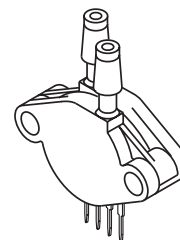


Mounting Techniques, Lead Forming, and Testing of the MPX Series Pressure Sensors

by: Randy Frank

INTRODUCTION

Freescale'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 344C-01

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

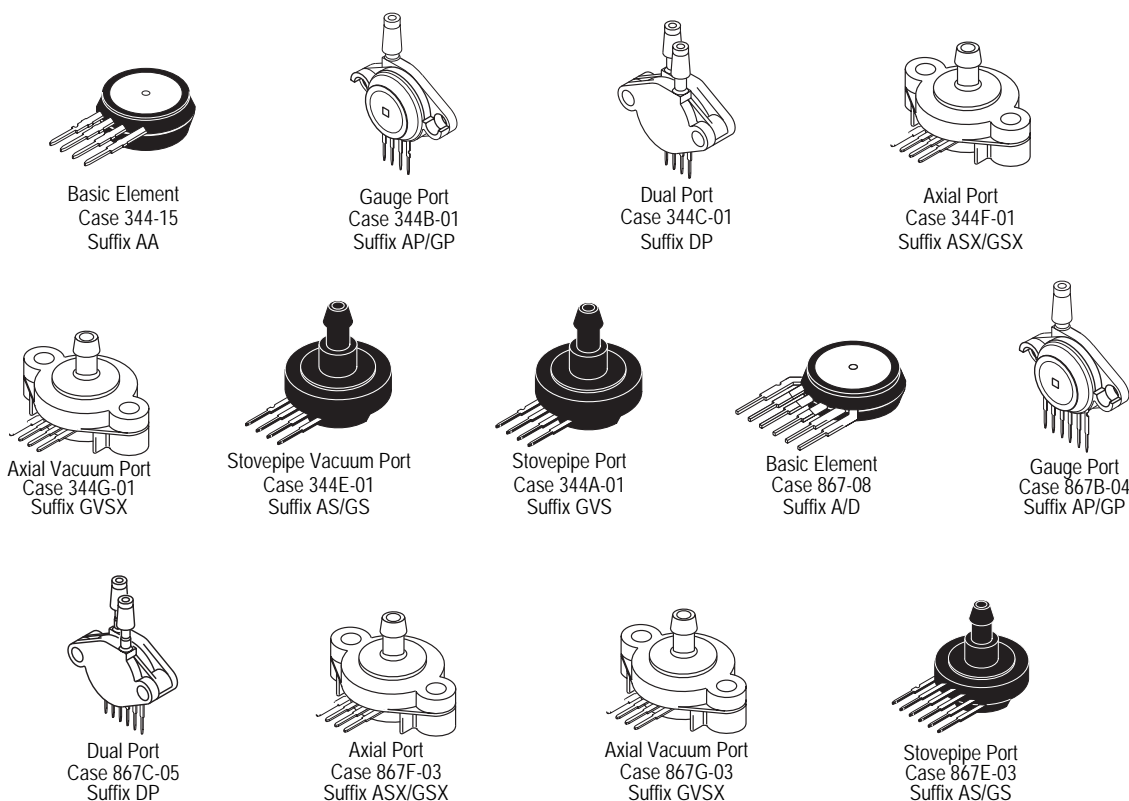


Figure 2. Chip-Carrier and Available Ported Packages

MOUNTING TORQUE

The sensor package should not be over tightened during mounting to avoid fractures in mounting flanges of port and adhesive bond lines. The recommended torque specification for the sensor packages are as follows:

Port Style	Torque Limit (max)
Single-Sided Port:	
Port Down	3 in-lbs
Port Up	3 in-lbs
Dual Port	3 in-lbs
Axial Port	3 in-lbs

It is recommended that a precision torque wrench be used to ensure these limits are not exceeded. If a torque wrench is not available, these limits equate to approximately 1/4 to 1/2 turn past finger tight contact.

Tightening beyond these limits may result in damage to package, or affect device performance.

