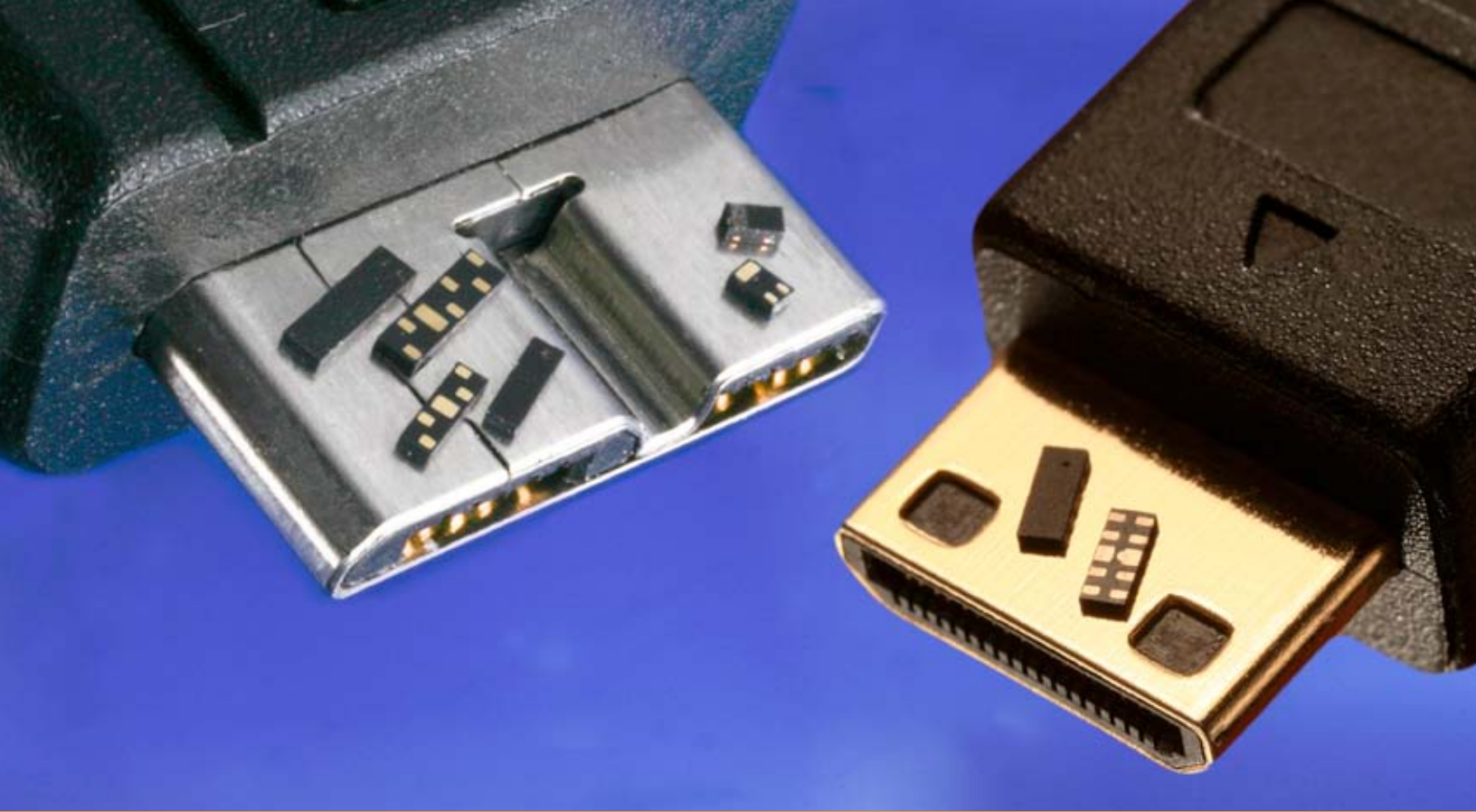




## Product Overview

### Multi-channel Silicon ESD Flow-Through Arrays

TE Connectivity's Silicon ESD arrays help to protect electronic circuits against damage from Electrostatic Discharge (ESD), surge and cable discharge events.





## KEY FEATURES

- Low Capacitance 0.20pF (typ, 200fF)
- Low leakage current – 50nA @ 5V (typ)
- Low clamping voltage – +9.20/-0.80V (typ) @ (tp=8x20μs, Ipp=2A)
- ESD – 20kV contact and air discharge per IEC61000-4-2
- Surge – 2A (tp=8x20μs) per IEC61000-4-5
- Small size and low profile XDFN Array packages – 0.31mm height

RoHS Complaint, Pb and Halogen Free (refers to: Br ≤ 900ppm, Cl ≤ 900ppm, Br+Cl ≤ 1500ppm)

The Silicon ESD (SESD) arrays help provide protection and improve reliability of electronics in applications including but not limited to consumer, portable and mobile electronics. The multi-channel SESD flow-through arrays have industry leading ultra-low capacitance of 0.20pF with low insertion loss which help protect high-speed data signals. The SESD arrays provide robust ESD protection with an industry-leading 20kV contact and air discharge rating per the IEC61000-4-2 standard. The ultra-low capacitance SESD arrays enable signal integrity for today's highest-speed interfaces including USB 3.0/2.0, HDMI, eSATA, DisplayPort, and Thunderbolt.

TE offers four- and six- channel miniature arrays which are up to 85% smaller than common multi-channel arrays to fit into space constrained applications. TE's ultra-small packages have lower parasitic impedance which reduces insertion loss at high frequencies compared to larger size packaged devices. The four- and six-channel arrays, with 0.31mm package height, have a 50% lower profile than other package options in the market. All of TE's SESD arrays are in flow-through design packages which allow for matched impedance PCB trace routing essential for high speed signal integrity.

