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# IMPORTANT NOTICE

10 December 2015

## 1. Global joint venture starts operations as WeEn Semiconductors

Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

In this document where the previous NXP references remain, please use the new links as shown below.

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WeEn Semiconductors





# BT138Y-800E

4Q Triac

1 May 2015

Product data sheet

## 1. General description

Planar passivated sensitive gate four quadrant triac in an internally insulated SOT78D (TO-220AB) plastic package intended for use in general purpose bidirectional switching and phase control applications. This sensitive gate "series E" triac can be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits. The internally insulated mounting base gives good thermal performance combined with ease of handling and assembly by the user.

## 2. Features and benefits

- 2500 V RMS isolation voltage capability
- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drivers and microcontrollers
- High blocking voltage capability
- Industry standard TO-220 package for ease of handling
- Isolated mounting base
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate
- Triggering in all four quadrants

## 3. Applications

- 230 V lamp dimmers
- General-purpose switching and phase control

## 4. Quick reference data

Table 1. Quick reference data

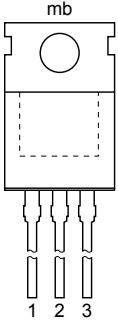

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	800	V
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	95	A
$I_{T(\text{RMS})}$	RMS on-state current	full sine wave; $T_{mb} \leq 85\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	12	A
<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>	-	-	10	mA



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>	-	-	10	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>	-	-	10	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>	-	-	25	mA

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 <p>TO-220AB (SOT78D)</p>	
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

## 6. Ordering information

Table 3. Ordering information

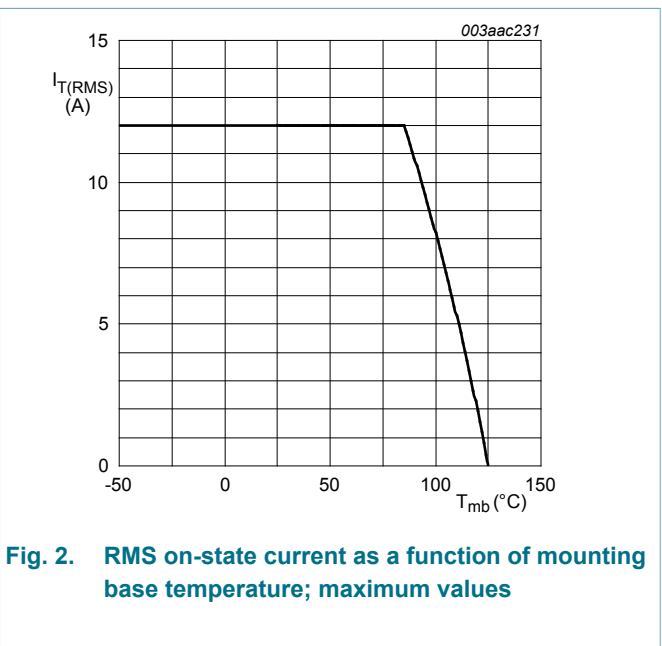
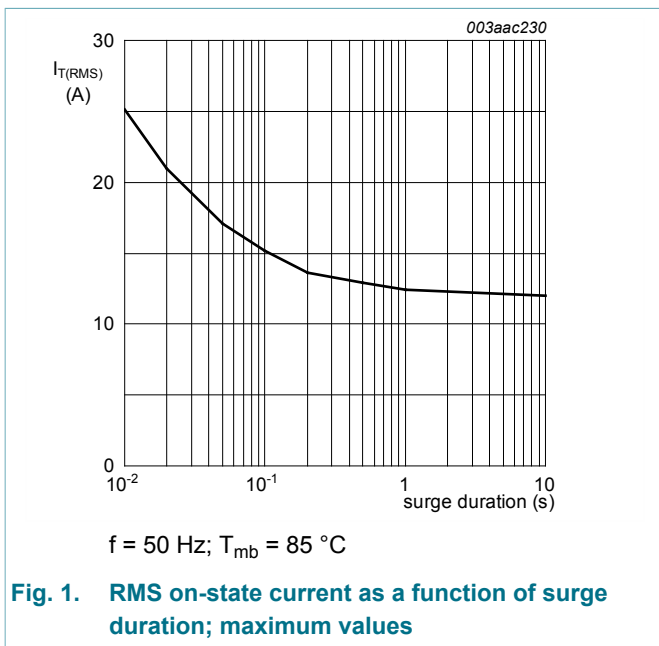
Type number	Package		
	Name	Description	Version
BT138Y-800E	TO-220AB	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D

