ACT108W-600E

AC Thyristor power switch

Rev. 03 — 21 October 2009 Product data sheet

1. Product profile

1.1 General description

AC Thyristor power switch in a SOT223 surface-mountable plastic package with self-protective capabilities against low and high energy transients

1.2 Features and benefits

- Common terminal on mounting base allows multiple ACTs on shared cooling pad
- Exclusive negative gate triggering
- Full cycle AC conduction
- Remote gate separates the gate driver from the effects of the load current
- Safe clamping of low energy over-voltage transients
- Self-protective turn-on during high energy voltage transients
- Suface-mountable package
- Very high noise immunity

1.3 Applications

- Contactors, circuit breakers, valves, dispensers and door locks
- Fan motor circuits
- Lower-power highly inductive, resistive and safety loads
- Pump motor circuits

1.4 Quick reference data

Table 1. Quick reference

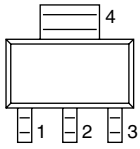
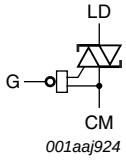
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	600	V
I_{GT}	gate trigger current	V_D = 12 V; I_T = 100 mA; LD+ G-; T_j = 25 °C; see Figure 10	1	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD- G-; T_j = 25 °C	1	-	10	mA
$I_{T(RMS)}$	RMS on-state current	full sine wave; T_{sp} ≤ 112 °C; see Figure 3, 1 and 2	-	-	0.8	A
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 402 V; T_j = 125 °C; gate open circuit; see Figure 14	1000	-	-	V/µs

Table 1. Quick reference *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CL}	clamping voltage	I_{CL} = 100 mA; t_p = 1 ms; $T_j \leq 125$ °C; see Figure 17	650	-	-	V
V_{PP}	peak pulse voltage	T_j = 25 °C; non-repetitive, off-state; see Figure 6	-	-	2	kV
V_T	on-state voltage	I_T = 1.1 A; see Figure 13	-	-	1.3	V

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	LD	load	 SOT223 (SC-73)	 001aaj924
2	CM	common		
3	G	gate		
mb	CM	mounting base; connected to common		

3. Ordering information

Table 3. Ordering information

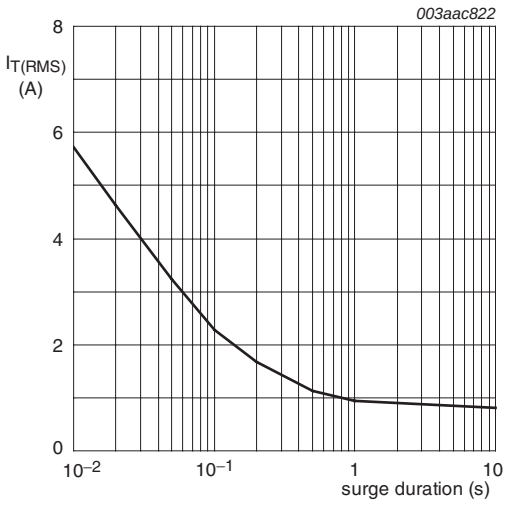
Type number	Package		
	Name	Description	Version
ACT108W-600E	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

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		-	600	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{sp} \leq 112$ °C; see Figure 3, 1 and 2	-	0.8	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms	-	8.8	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; see Figure 4 and 5	-	8	A
I^2t	I^2t for fusing	$t_p = 10$ ms; sin-wave pulse	-	0.32	A^2s
dI_T/dt	rate of rise of on-state current	$I_T = 1$ A; $I_G = 20$ mA; $dI_G/dt = 0.2$ A/µs	-	100	A/µs
I_{GM}	peak gate current	t = 20 µs	-	1	A
V_{GM}	peak gate voltage	positive applied gate voltage	-	15	V
$P_{G(AV)}$	average gate power	over any 20 ms period	-	0.1	W
T_{stg}	storage temperature		-40	150	°C
T_j	junction temperature		-	125	°C
V_{PP}	peak pulse voltage	$T_j = 25$ °C; non-repetitive, off-state; see Figure 6	-	2	kV



