# ACT108W-600E

## AC Thyristor power switch

Rev. 5 — 13 July 2010 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 data**

| 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 4; see Figure 1; see Figure 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 |

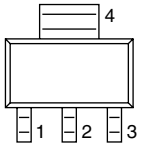
**Table 1. Quick reference data** *...continued*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CL}$ | clamping voltage | $I_{CL}$ = 100 µA; $t_p$ = 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 3 | - | - | 2 | kV |
| $V_T$ | on-state voltage | $I_T$ = 1.1 A; see Figure 13 | - | - | 1.3 | V |

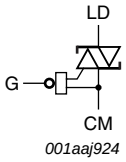
## 2. Pinning information

**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)**

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## 3. Ordering information

**Table 3. Ordering information**

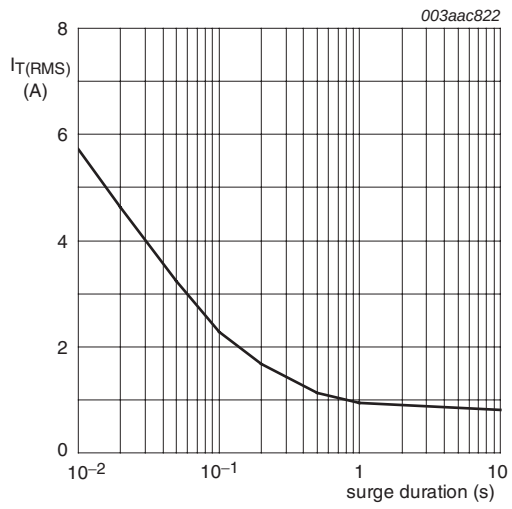
| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| ACT108W-600E | SC-73 | plastic surface-mounted package with increased heatsink; 4 leads | SOT223 |

## 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 4; see Figure 1; see Figure 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 5; see Figure 6 | - | 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 3 | - | 2 | kV |




