

## PROTECTION PRODUCTS

### Description

The SMF series TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD and other voltage-induced transient events. They are designed for use in applications where board space is at a premium. Each device will protect up to four lines. They are unidirectional devices and may be used on lines where the signal polarities are above ground.

TVS diodes are solid-state devices designed specifically for transient suppression. They feature large cross-sectional area junctions for conducting high transient currents. They offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

The SMF series devices may be used to meet the immunity requirements of IEC 61000-4-2, level 4. The small SC70 package makes them ideal for use in portable electronics such as cell phones, PDA's, notebook computers, and digital cameras.

### Features

- ◆ Transient protection for data lines to **IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact) IEC 61000-4-4 (EFT) 40A (5/50ns)**
- ◆ Small package for use in portable electronics
- ◆ Protects four I/O lines
- ◆ Working voltage: 5V & 12V
- ◆ Low leakage current
- ◆ Low operating and clamping voltages
- ◆ Solid-state silicon-avalanche technology

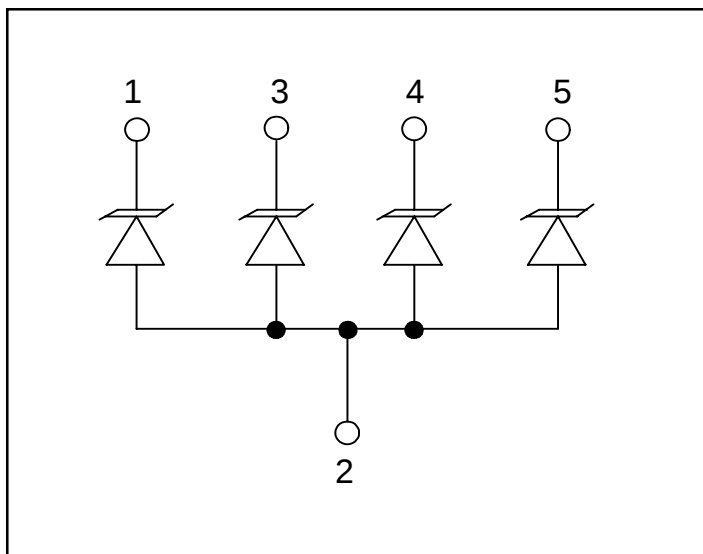
### Mechanical Characteristics

- ◆ EIAJ SC70-5L package
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking Code
- ◆ Packaging : Tape and Reel per EIA 481

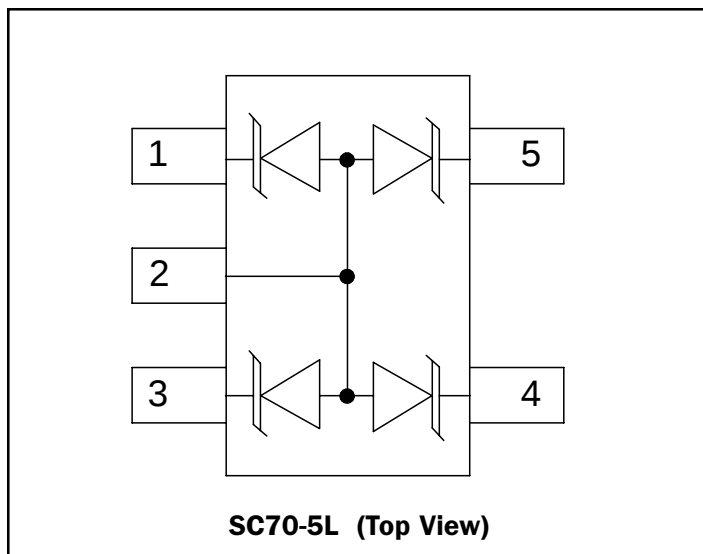
### Applications

- ◆ Cellular Handsets & Accessories
- ◆ Cordless Phones
- ◆ Personal Digital Assistants (PDA's)
- ◆ Notebooks & Handhelds
- ◆ Portable Instrumentation
- ◆ Digital Cameras
- ◆ Peripherals
- ◆ MP3 Players

