

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 CTN" 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

- Clamping structure ensuring safe high over-voltage withstand capability
- High junction operating temperature capability ($T_{j(max)} = 150\text{ °C}$)
- 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 and IEC 61000-4-4 fast transient
- Package is RoHS compliant
- Package meets UL94V0 flammability requirement

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 ($T_{j(max)} = 150\text{ °C}$)

4. Quick reference data

Table 1. Quick reference data

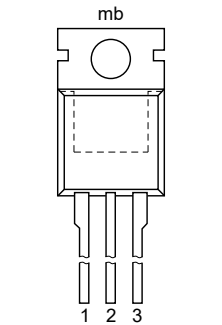
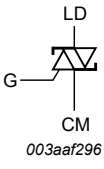
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------|-----------------------------------|--|-----|-----|-----|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 130\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 8 | A |

Enhanced and high temperature ACTT power switch

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|---|------|-----|-----|------|
| I _{TSM} | non-repetitive peak on-state current | full sine wave; T _{j(init)} = 25 °C; t _p = 20 ms; Fig. 4 ; Fig. 5 | - | - | 80 | A |
| | | full sine wave; T _{j(init)} = 25 °C; t _p = 16.7 ms | - | - | 88 | A |
| T _j | junction temperature | | - | - | 150 | °C |
| V _{PP} | peak pulse voltage | T _j = 25 °C; non-repetitive, off-state; Fig. 6 | - | - | 2 | kV |
| Static characteristics | | | | | | |
| I _{GT} | gate trigger current | V _D = 12 V; I _T = 100 mA; LD+ G+; T _j = 25 °C; Fig. 8 | 5 | - | 35 | mA |
| | | V _D = 12 V; I _T = 100 mA; LD+ G-; T _j = 25 °C; Fig. 8 | 5 | - | 35 | mA |
| | | V _D = 12 V; I _T = 100 mA; LD- G-; T _j = 25 °C; Fig. 8 | 5 | - | 35 | mA |
| I _H | holding current | V _D = 12 V; T _j = 25 °C; Fig. 10 | - | - | 40 | mA |
| V _T | on-state voltage | I _T = 10 A; T _j = 25 °C; Fig. 11 | - | - | 1.5 | V |
| V _{CL} | clamping voltage | I _{CL} = 0.1 mA; t _p = 1 ms; T _j = 25 °C | 850 | - | - | V |
| Dynamic characteristics | | | | | | |
| dV _D /dt | rate of rise of off-state voltage | V _{DM} = 536 V; T _j = 125 °C; (V _{DM} = 67% of V _{DRM}); exponential waveform; gate open circuit | 4000 | - | - | V/μs |
| | | V _{DM} = 536 V; T _j = 150 °C; exponential waveform; gate open circuit | 2000 | - | - | V/μs |
| di _{com} /dt | rate of change of commutating current | V _D = 400 V; T _j = 150 °C; I _{T(RMS)} = 8 A; dV _{com} /dt = 20 V/μs; gate open circuit; snubberless condition | 12 | - | - | A/ms |
| | | V _D = 400 V; T _j = 150 °C; I _{T(RMS)} = 8 A; dV _{com} /dt = 10 V/μs; gate open circuit | 15 | - | - | A/ms |
| | | V _D = 400 V; T _j = 150 °C; I _{T(RMS)} = 8 A; dV _{com} /dt = 1 V/μs; gate open circuit | 20 | - | - | A/ms |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|---------------------|---|---|
| 1 | CM | common |  <p>TO-220AB (SOT78)</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 |
| ACTT8-800CTN | 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; $T_{mb} \leq 130\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 8 | 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 | - | 80 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 88 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; sine-wave pulse | - | 32 | A ² s |
| di_T/dt | rate of rise of on-state current | $I_G = 70\text{ mA}$ | - | 100 | A/ μ 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_{stg} | storage temperature | | -40 | 150 | °C |
| T_j | junction temperature | | - | 150 | °C |
| V_{PP} | peak pulse voltage | $T_j = 25\text{ °C}$; non-repetitive, off-state; Fig. 6 | - | 2 | kV |

