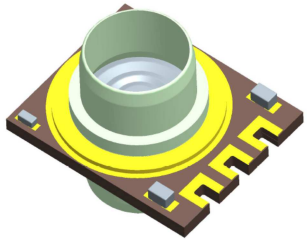
Pressure sensors

Media-separated pressure transmitters (voltage output)

Series/Type:	**MiniCell series**
Ordering code:	**AMD XX.XX KA VR Z1E L P**
Date:	2017-04-03
Version:	0.5

Preliminary data

Description



- Miniaturized media separated differential pressure transmitters
- Sensing element based on piezoresistive MEMS technology
- Suitable for applications with pressure ranges of 0.5 bar to 10 bar and temperature ranges of –40 °C … 140 °C
- Voltage output (0.5 V … 4.5 V) proportional to pressure and supply voltage (ratiometric)

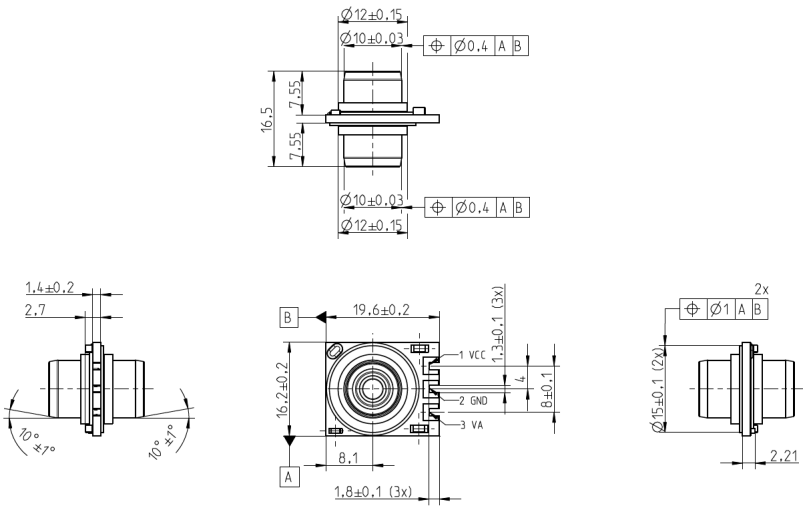
Features

- High media resistance on both pressure ports due to high alloyed steel diaphragms of DIN 1.4435 and DIN 1.4404. Suitable for all media not reacting with high alloyed steel like fuel, diluted acids, contaminated air, exhaust gases
- Miniaturized integrated ceramic package for OEM applications
- High accuracy during temperature changes due to compact design
- 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).
- Overvoltage and reverse voltage protection
- Various mounting solutions due to the stainless steel interfaces
- RoHS-compatible

Options

- Customer specific output characteristics on request
- Housing and connector on request

Dimensional drawings



Preliminary data

1. Technical data

Absolute maximum ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Common sensor characteristics						
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
Supply voltage /-current						
Supply voltage	V_{CC}	6)	4.5		5.5	V
Supply current	I_{CC}	without output current I_A			7	mA
Signal output current	I_A	7)			2	mA
Load resistor	R_L		2.7			k Ω
Overvoltage	V_{ov}	8)	33			V
Output signal at sensor failure	V_{ERR}				0.25	V
Output signal (ratiometric) @ T_a = 25°C, I_A < 0.1 mA, V_{A0} = 5 V						
Offset	V_{A0}	One-sided output 9)		0.5		V
Signal at rated pressure	V_{pr}	One-sided output 10)		4.5		V
Measuring error I_A < 0.1 mA, p_{line} = ambient pressure						
Non-linearity	L	10), 11)		±0.25	±0.5	% FS
Response time	t_{10-90}	11)		1		ms
Specific pressure ranges and Measuring error I_A < 0.1 mA, p_{line} = ambient pressure						
AMD 0.500 KA VR Z1E L P B359						
Rated differential pressure	p_r	One-sided output 4)	0 … 0.5			bar
Overpressure	p_{ov}	5)			3	bar
Burst pressure	p_{burst}	5)			4	bar
Line pressure	p_{line}	5)	0.1		5	bar a
Line overpressure	$p_{ov\ line}$	5)	0.01		16	bar a
Total error	E_T	T_a = 0 ... 85 °C, 12)			±2.0	% FS
	E_T	Ta = –40 ... 140 °C, 12)			±2.5	% FS
AMD 1.000 KA VR Z1E L P B506						
Rated differential pressure	p_r	One-sided output 4)	-0.690 … 1.034			bar
Overpressure	p_{ov}	5)			3	bar
Burst pressure	p_{burst}	5)			4	bar

