TISP4290T3BJ, TISP4350T3BJ, TISP4400T3BJ

BIDIRECTIONAL THYRISTOR OVERVOLTAGE PROTECTORS

TISP4xxxT3BJ Overvoltage Protector Series

MODEM Protection against:
-TIA/EIA-IS-968 Type A & B surge
-UL 60950, Clause 6. power cross
-CSA 22.2 No. 60950, Clause 6. power cross

Low Differential Capacitance ..... 23 pF typ.

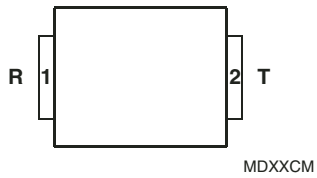
Ion-Implanted Breakdown Region
-Precise and Stable Voltage
-Low Voltage Overshoot Under Surge

Device	V_{DRM} V	$V_{(BO)}$ V
'4290T3	220	290
'4350T3	275	350
'4400T3	335	400

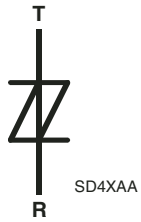
Rated for International Surge Wave Shapes

Wave Shape	Standard	I_{PPSM} A
2/10	GR-1089-CORE	250
8/20	IEC 61000-4-5	250
10/160	TIA/EIA-IS-968	150
10/700	ITU-T K.20/.21/.45	120
9/720	TIA/EIA-IS-968	120
10/560	TIA/EIA-IS-968	100
10/1000	GR-1089-CORE	80

SMB Package (Top View)



Device Symbol



..... UL Recognized Component

How to Order

Device	Package	Carrier	Order As
TISP4xxxT3BJ	BJ (SMB/DO-214AA J-Bend)	R (Embossed Tape Reeled)	TISP4xxxT3BJR-S

Description

These devices are 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 protector consists of a symmetrical voltage-triggered bidirectional thyristor. Overvoltages are initially clipped by breakdown clamping until the voltage rises to the breakover level, which causes the device to crowbar into a low-voltage on state. This low-voltage on state causes the current resulting from the overvoltage to be safely diverted through the device. The high crowbar holding current helps prevent d.c. latchup as the diverted current subsides.These protectors are guaranteed to voltage limit and withstand the listed lightning surges in both polarities.

After a TIA/EIA-IS-968 (replaces FCC Part 68) 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 TISP4350T3BJ connected between the Ring and Tip wires (and without overvoltage protection to ground), the longitudinal 10/160 applied to both Ring and Tip will not activate the TISP4350T3BJ, giving an operational pass. The metallic 10/560 is applied between Ring and Tip wires and will operate the TISP4350T3BJ. As the TISP4350T3BJ has a current rating of 100 A, 10/560 it will survive the FCC Part Type A 100 A, 10/560 metallic surge giving an operational pass.

*RoHS Directive 2002/95/EC Jan 27 2003 including Annex
DECEMBER 2001 - REVISED MAY 2008

Description (Continued)

After a TIA/EIA-IS-968 Type B surge the equipment must be operational. As the TISP4350T3BJ has a current rating of 120 A, it will survive both Type B surges, metallic (25 A, 9/720) and longitudinal (37.5 A, 9/720), giving an operational pass to FCC Part 68 Type B surges.

The TIA/EIA-IS-968 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 TISP4350T3BJ will not clip the B type ringing voltage as it has a high impedance up to 275 V.

Absolute Maximum Ratings, T_A = 25 °C (Unless Otherwise Noted)

Rating		Symbol	Value	Unit
Repetitive peak off-state voltage (see Note 1)	'4290T3 '4350T3 '4400T3	V_{DRM}	±220 ±275 ±335	V
Non-repetitive peak on-state pulse current (see Notes 1 and 2)		I_{PPSM}		A
2/10 (Telcordia GR-1089-CORE, 2/10 voltage wave shape)			±250	
8/20 (IEC 61000-4-5, combination wave generator, 1.2/50 voltage wave shape)			±250	
10/160 (TIA/EIA-IS-968 (replaces FCC Part 68), 10/160 voltage wave shape)			±150	
5/310 (ITU-T K.44, 10/700 voltage wave shape used in K.20/45/21)			±120	
5/320 (TIA/EIA-IS-968 (replaces FCC Part 68), 9/720 voltage wave shape)			±120	
10/560 (TIA/EIA-IS-968 (replaces FCC Part 68), 10/560 voltage wave shape)			±100	
10/1000 (Telcordia GR-1089-CORE, 10/1000 voltage wave shape)			±80	
Non-repetitive peak on-state current (see Notes 1, 2 and 3)		I_{TSM}		A
20 ms (50 Hz), full sine wave			25	
16.7 ms (60 Hz), full sine wave			30	
1000 s 50 Hz/60 Hz			2.1	
Initial rate of rise of on-state current, Linear current ramp, Maximum ramp value < 50 A		di_T/dt	500	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 °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.
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 %/°C for ambient temperatures above 25 °C.

