Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power (t_p = 10/1000µs)	P_{pk}	600	Watts
Peak Pulse Current (t_p = 10/1000 µs)	I_{PP}	25	A
Peak Pulse Current (t_p = 8/20µs)	I_{PP}	100	A
Lead Soldering Temperature	T_L	260 (10 sec.)	°C
Operating Temperature	T_J	-55 to +125	°C
Storage Temperature	T_{STG}	-55 to +150	°C

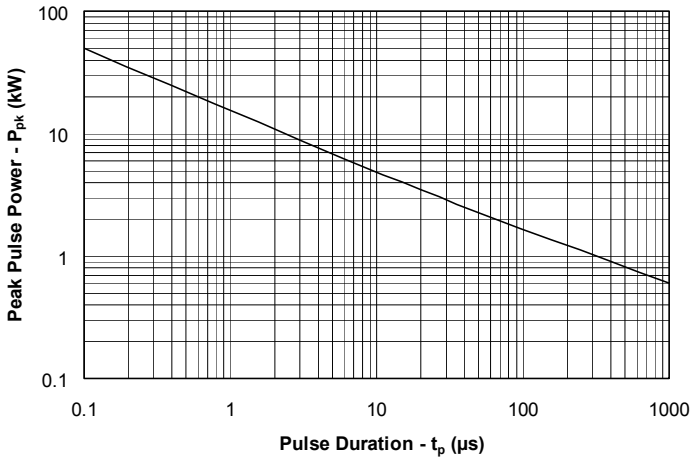
Electrical Characteristics

LC04-12

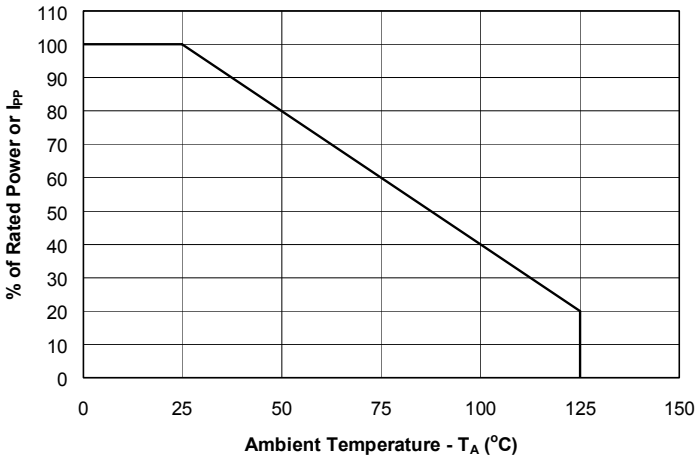
Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Units
Reverse Stand-Off Voltage	V_{RWM}				12	V
Reverse Breakdown Voltage	V_{BR}	I_t = 1mA	13.3			V
Reverse Leakage Current	I_R	V_{RWM} = 12V, T=25°C			2	µA
Clamping Voltage	V_C	I_{PP} = 10A, t_p = 10/1000µs			19.5	V
Clamping Voltage	V_C	I_{PP} = 25A, t_p = 10/1000µs			24	V
Junction Capacitance	C_j	Each Line V_R = 0V, f = 1MHz			15	pF

Typical Characteristics

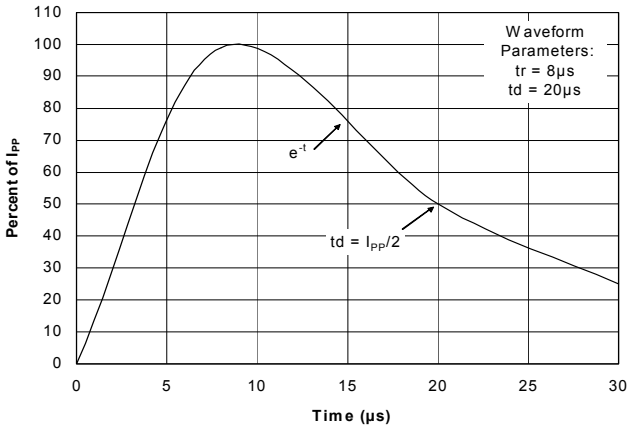
Non-Repetitive Peak Pulse Power vs. Pulse Time



