



# IMPORTANT NOTICE

10 December 2015

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## 1. Global joint venture starts operations as WeEn Semiconductors

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Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

In this document where the previous NXP references remain, please use the new links as shown below.

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Thank you for your cooperation and understanding,

WeEn Semiconductors





# ACTT12X-800CTN

Enhanced, high temperature ACTT power switch

30 July 2015

Product data sheet

## 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. This "series CTN" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ ) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

## 2. Features and benefits

- Clamping structure ensuring safe high over-voltage withstand capability
- High junction operating temperature capability ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ )
- High minimum  $I_{GT}$  for guaranteed immunity to gate noise
- Full cycle AC conduction
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- Planar passivated for voltage ruggedness and reliability
- Protective self turn-on capability for high energy transients
- Safe clamping capability for low energy over-voltage transients
- Less sensitive gate for high noise immunity
- Triggering in three quadrants only
- Very high immunity to false turn-on by  $dV/dt$  and IEC 61000-4-4 fast transient
- Package meets UL94V0 flammability requirement
- Package is RoHS compliant
- Package meets UL1557 isolation test requirement rated at 2500V RMS

## 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 ( $T_{j(max)} = 150\text{ }^{\circ}\text{C}$ )

## 4. Quick reference data

Table 1. Quick reference data

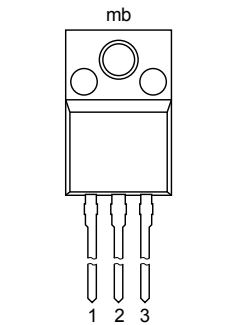
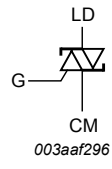
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	800	V



Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 85\text{ }^\circ\text{C}$ ; <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; $T_{j(init)} = 25\text{ }^\circ\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	120	A
		full sine wave; $T_{j(init)} = 25\text{ }^\circ\text{C}$ ; $t_p = 16.7\text{ ms}$	-	-	132	A
$T_j$	junction temperature		-	-	150	$^\circ\text{C}$
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ }^\circ\text{C}$ ; non-repetitive, off-state; <a href="#">Fig. 6</a>	-	-	2	kV
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G+; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>	5	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>	5	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>	5	-	35	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>	-	-	30	mA
$V_T$	on-state voltage	$I_T = 17\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>	-	-	1.5	V
$V_{CL}$	clamping voltage	$I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ }^\circ\text{C}$	850	-	-	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	4000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 536\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; exponential waveform; gate open circuit	2000	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; gate open circuit; snubberless condition	12	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	15	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	20	-	-	A/ms

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CM	common	 <p style="text-align: center;"><b>TO-220F (SOT186A)</b></p>	 <p style="text-align: center;"><small>003aaf296</small></p>
2	LD	load		
3	G	gate		
mb	n.c.	mounting base; isolated		

## 6. Ordering information

Table 3. Ordering information

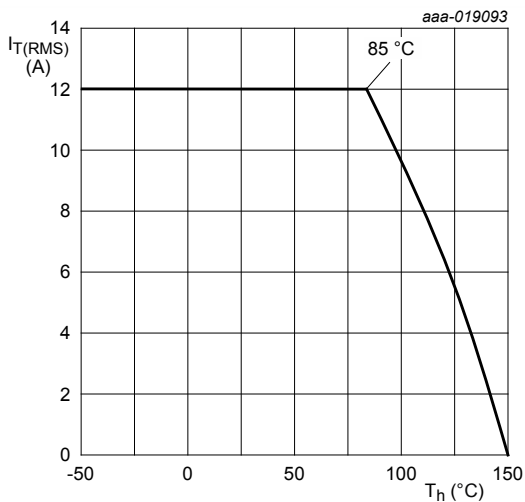
Type number	Package		
	Name	Description	Version
ACTT12X-800CTN	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

