

# ACT108-600D

## AC Thyristor power switch

Rev. 02 — 27 December 2010

Product data sheet

## 1. Product profile

### 1.1 General description

AC Thyristor power switch in a SOT54 plastic package with self-protective capabilities against low and high energy transients

### 1.2 Features and benefits

- Exclusive negative gate triggering
- Full cycle AC conduction
- High noise immunity
- 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
- Very sensitive gate for lowest gate trigger current

### 1.3 Applications

- 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             |
|---------------------|-----------------------------------|---|-----|-----|-----|------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage |   | -   | -   | 600 | V                |
| $I_{\text{GT}}$     | gate trigger current              | $V_{\text{D}} = 12 \text{ V}$ ; $I_{\text{T}} = 100 \text{ mA}$ ; LD- G-; $T_{\text{j}} = 25 \text{ }^{\circ}\text{C}$  | 0.5 | -   | 5   | mA               |
|                     |                                   | $V_{\text{D}} = 12 \text{ V}$ ; $I_{\text{T}} = 100 \text{ mA}$ ; LD+ G-; $T_{\text{j}} = 25 \text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 6</a>         | 0.5 | -   | 5   | mA               |
| $I_{\text{T(RMS)}}$ | RMS on-state current              | full sine wave; $T_{\text{lead}} \leq 71 \text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>   | -   | -   | 0.8 | A                |
| $dV_{\text{D}}/dt$  | rate of rise of off-state voltage | $V_{\text{DM}} = 402 \text{ V}$ ; $T_{\text{j}} = 125 \text{ }^{\circ}\text{C}$ ; gate open circuit; exponential waveform; see <a href="#">Figure 10</a>      | 300 | -   | -   | V/ $\mu\text{s}$ |
| $V_{\text{CL}}$     | clamping voltage                  | $I_{\text{CL}} = 100 \text{ } \mu\text{A}$ ; $t_{\text{p}} = 1 \text{ ms}$ ; $T_{\text{j}} \leq 125 \text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 13</a> | 650 | -   | -   | V                |

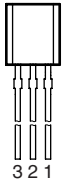
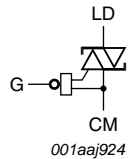


Table 1. Quick reference data ...continued

| Symbol   | Parameter            | Conditions  | Min | Typ | Max | Unit |
|----------|----------------------|---|-----|-----|-----|------|
| $V_{GT}$ | gate trigger voltage | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ;<br>$T_j = 25\text{ °C}$             | -   | -   | 0.9 | V    |
| $V_{PP}$ | peak pulse voltage   | $T_j = 25\text{ °C}$ ; non-repetitive,<br>off-state; see <a href="#">Figure 1</a> | -   | -   | 2   | kV   |
| $V_T$    | on-state voltage     | $I_T = 1.1\text{ A}$ ; see <a href="#">Figure 9</a>                               | -   | -   | 1.3 | V    |

## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline  | Graphic symbol  |
|-----|--------|-------------|---|---|
| 1   | CM     | common      |  |  |
| 2   | G      | gate        |   |   |
| 3   | LD     | load        |   |   |

**SOT54 (TO-92)**

## 3. Ordering information

Table 3. Ordering information

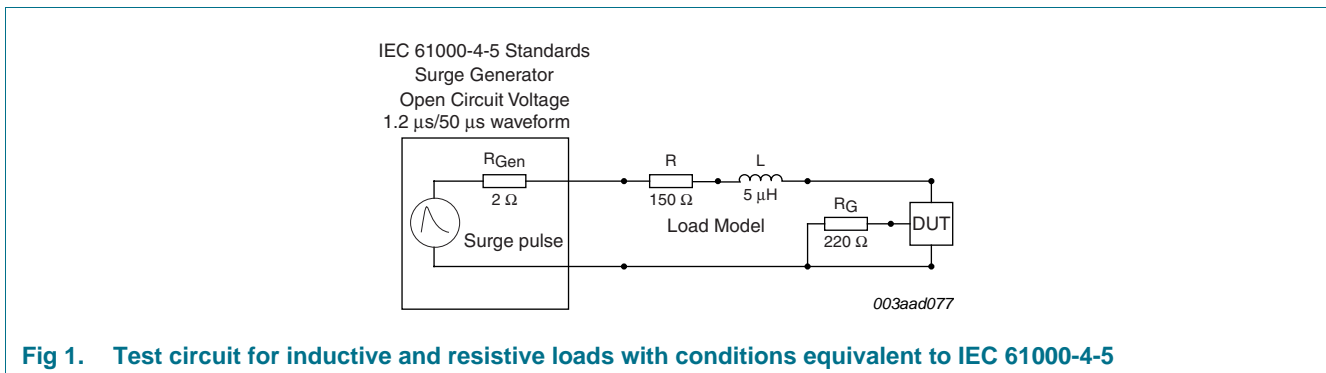
| Type number | Package |   | Version |
|-------------|---------|---|---------|
|             | Name    | Description   |         |
| ACT108-600D | TO-92   | plastic single-ended leaded (through hole) package; 3 leads | SOT54   |

