

## 1. General description

Planar passivated AC Thyristor Triac power switch in a SOT186A (TO-220F) "full pack" plastic package with self-protective capabilities against low and high energy transients.

## 2. Features and benefits

- Clamping structure ensuring safe high over-voltage withstand capability
- Full cycle AC conduction
- Isolated mounting base package
- Less sensitive gate for high noise immunity
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- Planar passivated for voltage ruggedness and reliability
- Safe clamping capability for low energy over-voltage transients
- Self-protective turn-on during high energy voltage transients
- Triggering in three quadrants only
- Very high immunity to false turn-on by  $dV/dt$

## 3. Applications

- AC fan, pump and compressor controls
- Highly inductive, resistive and safety loads
- Large and small appliances (White Goods)
- Reversing induction motor controls
- Applications subject to high temperature

## 4. Quick reference data

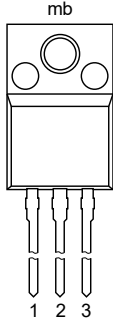

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 57\text{ °C}$ ; <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; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	120	A
		full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$	-	-	132	A
$T_j$	junction temperature		-	-	125	°C
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ °C}$ ; non-repetitive, off-state; <a href="#">Fig. 6</a>	-	-	2	kV

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
I <sub>GT</sub>	gate trigger current	V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; LD+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	35	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; LD+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	35	mA
		V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; LD- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 8</a>	-	-	35	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>	-	-	50	mA
V <sub>T</sub>	on-state voltage	I <sub>T</sub> = 17 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 11</a>	-	1.25	1.5	V
V <sub>CL</sub>	clamping voltage	I <sub>CL</sub> = 0.1 mA; t <sub>p</sub> = 1 ms; T <sub>j</sub> = 25 °C	850	-	-	V
<b>Dynamic characteristics</b>						
dV <sub>D</sub> /dt	rate of rise of off-state voltage	V <sub>DM</sub> = 536 V; T <sub>j</sub> = 125 °C; exponential waveform; gate open circuit	3000	-	-	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	14	-	-	A/ms

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	 <p style="text-align: center;">mb</p> <p style="text-align: center;">1 2 3</p> <p style="text-align: center;"><b>TO-220F (SOT186A)</b></p>	 <p style="text-align: center;">sym051</p>
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

## 6. Ordering information

Table 3. Ordering information

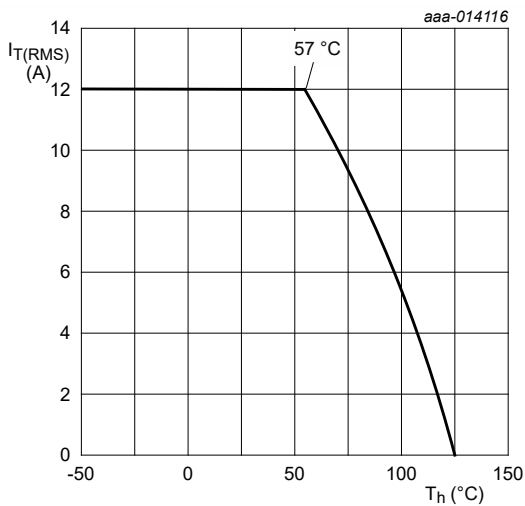
Type number	Package		
	Name	Description	Version
ACTT12X-800C	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

## 7. Limiting values

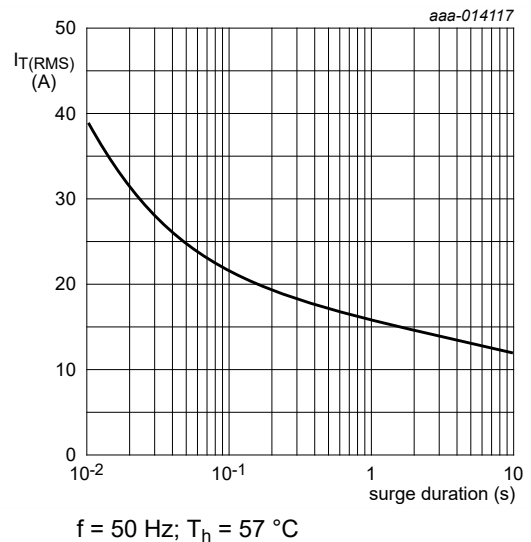
**Table 4. Limiting values**

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; $T_h \leq 57\text{ }^\circ\text{C}$ ; <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>	-	120	A
		full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$	-	132	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	72	$\text{A}^2\text{s}$
$di_T/dt$	rate of rise of on-state current	$I_G = 0.2\text{ A}$	-	100	$\text{A}/\mu\text{s}$
$I_{GM}$	peak gate current	$t = 20\text{ }\mu\text{s}$	-	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	$^\circ\text{C}$
$T_j$	junction temperature		-	125	$^\circ\text{C}$
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ }^\circ\text{C}$ ; non-repetitive, off-state; <a href="#">Fig. 6</a>	-	2	kV



