



# ACT108-600E

## AC Thyristor power switch

20 August 2014

Product data sheet

## 1. General description

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

## 2. Features and benefits

- Exclusive negative gate triggering
- Full cycle AC conduction
- Remote gate separates the gate driver from the effects of the load current
- Very high noise immunity
- Safe clamping of low energy over-voltage transients
- Self-protective turn-on during high energy voltage transients

## 3. Applications

- Fan motor circuits
- Pump motor circuits
- Lower-power highly inductive, resistive and safety loads

## 4. Quick reference data

Table 1. Quick reference data

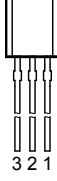
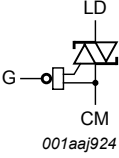
| Symbol                        | Parameter                            | Conditions                                                                                                                                                                   | Min | Typ | Max | Unit               |
|-------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|--------------------|
| $V_{\text{DRM}}$              | repetitive peak off-state voltage    |                                                                                                                                                                              | -   | -   | 600 | V                  |
| $I_{\text{TSM}}$              | non-repetitive peak on-state current | full sine wave; $T_{\text{J}(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>                   | -   | -   | 13  | A                  |
| $T_{\text{J}}$                | junction temperature                 |                                                                                                                                                                              | -   | -   | 125 | $^{\circ}\text{C}$ |
| $I_{\text{T(RMS)}}$           | RMS on-state current                 | full sine wave; $T_{\text{lead}} \leq 71\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a>                                                                                   | -   | -   | 0.8 | A                  |
| $V_{\text{PP}}$               | peak pulse voltage                   | $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; non-repetitive, off-state; ten pulses on each voltage polarity; 20s or more between successive pulses;; <a href="#">Fig. 4</a> | -   | -   | 2.5 | kV                 |
| <b>Static characteristics</b> |                                      |                                                                                                                                                                              |     |     |     |                    |
| $I_{\text{GT}}$               | gate trigger current                 | $V_{\text{D}} = 12\text{ V}$ ; $I_{\text{T}} = 100\text{ mA}$ ; LD+ G-; $T_{\text{J}} = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 6</a>                                 | 1   | -   | 10  | mA                 |



| Symbol                         | Parameter                             | Conditions                                                                                                                                                                                                                             | Min  | Typ | Max | Unit             |
|--------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|------------------|
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 6</a>                                                                                                                     | 1    | -   | 10  | mA               |
| $V_{CL}$                       | clamping voltage                      | $I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 12</a>                                                                                                                         | 650  | -   | -   | V                |
| <b>Dynamic characteristics</b> |                                       |                                                                                                                                                                                                                                        |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 9</a>                                                                        | 2000 | -   | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br>$I_{T(RMS)} = 0.8\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ;<br>(snubberless condition); gate open circuit; <a href="#">Fig. 10</a> ; <a href="#">Fig. 11</a> | 0.5  | -   | -   | A/ms             |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                                       | Graphic symbol                                                                                         |
|-----|--------|-------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1   | CM     | common      |  <p>TO-92 (SOT54)</p> |  <p>001aa/924</p> |
| 2   | G      | gate        |                                                                                                          |                                                                                                        |
| 3   | LD     | load        |                                                                                                          |                                                                                                        |

