

# DATA SHEET

**BTA216X series D, E and F**  
Three quadrant triacs  
guaranteed commutation

Product specification

April 2002



# Three quadrant triacs guaranteed commutation

# BTA216X series D, E and F

## GENERAL DESCRIPTION

Passivated guaranteed commutation triacs in a full pack, plastic envelope 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.

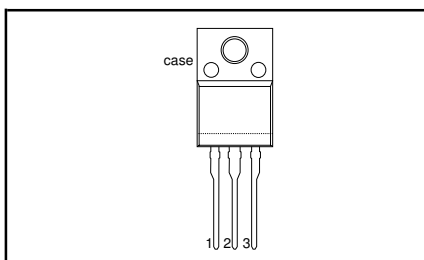
## QUICK REFERENCE DATA

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

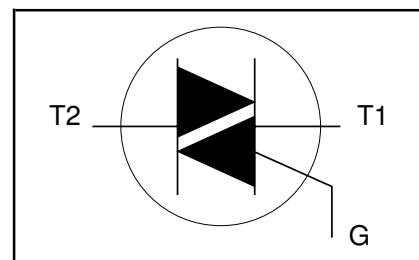
## PINNING - SOT186A

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

## PIN CONFIGURATION



## SYMBOL



## LIMITING VALUES

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

| SYMBOL       | PARAMETER                                                    | CONDITIONS                                                                                                                             | MIN. | MAX.             | UNIT             |
|--------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------|------------------|------------------|
| $V_{DRM}$    | Repetitive peak off-state voltages                           |                                                                                                                                        | -    | 600 <sup>1</sup> | V                |
| $I_{T(RMS)}$ | RMS on-state current                                         | full sine wave;<br>$T_{hs} \leq 38 \text{ }^\circ\text{C}$                                                                             | -    | 16               | A                |
| $I_{TSM}$    | Non-repetitive peak on-state current                         | full sine wave;<br>$T_j = 25 \text{ }^\circ\text{C}$ prior to surge                                                                    | -    | 140              | A                |
| $I^2t$       | $I^2t$ for fusing                                            | $t = 20 \text{ ms}$                                                                                                                    | -    | 150              | A <sup>2</sup> s |
| $dl_T/dt$    | Repetitive rate of rise of on-state current after triggering | $t = 16.7 \text{ ms}$<br>$t = 10 \text{ ms}$<br>$I_{TM} = 20 \text{ A}; I_G = 0.2 \text{ A};$<br>$dl_G/dt = 0.2 \text{ A}/\mu\text{s}$ | -    | 98               | A <sup>2</sup> s |
| $I_{GM}$     | 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  | 150              | $^\circ\text{C}$ |
| $T_j$        | Operating junction temperature                               |                                                                                                                                        | -    | 125              | $^\circ\text{C}$ |

<sup>1</sup> 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/ $\mu\text{s}$ .

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### ISOLATION LIMITING VALUE & CHARACTERISTIC

$T_{hs} = 25\text{ °C}$  unless otherwise specified

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

### THERMAL RESISTANCES

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

### STATIC CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise stated

| SYMBOL   | PARAMETER                         | CONDITIONS                                                                                                           | MIN. | MAX.              |             |             | UNIT |
|----------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|------|-------------------|-------------|-------------|------|
|          |                                   | <b>BTA216X-</b>                                                                                                      |      | <b>...D</b>       | <b>...E</b> | <b>...F</b> |      |
| $I_{GT}$ | Gate trigger current <sup>2</sup> | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$<br>T2+ G+<br>T2+ G-<br>T2- G-<br>T2- G-                                   | -    | 5                 | 10          | 25          | mA   |
| $I_L$    | Latching current                  | $V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$<br>T2+ G+<br>T2+ G-<br>T2- G-                                          | -    | 15                | 25          | 30          | mA   |
| $I_H$    | Holding current                   | $V_D = 12\text{ V}$ ; $I_{GT} = 0.1\text{ A}$                                                                        | -    | 15                | 25          | 30          | mA   |
|          |                                   |                                                                                                                      |      | <b>...D, E, F</b> |             |             |      |
| $V_T$    | On-state voltage                  | $I_T = 20\text{ A}$                                                                                                  | -    | 1.5               |             |             | V    |
| $V_{GT}$ | Gate trigger voltage              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$<br>$V_D = 400\text{ V}$ ; $I_T = 0.1\text{ A}$ ;<br>$T_j = 125\text{ °C}$ | -    | 1.5               |             |             | V    |
|          |                                   |                                                                                                                      | 0.25 | -                 |             |             | V    |
| $I_D$    | Off-state leakage current         | $V_D = V_{DRM(max)}$ ; $T_j = 125\text{ °C}$                                                                         | -    | 0.5               |             |             | mA   |

