2SMPP-03

MEMS Gauge Pressure Sensor

MEMS Gauge Pressure Sensor Featuring Small Size and Low Power Consumption



- **Superior electrical characteristics**
  at -50 kPa to 50 kPa pressure range.
  Offset voltage of -2.5±4.0 mV
  Span voltage of 42.0±5.5 mV
  (At rated pressure 50 kPa, 100 µADC Current supply)
- **Small package 6.1 × 4.7 × 8.2 mm (L × W × H).**
- **Good temperature dependency**
  at 0 to 85°C, at rated pressure 0 to 50 kPa
  Temp. influence of span of ±3.0%FS
  Temp. influence of offset of ±5.0%FS
  (100 µADC Current supply)
- **Rated power consumption of 0.2 mW**

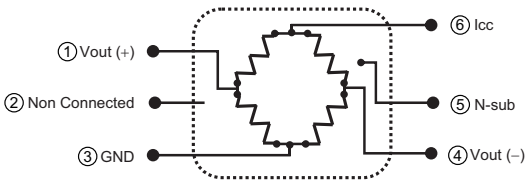
Refer to the *Safety Precautions* on page 7.

Ordering Information

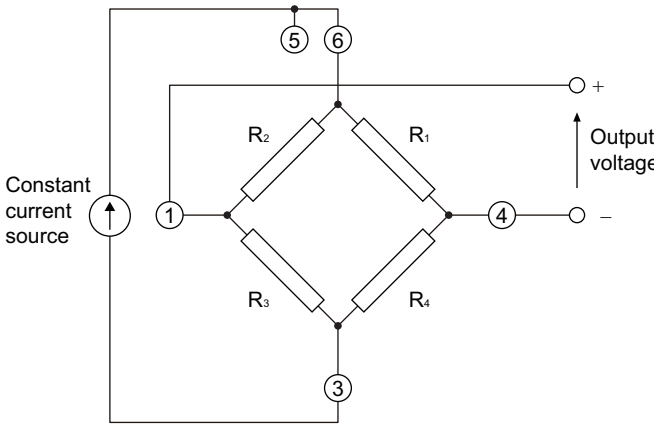
Standard Models with Surface mount package

Model	Classification	Structure	Packaging	MOQ (Minimum Order Quantity)
2SMPP-03	Bottom Port Type	SOP	Plastic sleeve	112 pcs/ 1 sleeve

Terminal Arrangement



Connection Diagram



Note: If necessary, add a variable resistor below the GND pin (3). The NC pin (2) must be secured to the circuit board.

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Application Examples

- Home appliance
- Air movement control
- Level indicators
- Leak detection
- Pressure controller

Specifications

■ Ratings

Item	2SMPP-03
Type of pressure	Gauge pressure
Sensing method	Piezoresistance
Pressure medium	Air
Driving method	Constant current drive
Drive current	100 μADC
Pressure range	-50 to 50 kPa
Withstand pressure	-80 to 120 kPa
Absolute maximum current	200 μADC max.
Ambient operating temperature	-20 to 100°C (with no icing and condensation)
Ambient operating humidity	10 to 95%RH (with no icing and condensation)
Ambient storage temperature	-40 to 120°C (with no icing and condensation)
Ambient storage humidity	10 to 95%RH (with no icing and condensation)
Weight	0.17 g

Note: 1. The above values are initial values measured at ambient temperature condition of 23°C.
Note: 2. Please avoid caustic gases.

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Characteristics

■ Operating characteristics

Positive pressure (at rated pressure 0 to 50 kPa)

Item	Min.	Typ.	Max.	Unit
Supply current	-	100	-	μADC
Bridge resistance	18.0	20.0	22.0	kohm
Operating pressure range	0	-	50	kPa
Offset voltage	-6.5	-2.5	1.5	mV
Span voltage	36.5	42.0	47.5	mV
Non-linearity	0.3	0.8	1.3	%FS
Pressure hysteresis	-0.2	0.0	0.2	%FS
Temperature influence of span voltage at 0°C	-1.0	1.0	3.0	%FS
Temperature influence of span voltage at 50°C	-2.1	-0.1	1.9	%FS
Temperature influence of span voltage at 85°C	-2.0	1.0	4.0	%FS
Temperature influence of offset voltage at 0°C	-4.0	-1.0	2.0	%FS
Temperature influence of offset voltage at 50°C	-2.0	1.0	4.0	%FS
Temperature influence of offset voltage at 85°C	-3.0	2.0	7.0	%FS

