

## 1. General description

AC Thyristor Triac power switch in a SOT78 (TO-220AB) plastic package with self-protective clamping capabilities against low and high energy transients. This "series C0T" triac will commutate 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

- Clamping structure ensuring safe high over-voltage withstand capability
- High junction operating temperature capability
- High minimum  $I_{GT}$  for guaranteed immunity to gate noise
- Full cycle AC conduction
- Over-voltage withstand capability to IEC 61000-4-5
- Pin compatible with standard triacs
- Protective self turn-on capability for high energy transients
- Safe clamping capability for low energy over-voltage transients
- Less sensitive gate for high noise immunity
- Triggering in three quadrants only
- Planar passivated for voltage ruggedness and reliability
- High commutation capability with maximum false trigger immunity
- Very high immunity to false turn-on by  $dV/dt$

## 3. Applications

- AC fan, pump and compressor controls
- Highly inductive, resistive and safety loads
- Large and small appliances (White Goods)
- Reversing induction motor controls
- Applications subject to high temperature

## 4. Quick reference data

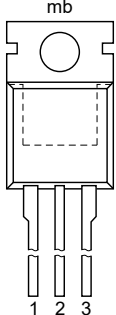
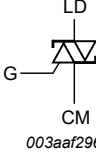
Table 1. Quick reference data

| 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; $T_{mb} \leq 130\text{ °C}$ ; <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; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>  | -   | -   | 80  | A    |

| Symbol                         | Parameter                             | Conditions  | Min | Typ | Max | Unit             |
|--------------------------------|---------------------------------------|---|-----|-----|-----|------------------|
|                                |                                       | full sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ;<br>$t_p = 16.7\text{ ms}$   | -   | -   | 88  | A                |
| $T_j$                          | junction temperature                  |   | -   | -   | 150 | $^\circ\text{C}$ |
| $V_{PP}$                       | peak pulse voltage                    | $T_j = 25\text{ }^\circ\text{C}$ ; non-repetitive, off-state;<br><a href="#">Fig. 6</a>   | -   | -   | 2   | kV               |
| <b>Static characteristics</b>  |                                       |   |     |     |     |                  |
| $I_{GT}$                       | gate trigger current                  | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G+;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>  | 5   | -   | 30  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>  | 5   | -   | 30  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>  | 5   | -   | 30  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>  | -   | -   | 35  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 10\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>  | -   | 1.3 | 1.5 | V                |
| $V_{CL}$                       | clamping voltage                      | $I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ }^\circ\text{C}$   | 850 | -   | -   | V                |
| <b>Dynamic characteristics</b> |                                       |   |     |     |     |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage     | $V_{DM} = 536\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit                                     | 600 | -   | -   | V/ $\mu\text{s}$ |
| $di_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$ ; $I_{T(RMS)} = 8\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 3   | -   | -   | A/ms             |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description         | Simplified outline  | Graphic symbol  |
|-----|--------|---------------------|---|---|
| 1   | CM     | common              |  <p style="text-align: center;">mb</p> <p style="text-align: center;">1 2 3</p> <p style="text-align: center;"><b>TO-220AB (SOT78)</b></p> |  <p style="text-align: center;">LD</p> <p style="text-align: center;">G</p> <p style="text-align: center;">CM</p> <p style="text-align: center;">003aaf296</p> |
| 2   | LD     | load                |   |   |
| 3   | G      | gate                |   |   |
| mb  | LD     | mounting base; load |   |   |

## 6. Ordering information

Table 3. Ordering information

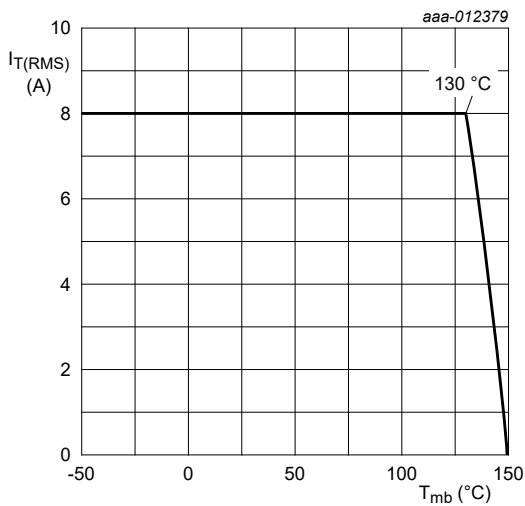
| Type number  | Package  |  |         |
|--------------|----------|--|---------|
|              | Name     | Description  | Version |
| ACTT8-800C0T | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 7. Limiting values

