All Sensors ***Pressure Points*** are application tips to simplify designing with microelectromechanical systems (MEMS) pressure sensors and avoiding common pitfalls.

Pressure Point 10: Media Capability

Harsh media poses one of the most significant application problems for most pressure sensors. Pressure sensors measuring flow (liquids or gases) and/or liquid depth and that interface to a variety of chemicals can present the most serious challenges but, in some instances, even exposure to water can compromise the sensor's durability.

Sensor manufacturers are usually well aware of the limitations of their products in this critical area. Typical manufacturers' responses are: to provide warnings regarding applications that are strictly not recommended; to provide recommendations for approaches that users can implement to overcome these limitations; and to implement unique packaging that makes the sensor capable of withstanding a selected or several harsh media situations.

Harsh Media Packaging

The use of stainless steel packaging, especially for the sensor diaphragm and the use of other highly durable materials for other packaging aspects can make a sensor suitable for many harsh applications. These sensors solve the harsh environment requirement at a cost that would be prohibitive in most other environments. However, for those applications that require harsh media capability, the cost is quite justified.

Techniques to Improve Media Compatibility

Protective diaphragms made of silicone or other materials and conformal coatings such as Parylene or fluoropolymers are common approaches that sensor manufacturers either implement themselves, frequently as options, or recommend to users. These techniques provide a means to make their product more likely to survive and withstand the rigors of some applications.

If the sensor manufacturer provides this protection, the added materials and assembly effort increases the cost. If users implement these recommendations, the responsibility for product lifetime is solely their responsibility. In addition, the response time of the sensor may be reduced and other sensor parameters could be affected by the addition of the protective technology. Since the sensor manufacturer has no control over the impact implementation of the protection technique, the user must evaluate the protected device for secondary effects. These are just two considerations for users who choose to provide their own protection.

Limiting the Applications to Manufacturer's Recommendations

For pressure sensor manufacturers to offer the highest volume and most cost-effective sensors, plastic packaging is the most commonly used packaging material. Ceramic substrates provide added capability. In either case, the compatibility of these and other exposed packaging materials to those found in the operating environment provides a basis for sensor manufacturers to recommend or not recommend their sensors for specific applications.

All Sensors pressure sensors are specifically intended for use with non-corrosive, non-ionic working fluids such as air, and dry gases. All Sensors recommends evaluating sensors in their intended environment to determine if added protection from the environment is required.

Successful applications require end users to avoid interface materials that would compromise or interact with any of the sensor's packaging materials. For piezoresistive, microelectromechanical system (MEMS) sensors, the most common material after the plastic packaging is the silicon that provides the sensor's diaphragm, supporting foundation and working surface for piezoresistors and other electronics. Other packaging materials can include protective gel coatings that have limited media capability and mounting materials that can include glass, silicone rubber or other materials. Silicone gel coatings can typically be used down to pressures as low as 5 PSI as long as the sensor manufacturer's recommendations are followed. (See Figure 1.) Parylene can be used be used to pressures as low as 5 inches of water without incurring problems as the sensor manufacturer's recommendations are followed. (See Figure 2.)

Figure 1. The cross section and typical materials of plastic-packaged MEMS pressure sensors.

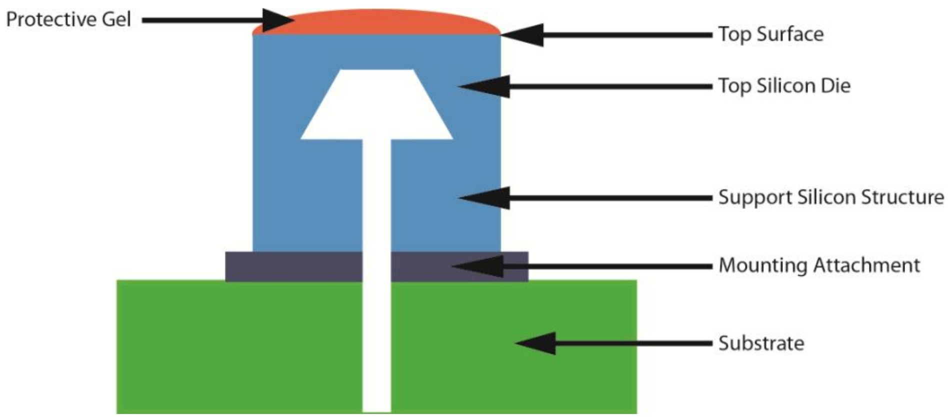
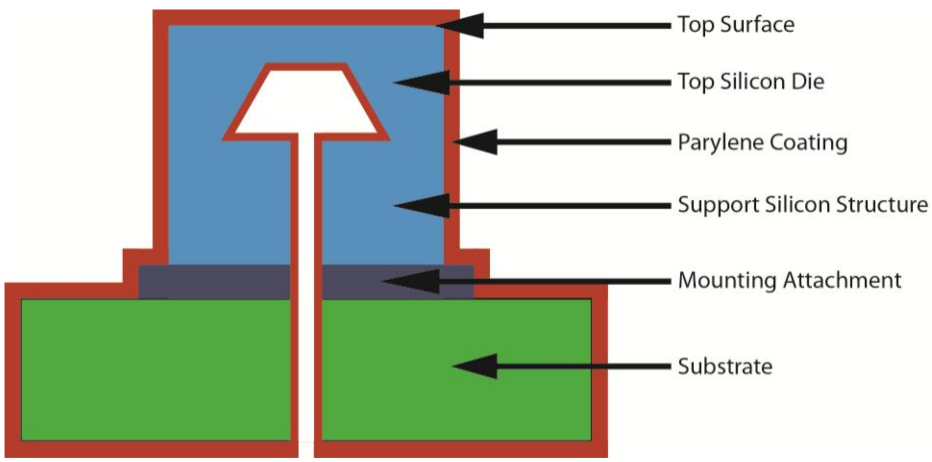


Figure 2. The cross section and typical materials of plastic-packaged MEMS pressure sensors coated with Parylene.



One technique that minimizes the exposure of the more susceptible top surface of the sensor is applying pressure to the back side. Users should be aware that manufacturers typically test and ensure conformance only to product specifications when pressure is applied to the top surface. If the supplier tests one side and the customer uses the opposite side, the performance can be quite different. In addition to sensitivity, the linearity can be directly impacted as well. (See Pressure Point 3: Linearity for MEMS Pressure Sensors for more details.)

To avoid problems in this area and provide a more media-compatible pressure sensor, All Sensors' pioneered its CoBeam2™ design technique. Front-to-back linearity (LinFB) can have as much as a 7 to 8% difference if the sensor manufacturer has not taken it into account in the sensor design. With a CoBeam2™ design technique that targets improved front-to-back linearity, a LinFB of 0.3 to 0.5% can be achieved. For many users, this is sufficient to eliminate any concerns for front-to-back linearity. With CoBeam2™ design technology, pressure sensors users can address more commonly encountered media in high volume/low cost applications and avoid front-to-back linearity issues.