



BT138Y-600E

4Q Triac

1 May 2015

Product data sheet

1. General description

Planar passivated sensitive gate four quadrant triac in an internally insulated SOT78D (TO-220AB) plastic package intended for use in general purpose bidirectional switching and phase control applications. This sensitive gate "series E" triac can be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits. The internally insulated mounting base gives good thermal performance combined with ease of handling and assembly by the user.

2. Features and benefits

- 2500 V RMS isolation voltage capability
- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drivers and microcontrollers
- High blocking voltage capability
- Industry standard TO-220 package for ease of handling
- Isolated mounting base
- Planar passivated for voltage ruggedness and reliability
- Sensitive gate
- Triggering in all four quadrants

3. Applications

- 230 V lamp dimmers
- General purpose switching and phase control

4. Quick reference data

Table 1. Quick reference data

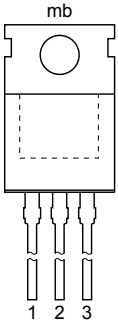

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------------|---|-----|-----|-----|------|
| V_{DRM} | repetitive peak off-state voltage | | - | - | 600 | V |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig. 4 ; Fig. 5 | - | - | 95 | A |
| $I_{T(\text{RMS})}$ | RMS on-state current | full sine wave; $T_{mb} \leq 85\text{ }^{\circ}\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 12 | A |
| 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 | - | - | 10 | mA |



| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------|---|-----|-----|-----|------|
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | mA |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------------------|---|---|
| 1 | T1 | main terminal 1 |  <p>TO-220AB (SOT78D)</p> |  <p>sym051</p> |
| 2 | T2 | main terminal 2 | | |
| 3 | G | gate | | |
| mb | n.c. | mounting base; isolated | | |

6. Ordering information

Table 3. Ordering information

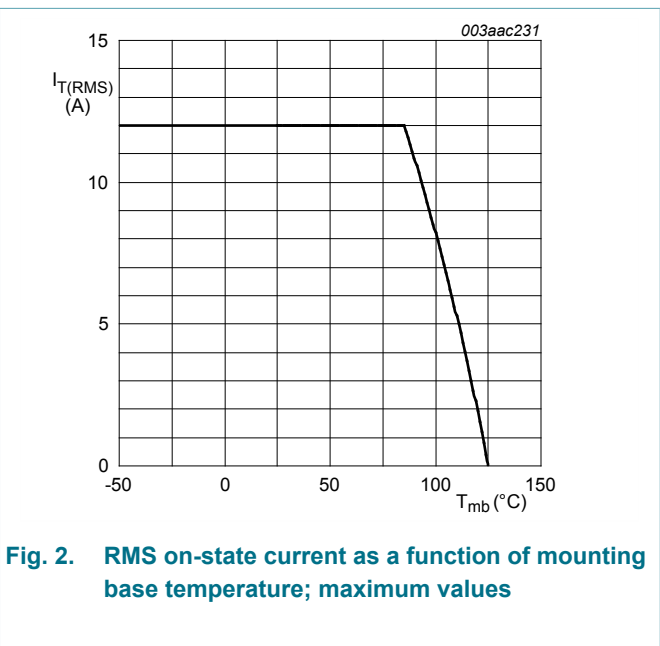
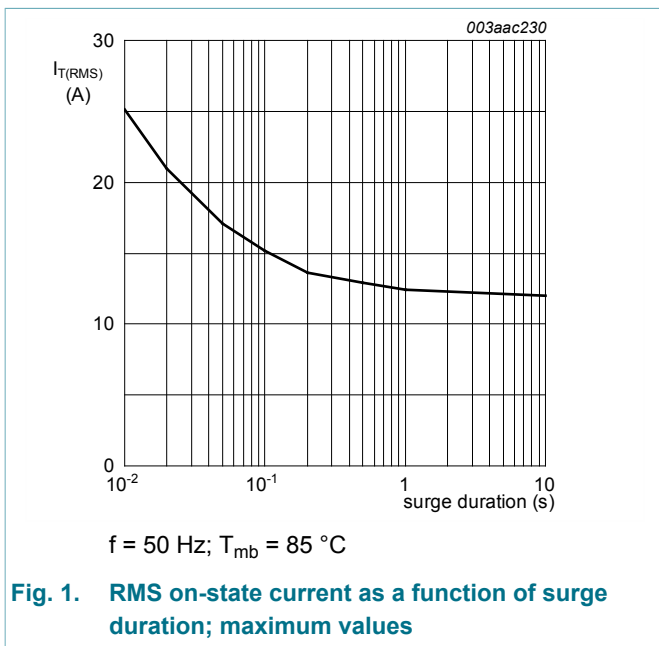
| Type number | Package | | |
|-------------|----------|---|---------|
| | Name | Description | Version |
| BT138Y-600E | TO-220AB | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 | SOT78D |

