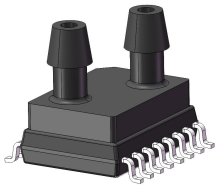
XGZP6891D PRESSURE SENSOR

FEATURES

- Wide Ranges: -100kPa···-0.5 ~ 0 ~ 0.5···100kPa(show in Pressure Range Example)
- Optional 2.5V ~ 5.5V Power Supply
- Differential Pressure(Positive&Vacuum) Type
- For Dry Non-corrosive Gas or Air
- Calibrated Digital Signal(I2C Interface)(Refer to XGZP6891A for Analog signal)
- Temp. Compensated: 0℃ ~ +60℃(32℉ ~ +140℉)
- Current Consumption: 5uA(single measurement)
- Standby Current: <100nA (25°C)



APPLICATIONS

- Medical&Healthy: e.g. ventilators, CPAP, NPWT, DVT, blood analysis, blood pressure monitoring, drug dosing, hospital beds, oxygen concentrators, patient monitoring, sleep apnea equipment, urine analyzers and wound therapy, breast pumps, massage device etc.
- Consumer&Household: e.g. Robot, UAV, wearable device, coffee makers, washing machines, vacuum cleaners, hand dryers, air pump, air beds etc.
- Industrial&Automation: e.g. HVAC, flow and liquid level measurement, process control and monitoring, life sciences, pressure switch and meter, IoT and automotive application etc.

INTRODUCTION

XGZP6891D is a prefect silicon pressure sensor offering a ratiometric digital data(I2C interface) for reading differential pressure over the specified full scale pressure span.

The XGZP6891D incorporates a silicon piezoresistive pressure sensor chip and an interior signal-conditional Application Specific Integrated Circuit(ASIC) in a SOIC-16 package with two air vents, which can be mounted directly on a standard PCB.

The XGZP6891D is fully calibrated and temperature compensated for specified span, so XGZP6891D pressure sensor satisfy the perfect accuracry, which is designed for a wide range of application in medical care&health, home appliances, consumer electronic, industry, automotive, IoT and other pneumatic devices etc by utilizing a microcontroller or microprocessor with D/A inputs.

XGZP6891D pressure sensor is for high volume application at an affordable cost and perfect performance. Customized calibration parameter (e.g.pressure range etc.) are available. If measured media is rather than the dry gas or air, e.g.moist media, contact CFSensor for solution.

PERFORMANCE PARAMETER

Unless otherwise specified, measurements were taken with a a temperature of 25±1℃ and humidity of 50%RH.

Item	Data	Unit	Remark
Available Pressure Range[1]	-10···-0.5 ~ 0 ~ 0.5···10	kPa	Customization acceptable
Power Supply[2]	2.5~5.5	Vdc	
Max. Excitation Current	3	mA	
ADC Resolution[3]	24	Bit	
SDA/SCL pull up resistor	4.7	Kohm	
ESD HBM	4000	V	
Total Accuracy[4]	±2.5	%Span	Customization acceptable
Long Term Stability[5]	±1	%Span	
Over Pressure[6]	20	KPa	Base on P1 > P2
Burst Pressure[7]	60	KPa	
Max. Pressure on P2 Port	250	kPa	
Compensation Temp.[8]	0 ~ 60/32 ~ 140	℃/℉	Customization acceptable
Operating Temp.[9]	-20 ~ 100/-4 ~ 212	℃/℉	
Storage Temp.	-30 ~ 125/-22 ~ 257	℃/℉	
Response Time[10]	2.5	mS	

1 Pressure Range(Operating pressure): The available pressure range including various span, not a specific pressure range.

2 Power supply: The default test voltage value: 3.3V, available working power supply voltage range:2.5 ~ 5.5V.

3 ADC Resolution: The ADC resolution is defined as the smallest incremental voltage that can be recognized and thus causes a change in the digital output.

4 Total Accuracy: The max. deviation in output from ideal transfer function at any pressure or temperature over the specified ranges, units are in percent of full scale span (%FSS), which mainly consists of: Offset and Span Shift;Linearity(Non-linearity); Repeatability; Pressure Hsteresis ; TcOffset and TcSpan.

4.1. The accuracy in table is the typical output accuracy. The accuracy is not identical accroding to different specified pressure range. Contact factory for more information or for higher accuracy requirement(e.g ±1%Span) if need.

