

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78D (IITO-220) internally insulated plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series CT" triac will commutate the full RMS current at the maximum rated junction temperature without the aid of a snubber where "high junction operating temperature capability" is required.

## 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 junction operating temperature capability ( $T_{j(max)} = 150\text{ °C}$ )
- High voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Internally insulated package
- Isolated mounting base with 2500 V (RMS) isolation

## 3. Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g washing machine and vacuum cleaners
- Rectifier-fed DC inductive loads e.g DC motors and solenoids
- Refrigeration and air conditioning compressors

## 4. Quick reference data

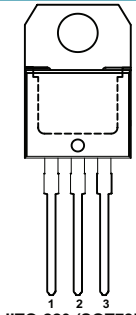
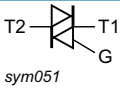
Table 1. Quick reference data

Symbol	Parameter	Conditions	Values	Unit
<b>Absolute maximum rating</b>				
$V_{DRM}$	repetitive peak off-state voltage		800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 112\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	16	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>	160	A
		full sine wave; $t_p = 16.7\text{ ms}$ ; $T_{j(init)} = 25\text{ °C}$	176	A
$T_j$	junction temperature		150	°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G+$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	-	-	35	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2+ G-$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	-	-	35	mA
		$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_2- G-$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 7</a>	-	-	35	mA
$I_H$	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 9</a>	-	-	40	mA
$V_T$	on-state voltage	$I_T = 20\text{ A}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 10</a>	-	-	1.5	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}; T_j = 125\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	1000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 536\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM}$ ); gate open circuit	500	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}; T_j = 150\text{ }^\circ\text{C}; I_{T(RMS)} = 16\text{ A};$ $dV_{com}/dt = 20\text{ V}/\mu\text{s};$ gate open circuit; snubberless condition	12	-	-	A/ms

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 <p>IITO-220 (SOT78D)</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
BTA316Y-800CT	IITO-220	BTA316Y-800CTQ	Tube	50	IITO-220E	15-Dec-2017

