SESD Series
Enhanced ESD Discrete TVS

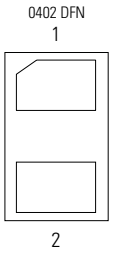
AUTOMOTIVE GRADE | RoHS | Pb | GREEN | ELV



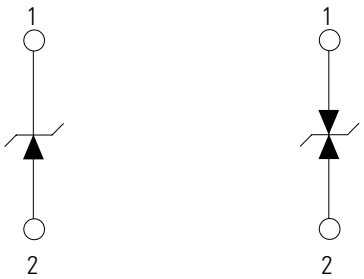
Web Resources

Download ECAD models, order samples, and find technical recources at 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

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Absolute Maximum Ratings

Symbol	Parameter	Value	Units
I_{PP}	Peak Current (t_p=8/20µs)	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.

Uidirectional Electrical Characteristics - (T_{OP}=25°C)

Parameter	Test Conditions	Min	Typ	Max	Units
Diode Capacitance[1]	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[1]	V_{CL} @ I_{PP}=2.5A	-	13.0	-	V
ESD Withstand Voltage[1]	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°C)

Parameter	Test Conditions	Min	Typ	Max	Units
Diode Capacitance[1]	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[1]	V_{CL} @ I_{PP}=2.5A	-	14.0	-	V
ESD Withstand Voltage[1]	IEC61000-4-2 (Contact)	±22	-	-	kV
	IEC61000-4-2 (Air)	±22	-	-	

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

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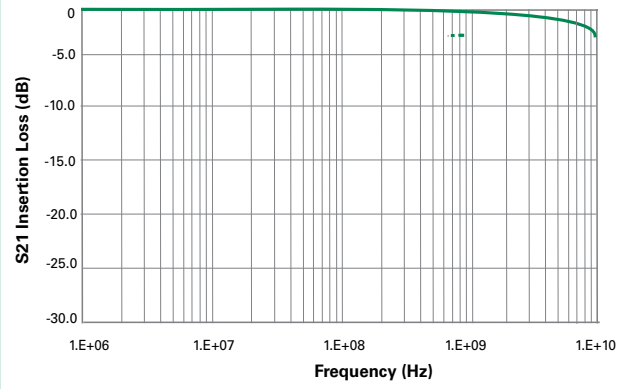
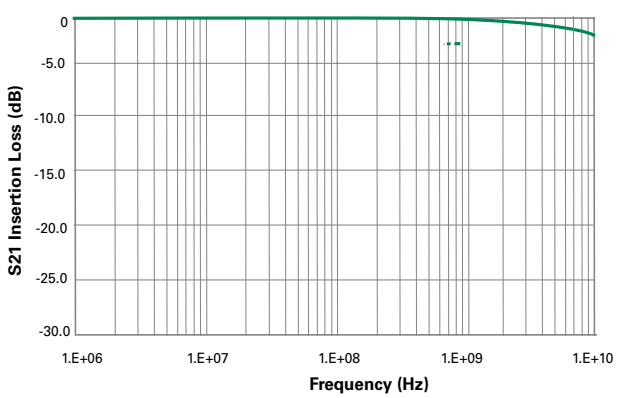
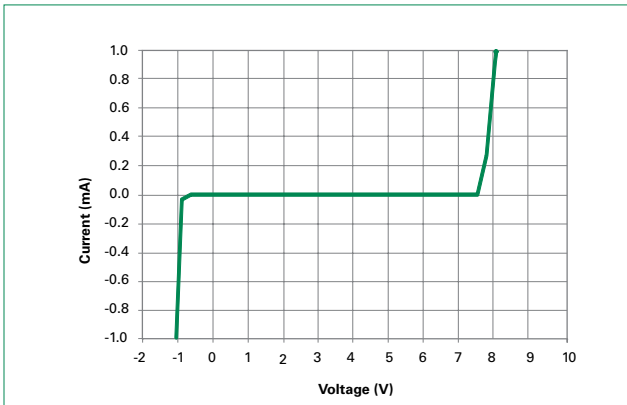
Insertion Loss Diagram - Unidirectional



