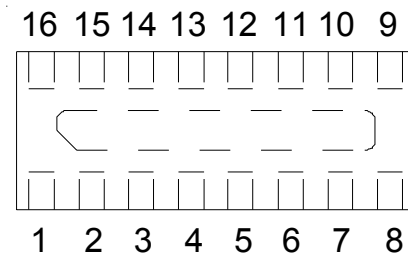


PROTECTION PRODUCTS

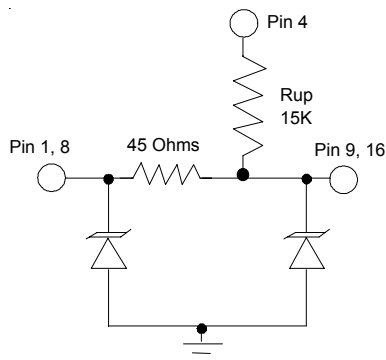
Pin Identification and Configuration

Pin	Symbol	Identification
1, 16	DAT1	Data line #1 input/output with pull-up resistor
2, 15	DAT0	Data line #0 Input/Output
3, 14	Clock	Clock line Input/Output
4	Rup1	15K Pull-up resistor from DAT1 & DAT2
5	Vdd	Power Supply ESD Protection
6, 11	CMD	Command Line Input/Output
7, 10	DAT3	Data line #3 input/output with pull-up resistor
8, 9	DAT2	Data line #2 input/output with pull-up resistor
12	Rup2	50K Pull-Up Resistor from DAT3
13	Rup3	VCC Circuit 3A
Center tab	GND	Ground connection

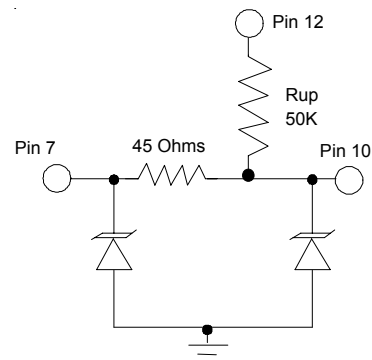


Pin Configuration (Top View)

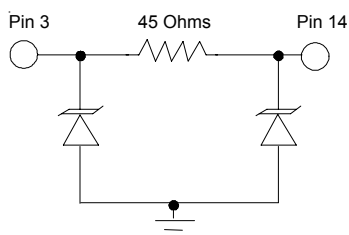
Schematics & Component Values



DAT1, DAT2



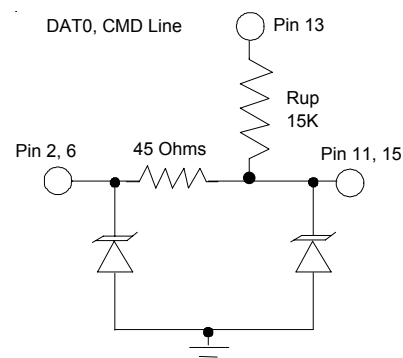
DAT3



CLK



Vdd



DAT0, CMD

PROTECTION PRODUCTS

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

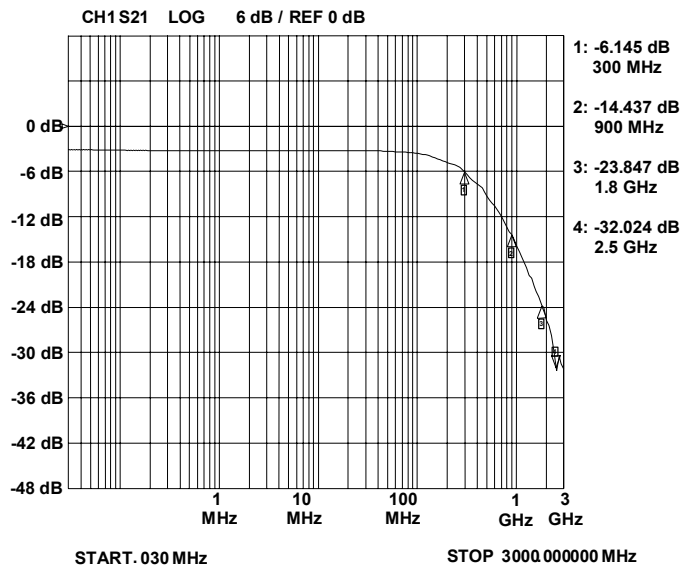
Electrical Characteristics (T = 25°C)

