µClamp2501ZA
Low Voltage µClamp®
2.5V TVS Diode

Description

µClamp® TVS diodes are designed to protect sensitive electronics from damage or latch-up due to ESD. They features large cross-sectional area junctions for conducting high transient currents. These devices offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

The µClamp®2501ZA is constructed using Semtech's proprietary EPD TVS process technology. The EPD process provides low operating voltages with significant reductions in leakage currents and capacitance over silicon-avalanche diode processes.

µClamp2501ZA is in a DFN 0.60x0.30x0.25mm 2-Lead package. Each device will protect one line operating at 2.5 volts. It 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, tablets, and notebook computers.

Features

- High ESD withstand Voltage: +/-22kV (Contact) & +/-25kV (Air) per IEC 61000-4-2
- Ultra-small package
- Uni-directional
- Protect one line
- Low ESD clamping voltage
- Working voltage: +2.5 V
- Low leakage current
- Low dynamic resistance
- Solid-state silicon-avalanche technology

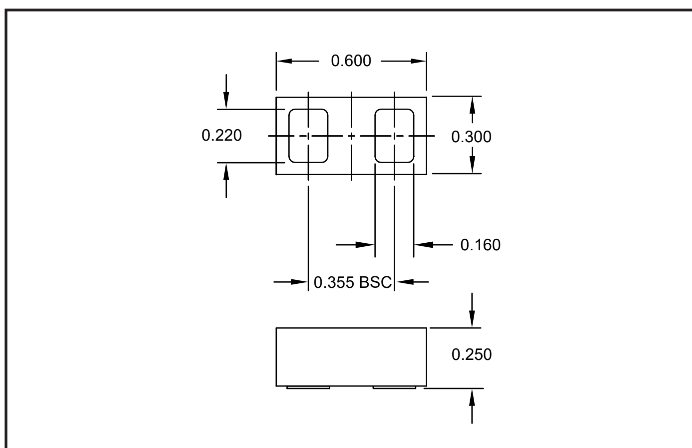
Mechanical Characteristics

- Package: DFN 0.60x0.30x0.25mm 2-Lead
- Pb-free, Halogen Free, RoHS/WEEE compliant
- Lead Finish: Pb-free
- Marking: Marking code
- Packaging: Tape and Reel

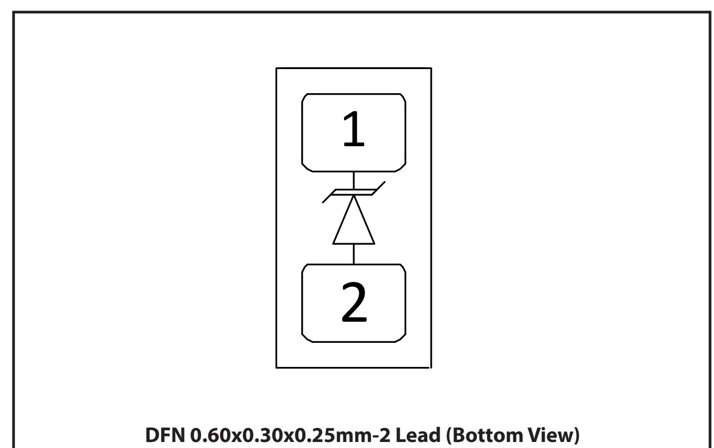
Applications

- Cellular Handsets & Accessories
- Portable instrumentation
- Keypads, Side Keys, LCD Displays
- Notebooks & Desktop Computers
- VBUS Power Lines

Package Dimension



Schematic & Pin Configuration



DFN 0.60x0.30x0.25mm-2 Lead (Bottom View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20µs)	P_{PK}	65	W
Peak Pulse Current (tp = 8/20µs)	I_{PP}	8	A
ESD per IEC 61000-4-2 (Air)[(1)] ESD per IEC 61000-4-2 (Contact)[(1)]	V_{ESD}	±25 ±22	kV
Operating Temperature	T_{OP}	-40 to +125	^{o}C
Storage Temperature	T_{STG}	-55 to +150	^{o}C