### 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; $T_{lead} \leq 71\text{ }^{\circ}\text{C}$ ; see <a href="#">Figure 2</a>  | -   | 0.8  | A                      |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_p = 16.7\text{ ms}$   | -   | 8.8  | A                      |
|              |                                      | full sine wave; $T_{j(init)} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ;<br>see <a href="#">Figure 3</a> ; see <a href="#">Figure 4</a> | -   | 8    | A                      |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; sine-wave pulse   | -   | 0.32 | $\text{A}^2\text{s}$   |
| $dl_T/dt$    | rate of rise of on-state current     | $I_T = 1\text{ A}$ ; $I_G = 10\text{ mA}$ ; $dl_G/dt = 0.2\text{ A}/\mu\text{s}$   | -   | 50   | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | peak gate current                    | $t = 20\text{ }\mu\text{s}$  | -   | 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  | $^{\circ}\text{C}$     |
| $T_j$        | junction temperature                 |  | -   | 125  | $^{\circ}\text{C}$     |
| $V_{PP}$     | peak pulse voltage                   | $T_j = 25\text{ }^{\circ}\text{C}$ ; non-repetitive, off-state;<br>see <a href="#">Figure 1</a>  | -   | 2    | kV                     |



**Fig 1. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5**

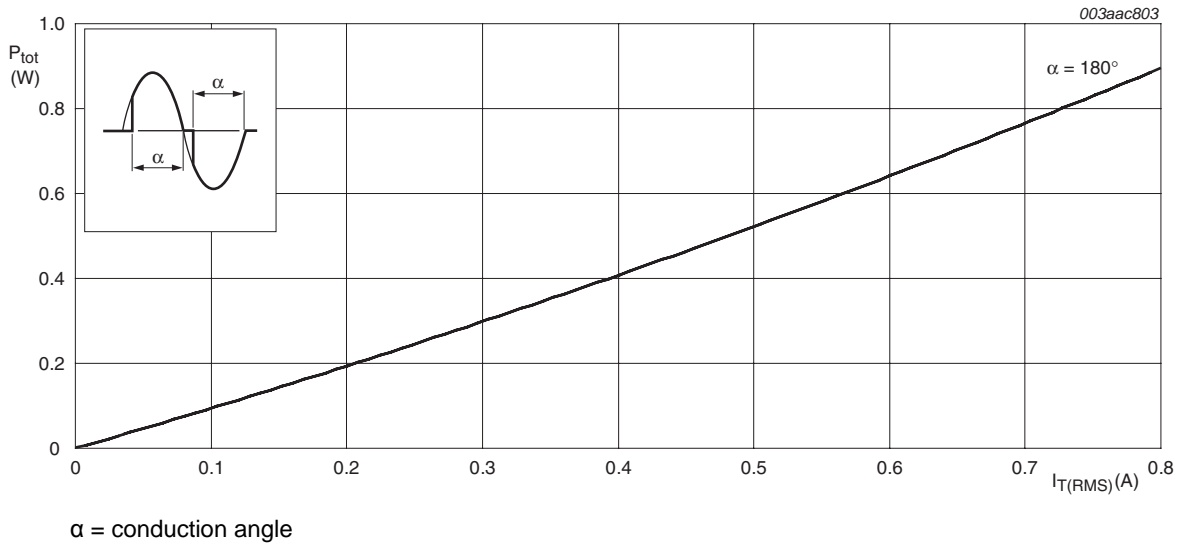


Fig 2. Total power dissipation as a function of RMS on-state current; maximum values

