308 Constitution Drive
Menlo Park, CA USA
*www.circuitprotection.com*

# Multi-Channel
## Silicon ESD Protector
**Overvoltage Protection Device**

**PRODUCT: SESD0402Q2UG-0020-090**

DOCUMENT: SCD28188
REV LETTER: D
REV DATE: JUNE 18, 2012


# Specification Status: RELEASED

## BENEFITS

- Industry-leading lowest capacitance; provides lowest insertion loss for high speed data signals
- Industry's smallest footprint and lowest profile multi-channel ESD array helps to optimize board space
- Flow-through and single connection design helps routing PCB matched impedance high speed data lines
- Helps protect electronic circuits against damage from Electrostatic Discharge (ESD), surge and cable discharge events
- Assists equipment to pass IEC61000-4-2, level 4 testing

## FEATURES

- Low Capacitance: 0.20 pF(200fF) (typ)
- Low leakage current : 50nA @ 5V (typ)
- Low clamping voltage : +9.20 / -0.8V (typ) @ (tp=8x20µs, Ipp=2A)
- ESD maximum rating per IEC61000-4-2 standard:
  - 20kV contact discharge
  - 20kV air discharge
- Surge: 2A (max) @ (tp=8x20µs) per IEC61000-4-5
- Small size and low profile XDFN array package: 0.31mm height

## APPLICATIONS

- Consumer, mobile and portable electronics
- Tablet PC and external storage with high speed interfaces
- Ultra-high speed data lines
- USB 3.0/2.0, HDMI 1.3/1.4, DisplayPort, Thunderbolt (Light Peak), V-by-One HS, and LVDS interfaces
- Applications requiring high ESD performance in small DFN packages

## MATERIALS INFORMATION

**RoHS Compliant** Directive 2000/53/EC Compliant
**ELV Compliant** Directive 2002/95/EC Compliant
**Halogen Free * Lead Free**

* Halogen Free refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm
SESD devices meet MSL-1 Requirements
DFN case epoxy meets UL 94 V-0

## PART NUMBERING

SESD 0402 Q2UG - 0020 - 090

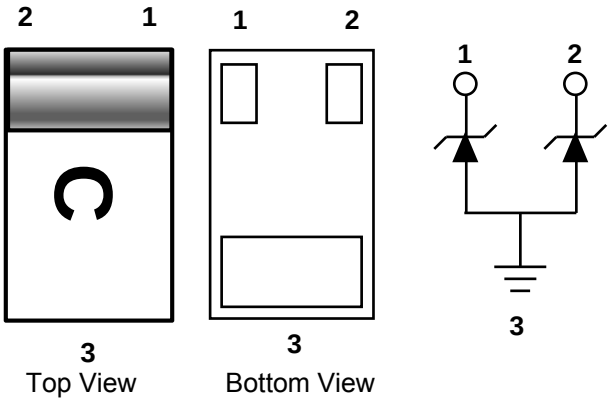
- SESD — Series
- 0402 — EIA Size
- Q2UG — Package Type: Q - Array; 2 - two channels; G - Common GND pin; U - Unidirectional
- 0020 — Input Capacitance: 0.20 pF (typ)
- 090 — Breakdown Voltage: 9.0V (typ)

## PART MARKING

C — Factory Code Marking
- Factory 1 : Blank
- Factory 2 : Single alphanumeric charcter

Cathode Band
- Unidirectional

## PIN CONFIGURATION AND SCHEMATIC



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## DEVICE MAXIMUM RATING

| ESD Withstand[1] (IEC 61000-4-2, level 4) | | Temperature | | Peak Current (tp=8x20µs) |
|---|---|---|---|---|
| Contact (kV) | Air (kV) | Operating (°C) | Storage (°C) | Ipp (A) |
| 20 | 20 | -55 to +125 | -55 to +150 | 2.0 |

[1] 20kV @ 1 pulse; 10kV @ 100 pulses; 8kV @ 1,000 pulses (under IEC6100-4-2)

