

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
- Less sensitive gate for high noise immunity
- 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
- 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

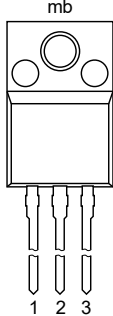
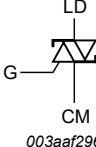
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	800	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 94\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	-	4	A
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	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	-	39	A
T_j	junction temperature		-	-	125	°C
V_{PP}	peak pulse voltage	$T_j = 25\text{ °C}$; non-repetitive, off-state; Fig. 6	-	-	2	kV

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	-	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD+ G-; T _j = 25 °C; Fig. 8	-	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD- G-; T _j = 25 °C; Fig. 8	-	-	35	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 10	-	-	35	mA
V _T	on-state voltage	I _T = 6 A; T _j = 25 °C; Fig. 11	-	-	1.7	V
V _{CL}	clamping voltage	I _{CL} = 0.1 mA; t _p = 1 ms; T _j = 25 °C	850	-	-	V
Dynamic characteristics						
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	1000	-	-	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/μs; (snubberless condition); gate open circuit; Fig. 14 ; Fig. 15	8	-	-	A/ms
		V _D = 400 V; T _j = 125 °C; I _{T(RMS)} = 4 A; dV _{com} /dt = 10 V/μs; gate open circuit; Fig. 15 ; Fig. 16	10	-	-	A/ms
		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	15	-	-	A/ms

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
ACTT4X-800C	TO220F	ACTT4X-800C,127	Tube	50	SOT186A	14-Nov-2013
ACTT4X-800C/DG	TO220F	ACTT4X-800C/DGQ	Tube	50	SOT186A HF	14-Nov-2013

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; $T_h \leq 94\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	-	4	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5	-	35	A
		full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$	-	39	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; sine-wave pulse	-	6	A ² s
di_T/dt	rate of rise of on-state current	$I_G = 70\text{ mA}$	-	100	A/ μ 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_j	junction temperature		-	125	°C
V_{PP}	peak pulse voltage	$T_j = 25\text{ °C}$; non-repetitive, off-state; Fig. 6	-	2	kV

