

FEATURES

- Ultra-small board mount pressure sensor series with analog voltage output 0.5 to 4.5V ratiometric
- Pressure ranges from ultra-low pressure of 1.25 mbar (125 Pa) up to 2 bar
- Differential/relative, bidirectional differential, absolute and barometric sensor versions
- Piezoresistive sensor with high precision digital signal conditioning
- Calibrated and temperature compensated
- Total accuracy at room temperature: < 0.5 %FSO for pressure range 0 to 10 mbar
- Total error band (-25 ... 85 °C): < 1 %FSO for pressure range 0 to 10 mbar
- High long term stability
- Fast response time: < 2ms
- Physical resolution A/D converter: 18 bit
- Resolution analog output: 16 bit
- Short circuit protection of analog output against ground
- Extremely compact ceramic DIP-6 package (width: 0.43 inch)
- RoHS compliant

TYPICAL APPLICATIONS

- Medical instrumentation
- HVAC (Heating, Ventilation, Air Conditioning)
- Building automation
- Gas and air flow measurement
- Safety-critical applications
- Air Speed
- Barometric altitude measurement
- Vacuum control

GENERAL DESCRIPTION

The OEM pressure sensors in the AMS 6836 series are high-precision board mount sensors in an extremely compact DIP-6 package. They feature an analog 0.5 to 4.5 V output, which is ratiometric to the supply voltage. Due to the membrane-based measurement principle, the sensors are completely gas-tight and the media connections are completely separated.

The AMS 6836 are extensively calibrated, linearized and temperature compensated in a wide temperature range of -25 ... 85 °C. As a result, high accuracy at room temperature and a very small total error band in the complete temperature range are achieved.

The sensors in the AMS 6836 series are available in variants for absolute, relative/gage, differential and bidirectional differential pressure measurements in various pressure ranges:

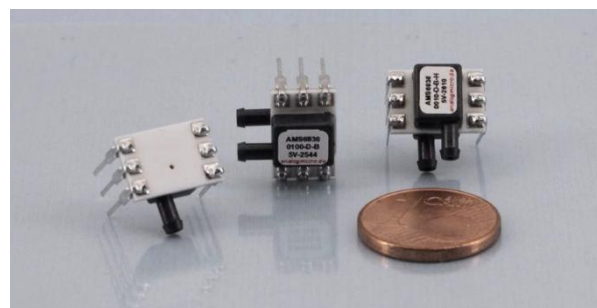
differential (relative) pressure types in ranges from 0 to 2.5 mbar (250 Pa) up to 0 to 2 bar,

bidirectional differential pressure types (positive and negative pressure) from -1.25 to +1.25 mbar (-125 to 125 Pa) up to -1 to +1 bar.

absolute pressure types from 0 to 500 mbar up to 0 to 2bar and

a barometric pressure type from 700 to 1200 mbar.

Additionally customized pressure ranges, 3.3 V supply voltage, further voltage output options or other modifications are available on request.



