



# Silicon ESD Protection Devices



Silicon ESD (SESD) devices help protect electronic circuits against damage from electrostatic discharge (ESD) events. The 0201-sized SESD device's miniature footprint - measuring 0.6mm x 0.3mm x 0.3mm - is approximately 70 percent smaller than prior-generation devices, offering designers flexibility in space-constrained applications.

The SESD0201C-006-058 device is a bi-directional and ultra-low capacitance 0.6 picofarad (pF) device that is suitable for helping to protect very-high-speed data lines, such as USB and HDMI, or low-voltage antenna ports. The device's ultra-low capacitance, low insertion loss (<0.5dB up to 3GHz), and high linearity of capacitance versus frequency helps minimize signal degradation.

The SESD0201C-120-058 device is a higher-capacitance (12pF) bi-directional device that can be used for low-speed generic interfaces such as keypads, power buttons, speakers, and microphone ports in portable electronics. Both SESD0201C-006-058 and SESD0201C-120-058 devices offer 8kV contact and 15kV air discharge protection per the IEC61000-4-2, level 4 standard.

Also included in the product line is the SESD0402S-005-054 device, an ultra-low-capacitance SOD-923 (0402-size package) uni-directional device with 0.5pF typical capacitance. This device offers a 10kV contact discharge rating per IEC61000-4-2, level 4 and can be used with digital applications such as USB and HDMI.



## Benefits

- Small size SESD protection diodes for high speed signals
- ESD protection in space-constrained portable electronics and mobile handsets
- Helps protect electronic circuits against damage from ESD
- Assist equipment to pass IEC61000-4-2, level 4 testing

## Features

- RoHS compliant
- Halogen free (refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm)
- Low-leakage current - 1.0μA (max)
- Low-breakdown voltage < 5.8V
- Capable of withstanding numerous ESD strikes
- Low capacitance and insertion loss
- SOD-923 case epoxy material meets UL 94 V-0
- SESD0402S devices meet MSL-1 requirements

## Applications

- Mobile phones and portable electronics
- High-speed data lines (low capacitance 0201 and 0402)
- Low-voltage antenna ports (bi-directional 0201)
- USB 2.0/3.0, HDMI 1.3/1.4, and DisplayPort
- Applications requiring high ESD performance in a small package

**Table SE1 Maximum Ratings for SESD Devices**

Part Number	IEC61000-4-2, level 4 (ESD Withstand)		Temperature		Total Power Dissipation on FR-4 board* (mW)
	Contact (kV)	Air (kV)	Operating (°C)	Storage (°C)	
SESD0201C-006-058	±8	±15	-40 to +125	-40 to +125	150
SESD0201C-120-058	±8	±15	-40 to +125	-40 to +125	250
SESD0402S-005-054	±10	±15	-55 to +125	-55 to +150	250

\*FR-4 board = 30mm x 30mm x 2mm

**Table SE2 Electrical Characteristics @T=25°C for SESD Devices**

Part Number	Input Capacitance*		Leakage Current (max) $I_L$ @ $V_{WRV} = 5.0V$ (µA)	Breakdown Voltage (min) $V_{br}$ @ $I_T^{**} = 1mA$ (V)	Working Reverse Voltage $V_{WRV}$ @ peak (V)
	Typical (pF)	Maximum (pF)			
SESD0201C-006-058	0.6 <sup>†</sup>	0.9	1.0	±5.8	5.0
SESD0201C-120-058	12.0	13.5	1.0	±5.8	5.0
SESD0402S-005-054	0.5 <sup>‡</sup>	0.9	1.0	+5.4 / -1.0	5.0

