RClamp5031ZA

Ultra Small RClamp®

1 Line, 5V ESD Protection

PROTECTION PRODUCTS

Description

RClamp® TVS diodes are designed to protect sensitive electronics from damage or latch-up due to ESD. They are designed to replace 0201 size multilayer varistors (MLVs) in portable applications such as cell phones, notebook computers, and other portable electronics. This device offers desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

RClamp®5031ZA features extremely good ESD protection characteristics highlighted by low typical dynamic resistance of 0.17 Ohms, low peak ESD clamping voltage, and high ESD withstand voltage (+/-17kV contact per IEC 61000-4-2). Low maximum capacitance (0.45pF at VR=0V) minimizes loading on sensitive cirucuits. Each device will protect one high-speed data line operating at 5 Volts.

RClamp5031ZA is in a 2-pin SLP0603P2X3F package measuring 0.6 x 0.3 mm with a nominal height of only 0.25mm. Leads are finished with NiAu. The small package gives the designer the flexibility to protect single lines in applications where arrays are not practical. The combination of small size and high ESD surge capability makes them ideal for use in portable applications.

Features

- High ESD withstand Voltage: +/-17kV (Contact) per IEC 61000-4-2 and +/- 24kV (air) per IEC 61000-4-2
- Ultra-small package
- Protects one data line
- Low ESD clamping voltage
- Working voltage: 5V
- Low capacitance: 0.45pF maximum
- Low leakage current
- Low dynamic resistance: 0.17 Ω (typ.)
- Solid-state silicon-avalanche technology

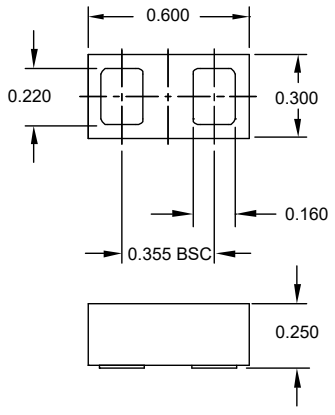
Mechanical Characteristics

- SLP0603P2X3F package
- Pb-Free, Halogen Free, RoHS/WEEE compliant
- Nominal Dimensions: 0.6 x 0.3 x 0.25 mm
- Lead Finish: NiAu
- Marking: Marking code
- Packaging: Tape and Reel

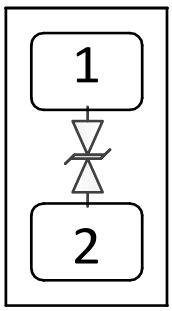
Applications

- USB3.0
- USB Type-C
- MiPi/MDDI
- MHL
- FM antenna
- Wearables

Package Dimension (mm)



Schematic & Pin Configuration



SLP0603P2X3F (Bottom View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Current (tp = 1.2/50µs)	I_{PP}	4	A
ESD per IEC 61000-4-2 (Air)(2) ESD per IEC 61000-4-2 (Contact)(2)	V_{ESD}	±24 ±17	kV
Operating Temperature	T_{OP}	-40 to +85	^{O}C
Storage Temperature	T_{STG}	-55 to +150	^{O}C

Electrical Characteristics (T=25^{O}C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}					5	V
Reverse Breakdown Voltage	V_{BR}	I_t = 10mA		6.5	8.5	10.5	V
Holding Current	I_H	V=V_H			100		mA
Reverse Leakage Current	I_R	V_{RWM} = 5V			<5	50	nA
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 4A			13	V
ESD Clamping Voltage[2]	V_C	tp = 0.2/100ns	I_{PP} = 4A		5		V
			I_{PP} = 16A		7		
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.17		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz	T = 25^{O}C		0.35	0.45	pF

Notes:

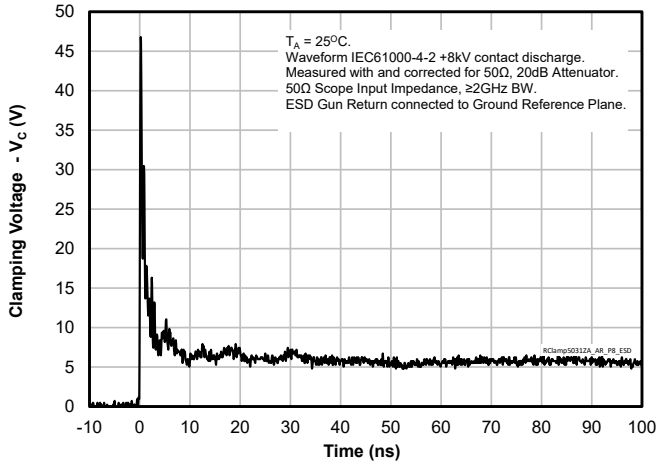
1) ESD gun return path connected to ESD ground plane.

2) Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, I_{TLP} and V_{TLP} averaging window: t1 = 70ns to t2 = 90ns.

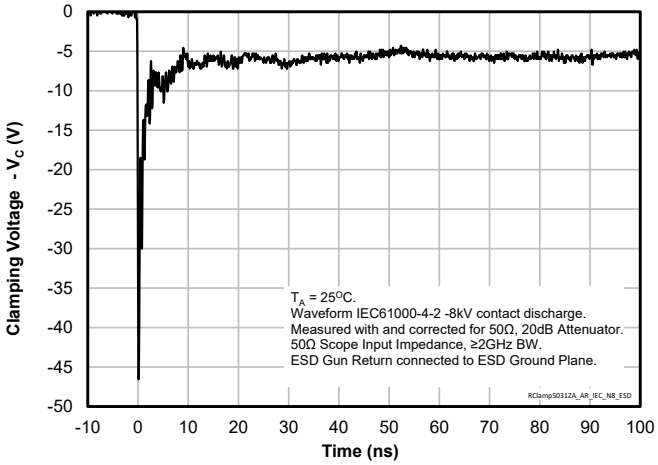
3) Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A

Typical Characteristics

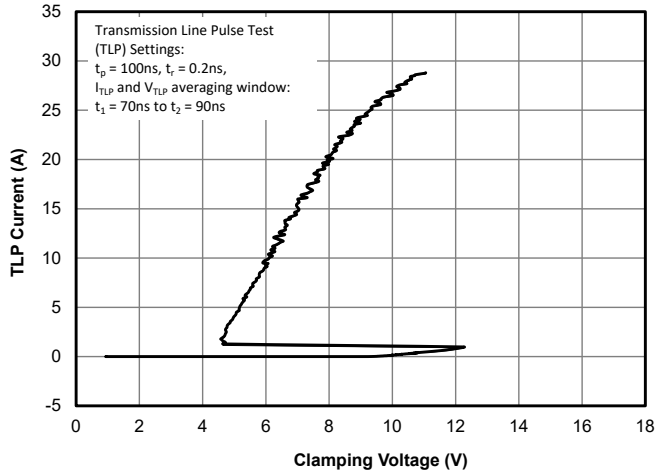
ESD Clamping (8kV Contact per IEC 61000-4-2)



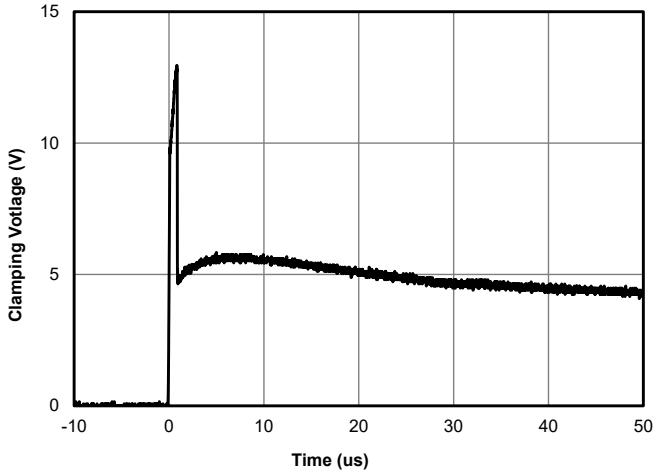
ESD Clamping (-8kV Contact per IEC 61000-4-2)



