RClamp3552T
Low Voltage RailClamp®
2-Line ESD Protection

PROTECTION PRODUCTS - RailClamp®

Description

RClamp®3552T is a low voltage RailClamp which can provide ESD protection to IEC 61000-4-2 on high-speed ports. It is manufactured using Semtech's proprietary low voltage technology, designed to minimize both the ESD peak clamping and TLP clamping voltage. These devices “snap-back” to a low on-state voltage when the breakdown voltage of the device is exceeded. This has the advantage of lowering the overall ESD clamping voltage. When the device is in the on-state, the dynamic resistance is typically 0.30 Ohms, further minimizing the ESD clamping. Maximum capacitance is only 0.40pF allowing the RClamp3552T to be used in applications operating in excess of 6GHz without appreciable signal attenuation. Each device will protect two lines operating at 3.5 volts.

RClamp3552T is in a 3-pin SLP1006N3T package. It measures 1.0 x 0.6 mm with a nominal height of only 0.4mm. The leads are finished with lead-free NiPdAu.

The combination of low peak ESD clamping, low dynamic resistance, and low capacitance makes this device suitable for applications such as USB 3.0, LVDS, audio, and V-By-One interfaces.

Features

- High ESD withstand Voltage: **+/-17kV** (Contact), **+/-20kV** (Air) per **IEC 61000-4-2**
- Very small PCB area: 0.6mm^2
- Protects up to two data lines
- Low capacitance: **0.40pF Maximum**
- Dynamic Resistance: **0.30 Ohms Typical**
- Low ESD clamping voltage
- Operating voltage: **3.5V**
- Qualified to AEC-Q100
- Solid-state silicon-avalanche technology

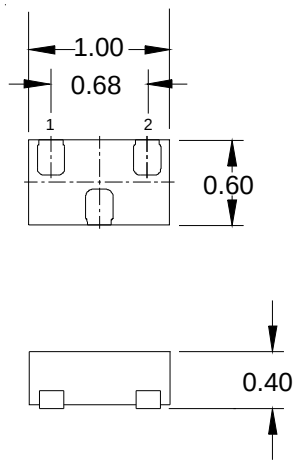
Mechanical Characteristics

- SLP1006N3T package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 1.0 x 0.6 x 0.40 mm
- Lead Finish: NiPdAu
- Molding compound flammability rating: UL 94V-0
- Marking : Marking code + dot matrix date code
- Packaging : Tape and Reel

Applications

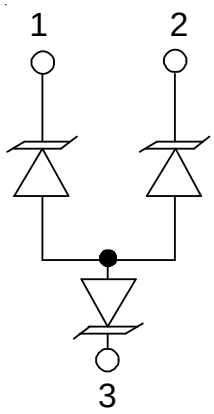
- USB 3.0
- V-By-One
- LVDS
- MIPI/MDDI
- MyDP
- Audio Ports

Dimensions



Nominal Dimensions (mm)

Schematic & PIN Configuration



2-Line, Bidirectional

Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Current (tp = 8/20μs)	I_{PP}	4	A
ESD per IEC 61000-4-2 (Air)[1] ESD per IEC 61000-4-2 (Contact)[1]	V_{ESD}	+/- 20 +/- 17	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)

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}	Any I/O to GND			3.5	V
Breakdown Voltage	V_{BR}	I_{BR} = 10μA	7.5	8.8	9.8	V
Reverse Leakage Current	I_R	V_{RWM} = 3.5V, T=25°C Any I/O to GND		0.01	0.05	μA
Clamping Voltage	V_C	I_{PP} = 1A, tp = 8/20μs Any I/O to GND		3.5	5	V
Clamping Voltage	V_C	I_{PP} = 4A, tp = 8/20μs Any I/O to GND		5	6.5	V
ESD Clamping Voltage[2]	V_C	I_{PP} = 16A, tlp = 0.2/100ns		9.5		V
ESD Clamping Voltage[2]	V_C	I_{PP} = -16A, tlp = 0.2/100ns		9.5		V
Dynamic Resistance (Positive)[2,3]	R_D	tlp = 0.2/100ns		0.30		Ohms
Dynamic Resistance (Negative)[2,3]	R_D	tlp = 0.2/100ns		0.30		Ohms
Junction Capacitance	C_j	V_R = 0V, f = 1MHz, Any I/O to GND		0.30	0.40	pF