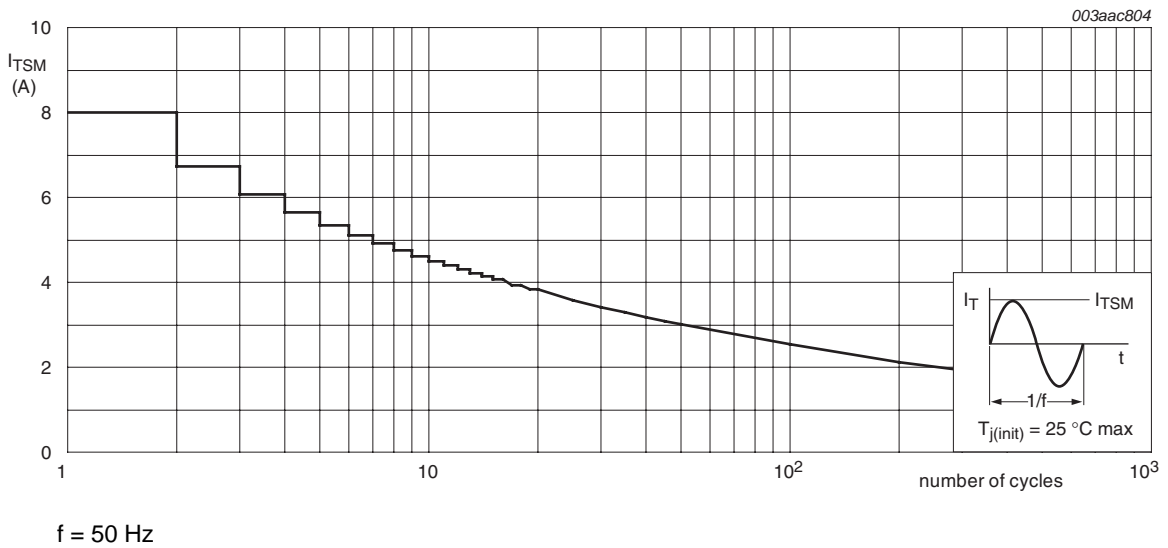
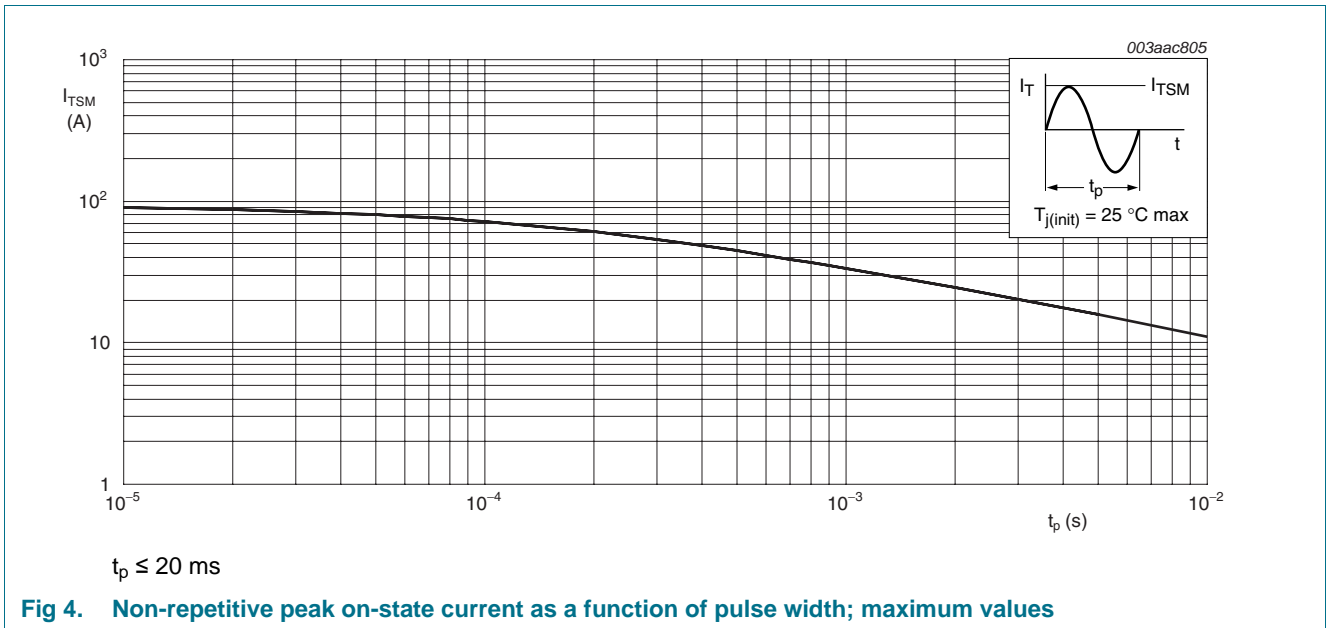