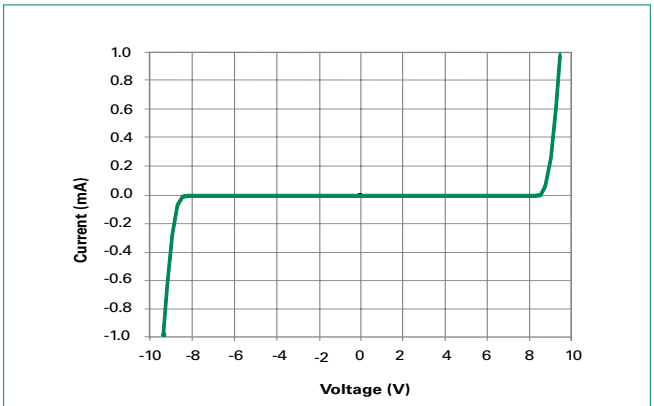
Insertion Loss Diagram - Bidirectional



Device IV Curve - Unidirectional

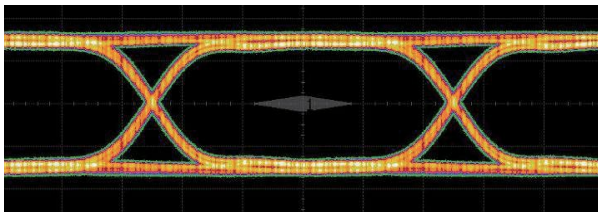


Device IV Curve - Bidirectional

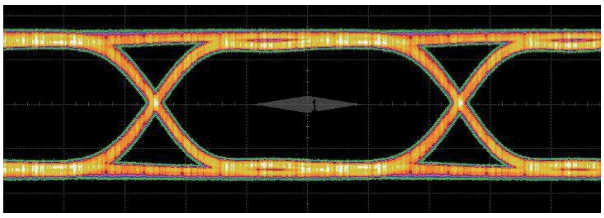


USB3.0 Eye Diagram

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



Without SESD Device



With SESD Device

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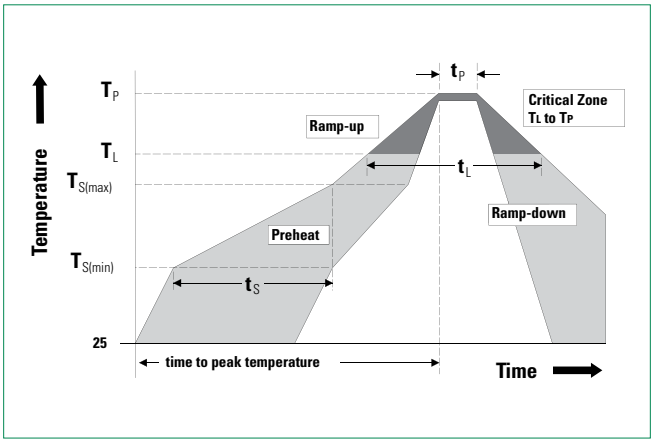
Soldering Parameters