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
Series Resistors	R	Each Line	38	45	52	Ohms
DAT Pull Up Resistor 1	R_{up1}		12	15	17	k Ohms
DAT Pull Up Resistor 2	R_{up2}		42	50	58	k Ohms
Total Capacitance	C_{in}	Input to Gnd, Each Line $V_R = 2.5V, f = 1MHz$	10	12	15	pF

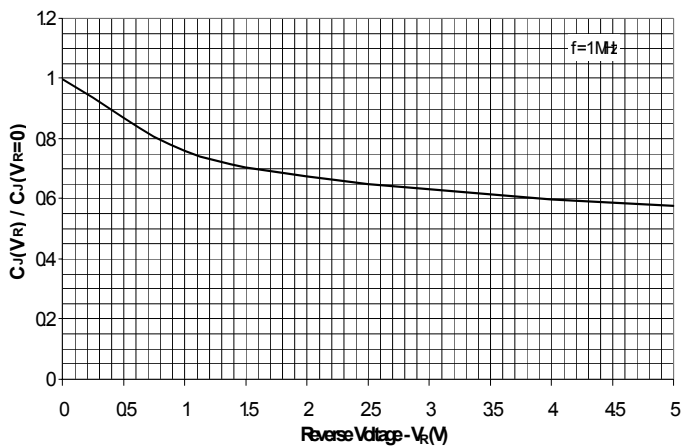
PROTECTION PRODUCTS

Typical Characteristics

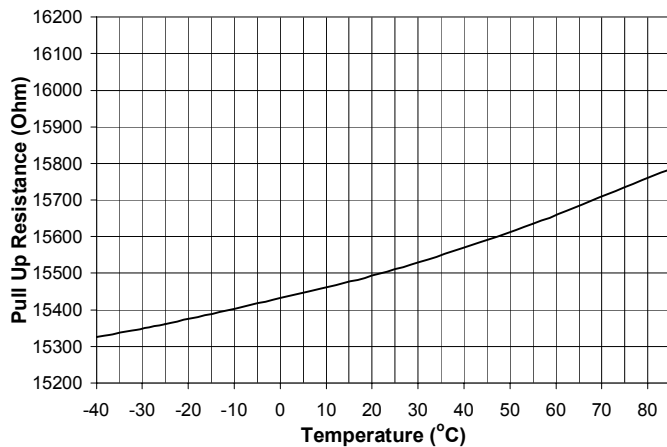
Typical Insertion Loss S21 (Each Line)



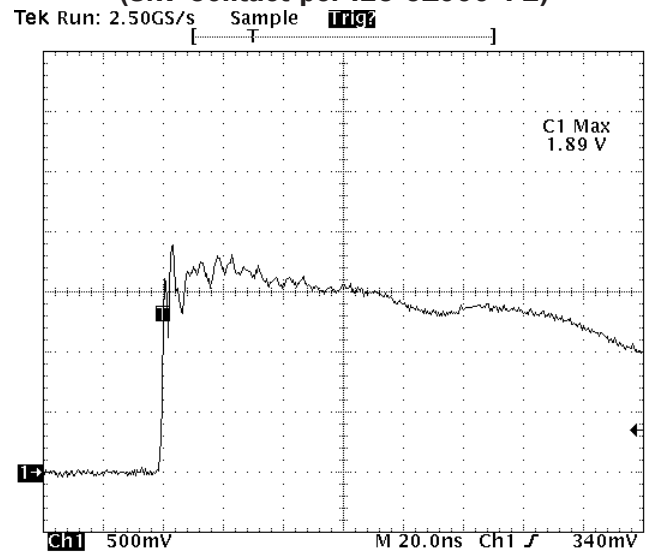
Normalized Capacitance vs. Reverse Voltage