\* @ Vr=0V, f=1MHz

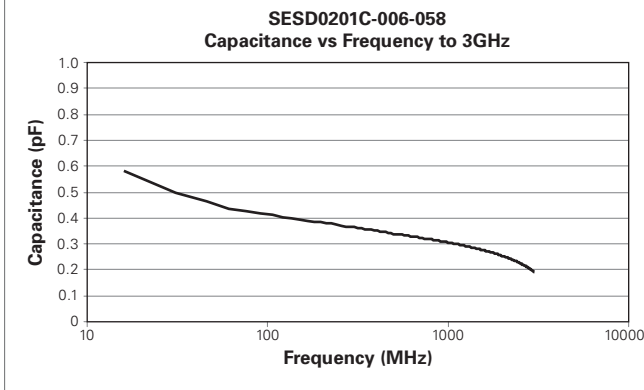
† 0.19pF@f=3GHz

‡ 0.17pF@f=3GHz

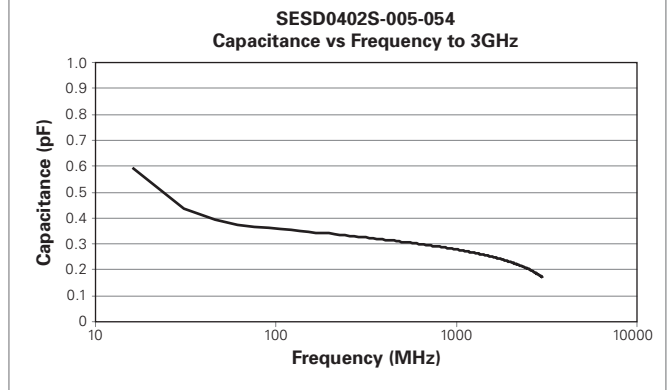
\*\*  $V_{br}$  is measured at test current  $I_T$

