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
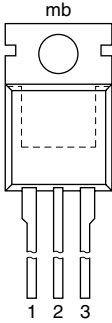- Motor control
- Protection Circuits
- Static switching

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
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 109$ °C; see Figure 3	-	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 109$ °C; see Figure 1; see Figure 2	-	-	12	A
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12$ V; $T_j = 25$ °C; $I_T = 100$ mA; see Figure 8	-	2	5	mA

founded by Philips

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		
	Name	**Description**	**Version**
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; $T_{mb} \leq 109\ °C$; see Figure 3	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 109\ °C$; see Figure 1; see Figure 2	-	12	A
dI_T/dt	rate of rise of on-state current	$I_T = 20\ A$; $I_G = 50\ mA$; $dI_G/dt = 50\ mA/μs$	-	50	A/μs
I_{GM}	peak gate current		-	2	A
P_{GM}	peak gate power		-	5	W
T_{stg}	storage temperature		-40	150	°C
T_j	junction temperature		-	125	°C
I_{TSM}	non-repetitive peak on-state current	half sine wave; $t_p = 8.3\ ms$; $T_{j(init)} = 25\ °C$	-	132	A
		half sine wave; $t_p = 10\ ms$; $T_{j(init)} = 25\ °C$; see Figure 4; see Figure 5	-	120	A
I^2t	I2t for fusing	$t_p = 10\ ms$; 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
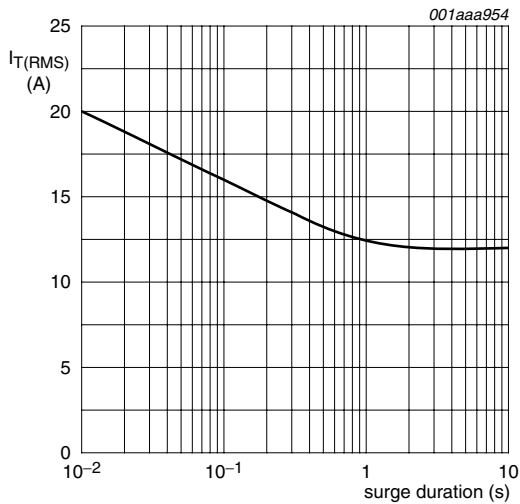
$$f = 50 Hz;\ T_{mb} = 109\ °C$$

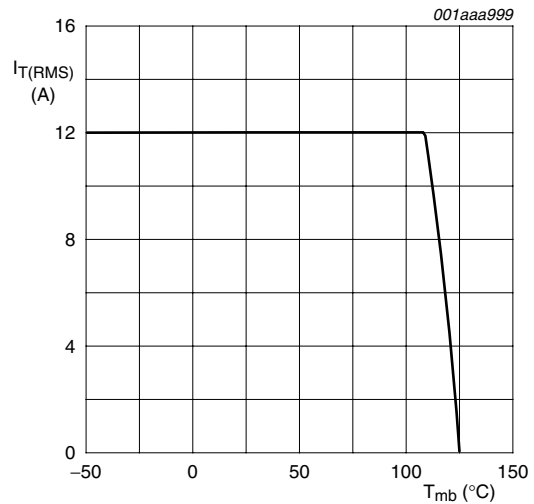**Fig 1.   RMS on-state current as a function of surge duration; maximum values**

