# TPN3021

## Tripolar overvoltage protection for network interfaces

## Features

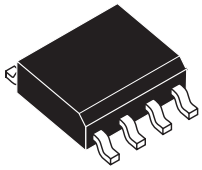
- Triple crowbar protection
- Low capacitance
- Low holding current: $I_H$ = 30 mA minimum
- Surge current:
  $I_{PP}$ = 200 A, 2/10 µs
  $I_{PP}$ = 30 A, 10/1000 µs

### 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.

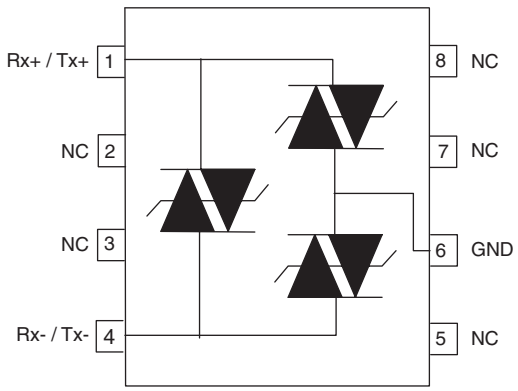
## Applications

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.



**SO-8**

**Figure 1. Schematic diagram**




## Description

The TPN is a low capacitance transient surge arrestor designed for protection of high debit rate communication networks. Its low capacitance avoids distorsion 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) |
|---|---|---|---|---|---|
| **GR-1089-CORE First level** | 2500<br>1000 | 2/10<br>10/1000 | 500<br>100 | 2/10<br>10/1000 | 7.5<br>25 |
| **GR-1089-CORE Intrabuilding** | 1500 | 2/10 | 100 | 2/10 | 0 |
| **ITU-T-K20/K21** | 1000 | 10/700 | 25 | 5/310 | 0 |
| **ITU-T-K20 (IEC 61000-4-2)** | 6000<br>8000 | 1/60 ns | ESD contact discharge<br>ESD air discharge | | -<br>- |
| **VDE0433** | 4000<br>2000 | 10/700 | 100<br>50 | 5/310 | 40<br>0 |
| **VDE0878** | 4000<br>2000 | 1.2/50 | 100<br>50 | 1/20 | 0<br>0 |
| **IEC 61000-4-5** | 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 °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 | A |
| $I_{TSM}$ | Non repetitive surge peak on-state current One cycle | 50 Hz<br>60 Hz | 8<br>9 | A |
| | Non repetitive surge peak on-state current (F = 50Hz) | 0.2 s<br>2 s | 3<br>1.5 | A |
| $T_{stg}$ | Storage temperature range | | -55 to +150 | °C |
| $T_j$ | Operating junction temperature range | | -40 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering during 10s | | 260 | °C |

**Table 3. Thermal resistances**

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

**Table 4. Electrical characteristics - definitions ($T_{amb}$ = 25° 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 |

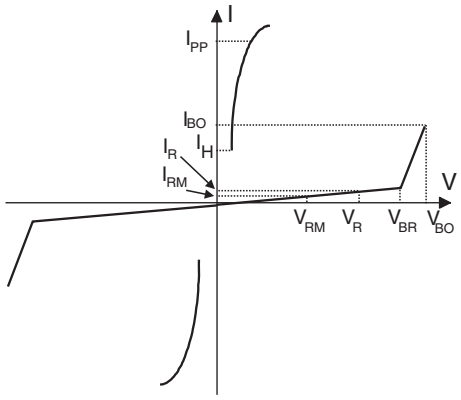



**Table 5. Static parameters**

| Order code | $I_{RM}$ max. @ $V_{RM}$ | | $V_{BO}$(1) max.@ $I_{BO}$ | | $I_H$(2) min. | C(3) typ. |
|---|---|---|---|---|---|---|
| | µA | 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 IH parameter*
3. $V_R$ = 0 V bias, $V^{RMS}$ = 1 V, F = 1 MHz