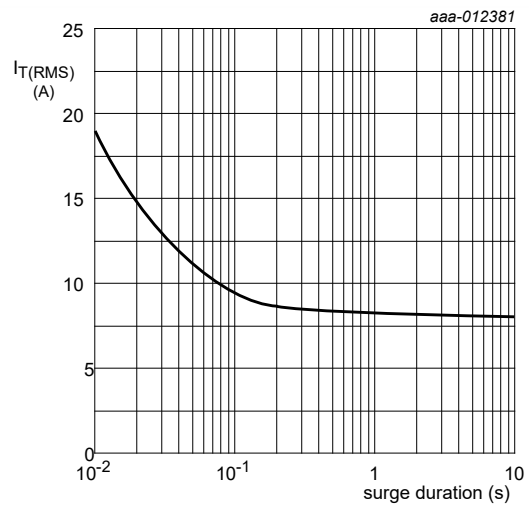
**Table 4. Limiting values**

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; $T_{mb} \leq 130\text{ °C}$ ; <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; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 20\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 80  | A                |
|              |                                      | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 16.7\text{ ms}$   | -   | 88  | A                |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; sine-wave pulse   | -   | 32  | A <sup>2</sup> s |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 70\text{ mA}$   | -   | 100 | A/ $\mu$ s       |
| $I_{GM}$     | peak gate current                    | $t = 20\text{ }\mu$ s  | -   | 2   | A                |
| $P_{GM}$     | peak gate power                      |  | -   | 5   | W                |
| $P_{G(AV)}$  | average gate power                   | over any 20 ms period  | -   | 0.5 | W                |
| $T_j$        | junction temperature                 |  | -   | 150 | °C               |
| $V_{PP}$     | peak pulse voltage                   | $T_j = 25\text{ °C}$ ; non-repetitive, off-state; <a href="#">Fig. 6</a>   | -   | 2   | kV               |



