µClamp0571P - µClamp3671P

High-Power µClamp®
1-Line Surge Protection

PROTECTION PRODUCTS

Description

µClamp® TVS diodes are designed to protect sensitive electronics from damage or latch-up due to EOS, lightning, CDE, and ESD. They feature large cross-sectional area junctions for conducting high transient currents. These devices offer desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

The µClamp®xx71P series are in 2-pin SGP1610N2 package measuring 1.6 x 1.0 mm with a nominal height of 0.57mm. The leads are finished with leadfree NiPdAu. They may be used to protect 5V, 8V, 10V, 12V, 15V, 18V, 22V, 26V, and 36V systems. They feature high surge current capability and low clamping voltage making them ideal for use in harsh transient environments.

Features

- Transient protection for high-speed data lines to
- IEC 61000-4-2 (ESD) 30kV (air), 30kV (contact)
- IEC 61000-4-4 (EFT) 40A (5/50ns)
- IEC 61000-4-5 (Lightning) 20 - 80A (8/20µs)
- Protects one data or power line
- Low leakage current
- High peak pulse current capability
- Operating voltage options: 5V, 8V, 10V, 12V, 15V,
- 18V, 22V, 26V, 36V
- Solid-state silicon-avalanche technology

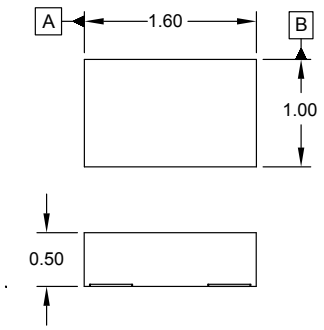
Mechanical Characteristics

- SGP1610N2 package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 1.6 x 1.0 x 0.57 mm
- Lead Finish: NiPdAu
- Marking: Marking code
- Packaging: Tape and Reel

Applications

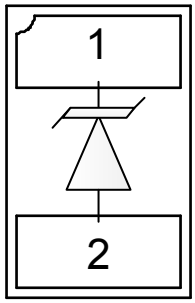
- Cellular Handsets & Accessories
- USB Voltage Bus
- Battery Protection
- Digital Lines
- Proximity Sensors

Package Dimension



Nominal Dimensions (mm)

Schematic & Pin Configuration



SGP1610N2 (Bottom View)

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20µs)	P_{PK}	1200-1500	W
ESD per IEC 61000-4-2 (Air)[1] ESD per IEC 61000-4-2 (Contact)[1]	V_{ESD}	±30 ±30	kV
Operating Temperature	T_J	-40 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T=25°C unless otherwise specified)

µClamp0571P

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				5	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		6	7	9	V
Reverse Leakage Current	I_R	V_{RWM} = 5V	T = 25°C		<10	100	nA
Peak Pulse Current	I_{PP}	tp = 8/20µs, Pin 1 to 2				80	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 40A			10	V
			I_{PP} = 80A			15	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.05		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				675	pF

µClamp0871P

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				8	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		9.5	11	13	V
Reverse Leakage Current	I_R	V_{RWM} = 8V	T = 25°C		<10	100	nA
Peak Pulse Current	I_{PP}	tp = 8/20µs, Pin 1 to 2				65	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 10A			15	V
			I_{PP} = 65A			23	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.05		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				475	pF

Electrical Characteristics (T=25°C unless otherwise specified)

µClamp1071P

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				10	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		12	13.5	15.5	V
Reverse Leakage Current	I_R	V_{RWM} = 10V, Pin 1 to 2	T = 25°C		<10	100	nA
Peak Pulse Current	I_{pp}	tp = 8/20µs , Pin 1 to 2				60	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 10A			17	V
			I_{PP} = 60A			25	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.05		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				350	pF

µClamp1271P

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				12	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		14	16	19	V
Reverse Leakage Current	I_R	V_{RWM} = 12V, Pin 1 to 2	T = 25°C		<10	100	nA
Peak Pulse Current	I_{pp}	tp = 8/20µs , Pin 1 to 2				45	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 10A			22	V
			I_{PP} = 45A			30	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.05		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				275	pF

µClamp1571P							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				15	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		17.5	20	23	V
Reverse Leakage Current	I_R	V_{RWM} = 15V, Pin 1 to 2	T = 25°C		<10	100	nA
Peak Pulse Current	I_{pp}	tp = 8/20µs , Pin 1 to 2				40	A
Clamping Voltage	V_C	tp = 8/20µs Pin 1 to 2	I_{PP} = 10A			25	V
			I_{PP} = 40A			40	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.05		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				220	pF