Line pressure	p_{line}	[5]	0.1		5	bar a
Line overpressure	$p_{ov\ line}$	[5]	0.01		16	bar a
Total error	E_T	T_a = 0 ... 85 °C, [12]			±1.5	% FS
	E_T	Ta = –40 ... 140 °C, [12]			±2.0	% FS
AMD 2.500 KA VR Z1E L P B507						
Rated differential pressure	p_r	One-sided output [4]	0 … 2.5			bar
Overpressure	p_{ov}	[5]			5	bar
Burst pressure	p_{burst}	[5]			7.5	bar
Line pressure	p_{line}	[5]	0.1		16	bar a
Line overpressure	$p_{ov\ line}$	[5]	0.01		25	bar a
Total error	E_T	T_a = 0 ... 85 °C, [12]			±1.0	% FS
	E_T	Ta = –40 ... 140 °C, [12]			±1.5	% FS
AMD 5.000 KA VR Z1E L P B508						
Rated differential pressure	p_r	One-sided output [4]	0 … 5			bar
Overpressure	p_{ov}	[5]			10	bar
Burst pressure	p_{burst}	[5]			15	bar
Line pressure	p_{line}	[5]	0.1		20	bar a
Line overpressure	$p_{ov\ line}$	[5]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [12]			±1.0	% FS
	E_T	Ta = –40 ... 140 °C, [12]			±1.5	% FS
AMD 10.00 KA VR Z1E L P B509						
Rated differential pressure	p_r	One-sided output [4]	0 … 10			bar
Overpressure	p_{ov}	[5]			20	bar
Burst pressure	p_{burst}	[5]			30	bar
Line pressure	p_{line}	[5]	0.1		30	bar a
Line overpressure	$p_{ov\ line}$	[5]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [12]			±1.0	% FS
	E_T	Ta = –40 ... 140 °C, [12]			±1.5	% FS

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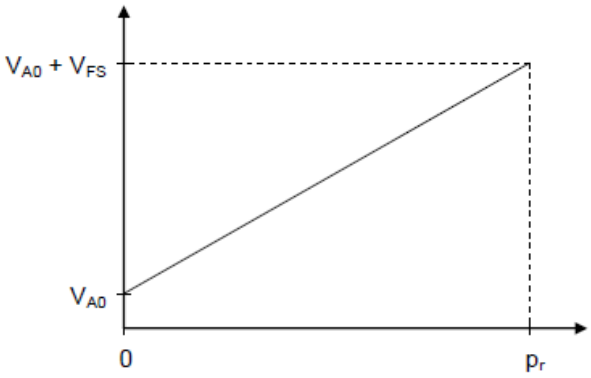
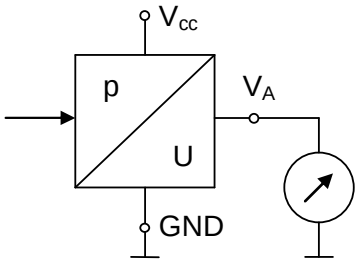
2. Characteristics

One-sided output

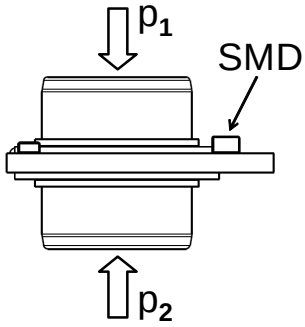


3. Connection diagram

Supply voltage and signal



Pressure feed



Terminal assignment

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

$p_r = p_1 - p_2$

$p_{ov} = p_1 - p_2$

Preliminary data

4. Type designation

Pressure ranges are distinguished by color:

Type	Rated differential pressure		Color
AMD 0.500 KA VR Z1E ST B359	0 ... 0.5	bar	White
AMD 1.000 KA VR Z1E ST B506	-0.690 … 1.0	bar	Purple
AMD 2.500 KA VR Z1E ST B507	0 … 2.5	bar	Blue
AMD 5.000 KA VR Z1E ST B508	0 … 5.0	bar	Green
AMD 10.00 KA VR Z1E ST B509	0 … 10.0	bar	Yellow

Labeling enables a distinction of pressure ranges and may vanish after installation.

5. 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 will not exceed the temperature specific measurement error. 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: $\pm p_r$) the signal output characteristic corresponds to this specification. Rated pressure is defined as: $p_r = p_1 - p_2$.

5) **Overpressure p_{OV} , Line pressure p_{Line} , Line overpressure $p_{ov\ line}$**
1000 pressure cycles within the pressure range 0 up to p_{ov} will not affect the performance of the pressure sensor. Overpressure is defined as: $p_{ov} = p_1 - p_2$. The line pressure is defined as the maximum common mode pressure affecting on both pressure ports simultaneously. Line pressure above ambient pressure may lead to an additional total error of the sensor. For application with higher line pressure: By reducing the overpressure the line pressure can be enlarged accordingly ($p_{ov} + p_{ov\ line} < 40$ bar).

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) **Overvoltage V_{ov}**
Maximum voltage being applied in any polarity to all contact pins without damaging the pressure sensor.

9) **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}.

One-sided output: $V_{A0} = 0.1\ V_{CC}$
Symmetrical output: $V_{A0} = 0.5\ V_{CC}$

10) **Signal span (Full Scale)**
The value is related to the supply voltage V_{CC}.

One-sided output: $V_{FS} = FS = V_A(pr) - V_{A0} = 0.8\ V_{CC}$
Symmetrical output: $V_{FS} = FS = V_A(+pr) - V_A(-pr) = 0.8\ V_{CC}$

11) **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:

$$L = \frac{V_A(p_x) - V_{A0}}{V_A(p_r) - V_{A0}} - \frac{p_x}{p_r}$$

[12] **Response time $t_{10\text{-}90}$**
Delay between a pressure change (10 ... 90% p_r) and the corresponding signal output change (10 ... 90% FS) based on theoretical estimations.

[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.

6. 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.

■ Mounting and Soldering

Be sure that no shear forces caused by sensors mounting are effecting between the pressure ports. It may have influence on the signal accuracy or may damage the pressure sensor. Axial forces in direction of pressure port should not exceed 100 N.

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 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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