XGZP6897D Pressure Sensor Module

Features

- Ranges: -100kPa～-0.5～0…0.5～200kPa
- Power Supply:2.5V～5.5V
- Differential Type or Gauge Type
- For Non-corrosive gas or air
- Calibrated, I2C Signal output or Analog signal
- Temp. Compensated:0℃～+60℃(32℉～+140℉)
- Low Cost for high volume application

Applications

■ For Medical and healthy equipment field, such as Ventilators/ breathing machine/ respiration, CPAP(Continueous Positive Airway Pressure), Sleep Apnea, Spirometers,Gas flow instruction, Air flow monitor, hospital bed etc,.

■ For Industrial field, such as Airflow measurement, HVAC and Pneumatic gauges, Gas flow instrumentation, Exhaust systme, Pressure swithes,Liquid level measurement,etc.

■ For Other fields, such as sport equipment, Fire protection, Biological Science,Consumer appliances application etc.

Introduction

XGZP6897D is a prefect silicon pressure sensor module offering a digital IIC interface for reading differential pressure over the specified full scale pressure span and temp.range.

The XGZP6897D incorporates a silicon piezoresistive pressure sensor chip and an interior signal-conditional Application Specific Integrated Circuit(ASIC) in a SOP8 package with two air vents, which can be mounted directly on a standard PCB.

The XGZP6897D is fully calibrated and temperature compensated for offset,sensitivity, temperature and non-linearity,so XGZP6897D pressure sensor module satisfy the prefect repeatability,linearity, stability and sensibility, which can be applied directly in medical equipment, fitness machine,home electronics,and other pneumatic devices etc.

XGZP6897D pressure sensor module is for high volume application at an affordable cost and perfect performance.

Customized calibrations(excitation voltage and pressure range) are available.

Performance Parameter

Unless otherwise specified, measurements were taken with a supply voltage of 5 Vdc at a temperature of 25±1℃ and humidity ranging from 25％～85％

Item	Data	Unit
Power Supply	5(or 3.3V or 3V)	V
Max. Excitation current	3	mA
Output Resolution	24	Bit
Accuracy	±2.5(≤10kPa) and ±1.0(≥20kPa)	%Span
Response Time	2.5ms@OSR_P=1024X	Ms
SDA/SCL pull up resistor	4.7	Kohm
ESD HBM	4000	V
TCO(Temp. Coefficient of Offset)	±0.03	%FS/℃
TCS(Temp. Coefficient of Span)	±0.03	%FS/℃
Long Term Stability(1year)	±0.5	%Span
Over Pressure	2X	Rated
Compensation Temp.	0 ～ 65/32 ～ 149	℃/℉
Ambient Temp.	-10 ～ 85/14 ～ 176	℃/℉
Storage Temp.	-40 ～ 125/-40 ～ 257	℃/℉
TSO(Temp. Coefficient of Offset)	±0.03	%FS/℃

