# Three quadrant triacs guaranteed commutation — BTA216B series D, E and F

## GENERAL DESCRIPTION

Passivated guaranteed commutation triacs in a plastic envelope suitable for surface mounting, intended for use in motor control circuits or with other highly inductive loads. These devices balance the requirements of commutation performance and gate sensitivity. The "sensitive gate" E series and "logic level" D series are intended for interfacing with low power drivers, including micro controllers.

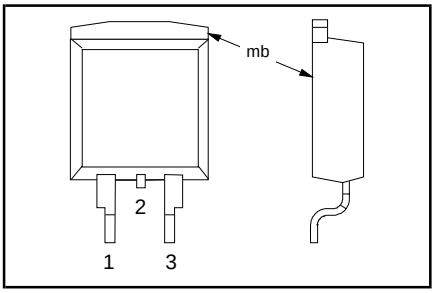
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | MAX. | UNIT |
|---|---|---|---|---|
| | **BTA216B-** | **600D** | **-** | |
| | **BTA216B-** | **600E** | **800E** | |
| $V_{DRM}$ | **BTA216B-** | **600F** | **800F** | V |
| | Repetitive peak off-state voltages | 600 | 800 | |
| $I_{T(RMS)}$ | RMS on-state current | 16 | 16 | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | 140 | 140 | A |

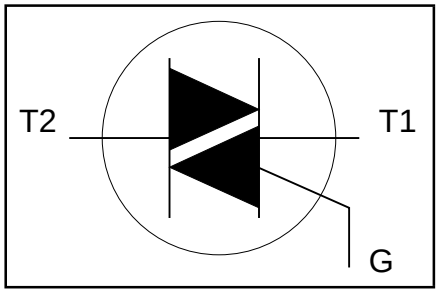
## PINNING - SOT404

| PIN | DESCRIPTION |
|---|---|
| 1 | main terminal 1 |
| 2 | main terminal 2 |
| 3 | gate |
| mb | main terminal 2 |

## PIN CONFIGURATION




## SYMBOL




## LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | | UNIT |
|---|---|---|---|---|---|---|
| | | | | **-600** | **-800** | |
| $V_{DRM}$ | Repetitive peak off-state voltages | | - | 600[1] | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 99$ ˚C | - | 16 | | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | full sine wave; $T_j = 25$ ˚C prior to surge | | | | |
| | | t = 20 ms | - | 140 | | A |
| | | t = 16.7 ms | | 150 | | A |
| $I^2t$ | $I^2t$ for fusing | t = 10 ms | - | 98 | | $A^2s$ |
| $dI_T/dt$ | Repetitive rate of rise of on-state current after triggering | $I_{TM}$ = 20 A; $I_G$ = 0.2 A; $dI_G/dt$ = 0.2 A/µs | | 100 | | A/µs |
| $I_{GM}$ | Peak gate current | | - | 2 | | A |
| $V_{GM}$ | Peak 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 | | ˚C |
| $T_j$ | Operating junction temperature | | - | 125 | | ˚C |

**1** Although not recommended, off-state voltages up to 800V may be applied without damage, but the triac may switch to the on-state. The rate of rise of current should not exceed 15 A/µs.

## THERMAL RESISTANCES

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $R_{th\ j\text{-}mb}$ | Thermal resistance junction to mounting base | full cycle | - | - | 1.2 | K/W |
| | | half cycle | - | - | 1.7 | K/W |
| $R_{th\ j\text{-}a}$ | Thermal resistance junction to ambient | minimum footprint, FR4 board | - | 55 | - | K/W |

