



**BIDIRECTIONAL THYRISTOR OVERVOLTAGE PROTECTOR**

**TISP4310T3BJ Overvoltage Protector**

**Industry-Leading  $V_{DRM}$  to  $V_{(BO)}$  Ratio**

- Modem Protection Against:**
- TIA-968-A Type A & B Surge
  - UL 60950, Clause 6. Power Cross
  - CSA 22.2 No. 60950, Clause 6. Power Cross

- Ion-Implanted Breakdown Region**
- Precise and Stable Voltage

**Low Voltage Overshoot Under Surge**

| Device Name  | $V_{DRM}$<br>V | $V_{(BO)}$<br>V |
|--------------|----------------|-----------------|
| TISP4310T3BJ | 269            | 310             |

**Rated for International Surge Wave Shapes**

| Wave Shape | Standard         | $I_{PPSM}$<br>A |
|------------|------------------|-----------------|
| 10/160     | TIA-968-A        | 150             |
| 10/700     | ITU-T K.20/21/45 | 120             |
| 9/720      | TIA-968-A        | 120             |
| 10/560     | TIA-968-A        | 100             |
| 10/1000    | GR-1089-CORE     | 80              |

**SMB Package (Top View)**



Terminal typical application names shown in parenthesis

MD-SMB-007-a

**Device Symbol**



SD-TISP4-001-a

.....UL Recognized Component

**How To Order**

| Device       | Package | Carrier              | Order As        | Marking Code | Standard Quantity |
|--------------|---------|----------------------|-----------------|--------------|-------------------|
| TISP4310T3BJ | SMB     | Embossed Tape Reeled | TISP4310T3BJR-S | 4310T3       | 3000              |

**Description**

This device is designed to limit overvoltages on the telephone line. Overvoltages are normally caused by a.c. power system or lightning flash disturbances which are induced or conducted on to the telephone line. A single device provides 2-point protection and is typically used for the protection of 2-wire telecommunication equipment (e.g. between the Ring and Tip wires for telephones and modems). Combinations of devices can be used for multi-point protection (e.g. 3-point protection between Ring, Tip and Ground).

The device consists of a symmetrical voltage-triggered bidirectional thyristor. Overvoltages are initially clipped by breakdown clamping. If sufficient current is available from the overvoltage, the breakdown voltage will rise to the breakover level, which causes the device to switch into a low-voltage on-state condition. This switching action removes the high-voltage stress from the following circuitry and causes the current resulting from the overvoltage to be safely diverted through the device. The high holding (switch off) current helps prevent d.c. latchup as the diverted current subsides. This device is designed to voltage limit and withstand the listed lightning surges in both polarities.



**WARNING Cancer and Reproductive Harm**  
[www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)

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\*RoHS Directive 2002/95/EC Jan. 27, 2003 including Annex.

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# TISP4310T3BJ Overvoltage Protector

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## Description (Continued)

After a TIA-968-A Type A surge, the equipment can be faulty, provided that the fault mode causes the equipment to be unusable. There are two wave shapes used: 10/160 for longitudinal surges and 10/560 for metallic surges. For modems with a TISP4310T3BJ connected between the Ring and Tip wires (and without overvoltage protection to ground), the longitudinal 10/160 surge applied to both Ring and Tip will not activate the TISP4310T3BJ, giving an operational pass. The metallic 10/560 surge is applied between Ring and Tip wires and will operate the TISP4310T3BJ. As the TISP4310T3BJ has a current rating of 100 A 10/560, it will survive the TIA-968-A Type A 100 A 10/560 metallic surge, giving an operational pass.

After a TIA-968-A Type B surge, the equipment must be operational. The 9/720 wave shape is used for both longitudinal surges and metallic surges. For modems with a TISP4310T3BJ connected between the Ring and Tip wires (and without overvoltage protection to ground), the longitudinal 9/720 surge applied to both Ring and Tip will not activate the TISP4310T3BJ, giving an operational pass. The metallic 9/720 surge is applied between Ring and Tip wires and will operate the TISP4310T3BJ. As the TISP4310T3BJ has a current rating of 120 A 9/720, it will survive the TIA-968-A Type B 25 A 9/720 metallic surge, giving an operational pass.

The TIA-968-A B-type ringer has voltages of 56.5 V d.c. and up to 150 V rms a.c., giving a peak voltage of 269 V. The TISP4310T3BJ will not clip the B-type ringing voltage, as it has a high impedance up to 269 V.

