

# BT138Y series E

12 A four-quadrant triacs, sensitive gate, insulated

Rev. 01 — 3 June 2008

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated sensitive gate triac in an internally insulated TO-220 plastic package.

### 1.2 Features

- Isolated mounting base
- Sensitive gate
- Direct interfacing to logic level ICs
- 2500 V RMS isolation voltage
- Gate triggering in four quadrants
- Direct interfacing to low-power gate drive circuits

### 1.3 Applications

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

### 1.4 Quick reference data

- $I_{T(RMS)} \leq 12$  A
- $V_{DRM} \leq 600$  V (BT138Y-600E)
- $V_{DRM} \leq 800$  V (BT138Y-800E)
- $I_{GT} \leq 10$  mA
- $I_{GT} \leq 25$  mA (T2– G+)
- $I_{TSM} \leq 95$  A (t = 20 ms)

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	main terminal 1 (T1)	<p>SOT78D (TO-220)</p>	<p>sym051</p>
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base; isolated		

### 3. Ordering information

**Table 2. Ordering information**

Type number	Package		Version
	Name	Description	
BT138Y-600E	TO-220	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220	SOT78D
BT138Y-800E			

### 4. Limiting values

**Table 3. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage	BT138Y-600E	[1]	600	V
		BT138Y-800E	-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_{\text{mb}} \leq 85\text{ °C}$ ; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	12	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25\text{ °C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 20\text{ ms}$	-	95	A
		$t = 16.7\text{ ms}$	-	105	A
$I^2t$	$I^2t$ for fusing	$t_{\text{p}} = 10\text{ ms}$	-	45	A <sup>2</sup> s
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{TM}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$			
		T2+ G+	-	50	A/ $\mu\text{s}$
		T2+ G-	-	50	A/ $\mu\text{s}$
		T2- G-	-	50	A/ $\mu\text{s}$
		T2- G+	-	10	A/ $\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$P_{\text{GM}}$	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
$T_{\text{stg}}$	storage temperature		-40	+150	°C
$T_{\text{j}}$	junction temperature		-	125	°C

[1] Although not recommended, off-state voltages up to 800 V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/ $\mu\text{s}$ .

