

# BTA202X series D and E

## 2 A Three-quadrant triacs high commutation

Rev. 01 — 7 February 2008

Product data sheet

## 1. Product profile

### 1.1 General description

Passivated high commutation triacs in a SOT186A 'full pack' plastic package. These triacs balance the requirements of commutation performance and gate sensitivity. The 'sensitive' gate E series and 'logic level' D series are intended for interfacing with low-power drivers, including microcontrollers.

### 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

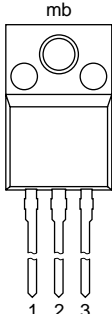
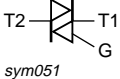
- Motor control
- Solenoid driver

### 1.4 Quick reference data

- |  |   |
|--|---|
| ■ $V_{\text{DRM}} \leq 600 \text{ V}$ (BTA202X-600D) | ■ $I_{\text{GT}} \leq 5 \text{ mA}$ (BTA202X-600D)  |
| ■ $V_{\text{DRM}} \leq 600 \text{ V}$ (BTA202X-600E) | ■ $I_{\text{GT}} \leq 10 \text{ mA}$ (BTA202X-600E) |
| ■ $V_{\text{DRM}} \leq 800 \text{ V}$ (BTA202X-800D) | ■ $I_{\text{GT}} \leq 5 \text{ mA}$ (BTA202X-800D)  |
| ■ $V_{\text{DRM}} \leq 800 \text{ V}$ (BTA202X-800E) | ■ $I_{\text{GT}} \leq 10 \text{ mA}$ (BTA202X-800E) |
| ■ $I_{\text{T(RMS)}} \leq 2 \text{ A}$               |   |

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Graphic 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	
BTA202X-600D	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack'	SOT186A
BTA202X-600E			
BTA202X-800D			
BTA202X-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	BTA202X-600D; BTA202X-600E	[1] -	600	V
		BTA202X-800D; BTA202X-800E		800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 110^\circ\text{C}$ ; see Figure 4 and 5	-	2	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_j = 25^\circ\text{C}$ prior to surge; see Figure 2 and 3			
		$t = 20\text{ ms}$	-	14	A
		$t = 16.7\text{ ms}$	-	15.4	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$	-	0.98	A <sup>2</sup> s
$dl_T/dt$	rate of rise of on-state current	$I_{\text{TM}} = 1.5\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $dl_G/dt = 0.2\text{ A}/\mu\text{s}$	-	100	A/ $\mu\text{s}$
$I_{\text{GM}}$	peak gate current		-	2	A
$P_{\text{GM}}$	peak gate power		-	5	W

Table 3. Limiting values ...continued  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$P_{G(AV)}$	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 6 A/μs.