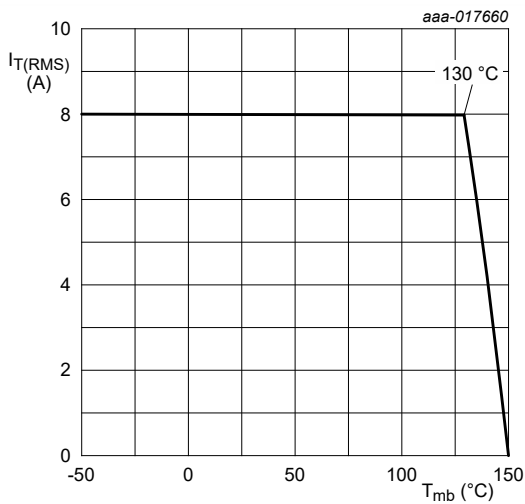


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values

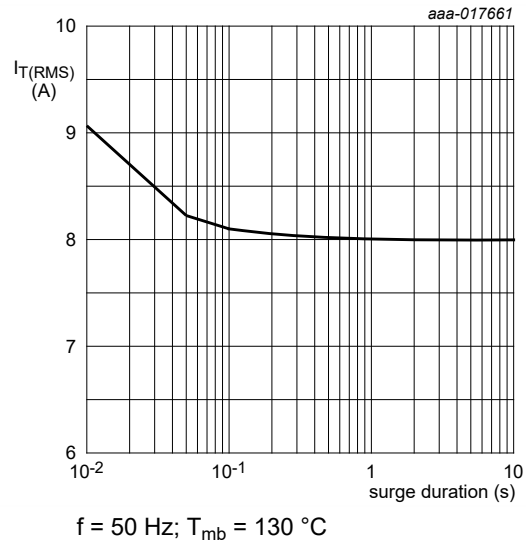


Fig. 2. RMS on-state current as a function of surge duration; maximum values