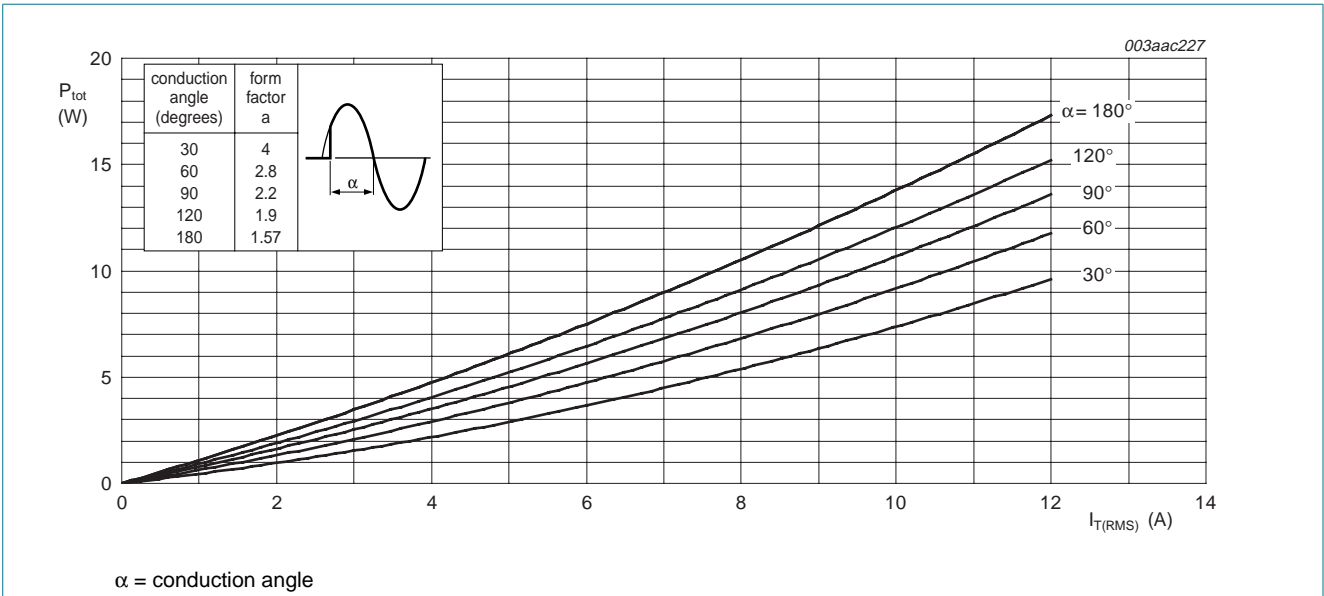


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

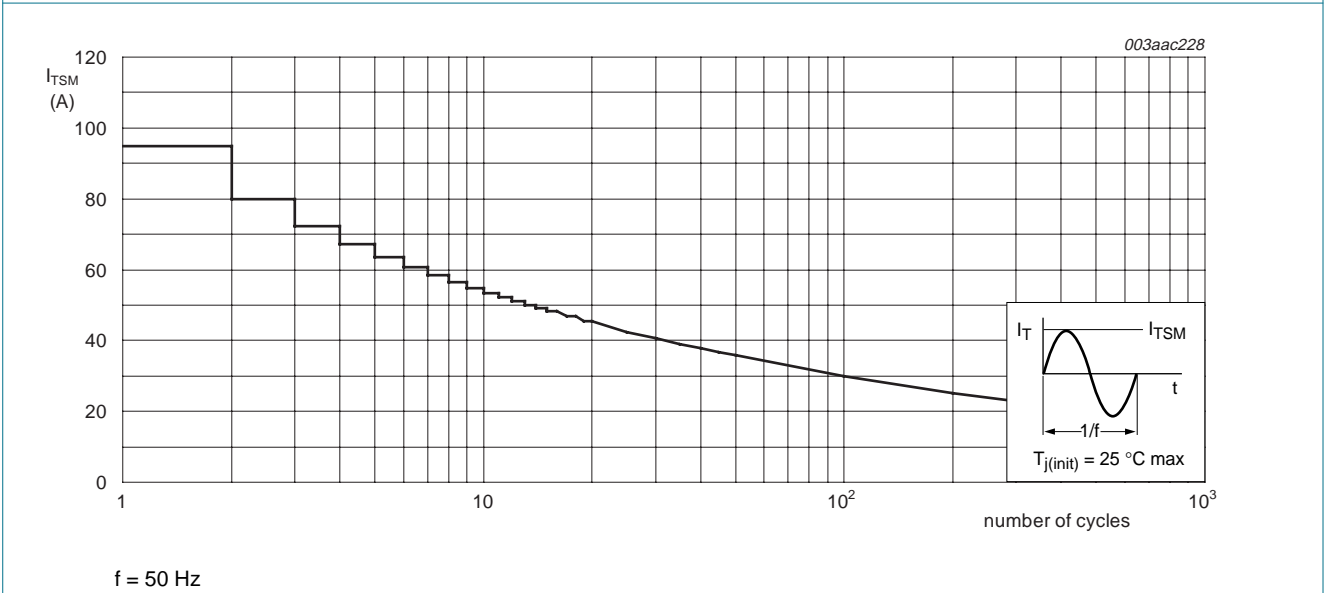


