

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)		
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	
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			

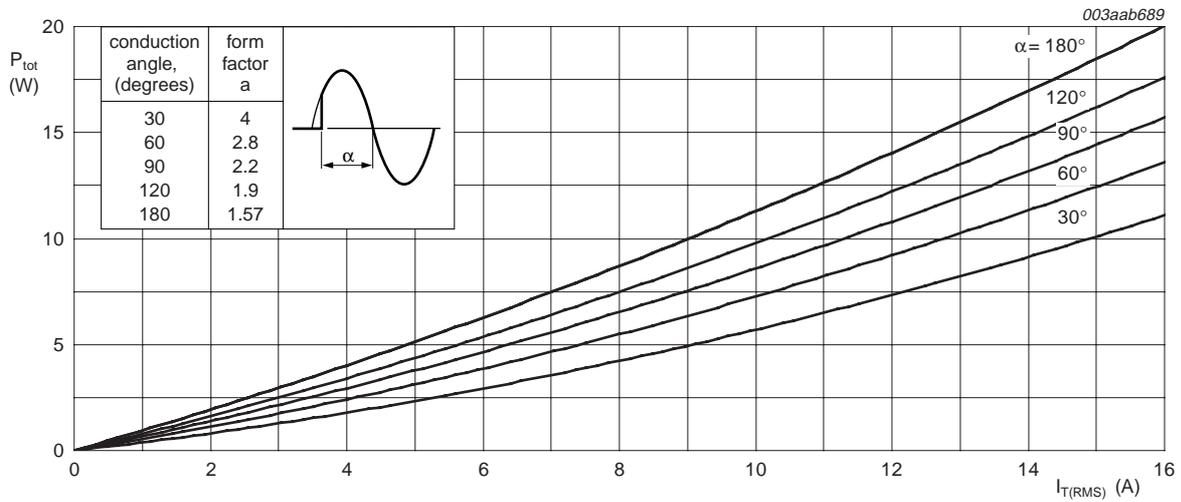
4. Limiting values

Table 3. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{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; $T_{\text{h}} \leq 45 \text{ }^{\circ}\text{C}$; see Figure 4 and 5	-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j}} = 25 \text{ }^{\circ}\text{C}$ prior to surge; see Figure 2 and 3			
		$t = 20 \text{ ms}$	-	140	A
		$t = 16.7 \text{ ms}$	-	150	A
I^2t	I^2t for fusing	$t = 10 \text{ ms}$	-	98	A^2s
di_{T}/dt	rate of rise of on-state current	$I_{\text{TM}} = 20 \text{ A}$; $I_{\text{G}} = 0.2 \text{ A}$; $di_{\text{G}}/dt = 0.2 \text{ A}/\mu\text{s}$	-	100	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		-	2	A
P_{GM}	peak gate power		-	5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	-	0.5	W
T_{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/ μs .



