

1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a SOT78 plastic package intended for use in applications requiring high bidirectional blocking voltage capability, high surge current capability and high thermal cycling performance.

2. Features and benefits

- High bidirectional blocking voltage capability
- High surge current capability
- High thermal cycling performance

3. Applications

- Ignition circuits
- Motor control
- Protection circuits
- Voltage regulation

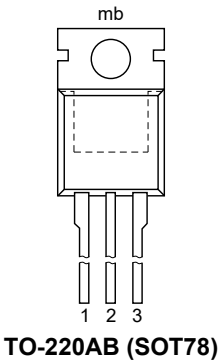

4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|--|-----|------|-----|------------|
| V_{RRM} | repetitive peak reverse voltage | | - | - | 650 | V |
| $I_{T(AV)}$ | average on-state current | half sine wave; $T_{mb} \leq 109\text{ °C}$; Fig. 1 | - | - | 7.5 | A |
| $I_{T(RMS)}$ | RMS on-state current | half sine wave; $T_{mb} \leq 109\text{ °C}$; Fig. 2 ; Fig. 3 | - | - | 12 | A |
| I_{TSM} | non-repetitive peak on-state current | half sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 10\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 120 | A |
| | | half sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 8.3\text{ ms}$ | - | - | 132 | A |
| T_j | junction temperature | | - | - | 125 | °C |
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 7 | - | 2 | 15 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 436\text{ V}$; $T_j = 125\text{ °C}$; $R_{GK} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; Fig. 12 | 200 | 1000 | - | V/ μ s |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | K | cathode |  <p>TO-220AB (SOT78)</p> |  <p>sym037</p> |
| 2 | A | anode | | |
| 3 | G | gate | | |
| mb | A | mounting base; connected to anode | | |

6. Ordering information

Table 3. Ordering information

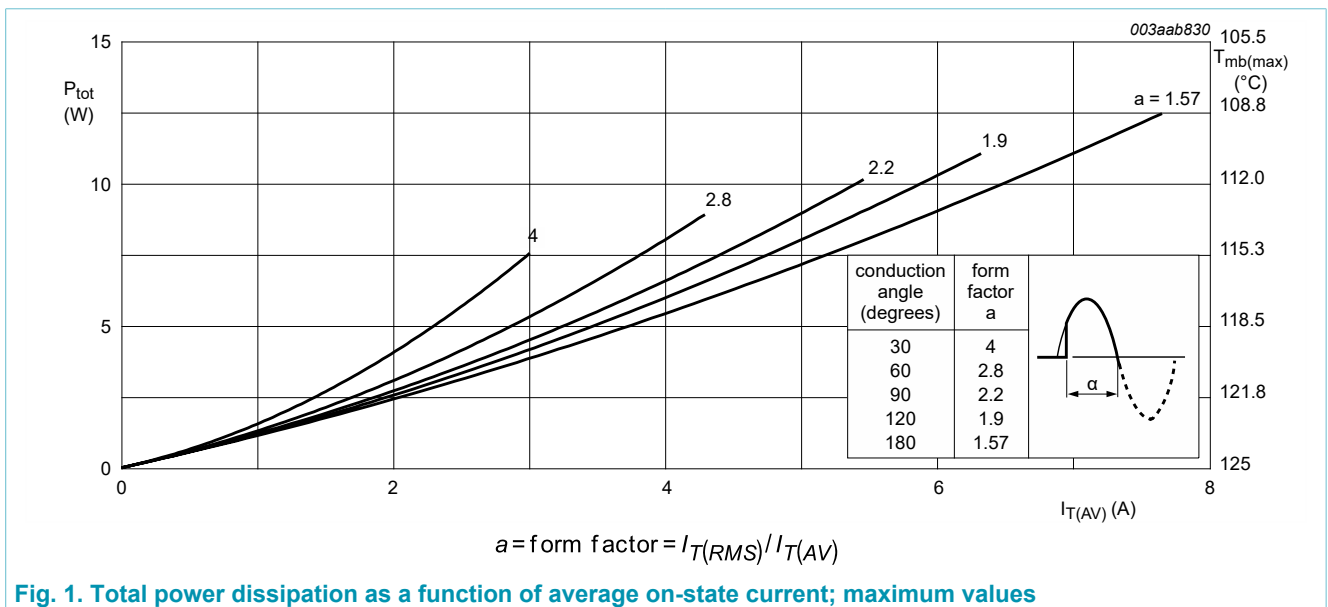
| Type number | Package | | |
|-------------|----------|--|---------|
| | Name | Description | Version |
| BT151-650R | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

