

## 1. General description

Planar passivated four quadrant triac in a SOT78 plastic package intended for use in general purpose bidirectional switching and phase control applications.

## 2. Features and benefits

- High voltage capability
- Least sensitive gate for highest noise immunity
- High minimum IGT for guaranteed immunity to gate noise
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

## 3. Applications

- General purpose motor controls
- General purpose switching

## 4. Quick reference data

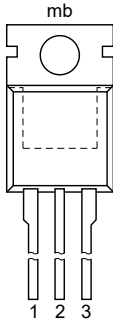

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	-	600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	12	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	95	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$	-	-	105	A
$T_{\text{j}}$	junction temperature		-	-	125	$^{\circ}\text{C}$
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; LD+ G+; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	10	-	50	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; LD+ G-; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	10	-	50	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; LD- G-; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	10	-	50	mA
		$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2- G+; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	10	-	100	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 9	-	-	60	mA
$V_T$	on-state voltage	$I_T = 15\text{ A}$ ; $T_j = 25\text{ °C}$ ; Fig. 10	-	1.4	1.65	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	200	-	-	V/ $\mu$ s
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit	3	14	-	A/ms

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 <p><b>TO-220AB (SOT78)</b></p>	 <p>sym051</p>
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; main terminal 2		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BT138-600G0	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 7. Marking

Table 4. Marking codes

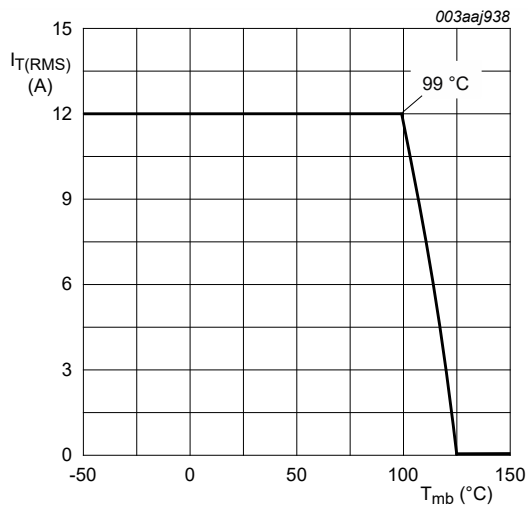
Type number	Marking code
BT138-600G0	BT138-600G0

