

## Tripolar overvoltage protection for network interfaces

### Features

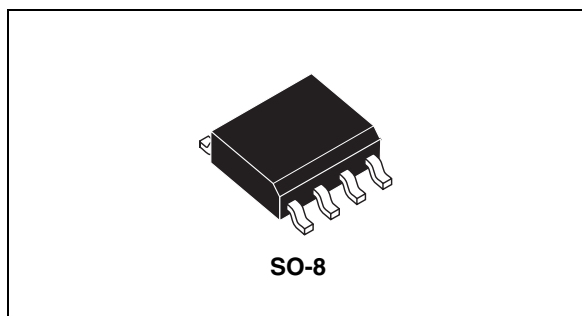
- Triple crowbar protection
- Low capacitance
- Low holding current:  $I_H = 30 \text{ mA}$  minimum
- Surge current:  
 $I_{PP} = 200 \text{ A}$ , 2/10  $\mu\text{s}$   
 $I_{PP} = 30 \text{ A}$ , 10/1000  $\mu\text{s}$

### Benefits

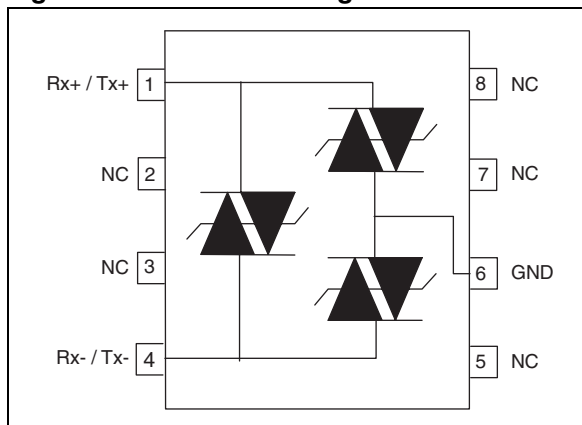
- Trisil™ technology is not subject to ageing and provides a fail safe mode in short circuit for a better protection.
- This device can be used to help equipment to meet main standards such as UL1950, IEC 950 / CSA C22.2 and UL1459.
- Trisils have UL94 V0 approved resin.
- SO8 package is JEDEC registered.
- Trisils comply with the following standards GR-1089 Core, ITU-T-K20/K21, VDE0433, VDE0878, IEC 61000-4-2.

### Applications

Dedicated to data line protection, this device provides a tripolar protection function. It ensures the same protection capability with the same breakdown voltage in both common and differential modes.



**Figure 1. Schematic diagram**



### Description

The TPN is a low capacitance transient surge arrester designed for protection of high debit rate communication networks. Its low capacitance avoids distortion of the signal as it has been designed for T1/E1 and Ethernet networks.

**TM:** Trisil is a trademark of STMicroelectronics

# 1 Characteristics

**Table 1. Compliant with the following standards**

	Peak surge voltage (V)	Voltage waveform (μs)	Required peak current (A)	Current waveform (μs)	Minimum serial resistor to meet standard (Ω)
<b>GR-1089-CORE First level</b>	2500 1000	2/10 10/1000	500 100	2/10 10/1000	7.5 25
<b>GR-1089-CORE Intrabuilding</b>	1500	2/10	100	2/10	0
<b>ITU-T-K20/K21</b>	1000	10/700	25	5/310	0
<b>ITU-T-K20 (IEC 61000-4-2)</b>	6000 8000	1/60 ns	ESD contact discharge ESD air discharge		- -
<b>VDE0433</b>	4000 2000	10/700	100 50	5/310	40 0
<b>VDE0878</b>	4000 2000	1.2/50	100 50	1/20	0 0
<b>IEC 61000-4-5</b>	2000 2000	10/700 1.2/50	50 50	5/310 8/20	0 0

**Table 2. Absolute ratings ( $T_{amb} = 25^{\circ}\text{C}$ )**

Symbol	Parameter	Value	Unit
$I_{PP}$	Peak pulse current: $t_r / t_p$	10/1000 8/20 10/560 5/310 10/160 1/20 2/10	30 100 40 50 75 100 200
$I_{TSM}$	Non repetitive surge peak on-state current One cycle	50 Hz 60 Hz	8 9
	Non repetitive surge peak on-state current ( $F = 50\text{Hz}$ )	0.2 s 2 s	3 1.5
$T_{stg}$	Storage temperature range	-55 to +150	$^{\circ}\text{C}$
$T_j$	Operating junction temperature range	-40 to +150	$^{\circ}\text{C}$
$T_L$	Maximum lead temperature for soldering during 10s	260	$^{\circ}\text{C}$

