# Triacs
# sensitive gate

# BT138X series E

## GENERAL DESCRIPTION

Passivated, sensitive gate triacs in a full pack plastic envelope, intended for use in general purpose bidirectional switching and phase control applications, where high sensitivity is required in all four quadrants.
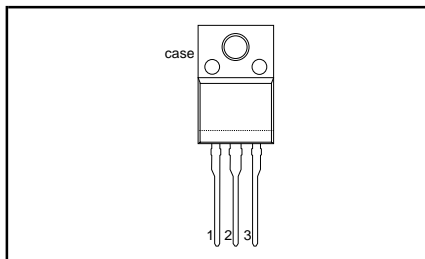
## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | MAX. | MAX. | UNIT |
|---|---|---|---|---|
| | **BT138X-** | **600E** | **800E** | |
| $V_{DRM}$ | Repetitive peak off-state voltages | 600 | 800 | V |
| $I_{T(RMS)}$ | RMS on-state current | 12 | 12 | A |
| $I_{TSM}$ | Non-repetitive peak on-state current | 95 | 95 | A |

## PINNING - SOT186A

| PIN | DESCRIPTION |
|---|---|
| 1 | main terminal 1 |
| 2 | main terminal 2 |
| 3 | gate |
| case | isolated |

## PIN CONFIGURATION



case

1 2 3

## SYMBOL



T2　　T1

G
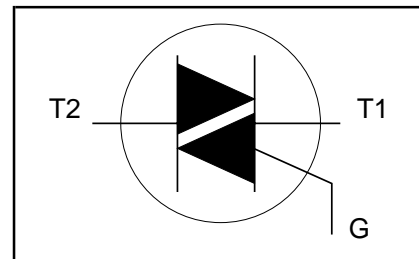
## LIMITING VALUES

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; $T_{hs} \leq 56$ °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.

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## ISOLATION LIMITING VALUE & CHARACTERISTIC

$T_{hs}$ = 25 ˚C unless otherwise specified

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-----------|------------|------|------|------|------|
| $V_{isol}$ | R.M.S. isolation voltage from all three terminals to external heatsink | f = 50-60 Hz; sinusoidal waveform; R.H. $\leq$ 65% ; clean and dustfree | - | - | 2500 | V |
| $C_{isol}$ | Capacitance from T2 to external heatsink | f = 1 MHz | - | 10 | - | pF |

## THERMAL RESISTANCES

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-----------|------------|------|------|------|------|
| $R_{th\ j-hs}$ | Thermal resistance junction to heatsink | full or half cycle with heatsink compound without heatsink compound | - - | - - | 4.0 5.5 | K/W K/W |
| $R_{th\ j-a}$ | Thermal resistance junction to ambient | in free air | - | 55 | - | 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

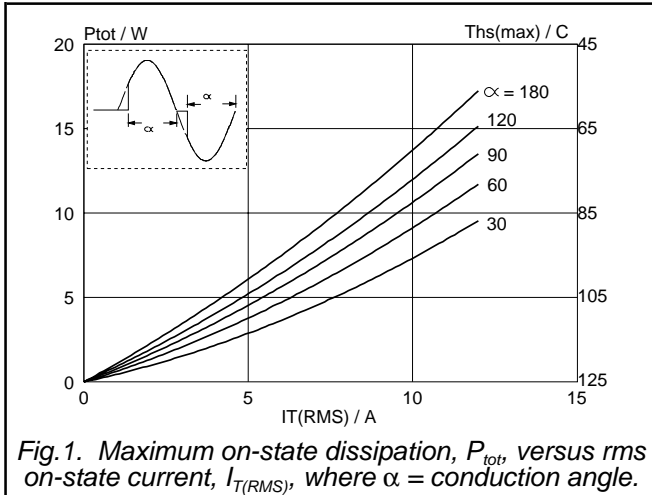| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--------|-----------|------------|------|------|------|------|
| $dV_D/dt$ | Critical rate of rise of off-state voltage | $V_{DM}$ = 67% $V_{DRM(max)}$; $T_j$ = 125 ˚C; exponential waveform; gate open circuit | - | 50 | - | V/$\mu$s |
| $t_{gt}$ | Gate controlled turn-on time | $I_{TM}$ = 16 A; $V_D$ = $V_{DRM(max)}$; $I_G$ = 0.1 A; $dI_G/dt$ = 5 A/$\mu$s | - | 2 | - | $\mu$s |

