BAROMETER MODULE
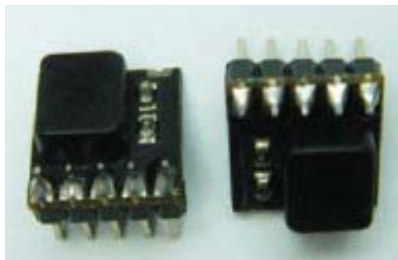
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. Integrated pressure sensor
. Pressure Range 900-1100hpa
. 16 Bit $\Sigma-\Delta$ ADC
. I^2C Serial Interface
. One system clock line (32768Hz)
. Low voltage, low power

Description

The HP01 pressure module includes a piezo-resistive pressure sensor and an ADC interface. It provides 16 bit word data for pressure and temperature related voltage. HP01 is a low power, low voltage device with automatic power down switching. I^2C Serial Interface is used for communications with a microprocessor. Sensor is in DIP packaging.
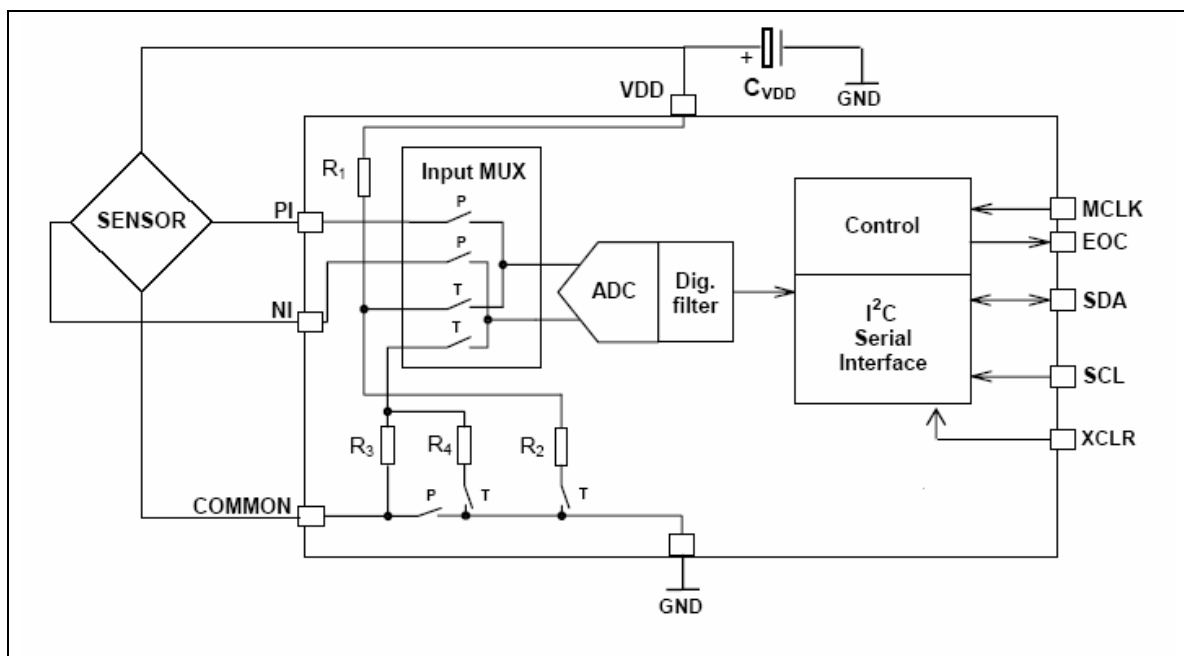
Features

. 15 Bit ENOB ADC resolution
. Supply voltage 2.0v-5.0v
. 0°C to + 50°C operating range

Applications

. Pressure measurement and control systems
. Weather forecast products

Block Diagram

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Pin Name	Pin Number	Type	Function
VSS	1	G	power ground
VDD	2	P	power VCC
MCLK	3	I	master clock(32k) input
XCLR*	4	I	ADC reset input (not available on HP01D)*
SDA	5	I/O	. I²C data input and output
SCL	6	I	I^2C clock input

* XCLR is to reset the AD converter (active low). During the AD conversion phase, XCLR should stay high. After AD conversion end, keep XCLR pin low before another AD conversion starts. For HP01, this pin is not available - pull high internally.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	VDD	-0.3	5.0	V
Over pressure	P		5	Bar(abs)
Storage Temperature	Tstg	-30	90	°C

