



## 1500 Watt Low Capacitance Transient Voltage Suppressor

Screening in  
reference to  
MIL-PRF-19500  
available

### DESCRIPTION

This hermetically sealed Transient Voltage Suppressor (TVS) product family includes a rectifier diode element in series and in the opposite direction. This allows it to present a very low (< 100 pF) capacitance to the system it is protecting (see [Figure 2](#)). The low capacitance of these devices makes them particularly useful for protecting lines carrying high frequency signals. They are also useful in protecting from the secondary effects of lightning in airborne avionics per IEC61000-4-5, RTCA/DO-160G, and ARINC 429. If bidirectional transient capability is required, two of these low capacitance TVS devices may be used in parallel in opposite directions (anti-parallel) for complete ac protection as shown in [Figure 4](#).

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

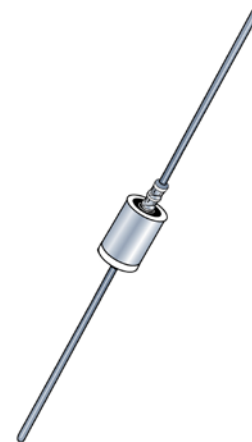
### FEATURES

- Unidirectional low-capacitance TVS series for flexible thru-hole mounting.
- For bidirectional applications, use two in anti-parallel (see [Figure 4](#)).
- Suppresses transients up to 1500 watts @ 10/1000  $\mu$ s (see [Figure 1](#)).
- Clamps transients in less than 100 pico seconds (theoretical for unidirectional).\*
- Working voltage ( $V_{WM}$ ) range 6.5 V to 170 V.
- 5% and 10% tolerance versions available.
- Hermetic sealed DO-13 metal package.
- Screening options available in reference to MIL-PRF-19500.  
(See [Part Nomenclature](#) for all available options.)
- RoHS compliant versions available.

\*measurement limitation

### APPLICATIONS / BENEFITS


- Protection from switching transients and induced RFI.
- Low capacitance for data line protection up to 1 MHz.
- Protection for fast data rate lines in aircraft up to:
  - RTCA/DO-160G Level 5 Waveform 4 and Level 2 Waveform 5A (also see [MicroNote 130](#))
  - ARINC 429, Part 1, paragraph 2.4.1.1 up to bit rates of 100 kb/s
- ESD & EFT protection per IEC 61000-4-2 and -4-4.
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:
  - Class 1: LC6.5 to LC170A
  - Class 2: LC6.5 to LC150A
  - Class 3: LC6.5 to LC70A
  - Class 4: LC6.5 to LC36A
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  - Class 1: LC6.5 to LC90A
  - Class 2: LC6.5 to LC45A
  - Class 3: LC6.5 to LC22A
  - Class 4: LC6.5 to LC11A
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  - Class 2: LC6.5 to LC20A
  - Class 3: LC6.5 to LC10A
- Inherently radiation hard as described in Microsemi [MicroNote 050](#).




**DO-202AA (DO-13)  
Package**

Also available in:


**Case 1 package**  
(plastic equivalent)

 [LCE6.5 – LCE170A](#)

**DO-215AB package**  
(Gull wing surface mount)

 [SMCGLCE6.5 – SMCGLCE170A](#)

**DO-214AB package**  
(J-bend surface mount)

 [SMCJLCE6.5 – SMCJLCE170A](#)

