

### PROTECTION PRODUCTS

#### Description

The SMDAxxC-5 series of transient voltage suppressors are designed to protect components which are connected to data and transmission lines from voltage surges caused by ESD (electrostatic discharge), EFT (electrical fast transients), and lightning.

TVS diodes are characterized by their high surge capability, low operating and clamping voltages, and fast response time. This makes them ideal for use as board level protection of sensitive semiconductor components. The SMDAxxC-5 is designed to provide transient suppression on multiple data lines and I/O ports. The low profile SO-8 design allows the user to protect up to five data and I/O lines with one package.

The SMDAxxC-5 TVS diode array will meet the surge requirements of IEC 61000-4-2 (Formerly IEC 801-2), Level 4, "Human Body Model" for air and contact discharge.

#### Features

- ◆ Transient protection for data lines to **IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)**  
**IEC 61000-4-4 (EFT) 40A (5/50ns)**  
**IEC 61000-4-5 (Lightning) 12A (8/20µs)**
- ◆ Small SO-8 surface mount package
- ◆ Protects five I/O lines
- ◆ Working voltages: 5V, 12V, 15V and 24V
- ◆ Low leakage current
- ◆ Low operating and clamping voltages
- ◆ Solid-state silicon avalanche technology

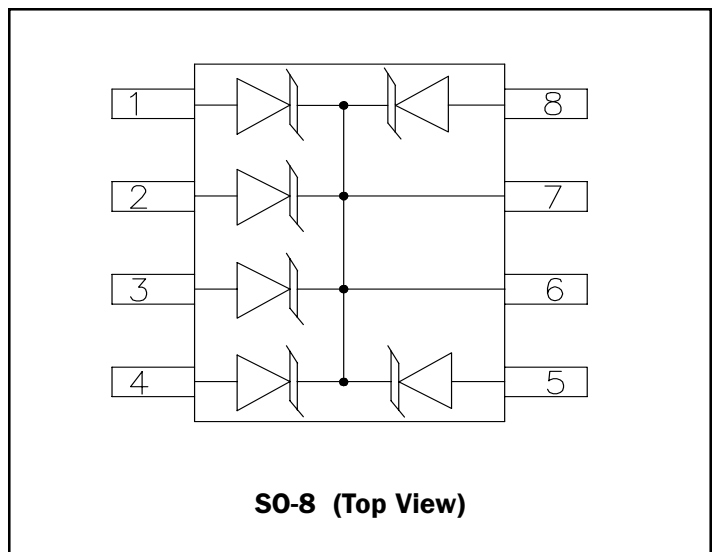
#### Mechanical Characteristics

- ◆ 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

- ◆ RS-232 & RS-422 Data Lines
- ◆ Microprocessor Based Equipment
- ◆ LAN/WAN Equipment
- ◆ Notebooks, Desktops, & Servers
- ◆ Instrumentation
- ◆ Peripherals
- ◆ Set Top Box
- ◆ Serial and Parallel Ports

#### Schematic & PIN Configuration



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

| Rating                         | Symbol           | Value         | Units |
|--------------------------------|------------------|---------------|-------|
| Peak Pulse Power (tp = 8/20μs) | P <sub>pk</sub>  | 300           | Watts |
| 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**

| <b>SMDA05C-5</b>           |                  |   |         |         |         |       |
|----------------------------|------------------|---|---------|---------|---------|-------|
| 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     |
| Maximum Peak Pulse Current | I <sub>pp</sub>  | tp = 8/20μs   |         |         | 17      | A     |
| Junction Capacitance       | C <sub>J</sub>   | Between I/O Pins and Gnd<br>V <sub>R</sub> = 0V, f = 1MHz |         |         | 350     | pF    |

| <b>SMDA12C-5</b>           |                  |   |         |         |         |       |
|----------------------------|------------------|---|---------|---------|---------|-------|
| 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                                      | 16.7    |         |         | 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     |
| Maximum Peak Pulse Current | I <sub>pp</sub>  | tp = 8/20μs   |         |         | 12      | A     |
| Junction Capacitance       | C <sub>J</sub>   | Between I/O Pins and Gnd<br>V <sub>R</sub> = 0V, f = 1MHz |         |         | 120     | pF    |

