

## Features

- RoHS compliant\*
- ESD protection >25 kV
- Low capacitance <0.5 pF
- Low leakage current <50 nA

## Applications

- HDMI 1.4
- Digital Visual Interface (DVI)
- USB 3.0 / USB OTG
- Memory protection
- SIM card ports

# ChipGuard® MLC Series - ESD Protectors

### General Information

The ChipGuard® MLC Series has been specifically designed to protect sensitive electronic components from electrostatic discharge damage. The MLC family has been designed to protect equipment to IEC61000-4-2, Level 4 (±8 kV Contact / ±15 kV Air Discharge) ESD specifications targeted for high speed USB 3.0/USB OTG, HDMI 1.4, DVI or IEEE1394 applications.

The ChipGuard® MLC Series has been manufactured to provide low 0.5 pF capacitance and leakage currents less than 5 nA with excellent clamp qualities, making the family almost transparent under normal working conditions.

### Device Symbol



### Electrical Characteristics @ 25 °C (unless otherwise noted)

| Parameter  | Symbol           | CG0402MLC-                |      |      |      |             |       |       |       | Unit           |
|--|------------------|---------------------------|------|------|------|-------------|-------|-------|-------|----------------|
|  |                  | 3.3LG                     | 05LG | 12LG | 24LG | 3.3LGA      | 05LGA | 12LGA | 24LGA |                |
| Typical Continuous Operating Voltage   | V <sub>DC</sub>  | 3.3                       | 5    | 12   | 24   | 3.3         | 5     | 12    | 24    | V              |
| Typical Clamping Voltage (Note 1)  | V <sub>C</sub>   | 25                        |      |      |      |             |       |       |       | V              |
| Maximum Capacitance @ 1 VRMS 1 MHz   | C <sub>O</sub>   | 0.5                       |      |      |      |             |       |       |       | pF             |
| Maximum Leakage Current @ Max. VDC   | I <sub>L</sub>   | 5                         |      |      |      |             |       |       |       | nA             |
| Typical Trigger Voltage (Note 2)   | V <sub>T</sub>   | 250                       |      |      |      |             |       |       |       | V              |
| Maximum Response Time  | R <sub>T</sub>   | 1                         |      |      |      |             |       |       |       | ns             |
| ESD Protection:<br>Per IEC 61000-4-2 Level 4<br>Min. Contact Discharge<br>Min. Air Discharge<br>Min. Air Discharge |                  | ±8<br>±15 (Note 3)<br>±25 |      |      |      |             |       |       |       | kV<br>kV<br>kV |
| Operating Temperature  | T <sub>OPR</sub> | -40 to +85                |      |      |      | -40 to +125 |       |       |       | °C             |
| Storage Temperature  | T <sub>STG</sub> | -55 to +150               |      |      |      |             |       |       |       | °C             |

| Parameter  | Symbol           | CG0603MLC-                |      |      |      |             |       |       |       | Unit           |
|--|------------------|---------------------------|------|------|------|-------------|-------|-------|-------|----------------|
|  |                  | 3.3LE                     | 05LE | 12LE | 24LE | 3.3LEA      | 05LEA | 12LEA | 24LEA |                |
| Typical Continuous Operating Voltage   | V <sub>DC</sub>  | 3.3                       | 5    | 12   | 24   | 3.3         | 5     | 12    | 24    | V              |
| Typical Clamping Voltage (Note 1)  | V <sub>C</sub>   | 25                        | 25   | 25   |      |             |       |       |       | V              |
| Maximum Capacitance @ 1 VRMS 1 MHz   | C <sub>O</sub>   | 0.5                       |      |      |      |             |       |       |       | pF             |
| Maximum Leakage Current @ Max. VDC   | I <sub>L</sub>   | 5                         | 5    | 5    |      |             |       |       |       | nA             |
| Typical Trigger Voltage (Note 2)   | V <sub>T</sub>   | 250                       | 250  | 250  |      |             |       |       |       | V              |
| Maximum Response Time  | R <sub>T</sub>   | 1                         |      |      |      |             |       |       |       | ns             |
| ESD Protection:<br>Per IEC 61000-4-2 Level 4<br>Min. Contact Discharge<br>Min. Air Discharge<br>Min. Air Discharge |                  | ±8<br>±15 (Note 3)<br>±25 |      |      |      |             |       |       |       | kV<br>kV<br>kV |
| Operating Temperature  | T <sub>OPR</sub> | -40 to +85                |      |      |      | -40 to +125 |       |       |       | °C             |
| Storage Temperature  | T <sub>STG</sub> | -55 to +150               |      |      |      |             |       |       |       | °C             |

- Notes: 1. Per IEC 61000-4-2, Level 4 8 kV Contact Discharge. Measurement 30 ns after initiation of pulse.  
 2. Per IEC 61000-4-2, Level 4 8 kV Contact Discharge. Measurement at maximum pulse voltage.  
 3. IEC 61000-4-2 ESD Performance will meet minimum 1000 reps without degradation in performance.



