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APPLICATION NOTE

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Mounting Techniques, Lead Forming and Testing of Motorola's MPX Series Pressure Sensors

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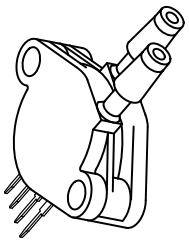
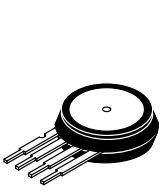
INTRODUCTION

Motorola's MPX series pressure sensors are silicon piezoresistive strain-gauges offered in a chip-carrier package (see Figure 1). The exclusive chip-carrier package was developed to realize the advantages of high-speed, automated assembly and testing. In addition to high volume availability and low cost, the chip-carrier package offers users a number of packaging options. This Application Note describes several mounting techniques, offers lead forming recommendations, and suggests means of testing the MPX series of pressure sensors.

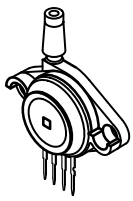


DIFFERENTIAL PORT OPTION CASE 352

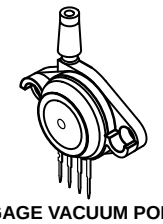
Figure 1. MPX Pressure Sensor In Chip Carrier Package Shown with Port Options



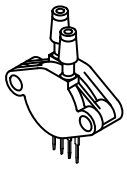
BASIC ELEMENT CASE 344 SUFFIX A/D



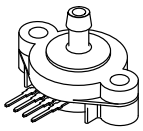
GAGE PORT CASE 350-03 SUFFIX AP/GP



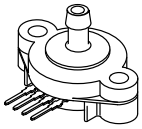
GAGE VACUUM PORT CASE 350-04 SUFFIX GVP



DUAL PORT CASE 352 SUFFIX DP



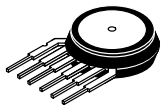
AXIAL PORT CASE 371C SUFFIX ASX/GSX



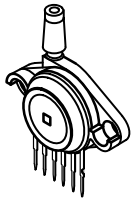
AXIAL VACUUM PORT CASE 371D SUFFIX GVSX

STOVEPIPE PORT CASE 371-05 SUFFIX AS/GS

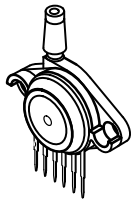
STOVEPIPE VACUUM PORT CASE 371-06 SUFFIX GVS



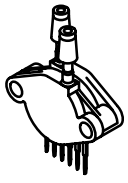
BASIC ELEMENT CASE 867 SUFFIX A/D



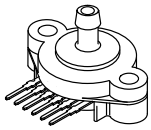
GAGE PORT CASE 867B SUFFIX AP/GP



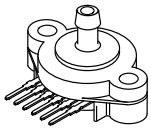
GAGE VACUUM PORT CASE 867D SUFFIX GVP



DUAL PORT CASE 867C



AXIAL PORT CASE 867F



AXIAL VACUUM PORT CASE 867G

STOVEPIPE PORT CASE 867E

STOVEPIPE VACUUM PORT CASE 867A

PORT ADAPTERS

Available Packages

Motorola's chip-carrier package and available ports for attachment of 1/8″ I.D. hose are made from a high temperature thermoplastic that can withstand temperature extremes from –50 to 150°C (see Figure 2). The port adapters were designed for rivet or 5/32″ screw attachment to panels, printed circuit boards or chassis mounting.

Custom Port Adaptor Installation Techniques

The Motorola MPX silicon pressure sensor is available in a basic chip carrier cell which is adaptable for attachment to customer specific housings/ports (Case 344 for 4-pin devices and Case 867 for 6-pin devices). The basic cell has chamfered shoulders on both sides which will accept an O-ring such as Parker Seal's silicone O-ring (p/n#2-015-S-469-40). Refer to Figure 3 for the recommended O-ring to sensor cell interface dimensions.

The sensor cell may also be glued directly to a custom housing or port using many commercial grade epoxies or RTV adhesives which adhere to grade Valox 420, 30% glass reinforced polyester resin plastic or Union Carbide's Udel® polysulfone (MPX2040D only). Motorola recommends using *Thermoset* EP530 epoxy or an equivalent. The epoxy should be dispensed in a continuous bead around the cell-to-port interface shoulder. Refer to Figure 4. Care must be taken to avoid gaps or voids in the adhesive bead to help ensure that a complete seal is made when the cell is joined to the port. The recommended cure conditions for *Thermoset* EP539 are 15 minutes at 150°C. After cure, a simple test for gross leaks should be performed to ensure the integrity of the cell to port bond. Submerging the device in water for 5 seconds with full rated pressure applied to the port nozzle and checking for air bubbles will provide a good indication.

