

## Tripolar overvoltage protection for network interfaces

### Features

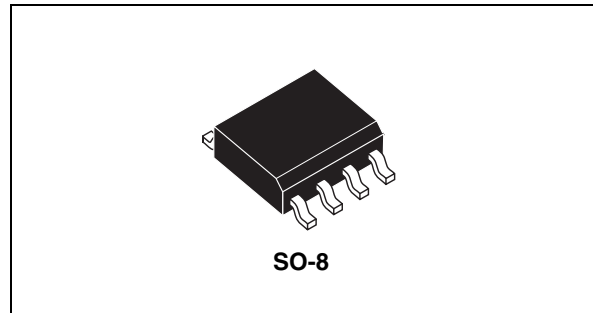
- Triple crowbar protection
- Low capacitance
- Low holding current:  $I_H = 30 \text{ mA}$  minimum
- Surge current:  
 $I_{PP} = 200 \text{ A}$ , 2/10  $\mu\text{s}$   
 $I_{PP} = 30 \text{ A}$ , 10/1000  $\mu\text{s}$

### Benefits

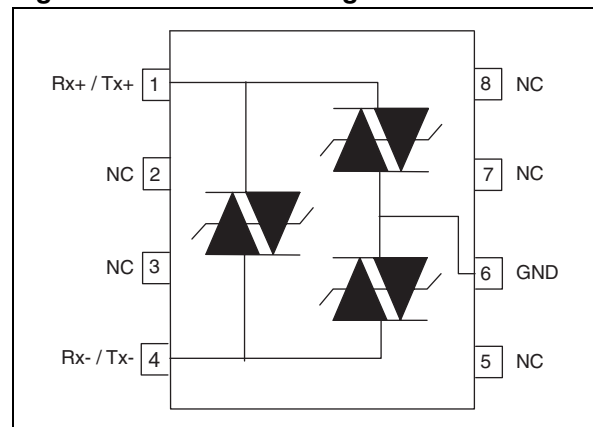
- Trisil™ technology is not subject to ageing and provides a fail safe mode in short circuit for a better protection.
- This device can be used to help equipment to meet main standards such as UL1950, IEC 950 / CSA C22.2 and UL1459.
- Trisils have UL94 V0 approved resin.
- SO8 package is JEDEC registered.
- 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<br>1000           | 2/10<br>10/1000       | 500<br>100                                 | 2/10<br>10/1000       | 7.5<br>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<br>8000           | 1/60 ns               | ESD contact discharge<br>ESD air discharge |                       | -<br>-                                       |
| <b>VDE0433</b>                    | 4000<br>2000           | 10/700                | 100<br>50                                  | 5/310                 | 40<br>0                                      |
| <b>VDE0878</b>                    | 4000<br>2000           | 1.2/50                | 100<br>50                                  | 1/20                  | 0<br>0                                       |
| <b>IEC 61000-4-5</b>              | 2000<br>2000           | 10/700<br>1.2/50      | 50<br>50                                   | 5/310<br>8/20         | 0<br>0                                       |

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

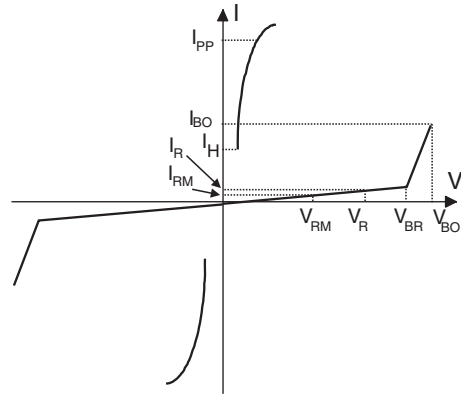
| Symbol    | Parameter                                                        | Value                                                        | Unit                                      |
|-----------|------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------|
| $I_{PP}$  | Peak pulse current: $t_r / t_p$                                  | 10/1000<br>8/20<br>10/560<br>5/310<br>10/160<br>1/20<br>2/10 | 30<br>100<br>40<br>50<br>75<br>100<br>200 |
| $I_{TSM}$ | Non repetitive surge peak on-state current One cycle             | 50 Hz<br>60 Hz                                               | 8<br>9                                    |
|           | Non repetitive surge peak on-state current ( $F = 50\text{Hz}$ ) | 0.2 s<br>2 s                                                 | 3<br>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                          |

