Product data sheet

1. General description

Planar passivated four quadrant triac in a SOT186A "full pack" plastic package intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance. Typical applications include motor control, industrial and domestic lighting, heating and static switching.

2. Features and benefits

- High blocking voltage capability
- · High noise immunity
- Isolated package
- · Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

3. Applications

- · General purpose motor control
- Protection Circuits

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{DRM}	repetitive peak off- state voltage		-	-	600	V
I _{T(RMS)}	RMS on-state current	full sine wave; $T_h \le 25$ °C; Fig. 1; Fig. 2; Fig. 3	-	-	20	А
I _{TSM}	non-repetitive peak on- state current	full sine wave; $T_{j(init)} = 25 \text{ °C}$; $t_p = 20 \text{ ms}$; Fig. 4; Fig. 5	-	-	190	А
		full sine wave; $T_{j(init)} = 25 \text{ °C}$; $t_p = 16.7 \text{ ms}$	-	-	230	А
T _j	junction temperature		-40	-	125	°C
Static charact	eristics			'	'	<u>'</u>
I _{GT}	gate trigger current	$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T2+ G+;$ $T_j = 25 \text{ °C}; Fig. 7$	-	6	50	mA
		$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T2+ \text{ G-};$ $T_j = 25 \text{ °C}; Fig. 7$	-	10	50	mA
		$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; \text{ T2- G-};$ $T_j = 25 \text{ °C}; \underline{\text{Fig. 7}}$	-	11	50	mA

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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
		$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; \text{ T2- G+};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 7}}{}$	-	23	75	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; T2+; <u>Fig. 9</u>	-	7	30	Α
		V _D = 12 V; T _j = 25 °C; T2-; <u>Fig. 9</u>	-	12	30	mA
V _T	on-state voltage	I _T = 30 A; T _j = 25 °C; <u>Fig. 10</u>	-	1.3	1.55	V
Dynamic char	acteristics					
dV _D /dt	rate of rise of off-state voltage	V_{DM} = 536 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit	100	300	-	V/µs
dV _{com} /dt	rate of change of commutating voltage	$V_D = 400 \text{ V}; T_j = 95 ^{\circ}\text{C}; dI_{com}/dt = 9 \text{ A/}$ ms; $I_T = 25 \text{ A}; \text{ gate open circuit}$	-	10	-	V/µs

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1	mb	T2——T1
2	T2	main terminal 2		G sym051
3	G	gate		Symost
mb	n.c.	mounting base; isolated		
			TO-220F (SOT186A)	

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
MAC223A8X	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

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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		-	600	V
I _{T(RMS)}	RMS on-state current	full sine wave; $T_h \le 25 \text{ °C}$; Fig. 1; Fig. 2; Fig. 3	-	20	Α
non-repetitive state current	non-repetitive peak on- state current	full sine wave; $T_{j(init)}$ = 25 °C; t_p = 20 ms; Fig. 4; Fig. 5	-	190	Α
		full sine wave; $T_{j(init)} = 25 \text{ °C}$; $t_p = 16.7 \text{ ms}$	-	230	Α
l ² t	I ² t for fusing	t _p = 10 ms; SIN	-	180	A²s
dI _T /dt	rate of rise of on-state current	I _G = 200 mA; T2+ G+	-	50	A/µs
		I _G = 200 mA; T2+ G-	-	50	A/µs
		I _G = 200 mA; T2- G-	-	50	A/µs
		I _G = 200 mA; T2- G+	-	10	A/µs
I _{GM}	peak gate current		-	2	Α
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
Tj	junction temperature		-40	125	°C

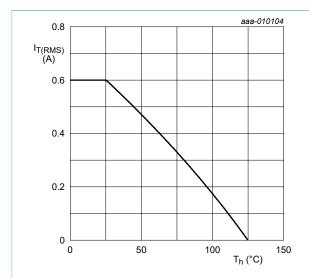


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values

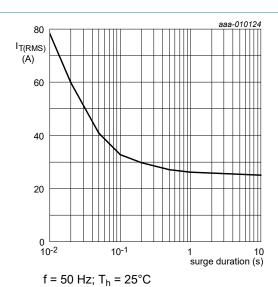


Fig. 2. RMS on-state current as a function of surge duration; maximum values

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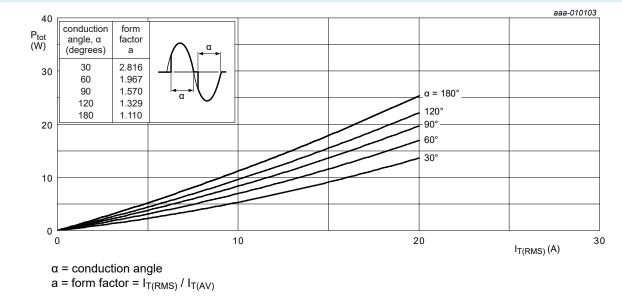


