

### PROTECTION PRODUCTS

#### Description

The LCDAxxC-1 is a low capacitance transient voltage suppressor (TVS) diode array. It is designed to protect sensitive CMOS ICs from the damaging effects of ESD and lightning. Each device will protect one line in common (line-to-ground) mode or one line pair in metallic (Line-to-line) mode. They are low capacitance (< 15pF) making them suitable for use on high-speed telecom and datacom interfaces without signal degradation.

The configuration of the LCDAxxC-1 has been optimized for easy layout on high density boards. The small SOT-143 package minimizes required board space. These devices will handle up to 20 Amps for an 8/20 $\mu$ s lightning impulse. The low inductance construction minimizes voltage overshoot during high current surges.

The LCDAxxC-1 may be used to protect ADSL interfaces, multi-protocol serial transceivers, portable electronics, and wireless systems.

#### Features

- ◆ Transient protection to high-speed data lines  
**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) 0.5kV, 12A (8/20 $\mu$ s)**
- ◆ Configuration optimized for easy board layout
- ◆ Protects one line pair
- ◆ Low capacitance (<15pF) for high-speed interfaces
- ◆ Low clamping voltage
- ◆ Low leakage current
- ◆ Operating voltage: 12V and 15V
- ◆ Solid-state silicon-avalanche technology

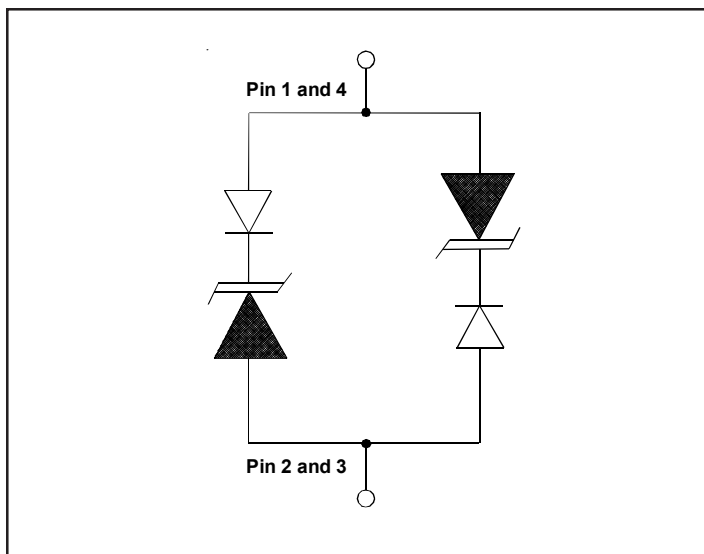
#### Mechanical Characteristics

- ◆ JEDEC SOT-143 package
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking code
- ◆ Packaging : Tape and Reel per EIA 481
- ◆ RoHS/WEEE Compliant

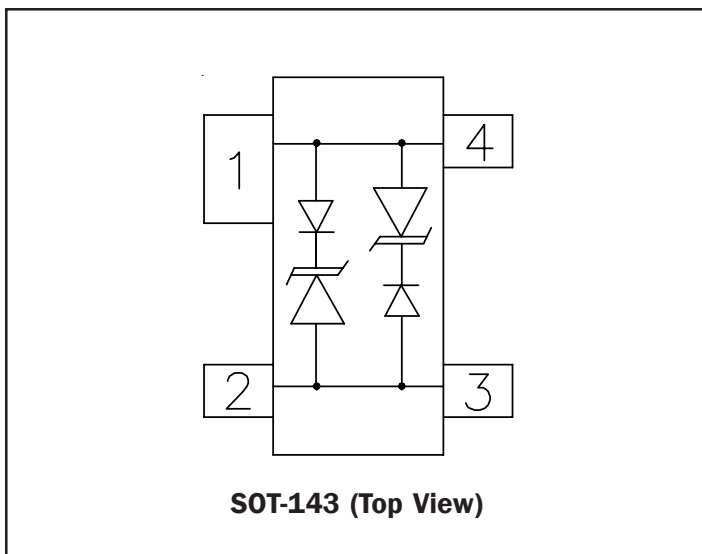
#### Applications

- ◆ ADSL Interfaces
- ◆ RS-232, RS-422, V.90 Interfaces
- ◆ Multi-Protocol Serial Transceivers
- ◆ High-Speed Data Lines
- ◆ Portable Electronics
- ◆ WAN/LAN Equipment
- ◆ Wireless Systems

#### Circuit Diagram



#### Schematic & PIN Configuration



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

| Rating                                 | Symbol    | Value         | Units       |
|----------------------------------------|-----------|---------------|-------------|
| Peak Pulse Power ( $t_p = 8/20\mu s$ ) | $P_{pk}$  | 500           | Watts       |
| Lead Soldering Temperature             | $T_L$     | 260 (10 sec.) | $^{\circ}C$ |
| Operating Temperature                  | $T_J$     | -55 to +125   | $^{\circ}C$ |
| Storage Temperature                    | $T_{STG}$ | -55 to +150   | $^{\circ}C$ |