**WARNING Cancer and Reproductive Harm - [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov)**

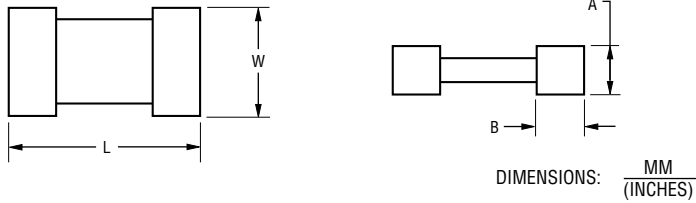
\*RoHS Directive 2015/863, Mar 31, 2015 and Annex.

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

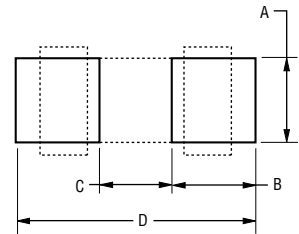
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**Product Dimensions**



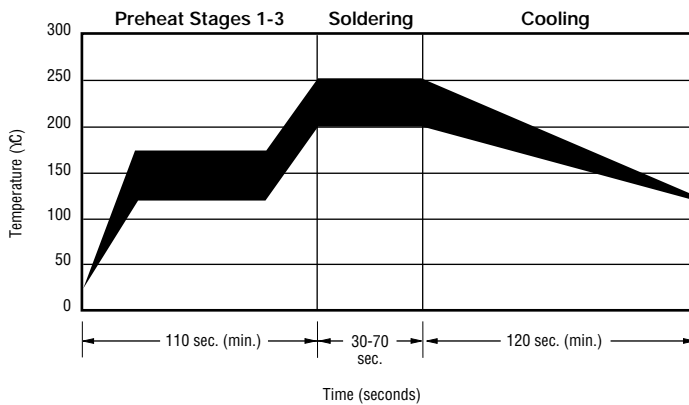
| Dimension | CG0402 Series                             | CG0603 Series                             |
|-----------|---|---|
| L         | $\frac{1.00 \pm 0.15}{(0.04 \pm 0.006)}$  | $\frac{1.60 \pm 0.20}{(0.064 \pm 0.008)}$ |
| W         | $\frac{0.50 \pm 0.10}{(0.02 \pm 0.004)}$  | $\frac{0.80 \pm 0.20}{(0.032 \pm 0.008)}$ |
| A         | $\frac{0.36 \pm 0.05}{(0.014 \pm 0.002)}$ | $\frac{0.45 \pm 0.10}{(0.018 \pm 0.004)}$ |
| B         | $\frac{0.25 \pm 0.15}{(0.10 \pm 0.006)}$  | $\frac{0.30 \pm 0.20}{(0.012 \pm 0.008)}$ |

**Recommended Pad Layout**



| Dim. | CG0402 Series          | CG0603 Series          |
|------|------------------------|------------------------|
| A    | $\frac{0.51}{(0.020)}$ | $\frac{0.76}{(0.030)}$ |
| B    | $\frac{0.61}{(0.024)}$ | $\frac{1.02}{(0.040)}$ |
| C    | $\frac{0.51}{(0.020)}$ | $\frac{0.50}{(0.020)}$ |
| D    | $\frac{1.70}{(0.067)}$ | $\frac{2.54}{(0.100)}$ |

**Solder Reflow Recommendations**



|   |                 |  |   |
|---|-----------------|--|---|
| A | Stage 1 Preheat | Ambient to Preheating Temperature                                  | 30 s to 60 s  |
| B | Stage 2 Preheat | 140 °C to 160 °C   | 60 s to 120 s   |
| C | Stage 3 Preheat | Preheat to 200 °C  | 20 s to 40 s  |
| D | Main Heating    | 200 °C<br>210 °C<br>220 °C<br>230 °C<br>240 °C<br>250 °C to 255 °C | 60 s to 70 s<br>55 s to 65 s<br>50 s to 60 s<br>40 s to 50 s<br>30 s to 40 s<br>5 s |
| E | Cooling         | 200 °C to 100 °C   | 1 °C/s to 4 °C/s  |

