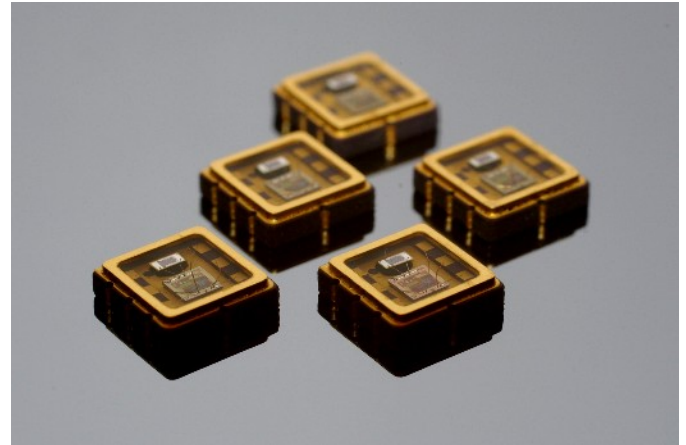


Micro-Machined Capacitive Absolute Pressure Sensors

Main Features

- Capacitive absolute pressure sensor
- Surface micro-machined poly-silicon on fused silica
- Very small chip size: 0.6x1.2 mm², height 0.48 mm
- 2 measurement ranges: 0,7 - 1.3 bar and 2 - 7 bar
- High sensitivity
- Small hysteresis
- Low power consumption
- Customized products
 - bare dies
 - packaged dies
 - sensor systems with ASIC
 - calibrated sensor systems



Pressure sensors with ASIC in a 5x5mm² package

General Description

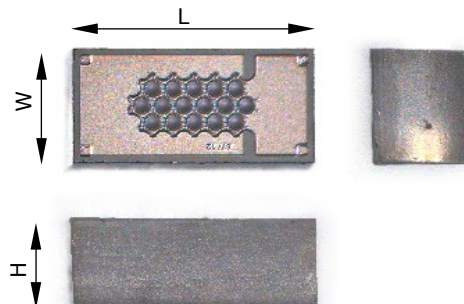
Protron's absolute pressure sensor consist of an ultra small capacitor array with 16 deformable poly-silicon membranes on top of insulated bottom electrodes. The non-conducting fused silica material minimizes all parasitic capacitances to the substrate. The sensor design ensures a high sensitivity, minimum hysteresis and a very low power consumption compared to piezo-resistive pressure sensors.

The dielectric insulation between the electrodes allows the sensor to be operated in normal mode for barometric measurements (typical range 0.7 - 1.3 bar) or in touch mode for high pressure measurements (typical range 2 - 7 bar). Even higher pressures can be detected because the membrane stress does not increase significantly and the sensor withstands over-pressures without damage. The resolution and the accuracy of the sensor depend on the applied electronic. Please note description of "pressure sensor system".

Protron offers the pressure sensors as bare dies with or without package and as calibrated sensor systems with sensor chip and ASIC in a ceramic package. Furthermore evaluation boards for test purposes are available.

Dimensions of Sensor Element

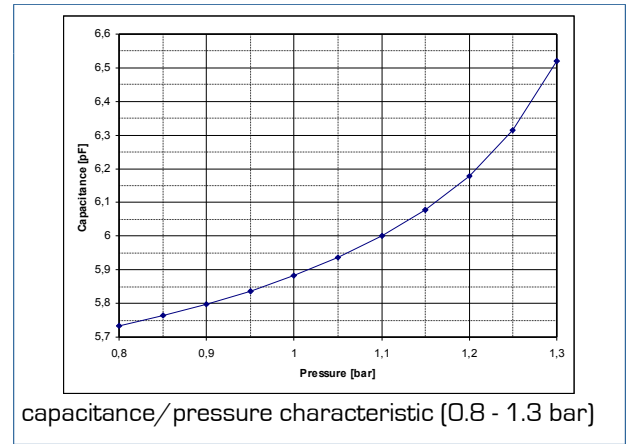
width	W = 0.6 mm
length	L = 1.2 mm
height	H = 0.5 mm (thinning possible)
bond pad length	L _{BP} = 210 μm
bond pad width	W _{BP} = 530 μm
bond pad pitch	D _{BP} = 960 μm
topography on die	H _{BP} < 5 μm
sensitive area length	L _S = 690 μm
sensitive area width	W _S = 370 μm
bond pad material	aluminum (gold possible)