TESTING MPX SERIES PRESSURE SENSORS

Pressure Connection

Testing of pressure sensing elements in the chip carrier package can be performed easily by using a clamping fixture which has an O-ring seal to attach to the beveled surface. Figure 8 shows a diagram of the fixture that Motorola uses to apply pressure or vacuum to unported elements.

When performing tests on packages with ports, a high durometer tubing is necessary to minimize leaks, especially in higher pressure range sensors. Removal of tubing must be parallel to the port since large forces can be generated to the pressure port which can break the nozzle if applied at an angle. Whether sensors are tested with or without ports, care must be exercised so that force is not applied to the back metal cap or offset errors can result.

Standard Port Attach Connection

Motorola also offers standard port options designed to accept readily available silicone, vinyl, nylon or polyethylene tubing for the pressure connection. The inside dimension of the tubing selected should provide a snug fit over the port nozzle. Dimensions of the ports may be found in the case outline drawings found in section six. Installation and removal of tubing from the port nozzle must be parallel to the nozzle to avoid undue stress which may break the nozzle from the port base. Whether sensors are used with Motorola's standard ports or customer specific housings, care must be taken to ensure that force is uniformly distributed to the package or offset errors may be induced.

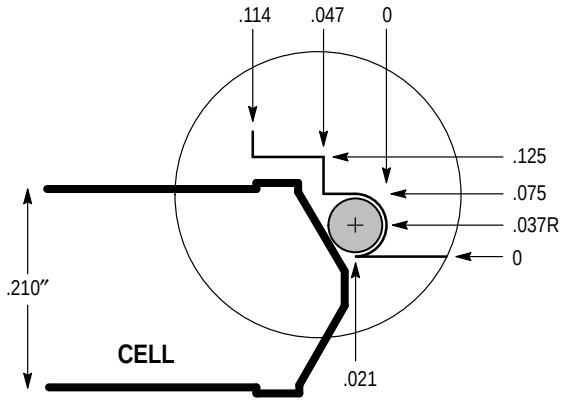


Figure 3. Examples of Motorola Sensors in Custom Housings

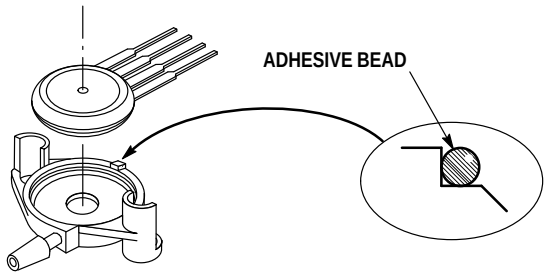


Figure 4. Port Adapter Dimensions

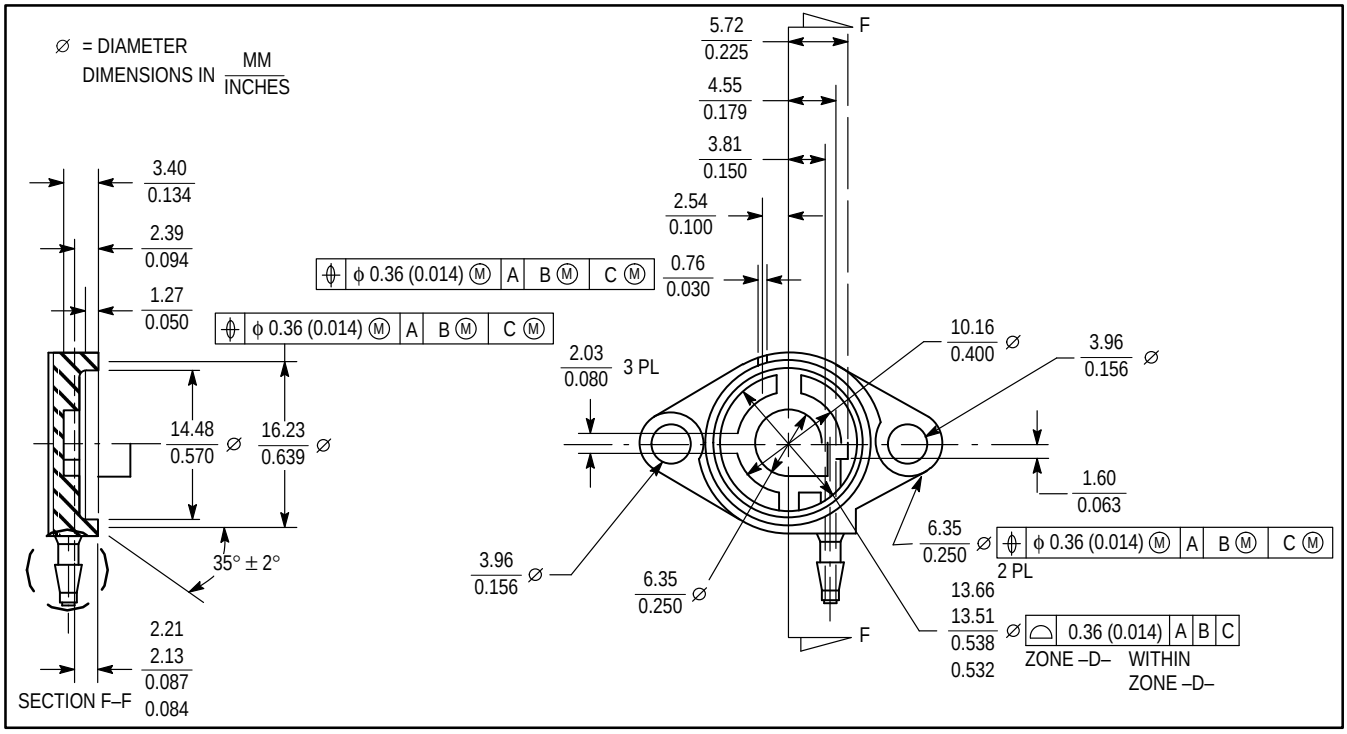
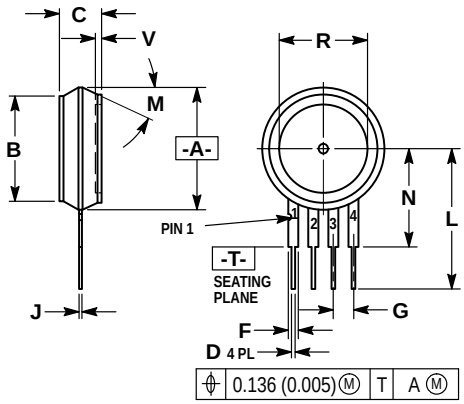


Figure 5. Port Adapter Dimensions



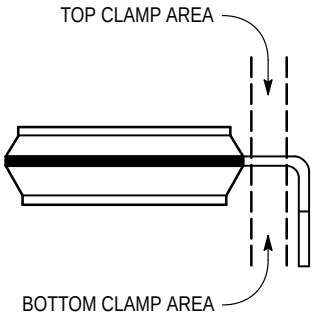
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 344–01 THRU –04 OBSOLETE.
4. 344–05 THRU –07 OBSOLETE, NEW STANDARD 344–08.

