

NXP BT138Y-600E 4Q Triac datasheet

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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.

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BT138Y-600E

4Q Triac

29 October 2013

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		-	-	600	V
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{J}(\text{init})} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	-	95	A
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 85\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	-	12	A
Static characteristics						
I_{GT}	gate trigger current	$V_{\text{D}} = 12\text{ V}$; $I_{\text{T}} = 0.1\text{ A}$; T2+ G+; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$; Fig. 7	-	-	10	mA



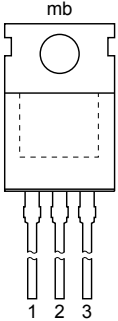

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7	-	-	10	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7	-	-	10	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7	-	-	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>	 <p>sym051</p>
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

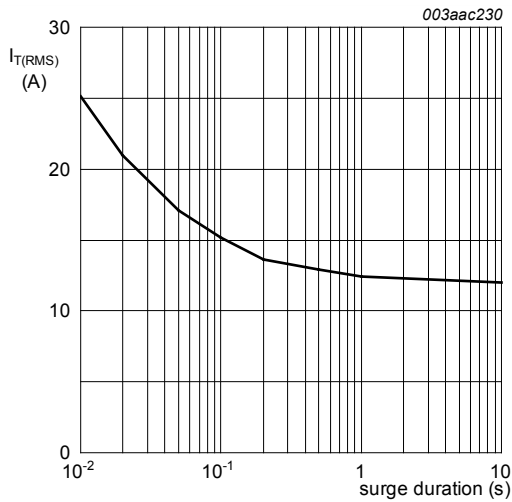
Type number	Package		
	Name	Description	Version
BT138Y-600E	TO-220AB	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D

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		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 85\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	12	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	95	A
		full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	105	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; SIN	-	45	A^2s
di_T/dt	rate of rise of on-state current	$I_T = 20\text{ A}$; $I_G = 200\text{ mA}$; $di_G/dt = 0.2\text{ A}/\mu s$; T2+ G+	-	50	$A/\mu s$
		$I_T = 20\text{ A}$; $I_G = 200\text{ mA}$; $di_G/dt = 0.2\text{ A}/\mu s$; T2+ G-	-	50	$A/\mu s$
		$I_T = 20\text{ A}$; $I_G = 200\text{ mA}$; $di_G/dt = 0.2\text{ A}/\mu s$; T2- G-	-	50	$A/\mu s$
		$I_T = 20\text{ A}$; $I_G = 200\text{ mA}$; $di_G/dt = 0.2\text{ A}/\mu s$; T2- G+	-	10	$A/\mu s$
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	$^{\circ}C$