f = 50 Hz

$T_{sp} = 112$ °C

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

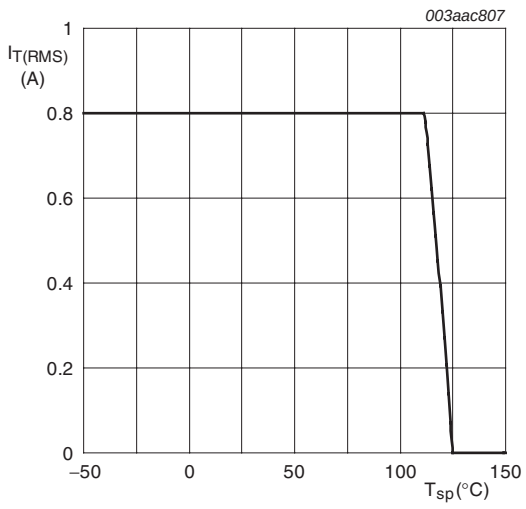



**Fig 2. RMS on-state current as a function of solder point temperature; maximum values**

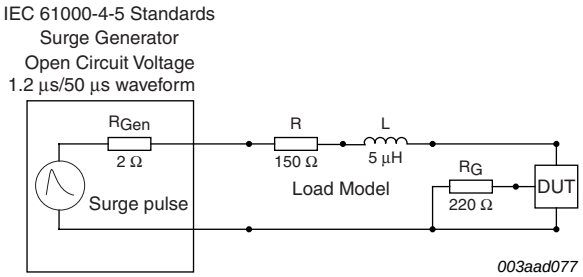
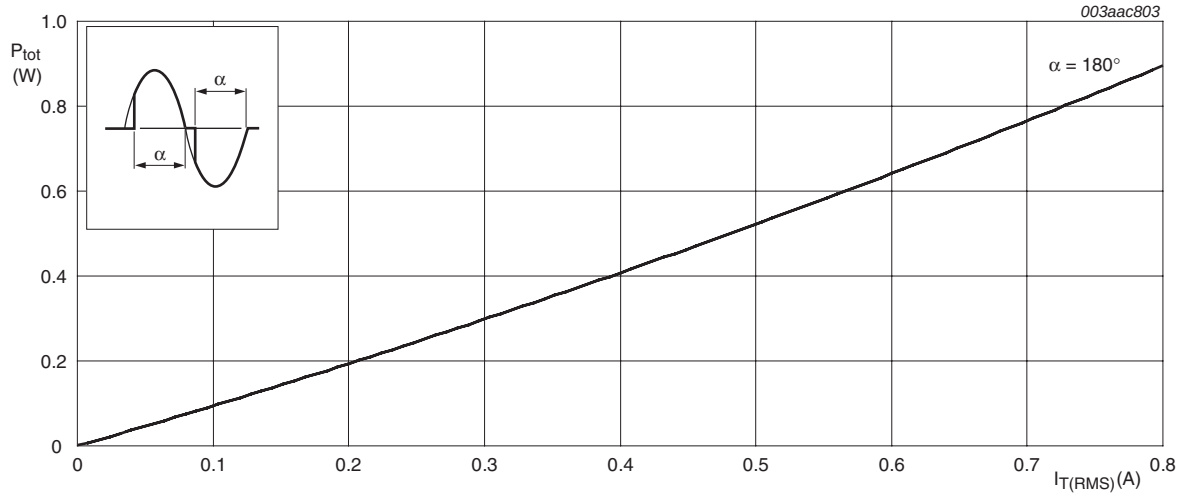
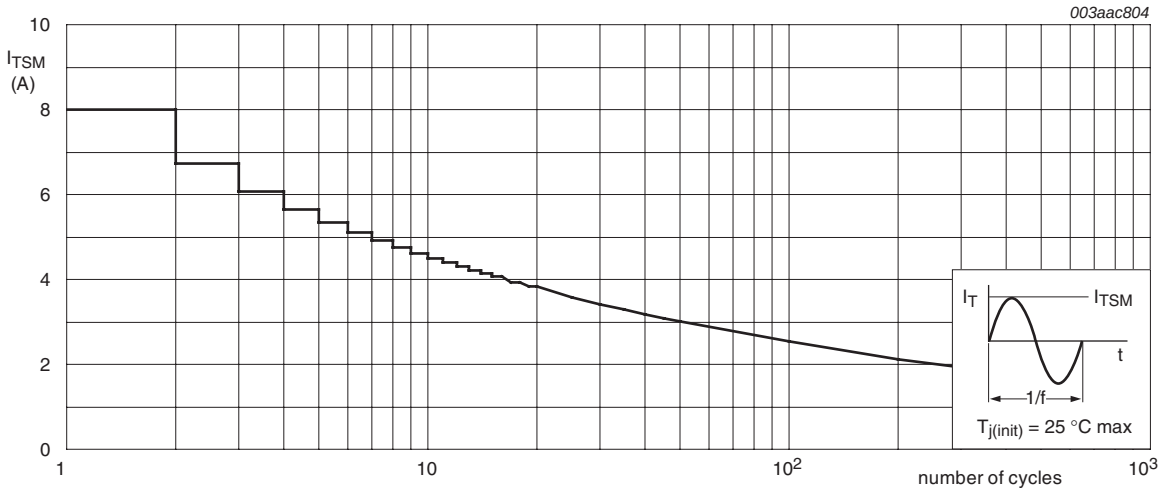



