# RClamp3344T
## Low Voltage RailClamp®
## 4-Line ESD Protection

**PROTECTION PRODUCTS - RailClamp®**

## Description

RClamp®3344T is a low voltage RailClamp which can provide ESD protection to IEC 61000-4-2 on high-speed ports. It is manufactured using Semtech's proprietary low voltage technology, designed to minimize both the ESD peak clamping and TLP clamping voltage. These devices “snap-back” to a low on-state voltage when the breakdown voltage of the device is exceeded. This has the advantage of lowering the overall ESD clamping voltage. When the device is in the on-state, the dynamic resistance is typically 0.30 Ohms, further minimizing the ESD clamping. Maximum capacitance is only 0.35pF allowing the RClamp3344T to be used in applications operating in excess of 6GHz without appreciable signal attenuation. Each device will protect four lines operating at 3.3 volts.

RClamp3344T is in a 5-pin SLP1308N5T package. It measures 1.3 x 0.8mm with a nominal height of 0.40mm. The innovative flow through package design simplifies pcb layout and allows matched trace lengths for consistant impedance between high speed differential lines.

The combination of low peak ESD clamping, low dynamic resistance, and innovative package design enables this device to provide the highest level of ESD protection for applications such as USB 3.0, MIPI/MDDI, and LVDS lines.

## Features

- High ESD withstand Voltage: **+/-17kV** (Contact), **+/-20kV** (Air) per **IEC 61000-4-2**
- Package design optimized for high speed lines
- Protects four high-speed lines
- Flow-Through design
- Low capacitance: **0.35pF Maximum**
- Dynamic Resistance: **0.30 Ohms Typical**
- Low ESD clamping voltage
- Operating voltage: **3.3V**
- Solid-state silicon-avalanche technology

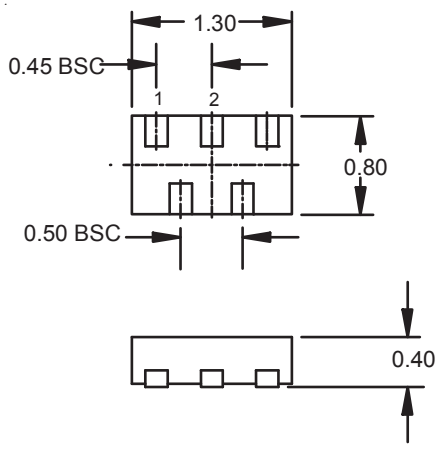
## Mechanical Characteristics

- SLP1308N5T 5-pin package (1.3 x 0.8 x 0.40mm)
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Lead finish: NiPdAu
- Marking: Marking Code
- Packaging: Tape and Reel

## Applications

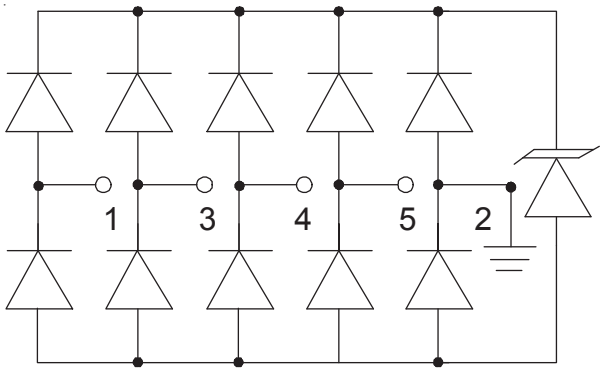
- USB 3.0
- V-By-One
- LVDS
- MIPI/MDDI
- MyDP

## Dimensions




**Nominal Dimensions (mm)**

## Schematic & PIN Configuration




**4-Line, Bidirectional**

## PROTECTION PRODUCTS

### Absolute Maximum Rating

| Rating | Symbol | Value | Units |
|---|---|---|---|
| Peak Pulse Current (tp = 8/20µs) | $I_{PP}$ | 4 | A |
| ESD per IEC 61000-4-2 (Air)[1]<br>ESD per IEC 61000-4-2 (Contact)[1] | $V_{ESD}$ | +/- 20<br>+/- 17 | kV |
| Operating Temperature | $T_J$ | -40 to +85 | °C |
| Storage Temperature | $T_{STG}$ | -55 to +150 | °C |

