

1. General description

Planar passivated high commutation three quadrant triac in a TO220 plastic package. This "series D" 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 very sensitive gate
- High voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Very sensitive gate for easy logic level triggering

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

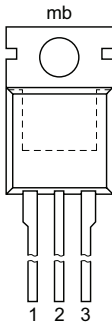
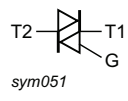
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|---|-----|-----|-----|------------------|
| Absolute maximum rating | | | | | | |
| V_{DRM} | repetitive peak off-state voltage | | - | - | 800 | 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 |
| T_{j} | junction temperature | | - | - | 125 | $^\circ\text{C}$ |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_{\text{D}} = 12 \text{ V}$; $I_{\text{T}} = 0.1 \text{ A}$; T2+ G+; $T_{\text{j}} = 25 \text{ }^\circ\text{C}$; Fig. 7 | 0.3 | - | 5 | mA |
| | | $V_{\text{D}} = 12 \text{ V}$; $I_{\text{T}} = 0.1 \text{ A}$; T2+ G-; $T_{\text{j}} = 25 \text{ }^\circ\text{C}$; Fig. 7 | 0.3 | - | 5 | mA |
| | | $V_{\text{D}} = 12 \text{ V}$; $I_{\text{T}} = 0.1 \text{ A}$; T2- G-; $T_{\text{j}} = 25 \text{ }^\circ\text{C}$; Fig. 7 | 0.3 | - | 5 | mA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|-----|------|-----|------------|
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 10 | mA |
| V_T | on-state voltage | $I_T = 12\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.25 | 1.5 | V |
| Dynamic characteristics | | | | | | |
| 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 | 20 | - | - | V/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 1 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 1.5 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 4.5 | - | - | A/ms |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|--------------------------------|--|---|
| 1 | T1 | main terminal 1 |  |  |
| 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 | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|-------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| BTA310-800D | TO220 | BTA310-800D,127 | Tube | 50 | SOT78 | 13-Jun-2008 |

7. Marking

Table 4. Marking codes

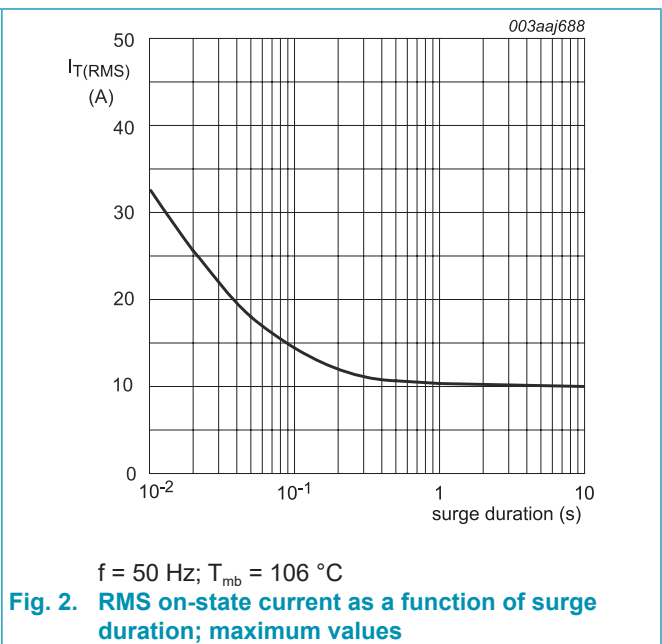
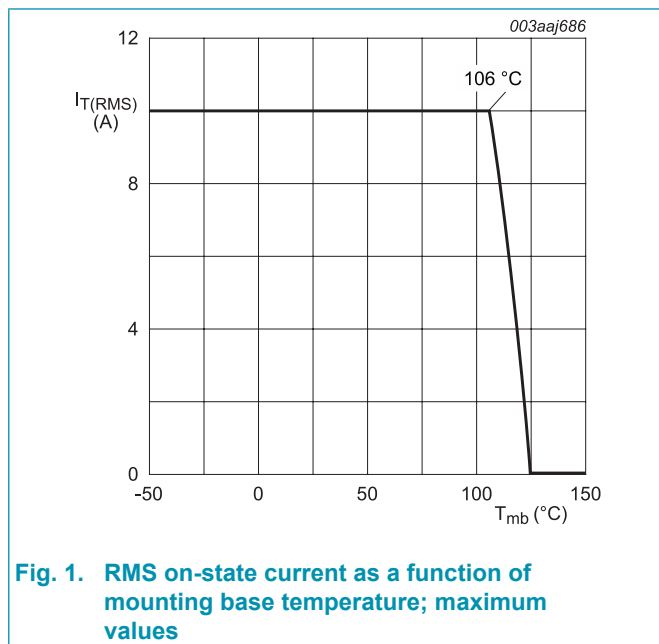
| Type number | Marking codes | |
|-------------|------------------------------|------------------------------|
| | Assembly factory: d | Assembly factory: A |
| BTA310-800D | BTA310 800D PJdxxxx xx | BTA310 800D PJAxxxx xx |