Pull Up Resistance (Rup1) vs. Temperature

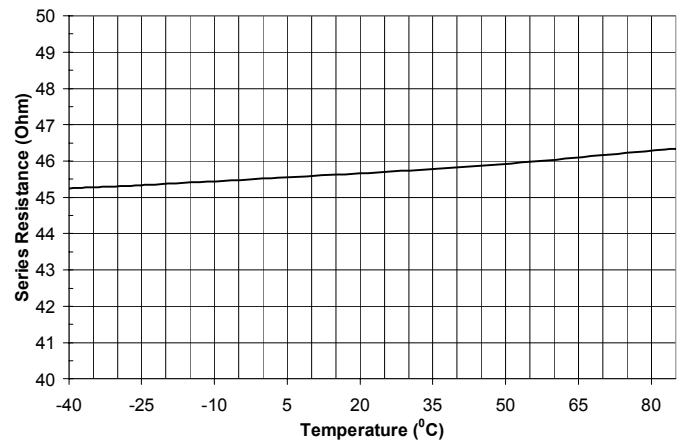


**ESD Clamping
(8kV Contact per IEC 61000-4-2)**

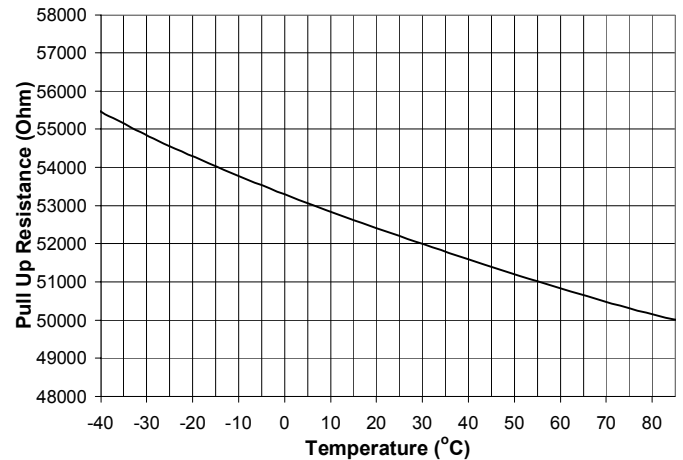


Note: Data is taken with a 10x attenuator

Series Resistance vs. Temperature



Pull Up Resistance (Rup2) vs. Temperature



PROTECTION PRODUCTS

Applications Information

Device Connection

The EClamp2410P is a microSD/T-Flash interface device designed for use in cell phones and other portable electronic devices. The EClamp2410P is comprised of series and pull up resistors required on the microSD interface. Each line also includes TVS diodes for ESD protection. The device may be configured for SD or SPI mode operation. In SD mode for example, the 15k Ohm pull up resistors (Rup 1 and Rup 3) are connected to VDD. In SPI mode pin 4 is not connected (Rup 1) since these are reserved lines. The 50k Ohm pull up resistor is used for card detection or SPI mode selection during power up and is disconnected by the user during regular data transfer.

The EClamp2410P is in a 16-pin SLP package. Electrical connection is made to the 16 pins located at the bottom of the device. The device has a flow through design for easy layout. Pin connections are noted in Figure 1. A center tab serves as the ground connection. Recommendations for the ground connection are given below.

Ground Connection Recommendation

Parasitic inductance present in the board layout will affect the filtering and ESD performance of the device. Ground loop inductance can be reduced by using multiple vias to make the connection to the ground plane. Figure 2 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.

Layout Guidelines for Optimum ESD Protection

Good circuit board layout is critical not only for signal integrity, but also for effective suppression of ESD induced transients. For optimum ESD protection, the following guidelines are recommended:

- Place the device as close to the connector as possible. This practice restricts ESD coupling into adjacent traces and reduces parasitic inductance.