PRESSURE RANGES

Sensor type (code)	Pressure type	Pressure range in mbar	Burst pressure ¹⁾ in bar	Pressure range in Pa	Burst pressure in kPa
Ultra-low pressure ranges					
AMS 6836-0002-D-...	differential / relative ²⁾	0 ... 2.5	> 0.2	0 ... 250	> 20
AMS 6836-0005-D-...	differential / relative	0 ... 5	> 0.2	0 ... 500	> 20
AMS 6836-0010-D-...	differential / relative	0 ... 10	> 0.2	0 ... 1000	> 20
AMS 6836-0012-D-...	differential / relative	0 ... 12.5	> 0.2	0 ... 1250	> 20
AMS 6836-0001-D-B-...	bidirectional differential	-1.25 ... 1.25	> 0.2	-125 ... 125	> 20
AMS 6836-0002-D-B-...	bidirectional differential	-2.5 ... +2.5	> 0.2	-250 ... +250	> 20
AMS 6836-0005-D-B-...	bidirectional differential	-5 ... +5	> 0.2	-500 ... +500	> 20
AMS 6836-0010-D-B-...	bidirectional differential	-10 ... +10	> 0.2	-1000 ... +1000	> 20
AMS 6836-0012-D-B-...	bidirectional differential	-12.5 ... +12.5	> 0.2	-1250 ... +1250	> 20
Low pressure ranges					
AMS 6836-0020-D-...	differential / relative	0 ... 20	> 0.4	0 ... 2000	> 40
AMS 6836-0035-D-...	differential / relative	0 ... 35	> 0.4	0 ... 3500	> 40
AMS 6836-0050-D-...	differential / relative	0 ... 50	> 1	0 ... 5000	> 100
AMS 6836-0100-D-...	differential / relative	0 ... 100	> 1	0 ... 10000	> 100
AMS 6836-0020-D-B-...	bidirectional differential	-20 ... +20	> 0.4	-2000 ... +2000	> 40
AMS 6836-0035-D-B-...	bidirectional differential	-35 ... +35	> 0.4	-3500 ... +3500	> 40
AMS 6836-0050-D-B-...	bidirectional differential	-50 ... +50	> 1	-5000 ... +5000	> 100
AMS 6836-0100-D-B-...	bidirectional differential	-100 ... +100	> 1	-10000 ... 10000	> 100
Standard pressure ranges					
AMS 6836-0200-D-...	differential / relative	0 ... 200	> 1.7	0 ... 20000	> 170
AMS 6836-0350-D-...	differential / relative	0 ... 350	> 5	0 ... 35000	> 500
AMS 6836-0500-D-...	differential / relative	0 ... 500	> 5	0 ... 50000	> 500
AMS 6836-1000-D-...	differential / relative	0 ... 1000	> 5	0 ... 100000	> 500
AMS 6836-2000-D-...	differential / relative	0 ... 2000	> 5	0 ... 100000	> 500
AMS 6836-0200-D-B-...	bidirectional differential	-200 ... +200	> 1.7	-20000 ... +20000	> 170
AMS 6836-0350-D-B-...	bidirectional differential	-350 ... +350	> 5	-35000 ... +35000	> 500
AMS 6836-0500-D-B-...	bidirectional differential	-500 ... +500	> 5	-50000 ... +50000	> 500
AMS 6836-1000-D-B-...	bidirectional differential	-1000 ... +1000	> 5	-100000 ... 100000	> 500
AMS 6836-0500-A-...	absolute	0 ... 500	> 5	0 ... 50000	> 500
AMS 6836-1000-A-...	absolute	0 ... 1000	> 5	0 ... 100000	> 500
AMS 6836-1500-A-...	absolute	0 ... 1500	> 5	0 ... 150000	> 500
AMS 6836-2000-A-...	absolute	0 ... 2000	> 5	0 ... 200000	> 500
AMS 6836-1200-B-...	absolute (barometric)	700 ... 1200	> 5	0 ... 200000	> 500

Table 1: AMS 6836 standard pressure ranges (other pressure ranges on request)

Notes:

- 1) Burst pressure is defined as the maximum pressure which may be applied to one pressure port relative to the other port (or while only one pressure port is connected) without causing leaks in the sensor.
- 2) Relative pressure is the difference between applied pressure and atmospheric pressure. It is often also called gage or gauge pressure.

MAXIMUM RATINGS

Parameter	Minimum	Typical	Maximum	Units
Maximum supply voltage: $V_{S,max}$			6.5	V
Operating temperature: T_{op}	-25		85	°C
Storage temperature: T_{amb}	-40		125	°C
Common mode pressure: $p_{CM}^{1)}$			8	bar

Table 2: Maximum ratings

Note:

- 1) Common mode pressure is defined as the maximum pressure, which can be applied simultaneously on both pressure ports without causing damages, while no differential pressure is applied.

SPECIFICATIONS

All parameters apply $V_S = 5.0\text{ V}$, $p_{CM} = 0\text{ mbar}$ and $T_{op} = 25\text{ °C}$, unless otherwise stated.

