

## BIDIRECTIONAL THYRISTOR SURGE SUPPRESSOR

### APPLICATIONS

- T1/E1 Trunk & Line Card
- SLIC Line Card
- DBX Branch Exchange Switches
- FCC Part 68 Customer Premise Equipment
- Line Interface Modem
- ADSL Architecture Interface
- ISDN Architecture Interface

### FEATURES

- Meets IEC 1000-4-4 & -5 Industry Requirements
- Provides Protection in Accordance with FCC Part 68, UL 1459, Bellcore 1089, ITU-TK.20 & K.21
- Peak Off-State Voltage from 58 to 300 Volts
- Surge Current Capability (See Surge Ratings Table)
- ESD Protection > 40 kilovolts
- Low Capacitance for T1/E1 Trunk & Line Card Applications
- UL 94V-0 Flammability Classification

### MAXIMUM RATINGS

- Surge Current: 60A Max. (50/60 Hz) ( $I_{TSM}$ )
- Storage Temperatures: -55° to + 150°C
- Junction Temperatures:  $T_j$  = -40° to 150°C
- Thermal Resistance for PPxxxxSA in a DO-214AA Package is  $R_{\theta JC}$  = 28°C/Watt &  $R_{\theta JA}$  = 90°C/Watt
- Thermal Resistance for PPxxxxSB or SC in a DO-214AA Package is  $R_{\theta JC}$  = 26°C/Watt &  $R_{\theta JA}$  = 85°C/Watt
- Critical Rate of Rise of Maximum On-State Current:  $di/dt$  = 500A/ $\mu$ s
- Critical Rate of Rise of Maximum Off-State Voltage:  $dv/dt$  > 2kv/ $\mu$ s

### MECHANICAL CHARACTERISTICS

- Package: Molded DO-214AA (JEDEC)
- Approximate Weight: 2.5 grams
- Body Marked with Logo and Marking Code

| SURGE RATINGS |                                    |                                      |                                      |                                       |                            |                          |
|---------------|------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|----------------------------|--------------------------|
| SERIES        | $I_{PP}$<br>2 X 10 $\mu$ S<br>AMPS | $I_{PP}$<br>10 X 160 $\mu$ S<br>AMPS | $I_{PP}$<br>10 X 560 $\mu$ S<br>AMPS | $I_{PP}$<br>10 X 1000 $\mu$ S<br>AMPS | $I_{TSM}$<br>60 Hz<br>AMPS | $di/dt$<br>AMPS/ $\mu$ S |
| SA            | N/A                                | 100                                  | 50                                   | N/A                                   | 20                         | 500                      |
| SB            | N/A                                | 150                                  | 100                                  | N/A                                   | 30                         | 500                      |
| SC            | 500                                | 200                                  | N/A                                  | 100                                   | 60                         | 500                      |

### IEC 1000-4 COMPATIBLE



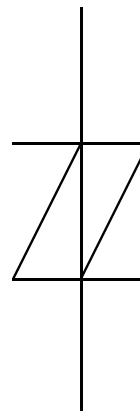
### DO-214AA PACKAGE

#### DESCRIPTION

The PPxxxxSA, SB and SC families are a series of Thyristor surge suppression (TSS) devices designed to protect telecommunication equipment against lightning and transients induced by AC power lines. These devices can be used on central office equipment, PBX, DSU, OCU, digital telephones, fax machines, modems and radio controlled equipment. The bidirectional configuration provides protection for both positive and negative transients and the discrete surface mount package allows individual placement of the device on line cards or other locations where multiple component devices do not offer the versatile in board trace layout.

The ProTek TSS device can be used to provide protection in accordance with industry standard requirements, such as FCC Part 68, ANSI C62.41, UL 1459 and GR-1089-CORE. Their low capacitance is ideal for T1/E1 trunk or line card applications.