## 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 interface, Thunderbolt interface (Light Peak), V-by-One HS, and LVDS interface
- Applications requiring high ESD performance in small DFN packages

## BENEFITS

- Industry-leading lowest capacitance; provides lowest insertion loss for high speed data signals
- Provides ESD protection up to 20kV contact and air discharge per IEC61000-4-2
- Industry's smallest footprint and lowest profile multi-channel ESD arrays 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), lightning and cable discharge events
- Assist equipment to pass IEC61000-4-2, level 4 testing

## DEVICE ELECTRICAL CHARACTERISTICS

### Device Maximum Ratings

| Multi-Channel Arrays         | IEC 61000-4-2, level 4<br>(ESD withstand) |          | Temperature    |              | Peak Current<br>(tp=8x20μs) |
|------------------------------|-------------------------------------------|----------|----------------|--------------|-----------------------------|
|                              | Contact (kV)                              | Air (kV) | Operating (°C) | Storage (°C) | Ipp (A)                     |
| SESD0402Q2UG-0020-090 (2-ch) | 20                                        | 20       | -55 to +125    | -55 to +150  | 2.0                         |
| SESD0802Q4UG-0020-090 (4-ch) |                                           |          |                |              |                             |
| SESD1004Q4UG-0020-090 (4-ch) |                                           |          |                |              |                             |
| SESD1103Q6UG-0020-090 (6-ch) |                                           |          |                |              |                             |

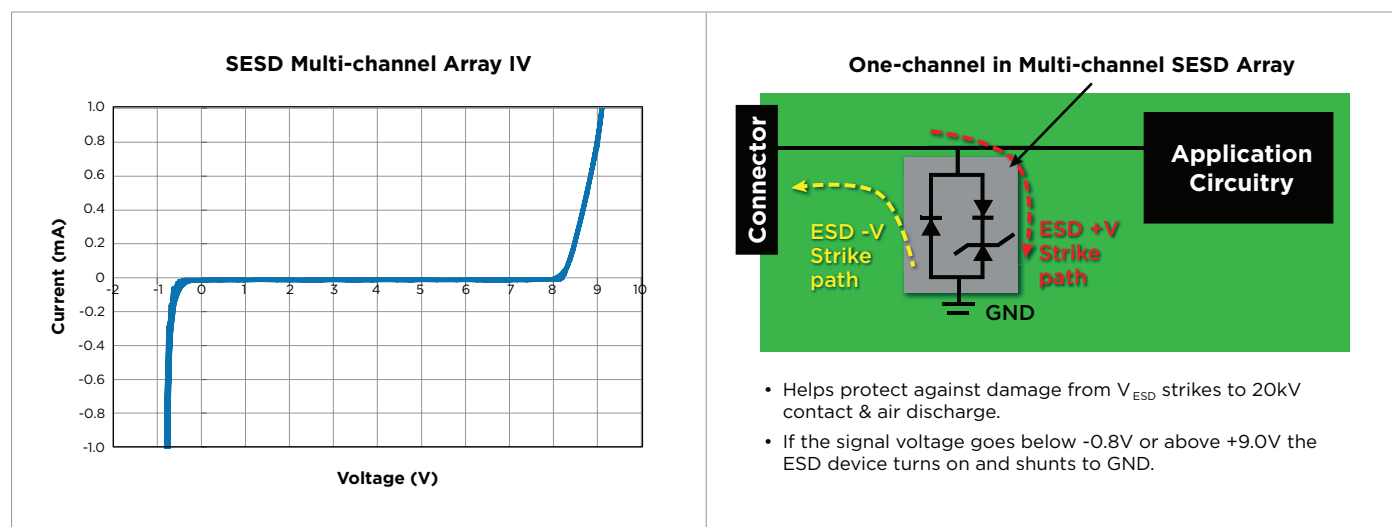
Caution: Stress exceeding Device Maximum Ratings may damage the device.  
Prolong exposure to stresses above the Recommended Operating Conditions may affect device reliability.