## 6. Ordering information

Table 3. Ordering information

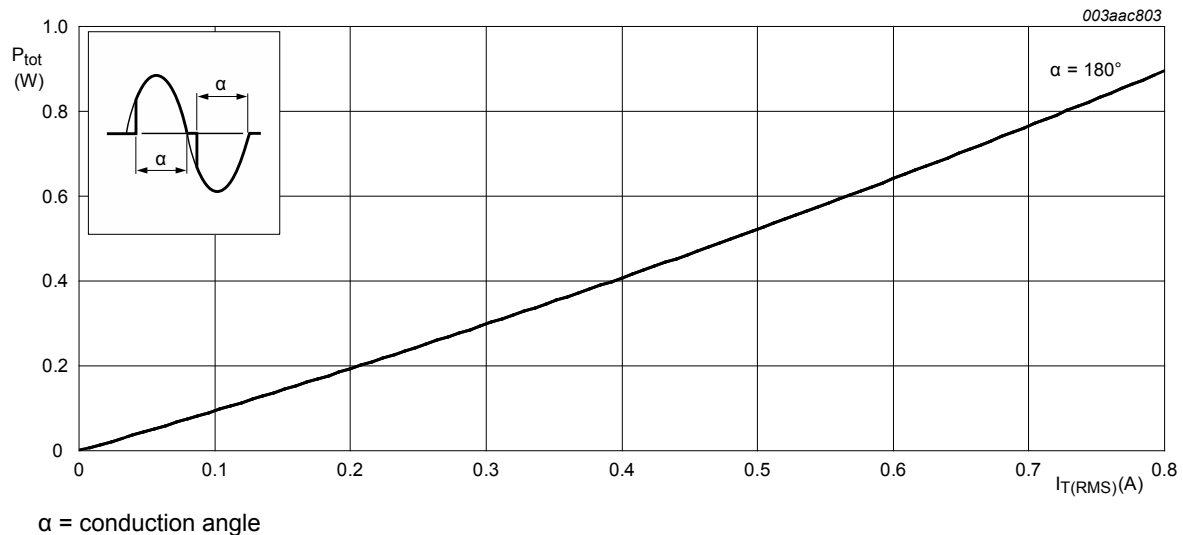
| Type number | Package |                                                             |         |
|-------------|---------|-------------------------------------------------------------|---------|
|             | Name    | Description                                                 | Version |
| ACT108-600E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

## 7. Limiting values

**Table 4. Limiting values**

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

| Symbol              | Parameter                            | Conditions                                                                                                                                                                   | Min | Max  | Unit                   |
|---------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                                              | -   | 600  | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{lead}} \leq 71\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a>                                                                                   | -   | 0.8  | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>                          | -   | 13   | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$                                                                          | -   | 14.3 | A                      |
| $I^2t$              | $I_2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; SIN                                                                                                                                          | -   | 0.32 | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{T}} = 1\text{ A}$ ; $I_{\text{G}} = 20\text{ mA}$ ; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$                                                                  | -   | 100  | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | peak gate current                    | $t = 20\text{ }\mu\text{s}$                                                                                                                                                  | -   | 1    | A                      |
| $V_{\text{GM}}$     | peak gate voltage                    | positive applied gate voltage                                                                                                                                                | -   | 15   | V                      |
| $P_{\text{G(AV)}}$  | average gate power                   | over any 20 ms period                                                                                                                                                        | -   | 0.1  | W                      |
| $T_{\text{stg}}$    | storage temperature                  |                                                                                                                                                                              | -40 | 150  | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                                                              | -   | 125  | $^{\circ}\text{C}$     |
| $V_{\text{PP}}$     | peak pulse voltage                   | $T_{\text{j}} = 25\text{ }^{\circ}\text{C}$ ; non-repetitive, off-state; ten pulses on each voltage polarity; 20s or more between successive pulses;; <a href="#">Fig. 4</a> | -   | 2.5  | kV                     |



