



## INTEGRATED COMPLEMENTARY BUFFERED-GATE SCRS FOR DUAL POLARITY SLIC OVERVOLTAGE PROTECTION

### TISP9110MDM Overvoltage Protector

#### High Performance Protection for SLICs with +ve and -ve Battery Supplies

- Wide -110 V to +110 V Programming Range
- Low 5 mA max. Gate Triggering Current
- Dynamic Protection Performance Specified for International Surge Waveshapes

#### Applications include:

- Wireless Local Loop
- Access Equipment
- Regenerated POTS
- VOIP Applications

#### Rated for International Surge Wave Shapes

| Wave Shape | Standard         | I <sub>PPSM</sub><br>A |
|------------|------------------|------------------------|
| 2/10       | GR-1089-CORE     | 150                    |
| 10/700     | ITU-T K.20/21/45 | 80                     |
| 10/1000    | GR-1089-CORE     | 50                     |

#### Description

The Model TISP9110MDM is a programmable overvoltage protection device designed to protect modern dual polarity supply rail ringing SLICs (Subscriber Line Interface Circuits) against overvoltages on the telephone line. Overvoltages can be caused by lightning, a.c. power contact and induction. Four separate protection structures are used; two positive and two negative to provide optimum protection during Metallic (Differential) and Longitudinal (Common Mode) protection conditions in both polarities. Dynamic protection performance is specified under typical international surge waveforms from Telcordia GR-1089-CORE, ITU-T K.44 and YD/T 950.

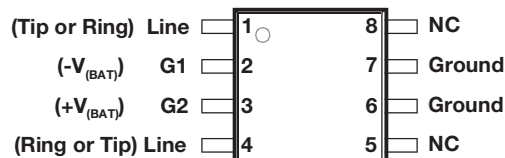
The Model TISP9110MDM is programmed by connecting the G1 and G2 gate terminals to the negative ( $-V_{(BAT)}$ ) and positive ( $+V_{(BAT)}$ ) SLIC Battery supplies respectively. This creates a protector operating at typically +1.4 V above  $+V_{(BAT)}$  and -1.4 V below  $-V_{(BAT)}$  under a.c. power induction and power contact conditions. The protector gate circuitry incorporates 4 separate buffer transistors designed to provide independent control for each protection element. The gate buffer transistors minimize supply regulation issues by reducing the gate current drawn to around 5 mA, while the high voltage base emitter structures eliminate the need for expensive reverse bias protection gate diodes.

The Model TISP9110MDM is rated for common surges contained in regulatory requirements such as ITU-T K.20, K.45, Telcordia GR-1089-CORE, YD/T 950. With the use of appropriate overcurrent protection devices such as the Bourns® Multifuse® and Telefuse™ devices, circuits can be designed to comply with modern telecom standards.

#### How To Order

| Device      | Package          | Carrier              | Order As       | Marking Code | Standard Quantity |
|-------------|------------------|----------------------|----------------|--------------|-------------------|
| TISP9110MDM | 8-SOIC (210 mil) | Embossed Tape Reeled | TISP9110MDMR-S | 9110M        | 2000              |

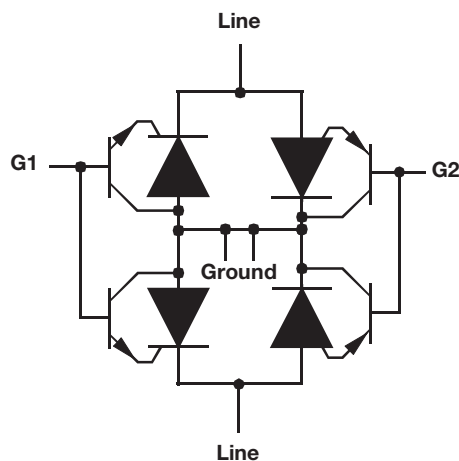
#### 8-SOIC (210 mil) Package (Top View)



NC - No internal connection  
Terminal typical application names shown in parenthesis

MD-8SOIC(210)-003-a

#### Device Symbol



SD-TISP9-001-a

\*RoHS Directive 2002/95/EC Jan. 27, 2003 including annex and RoHS Recast 2011/65/EU June 8, 2011.

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The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.

