

## 1. General description

Planar passivated four quadrant triac in a SOT78 (TO-220AB) plastic package intended for use in general purpose bidirectional switching and phase control applications.

## 2. Features and benefits

- High blocking voltage capability
- Less sensitive gate for improved noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants

## 3. Applications

- General purpose motor controls
- General purpose switching

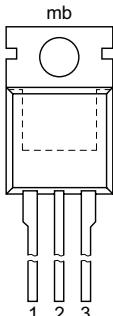
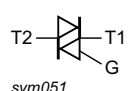
## 4. Quick reference data

Table 1. Quick reference data

| Symbol                  | Parameter                            | Conditions                                                                                                            | Values |     |     |     | Unit |
|-------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------|-----|-----|-----|------|
| Absolute maximum rating |                                      |                                                                                                                       |        |     |     |     |      |
| V <sub>DRM</sub>        | repetitive peak off-state voltage    |                                                                                                                       | 600    |     |     |     | V    |
| I <sub>T(RMS)</sub>     | RMS on-state current                 | full sine wave; T <sub>mb</sub> ≤ 102 °C; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>    | 8      |     |     |     | A    |
| I <sub>TSM</sub>        | non-repetitive peak on-state current | full sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 20 ms; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | 65     |     |     |     | A    |
| Symbol                  | Parameter                            | Conditions                                                                                                            |        | Min | Typ | Max | Unit |
| Static characteristics  |                                      |                                                                                                                       |        |     |     |     |      |
| I <sub>GT</sub>         | gate trigger current                 | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 5   | 35  | mA   |
|                         |                                      | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2+ G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 8   | 35  | mA   |
|                         |                                      | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G-; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 11  | 35  | mA   |
|                         |                                      | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T2- G+; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>                 |        | -   | 30  | 70  | mA   |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                    | Simplified outline                                                                | Graphic symbol                                                                      |
|-----|--------|--------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | T1     | main terminal 1                |  |  |
| 2   | T2     | main terminal 2                |                                                                                   |                                                                                     |
| 3   | G      | gate                           |                                                                                   |                                                                                     |
| mb  | T2     | mounting base; main terminal 2 |                                                                                   |                                                                                     |

6. Ordering information

Table 3. Ordering information

| Type number | Package  |                                                                                     |         |
|-------------|----------|-------------------------------------------------------------------------------------|---------|
|             | Name     | Description                                                                         | Version |
| BT137-600   | TO-220AB | plastic single-ended package; heatsink mounted;<br>1 mounting hole; 3-lead TO-220AB | SOT78   |

7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|-------------|---------------|
| BT137-600   | BT137-600     |

## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol              | Parameter                            | Conditions                                                                                                                                             | Values     | Unit                   |
|---------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                        | 600        | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 102\text{ }^{\circ}\text{C}$ ;<br><a href="#">Fig 1</a> ; <a href="#">Fig 2</a> ; <a href="#">Fig 3</a>            | 8          | A                      |
| $I_{\text{TSM}}$    | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_{\text{p}} = 20\text{ ms}$ ; <a href="#">Fig 4</a> ; <a href="#">Fig 5</a>   | 65         | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ;<br>$t_{\text{p}} = 16.7\text{ ms}$ ; <a href="#">Fig 4</a> ; <a href="#">Fig 5</a> | 71         | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; SIN                                                                                                                    | 21         | $\text{A}^2\text{s}$   |
| $dI_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{G}} = 70\text{ mA}$ ; T2+ G+                                                                                                                 | 50         | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{G}} = 70\text{ mA}$ ; T2+ G-                                                                                                                 | 50         | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{G}} = 70\text{ mA}$ ; T2- G-                                                                                                                 | 50         | $\text{A}/\mu\text{s}$ |
|                     |                                      | $I_{\text{G}} = 140\text{ mA}$ ; T2- G+                                                                                                                | 10         | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | peak gate current                    |                                                                                                                                                        | 2          | A                      |
| $P_{\text{GM}}$     | peak gate power                      |                                                                                                                                                        | 5          | W                      |
| $P_{\text{G(AV)}}$  | average gate power                   | over any 20 ms period                                                                                                                                  | 0.5        | W                      |
| $T_{\text{stg}}$    | storage temperature                  |                                                                                                                                                        | -40 to 150 | $^{\circ}\text{C}$     |
| $T_{\text{j}}$      | junction temperature                 |                                                                                                                                                        | 125        | $^{\circ}\text{C}$     |

