

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78 (TO-220AB) plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series C" triac will commute the full RMS current at the maximum rated junction temperature without the aid of a snubber.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High voltage capability
- Less sensitive gate for high noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Very high immunity to false turn-on by  $dV/dt$

## 3. Applications

- Electronic thermostats (heating and cooling)
- High power motor controls e.g. washing machines and vacuum cleaners
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

## 4. Quick reference data

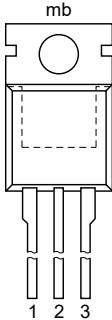
Table 1. Quick reference data

| 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; $T_{mb} \leq 100\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>       | -   | -   | 12  | 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> | -   | -   | 100 | A                  |
|                               |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 16.7\text{ ms}$                                                 | -   | -   | 110 | A                  |
| $T_j$                         | junction temperature                 |                                                                                                                                            | -   | -   | 125 | $^{\circ}\text{C}$ |
| <b>Static characteristics</b> |                                      |                                                                                                                                            |     |     |     |                    |
| $I_{GT}$                      | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G+; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                           | 2   | -   | 35  | mA                 |
|                               |                                      | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2+ G-; $T_j = 25\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 7</a>                           | 2   | -   | 35  | mA                 |

| Symbol                         | Parameter                             | Conditions                                                                                                                                                       | Min | Typ | Max | Unit       |
|--------------------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------------|
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; T2- G-;<br>$T_j = 25\text{ °C}$ ; Fig. 7                                                                            | 2   | -   | 35  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 9                                                                                                              | -   | -   | 35  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 15\text{ A}$ ; $T_j = 25\text{ °C}$ ; Fig. 10                                                                                                             | -   | 1.3 | 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                                      | 500 | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 20  | -   | -   | A/ms       |

## 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

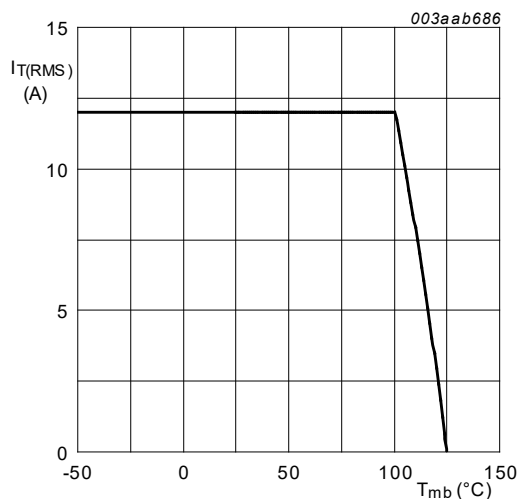
| Type number | Package  |                                                                                  |         |
|-------------|----------|----------------------------------------------------------------------------------|---------|
|             | Name     | Description                                                                      | Version |
| BTA312-800C | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 7. Limiting values