#### DEVICE SYMBOL (BIDIRECTIONAL)

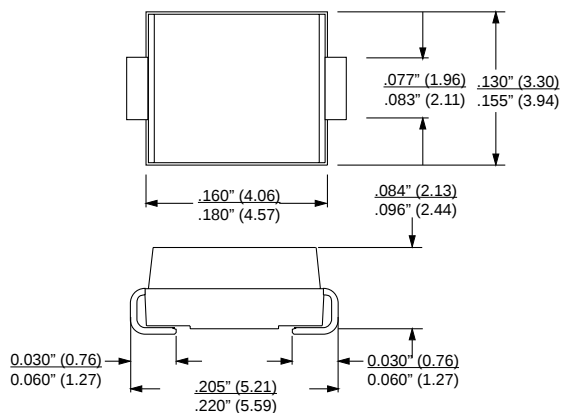


# ELECTRICAL CHARACTERISTICS @ 25°C Ambient Temperature

| PROTEK<br>PART<br>NUMBER | DEVICE<br>MARKING<br>CODE | REPETITIVE<br>PEAK<br>OFF-STATE<br>VOLTAGE<br><br>$V_{DRM}$<br>VOLTS | SWITCHING<br>VOLTAGE<br><br>@ 100V/ $\mu$ s<br>$V_S$<br>VOLTS | MINIMUM<br>HOLDING<br>CURRENT<br>(Figure 4)<br><br>di/dt = 1A/ms<br>$I_H$<br>mA | SWITCHING<br>CURRENT<br><br>$I_S$<br>mA | MAXIMUM<br>OFF-STATE<br>CURRENT<br>(Figure 2)<br><br>@ $V_{DRM}$<br>$I_{DRM}$<br>$\mu$ A | MAXIMUM<br>ON-STATE<br>VOLTAGE<br>(Figure 3)<br><br>@ $I_T$<br>$V_T$<br>VOLTS | ON-STATE<br>CURRENT<br><br>$I_T$<br>A | TYPICAL<br>CAPACITANCE<br><br>(See Note 1)<br><br>@ 2V, 1 MHz<br>C<br>pF |
|--------------------------|---------------------------|----------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------|--------------------------------------------------------------------------|
| PP0640SA                 | GC                        | 58                                                                   | 77                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP0720SA                 | GD                        | 65                                                                   | 88                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP0800SA                 | GE                        | 75                                                                   | 98                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP1100SA                 | GF                        | 90                                                                   | 130                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP1300SA                 | GG                        | 120                                                                  | 160                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP1500SA                 | GH                        | 140                                                                  | 180                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP1800SA                 | GI                        | 160                                                                  | 220                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP2300SA                 | GJ                        | 190                                                                  | 260                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP2600SA                 | GK                        | 220                                                                  | 300                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP3100SA                 | GL                        | 275                                                                  | 350                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP3500SA                 | GM                        | 300                                                                  | 400                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP0640SB                 | GP                        | 58                                                                   | 77                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP0720SB                 | GQ                        | 65                                                                   | 88                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP0800SB                 | GR                        | 75                                                                   | 98                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP1100SB                 | GS                        | 90                                                                   | 130                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP1300SB                 | GT                        | 120                                                                  | 160                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP1500SB                 | GU                        | 140                                                                  | 180                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP1800SB                 | GV                        | 160                                                                  | 220                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 40                                                                       |
| PP2300SB                 | GW                        | 190                                                                  | 260                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP2600SB                 | GX                        | 220                                                                  | 300                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP3100SB                 | GY                        | 275                                                                  | 350                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP3500SB                 | GZ                        | 300                                                                  | 400                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 30                                                                       |
| PP0640SC                 | HC                        | 58                                                                   | 77                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 120                                                                      |
| PP0720SC                 | HD                        | 65                                                                   | 88                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 120                                                                      |
| PP0800SC                 | HE                        | 75                                                                   | 98                                                            | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 120                                                                      |
| PP1100SC                 | HF                        | 90                                                                   | 130                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 120                                                                      |
| PP1300SC                 | HG                        | 120                                                                  | 160                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 80                                                                       |
| PP1500SC                 | HH                        | 140                                                                  | 180                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 80                                                                       |
| PP1800SC                 | HI                        | 160                                                                  | 220                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 80                                                                       |
| PP2300SC                 | HJ                        | 190                                                                  | 260                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP2600SC                 | HK                        | 220                                                                  | 300                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP3100SC                 | HL                        | 275                                                                  | 350                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |
| PP3500SC                 | HM                        | 300                                                                  | 400                                                           | 150                                                                             | 800                                     | 5                                                                                        | 5                                                                             | 1.0                                   | 60                                                                       |

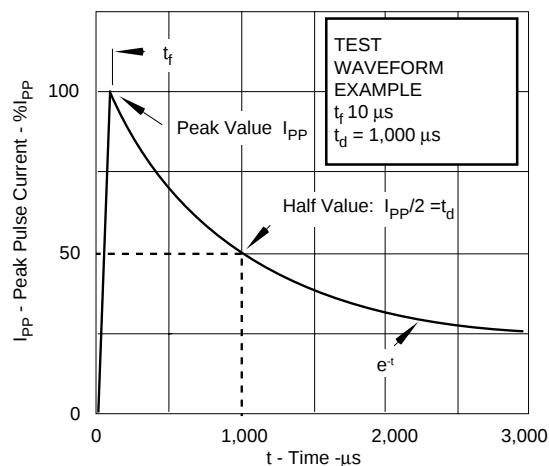
**Note 1:** Capacitance imbalance between positive and negative polarities is typically < 15pF.

