

1. General description

Planar passivated high commutation three quadrant triac in a ITO220 internally insulated plastic package intended for use in circuits where high static and dynamic dV/dt and high dI/dt can occur. This "series C" triac will commute the full RMS current at the maximum rated junction temperature without the aid of a snubber. This device has high T_j operating capability and an internally isolated mounting base.

2. Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by dV/dt
- High surge capability
- High $T_{j(max)}$
- Isolated mounting base with 2500 V (RMS) isolation
- Less sensitive gate for high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

3. Applications

- Electronic thermostats (heating and cooling)
- High power motor controls
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

4. Quick reference data

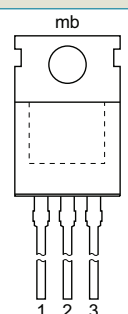
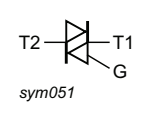
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116^\circ\text{C}$; Fig.1 ; Fig. 2 ; Fig. 3	-	-	12	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25^\circ\text{C}$; $t_p = 20\text{ms}$; Fig. 4 ; Fig. 5	-	-	140	A
		full sine wave; $T_{j(init)} = 25^\circ\text{C}$; $t_p = 16.7\text{ms}$	-	-	153	A
T_j	junction temperature		-	-	150	$^\circ\text{C}$
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25^\circ\text{C}$; Fig. 7	2	-	35	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ \text{ G-}; T_j = 25\text{ }^\circ\text{C};$ Fig. 7	2	-	35	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2- \text{ G-}; T_j = 25\text{ }^\circ\text{C};$ Fig. 7	2	-	35	mA
I_H	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 9	-	-	35	mA
V_T	on-state voltage	$I_T = 18\text{ A}; T_j = 25\text{ }^\circ\text{C};$ Fig. 10	-	1.3	1.6	V
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}; T_j = 125\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit	500	-	-	V/ μ s
		$V_{DM} = 402\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit	300	-	-	V/ μ s
dI_{com}/dt	rate of change of commutating current	$V_{DM} = 400\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{T(RMS)} = 12\text{ A}; dV_{com}/dt = 20\text{ V}/\mu\text{s};$ (snubberless condition); gate open circuit	15	-	-	A/ms
		$V_{DM} = 400\text{ V}; T_j = 150\text{ }^\circ\text{C}; I_{T(RMS)} = 12\text{ A}; dV_{com}/dt = 20\text{ V}/\mu\text{s};$ (snubberless condition); 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		
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

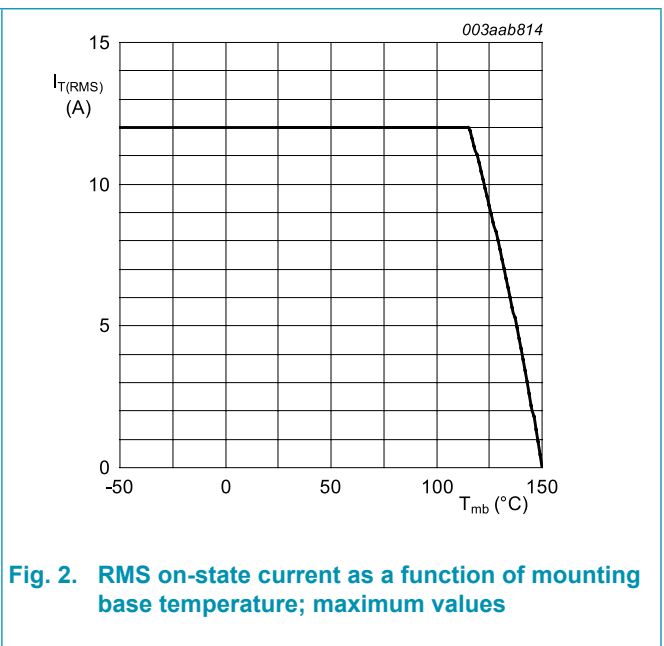
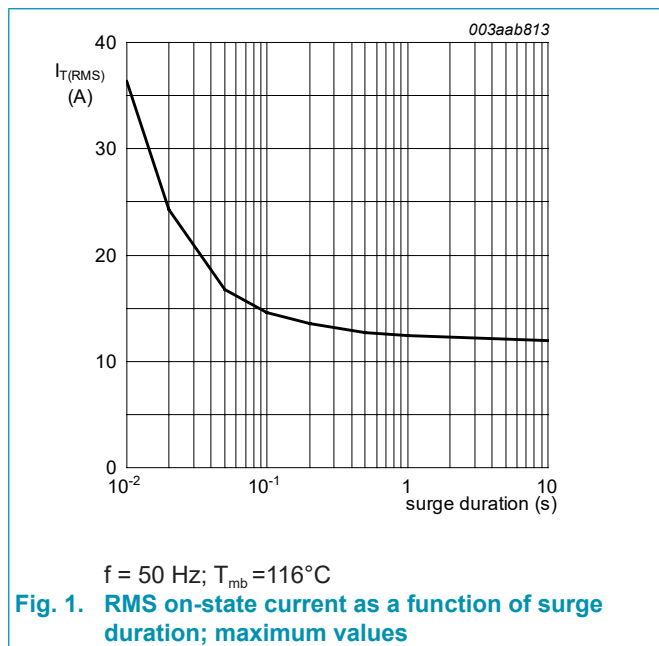
Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BTA412Y-600C	IITO220	BTA412Y-600C,127	Tube	50	SOT78D	7-July-2010

