



ACTT16-800CTN

Enhanced and high temperature ACTT power switch

24 July 2015

Product data sheet

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

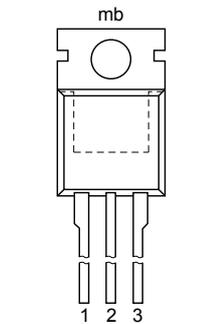
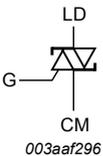


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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{mb} \leq 126\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	-	140	A
		full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 16.7\text{ ms}$	-	-	150	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; Fig. 6	-	-	2	kV
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD+ G+; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 8	5	-	35	mA
		$V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD+ G-; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 8	5	-	35	mA
		$V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD- G-; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 8	5	-	35	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 10	-	-	30	mA
V_T	on-state voltage	$I_T = 20\text{ A}$; $T_j = 25\text{ }^{\circ}\text{C}$; Fig. 11	-	-	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
Dynamic characteristics						
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	1500	-	-	V/ μs
		$V_{DM} = 536\text{ V}$; $T_j = 150\text{ }^{\circ}\text{C}$; exponential waveform; gate open circuit	1000	-	-	V/ μs
dI_{com}/dt	rate of change of commutating current	$V_D = 400\text{ V}$; $T_j = 150\text{ }^{\circ}\text{C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; gate open circuit; snubberless condition	12	-	-	A/ms
		$V_D = 400\text{ V}$; $T_j = 150\text{ }^{\circ}\text{C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit	15	-	-	A/ms
		$V_D = 400\text{ V}$; $T_j = 150\text{ }^{\circ}\text{C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit	20	-	-	A/ms

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CM	common	 <p>TO-220AB (SOT78)</p>	 <p>003aaf296</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
ACTT16-800CTN	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
ACTT16-800CTN	ACTT16-800CTN

8. Limiting values

Table 5. 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; $T_{mb} \leq 126\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	140	A
		full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$; $t_p = 16.7\text{ ms}$	-	150	A

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Symbol	Parameter	Conditions	Min	Max	Unit
I^2t	I^2t for fusing	$t_p = 10$ ms; sine-wave pulse	-	98	A ² s
di_T/dt	rate of rise of on-state current	$I_G = 70$ mA	-	100	A/ μ s
I_{GM}	peak gate current	$t = 20$ μ 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	$^{\circ}$ C
T_j	junction temperature		-	150	$^{\circ}$ C
V_{PP}	peak pulse voltage	$T_j = 25$ $^{\circ}$ C; non-repetitive, off-state; Fig. 6	-	2	kV

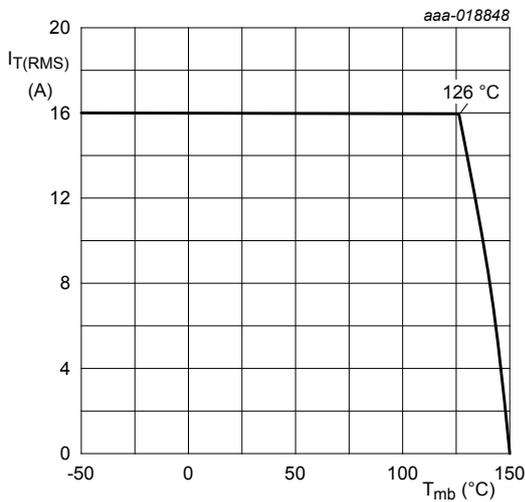
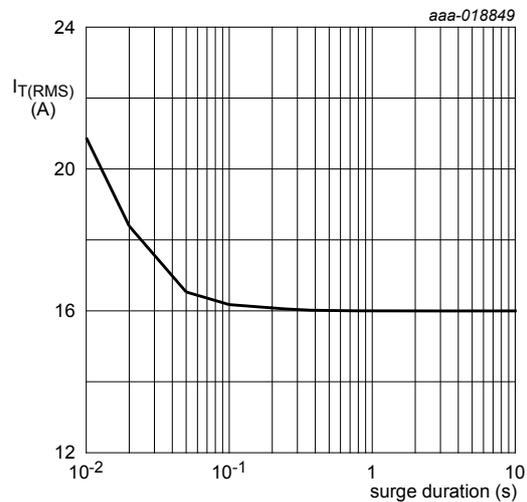


