BTA204X series D, E and F

Three quadrant triacs guaranteed commutation

Rev. 5 — 3 November 2011 Product data sheet

1. Product profile

1.1 General description

Passivated guaranteed commutation triacs in a plastic full pack package. These devices balance the requirements of commutation performance and gate sensitivity. The ‘sensitive gate’ E series and ‘logic level’ D series are intended for interfacing with low power drivers, including microcontrollers.

1.2 Features and benefits

- Suitable for interfacing with low power drivers, including microcontrollers
- Isolated mounting base

1.3 Applications

- Motor control
- High inductive loads

1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BTA204X-600D)
- $V_{DRM} \leq 600$ V (BTA204X-600E)
- $V_{DRM} \leq 600$ V (BTA204X-600F)
- $V_{DRM} \leq 800$ V (BTA204X-800E)
- $I_{T(RMS)} \leq 4$ A
- $I_{GT} \leq 5$ mA (BTA204X-600D)
- $I_{GT} \leq 10$ mA (BTA204X-600E)
- $I_{GT} \leq 25$ mA (BTA204X-600F)

2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	main terminal 1 (T1)	mb	T2, T1, G
2	main terminal 2 (T2)		
3	gate (G)		
mb	mounting base (isolated)	1 2 3	*sym051*

SOT186A (TO-220F)

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BTA204X-600D	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 lead TO-220 'full pack'	SOT186A
BTA204X-600E			
BTA204X-600F			
BTA204X-800E			