4.2 Non-linearity(Linearity): the deviation of measured output from "Best Straight Line" through three points (Offset pressure, FS pressure and ½ FS pressure)at constant temperature.

4.3 Repeatability: the deviation of measured output when the same pressure is applied continuously, with pressure approaching from the same direction within the specified operating pressure range,under the same operating conditions.

4.4 Pressure Hysteresis: the deviation of measured output at any pressure within the specified range, when this pressure is applied continuously, with pressure approaching from opposite directions within the specified operating pressure range, under the same operating conditions.

4.5 TcOffset (TCO:Temp. Coefficient of Offset): the deviation of measured output with minimum rated pressure applied, over the temperature range of 0° to 60°C, relative to 25°C.

4.6 TcSpan (TCS:Temp. Coefficient of Span): the deviation of measured output over the temperature range of 0° to 60°C, relative to 25°C.

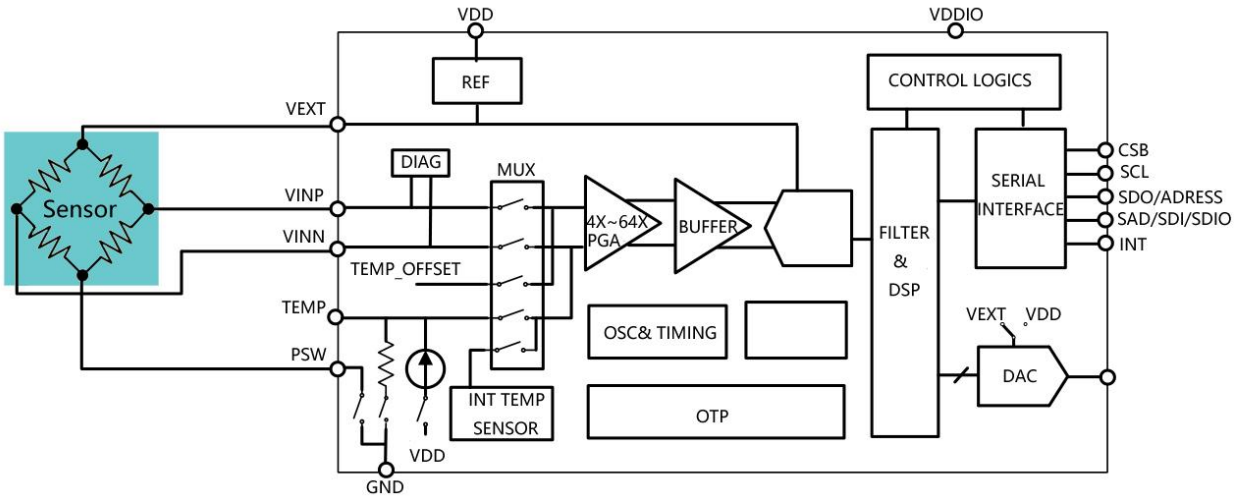
5. Long Term Stability: the sensor's output deviation when subjected to 1000 hours pressure test.

6. Over Pressure (Proof pressure): the maximum pressure which may be applied without causing durable shifts of the electrical parameters of the sensing element and remain the specification once pressure is returned to the operating pressure range.
7. Burst Pressure: the maximum pressure which may be applied without causing damage to the sensing die or leaks; The sensor should not be expected to recover function after exposure to any pressure beyond the burst pressure.
8. Compensated Temperature: the temperature range over which the sensor have an output proportional to pressure within the specified performance limits.
9. Operating Temperature (or Ambient Temperature): the temperature range over which the sensor have an output proportional to pressure but may not remain within the specified performance limits.
10. Response Time: it is defined as the time for the incremental change in the output from 10% to 90% of of its final value when subjected to a specified step change in pressure.

ELECTRICAL CHARACTERISTICS(Interior ASIC)

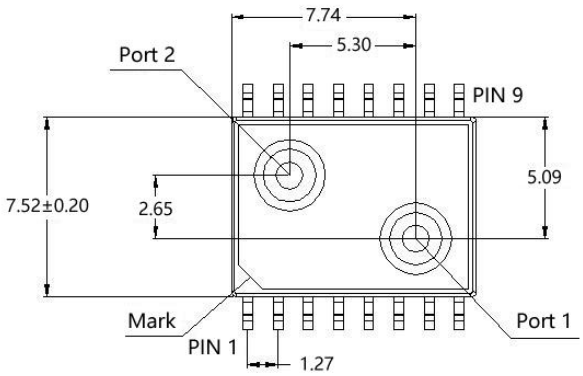
Parameter	Min.	Typ.	Max.	Unit	Notes
Power Supply			5.5	V	
Working Current		100		nA	
Filter Capacitor		100		nF	
PSRR		60		dB	
Output Current Load			5	mA	
Input Common Mode Rejection Ratio	80	110		dB	
Short-circuit Current Limit	15	20	25	mA	
Upper limit Clamping Voltage	3/4		1	VDD	
Lower limit Clamping Voltage	0		1/4	VDD	

