

# SESD Series

## Enhanced ESD Discrete TVS

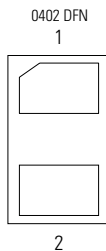


### Web Resources

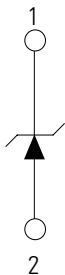


Download ECAD models, order samples, and find technical resources at [www.littelfuse.com](http://www.littelfuse.com)

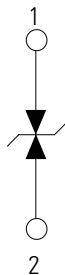
### Pinout



### Functional Block Diagram



**Unidirectional**



**Bidirectional**

### Description

The SESD Series Enhanced ESD Discrete TVS provides ultra low capacitance unidirectional and bidirectional ESD protection for the world's most challenging high speed serial interfaces. Ultra low capacitance helps ensure excellent signal integrity on the most challenging consumer electronics interfaces, such as USB 3.1, HDMI 2.0, DisplayPort, Thunderbolt, and V-by-One®. Providing in excess of 22kV contact ESD protection (IEC 61000-4-2) while maintaining extremely low leakage and dynamic resistance, offered in the industry's most popular footprints (0402), the SESD series sets higher standards for signal integrity and usability.

### Features and Benefits

- 0.15pF TYP bidirectional
- 0.30pF TYP unidirectional
- ESD, IEC 61000-4-2, ±22kV contact, ±22kV air
- Low clamping voltage of 14V @ IPP=2.5A (Bidirectional) (tP=8/20µs)
- Low profile 0402 DFN packages
- Facilitates excellent signal integrity
- ELV-Compliant
- RoHS-Compliant and Lead-free
- AEC-Q101 qualified
- PPAP capable

### Applications

- Ultra-high speed data lines
- USB 3.1, 3.0, 2.0
- HDMI 2.0, 1.4a, 1.3
- Thunderbolt
- DisplayPort(TM)
- V-by-One®
- LVDS interfaces
- Consumer, mobile and portable electronics
- Tablet PC and external storage with high speed interfaces
- Applications requiring high ESD performance in small packages

# SESD Series

## Enhanced ESD Discrete TVS

### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$I_{PP}$	Peak Current ( $t_p=8/20\mu s$ )	2.5	A
$T_{OP}$	Operating Temperature	-55 to 125	°C
$T_{STOR}$	Storage Temperature	-55 to 150	°C

**Caution:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### Unidirectional Electrical Characteristics - ( $T_{OP}=25^\circ C$ )

Parameter	Test Conditions	Min	Typ	Max	Units
Diode Capacitance <sup>1</sup>	Reverse Bias=0V, f=3GHz	-	0.30	-	pF
Breakdown Voltage	$V_{BR}$ @ $I_T=1mA$	-	8.80	-	V
Reverse Working Voltage	-	-	-	7.0	V
Reverse Leakage Current	$I_L$ @ $V_{RWM}=5.0V$	-	25	-	nA
Clamp Voltage <sup>1</sup>	$V_{CL}$ @ $I_{PP}=2.5A$	-	13.0	-	V
ESD Withstand Voltage <sup>1</sup>	IEC61000-4-2 (Contact)	±22	-	-	kV
	IEC61000-4-2 (Air)	±22	-	-	

