



**THE DATASHEET OF  
BT139-800G,127**



## 1. General description

Planar passivated four quadrant triac in a SOT78 (T0-220AB) plastic package intended for use in applications requiring high bidirectional transient and blocking voltage capability and high thermal cycling performance.

## 2. Features and benefits

- High voltage capability
- Least sensitive gate for highest noise immunity
- High minimum IGT for guaranteed immunity to gate noise
- 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

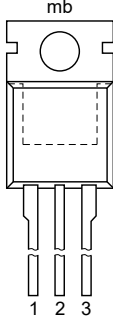

Table 1. Quick reference data

| Symbol                        | Parameter                            | Conditions   | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|--|-----|-----|-----|------|
| $V_{DRM}$                     | repetitive peak off-state voltage    |  | -   | -   | 800 | V    |
| $I_{T(RMS)}$                  | RMS on-state current                 | full sine wave; $T_{mb} \leq 99\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>        | -   | -   | 16  | A    |
| $I_{TSM}$                     | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 155 | A    |
|                               |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$   | -   | -   | 170 | A    |
| $T_j$                         | junction temperature                 |  | -   | -   | 125 | °C   |
| <b>Static characteristics</b> |                                      |  |     |     |     |      |
| $I_{GT}$                      | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                           | -   | 5   | 50  | mA   |
|                               |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                           | -   | 8   | 50  | mA   |
|                               |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                           | -   | 10  | 50  | mA   |
|                               |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G+; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                           | -   | 22  | 100 | mA   |

| Symbol                         | Parameter                             | Conditions  | Min | Typ | Max | Unit       |
|--------------------------------|---------------------------------------|---|-----|-----|-----|------------|
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 9   | -   | 6   | 60  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; Fig. 10  | -   | 1.2 | 1.6 | V          |
| <b>Dynamic characteristics</b> |                                       |   |     |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit | 200 | 250 | -   | V/ $\mu$ s |
| $dV_{com}/dt$                  | rate of change of commutating voltage | $V_D = 400\text{ V}$ ; $T_j = 95\text{ °C}$ ; $dI_{com}/dt = 7.2\text{ A/ms}$ ; $I_T = 16\text{ A}$ ; gate open circuit     | 10  | 20  | -   | V/ $\mu$ s |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                    | Simplified outline   | Graphic symbol  |
|-----|--------|--------------------------------|--|---|
| 1   | T1     | main terminal 1                |  <p>TO-220AB (SOT78)</p> |  <p>sym051</p> |
| 2   | T2     | main terminal 2                |  |   |
| 3   | G      | gate                           |  |   |
| mb  | T2     | mounting base; main terminal 2 |  |   |

## 6. Ordering information

Table 3. Ordering information

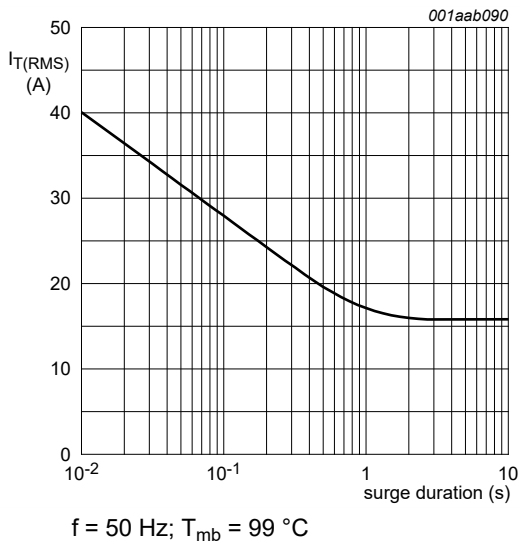
| Type number | Package  |  |         |
|-------------|----------|--|---------|
|             | Name     | Description  | Version |
| BT139-800G  | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 7. Limiting values

