



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 (12pF) device and SESD0201P1BN-0400-090 (4pF) device are higher-capacitance bi-directional devices 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, while the SESD0201P1BN-0400-090 device offers 10kV contact and 16kV air discharge protection per the IEC61000-4-2, level 4 standard.

The SESD0402S-005-054 device is 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.

Also included in the product line is the SESD0402P1BN-0450-090 device. This device is a higher-capacitance (4.5pF), SMD bi-directional device that offers 10kV contact and 16kV air discharge protection per the IEC61000-4-2, level 4 standard.



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)
- 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	250
SESD0201C-120-058	±8	±15	-40 to +125	-40 to +125	250
SESD0402S-005-054	±10	±15	-55 to +125	-55 to +150	150
NEW SESD0201P1BN-0400-090	±10*	±16	-40 to +125	-40 to +125	–
NEW SESD0402P1BN-0450-090	±10*	±16	-40 to +125	-40 to +125	–

* 10kV @ 50 ± pulses under IEC61000-4-2; 8kV @ 1,000 pulses under IEC61000-4-2

† 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 _{RWM} = 5.0V (μA)	Breakdown Voltage (min) V _{br} @ I _T †† = 1mA (V)	Working Reverse Voltage V _{RWM} @ peak (V)
	Typical (pF)	Maximum (pF)			
SESD0201C-006-058	0.6†	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‡	0.9	1.0	+5.4 / -1.0	5.0
NEW SESD0201P1BN-0400-090	4.0	5.0	1.0**	9.0	6.0
NEW SESD0402P1BN-0450-090	4.5	5.5	1.0**	9.0	6.0

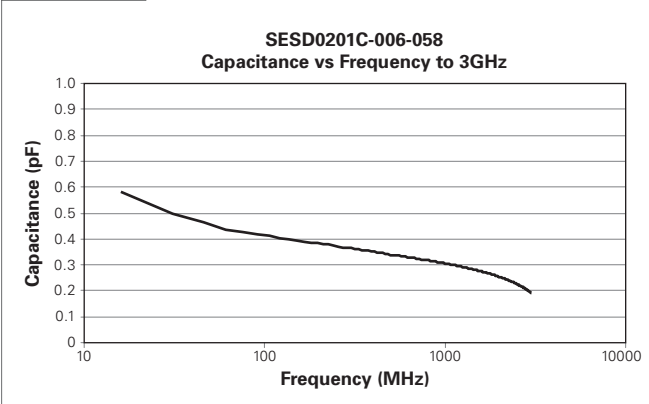
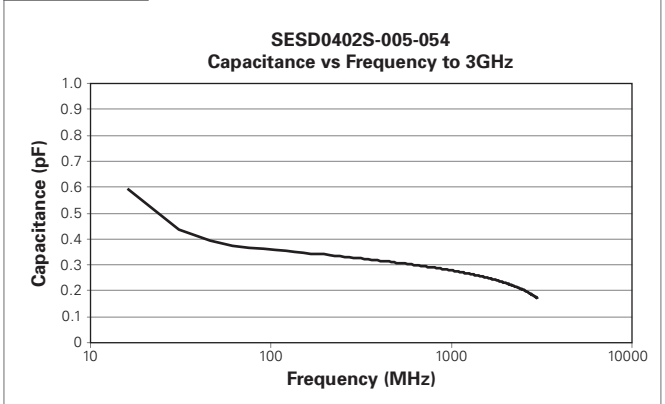
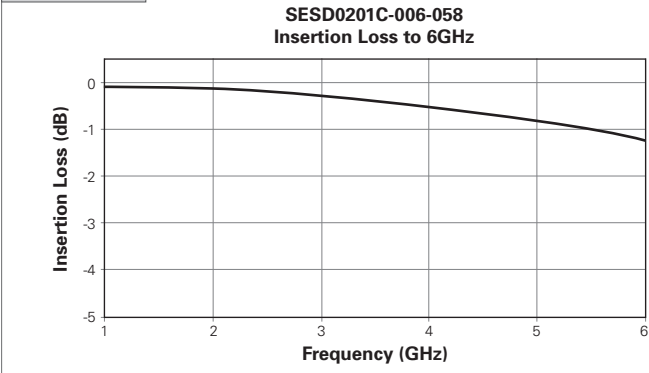
* @ V_r=0V, f=1MHz

