HME Series
Amplified pressure sensors

FEATURES

- 100 mbar to 10 bar, 1 to 150 psi, gage or differential pressure
- Increased media compatibility[1]
- Digital SPI bus output
- Precision ASIC signal conditioning
- Calibrated and temperature compensated[2]
- DIP housings
- RoHS compliant
- Quality Management System according to ISO 13485:2003 and ISO 9001:2008

MEDIA COMPATIBILITY[1,2]

High pressure port: To be used with gases and liquids which are compatible with the wetted materials (high temperature polyamide, ceramic AL_2O_3, epoxy, fluorosilicone, glass, silicon).

Low pressure port: To be used with non-corrosive, non-ionic working fluids such as clean dry air, dry gases and the like.

SPECIFICATIONS

Maximum ratings

Supply voltage V_S

HME...3	2.7 ... 4.2 V_{DC}
HME...5	4.2 ... 5.5 V_{DC}
	max. 6.5 V_{DC}

Output current

Sink	1 mA
Source	1 mA

Environmental

Temperature ranges

Compensated	-20 ... +85 °C
Operating	-20 ... +85 °C
Storage[3]	-40 ... +125 °C

Humidity limits (non-condensing) ...95 %RH[10]

(100 % condensing or direct liquid media on high pressure port[1])

Vibration	max. 10 g, 10...2000 Hz, random (EN 60068-2-64)
Mechanical shock	max. 50 g, 11 ms (EN 60068-2-27)
Lead solder temperature	max. 270 °C (JESD22-B106D)

ELECTRICAL CONNECTION

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PRESSURE SENSOR CHARACTERISTICS

(T_A=25 °C, RH=50 %)

Part no.	Operating pressure	Proof pressure[4]
HMEM100U...	0...100 mbar	2 bar
HMEM100B...	0...±100 mbar	2 bar
HMEM250U...	0...250 mbar	2 bar
HMEM250B...	0...±250 mbar	2 bar
HMEB001U...	0...1 bar	5 bar
HMEB001B...	0...±1 bar	5 bar
HMEB2x5U...	0...2.5 bar	10 bar
HMEB005U...	0...5 bar	14 bar
HMEB010U...	0...10 bar	14 bar
HMEP001U...	0...1 psi	30 psi
HMEP001B...	0...±1 psi	30 psi
HMEP100U...	0...100 psi	200 psi

Other pressure ranges (e.g. 500 mbar, 5 psi, 150 psi) are available on request. Please contact First Sensor.

PERFORMANCE CHARACTERISTICS[2]

(T_A=25 °C, RH=50 %,
for HME...3 devices (V_S=3.0 V_{DC}) digital output signal is non-ratiometric to V_S in the range of V_S=2.7...4.2 V,
for HME...5 devices (V_S=5.0 V_{DC}) digital output signal is non-ratiometric to V_S in the range of V_S=4.2...5.5 V)

Characteristics		Min.	Typ.	Max.	Units
Non-linearity (-20...85 °C)[6]				±0.25	%FSS
Accuracy[7]				±0.25	
Total accuracy (-20...85 °C)[8]				±1.5	
Response delay[9]			0.5		ms
A/D resolution			12		bit
Current consumption	HME...3		4.5		mA
	HME...5		5.3		

All HME...U... (unidirectional devices)

Characteristics	Min.	Typ.	Max.	Units
Zero pressure offset	2595	3000	3405	counts
Full scale span (FSS)[5]		27000		
Full scale output	29595	30000	30405	

All HME...B... (bidirectional devices)

Characteristics		Min.	Typ.	Max.	Units
Zero pressure offset		16095	16500	16905	counts
Full scale span (FSS)[5]			27000		
Output	at max. specified pressure	29595	30000	30405	
	at min. specified pressure	2595	3000	3405	

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SPI - SERIAL PERIPHERAL INTERFACE

Introduction

The HME is capable to generate a digital output signal. The device runs a cyclic program, which will store a corrected sensor value with 12 bit resolution about every 500 µs within the output registers of the internal ASIC. This cyclic program runs independent from the bus communication. In order to use the pressure sensor for digital signal readout, it should be connected to a SPI Master device.

SPI specifies four signals: The clock (CLK) is generated by the master and input to all slaves. MOSI carries data from master to slave. MISO carries data from slave back to master. A slave select line (SS) allows individual selection of a slave device.