## 7. Limiting values

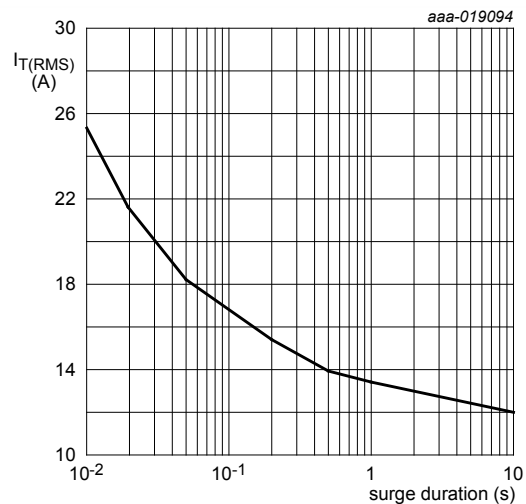
**Table 4. Limiting values**

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; $T_h \leq 85\text{ }^\circ\text{C}$ ; <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	A <sup>2</sup> s
$dl_T/dt$	rate of rise of on-state current	$I_G = 70\text{ mA}$	-	100	A/ $\mu\text{s}$
$I_{GM}$	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	$^\circ\text{C}$
$T_j$	junction temperature		-	150	$^\circ\text{C}$
$V_{PP}$	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**



