

1. General description

Planar passivated high commutation three quadrant triac in a SOT78 (TO-220AB) plastic package. This "series E" triac balances the requirements of commutation performance and gate sensitivity and is intended for interfacing with low power drivers including microcontrollers.

2. Features and benefits

- 3Q technology for improved noise immunity
- Direct interfacing with low power drivers and microcontrollers
- Good immunity to false turn-on by dV/dt
- High commutation capability with sensitive gate
- High voltage capability
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate for easy logic level triggering
- Triggering in three quadrants only

3. Applications

- Electronic thermostats (heating and cooling)
- Motor controls e.g. washing machines and vacuum cleaners
- Refrigeration and air-conditioner compressor controls

4. Quick reference data

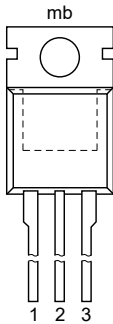
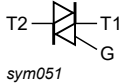
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|--|-----|-----|-----|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 600 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 106\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 10 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 85 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 93 | A |
| T_j | junction temperature | | - | - | 125 | °C |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 7 | 0.5 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | 0.5 | - | 10 | mA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|------|-----|------------------|
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 0.5 | - | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | - | 15 | mA |
| V_T | on-state voltage | $I_T = 12\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.25 | 1.5 | V |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 50 | - | - | V/ μs |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 2 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 3 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 6 | - | - | 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 |
| BTA310-600E | 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 | | - | 600 | V |
| $I_{\text{T(RMS)}}$ | RMS on-state current | full sine wave; $T_{\text{mb}} \leq 106\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 10 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | 85 | A |
| | | full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_{\text{p}} = 16.7\text{ ms}$ | - | 93 | A |
| I^2t | I^2t for fusing | $t_{\text{p}} = 10\text{ ms}$; SIN | - | 36.1 | A^2s |
| di_{T}/dt | rate of rise of on-state current | $I_{\text{G}} = 0.2\text{ A}$ | - | 100 | $\text{A}/\mu\text{s}$ |
| I_{GM} | peak gate current | | - | 2 | A |
| P_{GM} | peak gate power | | - | 5 | W |
| $P_{\text{G(AV)}}$ | 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 | $^{\circ}\text{C}$ |

