RClamp03348P

Low Capacitance RailClamp®
8-Line Surge and ESD Protection

Description

RClamp03348P provides low-voltage ESD protection for up to eight lines on high-speed ports. RClamp03348P is designed to minimize both ESD peak clamping and TLP clamping voltage. The maximum capacitance of RClamp03348P on each line to ground is only 0.65pF; this allows RClamp03348P to be used in applications operating at more than 5GHz without signal attenuation.

The RClamp03348P is in a 9-pin DFN 3.80 x 1.00 x 0.50 mm 9-Lead package. The intra-pair lead pitch is 0.40mm. Innovative flow-through package design simplifies PCB layout and allows matched trace lengths for consistent impedance between high-speed differential lines.

Features

- Transient protection for high-speed data lines to
  - IEC 61000-4-2 (ESD): ±14kV (Contact), ±16kV (Air)
  - IEC 61000-4-5 (Lightning): 3.8A (8/20µs)
- Package design optimized for high speed lines
- Protects eight high-speed data lines
- Low ESD clamping voltage
- Working voltage: 3.3V
- Low capacitance: 0.65pF max (I/O to GND)
- Low dynamic resistance: 0.42Ω typical (I/O to GND)
- Solid-state silicon-avalanche technology

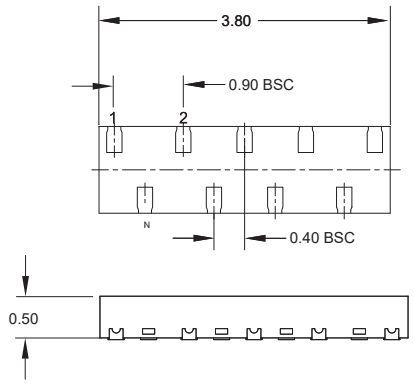
Applications

- V-By-One
- LVDS
- eDP
- MHL
- eSATA

Mechanical Characteristics

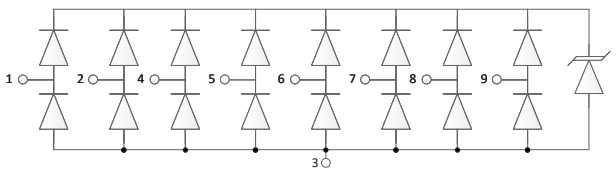
- Package: DFN 3.80 x 1.00 x 0.50 mm 9-Lead
- Lead Pitch: 0.40mm (intra-pair)
- Pb-Free, Halogen Free, RoHS/WEEE compliant
- Lead Finish: Pb-free
- Molding Compound Flammability Rating: UL 94V-0
- Marking: Marking Code + Data Code
- Packaging: Tape and Reel

Package Dimension



Nominal Dimensions in mm

Schematic and Pin Configuration



9-Line Protection

Absolute Maximum Rating

RATING	SYMBOL	VALUE	UNITS
Peak Pulse Power (t_p = 8/20µs)	P_{PK}	36	W
Peak Pulse Current (t_p = 8/20µs)	I_{PP}	3.8	A
ESD per IEC 61000-4-2 (Contact)(1)	V_{ESD}	±14	kV
ESD per IEC 61000-4-2 (Air)(1)		±16	
Operating Temperature	T_{OP}	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics

T=25°C unless otherwise specified

All measurements from any I/O to ground

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse Stand-Off Voltage	V_{RWM}				3.3	V
Punch-Through Voltage	V_{PT}	I_{PT} = 2µA	3.8	4.9	6	V
Reverse Leakage Current	I_R	V_{RWM} = 3.3V		5	100	nA
Clamping Voltage	V_C	I_{PP} = 1A, t_p = 8/20 µs		5.8	7	V
		I_{PP} = 3.8A, t_p = 8/20 µs		6.8	9	
ESD Clamping Voltage(2)	V_C	I_{TLP} = 16A, t_p = 0.2/100ns (TLP)		12.2		V
		I_{TLP} = -16A, t_p = 0.2/100ns (TLP)		5.8		
Dynamic Resistance(2),(3)	R_{DYN}	t_p = 0.2/100ns (TLP), I/O to GND		0.42		Ω
		t_p = 0.2/100ns (TLP), GND to I/O		0.29		
Junction Capacitance	C_J	V_R = 0V, f = 1MHz, I/O to GND		0.49	0.65	pF
		V_R = 0V, f = 1MHz, between I/O pins		0.20	0.40	