**Electrical Characteristics**

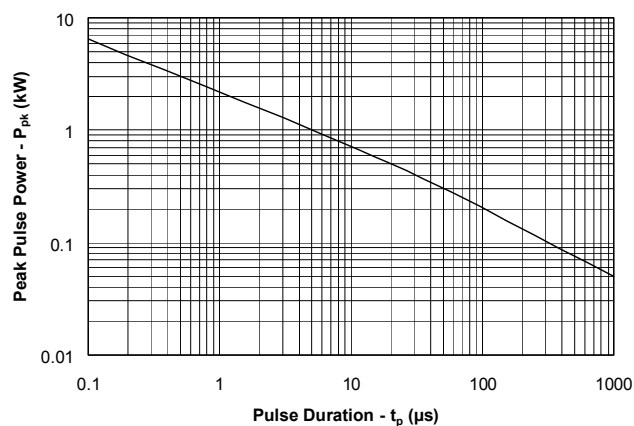
| <b>LCDA12C-1</b>          |           |                                                     |         |         |         |         |
|---------------------------|-----------|-----------------------------------------------------|---------|---------|---------|---------|
| Parameter                 | 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   | $I_R$     | $V_{RWM} = 12V, T=25^{\circ}C$                      |         |         | 5       | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{PP} = 5A, t_p = 8/20\mu s$                      |         |         | 19      | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 20A, t_p = 8/20\mu s$                     |         |         | 26.6    | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                                   |         |         | 20      | A       |
| Junction Capacitance      | $C_J$     | Between I/O pins and Ground<br>$V_R = 0V, f = 1MHz$ |         | 8       | 15      | pF      |

| <b>LCDA15C-1</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   | $I_R$     | $V_{RWM} = 15V, T=25^{\circ}C$                      |         |         | 5       | $\mu A$ |
| Clamping Voltage          | $V_C$     | $I_{PP} = 1A, t_p = 8/20\mu s$                      |         |         | 24      | V       |
| Clamping Voltage          | $V_C$     | $I_{PP} = 15A, t_p = 8/20\mu s$                     |         |         | 33      | V       |
| Peak Pulse Current        | $I_{PP}$  | $t_p = 8/20\mu s$                                   |         |         | 15      | A       |
| Junction Capacitance      | $C_J$     | Between I/O pins and Ground<br>$V_R = 0V, f = 1MHz$ |         | 8       | 15      | pF      |

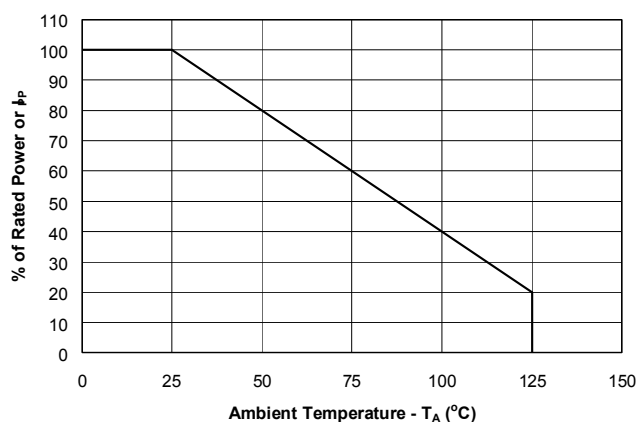
## PROTECTION PRODUCTS

### Typical Characteristics

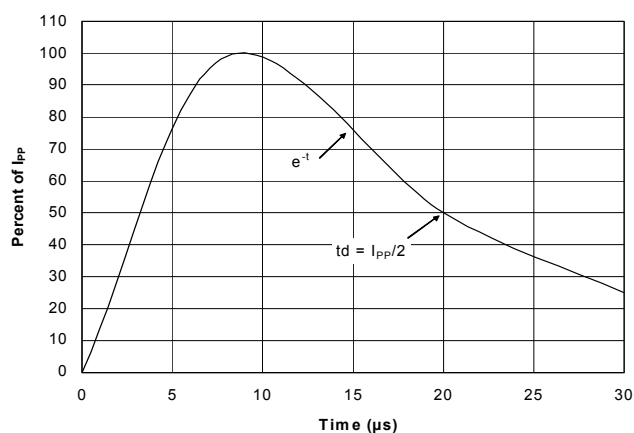
**Non-Repetitive Peak Pulse Power vs. Pulse Time**



