ACT108W-600E

AC Thyristor power switch

Rev. 04 — 9 December 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
- Surface-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

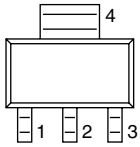
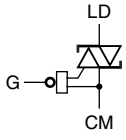
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	600	V
I_{GT}	gate trigger current	V_D = 12 V; I_T = 100 mA; LD+ G-; T_j = 25 °C; see Figure 10	1	-	10	mA
		V_D = 12 V; I_T = 100 mA; LD- G-; T_j = 25 °C	1	-	10	mA
$I_{T(RMS)}$	RMS on-state current	full sine wave; 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		
2	CM	common		
3	G	gate		
4	CM	common		

SOT223 (SC-73)

001aaj924

3. Ordering information

Table 3. Ordering information

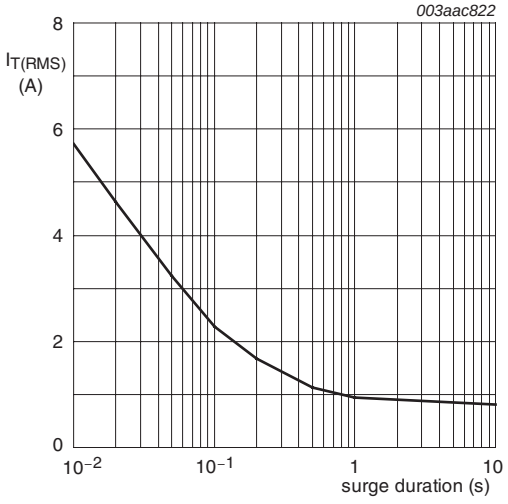
Type number	Package		
	Name	Description	Version
ACT108W-600E	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

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; sine-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

