

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 isolation voltage
- High immunity to dV/dt
- Wide range of gate sensitivities

1.3 Applications

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

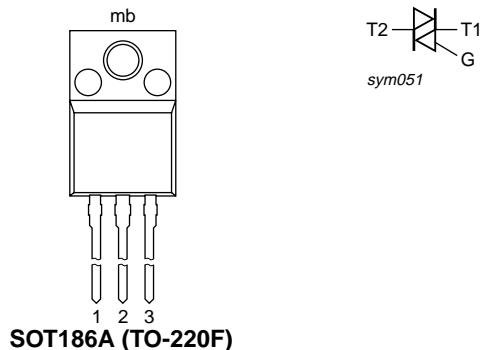
1.4 Quick reference data

- $V_{DRM} \leq 600$ 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		



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			

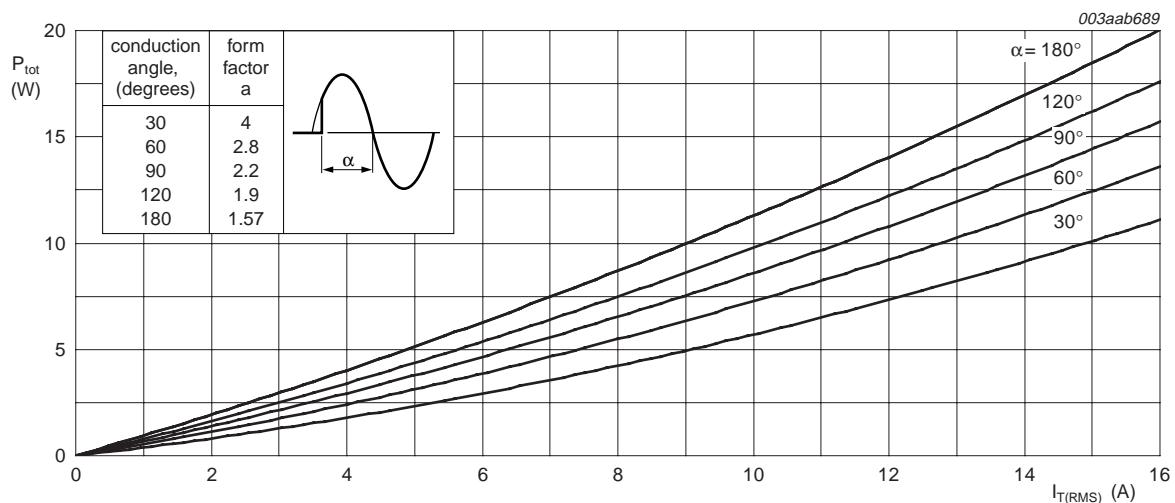
4. Limiting values

Table 3. Limiting values

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

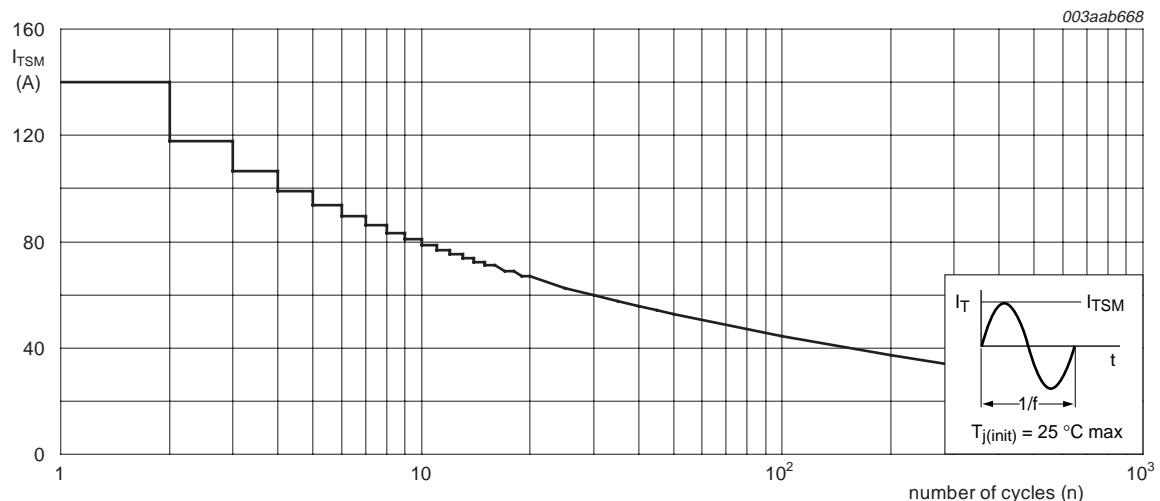
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage	BTA316X-600B; BTA316X-600C; BTA316X-600E	[1]	- 600	V
		BTA316X-800B; BTA316X-800C; BTA316X-800E			
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 45^\circ\text{C}$; see Figure 4 and 5	-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_j = 25^\circ\text{C}$ prior to surge; see Figure 2 and 3		- 140	A
		$t = 20 \text{ ms}$			
		$t = 16.7 \text{ ms}$			
I^2t	I^2t for fusing	$t = 10 \text{ ms}$	-	98	A^2s
dI_t/dt	rate of rise of on-state current	$I_{TM} = 20 \text{ A}$; $I_G = 0.2 \text{ A}$; $dI_G/dt = 0.2 \text{ A}/\mu\text{s}$	-	100	$\text{A}/\mu\text{s}$
I_{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	$^\circ\text{C}$
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