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values



$f = 50$ Hz; $T_{mb} = 126$ $^{\circ}$ C

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

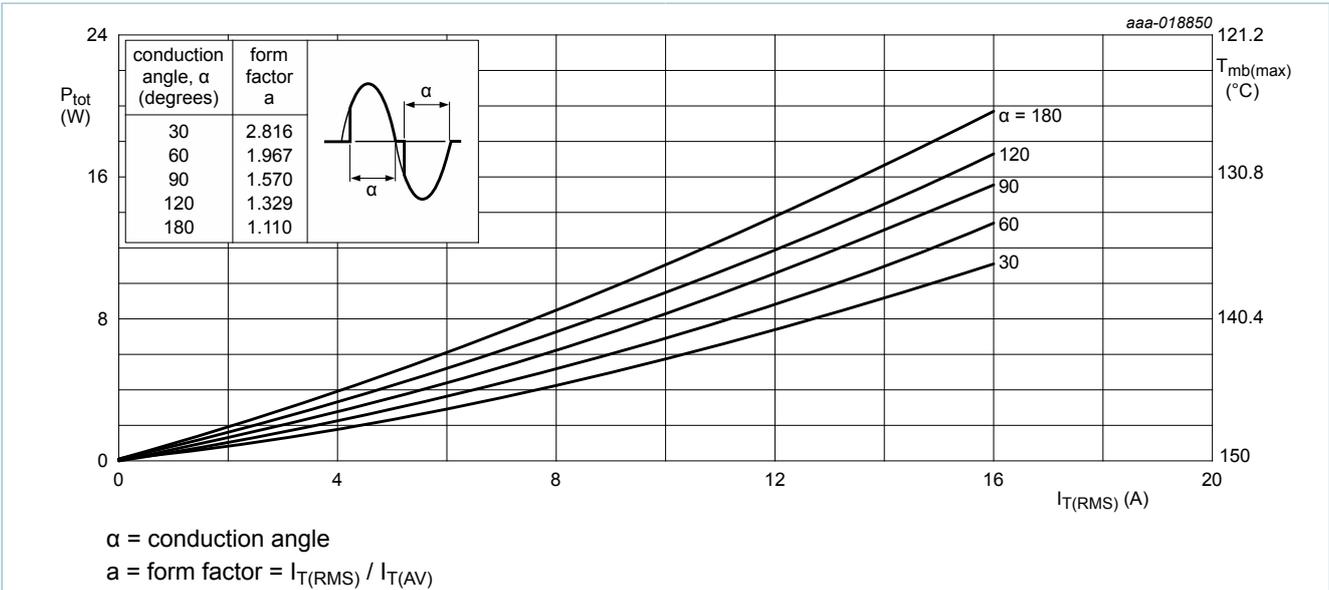