α = conduction angle

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

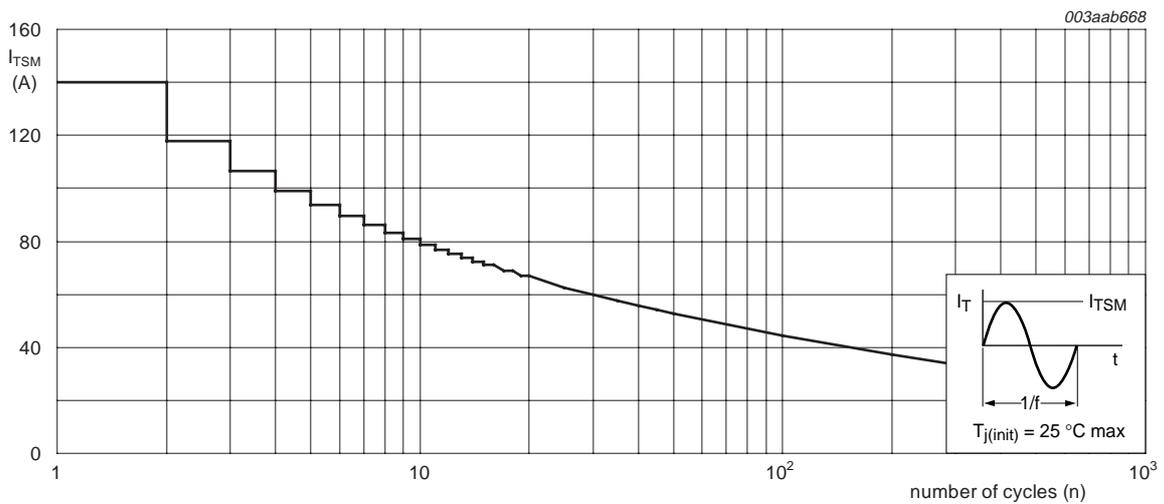
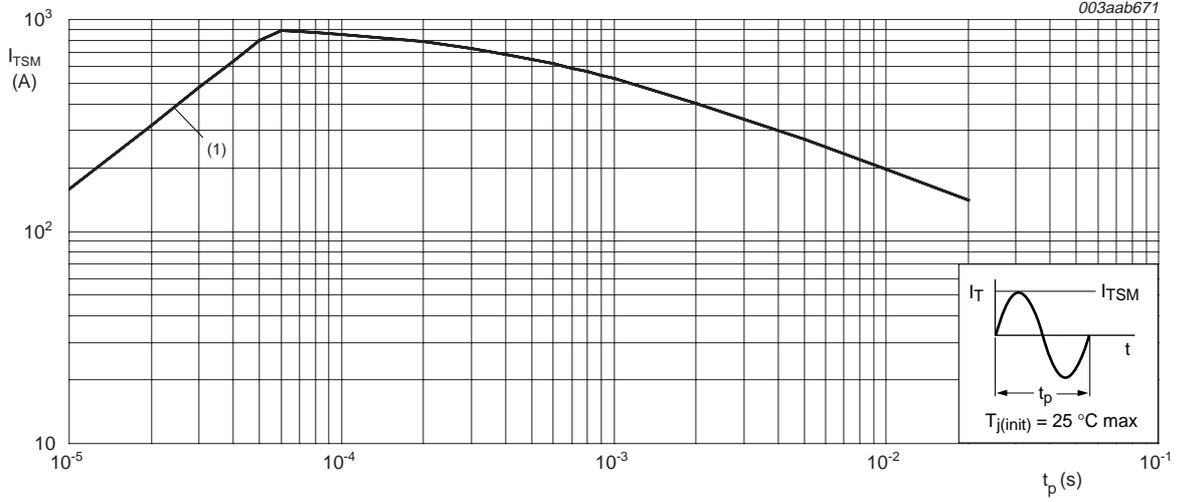


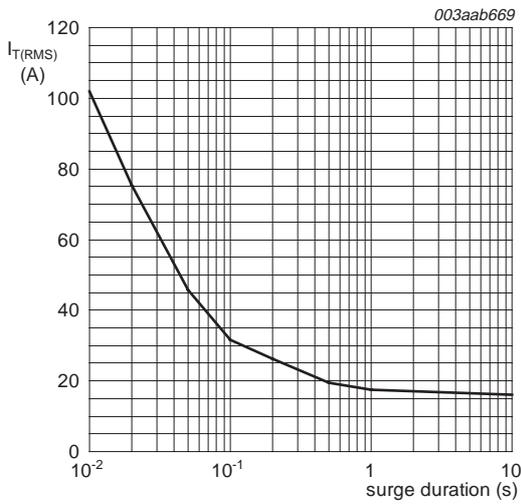
Fig 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20 \text{ ms}$

(1) di_T/dt limit

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



$f = 50 \text{ Hz}$;

