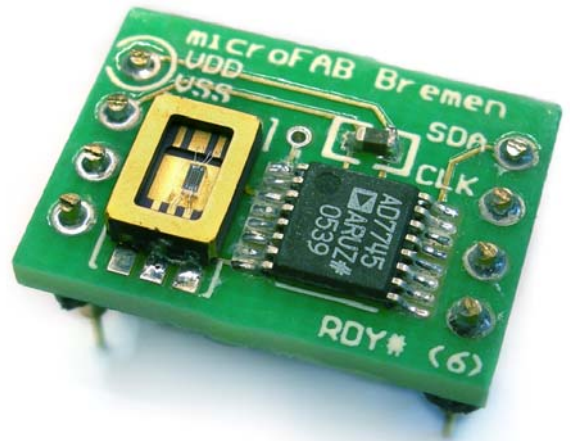




Sample Board Sensor E1.3N/E8.0T with AD7745

Features

- Surface micromachined capacitive absolute pressure sensor fabricated on non-conductive fused silica
- Very small die size (0.6x1.2 mm², height 0.48 mm)
- 0.5 to 1.3 (E1.3N)/1.2 to 8.0 (E8.0T) measuring range
- Very high input resistance >300 MΩ
- Overpressure >9 bar causes no damage
- Floating capacitance
- Large bond pads for conductive adhesive mount
- Membrane counter electrode with dielectric insulation
- Analog Devices AD7745 as CADC and I²C interface
- Single power supply 2.7 to 5.25 V



General Description

The sample board integrates a surface micromachined capacitive pressure sensor and an AD7745 (Analog Devices) as capacitance to digital converter. The AD7745 provides also a standard I²C interface. The type of mounted pressure sensor (E1.3N or E8.0T) can be identified by the number on the back of the sample board and the enclosed documents. **The sensor is electrically and mechanically connected to the LCC socket by wire bonds! No adhesive is used to attach the sensor die** in order to cancel out all influences of the package on the sensor signal. The sensor characteristics can be found in the appropriate datasheets (for information about the operation of the AD7745 see www.analog.com).

A schematic of the sample board circuit is given in fig. 1 along with a top-view of the PCB layout (see tab. 1 for a pin description). The board dimensions are displayed in fig. 2.

Recommended Operation

The AD7745's capacitance gain is factory calibrated that allows to measure capacitances of up to ±4 pF very accurately with no need for additional calibration procedures. The sensor capacitance is larger than 4 pF (see sensor datasheet). As consequence programmable internal capacitances need to be switched to the inputs of the AD7745 which are subtracted from the external capacitance under test in order to meet the required maximum capacitance range of the AD7745. Unfortunately, these **internal capacitances are not factory calibrated and can vary up to ±20% (see datasheet AD7745)**. As consequence the sensor offset shifts accordingly but gain remains accurate. In case if a large pressure range is applied to the sensors, its capacitance swing exceeds 8 pF. In order to readout the capacitance over the whole range the gain registers of the AD7745 need to be reprogrammed (for further assistance on programming the AD7745 please contact microFAB Bremen). Table 2 presents a summary of the recommended AD7745 register settings.

Table 1: Sample board pin connections and descriptions.

Pin-No.	Name	Notes
1	VDD	Supply voltage (2.7 to 5.25 V)
2	VSS	Ground
3	NC	Not connected
4	NC	Not connected
5	NC	Not connected
6	RDY#	Data conversion ready indicator output (low active).
7	CLK	I ² C clock line.
8	SDA	I ² C data line.

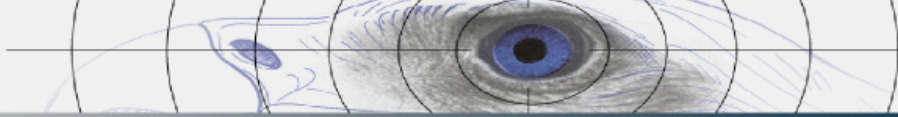


Table 2: Recommended register settings for the operation of the AD7745.

