

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78 (TO-220AB) plastic package. This "series E" triac balances the requirements of commutation performance and gate sensitivity and is intended for interfacing with low power drivers including microcontrollers.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- Direct interfacing with low power drivers and microcontrollers
- Good immunity to false turn-on by  $dV/dt$
- High commutation capability with sensitive gate
- High voltage capability
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate for easy logic level triggering
- Triggering in three quadrants only

## 3. Applications

- Electronic thermostats (heating and cooling)
- Motor controls e.g. washing machines and vacuum cleaners
- Refrigeration and air-conditioner compressor controls

## 4. Quick reference data

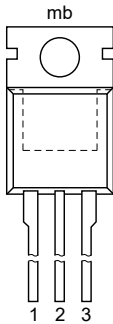
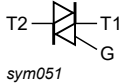
Table 1. Quick reference data

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; $T_{\text{mb}} \leq 106\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	10	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>	-	-	85	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$	-	-	93	A
$T_{\text{j}}$	junction temperature		-	-	125	$^{\circ}\text{C}$
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 0.1\text{ A}$ ; T2+ G+; $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	0.5	-	10	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>	0.5	-	10	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ }^\circ\text{C}$ ; Fig. 7	0.5	-	10	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; Fig. 9	-	-	15	mA
$V_T$	on-state voltage	$I_T = 12\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; Fig. 10	-	1.25	1.5	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	50	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit	2	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	3	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	6	-	-	A/ms

## 5. Pinning information

Table 2. Pinning information

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

## 6. Ordering information

Table 3. Ordering information

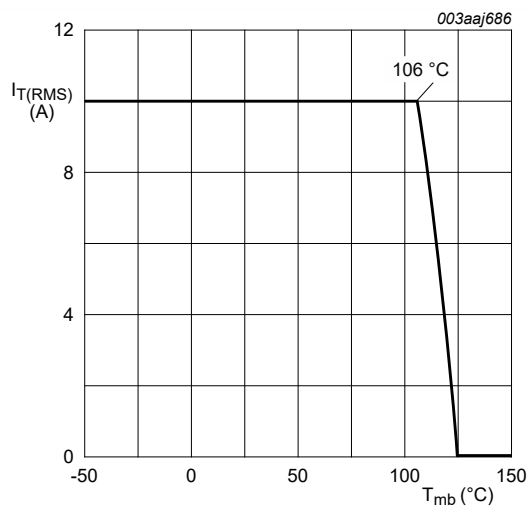
Type number	Package		
	Name	Description	Version
BTA310-600E	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 7. Limiting values

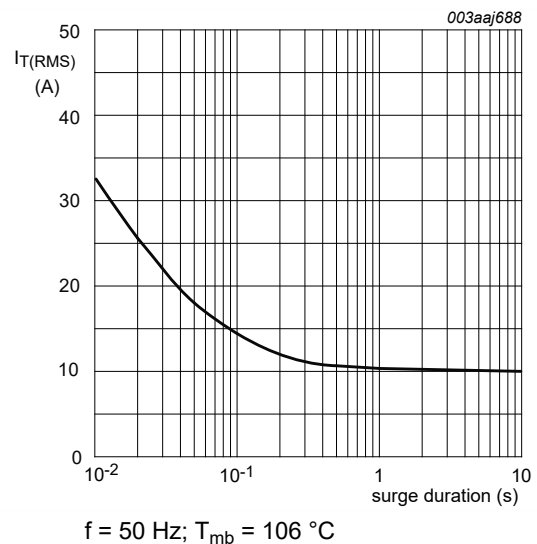
**Table 4. Limiting values**

*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; $T_{\text{mb}} \leq 106\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	10	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>	-	85	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$	-	93	A
$I^2t$	$I^2t$ for fusing	$t_{\text{p}} = 10\text{ ms}$ ; SIN	-	36.1	$\text{A}^2\text{s}$
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{G}} = 0.2\text{ A}$	-	100	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	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**

