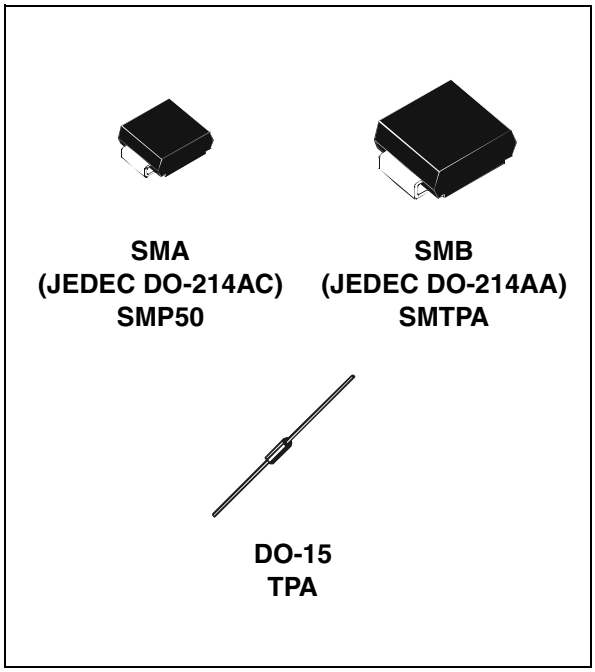
# SMP50 / SMTPA / TPA

## TRISIL™ FOR TELECOM EQUIPMENT PROTECTION

### FEATURES

- Bidirectional crowbar protection
- Voltage range from 62V to 270V
- Low capacitance from 12pF to 20pF @ 50V
- Low leakage current : $I_R$ = 2µA max
- Holding current: $I_H$ = 150 mA min
- Repetitive peak pulse current : $I_{PP}$ = 50 A (10/1000µs)




### 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).

**Table 1: Order Codes**

| Part Number | Marking |
|---|---|
| SMP50-xxx | See page 9 |
| TPAxxx | |
| SMTPAxxx | |

**Figure 1: Schematic Diagram**

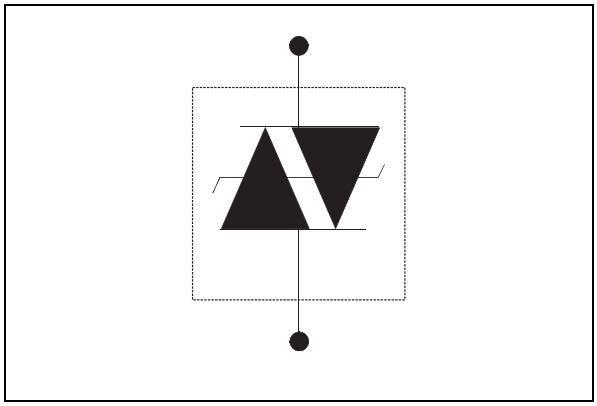


**Table 2: In compliances with the following standards**

| STANDARD | Peak Surge Voltage (V) | Waveform Voltage | 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 | 20<br>10 |
| **GR-1089 Core Second level** | 5000 | 2/10 µs | 500 | 2/10 µs | 40 |
| **GR-1089 Core Intra-building** | 1500 | 2/10 µs | 100 | 2/10 µs | 0 |
| **ITU-T-K20/K21** | 6000<br>1500 | 10/700 µs | 150<br>37.5 | 5/310 µs | 53<br>0 |
| **ITU-T-K20 (IEC61000-4-2)** | 8000<br>15000 | 1/60 ns | ESD contact discharge<br>ESD air discharge | | 0<br>0 |
| **VDE0433** | 4000<br>2000 | 10/700 µs | 100<br>50 | 5/310 µs | 21.5<br>0 |
| **VDE0878** | 4000<br>2000 | 1.2/50 µs | 100<br>50 | 1/20 µs | 0<br>0 |
| **IEC61000-4-5** | 4000<br>4000 | 10/700 µs<br>1.2/50 µs | 100<br>100 | 5/310 µs<br>8/20 µs | 21.5<br>0 |
| **FCC Part 68, lightning surge type A** | 1500<br>800 | 10/160 µs<br>10/560 µs | 200<br>100 | 10/160 µs<br>10/560 µs | 12.5<br>6.5 |
| **FCC Part 68, lightning surge type B** | 1000 | 9/720 µs | 25 | 5/320 µs | 0 |

