



Pressure sensors

Media-separated pressure transmitters (voltage output)

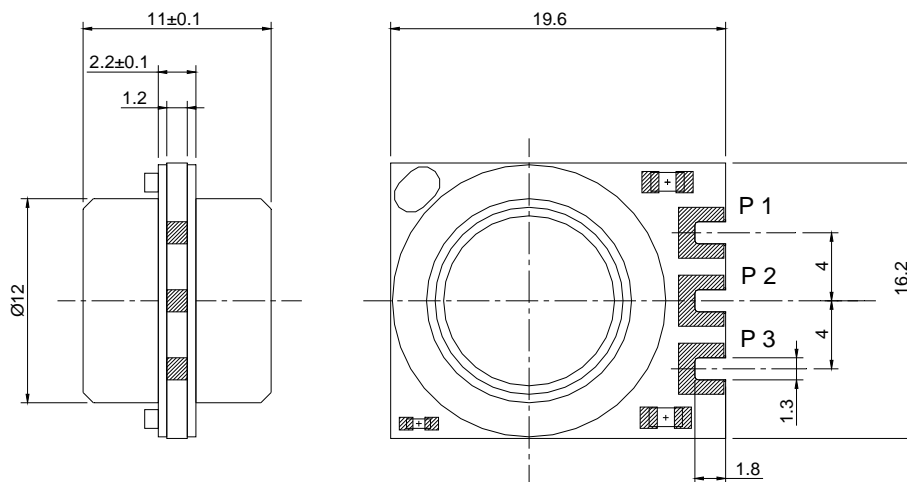
Series/Type:	MiniCell series
Ordering code:	
Date:	2010-05-08
Version:	3

Preliminary data
Description

- Miniaturized media-separated differential pressure transmitters
- Suitable for applications in a temperature range of -40 °C up to 140 °C
- The transmitters are based on piezoresistive silicon pressure sensors from our own clean room
- The integrated signal conditioner compensates non-linearity and temperature errors and supplies a precise calibrated output signal with a high immunity against electromagnetic influences (EMI)


Features

- Piezoresistive MEMS technology
- High media resistance on both pressure ports because of high alloyed steel diaphragms: suitable for all media not reacting with high alloyed steel DIN 1.4435 like fuel, diluted acids, contaminated air, exhaust gases
- Miniaturized integrated ceramic package for OEM applications.
- Pressure ports are adaptable for applications
- Voltage output proportional to pressure: $0.5 \dots 4.5\text{ V}$
- Ratiometric output signal
- RoHS-compatible, halogen-free

Dimensional drawings

Terminal assignment

Pin	Symbol	Signal
1	VCC	Supply voltage
2	GND	Ground
3	VA	Output signal

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Technical data
Absolute maximum ratings