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 | | - | 650 | V |
| V_{RRM} | repetitive peak reverse voltage | | - | 650 | V |
| $I_{T(AV)}$ | average on-state current | half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$; Fig. 1 | - | 7.5 | A |
| $I_{T(RMS)}$ | RMS on-state current | half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$; Fig. 2 ; Fig. 3 | - | 12 | A |
| I_{TSM} | non-repetitive peak on-state current | half sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ ms}$; Fig. 4 ; Fig. 5 | - | 120 | A |
| | | half sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; $t_p = 8.3\text{ ms}$ | - | 132 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 72 | A^2s |
| di_T/dt | rate of rise of on-state current | $I_G = 30\text{ mA}$ | - | 50 | $\text{A}/\mu\text{s}$ |
| I_{GM} | peak gate current | | - | 2 | A |
| V_{RGM} | peak reverse gate voltage | | - | 5 | V |
| 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 | $^{\circ}\text{C}$ |
| T_j | junction temperature | | - | 125 | $^{\circ}\text{C}$ |



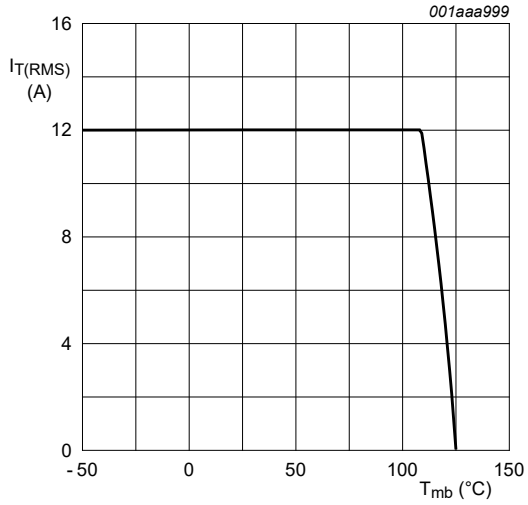


Fig. 2. RMS on-state current as a function of mounting base temperature; maximum values

