# BTA316Y-800CT

## 3Q Hi-Com Triac

Rev.02 - 16 January 2019 Product data sheet

## 1. General description

Planar passivated high commutation three quadrant triac in a SOT78D (IITO-220) internally insulated plastic package intended for use in circuits where high static and dynamic dV/dt and high dI/dt can occur. This "series CT" triac will commutate the full RMS current at the maximum rated junction temperature without the aid of a snubber where "high junction operating temperature capability" is required.

## 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 junction operating temperature capability ($T_{j(max)}$ = 150 °C)
- High voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in three quadrants only
- Internally insulated package
- Isolated mounting base with 2500 V (RMS) isolation

## 3. Applications

- Electronic themostats (heating and cooling)
- High power motor controls e.g washing machine and vacuum cleaners
- Rectifier-fed DC inductive loads e.g DC motors and solenoids
- Refrigeration and air conditioning compressors

## 4. Quick reference data

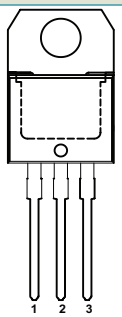
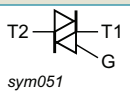
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | Values | Unit |
|---|---|---|---|---|
| **Absolute maximum rating** | | | | |
| $V_{DRM}$ | repetitive peak off-state voltage | | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 112$ °C; Fig. 1; Fig. 2; Fig. 3 | 16 | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $t_p$ = 20 ms; $T_{j(init)}$ = 25 °C; Fig. 4; Fig. 5 | 160 | A |
| | | full sine wave; $t_p$ = 16.7 ms; $T_{j(init)}$ = 25 °C | 176 | A |
| $T_j$ | junction temperature | | 150 | °C |

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G+ $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G- $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2- G- $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $T_j$ = 25 °C; Fig. 9 | | - | - | 40 | mA |
| $V_T$ | on-state voltage | $I_T$ = 20 A; $T_j$ = 25 °C; Fig. 10 | | - | - | 1.5 | 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 | | 1000 | - | - | V/µs |
| | | $V_{DM}$ = 536 V; $T_j$ = 150 °C; ($V_{DM}$ = 67% of $V_{DRM}$); gate open circuit | | 500 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit; snubberless condition | | 12 | - | - | A/ms |

# 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | T1 | main terminal 1 |   IITO-220 (SOT78D) |   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 |
|---|---|---|---|---|---|---|
| BTA316Y-800CT | IITO-220 | BTA316Y-800CTQ | Tube | 50 | IITO-220E | 15-Dec-2017 |

# 7. Marking

**Table 4. Marking codes**

| Type number | Marking codes |
|---|---|
| BTA316Y-800CT | BTA316Y-800CT |

# 8. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Values | Unit |
|---|---|---|---|---|
| $V_{DRM}$ | repetitive peak off-state voltage | | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 112°C$; Fig. 1; Fig. 2; Fig. 3 | 16 | A |
| $I_{TSM}$ | non-repetitive peak on-state current | full sine wave; $t_p$ = 20 ms; $T_{j(init)}$ = 25 °C; Fig. 4; Fig. 5 | 160 | A |
| | | full sine wave; $t_p$ = 16.7 ms; $T_{j(init)}$ = 25 °C | 176 | A |
| $I^2t$ | $I^2t$ for fusing | $t_p$ = 10ms; sine wave | 128 | $A^2s$ |
| $dI_T/dt$ | rate of rise of on-state current | $I_G$ = 150mA | 100 | A/µs |
| $I_{GM}$ | 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 to 150 | °C |
| $T_j$ | junction temperature | | 150 | °C |

