TSIxxB1

Application Specific Discretes
A.S.D.™

TERMINAL SET INTERFACE PROTECTION AND DIODE BRIDGE

MAIN APPLICATION

Telecom equipment requiring combined protection against transient overvoltages and rectification by diode bridge :

- Telephone set
- Base station for cordless set
- Fax machine
- Modem
- Caller Id equipment
- Set top box

DESCRIPTION

The TSIxxB1 provides the diode bridge and the crowbar protection function that can be found in most of telecom terminal equipment.

Integrated monolithically within a SO8 package, this ASD device allows space saving on the board and greater reliability.

FEATURES

- STAND-OFF VOLTAGE FROM 62V TO 265V
- PEAK PULSE CURRENT : 30 A (10/1000 μs)
- MAXIMUM DC CURRENT : I_F = 0.2 A
- HOLDING CURRENT :150 mA

IN ACCORDANCE WITH THE FOLLOWING STANDARDS :

CCITT K17 - K20	10/700	μs	1.5 kV
	5/310	μs	38A
VDE 0433	10/700	μs	2 kV
	5/310	μs	40A(*)
CNET	0.5/700	μs	1.5 kV
	0.2/310	μs	38A
Bellcore TR-NWT-000974:	10/1000	μs	1 kV
	10/1000	μs	30A(*)
FCC Part 68	2/10	μs	2.5 kV
	2/10	μs	75A (*)

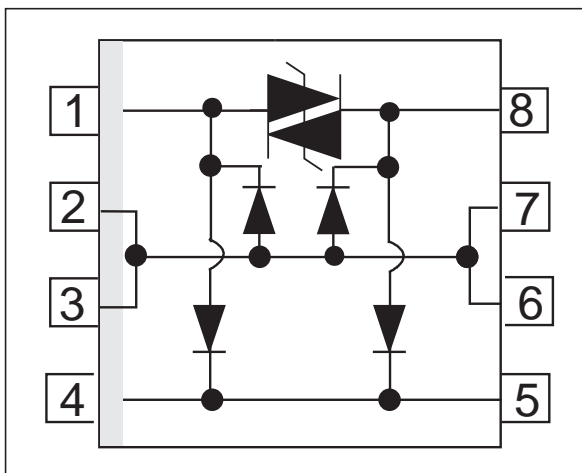**MIL STD883C Method 3015-6**

(*) with series resistor or PTC.

TM: ASD is trademarks of SGS-THOMSON Microelectronics.
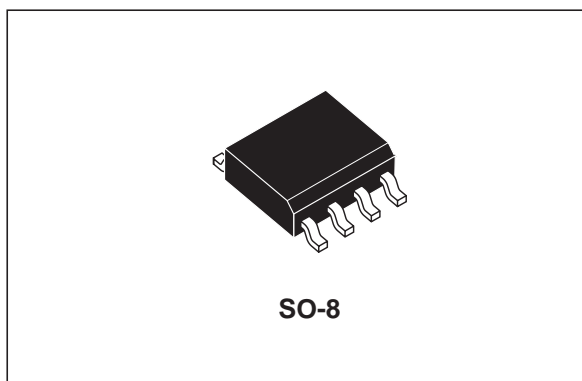
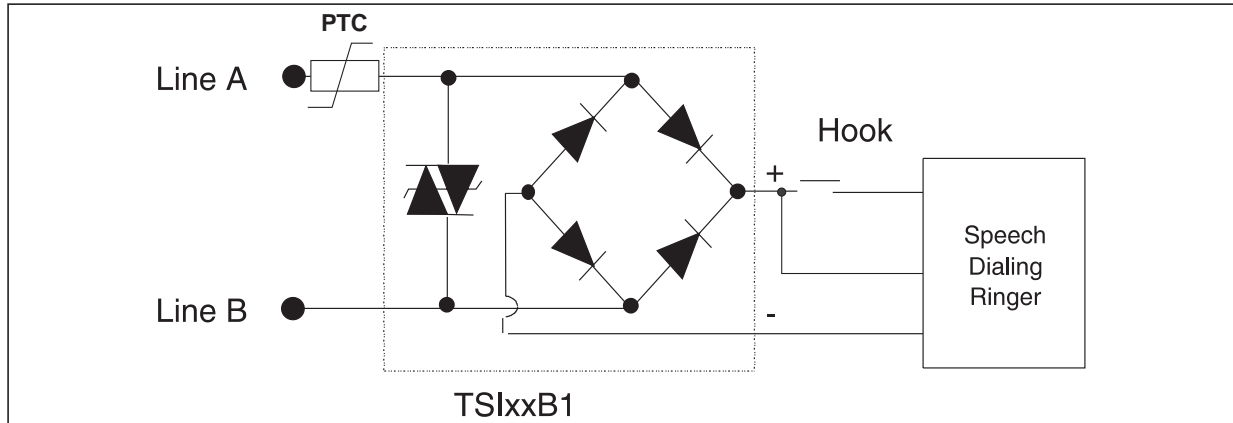**SO-8**

