

BIDIRECTIONAL THYRISTOR OVERVOLTAGE PROTECTORS



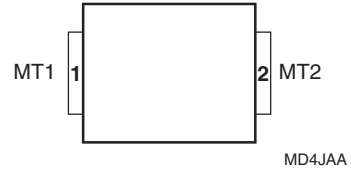
TISP4xxxJ1BJ Overvoltage Protector Series

- Ground Return Element of Y Configuration
- 2x Current Capability of Y Upper Elements
- Available in a Wide Range of Voltages
- Enables Symmetrical and Asymmetrical Y Designs
- SMB (DO-214AA) Package

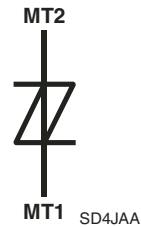
- Ion-Implanted Breakdown Region
- Precise and Stable Voltage
- Low Voltage Overshoot Under Surge

| Device     | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V |
|------------|-----------------------|------------------------|
| TISP4070J1 | 58                    | 70                     |
| TISP4080J1 | 65                    | 80                     |
| TISP4095J1 | 75                    | 95                     |
| TISP4115J1 | 90                    | 115                    |
| TISP4125J1 | 100                   | 125                    |
| TISP4145J1 | 120                   | 145                    |
| TISP4165J1 | 135                   | 165                    |
| TISP4180J1 | 145                   | 180                    |
| TISP4200J1 | 155                   | 200                    |
| TISP4219J1 | 180                   | 219                    |
| TISP4250J1 | 190                   | 250                    |
| TISP4290J1 | 220                   | 290                    |
| TISP4350J1 | 275                   | 350                    |
| TISP4395J1 | 320                   | 395                    |

SMB Package (Top View)



Device Symbol



Rated for International Surge Wave Shapes

| Wave Shape | Standard                     | I <sub>PPSM</sub><br>A |
|------------|------------------------------|------------------------|
| 2/10       | GR-1089-CORE                 | 1000                   |
| 8/20       | IEC 61000-4-5                | 800                    |
| 10/160     | TIA/EIA-IS-968 (FCC Part 68) | 400                    |
| 10/700     | ITU-T K.20/21/45             | 350                    |
| 10/560     | TIA/EIA-IS-968 (FCC Part 68) | 250                    |
| 10/1000    | GR-1089-CORE                 | 200                    |

..... UL Recognized Components

Description

The TISP4xxxJ1BJ is a symmetrical voltage-triggered bidirectional thyristor device which has been designed as the tail (ground return) element of a Y circuit configured protector. As such, the TISP4xxxJ1BJ must be rated to conduct the sum of the TIP and RING currents. For example, the normal GR-1089-CORE testing can impose 200 A, 10/1000 and 1000 A, 2/10 on the ground return element of the Y configuration. Using the TISP4xxxJ1BJ together with two TISP4xxxH3BJ parts gives a 2x 100 A, 10/1000 Y protector circuit. For ITU-T applications, using the TISP4xxxJ1BJ with a TISP3xxxT3BJ gives a coordinated Y protector with a 2x 120 A, 5/310 capability. Design tables are given in the Applications Information section. These SMB package combinations are often more space efficient than single package Y protection multi-chip integrations.

These devices allow signal voltages, without clipping, up to the maximum off-state voltage value, V<sub>DRM</sub>, see Figure 1. Voltages above V<sub>DRM</sub> are limited and will not exceed the breakover voltage, V<sub>(BO)</sub>, level. If sufficient current flows due to the overvoltage, the device switches into a low-voltage on-state condition, which diverts the current from the overvoltage through the device. When the diverted current falls below the holding current, I<sub>H</sub>, level the devices switches off and restores normal system operation.

How to Order

| Device       | Package                  | Carrier                  | Order As        |
|--------------|--------------------------|--------------------------|-----------------|
| TISP4xxxJ1BJ | BJ (SMB/DO-214AA J-Bend) | R (Embossed Tape Reeled) | TISP4xxxJ1BJR-S |

\*RoHS Directive 2002/95/EC Jan 27 2003 including Annex  
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# TISP4xxxJ1BJ Overvoltage Protector Series

