

## PROTECTION PRODUCTS

### Absolute Maximum Rating

| Rating                                 | Symbol    | Value         | Units |
|----------------------------------------|-----------|---------------|-------|
| Peak Pulse Power ( $t_p = 8/20\mu s$ ) | $P_{pk}$  | 300           | Watts |
| ESD Voltage (HBM per IEC 61000-4-2)    | $V_{ESD}$ | >25           | kV    |
| Lead Soldering Temperature             | $T_L$     | 260 (10 sec.) | °C    |
| Operating Temperature                  | $T_J$     | -55 to +125   | °C    |
| Storage Temperature                    | $T_{STG}$ | -55 to +150   | °C    |

### Electrical Characteristics

#### SL05

| 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   | $I_R$     | $V_{RWM} = 5V, T=25^\circ C$        |         |         | 20      | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{PP} = 1A,$<br>$t_p = 8/20\mu s$ |         |         | 9.8     | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 5A,$<br>$t_p = 8/20\mu s$ |         |         | 11      | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                   |         |         | 17      | A       |
| Junction Capacitance      | $C_J$     | Pin 1 to 2<br>$V_R = 0V, f = 1MHz$  |         |         | 5       | pF      |

#### SL12

| 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          | $V_C$     | $I_{PP} = 1A,$<br>$t_p = 8/20\mu s$ |         |         | 19      | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 5A,$<br>$t_p = 8/20\mu s$ |         |         | 24      | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                   |         |         | 12      | A       |
| Junction Capacitance      | $C_J$     | Pin 1 to 2<br>$V_R = 0V, f = 1MHz$  |         |         | 5       | pF      |

# PROTECTION PRODUCTS

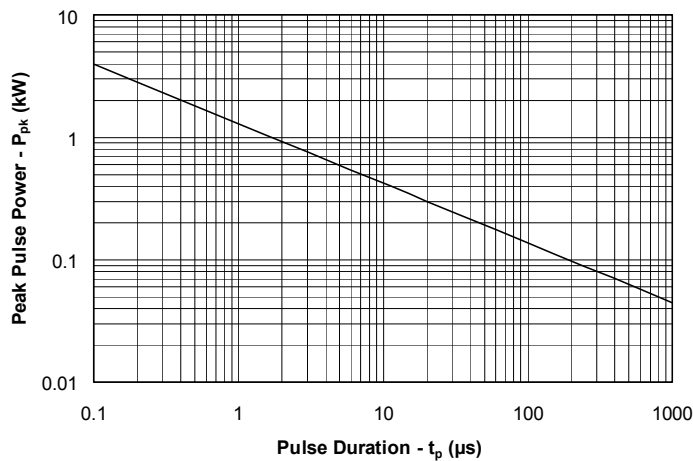
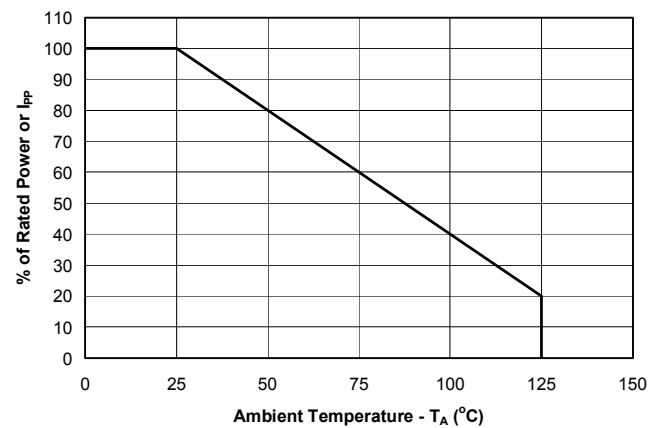
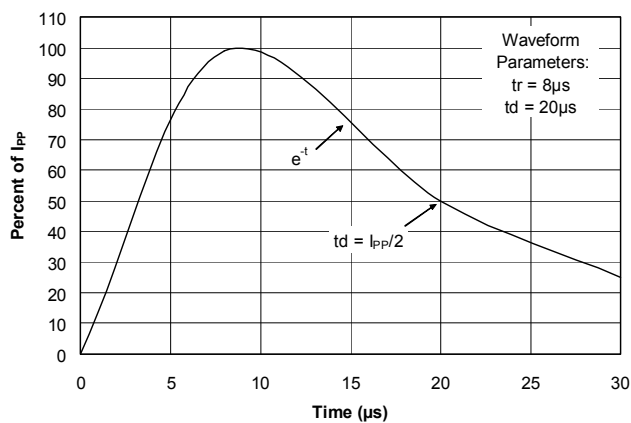
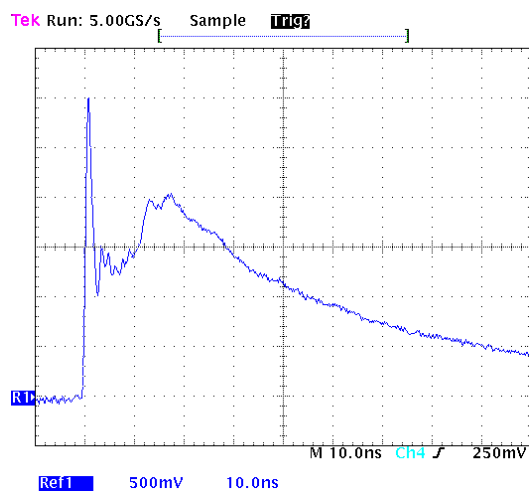
## Electrical Characteristics (Continued)

