

# BT152-500RT

SCR, 20 A, 32 mA, 500 V, SOT78

Rev. 01 — 12 May 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 thermal cycling performance
- High temperature capable
- Very high surge capability

### 1.3 Applications

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

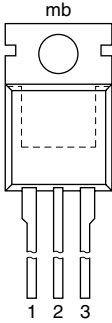

### 1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	500	V
$V_{RRM}$	repetitive peak reverse voltage		-	-	500	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 122\text{ °C}$ ; see <a href="#">Figure 3</a>	-	-	13	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; all conduction angles; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	-	20	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $t_p = 8.3\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ °C}$	-	-	220	A
		half sine wave; $t_p = 10\text{ ms}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	-	200	A
<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>	-	3	32	mA

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode		 sym037
2	A	anode		
3	G	gate		
mb	A	mounting base; connected to anode		

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

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
BT152-500RT	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**

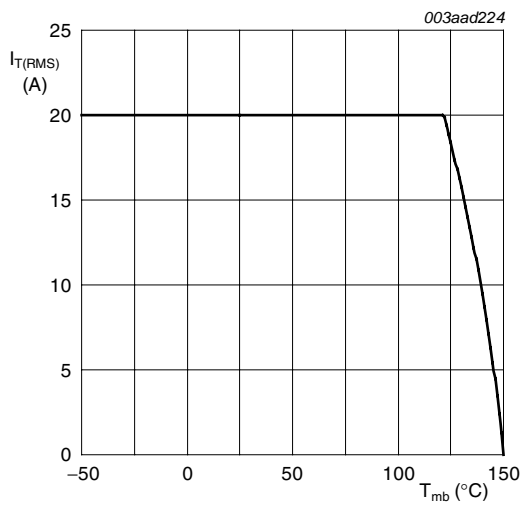
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	500	V
$V_{RRM}$	repetitive peak reverse voltage		-	500	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 122\text{ °C}$ ; see <a href="#">Figure 3</a>	-	13	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; all conduction angles; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	20	A
$di_T/dt$	rate of rise of on-state current	$I_T = 50\text{ A}$ ; $I_G = 200\text{ mA}$ ; $di_G/dt = 200\text{ mA}/\mu\text{s}$	-	200	A/ $\mu\text{s}$
$I_{GM}$	peak gate current		-	5	A
$P_{GM}$	peak gate power		-	20	W
$T_{stg}$	storage temperature		-40	150	°C
$T_j$	junction temperature		-	150	°C

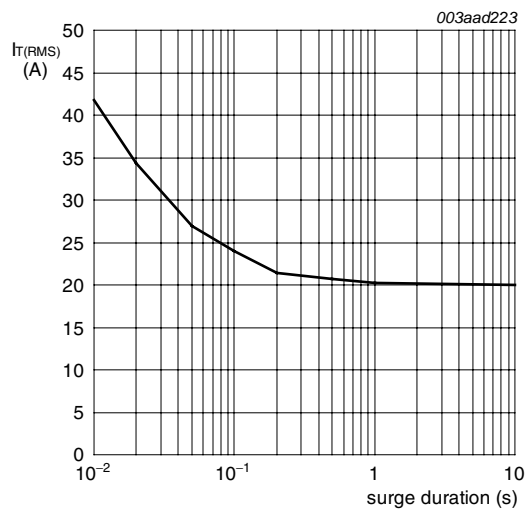
**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $t_p = 8.3$ ms; $T_{j(\text{init})} = 25$ °C	-	220	A
		half sine wave; $t_p = 10$ ms; $T_{j(\text{init})} = 25$ °C; see <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	-	200	A
$I^2t$	$I^2t$ for fusing	$t_p = 10$ ms; sine-wave pulse	-	200	A <sup>2</sup> s
$P_{G(AV)}$	average gate power	over any 20 ms period	-	1	W
$V_{RGM}$	peak reverse gate voltage		-	5	V

