

## 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 CT" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ ) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- 2500V RMS isolation voltage capability
- 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
- High current capability
- Isolated mounting base package
- Least sensitive gate for highest noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- UL1557 certified (Document number E346397)

## 3. Applications

- Applications subject to high temperature
- Heating controls
- High power motor control
- High power switching

## 4. Quick reference data

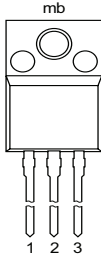
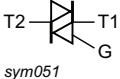
Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
$V_{DRM}$	repetitive peak off-state voltage			800			V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 42\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		30			A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>		270			A
		full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$		297			A
$T_j$	junction temperature			150			$^{\circ}\text{C}$
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>		-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>		-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>		-	-	35	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 9</a>		-	-	50	mA
$V_T$	on-state voltage	$I_T = 42\text{ A}$ ; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 10</a>		-	1.20	1.55	V

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Dynamic characteristics</b>							
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit		2000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 536 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit		1000	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 30 \text{ A}$ ; $dV_{com}/dt = 20 \text{ V}/\mu\text{s}$ ; gate open circuit		16	-	-	A/ms
		$V_D = 400 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 30 \text{ A}$ ; $dV_{com}/dt = 20 \text{ V}/\mu\text{s}$ ; gate open circuit		13	-	-	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
BTA330X-800CT	TO220F	BTA330X-800CTQ	Tube	50	SOT186A	14-Nov-2013

## 7. Marking

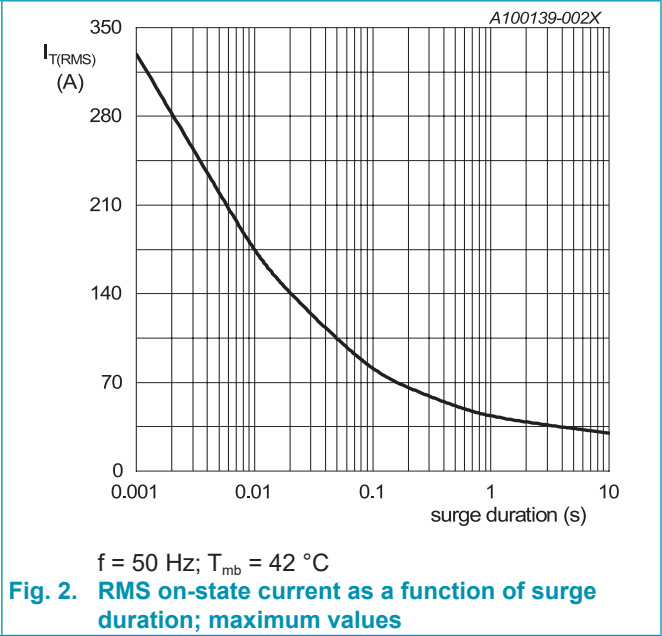
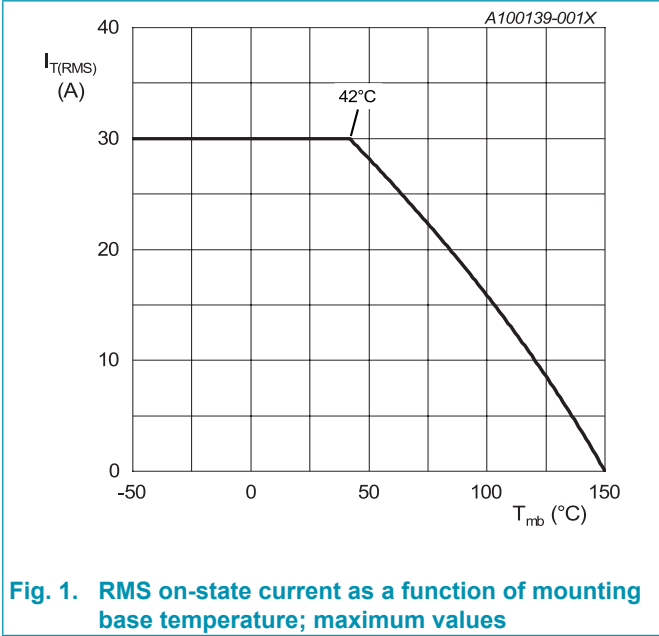
Table 4. Marking codes