Notes

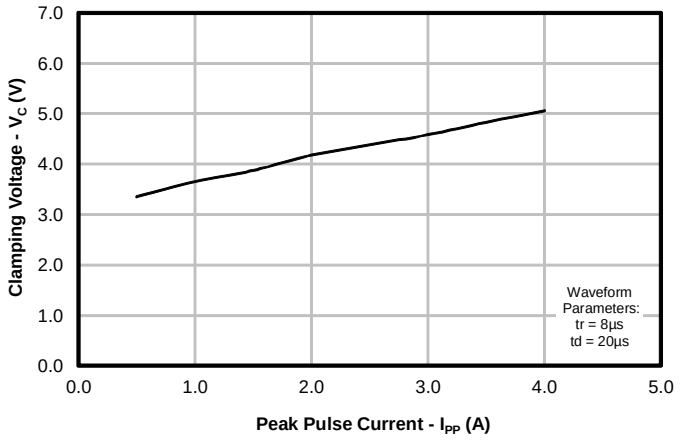
1)Measured with a 20dB attenuator, 50 Ohm scope input impedance, 2GHz bandwidth. ESD gun return path connected to ESD ground plane.

2)Transmission Line Pulse Test (TLP) Settings: t_p = 100ns, t_r = 0.2ns, I_{TLP} and V_{TLP} averaging window: t_1 = 70ns to t_2 = 90ns. Parameters guaranteed by design.

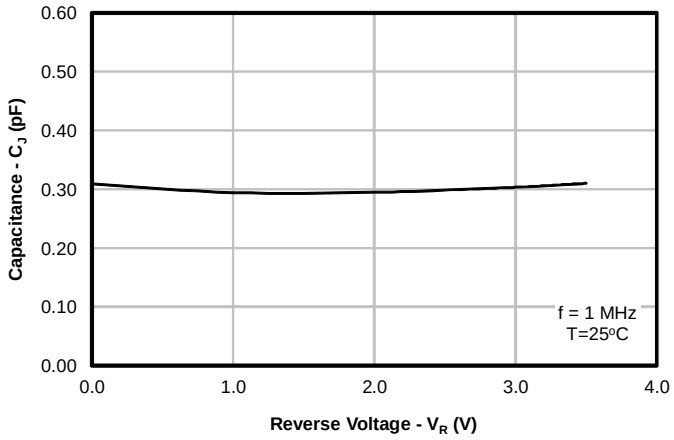
3) Dynamic resistance calculated from I_{TLP} = 4A to I_{TLP} = 16A

Typical Characteristics

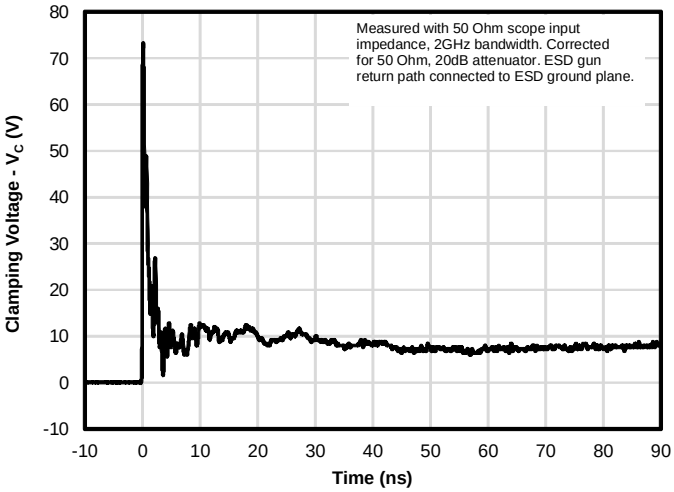
Clamping Voltage vs. Peak Pulse Current (Between any I/O and Ground)



