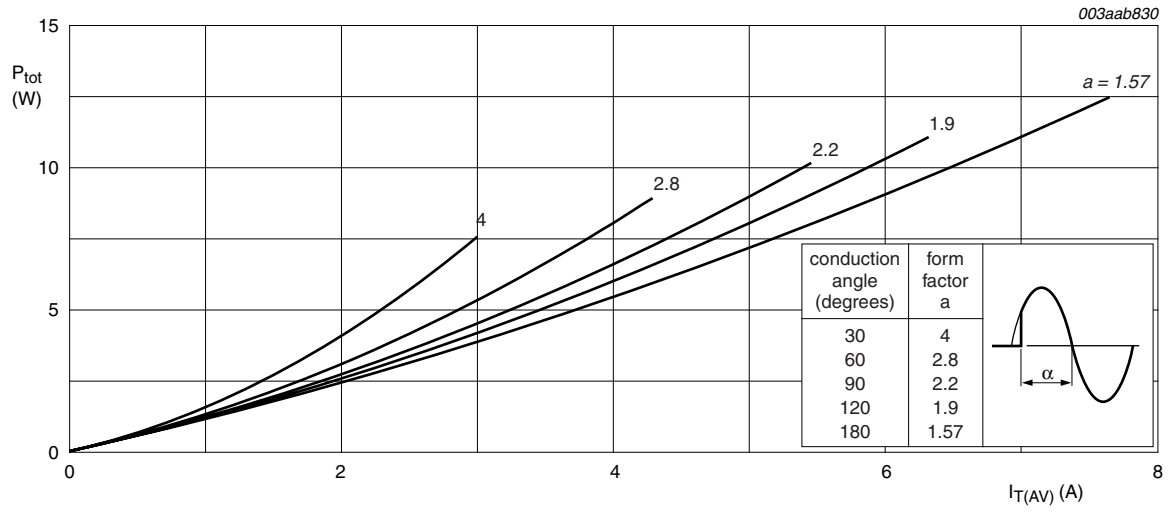
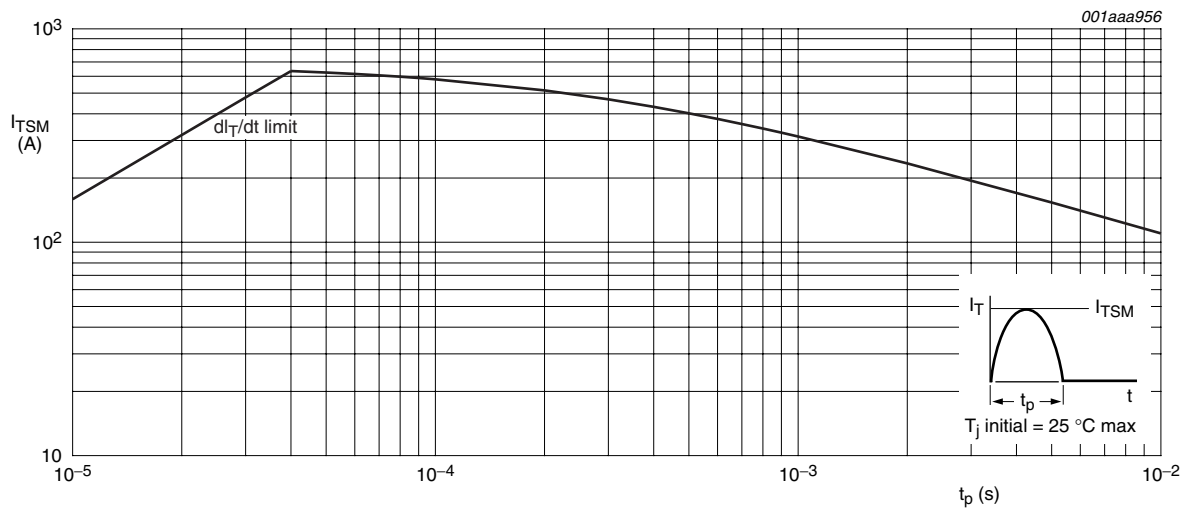