$T_h = 45 \text{ }^\circ\text{C}$

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

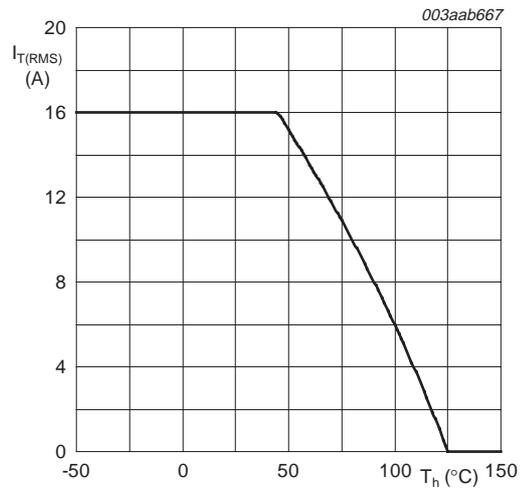
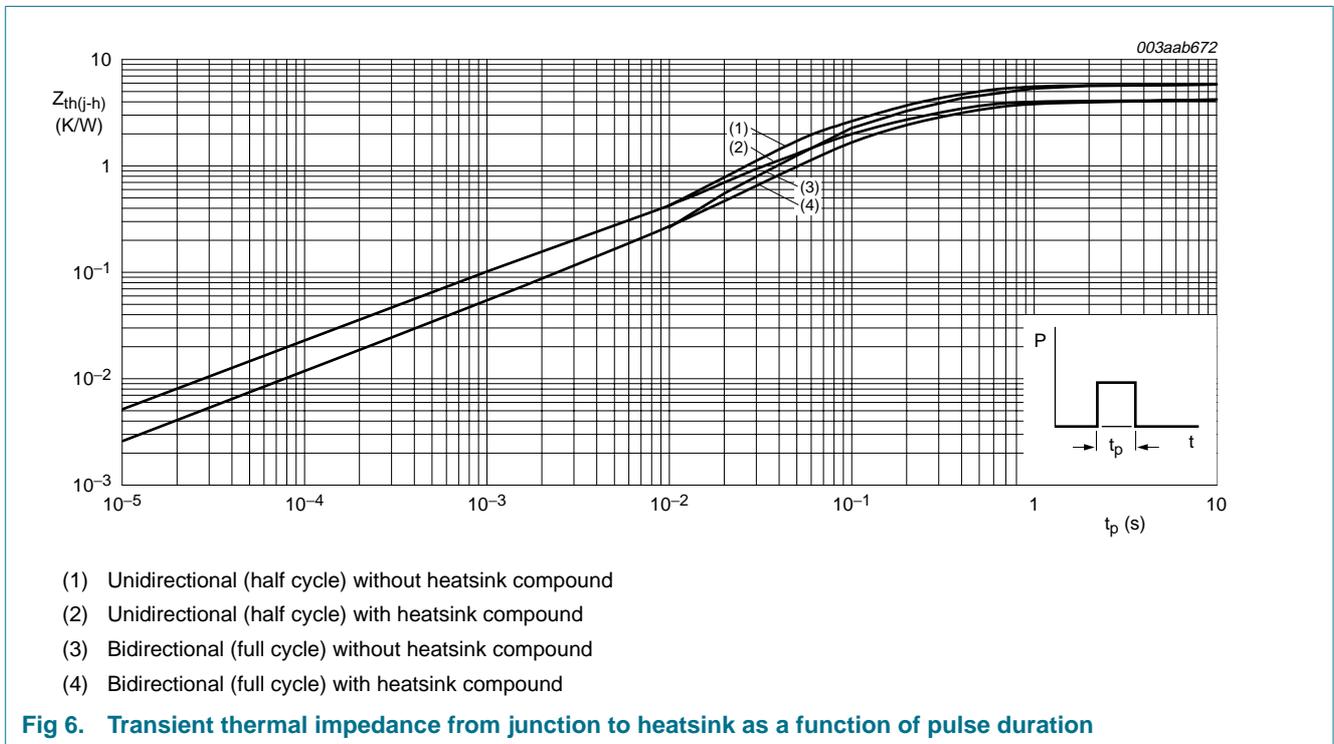