8. Limiting values

Table 5. 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; $T_{mb} \leq 106\text{ °C}$; Fig 1 ; Fig 2 ; Fig 3 | - | 10 | A |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 20\text{ ms}$; Fig 4 ; Fig 5 | - | 85 | A |
| | | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 93 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; sine-wave pulse | - | 36.1 | A^2s |
| di_T/dt | rate of rise of on-state current | $I_G = 0.2\text{ A}$ | - | 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 | $^{\circ}C$ |
| T_j | junction temperature | | - | 125 | $^{\circ}C$ |



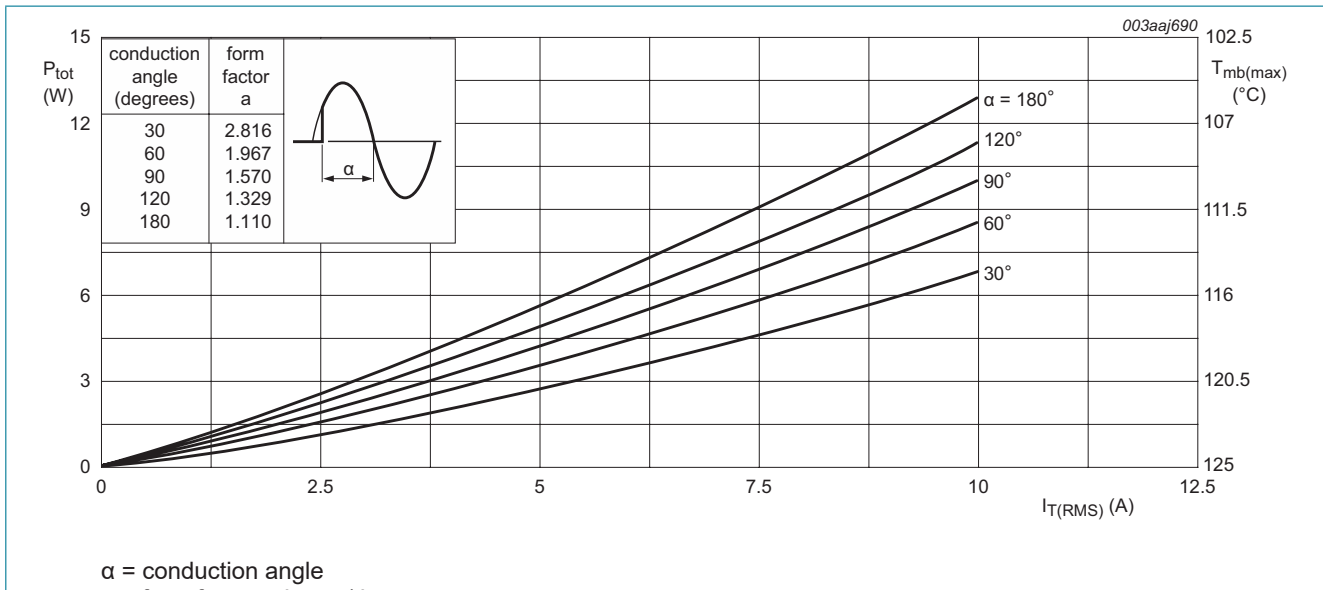


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

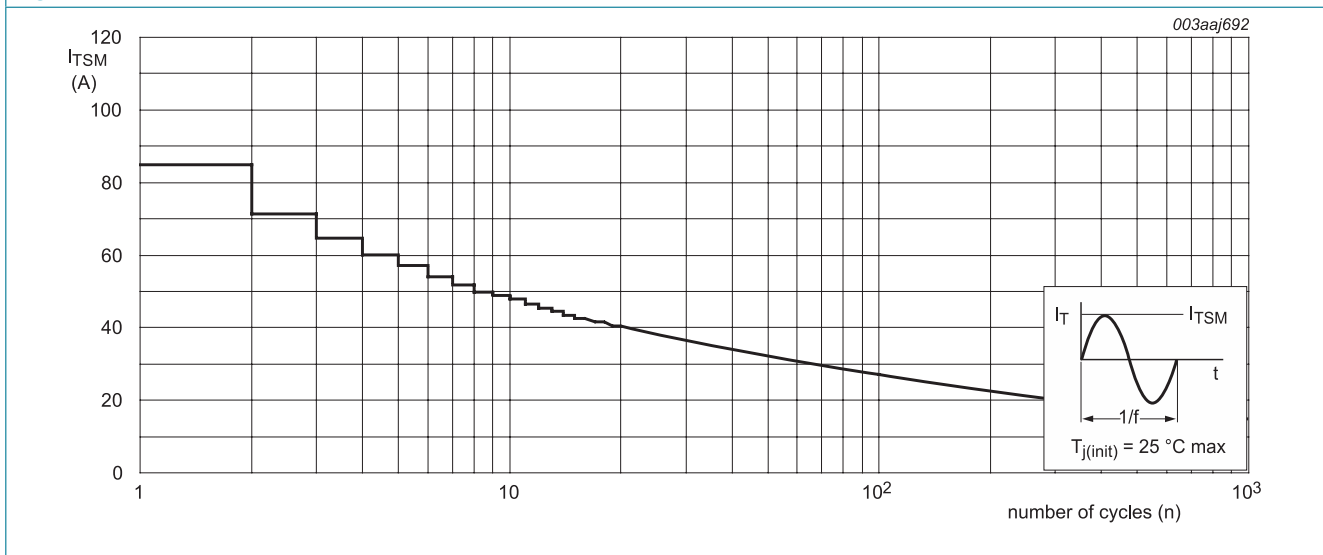
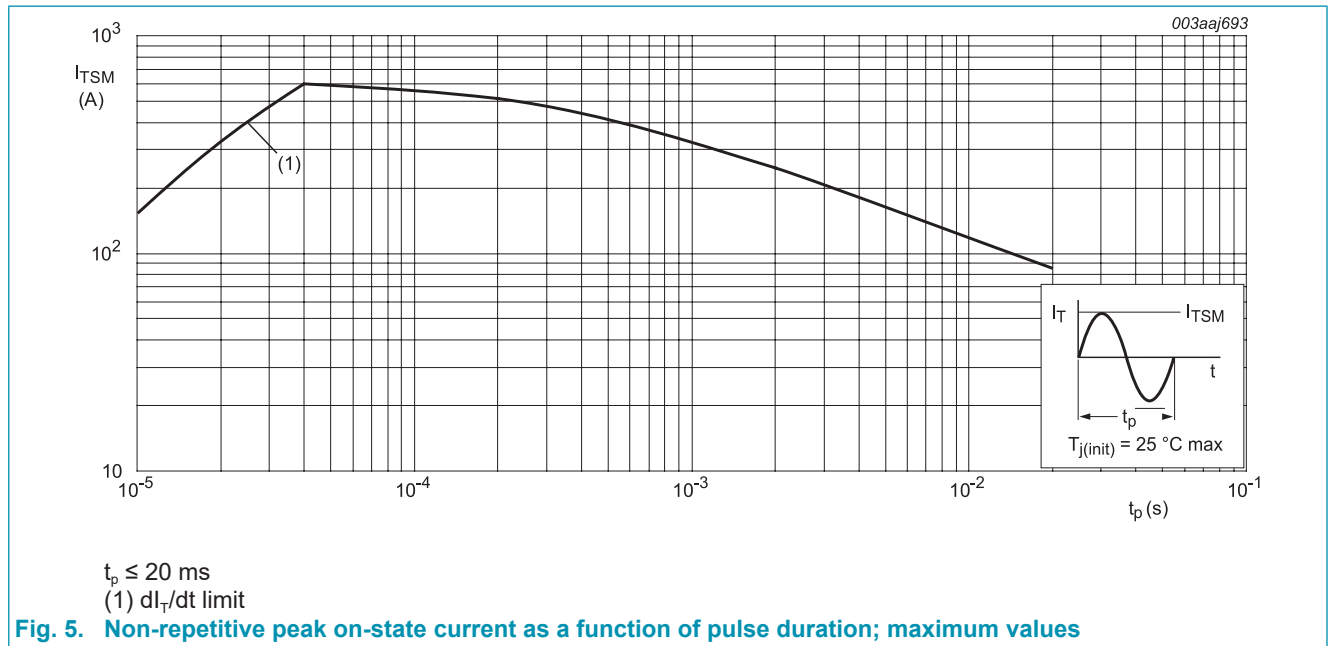