Users should verify actual device performance in their specific applications.

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

| Rating                                                                                                                                                                                                                                                          | Symbol                     | Value                             | Unit             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------------|------------------|
| Repetitive peak off-state voltage<br>$V_{G1(\text{Line})} = 0, V_{G2} \geq +5\text{ V}$<br>$V_{G2(\text{Line})} = 0, V_{G1} \geq -5\text{ V}$                                                                                                                   | $V_{\text{DRM}}$           | -120<br>+120                      | V                |
| Non-repetitive peak impulse current (see Notes 1, 2, 3 and 4)<br>2/10 $\mu\text{s}$ (Telcordia GR-1089-CORE)<br>5/310 $\mu\text{s}$ (ITU-T K.20, K.21 & K.45, K.44 open-circuit voltage wave shape 10/700 ms)<br>10/1000 $\mu\text{s}$ (Telcordia GR-1089-CORE) | $I_{\text{PPSM}}$          | $\pm 150$<br>$\pm 80$<br>$\pm 50$ | A                |
| Non-repetitive peak on-state current, 50 Hz / 60 Hz (see Notes 1, 2, 3 and 5)<br>0.2 s<br>1 s<br>900 s                                                                                                                                                          | $I_{\text{TSM}}$           | 9.0<br>5.0<br>1.7                 | A                |
| Maximum negative battery supply voltage                                                                                                                                                                                                                         | $V_{G1M}$                  | -110                              | V                |
| Maximum positive battery supply voltage                                                                                                                                                                                                                         | $V_{G2M}$                  | +110                              | V                |
| Maximum differential battery supply voltage                                                                                                                                                                                                                     | $\Delta V_{(\text{BAT})M}$ | 220                               | V                |
| 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  $T_J = 25^\circ\text{C}$ . The surge may be repeated after the device returns to its initial conditions.
2. The rated current values may be applied to either of the Line to Ground terminal pairs. Additionally, both terminal pairs may have their rated current values applied simultaneously (in this case the Ground terminal current will be twice the rated current value of a single terminal pair).
3. Rated currents only apply if pins 6 & 7 (Ground) are connected together.
4. Applies for the following bias conditions:  $V_{G1} = -20\text{ V}$  to  $-110\text{ V}$ ,  $V_{G2} = 0\text{ V}$  to  $+110\text{ V}$ .
5. EIA/JESD51-2 environment and EIA/JESD51-7 high effective thermal conductivity test board (multi-layer) connected with 0.6 mm printed wiring track widths.

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

| Parameter                                                  | Test Conditions                                                                                                                                                                                                                                                                  | Min  | Typ | Max                    | Unit          |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|------------------------|---------------|
| $I_D$ Off-state current                                    | $V_D = V_{\text{DRM}}$ , $V_{G1(\text{Line})} = 0$ , $V_{G2} \geq +5\text{ V}$<br>$V_D = V_{\text{DRM}}$ , $V_{G2(\text{Line})} = 0$ , $V_{G1} \geq -5\text{ V}$<br>$T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$<br>$T_A = 25^\circ\text{C}$<br>$T_A = 85^\circ\text{C}$ |      |     | -5<br>-50<br>+5<br>+50 | $\mu\text{A}$ |
| $I_{G1(\text{Line})}$ Negative-gate leakage current        | $V_{G1(\text{Line})} = -220\text{ V}$                                                                                                                                                                                                                                            |      |     | - 5                    | $\mu\text{A}$ |
| $I_{G2(\text{Line})}$ Positive-gate leakage current        | $V_{G2(\text{Line})} = +220\text{ V}$                                                                                                                                                                                                                                            |      |     | + 5                    | $\mu\text{A}$ |
| $V_{G1L(\text{BO})}$ Gate - Line impulse breakover voltage | $V_{G1} = -100\text{ V}$ , $I_T = -100\text{ A}$ (see Note 6)<br>$V_{G1} = -100\text{ V}$ , $I_T = -30\text{ A}$<br>2/10 $\mu\text{s}$<br>10/1000 $\mu\text{s}$                                                                                                                  |      |     | -15<br>-11             | V             |
| $V_{G2L(\text{BO})}$ Gate - Line impulse breakover voltage | $V_{G2} = +100\text{ V}$ , $I_T = +100\text{ A}$ (see Note 6)<br>$V_{G2} = +100\text{ V}$ , $I_T = +30\text{ A}$<br>2/10 $\mu\text{s}$<br>10/1000 $\mu\text{s}$                                                                                                                  |      |     | +15<br>+11             | V             |
| $I_{H-}$ Negative holding current                          | $V_{G1} = -60\text{ V}$ , $I_T = -1\text{ A}$ , $di/dt = 1\text{ A/ms}$                                                                                                                                                                                                          | -150 |     |                        | mA            |
| $I_{G1T}$ Negative-gate trigger current                    | $I_T = -5\text{ A}$ , $t_{p(q)} \geq 20\text{ }\mu\text{s}$ , $V_{G1} = -60\text{ V}$                                                                                                                                                                                            |      |     | + 5                    | mA            |
| $I_{G2T}$ Positive-gate trigger current                    | $I_T = 5\text{ A}$ , $t_{p(q)} \geq 20\text{ }\mu\text{s}$ , $V_{G2} = 60\text{ V}$                                                                                                                                                                                              |      |     | - 5                    | mA            |
| $C_O$ Line - Ground off-state capacitance                  | $f = 1\text{ MHz}$ , $V_D = -3\text{ V}$ , $G1$ & $G2$ open circuit                                                                                                                                                                                                              |      | 33  |                        | pF            |

