

## Description

µClamp® 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. They feature large cross-sectional area junctions for conducting high transient currents. This device offers desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

µClamp®3321ZA features extremely good ESD protection characteristics highlighted by low typical dynamic resistance of 0.33 Ohms, low peak ESD clamping voltage, and high ESD withstand voltage (+/-15kV contact per IEC 61000-4-2). Low maximum capacitance (5pF at VR=0V) minimizes loading on sensitive circuits. Each device will protect one data line operating at 3.3 Volts. µClamp3321ZA is in a 2-pin SLP0603P2X3F package. It measures 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 such as cellular phones, digital cameras, and tablet PC's.

## Features

- ◆ High ESD withstand Voltage: +/-15kV (Contact) and +/- 17kV (Air) per IEC 61000-4-2
- ◆ Ultra-small package
- ◆ Protects one data line
- ◆ Low ESD clamping voltage
- ◆ Working voltage: 3.3V
- ◆ Low capacitance: 5pF maximum
- ◆ Low leakage current
- ◆ Extremely low dynamic resistance: 0.33 Ohms (Typ)
- ◆ Solid-state silicon-avalanche technology

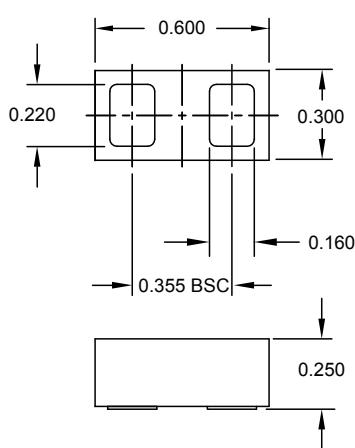
## Mechanical Characteristics

- ◆ 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

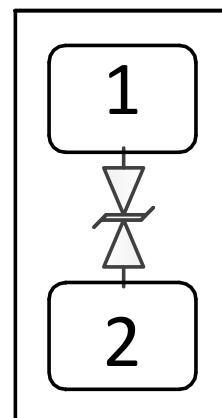
- ◆ Cellular Handsets & Accessories
- ◆ Notebook Computers
- ◆ Tablet PC
- ◆ Portable Instrumentation
- ◆ Peripherals

## Package Dimensions



Nominal Dimensions in mm

## Schematic & Pin Configuration



SLP0603P2X3F (Bottom View)

**PROTECTION PRODUCTS**
**Absolute Maximum Ratings**

Rating	Symbol	Value	Units
Peak Pulse Power ( $tp = 8/20\mu s$ )	$P_{PK}$	40	W
Peak Pulse Current ( $tp = 8/20\mu s$ )	$I_{PP}$	4	A
ESD per IEC 61000-4-2 (Air) <sup>(1)</sup> ESD per IEC 61000-4-2 (Contact) <sup>(1)</sup>	$V_{ESD}$	$\pm 17$ $\pm 15$	kV
Operating Temperature	$T_J$	-40 to +125	°C
Storage Temperature	$T_{STG}$	-55 to +150	°C