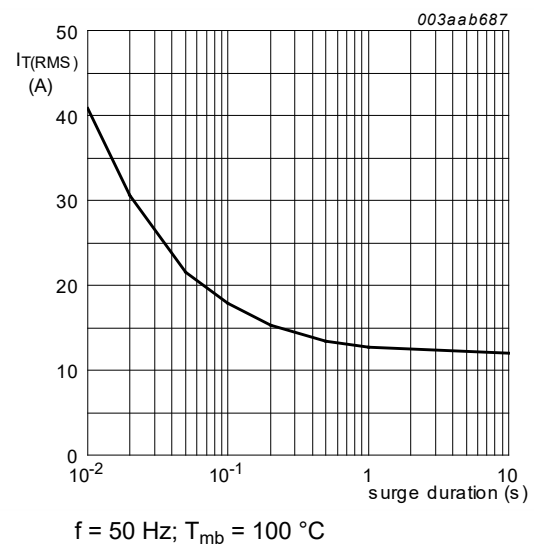
**Table 4. Limiting values**

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

| Symbol              | Parameter                            | Conditions                                                                                                                                          | Min | Max | Unit                   |
|---------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------------------------|
| $V_{\text{DRM}}$    | repetitive peak off-state voltage    |                                                                                                                                                     | -   | 800 | V                      |
| $I_{\text{T(RMS)}}$ | RMS on-state current                 | full sine wave; $T_{\text{mb}} \leq 100\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>         | -   | 12  | 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. 4</a> ; <a href="#">Fig. 5</a> | -   | 100 | A                      |
|                     |                                      | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$ ; $t_{\text{p}} = 16.7\text{ ms}$                                                 | -   | 110 | A                      |
| $I^2t$              | $I^2t$ for fusing                    | $t_{\text{p}} = 10\text{ ms}$ ; SIN                                                                                                                 | -   | 50  | $\text{A}^2\text{s}$   |
| $di_{\text{T}}/dt$  | rate of rise of on-state current     | $I_{\text{G}} = 0.2\text{ A}$                                                                                                                       | -   | 100 | $\text{A}/\mu\text{s}$ |
| $I_{\text{GM}}$     | 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 | 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**