Fig 3. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



### 5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol           | Parameter                                   | Conditions  | Min | Typ | Max | Unit |
|------------------|---|---|-----|-----|-----|------|
| $R_{th(j-lead)}$ | thermal resistance from junction to lead    | full cycle with heatsink compound; see <a href="#">Figure 5</a> | -   | -   | 60  | K/W  |
| $R_{th(j-a)}$    | thermal resistance from junction to ambient | full cycle; printed-circuit board mounted; lead length 4 mm     | -   | 150 | -   | K/W  |

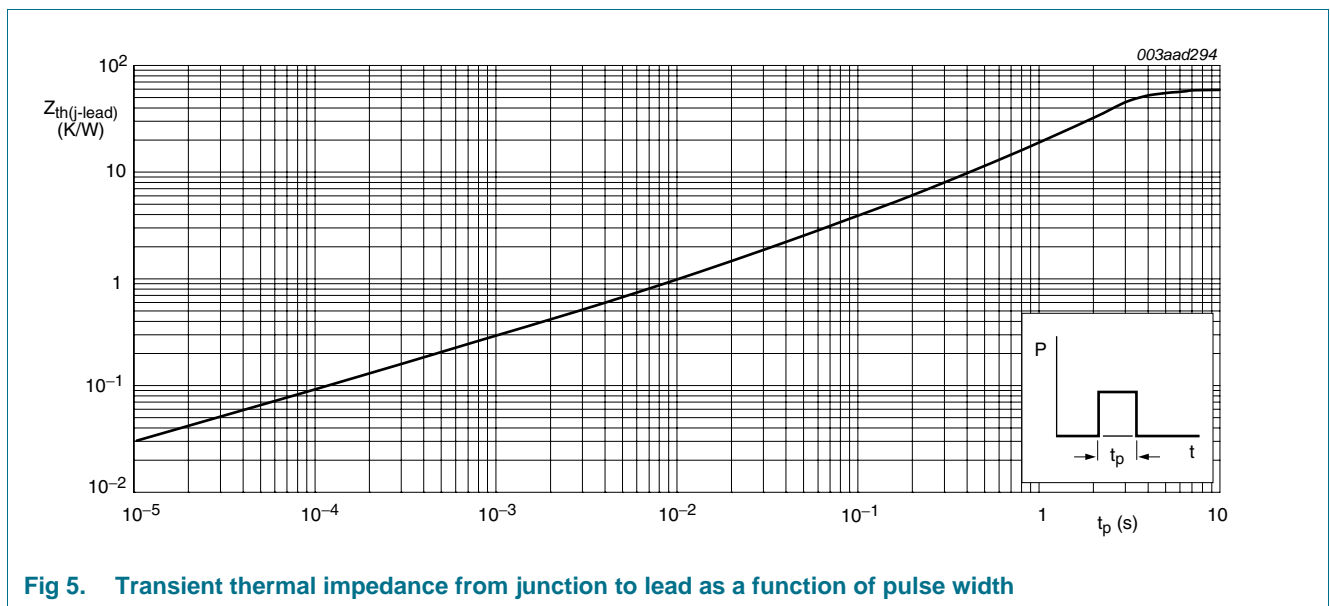
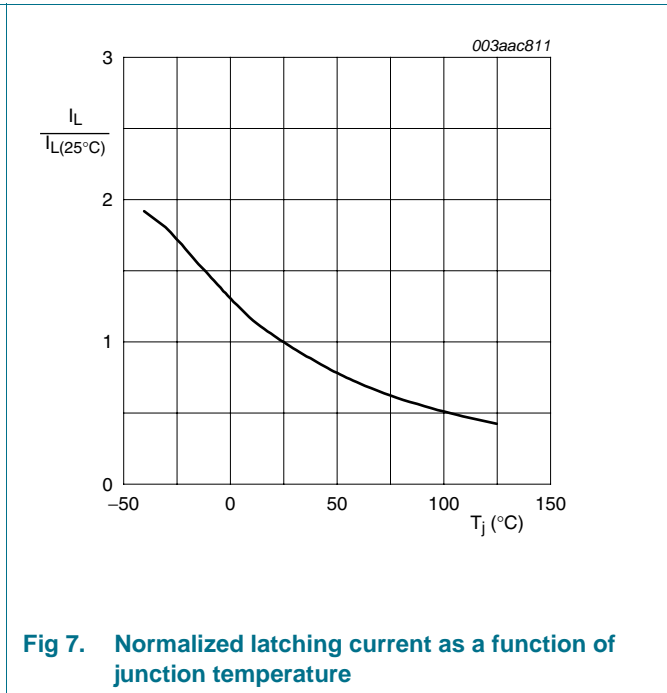
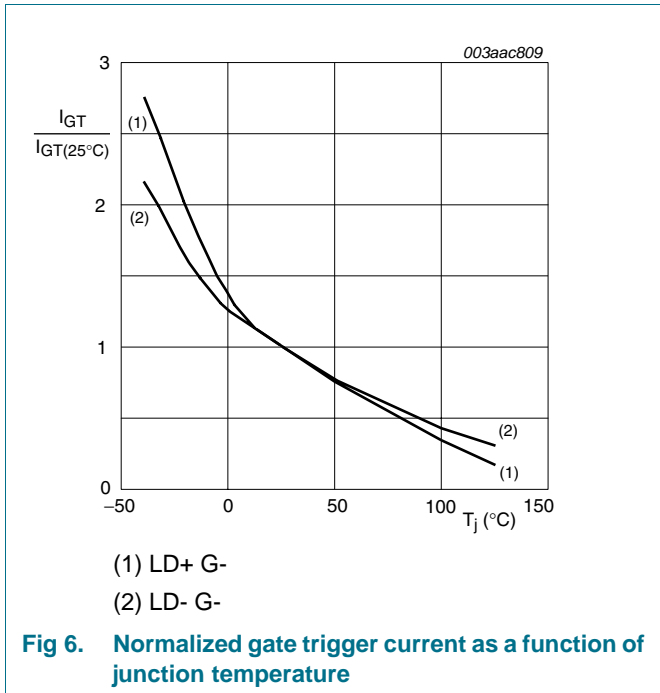