**Table 3: Absolute Ratings** ($T_{amb}$ = 25°C)

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

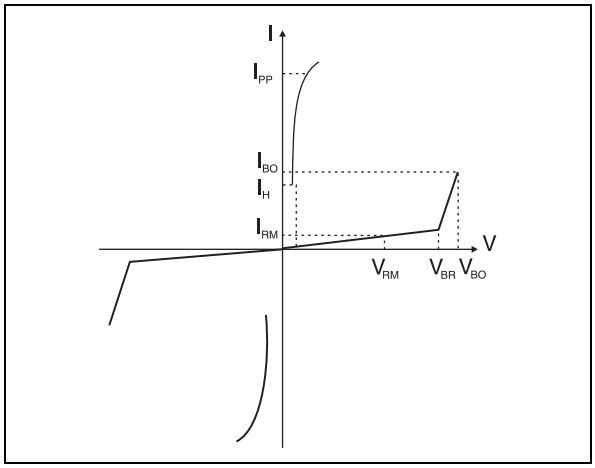
**Note 1:** in fail safe mode, the device acts as a short circuit

**Table 4: Thermal Resistances**

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

**Table 5: Electrical Characteristics** ($T_{amb}$ = 25°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 |




| Types | $I_{RM}$ @ $V_{RM}$ max. | | $I_R$ @ $V_R$ max. note1 | | Dynamic $V_{BO}$ max. note 2 | Static $V_{BO}$ @ $I_{BO}$ max. note 3 | | $I_H$ min. note 4 | C typ. note 5 | C typ. note 6 |
|---|---|---|---|---|---|---|---|---|---|---|
| | µA | V | µA | V | V | V | mA | mA | pF | pF |
| SMP50-62 / TPA62 SMTPA62 | 2 | 56 | 5 | 62 | 85 | 82 | 800 | 150 | 20 | 40 |
| SMP50-68 / TPA68 SMTPA68 | | 61 | | 68 | 93 | 90 | | | 20 | 40 |
| SMP50-100 / TPA100 SMTPA100 | | 90 | | 100 | 135 | 133 | | | 16 | 35 |
| SMP50-120 / TPA120 SMTPA120 | | 108 | | 120 | 160 | 160 | | | 16 | 30 |
| SMP50-130 / TPA130 SMTPA130 | | 117 | | 130 | 173 | 173 | | | 14 | 30 |
| SMP50-180 / TPA180 SMTPA180 | | 162 | | 180 | 235 | 240 | | | 14 | 25 |
| SMP50-200 / TPA200 SMTPA200 | | 180 | | 200 | 262 | 267 | | | 12 | 25 |
| SMP50-220 / TPA220 SMTPA220 | | 198 | | 220 | 285 | 293 | | | 12 | 25 |
| SMP50-240 / TPA240 SMTPA240 | | 216 | | 240 | 300 | 320 | | | 12 | 25 |
| SMP50-270 / TPA270 SMTPA270 | | 243 | | 270 | 350 | 360 | | | 12 | 25 |

**Note 1:** $I_R$ measured at $V_R$ guarantee $V_{BR}$ min ≥ VR
**Note 2:** see functional test circuit 1
**Note 3:** see test circuit 2
**Note 4:** see functional holding current test circuit 3
**Note 5:** $V_R$ = 50V bias, $V_{RMS}$=1V, F=1MHz
**Note 6:** $V_R$ = 2V bias, $V_{RMS}$=1V, F=1MHz