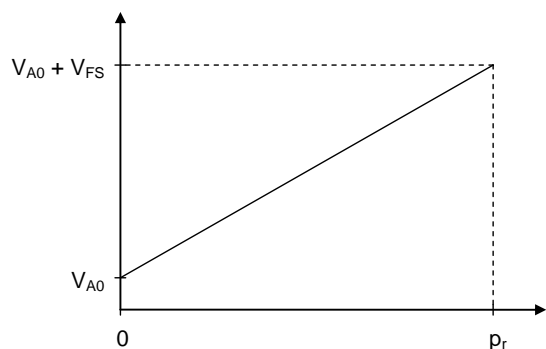
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Temperature ranges						
Storage temperature range	T_{st}	1)	-40		+140	°C
Operating temperature range	T_a	2)	-40		+140	°C
Compensated temperature range	T_c	3)	-40		+140	°C
Soldering temperature	T_{solder}	<5 s (no reflow soldering)			+240	°C
Pressure ranges						
Rated differential pressure	p_r	4)	±0.5	±1.0	±2.5	bar
Overpressure	p_{ov}	4), 5)	2	3	5	p_r
Supply voltage /-current						
Supply voltage	V_{CC}	6)	4.75		5.5	V
Supply current	I_{CC}	$I_A = 0$			7	mA
Signal output current	I_A	7)			2	mA
Output signal at sensor failure	V_{ERR}				0.25	V
DC break down voltage	V_{is}	Types KD, KC only ⁸⁾	500			V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output signal (ratiometric) @ $T_a = 25^\circ\text{C}$, $I_A < 0.1\text{ mA}$						
Offset	V_{A0}	Simple output ⁹⁾	0.092	0.1	0.108	V/V_{CC}
		Symmetrical output ⁹⁾	0.492	0.5	0.508	V/V_{CC}
Signal span (Full scale)	V_{FS}	¹⁰⁾	0.792	0.8	0.808	V/V_{CC}
Non-linearity	L	Simple output ^{10), 11)}		±0.25	±0.5	% FS
		Symmetrical output ^{10), 11)}		±0.25	±0.5	% FS
Response time	t_{10-90}	¹²⁾		1		ms
Measuring error $I_A < 0.1\text{ mA}$						
Total error	E_T	$T_a = 25^\circ\text{C}$, ¹³⁾			0.7	% FS
	E_T	$T_a = 0 \dots 85^\circ\text{C}$, ¹³⁾			1.0	% FS
	E_T	$T_a = -40 \dots 140^\circ\text{C}$, ¹³⁾			1.5	% FS

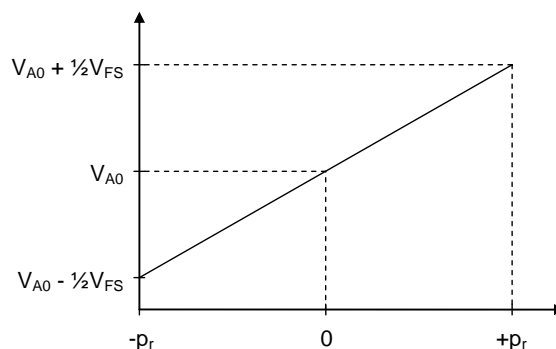
Preliminary data

Characteristics

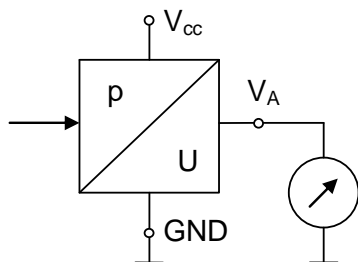
Simple output



Symmetrical output



Connection diagram



Samples available on request.

