BTA408X-1000C0T

3Q Triac

Rev.01 - 18 May 2020 Product data sheet

1. General description

Planar passivated high commutation three quadrant triac in a TO220F "full pack" plastic package. This triac is intended for use in motor control circuits where very high blocking voltage can occur. It is used in applications where "high junction operating temperature capability ($T_{j(max)}$ = 150 °C)" is required.

2. Features and benefits

- Full cycle AC conduction
- High junction operating temperature capability ($T_{j(max)}$ = 150 °C)
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- Planar passivated for voltage ruggedness and reliability
- Protective self turn-on capability for high energy transients
- Triggering in three quadrants only
- Very high immunity to IEC 61000-4-4 fast transient
- Package meets UL94V0 lammability requirement
- Package is RoHS compliant
- Package meets UL1557 isolation test requirement rated at 2500V RMS

3. Applications

- AC fan, pump and compressor controls
- Highly inductive, resistive and safety loads
- Large and small appliances (White Goods)
- Reversing induction motor controls e.g. vertical axis washing machines

4. Quick reference data

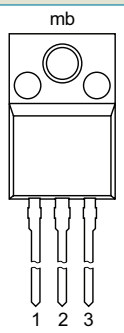
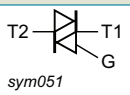
Table 1. Quick reference data

Symbol	Parameter	Conditions	Values	Unit
Absolute maximum rating				
V_{DRM}	repetitive peak off-state voltage		1000	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 105$ °C; Fig. 1; Fig. 2; Fig. 3	8	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; t_p = 20 ms; $T_{j(init)}$ = 25 °C; Fig. 4; Fig. 5	90	A
		full sine wave; t_p = 16.7 ms; $T_{j(init)}$ = 25 °C	99	A
T_j	junction temperature		150	°C

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; Fig. 7		-	-	35	mA
		V_D = 12 V; I_T = 0.1 A; T2+ G- T_j = 25 °C; Fig. 7		-	-	35	mA
		V_D = 12 V; I_T = 0.1 A; T2- G- T_j = 25 °C; Fig. 7		-	-	35	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	-	40	mA
V_T	on-state voltage	I_T = 10 A; T_j = 25 °C; Fig. 10		-	1.21	1.6	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 670 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		100	-	-	V/µs
		V_{DM} = 670 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		50	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 8 A; dV_{com}/dt = 20 V/µs; gate open circuit; snubberless condition		1	-	-	A/ms

5. 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		

6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BTA408X-1000C0T	TO220F	BTA408X-1000C0T,127	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

Type number	Marking codes
BTA408X-1000C0T	BTA408X 1000C0T

8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Values	Unit
V_{DRM}	repetitive peak off-state voltage		1000	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 105°C$; Fig. 1; Fig. 2; Fig. 3	8	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; t_p = 20 ms; $T_{j(init)}$ = 25 °C; Fig. 4; Fig. 5	90	A
		full sine wave; t_p = 16.7 ms; $T_{j(init)}$ = 25 °C	99	A
I^2t	I^2t for fusing	t_p = 10 ms; sine wave	40.5	A^2s
dI_T/dt	rate of rise of on-state current	I_G = 70 mA	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 to 150	°C
T_j	junction temperature		150	°C
V_{pp}	peak pulse voltage	T_j = 25 °C; non-repetitive, off-state; ten pulses on each voltage polarity; 20s or more between successive pulses	2	kV

