

# BTA312X series D and E

12 A Three-quadrant triacs high commutation

Rev. 01 — 16 April 2007

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated, new generation, high commutation triacs in a SOT186A full pack plastic package

### 1.2 Features

- Sensitive gate
- Very high commutation performance maximized at each gate sensitivity
- High immunity to dV/dt
- High isolation voltage

### 1.3 Applications

- High power motor control - e.g. washing machines, vacuum cleaners
- Electronic thermostats
- Refrigeration and air conditioning compressors

### 1.4 Quick reference data

- $V_{DRM} \leq 600$  V (BTA312X-600D/E)
- $V_{DRM} \leq 800$  V (BTA312X-800E)
- $I_{TSM} \leq 95$  A ( $t = 20$  ms)
- $I_{GT} \leq 10$  mA (BTA312X series E)
- $I_{GT} \leq 5$  mA (BTA312X-600D)
- $I_{T(RMS)} \leq 12$  A

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)		
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base; isolated		

**SOT186A (TO-220F)**

### 3. Ordering information

**Table 2. Ordering information**

Type number	Package		Version
	Name	Description	
BTA312X-600D	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack'	SOT186A
BTA312X-600E			
BTA312X-800E			

### 4. Limiting values

**Table 3. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage	BTA312X-600D; BTA312X-600E BTA312X-800E	[1] -	600 800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 61$ °C; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	12	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_j = 25$ °C prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 20$ ms	-	95	A
		$t = 16.7$ ms	-	105	A
$I^2t$	$I^2t$ for fusing	$t = 10$ ms	-	45	A <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_{TM} = 20$ A; $I_G = 0.2$ A; $di_G/dt = 0.2$ A/ $\mu$ s	-	100	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	°C
$T_j$	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/ $\mu$ s.