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

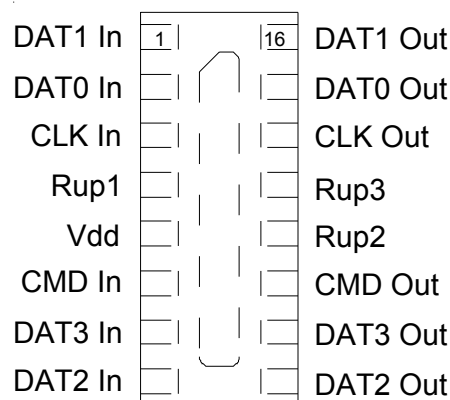
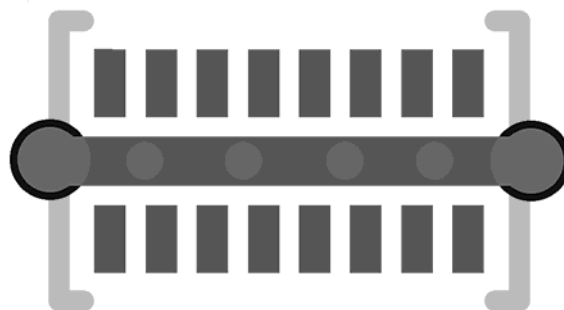
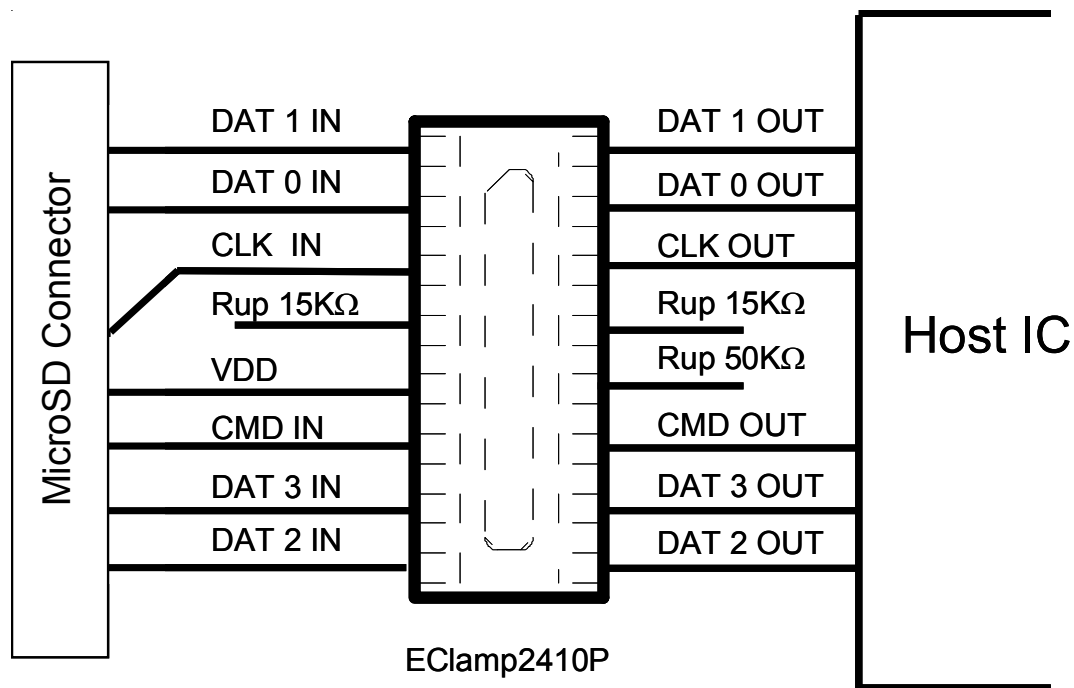


Figure 2 - Recommended Layout using Ground Vias

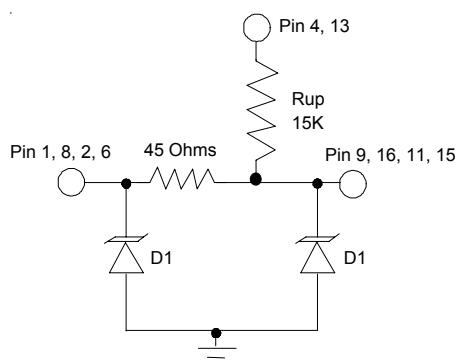


- The ESD transient return path to ground should be kept as short as possible. Whenever possible, use multiple micro vias connected directly from the device ground pad to the ground plane.
- Avoid running critical signals near board edges.