f = 50 Hz; T_{mb} = 85 °C

Fig. 1. RMS on-state current as a function of surge duration; maximum values

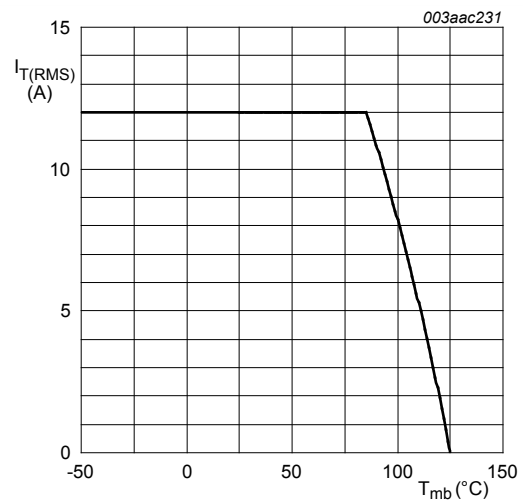
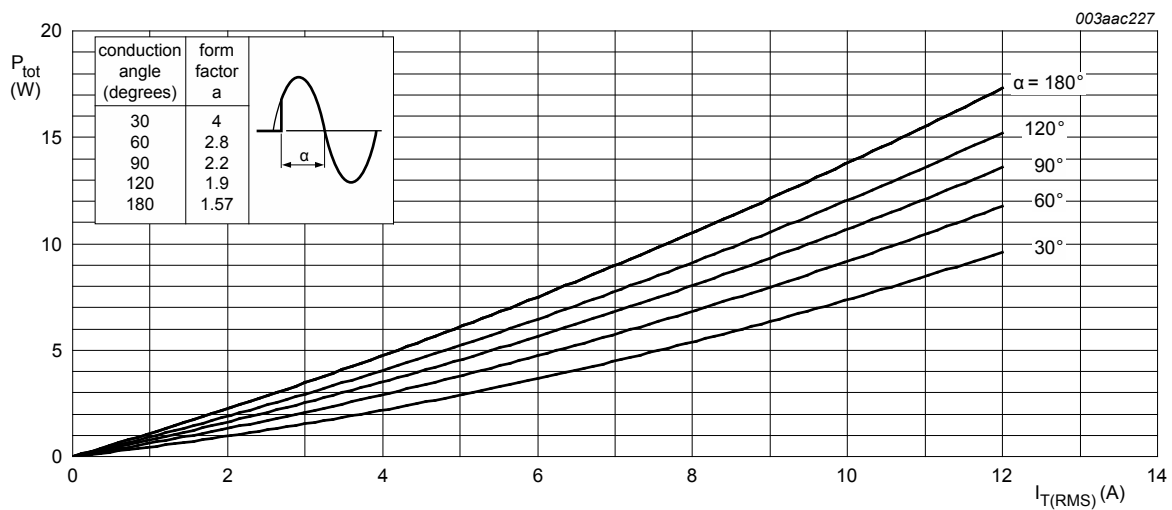


Fig. 2. RMS on-state current as a function of mounting base temperature; maximum values



