

#### PROTECTION PRODUCTS - MicroClamp™

#### Description

The  $\mu$ Clamp™ series of TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD. It is designed to replace multilayer varistors (MLVs) in portable applications such as cell phones, notebook computers, and other portable electronics. It features large cross-sectional area junctions for conducting high transient currents. They offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

The  $\mu$ Clamp™0511T is in a 2-pin, RoHS/WEEE compliant, SLP1006P2T package. It measures 1.0 x 0.6 mm with a nominal height of only 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 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, Level 4 ( $\pm 15$ kV air,  $\pm 8$ kV contact discharge). 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 MP3 players.

#### Features

- ◆ Transient protection for data lines to **IEC 61000-4-2 (ESD)  $\pm 15$ kV (air),  $\pm 8$ kV (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 or power line
- ◆ Low reverse current: 3nA typical (VR=3.3V)
- ◆ Working voltage: - 5V / +5V
- ◆ Low capacitance: 4pF typical
- ◆ Solid-state silicon-avalanche technology

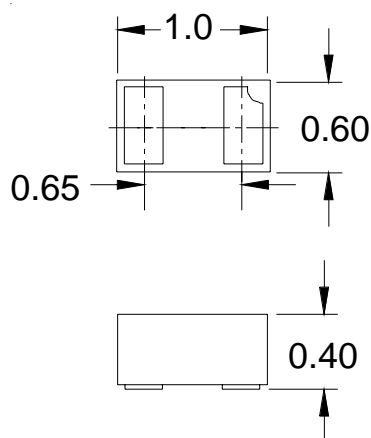
#### Mechanical Characteristics

- ◆ SLP1006P2T package
- ◆ 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

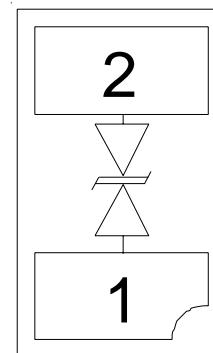
- ◆ Cellular Handsets & Accessories
- ◆ Keypads, Side Keys, USB 2.0, LCD Displays
- ◆ Notebooks & Desktop Computers
- ◆ Portable Instrumentation
- ◆ Digital Cameras
- ◆ Peripherals
- ◆ MP3 Players

#### Dimensions



Nominal Dimensions (mm)

#### Schematic & PIN Configuration



SLP1006P2T (Bottom View)

## PROTECTION PRODUCTS

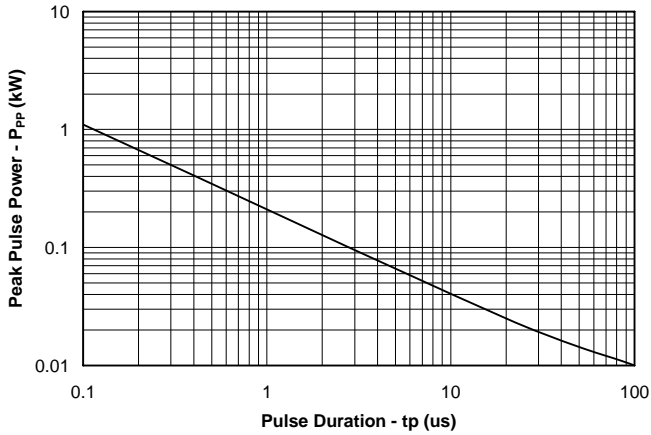
### Absolute Maximum Rating

| Rating                                                         | Symbol    | Value           | Units |
|----------------------------------------------------------------|-----------|-----------------|-------|
| ESD per IEC 61000-4-2 (Air)<br>ESD per IEC 61000-4-2 (Contact) | $V_{ESD}$ | +/- 15<br>+/- 8 | kV    |
| Operating Temperature                                          | $T_J$     | -55 to +125     | °C    |
| Storage Temperature                                            | $T_{STG}$ | -55 to +150     | °C    |

