

### LCE Series



#### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E128662/E230531    |

#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                             | Symbol                            | Value      | Unit |
|---------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10x1000µs test waveform (Fig.1) (Note 1)              | P <sub>PPM</sub>                  | 1500       | W    |
| Steady State Power Dissipation on infinite heat sink at T <sub>L</sub> =75°C (Fig. 5) | P <sub>D</sub>                    | 6.5        | W    |
| Operating Junction and Storage Temperature Range                                      | T <sub>J</sub> , T <sub>STG</sub> | -55 to 175 | °C   |

**Note:**

1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub> = 25°C per Fig. 2.

#### Description

The LCE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

#### Features

- Glass passivated chip junction in DO-201 Package
- 1500W peak pulse power capability at 10x1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Low incremental surge resistance
- High temperature soldering guaranteed: 260°C/40 seconds / 0.375"(9.5mm) lead length, 5 lbs., (2.3kg) tension
- Plastic package has underwriters laboratory flammability classification 94V-0
- Matte tin lead-free plated
- Ideal for data line applications
- Halogen free and RoHS compliant

#### Applications

TVS devices are ideal for the protection of I/O interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

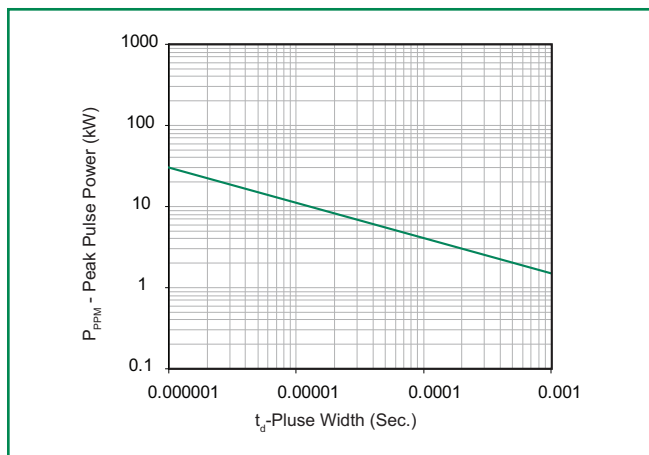
### Electrical Characteristics

| Part Number | Reverse Stand off Voltage $V_R$ (V) | Breakdown Voltage $V_{BR}$ (V) |        | Test Current $I_T$ (mA) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu$ A) | Maximum Clamping Voltage at $I_{PP}$ $V_C$ (V) | Maximum Peak Pulse Current (Fig.3) $I_{PPM}$ (A) | Maximum Junction Capacitance @ 0Volts (pF) | Working Inverse Blocking Voltage $V_{WIB}$ (V) | Inverse Blocking Leakage Current at $I_{IB}$ @ $V_{WIB}$ (mA) | Peak Inverse Blocking Voltage $V_{PIB}$ (V) | Agency Approval  |
|-------------|-------------------------------------|--------------------------------|--------|-------------------------|--------------------------------------------------|------------------------------------------------|--------------------------------------------------|--------------------------------------------|------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------|
|             |                                     | MIN                            | MAX    |                         |                                                  |                                                |                                                  |                                            |                                                |                                                               |                                             |                                                                                                     |
| LCE6.5A     | 6.5                                 | 7.22                           | 7.98   | 10                      | 1000                                             | 11.2                                           | 100.0                                            | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE7.0A     | 7.0                                 | 7.78                           | 8.60   | 10                      | 500                                              | 12.0                                           | 100.0                                            | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE7.5A     | 7.5                                 | 8.33                           | 9.21   | 10                      | 250                                              | 12.9                                           | 100.0                                            | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE8.0A     | 8.0                                 | 8.89                           | 9.83   | 1                       | 100                                              | 13.6                                           | 100.0                                            | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE8.5A     | 8.5                                 | 9.44                           | 10.40  | 1                       | 50                                               | 14.4                                           | 100.0                                            | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE9.0A     | 9.0                                 | 10.00                          | 11.10  | 1                       | 10                                               | 15.4                                           | 97.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE10A      | 10.0                                | 11.10                          | 12.30  | 1                       | 5                                                | 17.0                                           | 88.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE11A      | 11.0                                | 12.20                          | 13.50  | 1                       | 1                                                | 18.2                                           | 82.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE12A      | 12.0                                | 13.30                          | 14.70  | 1                       | 1                                                | 19.9                                           | 75.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE13A      | 13.0                                | 14.40                          | 15.90  | 1                       | 1                                                | 21.5                                           | 70.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE14A      | 14.0                                | 15.60                          | 17.20  | 1                       | 1                                                | 23.2                                           | 65.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE15A      | 15.0                                | 16.70                          | 18.50  | 1                       | 1                                                | 24.4                                           | 61.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE16A      | 16.0                                | 17.80                          | 19.70  | 1                       | 1                                                | 26.0                                           | 57.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE17A      | 17.0                                | 18.90                          | 20.90  | 1                       | 1                                                | 27.6                                           | 54.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE18A      | 18.0                                | 20.00                          | 22.10  | 1                       | 1                                                | 29.2                                           | 51.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE20A      | 20.0                                | 22.20                          | 24.50  | 1                       | 1                                                | 32.4                                           | 46.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE22A      | 22.0                                | 24.40                          | 26.90  | 1                       | 1                                                | 35.5                                           | 42.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE24A      | 24.0                                | 26.70                          | 29.50  | 1                       | 1                                                | 38.9                                           | 39.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE26A      | 26.0                                | 28.90                          | 31.90  | 1                       | 1                                                | 42.1                                           | 36.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE28A      | 28.0                                | 31.10                          | 34.40  | 1                       | 1                                                | 45.5                                           | 33.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         | X                                                                                                   |