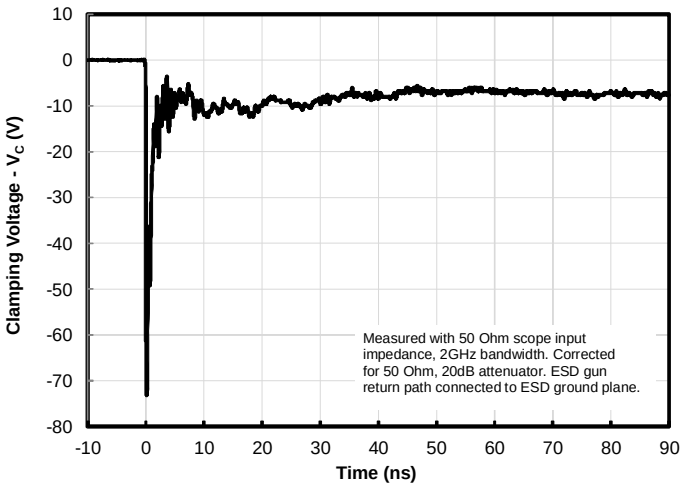
Junction Capacitance vs. Reverse Voltage (Between any I/O and Ground)



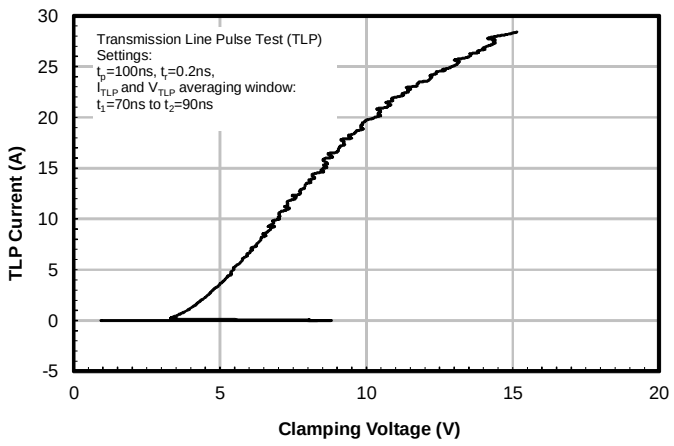
ESD Clamping (+8kV Contact per IEC 61000-4-2) (Between any I/O and Ground)



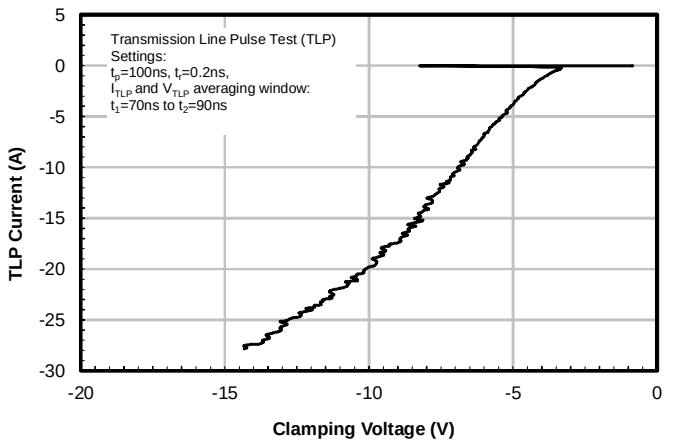
ESD Clamping (-8kV Contact per IEC 61000-4-2) (Between any I/O and Ground)



TLP Characteristic (Positive)