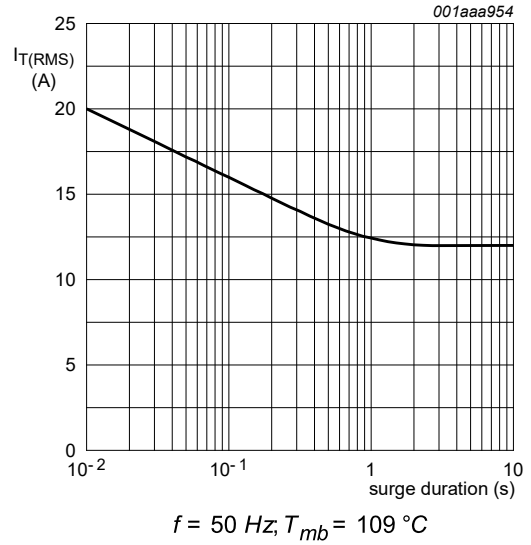


Fig. 3. RMS on-state current as a function of surge duration; maximum values

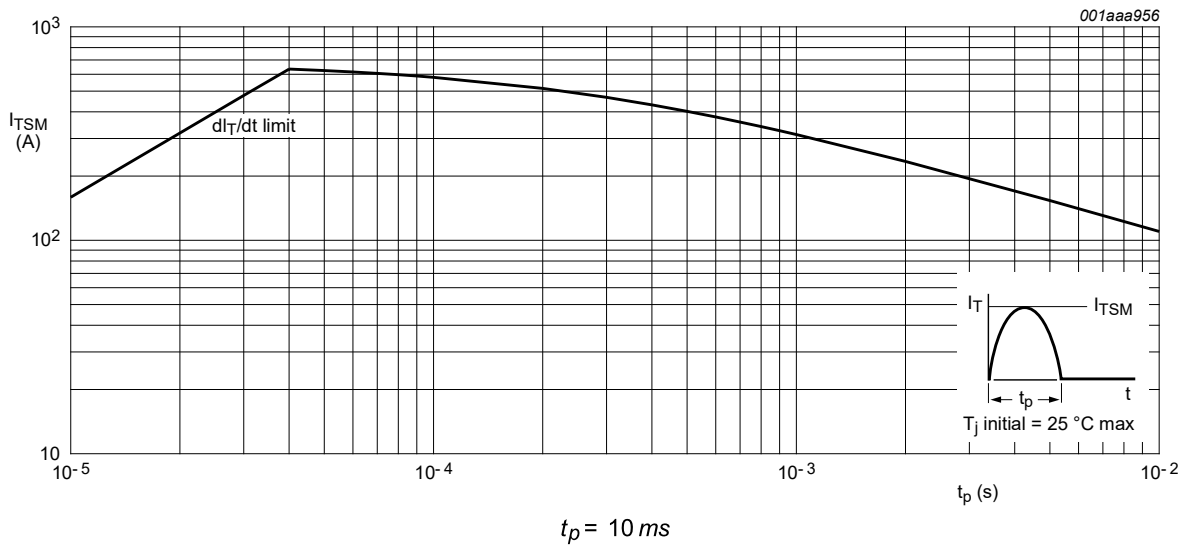
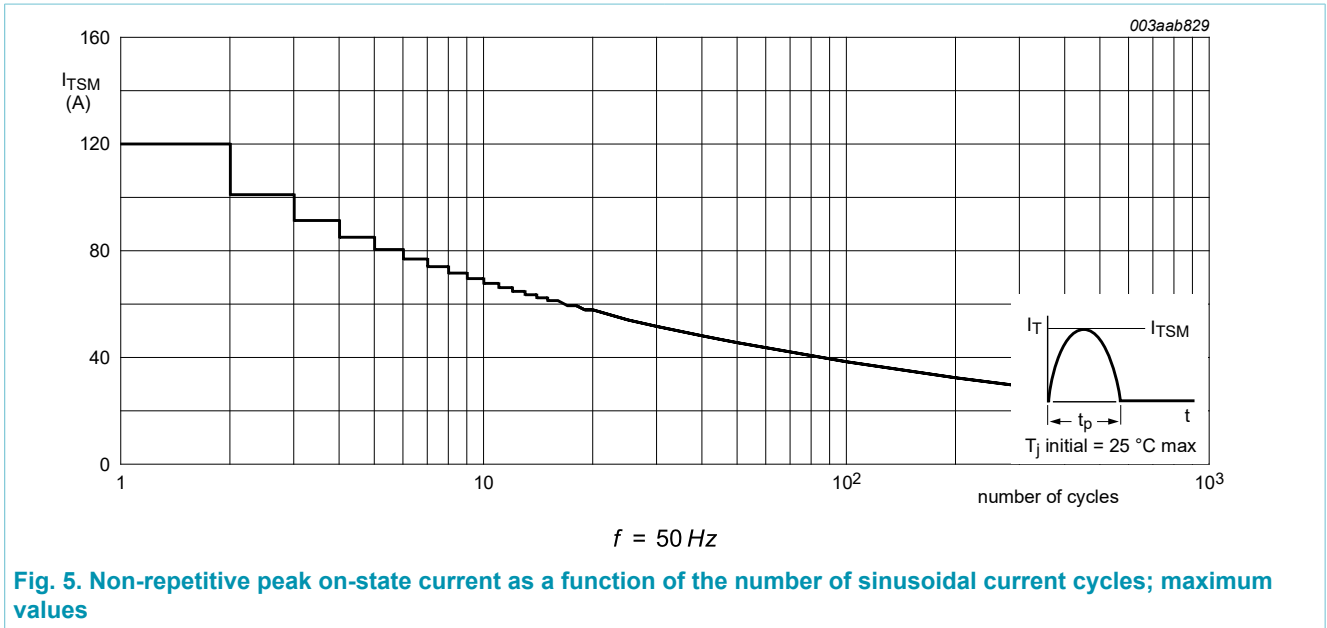


Fig. 4. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values



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 | Fig. 6 | - | - | 1.3 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | in free air | - | 60 | - | K/W |

