Maximum Ratings

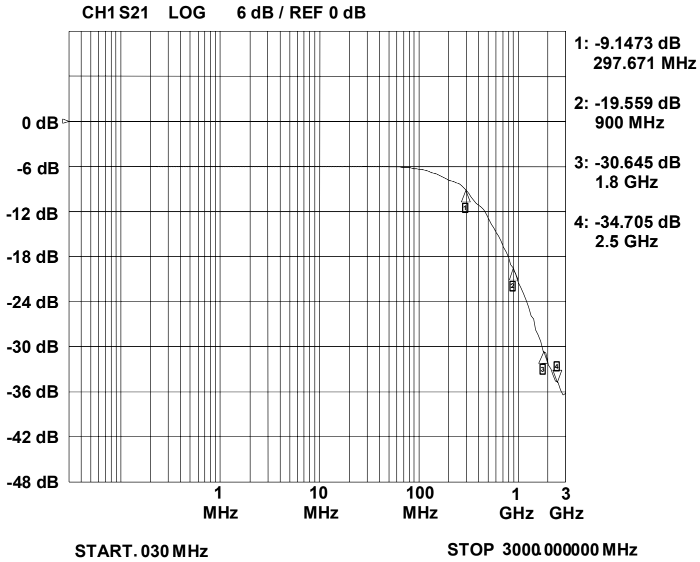
Rating	Symbol	Value	Units
ESD per IEC 61000-4-2 (Air) ESD per IEC 61000-4-2 (Contact)	V_{ESD}	+/- 17 +/- 12	kV
Junction Temperature	T_J	125	°C
Operating Temperature	T_{op}	-40 to +85	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Electrical Characteristics (T = 25°C)

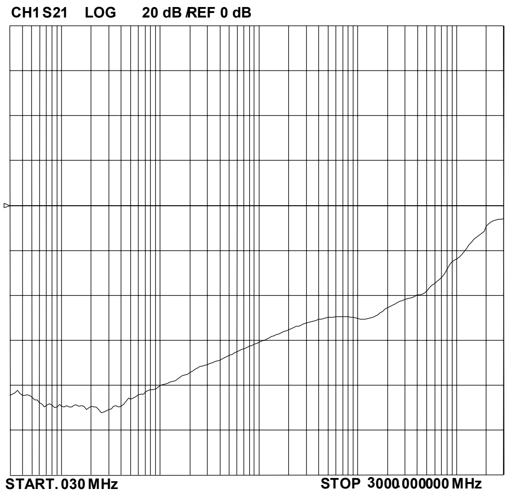
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
TVS Reverse Stand-Off Voltage	V_{RWM}				5	V
TVS Reverse Breakdown Voltage	V_{BR}	I_t = 1mA	6	8	10	V
TVS Reverse Leakage Current	I_R	V_{RWM} = 3.0V			0.5	μA
Total Series Resistance	R	Each Line	85	100	115	Ohms
Total Capacitance	C_{in}	Input to Gnd, Each Line V_R = 0V, f = 1MHz	16	20	24	pF
Total Capacitance	C_{in}	Input to Gnd, Each Line V_R = 2.5V, f = 1MHz	9	11	13	pF

Typical Characteristics

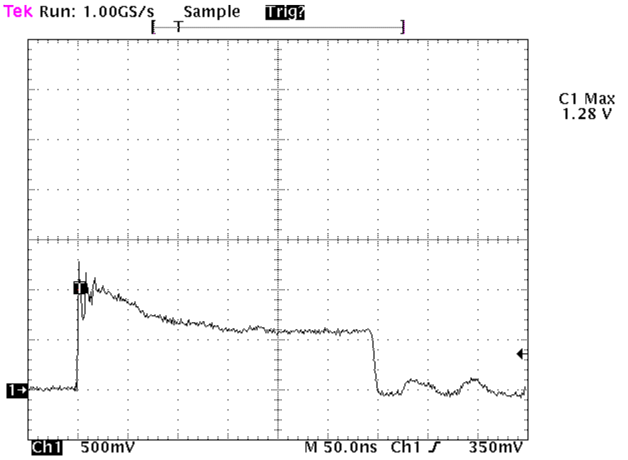
Typical Insertion Loss S21 (Each Line)