### Electrical Characteristics (T=25°C Unless Otherwise Specified)

| Parameter | Symbol | Conditions | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|---|
| Reverse Stand-Off Voltage | $V_{RWM}$ | Any I/O to GND | | | 3.3 | V |
| Breakdown Voltage | $V_{BR}$ | $I_{BR}$ = 10µA | 7.5 | 8.8 | 9.8 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 3.3V, T=25°C<br>Any I/O to GND | | 0.01 | 0.05 | µA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 1A, tp = 8/20µs<br>Any I/O to GND | | 3.5 | 5 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 4A, tp = 8/20µs<br>Any I/O to GND | | 5 | 6.5 | V |
| ESD Clamping Voltage[2] | $V_C$ | $I_{PP}$ = 16A,<br>tlp = 0.2/100ns | | 9.5 | | V |
| ESD Clamping Voltage[2] | $V_C$ | $I_{PP}$ = -16A,<br>tlp = 0.2/100ns | | 9.5 | | V |
| Dynamic Resistance (Positive)[2,3] | $R_D$ | tlp = 0.2/100ns | | 0.30 | | Ohms |
| Dynamic Resistance (Negative)[2,3] | $R_D$ | tlp = 0.2/100ns | | 0.30 | | Ohms |
| Junction Capacitance | $C_j$ | $V_R$ = 0V, f = 1MHz,<br>Any I/O to GND | | 0.30 | 0.35 | pF |

Notes

1)Measured with a 20dB attenuator, 50 Ohm scope input impedance, 2GHz bandwidth. ESD gun return path connected to ESD ground plane.

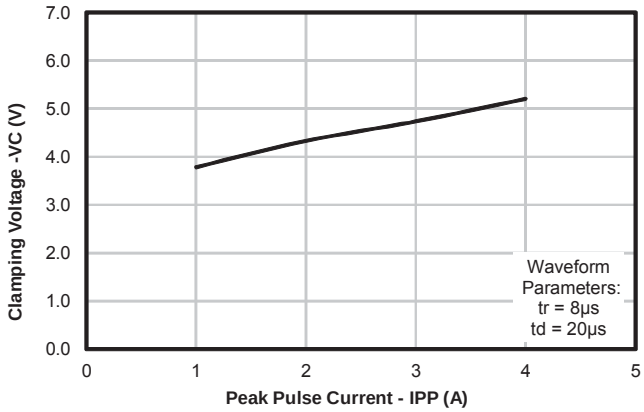
2)Transmission Line Pulse Test (TLP) Settings: $t_p$ = 100ns, $t_r$ = 0.2ns, $I_{TLP}$ and $V_{TLP}$ averaging window: $t_1$ = 70ns to $t_2$ = 90ns. Parameters guaranteed by design.

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

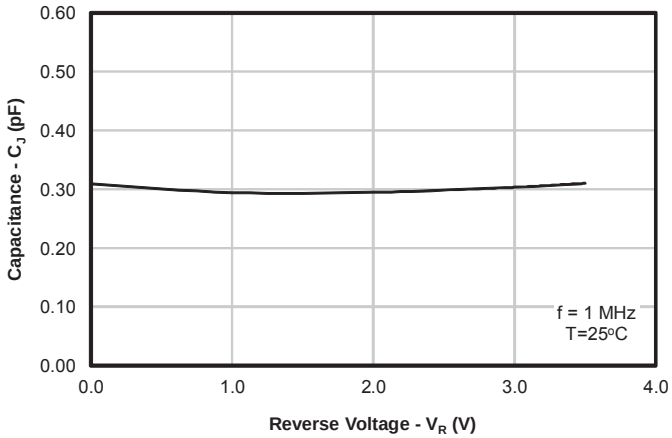
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## Typical Characteristics