**Figure 2: Pulse waveform (10/1000µs)**

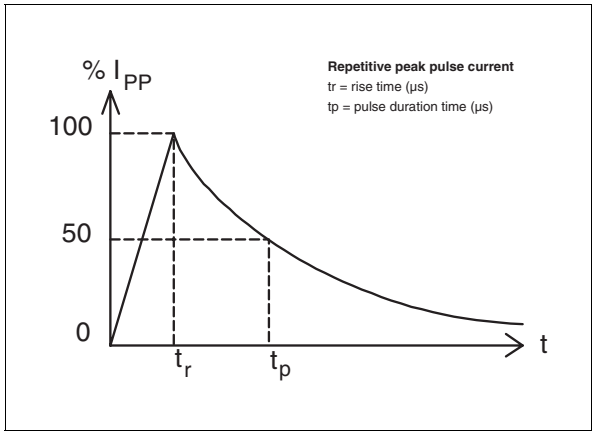



**Figure 3: Non repetitive surge peak on-state current versus overload duration**

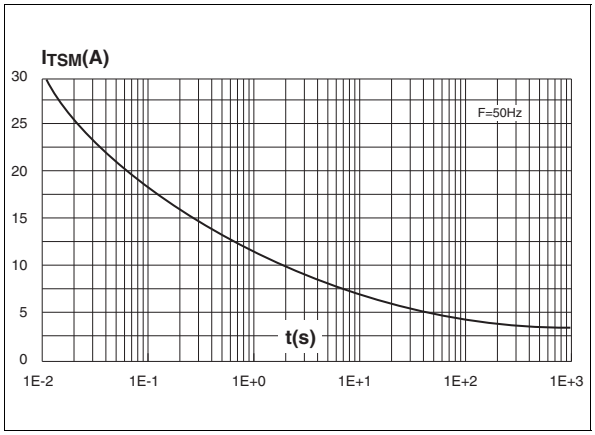



**Figure 4: On-state voltage versus on-state current (typical values)**

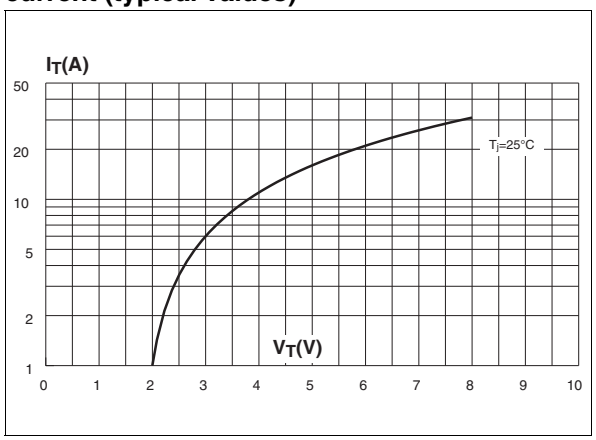



**Figure 5: Relative variation of holding current versus junction temperature**

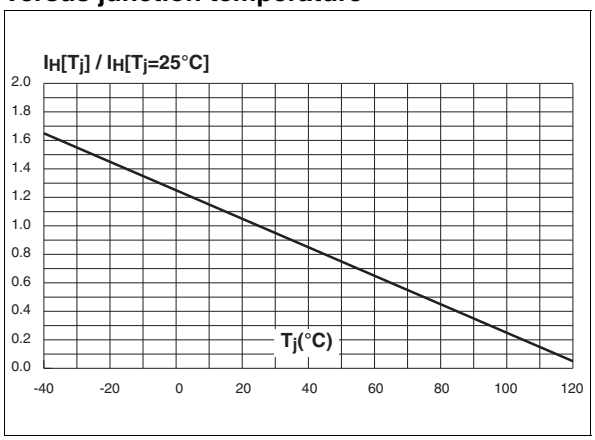



**Figure 6: Relative variation of breakover voltage versus junction temperature**

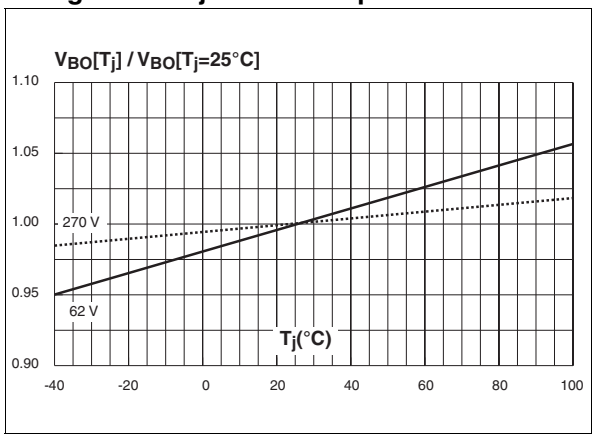



**Figure 7: Relative variation of leakage current versus reverse voltage applied (typical values)**

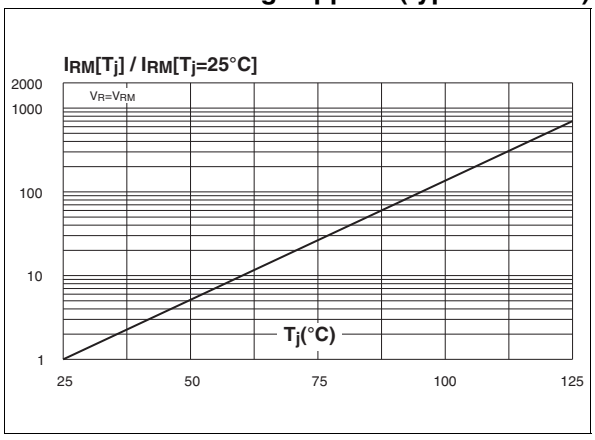


**Figure 8: Variation of thermal impedance junction to ambient versus pulse duration (Printed circuit board FR4, SCu=35µm, recommended pad layout)**

