BTA410X-600BT

3Q Hi-Com Triac

Rev. 1 — 13 March 2012 Product data sheet

1. Product profile

1.1 General description

Planar passivated high commutation three quadrant triac in a SOT186A (TO-220F) "full pack" plastic package intended for use in circuits where high static and dynamic dV/dt and high dI/dt can occur. This "series BT" triac will commutate the full RMS current at the maximum rated junction temperature ($T_{j(max)}$ = 150 °C) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

1.2 Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by dV/dt
- High junction operating temperature capability
- High voltage capability
- Isolated mounting base package
- Least sensitive gate for highest noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

1.3 Applications

- Applications subject to high temperature
- Industrial and domestic heating circuits
- Motor controls e.g. washing machines and vacuum cleaners
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

1.4 Quick reference data

Table 1. Quick reference data

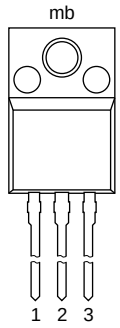
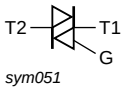
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	600	V
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)}$ = 25 °C; t_p = 20 ms; see Figure 4; see Figure 5	-	-	100	A
T_j	junction temperature		-	-	150	°C
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 98$ °C; see Figure 1; see Figure 2; see Figure 3	-	-	10	A

Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; T2+ G-; T_j = 25 °C; see Figure 7	2	-	50	mA
		V_D = 12 V; I_T = 0.1 A; T2+ G+; T_j = 25 °C; see Figure 7	2	-	50	mA
		V_D = 12 V; I_T = 0.1 A; T2- G-; T_j = 25 °C; see Figure 7	2	-	50	mA
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 402 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit	1000	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 10 A; dV_{com}/dt = 20 V/µs; (snubberless condition); gate open circuit	20	-	-	A/ms

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1		 sym051
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

SOT186A (TO-220F)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BTA410X-600BT	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

4. Limiting values

Table 4. 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		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 98$ °C; see Figure 1; see Figure 2; see Figure 3	-	10	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; see Figure 4; see Figure 5	-	100	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms	-	110	A
I^2t	I^2t for fusing	$t_p = 10$ ms; sine-wave pulse	-	50	A^2s
dI_T/dt	rate of rise of on-state current	$I_T = 20$ 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		-	150	°C

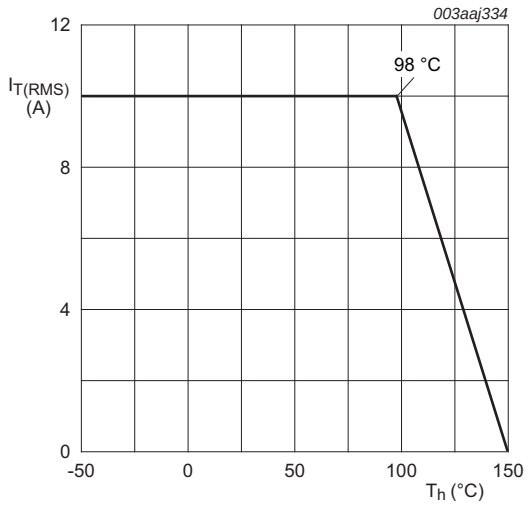


Fig 1. RMS on-state current as a function of heatsink temperature; maximum values