Notes:

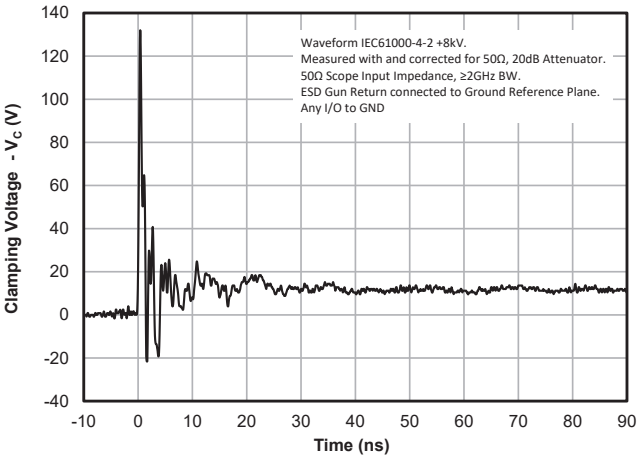
(1): ESD gun return path connected to Ground Reference Plane (GRP).

(2): Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, I_{TLP} and V_{TLP} averaging window: t_1 = 70ns to t_2 = 90ns.

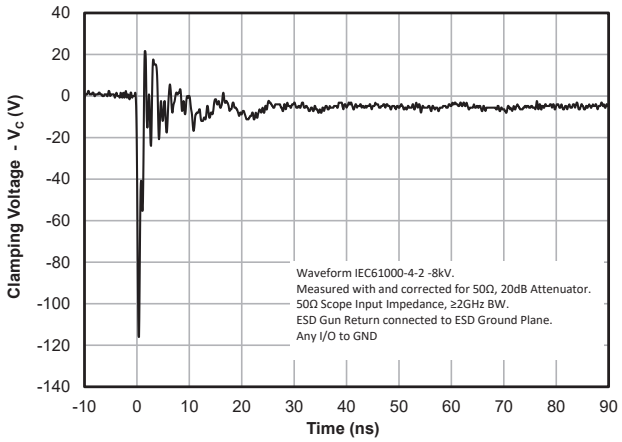
(3): Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A.

Typical Characteristics

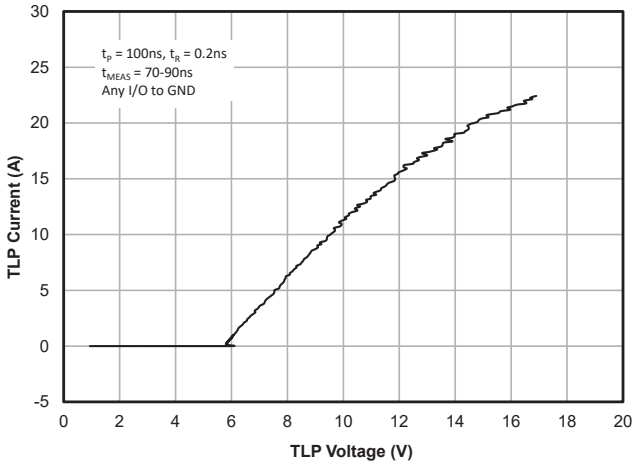
ESD Clamping (8kV Contact per IEC 61000-4-2)



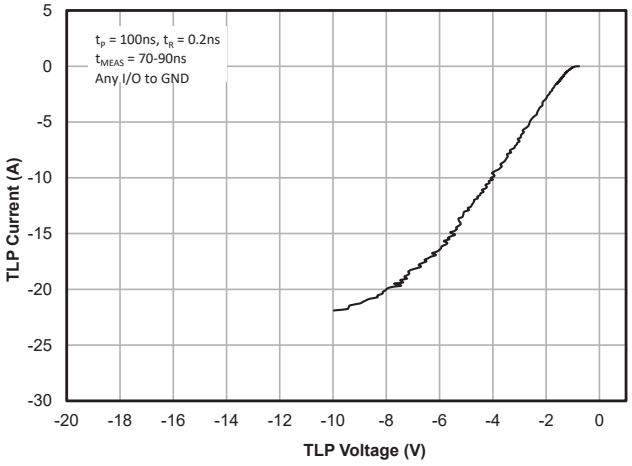
ESD Clamping (-8kV Contact per IEC 61000-4-2)