$f = 50Hz$; $T_{sp} = 112\,°C$

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

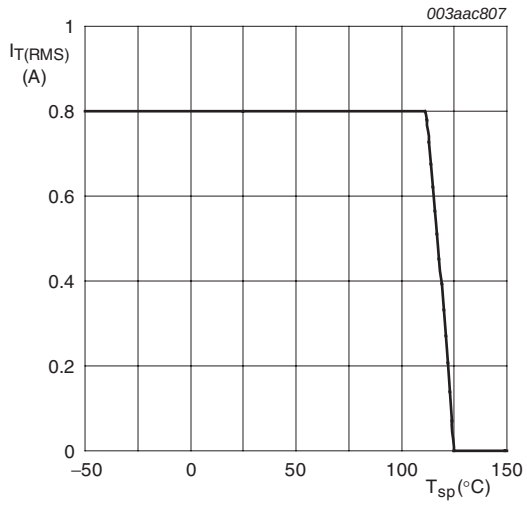
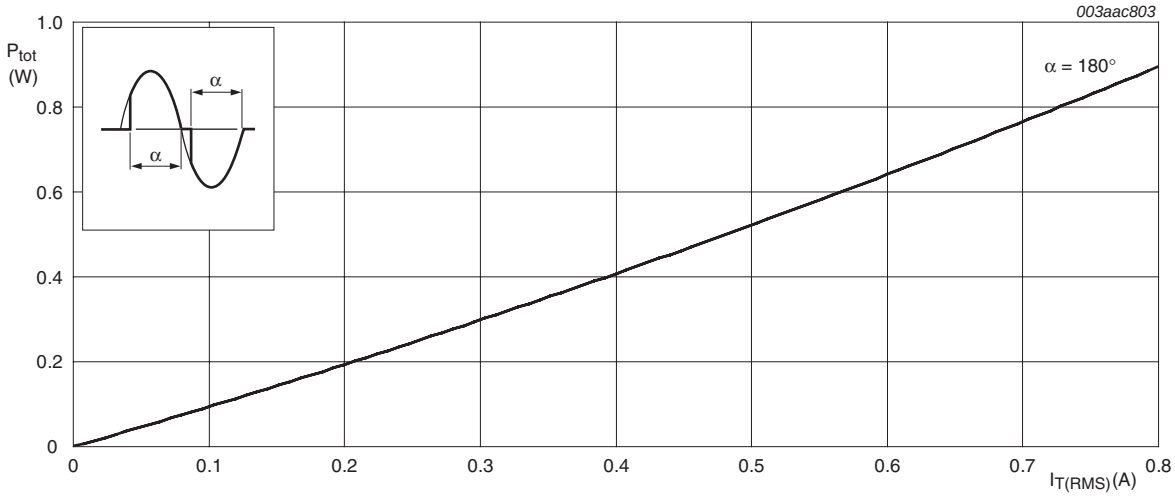
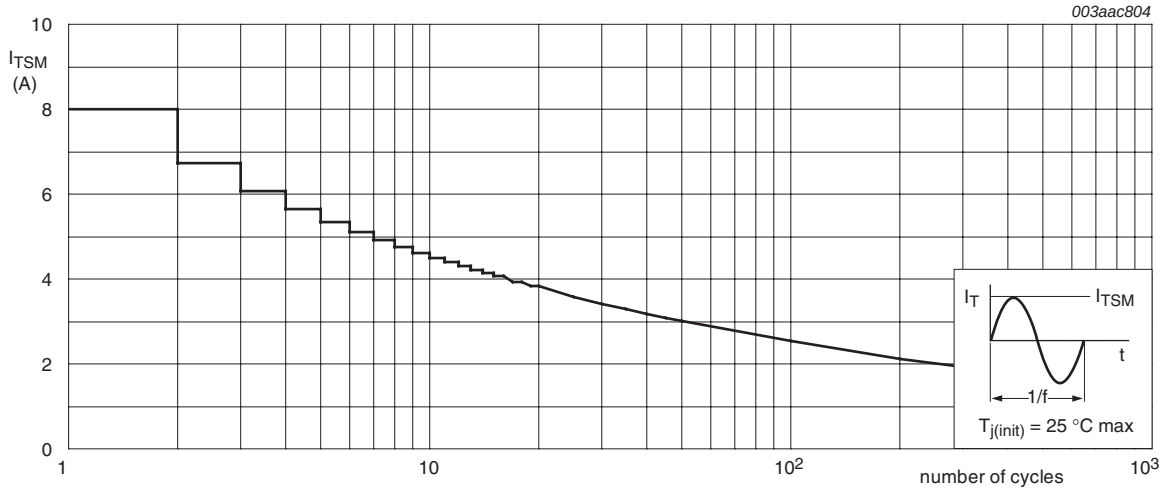