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

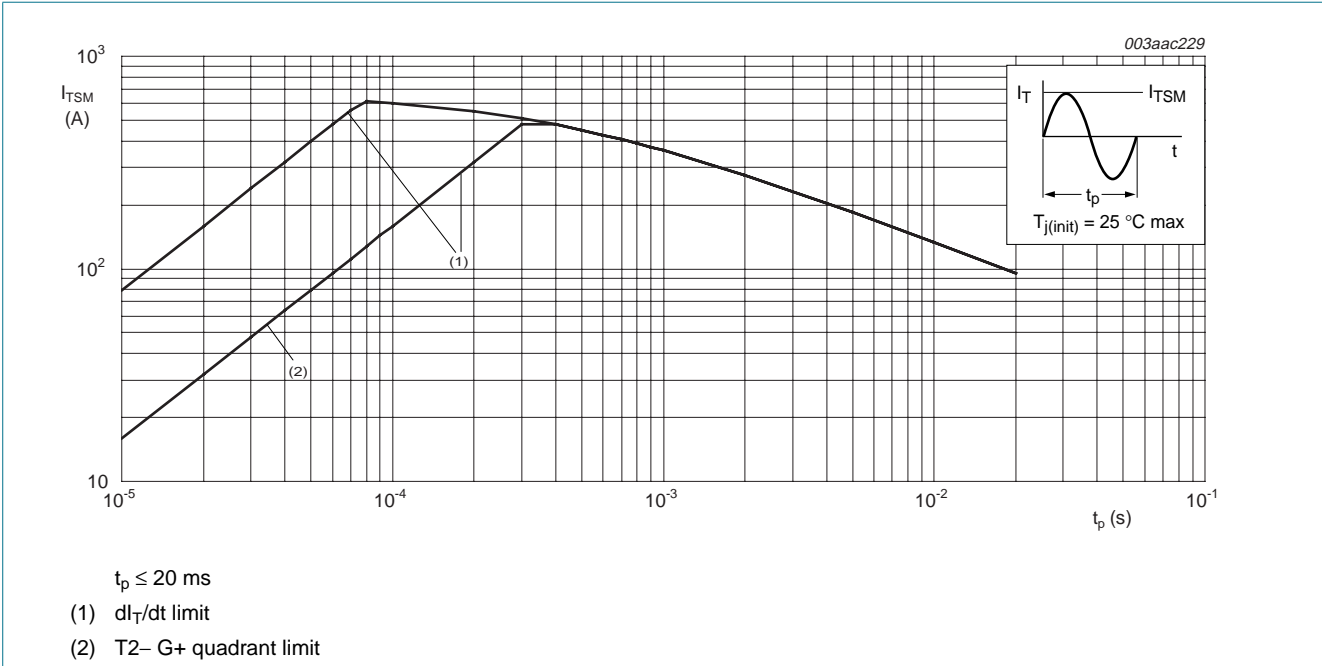


Fig 3. Non-repetitive peak on-state current as a function of pulse width; maximum values