α = 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

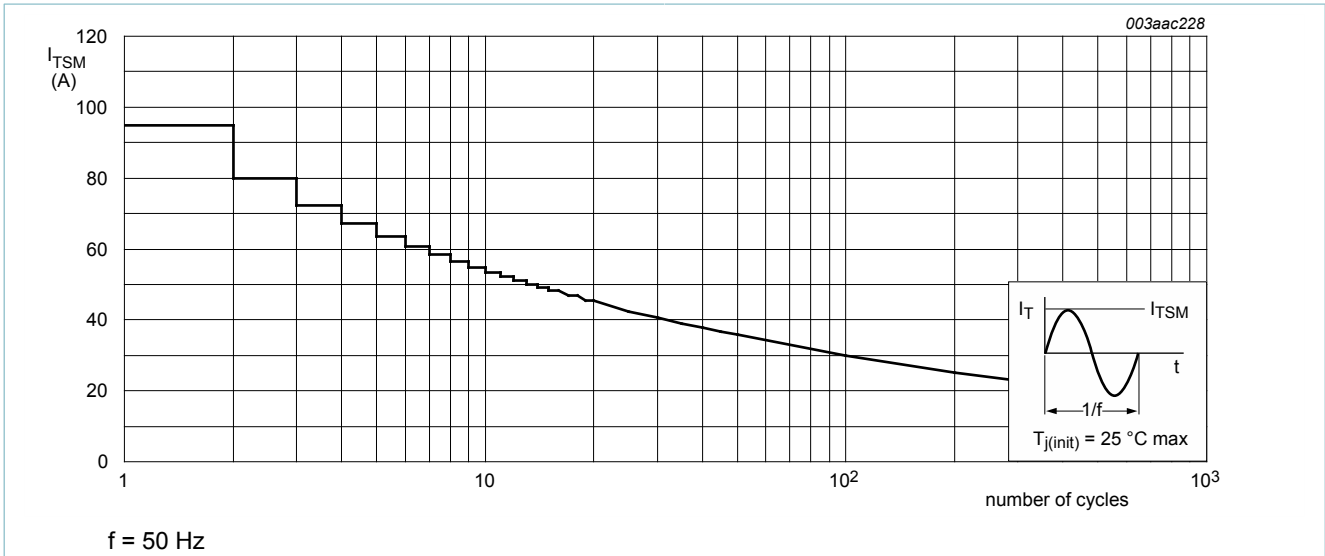


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

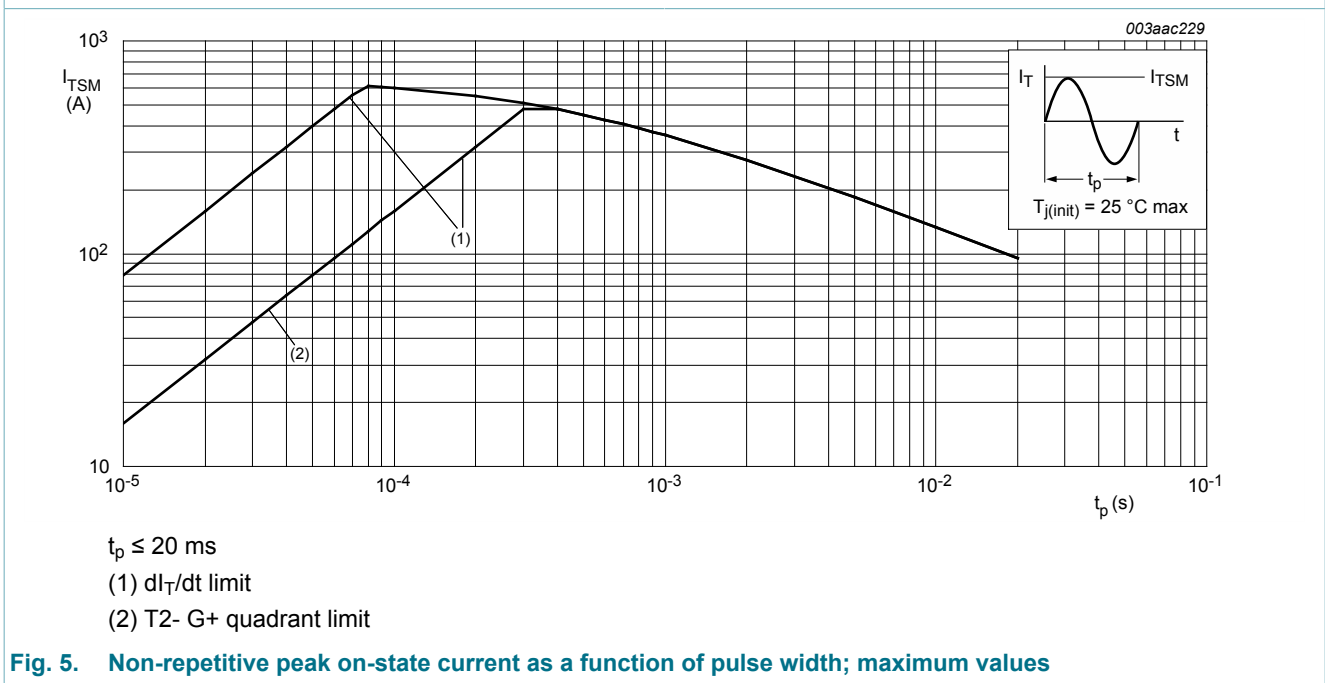


