

# BTA312X-800E

3Q Hi-Com Triac

5 October 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. This "series E" triac balances the requirements of commutation performance and gate sensitivity and is intended for interfacing with low power drivers including microcontrollers.

### 1.2 Features and benefits

- 3Q technology for improved noise immunity
- Direct interfacing with low power drivers and microcontrollers
- Good immunity to false turn-on by dV/dt
- High commutation capability with sensitive gate
- High voltage capability
- Isolated mounting base package
- Sensitive gate for easy logic level triggering
- Triggering in three quadrants only

### 1.3 Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g. washing machines and vacuum cleaners

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage			-	-	800	V
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$ ; $t_p = 20 \text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>		-	-	100	A
$I_{T(\text{RMS})}$	RMS on-state current	full sine wave; $T_h \leq 59^\circ\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		-	-	12	A
Static characteristics							
$I_{GT}$	gate trigger current	$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; T2+ G+; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA
		$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; T2+ G-; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA



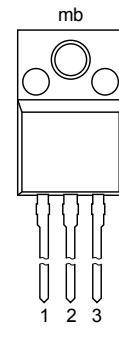
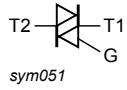
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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
		$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; T2- G-; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA

## 2. 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	 <b>TO-220F (SOT186A)</b>	

## 3. Ordering information

Table 3. Ordering information

Type number	Package			Version
	Name	Description	Version	
BTA312X-800E	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			-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 59 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		-	12	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$ ; $t_p = 20 \text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>		-	100	A
		full sine wave; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$ ; $t_p = 16.7 \text{ ms}$		-	110	A
$I^2t$	$I^2t$ for fusing	$t_p = 10 \text{ ms}$ ; SIN		-	50	$\text{A}^2\text{s}$
$dl_T/dt$	rate of rise of on-state current	$I_T = 20 \text{ A}$ ; $I_G = 0.2 \text{ A}$ ; $dl_G/dt = 0.2 \text{ A}/\mu\text{s}$		-	100	$\text{A}/\mu\text{s}$

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{GM}$	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