## 8. Limiting values

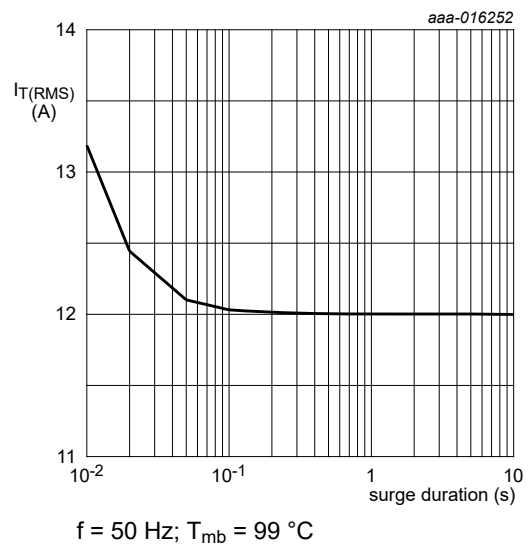
**Table 5. Limiting values**

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

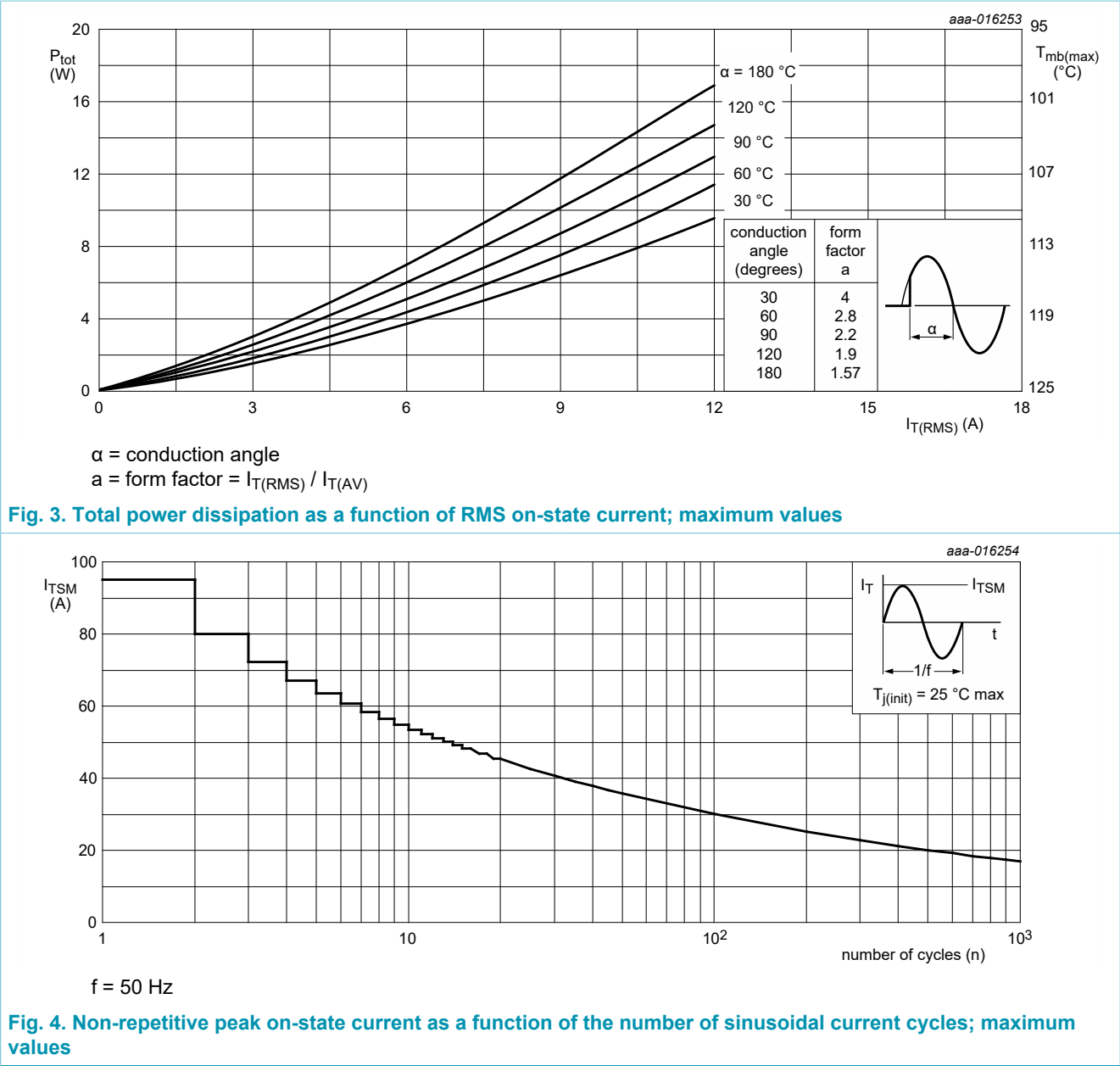
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	12	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	95	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$	-	105	A
$I^2t$	$I^2t$ for fusing	$t_{\text{p}} = 10\text{ ms}$ ; sine-wave pulse	-	45	$\text{A}^2\text{s}$
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{G}} = 0.2\text{ A}$	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 0.2\text{ A}$	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 0.2\text{ A}$	-	50	$\text{A}/\mu\text{s}$
		$I_{\text{G}} = 0.2\text{ A}$	-	10	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$P_{\text{GM}}$	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
$T_{\text{stg}}$	storage temperature		-40	150	$^{\circ}\text{C}$
$T_{\text{j}}$	junction temperature		-	125	$^{\circ}\text{C}$