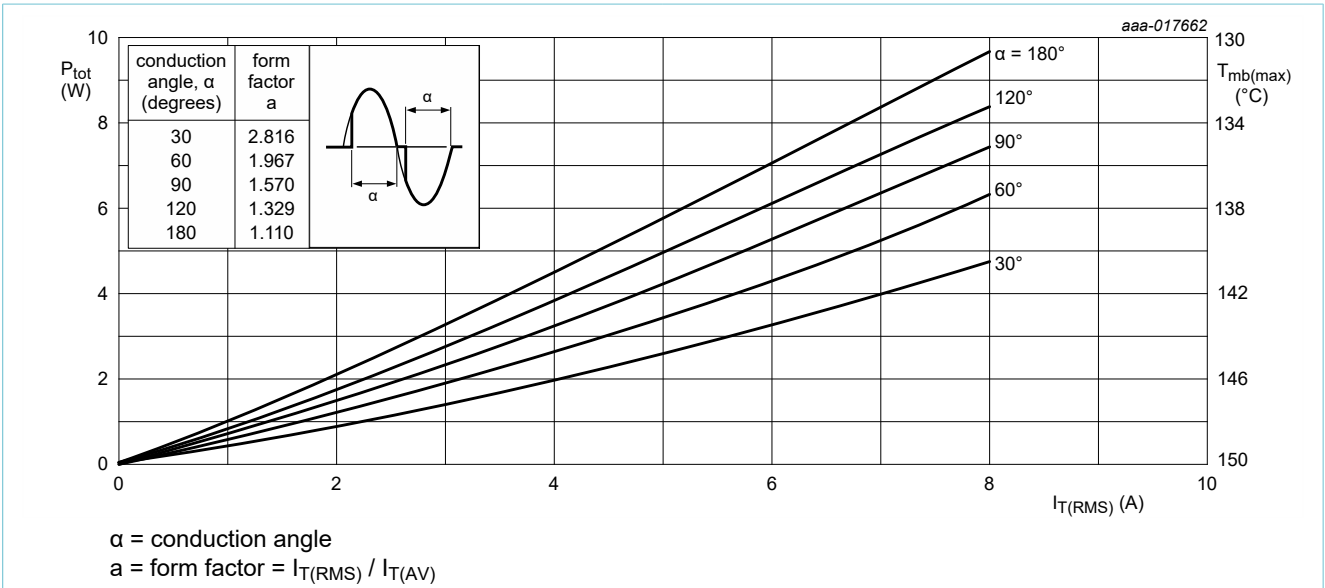


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

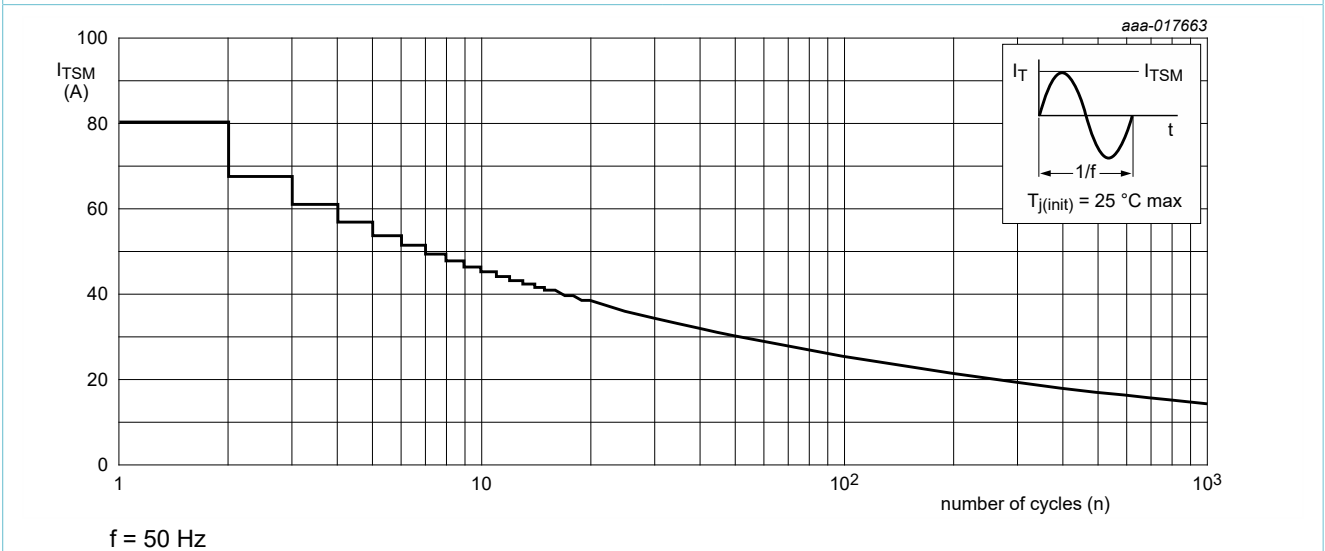


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