Preliminary data
Symbols and terms

- 1) **Storage temperature range T_{st}**
A storage of the pressure sensor within the temperature range $T_{st,min}$ up to $T_{st,max}$ and without applied pressure and supply voltage will not affect the performance of the pressure sensor.
- 2) **Operating temperature range T_a**
An operation of the pressure sensor within the temperature range $T_{a,min}$ up to $T_{a,max}$ will not affect the performance of the pressure sensor.
- 3) **Compensated temperature range T_c**
While operating the pressure sensor within the temperature range $T_{c,min}$ up to $T_{c,max}$, the deviation of the output signal from the values at 25 °C will not exceed the temperature coefficients. Out of the compensated temperature range, the deviations may increase.
- 4) **Rated pressure p_r**
Within the rated pressure range 0 up to p_r (symmetrical output: $-p_r$ up to $+p_r$) the signal output characteristic corresponds to this specification.
- 5) **Overpressure p_{ov}**
Pressure cycles within the pressure range 0 up to p_{ov} will not affect the performance of the pressure sensor.
- 6) **Supply voltage V_{CC}**
 $V_{CC,max}$ is the maximum permissible supply voltage, which can be applied without damages.
 $V_{CC,min}$ is the minimum required supply voltage, which has to be applied for normal operation.
- 7) **Signal output current I_A**
 $I_{A,max}$ is the maximum permissible sink current of the signal output.
Exceeding (e.g. short circuit) may cause irreparable damages.
- 8) **DC break down voltage V_{is}**
The pressure sensor withstands a high voltage between the stainless steel pressure connection and the electrical connection V_{CC} , V_A and GND (all short circuited) without damage.
Offset V_{A0}
The offset V_{A0} is the signal output $V_A(p = 0)$ at zero pressure. The value is related to the supply voltage V_{CC} .
Simple output: $V_{A0} = 0.1 V_{CC}$
Symmetrical output: $V_{A0} = 0.5 V_{CC}$
- 9) **Signal span (Full Scale)**
The value is related to the supply voltage V_{CC} .
Simple output: $V_{FS} = FS = V_A(p_r) - V_{A0} = 0.8 V_{CC}$
Symmetrical output: $V_{FS} = FS = V_A(+p_r) - V_A(-p_r) = 0.8 V_{CC}$
- 10) **Non-linearity L (including pressure hysteresis)**
The non-linearity is the deviation of the real sensor characteristic $V_A = f(p)$ from the ideal straight line. It can be approximated by a polynomial of second order, with the maximum at $p_x = p_r / 2$.
The equation to calculate the non-linearity is:
$$L = \frac{V_A(p_x) - V_{A0}}{V_A(p_r) - V_{A0}} - \frac{p_x}{p_r}$$
- 11) **Response time t_{10-90}**
Delay between a pressure change (10 ... 90% p_r) and the corresponding signal output change (10 ... 90% FS).
- 12) **Supply voltage rejection SVR**
While varying the supply voltage within the range $V_{CC,min}$ up to $V_{CC,max}$ at constant pressure and temperature, the signal output change will not exceed SVR_{max} .
- 13) **Total measuring error E_T**
The total measuring error includes nonlinearity, pressure hysteresis, temperature hysteresis, and signal noise. It describes the deviation of the signal to the nominal output signal.

Preliminary data

Cautions and warnings

■ **Storage**

The pressure sensors should be stored in their original packaging. They should not be placed in harmful environments such as corrosive gases nor exposed to heat or direct sunlight, which may cause deformations. Similar effects may result from extreme storage temperatures and climatic conditions.

Avoid storing the pressure sensors in an environment where condensation may form or in a location exposed to corrosive gases, which will adversely affect their performance.

■ **Soldering**

The thermal capacity of the pressure sensor is normally low, so steps should be taken to minimize the effects of external heat. High temperatures may lead to damage or changes in characteristics.

A non-corrosive type of flux resin should normally be used and complete removal of the flux is recommended.

Avoid rapid cooling due to dipping in solvent. Note that the output signal may change if pressure is applied to the terminals during soldering.

■ **Operation**

Media compatibility with the pressure sensors must be ensured to prevent their failure (see page 2).

The use of other media can cause damage and malfunction.

Never use them in atmospheres containing explosive liquids or gases.

Ensure pressure equalization to the environment, if relative pressure sensors are used.

Avoid operating the pressure sensors in an environment where condensation may form or in a location exposed to corrosive gases. These environments adversely affect their performance.

If the operating pressure is not within the rated pressure range, it may change the output characteristics.

Be sure that the applicable pressure does not exceed the overpressure, it may damage the pressure sensor.

Do not exceed the maximum rated supply voltage, it may damage the pressure sensor.

Do not exceed the rated storage temperature range, it may damage the pressure sensor.

Temperature variations in both the ambient conditions and the media (liquid or gas) can affect the accuracy of the output signal from the pressure sensors. Be sure to check the operating temperature range and thermal error specification of the pressure sensors to determine their suitability for the application.

Connections must be wired in accordance with the terminal assignment specified in this publication.

Care should be taken as reversed pin connections can damage the pressure sensors or degrade their performance.

Contact between the pressure sensor terminals and metals or other materials may cause errors in the output characteristics.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

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