**PROTECTION PRODUCTS**
**Electrical Characteristics**
**SMDA15C-5**

| 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           | $V_C$     | $I_{PP} = 1A, t_p = 8/20\mu s$                   |         |         | 24      | V       |
| Maximum Peak Pulse Current | $I_{PP}$  | $t_p = 8/20\mu s$                                |         |         | 10      | A       |
| Junction Capacitance       | $C_J$     | Between I/O Pins and Gnd<br>$V_R = 0V, f = 1MHz$ |         |         | 75      | pF      |

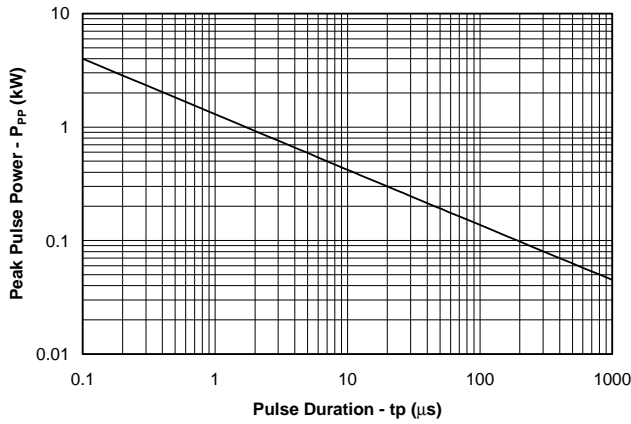
**SMDA24C-5**

| 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           | $V_C$     | $I_{PP} = 1A, t_p = 8/20\mu s$                   |         |         | 43      | V       |
| Maximum Peak Pulse Current | $I_{PP}$  | $t_p = 8/20\mu s$                                |         |         | 5       | A       |
| Junction Capacitance       | $C_J$     | Between I/O Pins and Gnd<br>$V_R = 0V, f = 1MHz$ |         |         | 50      | pF      |

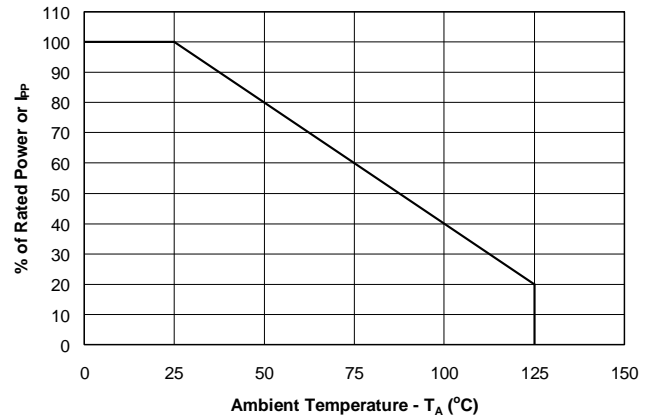
## PROTECTION PRODUCTS

### Typical Characteristics

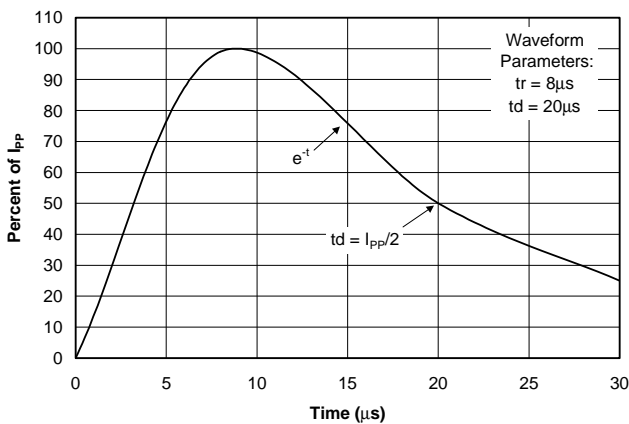
#### Non-Repetitive Peak Pulse Power vs. Pulse Time