**Fig 3. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5**



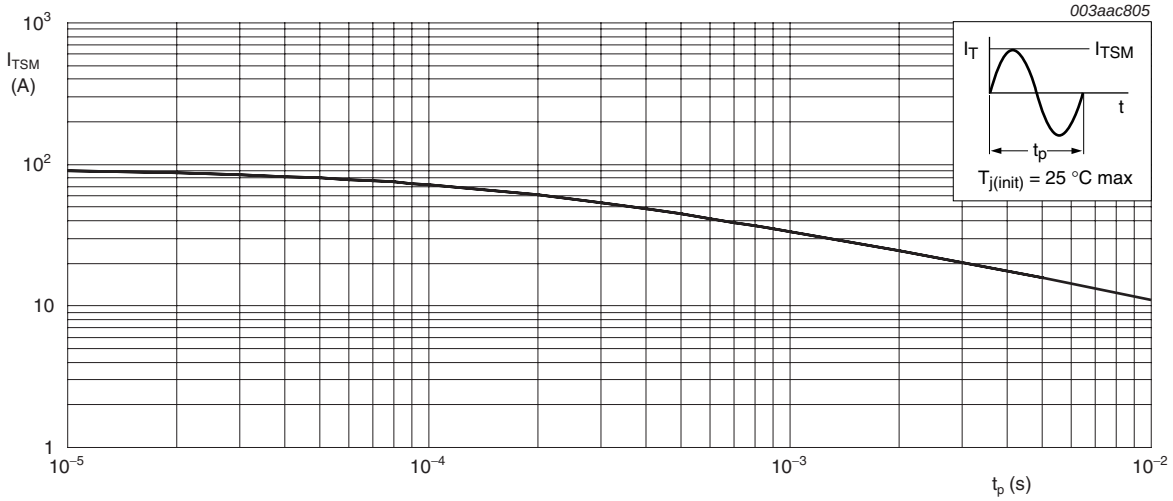

α = conduction angle

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




f = 50 Hz

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



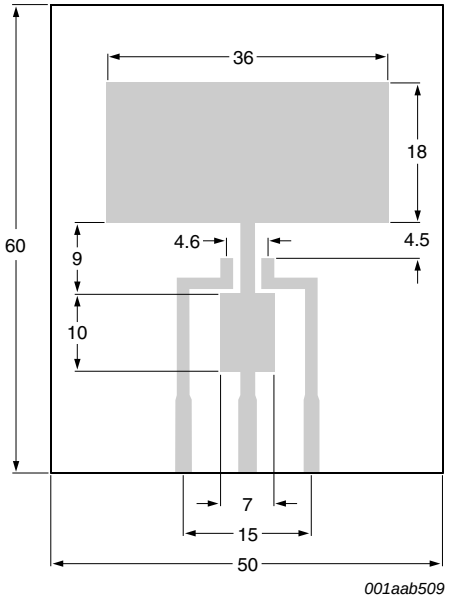

$t_p \leq 20$ ms

**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 |
|---|---|---|---|---|---|---|
| $R_{th(j-sp)}$ | 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 |

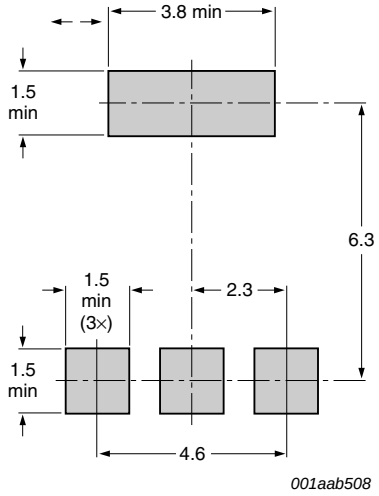



All dimensions are in mm

Printed-circuit board:

FR4 epoxy glass (1.6 mm thick), copper laminate (35 um thick),

**Fig 7. Printed-circuit board pad area SOT223**




All dimensions are in mm

**Fig 8. Minimum footprint SOT223**

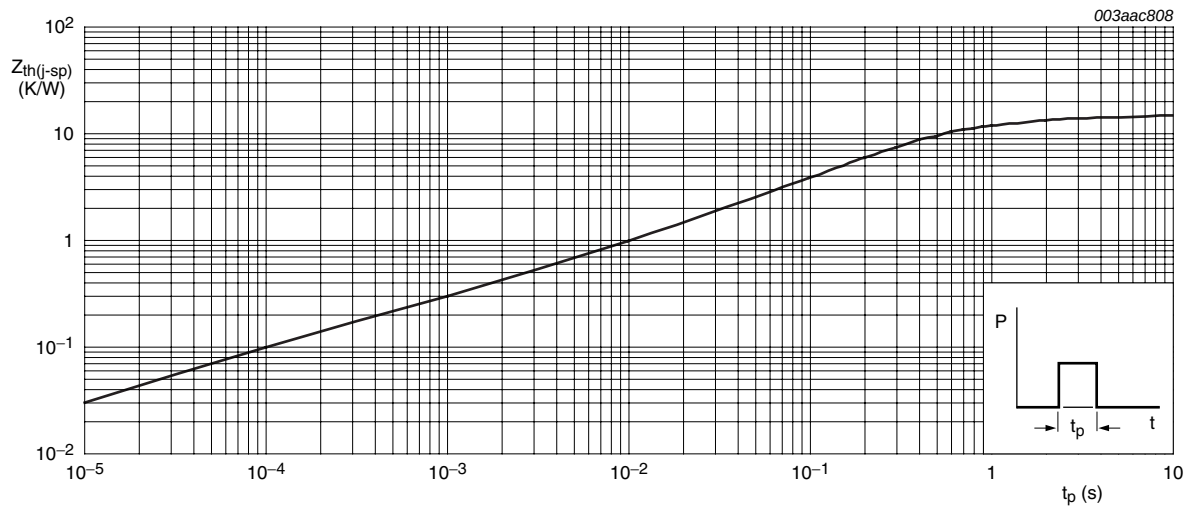
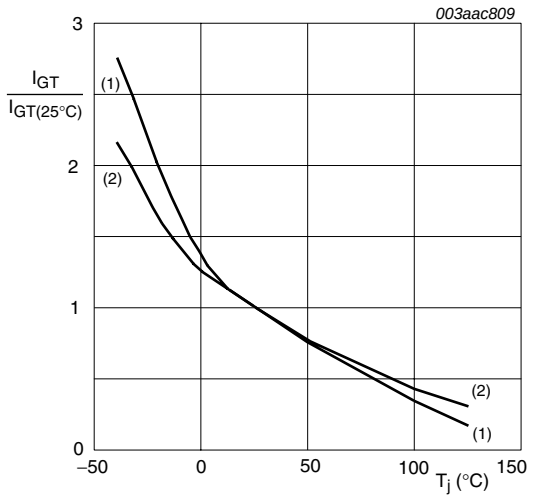