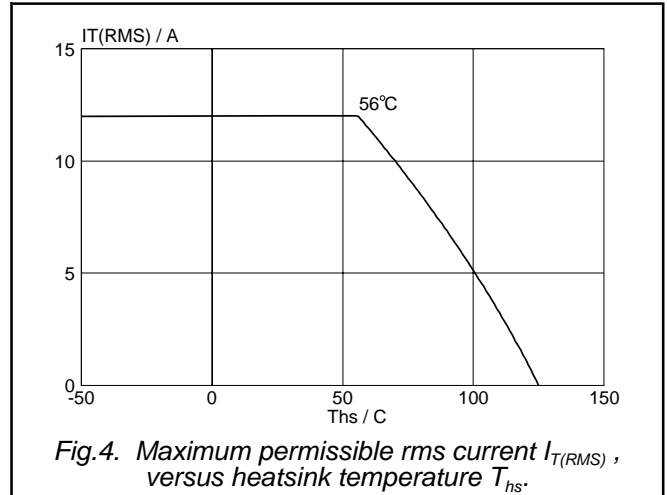Fig.1. Maximum on-state dissipation, $P_{tot}$, versus rms on-state current, $I_{T(RMS)}$, where α = conduction angle.
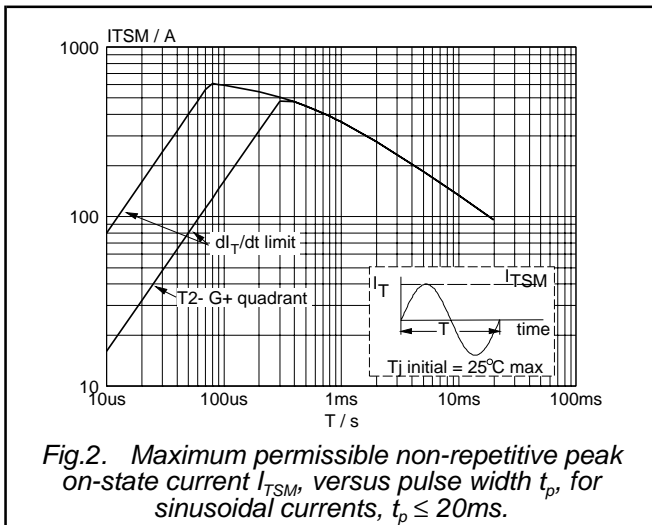


