PROTECTION PRODUCTS - MicroClamp™

Description

The µClamp™ series of TVS arrays are designed to protect sensitive electronics from damage or latch-up due to ESD, lightning, and other voltage-induced transient events. Each device will protect up to four lines operating at **3.3 volts**.

The µClamp™3305P is a solid-state device designed specifically for transient suppression. It is constructed using Semtech's proprietary EPD process technology. The EPD process provides low standoff voltages with significant reductions in leakage currents and capacitance over traditional pn junction processes. They offer desirable characteristics for board level protection including fast response time, low clamping voltage and no device degradation.

The µClamp3305P may be used to meet the immunity requirements of IEC 61000-4-2, level 4 (±15kV air, ±8kV contact discharge). It is packaged in an ultra small SLP1616P6 package with a low profile of only 0.58mm. The leads are spaced at a pitch of 0.5mm and are finished with lead-free NiPdAu. The small package makes it ideal for use in portable electronics such as cell phones, digital still cameras, and notebook computers.

Features

- ◆ Transient protection for data lines to
  IEC 61000-4-2 (ESD) ±15kV (air), ±8kV (contact)
  IEC 61000-4-4 (EFT) 40A (tp = 5/50ns)
- ◆ Small package for use in portable electronics
- ◆ Protects five I/O lines
- ◆ Working voltage: 3.3V
- ◆ Low leakage current
- ◆ Low operating and clamping voltages
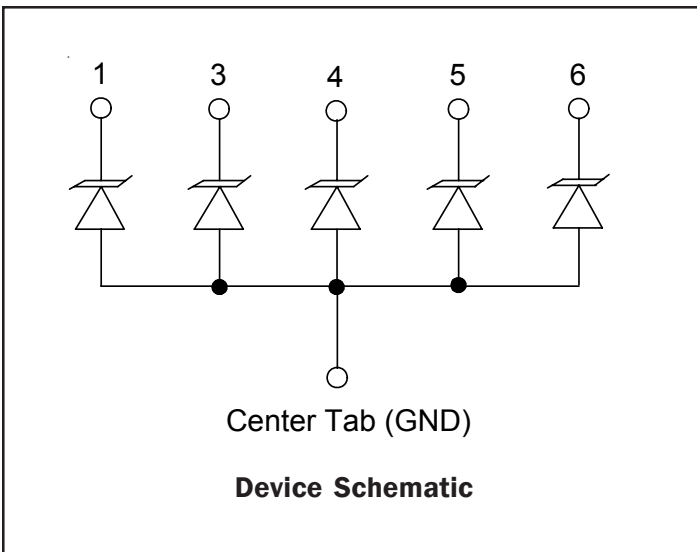- ◆ Solid-state silicon-avalanche technology

Mechanical Characteristics

- ◆ SLP1616P6 package
- ◆ RoHS/WEEE Compliant
- ◆ Nominal Dimensions: 1.6 x 1.6 x 0.58 mm
- ◆ Lead Pitch: 0.5mm
- ◆ Lead Finish: NiPdAu
- ◆ Marking : Orientation Mark and Marking Code
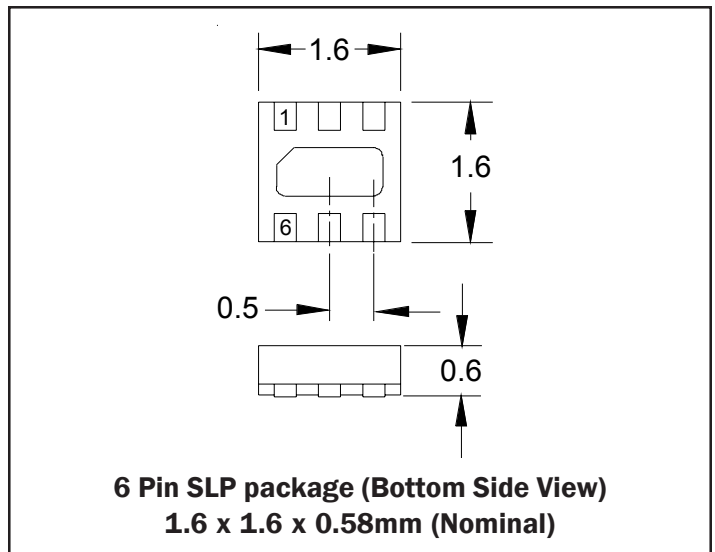- ◆ Packaging : Tape and Reel

