

## 1. General description

Planar passivated four quadrant triac in a SOT186A (TO-220F) plastic package intended for use in general purpose bidirectional switching and phase control applications.

## 2. Features and benefits

- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Less sensitive gate for improved noise immunity
- Triggering in all four quadrants
- Isolated package

## 3. Applications

- General purpose motor control
- General purpose switching

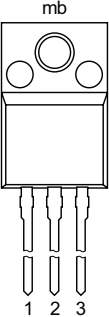
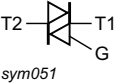
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values				Unit
Absolute maximum rating							
V <sub>DRM</sub>	repetitive peak off-state voltage		600				V
I <sub>T(RMS)</sub>	RMS on-state current	full sine wave; T <sub>h</sub> ≤ 73 °C; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	8				A
I <sub>TSM</sub>	non-repetitive peak on-state current	full sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 20 ms; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	65				A
Symbol	Parameter	Conditions		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>		-	5	25	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>		-	8	25	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>		-	11	25	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G+; T <sub>i</sub> = 25 °C; <a href="#">Fig. 7</a>		-	30	70	mA

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1		
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	Description	Version
BT137X-600F	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

7. Marking

Table 4. Marking codes

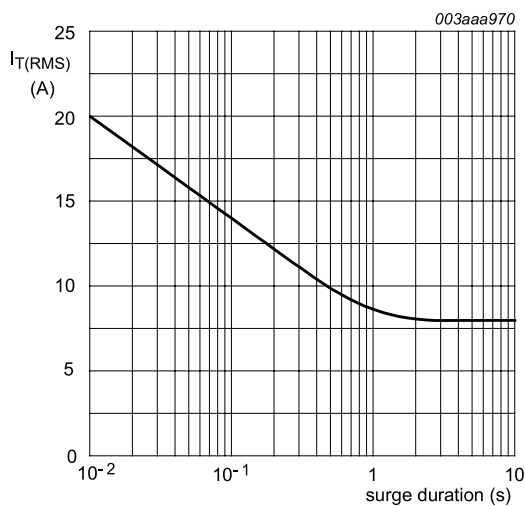
Type number	Marking codes
BT137X-600F	BT137X-600F

## 8. Limiting values

**Table 5. Limiting values**

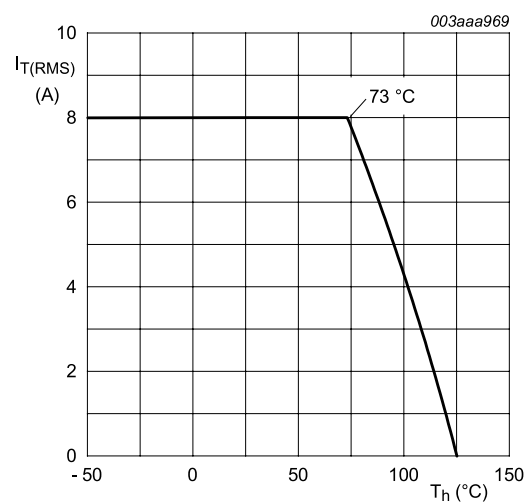
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Values	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 73\text{ }^{\circ}\text{C}$ ; <a href="#">Fig 1</a> ; <a href="#">Fig 2</a> ; <a href="#">Fig 3</a>	8	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig 4</a> ; <a href="#">Fig 5</a>	65	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$	71	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; SIN	21	$\text{A}^2\text{s}$
$di_{\text{T}}/dt$	rate of rise of on-state current	$I_G = 50\text{ mA}$ ; T2+ G+	50	$\text{A}/\mu\text{s}$
		$I_G = 50\text{ mA}$ ; T2+ G-	50	$\text{A}/\mu\text{s}$
		$I_G = 50\text{ mA}$ ; T2- G-	50	$\text{A}/\mu\text{s}$
		$I_G = 140\text{ mA}$ ; T2- G+	140	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	peak gate current		2	A
$P_{\text{GM}}$	peak gate power		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	$^{\circ}\text{C}$
$T_{\text{j}}$	junction temperature		125	$^{\circ}\text{C}$