## STATIC CHARACTERISTICS

$T_j$ = 25 ˚C unless otherwise stated

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | **BTA216-** | | **...D** | **...D** | **...E** | **...F** | |
| $I_{GT}$ | Gate trigger current[2] | $V_D$ = 12 V; $I_T$ = 0.1 A | | | | | | |
| | | T2+ G+ | - | 1.3 | 5 | 10 | 25 | mA |
| | | T2+ G- | - | 2.6 | 5 | 10 | 25 | mA |
| | | T2- G- | - | 3.4 | 5 | 10 | 25 | mA |
| $I_L$ | Latching current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A | | | | | | mA |
| | | T2+ G+ | - | 10.2 | 15 | 25 | 30 | mA |
| | | T2+ G- | - | 11.3 | 25 | 30 | 40 | mA |
| | | T2- G- | - | 19.3 | 25 | 30 | 40 | |
| $I_H$ | Holding current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A | - | 8 | 15 | 25 | 30 | mA |
| | | | **...D, E, F** | | | | | |
| $V_T$ | On-state voltage | $I_T$ = 20 A | - | 1.2 | 1.5 | | | V |
| $V_{GT}$ | Gate trigger voltage | $V_D$ = 12 V; $I_T$ = 0.1 A | - | 0.7 | 1.5 | | | V |
| | | $V_D$ = 400 V; $I_T$ = 0.1 A; $T_j$ = 125 ˚C | 0.25 | 0.4 | - | | | V |
| $I_D$ | Off-state leakage current | $V_D$ = $V_{DRM(max)}$; $T_j$ = 125 ˚C | - | 0.1 | 0.5 | | | mA |

## DYNAMIC CHARACTERISTICS

$T_j$ = 25 ˚C unless otherwise stated

| SYMBOL | PARAMETER | CONDITIONS | MIN. | | | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | **BTA216-** | **...D** | **...E** | **...F** | **...D** | | |
| $dV_D/dt$ | Critical rate of rise of off-state voltage | $V_{DM}$ = 67% $V_{DRM(max)}$; $T_j$ = 110 ˚C; exponential waveform; gate open circuit | 30 | 60 | 70 | 65 | - | V/µs |
| $dI_{com}/dt$ | Critical rate of change of commutating current | $V_{DM}$ = 400 V; $T_j$ = 110 ˚C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 20V/µs; gate open circuit | 2.5 | 4.7 | 9.5 | 7.5 | - | A/ms |
| $dI_{com}/dt$ | Critical rate of change of commutating current | $V_{DM}$ = 400 V; $T_j$ = 110 ˚C; $I_{T(RMS)}$ = 16 A; $dV_{com}/dt$ = 0.1V/µs; gate open circuit | 12 | 40 | 50 | 100 | - | A/ms |
| | | | **...D, E, F** | | | | | |
| $t_{gt}$ | Gate controlled turn-on time | $I_{TM}$ = 20 A; $V_D$ = $V_{DRM(max)}$; $I_G$ = 0.1 A; $dI_G/dt$ = 5 A/µs | - | - | - | 2 | - | µs |

**2** Device does not trigger in the T2-, G+ quadrant.

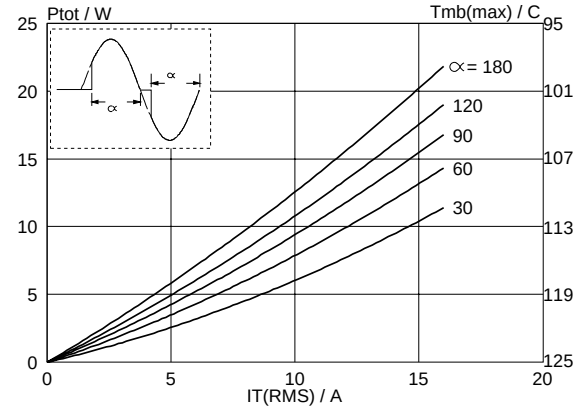



*Fig.1. Maximum on-state dissipation, $P_{tot}$, versus rms on-state current, $I_{T(RMS)}$, where α = conduction angle.*

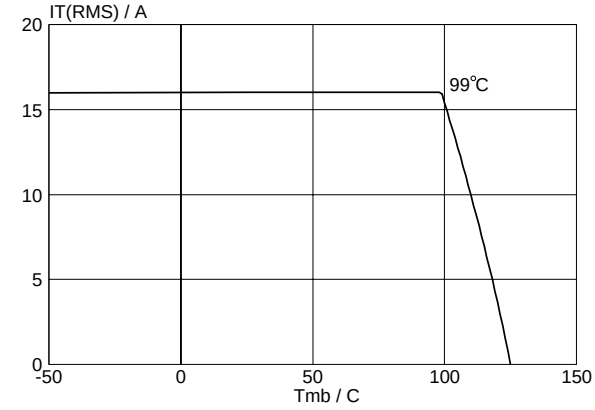



*Fig.4. Maximum permissible rms current $I_{T(RMS)}$, versus mounting base temperature $T_{mb}$.*