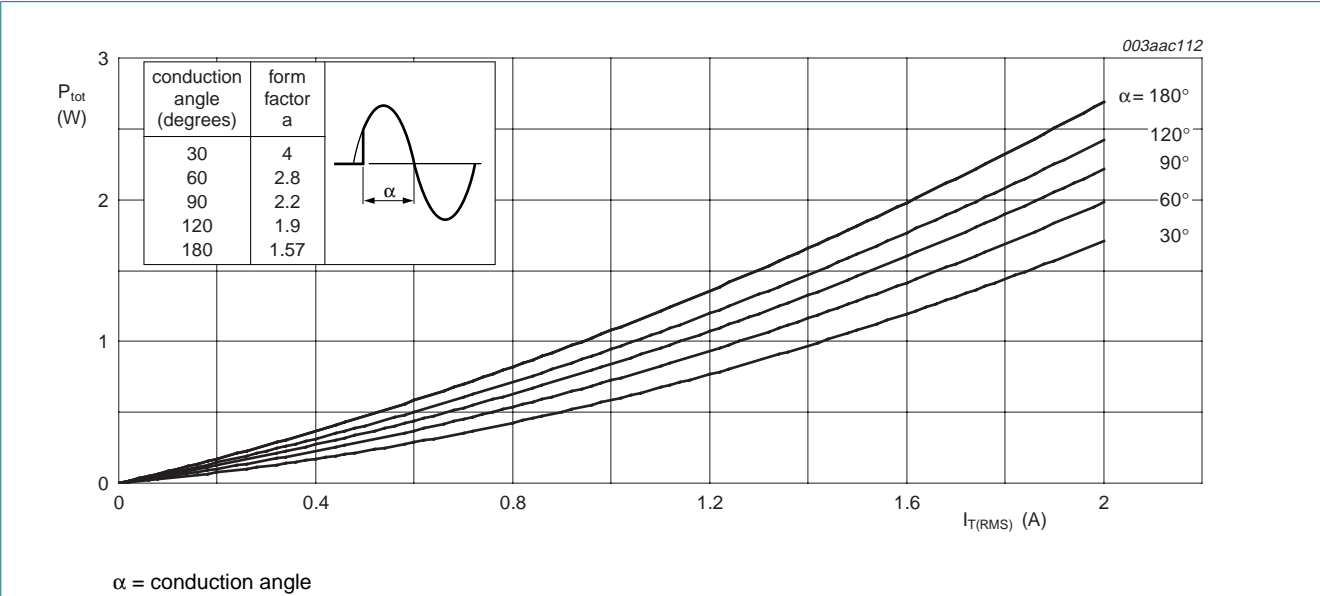


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

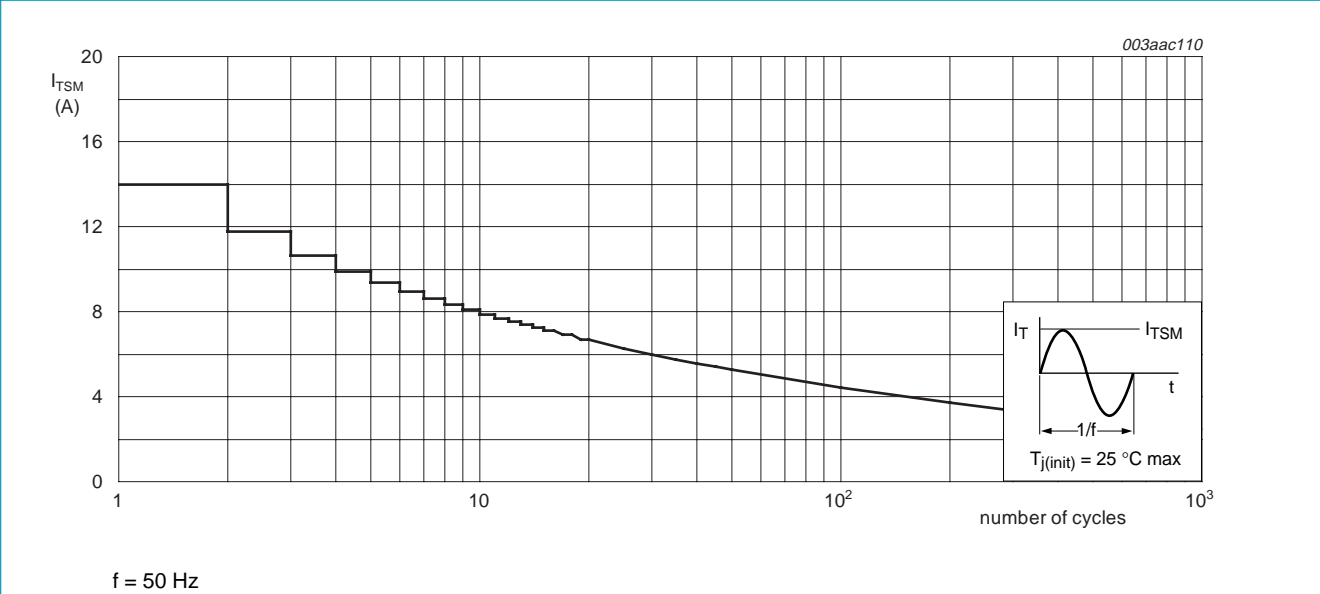
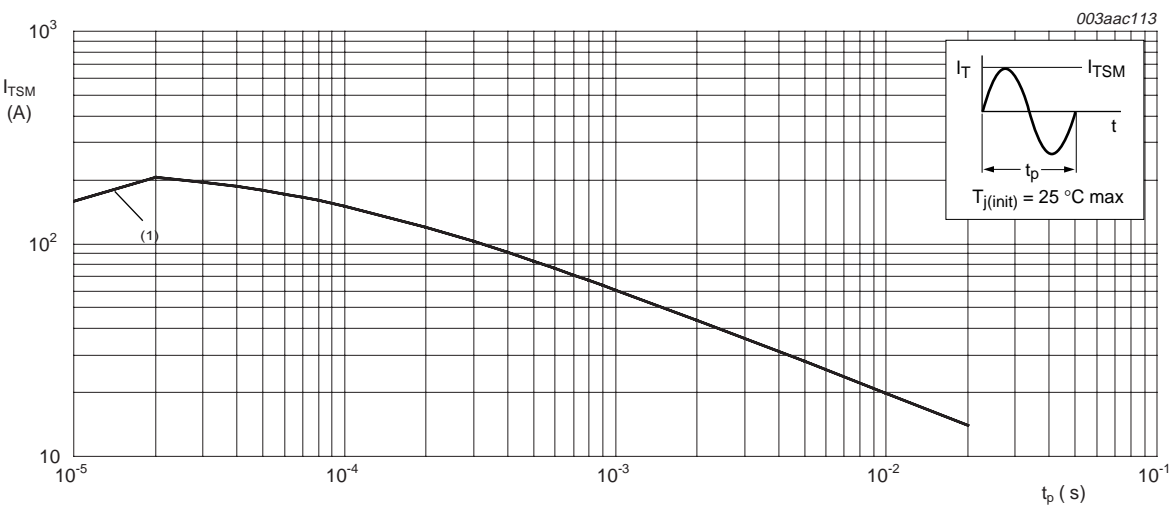
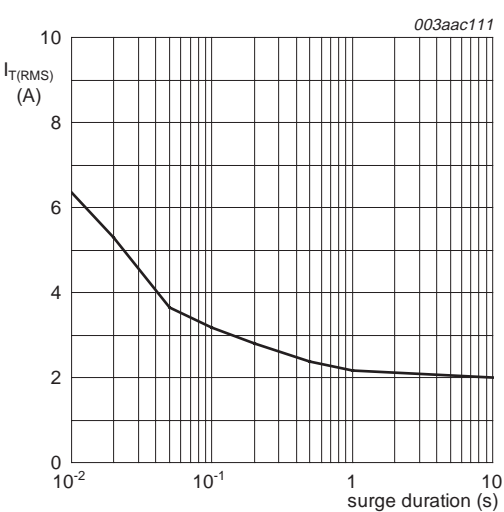


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20\text{ ms}$   
(1)  $dI_T/dt$  limit

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



$f = 50\text{ Hz}$ ;  $T_h = 110\text{ }^{\circ}\text{C}$

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

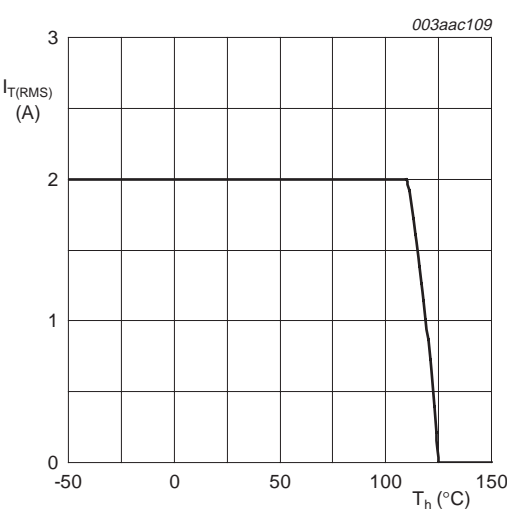


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	bidirectional; see <a href="#">Figure 6</a>	-	-	5.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W

