µClamp2501T
Low Voltage µClamp®
2.5V TVS Diode

PROTECTION PRODUCTS

Description

The µClamp® series of Transient Voltage Suppressors (TVS) are designed to replace multilayer varistors (MLVs) in portable applications. They offer superior electrical characteristics such as lower clamping voltage and no device degradation when compared to MLVs. They are designed to protect sensitive semiconductor components from damage or upset due to electrostatic discharge (ESD), lightning, electrical fast transients (EFT), and cable discharge events (CDE).

The µClamp2501T is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage currents and capacitance over silicon avalanche diode processes. They feature a true operating voltage of 2.5V for superior protection when compared to traditional pn junction devices.

The µClamp2501T is in a two-pin, SLP1006P2T package. It measures 1.0 x 0.6 x 0.4mm. The leads are spaced at a pitch of 0.65mm and are finished with lead-free NiPdAu. 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. They may be used to meet the ESD immunity requirements of IEC 61000-4-2 (±20kV air, ±15kV contact discharge). The combination of small size and high ESD surge capability makes them ideal for use in portable applications.

Features

- Transient protection for data lines to
  - IEC 61000-4-2 (ESD) ±20kV (Air), ±15kV (Contact)
  - IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
  - Cable Discharge Event (CDE)
- Ultra-small package (1.0 x 0.6 x 0.4mm)
- Protects one data line
- Low reverse current: <10nA typical (V_R = 2.5V)
- Working voltage: 2.5 V
- Low leakage current
- Solid-state silicon-avalanche technology

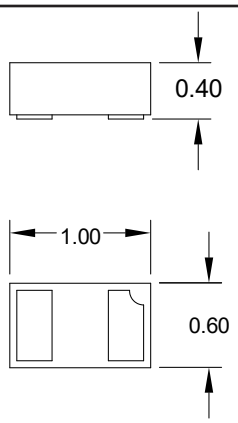
Mechanical Characteristics

- SLP1006P2T package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 1.0 x 0.6 x 0.4 mm
- Lead Finish: NiPdAu
- Molding compound flammability rating: UL 94V-0
- Marking: Marking code, cathode band
- Packaging: Tape and Reel

Applications

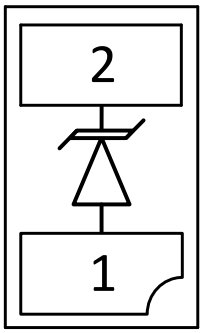
- Cellular Handsets & Accessories
- Portable Instrumentation
- Notebooks & Desktop Computers
- Internet of Things (IOT) Devices

Package Dimension



Nominal Dimensions (mm)

Schematic & Pin Configuration



SLP1006P2T (Bottom View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (t_p = 8/20µs)	P_{PK}	40	W
Maximum Peak Pulse Current (t_p = 8/20µs)	I_{PP}	5	A
ESD per IEC 61000-4-2 (Air)(1) ESD per IEC 61000-4-2 (Contact)(1)	V_{ESD}	±20 ±15	kV
Operating Temperature	T_{OP}	-40 to +85	°C
Storage Temperature	T_{STG}	-55 to +150	°C

