

## 1 and 2 Channel *PicoGuard*™ AC Signal ESD Protector

### Features

- Single channel ESD protection for an AC signal up to  $\pm 5V$  for 0.25W transmit power
- Connects two channels in series for signals up to  $\pm 10V$  (1W transmit power)
- $\pm 8kV$  ESD protection per IEC 61000-4-2 contact discharge
- Sub-1pF loading capacitance
- Minimal variation with voltage and temperature
- Each I/O pin can withstand over 1000 ESD strikes\*
- SOT23-3 and MSOP-8 lead-free packages

### Applications

- RF switch and amplifier protection
- RF modules and RF IC protection
- Wireless handsets and WLAN
- High-speed AC signals for Gbit Ethernet, etc.

### Product Description

The CM1214A *PicoGuard*™ ESD protector is used to protect bipolar signal lines against electrostatic discharge (ESD). The CM1214A allows operation in high-speed environments with signals levels up to  $\pm 5V$ .

The CM1214A comes in two versions:

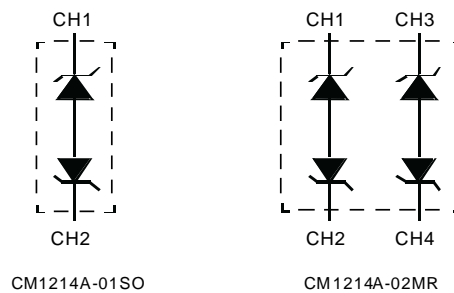
- The CM1214A-01SO is a single channel ESD protector and is available in a 3-lead SOT23-3 package.
- The CM1214A-02MR is a dual channel ESD protector and is available in an 8-lead MSOP-8 package.

The low sub-1pF loading capacitance makes the CM1214A-01SO ideal for protecting high-speed interfaces including RF switches and amplifiers.

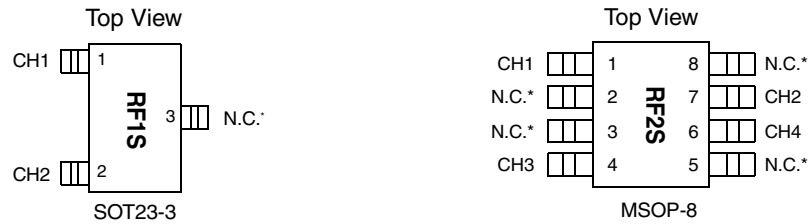
The CM1214A-02MR is ideal for dual high-speed signal pairs used in Gigabit Ethernet, ADSL, etc. The CM1214A-02MR can also be used for higher transmit voltage applications by connecting the two channels in series.

Both devices come in lead-free finishing.

### Electrical Schematics



\*Standard test condition is IEC61000-4-2 level 4 test circuit with each pin subjected to  $\pm 8kV$  contact discharge for 1000 pulses. Discharges are timed at 1 second intervals and all 1000 strikes are completed in one continuous test run. The part is then subjected to standard production test to verify that all of the tested parameters are within spec after the 1000 strikes.

**PACKAGE / PINOUT DIAGRAMS**

**Notes:**

- 1) These drawings are not to scale.
- 2) All N.C. pins must be left floating (i.e., not connected to the PCB). See applications section for more information.

**SOT23-3 PACKAGE PIN DESCRIPTIONS**

PIN	NAME	DESCRIPTION
1	CH1	ESD Channel
2	CH2	ESD Channel
3	N.C.	No connect

**MSOP-8 PACKAGE PIN DESCRIPTIONS**

PIN	NAME	DESCRIPTION
1	CH1	ESD Channel
2	N.C.	No connect
3	N.C.	No connect
4	CH3	ESD Channel
5	N.C.	No connect
6	CH4	ESD Channel
7	CH2	ESD Channel
8	N.C.	No connect

**Ordering Information**
**PART NUMBERING INFORMATION**

Pins	Package	Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking
3	SOT23	CM1214A-01SO	RF1S
8	MSOP	CM1214A-02MR	RF2S

Note 1: Parts are shipped in Tape & Reel form unless otherwise specified.