$f = 50\text{ Hz}$ ;  $T_h = 73\text{ }^{\circ}\text{C}$

**Fig. 1. RMS on-state current as a function of surge duration; maximum values**



**Fig. 2. RMS on-state current as a function of heatsink temperature; maximum values**

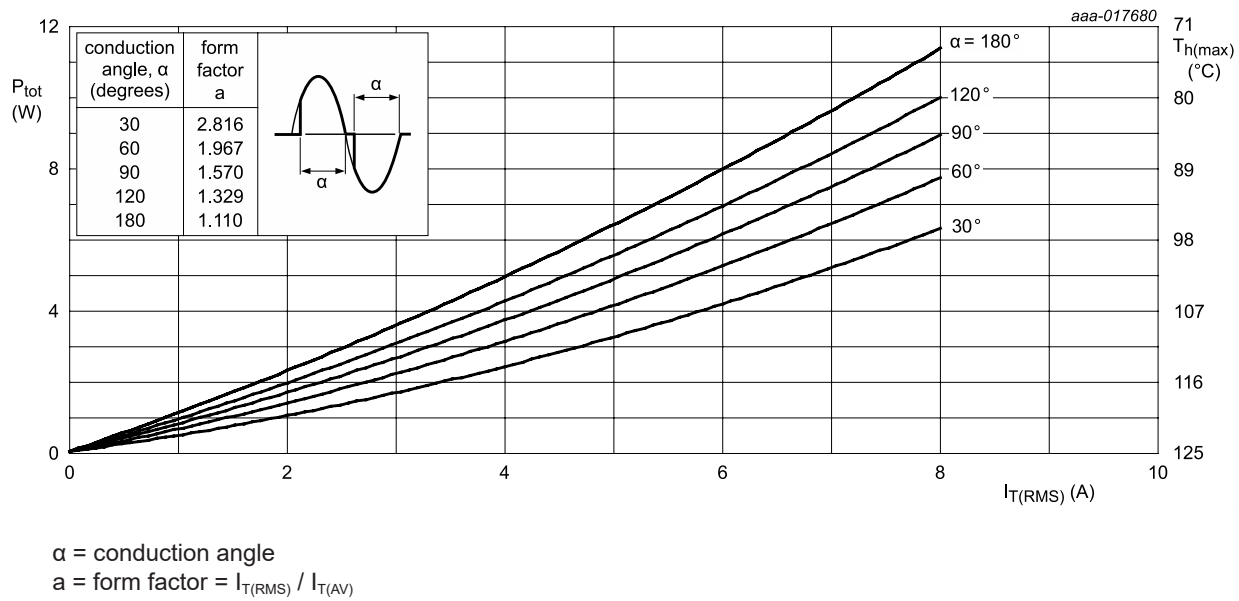


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

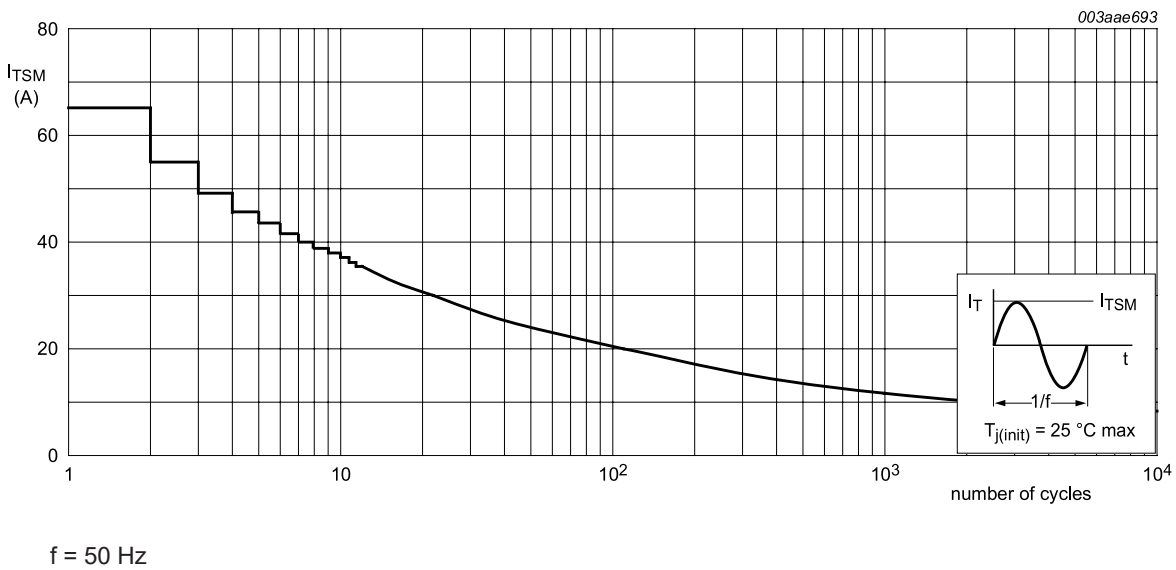
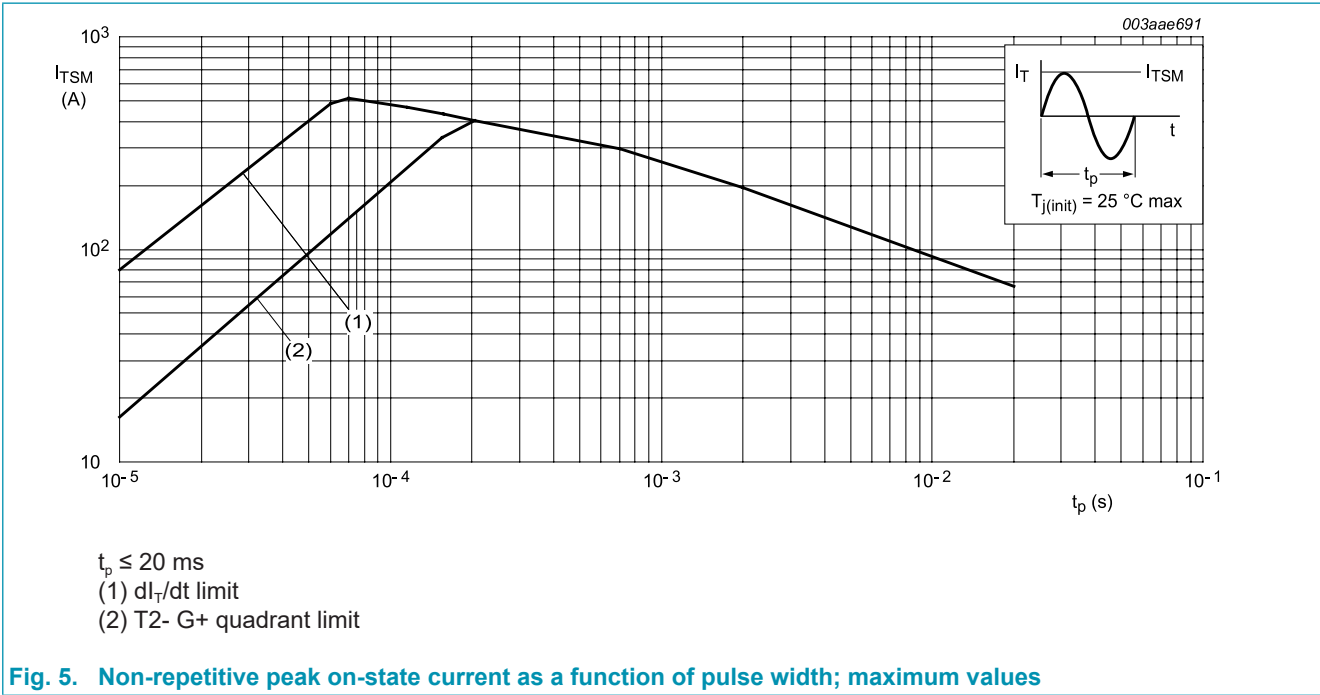