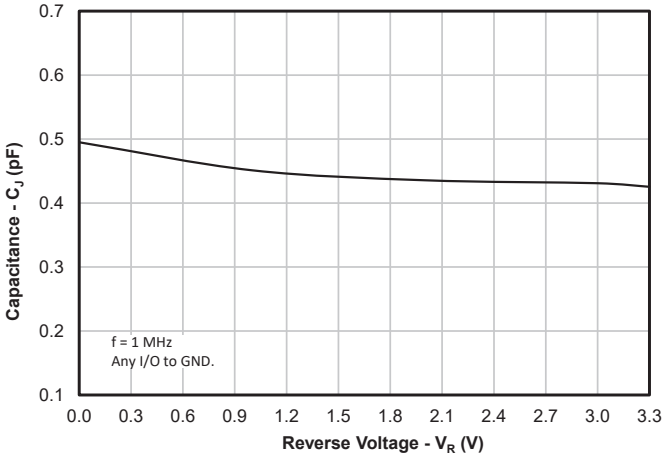
TLP Characteristics (Positive Pulse)



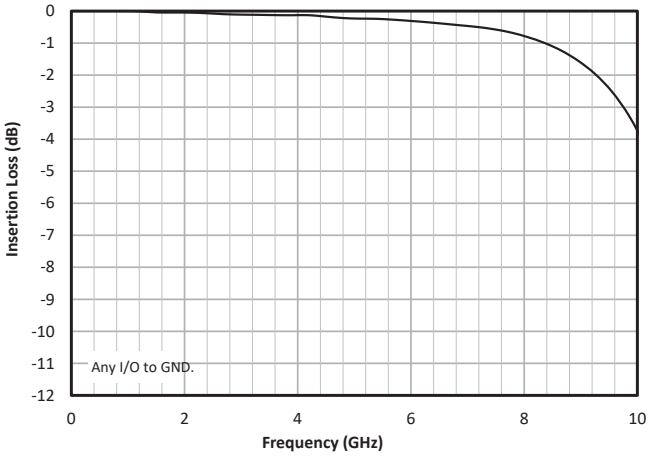
TLP Characteristics (Negative Pulse)



Capacitance vs. Reverse Voltage



Insertion Loss - S21



Applications Information

Assembly Guidelines

The figure at the right details Semtech's recommended mounting pattern. Recommended assembly guidelines are shown in Table 2. Note that these are only recom-mendations 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. Semtech's recommended mounting pattern is based on the following design guidelines:

Land Pattern

The recommended land pattern follows IPC standards and is designed for maximum solder coverage. Detailed dimensions are shown elsewhere in this document.

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 thickness of 0.100mm for this device. The stencil should be laser cut with electro-polished finish. The stencil should have a positive taper of approximately 5 degrees. Electro polishing and tapering the walls results in reduced surface friction and better paste release. Due to the small aperture size, a solder paste with Type 4 or smaller particles are recommended. Assuming a 100µm thick stencil, the aperture dimensions shown will yield an area ratio of approximately 0.92.