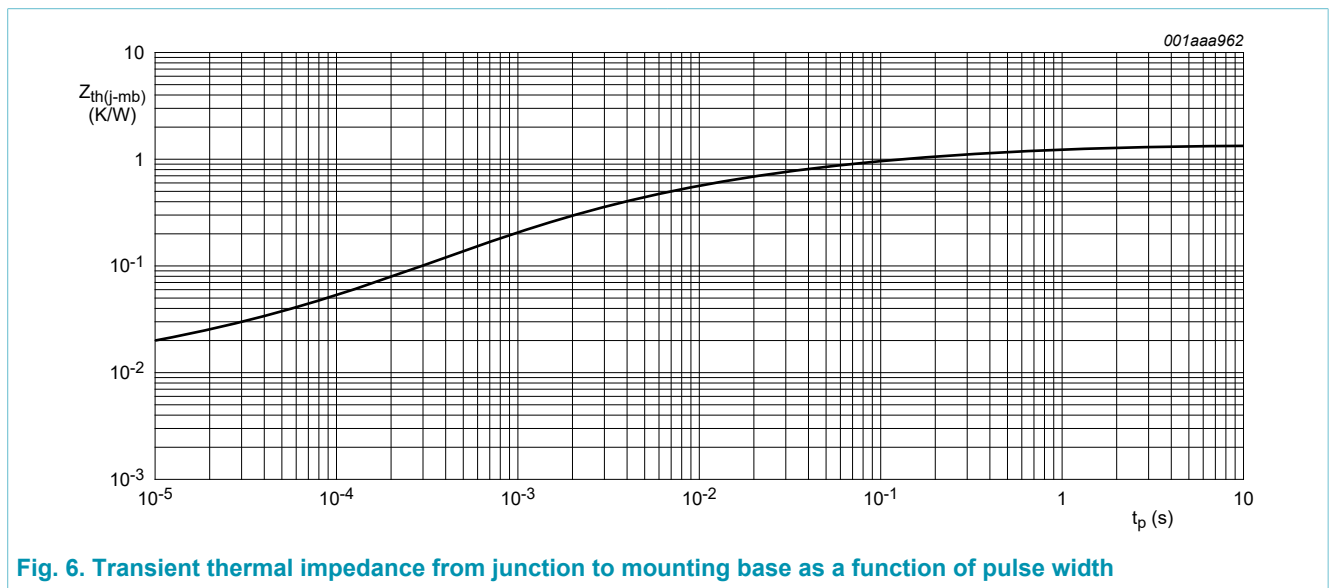


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|---|------|------|------|------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 7 | - | 2 | 15 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 8 | - | 10 | 40 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 9 | - | 7 | 20 | mA |
| V_T | on-state voltage | $I_T = 23\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 10 | - | 1.4 | 1.75 | 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 | - | 0.6 | 1.5 | V |
| | | $V_D = 650\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ }^\circ\text{C}$; Fig. 11 | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 650\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$ | - | 0.1 | 0.5 | mA |
| I_R | reverse current | $V_R = 650\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$ | - | 0.1 | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 436\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $R_{GK} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; Fig. 12 | 200 | 1000 | - | V/ μs |
| | | $V_{DM} = 436\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit; Fig. 12 | 50 | 130 | - | V/ μs |
| t_{gt} | gate-controlled turn-on time | $I_{TM} = 40\text{ A}$; $V_D = 650\text{ V}$; $I_G = 0.1\text{ A}$; $dI_G/dt = 5\text{ A}/\mu\text{s}$; $T_j = 25\text{ }^\circ\text{C}$ | - | 2 | - | μs |
| t_q | commutated turn-off time | $V_{DM} = 436\text{ V}$; $T_j = 125\text{ }^\circ\text{C}$; $I_{TM} = 20\text{ A}$; $V_R = 25\text{ V}$; $(dI_T/dt)_M = 30\text{ A}/\mu\text{s}$; $dV_D/dt = 50\text{ V}/\mu\text{s}$; $R_{GK(ext)} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM}) | - | 70 | - | μs |