Parameter	Minimum	Typical	Maximum	Units
Analog output signal¹⁾				
@ specified minimum pressure (see "pressure range") ²⁾		0.5		V
@ specified maximum pressure (see "pressure range") ²⁾		4.5		V
Full span output (FSO) ³⁾		4.0		V
without pressure (bidirectional differential)		2.5		V
Total accuracy⁴⁾ (pressure measurement) @ $T = 25\text{ °C}$				
For pressure ranges: $\pm 1.25\text{ mbar}$, $0 \dots 2.5\text{ mbar}$			± 1.5	%FSO
Pressure ranges: $\pm 2.5\text{ mbar}$, $0 \dots 5\text{ mbar}$			± 1.0	%FSO
Pressure ranges: $\pm 5\text{ mbar}$, $0 \dots 10\text{ mbar}$ and $\pm 10\text{ mbar}$			± 0.5	%FSO
Pressure ranges: $0 \dots 20\text{ mbar}$, $\pm 20\text{ mbar}$ and above			± 0.35	%FSO
TEB/Overall error⁵⁾ (pressure meas.) @ $T = -25 \dots 85\text{ °C}$				
Pressure ranges: $\pm 1.25\text{ mbar}$, $0 \dots 2.5\text{ mbar}$			± 2.0	%FSO
Pressure ranges: $\pm 2.5\text{ mbar}$, $0 \dots 5\text{ mbar}$			± 1.5	%FSO
Pressure ranges: $\pm 5\text{ mbar}$, $0 \dots 10\text{ mbar}$ and $\pm 10\text{ mbar}$			± 1.0	%FSO
Pressure ranges: $0 \dots 20\text{ mbar}$, $\pm 20\text{ mbar}$ and above			± 0.5	%FSO
Long term stability			< 0.5	%FSO/a
Supply voltage (V_S)	4.5	5.00	5.5	V
Ratiometricity error (@ $V_S = 4.75 \dots 5.25\text{ V}$)			0.15	%FSO
Resolution A/D converter		18		bits
Minimum resolution analog voltage output		0.0015		%FSO
Maximum output current ⁶⁾		10		mA
Current consumption ($R_L = 1\text{ M}\Omega$)			3.5	mA
Output update rate		500		Hz
Start-up time analog output (V_S ramp up to output signal)		5		ms
Compensated temperature range	-25		85	°C
External Capacitance (between V_S and GND) ⁷⁾	0	100		nF

Parameter	Minimum	Typical	Maximum	Units
Pressure cycles (0 to 120 % full scale pressure)	> 10 ⁶			cycles
Lifetime / MTTF	> 10			years
Package	DIP-6 (width: 0.43 inch)			
Weight		1		g
Dimensions without tubes and pins (L x W x H)		11 x 7.6 x 7.2		mm
Media compatibility	See "Specification notes" 8), 9)			

Table 3: Specifications

SPECIFICATION NOTES

- 1) The analog output signal is ratiometric to the supply voltage.
- 2) The pressure ranges with specified minimum and maximum pressure are listed in *Table 1*.
- 3) The Full Span Output (FSO) is the algebraic difference between the output signal at the specified maximum pressure and the output signal at the specified minimum pressure.
- 4) Total accuracy is defined as the maximum deviation of the measurement value from the ideal characteristic curve at room temperature (RT) in %FSO including the adjustment errors (offset and span), nonlinearity, pressure hysteresis and repeatability. Nonlinearity is the measured deviation from the best fit straight line (BFSL) across the entire pressure range. Pressure hysteresis is the maximum deviation of the output value at any pressure within the specified range when the pressure is cycled to and from the minimum or maximum rated pressure. Repeatability is the maximum deviation of the output value at any pressure within the specified range after 10 pressure cycles.
- 5) The TEB (total error band or overall error) is defined as the maximum deviation of the measurement value from the ideal characteristic curve in %FSO across the entire temperature range (-25 ... 85 °C).
- 6) The analog output is protected against short circuit to ground (GND).
- 7) An external capacitor is recommended.
- 8) Media compatibility of pressure port 1 (for a description of port 1 see *Figure 3*): fluids and gases non-corrosive to silicon, Pyrex, RTV silicone rubber, epoxy and LCP.
- 9) Media compatibility of pressure port 2 (for a description of port 2 see *Figure 3*): clean, dry gases, non-corrosive to LCP, silicon, RTV silicone rubber, epoxy, gold (alkaline or acidic liquids can destroy the sensor).