| LCE30A      | 30.0                                | 33.30                          | 36.80  | 1                       | 1                                                | 48.4                                           | 31.0                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE33A      | 33.0                                | 36.70                          | 40.60  | 1                       | 1                                                | 53.3                                           | 28.1                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE36A      | 36.0                                | 40.00                          | 44.20  | 1                       | 1                                                | 58.1                                           | 25.8                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE40A      | 40.0                                | 44.40                          | 49.10  | 1                       | 1                                                | 64.5                                           | 23.3                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE43A      | 43.0                                | 47.80                          | 52.80  | 1                       | 1                                                | 69.4                                           | 21.6                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE45A      | 45.0                                | 50.00                          | 55.30  | 1                       | 1                                                | 72.7                                           | 20.6                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE48A      | 48.0                                | 53.30                          | 58.90  | 1                       | 1                                                | 77.4                                           | 19.4                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE51A      | 51.0                                | 56.70                          | 62.70  | 1                       | 1                                                | 82.4                                           | 18.2                                             | 100                                        | 75                                             | 1.0                                                           | 100                                         |                                                                                                     |
| LCE54A      | 54.0                                | 60.00                          | 66.30  | 1                       | 1                                                | 87.1                                           | 17.2                                             | 100                                        | 100                                            | 1.0                                                           | 125                                         |                                                                                                     |
| LCE58A      | 58.0                                | 64.40                          | 71.20  | 1                       | 1                                                | 93.6                                           | 16.0                                             | 100                                        | 100                                            | 1.0                                                           | 125                                         |                                                                                                     |
| LCE60A      | 60.0                                | 66.70                          | 73.70  | 1                       | 1                                                | 96.8                                           | 15.5                                             | 100                                        | 100                                            | 1.0                                                           | 125                                         |                                                                                                     |
| LCE64A      | 64.0                                | 71.10                          | 78.60  | 1                       | 1                                                | 103.0                                          | 14.6                                             | 100                                        | 100                                            | 1.0                                                           | 125                                         |                                                                                                     |
| LCE70A      | 70.0                                | 77.80                          | 86.00  | 1                       | 1                                                | 113.0                                          | 13.3                                             | 100                                        | 125                                            | 1.0                                                           | 150                                         |                                                                                                     |
| LCE75A      | 75.0                                | 83.30                          | 92.10  | 1                       | 1                                                | 121.0                                          | 12.4                                             | 100                                        | 125                                            | 1.0                                                           | 150                                         |                                                                                                     |
| LCE85A      | 85.0                                | 94.40                          | 104.00 | 1                       | 1                                                | 129.0                                          | 11.6                                             | 100                                        | 125                                            | 1.0                                                           | 150                                         |                                                                                                     |
| LCE90A      | 90.0                                | 100.00                         | 111.00 | 1                       | 1                                                | 146.0                                          | 10.3                                             | 100                                        | 125                                            | 1.0                                                           | 150                                         |                                                                                                     |

