



## MS5525DSO

(Digital Small Outline)

### SPECIFICATIONS

- **Integrated Digital Pressure Sensor (24-bit  $\Delta\Sigma$  ADC)**
- **Fast Conversion Down to 1 ms**
- **Low Power, 1  $\mu\text{A}$  (standby < 0.15  $\mu\text{A}$ )**
- **Supply Voltage: 1.8 to 3.6V**
- **Pressure Range: 1 to 30 PSI**
- **I<sup>2</sup>C and SPI Interface**

### FEATURES

- Small Outline IC Package
- Barbed Pressure Ports
- Low Power, High Resolution ADC
- Digital Pressure and Temperature Outputs

### APPLICATIONS

- Factory Automation
- Altitude and Airspeed Measurements
- Medical Instruments
- Leak Detection

The MS5525DSO is a new generation of Digital Small Outline pressure sensors from MEAS with SPI and I<sup>2</sup>C bus interface designed for high volume OEM users. The sensor module includes a pressure sensor and an ultra-low power 24-bit  $\Delta\Sigma$  ADC with internal factory calibrated coefficients. It provides a 24-bit digital pressure and temperature value and different operation modes that allow the user to optimize for conversion speed and current consumption. The MS5525DSO can be interfaced to virtually any microcontroller. The communication protocol is simple, without the need of programming internal registers in the device.

This new sensor module generation is based on leading MEMS technology and latest benefits from TE proven experience and know-how in high volume manufacturing of pressure modules, which have been widely used for over a decade.

The rugged engineered thermoplastic transducer is available in single and dual port configurations, and can measure absolute, gauge, compound, and differential pressure from 1 to 30psi.

## STANDARD RANGES (PSI)

| FS Pressure | Absolute       | Gauge             | Differential  |
|-------------|----------------|-------------------|---------------|
| 001         |                |                   | DB, SB,ST, DH |
| 002         |                | DB, SB, ST, DH,FT | DB, SB,ST, DH |
| 005         |                | DB, SB, ST, DH,FT | DB, SB,ST ,DH |
| 015         | DB, FB, DH, FT | DB, SB, ST, DH,FT | DB, DH        |
| 030         | DB, FB, DH, FT | DB, SB, ST, DH,FT | DB, DH        |

See Package Configurations: DB= Dual Barb, DH= Dual Hole, SB=Single Barb, ST=Single Tube, FT=Front Side Tube, FB=Front Single Barb

## ABSOLUTE MAXIMUM RATING

| Parameter           | Conditions                         | Min               | Max | Unit | Symbol/Notes    |
|---------------------|------------------------------------|-------------------|-----|------|-----------------|
| Supply Voltage      | T <sub>A</sub> = 25°C              | -0.3              | 3.6 | V    | V <sub>DD</sub> |
| Storage Temperature |                                    | -40               | 125 | °C   |                 |
| Overpressure        | T <sub>A</sub> = 25 °C, both Ports |                   | 60  | psi  |                 |
| Burst Pressure      | T <sub>A</sub> = 25 °C, Port 1     |                   |     | psi  | See Table 1     |
| ESD                 | HBM                                | -4                | +4  | kV   | EN 61000-4-2    |
| Solder Temperature  |                                    | 250°C, 5 sec max. |     |      |                 |

**Table 1- BURST PRESSURE BY RANGE AND PORT DESIGNATION.**

| Range | Port 1 | Port 2 | Unit |
|-------|--------|--------|------|
| 001   | 10     | 10     | psi  |
| 002   | 20     | 20     | psi  |
| 005   | 50     | 15     | psi  |
| 015   | 120    | 60     | psi  |
| 030   | 120    | 120    | psi  |

## ENVIRONMENTAL SPECIFICATIONS

| Parameter            | Conditions   |
|----------------------|--|
| Mechanical Shock     | Mil Spec 202F, Method 213B, Condition C, 3 Drops           |
| Mechanical Vibration | Mil Spec 202F, Method 214A, Condition 1E, 1Hr Each Axis    |
| Thermal Shock        | 100 Cycles over Storage Temperature, 30 minute dwell       |
| Life                 | 1 Million FS Cycles  |
| MTTF                 | >10Yrs, 70 °C, 10 Million Pressure Cycles, 120%FS Pressure |
| MSL                  | Moisture Sensitivity Level is 3                            |

## PERFORMANCE SPECIFICATIONS

Unless otherwise specified: Supply Voltage<sup>1</sup> 3.0 V<sub>DC</sub>, Reference Temperature: 25°C

| PARAMETERS                                   | MIN                 | TYP  | MAX  | UNITS | NOTES |
|--|---------------------|------|------|-------|-------|
| Operating Voltage                            | 1.8                 |      | 3.6  |       |       |
| ADC  |                     |      | 24   | bits  |       |
| Pressure Accuracy                            | See Table 2 Below   |      |      | %FS   | 2,5   |
| Total Error Band (TEB)                       | -2.5                |      | 2.5  | %FS   | 3     |
| Temperature Accuracy (Reference Temperature) |                     | ±1.5 |      | °C    | 4,5   |
| Temperature Accuracy                         |                     | ±2.5 |      | °C    | 4,5   |
| Supply Current                               | See OSR Table Below |      |      | mA    |       |
| Compensated Temperature                      | 0                   |      | 85   | °C    |       |
| Operating Temperature                        | -40                 |      | +125 | °C    |       |
| Conversion Time                              | See OSR Table Below |      |      | ms    |       |
| Weight                                       |                     | 3    |      | grams |       |

Media Non-Corrosive Dry Gases Compatible with Silicon, Glass, LCP, RTV, Gold, Thermo-Epoxy, Silicone Gel, Aluminum and Epoxy. See "Wetted Material by Port Designation" chart.

### Notes

- Proper operation requires an external capacitor placed as shown in Application Circuit. Output is not ratiometric to supply voltage.
- The maximum deviation from a best fit straight line (BFSL) fitted to the output measured over the pressure range at 25°C. Includes all errors due to pressure non-linearity, hysteresis, and non-repeatability.
- The maximum deviation from ideal output with respect to input pressure and temperature over the compensated temperature range. Total error band (TEB) includes all accuracy errors, thermal errors over the compensated temperature range, span and offset calibration tolerances. TEB values are valid only at the calibrated supply voltage.
- The deviation from a best fit straight line (BFSL) from 25°C. to 85°C.
- Six coefficients must be read by microcontroller software and are used in a mathematical calculation for converting D1 and D2 into compensated pressure and temperature values.

**Table 2- TYPICAL ACCURACY SPECIFICATION BY PRESSURE RANGE**

| Range | Port 1 | Port 2 | Unit |
|-------|--------|--------|------|
| 001   | ±0.25  | ±1.0   | %FSS |
| 002   | ±0.25  | ±0.5   | %FSS |
| 005   | ±0.50  | ±1.0   | %FSS |
| 015   | ±0.25  | ±0.25  | %FSS |
| 030   | ±0.25  | ±0.25  | %FSS |

## OVERSAMPLING RATIO (OSR) PERFORMANCE CHARACTERISTICS

### SUPPLY CURRENT CHARACTERISTICS

| Parameter                             | Symbol          | Conditions        | Min. | Typ. | Max  | Unit |
|---------------------------------------|-----------------|-------------------|------|------|------|------|
| Supply current<br>(1 sample per sec.) | I <sub>DD</sub> | OSR               | 4096 | 12.5 |      |      |
|                                       |                 |                   | 2048 | 6.3  |      |      |
|                                       |                 |                   | 1024 | 3.2  |      | μA   |
|                                       |                 |                   | 512  | 1.7  |      |      |
|                                       |                 |                   | 256  | 0.9  |      |      |
| Peak supply current                   |                 | during conversion |      | 1.4  |      | mA   |
| Standby supply current                |                 | at 25°C           |      | 0.02 | 0.14 | μA   |

### ANALOG DIGITAL CONVERTER (ADC)

| Parameter       | Symbol         | Conditions | Min. | Typ. | Max  | Unit |
|-----------------|----------------|------------|------|------|------|------|
| Conversion time | t <sub>c</sub> | OSR        | 4096 | 7.40 | 8.22 | 9.04 |
|                 |                |            | 2048 | 3.72 | 4.13 | 4.54 |
|                 |                |            | 1024 | 1.88 | 2.08 | 2.28 |
|                 |                |            | 512  | 0.95 | 1.06 | 1.17 |
|                 |                |            | 256  | 0.48 | 0.54 | 0.60 |

## INPUT/OUTPUT SPECIFICATIONS

### DIGITAL INPUTS (CSB, I<sup>2</sup>C, DIN, SCLK)

| Parameter             | Symbol                | Conditions                | Min. | Typ. | Ma                   | Unit |
|-----------------------|-----------------------|---------------------------|------|------|----------------------|------|
| Serial data clock     | SCLK                  | SPI protocol              |      |      | 2                    | MHz  |
| Serial data clock     | SCL                   | I <sup>2</sup> C protocol |      |      | 400                  | kHz  |
| Input high voltage    | V <sub>IH</sub>       | Pins CSB                  | 80%  |      | 100% V <sub>DD</sub> | V    |
| Input low voltage     | V <sub>IL</sub>       |                           | 0%   |      | 20% V <sub>DD</sub>  | V    |
| Input leakage current | I <sub>leak25°C</sub> | at 25°C                   |      |      | 0.1                  | μA   |
|                       | I <sub>leak85°C</sub> |                           |      |      | 5                    |      |
| Input capacitance     | C <sub>IN</sub>       |                           |      |      | 6                    | pF   |