### Device Electrical Characteristics @ T = 25°C

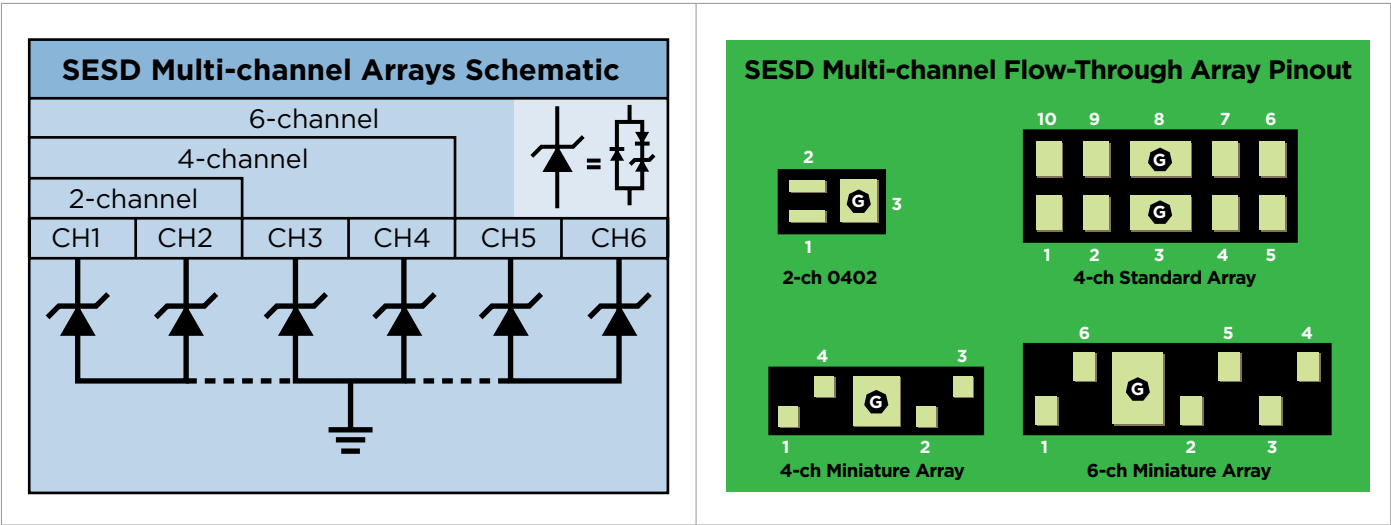
| Multi-Channel Arrays         | Input Capacitance <sup>(1)</sup> |              | Breakdown Voltage<br>(typ)                 | Reverse Leakage Current<br>(typ)              | Clamping Voltage<br>(typ)        |
|------------------------------|----------------------------------|--------------|--------------------------------------------|-----------------------------------------------|----------------------------------|
|                              | Typical (pF)                     | Maximun (pF) | V <sub>br</sub> @ I <sub>t</sub> = 1mA (V) | I <sub>L</sub> @ V <sub>RWM</sub> = 5.0V (nA) | V <sub>CL</sub> @ Ipp = 2.0A (V) |
| SESD0402Q2UG-0020-090 (2-ch) | 0.20                             | 0.22         | +9.00 / -0.80                              | 50.0                                          | +9.20 / -0.80                    |
| SESD0802Q4UG-0020-090 (4-ch) |                                  |              |                                            |                                               |                                  |
| SESD1004Q4UG-0020-090 (4-ch) |                                  |              |                                            |                                               |                                  |
| SESD1103Q6UG-0020-090 (6-ch) |                                  |              |                                            |                                               |                                  |

<sup>(1)</sup> @ Vr = 0V, f = 3GHz, I/O to GND

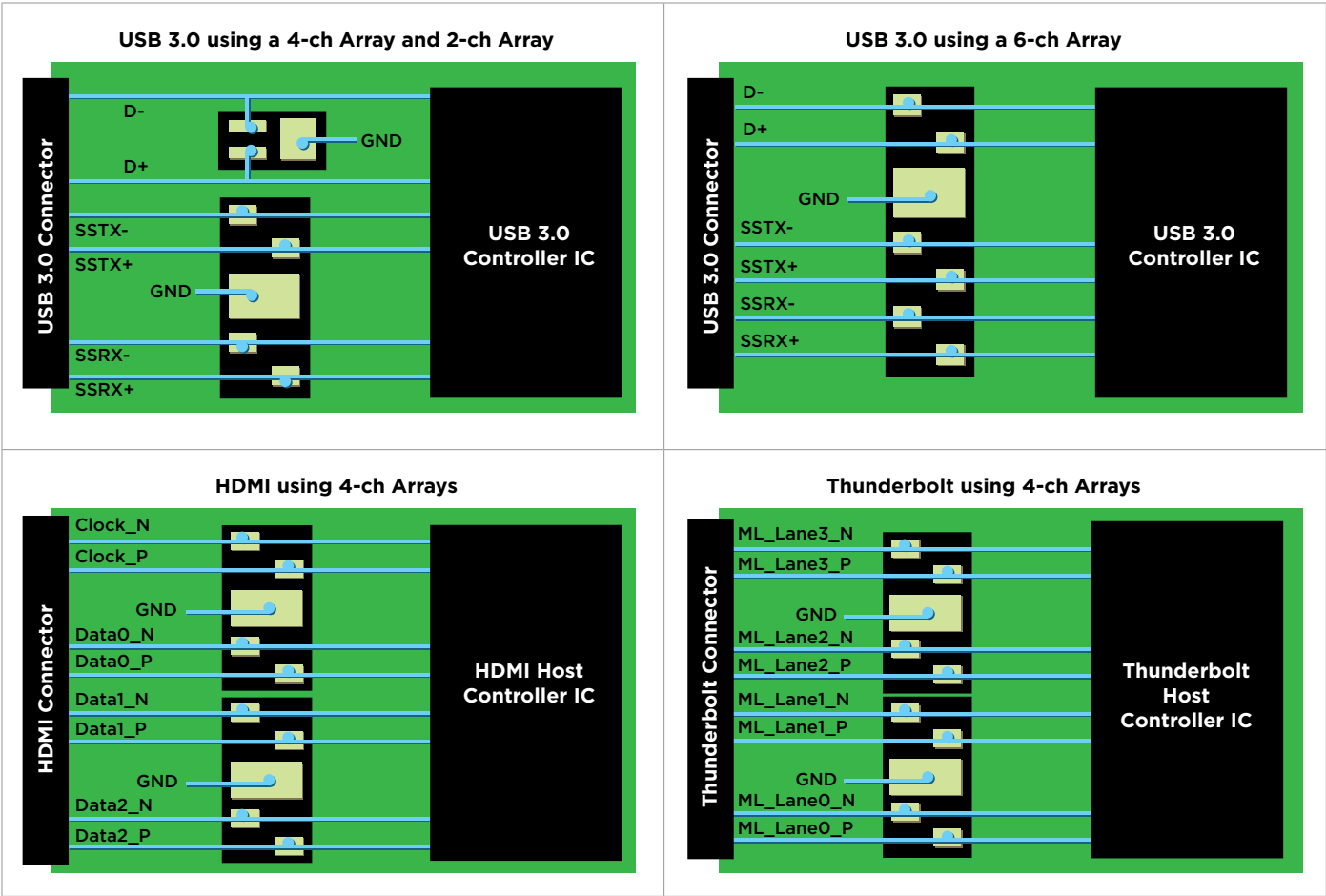
## DEVICE IV CHARACTERISTICS AND OPERATION