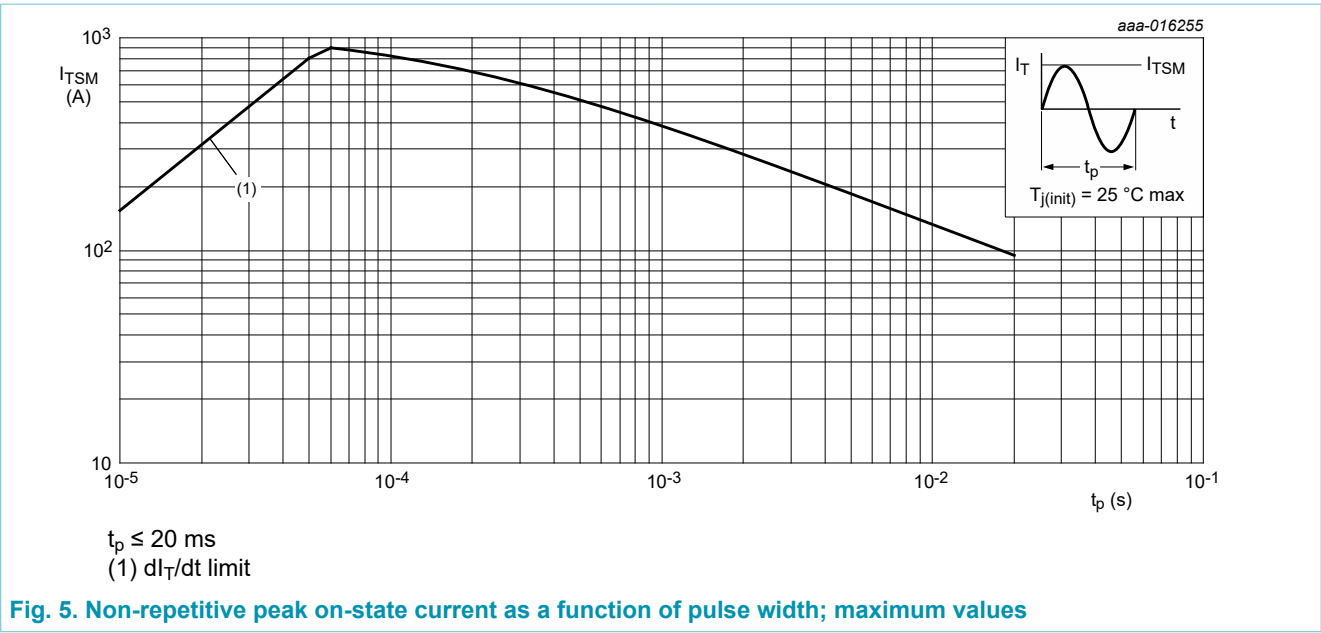


**Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values**



**Fig. 2. RMS on-state current as a function of surge duration; maximum values**  
 $f = 50\text{ Hz}$ ;  $T_{\text{mb}} = 99\text{ }^{\circ}\text{C}$