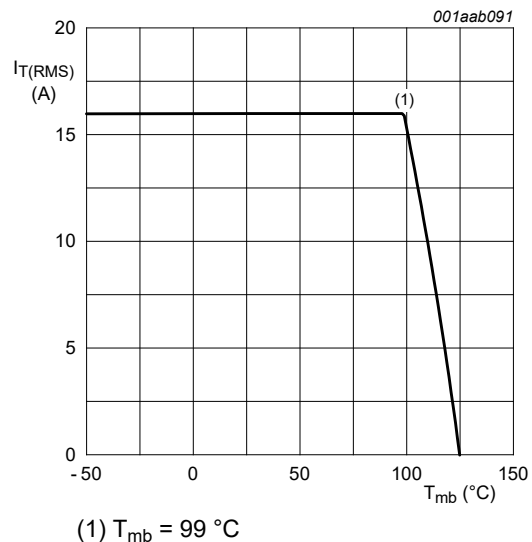
**Table 4. Limiting values**

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

| Symbol       | Parameter                            | Conditions   | Min | Max | Unit                   |
|--------------|--------------------------------------|--|-----|-----|------------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | 800 | V                      |
| $I_{T(RMS)}$ | RMS on-state current                 | full sine wave; $T_{mb} \leq 99\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>        | -   | 16  | A                      |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 155 | A                      |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$   | -   | 170 | A                      |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN   | -   | 120 | $\text{A}^2\text{s}$   |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 100\text{ mA}$  | -   | 50  | $\text{A}/\mu\text{s}$ |
|              |                                      | $I_G = 100\text{ mA}$  | -   | 50  | $\text{A}/\mu\text{s}$ |
|              |                                      | $I_G = 100\text{ mA}$  | -   | 50  | $\text{A}/\mu\text{s}$ |
|              |                                      | $I_G = 200\text{ mA}$  | -   | 10  | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | 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 | 150 | $^{\circ}\text{C}$     |
| $T_j$        | junction temperature                 |  | -   | 125 | $^{\circ}\text{C}$     |



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



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

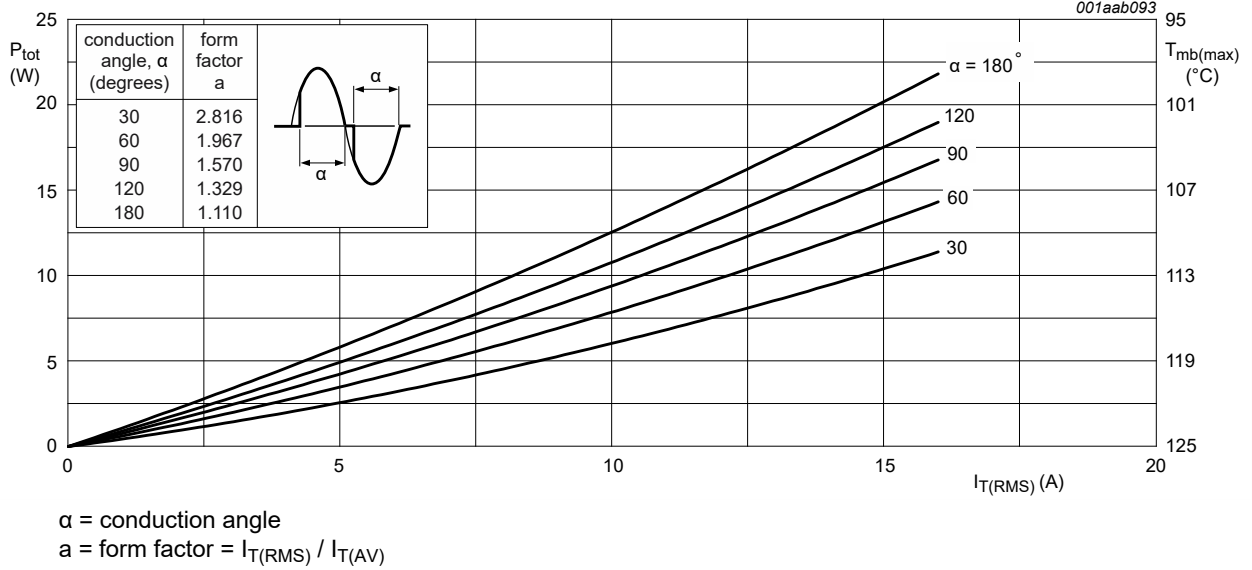


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values.