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

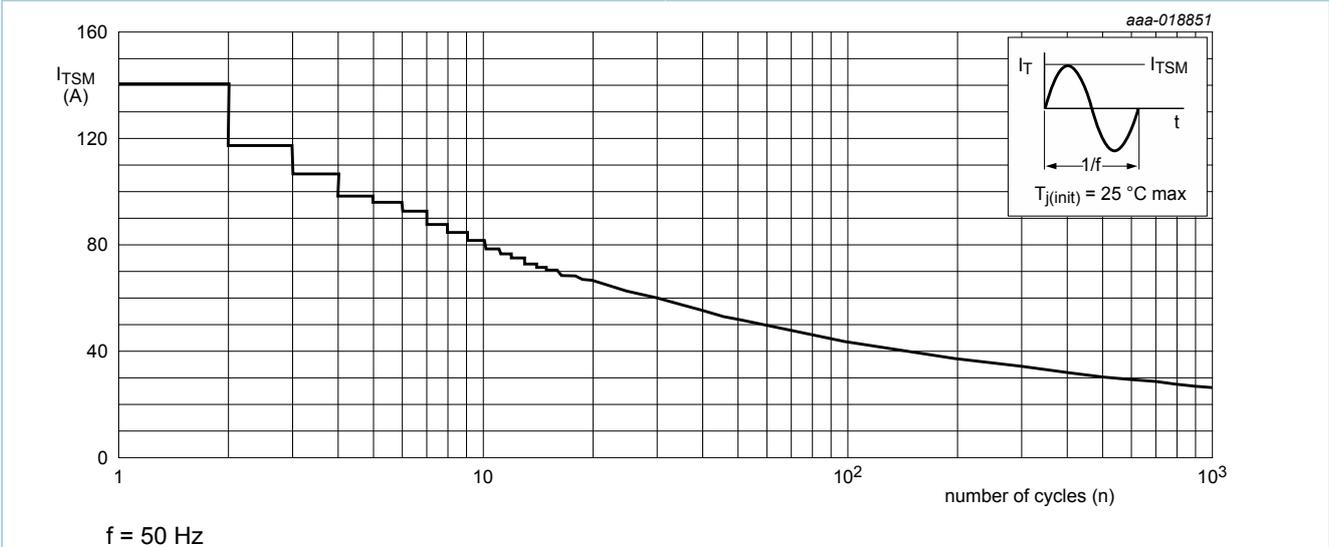


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

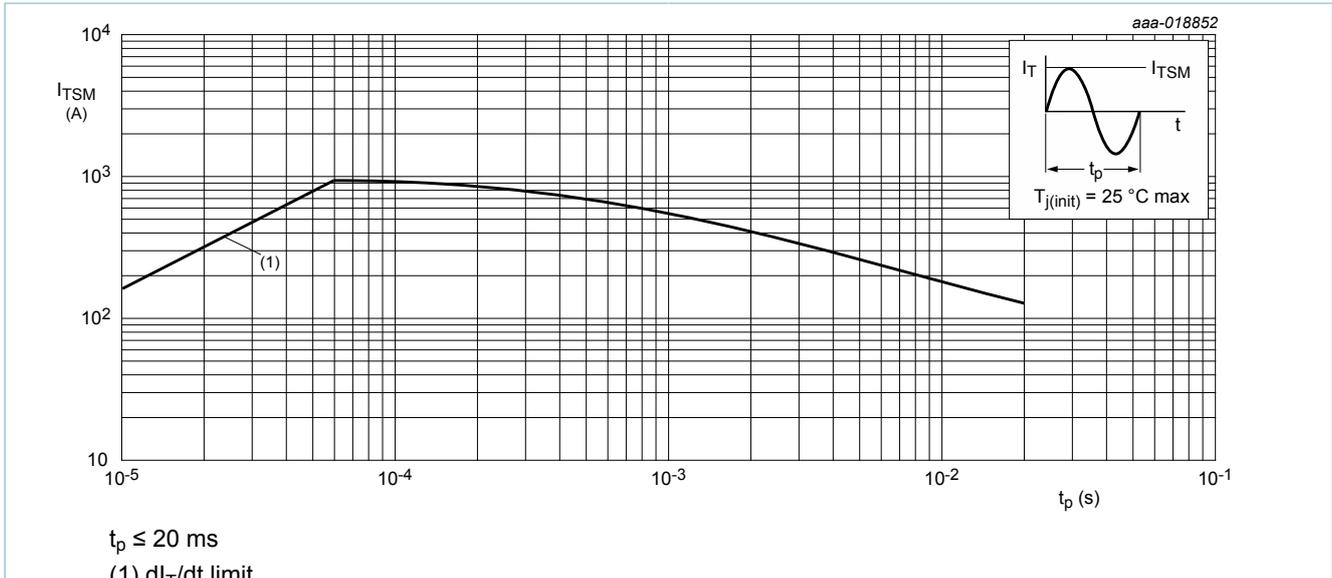


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