SPI Modes

A pair of parameters called clock polarity (CPOL) and clock phase (CPHA) determine the edges of the clock signal on which the data are driven and sampled. Each of the two parameters has two possible states, which allows for four possible combinations, all of which are incompatible with one another.

In general the HME series supports all combinations of clock phase (CPHA) and polarity (CPOL). By default it is programmed to CPHA = 0 and CPOL = 0, which means that data transmission starts with the rising first clock edge (see Fig 1).

Slave select

The falling edge of the SS line indicates the beginning of the transfer. Additionally the SS line must not be negated and reasserted between the three bytes to be transmitted.

Data operation

The MOSI line should always be set to high level. So there is no data transmission from master to slave. Because of internal configuration the slave will answer the first byte with an FFxh. The second and third byte contain the 15 bit pressure information (see Fig. 2).

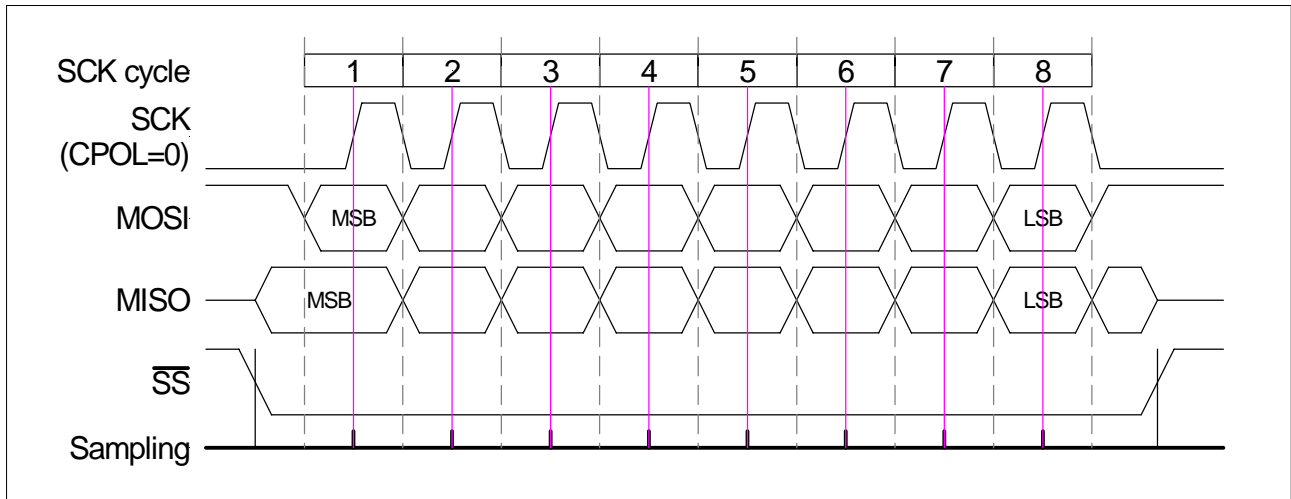**For further information please refer to First Sensor's SPI bus application note**

Fig. 1:   Example of a standard 1 byte SPI data transfer for CPHA=0 and CPOL=0
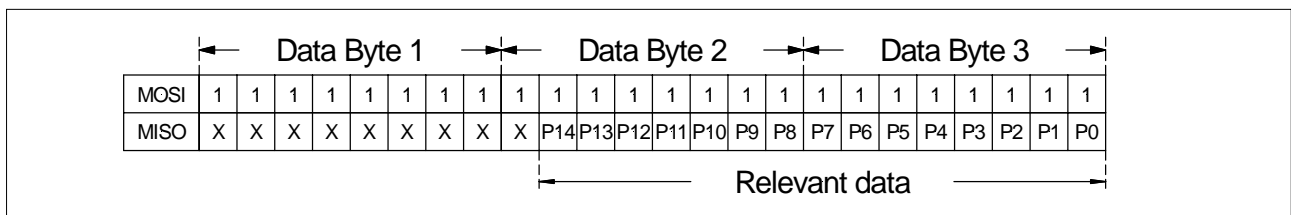
	Data Byte 1								Data Byte 2								Data Byte 3							
MOSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MISO	X	X	X	X	X	X	X	X	X	P14	P13	P12	P11	P10	P9	P8	P7	P6	P5	P4	P3	P2	P1	P0

Relevant data

Fig. 2:   3 byte data stream between HME sensor and master containing the pressure value as a 15 bit information

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SPI - SERIAL PERIPHERAL INTERFACE (cont.)