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 |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 85\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | 12 | 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 | - | 95 | A |
| | | full sine wave; $T_{j(\text{init})} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 105 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 45 | A^2s |
| dl_T/dt | rate of rise of on-state current | $I_G = 20\text{ mA}$; T2+ G+ | - | 50 | $A/\mu s$ |
| | | $I_G = 20\text{ mA}$; T2+ G- | - | 50 | $A/\mu s$ |
| | | $I_G = 50\text{ mA}$; T2- G+ | - | 10 | $A/\mu s$ |
| | | $I_G = 20\text{ mA}$; T2- G- | - | 50 | $A/\mu s$ |
| 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 | $^{\circ}C$ |



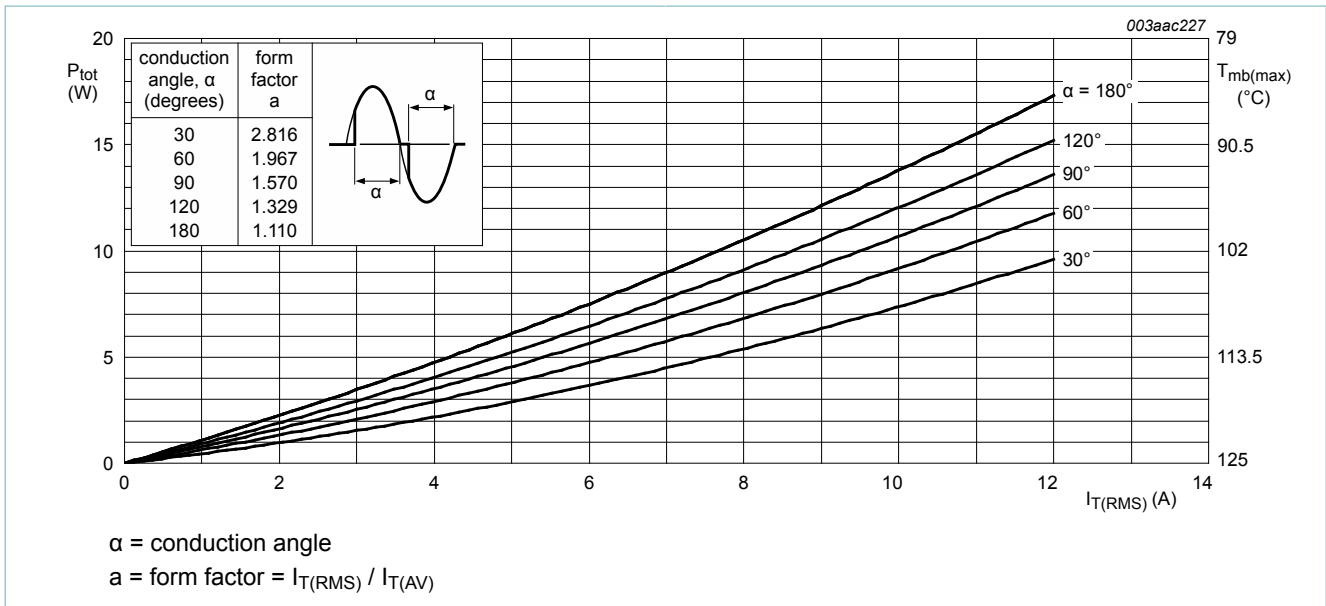


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

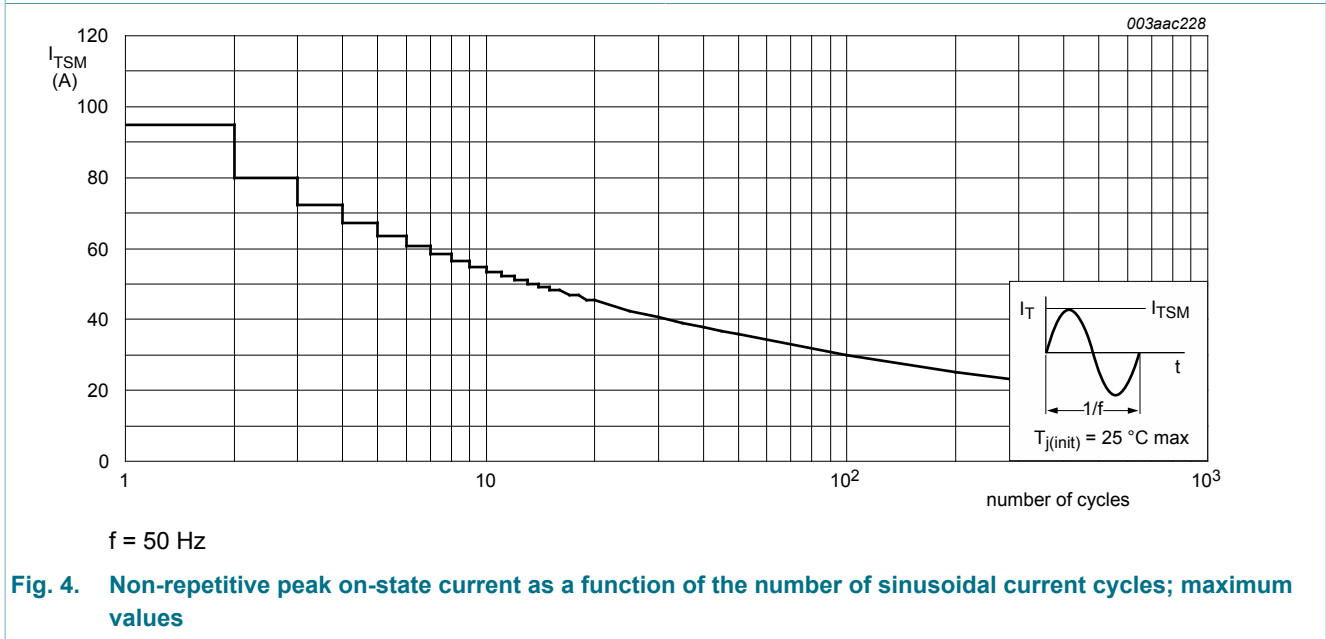


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values

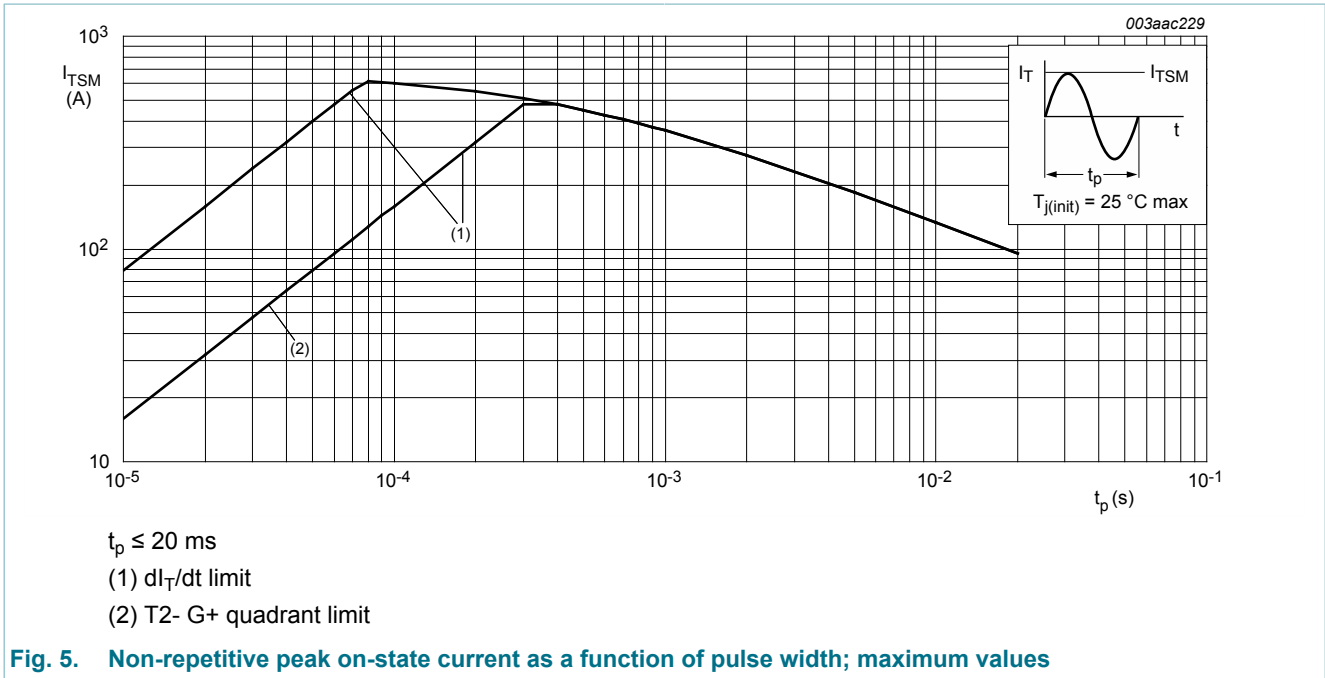


Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

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 | - | - | 2.3 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | full cycle; in free air | - | 60 | - | K/W |