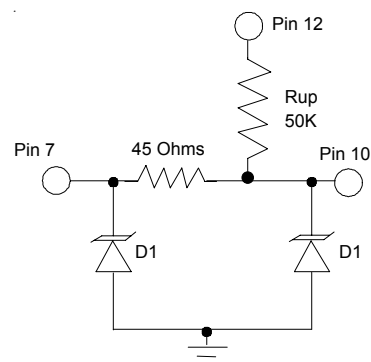
PROTECTION PRODUCTS
Applications Information

Figure 3 - MicroSD Protection

PROTECTION PRODUCTS

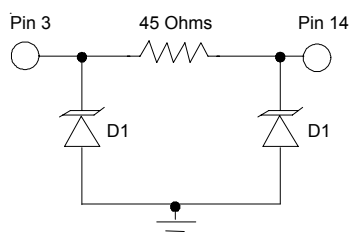
Applications Information - Spice Model



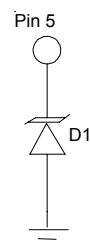
DAT1, DAT2, DAT0, CMD



DAT3



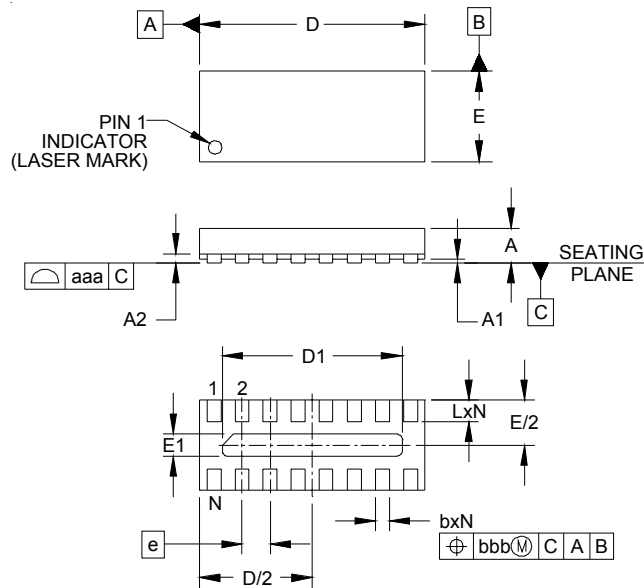
CLK



Vdd

EClamp2410P Spice Model

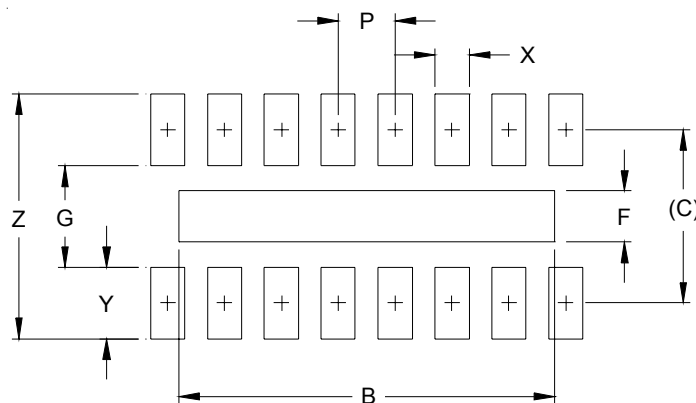
EClamp2410P Spice Parameters		
Parameter	Unit	D1 (TVS)
IS	Amp	2E-15
BV	Volt	7.46
VJ	Volt	0.777
RS	Ohm	1.00
IBV	Amp	1E-3
CJO	Farad	10E-12
TT	sec	2.541E-9
M	--	0.246
N	--	1.1
EG	eV	1.11

