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NXP Semiconductors/Freescale Semiconductor, Inc. ACTT4X-800E,127

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Datasheet of ACTT4X-800E,127 - TRIAC SENS GATE 800V 4A TO220F

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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
- · Direct interfacing with low power drivers and microcontrollers
- Full cycle AC conduction
- Isolated mounting base package
- 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
- Sensitive gate for easy logic level triggering
- · 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

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{DRM}	repetitive peak off- state voltage		-	-	800	V
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	-	-	35	А
Tj	junction temperature		-	-	125	°C
I _{T(RMS)}	RMS on-state current	full sine wave; $T_h \le 94$ °C; <u>Fig. 1</u> ; <u>Fig. 2</u> ; <u>Fig. 3</u>	-	-	4	А







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Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V_{PP}	peak pulse voltage	T _j = 25 °C; non-repetitive, off-state; Fig. 6	-	-	2	kV
Static chara	acteristics		,			
I _{GT}	gate trigger current	$V_D = 12 \text{ V; } I_T = 100 \text{ mA; LD+ G+;}$ $T_j = 25 \text{ °C; } Fig. 8$	-	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD+ G-; T_j = 25 °C; <u>Fig. 8</u>	-	-	10	mA
		$V_D = 12 \text{ V; } I_T = 100 \text{ mA; LD- G-;}$ $T_j = 25 \text{ °C; } Fig. 8$	-	-	10	mA
V _{CL}	clamping voltage	I_{CL} = 0.1 mA; t_p = 1 ms; T_j = 25 °C	850	-	-	V
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; Fig. 13	500	-	-	V/µs
dl _{com} /dt	rate of change of commutating current	V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 1 V/µs; gate open circuit; Fig. 14; Fig. 15	8	-	-	A/ms

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		sym051
3	G	gate		J
mb	n.c.	mounting base; isolated		
			TO-220F (SOT186A)	

6. Ordering information

Table 3. Ordering information

Table 6. Grading III	ioiiiiatioii							
Type number	Package							
	Name	Description	Version					
ACTT4X-800E	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A					

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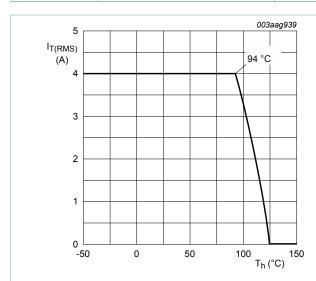
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Limiting values

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; $T_h \le 94$ °C; Fig. 1; Fig. 2; Fig. 3	-	4	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	-	35	А
		full sine wave; $T_{j(init)} = 25 ^{\circ}\text{C}$; $t_p = 16.7 \text{ms}$	-	39	А
I ² t	I ² t for fusing	t _p = 10 ms; sine-wave pulse	-	6	A ² s
dI _T /dt	rate of rise of on-state current	$I_T = 6 \text{ A}; I_G = 0.2 \text{ A}; dI_G/dt = 0.2 \text{ A/}\mu\text{s}$	-	100	A/µs
I _{GM}	peak gate current	t = 20 μs	-	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		-	125	°C
V _{PP}	peak pulse voltage	T _j = 25 °C; non-repetitive, off-state; Fig. 6	-	2	kV



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

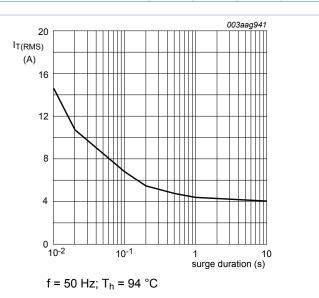


Fig. 2. on-state current as a function of surge duration; maximum values

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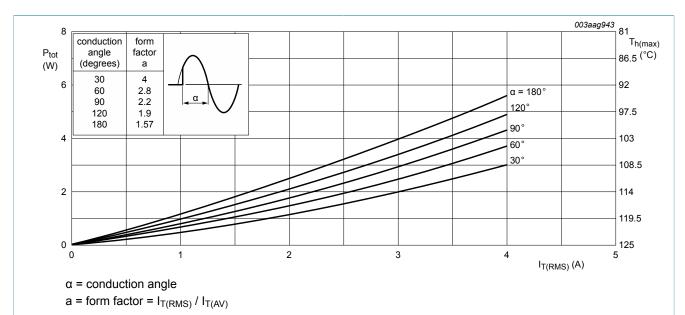