**Electrical Characteristics (T=25°C unless otherwise specified)**

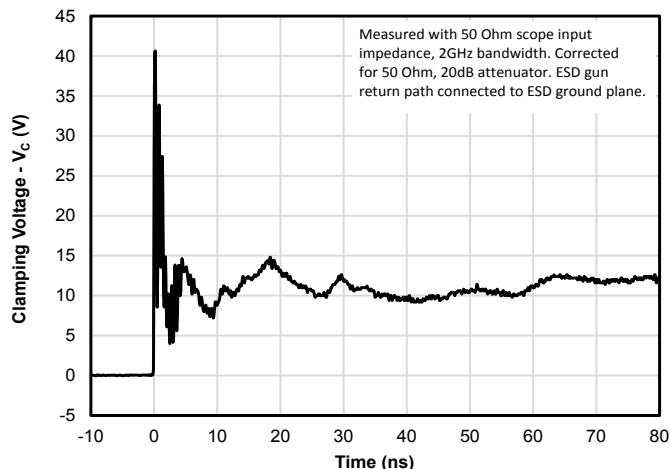
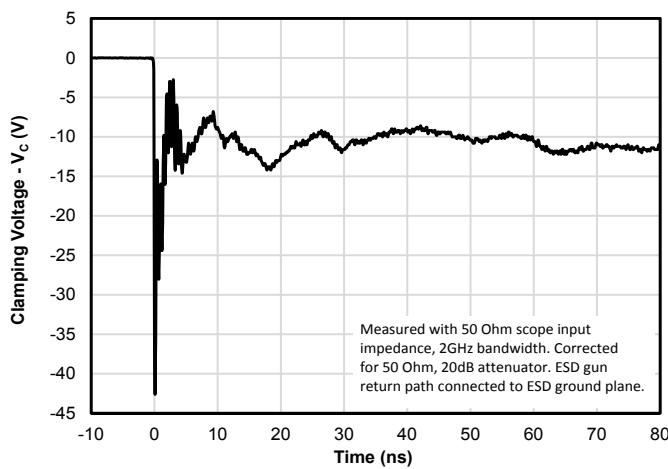
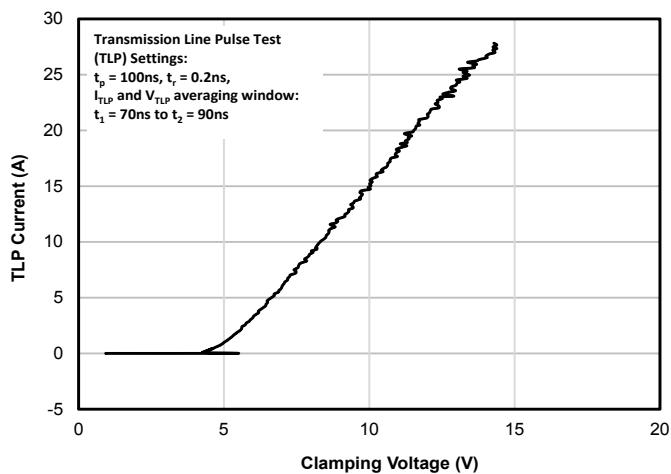
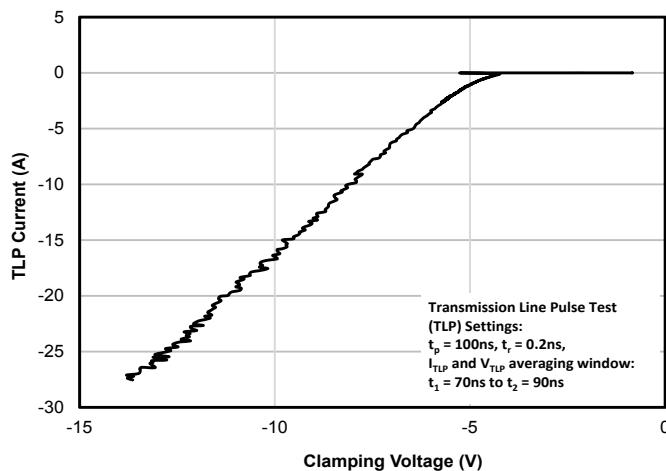
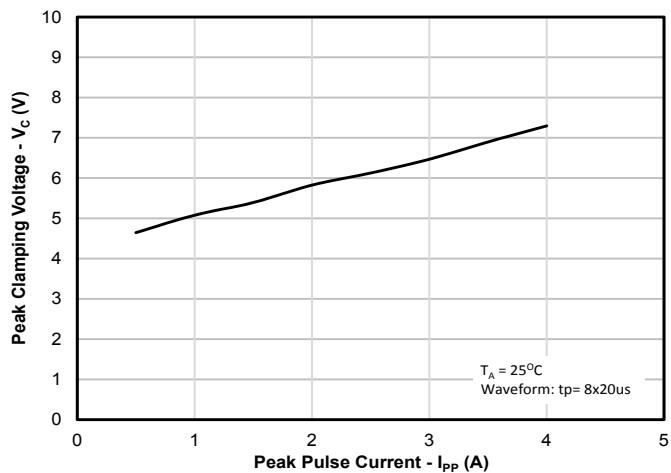
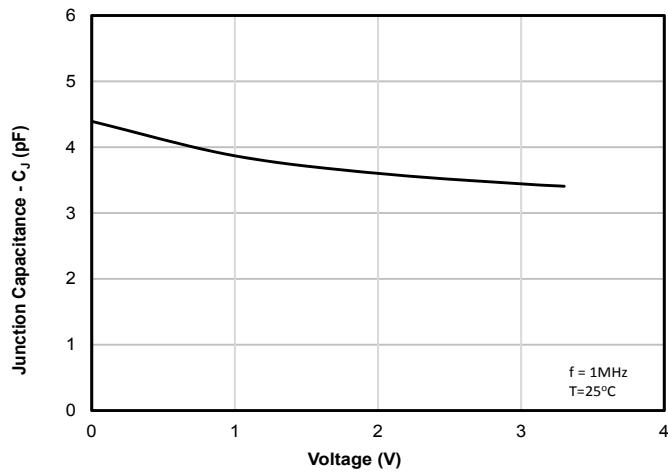
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	$V_{RWM}$	Pin 1 to 2 or Pin 2 to 1			3.3	V
Punch-Through Voltage	$V_{PT}$	$I_{PT} = 50\mu A$ Pin 1 to 2 or Pin 2 to 1	3.7	4.0	4.7	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 3.3V$ Pin 1 to 2 or Pin 2 to 1		1	50	nA
Clamping Voltage	$V_C$	$I_{PP} = 4A$ , $tp = 8/20\mu s$			8.5	V
ESD Clamping Voltage <sup>2</sup>	$V_C$	$I_{PP} = 4A$ $tp = 0.2/100ns$		6.5		V
ESD Clamping Voltage <sup>2</sup>	$V_C$	$I_{PP} = 16A$ $tp = 0.2/100ns$		10.5		V
Dynamic Resistance <sup>2,3</sup>	$R_{DYN}$	$tp = 100ns$		0.33		Ohms
Junction Capacitance	$C_J$	I/O pin to GND $f = 1MHz$	$V_R = 0V$		4.2	pF