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

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| conduction angle (degrees)	form factor a
30	4
60	2.8
90	2.2
120	1.9
180	1.57
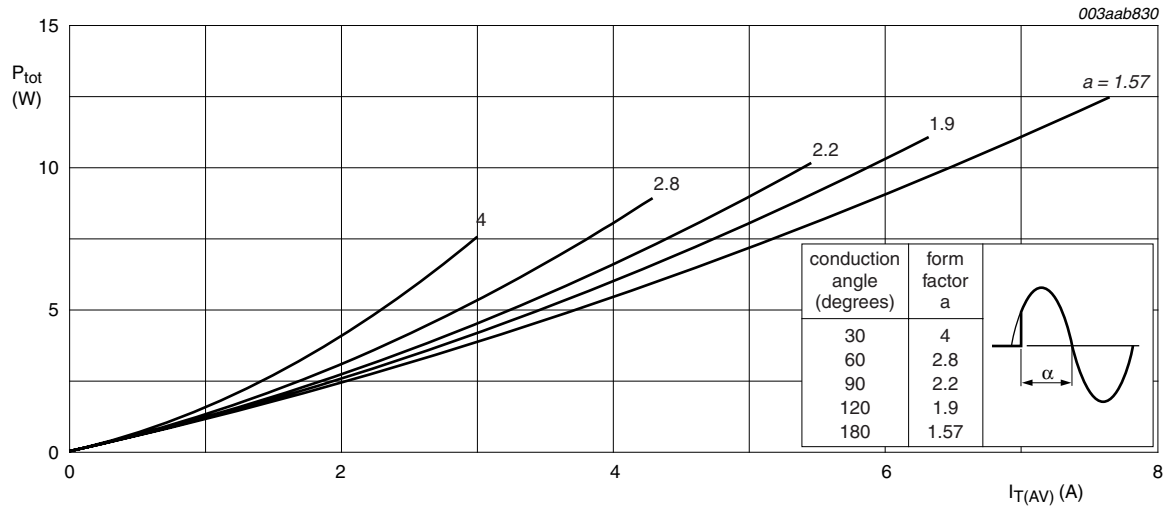
$$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$$

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

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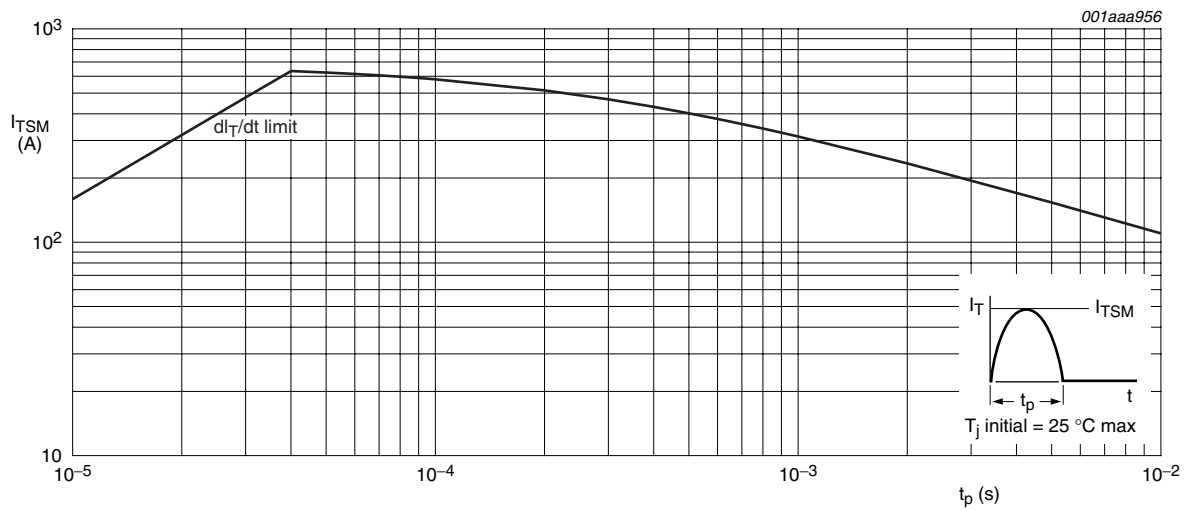
$$t_p = 10\,ms$$