HARDWARE

Screws can be metal or nylon depending on application and customer preference. A #6 button head screw having head diameter of approximately 0.250" is recommended. The larger head diameter will provide force distribution over greater area minimizing potential of damage to part.

The screws can be threaded directly into mounting surface or through the board and use a flat washer and nut to secure the device. A locking compound applied to the threads may be desired depending on application.

PORT ADAPTERS

Available Packages

Freescale'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°C 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 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.

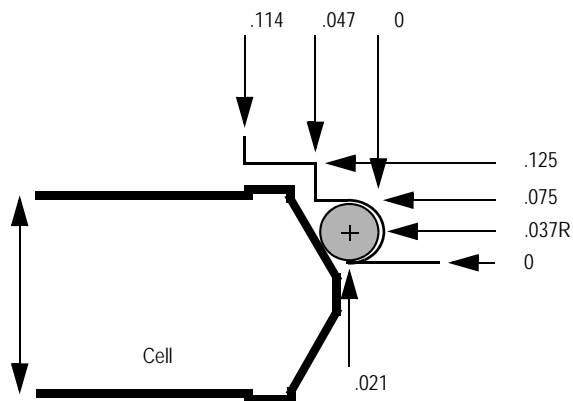


Figure 3. Examples of Sensors in Custom Housings

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 percent glass reinforced polyester resin plastic or Union Carbide's Udel® polysulfone (MPX2300DT1 only). Freescale recommends using Thermoset EP530 epoxy or an equivalent. The epoxy should be dispensed in a continuous bead around the case-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 five seconds with full rated pressure applied to the port nozzle and checking for air bubbles will provide a good indication.

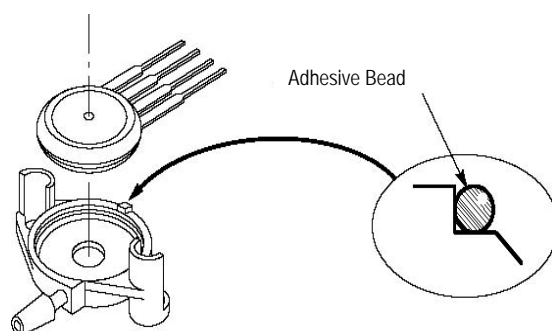


Figure 4. Case to Port Interface

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 Freescale 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

Freescale 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. 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 Freescale'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.