<sup>2</sup> Device does not trigger in the T2-, G+ quadrant.

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**DYNAMIC CHARACTERISTICS**

$T_j = 25\text{ °C}$  unless otherwise stated

| SYMBOL        | PARAMETER                                      | CONDITIONS                                                                                                                                        | MIN. |      |      | MAX. | UNIT       |
|---------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------------|
|               |                                                |                                                                                                                                                   | ...D | ...E | ...F |      |            |
| $dV_D/dt$     | Critical rate of rise of off-state voltage     | <b>BTA216X-</b><br>$V_{DM} = 67\% V_{DRM(max)}$ ;<br>$T_j = 110\text{ °C}$ ; exponential waveform; gate open circuit                              | 30   | 60   | 70   | -    | V/ $\mu$ s |
| $di_{com}/dt$ | Critical rate of change of commutating current | $V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ;<br>$I_{T(RMS)} = 16\text{ A}$ ;<br>$dV_{com}/dt = 10\text{ V}/\mu\text{s}$ ; gate open circuit  | 2.5  | 6.2  | 18   | -    | A/ms       |
| $di_{com}/dt$ | Critical rate of change of commutating current | $V_{DM} = 400\text{ V}$ ; $T_j = 125\text{ °C}$ ;<br>$I_{T(RMS)} = 16\text{ A}$ ;<br>$dV_{com}/dt = 0.1\text{ V}/\mu\text{s}$ ; gate open circuit | 12   | 20   | 50   | -    | A/ms       |

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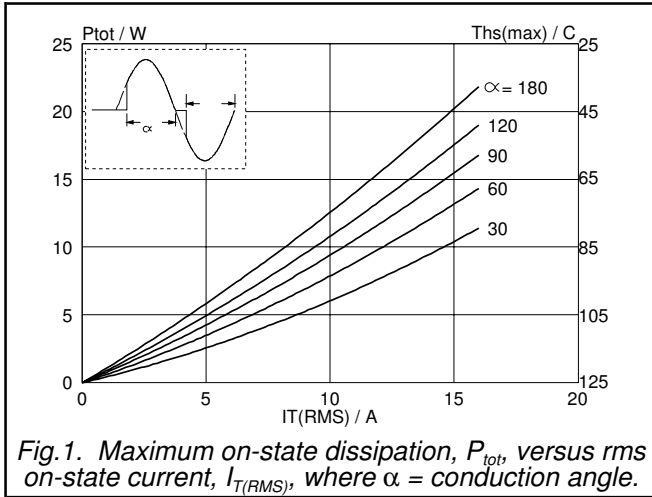


Fig. 1. Maximum on-state dissipation,  $P_{tot}$ , versus rms on-state current,  $I_{T(RMS)}$ , where  $\alpha$  = conduction angle.

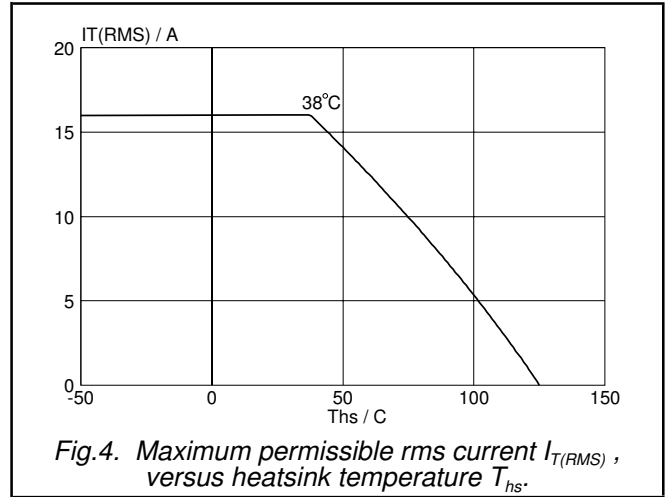


Fig. 4. Maximum permissible rms current  $I_{T(RMS)}$ , versus heatsink temperature  $T_{hs}$ .

