

1. General description

Planar passivated four quadrant triac in a SOT78 (TO-220AB) 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
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants
- High minimum I_{GT} for guaranteed immunity to gate noise

3. Applications

- General purpose motor controls
- General purpose switching

4. Quick reference data

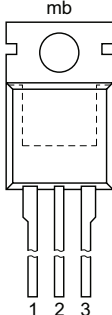
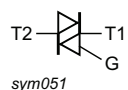
Table 1. Quick reference data

Symbol	Parameter	Conditions	Values				Unit
Absolute maximum rating							
V _{DRM}	repetitive peak off-state voltage		600				V
I _{T(RMS)}	RMS on-state current	full sine wave; T _{mb} ≤ 99 °C; Fig. 1 ; Fig. 2 ; Fig. 3	16				A
I _{TSM}	non-repetitive peak on-state current	full sine wave; T _{j(init)} = 25 °C; t _p = 20 ms; Fig. 4 ; Fig. 5	155				A
		full sine wave; T _{j(init)} = 25 °C; t _p = 16.7 ms	170				A
T _j	junction temperature		125				°C
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2- G-; T _j = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2- G+; T _j = 25 °C; Fig. 7		10	-	100	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 9		-	-	60	mA
V _T	on-state voltage	I _T = 20 A; T _j = 25 °C; Fig. 10		-	1.2	1.6	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
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	200	-	-	V/ μs
dI_{com}/dt	rate of change of commutating current	$V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (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		
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
BT139-600G0	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 codes
BT139-600G0	BT139-600G0

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Values	Unit
V_{DRM}	repetitive peak off-state voltage		600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 99\text{ }^{\circ}\text{C}$; Fig 1 ; Fig 2 ; Fig 3	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig 4 ; Fig 5	155	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 16.7\text{ ms}$	170	A
I^2t	I^2t for fusing	$t_{\text{p}} = 10\text{ ms}$; sine-wave pulse	120	A^2s
di_{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_{GM}	peak gate current		2	A
P_{GM}	peak gate power		5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	0.5	W
T_{stg}	storage temperature		-40 to 150	$^{\circ}\text{C}$
T_{j}	junction temperature		125	$^{\circ}\text{C}$

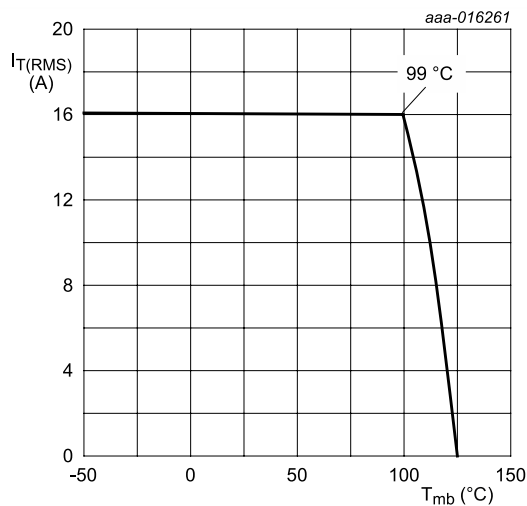
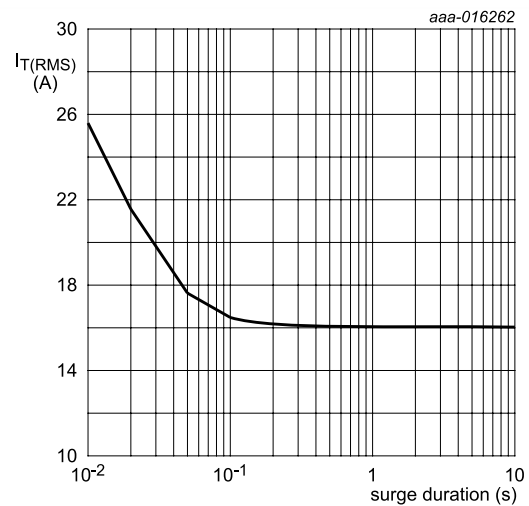