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**MAXIMUM RATINGS**

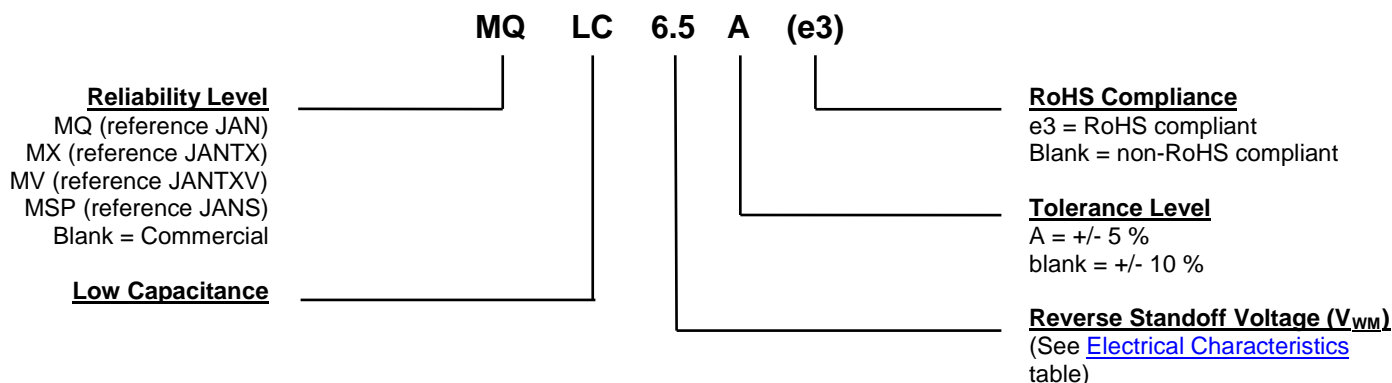
| Parameters/Test Conditions  | Symbol              | Value       | Unit |
|---|---------------------|-------------|------|
| Junction and Storage Temperature                                    | $T_J$ and $T_{STG}$ | -65 to +175 | °C   |
| Thermal Resistance, Junction to Lead @ 0.375 inch (10 mm) from body | $R_{\theta JL}$     | 50          | °C/W |
| Thermal Resistance, Junction to Ambient <sup>(1)</sup>              | $R_{\theta JA}$     | 110         | °C/W |
| Peak Pulse Power @ $T_L = +25$ °C <sup>(2)</sup>                    | $P_{PP}$            | 1500        | W    |
| Power Dissipation @ $T_L \leq +125$ °C <sup>(3)</sup>               | $P_D$               | 1           | W    |
| Solder Temperature @ 10 s   | $T_{SP}$            | 260         | °C   |

**Notes:**

- When mounted on FR4 PC board with 4 mm<sup>2</sup> copper pads (1 oz) and track width 1 mm, length 25 mm.
- At 10/1000  $\mu$ s with repetition rate of 0.01% or less (see [Figure 1](#)).
- At 3/8 inch (10 mm) from body. TVS devices are not typically used for dc power dissipation and are instead operated at or less than their rated standoff voltage ( $V_{WM}$ ) except for transients that briefly drive the device into avalanche breakdown ( $V_{BR}$  to  $V_C$  region). Also see [Figures 2, 3 and 4](#) for further protection details in rated peak pulse power for unidirectional and bidirectional configurations respectively.

**MECHANICAL and PACKAGING**

- CASE: Welded, hermetically sealed metal and glass.
- TERMINALS: Tin-lead plated or RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750 method 2026.
- MARKING: Part number and polarity diode symbol.
- POLARITY: Cathode connected to case and polarity indicated by diode symbol.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 1.4 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

| Symbol     | Definition   |
|------------|--|
| $I_{(BR)}$ | Breakdown Current: The current used for measuring breakdown voltage $V_{(BR)}$ .   |
| $V_{(BR)}$ | Breakdown Voltage: This is the breakdown voltage the device will exhibit at 25 °C.   |
| $V_{WM}$   | Rated Working Standoff Voltage: The maximum peak voltage that can be applied over the operating temperature range.   |
| $V_C$      | Maximum Clamping Voltage: The maximum peak voltage appearing across the TVS when subjected to the peak pulse current in a one millisecond time interval. The peak pulse voltage is the combination of voltage rise due to both the series resistance and thermal rise and positive temperature coefficient ( $\alpha_{V(BR)}$ ). |
| $I_{PP}$   | Peak Impulse Current: The peak current during the impulse.   |
| $P_{PP}$   | Peak Pulse Power: The pulse power as determined by the product of $V_C$ and $I_{PP}$ .   |
| $I_D$      | Standby Current: The current at the standoff voltage $V_{WM}$ .  |