STYLE 1:
PIN 1. GROUND
2. + OUTPUT
3. + SUPPLY
4. – OUTPUT

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	14.99	15.62	0.590	0.615
B	12.83	13.34	0.505	0.525
C	4.95	5.72	0.195	0.225
D	0.41	0.51	0.016	0.020
F	1.22	1.32	0.048	0.052
G	2.54 BSC		0.100 BSC	
J	0.36	0.40	0.014	0.016
L	17.40	18.16	0.685	0.715
M	30° NOM		30° NOM	
N	12.19	12.70	0.480	0.500
R	10.67	11.43	0.420	0.450

CASE 344-08
All seals to be made on pressure sealing surface.

Figure 6. Chip-Carrier Package



Leads should be securely clamped top and bottom in the area between the plastic body and the form being sure that no stress is being put on plastic body. The area between dotted lines represents surfaces to be clamped.

Figure 7. Leadforming

Electrical Connection

The MPX series pressure sensor is designed to be installed on a printed circuit board (standard 0.100″ lead spacing) or to accept an appropriate connector if installed on a baseplate. The leads of the sensor may be formed at right angles for assembly to the circuit board, but one must ensure that proper leadform techniques and tools are employed. Hand or "needlenose" pliers should never be used for leadforming unless they are specifically designed for that purpose. Industrial leadform tooling is available from various companies including *Janesville Tool & Manufacturing* (608-868-4925). Refer to Figure 7 for the recommended leadform technique. It is also important that once the leads are formed, they should not be straightened and reformed without expecting reduced durability. The recommended connector for off-circuit board applications may be supplied by JST Corp. (1-800-292-4243) in Mount Prospect, IL. The part numbers for the housing and pins are listed below.

CONCLUSION

Motorola's MPX series pressure sensors in the chip carrier package provide the design engineer several packaging alternatives. They can easily be tested with or without pressure ports using the information provided.