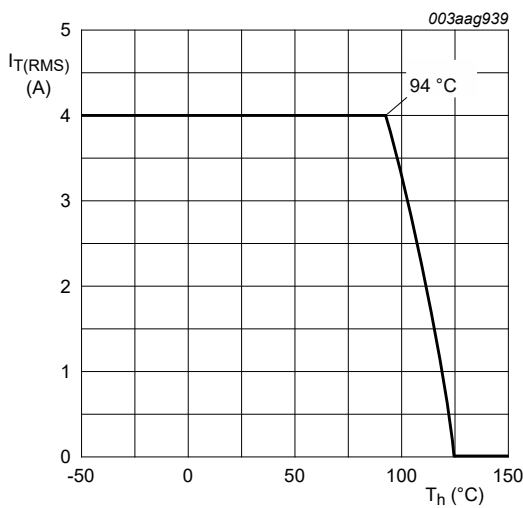


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values

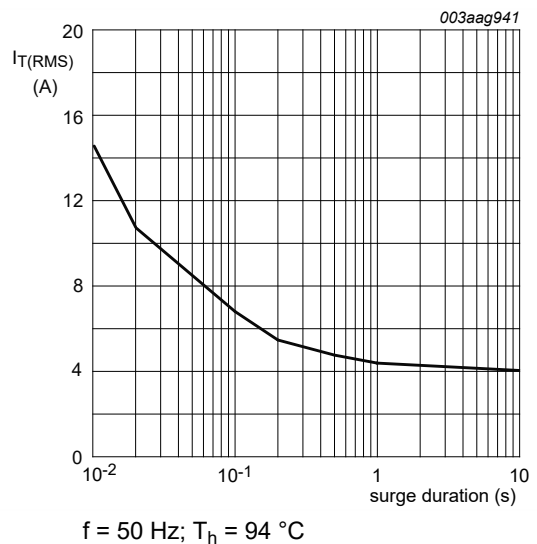


Fig. 2. on-state current as a function of surge duration; maximum values

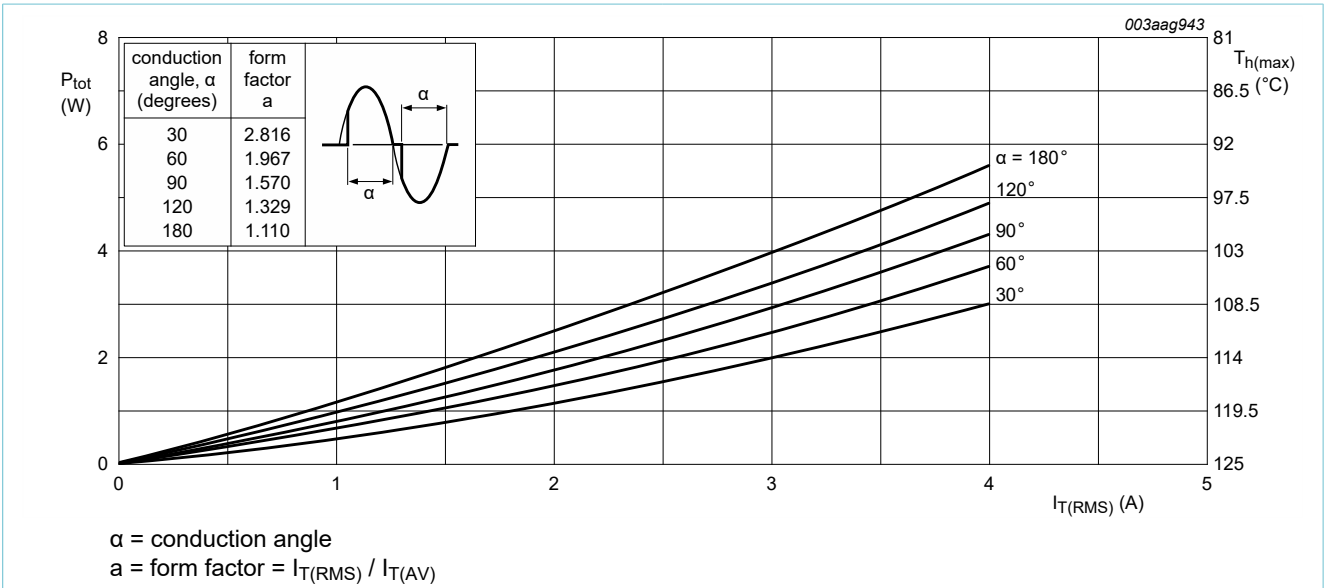


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

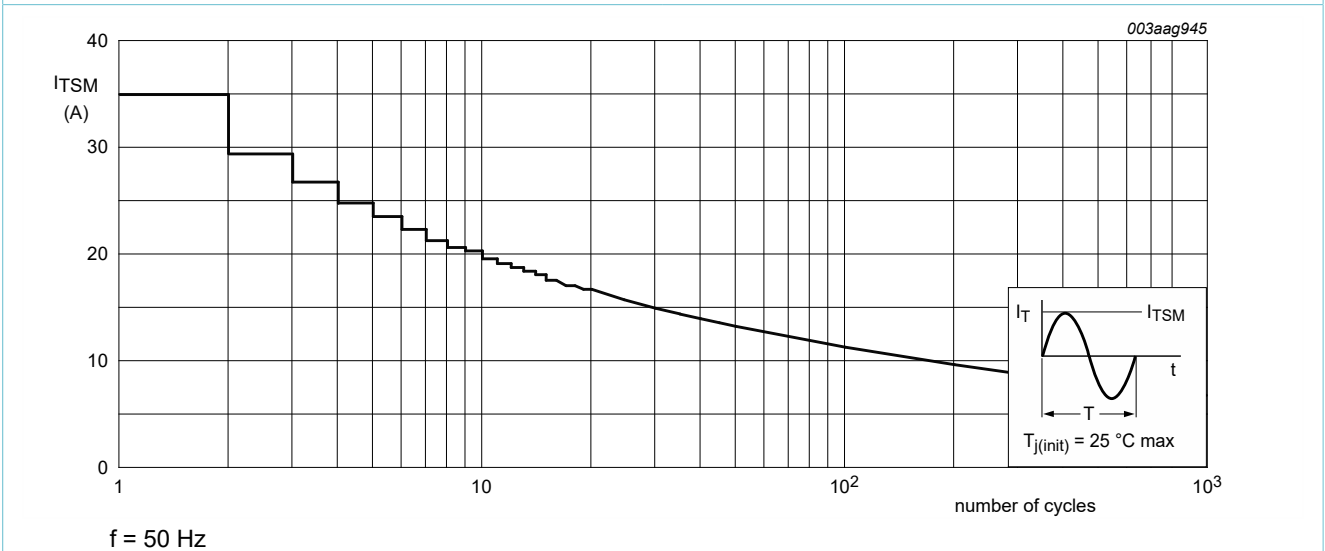