Fig 2. RMS on-state current as a function of solder point temperature; maximum values



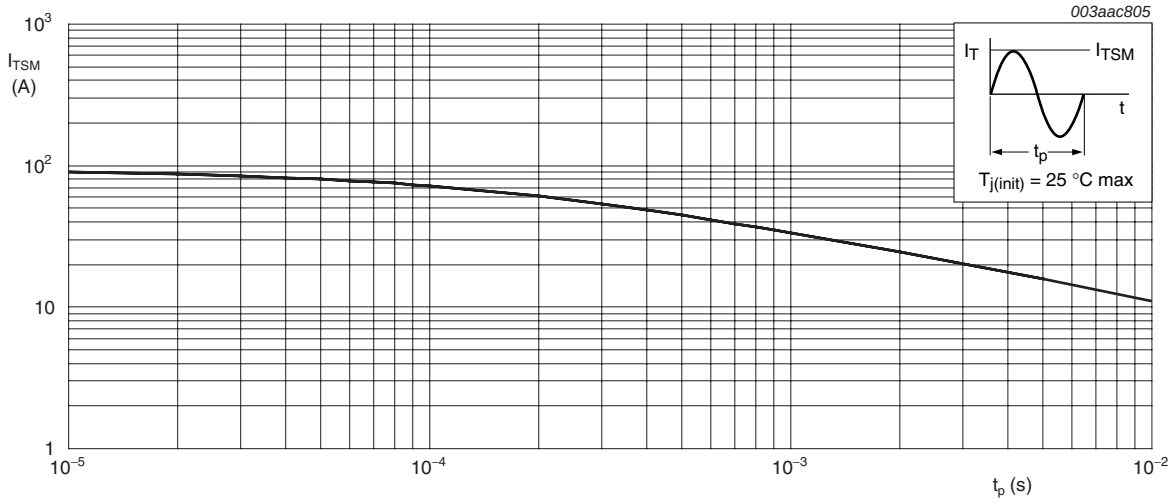
α = conduction angle

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



f = 50 Hz

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



$t_p \leq 20$ ms

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

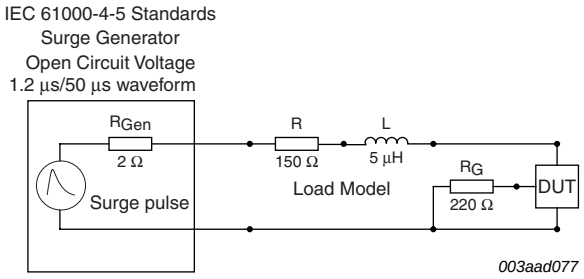
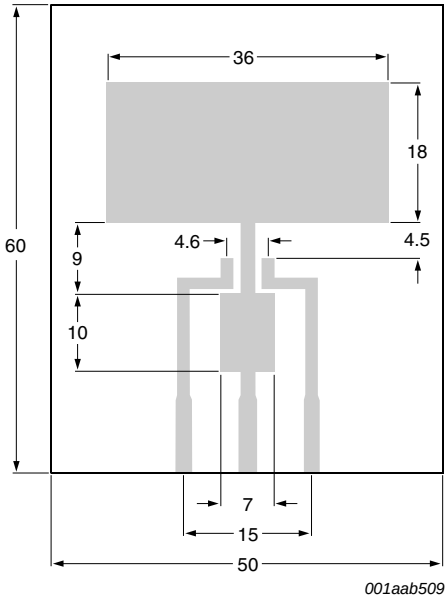