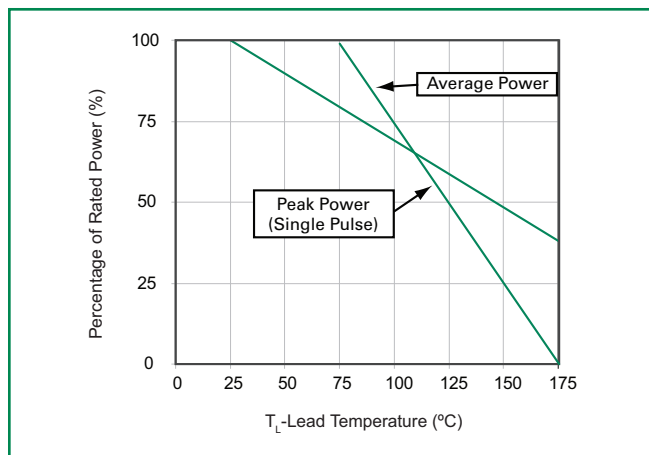
**Note:** For parts without A, the  $V_{BR}$  is +10% and  $V_C$  is 5% higher than with A parts.

### Ratings and Characteristic Curves ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

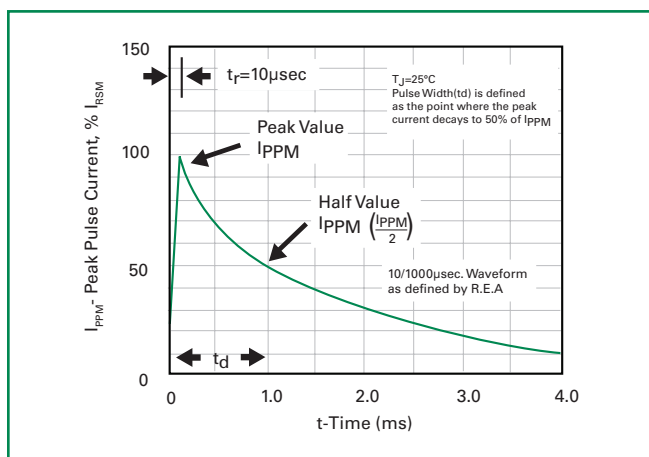
**Figure 1 - Peak Pulse Power Rating**



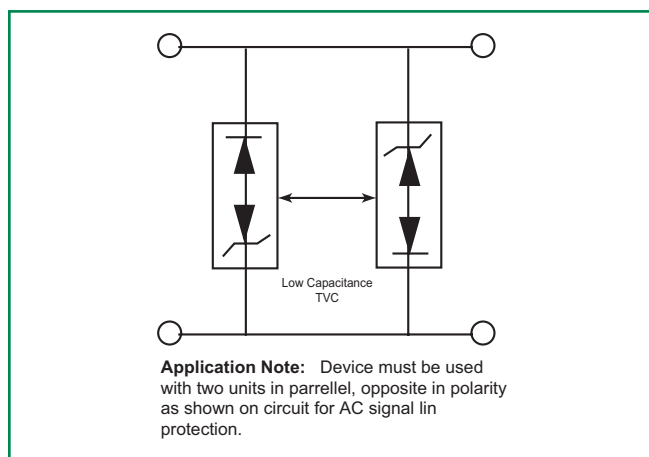
**Figure 2 - Power Derating Curve**



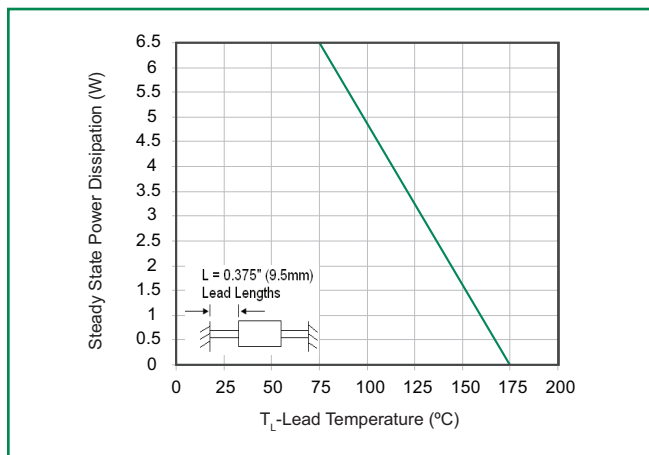
**Figure 3 - Pulse Waveform**



**Figure 4 - AC Line Protection Application**

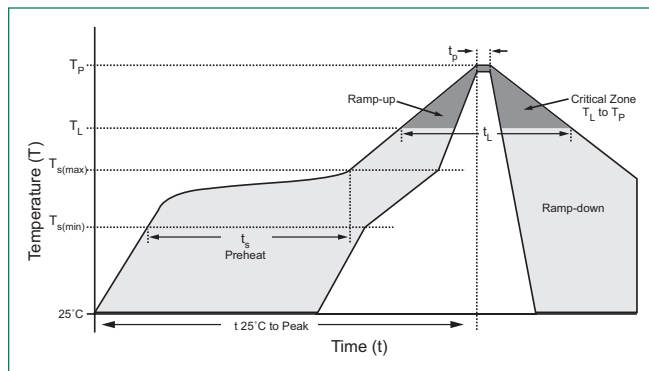


**Figure 5 - Steady State Power Derating Curve**



### Soldering Parameters

|                                                       |                                    |                         |
|-------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                      |                                    | Lead-free assembly      |
| Pre Heat                                              | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                       | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                       | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                  |                                    | 3°C/second max          |