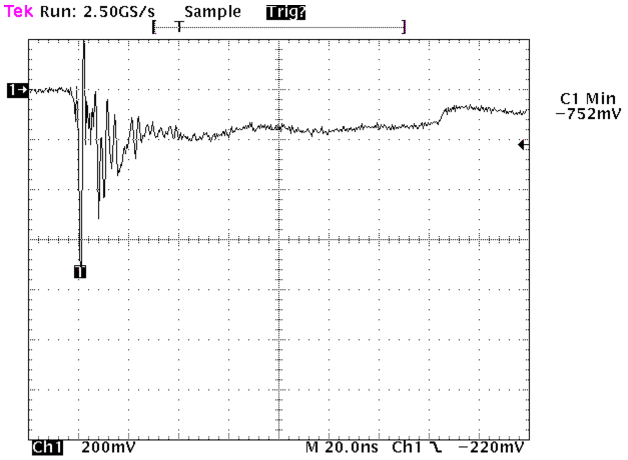
Analog Crosstalk (Each Line)



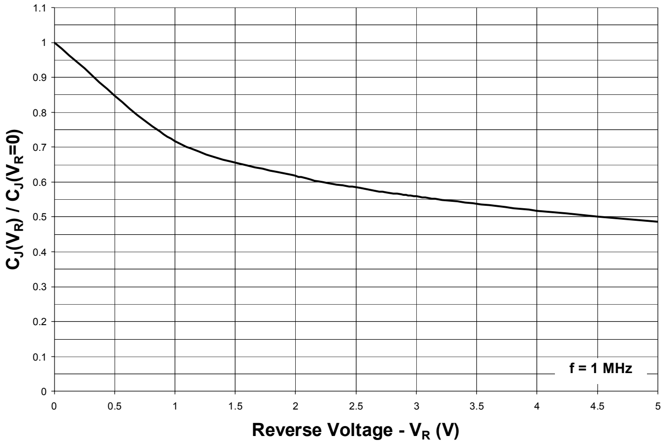
ESD Clamping (+8kV Contact)



ESD Clamping (-8kV Contact)



Capacitance vs. Reverse Voltage (Normalized to 0 volts)



Device Connection

The EClamp2376P is comprised of six identical circuits each consisting of a low pass filter for EMI/RFI suppression and dual TVS diodes for ESD protection. The device is in a 12-pin SLP package. Electrical connection is made to the 12 pins located at the bottom of the device. A center tab serves as the ground connection. The device has a flow through design for easy layout. Pin connections are noted in Figure 1. All path lengths should be kept as short as possible to minimize the effects of parasitic inductance in the board traces. Recommendations for the ground connection are given below.

Ground Connection Recommendation

Parasitic inductance present in the board layout will affect the filtering performance of the device. As frequency increases, the effect of the inductance becomes more dominant. This effect is given by Equation 1.

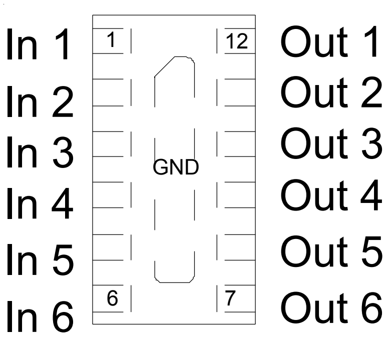
Equation 1: The Impedance of an Inductor at Frequency XLF

$$XLF(L, f) = 2 * \pi * f * L$$

Where:
L= Inductance (H)
f = Frequency (Hz)

