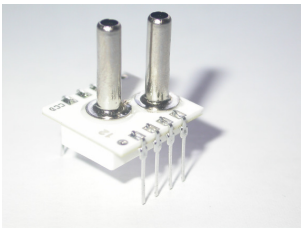
SPECIAL LOW PRESSURE RANGE DIFFERENTIAL SENSOR WITH DIGITAL OUTPUT

This Smartec differential pressure sensor has an amplified analogue output. The sensor is compensated for offset, sensitivity, temperature drift and nonlinearity.
The sensor has a range of 102 mm H_2O FS(=0.15 PSI) and the output is a 1 bit serial signal (12 bit Manchester code). Other pressure ranges on request (0.3 – 100 PSI, differential/single).



Electrical Characteristics

Performance Characteristic at Vcc =5V excitation @ 25 °C.

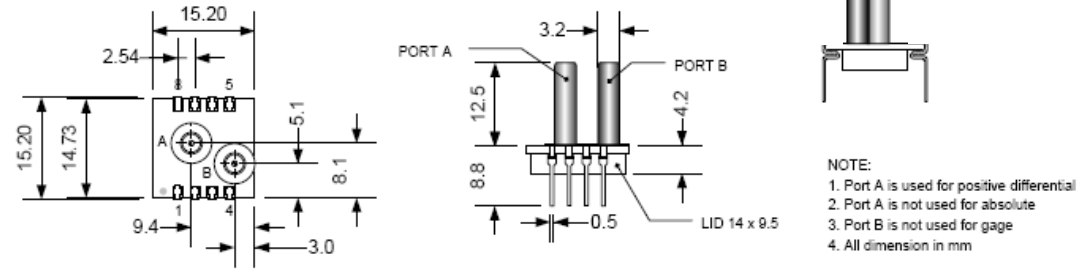
Parameter	Min	Typ	Max	Units.
Supply Voltage [1])	4.75	5.00	5.25	V
Supply Current	-		2.0	mA
Pressure range (fs) [2])	-102	-	102	mm H_2O
Resolution		14		Bit
Zero output		2000		Hex
FS output		0666/3999		Hex
Startup time			2	ms
Update rate		1000		Hz
Response time		25		ms
Accuracy [3])		±4.5		%FS+1LSB
Pressure overload			3x	rating
Temp compensation	0		50	°C
Operating Temp range	-20		80	°C
Storage temperature	-40		125	°C

[1]) It is advised to place a 100nF capacitor between Gnd and Vdd
[2]) 102 mm H_2O = 0.15 PSI = 4 Inch H_2O
[3]) all errors included

Pin	Description
1	N.C.
2	Gnd
3	Out
4	Vdd
5 - 8	N.C.

Wetted materials are: Pyrex glass, RTV, Ceramic, Nickel and Silicon

Dimension



NOTE:
1. Port A is used for positive differential
2. Port A is not used for absolute
3. Port B is not used for gage
4. All dimension in mm

Use of N.C. pins will cause malfunction
Connect between Gnd and Vdd a capacitor of 100 nF

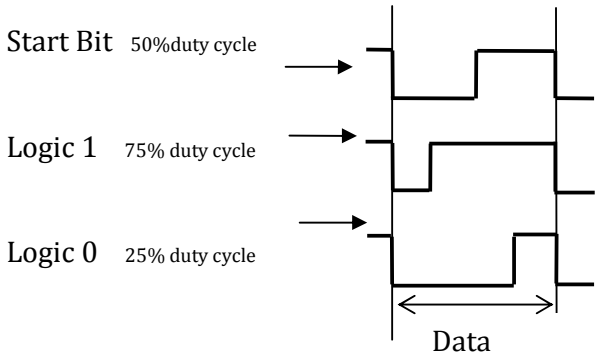
Hardware Communications

In the table below the hardware output specifications are depicted.

Output Parameter	Min	Typ	Max	Unit	Remarks
Rise time			9	µs	
load Capacitance	0	1	15	nF	
Voltage level-low		0	0,2x	Vcc	CMOS driver
Voltage level high	0,8x	1x		Vcc	with respect to Vcc
ESD protection			>4000	V	for all pins

It is advised to apply a 100nF capacitor between Vcc and GND.

The digital interface protocol is based on bit serial manchestercode output. This represents a signal duty cycle of 75% is a logical 1 and a duty cycle of 25% represents a logical 0. Below in little drawing the manchestercode is depicted.



Output format

The output of the sensor is a two byte word. The first byte contains the most significant 6 bits of the 14 bit output word and the second byte represent the least 8 significant bits of the 14 bits output. The first two bits of the first byte are zero. The format of the pressure sensor output is depicted below:

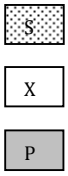
Digital pressure sensor output a two bytes package

S	0	0	13	12	11	10	9	8	P

Data byte –high

S	7	6	5	4	3	2	1	0	P

Data byte –low



Between the two data bytes there is a stop bit (always "1") with the length of half of the data cell (not drawn)

The transmission speed depends on the update rate and ranges up to 8 KHz.

The software has to determine the digital output speed by the "Start Bit". This Start bit is 50% low and 50% high. Based on this in formation the speed of the incoming data can be interpreted. The parity is defined as even meaning in case the number of 1's in the word is even the parity is zero and in case the number is odd the parity bit is 1.

Between the high and lower byte there is a stop bit, level 1, with the length of half the data cell (not drawn in picture).

From 14 bits incoming data to pressure value.

The digital SPD series pressure sensors are calibrated to a straight line transfer function between the incoming pressure and the outgoing digital word. The pressure can easily be calculated from the transfer function. Below is explained how the pressure can be derived from the 14-bits data word.

The pressure is presented as a 14-bits digital word. The digital word is between 0 and 3FFF in Hexadecimal or from 0 to 16383 in decimal. For the ease of calculation we use only the decimal presentation.

In general the upper 10% and the lower 10% of the numeric range of the 14 bits are outside the pressure range.

To make it more clear for the user two examples are given how to calculate the relation between pressure and digital output.

102 mm differential sensor

The relation between the pressure and the output digital word can be calculated as given below:

In case a – 102 to +102 mm sensor the lower end of the scale will be decimal 1638 (= 10% of the full scale of 16383 and the +102 mm value will be 14,745 (= 90% of 16,383)

This means the plus and minus 102 mm range will be transferred to 13,107 decimal values (= 14,745 – 1638). This means each mm pressure will be equal to 13,107/(2x102) = 64.25 dec points.

The transfer function can be determined by the formula below:

SPD102DDhyb

$$\text{Pressure (mm } H_2O) = \frac{\text{Output (dec)} - 1{,}638}{64.25} - 102$$

We always advise to limit the transfer from 10 to 90% of the binary range. This means an over- and under-pressure can be detected.

The same way calculation can be used for the transfer function of differential sensor.

In case another transfer function is needed please contact us.

Order Code:

SPD102DDhyb	102 mm differential pressure sensor with serial digital output. (For other pressure ranges please contact your distributor)