

## 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 B" 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 junction operating temperature capability ( $T_{j(max)} = 150\text{ °C}$ )
- High surge capability
- Isolated mounting base with 2500 V (RMS) isolation
- Least sensitive gate for highest noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Very high immunity to false turn-on by  $dV/dt$

## 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

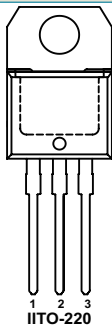
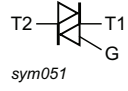
Table 1. Quick reference data

Symbol	Parameter	Conditions	Values			Unit
$V_{DRM}$	repetitive peak off-state voltage		600			V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116\text{ °C}$ ; <a href="#">Fig.1</a> ; <a href="#">Fig.2</a> ; <a href="#">Fig.3</a>	12			A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $t_p = 20\text{ ms}$ ; $T_{j(init)} = 25\text{ °C}$ ; <a href="#">Fig.4</a> ; <a href="#">Fig.5</a>	140			A
		full sine wave; $t_p = 16.7\text{ ms}$ ; $T_{j(init)} = 25\text{ °C}$	153			A
$T_j$	junction temperature		150			°C
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>	2	-	50	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	2	-	50	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	2	-	50	mA

$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ °C};$ <a href="#">Fig. 9</a>	-	-	60	mA
$V_T$	on-state voltage	$I_T = 18\text{ A}; T_j = 25\text{ °C};$ <a href="#">Fig. 10</a>	-	1.3	1.5	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}; T_j = 125\text{ °C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit	1000	-	-	V/ $\mu$ s
		$V_{DM} = 402\text{ V}; T_j = 150\text{ °C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit	600	-	-	V/ $\mu$ s
$dI_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}; T_j = 125\text{ °C}; I_{T(RMS)} = 12\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ gate open circuit; snubberless condition	20	-	-	A/ms
		$V_{DM} = 400\text{ V}; T_j = 150\text{ °C}; I_{T(RMS)} = 12\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ gate open circuit; snubberless condition	8	-	-	A/ms

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 <p>IITO-220</p>	 <p>sym051</p>
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-600B	IITO220	BTA412Y-600B,127	Tube	50	IITO220E	15-Dec-2017

## 7. Marking

Table 4. Marking codes

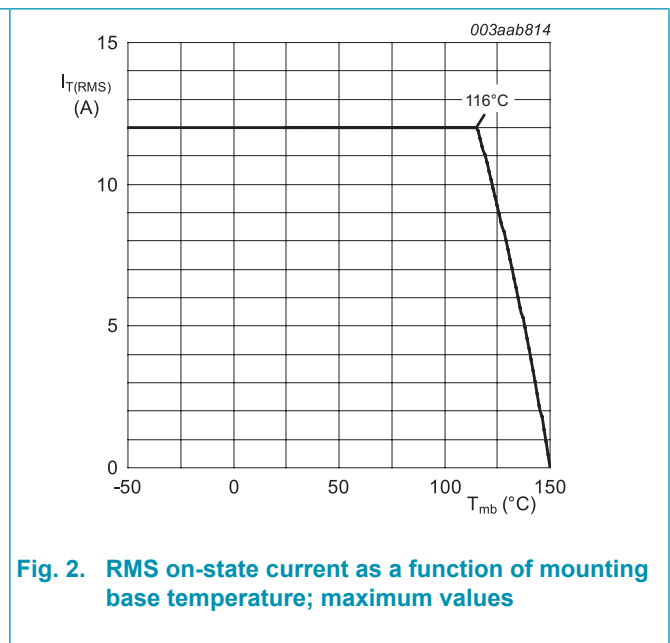
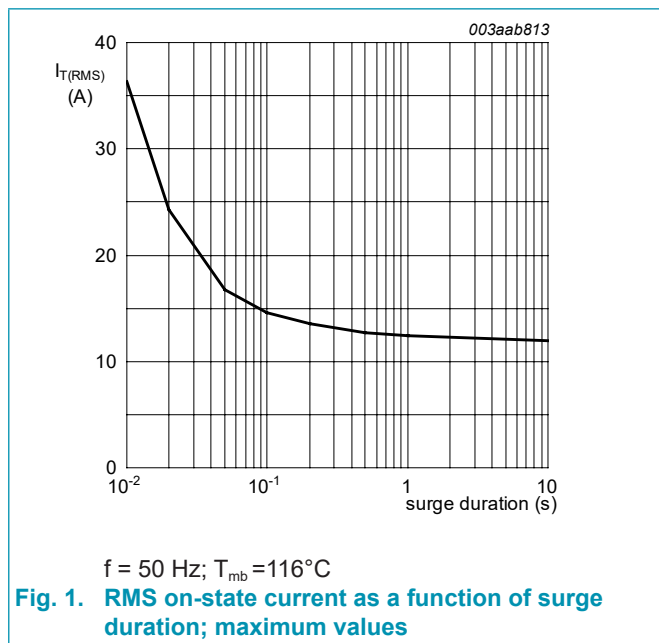
Type number	Marking codes
BTA412Y-600B	BTA412Y-600B