### PRESSURE OUTPUTS (I<sup>2</sup>C, DOUT)

| Parameter           | Symbo             | Conditions                   | Min.                | Ty | M                   | Unit |
|---------------------|-------------------|------------------------------|---------------------|----|---------------------|------|
| Output high voltage | V <sub>OH</sub>   | I <sub>source</sub> = 0.6 mA | 80% V <sub>DD</sub> |    | 100%                | V    |
| Output low voltage  | V <sub>OL</sub>   | I <sub>sink</sub> = 0.6 mA   | 0% V <sub>DD</sub>  |    | 20% V <sub>DD</sub> | V    |
| Load capacitance    | C <sub>LOAD</sub> |                              |                     |    | 1                   | pF   |

## FUNCTIONAL DESCRIPTION

### GENERAL

The MS5525DSO consists of a piezo-resistive sensor and a sensor interface IC. The main function of the MS5525DSO is to convert the uncompensated analog output voltage from the piezo-resistive pressure sensor to a 24-bit digital value, as well as providing a 24-bit digital value for the temperature of the sensor.

### FACTORY CALIBRATION

Every module is individually factory calibrated at two temperatures and three pressures. As a result, six coefficients necessary to compensate for process variations and temperature variations are calculated and stored in the 128-bit PROM of each module. These bits, partitioned into six coefficients, C1 through C6, must be read by the microcontroller software and used in the program converting D1 and D2 into compensated pressure and temperature values.

The coefficients C0 and C7 are for factory calibration and CRC.

### SERIAL INTERFACE

The MS5525DSO has built in two types of serial interfaces: SPI and I<sup>2</sup>C. Pulling the Protocol Select pin PS to low selects the SPI protocol, pulling PS to high activates the I<sup>2</sup>C bus protocol.

| Pin PS | Mode             | Pins used           |
|--------|------------------|---------------------|
| High   | I <sup>2</sup> C | SDA, SCL CSB        |
| Low    | SPI              | SDI, SDO, SCLK, CSB |

### SPI MODE

The external microcontroller clocks in the data through the input SCLK (Serial CLock) and SDI (Serial Data In). In the SPI mode module can accept both mode 0 and mode 3 for the clock polarity and phase. The sensor responds on the output SDO (Serial Data Out). The pin CSB (Chip Select) is used to enable/disable the interface, so that other devices can talk on the same SPI bus. The CSB pin can be pulled high after the command is sent or after the end of the command execution (for example end of conversion). The best noise performance from the module is obtained when the SPI bus is idle and without communication to other devices during the ADC conversion.

### I<sup>2</sup>C MODE & ADDRESSING

The external microcontroller clocks in the data through the input SCL (Serial CLock) and SDA (Serial Data). The sensor responds on the same pin SDA which is bidirectional for the I<sup>2</sup>C bus interface. So this interface type uses only 2 signal lines and does not require a chip select, which can be favorable to reduce board space. In I<sup>2</sup>C -Mode the complement of the pin CSB (Chip Select) represents the LSB of the I<sup>2</sup>C address. It is possible to use two sensors with two different addresses on the I<sup>2</sup>C bus. The pin CSB must be connected to VDD or GND do not leave these pins unconnected.

| Pin CSB | Address (7 bits) |
|---------|------------------|
| High    | 0x76             |
| Low     | 0x77             |

## COMMANDS

The MS5525DSO has only five basic commands:

1. Reset
2. Read PROM (128 bit of calibration words)
3. D1 conversion
4. D2 conversion
5. Read ADC result (24 bit pressure / temperature)

Size of each command is 1 byte (8 bits) as described in the table below. After ADC read commands the device will return 24 bit result and after the PROM read 16bit result. The address of the PROM is embedded inside of the PROM read command using the Ad2, Ad1 and Ad0 bits.

| Bit number            | Command byte |     |   |     |             |             |             |      | hex value       |
|-----------------------|--------------|-----|---|-----|-------------|-------------|-------------|------|-----------------|
|                       | 0            | 1   | 2 | 3   | 4           | 5           | 6           | 7    |                 |
| Bit name              | PRM          | COV | - | Typ | Ad2/<br>Os2 | Ad1/<br>Os1 | Ad0/<br>Os0 | Stop |                 |
| Command               |              |     |   |     |             |             |             |      |                 |
| Reset                 | 0            | 0   | 0 | 1   | 1           | 1           | 1           | 0    | 0x1E            |
| Convert D1 (OSR=256)  | 0            | 1   | 0 | 0   | 0           | 0           | 0           | 0    | 0x40            |
| Convert D1 (OSR=512)  | 0            | 1   | 0 | 0   | 0           | 0           | 1           | 0    | 0x42            |
| Convert D1 (OSR=1024) | 0            | 1   | 0 | 0   | 0           | 1           | 0           | 0    | 0x44            |
| Convert D1 (OSR=2048) | 0            | 1   | 0 | 0   | 0           | 1           | 1           | 0    | 0x46            |
| Convert D1 (OSR=4096) | 0            | 1   | 0 | 0   | 1           | 0           | 0           | 0    | 0x48            |
| Convert D2 (OSR=256)  | 0            | 1   | 0 | 1   | 0           | 0           | 0           | 0    | 0x50            |
| Convert D2 (OSR=512)  | 0            | 1   | 0 | 1   | 0           | 0           | 1           | 0    | 0x52            |
| Convert D2 (OSR=1024) | 0            | 1   | 0 | 1   | 0           | 1           | 0           | 0    | 0x54            |
| Convert D2 (OSR=2048) | 0            | 1   | 0 | 1   | 0           | 1           | 1           | 0    | 0x56            |
| Convert D2 (OSR=4096) | 0            | 1   | 0 | 1   | 1           | 0           | 0           | 0    | 0x58            |
| ADC Read              | 0            | 0   | 0 | 0   | 0           | 0           | 0           | 0    | 0x00            |
| PROM Read             | 1            | 0   | 1 | 0   | Ad2         | Ad1         | Ad0         | 0    | 0xA0 to<br>0xAE |

Figure 1: Command structure

**Start**  
5525DSO-pp005GS Example  
 $T_{min} = -40^{\circ}\text{C}$ ,  $T_{max} = 125^{\circ}\text{C}$

**Read Calibration Data from PROM**

| Variable | Coefficient Description                                    | Recommended Variable Type | Size <sup>[1]</sup> | Value |       | Example/ Typical |
|----------|--|---------------------------|---------------------|-------|-------|------------------|
|          |  |                           | [Bit]               | Min   | Max   |                  |
| C1       | Pressure Sensitivity   $\text{SENS}_{T1}$                  | unsigned int 16           | 16                  | 0     | 65535 | 36402            |
| C2       | Pressure Offset   $\text{OFF}_{T1}$                        | unsigned int 16           | 16                  | 0     | 65535 | 39473            |
| C3       | Temperature Coefficient of Pressure Sensitivity   TCS      | unsigned int 16           | 16                  | 0     | 65535 | 40393            |
| C4       | Temperature Coefficient of Pressure Offset   TCO           | unsigned int 16           | 16                  | 0     | 65535 | 29523            |
| C5       | Reference Temperature   $T_{REF}$                          | unsigned int 16           | 16                  | 0     | 65535 | 29854            |
| C6       | Temperature Coefficient of Temperature   $\text{TEMPSENS}$ | unsigned int 16           | 16                  | 0     | 65535 | 21917            |

**Read Digital Pressure and Temperature Data**

|    |                           |                 |    |   |          |         |
|----|---------------------------|-----------------|----|---|----------|---------|
| D1 | Digital Pressure Value    | unsigned int 32 | 24 | 0 | 16777216 | 5240585 |
| D2 | Digital Temperature Value | unsigned int 32 | 24 | 0 | 16777216 | 3869265 |

**Calculate Temperature**

|      |   |               |    |           |          |                   |
|------|---|---------------|----|-----------|----------|-------------------|
| dT   | Difference between actual and reference temperature<br>$dT = D2 - T_{REF} = D2 - C5 * 2^{Q5}$               | signed int 32 | 25 | -16776960 | 16777216 | 47953             |
| TEMP | Measured temperature<br>$\text{TEMP} = 20^{\circ}\text{C} + dT * \text{TEMPSENS} = 2000 + dT * C6 / 2^{Q6}$ | signed int 32 | 41 | -4000     | 12500    | 2501<br>=25.01 °C |

**Calculate Temperature Compensated Pressure**

|      |   |               |    |  |  |                     |
|------|---|---------------|----|--|--|---------------------|
| OFF  | Offset at actual temperature<br>$\text{OFF} = \text{OFF}_{T1} + \text{TCO} * dT = C2 * 2^{Q2} + (C4 * dT) / 2^{Q4}$         | signed int 64 | 41 |  |  | 5218046194          |
| SENS | Sensitivity at actual temperature<br>$\text{SENS} = \text{SENS}_{T1} + \text{TCS} * dT = C1 * 2^{Q1} + (C3 * dT) / 2^{Q3}$  | signed int 64 | 41 |  |  | 2415906558          |
| P    | Temperature Compensated Pressure<br>$P = D1 * \text{SENS} - \text{OFF} = (D1 * \text{SENS} / 2^{21} - \text{OFF}) / 2^{15}$ | signed int 32 | 61 |  |  | 24996<br>=2.4996psi |

**Display Pressure and Temperature Value**

Figure 2: Flow chart for pressure and temperature reading and software compensation.