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

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

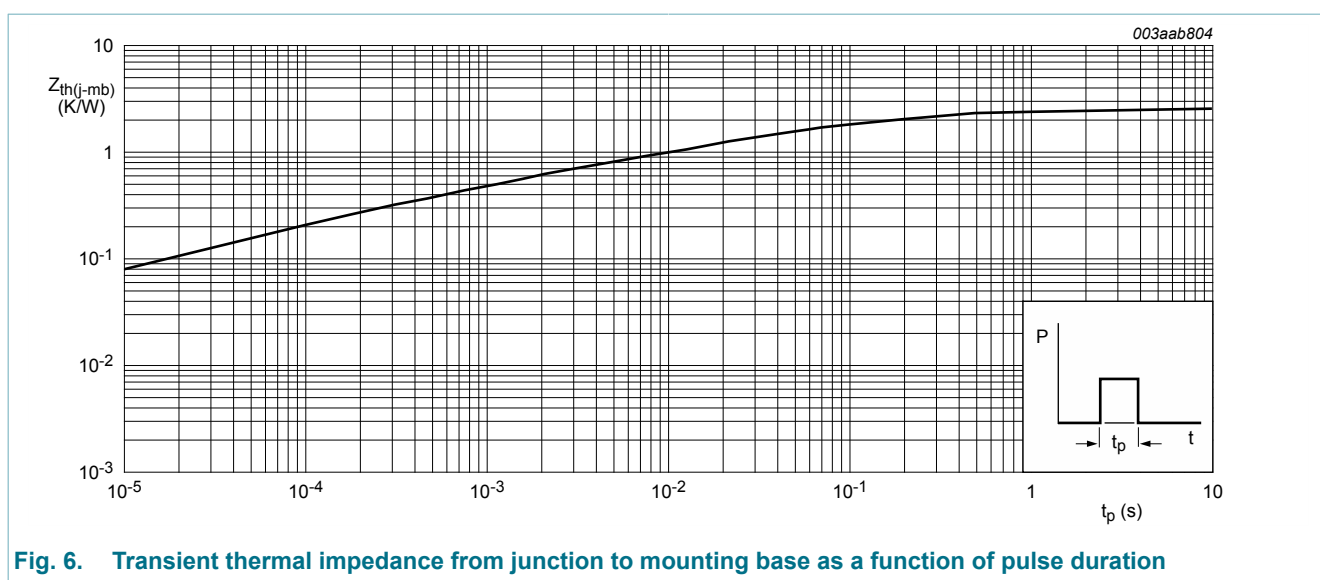


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Isolation characteristics