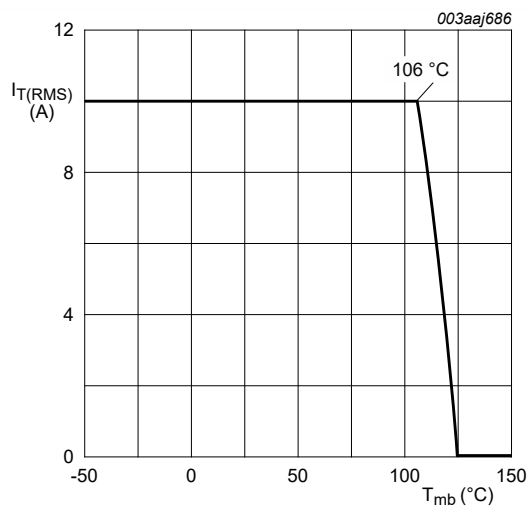


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values

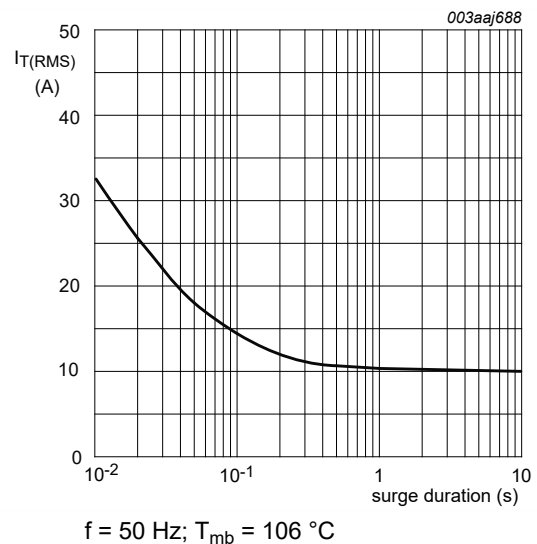


Fig. 2. RMS on-state current as a function of surge duration; maximum values

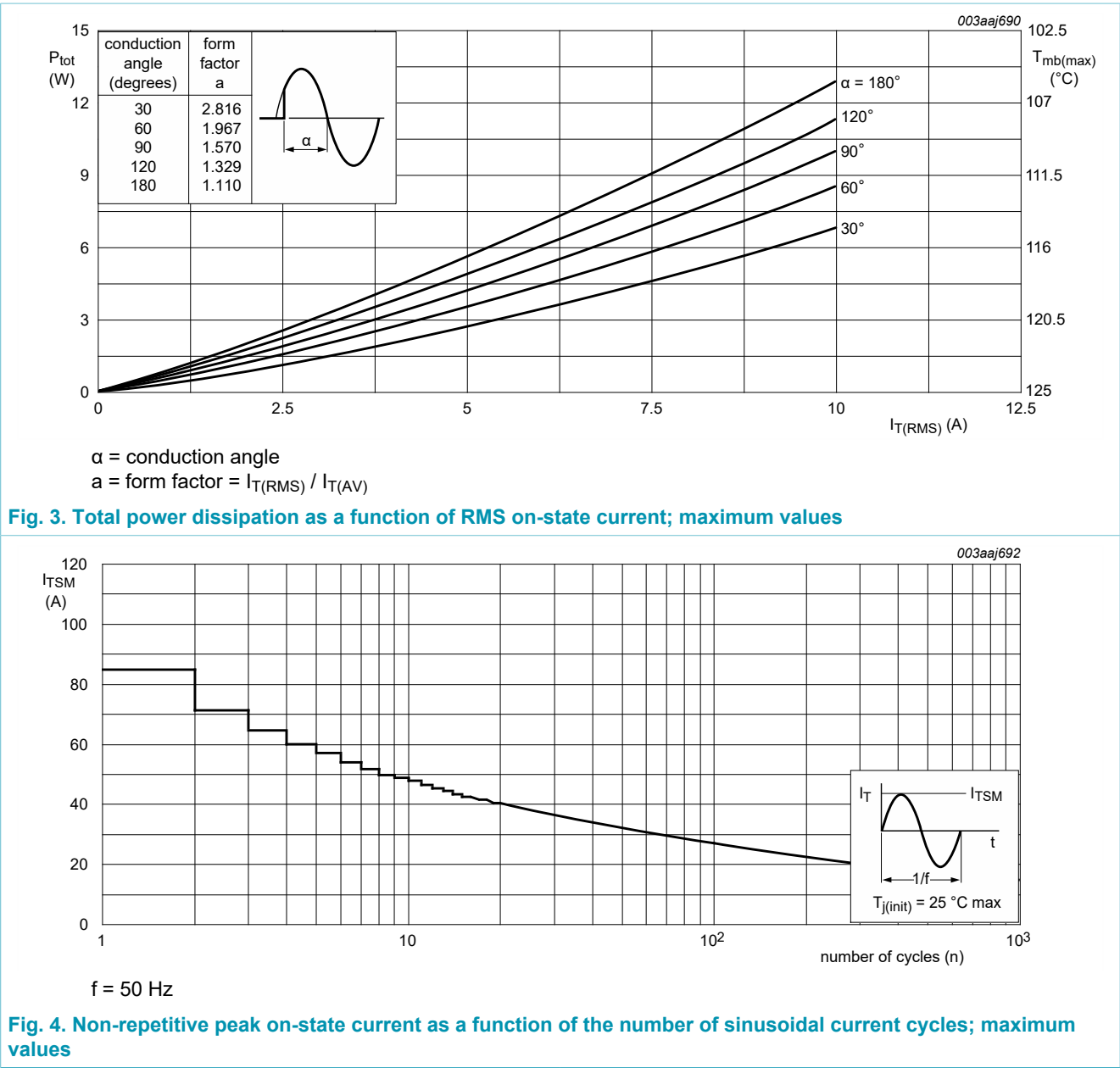


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

120

I_{TSM}
(A)

100

80

60

40

20

0

1

10

10²

10³

number of cycles (n)