$f = 50$ Hz

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

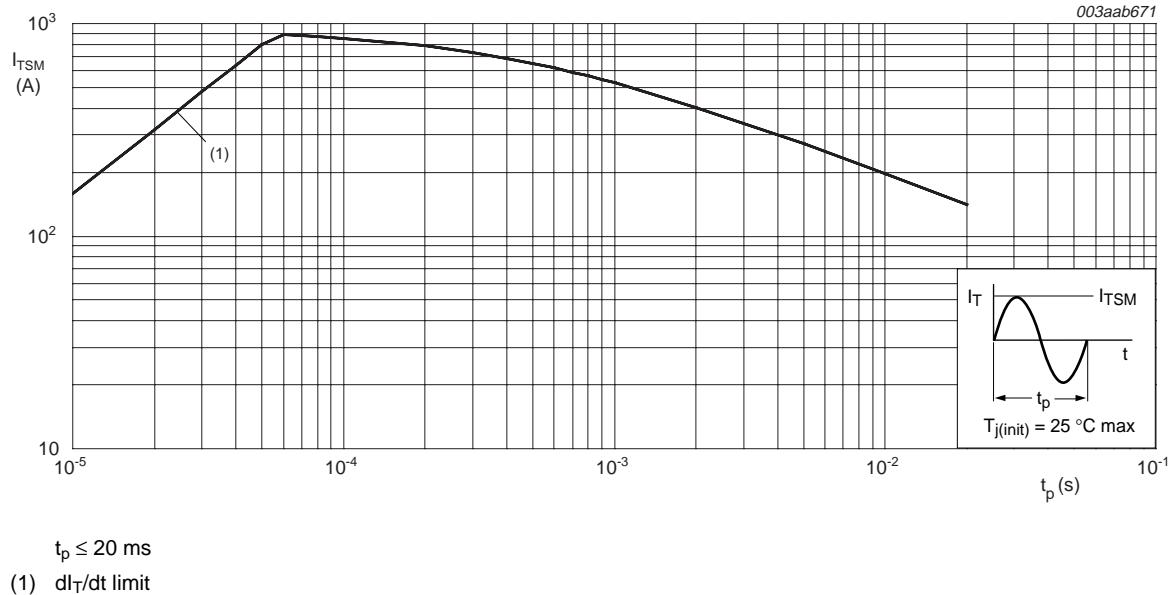


Fig 3. Non-repetitive peak on-state current as a function of pulse duration; maximum values