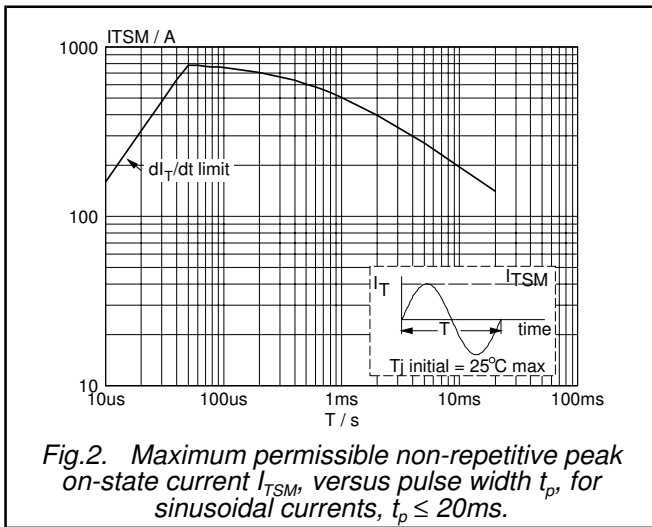


Fig. 2. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus pulse width  $t_p$ , for sinusoidal currents,  $t_p \leq 20$ ms.

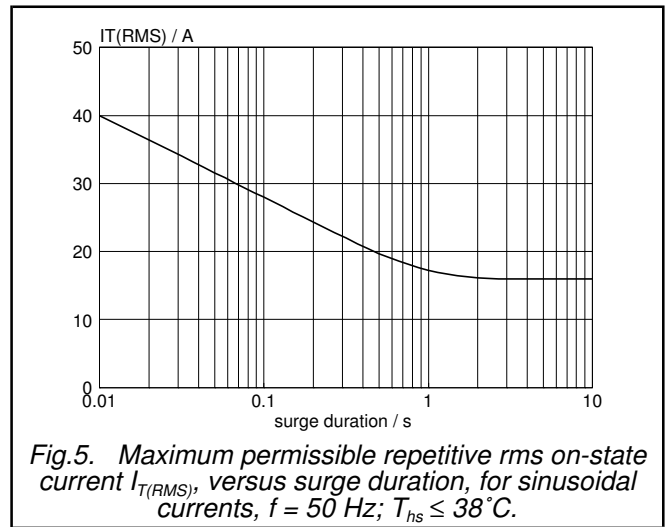


Fig. 5. Maximum permissible repetitive rms on-state current  $I_{T(RMS)}$ , versus surge duration, for sinusoidal currents,  $f = 50$  Hz;  $T_{hs} \leq 38^\circ\text{C}$ .

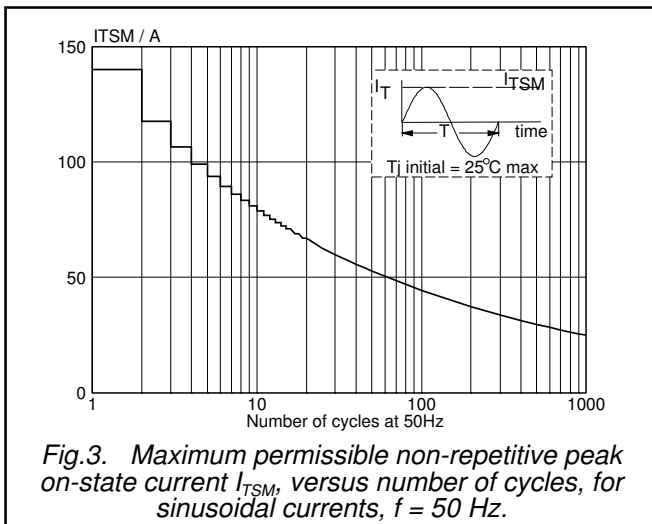


Fig. 3. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus number of cycles, for sinusoidal currents,  $f = 50$  Hz.

