

PROTECTION PRODUCTS - RailClamp®

Description

RailClamps® are low capacitance TVS arrays designed to protect high speed data interfaces. This series has been specifically designed to protect sensitive components which are connected to data and transmission lines from overvoltage caused by **ESD** (electrostatic discharge), **CDE** (Cable Discharge Events), and **Lightning**.

The unique design incorporates surge rated, low capacitance steering diodes and a TVS diode in a single package. During transient conditions, the steering diodes direct the transient current to ground. The internal TVS diode clamps the transient voltage to a safe level. The low capacitance array configuration allows the user to protect up to four high-speed data lines.

The RClamp™3304N is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage current and capacitance over silicon-avalanche diode processes. They feature a true operating voltage of 3.3 volts for superior protection.

The RClamp3304N is in a 10-pin, RoHs compliant, SLP2626P10 package. It measures 2.6 x 2.6 x 0.60mm. The leads are spaced at a pitch of 0.5mm and are finished with lead-free NiPd. The high surge capability ($I_{pp}=25A$, $t_p=8/20\mu s$) means it can be used in high threat environments and applications such as Gigabit Ethernet, telecommunication lines, and digital video.

Features

- ◆ Transient protection for high-speed data lines to **IEC 61000-4-2 (ESD) 15kV (air), 8kV (contact)**
- ◆ **IEC 61000-4-4 (EFT) 40A (5/50ns)**
- ◆ **IEC 61000-4-5 (Lightning) 25A (8/20μs)**
- ◆ Array of surge rated diodes with internal TVS Diode
- ◆ Small package saves board space
- ◆ Protects up to four I/O lines & power line
- ◆ Low capacitance (**<5pF**) for high-speed interfaces
- ◆ Low leakage current and clamping voltage
- ◆ Low operating voltage: **3.3V**
- ◆ Solid-state silicon-avalanche technology

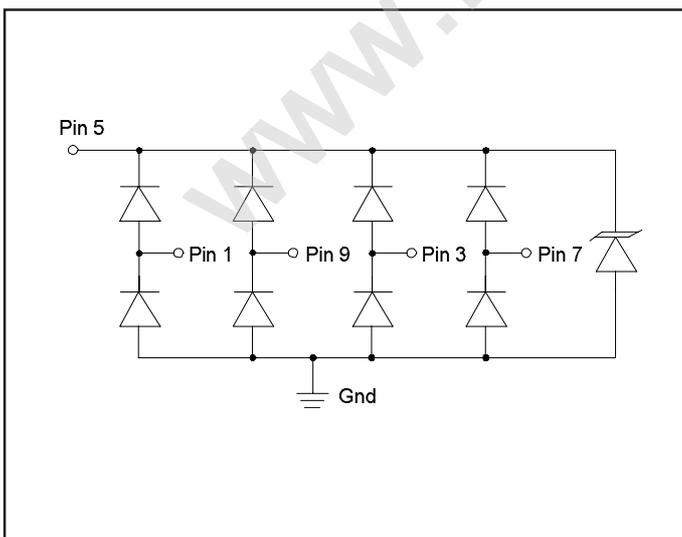
Mechanical Characteristics

- ◆ SLP2626P10 10L package
- ◆ RoHs Compliant
- ◆ Nominal Dimensions: 2.6 x 2.6 x 0.60 mm
- ◆ Lead Pitch: 0.5mm
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking Code
- ◆ Packaging : Tape and Reel per EIA 481

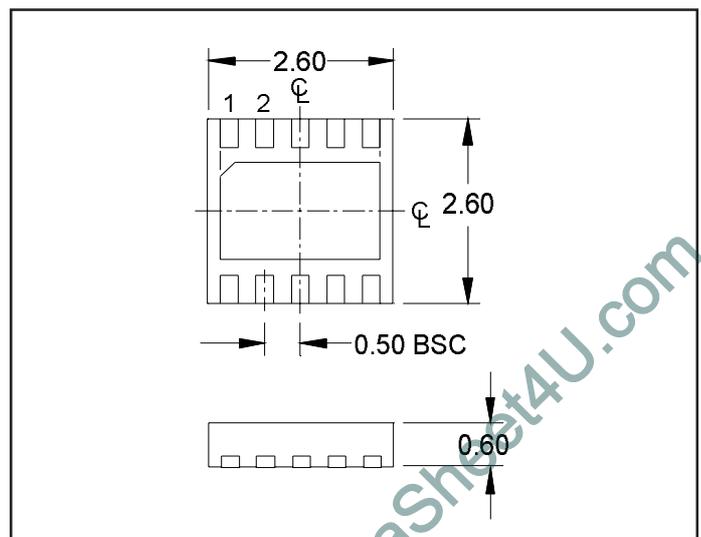
Applications

- ◆ USB 2.0
- ◆ Gigabit Ethernet
- ◆ Digital Visual Interface (DVI)
- ◆ T1/E1 Secondary Protection
- ◆ T3/E3 Secondary Protection
- ◆ IEEE 1394 Firewire Ports