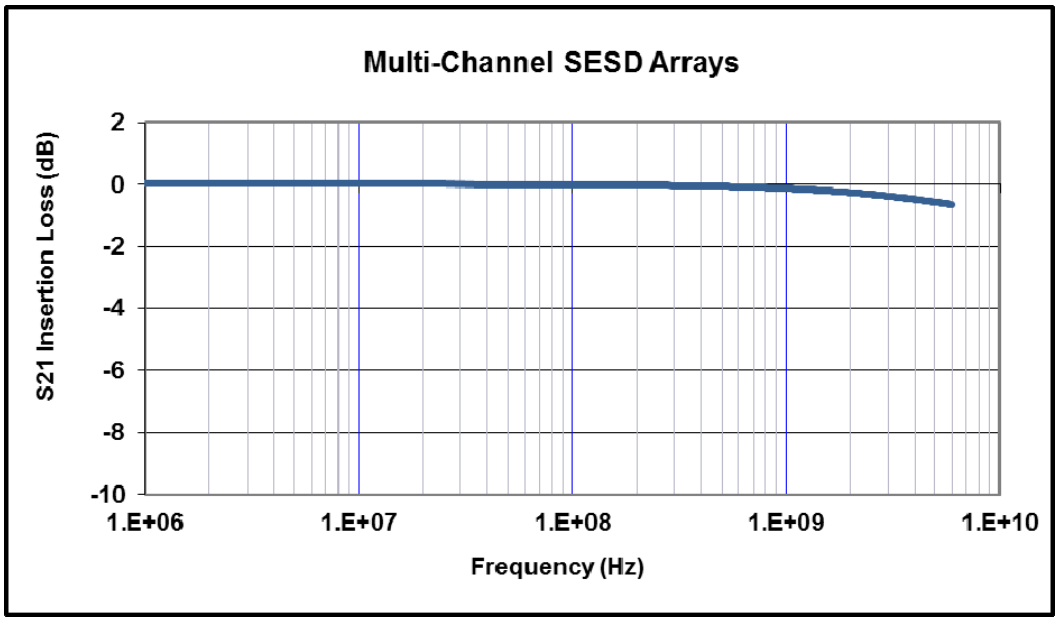
- Device maximum rating @ T = 25ºC, unless otherwise specified.
- Caution: Stress exceeding Device Maximum Ratings may damage the device. Prolonged exposure to stresses above the recommended operating conditions may affect device reliability.

## DEVICE ELECTRICAL CHARACTERISTICS

| Input Capacitance @ $V_R$ = 0V, f = 3GHz, I/O to GND (pF) | | Breakdown Voltage $V_{BR}$ @ $I_T$=1mA (V) | Reverse Working Voltage (V) | | Reverse Leakage Current $I_L$ @ $V_{RWM}$=5.0V (nA) | | Clamping Voltage $V_{CL}$ @ Ipp=2.0A (V) |
|---|---|---|---|---|---|---|---|
| Typ | Maximum | Typ | Min | Max | Typ | Max | Typ |
| 0.20 | 0.22 | +9.00 / -0.80 | 0 | +7.00 | 25.0 | 50.0 | +9.20 / -0.80 |

- All device electrical characteristics @ T = 25ºC, unless otherwise specified.