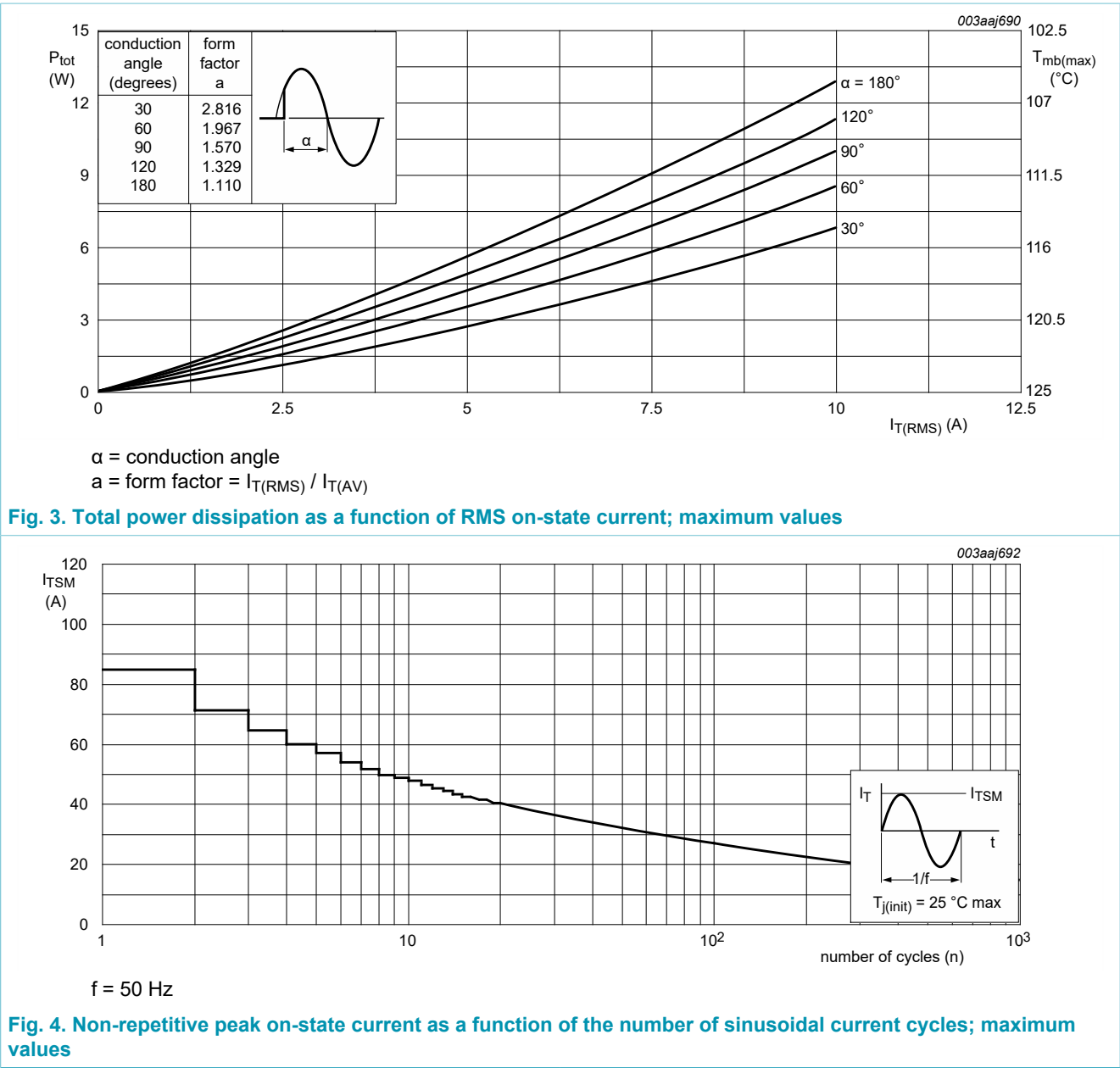