**Qx Coefficients Matrix by Pressure Range**

| Part Number     | Pmin | Pmax | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | T <sub>RES</sub><br>(°C) | P <sub>RES</sub><br>(PSI) |
|-----------------|------|------|----|----|----|----|----|----|--------------------------|---------------------------|
| 5525DSO-pp001DS | -1   | 1    | 15 | 17 | 7  | 5  | 7  | 21 | 0.01                     | 0.0001                    |
| 5525DSO-pp002GS | 0    | 2    | 14 | 16 | 8  | 6  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp002DS | -2   | 2    | 16 | 18 | 6  | 4  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp005GS | 0    | 5    | 16 | 17 | 6  | 5  | 7  | 21 | 0.01                     | 0.0001                    |
| 5525DSO-pp005DS | -5   | 5    | 17 | 19 | 5  | 3  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp015GS | 0    | 15   | 16 | 17 | 6  | 5  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp015AS | 0    | 15   | 16 | 17 | 6  | 5  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp015DS | -15  | 15   | 17 | 19 | 5  | 3  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp030AS | 0    | 30   | 17 | 18 | 5  | 4  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp030GS | 0    | 30   | 17 | 18 | 5  | 4  | 7  | 22 | 0.01                     | 0.0001                    |
| 5525DSO-pp030DS | -30  | 30   | 18 | 21 | 4  | 1  | 7  | 22 | 0.01                     | 0.0001                    |

**MEMORY MAPPING**

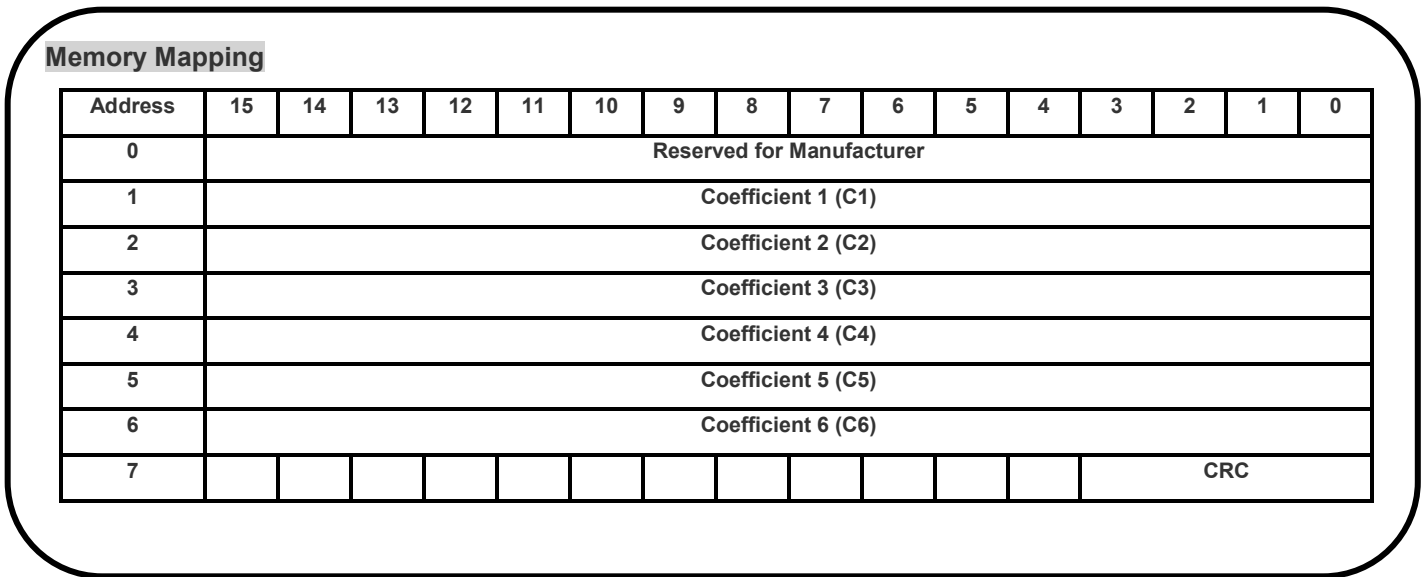


Figure 3: Memory PROM Mapping

Notes

[1] Maximal size of intermediate result during evaluation of variable.



## SPI INTERFACE

### RESET SEQUENCE

The Reset sequence shall be sent once after power-on to make sure that the calibration PROM gets loaded into the internal register. It can be also used to reset the device ROM from an unknown condition

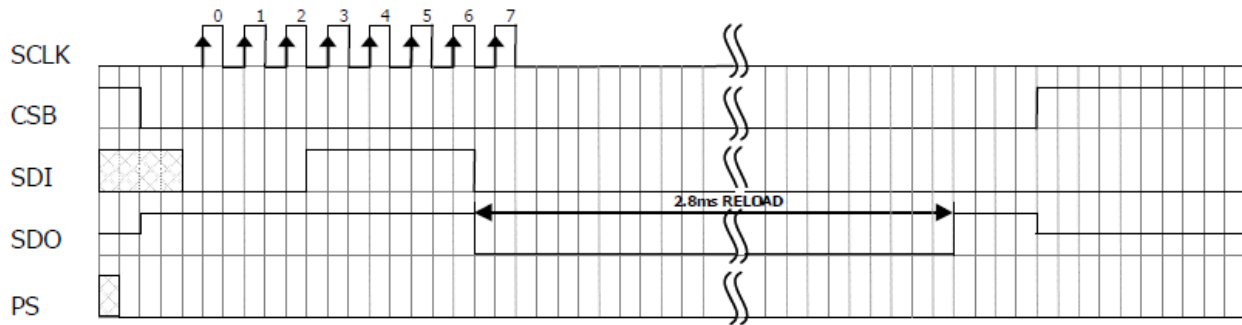


Figure 5: Reset command sequence SPI mode 0

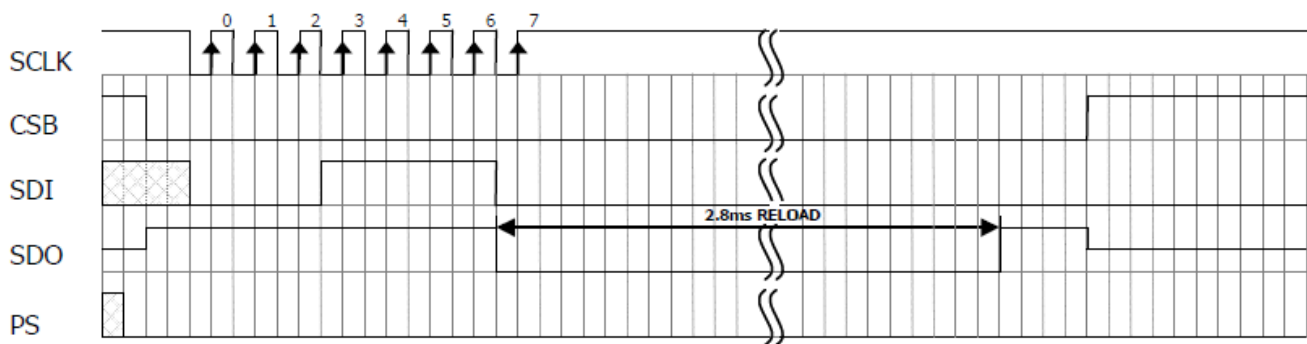


Figure 6: Reset command sequence SPI mode 3

### CONVERSION SEQUENCE

The conversion command is used to initiate uncompensated pressure (D1) or uncompensated temperature (D2) conversion. The chip select can be disabled during this time to communicate with other devices. After the conversion, using ADC read command the result is clocked out with the MSB first. If the conversion is not executed before the ADC read command, or the ADC read command is repeated, it will give 0 as the output result. If the ADC read command is sent during conversion the result will be 0, the conversion will not stop and the final result will be wrong. Conversion sequence sent during the already started conversion process will yield incorrect result as well.