**ELECTRICAL CHARACTERISTICS @ 25 °C**

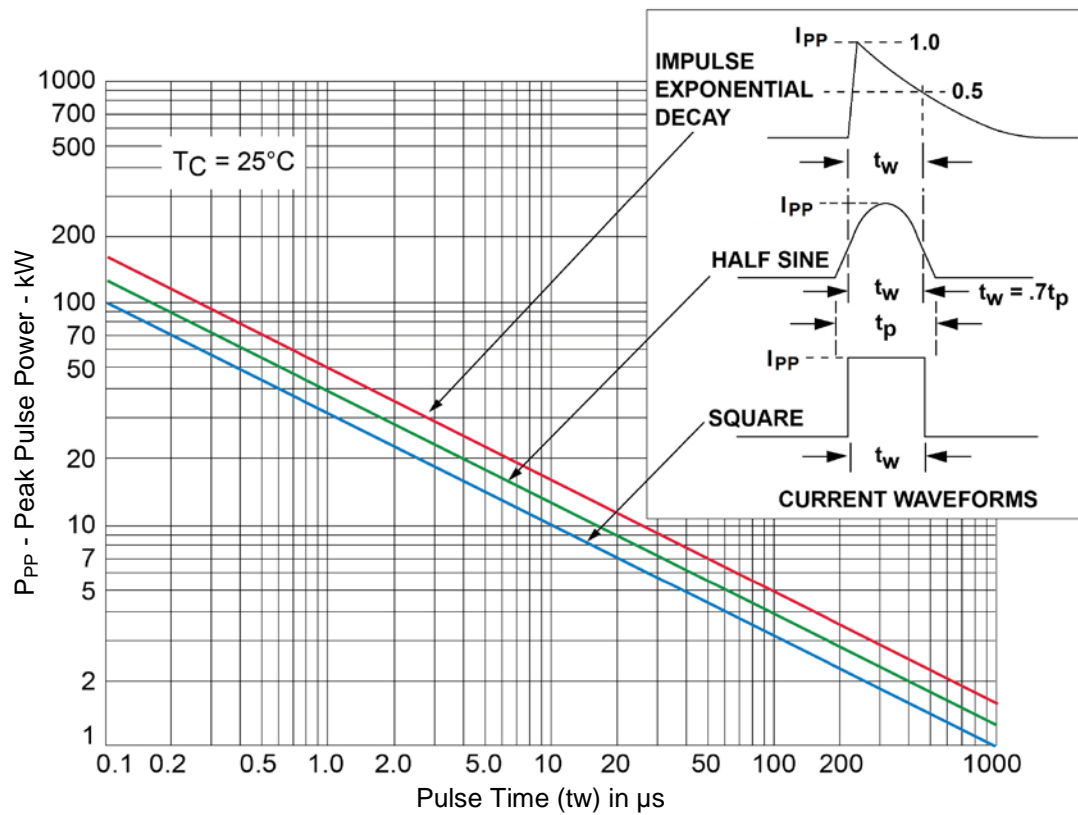
| PART<br>NUMBER | RATED<br>WORKING<br>STANDOFF<br>VOLTAGE<br>V <sub>WM</sub><br><br>Volts | BREAKDOWN VOLTAGE          |      |                              | MAXIMUM<br>STANDBY<br>CURRENT<br>I <sub>D</sub> @ V <sub>WM</sub><br><br>μA | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>V <sub>C</sub> @ I <sub>PP</sub><br><br>Volts | MAXIMUM<br>PEAK<br>IMPULSE<br>CURRENT<br>I <sub>PP</sub> @<br>10/1000 μs<br>Amps | MAXIMUM<br>CAPACI-<br>TANCE<br>C @ 0<br>Volts,<br>f = 1 MHz<br>pF | WORKING<br>INVERSE<br>BLOCKING<br>VOLTAGE<br>V <sub>WIB</sub><br><br>Volts | INVERSE<br>BLOCKING<br>LEAKAGE<br>CURRENT<br>I <sub>IB</sub> @ V <sub>WIB</sub><br><br>μA | PEAK<br>INVERSE<br>BLOCKING<br>VOLTAGE<br>V <sub>PIB</sub><br>Volts |
|----------------|---|----------------------------|------|------------------------------|---|---|--|---|--|---|---|
|                |   | V <sup>(BR)</sup><br>Volts |      | @<br>I <sup>(BR)</sup><br>mA |   |   |  |   |  |   |   |
|                |   |                            |      |                              |   |   |  |   |  |   |   |
| LC6.5          | 6.5   | 7.22                       | 8.82 | 10                           | 1000  | 12.3  | 100  | 100   | 75   | 10  | 100   |
| LC6.5A         | 6.5   | 7.22                       | 7.98 | 10                           | 1000  | 11.2  | 100  | 100   | 75   | 10  | 100   |
| LC7.0          | 7.0   | 7.78                       | 9.51 | 10                           | 500   | 13.3  | 100  | 100   | 75   | 10  | 100   |
| LC7.0A         | 7.0   | 7.78                       | 8.60 | 10                           | 500   | 12.0  | 100  | 100   | 75   | 10  | 100   |
| LC7.5          | 7.5   | 8.33                       | 10.2 | 10                           | 250   | 14.3  | 100  | 100   | 75   | 10  | 100   |
| LC7.5A         | 7.5   | 8.33                       | 9.21 | 10                           | 250   | 12.9  | 100  | 100   | 75   | 10  | 100   |
| LC8.0          | 8.0   | 8.89                       | 10.9 | 1                            | 100   | 15.0  | 100  | 100   | 75   | 10  | 100   |
| LC8.0A         | 8.0   | 8.89                       | 9.83 | 1                            | 100   | 13.6  | 100  | 100   | 75   | 10  | 100   |
| LC8.5          | 8.5   | 9.44                       | 11.5 | 1                            | 50  | 15.9  | 94   | 100   | 75   | 10  | 100   |
| LC8.5A         | 8.5   | 9.44                       | 10.4 | 1                            | 50  | 14.4  | 100  | 100   | 75   | 10  | 100   |
| LC9.0          | 9.0   | 10.0                       | 12.2 | 1                            | 10  | 16.9  | 89   | 100   | 75   | 10  | 100   |
| LC9.0A         | 9.0   | 10.0                       | 11.1 | 1                            | 10  | 15.4  | 97   | 100   | 75   | 10  | 100   |
| LC10           | 10  | 11.1                       | 13.6 | 1                            | 5   | 18.8  | 80   | 100   | 75   | 10  | 100   |