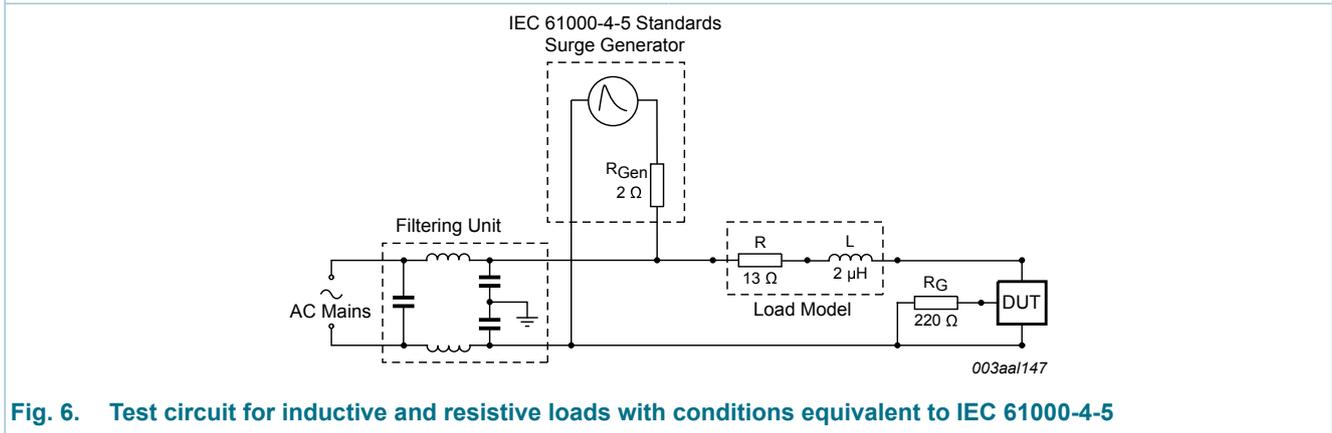


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	full cycle; Fig. 7	-	-	1.2	K/W
		half cycle	-	-	1.7	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W