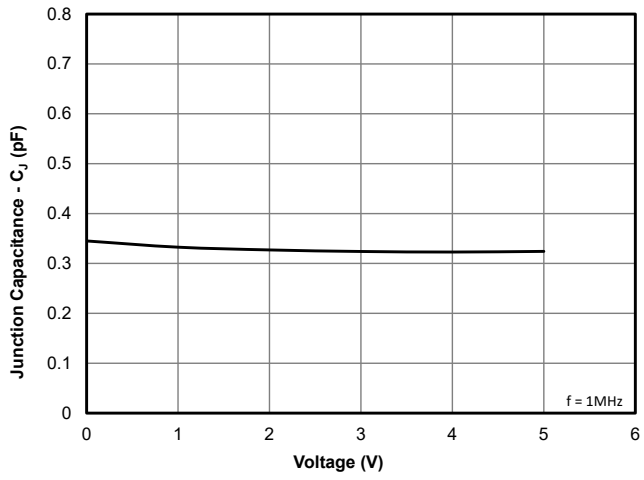
TLP Characteristic (Positive Pulse)



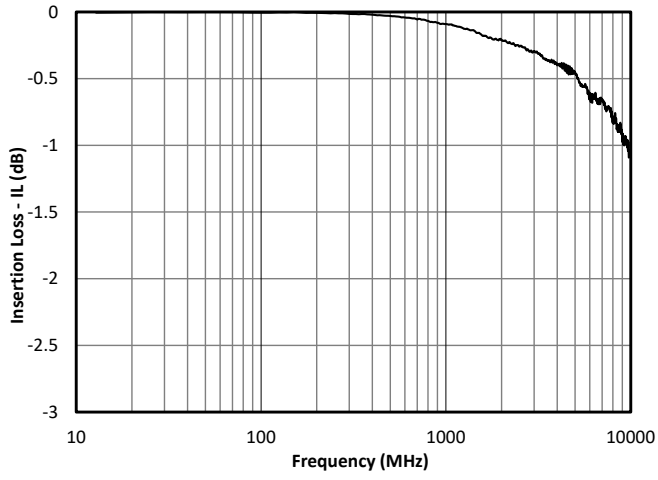
Clamping Voltage Waveform (tp=1.2/50µs)



