

# BTA316X series B, C and E

16 A Three-quadrant triacs high commutation

Rev. 01 — 11 April 2007

Product data sheet

## 1. Product profile

### 1.1 General description

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

### 1.2 Features

- Very high commutation performance maximized at each gate sensitivity
- High immunity to dV/dt
- High isolation voltage
- Wide range of gate sensitivities

### 1.3 Applications

- High power motor control - e.g. washing machines and vacuum cleaners
- Refrigeration and air conditioning compressors
- Non-linear rectifier-fed motor loads
- Electronic thermostats

### 1.4 Quick reference data

- $V_{DRM} \leq 600$  V (BTA316X-600B/C/E)
- $V_{DRM} \leq 800$  V (BTA316X-800B/C/E)
- $I_{TSM} \leq 140$  A ( $t = 20$  ms)
- $I_{T(RMS)} \leq 16$  A
- $I_{GT} \leq 50$  mA (BTA316X series B)
- $I_{GT} \leq 35$  mA (BTA316X series C)
- $I_{GT} \leq 10$  mA (BTA316X series E)

## 2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)	<p>SOT186A (TO-220F)</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	
BTA316X-600B	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack'	SOT186A
BTA316X-600C			
BTA316X-600E			
BTA316X-800B			
BTA316X-800C			
BTA316X-800E			

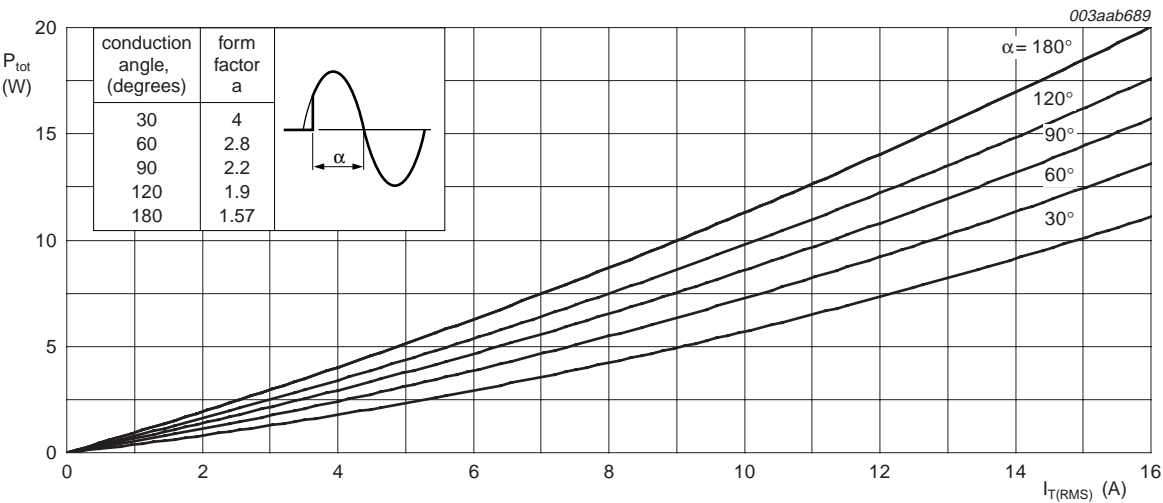
### 4. Limiting values

**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	BTA316X-600B; BTA316X-600C; BTA316X-600E	[1] -	600	V
		BTA316X-800B; BTA316X-800C; BTA316X-800E	-	800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 45^\circ\text{C}$ ; see <a href="#">Figure 4</a> and <a href="#">5</a>	-	16	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_j = 25^\circ\text{C}$ prior to surge; see <a href="#">Figure 2</a> and <a href="#">3</a>			
		$t = 20\text{ ms}$	-	140	A
		$t = 16.7\text{ ms}$	-	150	A
$I^2t$	$I^2t$ for fusing	$t = 10\text{ ms}$	-	98	$\text{A}^2\text{s}$
$di_T/dt$	rate of rise of on-state current	$I_{\text{TM}} = 20\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $di_G/dt = 0.2\text{ A}/\mu\text{s}$	-	100	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	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	$^\circ\text{C}$
$T_j$	junction temperature		-	125	$^\circ\text{C}$

[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/ $\mu\text{s}$ .



