



# ACTT2X-800E

## AC Thyristor Triac power switch

Rev. 2 — 26 October 2011

Product data sheet

## 1. Product profile

### 1.1 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.

### 1.2 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

### 1.3 Applications

- AC Fan controllers
- Highly inductive, resistive and safety loads of lower power
- Large and small appliances (White Goods)
- Loads such as contactors, circuit breakers, valves, dispensers and door locks
- Pump motor circuits

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DRM}$	repetitive peak off-state voltage		-	-	800	V
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; see <a href="#">Figure 5</a> ; see <a href="#">Figure 6</a>	-	-	14	A
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_h \leq 106\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 4</a>	-	-	2	A

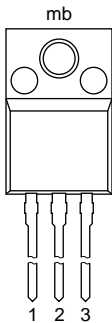
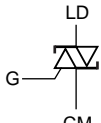


Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; gate open circuit; exponential waveform; see <a href="#">Figure 13</a>	500	-	-	V/ $\mu$ s
$V_{CL}$	clamping voltage	$I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ °C}$	850	-	-	V
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ °C}$ ; non-repetitive, off-state; see <a href="#">Figure 3</a>	-	-	2	kV

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	CM	common		
2	LD	load		
3	G	gate		
mb	n.c.	mounting base; isolated		

SOT186A (TO-220F)

## 3. Ordering information

Table 3. Ordering information

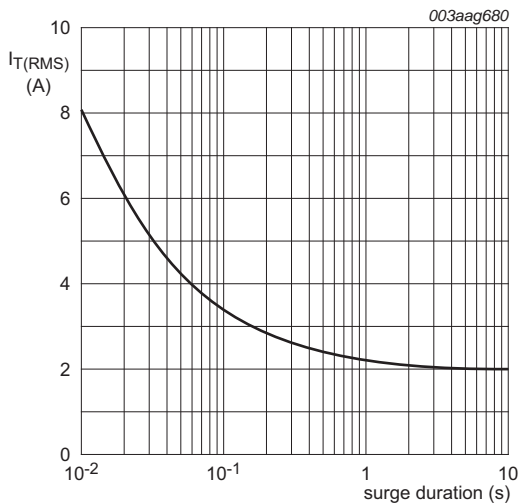
Type number	Package		
	Name	Description	Version
ACTT2X-800E	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

### 4. Limiting values

**Table 4. Limiting values**

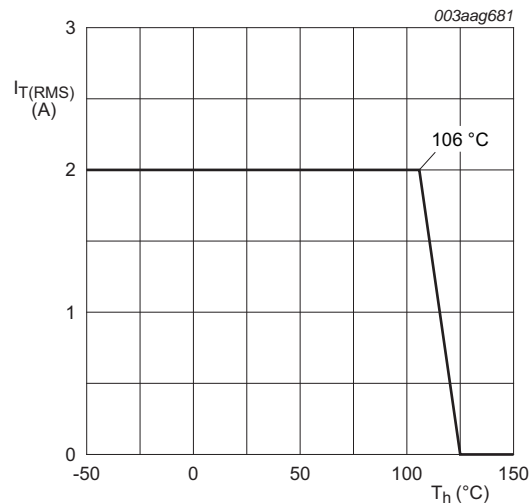
In accordance with the Absolute Maximum Rating System (IEC 60134).

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; $T_h \leq 106\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a> ; see <a href="#">Figure 4</a>	-	2	A
$I_{TSM}$	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$	-	15.4	A
		full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; see <a href="#">Figure 5</a> ; see <a href="#">Figure 6</a>	-	14	A
$I^2t$	$I^2t$ for fusing	$t_p = 10\text{ ms}$ ; sine-wave pulse	-	0.98	A <sup>2</sup> s
$dl_T/dt$	rate of rise of on-state current	$I_T = 3\text{ A}$ ; $I_G = 0.2\text{ A}$ ; $dI_G/dt = 0.2\text{ A}/\mu\text{s}$	-	100	A/ $\mu\text{s}$
$I_{GM}$	peak gate current	$t = 20\text{ }\mu\text{s}$	-	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		-	125	°C
$V_{PP}$	peak pulse voltage	$T_j = 25\text{ °C}$ ; non-repetitive, off-state; see <a href="#">Figure 3</a>	-	2	kV



