

# BTA312X-800C

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 intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series C" triac will commute the full rated RMS current at the maximum rated junction temperature without the aid of a snubber.

### 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 voltage capability
- Isolated mounting base package
- Less sensitive gate for high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

### 1.3 Applications

- Electronic thermostats (heating and cooling)
- High power 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

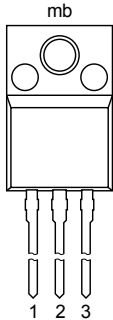

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	-	800	V
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	100	A
$I_{\text{T(RMS)}}$	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
<b>Static characteristics</b>						
$I_{\text{GT}}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_2+$ G+; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	2	-	35	mA



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$ ; Fig. 7	2	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ }^\circ\text{C}$ ; Fig. 7	2	-	35	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	500	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (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	 <p>TO-220F (SOT186A)</p>	 <p>sym051</p>
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

## 3. Ordering information

Table 3. Ordering information

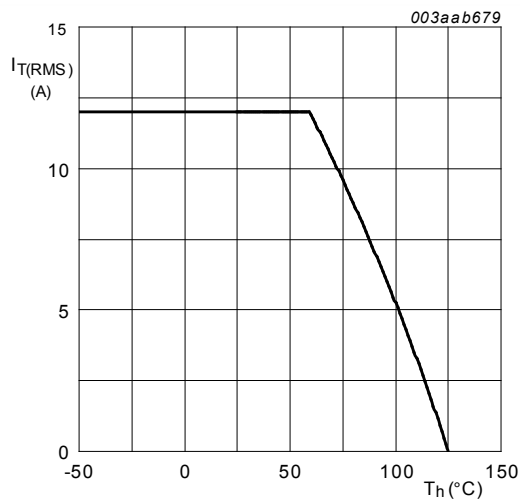
Type number	Package		
	Name	Description	Version
BTA312X-800C	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A
BTA312X-800C/L01	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

## 4. Limiting values

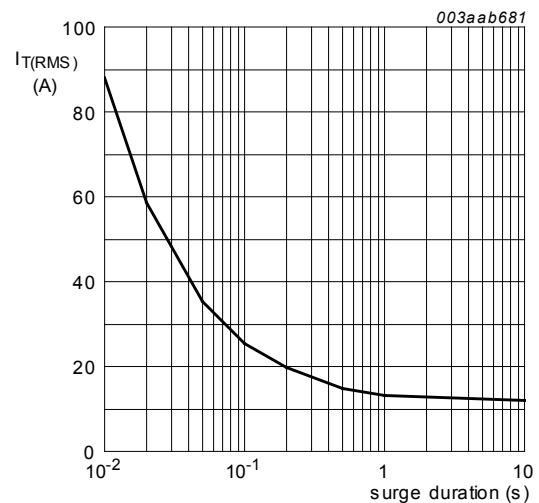
**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{\text{DRM}}$	repetitive peak off-state voltage		-	800	V
$I_{\text{T(RMS)}}$	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
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	100	A
		full sine wave; $T_{\text{j(init)}} = 25^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$	-	110	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	50	$\text{A}^2\text{s}$
$dl_{\text{T}}/dt$	rate of rise of on-state current	$I_{\text{T}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ; $dl_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$	-	100	$\text{A}/\mu\text{s}$
$I_{\text{GM}}$	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	150	$^\circ\text{C}$
$T_{\text{j}}$	junction temperature		-	125	$^\circ\text{C}$