**Figure SE1-SE2 Capacitance vs Frequency for SESD Devices**

**Figure SE1**

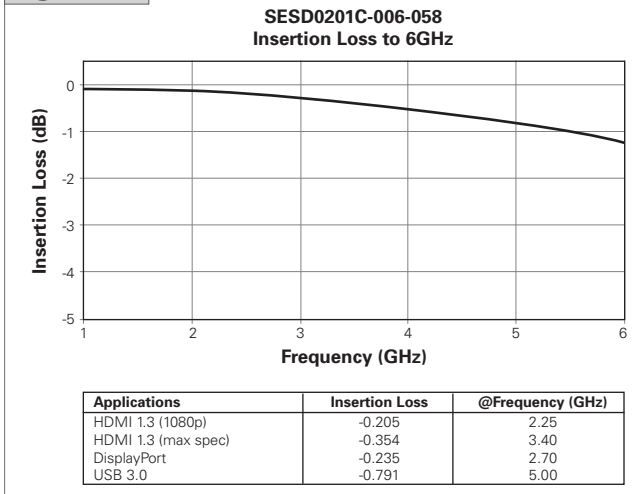


**Figure SE2**

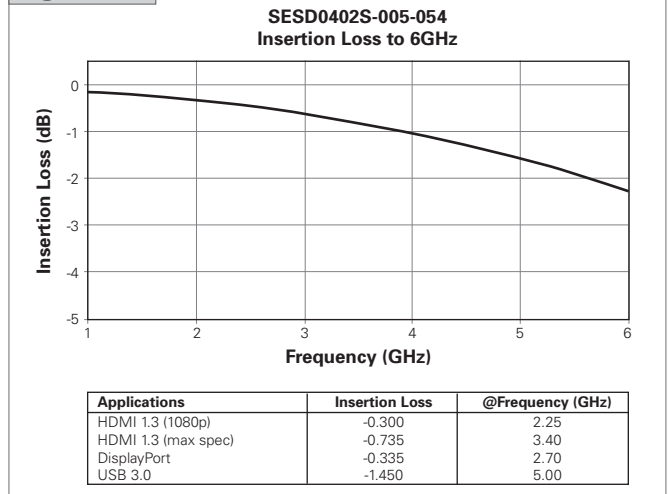


**Figure SE3-SE4 Insertion Loss Diagram for SESD Devices**

**Figure SE3**



**Figure SE4**

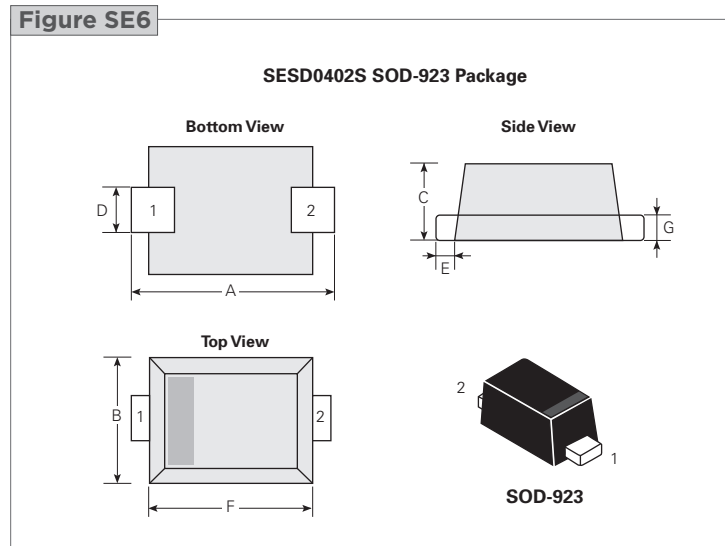
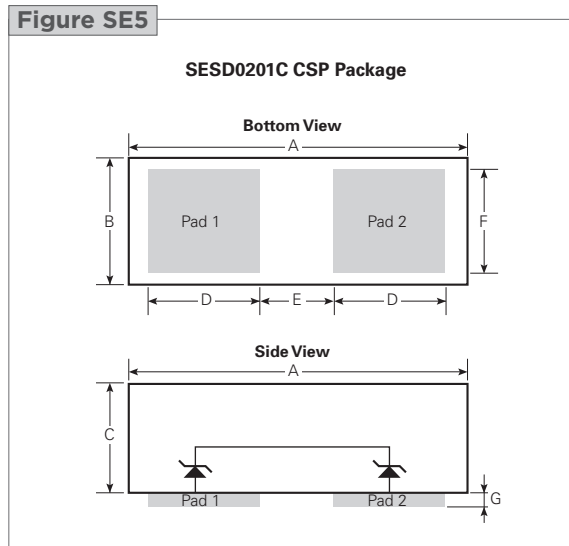


**Table SE3 Dimensions for SESD Devices in Millimeters (Mils)\***

Part Number	A	B	C	D	E	F	G	Figure
SESD0201C	0.60 ± 0.03 (23.62 ± 1.20)	0.30 ± 0.03 (11.81 ± 1.20)	0.27 ± 0.03 (10.63 ± 1.20)	0.15 ± 0.03 (5.91 ± 1.20)	0.25 ± 0.03 (9.84 ± 1.20)	0.25 ± 0.03 (9.84 ± 1.20)	0.005 (max) (0.197) (max)	SE5
SESD0402S	1.00 ± 0.05 39.37 ± 0.40	0.60 ± 0.05 23.62 ± 0.40	0.37 ± 0.03 14.57 ± 1.20	0.20 ± 0.05 7.87 ± 2.00	0.10 ± 0.05 3.94 ± 2.00	0.80 ± 0.05 31.50 ± 2.00	0.12 ± 0.05 4.72 ± 2.00	SE6

\* Round off approximation

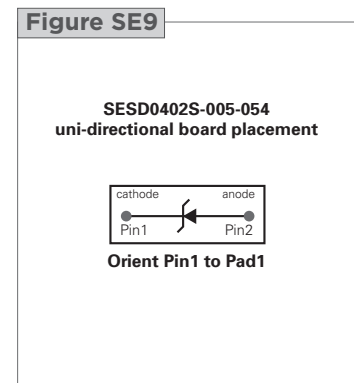
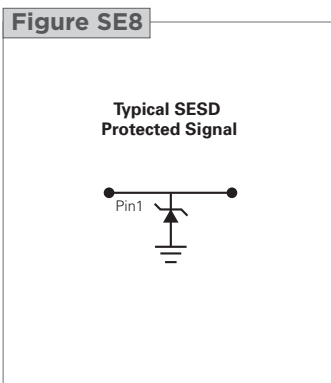
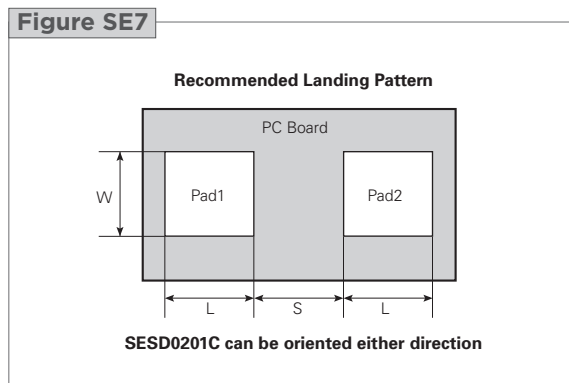
**Figure SE5-SE6 Dimension Figures for SESD Devices**



