



**THE DATASHEET OF  
RCLAMP3328P.TZT**



#### PROTECTION PRODUCTS - RailClamp®

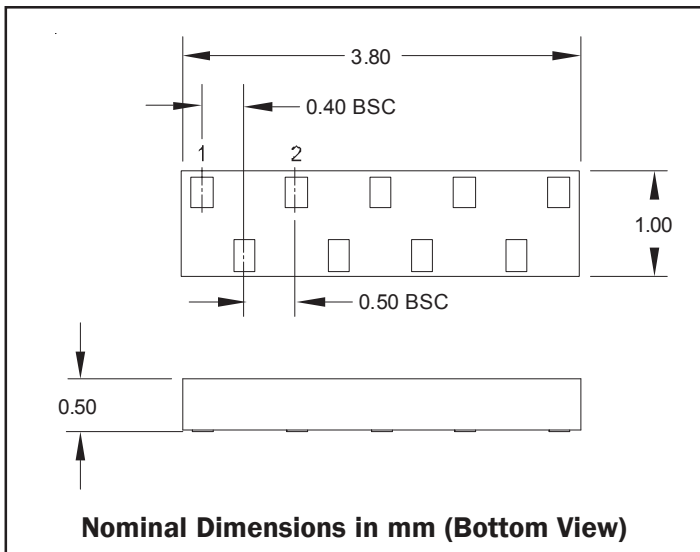
#### Description

The RClamp®3328P provides low voltage ESD protection for high-speed ports. It features a high maximum ESD withstand voltage of  $\pm 25\text{kV}$  contact and  $\pm 30\text{kV}$  air discharge per IEC 61000-4-2. RClamp3328P is designed to minimize both the ESD peak clamping and the TLP clamping. Peak ESD clamping voltage is extremely low and approximately the same at each pin. The dynamic resistance is among the industry's lowest at 0.35 Ohms (typical). Maximum capacitance on each line to ground is 0.65pF. This allows the RClamp3328P to be used in applications operating in excess of 5GHz without signal attenuation. These devices are manufactured using Semtech's proprietary low voltage EPD technology for superior characteristics at operating voltages up to 3.3 volts. Each device will protect up to eight lines (four high-speed pairs).

The RClamp3328P is in a 9-pin SGP3810N9 package. It measures 3.8 x 1.0mm with a nominal height of 0.50mm. Intra-pair lead pitch is 0.40mm while the pair-to-pair pitch is 0.5mm. The innovative flow through package design simplifies pcb layout and allows matched trace lengths for consistent impedance between high speed differential lines.

The combination of low peak ESD clamping, low dynamic resistance, and innovative package design enables this device provides the highest level of ESD protection for applications such as USB 3.0, HDMI and V-By-One interfaces.

#### Dimensions



#### Features

- ◆ ESD protection for high-speed data lines to **IEC 61000-4-2 (ESD)  $\pm 30\text{kV}$  (air),  $\pm 25\text{kV}$  (contact)**
- ◆ **IEC 61000-4-5 (Lightning) 5A (8/20 $\mu\text{s}$ )**
- ◆ **IEC 61000-4-4 (EFT) 40A (5/50ns)**
- ◆ Package design optimized for high speed lines
- ◆ Flow-Through design
- ◆ Protects eight high-speed lines
- ◆ Low capacitance: **0.65pF** Maximum (I/O to Ground)
- ◆ Low ESD clamping voltage
- ◆ Low dynamic resistance: 0.35 Ohms (Typ)
- ◆ Solid-state silicon-avalanche technology

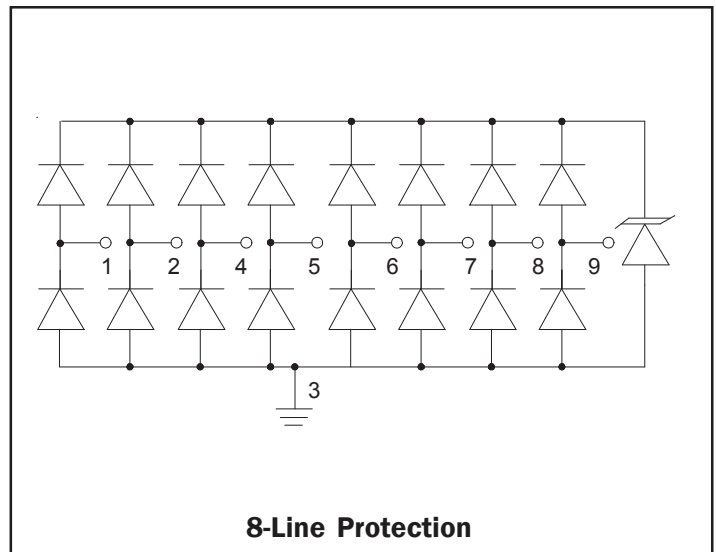
#### Mechanical Characteristics

- ◆ SGP3810N9 9-pin package (3.8 x 1.0 x 0.50mm)
- ◆ Pb-Free, Halogen Free, RoHS/WEEE Compliant
- ◆ Lead Pitch: 0.4mm (intra-pair), 0.50mm (pair-to-pair)
- ◆ Lead finish: NiPdAu
- ◆ Marking: Marking Code
- ◆ Packaging: Tape and Reel