Circuit Diagram



Package Configuration



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Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power ($t_p = 8/20\mu s$)	P_{pk}	450	Watts
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{pp}	25	A
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	25 15	kV
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T=25°C)

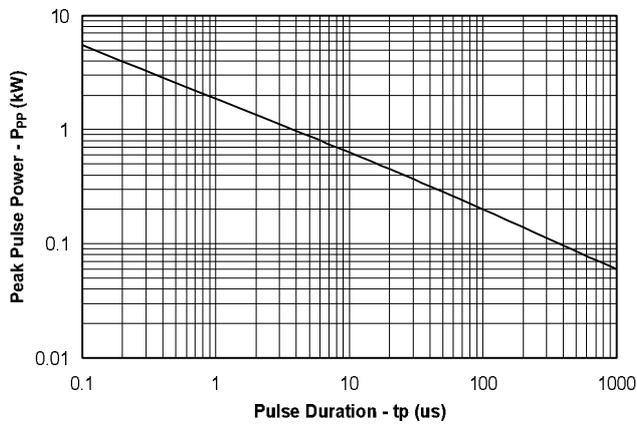
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}				3.3	V
Punch-Through Voltage	V_{PT}	$I_{PT} = 5\mu A$	3.5			V
Snap-Back Voltage	V_{SB}	$I_{SB} = 50mA$	2.8			V
Reverse Leakage Current	I_R	$V_{RWM} = 3.3V, T=25^\circ C$			5	μA
Clamping Voltage	V_C	$I_{pp} = 1A, t_p = 8/20\mu s$			5.5	V
Clamping Voltage	V_C	$I_{pp} = 10A, t_p = 8/20\mu s$			10.5	V
Clamping Voltage	V_C	$I_{pp} = 25A, t_p = 8/20\mu s$			18	V
Junction Capacitance	C_j	Between I/O pins and Ground $V_R = 0V, f = 1MHz$		3.8	5	pF
		Between I/O pins $V_R = 0V, f = 1MHz$		2.0		pF

Note 1: I/O pins are pin 1, 3, 7, and 9

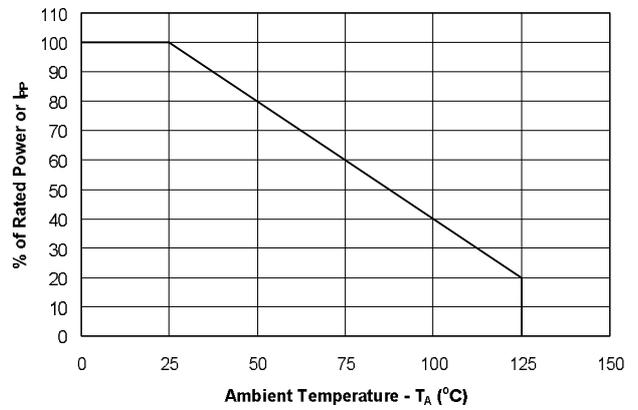
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Typical Characteristics

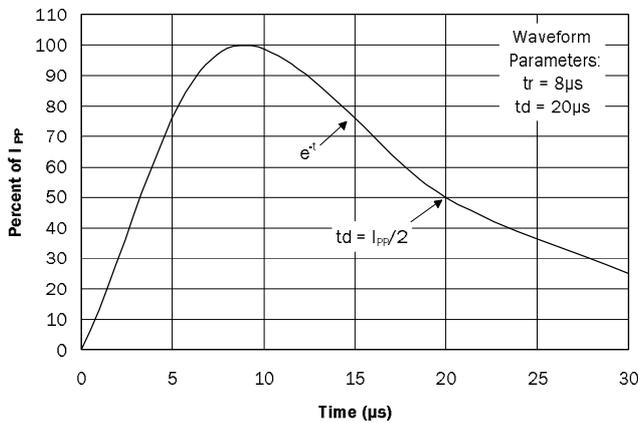
Non-Repetitive Peak Pulse Power vs. Pulse Time