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



$f = 50\text{ Hz}$ ;  $T_{mb} = 130\text{ °C}$

**Fig. 2. RMS on-state current as a function of surge duration; maximum values**

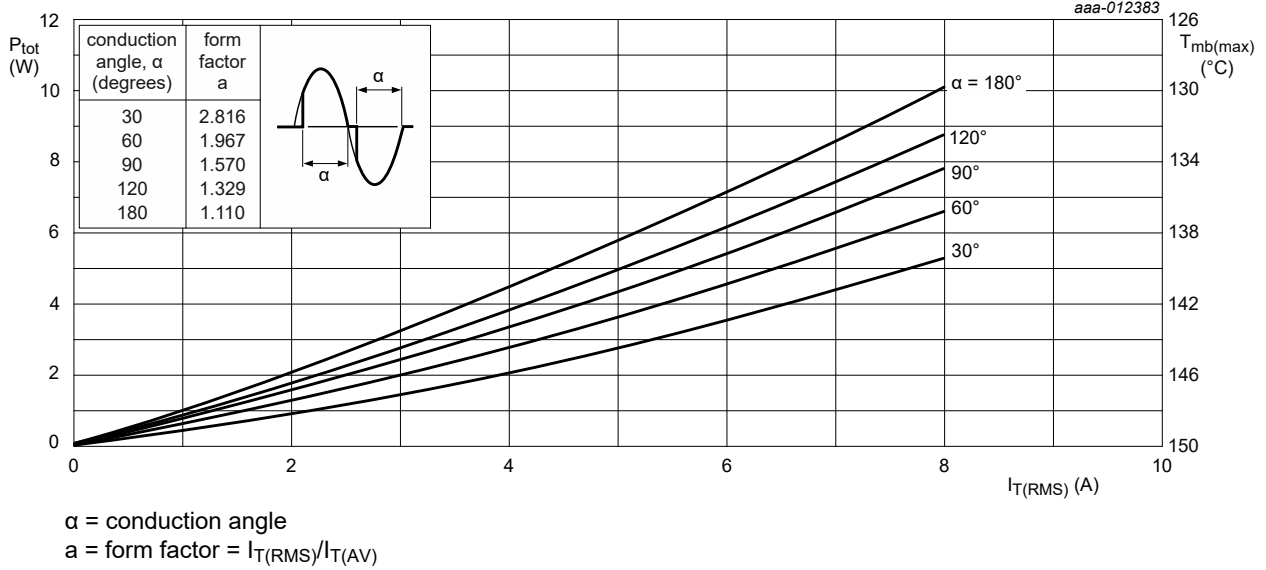


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

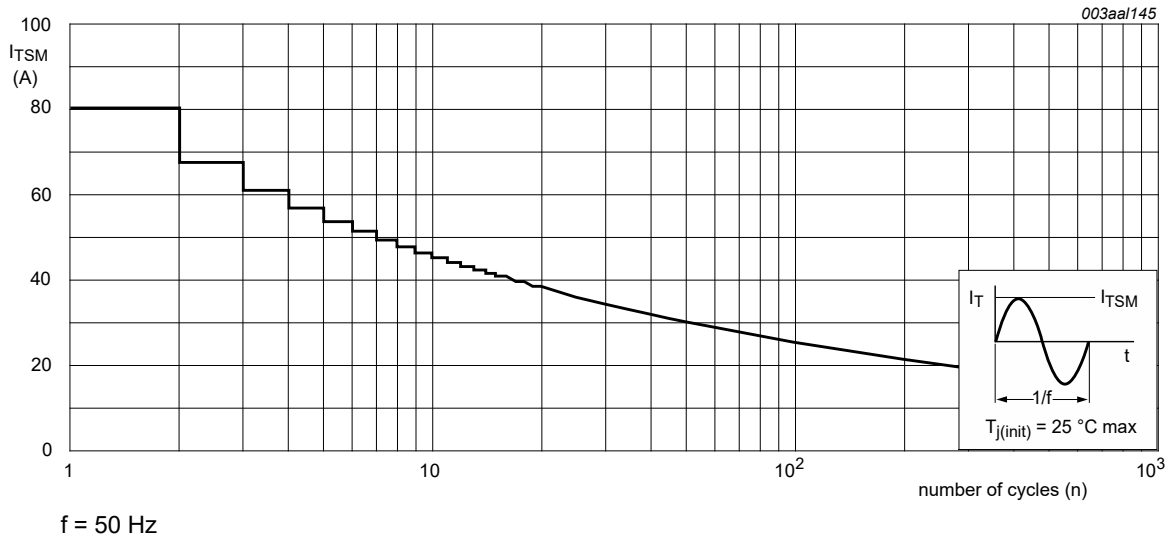


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