Negative pressure (at rated pressure 0 to -50 kPa)

Item	Min.	Typ.	Max.	Unit
Supply current	-	100	-	μADC
Bridge resistance	18.0	20.0	22.0	kohm
Operating pressure range	-50	-	0	kPa
Offset voltage	-6.5	-2.5	1.5	mV
Span voltage	-48.5	-43.0	-37.5	mV
Non-linearity	-0.3	0.2	0.7	%FS
Pressure hysteresis	-0.2	0.0	0.2	%FS
Temperature influence of span voltage at 0°C	-1.2	0.8	2.8	%FS
Temperature influence of span voltage at 50°C	-1.9	0.1	2.1	%FS
Temperature influence of span voltage at 85°C	-1.8	1.2	4.2	%FS
Temperature influence of offset voltage at 0°C	-4.0	-1.0	2.0	%FS
Temperature influence of offset voltage at 50°C	-2.0	1.0	4.0	%FS
Temperature influence of offset voltage at 85°C	-3.0	2.0	7.0	%FS

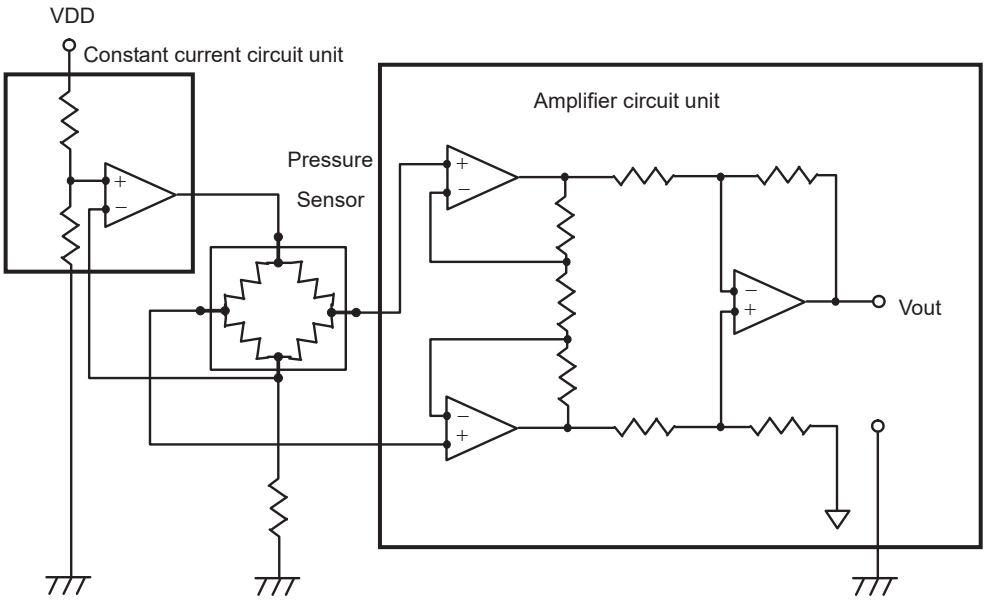
Note: 1. The above values are initial values.
Note: 2. Ambient temperature condition: 23°C without Temperature property.
Note: 3. The above values are operated at 100 μADC
Note: 4. The above values are operated at 0 to 50 kPa, and 0 to -50 kPa.
Note: 5. Offset voltage is defined as the output voltage at 0 kPa rated pressure.
Note: 6. Positive span voltage is defined as the algebraic difference between the output voltage at 50 kPa rated pressure and the output voltage at 0 kPa rated pressure.
Note: 7. Negative span voltage is defined as the algebraic difference between the output voltage at -50 kPa rated pressure and the output voltage at 0 kPa rated pressure.
Note: 8. Hysteresis is defined as follows,
In case of positive pressure:
{The output voltage difference at 0 kPa before and after a pressure cycle (0 to 50 to 0 kPa)} / (span voltage) × 100 [%FS].
In case of negative pressure:
{The output voltage difference at 0 kPa before and after a pressure cycle (0 to -50 to 0 kPa)} / (span voltage) × 100 [%FS].
Note: 9. Temperature influence of span voltage is defined as follows,
{Span voltage at 0°C. - span voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]
{Span voltage at 50°C. - span voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]
{Span voltage at 85°C. - span voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]
Note: 10. Temperature influence of offset voltage is defined as follows,
{Offset voltage at 0°C. - offset voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]
{Offset voltage at 50°C. - offset voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]
{Offset voltage at 85°C. - offset voltage at 25°C. } / span voltage at 25°C. × 100 [%FS]

