

## 1. General description

Planar passivated high commutation three quadrant triac in a TO220F "full pack" plastic package. The "series E" triac balances the requirements of commutation performance and gate sensitivity. The "sensitive gate" "series E" is intended for interfacing with low power drivers including microcontrollers.

## 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
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

## 3. Applications

- Electronic thermostats
- High power motor controls e.g. washing machines and vacuum cleaners

## 4. Quick reference data

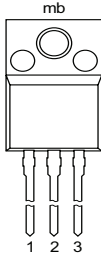
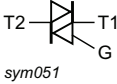
Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
$V_{DRM}$	repetitive peak off-state voltage			600			V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 45^\circ\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		16			A
$I_{TSM}$	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>		140			A
		full sine wave; $T_{j(\text{init})} = 25^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$		150			A
$T_j$	junction temperature			125			$^\circ\text{C}$
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+; $T_j = 25^\circ\text{C}$ ; <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
		$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 7</a>		-	-	10	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 9</a>		-	-	15	mA
$V_T$	on-state voltage	$I_T = 18\text{ A}$ ; $T_j = 25^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	1.3	1.5	V

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Dynamic characteristics							
$dV_D/dt$	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		60	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit		5	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit		8	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 125\text{ }^{\circ}\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit		12	-	-	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
BTA316X-600E	TO220F	BTA316X-600E,127	Tube	50	SOT186A	14-Nov-2013
BTA316X-600E/DG		BTA316X-600E/DG,127	Tube	50	SOT186A (Halogen free)	14-Nov-2013

7. Marking

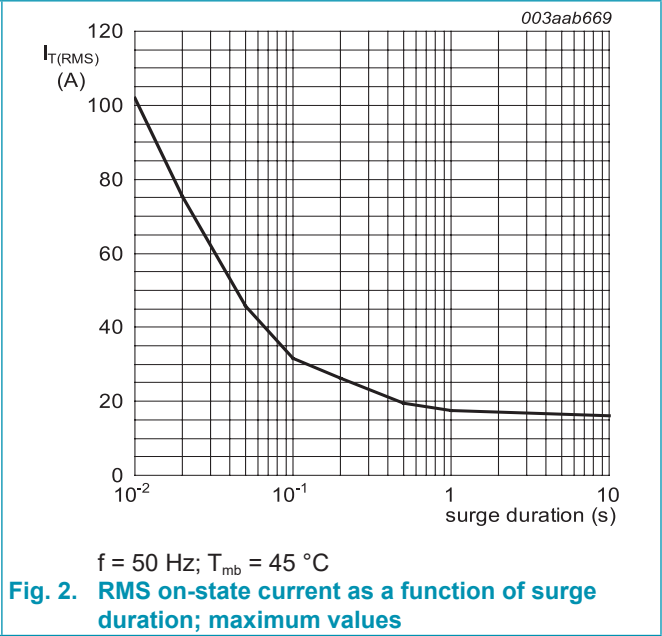
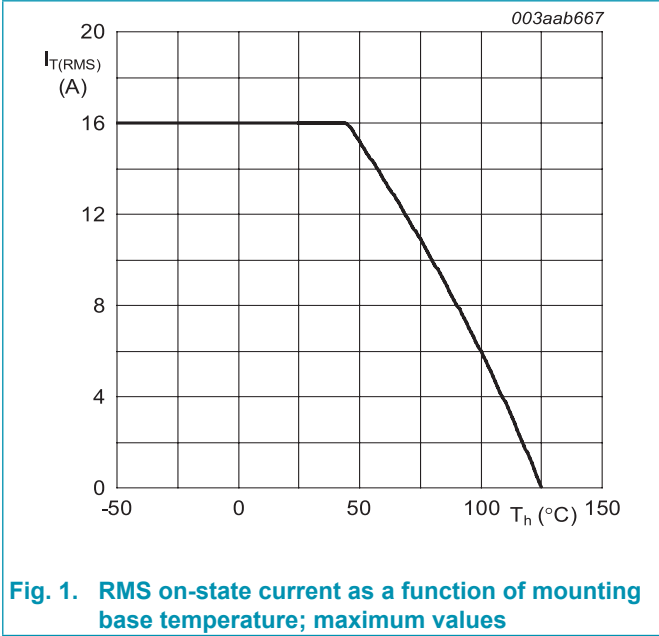
Table 4. Marking codes

