

# DATA SHEET

## **BT138B series E** Triacs sensitive gate

Product specification

July 2001



# Triacs

## sensitive gate

# BT138B series E

## GENERAL DESCRIPTION

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

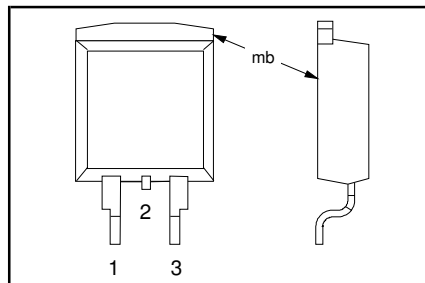
## QUICK REFERENCE DATA

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

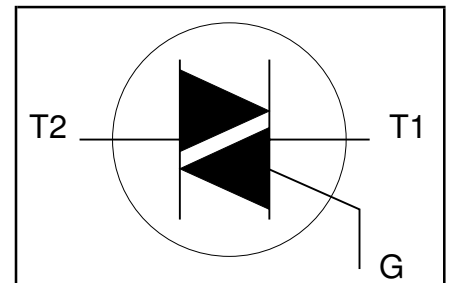
## PINNING - SOT404

| 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               |
|---------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------|-------------|--------------------|
| $V_{\text{DRM}}$    | Repetitive peak off-state voltages                           |                                                                                                                                       | -    | -600<br>600 <sup>1</sup> | -800<br>800 | V                  |
| $I_{\text{T(RMS)}}$ | RMS on-state current                                         | full sine wave; $T_{\text{mb}} \leq 99\text{ }^{\circ}\text{C}$                                                                       | -    | 12                       |             | A                  |
| $I_{\text{TSM}}$    | Non-repetitive peak on-state current                         | full sine wave; $T_j = 25\text{ }^{\circ}\text{C}$ prior to surge<br>$t = 20\text{ ms}$<br>$t = 16.7\text{ ms}$<br>$t = 10\text{ ms}$ | -    | 95                       |             | A                  |
| $I^2t$              | $I^2t$ for fusing                                            |                                                                                                                                       | -    | 105                      |             | A                  |
| $di_t/dt$           | Repetitive rate of rise of on-state current after triggering | $I_{\text{TM}} = 20\text{ A}$ ; $I_{\text{G}} = 0.2\text{ A}$ ;<br>$di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$                      | -    | 45                       |             | A <sup>2</sup> s   |
| $I_{\text{GM}}$     | Peak gate current                                            | T2+ G+<br>T2+ G-<br>T2- G-<br>T2- G+                                                                                                  | -    | 50                       |             | A/ $\mu\text{s}$   |
| $V_{\text{GM}}$     | Peak gate voltage                                            |                                                                                                                                       | -    | 50                       |             | A/ $\mu\text{s}$   |
| $P_{\text{GM}}$     | Peak gate power                                              |                                                                                                                                       | -    | 50                       |             | A/ $\mu\text{s}$   |
| $P_{\text{G(AV)}}$  | Average gate power                                           |                                                                                                                                       | -    | 10                       |             | A/ $\mu\text{s}$   |
| $T_{\text{stg}}$    | Storage temperature                                          |                                                                                                                                       | -    | 2                        |             | A                  |
| $T_j$               | Operating junction temperature                               |                                                                                                                                       | -    | 5                        |             | V                  |
|                     |                                                              |                                                                                                                                       | -    | 5                        |             | W                  |
|                     |                                                              | over any 20 ms period                                                                                                                 | -    | 0.5                      |             | W                  |
|                     |                                                              |                                                                                                                                       | -40  | 150                      |             | $^{\circ}\text{C}$ |
|                     |                                                              |                                                                                                                                       | -    | 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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### THERMAL RESISTANCES

| SYMBOL         | PARAMETER                                       | CONDITIONS                   | MIN. | TYP. | MAX. | UNIT |
|----------------|-------------------------------------------------|------------------------------|------|------|------|------|
| $R_{th\ j-mb}$ | Thermal resistance<br>junction to mounting base | full cycle                   | -    | -    | 1.5  | K/W  |
| $R_{th\ j-a}$  | Thermal resistance<br>junction to ambient       | half cycle                   | -    | -    | 2.0  | K/W  |
|                |                                                 | minimum footprint, FR4 board | -    | 55   | -    | K/W  |