$\alpha$  = conduction angle

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

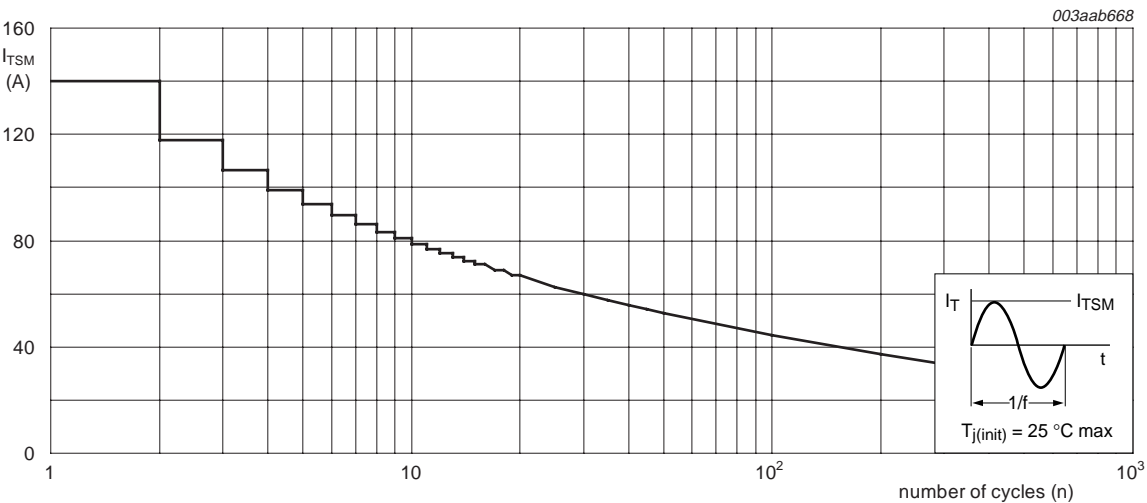
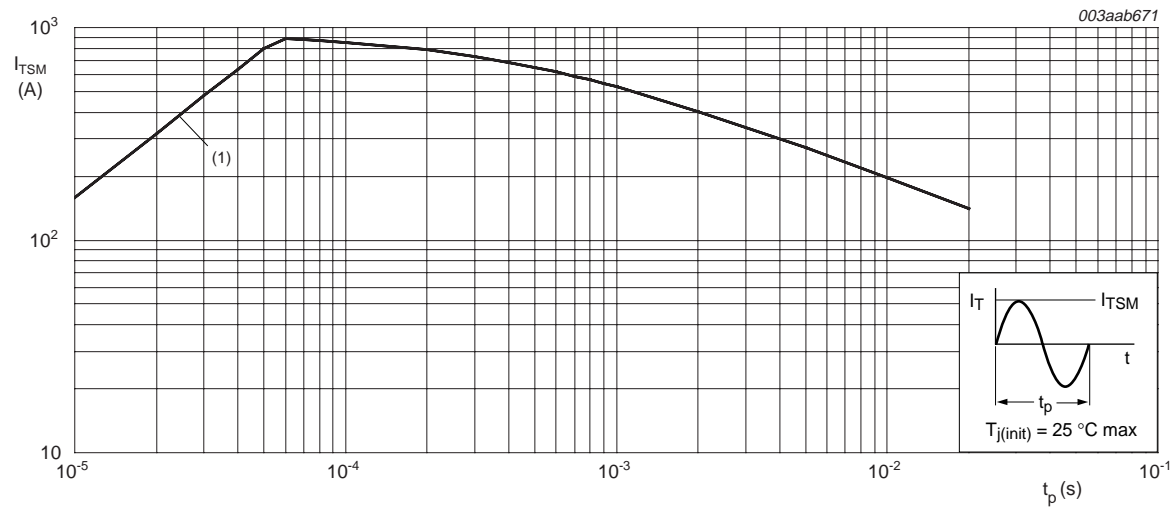
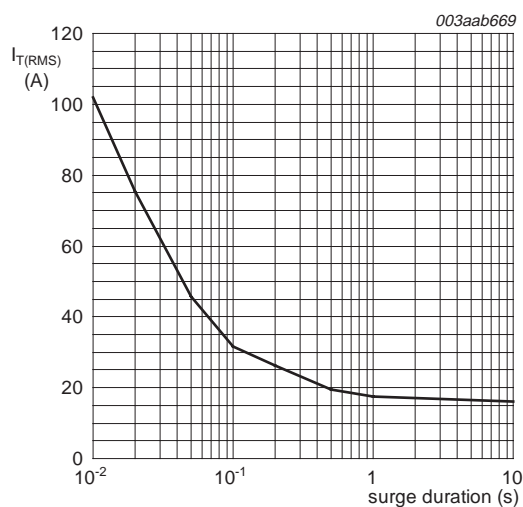


Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



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

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



$f = 50\text{ Hz};$   
 $T_h = 45^\circ\text{C}$

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

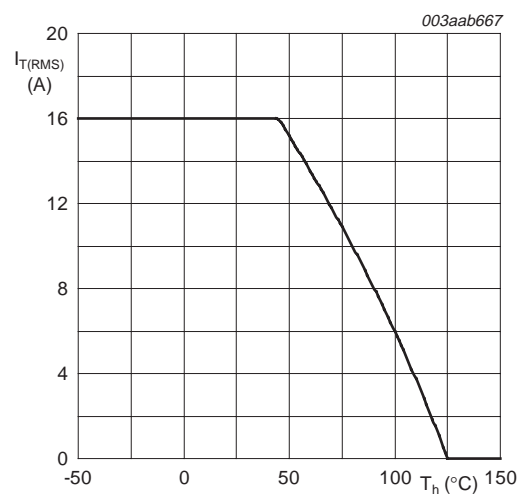
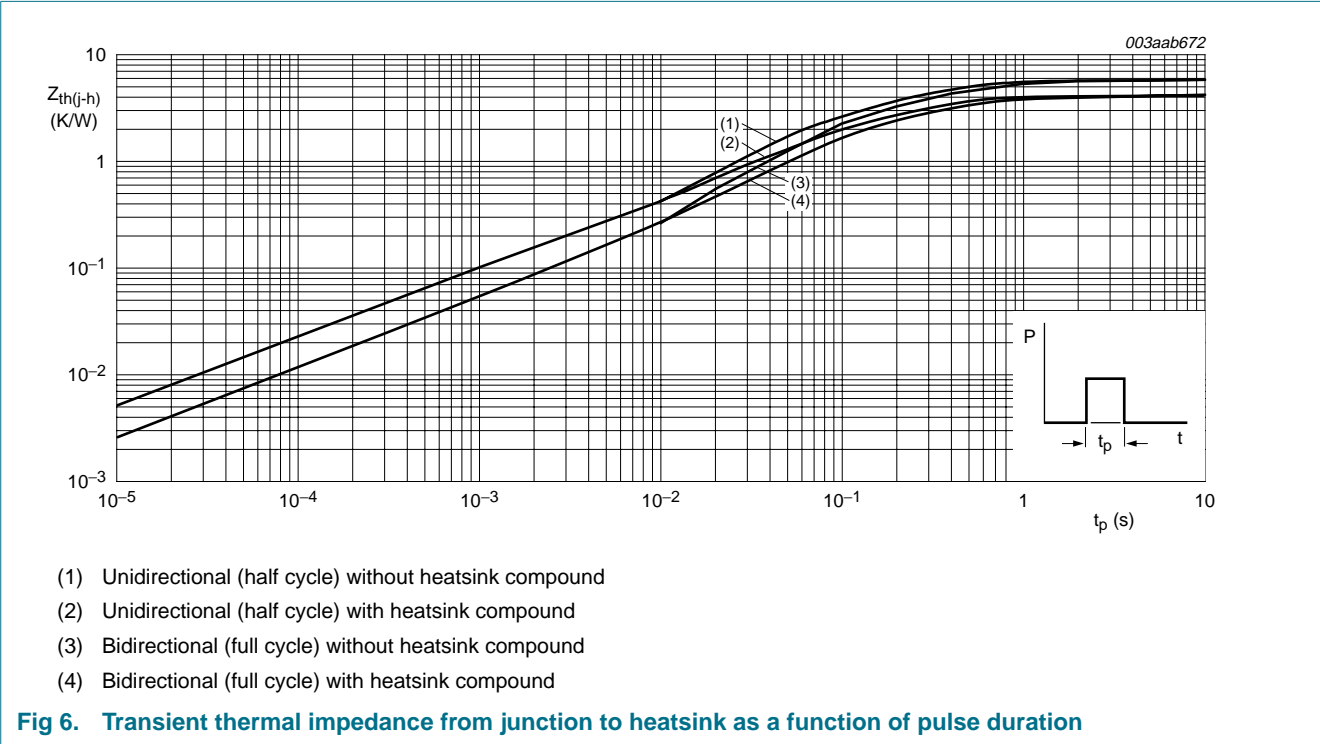