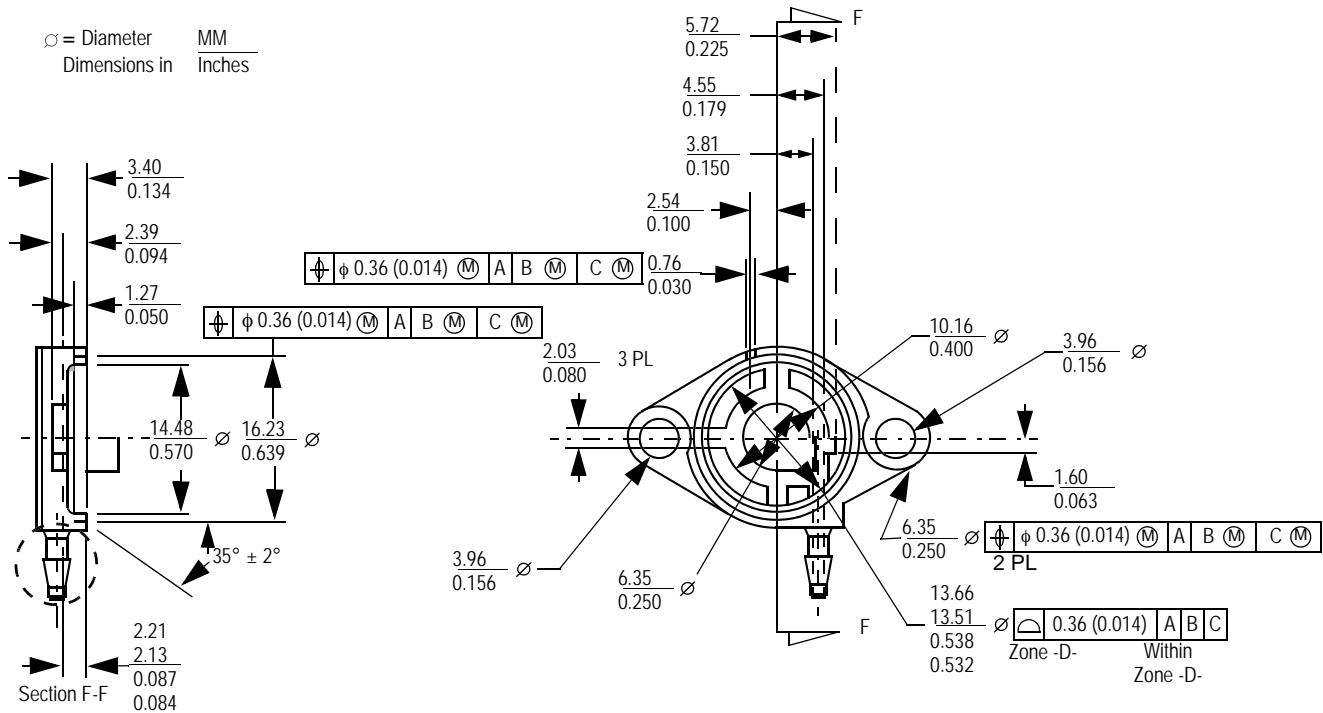
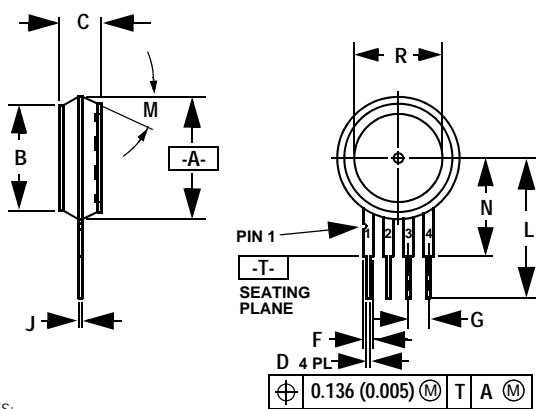


Figure 5. Port Adapter Dimensions



NOTES:

DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 CONTROLLING DIMENSION: INCH.
 DIMENSION -A- IS INCLUSIVE OF THE MOLD STOP RING. MOLD STOP RING NOT TO EXCEED 16.00 (0.630).

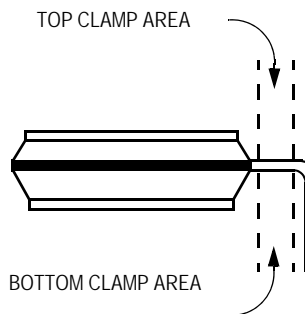
STYLE 1:
 PIN 1.GROUND
 2.+ OUTPUT
 3.+ SUPPLY
 4.- OUTPUT

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.595	0.630	15.11	16.00
B	0.514	0.534	13.06	13.56
C	0.200	0.220	5.08	5.59
D	0.016	0.020	0.41	0.51
F	0.048	0.064	1.22	1.63
G	0.100 BSC		2.54 BSC	
J	0.014	0.016	0.36	0.40
L	0.695	0.725	17.65	18.42
M	30	NOM	30	NOM
N	0.475	0.495	12.07	12.57
R	0.430	0.450	10.92	11.43

Case 344-15

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. Lead Forming

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 base plate. The leads of the sensor may be formed at right angles for assembly to the circuit board, but one must ensure that proper lead form techniques and tools are employed. Hand or "needle nose" pliers should never be used for lead forming unless they are specifically designed for that purpose. Refer to Figure 7 for the recommended lead form 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 on the following page.