$f = 50\text{ Hz}$ ;  $T_h = 106\text{ °C}$

**Fig 1. RMS on-state current as a function of surge duration; maximum values**



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

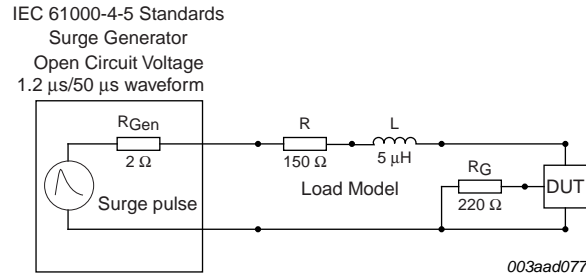


Fig 3. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

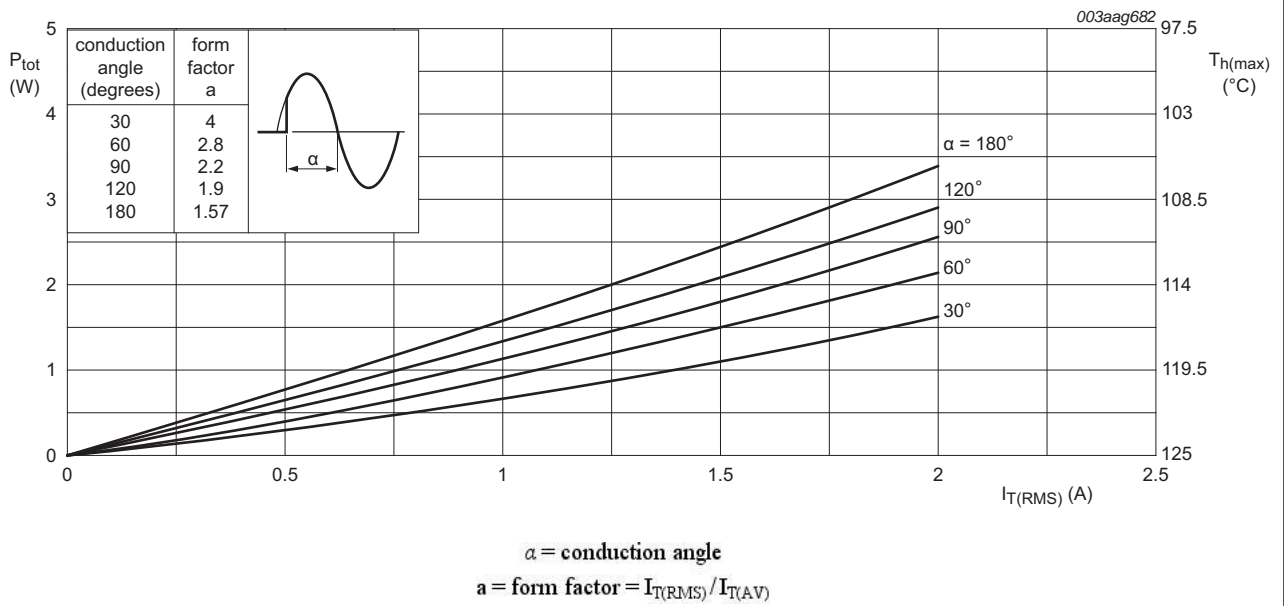


Fig 4. Total power dissipation as a function of RMS on-state current; maximum values

