

## Trisil™ for telecom equipment protection

### Features

- Bidirectional crowbar protection
- Voltage range from 62 V to 320 V
- Low capacitance from 12 pF to 20 pF @ 50 V
- Low leakage current :  $I_R = 2 \mu\text{A max}$
- Holding current:  $I_H = 150 \text{ mA min}$
- Repetitive peak pulse current :  
 $I_{PP} = 50 \text{ A (10/1000 } \mu\text{s)}$

### Main applications

Telecommunication equipment such as:

- Analog and digital line cards (xDSL, T1/E1, ISDN, ...)
- Terminals (phone, fax, modem, ...) and central office equipment

### Description

These Trisil series have been designed to protect telecommunication equipment against lightning and transient induced by AC power lines.

They are available in SMA, SMB and DO-15 packages.

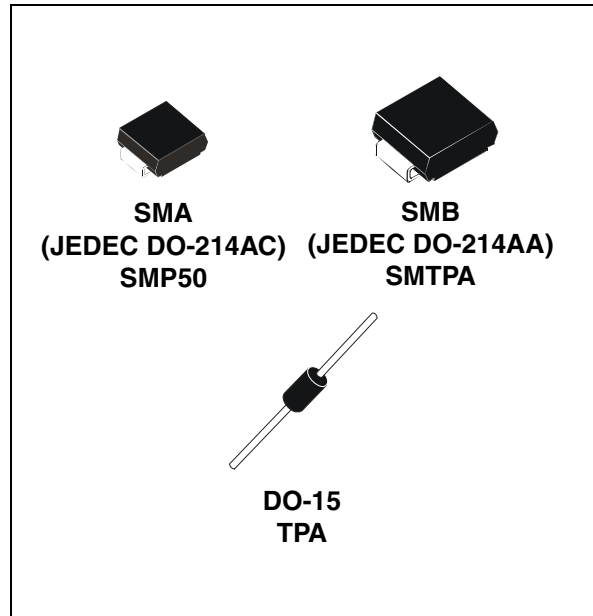
### Benefits

Trisils are not subject to ageing and provide a fail safe mode in short circuit for a better protection. They are used to help equipment to meet various standards such as UL1950, IEC950 / CSA C22.2, UL1459 and FCC part 68.

Trisils have UL94 V0 approved resin. SMA and SMB packages are JEDEC registered (DO-214AC and DO-214AA).

Trisils are UL497B approved (file: E136224).

TM: TRISIL is a trademark of STMicroelectronics



### Order codes

| Part Number | Marking  |
|-------------|--|
| SMP50-xxx   | See <a href="#">Ordering Information</a> on page 9 |
| TPAxxx      |  |
| SMTPAxxx    |  |

### Schematic Diagram



# 1 Characteristics

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

| Standard                            | Peak Surge Voltage (V) | Waveform Voltage | Required peak current (A) | Current waveform | Minimum serial resistor to meet standard ( $\Omega$ ) |
|-------------------------------------|------------------------|------------------|---------------------------|------------------|---|
| GR-1089 Core First level            | 2500                   | 2/10 $\mu$ s     | 500                       | 2/10 $\mu$ s     | 20  |
|                                     | 1000                   | 10/1000 $\mu$ s  | 100                       | 10/1000 $\mu$ s  | 10  |
| GR-1089 Core Second level           | 5000                   | 2/10 $\mu$ s     | 500                       | 2/10 $\mu$ s     | 40  |
| GR-1089 Core Intra-building         | 1500                   | 2/10 $\mu$ s     | 100                       | 2/10 $\mu$ s     | 0   |
| ITU-T-K20/K21                       | 6000                   | 10/700 $\mu$ s   | 150                       | 5/310 $\mu$ s    | 53  |
|                                     | 1500                   |                  | 37.5                      |                  | 0   |
| ITU-T-K20 (IEC61000-4-2)            | 8000                   | 1/60 ns          | ESD contact discharge     |                  | 0   |
|                                     | 15000                  |                  | ESD air discharge         |                  | 0   |
| VDE0433                             | 4000                   | 10/700 $\mu$ s   | 100                       | 5/310 $\mu$ s    | 21.5  |
|                                     | 2000                   |                  | 50                        |                  | 0   |
| VDE0878                             | 4000                   | 1.2/50 $\mu$ s   | 100                       | 1/20 $\mu$ s     | 0   |
|                                     | 2000                   |                  | 50                        |                  | 0   |
| IEC61000-4-5                        | 4000                   | 10/700 $\mu$ s   | 100                       | 5/310 $\mu$ s    | 21.5  |
|                                     | 4000                   | 1.2/50 $\mu$ s   | 100                       | 8/20 $\mu$ s     | 0   |
| FCC Part 68, lightning surge type A | 1500                   | 10/160 $\mu$ s   | 200                       | 10/160 $\mu$ s   | 12.5  |
|                                     | 800                    | 10/560 $\mu$ s   | 100                       | 10/560 $\mu$ s   | 6.5   |
| FCC Part 68, lightning surge type B | 1000                   | 9/720 $\mu$ s    | 25                        | 5/320 $\mu$ s    | 0   |

