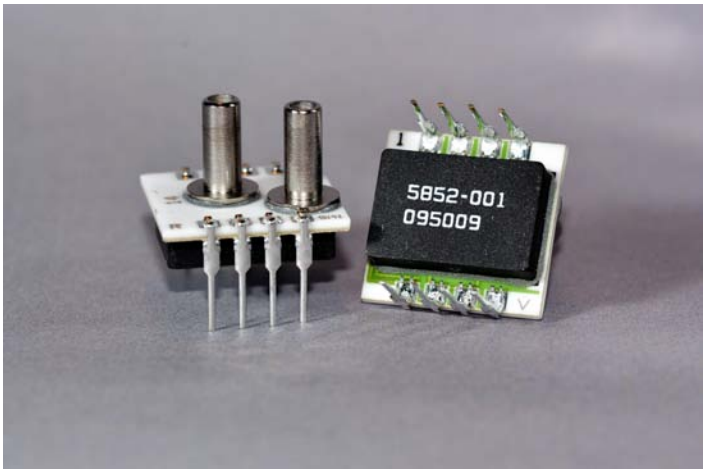
SIGNAL-CONDITIONED ULTRA-LOW PRESSURE SENSOR

PRESSURE SENSORS

Product Number: SM5852-001

HIGHLIGHTS

- Fully amplified, pressure calibrated and temperature compensated in a single package
- Both analog and digital pressure output with access to temperature signal-conditioned digital analog and digital pressure output
- Available for differential, gauge & single-ended applications
- 2nd Generation ceramic package and tubes for high reliability
- Rugged and highly stable ceramic package
- Unique low-pressure die allows for a full-scale pressure range of 0-0.15 PSI (1.0 kPa)



TYPICAL APPLICATIONS

- Barometric measurement
- Medical instrumentation
- Pneumatic control
- Gas flow
- Heating, Ventilation and Air Conditioning (HVAC)

TECHNICAL FEATURES

- Amplified, calibrated, fully signal-conditioned output span of 4.0 VDC full-scale
- Analog and digital temperature compensated and calibrated pressure available
- Multi-order correction for pressure non-linearity and for temperature coefficient of span and offset (factory programmed)
- Digital read-out through I^2C interface
- Output is ratiometric with supply voltage
- Variety of versions (differential, gauge, and single-ended), depending on the pressure range

DESCRIPTION

The Silicon Microstructures SM5852 series of OEM pressure sensors combines state-of-the-art pressure sensor technology with CMOS mixed signal processing technology to produce an amplified, fully conditioned, multi-order pressure and temperature compensated sensor in a dual in-line package (DIP) configuration.

Combining the pressure sensor with a custom signal conditioning ASIC in a single package simplifies the use of advanced silicon micromachined pressure sensors. The pressure sensor can be mounted directly to a standard printed circuit board and an amplified, high-level, calibrated pressure signal can be acquired from the digital interface or analog output. This eliminates the need for additional circuitry, such as a compensation network or micro-controller containing a custom correction algorithm.

The SM5852 Series pressure sensors are based on SMI's highly stable, piezoresistive pressure sensor chips mounted on a ceramic substrate.

The model SM5852 is designed for operating pressure ranges of 0-0.15 PSI (1.0 kPa).

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ABSOLUTE MAXIMUM RATING TABLE FOR SM5852
All parameters are specifed at VSUPPLY = 5.00 V DC supply at room temperature, unless otherwise noted.

No.	Characteristic	Symbol	Minimum	Typical	Maximum	Units
1	Excitation Voltage[a, b]	V_{SUPPLY}	4.75	5.00	5.25	V
2	Current Consumption[c]	I_{SUPPLY}		7	10	mA
3	Proof Pressure[d, e]	p_{PROOF}	10x			p_{RANGE}
4	Burst Pressure[d, e]	p_{BURST}	15x			p_{RANGE}
5	Operating Temperature[f]	T_{OP}	-40		+125	°C
6	Storage Temperature[f]	T_{STG}	-40		+150	°C
7	Media Compatibility[f, g]					

OPERATING CHARACTERISTICS FOR SM5852 - SPECIFICATIONS
All parameters are specifed at VSUPPLY = 5.00 V DC supply at room temperature, unless otherwise noted.