**Fig. 1. Total power dissipation as a function of RMS on-state current; maximum values**

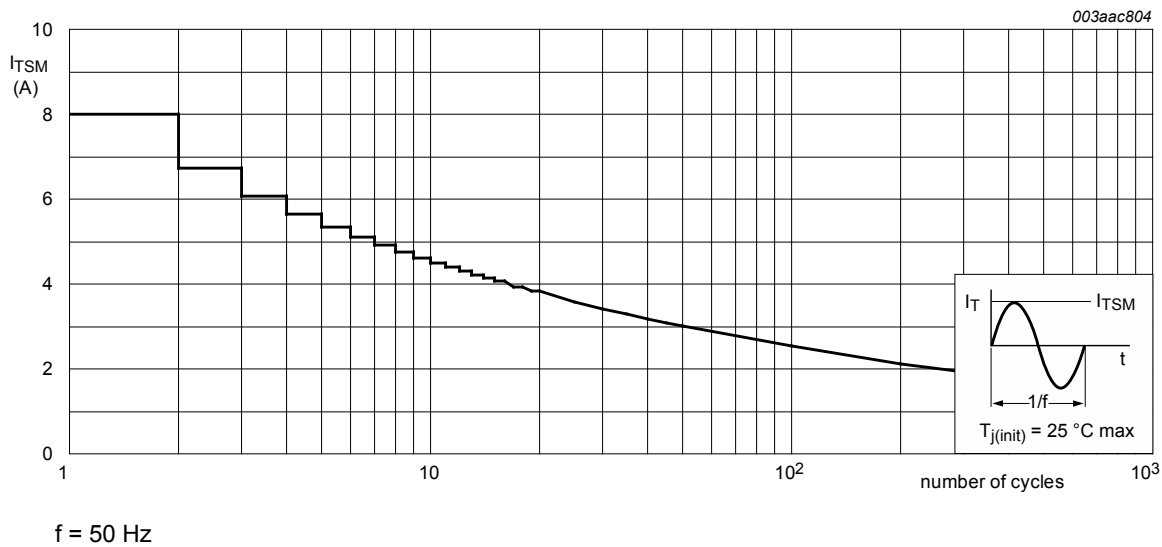


Fig. 2. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

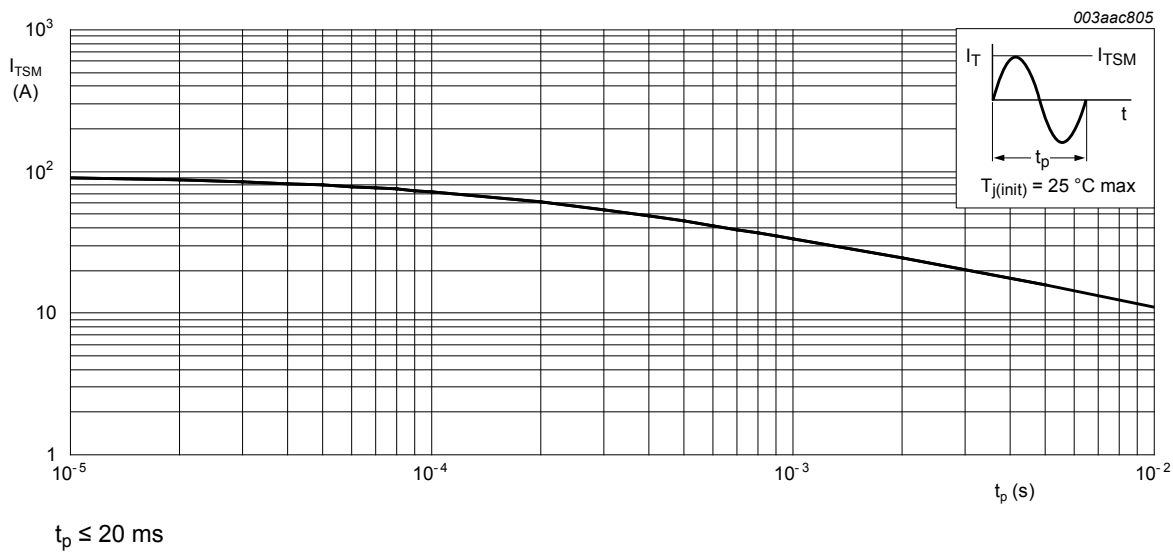


Fig. 3. Non-repetitive peak on-state current as a function of pulse width; maximum values