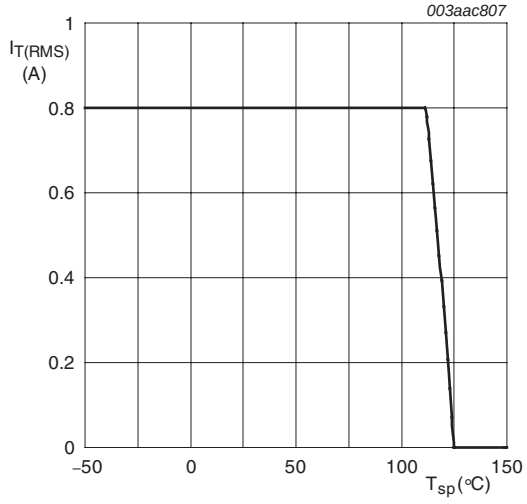
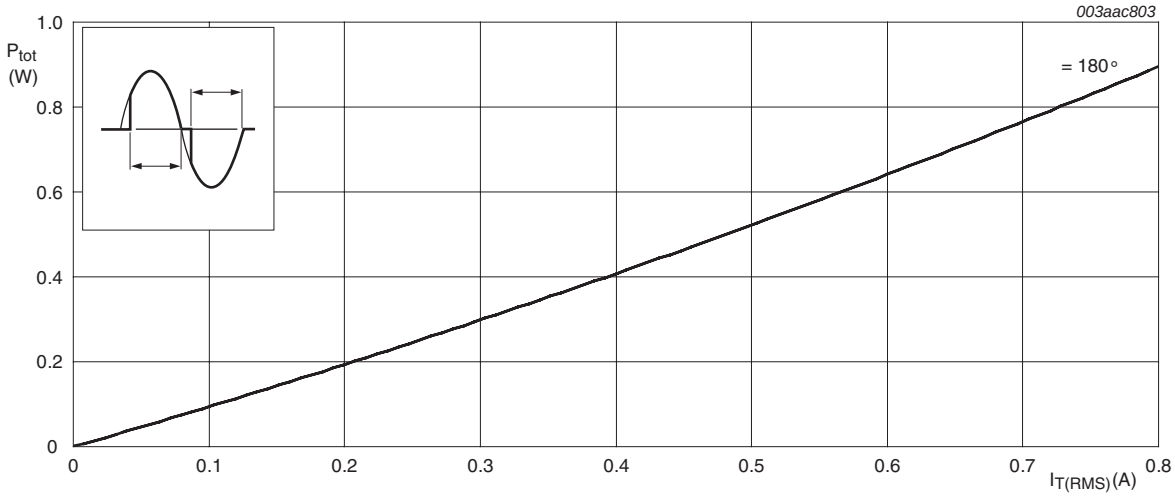
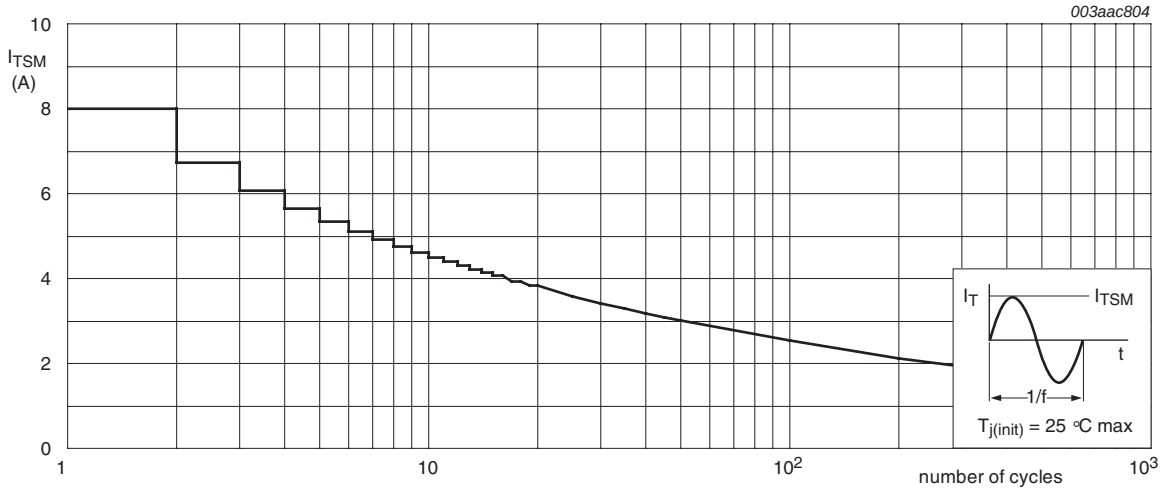


Fig 2. RMS on-state current as a function of solder point temperature; maximum values



