

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78D (TO-220AB) internally insulated plastic package intended for use in circuits where high static and dynamic  $dV/dt$  and high  $dI/dt$  can occur. This "series BT" triac will commute the full RMS current at the maximum rated junction temperature ( $T_{j(max)} = 150\text{ °C}$ ) without the aid of a snubber. It is used in applications where "high junction operating temperature capability" is required.

## 2. Features and benefits

- 3Q technology for improved noise immunity
- 2500 V RMS isolation voltage capability
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by  $dV/dt$
- High junction operating temperature capability
- High voltage capability
- Least sensitive gate for highest noise immunity
- Internally insulated package
- Internally isolated mounting base
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only

## 3. Applications

- Applications subject to high temperature
- Heating controls
- High power motor control
- High power switching

## 4. Quick reference data

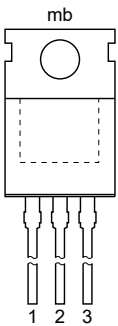
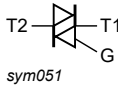
Table 1. Quick reference data

| 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; $T_{mb} \leq 100\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | -   | -   | 20  | A    |
| $I_{TSM}$    | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>  | -   | -   | 200 | A    |
|              |                                      | full sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$  | -   | -   | 220 | A    |
| $T_j$        | junction temperature                 |  | -   | -   | 150 | °C   |

| Symbol                         | Parameter                             | Conditions  | Min  | Typ | Max | Unit |
|--------------------------------|---------------------------------------|---|------|-----|-----|------|
| <b>Static characteristics</b>  |                                       |   |      |     |     |      |
| 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>                                   | -    | -   | 50  | 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>                                   | -    | -   | 50  | 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>                                   | -    | -   | 50  | mA   |
| I <sub>H</sub>                 | holding current                       | V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 9</a>   | -    | -   | 60  | mA   |
| V <sub>T</sub>                 | on-state voltage                      | I <sub>T</sub> = 24 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 10</a>  | -    | 1.2 | 1.5 | V    |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |      |
| dV <sub>D</sub> /dt            | rate of rise of off-state voltage     | V <sub>DM</sub> = 536 V; T <sub>j</sub> = 150 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit | 1800 | -   | -   | V/μs |
| dI <sub>com</sub> /dt          | rate of change of commutating current | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 20 A; dV <sub>com</sub> /dt = 10 V/μs; gate open circuit         | 25   | -   | -   | A/ms |
|                                |                                       | V <sub>D</sub> = 400 V; T <sub>j</sub> = 150 °C; I <sub>T(RMS)</sub> = 20 A; dV <sub>com</sub> /dt = 1 V/μs; gate open circuit          | 65   | -   | -   | A/ms |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline   | Graphic symbol  |
|-----|--------|-------------------------|--|---|
| 1   | T1     | main terminal 1         |  <p>TO-220AB (SOT78D)</p> |  <p>sym051</p> |
| 2   | T2     | main terminal 2         |  |   |
| 3   | G      | gate                    |  |   |
| mb  | n.c.   | mounting base; isolated |  |   |

## 6. Ordering information

Table 3. Ordering information

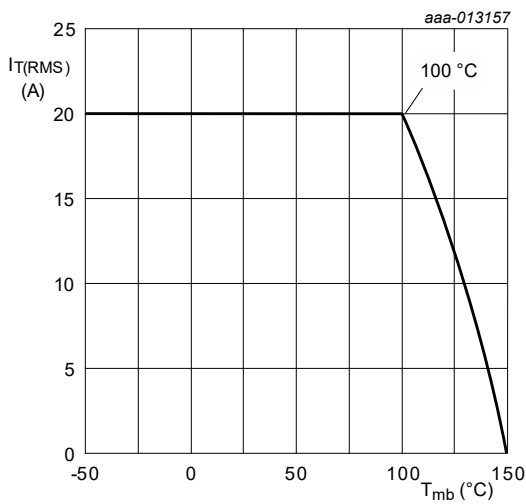
| Type number   | Package  |   |         |
|---------------|----------|---|---------|
|               | Name     | Description   | Version |
| BTA420Y-800BT | TO-220AB | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 | SOT78D  |