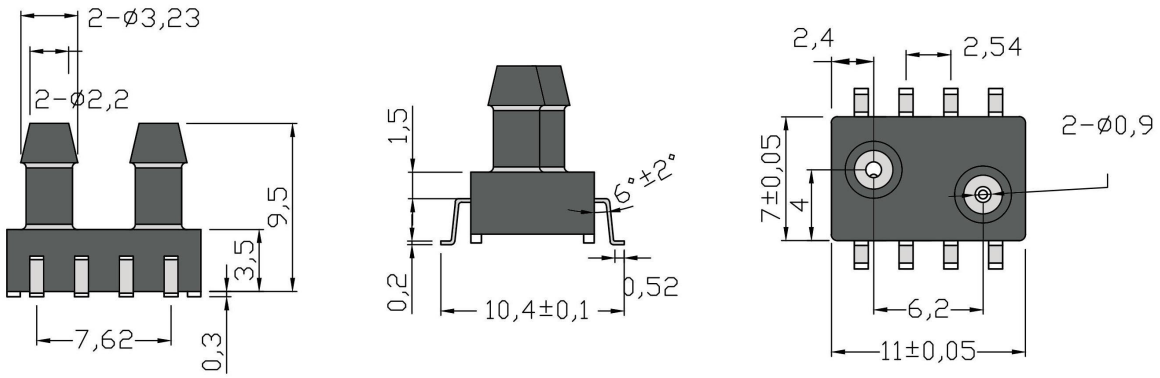
Electrical Specification

Parameter	Min.	Typ.	Max.	Unit	Note
Power Supply	2.5		5.5	V	
Working Temp.	-40		150	℃	
Standby Current		100		nA	
Regulator Output	1.62	1.8	1.98	V	‘regulator_sel’= 0
	3.24	3.6	3.96	V	‘regulator_sel’= 1
Regulator PSRR		60		dB	
Resolution		24		Bits	
Output Data Resolution					LSB=(1/2^23)*VEXT (‘raw_data_on’=1)
Input Signal CMRR	80	110			
Interior Temp. Accuarcy			±0.5	℃	@25℃
			±1	℃	-40 to 85 ℃
Temp Output Data Resolution	16			Bit	LSB = (1/256) ℃
Serial Clock Frequency			400	KHz	IIC Interface

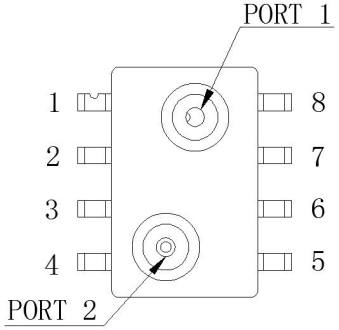
Pressure Range (1kPa=10HPa≈102mmH₂O≈7.5mmHg)

Pressure Range（kPa）	Model
-0.5 ～ 0.5	XGZP6897D005HPDPN
-1 ～ 1	XGZP6897D001KPDPN
-2.5 ～ 2.5	XGZP6897D025HPDPN
-5 ～ 5	XGZP6897D005KPDPN
-10 ～ 10	XGZP6897D010KPDPN
-40 ～ 40	XGZP6897D040KPDPN
-100 ～ 100	XGZP6897D100KPDPN
-100 ～ 200	XGZP6897D200KPDPN
-100 ～ 0	XGZP6897D100KPDN
0 ～ 1	XGZP6897D010HPD
0 ～ 2.5	XGZP6897D025HPD
0 ～ 5	XGZP6897D005KPD
0 ～ 10	XGZP6897D010KPD
0 ～ 20	XGZP6897D020KPD
0 ～ 40	XGZP6897D040KPD
0 ～ 100	XGZP6897D100KPD
0 ～ 200	XGZP6897D200KPD
Available for more custom pressure range such like -7～7kPa, 0～60kPa etc,.	

Dimension (Unit:mm)



Electric Definition



Type	1	2	3	4	5	6	7	8
IIC	N/C	Vdd	N/C	N/C	N/C	SDA	SCL	GND
Analog	REFER TO XGZP6897A DATA SHEET							

1 N/C Pins must be left floating, or cause function failure.

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

3 Add 0.1uf capacitor between VDD and GND

Order Guide

XGZP6897 D 005 KP DPN

- DPN — Pressure Type((D:Postive Differential Pressure; DN:Negative Differential Pressure; DPN:Postive and Negative Differential Pressure)）
- KP — Pressure Unit(KP：kPa HP:hPa)
- 005 — Pressure Range(000-999）
- D — Output Signal(A: Analog(0.5-4.5V) D:I2C)
- XGZP6897 — Series

Notes:

1. Implement ESD protection during soldering and assembly.
2. Overload voltage(6.5Vdc) or current(5mA) may burn the ASIC.
3. The medium must be compatible with the pressurized parts.
4. Please contact us for special request on parameter and application.

I2C INTERFACE

I2C bus uses SCL and SDA as signal lines. Both lines are connected to VDDIO externally via pull-up resistors so that they are pulled high when the bus is free. The I2C device address of IC is shown below. The LSB bit of the 7bits device address is configured via SDO/ADDR pin(set as 1).