### STATIC CHARACTERISTICS

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

| SYMBOL   | PARAMETER                 | CONDITIONS                                                                  | MIN. | TYP. | MAX. | UNIT |
|----------|---------------------------|-----------------------------------------------------------------------------|------|------|------|------|
| $I_{GT}$ | Gate trigger current      | $V_D = 12\ \text{V}$ ; $I_T = 0.1\ \text{A}$                                | -    | -    | -    | -    |
|          |                           | 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          | $V_D = 12\ \text{V}$ ; $I_{GT} = 0.1\ \text{A}$                             | -    | -    | -    | -    |
|          |                           | 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           | $V_D = 12\ \text{V}$ ; $I_{GT} = 0.1\ \text{A}$                             | -    | 4.0  | 30   | mA   |
| $V_T$    | On-state voltage          | $I_T = 15\ \text{A}$                                                        | -    | 1.4  | 1.65 | V    |
| $V_{GT}$ | Gate trigger voltage      | $V_D = 12\ \text{V}$ ; $I_T = 0.1\ \text{A}$                                | -    | 0.7  | 1.5  | V    |
|          |                           | $V_D = 400\ \text{V}$ ; $I_T = 0.1\ \text{A}$ ; $T_j = 125\ ^\circ\text{C}$ | 0.25 | 0.4  | -    | V    |
| $I_D$    | Off-state leakage current | $V_D = V_{DRM(max)}$ ; $T_j = 125\ ^\circ\text{C}$                          | -    | 0.1  | 0.5  | mA   |

### DYNAMIC CHARACTERISTICS

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

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

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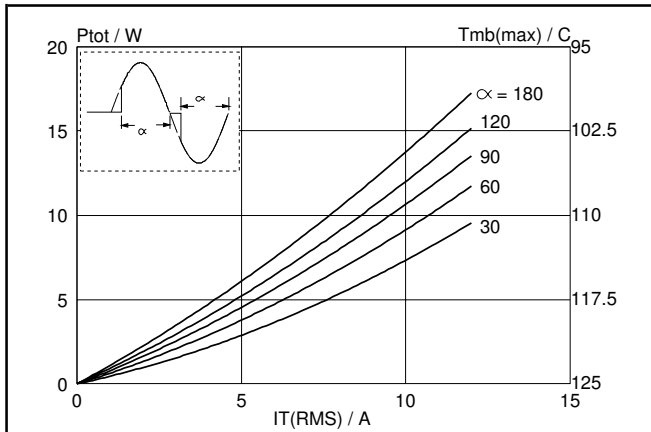


Fig.1. Maximum on-state dissipation,  $P_{tot}$ , versus rms on-state current,  $I_{T(RMS)}$ , where  $\alpha$  = conduction angle.

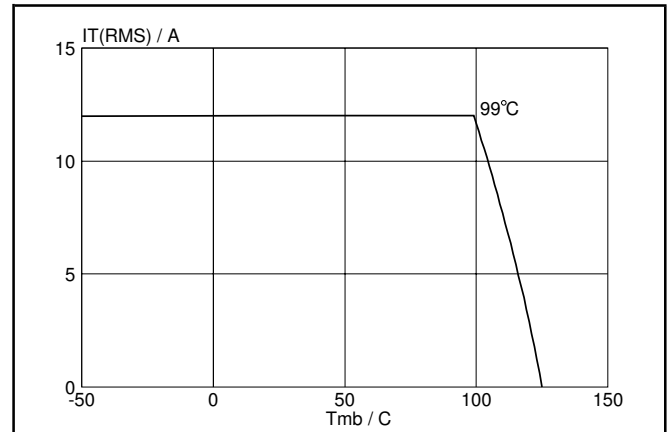


Fig.4. Maximum permissible rms current  $I_{T(RMS)}$ , versus mounting base temperature  $T_{mb}$ .

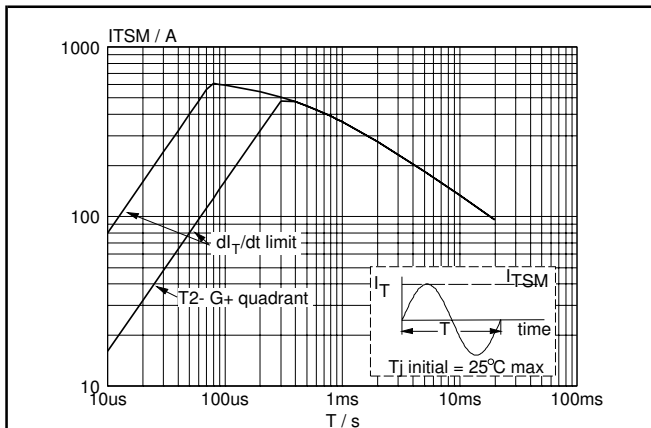


Fig.2. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus pulse width  $t_p$ , for sinusoidal currents,  $t_p \leq 20ms$ .