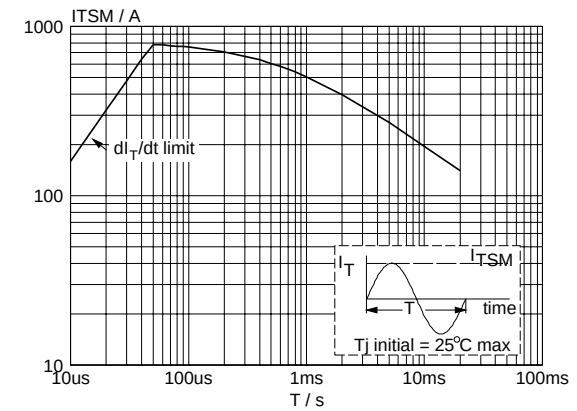



*Fig.2. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus pulse width $t_p$, for sinusoidal currents, $t_p \leq 20ms$.*

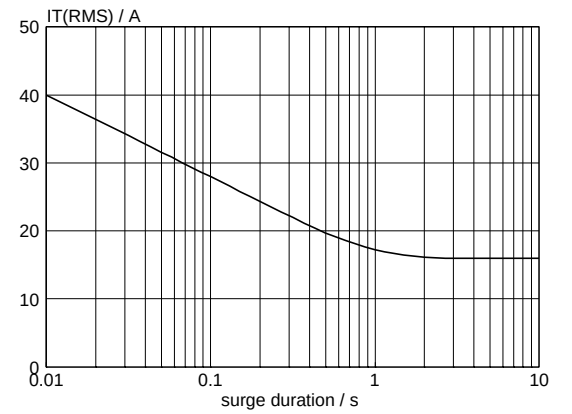



*Fig.5. Maximum permissible repetitive rms on-state current $I_{T(RMS)}$, versus surge duration, for sinusoidal currents, f = 50 Hz; $T_{mb} \leq 99˚C$.*

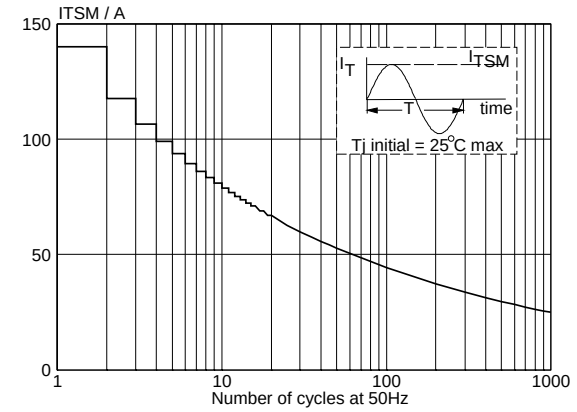



*Fig.3. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus number of cycles, for sinusoidal currents, f = 50 Hz.*

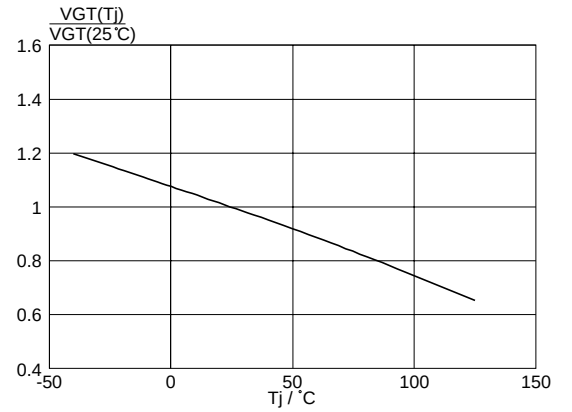



*Fig.6. Normalised gate trigger voltage $V_{GT}(T_j)/ V_{GT}(25˚C)$, versus junction temperature $T_j$.*