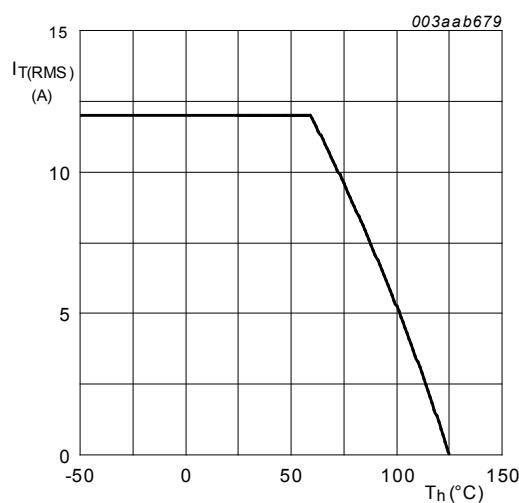
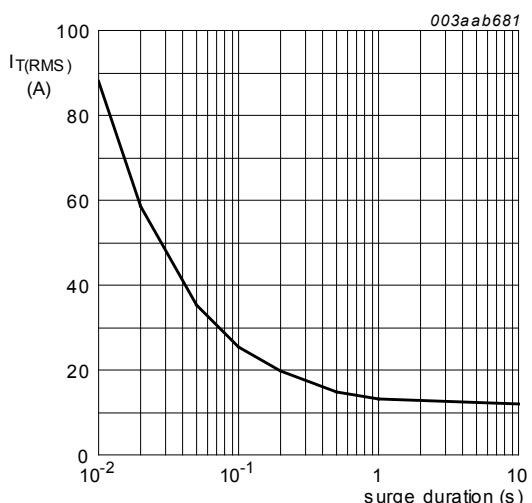
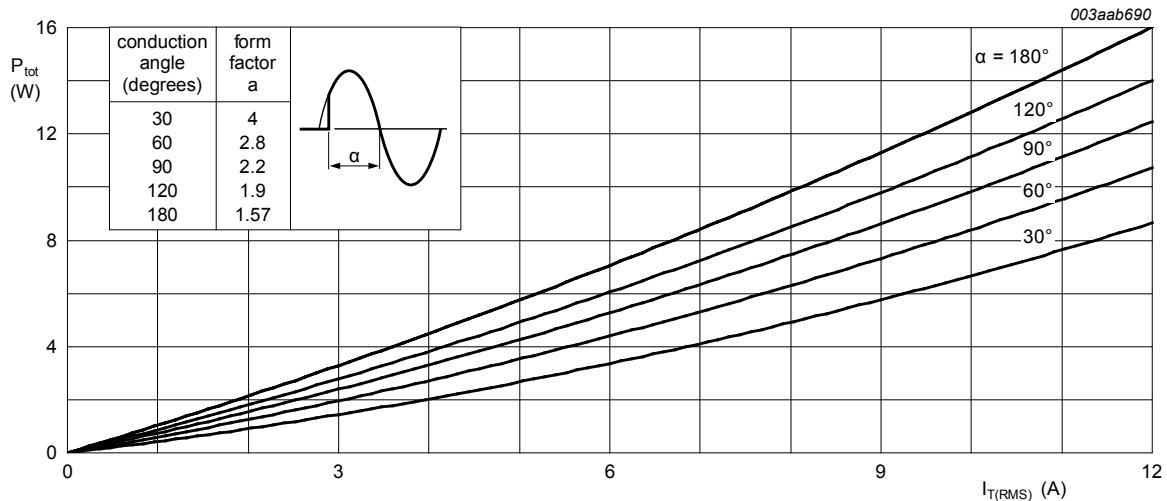


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values



$f = 50$  Hz;  $T_h = 59$  °C

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