NOTE: 6. Voltage measurements should be made with an oscilloscope with limited bandwidth (20 MHz) to avoid high frequency noise.

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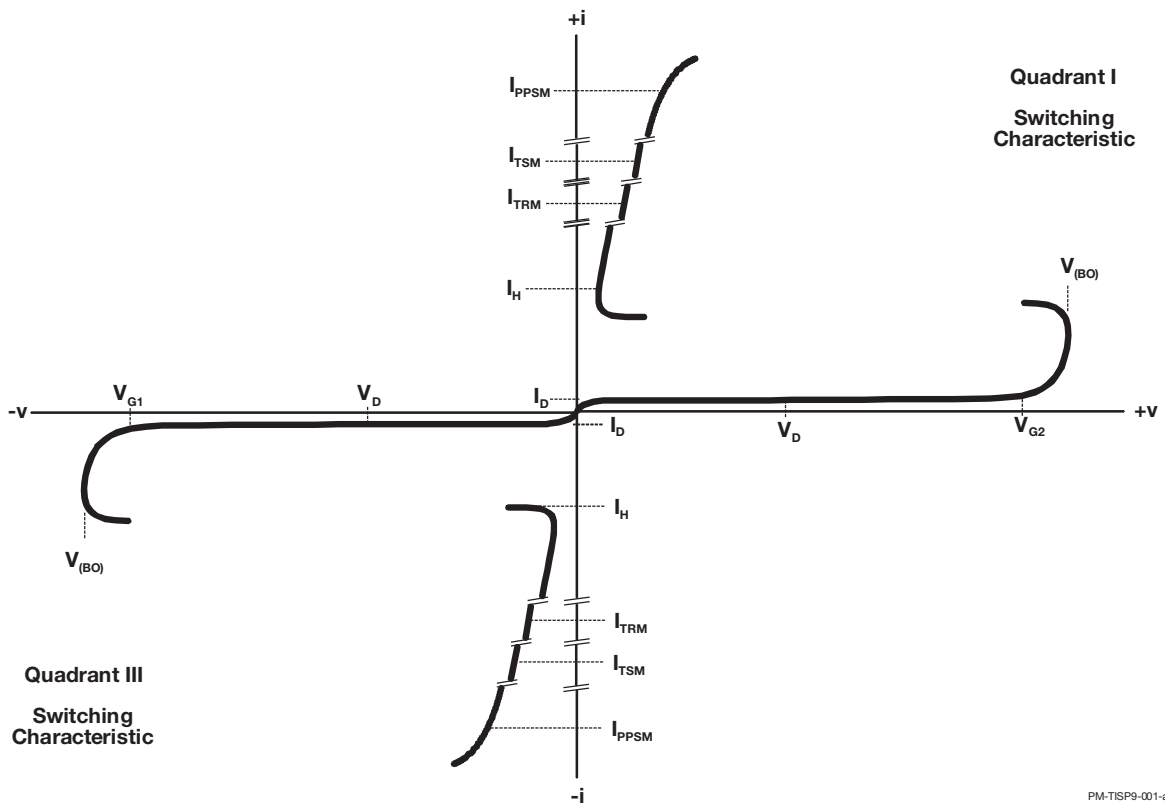
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## Thermal Characteristics, $T_A = 25\text{ }^{\circ}\text{C}$ (Unless Otherwise Noted)