Fig 2. RMS on-state current as a function of mounting base temperature; maximum values



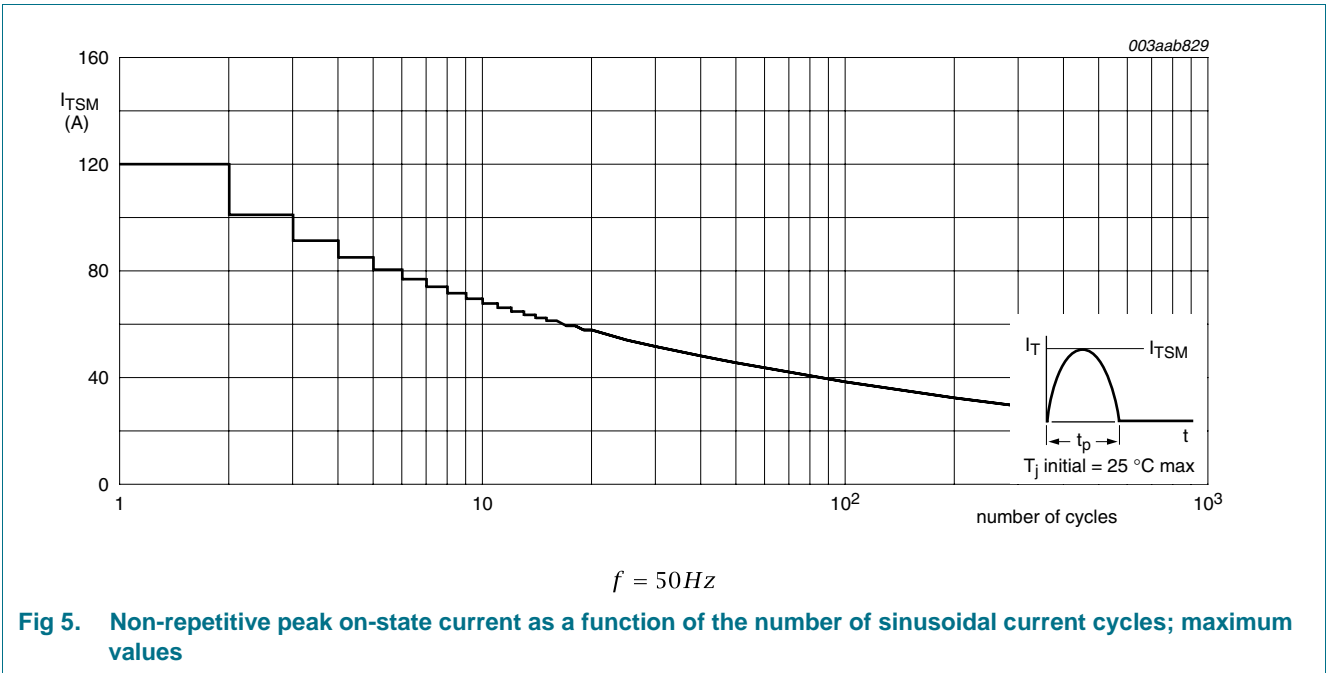
$$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$$