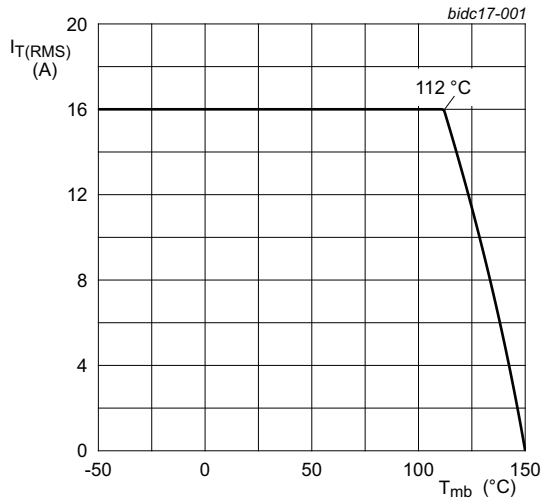
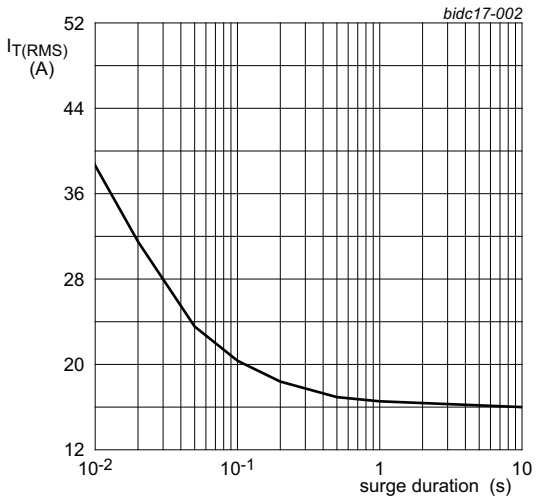
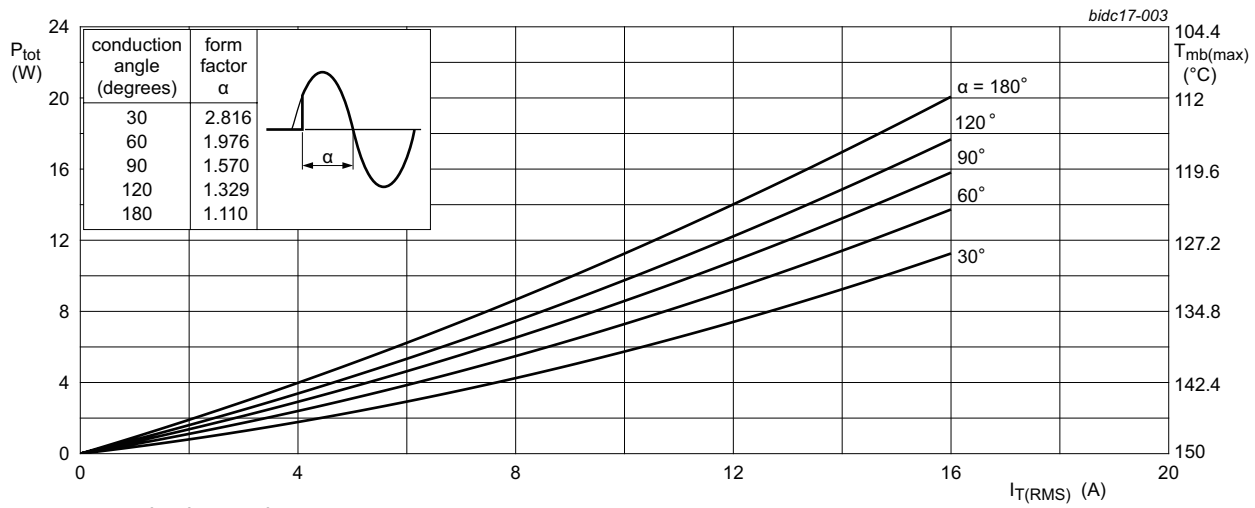