FUNCTIONAL DESCRIPTION

The pressure sensors in the series AMS 6836 combine a high quality piezoresistive silicon sensing element with a modern mixed-signal CMOS ASIC for signal-conditioning in a ceramic hybrid package. This combination enables a low total error band, excellent temperature behavior and long-term stability.

AMS 6836's functional principle is explained using *Figure 1*.

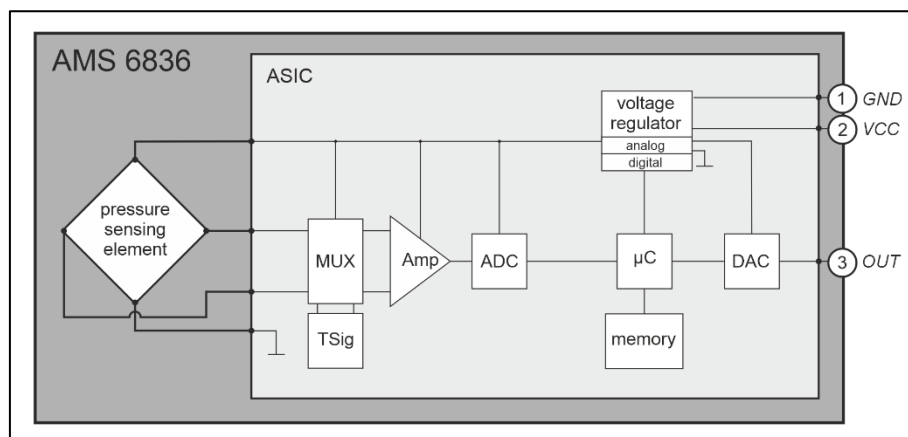


Figure 1: Functional principle

The physical pressure applied to AMS 6836's pressure ports is converted into a differential voltage signal at the sensor's pressure sensing element. This pressure related differential voltage is signal conditioned in the mixed-signal ASIC to realize a standardized output voltage.

In detail, the signal conditioning is realized in the following way:

At first, the pressure related differential voltage is transmitted through a multiplexer (MUX) and an amplifier (Amp) to the A/D converter block (ADC). There it is converted into a digital value with 18 bit physical resolution. This digitized raw pressure value is then mathematically processed by the ASIC's integrated microcontroller unit (μC).

To obtain a calibrated and temperature compensated pressure signal, the ASIC's microcontroller unit (μC) executes a cyclic program, which continuously calculates the current standardized and corrected digital pressure value based on the current digitized raw pressure value, the current temperature measurement value and the stored calibration coefficients. The necessary temperature measurement values are generated in the ASIC's temperature reference block (TSig) and transmitted via the multiplexer and the amplifier to the ADC, where they are digitized too.

In the last step, the current standardized digital pressure value is converted by the ASIC's 16 bit-D/A converter block into an analog output voltage signal, which is ratiometric to the supply voltage and typically updated every 2 ms. The analog output signal is available at the sensor's PIN3 (OUT).

INITIAL OPERATION

Electrical Connection

The electrical connection of AMS 6836 sensors is typically established by soldering them directly on a printed circuit board or by mounting them on a suitable socket.¹⁾

The basic circuit of the AMS 6836 sensor with analog output is shown in *Figure 2*. It is sufficient to connect PIN1 (GND), PIN2 (VCC) and PIN3 (OUT). An external capacitor, e.g. 100 nF, is recommended between VCC and GND to reduce noise and stabilize the supply voltage. PIN4 and PIN 5 are not connected.

Important: PIN6 is used for calibration purposes only and may not be connected.