10³

I_T

I_{TSM}

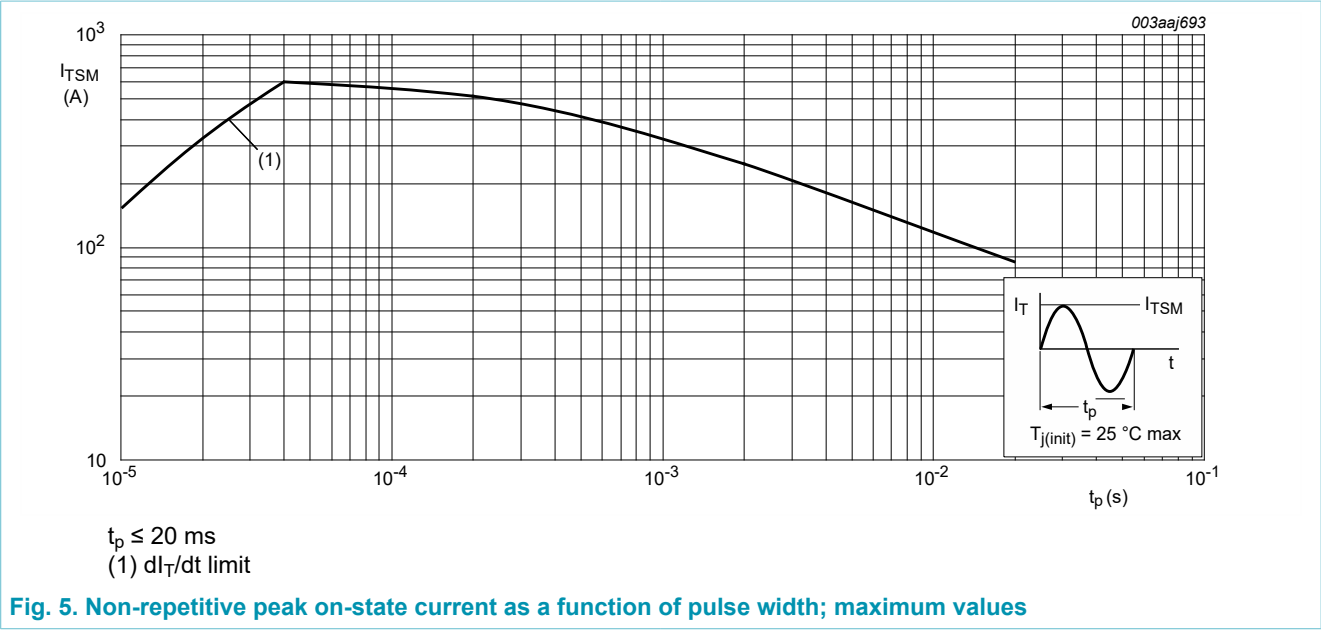
t

1/f

$T_{J(init)} = 25\text{ °C max}$

f = 50 Hz

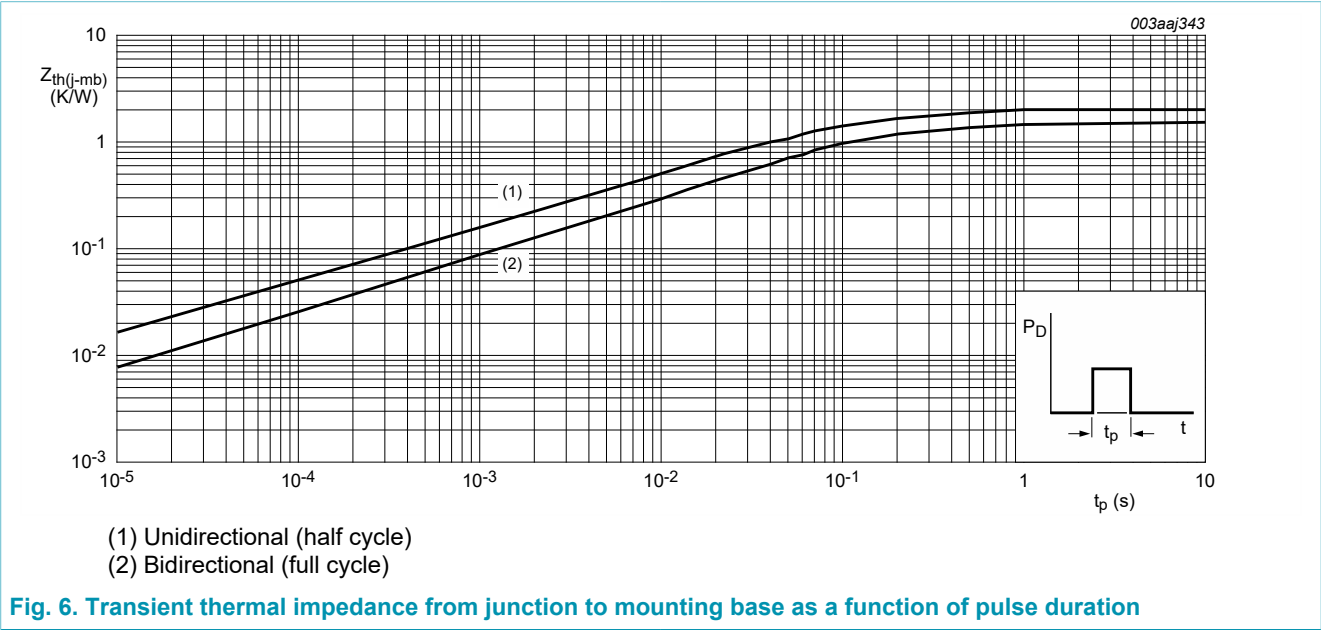
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