## Specifications

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNITS
DC Voltage between CH pins	7	V
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-65 to +150	°C
Package Power Rating		
SOT23-3 Package (CM1214A-01SO)	225	mW
MSOP8 Package (CM1214A-02MR)	400	mW

### STANDARD OPERATING CONDITIONS

PARAMETER	RATING	UNITS
Operating Temperature Range	-40 to +85	°C

### ELECTRICAL OPERATING CHARACTERISTICS (SEE NOTE 1)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V <sub>ST</sub>	Standoff Voltage	I=10μA		±7		V
V <sub>ESD</sub>	ESD Voltage Protection Peak discharge voltage between CH pins a) Contact discharge per IEC 61000-4-2 standard	Notes 2, 3 and 4	±8			kV
I <sub>LEAK</sub>	Channel Leakage Current	T <sub>A</sub> =25°C, 5.5V between CH pins		±0.1	±1.0	μA
R <sub>DYN</sub>	Dynamic Resistance	T <sub>A</sub> =25°C, I <sub>PP</sub> = 1A, t <sub>P</sub> = 8/20μS; Any I/O pin to Ground; Notes 2 and 5		1.36		Ω
V <sub>CL</sub>	Channel Clamp Voltage	T <sub>A</sub> =25°C, I <sub>PP</sub> = 1A, t <sub>P</sub> = 8/20μS; Notes 2 & 5		11.3		V
C <sub>IN</sub>	Channel Input Capacitance Voltage between CH pins = 0V Voltage between CH pins = 5V	Measured at 1MHz between CH pins; Note 2 applies	0.4 0.35	0.6 0.54	0.9 0.8	pF pF

Note 1: All parameters specified at T<sub>A</sub> = -40°C to +85°C unless otherwise noted.

Note 2: These parameters guaranteed by design and characterization.

Note 3: Standard IEC 61000-4-2 with C<sub>Discharge</sub> = 150pF, R<sub>Discharge</sub> = 330Ω.

Note 4: From CH pin with other CH pin grounded.

Note 5: No Connect pins are left open for all tests.

## Performance Information

### Typical Capacitance Characteristics vs. Voltage

Figure 1 illustrates how the loading capacitance remains mainly flat across the voltage range from 0V to 5V, the voltage between CH pins.

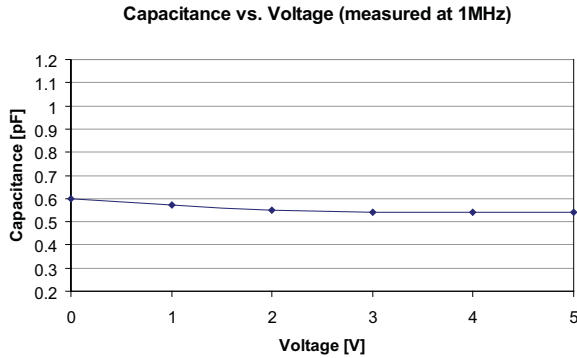


Figure 1. CM1214A Capacitance vs. Voltage

### Typical Voltage Current (VI) Characteristics (low current)

Figure 2 shows how the CM1214A experiences a symmetrical I/V curve, without any snapback or trigger voltage. It gradually starts to turn on at about 6V and clamps about 7V.

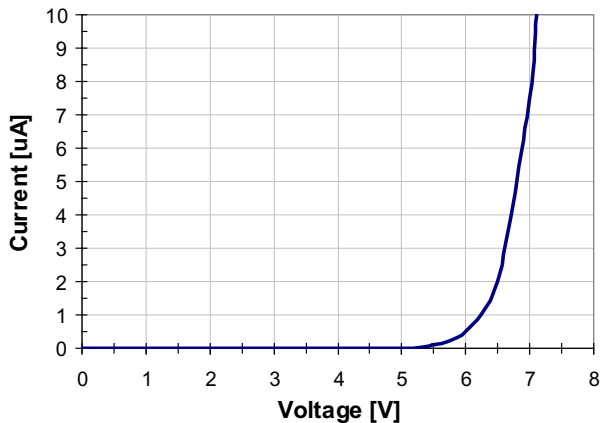


Figure 2. CM1214A VI Characteristics, Low Current

### Typical Voltage-Current (VI) Characteristics (high current, pulse condition)

Figure 3 shows how the CM1214A experiences a symmetrical I/V curve, without any snapback or trigger voltage. The curve shows only one polarity.