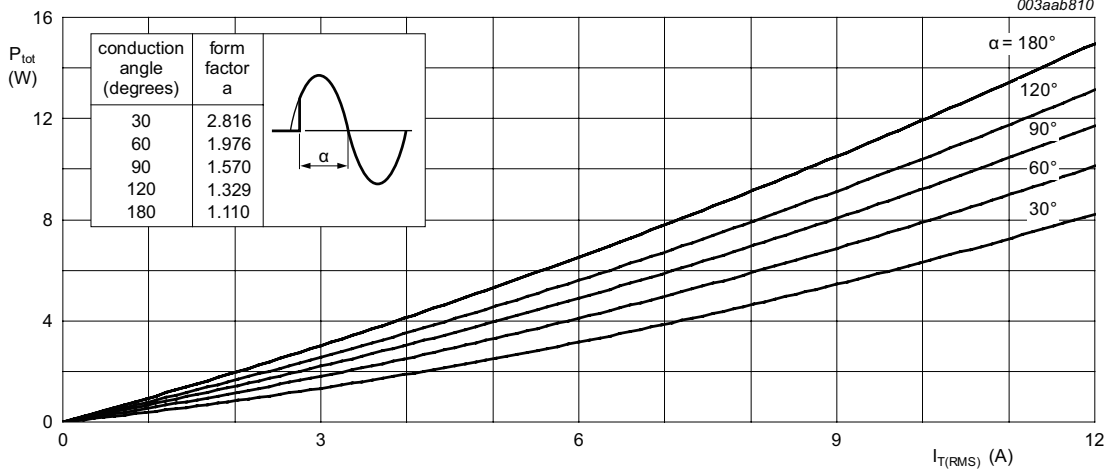
## 8. Limiting values

**Table 5. Limiting values**

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

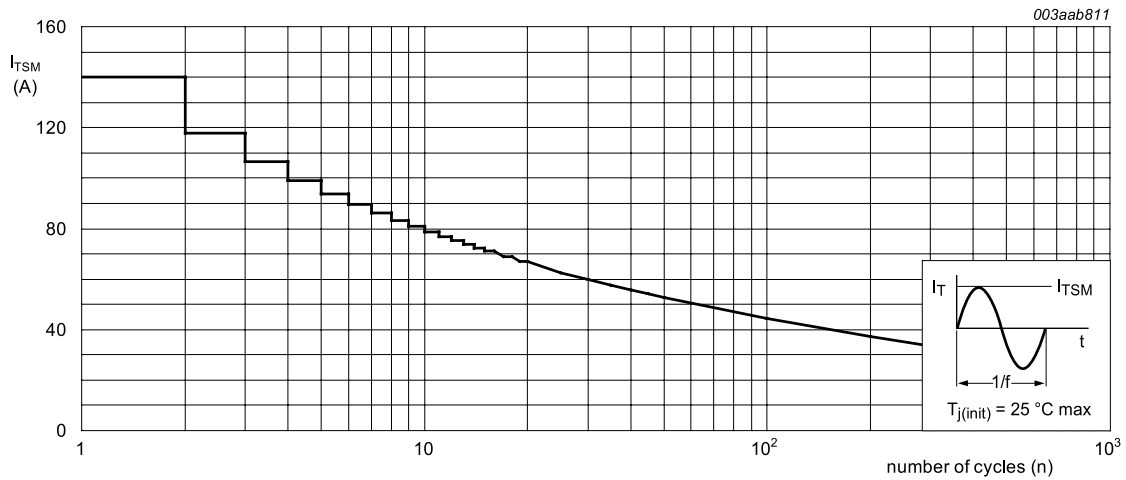
Symbol	Parameter	Conditions	Values	Unit
$V_{DRM}$	repetitive peak off-state voltage		600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 116^\circ\text{C}$ ; <a href="#">Fig.1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	12	