Type number	Marking codes	
BTA316X-600E	Assembly factory: d	Assembly factory: A
	BTA316X 600E PJdxxxx xx	BTA316X 600E PJAxxxx xx
BTA316X-600E/DG	BTA316X 600EDG PJdxxxx xx	BTA316X 600EDG PJAxxxx xx

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			600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 45\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>		16	A
$I_{\text{TSM}}$	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig 4</a> ; <a href="#">Fig 5</a>		140	A
		full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$		150	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; SIN		98	A <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_G = 0.2\text{ A}$		100	A/ $\mu$ 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	°C
$T_j$	junction temperature			125	°C



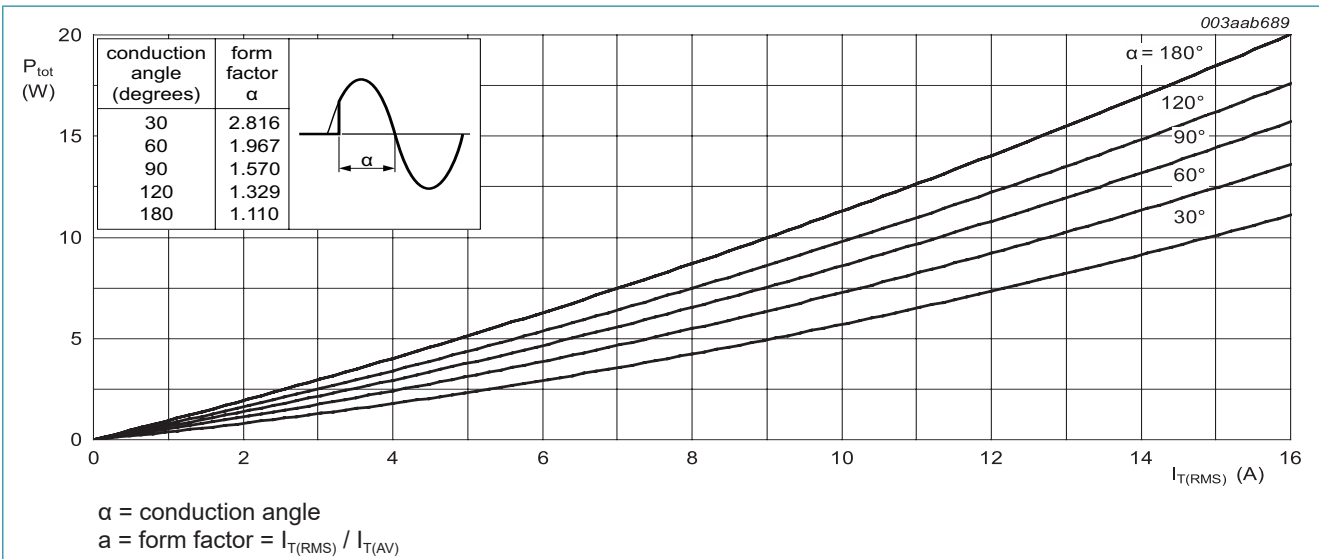


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

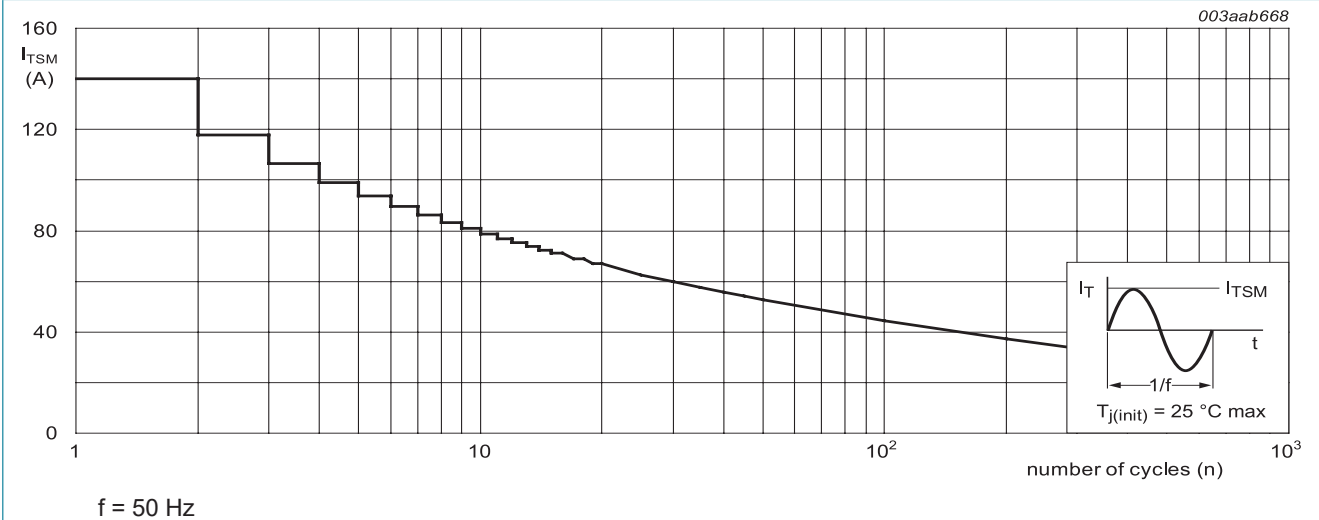


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

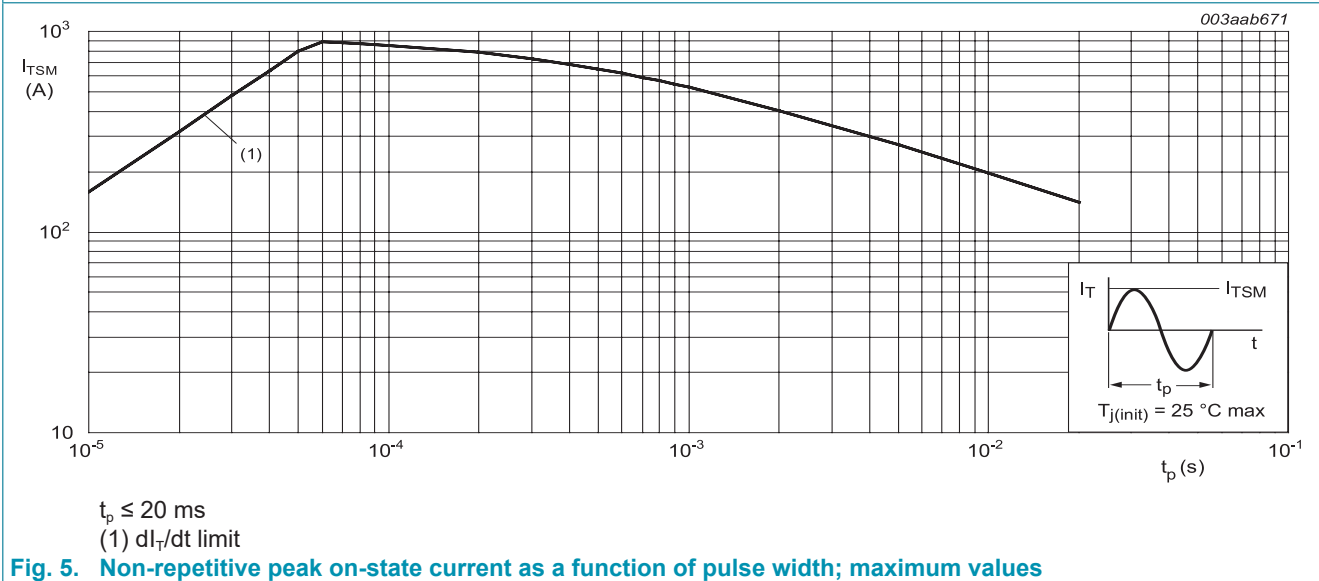
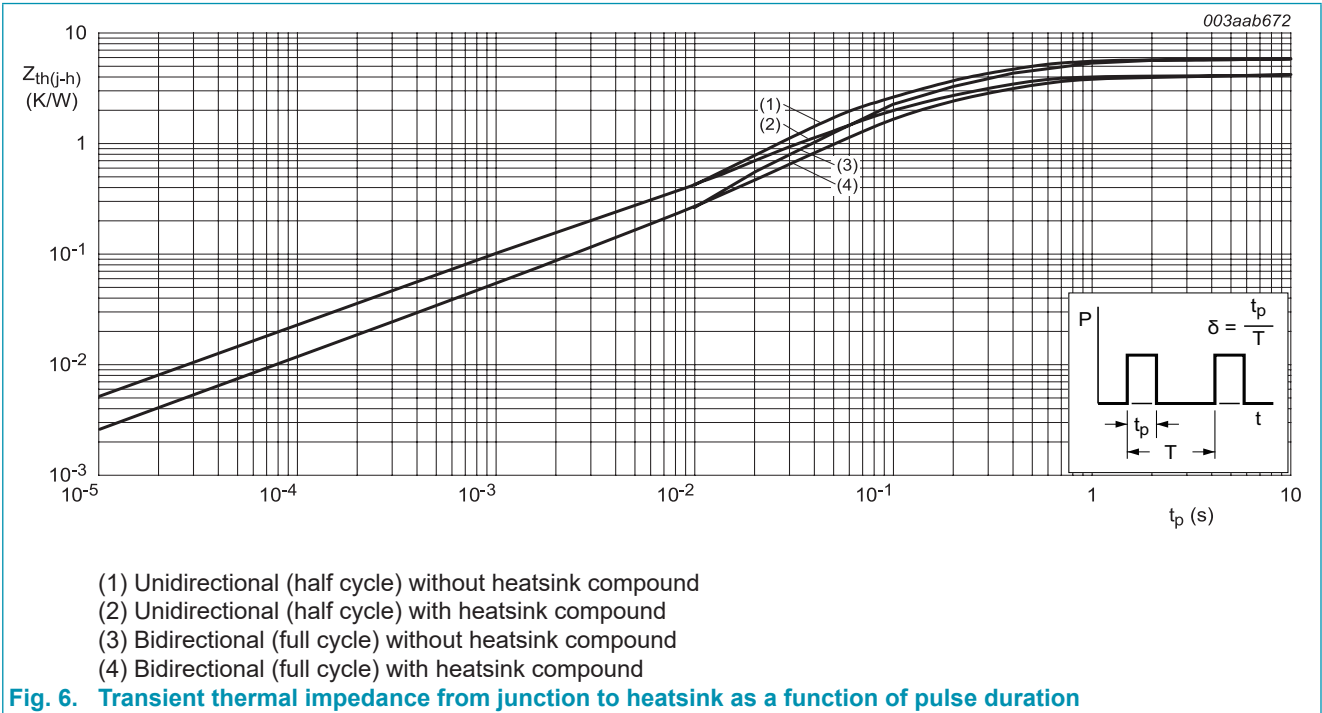