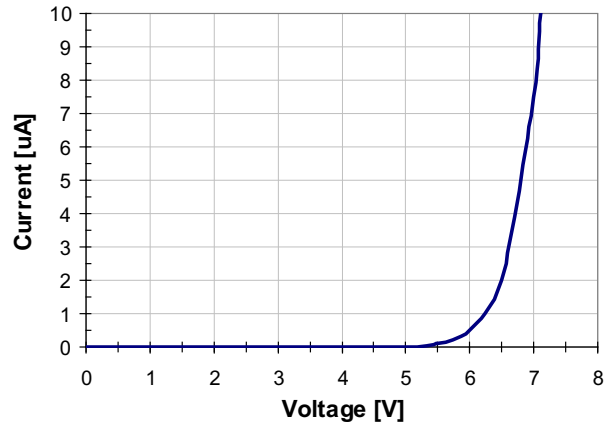


Figure 3. CM1214A VI Characteristics, Low Current, Pulse (clamping) Condition

### Typical Capacitance Characteristics vs. Temperature

Figure 4 illustrates the loading capacitance for both 0VDC and 1.65VDC input across the -40 to 85°C temperature range.

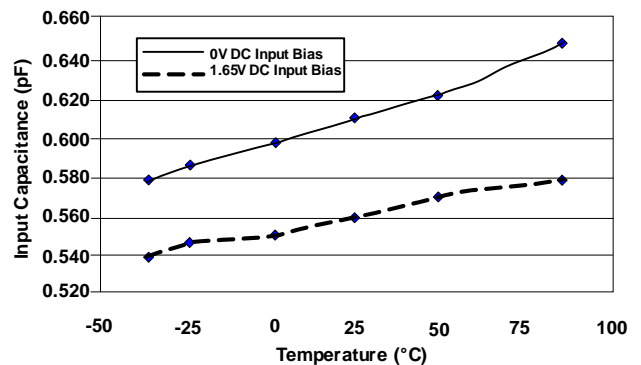
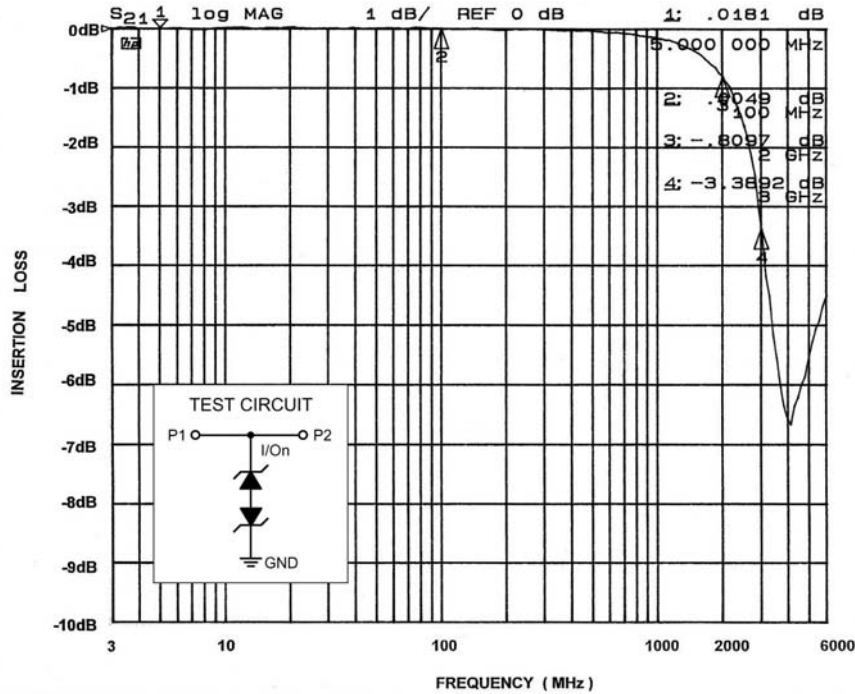