Capacitance vs. Reverse Voltage

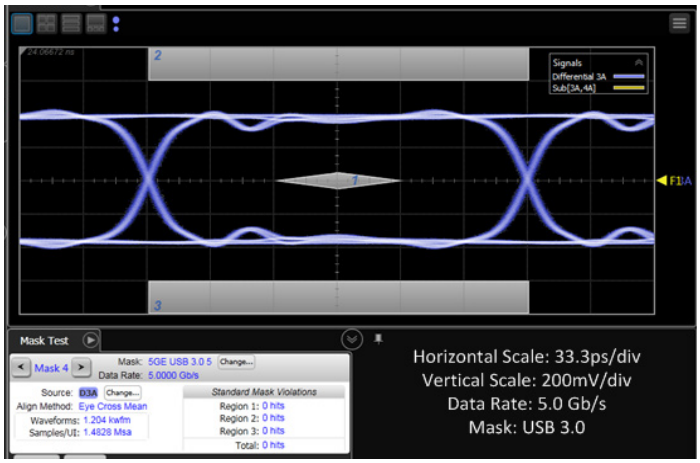


Insertion Loss - S21

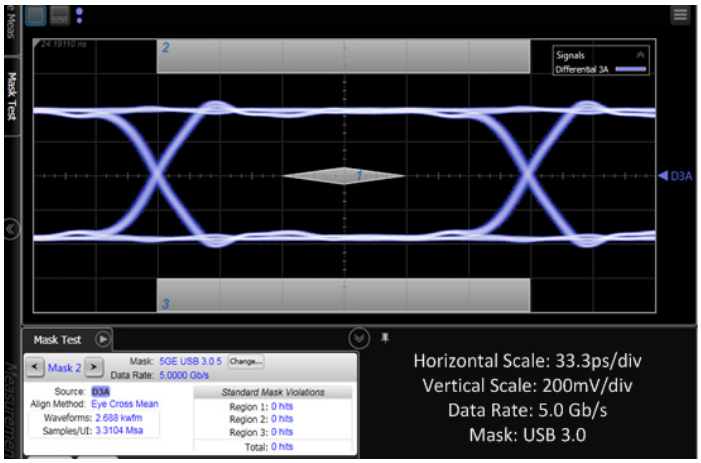


Typical Characteristics (Continued)

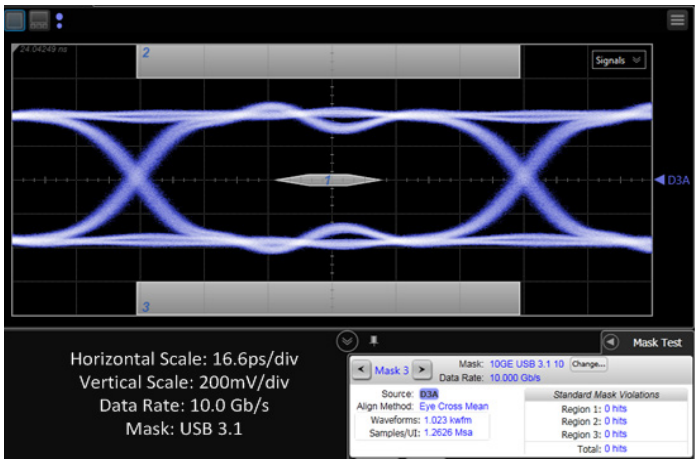
5Gb/s (USB 3.0) Eye Diagram with RClamp5031ZA



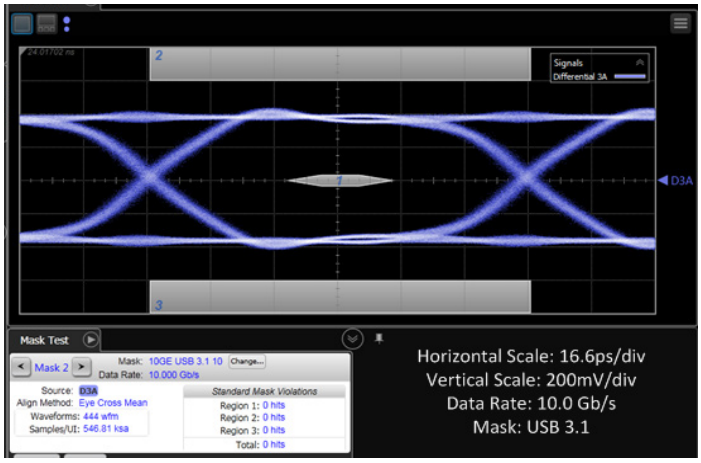
5Gb/s (USB 3.0) Eye Diagram without RClamp5031ZA



10Gb/s (USB 3.1) Eye Diagram with RClamp5031ZA



10Gb/s (USB 3.1) Eye Diagram without RClamp5031ZA



Application Information

Assembly Guidelines

The small size of this device means that some care must be taken during the mounting process to ensure reliable solder joints. The figure at the right details Semtech's recommended mounting pattern. Recommended assembly guidelines are shown in Table 1. Note that these are only recommendations and should serve only as a starting point for design since there are many factors that affect the assembly process. Exact manufacturing parameters will require some experimentation to get the desired solder application.