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full or half cycle without heatsink compound; see Figure 6	-	-	5.5	K/W
		full or half cycle with heatsink compound; see Figure 6	-	-	4.0	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

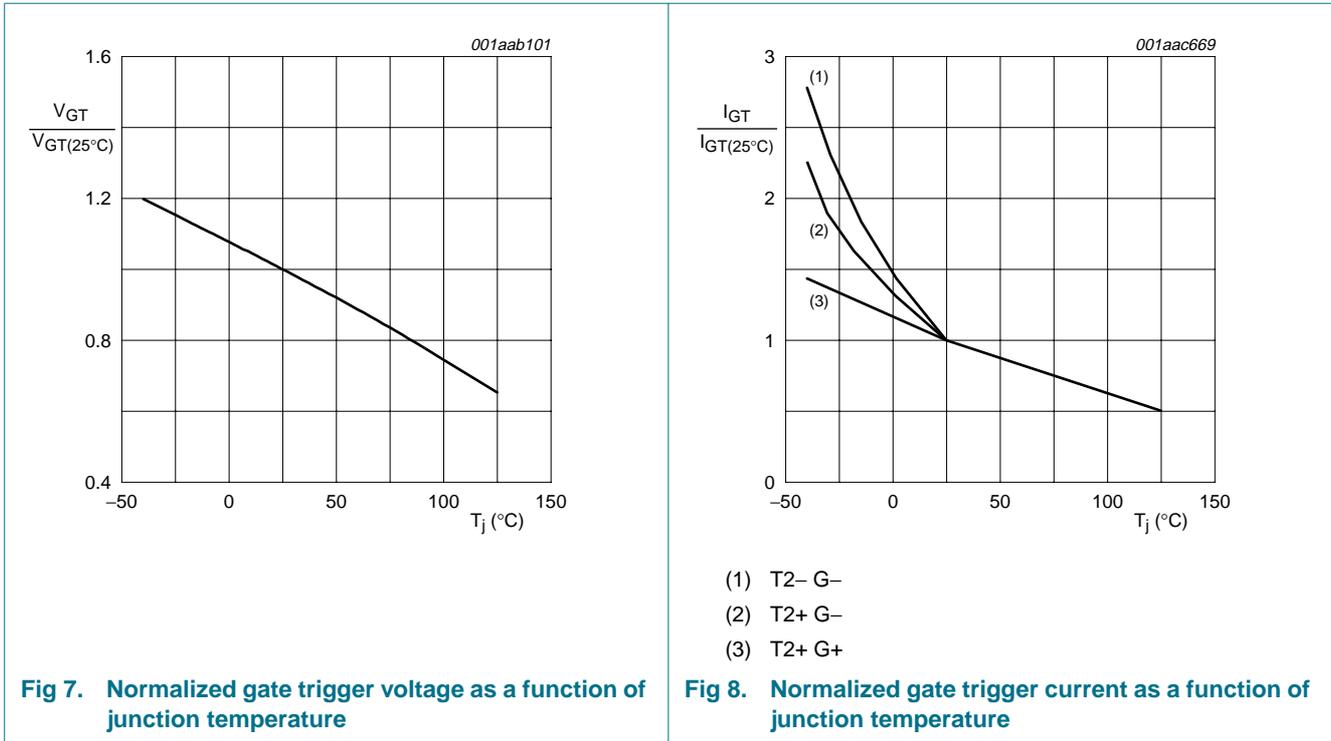
Table 6. Static characteristics
T_j = 25 °C unless otherwise specified.