## 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		-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 85\text{ °C}$ ; <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; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	95	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$	-	105	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; SIN	-	45	$A^2s$
$dl_T/dt$	rate of rise of on-state current	$I_G = 20\text{ mA}$ ; T2+ G+	-	50	$A/\mu s$
		$I_G = 20\text{ mA}$ ; T2+ G-	-	50	$A/\mu s$
		$I_G = 50\text{ mA}$ ; T2- G+	-	10	$A/\mu s$
		$I_G = 20\text{ mA}$ ; T2- G-	-	50	$A/\mu s$
$I_{GM}$	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	$^{\circ}C$
$T_j$	junction temperature		-	125	$^{\circ}C$



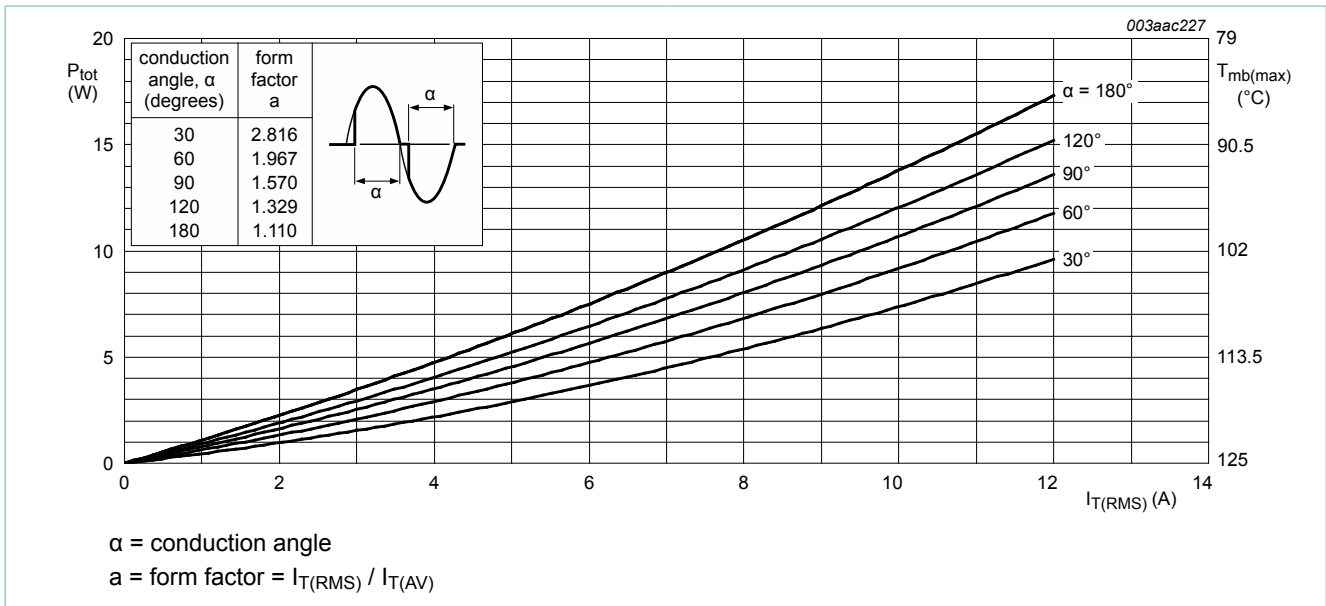


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

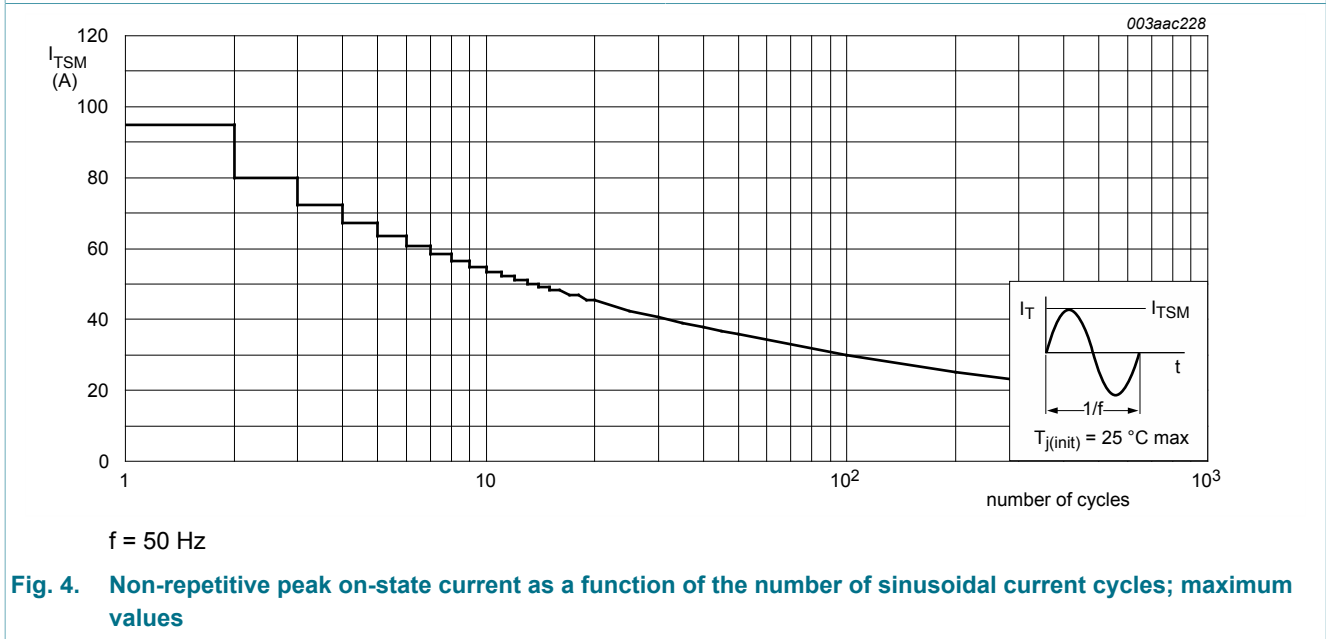