† 0.19pF@f=3GHz

‡ 0.17pF@f=3GHz

** I_L @ V_{RWM} = 6.0V (μA)

†† 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


Applications	Insertion Loss	@Frequency (GHz)
HDMI 1.3 (1080p)	-0.205	2.25
HDMI 1.3 (max spec)	-0.354	3.40
DisplayPort	-0.235	2.70
USB 3.0	-0.791	5.00

Figure SE3-SE4 Insertion Loss Diagram for SESD Devices

Cont'd

Figure SE4

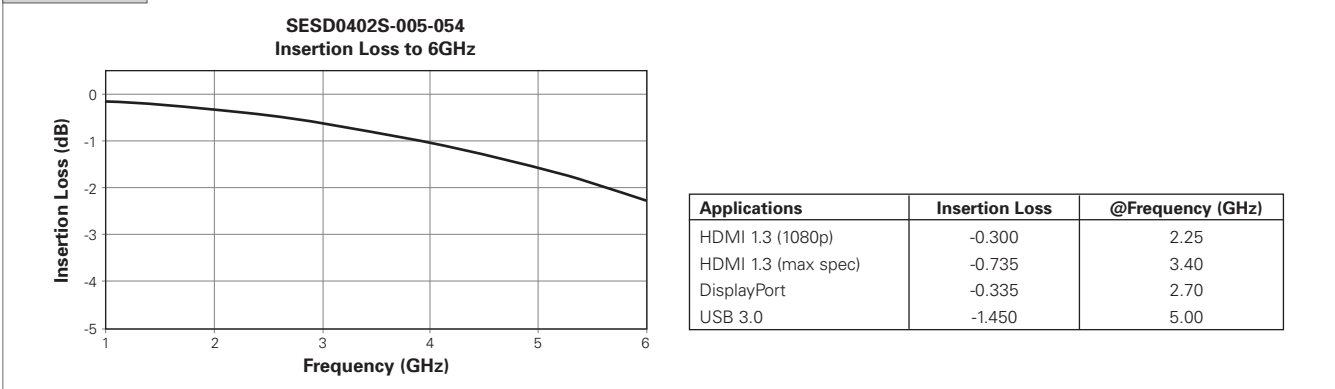


Table SE3 Dimensions for SESD Devices in Millimeters (Mils)*

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
NEW SESD0201P	0.60 ± 0.05 (23.62 ± 2.00)	0.30 ± 0.05 (11.81 ± 2.00)	0.30 ± 0.05 (11.81 ± 2.00)	0.21 ± 0.07 (8.27 ± 2.80)	– –	– –	– –	SE7
NEW SESD0402P	1.10 ± 0.10 (43.31 ± 0.40)	0.50 ± 0.10 (19.69 ± 4.00)	0.50 ± 0.10 (19.69 ± 4.00)	0.25 ± 0.15 (9.84 ± 6.00)	– –	– –	– –	SE7

