

## PROTECTION PRODUCTS

### Description

The SMS series of TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD, lightning, and other voltage-induced transient events. Each device will protect up to four lines operating at **3.3 volts**.

The SMS3.3 is a solid-state device designed specifically for transient suppression. It is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage currents and capacitance over traditional pn junction processes. They offer desirable characteristics for board level protection including fast response time, low clamping voltage and no device degradation.

The SMS3.3 may be used to meet the immunity requirements of IEC 61000-4-2, level 4 ( $\pm 15\text{kV}$  air,  $\pm 8\text{kV}$  contact discharge). The low cost SOT23-6L package makes them ideal for use in portable electronics such as cell phones, PDA's, and notebook computers.

### Features

- ◆ Transient protection for data lines to  
**IEC 61000-4-2 (ESD)  $\pm 15\text{kV}$  (air),  $\pm 8\text{kV}$  (contact)**  
**IEC 61000-4-4 (EFT) 40A (5/50ns)**  
**IEC 61000-4-5 (Lightning) 12A (8/20 $\mu\text{s}$ )**
- ◆ Protects four I/O lines
- ◆ Working voltage: 3.3V
- ◆ Low leakage current ( $<1\mu\text{A}$ )
- ◆ Low clamping voltage
- ◆ Low capacitance (35pF typical)
- ◆ Solid-state EPD TVS technology

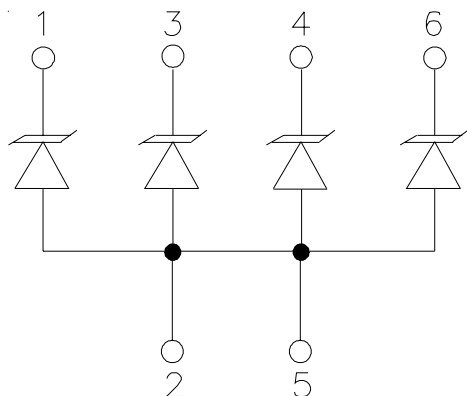
### Mechanical Characteristics

- ◆ EIAJ SOT23-6L package
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking Code
- ◆ Packaging : Tape and Reel per EIA 481

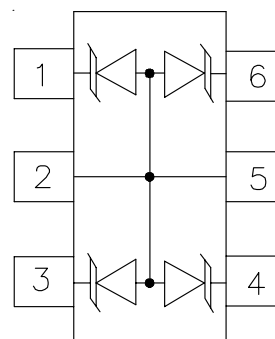
### Applications

- ◆ Cell phone Handsets and Accessories
- ◆ Microprocessor Based Equipment
- ◆ Personal Digital Assistants (PDA's) and Pagers
- ◆ Desktops PC and Servers
- ◆ Notebook, Laptop, and Palmtop Computers
- ◆ Portable Instrumentation
- ◆ Peripherals
- ◆ MP3 Players
- ◆ Cordless Phones