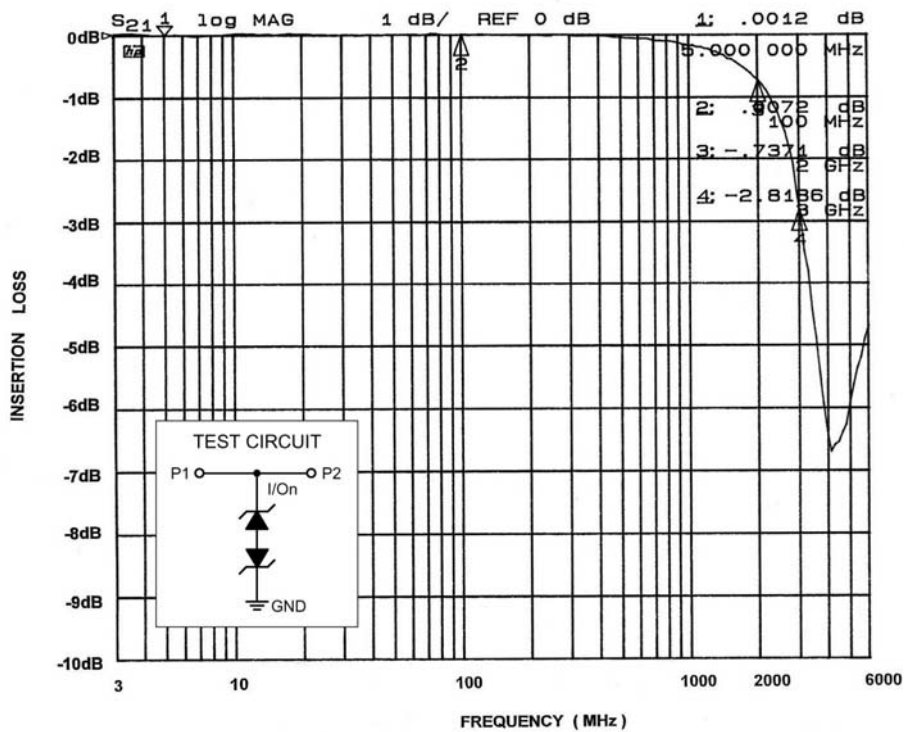
Figure 4. CM1214A Capacitance vs. Temperature

**Performance Information (cont'd)**

Typical Filter Performance (nominal conditions unless specified otherwise, 50 Ohm Environment)



**Figure 5. Insertion Loss vs. Frequency (0V DC Bias)**



**Figure 6. Insertion Loss vs. Frequency (2.5V DC Bias)**

**Application Information**

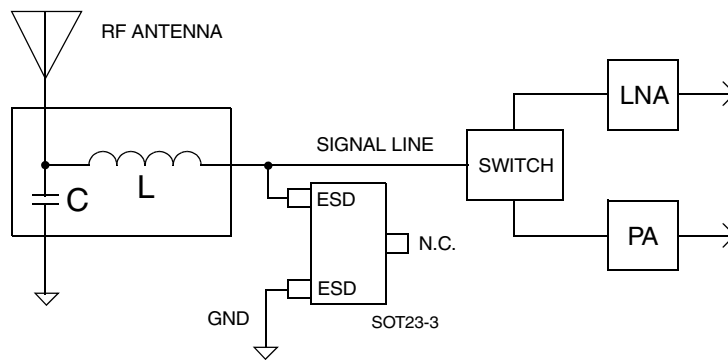
**CM1214A-01SO**

The CM1214A-01SO protects a single bipolar signal line often found in RF circuits. One I/O pin (pin 1 for example) is connected to the signal line for protection, and the other I/O pin is tied to GND. It is important to have a solid ground connection to reduce the clamping voltage. *Pin 3 of the 3-lead SOT23 must be left open (and not connected on the PCB).*