**Fig. 1. RMS on-state current as a function of mounting base temperature; maximum values**




f = 50 Hz; $T_{mb}$ = 112 °C

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

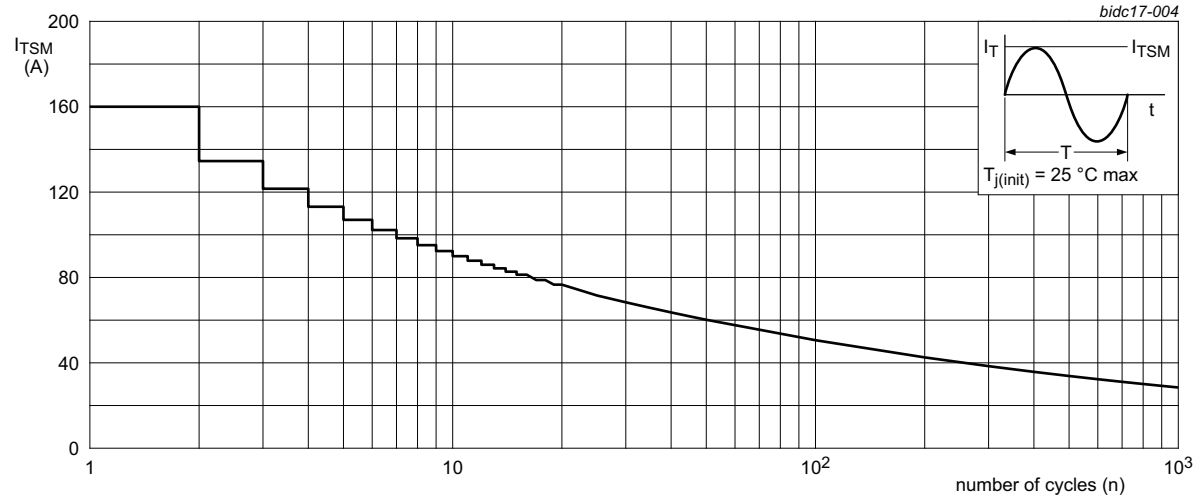



| conduction angle (degrees) | form factor α |
|---|---|
| 30 | 2.816 |
| 60 | 1.976 |
| 90 | 1.570 |
| 120 | 1.329 |
| 180 | 1.110 |

α = conduction angle

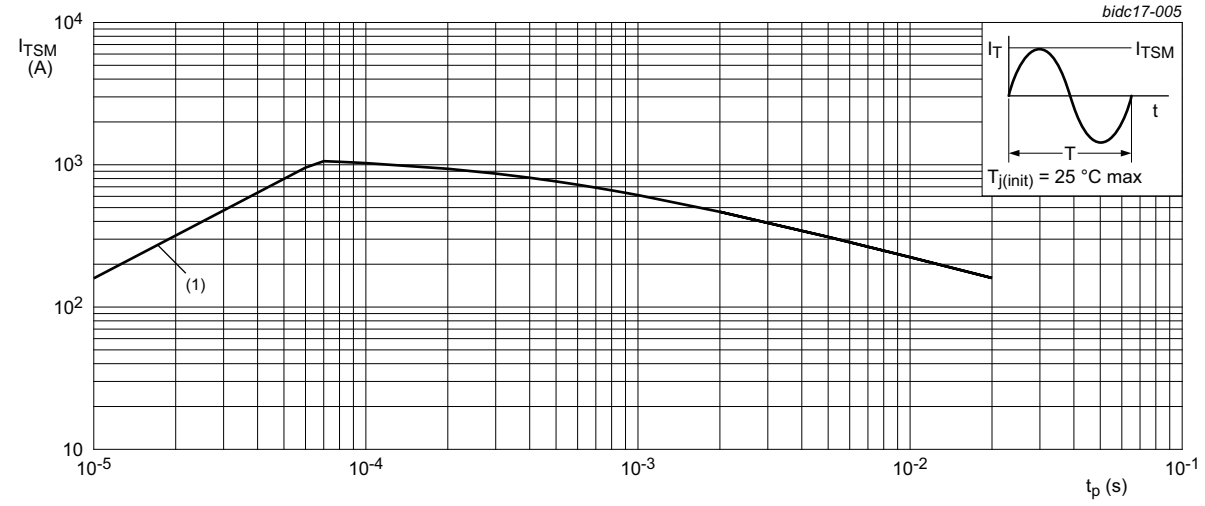
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

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

# 9. 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 | | - | - | 1.9 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | in free air | | - | 60 | - | K/W |