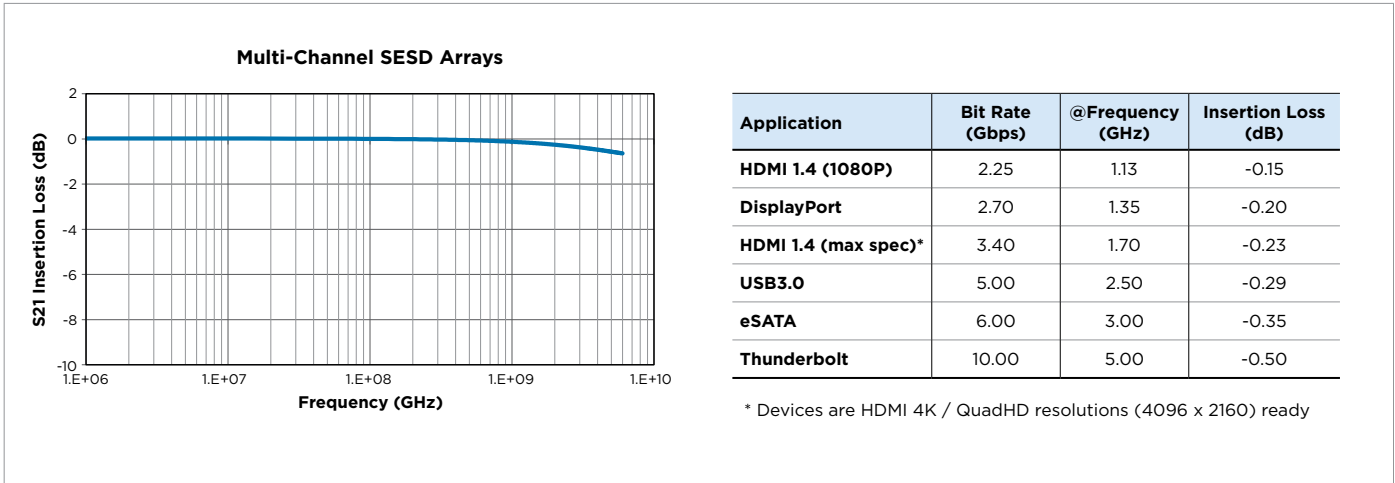
SESD MULTI-CHANNEL ARRAY SCHEMATIC AND PIN CONFIGURATION



RECOMMENDED APPLICATION CONFIGURATIONS



INSERTION LOSS DIAGRAMS



MATERIAL INFORMATION

RoHS Compliant

Directive 2000/53/EC  
Compliant

ELV Compliant

Directive 2002/95/EC  
Compliant

Halogen Free\*



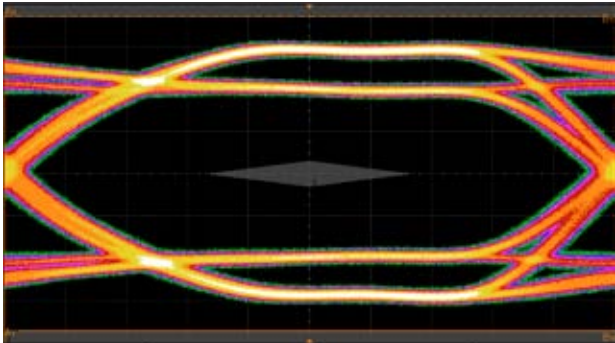
Pb-Free



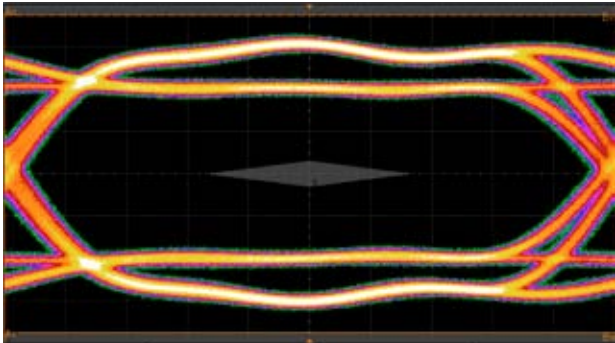
\* Halogen Free refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm.  
SESD devices meet MSL-1 Requirements  
DFN case epoxy meets UL 94 V-0

EYE DIAGRAMS

USB3.0 Eye Diagrams  
5.0Gb/s, 1000mV differential, CPO Compliant Test Pattern

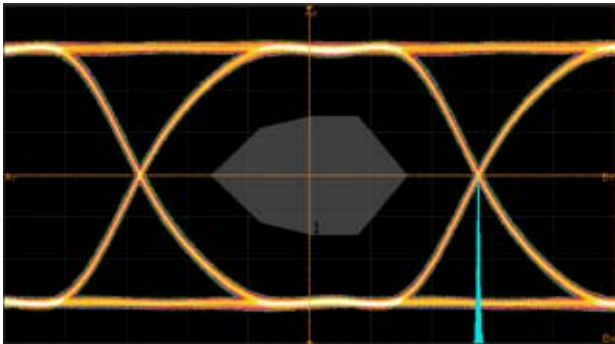


Without SESD Device

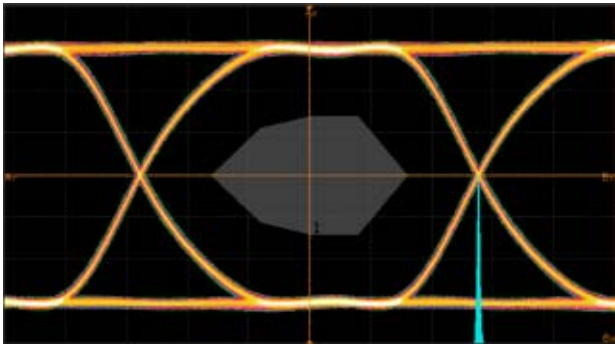


With SESD Device

DisplayPort Eye Diagrams  
2.7Gb/s, 800mV differential, PRBS7 Compliant Test Pattern, SSC enabled