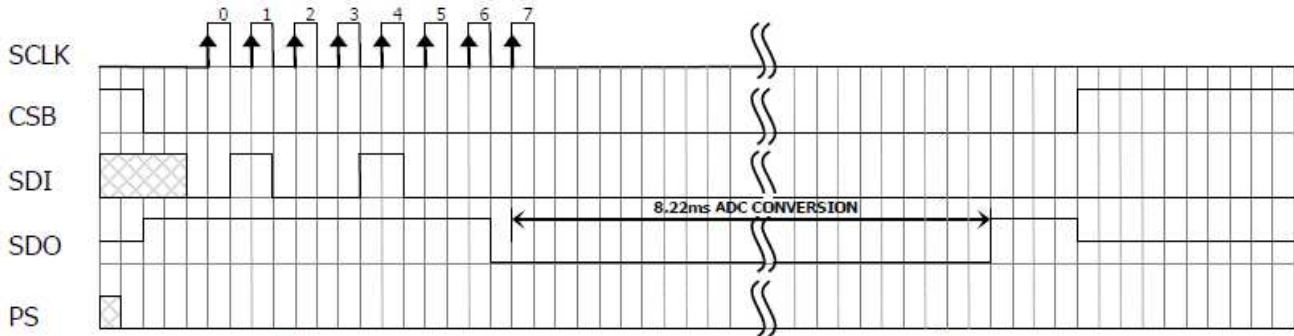


Figure 7: Conversion out sequence, Typ=d1, OSR = 4096

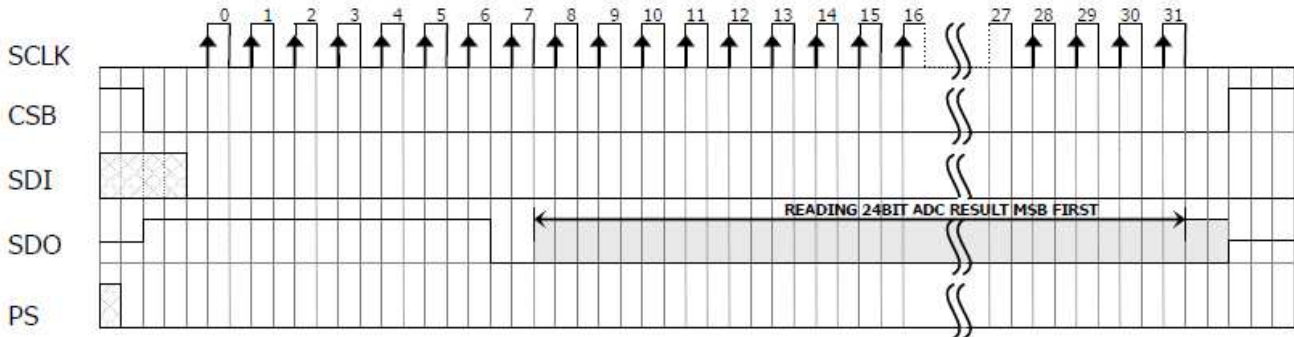


Figure 8: ADC Read sequence

### PROM READ SEQUENCE

The read command for PROM shall be executed once after reset by the user to read the content of the calibration PROM and to calculate the calibration coefficients. There are in total 8 addresses resulting in a total memory of 128 bit. Address 0 contains factory data and the setup, addresses 1-6 calibration coefficients and address 7 contains the serial code and CRC. The command sequence is 8 bits long with a 16 bit result which is clocked with the MSB first.

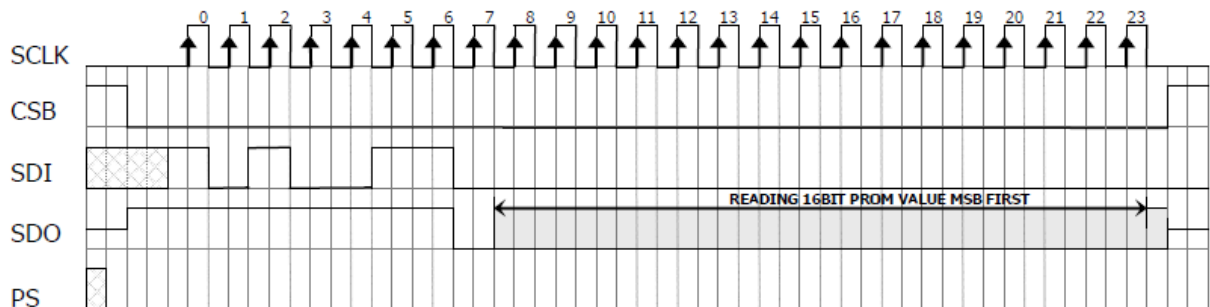


Figure 9: PROM Read sequence, address = 011 (Coefficient 3).

## I<sup>2</sup>C INTERFACE

### COMMANDS

Each I<sup>2</sup>C communication message starts with the start condition and it is ended with the stop condition. The MS5525DSO address is 111011Cx, where C is the complementary value of the pin CSB. Since the IC does not have a microcontroller inside, the commands for I<sup>2</sup>C and SPI are quite similar.

### RESET SEQUENCE

The reset can be sent at any time. In the event that there is not a successful power on reset this may be caused by the SDA being blocked by the module in the acknowledge state. The only way to get the MS5525DSO to function is to send several SCLKs followed by a reset sequence or to repeat power on reset.

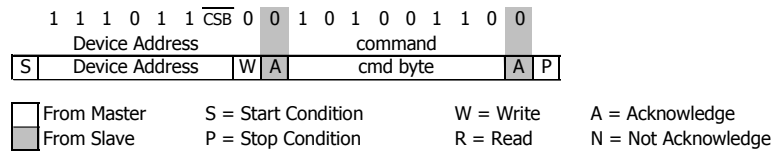


Figure 10: I2C Reset Command

### PROM READ SEQUENCE

The PROM Read command consists of two parts. First command sets up the system into PROM read mode. The second part gets the data from the system.

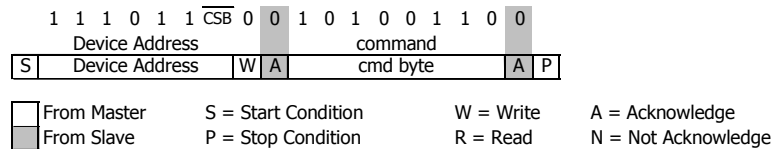


Figure 11: I2C Command to read memory address= 011 (Coefficient 3)

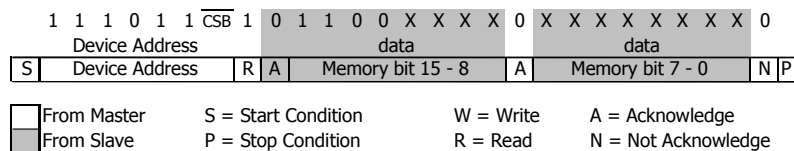


Figure 12: I2C response from MS5525DSO

## CONVERSION SEQUENCE

A conversion can be started by sending the command to MS5525DSO. When command is sent to the system it stays busy until conversion is done. When conversion is finished the data can be accessed by sending a Read command, when an acknowledge appears from the MS5525DSO, 24 SCLK cycles may be sent to receive all result bits. Every 8-bit the system waits for an acknowledge signal.

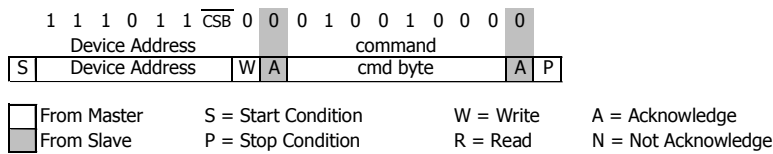


Figure 13: I<sup>2</sup>C Command to initiate a pressure conversion (OSR=4096, typ=D1)

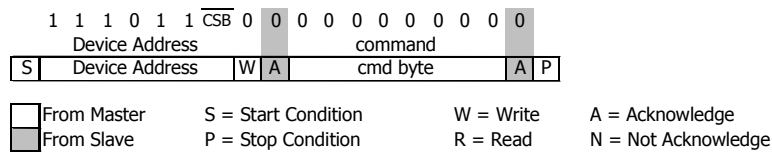


Figure 14: I<sup>2</sup>C ADC read sequence

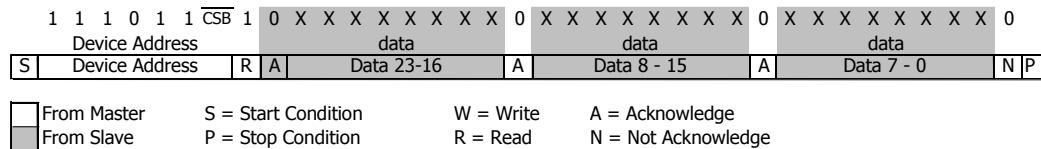
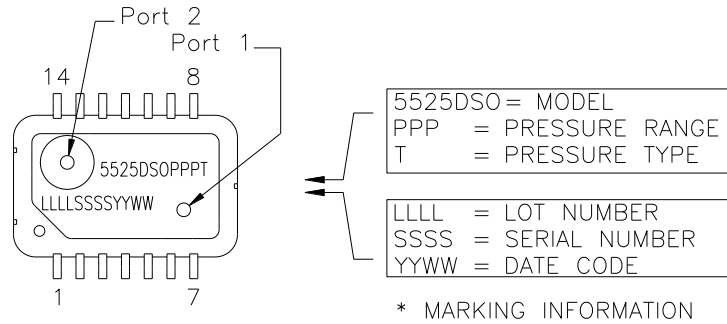


Figure 15: I<sup>2</sup>C response from MS5525DSO

## CYCLIC REDUNDANCY CHECK (CRC)

MS5525DSO contains a PROM memory with 128-Bit. A 4-bit CRC has been implemented to check the data validity in memory. The application note AN520 describes in detail CRC-4 code used.