**Fig 9. Transient thermal impedance from junction to solder point as a function of pulse width**

## 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 | $V_D$ = 12 V; $I_T$ = 100 mA; $T_j$ ≤ 125 °C | 0.15 | - | - | V |
| | | $V_D$ = 12 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; see Figure 16 | 0.3 | - | - | A/ms |
| $V_{CL}$ | clamping voltage | $I_{CL}$ = 100 µA; $t_p$ = 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**

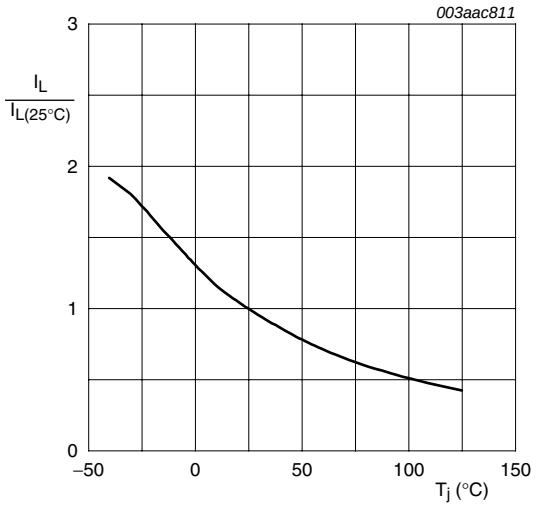



**Fig 11. Normalized latching current as a function of junction temperature**

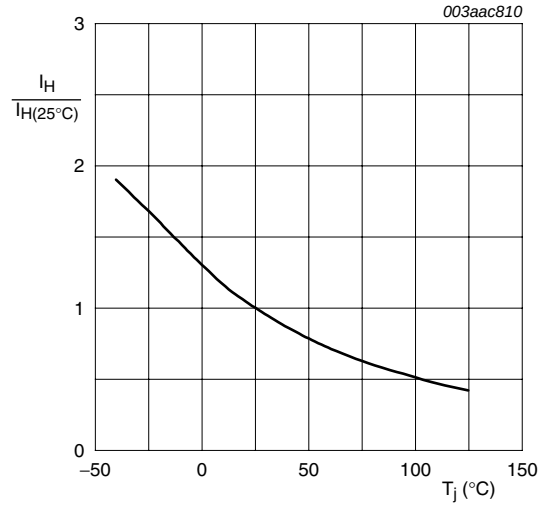
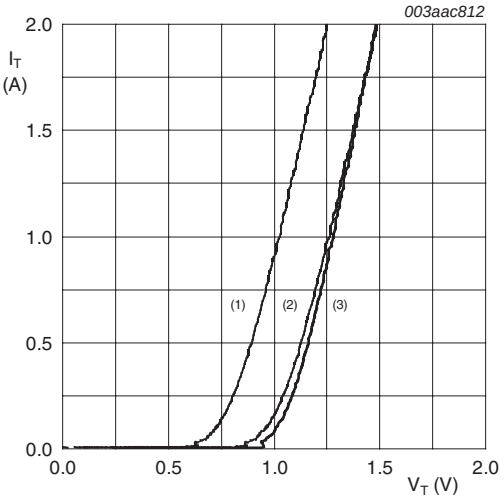