I2C Device Address:0X6D

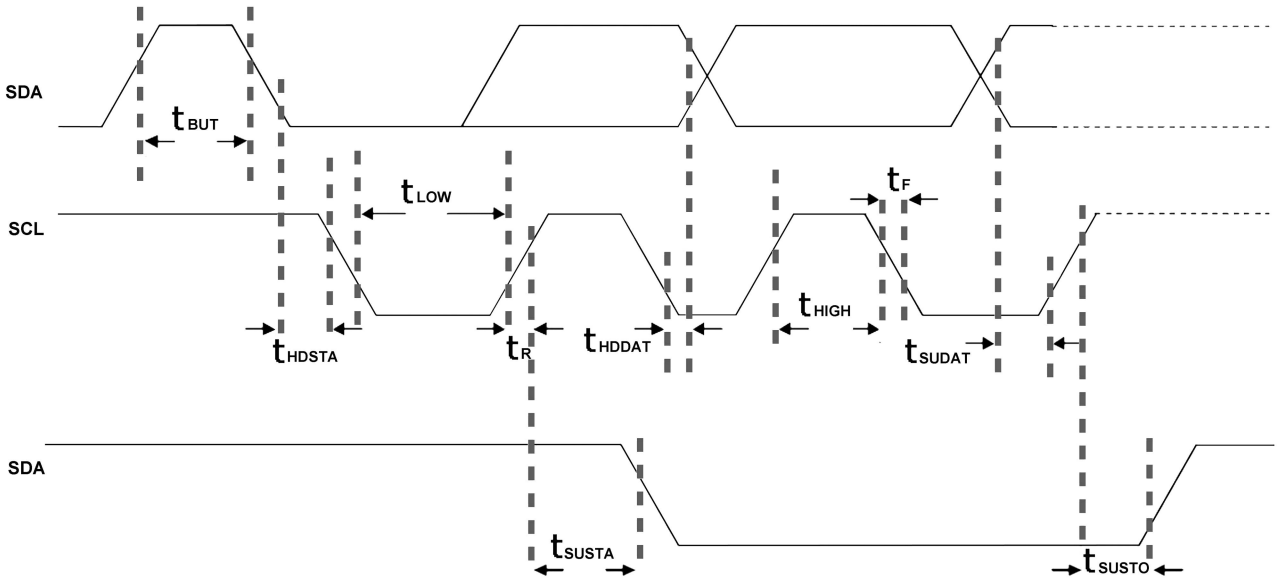
■ Electrical specification of the I2C interface pins