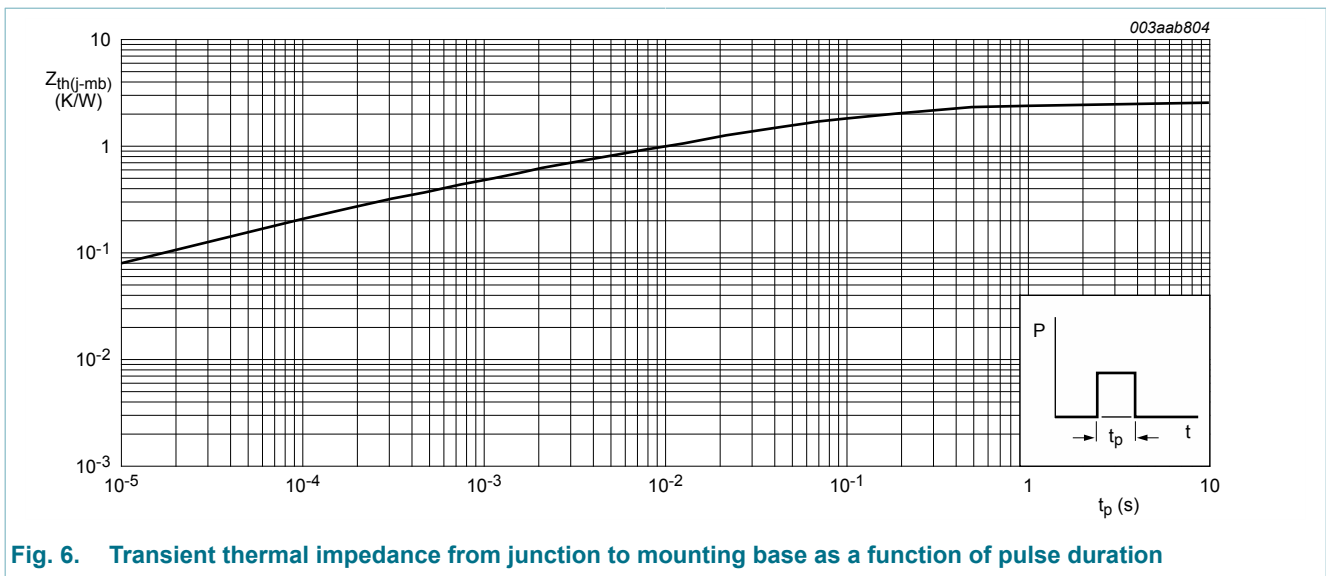


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

9. Isolation characteristics

Table 6. Isolation characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|-----------------------|---|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | from all terminals to external heatsink; sinusoidal waveform; clean and dust free; $50\text{ Hz} \leq f \leq 60\text{ Hz}$; $RH \leq 65\%$; $T_{mb} = 25\text{ }^\circ\text{C}$ | - | - | 2500 | V |
| C_{isol} | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$; $T_{mb} = 25\text{ }^\circ\text{C}$ | - | 10 | - | pF |