* Round off approximation

Figure SE5-SE7 Dimension Figures for SESD Devices

Figure SE5

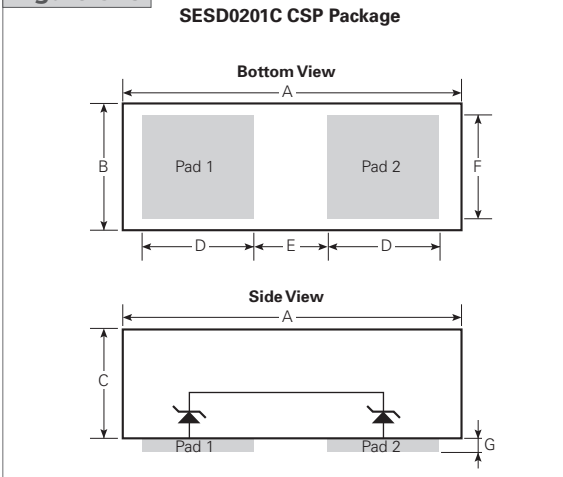


Figure SE6

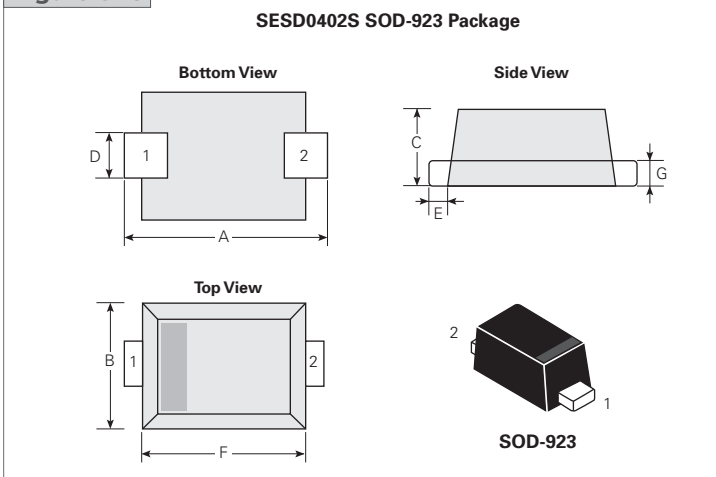


Figure SE7

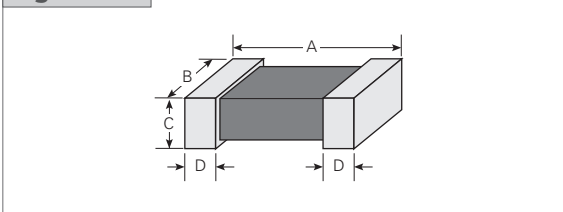
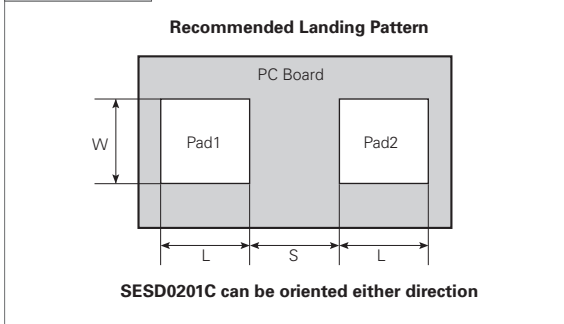
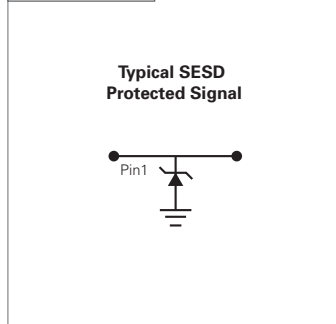
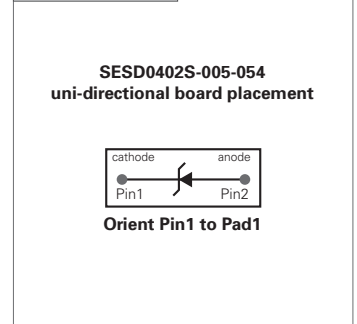


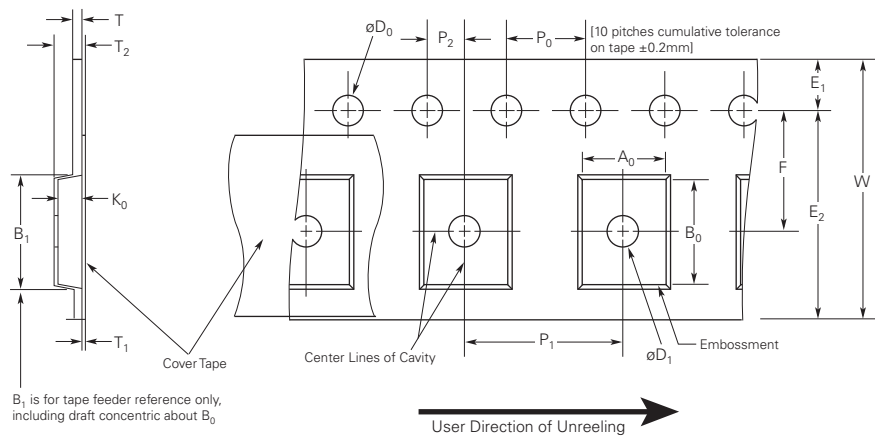
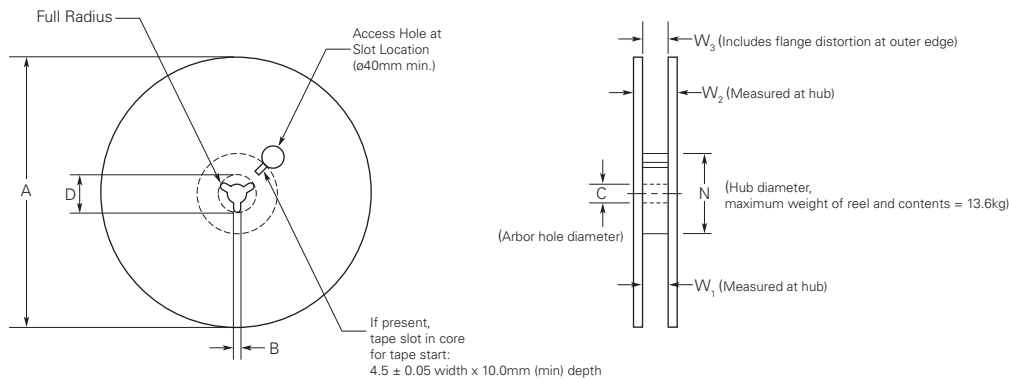
Table SE4 PCB Pad Layout for SESD Devices in Millimeters (Mils)*