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



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

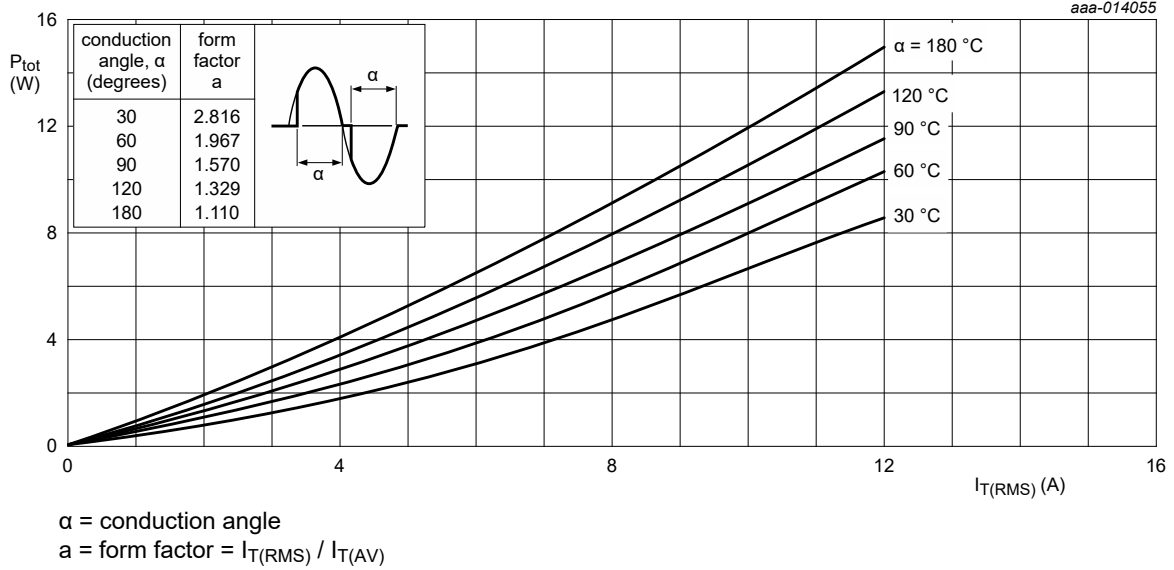


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

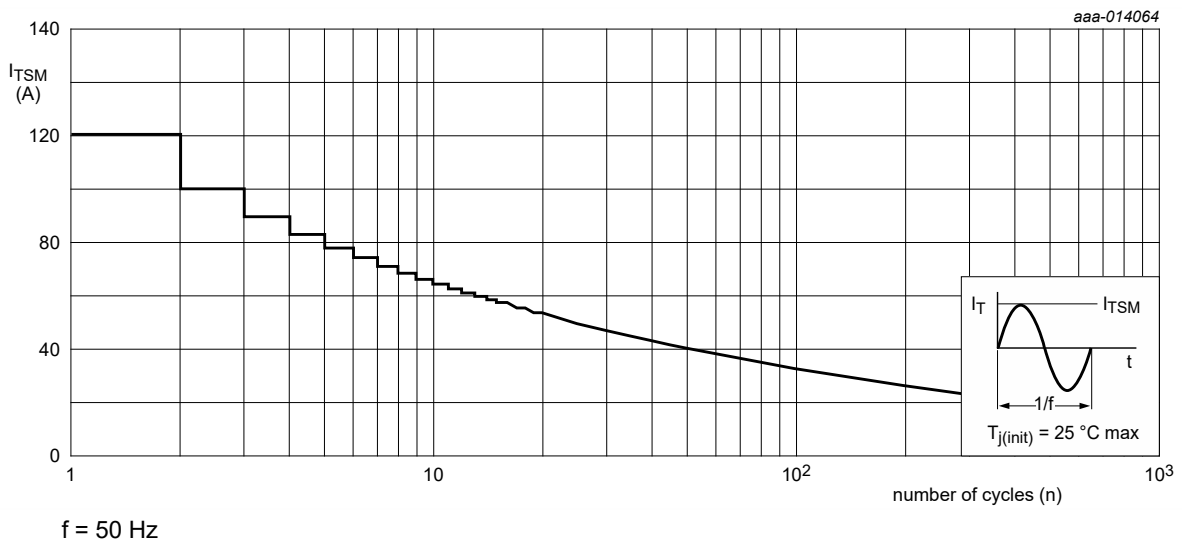


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

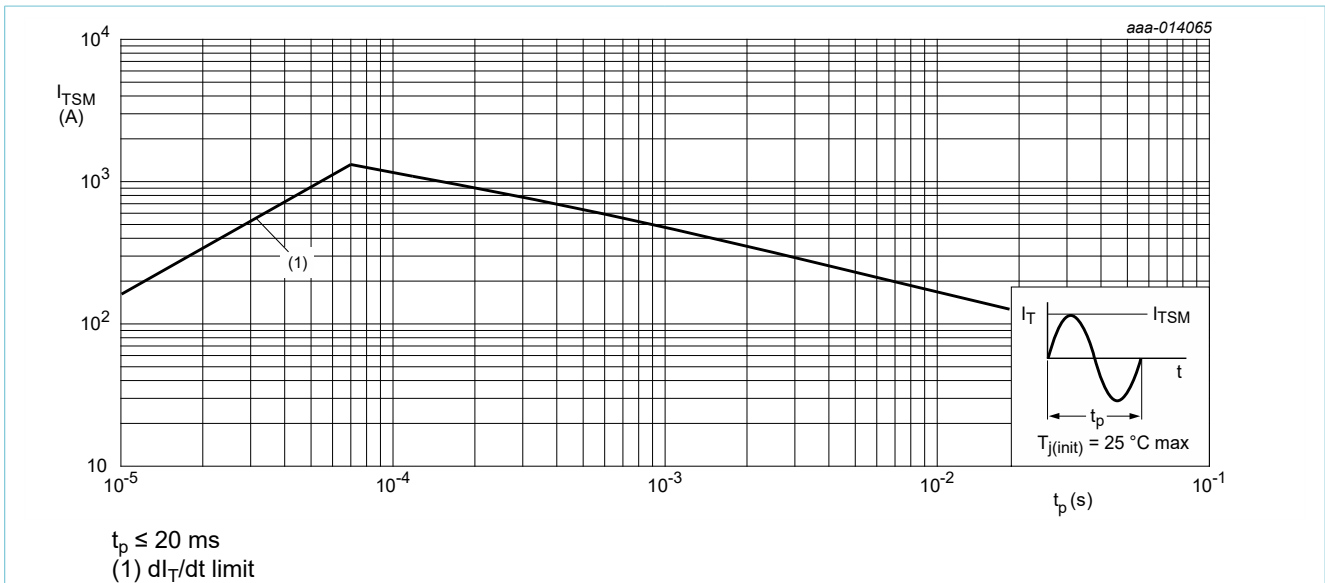


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