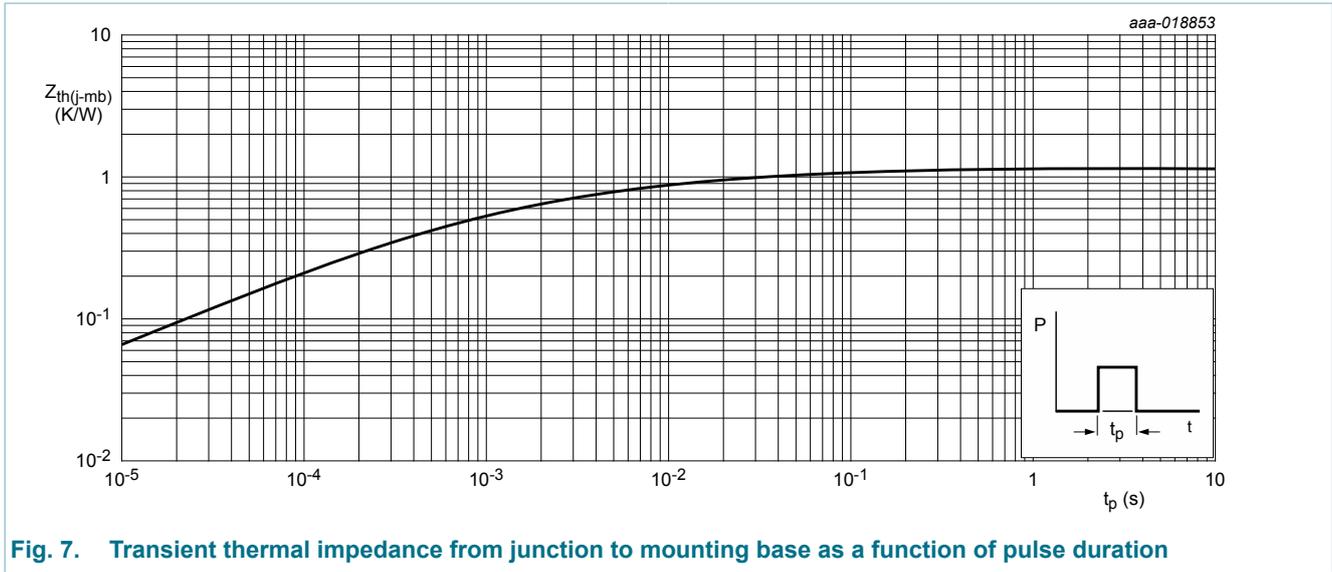


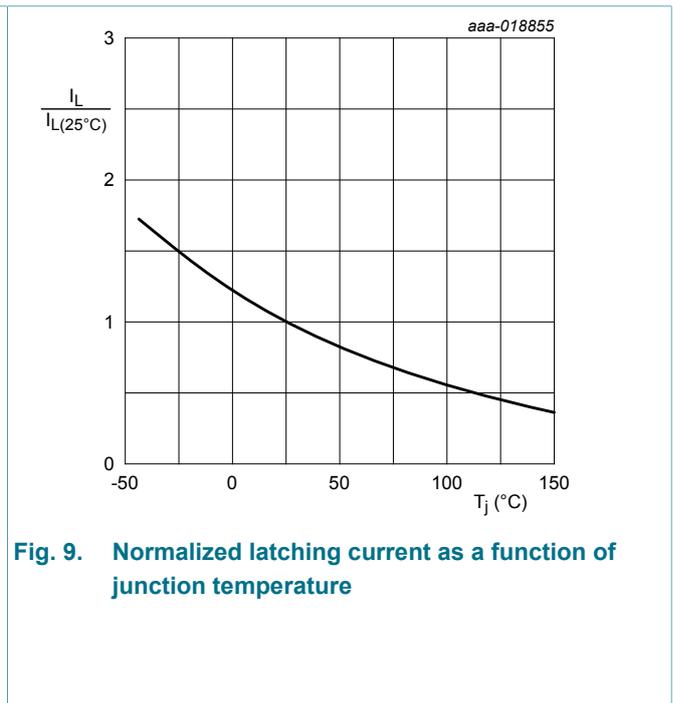
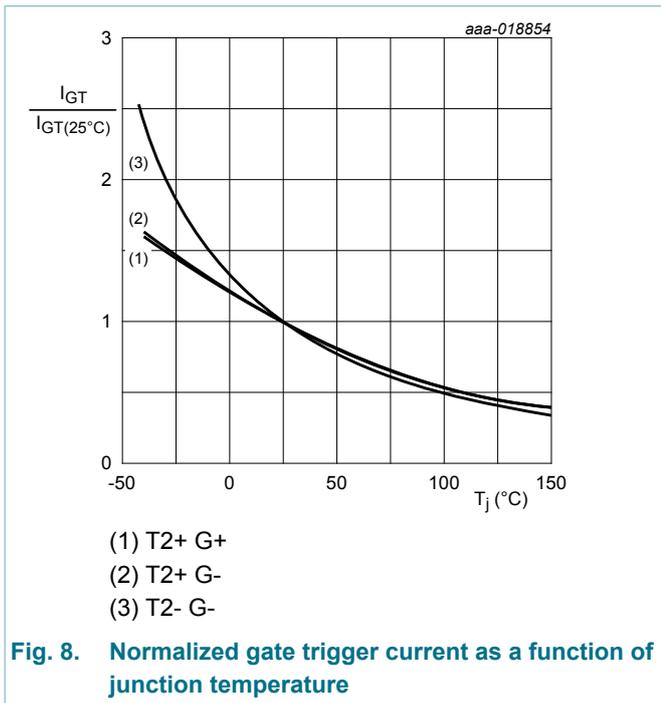
Fig. 7. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I _{GT}	gate trigger current	V _D = 12 V; I _T = 100 mA; LD+ G+; T _j = 25 °C; Fig. 8	5	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD+ G-; T _j = 25 °C; Fig. 8	5	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD- G-; T _j = 25 °C; Fig. 8	5	-	35	mA
I _L	latching current	V _D = 12 V; I _G = 100 mA; LD+ G+; T _j = 25 °C; Fig. 9	-	-	40	mA
		V _D = 12 V; I _G = 100 mA; LD+ G-; T _j = 25 °C; Fig. 9	-	-	50	mA
		V _D = 12 V; I _G = 100 mA; LD- G-; T _j = 25 °C; Fig. 9	-	-	40	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 10	-	-	30	mA
V _T	on-state voltage	I _T = 20 A; T _j = 25 °C; Fig. 11	-	-	1.5	V
V _{GT}	gate trigger voltage	V _D = 12 V; I _T = 100 mA; T _j = 25 °C; Fig. 12	-	0.8	1	V
		V _D = 400 V; I _T = 100 mA; T _j = 150 °C; Fig. 12	0.2	0.45	-	V
I _D	off-state current	V _D = 800 V; T _j = 25 °C	-	-	10	μA