### Circuit Diagram



### Schematic & PIN Configuration



**PROTECTION PRODUCTS**
**Absolute Maximum Rating**

| Rating                                                         | Symbol    | Value            | Units |
|----------------------------------------------------------------|-----------|------------------|-------|
| Peak Pulse Power ( $t_p = 8/20\mu s$ )                         | $P_{pk}$  | 200              | Watts |
| Peak Pulse Current ( $t_p = 8/20\mu s$ )                       | $I_{pp}$  | 12               | A     |
| Peak Forward Voltage ( $I_F = 1A$ , $t_p = 8/20\mu s$ )        | $V_{FP}$  | 1.5              | V     |
| ESD per IEC 61000-4-2 (Air)<br>ESD per IEC 61000-4-2 (Contact) | $V_{ESD}$ | 20<br>15         | kV    |
| Lead Soldering Temperature                                     | $T_L$     | 260 (10 seconds) | °C    |
| Operating Temperature                                          | $T_J$     | -55 to +125      | °C    |
| Storage Temperature                                            | $T_{STG}$ | -55 to +150      | °C    |

**Electrical Characteristics**
**SMF05**

| Parameter                 | Symbol    | Conditions                                          | Minimum | Typical | Maximum | Units   |
|---------------------------|-----------|-----------------------------------------------------|---------|---------|---------|---------|
| Reverse Stand-Off Voltage | $V_{RWM}$ |                                                     |         |         | 5       | V       |
| Reverse Breakdown Voltage | $V_{BR}$  | $I_t = 1mA$                                         | 6       |         |         | V       |
| Reverse Leakage Current   | $I_R$     | $V_{RWM} = 5V$ , $T = 25^\circ C$                   |         |         | 10      | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{pp} = 1A$ , $t_p = 8/20\mu s$                   |         |         | 9.5     | V       |
| Clamping Voltage          | $V_C$     | $I_{pp} = 12A$ , $t_p = 8/20\mu s$                  |         |         | 12.5    | V       |
| Junction Capacitance      | $C_J$     | Between I/O pins and Gnd<br>$V_R = 0V$ , $f = 1MHz$ |         | 150     | 175     | pF      |

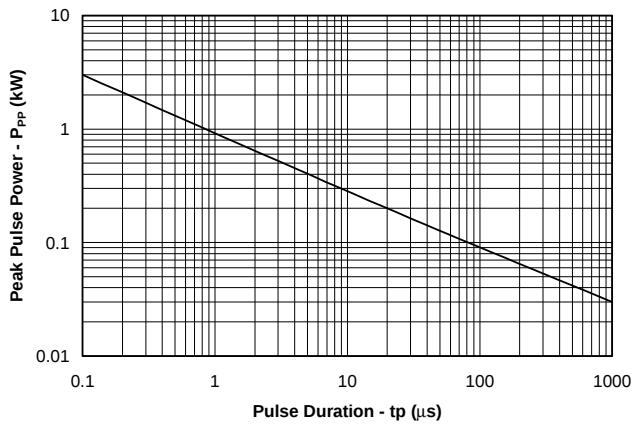
**SMF12**

| Parameter                 | Symbol    | Conditions                                          | Minimum | Typical | Maximum | Units   |
|---------------------------|-----------|-----------------------------------------------------|---------|---------|---------|---------|
| Reverse Stand-Off Voltage | $V_{RWM}$ |                                                     |         |         | 12      | V       |
| Reverse Breakdown Voltage | $V_{BR}$  | $I_t = 1mA$                                         | 13.3    |         |         | V       |
| Reverse Leakage Current   | $I_R$     | $V_{RWM} = 12V$ , $T = 25^\circ C$                  |         |         | 1       | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{pp} = 1A$ , $t_p = 8/20\mu s$                   |         |         | 19      | V       |
| Clamping Voltage          | $V_C$     | $I_{pp} = 8A$ , $t_p = 8/20\mu s$                   |         |         | 25      | V       |
| Junction Capacitance      | $C_J$     | Between I/O pins and Gnd<br>$V_R = 0V$ , $f = 1MHz$ |         | 60      | 75      | pF      |