### Equivalent Circuit Diagram



### Schematic & PIN Configuration



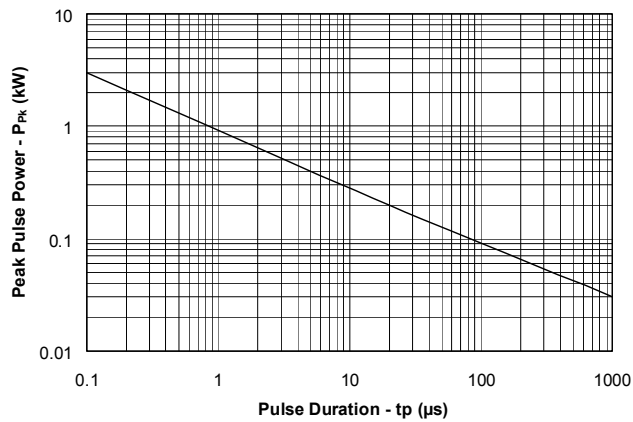
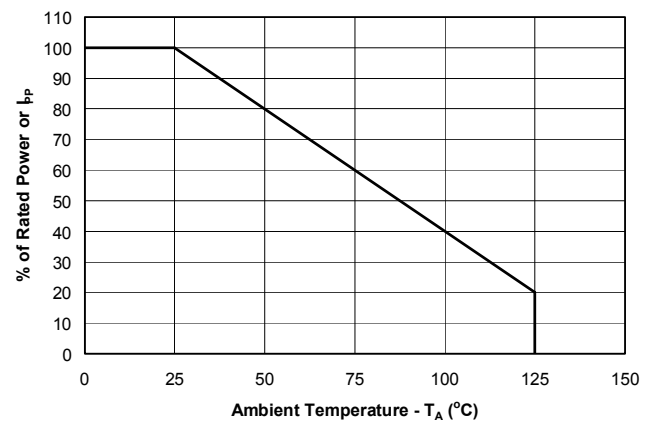
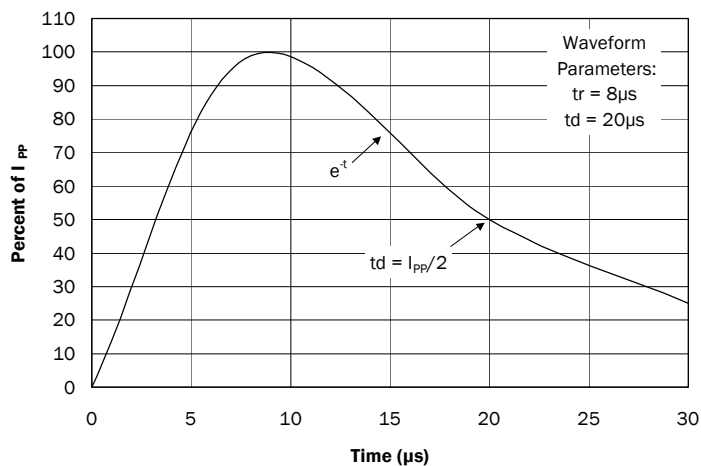
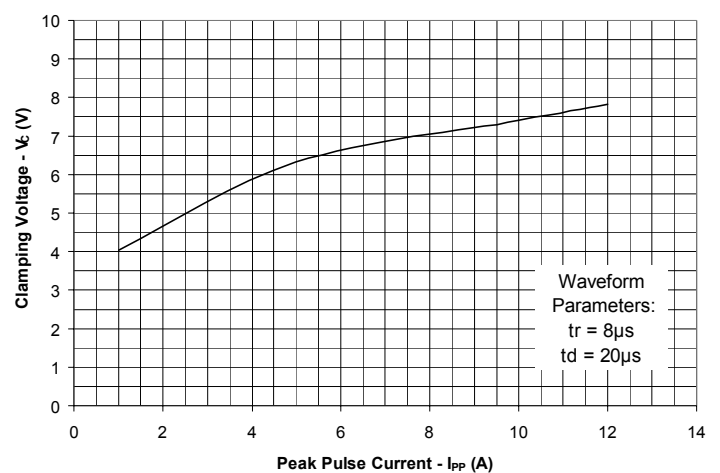
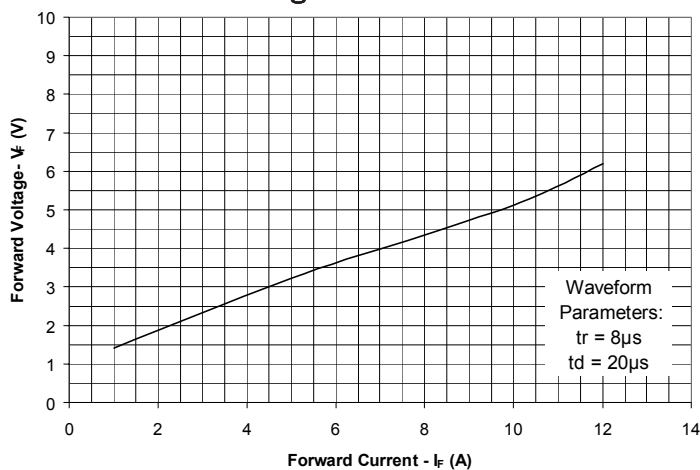
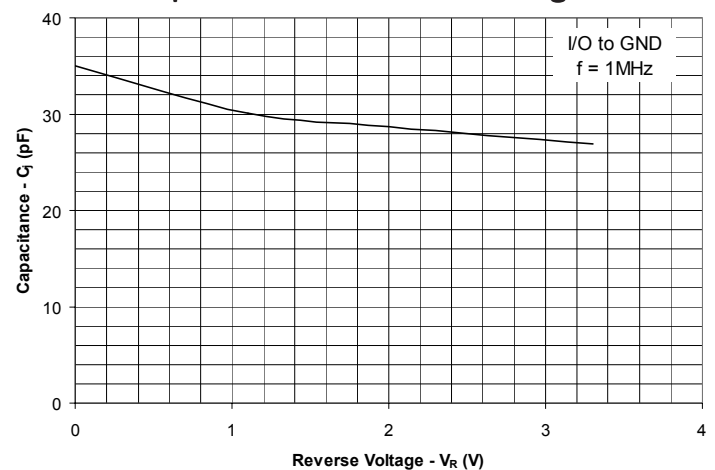
**SOT23-6L (Top View)**