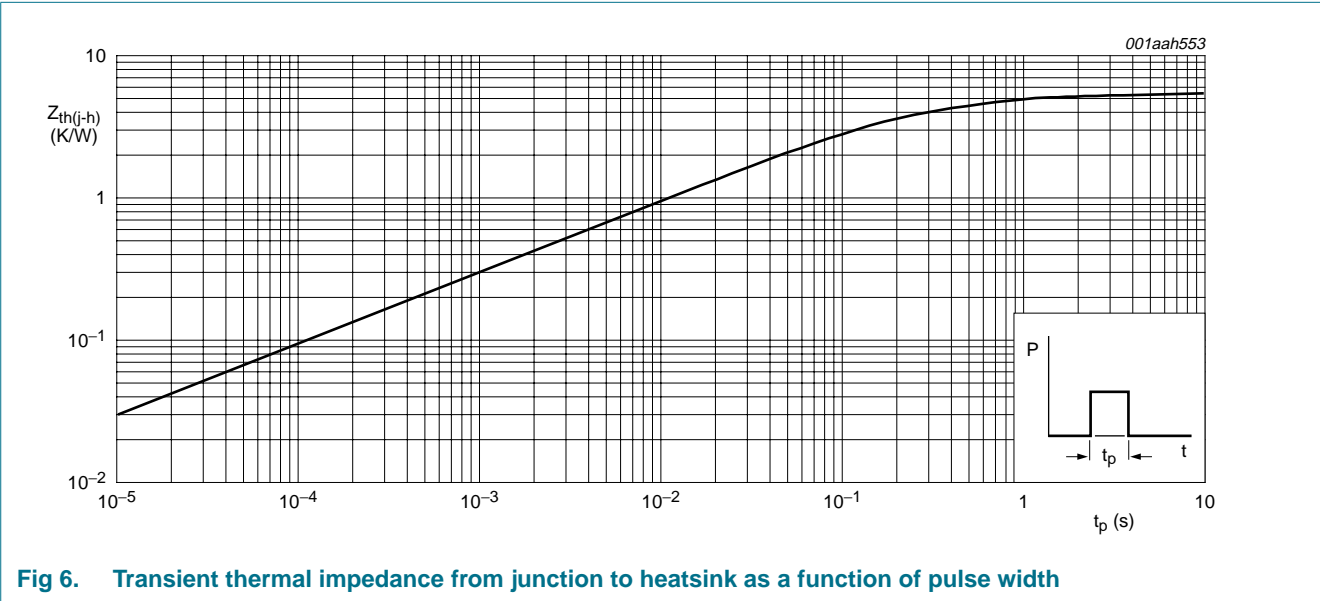


Fig 6. Transient thermal impedance from junction to heatsink as a function of pulse width

