

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)	<p style="text-align: center;">SOT186A (TO-220F)</p>	<p style="text-align: center;">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	
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 V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 61$ °C; see Figure 4 and 5	-	12	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_j = 25$ °C prior to surge; see Figure 2 and 3			
		$t = 20$ ms	-	95	A
		$t = 16.7$ ms	-	105	A
I^2t	I^2t for fusing	$t = 10$ ms	-	45	A ² 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/ μ s	-	100	A/ μ 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/ μ s.

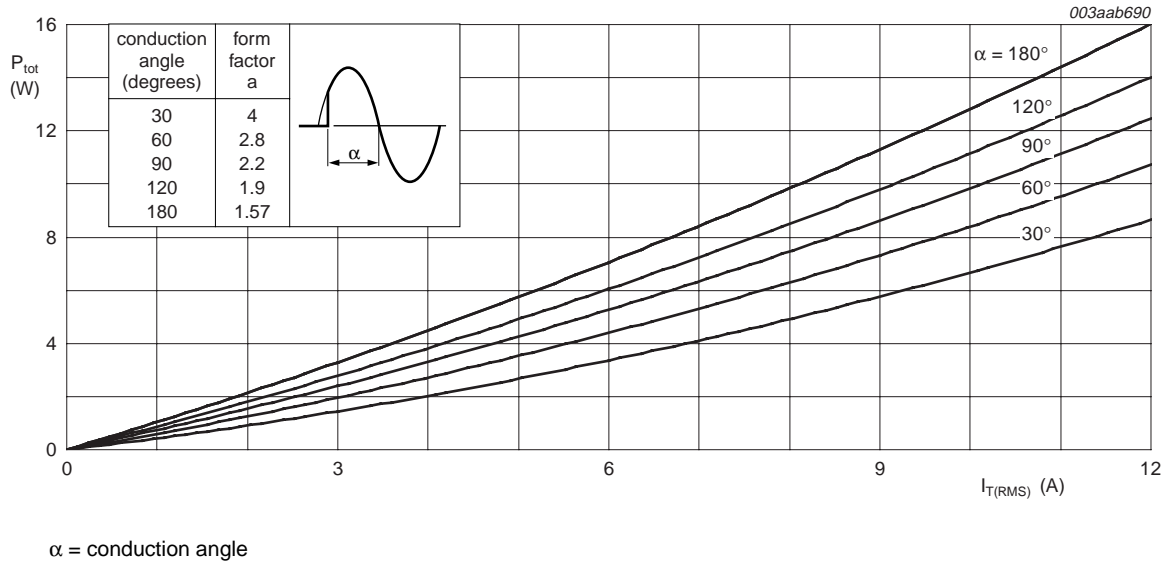


Fig 1. Total power dissipation as a function of RMS on-state current; maximum values