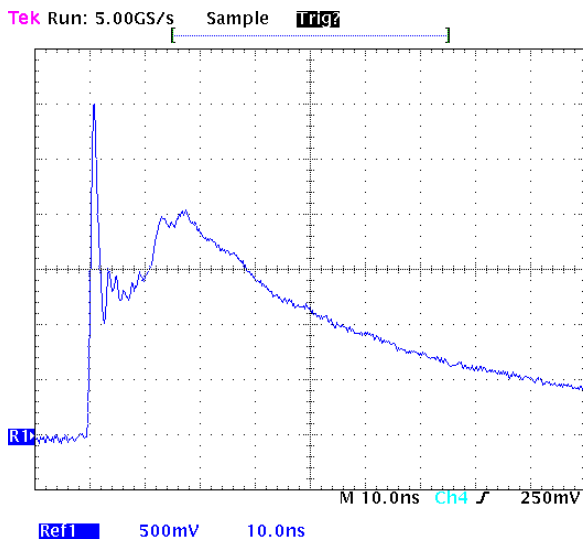
#### Power Derating Curve



#### Pulse Waveform



#### ESD Pulse Waveform (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 Five Data Lines

The SMDAxxC-5 is designed to protect up to 5 data or I/O lines. They are bidirectional devices and may be used on lines where the signal polarities are above and below ground.

The SMDAxxC-5 TVS arrays employ a monolithic structure. Therefore, the working voltage ( $V_{RWM}$ ) and breakdown voltage ( $V_{BR}$ ) specifications apply to the differential voltage between any two data line pins. For example, the SMDA24C-5 is designed for a maximum voltage excursion of +/-12V between any two data lines.

The device is connected as follows:

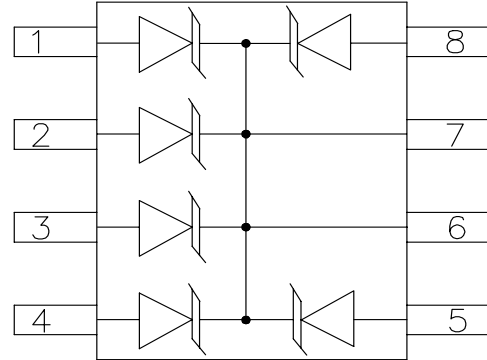
- Pins 1, 2, 3, 4, and 5 are connected to the lines that are to be protected. Pin 8 is connected to ground. The ground connections should be made directly to the ground plane for best results. The path length is kept as short as possible to reduce the effects of parasitic inductance in the board traces. Pins 6 and 7 are not connected.

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

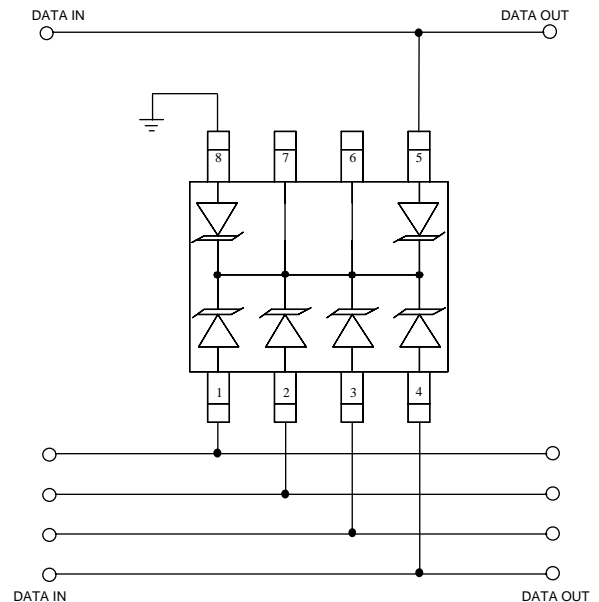
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- 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.

**Circuit Diagram**

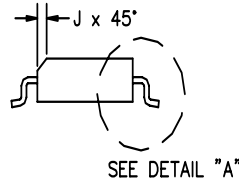
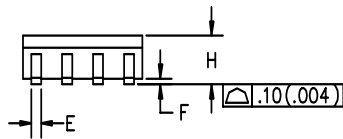
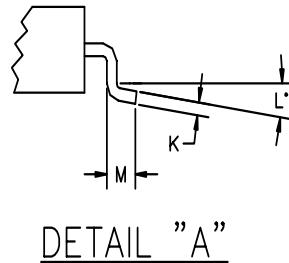
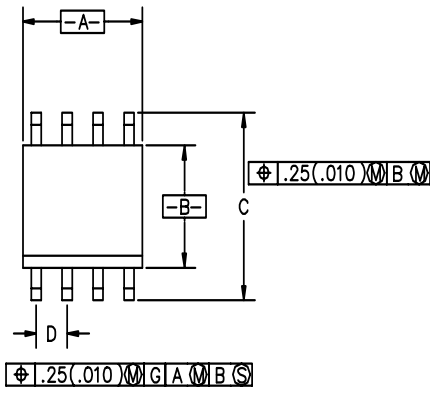