## DO-214AA PACKAGE DIMENSIONS

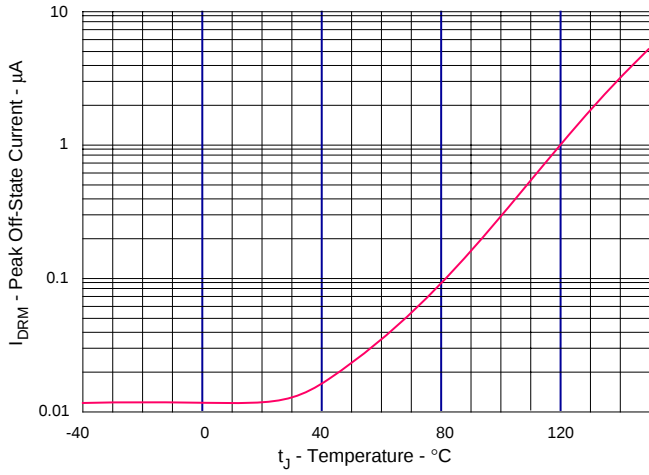


Measurements are in inches, (mm) denotes millimeters

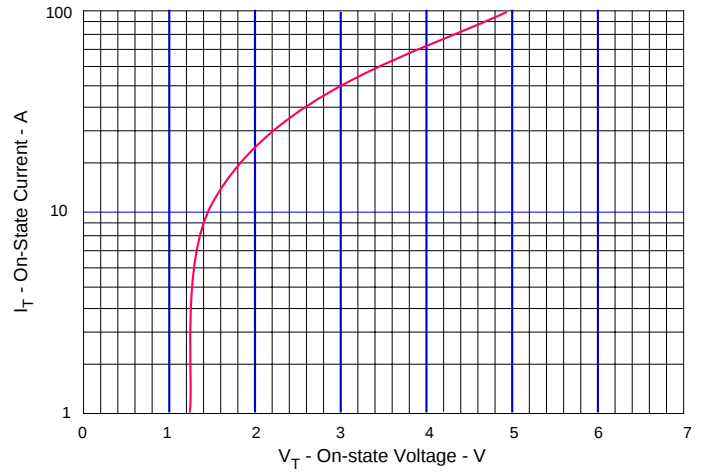
**FIGURE 1**  
**PULSE WAVE FORM EXAMPLE**