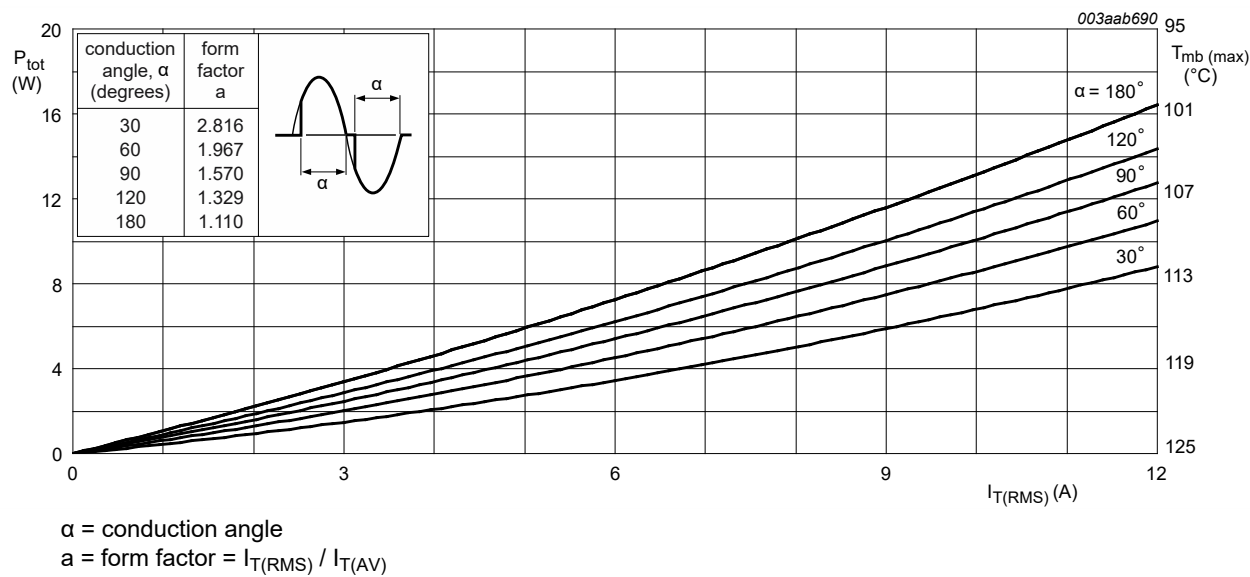


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