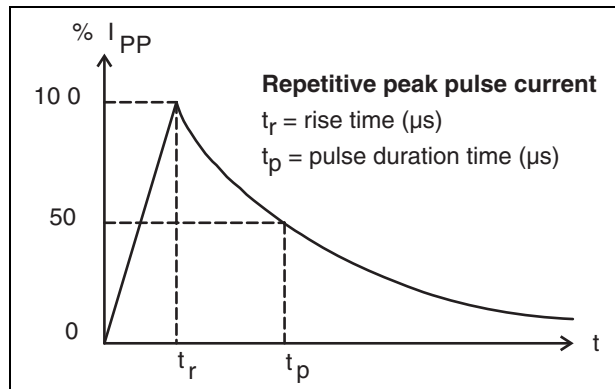
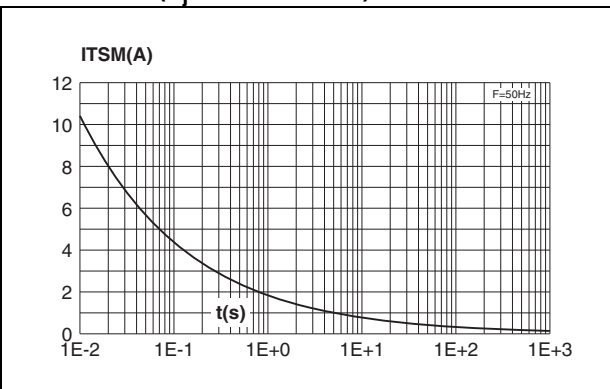
**Table 5. Static parameters**

| 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             |

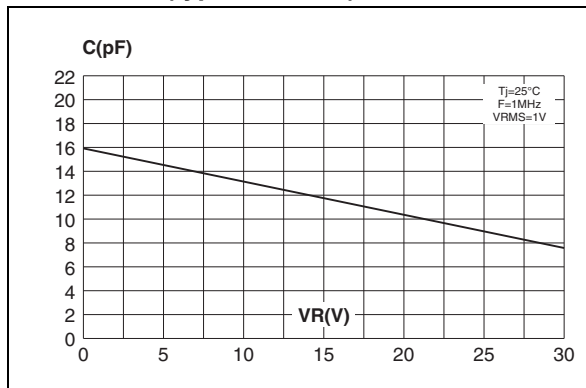
1. See [Figure 6: Test circuit 1 for IBO and VBO parameters](#).

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

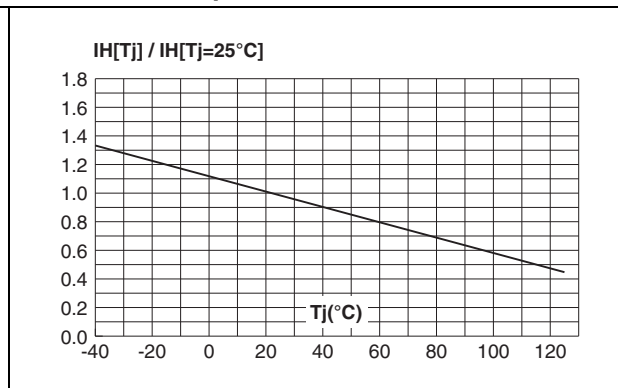
3.  $V_R = 0$  V bias,  $V_{RMS} = 1$  V,  $F = 1$  MHz

**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)**



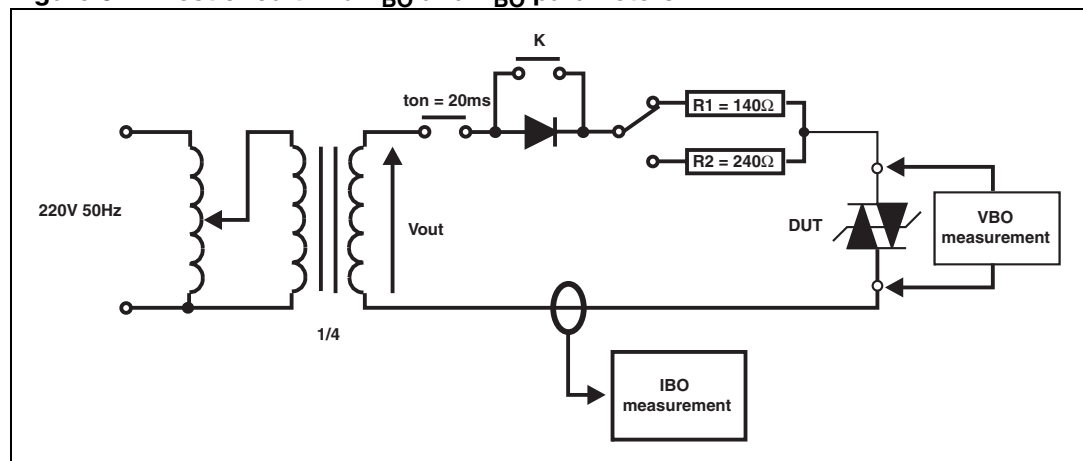
**Figure 5. Relative variation of holding current versus junction temperature**



