

## 1. General description

Planar passivated very sensitive gate four quadrant triac in a SOT78 (TO-220AB) plastic package intended for use in general purpose bidirectional switching and phase control applications, where high sensitivity is required in all four quadrants. This very sensitive gate "series D" triac is intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

## 2. Features and benefits

- High blocking voltage capability
- Direct triggering from low power drivers and logic ICs
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants
- Low holding current for low current loads and lowest EMI at commutation
- Very sensitive gate

## 3. Applications

- General purpose motor control
- General purpose switching

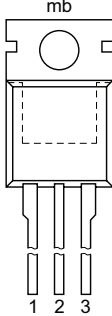
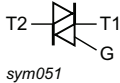
## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                            | Conditions  | Values |     |     | Unit |
|--------------------------------|--------------------------------------|---|--------|-----|-----|------|
| <b>Absolute maximum rating</b> |                                      |   |        |     |     |      |
| $V_{DRM}$                      | repetitive peak off-state voltage    |   | 600    |     |     | V    |
| $I_{T(RMS)}$                   | RMS on-state current                 | full sine wave; $T_{mb} \leq 102\text{ °C}$ ;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>   | 8      |     |     | A    |
| $I_{TSM}$                      | non-repetitive peak on-state current | full sine wave; $T_{j(initial)} = 25\text{ °C}$ ;<br>$t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | 65     |     |     | A    |
| 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>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                       | -      | 2.5 | 5   | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                       | -      | 3.5 | 5   | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                       | -      | 3.5 | 5   | mA   |
|                                |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                       | -      | 6.5 | 10  | mA   |
| $I_H$                          | holding current                      | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; ; <a href="#">Fig. 9</a>   | -      | 1.5 | 10  | 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 |
| BT137-600D  | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 7. Marking

Table 4. Marking codes

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

## 8. Limiting values

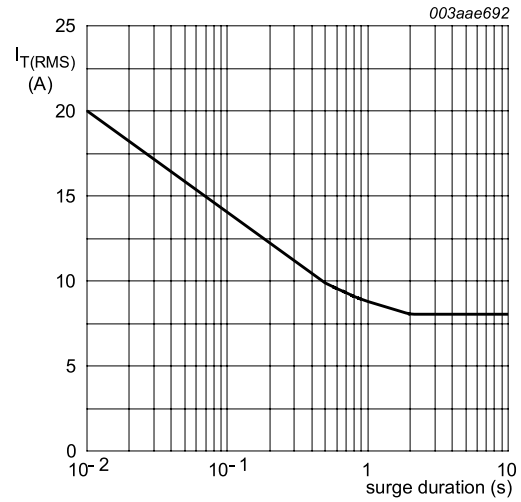
**Table 5. Limiting values**

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

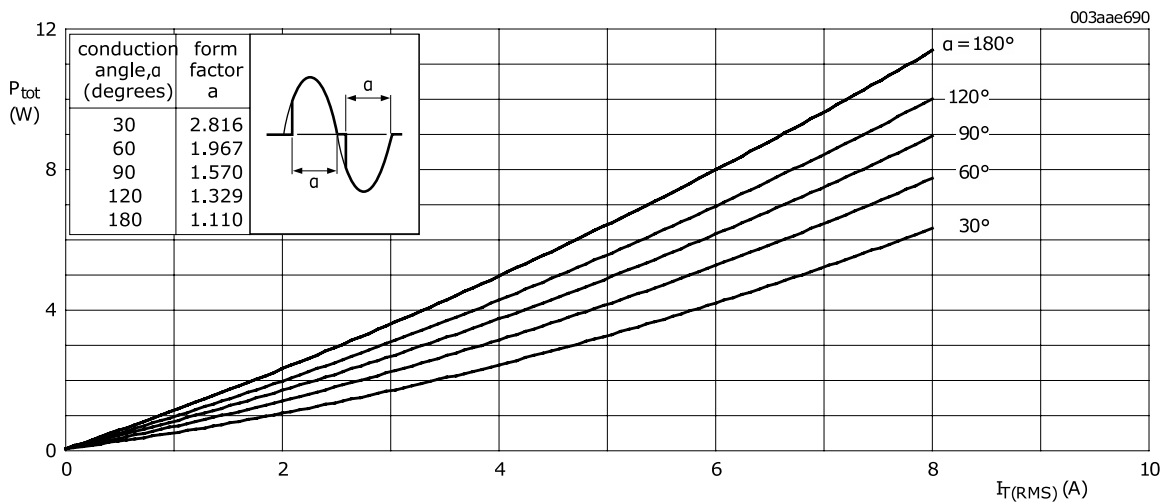
| Symbol       | Parameter                            | Conditions  | Values     | Unit             |
|--------------|--------------------------------------|---|------------|------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |   | 600        | V                |
| $I_{T(RMS)}$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