µClamp1871P							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				18	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		20	22	25	V
Reverse Leakage Current	I_R	V_{RWM} = 18V, Pin1 to 2	T = 25°C		<10	100	nA
Peak Pulse Current	I_{pp}	tp = 8/20µs , Pin 1 to 2				35	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 10A			28	V
			I_{PP} = 35A			45	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.10		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				225	pF

µClamp2271P							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				22	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		25.5	29	33.5	V
Reverse Leakage Current	I_R	V_{RWM} = 22V, Pin 1 to 2	T = 25°C		<10	100	nA
Peak Pulse Current	I_{PP}	tp = 8/20µs , Pin 1 to 2				25	A
Clamping Voltage	V_C	tp = 8/20µs, Pin 1 to 2	I_{PP} = 10A			40	V
			I_{PP} = 25A			55	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.10		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				165	pF

µClamp2671P							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				26	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		29	32	35	V
Reverse Leakage Current	I_R	V_{RWM} = 5V	T = 25°C		<10	100	nA
Peak Pulse Current	I_{PP}	tp = 8/20µs , Pin 1 to 2				23	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 10A			50	V
			I_{PP} = 23A			65	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.15		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				155	pF

µClamp3671P							
Parameter	**Symbol**	**Conditions**		**Min.**	**Typ.**	**Max.**	**Units**
Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to 2				36	V
Reverse Breakdown Voltage	V_{BR}	I_{BR} = 1mA, Pin 1 to 2		37		44	V
Reverse Leakage Current	I_R	V_{RWM} = 36V	T = 25°C		<10	100	nA
Peak Pulse Current	I_{pp}	tp = 8/20µs , Pin 1 to 2				18	A
Clamping Voltage	V_C	tp = 8/20µs	I_{PP} = 2A			48	V
			I_{PP} = 18A			80	
Dynamic Resistance[2,3]	R_{DYN}	tp = 0.2/100ns			0.29		Ω
Junction Capacitance	C_J	V_R = 0V, f = 1MHz				150	pF

Notes

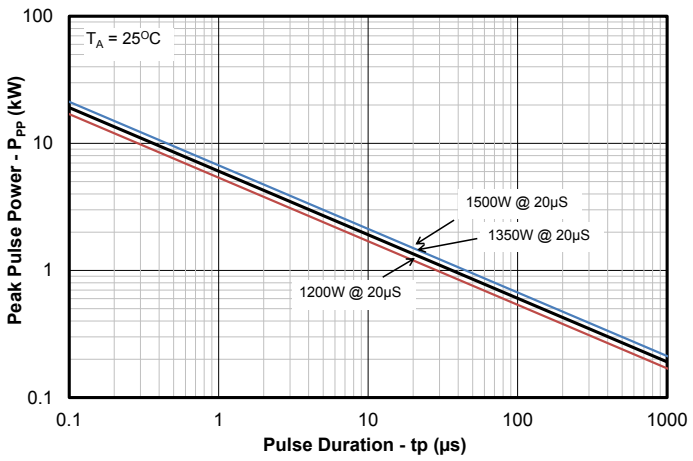
1) Measured with a 40dB attenuator, 50 Ohm scope input impedance, 2GHz bandwidth. ESD gun return path connected to ESD ground plane.

2) Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, I_{TLP} and V_{TLP} averaging window: t1 = 70ns to t2 = 90ns.

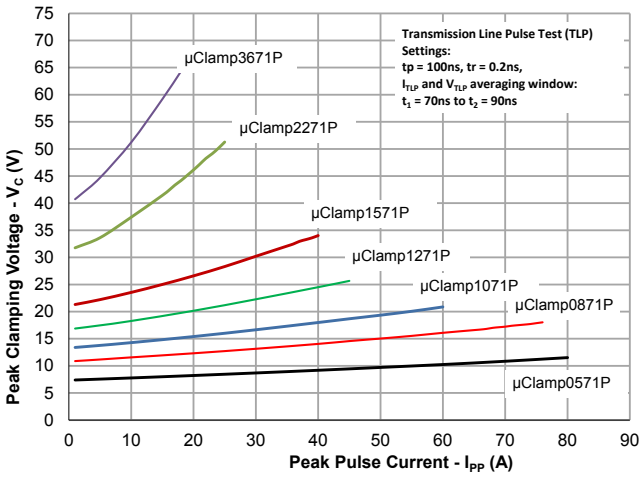
3) Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A