## 7. Limiting values

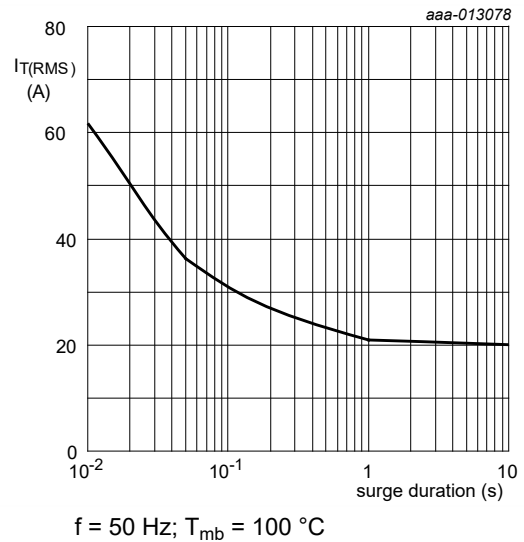
**Table 4. Limiting values**

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; $T_{mb} \leq 100\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>       | -   | 20  | 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> | -   | 200 | A                |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$   | -   | 220 | A                |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; sine-wave pulse   | -   | 200 | A <sup>2</sup> s |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 100\text{ mA}$  | -   | 100 | 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 | 150 | °C               |
| $T_j$        | junction temperature                 |  | -   | 150 | °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**