$\alpha$  = conduction angle

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

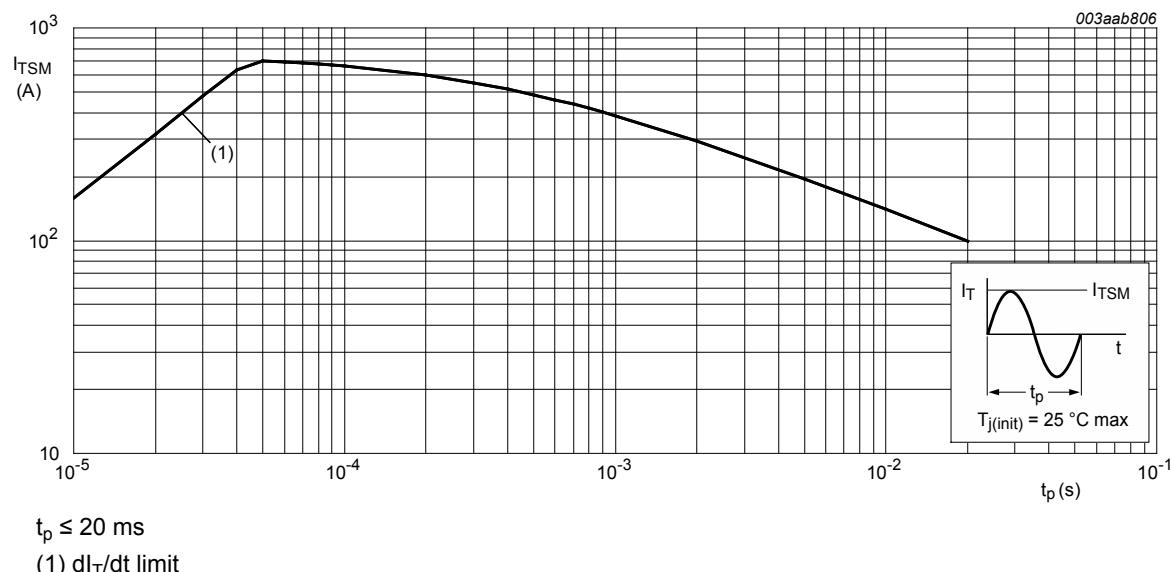


Fig. 4. Non-repetitive peak on-state current as a function of pulse duration; maximum values