Fig.2. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus pulse width $t_p$, for sinusoidal currents, $t_p \leq 20ms$.
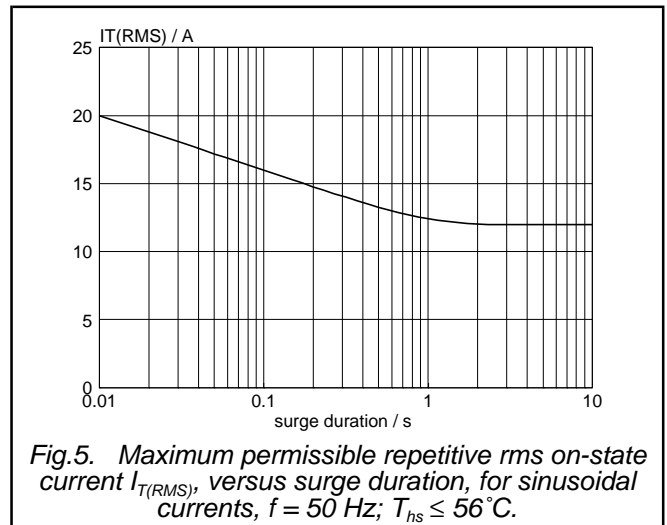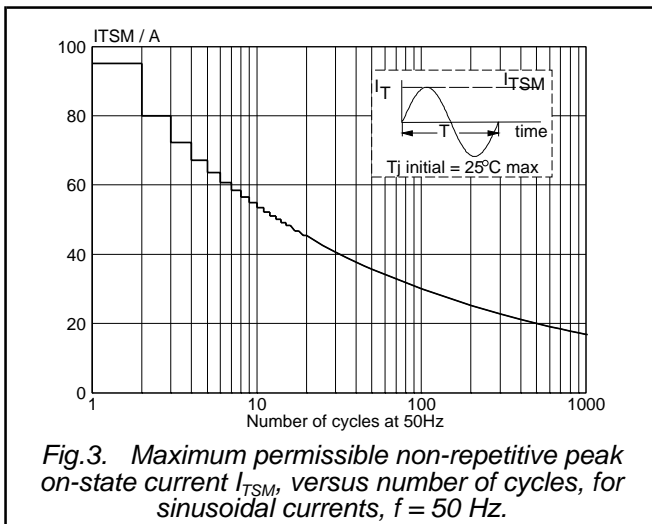


Fig.3. Maximum permissible non-repetitive peak on-state current $I_{TSM}$, versus number of cycles, for sinusoidal currents, f = 50 Hz.



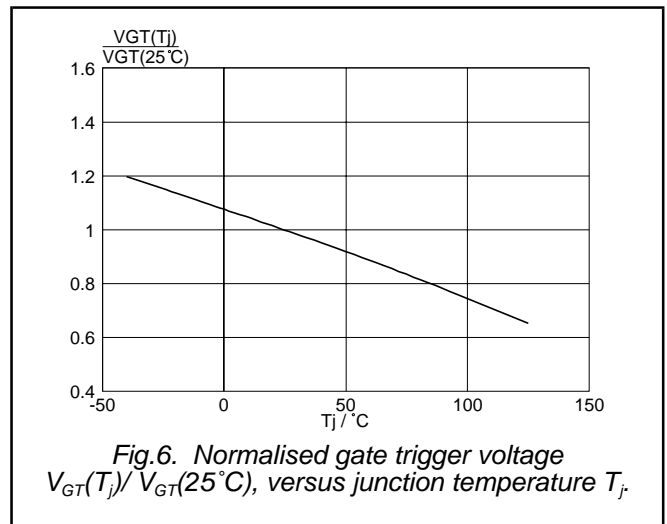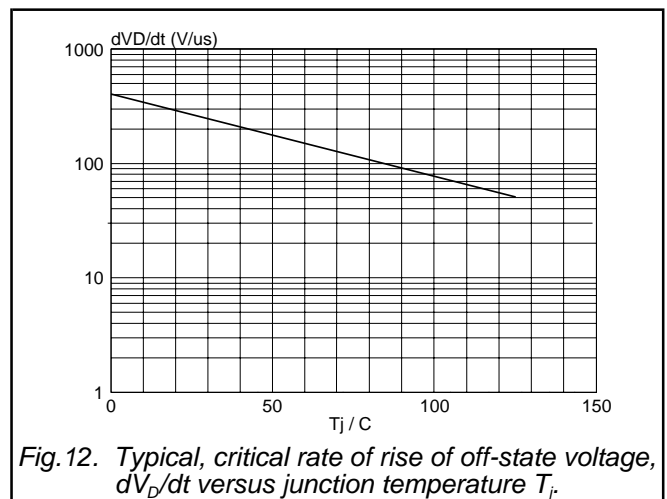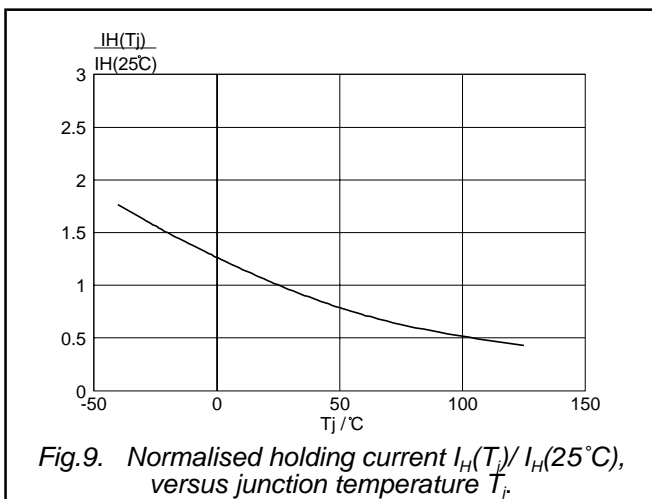Fig.4. Maximum permissible rms current $I_{T(RMS)}$, versus heatsink temperature $T_{hs}$.