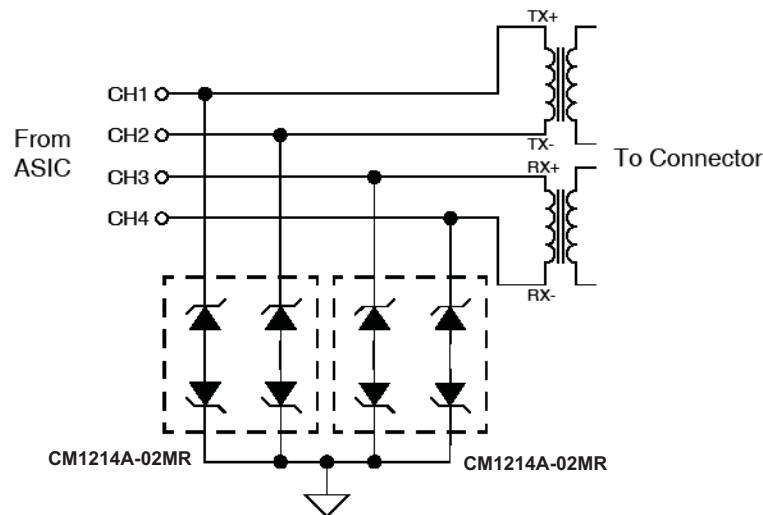
**CM1214A-02MR**

The CM1214A-02MR protects two bipolar lines, such as for Gbit Ethernet. The PCB traces underneath the package connect across to the corresponding pins (Pins 1, 4, 6 and 7). *Pins 2, 3, 5 and 8 of the MSOP-8 package must be left open (and not connected on the PCB).*

Any disturbance on the line above or below the standoff voltage is clamped.

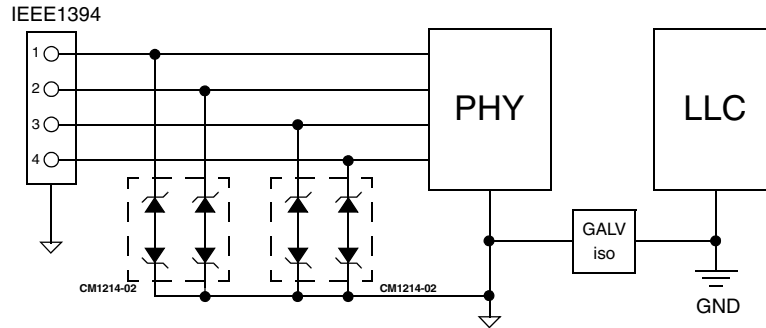


**Figure 7. Typical Application - RF Switch and Amplifier Protection, CM1214A-01SO in 3-lead SOT23**



**Figure 8. Typical Application - Ethernet Protection, CM1214A-02MR in 8-lead MSOP**

**Application Information (cont'd)**



Keep the ESD devices on the PHY side of the galvanic isolation and inside the  $V_{CC}$  domain of the PHY controller.

**Figure 9. Typical Application - IEEE1394 Protection, CM1214A-02MR in 8-lead MSOP**

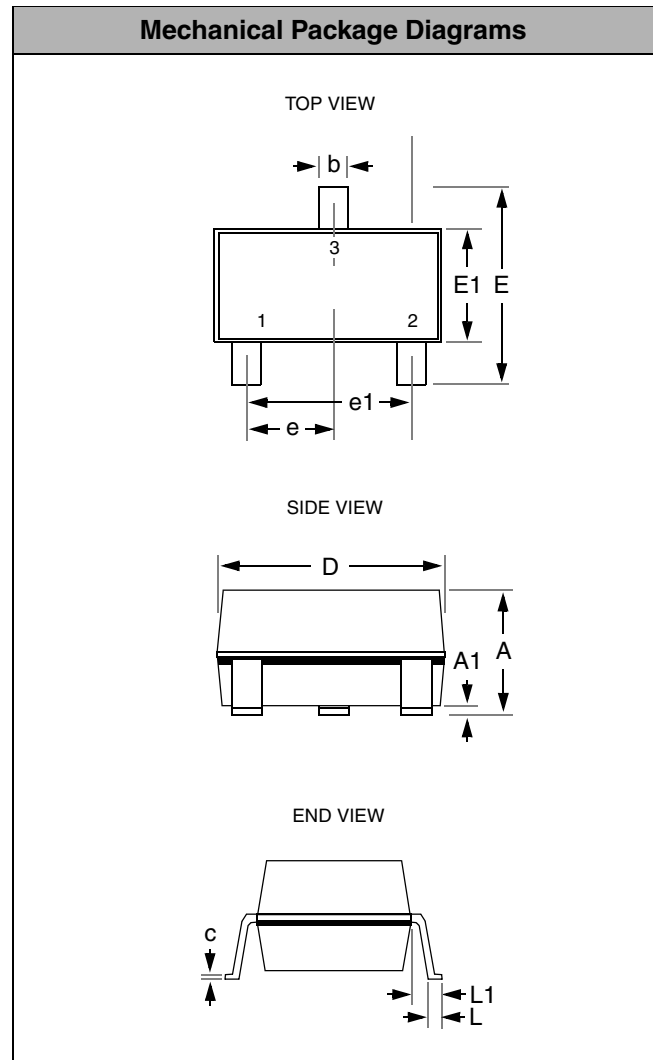
## Mechanical Details

The CM1214A is supplied in SOT23-3 and MSOP-8 packages. Dimensions are presented below.