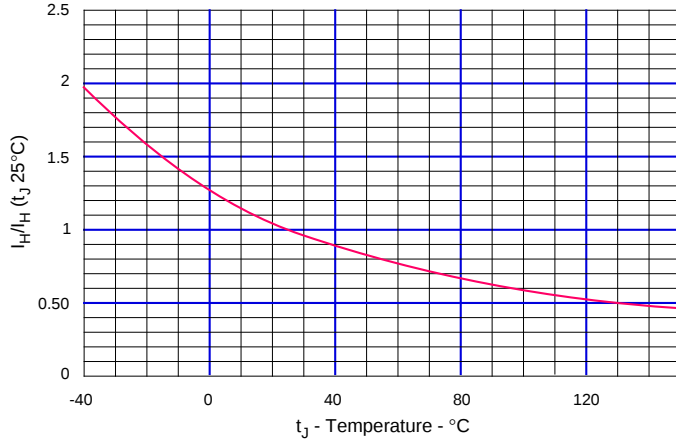
**FIGURE 2**  
**TYPICAL PEAK OFF-STATE CURRENT VS JUNCTION TEMPERATURE**



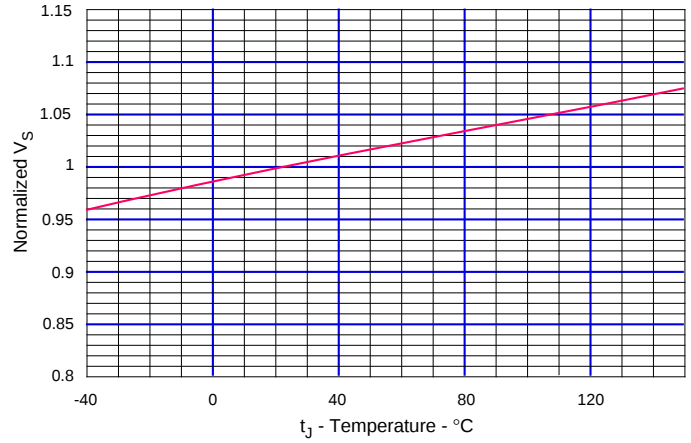
**FIGURE 3**  
**TYPICAL ON-STATE CURRENT VS ON-STATE VOLTAGE**



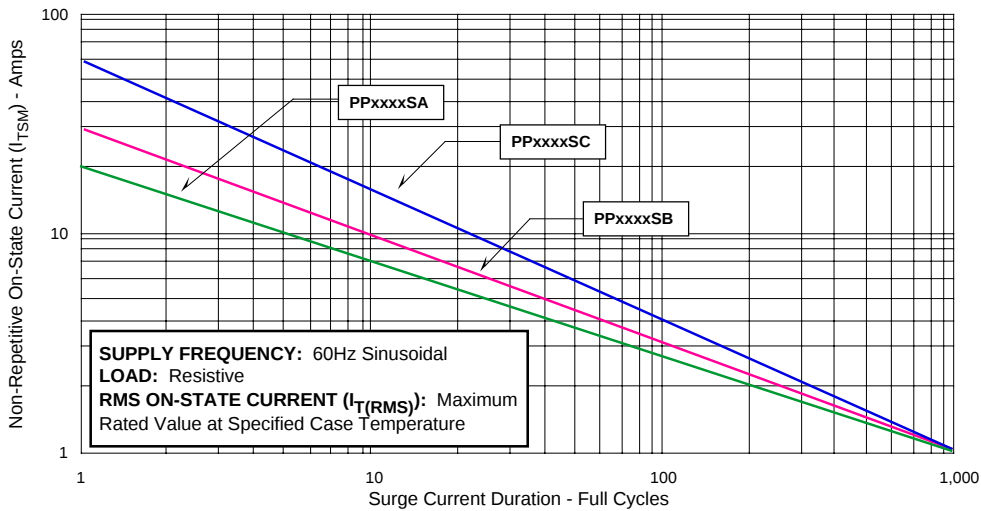
**FIGURE 4**  
**TYPICAL HOLDING CURRENT VS JUNCTION TEMPERATURE**



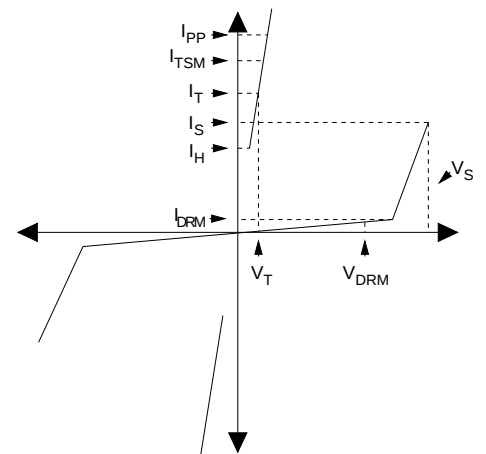
**FIGURE 5**  
**TYPICAL NORMALIZED  $V_S$  VS JUNCTION TEMPERATURE**



**FIGURE 6**  
**ON-STATE CURRENT VS SURGE CURRENT DURATION**

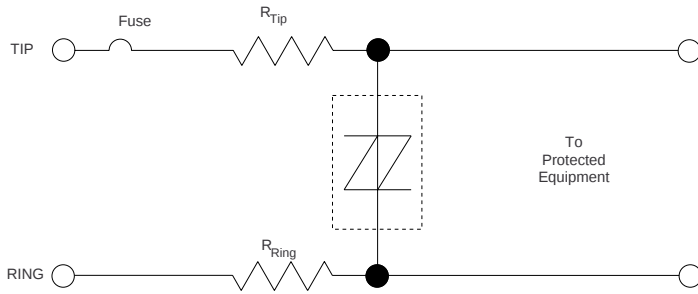


**FIGURE 7**  
**V - I CHARACTERISTICS CURVE**



# Application Notes for Thyristor Surge Suppressors used in Telecommunication Circuits

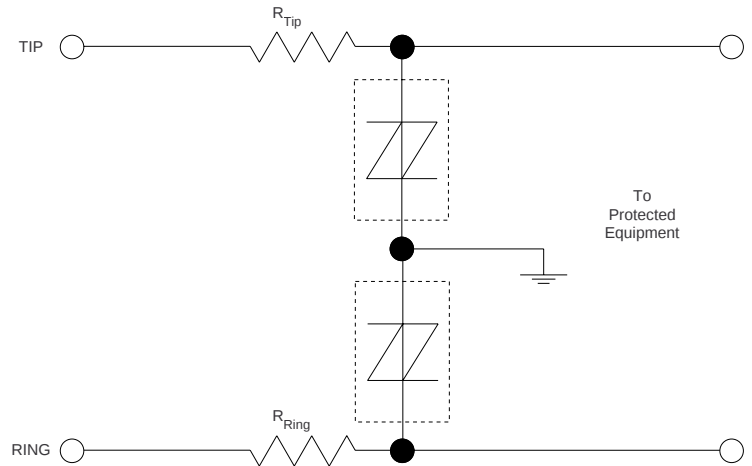
**FIGURE 8 - UL 1459 & FCC Part 68 Metallic Protection**



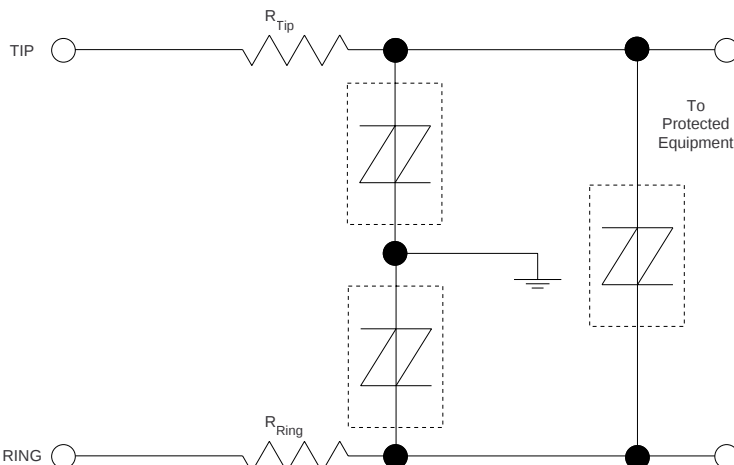
The TSS device is located across the tip-to-ring line after a limiting resistor and fuse combination.  $R_{TIP}$  and  $R_{RING}$  resistors are optional depending upon the TSS device selection. Without the resistors, the PP3100SB/SC is recommended. However, with a resistance value of 7.5 ohms for tip and ring, the PP3100SA is recommended. Digital signals may use a lower TSS device depending upon the total tip to ring voltage range. Selection of the TSS device, either PPxxxxSA or SB/SC is based upon the value of the tip and ring resistors. For the National Electronic Code (NEC) article 800, it is recommended that at least one fuse be used in the tip or ring line for metallic surges. Fuses may be replaced with a suitable Positive Temperature Coefficient (PTC) automatic resettable current limiting device.