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

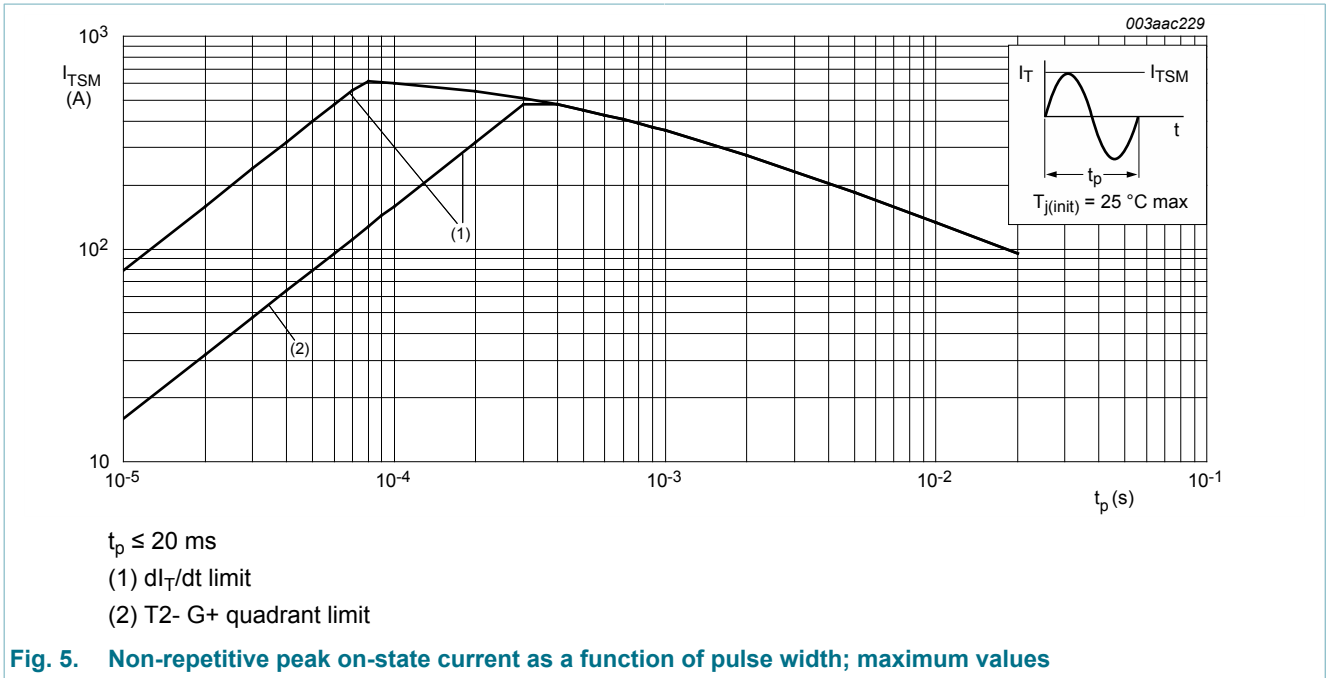


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

## 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; <a href="#">Fig. 6</a>	-	-	2.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; full cycle	-	60	-	K/W

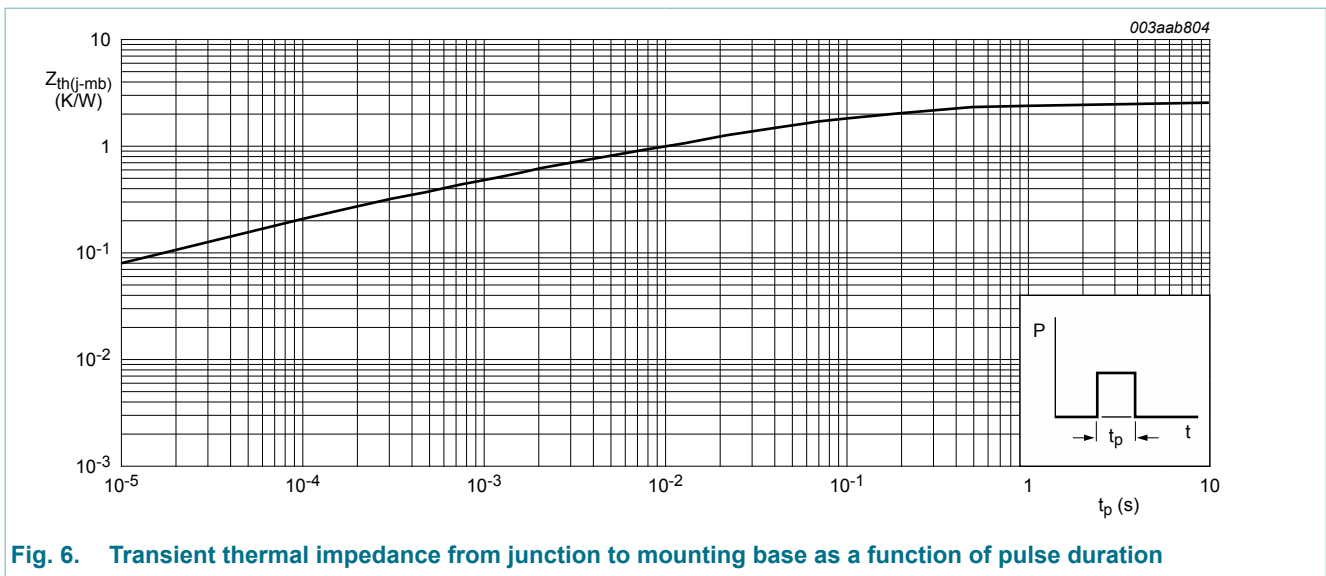


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 9. Isolation characteristics