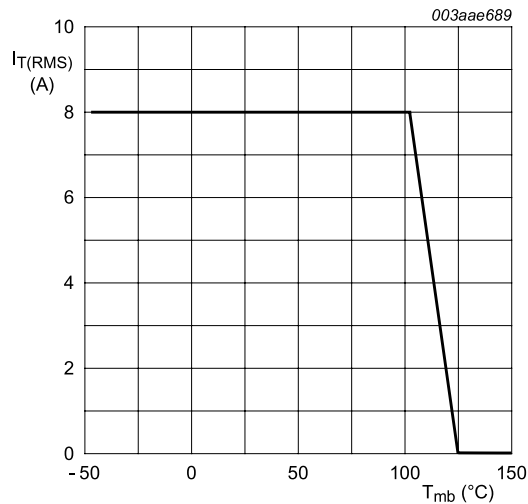


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values

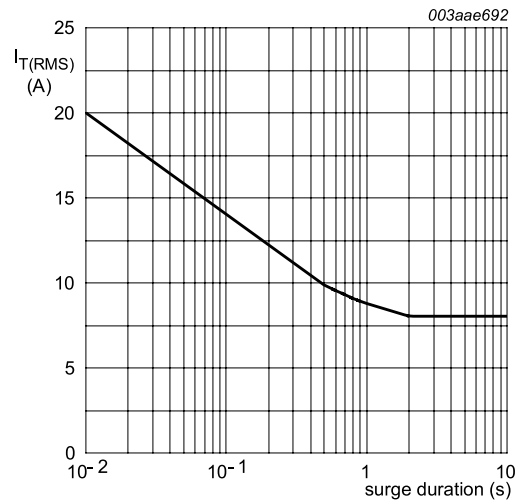


Fig. 2. RMS on-state current as a function of surge duration; maximum values  
 $f = 50 \text{ Hz}; T_{mb} \leq 102 \text{ °C}$