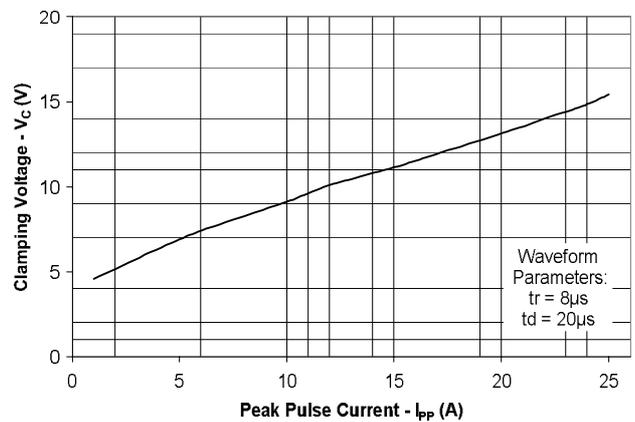
Power Derating Curve



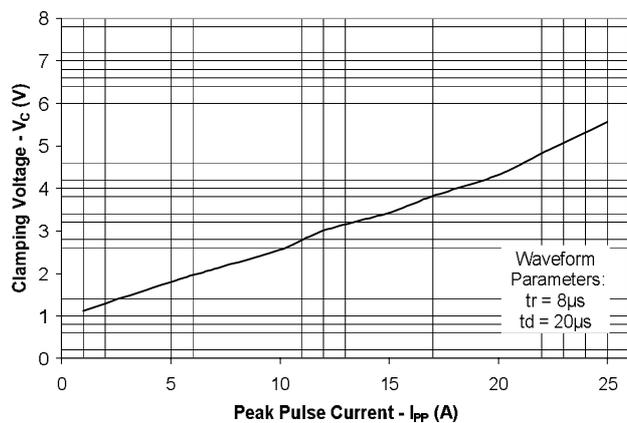
Pulse Waveform



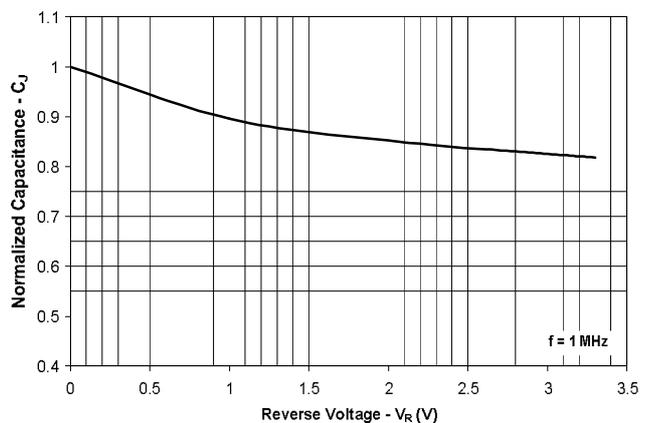
Clamping Voltage vs. Peak Pulse Current



Forward Voltage vs. peak Pulse Current



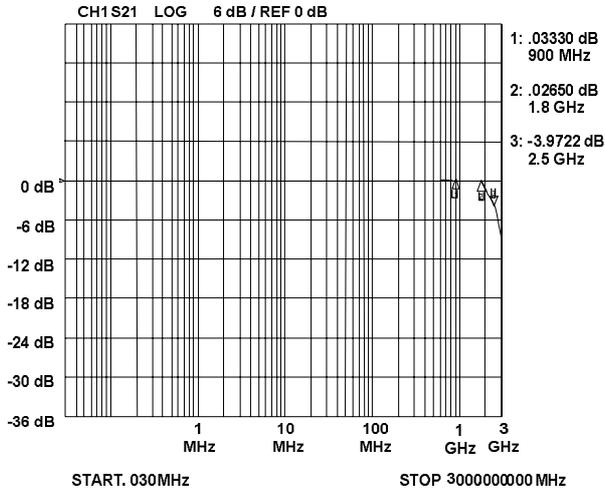
Normalized Junction Capacitance vs. Reverse Voltage



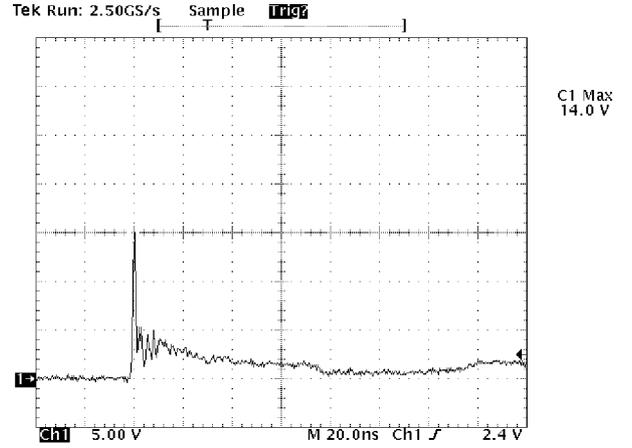
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Typical Characteristics

Insertion Loss S21 (I/O to Ground)



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



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Applications Information

Device Connection Options for Protection of Four High-Speed Data Lines

This device is designed to protect data lines by clamping them to a fixed reference. When the voltage on the protected line exceeds the reference voltage the steering diodes are forward biased, conducting the transient current away from the sensitive circuitry. Data lines are connected at pins 1, 3, 7 and 9. The center pin should be connected directly to a ground plane. The path length is kept as short as possible to minimize parasitic inductance. Pins 2, 4, 6, 8, and 10 are not connected.