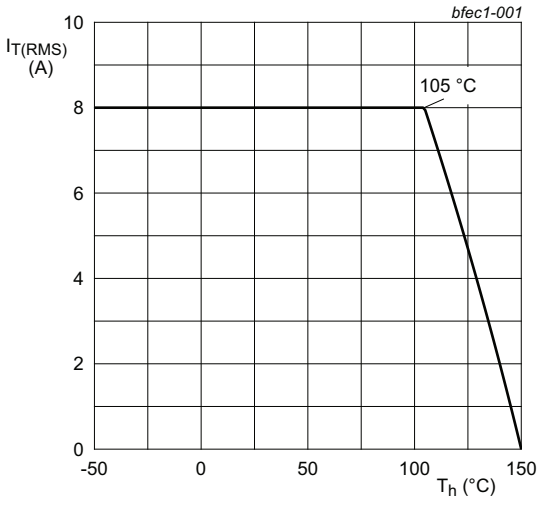
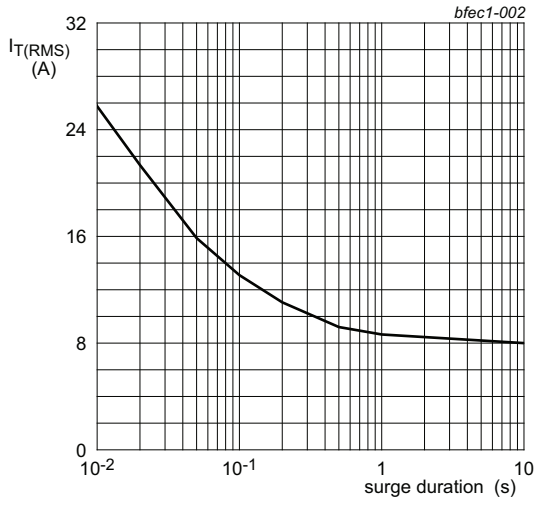
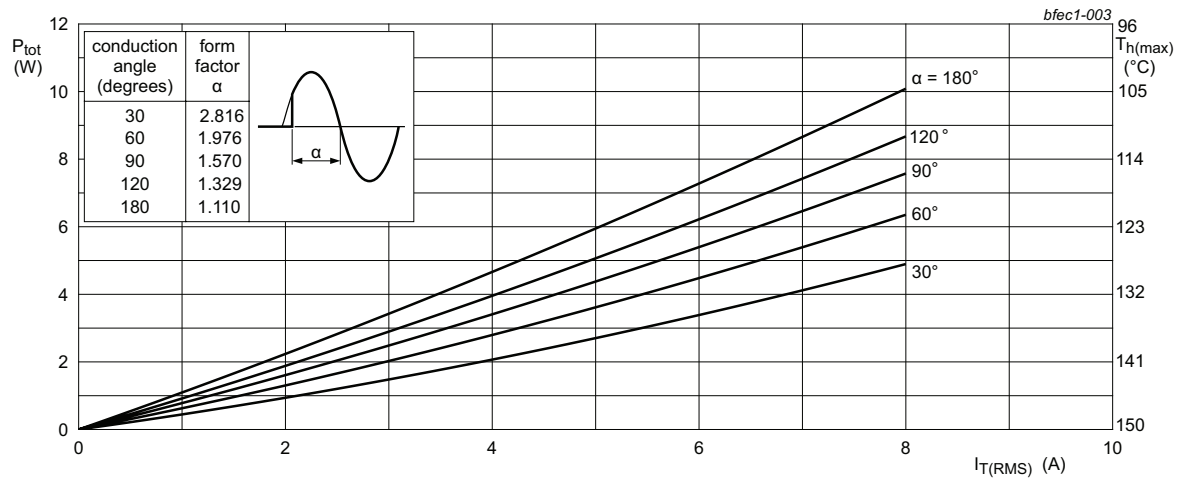