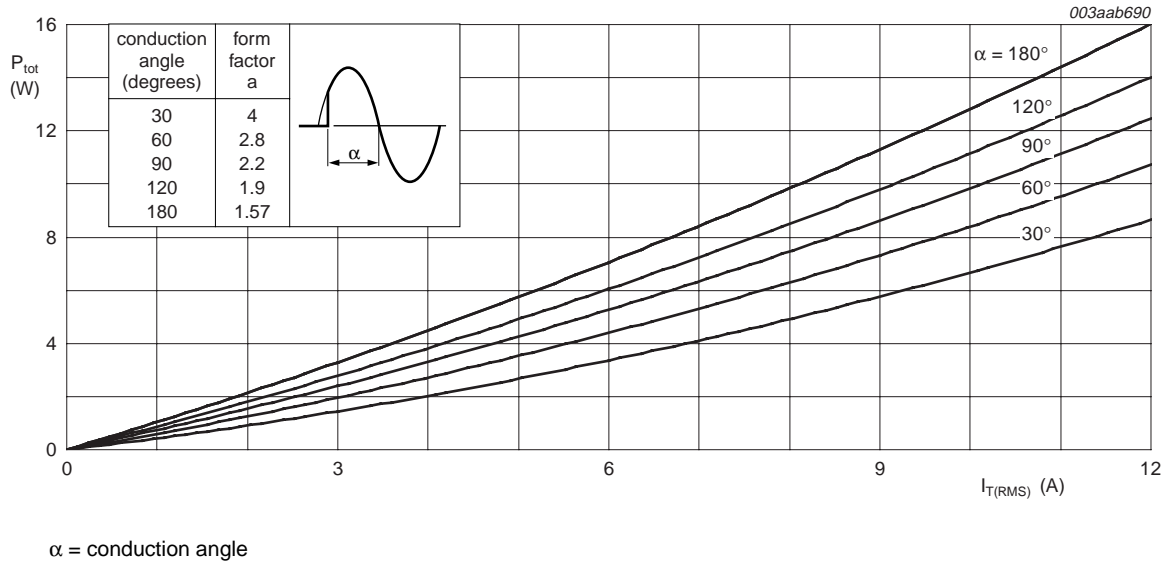


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

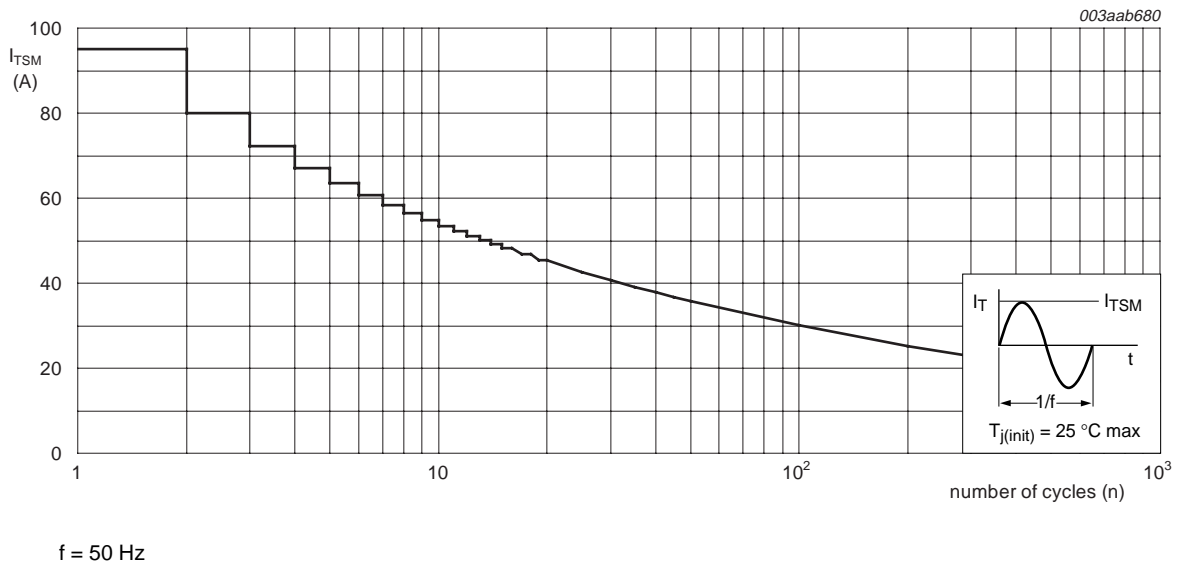
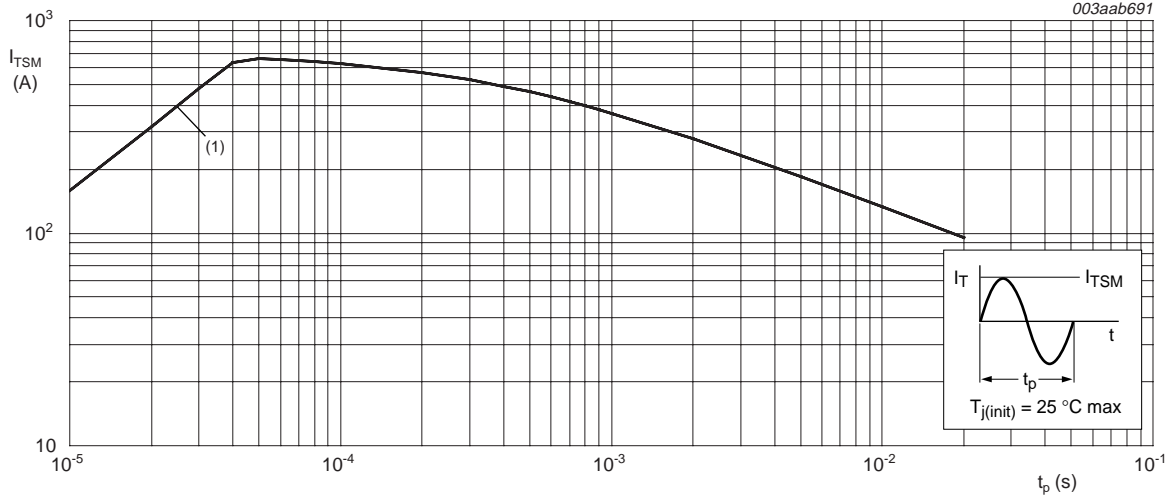


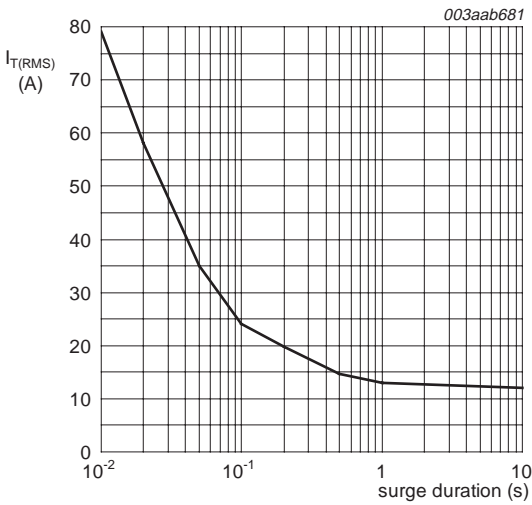
Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20 \text{ ms}$