| Reflow                                                | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                       | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                            |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )  |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                        |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )               |                                    | 8 minutes Max.          |
| Do not exceed                                         |                                    | 280°C                   |



### Flow/Wave Soldering (Solder Dipping)

|                    |            |
|--------------------|------------|
| Peak Temperature : | 265°C      |
| Dipping Time :     | 10 seconds |
| Soldering :        | 1 time     |

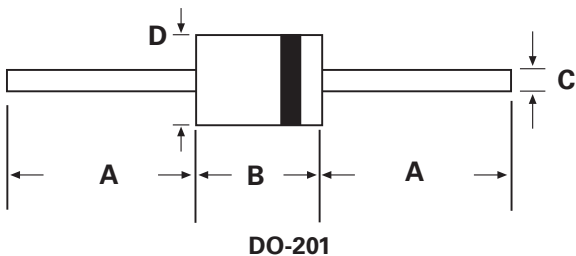
### Physical Specifications

|          |                                                            |
|----------|------------------------------------------------------------|
| Weight   | 0.045oz., 1.2g                                             |
| Case     | JEDEC DO-201 molded plastic body over passivated junction. |
| Polarity | Color band denotes the cathode except Bipolar.             |
| Terminal | Matte Tin axial leads, solderable per JESD22-B102D.        |