Interface parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input high level		90		100	
Input low level		0		10	% of Vs
Output low level				10	
Pull-up resistor		1		5	kΩ
Load capacitance @ MISO	C_{MISO}			400	
Input capacitance @ each pin	C_{SPI_IN}			10	pF
Signal clock frequency	f_{SCK}	100*		640	kHz
MISO hold time after SCK sample slope	$t_{SPI\_HD\_MISO}$	200			ns
MOSI setup time before SCK sample slope	$t_{SPI\_SU\_MOSI}$	$2/f_{CLK}$			
/SS setup time before SCK sample slope	$t_{SPI\_SU\_SS}$	10			ns
/SS hold time after SCK sample slope	$t_{SPI\_HD\_SS}$	$1/f_{CLK}$			

* recommended

Note: **First Sensor recommends communication speeds of at least 100 kHz (max. 640 kHz).**
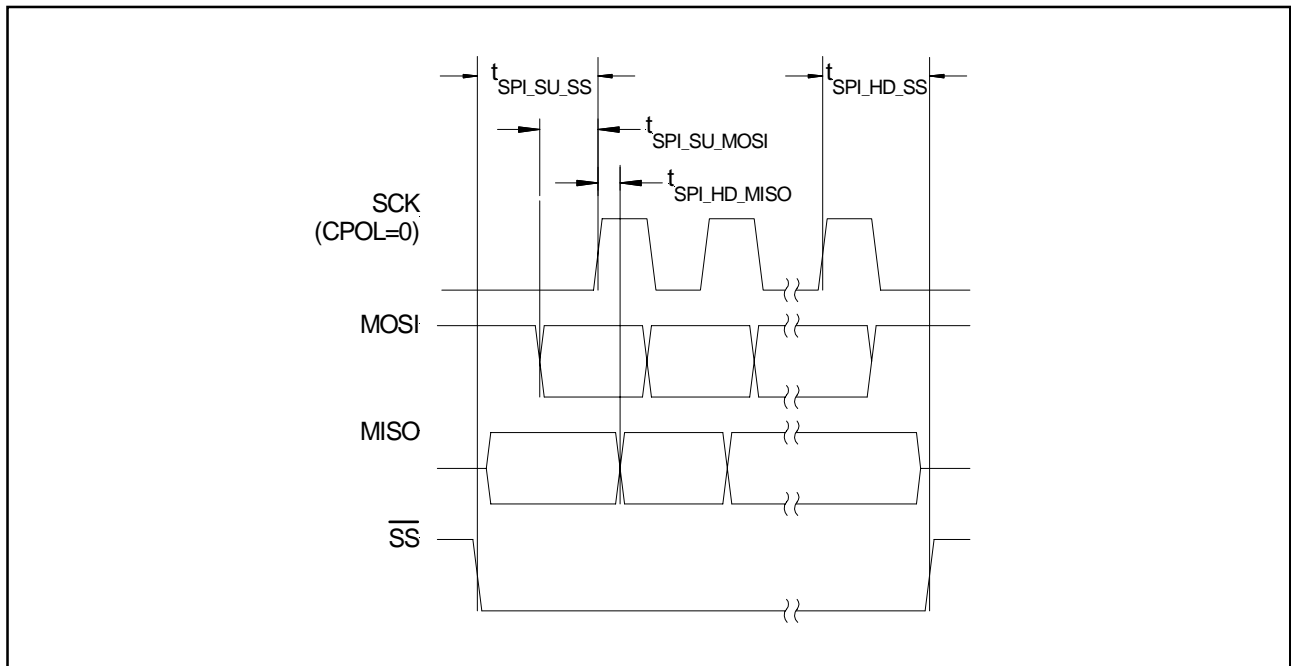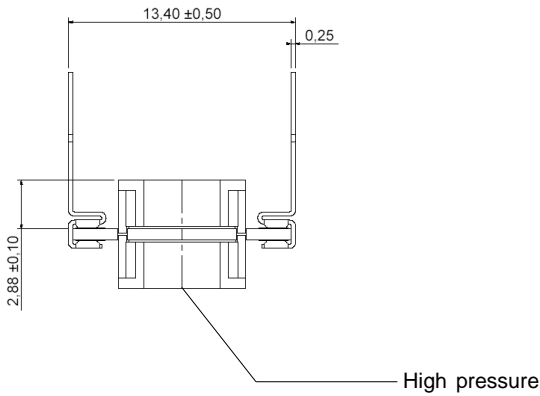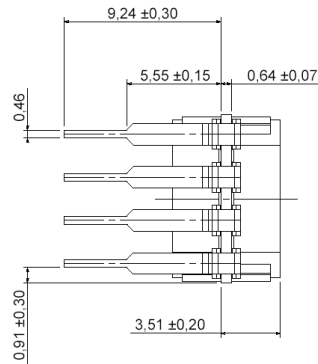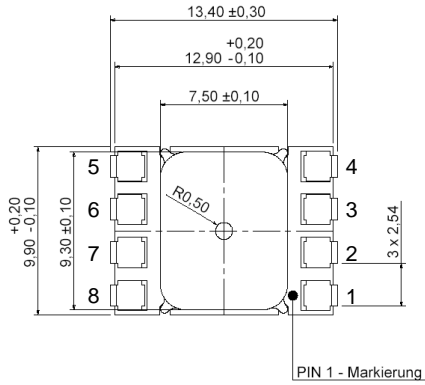**Please contact us for further information.**

