Maximum Ratings

Rating	Symbol	Value	Units
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	+/- 17 +/- 12	kV
Junction Temperature	T_J	125	°C
Operating Temperature	T_{op}	-40 to +85	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T=25°C)

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
TVS Reverse Stand-Off Voltage	V_{RWM}	Pin 1 to GND			5.5	V
TVS Reverse Breakdown Voltage	V_{BR}	Pin 1 to GND I_t = 1mA	6	7.5	9	V
TVS Reverse Leakage Current	I_R	V_{RWM}= 5.5V Between data (D+, D-) pin and Ground			1	µA
TVS Reverse Leakage Current	I_R	Each Line			1	µA
Series Resistance	R_S	Each Line	20	22	24	Ohms
Pull Up Resistance	R_{PU}		1.35	1.5	1.65	kOhms
Total Capacitance	C_{TOT}	Pin 1, 2 or 3 to GND V_R = 0V, f = 1MHz	30	40	45	pF

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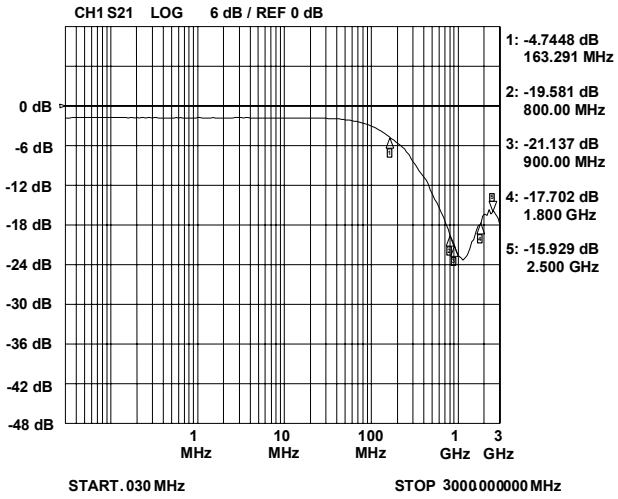
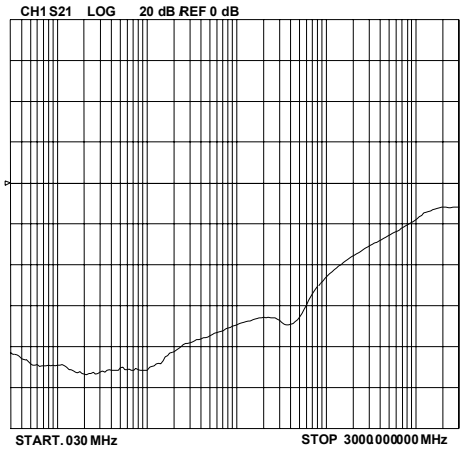
Typical Characteristics

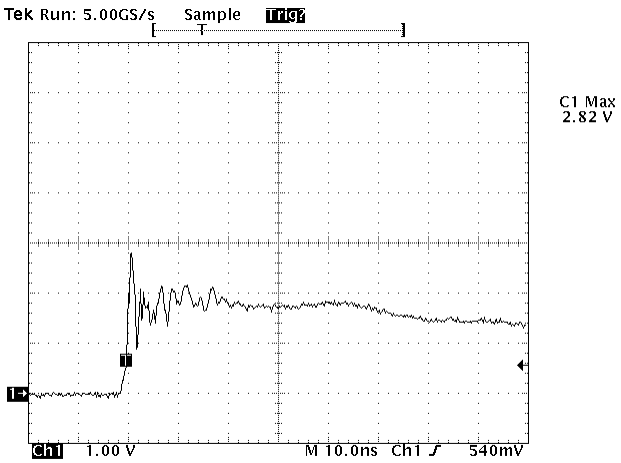
Typical Insertion Loss S21



Analog Crosstalk (Each Line)

