

## 1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a TO220 plastic package intended for use in applications requiring good bidirectional blocking voltage capability, high surge current capability, high junction temperature capability and high thermal cycling performance.

## 2. Features and benefits

- Good bidirectional blocking voltage capability
- High junction operating temperature capability
- High surge current capability
- High thermal cycling performance
- Planar passivated for voltage ruggedness and reliability

## 3. Applications

- Capacitive Discharge Ignition (CDI)
- Crowbar protection
- Inrush protection
- Motor control
- Voltage regulation

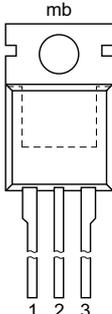
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	500	V
$V_{RRM}$	repetitive peak reverse voltage		-	-	500	V
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$	-	-	132	A
		half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	120	A
$T_j$	junction temperature		-	-	150	°C
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 133\text{ °C}$	-	-	8	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 133\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	12.5	A
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	-	2	15	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 335\text{ V}$ ; $T_j = 150\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 12</a>	-	300	-	V/ $\mu$ s

## 5. Pinning information

Table 2. Pinning information

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

## 6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BT151-500RT	TO220	BT151-500RT,127	Tube	50	SOT78	13-Jun-2008

## 7. Marking

Table 4. Marking codes

Type number	Marking codes	
	Assembly factory: d	Assembly factory: A
BT151-500RT	BT151 500RT PJdxxxx xx	BT151 500RT PJAxxxx xx

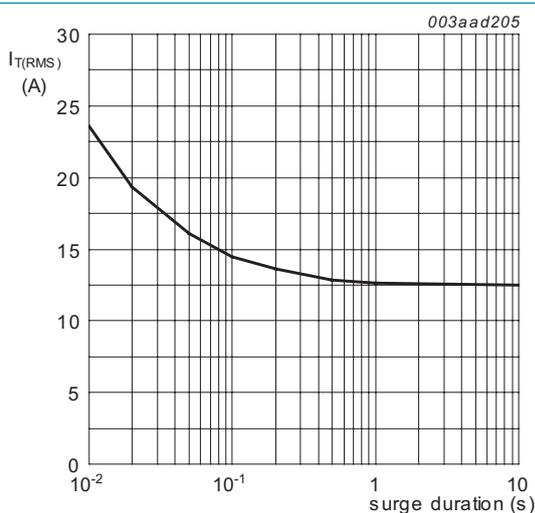
## 8. Limiting values

**Table 5. Limiting values**

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

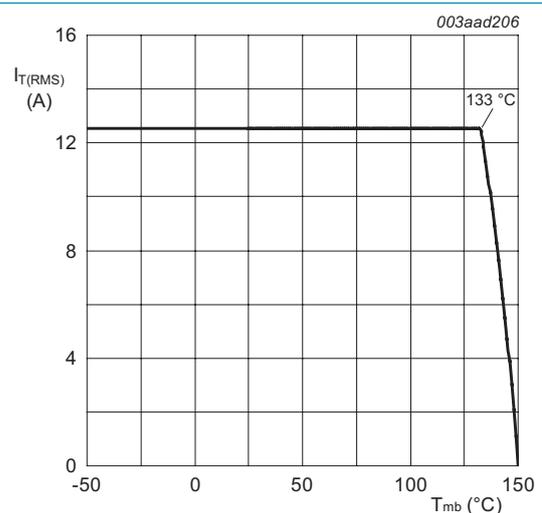
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	500	V
$V_{RRM}$	repetitive peak reverse voltage		-	500	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 133\text{ °C}$	-	8	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 133\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	12.5	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$	-	132	A
		half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	120	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	72	A <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_G = 30\text{ mA}$	-	50	A/ $\mu$ s
$I_{GM}$	peak gate current		-	4	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	-	1	W
$T_{stg}$	storage temperature		-40	150	°C
$T_j$	junction temperature		[1]	150	°C

[1] Operation above 110°C may require the use of a gate to cathode resistor of 1kΩ or less.

