

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 μs
 $I_{PP} = 30 \text{ A}$, 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.

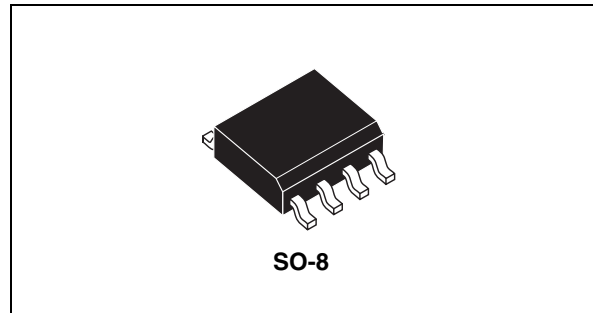
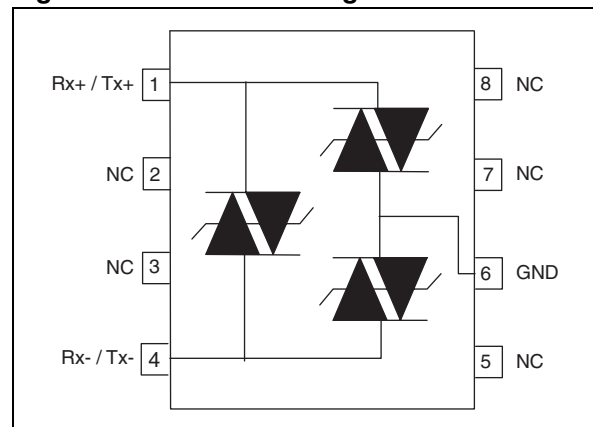


Figure 1. Schematic diagram



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.

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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 1000 | 2/10 10/1000 | 500 100 | 2/10 10/1000 | 7.5 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 8000 | 1/60 ns | ESD contact discharge ESD air discharge | | - - |
| VDE0433 | 4000 2000 | 10/700 | 100 50 | 5/310 | 40 0 |
| VDE0878 | 4000 2000 | 1.2/50 | 100 50 | 1/20 | 0 0 |
| IEC 61000-4-5 | 2000 2000 | 10/700 1.2/50 | 50 50 | 5/310 8/20 | 0 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 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. |
|------------|--------------------------|----|--------------------------------|-----|------------------|----------------|
| | 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 I_H parameter](#)

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

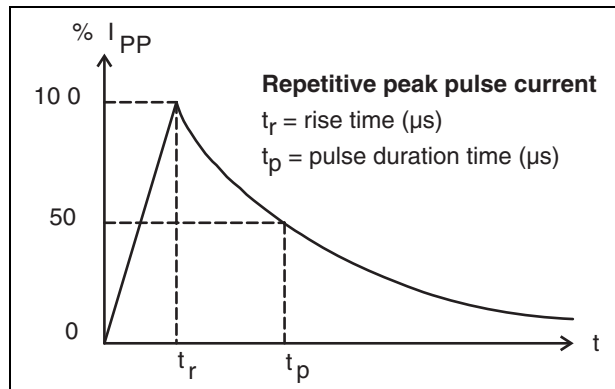
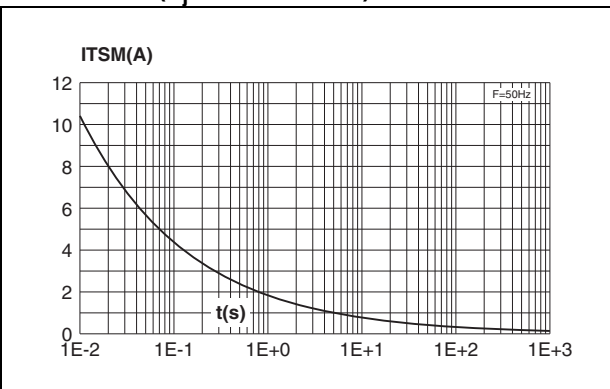
Figure 2. Pulse waveform**Figure 3. Non repetitive surge peak on-state current versus overload duration (T_j initial = $25^{\circ}C$)**