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



$$t_p = 10 \text{ ms}$$

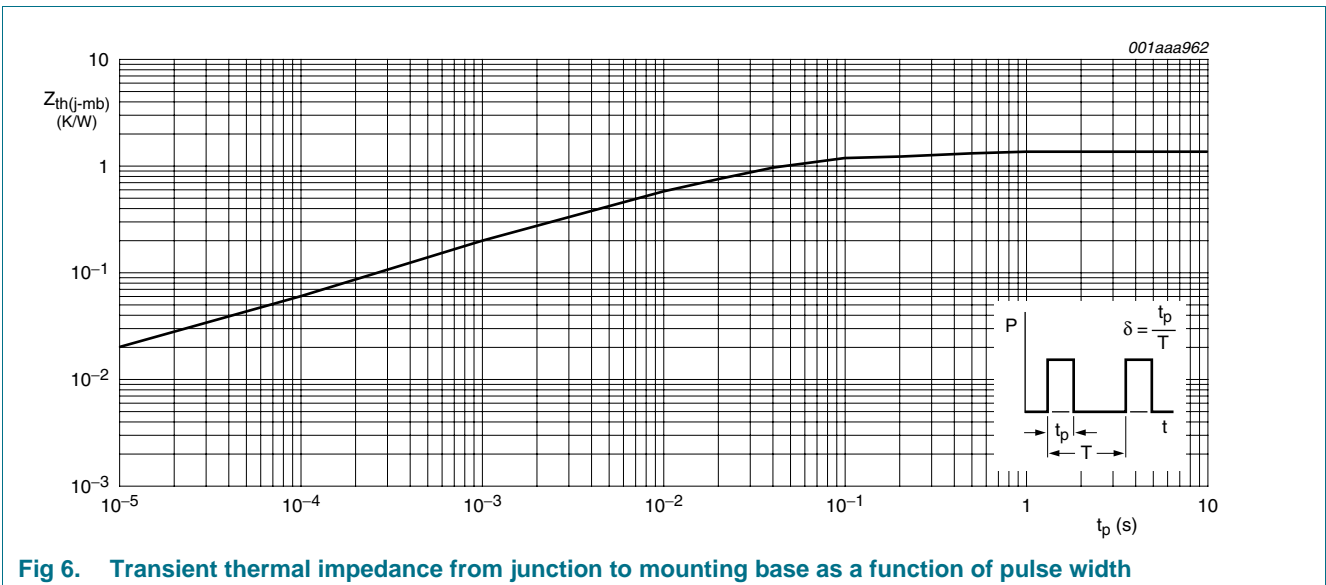
Fig 4. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values



5. Thermal characteristics

Table 5. Thermal characteristics

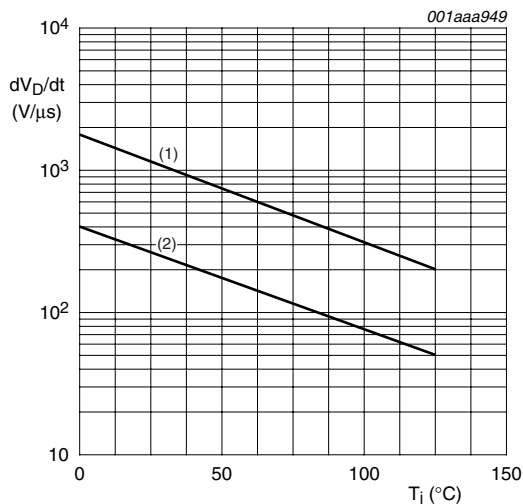
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 6	-	-	1.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air		-	60	-	K/W



