

1. General description

Planar passivated high commutation three quadrant triac in a ITO220 internally insulated plastic package intended for use in circuits where high static and dynamic dV/dt and high dI/dt can occur. This "series B" triac will commute the full RMS current at the maximum rated junction temperature without the aid of a snubber. This device has high T_j operating capability and an internally isolated mounting base.

2. Features and benefits

- 3Q technology for improved noise immunity
- High commutation capability with maximum false trigger immunity
- High immunity to false turn-on by dV/dt
- High surge capability
- High $T_{j(max)}$
- Isolated mounting base with 2500 V (RMS) isolation
- Least sensitive gate for highest noise immunity
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Very high immunity to false turn-on by dV/dt

3. Applications

- Electronic thermostats (heating and cooling)
- High power motor controls
- Rectifier-fed DC inductive loads e.g. DC motors and solenoids

4. Quick reference data

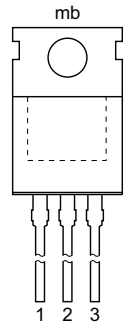

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|---|-----|-----|-----|------|
| Absolute maximum rating | | | | | | |
| V_{DRM} | repetitive peak off-state voltage | | - | - | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 108\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3 | - | - | 16 | 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 | - | - | 160 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | - | 176 | A |
| T_j | junction temperature | | - | - | 150 | °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 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_j = 25\text{ °C}$; Fig. 7 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_j = 25\text{ °C}$; Fig. 7 | 2 | - | 50 | mA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|---------------------------------------|--|------|-----|-----|------------|
| I_H | holding current | $V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9 | - | - | 60 | mA |
| V_T | on-state voltage | $I_T = 20\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 1.2 | 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 | 1000 | - | - | V/ μ s |
| | | $V_{DM} = 536\text{ V}$; $T_j = 150\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 600 | - | - | V/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_j = 125\text{ °C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 15 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_j = 150\text{ °C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); 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 |  |  sym051 |
| 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 | Orderable part number | Packing method | Small packing quantity | Package version | Package issue date |
|--------------|--------------|-----------------------|----------------|------------------------|-----------------|--------------------|
| BTA416Y-800B | IITO220 | BTA416Y-800B,127 | Tube | 50 | SOT78D (A) | 10-July-2007 |
| | | | | | IITO220P (P) | 31-Mar-2023 |

7. Marking

Table 4. Marking codes

| Type number | Marking codes | |
|--------------|-------------------------------|-------------------------------|
| | Assembly factory: A | Assembly factory: P |
| BTA416Y-800B | BTA416Y 800B PJAxxxx xx | BTA416Y 800B PJPxxxx 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; $T_{mb} \leq 108\text{ °C}$; Fig 1 ; Fig 2 ; Fig 3 | - | 16 | 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 | - | 160 | A |
| | | full sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 16.7\text{ ms}$ | - | 176 | A |
| I^2t | I^2t for fusing | $t_p = 10\text{ ms}$; SIN | - | 128 | A ² s |
| di_T/dt | rate of rise of on-state current | $I_G = 0.2\text{ A}$ | - | 100 | A/ μ s |
| I_{GM} | peak gate current | | - | 4 | A |
| P_{GM} | peak gate power | | - | 5 | W |
| $P_{G(AV)}$ | average gate power | over any 20 ms period | - | 1 | W |
| T_{stg} | storage temperature | | -40 | 150 | °C |
| T_j | junction temperature | | - | 150 | °C |