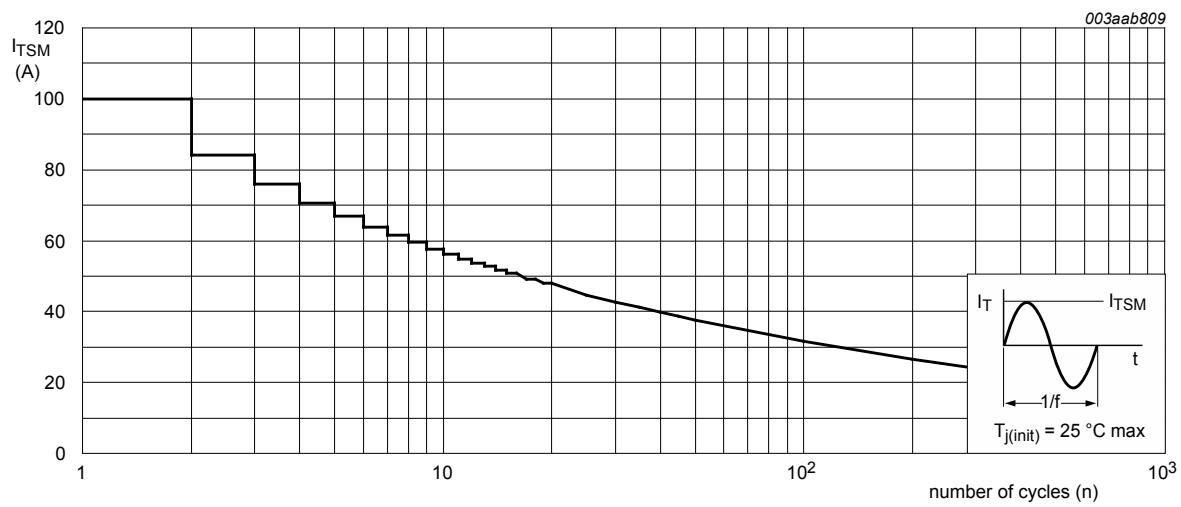


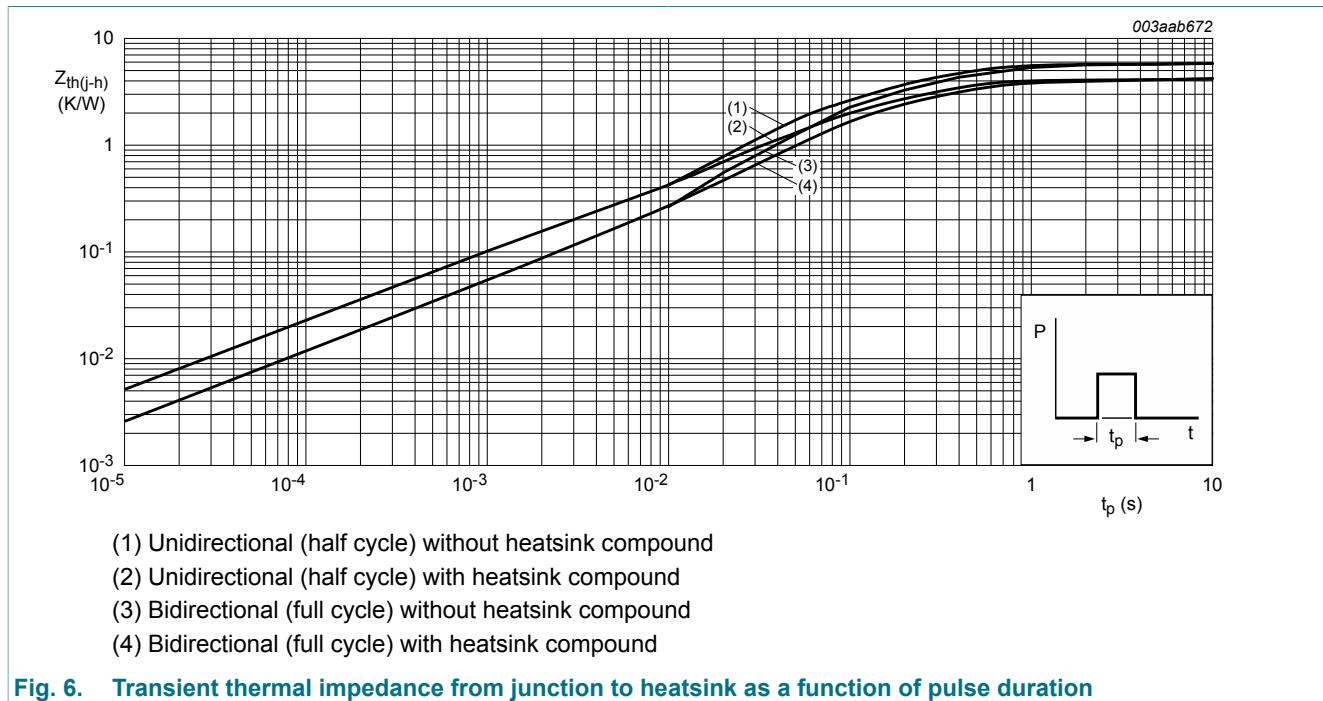
Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

## 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink compound; <a href="#">Fig. 6</a>	full cycle or half cycle; with heatsink compound; <a href="#">Fig. 6</a>	-	-	4	K/W
		full cycle or half cycle; without heatsink compound; <a href="#">Fig. 6</a>	-	-	5.5	K/W