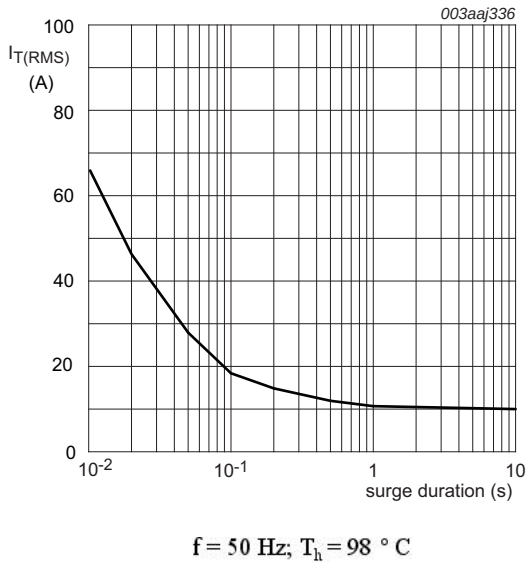
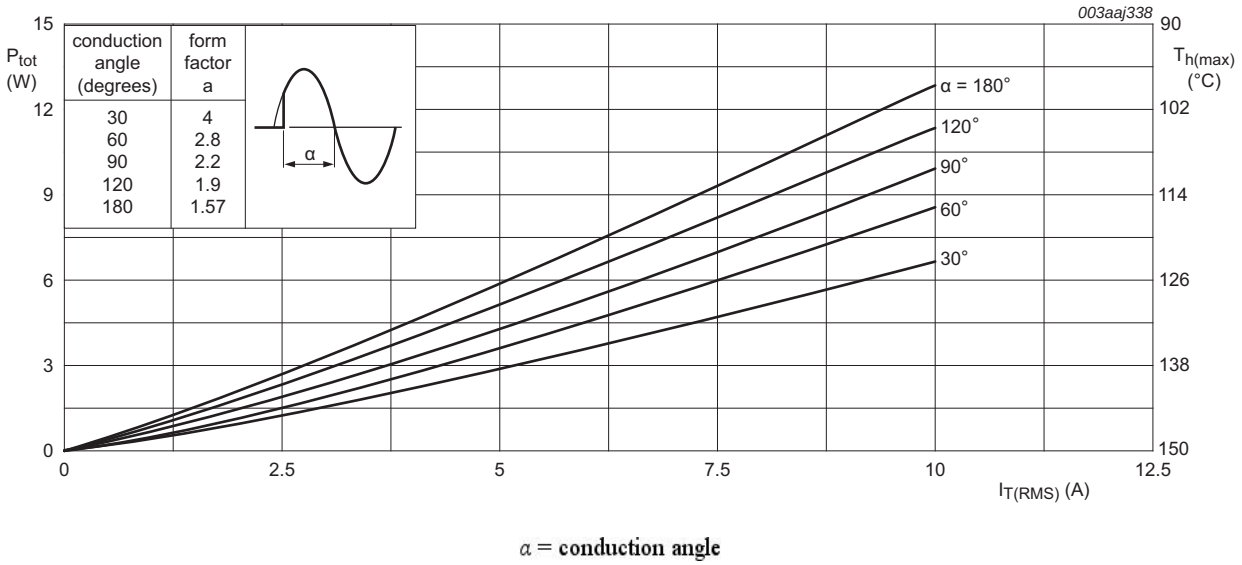
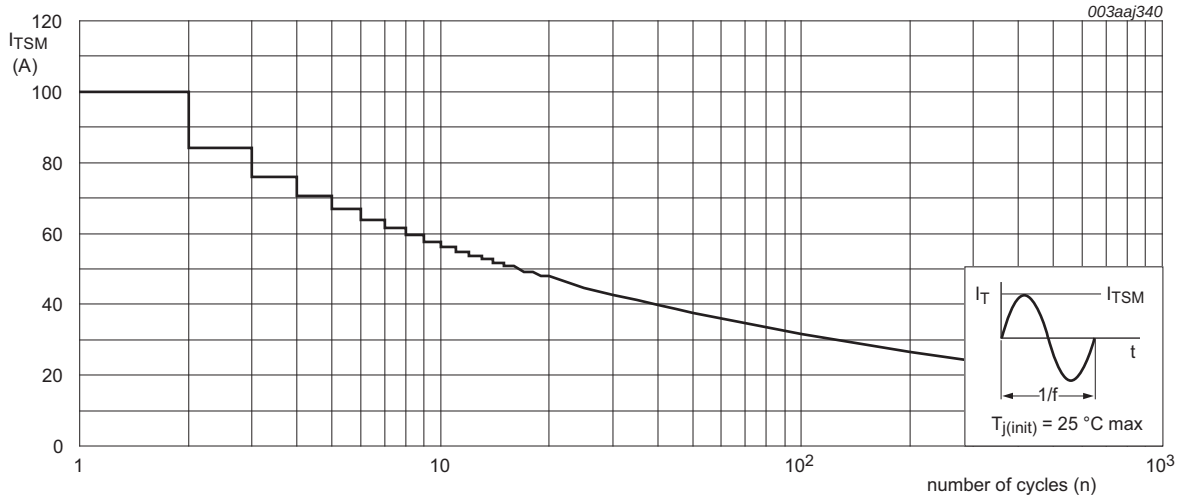