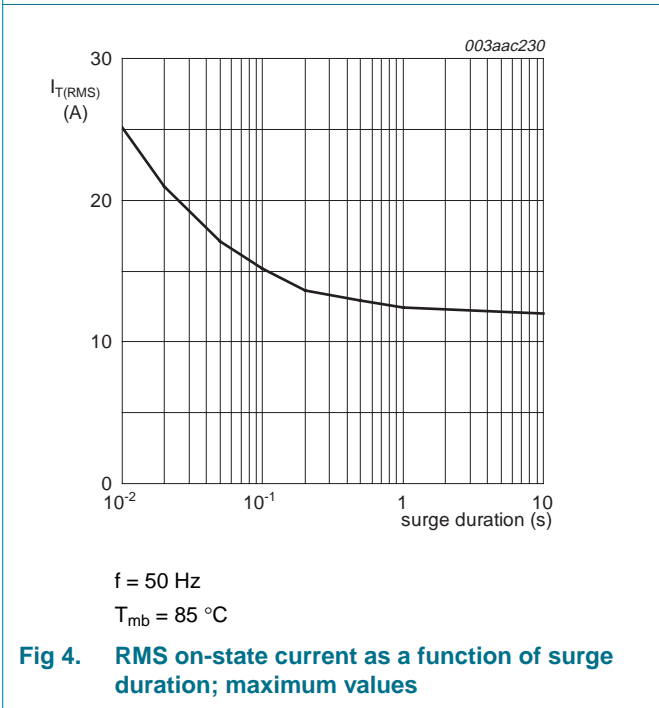


Fig 4. RMS on-state current as a function of surge duration; maximum values

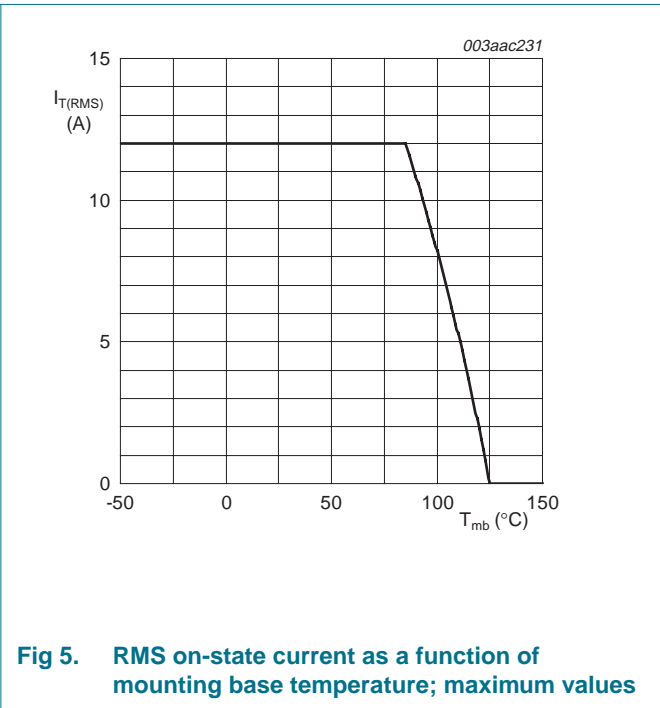


Fig 5. RMS on-state current as a function of mounting base temperature; maximum values

### 5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; see Figure 6	-	-	2.3	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	full cycle; in free air	-	60	-	K/W

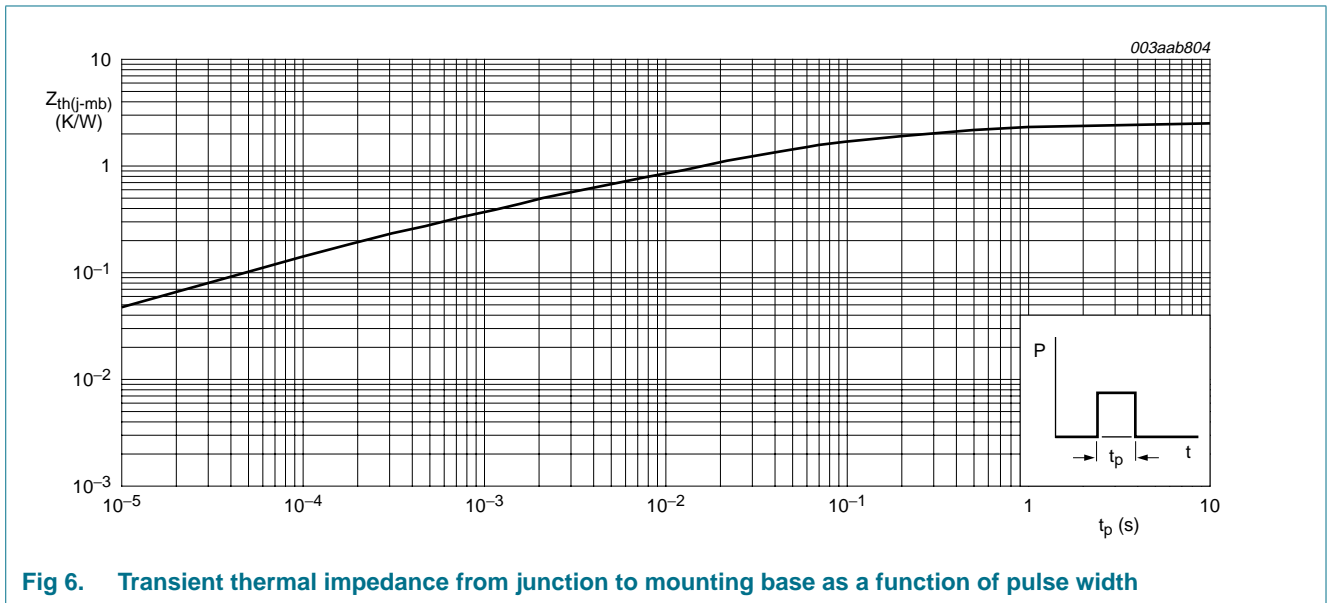


Fig 6. Transient thermal impedance from junction to mounting base as a function of pulse width

### 6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

$T_h = 25\text{ }^\circ\text{C}$  unless otherwise specified.