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

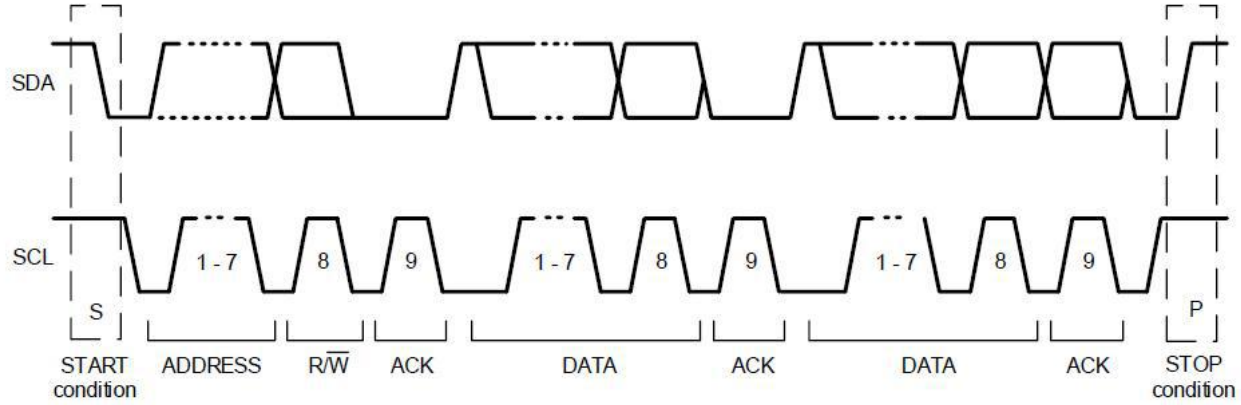
■ I2C Time Diagram

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



General Register Description

Addr	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0x00	SPI _Ctrl	RW	SDO_active	LSB_first	Softreset			Softreset	LSB_first	SDO_active	0x00
0x01	Part_ID	R	PartID<7:0>								0x00
0x02	Status	R	Error_code<3:0>						1'b0	DRDY	
0x06	DATA_MSB	R	Data out<23:16>								0x00
0x07	DATA_CSB	R	Data out<15:8>								0x00
0x08	DATA_LSB	R	Data out<7:0>								0x00
0x09	TEMP_MSB	R	Temp out<15:8>								0x00
0x0A	TEMP_LSB	R	Temp out<7:0>								0x00
0x30	CMD	RW	Sleep_time<3:0>				Sco	Measurement_ctrl<2:0>			0x00
0x6C	OTP_CMD	RW	Blow Start<6:0>							margin	0x00

Reg0x00

SDO_active: 1: 4-wire SPI, 0: 3-wire SPI

LSB_first: 1: LSB first for SPI interface, 0: MSB first for SPI interface

Soft_reset: 1: Reset all the registers (except 'margin'), automatically come back to 0 after reset complete.

Reg0x01

Part ID: OTP programmed 8 bits Part ID, corresponding to OTP register Reg0xA4. Read only from the address 0x01.

Reg0x02

DRDY：1, indicates once conversion complete, and the output data is ready for reading.

Error_code: When diagnostic function enabled, These bits stores the error information.

Error_code[3]: VINP short to VDD

Error_code[2]: VINP short to GND

Error_code[1]: VINN short to VDD

Error_code[0]: VINN short to GND

Reg0x06-Reg0x08

Data_out: 24 bits ADC output data when 'raw_data_on' = 0 with an LSB equals to (1/2^23)*(VEXT-PSW). 24 bits calibrated data when 'raw_data_on' = 1.

Reg0x09-Reg0x0a

Temp_out: Temperature output with an LSB equals to (1/256) °C

Reg0x30

Sleep_time<3:0>: 0000:0ms, 0001:62.5ms, 0010:125ms ... 1111: 1s, only active during sleep mode conversion.

Measurement_control<1:0>: 000b, indicate a single shot temperature signal conversion. 001b, indicate a single shot sensor signal conversion. 010b: indicate a combined conversion (once temperature conversion immediately followed by once sensor signal conversion). 011b: indicate a sleep mode conversion (periodically perform once combined conversion with an interval time of 'sleep_time'), 100b: OTP programming mode, enter this mode to when programming OTP banks.

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

Reg0x6C(Factory setting, no necessory to access)

OTP Register Description

Addr	Description	R/W	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Default
0xA4	PartID	RW	PartID<7:0>								OTP
0xA5	Sys_config	RW	DAC_on	P_T_ration <1:0>		Vout_sel	Regulator_sel	Unipolar	Raw_data_on	DIAG_on	OTP
0xA6	P_config	RW	1'b0	Input_swap	Gain_P<2:0>			OSR_P<2:0>			OTP
0xA7	T_config_1	RW	Temp_sel<1:0>		Gain_T<2:0>			OSR_T<2:0>			OTP
0xA8	T_config_2	RW	4'b0000				T_offset_trim<3:0>				OTP
0xA9	DAC_limit	RW	DAC_limit_h<3:0>				DAC_limit_l<3:0>				OTP
0xAA	Cal_OTP_1	RW	Cal_coff_1<7:0>								OTP
...	...	RW	...								OTP
0xBB	Cal_OTP_18	RW	Cal_coff_19<7:0>								OTP
0xBC	Redundancy	RW	Redundancy<7:0>								OTP

Reg0xA4

PartID: OTP programmed 8 bits Part ID, also can be read from address 0x01.

Reg0xA5

DAC_on: 1, enable analog output. When analog output enabled, ASIC continuously performs once temperature conversion after 64/32/16/1 (configured by 'P_T_ratio') times sensor signal conversions, no matter what 'CMD' (reg0x30) register settings.