Gauge & Single-ended[h] Pressure Sensors

No.	Characteristic	Symbol	Minimum	Typical	Maximum	Units
8	Span (FS p_{RANGE})[a, b, d, e, i]	V_{SPAN}	3.80	4.00	4.20	V FS
9	Zero Offset[j, k]	V_{ZERO}	0.42	0.50	0.58	V
10	Total Accuracy[f, l]	ACC_{RSS}			2.0	%FS
11	Pressure Response Time[f, m]	t_{RESP}		2		ms
12	Warm-up Deviation[f, n]	ACC_{WUD}		0.4		%FS
13	Linearity[o]	NL	-1.3		1.3	%FS
14	Compensated Temp. Range	T_{COMP}	15		75	°C

Differential[b] Pressure Sensors

No.	Characteristic	Symbol	Minimum	Typical	Maximum	Units
15	Span (FS p_{RANGE})[a, b, d, e, i]	V_{SPAN}	1.90	2.00	2.10	V FS
16	Zero Offset[j, k]	V_{ZERO}	2.42	2.50	2.58	V
17	Total Accuracy[f, l]	ACC_{RSS}			2.0	%FS
18	Pressure Response Time[f, m]	t_{RESP}		2		ms
19	Warm-up Deviation[f, n]	ACC_{WUD}		0.4		%FS
20	Linearity[o]	NL	-1.3		1.3	%FS
21	Compensated Temp. Range	T_{COMP}	15		75	°C

Digital Interface Information

For digital interface guidelines and recommendations, please refer to Application Note: AN01 – 10.

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NOTES:

(a) Specified parameter values will not be met when supply voltage is not 5.00 V.

(b) A 100 nF filter capacitor (capacitor type: X7R or X2Y) must be placed between VDD and GND in a maximum distance of 5 mm. See wiring diagram for optimal signal conditioning of the pressure device.

(c) Operating values for the current consumption. The current draw may be higher upon power-up of the device.

(d) For the SM5852 series the specified values apply for positive (top side) pressure only.

(e) The output voltage value will saturate at about 4.75 V for applied pressure above the rated full-scale.

(f) Tested on a sample basis.

(g) Clean, dry gas compatible with wetted materials. Wetted materials include Pyrex glass, silicon, alumina ceramic, epoxy, RTV, gold, aluminum, and nickel.

(h) Single-ended parts (pressure type - S) have 2 ports and are for higher gain differential applications, where the differential pressure is always positive.

(i) Full-scale (FS) is defined as zero pressure to rated pressure; differential parts can be used ±FS. Gauge zero output is 0.5 V, typical, and full-scale output is typically 4.5 V. Span is the difference between full-scale output and zero output, (typical 4 V). For differential parts, the negative full-scale is typically at 0.5 V, zero is typically 2.5 V, and positive (topside) full-scale is 4.5 volts, typical, to give a span of ±2.0 V, typical.

(j) Due to the sensitivity of the SM5852 series, external mechanical stresses and mounting position can affect the zero pressure output reading.

(k) The output offset voltage value will saturate at about 0.25 V for applied pressure below the pressure-type related minimum pressure value.

(l) The total accuracy is defined by the root of the sum of the squares (RSS) of the individual components contributing to the total error. The main contributors are the temperature coefficient of zero offset (TCZ), the temperature coefficient of span (TCS), the non-linearity (NL), the temperature (Tp) and the pressure hysteresis (Hp). The given value applies to the compensated temperature range.

(m) The pressure response time is the amount of time, which the ASIC needs to update the pressure values within the internal registers.

(n) The warm-up deviation is the deviation from the total accuracy (l) of the output values upon each biasing of the device at supply voltage over a period of the first 60 seconds.

(o) The non-linearity calculation uses the “best-fit-straight-line” (BFSL) approach.