Fig 2. RMS on-state current as a function of surge duration; maximum values



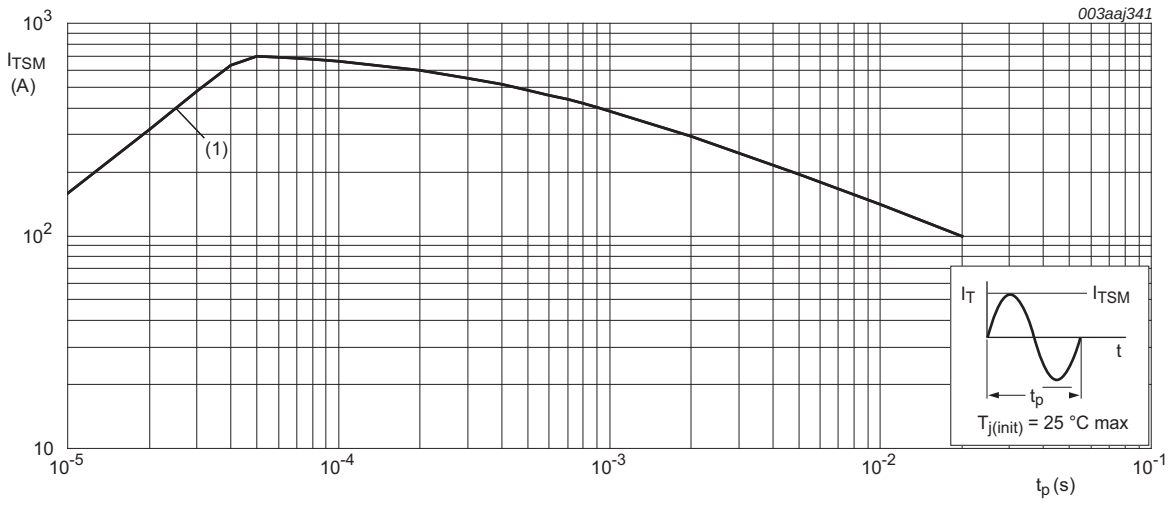
α = conduction angle

Fig 3. Total power dissipation as a function of RMS on-state current; maximum values



f = 50 Hz

Fig 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



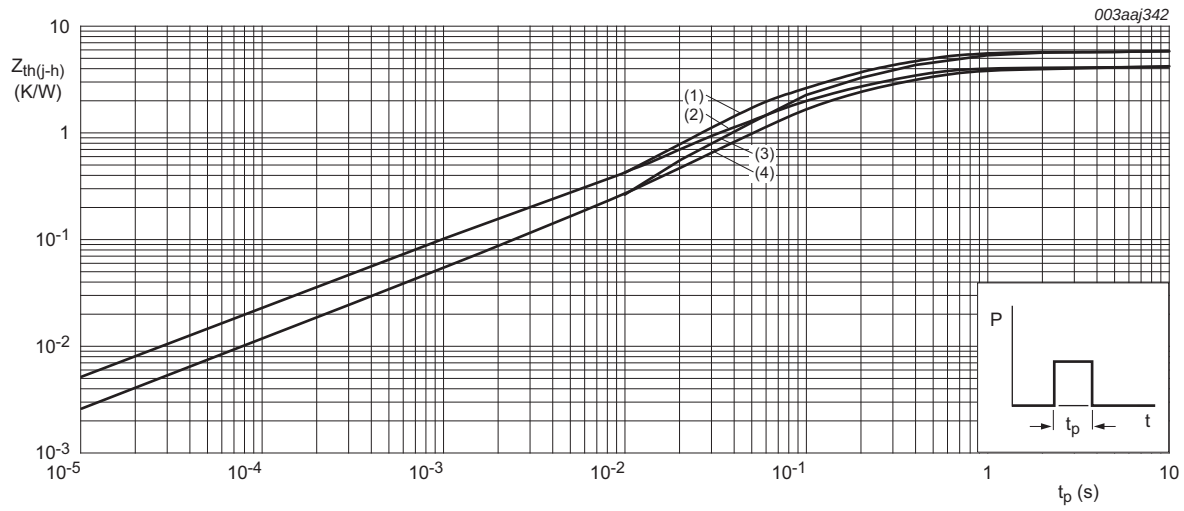
$t_p \leq 20$ ms; (1) dI_T / dt limit

Fig 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full cycle or half cycle; with heatsink compound; see Figure 6	-	-	4	K/W
		full cycle or half cycle; without heatsink compound; see Figure 6	-	-	5.5	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