## MARKING, AND PRESSURE TYPE CONFIGURATION



| Pressure Type                  | Pmin    | Pmax    | Description  |
|--------------------------------|---------|---------|--|
| Absolute                       | 0psiA   | +Prange | Output is proportional to the difference between 0psiA (Pmin) and pressure applied to Port 1.  |
| Differential/<br>Bidirectional | -Prange | +Prange | Output is proportional to the difference between Port 1 and Port 2. Output swings positive when Port 2 > Port 1. Output is 50% of total counts when Port 1 = Port 2. |
| Gauge                          | 0psiG   | +Prange | Output is proportional to the difference between 0psiG (Pmin) and Port 1. Output swings positive when Port 2 > Port 1.   |

## WETTED MATERIAL BY PORT DESIGNATION

| Material Style | Port   | Material |                    |       |     |       |         |              |
|----------------|--------|----------|--------------------|-------|-----|-------|---------|--------------|
|                |        | LCP      | Thermo-Epoxy Resin | Epoxy | RTV | Glass | Silicon | Silicone Gel |
| All            | Port 1 | X        | X                  | X     |     |       |         | X            |
|                | Port 2 | X        | X                  | X     | X   | X     | X       |              |

"X" Indicates Wetted Materials

## PINOUT DESIGNATION

| Pin Name | Pin   | Function  |                          |
|----------|-------|---|--------------------------|
|          |       | I <sup>2</sup> C  | SPI                      |
| SIN-     | 1,3   | Sensor Input, Negative                                      | Sensor Input, Negative   |
| SOUT-    | 2,4   | Sensor Outputs, Negative                                    | Sensor Outputs, Negative |
| SDO      | 5     | Not Applicable  | Serial Data Output       |
| SDA/SDI  | 6     | I <sup>2</sup> C Data Input and Output                      | SPI Serial Data Input    |
| SCL/SCLK | 7     | I <sup>2</sup> C Clock                                      | SPI Clock                |
| CSB      | 8     | Defines I <sup>2</sup> C Address                            | Chip Select (Active Low) |
| Supply - | 9     | Return Supply Voltage                                       | Return Supply Voltage    |
| PS       | 10    | Protocol Select   |                          |
|          |       | PS = (VDD)  | PS = (GND)               |
|          |       | I <sup>2</sup> C Protocol Selected                          | SPI Protocol Selected    |
|          |       | CSB= (VDD) I <sup>2</sup> C Address = 1110110X (0xEC, 0xED) |                          |
|          |       | CSB= (GND) I <sup>2</sup> C Address = 1110111X (0xEE, 0xEF) |                          |
| Supply + | 11,13 | Positive Supply Voltage                                     | Positive Supply Voltage  |
| SOUT+    | 12,14 | Sensor Outputs, Positive                                    | Sensor Outputs, Positive |

**BLOCK DIAGRAM**

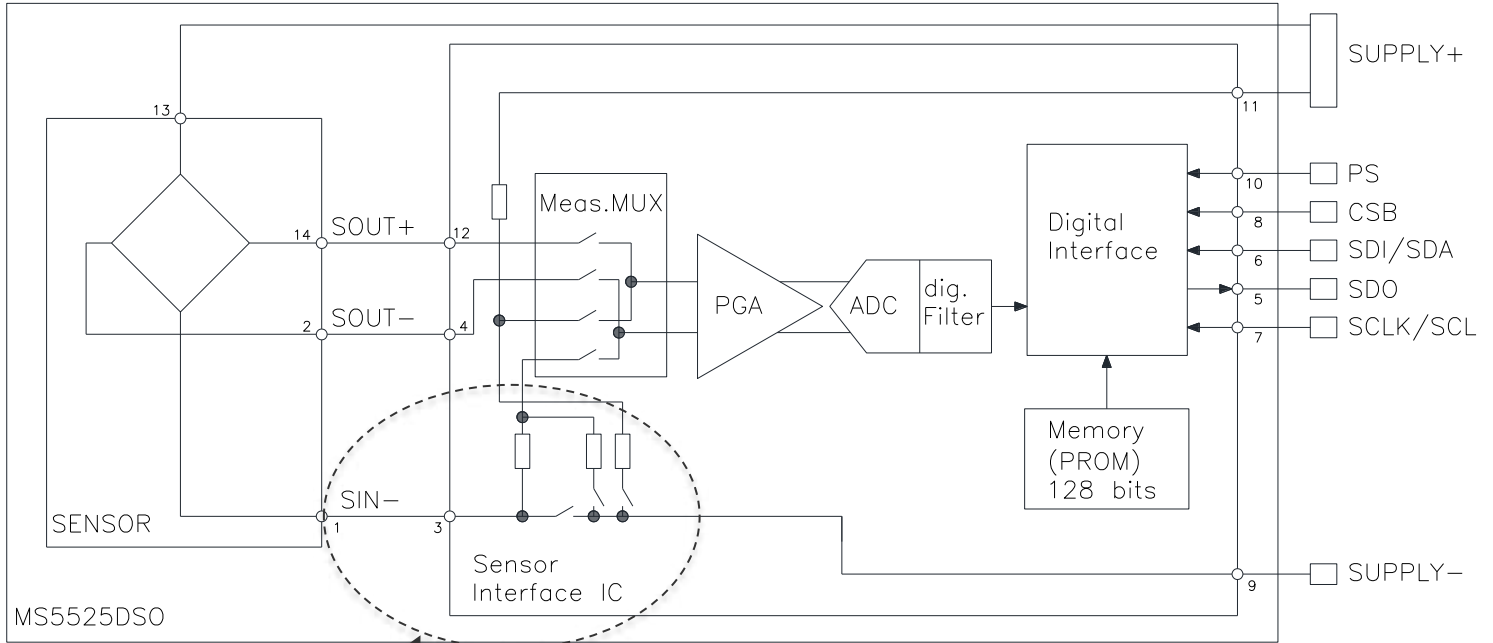


Figure 4: Block diagram of MS5525DSO

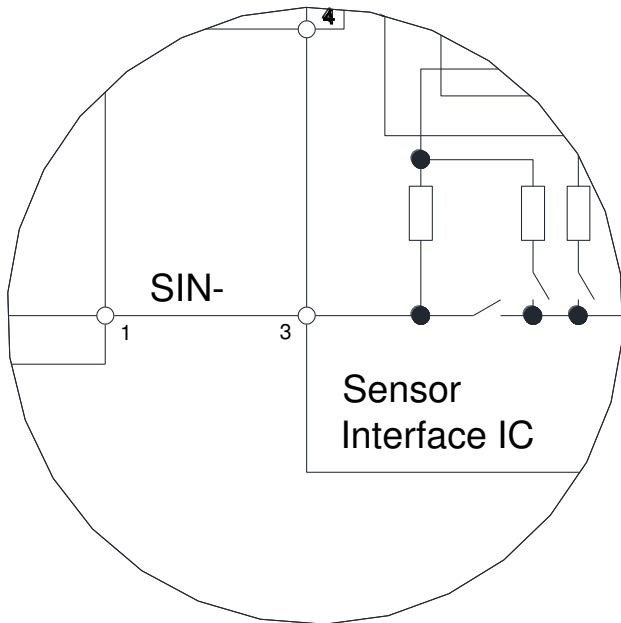


Figure 5: SIN- Pins 1 and 3 of MS5525DSO

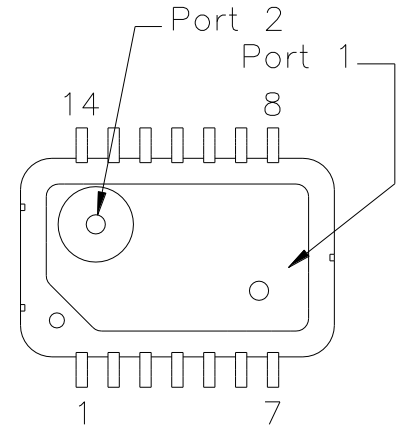
**NOTE:**

**DO NOT CONNECT SIN- to SUPPLY-**

This will short the internal switch within the sensor interface IC resulting in a disruption of the temperature measurements.