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

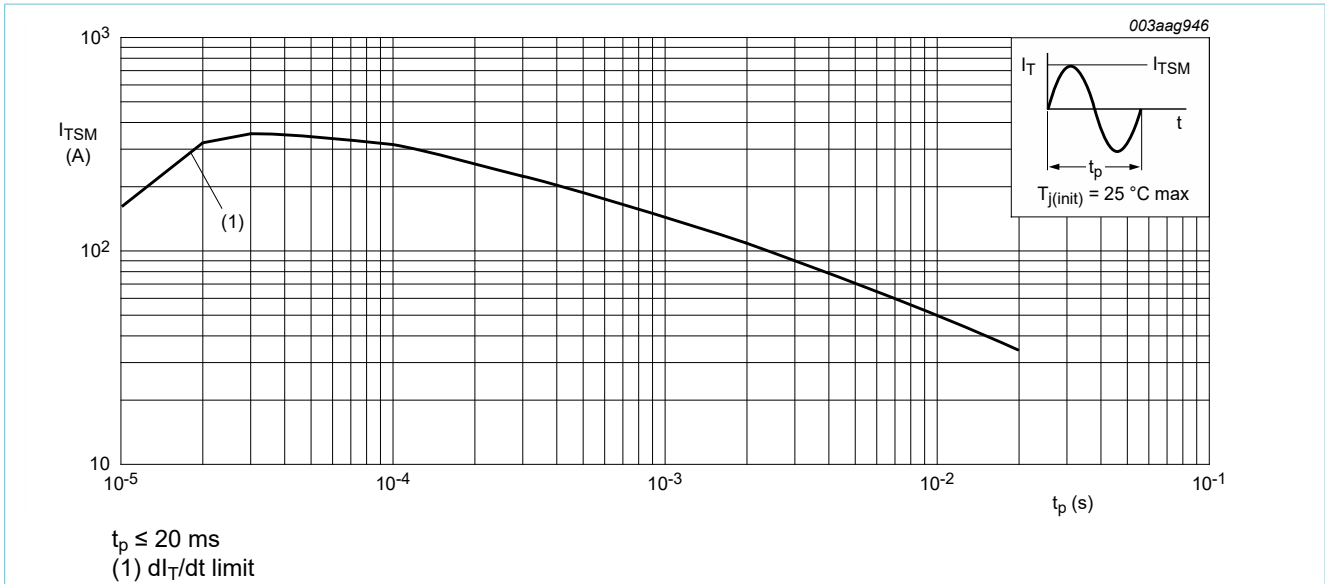


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

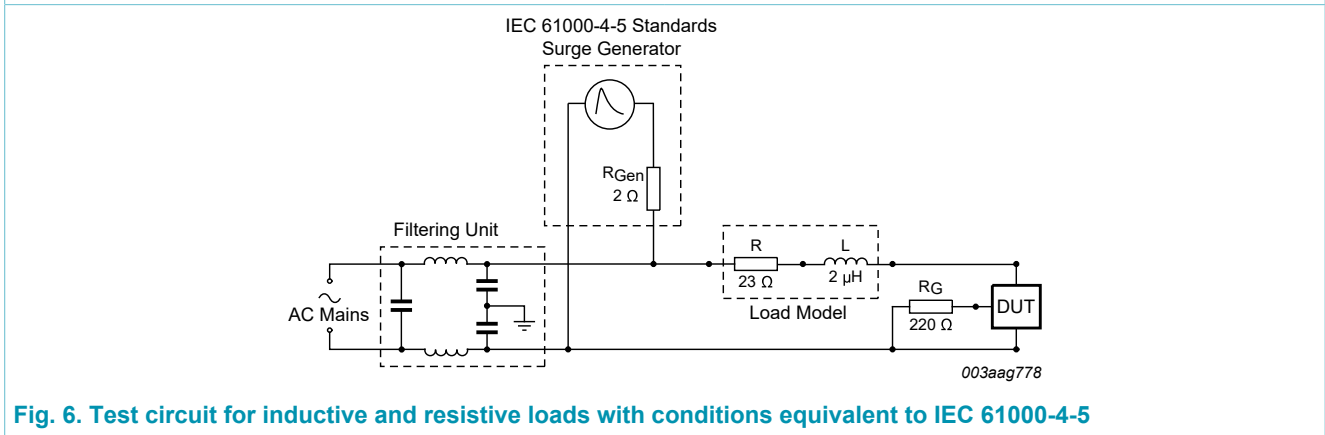


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

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 cycle or half cycle; with heatsink compound; Fig. 7	-	-	5.5	K/W