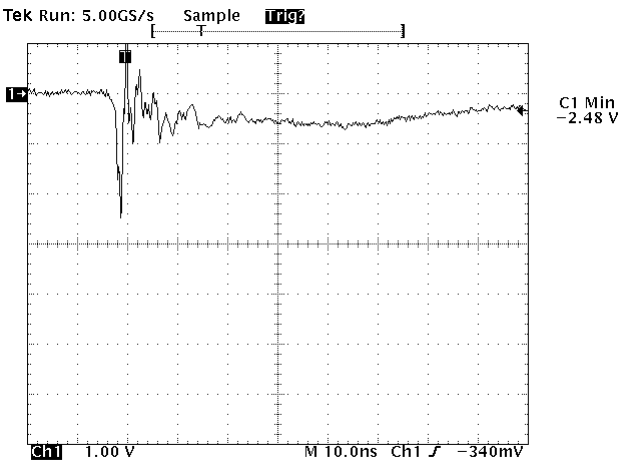


ESD Clamping (+8kV Contact)



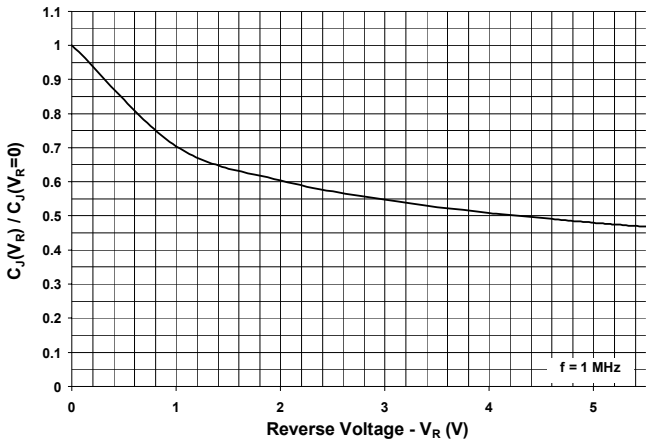
Note: Data is taken with a 10x attenuator

ESD Clamping (-8kV Contact)



Note: Data is taken with a 10x attenuator

Normalized Capacitance vs. Reverse Voltage



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Device Connection

The EClamp2522P is designed to provide termination, EMI filtering and ESD protection for one USB port. The device is connected as follows:

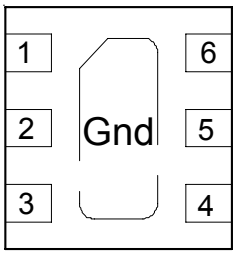
1. **Full-Speed Devices:** For full-speed devices the pull-up resistor is connected to the D+ line. Route the D+ line from the connector to pin 2. Pin 5 is connected to the D+ line of the IC. Route the D- line from the connector to pin 3. Pin 4 is connected to the D- line of the IC. Pin 1 is connected to the voltage supply line (V_{BUS}). Pin 6 is connected to the 3.3 Volt supply. The ground connection is made to the center tab. For best results, use multiple vias to the ground plane to reduce parasitic inductance.
2. **Low-Speed Devices:** For low speed devices the pull-up resistor is connected to the D- line. Route the D- line from the connector to pin 2. Pin 5 is connected to the D- line of the IC. Route the D+ line from the connector to pin 3. Pin 4 is connected to the D+ line of the IC. Pin 1 is connected to the voltage supply line (V_{BUS}). Pin 6 is connected to the 3.3 Volt supply. The ground connection is made to the center tab. For best results, use multiple vias to the ground plane to reduce parasitic inductance.

USB Port Design Considerations

The Universal Serial Bus (USB) specification requires termination and filtering components for proper operation. In addition, an open USB socket is vulnerable to hazardous ESD discharges in excess of 15kV. These discharges can occur on the data lines or the voltage bus. The EClamp2522P is an easily implemented solution that is designed to meet the termination and EMI filter requirements of the USB specification for low speed and full speed devices. It also provides ESD protection to IEC 61000-4-2, level 4.