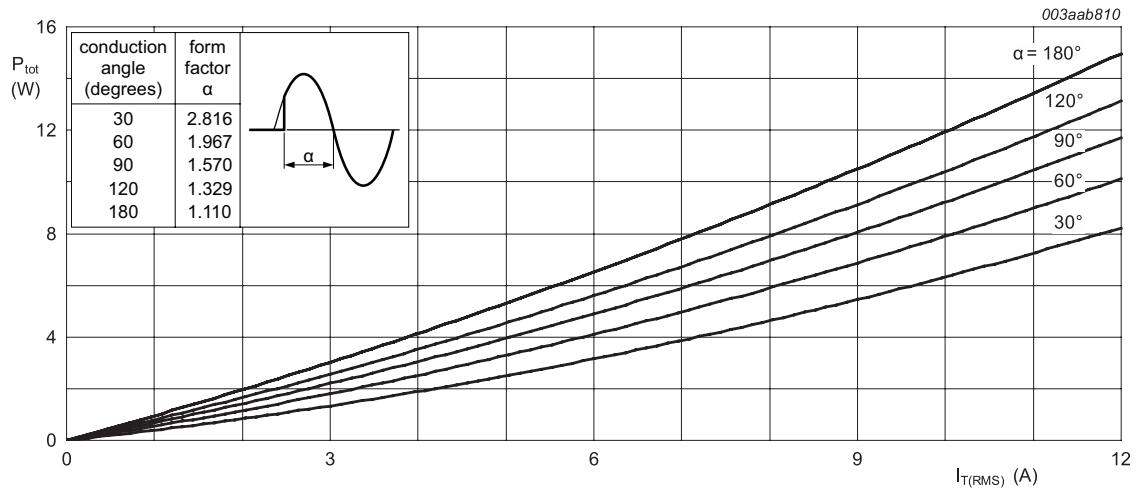
7. Limiting values

Table 4. Limiting values

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

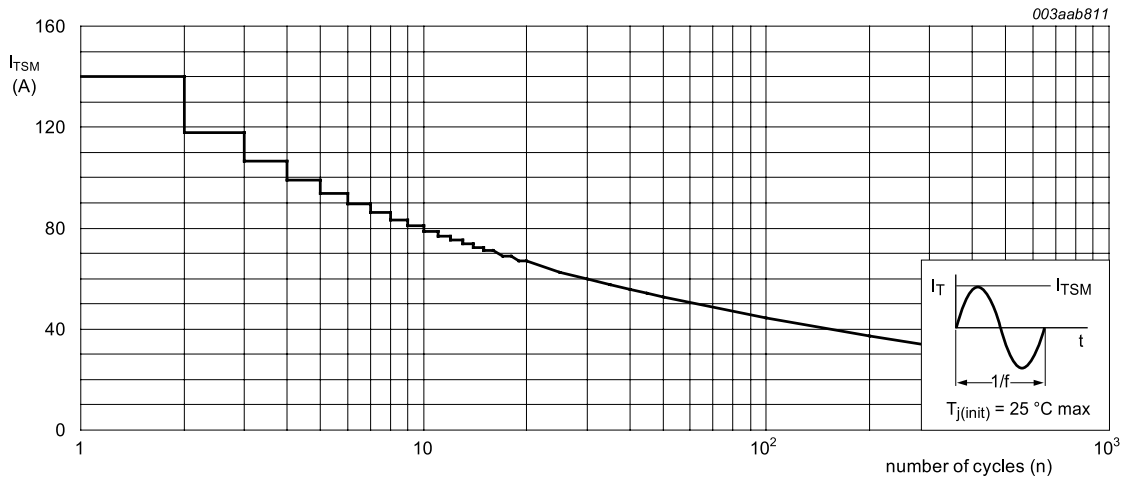
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116^\circ\text{C}$; Fig.1 ; Fig.2 ; Fig.3	-	12	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$; $t_p = 20\text{ ms}$; Fig.4 ; Fig.5	-	140	A
		full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$; $t_p = 16.7\text{ ms}$	-	153	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; sine wave pulse	-	98	A^2s
di_T/dt	rate of rise of on-state current	$I_G = 0.2\text{ A}$	-	100	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		-	2	A
P_{GM}	peak gate power		-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period	-	0.5	W
T_{stg}	storage temperature		-40	150	$^\circ\text{C}$
T_j	junction temperature		-	150	$^\circ\text{C}$