Fig. 3:   Timing characteristics

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PHYSICAL DIMENSIONS AND ELECTRICAL CONNECTION

HME...W1... (DIP, axial no ports)

Pin	Connection
1	+Vs
2	GND
3	C
4	MISO
5	CLK
6	SS
7	I / C*
8	MOSI

* Internal connection.
Do not connect for
any reason

first angle projection

dimensions in mm

High pressure

PIN 1 - Markierung

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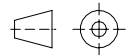
PHYSICAL DIMENSIONS AND ELECTRICAL CONNECTION (cont.)

HME...Z7... (DIP, 1 port axial, barbed)
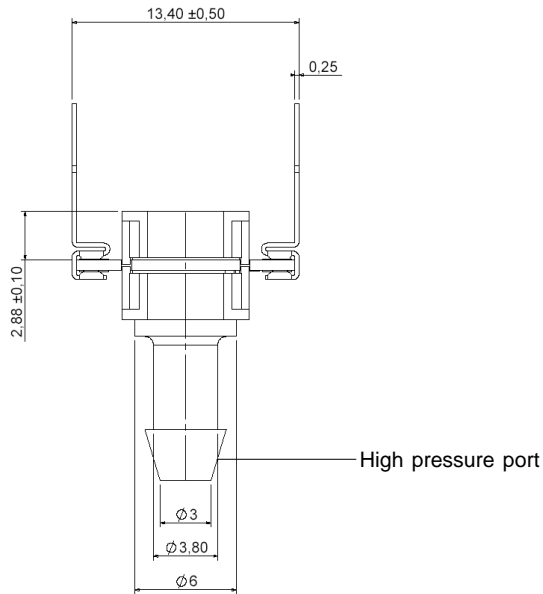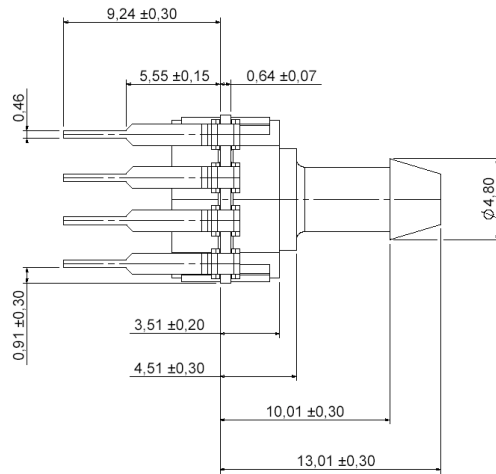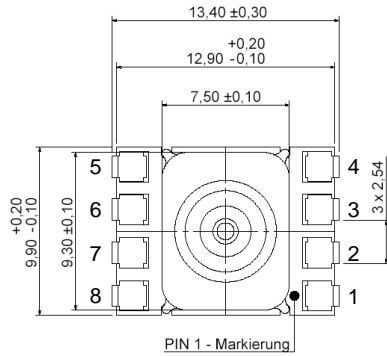
High pressure port