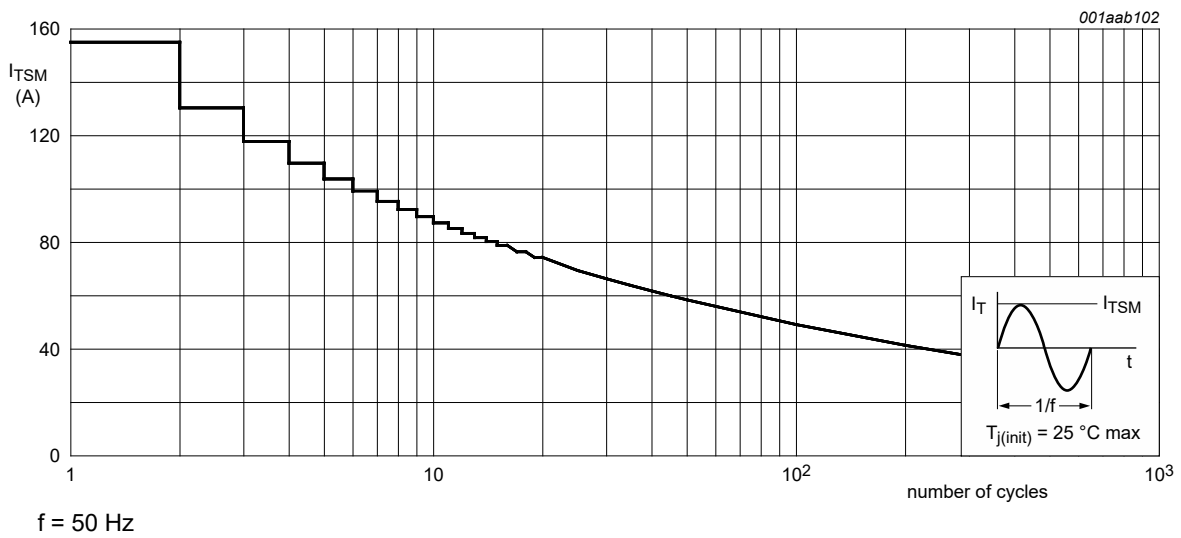


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

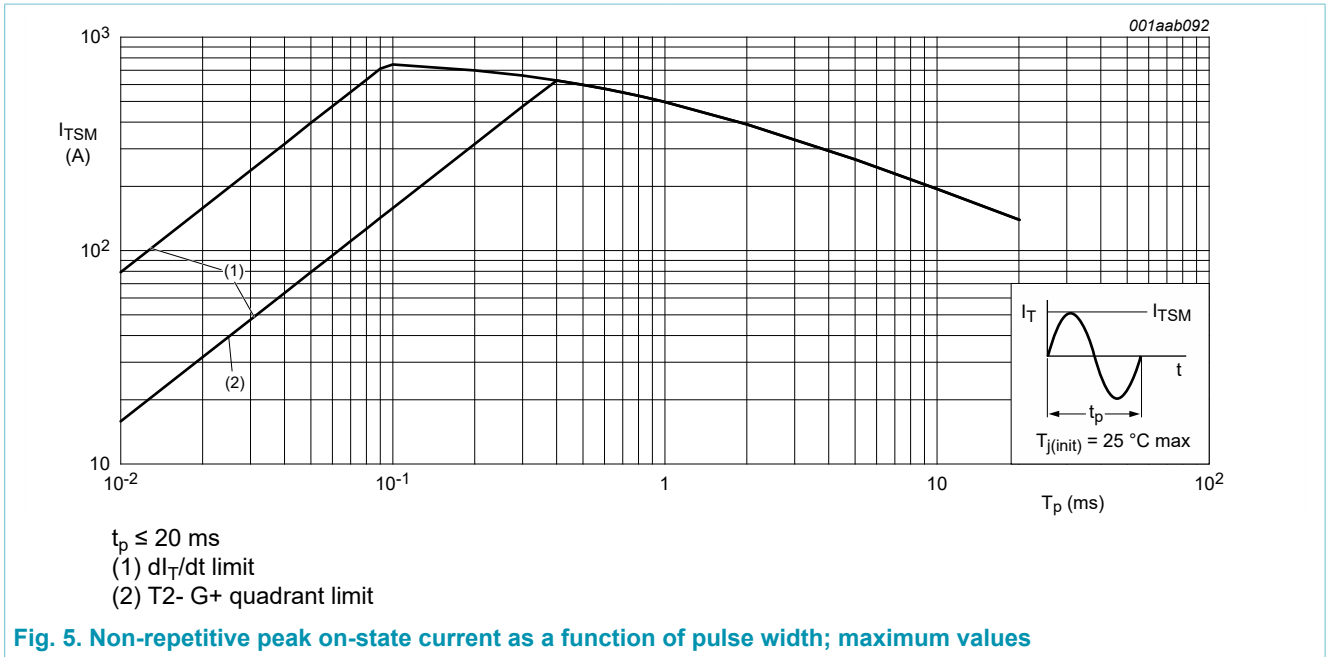
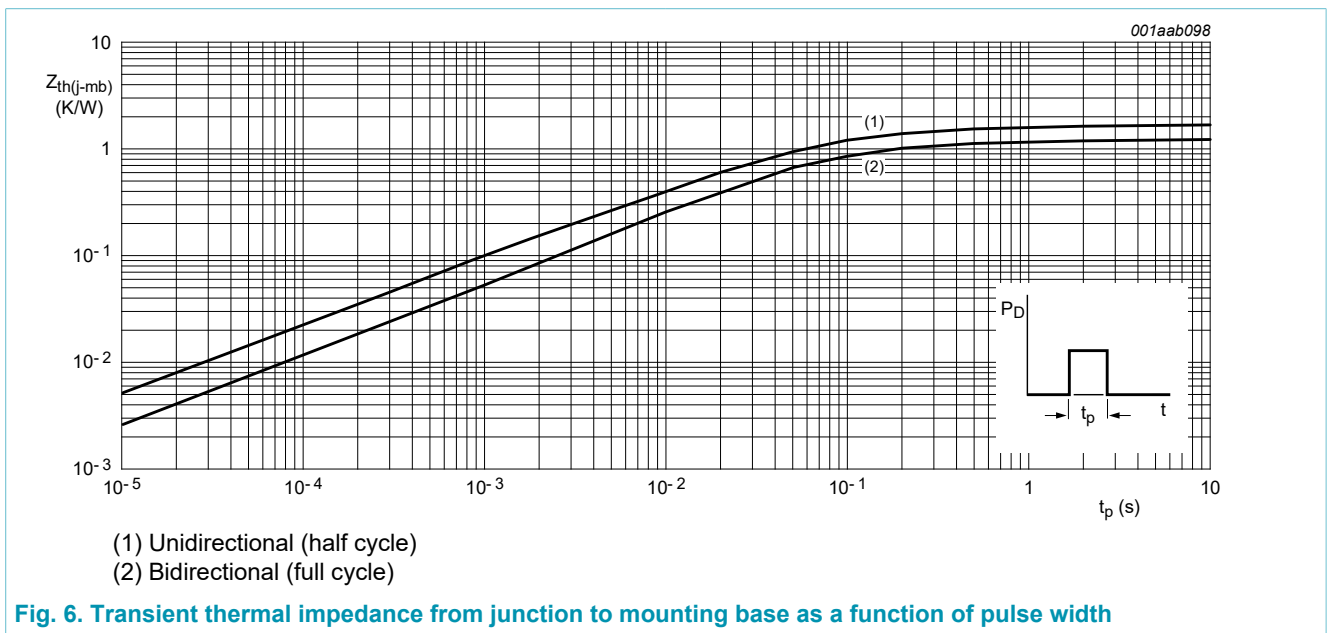


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

## 8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter  | Conditions         | Min | Typ | Max | Unit |
|----------------|--|--------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base    | half cycle; Fig. 6 | -   | -   | 1.7 | K/W  |
|                |  | full cycle; Fig. 6 | -   | -   | 1.2 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient free air | in free air        | -   | 60  | -   | K/W  |