**Table B**

| Pad No. | Function | Notes             |
|---------|----------|-------------------|
| 1       | SIN-     | Connect to Pin 3  |
| 2       | SOUT-    | Connect to Pin 4  |
| 3       | SIN-     | Connect to Pin 1  |
| 4       | SOUT-    | Connect to Pin 2  |
| 5       | SDO      |                   |
| 6       | SDI/SDA  |                   |
| 7       | SCLK/SCL |                   |
| 8       | CSB      |                   |
| 9       | SUPPLY-  |                   |
| 10      | PS       |                   |
| 11      | SUPPLY+  | Connect to Pin 13 |
| 12      | SOUT+    | Connect to Pin 14 |
| 13      | SUPPLY+  | Connect to Pin 11 |
| 14      | SOUT+    | Connect to Pin 12 |

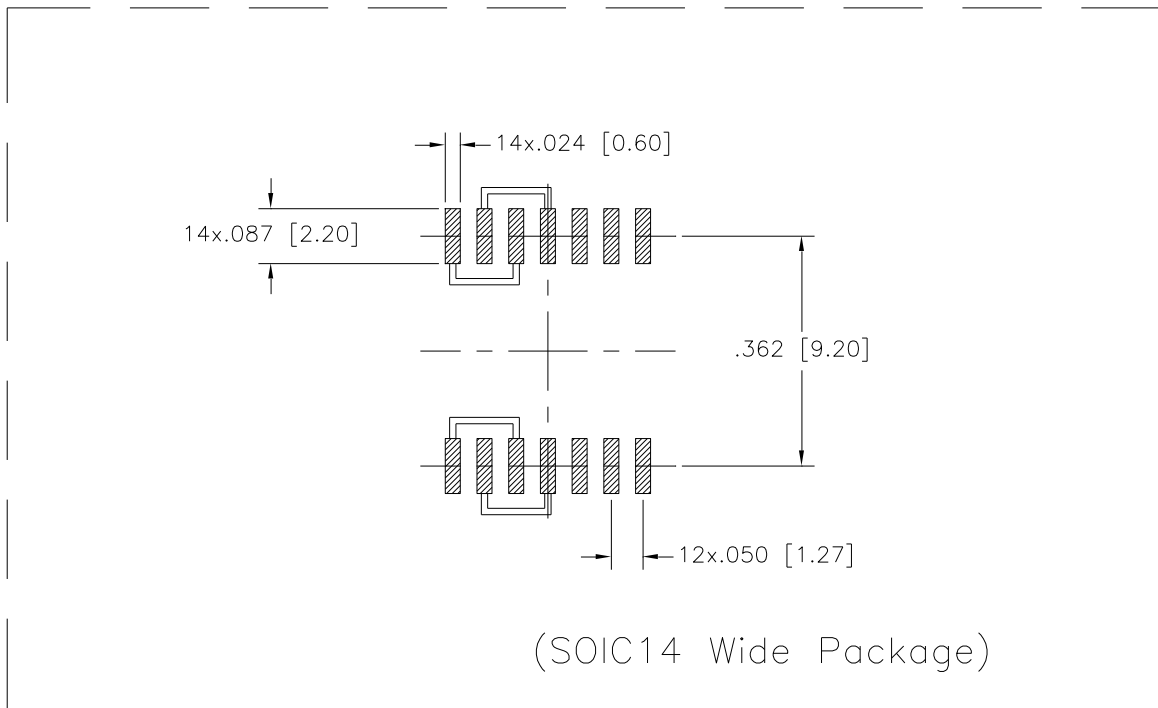


**Notes:**

[1] Function pins that share the same name (SOUT+, SOUT-, SIN-, SUPPLY+) must be connected on the PCB for proper operation, as described in the ‘Notes’ column of Table B.

[2] Must place a 0.1µf decoupling capacitor between VDD and GND on PCB and as close as possible to sensor.

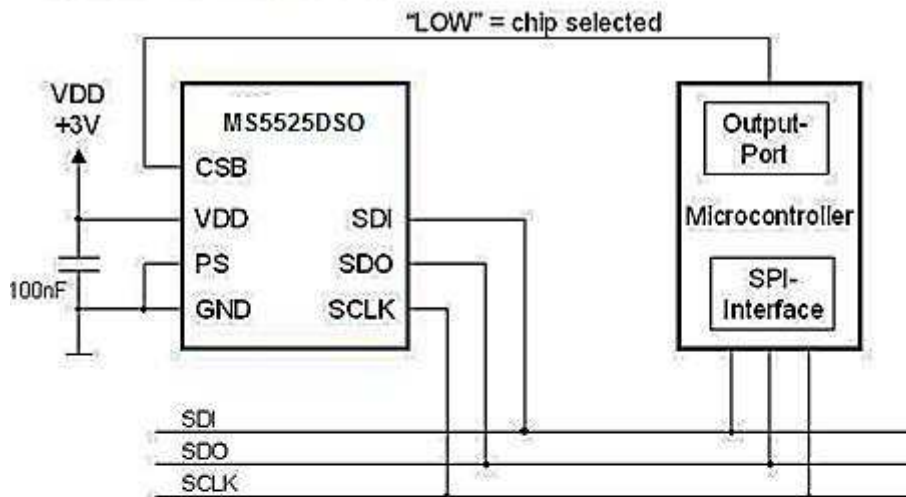
**RECOMMEND PCB LAYOUT**



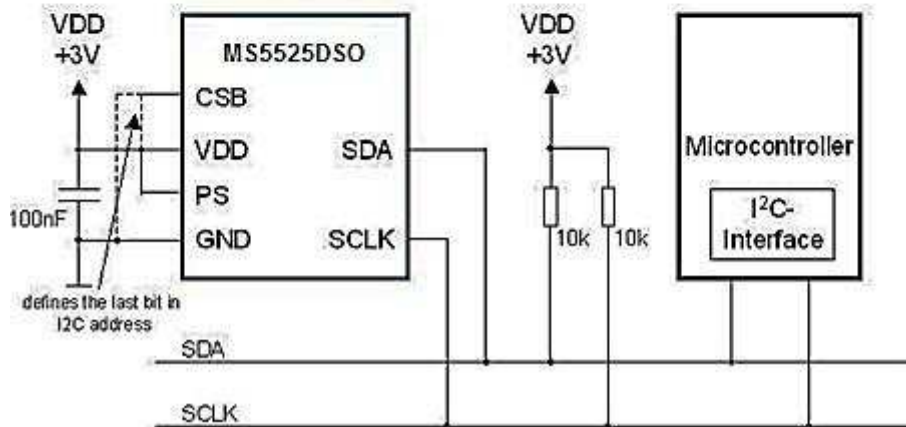
## APPLICATION CIRCUIT

The MS5525DSO is a circuit that can be used in conjunction with a microcontroller. It is designed for low-voltage systems with a supply voltage of 3 V.

### SPI protocol communication



### I<sup>2</sup>C protocol communication



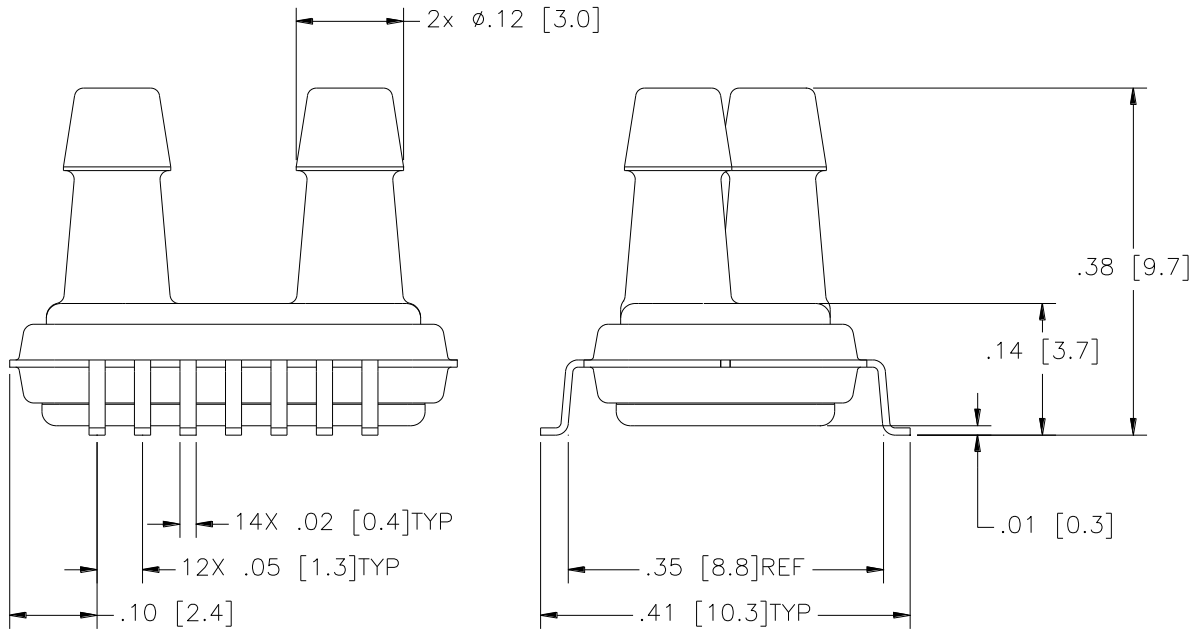
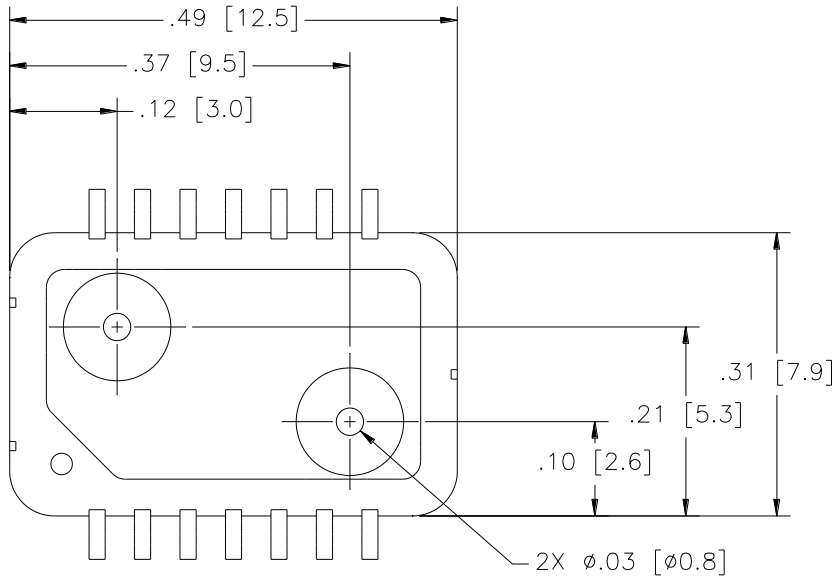
#### Note:

1. Place 100nF capacitor between Supply and GND to within 2cm of sensor

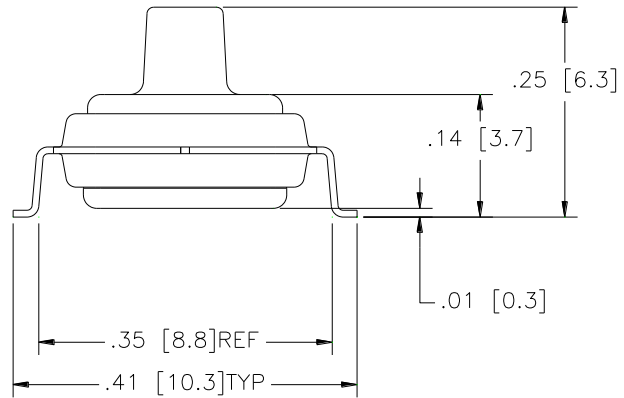
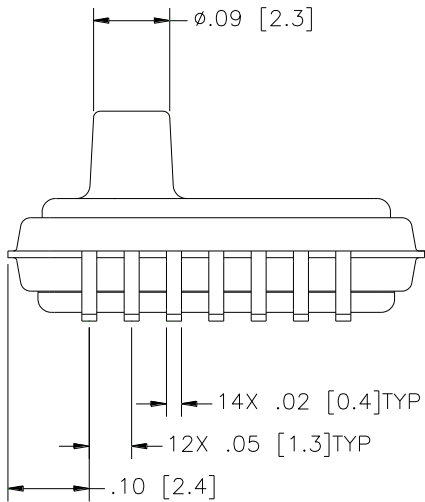
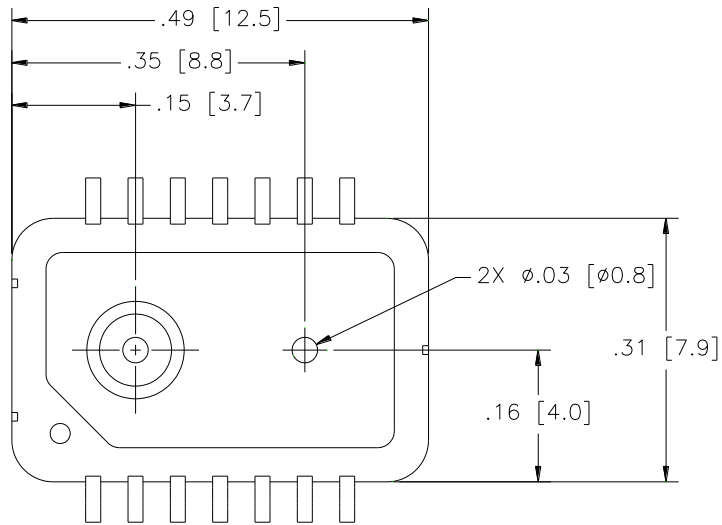


**DIMENSIONS**

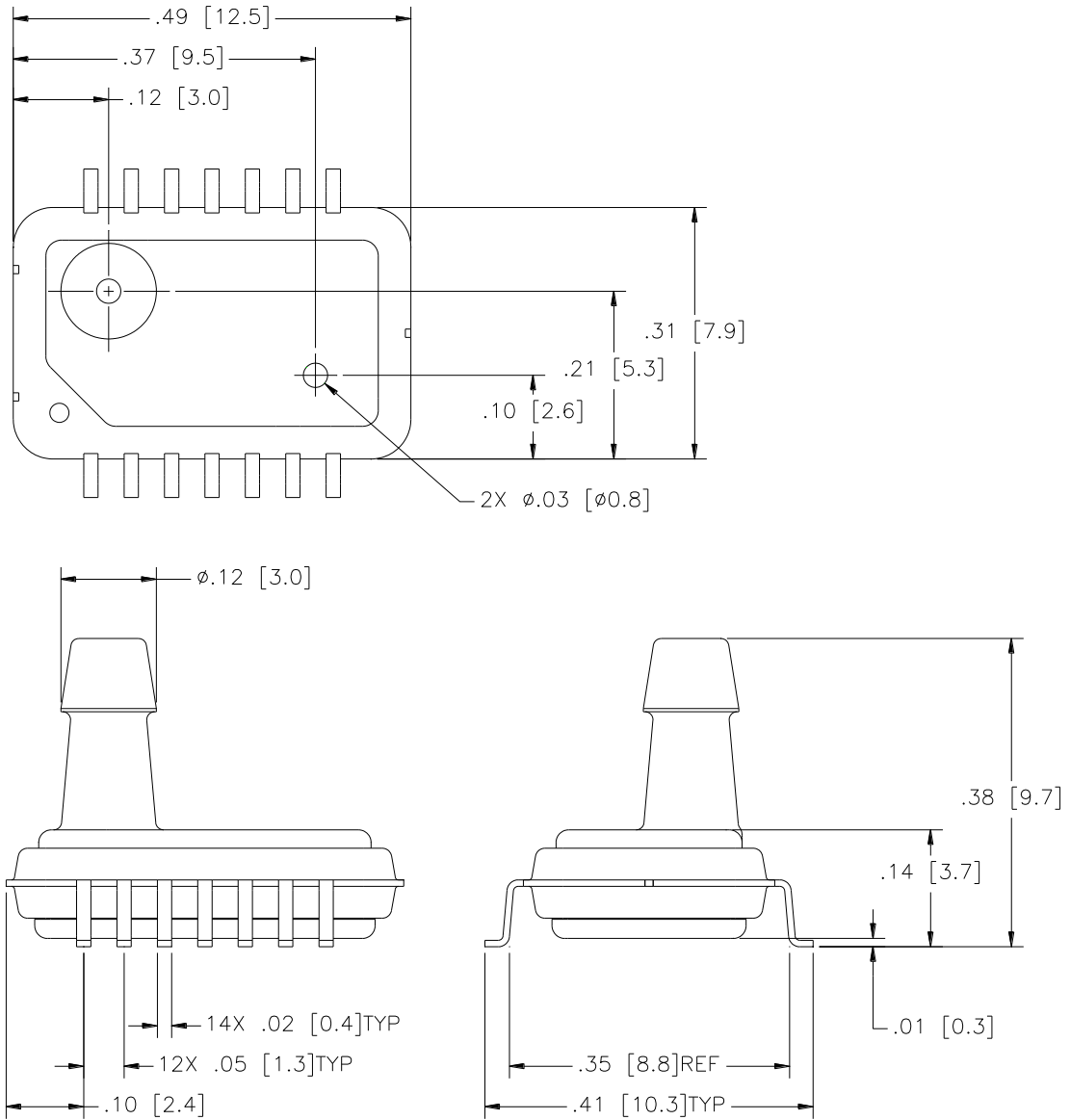
**MS5525DSO-DBxxxS**



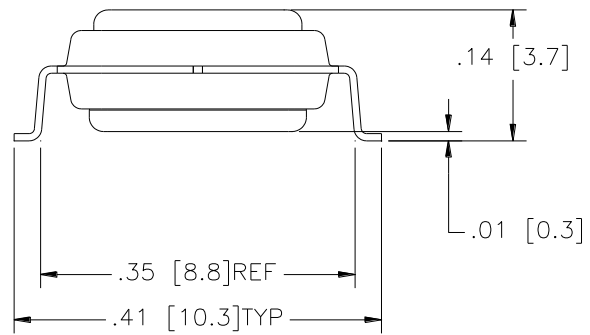
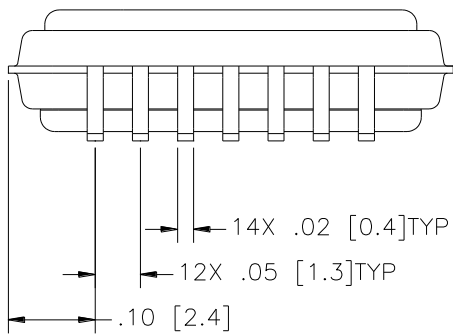
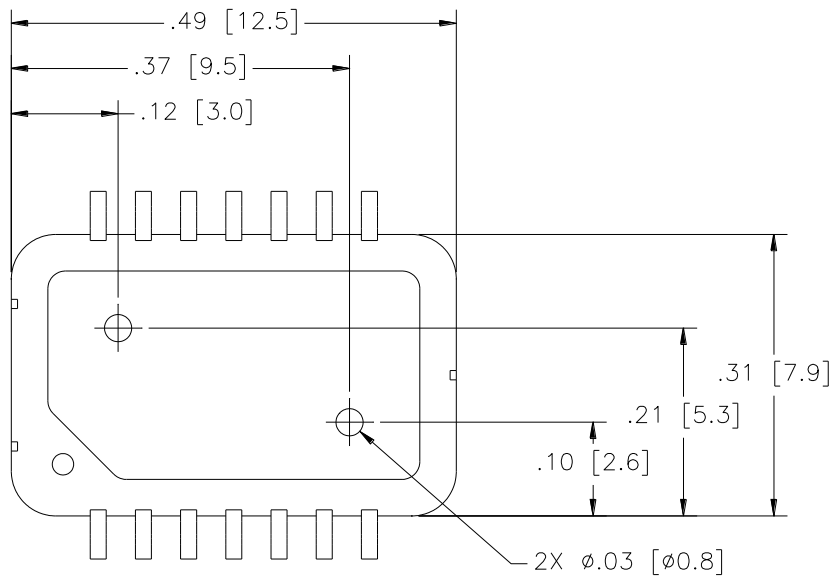
**MS5525DSO-STxxxS**