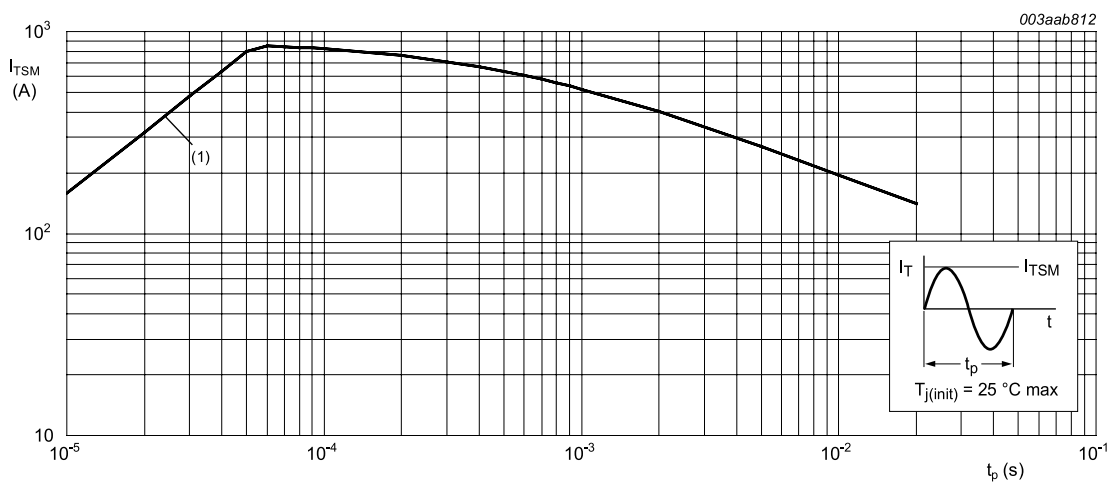
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$
 $\alpha = \text{conduction angle}$

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



$f = 50 \text{ Hz}$

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



$t_p \leq 20 \text{ ms}$
 (1) di_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values

8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; Fig. 6	-	-	2.1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	60	-	K/W

