

### PROTECTION PRODUCTS

#### Description

The SMDAxxC series of TVS arrays are designed to provide bidirectional protection for sensitive electronics from damage or latch-up due to ESD, lightning and other voltage-induced transient events. Each device will protect four data or I/O lines. They are available with operating voltages of 5V, 12V, 15V and 24V.

TVS diodes are solid-state devices designed specifically for transient suppression. They offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage and no device degradation. The low profile SO-8 package allows the user to protect up to four independent lines with one package. The SMDAxxC series is suitable protection for sensitive semiconductor components such as microprocessors, ASICs, transceivers, transducers, and CMOS memory.

The SMDAxxC series devices may be used to meet the ESD immunity requirements of IEC 61000-4-2, level 4 for air and contact discharge.

#### 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 $\mu$ s)**
- ◆ Bidirectional protection
- ◆ Small SO-8 package
- ◆ Protects four I/O lines
- ◆ Working voltages: 5V, 12V, 15V and 24V
- ◆ Low leakage current
- ◆ Low operating and clamping voltages
- ◆ Solid-state silicon avalanche technology

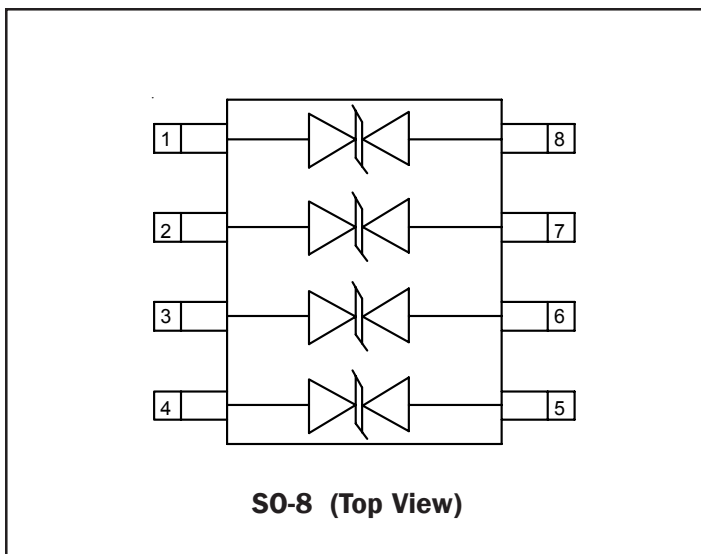
#### Mechanical Characteristics

- ◆ JEDEC SO-8 package
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Part number, date code, logo
- ◆ Packaging : Tube or Tape and Reel per EIA 481

#### Applications

- ◆ Data and I/O Lines
- ◆ Microprocessor based equipment
- ◆ Notebooks, Desktops, and Servers
- ◆ Instrumentation
- ◆ LAN/WAN equipment
- ◆ Peripherals
- ◆ Serial and Parallel Ports

#### Schematic & PIN Configuration



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### Absolute Maximum Rating

| Rating                              | Symbol           | Value         | Units |
|-------------------------------------|------------------|---------------|-------|
| Peak Pulse Power (tp = 8/20μs)      | P <sub>pk</sub>  | 300           | Watts |
| ESD Voltage (HBM per IEC 61000-4-2) | V <sub>ESD</sub> | >25           | kV    |
| Lead Soldering Temperature          | T <sub>L</sub>   | 260 (10 sec.) | °C    |
| Operating Temperature               | T <sub>J</sub>   | -55 to +125   | °C    |
| Storage Temperature                 | T <sub>STG</sub> | -55 to +150   | °C    |