### SL15

| Parameter                 | Symbol    | Conditions                          | Minimum | Typical | Maximum | Units   |
|---------------------------|-----------|-------------------------------------|---------|---------|---------|---------|
| Reverse Stand-Off Voltage | $V_{RWM}$ |                                     |         |         | 15      | V       |
| Reverse Breakdown Voltage | $V_{BR}$  | $I_t = 1mA$                         | 16.7    |         |         | V       |
| Reverse Leakage Current   | $I_R$     | $V_{RWM} = 15V, T=25^{\circ}C$      |         |         | 1       | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{PP} = 1A,$<br>$t_p = 8/20\mu s$ |         |         | 24      | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 5A,$<br>$t_p = 8/20\mu s$ |         |         | 30      | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                   |         |         | 10      | A       |
| Junction Capacitance      | $C_j$     | Pin 1 to 2<br>$V_R = 0V, f = 1MHz$  |         |         | 5       | pF      |

### SL24

| Parameter                 | Symbol    | Conditions                          | Minimum | Typical | Maximum | Units   |
|---------------------------|-----------|-------------------------------------|---------|---------|---------|---------|
| Reverse Stand-Off Voltage | $V_{RWM}$ |                                     |         |         | 24      | V       |
| Reverse Breakdown Voltage | $V_{BR}$  | $I_t = 1mA$                         | 26.7    |         |         | V       |
| Reverse Leakage Current   | $I_R$     | $V_{RWM} = 24V, T=25^{\circ}C$      |         |         | 1       | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{PP} = 1A,$<br>$t_p = 8/20\mu s$ |         |         | 43      | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 5A,$<br>$t_p = 8/20\mu s$ |         |         | 55      | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                   |         |         | 5       | A       |
| Junction Capacitance      | $C_j$     | Pin 1 to 2<br>$V_R = 0V, f = 1MHz$  |         |         | 5       | pF      |

**PROTECTION PRODUCTS**
**Typical Characteristics**
**Non-Repetitive Peak Pulse Power vs. Pulse Time**

**Power Derating Curve**

**Pulse Waveform**

**ESD Pulse Waveform (Per IEC 61000-4-2)**

**IEC 61000-4-2 Discharge Parameters**

| Level | First Peak Current (A) | Peak Current at 30 ns (A) | Peak Current at 60 ns (A) | Test Voltage (Contact Discharge) (kV) | Test Voltage (Air Discharge) (kV) |
|-------|------------------------|---------------------------|---------------------------|---------------------------------------|-----------------------------------|
| 1     | 7.5                    | 4                         | 8                         | 2                                     | 2                                 |
| 2     | 15                     | 8                         | 4                         | 4                                     | 4                                 |
| 3     | 22.5                   | 12                        | 6                         | 6                                     | 8                                 |
| 4     | 30                     | 16                        | 8                         | 8                                     | 15                                |