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

| Rating   | Symbol     | Value  | Unit |   |
|--|------------|--|------|---|
| Repetitive peak off-state voltage  | $V_{DRM}$  | '4070  | ±58  | V |
|  |            | '4080  | ±65  |   |
|  |            | '4095  | ±75  |   |
|  |            | '4115  | ±90  |   |
|  |            | '4125  | ±100 |   |
|  |            | '4145  | ±120 |   |
|  |            | '4165  | ±135 |   |
|  |            | '4180  | ±145 |   |
|  |            | '4200  | ±155 |   |
|  |            | '4219  | ±180 |   |
|  |            | '4250  | ±190 |   |
|  |            | '4290  | ±220 |   |
|  |            | '4350  | ±275 |   |
|  |            | '4395  | ±320 |   |
| Non-repetitive peak on-state pulse current (see Notes 1 and 2)                           | $I_{PPSM}$ | 2/10 (Telcordia GR-1089-CORE, 2/10 voltage wave shape) | 1000 | A |
| 8/20 (IEC 61000-4-5, combination wave generator, 1.2/50 voltage wave shape)              |            | 800  |      |   |
| 10/160 (TIA/EIA-IS-968 (Replaces FCC Part 68), 10/160 voltage wave shape)                |            | 400  |      |   |
| 4/250 (ITU-T K.20/21, 10/700 voltage wave shape, simultaneous)                           |            | 370  |      |   |
| 5/310 (ITU-T K.20/21, 10/700 voltage wave shape, single)                                 |            | 350  |      |   |
| 5/320 (TIA/EIA-IS-968 (Replaces FCC Part 68), 9/720 voltage wave shape, single)          |            | 350  |      |   |
| 10/560 (TIA/EIA-IS-968 (Replaces FCC Part 68), 10/560 voltage wave shape)                |            | 250  |      |   |
| 10/1000 (Telcordia GR-1089-CORE, 10/1000 voltage wave shape)                             |            | 200  |      |   |
| Non-repetitive peak on-state current (see Notes 1 and 2)                                 | $I_{TSM}$  | 50 Hz, 1 cycle   | 80   | A |
| 60 Hz, 1 cycle   |            | 100  |      |   |
| Initial rate of rise of on-state current, Linear current ramp, Maximum ramp value < 50 A | $di_T/dt$  | 800  | A/μs |   |
| Junction temperature   | $T_J$      | -40 to +150  | °C   |   |
| Storage temperature range  | $T_{stg}$  | -65 to +150  | °C   |   |

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

2. These non-repetitive rated currents are peak values of either polarity. The surge may be repeated after the device returns to its initial conditions.

## Recommended Operating Conditions

| Component   | Min | Typ | Max | Unit |
|---|-----|-----|-----|------|
| Series resistor for GR-1089-CORE first-level surge survival                                 | 0   |     |     | Ω    |
| Series resistor for ITU-T recommendation K.20/K.45/K.21 (Basic coordination with 400 V GDT) | 6.5 |     |     |      |
| R1, R2 Series resistor for TIA/EIA-IS-968 (Replaces FCC Part 68), 9/720 survival            | 0   |     |     |      |
| Series resistor for TIA/EIA-IS-968 (Replaces FCC Part 68), 10/560 survival                  | 0   |     |     |      |
| Series resistor for TIA/EIA-IS-968 (Replaces FCC Part 68), 10/160 survival                  | 0   |     |     |      |