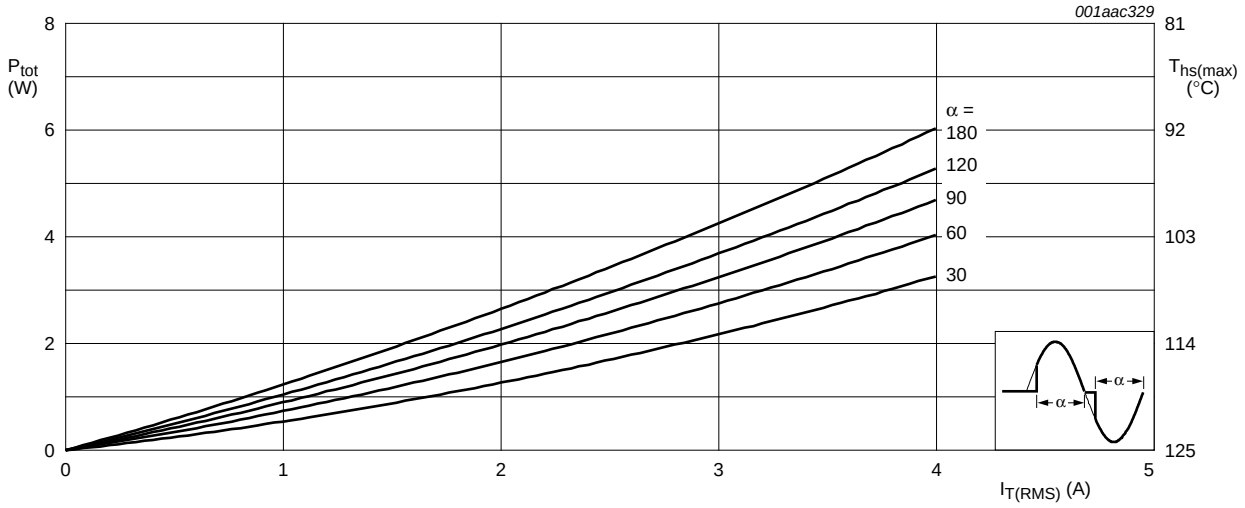
4. Limiting values

Table 3. Limiting values

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

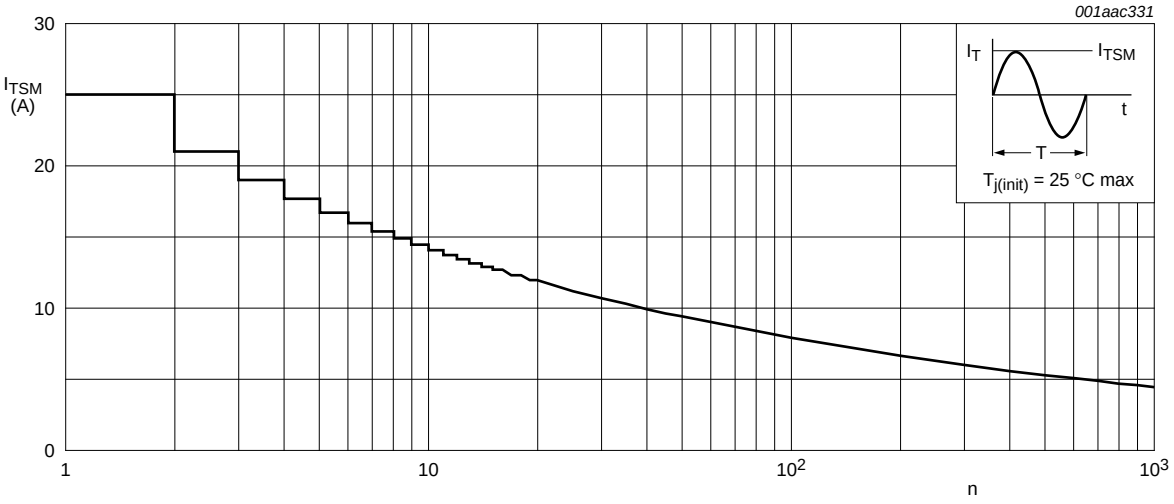
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage					
	BTA204X-600D		[1]	-	600	V
	BTA204X-600E		[1]	-	600	V
	BTA204X-600F		[1]	-	600	V
	BTA204X-800E			-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{hs} \leq 92$ °C; Figure 4 and Figure 5		-	4	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_j = 25$ °C prior to surge; Figure 2 and Figure 3				
		t = 20 ms		-	25	A
		t = 16.7 ms		-	27	A
I^2t	I^2t for fusing	t = 10 ms		-	3.1	A^2S
dI_T/dt	repetitive rate of rise of on-state current after triggering	$I_{TM} = 6$ 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 6 A/µs.