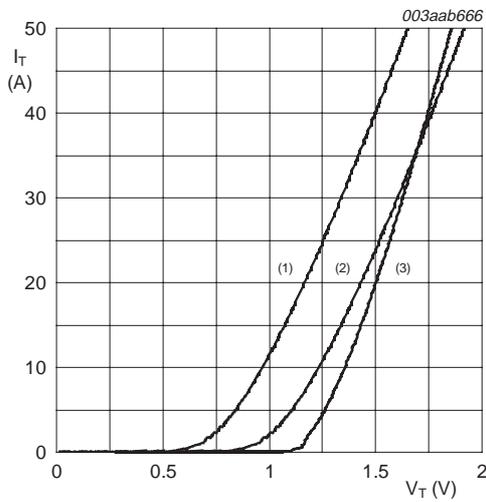
Symbol	Parameter	Conditions	BTA316X-600B BTA316X-800B			BTA316X-600C BTA316X-800C			BTA316X-600E BTA316X-800E			Unit	
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; see Figure 8	T2+ G+	2	-	50	2	-	35	-	-	10	mA
			T2+ G-	2	-	50	2	-	35	-	-	10	mA
			T2- G-	2	-	50	2	-	35	-	-	10	mA
I _L	latching current	V _D = 12 V; I _{GT} = 0.1 A; see Figure 10	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 V; I _{GT} = 0.1 A; see Figure 11	-	-	60	-	-	35	-	-	15	mA	
V _T	on-state voltage	I _T = 18 A; see Figure 9	-	1.3	1.5	-	1.3	1.5	-	1.3	1.5	V	
V _{GT}	gate trigger voltage	V _D = 12 V; I _T = 0.1 A; see Figure 7	-	0.8	1.5	-	0.8	1.5	-	0.8	1.5	V	
		V _D = 400 V; I _T = 0.1 A; T _j = 125 °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 °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/ μs
di_{com}/dt	rate of change of commutating current	$V_{DM} = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 16\text{ A}$; 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	-	μs





$V_o = 1.024 \text{ V}$
 $R_s = 0.021 \text{ } \Omega$
 (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

