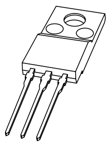


BTA312X series D and E

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

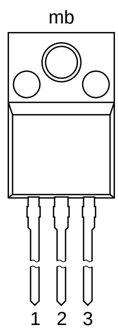
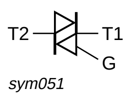
- High power motor control - e.g. washing machines, vacuum cleaners
- Electronic thermostats
- Refrigeration and air conditioning compressors

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)	 **SOT186A (TO-220F)**	
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base; isolated		

founded by Philips

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
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	[1]	-	600	V
		BTA312X-800E		-	800	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^2s
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/µs		-	100	A/µs
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/µs.

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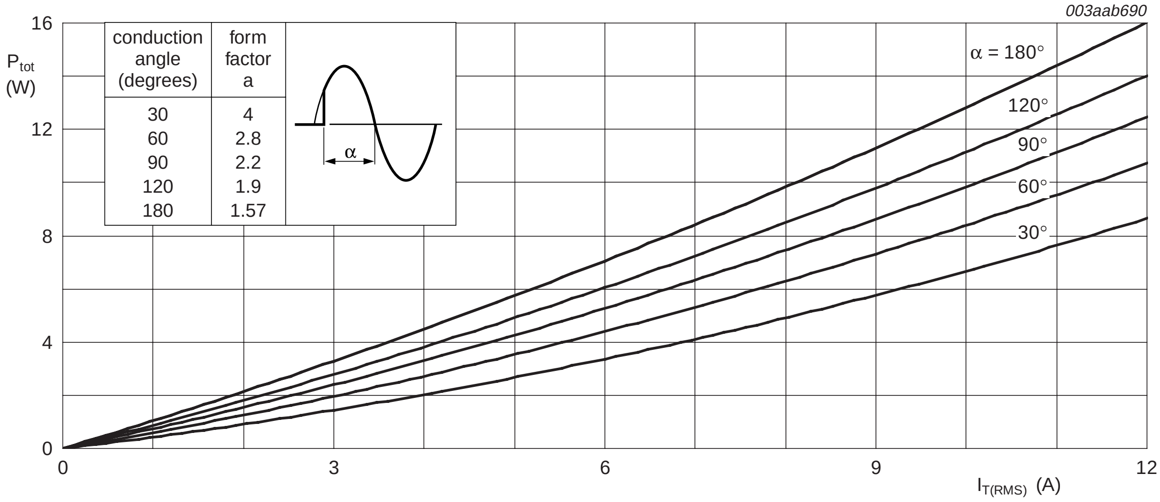
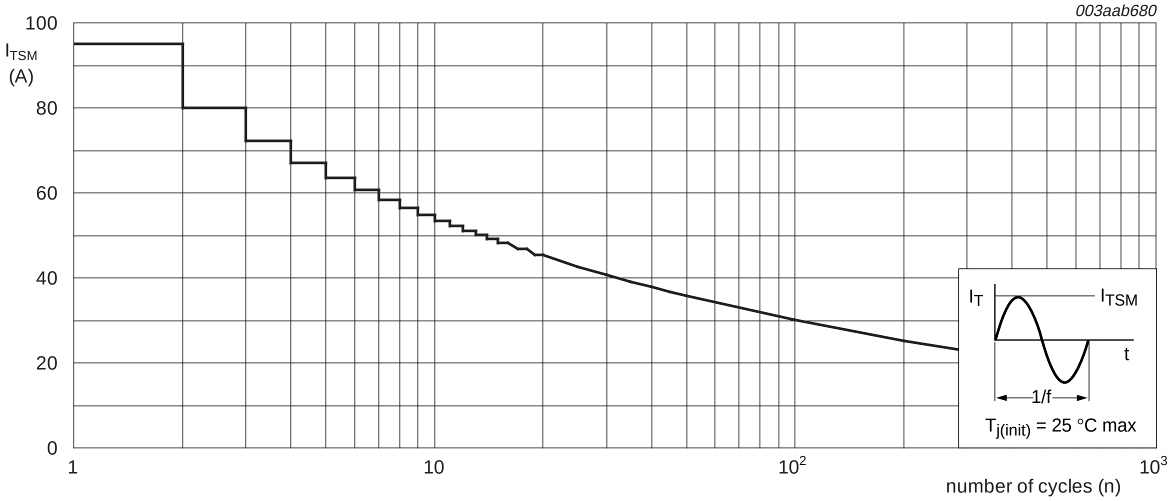