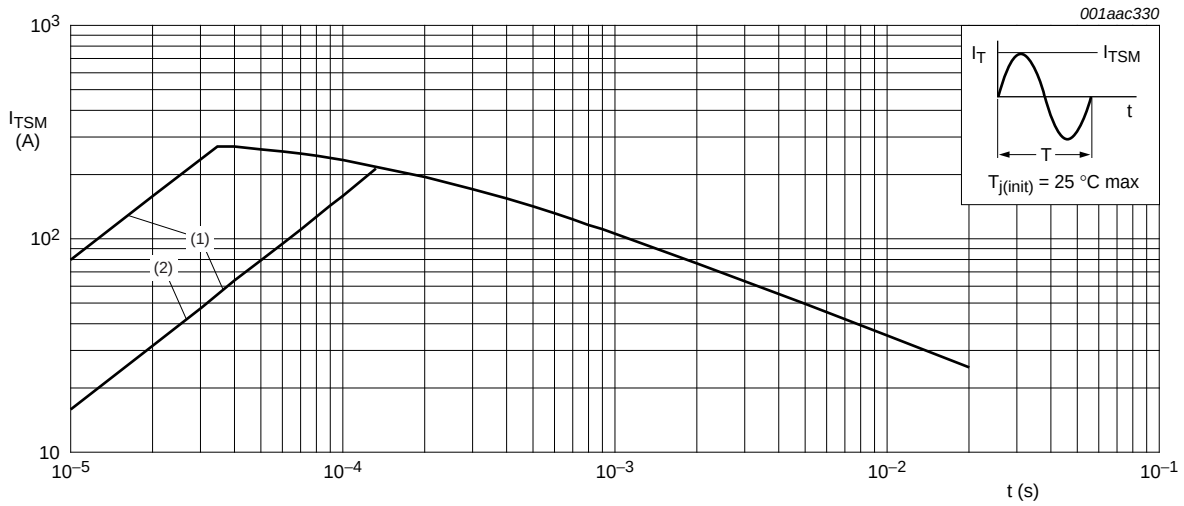
α = conduction angle

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

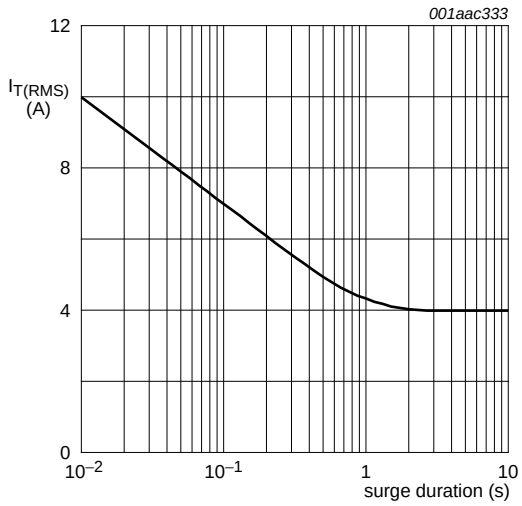


$t_p \leq 20$ ms

(1) dI_T/dt limit

(2) T2– G+ quadrant

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



f = 50 Hz; $T_h \leq 92$ °C

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

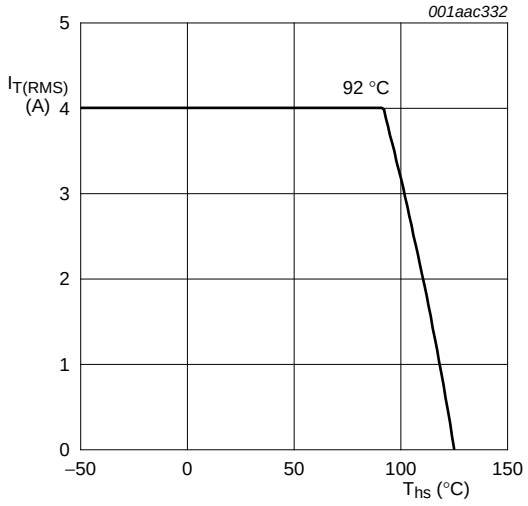
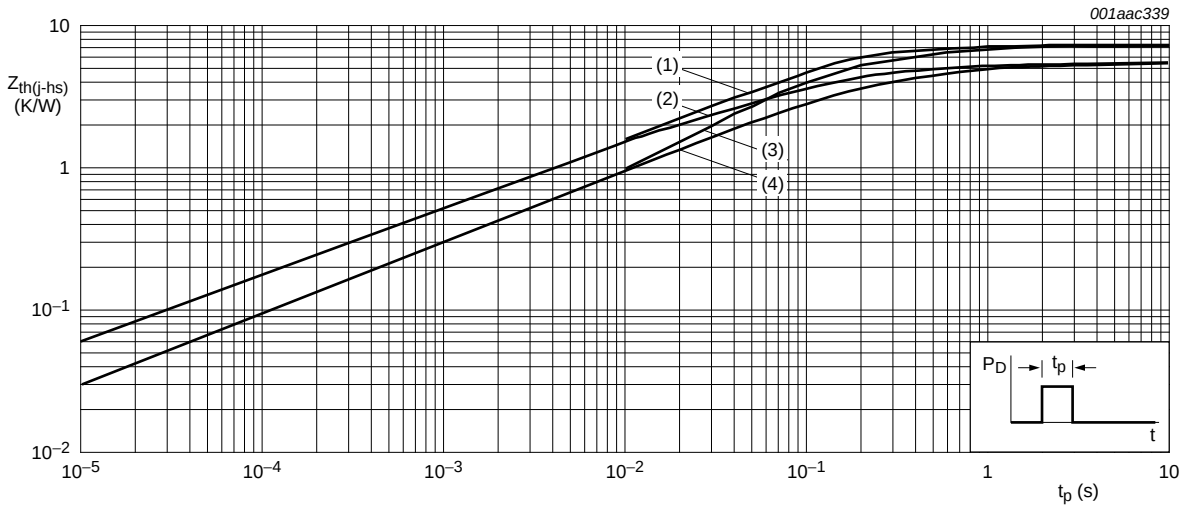