Fig 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

5. Thermal characteristics

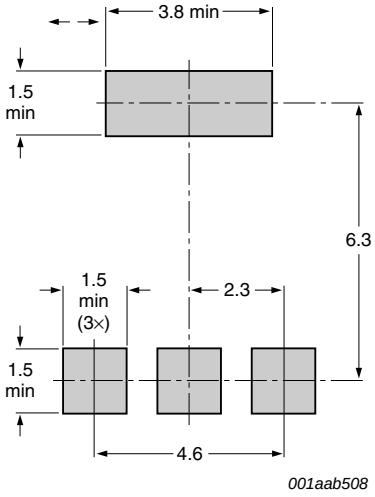
Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	full cycle with heatsink compound; see Figure 9	-	-	15	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	full cycle; printed-circuit board mounted for pad area; see Figure 7	-	70	-	K/W
		full cycle; printed-circuit board mounted for minimum footprint; see Figure 8	-	156	-	K/W



All dimensions are in mm
Printed-circuit board: FR4 epoxy glass (1.6 mm thick), copper laminate (35μm thick)

Fig 7. Printed-circuit board pad area SOT223



All dimensions are in mm

Fig 8. Minimum footprint SOT223

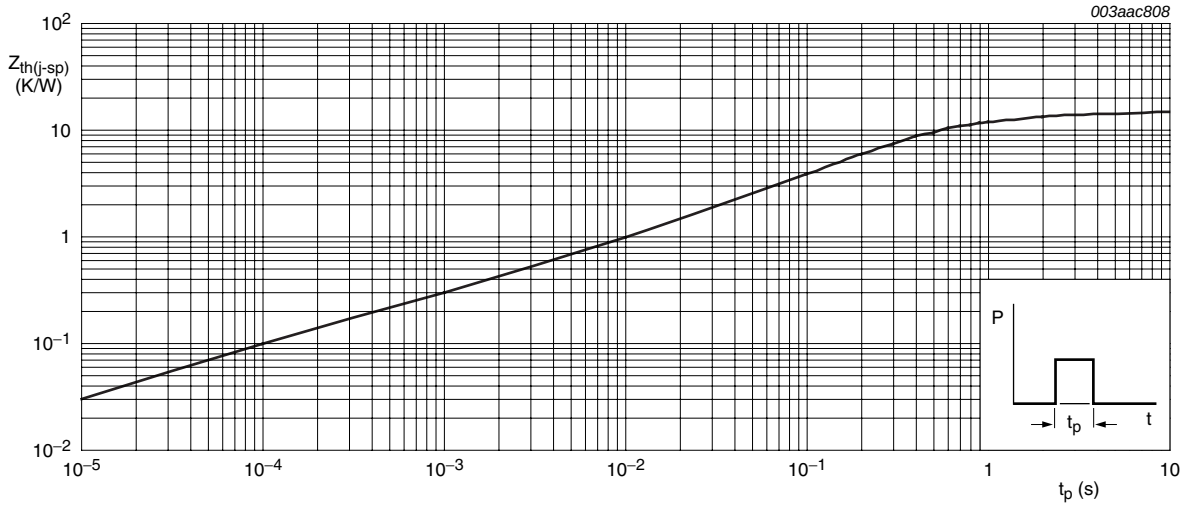
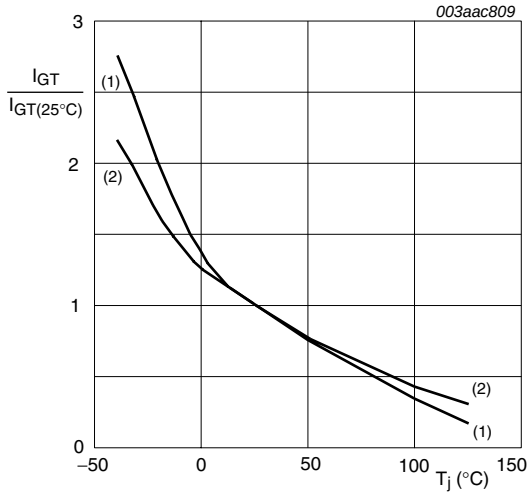