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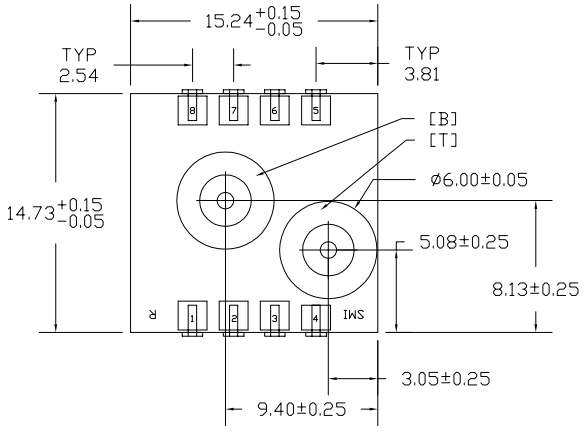
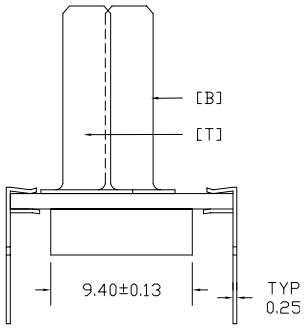
Package Dimensions & Pin-Out

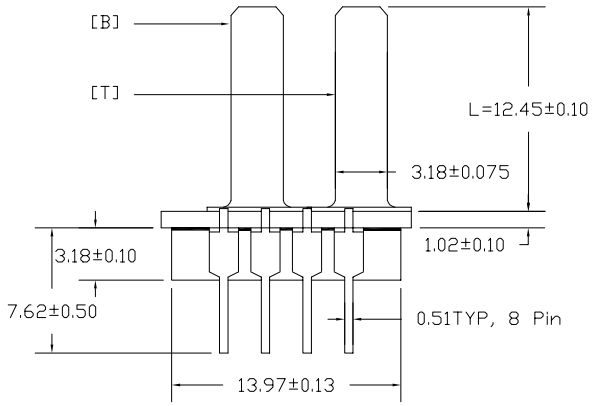


Top View



All dimensions are shown in millimeters

PIN	DESCRIPTION
1	NC
2	GND
3	NC
4	SDA
5	SCL
6	NC
7	VDD
8	ANALOG OUT



Side View

NOTES:
- Do not connect to NC pins.
- External connections to NC pins will cause part malfunction.
- [B] is tube connected to bottom side of sensor die.
- [T] is tube connected to top side of sensor die.
- Not to exceed 5kg force on tubes.

Pressure Type:
D: Differential (2 Tubes)
G: Gauge (1 Tube)
S: Single-Ended (2 Tubes)

Tube Length:
L: Long (12.45 mm ± 0.10 mm)
S: Short (8.25 mm ± 0.10 mm)

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Ordering Information

Order Code	Pressure Type	Full-Scale Pressure Range	Tube Length
5852-001-D-3-LR	Differential	0.15 PSI / 1.0 kPa	Long
5852-001-S-3-LR	Single-ended	0.15 PSI / 1.0 kPa	Long

Qualification Standards

- REACH Compliant
- RoHS Compliant
- PFOS/PFOA Compliant
- For qualification specifications, please contact Sales at sales@si-micro.com

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I²C Features

I²C

I²C is a bidirectional digital interface using two lines for communication, Serial Data Line (SDA) and Serial Clock (SCL).

In the SM5800 series parts, the I²C interface is, for example, used to store information in the EEPROM during calibration but also to read out pressure and temperature information in the final application.

The I²C bus has two roles for nodes: master and slave. The master node issues the clock and addresses slaves; the slave node receives the clock line and address.

The SM5800 family parts can only be used as a slave on the I²C bus. The factory programmed address is decimal 95.

Please refer to Section 3 for details on the I²C communication. Please refer to Section 4 for details on how to program the EEPROM using the I²C interface.

Register (decimal)	Register (hexadecimal)	Register (binary)	Description
132	84	1000 0100	Uncorrected Pressure, LSB [5:0]
133	85	1000 0101	Uncorrected Pressure, MSB [11:6]
134	86	1000 0110	Supply Voltage, LSB [5:0]
135	87	1000 0111	Supply Voltage, MSB [11:6]

The I2C interface can be used to read the values from the respective registers.

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Wiring Diagrams

VDD The optimum operation value for the power supply is 5.00 V.