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

## 7. Static characteristics

**Table 6. Static characteristics**

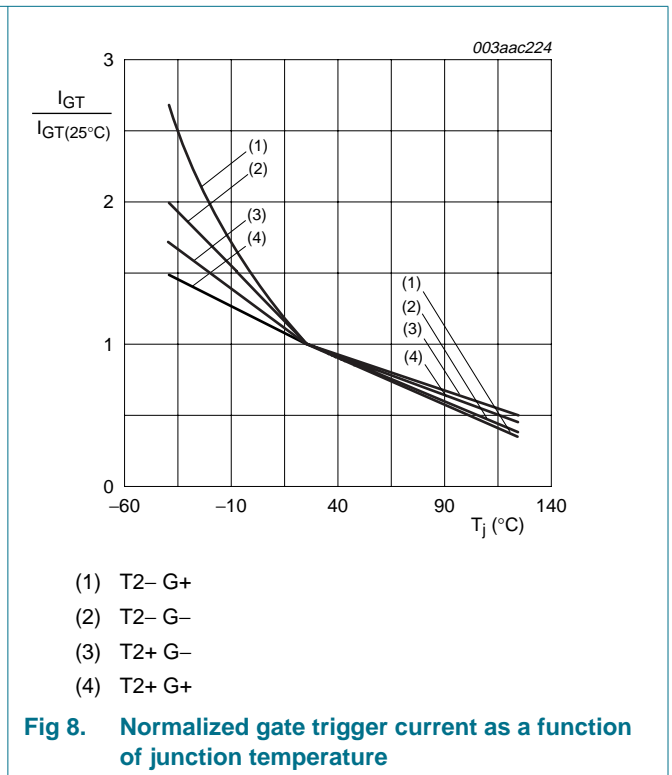
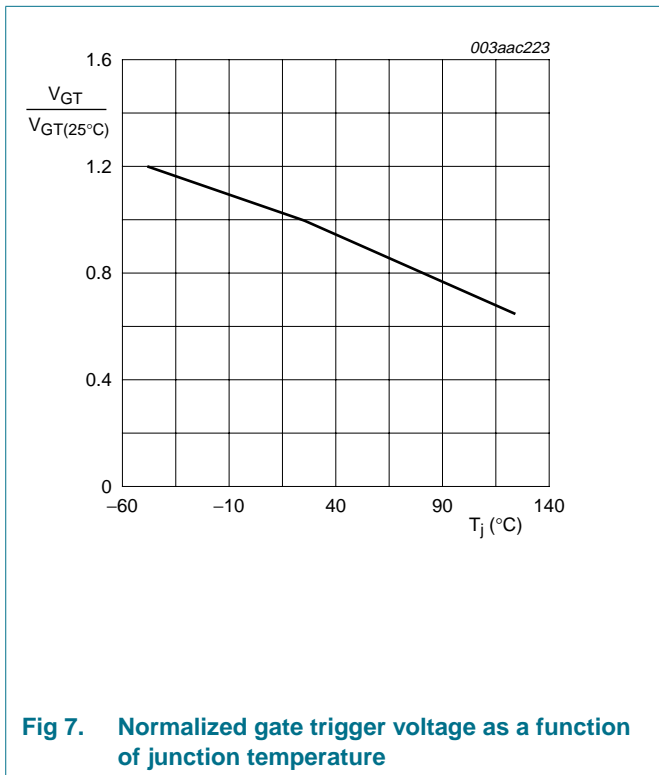
$T_j = 25\text{ °C}$  unless otherwise specified.