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

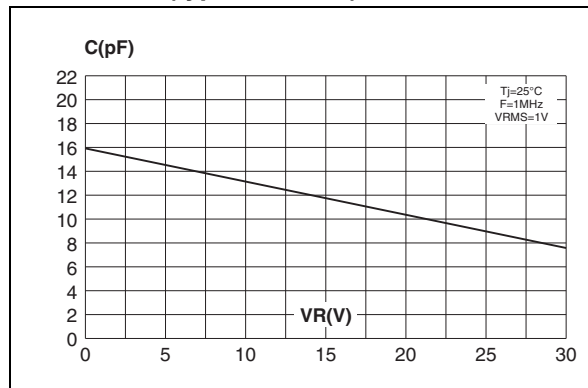
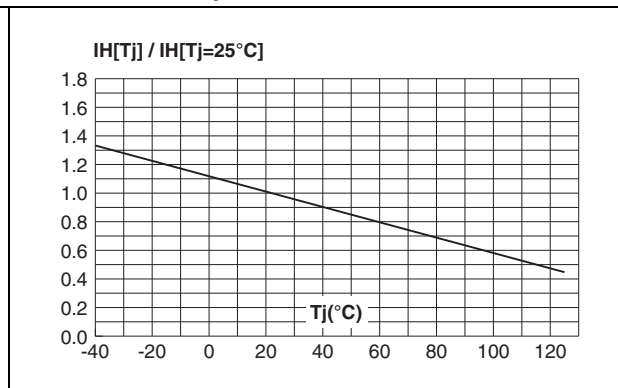


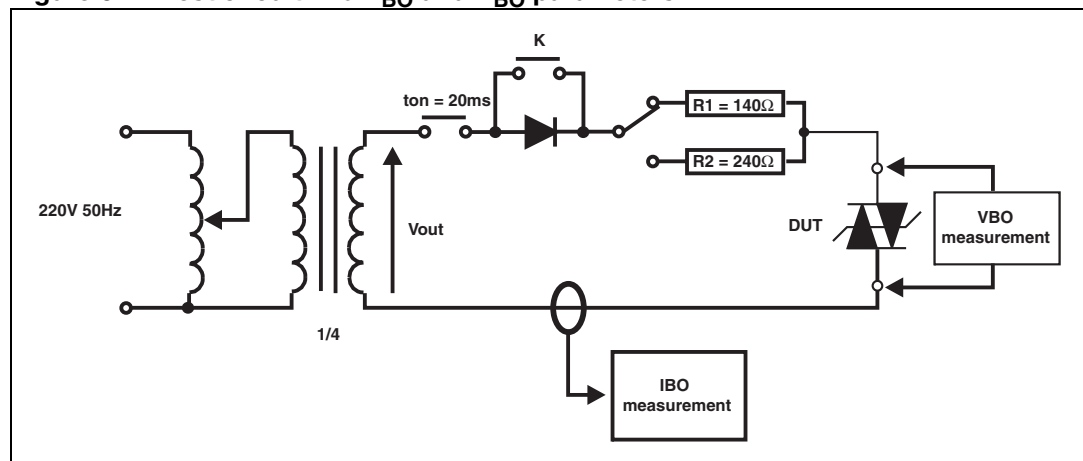
Figure 5. Relative variation of holding current versus junction temperature



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

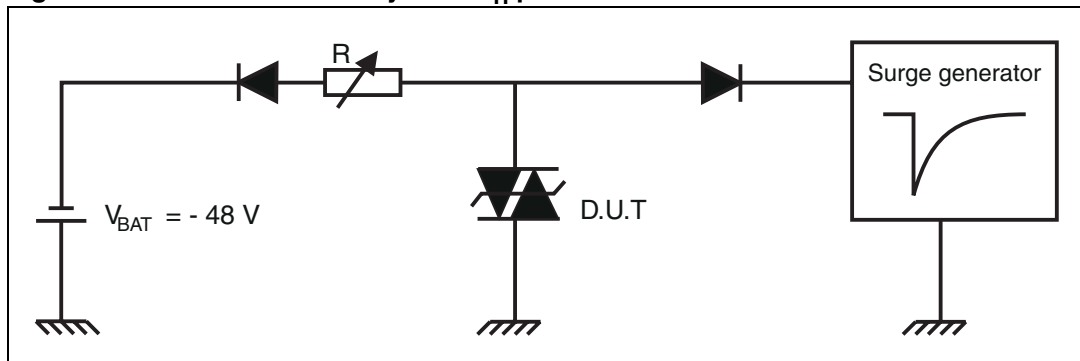
V_{OUT} selection:

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



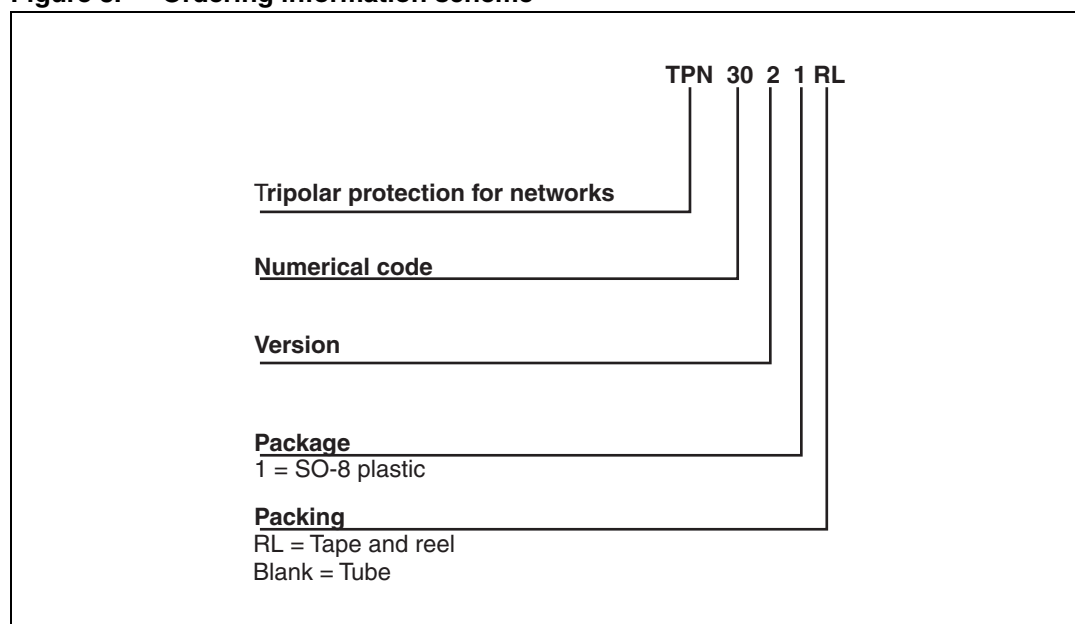
This is a go no-go test, which can confirm the holding current (I_H) level.

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

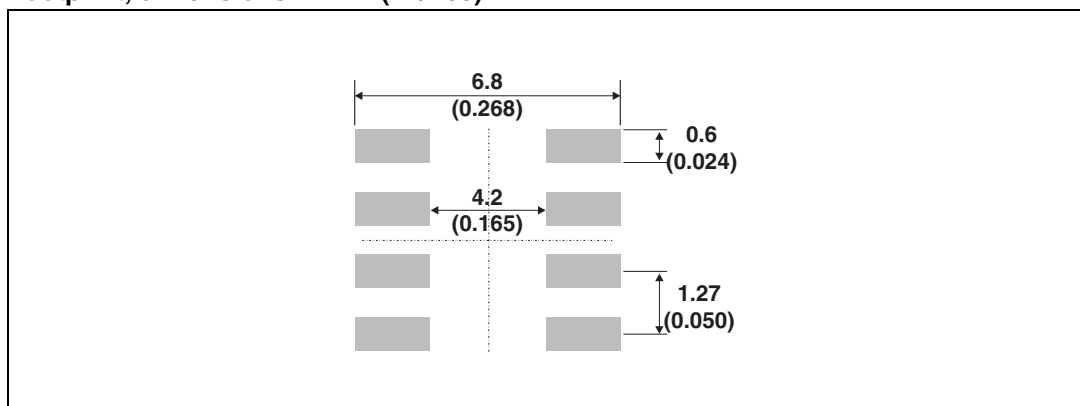
- Epoxy meets UL94, V0
- Lead-free package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] 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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