**Figure 2. Pulse waveform**

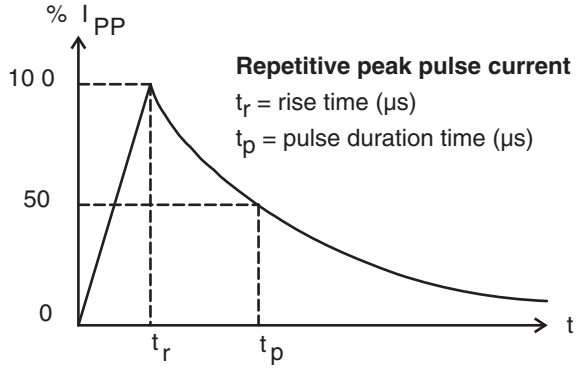



**Figure 3. Non repetitive surge peak on-state current versus overload duration ($T_j$ initial = 25 °C)**

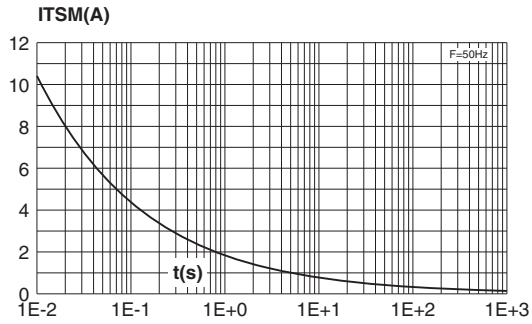


**Figure 4. Variation of junction capacitance versus reverse voltage applied (typical values)**

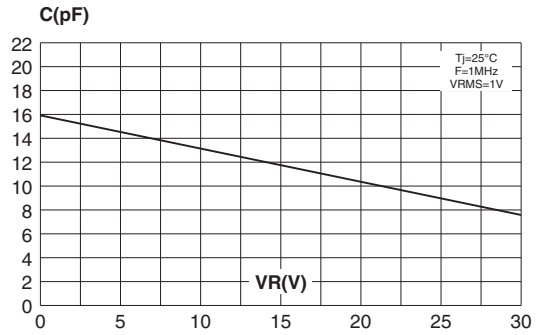
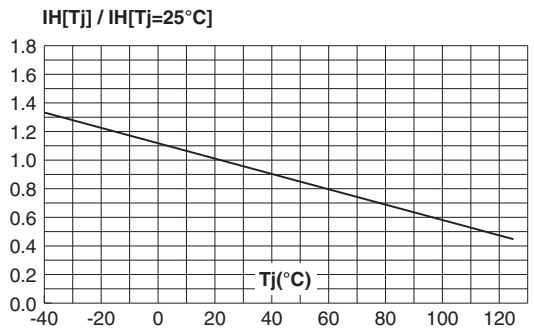


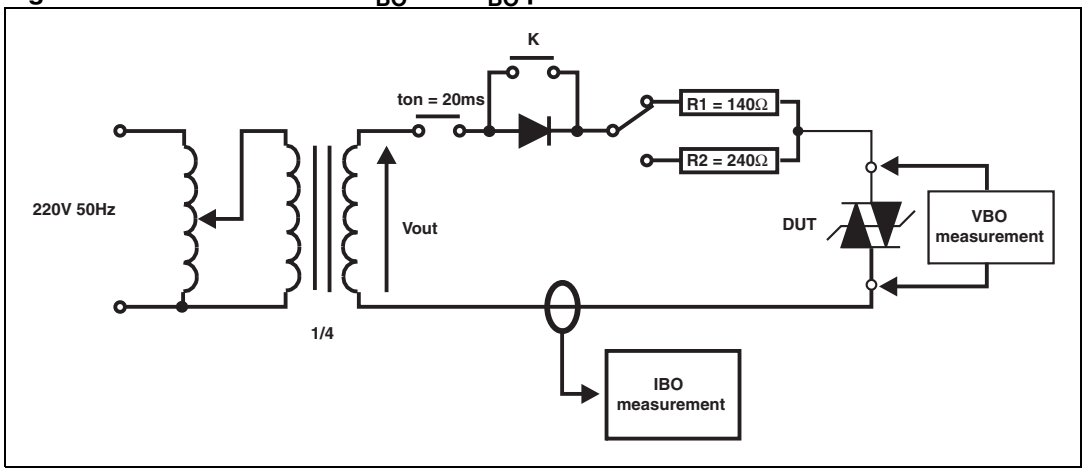

**Figure 5. Relative variation of holding current versus junction temperature**




# 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

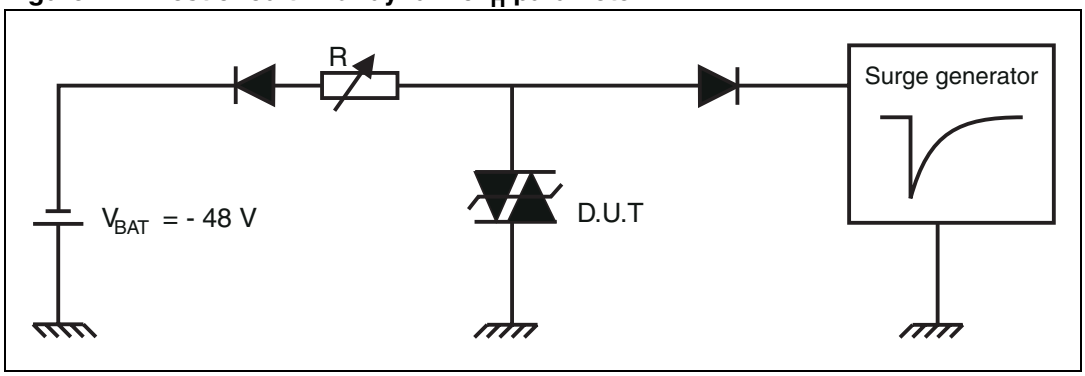
$V_{OUT}$ selection:

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

Device with $V_{BO}$ ≥ 200 V, $V_{OUT}$ = 480 $V_{RMS}$, R2 = 240 Ω

## 2.2 Test procedure for test circuit 2

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



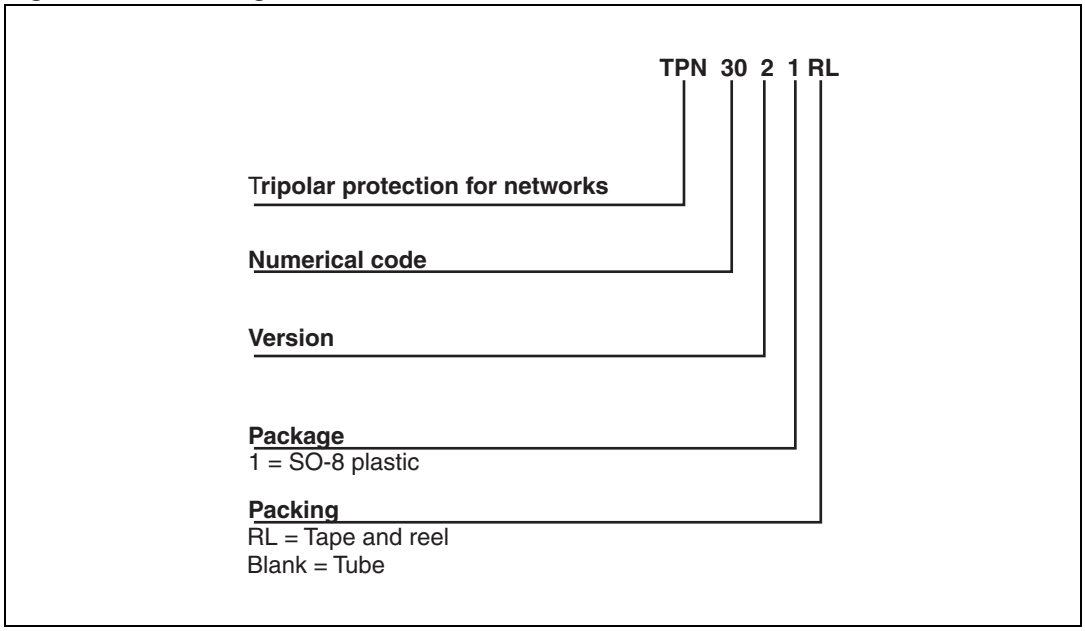

This is a go no-go test, which can confirm the holding current ($I_H$) level.

### 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 $I_{PP}$ = 10A, 10/1000µs.
3. The D.U.T. will come back off-state within 50 ms maximum.

# 3 Ordering information scheme

**Figure 8. Ordering information scheme**

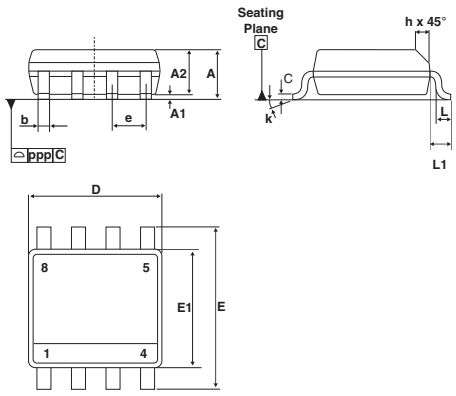


# 4 Package information

- Epoxy meets UL94, V0
- Lead-free package

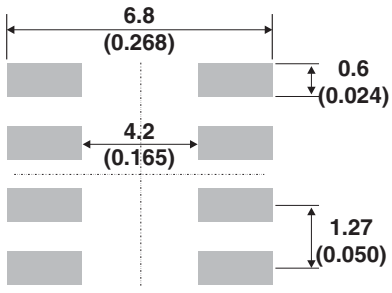
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

**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(1) | 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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