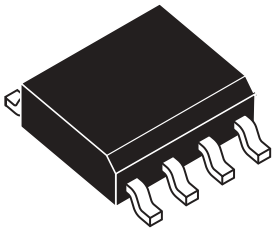
# TPN3021

## 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



**SO-8**

## Main 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.

## Description

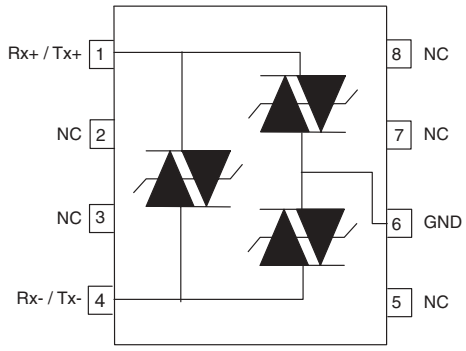
The TPN3021 is a low capacitance transient surge arrestor designed for protection of high debit rate communication network. Its low capacitance avoids distorsion of the signal as it has been designed for T1/E1 and Ethernet networks.

## Benefits

Trisil technology is not subject to ageing and provides a fail safe mode in short circuit for a better protection. They are used to help equipment to meet main standards such as UL1950, IEC950 / CSA C22.2 and UL1459. They have UL94 V0 ap-proved resin. SO8 package is JEDEC registered.

Trisils comply with the following standards GR-1089 Core, ITU-T-K20/K21, VDE0433, VDE0878, IEC61000-4-2.

## Schematic diagram



# 1 Characteristics

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

| Standard | Peak surge voltage (V) | Voltage waveform | Required peak current (A) | Current waveform | Minimum serial resistor to meet standard (Ω) |
|---|---|---|---|---|---|
| **GR-1089 Core First level** | 2500<br>1000 | 2/10 µs<br>10/1000 µs | 500<br>100 | 2/10 µs<br>10/1000 µs | 7.5<br>25 |
| **GR-1089 Core Intrabuilding** | 1500 | 2/10 µs | 100 | 2/10 µs | 0 |
| **ITU-T-K20/K21** | 1000 | 10/700 µs | 25 | 5/310 µs | 0 |
| **ITU-T-K20 (IEC61000-4-2)** | 6000<br>8000 | 1/60 ns | ESD contact discharge<br>ESD air discharge | | -<br>- |
| **VDE0433** | 4000<br>2000 | 10/700 µs | 100 50 | 5/310 µs | 40<br>0 |
| **VDE0878** | 4000<br>2000 | 1.2/50 µs | 100 50 | 1/20 µs | 0<br>0 |
| **IEC61000-4-5** | 2000<br>2000 | 10/700 µs<br>1.2/50 µs | 50 50 | 5/310 µs<br>8/20 µs | 0<br>0 |

**Table 2. 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 VRM |
| $I_{PP}$ | Peak pulse current |
| C | Capacitance |
| $V_R$ | Continous reverse voltage |
| $I_R$ | Leakage current at VR |

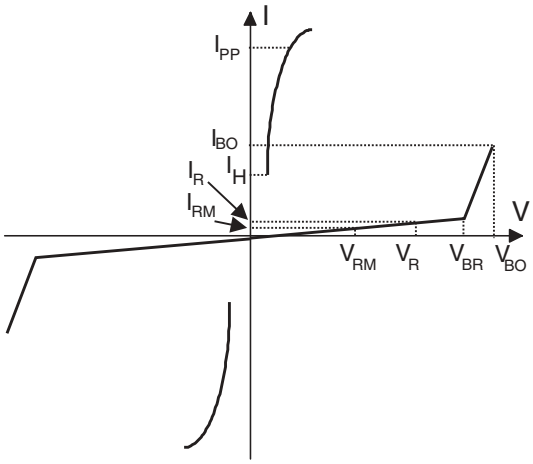


**Table 3. Absolute ratings ($T_{amb}$ =25°C)**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $I_{pp}$ | Peak pulse pulse current: tr / tp | 10/1000 µs<br>8/20 µs<br>10/560 µs<br>5/310 µs<br>10/160 µs<br>1/20 µs<br>2/10 µs | 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 |
| $T_{stg}$<br>$T_j$ | Storage temperature range<br>Operating junction temperature range | | -55 to +150<br>-40 to +150 | °C<br>°C |
| $T_L$ | Maximum lead temperature for soldering during 10s | | 260 | °C |