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**

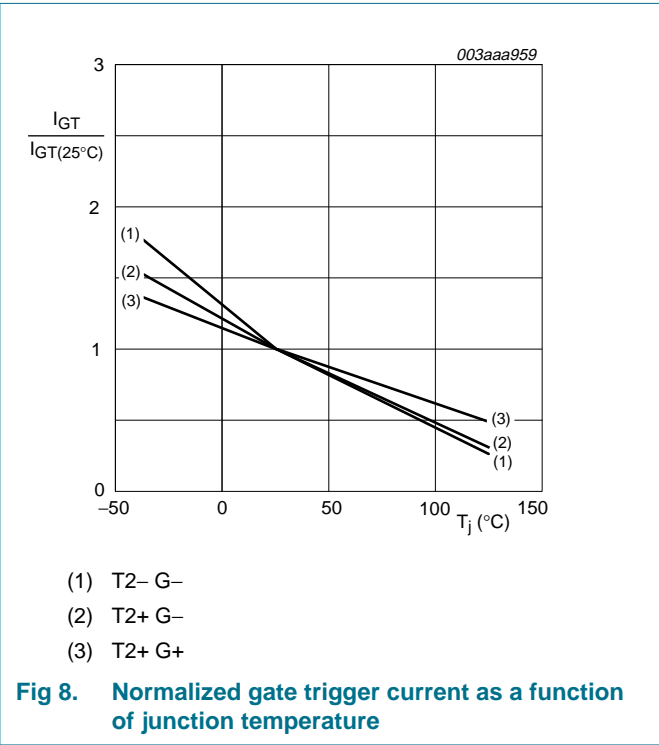
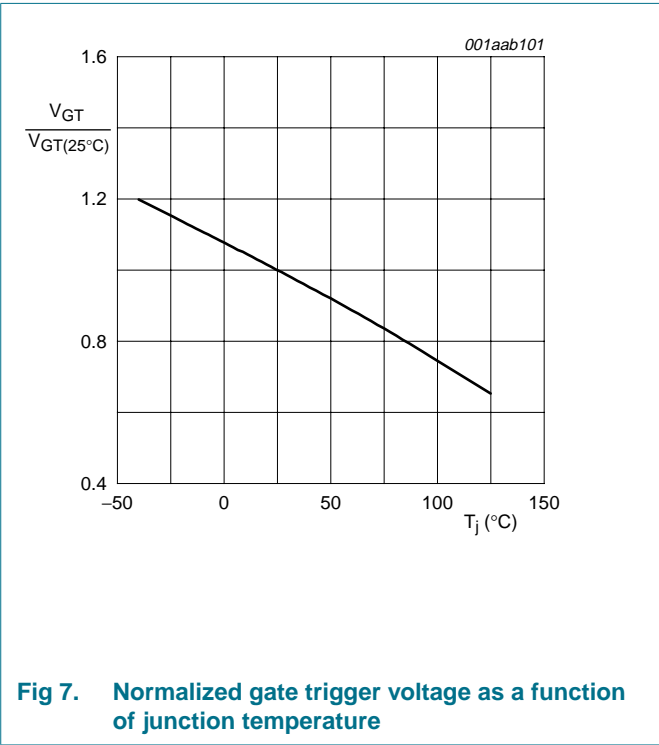
$T_j = 25\text{ °C}$  unless otherwise specified.

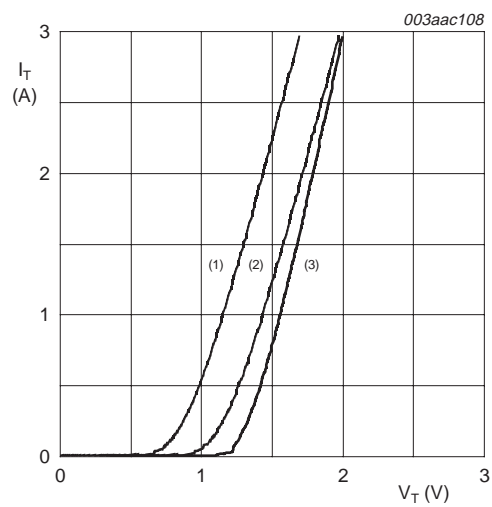
Symbol	Parameter	Conditions	BTA202X-600D BTA202X-800D			BTA202X-600E BTA202X-800E			Unit
			Min	Typ	Max	Min	Typ	Max	
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; see <a href="#">Figure 8</a>							
		T2+ G+	0.25	-	5	0.5	-	10	mA
		T2+ G-	0.25	-	5	0.5	-	10	mA
		T2- G-	0.25	-	5	0.5	-	10	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; see <a href="#">Figure 10</a>							
		T2+ G+	-	-	5	-	-	12	mA
		T2+ G-	-	-	10	-	-	20	mA
		T2- G-	-	-	5	-	-	12	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$ ; see <a href="#">Figure 11</a>	-	-	5	-	-	12	mA
$V_T$	on-state voltage	$I_T = 3\text{ A}$ ; see <a href="#">Figure 9</a>	-	1.63	2	-	1.63	2	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	-	0.7	1.5	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$	0.2	0.3	-	0.2	0.3	-	V
$I_D$	off-state current	$V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$	-	0.1	0.5	-	0.1	0.5	mA