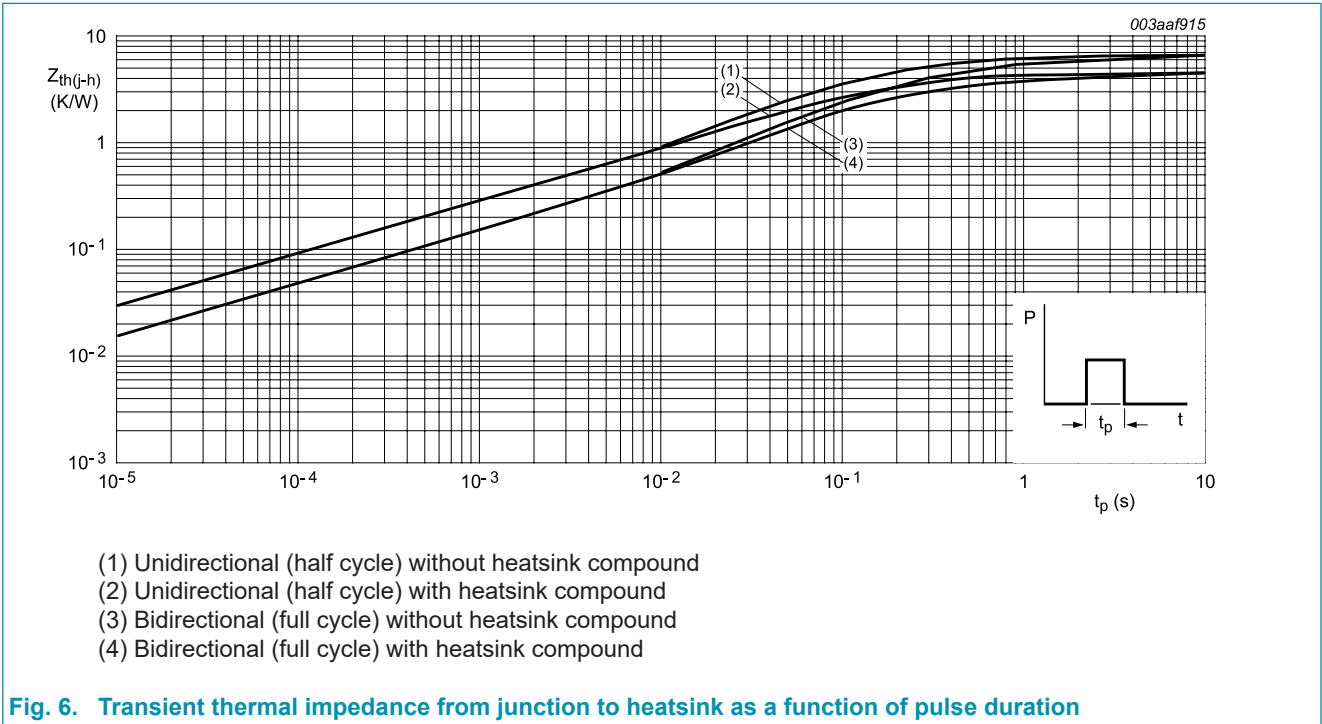
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full or half cycle; with heatsink compound; Fig 6	-	-	4.5	K/W
		full or half cycle; without heatsink compound; Fig 6	-	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



10. Isolation characteristics

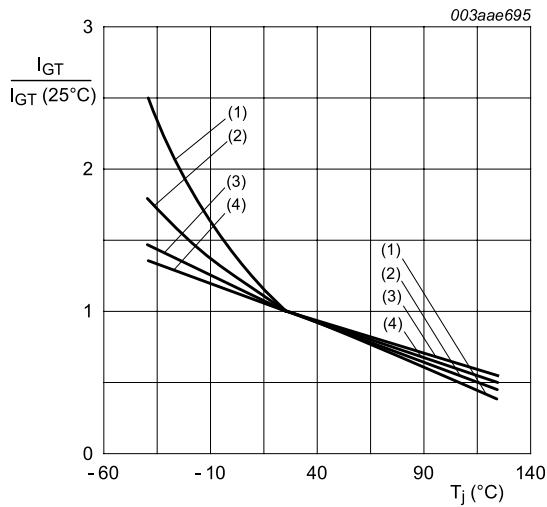
Table 7. Isolation characteristics

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 <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