**Repetitive peak pulse current**
$t_r$: rise time (µs)
$t_p$: pulse duration time (µs)

example: pulse waveform
10/1000 µs, tr = 10 µs, tp = 1000 µs

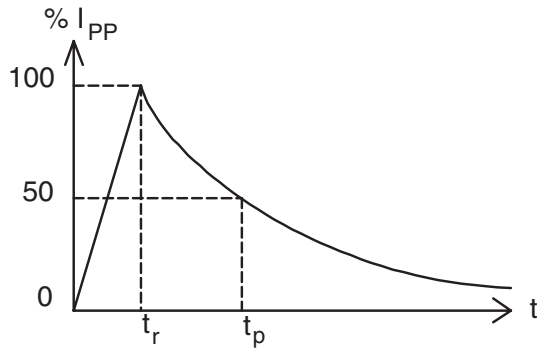



**Table 4. Thermal resistances**

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

**Table 5. Electrical parameters ($T_{amb}$ = 25°C)**

| Type | $I_{RM}$ @$V_{RM}$ max. | | $V_{BO}$ max@$I_{BO}$ (1) max. | | $I_H$ (2) min. | C(3) typ. |
|---|---|---|---|---|---|---|
| | µA | V | V | mA | mA | pF |
| TPN3021 | 4 | 28 | 38 | 300 | 30 | 16 |

1. See *Figure 1: Test circuit 1 for $I_{BO}$ and $V_{BO}$ parameters*
2. See *Figure 2: Test circuit 2 for $I_H$ parameter*
3. $V_R$ = 0 V bias, $V_{RMS}$ = 1 V, F = 1 MHz