α = conduction angle

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

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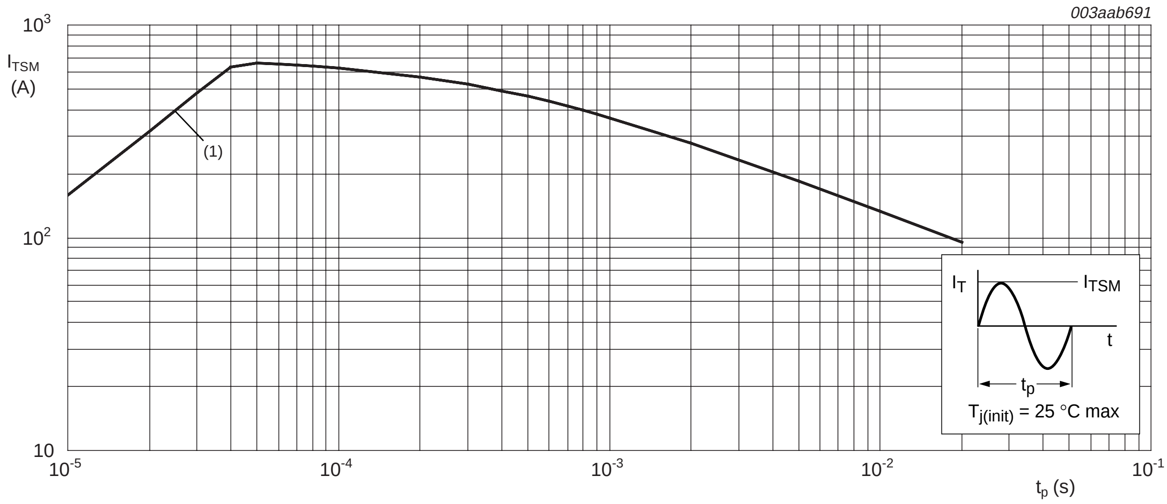
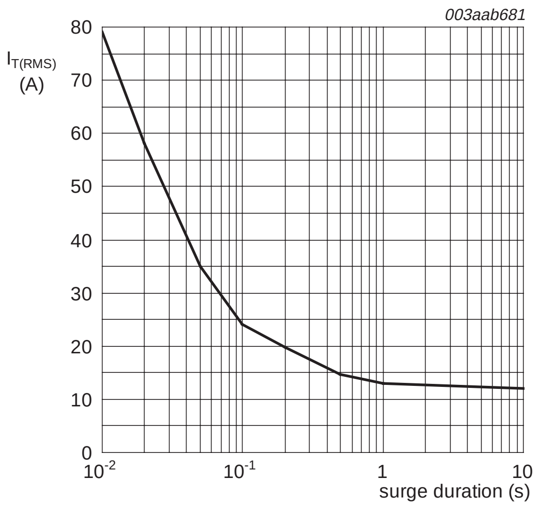