**Fig 12. Normalized holding current as a function of junction temperature**



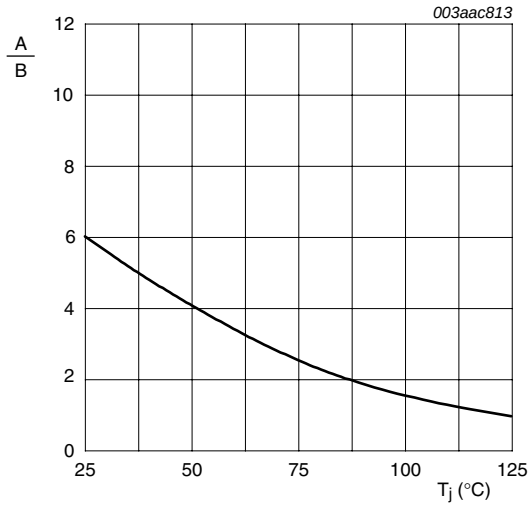

$V_O$ = 0.758 V; $R_S$ = 0.263 Ω

(1)$T_j$ = 125 °C; typical values

(2)$T_j$ = 125 °C; maximum values

(3)$T_j$ = 25 °C; maximum values

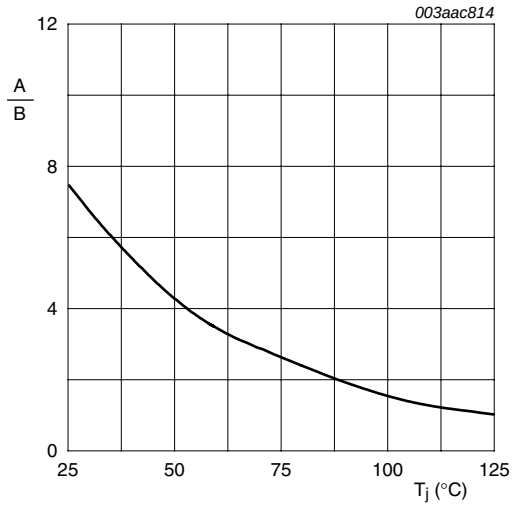
**Fig 13. On-state current as a function of on-state voltage**




A is $dV_D/dt$ at condition $T_j$ °C

B is $dV_D/dt$ at condition $T_j$ 125 °C

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

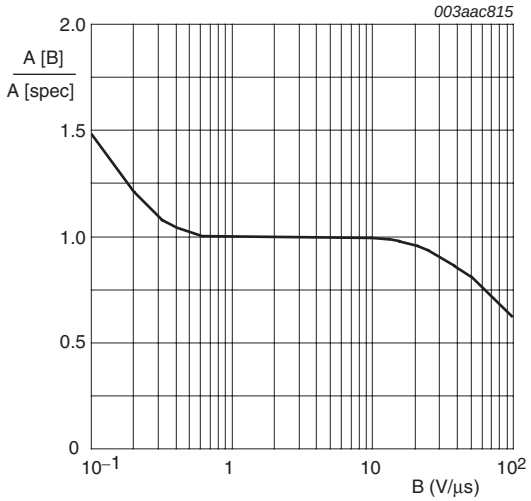



A is $dI_{com}/dt$ at condition $T_j$ °C

B is $dI_{com}/dt$ at condition $T_j$ 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 $dI_{com}/dt$ at condition B, $dV_{com}/dt$