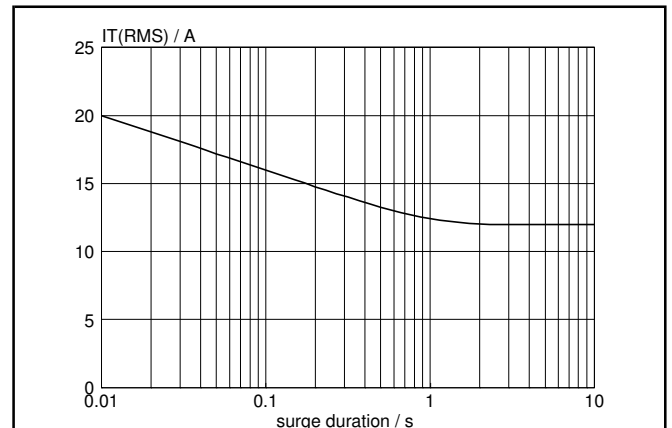


Fig.5. Maximum permissible repetitive rms on-state current  $I_{T(RMS)}$ , versus surge duration, for sinusoidal currents,  $f = 50 Hz$ ;  $T_{mb} \leq 99^{\circ}C$ .

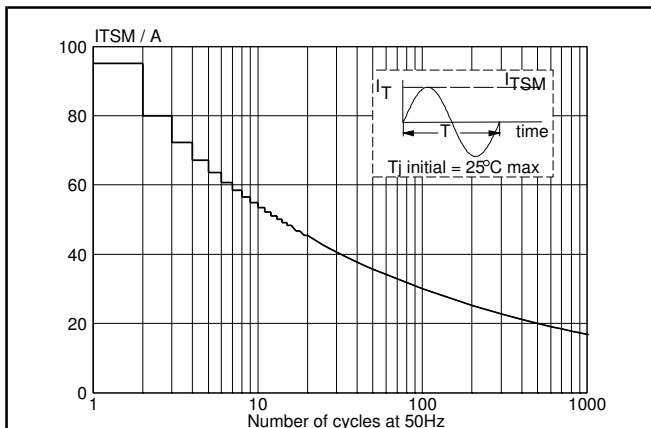


Fig.3. Maximum permissible non-repetitive peak on-state current  $I_{TSM}$ , versus number of cycles, for sinusoidal currents,  $f = 50 Hz$ .