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full cycle or half cycle; with heatsink compound; Fig 6		-	-	4	K/W
		full cycle or half cycle; without heatsink compound; Fig 6		-	-	5.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	55	-	K/W



10. Isolation characteristics

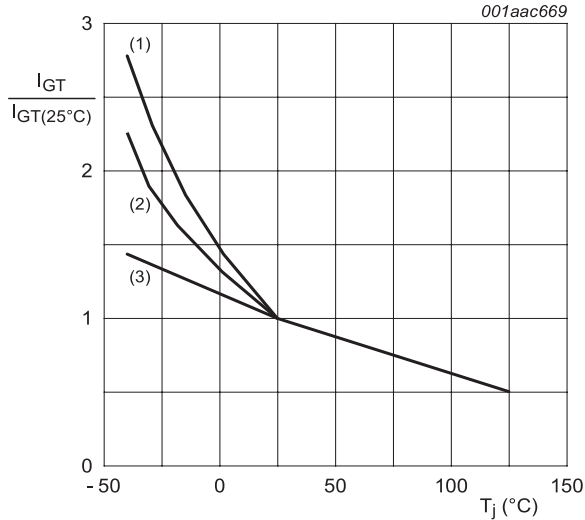
Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Notes	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	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>		-	-	10	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>		-	-	10	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>		-	-	10	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>		-	-	25	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>		-	-	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>		-	-	30	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	$I_T = 18\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>		-	1.3	1.5	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>		-	0.8	1	V
		$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 125\text{ }^\circ\text{C}$		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		60	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit		5	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit		8	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 16\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit		12	-	-	A/ms