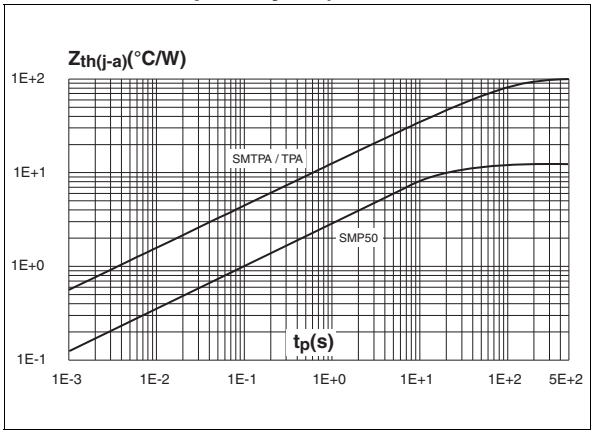



**Figure 9: Relative variation of junction capacitance versus reverse voltage applied (typical values)**

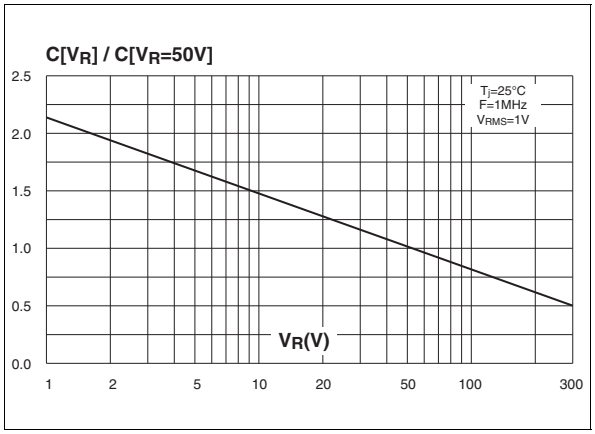
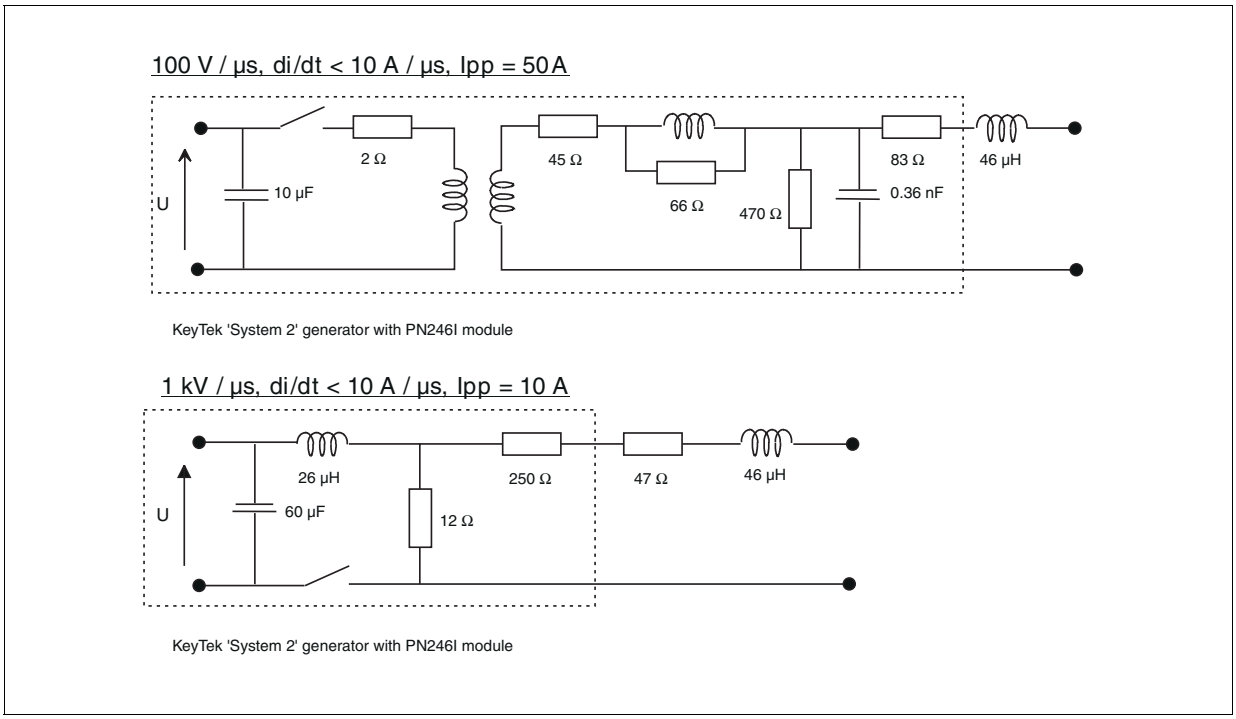
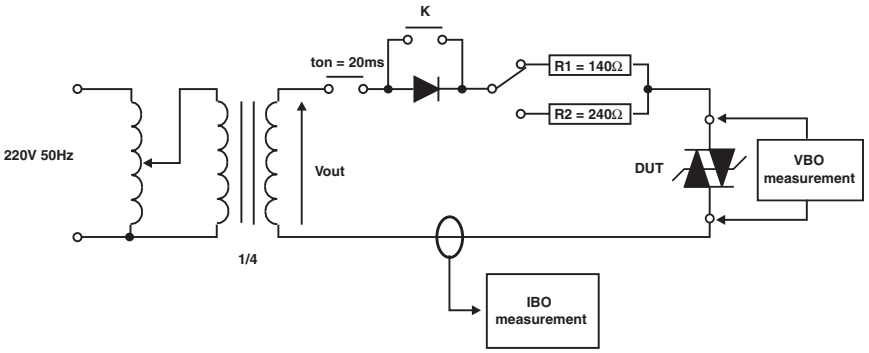



**Figure 10: Test circuit 1 for Dynamic $I_{BO}$ and $V_{BO}$ parameters**



## Figure 11: Test circuit 2 for $I_{BO}$ and $V_{BO}$ parameters




**TEST PROCEDURE**

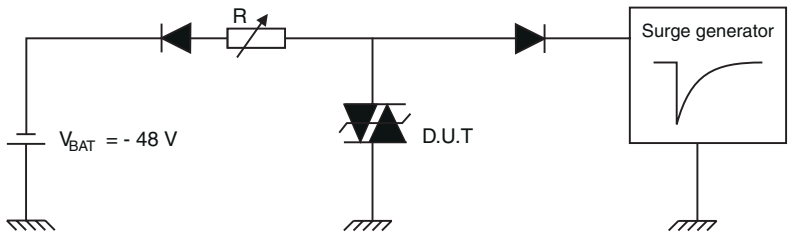
**Pulse test duration (tp = 20ms):**

- for Bidirectional devices = Switch K is closed
- for Unidirectional devices = Switch K is open