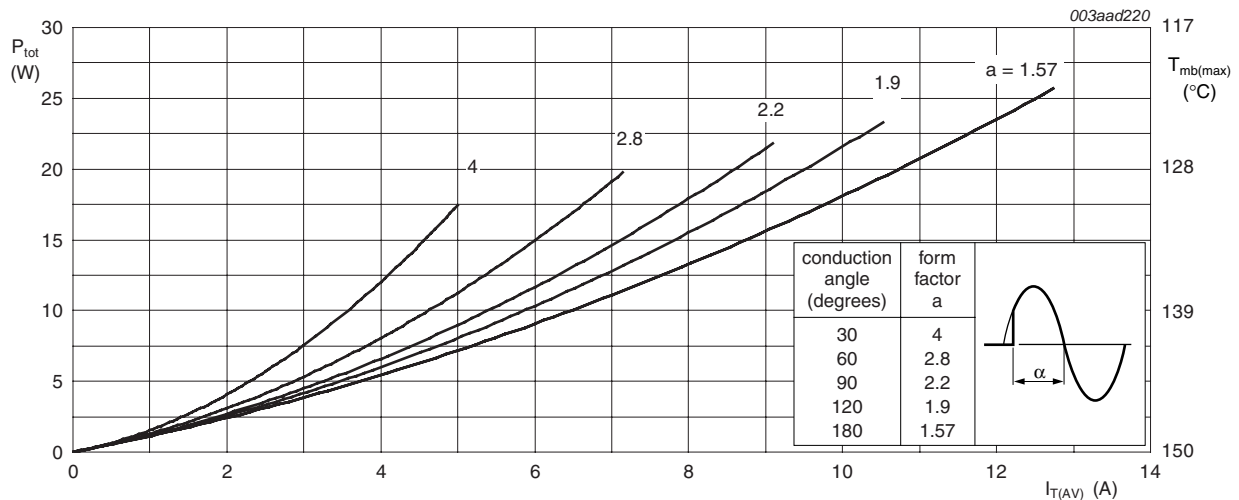


**Fig 1. RMS on-state current as a function of mounting base temperature; maximum values**



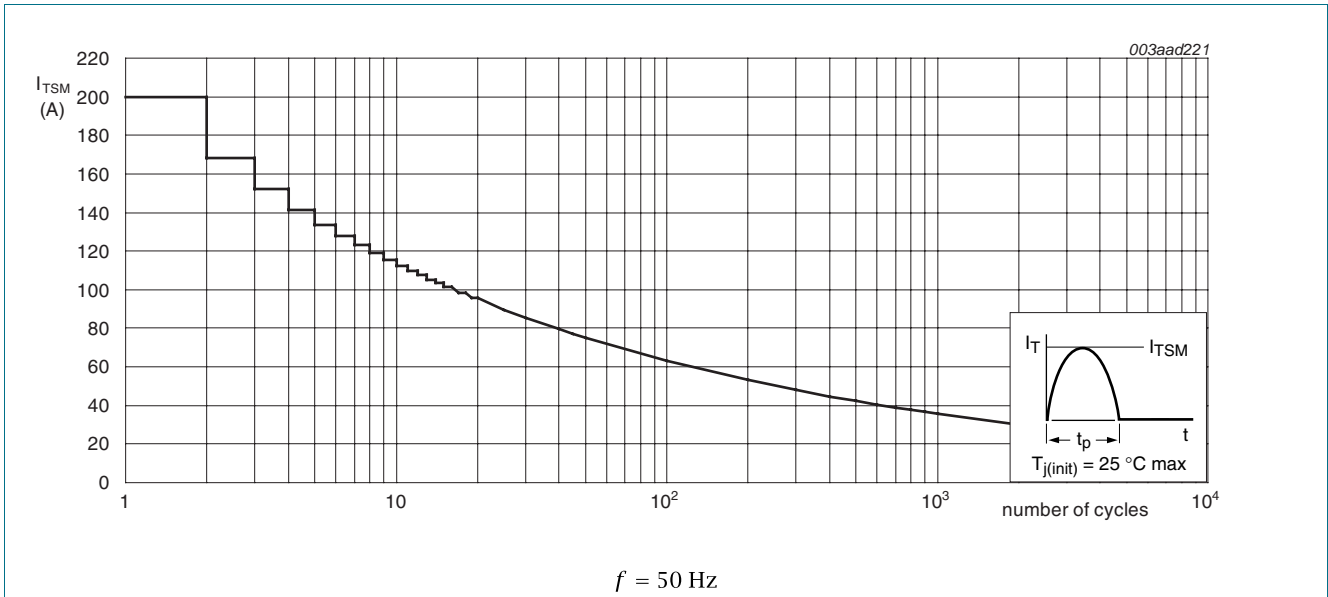
$f = 50$  Hz  $T_{sp} = 122$  °C

**Fig 2. RMS on-state current as a function of surge duration; maximum values**

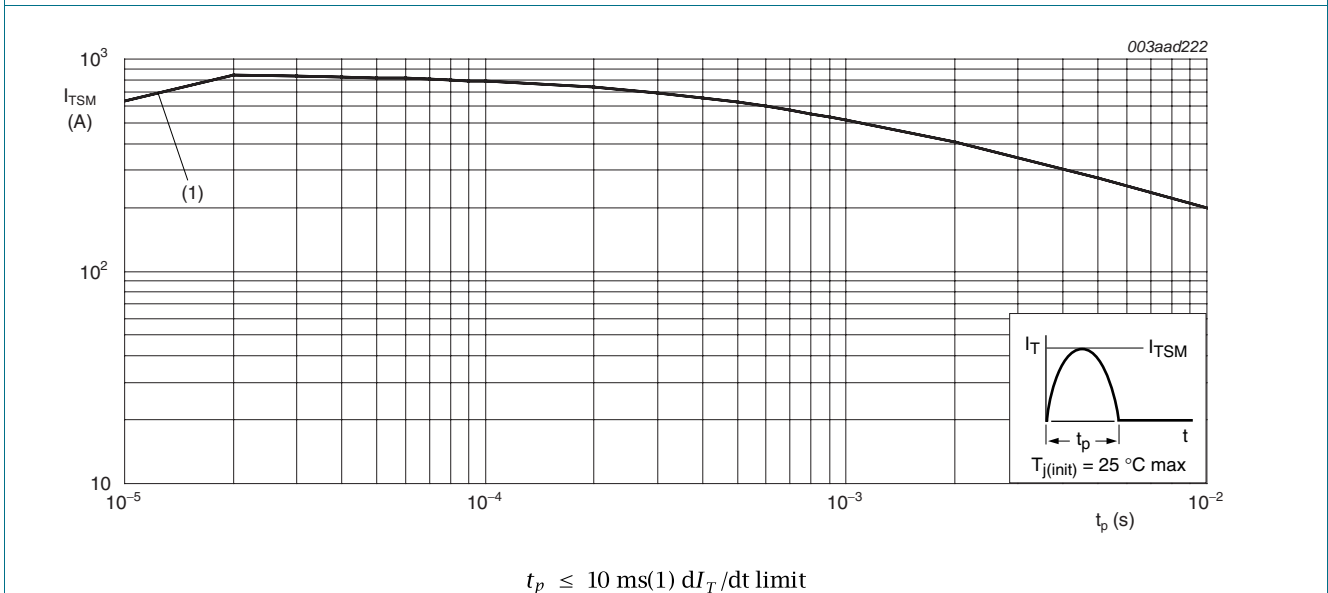


$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$

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



**Fig 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values**



**Fig 5. 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>	-	-	1.1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air		-	60	-	K/W