Applications

- ◆ Cellular handsets and accessories
- ◆ Notebooks and handhelds
- ◆ MP3 Players
- ◆ Digital cameras
- ◆ Portable instrumentation
- ◆ PDA's

Circuit Diagram

Center Tab (GND)

Device Schematic

Package

6 Pin SLP package (Bottom Side View)
1.6 x 1.6 x 0.58mm (Nominal)

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Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (tp = 8/20μs)	P_{pk}	40	Watts
Maximum Peak Pulse Current (tp = 8/20μs)	I_{pp}	5	Amps
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{PP}	+/- 20 +/- 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} = 2μA	3.5	3.9	4.6	V
Snap-Back Voltage	V_{SB}	I_{SB} = 50mA	2.8			V
Reverse Leakage Current	I_R	V_{RWM} = 3.3V		0.05	0.5	μA
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20μs Any I/O to Gnd			5.5	V
Clamping Voltage	V_C	I_{PP} = 5A, tp = 8/20μs Any I/O to Gnd			8.0	V
Reverse Clamping Voltage	V_{CR}	I_{PP} = 1A, tp = 8/20μs Any I/O to Gnd			2.4	V
Junction Capacitance	C_j	I/O pin to Gnd V_R = 0V, f = 1MHz		20	25	pF
		I/O pin to Gnd V_R = 3.3V, f = 1MHz		12		pF
		I/O pin to I/O pin V_R = 0V, f = 1MHz		10	12.5	pF
		I/O pin to I/O pi n V_R = 3.3V, f = 1MHz		7.5		pF

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Typical Characteristics

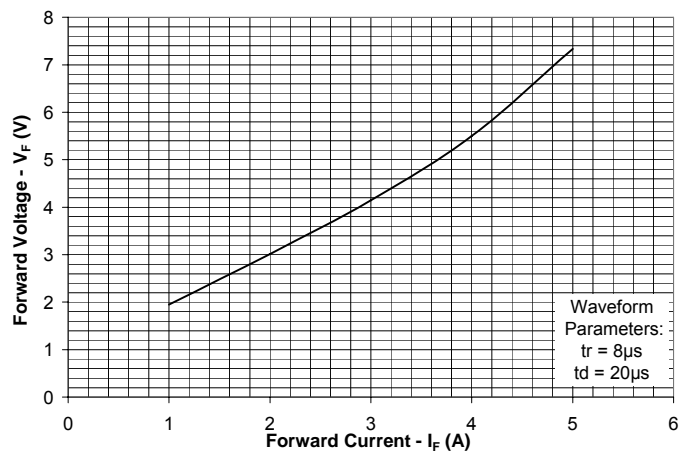### Non-Repetitive Peak Pulse Power vs. Pulse Time
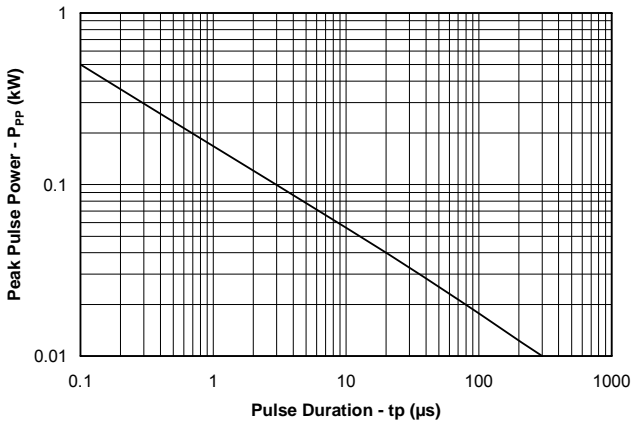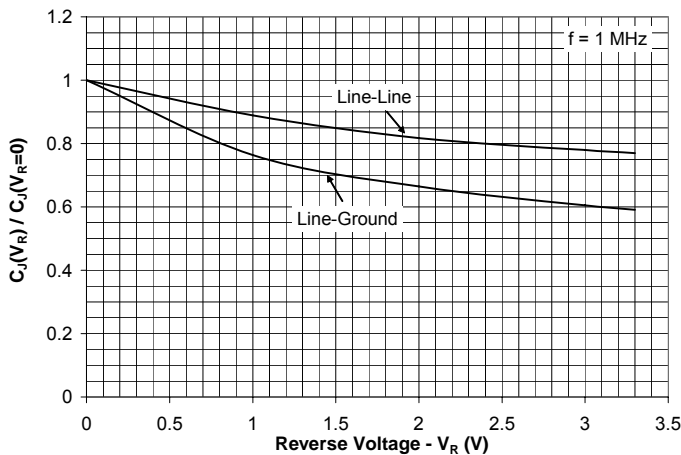