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



$f = 50\text{ Hz}$ ;  $T_h = 59^\circ\text{C}$

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

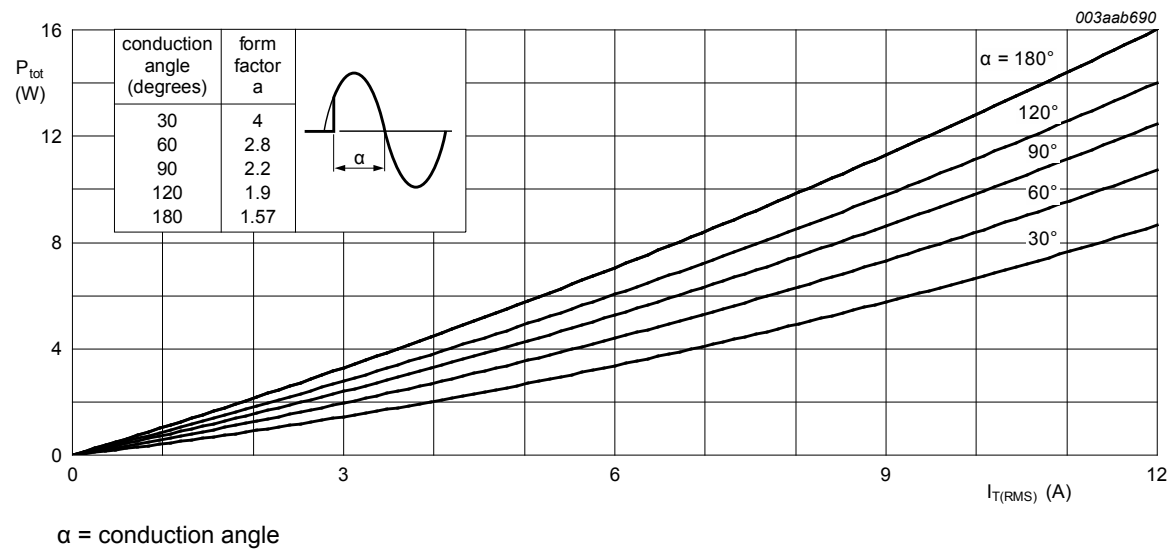


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

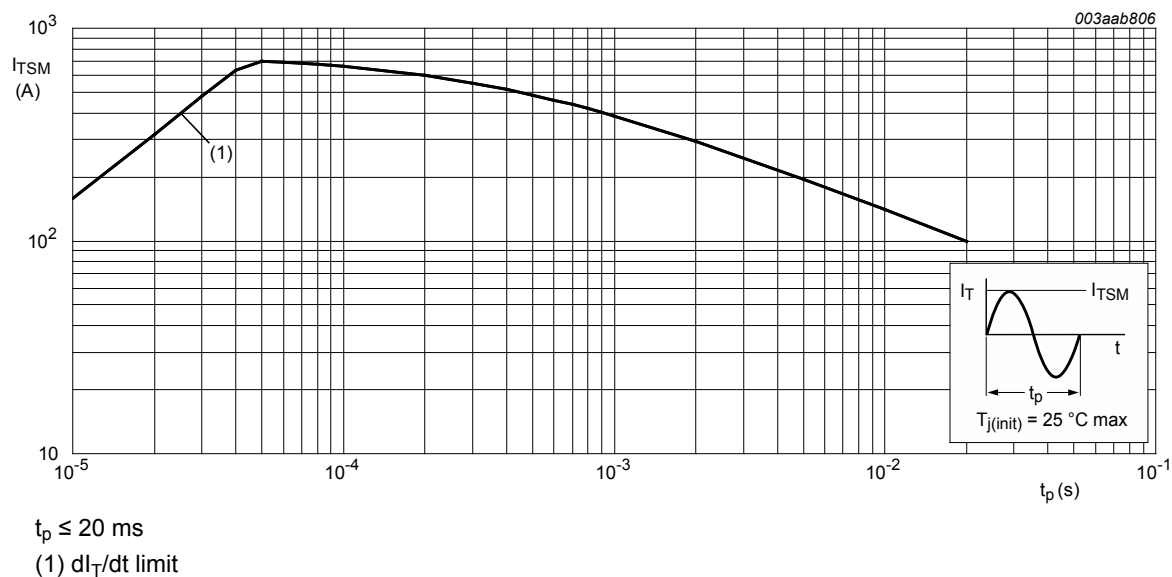
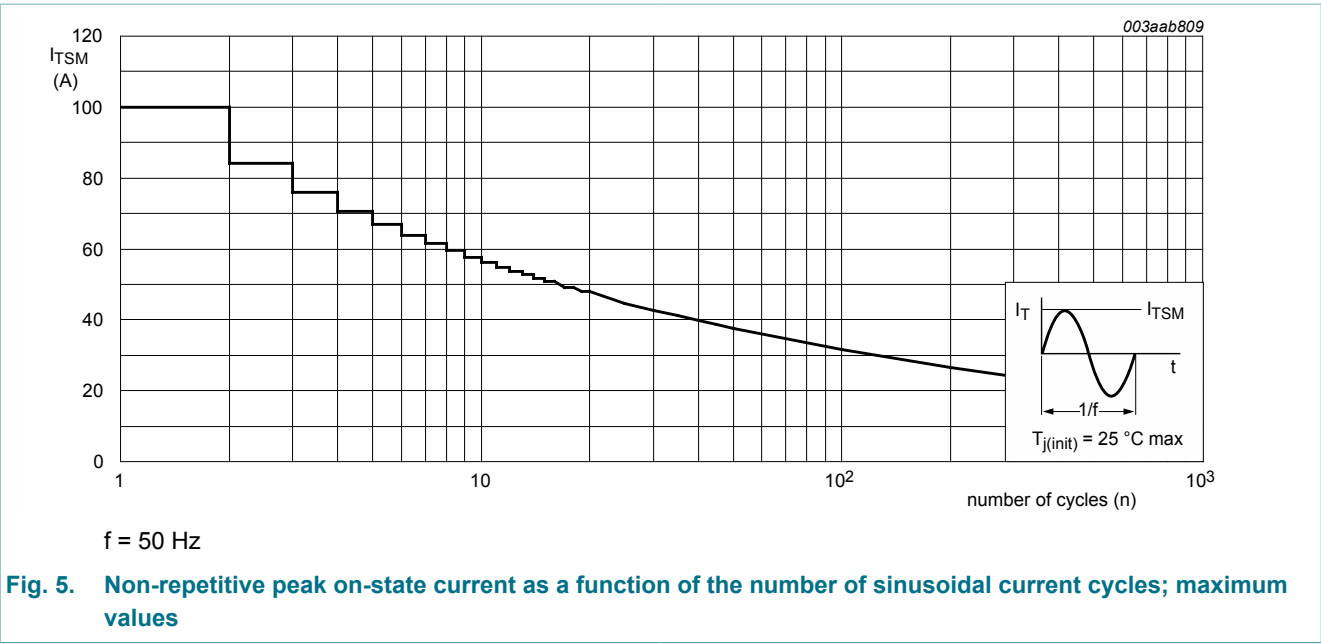