$f = 50\text{ Hz}$ ;  $T_h = 85\text{ }^\circ\text{C}$

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

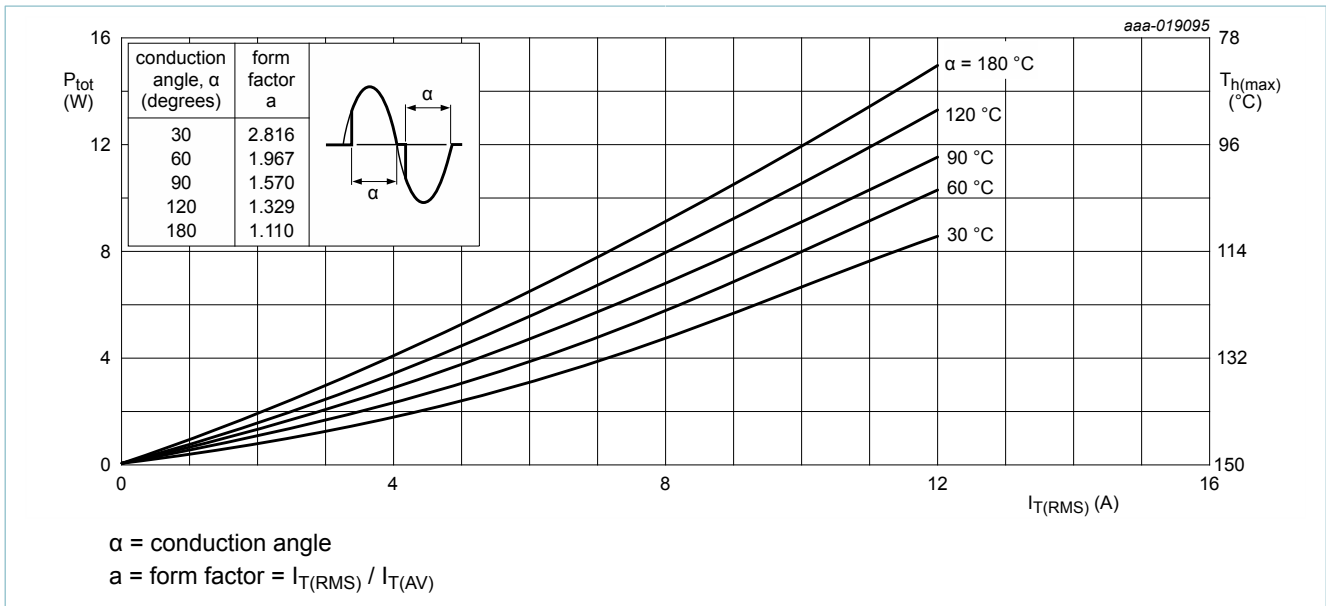


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

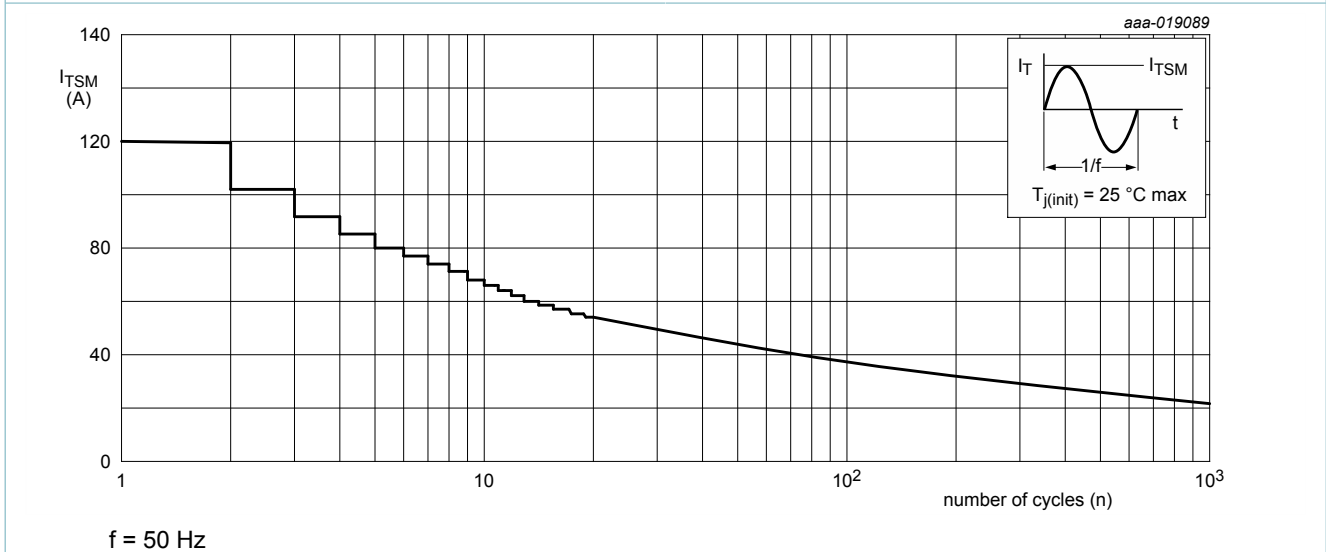


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

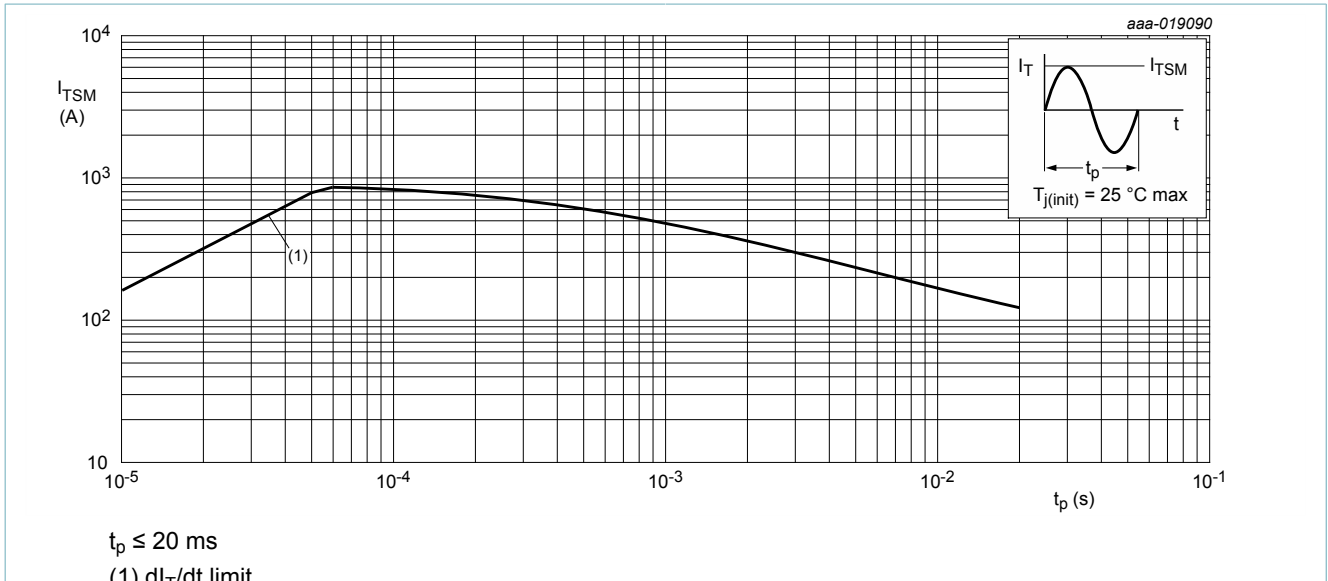


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

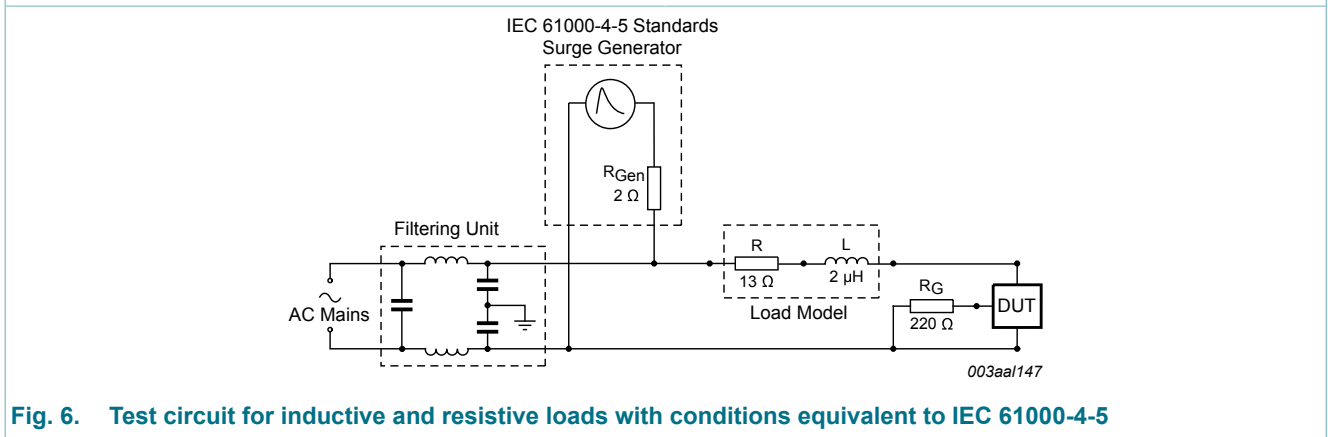


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

## 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 or half 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

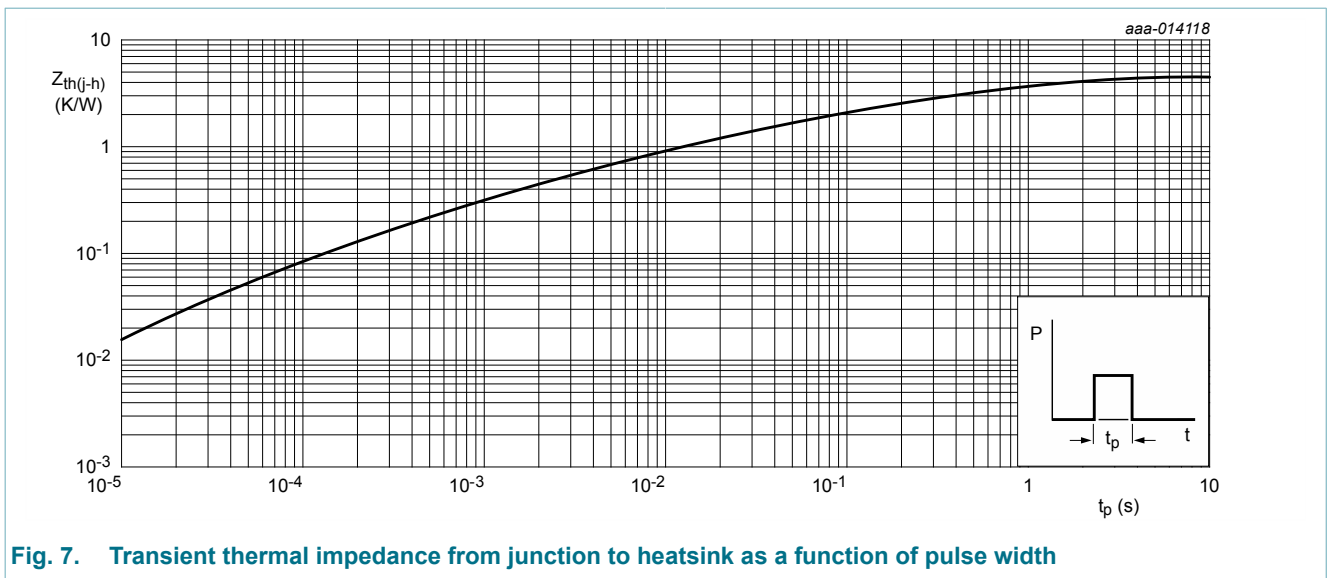


Fig. 7. Transient thermal impedance from junction to heatsink as a function of pulse width

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



## 10. Characteristics

Table 7. Characteristics

