# Triacs sensitive gate

# BT138 series E

## GENERAL DESCRIPTION

Glass passivated, sensitive gate triacs in a plastic envelope, intended for use in general purpose bidirectional switching and phase control applications, where high sensitivity is required in all four quadrants.

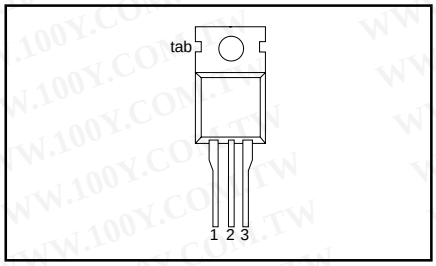
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | MAX. | MAX. | UNIT |
|---|---|---|---|---|---|
| | BT138- | 500E | 600E | 800E | |
| $V_{DRM}$ | Repetitive peak off-state voltages | 500 | 600 | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | 12 | 12 | 12 | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | 95 | 95 | 95 | A |

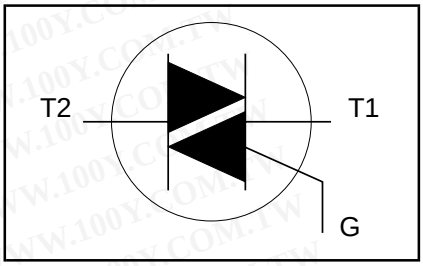
## PINNING - TO220AB

| PIN | DESCRIPTION |
|---|---|
| 1 | main terminal 1 |
| 2 | main terminal 2 |
| 3 | gate |
| tab | 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 |
|---|---|---|---|---|---|---|---|
| | | | | -500 | -600 | -800 | |
| $V_{DRM}$ | Repetitive peak off-state voltages | | - | 500[1] | 600[1] | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | full sine wave; $T_{mb} \leq 99$ ˚C | - | | 12 | | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | full sine wave; $T_j = 25$ ˚C prior to surge | | | | | |
| | | t = 20 ms | - | | 95 | | A |
| | | t = 16.7 ms | - | | 105 | | A |
| $I^2t$ | $I^2t$ for fusing | t = 10 ms | - | | 45 | | $A^2s$ |
| $dI_T/dt$ | 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 | | | | | |
| | | T2+ G+ | - | | 50 | | A/µs |
| | | T2+ G- | - | | 50 | | A/µs |
| | | T2- G- | - | | 50 | | A/µs |
| | | T2- G+ | - | | 10 | | 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 | - | - | 1.5 | K/W |
| | | half cycle | - | - | 2.0 | K/W |
| $R_{th\ j\text{-}a}$ | Thermal resistance junction to ambient | in free air | - | 60 | - | K/W |

## STATIC CHARACTERISTICS

$T_j$ = 25 ˚C unless otherwise stated

| SYMBOL | PARAMETER | CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|
| $I_{GT}$ | Gate trigger current | $V_D$ = 12 V; $I_T$ = 0.1 A | | | | | |
| | | | T2+ G+ | - | 2.5 | 10 | mA |
| | | | T2+ G- | - | 4.0 | 10 | mA |
| | | | T2- G- | - | 5.0 | 10 | mA |
| | | | T2- G+ | - | 11 | 25 | mA |
| $I_L$ | Latching current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A | | | | | |
| | | | T2+ G+ | - | 3.2 | 30 | mA |
| | | | T2+ G- | - | 16 | 40 | mA |
| | | | T2- G- | - | 4.0 | 30 | mA |
| | | | T2- G+ | - | 5.5 | 40 | mA |
| $I_H$ | Holding current | $V_D$ = 12 V; $I_{GT}$ = 0.1 A | | - | 4.0 | 30 | mA |
| $V_T$ | On-state voltage | $I_T$ = 15 A | | - | 1.4 | 1.65 | 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 |
|---|---|---|---|---|---|---|
| $dV_D/dt$ | Critical rate of rise of off-state voltage | $V_{DM}$ = 67% $V_{DRM(max)}$; $T_j$ = 125 ˚C; exponential waveform; gate open circuit | - | 50 | - | V/µs |
| $t_{gt}$ | Gate controlled turn-on time | $I_{TM}$ = 16 A; $V_D$ = $V_{DRM(max)}$; $I_G$ = 0.1 A; $dI_G/dt$ = 5 A/µs | - | 2 | - | µs |