Pressure sensor die

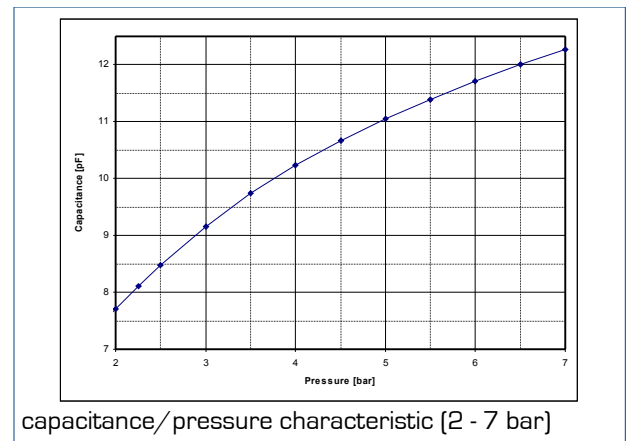
Specifications of Barometric Sensor (typical values)

zero-scale pressure	$P_{ZS} = 0.8 \text{ bar}$	
full-scale pressure	$P_{FS} = 1.3 \text{ bar}$	
reference pressure	$P_{ref} = 1.0 \text{ bar}$	
reference temperature	$T_{ref} = 20 \text{ }^\circ\text{C}$	
capacitance @ P_{ZS}	$C_{ZS} = 5.73 \text{ pF}$	
capacitance @ P_{ref}	$C_{ref} = 5.88 \text{ pF}$	
capacitance @ P_{FS}	$C_{FS} = 6.52 \text{ pF}$	
full-scale sensitivity	$S_{FS} = 13.4 \%$	$(C_{FS}-C_{ZS})/C_{ref} \times 100$
average sensitivity	$S = 1.58 \text{ pF/bar}$	
hysteresis	$C_H < 0.02 \%$	$\max(C_{Down}-C_{Up})/C_{FS} \times 100$
input resistance	$R_i > 300 \text{ M}\Omega$	



Specifications of High Pressure Sensor (typical values)

zero-scale pressure	$P_{ZS} = 2.0 \text{ bar}$	
full-scale pressure	$P_{FS} = 7.0 \text{ bar}$	
reference pressure	$P_{ref} = 4.0 \text{ bar}$	
reference temperature	$T_{ref} = 20 \text{ }^\circ\text{C}$	
capacitance @ P_{ZS}	$C_{ZS} = 7.71 \text{ pF}$	
capacitance @ P_{ref}	$C_{ref} = 10.24 \text{ pF}$	
capacitance @ P_{FS}	$C_{FS} = 12.27 \text{ pF}$	
full-scale sensitivity	$S_{FS} = 45 \%$	$(C_{FS}-C_{ZS})/C_{ref} \times 100$
average sensitivity	$S = 0.91 \text{ pF/bar}$	
hysteresis	$C_H < 0.2 \%$	$\max(C_{Down}-C_{Up})/C_{FS} \times 100$
input resistance	$R_i > 300 \text{ M}\Omega$	



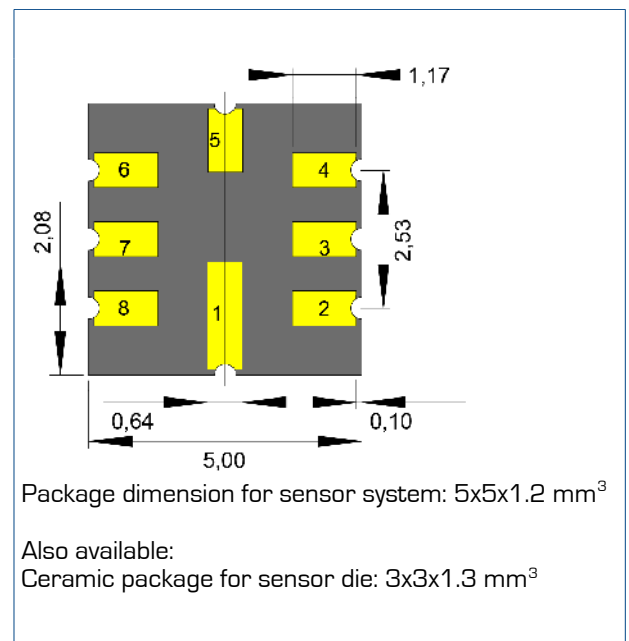
Pressure Sensor System

Protron's absolute capacitive pressure sensor system consists of the sensor chip and a 14 bit analog-to-digital converter. Packaged in a 5x5mm² LCC-housing, the sensor system can be provided with a metal lid protection or in a simple gel encapsulated version. Using a simple external transistor circuit, the digital interface allows easy adjustment of different sampling rates, from 54Hz (14 bit) to 1.3kHz (8 bit), or single shot measurements. The system is suited for battery applications because of the low power consumption.

Main parameters for barometric and high pressure systems:

pressure range	0.8 - 1.3 bar / 2.0 - 7.0 bar
typical accuracy	+/-1 mbar / +/-20 mbar
signal output	I ² C digital output
supply voltage	2.3 - 5.5 V
supply current	60 - 750 μA / 1 μA sleep mode
sampling rate	54 Hz (14 bit) to 1.3 kHz (8 bit)

Protron's pressure sensor systems are optimized for a small scale footprint. Customized developments for low power or high resolution applications are possible by the use of alternative ASICs.



Contact

Protron Mikrotechnik GmbH
 Universitätsallee 5
 28359 Bremen, Germany
 phone +49 421 2234818
 e-mail info@protron.de
 webpage www.protron.de