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

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin1 to Pin2				2.5	V
Reverse Breakdown Voltage	V_{BR}	I_t = 1mA, Pin 1 to Pin 2		3	3.5	4	V
Reverse Leakage Current	I_R	V_{RWM} = 2.5V, Pin1 to Pin2	T = 25°C		<1	50	nA
Clamping Voltage	V_C	tp = 8/20µs, Pin1 to Pin2	I_{PP} = 1A		4.9	6	V
			I_{PP} = 8A		7.5	8.5	
Forward Voltage	V_F	tp = 8/20µs, Pin2 to Pin1	I_{PP} = 1A		1.2	2	V
ESD Clamping Voltage[2]	V_C	tp = 0.2/100ns, Pin1 to Pin2	I_{PP} = 4A		5.6		V
			I_{PP} = 16A		7		
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns, Pin1 to Pin2			0.11		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz	T = 25°C		3.7	4.5	pF

Notes:

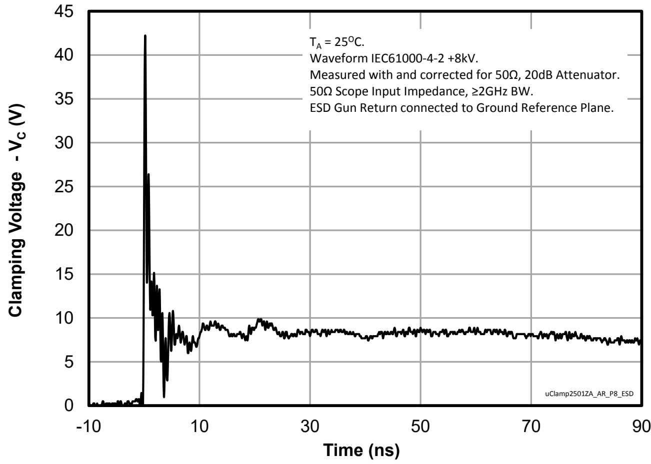
1) ESD gun return path connected to ESD ground plane

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

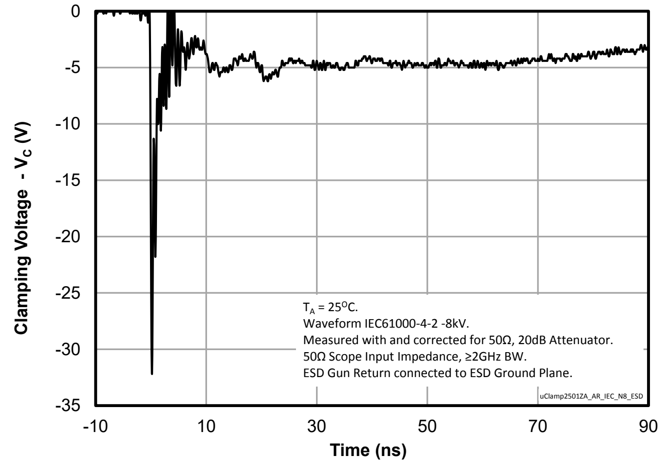
3) Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A

Typical Characteristics

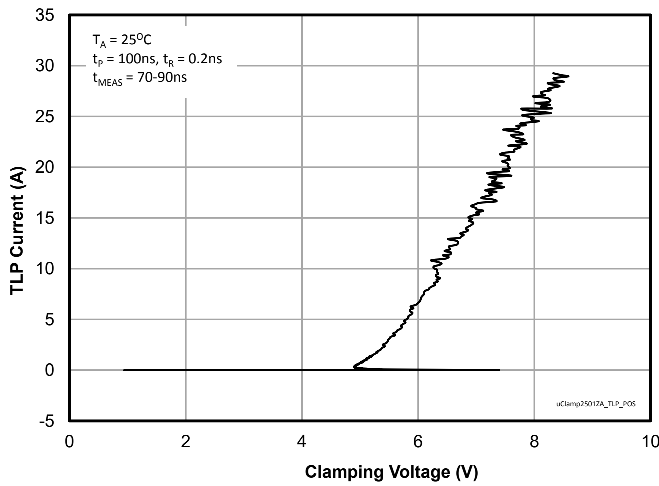
ESD Clamping (8kV Contact per IEC 61000-4-2)



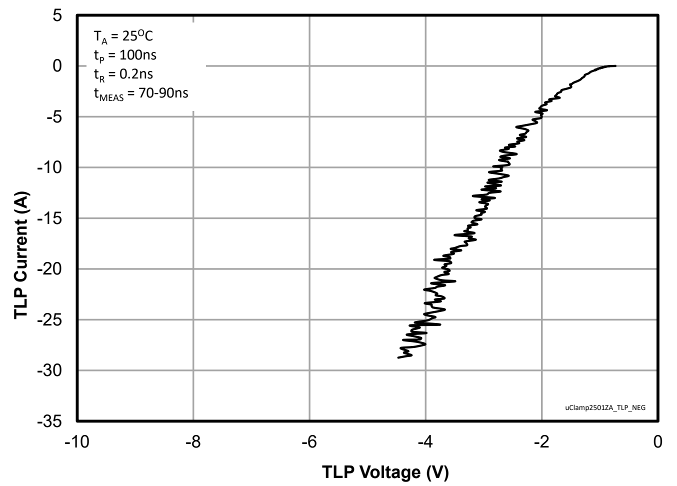
ESD Clamping (-8kV Contact per IEC 61000-4-2)