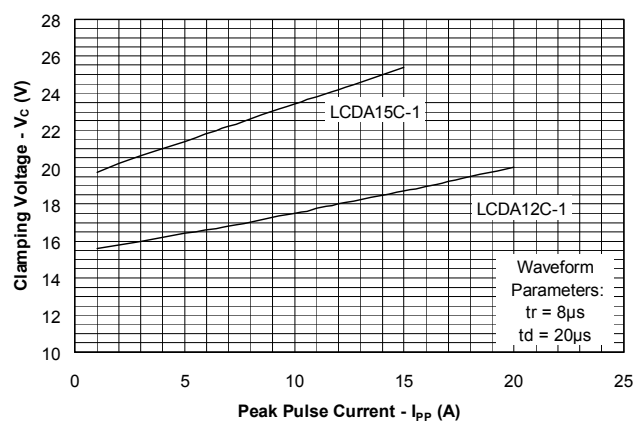
**Power Derating Curve**



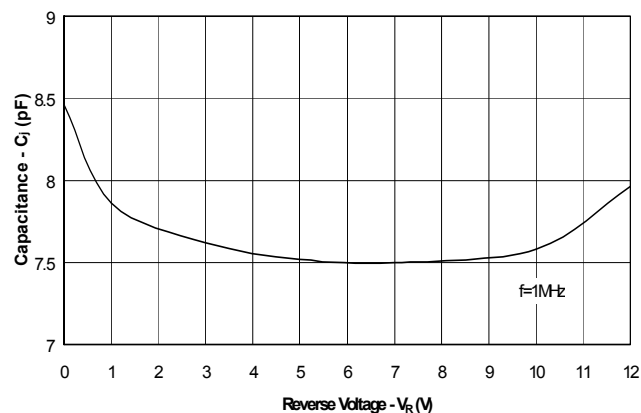
**Pulse Waveform**



**Clamping Voltage vs. Peak Pulse Current**



**Capacitance vs. Reverse Voltage**



## PROTECTION PRODUCTS

### Applications Information

#### Device Connection for Metallic Protection of High-Speed Data Lines

The LCDAXxC-1 is designed to protect high-speed data lines from transient over-voltages which result from lightning and ESD. The device is designed to protect one line in common mode (Line-to-Ground) or one line pair in metallic (Line-to-Line) mode. For metallic mode protection, the input of line 1 is connected at pin 1 and the output is connected at pin 4. Likewise, the input of line 2 is connected at pin 2 and the output is connected at pin 3. For common mode protection, ground either pins 1 and 4 or pins 2 and 3. The ground connection should be made directly to the ground plane for best results.

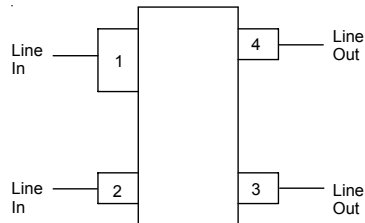
#### ADSL Protection

A typical ADSL protection circuit is shown in Figure 3. The LCDA12C-1 (or LCDA15C-1 for 15 volt drivers) is connected from each line to ground on the IC side of the line. They provide lightning and ESD protection for the sensitive line driver IC.

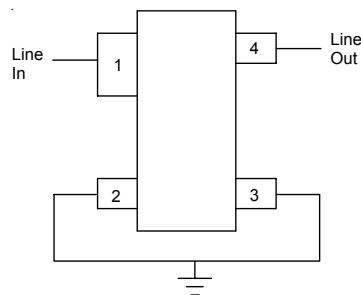
#### Matte Tin Lead Finish

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

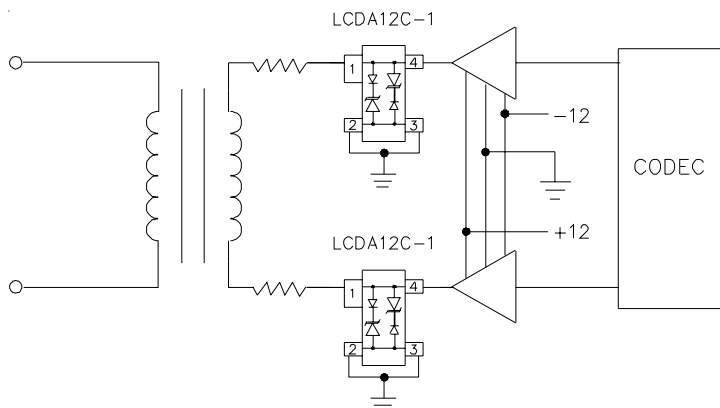
determined by the requirements of the solder paste. Therefore, these devices are compatible with both lead-free and SnPb assembly techniques. In addition, unlike other lead-free compositions, matte tin does not have any added alloys that can cause degradation of the solder joint.