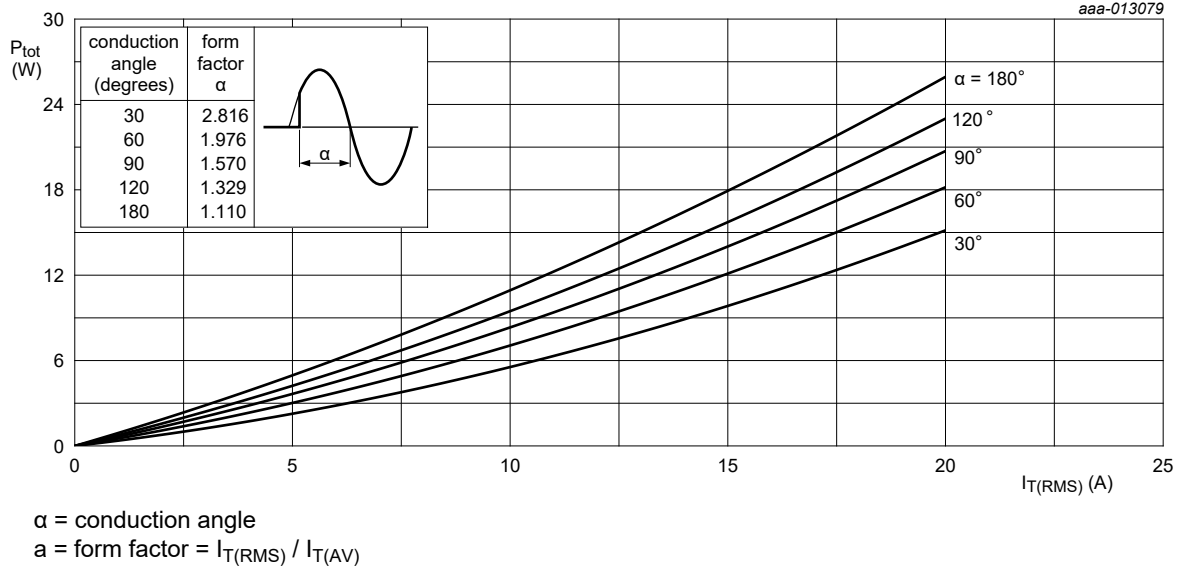


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

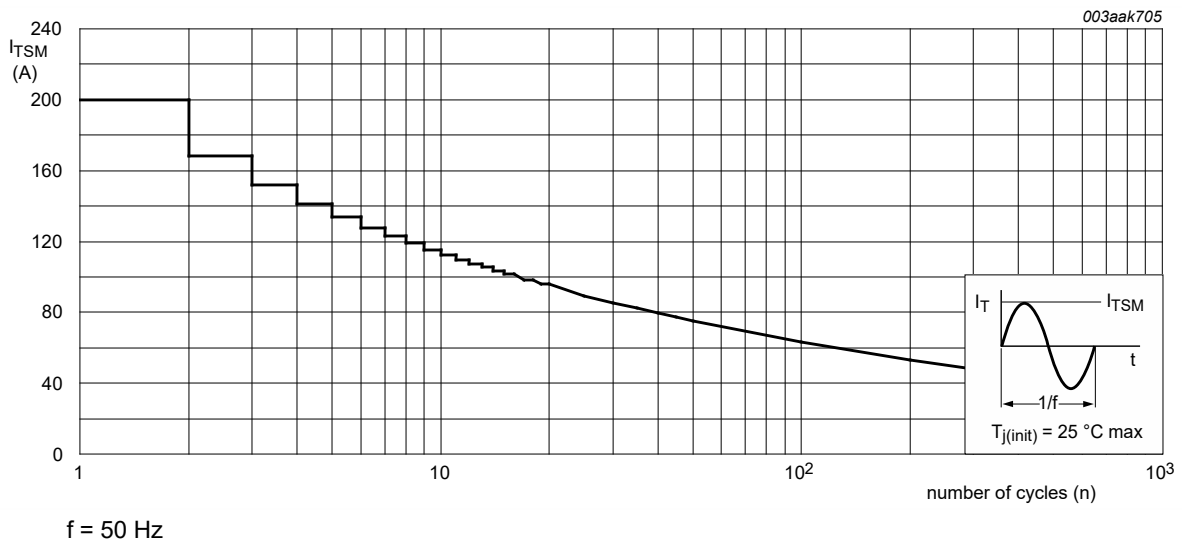
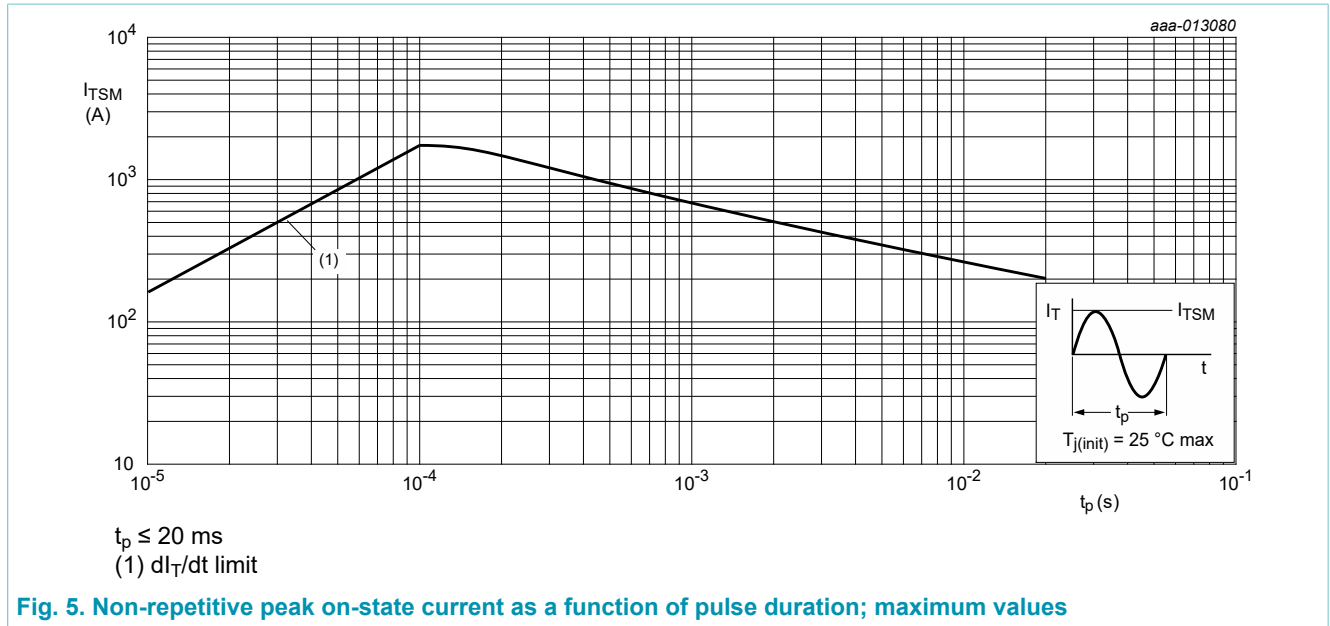