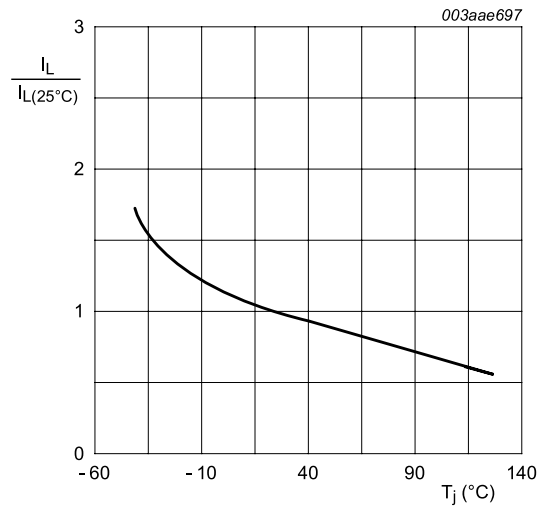
Table 8. Characteristics

Symbol	Parameter	Conditions		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>		-	5	25	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>		-	8	25	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>		-	11	25	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>		-	30	70	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	7	30	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	16	45	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	5	30	mA
		$V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	7	45	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	5	20	mA
$V_T$	on-state voltage	$I_T = 10\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	1.3	1.65	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>		-	0.7	1	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>		0.25	0.4	-	V
$I_D$	off-state current	$V_D = 600\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$		-	0.1	0.5	mA
<b>Dynamic characteristics</b>							
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit		50	250	-	V/ $\mu\text{s}$
$dV_{com}/dt$	rate of change of commutating voltage	$V_D = 400\text{ V}$ ; $T_J = 95\text{ }^\circ\text{C}$ ; $dI_{com}/dt = 3.6\text{ A/ms}$ ; $I_T = 8\text{ A}$		-	20	-	V/ $\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$V_D = 600\text{ V}$ ; $I_{TM} = 12\text{ A}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$		-	2	-	$\mu\text{s}$

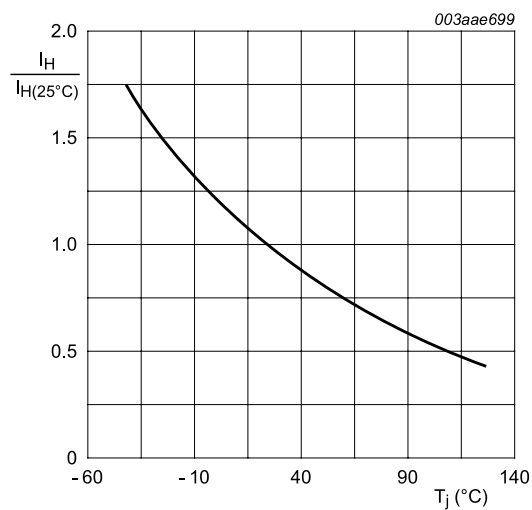


- (1) T2- G+
- (2) T2- G-
- (3) T2+ G-
- (4) T2+ G+

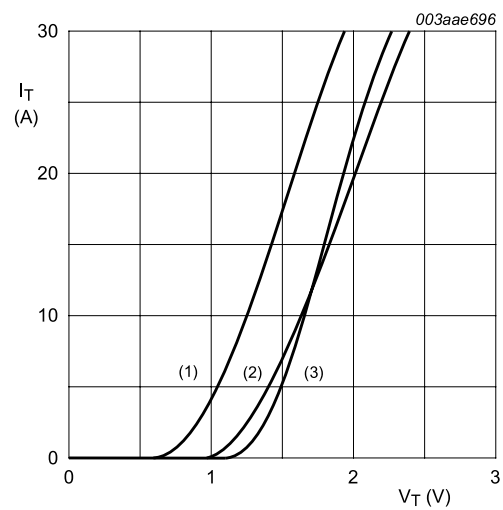
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



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



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



$V_o = 1.264 \text{ V}$ ;  $R_s = 0.038 \Omega$

- (1)  $T_j = 125^{\circ}\text{C}$ ; typical values
- (2)  $T_j = 125^{\circ}\text{C}$ ; maximum values
- (3)  $T_j = 25^{\circ}\text{C}$ ; maximum values

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



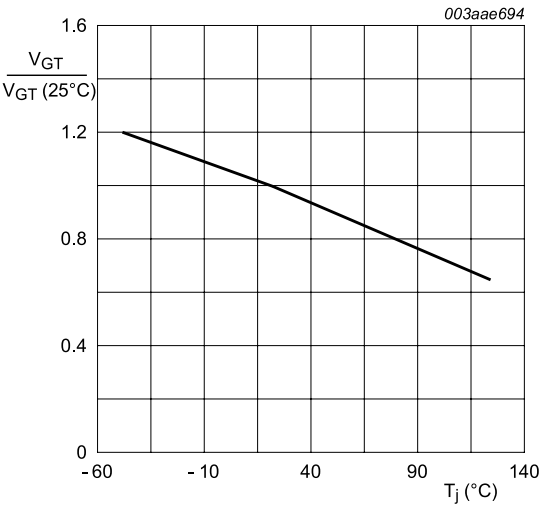


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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.
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## 14. Contents

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1. General description.....	1
2. Features and benefits .....	1
3. Applications .....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values .....	3
9. Thermal characteristics .....	6
10. Isolation Characteristics.....	6
11. Characteristics.....	7
12. Package outline .....	10
13. Legal information .....	11
14. Contents .....	13

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