Fig 5. Transient thermal impedance from junction to lead as a function of pulse width

6. Characteristics

Table 6. Characteristics

| Symbol                | Parameter                             | Conditions  | Min  | Typ | Max | Unit |
|-----------------------|---------------------------------------|---|------|-----|-----|------|
| I <sub>GT</sub>       | gate trigger current                  | V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; LD- G-; T <sub>j</sub> = 25 °C  | 0.5  | -   | 5   | mA   |
|                       |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; LD+ G-; T <sub>j</sub> = 25 °C; see <a href="#">Figure 6</a>  | 0.5  | -   | 5   | mA   |
| I <sub>L</sub>        | latching current                      | V <sub>D</sub> = 12 V; I <sub>G</sub> = 12 mA; T <sub>j</sub> = 25 °C; see <a href="#">Figure 7</a>   | -    | -   | 25  | mA   |
| I <sub>H</sub>        | holding current                       | V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 8</a>   | -    | -   | 20  | mA   |
| V <sub>T</sub>        | on-state voltage                      | I <sub>T</sub> = 1.1 A; see <a href="#">Figure 9</a>  | -    | -   | 1.3 | V    |
| V <sub>GT</sub>       | gate trigger voltage                  | V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; T <sub>j</sub> ≤ 125 °C   | 0.15 | -   | -   | V    |
|                       |                                       | V <sub>D</sub> = 12 V; I <sub>T</sub> = 100 mA; T <sub>j</sub> = 25 °C  | -    | -   | 0.9 | V    |
| I <sub>D</sub>        | off-state current                     | V <sub>D</sub> = 600 V; T <sub>j</sub> ≤ 25 °C  | -    | -   | 2   | µA   |
|                       |                                       | V <sub>D</sub> = 600 V; T <sub>j</sub> ≤ 125 °C   | -    | -   | 0.2 | mA   |
| dV <sub>D</sub> /dt   | rate of rise of off-state voltage     | V <sub>DM</sub> = 402 V; T <sub>j</sub> = 125 °C; gate open circuit; exponential waveform; see <a href="#">Figure 10</a>  | 300  | -   | -   | V/µs |
| di <sub>com</sub> /dt | rate of change of commutating current | V <sub>D</sub> = 400 V; T <sub>j</sub> = 125 °C; I <sub>T(RMS)</sub> = 1 A; dV <sub>com</sub> /dt = 15 V/µs; gate open circuit; see <a href="#">Figure 11</a> ; see <a href="#">Figure 12</a> | 0.15 | -   | -   | A/ms |
| V <sub>CL</sub>       | clamping voltage                      | I <sub>CL</sub> = 100 µA; t <sub>p</sub> = 1 ms; T <sub>j</sub> ≤ 125 °C; see <a href="#">Figure 13</a>   | 650  | -   | -   | V    |