SCHEMATIC DIAGRAM

BENEFITS

- Diode bridge for polarity guard and crowbar protection within one device.
- Single chip for greater reliability
- Reduces component count versus discrete solution
- Saves space on the board

TYPICAL APPLICATION

Telecom terminals have a diode bridge for polarity guard, located at the line interface stage. They also have above this diode bridge one crowbar protection device that is mandatory to prevent atmospheric effects and AC mains disturbances from damaging the electronic circuitry that follows the diode bridge.

SGS-THOMSON proposes a one chip device that includes both protection and diode bridge. This is the concept of the TSIxxB1 devices.

Fig. 1 : The various uses of the TSIxxB1 in a conventional telecom network
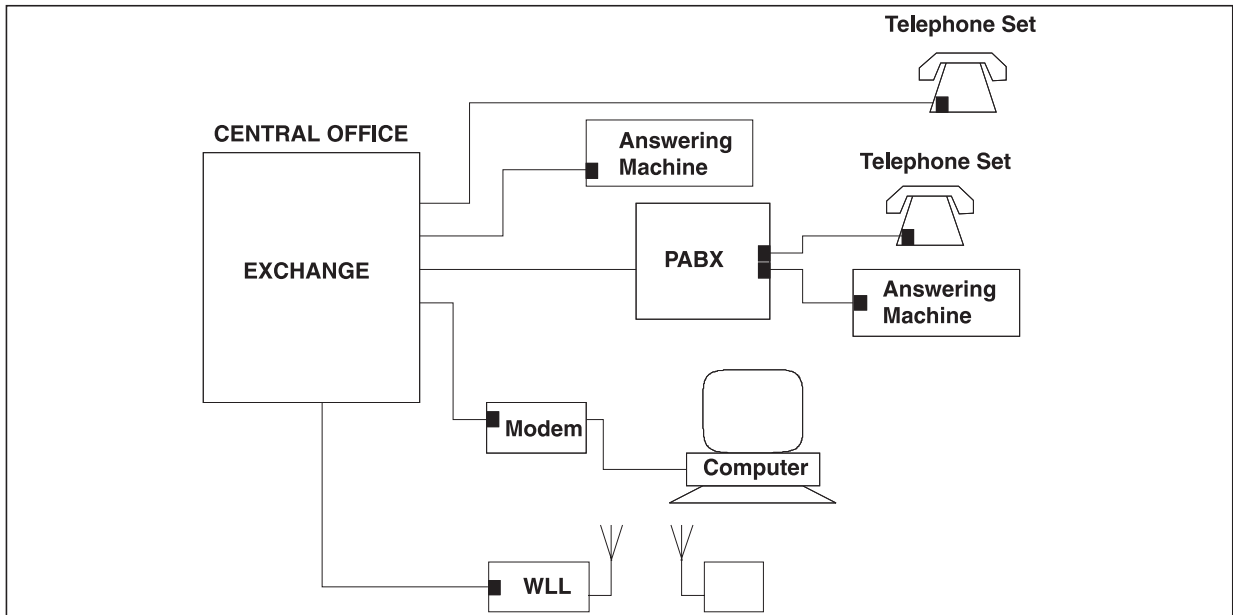
ELECTRICAL PARAMETERS

The V_{RM} value corresponds to the maximum voltage of the application in normal operation. For instance, if the maximum line voltage is ranging between $\int 100V_{RMS}$ of ringing plus 48V of battery voltage, then the protection chosen for this application shall have a V_{RM} close to 200V.