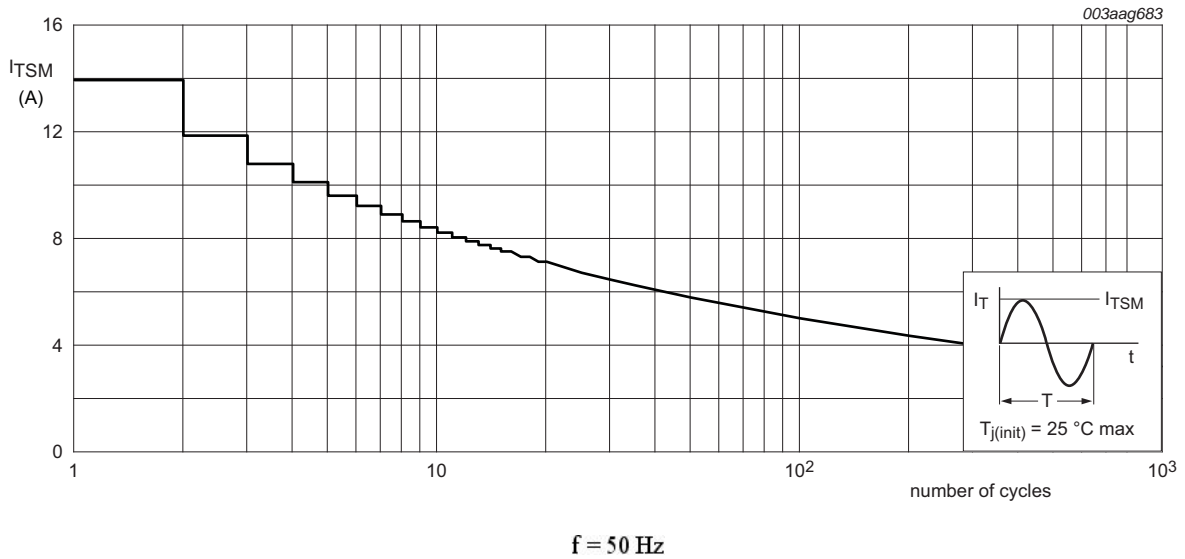


Fig 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

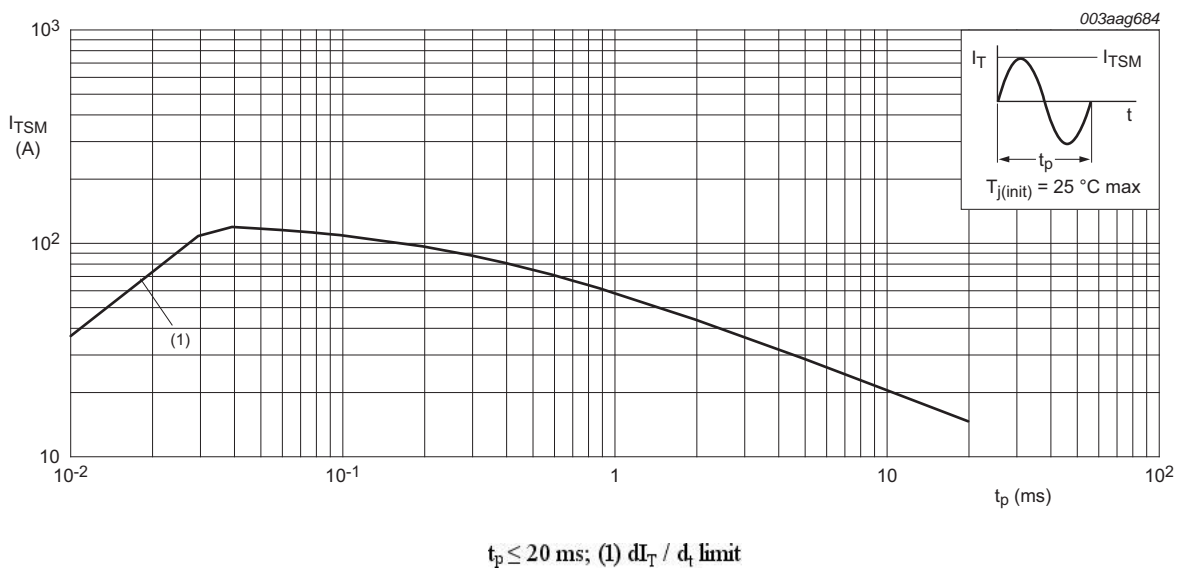
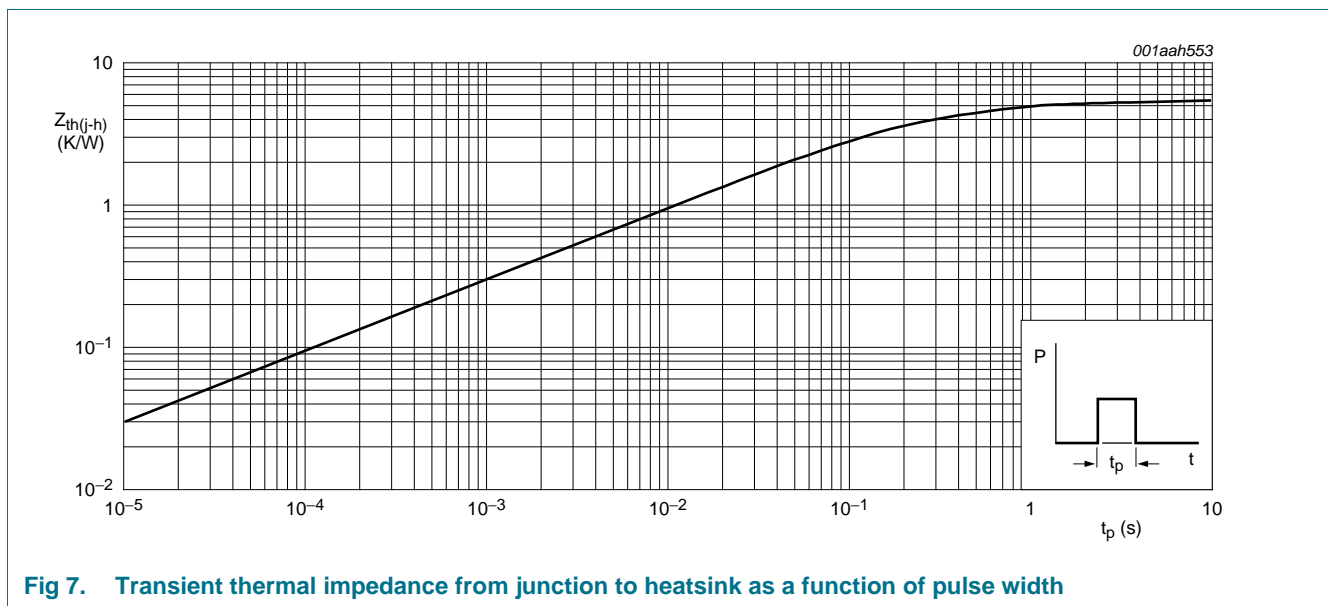