Environment characteristics

Item		2SMPP-03
Vibration Resistance	Destruction	10 to 500 Hz 10 G
	Malfunction	10 to 500 Hz 10 G
Shock Resistance	Destruction	15 G
	Malfunction	15 G
Life Expectancy		100,000 Operations min. (0 to 75 kPa)
ESD		1,000 V (Human body model)
Package Material		PPS (Polyphenylenesulfide)

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Example of Application Circuit for MEMS Pressure Sensor



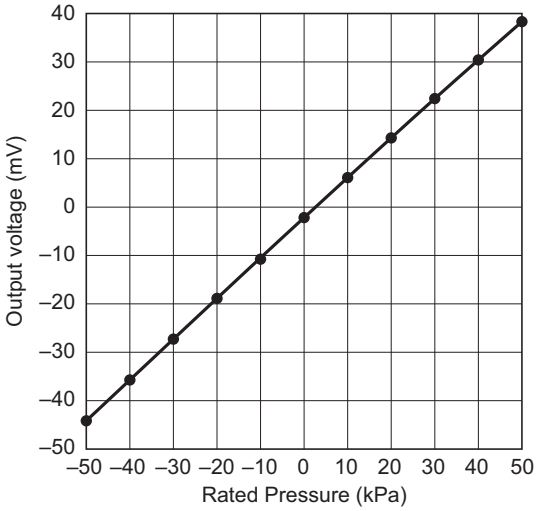
(1) The pressure sensor is designed to convert a voltage by means of constant current drive.

(2) Please amplifier the output voltage of the pressure sensor by using the amplifying circuit if necessary.

Engineering Data (for Reference)

■ Output Characteristics

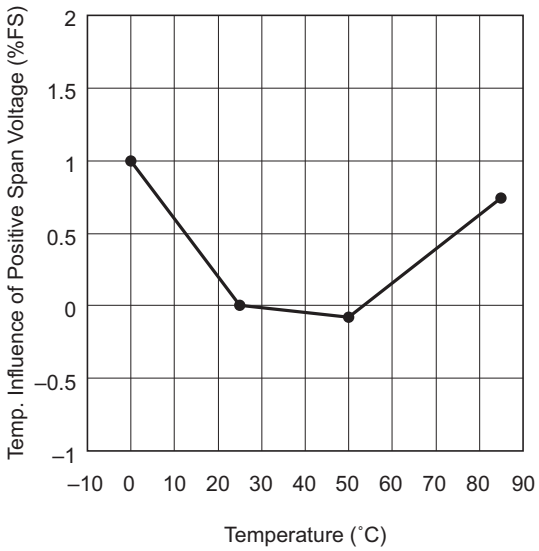
Rated Pressure vs. Output Voltage



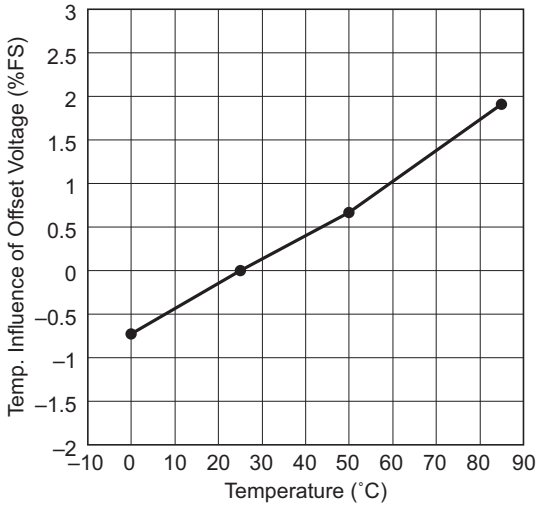
Note: 1. Ambient temperature condition: 23°C.
Note: 2. Drive current: 100 μA
Note: 3. These output voltage characteristics are measured with tester without a mounting board.
Note: 4. The output voltage characteristics may be influenced by the mounting board. Be sure to check operation including durability in actual equipment before use.