#### Applications

- ◆ HDMI 1.3/1.4
- ◆ V-By-One
- ◆ USB 3.0
- ◆ eDP
- ◆ MHL
- ◆ LVDS Interfaces
- ◆ eSATA Interfaces

#### Circuit Diagram



**PROTECTION PRODUCTS**
**Absolute Maximum Rating**

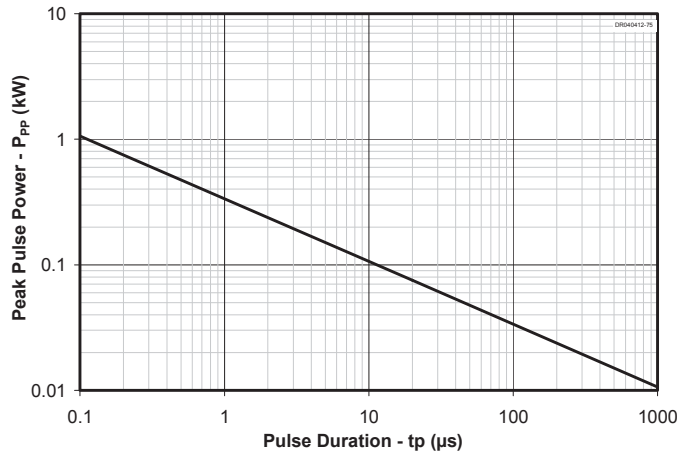
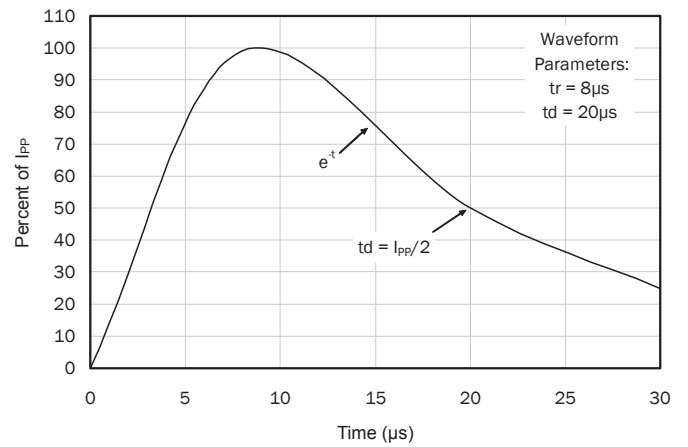
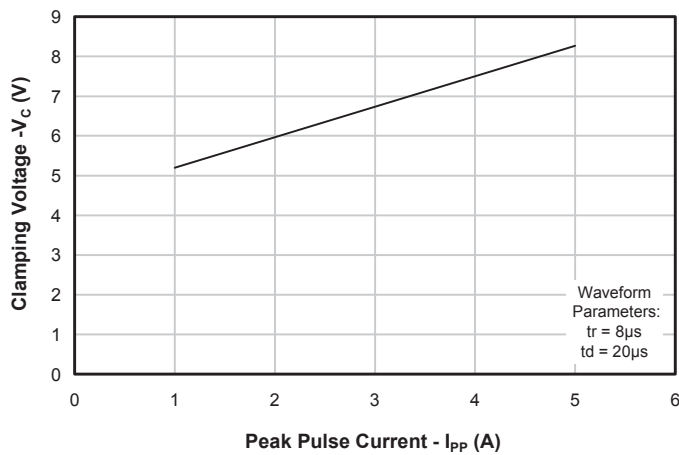
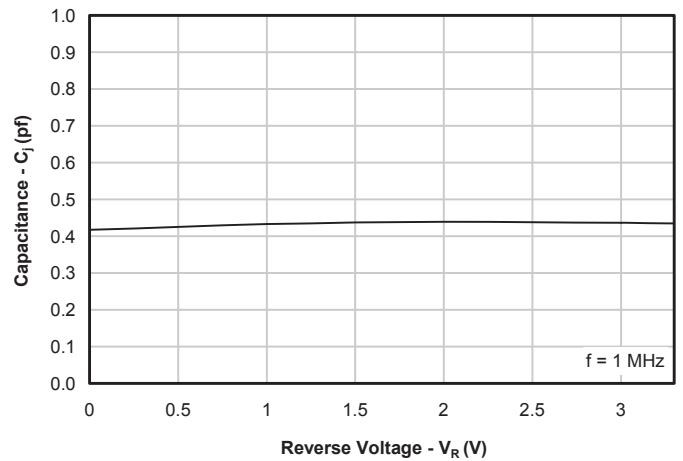
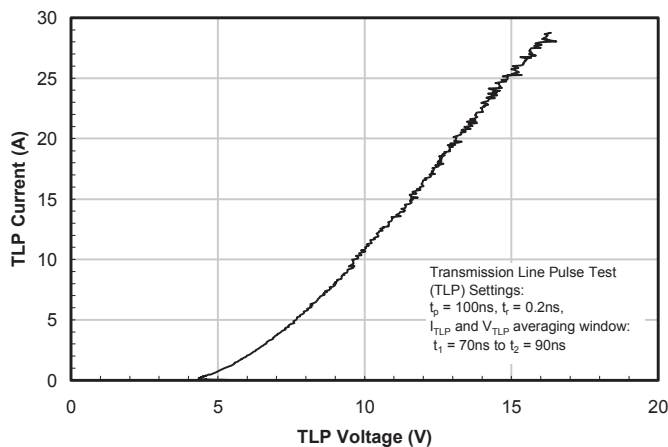
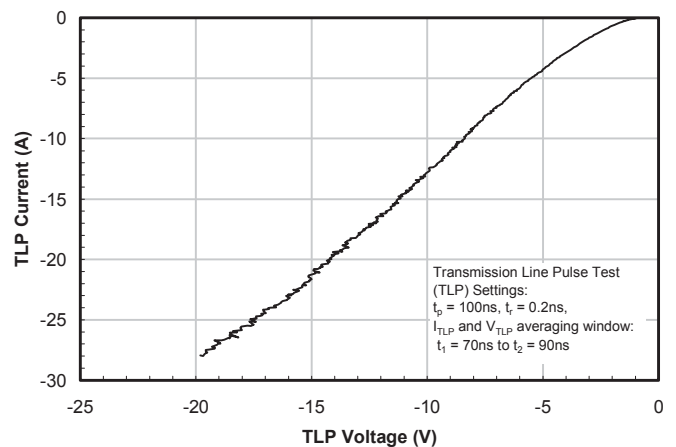
| Rating   | Symbol    | Value            | Units |
|--|-----------|------------------|-------|
| Peak Pulse Power (tp = 8/20μs)   | $P_{pk}$  | 75               | Watts |
| Peak Pulse Current (tp = 8/20μs)   | $I_{pp}$  | 5                | A     |
| ESD per IEC 61000-4-2 (Air) <sup>1</sup><br>ESD per IEC 61000-4-2 (Contact) <sup>1</sup> | $V_{ESD}$ | +/- 30<br>+/- 25 | kV    |
| Operating Temperature  | $T_J$     | -55 to +125      | °C    |
| Storage Temperature  | $T_{STG}$ | -55 to +150      | °C    |