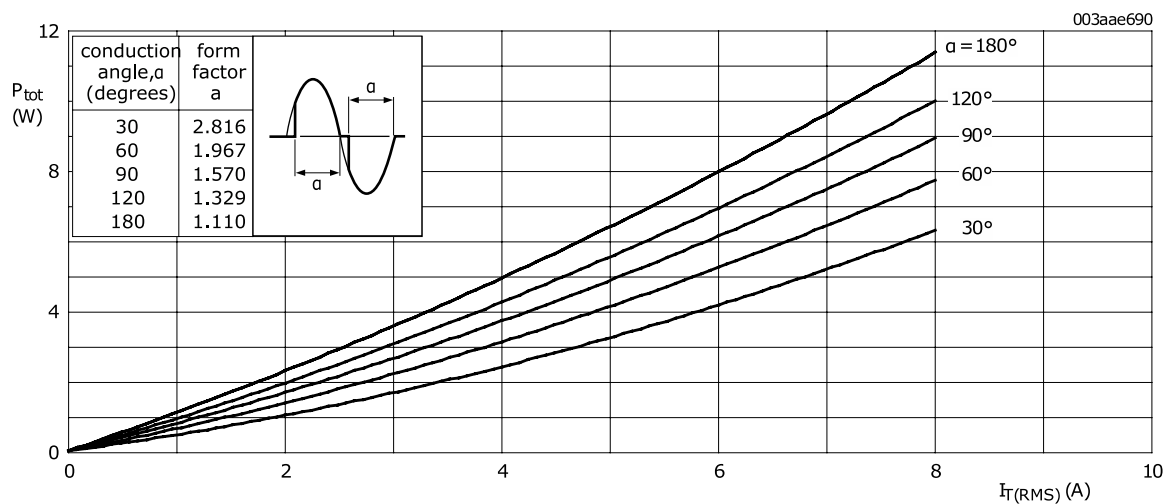
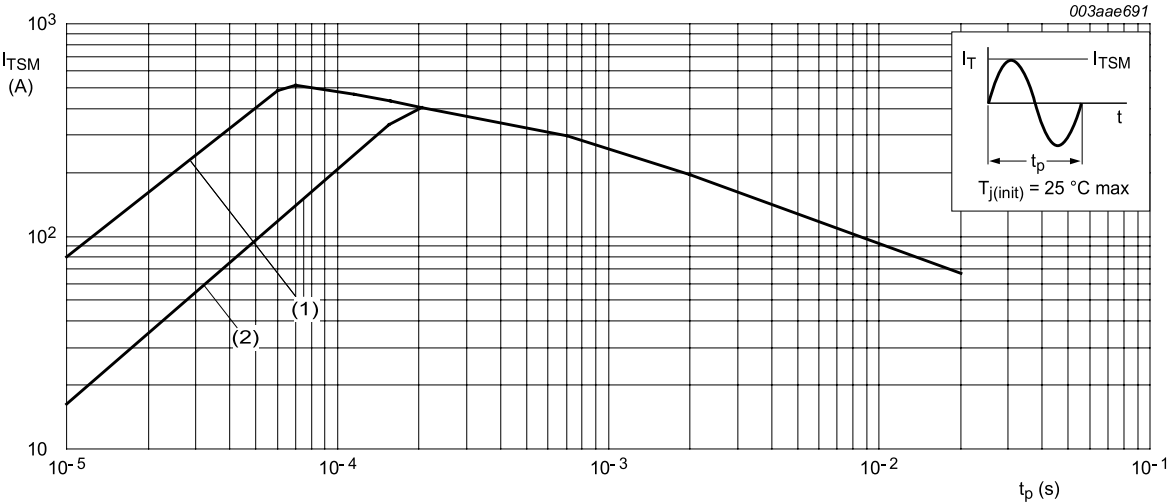
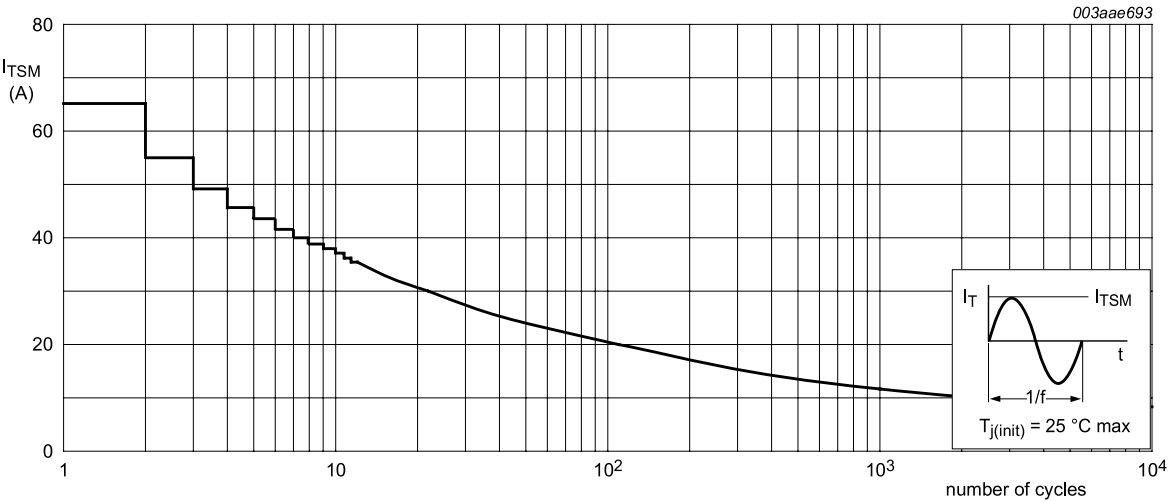


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



$t_p \leq 20\text{ ms}$   
(1)  $di_T/dt$  limit  
(2) T2- G+ quadrant limit

Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



$f = 50\text{ Hz}$

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

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                         | Conditions        |  | Min | Typ | Max | Unit |
|----------------|---------------------------------------------------|-------------------|--|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full cycle; Fig.6 |  | -   | -   | 2   | K/W  |
|                |                                                   | half cycle; Fig.6 |  | -   | -   | 2.4 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air       |  | -   | 60  | -   | K/W  |