8. Thermal characteristics

Table 5. Thermal characteristics

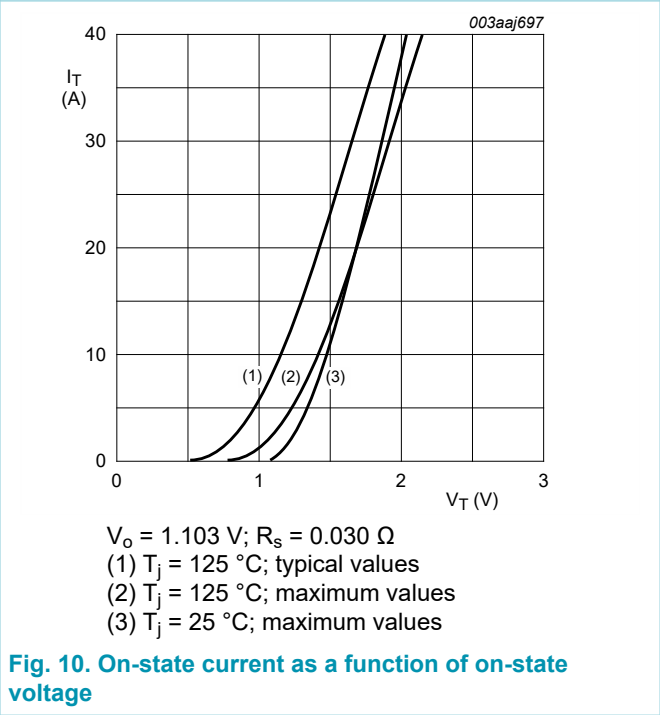
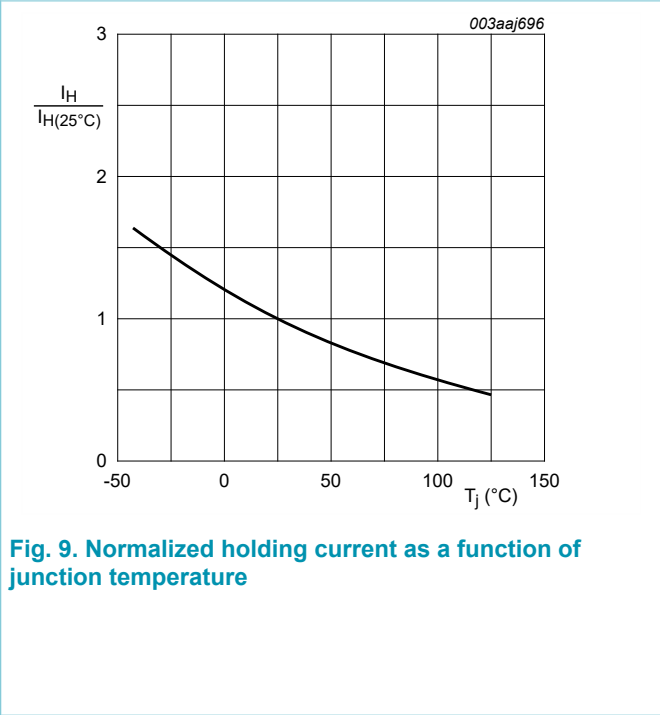
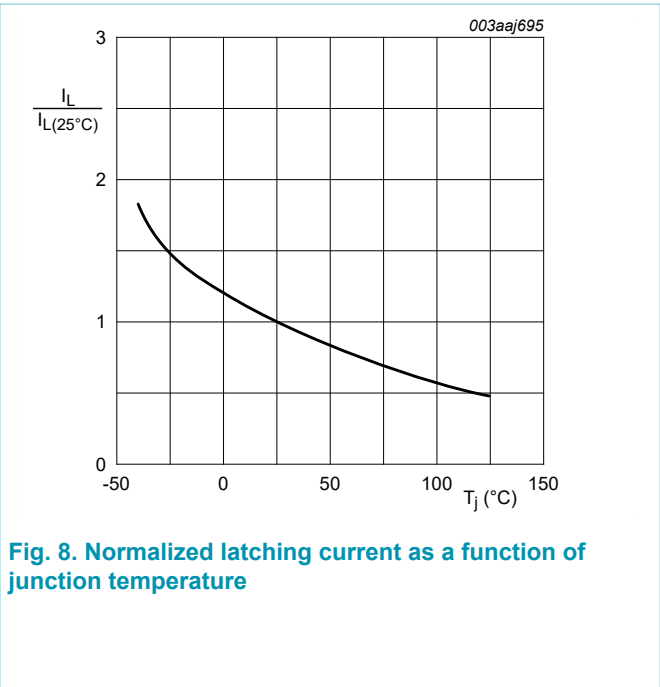
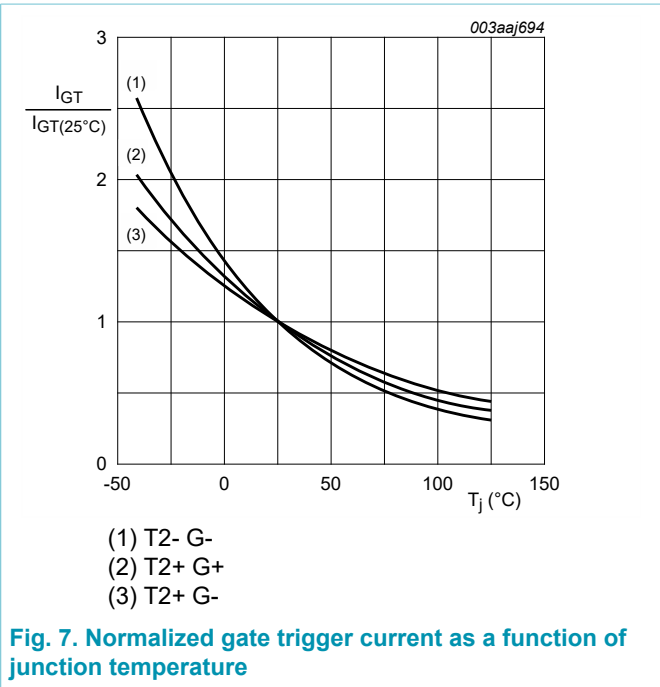
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|--------------------|--|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full cycle; Fig. 6 | | - | - | 1.5 | K/W |
| | | half cycle; Fig. 6 | | - | - | 2 | K/W |
| $R_{th(j-a)}$ | 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 |
|--------------------------------|---------------------------------------|---|------|------|-----|------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 0.5 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 0.5 | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | 0.5 | - | 10 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 25 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | - | 25 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | - | 15 | mA |
| V_T | on-state voltage | $I_T = 12\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.25 | 1.5 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 11 | - | 0.7 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ }^\circ\text{C}$; Fig. 11 | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$ | - | 0.1 | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 50 | - | - | V/ μs |
| di_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 2 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 3 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 6 | - | - | A/ms |