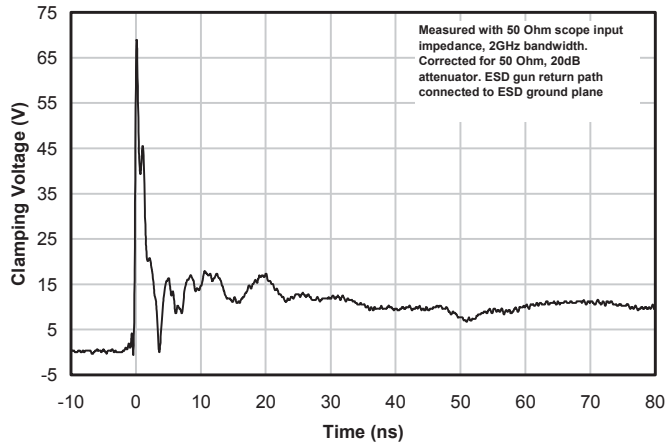
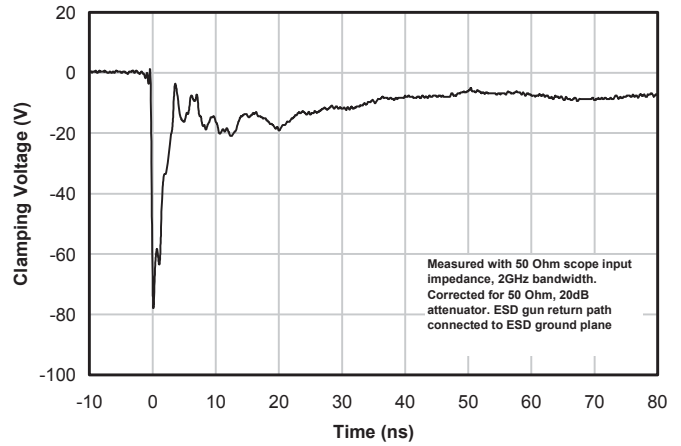
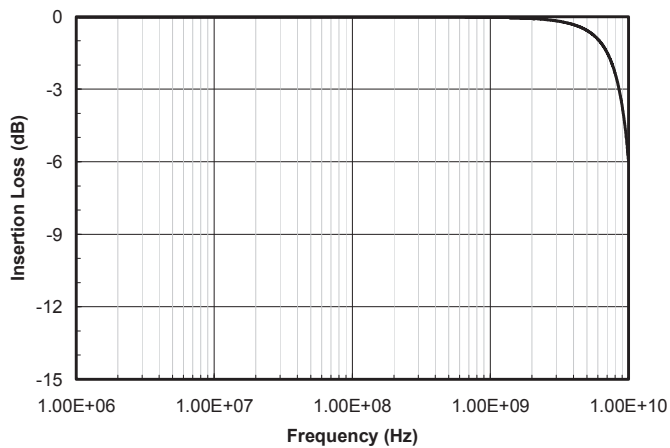
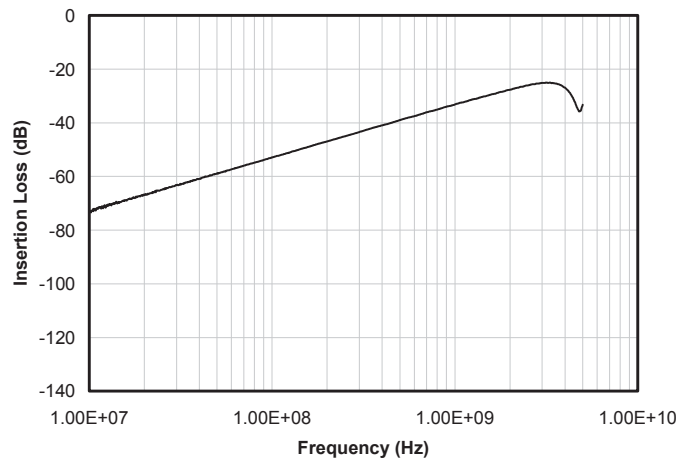
**Electrical Characteristics (T=25°C)**