Typical Characteristics

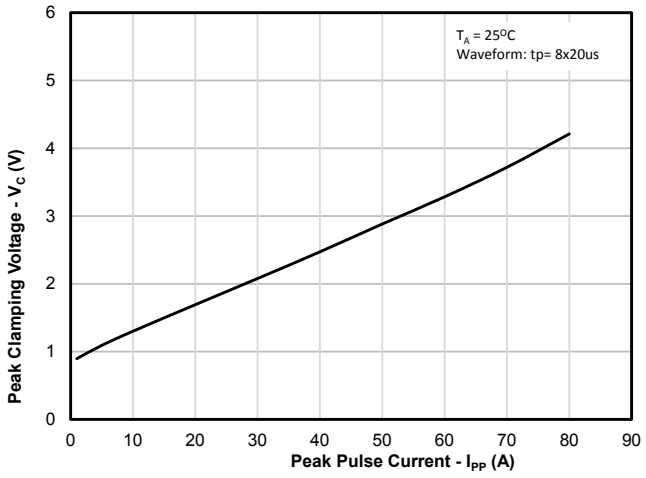
Non-Repetitive Peak Pulse Power vs. Pulse Time



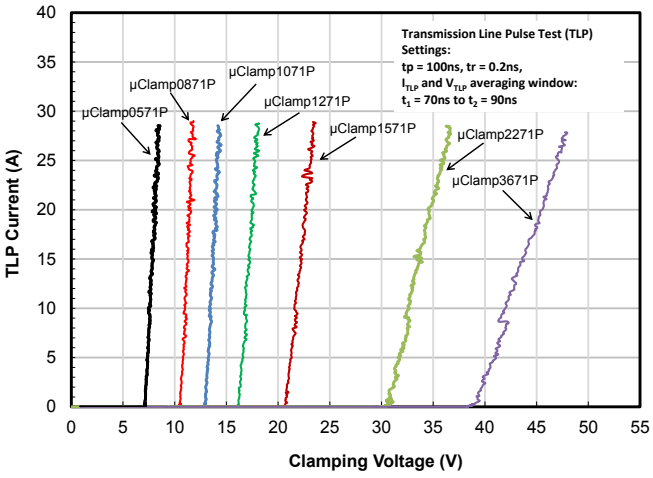
Clamping Voltage vs. Peak Pulse Current (tp = 8/20 µs)



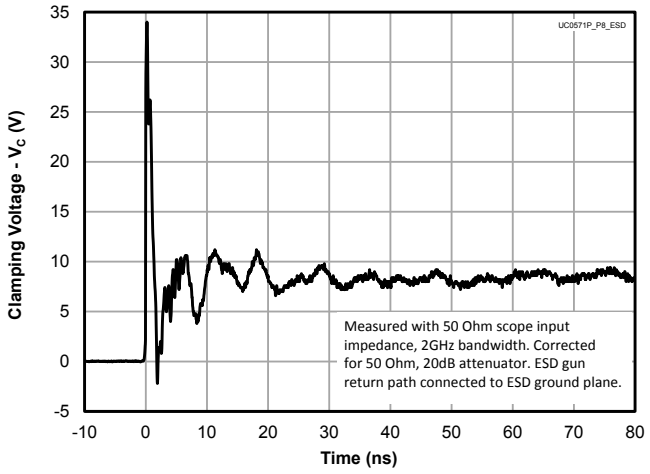
Forward Voltage vs. Peak Pulse Current (tp = 8/20 µs)



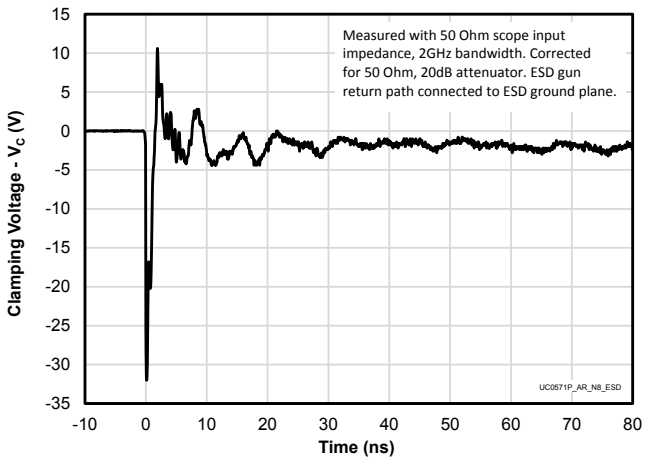
TLP Characteristic



ESD Clamping - µClamp0571P (+8kV Contact per IEC 61000-4-2)