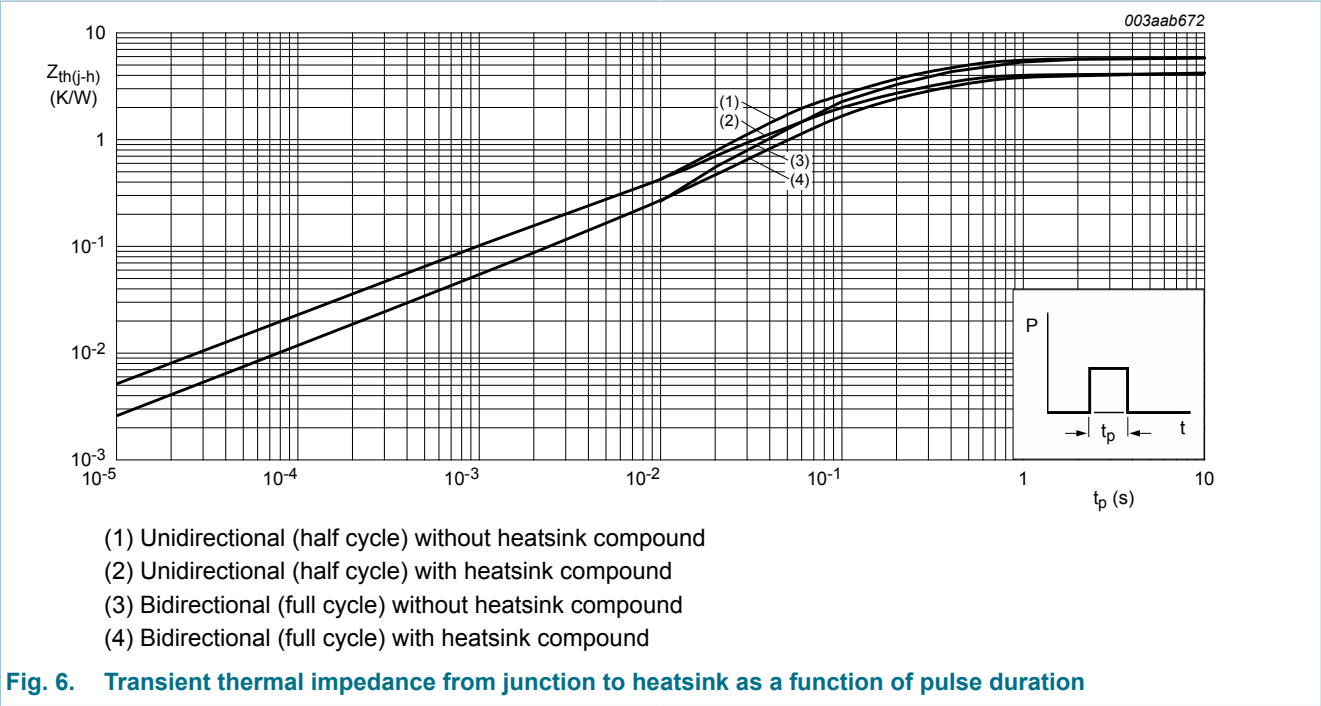
Fig. 4. Non-repetitive peak on-state current as a function of pulse duration; maximum values