8. Dynamic characteristics

Table 7. Dynamic characteristics

Symbol	Parameter	Conditions	BTA202X-600D BTA202X-800D			BTA202X-600E BTA202X-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; $R_{(G-MT1)} = 220\text{ }\Omega$	-	350	-	-	500	-	V/ $\mu\text{s}$
$di_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 2\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; gate open circuit	1.0	-	-	2.0	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 2\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	1.2	-	-	2.3	-	-	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	-	$\mu\text{s}$





- $V_o = 0.9\text{ V}$   
 $R_s = 0.267\text{ }\Omega$
- (1)  $T_j = 125^\circ\text{C}$ ; typical values
  - (2)  $T_j = 125^\circ\text{C}$ ; maximum values
  - (3)  $T_j = 25^\circ\text{C}$ ; maximum values

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

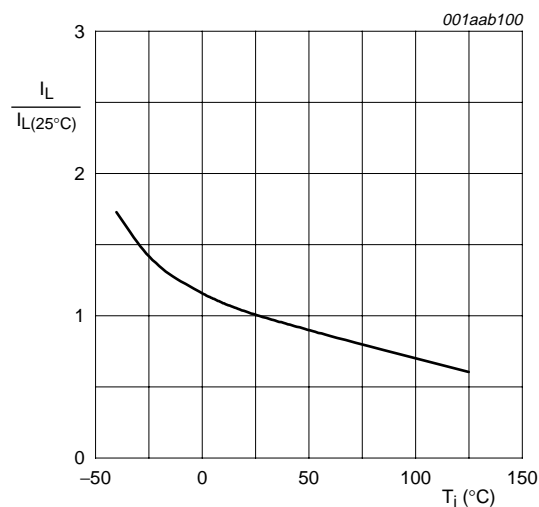


Fig 10. Normalized latching current as a function of junction temperature

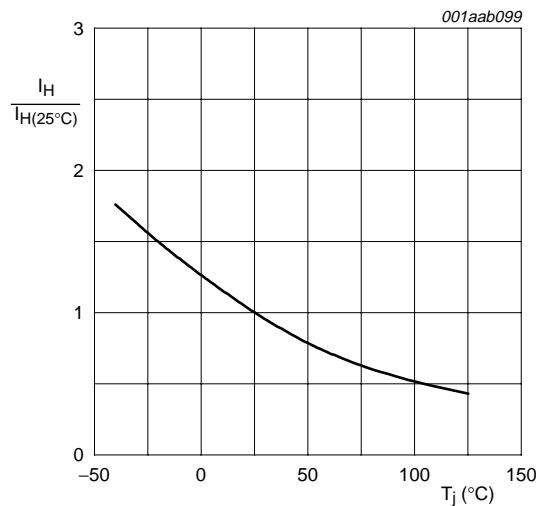


Fig 11. Normalized holding current as a function of junction temperature

## 9. Package information

Refer to mounting instructions for F-pack packages.