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>	5	-	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>	5	-	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>	5	-	35	mA
I <sub>L</sub>	latching current	V <sub>D</sub> = 12 V; I <sub>G</sub> = 100 mA; LD+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	-	40	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 100 mA; LD+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	-	60	mA
		V <sub>D</sub> = 12 V; I <sub>G</sub> = 100 mA; LD- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>	-	-	40	mA
I <sub>H</sub>	holding current	V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>	-	-	30	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>	-	-	1.5	V
V <sub>GT</sub>	gate trigger voltage	V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; T <sub>j</sub> = 25 °C; <a href="#">Fig. 12</a>	-	0.8	1	V
		V <sub>D</sub> = 400 V; I <sub>T</sub> = 100 mA; T <sub>j</sub> = 150 °C; <a href="#">Fig. 12</a>	0.2	0.45	-	V
I <sub>D</sub>	off-state current	V <sub>D</sub> = 800 V; T <sub>j</sub> = 25 °C	-	-	10	µA
		V <sub>D</sub> = 800 V; T <sub>j</sub> = 150 °C	-	-	2	mA
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; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit	4000	-	-	V/µs
		V <sub>DM</sub> = 536 V; T <sub>j</sub> = 150 °C; exponential waveform; gate open circuit	2000	-	-	V/µs
dI <sub>com</sub> /dt	rate of change of commutating current	V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 12 A; dV <sub>com</sub> /dt = 20 V/µs; gate open circuit; snubberless condition	12	-	-	A/ms
		V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 12 A; dV <sub>com</sub> /dt = 10 V/µs; gate open circuit	15	-	-	A/ms
		V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 12 A; dV <sub>com</sub> /dt = 1 V/µs; gate open circuit	20	-	-	A/ms