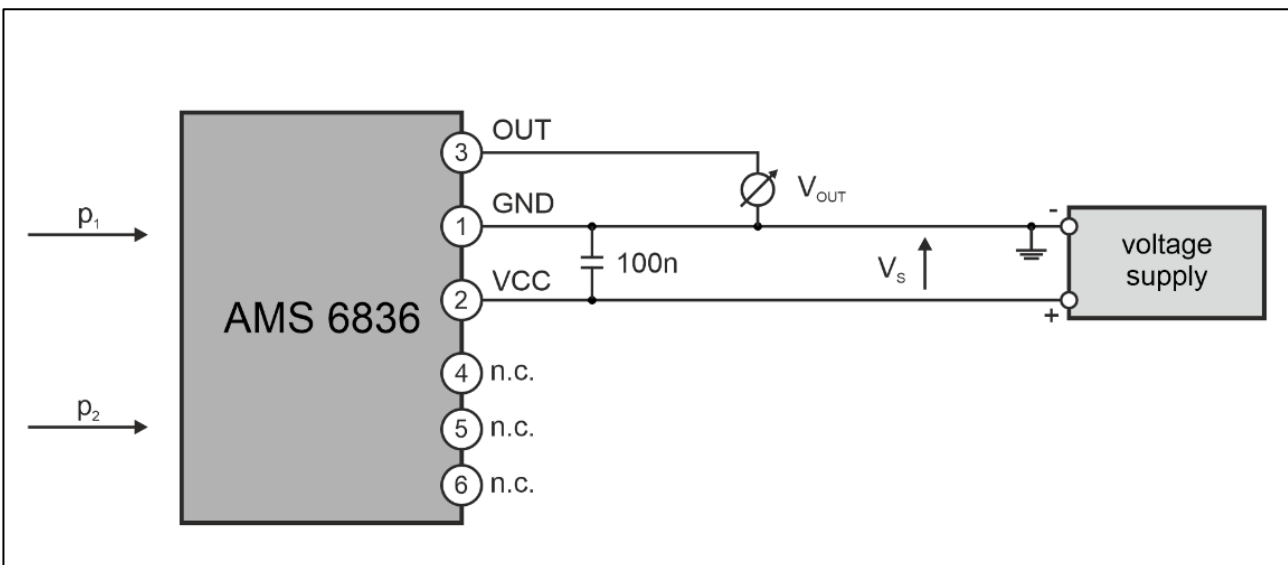


Figure 2: Principle electric circuitry

Pressure Connection

The pressure connection is established using suitable hoses²⁾ attached to AMS 6836's barbed pressure ports. Depending on the sensor type and the type of measuring pressure, one or two of the pressure ports have to be connected to the measuring medium / volume, as described in the table below:

Sensor type	Pressure type to measure	Port 1	Port 2	Requirement
AMS 6836-xxxx-D	differential ($\Delta p = p_1 - p_2$)	connected to p_1	connected to p_2	$p_1 \geq p_2$
	positive gage	connected to p_1	open	$p_1 \geq p_{\text{ambient}}$
	negative gage (vacuum)	open	connected to p_2	$p_2 \leq p_{\text{ambient}}$
AMS 6836-xxxx-D-B	bidirectional differential ($\pm \Delta p$)	connected to p_1	connected to p_2	$p_1 \geq p_2$ or $p_1 \leq p_2$
AMS 6836-xxxx-A	absolute	n.a.(open)	connected to p_2	$p_2 = \text{meas. pressure}$
AMS 6836-xxxx-B	absolute (barometric)	n.a.(open)	connected to p_2	$p_2 = \text{meas. pressure}$

with p_1 = pressure connected to pressure port 1 and p_2 = pressure connected to pressure port 2. For port declaration see *Figure 3*.

The media compatibility of pressure ports 1 and 2 can be found in "Specification notes", 7) and 8).

Notes:

- 1) ESD precautions are necessary, it is essential to ground machines and personnel properly during assembly and handling of the device.
- 2) For horizontal pressure port configuration Analog Microelectronics GmbH recommends a silicone hose with inner diameter $\varnothing = 1.6$ mm and outer diameter $\varnothing = 3.2$ mm.