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; <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
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



6. Isolation characteristics

Table 6. Isolation characteristics

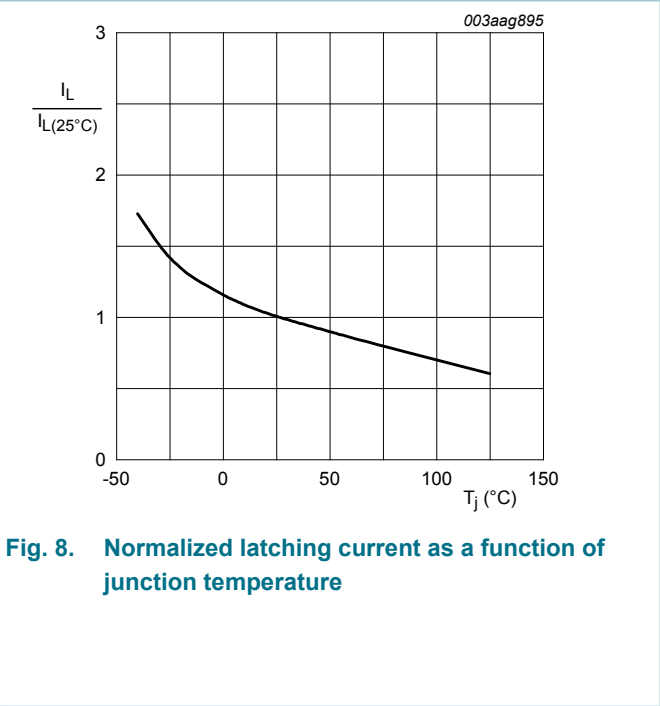
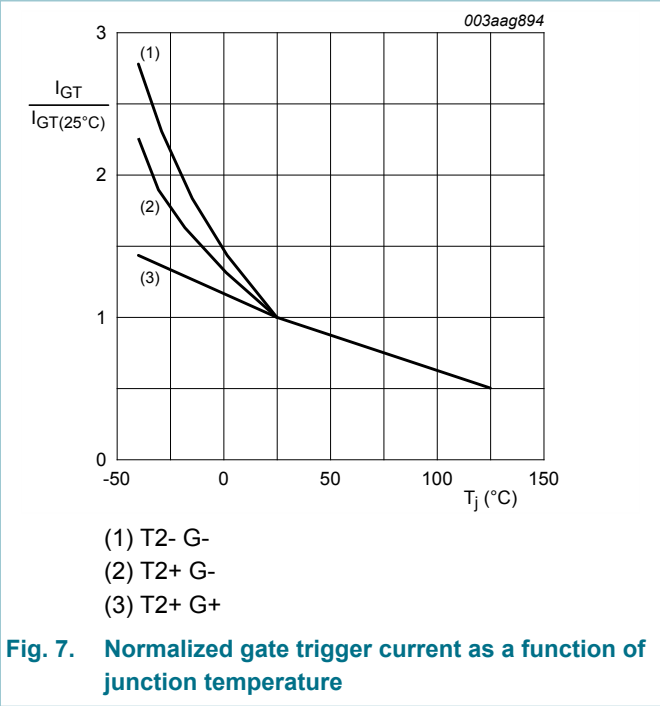
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free ; 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; $T_h = 25\text{ }^{\circ}\text{C}$	-	-	2500	V
$C_{isol}$	isolation capacitance	from main terminal 2 to external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