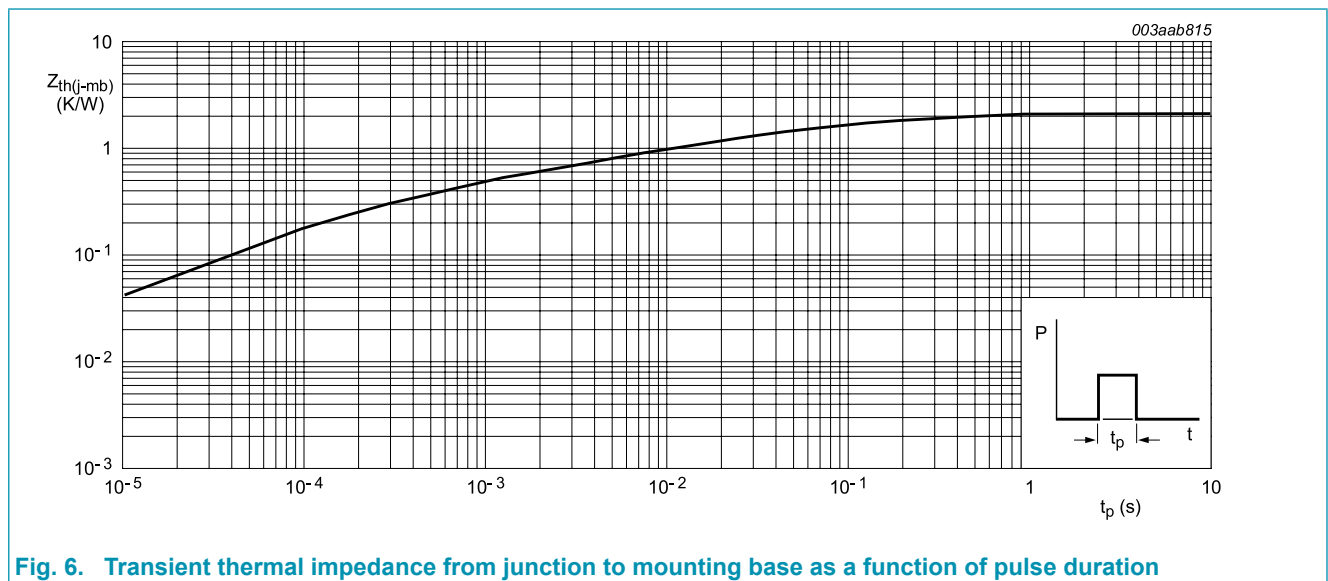


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Isolation characteristics

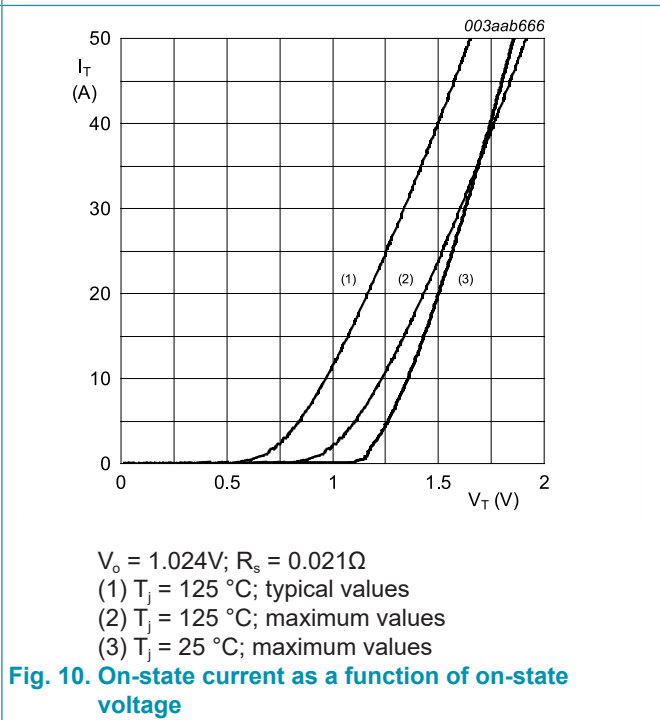
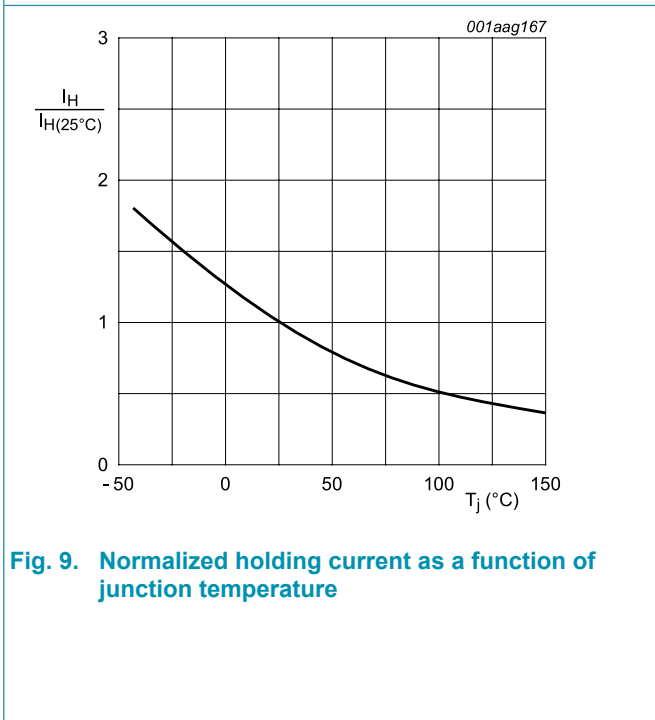
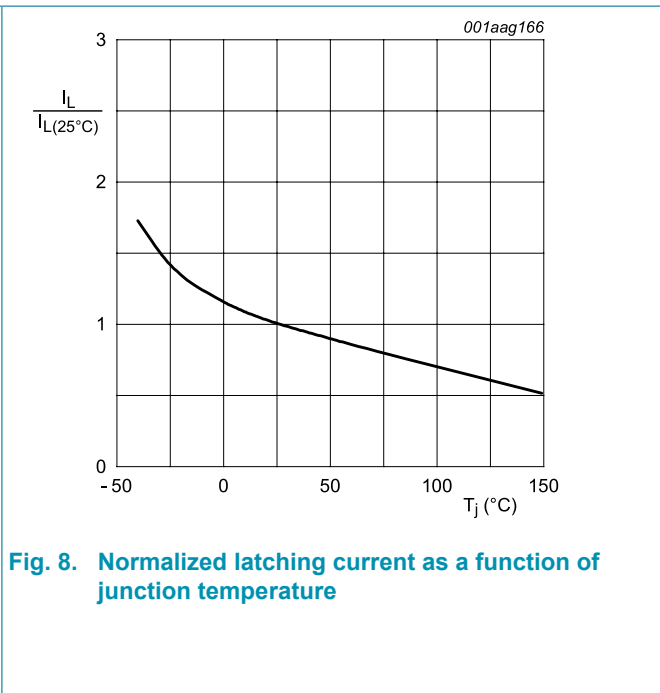
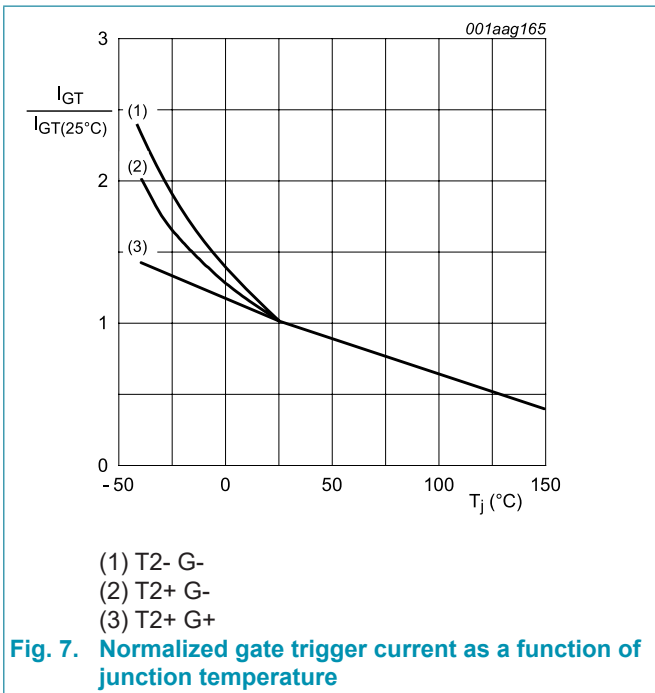
Table 6. Isolation Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$; $RH \leq 65\%$; $T_{mb} = 25\text{ }^\circ\text{C}$	-	-	2500	V
C_{isol}	isolation capacitance	from main terminal 2 to external heatsink; $f = 1\text{ MHz}$; $T_{mb} = 25\text{ }^\circ\text{C}$	-	10	-	pF