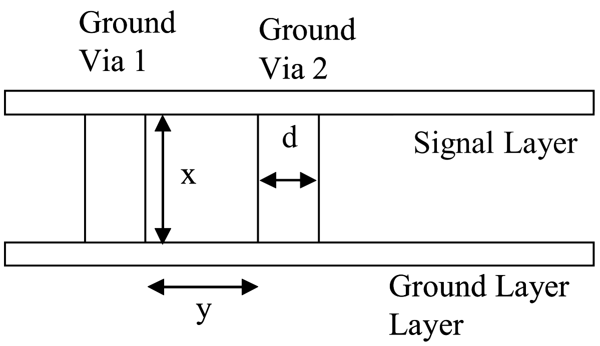
Via connections to the ground plane form rectangular wire loops or ground loop inductance as shown in Figure 2. Ground loop inductance can be reduced by using multiple vias to make the connection to the ground plane. Bringing the ground plane closer to the signal layer (preferably the next layer) also reduces ground loop inductance. Multiple vias in the device ground pad will result in a lower inductive ground loop over two exterior vias. Vias with a diameter d are separated by a distance y run between layers separated by a distance x. The inductance of the loop path is given by Equation 2. Thus, decreasing distance x and y will reduce the loop inductance and result in better high frequency filter characteristics.

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



Pin	Identification
1 - 6	Input Lines
7 - 12	Output Lines
Center Tab	Ground

Figure 2 - Inductance of Rectangular Wire Loops



Equation 2: Inductance of Rectangular Wire Loop

$$LRECT(d, x, y) = 10.16 * 10^{-9} * \left[x * \ln\left[\frac{2*y}{d}\right] + y * \ln\left[\frac{2*x}{d}\right] \right]$$

Where:
d = Diameter of the wire (in)
x = Length of wire loop (in)
y = Breath of wire loop (in)

Applications Information

Figure 3 shows the recommended device layout. The ground pad vias have a diameter of 0.008 inches (0.20 mm) while the two external vias have a diameter of 0.010 inches (0.250mm). The internal vias are spaced approximately evenly from the center of the pad. The designer may choose to use more vias with a smaller diameter (such as 0.005 inches or 0.125mm) since changing the diameter of the via will result in little change in inductance (i.e. the log function in Equation 2 in highly insensitive to parameter d) . Figure 4 shows a typical insertion loss (S21) plot for the device using Semtech's filter evaluation board with 50 Ohm traces and the recommended via configuration. Figure 5 shows a typical insertion loss (S21) plot using a similar board without the internal ground pad vias. The result is a more inductive ground loop. Note the "hump" at a frequency of 2.5GHz. This is the resonant frequency of the higher ground loop inductance.

Figure 4 - Filter Characteristics Using Recommended Layout with Internal Vias

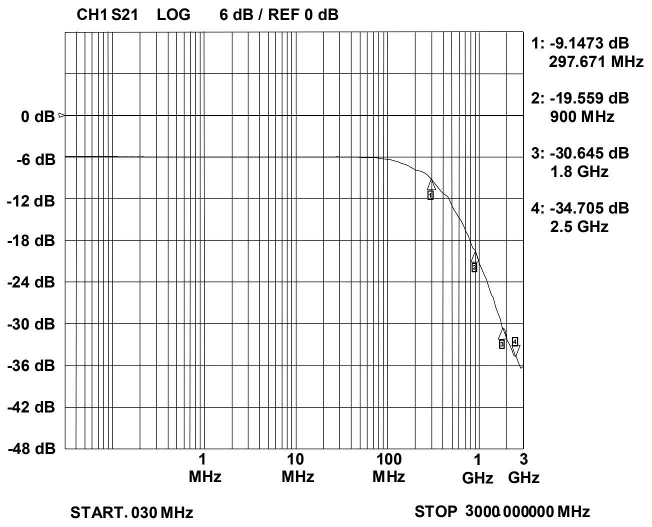


Figure 3 - Recommended Layout Using Ground Vias

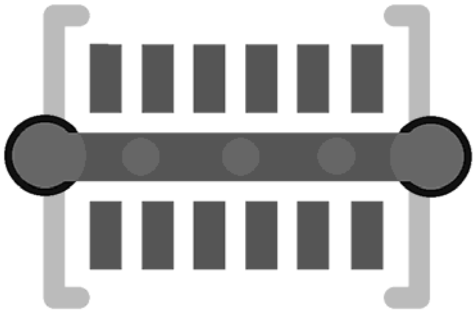
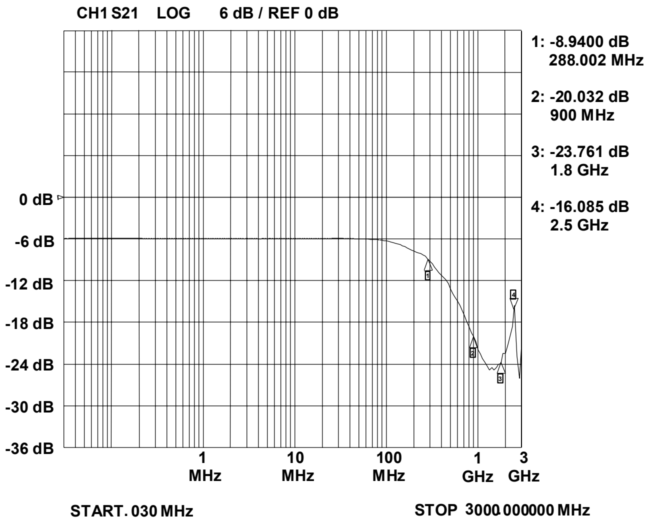