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	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	98	$\text{A}^2\text{s}$
$di_T/dt$	rate of rise of on-state current	$I_G = 100\text{ mA}$	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 to 150	$^\circ\text{C}$
$T_j$	junction temperature		150	$^\circ\text{C}$





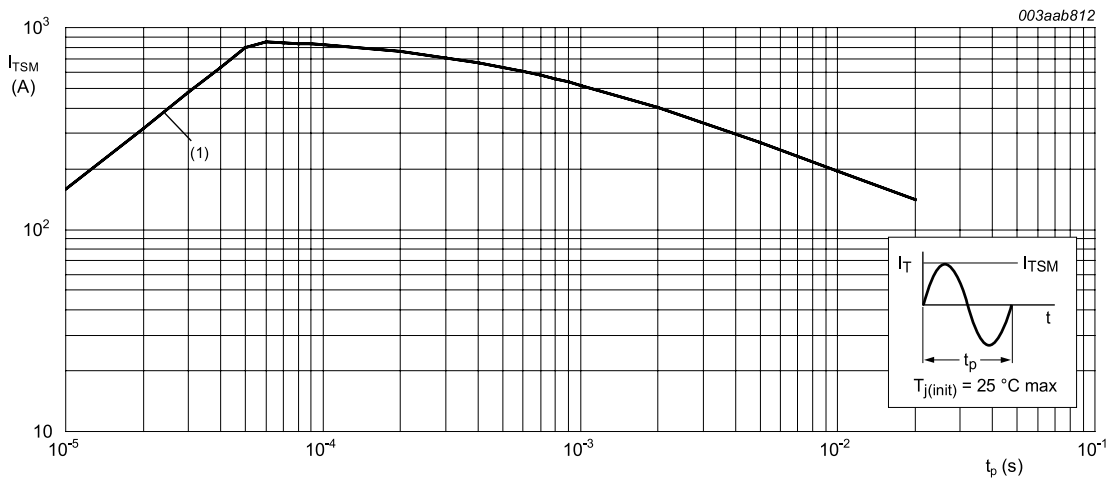
$a = \text{form factor} = I_{T(RMS)} / I_{T(AV)}$   
 $\alpha = \text{conduction angle}$