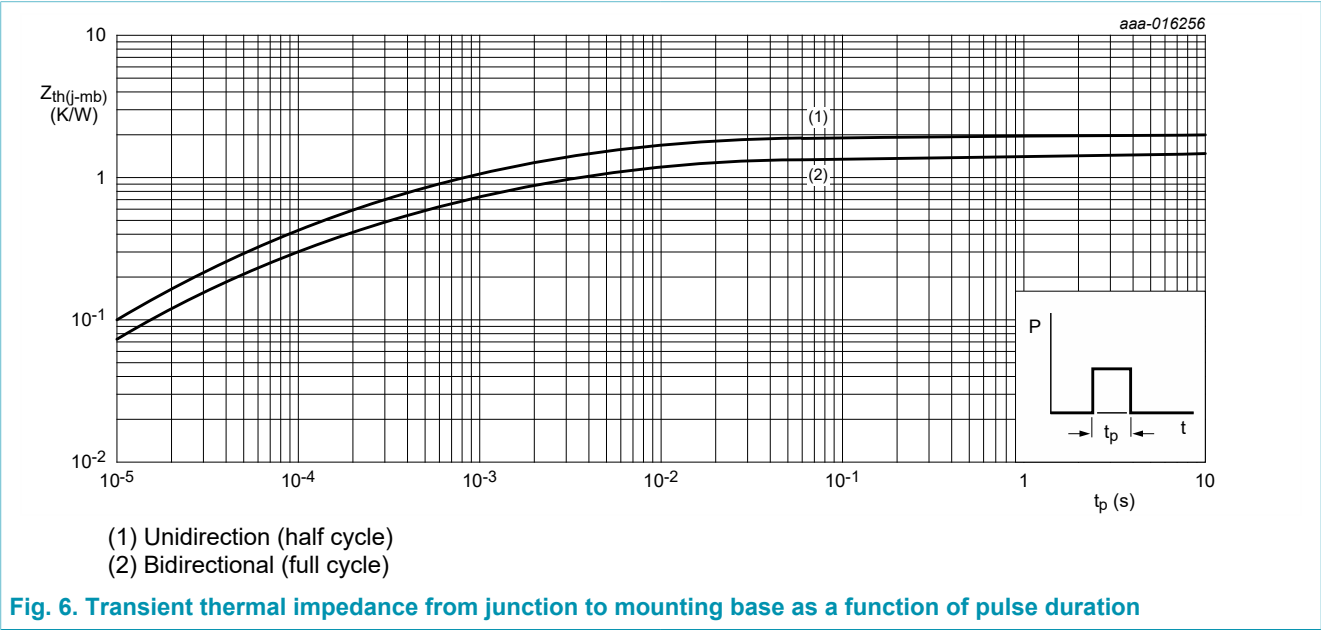




9. Thermal characteristics

Table 6. Thermal characteristics

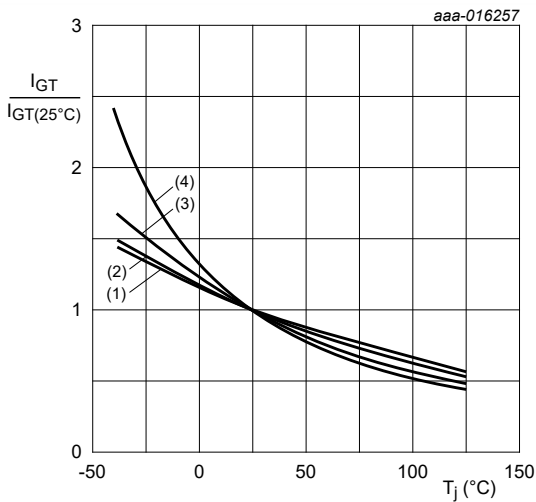
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; Fig. 6	-	-	1.5	K/W
		half cycle	-	-	2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W



## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; LD+ G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		10	-	50	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; LD+ G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		10	-	50	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; LD- G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		10	-	50	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		10	-	100	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	60	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	90	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	60	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	90	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>J</sub> = 25 °C; <a href="#">Fig. 9</a>		-	-	60	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 15 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 10</a>		-	1.4	1.65	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>		-	0.7	1	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 125 °C; <a href="#">Fig. 11</a>		0.2	0.45	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 600 V; T <sub>J</sub> = 25 °C		-	-	10	μA
		V <sub>D</sub> = 600 V; T <sub>J</sub> = 125 °C		-	0.1	0.5	mA
Dynamic characteristics							
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 402 V; T <sub>J</sub> = 125 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit		200	-	-	V/μs
dI <sub>com</sub> /dt	rate of change of commutating current	V <sub>D</sub> = 400 V; T <sub>J</sub> = 125 °C; I <sub>T(RMS)</sub> = 12 A; dV <sub>com</sub> /dt = 20 V/μs; (snubberless condition); gate open circuit		3	14	-	A/ms
t <sub>gt</sub>	gate-controlled turn-on time	I <sub>TM</sub> = 16 A; V <sub>D</sub> = 600 V; I <sub>G</sub> = 0.1 mA; dI <sub>G</sub> /dt = 5 A/μs		-	2	-	μs