| Parameter                                    | Symbol    | Conditions                                    | Minimum | Typical | Maximum | Units |
|--|-----------|---|---------|---------|---------|-------|
| Reverse Stand-Off Voltage                    | $V_{RWM}$ | Any I/O to GND                                |         |         | 3.3     | V     |
| Punch-Through Voltage                        | $V_{PT}$  | $I_{PT} = 2\mu A$<br>Any I/O to GND           | 3.8     | 4.8     | 5.5     | V     |
| Reverse Leakage Current                      | $I_R$     | $V_{RWM} = 3.3V$ ,<br>Any I/O to GND          |         | 0.005   | 0.100   | μA    |
| Clamping Voltage                             | $V_C$     | $I_{pp} = 1A$ , tp = 8/20μs<br>Any I/O to GND |         | 5.2     | 7       | V     |
| Clamping Voltage                             | $V_C$     | $I_{pp} = 5A$ , tp = 8/20μs<br>Any I/O to GND |         | 8.2     | 10.5    | V     |
| ESD Clamping Voltage <sup>2</sup>            | $V_C$     | IPP = 16A,<br>t1p = 0.2/100ns                 |         | 11.8    |         | V     |
| ESD Clamping Voltage <sup>2</sup>            | $V_C$     | IPP = -16A,<br>t1p = 0.2/100ns                |         | 11.7    |         | V     |
| Dynamic Resistance (Positive) <sup>2,3</sup> | $R_D$     | tp = 100ns                                    |         | 0.35    |         | Ohms  |
| Dynamic Resistance(negative) <sup>2,3</sup>  | $R_D$     | tp = 100ns                                    |         | 0.50    |         | Ohms  |
| Junction Capacitance                         | $C_J$     | $V_R = 0V$ , f = 1MHz,<br>Any I/O to GND      |         | 0.40    | 0.65    | pF    |
|  |           | $V_R = 0V$ , f = 1MHz,<br>Between I/O pins    |         | 0.30    | 0.4     | 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:  $t_p = 100ns$ ,  $t_r = 0.2ns$ ,  $I_{TLP}$  and  $V_{TLP}$  averaging window:  $t_1 = 70ns$  to  $t_2 = 90ns$ .
- 3) Dynamic resistance calculated from  $I_{TLP} = 4A$  to  $I_{TLP} = 16A$