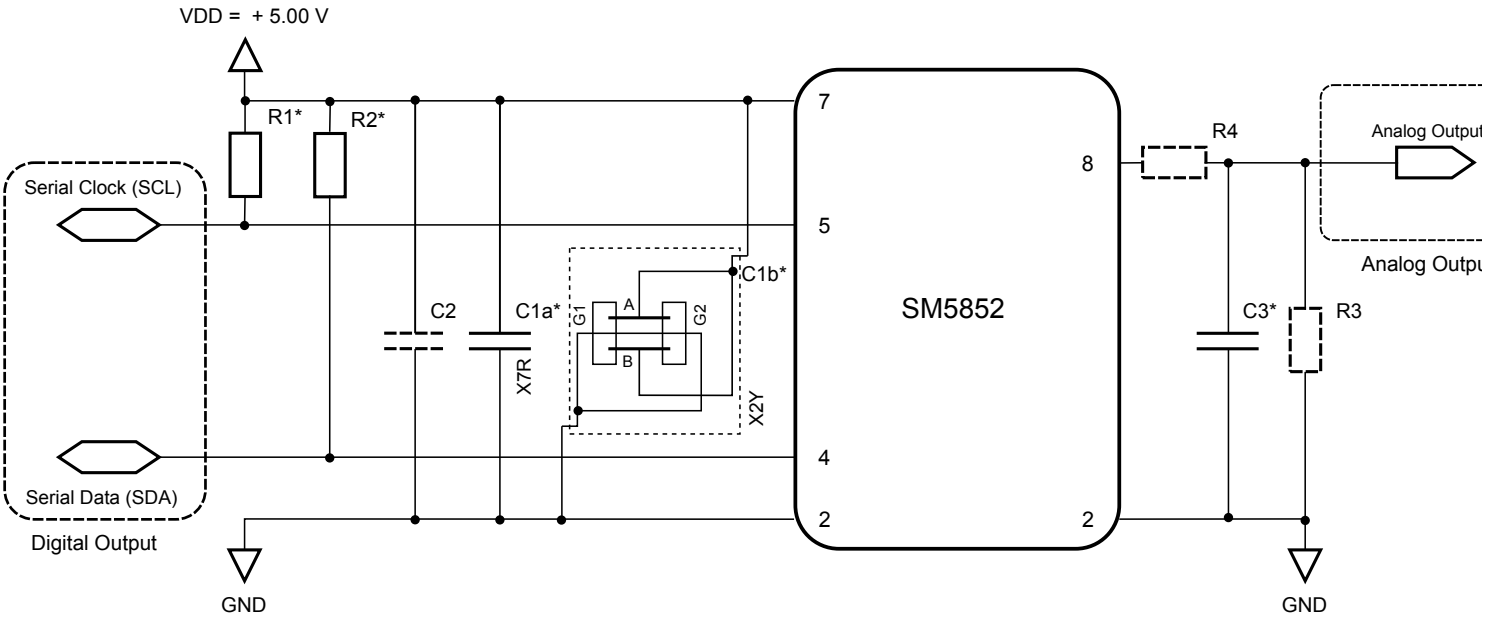
R1/R2 Pull-up resistors for the digital data lines. Recommended resistor values are 10 to 100 kOhm.

C1a/C1b Buffer capacitor. For best performance of the sensor output signals it is obligatory to use a 100 nF buffer capacitor between the supply pins VDD and GND of the sensor device. SMI recommends high quality capacitors, such as X7R or X2Y. The maximum distance between the package supply pins and this capacitor should be no more than 5 mm. Usually this buffer capacitor is sufficient, but in connection with a poor power supply and to reduce power consumption a reload capacitor (C2) of min. 1 µF is advised. In this case, SMI recommends using ceramic capacitors of 47 µF.

C3 Capacitive load of the analog output. The capacitive load should be between 15 nF to 33 nF (recommended: 22 nF) with a resistor (optional: R3) of min. 3 kOhm. For a chosen lower capacitive load of 1 nF to 15 nF the resistor value should be at least 6.8 kOhm.

R4 Optional resistor for low-pass filtering (in lieu of R3) of the analog output. The recommended resistor value is: 4.7 kOhm

* Obligatory components for best performance of pressure sensor device.



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