USB line termination is achieved with series resistors on both the D+ and D- lines. These resistors preserve signal integrity by matching the cable impedance to that of the differential driver. A 1.5kΩ pull-up resistor is used to identify an upstream port on either the D+ (full speed devices) or the D- (low speed devices) data line. TVS diodes provide ESD protection of both (D+ and D-) data lines and the voltage bus (V_{BUS}). This integrated solution simplifies design and requires minimal board space.

Figure 1 - Pin Identification and Configuration (Top Side View)



Pin	Symbol	Identification
1	VBus	5.25V VBus ESD Protection
2	DM In	USB data input with termination resistor
3	DP In	USB data input with termination resistor
4	DP Out	USB data output with termination resistor
5	DM Out	USB data output with termination resistor
6	V_{Term}	1.5k Ohm pull-up resistor
Center Tab	GND	Ground connection

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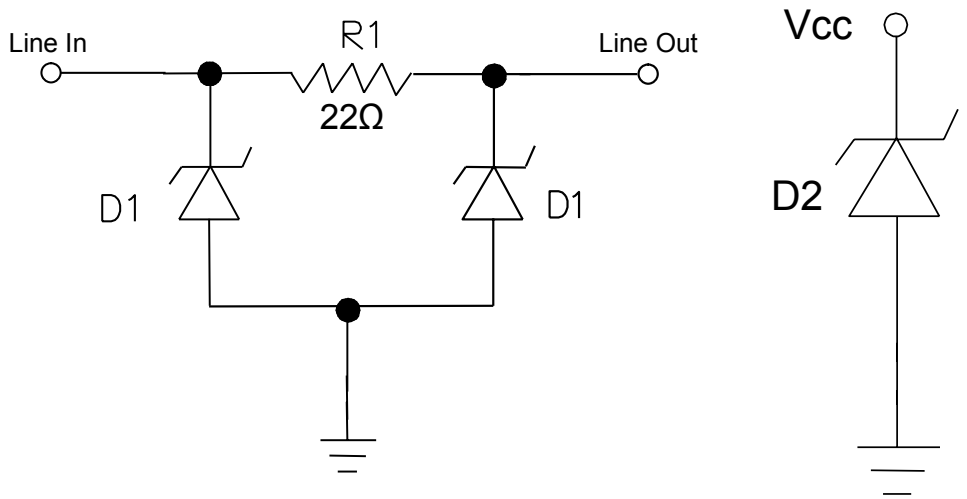
Applications Information - Spice Model



EClamp2522P Spice Model

EClamp2522P Spice Parameters			
Parameter	**Unit**	**D1**	**D2**
IS	Amp	3.4E-15	3.4E-15
BV	Volt	7.546	7.594
VJ	Volt	0.753	0.753
RS	Ohm	0.649	0.441
IBV	Amp	1E-3	1E-3
CJO	Farad	17E-12	31E-12
TT	sec	2.541E-9	2.541E-9
M	--	0.24	0.26
N	--	1.1	1.1
EG	eV	1.11	1.11

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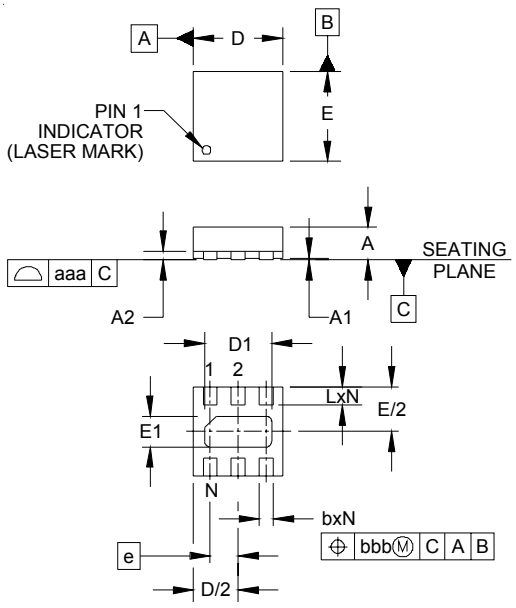
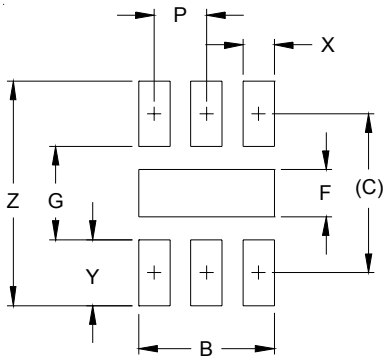
Outline Drawing - SLP1616P6