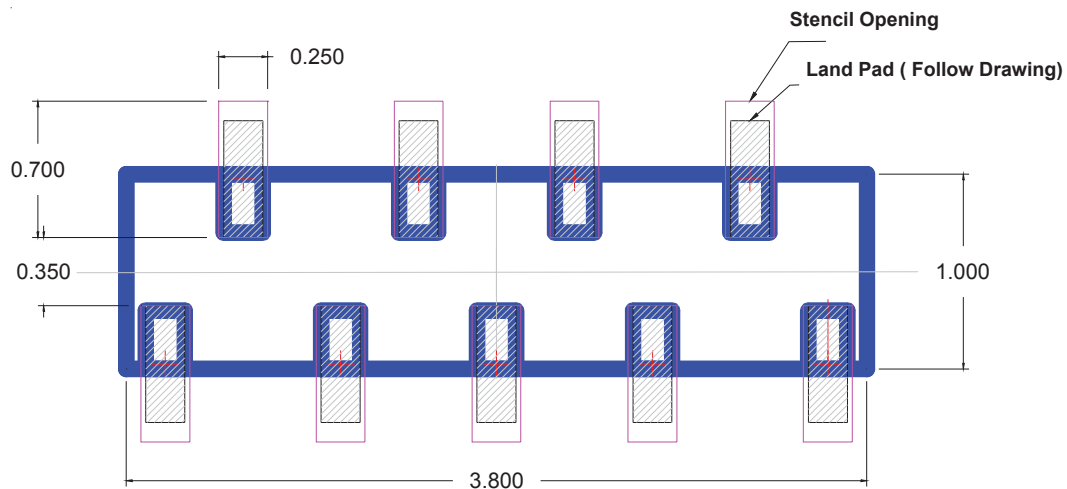
**PROTECTION PRODUCTS**
**Typical Characteristics**
**Non-Repetitive Peak Pulse Power vs. Pulse Time**

**8/20us Pulse Waveform**

**Clamping Voltage vs. Peak Pulse Current  
(Between any I/O and Ground)**

**Junction Capacitance vs. Reverse Voltage  
(Between any I/O and Ground)**

**TLP Characteristic (Positive)**

**TLP Characteristic (Negative)**


**PROTECTION PRODUCTS**
**Typical Characteristics (Con't)**
**ESD Clamping (+8kV Contact per IEC 61000-4-2)  
(Between any I/O and Ground)**

**ESD Clamping (-8kV Contact per IEC 61000-4-2)  
(Between any I/O and Ground)**

**Typical Insertion Loss S21**

**Analog Crosstalk**


**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. Semtech's recommended assembly guidelines for mounting this device are shown in the Table. The figure below 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.