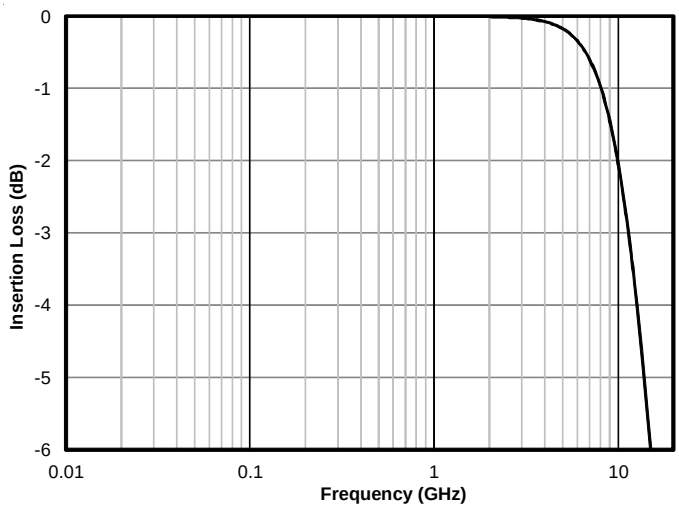


TLP Characteristic (Negative)

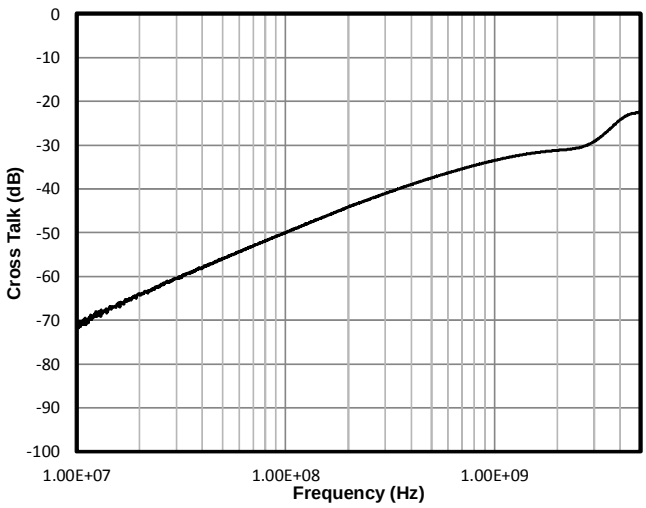


Typical Characteristics

Typical Insertion Loss S21



Analog Crosstalk

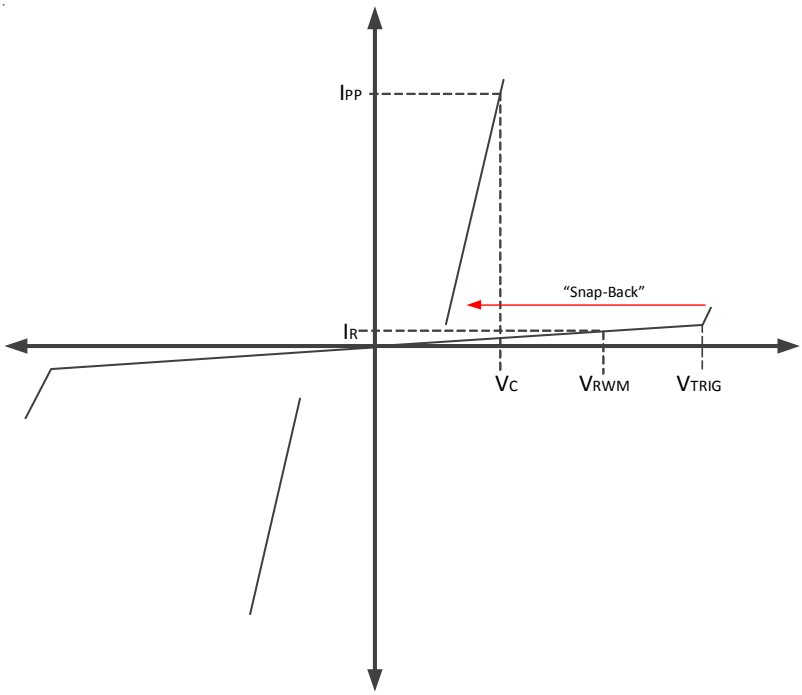


Applications Information

Device Operation

This device utilizes a multi-junction structure that is designed to switch to a low voltage state when triggered by ESD, EOS, or other transient events. During normal operation, the device will present a high-impedance to the circuit for voltage up to the working voltage (V_{RWM}) of the device. When the voltage across the device terminals exceeds the breakdown voltage (V_{BR}), avalanche breakdown occurs in the blocking junction causing the device to "snap-back" or switch to a low impedance on-state. This has the advantage of lowering the overall clamping voltage (V_C) as ESD peak pulse current (I_{PP}) flows through the device. Once the current subsides, the device will return to a high-impedance off-state. Since this device is bidirectional, it will behave the same way for positive or negative polarity transient events.

