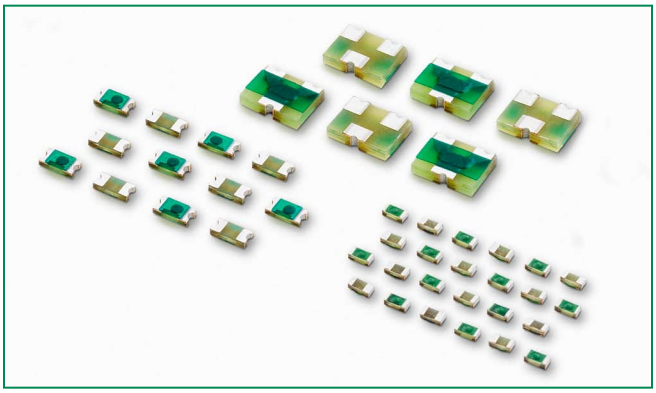
# RoHS Pb PGB1 Series Lead-Free



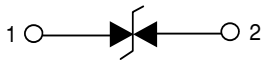
## Description

PulseGuard ESD Suppressors help protect sensitive electronic equipment against electrostatic discharge (ESD). They supplement the on-chip protection of integrated circuitry and are best suited for low-voltage, high-speed applications where low capacitance is important. Data ports utilizing such high-speed protocols as USB 2.0, IEEE1394, HDMI and DVI can benefit from this new technology.

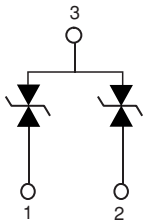
PulseGuard suppressors use polymer composite materials to suppress fast-rising ESD transients (as specified in IEC 61000-4-2), while adding virtually no capacitance to the circuit.

## Equivalent Circuits

### 0402 and 0603 Devices




### SOT23 Device




## Features

- RoHS compliant and lead-free
- Ultra-low capacitance
- Low leakage current
- Fast response time
- Bi-directional
- Withstands multiple ESD strikes
- Compatible with pick-and-place processes
- Available in 1000, 3000, 5000 and 10000 piece reels (EIA-RS481)

## Applications

- HDTV Hardware
- Laptop/Desktop Computers
- Network Hardware
- Computer Peripherals
- Digital Cameras
- External Storage
- Set-Top Boxes

## Product Characteristics

| Part Number | Lines Protected | Component Package |
|---|---|---|
| PGB1010402 | 1 | 0402 |
| PGB1010603 | 1 | 0603 |
| PGB102ST23 | 2 | SOT23 |

## Electrical Characteristics

| Specification | PGB1010402 | PGB1010603 | PGB102ST23 | Notes |
|---|---|---|---|---|
| ESD Capability:<br>IEC 61000-4-2 Contact Discharge<br>IEC 61000-4-2 Air Discharge | <br>8kV<br>15kV | <br>8kV<br>15kV | <br>8kV<br>15kV | |
| Peak Voltage (typical) | 1000V | 500V | 500V | Measured per IEC 61000-4-2 8kV Contact Discharge[1] |
| Clamping Voltage (typical) | 250V | 150V | 150V | Measured per IEC 61000-4-2 8kV Contact Discharge[1], at 25 nsec. |
| Rated Voltage (maximum) | 12VDC | 24VDC | 24VDC | |
| Capacitance (typical) | 0.04 pF | 0.06 pF | 0.12 pF | Measured at 250 MHz |
| Response Time | <1nS | <1nS | <1nS | |
| Leakage Current (typical) | <1nA (12 VDC) | <1nA (6 VDC) | <1nA (6 VDC) | |
| ESD Pulse Withstand | 100 pulses min | 1000 pulses min | 1000 pulses min | Some shifting in characteristics may occur when tested over multiple pulses at a very rapid rate |

Notes: [1] Testing performed on Littelfuse Test Set up as described in typical test setup section.

## Part Numbering System

**PGB1 01 0603 MR**

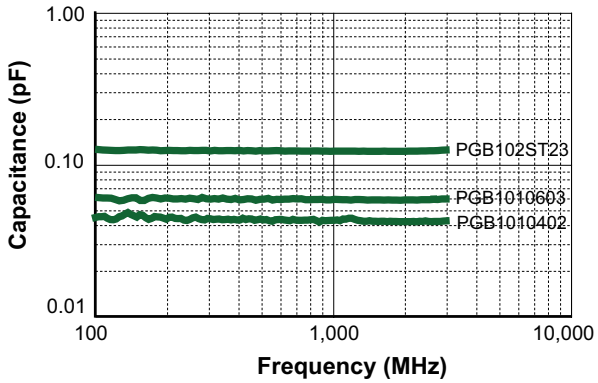
**LEAD-FREE PULSEGUARD® ESD SUPPRESSORS**