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



f = 50 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

## 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	-	-	2.1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W

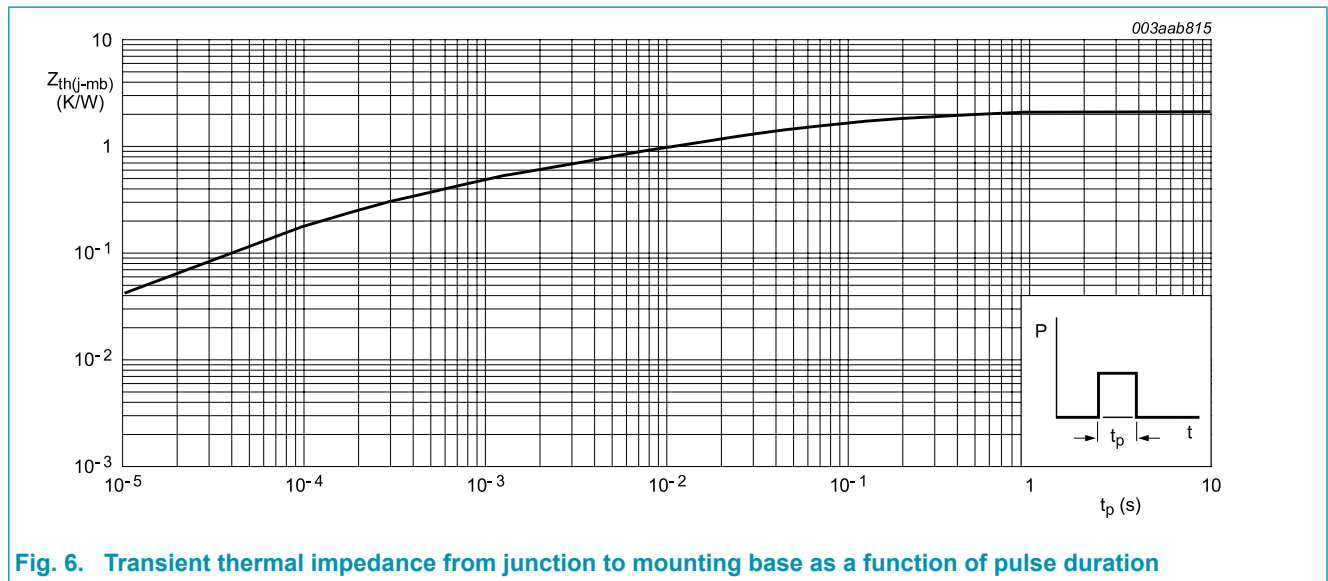