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 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 10 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | - | - | 25 | 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 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 40 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 30 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_j = 25\text{ °C}$; Fig. 8 | - | - | 40 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 30 | mA |
| V_T | on-state voltage | $I_T = 15\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.4 | 1.65 | 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 |
| | | $V_D = 600\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 125\text{ °C}$; Fig. 11 | 0.25 | 0.4 | - | V |
| I_D | off-state current | $V_D = 600\text{ V}$; $T_j = 125\text{ °C}$ | - | 0.1 | 0.5 | mA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | rate of rise of off-state voltage | $V_{DM} = 402\text{ V}$; $T_j = 125\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | - | 50 | - | V/ μ s |
| t_{gt} | gate-controlled turn-on time | $I_{TM} = 16\text{ A}$; $V_D = 600\text{ V}$; $I_G = 100\text{ mA}$; $di_G/dt = 5\text{ A}/\mu\text{s}$ | - | 2 | - | μ s |

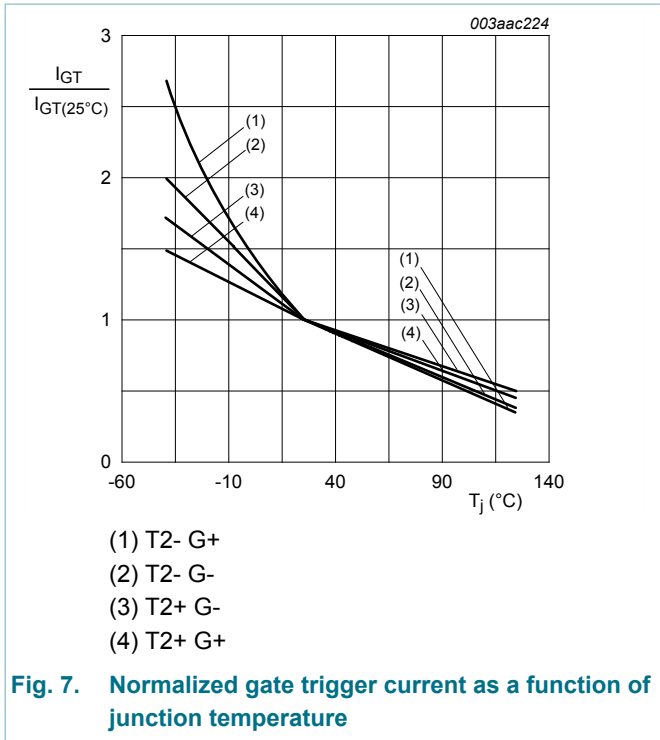


Fig. 7. Normalized gate trigger current as a function of junction temperature

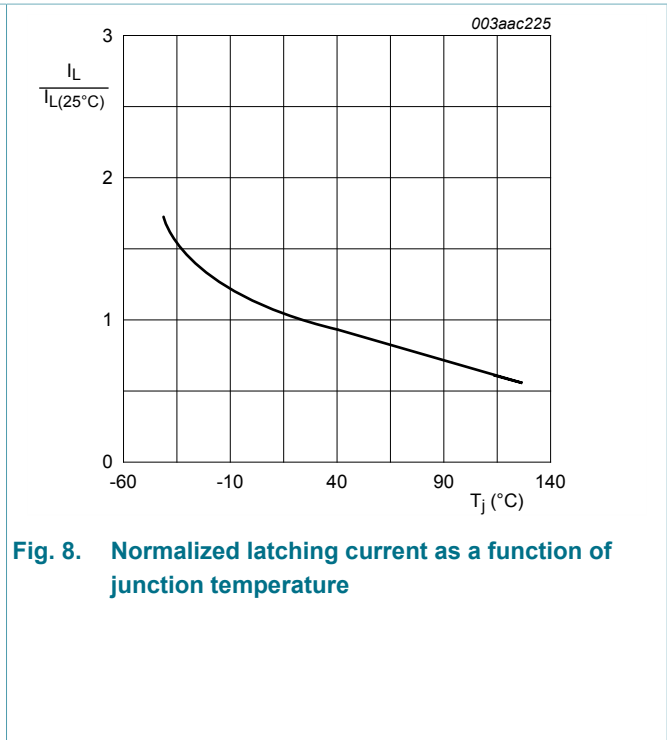


Fig. 8. Normalized latching current as a function of junction temperature

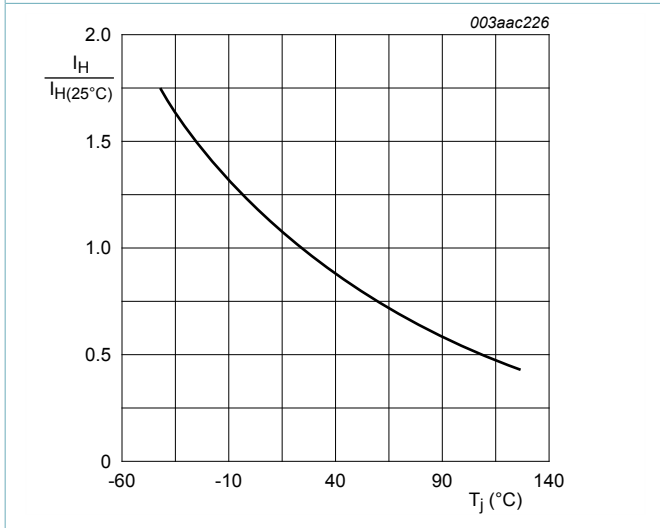
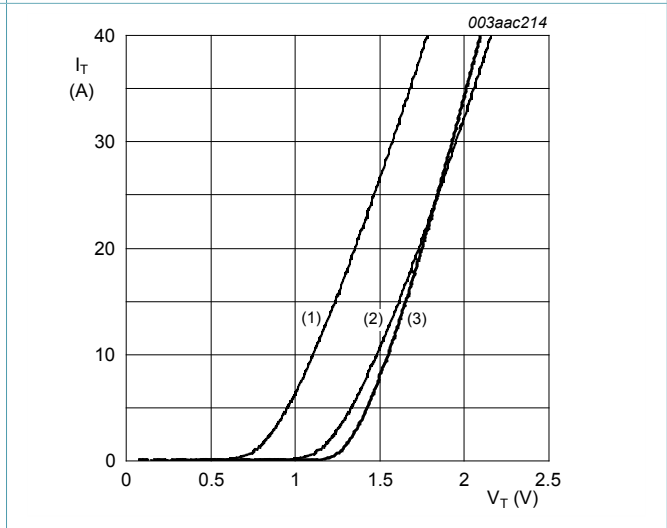


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.175\text{ V}$; $R_s = 0.032\ \Omega$
 (1) $T_j = 125^\circ\text{C}$; typical values
 (2) $T_j = 125^\circ\text{C}$; maximum values
 (3) $T_j = 25^\circ\text{C}$; maximum values