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



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



$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$

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

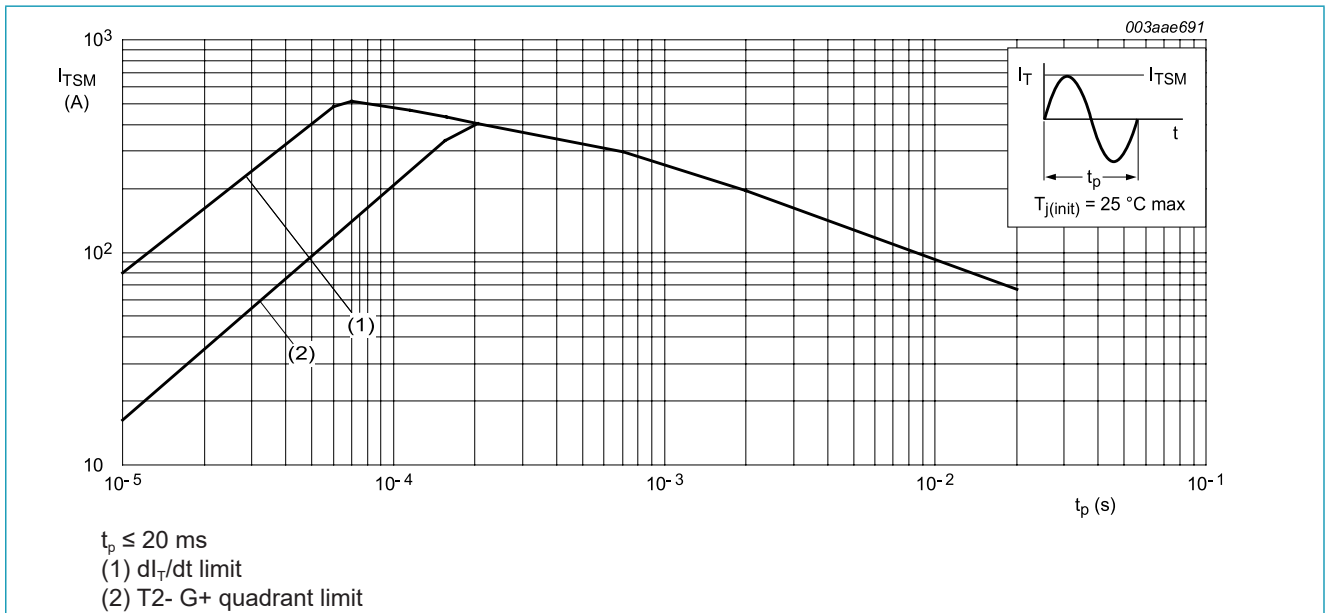


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values

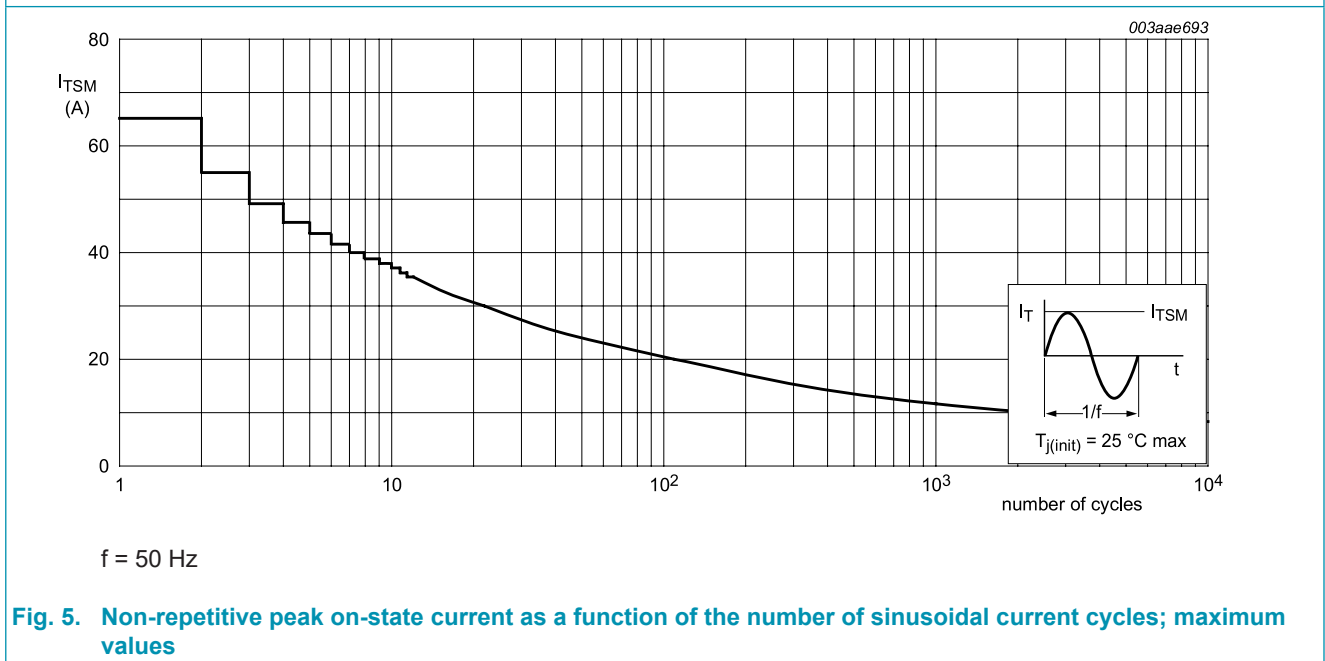


Fig. 5. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

## 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; <a href="#">Fig 6</a> | -   | -   | 2   | K/W  |
|                |   | half cycle; <a href="#">Fig 6</a> | -   | -   | 2.4 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | in free air                       | -   | 60  | -   | K/W  |