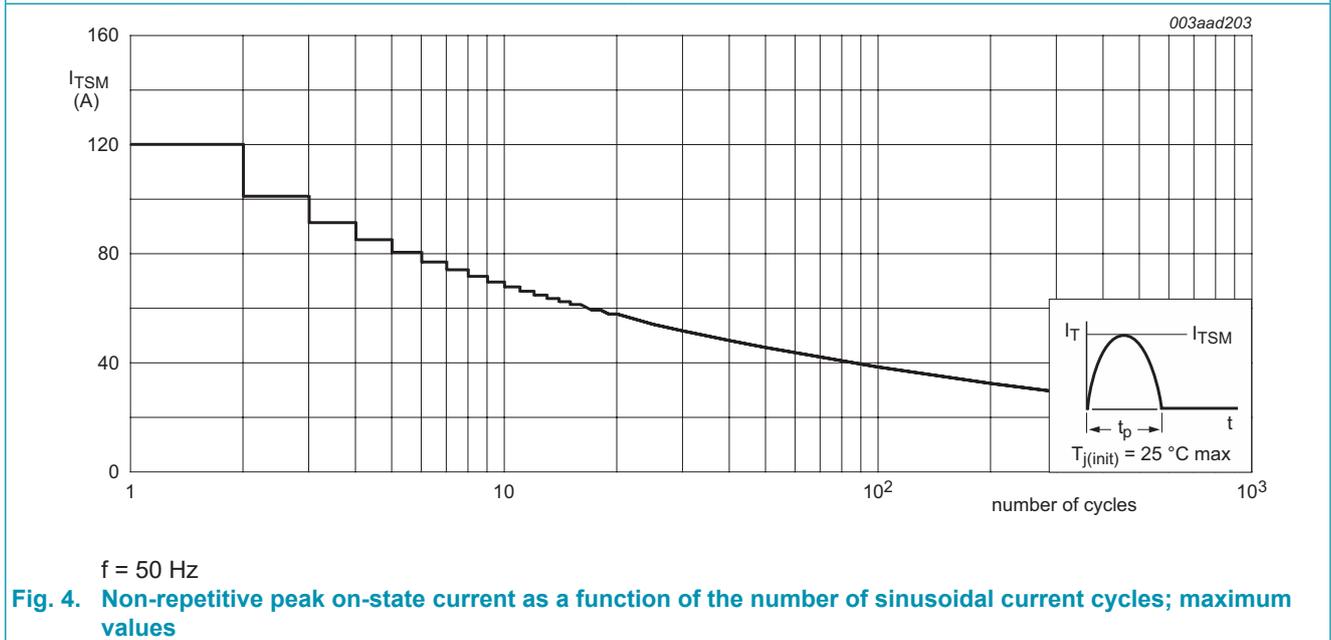
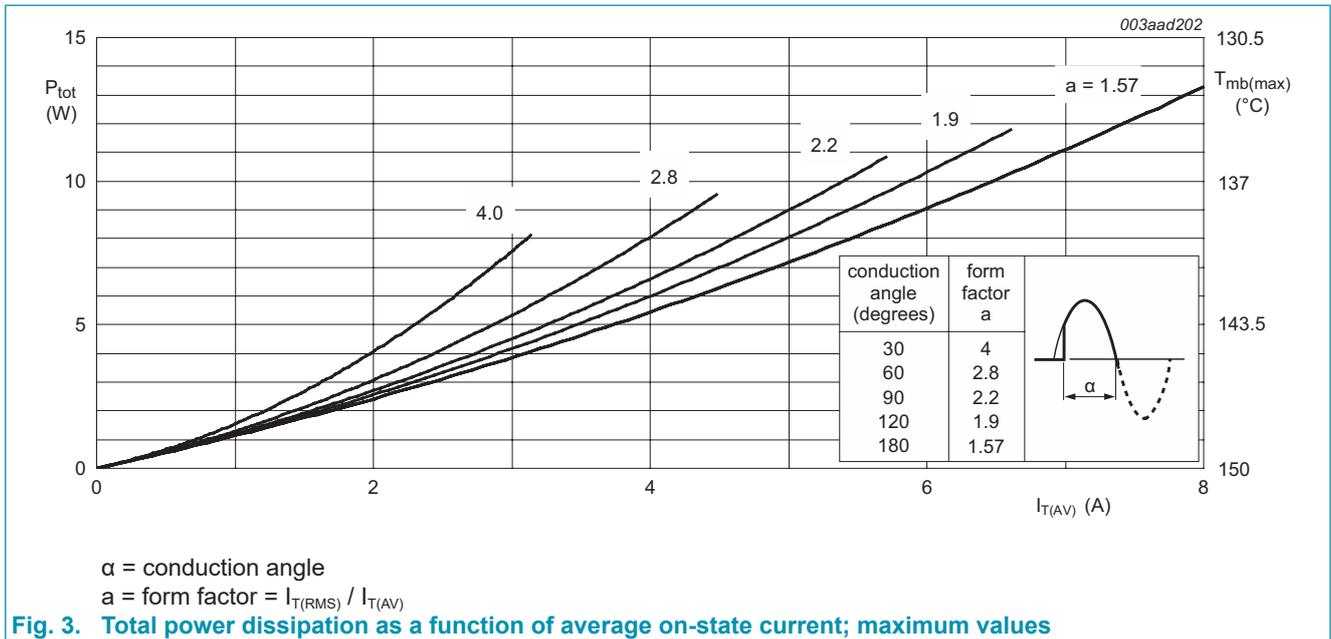