$t_p \leq 20$ ms

(1) dI_T/dt limit

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



f = 50 Hz

T_h = 61 °C

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

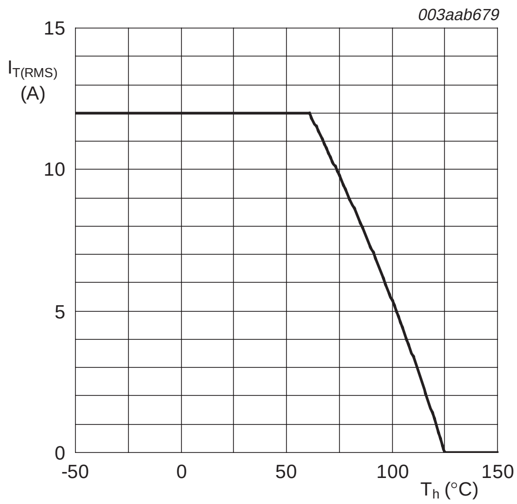


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

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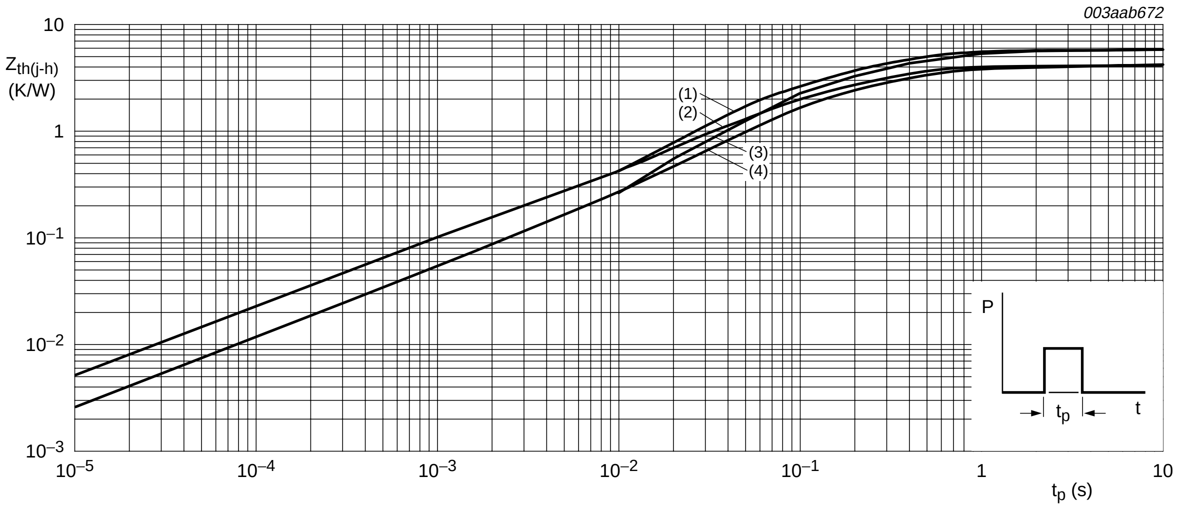
5. Thermal characteristics

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



(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

$T_h = 25\,°C$ 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 Hz to 60 Hz; sinusoidal waveform; RH ≤ 65 %; clean and dust free	-	-	2500	V
C_{isol}	isolation capacitance	from pin 2 to external heatsink; f = 1 MHz	-	10	-	pF

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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
		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
		T2– G–	-	-	15	-	-	25	mA
I_H	holding current	V_D = 12 V; I_{GT} = 0.1 A; see Figure 11	-	-	10	-	-	15	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

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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	$V_{DM} = 0.67 \times V_{DRM(max)}$; $T_j = 125$ °C; exponential waveform; gate open circuit	20	-	-	50	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	$V_{DM} = 400$ V; $T_j = 125$ °C; $I_{T(RMS)} = 12$ A; without snubber; gate open circuit	1	-	-	3	-	-	A/ms
		$V_{DM} = 400$ V; $T_j = 125$ °C; $I_{T(RMS)} = 12$ A; dV/dt = 10 µs; gate open circuit	1.5	-	-	6	-	-	A/ms
		$V_{DM} = 400$ V; $T_j = 125$ °C; $I_{T(RMS)} = 12$ A; dV/dt = 1 µs; gate open circuit	4.5	-	-	10	-	-	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/µs	-	2	-	-	2	-	µs