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

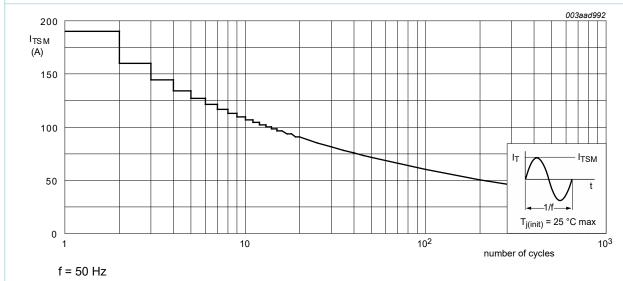
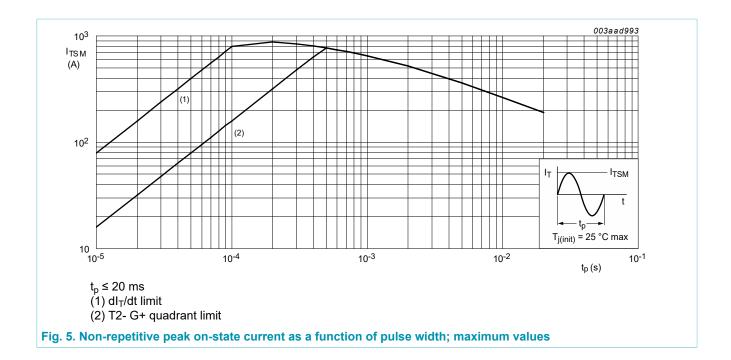


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

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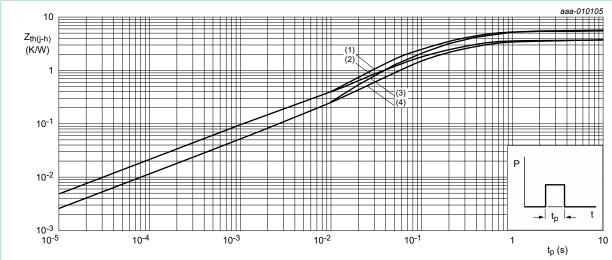


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8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{th(j-h)}	thermal resistance from junction to	full or half cycle; without heatsink compound; Fig. 6	-	-	5.5	K/W
	heatsink	full or half cycle; with heatsink compound; Fig. 6	-	-	3.85	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	55	-	K/W



- (1) Unidirectional (half cycle) without heatsink compound
- (2) Unidirectional (half cycle) with heatsink compound
- (3) Bidirectional (full cycle) without heatsink compound
- (4) Bidirectional (full cycle) with heatsink compound

Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration

9. Isolation characteristics

Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{isol(RMS)}	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50 \text{ Hz} \le f \le 60 \text{ Hz}$; $RH \le 65 \%$; $T_h = 25 ^{\circ}\text{C}$	-	-	2500	V
C _{isol}	isolation capacitance	from main terminal 2 to external heatsink; f = 1 MHz; T _h = 25 °C	-	10	-	pF

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10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static chara	acteristics					
I _{GT}	gate trigger current	V _D = 12 V; I _T = 0.1 A; T2+ G+; T _j = 25 °C; <u>Fig. 7</u>	-	6	50	mA
		$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T2+ \text{ G-};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 7}}{}$	-	10	50	mA
		V _D = 12 V; I _T = 0.1 A; T2- G-; T _j = 25 °C; <u>Fig. 7</u>	-	11	50	mA
		$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; \text{ T2- G+};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 7}}{}$	-	23	75	mA
I _L latching	latching current	$V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; T2+ G+;$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 8}}{}$	-	8	40	mA
		$V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; \text{ T2+ G-};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 8}}{}$	-	30	60	mA
		$V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; \text{ T2- G-};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 8}}{\text{C}}$	-	8	40	mA
		$V_D = 12 \text{ V}; I_G = 0.1 \text{ A}; \text{ T2- G+};$ $T_j = 25 \text{ °C}; \frac{\text{Fig. 8}}{\text{C}}$	-	15	60	mA
l _H	holding current	V _D = 12 V; T _j = 25 °C; T2+; <u>Fig. 9</u>	-	7	30	Α
		V _D = 12 V; T _j = 25 °C; T2-; <u>Fig. 9</u>	-	12	30	mA
V _T	on-state voltage	I _T = 30 A; T _j = 25 °C; <u>Fig. 10</u>	-	1.3	1.55	V
V_{GT}	gate trigger voltage	$V_D = 12 \text{ V}; I_T = 0.1 \text{ A}; T_j = 25 \text{ °C};$ Fig. 11	-	0.7	1	V
		$V_D = 400 \text{ V}; I_T = 0.1 \text{ A}; T_j = 125 ^{\circ}\text{C};$ Fig. 11	0.25	0.4	-	V
l _D	off-state current	V _D = 800 V; T _j = 125 °C	-	0.1	0.5	mA
Dynamic ch	naracteristics			,	'	,
dV _D /dt	rate of rise of off-state voltage	V_{DM} = 536 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit	100	300	-	V/µs
dV _{com} /dt	rate of change of commutating voltage	V_D = 400 V; T_j = 95 °C; dI_{com}/dt = 9 A/ ms; I_T = 25 A; gate open circuit	-	10	-	V/µs
t _{gt}	gate-controlled turn-on time	I_{TM} = 30 A; V_D = 800 V; I_G = 0.1 A; dI_G/dt = 5 A/ μ s	-	2	-	μs