**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     |
| ESD per IEC 61000-4-2 (Air)<br>ESD per IEC 61000-4-2 (Contact) | $V_{ESD}$ | >25<br>>15       | kV    |
| 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**

| <b>SMS3.3</b>                                                |           |                                                      |         |         |         |         |
|--------------------------------------------------------------|-----------|------------------------------------------------------|---------|---------|---------|---------|
| Parameter                                                    | Symbol    | Conditions                                           | Minimum | Typical | Maximum | Units   |
| Reverse Stand-Off Voltage                                    | $V_{RWM}$ |                                                      |         |         | 3.3     | V       |
| Punch-Through Voltage                                        | $V_{PT}$  | $I_{PT} = 2\mu A$                                    | 3.5     |         |         | V       |
| Snap-Back Voltage                                            | $V_{SB}$  | $I_{SB} = 50mA$                                      | 2.8     |         |         | V       |
| Reverse Leakage Current                                      | $I_R$     | $V_{RWM} = 3.3V, T=25^\circ C$                       |         | 0.05    | 0.5     | $\mu A$ |
| Clamping Voltage                                             | $V_C$     | $I_{pp} = 1A, t_p = 8/20\mu s$<br>Any I/O to Ground  |         |         | 4.5     | V       |
| Clamping Voltage                                             | $V_C$     | $I_{pp} = 5A, t_p = 8/20\mu s$<br>Any I/O to Ground  |         |         | 6.8     | V       |
| Clamping Voltage                                             | $V_C$     | $I_{pp} = 12A, t_p = 8/20\mu s$<br>Any I/O to Ground |         |         | 8.7     | V       |
| Steering Diode Forward Voltage<br>(Reverse Clamping Voltage) | $V_F$     | $I_{pp} = 1A, t_p = 8/20\mu s$<br>Any I/O to Ground  |         |         | 1.7     | V       |
| Junction Capacitance                                         | $C_j$     | Each I/O pin and<br>Ground<br>$V_R = 0V, f = 1MHz$   |         | 35      | 40      | pF      |

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

**Power Derating**

**Pulse Waveform**

**Clamping Voltage vs. Peak Pulse Current**

**Forward Voltage vs. Forward Current**

**Capacitance vs. Reverse Voltage**


## PROTECTION PRODUCTS

### Applications Information

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

The SMS3.3 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 6 to the data lines. Pin 2 and 5 are connected to ground. The ground connections 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

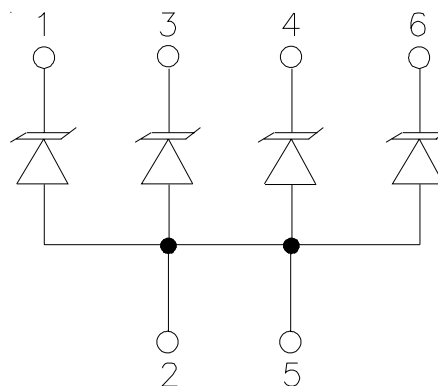
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- Place the TVS near the input terminals or connectors to restrict transient coupling.
- Minimize the path length between the TVS 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.