| LC10A          | 10  | 11.1                       | 12.3 | 1                            | 5   | 17.0  | 88   | 100   | 75   | 10  | 100   |
| LC11           | 11  | 12.2                       | 14.9 | 1                            | 5   | 20.1  | 74   | 100   | 75   | 10  | 100   |
| LC11A          | 11  | 12.2                       | 13.5 | 1                            | 5   | 18.2  | 82   | 100   | 75   | 10  | 100   |
| LC12           | 12  | 13.3                       | 16.3 | 1                            | 5   | 22.0  | 68   | 100   | 75   | 10  | 100   |
| LC12A          | 12  | 13.3                       | 14.7 | 1                            | 5   | 19.9  | 75   | 100   | 75   | 10  | 100   |
| LC13           | 13  | 14.4                       | 17.6 | 1                            | 5   | 23.8  | 63   | 100   | 75   | 10  | 100   |
| LC13A          | 13  | 14.4                       | 15.9 | 1                            | 5   | 21.5  | 70   | 100   | 75   | 10  | 100   |
| LC14           | 14  | 15.6                       | 19.1 | 1                            | 5   | 25.8  | 58   | 100   | 75   | 10  | 100   |
| LC14A          | 14  | 15.6                       | 17.2 | 1                            | 5   | 23.2  | 65   | 100   | 75   | 10  | 100   |
| LC15           | 15  | 16.7                       | 20.4 | 1                            | 5   | 26.9  | 56   | 100   | 75   | 10  | 100   |
| LC15A          | 15  | 16.7                       | 18.5 | 1                            | 5   | 24.4  | 61   | 100   | 75   | 10  | 100   |
| LC16           | 16  | 17.8                       | 21.8 | 1                            | 5   | 28.8  | 52   | 100   | 75   | 10  | 100   |
| LC16A          | 16  | 17.8                       | 19.7 | 1                            | 5   | 26.0  | 57   | 100   | 75   | 10  | 100   |
| LC17           | 17  | 18.9                       | 23.1 | 1                            | 5   | 30.5  | 49   | 100   | 75   | 10  | 100   |
| LC17A          | 17  | 18.9                       | 20.9 | 1                            | 5   | 27.6  | 54   | 100   | 75   | 10  | 100   |
| LC18           | 18  | 20.0                       | 24.4 | 1                            | 5   | 32.2  | 46   | 100   | 75   | 10  | 100   |
| LC18A          | 18  | 20.0                       | 22.1 | 1                            | 5   | 29.2  | 51   | 100   | 75   | 10  | 100   |
| LC20           | 20  | 22.2                       | 27.1 | 1                            | 5   | 35.8  | 42   | 100   | 75   | 10  | 100   |
| LC20A          | 20  | 22.2                       | 24.5 | 1                            | 5   | 32.4  | 46   | 100   | 75   | 10  | 100   |
| LC22           | 22  | 24.4                       | 29.8 | 1                            | 5   | 39.4  | 38   | 100   | 75   | 10  | 100   |
| LC22A          | 22  | 24.4                       | 26.9 | 1                            | 5   | 35.5  | 42   | 100   | 75   | 10  | 100   |
| LC24           | 24  | 26.7                       | 32.6 | 1                            | 5   | 43.0  | 35   | 100   | 75   | 10  | 100   |