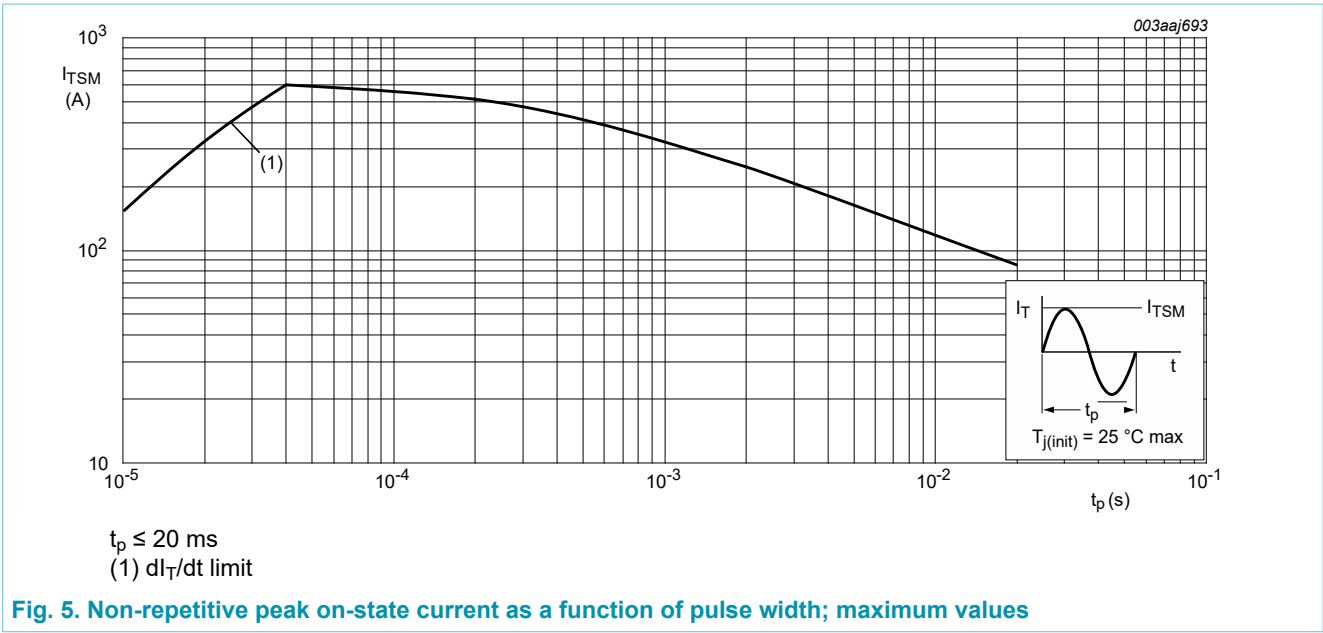