Fig. 1. RMS on-state current as a function of mounting base temperature



$f = 50\text{ Hz}$; $T_{\text{mb}} = 99\text{ }^{\circ}\text{C}$

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

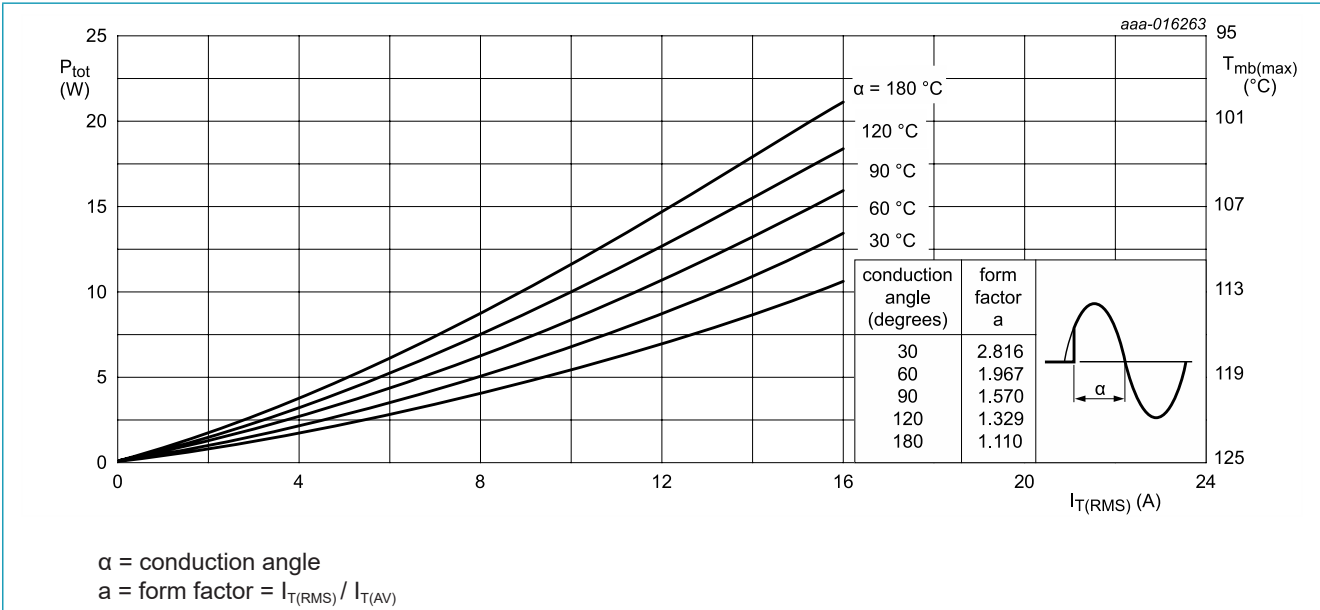


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

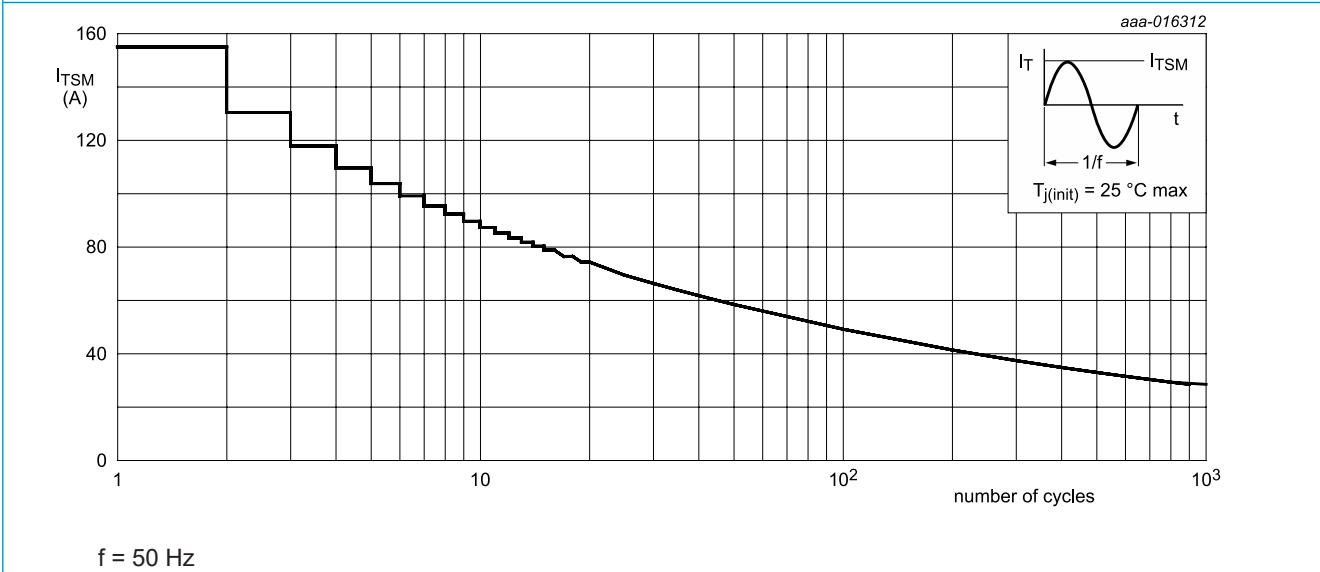
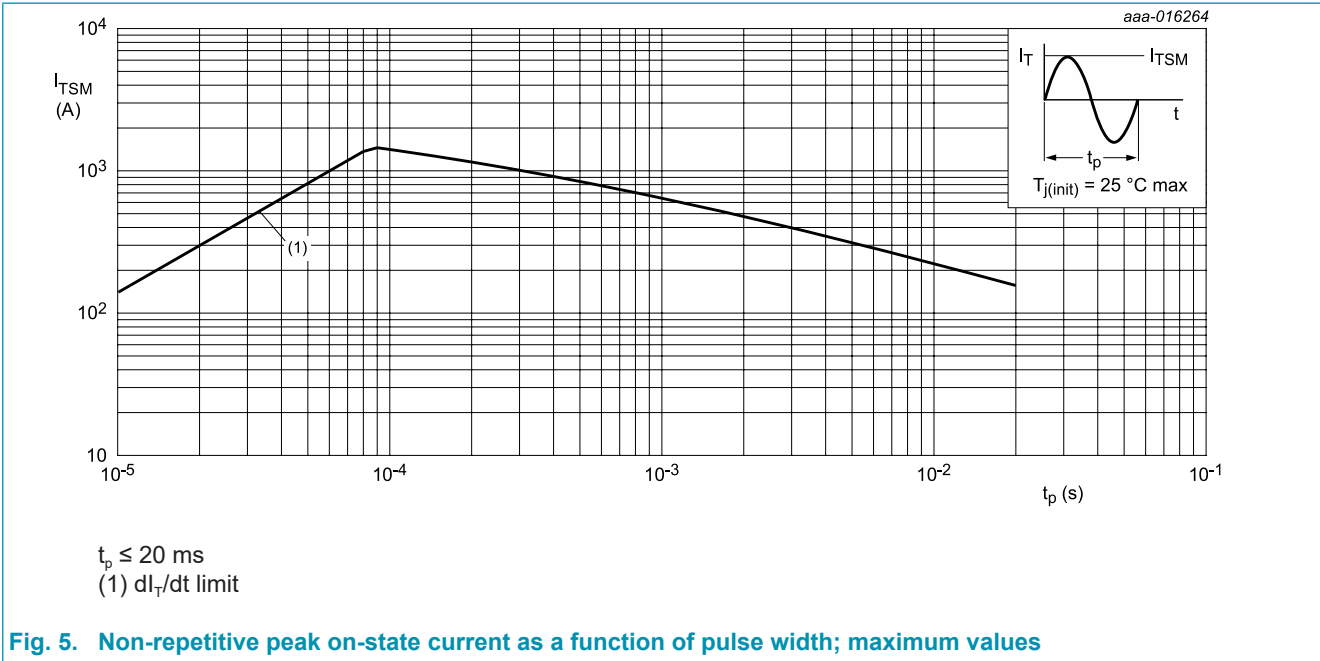