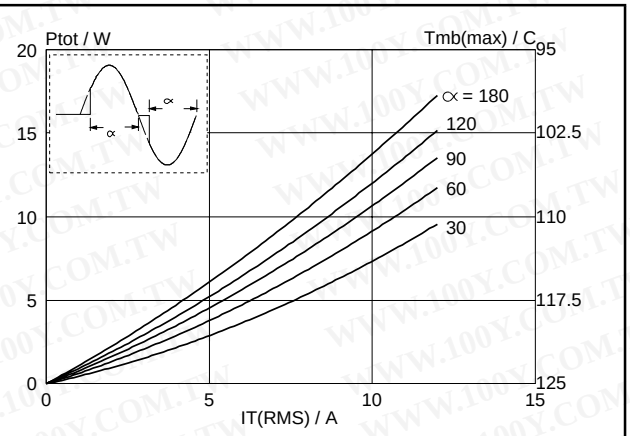



*Fig.1. Maximum on-state dissipation, $P_{tot}$, versus rms on-state current, $I_{T(RMS)}$, where α = conduction angle.*

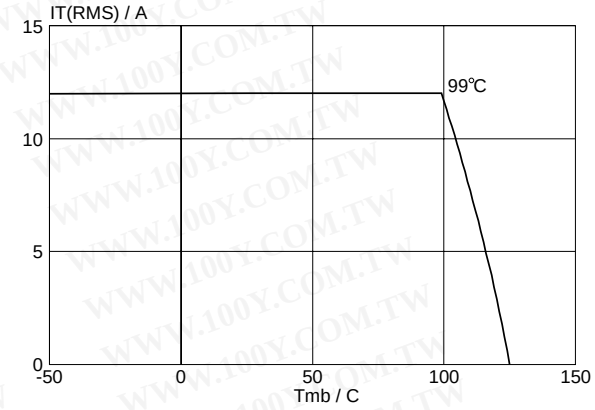



*Fig.4. Maximum permissible rms current $I_{T(RMS)}$, versus mounting base temperature $T_{mb}$.*

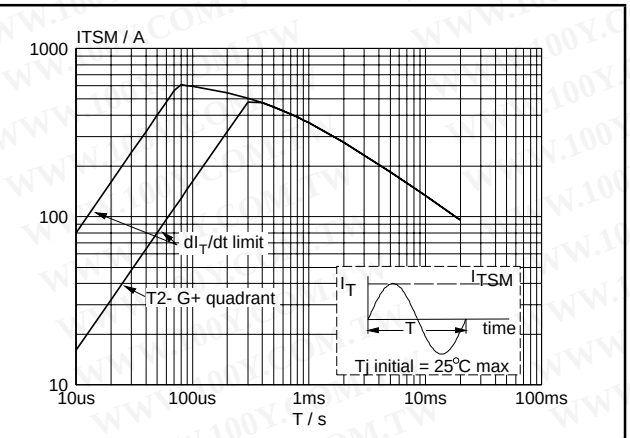



*Fig.2. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus pulse width $t_p$, for sinusoidal currents, $t_p \leq 20ms$.*

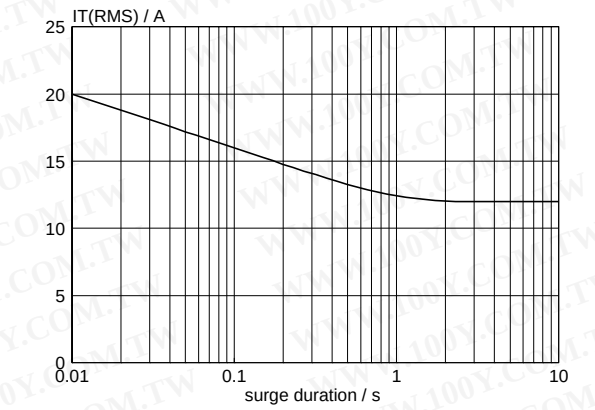



*Fig.5. Maximum permissible repetitive rms on-state current $I_{T(RMS)}$, versus surge duration, for sinusoidal currents, f = 50 Hz; $T_{mb} \leq 99°C$.*