Pin	Connection
1	+Vs
2	GND
3	C
4	MISO
5	CLK
6	SS
7	I / C*
8	MOSI

* Internal connection. Do not connect for any reason
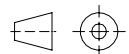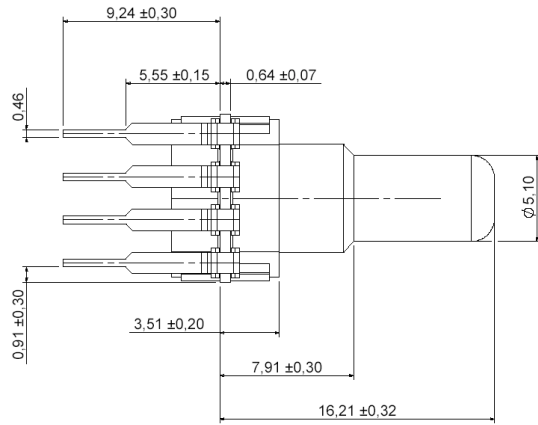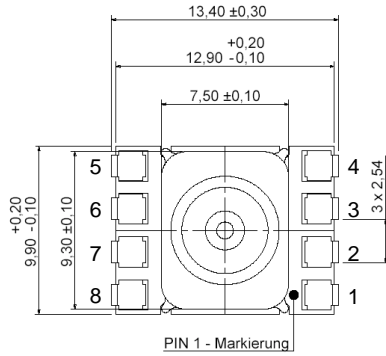
first angle projection

dimensions in mm

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PHYSICAL DIMENSIONS AND ELECTRICAL CONNECTION (cont.)

HME...Z6... (DIP, 1 port axial, straight big)
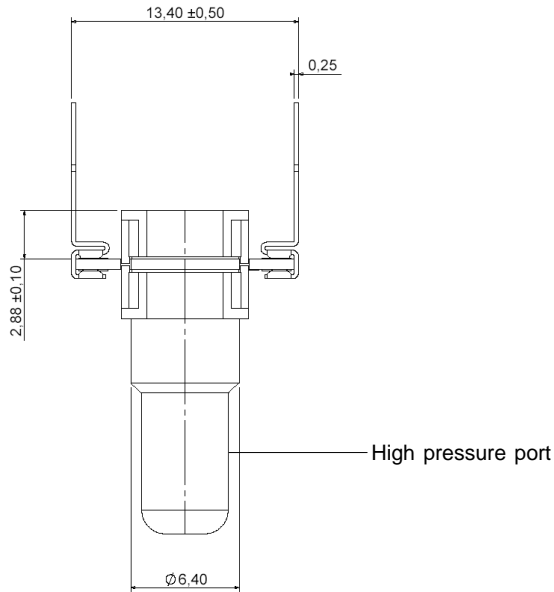
13,40 ±0,30

12,90 +0,20 -0,10

7,50 ±0,10

9,90 +0,20 -0,10

9,30 ±0,10

3 x 2,54

5   4
6   3
7   2
8   1

PIN 1 - Markierung

9,24 ±0,30

5,55 ±0,15   0,64 ±0,07

0,46

Ø 5,10

0,91 ±0,30

3,51 ±0,20

7,91 ±0,30

16,21 ±0,32

13,40 ±0,50

0,25

2,88 ±0,10

High pressure port

Ø 6,40

Pin	Connection
1	+Vs
2	GND
3	C
4	MISO
5	CLK
6	SS
7	I / C*
8	MOSI

* Internal connection.
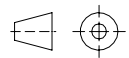Do not connect for
any reason

first angle projection

dimensions in mm

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PHYSICAL DIMENSIONS AND ELECTRICAL CONNECTION (cont.)