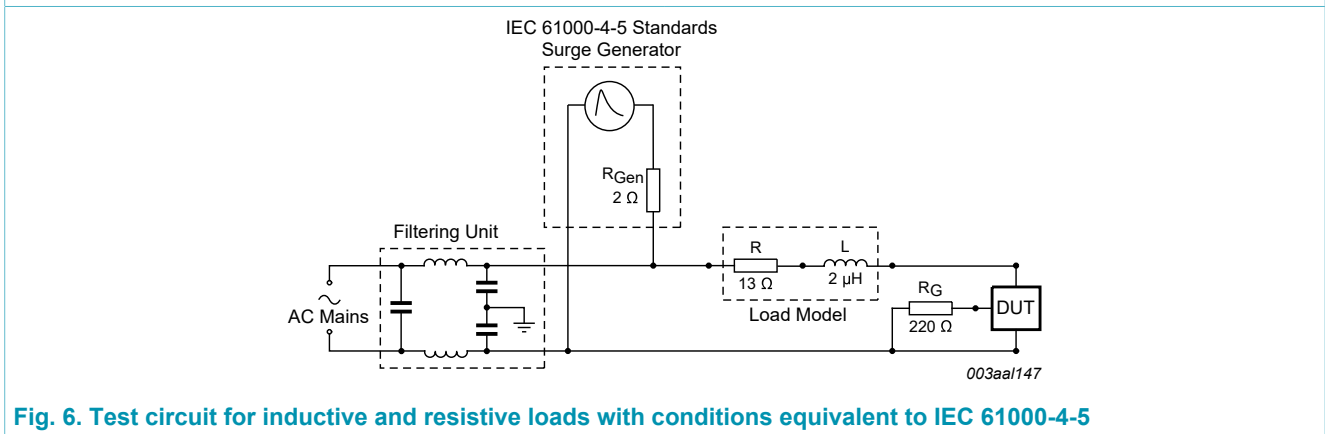


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

## 8. 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; with heatsink compound; <a href="#">Fig. 7</a>	-	-	4.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	55	-	K/W

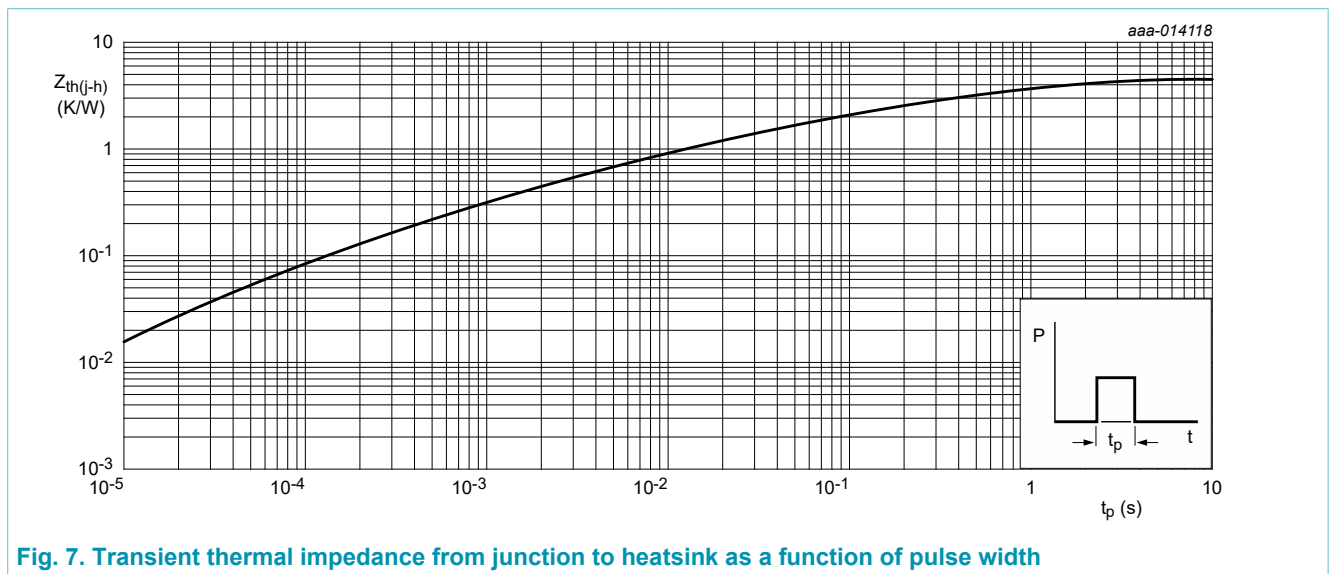


Fig. 7. Transient thermal impedance from junction to heatsink as a function of pulse width

## 9. Isolation characteristics

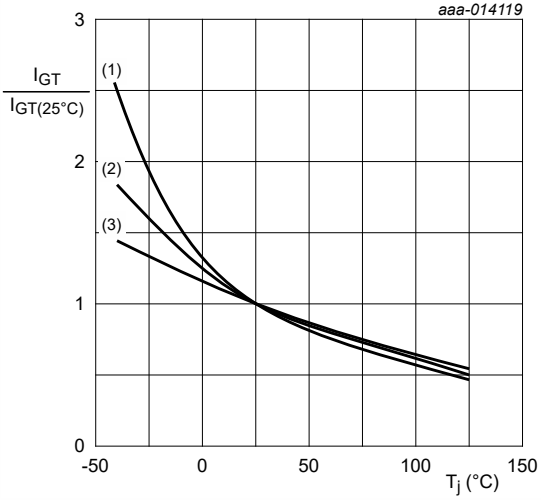
Table 6. Isolation characteristics

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; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $T_h = 25\text{ }^\circ\text{C}$	-	-	2500	V
$C_{isol}$	isolation capacitance	from main terminal 2 to external heatsink; $f = 1\text{ MHz}$ ; $T_h = 25\text{ }^\circ\text{C}$	-	10	-	pF