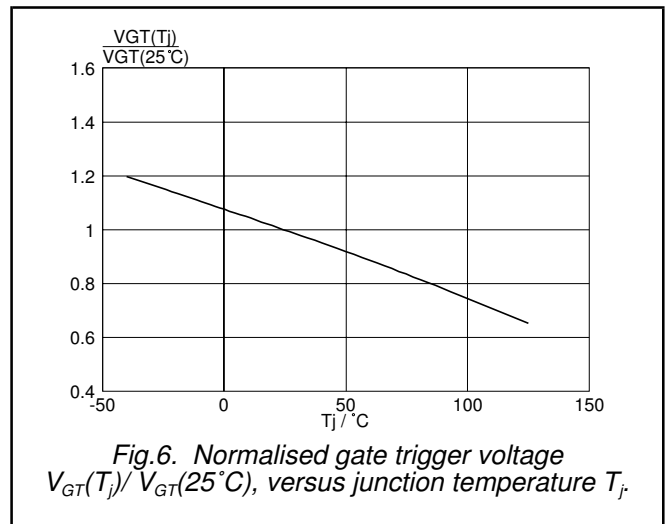
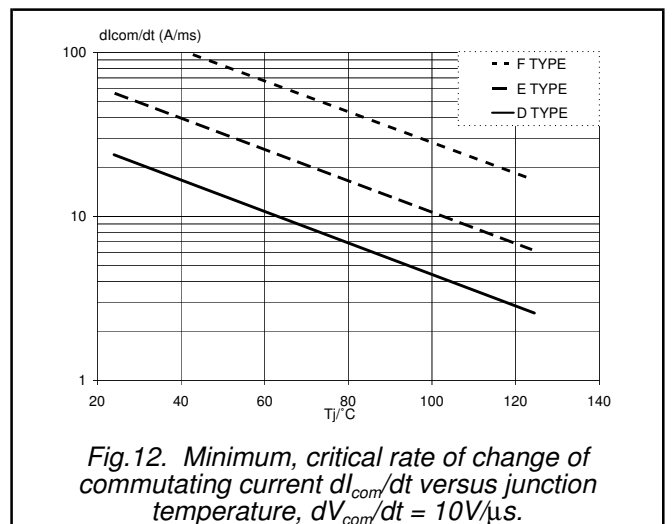
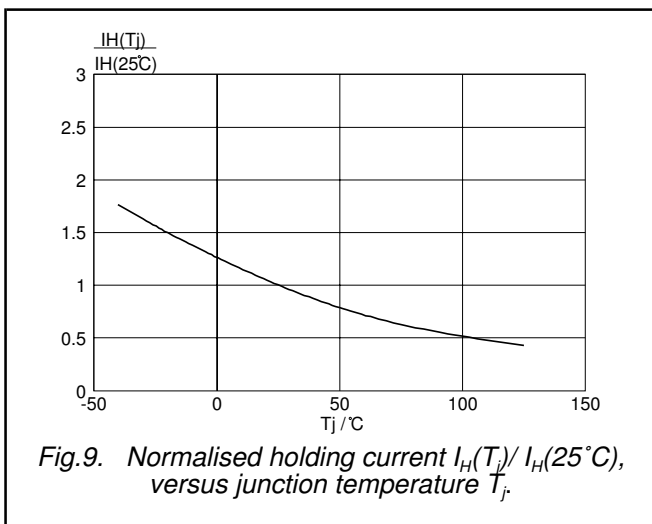
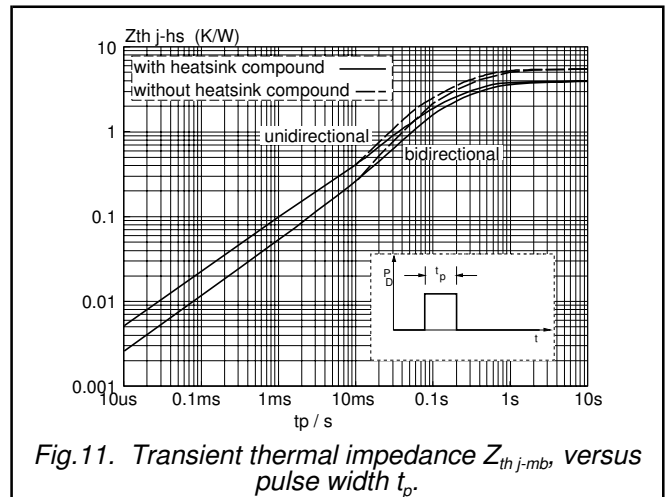