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R <sub>th(j-h)</sub>	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>	-	-	4.0	K/W
R <sub>th(j-a)</sub>	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 <sub>isol(RMS)</sub>	RMS isolation voltage	from all three terminals to external heatsink; f = 50 Hz to 60 Hz; sinusoidal waveform; RH ≤ 65 %; clean and dust free	-	-	2500	V
C <sub>isol</sub>	isolation capacitance	from pin 2 to external heatsink; f = 1 MHz	-	10	-	pF

## 7. Static characteristics

**Table 6. Static characteristics**

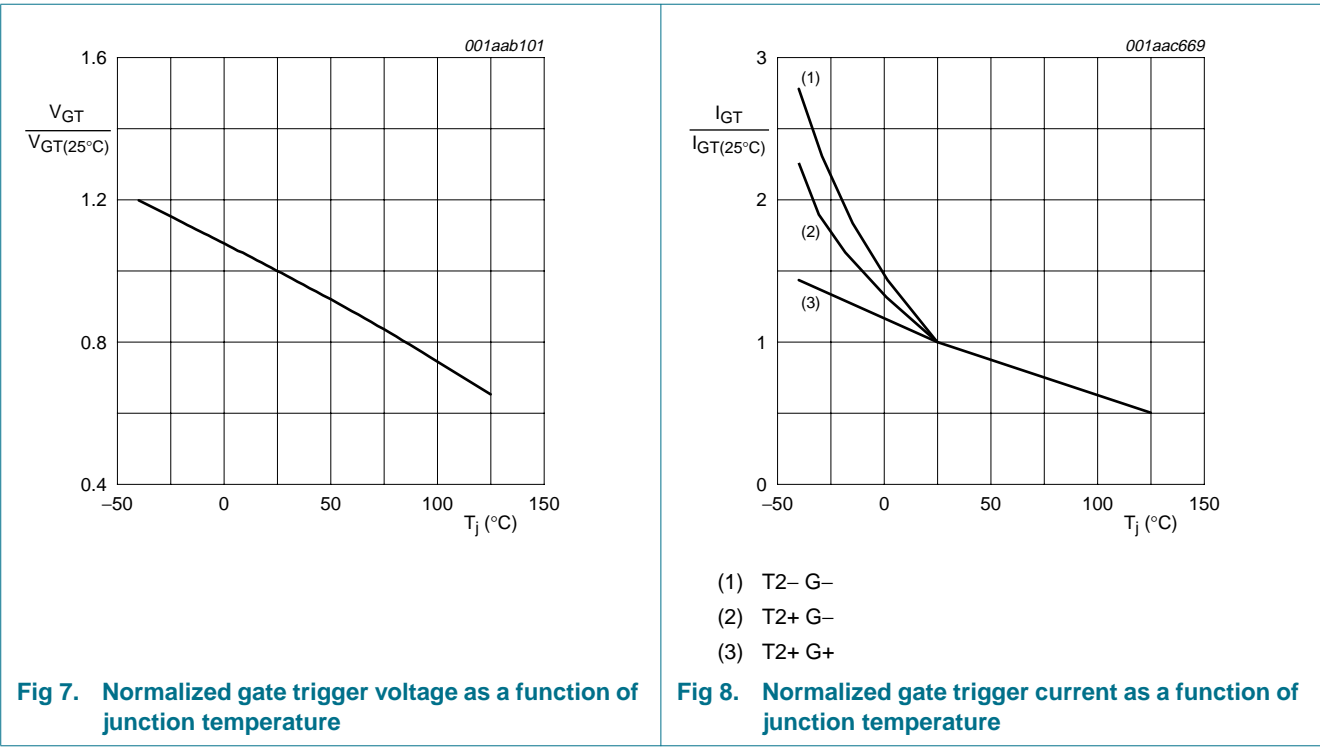
$T_j = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