Fig 6. Non-repetitive peak on-state current as a function of pulse width; maximum values

## 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full or half cycle with heatsink compound; see <a href="#">Figure 7</a>	-	-	5.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W



## 6. Isolation characteristics

Table 6. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	$50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_h = 25\text{ }^\circ\text{C}$ ; sinusoidal waveform; from all pins to external heatsink; clean and dust free	-	-	2500	V
$C_{isol}$	isolation capacitance	$T_h = 25\text{ }^\circ\text{C}$ ; from LD pin to external heatsink; $f = 1\text{ MHz}$	-	10	-	pF

## 7. Characteristics

**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	10	mA
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 8</a>	-	-	10	mA
$I_L$	latching current	$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G+; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	-	25	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	-	35	mA
		$V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD- G-; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a>	-	-	25	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 10</a>	-	-	25	mA
$V_T$	on-state voltage	$I_T = 3\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	-	2	V
$V_{GT}$	gate trigger voltage	$V_D = 400\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 125\text{ °C}$ ; see <a href="#">Figure 12</a>	0.2	-	-	V
		$V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	-	1.5	V
$I_D$	off-state current	$V_D = 800\text{ V}$ ; $T_j = 25\text{ °C}$	-	-	10	$\mu\text{A}$
		$V_D = 800\text{ V}$ ; $T_j = 125\text{ °C}$	-	-	0.5	mA
$dV_D/dt$	rate of rise of off-state voltage	$V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; gate open circuit; exponential waveform; see <a href="#">Figure 13</a>	500	-	-	V/ $\mu\text{s}$
$dI_{com}/dt$	rate of change of commutating current	$V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 2\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	3	-	-	A/ms
$V_{CL}$	clamping voltage	$I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ °C}$	850	-	-	V