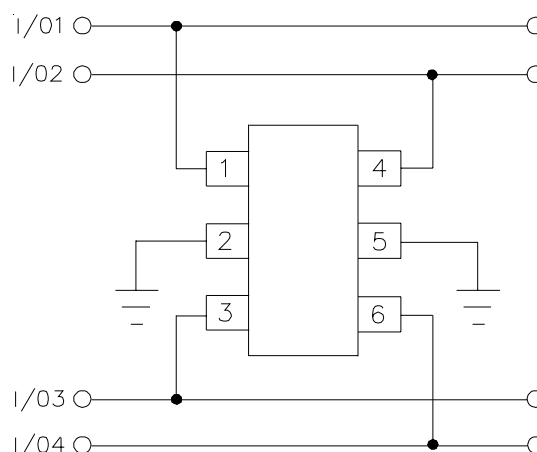
#### Matte Tin Lead Finish

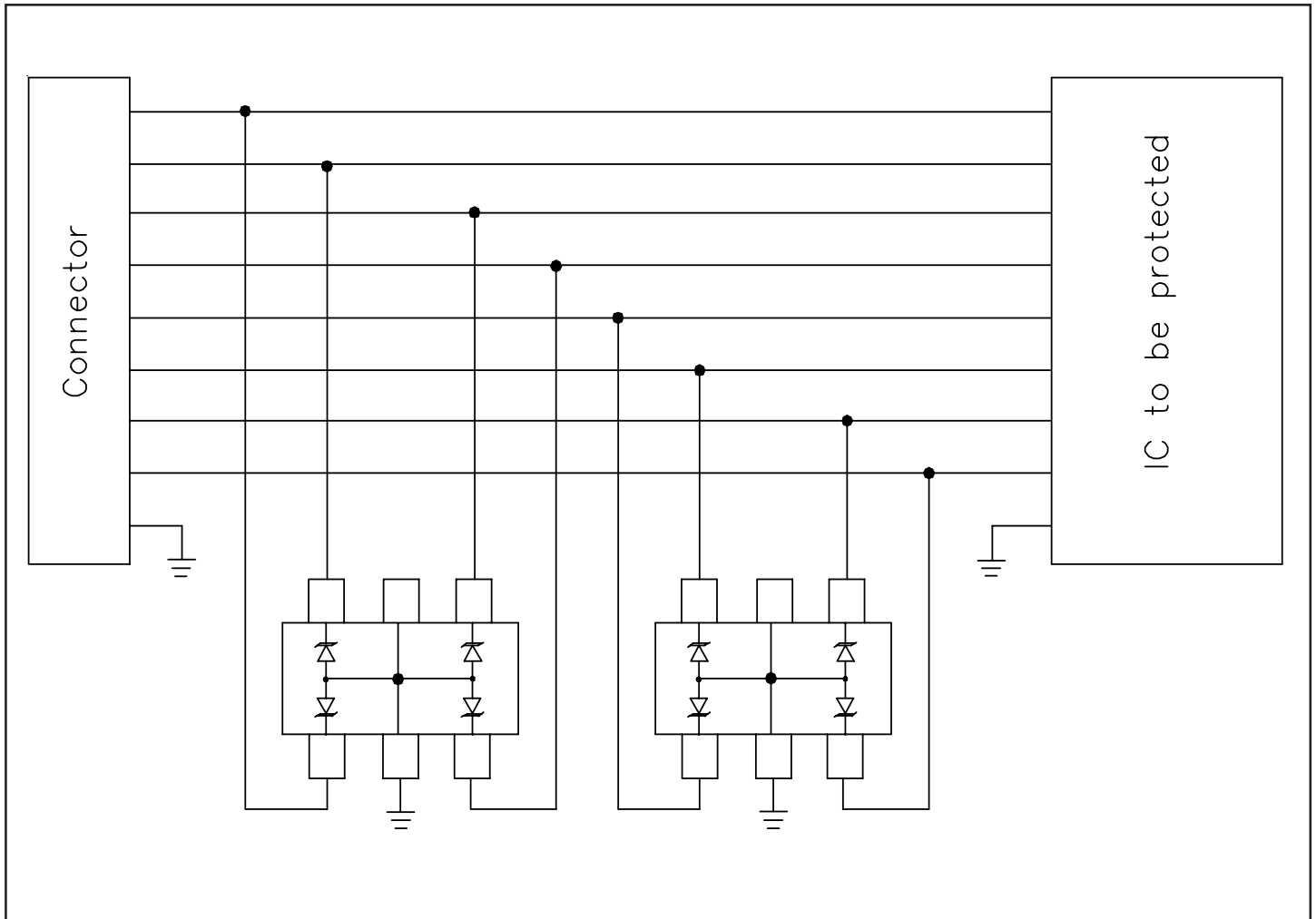
Matte tin has become the industry standard lead-free replacement for SnPb lead finishes. A matte tin finish is composed of 100% tin solder with large grains. Since the solder volume on the leads is small compared to the solder paste volume that is placed on the land pattern of the PCB, the reflow profile will be determined by the requirements of the solder paste. Therefore, these devices are compatible with both lead-free and SnPb assembly techniques. In addition, unlike other lead-free compositions, matte tin does not have any added alloys that can cause degradation of the solder joint.