Power Derating Curve
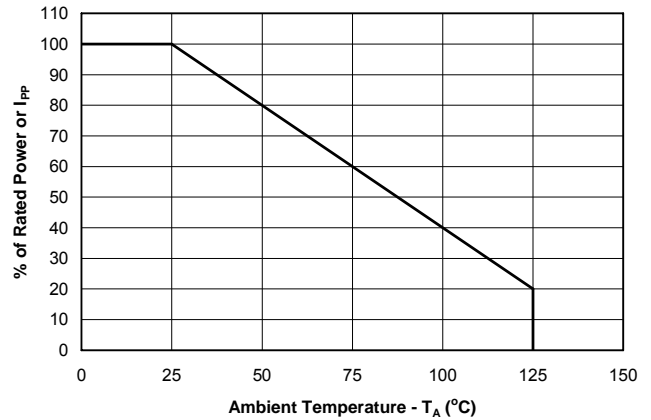
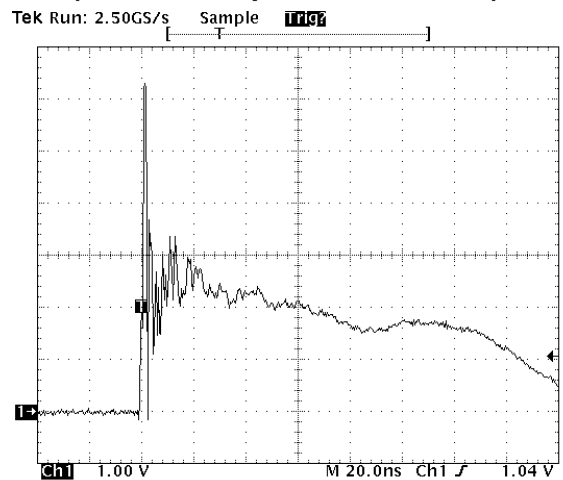### Clamping Voltage vs. Peak Pulse Current
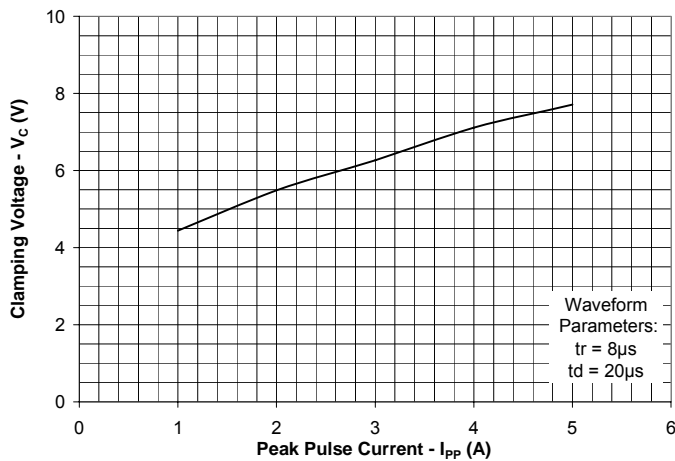
Forward Voltage vs. Forward Current