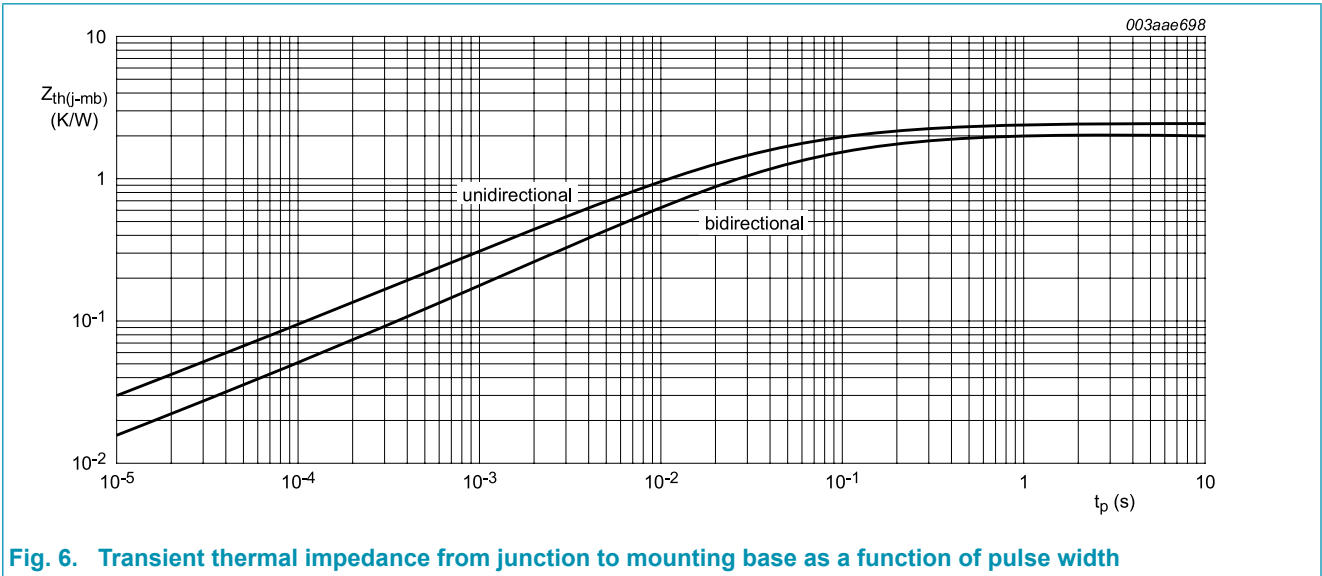
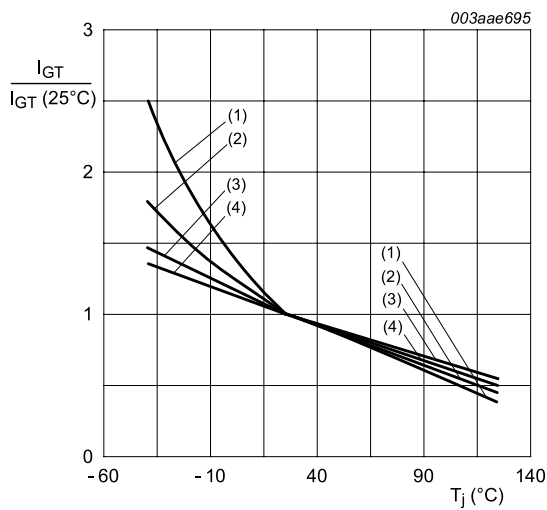