Recommended Stencil Design

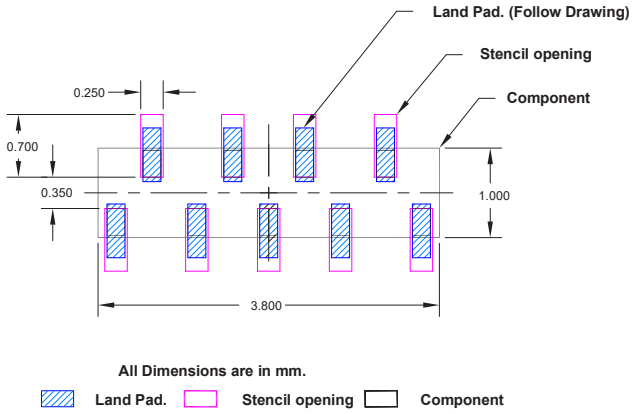
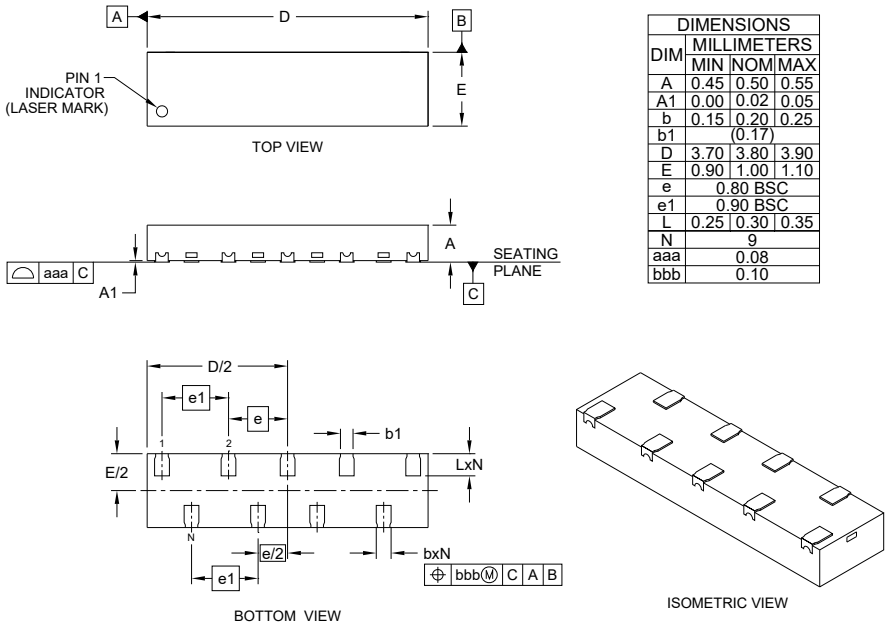


Table 2 - Assembly Guidelines

Assembly Parameter	Recommendation
Solder Stencil Design	Laser Cut, Electro-Polished
Aperture Shape	Rectangular
Solder Stencil Thickness	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	Non Solder Mask Defined
PCB Pad Finish	OSP or NiAu

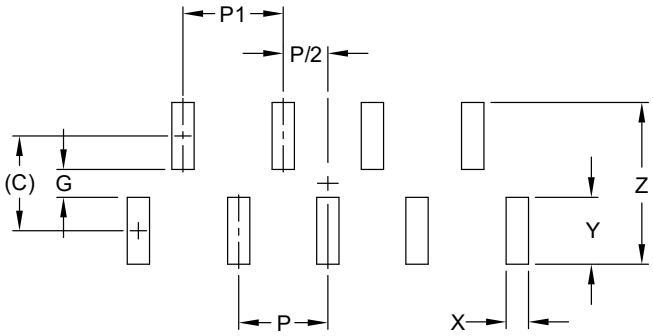
Outline Drawing - DFN 3.80 x 1.00 x 0.50mm 9-Lead



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
b1		(0.17)	
D	3.70	3.80	3.90
E	0.90	1.00	1.10
e		0.80 BSC	
e1		0.90 BSC	
L	0.25	0.30	0.35
N		9	
aaa		0.08	
bbb		0.10	