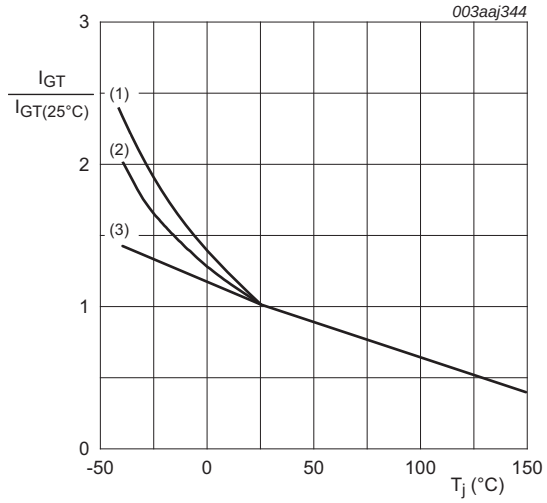
Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free ; 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; T_h = 25 °C	-	-	2500	V
C_{isol}	isolation capacitance	from main terminal 2 to external heatsink ; f = 1 MHz; T_h = 25 °C	-	10	-	pF

7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; T2+ G-; T_j = 25 °C; see Figure 7	2	-	50	mA
		V_D = 12 V; I_T = 0.1 A; T2+ G+; T_j = 25 °C; see Figure 7	2	-	50	mA
		V_D = 12 V; I_T = 0.1 A; T2- G-; T_j = 25 °C; see Figure 7	2	-	50	mA
I_L	latching current	V_D = 12 V; I_G = 0.1 A; T2+ G+; T_j = 25 °C; see Figure 8	-	-	60	mA
		V_D = 12 V; I_G = 0.1 A; T2+ G-; T_j = 25 °C; see Figure 8	-	-	90	mA
		V_D = 12 V; I_G = 0.1 A; T2- G-; T_j = 25 °C; see Figure 8	-	-	60	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; see Figure 9	-	-	60	mA
V_T	on-state voltage	I_T = 15 A; T_j = 25 °C; see Figure 10	-	1.3	1.6	V
V_{GT}	gate trigger voltage	V_D = 12 V; T_j = 25 °C; see Figure 11	-	0.8	1.5	V
		V_D = 400 V; T_j = 150 °C; see Figure 11	0.25	0.4	-	V
I_D	off-state current	V_D = 600 V; T_j = 150 °C	-	0.4	2	mA
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 402 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit	1000	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 10 A; dV_{com}/dt = 20 V/µs; (snubberless condition); gate open circuit	20	-	-	A/ms
		V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 10 A; dV_{com}/dt = 10 V/µs; gate open circuit	28	-	-	A/ms
		V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 10 A; dV_{com}/dt = 1 V/µs; gate open circuit	45	-	-	A/ms



(1) T2- G-

(2) T2+ G-

(3) T2+ G+

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

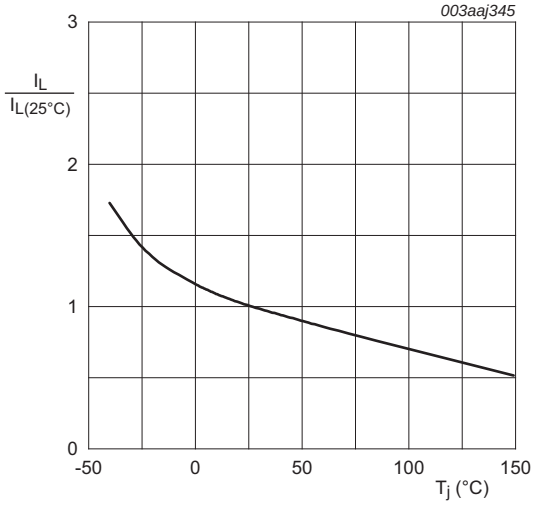


Fig 8. Normalized latching current as a function of junction temperature

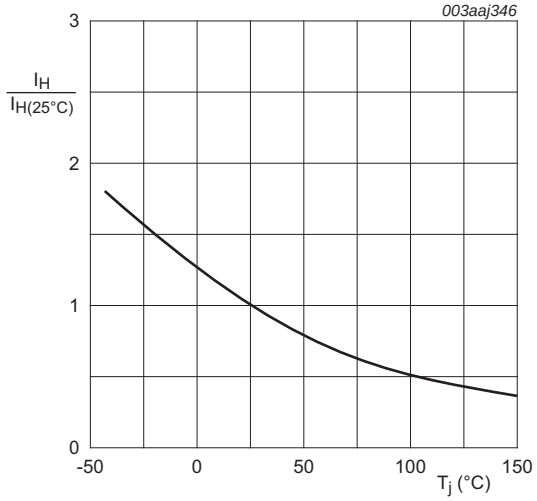
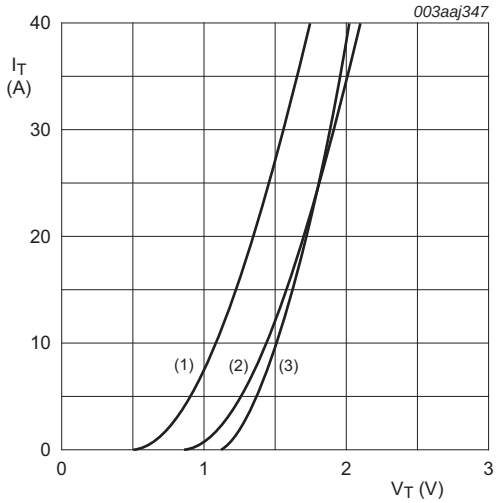