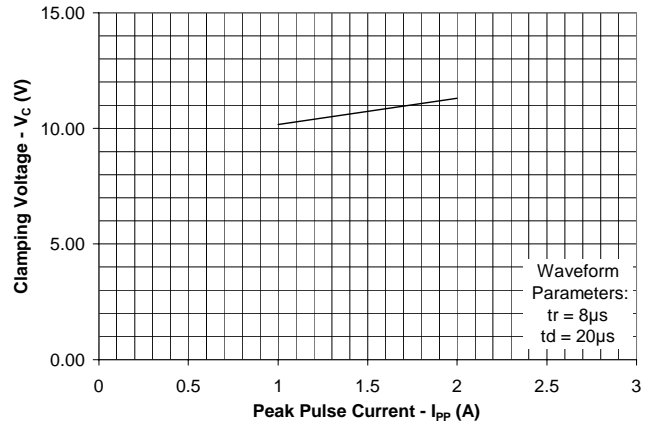
### Electrical Characteristics (T=25°C)

| Parameter                 | Symbol    | Conditions                                             | Minimum | Typical | Maximum | Units |
|---------------------------|-----------|--------------------------------------------------------|---------|---------|---------|-------|
| Reverse Stand-Off Voltage | $V_{RWM}$ | Pin 1 to 2 or 2 to 1                                   |         |         | 5       | V     |
| Reverse Breakdown Voltage | $V_{BR}$  | $I_t = 1mA$<br>Pin 1 to 2 or 2 to 1                    | 6       | 8.2     | 9.5     | V     |
| Reverse Leakage Current   | $I_R$     | $V_{RWM} = 3.3V, T=25^\circ C$<br>Pin 1 to 2 or 2 to 1 |         | 3       | 50      | nA    |
| Clamping Voltage          | $V_C$     | $I_{PP} = 2A, t_p = 8/20\mu s$<br>Pin 1 to 2 or 2 to 1 |         |         | 15      | V     |
| Junction Capacitance      | $C_J$     | $V_R = 0V, f = 1MHz$                                   |         | 4       | 7       | pF    |

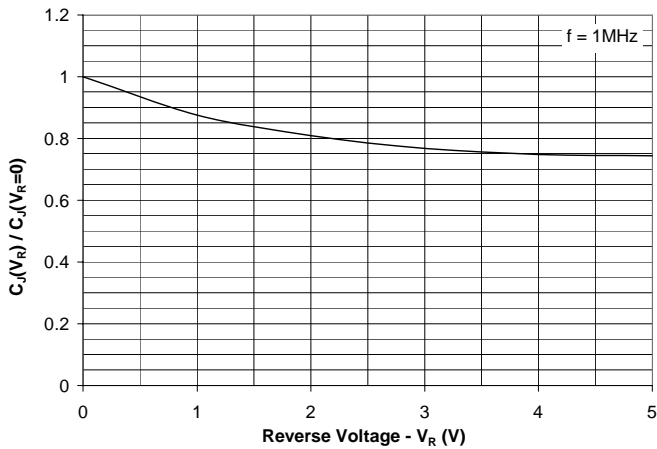
Non-Repetitive Peak Pulse Power vs. Pulse Time