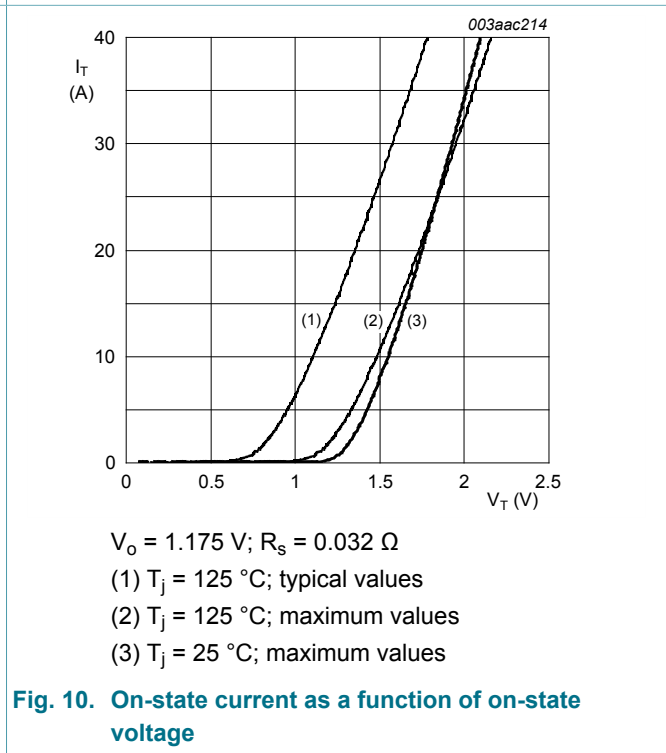
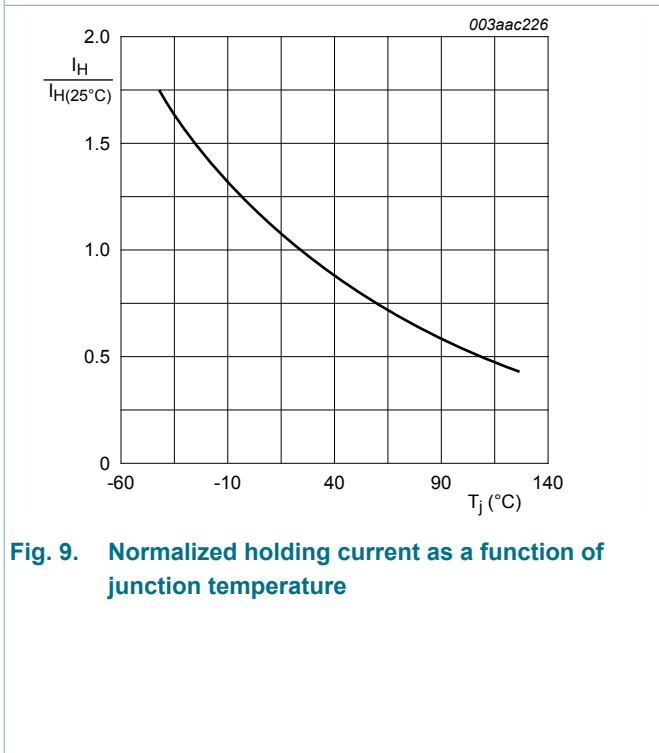
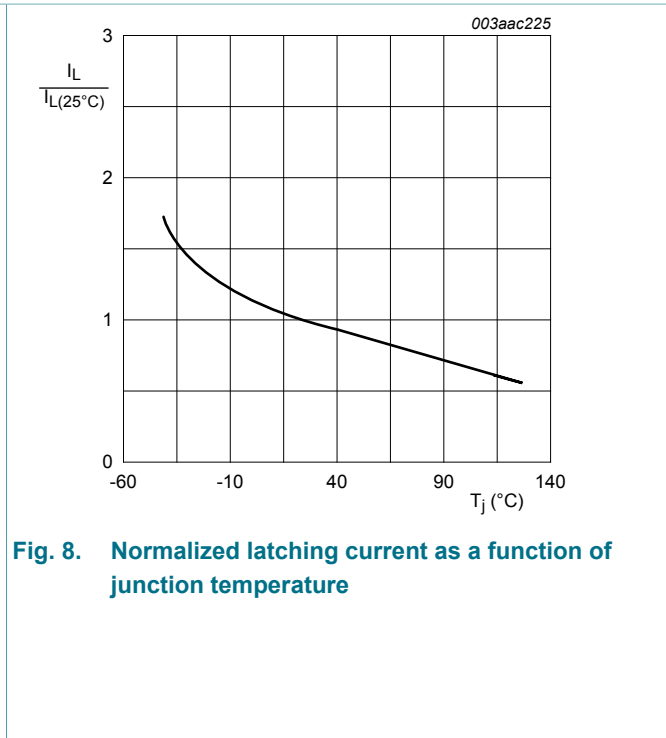
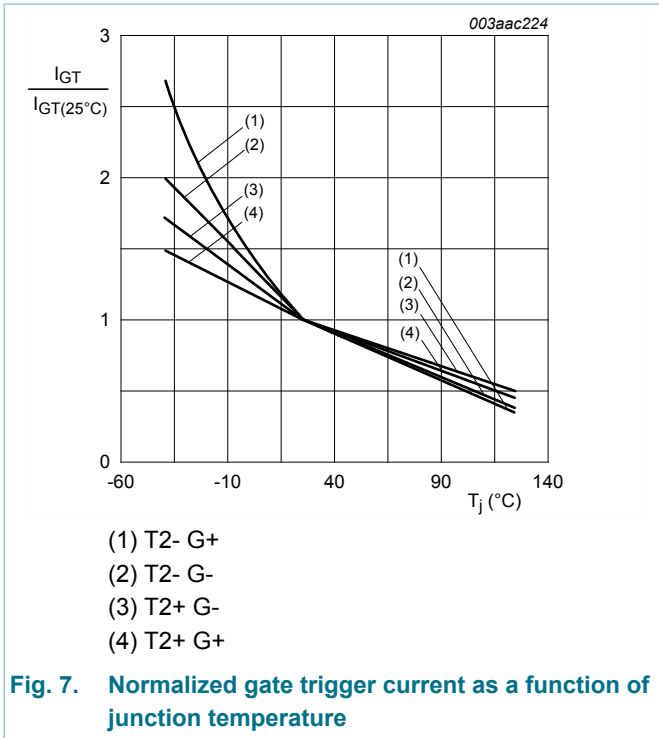
Table 6. Isolation characteristics

