

PROTECTION PRODUCTS

Absolute Maximum Rating

| Rating | Symbol | Value | Units |
|--|-----------|---------------|-------------|
| Peak Pulse Power ($t_p = 8/20\mu s$) | P_{pk} | 300 | 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

| LCDA05 | | | | | | |
|----------------------------|-----------|---|---------|---------|---------|---------|
| 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 | μA |
| Clamping Voltage | V_C | $I_{PP} = 1A, t_p = 8/20\mu s$ | | | 9.8 | V |
| Clamping Voltage | V_C | $I_{PP} = 5A, t_p = 8/20\mu s$ | | | 11 | V |
| Maximum Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 17 | A |
| Junction Capacitance | C_J | Between I/O Pins and Ground $V_R = 0V, f = 1MHz$ | | | 5 | pF |

| LCDA12 | | | | | | |
|----------------------------|-----------|---|---------|---------|---------|---------|
| 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 | μA |
| Clamping Voltage | V_C | $I_{PP} = 1A, t_p = 8/20\mu s$ | | | 19 | V |
| Clamping Voltage | V_C | $I_{PP} = 5A, t_p = 8/20\mu s$ | | | 24 | V |
| Maximum Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 12 | A |
| Junction Capacitance | C_J | Between I/O Pins and Ground $V_R = 0V, f = 1MHz$ | | | 5 | pF |

PROTECTION PRODUCTS

Electrical Characteristics (continued)

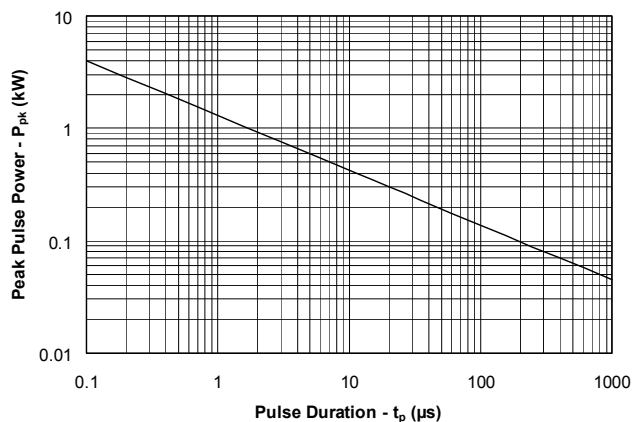
| LCDA15 | | | | | | |
|----------------------------|-----------|---|---------|---------|---------|---------|
| Parameter | Symbol | Conditions | Minimum | Typical | Maximum | Units |
| Reverse Stand-Off Voltage | V_{RWM} | | | | 15 | V |
| Reverse Breakdown Voltage | V_{BR} | $I_t = 1mA$ | 16.7 | | | V |
| Reverse Leakage Current | I_R | $V_{RWM} = 15V, T=25^{\circ}C$ | | | 1 | μA |
| Clamping Voltage | V_C | $I_{PP} = 1A, t_p = 8/20\mu s$ | | | 24 | V |
| Clamping Voltage | V_C | $I_{PP} = 5A, t_p = 8/20\mu s$ | | | 30 | V |
| Maximum Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 10 | A |
| Junction Capacitance | C_J | Between I/O Pins and Ground $V_R = 0V, f = 1MHz$ | | | 5 | pF |

| LCDA24 | | | | | | |
|----------------------------|-----------|---|---------|---------|---------|---------|
| 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 | μA |
| Clamping Voltage | V_C | $I_{PP} = 1A, t_p = 8/20\mu s$ | | | 43 | V |
| Clamping Voltage | V_C | $I_{PP} = 5A, t_p = 8/20\mu s$ | | | 55 | V |
| Maximum Peak Pulse Current | I_{PP} | $t_p = 8/20\mu s$ | | | 5 | A |
| Junction Capacitance | C_J | Between I/O Pins and Ground $V_R = 0V, f = 1MHz$ | | | 5 | pF |