## 7. Marking

Table 4. Marking codes

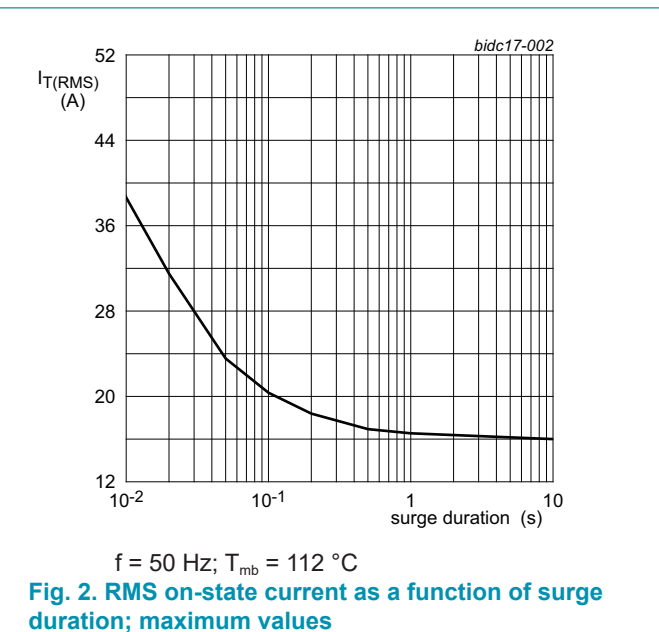
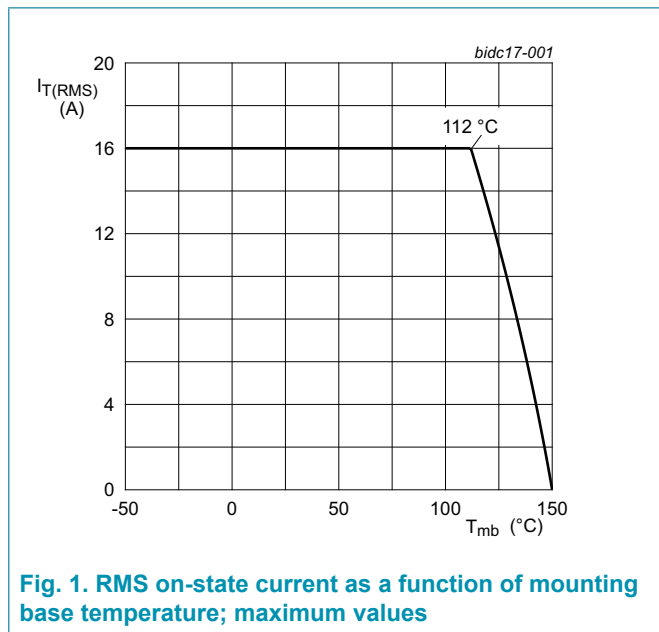
Type number	Marking codes
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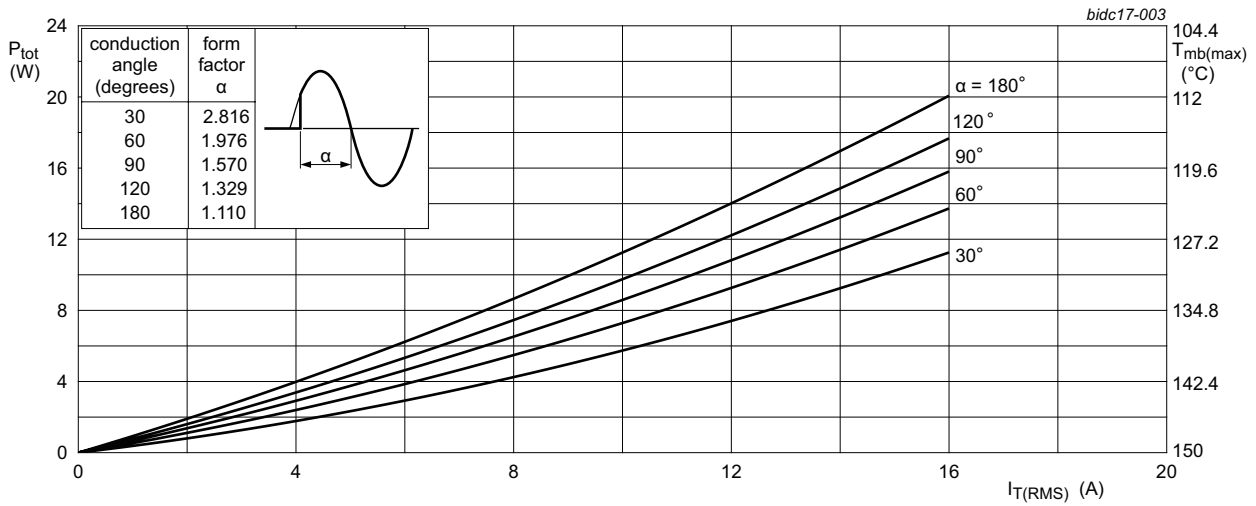
## 8. Limiting values

**Table 4. Limiting values**

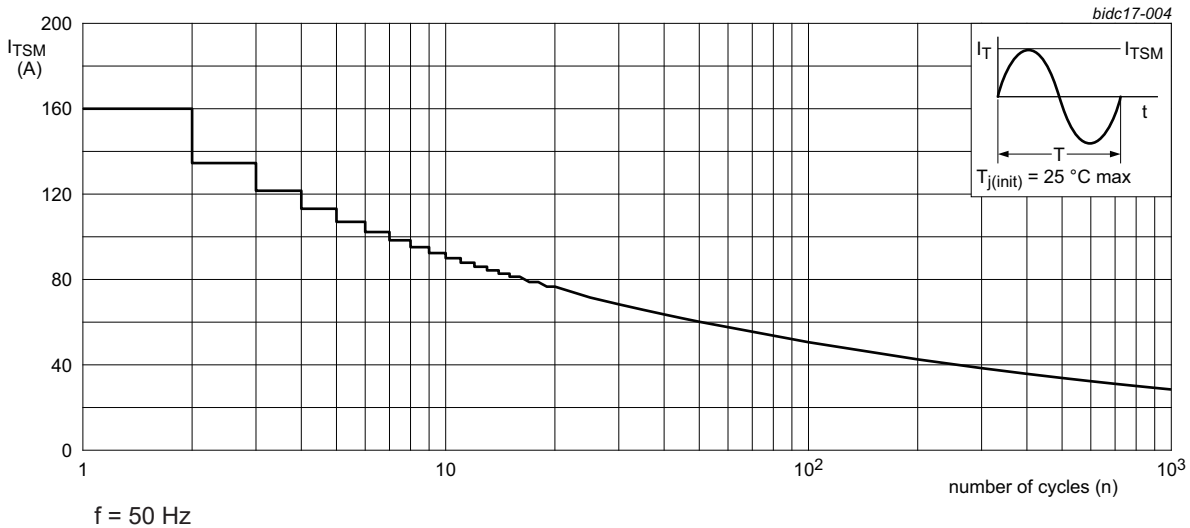
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Values	Unit
$V_{DRM}$	repetitive peak off-state voltage		800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 112^\circ\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	16	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $t_p = 20\text{ ms}$ ; $T_{j(\text{init})} = 25^\circ\text{C}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	160	A
		full sine wave; $t_p = 16.7\text{ ms}$ ; $T_{j(\text{init})} = 25^\circ\text{C}$	176	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ms}$ ; sine wave	128	$\text{A}^2\text{s}$
$dI_T/dt$	rate of rise of on-state current	$I_G = 150\text{mA}$	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	$^\circ\text{C}$