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values



f = 50 Hz; T_h = 105 °C

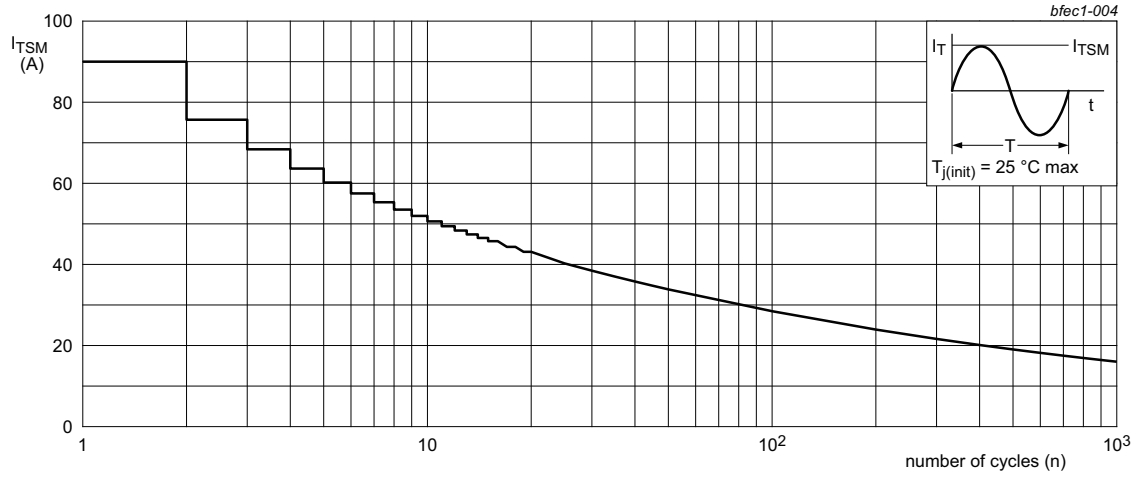
Fig. 2. RMS on-state current as a function of surge duration; maximum values



α = conduction angle

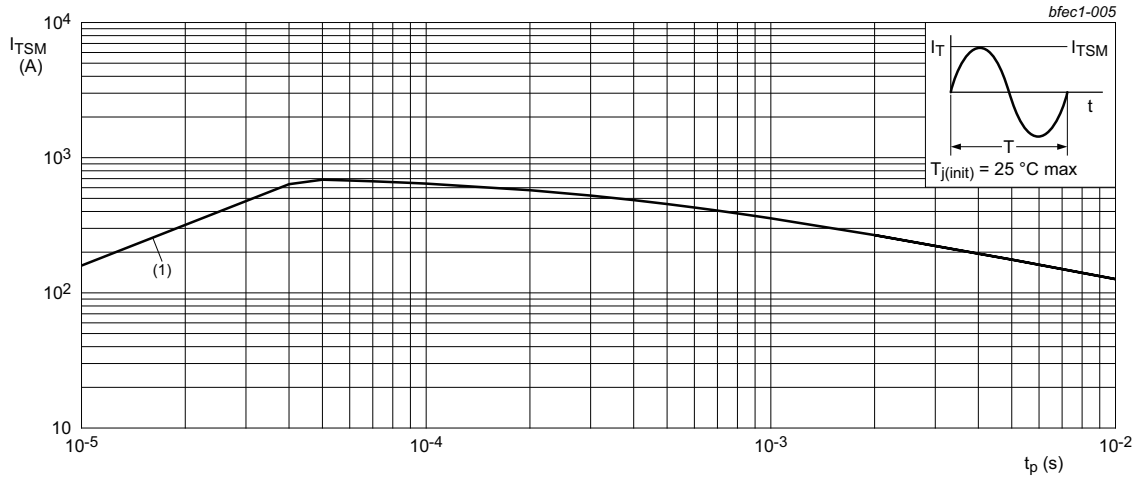
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

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

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	with heatsink compound; Fig. 6		-	-	4.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	55	-	K/W