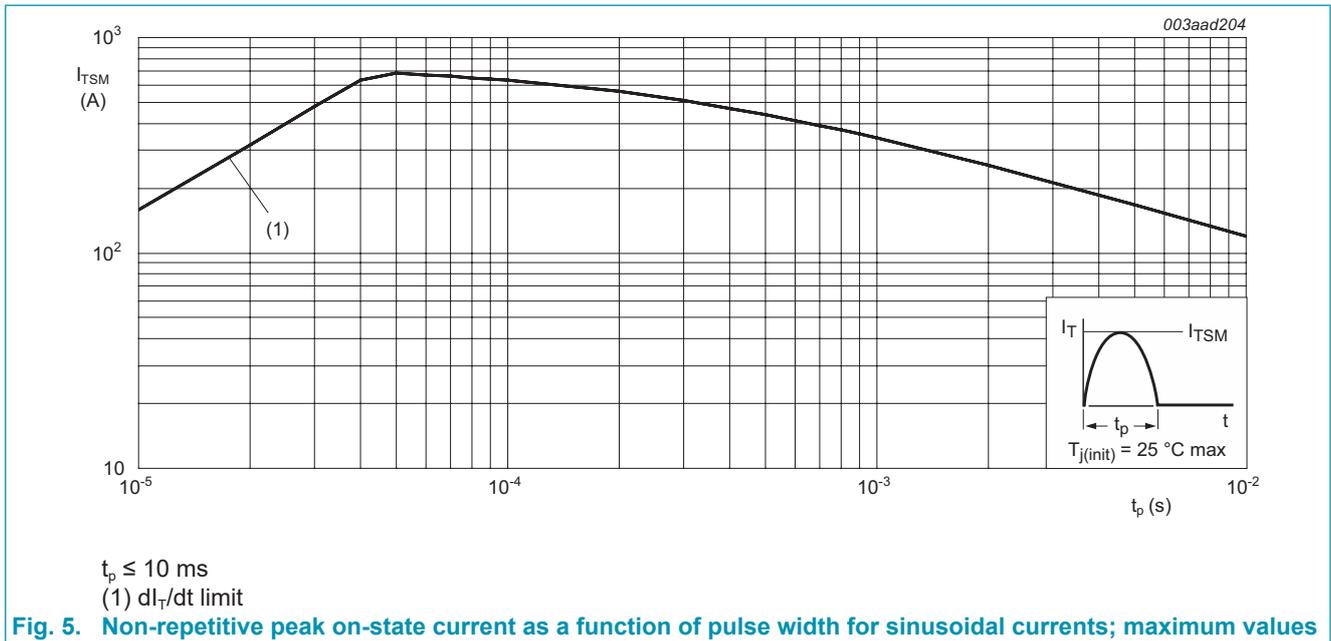
$f = 50\text{ Hz}$ ;  $T_{mb} = 133\text{ °C}$