- (1) T2+ G+
- (2) T2+ G-
- (3) T2- G-
- (4) T2- G+

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

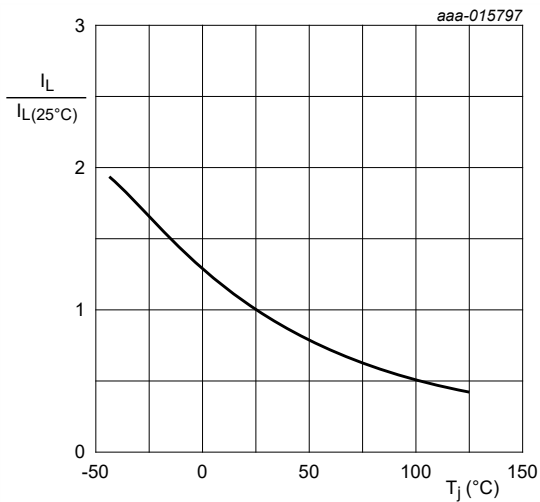


Fig. 8. Normalized latching current as a function of junction temperature

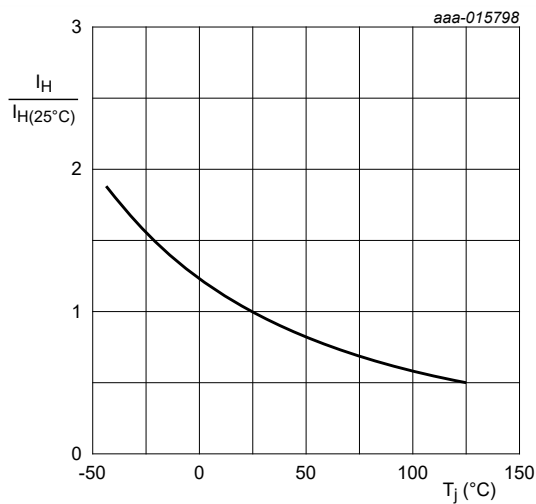
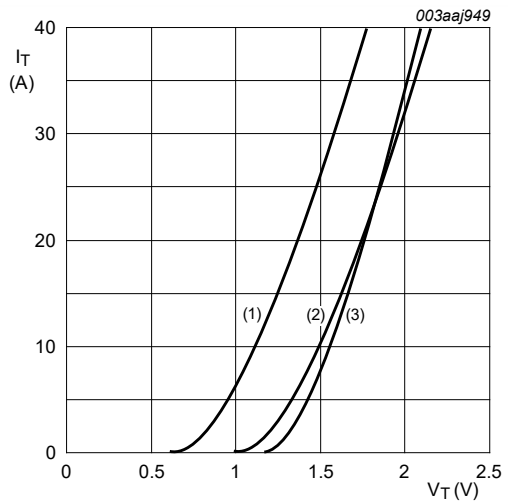


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.145 \text{ V}; R_s = 0.031 \Omega$
- (1)  $T_j = 125^{\circ}\text{C}$ ; typical values
  - (2)  $T_j = 125^{\circ}\text{C}$ ; maximum values
  - (3)  $T_j = 25^{\circ}\text{C}$ ; maximum values