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

| Symbol    | Parameter   | Value           | Unit       |
|-----------|---|-----------------|------------|
| $I_{PP}$  | Repetitive peak pulse current (see <a href="#">Figure 1</a> ) | 10/1000 $\mu$ s | 50         |
|           |   | 8/20 $\mu$ s    | 150        |
|           |   | 10/560 $\mu$ s  | 55         |
|           |   | 5/310 $\mu$ s   | 65         |
|           |   | 10/160 $\mu$ s  | 75         |
|           |   | 1/20 $\mu$ s    | 100        |
| $I_{FS}$  | Fail-safe mode : maximum current <sup>(1)</sup>               | 8/20 $\mu$ s    | 2.5        |
|           |   |                 | kA         |
| $I_{TSM}$ | Non repetitive surge peak on-state current (sinusoidal)       | t = 0.2 s       | 16         |
|           |   | t = 1 s         | 11.5       |
|           |   | t = 2 s         | 10         |
|           |   | t = 15 mn       | 3.5        |
| $I^2t$    | $I^2t$ value for fusing                                       | t = 16.6 ms     | 6.2        |
|           |   | t = 20 ms       | 6.5        |
| $T_{stg}$ | Storage temperature range                                     | -55 to 150      | $^\circ C$ |
| $T_j$     | Maximum junction temperature                                  | 150             | $^\circ C$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s.           | 260             | $^\circ C$ |

1. in fail safe mode, the device acts as a short circuit

**Table 3. Thermal resistances**

| Symbol        | Parameter   | Value |     |     | Unit          |
|---------------|---|-------|-----|-----|---------------|
|               |   | DO-15 | SMA | SMB |               |
| $R_{th(j-a)}$ | Junction to ambient (with recommended footprint or with $L_{lead} = 10$ mm for DO-15) | 100   | 120 | 100 | $^{\circ}C/W$ |
| $R_{th(j-l)}$ | Junction to leads ( $L_{lead} = 10$ mm for DO-15)                                     | 60    | 30  | 20  | $^{\circ}C/W$ |

