

## 1. General description

AC Thyristor Triac power switch in a SOT78 (TO-220AB) plastic package with selfprotective clamping capabilities against low and high energy transients. This "series CTN" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ °C}$ ) 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 ( $T_{j(max)} = 150\text{ °C}$ )
- High minimum IGT for guaranteed immunity to gate noise
- Full cycle AC conduction
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- 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
- Planar passivated for voltage ruggedness and reliability
- High commutation capability with maximum false trigger immunity
- Very high immunity to false turn-on by  $dV/dt$  and IEC 61000-4-4 fast transient
- Package is RoHS compliant
- Package meets UL94V0 flammability requirement

## 3. Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g washing machine and vacuum cleaners
- Rectifier-fed DC inductive loads e.g DC motors and solenoids
- Refrigeration and air conditioning compressors
- Applications subject to high temperature ( $T_{j(max)} = 150\text{ °C}$ )

## 4. Quick reference data

Table 1. Quick reference data

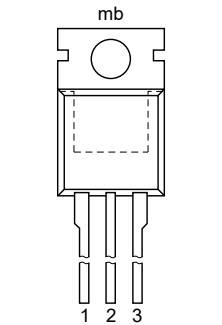
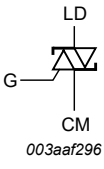
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 121\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	-	-	12	A

## Enhanced and high temperature ACTT power switch

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I <sub>TSM</sub>	non-repetitive peak on-state current	full sine wave; T <sub>j(initial)</sub> = 25 °C; t <sub>p</sub> = 20 ms; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	-	-	120	A
		full sine wave; T <sub>j(initial)</sub> = 25 °C; t <sub>p</sub> = 16.7 ms	-	-	132	A
T <sub>j</sub>	junction temperature		-	-	150	°C
V <sub>PP</sub>	peak pulse voltage	T <sub>j</sub> = 25 °C; non-repetitive, off-state; <a href="#">Fig. 6</a>	-	-	2	kV
<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>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>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

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CM	common	 <p>TO-220AB (SOT78)</p>	
2	LD	load		
3	G	gate		
mb	LD	mounting base; load		

## 6. Ordering information

Table 3. Ordering information

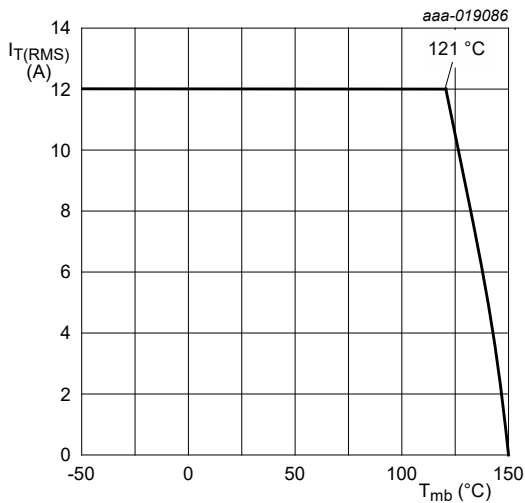
Type number	Package		
	Name	Description	Version
ACTT12-800CTN	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 7. Limiting values

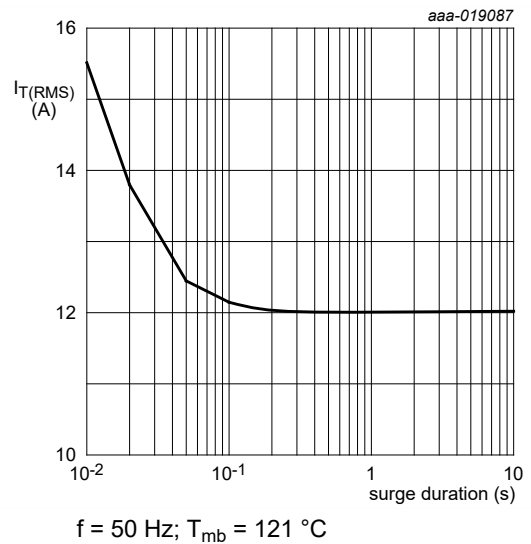
**Table 4. Limiting values**

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; $T_{mb} \leq 121\text{ °C}$ ; <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
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	72	A <sup>2</sup> s
$di_T/dt$	rate of rise of on-state current	$I_G = 70\text{ mA}$	-	100	A/ $\mu$ s
$I_{GM}$	peak gate current	$t = 20\text{ }\mu$ 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	°C
$T_j$	junction temperature		-	150	°C
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ °C}$ ; non-repetitive, off-state; <a href="#">Fig. 6</a>	-	2	kV