# TISP4xxxJ1BJ Overvoltage Protector Series

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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 | $V_D = \pm V_{\text{DRM}}$<br>$T_A = 25\text{ }^\circ\text{C}$<br>$T_A = 85\text{ }^\circ\text{C}$   |     |     | $\pm 5$<br>$\pm 10$  | $\mu\text{A}$ |
| $V_{(\text{BO})}$ AC breakover voltage             | $dv/dt = \pm 250\text{ V/ms}$ , $R_{\text{SOURCE}} = 300\ \Omega$  |     |     | 4070<br>'4080<br>'4095<br>'4115<br>'4125<br>'4145<br>'4165<br>'4180<br>'4200<br>'4219<br>'4250<br>'4290<br>'4350<br>'4395<br>$\pm 70$<br>$\pm 80$<br>$\pm 95$<br>$\pm 115$<br>$\pm 125$<br>$\pm 145$<br>$\pm 165$<br>$\pm 180$<br>$\pm 200$<br>$\pm 219$<br>$\pm 250$<br>$\pm 290$<br>$\pm 350$<br>$\pm 395$   | V             |
| $V_{(\text{BO})}$ Ramp breakover voltage           | $dv/dt \leq \pm 1000\text{ V}/\mu\text{s}$ , Linear voltage ramp,<br>Maximum ramp value = $\pm 500\text{ V}$<br>$di/dt = \pm 20\text{ A}/\mu\text{s}$ , Linear current ramp,<br>Maximum ramp value = $\pm 10\text{ A}$ |     |     | 4070<br>'4080<br>'4095<br>'4115<br>'4125<br>'4145<br>'4165<br>'4180<br>'4200<br>'4219<br>'4250<br>'4290<br>'4350<br>'4395<br>$\pm 77$<br>$\pm 88$<br>$\pm 104$<br>$\pm 125$<br>$\pm 135$<br>$\pm 156$<br>$\pm 177$<br>$\pm 192$<br>$\pm 212$<br>$\pm 231$<br>$\pm 263$<br>$\pm 303$<br>$\pm 364$<br>$\pm 409$  | V             |
| $V_{(\text{BO})}$ Impulse breakover voltage        | 2/10 wave shape, $I_{\text{PP}} = \pm 1000\text{ A}$ , $R_S = 2.5\ \Omega$ ,<br>(see Note 3)   |     |     | 4070<br>'4080<br>'4095<br>'4115<br>'4125<br>'4145<br>'4165<br>'4180<br>'4200<br>'4219<br>'4250<br>'4290<br>'4350<br>'4395<br>$\pm 96$<br>$\pm 101$<br>$\pm 112$<br>$\pm 130$<br>$\pm 140$<br>$\pm 161$<br>$\pm 183$<br>$\pm 199$<br>$\pm 221$<br>$\pm 242$<br>$\pm 276$<br>$\pm 320$<br>$\pm 386$<br>$\pm 434$ | V             |

NOTE 3: Dynamic voltage measurements should be made with an oscilloscope with limited band width (20 MHz) to avoid high frequency noise.

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# TISP4xxxJ1BJ Overvoltage Protector Series

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

| Parameter   | Test Conditions  | Min              | Typ | Max       | Unit              |
|---|--|------------------|-----|-----------|-------------------|
| $I_{(BO)}$ Breakover current  | $dv/dt = \pm 250\text{ V/ms}$ , $R_{SOURCE} = 300\ \Omega$         |                  |     | $\pm 600$ | mA                |
| $I_H$ Holding current   | $I_T = \pm 5\text{ A}$ , $di/dt = +/- 30\text{ mA/ms}$             | $\pm 20$         |     |           | mA                |
| $dv/dt$ Critical rate of rise of off-state voltage                                  | Linear voltage ramp, Maximum ramp value $< 0.85 V_{DRM}$           | $\pm 5$          |     |           | kV/ $\mu\text{s}$ |
| $I_D$ Off-state current   | $V_D = \pm 50\text{ V}$<br>$T_A = 85\text{ }^\circ\text{C}$        |                  |     | $\pm 10$  | $\mu\text{A}$     |
| $C_{off}$ Off-state capacitance   | $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$ , $V_D = 0$ ,          | '4070 thru '4115 | 195 | 235       | pF                |
|   |  | '4125 thru '4219 | 120 | 145       |                   |
|   |  | '4250 thru '4395 | 105 | 125       |                   |
|   | $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$ , $V_D = -1\text{ V}$  | '4070 thru '4115 | 180 | 215       |                   |
|   |  | '4125 thru '4219 | 110 | 132       |                   |
|   |  | '4250 thru '4395 | 95  | 115       |                   |
|   | $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$ , $V_D = -2\text{ V}$  | '4070 thru '4115 | 165 | 200       |                   |
|   |  | '4125 thru '4219 | 100 | 120       |                   |
|   |  | '4250 thru '4395 | 90  | 105       |                   |
|   | $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$ , $V_D = -50\text{ V}$ | '4070 thru '4115 | 85  | 100       |                   |
|   |  | '4125 thru '4219 | 50  | 60        |                   |
|   |  | '4250 thru '4395 | 42  | 50        |                   |
| '4125 thru '4219  |  | 40               | 50  |           |                   |
| $f = 1\text{ MHz}$ , $V_d = 1\text{ V rms}$ , $V_D = -100\text{ V}$<br>(see Note 4) | '4125 thru '4219   | 40               | 50  |           |                   |
|   | '4250 thru '4395   | 35               | 40  |           |                   |

NOTE 4: To avoid possible voltage clipping, the '4125 is tested with  $V_D = -98\text{ V}$

## Thermal Characteristics

| Parameter   | Test Conditions  | Min | Typ | Max | Unit               |
|---|--|-----|-----|-----|--------------------|
| $R_{\theta JA}$ Junction to free air thermal resistance | EIA/JESD51-3 PCB, $I_T = I_{TSM(1000)}$<br>$T_A = 25\text{ }^\circ\text{C}$ , (see Note 5) |     |     | 90  | $^\circ\text{C/W}$ |

NOTE 5: 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 Terminals 1-2  
All Measurements are Referenced to Terminal 2

## Typical Characteristics



Figure 2.