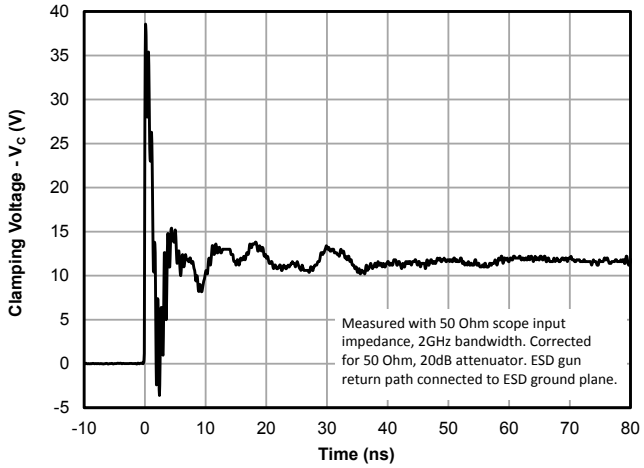


ESD Clamping - µClamp0571P (-8kV Contact per IEC 61000-4-2)

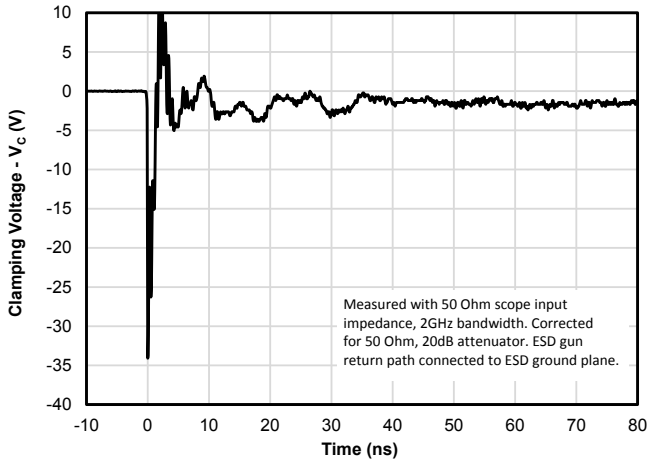


Typical Characteristics (Continued)

ESD Clamping - µClamp0871P
(+8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp0871P
(-8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp1071P
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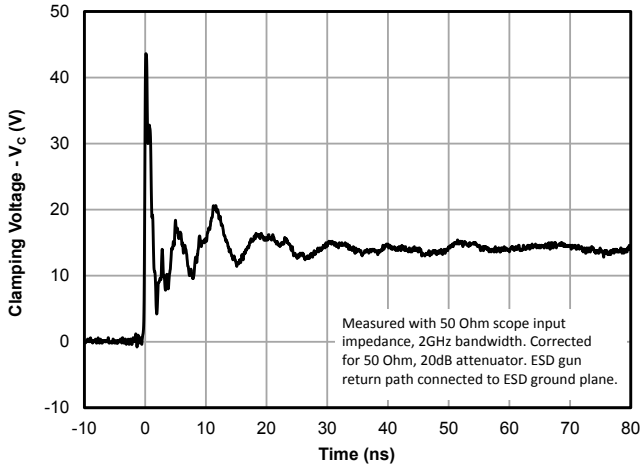
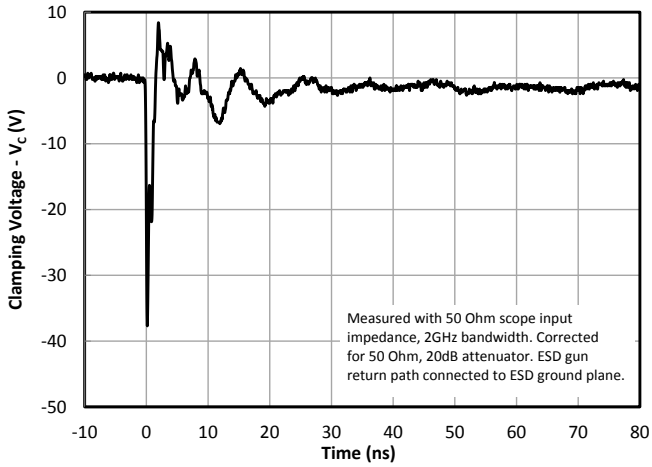
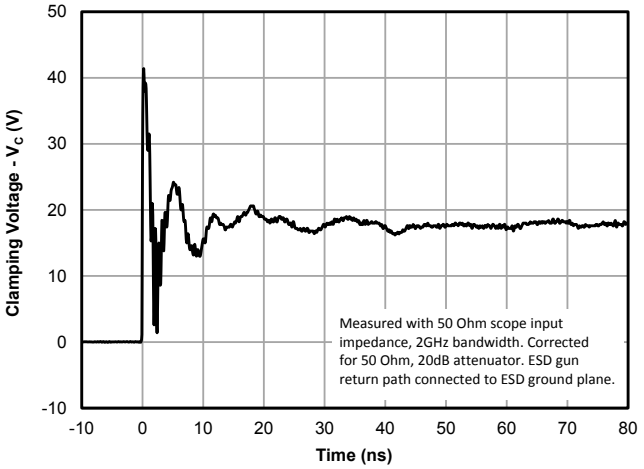