Fig 5. RMS on-state current as a function of heatsink temperature; maximum values

5. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-hs)}$	thermal resistance from junction to heatsink	full or half cycle with heatsink compound; Figure 6	-	-	5.5	K/W
		full or half cycle without heatsink compound; Figure 6	-	-	7.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



(1) Unidirectional without heatsink compound
(2) Unidirectional with heatsink compound
(3) Bidirectional without heatsink compound
(4) Bidirectional with heatsink compound

Fig 6. Transient thermal impedance as a function of pulse width

6. Isolation characteristics

Table 5. Isolation limiting values and characteristics

T_{hs} = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{isol}	RMS isolation voltage from all three terminals to external heatsink	f = 50 Hz to 60 Hz; sinusoidal waveform; R.H. ≤ 65 %; clean and dust free	-	-	2500	V
C_{isol}	capacitance from pin 2 to external heatsink	f = 1 MHz	-	10	-	pF

7. Static characteristics

Table 6. Static characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	BTA204X-600D			BTA204X-600E			BTA204X-600F			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; Figure 8										
		T2+ G+	-	-	5	-	-	10	-	-	25	mA
		T2+ G–	-	-	5	-	-	10	-	-	25	mA
		T2– G–	-	-	5	-	-	10	-	-	25	mA
I_L	latching current	V_D = 12 V; I_{GT} = 0.1 A; Figure 10										
		T2+ G+	-	-	6	-	-	12	-	-	20	mA
		T2+ G–	-	-	9	-	-	18	-	-	30	mA
		T2– G–	-	-	6	-	-	12	-	-	20	mA
I_H	holding current	V_D = 12 V; I_{GT} = 0.1 A; Figure 11	-	-	6	-	-	12	-	-	20	mA
V_T	on-state voltage	I_T = 5 A; Figure 9	-	1.4	1.7	-	1.4	1.7	-	1.4	1.7	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; Figure 7	-	0.7	1.5	-	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	-	0.25	0.4	-	V
I_D	off-state leakage 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	BTA204X-600D			BTA204X-600E			BTA204X-600F			Unit
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
dV_D/dt	critical rate of rise of off-state voltage	V_{DM} = 67 % $V_{DRM(max)}$; T_j = 125 °C; exponential waveform; gate open circuit	20	-	-	30	-	-	50	-	-	V/µs
dI_{com}/dt	critical rate of change of commutating current	V_{DM} = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 10 V/µs; gate open circuit	1.1	-	-	2.1	-	-	3	-	-	A/µs
		V_{DM} = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 0.1 V/µs; gate open circuit	4.5	-	-	8	-	-	15	-	-	A/µs
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	-	-	2	-	µs