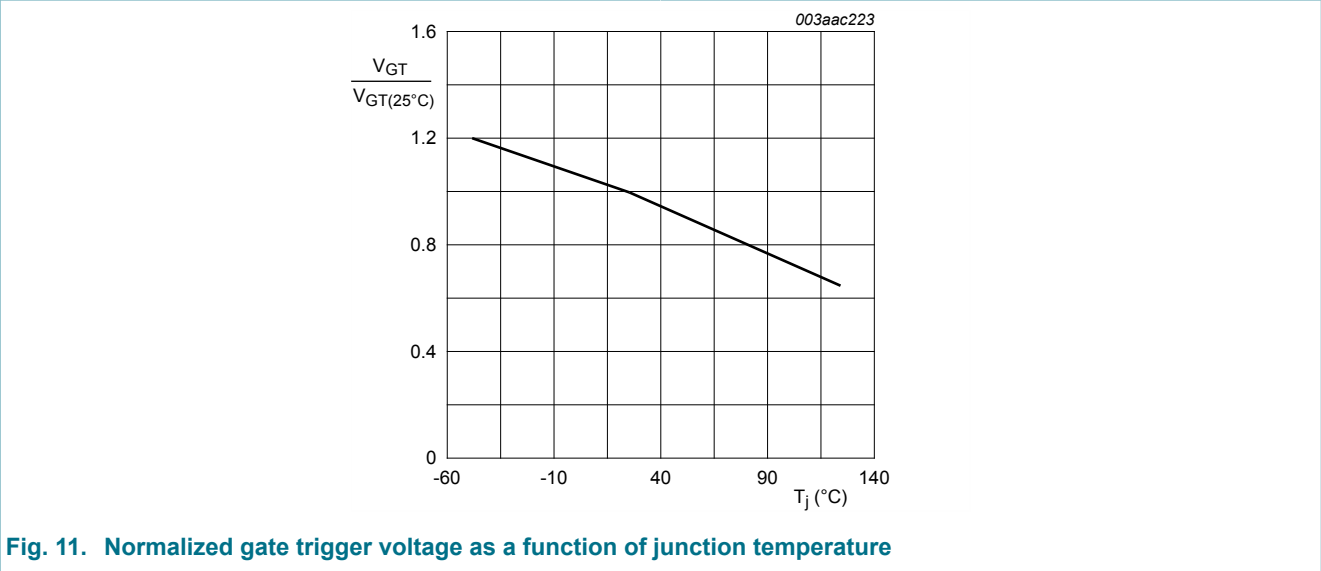
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free ; $50\text{ Hz} \leq f \leq 60\text{ Hz}$; $RH \leq 65\%$; $T_{mb} = 25\text{ }^\circ\text{C}$	-	-	2500	V
C_{isol}	isolation capacitance	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 V; I _T = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 7	-	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 7	-	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2- G+; T _j = 25 °C; Fig. 7	-	-	10	mA
		V _D = 12 V; I _T = 0.1 A; T2- G-; T _j = 25 °C; Fig. 7	-	-	25	mA
I _L	latching current	V _D = 12 V; I _G = 0.1 A; T2+ G+; T _j = 25 °C; Fig. 8	-	-	30	mA
		V _D = 12 V; I _G = 0.1 A; T2+ G-; T _j = 25 °C; Fig. 8	-	-	40	mA
		V _D = 12 V; I _G = 0.1 A; T2- G-; T _j = 25 °C; Fig. 8	-	-	30	mA
		V _D = 12 V; I _G = 0.1 A; T2- G+; T _j = 25 °C; Fig. 8	-	-	40	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 9	-	-	30	mA
V _T	on-state voltage	I _T = 15 A; T _j = 25 °C; Fig. 10	-	1.4	1.65	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 = 600 V; I _T = 0.1 A; T _j = 125 °C; Fig. 11	0.25	0.4	-	V
I _D	off-state current	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	-	50	-	V/μs
t _{gt}	gate-controlled turn-on time	I _{TM} = 16 A; V _D = 600 V; I _G = 100 mA; dI _G /dt = 5 A/μs	-	2	-	μs





