

PROTECTION PRODUCTS - RailClamp®
Description

RClamp® TVS diodes are ultra low capacitance devices designed to protect sensitive electronics from damage or latch-up due to ESD, EFT, and EOS. They are designed for use on high speed ports in applications such as cell phones, notebook computers, and other portable electronics. These devices offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

RClamp5031T feature extremely good ESD protection characteristics highlighted by low typical dynamic resistance of 0.25 Ohms, low peak ESD clamping voltage, and high ESD withstand voltage (+/-15kV contact per IEC 61000-4-2). Low maximum capacitance (0.45pF at VR=0V) minimizes loading on sensitive circuits. Each device will protect one high-speed data line operating at 5 Volts.

RClamp5031T is in a 2-pin SLP0806P2T package measuring 0.8 x 0.6 x 0.4mm. Leads are finished with lead-free NiPdAu. The combination of working voltage, low dynamic resistance, and low capacitance makes these devices ideal for use in applications such as HDMI, MHL, and USB 3.0.

Features

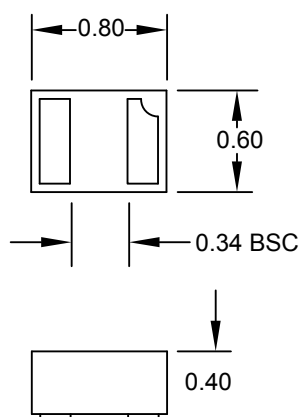
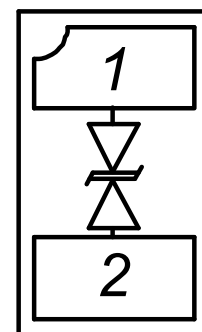
- ◆ Transient protection to
IEC 61000-4-2 (ESD) 18kV (air), 15kV (contact)
IEC 61000-4-4 (EFT) 40A (5/50ns)
IEC 61000-4-5 (Lightning) 3A (8/20µs)
- ◆ Protects one high-speed data line
- ◆ Low capacitance: 0.45pF maximum
- ◆ Operating Voltage: 5V
- ◆ Low dynamic resistance: 0.25 Ohms (Typ)
- ◆ Low ESD clamping voltage
- ◆ Low leakage current
- ◆ Solid-state silicon-avalanche technology

Mechanical Characteristics

- ◆ SLP0806P2T package
- ◆ Pb-Free, Halogen Free, RoHS/WEEE Compliant
- ◆ Lead Finish: NiPdAu
- ◆ Molding compound flammability rating: UL 94V-0
- ◆ Marking : Marking code
- ◆ Packaging : Tape and Reel

Applications

- ◆ HDMI 1.4
- ◆ MHL
- ◆ USB 3.0
- ◆ MiPi / MDDI
- ◆ FM Antenna

Nominal Dimensions

Nominal Dimensions in mm
Functional Schematic

Schematic (Bottom View)

PROTECTION PRODUCTS

Absolute Maximum Ratings

Rating	Symbol	Value	Units
Peak Pulse Current ($t_p = 8/20\mu s$)	I_{PP}	3	A
ESD per IEC 61000-4-2 (Air) ¹	V_{ESD}	18	kV
ESD per IEC 61000-4-2 (Contact) ¹		15	
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	Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	T = -40 to +85°C			5	V
Breakdown Voltage	V_{BR}	$I_{BR} = 10mA$	6.5	9.5	10.5	V
Holding Current	I_H			50		mA
Reverse Leakage Current	I_R	$V_{RWM} = 5V$		<5	100	nA
Clamping Voltage	V_C	$I_{PP} = 3A, t_p = 8/20\mu s$			10	V
ESD Clamping Voltage ²	V_C	$I_{PP} = 4A$ $t_p = 0.2/100ns$		5.5		V
ESD Clamping Voltage ²	V_C	$I_{PP} = 16A$ $t_p = 0.2/100ns$		8.5		V
Dynamic Resistance ^{2,3}	R_{DYN}	$t_p = 0.2/100ns$		0.25		Ohms
Junction Capacitance	C_J	VR = 0V; f = 1MHz		0.35	0.45	pF