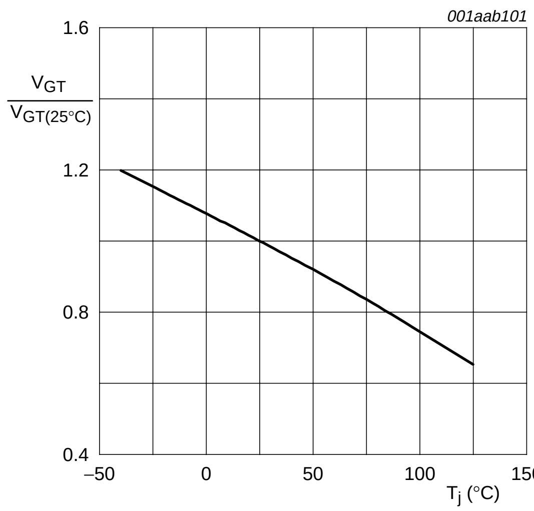
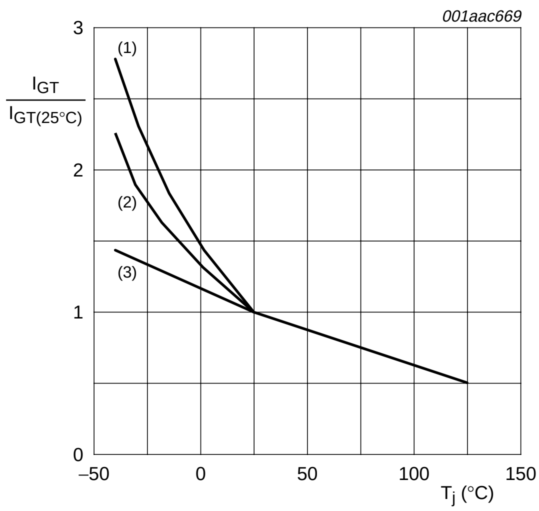


Fig 7. Normalized gate trigger voltage as a function of junction temperature



(1) T2− G−

(2) T2+ G−

(3) T2+ G+

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

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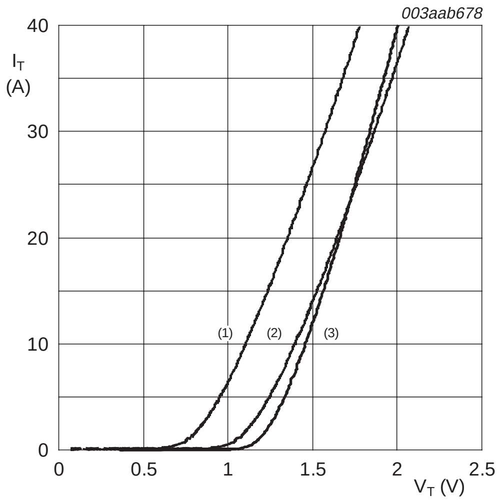