### Electrical Characteristics (T=25°C)

| SMDA05C                    |                  |                                   |         |         |         |       |
|----------------------------|------------------|-----------------------------------|---------|---------|---------|-------|
| Parameter                  | Symbol           | Conditions                        | Minimum | Typical | Maximum | Units |
| Reverse Stand-Off Voltage  | V <sub>RWM</sub> |                                   |         |         | 5       | V     |
| Reverse Breakdown Voltage  | V <sub>BR</sub>  | I <sub>t</sub> = 1mA              | 6       |         |         | V     |
| Reverse Leakage Current    | I <sub>R</sub>   | V <sub>RWM</sub> = 5V, T=25°C     |         |         | 20      | μA    |
| Clamping Voltage           | V <sub>C</sub>   | I <sub>pp</sub> = 1A, tp = 8/20μs |         |         | 9.8     | V     |
| Clamping Voltage           | V <sub>C</sub>   | I <sub>pp</sub> = 5A, tp = 8/20μs |         |         | 11      | V     |
| Maximum Peak Pulse Current | I <sub>pp</sub>  | tp = 8/20μs                       |         |         | 17      | A     |
| Junction Capacitance       | C <sub>J</sub>   | V <sub>R</sub> = 0V, f = 1MHz     |         |         | 350     | pF    |

| SMDA12C                    |                  |                                   |         |         |         |       |
|----------------------------|------------------|-----------------------------------|---------|---------|---------|-------|
| Parameter                  | Symbol           | Conditions                        | Minimum | Typical | Maximum | Units |
| Reverse Stand-Off Voltage  | V <sub>RWM</sub> |                                   |         |         | 12      | V     |
| Reverse Breakdown Voltage  | V <sub>BR</sub>  | I <sub>t</sub> = 1mA              | 13.3    |         |         | V     |
| Reverse Leakage Current    | I <sub>R</sub>   | V <sub>RWM</sub> = 12V, T=25°C    |         |         | 1       | μA    |
| Clamping Voltage           | V <sub>C</sub>   | I <sub>pp</sub> = 1A, tp = 8/20μs |         |         | 19      | V     |
| Clamping Voltage           | V <sub>C</sub>   | I <sub>pp</sub> = 5A, tp = 8/20μs |         |         | 24      | V     |
| Maximum Peak Pulse Current | I <sub>pp</sub>  | tp = 8/20μs                       |         |         | 12      | A     |
| Junction Capacitance       | C <sub>J</sub>   | V <sub>R</sub> = 0V, f = 1MHz     |         |         | 120     | pF    |

## PROTECTION PRODUCTS

### Electrical Characteristics (Continued)

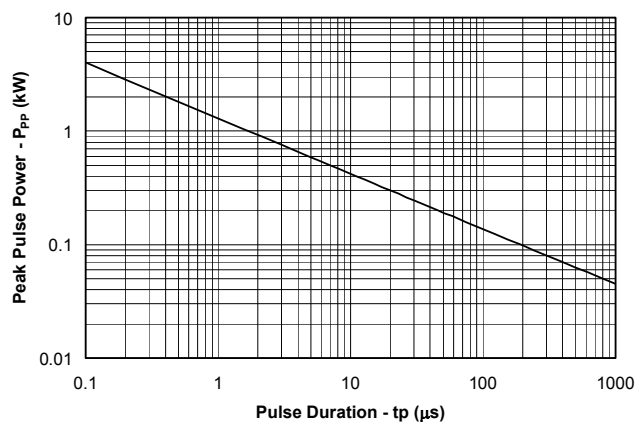
| <b>SMDA15C</b>             |           |                                |         |         |         |         |
|----------------------------|-----------|--------------------------------|---------|---------|---------|---------|
| Parameter                  | Symbol    | Conditions                     | 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           | $V_C$     | $I_{PP} = 1A, tp = 8/20\mu s$  |         |         | 24      | V       |
| Clamping Voltage           | $V_C$     | $I_{PP} = 5A, tp = 8/20\mu s$  |         |         | 30      | V       |
| Maximum Peak Pulse Current | $I_{PP}$  | $tp = 8/20\mu s$               |         |         | 10      | A       |
| Junction Capacitance       | $C_J$     | $V_R = 0V, f = 1MHz$           |         |         | 75      | pF      |

| <b>SMDA24C</b>             |           |                                |         |         |         |         |
|----------------------------|-----------|--------------------------------|---------|---------|---------|---------|
| 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           | $V_C$     | $I_{PP} = 1A, tp = 8/20\mu s$  |         |         | 43      | V       |
| Clamping Voltage           | $V_C$     | $I_{PP} = 5A, tp = 8/20\mu s$  |         |         | 55      | V       |
| Maximum Peak Pulse Current | $I_{PP}$  | $tp = 8/20\mu s$               |         |         | 5       | A       |
| Junction Capacitance       | $C_J$     | $V_R = 0V, f = 1MHz$           |         |         | 50      | pF      |