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	55	-	K/W



## 6. Isolation characteristics

Table 6. Isolation characteristics

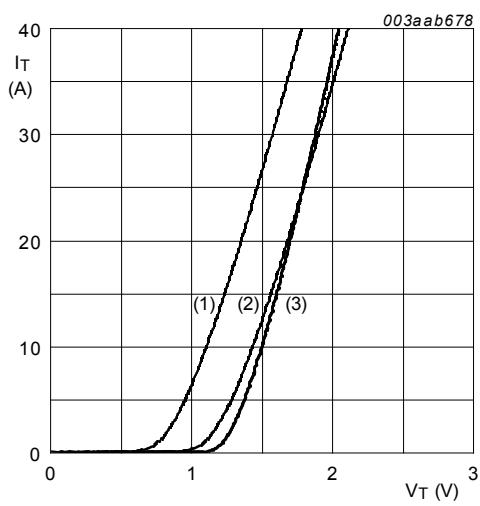
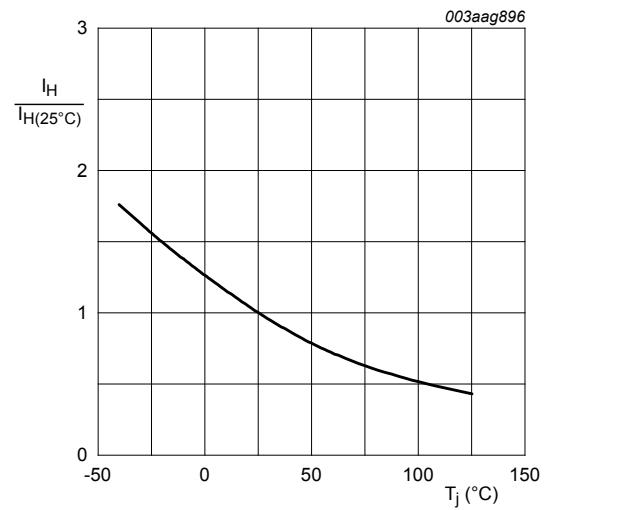
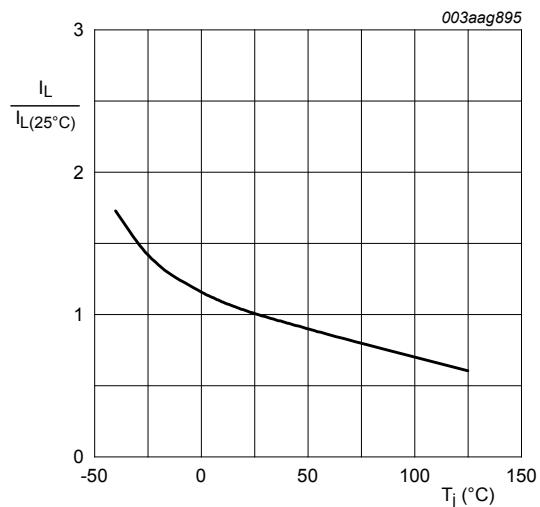
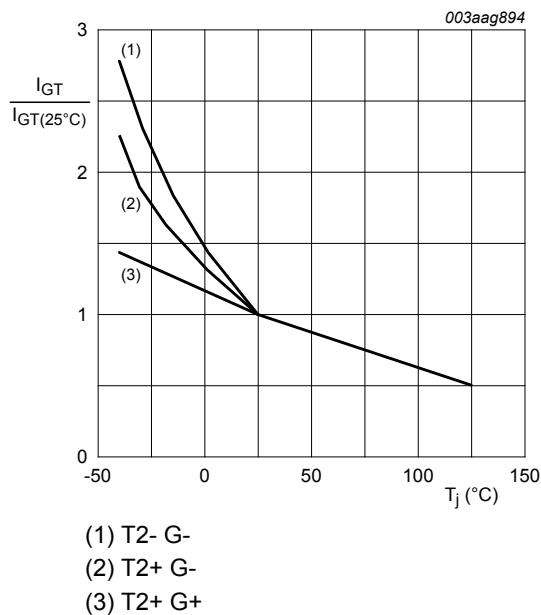
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free ; $50 \text{ Hz} \leq f \leq 60 \text{ Hz}$ ; $RH \leq 65\%$ ; $T_h = 25^\circ\text{C}$		-	-	2500	V
$C_{isol}$	isolation capacitance	from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

## 7. Characteristics

Table 7. 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+; $T_j = 25^\circ\text{C}$ ; Fig. 7		-	-	10	mA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
		$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; $T_2+ \text{ G-}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA
		$V_D = 12 \text{ V}$ ; $I_T = 0.1 \text{ A}$ ; $T_2- \text{ G-}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA
$I_L$	latching current	$V_D = 12 \text{ V}$ ; $I_G = 0.1 \text{ A}$ ; $T_2+ \text{ G+}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	-	25	mA
		$V_D = 12 \text{ V}$ ; $I_G = 0.1 \text{ A}$ ; $T_2+ \text{ G-}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	-	30	mA
		$V_D = 12 \text{ V}$ ; $I_G = 0.1 \text{ A}$ ; $T_2- \text{ G-}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>		-	-	25	mA
$I_H$	holding current	$V_D = 12 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	15	mA
$V_T$	on-state voltage	$I_T = 15 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	1.3	1.6	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	1.5	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	$V_D = 800 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$		-	0.1	0.5	mA
<b>Dynamic characteristics</b>							
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit		50	-	-	V/ $\mu$ s
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12 \text{ A}$ ; $dV_{com}/dt = 20 \text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit		3	-	-	A/ms
		$V_D = 400 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12 \text{ A}$ ; $dV_{com}/dt = 10 \text{ V}/\mu\text{s}$ ; gate open circuit		6	-	-	A/ms
		$V_D = 400 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12 \text{ A}$ ; $dV_{com}/dt = 1 \text{ V}/\mu\text{s}$ ; gate open circuit		10	-	-	A/ms