BLOCK DIAGRAM

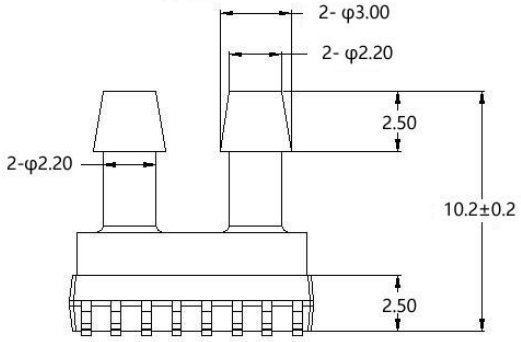


DIMENSION (Unit:mm)

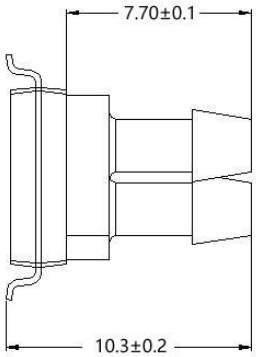
TOP VIEW



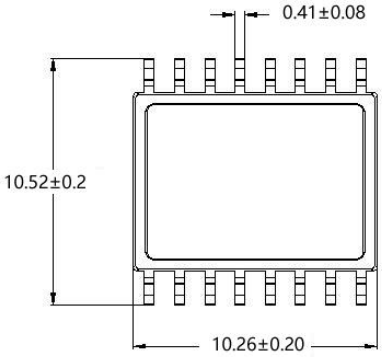
FRONT VIEW



SIDE VIEW



BOTTOM VIEW

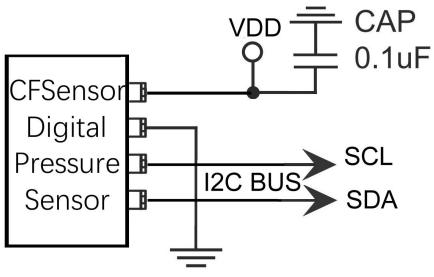


ELECTRIC CONNECTION

6	7	10	11	Other PINs
GND	VDD	SDA	SCL	N/C

NAME	FUNCTION
N/C	Do not connect to external circuitry or ground
VDD	Voltage supply
GND	Ground
SCL	The clock signal
SDA	Data signal(Send& Receive)

CIRCUIT DIAGRAM



Note: Diagram state schematic connection only;
Check Pin allocation in Dimension drawing.

Notes:

1.,Port 1 as High pressure cavity, and Port 2 as Low pressure cavitys.

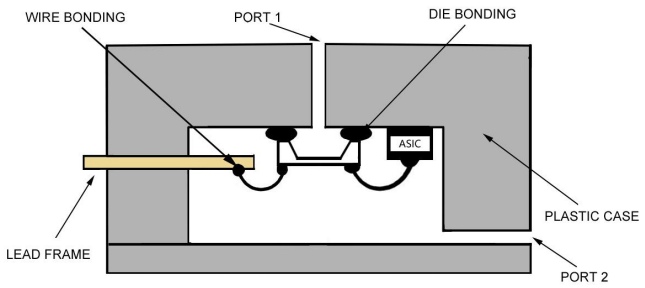
2. Implement ESD protection during overall soldering and assembly process.

3. Overload voltage(max.6.5Vdc) or current(max.5mA) may burn the ASIC and cause the sensor fail throughly.

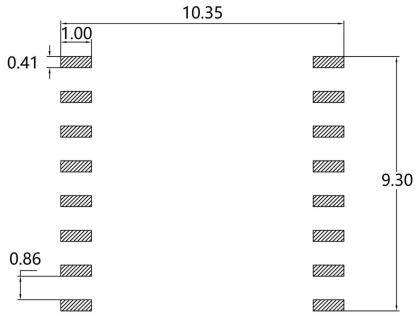
4. Donot make N/C PIN to any elctrical connenction, or may leads to function failure

5.More detalis about soldering and storage etc., refer to Overall notes.

