

- 1 Pressure and temperature ASIC.
- 2 Sensortransponders.

## SENSOR TRANSPONDER EVALUATION KIT

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A Sensor-Transponder has been developed for the remote measurement of absolute pressure and temperature in the fields of industrial environments. The device is fabricated in one monolithic CMOS-chip which increases reliability and reduces fabrication costs.

#### Pressure Sensor

The integrated capacitive pressure sensor, as shown in Figure 1, consists of an array of circular sensor elements. Each capacitor of a pressure sensor is formed by a fixed first electrode in the substrate and a second electrode as a deflectable membrane of polycrystalline silicon above. The cavity under the membrane is obtained by anisotropic etching and later vacuum sealing.

#### Sensor Readout Electronics

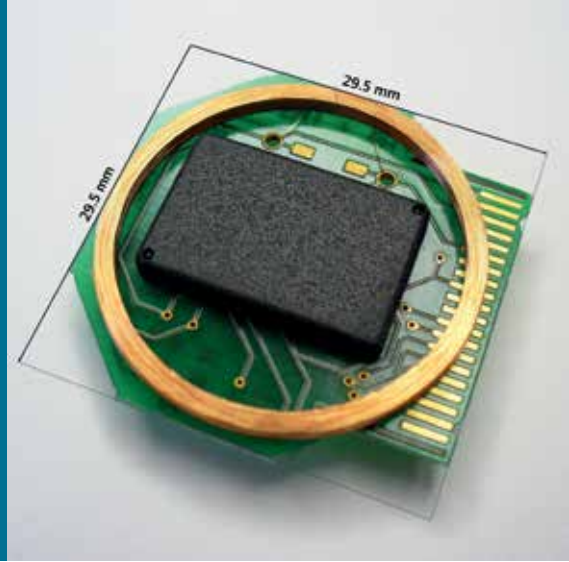
The on chip sensor readout electronic consists of a selection circuitry which switches between the pressure sensor and tempera-

ture sensor for readout, a special ultra low power A/D-converter and a wireless communication link for data transmission. A typical pressure curve for raw sensor data is shown in Figure 5.

#### Transponder System

The system consists of a passive transponder equipped with sensors, and a reader device which powers the transponder by an electromagnetic field and receives back information from the transponder (Figure 3). In this system load-modulation is used to transmit data from the transponder to the reader. Therefore, the impedance of the transponder is changed and modulates a carrier wave which is generated by the reader. The transmitted data package comprises of the sensor readout data, calibration data, a unique identification number and a checksum for data validation. The reader unit calculates the measured pressure and temperature out of the received data. The operating distance is in the range of 0 to





15 cm. As external components for the ASIC, only an antenna based on a coil with a resonance capacitor and an additional capacitor for smoothing the operating voltage are necessary, reducing cost and increasing reliability of the system (Figure 4). The sensor is calibrated in a fully automatic way, storing the calibration coefficients for pressure and temperature in the onchip and system EEPROM.

### Applications

Due to the low cost, small size and the high performance of the system, it is ideally suited for many applications such as:

- Remote pressure and temperature measurement in machines
- Remote pressure and temperature measurement in rotating parts
- Control of vacuum isolation panels
- Control of vacuum in insulating glass panes

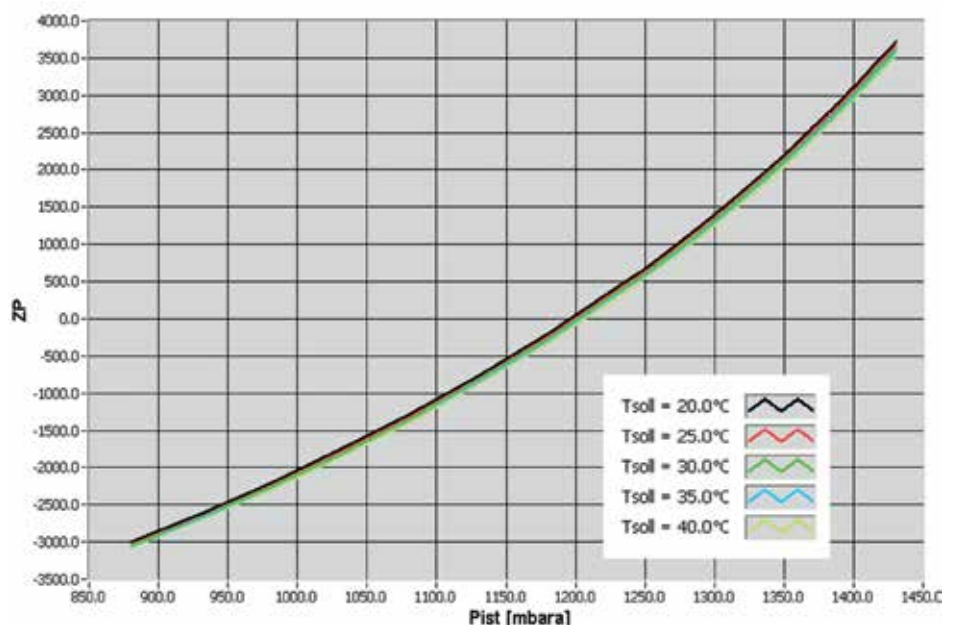
### Evaluation Kit

The evaluation kit consists of the handheld reader and a set of e.g. 10 fully calibrated sensor transponders, as shown in Figure 4.

#### Parameter

#### Value

Handheld reader size (l,w,h)	233 mm, 138 mm, 117 mm
Handheld reader HF-frequency	133 kHz
PC-Interface	USB
Li-ion Accu	7.4 V, 1000 mAh
Charging Device	Li-ion-charger, input DC 12 V
Sensor transponder size (l,w,h)	29.5 mm, 29.5 mm, 7 mm
Sensor weight	2.5 g
Max. pressure range	5 – 1250 hPa
Pressure sensor accuracy	± 2.5 hPa @ (800 – 1200 hPa)
(other pressure ranges are possible)	± 5 hPa @ (5 – 50 hPa)
Max. pressure sensor sample rate	44 Hz
Temperature range	-20 – +85 °C
Temperature sensor accuracy	1 K
Temperature sensor sample rate	22 Hz
Operation distance	0 – 15 cm
(depends on surrounding materials)	



3 Handheld reader unit measuring sensor transponder.

4 Size of sensor transponder.

5 Typical raw pressure curve.