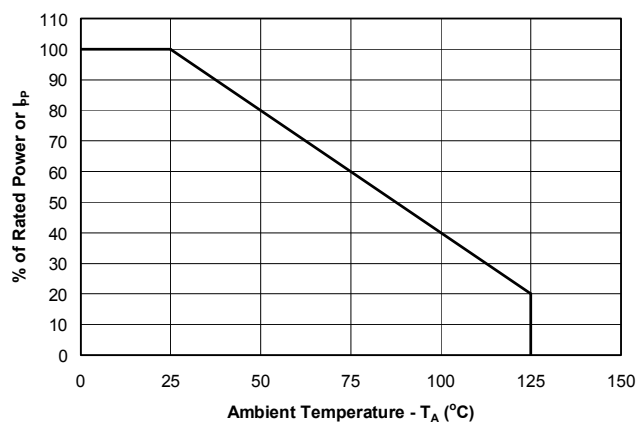
PROTECTION PRODUCTS

Typical Characteristics

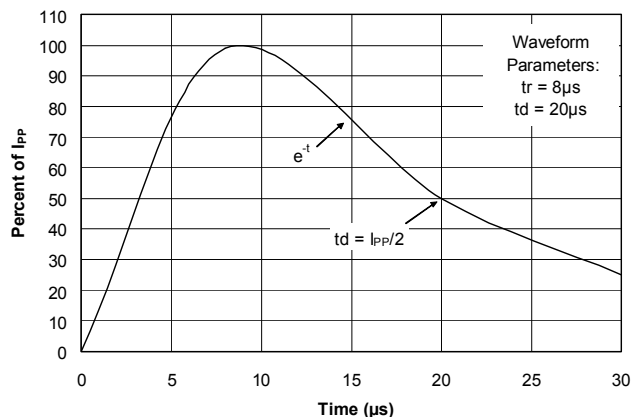
Non-Repetitive Peak Pulse Power vs. Pulse Time



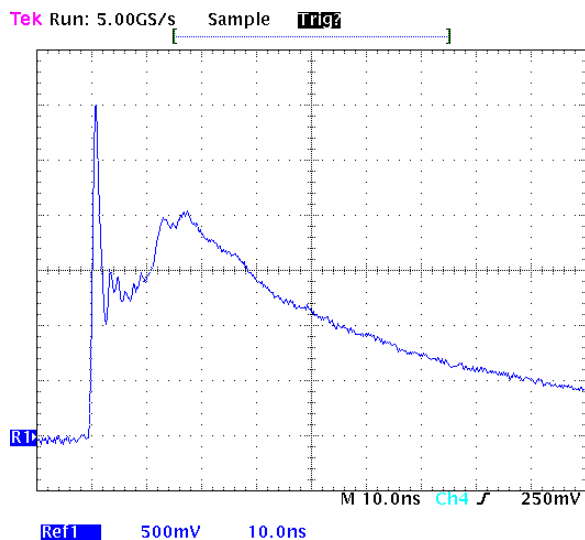
Power Derating Curve



Pulse Waveform



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



ESD Discharge Parameters Per IEC 61000-4-2

| Level | First Peak Current (A) | Peak Current at 30ns (A) | Peak Current at 60ns (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 Two High-Speed Data Lines

The LCD Axx is designed to protect up to two high-speed data lines. The LCD Axx utilizes a low capacitance compensation diode in series with, but in opposite polarity to a TVS diode in each line. The resulting capacitance is less than 5pF per line. Each line will only suppress transient events in one polarity. Therefore, to achieve protection in both positive and negative polarity, a second TVS/rectifier pair is connected in anti-parallel to the first. Pins 1, 2, 7, and 8 are used to protect one data line. Pins 3, 4, 5, and 6 are used to protect the second data line.

The device is connected as follows:

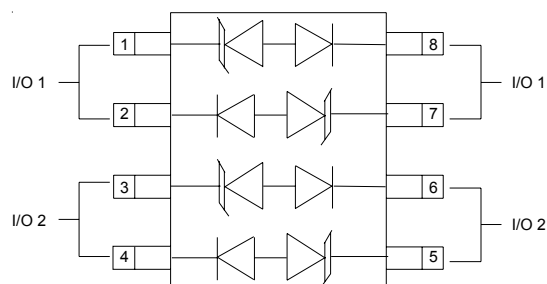
- Pins 1 and 2 are tied together and pins 7 and 8 are tied together providing the protection circuit for one I/O line. Pins 3 and 4 are tied together and pins 5 and 6 are tied together providing the protection circuit for the second I/O line. Since the device is electrically symmetrical, either side of the connected pairs may be used to protect the lines. The other side of the pair is used to make the ground connection. 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.

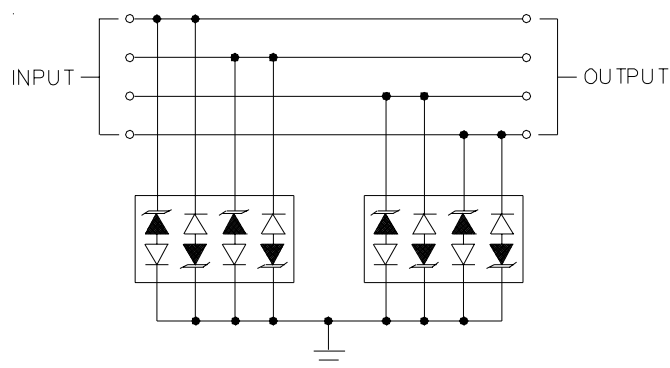
Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- 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.

