



KEY FEATURES

- Absolute and gauge ranges
- 0 to 500 PSI
- Stainless steel construction
- Digital output - I2C or SPI
- Pressure and Temperature

Description

The MPM2581 I2C/SPI digital pressure sensor features a silicon, Piezoresistive sensing element, which is housed in a stainless-steel body and is isolated from the pressure media via a convoluted diaphragm and silicone oil-fill. This design ensures a reliable and accurate conversion of the measured pressure into a digital signal.

Furthermore, a customized integrated circuit provides temperature compensation and non-linearity correction. The sensor outputs 14-Bit pressure data and 11-Bit temperature data, adhering to either the I2C interface protocol or SPI interface protocol. This product is characterized by low power consumption and high accuracy.

Scope of Supply

The sensor is shipped with the following items:

MPM2581 Pressure Sensor	1
Operation Manual	1
Calibration Sheet	1

Contents

Unpacking	2
Storage	2
Conditions of Use	2
Outline Construction and Installation	2
Installation	3
Electrical Connection	3
Operation	4
Warranty	7

Unpacking

Handle with care and avoid touching the diaphragm.

Please ensure that the risk of static electricity is minimized/removed when handling, assembling and operating the sensor. The electrical contact pads are protected against electrostatic discharge (ESD) up to 4 kV HBM (human body model).

Storage

The sensor should be stored in a dry, well-ventilated room with an ambient temperature of -20°C to 105°C and a relative humidity of ≤85%. The room should not contain any corrosive substances.

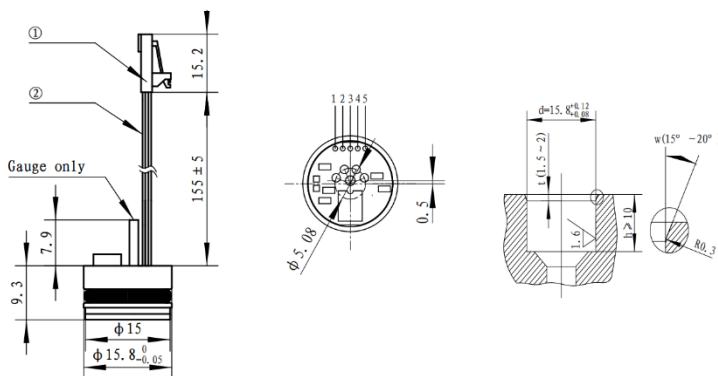
Conditions of Use

The MPM2581 Piezo-resistive pressure sensor is a precision measuring device. Please pay attention to the following items during operation:

- It is recommended that the Pressure Sensor should be installed per the guidance & dimensions on Page 3.
- Do not depress the diaphragm by hand, or use any hard material or sharp objects on the sensing diaphragm or irreparable damage may result.
- Do not pull the ribbon cable or push on the circuit board to avoid damaging the circuit board.
- Do not pressurise the sensor beyond the upper-limit. If the applied pressure is >1.5FS, it may damage the sensor.

Outline Construction and Installation

Dimensions (mm)



① : PIN: MOLEX P/N 16-02-0082; HOUSING: MOLEX P/N 50-57-9405

② : RIBBON CABLE, 26AWG

Fig. 1

Installation

Check before Installation:

- a) The measurement pressure is within the sensor's pressure range.
- b) The pressure media is compatible with the sensor's construction material.
- c) The pressure media is unlikely to obstruct the pressure port opening.
- d) Recommended installation dimension: $19\text{mm}^{+0.02}_{+0.05}$, Depth $\geq 18\text{mm}$

Do not allow wet, conductive or corrosive media to enter sensor electrical connection parts enter the vent tube (if fitted).

Please keep the pressure sensor's vent tube clear (if fitted). It must vent to atmosphere at all time.

It is recommend to remove the protection cap from the sensor very carefully during installation to avoid damaging the diaphragm.

Electrical Connection

Pin definition

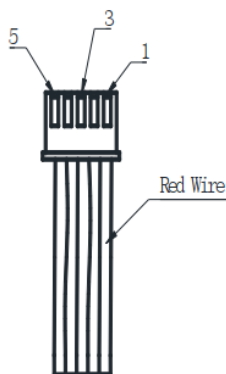


Fig. 2

Pin	I2C Definition	SPI Definition
1	VDD	VDD
2	GND	GND
3	SCL	SCLK
4	SDA	MISO
5	INT	SS

Operation

Operation sequence for Standard and Low Power configuration

Standard configuration

In the Standard configuration, the control circuit consistently supplies power to the sensor element as the digital core conducts analog to digital measurements, correction calculations, and subsequently updates the I2C/SPI output register. In this mode, data undergoes continuous updates at a consistent rate without any power-down intervals. The master can retrieve the data using an I2C or SPI Read_DF command. The valid data output to the digital register becomes available once the measurement and DSP calculations are finished. Please refer to figure 3 regarding the operation flow.