DIM	DIMENSIONS					
	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		(.006)			(0.15)	
b	.007	.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	.016	.022	.026	0.40	0.55	0.65
e		.020 BSC			0.50 BSC	
L	.013	.013	.016	0.25	0.33	0.40
N		6			6	
aaa		.004			0.09	
bbb		.004			0.09	

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



DIM	INCHES	MILLIMETERS
B	.051	1.30
C	.060	1.52
P	.020	0.50
F	.018	0.45
G	.035	0.89
X	.012	0.30
Y	.025	0.63
Z	.085	2.15

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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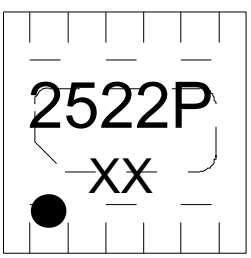
Marking



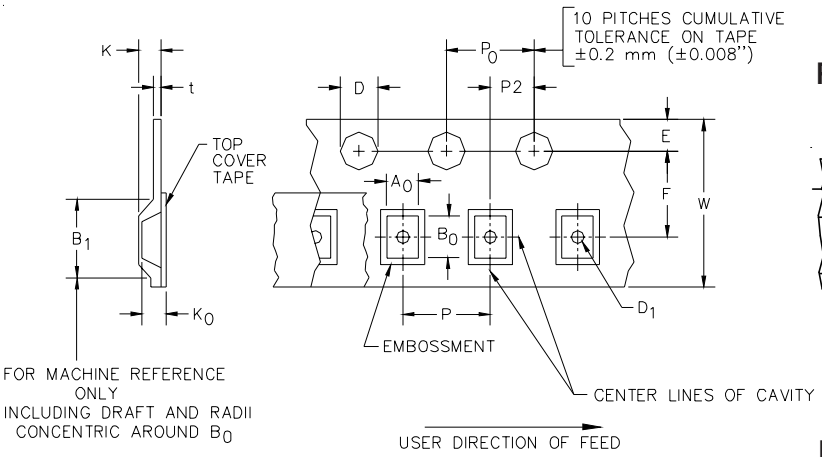
XX = Date Code

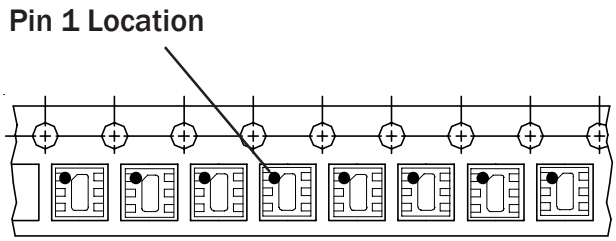
Ordering Information

Part Number	Qty per Reel	Reel Size
EClamp2522P.TCT	3000	7 Inch

This is a lead-free RoHS/WEEE Compliant Device
EMIClamp and EClamp are marks of Semtech Corporation

Tape and Reel Specification





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

A0	B0	K0
1.78 +/-0.05 mm	1.78 +/-0.05 mm	0.69 +/-0.05 mm

Tape Width	B, (Max)	D	D1	E	F	K (MAX)	P	P0	P2	T(MAX)	W
8 mm	4.2 mm	1.5 + 0.1 mm - 0.0 mm)	0.5 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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