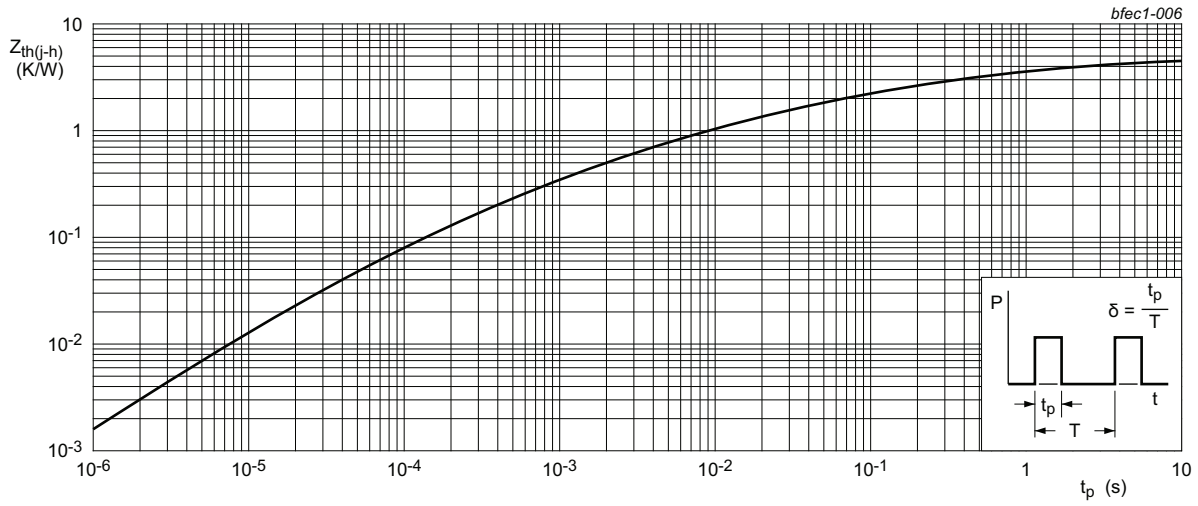


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

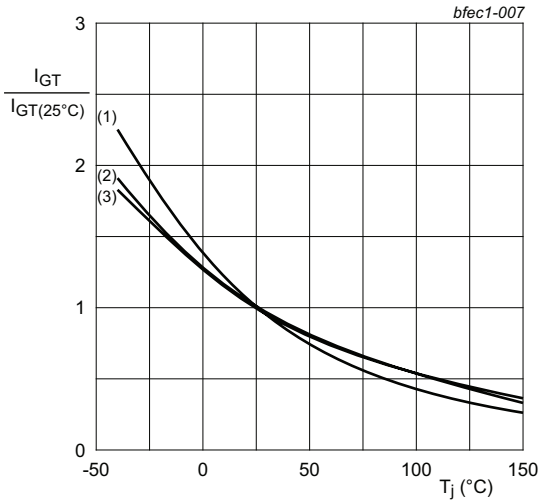
Table 7. Isolation characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free		-	-	2500	V
C_{isol}	isolation capacitance	from cathode to external heatsink		-	10	-	PF

11. Characteristics

Table 8. 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; Fig. 7		-	-	35	mA
		V_D = 12 V; I_T = 0.1 A; T2+ G-; T_j = 25 °C; Fig. 7		-	-	35	mA
		V_D = 12 V; I_T = 0.1 A; T2- G-; T_j = 25 °C; Fig. 7		-	-	35	mA
I_L	latching current	V_D = 12 V; I_G = 0.1 A; T2+ G+; T_j = 25 °C; Fig. 8		-	-	50	mA
		V_D = 12 V; I_G = 0.1 A; T2+ G-; T_j = 25 °C; Fig. 8		-	-	70	mA
		V_D = 12 V; I_G = 0.1 A; T2- G-; T_j = 25 °C; Fig. 8		-	-	50	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	-	40	mA
V_T	on-state voltage	I_T = 10 A; T_j = 25 °C; Fig. 10		-	1.21	1.6	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 11		-	0.7	1	V
		V_D = 400 V; I_T = 0.1 A; T_j = 150 °C; Fig. 11		0.25	0.4	-	V
I_D	off-state current	V_D = 1000 V; T_j = 25 °C		-	-	10	µA
		V_D = 1000 V; T_j = 150 °C		-	0.4	2	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 670 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		100	-	-	V/µs
		V_{DM} = 670 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		50	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 8 A; dV_{com}/dt = 20 V/µs; gate open circuit; snubberless condition		1	-	-	A/ms
		V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 8 A; dV_{com}/dt = 10 V/µs; gate open circuit		1.5	-	-	A/ms
		V_D = 400 V; T_j = 150 °C; $I_{T(RMS)}$ = 8 A; dV_{com}/dt = 1 V/µs; gate open circuit		4	-	-	A/ms