## Absolute Maximum Ratings, $T_A = 25\text{ }^\circ\text{C}$ (Unless Otherwise Noted)

| Rating   | Symbol            | Value       | Unit             |
|--|-------------------|-------------|------------------|
| Repetitive peak off-state voltage (see Note 1)   | $V_{\text{DRM}}$  | $\pm 269$   | V                |
| Non-repetitive peak impulse current (see Notes 1 and 2)  | $I_{\text{PPSM}}$ | $\pm 150$   | A                |
| 10/160 $\mu\text{s}$ (TIA-968-A, 10/160 $\mu\text{s}$ voltage wave shape)                              |                   | $\pm 120$   |                  |
| 5/310 $\mu\text{s}$ (ITU-T K.44, 10/700 $\mu\text{s}$ voltage wave shape used in K.20/21/45)           |                   | $\pm 120$   |                  |
| 5/320 $\mu\text{s}$ (TIA-968-A, 9/720 $\mu\text{s}$ voltage wave shape)                                |                   | $\pm 100$   |                  |
| 10/560 $\mu\text{s}$ (TIA-968-A, 10/560 $\mu\text{s}$ voltage wave shape)                              |                   | $\pm 80$    |                  |
| 10/1000 $\mu\text{s}$ (GR-1089-CORE, 10/1000 $\mu\text{s}$ voltage wave shape)                         |                   |             |                  |
| Non-repetitive peak on-state current (see Notes 1, 2 and 3)  | $I_{\text{TSM}}$  | 25          | A                |
| 20 ms, 50 Hz (full sine wave)  |                   | 30          |                  |
| 16.7 ms, 60 Hz (full sine wave)  |                   | 2.1         |                  |
| 1000 s, 50 Hz or 60 Hz a.c.  |                   |             |                  |
| Initial rate of rise of on-state current, exponential current ramp. Maximum ramp value $< 50\text{ A}$ | $di_T/dt$         | 500         | A/ $\mu\text{s}$ |
| Junction temperature   | $T_J$             | -40 to +150 | $^\circ\text{C}$ |
| Storage temperature range  | $T_{\text{stg}}$  | -65 to +150 | $^\circ\text{C}$ |

NOTES: 1. Initially the device must be in thermal equilibrium with  $T_J = 25\text{ }^\circ\text{C}$ .

2. The surge may be repeated after the device returns to its initial conditions.

3. EIA/JESD51-2 environment and EIA/JESD51-3 PCB with standard footprint dimensions connected with 5 A rated printed wiring track widths. Derate current values at  $-0.61\text{ }^\circ\text{C}$  for ambient temperatures above  $25\text{ }^\circ\text{C}$ .

## Recommended Operating Conditions

| Component |  | Min | Typ | Max | Unit     |
|-----------|--|-----|-----|-----|----------|
| $R_s$     | Series resistor for TIA-968-A, 10/160 type A surge survival (T-G or R-G connection)  | 2.5 |     |     | $\Omega$ |
|           | Series resistor for TIA-968-A, 10/560 type A surge survival                          | 0   |     |     |          |
|           | Series resistor for TIA-968-A, 9/720 type B surge survival                           | 0   |     |     |          |
|           | Series resistor for GR-1089-CORE first-level surge survival                          | 5   |     |     |          |
|           | Series resistor for K.20, K.21 and K.45 1.5 kV, 10/700 surge survival                | 0   |     |     |          |
|           | Series resistor for K.20, K.21 and K.45 co-ordination with a 400 V primary protector | 6   |     |     |          |

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# TISP4310T3BJ Overvoltage Protector

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## Electrical Characteristics, $T_A = 25\text{ }^\circ\text{C}$ (Unless Otherwise Noted)

| Parameter  | Test Conditions  | Min       | Typ | Max                 | Unit              |
|--|--|-----------|-----|---------------------|-------------------|
| $I_{\text{DRM}}$ Repetitive peak off-state current | $V_D = V_{\text{DRM}}$<br>$T_A = 25\text{ }^\circ\text{C}$<br>$T_A = 85\text{ }^\circ\text{C}$ |           |     | $\pm 5$<br>$\pm 10$ | $\mu\text{A}$     |
| $V_{(\text{BO})}$ Breakover voltage                | $dv/dt = \pm 250\text{ V/ms}$ , $R_{\text{SOURCE}} = 300\ \Omega$                              |           |     | $\pm 310$           | V                 |
| $I_{(\text{BO})}$ Breakover current                | $dv/dt = \pm 250\text{ V/ms}$ , $R_{\text{SOURCE}} = 300\ \Omega$                              |           |     | $\pm 800$           | mA                |
| $V_T$ On-state voltage                             | $I_T = \pm 5\text{ A}$ , $t_w = 100\ \mu\text{s}$  |           |     | $\pm 3$             | V                 |
| $I_H$ Holding current                              | $I_T = \pm 5\text{ A}$ , $di/dt = \pm 30\text{ mA/ms}$   | $\pm 150$ |     |                     | mA                |
| $dv/dt$ Critical rate of rise of off-state voltage | Linear voltage ramp<br>Maximum ramp value $< 0.85V_{\text{DRM}}$                               | $\pm 5$   |     |                     | kV/ $\mu\text{s}$ |
| $C_O$ Off-state capacitance                        | $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$  |           |     |                     | pF                |
|  | $V_D = 0$  |           | 54  | 65                  |                   |
|  | $V_D = -1\text{ V}$  |           | 48  | 58                  |                   |
|  | $V_D = -2\text{ V}$  |           | 43  | 52                  |                   |
|  | $V_D = -50\text{ V}$   |           | 20  | 24                  |                   |
|  | $V_D = -100\text{ V}$  |           | 16  | 19                  |                   |