CROSS SECTION



FOOTPRINT(REFERENCE)



ORDER GUIDE (100kPa=0.1MPa=1bar≈14.5PSI)

XGZP6891 D 001 KP DPN

- DPN — Pressure Type(DG:Positive; DN: Negative; DPN:Positive+Negative)
- KP — Pressure Unit(KP: kPa HP:hPa CM: cmH2O)
- 001 — Pressure Range(000-999)
- D — Output Signal(A: Analog D:I2C)
- XGZP6891 — Series

PRESSURE RANGE EXAMPLE

Notes: 1. Unit conversion: 1000hPa=1000mbar≈750mmHg≈100kPa≈14.5PSI≈10mH_2O≈1bar=0.1MPa;

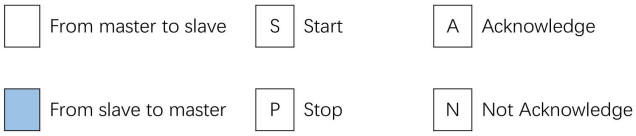
2. Available for more custom pressure range e.g. -5 ~ 100cm H2O; -20 ~ 140cmm H2O etc,.

Pressure Range	Pressure Range (Available units)	Part Number
-500 ~ 500Pa	-500 ~ 500Pa/-5mbar ~ 5mbar	XGZP6891D-005HPDPN
-1000 ~ 1000Pa	-1 ~ 1KPa/-10mbar ~ 10mbar	XGZP6891D-001KPDPN
-2500 ~ 2500Pa	-2.5 ~ 2.5KPa/-25mbar ~ 25mbar	XGZP6891D-025HPDPN
-5000 ~ 5000Pa	-5 ~ 5KPa/-50mbar ~ 50mbar	XGZP6891D-005KPDPN
-0.5 ~ 10cmH2O	-50 ~ 1000Pa/-0.5mbar ~ 10mbar	XGZP6891D-010CMDG
-10 ~ 10cmH2O	-1 ~ 1KPa/-10mbar ~ 10mbar	XGZP6891D-010CMDPN
-1 ~ 20cmH2O	-0.1 ~ 2KPa/-1mbar ~ 20mbar	XGZP6891D-020CMDG
-20 ~ 20cmH2O	-2 ~ 2KPa/-20mbar ~ 20mbar	XGZP6891D-020CMDPN
-5 ~ 40cmH2O	-0.5 ~ 4KPa/-5mbar ~ 40mbar	XGZP6891D-040CMDG
-40 ~ 40cmH2O	-4 ~ 4KPa/-40mbar ~ 40mbar	XGZP6891D-040CMDPN
◆ Please consult CFSensor whether required pressure range is under normal production before place order.		

I2C INTERFACE

I2C bus uses SCL and SDA as signal lines. Both lines are connected to VDD externally via pull-up resistors(Typ value:**4.7kΩ**) so that they are pulled high when the bus is free. I2C device factory setting slave address: **0x7F.**

The master device can communicate with the product using commands in the following format:



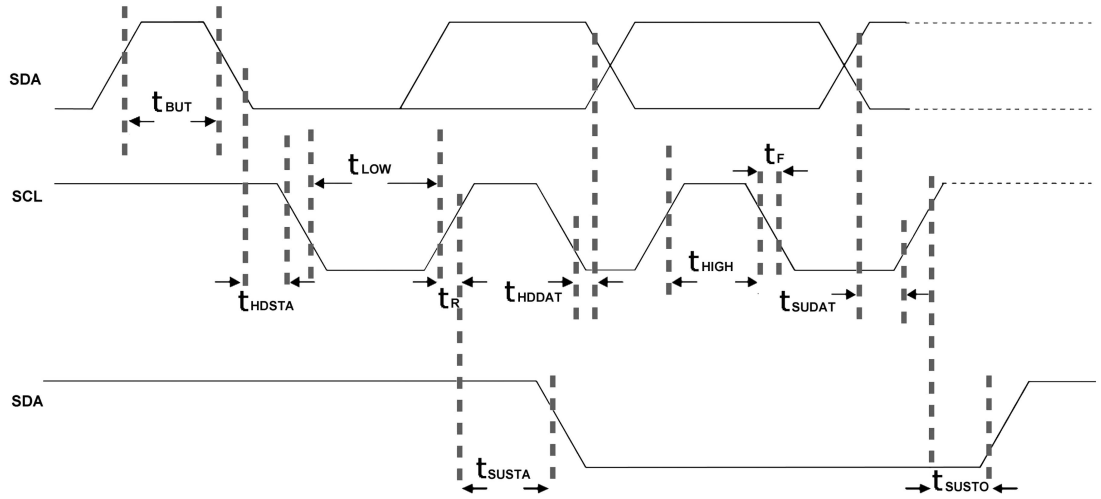
Write One Byte To One Register

Read One Byte From One Register

ELECTRICAL SPEC. OF I2C INTERFACE PIN

Symbol	Parameter	Condition	Min	Max	Unit
f_{scl}	Clock frequency			400	KHz
t_{LOW}	SCL low pulse		1.3		us
t_{HIGH}	SCL high pulse		0.6		us
t_{SUDAT}	SDA setup time		0.1		us
t_{HDDAT}	SDA hold time		0.0		us
t_{SUSTA}	Setup Time for a repeated start		0.6		us
t_{HDSTA}	Hold time for a start condition		0.6		us
t_{SUSTO}	Setup Time for a stop condition		0.6		us
t_{BUF}	Time before a new transmission		1.3		us

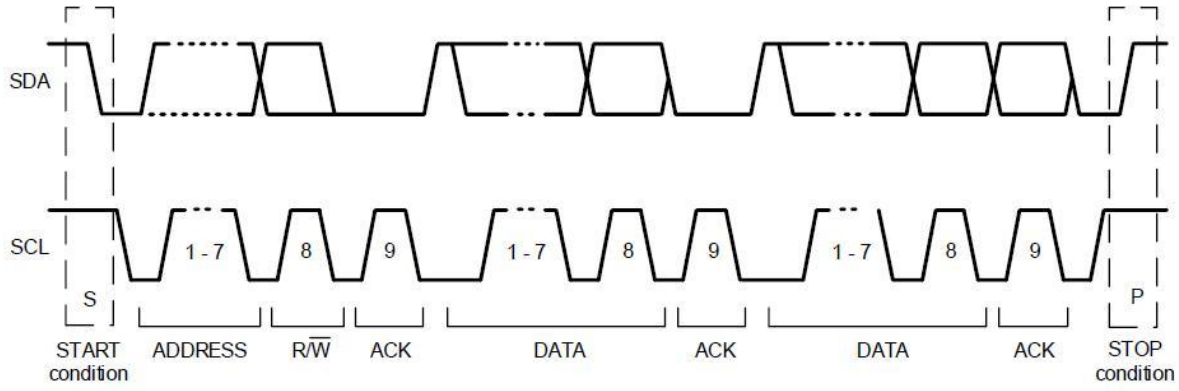
I2C TIME DIAGRAM



The I2C interface protocol has special bus signal conditions. Start (S), stop (P) and binary data conditions are shown below. At start condition, SCL is high and SDA has a falling edge. Then the slave address is sent. After the 7 address bits, the direction control bit R/W selects the read or write operation. When a slave device recognizes that it is being addressed, it should acknowledge by pulling SDA low in the ninth SCL (ACK) cycle.

At stop condition, SCL is also high, but SDA has a rising edge. Data must be held stable at SDA when SCL is high. Data can change value at SDA only when SCL is low.

I2C PROTOCAL



REGISTER DESC.

Add.	Desc.	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x06	DATA_MSB	R	Pressure Data out<23:16>								0x00
0x07	DATA_CSB	R	Pressure Data out<15:8>								0x00
0x08	DATA_LSB	R	Pressure Data out<7:0>								0x00
0x09	TEMP_MSB	R	Temp Data out<15:8>								0x00
0x0A	TEMP_LSB	R	Temp Data out<7:0>								0x00
0x30	CMD	RW	Sleep_time<7:4>				Sco	Measurement_ctrl<2:0>			0x00
0xA5	Sys_config	RW	Aout_config<7:4>				LDO_config	Unipolar	Data_out_control	Diag_on	OTP
0xA6	P_config	RW		Input Swap	Gain_P<5:3>			OSR_P<2:0>			OTP

Reg0x06-Reg0x0A :

Pressure ADC data Register(Reg0x06-Reg0x08); Temperature ADC data Register(Reg0x09-Reg0x0A)

Reg0x30 :

Measurement Command Register

Sleep_time<7:4>: 0000:0ms; 0001:62.5ms; 0010:125ms ;... 1111: 1s, only active during sleep mode conversion.