(1) T2- G-
(2) T2+ G-
(3) T2+ G+

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

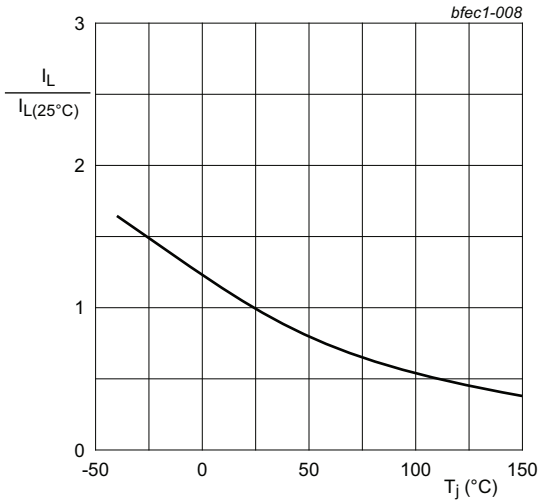


Fig. 8. Normalized latching current as a function of junction temperature

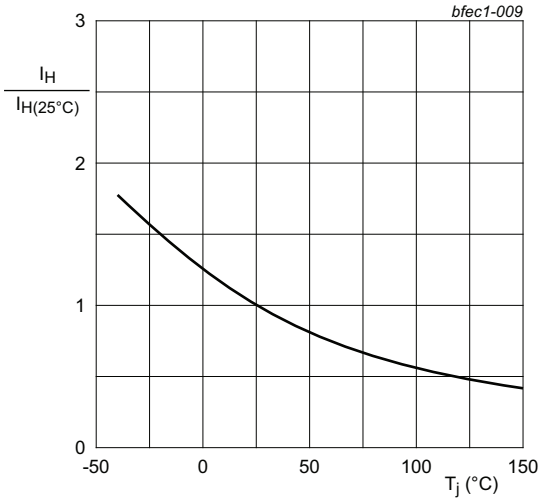
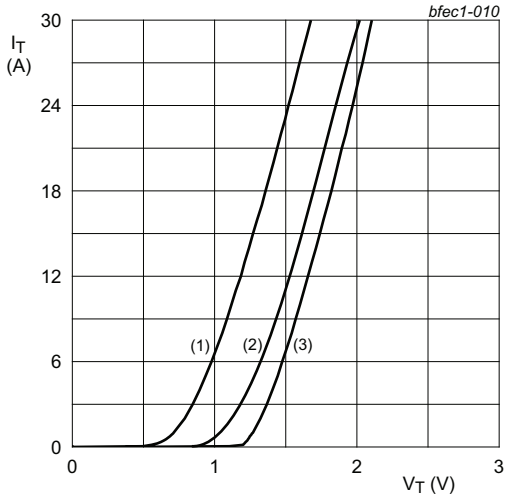


Fig. 9. Normalized holding current as a function of junction temperature



V_o = 1.188 V; R_s = 0.0237 Ω
(1) T_j = 150 °C; typical values
(2) T_j = 150 °C; maximum values
(3) T_j = 25 °C; maximum values