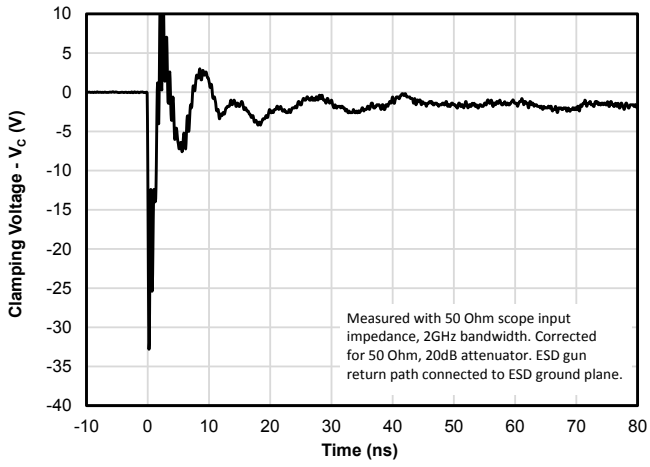
ESD Clamping - µClamp1071P
(-8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp1271P
(+8kV Contact per IEC 61000-4-2)

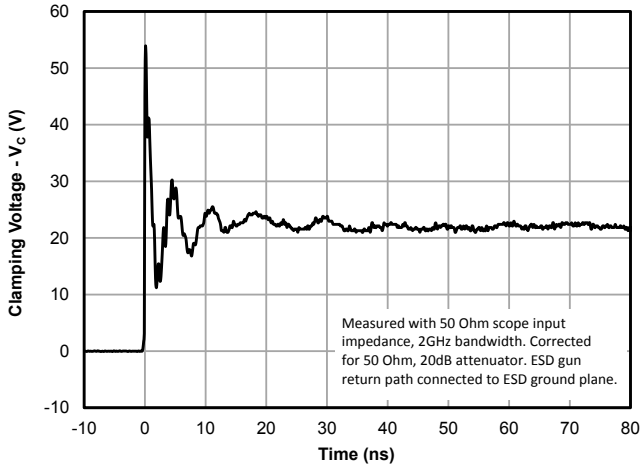


ESD Clamping - µClamp1271P
(-8kV Contact per IEC 61000-4-2)

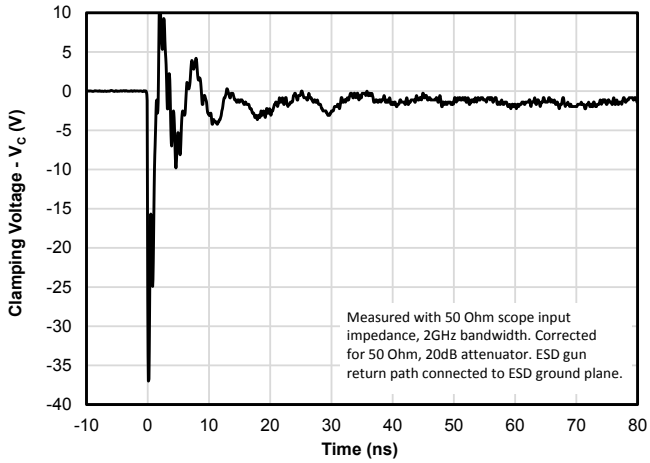


Typical Characteristics (Continued)

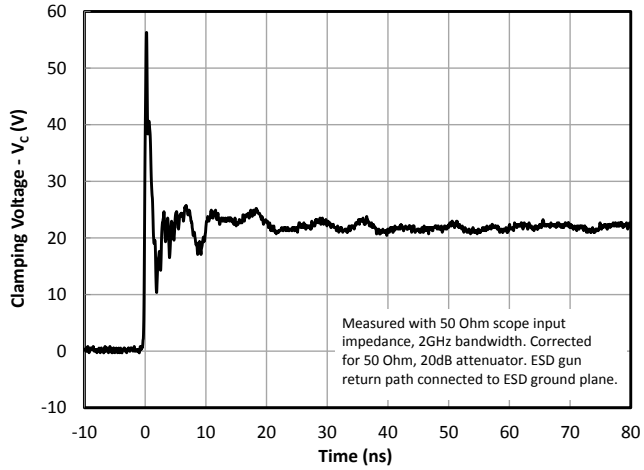
ESD Clamping - µClamp1571P
(+8kV Contact per IEC 61000-4-2)