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	-	-	35	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	50	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	70	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	50	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	-	50	mA
$V_T$	on-state voltage	$I_T = 17\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	-	1.25	1.5	V
$V_{GT}$	gate trigger voltage	$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 12</a>	-	0.8	1	V
		$V_D = 400\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 125\text{ °C}$ ; <a href="#">Fig. 12</a>	0.2	0.45	-	V
$I_D$	off-state current	$V_D = 800\text{ V}$ ; $T_j = 25\text{ °C}$	-	-	10	$\mu\text{A}$
		$V_D = 800\text{ V}$ ; $T_j = 125\text{ °C}$	-	-	0.5	mA
$V_{CL}$	clamping voltage	$I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ °C}$	850	-	-	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; exponential waveform; gate open circuit	3000	-	-	V/ $\mu\text{s}$
$di_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit	14	-	-	A/ms



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

Fig. 8. Normalized gate trigger current as a function of junction temperature

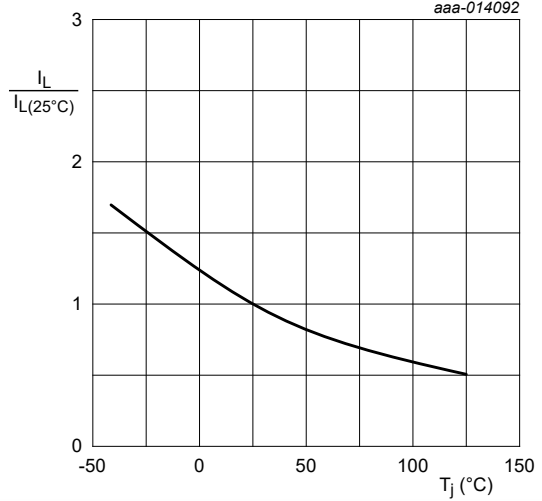


Fig. 9. Normalized latching current as a function of junction temperature

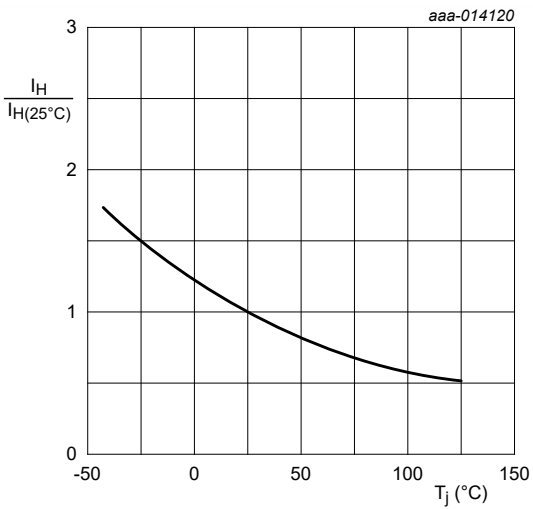
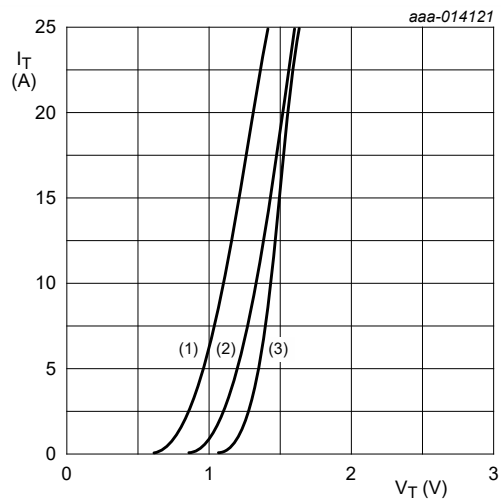


Fig. 10. Normalized holding current as a function of junction temperature



$V_o = 1.025\text{ V}; R_s = 0.028\ \Omega$

- (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. 11. On-state current as a function of on-state voltage