Register	Adress	Value	Notes
Cap Setup	0x07	0x80, 0b1000 0000	Enables single conversion on the capacitive channel and disables the differential capacitance mode.
VT Setup	0x08	0x81, 0b1000 0001	Enables single conversion on the temperature channel, sets the internal temperature sensor active and switches internal chopping on.
EXC Setup	0x09	0x0B, 0b0000 1011	Enables EXCA as excitation output with an excitation voltage level of VDD/2.
Configuration	0x0A	0xFA, 0b1111 1010	Slowest and most accurate capacitance and temperature conversion is selected (update rate: 8.2 Hz (temperature) 9.1 Hz (capacitance)) together with single conversion mode. Writing into the configuration register triggers the sensor evaluation.
CAP DAC A	0x0B	(E1.3N) 0xC0, 0b1100 0000 (E8.0T) 0xC9, 0b1100 1001	An offset capacitance of 10.6 pF/12.1 pF (E1.3N/E8.0T, ±20%) is subtracted from the positive capacitive input by writing 0x40/0x49 into the lower bits (bits 0 to 6) of CAP DAC A register. This offset allows to readout the E1.3N in a pressure range of 0.2 up to 7 bar and the E8.0T in a range of 1.1 to 5 bar. This register value needs to be altered to shift the readout range. The CAP DAC A must be enabled by writing a logic 1 into bit 7 of the CAP DAC A register.
CAP DAC B	0x0C	0x80, 0b1000 0000	By setting bits 0 through 6 to zero no capacitance offset is switched to the negative capacitive input. CAP DAC B must be enabled by writing a logic 1 into bit 7.

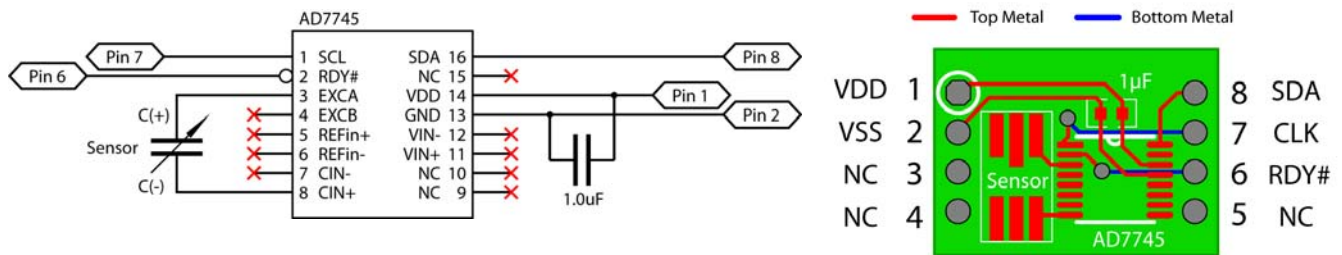


Fig. 1: Sample board schematic (left) and top-view of PCB-layout (right).

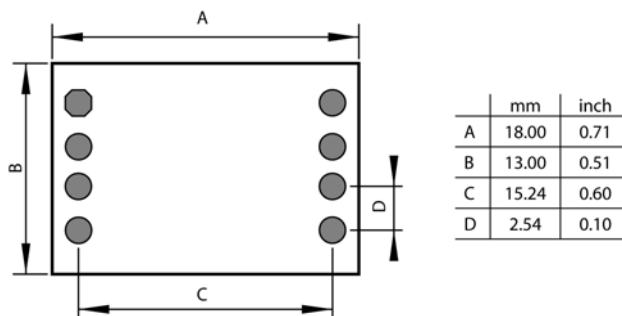


Fig. 2: Dimensional drawing of PC sample board (top-view).

microFAB Bremen GmbH

Lise-Meitner-Strasse 5
28359 Bremen
Germany

fon +49 (0)421 24100-0
fax +49 (0)421 24100-99