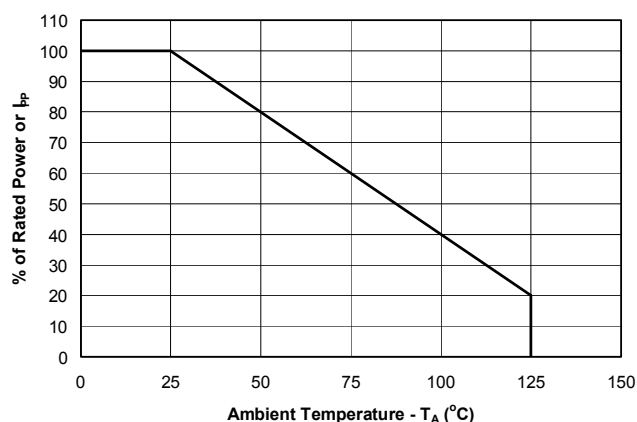
## PROTECTION PRODUCTS

### Typical Characteristics

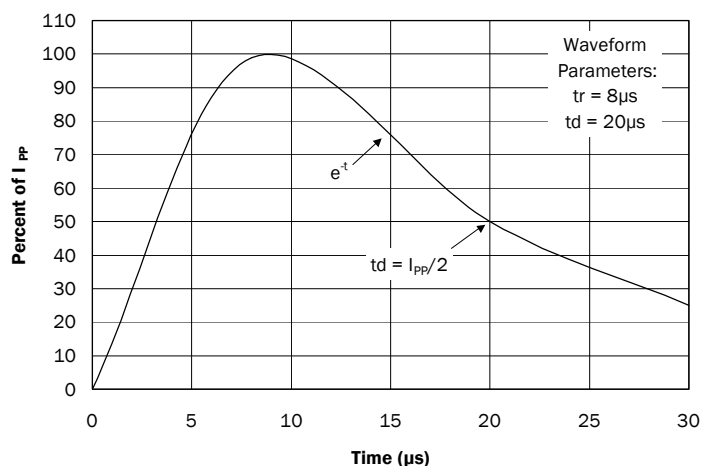
#### Non-Repetitive Peak Pulse Power vs. Pulse Time



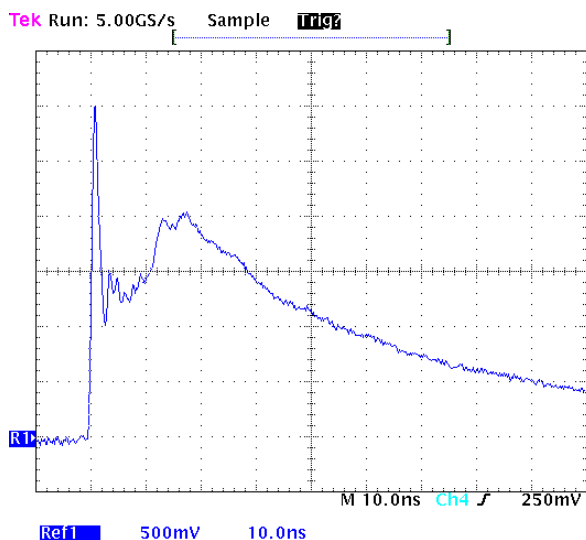
#### Power Derating Curve



#### Pulse Waveform



#### ESD Pulse Waveform (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 Four Data Lines

The SMDAxxC series of devices are designed to protect up to four data lines. The devices are connected as follows:

- The SMDAxxC are bidirectional devices and are designed for use on lines where the normal operating voltage is above and below ground. Pins 1, 2, 3, and 4 are connected to the protected lines. Pins 5, 6, 7, and 8 are connected to ground. Since the device is electrically symmetrical, these connections may be reversed. 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.