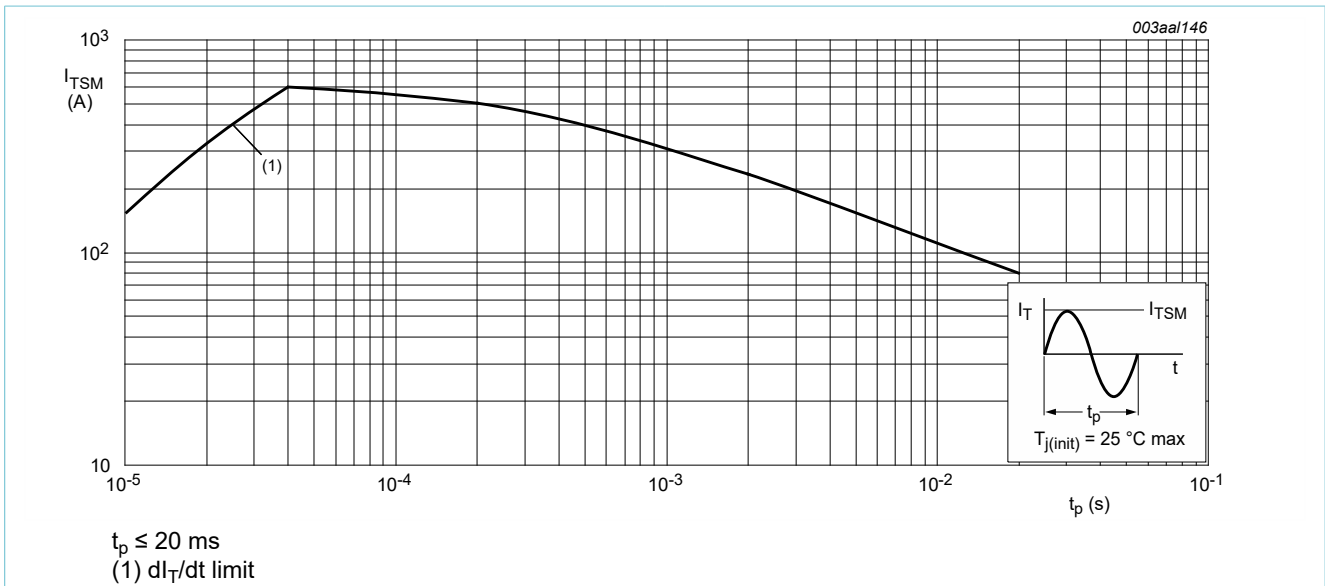


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

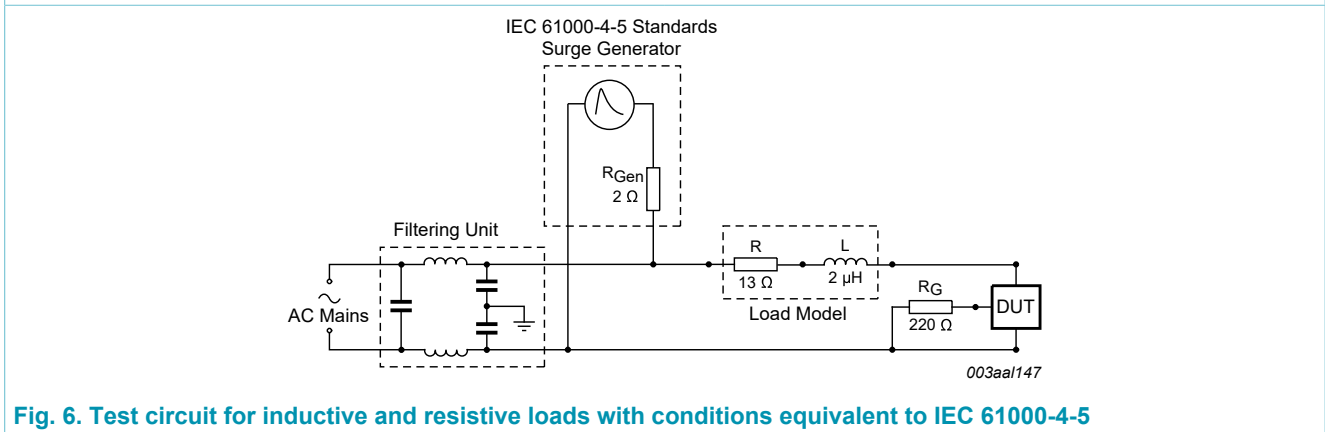
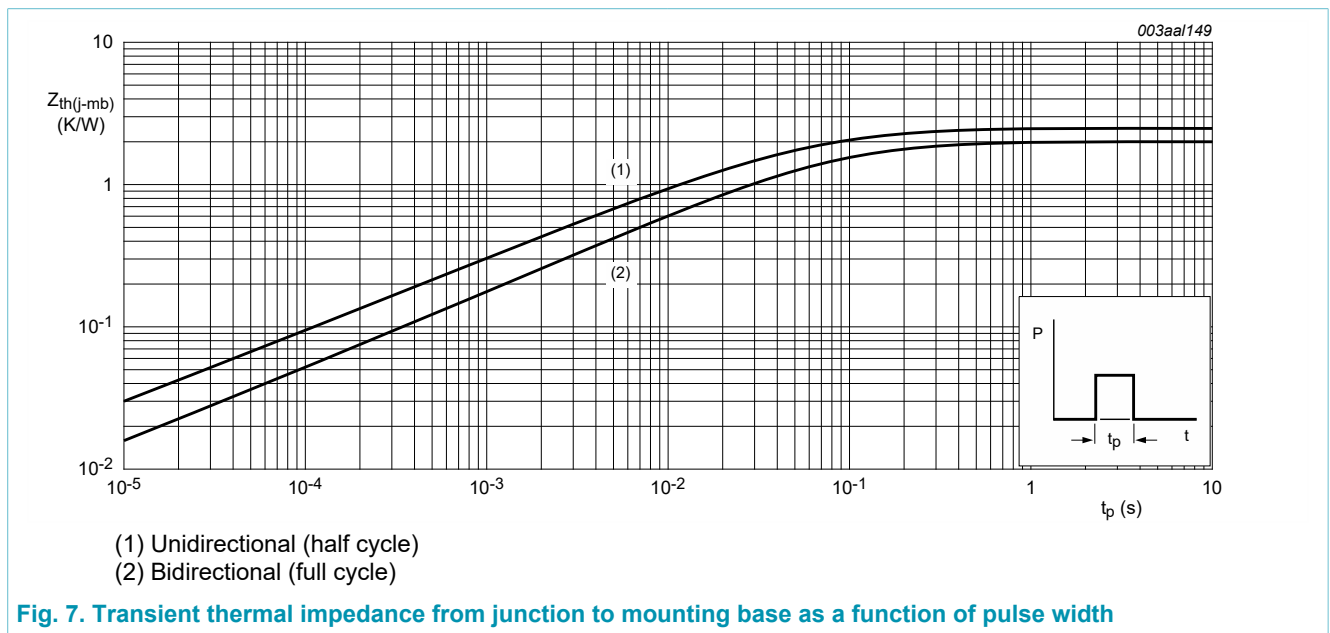