Symbol	Parameter
V_{RWM}	Maximum Working Voltage
V_{TRIG}	Trigger Voltage
V_C	Clamping Voltage
I_R	Reverse Leakage Current
I_{PP}	Peak Pulse Current



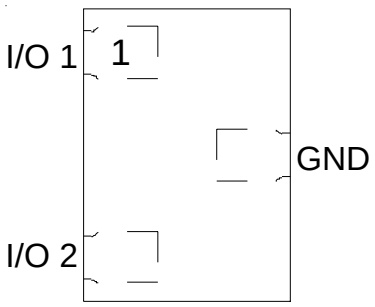
Characteristic Curve

Applications Information

Device Connection Options

RClamp3552T is designed to protect two data lines operating up to 3.5 volts. The device is bidirectional and may be used on lines where the signal polarity is above and below ground. The diagram at the right shows an example pin configuration with pin 3 connected to ground. However, due to the device symmetry, any pin may be connected to ground with the remaining pins connected to the protected lines.

Example Pin Configuration

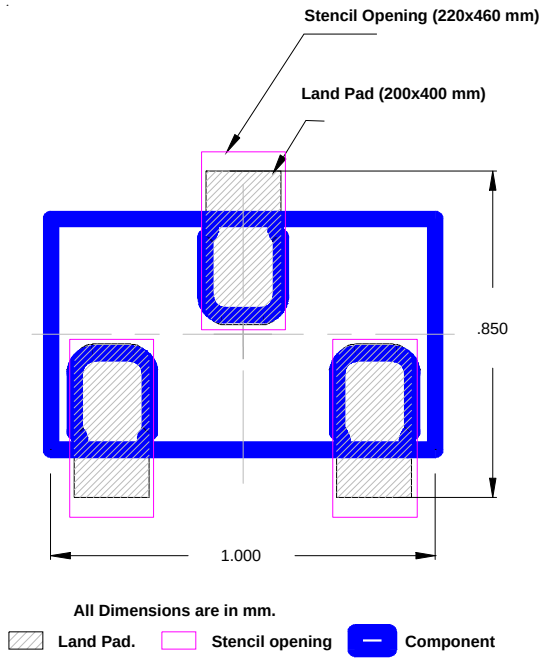


Assembly Guidelines

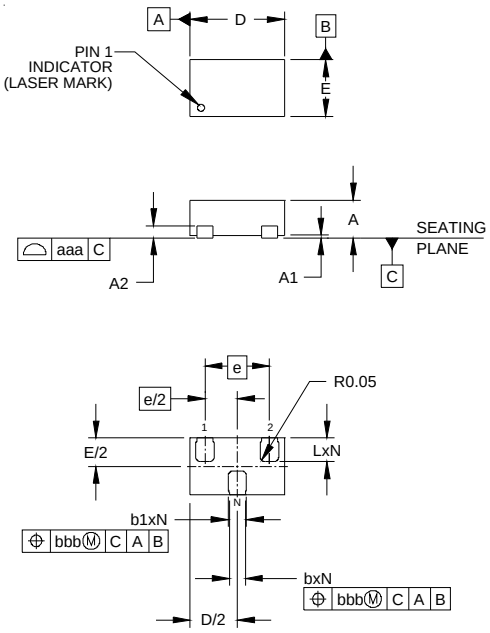
The small size of this device means that some care must be taken during the mounting process to insure reliable solder joint. The table below provides Semtech's recommended assembly guidelines for mounting this device. The figure at the right details Semtech's recommended aperture based on the below 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. 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
Solder Stencil Thickness	0.100 mm (0.004")
Solder Paste Type	Type 4 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