The V_{BO} is the triggering voltage. This indicates the voltage limit for which the component short-circuits. Passing this V_{BO} makes the device turn on.

The I_{BO} is the current that makes the device turn on. Indeed, if we want a Trisil to be turned on not only the voltage across it shall pass the V_{BO} value but the current through it shall also pass the I_{BO} value.

In other words, if a voltage surge occurring on the line is higher than the V_{BO} value of a Trisil, whereas the line surge current is limited to a value that does not exceed the Trisil's I_{BO} value, then the Trisil will never turn into short circuit. At this time the surge will be clamped by the Trisil.

Anyhow the electronic circuitry located after the Trisil will always be protected whatever the Trisil state is (crowbar or clamping mode).

The I_H stands for the holding current. When the Trisil is turned on, as soon as the crossing current surge gets lower than this I_H value, the Trisil protection device turns back in its idle state.

Remark : for this reason the Trisil 's I_H value shall be chosen higher than what the maximum telecom line current can be.

TSIxxB1 BEHAVIOUR WITH REGARD TO SURGE STANDARD :

The TSIxxB1 is able to replace both diode bridge and usual discrete protection on telecom terminals. Furthermore it complies with the CCITT K17 recommendations :

10/700 µs waveform surge test, $\int$ 1.5kV

AC power induction test

AC power contact test

Fig. 2 : Test circuit for the CCITT K17 recommendations
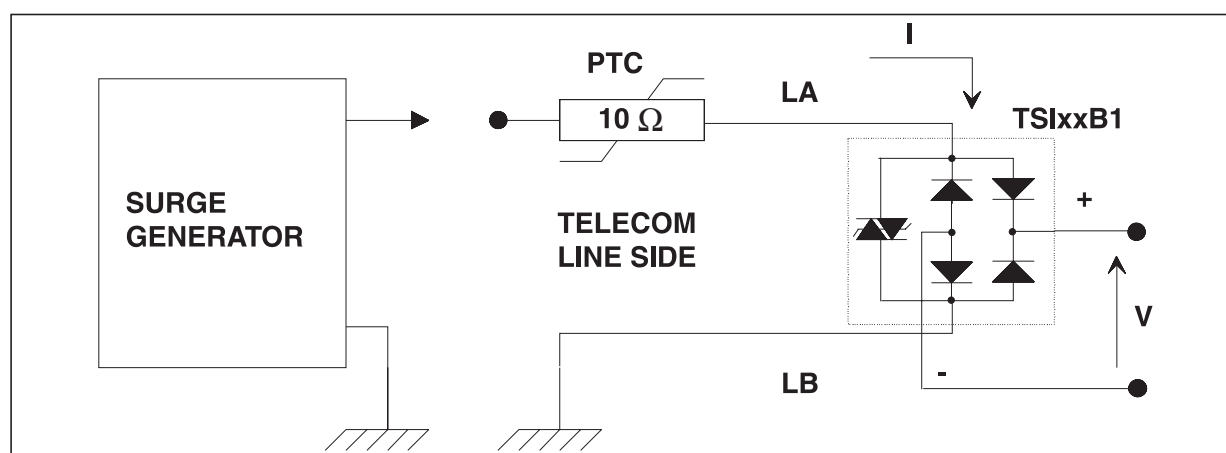
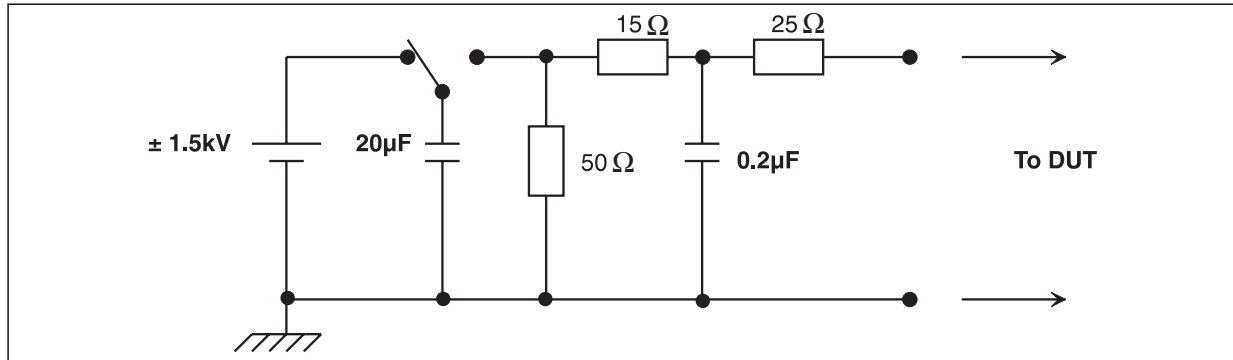## TEST # 1
LIGHTNING SIMULATION