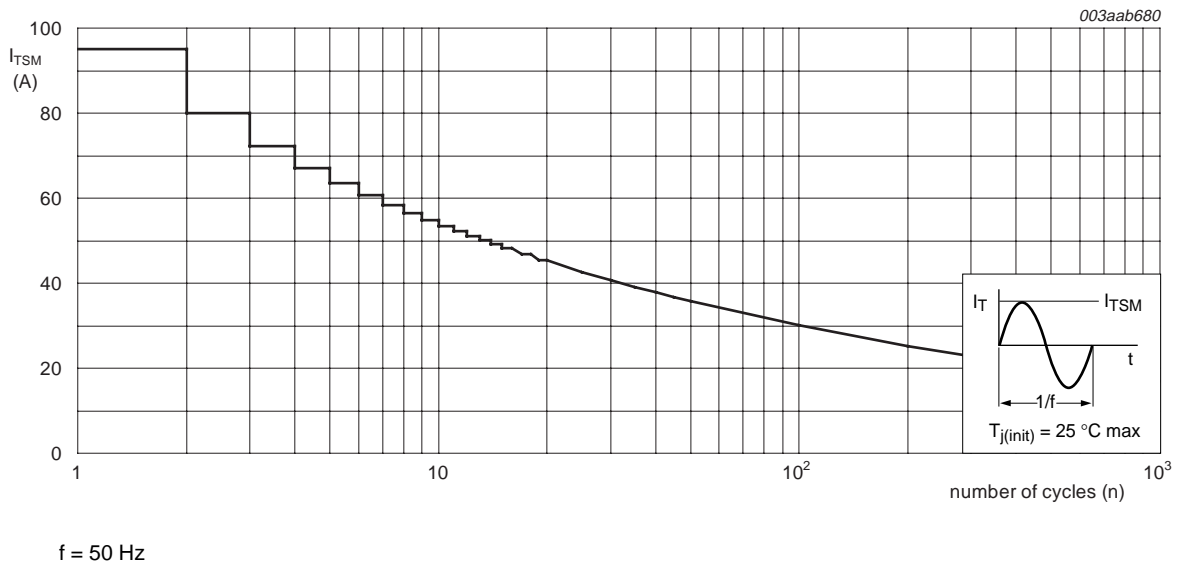
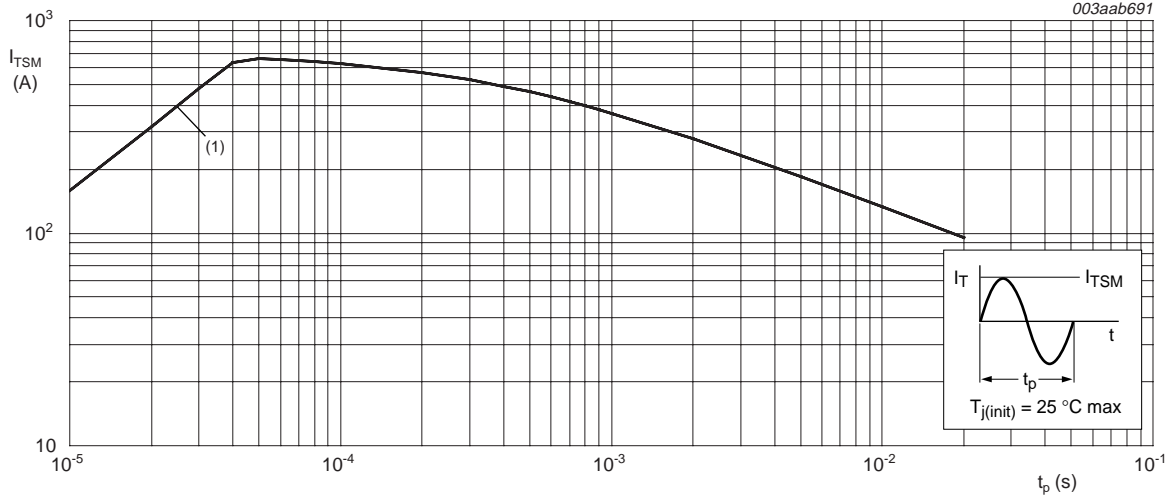


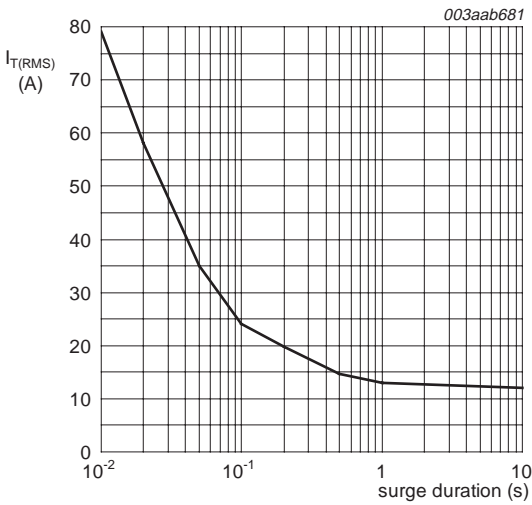
Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20 \text{ ms}$