CONCLUSION

Freescale'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 Cop. 1200 Business Center Dr. Mount Prospect, IL 60056 (800) 292-4243	4 Pin Housing: SMP-04V-BCS	SHF-001T-0.8SS
	6 Pin Housing: SMP-06V-BC	SHF-01T-0.8SS
Hand Crimper YC-12 Recommended		
Methode Electronics, Inc. Rolling Meadows, IL 60008 (312) 392-3500	1300-004	1400-213
		1402-213
	Requires Hand Crimper	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

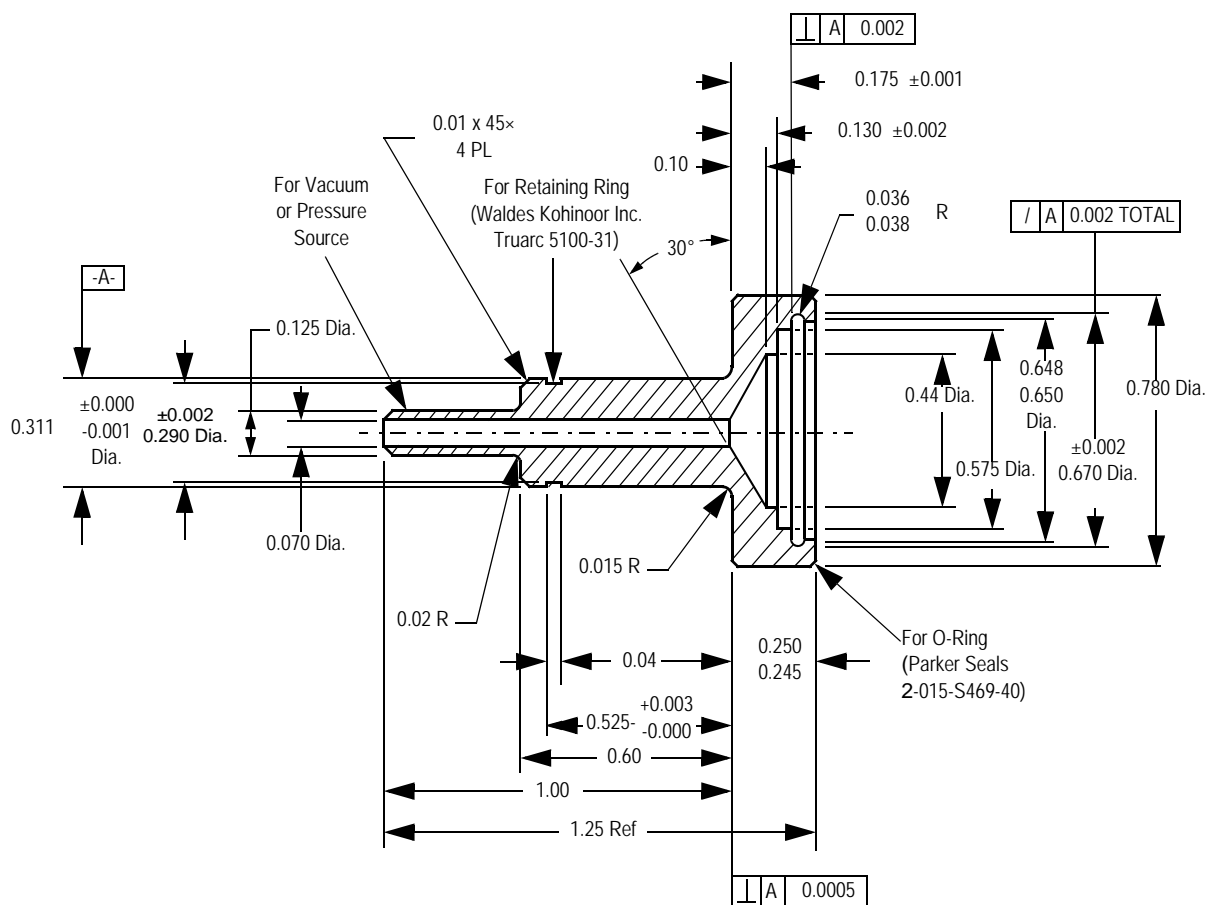


Figure 8. O-Ring Test Fixture



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