**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**





## 9. Thermal characteristics

Table 6. Thermal characteristics

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

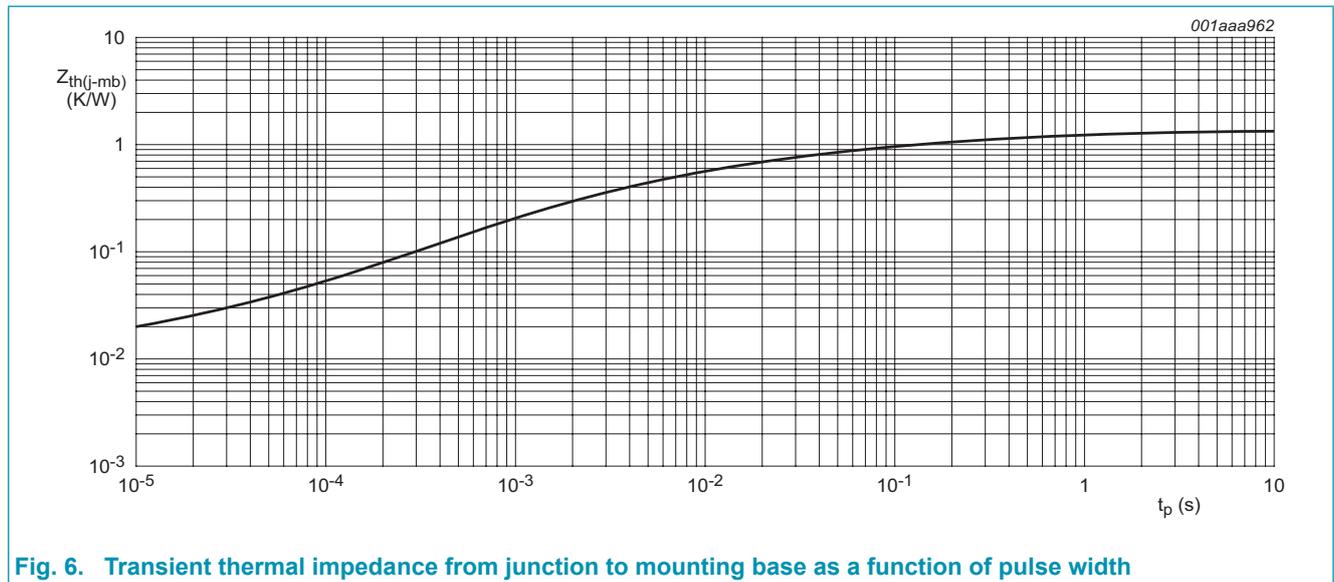


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$ ; Fig. 7	-	2	15	mA
$I_L$	latching current	$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$ ; Fig. 8	-	10	40	mA
$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C}$ ; Fig. 9	-	7	20	mA
$V_T$	on-state voltage	$I_T = 23\text{ A}; T_j = 25\text{ }^\circ\text{C}$ ; Fig. 10	-	1.4	1.75	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$ ; Fig. 11	-	0.6	1	V
		$V_D = 500\text{ V}; I_T = 0.1\text{ A}; T_j = 150\text{ }^\circ\text{C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 500\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	0.5	2.5	mA
$I_R$	reverse current	$V_R = 500\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	0.5	2.5	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 335\text{ V}; T_j = 150\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; Fig. 12	-	300	-	V/ $\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 40\text{ A}; V_D = 500\text{ V}; I_G = 0.1\text{ A}; dl_G/dt = 5\text{ A}/\mu\text{s}; T_j = 25\text{ }^\circ\text{C}$	-	2	-	$\mu\text{s}$
$t_q$	commutated turn-off time	$V_{DM} = 335\text{ V}; T_j = 150\text{ }^\circ\text{C}; I_{TM} = 20\text{ A}; V_R = 25\text{ V}; (dl_T/dt)_M = 30\text{ A}/\mu\text{s}; dV_D/dt = 50\text{ V}/\mu\text{s}; R_{GK(ext)} = 100\text{ }\Omega; (V_{DM} = 67\% \text{ of } V_{DRM})$	-	70	-	$\mu\text{s}$