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

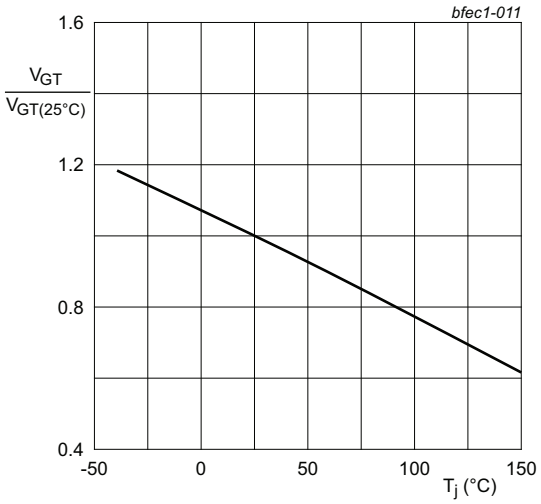
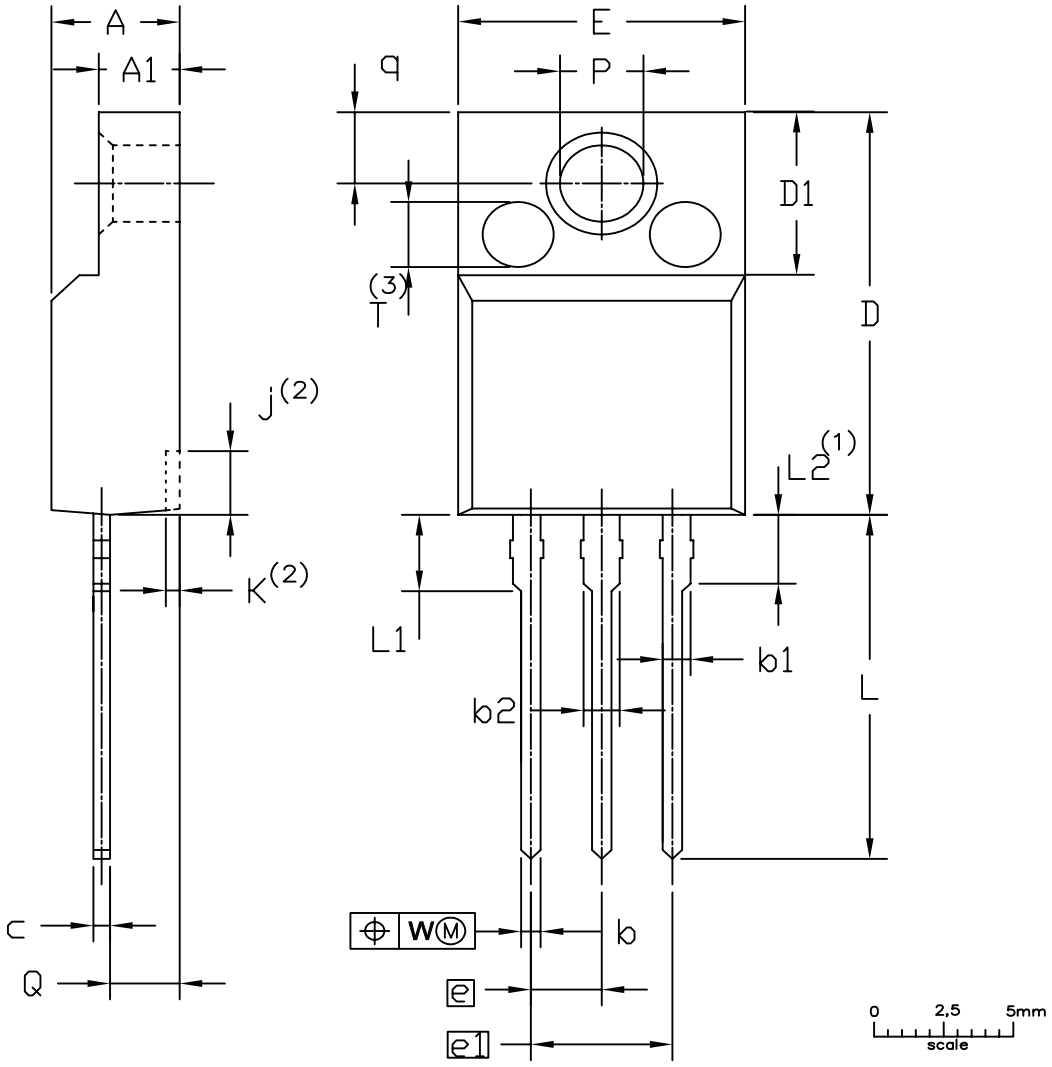


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack" SOT186A



UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j(2)	K(2)	L	L_1	L_2(1) max.	P	Q	q	W	T(3)
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	0.4	2.5
	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	2.3	2.6		

Notes
1. Terminal dimensions within this zone are uncotrolled
2. Dot lines area designs may vary
3. Eject pin mark is for reference only

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3 LEADS TO220F				2013-11-14

13. Legal information

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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