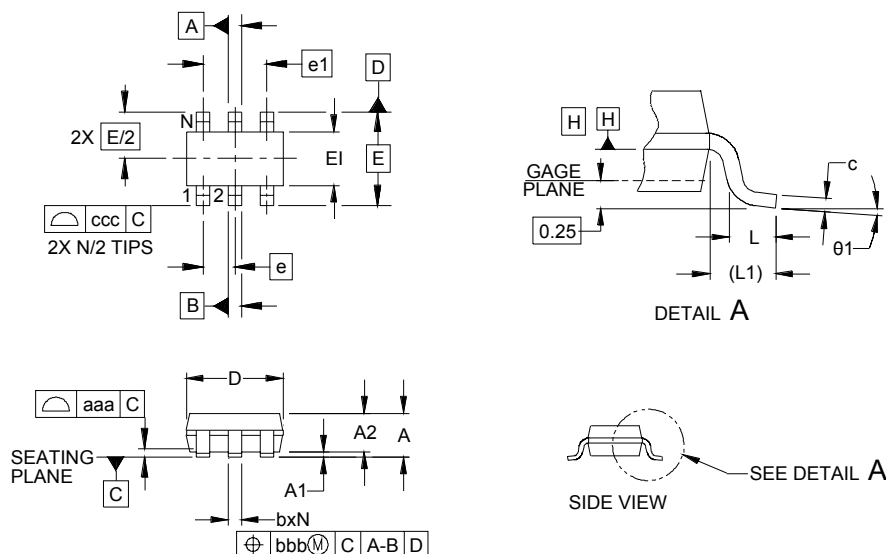
**SMS3.3 Circuit Diagram**



**Protection of Four Unidirectional Lines**



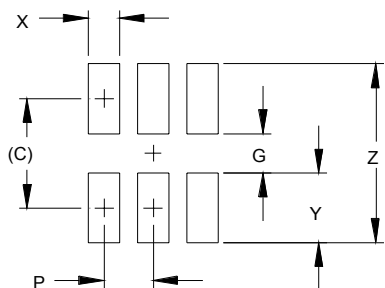
**PROTECTION PRODUCTS****Typical Applications**