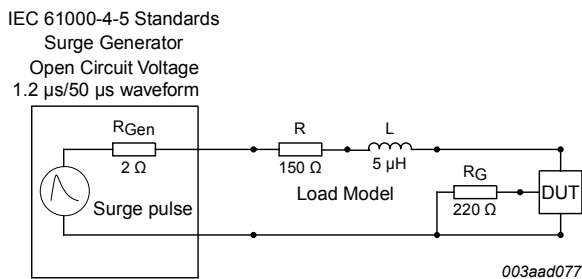
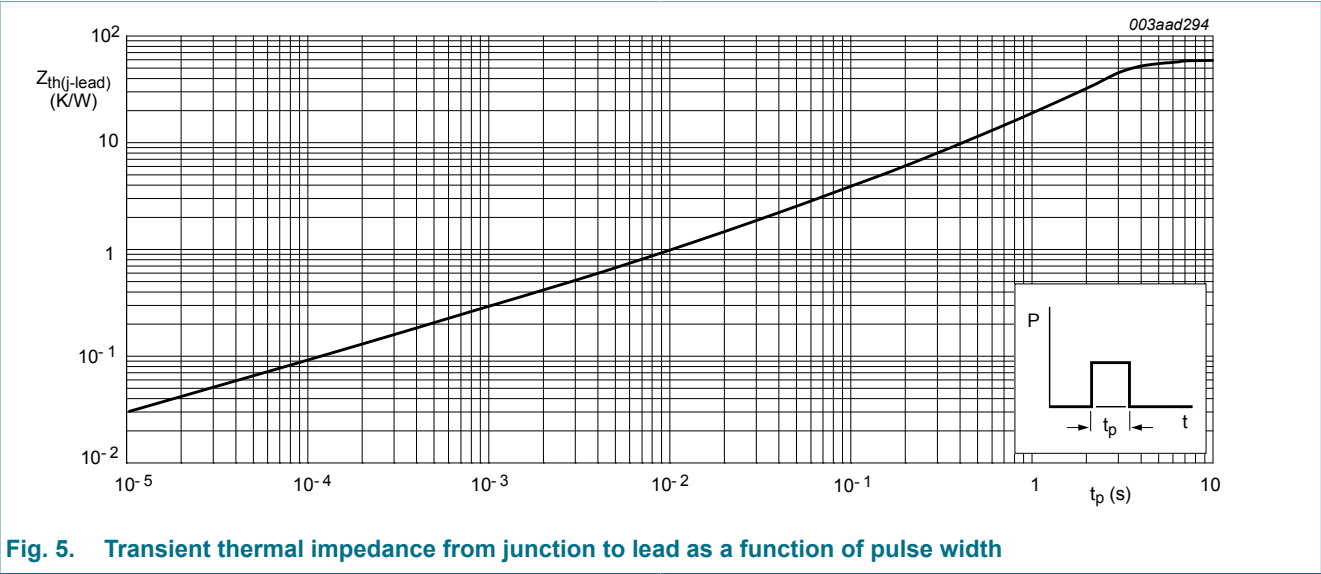


Fig. 4. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

8. Thermal characteristics

Table 5. Thermal characteristics

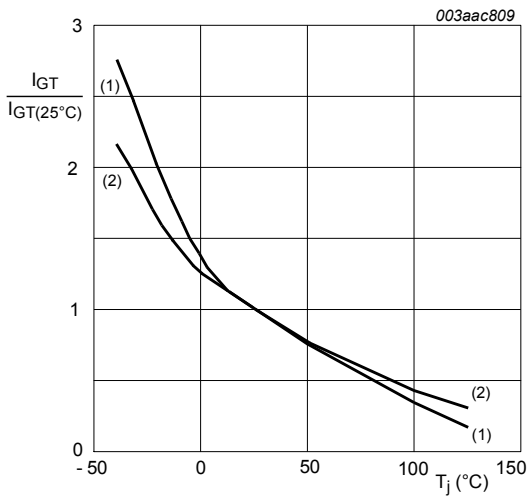
| Symbol           | Parameter                                   | Conditions                                                   | Min | Typ | Max | Unit |
|------------------|---------------------------------------------|--------------------------------------------------------------|-----|-----|-----|------|
| $R_{th(j-lead)}$ | thermal resistance from junction to lead    | full cycle with heatsink compound;<br><a href="#">Fig. 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  |