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)	SE8
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)	SE8
NEW SESD0201P	0.28 ± 0.01 (11.00 ± 0.40)	0.19 ± 0.01 (7.50 ± 0.40)	0.30 ± 0.01 (11.80 ± 0.40)	SE8
NEW SESD0402P	0.61 ± 0.05 (24.00 ± 2.00)	0.52 ± 0.05 (21.00 ± 2.00)	0.50 ± 0.05 (20.00 ± 2.00)	SE8

* Round off approximation

Figure SE8

Figure SE9

Figure SE10

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 ₀	0.37 ± 0.03	0.37 ± 0.03	0.66 ± 0.05
B ₀	0.67 ± 0.03	0.67 ± 0.03	1.06 ± 0.05
D ₀	1.60 (max)	1.60 (max)	1.60 (max)
D ₁	1.00 (min)	1.00 (min)	1.00 (min)
E ₁	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10
E ₂	5.85 (min)	5.85 (min)	5.85 (min)
F	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05
P ₀	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10
P ₁	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05
P ₂	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 ₁	0.67 ± 0.03	0.67 ± 0.03	1.06 ± 0.05
K ₀	0.35 ± 0.03	0.35 ± 0.03	0.48 ± 0.05
T	0.60 (max)	0.60 (max)	0.60 (max)
T ₁	0.10 (min)	0.10 (min)	0.10 (min)
T ₂	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	13.00 ± 0.20	13.00 ± 0.20	13.00 ± 0.20
D	20.20 (min)	20.20 (min)	20.20 (min)
N	50.00 (min)	50.00 (min)	50.00 (min)
W ₁	9.15 ± 0.75	9.15 ± 0.75	9.15 ± 0.75
W ₂	14.40 (max)	14.40 (max)	14.40 (max)
W ₃	10.90 (max)	10.90 (max)	10.90 (max)

Figure SE11 EIA Referenced Taped Component Dimensions for SESD Devices

Figure SE12 EIA Referenced Reel Dimensions for SESD Devices

Table SE6 Tape and Reel Specifications for ChipSESD Devices

Tape Dimension EIA Mark	SESD0201P1BN-0400-090	SESD0402P1BN-0450-090
	Dimension (mm)	Dimension (mm)
A	0.37 ± 0.03	0.58 ± 0.03
B	0.69 ± 0.03	1.20 ± 0.03
D	1.55 ± 0.05	1.55 ± 0.05
E	1.75 ± 0.05	1.75 ± 0.05
F	3.50 ± 0.05	3.50 ± 0.05
W	8.00 ± 0.10	8.00 ± 0.10
P ₀	4.00 ± 0.10	4.00 ± 0.10
P ₁	2.00 ± 0.05	2.00 ± 0.05
P ₂	2.00 ± 0.05	2.00 ± 0.05
T	0.37 ± 0.03	0.57 ± 0.03
	0.40 ± 0.03	0.60 ± 0.03
Reel Dimension EIA Mark	Dimension (mm)	Dimension (mm)
	Dimension (mm)	Dimension (mm)
A	178.0 ± 2.0	178.0 ± 2.0
B	2.0 ± 0.5	2.0 ± 0.5
C	13.0 ± 0.5	13.0 ± 0.5
D	21.0 ± 0.8	21.0 ± 0.8
E	62.0 ± 1.5	62.0 ± 1.5
F	9.0 ± 0.5	9.0 ± 0.5
G	13.0 ± 1.0	13.0 ± 1.0