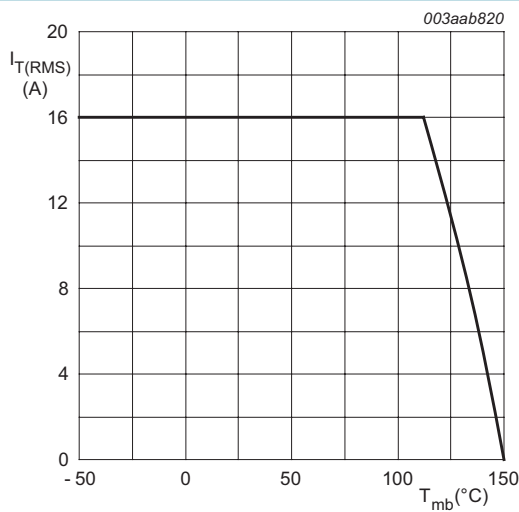
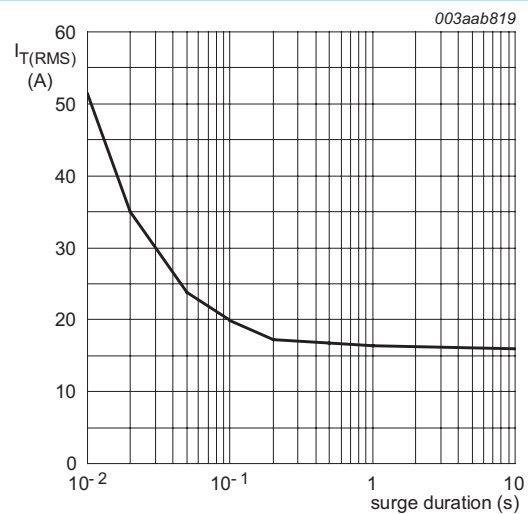
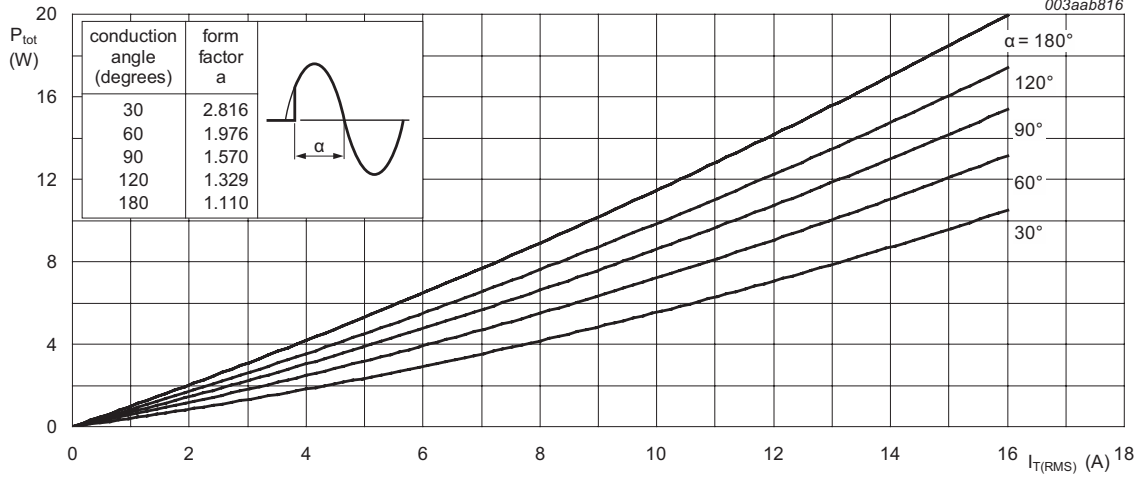


Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values



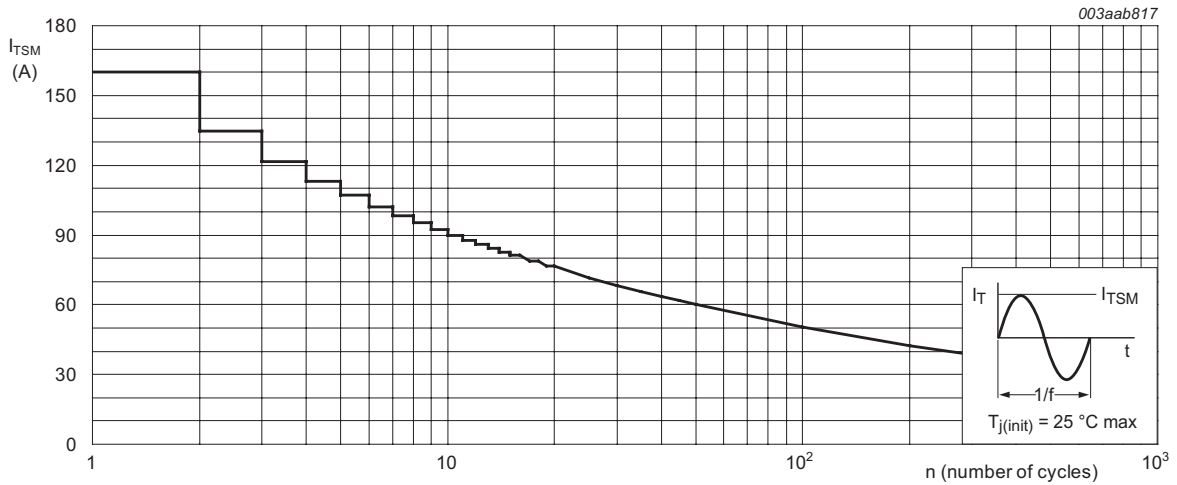
$f = 50\text{ Hz}$; $T_h = 108\text{ °C}$

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



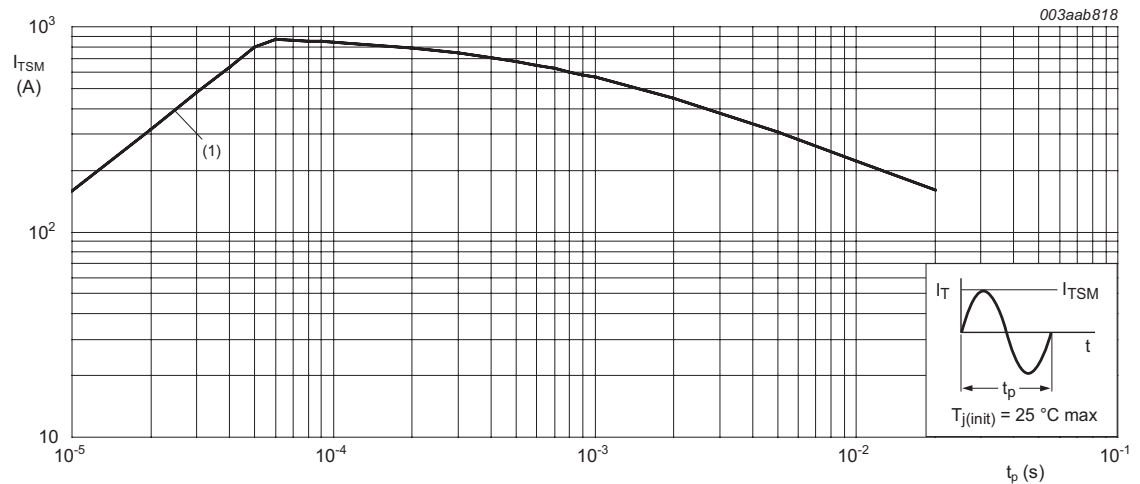
α = conduction angle
 a = form factor = $I_{T(RMS)} / I_{T(AV)}$

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



f = 50 Hz

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



$t_p \leq 20$ ms
 (1) di_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; 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 | - | - | 1.9 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | - | 60 | - | K/W |