**LINES PROTECTED:**
01 = 1 line
02 = 2 lines
04 = 4 lines

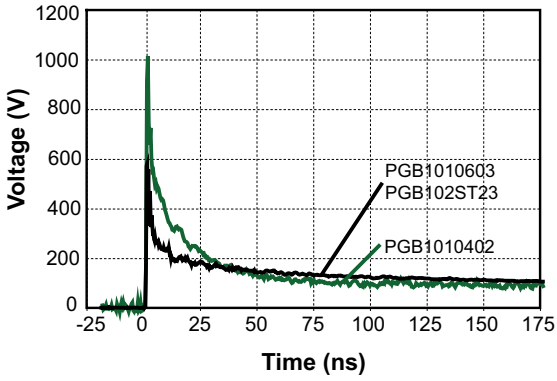
**DEVICE SIZE CODE:**
0402 = 0402 (1005)
0603 = 0603 (1608)
ST23 = SOT23

**QUANTITY & PACKAGING CODE:**
MR = 1000 pieces
WR = 3000 pieces
NR = 5000 pieces
KR = 10,000 pieces

## Typical Device Capacitance



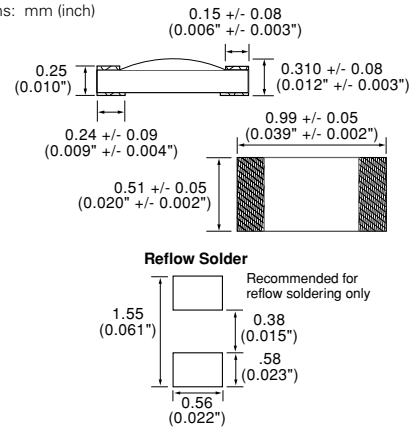

## Typical ESD Response




## Dimensions

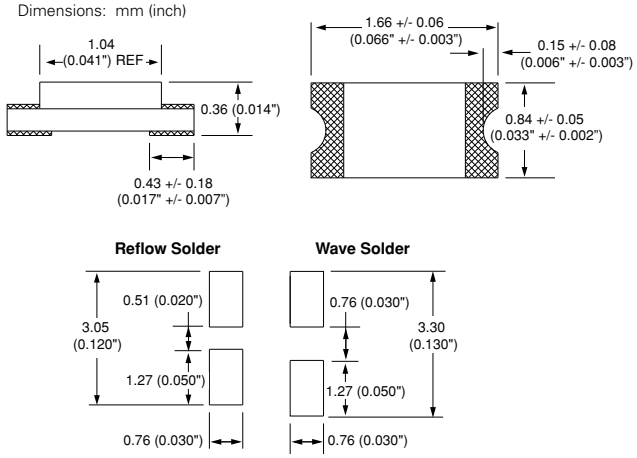
### 0402 Device

Dimensions: mm (inch)



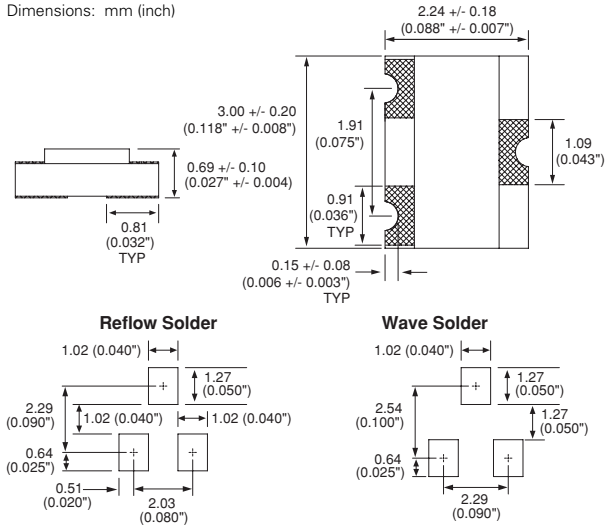

### 0603 Device

Dimensions: mm (inch)




### SOT23 Device

Dimensions: mm (inch)



## Physical Specifications

| | |
|---|---|
| **Materials** | Body: Glass Epoxy<br>Terminations: Copper/Nickel/Tin |
| **Solderability** | MIL-STD-202, Method 208 |
| **Soldering Parameters** | Wave solder - 260°C, 10 seconds maximum<br>Reflow solder - 260°C, 30 seconds maximum |