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

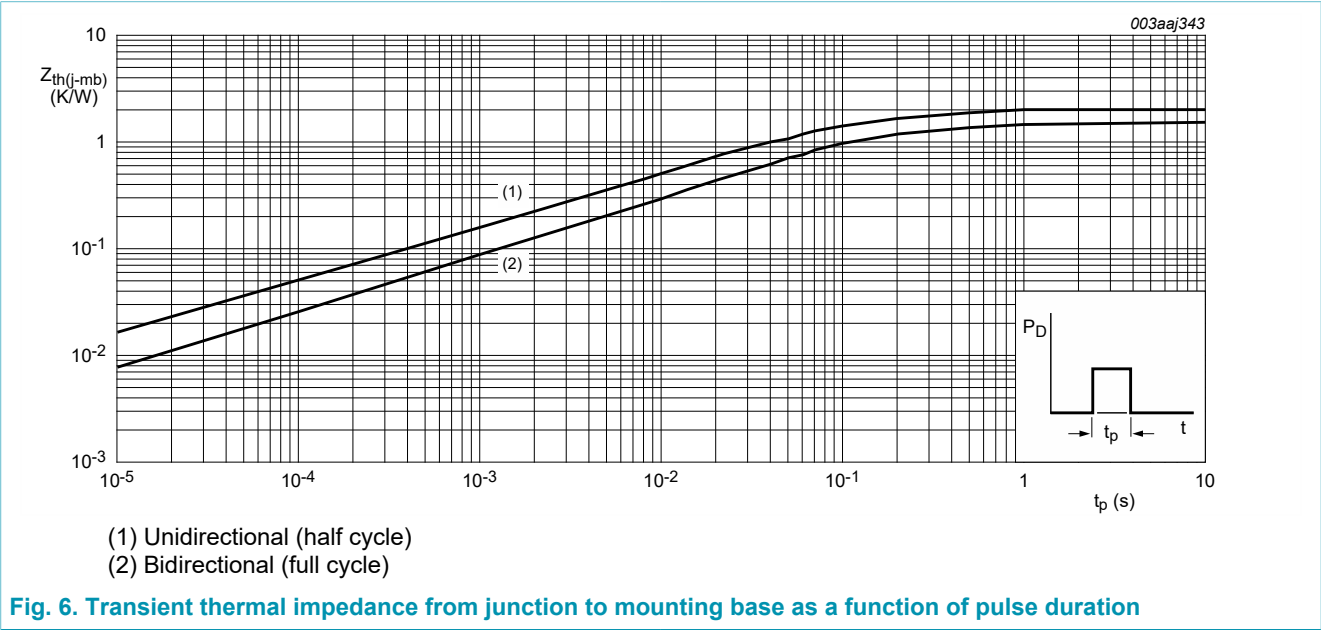
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