6. Characteristics

Table 6. Characteristics

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



(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

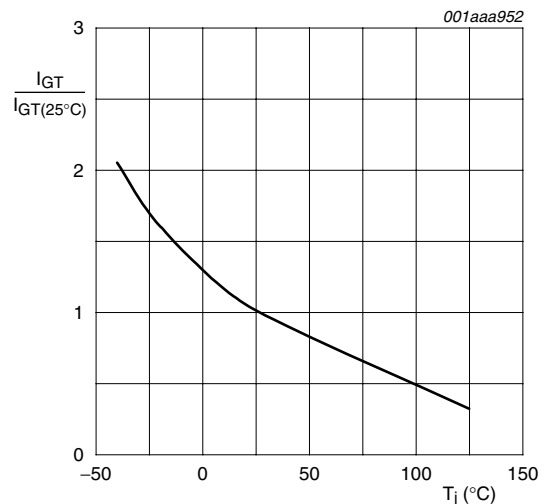


Fig 8. Normalized gate trigger current as a function of junction temperature

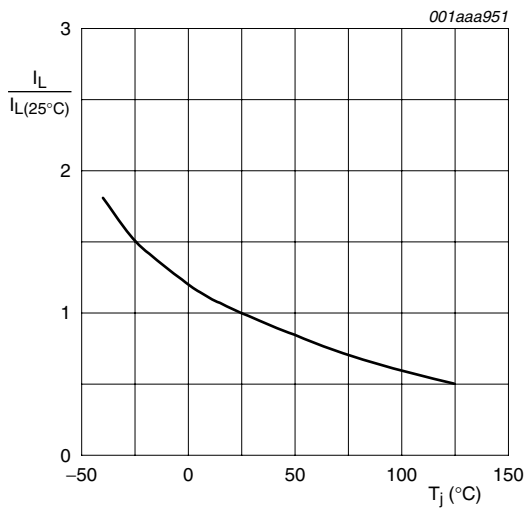


Fig 9. Normalized latching current as a function of junction temperature

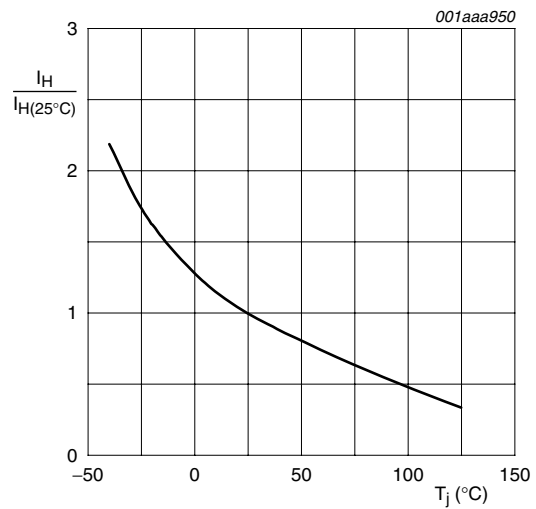
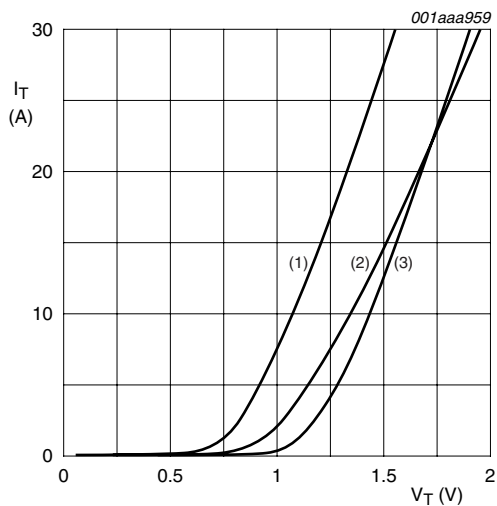


Fig 10. Normalized holding current as a function of junction temperature



- $V_0 = 1.06 \text{ V}; R_s = 0.0304 \Omega$
- (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