Sco: 1, Start of conversion, automatically come back to 0 after conversion ends (except sleep mode conversion).

Measurement_control<2:0>:

010: indicate the combined conversion (namely a temperature conversion followed by a pressure-signal conversion).

011: indicate a sleep mode conversion (periodically perform a combined conversion with an interval time of 'sleep_time'),

Reg0xA5(configured at factory)

Aout_config<7:4>: Analog output setting(recommending reserve default value)

LDO_config: 0: set with 1.8V; 1: setwith 3.6V.

Unipolar: 0: ADC output in bipolar format(signed binary), 1: ADC output in unipolar format. (Unsigned binary, Only take effect when 'raw_data_on' = 1)

Raw_data_on: 0: output calibrated data(as default value), 1: output ADC raw data.

Diag_on: 1, Enable diagnosis function(default).

Reg0xA6(configured at factory)

Input Swap: Swap VINP and VINN inside the ASIC

Gain_<5:3>: set the gain of the sensor signal conversion channel. 000: gain=1, 001: gain=2, 010: gain=4, 011: gain=8, 100: gain=16, 101: gain=32, 110: gain=64, 111: gain=128.

OSR_P<2:0>: set the over sampling ratio of the sensor signal conversion channel. 000:1024X, 001:2048X, 010:4096X, 011:8192X, 100:256X, 101:512X, 110:16384X, 111:32768X.

READ OPERATION

As the following instruction sequences for reading data:

(Only for combined conversion (namely a temperature conversion immediately followed by a pressure-signal conversion))

1. Send instructions 0x0A to 0x30 register for one temperature acquisition, one pressure data acquisition.
2. Read the 0x30 register address. If Sco bit is 0, signify the acquisition end, the data can be read.
   (Or, Hold 20mS and then skip this step to read data directly)
3. Read 0x06, 0x07, 0x08 register address data to form a 24-bit AD value (pressure data AD value); Read 0x09, 0x0A register address data to form a 16-bit AD value (temperature data AD value)

Read Pressure

The total pressure output value which include 0x06, 0x07 and 0x08 registers are 24 bits. The highest position is the symbol bit, and the value is "1", it represents "negative pressure"; The symbol digit value is "0", it represents "positive pressure".

Pressure_ADC value: = (Pressure 3rd Byte [23:16] x 65536+Pressure 2nd Byte [15:8] x 256 + Pressure1st Byte [7:0])

Note: 1 Pressure 3rd Byte [23:16] is the hexadecimal value read out by REG0x06 and need converte into decimal value;
2 Pressure 2nd Byte [15:8] is the hexadecimal value read out by REG0x07 and need converte into decimal value;
3 Pressure 1st Byte [7:0] is the hexadecimal value read out by REG0x08 and need converte into decimal value.

For Pressure conversion formula: Pressure=A*Pressure_ADC value+B:

(A and B is factor as below)

Pressure Range (Pa)		Output AD Span		Transfer-function Coefficient	
PL	PH	OL	OH	A	B
-500	500	838861	7549746	0.000149012	-625.0000559
-1000	1000	838861	7549746	0.000298023	-1250.000112
-2500	2500	838861	7549746	0.000745058	-3125.000279
-5000	5000	838861	7549746	0.001490116	-6250.000559
Pressure Range(CMH_2O)		Output AD Span		Transfer-function Coefficient	
PL	PH	OL	OH	A	B
-0.5	10	838861	7549746	0.000001565	-1.812500587
-10	10	838861	7549746	0.000002980	-12.50000112
-1	20	838861	7549746	0.000003129	-3.625001173
-20	20	838861	7549746	0.000005960	-25.00000224
-5	40	838861	7549746	0.000006706	-10.62500251
-40	40	838861	7549746	0.000011921	-50.00000447

Note: the A and B factor is selected according to the required pressure range and the pressure unit

Read Temperature

The bits of temperature output values in the 0x09 and 0x0A registers are 16 bits, the highest is the symbol bit.

The symbol digit value is "1" when it represents "negative", and the symbol digit value is "0" when it represents "positive".