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



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

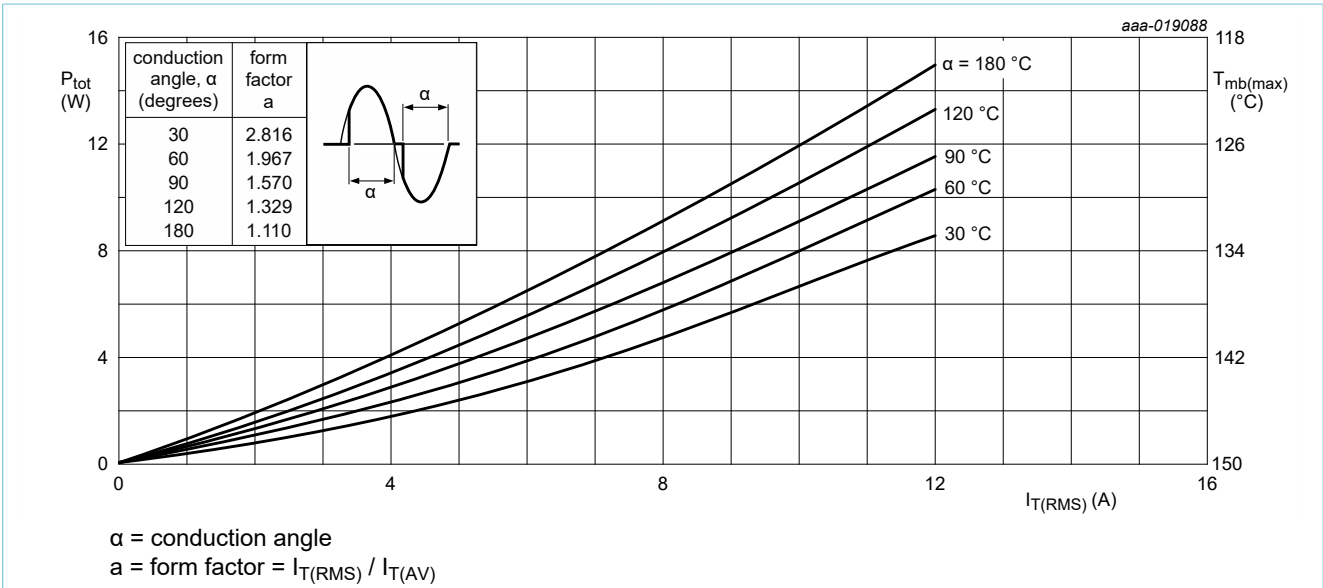


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

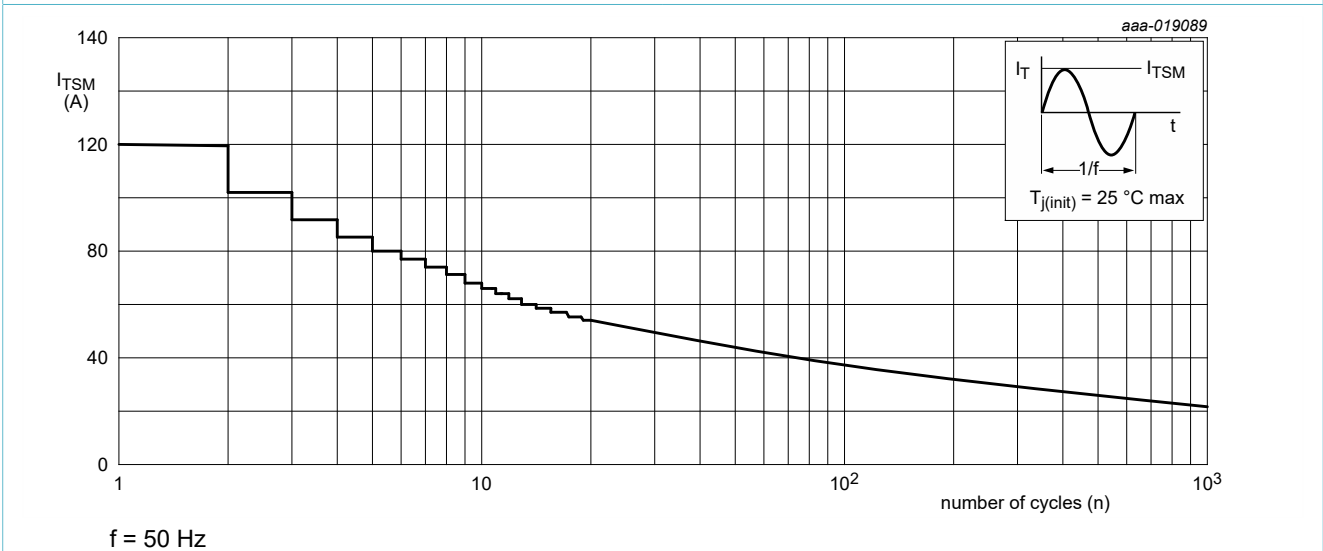


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

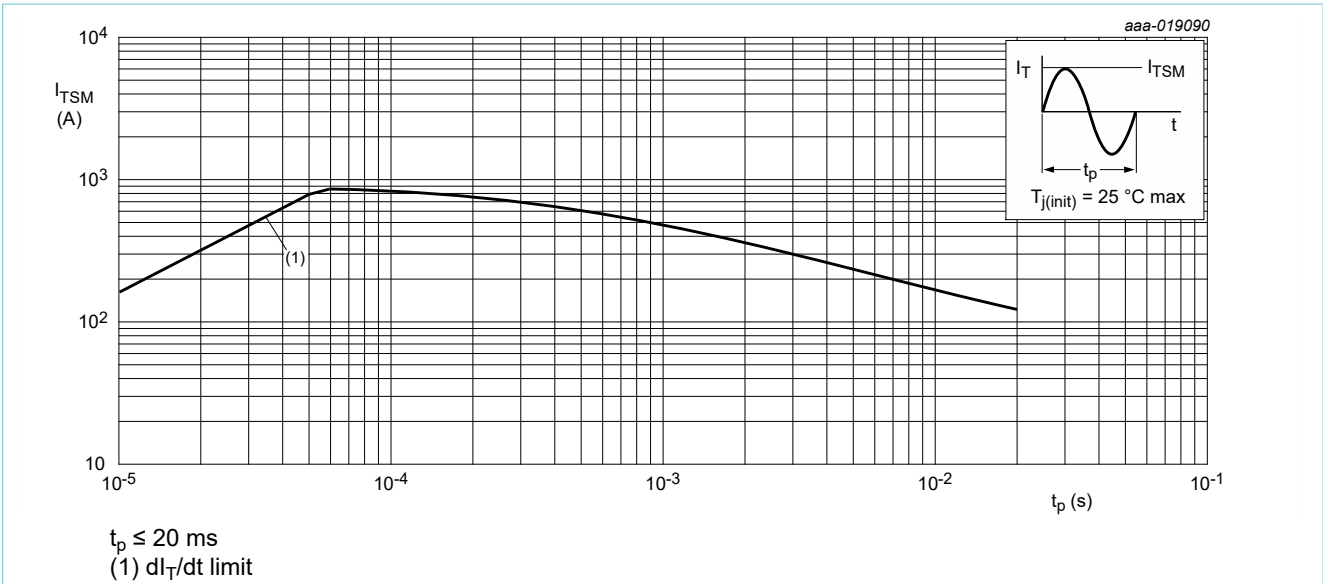


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

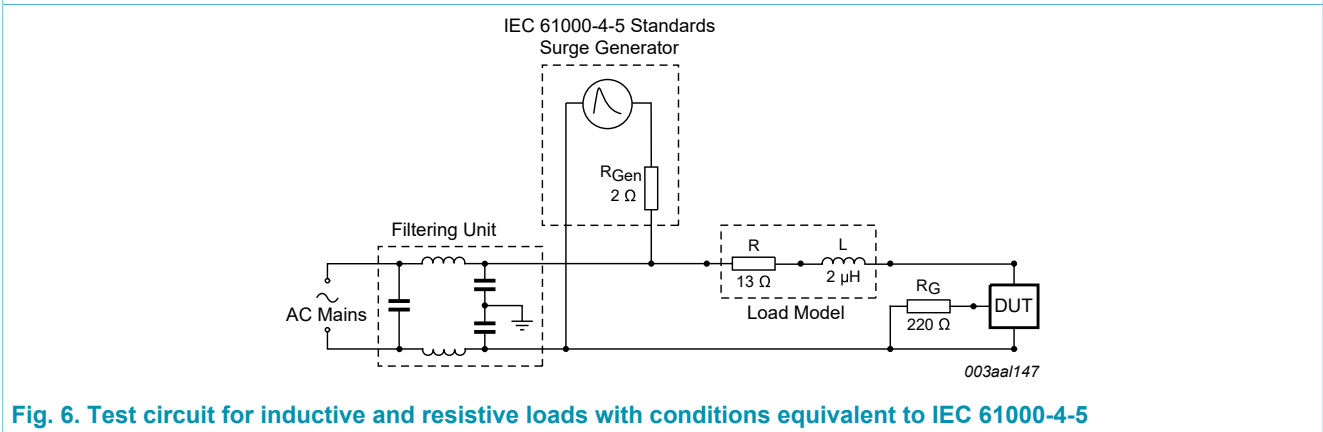
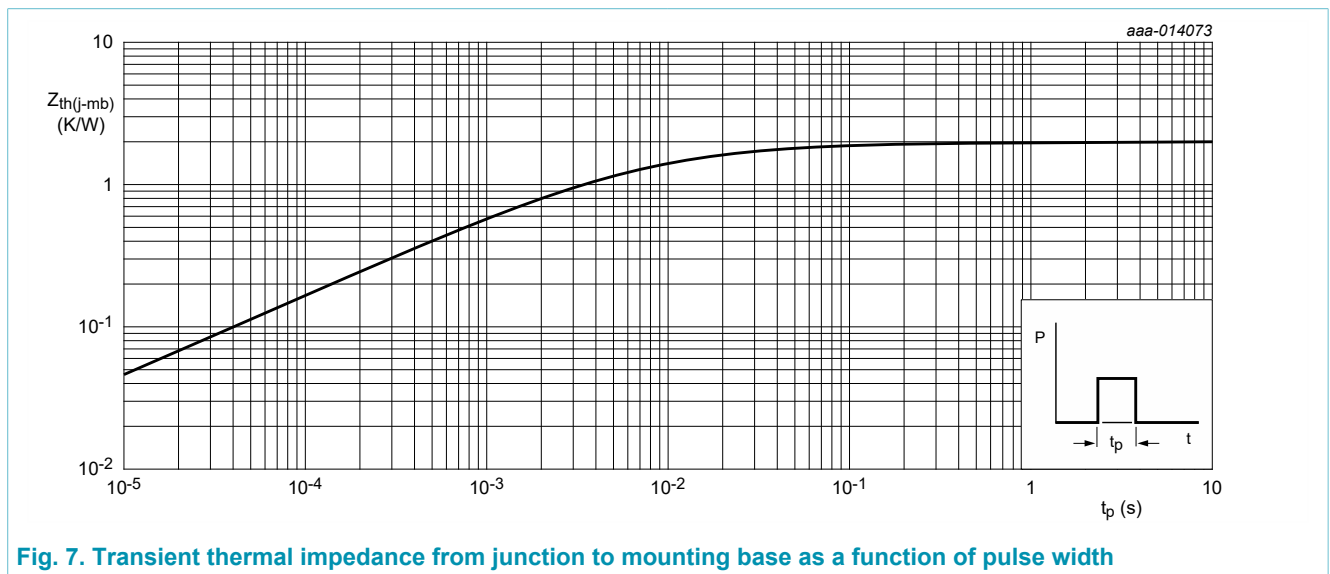


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

### 8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; <a href="#">Fig. 7</a>	-	-	2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W



## 9. Characteristics

Table 6. 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>	5	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	5	-	35	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>	5	-	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>	-	-	40	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	60	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	40	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	-	30	mA
$V_T$	on-state voltage	$I_T = 17\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>	-	-	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
		$V_D = 400\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 150\text{ °C}$ ; <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	$\mu\text{A}$
		$V_D = 800\text{ V}$ ; $T_j = 150\text{ °C}$	-	-	2	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	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit	4000	-	-	V/ $\mu\text{s}$
		$V_{DM} = 536\text{ V}$ ; $T_j = 150\text{ °C}$ ; exponential waveform; gate open circuit	2000	-	-	V/ $\mu\text{s}$
$di_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; gate open circuit; snubberless condition	12	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit	15	-	-	A/ms
		$V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit	20	-	-	A/ms