## Thermal Characteristics, $T_A = 25\text{ }^\circ\text{C}$ (Unless Otherwise Noted)

| Parameter  | Test Conditions   | Min | Typ | Max | Unit               |
|--|---|-----|-----|-----|--------------------|
| $R_{\theta\text{JA}}$ Junction to ambient thermal resistance | EIA/JESD51-3 PCB, $I_T = I_{\text{TSM}(1000)}$<br>(see Note 4)                    |     |     | 115 | $^\circ\text{C/W}$ |
|  | 265 mm x 210 mm populated line card,<br>4-layer PCB, $I_T = I_{\text{TSM}(1000)}$ |     | 52  |     |                    |

NOTE: 4. EIA/JESD51-2 environment and PCB has standard footprint dimensions connected with 5 A rated printed wiring track widths.

## Parameter Measurement Information

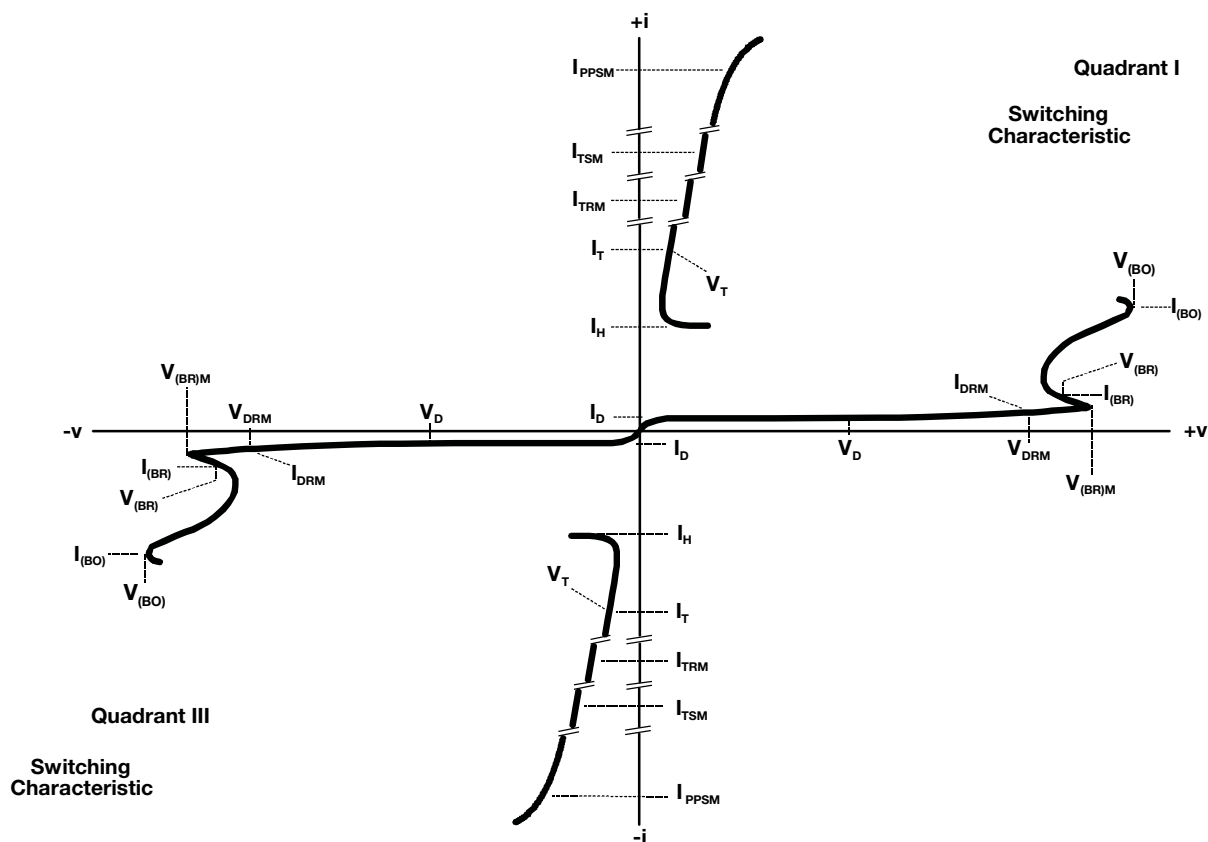


Figure 1. Voltage-Current Characteristic for the Ring and Tip Terminals  
All Measurements are Referenced to the Ring Terminal

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