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Temperature influence of Span voltage (at 0 to 50 kPa)

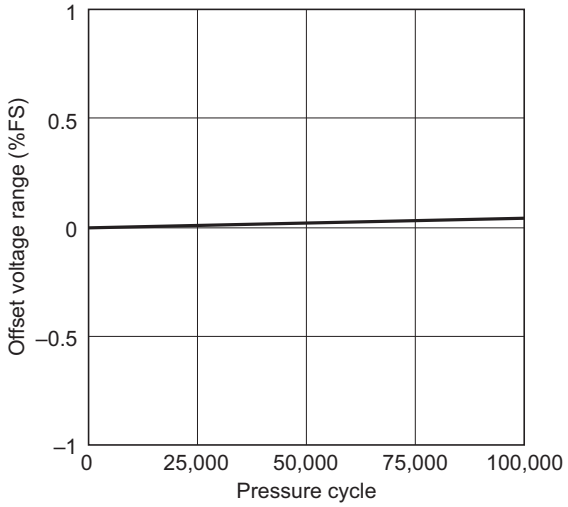


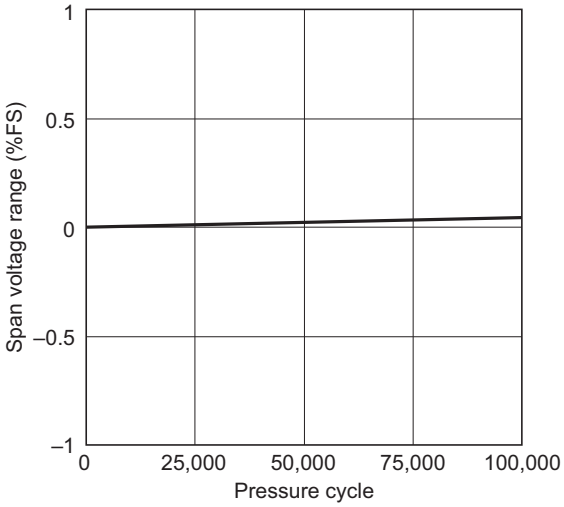
Temperature influence of Offset voltage (at 0 kPa)



Note: 1. Measured points are 0°C, 25°C, 50°C and 85°C at 0 to 50 kPa.
Note: 2. Drive current: 100 µA
Note: 3. These output voltage characteristics are measured with tester without a mounting board.
Note: 4. The output voltage characteristics may be influenced by the mounting board. Be sure to check operation including durability in actual equipment before use.

Pressure Cycle Range (0 to 75 kPa)





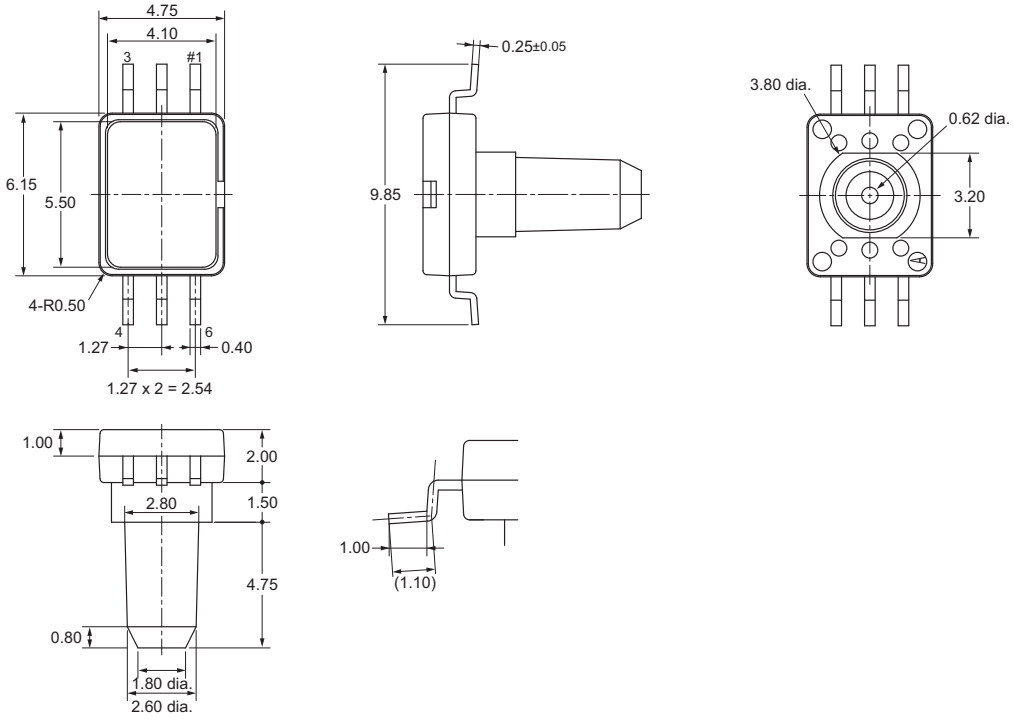
Note: 1. Tested temperature condition: 25°C
Note: 2. Number of pressure cycle time: 1×10^5
Note: 3. Rated cycle pressure: 0 to 75 kPa
Note: 4. These output voltage characteristics are measured with tester without a mounting board.