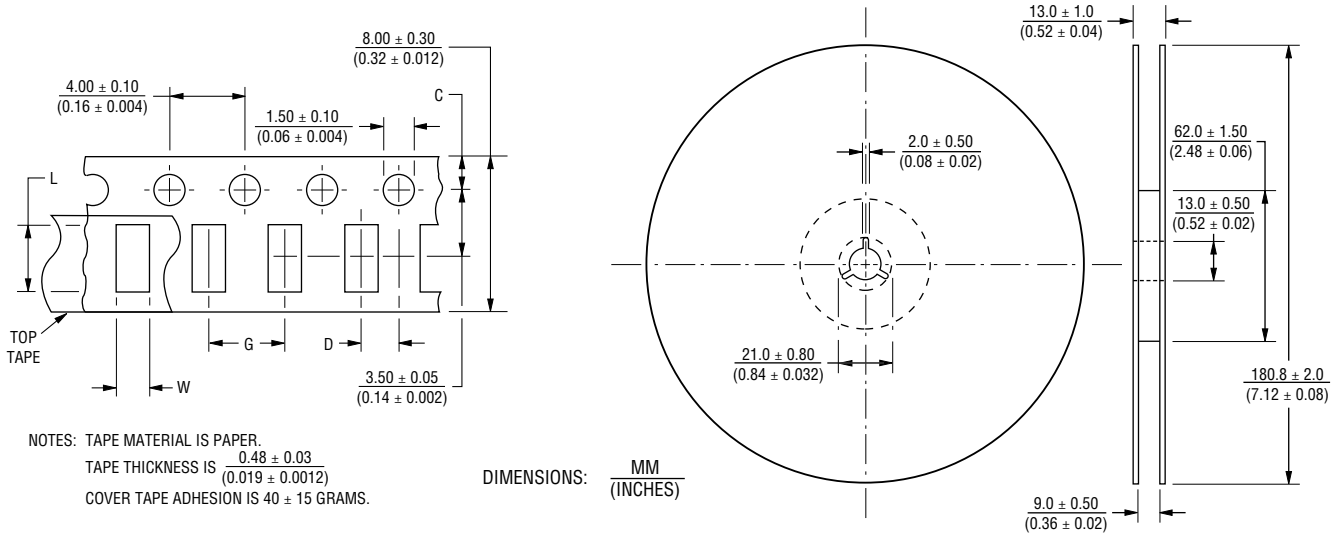
- This product can be damaged by rapid heating, cooling or localized heating.
- Heat shocks should be avoided. Preheating and gradual cooling recommended.
- Excessive solder can damage the device. Print solder thickness of 150 to 200 um recommended.
- Solder gun tip temperature should be kept below 280 °C and should not touch the device directly. Contact should be less than 3 seconds. A solder gun under 30 watts is recommended.

Specifications are subject to change without notice.

Users should verify actual device performance in their specific applications.

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**Packaging Dimensions**



| Dimension | CG0402 Series                              | CG0603 Series                             |
|-----------|--|---|
| C         | $\frac{1.75 \pm 0.05}{(0.04 \pm 0.002)}$   | $\frac{1.75 \pm 0.10}{(0.04 \pm 0.004)}$  |
| D         | $\frac{2.00 \pm 0.02}{(0.08 \pm 0.0008)}$  | $\frac{2.00 \pm 0.05}{(0.08 \pm 0.002)}$  |
| L         | $\frac{1.12 \pm 0.03}{(0.045 \pm 0.0012)}$ | $\frac{1.80 \pm 0.20}{(0.072 \pm 0.008)}$ |
| W         | $\frac{0.62 \pm 0.03}{(0.025 \pm 0.0012)}$ | $\frac{0.90 \pm 0.20}{(0.036 \pm 0.008)}$ |
| G         | $\frac{2.0 \pm 0.05}{(0.08 \pm 0.002)}$    | $\frac{4.0 \pm 0.05}{(0.16 \pm 0.002)}$   |

**How to Order**

**CG 0n0n MLC - n.n x x x**

- ChipGuard® Product Designator
  - Package Option
    - 0402 = 0402 Package
    - 0603 = 0603 Package
  - Multilayer Series Designator
  - Operating Voltage\*\*
    - 3.3 = 3.3 V
    - 05 = 5 V
    - 12 = 12 V
    - 24 = 24 V
  - Low Leakage Current Option
    - L = Low Leakage Current
    - Blank = Standard Product
  - Tape & Reel Packaging
    - E = 5,000 pcs. per reel (0603 Package)
    - G = 10,000 pcs. per reel (0402 Package)
  - Operating Temperature Option
    - A = Higher +125 °C Operating Temperature
    - Blank = Standard Product
- \*\* Only models lower than 10 volts require decimal point.