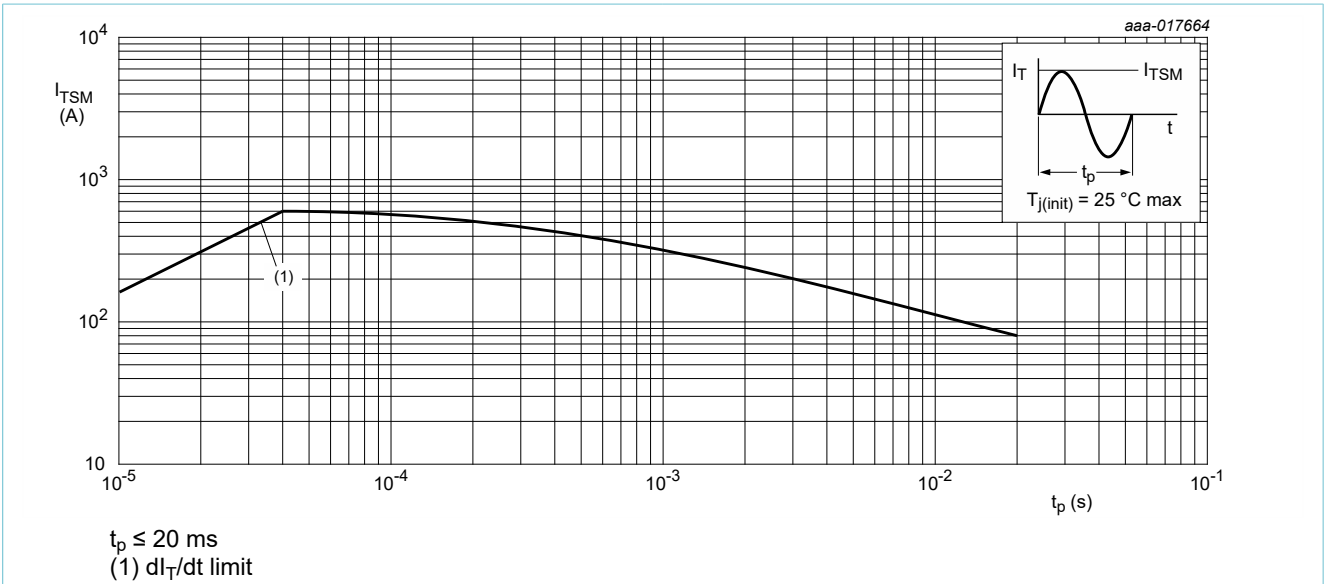


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

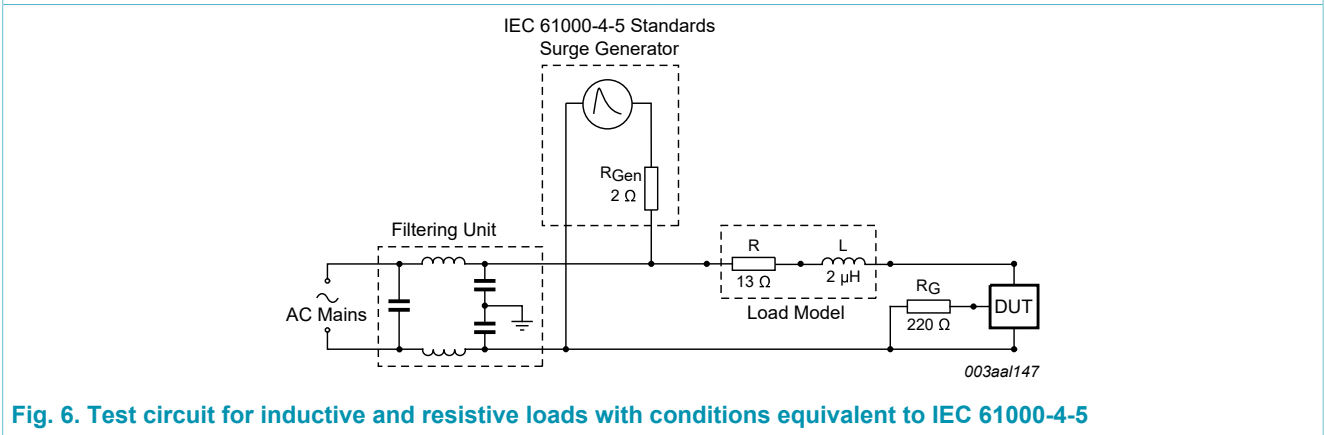


Fig. 6. Test circuit for inductive and resistive loads with conditions equivalent to IEC 61000-4-5