Solder Stencil

Stencil design is one of the key factors which will determine the volume of solder paste which is deposited onto the land pad. The area ratio of the stencil aperture will determine how well the stencil will print. The area ratio takes into account the aperture shape, aperture size, and stencil thickness. A minimum area ratio of 0.66 is preferred for the subject package. The area ratio of a rectangular aperture is given as:

Area Ratio = (L * W)/ (2 * (L + W) * T)

Where:
L = Aperture Length
W = Aperture Width
T = Stencil Thickness

Semtech recommends a stencil with square aperture and rounded corners for consistent solder release. The stencil should be laser cut with electro-polished finish. A stencil thickness of 0.075mm (0.003") is recommended. A 0.100mm (0.004") stencil may be used, however the stencil opening may need to be increased slightly to achieve the desired area ratio to ensure proper solder coverage on the pad.

Recommended Mounting Pattern

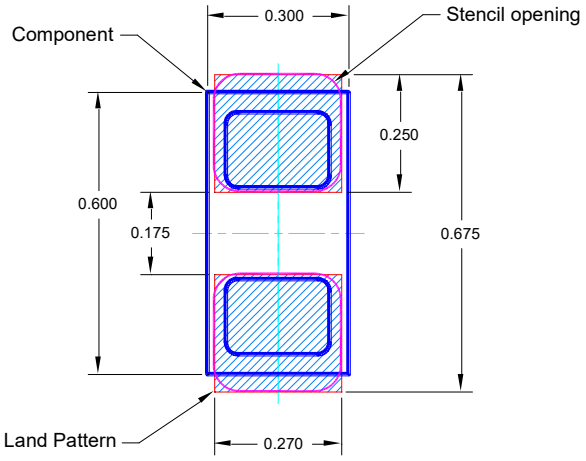
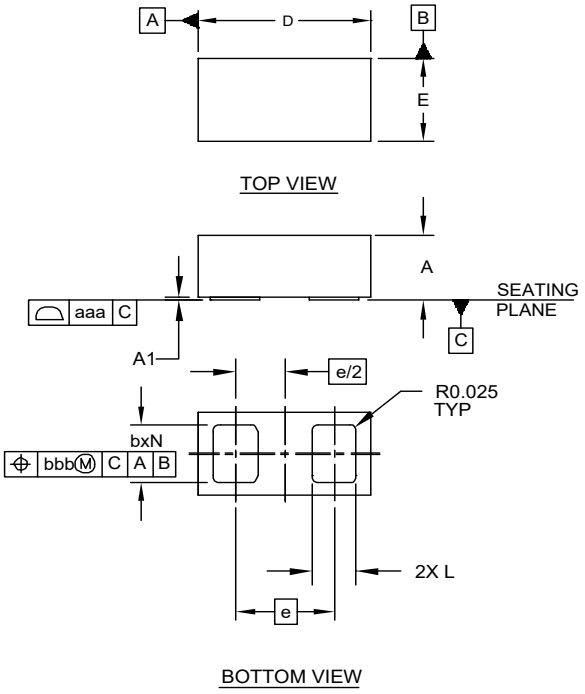


Table 1 - Assembly Guidelines

Assembly Parameter	Recommendation
Solder Stencil Design	Laser Cut, Electro-Polished
Aperture Shape	Rectangular with Rounded Corners
Solder Stencil Thickness	0.075mm (0.003") or 0.100mm (0.004")
Solder Paste Type	Type 4 Size Sphere or Smaller
Solder Reflow Profile	Per JEDEC J-STD-020
PCB Solder Pad Design	Solder Mask Defined or Non Solder Mask Defined
PCB Pad Finish	OSP or NiAu