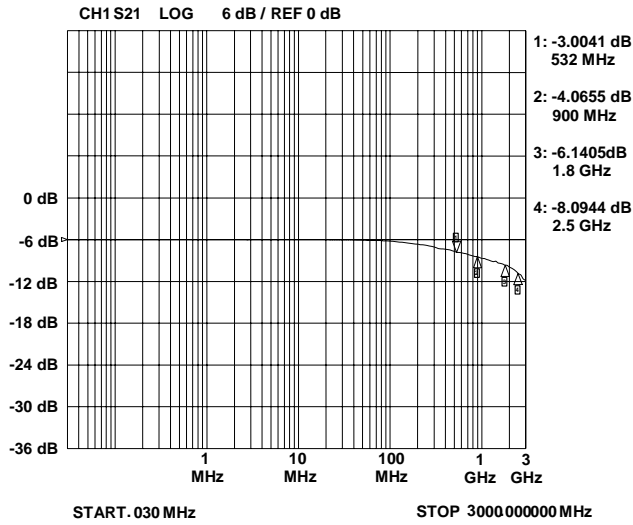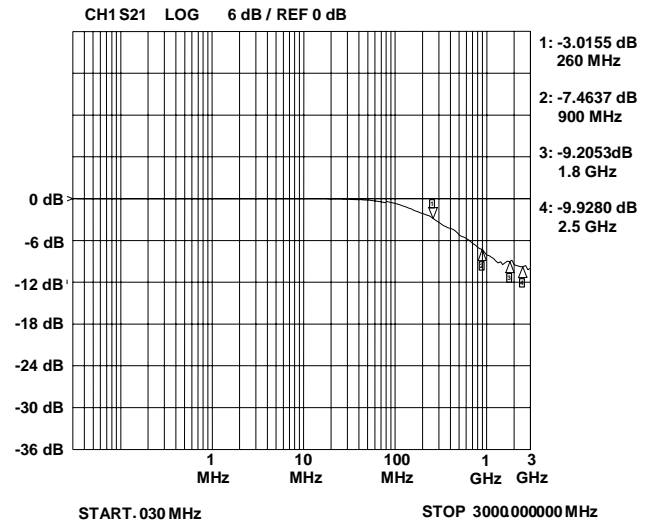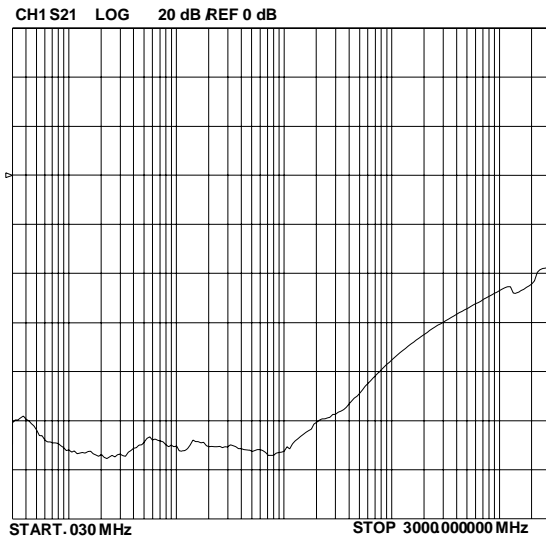### Normalized Capacitance vs. Reverse Voltage

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

Insertion Loss S21 - LtoL (I/O to I/O)

CH1 S21   LOG   6 dB / REF 0 dB

1: -3.0041 dB
   532 MHz

2: -4.0655 dB
   900 MHz

3: -6.1405dB
   1.8 GHz

4: -8.0944 dB
   2.5 GHz

```
  0 dB
 -6 dB
-12 dB
-18 dB
-24 dB
-30 dB
-36 dB
        1     10    100    1    3
       MHz   MHz   MHz   GHz  GHz
```