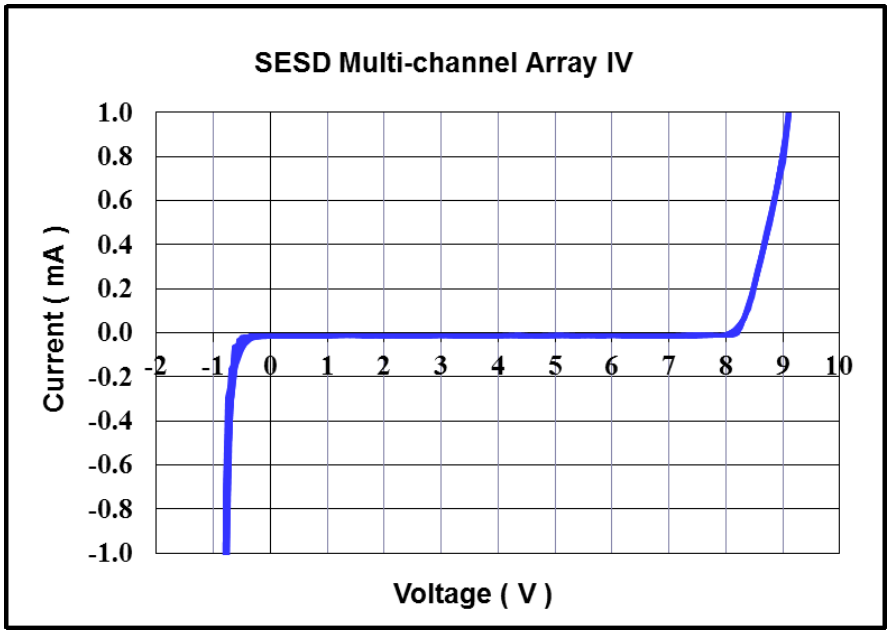
## FIGURE 1. INSERTION LOSS DIAGRAM



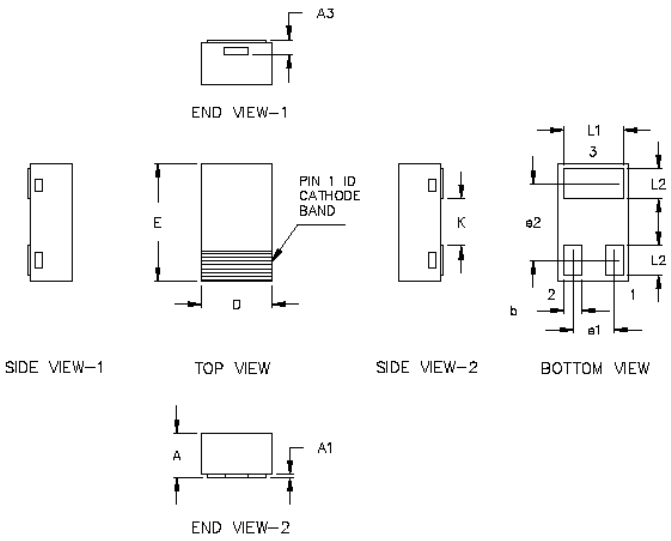

| Application | Bit Rate (Gbps) | @Freq (GHz) | Ins. Loss (dB) |
|---|---|---|---|
| HDMI 1.4 (1080P) | 2.25 | 1.13 | -0.15 |
| DisplayPort | 2.70 | 1.35 | -0.20 |
| HDMI 1.4 (4K / QuadHD)* | 3.40 | 1.70 | -0.23 |
| USB3.0 | 5.00 | 2.50 | -0.29 |
| eSATA | 6.00 | 3.00 | -0.35 |
| Thunderbolt | 10.0 | 5.00 | -0.50 |

*HDMI 4K / QuadHD resolutions (4096 x 2160) ready

## FIGURE 2. DEVICE IV CURVE




## DEVICE DIMENSIONS




| | SESD0402Q2UG-0020-090 | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters (mm) | | | Inches (in) | | |
| **Dim** | Min | Nom | Max | Min | Nom | Max |
| **A** | 0.33 | 0.38 | 0.43 | 0.0130 | 0.0150 | 0.0169 |
| **A1** | 0 | -- | 0.05 | 0 | -- | 0.0020 |
| **A3** | 0.13 ref. | | | 0.005 ref. | | |
| **D** | 0.55 | 0.60 | 0.65 | 0.022 | 0.024 | 0.026 |
| **E** | 0.95 | 1.00 | 1.05 | 0.037 | 0.039 | 0.041 |
| **K** | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| **L1** | 0.45 | 0.50 | 0.55 | 0.018 | 0.020 | 0.022 |
| **L2** | 0.20 | 0.25 | 0.30 | 0.008 | 0.010 | 0.012 |
| **b** | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| **e1** | 0.35 BSC | | | 0.014 BSC | | |
| **e2** | 0.65 BSC | | | 0.026 BSC | | |