| Parameter                                              | Test Conditions                                                                    | Min | Typ | Max | Unit                 |
|--------------------------------------------------------|------------------------------------------------------------------------------------|-----|-----|-----|----------------------|
| $R_{\theta JA}$ Junction to ambient thermal resistance | EIA/JESD51-7 PCB, EIA/JESD51-2 Environment, $P_{TOT} = 4\text{ W}$<br>(See Note 7) |     | 55  |     | $^{\circ}\text{C/W}$ |

NOTE 7. EIA/JESD51-7 high effective thermal conductivity test board (multi-layer) connected with 0.6 mm printed wiring track widths.

## Parameter Measurement Information



PM-TISP9-001-a

**Figure 1. Voltage-Current Characteristic**  
Unless Otherwise Noted, All Voltages are Referenced to the Ground Terminal

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## Typical Characteristics

### OFF-STATE CAPACITANCE vs OFF-STATE VOLTAGE

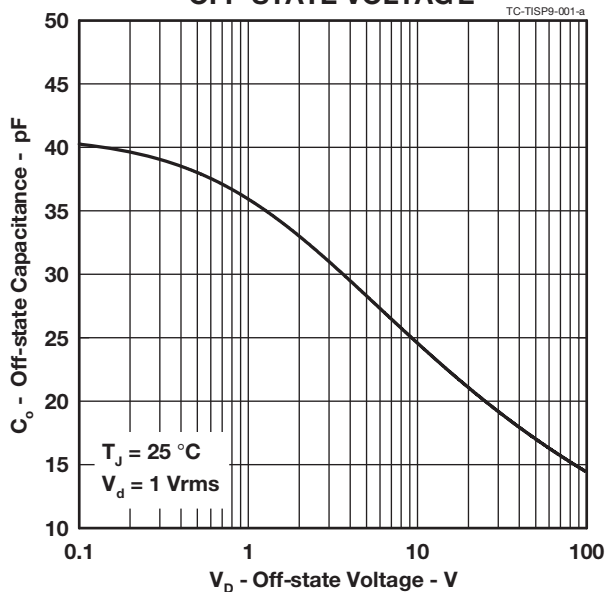


Figure 2.

## Thermal Information

### NON-REPETITIVE PEAK ON-STATE CURRENT vs CURRENT DURATION

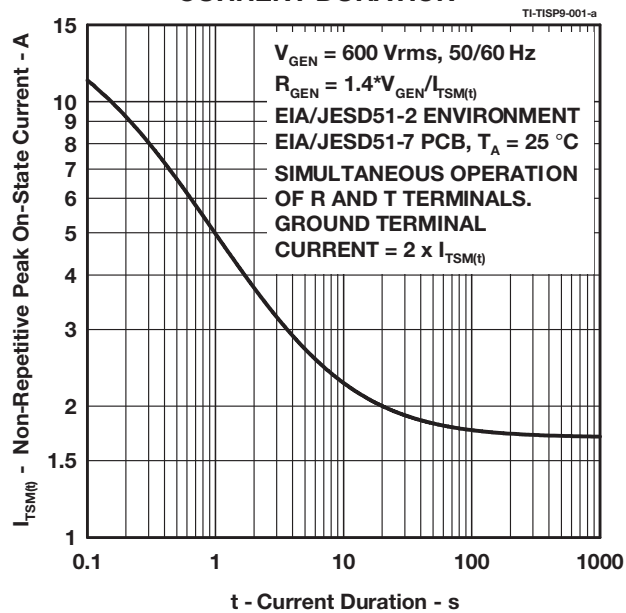


Figure 3.