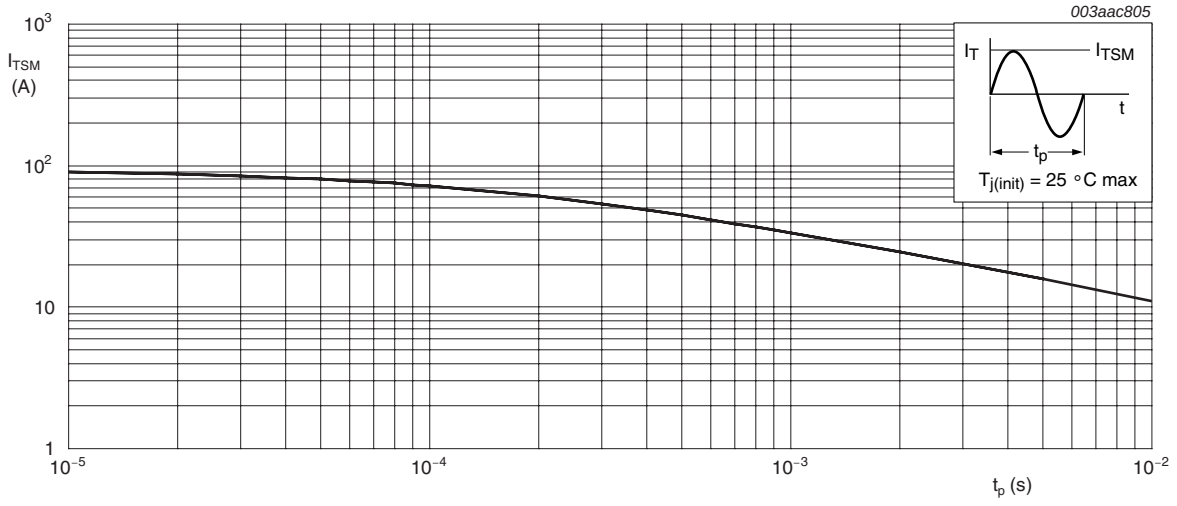
α = conduction angle

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

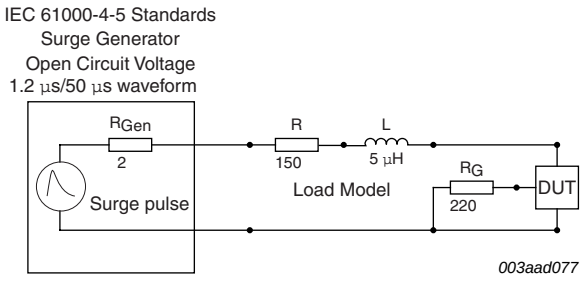
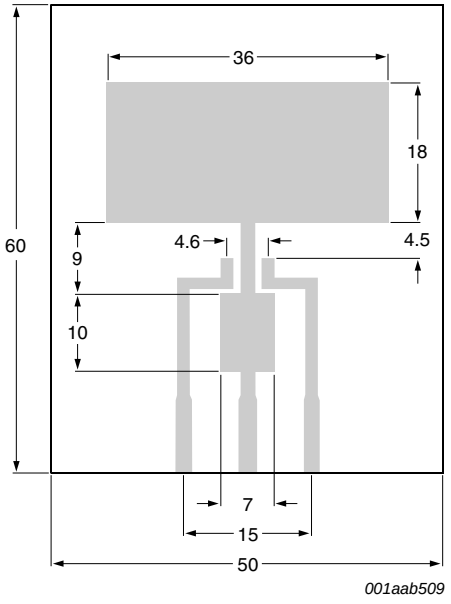


Fig 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

5. Thermal characteristics

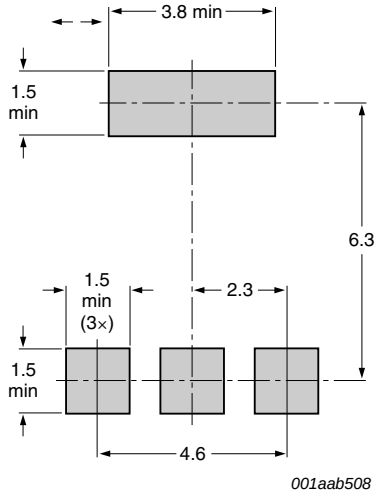
Table 5. Thermal characteristics

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 mmPrinted-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