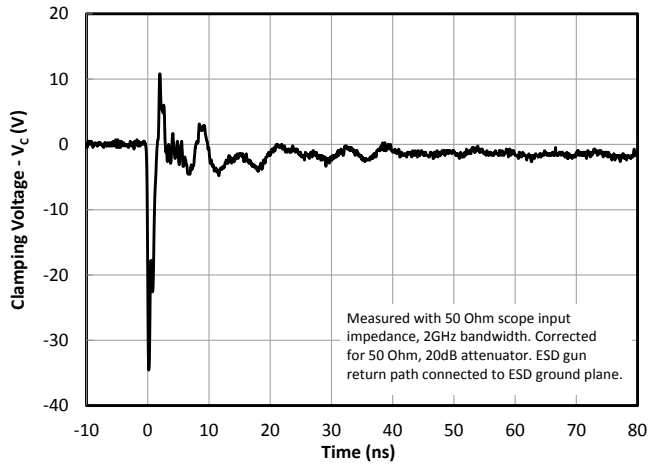
ESD Clamping - µClamp1571P
(-8kV Contact per IEC 61000-4-2)



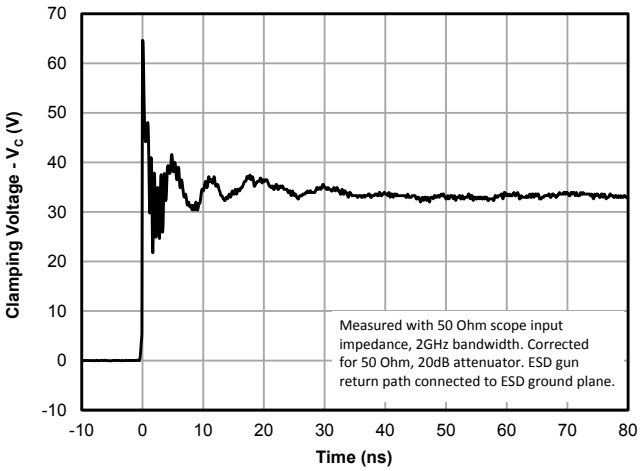
ESD Clamping - µClamp1871P
(+8kV Contact per IEC 61000-4-2)



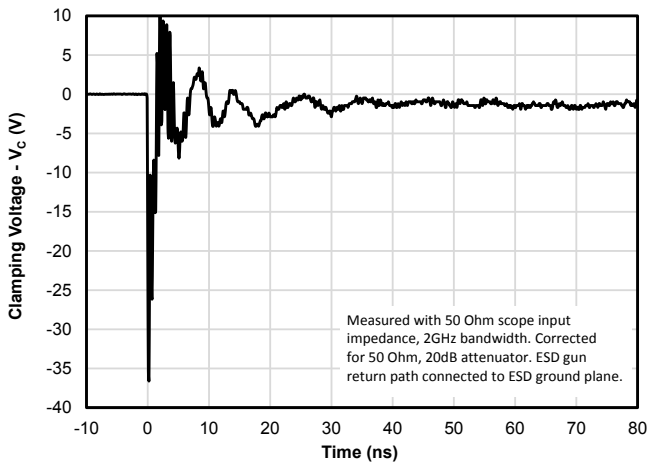
ESD Clamping - µClamp1871P
(-8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp2271P
(+8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp2271P
(-8kV Contact per IEC 61000-4-2)



Typical Characteristics (Continued)

ESD Clamping - µClamp2671P
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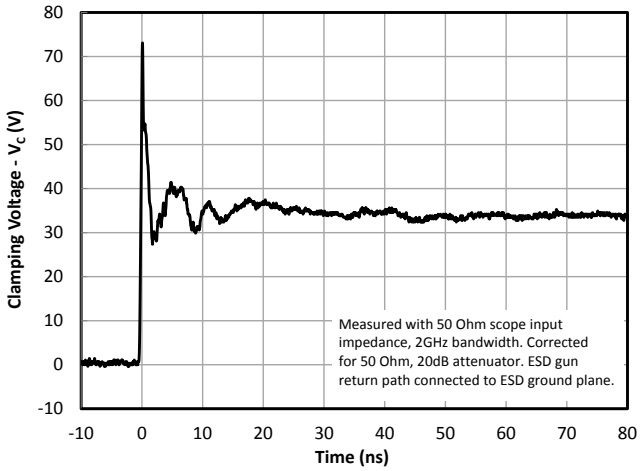
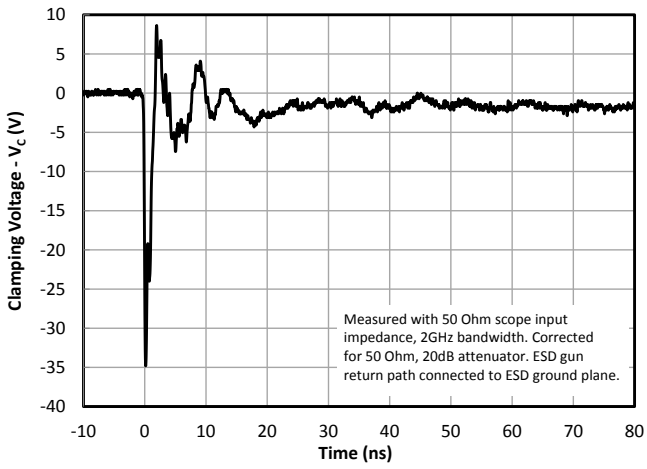