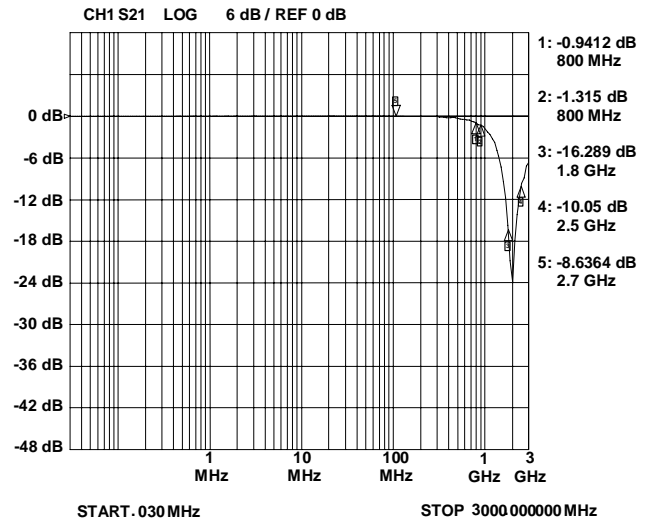
Clamping Voltage vs. Peak Pulse Current



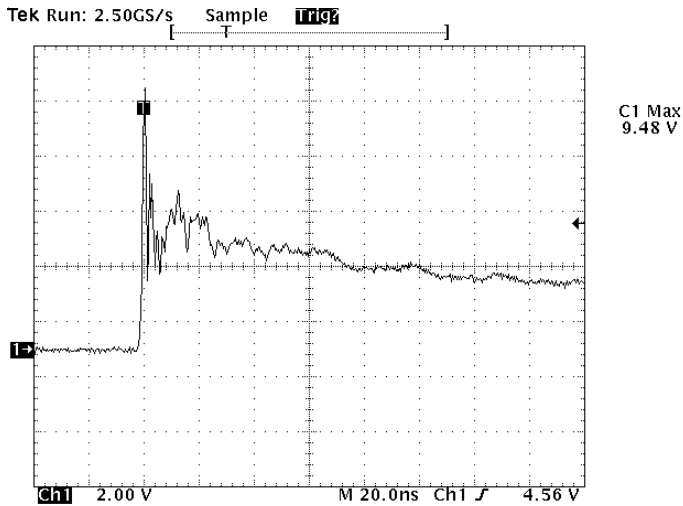
Normalized Junction Capacitance vs. Reverse Voltage



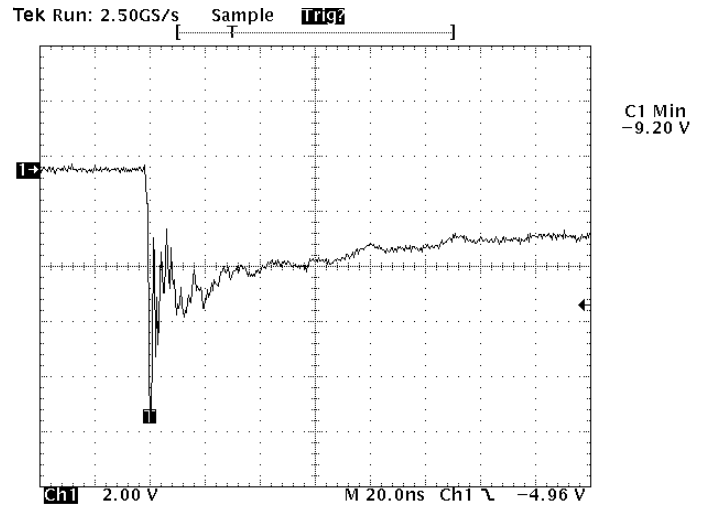
Typical Insertion Loss (S21)



ESD Clamping (Pin 1 to 2 and 2 to 1)  
(8kV Contact per IEC 61000-4-2)



ESD Clamping (Pin 1 to 2 and 2 to 1)  
(-8kV Contact per IEC 61000-4-2)



Note: Data is taken with a 10x attenuator

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**PROTECTION PRODUCTS****Applications Information****Device Connection Options**

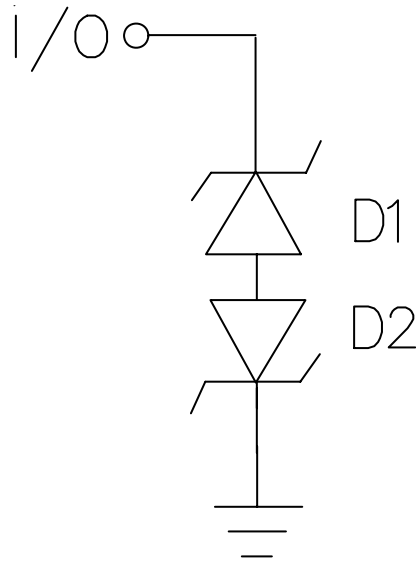
These TVS diodes are designed to protect one data, I/O, or power supply line. The device is bidirectional and may be used on lines where the signal polarity can go above and below ground.