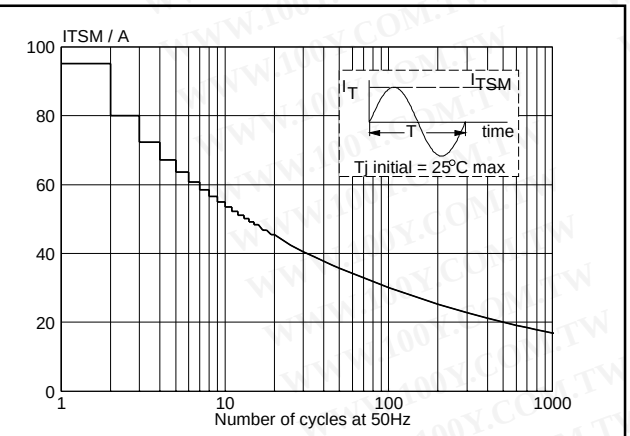



*Fig.3. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus number of cycles, for sinusoidal currents, f = 50 Hz.*

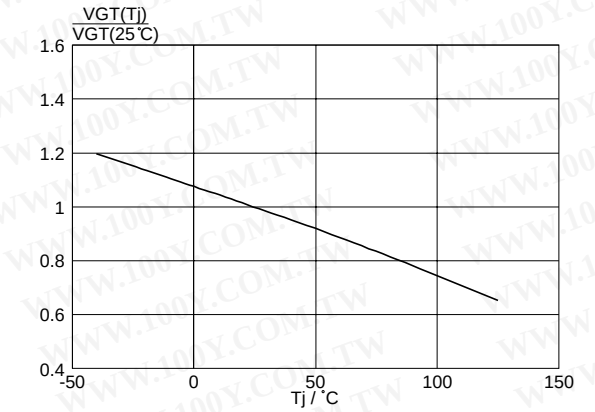



*Fig.6. Normalised gate trigger voltage $V_{GT}(T_j)/ V_{GT}(25°C)$, versus junction temperature $T_j$.*

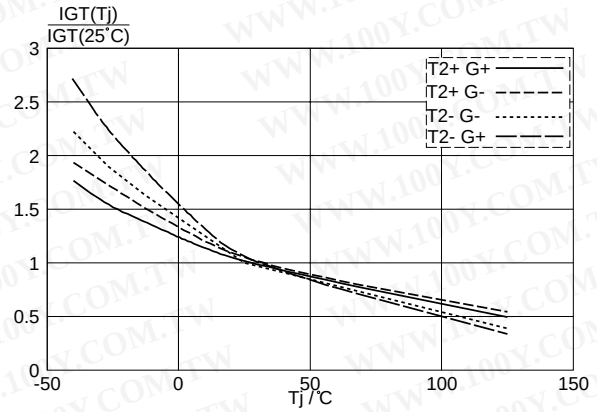



*Fig.7. Normalised gate trigger current $I_{GT}(T_j)/ I_{GT}(25˚C)$, versus junction temperature $T_j$.*