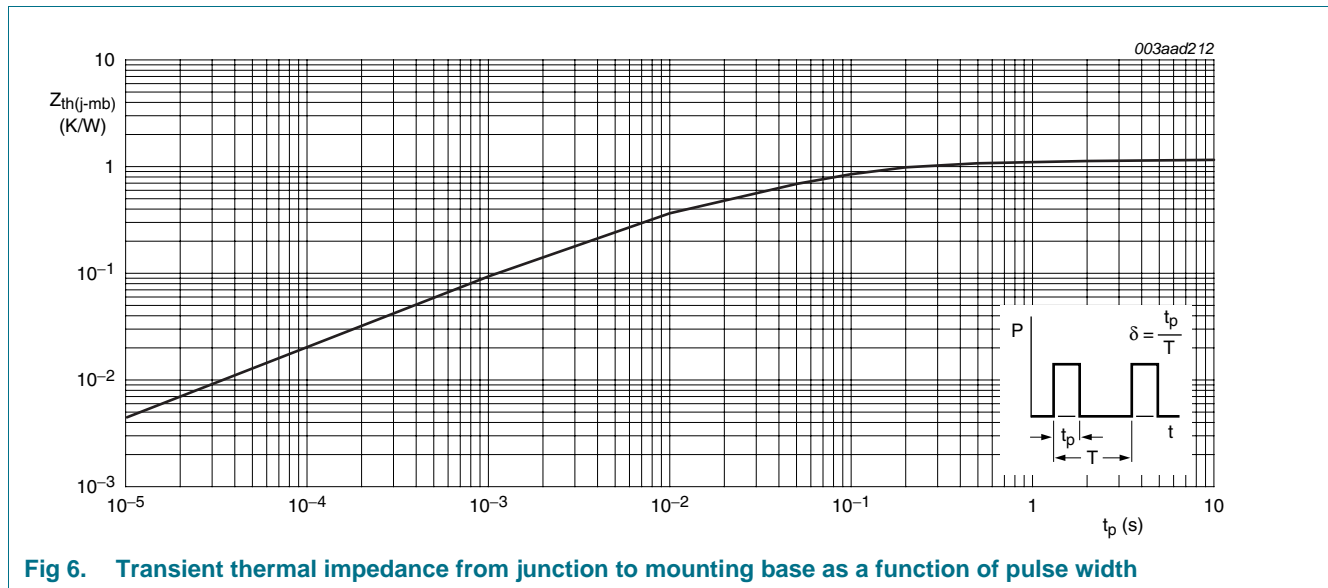


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse width

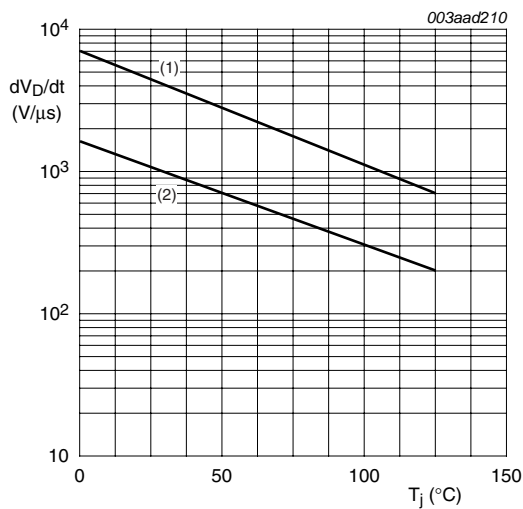
## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<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>	-	3	32	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; $I_G = 100\text{ mA}$ ; see <a href="#">Figure 9</a>	-	25	80	mA
$I_H$	holding current	$T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	15	60	mA
$V_T$	on-state voltage	$I_T = 40\text{ A}$ ; $T_j = 25\text{ °C}$ ; 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
		$I_T = 100\text{ mA}$ ; $V_D = 500\text{ V}$ ; $T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 500\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.2	1	mA
$I_R$	reverse current	$V_R = 500\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.2	1	mA

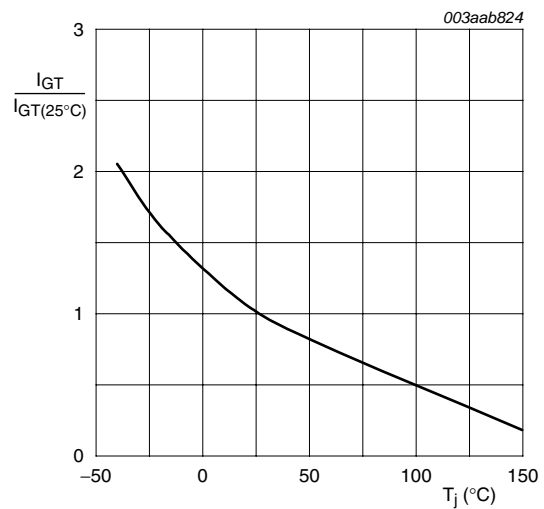
**Table 6. Characteristics ...continued**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; gate open circuit; see <a href="#">Figure 7</a>	200	300	-	$\text{V}/\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 40\text{ A}$ ; $V_D = 500\text{ V}$ ; $I_G = 100\text{ mA}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	$\mu\text{s}$
$t_q$	commutated turn-off time	$V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{TM} = 20\text{ A}$ ; $V_R = 25\text{ V}$ ; $(dI_T/dt)_M = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 50\text{ V}/\mu\text{s}$ ; $R_{GK} = 100\ \Omega$	-	70	-	$\mu\text{s}$