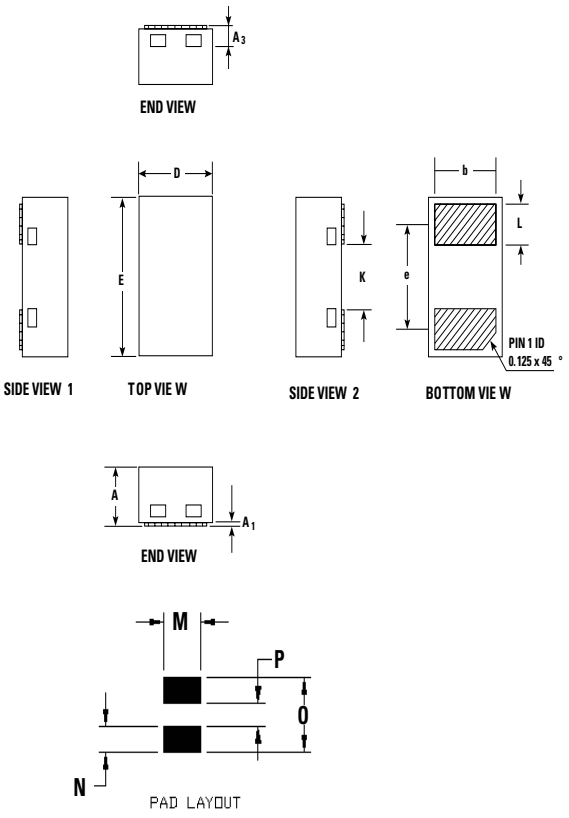
Reflow Condition		Pb – Free assembly
Pre Heat	**- Temperature Min ($T_{s(min)}$)**	150°C
	- Temperature Max ($T_{s(max)}$)	200°C
	- Time (min to max) (t_s)	60 – 180 secs
Average ramp up rate (Liquidus) Temp (T_L) to peak		3°C/second max
$T_{S(max)}$ to T_L - Ramp-up Rate		3°C/second max
Reflow	**- Temperature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



Product Characteristics of 0402 DFN Package

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

Package Dimensions — 0402 DFN



Symbol	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
A	0.33	0.38	0.43	0.013	0.015	0.017
A1	0	-	0.05	0	-	0.002
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
b	0.45	0.50	0.55	0.018	0.020	0.022
L	0.20	0.25	0.30	0.008	0.010	0.012
e		0.65 BSC			0.026 BSC	
M		0.60			0.024	
N		0.35			0.014	
O		1.00			0.039	
P		0.30			0.012	

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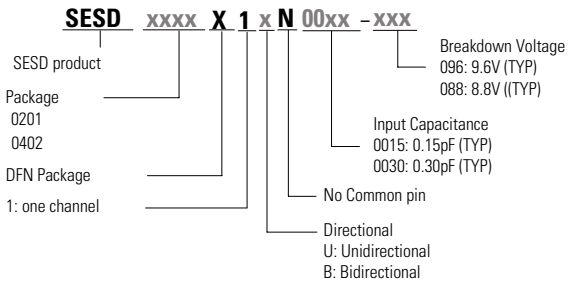
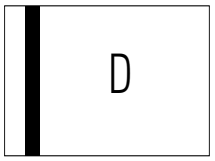
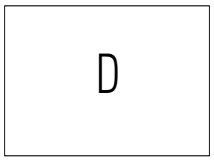
Part Numbering System



Part Marking System



Unidirectional

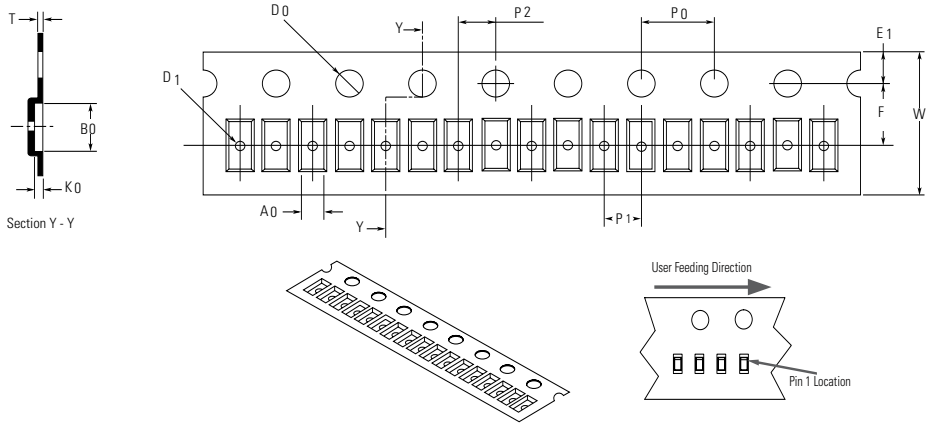


Bidirectional

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

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