This test concerns the 10/700 µs waveform surge, ± 1.5 kV.

The surge generator used for the test has the following circuitry (fig.2).

Fig. 2 : 10/700 µs waveform surge generator circuit

The behaviour of the TSI200B1 to this lightning surge is given below (fig. 3).

Fig. 3 : Voltage across the TSI200B1 at the + and - terminations and current throught it for a 1.5 kV positive surge (fig.3a) and negative surge (fig. 3b)
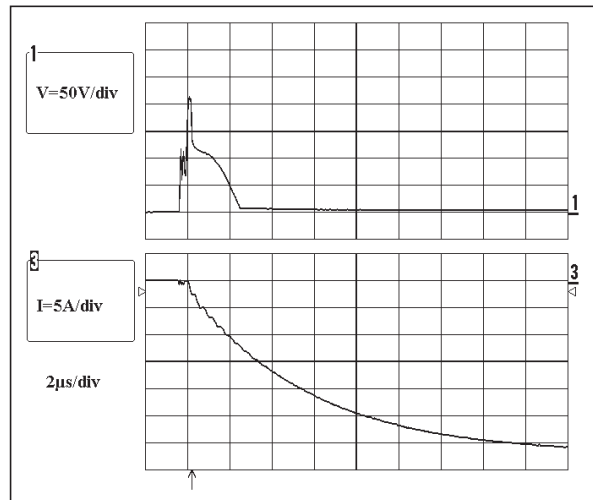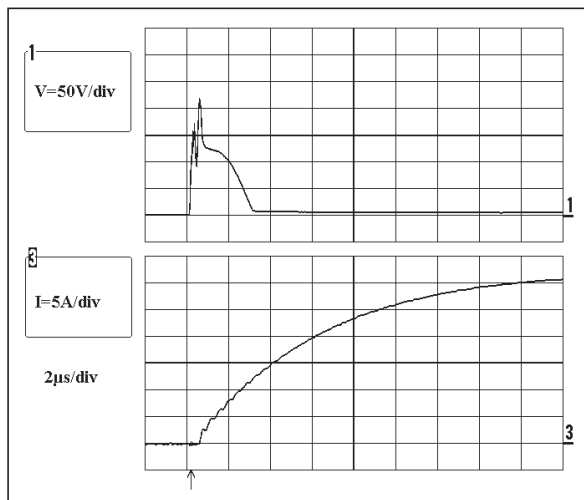

These curves show the peak voltage the surge generates across the TSI200B1 + and - terminations. This lasts a short time (′ 2 µs) and after, as the internal protection gehaves like a short circuit. The voltage drop across the TSIxxB1 becomes a few volts. In the meanwhile all the surge current flows in the protection.

As far as the 10/700 µs waveform surge test is concerned,the TSIxxB1 withstand the ±1.5 kV test.

TEST # 2
AC POWER INDUCTION TEST

This test simulates the induction phenomena that can happen between telecom lines and AC mains lines (fig. 4).

Fig. 4 : AC power induction test circuit
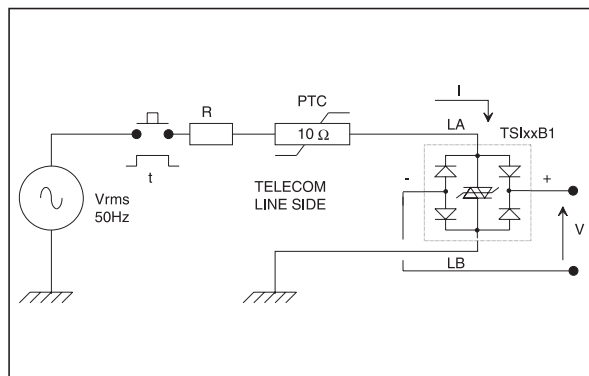
Part #1