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

## 10. Characteristics

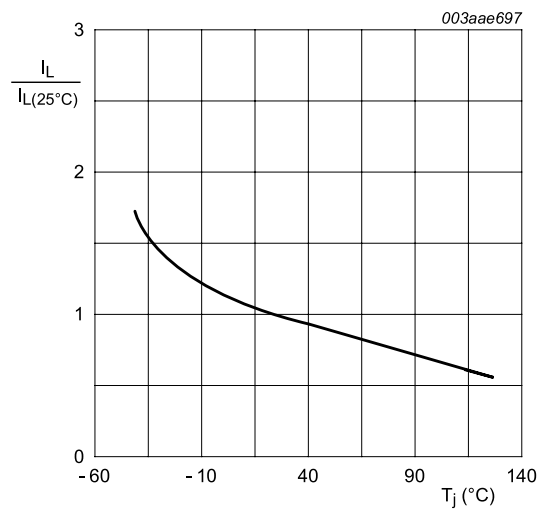
Table 7. Characteristics

| Symbol                         | Parameter                             | Conditions                                                                                                                              |  | Min  | Typ | Max  | Unit             |
|--------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--|------|-----|------|------------------|
| <b>Static characteristics</b>  |                                       |                                                                                                                                         |  |      |     |      |                  |
| $I_{GT}$                       | gate trigger current                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 5   | 35   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 8   | 35   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 11  | 35   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       |  | -    | 30  | 70   | mA               |
| $I_L$                          | latching current                      | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 7   | 30   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 16  | 45   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 5   | 30   | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+;<br>$T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>                       |  | -    | 7   | 45   | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                         |  | -    | 5   | 20   | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 10\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                                        |  | -    | 1.3 | 1.65 | V                |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 25\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>                              |  | -    | 0.7 | 1    | V                |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_J = 125\text{ }^\circ\text{C}$ ;<br><a href="#">Fig. 11</a>                            |  | 0.25 | 0.4 | -    | V                |
| $I_D$                          | off-state current                     | $V_D = 600\text{ V}$ ; $T_J = 125\text{ }^\circ\text{C}$                                                                                |  | -    | 0.1 | 0.5  | mA               |
| <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 |  | 100  | 250 | -    | V/ $\mu\text{s}$ |
| $dV_{com}/dt$                  | rate of change of commutating voltage | $V_D = 400\text{ V}$ ; $T_J = 95\text{ }^\circ\text{C}$ ; $dI_{com}/dt = 3.6\text{ A/ms}$ ; $I_T = 8\text{ A}$ ; gate open circuit      |  | -    | 20  | -    | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time          | $I_{TM} = 12\text{ A}$ ; $V_D = 600\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$                               |  | -    | 2   | -    | $\mu\text{s}$    |

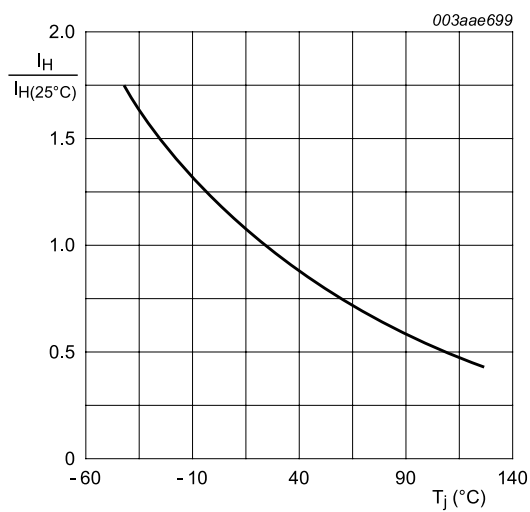


- (1) T2- G+
- (2) T2- G-
- (3) T2+ G-
- (4) T2+ G+

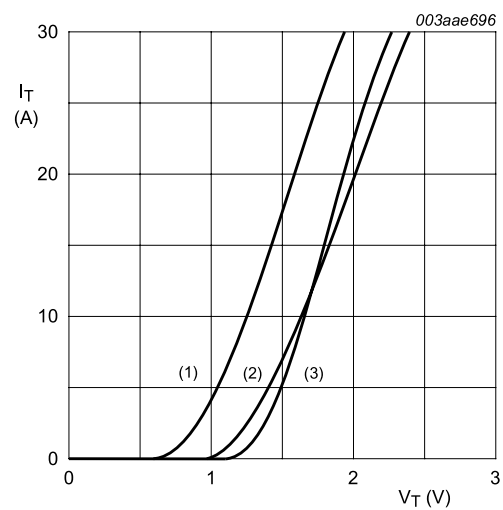
**Fig. 7. Normalized gate trigger current as a function of junction temperature**



**Fig. 8. Normalized latching current as a function of junction temperature**



**Fig. 9. Normalized holding current as a function of junction temperature**



- $V_o = 1.264 \text{ V}; R_s = 0.038 \Omega$
- (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. 10. On-state current as a function of on-state voltage**

