# 20PC Family Pressure Sensors

Technical Note

## Wet/Wet Differential Construction has a Competitive Advantage

For additional information on 20PC SMT Series (exploded view), point your browser to:
http://www.honeywell.com/sensing/prodinfo/pressure/20pc/assembly.asp

### BACKGROUND

The 20PC product is a true wet/wet differential device. The key differences between our 20PC product and competitors' lie in the fundamental construction of the sensor fabrication and package.

### ELASTOMERIC MOUNTING TECHNOLOGY

Elastomeric mounting technology is a technique that we use to package solid state electronic sensors. The IC is sandwiched between two elastomeric seals. One of the seals is conductive and when this sandwich is placed on the substrate and locked into place under compression, an electrical contact will be made between conductive pads on the substrate and the IC through the conductive elastomer. (see Figure 1) On the other side of the die is a flourosilicone seal, which is suitable for various media commonly used in commercial applications. Seals made of different material such as Neoprene, EPDM, or silicon are also available.

### ION-IMPLANTING METHOD

The sensing element of a MICRO SWITCH solid state pressure sensor consists of four piezoresistors buried in a thin circular silicon diaphragm to form the wheatstone bridge. These stress resistors are placed by Ion-implanting method. When the wafer is polished, the crystalline structure is open. The ion-implanter forces resistive ions down into the silicon to form a resistor in the crystalline structure. Most, if not all, liquid molecules are too large to penetrate the crystalline structure. In some cases, to ensure media compatibility, we put a very thin layer of silicon oxide/silicon nitride on the surface to protect the wheatstone bridge.

### COMPETITIVE ADVANTAGE

Figure 2 shows a typical differential pressure sensor design from our competitors. Most of our competitors apply a diffused method when placing the resistors. The diffused resistor method is less costly to manufacture. A layer of resistor material is put on the surface of the wafer, excess material is etched off, and then gold or aluminum pads are laid to connect the wire bonds to the diffused resistors. In order to be used as a differential unit, the sensor must be covered by silicone gel on the media side, which allows the pressure signal to be transmitted to the silicon diaphragm.

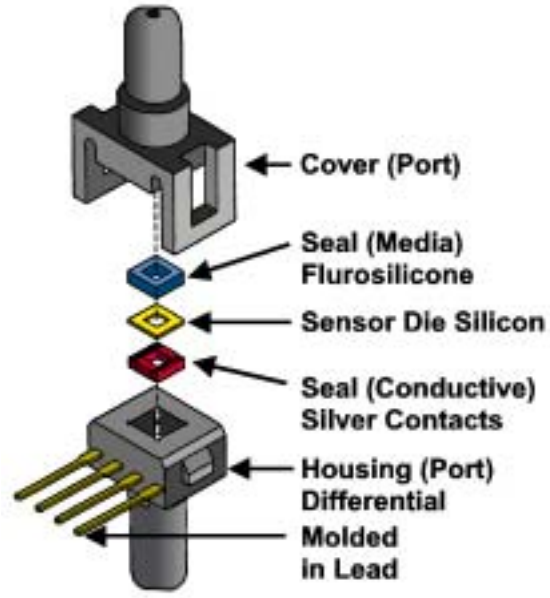


**Figure 1 Elastomeric Mounting Technology**

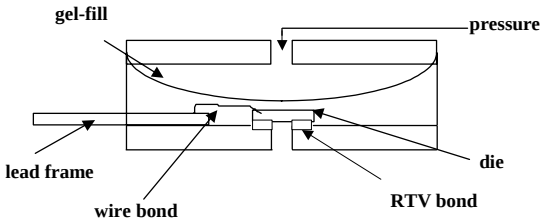


**Figure 2 A Gel-Filled Package Design**

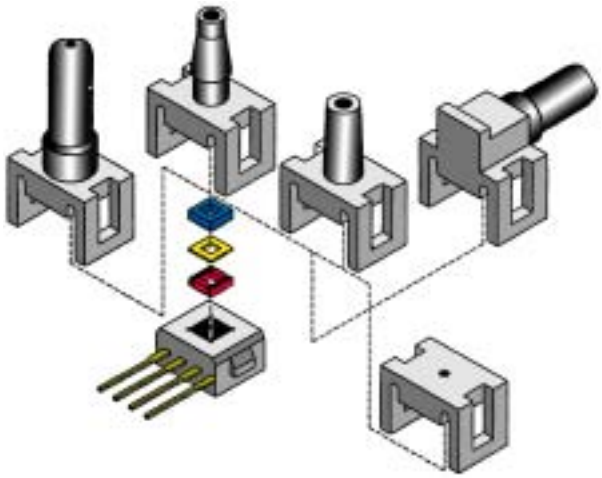

**Figure 3 Elastomeric Package Versatility**

There are many performance concerns with this design. Sensor reliability can be affected by gel characteristics such as:

- Gel viscosity variation
- Thermal coefficient of expansion differences
- Gel permeability
- Changes in material or process
- Gel height
- Gel coverage
- Gel uniformity
- Gel adhesive properties
- Gel media compatibility
- Gel aeration
- Gel compressability

Units with a gel design usually have very poor repeatability over temperature. When gel is exposed to media other than dry air several of the concerns listed above could be exacerbated. The gel can be washed away to cause a permanent failure.

Furthermore, this design requires that the pressure against the gel side always be greater or equal to the pressure on the bottom side because the die will flex upward exerting force against the gel and pulling against the wire bond that is encased in the gel. This may cause a deformation or detachment of the gel over time, or a wire bond opening.

Aluminum pads used to connect the leads and the die can be another reason competitors specify their designs for dry air only. Aluminum is extremely susceptible to corrosion when exposed to any moisture. Since the wire bond creates a potential path to the aluminum, any imperfections in the gel coating which allows traces of moisture to pass into the metalization could cause catastrophic results.

By using ion implanting method and conductive elastomers, we are able to eliminate many of the difficult conventional processes typically used to package solid state sensors such as wire bonds, tab bonds, adhesives (RTV), and field electric bonds. All of the connections are outside of the cavity where the measured pressure is located. The media only comes in contact with polyetherimide plastic, silicon (sensor die), fluorosilicone or other seal material as specified in the 20PC family. Additionally this allows greater design flexibility (see Figures 3 and 4) and higher manufacturing capability with very low scrap and PPM failure rates.

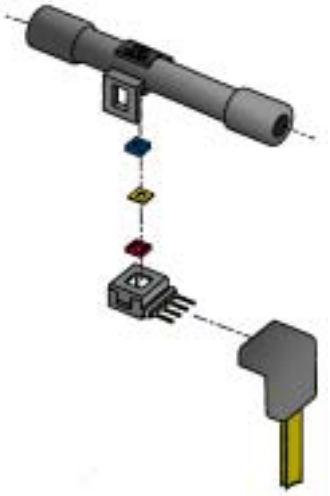

**Figure 4 More Elastomeric Package Versatility**

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