## Design Consideration

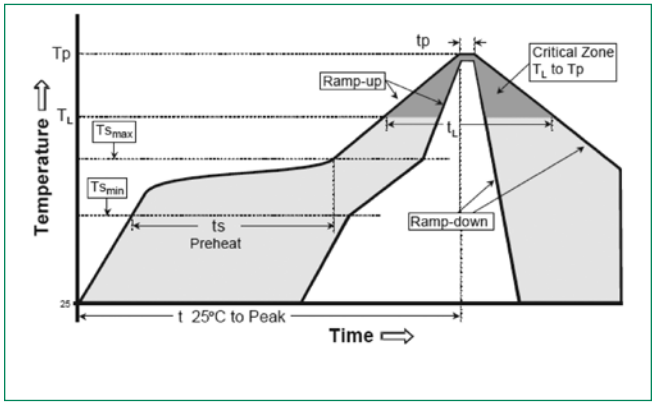
Because of the fast rise-time of the ESD transient, proper placement of PulseGuard suppressors are a key design consideration to achieving optimal ESD suppression. The devices should be placed on the circuit board as close to the source of the ESD transient as possible. Install PulseGuard suppressors (connected from signal/data line to ground) directly behind the connector so that they are the first board-level circuit component encountered by the ESD transient.

## Environmental Specifications

| | |
|---|---|
| **Operating Temperature** | -65°C to +125°C |
| **Moisture Resistance** | 0402 series:<br>40°C, 95% RH, 1000 hours<br>0603, ST23:<br>85°C, 85% RH, 1000 hours |
| **Thermal Shock** | MIL-STD-202, Method 107,<br>-65°C to 125°C, 30 min. cycle,<br>10 cycles |
| **Vibration** | MIL-STD-202, Method 201,<br>(10 to 55 to 10 Hz, 1 min.<br>cycle, 2 hrs each in X-Y-Z) |
| **Chemical Resistance** | MIL-STD-202, Method 215 |
| **Solder Leach Resistance and Terminal Adhesion** | IPC/EIA J-STD-002 |

## Soldering Parameters

| | | |
|---|---|---|
| Reflow Condition | | Pb – 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 seconds |
| 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 |
| | - Temperature ($t_L$) | 60 – 150 seconds |
| Peak Temperature ($T_P$) | | 260°C |
| Time within 5°C of actual peak Temperature ($t_p$) | | 10 – 30 seconds |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature ($T_P$) | | 8 minutes max |

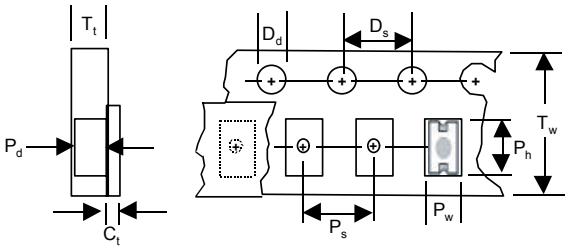



Based on IPC/JEDEC J-STD-020

## Packaging

| Part Number | Quantity & Packaging Code | Quantity | Packaging Option | Packaging Specification |
|---|---|---|---|---|
| PGB1010402 | KR | 10000 | Tape & Reel (7" reel) | EIA RS-481-1 (IEC 286, part 3) |
| PGB1010603 | MR | 1000 | Tape & Reel (7" reel) | EIA RS-481-1 (IEC 286, part 3) |
| PGB102ST23 | WR | 3000 | Tape & Reel (7" reel) | EIA RS-481-1 (IEC 286, part 3) |
| PGB1010603 | NR | 5000 | Tape & Reel (7" reel) | EIA RS-481-1 (IEC 286, part 3) |

## Tape and Reel Specifications




| Description | 0402 Series (mm) | 0603 Series (mm) | SOT23 Series (mm) |
|---|---|---|---|
| $C_t$ - Cover tape thickness | 0.05 | 0.05 | 0.06 |
| $D_d$ - Drive hole diameter | 1.50 | 1.50 | 1.50 |
| $D_s$ - Drive hole spacing | 4.00 | 4.00 | 4.00 |
| $P_d$ - Pocket depth | 0.41 | 0.58 | 1.02 |
| $P_h$ - Pocket height | 1.12 | 1.85 | 3.23 |
| $P_s$ - Pocket spacing | 2.00 | 4.00 | 4.00 |
| $P_w$ - Pocket width | 0.62 | 1.02 | 2.46 |
| $T_t$ - Carrier tape thickness | 0.61 | 0.65 | 1.77 |
| $T_w$ - Carrier tape width | 8.00 | 8.00 | 8.00 |

## Typical Test Setup