Overload Ratings, T_A = 25 °C (Unless Otherwise Noted)

Rating	Symbol	Value	Unit
Peak overload on-state current, a.c. power line cross tests UL 60950 (see Note 4)	$I_{T(OV)M}$	See Figure 4 for current versus time	A rms

NOTE 4: These electrical stress levels may damage the device silicon chip. After test, the pass criterion is either that the device is functional or, if it is faulty, that it has a short circuit fault mode. In the short circuit fault mode, the following equipment is protected as the device is a permanent short across the line. The equipment would be unprotected if an open circuit fault mode developed.

Recommended Operating Conditions

Component		Min	Typ	Max	Unit
R_S	Series resistor for TIA/EIA-IS-968 (replaces FCC Part 68), 10/160 type A surge survival (T-G or R-G connection)	2.5			Ω
	Series resistor for TIA/EIA-IS-968 (replaces FCC Part 68), 10/560 type A surge survival	0			
	Series resistor for TIA/EIA-IS-968 (replaces FCC Part 68), 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 coordination with a 400 V primary protector	6			

Electrical Characteristics, T_A = 25 °C (Unless Otherwise Noted)

Parameter		Test Conditions		Min	Typ	Max	Unit
I_{DRM}	Repetitive peak off-state current	$V_D = V_{DRM}$	T_A = 25 °C T_A = 85 °C			±5 ±10	μA
$V_{(BO)}$	AC breakover voltage	dv/dt = ±250 V/ms, R_{SOURCE} = 300 Ω	'4290T3 '4350T3 '4400T3			±290 ±350 ±400	V
$I_{(BO)}$	AC breakover current	dv/dt = ±250 V/ms, R_{SOURCE} = 300 Ω				±800	A
V_T	On-state voltage	I_T = ±5 A, t_W = 100 μs				±3	V
I_H	Holding current	I_T = ±5 A, di/dt = +/-30 mA/ms		±150			A
dv/dt	Critical rate of rise of off-state voltage	Linear voltage ramp, Maximum ramp value < 0.85 V_{DRM}		±5			kV/μs
I_D	Off-state current	V_D = ±50 V	T_A = 85 °C			±10	μA
C_{off}	Off-state capacitance	f = 1 MHz, V_d = 1 V rms, V_D = 0, f = 1 MHz, V_d = 1 V rms, V_D = -1 V f = 1 MHz, V_d = 1 V rms, V_D = -2 V f = 1 MHz, V_d = 1 V rms, V_D = -50 V f = 1 MHz, V_d = 1 V rms, V_D = -100 V			54 48 43 20 16	65 58 52 24 19	pF

Thermal Characteristics

Parameter		Test Conditions	Min	Typ	Max	Unit
$R_{\theta JA}$	Junction to free air thermal resistance	EIA/JESD51-3 PCB, T_A = 25 °C, (see Note 5)			115	°C/W
		265 mm x 210 mm populated line card, 4-layer PCB, $I_T = I_{TSM(1000)}$, T_A = 25 °C		52		