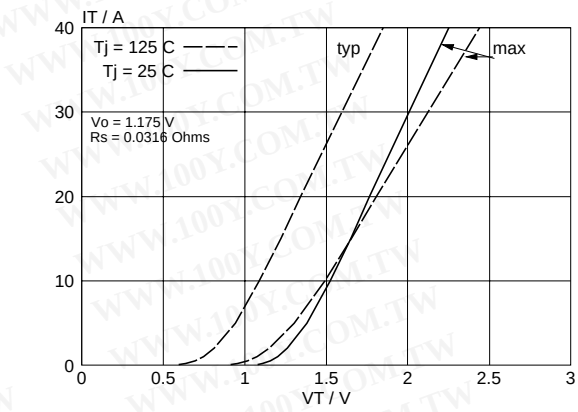



*Fig.10. Typical and maximum on-state characteristic.*

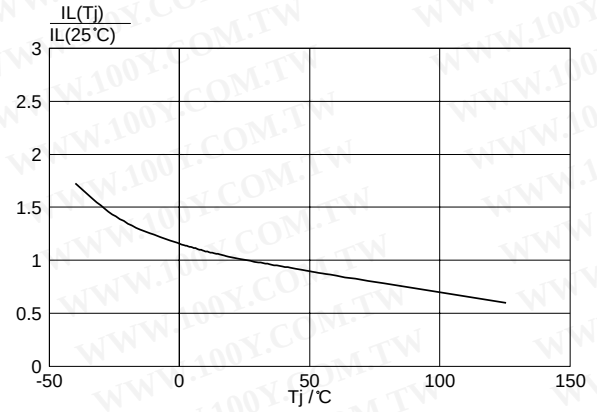



*Fig.8. Normalised latching current $I_L(T_j)/ I_L(25˚C)$, versus junction temperature $T_j$.*

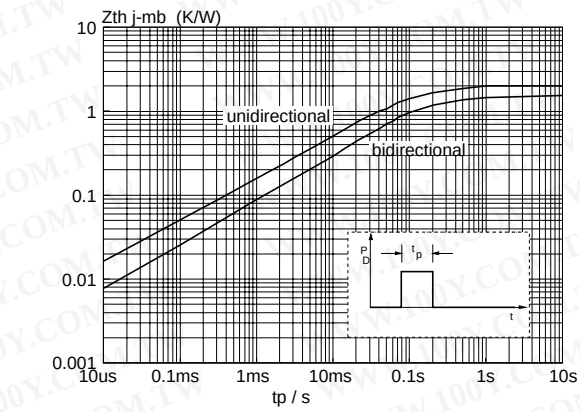



*Fig.11. Transient thermal impedance $Z_{th\ j\text{-}mb}$, versus pulse width $t_p$.*

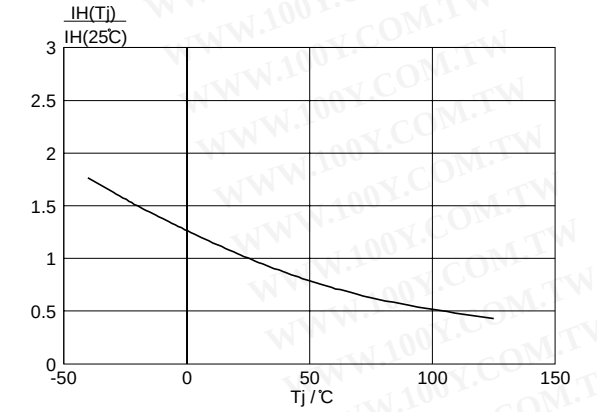



*Fig.9. Normalised holding current $I_H(T_j)/ I_H(25˚C)$, versus junction temperature $T_j$.*

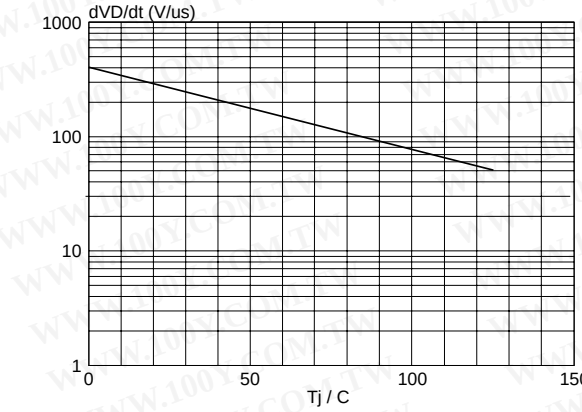



*Fig.12. Typical, critical rate of rise of off-state voltage, $dV_D/dt$ versus junction temperature $T_j$.*