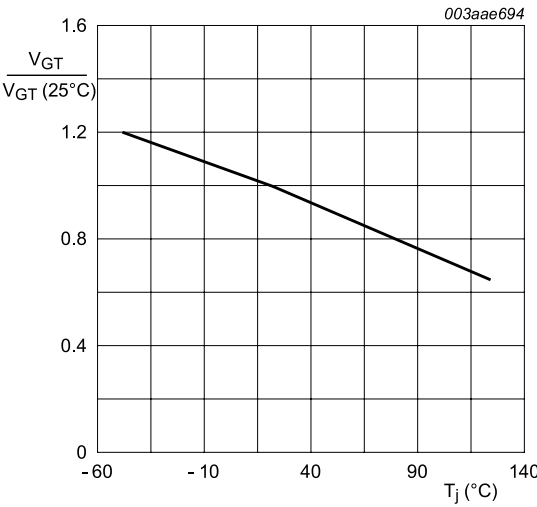
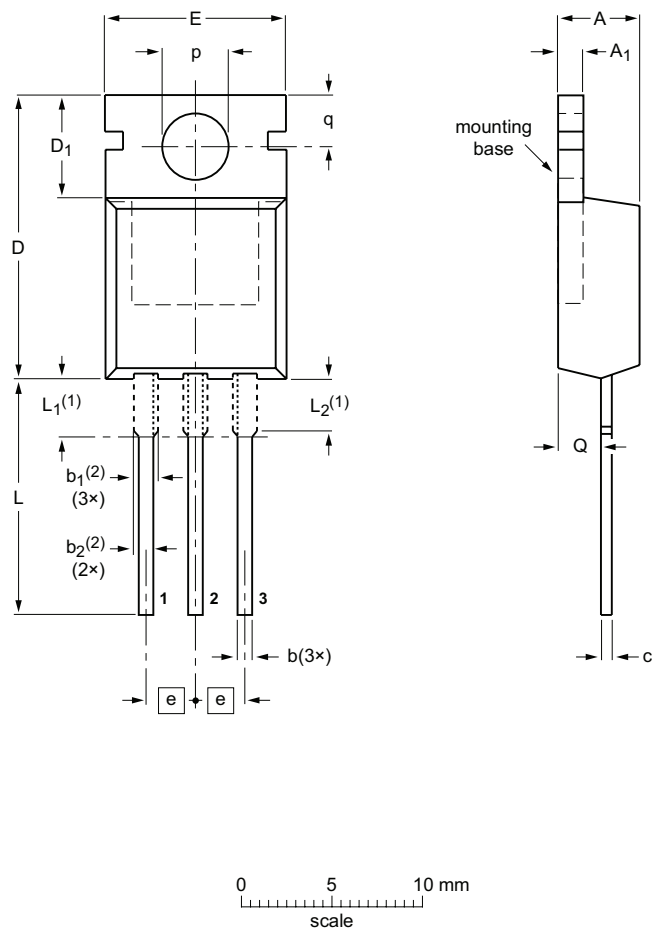


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub> | b          | b <sub>1</sub> (2) | b <sub>2</sub> (2) | c          | D            | D <sub>1</sub> | E           | e    | L            | L <sub>1</sub> (1) | L <sub>2</sub> (1)<br>max. | p          | q          | Q          |
|------|------------|----------------|------------|--------------------|--------------------|------------|--------------|----------------|-------------|------|--------------|--------------------|----------------------------|------------|------------|------------|
| mm   | 4.7<br>4.1 | 1.40<br>1.25   | 0.9<br>0.6 | 1.6<br>1.0         | 1.3<br>1.0         | 0.7<br>0.4 | 16.0<br>15.2 | 6.6<br>5.9     | 10.3<br>9.7 | 2.54 | 15.0<br>12.8 | 3.30<br>2.79       | 3.0                        | 3.8<br>3.5 | 3.0<br>2.7 | 2.6<br>2.2 |

Notes

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

| OUTLINE<br>VERSION | REFERENCES |                 |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-----------------|-------|--|------------------------|----------------------|
|                    | IEC        | JEDEC           | JEITA |  |                        |                      |
| SOT78              |            | 3-lead TO-220AB | SC-46 |  |                        | 08-04-23<br>08-06-13 |

## 12. Legal information

### 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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Date of release: 14 March 2018



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