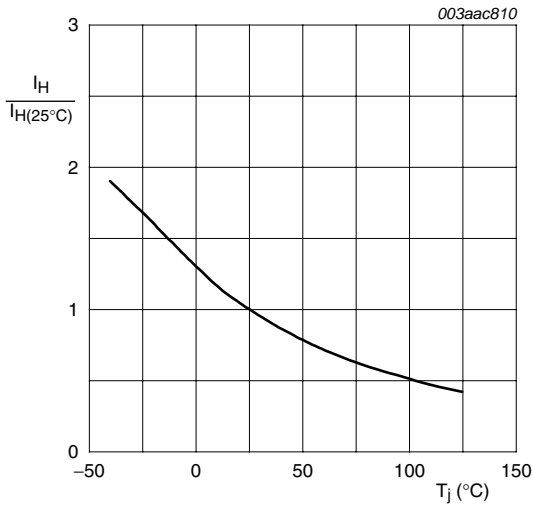
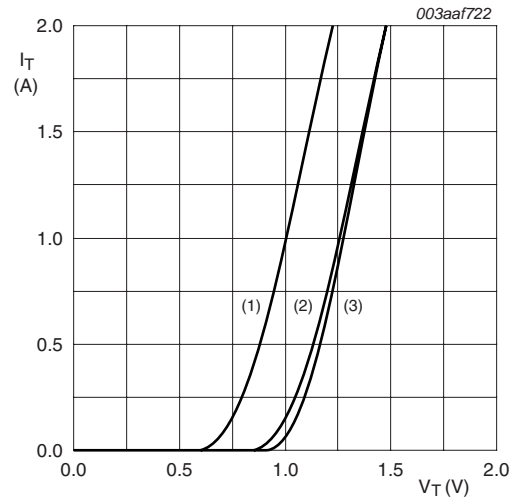
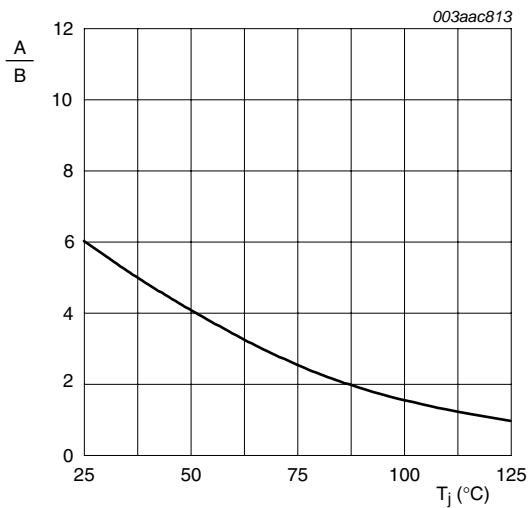


Fig 8. Normalized holding current as a function of junction temperature



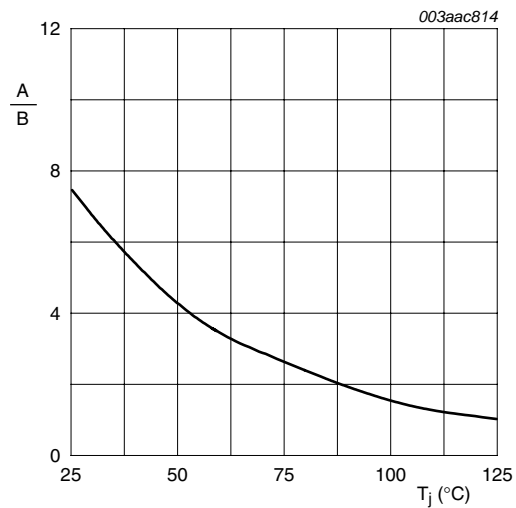
$V_o = 0.758 V$   
 $R_s = 0.263 \Omega$   
 (1)  $T_j = 125 \text{ }^\circ\text{C}$  ; typical values  
 (2)  $T_j = 125 \text{ }^\circ\text{C}$  ; maximum values  
 (3)  $T_j = 25 \text{ }^\circ\text{C}$  ; maximum values