### Environmental Specifications

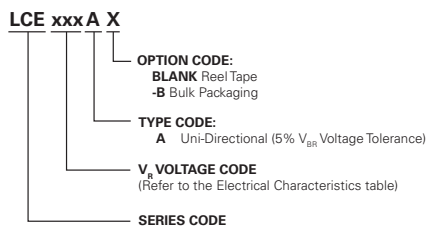
|                    |              |
|--------------------|--------------|
| Temperature Cycle  | JESD22-A104  |
| Pressure Cooker    | JESD 22-A102 |
| High Temp. Storage | JESD22-A103  |
| HTRB               | JESD22-A108  |
| Thermal Shock      | JESD22-A106  |

### Dimensions

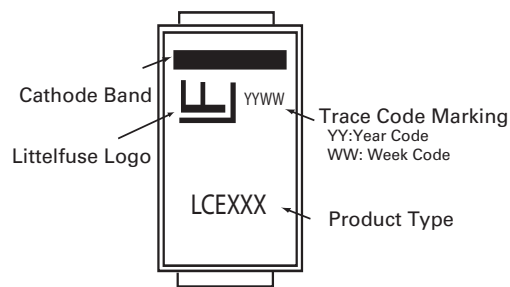


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.285  | 0.375 | 7.20        | 9.50 |
| C          | 0.038  | 0.042 | 0.96        | 1.07 |
| D          | 0.190  | 0.210 | 4.80        | 5.30 |

### Part Numbering System



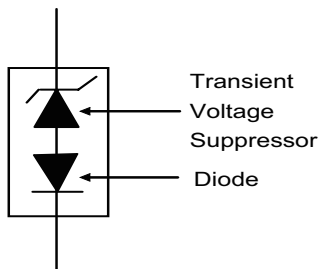
### Part Marking System



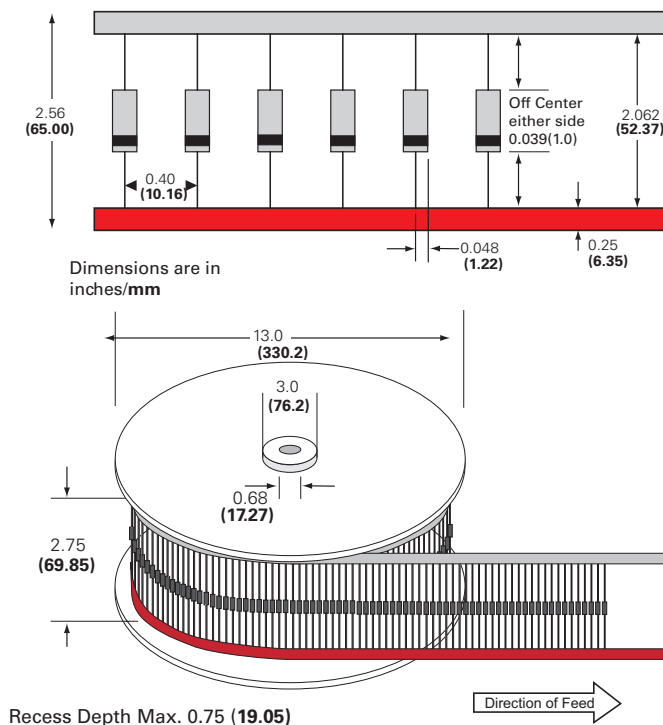
### Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification                  |
|-------------|-------------------|----------|------------------|------------------------------------------|
| LCExxxXX    | DO-201            | 1200     | Tape & Reel      | EIA STD RS-296E                          |
| LCExxxXX-B  | DO-201            | 500      | BULK             | Littelfuse Concord Packing Spec. DM-0016 |

### Schematic



### Tape and Reel Specification



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