Symbol	Parameter	Conditions	BTA316X-600B BTA316X-800B			BTA316X-600C BTA316X-800C			BTA316X-600E BTA316X-800E			Unit
			Min	Typ	Max	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+	2	-	50	2	-	35	-	-	10	mA
		T2+ G-	2	-	50	2	-	35	-	-	10	mA
		T2- G-	2	-	50	2	-	35	-	-	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+	-	-	60	-	-	50	-	-	25	mA
		T2+ G-	-	-	90	-	-	60	-	-	30	mA
		T2- G-	-	-	60	-	-	50	-	-	30	mA
$I_H$	holding current	$V_D = 12\text{ V};$ $I_{GT} = 0.1\text{ A};$ see <a href="#">Figure 11</a>	-	-	60	-	-	35	-	-	15	mA
$V_T$	on-state voltage	$I_T = 18\text{ A};$ see <a href="#">Figure 9</a>	-	1.3	1.5	-	1.3	1.5	-	1.3	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V};$ $I_T = 0.1\text{ A};$ see <a href="#">Figure 7</a>	-	0.8	1.5	-	0.8	1.5	-	0.8	1.5	V
		$V_D = 400\text{ V};$ $I_T = 0.1\text{ A};$ $T_j = 125\text{ }^{\circ}\text{C}$	0.25	0.4	-	0.25	0.4	-	0.25	0.4	-	V
$I_D$	off-state current	$V_D = V_{DRM(max)};$ $T_j = 125\text{ }^{\circ}\text{C}$	-	0.1	0.5	-	0.1	0.5	-	0.1	0.5	mA

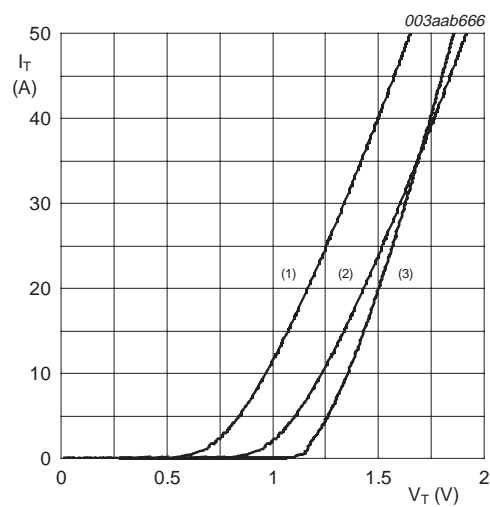
## 8. Dynamic characteristics

Table 7. Dynamic characteristics

Symbol	Parameter	Conditions	BTA316X-600B BTA316X-800B			BTA316X-600C BTA316X-800C			BTA316X-600E BTA316X-800E			Unit
			Min	Typ	Max	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	1000	-	-	500	-	-	60	-	-	V/ $\mu\text{s}$
$di_{com}/dt$	rate of change of commutating current	$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; without snubber; gate open circuit	20	-	-	15	-	-	5	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	-	-	-	-	-	-	8	-	-	A/ms
		$V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	-	-	-	-	-	-	12	-	-	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	-	-	2	-	$\mu\text{s}$