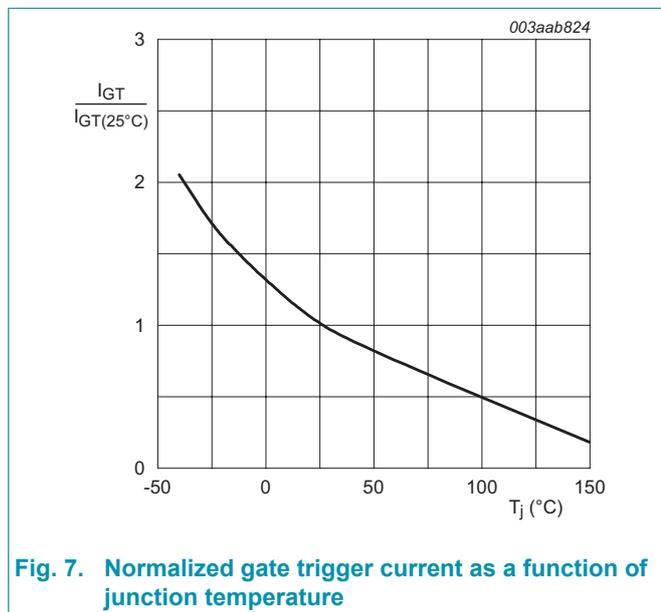


Fig. 7. Normalized gate trigger current as a function of junction temperature

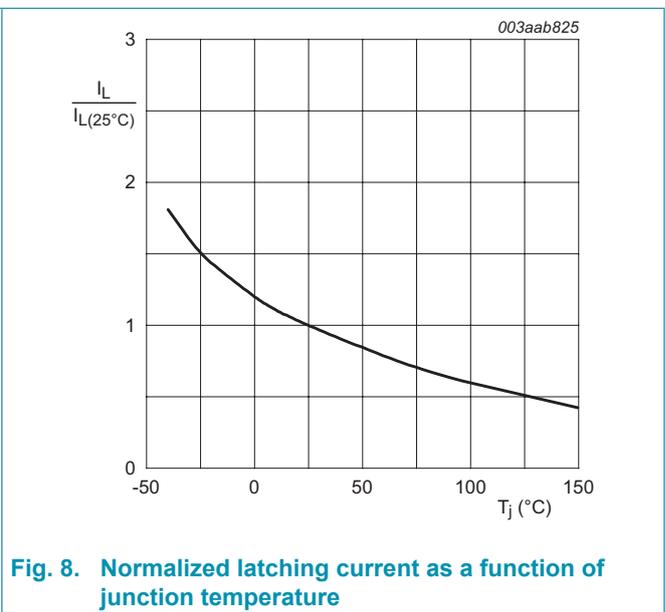


Fig. 8. Normalized latching current as a function of junction temperature

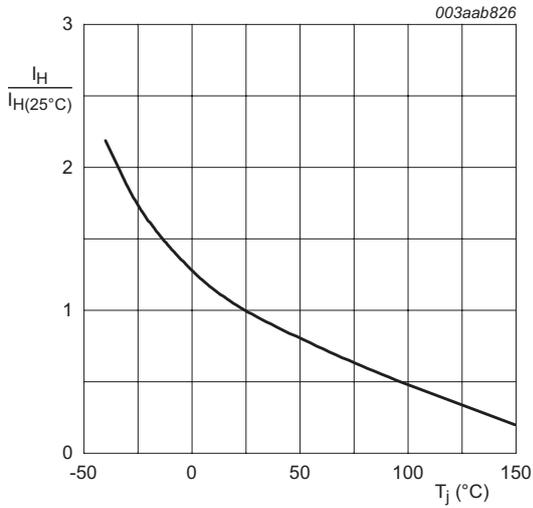
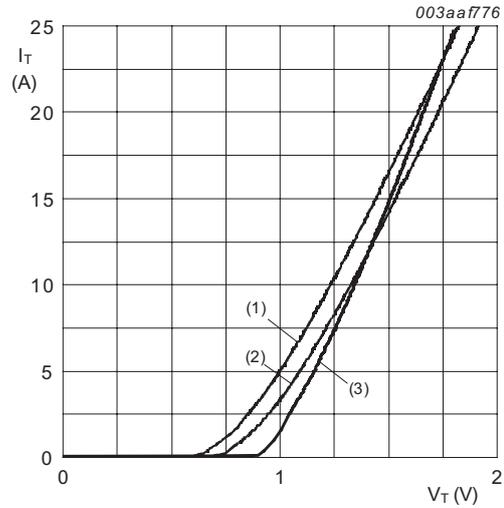