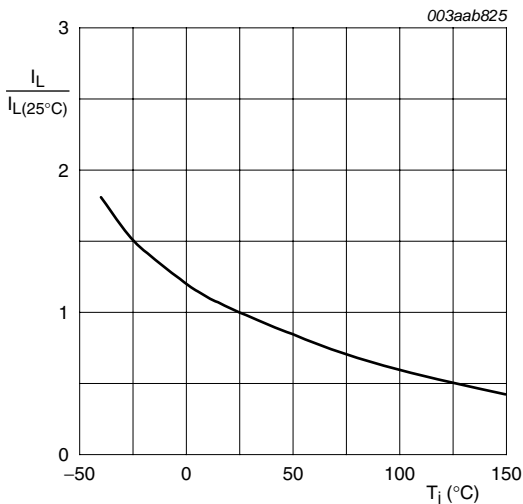


(1)  $R_{GK} = 100\ \Omega$   
 (2) Gate open circuit

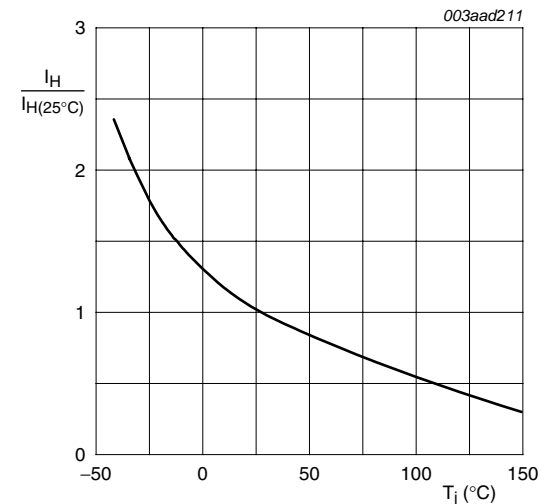
**Fig 7. Critical rate of rise of off-state voltage as a function of junction temperature; typical values**



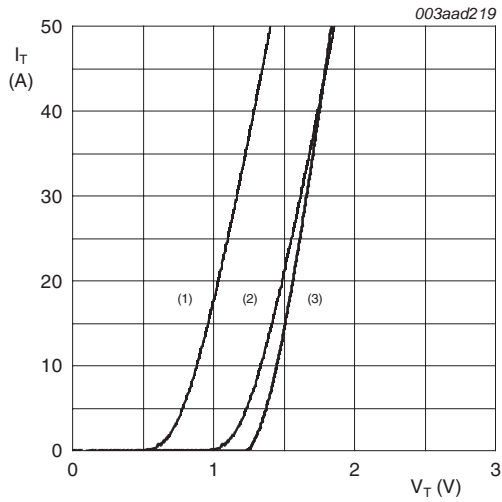
**Fig 8. Normalized gate trigger current as a function of junction temperature**



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

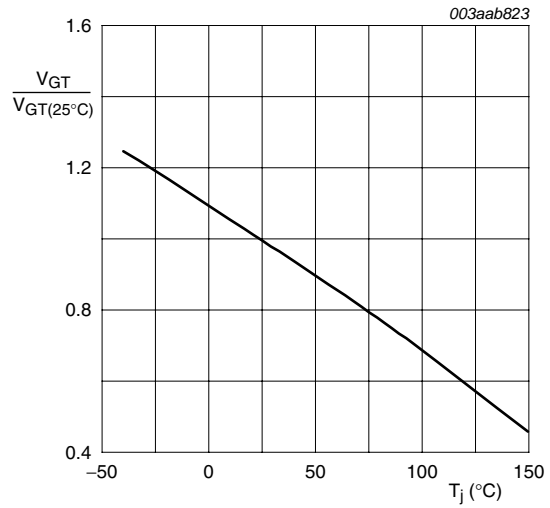


**Fig 10. Normalized holding current as a function of junction temperature**



$V_o = 1.06 \text{ V}; R_s = 0.03 \Omega$   
 (1)  $T_j = 150 \text{ }^\circ\text{C}$ ; typical values  
 (2)  $T_j = 150 \text{ }^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