Fig 9. Transient thermal impedance from junction to solder point as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{GT}	gate trigger current	V_D = 12 V; I_T = 100 mA; LD+ G-; T_j = 25 °C; see Figure 10	1	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD- G-; T_j = 25 °C	1	-	10	mA
I_L	latching current	V_D = 12 V; I_G = 12 mA; T_j = 25 °C; see Figure 11	-	-	30	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; see Figure 12	-	9	25	mA
V_T	on-state voltage	I_T = 1.1 A; see Figure 13	-	-	1.3	V
V_{GT}	gate trigger voltage	V_D = 600 V; I_T = 100 mA; T_j ≤ 125 °C	0.15	-	-	V
		V_D = 600 V; I_T = 100 mA; T_j = 25 °C	-	-	1	V
I_D	off-state current	V_D = 600 V; T_j ≤ 125 °C	-	-	0.2	mA
		V_D = 600 V; T_j ≤ 25 °C	-	-	2	µA
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 402 V; T_j = 125 °C; gate open circuit; see Figure 14	1000	-	-	V/µs
dI_{com}/dt	rate of change of commutating current	V_D = 400 V; T_j = 125 °C; $I_{T(RMS)}$ = 1 A; dV_{com}/dt = 15 V/µs; gate open circuit; see Figure 15 and 16	0.3	-	-	A/ms
V_{CL}	clamping voltage	I_{CL} = 100 mA; t_p = 1 ms; T_j ≤ 125 °C; see Figure 17	650	-	-	V



(1) LD + G − (2) LD − G −

Fig 10. Normalized gate trigger current as a function of junction temperature

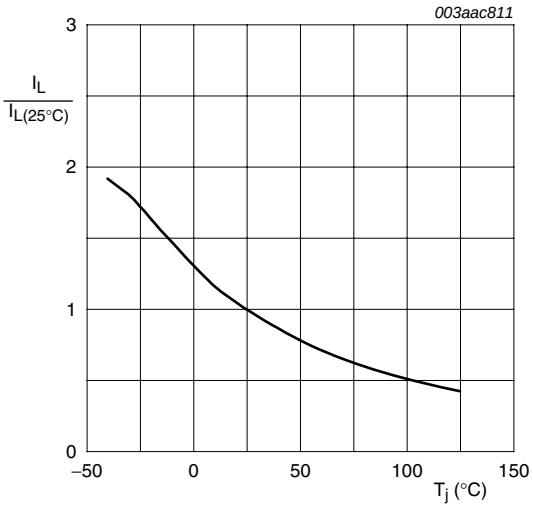


Fig 11. Normalized latching current as a function of junction temperature

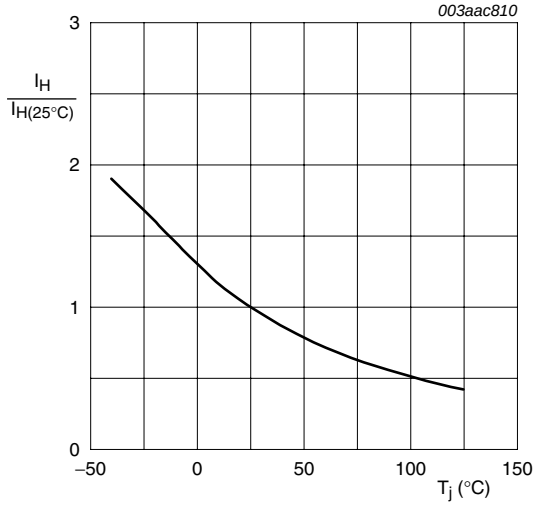
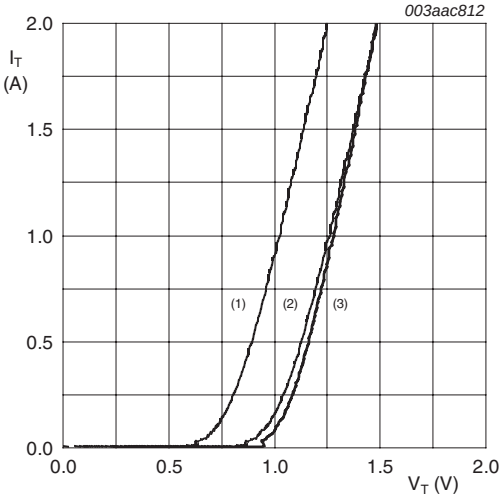
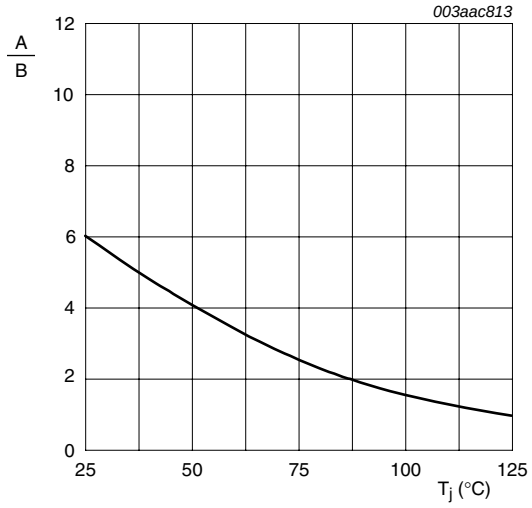