		full cycle or half cycle; without heatsink compound; Fig. 7	-	-	7.2	K/W
R _{th(j-a)}	thermal resistance from junction to ambient free air	in free air	-	55	-	K/W

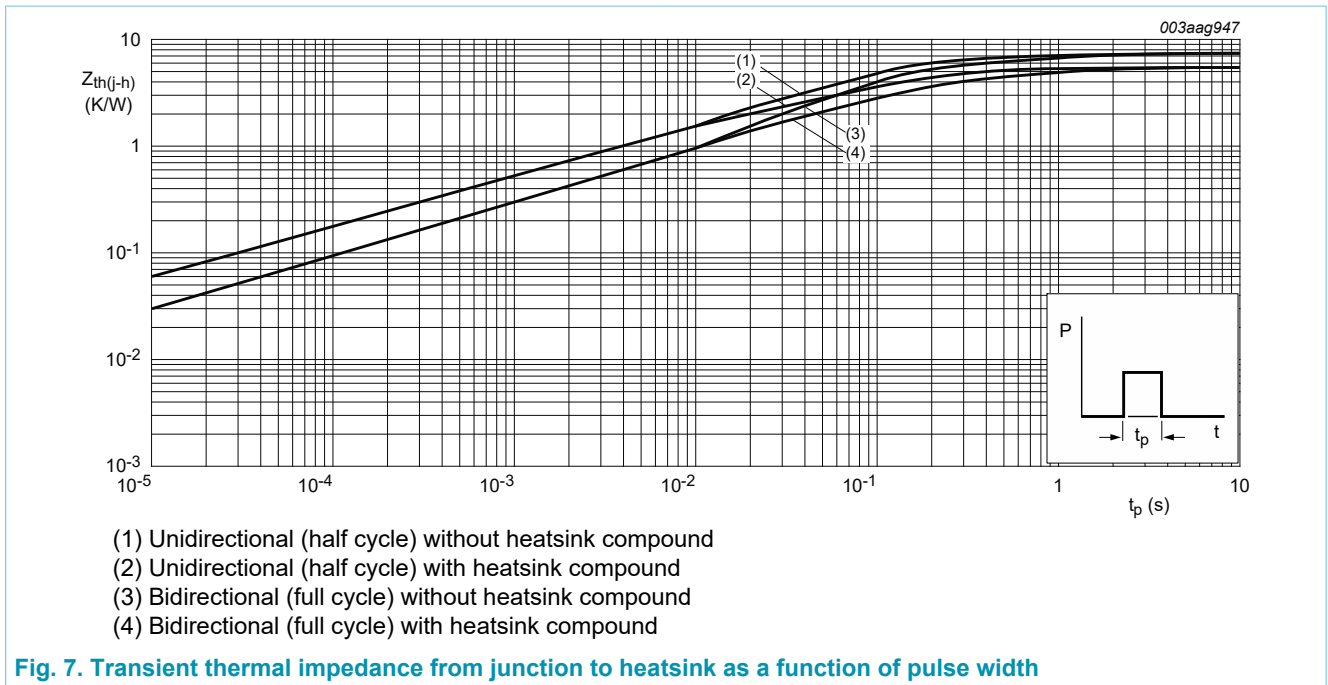


Fig. 7. Transient thermal impedance from junction to heatsink as a function of pulse width