## Notes

1)Measured with a 20dB attenuator, 50 Ohm scope input impedance, 2GHz bandwidth. 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  $t2 = 90ns$ .

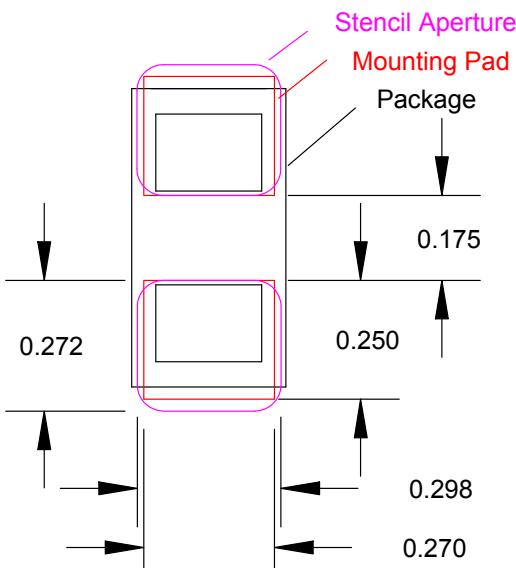
3) Dynamic resistance calculated from  $I_{TLP} = 4A$  to  $I_{TLP} = 16A$

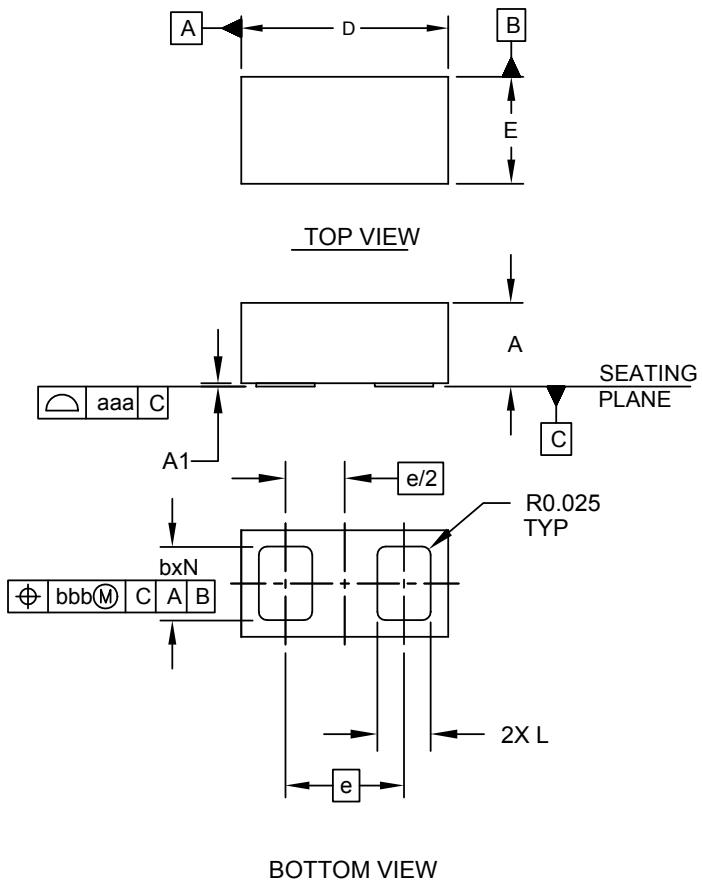
**PROTECTION PRODUCTS**
**Typical Characteristics**
**ESD Clamping (8kV Contact per IEC 61000-4-2)**