(1)  $di_T/dt$  limit

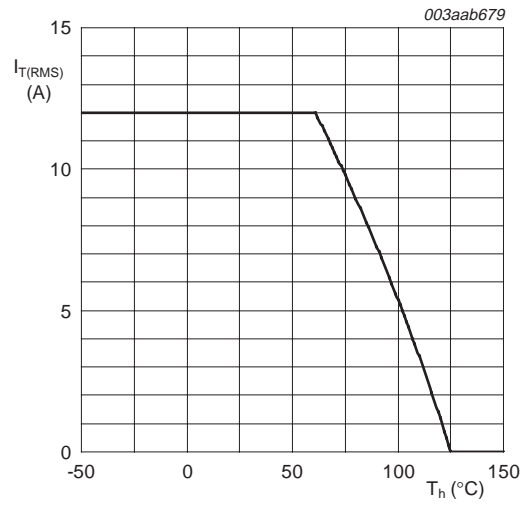
**Fig 3. Non-repetitive peak on-state current as a function of pulse duration; maximum values**



$f = 50 \text{ Hz}$

$T_h = 61 \text{ °C}$

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

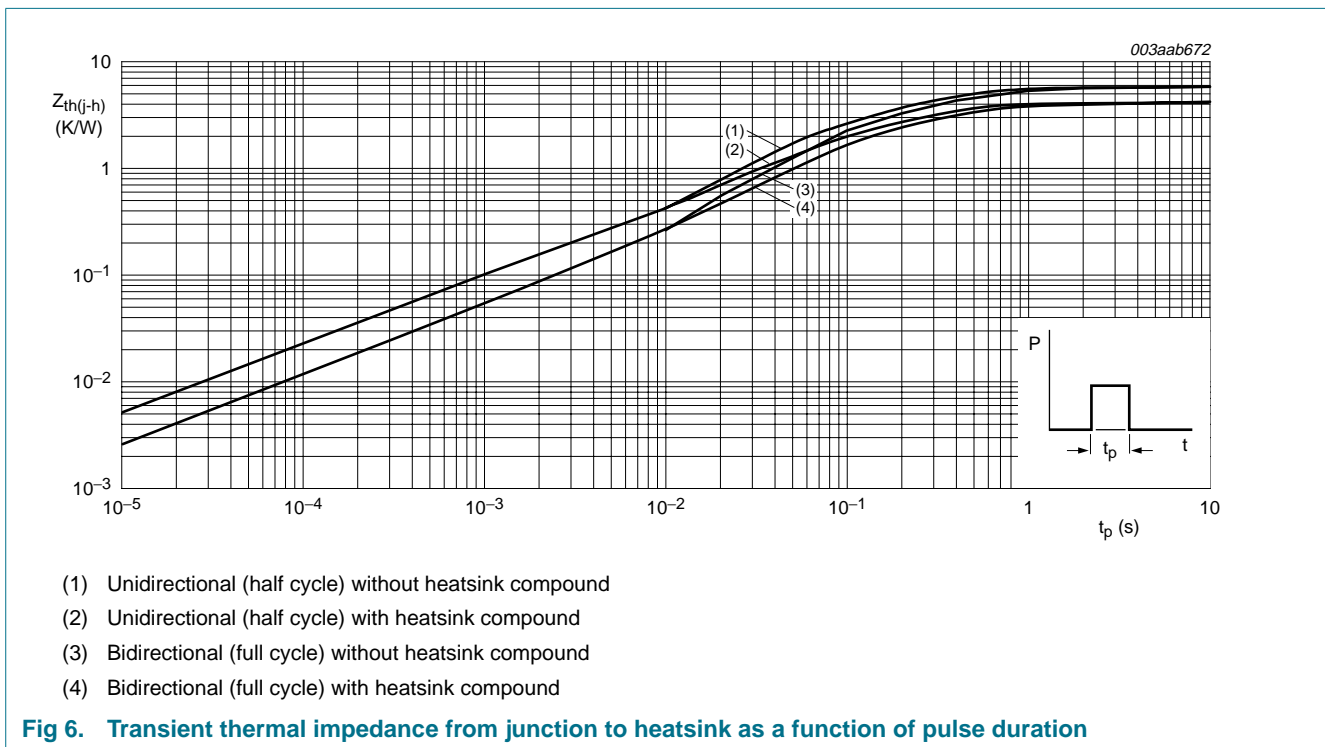


**Fig 5. RMS on-state current as a function of heatsink temperature; maximum values**

## 5. Thermal characteristics

**Table 4. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full or half cycle; without heatsink compound; see <a href="#">Figure 6</a>	-	-	5.5	K/W
		full or half cycle; with heatsink compound; see <a href="#">Figure 6</a>	-	-	4.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



## 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**

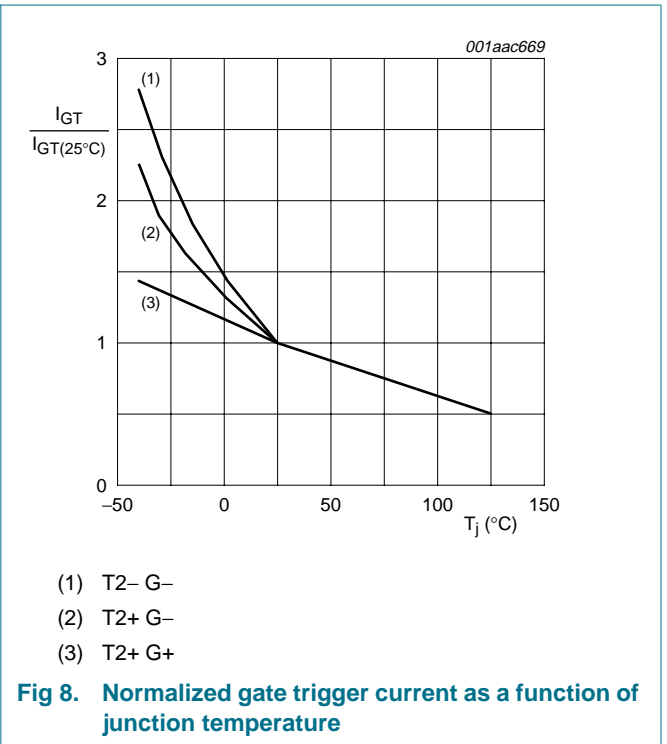
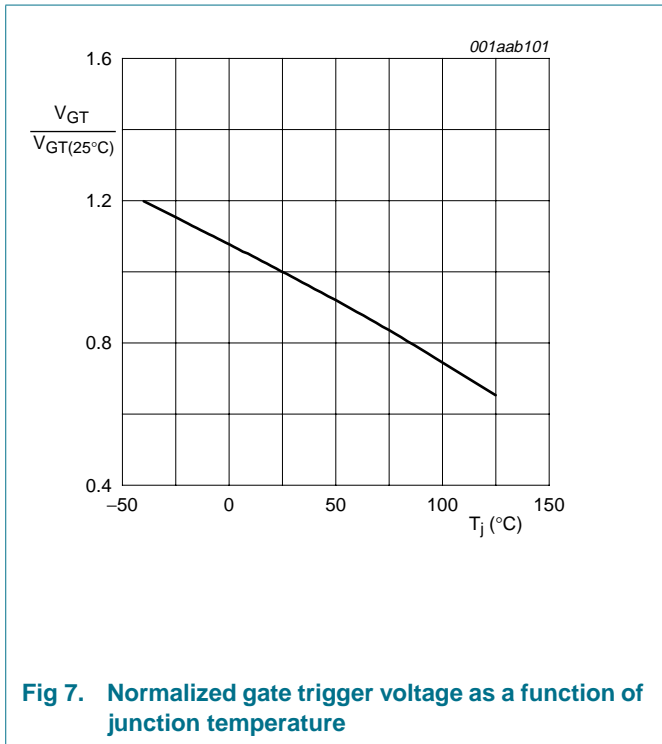
**Table 6. Static characteristics**  
*T<sub>j</sub> = 25 °C unless otherwise specified.*