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 Hz ≤ f ≤ 60 Hz; T _h = 25 °C	-	-	2500	V
C _{isol}	isolation capacitance	from main terminal 2 to external heatsink; f = 1 MHz; T _h = 25 °C	-	10	-	pF

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	-	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD+ G-; T _j = 25 °C; Fig. 8	-	-	35	mA
		V _D = 12 V; I _T = 100 mA; LD- G-; T _j = 25 °C; Fig. 8	-	-	35	mA
I _L	latching current	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	-	-	60	mA
		V _D = 12 V; I _G = 100 mA; LD- G-; T _j = 25 °C; Fig. 9	-	-	50	mA
I _H	holding current	V _D = 12 V; T _j = 25 °C; Fig. 10	-	-	35	mA
V _T	on-state voltage	I _T = 6 A; T _j = 25 °C; Fig. 11	-	-	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 characteristics						
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	1000	-	-	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/μs; (snubberless condition); gate open circuit; Fig. 14 ; Fig. 15	8	-	-	A/ms
		V _D = 400 V; T _j = 125 °C; I _{T(RMS)} = 4 A; dV _{com} /dt = 10 V/μs; gate open circuit; Fig. 15 ; Fig. 16	10	-	-	A/ms
		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	15	-	-	A/ms

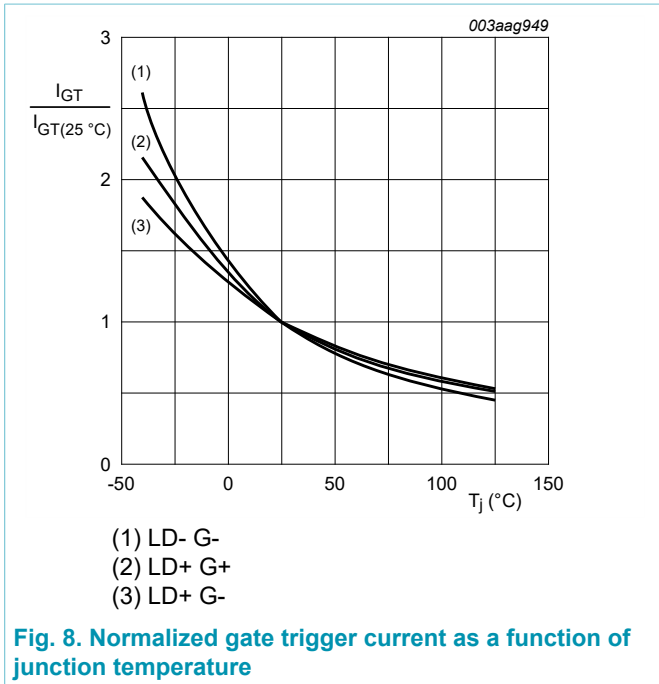


Fig. 8. Normalized gate trigger current as a function of junction temperature

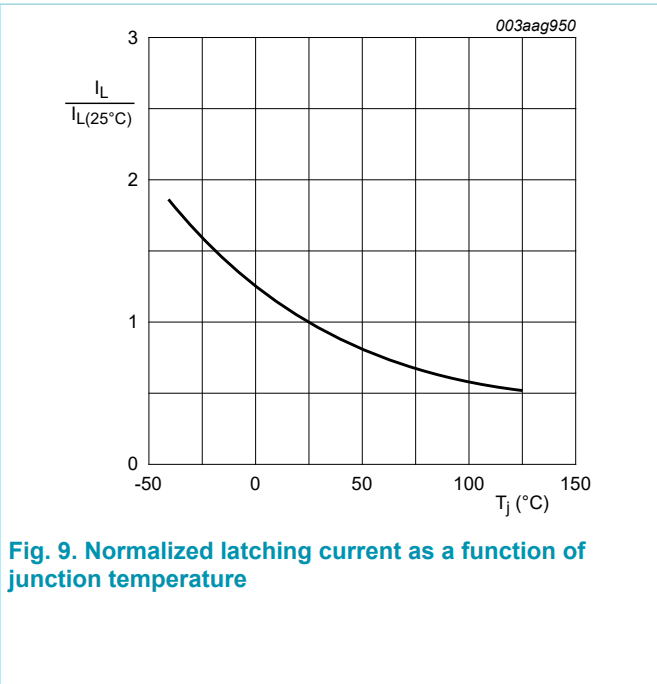


Fig. 9. Normalized latching current as a function of junction temperature

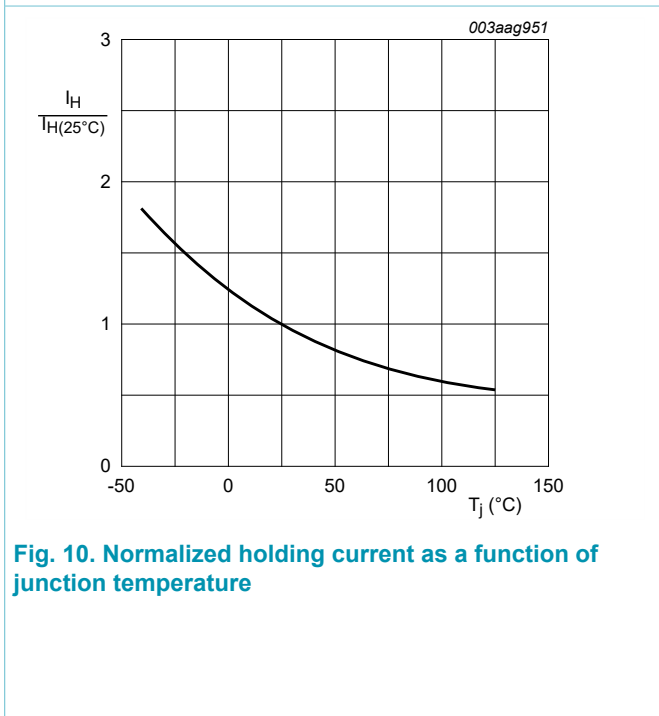


Fig. 10. Normalized holding current as a function of junction temperature

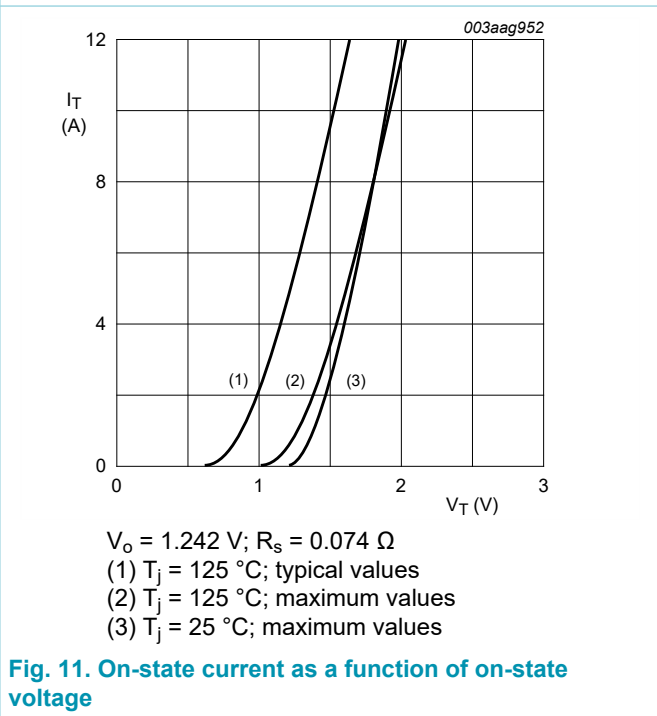