**Note: 1.** Parameter is guaranteed by design and/or component characterization.

### Bidirectional Electrical Characteristics - ( $T_{OP}=25^\circ C$ )

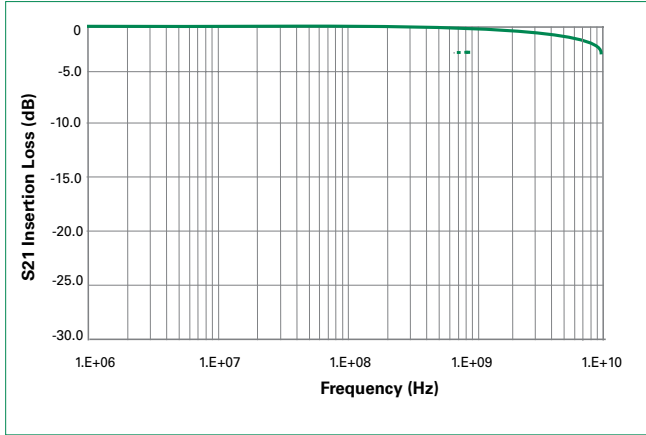
Parameter	Test Conditions	Min	Typ	Max	Units
Diode Capacitance <sup>1</sup>	Reverse Bias=0V, f=3GHz	-	0.15	-	pF
Breakdown Voltage	$V_{BR}$ @ $I_T=1mA$	-	9.6	-	V
Reverse Working Voltage	-	-	-	7.0	V
Reverse Leakage Current	$I_L$ @ $V_{RWM}=5.0V$	-	25	-	nA
Clamp Voltage <sup>1</sup>	$V_{CL}$ @ $I_{PP}=2.5A$	-	14.0	-	V
ESD Withstand Voltage <sup>1</sup>	IEC61000-4-2 (Contact)	±22	-	-	kV
	IEC61000-4-2 (Air)	±22	-	-	