## 9. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                             | Conditions                                                                                                                                                                                                                             |  | Min  | Typ | Max | Unit             |
|--------------------------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-----|-----|------------------|
| <b>Static characteristics</b>  |                                       |                                                                                                                                                                                                                                        |  |      |     |     |                  |
| $I_{GT}$                       | gate trigger current                  | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 6</a>                                                                                                                     |  | 1    | -   | 10  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 6</a>                                                                                                                     |  | 1    | -   | 10  | mA               |
| $I_L$                          | latching current                      | $V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                                                                                                                     |  | -    | -   | 25  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                                                                                                                     |  | -    | -   | 20  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                                                                                                                                                        |  | -    | -   | 20  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 1.1\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                                                                                                                                                       |  | -    | -   | 1.3 | V                |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 400\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 125\text{ }^\circ\text{C}$                                                                                                                                                       |  | 0.15 | -   | -   | V                |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 25\text{ }^\circ\text{C}$                                                                                                                                                         |  | -    | -   | 1   | V                |
| $I_D$                          | off-state current                     | $V_D = 600\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$                                                                                                                                                                                |  | -    | -   | 2   | $\mu\text{A}$    |
|                                |                                       | $V_D = 600\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$                                                                                                                                                                               |  | -    | -   | 0.2 | mA               |
| $V_{CL}$                       | clamping voltage                      | $I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 12</a>                                                                                                                         |  | 650  | -   | -   | V                |
| <b>Dynamic characteristics</b> |                                       |                                                                                                                                                                                                                                        |  |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 9</a>                                                                        |  | 2000 | -   | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ;<br>$I_{T(RMS)} = 0.8\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ;<br>(snubberless condition); gate open circuit; <a href="#">Fig. 10</a> ; <a href="#">Fig. 11</a> |  | 0.5  | -   | -   | A/ms             |



(1) LD+ G-  
(2) LD- G-

Fig. 6. Normalized gate trigger current as a function of junction temperature

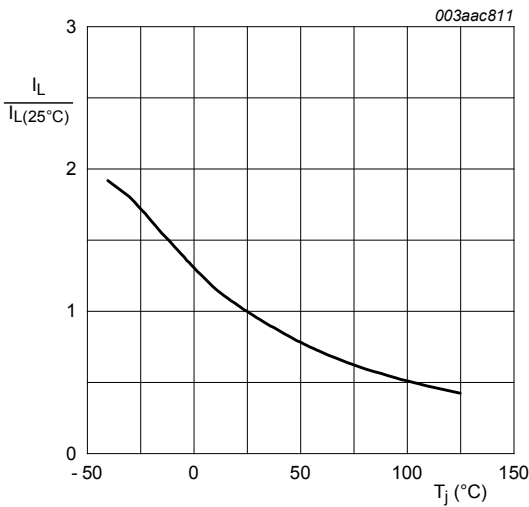
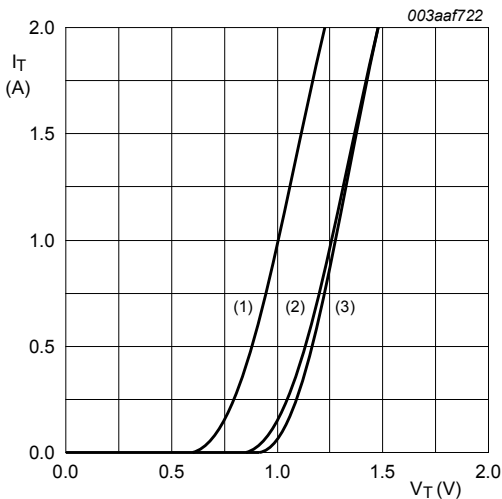


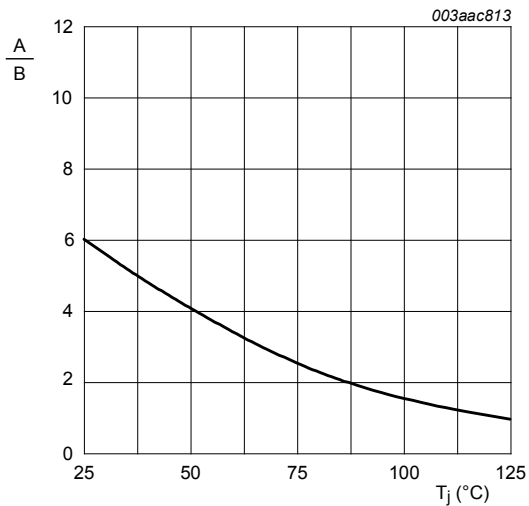
Fig. 7. Normalized latching current as a function of junction temperature