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

Fig 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values
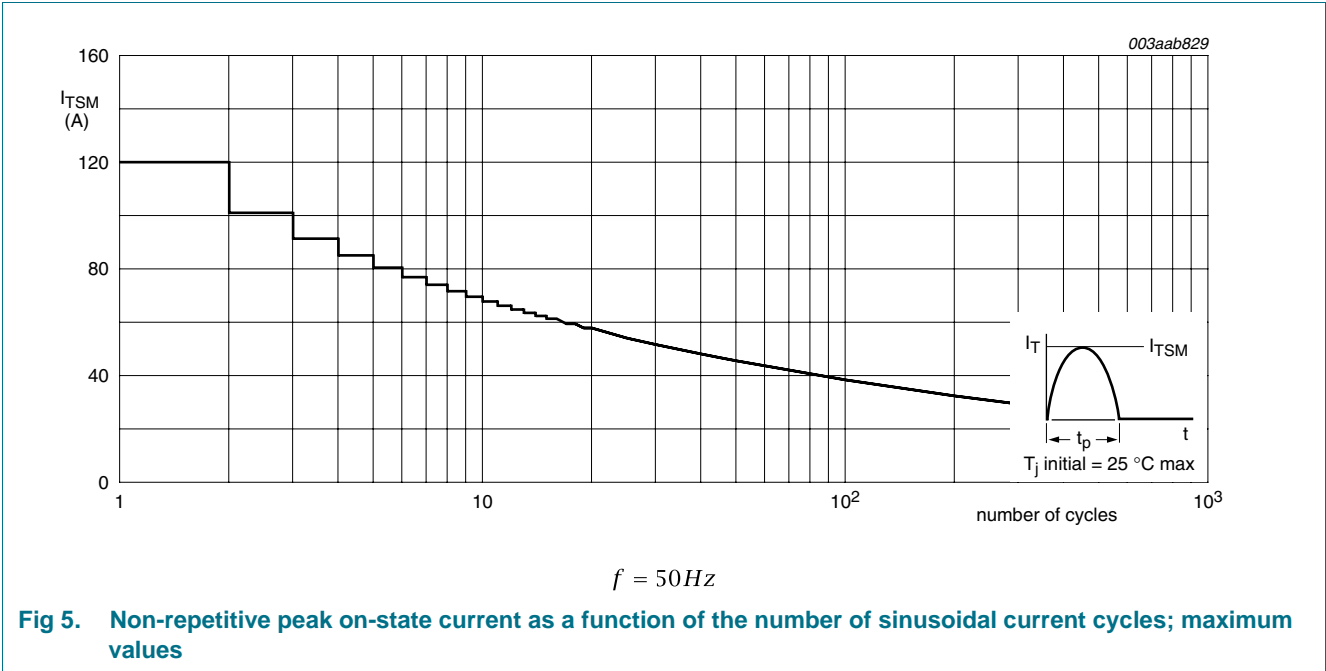
5. Thermal characteristics