**FIGURE 9 - UL 1459 & FCC Part 68 - Longitudinal Protection**

There are two TSS devices, one located from tip-to-ground and one ring-to-ground. For standard analog signals, the PP3100SA is recommended with a typical resistor value for tip and ring of 15 ohms. The PP3100SB/SC is recommended for resistor values of 7.5 ohms each. The National Electric Code (NEC) article 800 requires two fuse elements when connecting to ground. Fuses or a suitable Positive Temperature Coefficient (PTC) automatic resettable current limiting device may be used. The purpose of this circuit is to limit AC power current from getting on the ground line causing any safety hazard.



**FIGURE 10 - UL 1459 & FCC Part 68 - Metallic and Longitudinal Protection**



Three equal TSS devices are used in this application for metallic (tip-to-ring) and longitudinal (tip-to-ground and ring-to-ground) protection. For analog signals, the PP3100SB/SC is recommended. With a resistance value of 15 ohms for the tip and ring resistors, the PP3100SA may be used. The National Electric Code (NEC) article 800 requires two fuse elements when connecting to ground. Fuses or a suitable Positive Temperature Coefficient (PTC) automatic resettable current limiting device may be used. This is circuit is recommended for protection against the Bellcore requirement: First Level Lightning Surge Tests (Telecommunications Port), document #GR-1089-CORE.