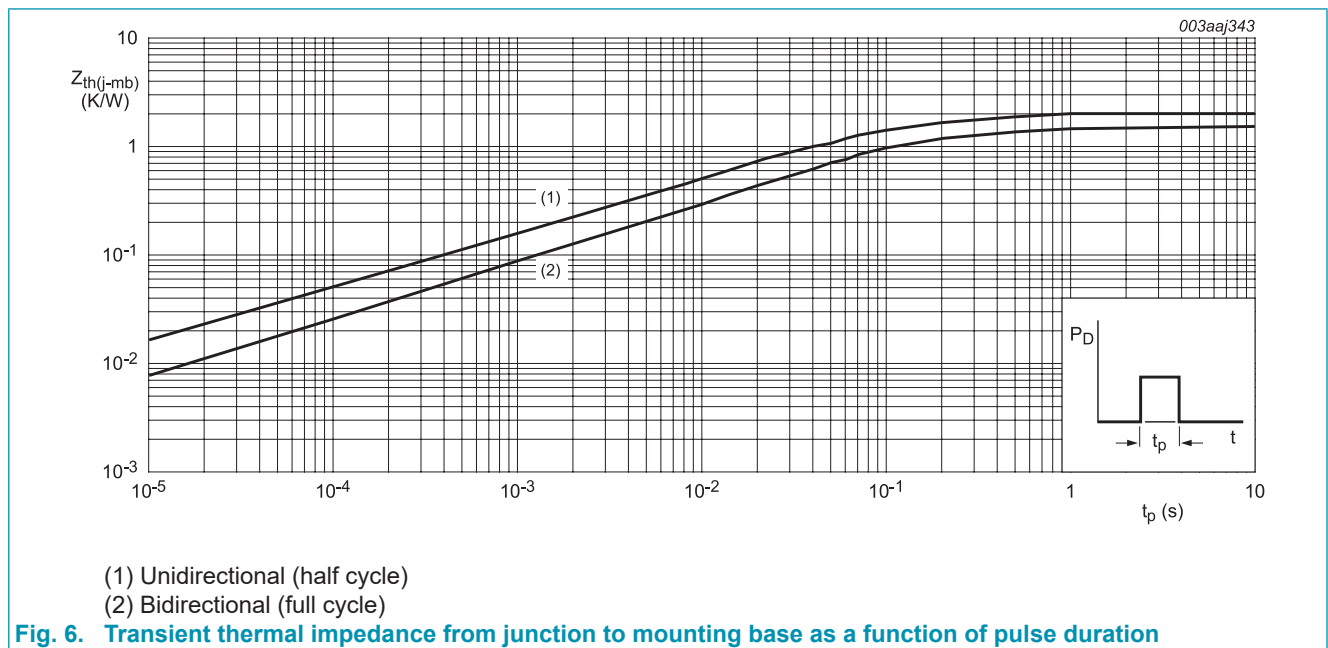
Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