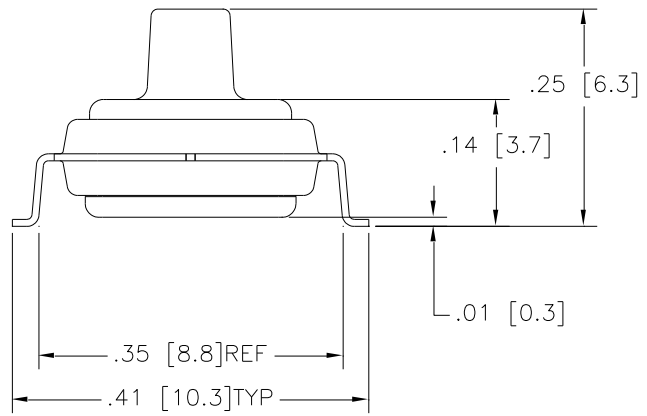
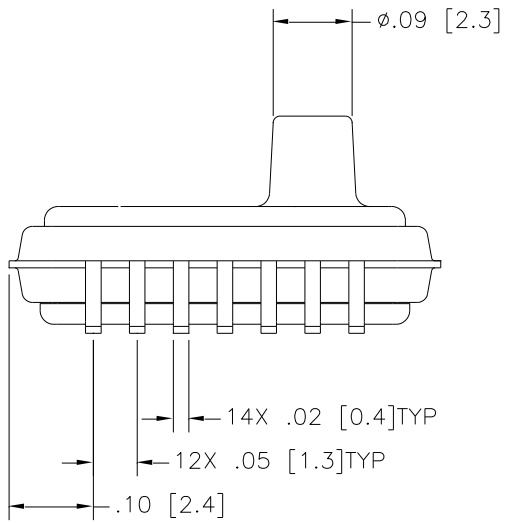
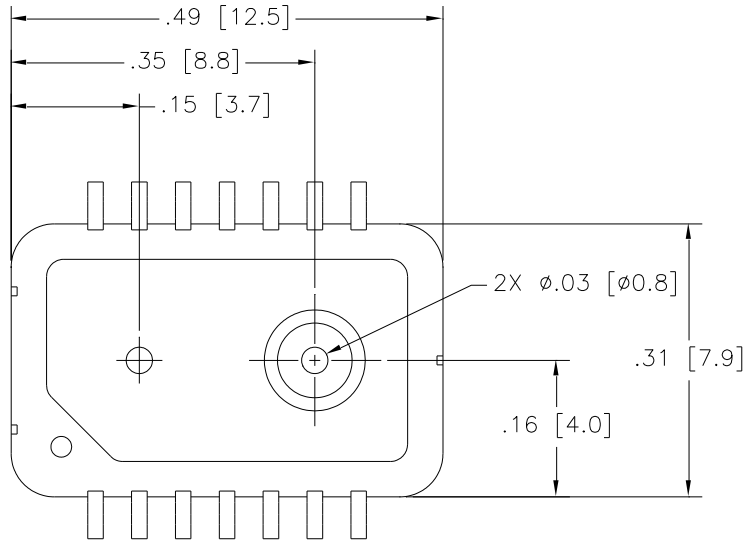
**MS5525DSO-SBxxxS**



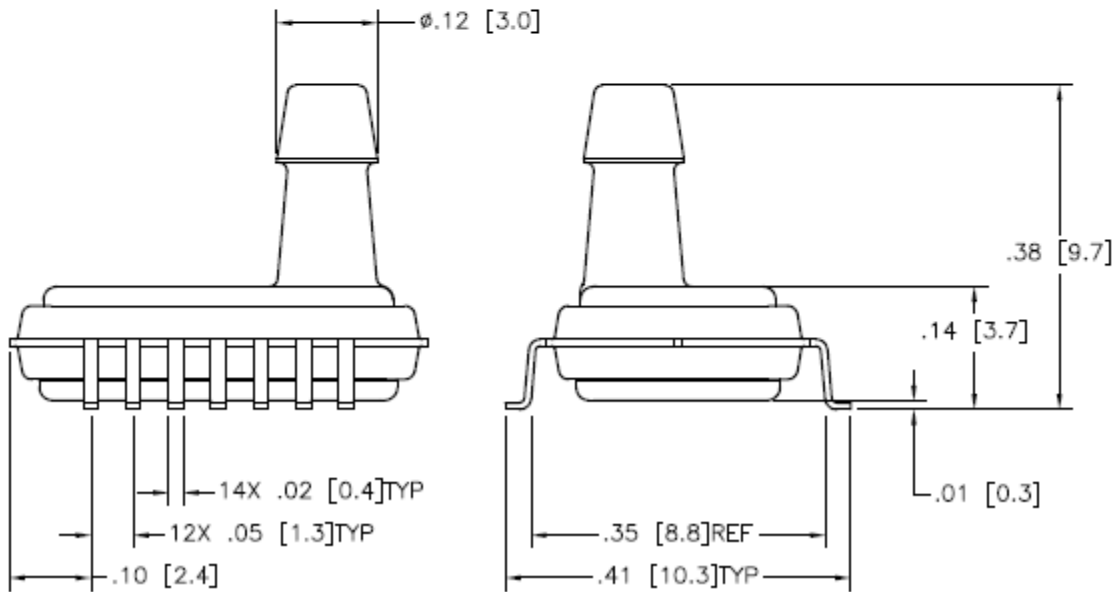
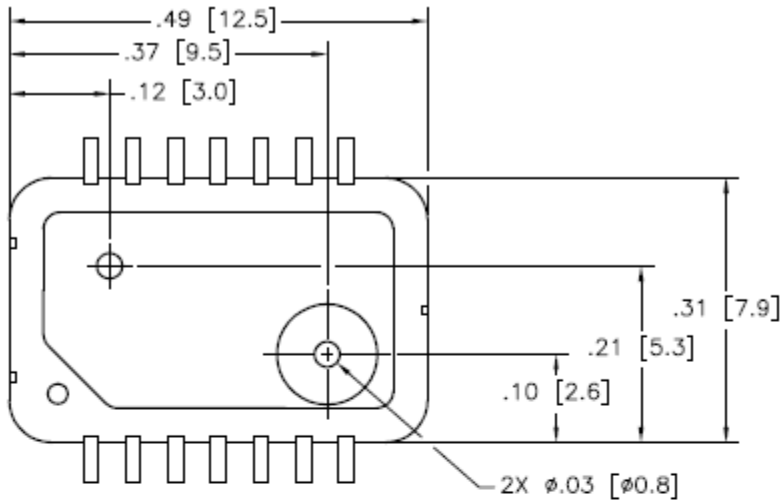
**MS5525DSO-DHxxxS**



**MS5525DSO-FTxxxS**



**MS5525DSO-FBxxxS**



## ORDERING INFORMATION

5525DSO – DB 005 G S

| Package Style |                   |
|---------------|-------------------|
| <b>DB</b>     | Dual Barb         |
| <b>SB</b>     | Single Barb       |
| <b>ST</b>     | Single Tube       |
| <b>DH</b>     | Dual Hole         |
| <b>FT</b>     | Front Tube        |
| <b>FB</b>     | Front Single Barb |

| Pressure Range (psi) |
|----------------------|
| 001 <sup>(1)</sup>   |
| 002 <sup>(2)</sup>   |
| 005 <sup>(2)</sup>   |
| 015                  |
| 030                  |

<sup>(1)</sup>Available only in Differential Pressure Type

<sup>(2)</sup>Available in Differential and Gauge Pressure Types

| Pin Style |           |
|-----------|-----------|
| <b>S</b>  | Gull Wing |

| Pressure Type |              |
|---------------|--------------|
| <b>G</b>      | Gage         |
| <b>A</b>      | Absolute     |
| <b>D</b>      | Differential |

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