(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

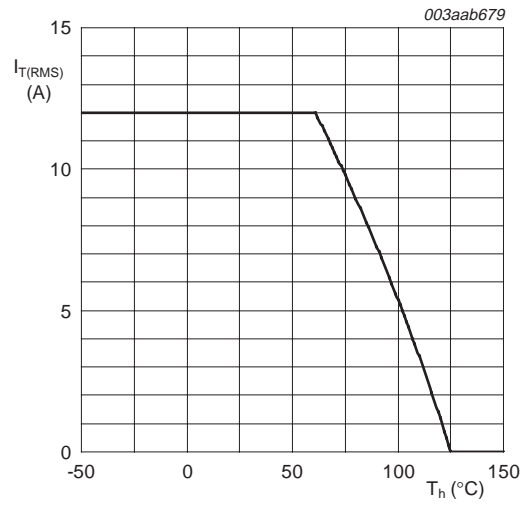
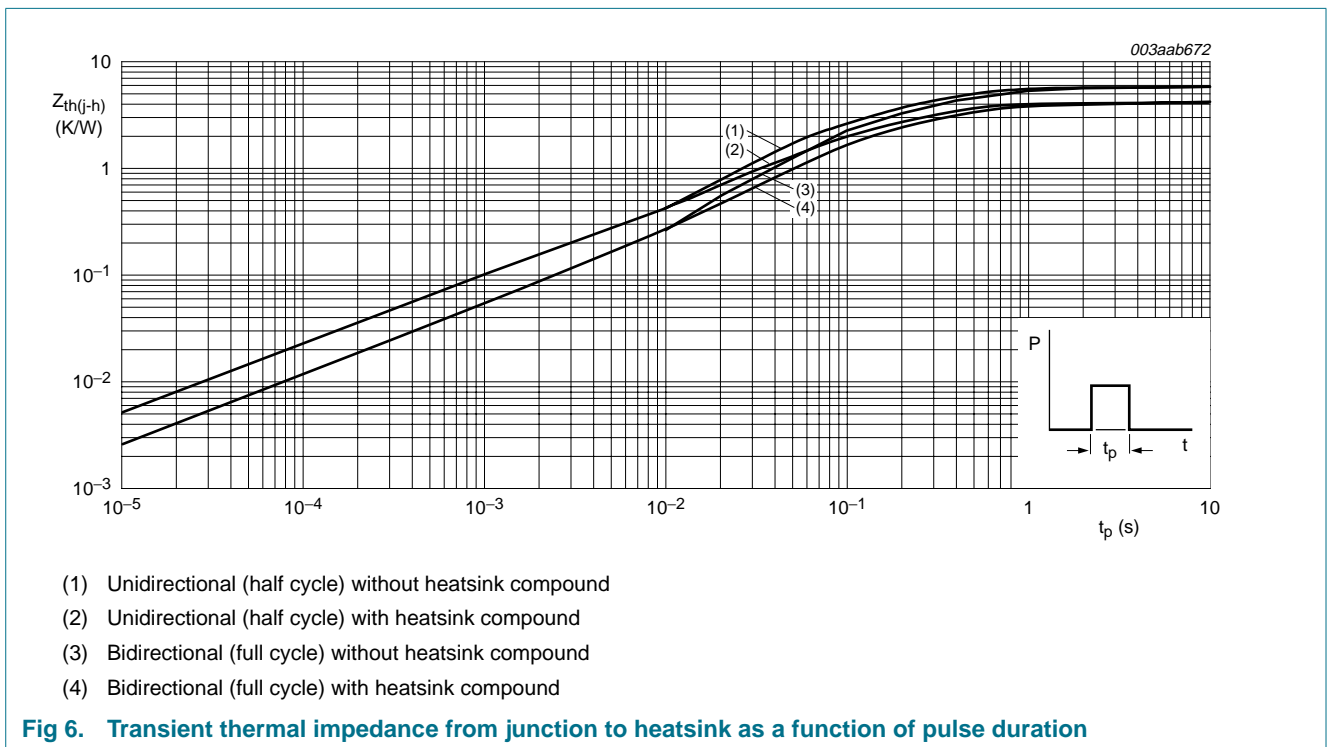