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

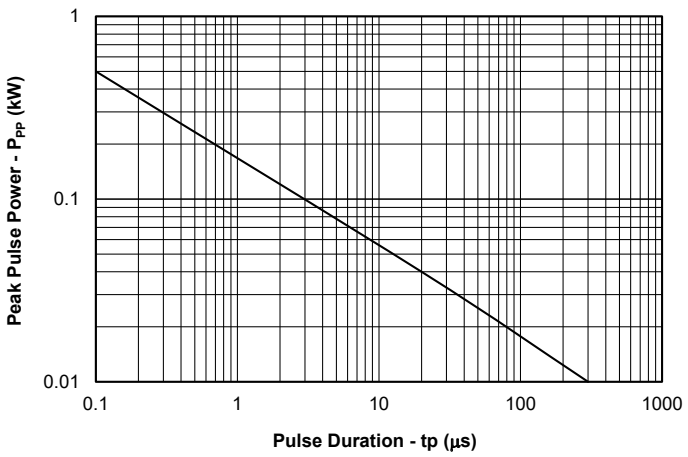
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}				2.5	V
Punch Through Voltage	V_{PT}	I_{PT} = 2µA	2.7	3.1	3.6	V
Snap-Back Voltage	V_{SB}	I_{SB} = 50mA	2.8			V
Reverse Leakage Current	I_R	V_{RWM} = 2.5V		0.01	0.05	µA
Clamping Voltage	V_C	I_{PP} = 1A, t_p = 8/20µs			5	V
		I_{PP} = 5A, t_p = 8/20µs			7.5	
Forward Voltage	V_F	I_{PP} = 1A, t_p = 8/20µs			2.4	
Junction Capacitance	C_J	V_R = 0V, f = 1MHz, Pin 2 to 1		25	30	pF
		V_R = 2.5V, f = 1MHz, Pin 2 to 1		14		

Notes:

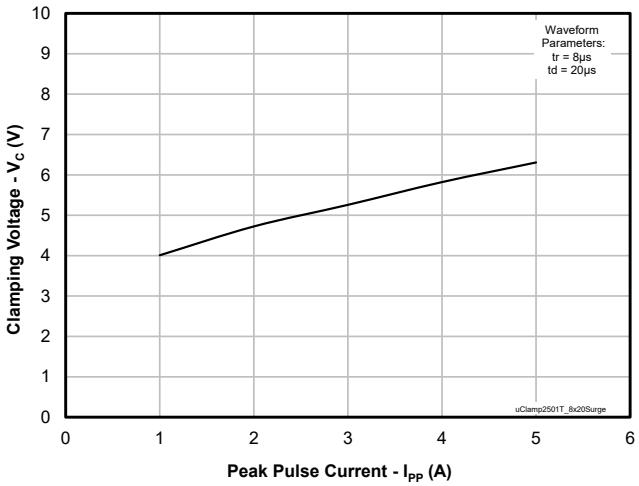
1) ESD gun return path connected to ESD ground plane.

Typical Characteristics

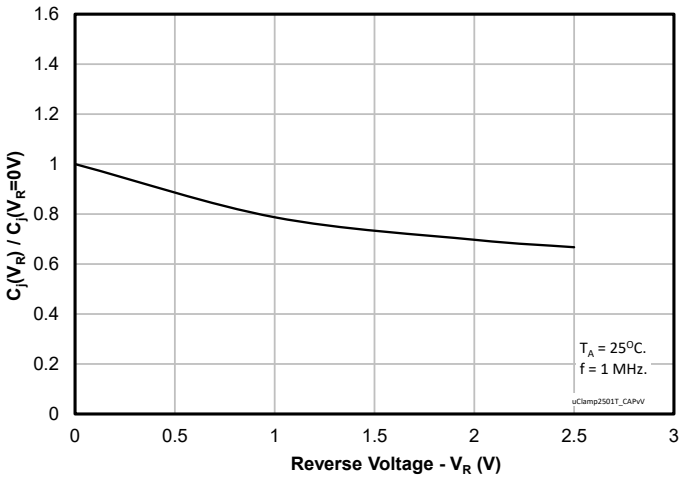
Non-Repetitive Peak Pulse Power vs. Pulse Time



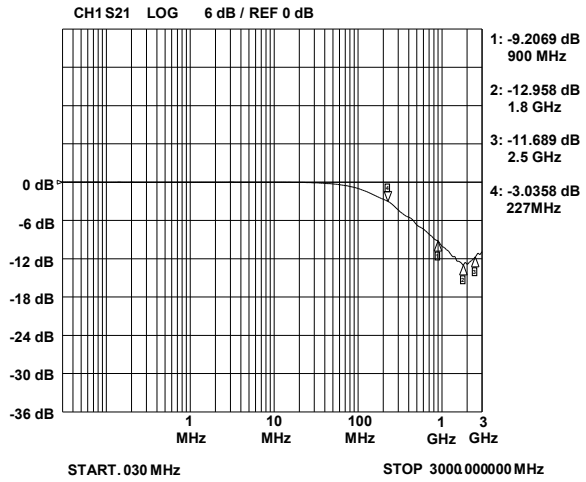
Clamping Voltage vs. Peak Pulse Current (tp=8/20µs)