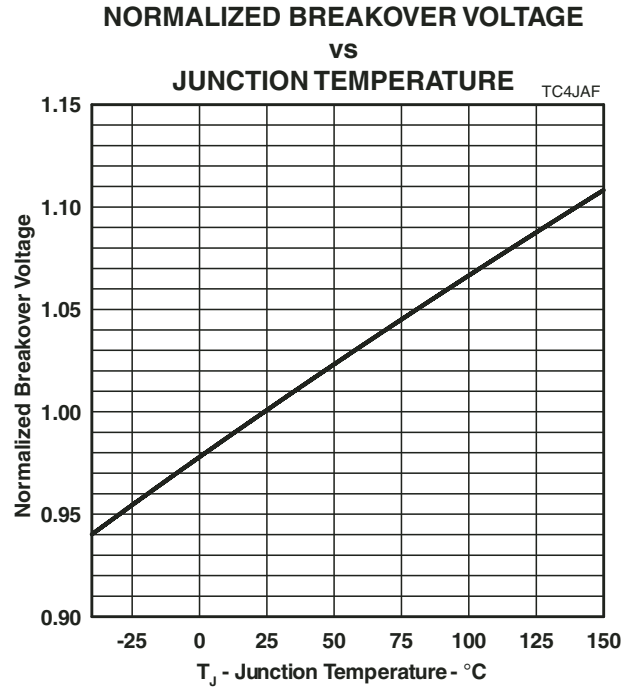


Figure 3.



Figure 4.



Figure 5.

## Typical Characteristics



Figure 6.



Figure 7.



Figure 8.

## Rating and Thermal Information

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

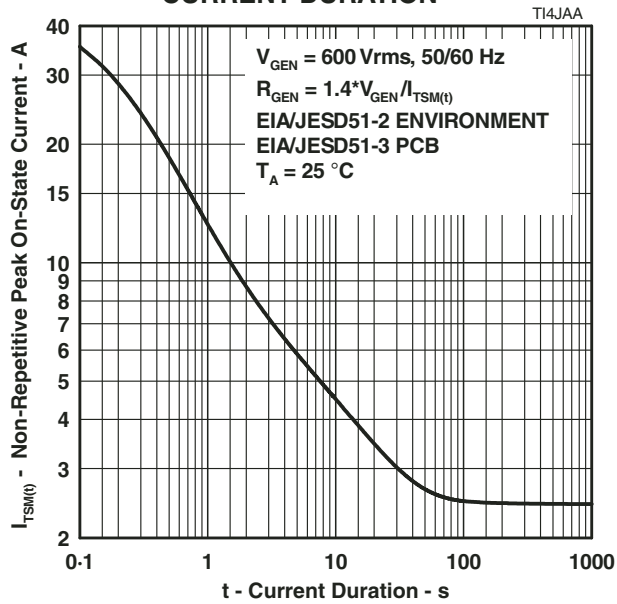


Figure 9.

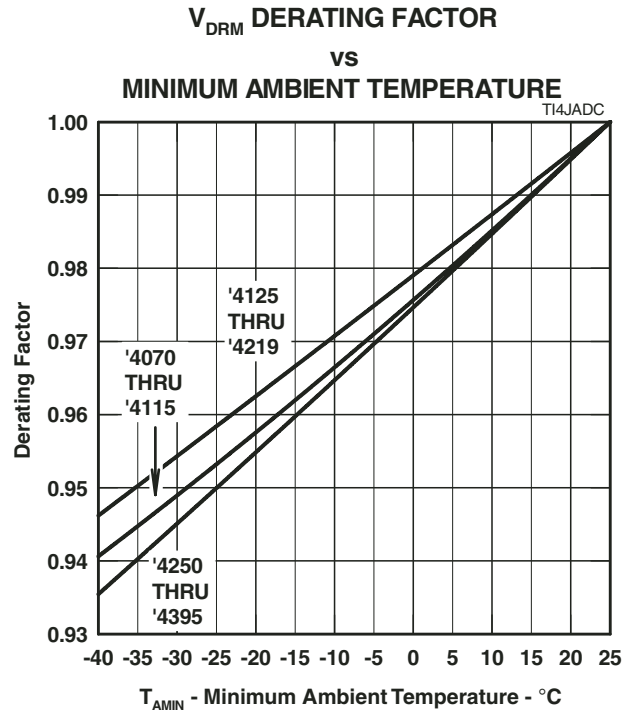


Figure 10.