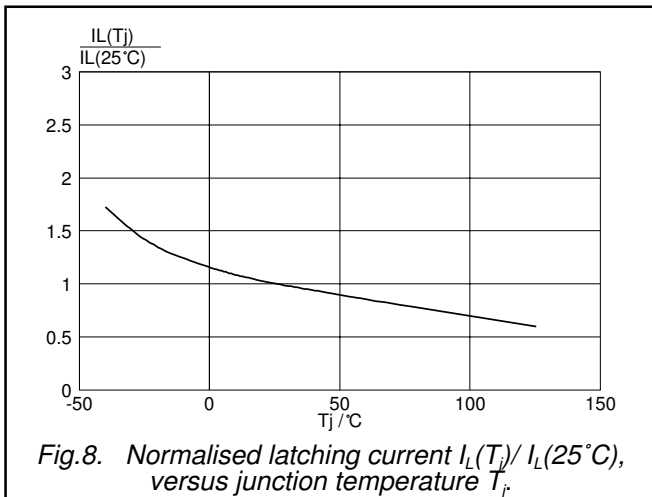
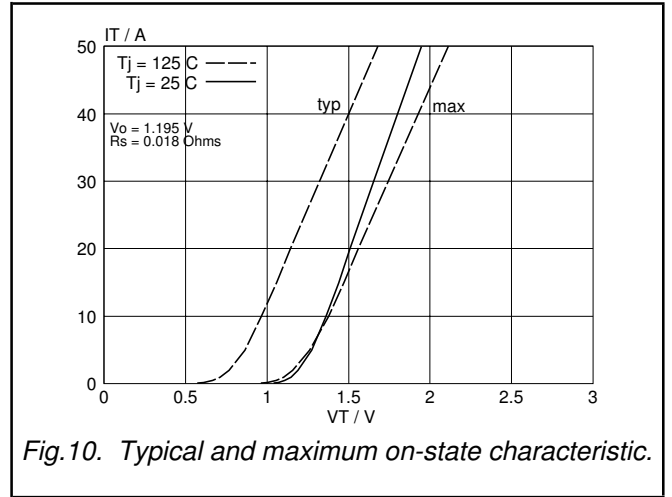
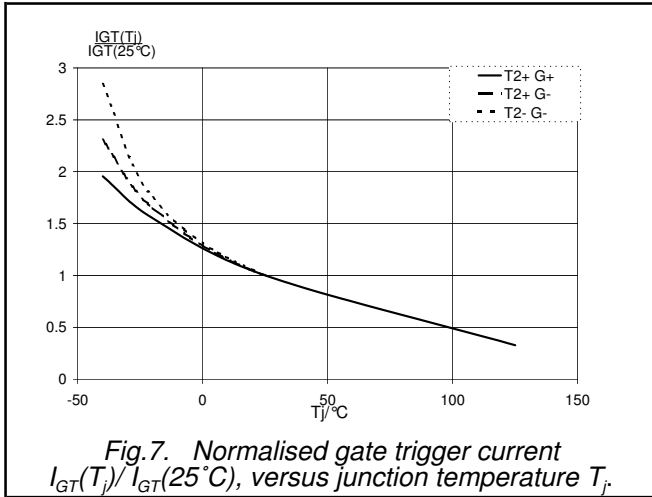