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G+;$ $T_j = 25\text{ °C};$ Fig. 7	2	-	35	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G-;$ $T_j = 25\text{ °C};$ Fig. 7	2	-	35	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2- G-;$ $T_j = 25\text{ °C};$ Fig. 7	2	-	35	mA
I_L	latching current	$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2+ G+;$ $T_j = 25\text{ °C};$ Fig. 8	-	-	50	mA
		$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2+ G-;$ $T_j = 25\text{ °C};$ Fig. 8	-	-	60	mA
		$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_2- G-;$ $T_j = 25\text{ °C};$ Fig. 8	-	-	50	mA
I_H	holding current	$V_D = 12\text{ V}; T_j = 25\text{ °C};$ Fig. 9	-	-	35	mA
V_T	on-state voltage	$I_T = 18\text{ A}; T_j = 25\text{ °C};$ Fig. 10	-	1.3	1.6	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ °C}$ Fig. 11	-	0.8	1	V
		$V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_j = 150\text{ °C}$	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
		$V_D = 600\text{ V}; T_j = 150\text{ °C}$	-	0.4	2	mA
Dynamic characteristics						
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	500	-	-	V/ μ s
		$V_{DM} = 402\text{ V}; T_j = 150\text{ °C}; (V_{DM} = 67\%$ of $V_{DRM});$ exponential waveform; gate open circuit	300	-	-	V/ μ s
dI_{com}/dt	rate of change of commutating current	$V_{DM} = 400\text{ V}; T_j = 125\text{ °C}; I_{T(RMS)} = 12\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ (snubberless condition); gate open circuit	15	-	-	A/ms
		$V_{DM} = 400\text{ V}; T_j = 150\text{ °C}; I_{T(RMS)} = 12\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ (snubberless condition); gate open circuit	6	-	-	A/ms



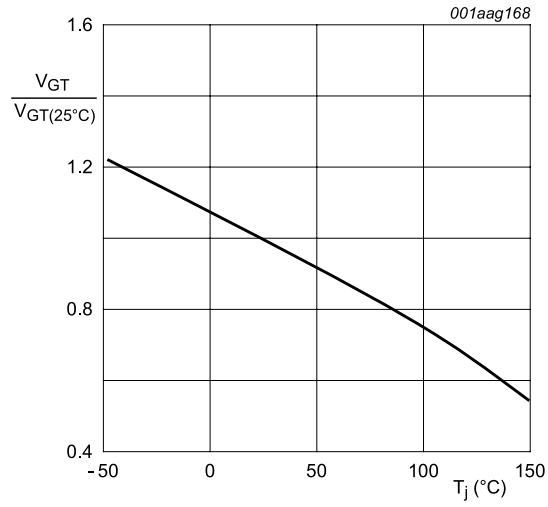
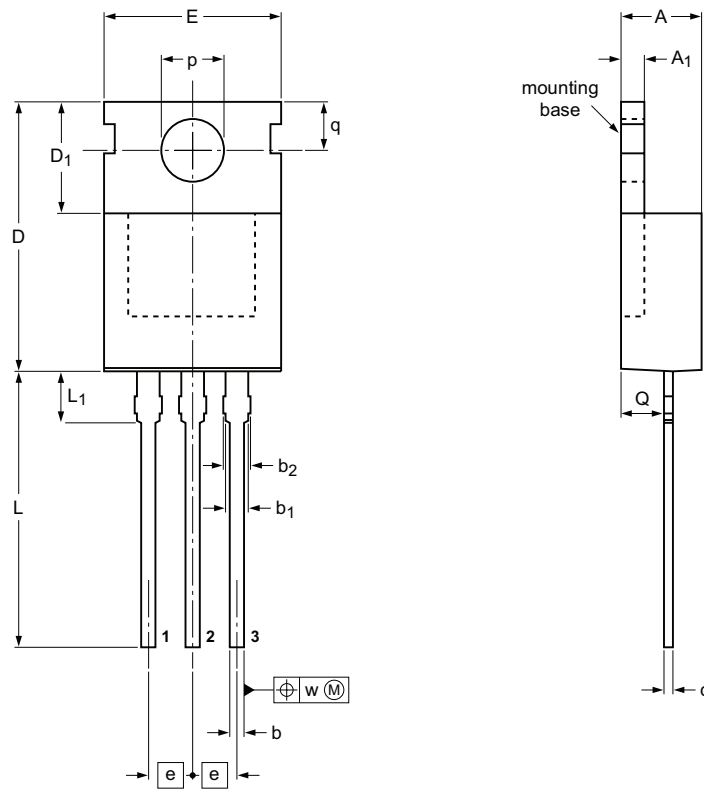


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

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

SOT78D



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁	b ₂	c	D	D ₁ ref	E	e	L	L ₁ ref	p	Q	q	w
mm	4.7 4.3	1.40 1.25	0.9 0.6	1.4 1.1	1.72 1.32	0.6 0.4	16.0 15.2	6.5	10.3 9.7	2.54	14.0 12.8	3.0	3.7 3.5	2.6 2.2	3.0 2.7	0.2

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78D		TO-220				07-04-04 07-07-10

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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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