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

**TLP Characteristic (Positive Pulse)**

**TLP Characteristic (Negative Pulse)**

**Clamping Voltage vs. Peak Pulse Current ( $t_p=8/20\mu\text{s}$ )**

**Junction Capacitance vs. Reverse Voltage**


**PROTECTION PRODUCTS**
**Applications Information**
**Assembly Guidelines**

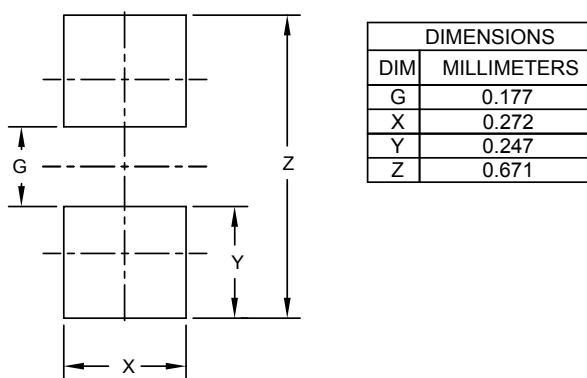
The small size of this device means that some care must be taken during the mounting process to insure reliable solder joint. The table below provides Semtech's recommended assembly guidelines for mounting this device. The figure at the right details Semtech's recommended aperture based on the below recommendations. 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. The exact manufacturing parameters will require some experimentation to get the desired solder application.

Assembly Parameter	Recommendation
Solder Stencil Design	Laser cut, Electro-polished
Aperture shape	Rectangular with rounded corners
Solder Stencil Thickness	0.100 mm (0.004")
Solder Paste Type	Type 4 size sphere or smaller
Solder Reflow Profile	Per JEDEC J-STD-020
PCB Solder Pad Design	Non-Solder mask defined
PCB Pad Finish	OSP OR NiAu


**Recommended Mounting Pattern**

**PROTECTION PRODUCTS**
**Outline Drawing - SLP0603P2X3F**


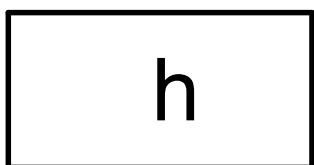
DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.235	0.250	0.265
A1	0.000	0.010	0.050
b	0.200	0.220	0.240
D	0.580	0.600	0.620
E	0.280	0.300	0.320
e	0.355	0.355	0.355 BSC
L	0.140	0.160	0.180
N	2		
aaa	0.08		
bbb	0.10		

**Land Pattern - SLP0603P2X3F**

**NOTES:**

CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY.

CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

**PROTECTION PRODUCTS**
**Marking**


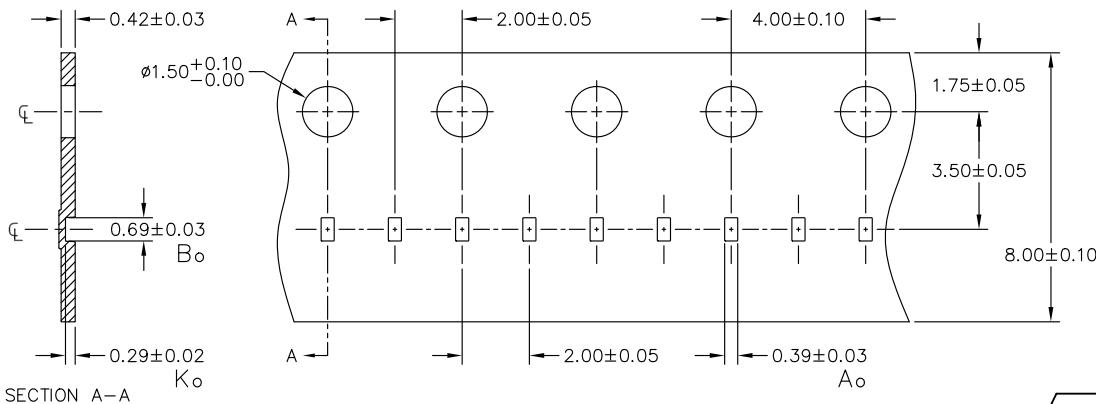
Notes: Device is Electrically Symmetrical

**Ordering Information**

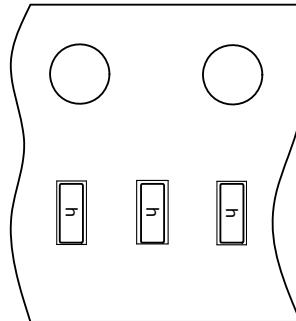
Part Number	Qty per Reel	Reel Size
µClamp3321ZATFT	15000	7"

## Notes:

 1) MicroClamp, uClamp and µClamp are trademarks of Semtech Corporation.

**Tape and Reel Specification**


NOTES: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.


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