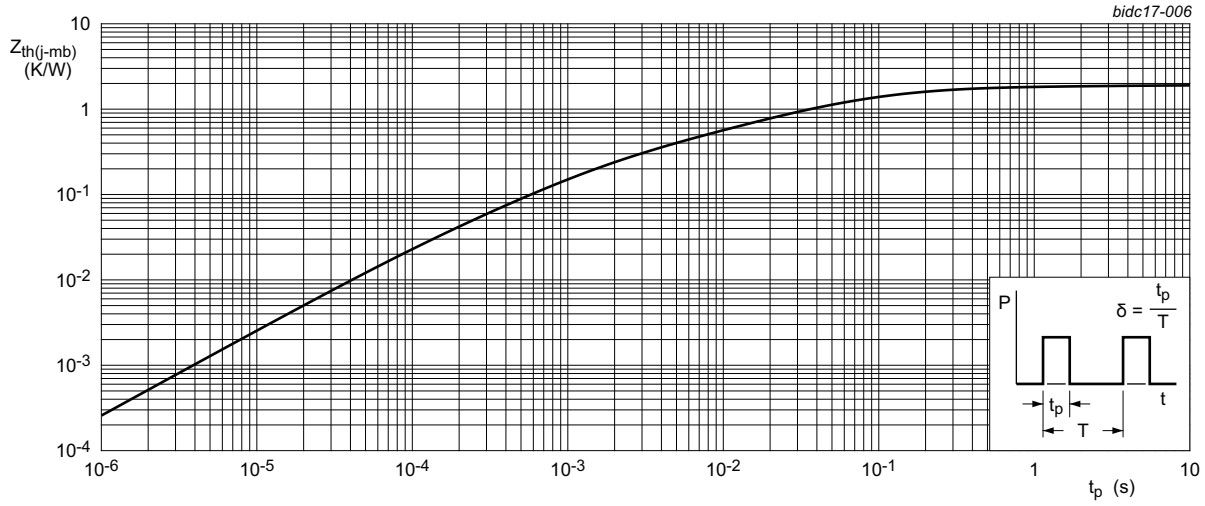



**Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration**

# 10. Isolation characteristics

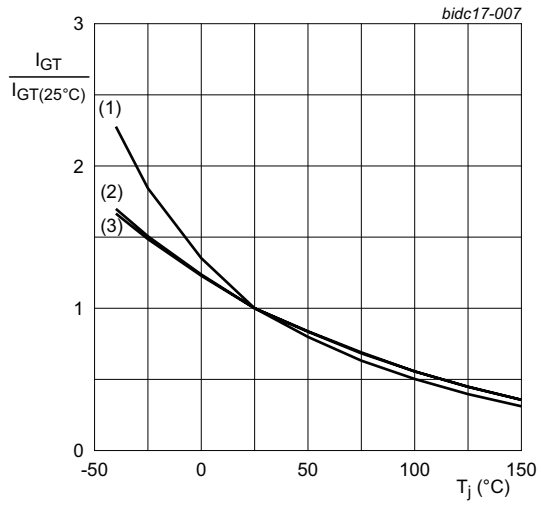
**Table 6. Isolation characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{isol(RMS)}$ | RMS isolation voltage | 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free | | - | - | 2500 | V |
| $C_{isol}$ | isolation capacitance | from cathode to external heatsink | | - | 10 | - | PF |

# 11. Characteristics

**Table 7. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $I_{GT}$ | gate trigger current | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G+; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2- G-; $T_j$ = 25 °C; Fig. 7 | | - | - | 35 | mA |
| $I_L$ | latching current | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G+; $T_j$ = 25 °C; Fig. 8 | | - | - | 50 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2+ G-; $T_j$ = 25 °C; Fig. 8 | | - | - | 70 | mA |
| | | $V_D$ = 12 V; $I_T$ = 0.1 A; T2- G-; $T_j$ = 25 °C; Fig. 8 | | - | - | 50 | mA |
| $I_H$ | holding current | $V_D$ = 12 V; $T_j$ = 25 °C; Fig. 9 | | - | - | 40 | mA |
| $V_T$ | on-state voltage | $I_T$ = 20 A; $T_j$ = 25 °C; Fig. 10 | | - | - | 1.5 | V |
| $V_{GT}$ | gate trigger voltage | $V_D$ = 12 V; $I_T$ = 0.1 A; $T_j$ = 25 °C; Fig. 11 | | - | 0.8 | 1 | V |
| | | $V_D$ = 400 V; $I_T$ = 0.1 A; $T_j$ = 150 °C; Fig. 11 | | 0.2 | 0.45 | - | V |
| $I_D$ | off-state current | $V_D$ = 800 V; $T_j$ = 25 °C | | - | - | 5 | µA |
| | | $V_D$ = 800 V; $T_j$ = 150 °C | | - | - | 2 | mA |
| **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 | | 1000 | - | - | V/µs |
| | | $V_{DM}$ = 536 V; $T_j$ = 150 °C; ($V_{DM}$ = 67% of $V_{DRM}$); exponential waveform; gate open circuit | | 500 | - | - | V/µs |
| $dI_{com}/dt$ | rate of change of commutating current | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 20 V/µs; gate open circuit; snubberless condition | | 12 | - | - | A/ms |
| | | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 10 V/µs; gate open circuit | | 15 | - | - | A/ms |
| | | $V_D$ = 400 V; $T_j$ = 150 °C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 1 V/µs; gate open circuit | | 20 | - | - | A/ms |