Fig. 11. On-state current as a function of on-state voltage

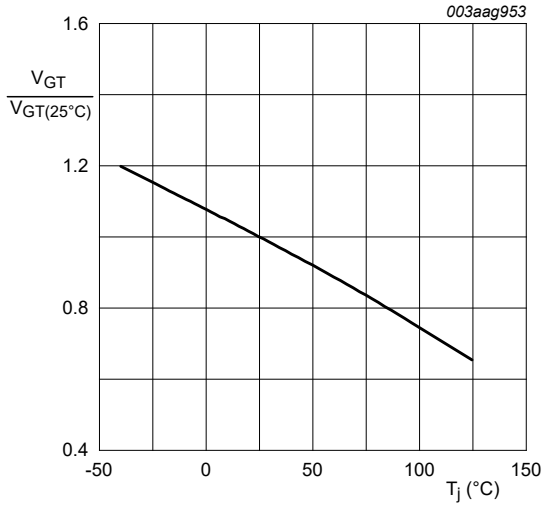
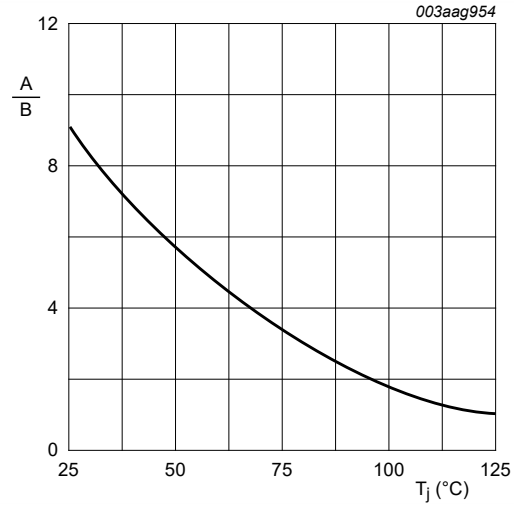
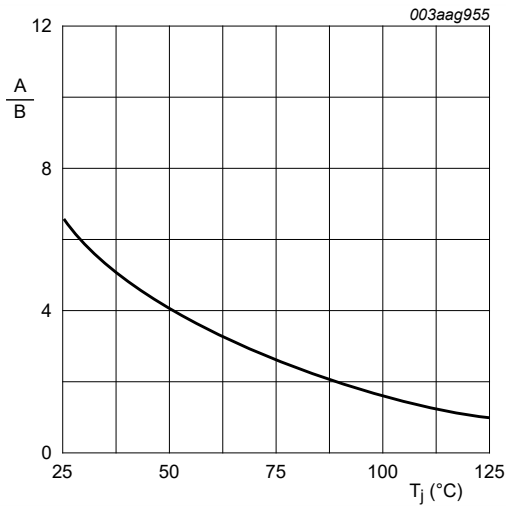


Fig. 12. Normalized gate trigger voltage as a function of junction temperature



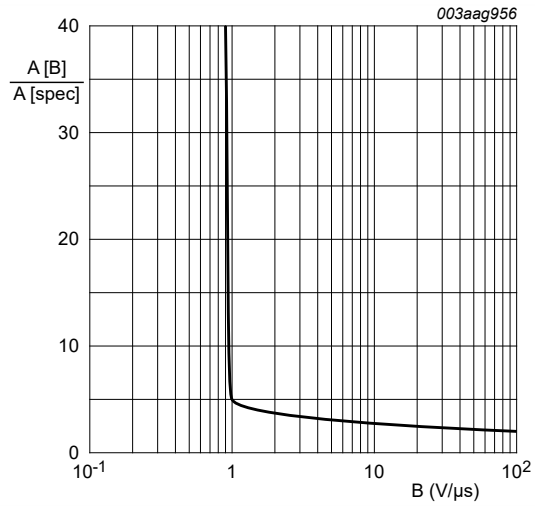
A = dV_D/dt at condition T_j $^{\circ}\text{C}$
 B = dV_D/dt at condition T_j [125] $^{\circ}\text{C}$

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



A = di_{com}/dt at condition T_j $^{\circ}\text{C}$
 B = di_{com}/dt at condition T_j [125] $^{\circ}\text{C}$
 $V_D = 400$ V

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



A [B] is di_{com}/dt at condition B, dV_{com}/dt
 A [spec] is the specified data sheet value of di_{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