**Figure 1 - Connection for Differential Protection (Line-to-Line)**



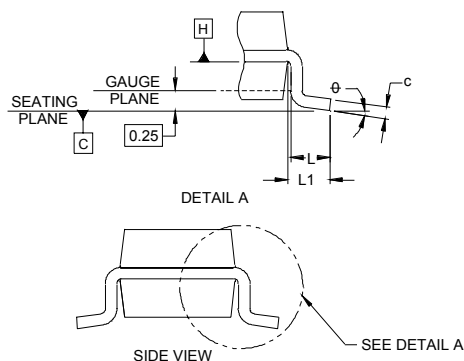
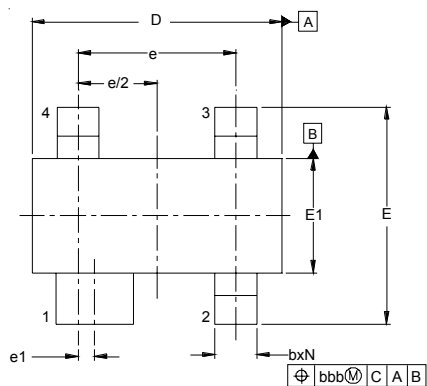
**Figure 2 - Connection for Common Mode Protection (Line-to-Ground)**



**Figure 3 - ADSL Protection Circuit**

## PROTECTION PRODUCTS

### Outline Drawing - SOT-143

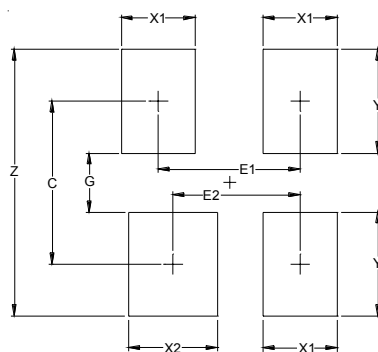


| DIM | INCHES |      |      | MILLIMETERS |      |      |
|-----|--------|------|------|-------------|------|------|
|     | MIN    | NOM  | MAX  | MIN         | NOM  | MAX  |
| A   | .031   | -    | .048 | 0.80        | -    | 1.22 |
| A1  | .000   | -    | .006 | 0.013       | -    | 0.15 |
| A2  | .029   | .035 | .042 | 0.75        | 0.90 | 1.07 |
| b   | .011   | -    | .020 | 0.30        | -    | 0.51 |
| b1  | .029   | -    | .037 | 0.76        | -    | 0.94 |
| c   | .003   | -    | .008 | 0.08        | -    | 0.20 |
| D   | .110   | .114 | .120 | 2.80        | 2.90 | 3.04 |
| E   | .082   | .093 | .104 | 2.10        | 2.37 | 2.64 |
| E1  | .047   | .051 | .055 | 1.20        | 1.30 | 1.40 |
| e   | .075   | -    | -    | 1.92        | BSC  | -    |
| e1  | .008   | -    | -    | 0.20        | BSC  | -    |
| L   | .015   | .020 | .024 | 0.40        | 0.50 | 0.60 |
| L1  | (.021) |      |      | (0.54)      |      |      |
| N   | 4      |      |      | 4           |      |      |
| φ   | 0°     | -    | 8°   | 0°          | -    | 8°   |
| aaa | .006   |      |      | 0.15        |      |      |
| bbb | .008   |      |      | 0.20        |      |      |
| ccc | .004   |      |      | 0.10        |      |      |

#### 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 TO-253, VARIATION D.

### Land Pattern - SOT-143



| DIM | DIMENSIONS |             |
|-----|------------|-------------|
|     | INCHES     | MILLIMETERS |
| C   | (.087)     | (2.20)      |
| E1  | .076       | 1.92        |
| E2  | .068       | 1.72        |
| G   | .031       | 0.80        |
| X1  | .039       | 1.00        |
| X2  | .047       | 1.20        |
| Y   | .055       | 1.40        |
| 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.
2. REFERENCE IPC-SM-782A

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

| <b>Part Number</b> | <b>Marking Code</b> |
|--------------------|---------------------|
| LCDA12C-1          | 12L                 |
| LCDA15C-1          | 15L                 |

**Ordering Information**

| <b>Part Number</b> | <b>Lead Finish</b> | <b>Qty per Reel</b> | <b>Reel Size</b> |
|--------------------|--------------------|---------------------|------------------|
| LCDA12C-1.TC       | SnPb               | 3,000               | 7 Inch           |
| LCDA15C-1.TC       | SnPb               | 3,000               | 7 Inch           |
| LCDA12C-1.TCT      | Pb Free            | 3,000               | 7 Inch           |
| LCDA15C-1.TCT      | Pb Free            | 3,000               | 7 Inch           |

**Contact Information**

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