3

2

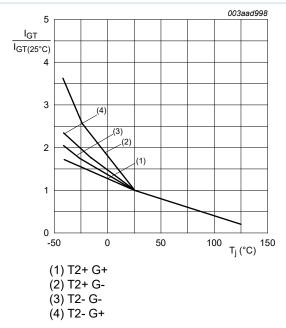
1

0

-50

 I_{L} I_{L(25°C)} **4Q Triac**

003aae000



T_i (°C) Fig. 8. Normalized latching current as a function of junction temperature

50

100

150

0

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

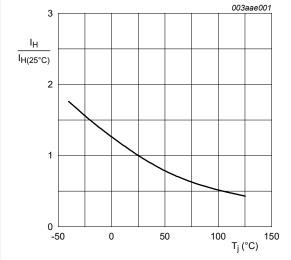
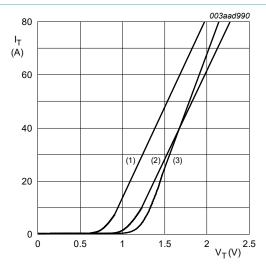


Fig. 9. Normalized holding current as a function of junction temperature



 V_o = 1.073 V; R_s = 0.015 Ω (1) T_j = 125 °C; typical values (2) T_j = 125 °C; maximum values (3) T_j = 25 °C; maximum values

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

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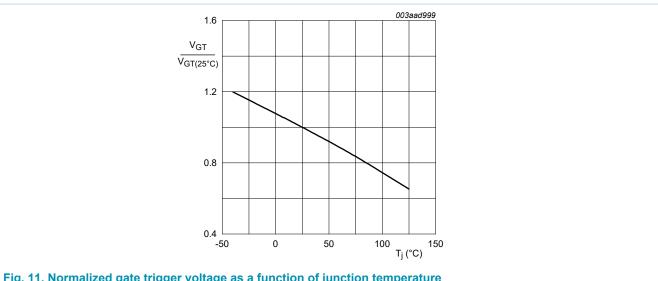


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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11. Package outline

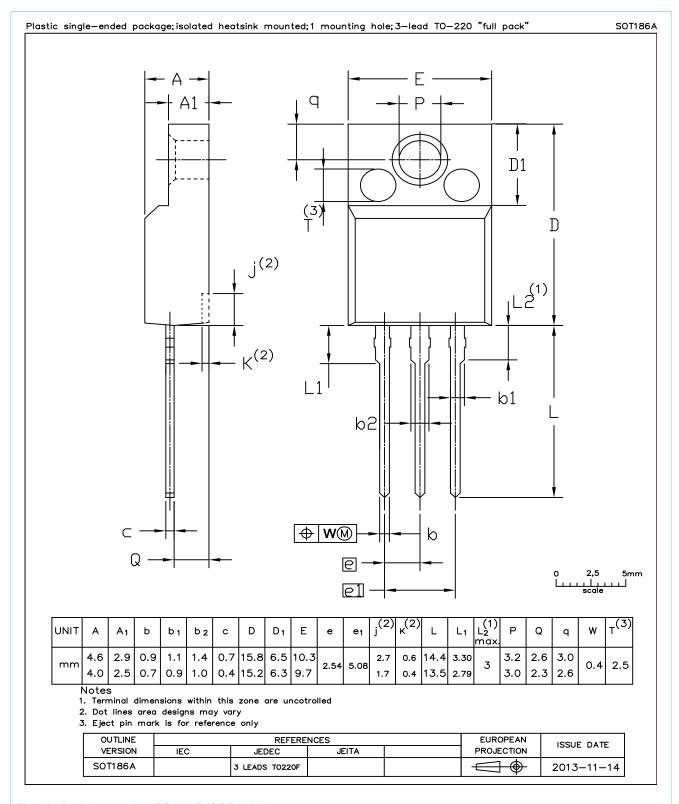


Fig. 12. Package outline TO-220F (SOT186A)

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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.
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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 Date of release: 15 September 2018

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