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

Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse width
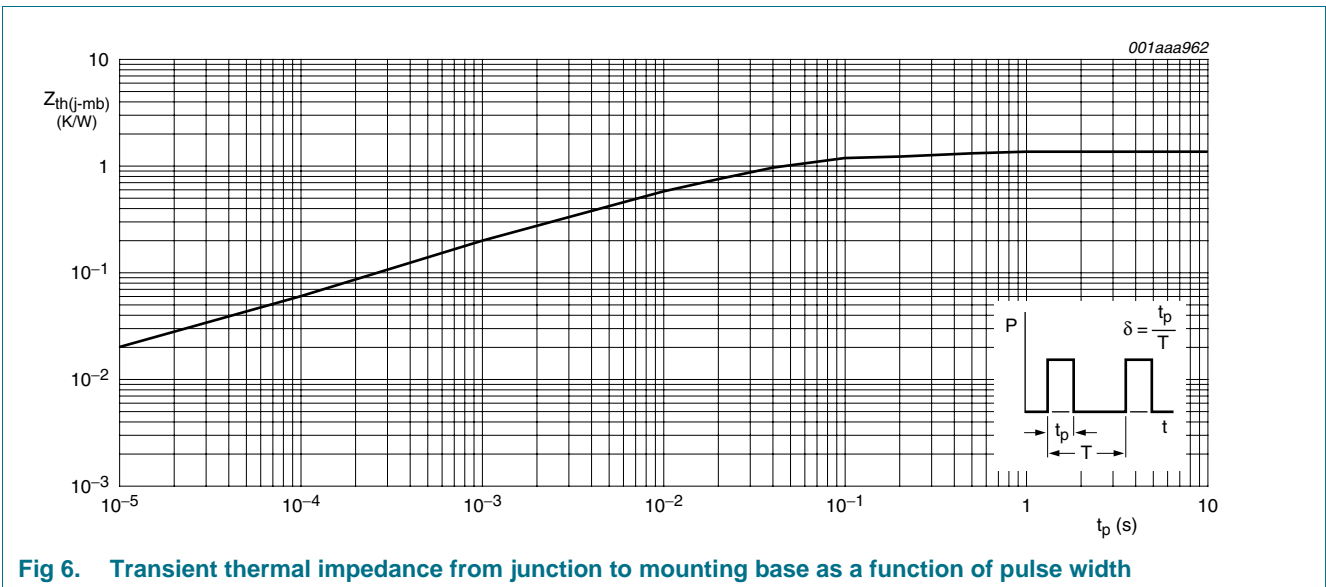
6. Characteristics

Table 6. **Characteristics**

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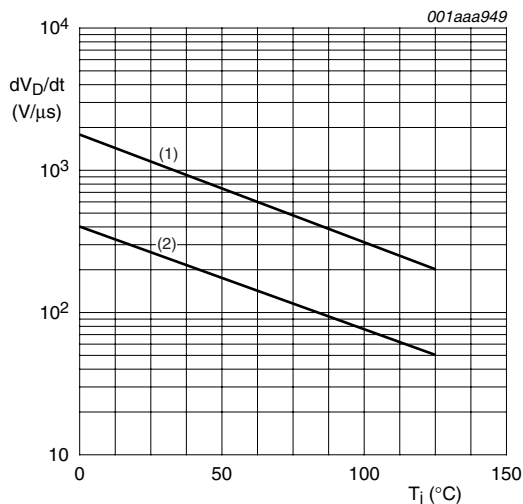
(1) $R_{GK} = 100\,\Omega$
(2) Gate open circuit

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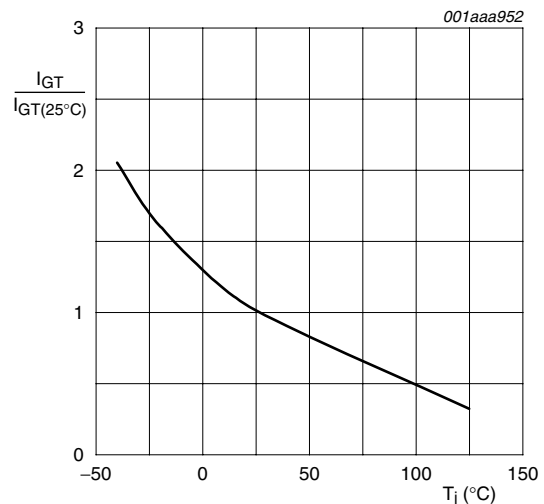

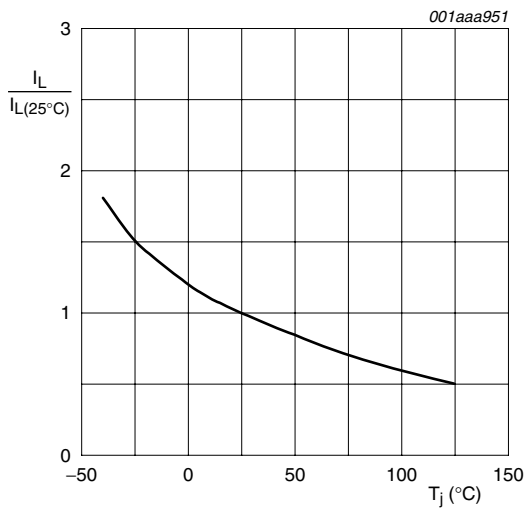**Fig 8.** **Normalized gate trigger current as a function of junction temperature**

