

# Low Cost Pressure Sensor

## Capacitive Sensors on Printed Circuit Boards

Pressure sensors are widely available on the market. The largest group are MEMS piezo-resistive pressure sensors. These are produced in large numbers. However, this is economic only for large quantities, since clean room technology is necessary. The presented sensor is based on a different approach and suitable for small series without the need of expensive technology.

Hahn-Schickard's capacitive low-cost pressure sensor consists of a substrate with a soldered membrane on its surface. This PCB carries a first electrode underneath a membrane, which presents the second electrode and is deformed by application of pressure. The membrane therefore acts as a pressure-to-capacitance converter. A Capacitance to Digital Converter (CDC) measures the capacitance.

Fig. 1 shows the sensor realized as a relative pressure sensor in PCB and MID technology packaged in an aluminum casing with the pressure interface compared to the size of a coin.

With this setup a repetition accuracy of  $\pm 20$  mbar in a range of 0-7 bar was reached. Different CDCs can be used depending on the requirements on cost and performance.

Customer specific designs re-

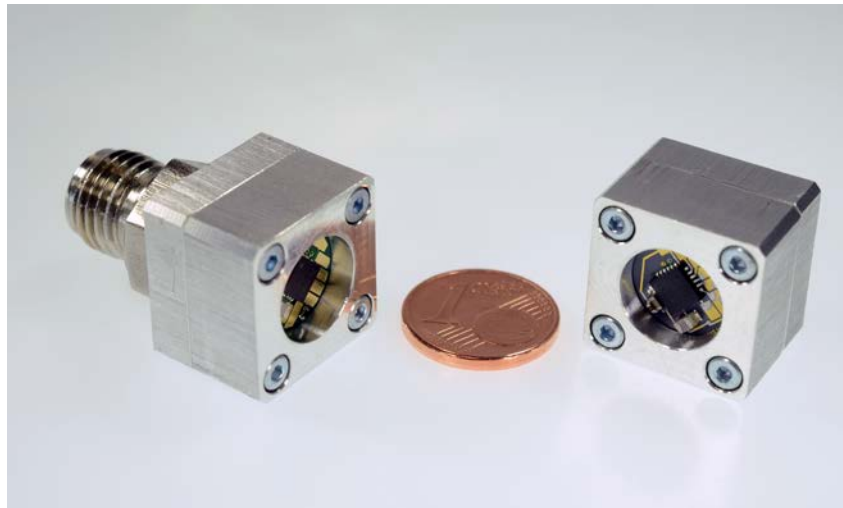


Fig. 1: Pressure Sensor in PCB (left) and MID (right) technology

### Sensor Features

- Membrane:  $\varnothing 9.2$  mm
- PCB:  $\varnothing 13$  mm
- Pressure range: 10 bar
- Repeatability:  $< \pm 0.5\%$  FS
- Resolution:  $< 0.05\%$  FS

garding accuracy, resolution, size and price can be realized quickly and at low cost as only changes to layout and membrane are necessary and the optimal CDC has to be selected.

### Fabrication process:

1. Dispensing / stencil printing of solder paste on PCB
2. Population of the membrane, CDC and passive components

### Field of application

- Fluid level sensor for white goods
- Pressure sensor for aggressive fluids
- Industrial automation
- Pneumatic brake systems
- ...

### 3. Reflow soldering

### Benefits:

Only standard surface-mounting technology (SMT) is necessary. Different Capacitance to Digital converters (CDC) for high-resolution measurement are available.

Due to low investment costs even small series are economic.