**Connection Diagram**



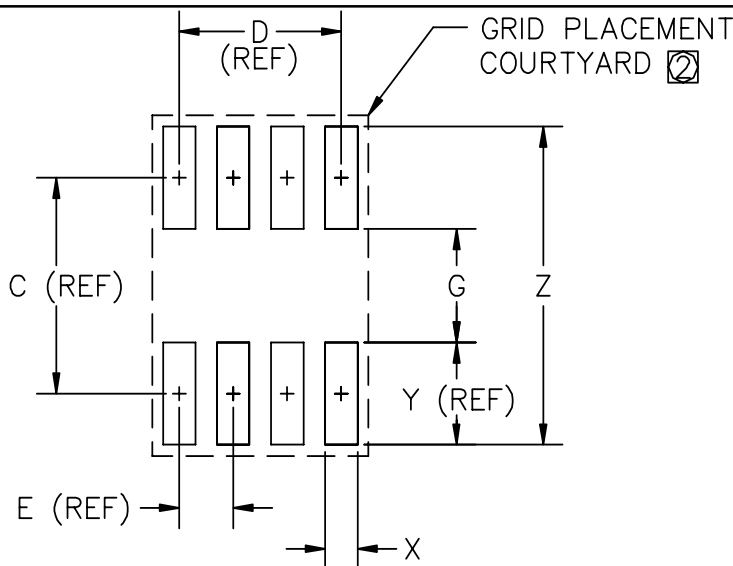
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### Outline Drawing - S0-8



| DIM <sup>N</sup> | INCHES |      | MM   |      | NOTE |
|------------------|--------|------|------|------|------|
|                  | MIN    | MAX  | MIN  | MAX  |      |
| A                | .188   | .197 | 4.80 | 5.00 |      |
| B                | .149   | .158 | 3.80 | 4.00 |      |
| C                | .228   | .244 | 5.80 | 6.20 |      |
| D                | .050   | BSC  | 1.27 | BSC  |      |
| E                | .013   | .020 | 0.33 | 0.51 |      |
| F                | .004   | .010 | 0.10 | 0.25 |      |
| H                | .053   | .069 | 1.35 | 1.75 |      |
| J                | .011   | .019 | 0.28 | 0.48 |      |
| K                | .007   | .010 | .19  | .25  |      |
| L                | 0°     | 8°   | 0°   | 8°   |      |
| M                | .016   | .050 | 0.40 | 1.27 |      |

### Land Pattern - S0-8



| DIM <sup>N</sup> | INCHES |     | MM   |      | NOTE |
|------------------|--------|-----|------|------|------|
|                  | MIN    | MAX | MIN  | MAX  |      |
| C                | —      | .19 | —    | 5.00 | —    |
| D                | —      | .15 | —    | 3.81 | —    |
| E                | —      | .05 | —    | 1.27 | —    |
| G                | .10    | .11 | 2.60 | 2.80 | —    |
| X                | .02    | .03 | .60  | .80  | —    |
| Y                | —      | .09 | —    | 2.40 | —    |
| Z                | —      | .29 | 7.20 | 7.40 | —    |

② GRID PLACEMENT COURTYARD IS 12x16 ELEMENTS (6 mm X 8mm) IN ACCORDANCE WITH THE INTERNATIONAL GRID DETAILED IN IEC PUBLICATION 97.

① CONTROLLING DIMENSION: MILLIMETERS

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

| <b>Part Number</b> | <b>Working Voltage</b> | <b>Qty per Reel</b> | <b>Reel Size</b> |
|--------------------|------------------------|---------------------|------------------|
| SMDA05C-5.TB       | 5V                     | 500                 | 7 Inch           |
| SMDA05C-5.TE       | 5V                     | 2,500               | 13 Inch          |
| SMDA12C-5.TB       | 12V                    | 500                 | 7 Inch           |
| SMDA12C-5.TE       | 12V                    | 2,500               | 13 Inch          |
| SMDA15C-5.TB       | 15V                    | 500                 | 7 Inch           |
| SMDA15C-5.TE       | 15V                    | 2,500               | 13 Inch          |
| SMDA24C-5.TB       | 24V                    | 500                 | 7 Inch           |
| SMDA24C-5.TE       | 24V                    | 2,500               | 13 Inch          |

**Note:**

(1) No suffix indicates tube pack.

**Contact Information**

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