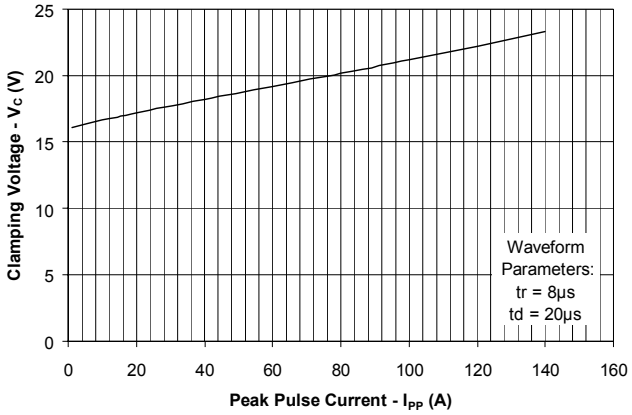
Power Derating Curve



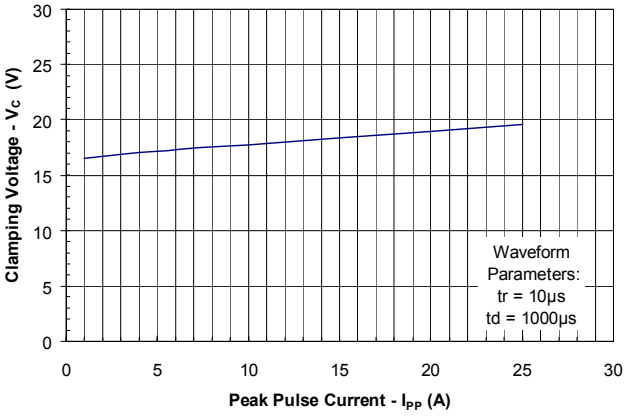
Pulse Waveform



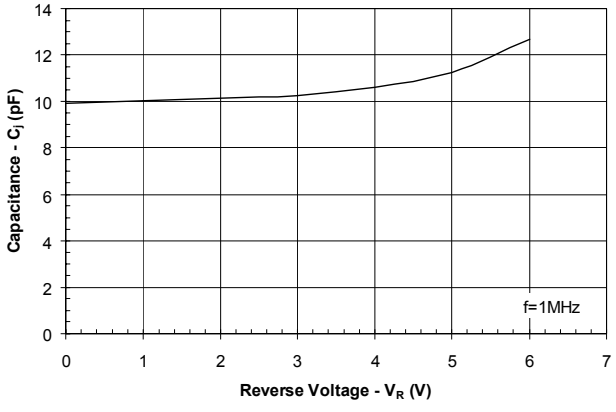
Clamping Voltage vs. Peak Pulse Current



Clamping Voltage vs. Peak Pulse Current



Capacitance vs. Reverse Voltage



Applications Information

Device Connection Options

The LC04-12 is designed to protect up to four high-speed data lines (two differential pairs) from transient over-voltages which result from lightning and ESD.

Differential protection of two line pairs is achieved by connecting the device as follows (Figure 1): Pins 1-4 are connected to line 1 of the first pair (i.e. Tip 1) and pins 13-16 are connected to line 2 of the first pair (i.e. Ring 1). Pins 5-8 are connected to line 1 of the second pair (i.e. Tip 2) and pins 9-12 are connected to line 2 of the second pair (i.e. Ring 2).

Common mode protection of one line pair is achieved by connecting the device as shown in Figure 2. The protected lines are connected at pins 1-4 and pins 9-12. connection to ground is made at pins 5-8 and 13-16. optionally, the lines may be connected at pins 1-4 and 5-8 with pins 9-16 being connected to ground.