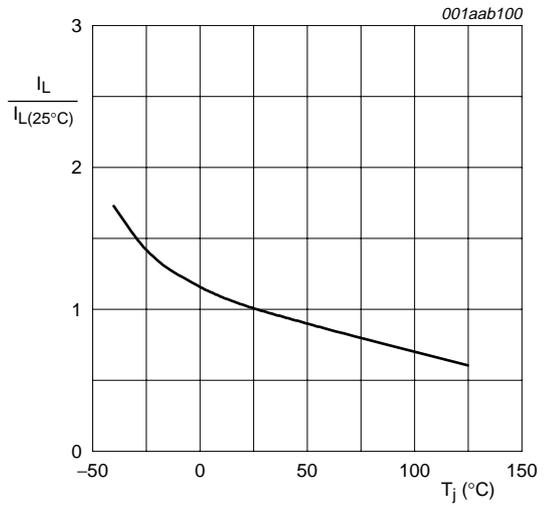


Fig 10. Normalized latching current as a function of junction temperature

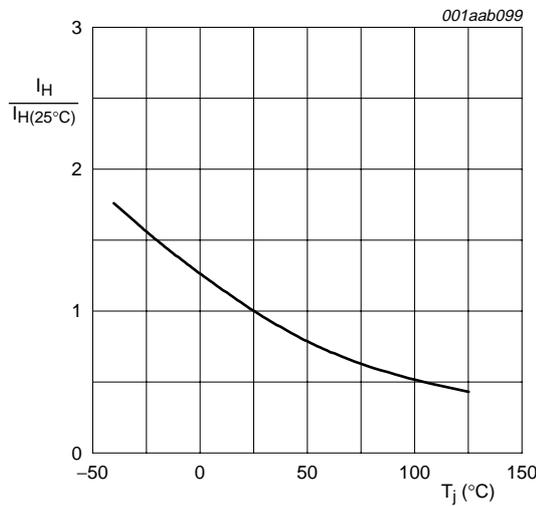


Fig 11. Normalized holding current as a function of junction temperature

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

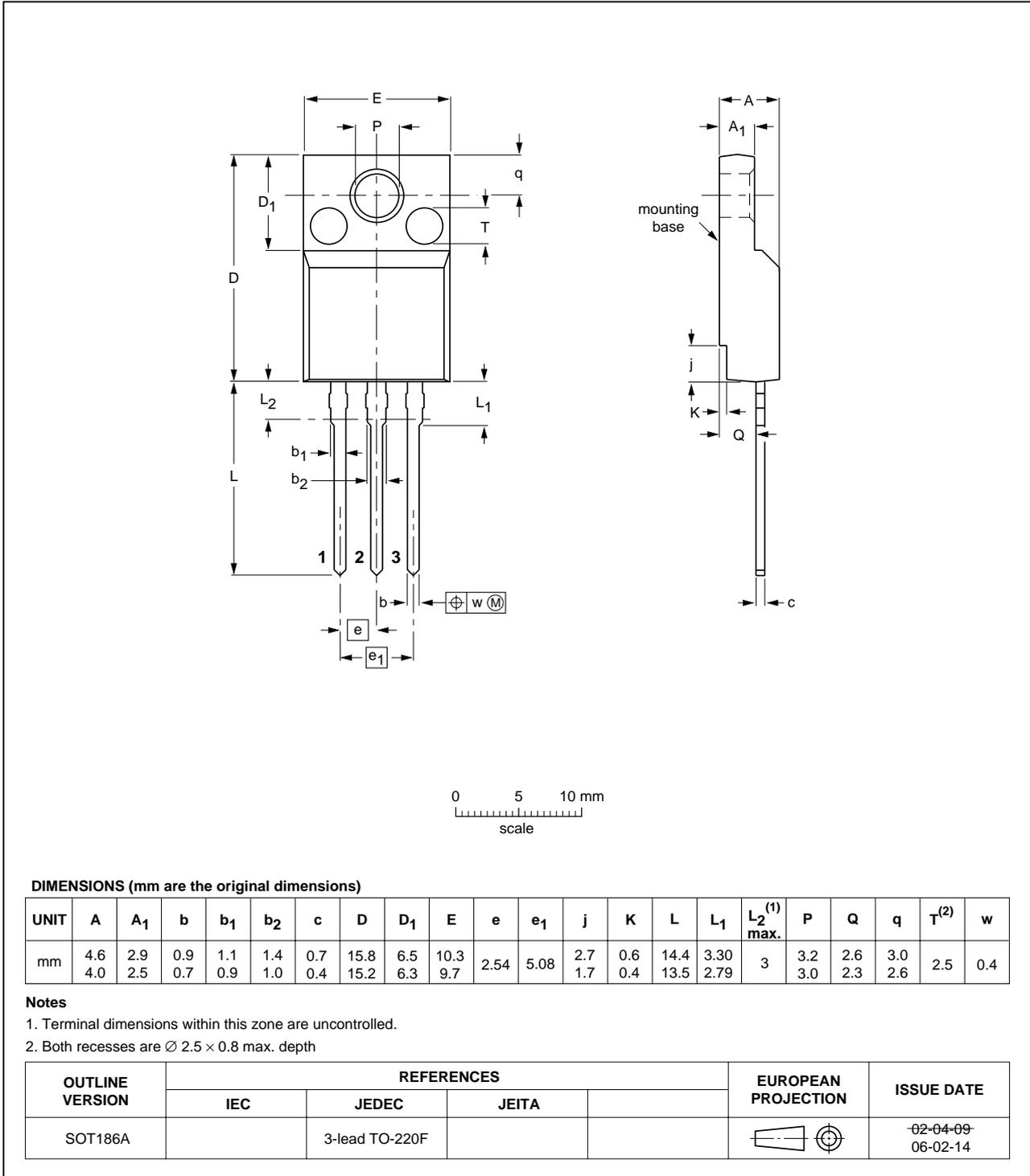


Fig 12. Package outline SOT186A (TO-220F)

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

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.

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

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