ESD Clamping - µClamp2671P
(-8kV Contact per IEC 61000-4-2)



ESD Clamping - µClamp3671P
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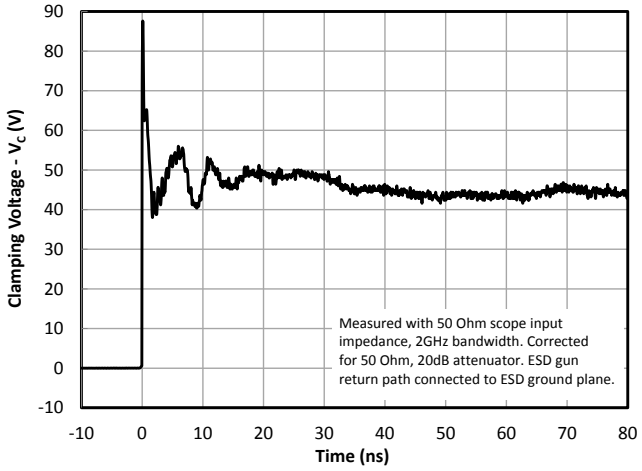
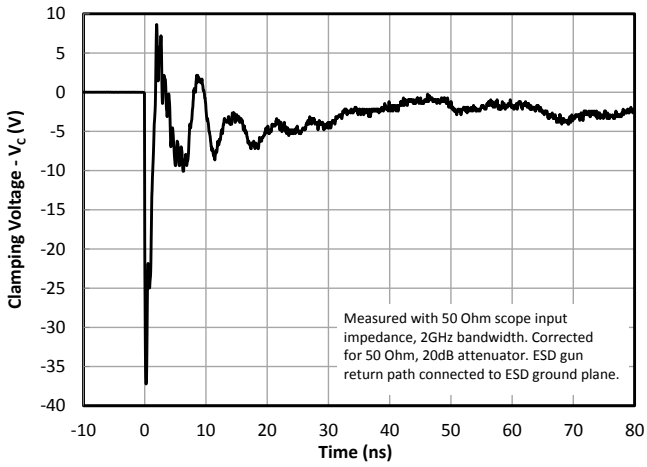


ESD Clamping - µClamp3671P
(-8kV Contact per IEC 61000-4-2)

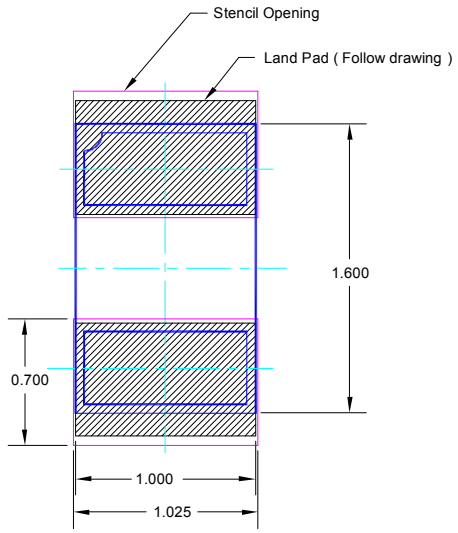


Application Information

Assembly Guidelines

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 with rounded corners
Solder Stencil Thickness	0.125 mm (0.005")
Solder Paste Type	Type 3 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