test conditions : V_{RMS} = 240 V
R = 600 Ω
t = 0.2 s

Part #2

test conditions : V_{RMS} = 600 V
R = 600 Ω
t = 0.2 s

Fig. 5 : Voltage at the + and - terminations of the TSI200B1, and current through it
while test part 1 is applied.
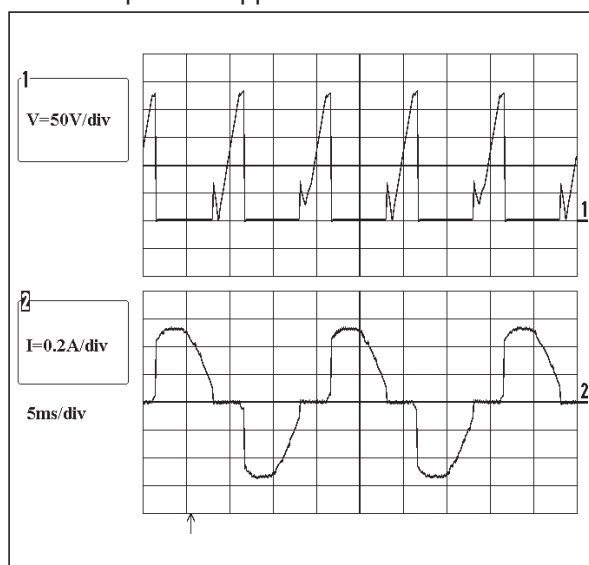
The TSIxxB1 withstand the AC power induction test in both cases.

TEST #3
AC POWER CONTACT TEST

This test simulates the direct contact between the telecom lines and the AC mains lines.

The AC power contact test consists in applying 240V$_{RMS}$ through a 10Ω PTC during 15 minutes long on the device under test. The CCITT K17 recommendation specifies an internal generator impedance allowing 10 A$_{RMS}$ when in short circuit.

The behavior of the TSI200B1 with respect to this surge is given in figure 6.

Fig. 6 : Voltage at the TSI200B1 + & - terminations and the current through it.
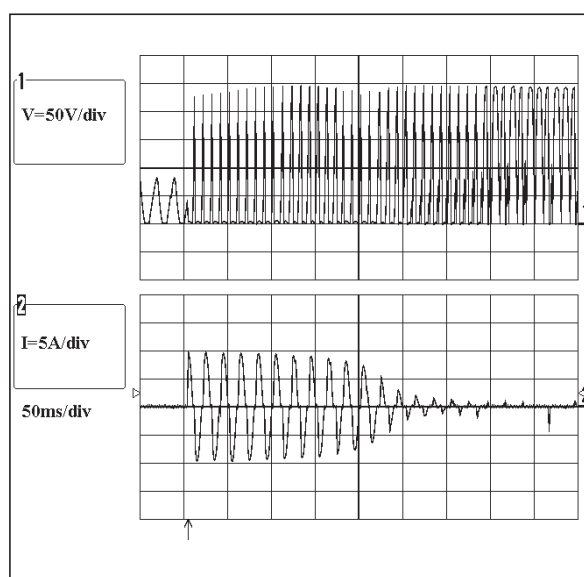
The figure 6 shows that after 250ms there is no current anymore flowing through the TSI200B1 device. This is due to the action of the serial PTC that limits the current through the line. This PTC is <u>mandatory</u> for this test. It can also be replaced by a fuse or any other serial protection that "opens" the line loop under AC contact test.
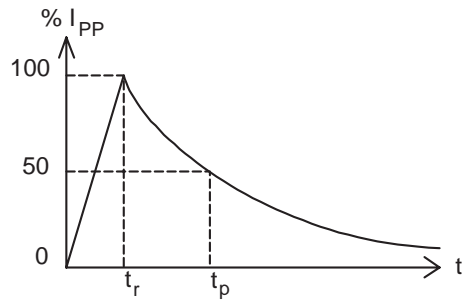
ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25°C)