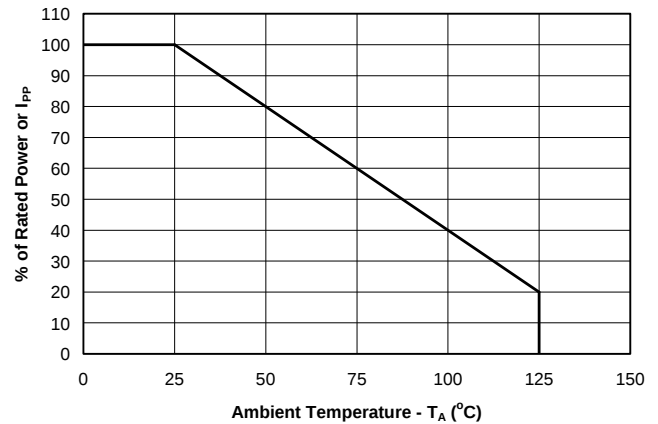
## PROTECTION PRODUCTS

### Typical Characteristics

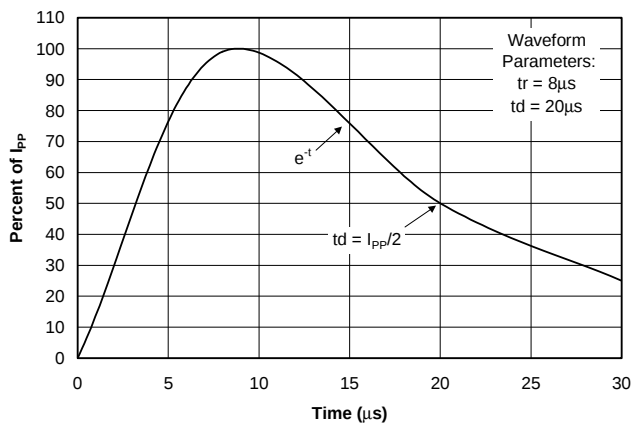
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