Figure SE13 EIA Referenced Taped Component Dimensions for ChipSESD Devices

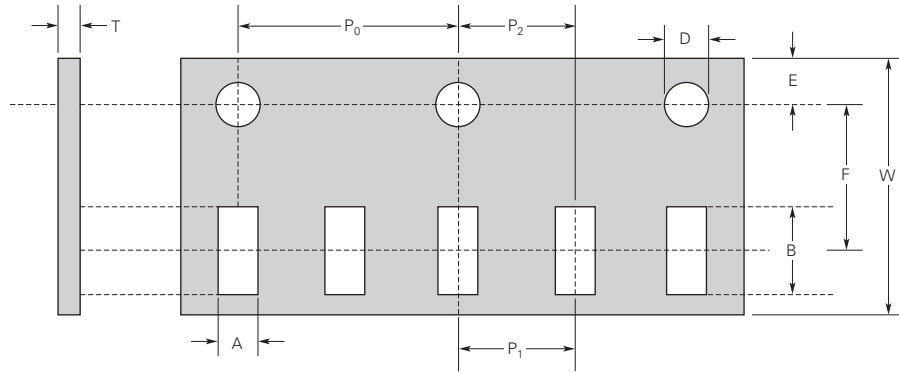
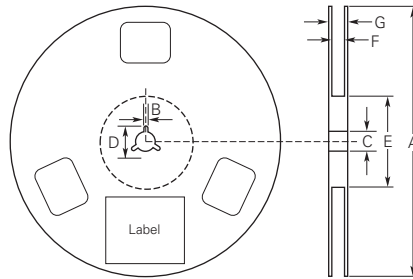


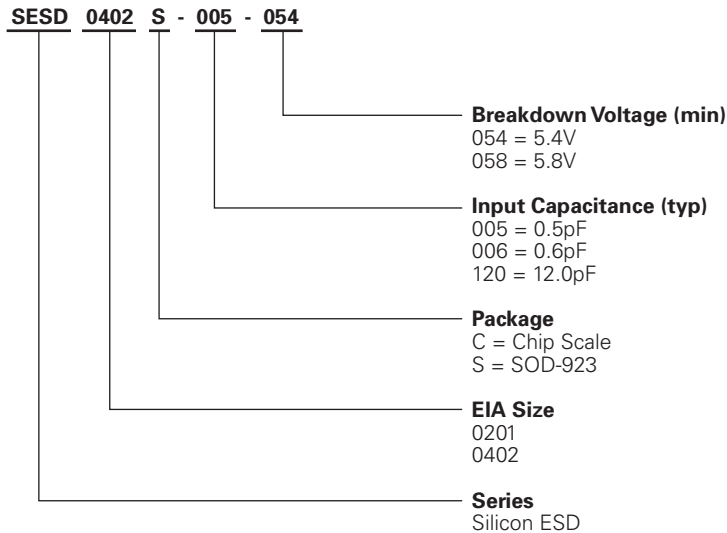
Figure SE14 EIA Referenced Reel Dimensions for ChipSESD Devices



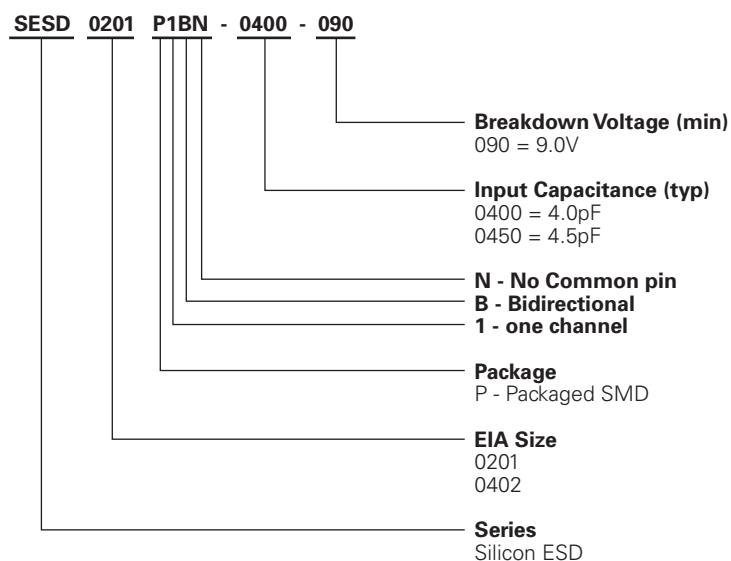
Definitions of Terms for SESD Devices

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

Part Numbering System for SESD Devices



Part Numbering System for ChipESD Devices



Warning :

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