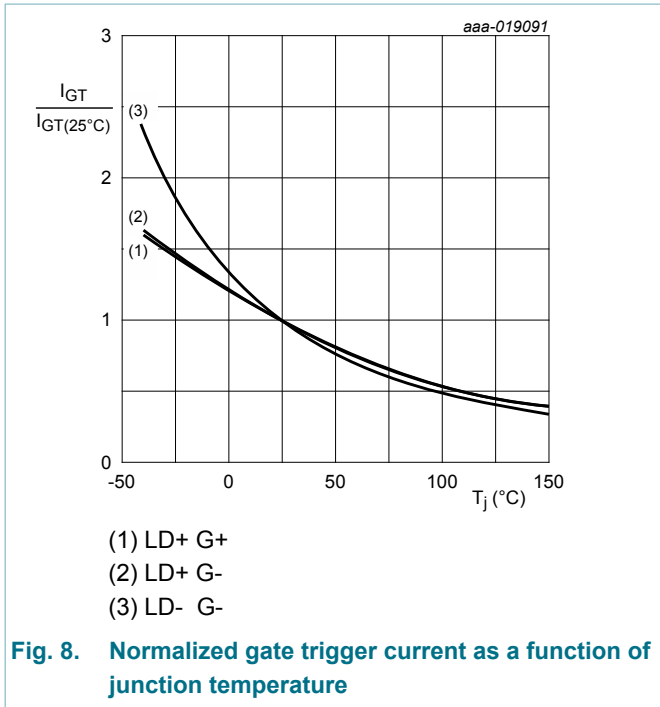


Fig. 8. Normalized gate trigger current as a function of junction temperature

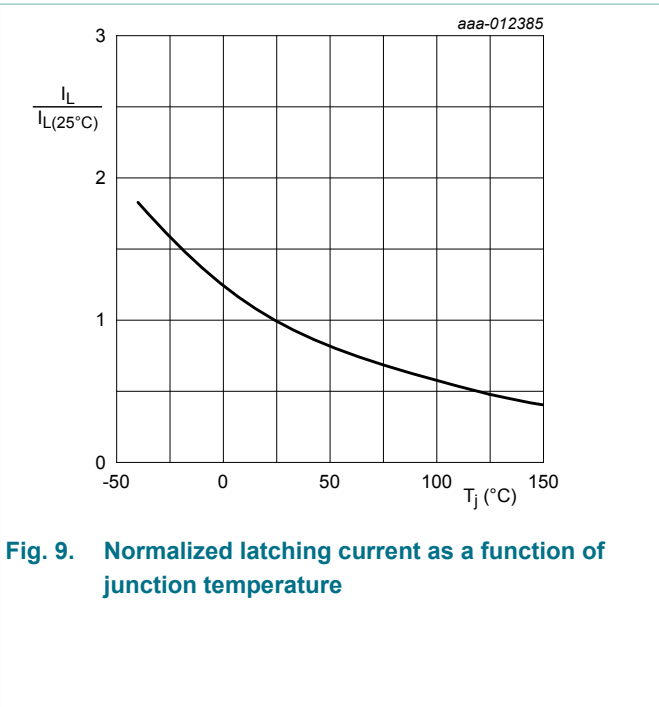


Fig. 9. Normalized latching current as a function of junction temperature

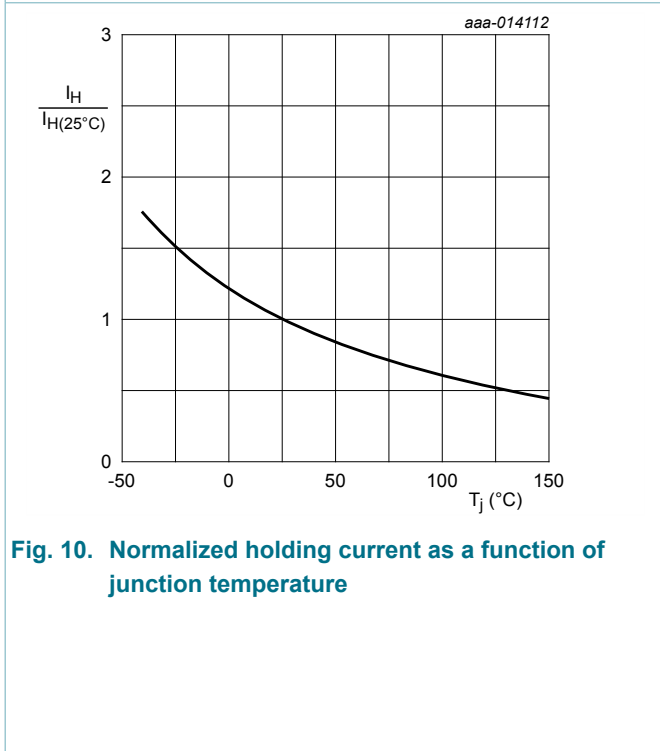


Fig. 10. Normalized holding current as a function of junction temperature

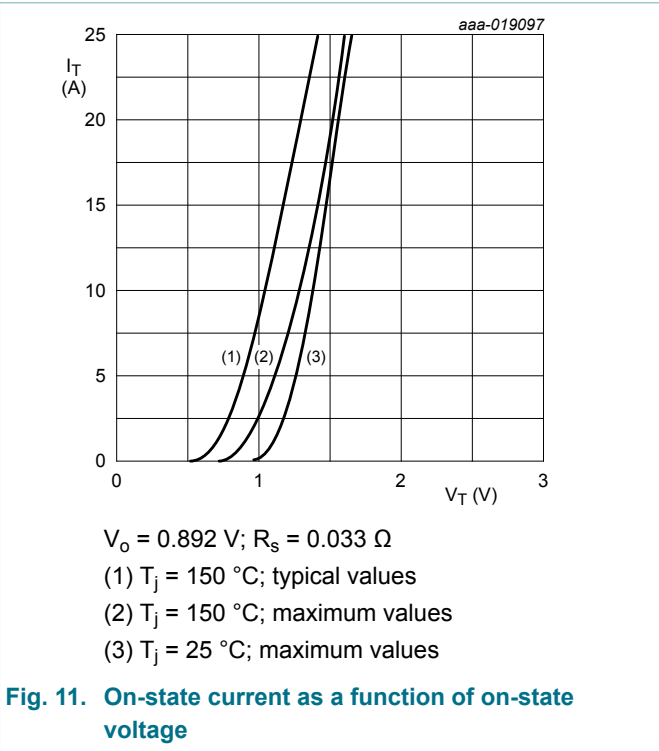


Fig. 11. On-state current as a function of on-state voltage