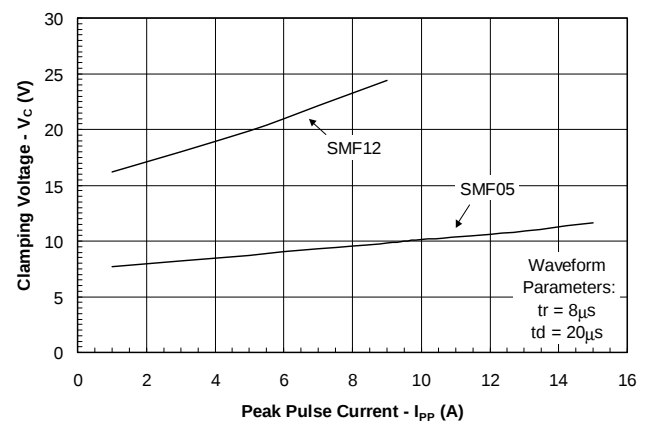
**Power Derating Curve**



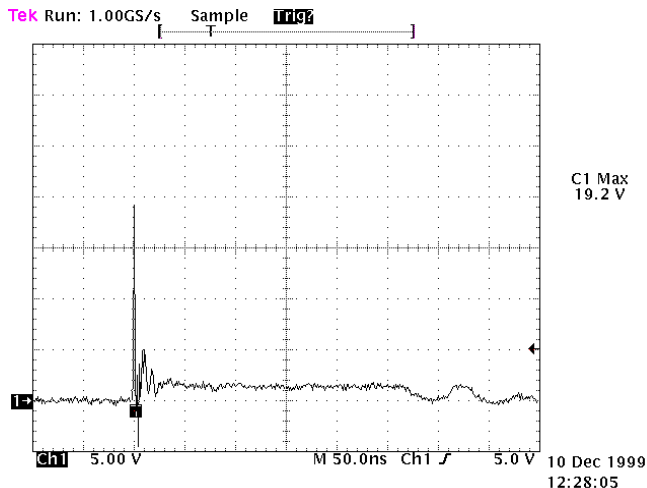
**Pulse Waveform**



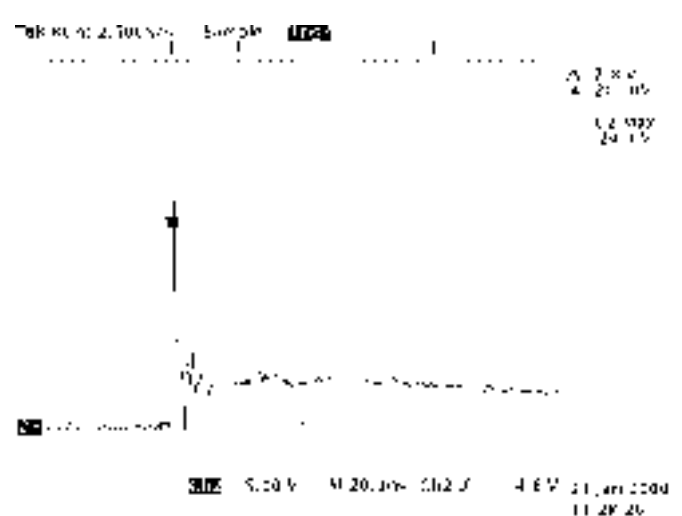
**Clamping Voltage vs. Peak Pulse Current**



**SMF05 ESD Clamping  
(8kV Contact per IEC 61000-4-2)**



**SMF12 ESD Clamping  
(8kV Contact per IEC 61000-4-2)**



## PROTECTION PRODUCTS

### Applications Information

#### Device Connection for Protection of Four Data Lines

The SMFxx is designed to protect up to four unidirectional data lines. The device is connected as follows:

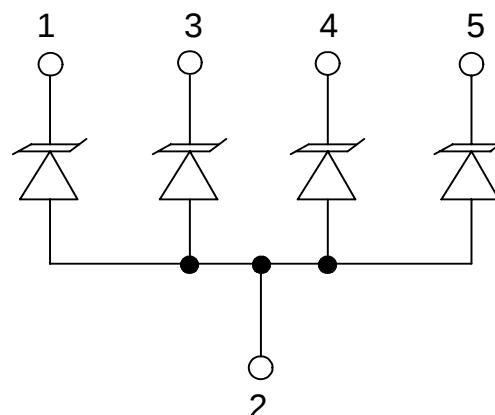
1. Unidirectional protection of four I/O lines is achieved by connecting pins 1, 3, 4, and 5 to the data lines. Pin 2 is connected to ground. The ground connection should be made directly to the ground plane for best results. The path length is kept as short as possible to reduce the effects of parasitic inductance in the board traces.

#### Circuit Board Layout Recommendations for Suppression of ESD.

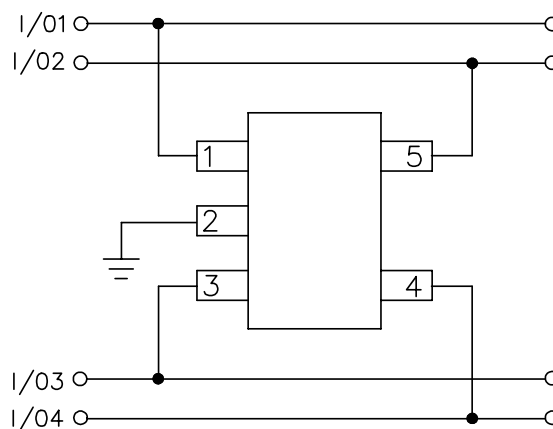
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