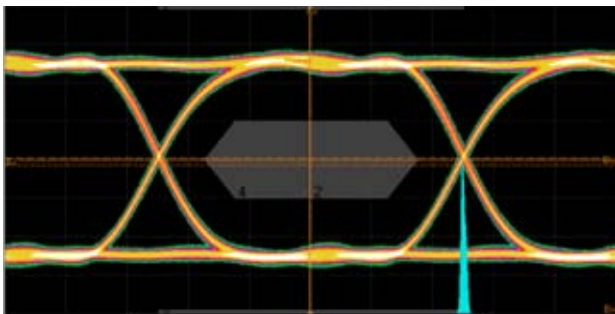


Without SESD Device

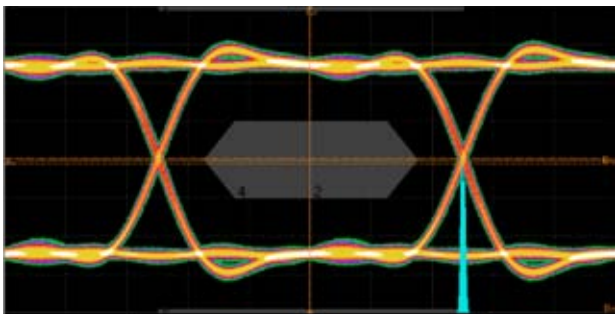


With SESD Device

HDMI Eye Diagrams  
3.4Gb/s, 990mV differential, TMDS Data



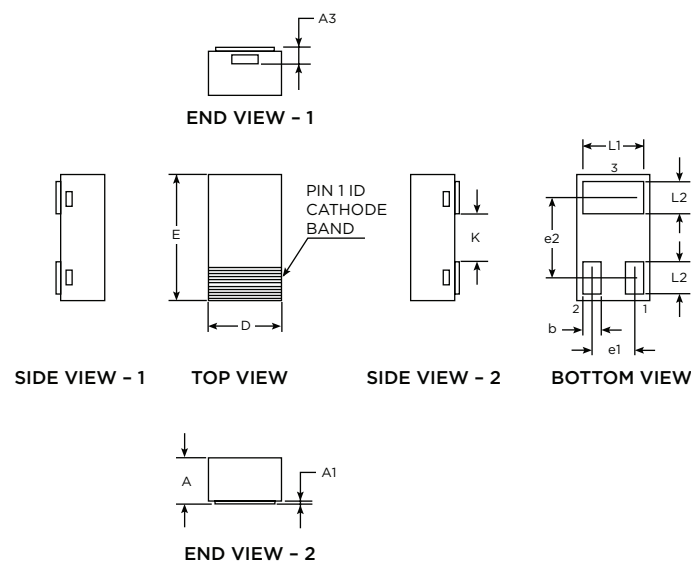
Without SESD Device



With SESD Device

DEVICE DIMENSION

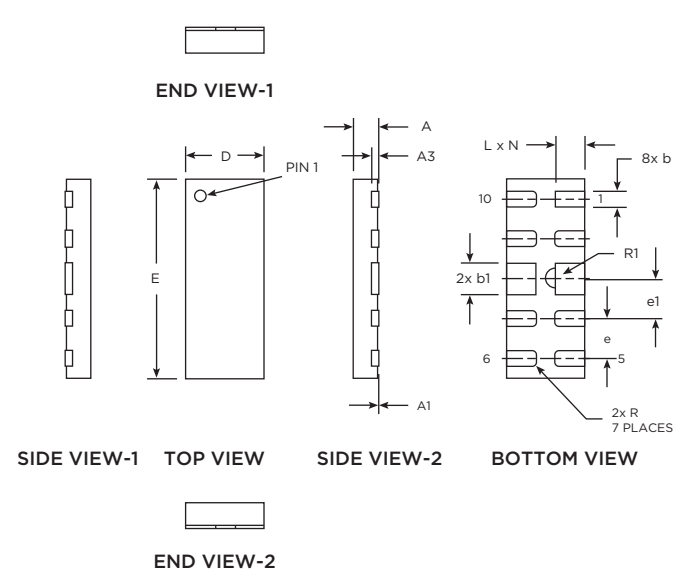
SESD0402Q2UG-0020-090: 2-ch 0402 Size Array



| Dim | SESD0402Q2UG-0020-090 |      |      |            |       |        |
|-----|-----------------------|------|------|------------|-------|--------|
|     | Millimeters           |      |      | Inches     |       |        |
|     | Min                   | Nom  | Max  | Min        | Nom   | Max    |
| A   | 0.33                  | 0.38 | 0.43 | 0.013      | 0.015 | 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