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

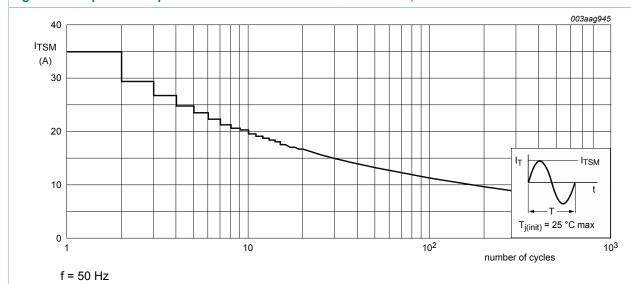


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



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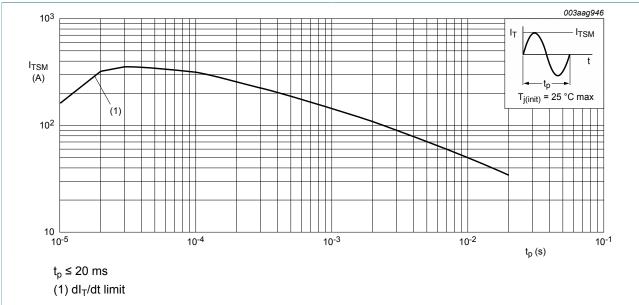


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

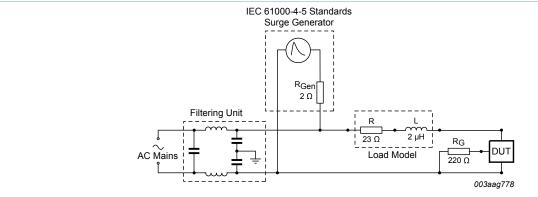


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

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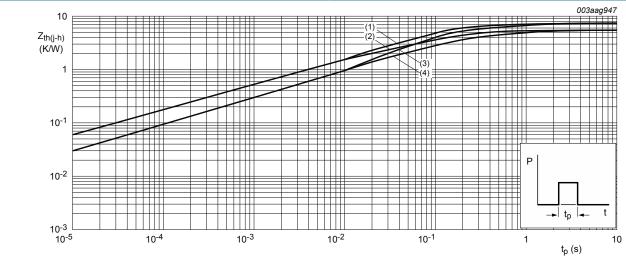
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8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
R _{th(j-h)}	thermal resistance from junction to	full cycle or half cycle; with heatsink compound; Fig. 7	-	-	5.5	K/W
	heatsink	full cycle or half cycle; without heatsink compound; Fig. 7	-	-	7.2	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	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. 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	Тур	Max	Unit
V _{isol} (RMS)	RMS isolation voltage	50 Hz \leq f \leq 60 Hz; RH \leq 65% RH; T _h = 25 °C; from all terminals to external heatsink; sinusoidal waveform; clean and dust free	-	-	2500	V
C _{isol}	isolation capacitance	f = 1 MHz; T _h = 25 °C; from main terminal 2 to external heatsink	-	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 = 100 mA; LD+ G+; T _j = 25 °C; <u>Fig. 8</u>	-	-	10	mA
		$V_D = 12 \text{ V; } I_T = 100 \text{ mA; LD+ G-;}$ $T_j = 25 \text{ °C; } Fig. 8$	-	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD- G-; T_j = 25 °C; Fig. 8	-	-	10	mA
IL	latching current	$V_D = 12 \text{ V; } I_G = 100 \text{ mA; LD+ G+;}$ $T_j = 25 \text{ °C; } Fig. 9$	-	-	30	mA
		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; <u>Fig. 9</u>	-	-	30	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; <u>Fig. 10</u>	-	-	20	mA
V _T	on-state voltage	I _T = 6 A; T _j = 25 °C; <u>Fig. 11</u>	-	-	1.7	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 = 125 °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 = 125 °C	-	-	0.5	mA
V _{CL}	clamping voltage	I_{CL} = 0.1 mA; t_p = 1 ms; T_j = 25 °C	850	-	-	V
Dynamic cl	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; Fig. 13	500	-	-	V/µs
dI _{com} /dt	rate of change of commutating current	V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 20 V/ μ s; (snubberless condition); gate open circuit; Fig. 14; Fig. 15	4	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 10 V/ μ s; gate open circuit; Fig. 14; Fig. 15	5	-	-	A/ms
		V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 4 A; dV_{com}/dt = 1 V/ μ s; gate open circuit; Fig. 14; Fig. 15	8	-	-	A/ms