Figure 5 - Filter Characteristics Using Layout without Internal Ground Vias



Applications Information - Spice Model

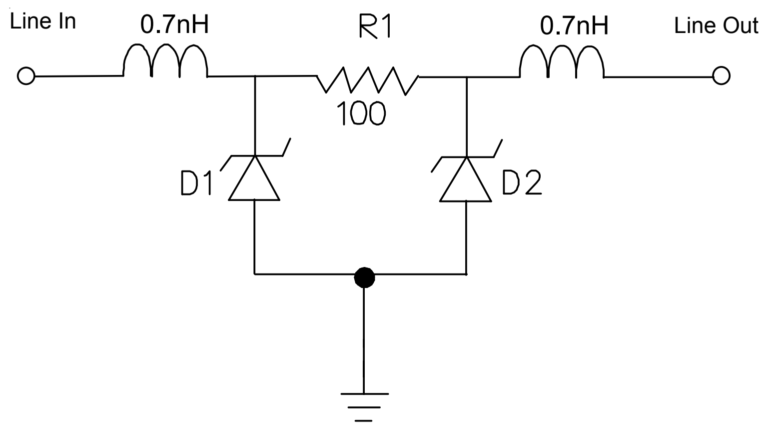
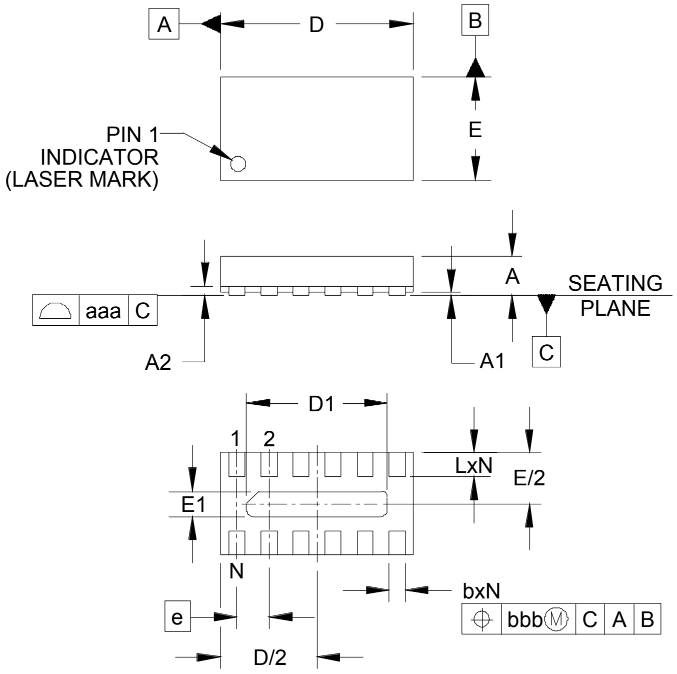


Figure 1 - EClamp2376P Spice Model

Table 1 - EClamp2376P Spice Parameters

Parameter	Unit	D1 (TVS)	D2 (TVS)
IS	Amp	2E-15	2E-15
BV	Volt	7.42	7.42
VJ	Volt	0.775	0.775
RS	Ohm	1.00	1.00
IBV	Amp	1E-3	1E-3
CJO	Farad	9.8E-12	9.8E-12
TT	sec	2.541E-9	2.541E-9
M	--	0.246	0.246
N	--	1.1	1.1
EG	eV	1.11	1.11