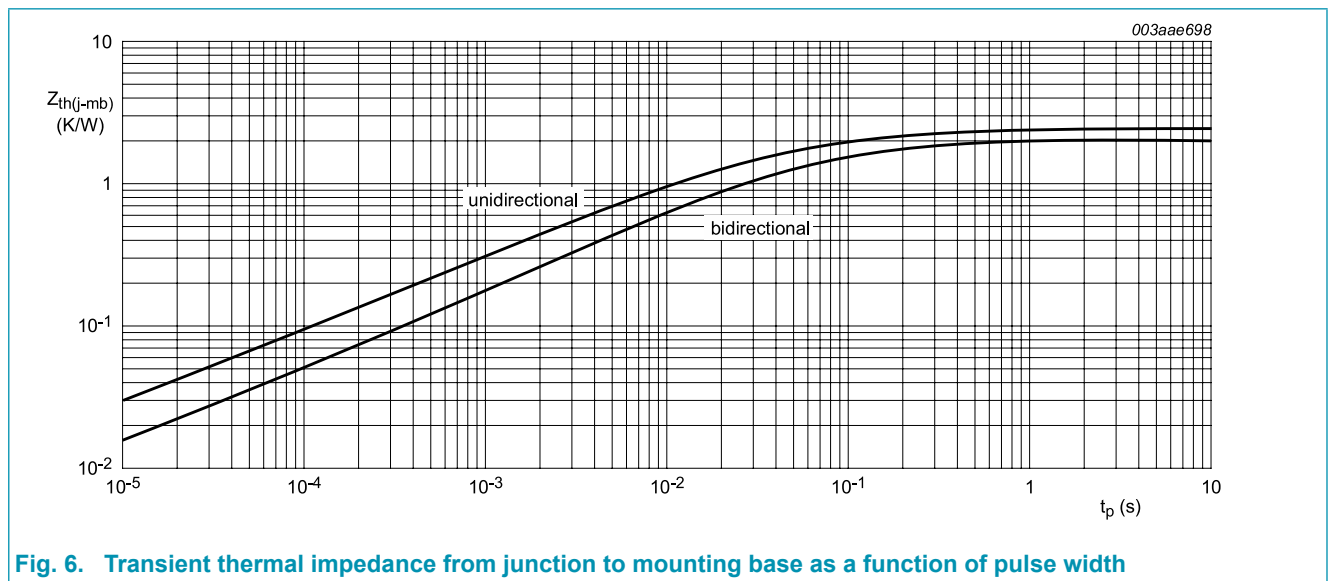
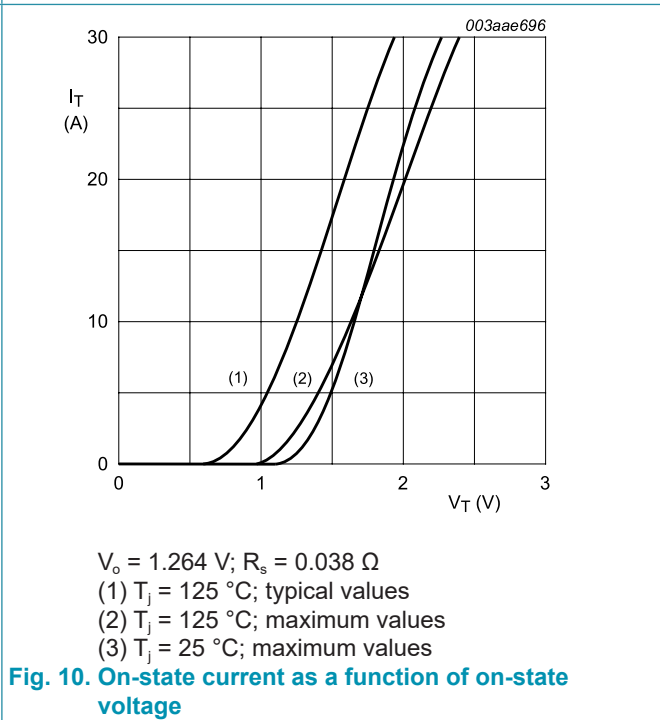
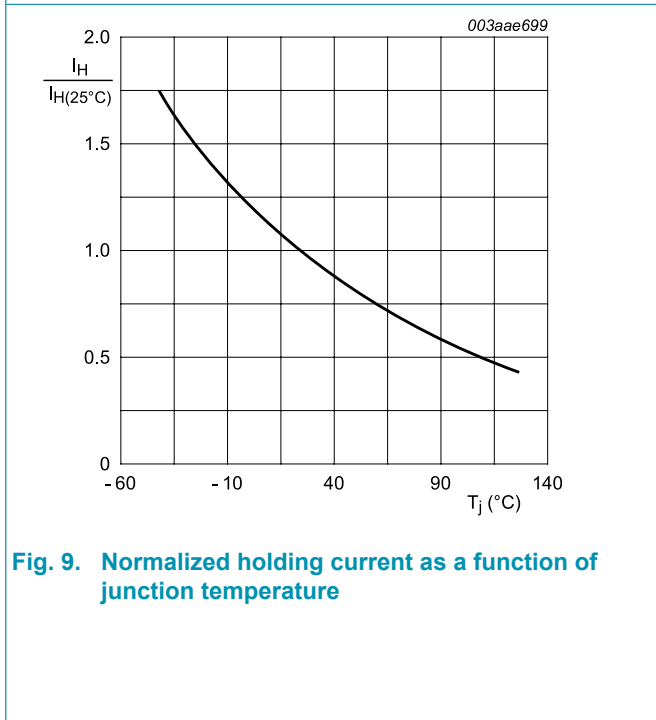