Fig.5. Maximum permissible repetitive rms on-state current $I_{T(RMS)}$, versus surge duration, for sinusoidal currents, f = 50 Hz; $T_{hs} \leq 56°C$.
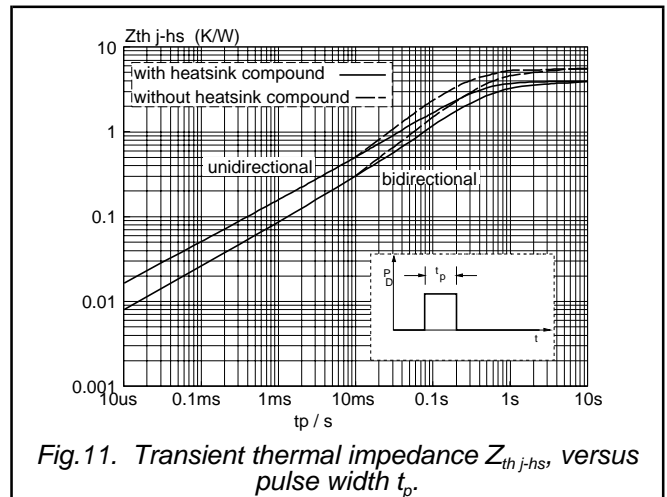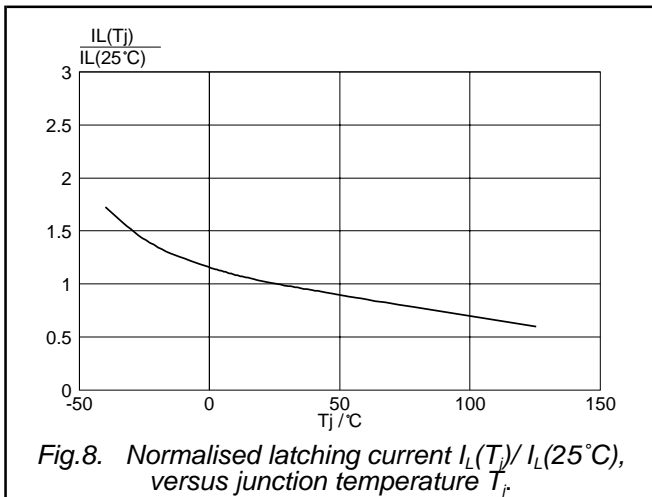


Fig.6. Normalised gate trigger voltage $V_{GT}(T_j)/ V_{GT}(25°C)$, versus junction temperature $T_j$.

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 $Z_{th\,j-hs}$, 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.  SOT186A; The seating plane is electrically isolated from all terminals.

**Notes**
1. Refer to mounting instructions for F-pack envelopes.
2. Epoxy meets UL94 V0 at 1/8".

## DEFINITIONS

| DATA SHEET STATUS | | |
|---|---|---|
| **DATA SHEET STATUS**[2] | **PRODUCT STATUS**[3] | **DEFINITIONS** |
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| **Application information** | | |
| Where application information is given, it is advisory and does not form part of the specification. | | |
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**2** Please consult the most recently issued datasheet before initiating or completing a design.

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