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

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 Figure 6	-	-	5.5	K/W
		full or half cycle; with heatsink compound; see Figure 6	-	-	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 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

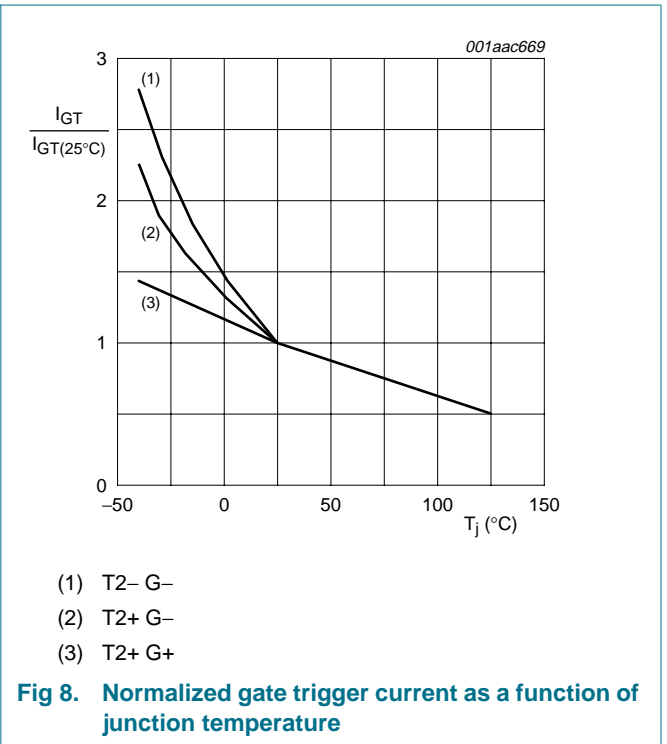
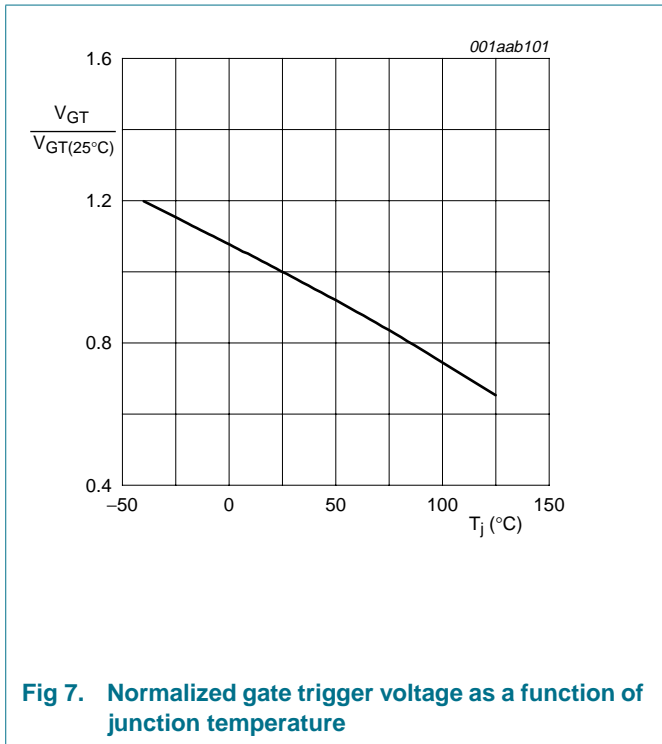
Table 6. Static characteristics
T_j = 25 °C unless otherwise specified.