9. Thermal characteristics

Table 6. Thermal characteristics

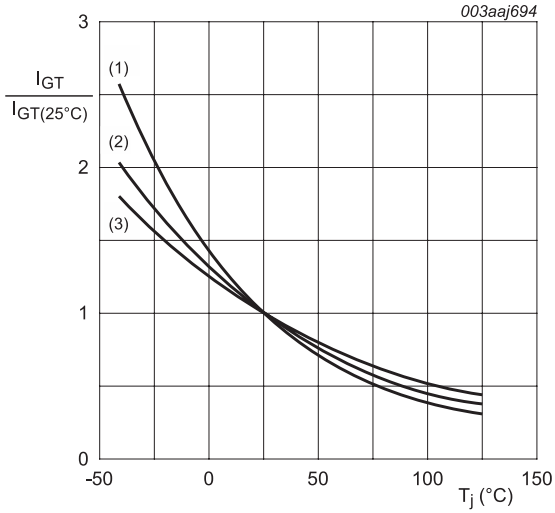
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|-------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | full cycle; Fig 6 | - | - | 1.5 | K/W |
| | | half cycle; Fig 6 | - | - | 2 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 60 | - | K/W |



10. Characteristics

Table 7. 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+; $T_j = 25\text{ °C}$; Fig. 7 | 0.3 | - | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | 0.3 | - | 5 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | 0.3 | - | 5 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 15 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 10 | mA |
| V_T | on-state voltage | $I_T = 12\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.25 | 1.5 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | - | 0.7 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ °C}$ | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 800\text{ V}$; $T_j = 125\text{ °C}$ | - | 0.1 | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| 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 | 20 | - | - | V/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 1 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 1.5 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 10\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 4.5 | - | - | A/ms |



- (1) T2- G-
- (2) T2+ G-
- (3) T2+ G+

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

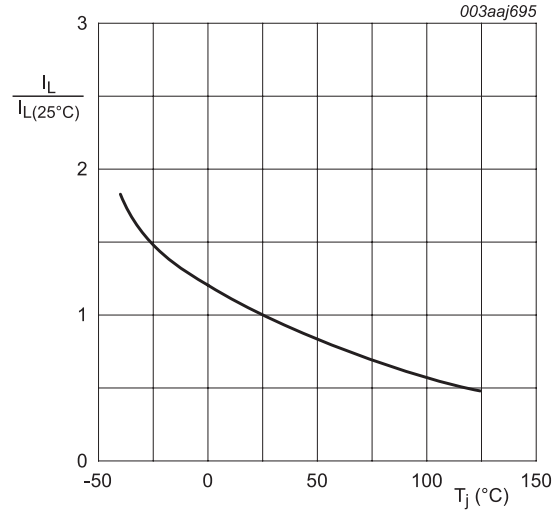


Fig. 8. Normalized latching current as a function of junction temperature

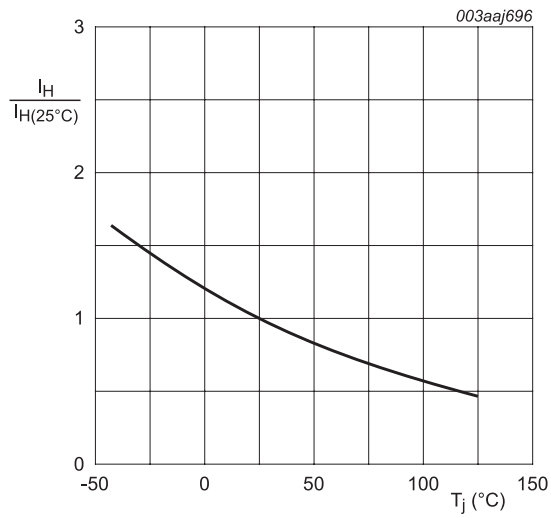
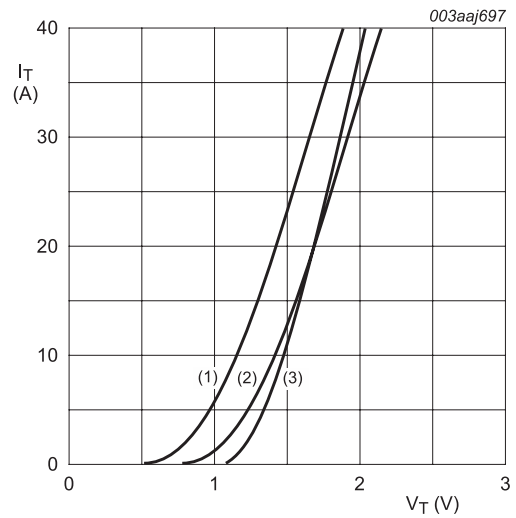