**$V_{OUT}$ selection:**

- Device with $V_{BO}$ < 200V → $V_{OUT}$ = 250 $V_{RMS}$, R1 = 140Ω
- Device with $V_{BO}$ ≤ 200V → $V_{OUT}$ = 480 $V_{RMS}$, R2 = 240Ω

## Figure 12: Test circuit 3 for dynamic $I_H$ parameters




This is a GO-NOGO test which allows to confirm the holding current ($I_H$) level in a functional test circuit.

**TEST 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 50ms maximum.**

**Figure 13: Ordering Information Scheme**

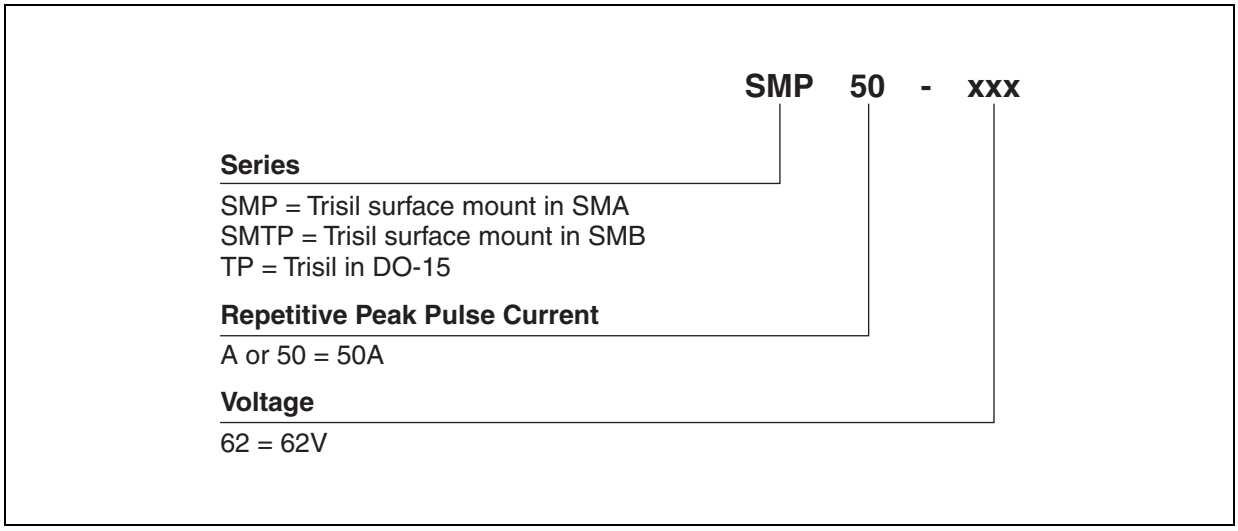
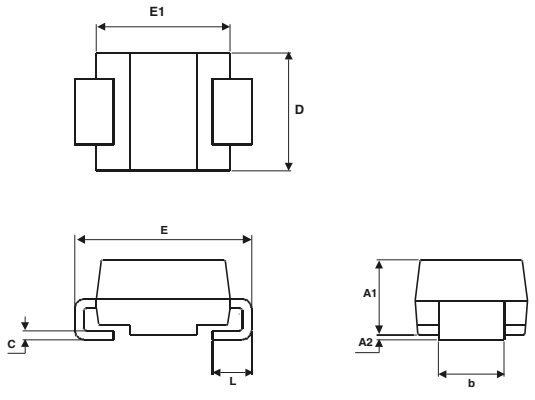



**Figure 14: SMA Package Mechanical Data**




| REF. | DIMENSIONS | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.03 | 0.075 | 0.080 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 1.25 | 1.65 | 0.049 | 0.065 |
| c | 0.15 | 0.41 | 0.006 | 0.016 |
| E | 4.80 | 5.60 | 0.189 | 0.220 |
| E1 | 3.95 | 4.60 | 0.156 | 0.181 |
| D | 2.25 | 2.95 | 0.089 | 0.116 |
| L | 0.75 | 1.60 | 0.030 | 0.063 |