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

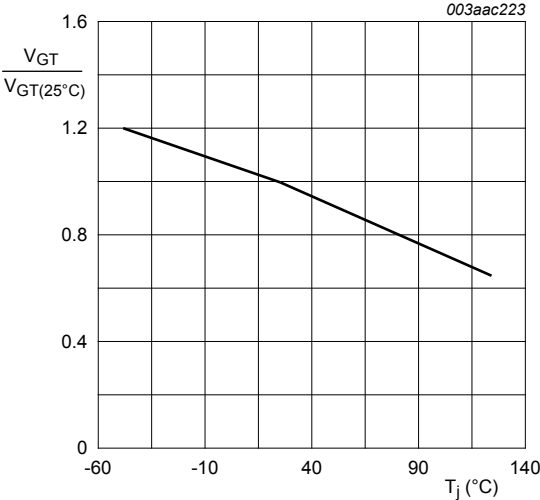


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

11. Package outline

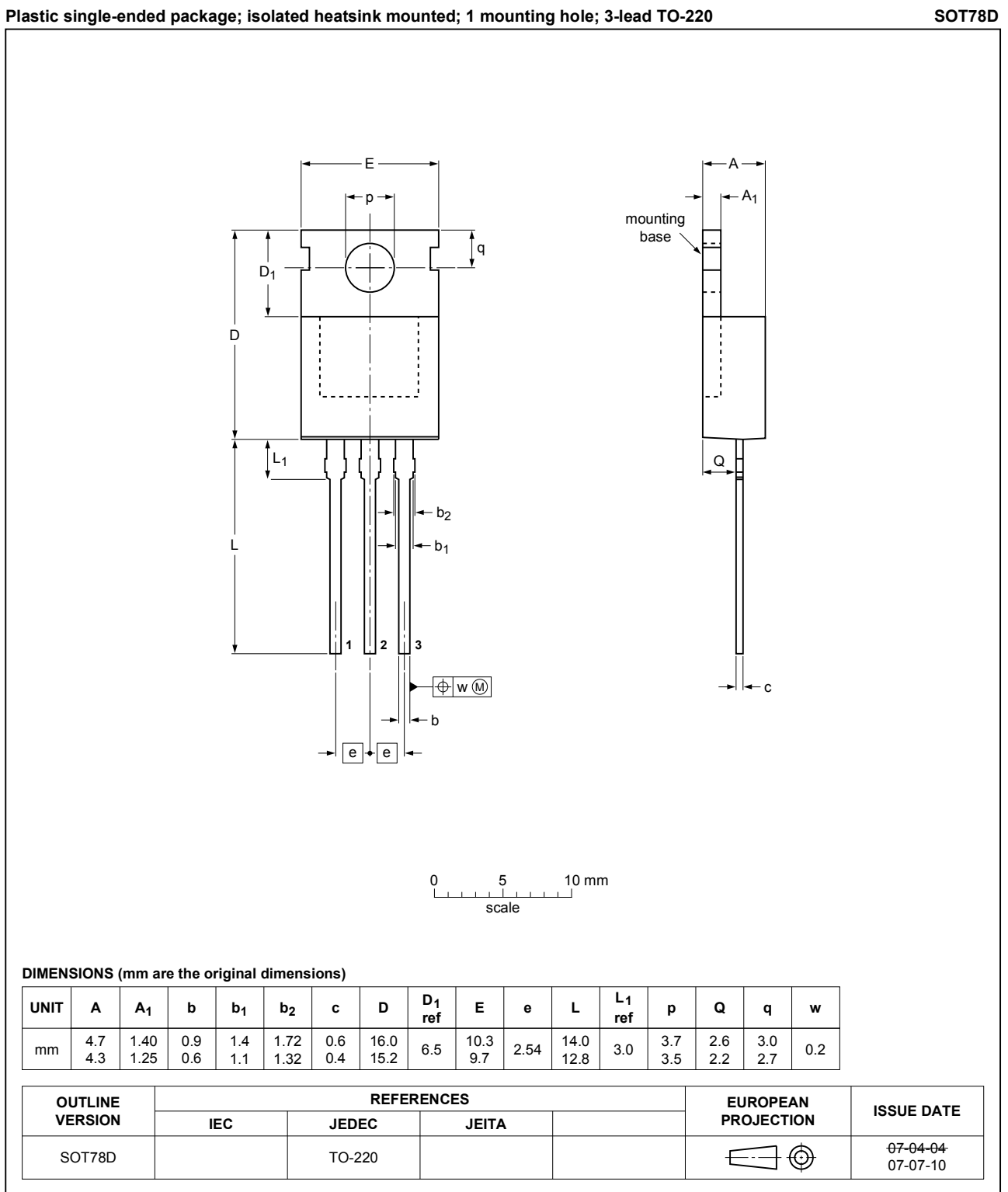


Fig. 12. Package outline TO-220AB (SOT78D)

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