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



## 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; <a href="#">Fig. 6</a> | -   | -   | 1.9 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient free air | in free air                        | -   | 60  | -   | K/W  |

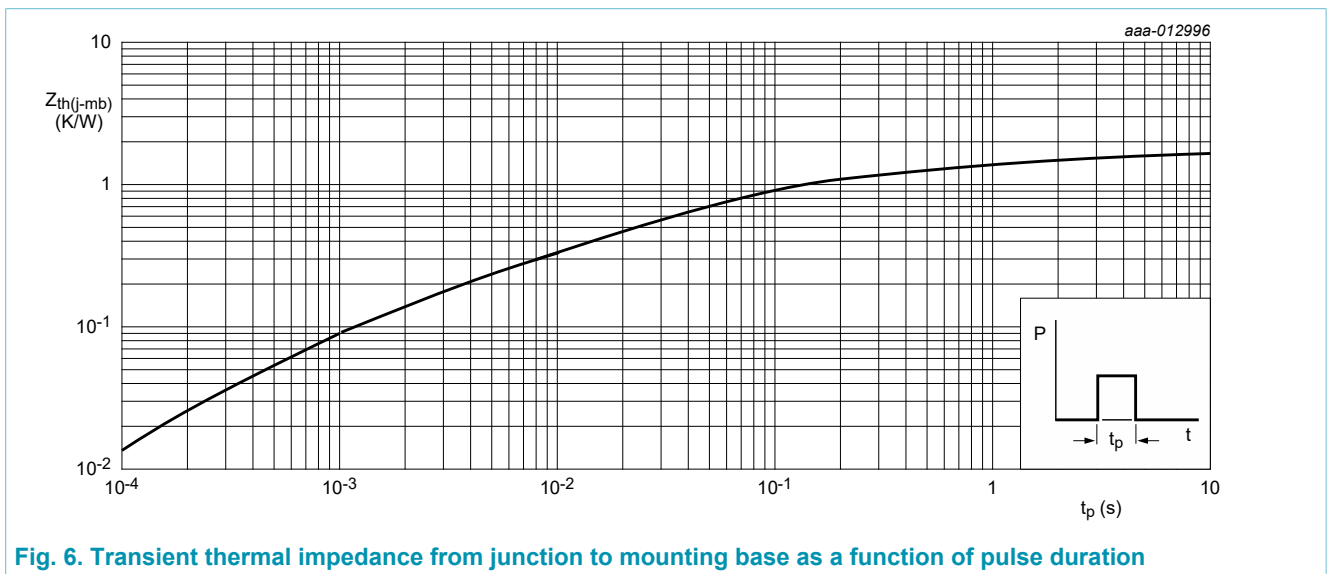


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 9. Isolation characteristics

Table 6. Isolation characteristics

| Symbol          | Parameter             | Conditions  | Min | Typ | Max  | Unit |
|-----------------|-----------------------|---|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$ ; $RH \leq 65\%$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$ ; $T_{mb} = 25\text{ }^\circ\text{C}$   | -   | 10  | -    | pF   |