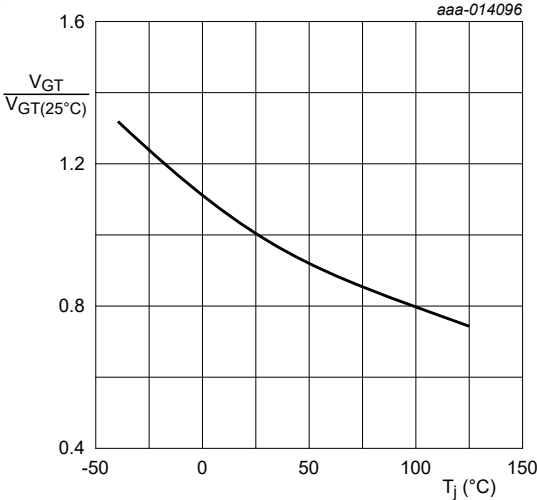


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline

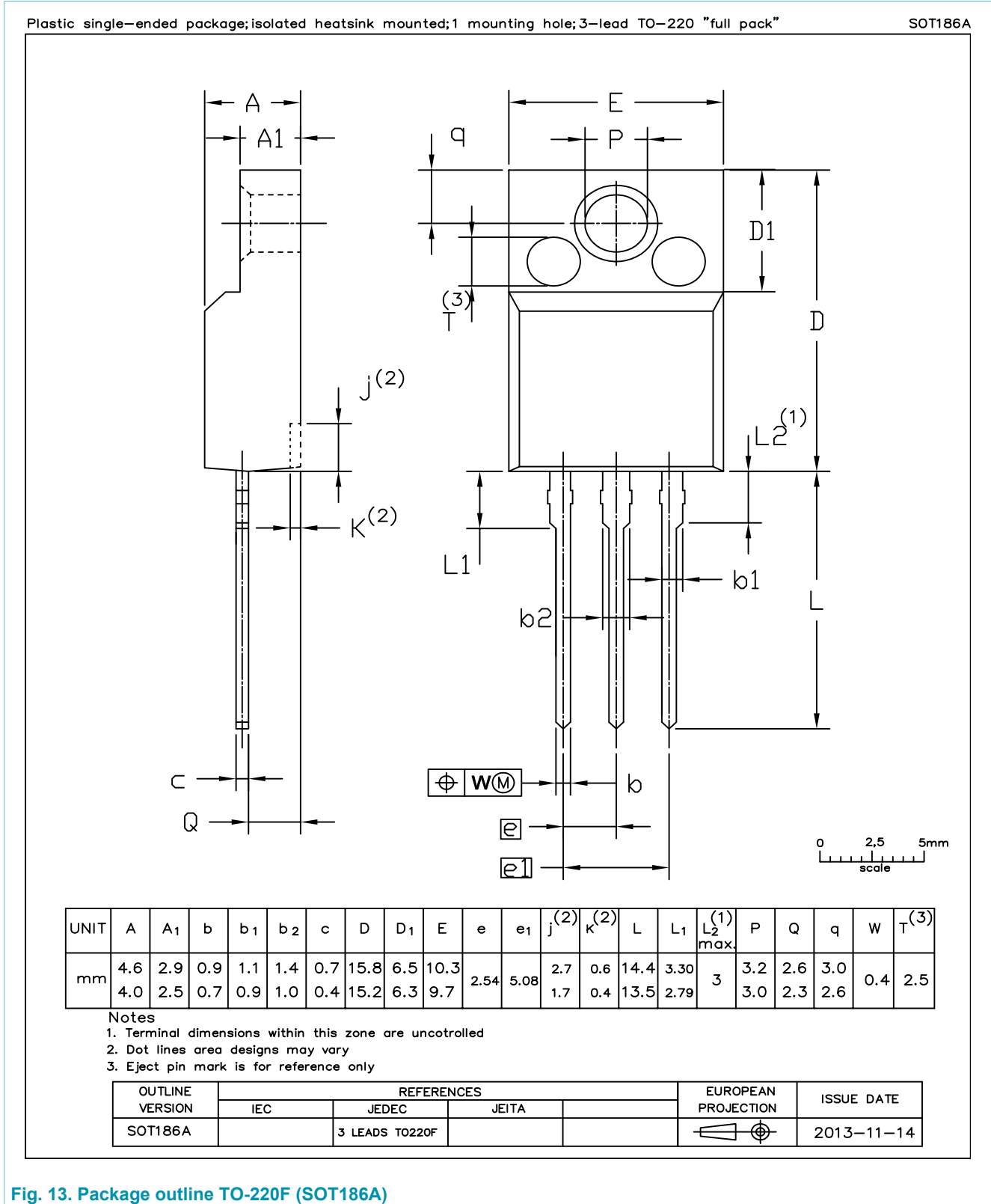


Fig. 13. Package outline TO-220F (SOT186A)

## 12. 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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