The positive reference is connected at pin 5. The options for connecting the positive reference are as follows:

1. To protect data lines and the power line, connect pin 5 directly to the positive supply rail (V_{∞}) with a maximum operating voltage of 3.3 volts. In this configuration the data lines are referenced to the supply voltage. The internal TVS diode prevents over-voltage on the supply rail.
2. In applications where the supply rail does not exit the system, the internal TVS may be used as the reference. In this case, pin 5 is not connected. The steering diodes will begin to conduct when the voltage on the protected line exceeds the working voltage of the TVS (plus one diode drop).

Circuit Diagram

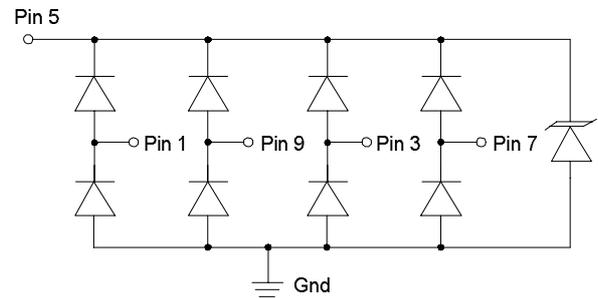
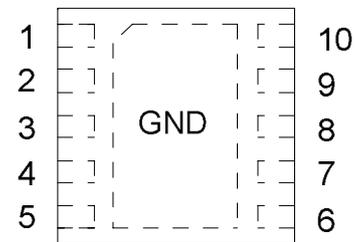


Figure 1. Pin Configuration (Top Side View)



Pin	Identification
1, 3, 7, 9	Input/Output Lines
2, 4, 6, 8, 10	No Connect
5	3.3V (Optional) or N/C
Center Tab	Ground

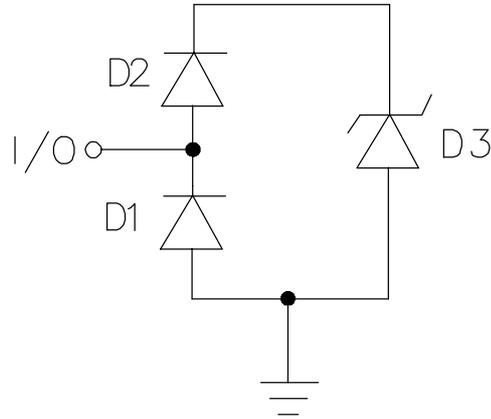
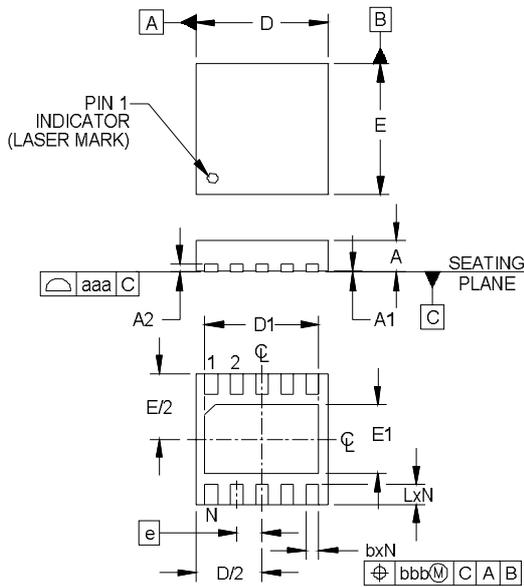


Figure 1 - RClamp3304N Spice Model

Table 1 - RClamp3304N Spice Parameters				
Parameter	Unit	D1 (LCRD)	D2 (LCRD)	D3 (TVS)
IS	Amp	1E-20	1E-20	1.66E-13
BV	Volt	100	100	3.55
VJ	Volt	0.62	0.59	0.6
RS	Ohm	0.138	0.241	0.182
IBV	Amp	1E-3	1E-3	1E-3
CJO	Farad	1.5E-12	1.5E-12	253E-12
TT	sec	2.541E-9	2.541E-9	2.541E-9
M	-	0.01	0.01	0.205
N	-	1.1	1.1	1.1
EG	eV	1.11	1.11	1.11