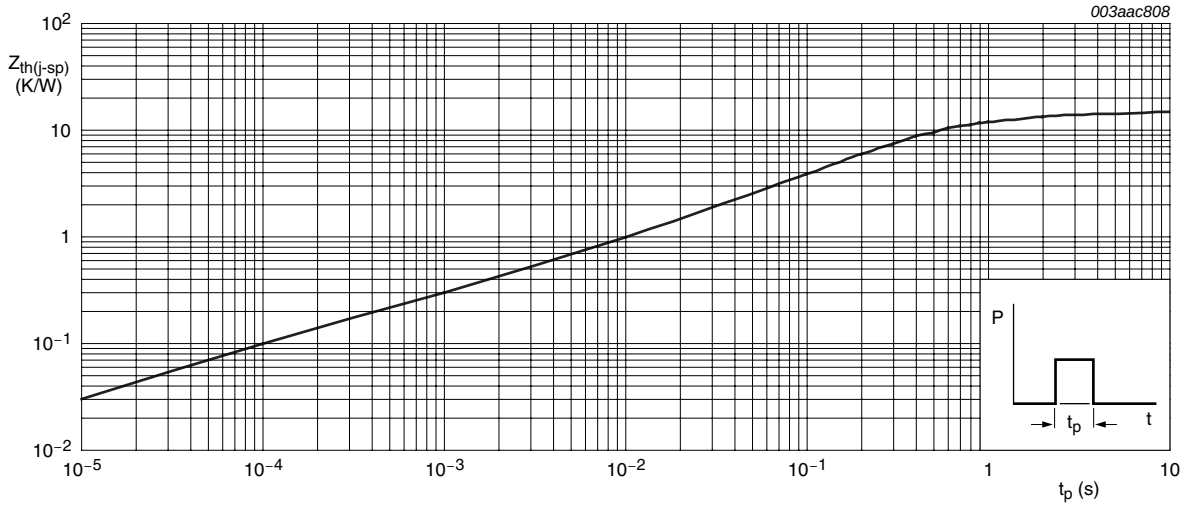
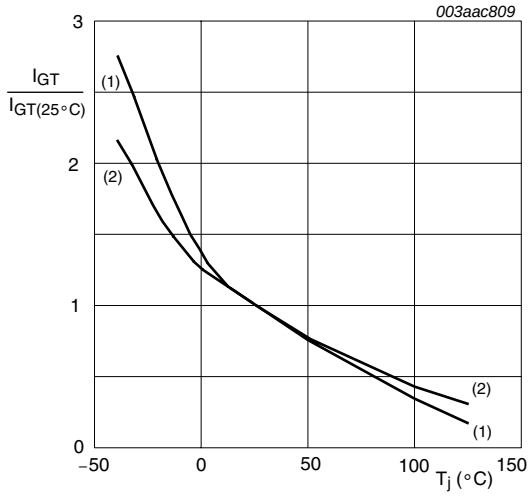


Fig 9. Transient thermal impedance from junction to solder point as a function of pulse width

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

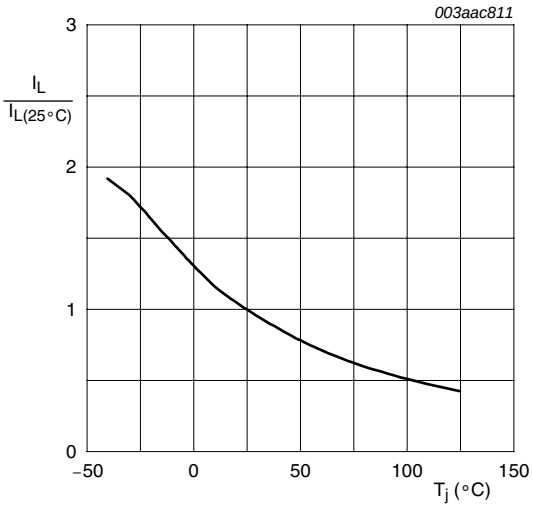


Fig 11. Normalized latching current as a function of junction temperature

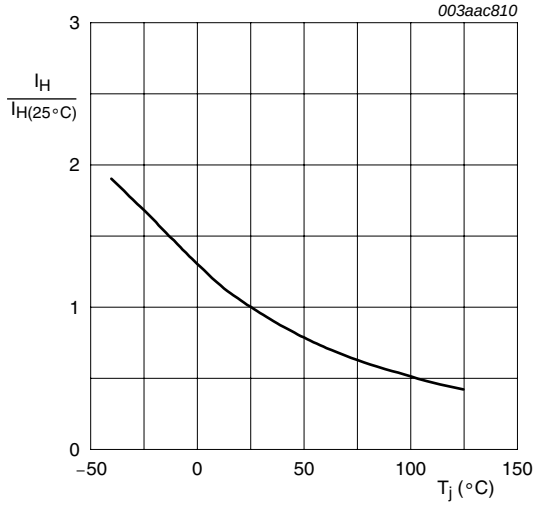
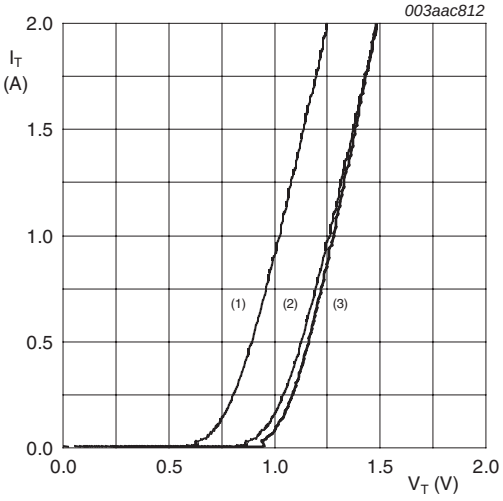