$V_o = 0.758 \text{ V}$ ;  $R_s = 0.263 \text{ }\Omega$

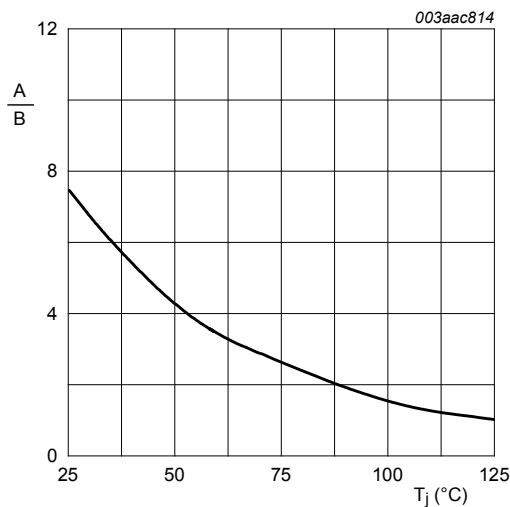
(1)  $T_j = 125^{\circ}\text{C}$ ; typical values  
(2)  $T_j = 125^{\circ}\text{C}$ ; maximum values  
(3)  $T_j = 25^{\circ}\text{C}$ ; maximum values

Fig. 8. On-state current as a function of on-state voltage



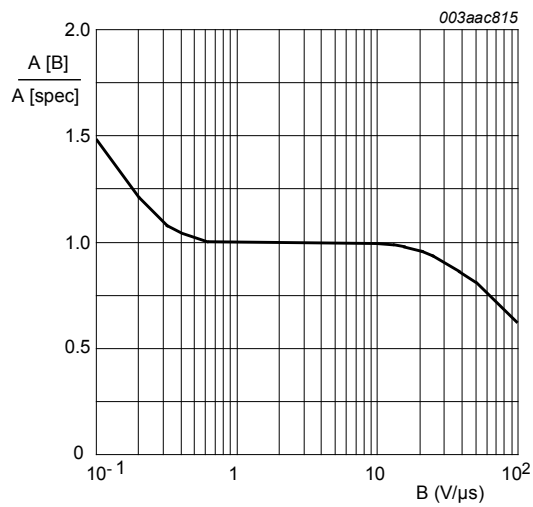
$A = dV_D/dt$  at condition  $T_j^{\circ}\text{C}$   
 $B = dV_D/dt$  at condition  $T_j [125]^{\circ}\text{C}$

Fig. 9. Normalized rate of rise of off-state voltage as a function of junction temperature



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

Fig. 10. Normalized critical rate of rise of commutating current as a function of junction temperature



$A[B] = di_{com}/dt$  at condition B,  $dV_{com}/dt$   
 $A[\text{spec}]$  is the data sheet value for  $di_{com}/dt$   
turn-off time is less than 20 ms

Fig. 11. Normalized critical rate of change of commutating current as a function of critical rate of change of commutating voltage; minimum values

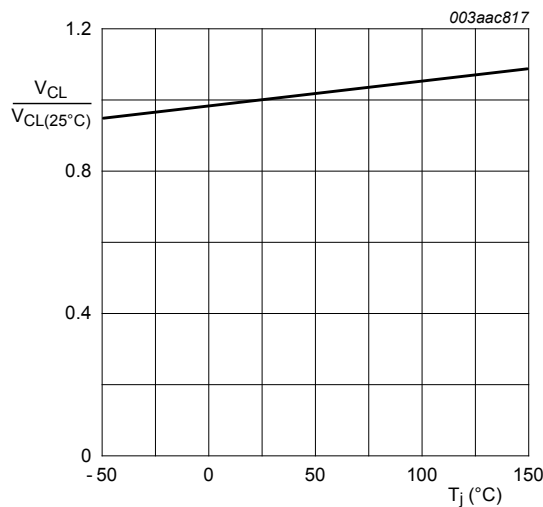


Fig. 12. Normalized clamping voltage (upper limit) as a function of junction temperature; minimum values