| LC24A          | 24  | 26.7                       | 29.5 | 1                            | 5   | 38.9  | 39   | 100   | 75   | 10  | 100   |
| LC26           | 26  | 28.9                       | 35.3 | 1                            | 5   | 46.6  | 32   | 100   | 75   | 10  | 100   |
| LC26A          | 26  | 28.9                       | 31.9 | 1                            | 5   | 42.1  | 36   | 100   | 75   | 10  | 100   |
| LC28           | 28  | 31.1                       | 38.0 | 1                            | 5   | 50.1  | 30   | 100   | 75   | 10  | 100   |
| LC28A          | 28  | 31.1                       | 34.4 | 1                            | 5   | 45.4  | 33   | 100   | 75   | 10  | 100   |
| LC30           | 30  | 33.3                       | 40.7 | 1                            | 5   | 53.5  | 28   | 100   | 75   | 10  | 100   |
| LC30A          | 30  | 33.3                       | 36.8 | 1                            | 5   | 48.4  | 31   | 100   | 75   | 10  | 100   |
| LC33           | 33  | 36.7                       | 44.9 | 1                            | 5   | 58.0  | 25.4   | 100   | 75   | 10  | 100   |
| LC33A          | 33  | 36.7                       | 40.6 | 1                            | 5   | 53.3  | 28.1   | 100   | 75   | 10  | 100   |
| LC36           | 36  | 40.0                       | 48.9 | 1                            | 5   | 64.3  | 23.3   | 100   | 75   | 10  | 100   |
| LC36A          | 36  | 40.0                       | 44.2 | 1                            | 5   | 58.1  | 25.8   | 100   | 75   | 10  | 100   |
| LC40           | 40  | 44.4                       | 54.3 | 1                            | 5   | 71.4  | 21.0   | 100   | 75   | 10  | 100   |
| LC40A          | 40  | 44.4                       | 49.1 | 1                            | 5   | 64.5  | 23.3   | 100   | 75   | 10  | 100   |
| LC43           | 43  | 47.8                       | 58.4 | 1                            | 5   | 76.7  | 19.5   | 100   | 150  | 10  | 200   |
| LC43A          | 43  | 47.8                       | 52.8 | 1                            | 5   | 69.4  | 21.6   | 100   | 150  | 10  | 200   |
| LC45           | 45  | 50.0                       | 61.1 | 1                            | 5   | 80.3  | 18.7   | 100   | 150  | 10  | 200   |
| LC45A          | 45  | 50.0                       | 55.3 | 1                            | 5   | 72.7  | 20.6   | 100   | 150  | 10  | 200   |
| LC48           | 48  | 53.3                       | 65.1 | 1                            | 5   | 85.5  | 17.5   | 100   | 150  | 10  | 200   |
| LC48A          | 48  | 53.3                       | 58.9 | 1                            | 5   | 77.4  | 19.4   | 100   | 150  | 10  | 200   |
| LC51           | 51  | 56.7                       | 69.3 | 1                            | 5   | 91.1  | 16.5   | 100   | 150  | 10  | 200   |
| LC51A          | 51  | 56.7                       | 62.7 | 1                            | 5   | 82.4  | 18.2   | 100   | 150  | 10  | 200   |