**Note: 1.** Parameter is guaranteed by design and/or component characterization.

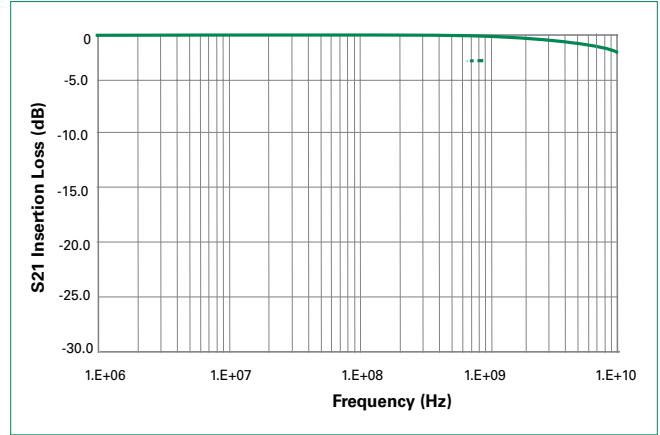
# SESD Series

## Enhanced ESD Discrete TVS

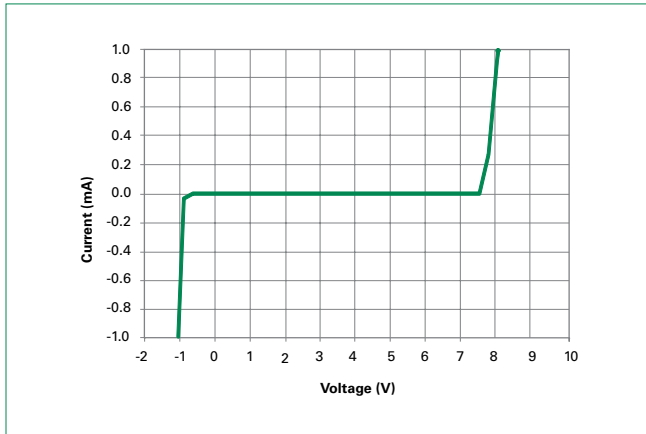
Insertion Loss Diagram - Unidirectional



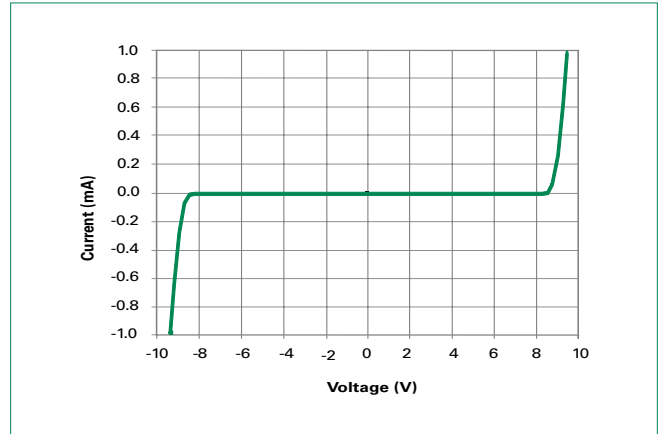
Insertion Loss Diagram - Bidirectional



Device IV Curve - Unidirectional

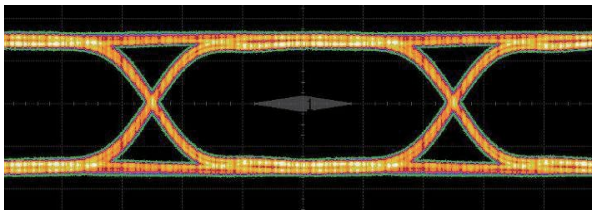


Device IV Curve - Bidirectional

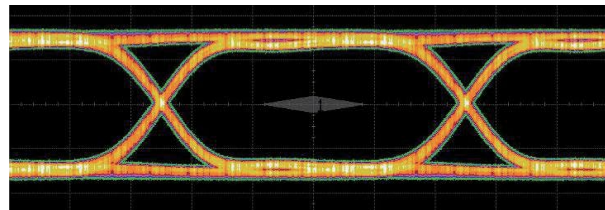


### USB3.0 Eye Diagram

5.0 Gb/s, 1000mV differential, CPO Compliant Test Pattern



Without SESD Device



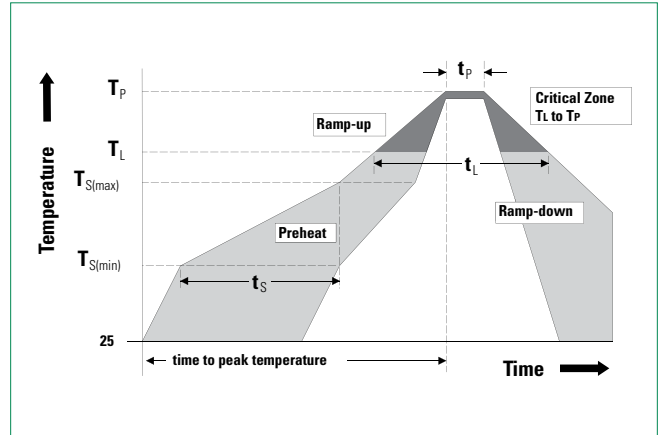
With SESD Device

# SESD Series

## Enhanced ESD Discrete TVS

### Soldering Parameters

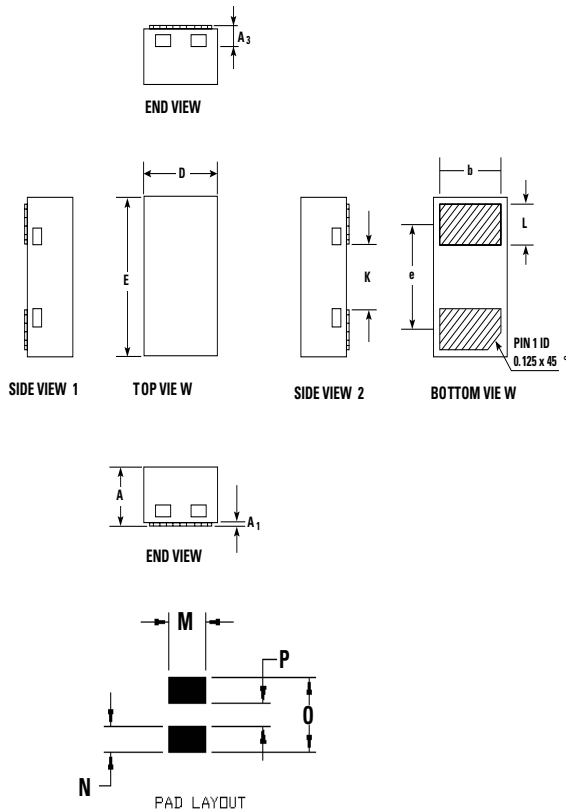
<b>Reflow Condition</b>		Pb – Free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
<b>Average ramp up rate (Liquidus) Temp (<math>T_L</math>) to peak</b>		3°C/second max
<b><math>T_{S(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Temperature ( $t_t$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		20 – 40 seconds
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C



### Product Characteristics of 0402 DFN Package

<b>Lead Plating</b>	Pre-Plated Frame
<b>Lead Material</b>	Copper Alloy
<b>Substrate Material</b>	Silicon
<b>Body Material</b>	UL Recognized epoxy meeting flammability rating V-0.