All pins should be connected for best results. Minimize parasitic inductance in the protection circuit path by keeping the trace length between the protected line and the LC04-12 as short as possible. Ground connections should be made directly to the ground plane.

ADSL Protection

Configuring The LC04-12 for Remote Terminal ADSL Applications

A typical ADSL protection circuit for remote terminals is shown in Figure 3. The LC04-12 is connected between Tip and Ring on the transmit and receive line pairs. It provides protection to common mode (line-to-ground) lightning and ESD surges. It is designed to meet the intra-building requirements of Bellcore GR-1089. To complete the protection circuit, the LCDA12C-1 is employed as the IC side protection element. This device helps prevent the transceiver from latching up by providing fine clamping of transients that are coupled through the transformer.

Figure 1 - Connection for Differential (Line-to-Line) Protection of two Tip/Ring Line Pairs

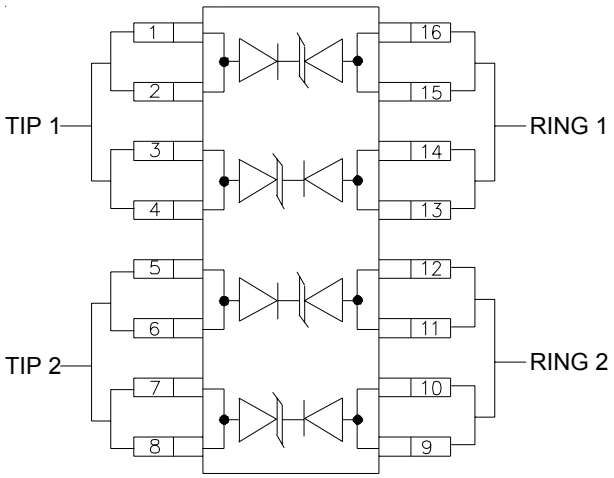
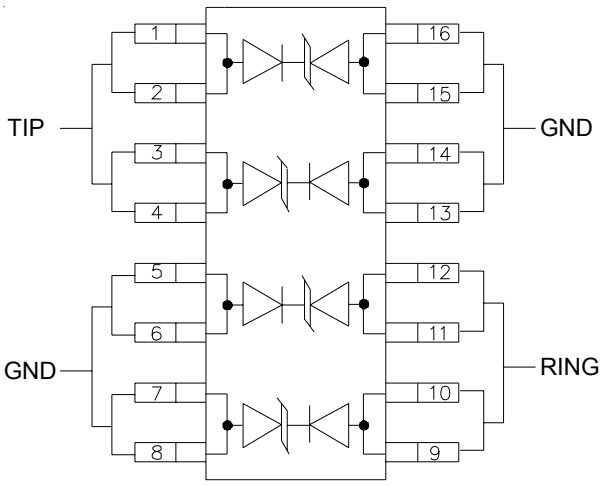


Figure 2 - Connection for Common Mode (Line-to-Ground) Protection of one Tip/Ring Line Pair



Applications Information *(Continued)*

Configuring The LC04-12 for Central Office ADSL Applications

For Central Office applications, the LC04-12 can be configured for operation to 24V with the addition of two external steering diodes. This is accomplished by connecting two adjacent legs of the LC04-12 in series and adding the steering diodes as shown in Figure 4.

Each of the TVS diodes has a working voltage of 12V. Since the voltages are additive when series connected, the device will have a working voltage of 24V. The power rating of the device is effectively doubled since the surge current capability remains unchanged.

During positive duration transients, the internal TVS diodes of the LC04-12 will be reversed biased when the line voltage exceeds 24V. Transient current will flow through the LC04-12 to ground. For negative duration transient, the external steering diodes (D1 and D2) will be forward biased when the voltage exceeds the forward voltage (V_F) of the device.