Fig 12. Normalized holding current as a function of junction temperature



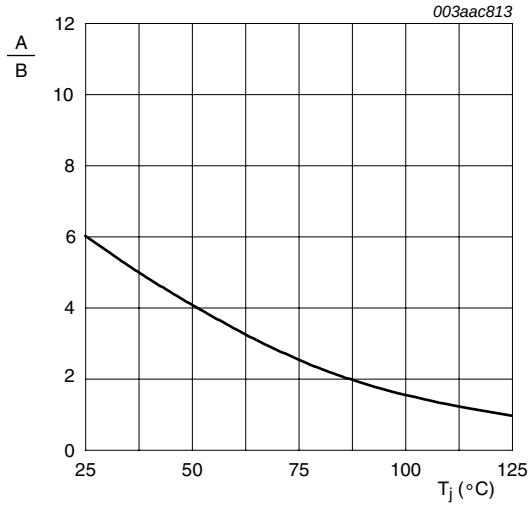
$V_o = 1.043$ V; $R_s = 0.239\ \Omega$

(1) $T_j = 125$ °C; typical values

(2) $T_j = 125$ °C; maximum values

(3) $T_j = 25$ °C; maximum values

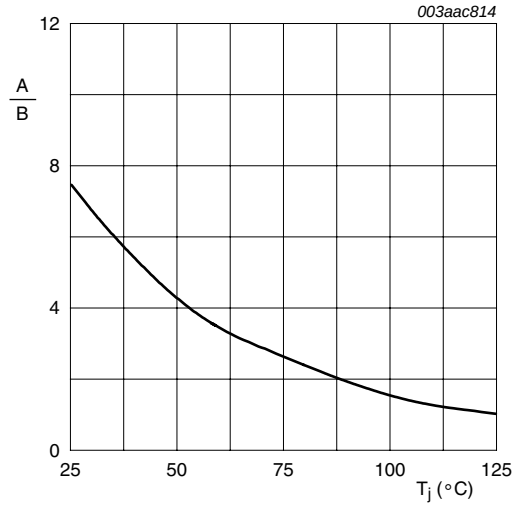
Fig 13. On-state current as a function of on-state voltage



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

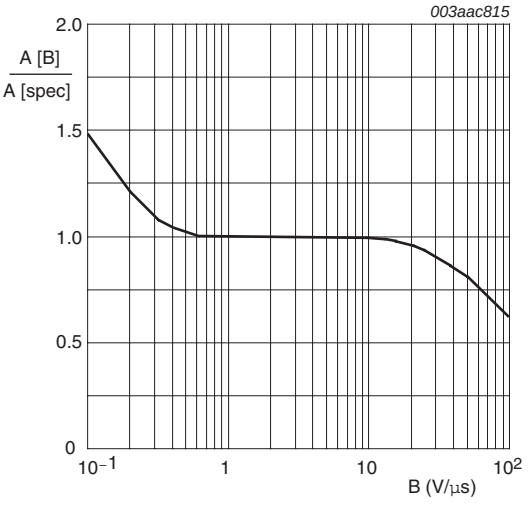
Fig 14. Normalized rate of rise of off-state voltage as a function of junction temperature



A is $dI_{com}/\mathrm{d}t$ at condition T_j °C

B is $dI_{com}/\mathrm{d}t$ at T_j = 125 °CV_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