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

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

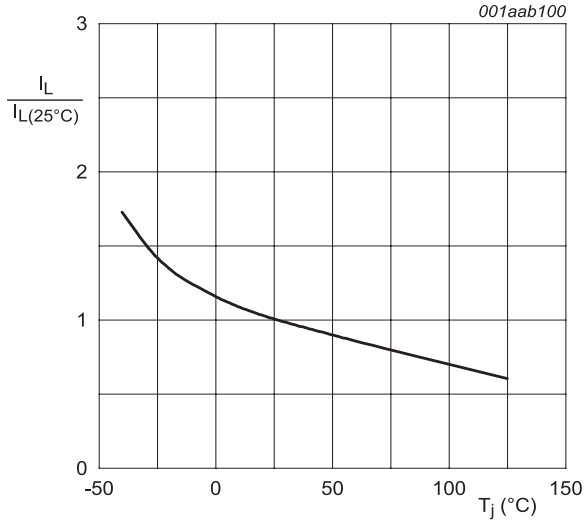


Fig. 8. Normalized latching current as a function of junction temperature

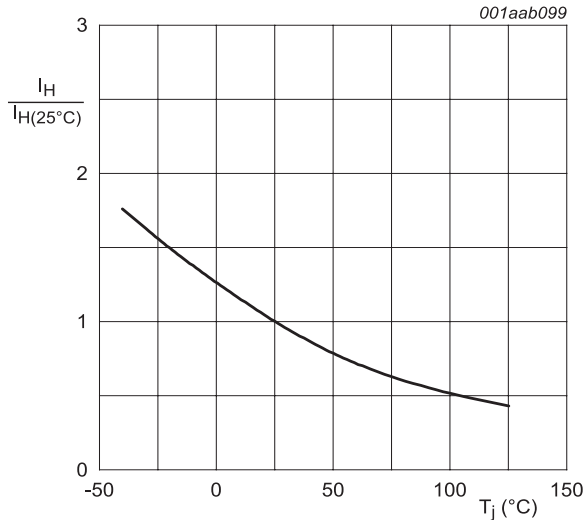
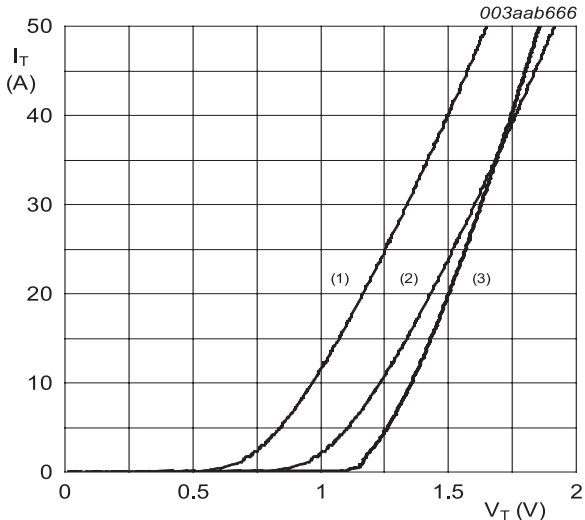


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.024\text{ V}$ ;  $R_s = 0.021\text{ }\Omega$
- (1)  $T_j = 125\text{ }^\circ\text{C}$ ; typical values
  - (2)  $T_j = 125\text{ }^\circ\text{C}$ ; maximum values
  - (3)  $T_j = 25\text{ }^\circ\text{C}$ ; maximum values