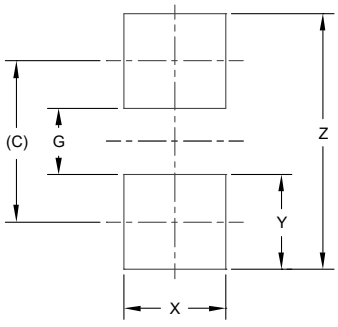
Outline Drawing - SLP0603P2X3F



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.235	0.250	0.265
A1	0.000	0.010	0.050
b	0.200	0.220	0.240
D	0.580	0.600	0.620
E	0.280	0.300	0.320
e	0.355 BSC		
L	0.140	0.160	0.180
N	2		
aaa	0.08		
bbb	0.10		

NOTES:
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

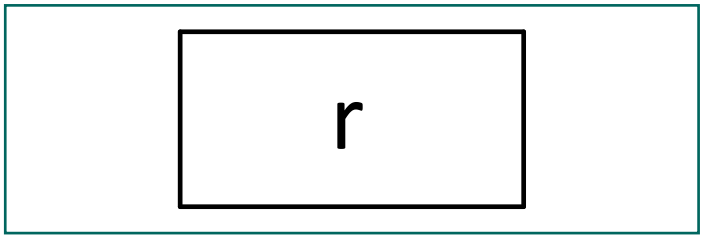
Land Pattern - SLP0603P2X3F



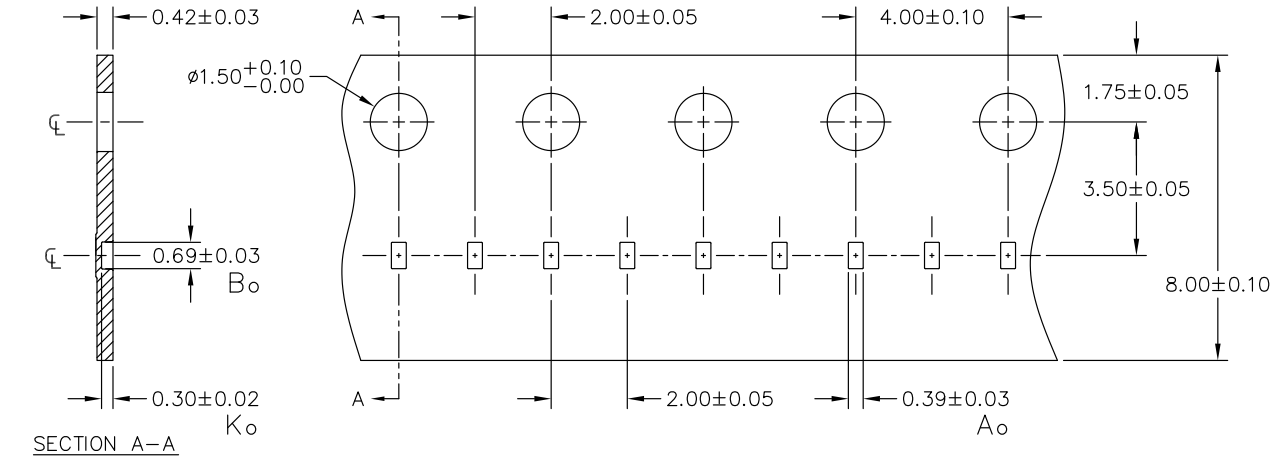
DIMENSIONS	
DIM	MILLIMETERS
(C)	(0.425)
G	0.175
X	0.270
Y	0.250
Z	0.675

NOTES:
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

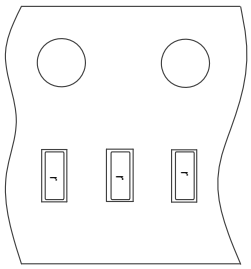
Marking Code



Tape and Reel Specification



NOTES: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



Ordering Information

Part Number	Qty per Reel	Reel Size
RClamp5031ZATFT	15,000	7”

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