The steering diodes are required to insure that the internal compensation diodes of the LC04-12 are not reverse biased as this would result in their destruction. The ES1A ultrafast rectifiers have been found to work well in this application. These devices will survive the Bellcore 1089 (intra-building) and ITU K.20/K.21 surges and have a repetitive reverse voltage rating of 50V, and a typical junction capacitance of 10pF.

The total capacitance seen by the line will typically be <25pF. This is determined by the sum of the capacitance of the steering diode and 1/2 of the capacitance of each line pair of the LC04-12.

Matte Tin Lead Finish

Matte tin has become the industry standard lead-free replacement for SnPb lead finishes. A matte tin finish is composed of 100% tin solder with large grains. Since the solder volume on the leads is small compared to the solder paste volume that is placed on the land pattern of the PCB, the reflow profile will be determined by the requirements of the solder paste. Therefore, these devices are compatible with both lead-free and SnPb assembly techniques. In addition, unlike other lead-free compositions, matte tin does not have any added alloys that can cause degradation of the solder joint.

Typical Applications

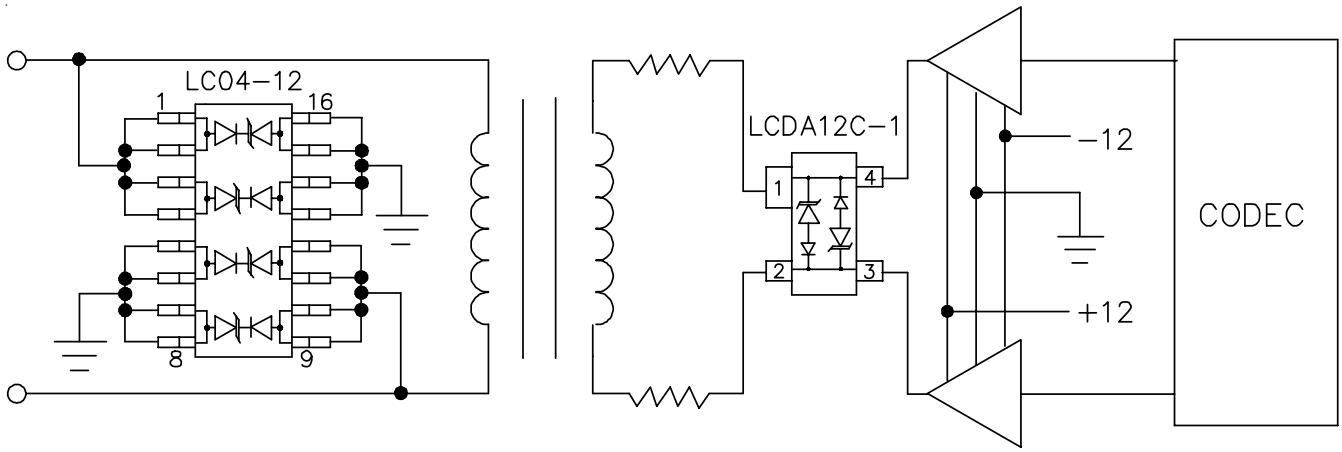
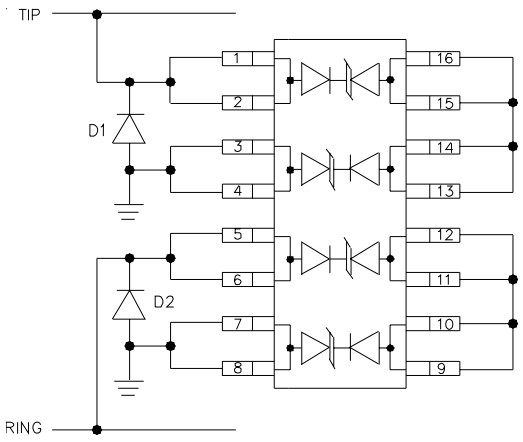