*continued*

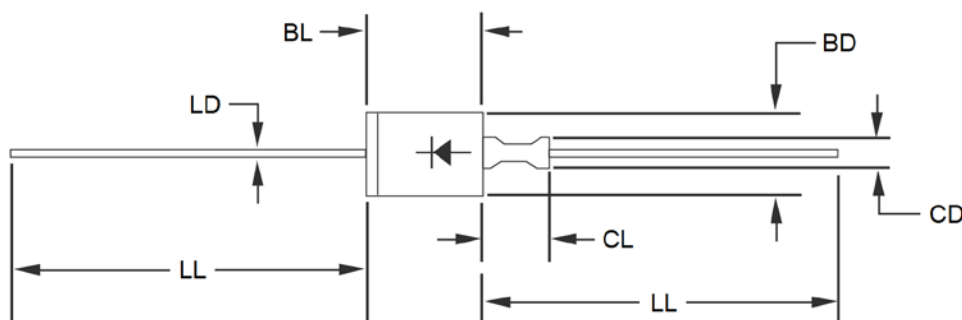
**ELECTRICAL CHARACTERISTICS @ 25 °C (continued)**

| PART<br>NUMBER | RATED<br>WORKING<br>STANDOFF<br>VOLTAGE<br>V <sub>WM</sub><br><br>Volts | BREAKDOWN VOLTAGE          |       |                              | MAXIMUM<br>STANDBY<br>CURRENT<br>I <sub>D</sub> @V <sub>WM</sub><br><br>µA | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>V <sub>C</sub> @ I <sub>PP</sub><br><br>Volts | MAXIMUM<br>PEAK<br>IMPULSE<br>CURRENT<br>I <sub>PP</sub> @<br>10/1000 µs<br>Amps | MAXIMUM<br>CAPACI-<br>TANCE<br>C @ 0<br>Volts,<br>f = 1 MHz<br>pF | WORKING<br>INVERSE<br>BLOCKING<br>VOLTAGE<br>V <sub>WIB</sub><br><br>Volts | INVERSE<br>BLOCKING<br>LEAKAGE<br>CURRENT<br>I <sub>IB</sub> @ V <sub>WIB</sub><br><br>µA | PEAK<br>INVERSE<br>BLOCKING<br>VOLTAGE<br>VOLTS<br>V <sub>PIB</sub><br>Volts |
|----------------|---|----------------------------|-------|------------------------------|--|---|--|---|--|---|--|
|                |   | V <sub>(BR)</sub><br>Volts |       | @<br>I <sub>(BR)</sub><br>mA |  |   |  |   |  |   |  |
|                |   | MIN                        | MAX   |                              |  |   |  |   |  |   |  |
| LC54           | 54  | 60.0                       | 73.3  | 1                            | 5  | 96.3  | 15.6   | 100   | 150  | 10  | 200  |
| LC54A          | 54  | 60.0                       | 66.3  | 1                            | 5  | 87.1  | 17.2   | 100   | 150  | 10  | 200  |
| LC58           | 58  | 64.4                       | 78.7  | 1                            | 5  | 103.0   | 14.6   | 100   | 150  | 10  | 200  |
| LC58A          | 58  | 64.4                       | 71.2  | 1                            | 5  | 93.6  | 16.0   | 100   | 150  | 10  | 200  |
| LC60           | 60  | 66.7                       | 81.5  | 1                            | 5  | 107.0   | 14.0   | 90  | 150  | 10  | 200  |
| LC60A          | 60  | 66.7                       | 73.7  | 1                            | 5  | 96.8  | 15.5   | 90  | 150  | 10  | 200  |
| LC64           | 64  | 71.1                       | 86.9  | 1                            | 5  | 114.0   | 13.2   | 90  | 150  | 10  | 200  |
| LC64A          | 64  | 71.1                       | 78.6  | 1                            | 5  | 103.0   | 14.6   | 90  | 150  | 10  | 200  |
| LC70           | 70  | 77.8                       | 95.1  | 1                            | 5  | 125   | 12.0   | 90  | 150  | 10  | 200  |
| LC70A          | 70  | 77.8                       | 86.0  | 1                            | 5  | 113   | 13.3   | 90  | 150  | 10  | 200  |
| LC75           | 75  | 83.3                       | 102.0 | 1                            | 5  | 134   | 11.2   | 90  | 150  | 10  | 200  |