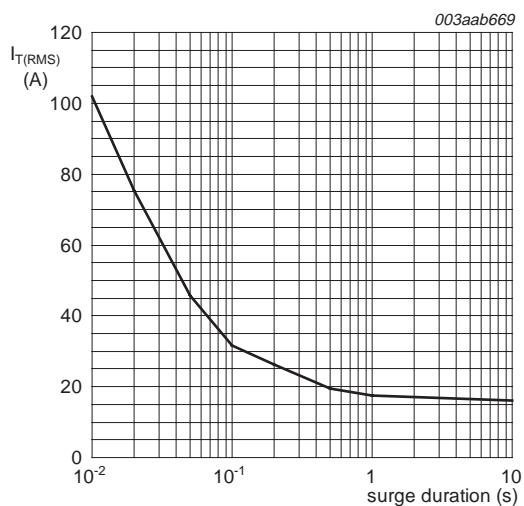


Fig 4. RMS on-state current as a function of surge duration; maximum values

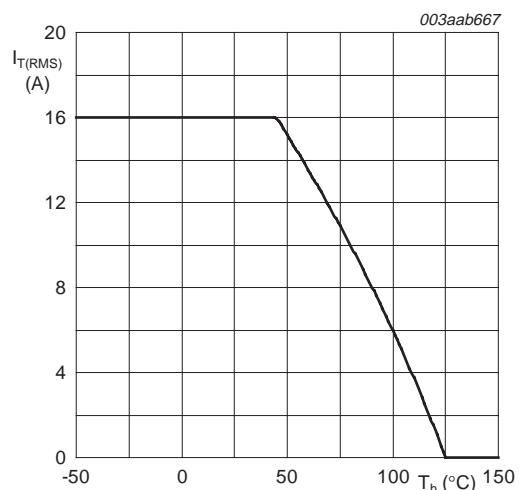
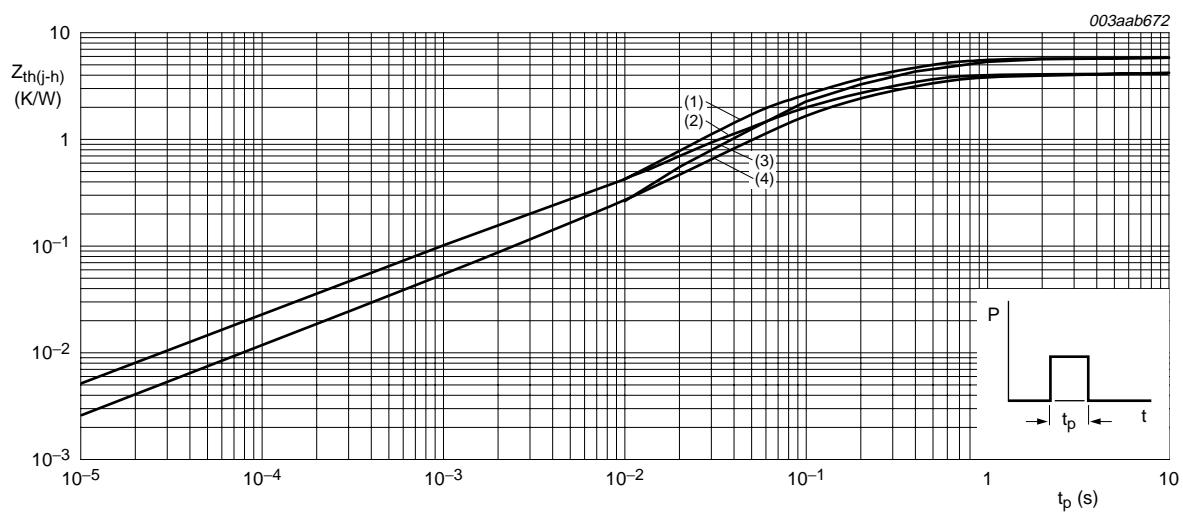


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

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



- (1) Unidirectional (half cycle) without heatsink compound
- (2) Unidirectional (half cycle) with heatsink compound
- (3) Bidirectional (full cycle) without heatsink compound
- (4) Bidirectional (full cycle) with heatsink compound

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

6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

$T_h = 25^\circ\text{C}$ 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

$T_j = 25^\circ\text{C}$ 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 Figure 8	2	-	50	2	-	35	-	-	10	mA
			2	-	50	2	-	35	-	-	10	mA
			2	-	50	2	-	35	-	-	10	mA
I_L	latching current	$V_D = 12\text{ V}$; $I_{GT} = 0.1\text{ A}$; see Figure 10	-	-	60	-	-	50	-	-	25	mA
			-	-	90	-	-	60	-	-	30	mA
			-	-	60	-	-	50	-	-	30	mA
I_H	holding current	$V_D = 12\text{ V}$; $I_{GT} = 0.1\text{ A}$; see Figure 11	-	-	60	-	-	35	-	-	15	mA
V_T	on-state voltage	$I_T = 18\text{ A}$; see Figure 9	-	1.3	1.5	-	1.3	1.5	-	1.3	1.5	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; see Figure 7	-	0.8	1.5	-	0.8	1.5	-	0.8	1.5	V
			0.25	0.4	-	0.25	0.4	-	0.25	0.4	-	V
I_D	off-state current	$V_D = V_{DRM(max)}$; $T_j = 125^\circ\text{C}$	-	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	$V_{DM} = 0.67 \times V_{DRM(max)}$; $T_j = 125^\circ C$; exponential waveform; gate open circuit	1000	-	-	500	-	-	60	-	-	V/ μ s
dl_{com}/dt	rate of change of commutating current	$V_{DM} = 400 V$; $T_j = 125^\circ C$; $I_{T(RMS)} = 16 A$; without snubber; gate open circuit	20	-	-	15	-	-	5	-	-	A/ms
		$V_{DM} = 400 V$; $T_j = 125^\circ C$; $I_{T(RMS)} = 16 A$; $dV/dt = 10 V/\mu$ s; gate open circuit	-	-	-	-	-	-	8	-	-	A/ms
		$V_{DM} = 400 V$; $T_j = 125^\circ C$; $I_{T(RMS)} = 16 A$; $dV/dt = 1 V/\mu$ s; gate open circuit	-	-	-	-	-	-	12	-	-	A/ms
t_{gt}	gate-controlled turn-on time	$I_{TM} = 20 A$; $V_D = V_{DRM(max)}$; $I_G = 0.1 A$; $dI_G/dt = 5 A/\mu$ s	-	2	-	-	2	-	-	2	-	μ s