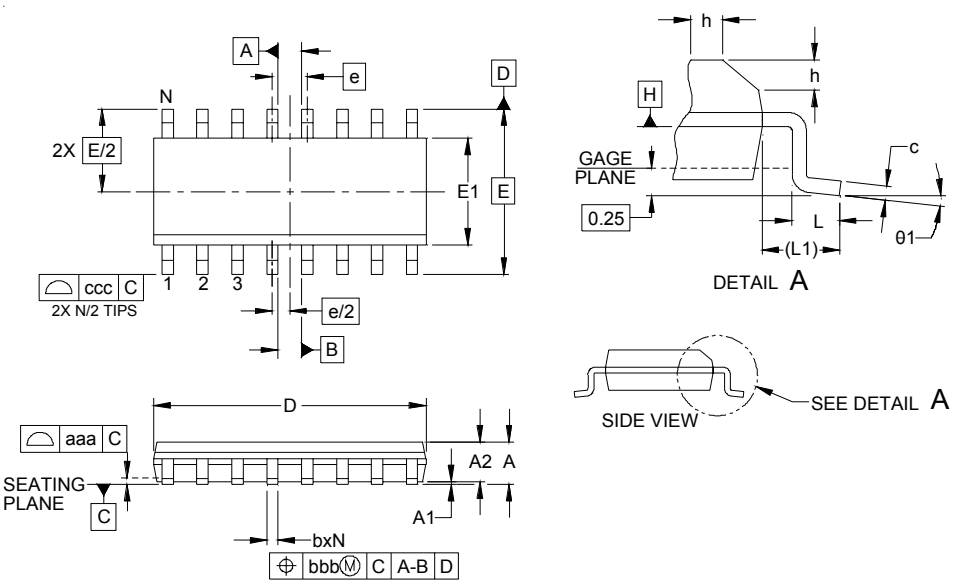
Figure 3 - ADSL Protection (Remote Terminal)



Component	Part Number	Description
TVS	LC04-12	Low capacitance TVS diode array
D1 and D2	ES1A	Ultrafast surface mount rectifier

Figure 4- LC04-12 Configured for 24V Lines (ADSL Central Office)

Outline Drawing - SO-16

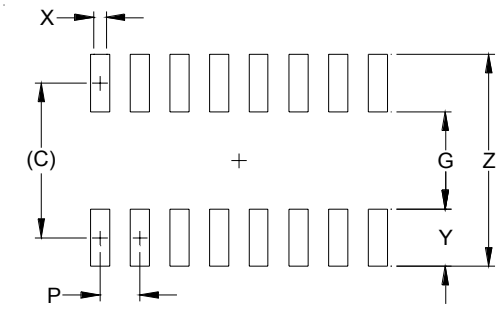


DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.053	-	.069	1.35	-	1.75
A1	.004	-	.010	0.10	-	0.25
A2	.049	-	.065	1.25	-	1.65
b	.012	-	.020	0.31	-	0.51
c	.007	-	.010	0.17	-	0.25
D	.386	.390	.394	9.80	9.90	10.00
E1	.150	.154	.157	3.80	3.90	4.00
E	.236 BSC			6.00 BSC		
e	.050 BSC			1.27 BSC		
h	.010	-	.020	0.25	-	0.50
L	.016	.028	.041	0.40	0.72	1.04
L1	(.041)			(1.04)		
N	16			16		
θ1	0°	-	8°	0°	-	8°
aaa	.004			0.10		
bbb	.010			0.25		
ccc	.008			0.20		

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-
3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. REFERENCE JEDEC STD MS-012, VARIATION AC.

Land Pattern - SO-16



DIM	INCHES	MILLIMETERS
C	(.205)	(5.20)
G	.118	3.00
P	.050	1.27
X	.024	0.60
Y	.087	2.20
Z	.291	7.40

NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
2. REFERENCE IPC-SM-782A, RLP NO. 304A.

Ordering Information

Part Number	Lead Finish	Qty per Reel	Reel Size
LC04-12.TB	SnPb	500	7 Inch
LC04-12.TBT	Pb free	500	7 Inch
LC04-12	SnPb	48/Tube	N/A

Contact Information

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