Symbol	Parameter		Value	Unit
I_{PP}	Non repetitive peak on-sate current (see note 1) 10/1000 µs (open circuit voltage wave shape 10/100 µs) 5/310 µs (open circuit voltage wave shape 10/700 µs) 2/10 µs (open circuit voltage wave shape 2/10 µs)		30 40 75	A
I_F	Maximum DC current		0.2	A
I_{TSM}	Non repetitive surge peak on-state current	t_p = 20 ms t = 1s	5 3.5	A
T_{stg} T_j	Storage temperature range Maximum junction temperature		- 55 to +150 150	°C
T_L	Maximum lead temperature for soldering during 10 s		260	°C

Note 1 : Pulse waveform :

10/1000µs	t_r=10µs	t_p=1000µs
5/310µs	t_r=5µs	t_p=310µs
2/10µs	t_r=2µs	t_p=10µs

THERMAL RESISTANCE

Symbol	Parameter	Value	Unit
$R_{th(j-a)}$	Junction to ambient	170	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb}=25°C)

Symbol	Parameter
V_{RM}	Stand-off voltage
V_{BO}	Breakover voltage
V_{BR}	Breakdown voltage
I_H	Holding current
I_{BO}	Breakover current
I_{RM}	Leakage current at V_{RM}
I_{PP}	Peak pulse current
C	Capacitance
αT	Temperature coefficient
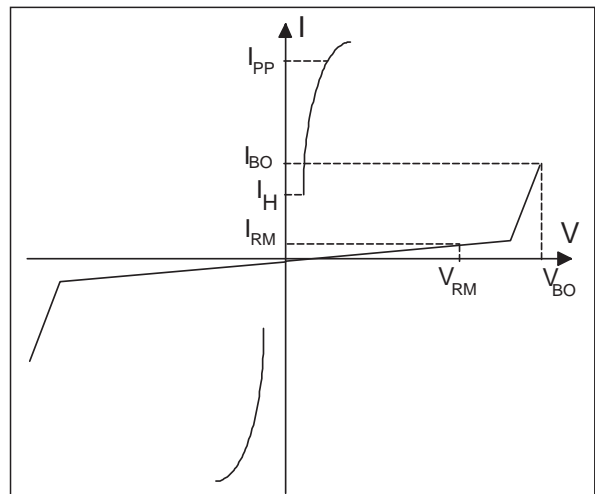
ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C)

1 - PROTECTION DEVICES PARAMETERS

Type	I_{RM} @ V_{RM}		V_{BO} @ I_{BO} note1	I_H note2	I_{BO} note1		C note3
	μA	V	V	mA	mA	mA	pF
	max.		max.	min.	min.	max.	typ.
TSI62B1	1 5	50 62	90	150	50	400	200
TSI180B1	1 5	50 180	250	150	50	400	200
TSI200B1	1 5	50 200	290	150	50	400	200
TSI220B1	1 5	50 220	330	150	50	400	200
TSI265B1	1 5	50 265	380	150	50	400	200