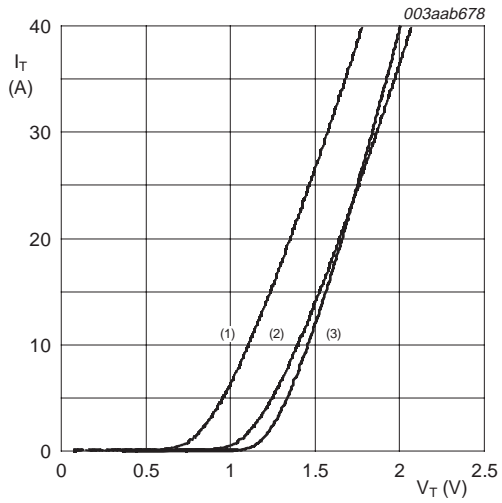
Symbol	Parameter	Conditions	BTA312X-600D			BTA312X-600E BTA312X-800E			Unit
			Min	Typ	Max	Min	Typ	Max	
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; see <a href="#">Figure 8</a>							
		T2+ G+	-	-	5	-	-	10	mA
		T2+ G-	-	-	5	-	-	10	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>GT</sub> = 0.1 A; see <a href="#">Figure 10</a>							
		T2+ G+	-	-	10	-	-	25	mA
		T2+ G-	-	-	15	-	-	30	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; I <sub>GT</sub> = 0.1 A; see <a href="#">Figure 11</a>	-	-	10	-	-	15	mA
		T2- G-	-	-	15	-	-	25	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 15 A; see <a href="#">Figure 9</a>	-	1.3	1.6	-	1.3	1.6	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; see <a href="#">Figure 7</a>	-	0.7	1.5	-	0.7	1.5	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 125 °C	0.25	0.4	-	0.25	0.4	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = V <sub>DRM(max)</sub> ; T <sub>j</sub> = 125 °C	-	0.1	0.5	-	0.1	0.5	mA

**8. Dynamic characteristics**

**Table 7. Dynamic characteristics**

Symbol	Parameter	Conditions	BTA312X-600D			BTA312X-600E BTA312X-800E			Unit
			Min	Typ	Max	Min	Typ	Max	
$dV_D/dt$	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	20	-	-	50	-	-	V/ $\mu\text{s}$
$di_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; without snubber; gate open circuit	1	-	-	3	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV/dt = 10\text{ }\mu\text{s}$ ; gate open circuit	1.5	-	-	6	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV/dt = 1\text{ }\mu\text{s}$ ; gate open circuit	4.5	-	-	10	-	-	A/ms
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 20\text{ A}$ ; $V_D = V_{DRM(max)}$ ; $I_G = 0.1\text{ A}$ ; $di_G/dt = 5\text{ A}/\mu\text{s}$	-	2	-	-	2	-	$\mu\text{s}$



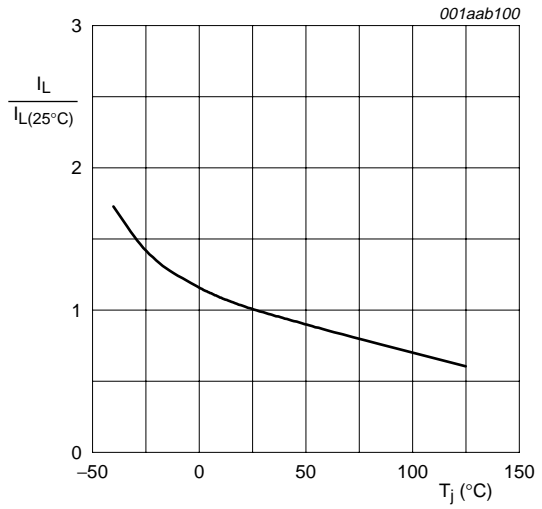


$V_o = 1.127 \text{ V}$

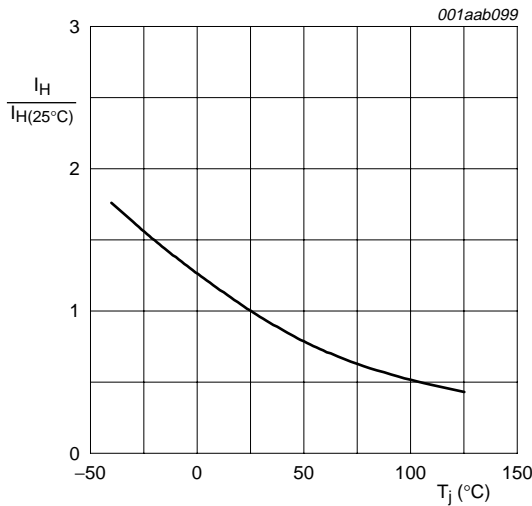
$R_s = 0.027 \text{ } \Omega$

- (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 information

Epoxy meets UL94 V-0 at 3.175 mm.