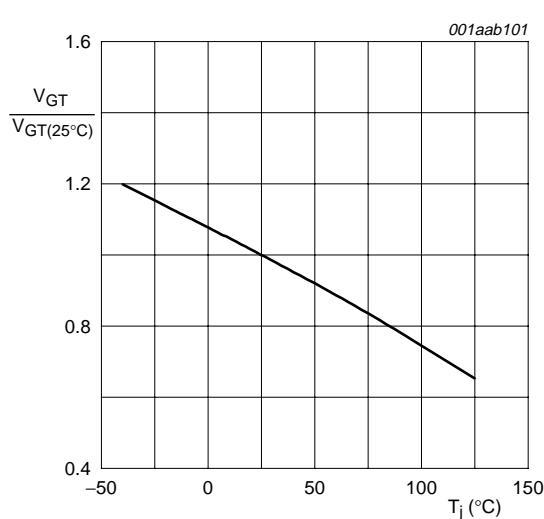


Fig 7. Normalized gate trigger voltage as a function of junction temperature

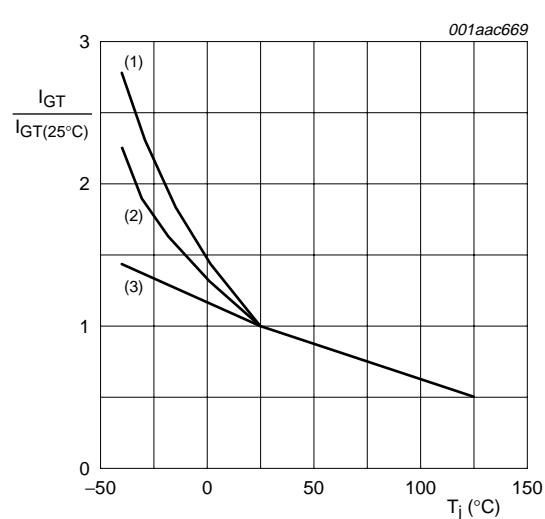
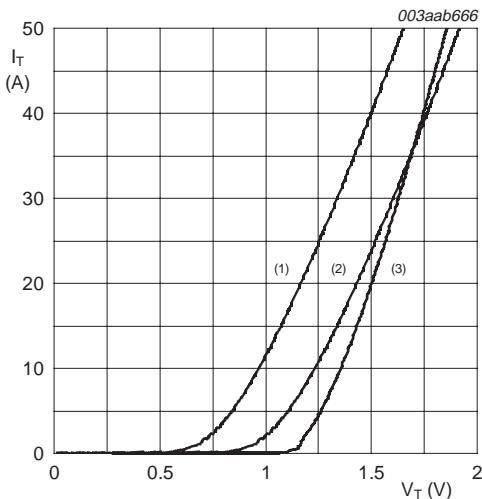


Fig 8. Normalized gate trigger current as a function of junction temperature



$V_o = 1.024$ V

$R_s = 0.021$ Ω

- (1) $T_j = 125$ °C; typical values
- (2) $T_j = 125$ °C; maximum values
- (3) $T_j = 25$ °C; maximum values