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

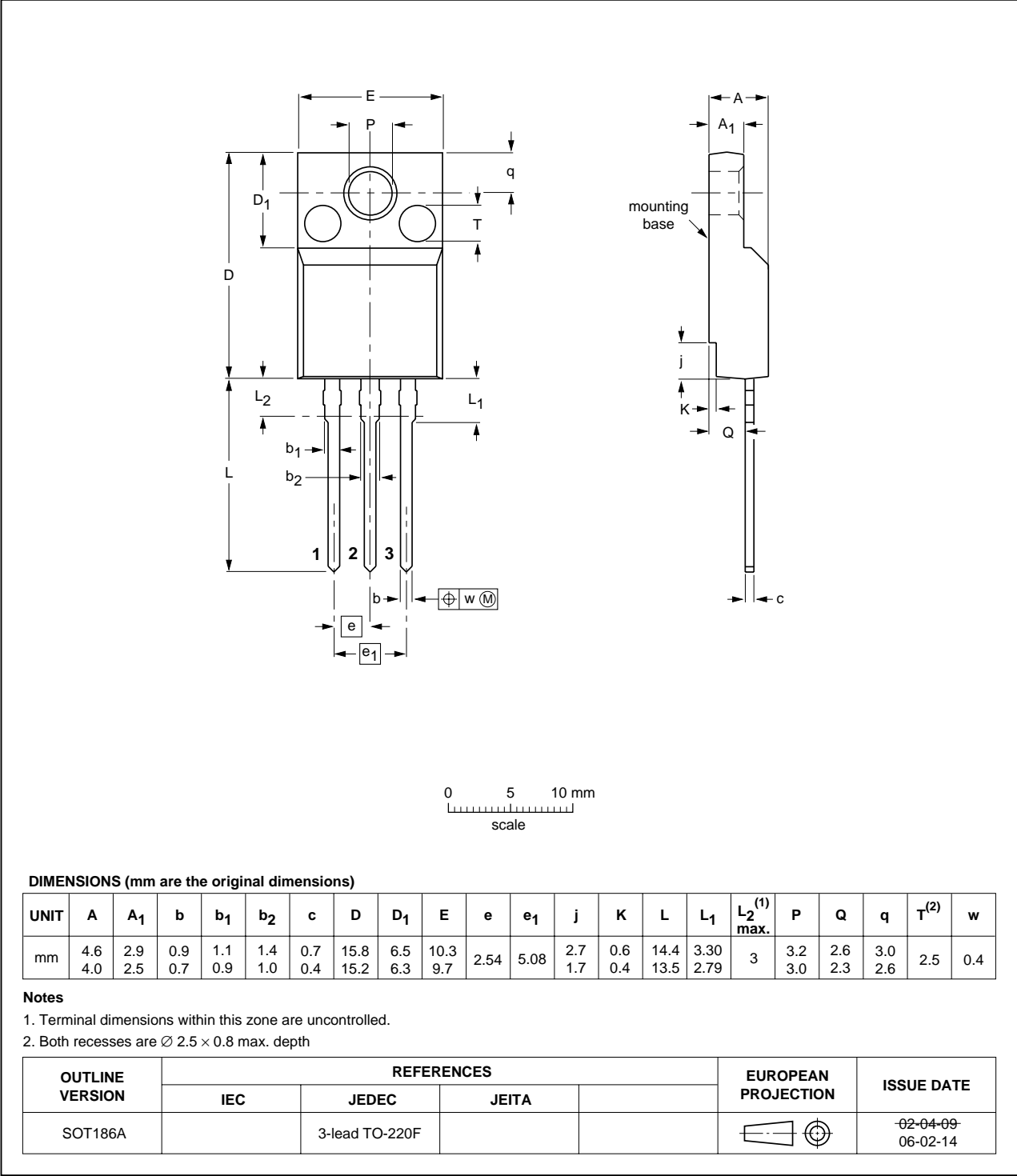


Fig 12. Package outline SOT186A (3-lead TO-220F)

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA202X_SER_D_E_1	20080207	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

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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