PROTECTION PRODUCTS
Outline Drawing - SLP4016P16


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		(.005)			(0.13)	
b	.007	.010	.012	0.20	0.25	0.30
D	.153	.157	.161	3.90	4.00	4.10
D1	.122	.126	.130	3.10	3.20	3.30
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		16			16	
aaa		.003			0.08	
bbb		.004			0.10	

NOTES:

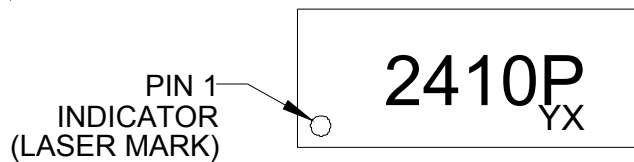
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

Land Pattern - SLP4016P16


DIM	DIMENSIONS	
	INCHES	MILLIMETERS
B	.130	3.30
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

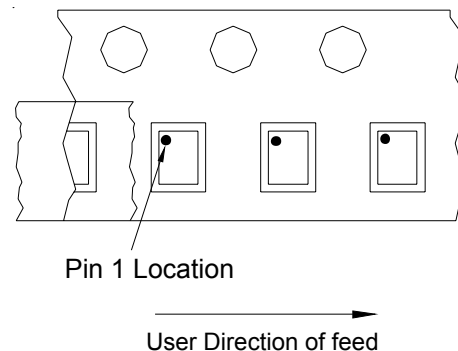
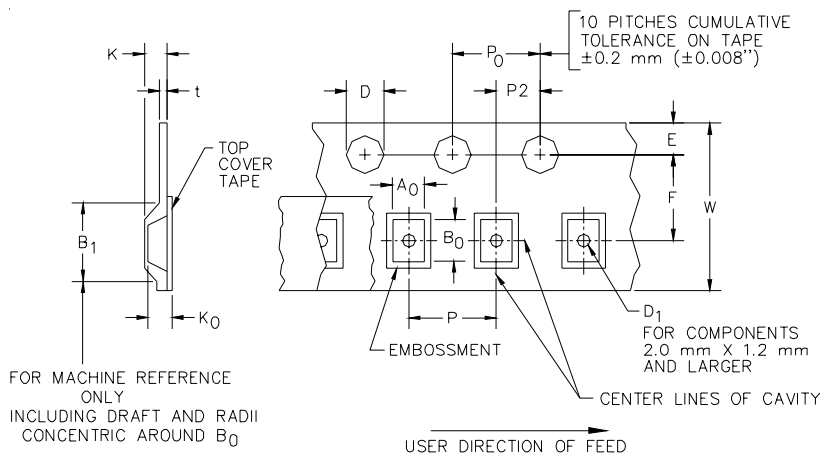
NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET

PROTECTION PRODUCTS
Marking

Ordering Information

Part Number	Qty per Reel	Reel Size
EClamp2410P.TCT	3000	7 Inch

EMIClamp and EClamp are marks of Semtech Corporation

Tape and Reel Specification

Device Orientation in Tape

A0	B0	K0
1.78 +/-0.10 mm	4.30 +/-0.10 mm	0.74 +/-0.10 mm

Tape Width	B, (Max)	D	D1	E	F	K (MAX)	P	P0	P2	T(MAX)	W
12 mm	8.2 mm (.476)	1.5 + 0.1 mm - 0.0 mm (0.59 +.005 - .000)	1.0 mm ±0.05 (.039)	1.750±.10 mm (.069±.004)	5.5±0.05 mm (.217±.002)	4.5 mm (.177)	4.0±0.1 mm (.157±.00-4)	4.0±0.1 mm (.157±.00-4)	2.0±0.05mm (.079±.002)	0.4 mm (.016)	12.0 mm + 0.3 mm - 0.1 mm (.472±.012)

Contact Information

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