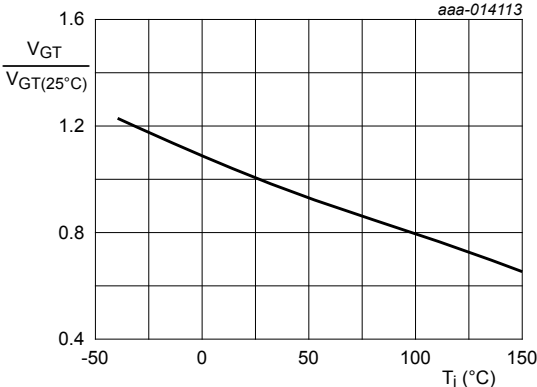


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline

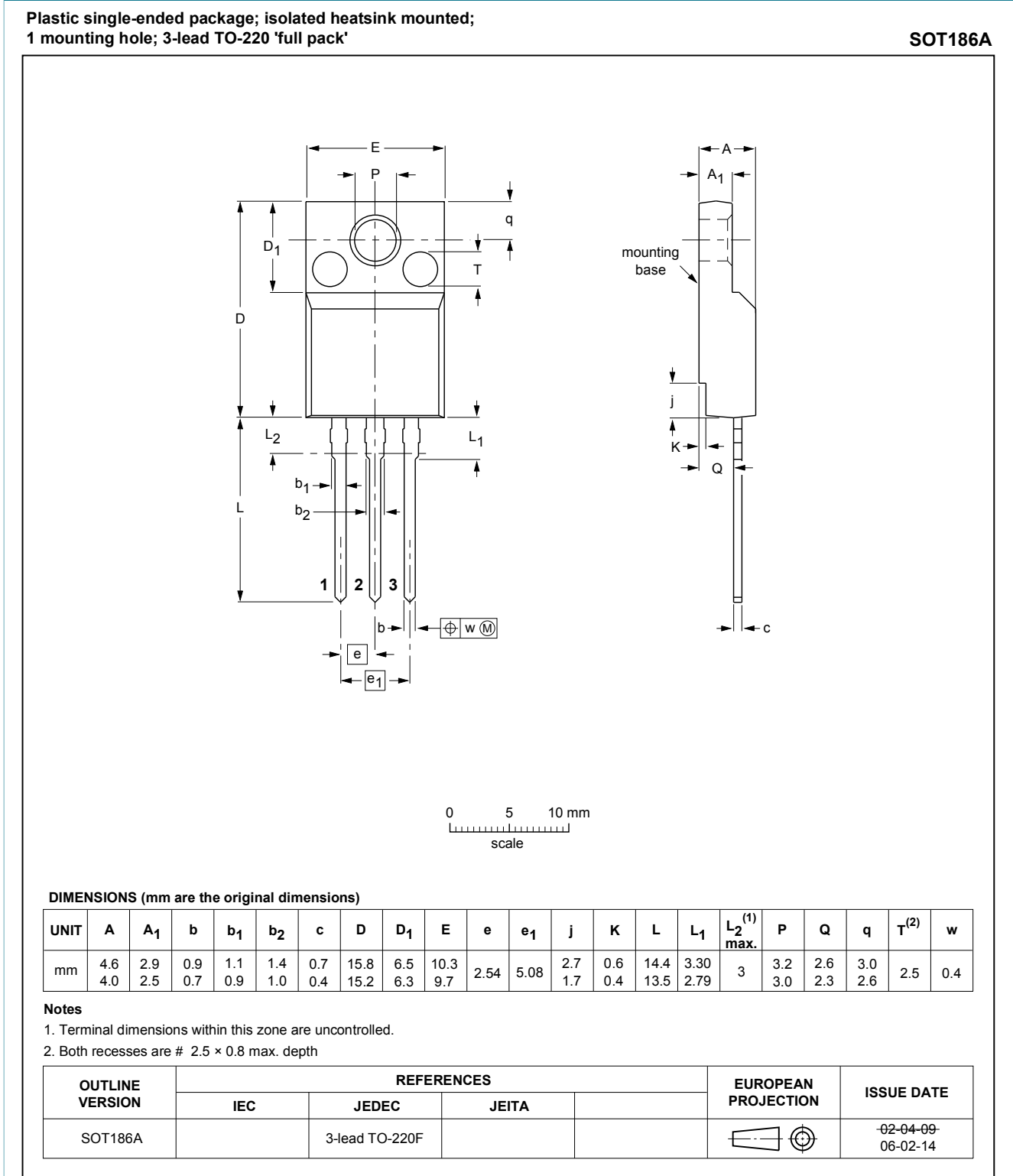


Fig. 13. Package outline TO-220F (SOT186A)

## 12. Legal information

### 12.1 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.
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## 13. Contents

1	General description .....	1
2	Features and benefits .....	1
3	Applications .....	1
4	Quick reference data .....	1
5	Pinning information .....	3
6	Ordering information .....	3
7	Limiting values .....	4
8	Thermal characteristics .....	7
9	Isolation characteristics .....	7
10	Characteristics .....	8
11	Package outline .....	11
12	Legal information .....	12
12.1	Data sheet status .....	12
12.2	Definitions .....	12
12.3	Disclaimers .....	12
12.4	Trademarks .....	13

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