		V _D = 800 V; T _j = 150 °C	-	-	2	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CL}	clamping voltage	$I_{CL} = 0.1 \text{ mA}$; $t_p = 1 \text{ ms}$; $T_j = 25 \text{ }^\circ\text{C}$	850	-	-	V
Dynamic characteristics						
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	1500	-	-	V/ μs
		$V_{DM} = 536 \text{ V}$; $T_j = 150 \text{ }^\circ\text{C}$; exponential waveform; gate open circuit	1000	-	-	V/ μs
dI_{com}/dt	rate of change of commutating current	$V_D = 400 \text{ V}$; $T_j = 150 \text{ }^\circ\text{C}$; $I_{T(RMS)} = 16 \text{ A}$; $dV_{com}/dt = 20 \text{ V}/\mu\text{s}$; gate open circuit; snubberless condition	12	-	-	A/ms
		$V_D = 400 \text{ V}$; $T_j = 150 \text{ }^\circ\text{C}$; $I_{T(RMS)} = 16 \text{ A}$; $dV_{com}/dt = 10 \text{ V}/\mu\text{s}$; gate open circuit	15	-	-	A/ms
		$V_D = 400 \text{ V}$; $T_j = 150 \text{ }^\circ\text{C}$; $I_{T(RMS)} = 16 \text{ A}$; $dV_{com}/dt = 1 \text{ V}/\mu\text{s}$; gate open circuit	20	-	-	A/ms