Fig. 9. Normalized holding current as a function of junction temperature



$V_0 = 0.825 \text{ V}; R_s = 0.41 \Omega$   
 (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. 10. On-state current as a function of on-state voltage

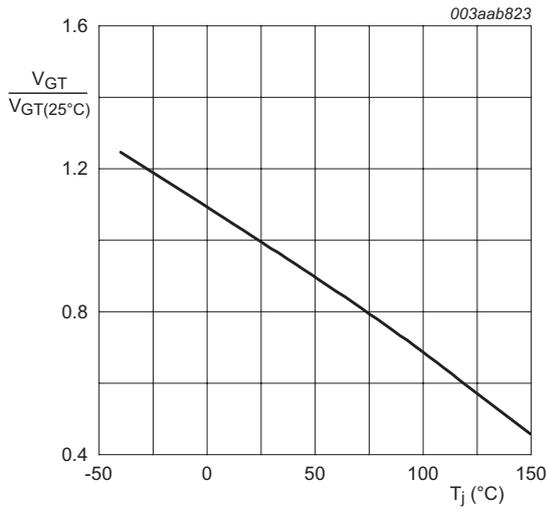
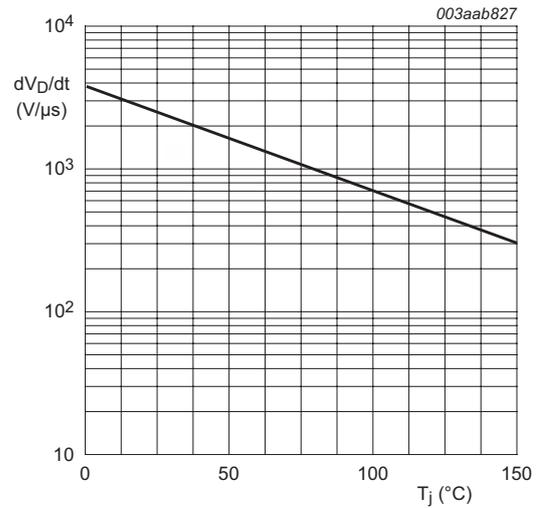


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



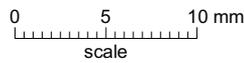
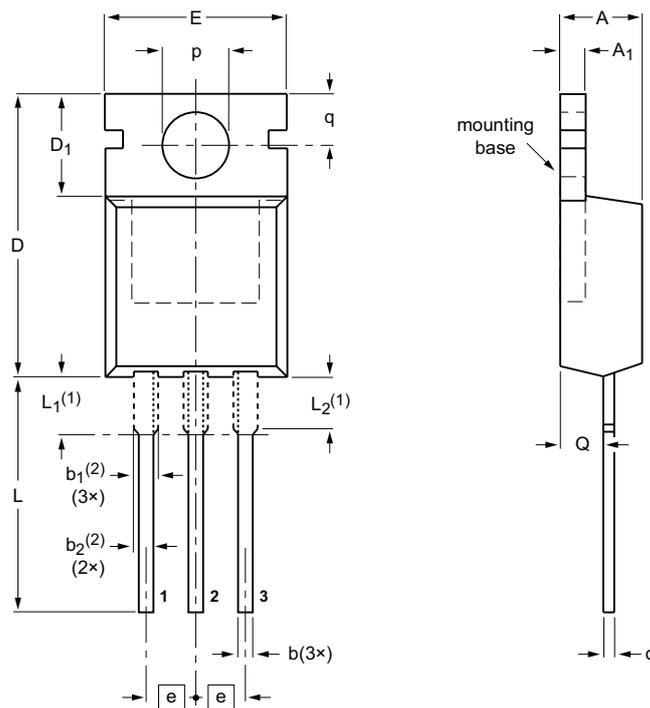
gate open circuit  
 Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values

### 11. Package outline

Assembly factory: d & A

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

SOT78



**DIMENSIONS** (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub> ( <sup>2</sup> )	b <sub>2</sub> ( <sup>2</sup> )	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> ( <sup>1</sup> )	L <sub>2</sub> ( <sup>1</sup> ) 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

## 12. Legal information

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