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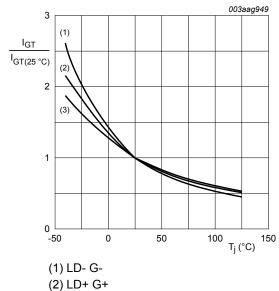
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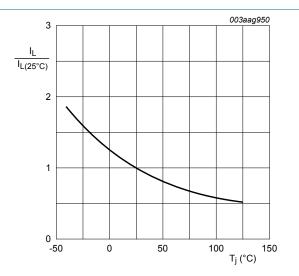
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- (3) LD+ G-

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



Normalized latching current as a function of junction temperature

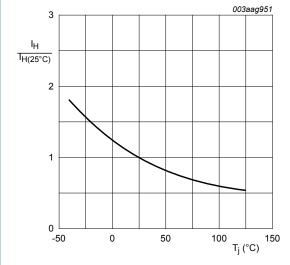
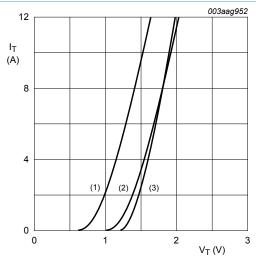


Fig. 10. Normalized holding current as a function of junction temperature



- $V_0 = 1.242 \text{ V}; R_s = 0.074 \Omega$
- (1) T_i = 125 °C; typical values
- (2) T_i = 125 °C; maximum values
- (3) T_i = 25 °C; maximum values

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



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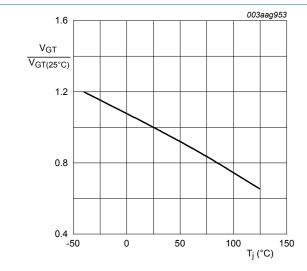
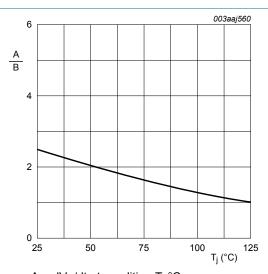
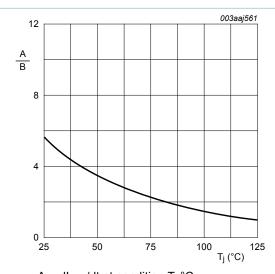


Fig. 12. Normalized gate trigger voltage as a function of junction temperature



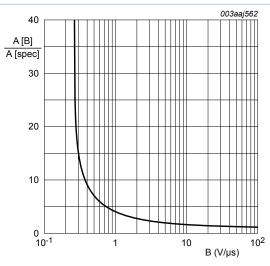
A = dV_D/dt at condition T_j °C B = dV_D/dt at condition T_i [125] °C

Fig. 13. Normalized rate of rise of off-state voltage as a function of junction temperature



A = dI_{com}/dt at condition T_j °C B = dI_{com}/dt at condition T_j [125] °C V_D = 400 V

Fig. 14. Normalized critical rate of rise of commutating current as a function of junction temperature



A [B] is dl_{com}/dt at condition B, dV_{com}/dt A [spec] is the specified data sheet value of dl_{com}/dt turn-off time < 20 ms

Fig. 15. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

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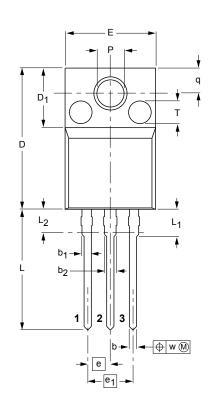
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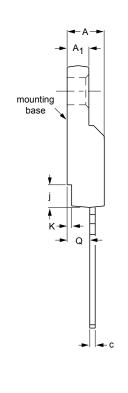
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11. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 'full pack'

SOT186A





0 5 10 mm Luuruuluuruul scale

DIMENSIONS (mm are the original dimensions)

UNIT	Α	A ₁	b	b ₁	b ₂	С	D	D ₁	E	е	e ₁	j	K	L	L ₁	L ₂ ⁽¹⁾ max.	Р	Q	q	T ⁽²⁾	w
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

- 1. Terminal dimensions within this zone are uncontrolled.
- 2. Both recesses are # 2.5 × 0.8 max. depth

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT186A		3-lead TO-220F				-02-04-09 06-02-14

Fig. 16. Package outline TO-220F (SOT186A)

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