$T_j = 25^{\circ}\text{C}$; $t_p = 300$ μs

Fig. 16. Output characteristics: drain current as a function of drain-source voltage; typical values

11. Package outline

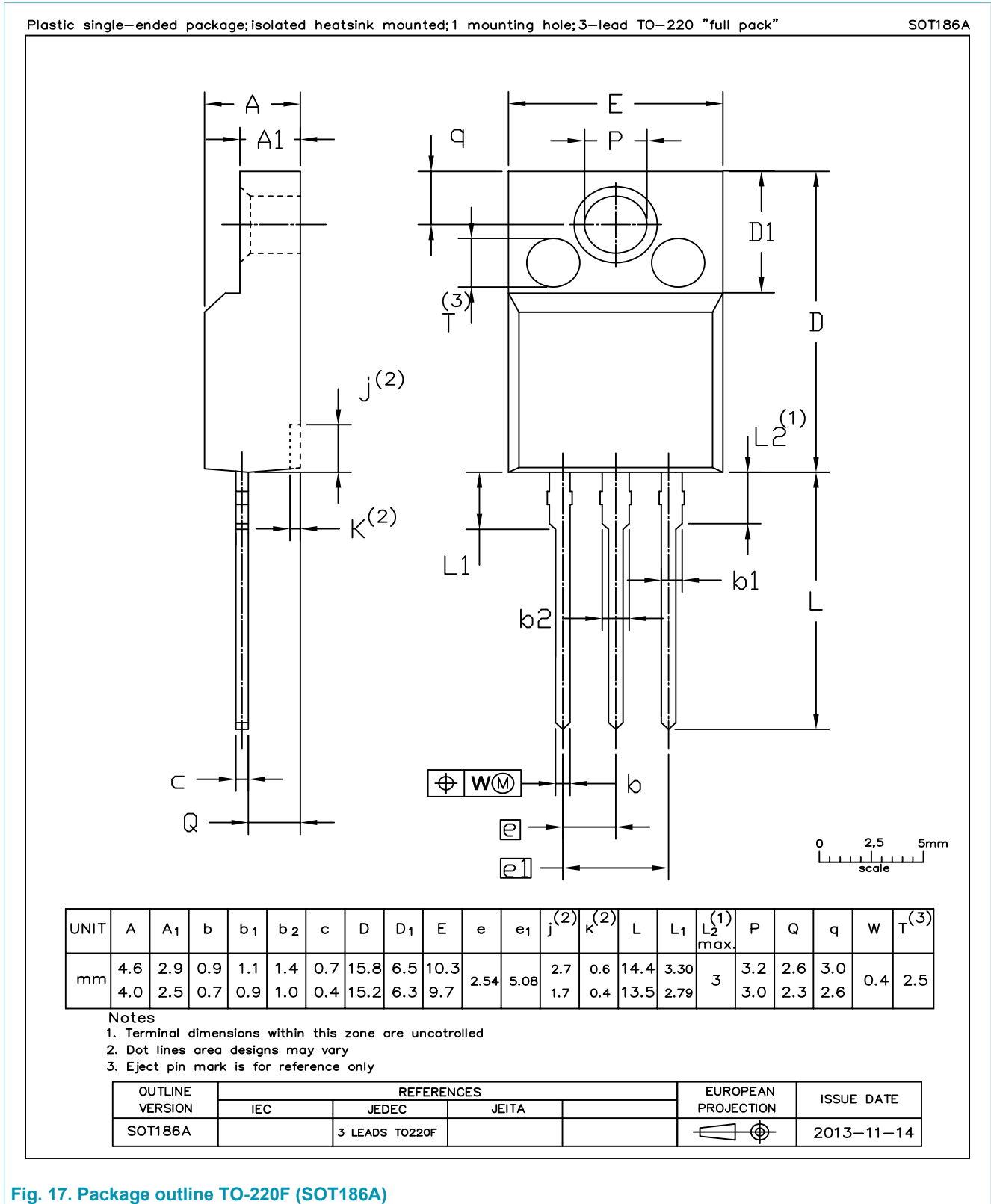


Fig. 17. Package outline TO-220F (SOT186A)

12. Legal information

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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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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