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Isolation characteristics

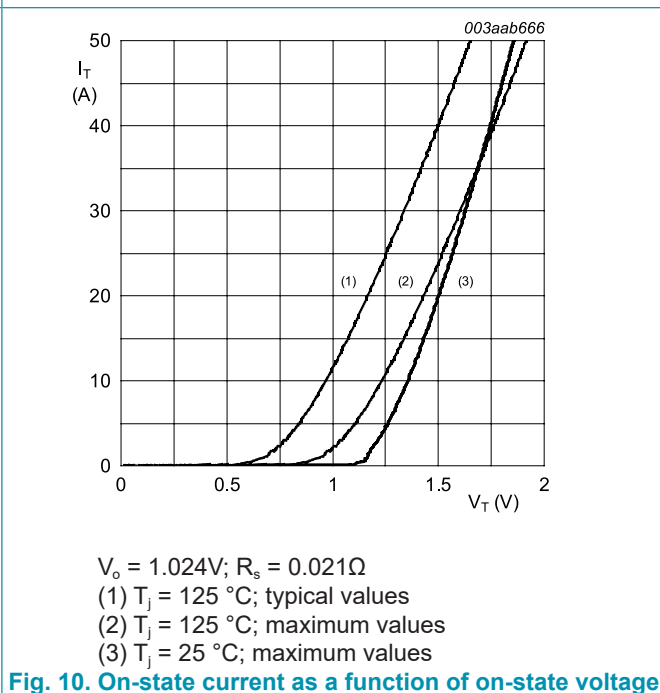
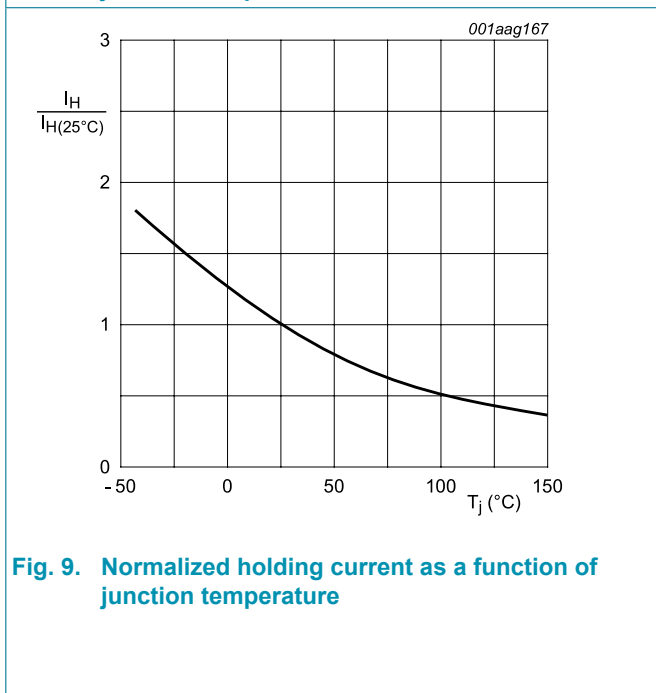
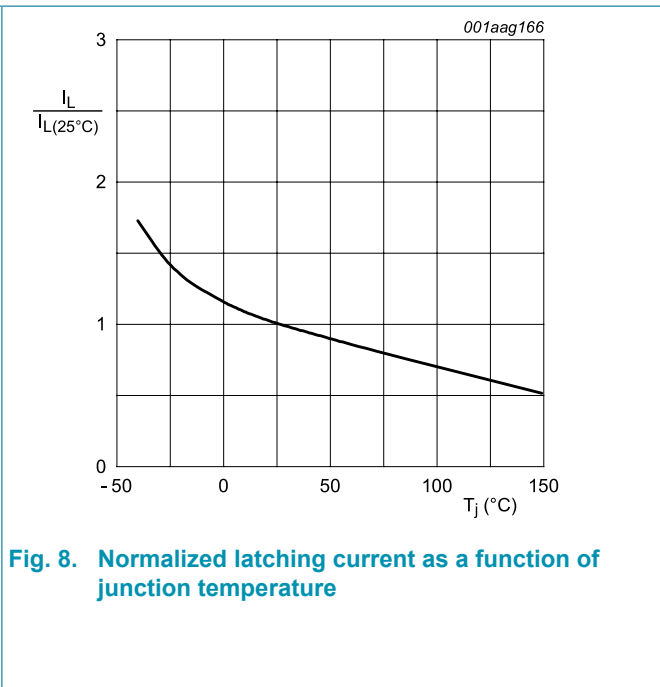
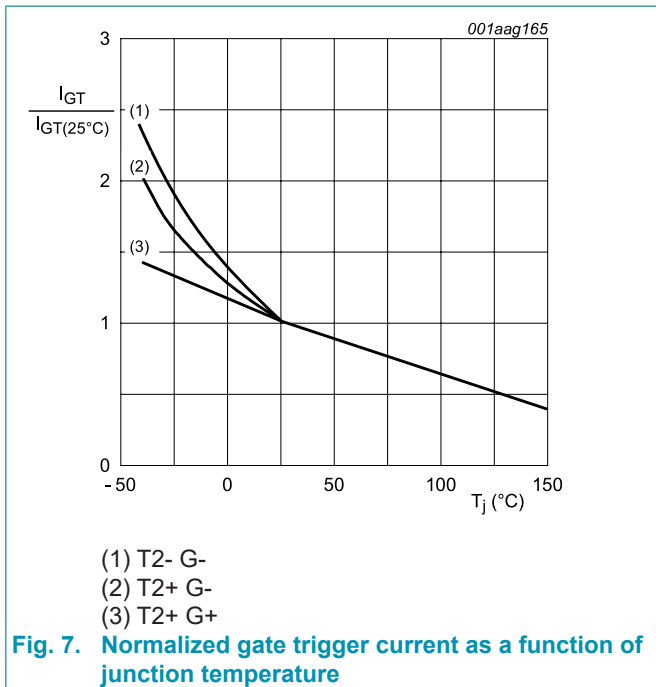
Table 7. Isolation characteristics