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



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	-	-	1.2	K/W
		half cycle	-	-	1.7	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

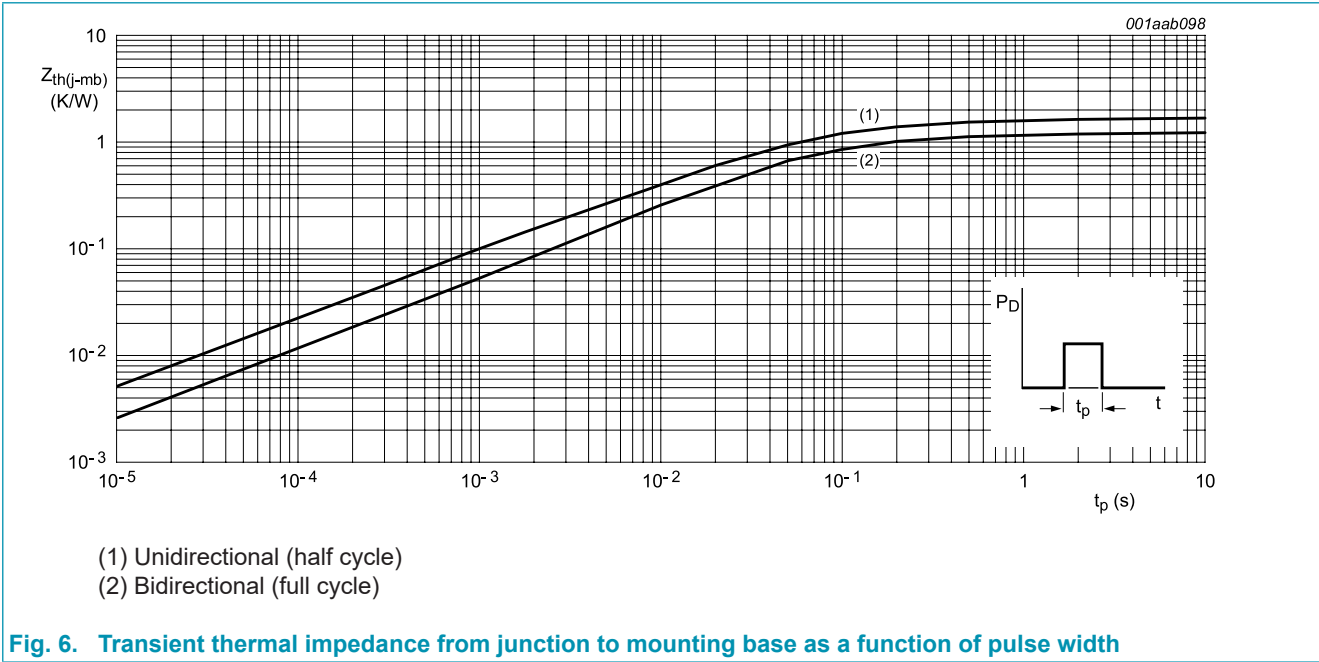
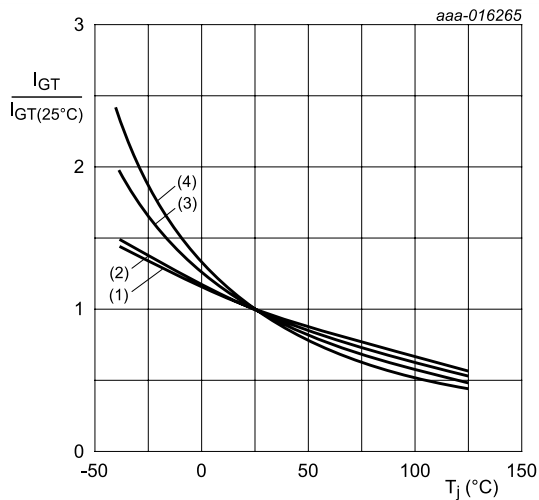