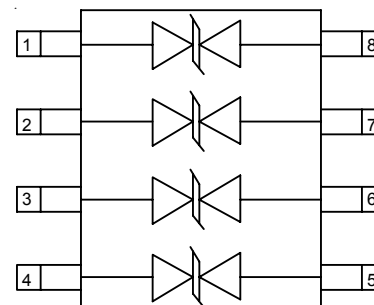
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- 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.

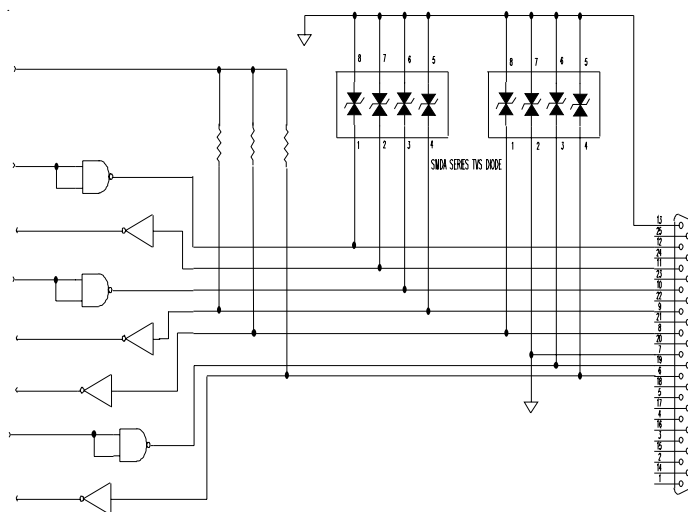
#### Matte Tin Lead Finish

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.

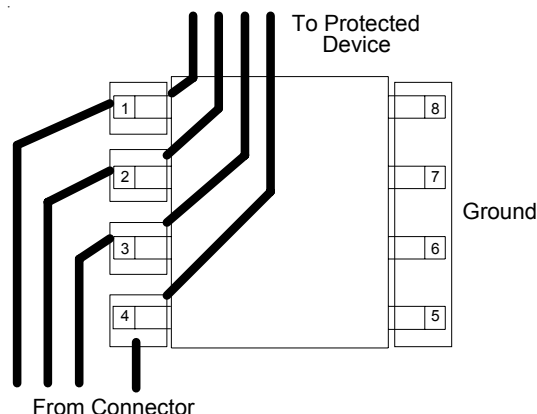
**Circuit Diagram**



**I/O Line Protection**

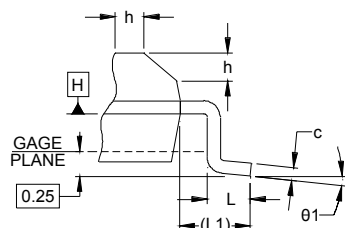
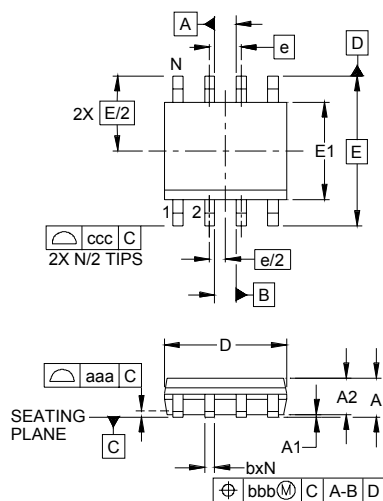