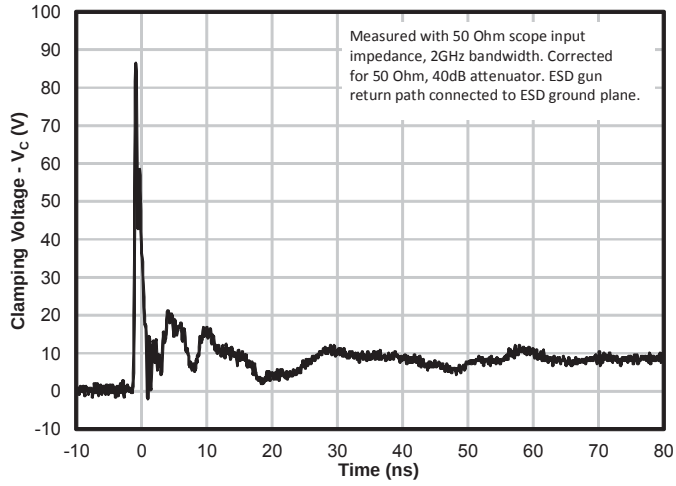
### Clamping Voltage vs. Peak Pulse Current (Between any I/O and Ground)



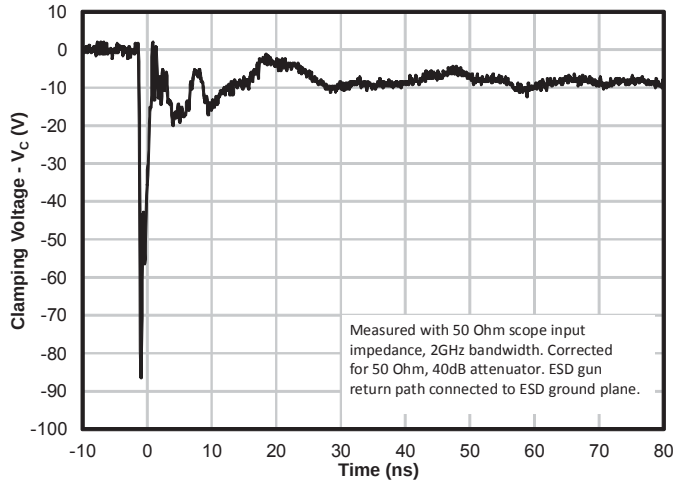

### Junction Capacitance vs. Reverse Voltage (Between any I/O and Ground)



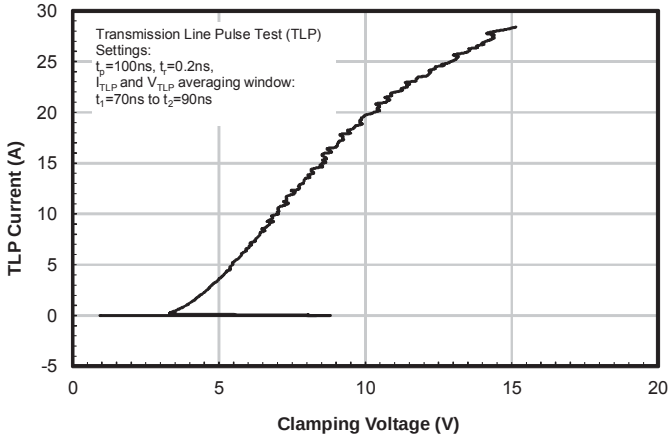

### ESD Clamping (+8kV Contact per IEC 61000-4-2) (Between any I/O and Ground)



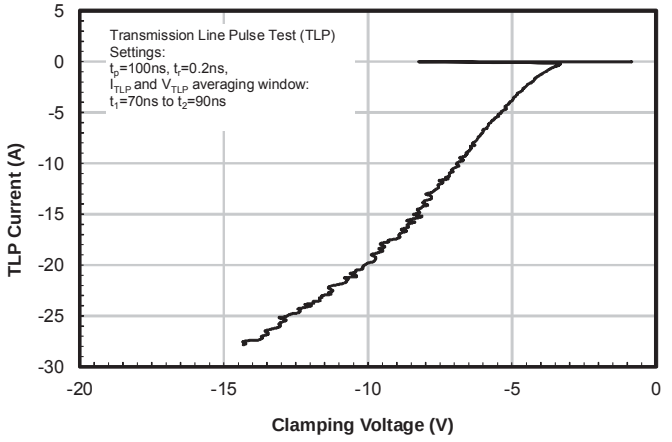

### ESD Clamping (-8kV Contact per IEC 61000-4-2) (Between any I/O and Ground)




### TLP Characteristic (Positive)

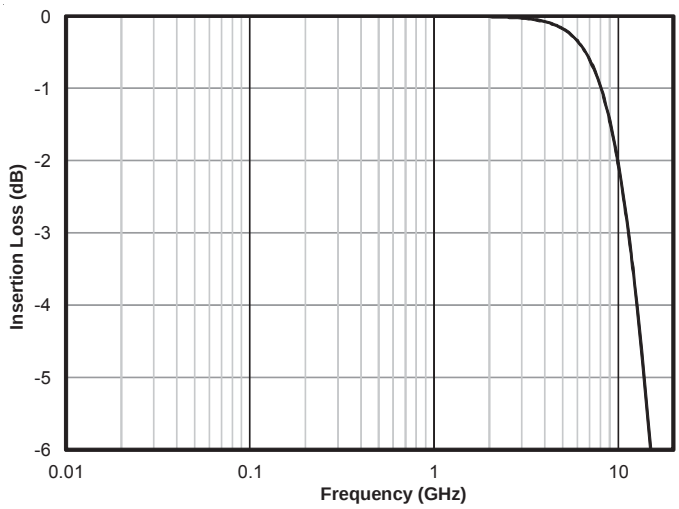



### TLP Characteristic (Negative)

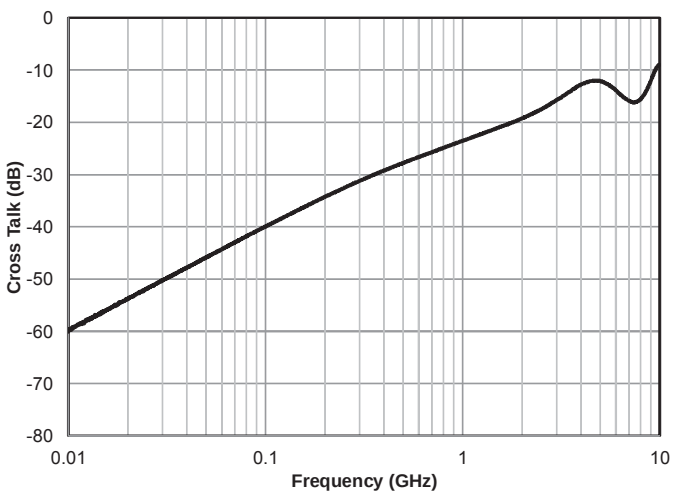


## Typical Characteristics

**Typical Insertion Loss S21**




**Analog Crosstalk**

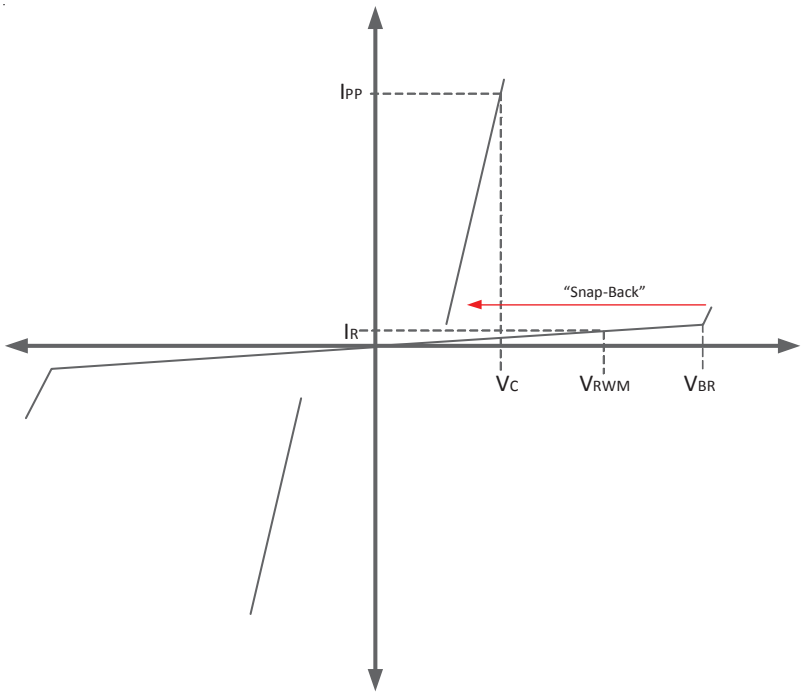