**Table 3. Thermal resistances**

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

**Table 4. Electrical characteristics - definitions ( $T_{amb} = 25^{\circ}C$ )**

Symbol	Parameter
$V_{RM}$	Stand-off voltage
$I_{RM}$	Leakage current at stand-off voltage
$V_R$	Continuos Reverse voltage
$V_{BR}$	Breakdown voltage
$V_{BO}$	Breakover voltage
$I_H$	Holding current
$I_{BO}$	Breakover current
$I_R$	Continuos reverse voltage
$I_{PP}$	Peak pulse current
C	Capacitance

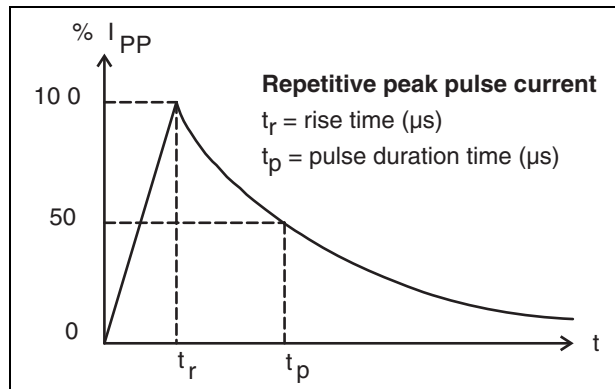
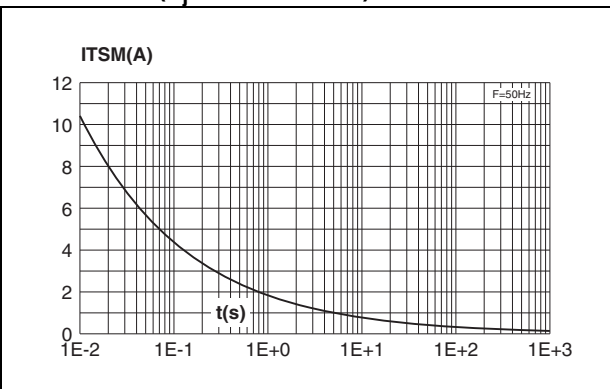
**Table 5. Static parameters**

Order code	$I_{RM}$ max. @ $V_{RM}$		$V_{BO}^{(1)}$ max. @ $I_{BO}$		$I_H^{(2)}$ min.	$C^{(3)}$ typ.
	$\mu A$	V	V	mA	mA	pF
TPN3021	4	28	38	300	30	16

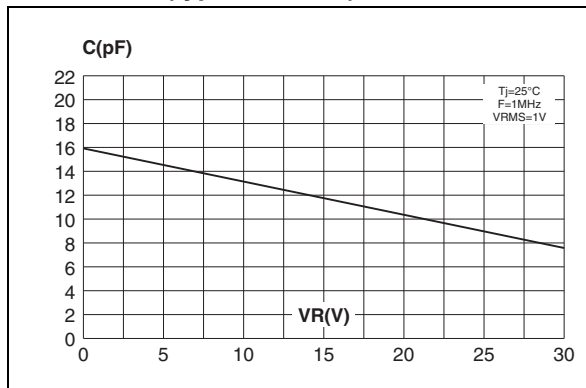
1. See [Figure 6: Test circuit 1 for IBO and VBO parameters](#).

2. See [Figure 7: Test circuit 2 for dynamic I<sub>H</sub> parameter](#)

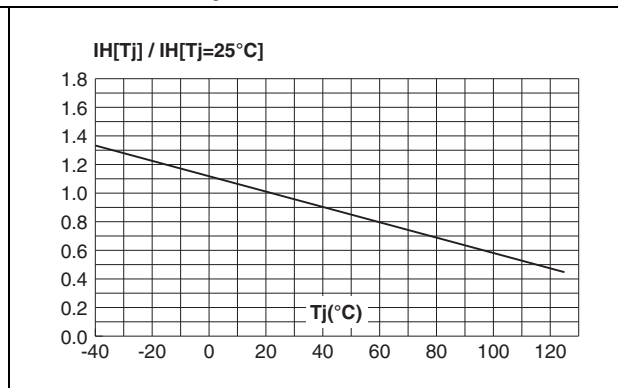
3.  $V_R = 0$  V bias,  $V_{RMS} = 1$  V,  $F = 1$  MHz