**Table SE4 PCB Pad Layout for SESD Devices in Millimeters (Mils)\***

Part Number	L	S	W	Figure
SESD0201C	0.28 ± 0.01 (11.0 ± 0.40)	0.19 ± 0.01 (7.50 ± 0.40)	0.30 ± 0.01 (11.80 ± 0.40)	SE7
SESD0402S	0.30 ± 0.01 (11.80 ± 0.40)	0.60 ± 0.01 (23.60 ± 0.40)	0.40 ± 0.01 (15.70 ± 0.40)	SE7

\* Round off approximation



**Table SE5 Tape and Reel Specifications for SESD Devices**

Tape Dimension EIA Mark	SESD0201C-006-058 Dimension (mm)	SESD0201C-120-058 Dimension (mm)	SESD0402S-005-054 Dimension (mm)
A <sub>0</sub>	0.37 ± 0.03	0.37 ± 0.03	0.66 ± 0.05
B <sub>0</sub>	0.67 ± 0.03	0.67 ± 0.03	1.06 ± 0.05
D <sub>0</sub>	1.60 (max)	1.60 (max)	1.60 (max)
D <sub>1</sub>	1.00 (min)	1.00 (min)	1.00 (min)
E <sub>1</sub>	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10
E <sub>2</sub>	5.85 (min)	5.85 (min)	5.85 (min)
F	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05
P <sub>0</sub>	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10
P <sub>1</sub>	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05
P <sub>2</sub>	2.00 ± 0.10	2.00 ± 0.10	2.00 ± 0.10
W	8.00 ± 0.30	8.00 ± 0.30	8.00 ± 0.30

Tape Thickness EIA Mark	Dimension (mm)	Dimension (mm)	Dimension (mm)
B <sub>1</sub>	0.67 ± 0.03	0.67 ± 0.03	1.06 ± 0.05
K <sub>0</sub>	0.35 ± 0.03	0.35 ± 0.03	0.48 ± 0.05
T	0.60 (max)	0.60 (max)	0.60 (max)
T <sub>1</sub>	0.10 (min)	0.10 (min)	0.10 (min)
T <sub>2</sub>	1.05 ± 0.03	1.05 ± 0.03	1.05 ± 0.03

Reel Dimension EIA Mark	Dimension (mm)	Dimension (mm)	Dimension (mm)
A	178 (max)	178 (max)	178 (max)
B	1.60 (min)	1.60 (min)	1.60 (min)
C	13.0 ± 0.2	13.0 ± 0.2	13.0 ± 0.2
D	20.2 (min)	20.2 (min)	20.2 (min)
N	50.0 (min)	50.0 (min)	50.0 (min)
W <sub>1</sub>	9.15 ± 0.75	9.15 ± 0.75	9.15 ± 0.75
W <sub>2</sub>	14.4 (max)	14.4 (max)	14.4 (max)
W <sub>3</sub>	10.9 (max)	10.9 (max)	10.9 (max)