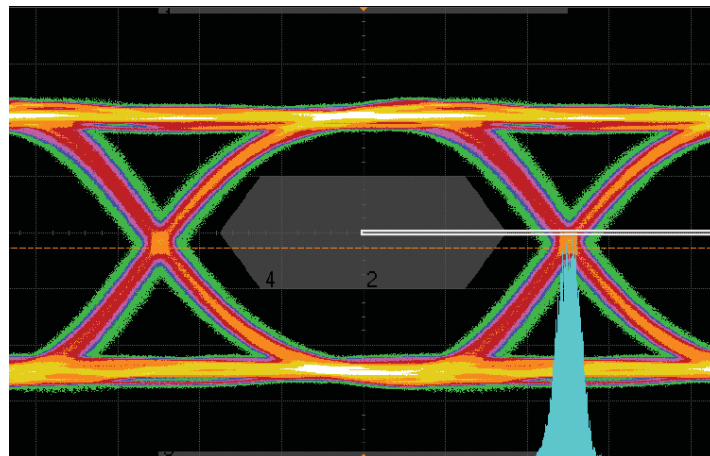
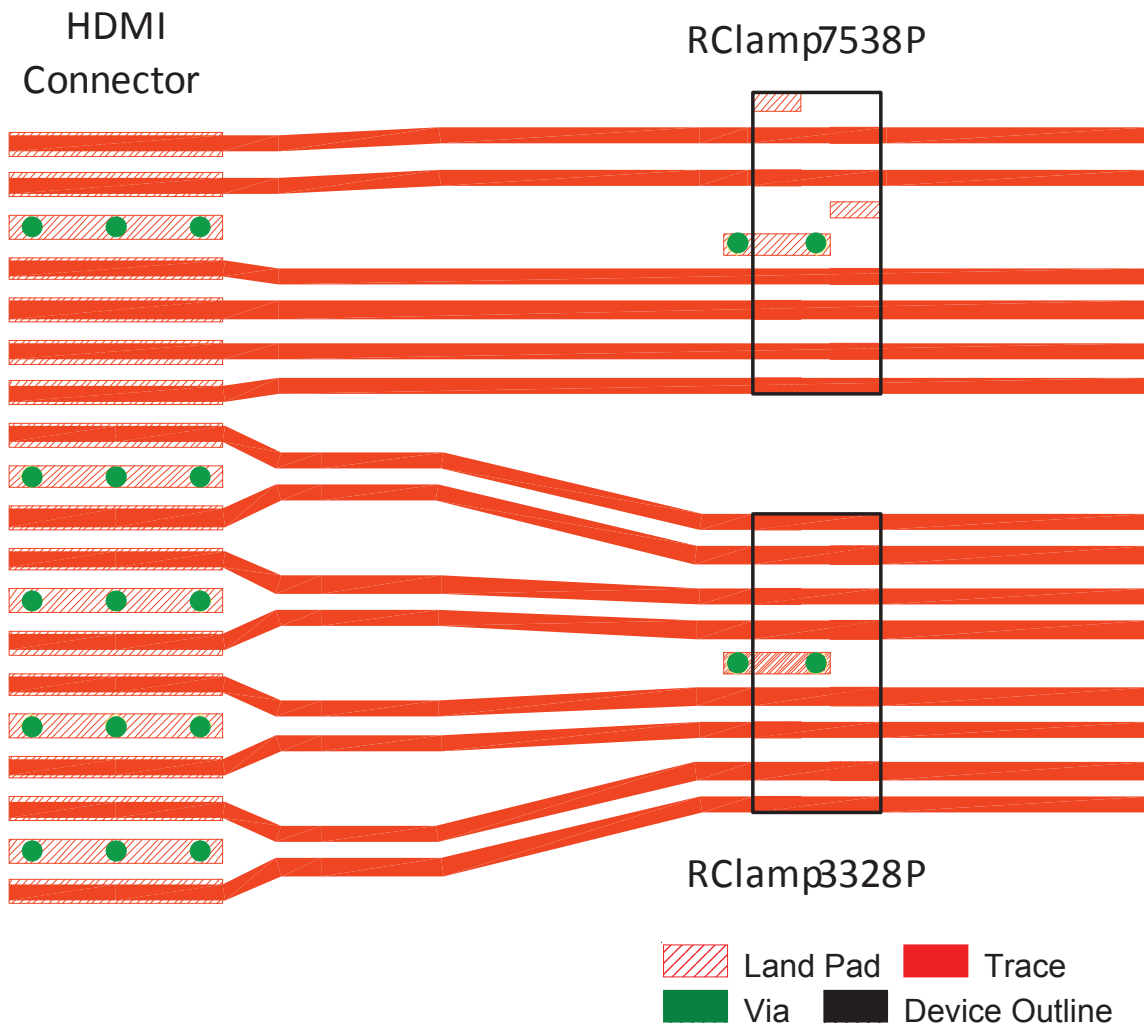
| Assembly Parameter       | Recommendation                   |
|--------------------------|----------------------------------|
| Solder Stencil Design    | Laser cut, Electro-polished      |
| Aperture shape           | Rectangular with rounded corners |
| Solder Stencil Thickness | 0.100 mm (0.004")                |
| 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                      |