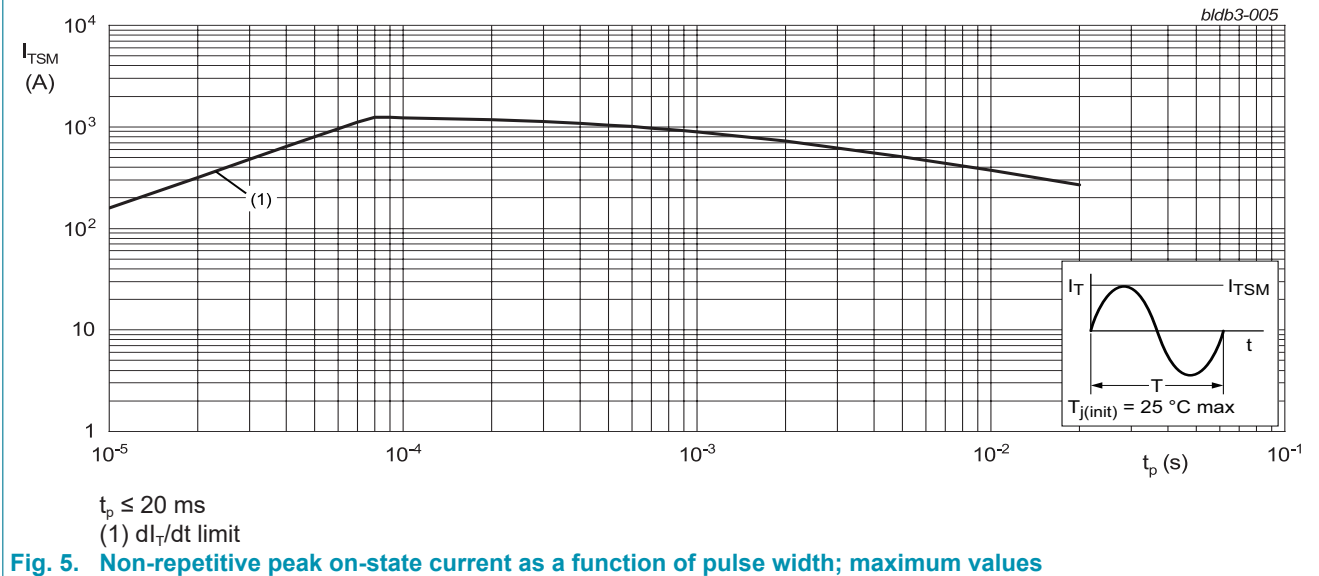
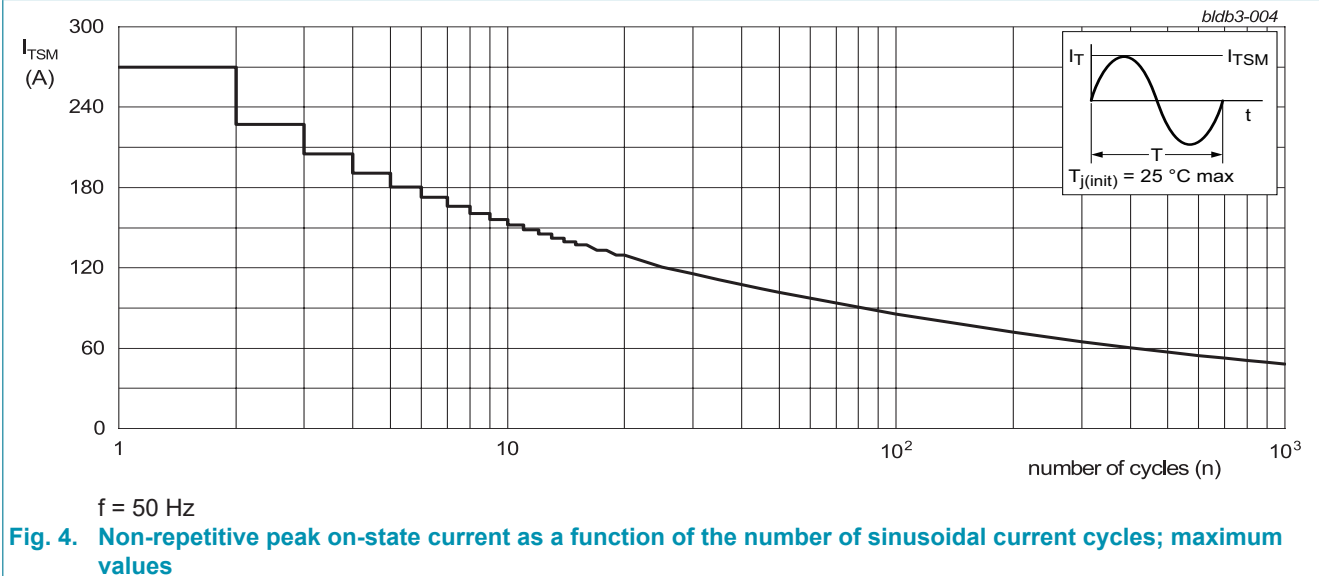