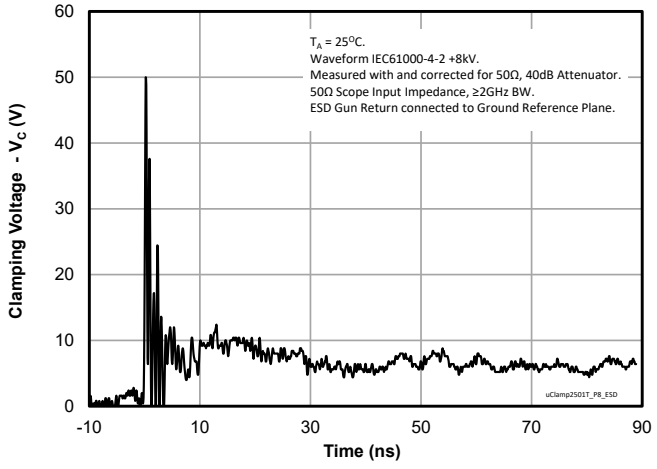
Normalized Capacitance vs. Voltage



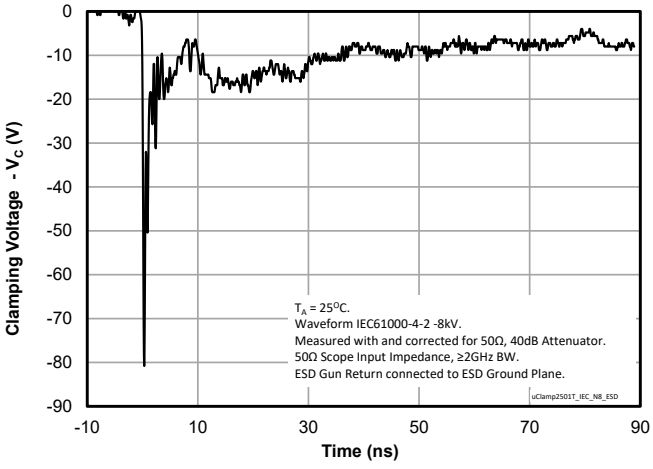
Insertion Loss (S21)



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



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



Application Information

Device Connection Options

The µClamp2501T is designed to protect one data line operating up to 2.5 volts. It will present a high impedance up to 2.5 volts. It will start conducting when the line voltage exceeds 2.7 volts. The device is unidirectional and may be used on lines where the signal polarity is above ground. These devices are not recommended for use on DC power supply lines due to their snap-back voltage characteristic.

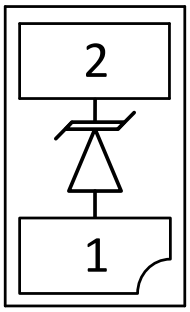


Figure 1 - Device Schematic

EPD TVS Characteristics

These devices are constructed using Semtech's proprietary EPD technology. The structure of the EPD TVS is vastly different from the traditional pn junction devices. At voltages below 5V, high leakage current and junction capacitance render the conventional avalanche technology impractical for most applications. By utilizing the EPD technology, these devices can effectively operate at 2.5V while maintaining excellent electrical characteristics.