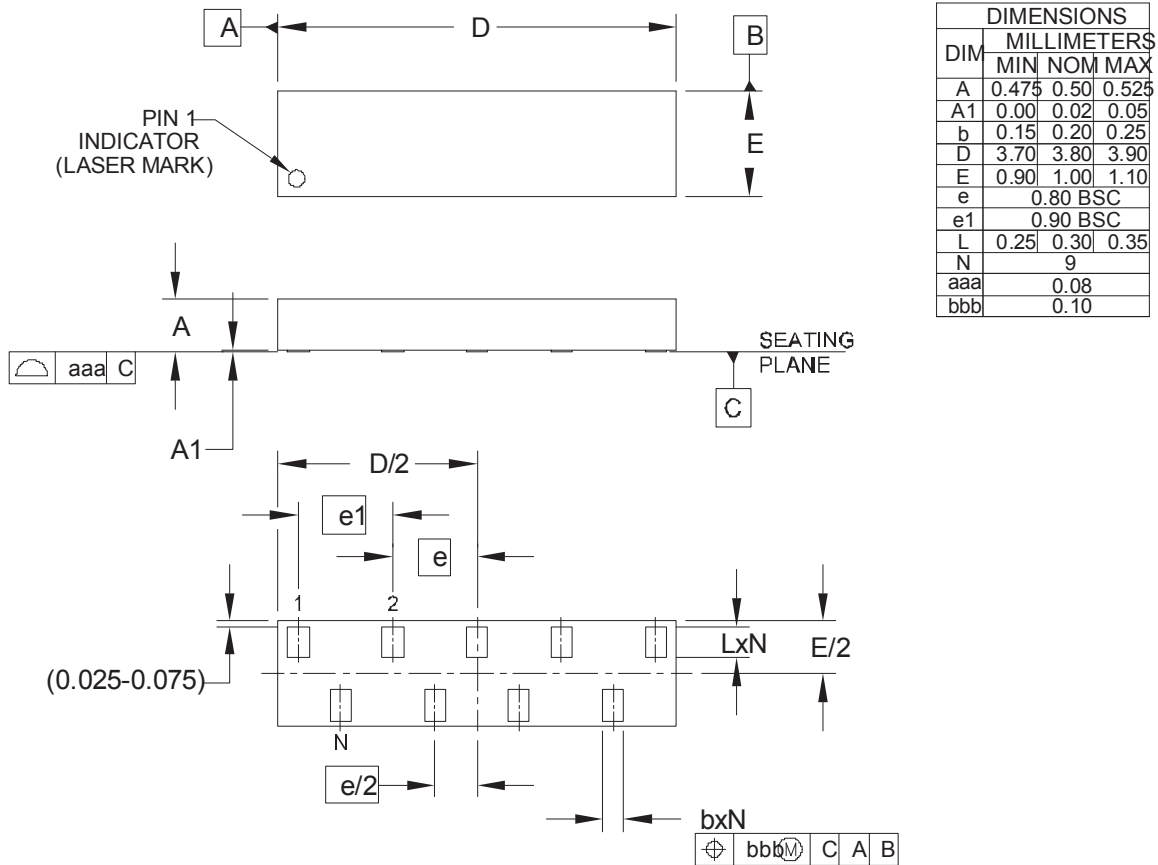


All Dimensions are in mm.

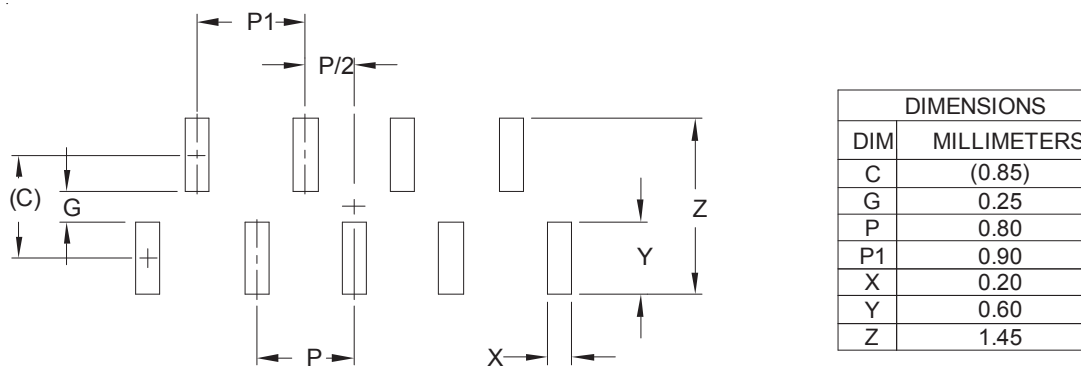
 Land Pad.  
  Stencil opening  
  Component