8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--|------------------------------------|-----|-----|-----|------|
| R _{th(j-mb)} | thermal resistance from junction to mounting base | full cycle; Fig. 7 | - | - | 2 | K/W |
| | | half cycle | - | - | 2.4 | K/W |
| R _{th(j-a)} | thermal resistance from junction to ambient free air | in free air | - | 60 | - | K/W |

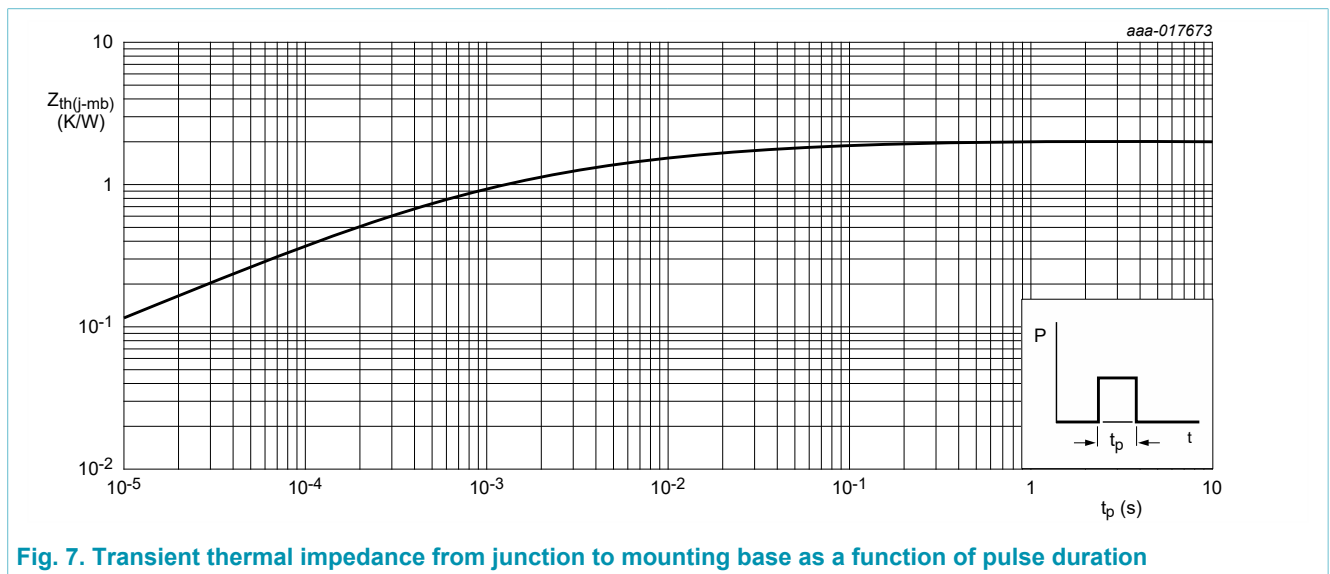
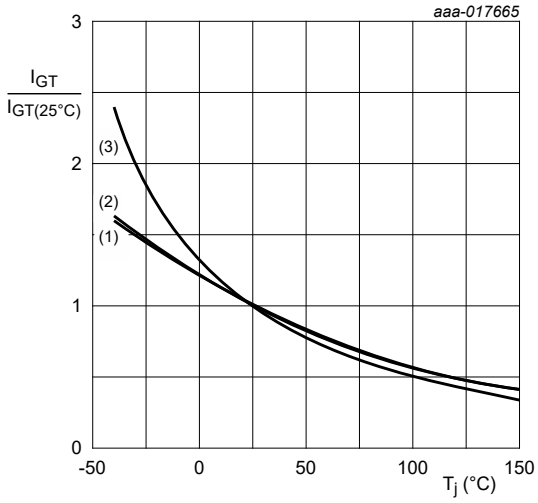