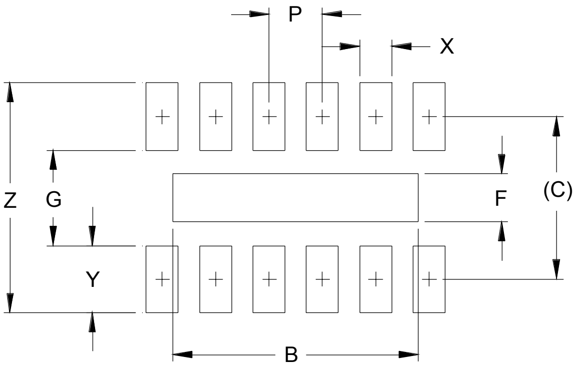
Outline Drawing - SLP3016P12



DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.020	.023	.026	0.50	0.58	0.65
A1	.000	.001	.002	0.00	.003	0.05
A2		(.006)			(0.15)	
b	.007	.010	.012	0.20	0.25	0.30
D	.114	.118	.122	2.90	3.00	3.10
D1	.083	.087	.091	2.10	2.20	2.30
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	.011	.013	.015	0.28	0.33	0.38
N		12			12	
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.

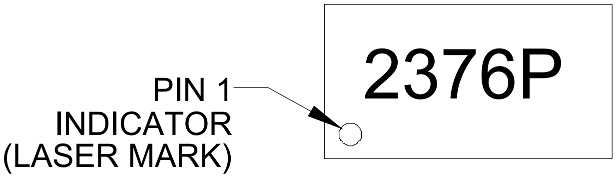
Land Pattern - SLP3016P12



DIM	INCHES	MILLIMETERS
B	.091	2.30
C	.060	1.52
F	.018	0.45
G	.035	0.89
P	.020	0.50
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

Marking



Ordering Information

Part Number	Qty per Reel	Reel Size
EClamp2376P.TCT	3000	7 Inch

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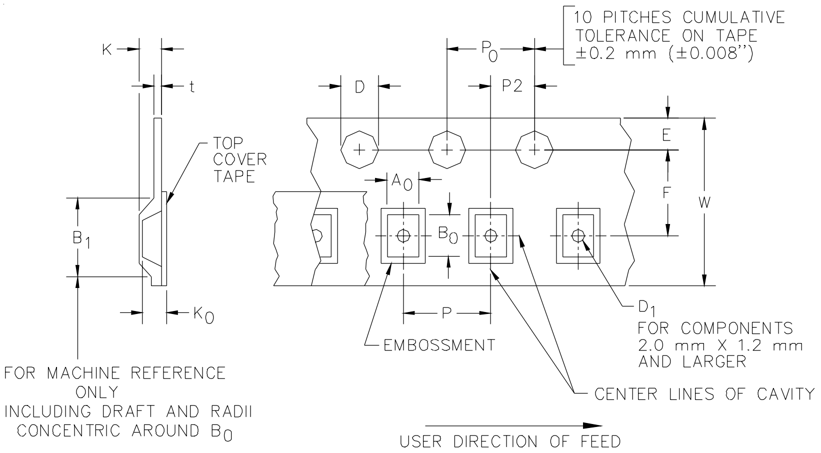
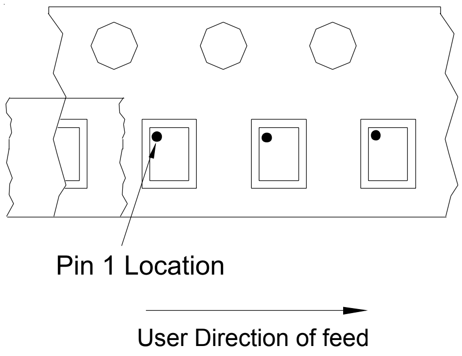
Tape and Reel Specification





Device Orientation in Tape

A0	B0	K0
1.78 +/-0.05 mm	3.18 +/-0.05 mm	0.76 +/-0.05 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±.004)	4.0±0.1 mm (.157±.004)	2.0±0.05mm (.079±.002)	0.4 mm (.016)	8.0 mm + 0.3 mm - 0.1 mm (.312±.012)

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