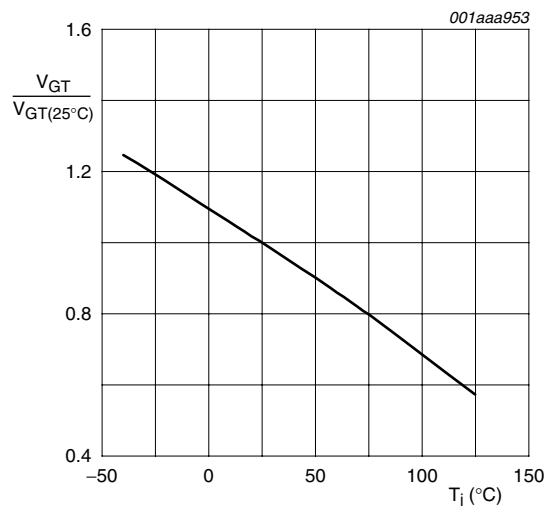


Fig 12. Normalized gate trigger voltage as a function of junction temperature

7. Package outline

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

SOT78

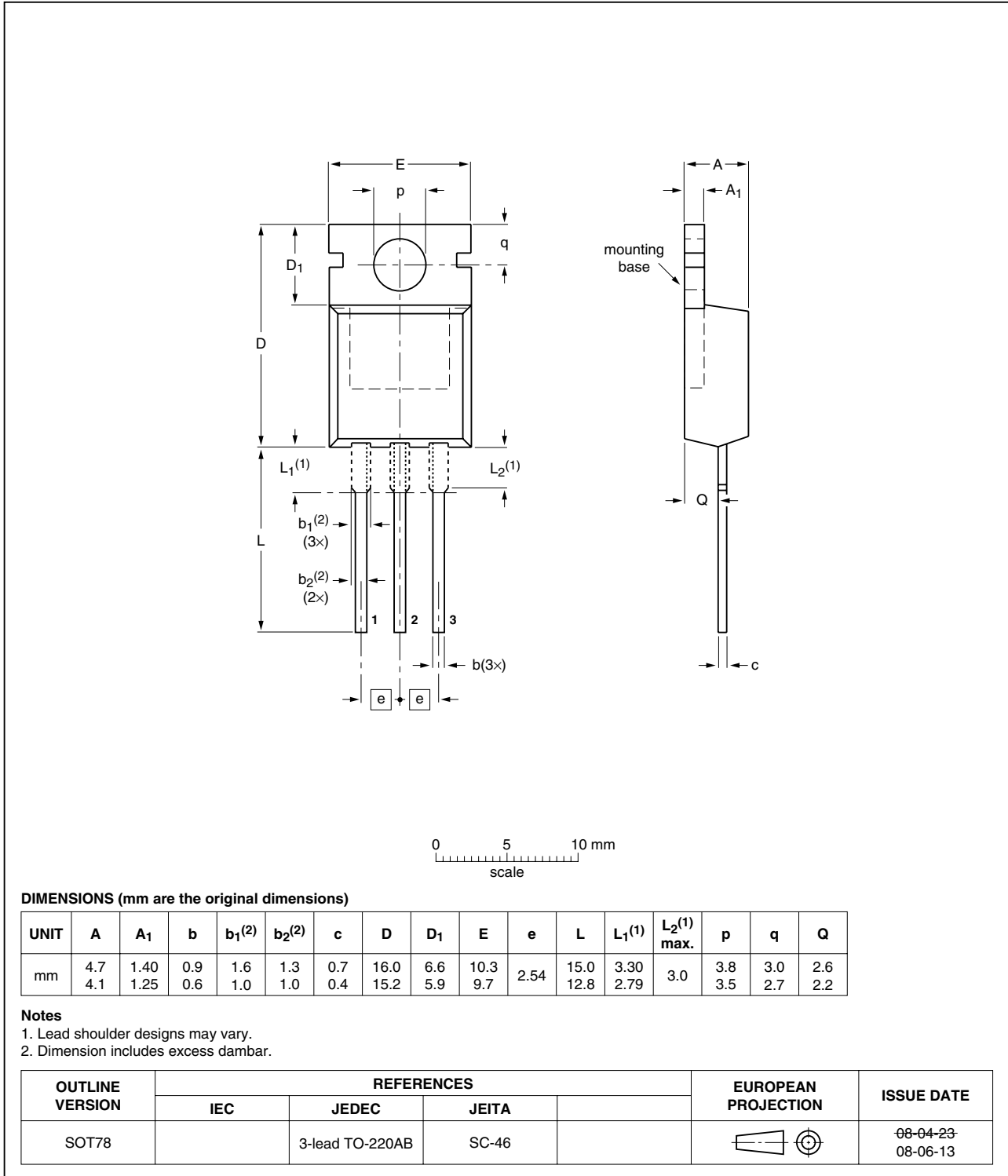


Fig 13. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT151-650L_5	20090302	Product data sheet	-	BT151_SER_L_R_4
Modifications:	<ul style="list-style-type: none"> • Package outline updated. • Type number BT151-650L separated from data sheet BT151_SER_L_R_4. 			
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	-	-

9. Legal information

9.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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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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11. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	3
5	Thermal characteristics	5
6	Characteristics	6
7	Package outline	8
8	Revision history	9
9	Legal information	10
9.1	Data sheet status	10
9.2	Definitions	10
9.3	Disclaimers	10
9.4	Trademarks	10
10	Contact information	10

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