**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.

**Circuit Diagram**

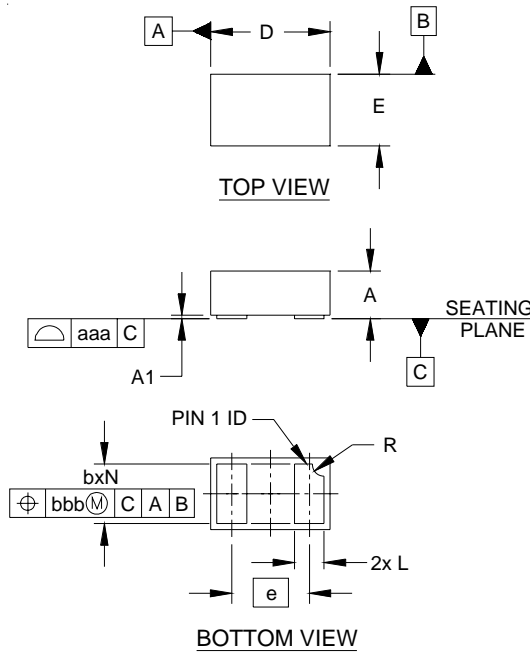


**uClamp0511T Spice Model**

| <b>uClamp0511T Spice Parameters</b> |             |                 |                 |
|-------------------------------------|-------------|-----------------|-----------------|
| <b>Parameter</b>                    | <b>Unit</b> | <b>D1 (TVS)</b> | <b>D2 (TVS)</b> |
| IS                                  | Amp         | 2.05E-15        | 2.05E-15        |
| BV                                  | Volt        | 7               | 7               |
| VJ                                  | Volt        | 0.8             | 0.8             |
| RS                                  | Ohm         | 0.83            | 0.83            |
| IBV                                 | Amp         | 1E-3            | 1E-3            |
| CJO                                 | Farad       | 3E-12           | 3E-12           |
| TT                                  | sec         | 2.541E-9        | 2.541E-9        |
| M                                   | --          | 0.25            | 0.25            |
| N                                   | --          | 1.1             | 1.1             |
| EG                                  | eV          | 1.11            | 1.11            |

**PROTECTION PRODUCTS**

**Outline Drawing - SLP1006P2T**

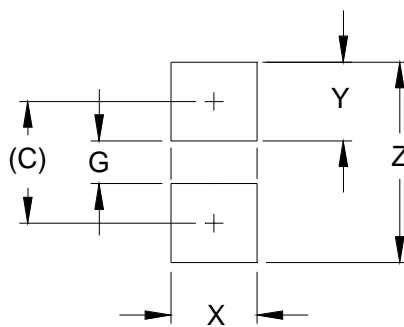


| DIM | DIMENSIONS |      |      |             |      |      |
|-----|------------|------|------|-------------|------|------|
|     | INCHES     |      |      | MILLIMETERS |      |      |
|     | MIN        | NOM  | MAX  | MIN         | NOM  | MAX  |
| A   | .015       | .016 | .017 | 0.37        | 0.40 | 0.43 |
| A1  | .000       | .001 | .002 | 0.00        | 0.03 | 0.05 |
| b   | .018       | .020 | .022 | 0.45        | 0.50 | 0.55 |
| D   | .035       | .039 | .043 | 0.90        | 1.00 | 1.10 |
| E   | .020       | .024 | .028 | 0.50        | 0.60 | 0.70 |
| e   | .026 BSC   |      |      | 0.65 BSC    |      |      |
| L   | .008       | .010 | .012 | 0.20        | 0.25 | 0.30 |
| R   | .002       | .004 | .006 | 0.05        | 0.10 | 0.15 |
| N   | 2          |      |      | 2           |      |      |
| aaa | .003       |      |      | 0.08        |      |      |
| bbb | .004       |      |      | 0.10        |      |      |

**NOTES:**

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

**Land Pattern - SLP1006P2T**



| DIM | DIMENSIONS |             |
|-----|------------|-------------|
|     | INCHES     | MILLIMETERS |
| C   | (.033)     | (0.85)      |
| G   | .012       | 0.30        |
| X   | .024       | 0.60        |
| Y   | .022       | 0.55        |
| Z   | .055       | 1.40        |

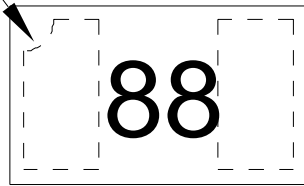
**NOTES:**

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.