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

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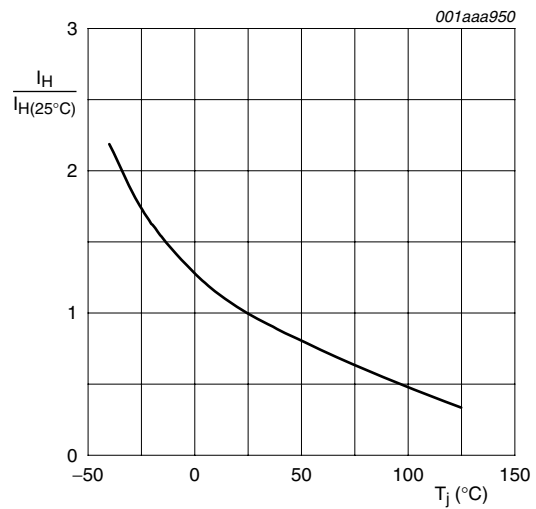
Fig 10. **Normalized holding current as a function of junction temperature**

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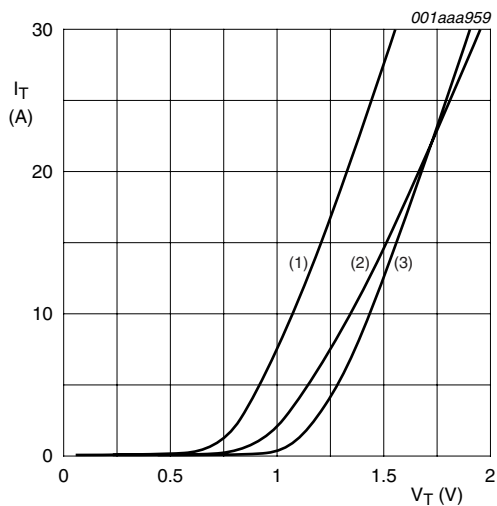
$V_0 = 1.06\,V; R_s = 0.0304\,\Omega$

(1) $T_j = 150\ ^\circ C$; typical values

(2) $T_j = 150\ ^\circ C$; maximum values

(3) $T_j = 25\ ^\circ C$; maximum values

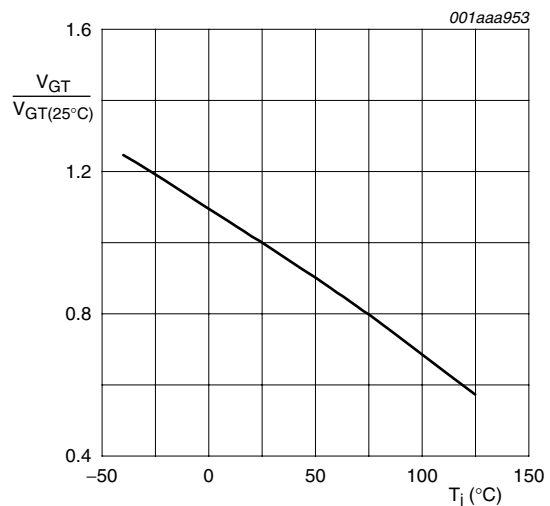Fig 11. **On-state current as a function of on-state voltage**

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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**

DIMENSIONS (mm are the original dimensions)

UNIT	A	A$_1$	b	b$_1$$^{(2)}$	b$_2$$^{(2)}$	c	D	D$_1$	E	e	L	L$_1$$^{(1)}$	L$_2$$^{(1)}$ max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