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

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

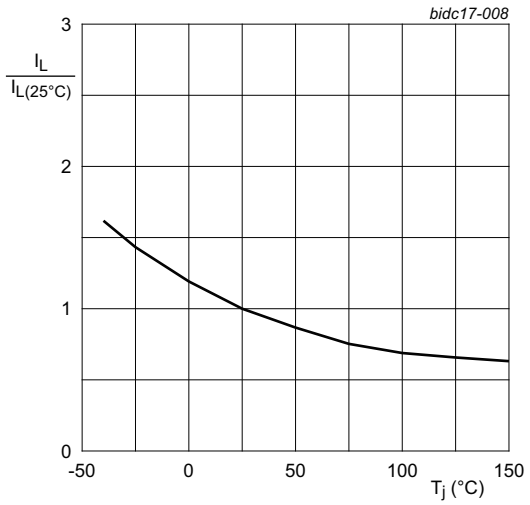



**Fig. 8. Normalized latching current as a function of junction temperature**

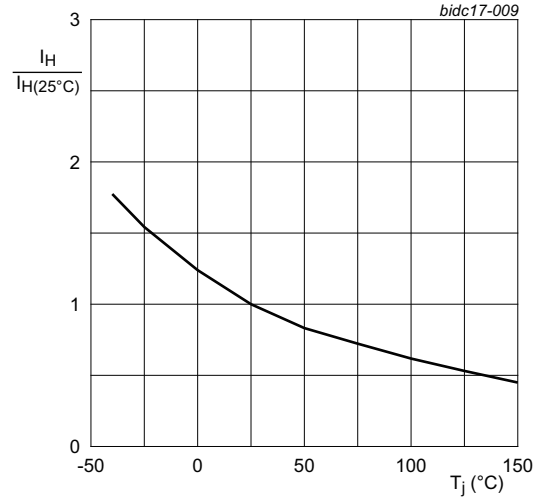
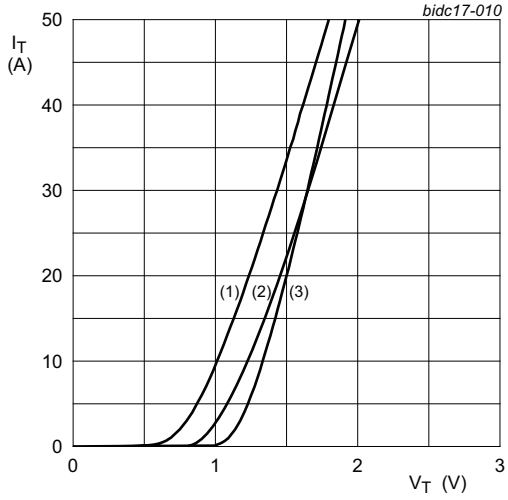



**Fig. 9. Normalized holding current as a function of junction temperature**




$V_o$ = 1.009 V; $R_s$ = 0.0216 Ω
(1) $T_j$ = 150 °C; typical values
(2) $T_j$ = 150 °C; maximum values
(3) $T_j$ = 25 °C; maximum values