| LC75A          | 75  | 83.3                       | 92.1  | 1                            | 5  | 121   | 12.4   | 90  | 150  | 10  | 200  |
| LC80           | 80  | 88.7                       | 108   | 1                            | 5  | 142   | 10.6   | 90  | 150  | 10  | 200  |
| LC80A          | 80  | 88.7                       | 98.0  | 1                            | 5  | 129   | 11.6   | 90  | 150  | 10  | 200  |
| LC90           | 90  | 100                        | 122   | 1                            | 5  | 160   | 9.4  | 90  | 300  | 10  | 200  |
| LC90A          | 90  | 100                        | 111   | 1                            | 5  | 146   | 10.3   | 90  | 300  | 10  | 200  |
| LC100          | 100   | 111                        | 136   | 1                            | 5  | 179   | 8.4  | 90  | 300  | 10  | 200  |
| LC100A         | 100   | 111                        | 123   | 1                            | 5  | 162   | 9.3  | 90  | 300  | 10  | 200  |
| LC110          | 110   | 122                        | 149   | 1                            | 5  | 196   | 7.7  | 90  | 300  | 10  | 400  |
| LC110A         | 110   | 122                        | 135   | 1                            | 5  | 178   | 8.4  | 90  | 300  | 10  | 400  |
| LC120          | 120   | 133                        | 163   | 1                            | 5  | 214   | 7.0  | 90  | 300  | 10  | 400  |
| LC120A         | 120   | 133                        | 147   | 1                            | 5  | 193   | 7.8  | 90  | 300  | 10  | 400  |
| LC130          | 130   | 144                        | 176   | 1                            | 5  | 231   | 6.5  | 90  | 300  | 10  | 400  |
| LC130A         | 130   | 144                        | 159   | 1                            | 5  | 209   | 7.2  | 90  | 300  | 10  | 400  |
| LC150          | 150   | 167                        | 204   | 1                            | 5  | 268   | 5.6  | 90  | 300  | 10  | 400  |
| LC150A         | 150   | 167                        | 185   | 1                            | 5  | 243   | 6.2  | 90  | 300  | 10  | 400  |
| LC160          | 160   | 178                        | 218   | 1                            | 5  | 287   | 5.2  | 90  | 300  | 10  | 400  |
| LC160A         | 160   | 178                        | 197   | 1                            | 5  | 259   | 5.8  | 90  | 300  | 10  | 400  |
| LC170          | 170   | 189                        | 231   | 1                            | 5  | 304   | 4.9  | 90  | 300  | 10  | 400  |
| LC170A         | 170   | 189                        | 209   | 1                            | 5  | 275   | 5.4  | 90  | 300  | 10  | 400  |