SESD1004Q4UG-0020-090: 4-ch Flow-Through Standard Array



| Dim | SESD1004Q4UG-0020-090 |      |       |            |        |        |
|-----|-----------------------|------|-------|------------|--------|--------|
|     | Millimeters           |      |       | Inches     |        |        |
|     | Min                   | Nom  | Max   | Min        | Nom    | Max    |
| A   | 0.30                  | 0.31 | 0.32  | 0.0118     | 0.0122 | 0.0126 |
| A1  | 0                     | -    | 0.05  | 0          | -      | 0.0020 |
| A3  | 0.10 ref.             |      |       | 0.004 ref. |        |        |
| D   | 0.90                  | 1.00 | 1.10  | 0.035      | 0.039  | 0.043  |
| E   | 2.40                  | 2.50 | 2.60  | 0.094      | 0.098  | 0.102  |
| b   | 0.15                  | 0.20 | 0.25  | 0.006      | 0.008  | 0.010  |
| b1  | 0.35                  | 0.40 | 0.45  | 0.014      | 0.016  | 0.018  |
| L   | 0.30                  | 0.38 | 0.425 | 0.012      | 0.015  | 0.017  |
| e   | 0.50 BSC              |      |       | 0.020 BSC  |        |        |
| e1  | 0.60 BSC              |      |       | 0.024 BSC  |        |        |
| N   | 10                    |      |       | 10         |        |        |
| R   | 0.075 BSC             |      |       | 0.003 BSC  |        |        |
| R1  | 0.125 BSC             |      |       | 0.005 BSC  |        |        |

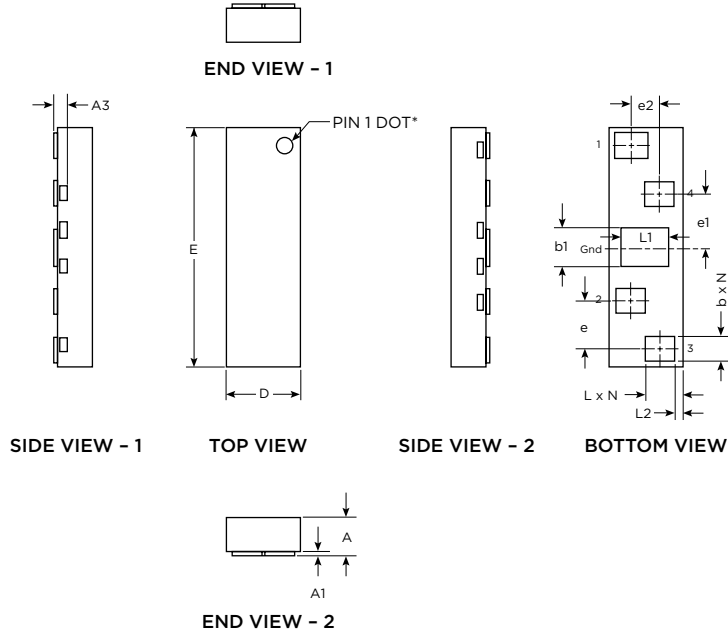
BSC - Basic Spacing between Centers

\* Pin 1 dot is laser marked. Radius and location within the pin 1 terminal.

## DEVICE DIMENSION

## CONT'D

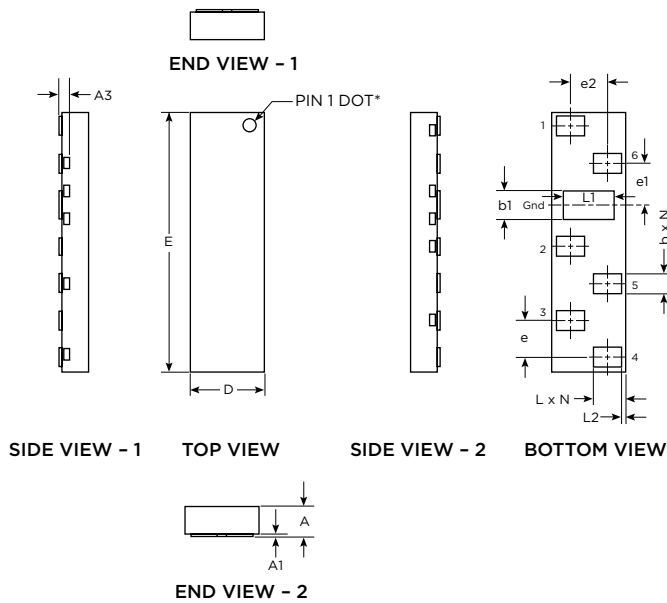
## SESD0802Q4UG-0020-090: 4-ch Flow-Through Miniature Array



| Dim | SESD0802Q4UG-0020-090 |      |      |            |        |        |
|-----|-----------------------|------|------|------------|--------|--------|
|     | Millimeters           |      |      | Inches     |        |        |
|     | Min                   | Nom  | Max  | Min        | Nom    | Max    |
| A   | 0.30                  | 0.31 | 0.32 | 0.0118     | 0.0122 | 0.0126 |
| A1  | 0                     | -    | 0.05 | 0          | -      | 0.0020 |
| A3  | 0.10 ref.             |      |      | 0.004 ref. |        |        |
| D   | 0.50                  | 0.60 | 0.70 | 0.020      | 0.024  | 0.028  |
| E   | 1.90                  | 2.00 | 2.10 | 0.075      | 0.079  | 0.083  |
| b   | 0.15                  | 0.20 | 0.25 | 0.006      | 0.008  | 0.010  |
| b1  | 0.25                  | 0.30 | 0.36 | 0.010      | 0.012  | 0.014  |
| L   | 0.25                  | 0.30 | 0.35 | 0.010      | 0.012  | 0.014  |
| L1  | 0.35                  | 0.40 | 0.45 | 0.014      | 0.016  | 0.018  |
| L2  | 0.05 BSC              |      |      | 0.002 BSC  |        |        |
| e   | 0.40 BSC              |      |      | 0.016 BSC  |        |        |
| e1  | 0.45 BSC              |      |      | 0.018 BSC  |        |        |
| e2  | 0.25 BSC              |      |      | 0.010 BSC  |        |        |
| N   | 4                     |      |      | 4          |        |        |