### Package Dimensions – 0402 DFN

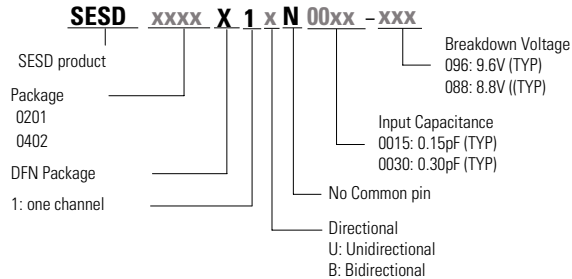


Symbol	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
<b>A</b>	0.33	0.38	0.43	0.013	0.015	0.017
<b>A1</b>	0	-	0.05	0	-	0.002
<b>A3</b>	0.13 ref.			0.005 ref.		
<b>D</b>	0.55	0.60	0.65	0.022	0.024	0.026
<b>E</b>	0.95	1.00	1.05	0.037	0.039	0.041
<b>K</b>	0.35	0.40	0.45	0.014	0.016	0.018
<b>b</b>	0.45	0.50	0.55	0.018	0.020	0.022
<b>L</b>	0.20	0.25	0.30	0.008	0.010	0.012
<b>e</b>	0.65 BSC			0.026 BSC		
<b>M</b>		0.60			0.024	
<b>N</b>		0.35			0.014	
<b>O</b>		1.00			0.039	
<b>P</b>		0.30			0.012	

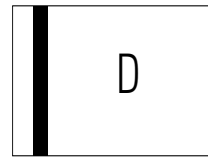
# SESD Series

## Enhanced ESD Discrete TVS

### Part Numbering System



### Part Marking System



Unidirectional

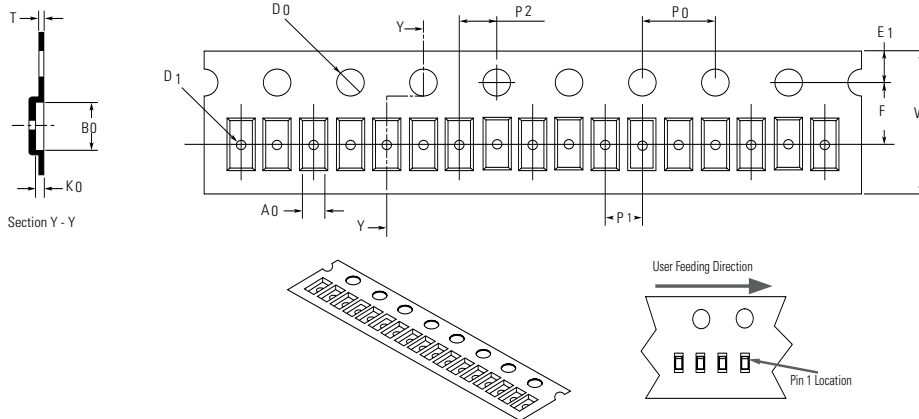


Bidirectional

### Ordering Information

Part Number	Package	Ordering Part Number	Minimum Order Quantity
SESD0402X1UN-0030-088	0402 DFN	RF3920-000	50000
SESD0402X1BN-0015-096	0402 DFN	RF3922-000	50000

### Embossed Carrier Tape & Reel Specification — 0402 DFN



Symbol	Millimeters
<b>A0</b>	0.70+/-0.05
<b>B0</b>	1.15+/-0.05
<b>D0</b>	∅ 1.55 + 0.05
<b>D1</b>	∅ 0.40 +/- 0.05
<b>E1</b>	1.75+/-0.10
<b>F</b>	3.50+/-0.05
<b>K0</b>	0.47+/-0.05
<b>P0</b>	4.00+/-0.10
<b>P1</b>	2.00+/-0.10
<b>P2</b>	2.00+/-0.05
<b>W</b>	8.00+/-0.10
<b>T</b>	0.20+/-0.05

**Disclaimer Notice** - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at <http://www.littelfuse.com/disclaimer-electronics>.