10. Package outline

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

SOT186A

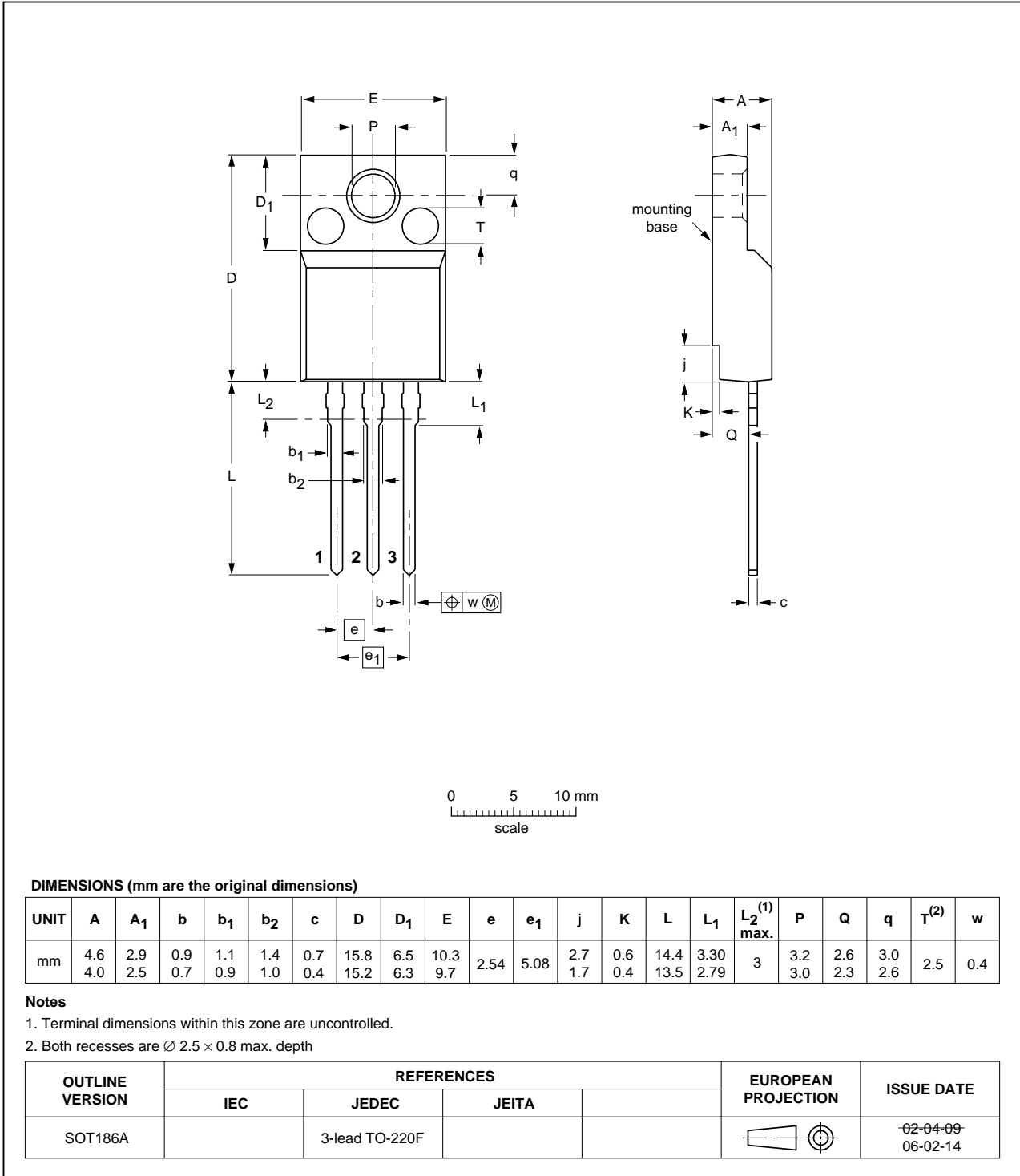


Fig 12. Package outline SOT186A (TO-220F)

## 11. Revision history

**Table 8. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA312X_SER_D_E_1	20070416	Product data sheet	-	-

## 12. 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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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