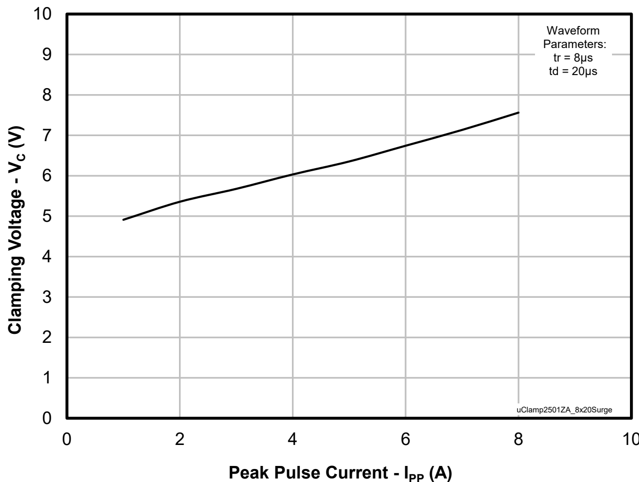
TLP Characteristic (Positive Pulse)



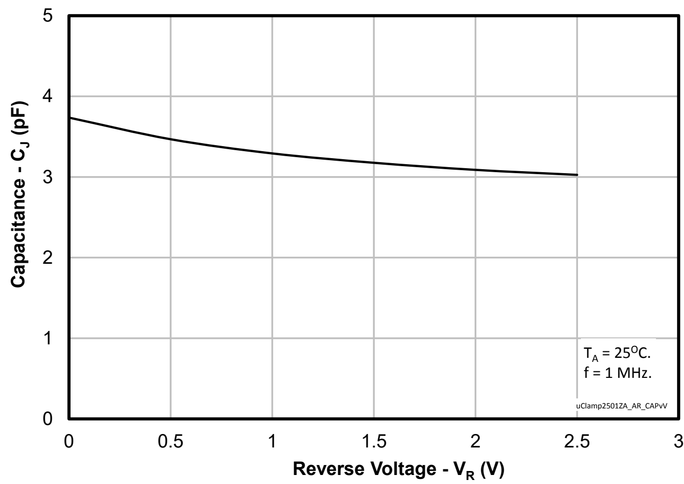
TLP Characteristic (Negative Pulse)

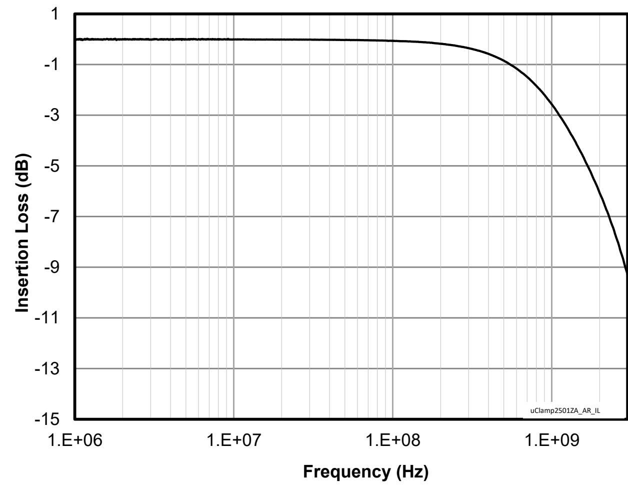


Clamping Voltage vs. Peak Pulse Current (tp=8/20µs)



Typical Characteristics



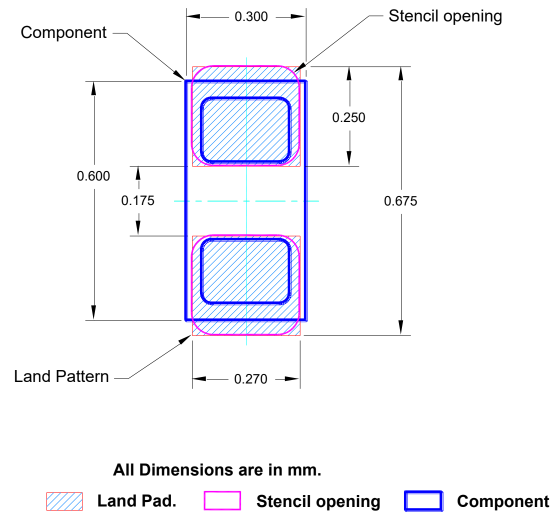


Application Information

Assembly Guidelines

The small size of this device means that some care must be taken during the mounting process to insure 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.