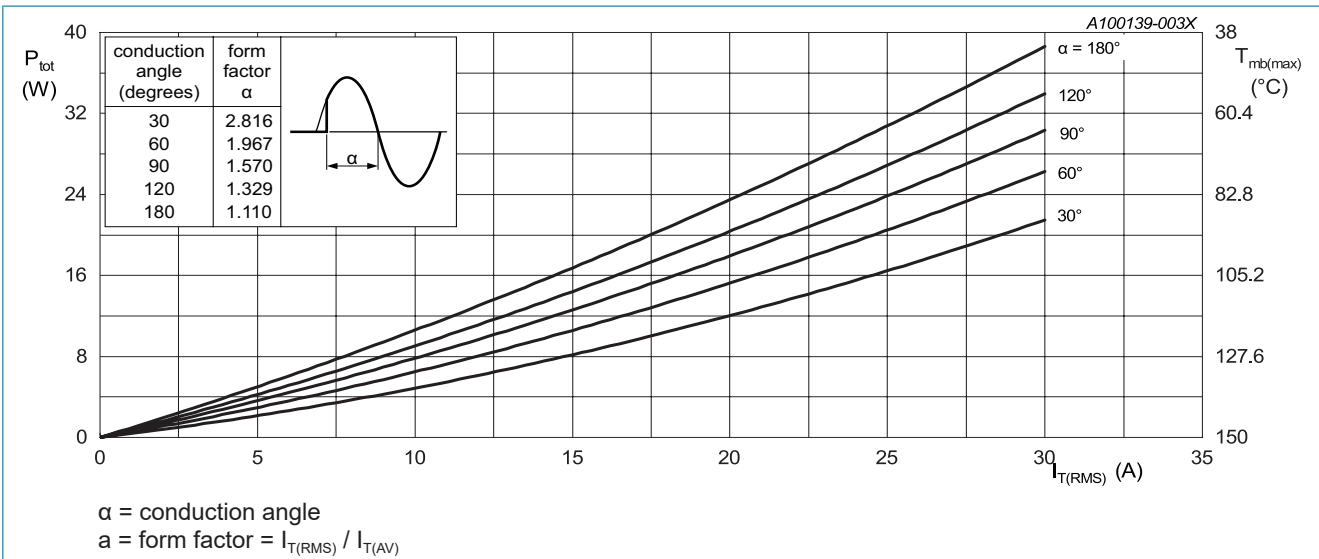
Type number	Marking codes
BTA330X-800CT	BTA330X 800CT