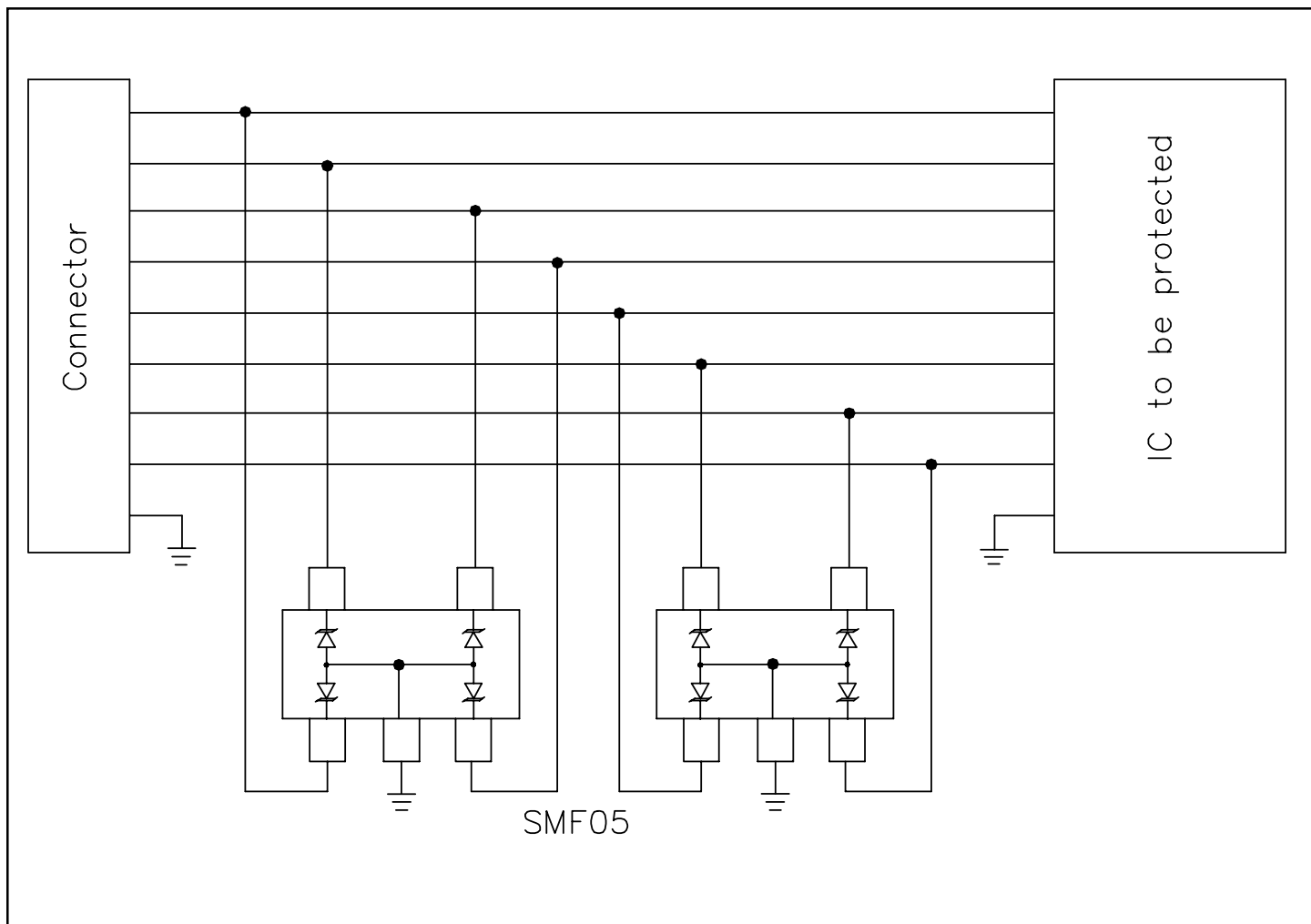
- Place the SMFxx near the input terminals or connectors to restrict transient coupling.
- Minimize the path length between the SMSxx and the protected line.
- Minimize all conductive loops including power and ground loops.
- The ESD transient return path to ground should be kept as short as possible.
- Never run critical signals near board edges.
- Use ground planes whenever possible.

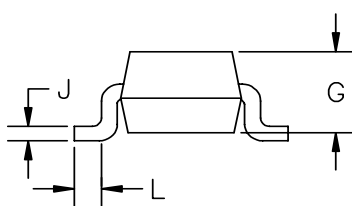
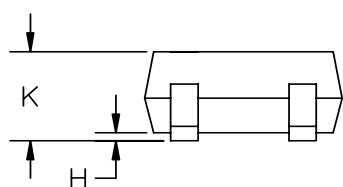
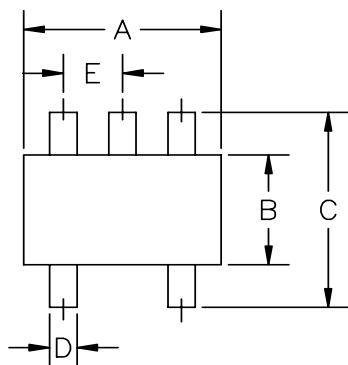
**SMF Circuit Diagram**