P_T_ratio: set how many sensor signal conversions performed after once temperature conversion during analog output mode. 00: 64 times, 01: 32 times, 10: 16 times, 11: once.

Vout_sel: 0: set the DAC output voltage to be rail to rail, that is goes with the voltage on VDD pin, 1: set the DAC output fixed at a voltage range of 0-1.5*VEXT.

Regulator_sel: 0: set the VEXT voltage to be 1.8V, 1: set the VEXT voltage to be 3.6V.
Unipolar: 0: ADC output in bipolar format, 1: ADC output in unipolar format. (Only take effect when 'raw_data_on' = 1)
Raw_data_on: 0: output calibrated data, 1: output ADC raw data. (Only take effect in single shot sensor signal conversion and single shot temperature conversion)
Diag_on: 1, Enable diagnosis function.

Reg0xA6

Input Swap: Swap VINP and VINN inside the ASIC
Gain_P: 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: 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.

Reg0xA7

Temp_sel: select different temperature sensing methods. 00: external temp sensor with a resistance connected between TEMP and GND inside chip, 01: external temperature sensor with a current source output via TEMP pin, 10: external temperature sensor, 11: internal temperature sensor.
Gain_T: set the gain of the temperature 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_T: set the over sampling ratio of the temperature conversion channel. 000:1024X, 001:2048X, 010:4096X, 011:8192X, 100:256X, 101:512X, 110:16384X, 111:32768X.

Reg0xA8

T_offset_trim: set the offset voltage for external temperature conversion from 0V to VEXT.

Reg0xA9

DAC_limit_h: set an upper clipping limit for the analog output from 3/4VfsB (0000b) to Vfs(1111b)
DAC_limit_l: set a lower clipping limit for the analog output from 0(0000b) to 1/4Vfs(1111b)

Reg0xAA-Reg0xBB

Cal_coff: Coefficients used for sensor calibrating.

Read Process

As the following instruction sequences for reading data:
1. Read the 0xA5 register value, put the read binary value "and" on "11111111101" then write to 0xA5.
2. Send instructions 0x0A to 0x30 register for one temperature acquisition, one pressure data acquisition.
3. Read the 0x30 register address. If Sco bit is 0,signify the acquisition end, the data can be read.
4. Read 0x06, 0x07, 0x08 register address data to form a 24-bit AD value (pressure data AD value).

Ouptut and AD Value

The output of the sensor after calibration can be regarded as the current actual pressure value (±1%Span)

1. The output of the sensor after calibration: the unit is Pa (default). If you want to display other units, you can enter the corresponding coefficient in the conversion formula for conversion;
2. The ADC value and conversion formula are as follows:
   (1) The highest bit is "0", which means positive pressure/positive temperature:
   Pressure = Pressure_ ADC /k;
   Temperature=Temperature_ ADC/256;
   (2) The highest bit is "1", which means negative pressure/negative temperature:
   Pressure=(pressure_ADC-16777216)/k;
   Temperature=(Temperature_ADC-65536)/256;
3. Refer to the following table for the selection of k value in the pressure ADC conversion formula:

Pressure range(kpa)	K(value)
1000<P≤2000	4
500<P≤1000	8
260<P≤500	16
131<P≤260	32
65<P≤131	64
32<P≤65	128
16<P≤32	256
8<P≤16	512
4<P≤8	1024
2<P≤4	2048
1<P≤2	4096
0.5<P≤1	8192

Range P is the difference between the upper and lower limits of the measurement interval, for example, when measuring 30~80kpa, P=50kpa, k value is 128.

Overall Notes:

■ Mounting

Adopting land on the PC board for ensuring the sensor is securely fixed.

