SILICON MICROSTRUCTURES INCORPORATED
Member of the ELMOS Group

SM5822/SM5872
Co-Integrated Pressure Sensor

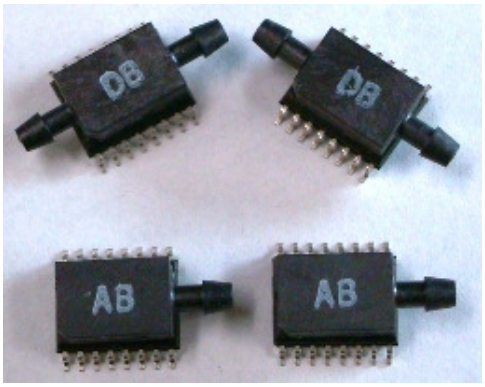
- ***FULLY INTEGRATED CMOS PRESSURE SENSOR SYSTEM IN A STANDARD SO-16 PACKAGE***
- ***FACTORY CALIBRATED SINGLE-CHIP INTEGRATED SENSOR***
- ***IMPROVED ACCURACY COMPARED TO COMPETITIVE PRODUCTS***
- ***LOWER COST ASSOCIATED WITH SENSOR INTEGRATION AND PACKAGE DESIGN***

DESCRIPTION

The Silicon Microstructures **SM5822** and **SM5872** series of OEM integrated pressure sensors combine state-of-the-art pressure sensor technology with on-chip signal processing technology to produce an amplified, fully conditioned, multi-order pressure and temperature compensated sensor die in a low cost SO-16 plastic package.

The sensor utilizes a CMOS digital signal processor and on-chip EEPROM for storage of calibration and compensation data. This allows the device to be factory calibrated including the effects from packaging stress. It also permits multi-order temperature and pressure compensation to achieve increased accuracy compared to conventional amplified pressure systems.

The **SM5822/SM5872** series pressure sensor is a factory calibrated ready-to-use sensor system. The model **SM5822** is designed for operating pressure ranges from 0-5 PSI to 0-60 PSI full-scale in gauge, differential, single-ended, and absolute pressure configurations. The model **SM5872** is designed for operating low-pressure ranges from 0-0.6 PSI up to 0-1.5 PSI full-scale for gauge, differential, and single-ended differential pressure applications. For both models, the sensor output is ratiometric with the supply voltage.



FEATURES

- Amplified, calibrated, fully signal conditioned output span of 4.0 VDC FS (0.5 to 4.5 V signal)
- Digital temperature and calibrated pressure available through I^2C interface
- Output ratiometric with supply voltage
- Multi-order correction for pressure non-linearity (factory programmed)
- Multi-order correction for temperature coefficient of span and offset (factory programmed)
- Gage, differential, single-ended and absolute versions

TYPICAL APPLICATIONS

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

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THEORY OF OPERATION

The operation of the signal processor is depicted in the block diagram below. The internal pressure sensor is a piezoresistive bridge. This transduces the applied pressure into an electronic signal, which feeds into the integrating amplifier.

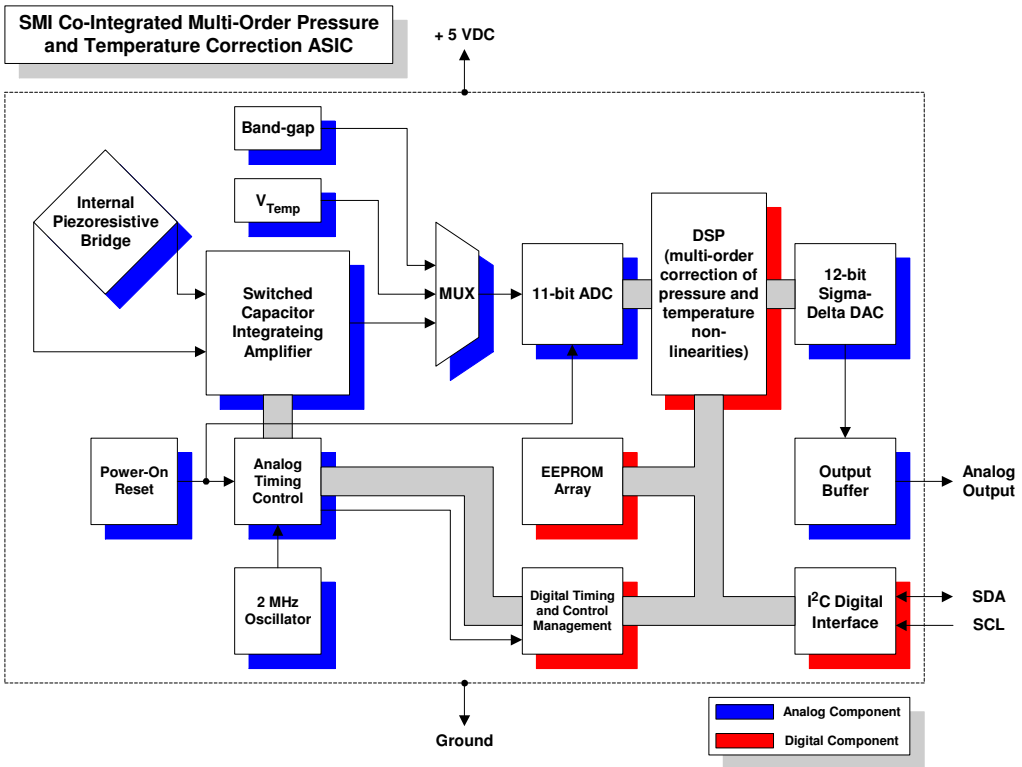
During the amplification step an offset correction factor is added to allow for maximum gain for a given pressure while minimizing the offset error.