**NOTE 1:** TVS devices are normally selected according to the reverse standoff voltage ( $V_{WM}$ ) which should be equal to or greater than the DC or peak operating voltage level.

**GRAPHS**


**FIGURE 1**  
Peak Pulse Power vs Pulse Time ( $t_w$ ) in  $\mu s$

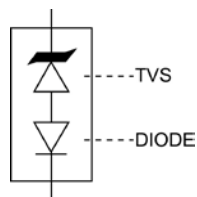
**PACKAGE DIMENSIONS**

**NOTES:**

- 1 Dimensions are in inches.
- 2 Millimeter equivalents are given for information only.
- 3 The major diameter is essentially constant along its length.
- 4 Dimension to allow for pinch or seal deformation anywhere along tubulation.
- 5 Symbol for bidirectional transient suppressor.
- 6 Lead 1 is electrically connected to the case.
- 7 In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi \times$  symbology.

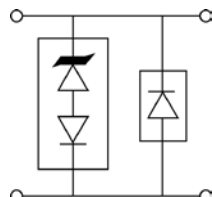
| Symbol | Dimensions |       |             |       | Notes |
|--------|------------|-------|-------------|-------|-------|
|        | Inches     |       | Millimeters |       |       |
|        | Min        | Max   | Min         | Max   |       |
| BD     | 0.215      | 0.235 | 5.46        | 5.97  |       |
| BL     | 0.315      | 0.350 | 8.00        | 8.90  | 3     |
| CD     | 0.045      | 0.100 | 1.14        | 2.54  | 4     |
| CL     | -          | 0.210 | -           | 5.33  |       |
| LD     | 0.026      | 0.035 | 0.660       | 0.889 |       |
| LL     | 1.000      | 1.625 | 25.40       | 41.28 |       |

**APPLICATIONS SCHEMATIC**

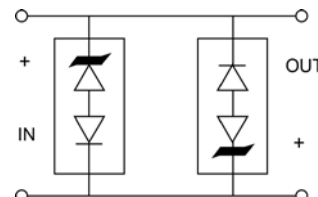
The TVS low capacitance device configuration is shown in figure 2. As a further option for unidirectional applications, an additional low capacitance rectifier diode may be used in parallel in the same polarity direction as the TVS as shown in figure 3. In applications where random high voltage transients occur, this will prevent reverse transients from damaging the internal low capacitance rectifier diode and also provide a low voltage conducting direction. The added rectifier diode should be of similar low capacitance and also have a higher reverse voltage rating than the TVS clamping voltage  $V_C$ . The Microsemi recommended rectifier part number is the "LCR80" for the application in figure 3. If using two (2) low capacitance TVS devices in anti-parallel for bidirectional applications, this added protective feature for both directions (including the reverse of each rectifier diode) is also provided. The unidirectional and bidirectional configurations in figure 3 and 4 will both result in twice the capacitance of figure 2.


**FIGURE 2**

TVS with internal Low Capacitance Diode


**FIGURE 3**

Optional Unidirectional configuration (TVS and separate rectifier diode in parallel)


**FIGURE 4**

Optional Bidirectional configuration (two TVS devices in anti-parallel)