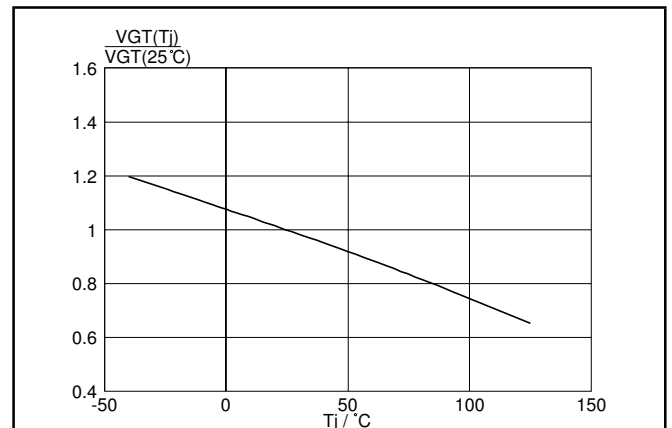
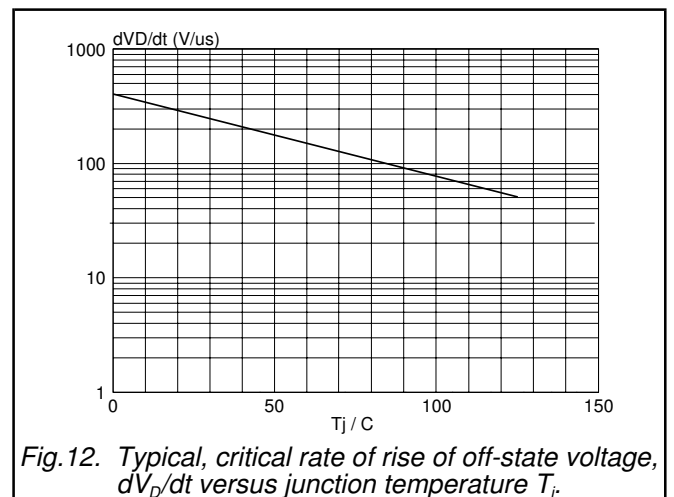
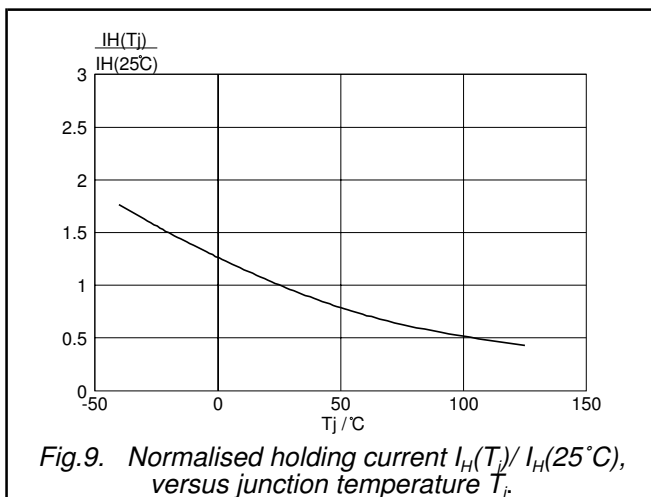
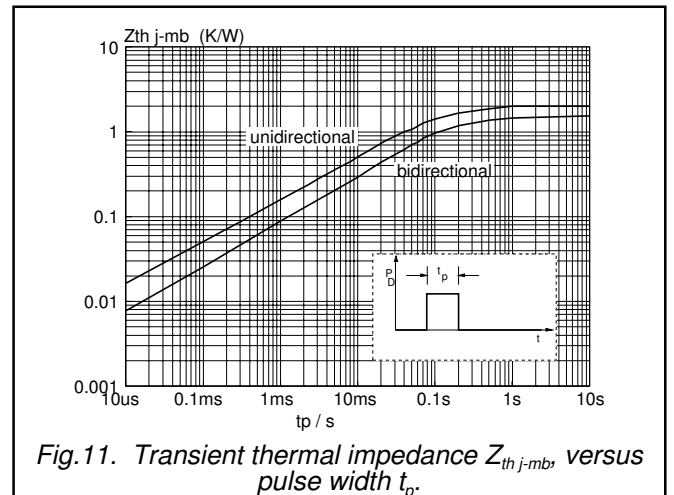
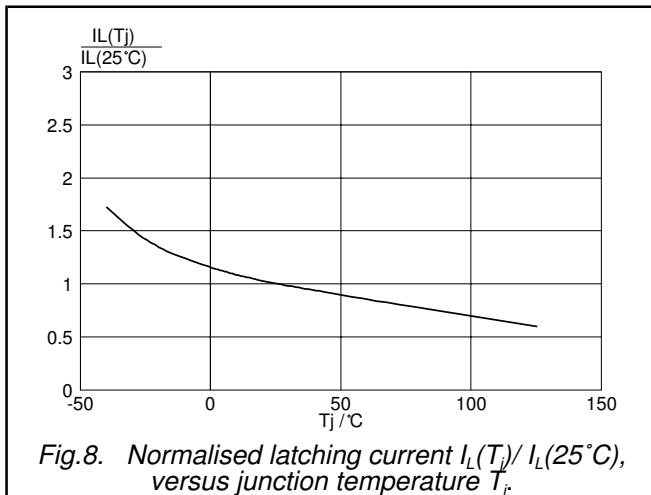
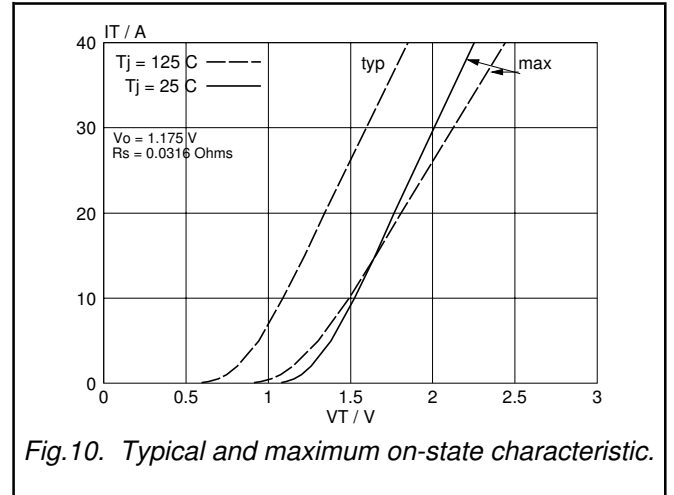
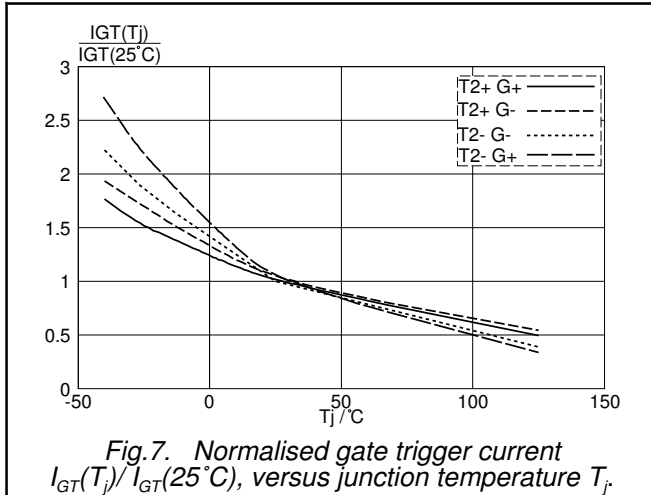