Notes
1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

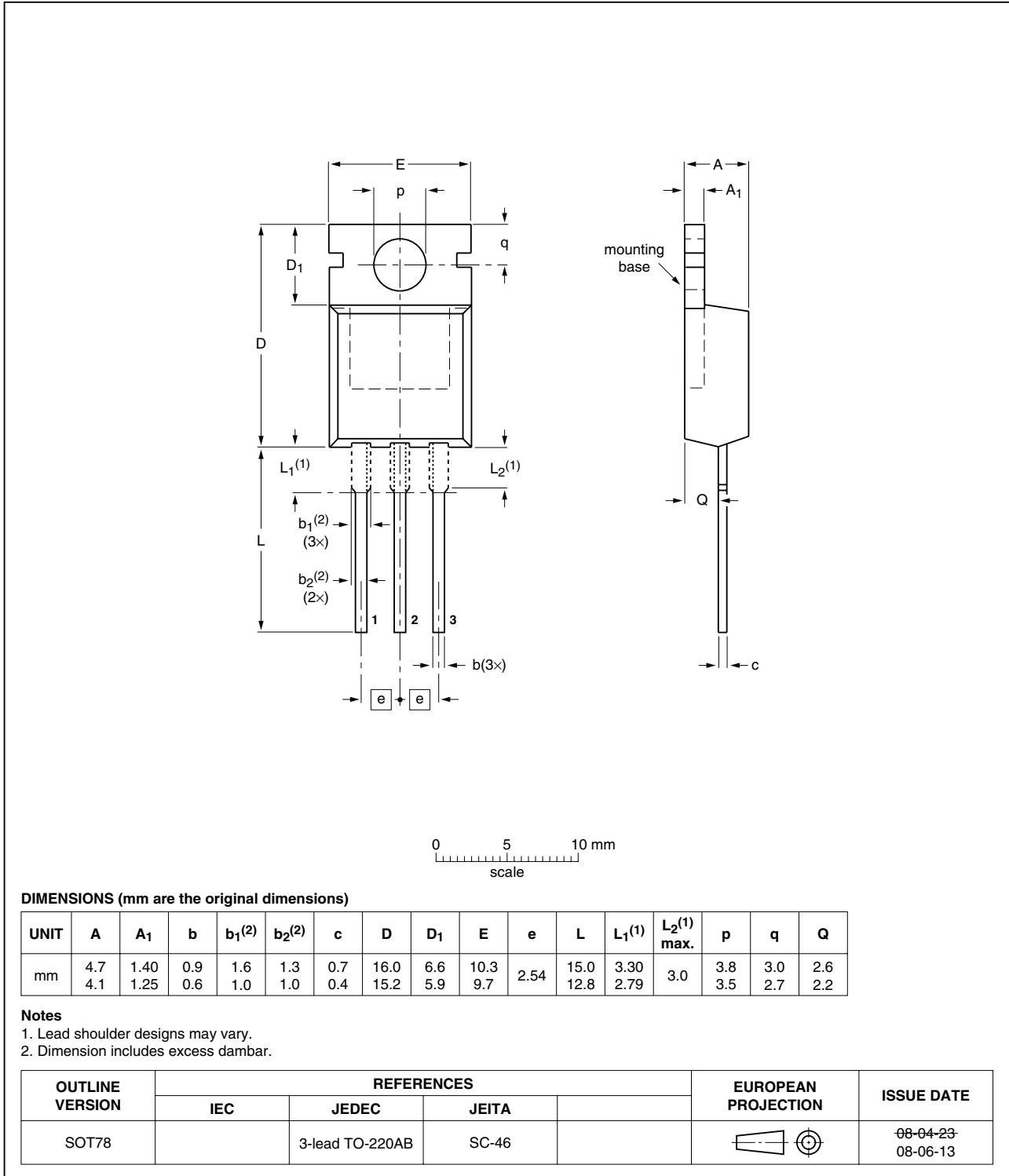| OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

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:	- 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	-	-

BT151-650L_5

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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.
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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