Fig 12. Normalized holding current as a function of junction temperature



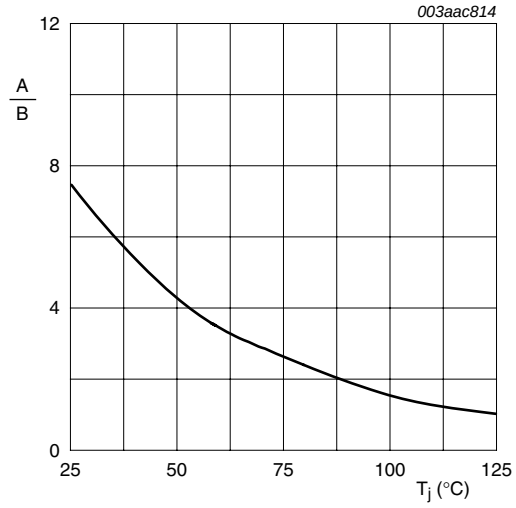
$V_o = 1.043$ V; $R_s = 0.239\ \Omega$
(1) $T_j = 125$ °C; typical values
(2) $T_j = 125$ °C; maximum values
(3) $T_j = 25$ °C; maximum values

Fig 13. On-state current as a function of on-state voltage



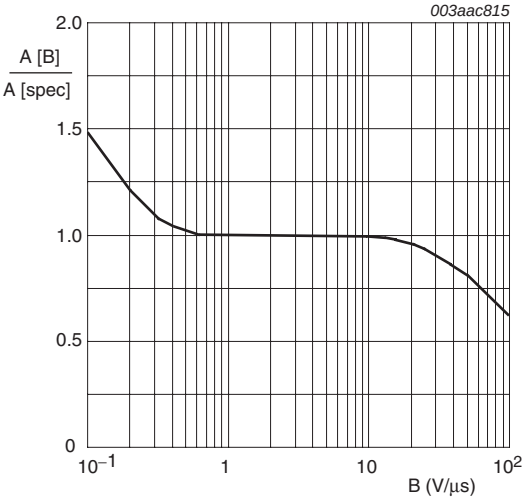
A is $dV_D/\mathrm{d}t$ at condition T_j °C
B is $dV_D/\mathrm{d}t$ at condition $T_j = 125$ °C

Fig 14. Normalized rate of rise of off-state voltage as a function of junction temperature



A is $dI_{com}/\mathrm{d}t$ at condition T_j °C
B is $dI_{com}/\mathrm{d}t$ at $T_j = 125$ °C $V_D = 400$ V

Fig 15. Normalized critical rate of rise of commutating current as a function of junction temperature