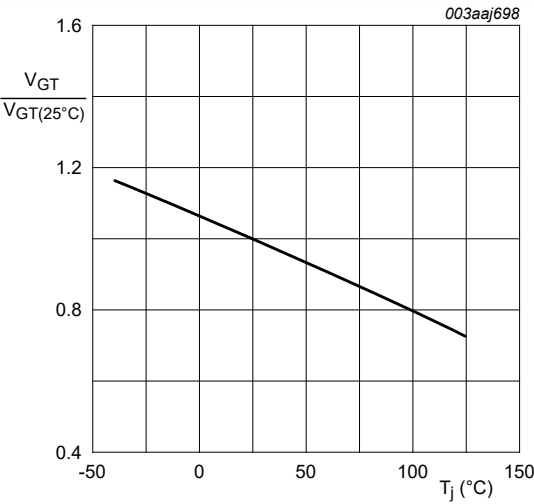


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

10. Package outline

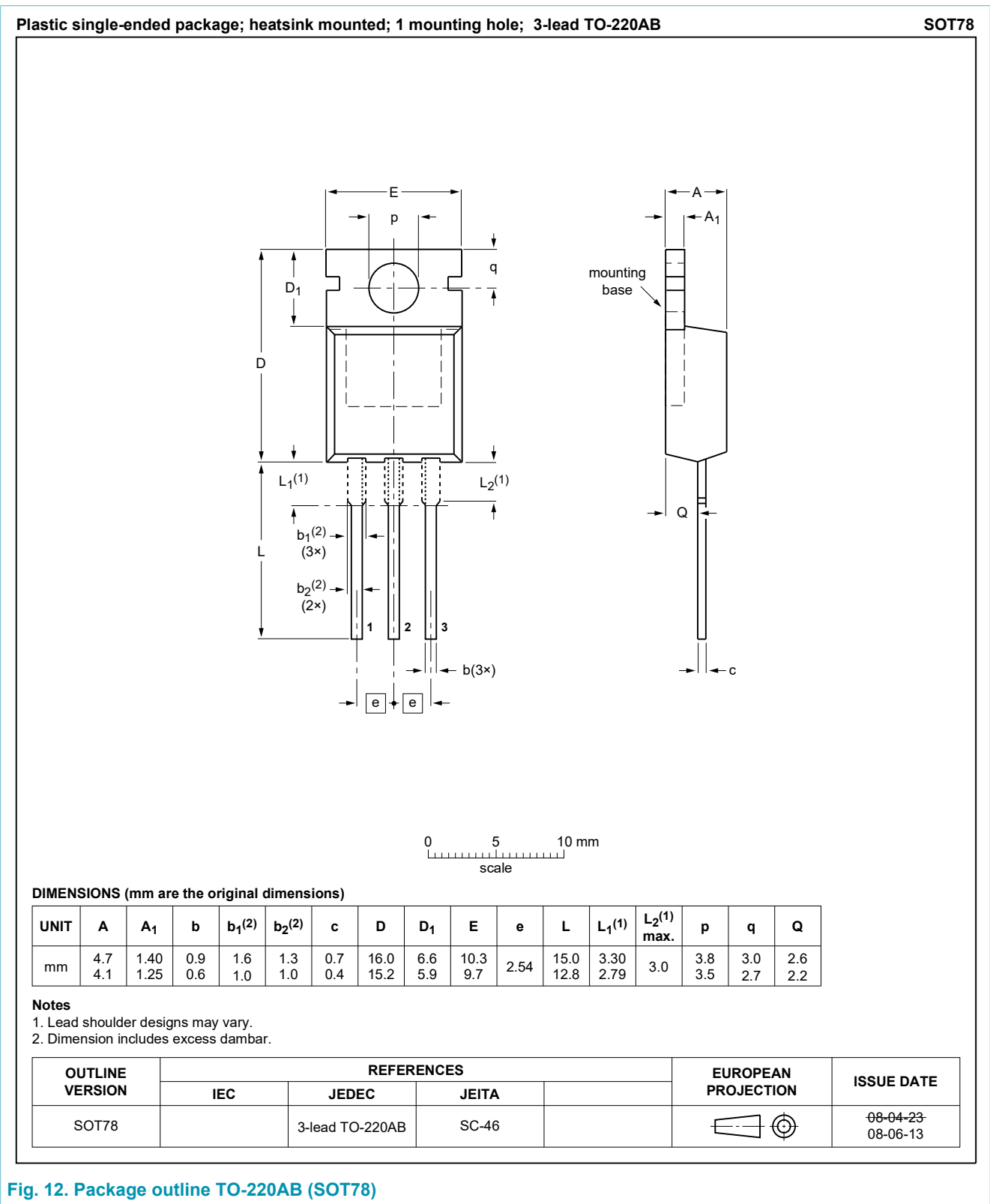


Fig. 12. Package outline TO-220AB (SOT78)

11. Legal information

Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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