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; T2+ G+; T _J = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2+ G-; T _J = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2- G-; T _J = 25 °C; Fig. 7		10	-	50	mA
		V _D = 12 V; I _T = 0.1 A; T2- G+; T _J = 25 °C; Fig. 7		10	-	100	mA
I _L	latching current	V _D = 12 V; I _G = 0.1 A; T2+ G+; T _J = 25 °C; Fig. 8		-	-	60	mA
		V _D = 12 V; I _G = 0.1 A; T2+ G-; T _J = 25 °C; Fig. 8		-	-	90	mA
		V _D = 12 V; I _G = 0.1 A; T2- G-; T _J = 25 °C; Fig. 8		-	-	60	mA
		V _D = 12 V; I _G = 0.1 A; T2- G+; T _J = 25 °C; Fig. 8		-	-	90	mA
I _H	holding current	V _D = 12 V; T _J = 25 °C; Fig. 9		-	-	60	mA
V _T	on-state voltage	I _T = 20 A; T _J = 25 °C; Fig. 10		-	1.2	1.6	V
V _{GT}	gate trigger voltage	V _D = 12 V; I _T = 0.1 A; T _J = 25 °C; Fig. 11		-	0.7	1	V
		V _D = 400 V; I _T = 0.1 A; T _J = 125 °C; Fig. 11		0.2	0.45	-	V
I _D	off-state current	V _D = 600 V; T _J = 25 °C		-	-	10	μA
		V _D = 600 V; T _J = 125 °C		-	0.1	0.5	mA
Dynamic characteristics							
dV _D /dt	rate of rise of off-state voltage	V _{DM} = 402 V; T _J = 125 °C; (V _{DM} = 67% of V _{DRM}); exponential waveform; gate open circuit		200	-	-	V/μs
dI _{com} /dt	rate of change of commutating current	V _D = 400 V; T _J = 125 °C; I _{T(RMS)} = 16 A; dV _{com} /dt = 20 V/μs; (snubberless condition); gate open circuit		3	14	-	A/ms
t _{gt}	gate-controlled turn-on time	I _{TM} = 20 A; V _D = 600 V; I _G = 0.1 mA; dI _G /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