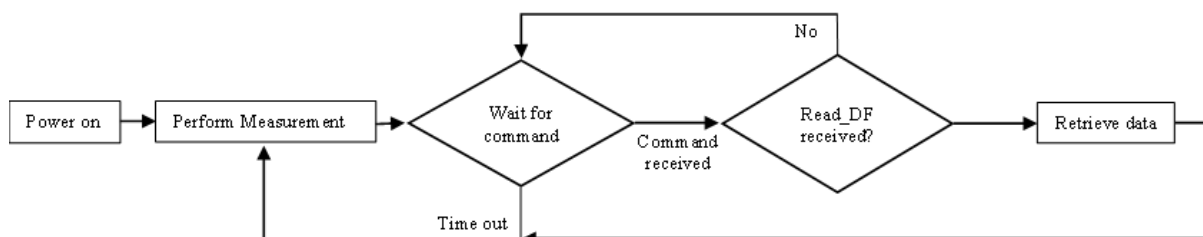


Fig. 3

Low power configuration (optional)

In the Low Power configuration (with -L in the part number), following the power-on sequence, the control circuit enters a standby state until the master initiates a wake-up by sending a Read_MR command (either through I²C or SPI) or a Write_MR command (exclusive to I²C). This action reactivates the control circuit and triggers a measurement cycle. In the case of a Read_MR command, the sequence involves temperature, auto-zero, and pressure measurements, followed by DSP correction calculations.

The Read_DF commands should be followed after the Read/Write_MR command.

The general flow of the low-power option is illustrated in Figure 4 below while it provides a depiction of the actions involved in fetching the Measurement Request (MR), relevant bus activity, and the outcomes of status bits.

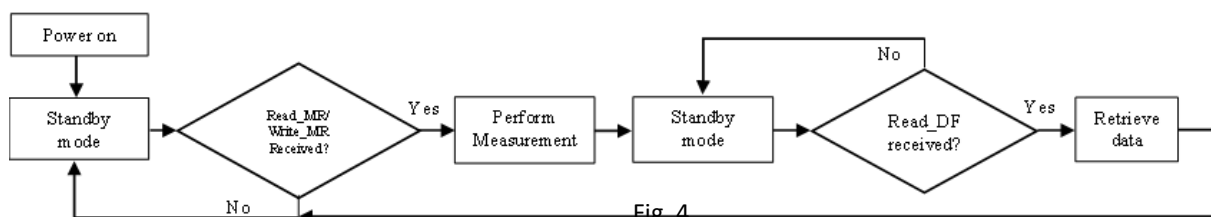


Fig. 4

I²C Command Set and Sequences for Data Transfer

The sensor functions as the slave and issues an acknowledgment (ACK) to signify success. The sensor encompasses four I²C read commands: Read_MR, Read_DF2, Read_DF3, and Read_DF4. The structure of the measurement packet for these four I²C read commands is illustrated in Figure 5.