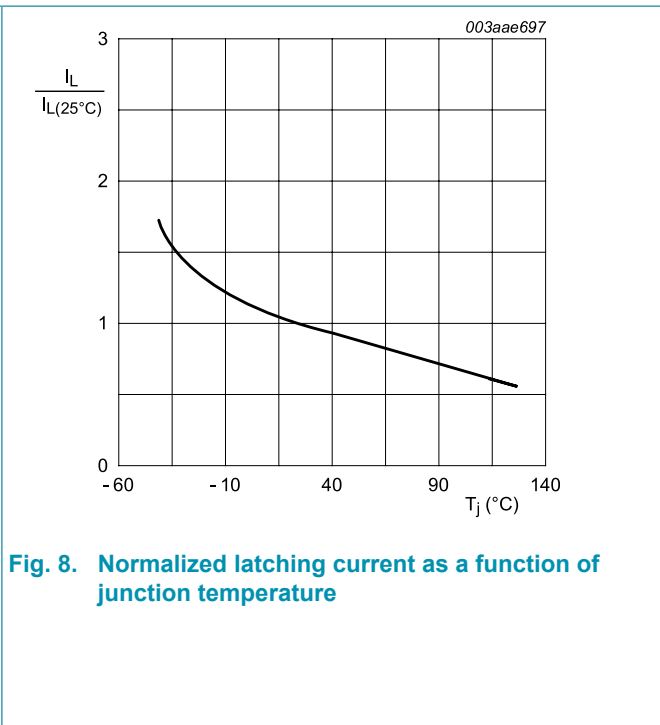
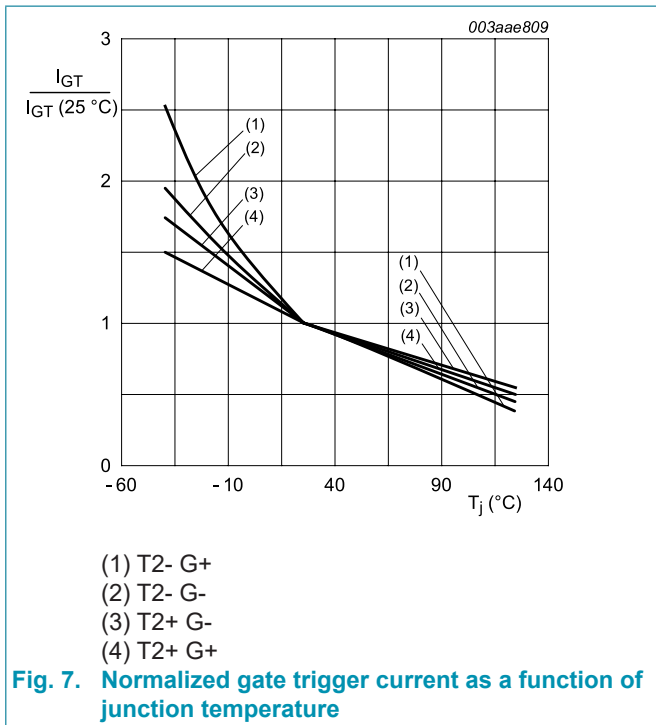