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

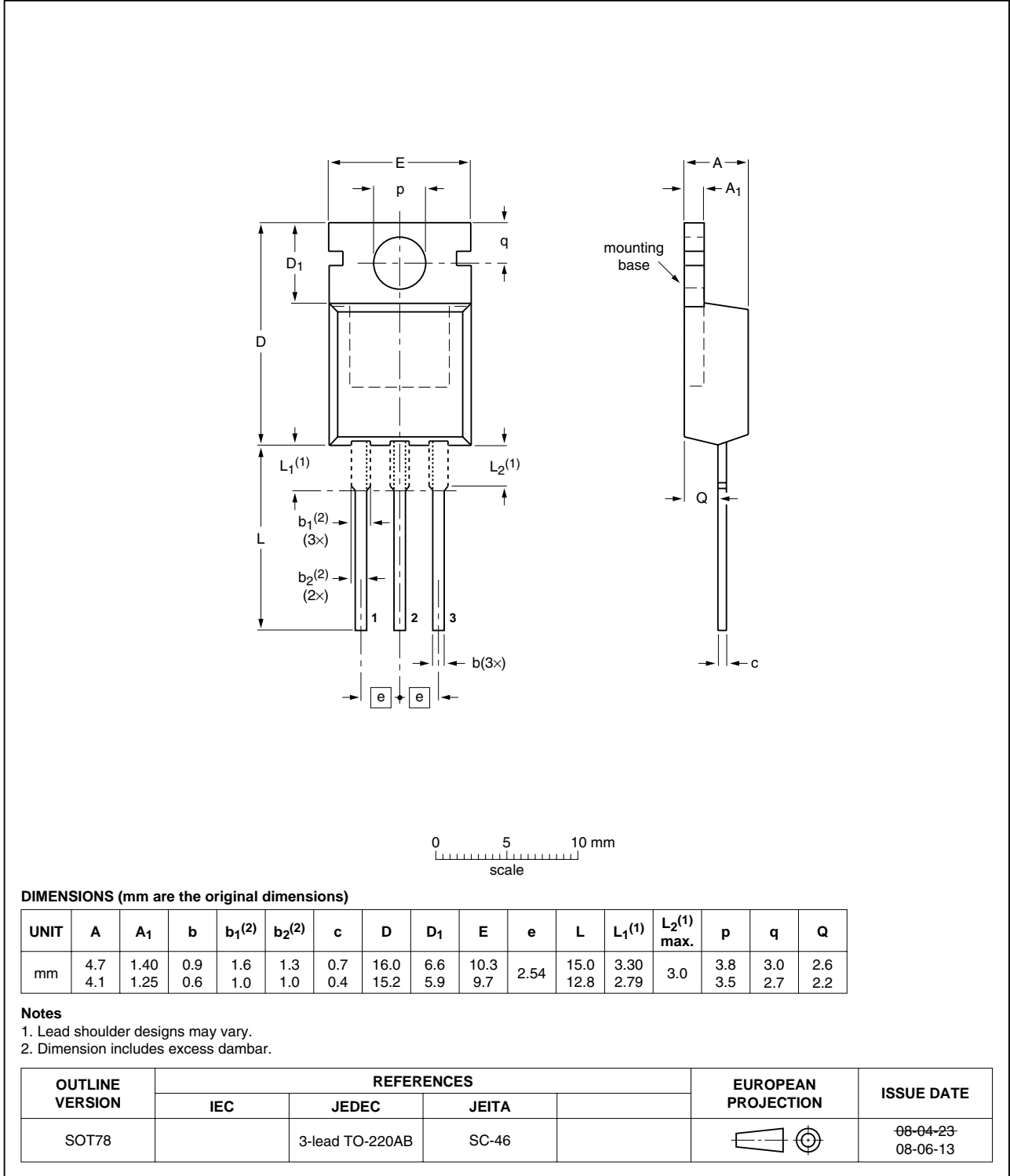


**Fig 12. Normalized gate trigger voltage as a function of junction temperature**

**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

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**Table 7.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT152-500RT_1	20090512	Product data sheet	-	-

## 9. Legal information

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

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