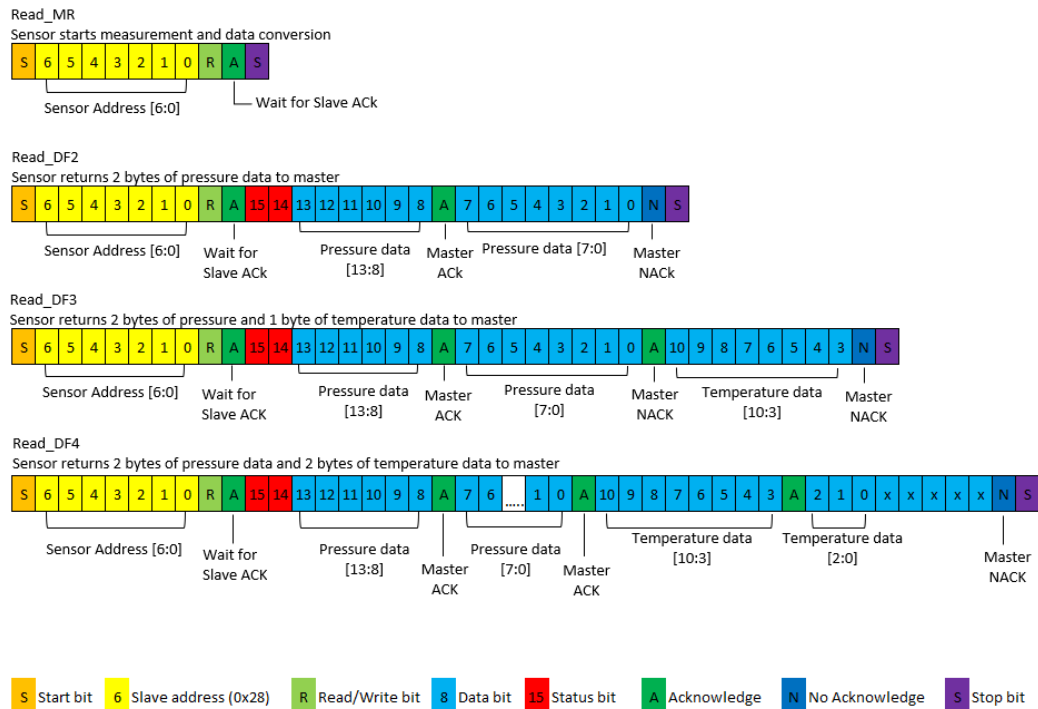


Fig. 5

Read_DF (Data Fetch) commands

For Data Fetch commands, the sensor determines the number of data bytes to return when the master issues a NACK and stop condition. In the case of the Read_DF3 data fetch command (Data Fetch 3 Bytes; illustrated in Figure 5), the sensor responds to the master's transmission of the slave address and the READ bit (1) by returning three bytes. These include two bytes of pressure data with the two status bits as the most significant bits (MSBs) and then 1 byte of temperature data (8-bit accuracy).

After receiving the required number of data bytes, the master sends a NACK and stop condition to conclude the read operation. In the case of the Read_DF4 command, the master delays sending the NACK and continues reading an additional final byte to obtain the complete corrected 11-bit temperature measurement. In this scenario, the last 5 bits of the final byte in the packet are undetermined and should be ignored in the application.

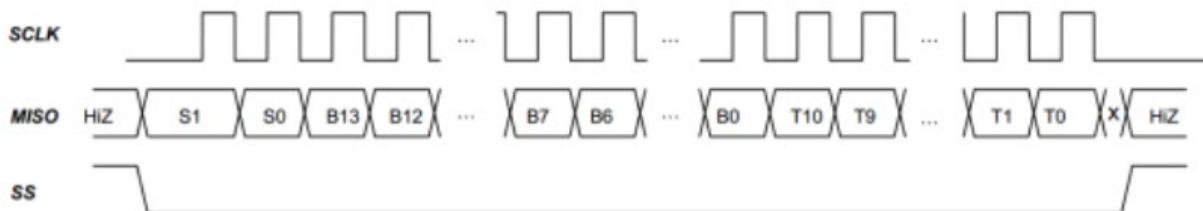
The Read_DF2 command is employed when corrected temperature is not needed, and the master concludes the READ operation after receiving the two bytes of temperature data.

The two status bits (Bit 15 and Bit 14) provide an indication of stale or valid data based on their values. A returned value of 00 signifies "normal operation and a good data packet," while a returned value of 10 indicates "stale data that has already been fetched." Refer to table 1 for further details. Users employing "status bit" polling should choose a frequency slower than 20% more than the update time.

Status Bits (Bit 15 & 14)	Description
00	Normal
01	N/A
10	Stale data
11	Fault status

SPI

The complete output packet consists of 4 bytes (32 bits). The initial byte contains the standby status in the first 2 bits (S[1:0]), which can be ignored and discarded. The remaining 6 bits of the first byte represent the upper 6 bits of pressure data (B[13:8]). The second byte contains the lower 8 bits of pressure data (B[7:0]). The third byte comprises the upper 8 bits of temperature data (T[10:3]). The first 3 bits of the fourth byte represent the lower 3 bits of temperature data (T[2:0]). The last 5 bits of the fourth byte are undefined and should be masked off in the application. If only pressure data is needed, the read can be terminated after the second byte. If temperature data is also required but only at an 8-bit resolution, the read can be terminated after the third byte.



Packet :

{{ S(1:0), B(13:8)},{ B(7:0)},{ T(10:3)},{ T(2:0),XXXXX}} Where

S(1:0): Invalid data, discard

B(13:8): Upper 6 bits of pressure data.

B(7:0): Lower 8 bits of pressure data.

T(10:3): Upper 8 bits of temperature data.

T(2:0), xxxxx: Remaining 3 bits of temperature data and 5 bits invalid data

Hiz: High impedance

Reading conversion formula

Pressure Calculation Formula: $\text{Pressure value} = \frac{(P_{\text{max}} - P_{\text{min}}) \times (P_{\text{count}} - 1638)}{13108} + P_{\text{min}}$

Temperature Calculation Formula: $\text{Temperature value} = \frac{T_{\text{count}} \times 200}{2047} - 50$

Pressure Output at Significant Percentages

%FS	Digital Counts (Decimal)	Digital Count (Hex)
0	0	0x0000
5	819	0x0333
10	1638	0x0666
50	8192	0x2000
90	14746	0x399A
95	15563	0x3CCB
100	16383	0x3FFF

Temperature Output at Significant Percentages

Temperature °C	Digital Counts (Decimal)	Digital Count (Hex)
-50	0	0x0000
0	512	0x0200
10	614	0x0266
25	767	0x02FF
40	921	0x0399
85	1381	0x0565
150	2047	0x07FF

Warranty

Within one year from the delivery date, we will repair or replace the instrument free of charge for any quality defect caused by material defects or our manufacturing process. However, for any non-quality malfunction that occurs during the user's operation, we will repair it but the user will be responsible for all material costs and shuttle transportation fees.