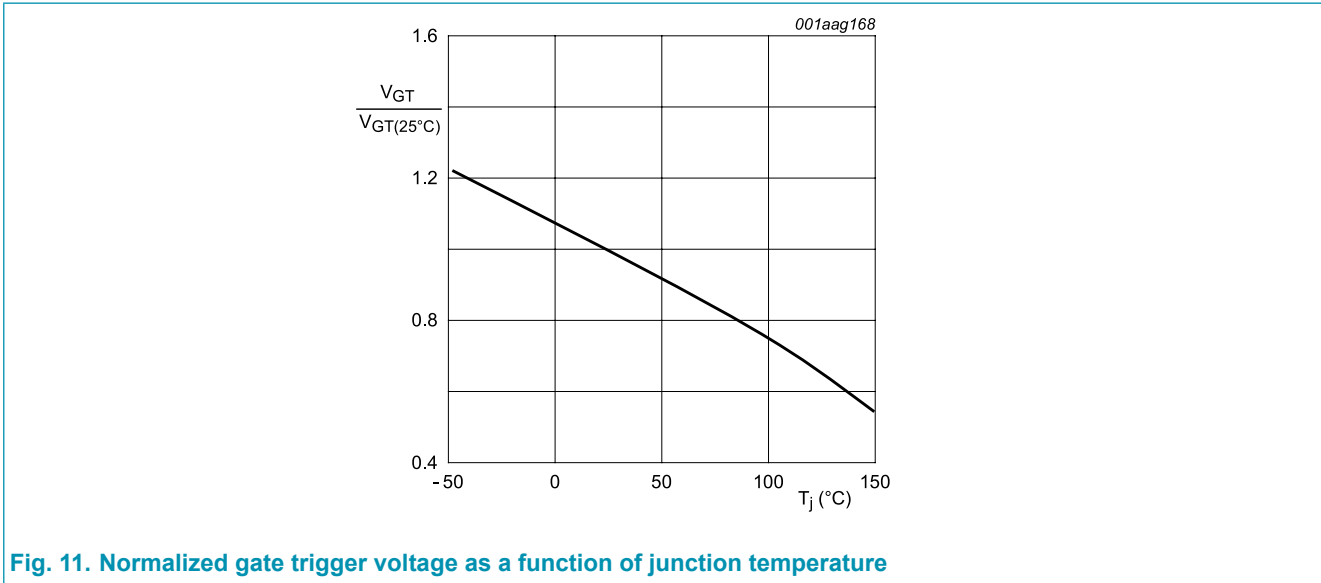
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz $\leq$ f $\leq$ 60 Hz; RH $\leq$ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free	-	-	2500	V
$C_{isol}$	isolation capacitance	from cathode to external heatsink	-	10	-	pF

## 11. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	2	-	50	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	2	-	50	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	2	-	50	mA
$I_L$	latching current	$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2+ G+;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>	-	-	60	mA
		$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2+ G-;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>	-	-	90	mA
		$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T2- G-;$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 8</a>	-	-	60	mA
$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 9</a>	-	-	60	mA
$V_T$	on-state voltage	$I_T = 18\text{ A}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>	-	1.3	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 11</a>	-	0.8	1	V
		$V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_j = 150\text{ }^\circ\text{C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = 600\text{ V}; T_j = 125\text{ }^\circ\text{C}$	-	0.1	0.5	$\mu\text{A}$
		$V_D = 600\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	0.4	2	mA
<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	1000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 402\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM});$ exponential waveform; gate open circuit	600	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{T(RMS)} = 8\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ gate open circuit; snubberless condition	20	-	-	A/ms
		$V_{DM} = 400\text{ V}; T_j = 150\text{ }^\circ\text{C}; I_{T(RMS)} = 8\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ gate open circuit; snubberless condition	8	-	-	A/ms