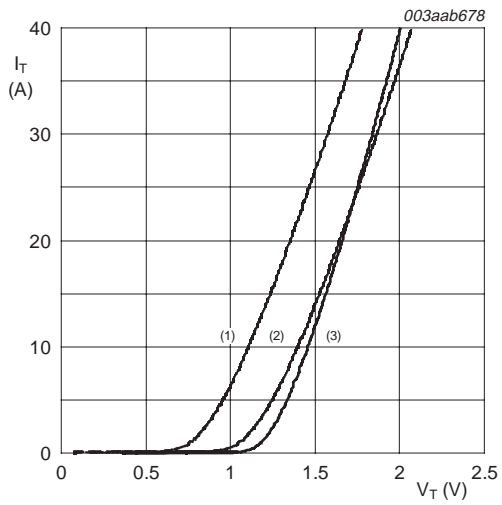
Symbol	Parameter	Conditions	BTA312X-600D			BTA312X-600E BTA312X-800E			Unit
			Min	Typ	Max	Min	Typ	Max	
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; see Figure 8							
		T2+ G+	-	-	5	-	-	10	mA
		T2+ G-	-	-	5	-	-	10	mA
I _L	latching current	V _D = 12 V; I _{GT} = 0.1 A; see Figure 10							
		T2+ G+	-	-	10	-	-	25	mA
		T2+ G-	-	-	15	-	-	30	mA
I _H	holding current	V _D = 12 V; I _{GT} = 0.1 A; see Figure 11	-	-	10	-	-	15	mA
		T2- G-	-	-	15	-	-	25	mA
V _T	on-state voltage	I _T = 15 A; see Figure 9	-	1.3	1.6	-	1.3	1.6	V
V _{GT}	gate trigger voltage	V _D = 12 V; I _T = 0.1 A; see Figure 7	-	0.7	1.5	-	0.7	1.5	V
		V _D = 400 V; I _T = 0.1 A; T _j = 125 °C	0.25	0.4	-	0.25	0.4	-	V
I _D	off-state current	V _D = V _{DRM(max)} ; T _j = 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/ μs
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	-	μs