**Typical Connection**

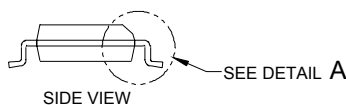


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### Outline Drawing - S0-8



DETAIL A

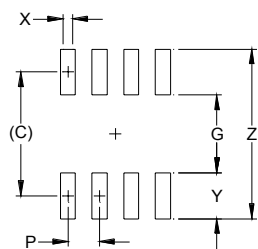


| DIM | INCHES   |      |      | MILLIMETERS |      |      |
|-----|----------|------|------|-------------|------|------|
|     | MIN      | NOM  | MAX  | MIN         | NOM  | MAX  |
| A   | .053     | -    | .069 | 1.35        | -    | 1.75 |
| A1  | .004     | -    | .010 | 0.10        | -    | 0.25 |
| A2  | .049     | -    | .065 | 1.25        | -    | 1.65 |
| b   | .012     | -    | .020 | 0.31        | -    | 0.51 |
| c   | .007     | -    | .010 | 0.17        | -    | 0.25 |
| D   | .189     | .193 | .197 | 4.80        | 4.90 | 5.00 |
| E1  | .150     | .154 | .157 | 3.80        | 3.90 | 4.00 |
| E   | .236 BSC |      |      | 6.00 BSC    |      |      |
| e   | .050 BSC |      |      | 1.27 BSC    |      |      |
| h   | .010     | -    | .020 | 0.25        | -    | 0.50 |
| L   | .016     | .028 | .041 | 0.40        | 0.72 | 1.04 |
| L1  | (.041)   |      |      | (1.04)      |      |      |
| N   | 8        |      |      | 8           |      |      |
| θ1  | 0°       | -    | 8°   | 0°          | -    | 8°   |
| aaa | .004     |      |      | 0.10        |      |      |
| bbb | .010     |      |      | 0.25        |      |      |
| 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 **-H-**.
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. REFERENCE JEDEC STD MS-012, VARIATION AA.

### Land Pattern - S0-8



| DIM | DIMENSIONS |             |
|-----|------------|-------------|
|     | INCHES     | MILLIMETERS |
| C   | (.205)     | (5.20)      |
| G   | .118       | 3.00        |
| P   | .050       | 1.27        |
| X   | .024       | 0.60        |
| Y   | .087       | 2.20        |
| Z   | .291       | 7.40        |

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, RLP NO. 300A.

**PROTECTION PRODUCTS****Ordering Information**

| <b>Part Number</b> | <b>Working Voltage</b> | <b>Lead Finish</b> | <b>Qty per Reel</b> | <b>Reel Size</b> |
|--------------------|------------------------|--------------------|---------------------|------------------|
| SMDA05C.TB         | 5                      | SnPb               | 500                 | 7 Inch           |
| SMDA12C.TB         | 12                     | SnPb               | 500                 | 7 Inch           |
| SMDA15C.TB         | 15                     | SnPb               | 500                 | 7 Inch           |
| SMDA24C.TB         | 24                     | SnPb               | 500                 | 7 Inch           |
| SMDA05C.TBT        | 5                      | Pb Free            | 500                 | 7 Inch           |
| SMDA12C.TBT        | 12                     | Pb Free            | 500                 | 7 Inch           |
| SMDA15C.TBT        | 15                     | Pb Free            | 500                 | 7 Inch           |
| SMDA24C.TBT        | 24                     | Pb Free            | 500                 | 7 Inch           |
| SMDA05C            | 5                      | SnPb               | 95/Tube             | N/A              |
| SMDA12C            | 12                     | SnPb               | 95/Tube             | N/A              |
| SMDA15C            | 15                     | SnPb               | 95/Tube             | N/A              |
| SMDA24C            | 24                     | SnPb               | 95/Tube             | N/A              |
| SMDA05C.T          | 5                      | Pb Free            | 95/Tube             | N/A              |
| SMDA12C.T          | 12                     | Pb Free            | 95/Tube             | N/A              |
| SMDA15C.T          | 15                     | Pb Free            | 95/Tube             | N/A              |
| SMDA24C.T          | 24                     | Pb Free            | 95/Tube             | N/A              |

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