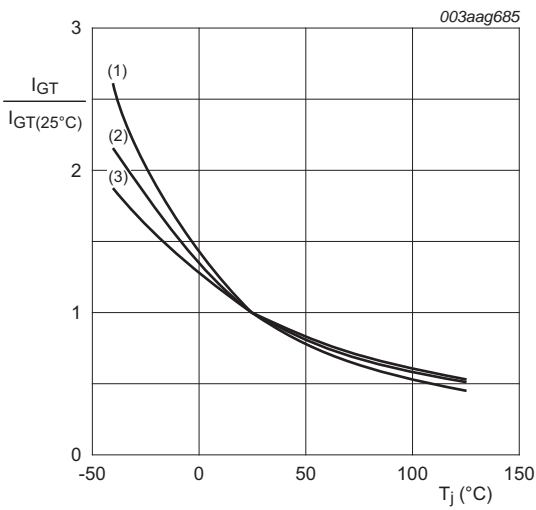


Fig 8. Normalized gate trigger current as a function of junction temperature

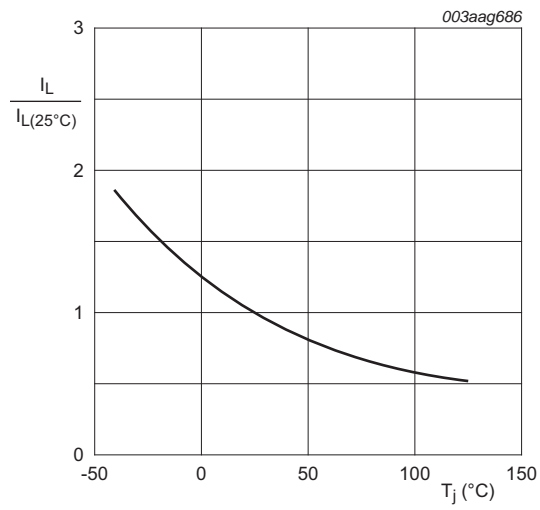


Fig 9. Normalized latching current as a function of junction temperature

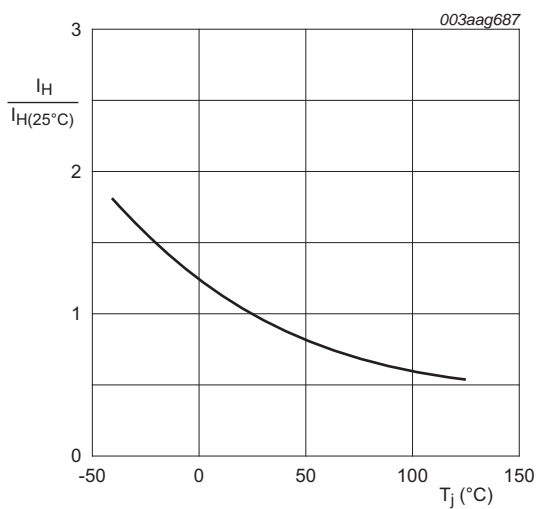


Fig 10. Normalized holding current as a function of junction temperature

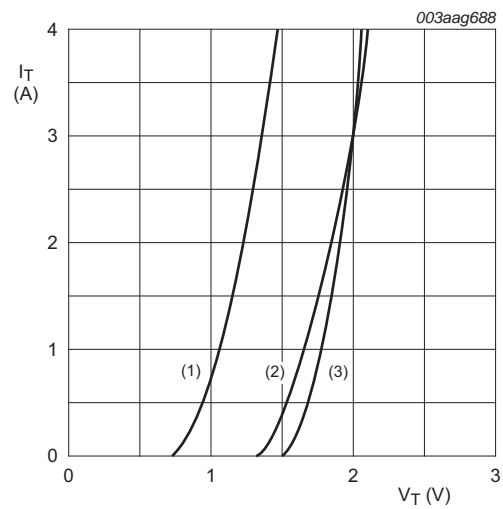


Fig 11. On-state current as a function of on-state voltage

$V_O = 1.612\text{ V}; R_S = 0.120\ \Omega;$   
 (1)  $T_j = 125^\circ\text{C}$ ; typical values;  
 (2)  $T_j = 125^\circ\text{C}$ ; maximum values;  
 (3)  $T_j = 25^\circ\text{C}$ ; maximum values