**Figure 2. Pulse waveform****Figure 3. Non repetitive surge peak on-state current versus overload duration ( $T_j$  initial =  $25^{\circ}C$ )**

**Figure 4. Variation of junction capacitance versus reverse voltage applied (typical values)**



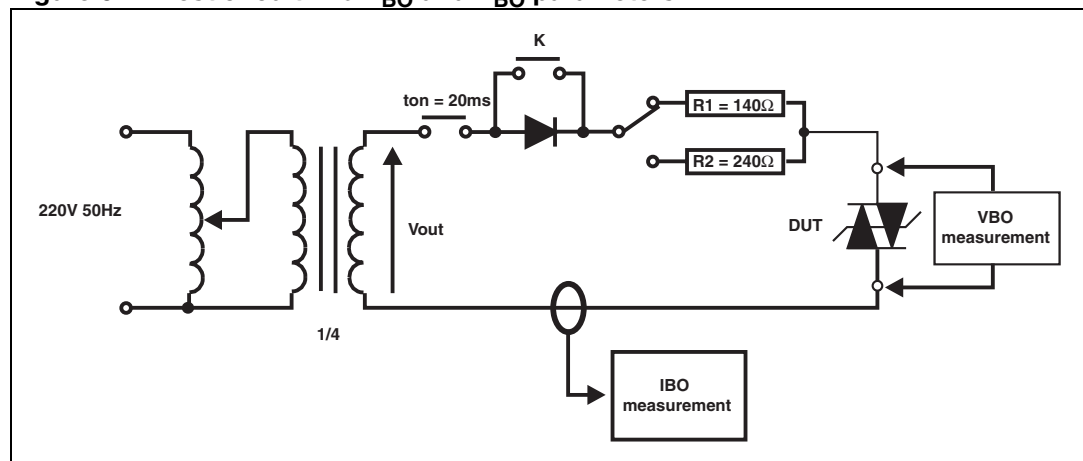
**Figure 5. Relative variation of holding current versus junction temperature**



## 2 Test circuits

### 2.1 Test procedure for test circuit 1

**Figure 6. Test circuit 1 for  $I_{BO}$  and  $V_{BO}$  parameters**



Pulse test duration ( $t_p = 20$  ms):

- For bidirectional devices = switch K is closed
- For unidirectional devices = switch K is open

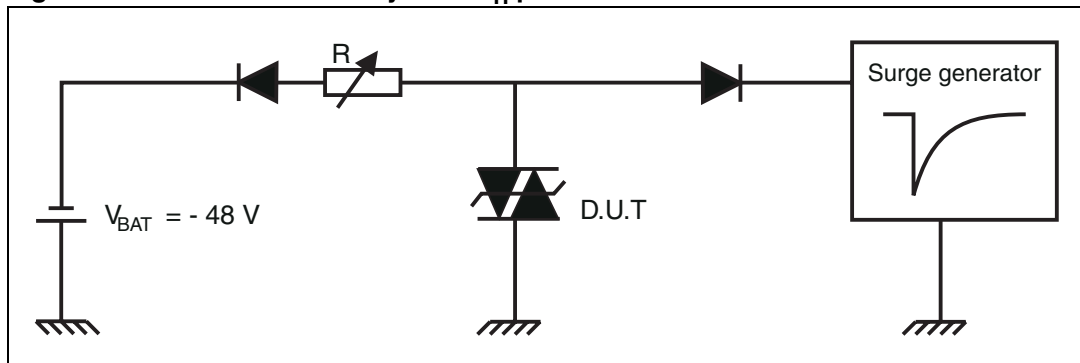
$V_{OUT}$  selection:

Device with  $V_{BO} < 200$  V,  $V_{OUT} = 250 V_{RMS}$ ,  $R1 = 140 \Omega$

Device with  $V_{BO} \geq 200$  V,  $V_{OUT} = 480 V_{RMS}$ ,  $R2 = 240 \Omega$

## 2.2 Test procedure for test circuit 2

Figure 7. Test circuit 2 for dynamic  $I_H$  parameter



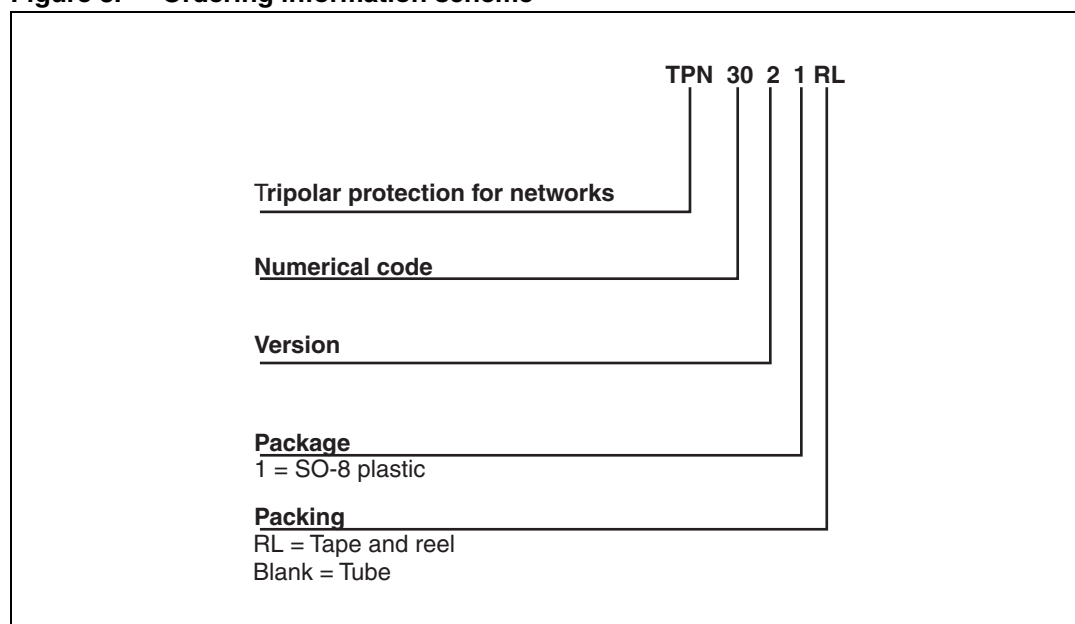
This is a go no-go test, which can confirm the holding current ( $I_H$ ) level.

### Procedure

1. Adjust the current level at the  $I_H$  value by short circuiting the AK of the D.U.T.
2. Fire the D.U.T. with a surge current  $I_{PP} = 10\text{ A}$ ,  $10/1000\mu\text{s}$ .
3. The D.U.T. will come back off-state within 50 ms maximum.

### 3 Ordering information scheme

Figure 8. Ordering information scheme



## 4 Package information

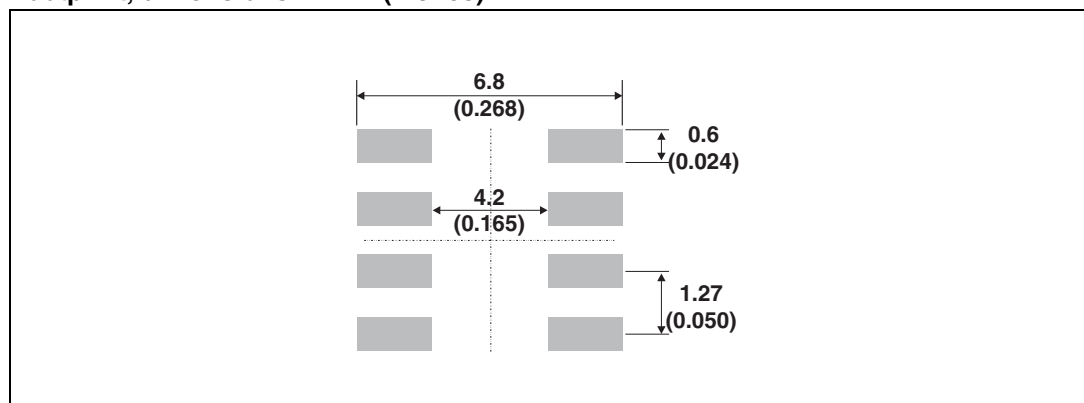
- Epoxy meets UL94, V0
- Lead-free package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Table 6. SO-8 dimensions**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.1		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
C	0.17		0.23	0.007		0.009
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.041	
k	0°		8°	0°		8°
ppp			0.10			0.004

**Footprint, dimensions in mm (inches)**



## 5 Ordering information

**Table 7. Ordering information**

Ordering code	Marking	Package	Weight	Base qty	Delivery mode
TPN3021	TPN302	SO-8	0.08g	100	Tube
TPN3021RL <sup>(1)</sup>	TPN302			2500	Tape and reel

1. Preferred device

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
Sep-2001	3	Previous release
07-Feb-2006	4	Reformatted to current template. Maximum junction temperature parameter replaced by Operating junction temperature range in Table 3. Added footnote 1 to Ordering information table.
25-Jun-2010	5	Updated trademark statement.



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