**Figure SE10 EIA Referenced Taped Component Dimensions for SESD Devices**

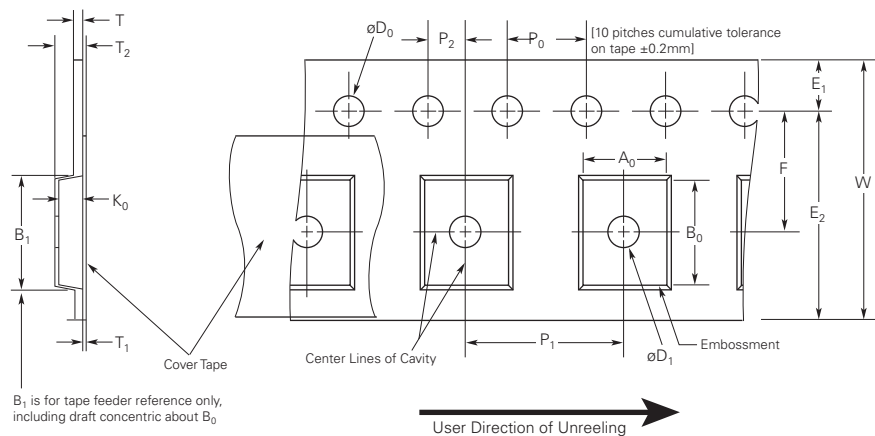
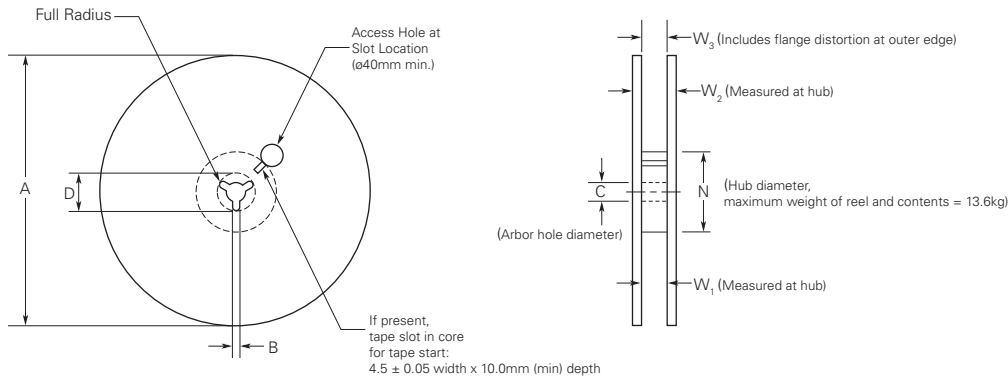


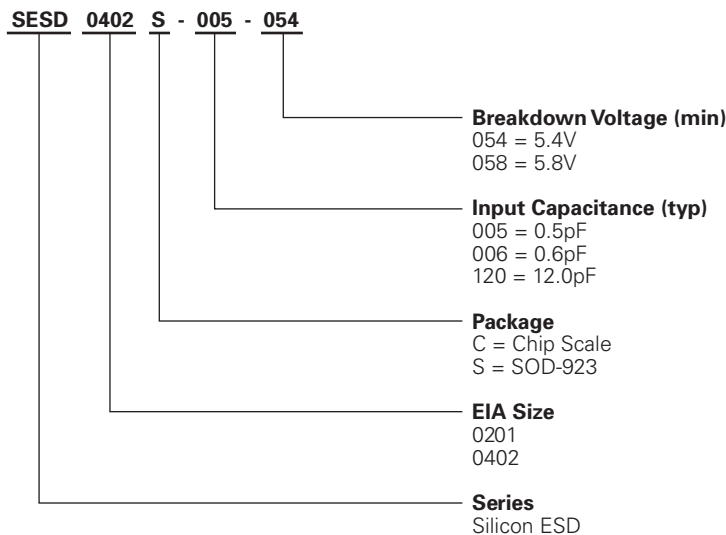
Figure SE11 EIA Referenced Reel Dimensions for SESD Devices



Definitions of Terms for SESD Devices

$I_L$	Reverse Leakage Current @ $V_{RWM}$
$V_{WRV}$	Working Peak Reverse Voltage
$V_{br}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current

Part Numbering System for SESD Devices



**Warning :**

All information, including illustrations, is believed to be accurate and reliable. Users, however, should independently evaluate the suitability of and test each product selected for their application. Tyco Electronics Corporation makes no warranties as to the accuracy or completeness of the information, and disclaims any liability regarding its use. Tyco Electronics only obligations are those in the Tyco Electronics Standard Terms and Conditions of Sale and in no case will Tyco Electronics be liable for any incidental, indirect, or consequential damages arising from the sale, resale, use, or misuse of its products. Specifications are subject to change without notice. In addition, Tyco Electronics reserves the right to make changes to materials or processing that do not affect compliance with any applicable specification without notification to Buyer. Without expressed or written consent by an officer of Tyco Electronics, Tyco Electronics does not authorize the use of any of its products as components in nuclear facility applications, aerospace, or in critical life support devices or systems.