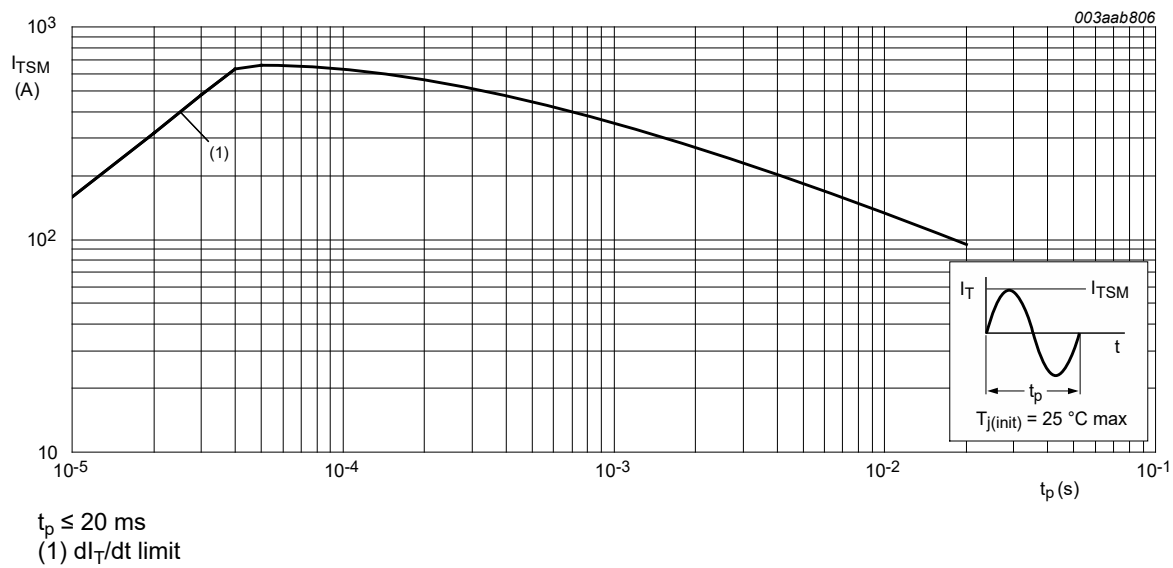
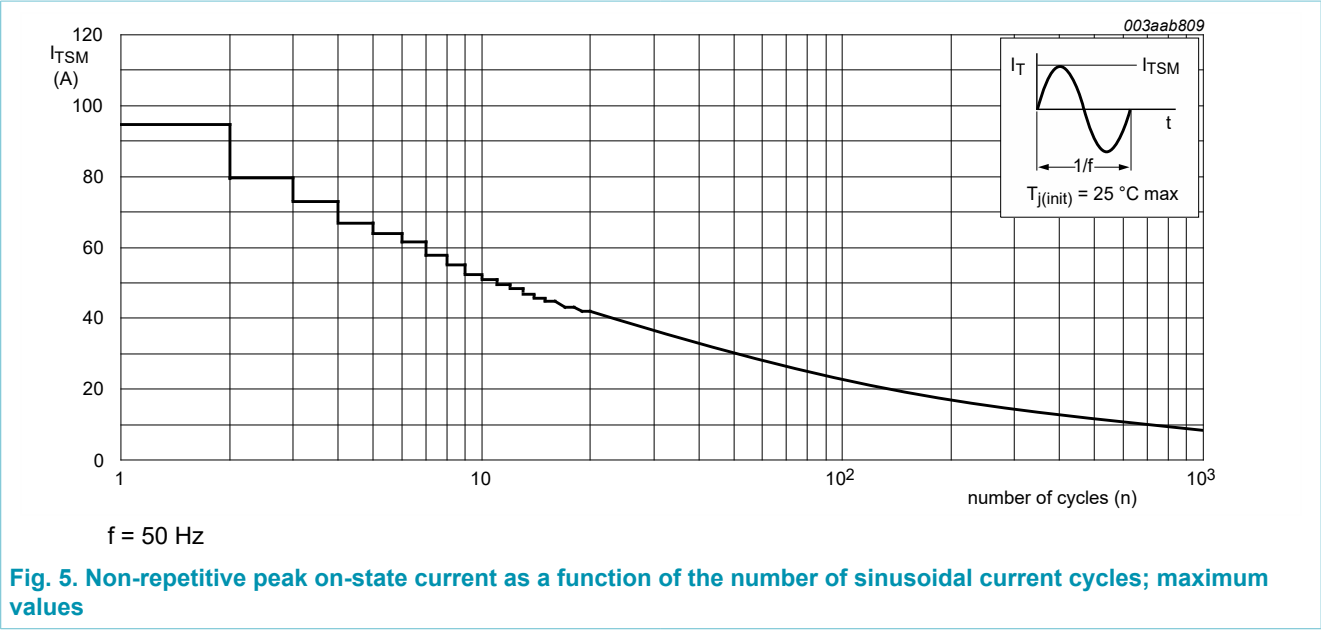