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

### 8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol                | Parameter  | Conditions         | Min | Typ | Max | Unit |
|-----------------------|--|--------------------|-----|-----|-----|------|
| R <sub>th(j-mb)</sub> | thermal resistance from junction to mounting base    | full cycle; Fig. 7 | -   | -   | 2   | K/W  |
|                       |  | half cycle; Fig. 7 | -   | -   | 2.4 | K/W  |
| R <sub>th(j-a)</sub>  | 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                  | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>  | 5   | -    | 30  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>  | 5   | -    | 30  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 8</a>  | 5   | -    | 30  | mA               |
| $I_L$                          | latching current                      | $V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G+;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>  | -   | -    | 50  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD+ G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>  | -   | -    | 70  | mA               |
|                                |                                       | $V_D = 12\text{ V}$ ; $I_G = 100\text{ mA}$ ; LD- G-;<br>$T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>  | -   | -    | 50  | mA               |
| $I_H$                          | holding current                       | $V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>  | -   | -    | 35  | mA               |
| $V_T$                          | on-state voltage                      | $I_T = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>  | -   | 1.3  | 1.5 | V                |
| $V_{GT}$                       | gate trigger voltage                  | $V_D = 12\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 25\text{ °C}$ ;<br><a href="#">Fig. 12</a>   | -   | 0.8  | 1   | V                |
|                                |                                       | $V_D = 400\text{ V}$ ; $I_T = 100\text{ mA}$ ; $T_j = 150\text{ °C}$ ;<br><a href="#">Fig. 12</a>   | 0.2 | 0.45 | -   | V                |
| $I_D$                          | off-state current                     | $V_D = 800\text{ V}$ ; $T_j = 25\text{ °C}$   | -   | -    | 10  | $\mu\text{A}$    |
|                                |                                       | $V_D = 800\text{ V}$ ; $T_j = 150\text{ °C}$  | -   | -    | 2   | mA               |
| $V_{CL}$                       | clamping voltage                      | $I_{CL} = 0.1\text{ mA}$ ; $t_p = 1\text{ ms}$ ; $T_j = 25\text{ °C}$   | 850 | -    | -   | V                |
| <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                                     | 600 | -    | -   | V/ $\mu\text{s}$ |
| $dI_{com}/dt$                  | rate of change of commutating current | $V_D = 400\text{ V}$ ; $T_j = 150\text{ °C}$ ; $I_{T(RMS)} = 8\text{ A}$ ; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$ ; (snubberless condition); gate open circuit | 3   | -    | -   | A/ms             |