Fig 9. On-state current as a function of on-state voltage



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

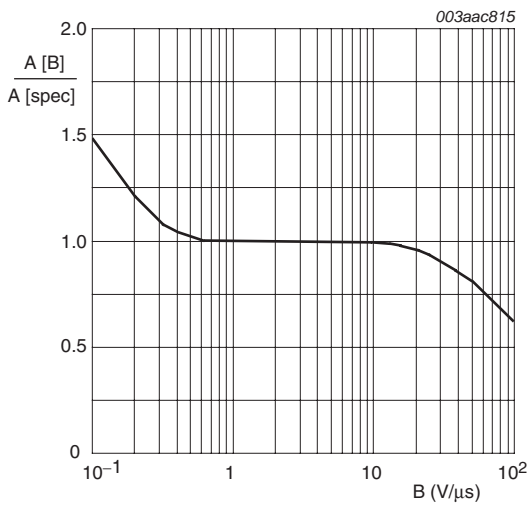
Fig 10. Normalized rate of rise of off-state voltage as a function of junction temperature



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

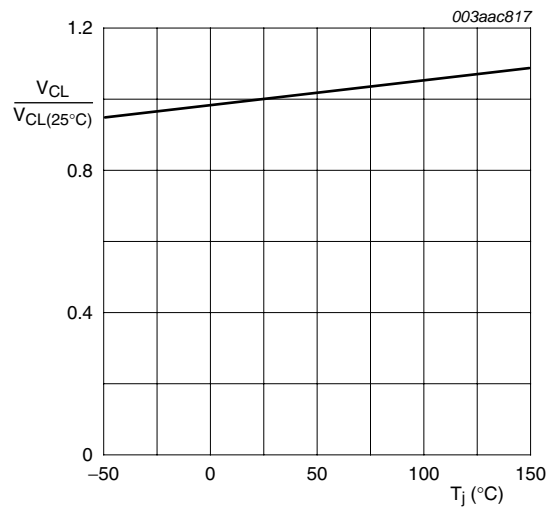
Fig 11. Normalized critical rate of rise of commutating current as a function of junction temperature





A[B] is  $dl_{com}/dt$  at condition B,  $dV_{com}/dt$   
 A[spec] is the specified data sheet value of  $dl_{com}/dt$   
 turn-off time < 20 ms