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

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



**Table 5. Electrical characteristics - values ( $T_{amb} = 25^{\circ}C$ )**

| Types                          | $I_{RM} @ V_{RM}$ |     | $I_R @ V_R^{(1)}$ |     | Dynamic $V_{BO}^{(2)}$ | Static $V_{BO} @ I_{BO}^{(3)}$ |      | $I_H^{(4)}$ | $C^{(5)}$ | $C^{(6)}$ |
|--------------------------------|-------------------|-----|-------------------|-----|------------------------|--------------------------------|------|-------------|-----------|-----------|
|                                | max.              |     | max.              |     | max.                   | max.                           | max. | min.        | typ.      | typ.      |
|                                | $\mu A$           | V   | $\mu A$           | V   | V                      | V                              | mA   | mA          | pF        | pF        |
| SMP50-62 / TPA62<br>SMTPA62    |                   | 56  |                   | 62  | 85                     | 82                             |      |             | 20        | 40        |
| SMP50-68 / TPA68<br>SMTPA68    |                   | 61  |                   | 68  | 93                     | 90                             |      |             | 20        | 40        |
| SMP50-100 / TPA100<br>SMTPA100 |                   | 90  |                   | 100 | 135                    | 133                            |      |             | 16        | 35        |
| SMP50-120 / TPA120<br>SMTPA120 |                   | 108 |                   | 120 | 160                    | 160                            |      |             | 16        | 30        |
| SMP50-130 / TPA130<br>SMTPA130 |                   | 117 |                   | 130 | 173                    | 173                            |      |             | 14        | 30        |
| SMP50-180 / TPA180<br>SMTPA180 | 2                 | 162 | 5                 | 180 | 235                    | 240                            | 800  | 150         | 14        | 25        |
| SMP50-200 / TPA200<br>SMTPA200 |                   | 180 |                   | 200 | 262                    | 267                            |      |             | 12        | 25        |
| SMP50-220 / TPA220<br>SMTPA220 |                   | 198 |                   | 220 | 285                    | 293                            |      |             | 12        | 25        |
| SMP50-240 / TPA240<br>SMTPA240 |                   | 216 |                   | 240 | 300                    | 320                            |      |             | 12        | 25        |
| SMP50-270 / TPA270<br>SMTPA270 |                   | 243 |                   | 270 | 350                    | 360                            |      |             | 12        | 25        |
| SMP50-320 / SMTPA320           |                   | 290 |                   | 320 | 400                    | 400                            |      |             | 12        | 25        |

- $I_R$  measured at  $V_R$  guarantee  $V_{BR} \min \geq V_R$
- See functional test circuit 1(Figure 9.)
- See test circuit 2(Figure 10.)
- See functional holding current test circuit 3(Figure 11.)
- $V_R = 50$  V bias,  $V_{RMS} = 1$  V,  $F = 1$  MHz
- $V_R = 2$  V bias,  $V_{RMS} = 1$  V,  $F = 1$  MHz

**Figure 1. Pulse waveform (10/1000  $\mu s$ )**



**Figure 2. Non repetitive surge peak on-state current versus overload duration**



**Figure 3. On-state voltage versus on-state current (typical values)**



**Figure 4. Relative variation of holding current versus junction temperature**



**Figure 5. Relative variation of breakover voltage versus junction temperature**



**Figure 6. Relative variation of leakage current versus reverse voltage applied (typical values)**



**Figure 7. Variation of thermal impedance junction to ambient versus pulse duration (Printed circuit board FR4,  $S_{Cu} = 35 \mu m$ , recommended pad layout)**



**Figure 8. Relative variation of junction capacitance versus reverse voltage applied (typical values)**



**Figure 9. Test circuit 1 for Dynamic  $I_{BO}$  and  $V_{BO}$  parameters**



**Figure 10. Test circuit 2 for  $I_{BO}$  and  $V_{BO}$  parameters**



**Figure 11. Test circuit 3 for dynamic  $I_H$  parameters**



## 2 Ordering information scheme



## 3 Package information

- Epoxy meets UL94, V0

**Table 6. SMA dimensions**

|    | Dimensions  |      |        |       |
|----|-------------|------|--------|-------|
|    | Millimeters |      | Inches |       |
|    | Min.        | Max. | Min.   | Max.  |
| A1 | 1.90        | 2.45 | 0.075  | 0.094 |
| A2 | 0.05        | 0.20 | 0.002  | 0.008 |
| b  | 1.25        | 1.65 | 0.049  | 0.065 |
| c  | 0.15        | 0.40 | 0.006  | 0.016 |
| D  | 2.25        | 2.90 | 0.089  | 0.114 |
| E  | 4.80        | 5.35 | 0.189  | 0.211 |
| E1 | 3.95        | 4.60 | 0.156  | 0.181 |
| L  | 0.75        | 1.50 | 0.030  | 0.059 |

**Figure 12. Footprint, dimensions in mm (inches)**



**Table 7. SMB dimensions**

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A1   | 1.90        | 2.45 | 0.075  | 0.096 |
| A2   | 0.05        | 0.20 | 0.002  | 0.008 |
| b    | 1.95        | 2.20 | 0.077  | 0.087 |
| c    | 0.15        | 0.40 | 0.006  | 0.016 |
| E    | 5.10        | 5.60 | 0.201  | 0.220 |
| E1   | 4.05        | 4.60 | 0.159  | 0.181 |
| D    | 3.30        | 3.95 | 0.130  | 0.156 |
| L    | 0.75        | 1.50 | 0.030  | 0.059 |