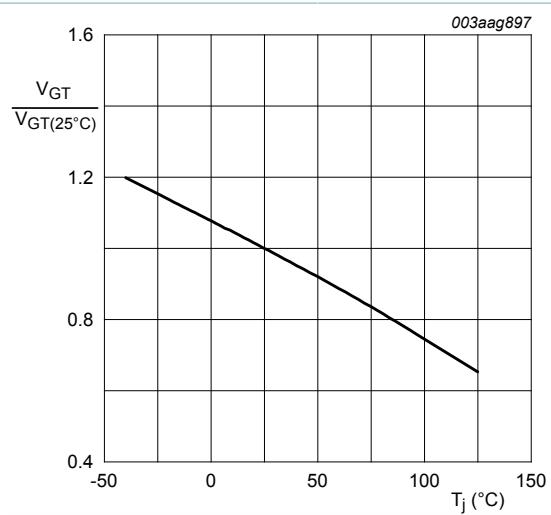
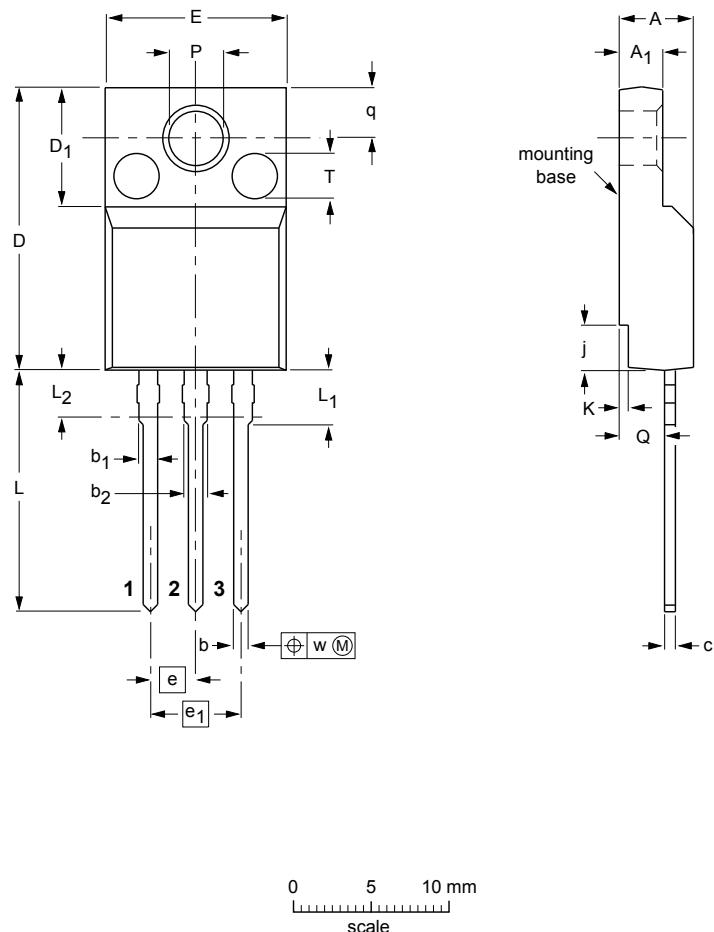


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

## 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 <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	K	L	L <sub>1</sub>	L <sub>2</sub> <sup>(1)</sup> max.	P	Q	q	T <sup>(2)</sup>	w
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	2.5	0.4
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7	2.54	5.08	1.7	0.4	13.5	2.79	3	3.0	2.3	2.6	2.5	0.4

### Notes

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are # 2.5 x 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 TO-220F (SOT186A)

## 9. Legal information

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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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