BSC – Basic Spacing between Centers

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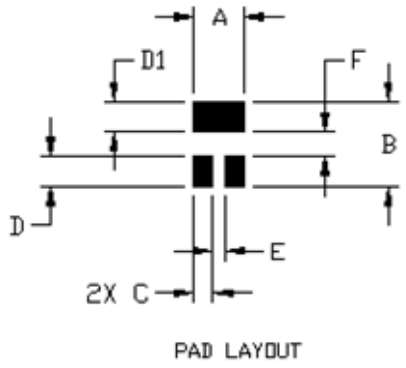
## RECOMMENDED LANDING PATTERN:

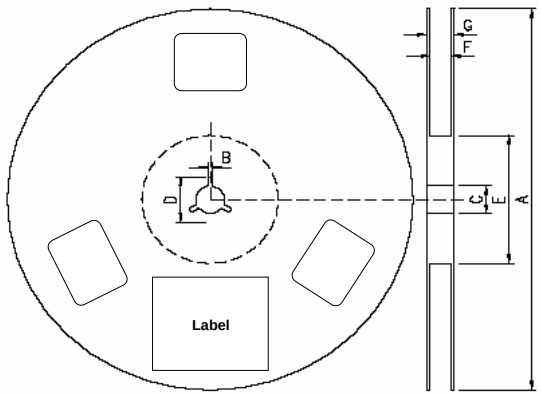



| SESD Landing Pad Layout 3 Pin 2-ch 0402 Size Array | | |
|---|---|---|
| **Symbol** | **Millimeters (mm)** | **Inches (in)** |
| **A** | 0.60 | 0.024 |
| **B** | 1.00 | 0.039 |
| **C** | 0.225 | 0.009 |
| **D** | 0.35 | 0.014 |
| **D1** | 0.35 | 0.014 |
| **E** | 0.15 | 0.006 |
| **F** | 0.30 | 0.012 |

## PACKAGING

| Packaging | Tape & Reel | Standard Box |
|---|---|---|
| SESD0402Q2UG-0020-090 | 10,000 | 50,000 |

## REEL DIMENSIONS




| Dimensions | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| **(mm)** | 180.0 ± 1.5 | 2.3. 0 ± 0.2 | 13.0 + 0.5 / -0.2 | 17.3 ± 0.2 | 60.5 ± 1.5 | 8.4 +1.5/-0.0 | 14.4 (max) |