**Figure 13. Footprint, dimensions in mm (inches)**



**Table 8. DO-15 dimensions**

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A    | 6.05        | 6.75 | 0.238  | 0.266 |
| B    | 2.95        | 3.53 | 0.116  | 0.139 |
| C    | 26          | 31   | 1.024  | 1.220 |
| D    | 0.71        | 0.88 | 0.028  | 0.035 |

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](http://www.st.com).



## 4 Ordering Information

| Part Number | Marking | Package | Weight  | Base qty | Delivery mode |
|-------------|---------|---------|---------|----------|---------------|
| SMP50-62    | V06     | SMA     | 0.068 g | 5000     | Tape & reel   |
| SMP50-68    | V07     |         |         |          |               |
| SMP50-100   | V10     |         |         |          |               |
| SMP50-120   | V12     |         |         |          |               |
| SMP50-130   | V13     |         |         |          |               |
| SMP50-180   | V18     |         |         |          |               |
| SMP50-200   | V20     |         |         |          |               |
| SMP50-220   | V22     |         |         |          |               |
| SMP50-240   | V24     |         |         |          |               |
| SMP50-270   | V27     |         |         |          |               |
| SMP50-320   | V32     |         |         |          |               |
| SMTPA62     | U01     |         |         |          |               |
| SMTPA68     | U05     |         |         |          |               |
| SMTPA100    | U13     |         |         |          |               |
| SMTPA120    | U17     |         |         |          |               |
| SMTPA130    | U19     |         |         |          |               |
| SMTPA180    | U25     |         |         |          |               |
| SMTPA200    | U27     |         |         |          |               |
| SMTPA220    | U31     |         |         |          |               |
| SMTPA240    | U35     |         |         |          |               |
| SMTPA270    | U39     |         |         |          |               |
| SMTPA320    | U47     |         |         |          |               |
| TPA62       | TPA62   | DO-15   | 0.40 g  | 1000     | Ammopack      |
| TPA62RL     |         |         |         | 6000     | Tape & reel   |
| TPA68       | TPA68   |         |         | 1000     | Ammopack      |
| TPA68RL     |         |         |         | 6000     | Tape & reel   |
| TPA100      | TPA100  |         |         | 1000     | Ammopack      |
| TPA100RL    |         |         |         | 6000     | Tape & reel   |
| TPA120      | TPA120  |         |         | 1000     | Ammopack      |
| TPA130      | TPA130  |         |         | 1000     | Ammopack      |
| TPA130RL    |         |         |         | 6000     | Tape & reel   |
| TPA180      | TPA180  |         |         | 1000     | Ammopack      |
| TPA180RL    |         |         |         | 6000     | Tape & reel   |
| TPA200      | TPA200  |         |         | 1000     | Ammopack      |
| TPA200RL    |         |         |         | 6000     | Tape & reel   |
| TPA220      | TPA220  |         |         | 1000     | Ammopack      |
| TPA220RL    |         |         |         | 6000     | Tape & reel   |
| TPA240      | TPA240  |         |         | 1000     | Ammopack      |
| TPA240RL    |         |         |         | 6000     | Tape & reel   |
| TPA270      | TPA270  |         |         | 1000     | Ammopack      |
| TPA270RL    |         |         |         | 6000     | Tape & reel   |

## 5 Revision History

| Date        | Revision | Description of Changes   |
|-------------|----------|--|
| 16-Nov-2004 | 1        | SMP50, SMTPA and TPA datasheets merge.   |
| 30-Mar-2007 | 2        | Reformatted to current standards. Updated $I_{PP}$ value in Table 2 . Added part numbers SMP50-320 and SMTPA320. Updated dimensions and footprint for SMA and footprint for SMB. |
| 12-Jun-2007 | 3        | Corrected typographical error in part number. Added dimensions in inches to footprint illustrations.   |

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