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Outline Drawing - SLP2626P10

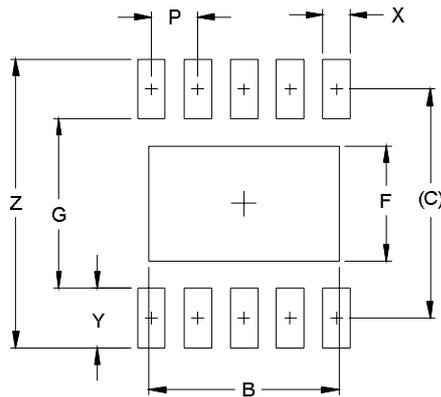


DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.020	.024	.026	0.50	0.60	0.65
A1	.000	.001	.002	0.00	0.03	0.05
A2	(0.007)			(0.17)		
b	.007	.010	.012	0.20	0.25	0.30
D	.098	.102	.106	2.50	2.60	2.70
D1	.079	.085	.089	2.00	2.15	2.25
E	.098	.102	.106	2.50	2.60	2.70
E1	.044	.050	.054	1.11	1.26	1.36
e	.020 BSC			0.50 BSC		
L	.011	.014	.016	0.30	0.35	0.40
N	10			10		
aaa	.003			0.08		
bbb	.004			0.10		

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

Land Pattern - SLP2626P10



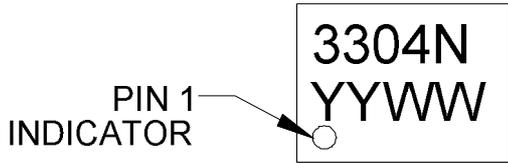
DIM	DIMENSIONS	
	INCHES	MILLIMETERS
B	.081	2.05
C	.100	2.50
F	.050	1.26
G	.073	1.85
P	.020	0.50
X	.012	0.30
Y	.025	0.65
Z	.124	3.15

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

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Marking



YY = year
WW = Week

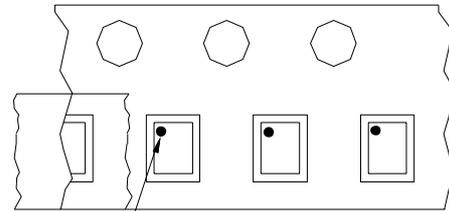
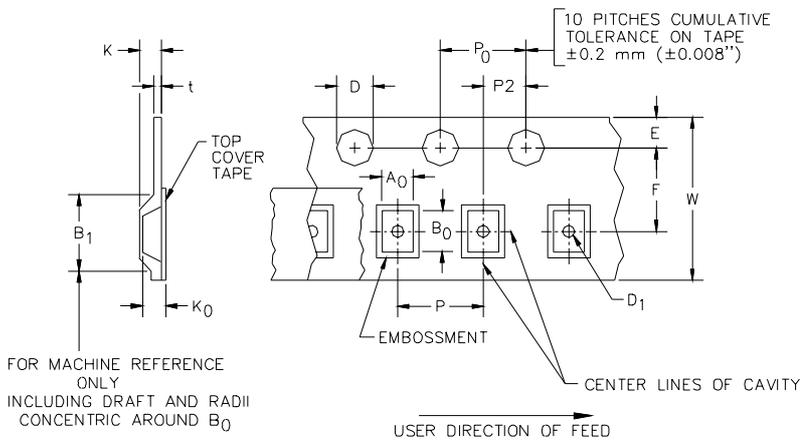
Ordering Information

Part Number	Qty per Reel	Reel Size
RClamp3304N.TCT	3,000	7 Inch

Note: Lead finish is lead-free NiPd

RailClamp and RClamp are marks of Semtech Corporation

Tape and Reel Specification



Pin 1 Location

→ User Direction of feed

Device Orientation in Tape

A0	B0	K0
2.77 +/-0.05 mm	2.77 +/-0.05 mm	0.80 +/-0.05 mm

Tape Width	B ₁ (Max)	D	D1	E	F	K (MAX)	P	P0	P2	T(MAX)	W
8 mm	4.2 mm (.165)	1.5 + 0.1 mm - 0.0 mm	1.0 mm ±0.05	1.750±.10 mm	3.5±0.05 mm	2.4 mm	4.0±0.1 mm	4.0±0.1 mm	2.0±0.05 mm	0.4 mm	8.0 mm + 0.3 mm - 0.1 mm

Contact Information

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