V_o = 1.127 V

R_s = 0.027 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

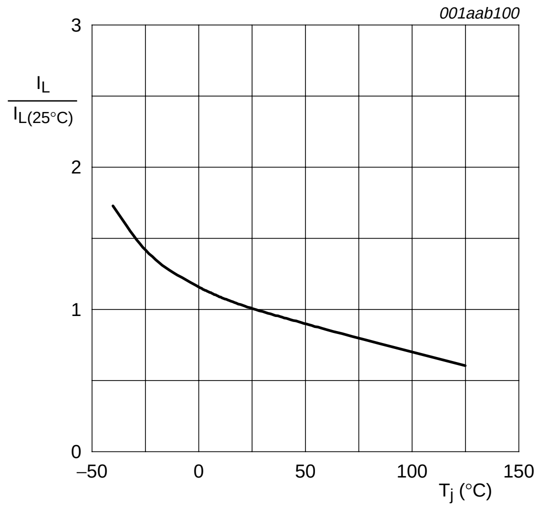

Fig 10. Normalized latching current as a function of junction temperature

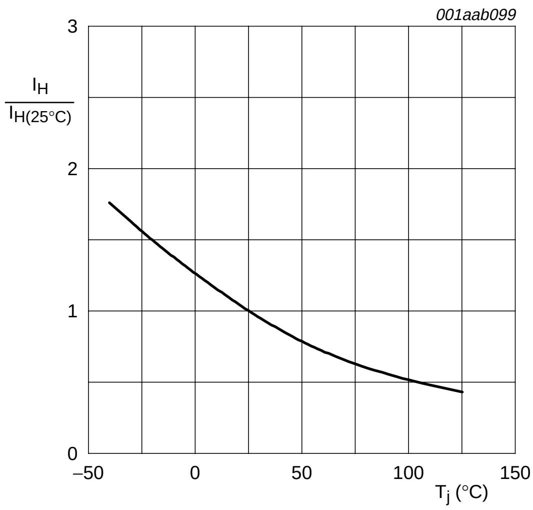

Fig 11. Normalized holding current as a function of junction temperature

9. Package information

Epoxy meets UL94 V-0 at 3.175 mm.

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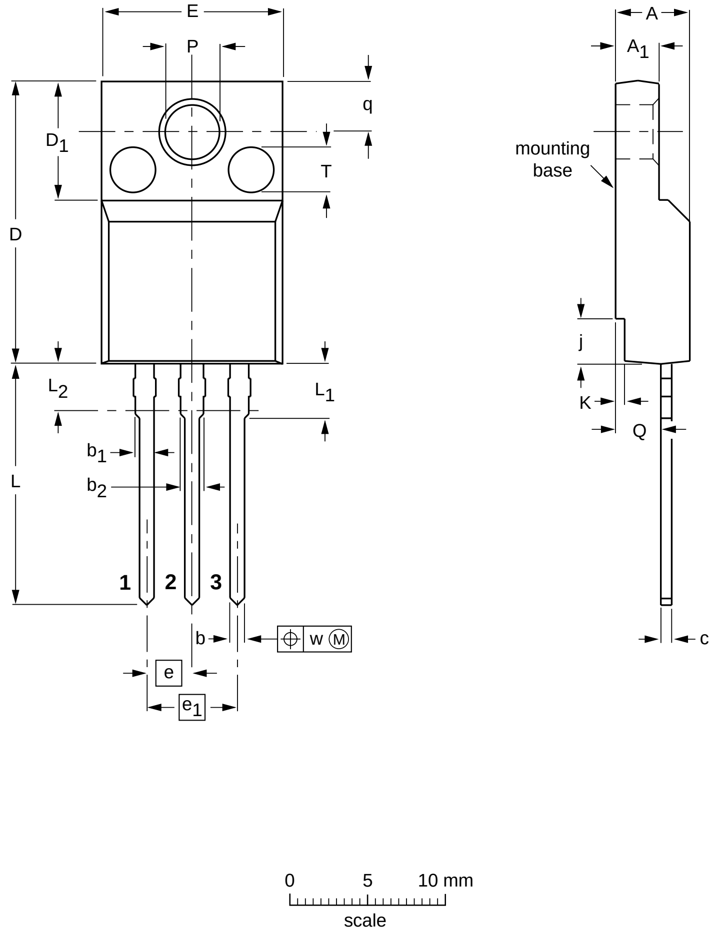
10. Package outline

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	A1	b	b1	b2	c	D	D1	E	e	e1	j	K	L	L1	L2(1) max.	P	Q	q	T(2)	w
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

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

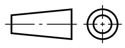
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3-lead TO-220F				~~02-04-09~~ 06-02-14

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

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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	-	-

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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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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14. Contents

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Document identifier: BTA312X_SER_D_E_1

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