BSC - Basic Spacing between Centers

## SESD1103Q6UG-0020-090: 6-ch Flow-Through Miniature Array



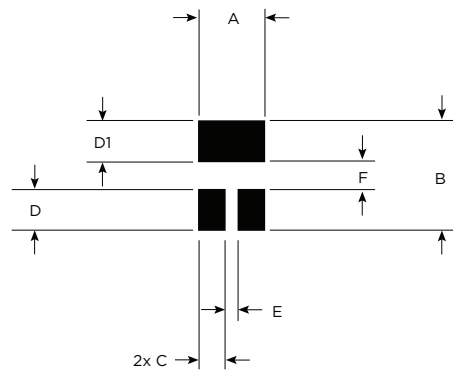
| Dim | SESD1103Q6UG-0020-090 |      |      |            |        |        |
|-----|-----------------------|------|------|------------|--------|--------|
|     | Millimeters           |      |      | Inches     |        |        |
|     | Min                   | Nom  | Max  | Min        | Nom    | Max    |
| A   | 0.30                  | 0.31 | 0.32 | 0.0118     | 0.0122 | 0.0126 |
| A1  | 0                     | -    | 0.05 | 0          | -      | 0.0020 |
| A3  | 0.10 ref.             |      |      | 0.004 ref. |        |        |
| D   | 0.70                  | 0.80 | 0.90 | 0.027      | 0.031  | 0.035  |
| E   | 2.70                  | 2.80 | 2.90 | 0.106      | 0.110  | 0.114  |
| b   | 0.15                  | 0.20 | 0.25 | 0.006      | 0.008  | 0.010  |
| b1  | 0.25                  | 0.30 | 0.35 | 0.010      | 0.012  | 0.014  |
| L   | 0.30                  | 0.35 | 0.40 | 0.012      | 0.014  | 0.016  |
| L1  | 0.50                  | 0.55 | 0.60 | 0.019      | 0.021  | 0.023  |
| L2  | 0.05 BSC              |      |      | 0.002 BSC  |        |        |
| e   | 0.40 BSC              |      |      | 0.016 BSC  |        |        |
| e1  | 0.45 BSC              |      |      | 0.018 BSC  |        |        |
| e2  | 0.40 BSC              |      |      | 0.016 BSC  |        |        |
| N   | 6                     |      |      | 6          |        |        |

BSC - Basic Spacing between Centers

\* Pin 1 dot is laser marked. Radius and location within the pin 1 terminal.

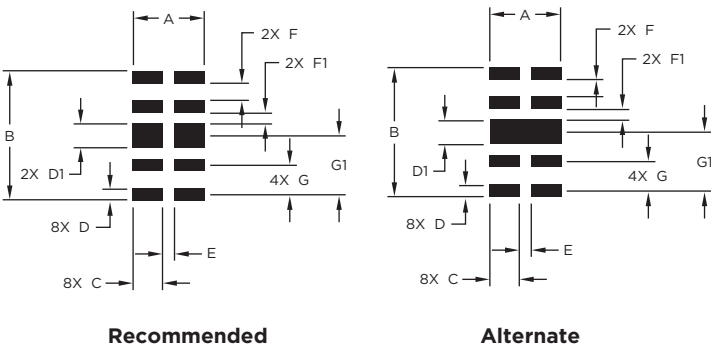
RECOMMENDED LANDING PAD LAYOUT

SESD0402Q2UG-0020-090: 2-ch 0402 Size Array



| SESD Landing Pad Layout<br>3 Pin 2-ch 0402 Size Array |             |        |
|-------------------------------------------------------|-------------|--------|
| Symbol                                                | Millimeters | Inches |
| 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  |

SESD1004Q4UG-0020-090: 4-ch Flow-Through Standard Array



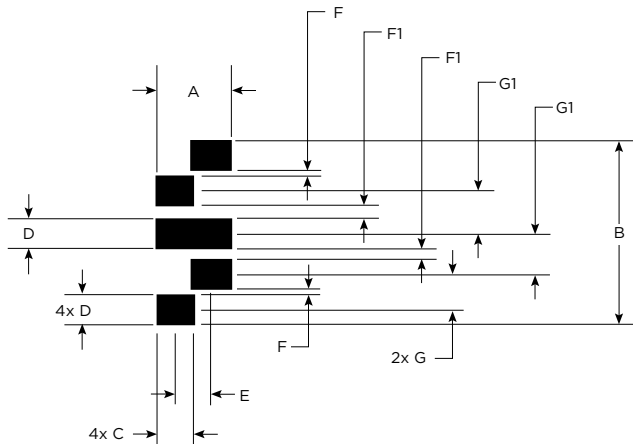
| SESD Landing Pad Layout<br>10 Pin 4-ch Standard FT Array |             |           |
|----------------------------------------------------------|-------------|-----------|
| Symbol                                                   | Millimeters | Inches    |
| A                                                        | 1.20        | 0.047     |
| B                                                        | 2.20        | 0.087     |
| C                                                        | 0.50        | 0.020     |
| D                                                        | 0.20        | 0.008     |
| D1                                                       | 0.40        | 0.016     |
| E                                                        | 0.20        | 0.008     |
| F                                                        | 0.30        | 0.012     |
| F1                                                       | 0.20        | 0.008     |
| G                                                        | 0.50 BSC    | 0.020 BSC |
| G1                                                       | 1.00 BSC    | 0.039 BSC |