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	VDD		2.0	3	5.0	V
Supply Current	I	VDD=3V				V
During conversion				500		μA
Stand by				1		μA
Operating Pressure Range	P		900		1100	Hpa (abs)
Operating Temperature Range	T		0	25	50	°C
Conversion Time	T	MCLK=32k			35	ms
Duty Cycle of MCLK			40%	50%	60%	%
Serial Date Rate	SCL				100	KHZ

Pressure and Temperature Output Characteristics

HP01D system is able to reach the following characteristics:

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Resolution			0.1			hpa
Accuracy		900-1100	-8		+10	hpa
Pressure Sensitivity	SNS	900-1100	25	27	30	Cnts/mbar
Maximum Error Over Temperature		0~+55	-5.0		5.0	hpa
Long Term Stability		12 month		1		hpa
VDD Dependency		2.0~5.0	-1.5	0	1.5	hpa
Temperature coefficient of sensitivity	TCS		-0.45	-0.55	-0.6	$\Delta D1/\Delta D2$

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Pressure Measurement

The main function of HP01D system is to convert the uncompensated pressure and temperature signal from a pressure sensor. After the conversion, the following two values can be obtained:

    . measured temperature   "D2"
    . measured pressure   "D1"

As the sensor is strongly temperature dependent, it is necessary to compensate for these effects. Therefore necessary temperature compensation is needed to achieve nominal accuracy.

Pressure and Temperature Compensation Calculation:

The following information is just a guide line for temperature compensate, the end user of this module should not be confined to this method. Many other methods can be deployed to achieve best accuracy.

Step 1: (set relative pressure starting reference point, normally this step be done after power up or reset relative pressure)

    P0=1013.2hp
    D1(P0)=D1
    D2(P0)=D2

Step 2: (normal pressure calculation with first order temperature compensation)

dUT=D2-D2(P0)   ; calculate current temperature difference with reference temperature
dTCS=TCS*dUT   ; calculate compensated pressure offset with temperature coefficients
dUP=D1-dTCS-D1(P0)   ; calculate temperature compensated pressure reading
P2=dUP/SNS   ; calculate pressure difference referred to starting pressure P0
P=P0+P2   ; calculate current relative pressure

Example:

D1(P0)=30000   (obtained after power up reading: D1)
D2(P0)=4100   (obtained after power up reading: D2)
TCS=-0.55   (nominal module value from this data sheet)
SNS=27   (nominal module value from this data sheet)

D1=30036   (current pressure AD reading from module)
D2=4107   (current temperature AD reading from module)

dUT = 4107-4100 = 7
dTCS=-0.55*7=-3.85
dUP=30036+3.85-30000=39
P2=39/27=1.44
P=1013.2+1.44=1014.6

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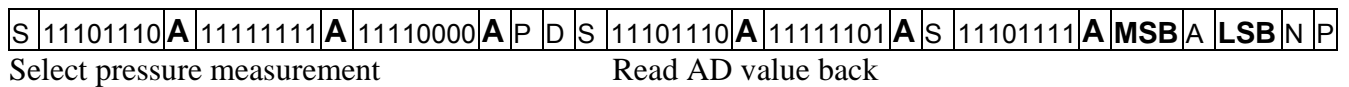2007-7-13   PRELIMINARY   Version: 1.2

Serial Interface

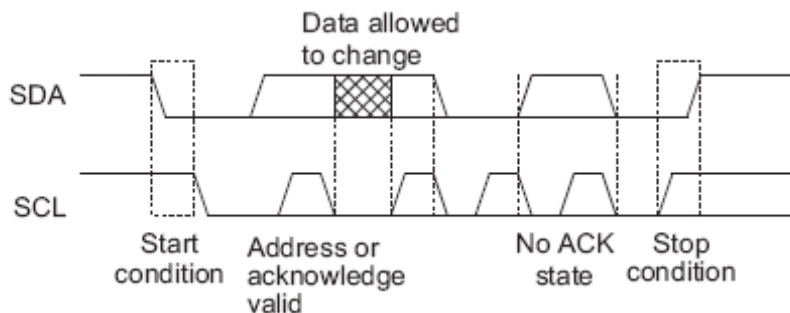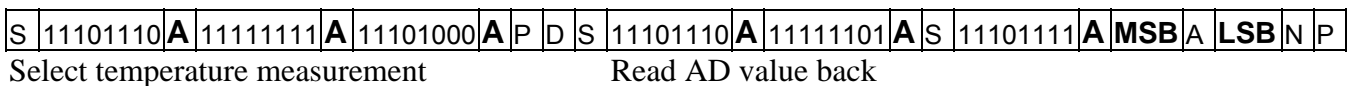The I^{2}C interface is used for reading measurement result from AD conversion:D1 and D2.