Notes

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

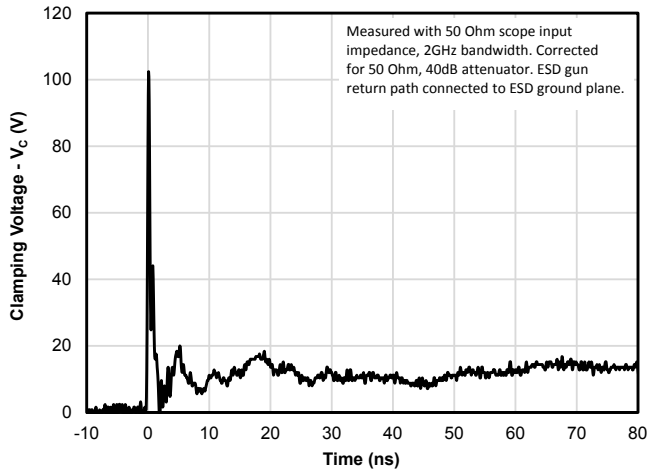
2) Transmission Line Pulse Test (TLP) Settings: $t_p = 100ns$, $t_r = 0.2ns$, I_{TLP} and V_{TLP} averaging window: $t_1 = 70ns$ to $t_2 = 90ns$.

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

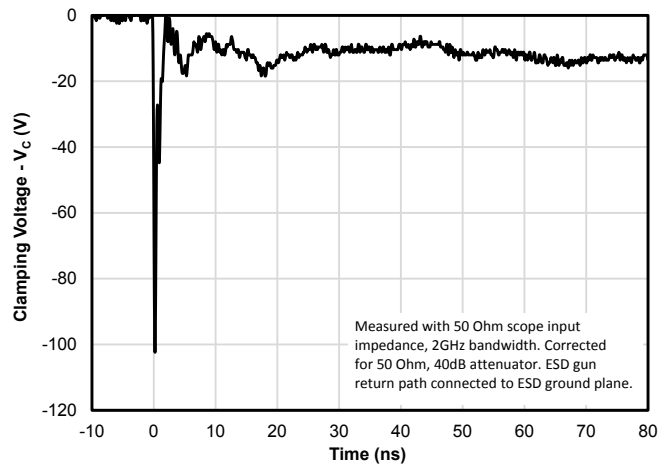
PROTECTION PRODUCTS

Typical Characteristics

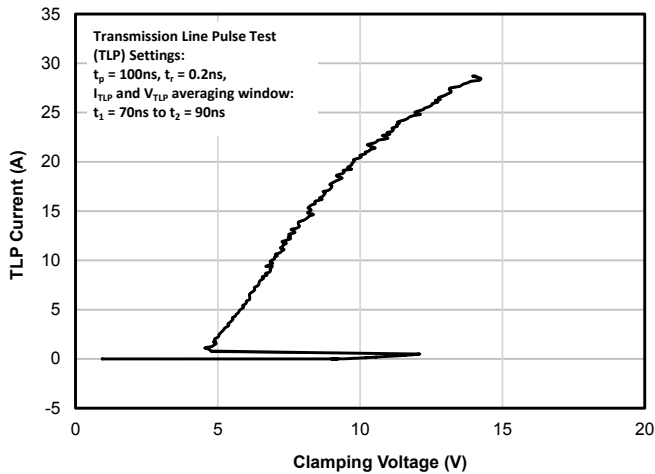
ESD Clamping (+8kV Contact per IEC 61000-4-2)



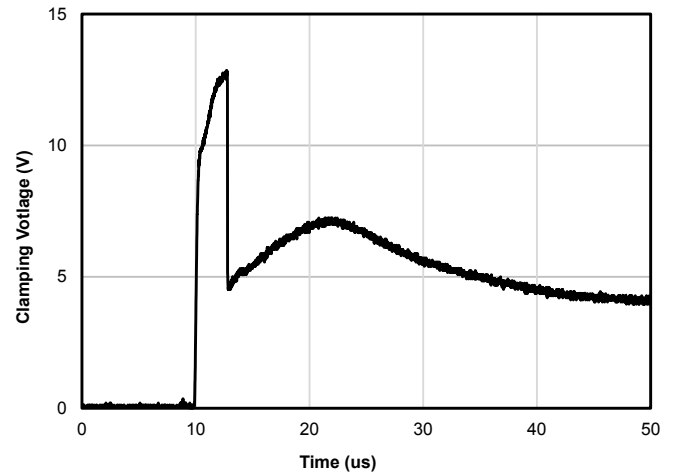
ESD Clamping (-8kV Contact per IEC 61000-4-2)