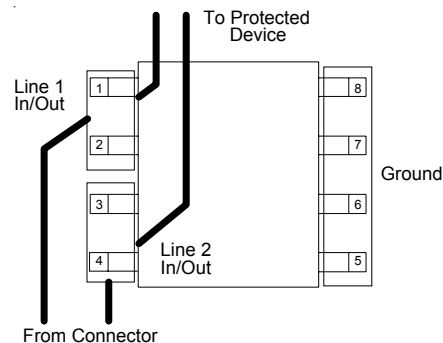
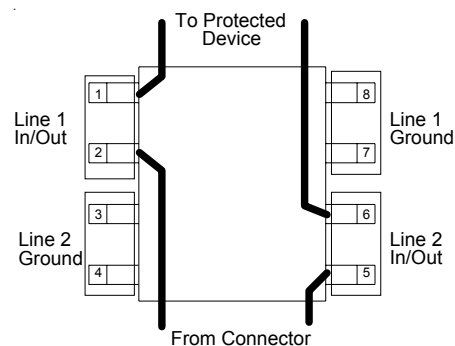
LCD A Connection Diagram



I/O Line Protection



Connection Options

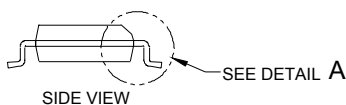
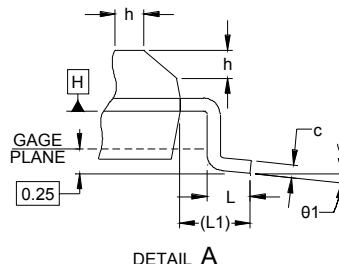
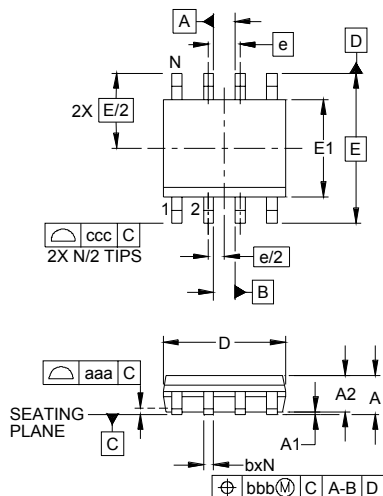


PROTECTION PRODUCTS**Applications Information (*continued*)****Matte Tin Lead Finish**

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 - SO-8

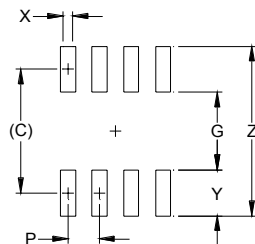


| DIM | INCHES | | | MILLIMETERS | | |
|-----|----------|------|------|-------------|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | .053 | - | .069 | 1.35 | - | 1.75 |
| A1 | .004 | - | .010 | 0.10 | - | 0.25 |
| A2 | .049 | - | .065 | 1.25 | - | 1.65 |
| b | .012 | - | .020 | 0.31 | - | 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 - SO-8



| DIMENSIONS | | |
|------------|--------|-------------|
| DIM | 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**

| Part Number | Lead Finish | Qty per Reel | Reel Size |
|--------------------|--------------------|---------------------|------------------|
| LCDA05.TB | SnPb | 500 | 7 Inch |
| LCDA12.TB | SnPb | 500 | 7 Inch |
| LCDA15.TB | SnPb | 500 | 7 Inch |
| LCDA24.TB | SnPb | 500 | 7 Inch |
| LCDA05.TBT | Pb Free | 500 | 7 inch |
| LCDA12.TBT | Pb Free | 500 | 7 inch |
| LCDA15.TBT | Pb Free | 500 | 7 inch |
| LCDA24.TBT | Pb Free | 500 | 7 inch |
| LCDA05 | SnPb | 95/Tube | N/A |
| LCDA12 | SnPb | 95/Tube | N/A |
| LCDA15 | SnPb | 95/Tube | N/A |
| LCDA24 | SnPb | 95/Tube | N/A |
| LCDA05.T | Pb Free | 95/Tube | N/A |
| LCDA12.T | Pb Free | 95/Tube | N/A |
| LCDA15.T | Pb Free | 95/Tube | N/A |
| LCDA24.T | Pb Free | 95/Tube | N/A |

Contact Information

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