Fig. 10. On-state current as a function of on-state voltage



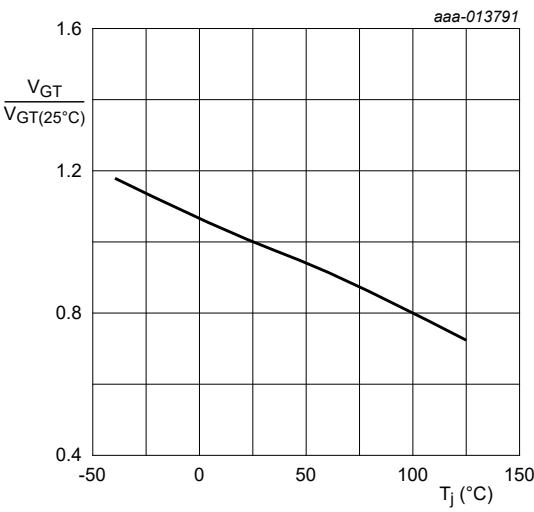


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

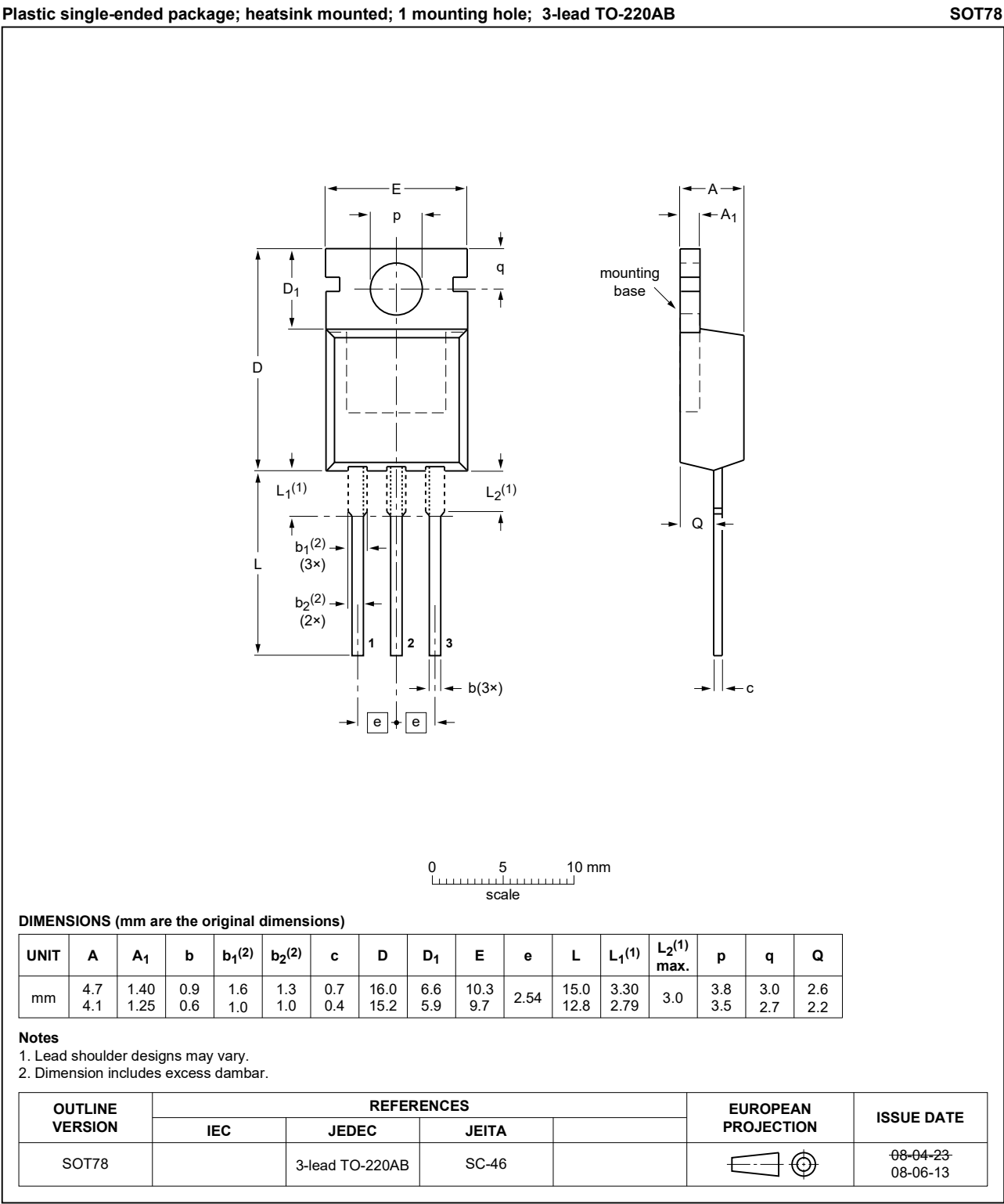


Fig. 12. Package outline TO-220AB (SOT78)

## 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.
Product [short] data sheet	Production	This document contains the product specification.

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