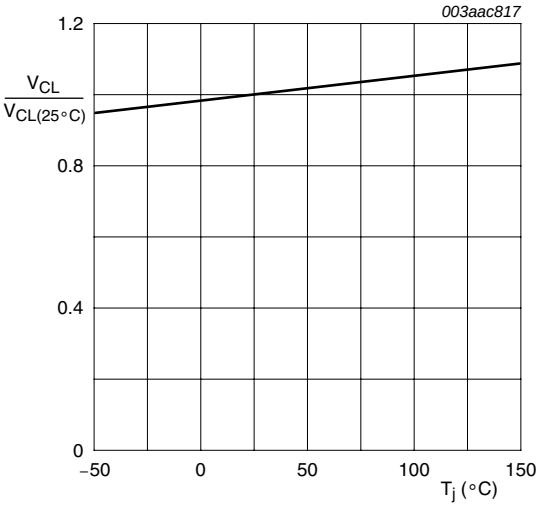
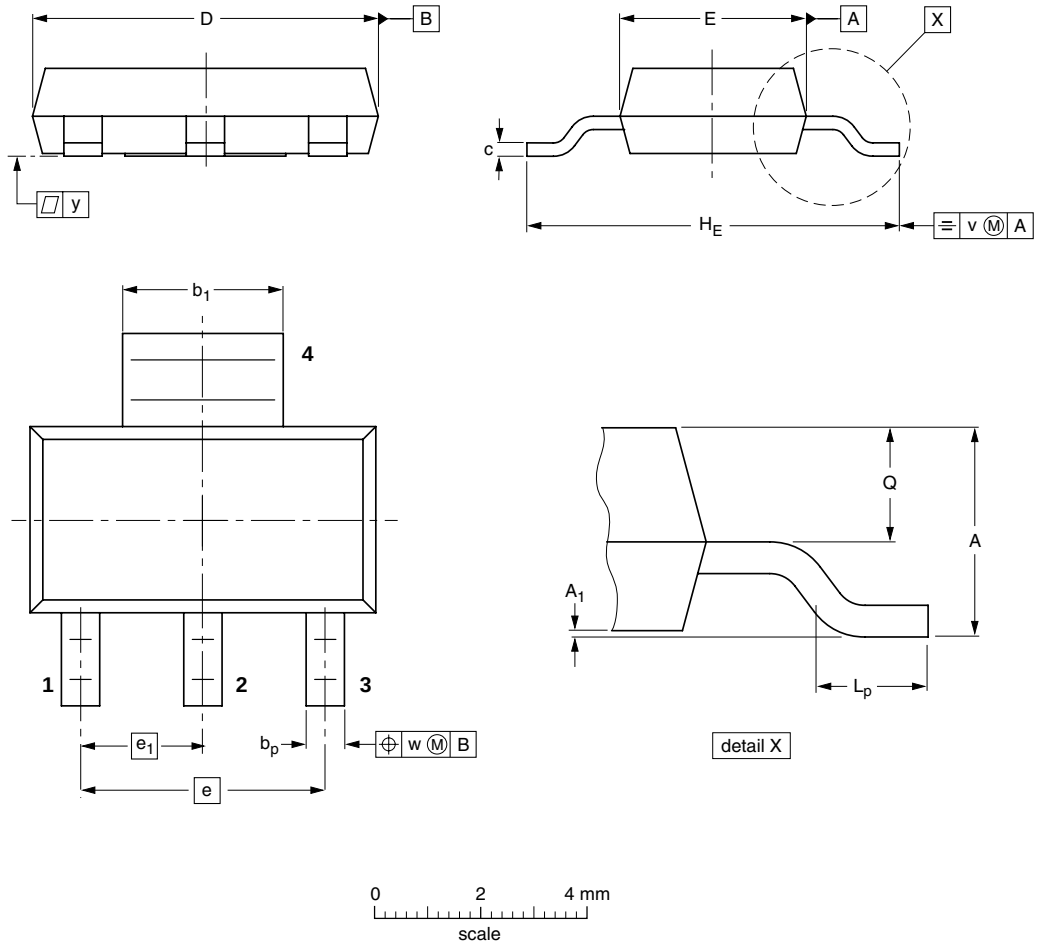


Fig 17. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values

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_4	20091209	Product data sheet	-	ACT108W-600E_3
Modifications:	• Various changes to content.			
ACT108W-600E_3	20091021	Product data sheet	-	ACT108W-600E_2
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".

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11. Contents

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