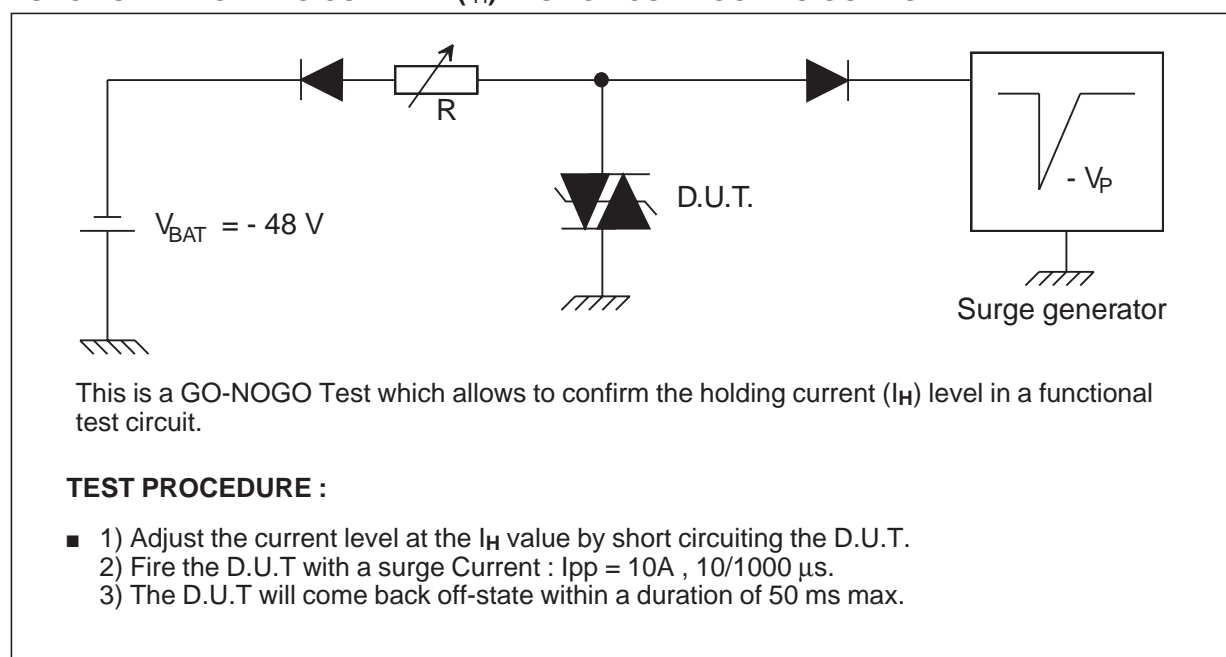**Note 1 :** Measured at 50 Hz, one cycle
Note 2 : See test cricuit
Note 3 : V_R = 0V, F = 1MHz, between pins 1 and 8.

2 - DIODE BRIDGE PARAMETERS

Symbol	Test condition	Value	Unit
V_F (for one diode)	I_F = 20 mA I_F = 100 mA	0.9 1.1	V V

FUNCTIONAL HOLDING CURRENT (I_H) TEST CIRCUIT : GO - NO GO TEST

This is a GO-NOGO Test which allows to confirm the holding current (I_H) level in a functional test circuit.

TEST PROCEDURE :

- 1) Adjust the current level at the I_H value by short circuiting the D.U.T.
  2) Fire the D.U.T with a surge Current : Ipp = 10A , 10/1000 μs.
  3) The D.U.T will come back off-state within a duration of 50 ms max.

MARKING

Type	Marking
TSI62B1	TSI62
TSI180B1	TSI180
TSI200B1	TSI200
TSI220B1	TSI220
TSI265B1	TSI265

ORDER CODE

TSI   265   B   1   RL

Terminal
Set
Interface

V_{BRmin}

RL = Tape & reel (2500pcs)
= Tube (100pcs)

SO-8 Package
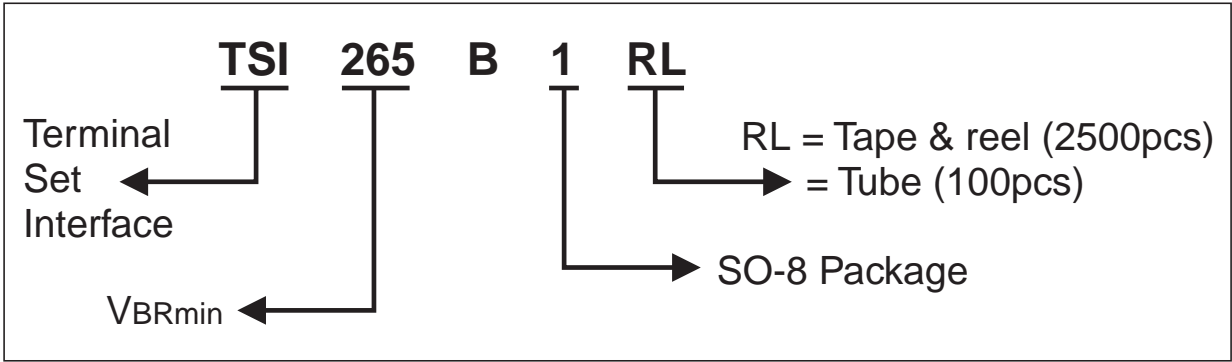
PACKAGE MECHANICAL DATA
SO-8

REF.	DIMENSIONS					
	Millimetres			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C		0.50			0.020	
c1	45° (typ)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max)					

Packaging : product supplied in tape and reel or antistatic tubes.