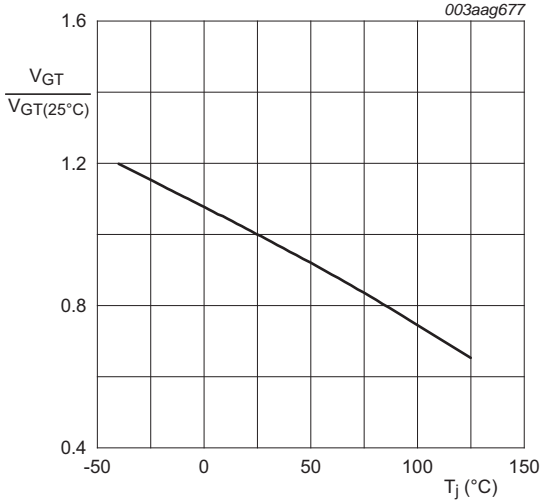
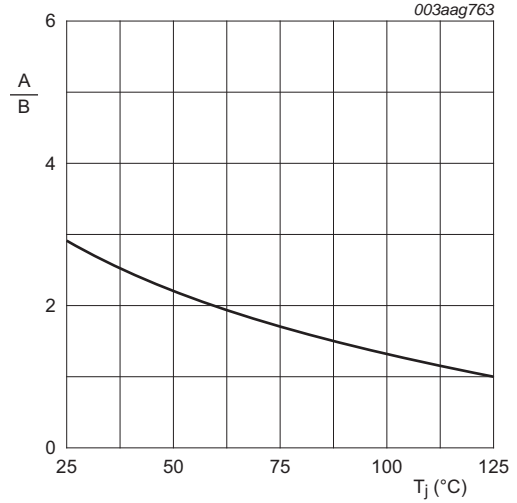
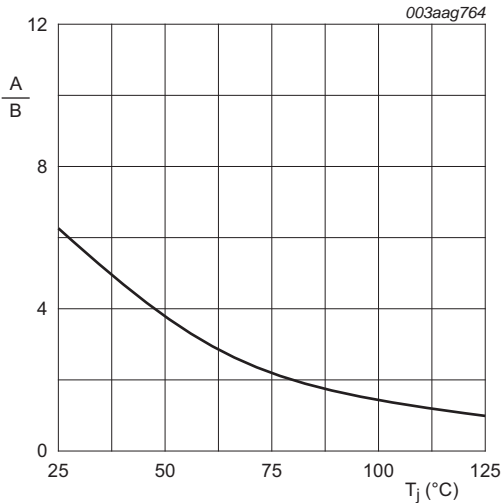


Fig 12. Normalized gate trigger voltage as a function of junction temperature



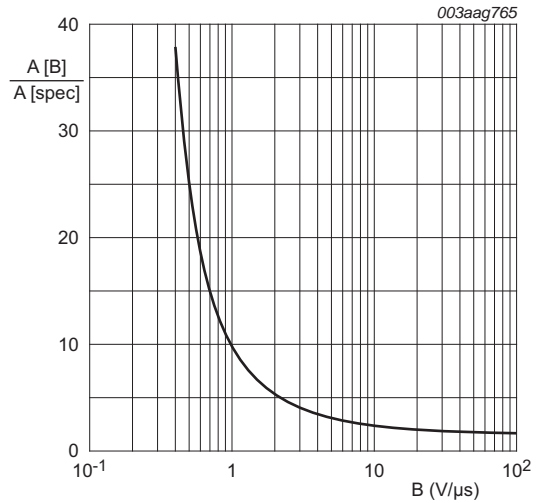
A is  $dV_D/dt$  at condition  $T_j$   $^{\circ}\text{C}$   
 B is  $dV_D/dt$  at condition  $T_j$  125  $^{\circ}\text{C}$

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



A is  $dI_{com}/dt$  at condition  $T_j$   $^{\circ}\text{C}$   
 B is  $dI_{com}/dt$  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 less than 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