BSC - Basic Spacing between Centers

RECOMMENDED LANDING PAD LAYOUT

CONT'D

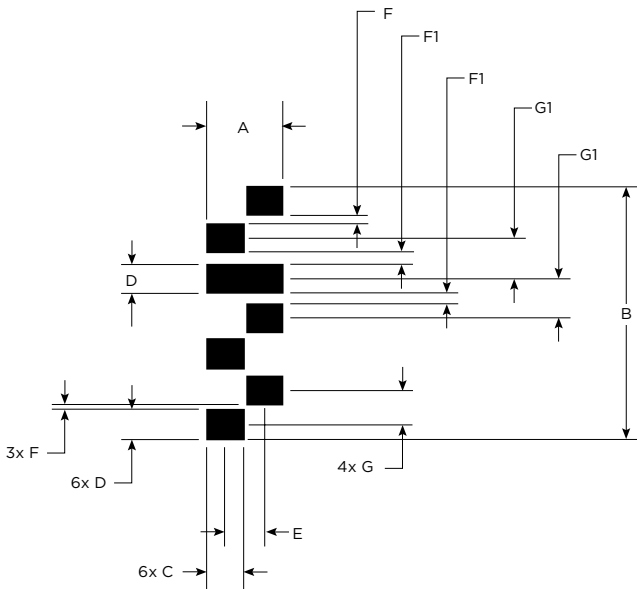
SESD0802Q4UG-0020-090: 4-ch Flow-Through Miniature Array



| SESD Landing Pad Layout<br>5 Pin 4-ch Miniature FT Array |             |           |
|----------------------------------------------------------|-------------|-----------|
| Symbol                                                   | Millimeters | Inches    |
| A                                                        | 0.60        | 0.024     |
| B                                                        | 2.00        | 0.079     |
| C                                                        | 0.30        | 0.012     |
| D                                                        | 0.30        | 0.012     |
| E                                                        | 0.30        | 0.012     |
| F                                                        | 0.10        | 0.004     |
| F1                                                       | 0.15        | 0.006     |
| G                                                        | 0.40 BSC    | 0.016 BSC |
| G1                                                       | 0.45 BSC    | 0.018 BSC |

BSC - Basic Spacing between Centers

SESD1103Q6UG-0020-090: 6-ch Flow-Through Miniature Array



| SESD Landing Pad Layout<br>7 Pin 6-ch Miniature FT Array |             |           |
|----------------------------------------------------------|-------------|-----------|
| Symbol                                                   | Millimeters | Inches    |
| A                                                        | 0.80        | 0.031     |
| B                                                        | 2.80        | 0.110     |
| C                                                        | 0.35        | 0.014     |
| D                                                        | 0.30        | 0.012     |
| E                                                        | 0.45        | 0.018     |
| F                                                        | 0.10        | 0.004     |
| F1                                                       | 0.15        | 0.006     |
| G                                                        | 0.40 BSC    | 0.016 BSC |
| G1                                                       | 0.40 BSC    | 0.016 BSC |

BSC - Basic Spacing between Centers

## FOR MORE INFORMATION

### TE Circuit Protection

308 Constitution Drive  
Menlo Park, CA USA 94025-1164  
Tel : (800) 227-7040, (650) 361-6900  
Fax : (650) 361-4600

[www.circuitprotection.com](http://www.circuitprotection.com)  
[www.circuitprotection.com.hk](http://www.circuitprotection.com.hk) (Chinese)  
[www.te.com/japan/bu/circuitprotection/](http://www.te.com/japan/bu/circuitprotection/) (Japanese)

#### Brazil

Tel : 55-11-2103-6090  
Fax: 55-11-2103-6216

#### UK / Eire / Benelux / Israel

**South Africa / Nordic / Baltic / Others**  
Tel : 49-89-6089485  
Fax: 49-89-6089394

#### Germany / Austria / Switzerland / Eastern Europe / Russia

Tel : 49-89-6089584  
Fax: 49-89-6089394

#### France / Italy / Iberia / Greece / Turkey

Tel : 33-1-34208455  
Fax: 33-1-34208479

#### Japan

Tel : 81-44-900-5110  
Fax: 81-44-900-5140

#### Korea

Tel : 82-2-3415-4654  
Fax: 82-2-3486-1786

#### Taiwan

Tel : 886-2-8768-2788 x 211  
Fax: 886-2-8768-1277

#### China, Hong Kong

Tel : 852-2738-8181  
Fax: 852-2735-1185

#### China, Beijing

Tel : 86-10-6569-3488 x 16526  
Fax: 86-10-6569-3206

#### China, Shanghai

Tel : 86-21-6106-7379  
Fax: 86-21-6485-3255

#### China, Shenzhen / Guangzhou

Tel : 86-755-2515-4797  
Fax: 86-755-2598-0419

#### Singapore / Indonesia

Tel : 65-6590-5089  
Fax: 65-6481-9377

#### Thailand / Malaysia / Vietnam

Tel : 6-04-217-8112  
Fax: 6-04-229-8177

#### Australia / Philippines

Tel : 63-2-988-9465  
Fax: 63-2-848-0205

#### India

Tel : 91-80-4161-3745  
Mobile : 91-99-0248-8886

Part numbers in this brochure are RoHS Compliant\*, unless marked otherwise.  
\*as defined [www.te.com/leadfree](http://www.te.com/leadfree)

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RCP0107E 02/2012

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