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

Parameter Measurement Information

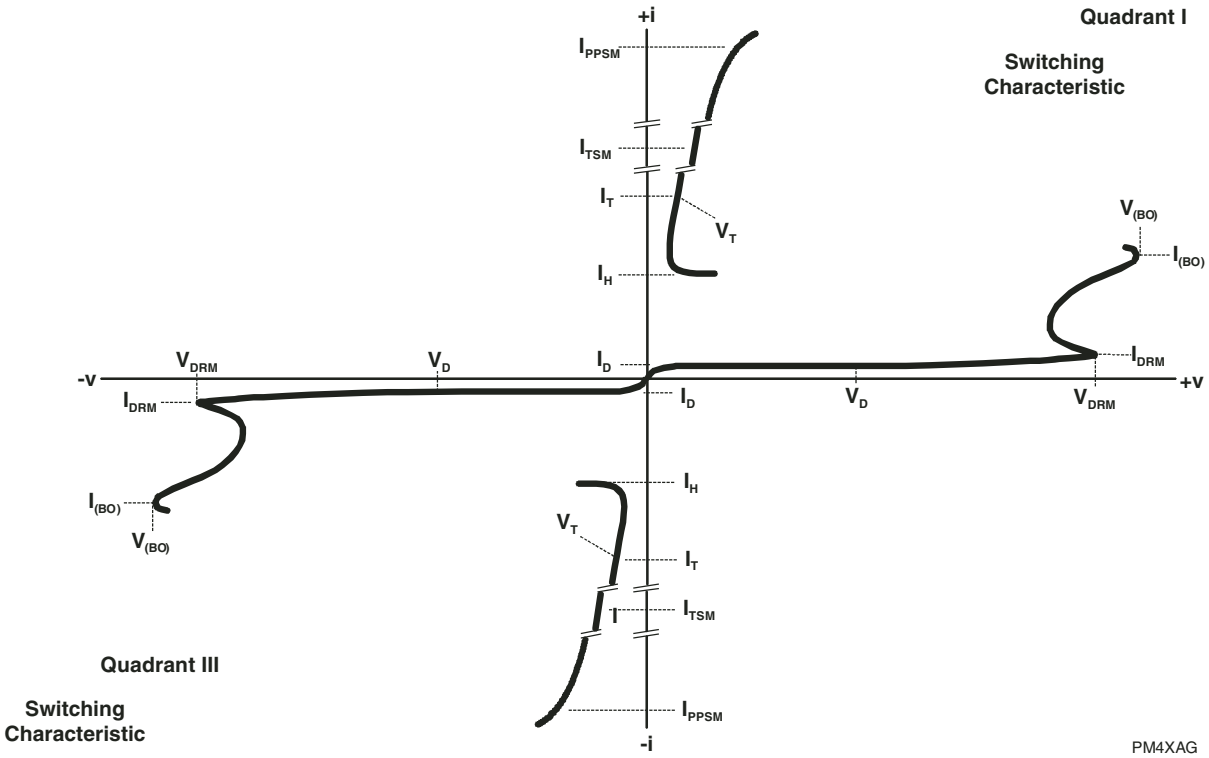


Figure 1. Voltage-Current Characteristic for T and R Terminals
All Measurements are Referenced to the R Terminal

Typical Characteristics

NORMALIZED CAPACITANCE vs OFF-STATE VOLTAGE

TC4TAA

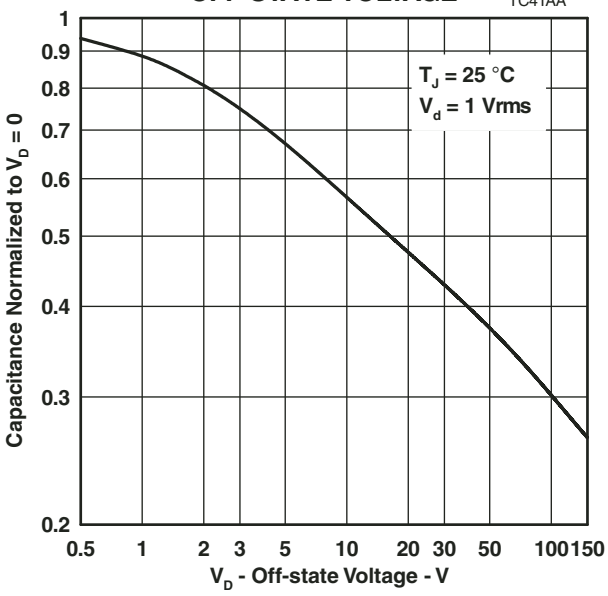


Figure 2.

TYPICAL CAPACITANCE ASYMMETRY vs OFF-STATE VOLTAGE

TC4TAB

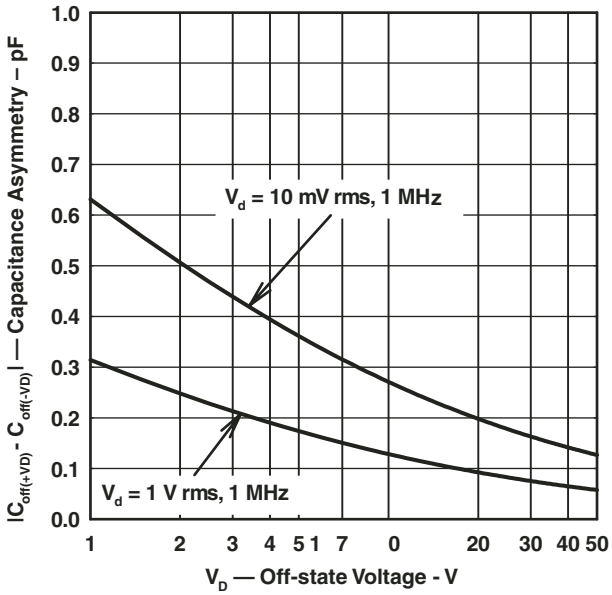


Figure 3.

Rating and Thermal Information

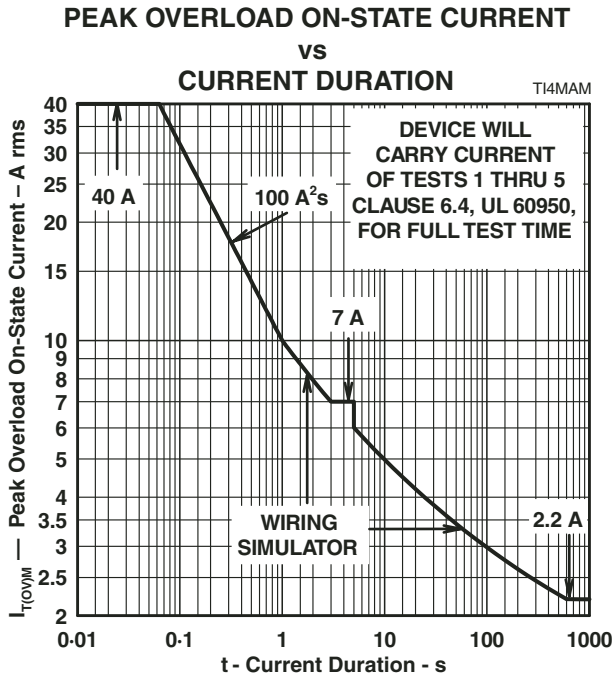


Figure 4. Peak Overload On-state Current against Duration