## Applications Information

**Device Operation**

This device utilizes a multi-junction structure that is designed to switch to a low voltage state when triggered by ESD, EOS, or other transient events. During normal operation, the device will present a high-impedance to the circuit for voltage up to the working voltage ($V_{RWM}$) of the device. When the voltage across the device terminals exceeds the breakdown voltage ($V_{BR}$), avalanche breakdown occurs in the blocking junction causing the device to "snap-back" or switch to a low impedance on-state. This has the advantage of lowering the overall clamping voltage ($V_C$) as ESD peak pulse current ($I_{PP}$) flows through the device. Once the current subsides, the device will return to a high-impedance off-state. Since this device is bidirectional, it will behave the same way for positive or negative polarity transient events.

| Symbol | Parameter |
|---|---|
| $V_{RWM}$ | Maximum Working Voltage |
| $V_{BR}$ | Breakdown Voltage |
| $V_C$ | Clamping Voltage |
| $I_R$ | Reverse Leakage Current |
| $I_{PP}$ | Peak Pulse Current |



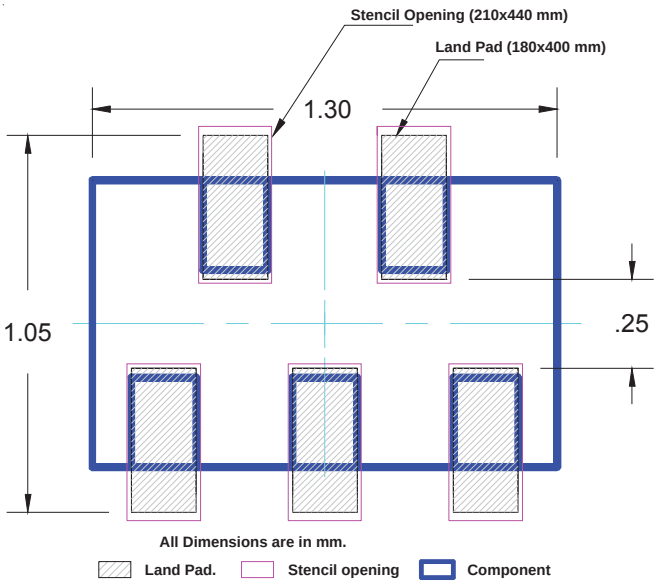

**Characteristic Curve**

## Applications Information

**Assembly Guidelines**

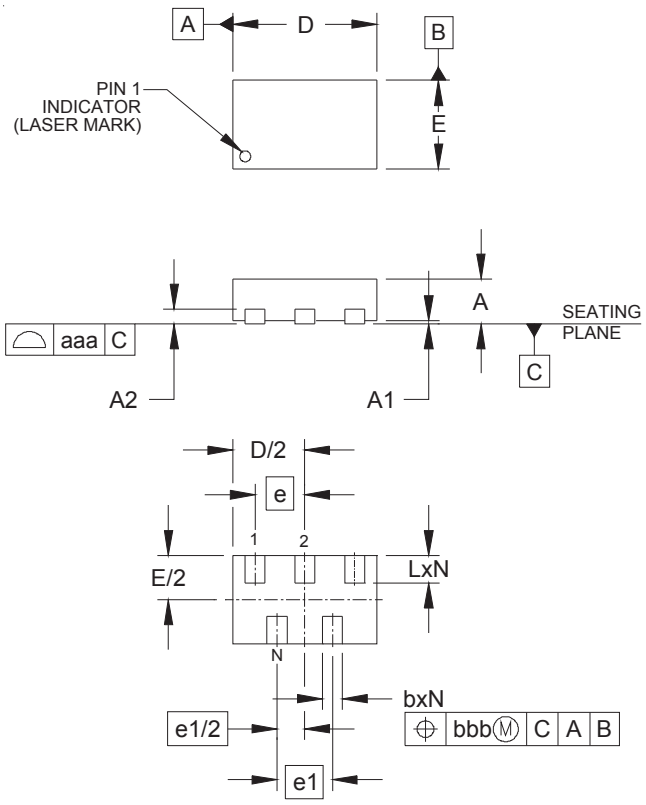
The small size of this device means that some care must be taken during the mounting process to insure reliable solder joint. The table below provides Semtech's recommended assembly guidelines for mounting this device. The figure at the right details Semtech's recommended aperture based on the below 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 |
| 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**