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

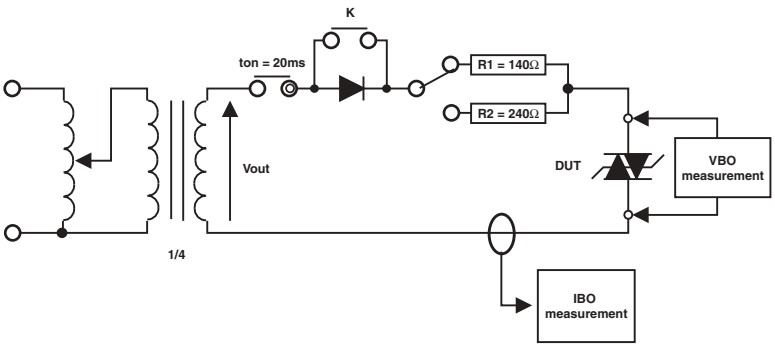



**Figure 2. Test circuit 2 for $I_H$ parameter**

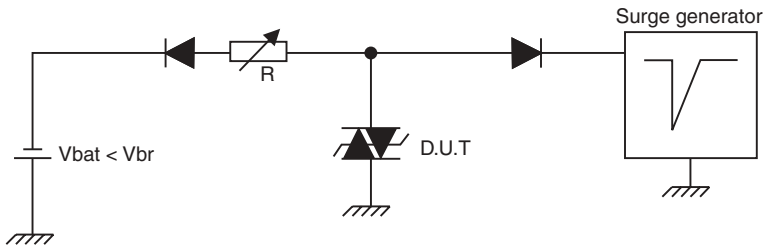


**Figure 3. Non repetitive surge peak on-state current versus overload duration ($T_j$ initial = 25°C)**

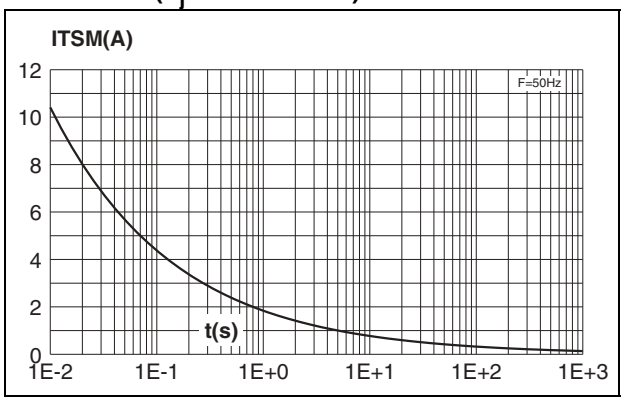



**Figure 4. Variation of junction capacitance versus reverse voltage applied (typical values)**

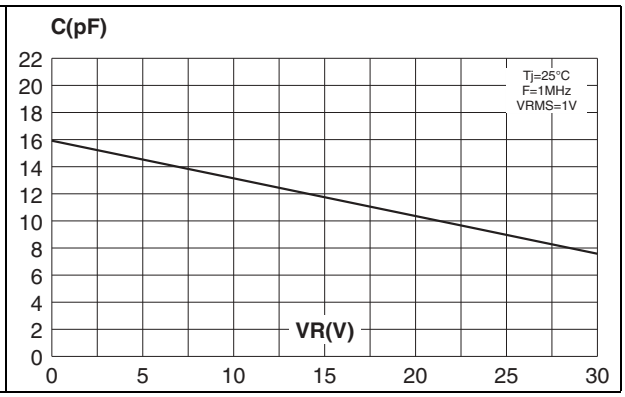
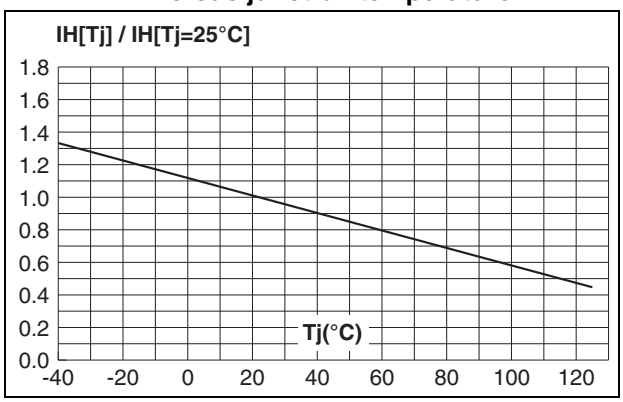
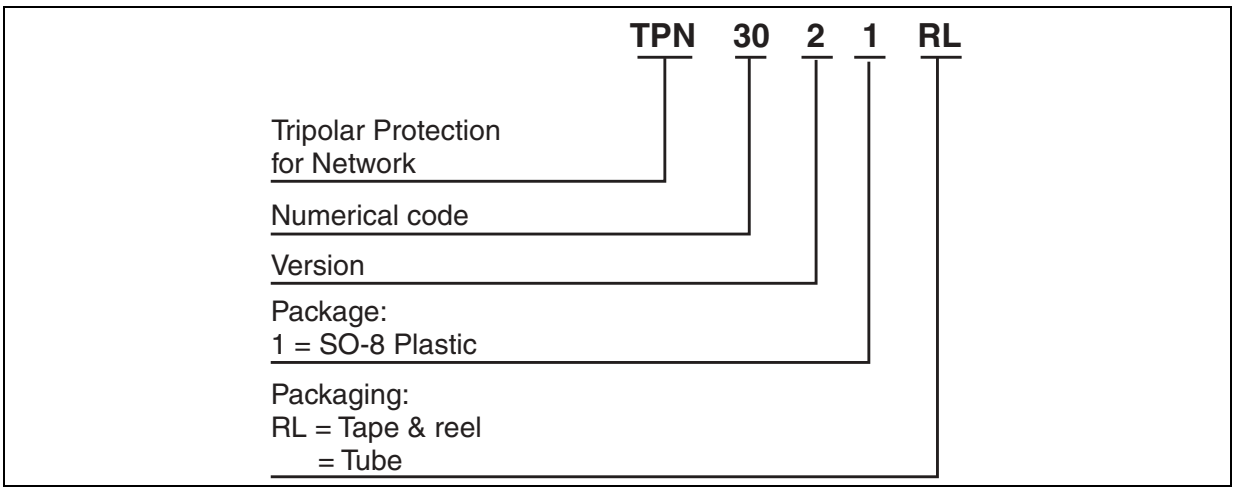



**Figure 5. Relative variation of holding current versus junction temperature**

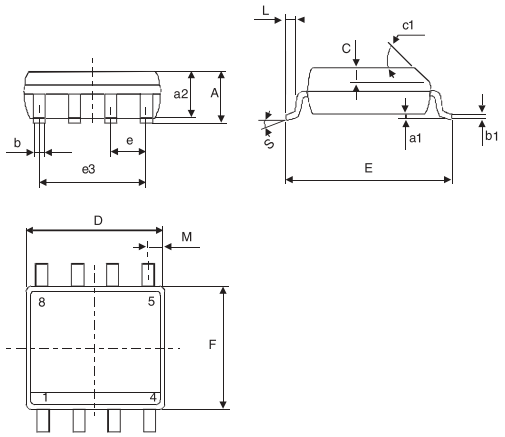



# 2 Ordering information scheme



# 3 Package mechanical data

**Table 6. SO-8 (Plastic) dimensions**




| 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) | | | | | |

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

# 4 Ordering information

| Part number | Marking | Package | Weight | Base qty | Delivery mode |
|---|---|---|---|---|---|
| TPN3021 | TPN302 | SO-8 | 0.08 g | 100 | Tube |
| **TPN3021RL**(1) | TPN302 | | | 2500 | Tape and reel |

1. Preferred device

# 5 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 |