Fig. 7. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|---|------|------|-----|------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD+ G+; $T_j = 25\text{ °C}$; Fig. 8 | 5 | - | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD+ G-; $T_j = 25\text{ °C}$; Fig. 8 | 5 | - | 35 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; LD- G-; $T_j = 25\text{ °C}$; Fig. 8 | 5 | - | 35 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 100\text{ mA}$; LD+ G+; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 100\text{ mA}$; LD+ G-; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 60 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 100\text{ mA}$; LD- G-; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 50 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 10 | - | - | 40 | mA |
| V_T | on-state voltage | $I_T = 10\text{ A}$; $T_j = 25\text{ °C}$; Fig. 11 | - | - | 1.5 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 100\text{ mA}$; $T_j = 25\text{ °C}$; Fig. 12 | - | 0.8 | 1 | V |
| | | $V_D = 400\text{ V}$; $I_T = 100\text{ mA}$; $T_j = 150\text{ °C}$; Fig. 12 | 0.2 | 0.45 | - | V |
| I_D | off-state current | $V_D = 800\text{ V}$; $T_j = 25\text{ °C}$ | - | - | 10 | μA |
| | | $V_D = 800\text{ V}$; $T_j = 150\text{ °C}$ | - | - | 2 | mA |
| V_{CL} | clamping voltage | $I_{CL} = 0.1\text{ mA}$; $t_p = 1\text{ ms}$; $T_j = 25\text{ °C}$ | 850 | - | - | V |
| 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 | 4000 | - | - | V/ μs |
| | | $V_{DM} = 536\text{ V}$; $T_j = 150\text{ °C}$; exponential waveform; gate open circuit | 2000 | - | - | V/ μs |
| di_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 150\text{ °C}$; $I_{T(RMS)} = 8\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; gate open circuit; snubberless condition | 12 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 150\text{ °C}$; $I_{T(RMS)} = 8\text{ A}$; $dV_{com}/dt = 10\text{ V}/\mu\text{s}$; gate open circuit | 15 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 150\text{ °C}$; $I_{T(RMS)} = 8\text{ A}$; $dV_{com}/dt = 1\text{ V}/\mu\text{s}$; gate open circuit | 20 | - | - | A/ms |