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Dimensions

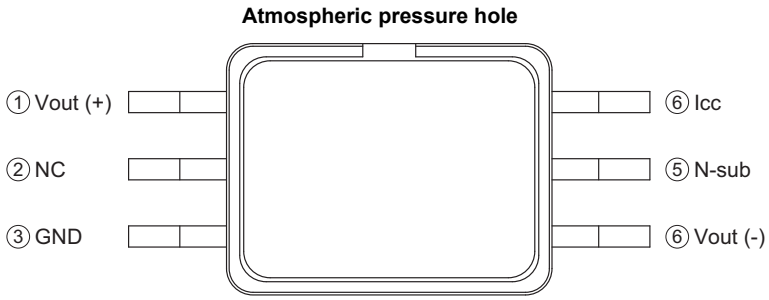
CAD Data marked products, 2D drawings and 3D CAD models are available.
For CAD information, please visit our website, which is noted on the last page.

Note: All units are in millimeters unless otherwise indicated.

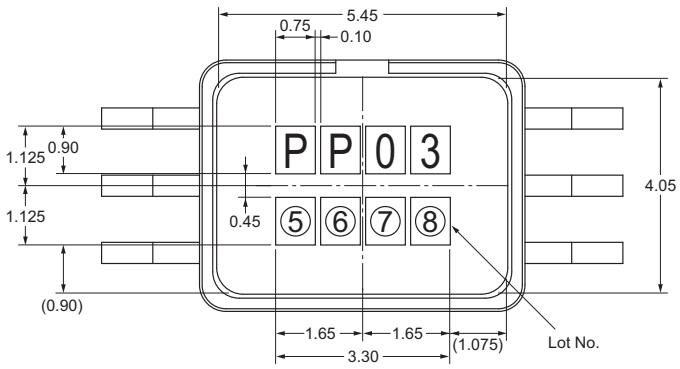


CAD Data

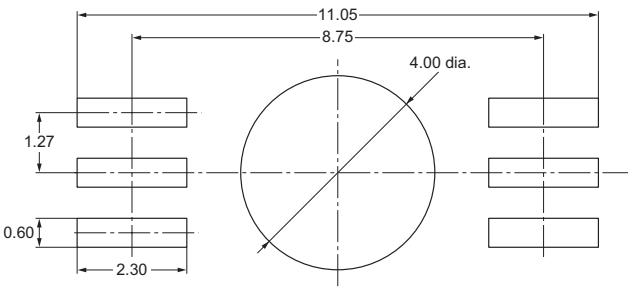
Pin Diagram
(Top Surface of Sensor)



Markings



Recommended Pad Dimensions



CAD Data

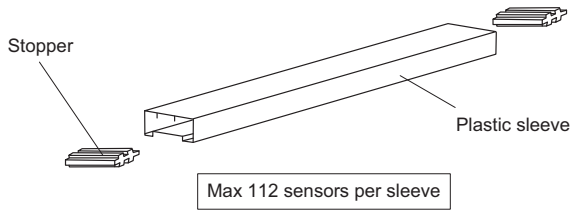
Note: Unless otherwise specified, the tolerance for all of the above drawings is ±0.3 mm.