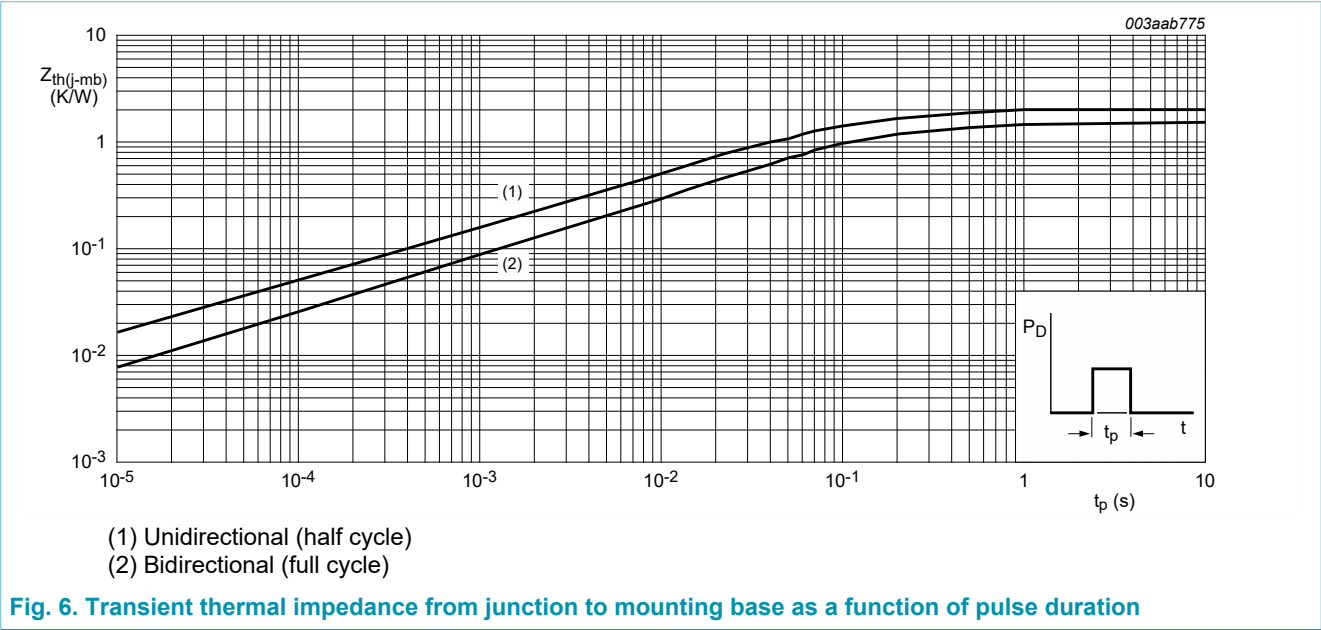
Fig. 4. Non-repetitive peak on-state current as a function of pulse duration; maximum values