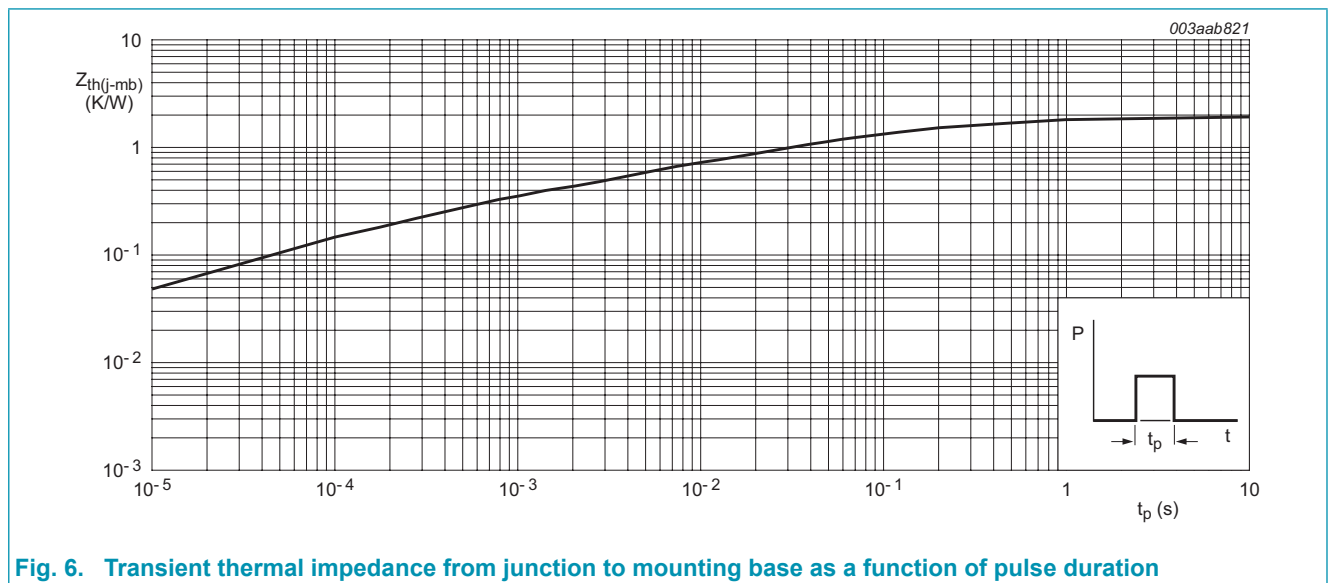


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Isolation characteristics

Table 7. 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; $50\text{ Hz} \leq f \leq 60\text{ Hz}$; $RH \leq 65\%$; $T_h = 25\text{ }^\circ\text{C}$ | - | - | 2500 | V |
| C_{isol} | isolation capacitance | from main terminal 2 to external heatsink; $f = 1\text{ MHz}$; $T_h = 25\text{ }^\circ\text{C}$ | - | 10 | - | pF |

11. Characteristics

Table 8. 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 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ °C}$; Fig. 7 | 2 | - | 50 | mA |
| | | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ °C}$; Fig. 7 | 2 | - | 50 | 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 | - | - | 60 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 90 | mA |
| | | $V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ °C}$; Fig. 8 | - | - | 60 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $T_J = 25\text{ °C}$; Fig. 9 | - | - | 60 | mA |
| V_T | on-state voltage | $I_T = 20\text{ A}$; $T_J = 25\text{ °C}$; Fig. 10 | - | 1.2 | 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 |
| | | $V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 150\text{ °C}$ | 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 |
| | | $V_D = 800\text{ V}$; $T_J = 150\text{ °C}$ | - | 0.4 | 2 | 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 | 1000 | - | - | V/ μ s |
| | | $V_{DM} = 536\text{ V}$; $T_J = 150\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit | 600 | - | - | V/ μ s |
| dI_{com}/dt | rate of change of commutating current | $V_D = 400\text{ V}$; $T_J = 125\text{ °C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 15 | - | - | A/ms |
| | | $V_D = 400\text{ V}$; $T_J = 150\text{ °C}$; $I_{T(RMS)} = 16\text{ A}$; $dV_{com}/dt = 20\text{ V}/\mu\text{s}$; (snubberless condition); gate open circuit | 6 | - | - | A/ms |