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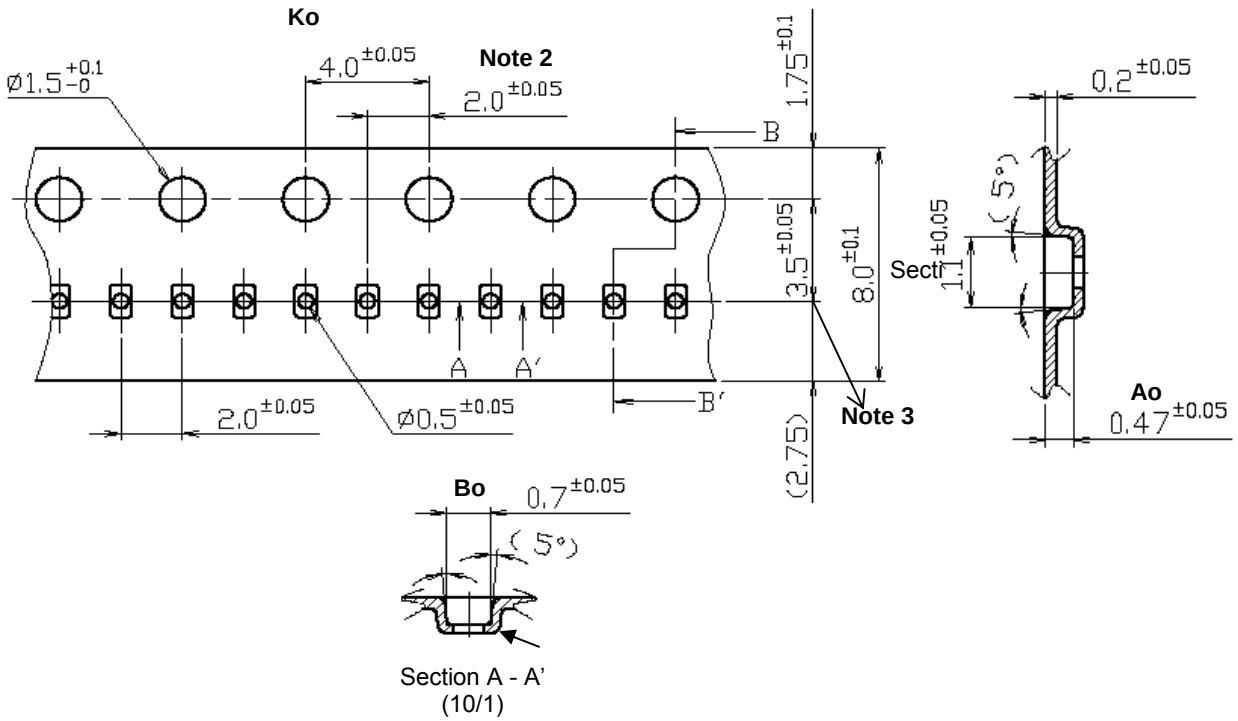
## CARRIER TAPE DIMENSIONS




Section A - A'
(10/1)

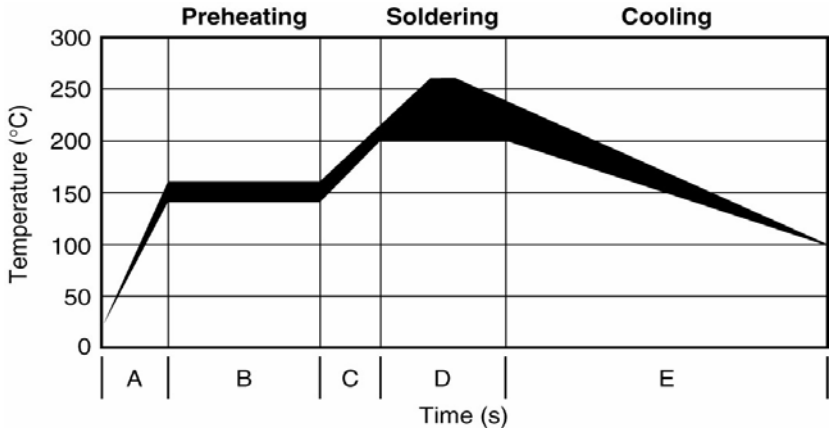
| | |
|---|---|
| Ao | 0.07 ± 0.05 |
| Bo | 1.10 ± 0.05 |
| Ko | 0.47 ± 0.05 |

Note 1. All dimensions in mm
Note 2. Cumulative tolerance is 200 ± 0.3 / 50MM pitch
Note 3. Center point of hole tolerance is 2.0 ± 0.5
Note 4. Center point of hole tolerance is 3.5 ± 0.5

## SOLDER REFLOW RECOMMENDATION

| | | | |
|---|---|---|---|
| A | Temperature ramp up 1 | From ambient to Preheating temperature | 30s to 60s |
| B | Preheating | 140°C - 160°C | 60s to 120s |
| C | Temperature ramp up 2 | From Preheating to Main heating temperature | 20s to 40s |
| D | Main heating | at 200°C<br>at 220°C<br>at 240°C<br>at 260°C | 60s ~ 70s<br>50s ~ 60s<br>30s ~ 40s<br>5s ~ 10s |
| E | Cooling | From main heating temperature to 100°C | 4°C/s (max) |

## FIGURE 4. REFLOW PROFILE

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