HME...Z5... (DIP, 1 port axial, needle big)
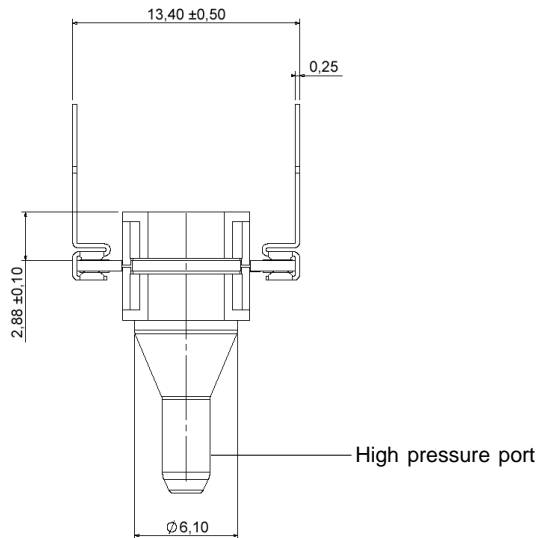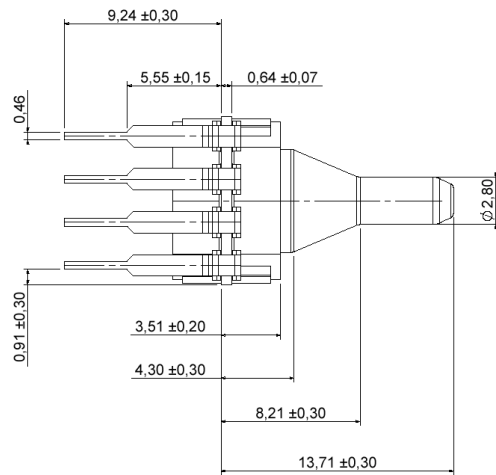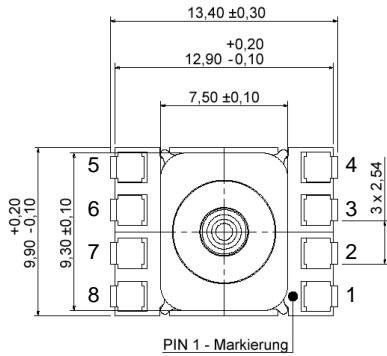
High pressure port

Pin	Connection
1	+Vs
2	GND
3	C
4	MISO
5	CLK
6	SS
7	I / C*
8	MOSI

* Internal connection.
Do not connect for
any reason

dimensions in mm

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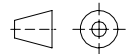
Specification notes:

1. All wetted materials are selected to give a high level of media compatibility. Media compatibility refers to media inside the pressure port and lid. Improved media compatibility on high pressure port (backward side of sensor chip) since media has no contact to electronic components. Nevertheless tests with the media used in the specific application are recommended.
2. Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.
3. Storage temperature of the sensor without package.
4. Proof pressure is the maximum pressure which may be applied without causing durable shifts of the electrical parameters of the sensing element.
5. Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.
6. Non-linearity is the measured deviation based on Best Fit Straight Line (BFSL).
7. Accuracy is the combined error from non-linearity and hysteresis. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure.
8. Total accuracy is the combined error from offset and span calibration, non-linearity, pressure hysteresis, and temperature effects. Calibration errors include the deviation of offset and full scale from nominal values.
9. Max. delay time between pressure change at the pressure die and signal change at the output.
10. Tested 1h, up to 85 °C.

Sensors are electronic components and should be handled only in ESD save environments.

NOMENCLATURE

Options	Series	Pressure range		Calibration		Housing	Porting		Grade		Voltage	
	HME	M100	100 mbar	B	Bidirectional	(W)	DIP, 2 ports axial opposite side	(1)	no port	H	High	(3)	3 V
		M250	250 mbar	U	Unidirectional			7	Barbed			5	5 V
		B001	1 bar			Z	DIP, 1 port axial	(5)	Needle big				
		B2x5	2.5 bar					(6)	Straight big				
		B005	5 bar										
		B010	10 bar										
		P001	1 psi										
		P100	100 psi										

( ) available on request. Please contact First Sensor.

| Example: | HME | M100 | | U | | Z | | 7 | | H | | 5 | |

LABEL INFORMATION

Digit	1	2	3	4		5		6		7		8		9	10	11	12	13	14
		Series		Pressure range		Pressure unit / pressure mode / calibration		Housing		Porting		Grade/ voltage		Production code					
Char	M	E	-	HME 6	1 psi	U	bar, gage/differential, unidirectional	W	DIP, 2 ports axial opposite side	1	no port	-	High, 5 V						
				7	100 mbar					7	Barbed	/	High, 3 V						
				8	250 mbar	B	bar, gage/differential, bidirectional	Z	DIP, 1 port axial	5	Needle big								
				A	1 bar					6	Straight big								
				B	2.5 bar														
				C	5 bar														
				L	100 psi														
				M	10 bar														

LGA InterCert
Certified Quality System
EN ISO 13485:2003+AC:2009
DIN EN ISO 9001:2008

E / 11814 / B

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