## MECHANICAL DATA

*Dimensions in mm*

*Net Mass: 2 g*

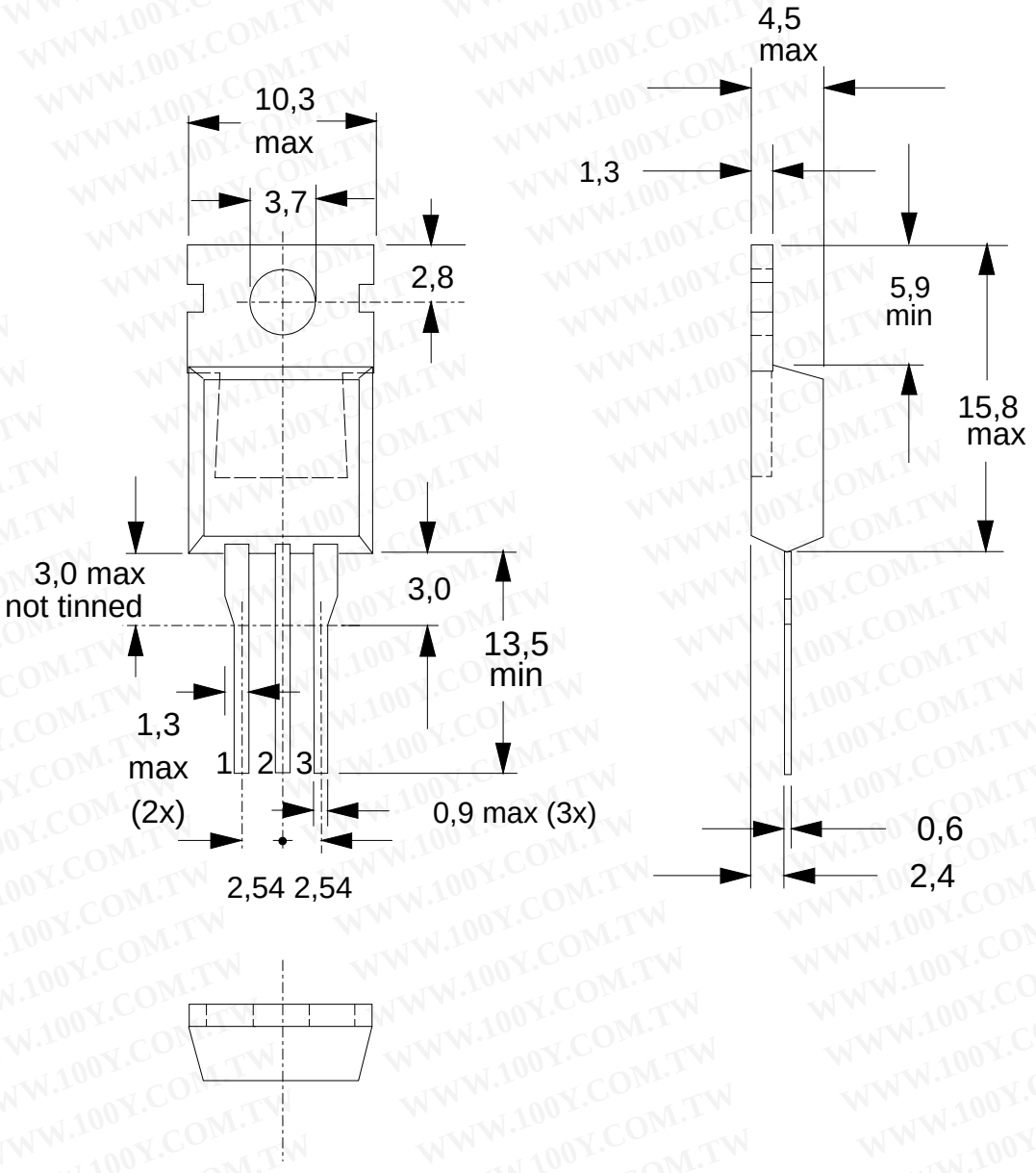



*Fig.13. TO220AB; pin 2 connected to mounting base.*

**Notes**
1. Refer to mounting instructions for TO220 envelopes.
2. Epoxy 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. |
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| 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** | |
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