CONNECTORS FOR CHIP CARRIER PACKAGES

MFG./ADDRESS/PHONE	CONNECTOR	PIN
J.S. Terminal Corp. 1200 Business Center Dr. Mount Prospect, IL 60056 (800) 292-4243	4 Pin Housing: SMP-04V-BC 6 Pin Housing: SMP-06V-BC Hand crimper YC-12 recommended	SHF-001T-0.8SS SHF-01T-0.8SS
Methode Electronics, Inc. Rolling Meadows, IL 60008 (312) 392-3500	1300-004 Requires hand crimper	1400-213 1402-213 1402-214 Reel
	TERMINAL BLOCKS	
Molex 2222 Wellington Court Lisle, IL 60532 (312) 969-4550	22-18-2043 22-16-2041	
Samtec P.O. Box 1147 New Albany, IN 47150 (812) 944-6733	SSW-104-02-G-S-RA SSW-104-02-G-S	

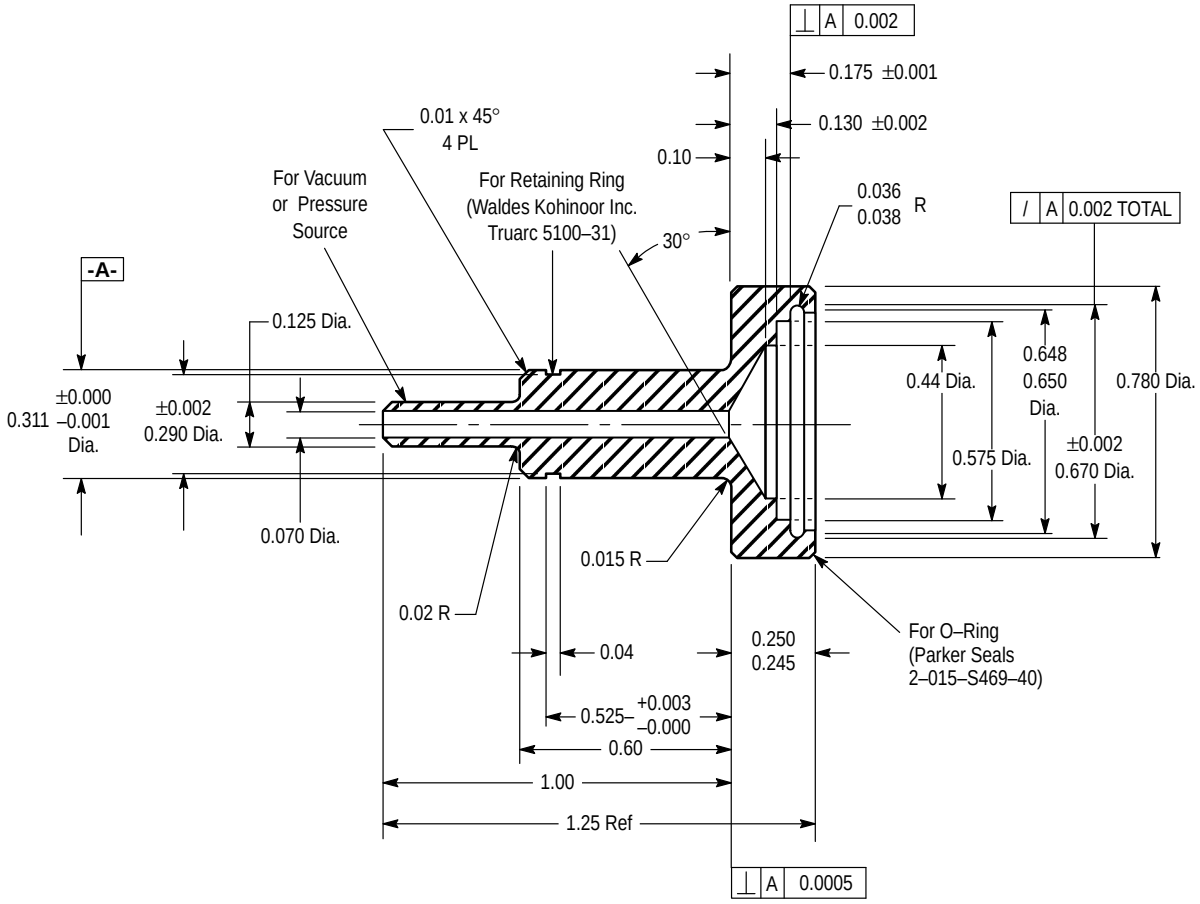


Figure 8. O-Ring Test Fixture

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