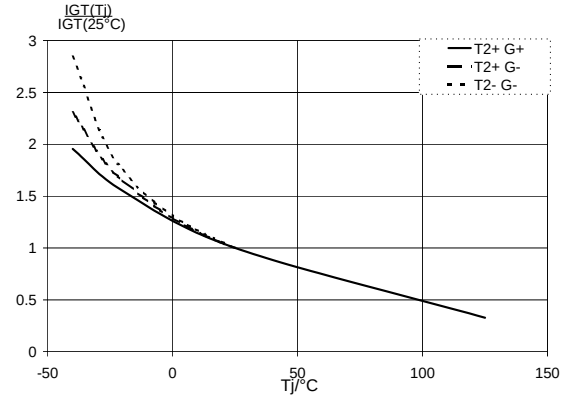



*Fig.7. Normalised gate trigger current $I_{GT}(T_j)/ I_{GT}(25^{\circ}C)$, versus junction temperature $T_j$.*

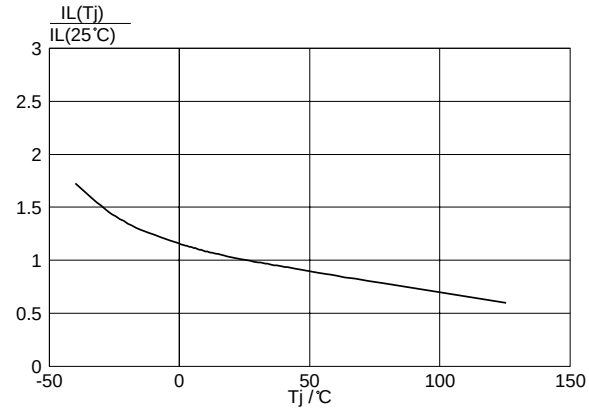



*Fig.8. Normalised latching current $I_L(T_j)/ I_L(25^{\circ}C)$, versus junction temperature $T_j$.*

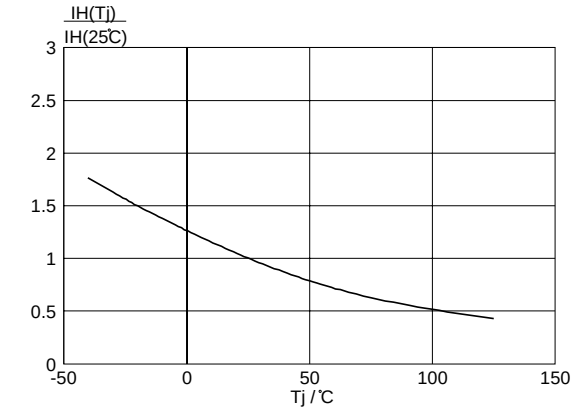



*Fig.9. Normalised holding current $I_H(T_j)/ I_H(25^{\circ}C)$, versus junction temperature $T_j$.*

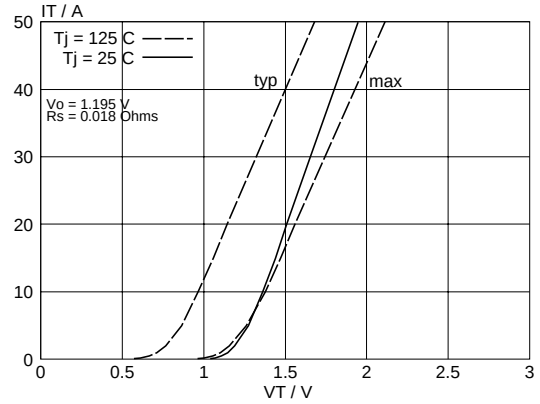



*Fig.10. Typical and maximum on-state characteristic.*

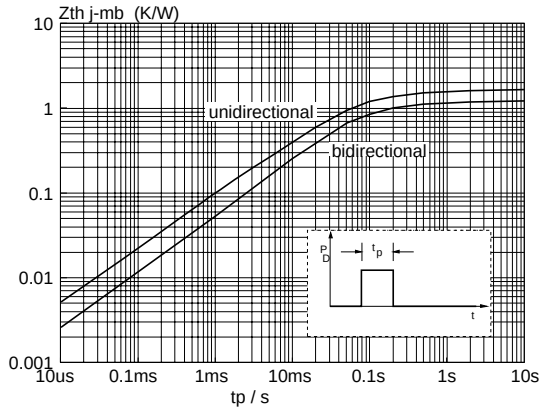



*Fig.11. Transient thermal impedance $Z_{th\ j\text{-}mb}$, versus pulse width $t_p$.*