Table 6. Isolation characteristics

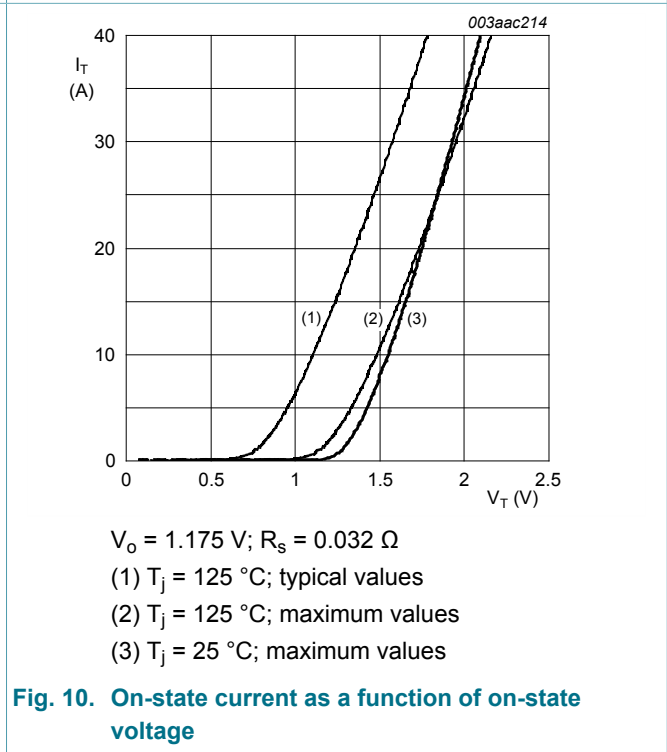
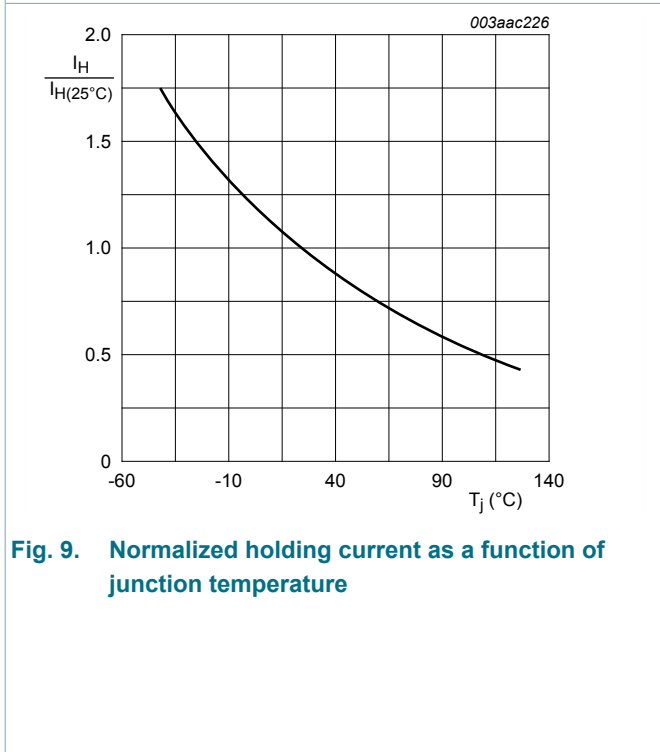
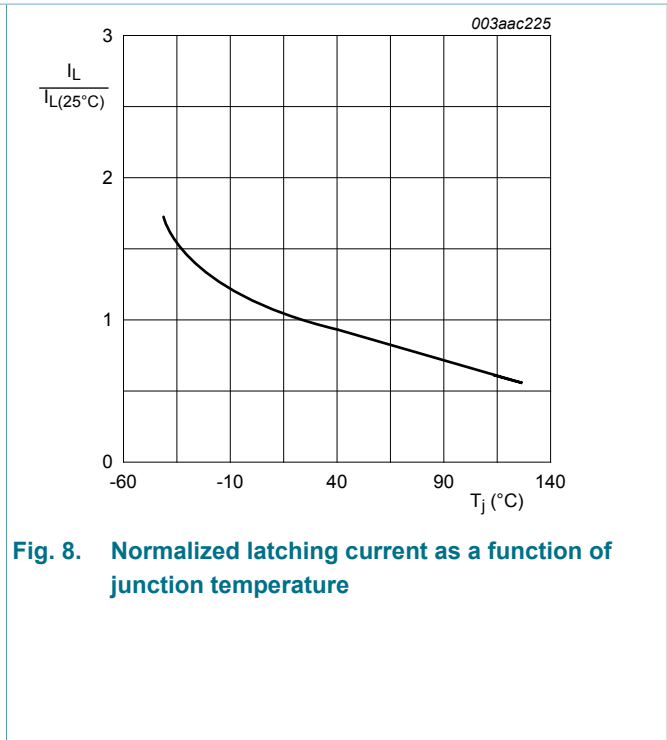
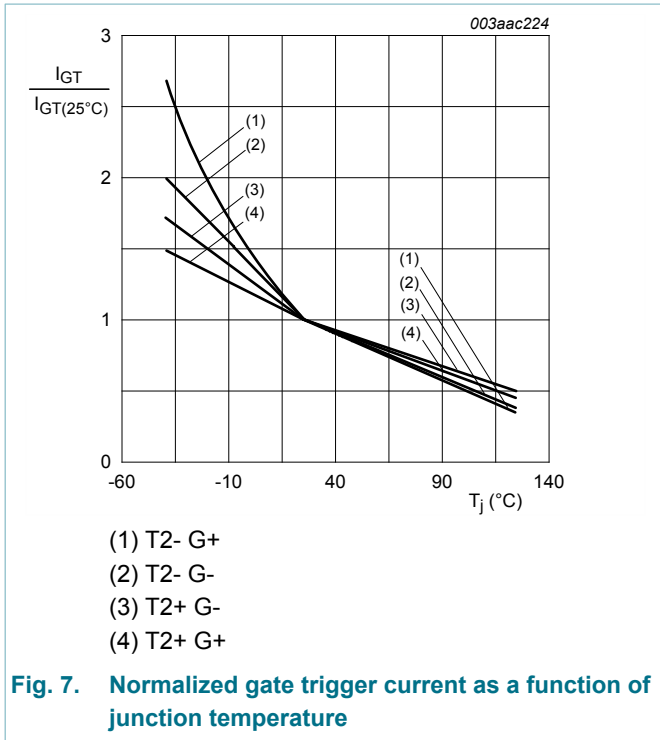
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_{mb} = 25\text{ }^\circ\text{C}$	-	-	2500	V
$C_{isol}$	isolation capacitance	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
<b>Static characteristics</b>						
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	-	10	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	-	10	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	-	10	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>	-	-	25	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	30	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	40	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	30	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	40	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	-	30	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 15 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>	-	1.4	1.65	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>	-	0.7	1	V
		V <sub>D</sub> = 800 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 125 °C; <a href="#">Fig. 11</a>	0.25	0.4	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 800 V; T <sub>j</sub> = 125 °C	-	0.1	0.5	mA
<b>Dynamic characteristics</b>						
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 536 V; T <sub>j</sub> = 125 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit	-	50	-	V/μs
t <sub>gt</sub>	gate-controlled turn-on time	I <sub>TM</sub> = 16 A; V <sub>D</sub> = 800 V; I <sub>G</sub> = 100 mA; dI <sub>G</sub> /dt = 5 A/μs	-	2	-	μs