## PROTECTION PRODUCTS

### Applications Information

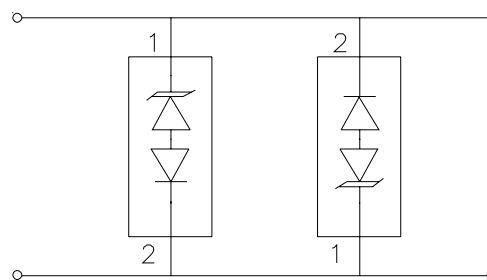
#### Device Connection for Protection of One High-Speed Data Line

The SL series devices are designed to protect high-speed data lines. The SLxx utilizes a low capacitance compensation diode in series with, but in opposite polarity to a TVS diode in each line to achieve an effective capacitance of less than 5pF per device. During a transient event, the internal rectifier must be forward biased (TVS is reversed biased). Therefore, each device will only suppress transient events in one polarity. To achieve protection in both positive and negative polarity, a second device is connected in anti-parallel to the first. On unidirectional lines, a fast switching steering diode may be used as an alternative to using two SL devices.

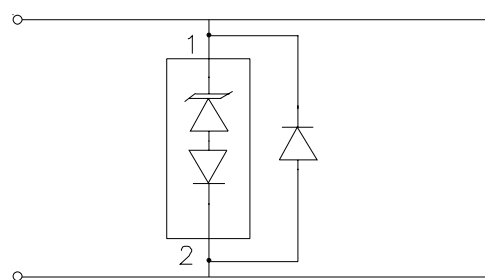
The options for connecting the devices are as follows:

- Low capacitance protection of one high-speed line:** Protection of one unidirectional or bidirectional high-speed line is achieved by connecting two devices in anti-parallel. Pin 1 of the first device is connected to the line and pin 2 is connected to ground (or to a second line for differential protection). Pin 2 of the second device is connected to line 1 and pin 1 is connected to ground (or line 2) as shown. Pin 3 is not connected. During positive duration transients, the first device will conduct from pin 1 to 2. The steering diode conducts in the forward direction while the TVS will avalanche and conduct in the reverse direction. During negative transients, the second device will conduct in the same manner. For optimum protection, 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. The path length between the TVS and the protected line should also be minimized.
- Connection Option for Unidirectional Lines Only:** An optional method for protecting unidirectional (normal signal polarities above ground) lines is to add a fast switching steering diode in parallel to the SL TVS. Input/outputs are connected to pin 1 of the SL device and the cathode of the rectifier. The anode of the diode and pin 2 of the SL TVS are connected to ground.