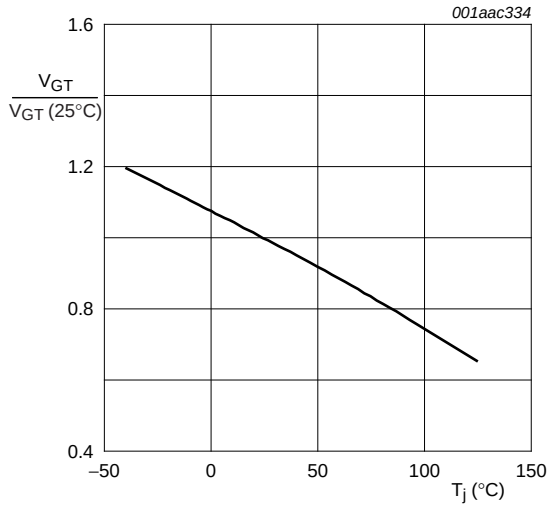
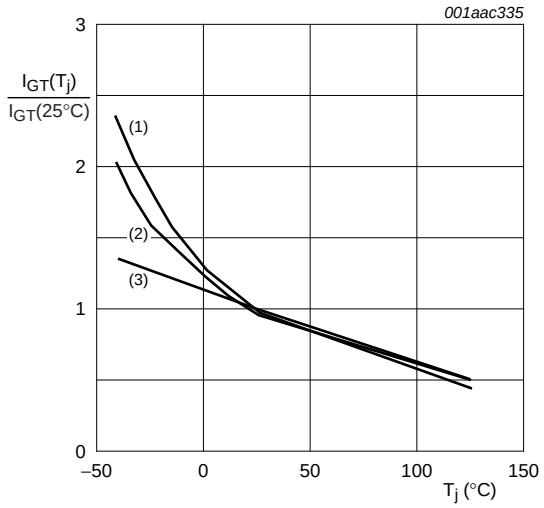
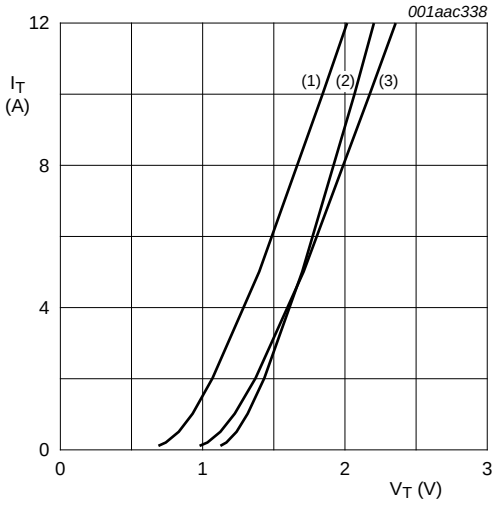