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.103$ V; $R_s = 0.030$ Ω
- (1) $T_j = 125$ $^\circ C$; typical values
 - (2) $T_j = 125$ $^\circ C$; maximum values
 - (3) $T_j = 25$ $^\circ C$; maximum values

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

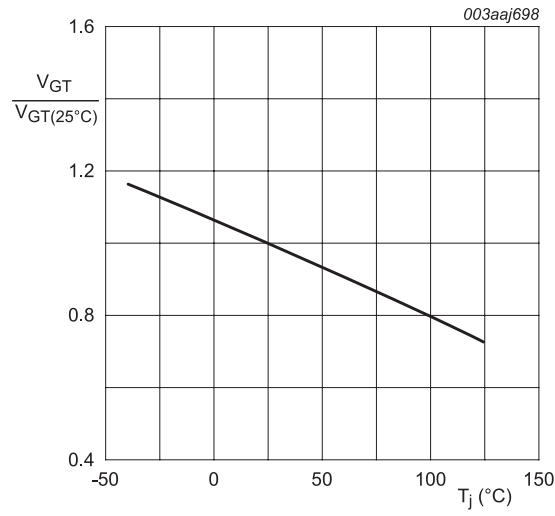


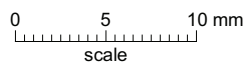
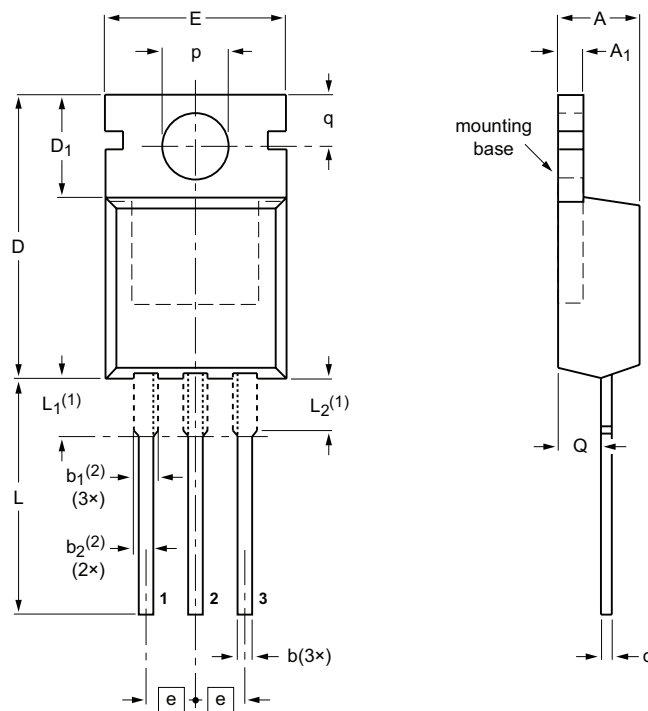
Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

Assembly factory: d & A

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ | b | b ₁ (²) | b ₂ (²) | c | D | D ₁ | E | e | L | L ₁ (¹) | L ₂ (¹) max. | p | q | Q |
|------|------------|----------------|------------|---------------------------------|---------------------------------|------------|--------------|----------------|-------------|------|--------------|---------------------------------|--------------------------------------|------------|------------|------------|
| mm | 4.7 4.1 | 1.40 1.25 | 0.9 0.6 | 1.6 1.0 | 1.3 1.0 | 0.7 0.4 | 16.0 15.2 | 6.6 5.9 | 10.3 9.7 | 2.54 | 15.0 12.8 | 3.30 2.79 | 3.0 | 3.8 3.5 | 3.0 2.7 | 2.6 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 08-06-13 |

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. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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- [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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