$V_o = 1.024 \text{ V}$

$R_s = 0.021 \text{ } \Omega$

- (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

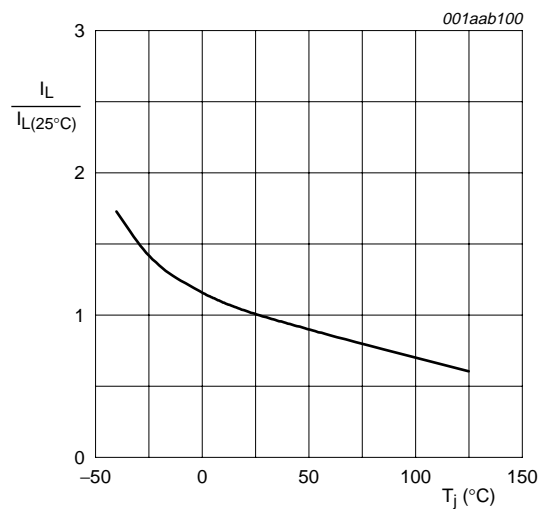


Fig 10. Normalized latching current as a function of junction temperature

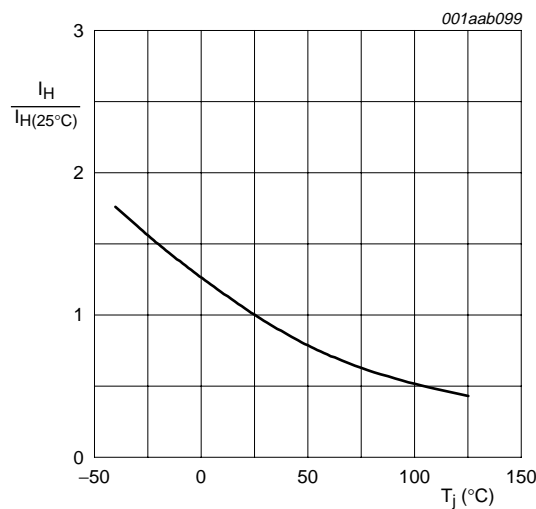


Fig 11. Normalized holding current as a function of junction temperature

## 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

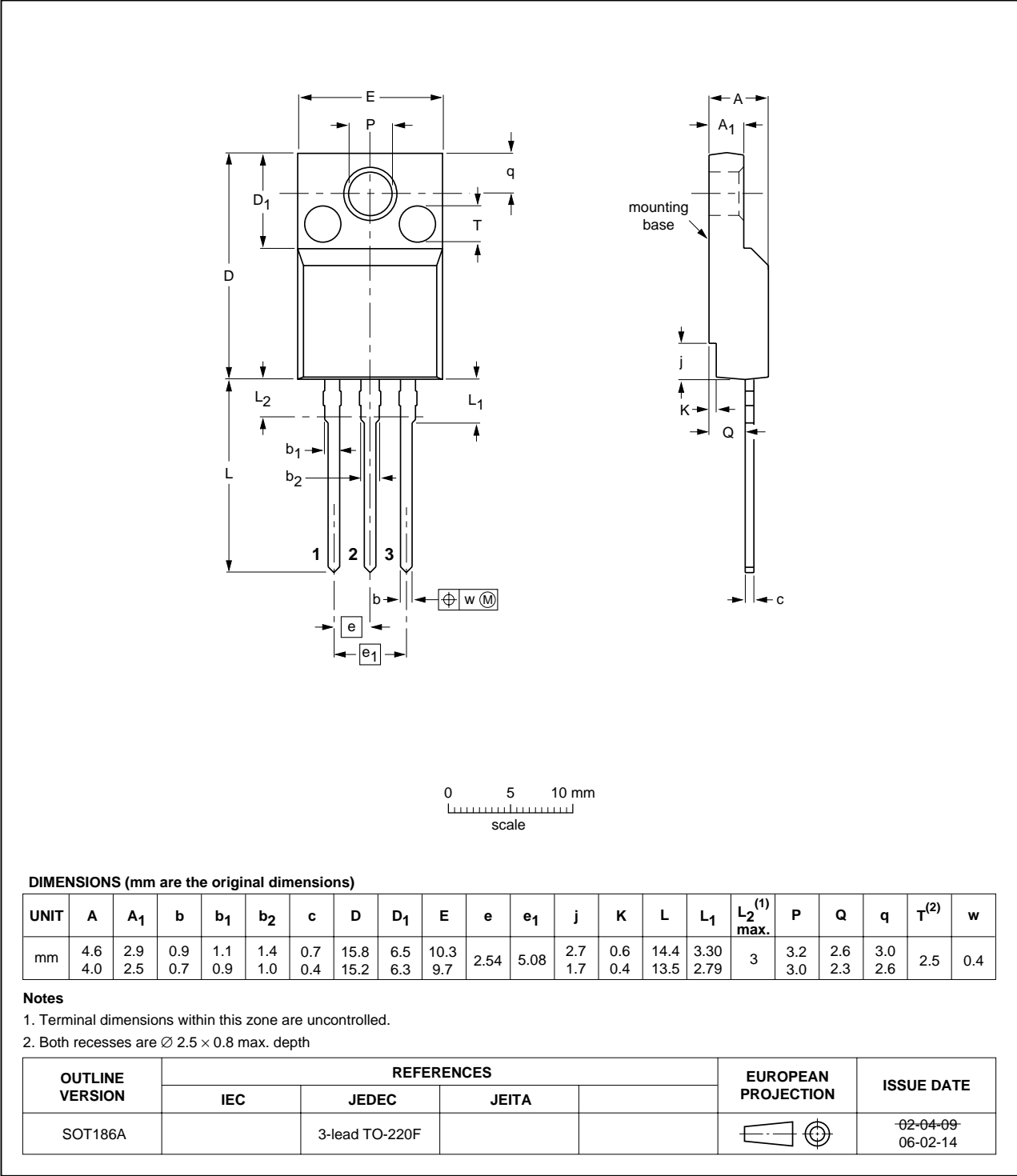


Fig 12. Package outline SOT186A (TO-220F)

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA316X_SER_B_C_E_1	20070411	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.
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