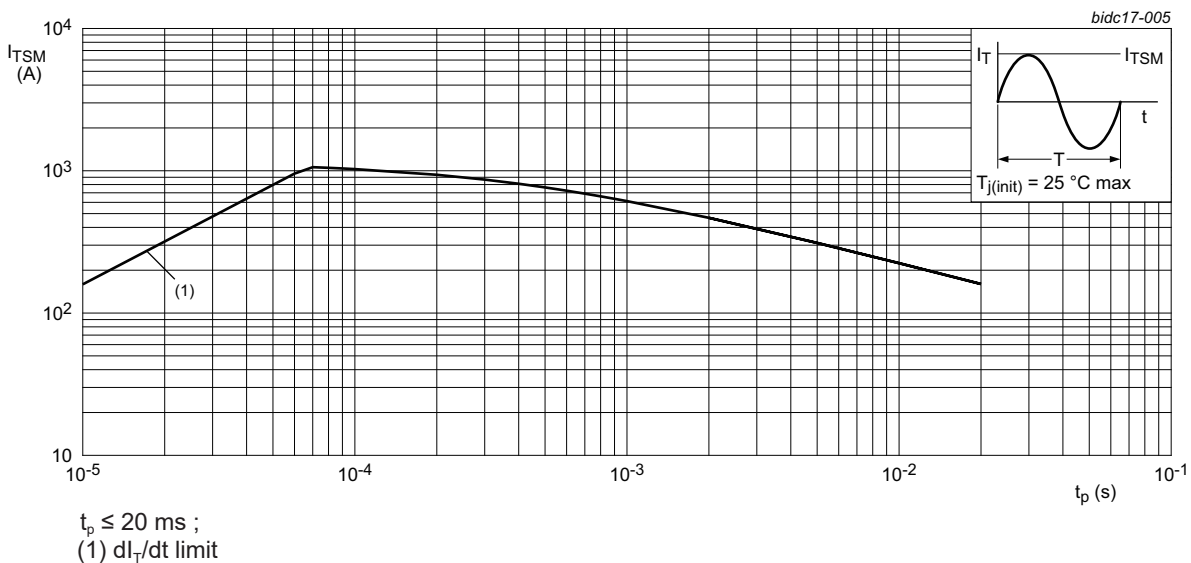




$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$   
**Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values**



$f = 50 \text{ Hz}$   
**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. Total power dissipation as a function of RMS on-state current; maximum values**

## 9. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	<a href="#">Fig. 6</a>	-	-	1.9	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W