**Recommended Mounting Pattern**

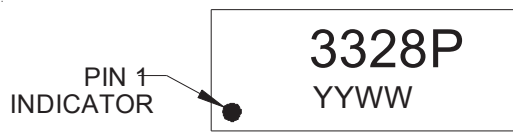

**HDMI 1.4 Layout and Eye Diagram with RClamp3328P**

**PROTECTION PRODUCTS**
**Outline Drawing - SGP3810N9**


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

**Land Pattern - SGP3810N9**


- 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

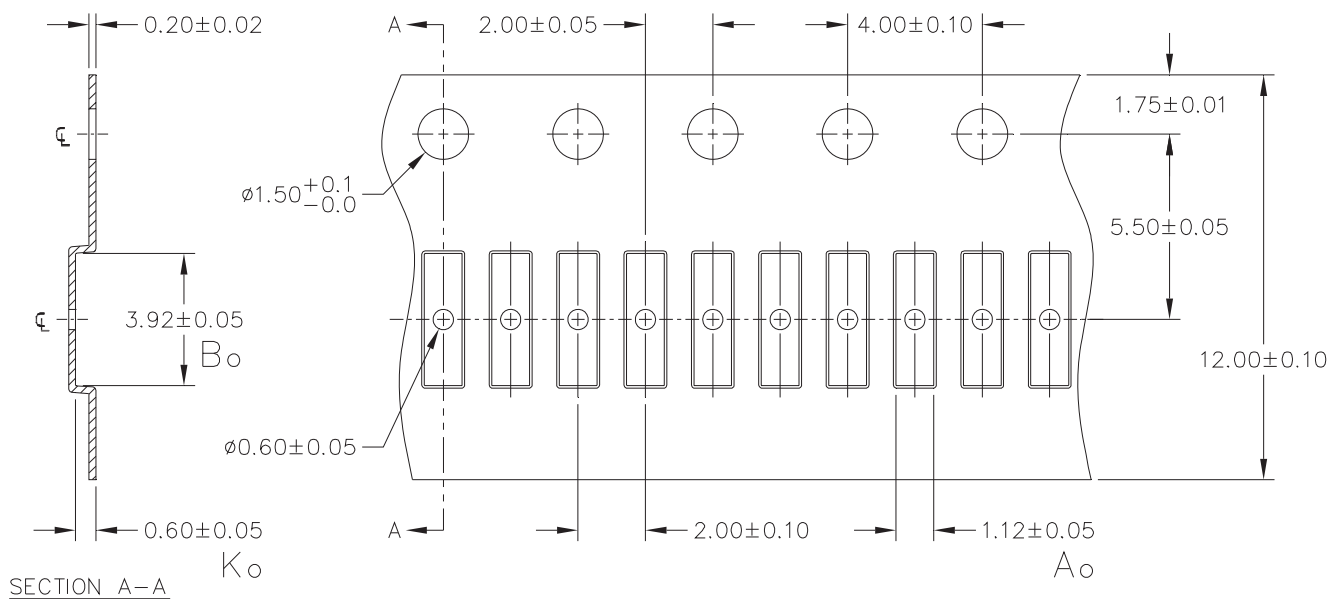
**PROTECTION PRODUCTS**
**Marking Code**


YYWW = Date Code

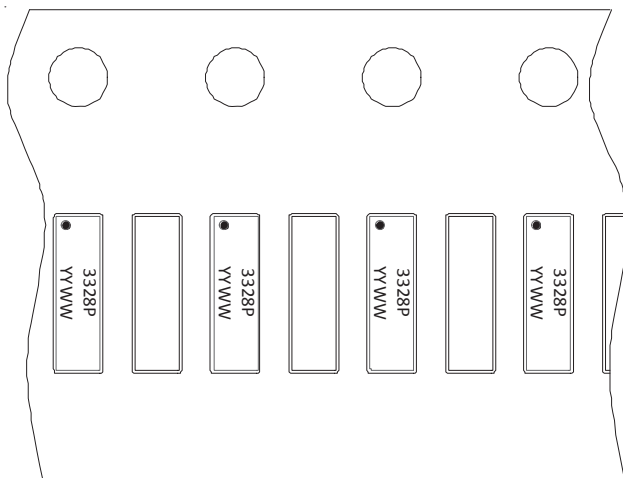
**Ordering Information**

| Part Number     | Qty per Reel | Device to Device Pitch | Reel Size |
|-----------------|--------------|------------------------|-----------|
| RClamp3328P.TZT | 5,000        | 4mm                    | 7 Inch    |
| RClamp3328P.TNT | 10,000       | 2mm                    | 7 Inch    |

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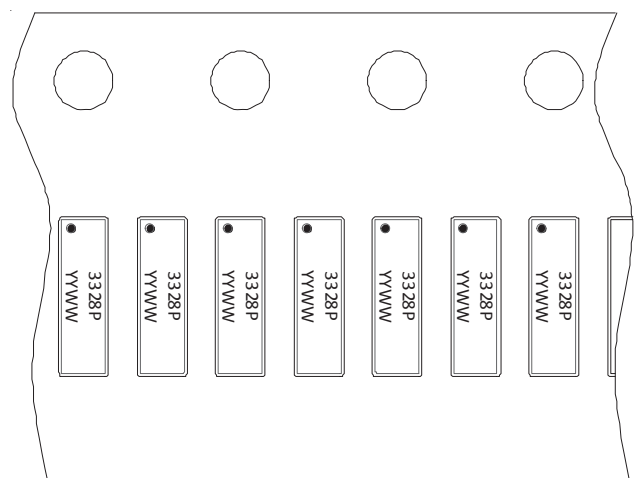
**Carrier Tape Specification**


NOTE: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



Notes:

- 1) Pin 1 towards sprocket holes
- 2) Every other pocket populated

**Device Orientation in Tape (5K Piece Option)**


Notes:

- 1) Pin 1 towards sprocket holes
- 2) Every pocket populated

**Device Orientation in Tape (10K Piece Option)**

**Contact Information**

Semtech Corporation  
Protection Products Division  
200 Flynn Road, Camarillo, CA 93012  
Phone: (805)498-2111 FAX (805)498-3804

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