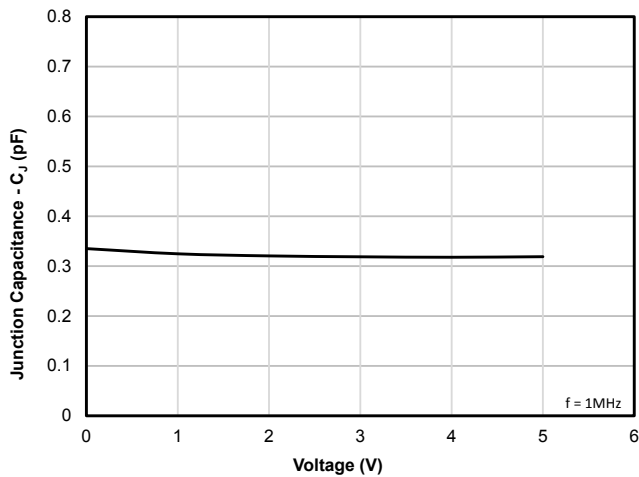
TLP Characteristic



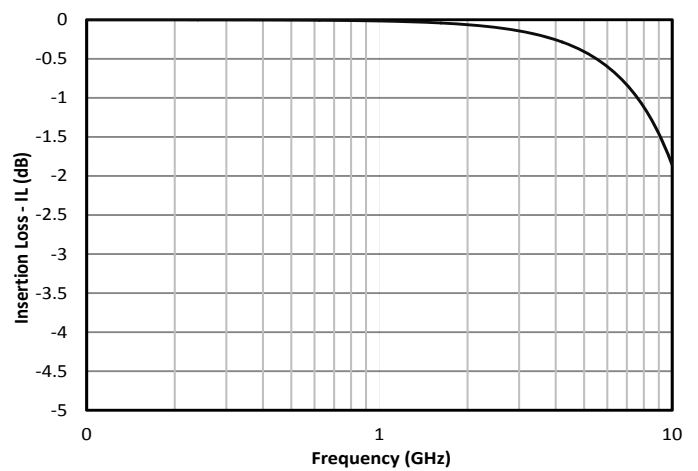
Clamping Voltage Waveform (1.2/50us Pulse)



Capacitance vs. Reverse Voltage



Insertion Loss - S21



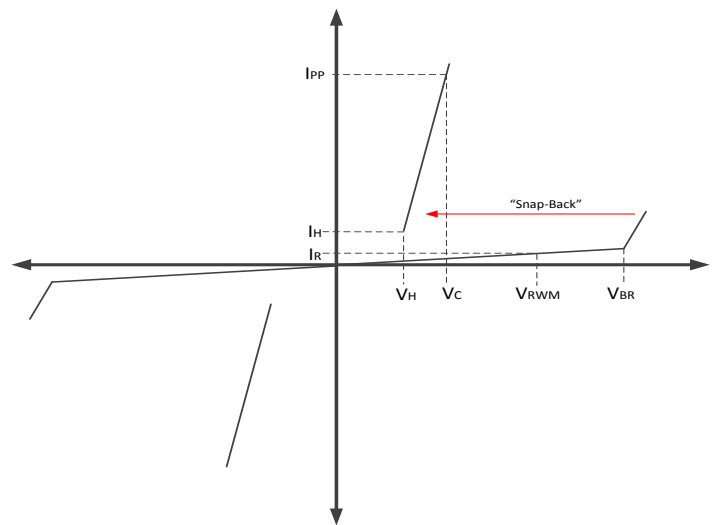
PROTECTION PRODUCTS

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 decreases below the holding current (I_H), 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.

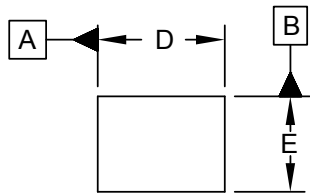
Symbol	Parameter
V_{RWM}	Maximum Working Voltage
V_{BR}	Breakdown Voltage
V_C	Clamping Voltage
I_H	Holding Current
I_R	Reserve Leakage Current
I_{PP}	Peak Pulse Current