8. Thermal characteristics

Table 5. Thermal characteristics

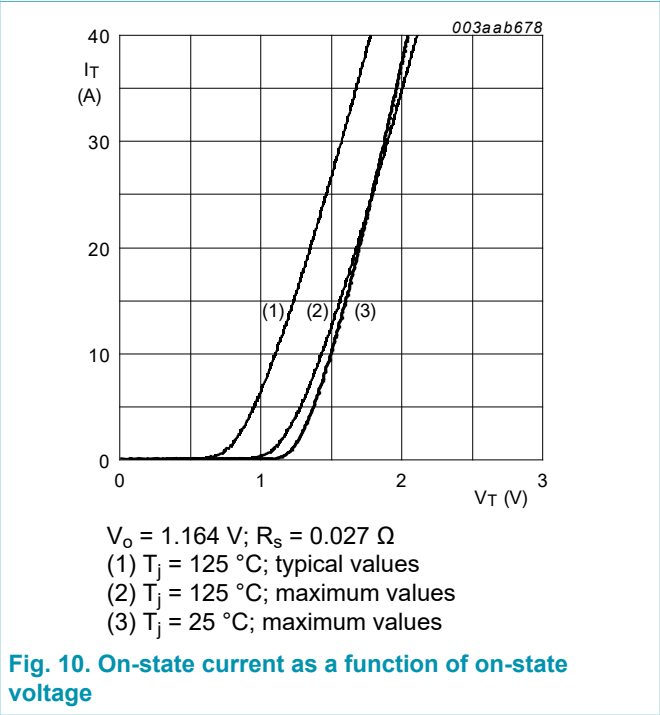
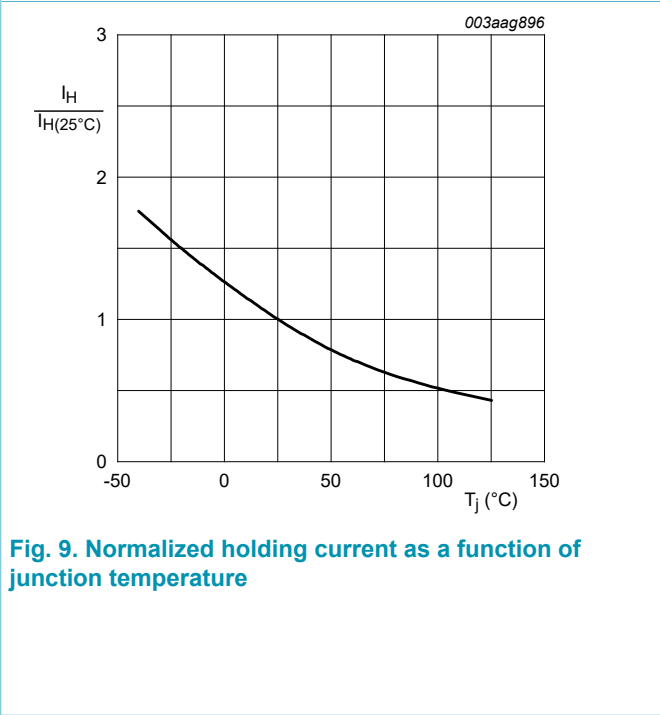
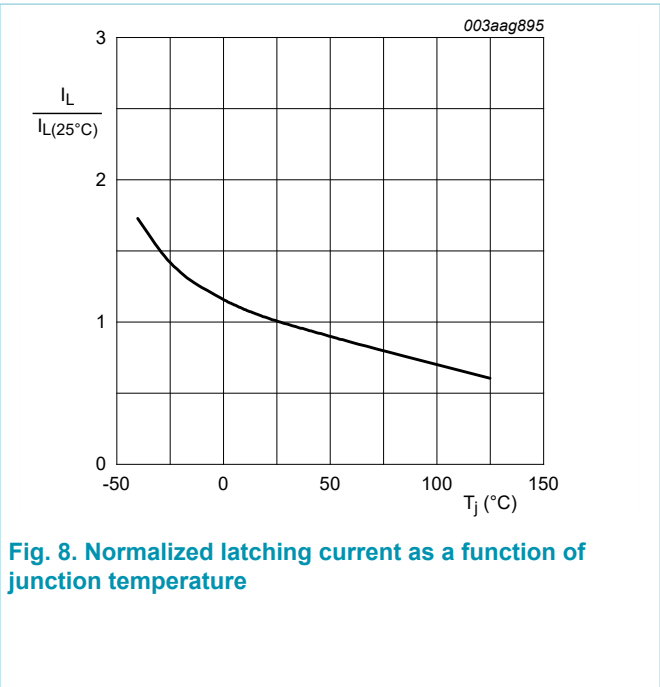
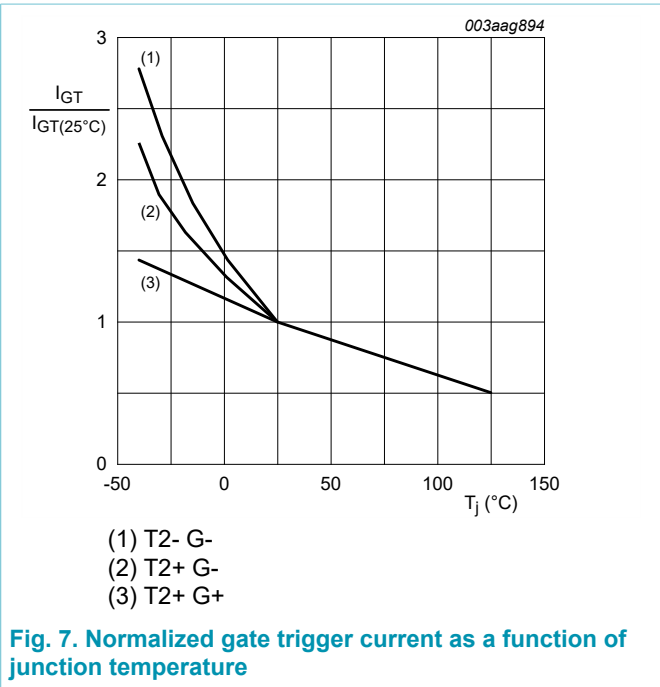
| Symbol         | Parameter                                            | Conditions         |  | Min | Typ | Max | Unit |
|----------------|------------------------------------------------------|--------------------|--|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base    | full cycle; Fig. 6 |  | -   | -   | 1.5 | K/W  |
|                |                                                      | half cycle; Fig. 6 |  | -   | -   | 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>                                                            |  | 2    | -   | 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>                                                            |  | 2    | -   | 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>                                                            |  | 2    | -   | 35  | 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>                                                            |  | -    | -   | 50  | 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>                                                            |  | -    | -   | 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>                                                            |  | -    | -   | 50  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>                                                                                              |  | -    | -   | 35  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 15\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>                                                                                             |  | -    | 1.3 | 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>                                                                   |  | -    | 0.8 | 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                                      |  | 500  | -   | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 12\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit |  | 20   | -   | -   | A/ms             |