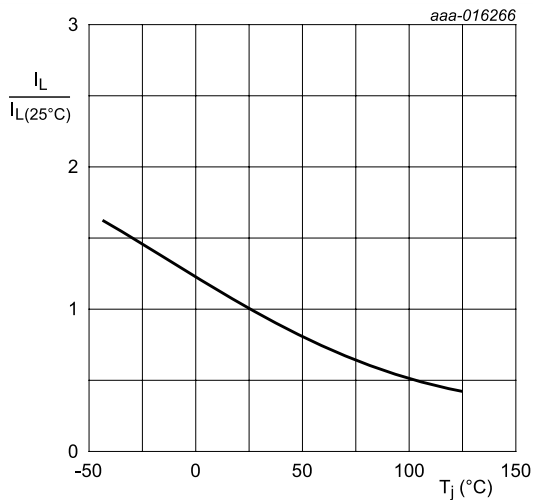


Fig. 8. Normalized latching current as a function of junction temperature

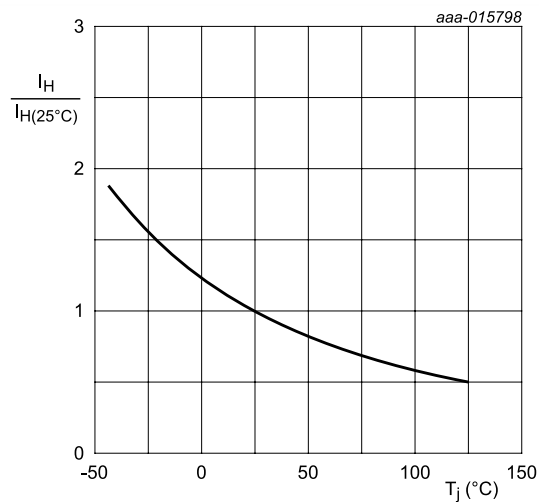
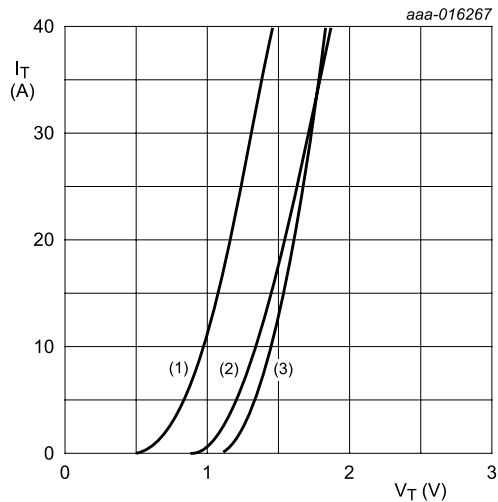


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.275 \text{ V}; R_s = 0.011 \Omega$
- (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

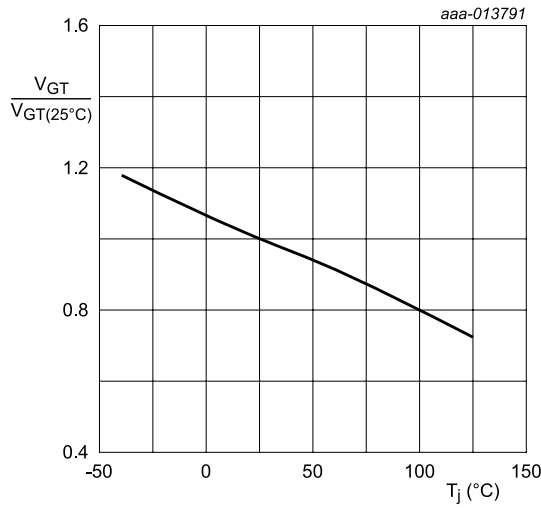
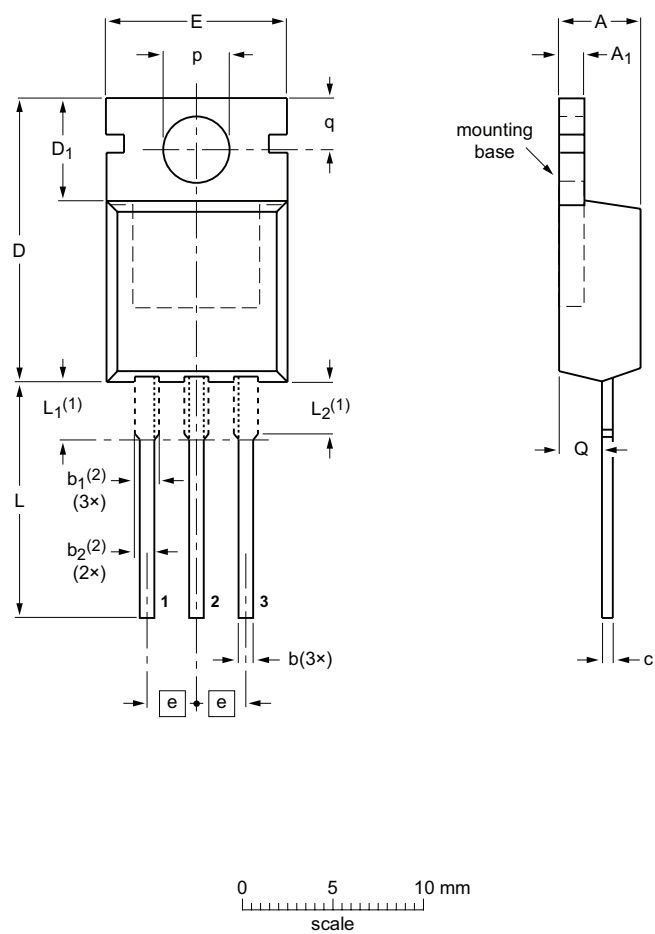


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

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

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 22 March 2018

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