Calculating the pressure measurement value from the analog output value in physical units

The following equations are used to convert the analog voltage output value to the pressure value in the desired physical unit (e.g. mbar):

$$p = \frac{\text{Outp}(p) - \text{Outp}_{\min}}{\text{Sensp}} + p_{\min} \quad \text{with} \quad \text{Sensp} = \frac{\text{Outp}_{\max} - \text{Outp}_{\min}}{p_{\max} - p_{\min}} \quad (1)$$

wherein

p is the current pressure in the desired physical unit (e.g. mbar, Pa),

$p_{\min}$ and $p_{\max}$ are the specified minimum and maximum pressure values in the desired physical unit (e.g. in mbar) depending on the sensor's specific pressure range (see *Table 1*),

$\text{Outp}(p)$ is the current voltage value at the analog output,

$\text{Outp}_{\min}$ is the analog output voltage value at the minimum specified pressure in V,

$\text{Outp}_{\max}$ is the analog output voltage value at the maximum specified pressure in V,

Sensp is the sensitivity of the pressure sensor (e.g. in V/mbar, V/Pa).

Example

At the analog output PIN3 (OUT) of an AMS 6836-0005-D-B (-5 ... 5 mbar bidirectional differential sensor) the following voltage against PIN1 (GND) is measured:

$$\text{Outp}(p) = 3 \text{ V}$$

For AMS 6836-0005-D-B the following values are specified:

$$p_{\min} = -5 \text{ mbar}, p_{\max} = 5 \text{ mbar} \text{ and } \text{Outp}_{\min} = 0.5 \text{ V}, \text{Outp}_{\max} = 4.5 \text{ V}$$

Using these values and equation (1) the current pressure in mbar can be calculated:

$$p = \frac{(3 - 0.5) \text{ V}}{(4 / 10) \text{ V / mbar}} + (-5) \text{ mbar} = 1.25 \text{ mbar}$$

DIMENSIONS and PINOUT

AMS 6836 pressure sensors come in a ultra miniaturized dual-in-line package (DIP-06) for assembly on printed circuit boards (PCB).

The pinout and the dimensions of AMS 6836's ceramic hybrid package with horizontal barbed pressure ports is illustrated in *Figure 3*.

Important: PIN\$ and PIN5 are not connected. PIN6 is reserved for use during the manufacturing process and must remain electrically unconnected.