8. Thermal characteristics

Table 5. Thermal characteristics

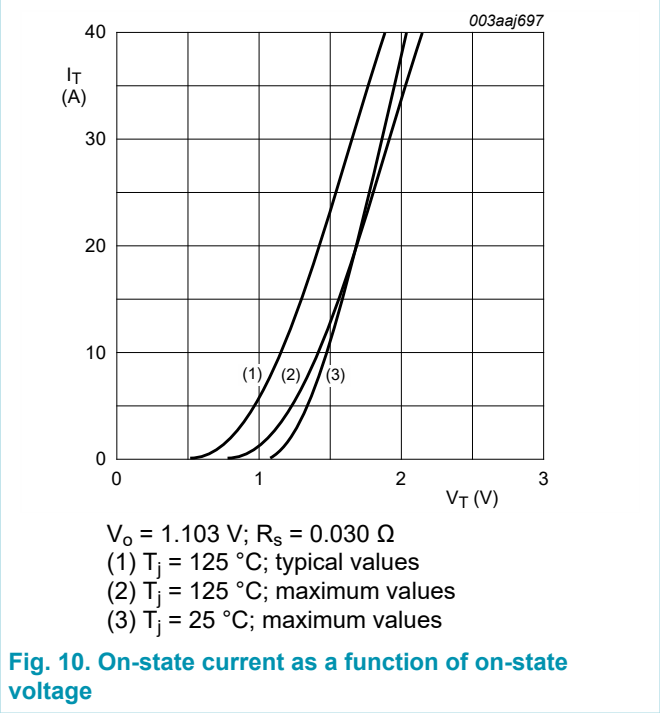
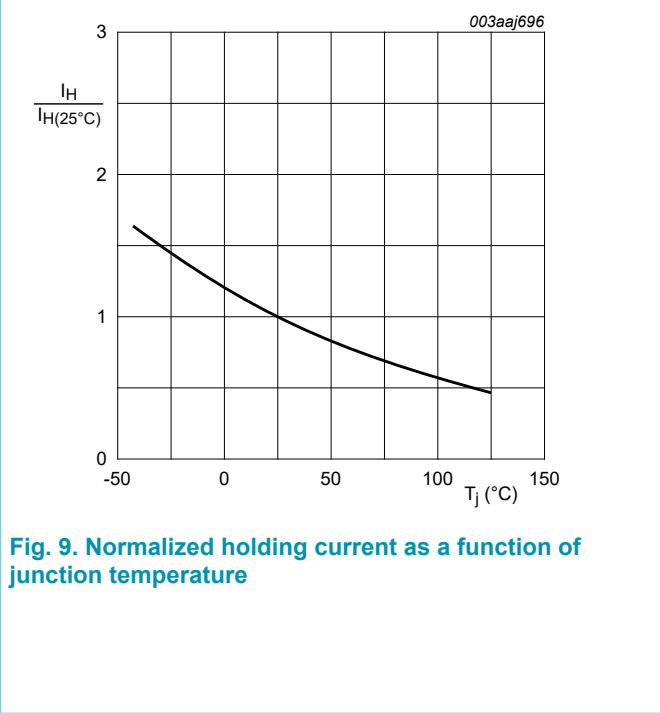
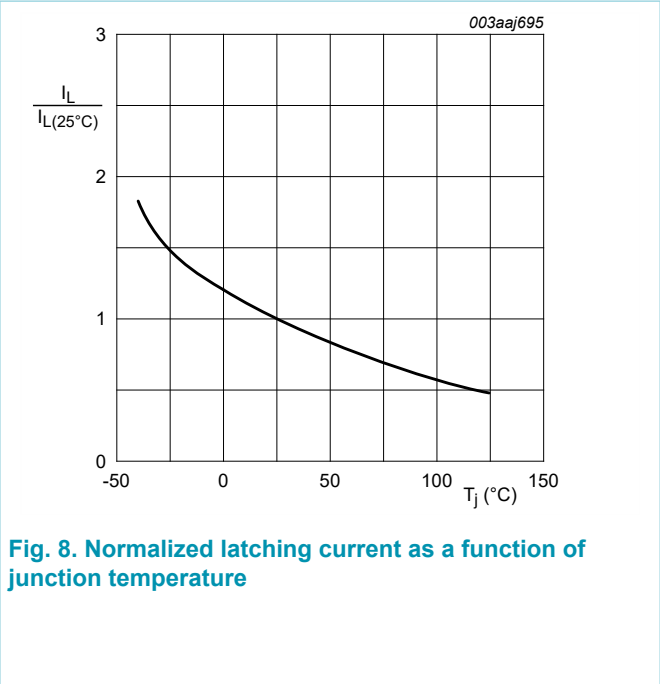
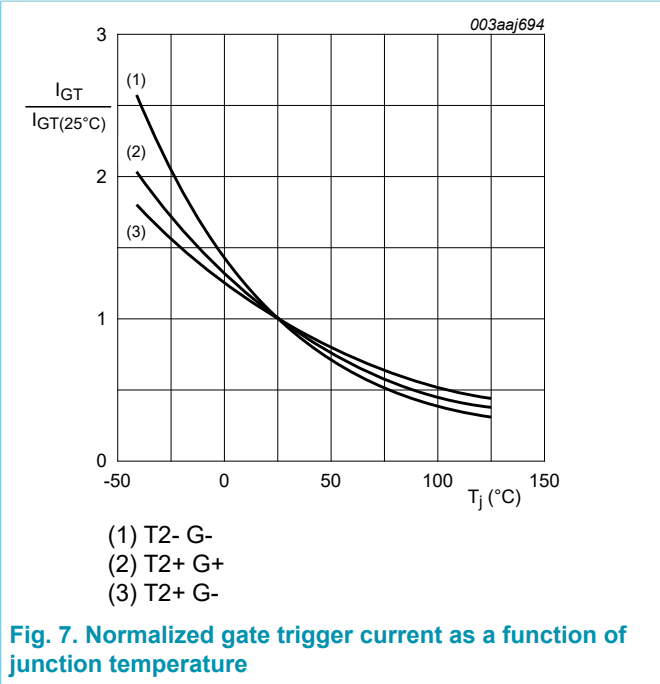
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R <sub>th(j-mb)</sub>	thermal resistance from junction to mounting base	full cycle; Fig. 6		-	-	1.5	K/W
		half cycle; Fig. 6		-	-	2	K/W
R <sub>th(j-a)</sub>	thermal resistance from junction to ambient free air	in free air		-	60	-	K/W