## 9. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                             | Conditions  | Min  | Typ | Max | Unit             |
|--------------------------------|---------------------------------------|---|------|-----|-----|------------------|
| <b>Static characteristics</b>  |                                       |   |      |     |     |                  |
| $I_{GT}$                       | gate trigger current                  | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>                       | -    | 5   | 50  | 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   | 50  | 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>                       | -    | 10  | 50  | 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>                       | -    | 22  | 100 | 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   | 60  | 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>                       | -    | 20  | 90  | 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>                       | -    | 8   | 60  | 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>                       | -    | 10  | 90  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>   | -    | 6   | 60  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 20\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>  | -    | 1.2 | 1.6 | 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                     | $V_D = 800\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$  | -    | 0.1 | 0.5 | mA               |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit | 200  | 250 | -   | V/ $\mu\text{s}$ |
| $dV_{com}/dt$                  | rate of change of commutating voltage | $V_D = 400\text{ V}$ ; $T_j = 95\text{ }^\circ\text{C}$ ; $dI_{com}/dt = 7.2\text{ A/ms}$ ; $I_T = 16\text{ A}$ ; gate open circuit     | 10   | 20  | -   | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time          | $I_{TM} = 20\text{ A}$ ; $V_D = 800\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$                               | -    | 2   | -   | $\mu\text{s}$    |