## APPLICATIONS INFORMATION

### Y Configuration Design

This protection configuration has three modes of protection. The RING to TIP terminal pair protection is given by the series combination of protectors Th1a and Th1b, see Figure 11. The terminal pair protection voltage will be the sum of the  $V_{(BO)}$ , breakover voltage, of Th1a and the  $V_{(BO)}$  of Th1b. Protectors Th1a and Th1b are the same device type and the terminal pair protection voltage will be  $2 V_{(BO)1}$ . For a terminal pair protection voltage of  $\pm 400$  V, Th1a and Th1b would have  $V_{(BO)1} = \pm 400/2 = \pm 200$  V.

Similarly for the other terminal pairs, RING to GROUND protection is given by the series combination of Th1b and Th2 and the terminal pair protection voltage is  $V_{(BO)1} + V_{(BO)2}$ . TIP to GROUND protection voltage will also be  $V_{(BO)1} + V_{(BO)2}$ .

The maximum terminal pair voltage before clipping might occur is the sum of the protector  $V_{DRM}$ , off-state voltages, see Figure 12. For RING to TIP this will be  $2 V_{DRM1}$ . The  $\pm 200$  V  $V_{(BO)1}$  protectors of the previous example have a  $V_{DRM}$  of  $\pm 155$  V, giving a maximum non-clipping signal voltage of  $\pm 310$  V. For RING to GROUND and TIP to GROUND terminal pairs, the maximum non-clipping signal voltage will be  $V_{DRM1} + V_{DRM2}$ .

Under longitudinal surge conditions, when the prospective currents of the line conductors,  $I_{RING}$  and  $I_{TIP}$ , are equal, Th2, the ground return protector, carries the sum of the Th1a and Th1b currents, see Figure 13. The current rating of Th2 must be twice that of Th1a and Th1b.



Figure 11. Protection Voltage

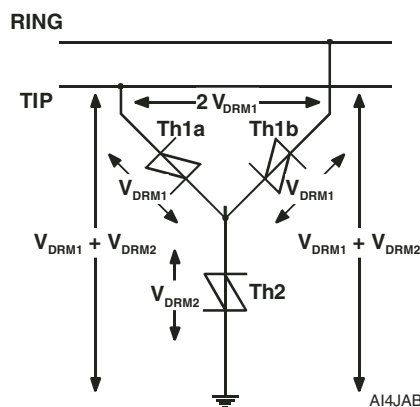


Figure 12. Off-State Voltage



Figure 13. Current Flow

### GR-1089-CORE Designs

The main impulse waveforms of the standard are 500 A, 2/10 and 100 A, 10/1000. Assuming fuse current limiters, F1a and F1b, a suitable Th1a and Th1b protector for these conductor currents is the TISP4xxxH3BJ series of devices. The ground return protector, Th2, must be rated for at least 1000 A, 2/10 and 200 A, 10/1000. A suitable Th2 protector for these ground currents is the TISP4xxxJ1BJ series of devices. This arrangement is shown in Figure 14 and the following table lists all the catalogue combinations.

| RING to TIP Voltages |                 | RING to GROUND, TIP to GROUND Voltages |                 | GR-1089-CORE Y Configuration Parts and Part Voltages |               |                |                 |
|----------------------|-----------------|--|-----------------|--|---------------|----------------|-----------------|
| $V_{DRM}$<br>V       | $V_{(BO)}$<br>V | $V_{DRM}$<br>V                         | $V_{(BO)}$<br>V | Th1a, Th1b<br>Part #                                 | Th2<br>Part # | $V_{DRM}$<br>V | $V_{(BO)}$<br>V |
| ±116                 | ±140            | ±116                                   | ±140            | TISP4070H3BJ   | TISP4070J1BJ  | ±58            | ±70             |
| ±130                 | ±160            | ±130                                   | ±160            | TISP4080H3BJ   | TISP4080J1BJ  | ±65            | ±80             |
| ±150                 | ±190            | ±150                                   | ±190            | TISP4095H3BJ   | TISP4095J1BJ  | ±75            | ±95             |
| ±180                 | ±230            | ±180                                   | ±230            | TISP4115H3BJ   | TISP4115J1BJ  | ±90            | ±115            |
| ±200                 | ±250            | ±200                                   | ±250            | TISP4125H3BJ   | TISP4125J1BJ  | ±100           | ±125            |
| ±240                 | ±290            | ±240                                   | ±290            | TISP4145H3BJ   | TISP4145J1BJ  | ±120           | ±145            |
| ±270                 | ±330            | ±270                                   | ±330            | TISP4165H3BJ   | TISP4165J1BJ  | ±135           | ±165            |
| ±290                 | ±360            | ±290                                   | ±360            | TISP4180H3BJ   | TISP4180J1BJ  | ±145           | ±180            |
| ±310                 | ±400            | ±310                                   | ±400            | TISP4200H3BJ   | TISP4200J1BJ  | ±155           | ±200            |
| ±360                 | ±438            | ±360                                   | ±438            | TISP4219H3BJ   | TISP4219J1BJ  | ±180           | ±219            |