**Protection of Four Unidirectional Lines**



**PROTECTION PRODUCTS****Typical Applications**

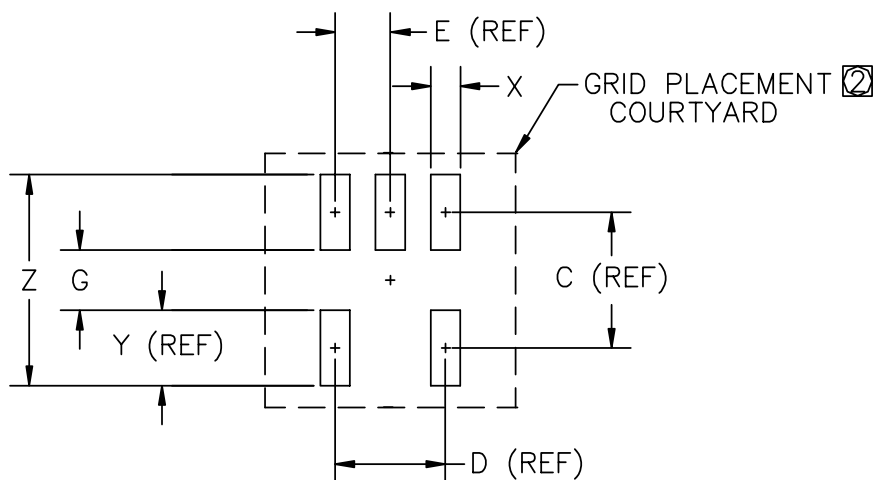
**PROTECTION PRODUCTS**
**Outline Drawing - SC70-5L**


| DIMENSIONS ①     |        |      |      |      | NOTE |
|------------------|--------|------|------|------|------|
| DIM <sup>N</sup> | INCHES |      | MM   |      |      |
|                  | MIN    | MAX  | MIN  | MAX  |      |
| A                | .071   | .087 | 1.80 | 2.20 | —    |
| B                | .045   | .053 | 1.15 | 1.35 | —    |
| C                | .071   | .094 | 1.80 | 2.40 | —    |
| D                | .006   | .012 | .150 | .300 | —    |
| E                | .026   | BSC  | .650 | BSC  | —    |
| G                | .031   | .039 | .800 | 1.00 | —    |
| H                | 0.00   | .004 | 0.00 | .100 | —    |
| J                | .004   | .007 | .100 | .180 | —    |
| K                | .031   | .043 | .800 | 1.10 | —    |
| L                | .004   | .012 | .100 | .300 | —    |

JEDEC EIAJSC70

② PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH AND METAL BURR.

① CONTROLLING DIMENSIONS: MILLIMETERS.

**Land Pattern - SC70-5L**


| DIMENSIONS ①     |        |      |     |      |      |
|------------------|--------|------|-----|------|------|
| DIM <sup>N</sup> | INCHES |      | MM  |      | NOTE |
|                  | MIN    | MAX  | MIN | MAX  |      |
| C                | —      | .063 | —   | 1.60 | —    |
| D                | —      | .052 | —   | 1.30 | —    |
| E                | —      | .026 | —   | .65  | —    |
| G                | —      | .028 | —   | .70  | —    |
| X                | —      | .014 | —   | .35  | —    |
| Y                | —      | .035 | —   | .90  | —    |
| Z                | —      | .098 | —   | 2.50 | —    |

② GRID PLACEMENT COURTYARD IS 6 x 6 ELEMENTS (3 mm X 3 mm) IN ACCORDANCE WITH THE INTERNATIONAL GRID DETAILED IN IEC PUBLICATION 97.

① CONTROLLING DIMENSION: MILLIMETERS

**PROTECTION PRODUCTS****Marking Codes**

| <b>Part Number</b> | <b>Marking Code</b> |
|--------------------|---------------------|
| SMF05              | F05                 |
| SMF12              | F12                 |

Note:

(1) Pin 1 Identified with a dot

**Ordering Information**

| <b>Part Number</b> | <b>Working Voltage</b> | <b>Qty per Reel</b> | <b>Reel Size</b> |
|--------------------|------------------------|---------------------|------------------|
| SMF05.TC           | 5V                     | 3,000               | 7 Inch           |
| SMF05.TG           | 5V                     | 10,000              | 13 Inch          |
| SMF12.TC           | 12V                    | 3,000               | 7 Inch           |
| SMF12.TG           | 12V                    | 10,000              | 13 Inch          |

**Contact Information**

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