**PROTECTION PRODUCTS**
**Outline Drawing -SOT23 6L**


| DIM        | INCHES   |      |      | MILLIMETERS |      |      |
|------------|----------|------|------|-------------|------|------|
|            | MIN      | NOM  | MAX  | MIN         | NOM  | MAX  |
| A          | .035     | -    | .057 | 0.90        | -    | 1.45 |
| A1         | .000     | -    | .006 | 0.00        | -    | 0.15 |
| A2         | .035     | .045 | .051 | .90         | 1.15 | 1.30 |
| b          | .010     | -    | .020 | 0.25        | -    | 0.50 |
| c          | .003     | -    | .009 | 0.08        | -    | 0.22 |
| D          | .110     | .114 | .118 | 2.80        | 2.90 | 3.00 |
| E1         | .060     | .063 | .069 | 1.50        | 1.60 | 1.75 |
| E          | .110 BSC |      |      | 2.80 BSC    |      |      |
| e          | .037 BSC |      |      | 0.95 BSC    |      |      |
| e1         | .075 BSC |      |      | 1.90 BSC    |      |      |
| L          | .012     | .018 | .024 | 0.30        | 0.45 | 0.60 |
| L1         | (.024)   |      |      | (0.60)      |      |      |
| N          | 6        |      |      | 6           |      |      |
| $\theta 1$ | 0°       | -    | 10°  | 0°          | -    | 10°  |
| aaa        | .004     |      |      | 0.10        |      |      |
| bbb        | .008     |      |      | 0.20        |      |      |
| ccc        | .008     |      |      | 0.20        |      |      |

**NOTES:**

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DATUMS **-A-** AND **-B-** TO BE DETERMINED AT DATUM PLANE **E-H**.
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

**Land Pattern -SOT23 6L**


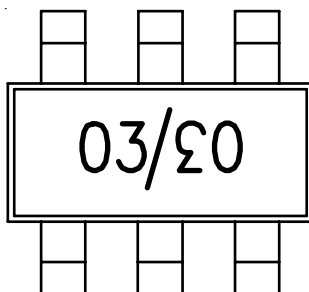
| DIM | DIMENSIONS |             |
|-----|------------|-------------|
|     | INCHES     | MILLIMETERS |
| C   | (.098)     | (2.50)      |
| G   | .055       | 1.40        |
| P   | .037       | 0.95        |
| X   | .024       | 0.60        |
| Y   | .043       | 1.10        |
| Z   | .141       | 3.60        |

**NOTES:**

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

## PROTECTION PRODUCTS

### Marking



**Top Side Mark**

### Ordering Information

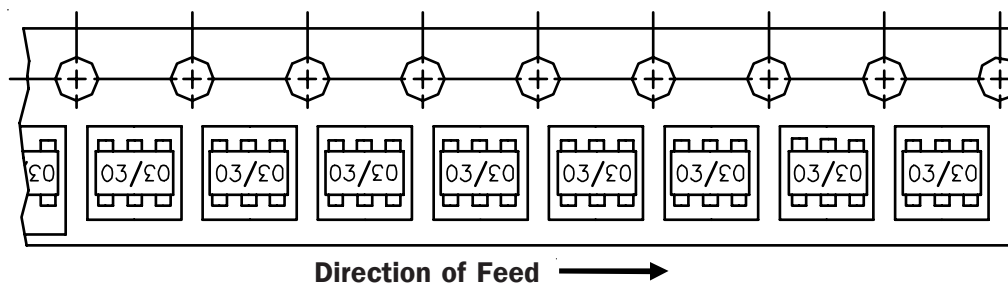
| Part Number | Lead Finish | Qty per Reel | Reel Size |
|-------------|-------------|--------------|-----------|
| SMS3.3.TC   | SnPb        | 3,000        | 7 Inch    |
| SMS3.3.TCT  | Pb free     | 3,000        | 7 Inch    |

Note:

(1) No suffix indicates tube pack.

### Tape and Reel Specification

#### Device Orientation in Tape:



#### Tape Specifications (per EIA 481)

Reel Material: Static Dissipative  
 Tape Material: Static Dissipative  
 Tape Width: 8mm +/- 0.30mm  
 Component Pitch (max.): 4mm +/- 0.10mm  
 Component Cavity Play: 20°

### Contact Information

Semtech Corporation  
 Protection Products Division  
 200 Flynn Rd., Camarillo, CA 93012  
 Phone: (805)498-2111 FAX (805)498-3804