**Fig 12. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values**



**Fig 13. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values**

7. Package outline

Plastic single-ended leaded (through hole) package; 3 leads

SOT54

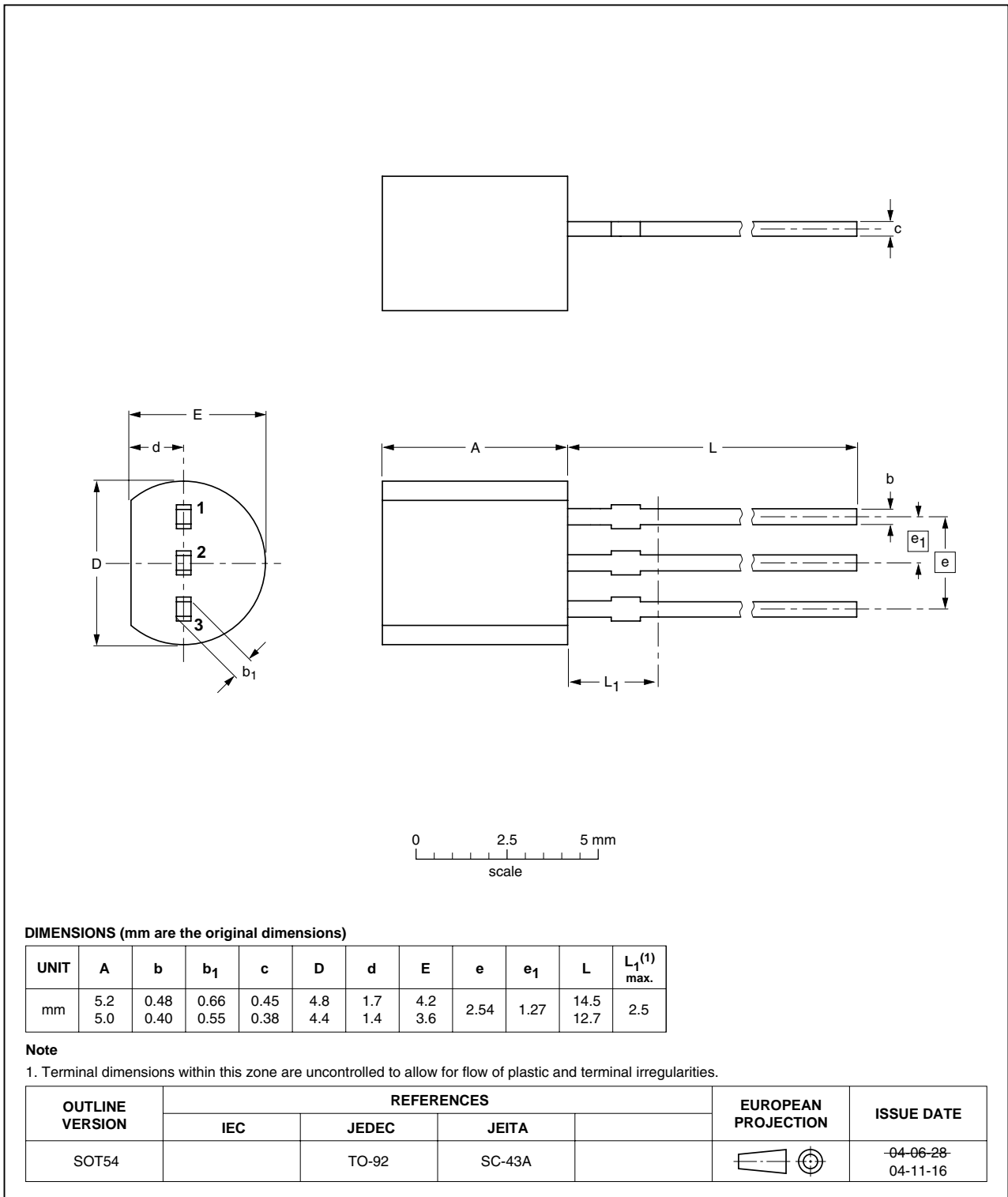


Fig 14. Package outline SOT54 (TO-92)

## 8. Revision history

Table 7. Revision history

| Document ID     | Release date  | Data sheet status      | Change notice | Supersedes      |
|-----------------|---|------------------------|---------------|-----------------|
| ACT108-600D v.2 | 20101227  | Product data sheet     | -             | ACT108-600D v.1 |
| Modifications:  | <ul style="list-style-type: none"><li>• Status changed from preliminary to product.</li><li>• Various changes to content.</li></ul> |                        |               |                 |
| ACT108-600D v.1 | 20100902  | Preliminary data sheet | -             | -               |

## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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|           |  |           |
|-----------|--|-----------|
| <b>1</b>  | <b>Product profile</b> . . . . .         | <b>1</b>  |
| 1.1       | General description . . . . .            | 1         |
| 1.2       | Features and benefits . . . . .          | 1         |
| 1.3       | Applications . . . . .                   | 1         |
| 1.4       | Quick reference data . . . . .           | 1         |
| <b>2</b>  | <b>Pinning information</b> . . . . .     | <b>2</b>  |
| <b>3</b>  | <b>Ordering information</b> . . . . .    | <b>2</b>  |
| <b>4</b>  | <b>Limiting values</b> . . . . .         | <b>3</b>  |
| <b>5</b>  | <b>Thermal characteristics</b> . . . . . | <b>6</b>  |
| <b>6</b>  | <b>Characteristics</b> . . . . .         | <b>7</b>  |
| <b>7</b>  | <b>Package outline</b> . . . . .         | <b>10</b> |
| <b>8</b>  | <b>Revision history</b> . . . . .        | <b>11</b> |
| <b>9</b>  | <b>Legal information</b> . . . . .       | <b>12</b> |
| 9.1       | Data sheet status . . . . .              | 12        |
| 9.2       | Definitions . . . . .                    | 12        |
| 9.3       | Disclaimers . . . . .                    | 12        |
| 9.4       | Trademarks . . . . .                     | 13        |
| <b>10</b> | <b>Contact information</b> . . . . .     | <b>13</b> |

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