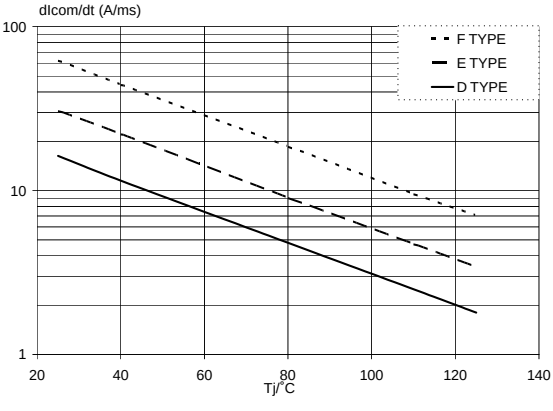



*Fig.12. Mimimum, critical rate of change of commutating current $dI_{com}/dt$ versus junction temperature, $dV_{com}/dt = 20V/\mu s$.*

## MECHANICAL DATA

*Dimensions in mm*

*Net Mass: 1.4 g*

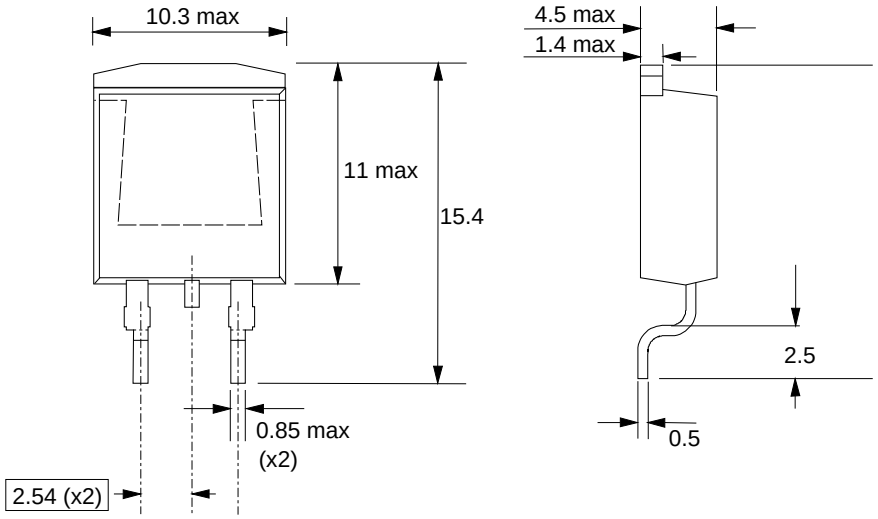



*Fig.13. SOT404 : centre pin connected to mounting base.*

## MOUNTING INSTRUCTIONS

*Dimensions in mm*

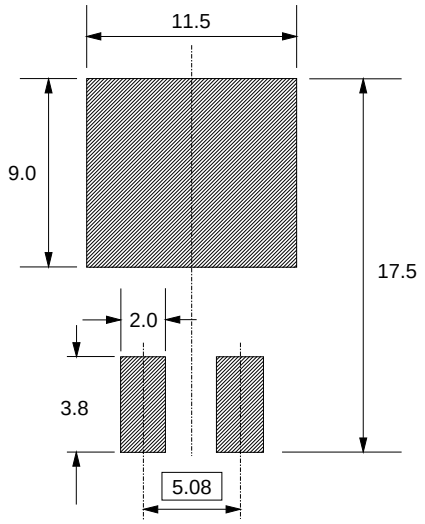



*Fig.14. SOT404 : minimum pad sizes for surface mounting*.

**Notes**

1. Plastic meets UL94 V0 at 1/8".

## DEFINITIONS

| **Data sheet status** | |
|---|---|
| Objective specification | This data sheet contains target or goal specifications for product development. |
| Preliminary specification | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification | This data sheet contains final product specifications. |
| **Limiting values** | |
| Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability. | |
| **Application information** | |
| Where application information is given, it is advisory and does not form part of the specification. | |
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## LIFE SUPPORT APPLICATIONS

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