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

Landing Pattern - DFN 3.80 x 1.00 x 0.50mm 9-Lead



DIMENSIONS	
DIM	MILLIMETERS
C	(0.85)
G	0.25
P	0.80
P1	0.90
X	0.20
Y	0.60
Z	1.45

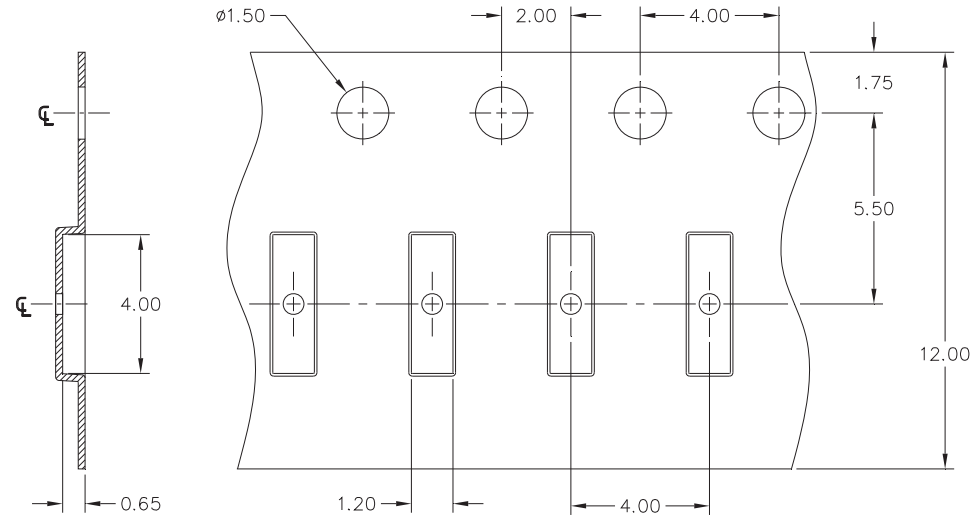
NOTES:

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.

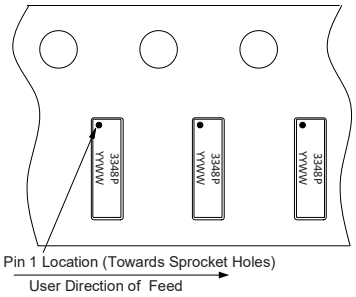
Marking Code

Note: Dot indicates pin 1 location.

Tape and Reel Specification (4mm Pitch)



Note: All dimensions are nominal dimensions in mm.



Order Information

PART NUMBER	QTY PER REEL	MATERIAL	REEL SIZE
RClamp03348P.C	3,000	Plastic	7"

RailClamp and RClamp are registered trademarks of Semtech Corporation.

Datasheet Identification Definitions

Datasheet Identification	Product Status	Definition
Draft	Formative or In Design	This datasheet contains the design specifications for product development. Semtech reserves the right to change the product or this document without notice.
Preliminary	First Production	This datasheet contains initial specifications. The product has passed Semtech's reliability testing. Changes to fit, form, or function are not expected however, Semtech reserves the right to change the product or this document at any time without notice.
Final	Full Production	This datasheet contains final specifications. Further product changes are not expected however, Semtech reserves the right to change the product or this document at any time without notice.

Important Notice

Information relating to this product and the application or design described herein is believed to be reliable, however such information is provided as a guide only and Semtech assumes no liability for any errors in this document, or for the application or design described herein. Semtech reserves the right to make changes to the product or this document at any time without notice. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. Semtech warrants performance of its products to the specifications applicable at the time of sale, and all sales are made in accordance with Semtech's standard terms and conditions of sale.

Product features listed in this datasheet may be suitable for "non-safety" applications in Automotive use cases. Information in this datasheet for such applications is provided as a guide only. No safety claim is made in respect of the product described in this datasheet when used in Automotive safety systems or security devices, including systems for controlling vehicles and other transportation equipment; responsibility for achieving safety goals belongs solely to the buyer and/or integrators. Semtech is under no obligation to provide any data regarding safety integration to the buyer or any integrator.

SEMTECH PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN AUTOMOTIVE SAFETY OR SECURITY DEVICES, INCLUDING SYSTEMS FOR CONTROLLING VEHICLES AND OTHER TRANSPORTATION EQUIPMENT, LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS, OR IN NUCLEAR APPLICATIONS IN WHICH THE FAILURE COULD BE REASONABLY EXPECTED TO RESULT IN PERSONAL INJURY, LOSS OF LIFE OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. INCLUSION OF SEMTECH PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. Should a customer purchase or use Semtech products for any such unauthorized application, the customer shall indemnify and hold Semtech and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs damages and attorney fees which could arise.