## PROTECTION PRODUCTS

### Marking Code

PIN 1 ID



### Ordering Information

| Part Number     | Working Voltage | Qty per Reel | Reel Size |
|-----------------|-----------------|--------------|-----------|
| uClamp0511T.TCT | 5V              | 3,000        | 7 Inch    |

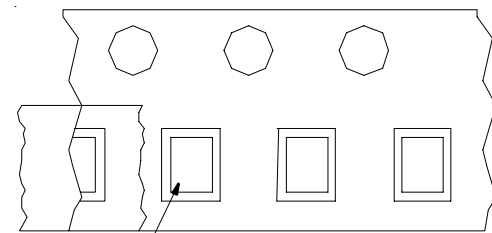
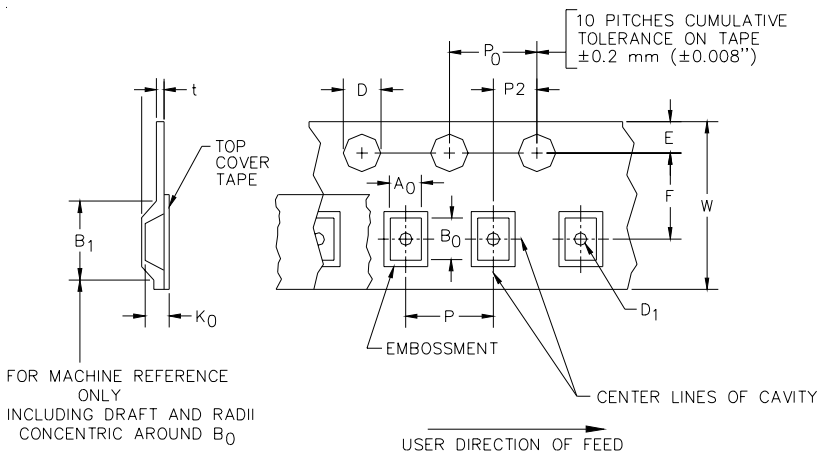
Notes:

1) This is a lead-free, RoHS/WEEE compliant product  
MicroClamp, uClamp and  $\mu$ Clamp are marks of Semtech Corporation

Notes:

1) Device is electrically symmetrical

### Tape and Reel Specification



Pin 1 Location

User Direction of feed

### Device Orientation in Tape

| A0              | B0              | K0              |
|-----------------|-----------------|-----------------|
| 0.69 +/-0.10 mm | 1.19 +/-0.10 mm | 0.66 +/-0.10 mm |

| Tape Width | B, (Max)      | D                                         | D1                  | E                        | F                       | P                       | P0                     | P2                      | T                    | W                                    |
|------------|---------------|-------------------------------------------|---------------------|--------------------------|-------------------------|-------------------------|------------------------|-------------------------|----------------------|--------------------------------------|
| 8 mm       | 4.2 mm (.165) | 1.5 + 0.1 mm - 0.0 mm (0.59 +.005 - .000) | 0.4 mm ±0.25 (.031) | 1.750±.10 mm (.069±.004) | 3.5±0.05 mm (.138±.002) | 4.0±0.10 mm (.157±.004) | 4.0±0.1 mm (.157±.004) | 2.0±0.05 mm (.079±.002) | 0.254±0.02 mm (.016) | 8.0 mm + 0.3 mm - 0.1 mm (.312±.012) |

### Contact Information for Semtech International AG

|                                                                                                                        |                                              |                                                  |                                                    |
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| Semtech International AG is a wholly-owned subsidiary of Semtech Corporation, which has its headquarters in the U.S.A. |                                              | <b>Semtech Germany GmbH</b>                      | Tel: 49-(0)8161-140-123<br>Fax: 49-(0)8161-140-124 |