7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>	2	-	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>	2	-	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>	2	-	35	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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>	-	-	50	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>	-	-	60	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>	-	-	50	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	-	35	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 15 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>	-	1.3	1.6	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>	-	0.8	1.5	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 125 °C; <a href="#">Fig. 11</a>	0.25	0.4	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 800 V; T <sub>j</sub> = 125 °C	-	0.1	0.5	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	500	-	-	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> = 12 A; dV <sub>com</sub> /dt = 20 V/μs; (snubberless condition); gate open circuit	20	-	-	A/ms



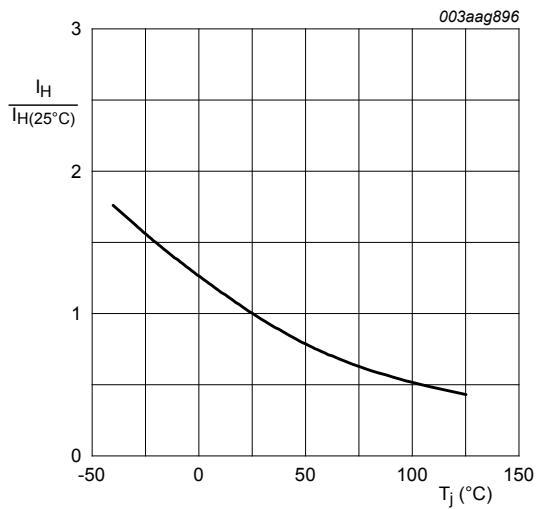
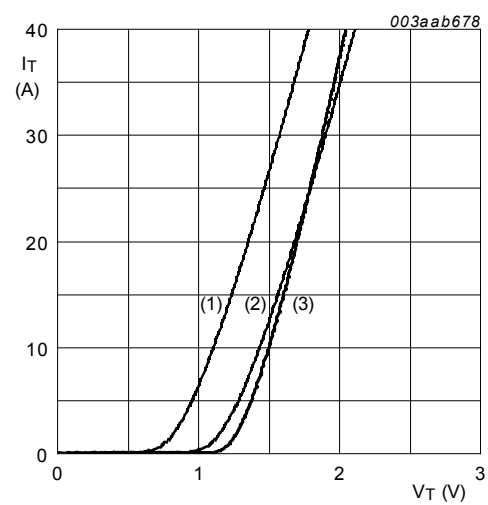


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.164\text{ V}; R_s = 0.027\ \Omega$   
(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