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

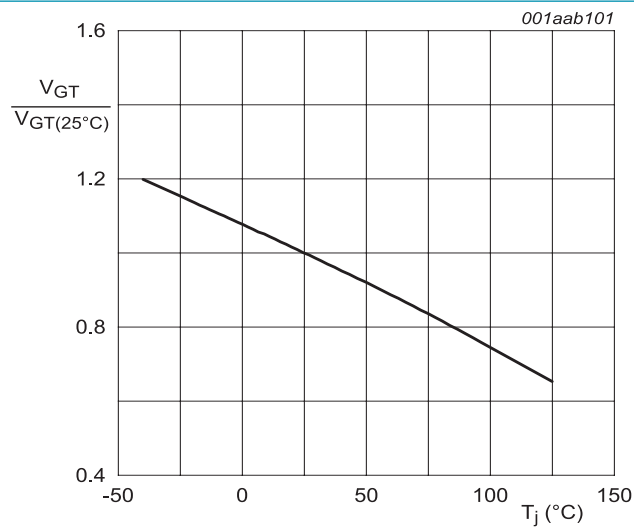
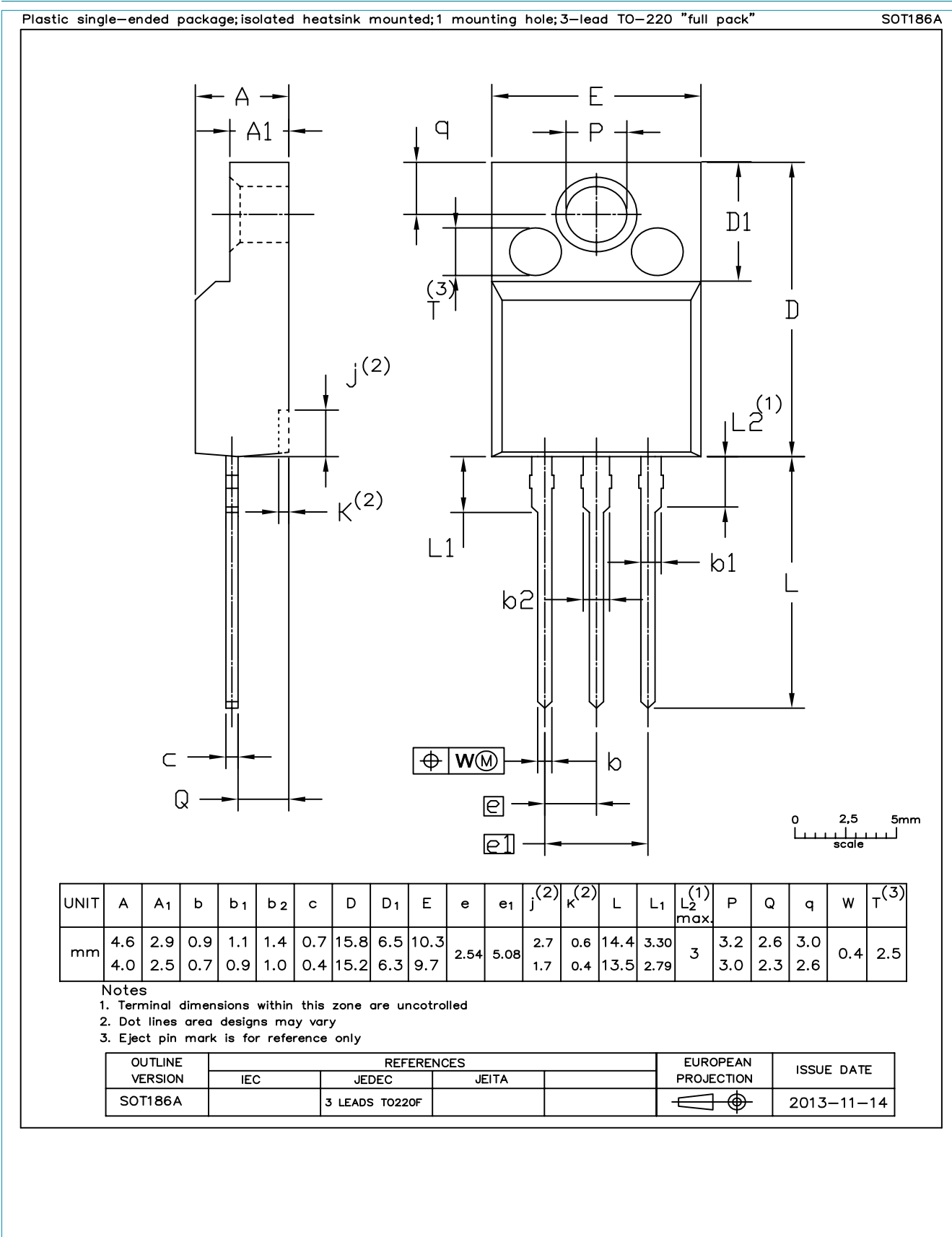


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



12. Package outline



## 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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