### SOT23-3 Mechanical Specifications

The CM1214A-01SO is supplied in a 3-pin SOT23 package. Dimensions are presented below.

PACKAGE DIMENSIONS				
Package	SOT23-3 (JEDEC name is TO-236)			
Pins	3			
Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A	0.89	1.12	0.0350	0.0441
A1	0.01	0.10	0.0004	0.0039
b	0.30	0.50	0.0118	0.0197
c	0.08	0.20	0.0031	0.0079
D	2.80	3.04	0.1102	0.1197
E	2.10	2.64	0.0827	0.1039
E1	1.20	1.40	0.0472	0.0551
e	0.95 BSC		0.0374 BSC	
e1	1.90 BSC		0.0748 BSC	
L	0.40	0.60	0.0157	0.0236
L1	0.54 REF		0.0213 REF	
# per tape and reel	3000 pieces			
Controlling dimension: millimeters				



Package Dimensions for SOT23-3

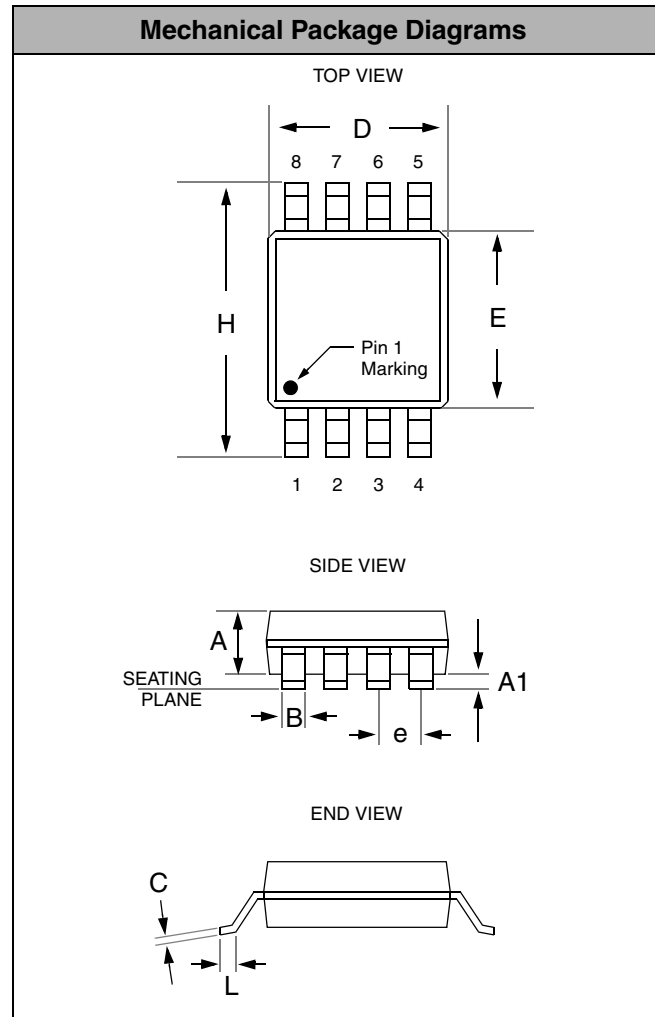


## Mechanical Details (cont'd)

### MSOP-8 Mechanical Specifications, 8 pin

The CM1214A-02MR is supplied in an 8-pin MSOP package. Dimensions are presented below.

PACKAGE DIMENSIONS				
Package	MSOP			
Pins	8			
Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A	0.75	0.95	0.030	0.037
A1	0.05	0.15	0.002	0.006
B	0.28	0.38	0.011	0.015
C	0.13	0.23	0.005	0.009
D	2.90	3.10	0.114	0.122
E	2.90	3.10	0.114	0.122
e	0.65 BSC		0.026 BSC	
H	4.90 BSC		0.193 BSC	
L	0.40	0.70	0.016	0.028
# per tape and reel	4000 pieces			
Controlling dimension: millimeters				



**Package Dimensions for MSOP-8**