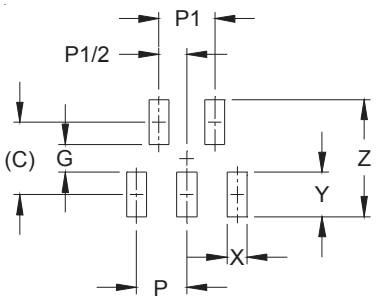
## Outline Drawing - SLP1308N5T




| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.37 | 0.40 | 0.43 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | | (0.13) | |
| b | 0.13 | 0.18 | 0.23 |
| D | 1.20 | 1.30 | 1.40 |
| E | 0.70 | 0.80 | 0.90 |
| e | | 0.45 BSC | |
| e1 | | 0.50 BSC | |
| L | 0.20 | 0.25 | 0.30 |
| N | | 5 | |
| aaa | | 0.08 | |
| bbb | | 0.10 | |

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

## Land Pattern - SLP1308N5T




| DIMENSIONS | |
|---|---|
| DIM | MILLIMETERS |
| C | (0.65) |
| G | 0.25 |
| P | 0.45 |
| P1 | 0.50 |
| X | 0.18 |
| Y | 0.40 |
| Z | 1.05 |

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



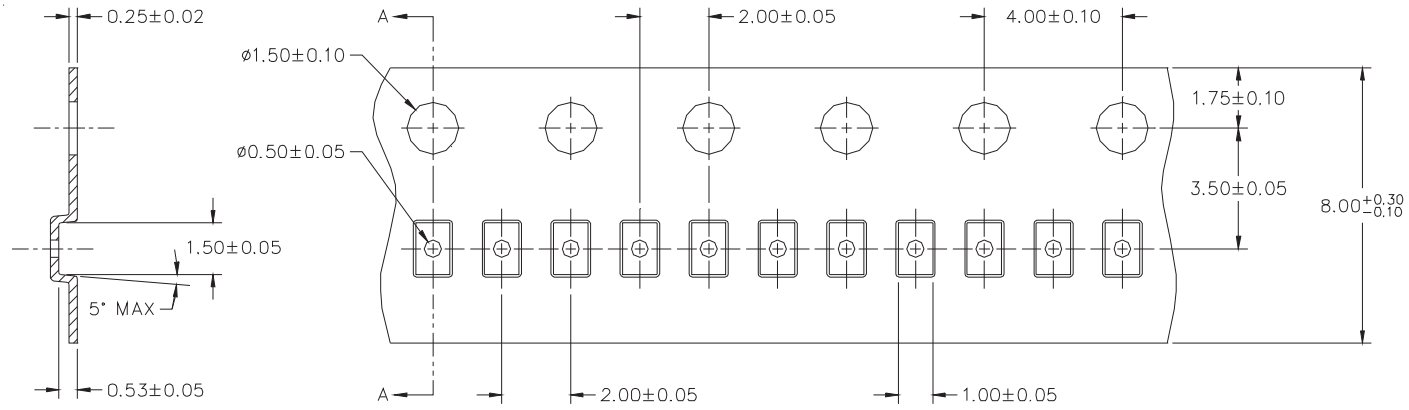

YYWW = Date Code
Dot indicates pin 1

## Ordering Information

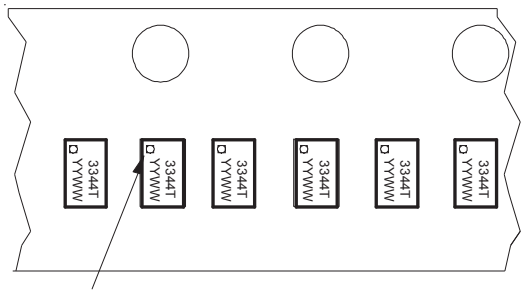
| Part Number | Qty per Reel | Reel Size |
|---|---|---|
| RClamp3344T.TNT | 10,000 | 7 Inch |

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## Carrier Tape Specification




SECTION A–A




Pin 1 Location (Towards Sprocket Holes)

User Direction of feed

**Device Orientation in Tape**

## Contact Information

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