## 9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	0.5	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	0.5	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	0.5	-	10	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	25	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	30	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	25	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	15	mA
$V_T$	on-state voltage	$I_T = 12\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	1.25	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	-	0.7	1	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 11</a>	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 600\text{ V}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA
<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	50	-	-	V/ $\mu$ s
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit	2	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	3	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 10\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	6	-	-	A/ms





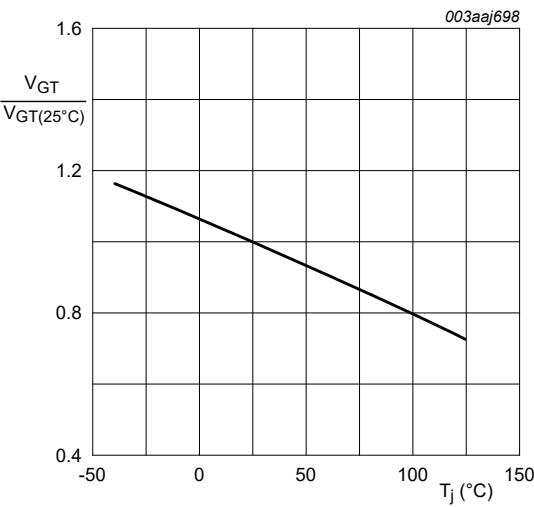
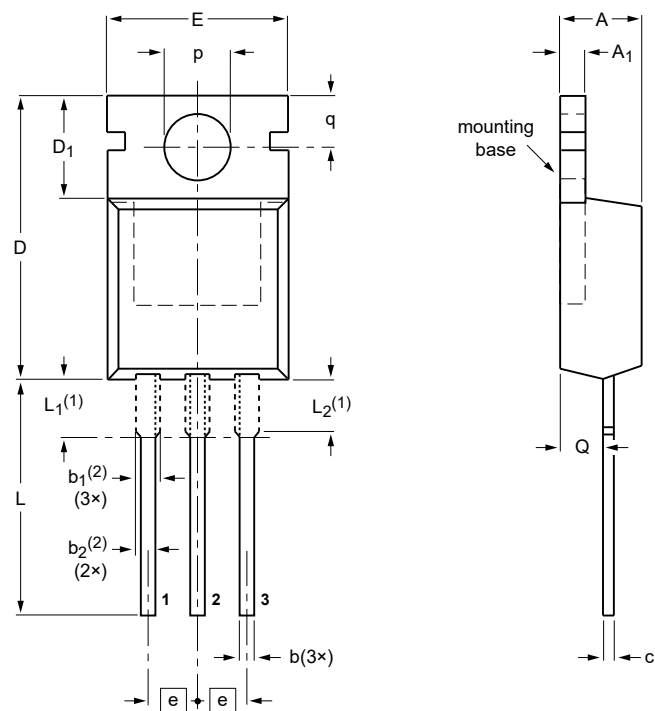


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

10. 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 <sub>1</sub>	b	b <sub>1</sub> (2)	b <sub>2</sub> (2)	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> (1)	L <sub>2</sub> (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. 12. Package outline TO-220AB (SOT78)

## 11. 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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 15 September 2018



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