**Figure 15: Foot Print Dimensions** (in millimeters)

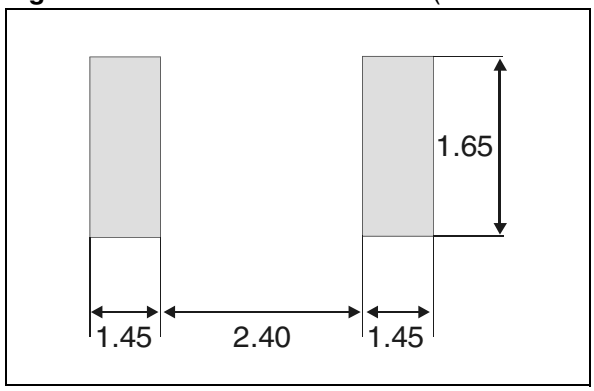
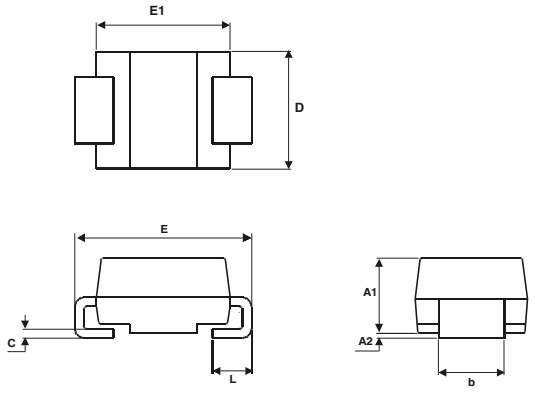


**Figure 16: SMB Package Mechanical Data**




| 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 | 0.41 | 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 | 1.60 | 0.030 | 0.063 |

**Figure 17: Foot Print Dimensions** (in millimeters)

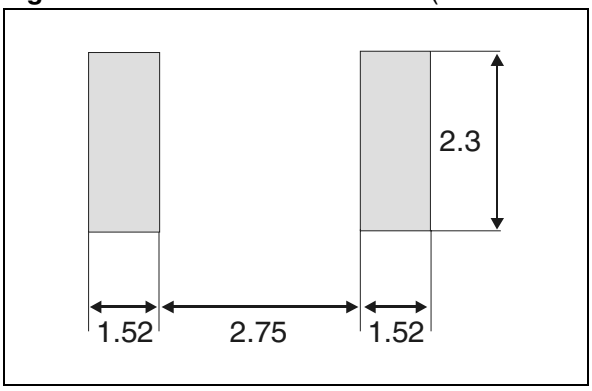
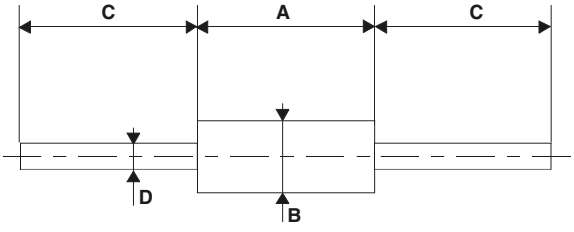



**Figure 18: DO-15 Package Mechanical data**




| 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 |

**Table 6: 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 | | | | |
| SMTPA62 | U01 | SMB | 0.11 g | 2500 | Tape & reel |
| SMTPA68 | U05 | | | | |
| SMTPA100 | U13 | | | | |
| SMTPA120 | U17 | | | | |
| SMTPA130 | U19 | | | | |
| SMTPA180 | U25 | | | | |
| SMTPA200 | U27 | | | | |
| SMTPA220 | U31 | | | | |
| SMTPA240 | U35 | | | | |
| SMTPA270 | U39 | | | | |
| 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 |

**Table 7: Revision History**

| Date | Revision | Description of Changes |
|---|---|---|
| 16-Nov-2004 | 1 | SMP50, SMTPA and TPA datasheets merge. |