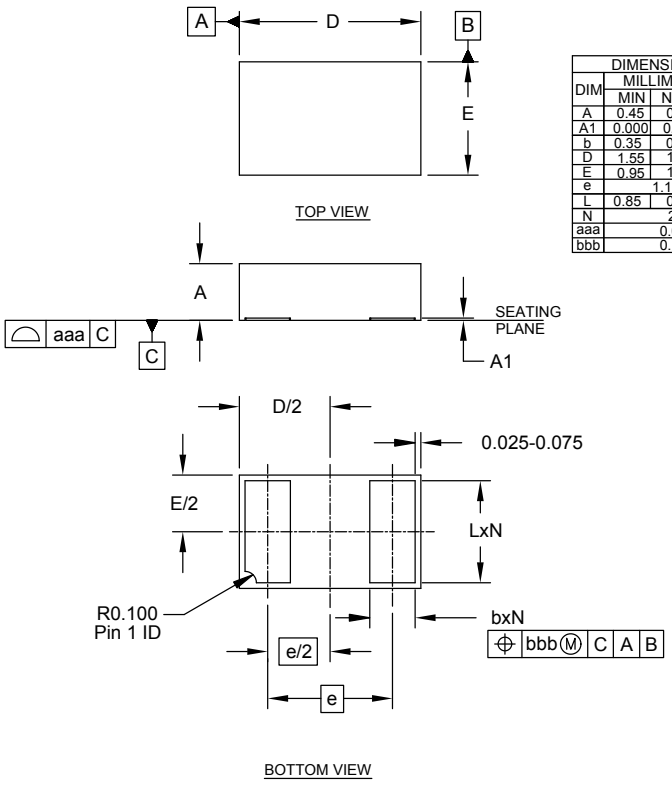


All Dimensions are in mm.

Land Pad. **Stencil opening** **Component**

Recommended Mounting Pattern

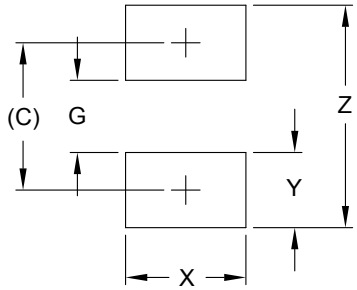
Outline Drawing - SGP1610N2



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0.000	0.015	0.05
b	0.35	0.40	0.45
D	1.55	1.60	1.65
E	0.95	1.00	1.05
e	1.10 BSC		
L	0.85	0.90	0.95
N	2		
aaa	0.08		
bbb	0.10		

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

Land Pattern - SGP1610N2

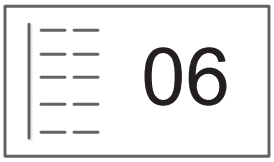


DIMENSIONS	
DIM	MILLIMETERS
C	(1.225)
G	0.60
X	1.00
Y	0.625
Z	1.85

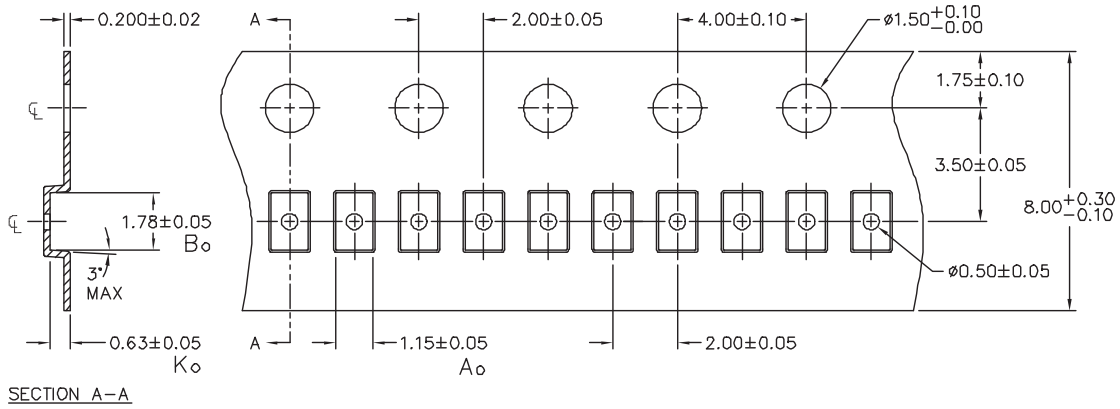
NOTES:

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.

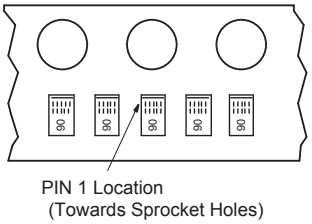
Marking Code



Tape and Reel Specification



NOTES: 1.) ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.



Ordering Information

Part Number	Marking Code	Working Voltage	Qty per Reel
µClamp0571P.TNT	06	5V	10,000
µClamp0871P.TNT	11	8V	10,000
µClamp1071P.TNT	12	10V	10,000
µClamp1271P.TNT	16	12V	10,000
µClamp1571P.TNT	18	15V	10,000
µClamp1871P.TNT	24	18V	10,000
µClamp2271P.TNT	26	22V	10,000
µClamp2671P.TNT	30	26V	10,000
µClamp3671P.TNT	37	36V	10,000

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