8. Limiting values

Table 5. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Notes	Values	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage			800	V
$V_{\text{RRM}}$	repetitive peak reverse voltage			800	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 42\text{ }^{\circ}\text{C}$ ; Fig. 1; Fig. 2; Fig. 3		30	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; Fig 4; Fig 5		270	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$		297	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; SIN		364.5	$\text{A}^2\text{s}$
$dI_T/dt$	rate of rise of on-state current	$I_G = 70\text{ mA}$		100	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	peak gate current			2	A
$P_{\text{GM}}$	peak gate power	$T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ }\mu\text{s}$		5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period		0.5	W
$T_{\text{stg}}$	storage temperature			-40 to 150	$^{\circ}\text{C}$
$T_j$	junction temperature			150	$^{\circ}\text{C}$





9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to heatsink	<a href="#">Fig. 6</a>		-	-	2.8	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	55	-	K/W

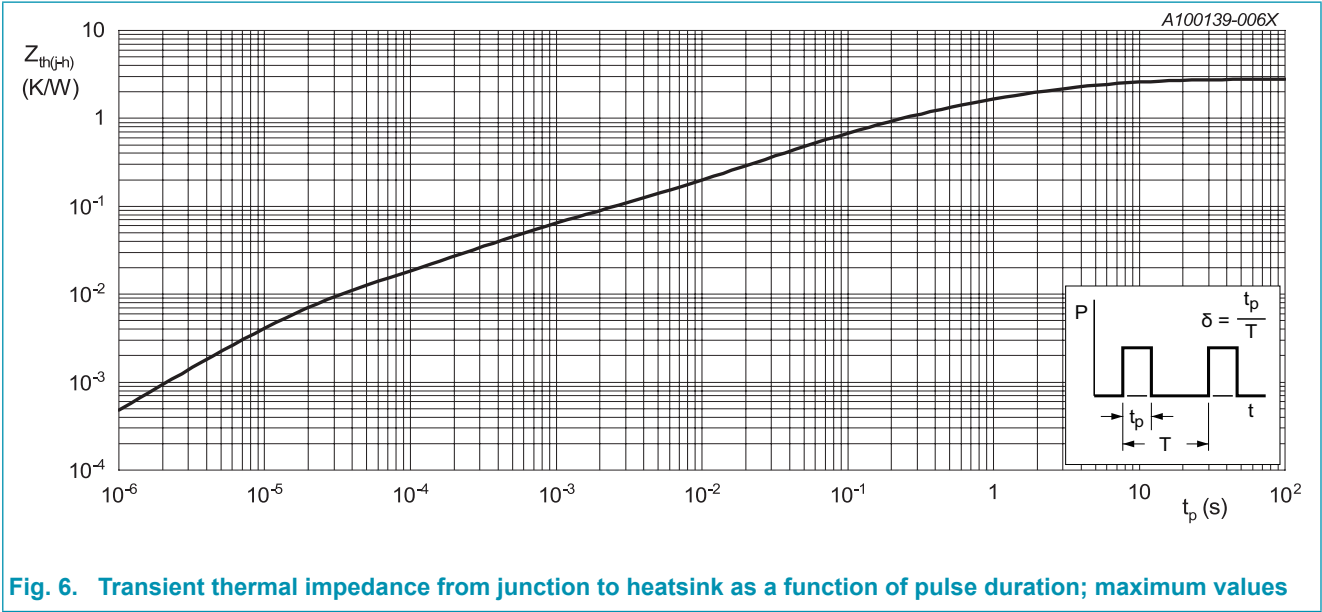


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration; maximum values

10. Isolation characteristics

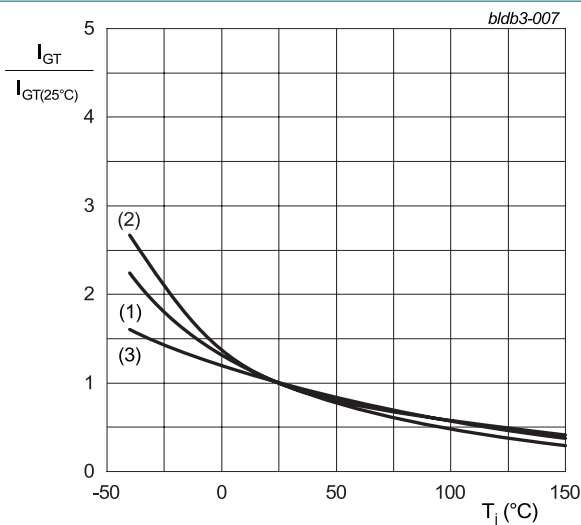
Table 7. Isolation characteristics

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

## 11. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		-	-	35	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		-	-	35	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 7</a>		-	-	35	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G+; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	70	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2+ G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	100	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 0.1 A; T2- G-; T <sub>J</sub> = 25 °C; <a href="#">Fig. 8</a>		-	-	70	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>J</sub> = 25 °C; <a href="#">Fig. 9</a>		-	-	50	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 42 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 10</a>		-	1.20	1.55	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>		-	0.9	1.3	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 150 °C		0.20	0.45	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 800 V; T <sub>J</sub> = 25 °C		-	-	10	μA
		V <sub>D</sub> = 800 V; T <sub>J</sub> = 150 °C		-	0.4	2	mA
I <sub>R</sub>	reverse current	V <sub>R</sub> = 800 V; T <sub>J</sub> = 25 °C		-	-	10	μA
		V <sub>R</sub> = 800 V; T <sub>J</sub> = 150 °C		-	0.4	2	mA
Dynamic characteristics							
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 536 V; T <sub>J</sub> = 125 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit		2000	-	-	V/μs
		V <sub>DM</sub> = 536 V; T <sub>J</sub> = 150 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit		1000	-	-	V/μs
dI <sub>com</sub> /dt	rate of change of commutating current	V <sub>D</sub> = 400 V; T <sub>J</sub> = 125 °C; I <sub>T(RMS)</sub> = 30 A; dV <sub>com</sub> /dt = 20 V/μs; gate open circuit		16	-	-	A/ms
		V <sub>D</sub> = 400 V; T <sub>J</sub> = 150 °C; I <sub>T(RMS)</sub> = 30 A; dV <sub>com</sub> /dt = 20 V/μs; gate open circuit		13	-	-	A/ms