START .030 MHz   STOP 3000.000000 MHz

Insertion Loss S21 -LtoG (I/O to Pin 2)

CH1 S21   LOG   6 dB / REF 0 dB

1: -3.0155 dB
   260 MHz

2: -7.4637 dB
   900 MHz

3: -9.2053dB
   1.8 GHz

4: -9.9280 dB
   2.5 GHz

```
  0 dB
 -6 dB
-12 dB
-18 dB
-24 dB
-30 dB
-36 dB
        1     10    100    1    3
       MHz   MHz   MHz   GHz  GHz
```

START .030 MHz   STOP 3000.000000 MHz

Crosstalk S21 (I/O to Pin 4)

CH1 S21   LOG   20 dB /REF 0 dB

START .030 MHz   STOP 3000.000000 MHz

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Applications Information

Device Connection Options

The µClamp3305P is designed to protect 5 signal lines with an operating voltage of 0 to 3.3V. It will present a high impedance to the protected line up to 3.3 volts. It will "turn on" when the line voltage exceeds 3.5 volts. The device is unidirectional and may be used on lines where the signal polarity is above ground.

Pin 1,3,4,5,6 are connected to I/O signals. The center tab is connected to system ground. Pin 2 should be left open or not connected. All signal lines and ground should be made with the lowest impedance and inductance path as possible. This will improve signal quality of the lines and keep the clamping voltage as low as possible during a fast transient.

Due to the "snap-back" characteristics of the low voltage TVS, it is not recommended that the I/O line be directly connected to a DC source greater than snap-back votlage (V_{SB}) as the device can latch on.

EPD TVS Characteristics

These devices are constructed using Semtech's proprietary EPD technology. The structure of the EPD TVS is vastly different from the traditional pn-junction devices. At voltages below 5V, high leakage current and junction capacitance render conventional ava-lanche technology impractical for most applications. However, by utilizing the EPD technology, these devices can effectively operate at 3.3V while maintaining excellent electrical characteristics.

The EPD TVS employs a complex nppn structure in contrast to the pn structure normally found in tradi-tional silicon-avalanche TVS diodes. The EPD mecha-nism is achieved by engineering the center region of the device such that the reverse biased junction does not avalanche, but will "punch-through" to a conduct-ing state. This structure results in a device with supe-rior DC electrical parameters at low voltages while maintaining the capability to absorb high transient currents.
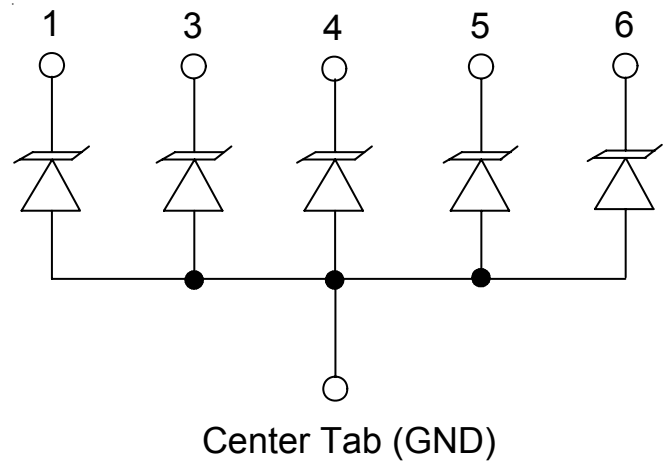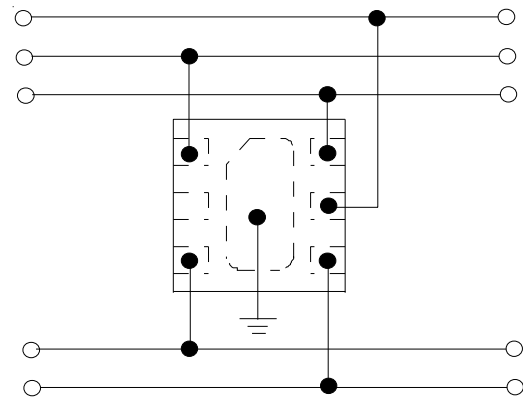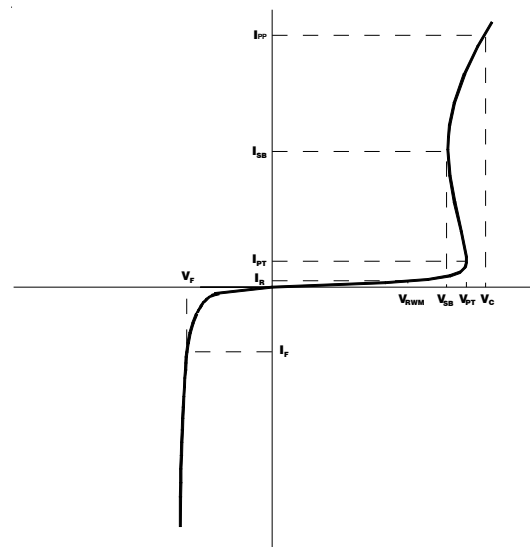
Figure 1 - Circuit Diagram