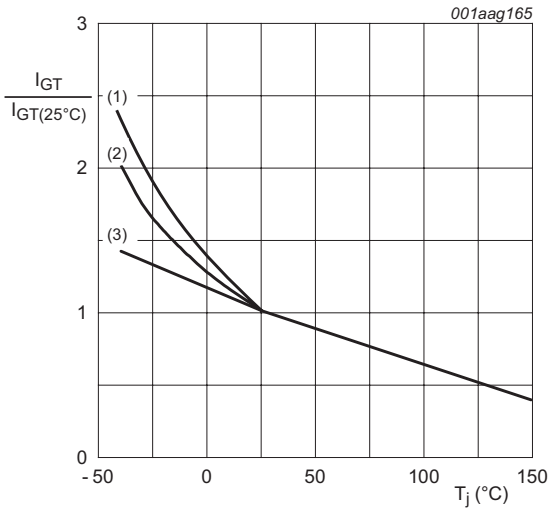


Fig. 7. Normalized gate trigger current as a function of junction temperature

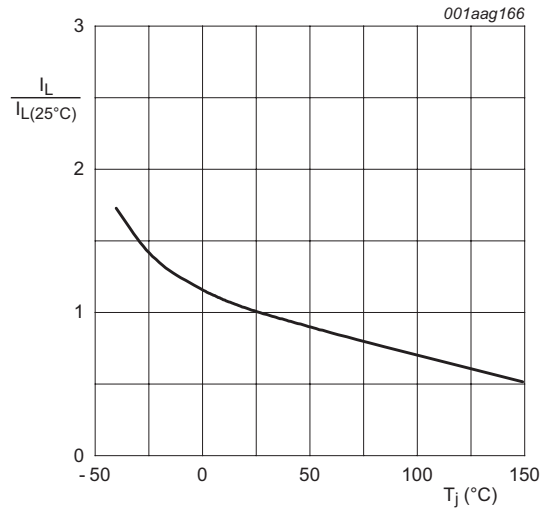


Fig. 8. Normalized latching current as a function of junction temperature

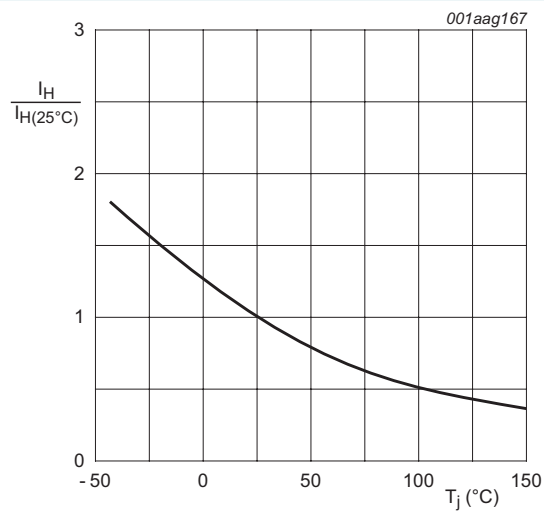
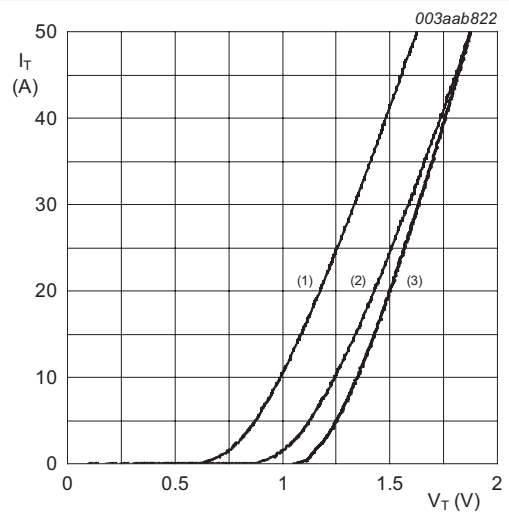
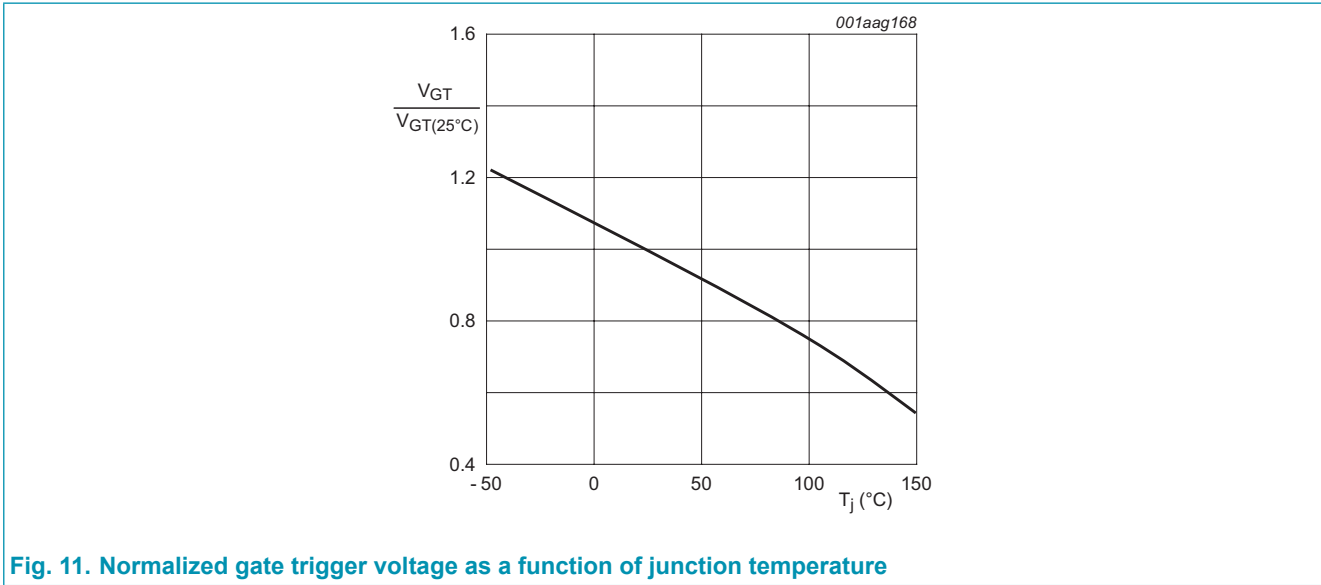