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

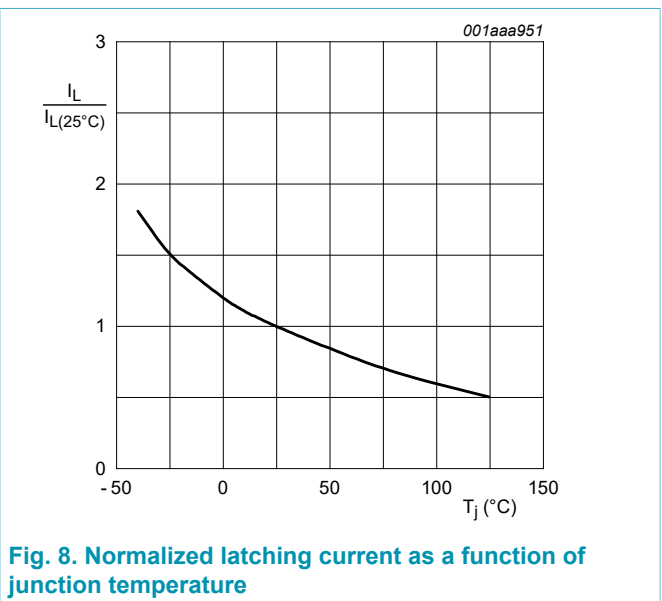


Fig. 8. Normalized latching current as a function of junction temperature

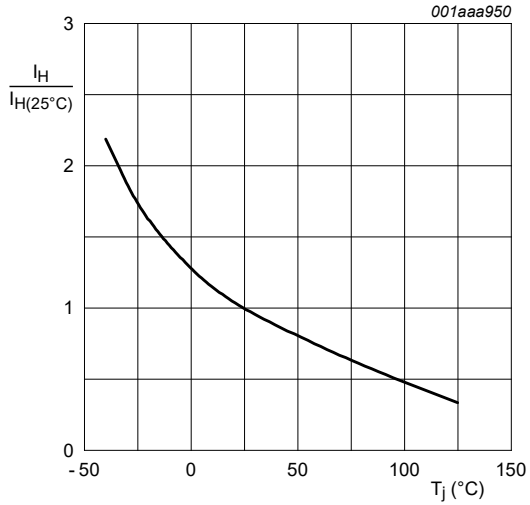


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.06 \text{ V}; R_s = 0.0304 \Omega$

- (1) $T_j = 125 \text{ }^\circ\text{C}$; typical values
- (2) $T_j = 125 \text{ }^\circ\text{C}$; maximum values
- (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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

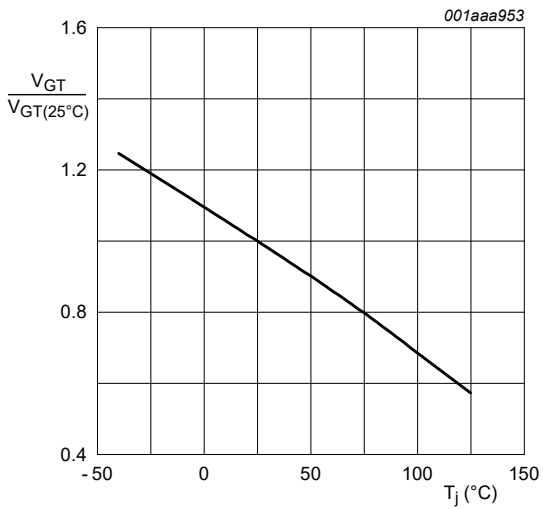


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

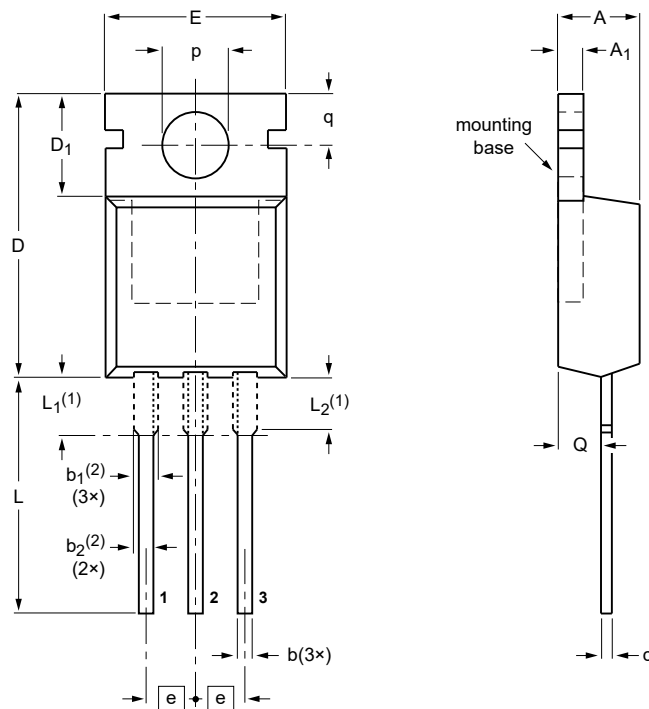


- (1) $R_{GK} = 100 \Omega$;
- (2) gate open circuit

Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values

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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| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 24 February 2018

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