Supposing if the decimal values of REG0x09 and REG0x0A readout are X, Y,

For Temperature ADC value and conversion formula are as:

Temperature AD value: N=X*256+Y

If n<2^15, Temperature is positive value, actual temperature T =N/256; (℃).

If n>2^15, Temperature is negative value, actual temperature value = (N-2^16) /256; (℃)

OVERALL NOTES

Unless otherwise specified, following notes are general attention or presentation for all products from CFSensor.

Mounting

The following steps is for transmitting the air pressure to sensor after sensor soldering on PCB.

▼ For some sensors that come with inlet tube, select the flexiable pipe to suit the pressure inlet that is firm enough to prevent the pressure leaks.

▼ Atmosphere hole (for Gauge type sensors) and Inlet pipe/hole can't be blocked with gel or glue etc,..

▼ Avoiding excessive external force operation

Soldering

Due to its small size, the thermal capacity of the pressure sensor is low. Therefore, take steps to minimize the effects of external heat. Damage and changes to characteristics may occur due to heat deformation. Use a non-corrosive resin type of flux. Since the pressure sensor is exposed to the atmosphere, do not allow flux to enter inside.

▼ Manual soldering

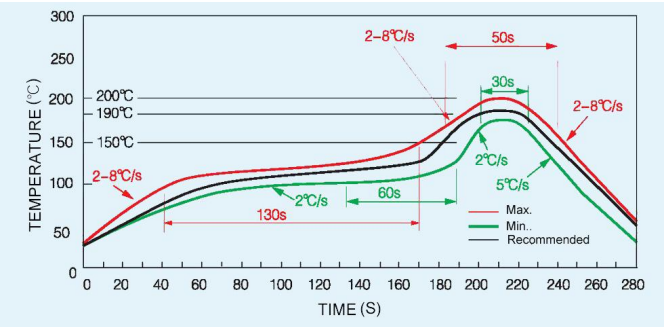
⊙Raise the temperature of the soldering tip to 190°C max. and solder within 5 seconds.

⊙The sensor output may vary if the load is applied on the terminal during soldering.

⊙Keep the soldering tip clean.

▼Reflow soldering (SMD Terminal)

⊙The recommended reflow temperature profile conditions are given below.



⊙Self alignment may not always work as expected, therefore, please carefully the position of the terminals and pattern.

⊙ The temperature of the profile is assumed to be a value measured with the printed wiring board of the terminal neighborhood.

⊙Please evaluate solderbility under the actual mounting conditions since welding and deformation of the pressure inlet port may occur due to heat stress depending on equipments or conditions.

▼ Rework soldering

⊙Complete rework at a time.

⊙Use a flattened soldering tip when performing rework on the solder bridge. Do not add the flux.

⊙Keep the soldering tip below the temperature described in the specifications.

▼ Avoid drop and rough handling as excessive force may deform the terminal and damage soldering characteristics.

▼ Keep the circuit board warpage within 0.05 mm of the full width of the sensor.

▼ After soldering, do not apply stress on the soldered part when cutting or bending the circuit board.

▼ Prevent human hands or metal pieces from contacting with the sensor terminal. Such contact may cause anomalous outlets as the terminal is exposed to the atmosphere.

▼ After soldering, prevent chemical agents from adhering to the sensor when applying coating to avoid insulation deterioration of the circuit board.

Connecting

▼ Correctly wire as in the connection diagram. Reverse connection may damage the product and degrade the performance.

▼ Do not use idle terminals(N/C) to prevent damages to the sensor.

Cleaning

▼ Since the pressure sensor is exposed to the atmosphere, do not allow cleaning fluid to enter inside from atmosphere hole (for Gauge type sensors) and inlet pipe.

▼ Avoid ultrasonic cleaning since this may cause breaks or disconnections in the wiring.

Environment

▼Please avoid using or storing the pressure sensor in a place exposed to corrosive gases (such as the gases given off by organic solvents, sulfurous acid gas, hydrogen sulfides, etc.) which will adversely affect the performance of the pressure sensor chip.

▼Since this pressure sensor itself does not have a water-proof construction(even available media can be liquid), please do not use the sensor in a location where it may be sprayed with water, etc.

▼Avoid using the pressure sensors in an environment where condensation may form. Furthermore, its output may fluctuate if any moisture adhering to it freezes.

▼The pressure sensor is constructed in such a way that its output will fluctuate when it is exposed to light. Especially when pressure is to be applied by means of a transparent tube, take steps to prevent the pressure sensor chip from being exposed