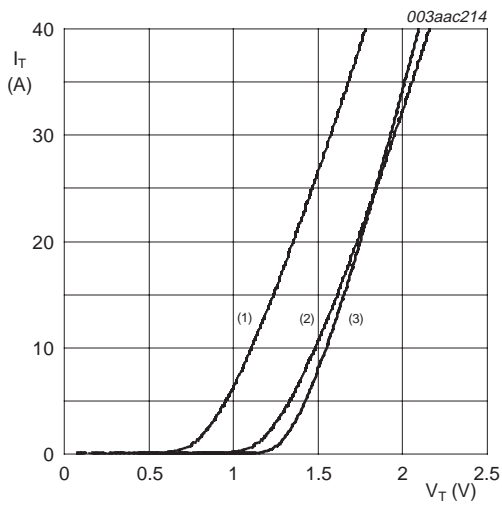
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 8</a>				
		T2+ G+	-	-	10	mA
		T2+ G-	-	-	10	mA
		T2- G-	-	-	10	mA
		T2- G+	-	-	25	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; see <a href="#">Figure 10</a>				
		T2+ G+	-	-	30	mA
		T2+ G-	-	-	40	mA
		T2- G-	-	-	30	mA
		T2- G+	-	-	40	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; see <a href="#">Figure 11</a>	-	-	30	mA
$V_T$	on-state voltage	$I_T = 15\text{ A}$ ; see <a href="#">Figure 9</a>	-	1.4	1.65	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 7</a>	-	0.7	1.5	V
		$V_D = V_{DRM}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$	0.25	0.4	-	V
$I_D$	off-state current	$V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	mA

**8. Dynamic characteristics**

**Table 7. Dynamic characteristics**

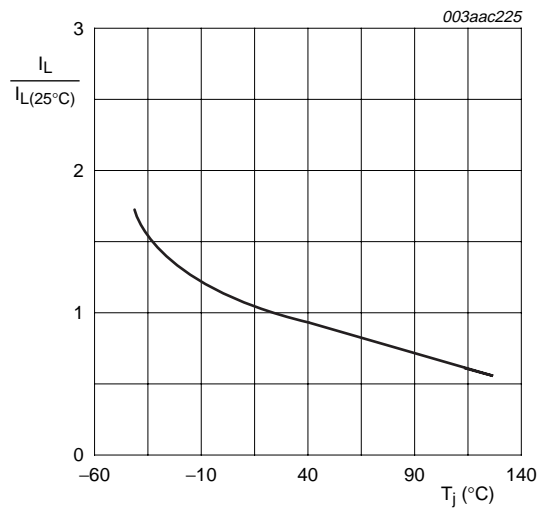
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 0.67 \times V_{DRM(max)}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; exponential waveform; gate open circuit	-	50	-	V/ $\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 16\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	$\mu\text{s}$



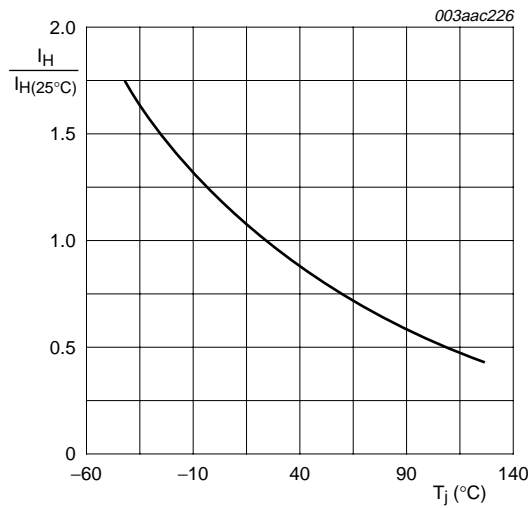


$V_o = 1.175 \text{ V}$   
 $R_s = 0.032 \text{ } \Omega$   
 (1)  $T_j = 125 \text{ } ^\circ\text{C}$ ; typical values  
 (2)  $T_j = 125 \text{ } ^\circ\text{C}$ ; maximum values  
 (3)  $T_j = 25 \text{ } ^\circ\text{C}$ ; maximum values