Center Tab (GND)

Figure 2 - Layout Example

Figure 3 - EPD TVS IV Characteristic Curve

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Applications Information - Spice Model
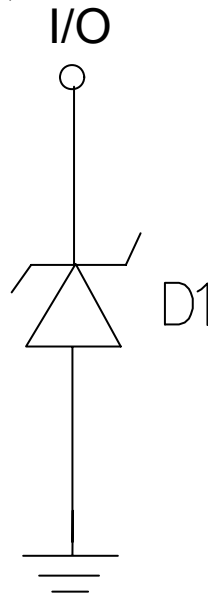
Figure 3 - µClamp3305P Spice Model

µClamp3305P Spice Parameters		
Parameter	**Unit**	**D1 (TVS)**
IS	Amp	2E-12
BV	Volt	20
VJ	Volt	0.57
RS	Ohm	1.444
IBV	Amp	1.0 E-3
CJO	Farad	20E-12
TT	sec	2.541E-9
M	--	0.236
N	--	1.1
EG	eV	1.11

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Outline Drawing - SLP1616P6
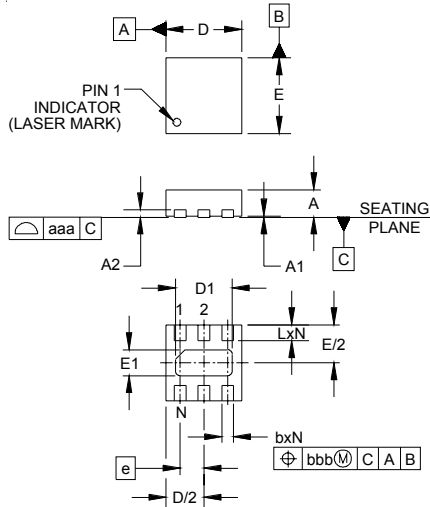
DIMENSIONS						
DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.020	.023	.026	0.50	0.58	0.65
A1	0.00	.001	.002	0.00	0.03	0.05
A2		(.005)			(0.13)	
b	.008	.010	.012	0.20	0.25	0.30
D	.059	.063	.067	1.50	1.60	1.70
D1	.041	.047	.051	1.05	1.20	1.30
E	.059	.063	.067	1.50	1.60	1.70
E1	.010	.016	.020	0.25	0.40	0.50
e		.020 BSC			0.50 BSC	
L	.010	.013	.016	0.25	0.33	0.40
N		6			6	
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 - SLP1616P6
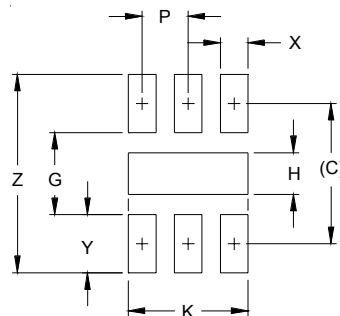
DIMENSIONS		
DIM	INCHES	MILLIMETERS
C	.060	1.52
G	.035	0.89
H	.018	0.45
K	.051	1.30
P	.020	0.50
X	.012	0.30
Y	.025	0.63
Z	.085	2.15