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

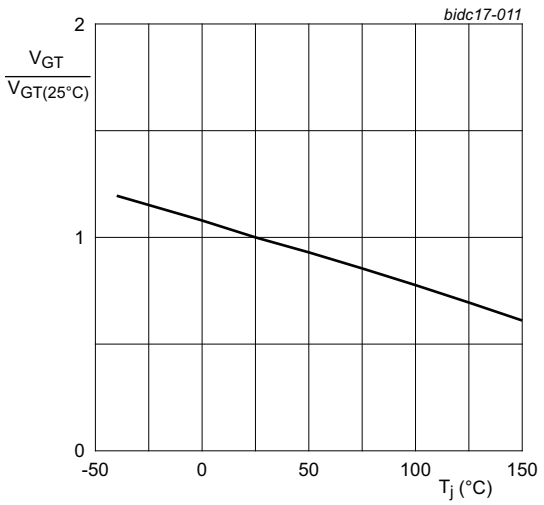
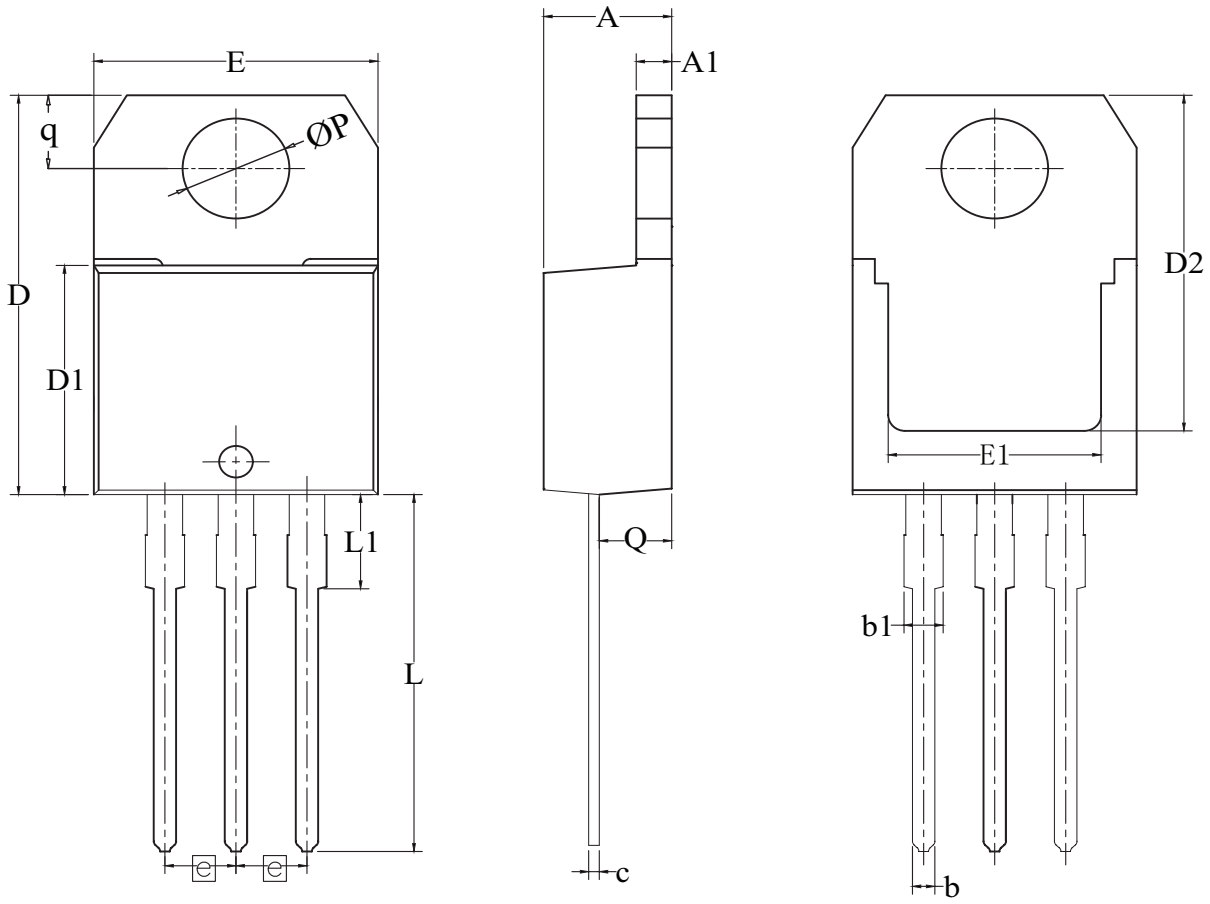



**Fig. 11. Normalized gate trigger voltage as a function of junction temperature**

## 12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 leads TO-220 IITO220




| Unit | | A | A1 | b | b1 | c | D | D1 | D2 | E | E1 | e | L | L1 | P | Q | q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MM | min | 4.30 | 1.25 | 0.69 | 1.20 | 0.40 | 15.20 | 8.50 | 12.20 | 10.00 | 6.86 | 2.54 (BSC) | 12.80 | 2.70 | 3.70 | 2.40 | 2.70 |
| | max | 4.70 | 1.40 | 0.90 | 1.72 | 0.60 | 16.00 | 9.02 | 12.88 | 10.40 | 8.89 | | 14.00 | 3.30 | 3.95 | 2.80 | 3.00 |

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| Document status [1][2] | Product status [3] | Definition |
|---|---|---|
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