Enhanced and high temperature ACTT power switch

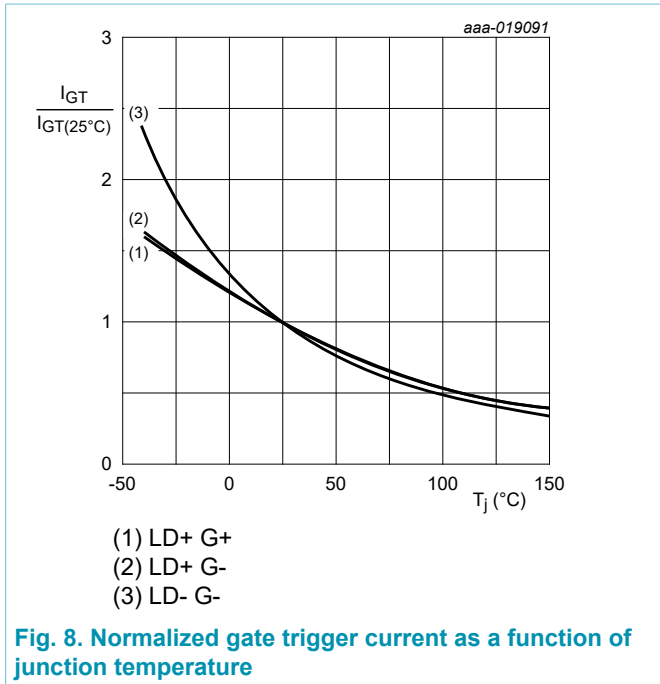


Fig. 8. Normalized gate trigger current as a function of junction temperature

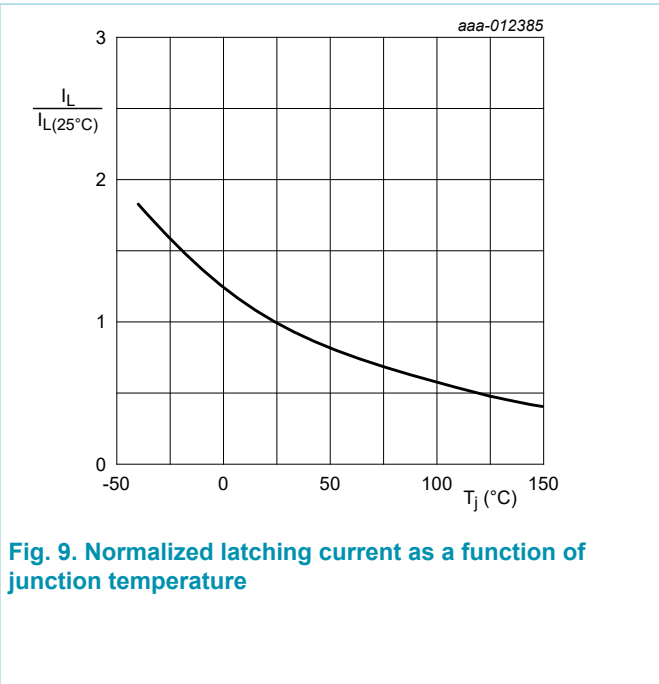


Fig. 9. Normalized latching current as a function of junction temperature

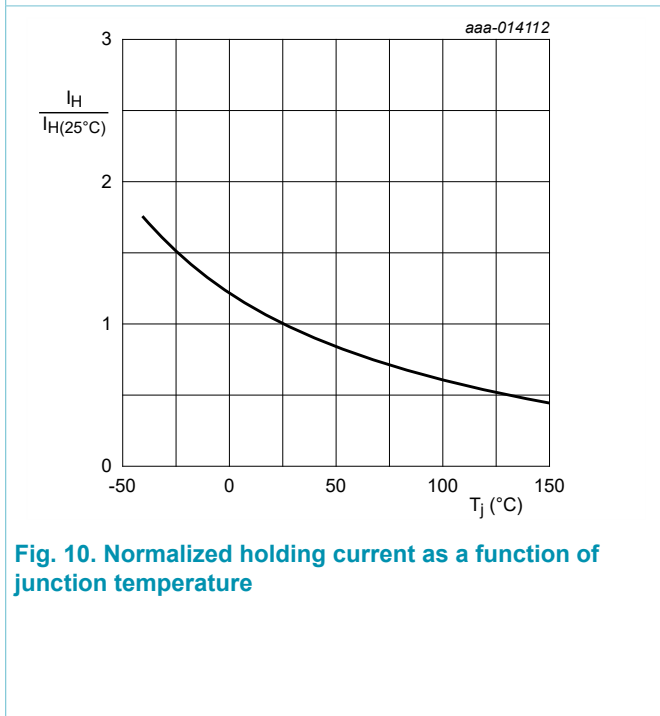


Fig. 10. Normalized holding current as a function of junction temperature

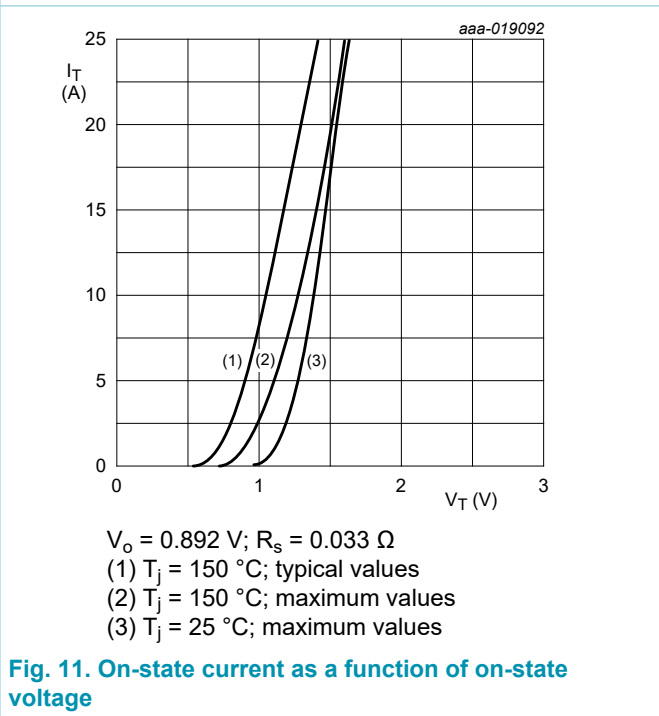


Fig. 11. On-state current as a function of on-state voltage

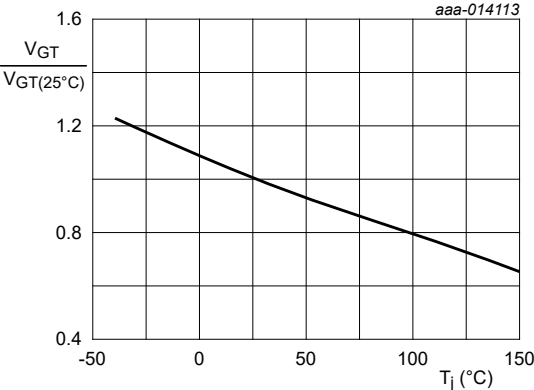
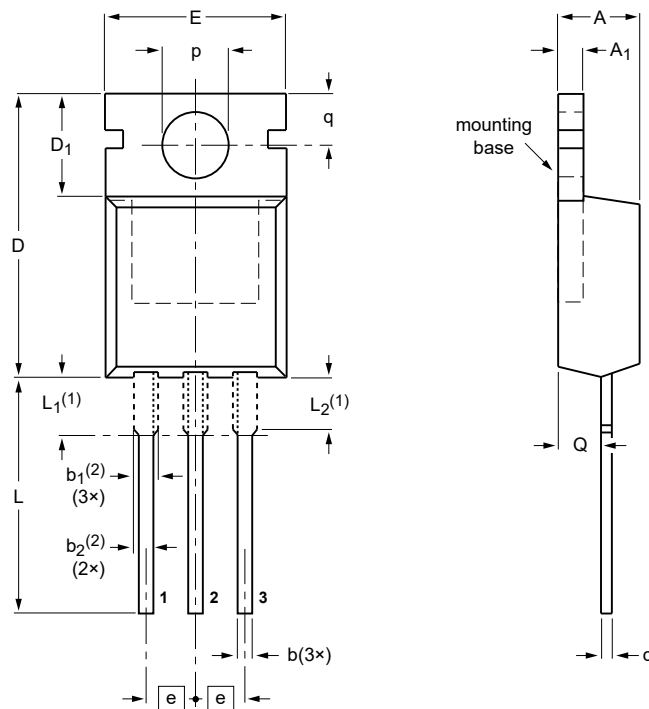


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

### 10. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78



**DIMENSIONS (mm are the original dimensions)**

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub> (2)	b <sub>2</sub> (2)	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> (1)	L <sub>2</sub> (1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

**Notes**

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT78		3-lead TO-220AB	SC-46		08-04-23 08-06-13

**Fig. 13. Package outline TO-220AB (SOT78)**

## 11. 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.
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For more information, please visit: <http://www.ween-semi.com>  
For sales office addresses, please send an email to: [salesaddresses@ween-semi.com](mailto:salesaddresses@ween-semi.com)  
Date of release: 5 September 2018