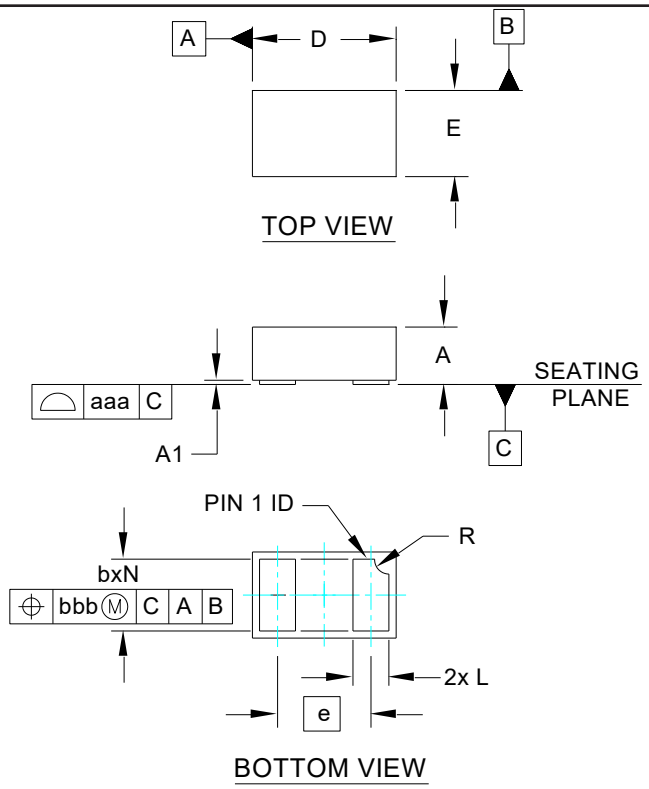
The EPD TVS employs a complex nppn structure in contrast to the pn structure normally found in traditional silicon-avalanche TVS diodes. The EPD mechanism is achieved by engineering the center region of the device such that the reverse biased junction does not avalanche, but will "punch-through" to a conducting state. This structure results in a device with superior DC electrical parameters at low voltages while maintaining the capability to absorb high transient currents.

Circuit Board Layout Recommendations for Suppression of ESD

Good circuit board layout is critical for the suppression of ESD induced transients. The following guidelines are recommended:

- Place the TVS near the input terminals or connectors to restrict transient coupling.
- Minimize the path length between the TVS and the protected line.
- Minimize all conductive loops including power and ground loops.
- The ESD transient return path to ground should be kept as short as possible.
- Never run critical signals near board edges.
- Use ground planes whenever possible.

Outline Drawing - SLP1006P2

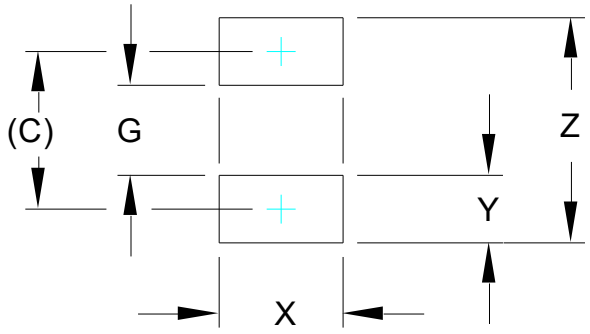


DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.37	0.40	0.43
A1	0.00	0.03	0.05
b	0.45	0.50	0.55
D	0.95	1.00	1.05
E	0.55	0.60	0.65
e	0.65 BSC		
L	0.20	0.25	0.30
R	0.05	0.10	0.15
N	2		
aaa	0.08		
bbb	0.10		

NOTES:

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

Land Pattern - SLP1006P2

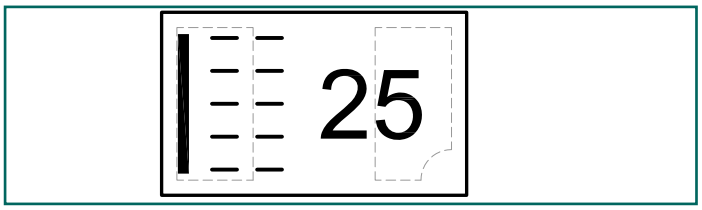


DIMENSIONS	
DIM	MILLIMETERS
C	(0.70)
G	0.40
X	0.55
Y	0.30
Z	1.00

NOTES:

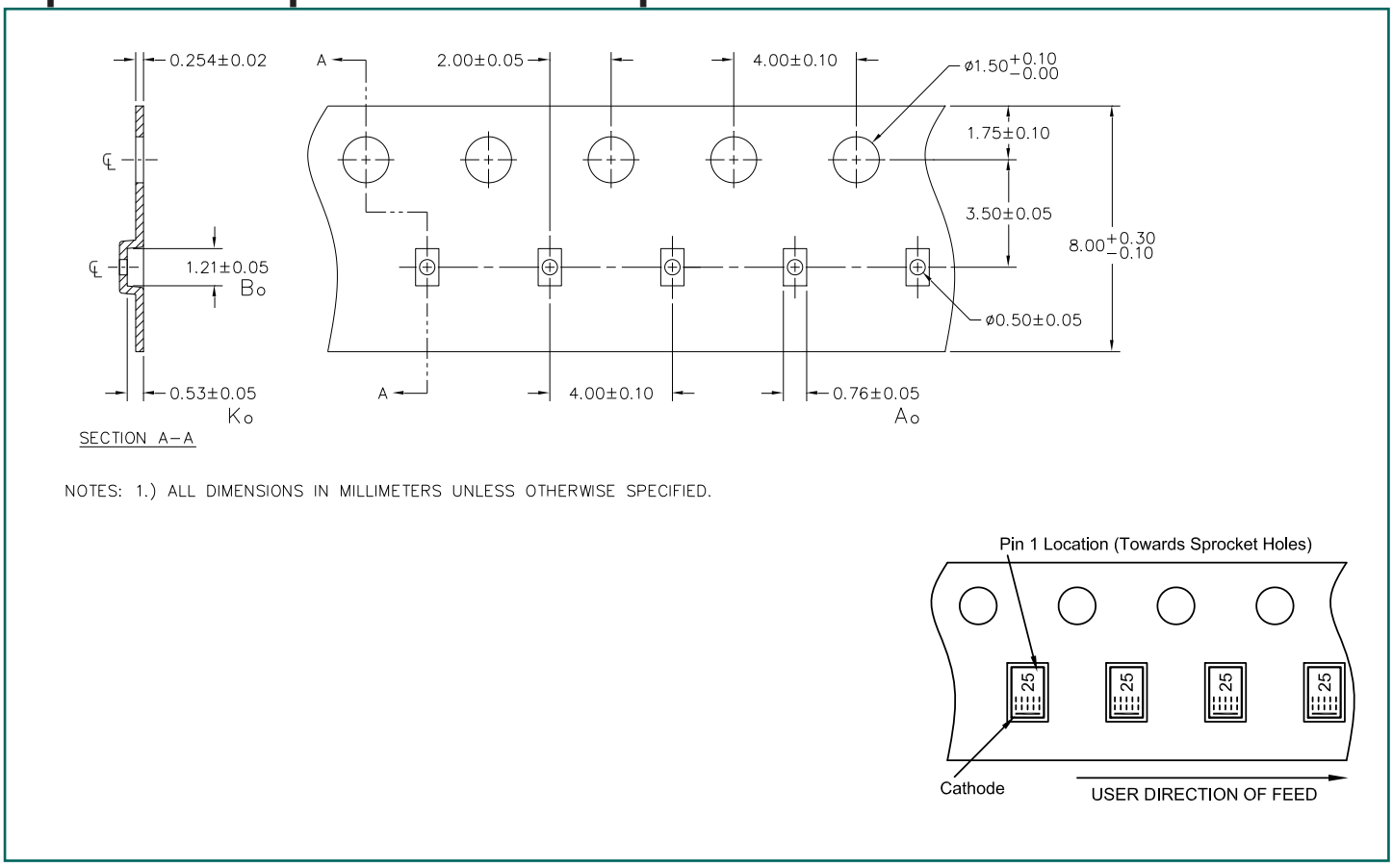
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

Marking Code



Notes:
1. Chamfer indicated Pin 1.
2. Bar indicates Pin 2 Cathode location.

Tape and Reel Specification: uClamp2501T.TCT



Ordering Information

Part Number	Qty per Reel	Reel Size
uClamp2501T.TCT	3,000	7″

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