Fig 7. Normalized gate trigger voltage as a function of junction temperature



(1) T2– G–
(2) T2+ G–
(3) T2+ G+

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



V_O = 1.27 V

R_S = 0.091 Ω

(1) T_j = 125 °C; typical values

(2) T_j = 25 °C; maximum values

(3) T_j = 125 °C; maximum values

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

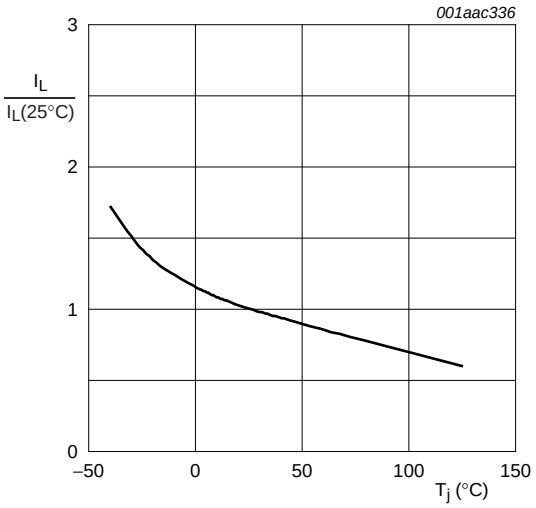


Fig 10. Normalized latching current as a function of junction temperature

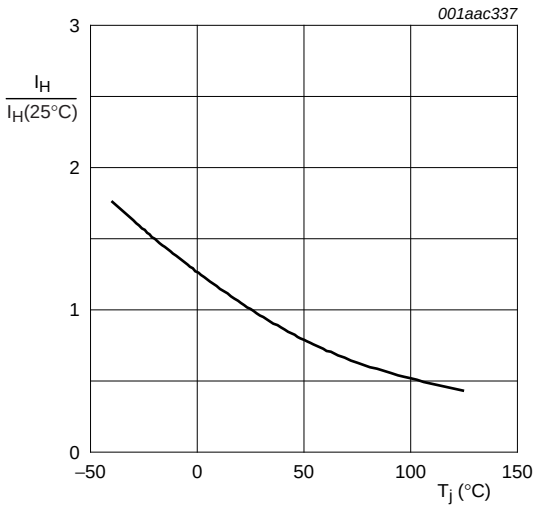


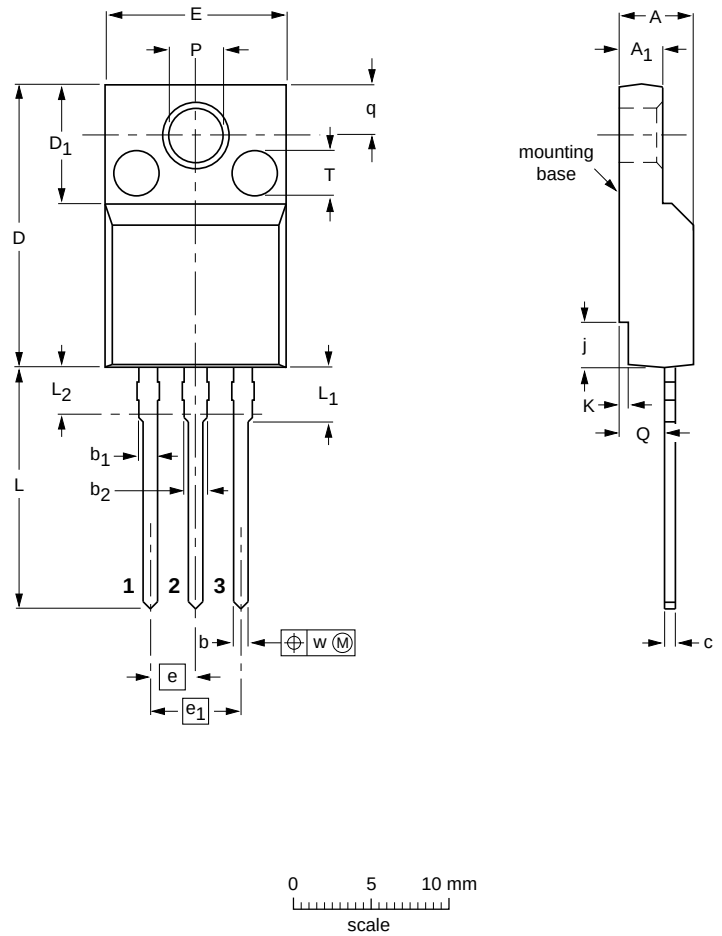
Fig 11. Normalized holding current as a function of junction temperature

9. Package information

Refer to mounting instructions for F-pack packages. Epoxy meets UL94 V-0 at 1/8 inch.

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 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)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA204X_SER_D_E_F v.5	20111103	Product data sheet	-	BTA204X_SER_D_E_F v.4
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate.			
BTA204X_SER_D_E_F v.4	20050317	Product data sheet	-	BTA204X_SERIES_D_E_F v.3
BTA204X_SERIES_D_E_F v.3	20030501	Product specification	-	BTA204X_SERIES_D_E_F v.2
BTA204X_SERIES_D_E_F v.2	19981201	Product specification	-	BTA204X_SERIES_D_E_F v.1
BTA204X_SERIES_D_E_F v.1	19971001	Product specification	-	-

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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Date of release: 3 November 2011

Document identifier: BTA204X_SER_D_E_F