## 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>                                   | -    | -   | 50  | 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>                                   | -    | -   | 50  | 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>                                   | -    | -   | 50  | 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>                                   | -    | -   | 60  | 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>                                   | -    | -   | 90  | 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>                                   | -    | -   | 60  | mA         |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>   | -    | -   | 60  | mA         |
| $V_T$                          | on-state voltage                      | $I_T = 24\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>  | -    | 1.2 | 1.5 | V          |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>  | -    | 0.7 | 1   | V          |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; <a href="#">Fig. 11</a>  | 0.2  | 0.4 | -   | V          |
| $I_D$                          | off-state current                     | $V_D = 800\text{ V}$ ; $T_j = 150\text{ °C}$  | -    | 0.2 | 1   | mA         |
| <b>Dynamic characteristics</b> |                                       |   |      |     |     |            |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_j = 150\text{ °C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit             | 1800 | -   | -   | V/ $\mu$ s |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 20\text{ A}$ ; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit | 25   | -   | -   | A/ms       |
|                                |                                       | $V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 20\text{ A}$ ; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$ ; gate open circuit  | 65   | -   | -   | A/ms       |

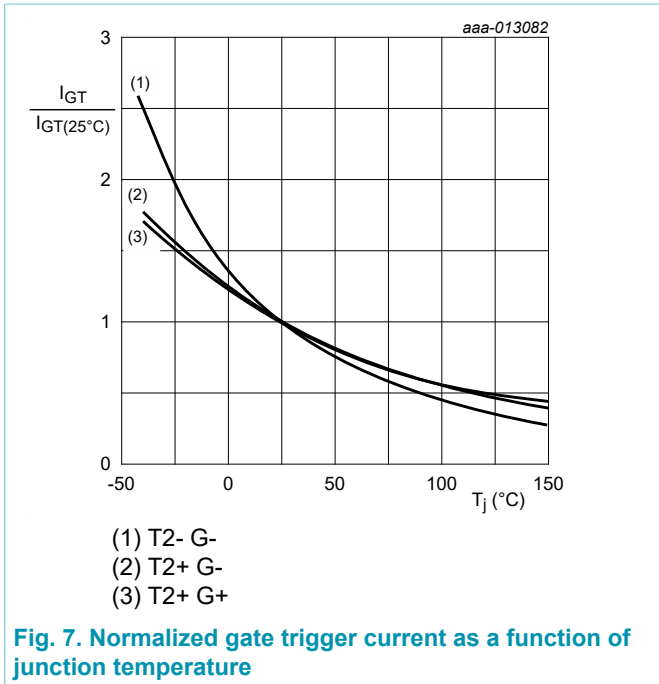


Fig. 7. Normalized gate trigger current as a function of junction temperature

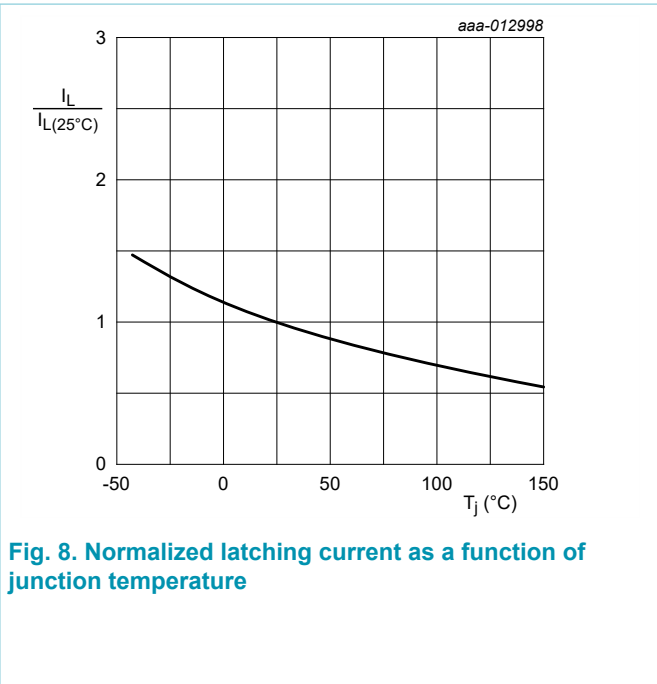


Fig. 8. Normalized latching current as a function of junction temperature

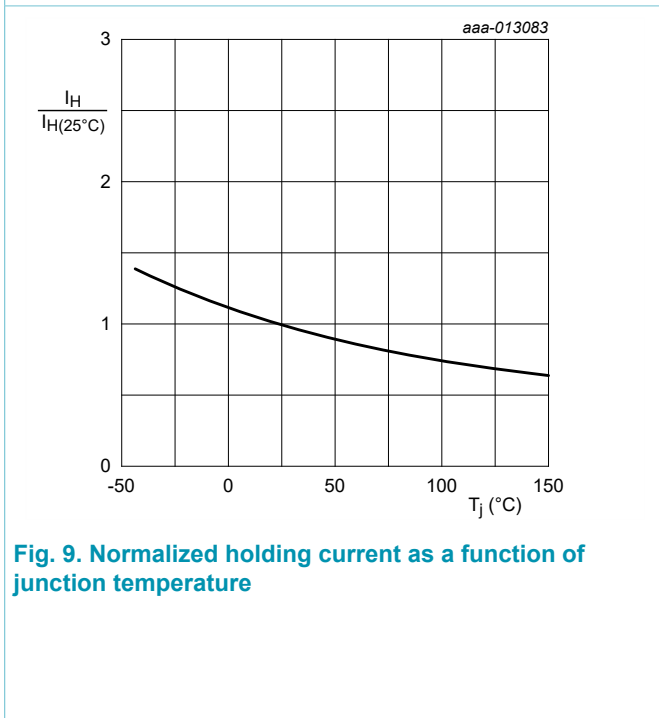


Fig. 9. Normalized holding current as a function of junction temperature

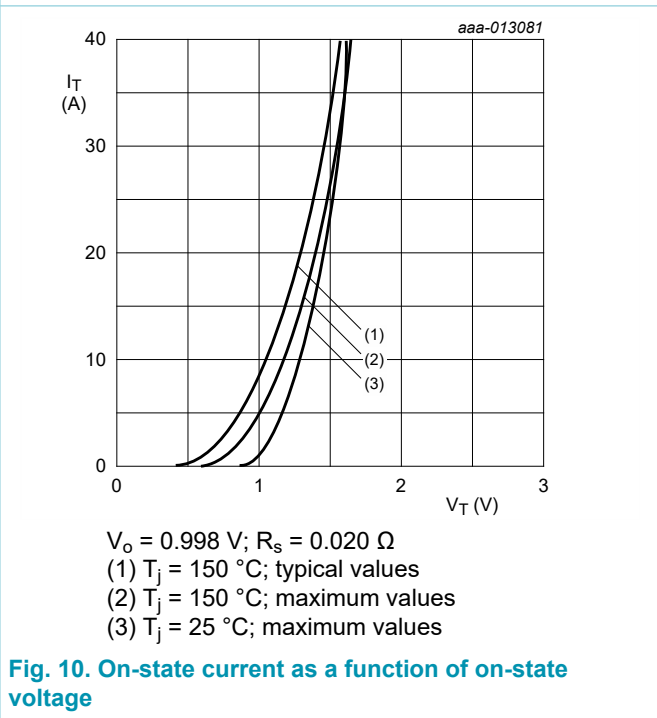


Fig. 10. On-state current as a function of on-state voltage



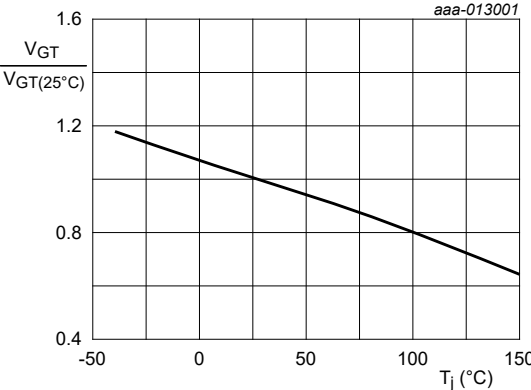


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

### 11. Package outline

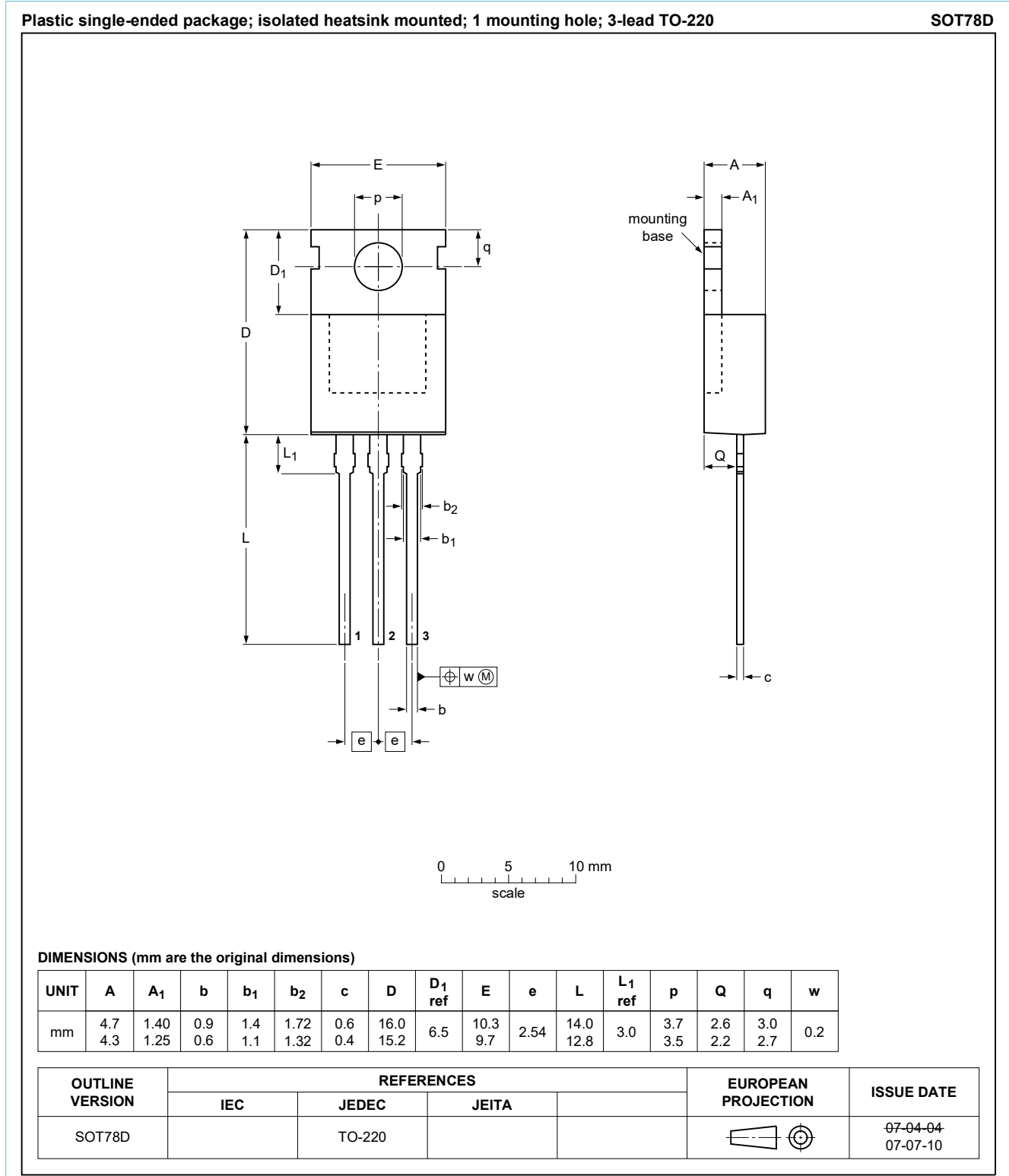


Fig. 12. Package outline TO-220AB (SOT78D)

## 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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