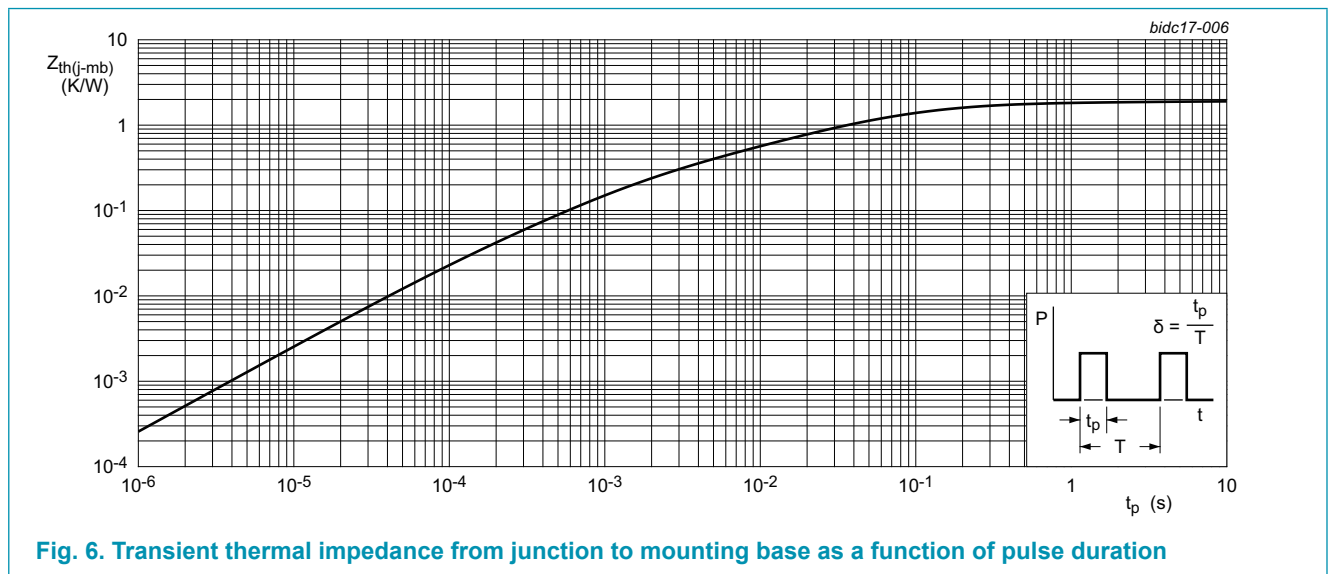


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Isolation characteristics

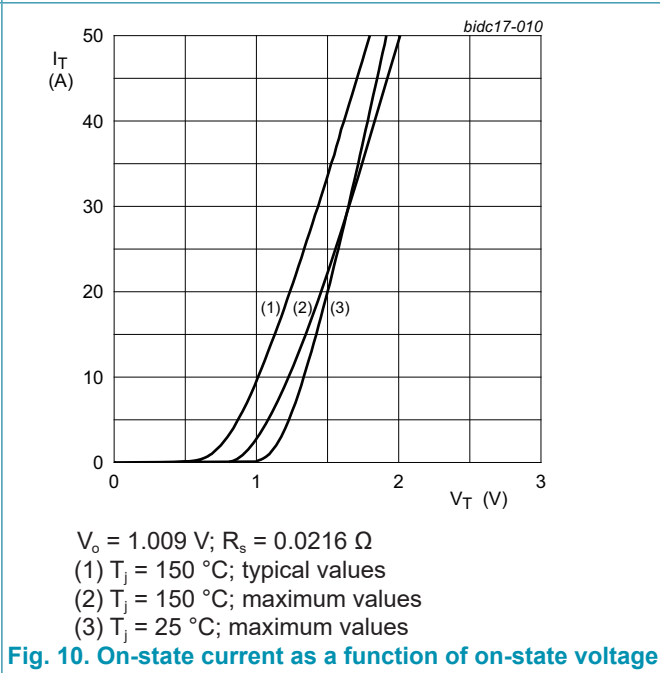
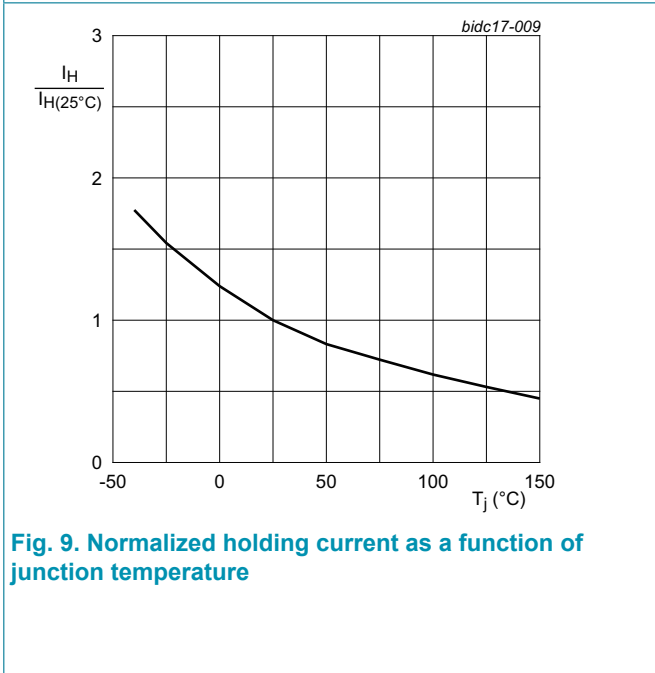
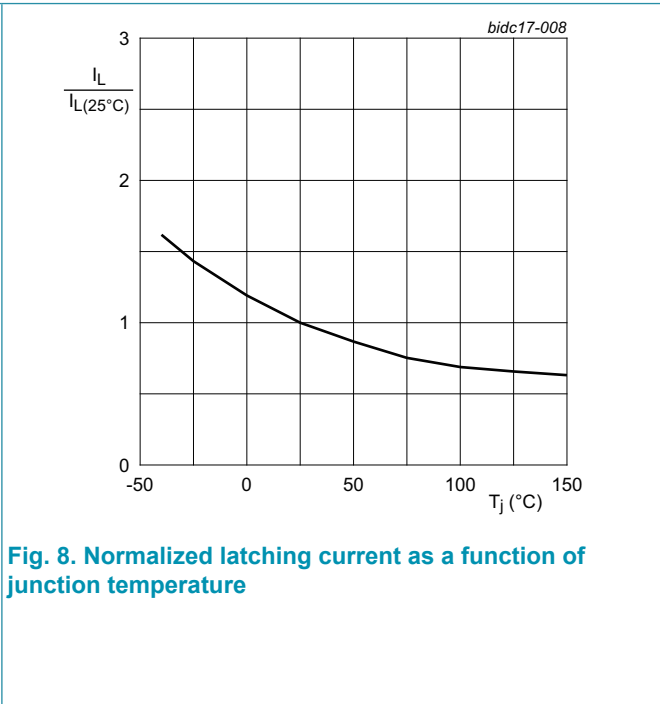
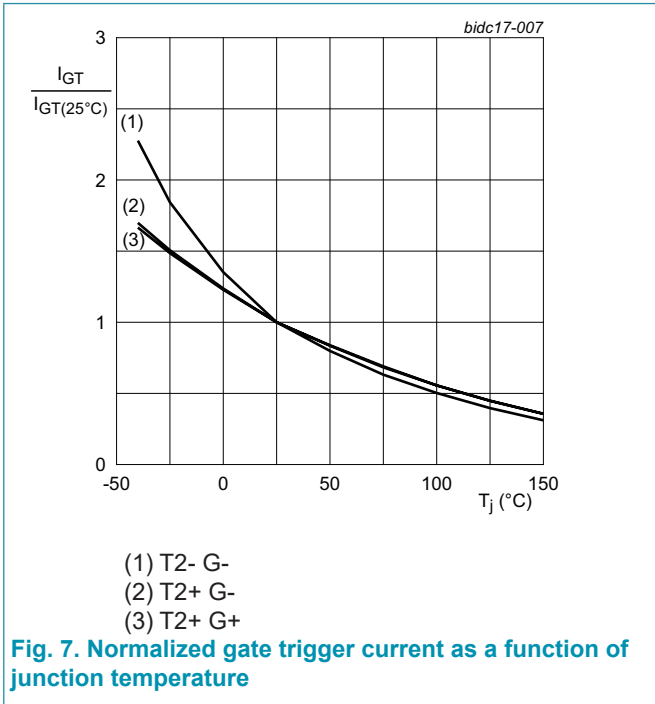
Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ f ≤ 60 Hz; RH ≤ 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 7. 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>	-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	-	-	35	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	50	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	70	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	50	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	40	mA
$V_T$	on-state voltage	$I_T = 20\text{ A}$ ; $T_J = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	-	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>	-	0.8	1	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 150\text{ °C}$ ; <a href="#">Fig. 11</a>	0.2	0.45	-	V
$I_D$	off-state current	$V_D = 800\text{ V}$ ; $T_J = 25\text{ °C}$	-	-	5	$\mu\text{A}$
		$V_D = 800\text{ V}$ ; $T_J = 150\text{ °C}$	-	-	2	mA
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_J = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	1000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 536\text{ V}$ ; $T_J = 150\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	500	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; gate open circuit; snubberless condition	12	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	15	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_J = 150\text{ °C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	20	-	-	A/ms