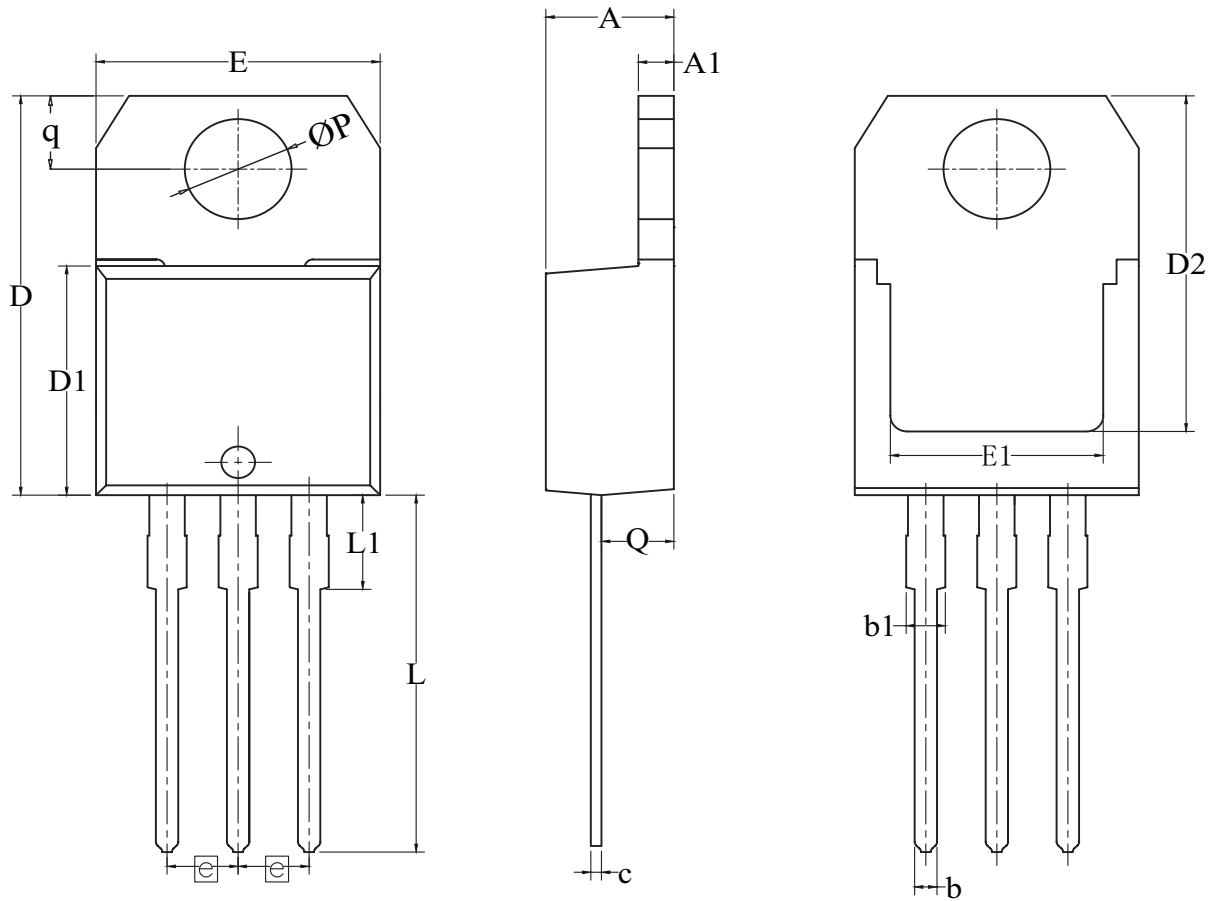






**12. Package outline**

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 leads TO-220 IITO220



Unit	A	A1	b	b1	c	D	D1	D2	E	E1	e	L	L1	P	Q	q
MM	min	4.30	1.25	0.69	1.20	0.40	15.20	8.50	12.20	10.00	6.86	12.80	2.70	3.70	2.40	2.70
	max	4.70	1.40	0.90	1.72	0.60	16.00	9.02	12.88	10.40	8.89	14.00	3.30	3.95	2.80	3.00

## 13. 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.
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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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