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

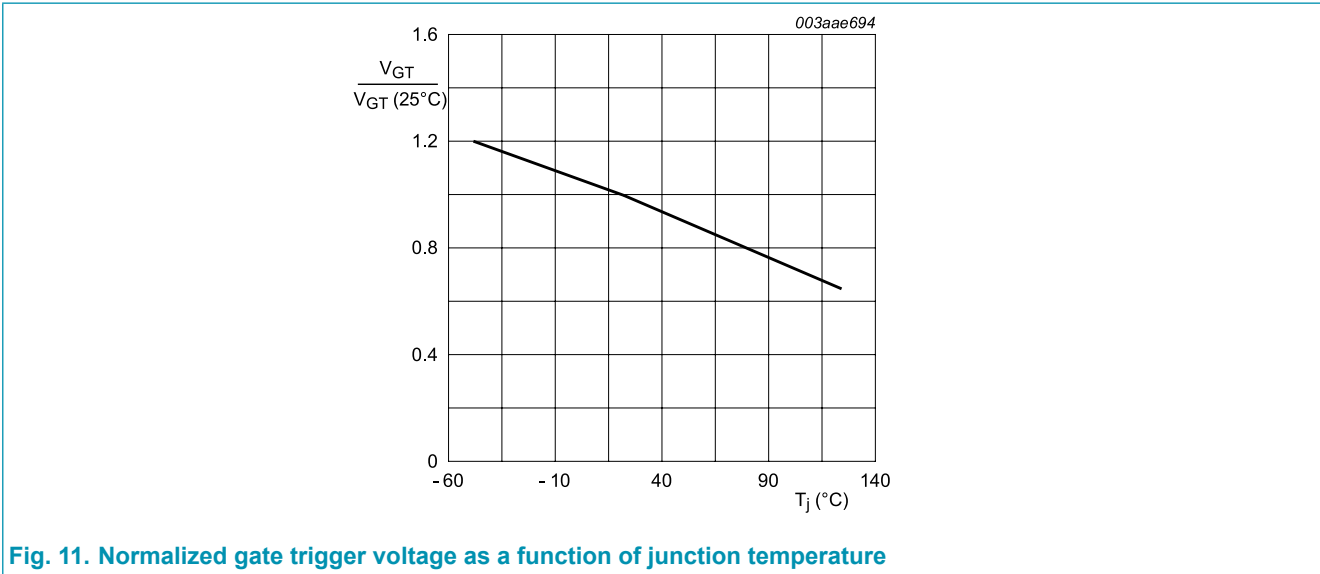
## 10. Characteristics

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>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>    | -    | 2.5 | 5    | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>    | -    | 3.5 | 5    | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>    | -    | 3.5 | 5    | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>    | -    | 6.5 | 10   | mA         |
| $I_L$                          | latching current                  | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>    | -    | 1.6 | 15   | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>    | -    | 8.5 | 20   | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>    | -    | 1.2 | 15   | mA         |
|                                |                                   | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; T2- G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>    | -    | 2.5 | 20   | mA         |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>                                      | -    | 1.5 | 10   | mA         |
| $V_T$                          | on-state voltage                  | $I_T = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>                                     | -    | 1.3 | 1.65 | V          |
| $V_{GT}$                       | gate trigger voltage              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ;<br><a href="#">Fig. 11</a>           | -    | 0.7 | 1    | V          |
|                                |                                   | $V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ °C}$ ;<br><a href="#">Fig. 11</a>         | 0.25 | 0.4 | -    | V          |
| $I_D$                          | off-state current                 | $V_D = 600\text{ V}$ ; $T_j = 125\text{ °C}$   | -    | 0.1 | 0.5  | mA         |
| <b>Dynamic characteristics</b> |                                   |  |      |     |      |            |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$ ; $T_j = 125\text{ °C}$ ; $R_{GT1} = 1\text{ k}\Omega$ ;<br>exponential waveform | -    | 5   | -    | V/ $\mu$ s |
| $t_{gt}$                       | gate-controlled turn-on time      | $I_{TM} = 12\text{ A}$ ; $V_D = 600\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu$ s      | -    | 2   | -    | $\mu$ s    |







### 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> ( <sup>2</sup> ) | b <sub>2</sub> ( <sup>2</sup> ) | c          | D            | D <sub>1</sub> | E           | e    | L            | L <sub>1</sub> ( <sup>1</sup> ) | L <sub>2</sub> ( <sup>1</sup> )<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 VERSION | REFERENCES |                 |       | EUROPEAN 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. |
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- [1] Please consult the most recently issued document before initiating or completing a design.
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