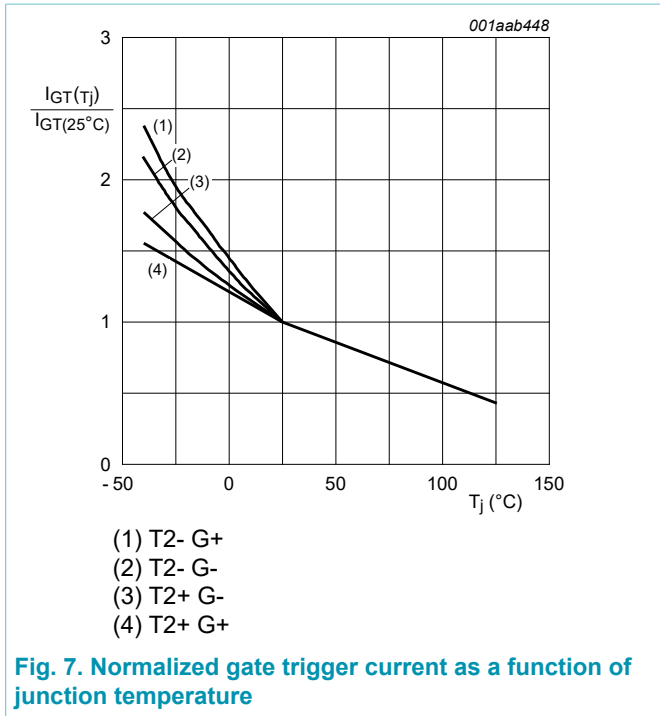


Fig. 7. Normalized gate trigger current as a function of junction temperature

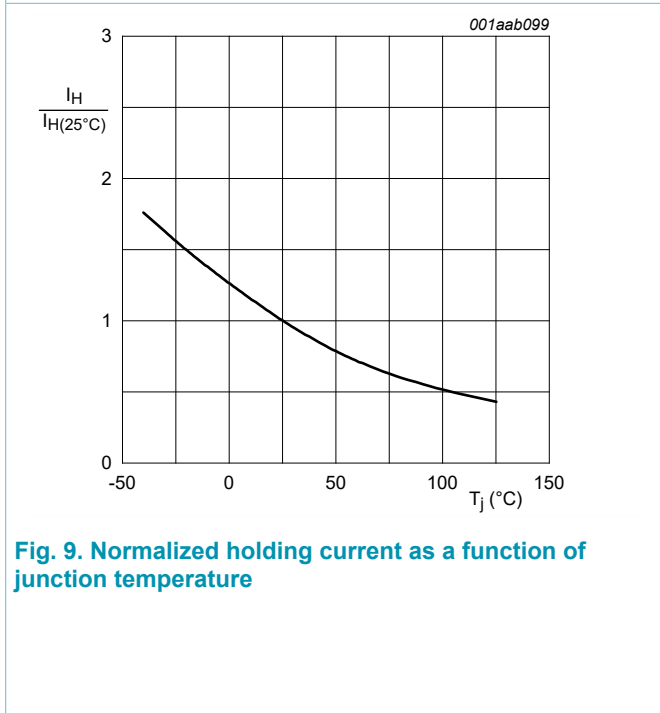


Fig. 9. Normalized holding current as a function of junction temperature

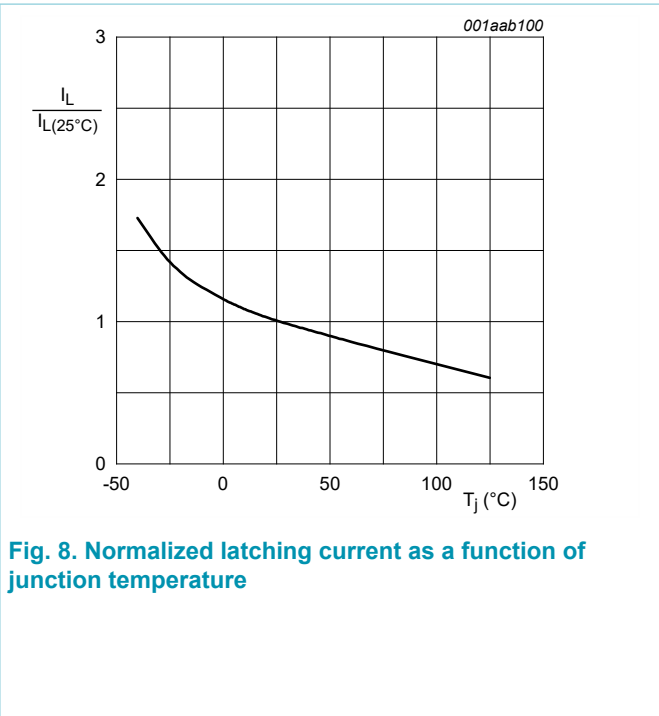


Fig. 8. Normalized latching current as a function of junction temperature

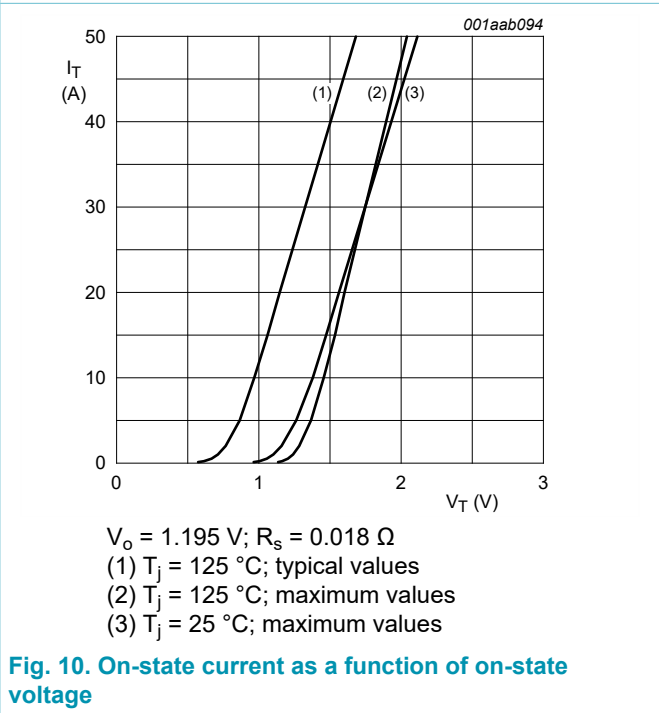
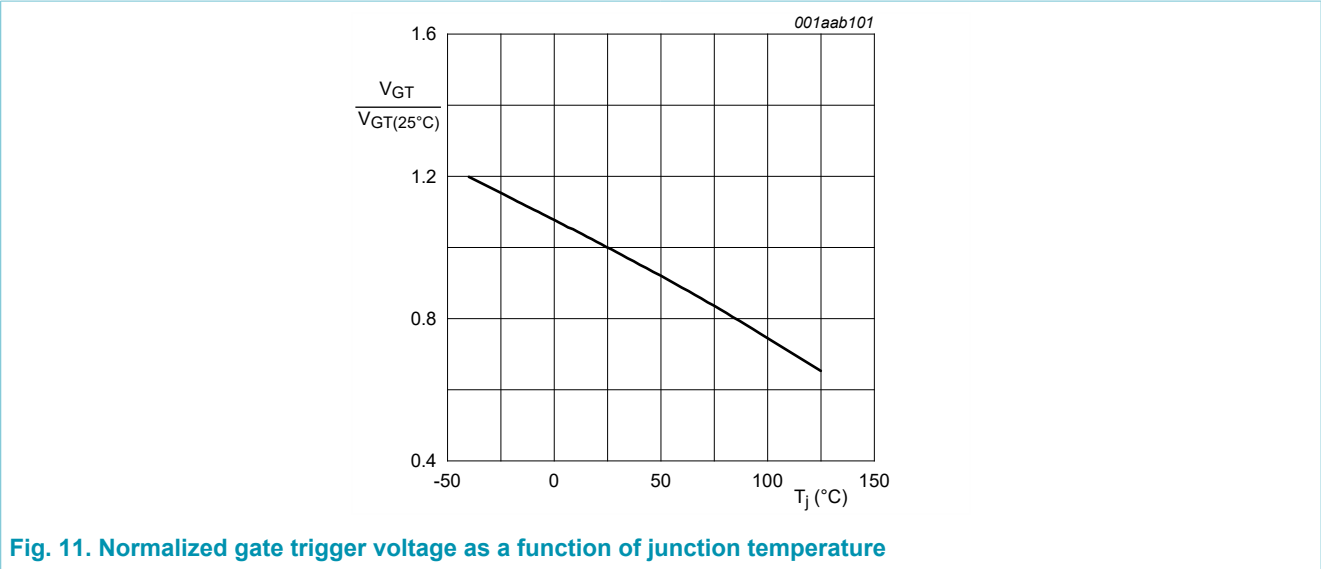