# TISP4xxxJ1BJ Overvoltage Protector Series

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## GR-1089-CORE Designs (Continued)

| RING to TIP Voltages  |                        | RING to GROUND,<br>TIP to GROUND Voltages |                        | GR-1089-CORE Y Configuration Parts and Part Voltages |               |                       |                        |
|-----------------------|------------------------|---|------------------------|--|---------------|-----------------------|------------------------|
| V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V | V <sub>DRM</sub><br>V                     | V <sub>(BO)</sub><br>V | Th1a, Th1b<br>Part #                                 | Th2<br>Part # | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V |
| ±380                  | ±500                   | ±380                                      | ±500                   | TISP4250H3BJ   | TISP4250J1BJ  | ±190                  | ±250                   |
| ±440                  | ±580                   | ±440                                      | ±580                   | TISP4290H3BJ   | TISP4290J1BJ  | ±220                  | ±290                   |
| ±550                  | ±700                   | ±550                                      | ±700                   | TISP4350H3BJ   | TISP4350J1BJ  | ±275                  | ±350                   |
| ±640                  | ±790                   | ±640                                      | ±790                   | TISP4395H3BJ   | TISP4395J1BJ  | ±320                  | ±395                   |

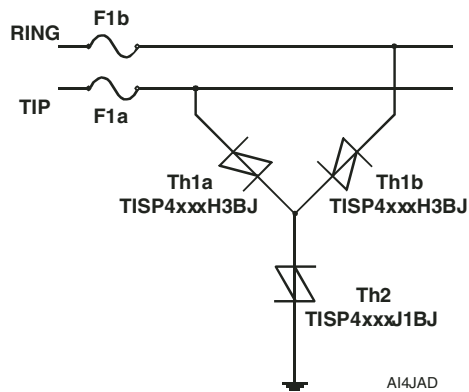


Figure 14. GR-1089-CORE Design

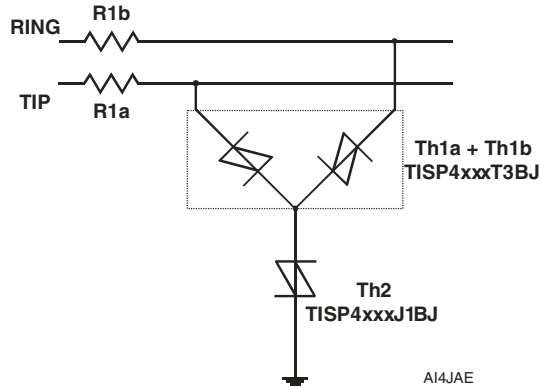


Figure 15. Coordinated ITU-T K Recommendation Design

## ITU-T K.20, K.45 and K.21 Designs

The main impulse voltage wave shape of these recommendations is 10/700. The current wave shape is loading dependent, but it is 5/310 into a short circuit. To coordinate with a ±400 V primary protector a minimum series resistance of 6.5 Ω is required ("The New ITU-T Telecommunication Equipment Resistibility Recommendations", Compliance Engineering Magazine, January-February 2002). The coordination resistance limits the peak non-truncated current to  $\pm 400/6.5 = 62$  A. A suitable Th1a and Th1b protector for these conductor currents is the TISP3xxxT3BJ series of devices, which combine Th1a and Th1b in a single SMB3 package. The ground return protector, Th2, must be rated for at least 124 A of a 5/310 waveshape. Suitable Th2 protectors for these ground currents are the TISP4xxxH3BJ or TISP4xxxJ1BJ series of devices. The arrangement is shown in Figure 15 and the following table lists all the catalogue device combinations. Using the SMB3 packaged TISP3xxxT3BJ saves one third of the PCB placement area compared to solution using three single protector SMB packaged devices.