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.086\text{ V}; R_s = 0.017\ \Omega$
 Fig. 10. On-state current as a function of on-state voltage

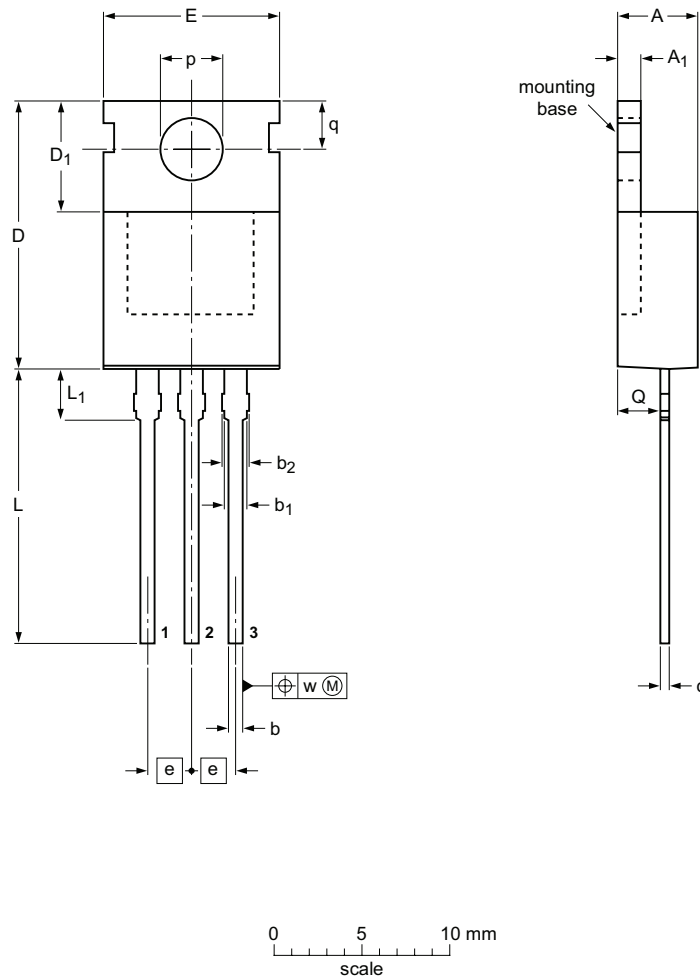


12. Package outline

Assembly factory: A

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

SOT78D



DIMENSIONS (mm are the original dimensions)