Fig. 6. Normalised gate trigger voltage  $V_{GT}(T_j) / V_{GT}(25^\circ\text{C})$ , versus junction temperature  $T_j$ .

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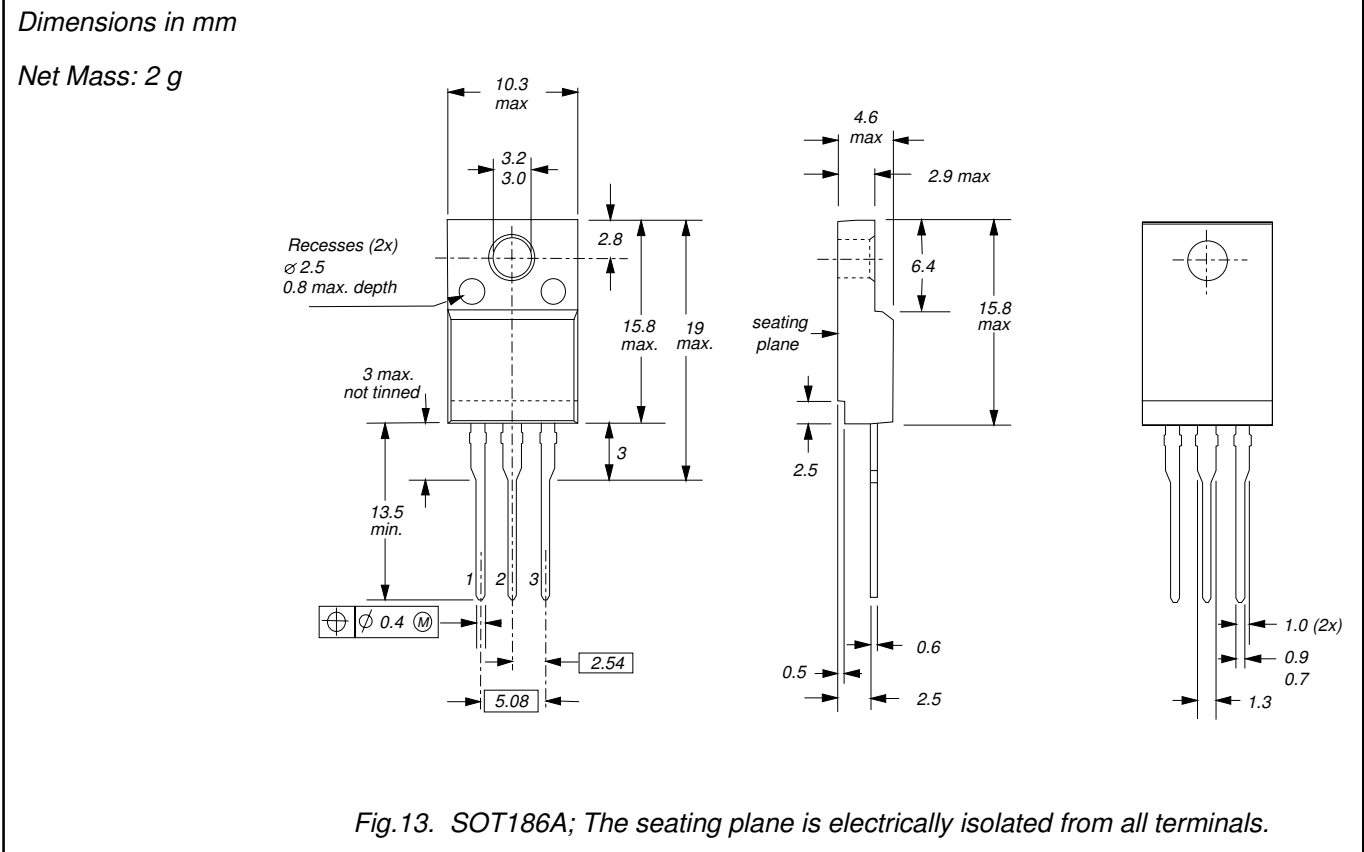
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**MECHANICAL DATA**



**Notes**

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

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| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION                                                                            |
|--------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
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