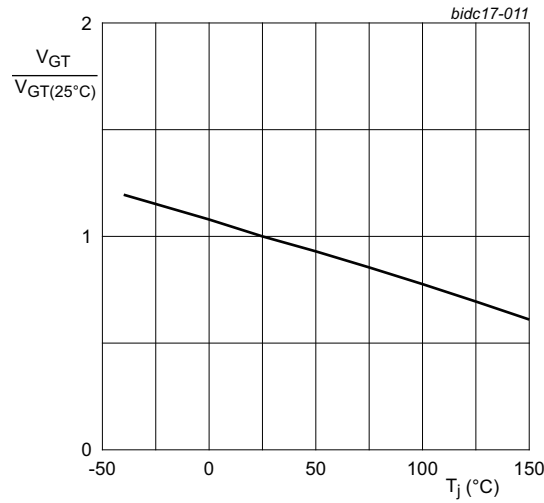
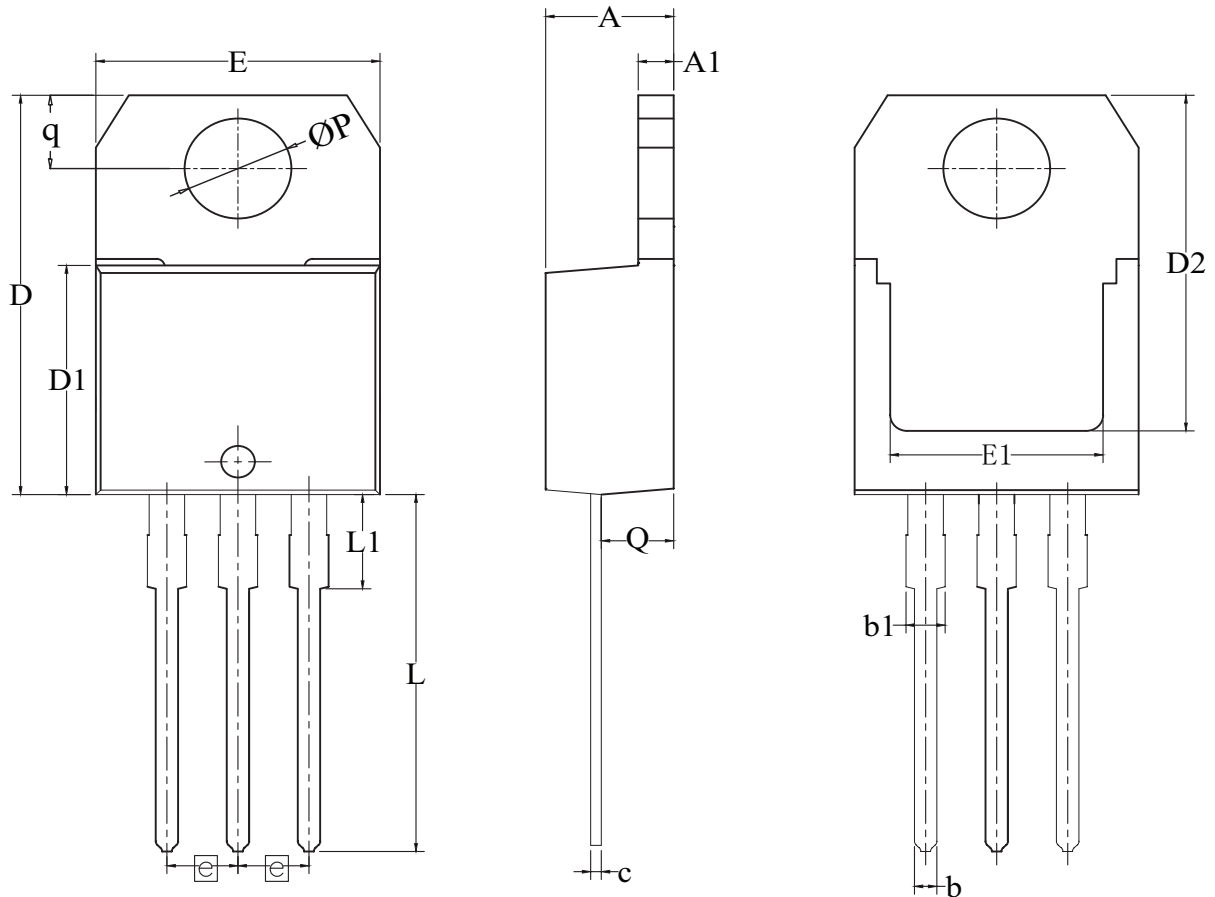


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



**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.
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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Date of release: 16 January 2019

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