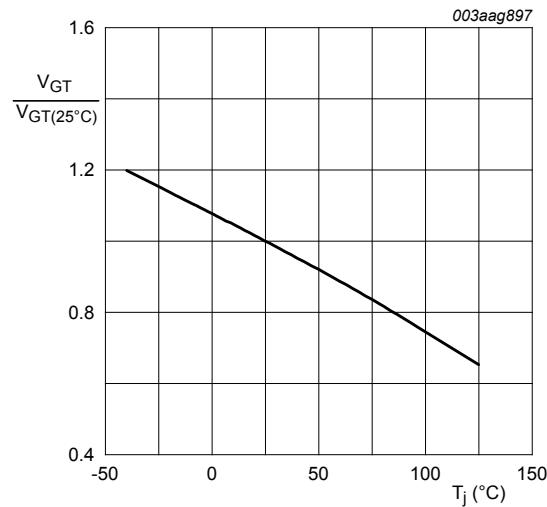


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



8. Package outline

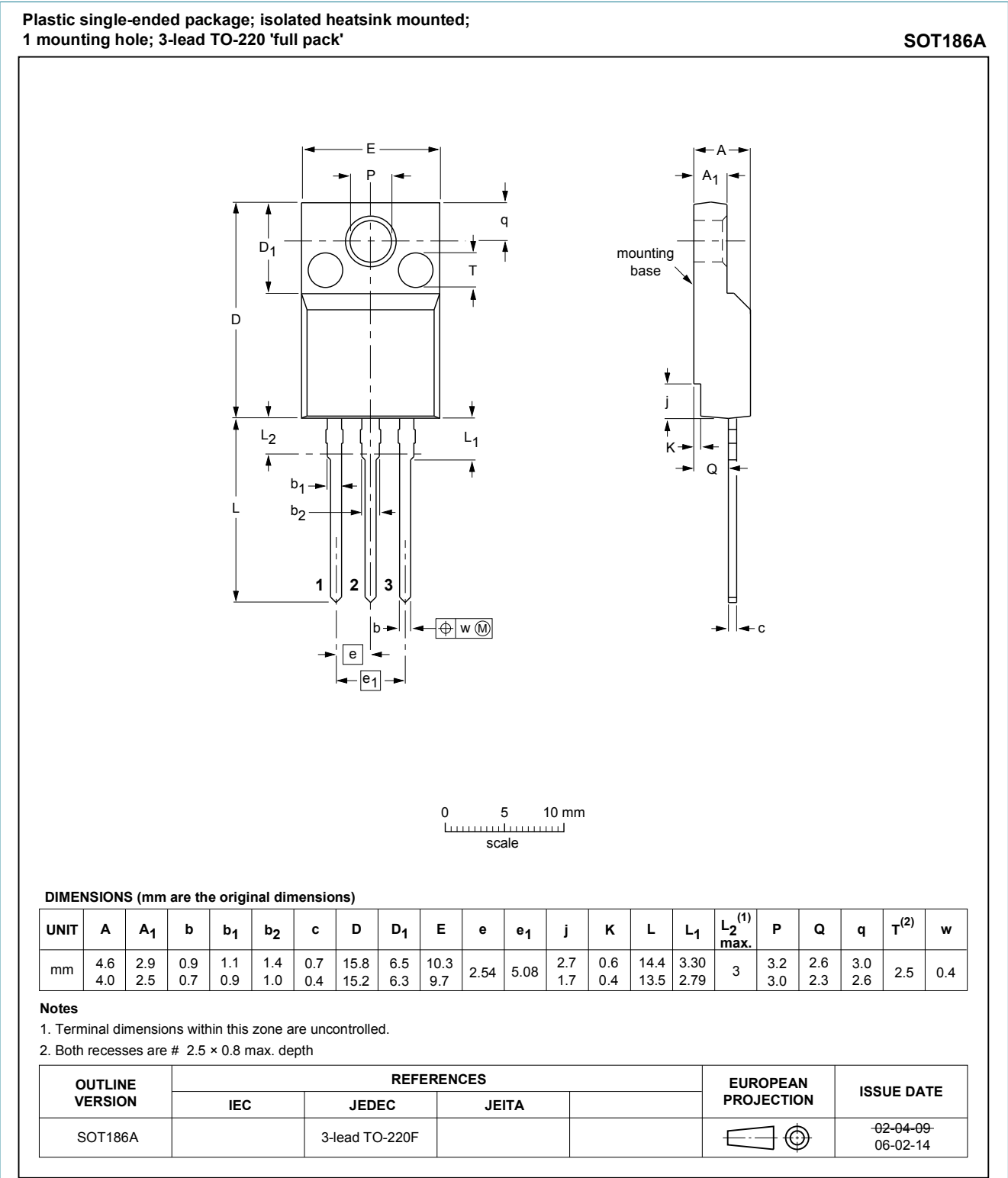


Fig. 12. Package outline TO-220F (SOT186A)

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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.
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