Fig 9. Normalized holding current as a function of junction temperature



Vo = 1.142 V; Rs = 0.027 Ω

(1) Tj = 150 °C; typical values

(2) Tj = 150 °C; maximum values

(3) Tj = 25 °C; maximum values

Fig 10. On-state current as a function of on-state voltage

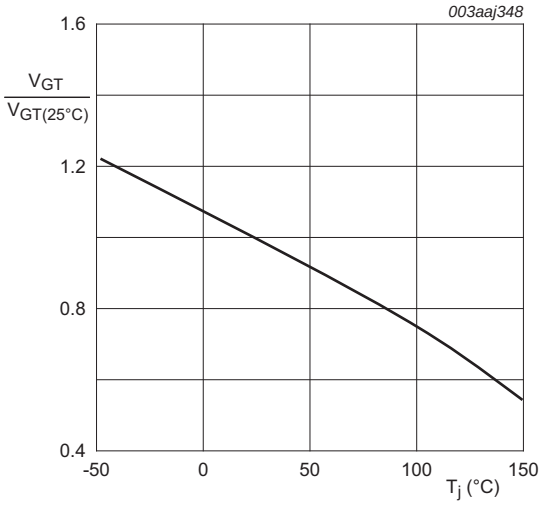
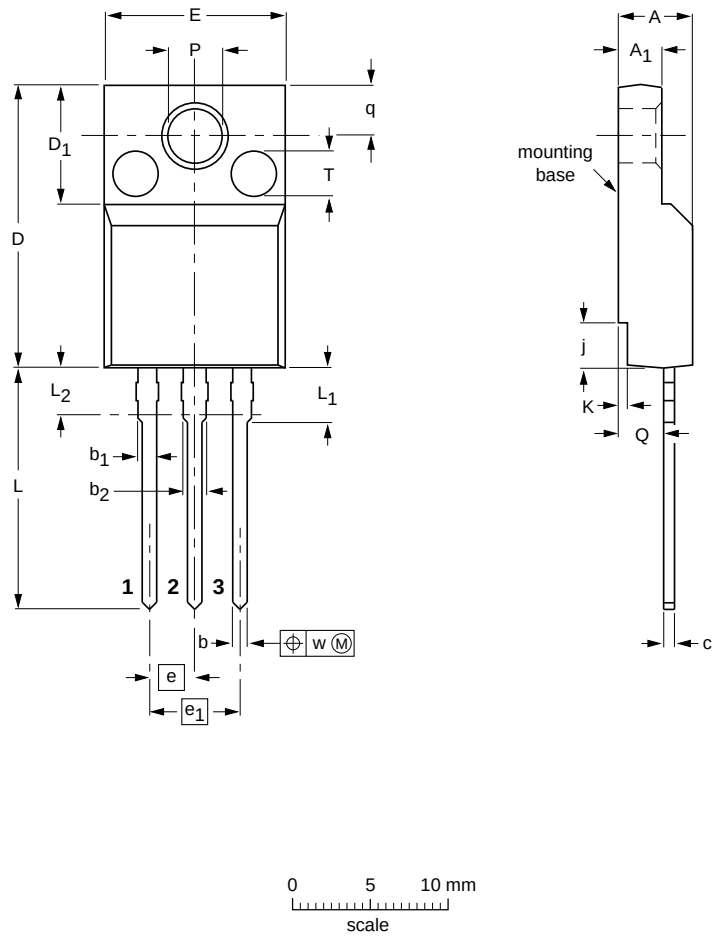


Fig 11. Normalized gate trigger voltage as a function of junction temperature

8. 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)

9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BTA410X-600BT v.1	20120313	Product data sheet	-	-

10. Legal information

10.1 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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12. Contents

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