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

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

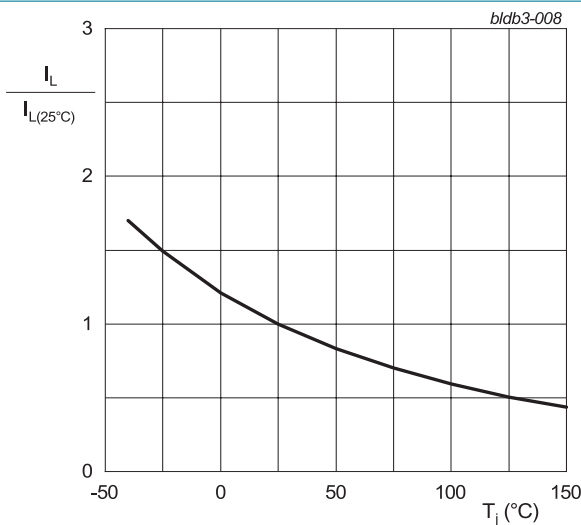


Fig. 8. Normalized latching current as a function of junction temperature

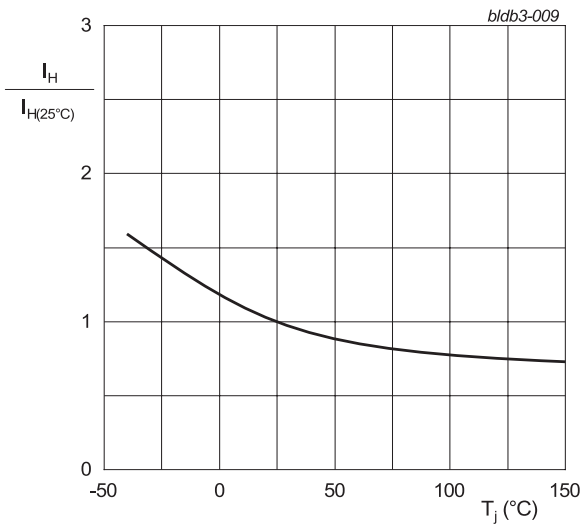
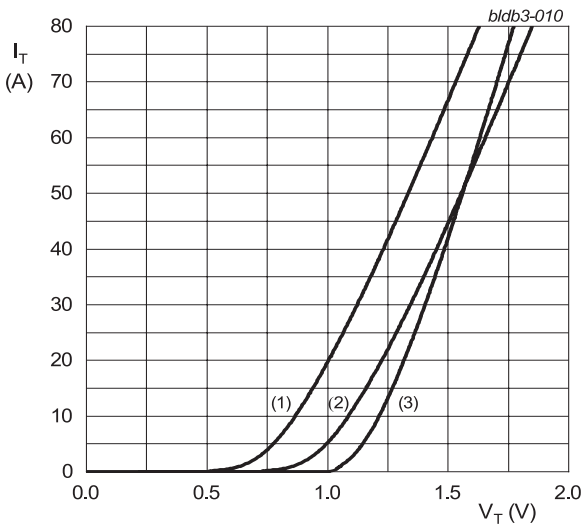


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.049 V$ ;  $R_s = 0.0114 \Omega$
- (1)  $T_j = 150^{\circ}C$ ; typical values
  - (2)  $T_j = 150^{\circ}C$ ; maximum values
  - (3)  $T_j = 25^{\circ}C$ ; maximum values