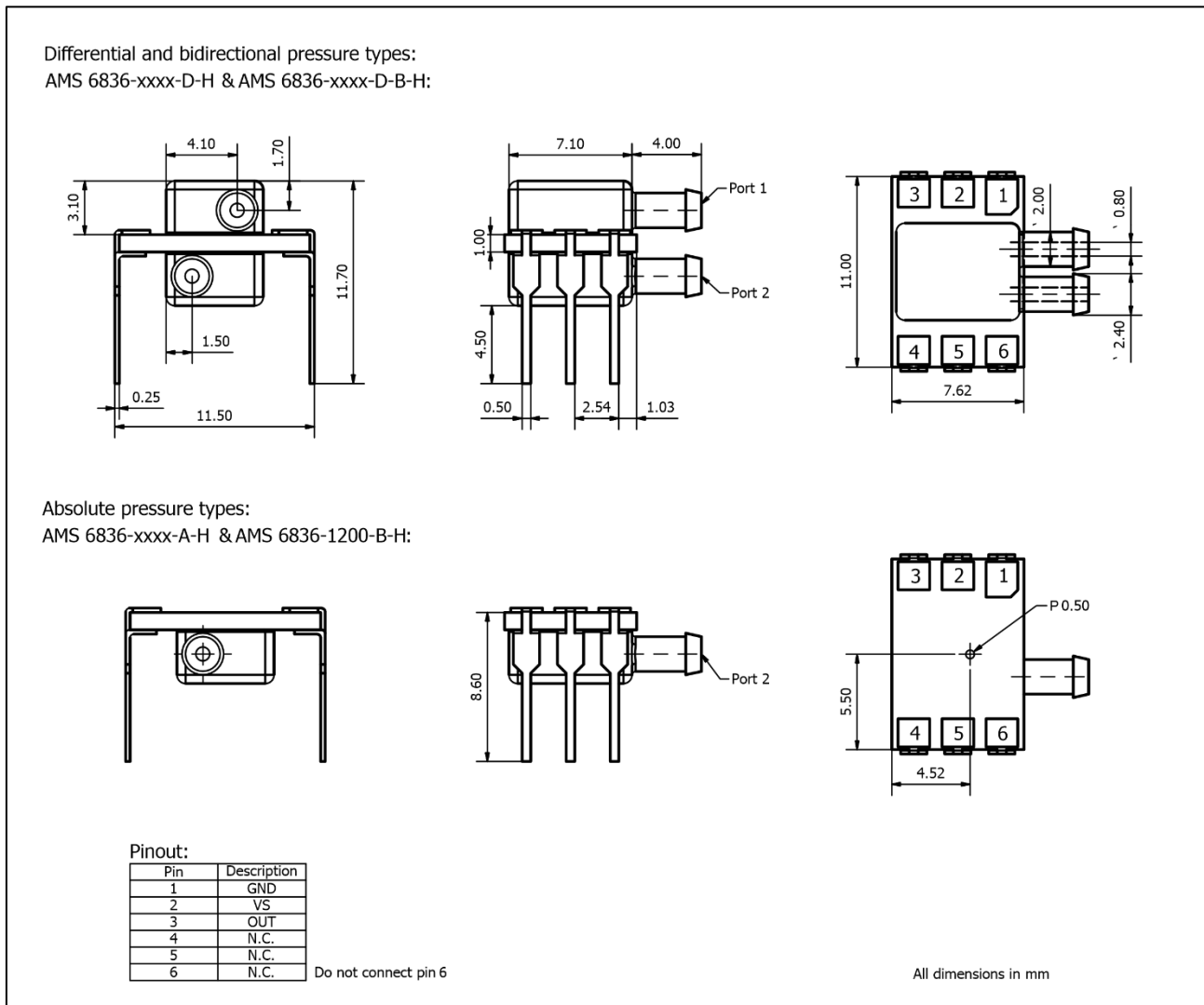
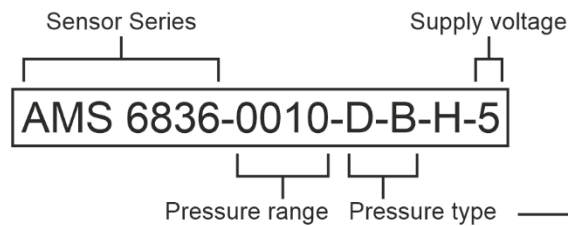


Figure 3: Dimensions and pinout of AMS 6836's standard package

INFORMATION FOR ORDERING

Ordering code:



Pressure range code	mbar	Pa	mmHg	psi	inH ₂ O
0001	1.25	125	0.9376	0.018	0.501
0002	2.5	250	1.8751	0.036	1.003
0005	5	500	3.7503	0.073	2.007
0010	10	1000	7.5006	0.145	4.014
0012	12.5	1250	9.3758	0.181	5.018
0020	20	2000	15.001	0.290	8.029
0035	35	3500	26.252	0.507	14.052
0050	50	5000	37.503	0.725	20.074
0100	100	10 000	75.006	1.450	40.147
0200	200	20 000	150.01	2.901	80.295
0350	350	35 000	262.52	5.076	140.516
0500	500	50 000	375.03	7.252	200.737
1000	1000	100 000	750.06	14.503	401.474
1500	1500	150 000	1125.1	21.756	600.211
2000	2000	200 000	1500.1	29.007	802.948
1200	1200	120 000	900.07	17.405	481.769

Code	Pressure type	Available pressure ranges
D	Differential / relative (gage)	0 ... 2.5 mbar to 0 ... 2 bar
D-B	Bidirectional differential	-1.25 ... +1.25 mbar to -1 ... 1 bar
A	Absolute	0 ... 500 mbar(a) to 0 ... 2 bar(a)
B	Barometric (absolute)	700 ... 1200 mbar(a)

Analog Microelectronics GmbH
An der Fahrt 13
55124 Mainz
Germany

Phone: +49 (0) 6131/91 073-0
Fax: +49 (0) 6131/91 073-30
Internet: www.analog-micro.com
E-Mail: info@analogmicro.de

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