## 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

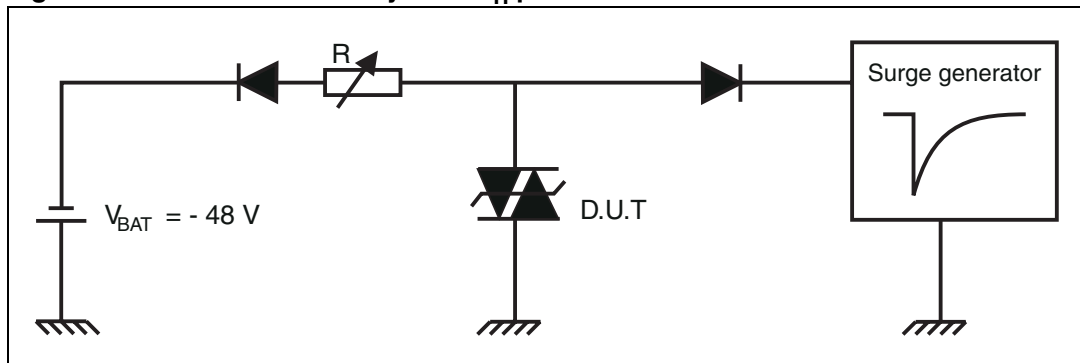
$V_{OUT}$  selection:

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



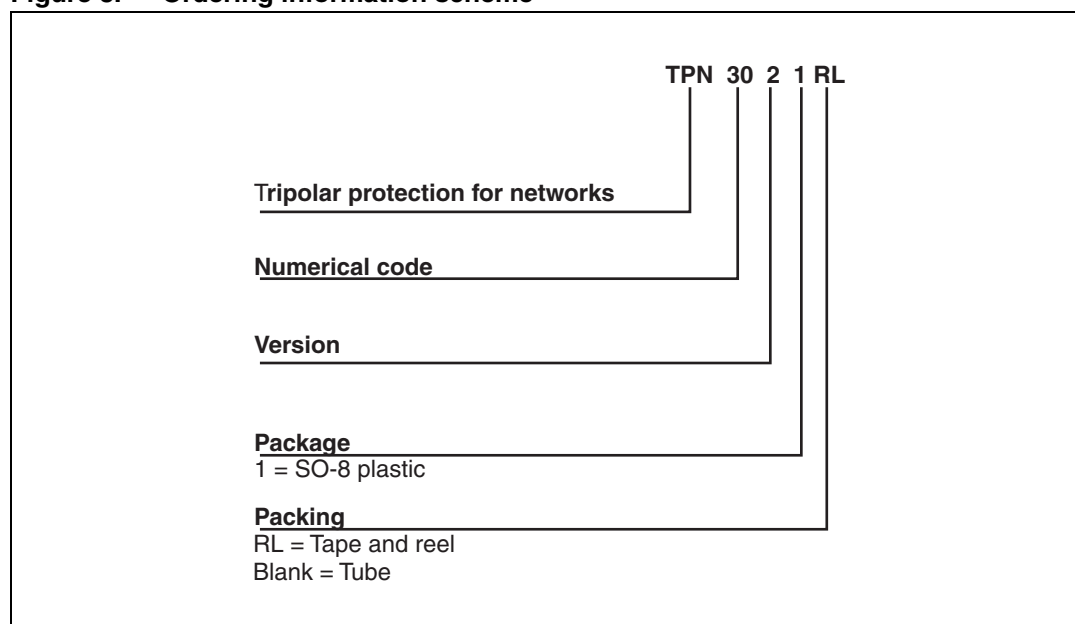
This is a go no-go test, which can confirm the holding current ( $I_H$ ) level.

### 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

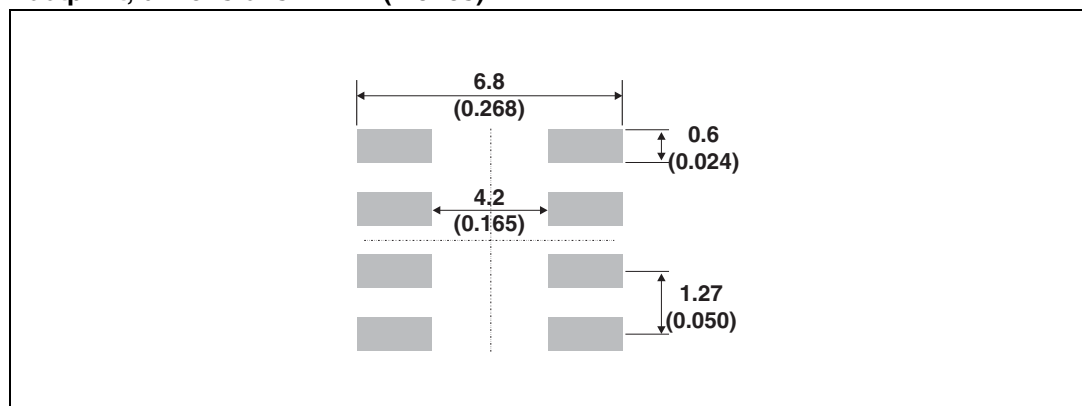
- Epoxy meets UL94, V0
- Lead-free package

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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