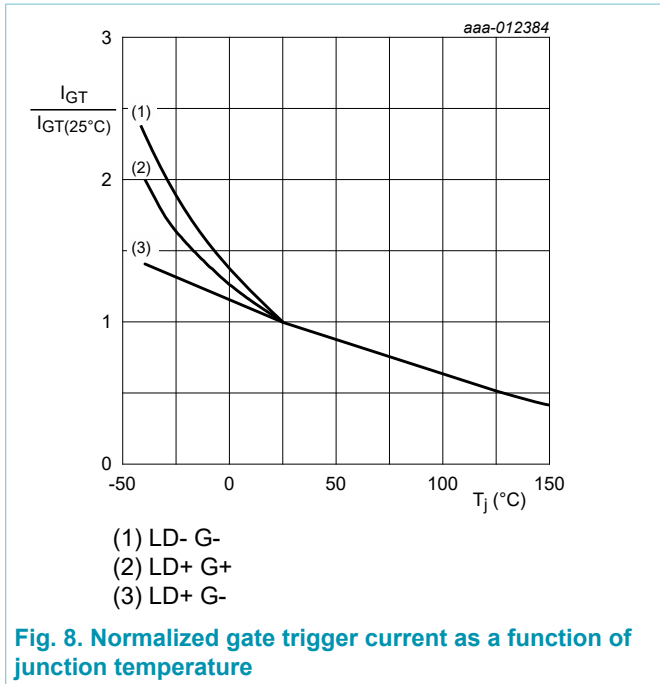


Fig. 8. Normalized gate trigger current as a function of junction temperature

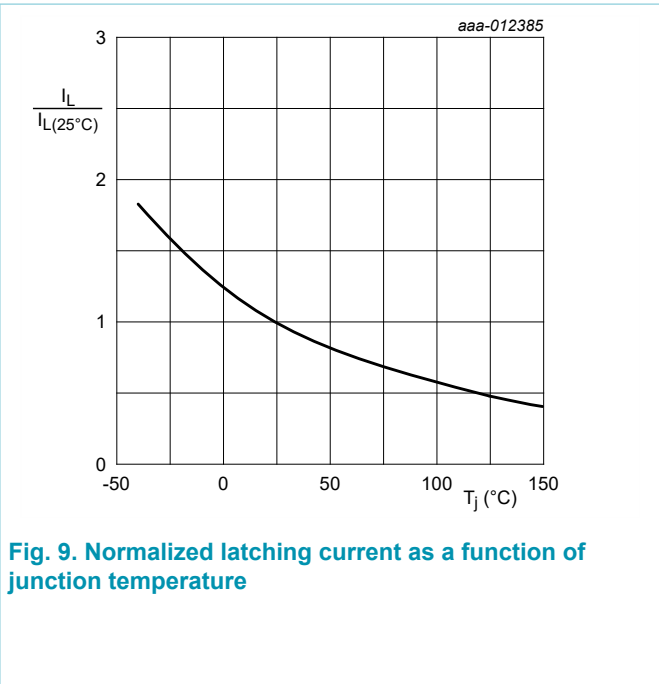


Fig. 9. Normalized latching current as a function of junction temperature

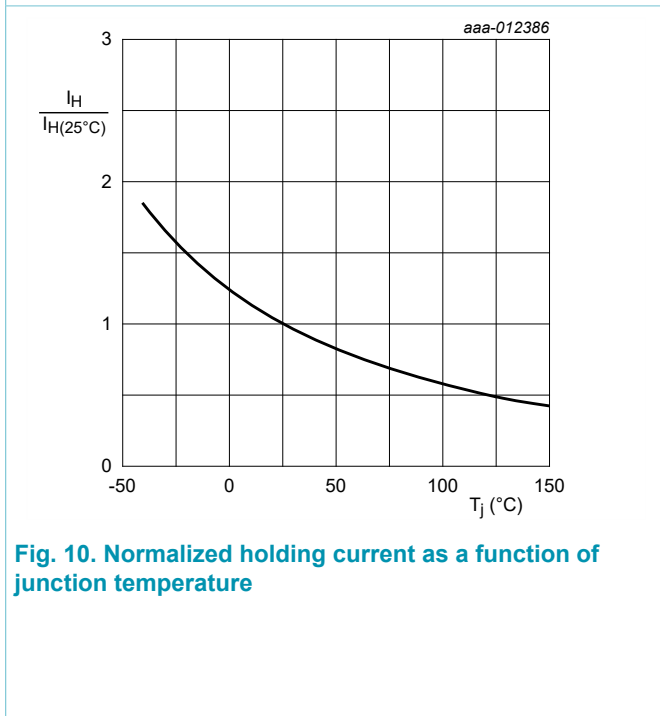


Fig. 10. Normalized holding current as a function of junction temperature

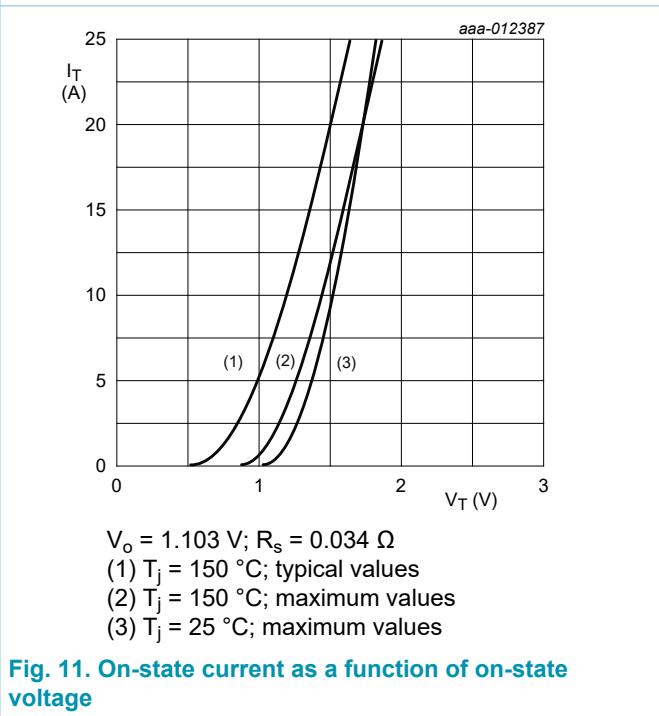


Fig. 11. On-state current as a function of on-state voltage

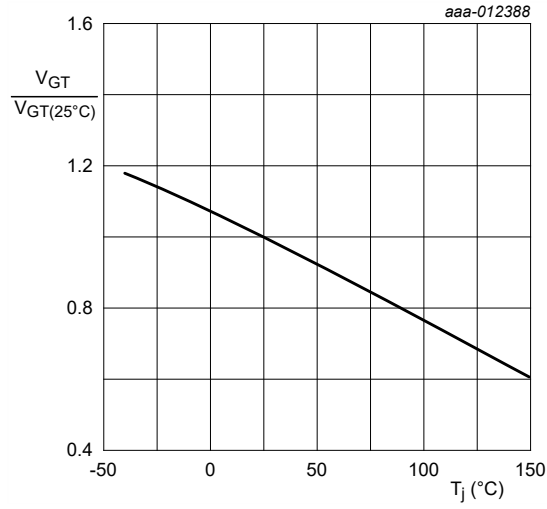


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

### 10. Package outline

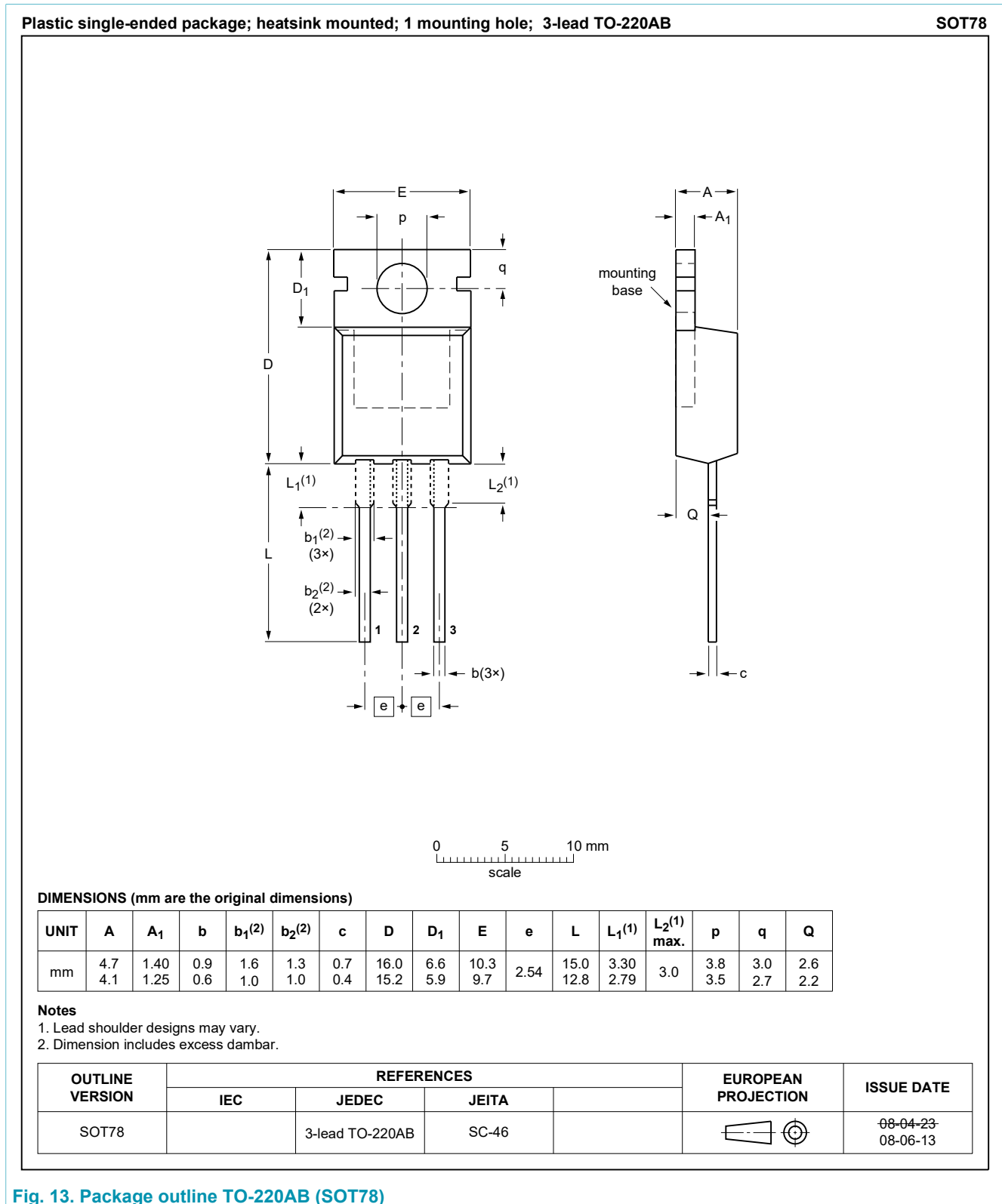


Fig. 13. Package outline TO-220AB (SOT78)

# 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. |
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## 12. Contents

|                                 |    |
|---------------------------------|----|
| 1. General description.....     | 1  |
| 2. Features and benefits.....   | 1  |
| 3. Applications.....            | 1  |
| 4. Quick reference data.....    | 1  |
| 5. Pinning information.....     | 2  |
| 6. Ordering information.....    | 3  |
| 7. Limiting values.....         | 4  |
| 8. Thermal characteristics..... | 7  |
| 9. Characteristics.....         | 8  |
| 10. Package outline.....        | 11 |
| 11. Legal information.....      | 12 |

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