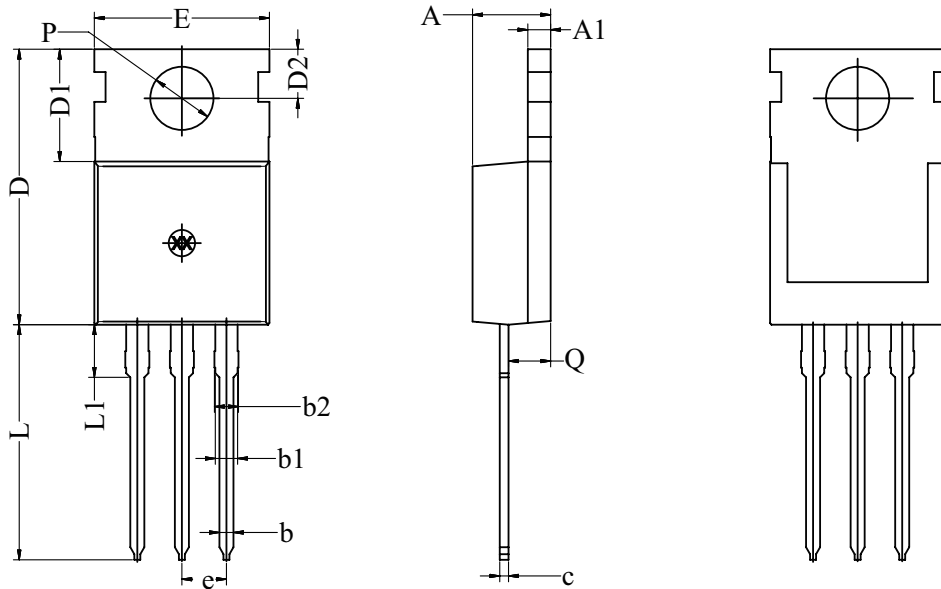
| UNIT | A | A ₁ | b | b ₁ | b ₂ | c | D | D ₁ ref | E | e | L | L ₁ ref | p | Q | q | w |
|------|------------|----------------|------------|----------------|----------------|------------|--------------|-----------------------|-------------|------|--------------|-----------------------|------------|------------|------------|-----|
| mm | 4.7 4.3 | 1.40 1.25 | 0.9 0.6 | 1.4 1.1 | 1.72 1.32 | 0.6 0.4 | 16.0 15.2 | 6.5 | 10.3 9.7 | 2.54 | 14.0 12.8 | 3.0 | 3.7 3.5 | 2.6 2.2 | 3.0 2.7 | 0.2 |

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT78D | | TO-220 | | | 07-04-04 07-07-10 |

Assembly factory: P

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 leads TO-220

IITO220



| Dim | All Dimensions in Millimeters | | |
|-----|-------------------------------|-------|-------|
| | Min | Typ | Max |
| A | 4.30 | 4.45 | 4.70 |
| A1 | 1.25 | 1.30 | 1.40 |
| b | 0.60 | 0.80 | 0.90 |
| b1 | 1.10 | 1.27 | 1.40 |
| b2 | 1.32 | 1.37 | 1.72 |
| c | 0.40 | 0.50 | 0.60 |
| D | 15.20 | 15.70 | 16.00 |
| D1 | 6.20 | 6.40 | 6.60 |
| D2 | 2.70 | 2.80 | 3.00 |
| E | 9.70 | 10.00 | 10.30 |
| e | 2.54 BSC | | |
| L | 12.80 | 13.40 | 14.00 |
| L1 | 2.80 | 3.00 | 3.20 |
| P | 3.50 | 3.60 | 3.70 |
| Q | 2.20 | 2.40 | 2.60 |

13. Legal information

Data sheet status

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

- [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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For sales office addresses, please send an email to: salesaddresses@ween-semi.com

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