$V_o = 1.127 \text{ V}$

$R_s = 0.027 \text{ } \Omega$

- (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

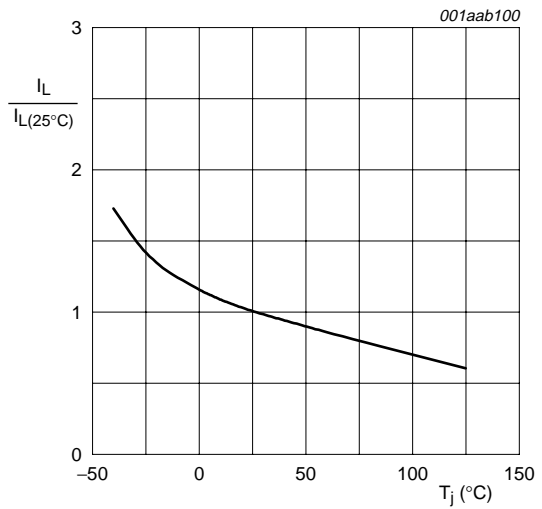


Fig 10. Normalized latching current as a function of junction temperature

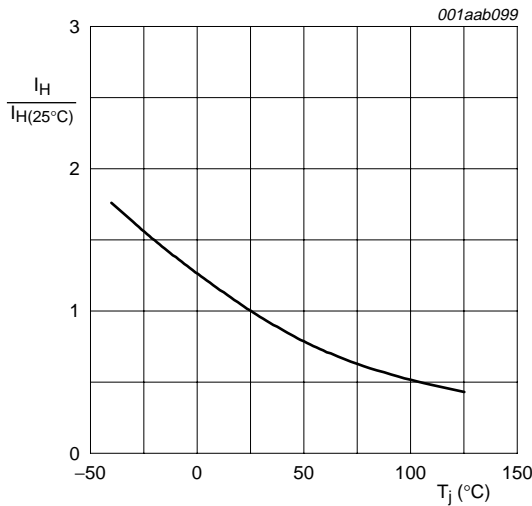


Fig 11. Normalized holding current as a function of junction temperature

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

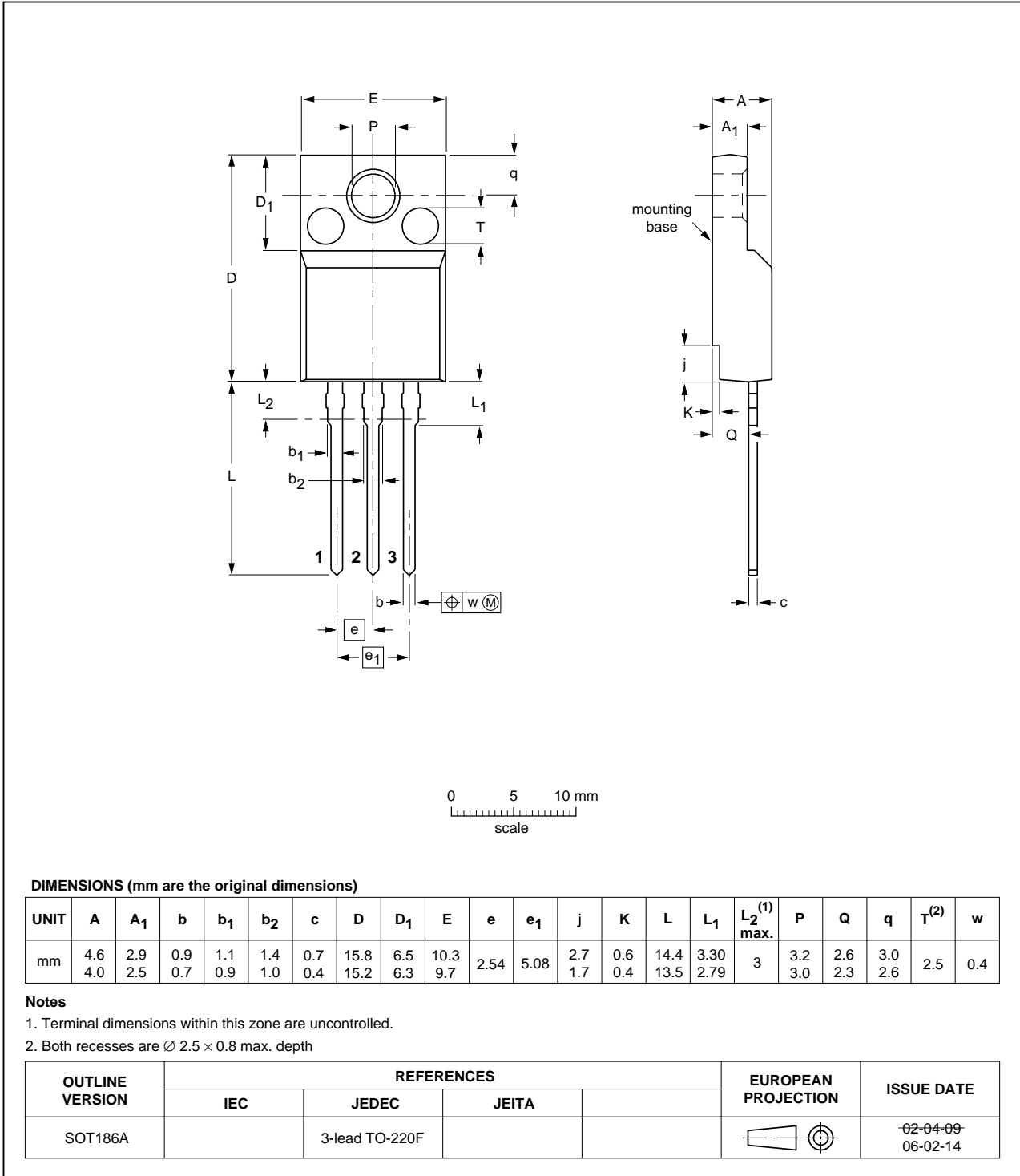


Fig 12. Package outline SOT186A (TO-220F)

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

12.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	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.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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