■ 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
⊙Set the soldering tip from 260 to 300°C (30W), and solder for no more than 5 seconds.
⊙Please note that output may change if the pressure is applied on the terminals when the soldering.
⊙Thoroughly clean the soldering iron.
▼ SMD soldering
As above.
▼ Solder reworking
⊙Finish reworking in one operation.
⊙For reworking of the solder bridge, use a soldering iron with a flat tip. Please do not add more flux when reworking.
⊙Please use a soldering iron that is below the temperature given in the specifications in order to maintain the correct temperature at the tip of the soldering iron.
⊙Too much force on the terminals will cause deformation and loss in effectiveness of the solder. Therefore, please avoid dropping and careless handling of the product.
⊙Please control warping of the PCB within 0.05 mm of the sensor width.
⊙When cut folding the PCB after mounting the sensor, take measures to prevent stress to the soldered parts.
⊙The sensor terminals are designed to be exposed, so contact of the terminals with metal shards and the like will cause output errors. Therefore, please be careful and prevent things such as metal shards and hands from contacting the terminals.
⊙To prevent degradation of the PCB insulation after soldering, please be careful not to get chemicals on the sensor when coating.

■ **Cleaning**
▼ Since the pressure sensor chip is exposed to the atmosphere, do not allow cleaning fluid to enter inside.
▼ Avoid ultrasonic cleaning since this may cause breaks or disconnections in the wiring.

■ **Environment**
▼Please avoid using or storing the pressure sensor chip 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 chip does not have a water-proof construction, please do not use the sensor in a location where it may be sprayed with water, etc.
▼Avoid using the pressure sensors chip in an environment where condensation may form. Furthermore, its output may fluctuate if any moisture adhering to it freezes.
▼The pressure sensor chip 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 to light.
▼Avoid using the pressure sensor chip where it will be susceptible to ultrasonic or other high-frequency vibration.
▼Please keep the sensors sealed using static shielding bags on storage. The PINs of sensor are

plated by Ag. If the sensors expose to an atmosphere, the PINs will be black by oxidation.

■ Quality check under actual loading conditions

To assure reliability, check the sensor under actual loading conditions. Avoid any situation that may adversely affect its performance.

■ Other handling precautions

▼That using the wrong pressure range or mounting method may result in accidents.

▼The only direct pressure medium you can use is dry air. The use of other media, in particular, corrosive gases (organic solvent based gases, sulfurous acid based gases, and hydrogen sulfide based gases, etc.) and media that contains moisture or foreign substances will cause malfunction and damage. Please do not use them.

▼The pressure sensor chip is positioned inside the pressure inlet. Never poke wires or other foreign matter through the pressure inlet since they may damage the chip or block the inlet. Avoid use when the atmospheric pressure inlet is blocked.

▼Use an operating pressure which is within the rated pressure range. Using a pressure beyond this range may cause damage.

▼Since static charge can damage the pressure sensor chip, bear in mind the following handling precautions.

⊙When storing the pressure sensor chips, use a conductive material to short the pins or wrap the entire chip in aluminum foil. Plastic containers should not be used to store or transport the chips since they readily become charged.

⊙ When using the pressure sensor chips, all the charged articles on the bench surface and the work personnel should be grounded so that any ambient static will be safely discharged.

▼Based on the pressure involved, give due consideration to the securing of the pressure sensor DIP type and to the securing and selection of the inlet tube.

Safety Precautions

● Do not use these sensors under any circumstances in which the range of their ratings, environment conditions or other specifications are exceeded. Using the sensors in any way which causes their specifications to be exceeded may generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry and possibly causing an accident.

● Before connecting a connector, check the pin layout by referring to the connector wiring diagram, specifications diagram, etc., and make sure that the connector is connected properly. Take note that mistakes made in connection may cause unforeseen problems in operation, generate abnormally high levels of heat, emit smoke, etc., resulting in damage to the circuitry.

● Do not use any pressure sensor which has been disassembled or remodeled.

● Protection circuit recommended.

The possible failure mode is either open or short of the output transistor.

An ecess heat is the cause for short mode failure. For any important and serious application in terms of safety, add protection circuit or any other protection method.

• Various safety equipment and safety equipment

- Traffic light
- Security crime prevention equipment
- Equipment concerning control and safety of trains, cars, etc.
- Applications such as temperature control using sensor output etc.

● If it is expected that malfunction of each sensor may cause injury to persons or serious expansion damage, be sure to implement safety measures such as double safety circuit.

Any more question, please contact sales or tech-support(info@CFSensor.com)

The listed specifications and dimensions are subject to change without prior notice.