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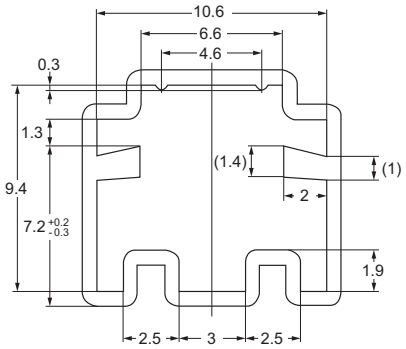
Package

Note: All units are in millimeters unless otherwise indicated.

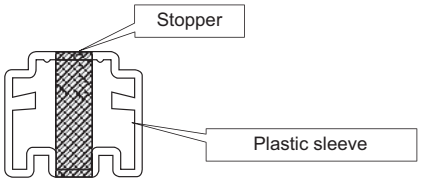
Plastic sleeve



Plastic sleeve size



Stopper insertion view



Material: PS (Transparent)
Processing: Static electricity prevention processing
Full length: 550 ± 1.5 mm
Board thickness: 0.6 mm

Note: The tolerance outside of the specified tolerances in the drawing is 0.2 mm. The bending/warping is within 2.0 mm throughout the entire length.

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Safety Precautions

Precautions for Correct Use

Handling the Sensor

(1) Only air can be used as pressure media on the products directly. It is prohibited to use pressure media including corrosive gases (e.g. organic solvents gases, sulfur dioxide and hydrogen sulfide gases), fluid and any other foreign materials.
(2) The products are not water proof. Please keep dry in use.
(3) Don't use the products under dew-condensing conditions. Frozen fluid on sensor chips may also cause fluctuation of sensor output and any other troubles.
(4) Don't put foreign materials (e.g. a wire and a pin) into a connecting tube. It may cause breakage of pressure sensor chips or fluctuation of sensor output caused by clogging the tube.
(5) Use the products within rated pressure. Usage at pressure out of the range may cause breakage.
(6) Don't use under high-frequency vibration including ultrasonic wave.
(7) The products may be broken by static electricity. Charged materials (e.g. a workbench and a floor) and workers must provide measures against static electricity, including ground connection.
(8) Overpowering terminals may deform them and detract their solder abilities. Don't drop and handle the products roughly.
(9) Don't use the products under humid or dusty condition.
(10) Terminals connection of pressure sensors must be handled as directed by a connection diagram.

Environmental Condition for Transportation and Storage

(1) It is prohibited to keep the products with corrosive gases (e.g. organic solvents gases, sulfur dioxide and hydrogen sulfide gases).
(2) The products are not water proof. Please keep dry during storage.
(3) An anti-static treatment has been applied to the sleeves. Please note the following points.
   1. Getting wet may remove an anti-static treatment and eliminate its effect.
   2. The sleeve may feel sticky under hot and humid condition due to the nature of the anti-static treatment.
   3. Anti-static has aging degradation. It is prohibited to keep the sleeves for more than six months. The sleeves are also non-reusable.
(4) Keep in an appropriate temperature and humidity condition specified as
   Temperature : 5 to 30°C , Humidity : 40 to 60%.
(5) As the lead is plated with silver, there is a possibility of being tarnished depending on storage condition.
   Not guarantee the tarnishing after shipping. Be careful the method of storage.
(6) Don't keep the products under humid or dusty condition.

Mounting Method

- Use lands on the printed-circuit boards to which the sensor can be securely fixed.
- Fix pin No.2 on the printed-circuit boards, not fixed causes fluctuation of sensor output signals.

Soldering Method

- Due to its small size, the thermal capacity of the pressure sensor is low. Therefore, take steps to minimize the effects of external heat.
- Dip soldering bath: Max. 260°C, within 10 sec.
- Soldering iron: Max. 260°C, within 10 sec.
- Do not heat the case of sensor package, heat only terminal.
- Use a non-corrosive resin type of flux. Since the pressure sensor chip is exposed to the atmosphere, do not allow flux to enter inside.

Cleaning

- Since the pressure sensor chip is exposed to atmosphere, do not allow cleaning fluid to enter inside.
- Avoid ultrasonic cleaning since this may cause breaks or disconnections in the wiring.
- Do not wash the print circuit board after the pressure sensor is mounted using detergent containing silicone. Otherwise, the detergent may remain on the surface of the pressure sensor.

Coating

- Do not coat the pressure sensor when it is mounted to the print circuit board.

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