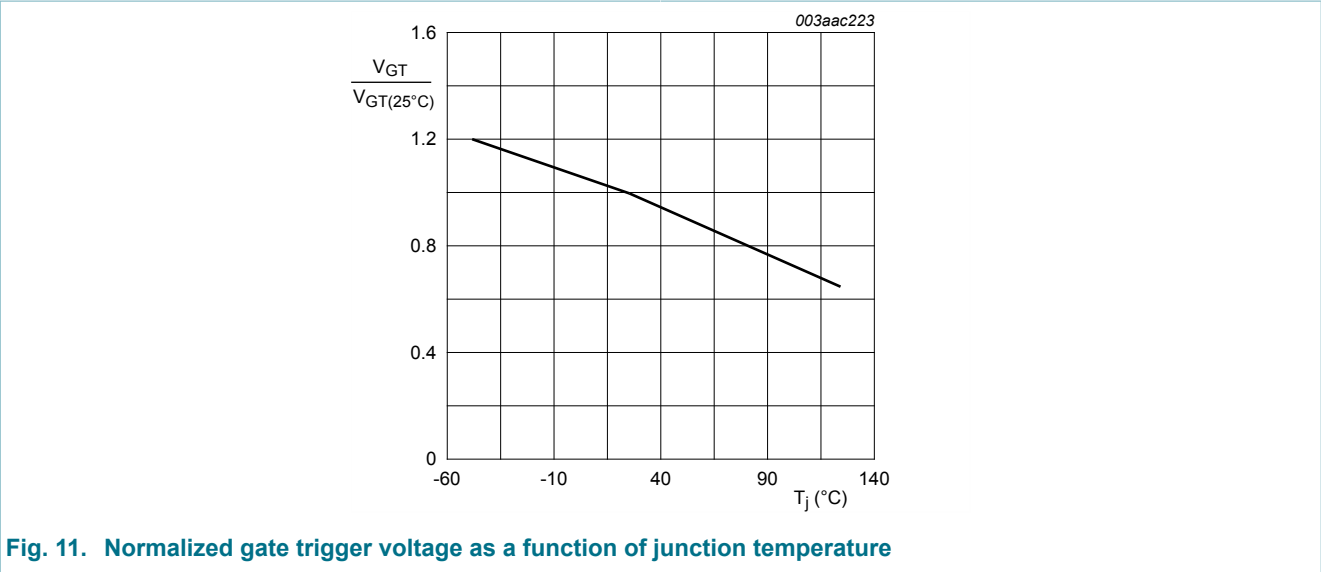
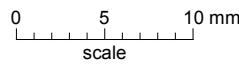
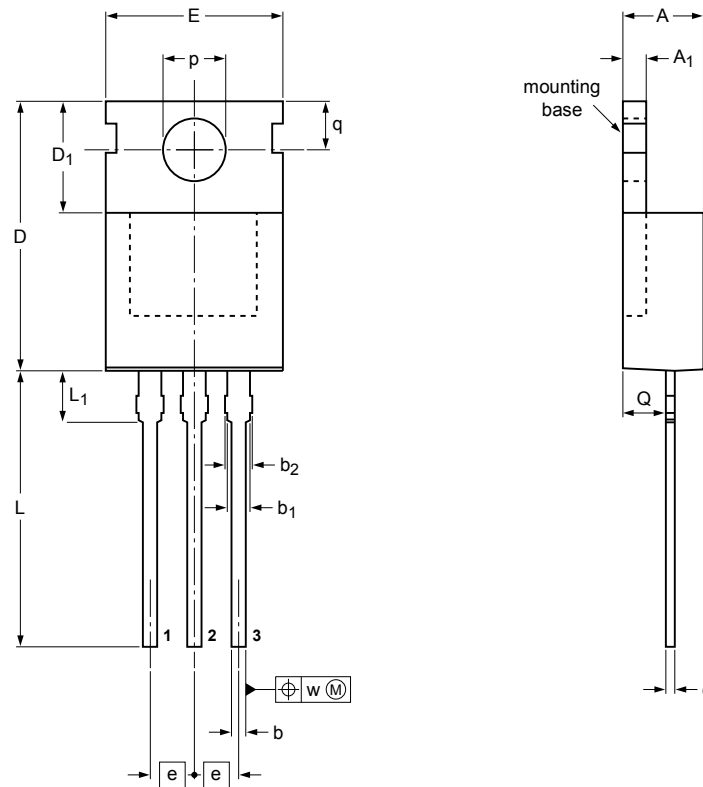


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

### 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 <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	c	D	D <sub>1</sub> ref	E	e	L	L <sub>1</sub> 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

Fig. 12. Package outline TO-220AB (SOT78D)

## 12. Legal information

### 12.1 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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