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

turn-off time < 20 ms

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

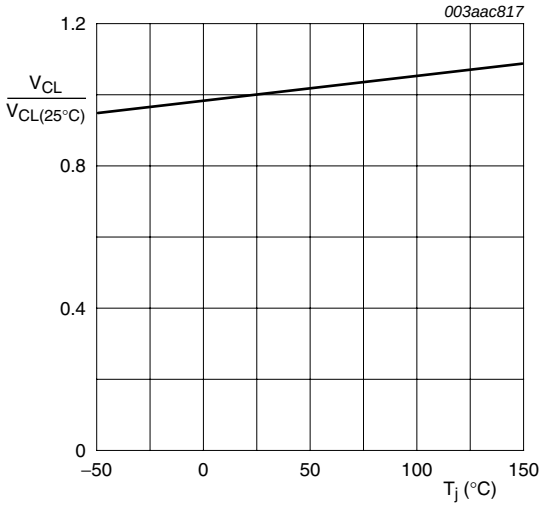
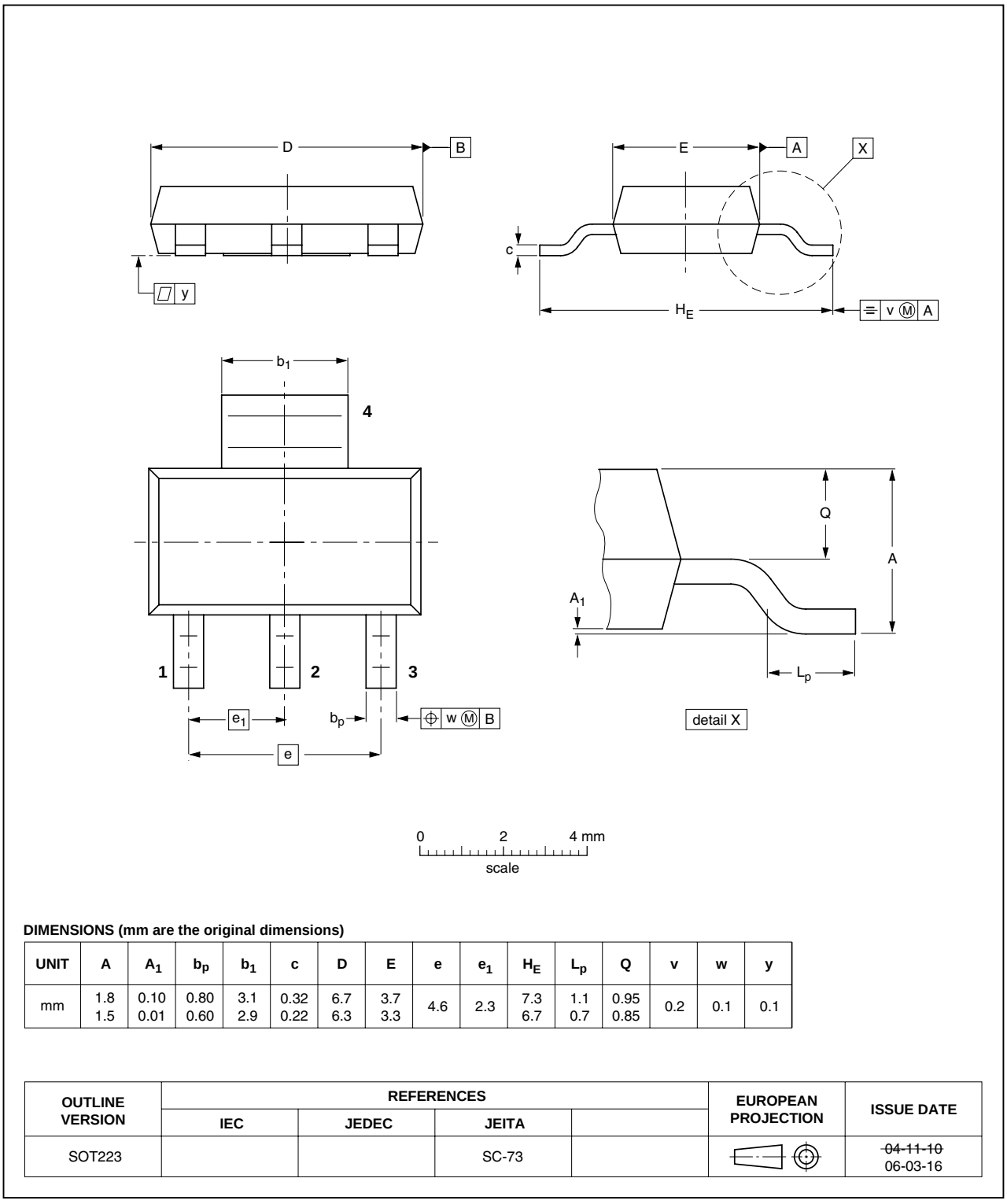



**Fig 17. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values**

## 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<br>1.5 | 0.10<br>0.01 | 0.80<br>0.60 | 3.1<br>2.9 | 0.32<br>0.22 | 6.7<br>6.3 | 3.7<br>3.3 | 4.6 | 2.3 | 7.3<br>6.7 | 1.1<br>0.7 | 0.95<br>0.85 | 0.2 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT223 | | | SC-73 | | | ~~04-11-10~~<br>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 v.5 | 20100713 | Product data sheet | - | ACT108W-600E v.4 |
| Modifications: | • Various changes to content. | | | |
| ACT108W-600E v.4 | 20091209 | 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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## 11. Contents





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