Recommended Mounting Pattern



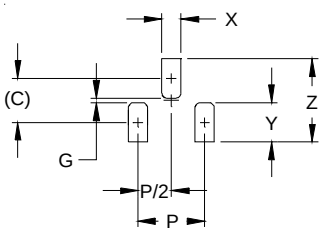
Outline Drawing - SLP1006N3T



DIMENSIONS			
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.37	0.40	0.43
A1	0.00	0.02	0.05
A2		(0.13)	
b	0.145	0.17	0.195
b1	0.175	0.20	0.225
D	0.90	1.00	1.10
E	0.50	0.60	0.70
e		0.68 BSC	
L	0.225	0.25	0.275
N		3	
aaa		0.08	
bbb		0.10	

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

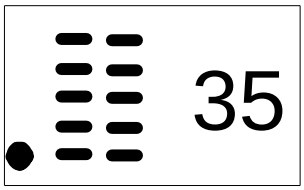
Land Pattern - SLP1006N3T



DIMENSIONS	
DIM	MILLIMETERS
C	(0.45)
G	0.05
P	0.68
X	0.20
Y	0.40
Z	0.85

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



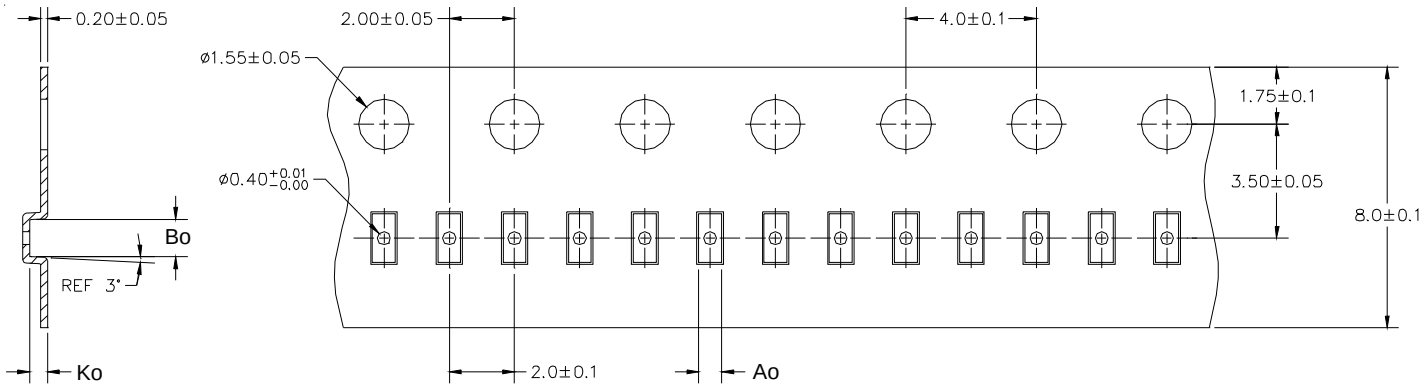
Notes:
Marking will also include line matrix date code

Ordering Information

Part Number	Qty per Reel	Reel Size
RClamp3552T.TNT	10,000	7 Inch

Notes:
RailClamp and RClamp are trademarks of Semtech Corporation

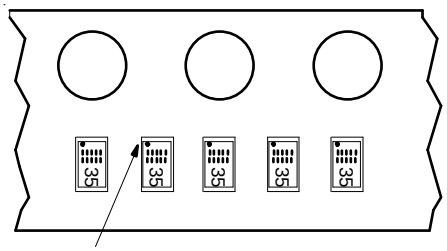
Carrier Tape Specification



A0	B0	K0
0.70 +/-0.05 mm	1.15 +/-0.05 mm	0.55 +/-0.05 mm

Note: All dimensions in mm unless otherwise specified

Device Orientation in Tape



Pin 1 Location
(Towards Sprocket Holes)

Contact Information

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