Reading Temperature and Pressure value:D1,D2

AD chip I^{2}C address is set to 0xEE (device write address), 0xEF (device read address). In order to get the AD value D1 and D2, you have to follow the following timing sequence:

Pressure Measure:

S	11101110	**A**	11111111	**A**	11110000	**A**	P	D	S	11101110	**A**	11111101	**A**	S	11101111	**A**	**MSB**	A	**LSB**	N	P

Select pressure measurement   Read AD value back

Temperature Measure:

S	11101110	**A**	11111111	**A**	11101000	**A**	P	D	S	11101110	**A**	11111101	**A**	S	11101111	**A**	**MSB**	A	**LSB**	N	P

Select temperature measurement   Read AD value back

S: I^{2}C bus START (refer to AT24C02 EEPROM start command)
P: I^{2}C bus STOP (refer to AT24C02 EEPROM stop command)
A (bold): I^{2}C bus acknowledge by slave (SDA pull low: slave send out bit 0)
A: I^{2}C bus acknowledge by master (SDA pull low: master send out bit 0)
N: I^{2}C bus no acknowledge from master (SDA keep high: master send out bit 1 instead)
D : delay for 38ms or above
MSB: conversion result (MSB bit clocked out first)
LSB: conversion result (MSB bit clocked out first).

Remark:

Before start an AD conversion cycle, remember to set XCLR pin high so that the system is no longer in the reset state (not valid for HP01D).

All data read from the module is in hex format.

After first power on, the first read data should be disregarded, and only the second value be used. This can assure that unstable reading after power on reset can be filtered out.

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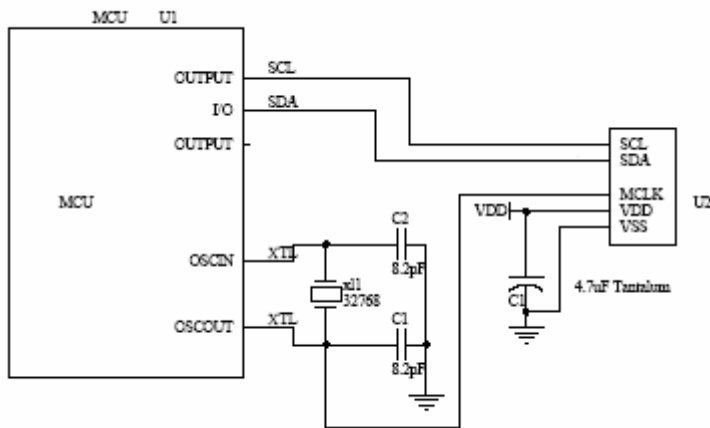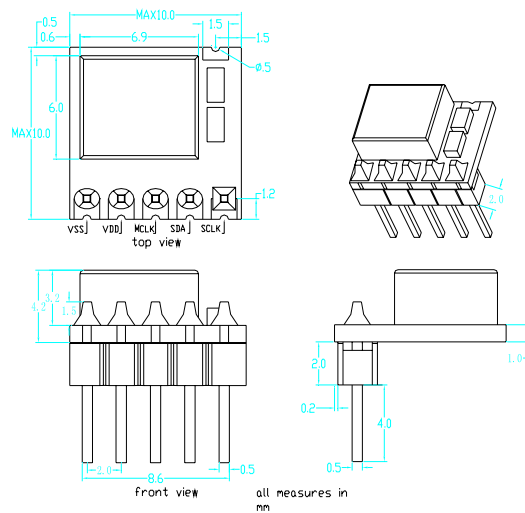2007-7-13   PRELIMINARY   Version: 1.2

Like any other semiconductor device, the sensor is sensitive to light. During the application of this sensor, please keep the sensor in dark place to achieve best accuracy.

Since the module is not calibrated for sensitivity and temperature, thus only relative pressure can be calculated. If you need higher accuracy with temperature, please refer to our HP02 or HP03 series pressure module accordingly.

Typical Application Circuit Diagram:

HP01D Mechanical Dimension

Important Notices

Never unplug the module when power is on.

Do not use this product as safety or emergency stop device or in any application where failure of this product could lead in personal injury. Failure to comply with these instructions could result with death or serious injury.

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