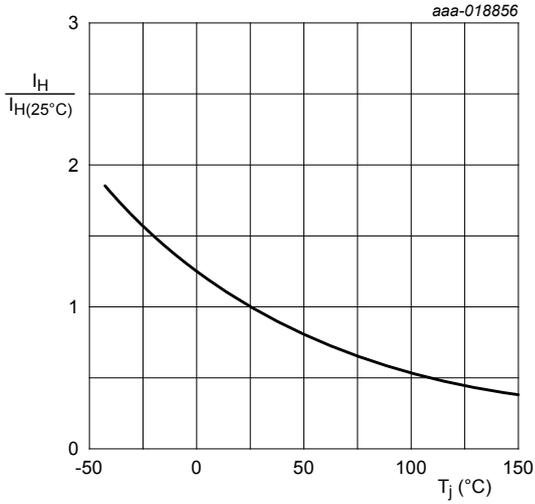
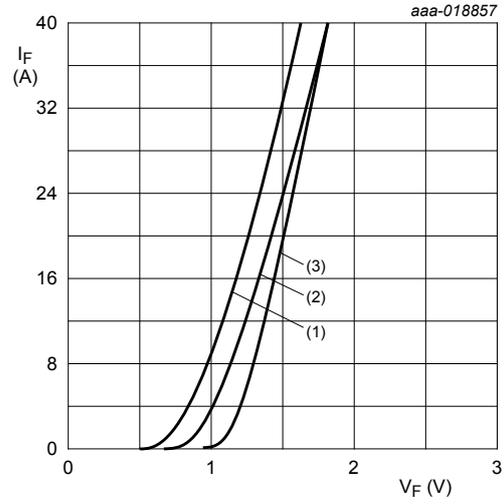


Fig. 10. Normalized holding current as a function of junction temperature



$V_o = 0.981 \text{ V}$; $R_s = 0.022 \Omega$

- (1) $T_j = 150 \text{ }^\circ\text{C}$; typical values
- (2) $T_j = 150 \text{ }^\circ\text{C}$; maximum values
- (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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

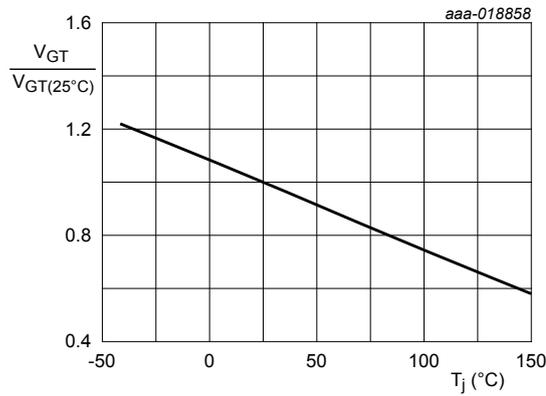
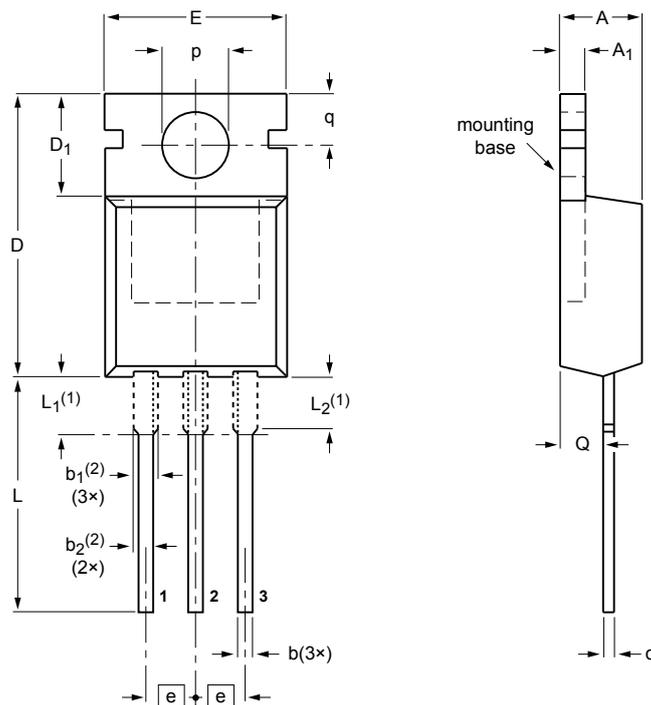


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

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

SOT78



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁ (2)	b ₂ (2)	c	D	D ₁	E	e	L	L ₁ (1)	L ₂ (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

- Lead shoulder designs may vary.
- 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)

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Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Product [short] data sheet	Production	This document contains the product specification.

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