| RING to TIP Voltages  |                        | RING to GROUND,<br>TIP to GROUND Voltages |                        | ITU-T Y Configuration Parts and Part Voltages<br>R1a = R1b = 6.5 Ω |               |                       |                        |
|-----------------------|------------------------|---|------------------------|--|---------------|-----------------------|------------------------|
| V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V | V <sub>DRM</sub><br>V                     | V <sub>(BO)</sub><br>V | Th1a + Th1b<br>Part #  | Th2<br>Part # | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V |
| ±116                  | ±140                   | ±116                                      | ±140                   | TISP3070T3BJ   | TISP4070J1BJ  | ±58                   | ±70                    |
| ±130                  | ±160                   | ±130                                      | ±160                   | TISP3080T3BJ   | TISP4080J1BJ  | ±65                   | ±80                    |
| ±150                  | ±190                   | ±150                                      | ±190                   | TISP3095T3BJ   | TISP4095J1BJ  | ±75                   | ±95                    |
| ±180                  | ±230                   | ±180                                      | ±230                   | TISP3115T3BJ   | TISP4115J1BJ  | ±90                   | ±115                   |
| ±200                  | ±250                   | ±200                                      | ±250                   | TISP3125T3BJ   | TISP4125J1BJ  | ±100                  | ±125                   |
| ±240                  | ±290                   | ±240                                      | ±290                   | TISP3145T3BJ   | TISP4145J1BJ  | ±120                  | ±145                   |
| ±270                  | ±330                   | ±270                                      | ±330                   | TISP3165T3BJ   | TISP4165J1BJ  | ±135                  | ±165                   |
| ±290                  | ±360                   | ±290                                      | ±360                   | TISP3180T3BJ   | TISP4180J1BJ  | ±145                  | ±180                   |
| ±310                  | ±400                   | ±310                                      | ±400                   | TISP3200T3BJ   | TISP4200J1BJ  | ±155                  | ±200                   |
| ±360                  | ±438                   | ±360                                      | ±438                   | TISP3219T3BJ   | TISP4219J1BJ  | ±180                  | ±219                   |
| ±380                  | ±500                   | ±380                                      | ±500                   | TISP3250T3BJ   | TISP4250J1BJ  | ±190                  | ±250                   |
| ±440                  | ±580                   | ±440                                      | ±580                   | TISP3290T3BJ   | TISP4290J1BJ  | ±220                  | ±290                   |

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# TISP4xxxJ1BJ Overvoltage Protector Series

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## ITU-T K.20, K.45 and K.21 Designs (Continued)

| RING to TIP Voltages  |                        | RING to GROUND,<br>TIP to GROUND Voltages |                        | ITU-T Y Configuration Parts and Part Voltages<br>R1a = R1b = 6.5 Ω |               |                       |                        |
|-----------------------|------------------------|---|------------------------|--|---------------|-----------------------|------------------------|
| V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V | V <sub>DRM</sub><br>V                     | V <sub>(BO)</sub><br>V | Th1a + Th1b<br>Part #  | Th2<br>Part # | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V |
| ±550                  | ±700                   | ±550                                      | ±700                   | TISP3350T3BJ   | TISP4350J1BJ  | ±275                  | ±350                   |
| ±640                  | ±790                   | ±640                                      | ±790                   | TISP3395T3BJ   | TISP4395J1BJ  | ±320                  | ±395                   |

## Asymmetrical Designs

These designs are for special needs, where the RING to TIP protection voltage must be different to the RING to GROUND and TIP to GROUND voltages. ADSL modem interfaces often have a need for asymmetric voltage limiting, see Figure 16. Here, the RING to TIP voltage limitation is given by the d.c. blocking capacitor, C1, and the RING to GROUND and TIP to GROUND limitation is insulation breakdown. Often the breakdown limit is set by the spacing of the PW (Printed Wiring) tracks. Figure 17 shows a solution. Using two ±165 V V<sub>(BO)</sub> parts for Th1a and Th1b, the RING to TIP voltage is limited to ±330 V. Using a higher voltage ±350 V V<sub>(BO)</sub> part for Th2 limits the insulation stress to ±515 V. Figure 17 and its following table is for a GR-1089-CORE compliant design.