The signal is then processed by an 11-bit analog to digital converter (ADC). The ADC samples the signal multiple times and uses the sum of those samples as a 13-bit word.

A digital signal processor (DSP) is then used to correct and calibrate the pressure signal. The DSP provides multi-order correction of both pressure and temperature non-linearity through the use of factory-programmed coefficients. A combined total of twenty coefficients are available for correcting pressure and temperature non-linearity. The unique coefficients are determined during a calibration process performed at the factory. Factory calibration is the last step performed, which means the effect of the package on the pressure signal will also be taken into account. This provides a great advantage over conventional laser-trimming approaches.

The DSP produces a corrected digital word, which is transferred to a 12-bit digital to analog converter (DAC) to provide a calibrated analog output. In addition to the analog output, the corrected pressure signal is accessible through an I^2C digital interface.

See SMI application note AN05-001 for a detailed description of how to read out the digital corrected pressure signal using the I2C bus interface.



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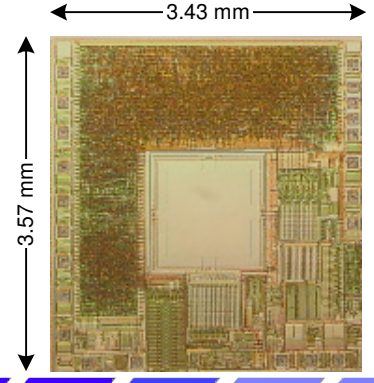
CHARACTERISTICS FOR SM5822/SM5872 – *SPECIFICATIONS*

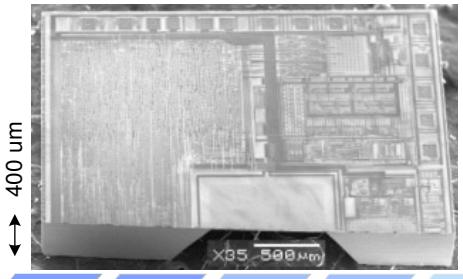
All parameters are measured at room temperature while applying 5.000V supply, unless otherwise specified.

	Absolute[1], Gage & Single[2]			Differential[3]				
	MIN	TYP	MAX	MIN	TYP	MAX	UNITS	NOTES
Zero output (absolute and gauge)	0.42	0.50	0.58				V	4
Zero output (differential)				2.42	2.50	2.58	V	4
Output span	3.92	4.00	4.08	1.96	2.00	2.04	V FS	4, 5
Total Error			1			1	%FS	11
Response time	2			2			msec	9
Supply voltage	4.75	5.00	5.25	4.75	5.00	5.25	V	4, 7
Current consumption			10			10	mA	9
Overpressure (burst pressure)		>5X			>5X		%FS	6, 9, 10
Operating temperature range	-40	+25	+125	-40	+25	+125	℃	9
Compensated temperature range	+15	+25	+75	+15	+25	+75	℃	
Storage temperature range	-40	+25	+150	-40	+25	+150	℃	9
Media compatibility								8, 9

Notes:

1. Absolute parts are only offered in the SM5822 Series.
2. Single-ended parts (Pressure Type - S) have 2 ports and are for higher gain differential applications where the differential pressure is **always** positive.
3. For the 5822 series this applies for positive pressure only.
4. Sensor output is ratiometric to supply.
5. Full-scale (FS) is defined as zero pressure to rated pressure; differential parts can be used ±FS. Absolute and Gauge zero output is 0.5 V typical and full-scale output is 4.5 V. Span is the difference between Full-scale output and zero output, (4 V). For Differential parts, the negative full-scale is typically at 0.5 V, zero is typically 2.5 V, and positive full-scale is 4.5 volts to give a span of ±2.0 V.
6. Or 150 PSI, whichever is less. Output amplifier will saturate at about 0.25 V for applied pressure below the rated Zero and at about 4.75 V for applied pressure above the rated Full-scale.
7. A 100 nF filter capacitor must be placed between Vsupply and Ground.
8. Clean, dry gas compatible with wetted materials. Wetted materials include Pyrex glass, silicon, Kovar™, epoxy, RTV, gold, aluminum, Ultem™ plastic, Duraplast™ plastic.
9. Tested on a sample basis
10. Maximum pressure on package is 150 PSI
11. Total error is defined as departure from ideal response at all temperatures and pressures as a percentage of full scale. This includes temperature error and pressure non-linearity error.





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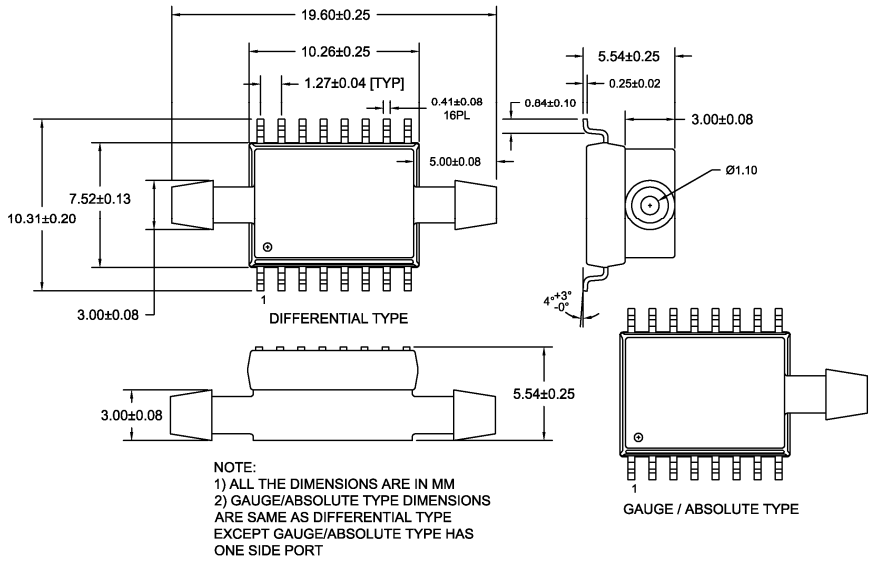
ADDITIONAL INFORMATION

Package Dimensions & Pin-Out



NOTE:
1) ALL THE DIMENSIONS ARE IN MM
2) GAUGE/ABSOLUTE TYPE DIMENSIONS ARE SAME AS DIFFERENTIAL TYPE EXCEPT GAUGE/ABSOLUTE TYPE HAS ONE SIDE PORT

PIN	DESCRIPTION
1	NC
2	NC
3	**SERIAL DATA (SDA)**
4	**SERIAL CLOCK (SCL)**
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	**GROUND**
13	**V_{exc} = 5.000 VDC**
14	NC
15	NC
16	**ANALOG OUTPUT**

NOTES:
- Do **not** connect to NC pins.
- External connections to NC pins will cause part malfunction.

Ordering Information

Pressure Type
A : Absolute (1 port)
D : Differential (2 ports)
G : Gauge (1 port)
S : Single-ended (2 ports)

Cap Type
B : Horizontal barbed ports

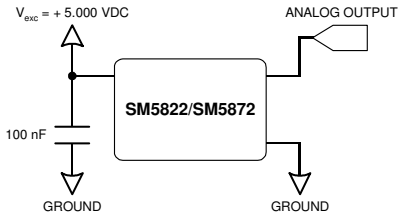
Model Number: **SM5822 - XXX - Y- B**
Pressure Range
Pressure Type
Cap Type

Notes
1. Absolute configuration only available in SM5822.
2. Single-ended configuration is for higher gain differential applications where differential pressure is **always** positive.
3. Other configurations available on large orders. Consult SMI for details.

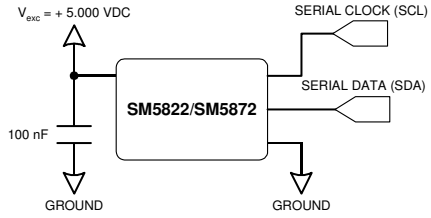
Full-Scale Pressure Ranges

SM5822	PSI	[kPa]	SM5872	PSI	[kPa]
005	5	[34.5]	006	0.6	[4.1]
015	15	[103.4]	015	1.5	[10.3]
030	30	[206.8]			
060	60	[413.7]			

Wiring Diagrams



Wiring diagram for analog output



Wiring diagram for digital output

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