# TISP9110MDM Overvoltage Protector

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## APPLICATIONS INFORMATION

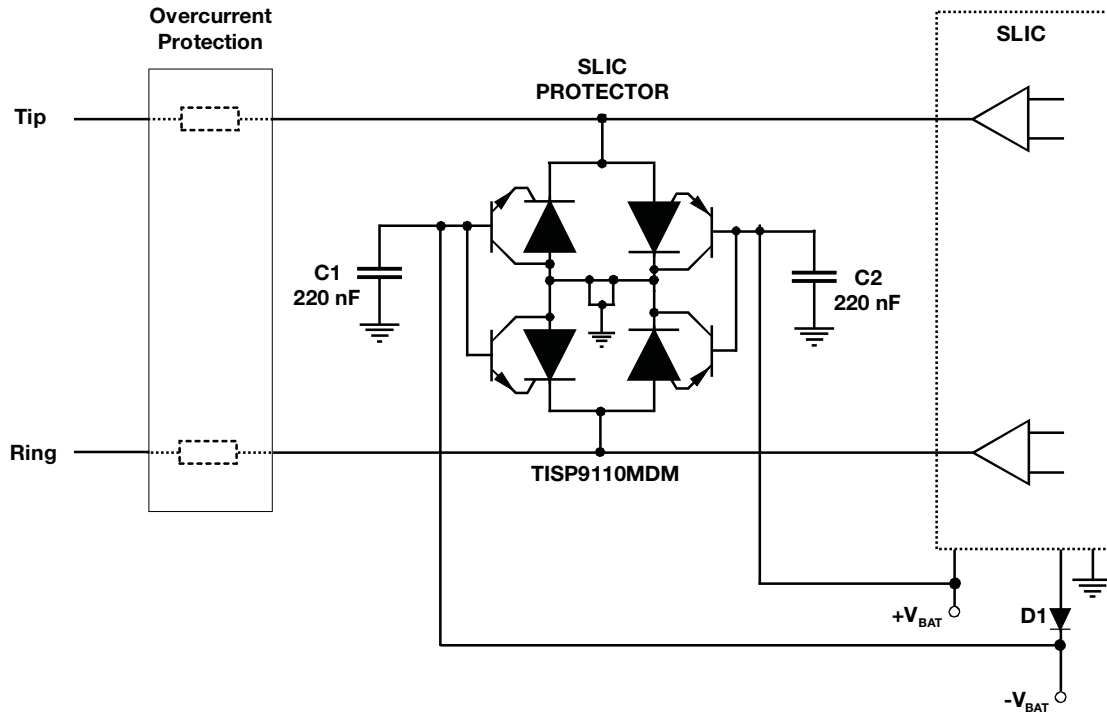
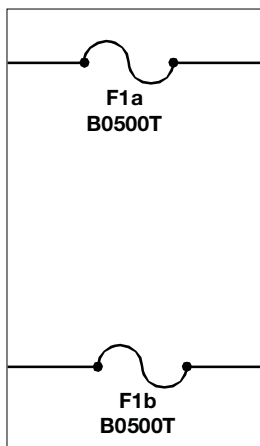
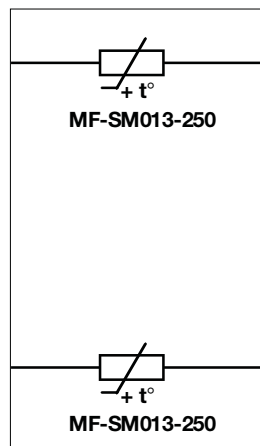


Figure 4. Typical Application Diagram

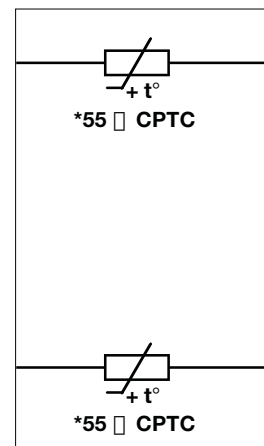
GR-1089-CORE Intra Building  
Overcurrent Protection 1



ITU-T K.20 (Basic)  
Overcurrent Protection 2



ITU-T K.20 (Enhanced 10/700  $\mu$ s 4 kV)  
Overcurrent Protection 3



\* Specific CPTC can withstand  
10/700 4 kV without primary protector.

Figure 5. Typical Overcurrent Protection

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Электрон  
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