Fig.6. Normalised gate trigger voltage  $V_{GT}(T_j)/V_{GT}(25^{\circ}C)$ , versus junction temperature  $T_j$ .

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## MECHANICAL DATA

Dimensions in mm

Net Mass: 1.4 g

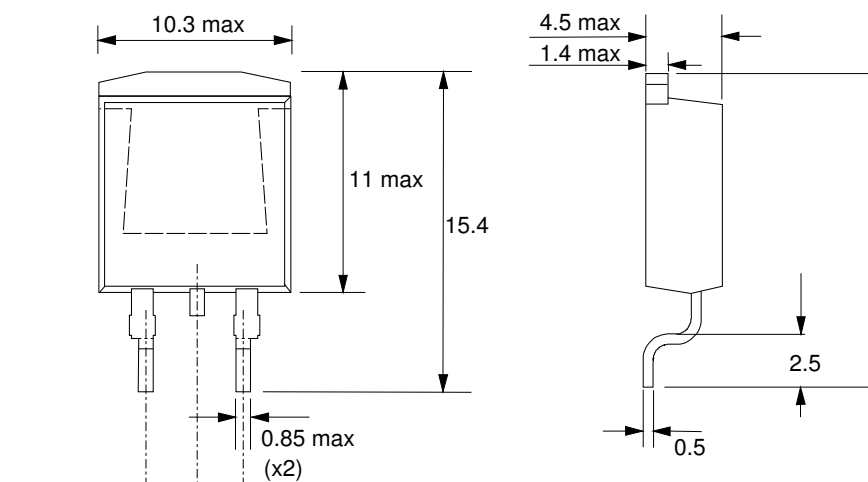


Fig.13. SOT404 : centre pin connected to mounting base.

## MOUNTING INSTRUCTIONS

Dimensions in mm

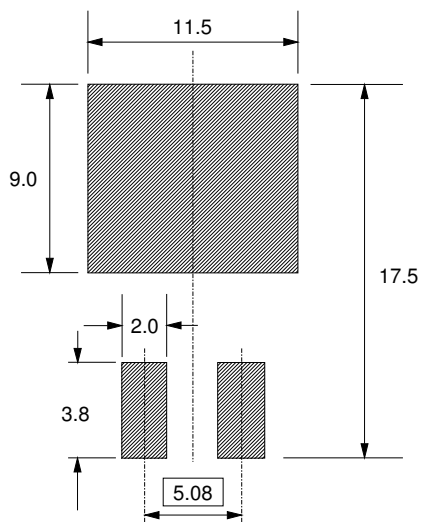


Fig.14. SOT404 : minimum pad sizes for surface mounting.

### Notes

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

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