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

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

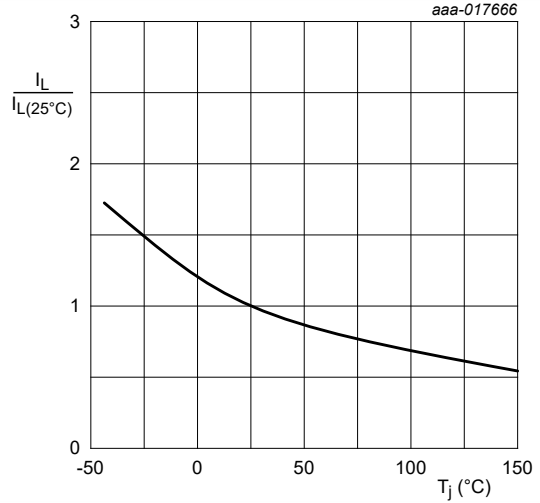


Fig. 9. Normalized latching current as a function of junction temperature

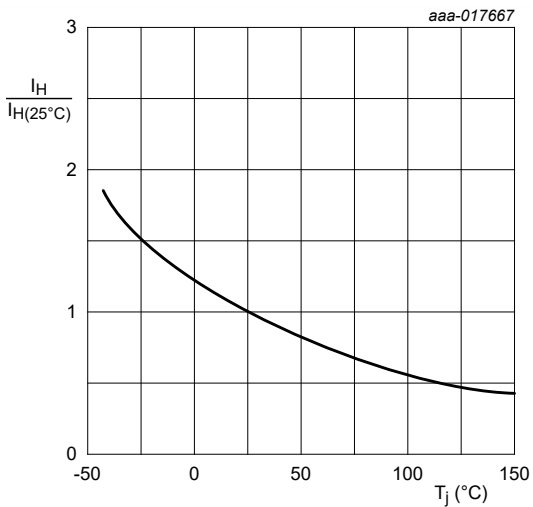
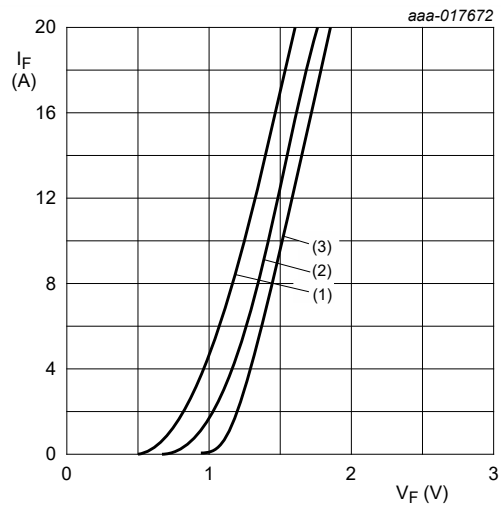


Fig. 10. Normalized holding current as a function of junction temperature



$V_o = 1.089 \text{ V}; R_s = 0.028 \Omega$

- (1) $T_j = 150 \text{ }^\circ\text{C}$; typical values
- (2) $T_j = 150 \text{ }^\circ\text{C}$; maximum values
- (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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

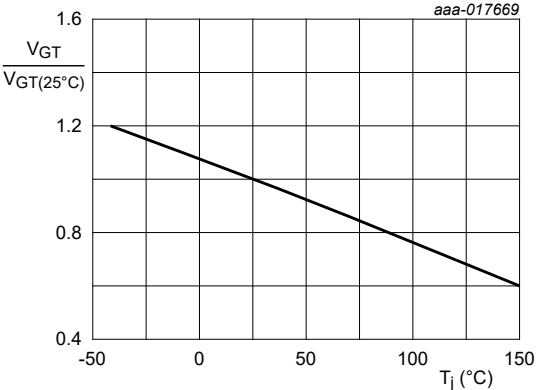
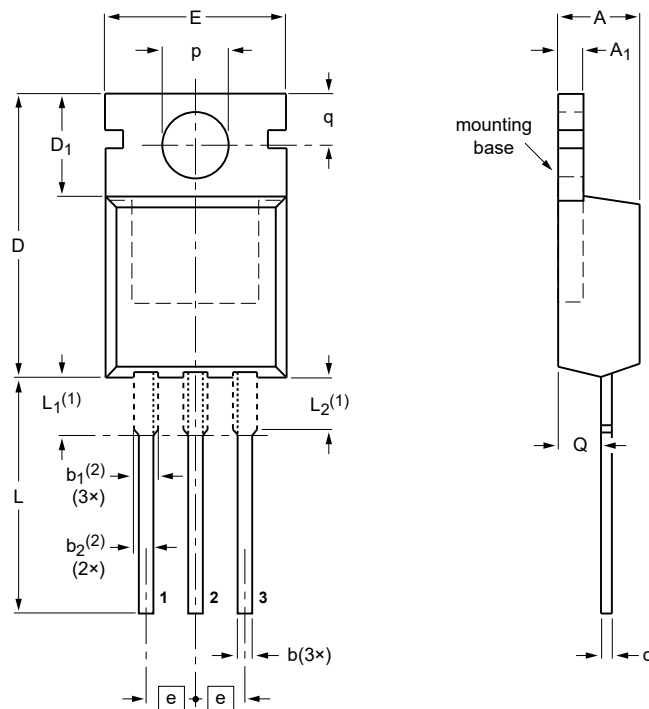


Fig. 12. Normalized gate trigger voltage as a function of junction temperature

10. Package outline

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 |

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

11. Legal information

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|--------------------------------|--------------------|---|
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