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

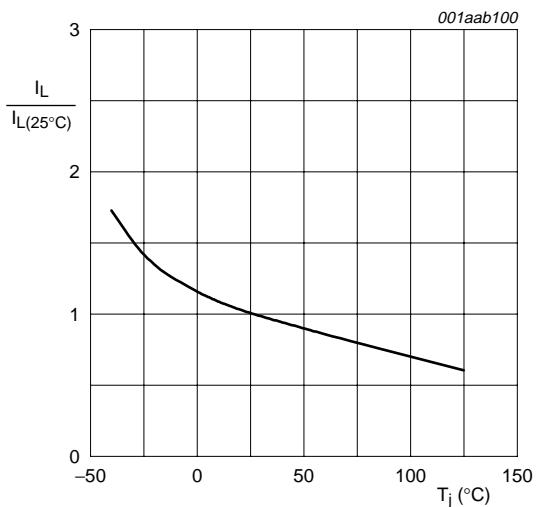


Fig 10. Normalized latching current as a function of junction temperature

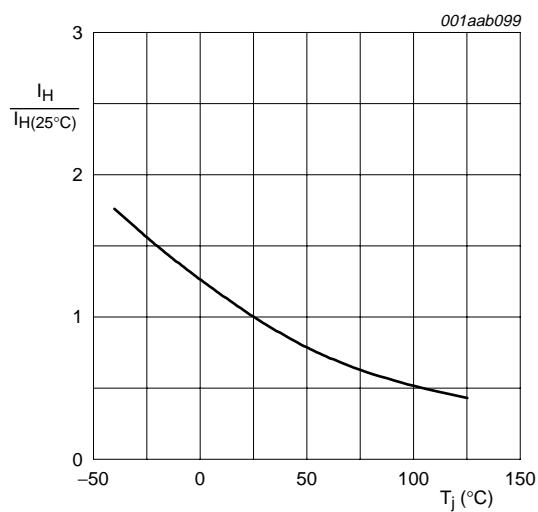


Fig 11. Normalized holding current as a function of junction temperature

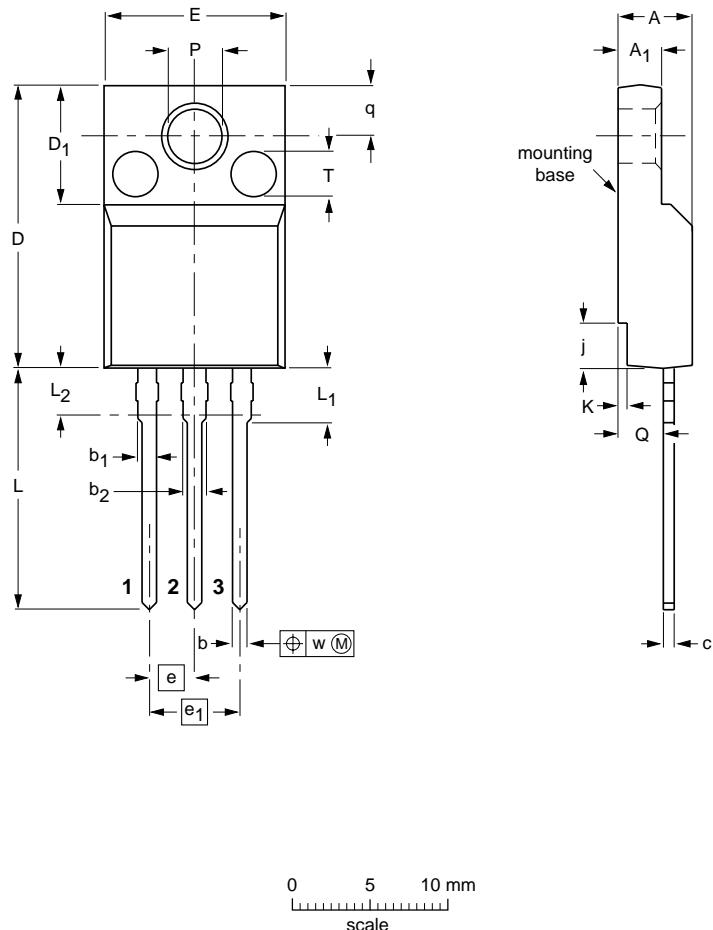
9. Package information

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



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁	b ₂	c	D	D ₁	E	e	e ₁	j	K	L	L ₁	L ₂ ⁽¹⁾ max.	P	Q	q	T ⁽²⁾	w
mm	4.6	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3	2.54	5.08	2.7	0.6	14.4	3.30	3	3.2	2.6	3.0	2.5	0.4
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7			1.7	0.4	13.5	2.79	3.0	3.0	2.3	2.6	2.5	

Notes

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are Ø 2.5 × 0.8 max. depth

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3-lead TO-220F				02-04-09 06-02-14

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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