10. Package outline

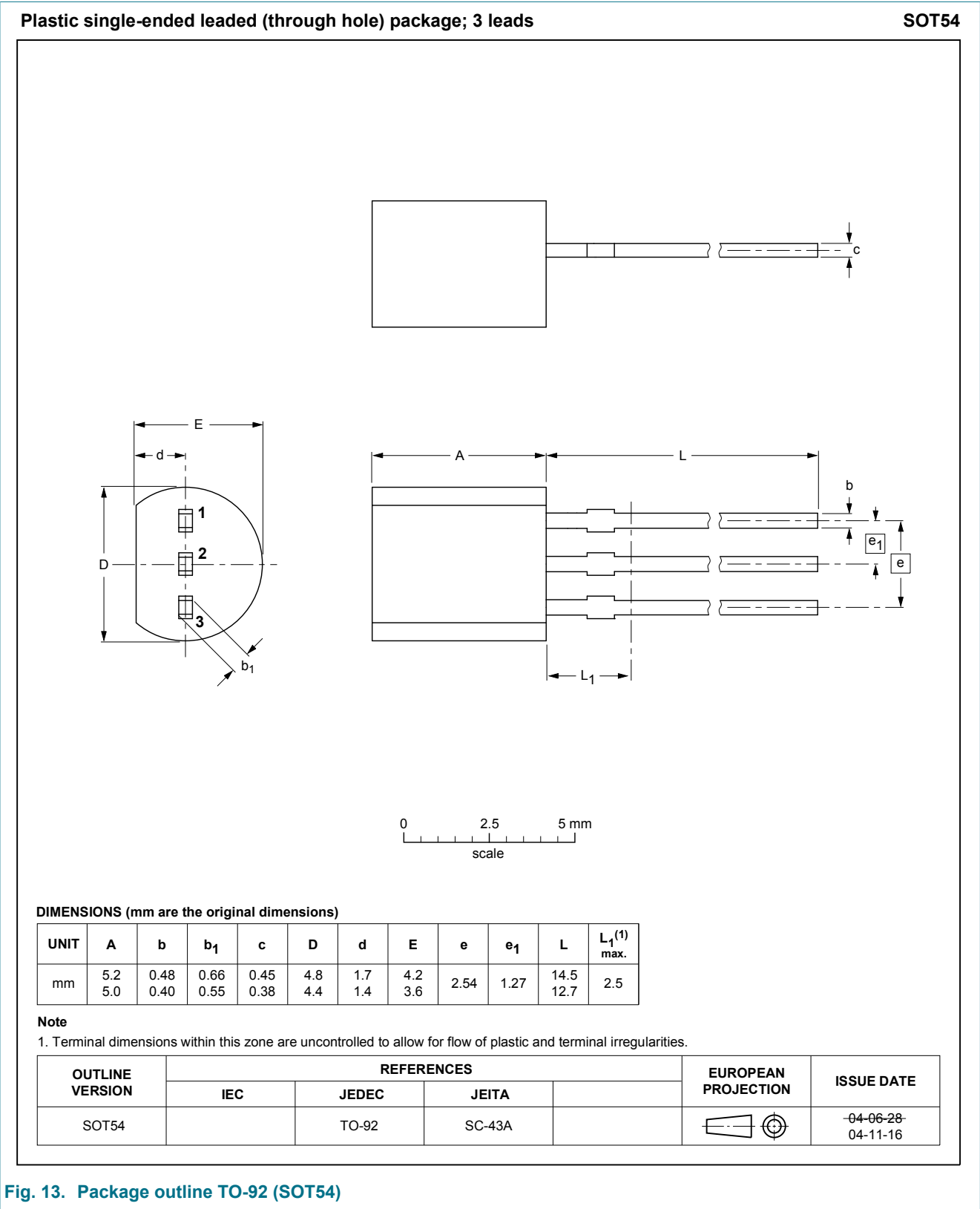


Fig. 13. Package outline TO-92 (SOT54)

## 11. Legal information

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|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
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| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

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