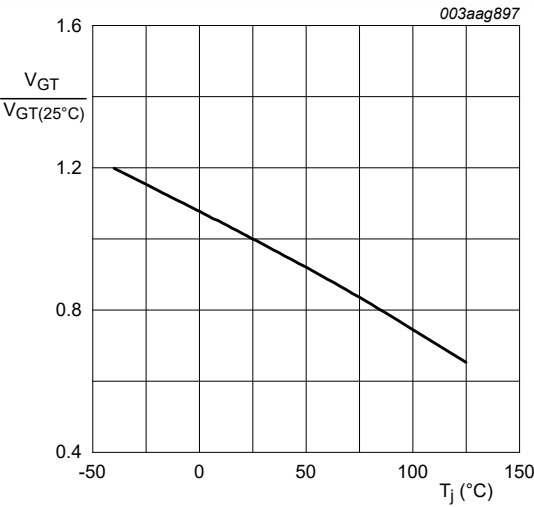


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

10. Package outline

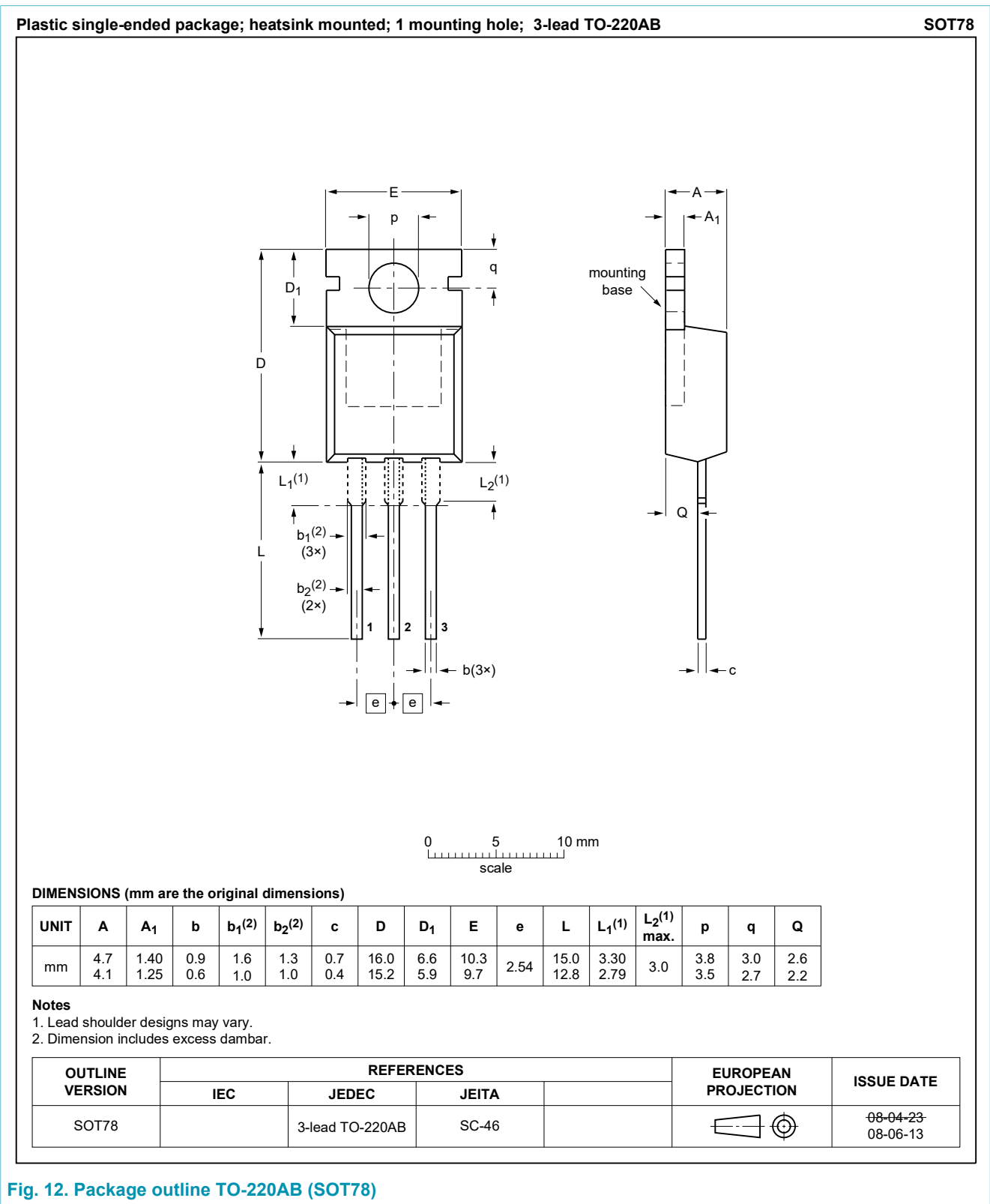


Fig. 12. Package outline TO-220AB (SOT78)

## 11. 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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