A[B] is $\frac{dI_{com}}{dt}$ at condition B, $\frac{dV_{com}}{dt}$

A[spec] is the specified data sheet value of $\frac{dI_{com}}{dt}$

Fig 16. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

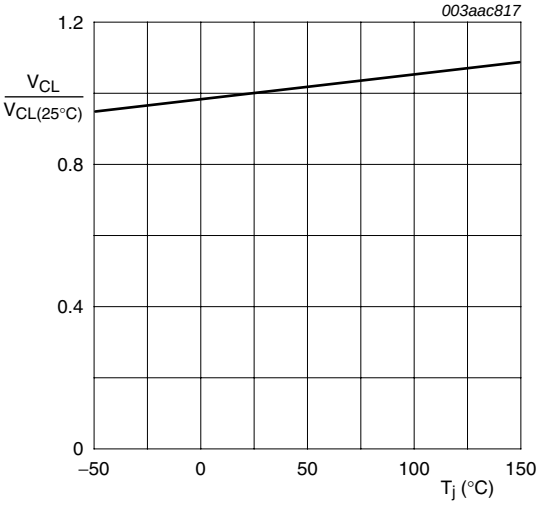
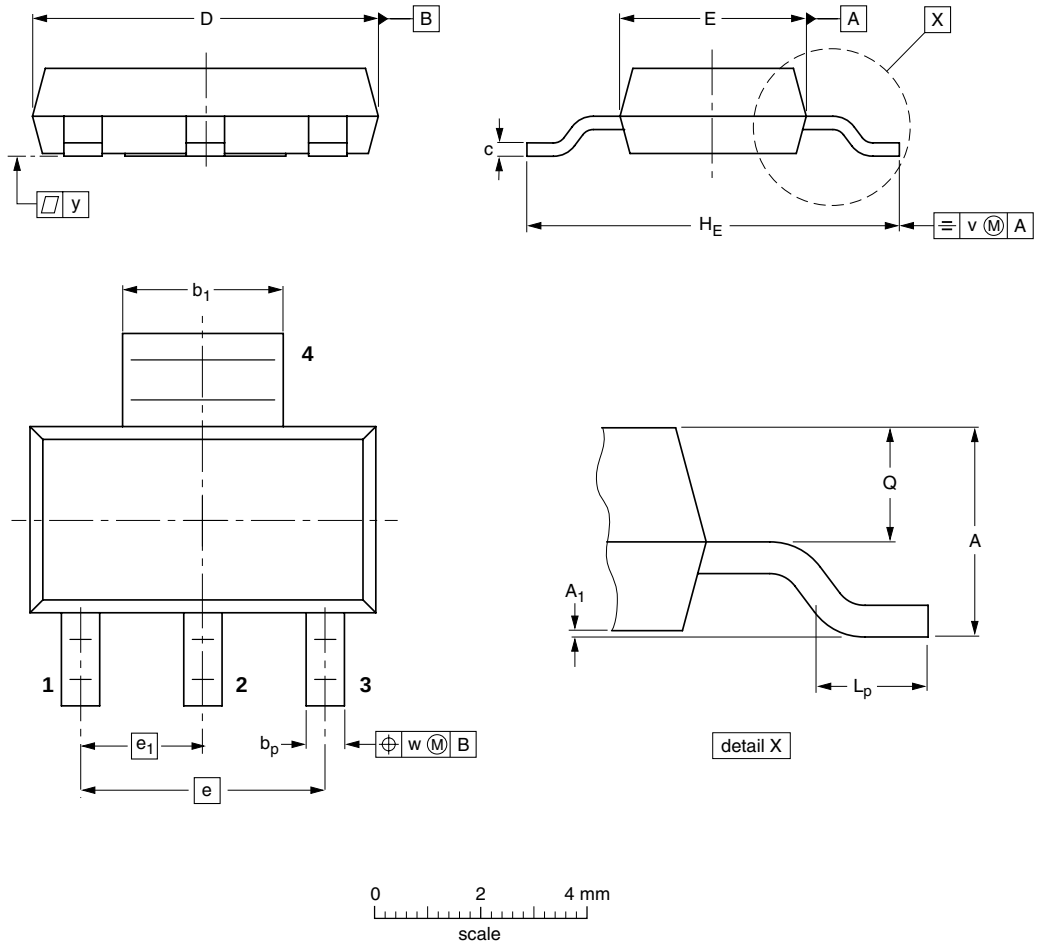


Fig 17. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values

7. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads **SOT223**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT223			SC-73			~~04-11-10~~ 06-03-16

Fig 18. Package outline SOT223 (SC-73)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
ACT108W-600E_3	20091021	Product data sheet	-	ACT108W-600E_2
Modifications:	• Various changes to content.			
ACT108W-600E_2	20090526	Product data sheet	-	ACT108W-600E_1
ACT108W-600E_1	20090429	Product data sheet	-	-

9. Legal information

9.1 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.
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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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Date of release: 21 October 2009
Document identifier: ACT108W-600E_3