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.
3. THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD
SHALL BE CONNECTED TO A SYSTEM GROUND PLANE.
FAILURE TO DO SO MAY COMPROMISE THE THERMAL AND/OR
FUNCTIONAL PERFORMANCE OF THE DEVICE.
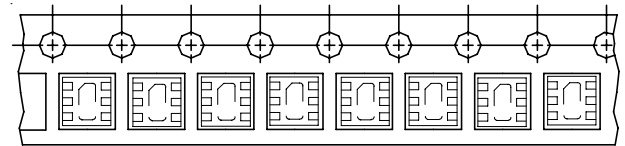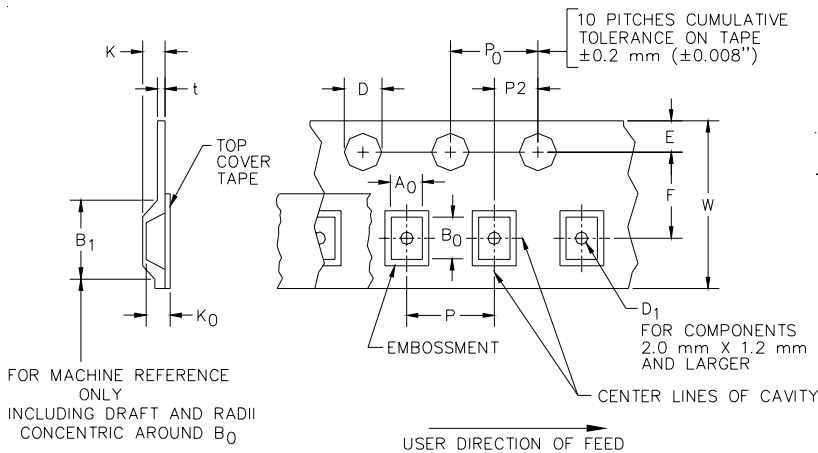
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Marking
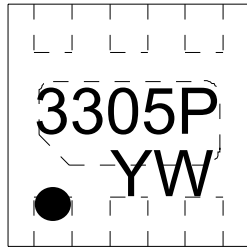
3305P
YW

Y = year
W = Week

Ordering Information

Part Number	Working Voltage	Lead Finish	Qty per Reel	Reel Size
uClamp3305P.TCT	3.3V	Pb Free	3,000	7 Inch

MicroClamp, uClamp and µClamp are marks of Semtech Corporation

Tape and Reel Specification

10 PITCHES CUMULATIVE TOLERANCE ON TAPE ±0.2 mm (±0.008")

TOP COVER TAPE

FOR MACHINE REFERENCE ONLY
INCLUDING DRAFT AND RADII CONCENTRIC AROUND B₀

EMBOSSMENT

CENTER LINES OF CAVITY

D₁ FOR COMPONENTS 2.0 mm X 1.2 mm AND LARGER

USER DIRECTION OF FEED

Device Orientation in Tape
(Pin 1 upper left towards sprocket holes)

A0	B0	K0
1.78 +/-0.10 mm	1.78 +/-0.10 mm	0.69 +/-0.10 mm

Tape Width	B, (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 (0.59 +.005 - .000)	0.8 mm ±0.05 (.031)	1.750±.10 mm (.069±.004)	3.5±0.05 mm (.138±.002)	2.4 mm (.094)	4.0±0.1 mm (.157±.00-4)	4.0±0.1 mm (.157±.00-4)	2.0±0.05m-m (.079±.002)	0.4 mm (.016)	8.0 mm + 0.3 mm - 0.1 mm (.312±.012)

Contact Information

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