8. Package outline

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

SOT186A

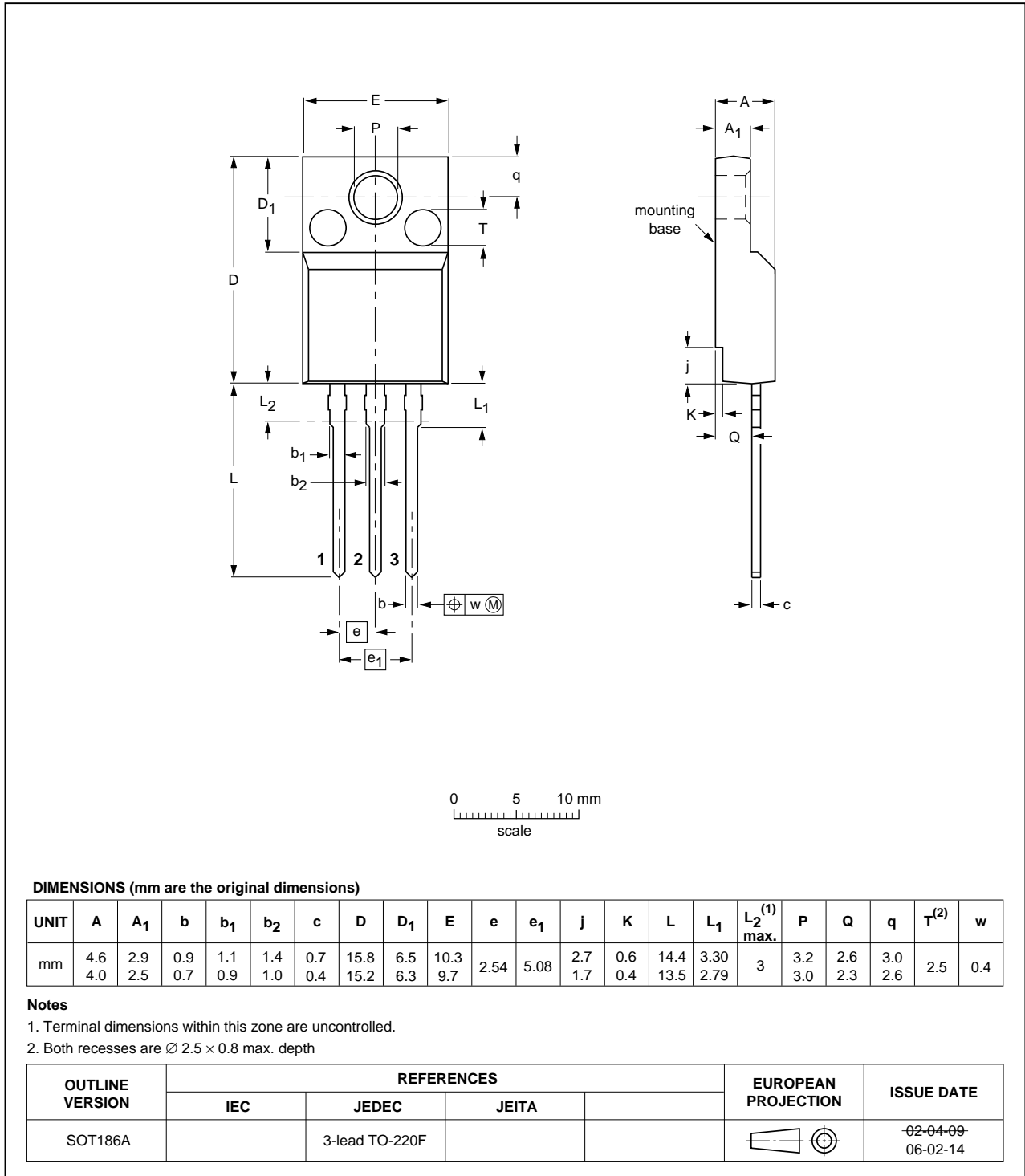


Fig 16. Package outline SOT186A (TO-220F)

## 9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
ACTT2X-800E v.2	20111026	Product data sheet	-	ACTT2X-800E v.1
Modifications:	• Various changes to content.			
ACTT2X-800E v.1	20110919	Product data sheet	-	-

## 10. Legal information

### 10.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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.

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

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