**Fig 9. On-state current as a function of on-state voltage**



**Fig 10. Normalized latching current as a function of junction temperature**



**Fig 11. Normalized holding current as a function of junction temperature**



9. Package outline

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

SOT78D

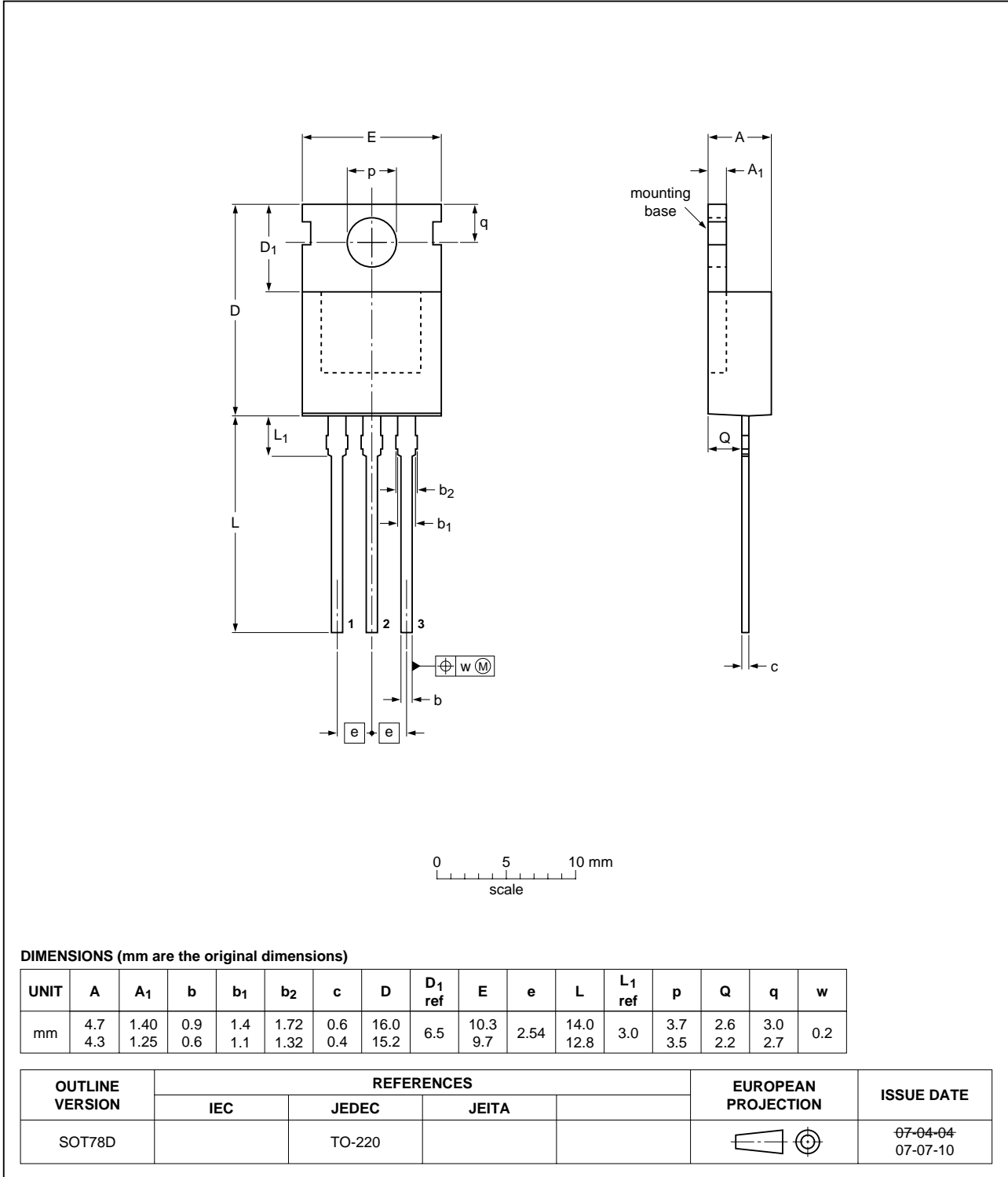


Fig 12. Package outline SOT78D (TO-220)

## 10. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BT138Y_SER_E_1	20080603	Product data sheet	-	-

## 11. Legal information

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Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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