#### SL Connection Options

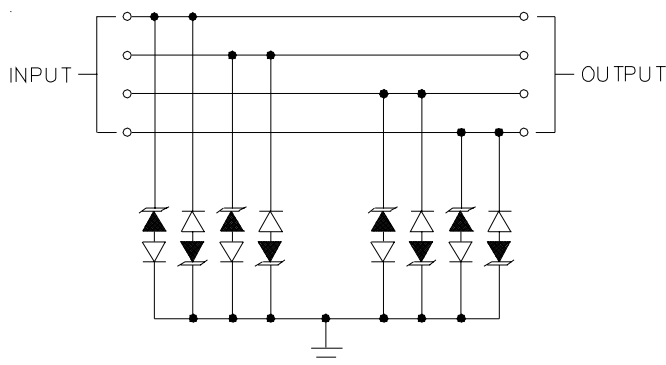


Two Devices : Bidirectional or Unidirectional Line



One Devices with Steering Diode : Unidirectional Line

#### I/O Line Protection

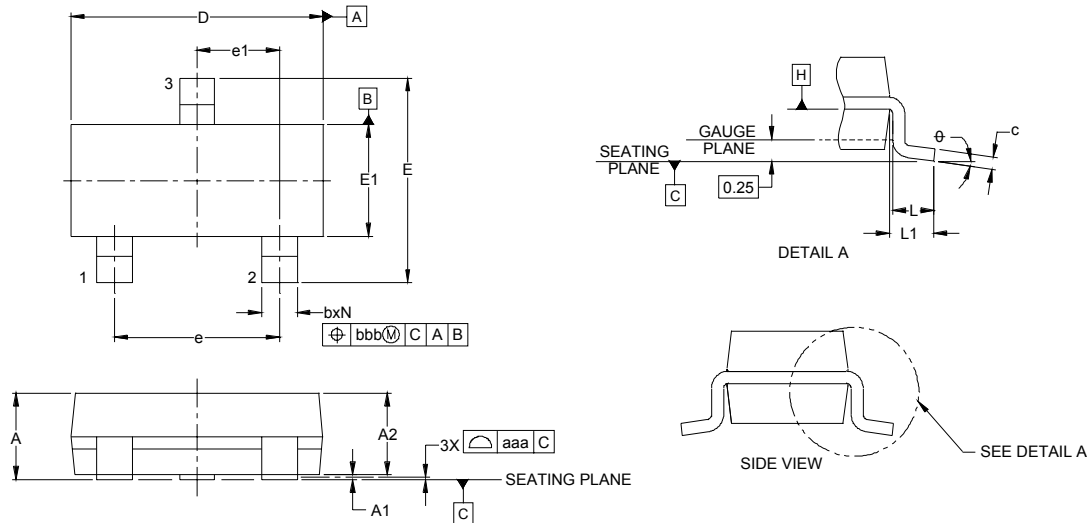


#### Matte Tin Lead Finish

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.

## PROTECTION PRODUCTS

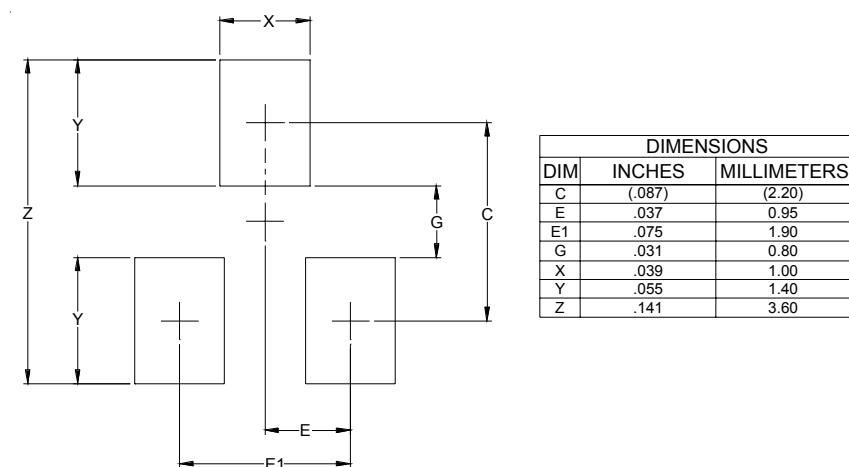
### Outline Drawing - SOT23 3L



#### NOTES:

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

### Land Pattern - SOT23 3L



#### NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
2. REFERENCE IPC-SM-782A.

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

| Part Number | Marking Code |
|-------------|--------------|
| SL05        | L05          |
| SL12        | L12          |
| SL15        | L15          |
| SL24        | L24          |

**Ordering Information**

| Part Number | Lead Finish | Qty per Reel | Reel Size |
|-------------|-------------|--------------|-----------|
| SL05.TC     | SnPb        | 3,000        | 7 Inch    |
| SL12.TC     | SnPb        | 3,000        | 7 Inch    |
| SL15.TC     | SnPb        | 3,000        | 7 Inch    |
| SL24.TC     | SnPb        | 3,000        | 7 Inch    |
| SL05.TCT    | Pb Free     | 3,000        | 7 Inch    |
| SL12.TCT    | Pb Free     | 3,000        | 7 Inch    |
| SL15.TCT    | Pb Free     | 3,000        | 7 Inch    |
| SL24.TCT    | Pb Free     | 3,000        | 7 Inch    |

**Contact Information**

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