Characteristic Curve

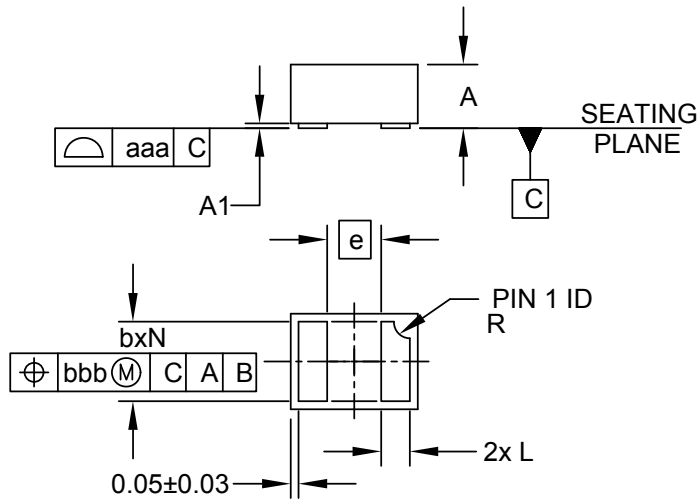
PROTECTION PRODUCTS

Outline Drawing - SLP0806P2T



TOP VIEW

DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.37	0.40	0.43
A1	0.00	0.03	0.05
b	0.45	0.50	0.55
D	0.75	0.80	0.875
E	0.55	0.60	0.675
e	0.34 BSC		
L	0.13	0.18	0.23
R	0.05	0.10	0.15
N	2		
aaa	0.08		
bbb	0.10		

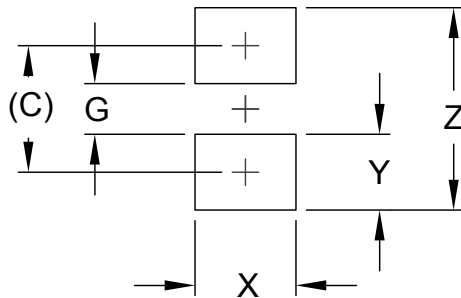


BOTTOM VIEW

NOTES:

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

Land Pattern - SLP0806P2T



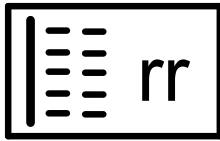
DIMENSIONS	
DIM	MILLIMETERS
(C)	0.75
G	0.30
X	0.60
Y	0.45
Z	1.20

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



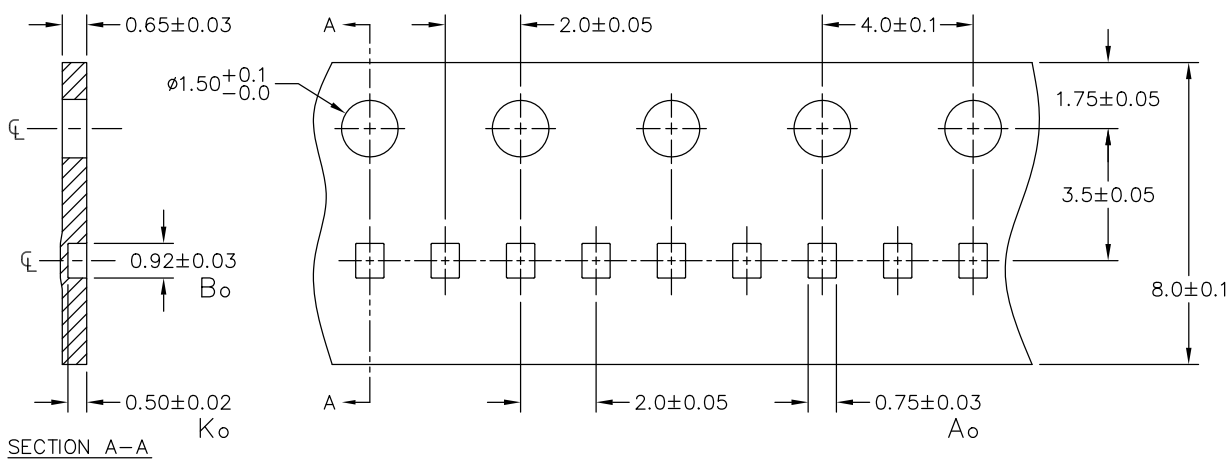
Notes: Marking will also include line matrix date code

Ordering Information

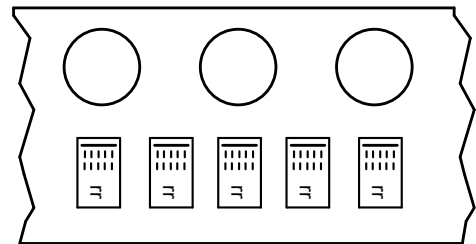
Part Number	Qty per Reel	Pocket Pitch	Reel Size
RClamp5031T.TNT	10000	2mm	7"

RailClamp and RClamp are registered trademarks of Semtech Corporation.

Tape and Reel Specification



NOTES: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



Contact Information

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