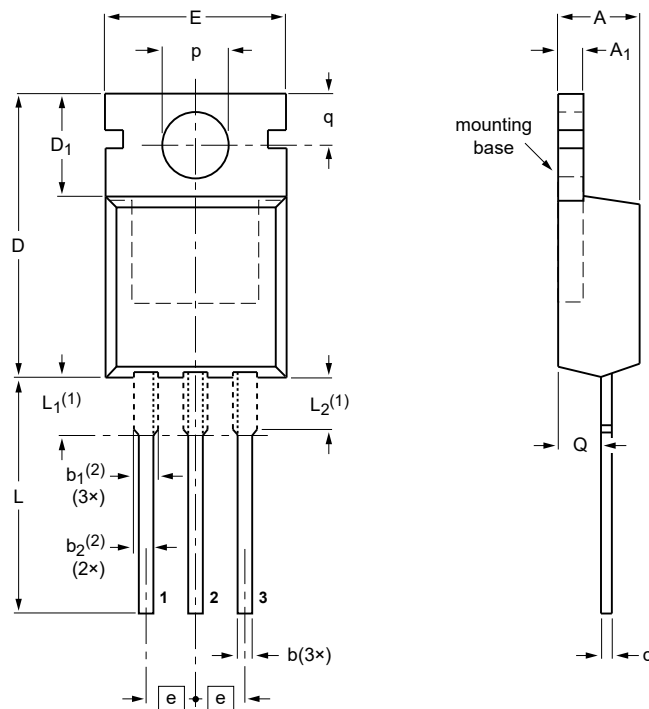
Fig. 10. On-state current as a function of on-state voltage



### 10. 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> ) 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 |

Fig. 12. Package outline TO-220AB (SOT78)

# 11. Legal information

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| 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: 26 September 2018

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