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

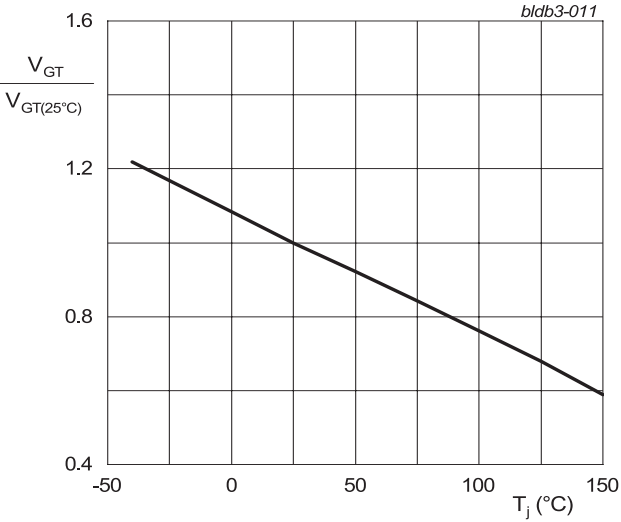
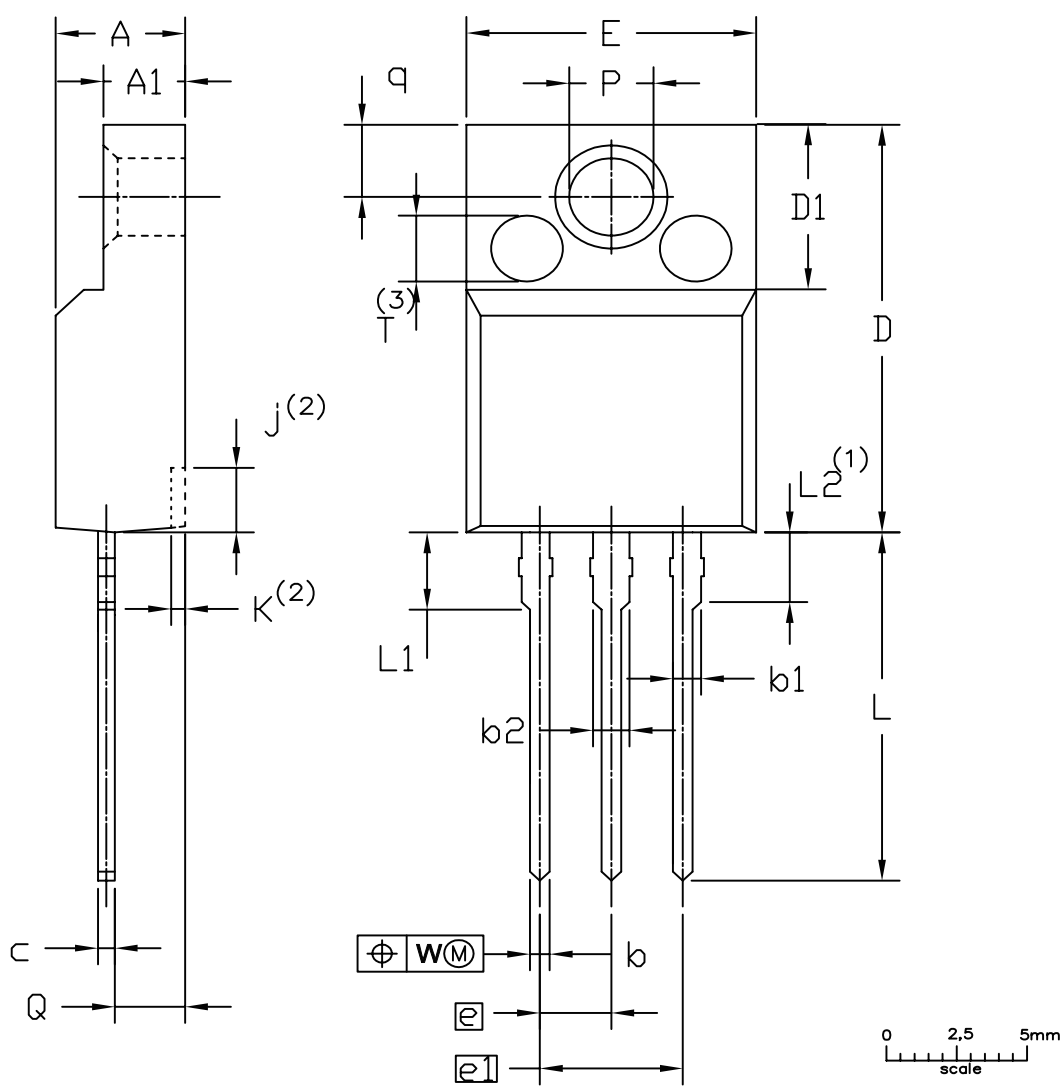


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



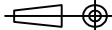
12. Package outline

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



UNIT	A	A <sub>1</sub>	b	b <sub>1</sub>	b <sub>2</sub>	c	D	D <sub>1</sub>	E	e	e <sub>1</sub>	j <sup>(2)</sup>	k <sup>(2)</sup>	L	L <sub>1</sub>	L <sub>2</sub> <sup>(1)</sup> max.	P	Q	q	W	T <sup>(3)</sup>
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	0.4	2.5

- Notes
1. Terminal dimensions within this zone are uncontrolled
  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.

- [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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