11. Package outline

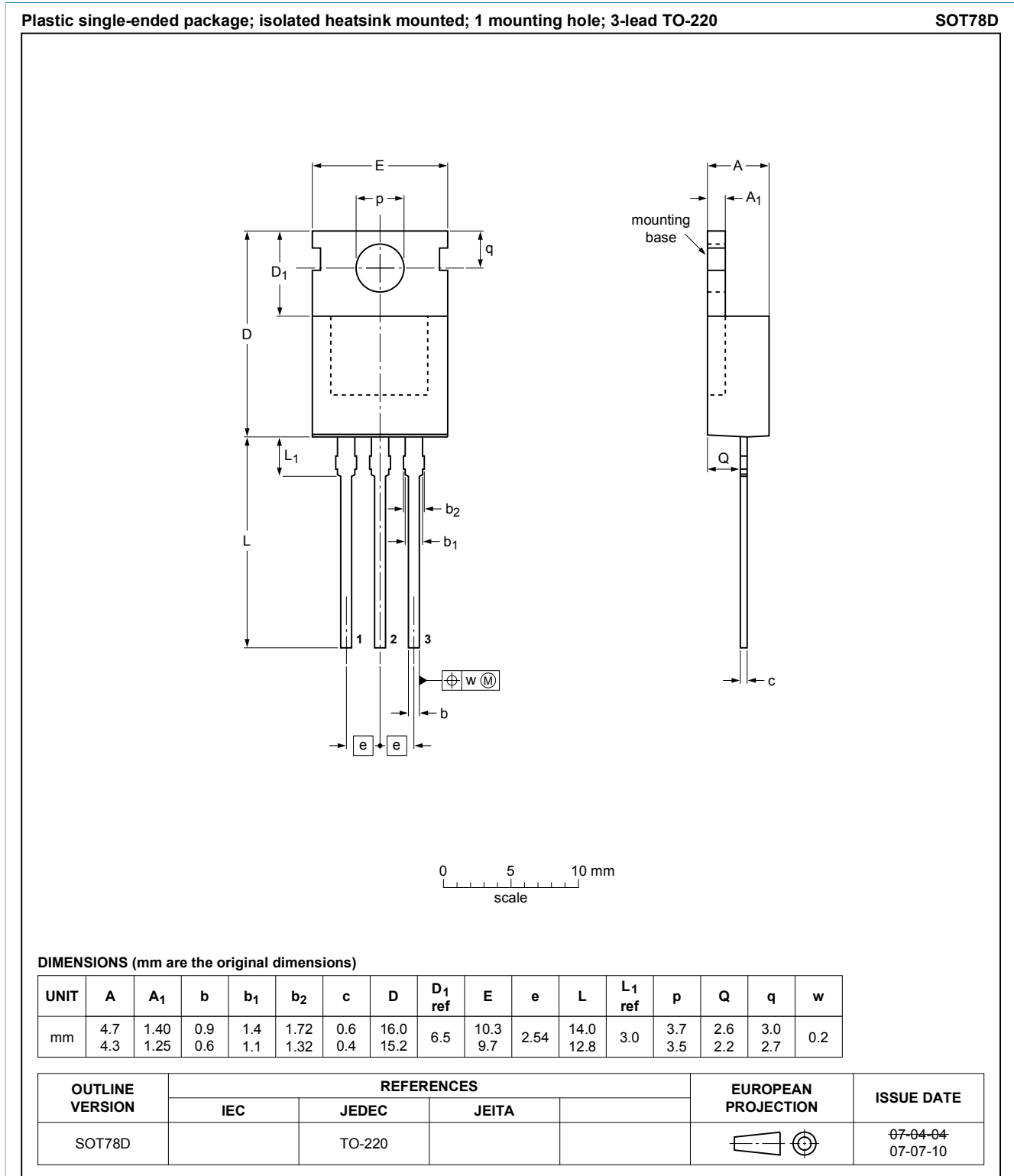


Fig. 12. Package outline TO-220AB (SOT78D)

12. Legal information

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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