Recommended Mounting Pattern



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)

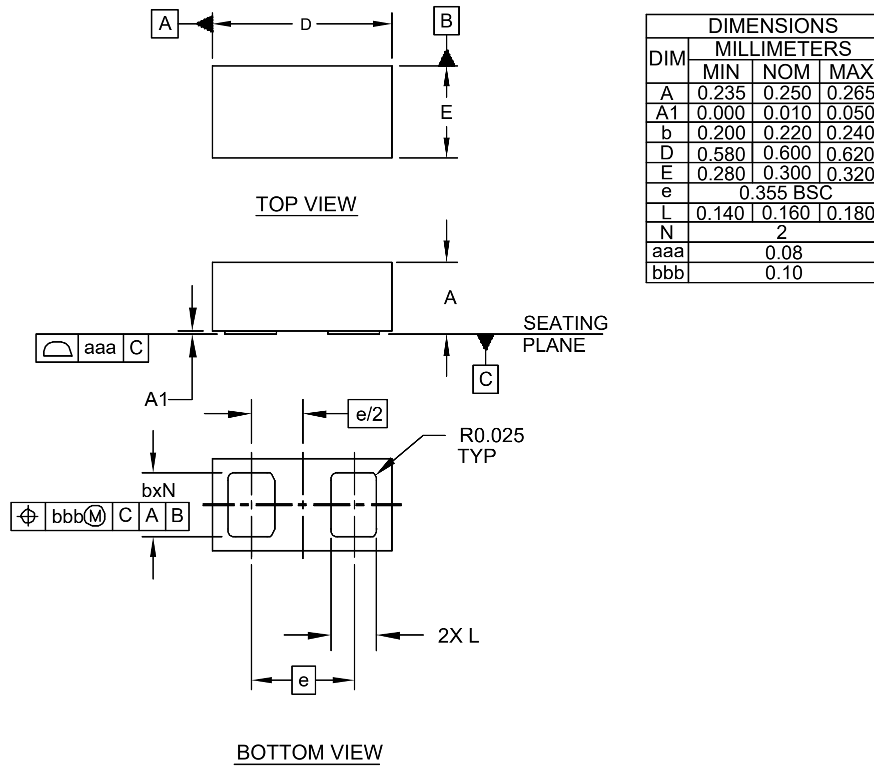
Where:
L = Aperture Length
W = Aperture Width
T = Stencil Thickness

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.

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
PCB Pad Finish	OSP or NiAu

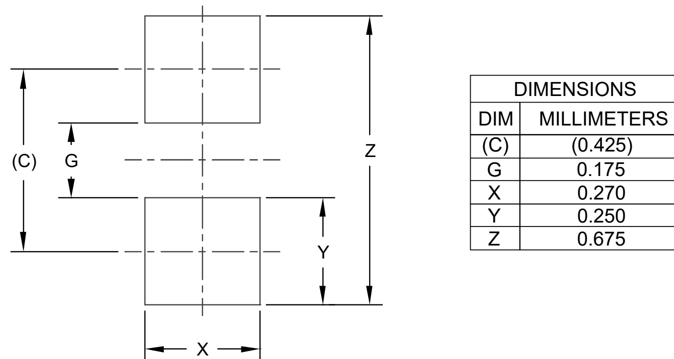
Outline Drawing - DFN 0.60x0.30X0.25mm 2-Lead



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).

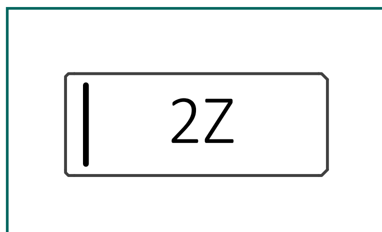
Land Pattern - DFN 0.60x0.30X0.25mm 2-Lead



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



Note:
Bar indicates Pin 1 location.

Tape and Reel Specification

Ordering Information

Part Number	Qty per Reel	Reel Size
µClamp2501ZATFT	15,000	7″

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