| RING to TIP Voltages  |                        | RING to GROUND,<br>TIP to GROUND Voltages |                        | GR-1089-CORE Y Configuration Parts and Part Voltages |                       |                        |              |                       |                        |
|-----------------------|------------------------|---|------------------------|--|-----------------------|------------------------|--------------|-----------------------|------------------------|
| V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V | V <sub>DRM</sub><br>V                     | V <sub>(BO)</sub><br>V | Th1a, Th1b   |                       |                        | Th2          |                       |                        |
|                       |                        |   |                        | Part #   | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V | Part #       | V <sub>DRM</sub><br>V | V <sub>(BO)</sub><br>V |
| ±270                  | ±330                   | ±410                                      | ±515                   | TISP4165H3BJ   | ±135                  | ±165                   | TISP4350J1BJ | ±275                  | ±350                   |

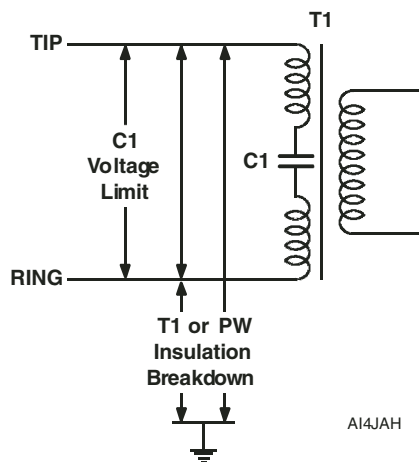


Figure 16. ADSL Modem Interface Voltage Limitations

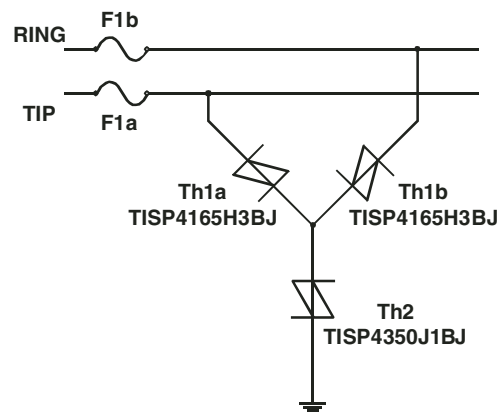


Figure 17. Asymmetrical Design for US ADSL Modems

An ITU-T compliant design would probably require the replacement of the fuses by coordination resistors. With a ±410 V off-state voltage, this may seem unnecessary as modern primary protectors will switch at lower voltages and automatically coordinate. On a perfect longitudinal waveform this is true. However, the ITU-T also applies a transverse (metallic) test as well, to simulate non-simultaneous switching of the primary protection. In this case, one conductor is grounded, which places the RING to TIP protection in parallel with the unswitched primary protector. The ±270 V off-state voltage is likely to be lower than the primary switching voltage and there isn't coordination. Under GR-1089-CORE conditions with non-simultaneous switching, the 100 A 10/1000 current, which should have gone through the unswitched primary protector, is diverted through the top arms of the Y into the switched primary, causing a 200 A current flow in that primary protector.

# TISP4xxxJ1BJ Overvoltage Protector Series



## MECHANICAL DATA

### Recommended Printed Wiring Land Pattern Dimensions



MDXX BID

### Device Symbolization Code

Devices will be coded as below. As the device parameters are symmetrical, terminal 1 is not identified.

| Device     | Symbolization Code |
|------------|--------------------|
| TISP4070J1 | 4070J1             |
| TISP4080J1 | 4080J1             |
| TISP4095J1 | 4095J1             |
| TISP4115J1 | 4115J1             |
| TISP4125J1 | 4125J1             |
| TISP4145J1 | 4145J1             |
| TISP4165J1 | 4165J1             |
| TISP4180J1 | 4180J1             |
| TISP4200J1 | 4200J1             |
| TISP4219J1 | 4219J1             |
| TISP4250J1 | 4250J1             |
| TISP4290J1 | 4290J1             |
| TISP4350J1 | 4350J1             |
| TISP4395J1 | 4395J1             |

### Carrier Information

For production quantities, the carrier will be embossed tape reel pack. Evaluation quantities may be shipped in bulk pack or embossed tape.

| Package | Carrier                 | Standard Quantity |
|---------|-------------------------|-------------------|
| SMB     | Embossed Tape Reel Pack | 3000              |

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 Specifications are subject to change without notice.  
 Customers should verify actual device performance in their specific applications.

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