PRESSURE SENSORS

Low Pressure Digital Sensor

SM7231, SM7331, SM7431
Gauge and Differential Pressure Sensor

FEATURES

- Pressure range from 0.07 to 0.29 psi; gauge, differential or asymmetric differential outputs
- Digital Accuracy: +/- 1 %FS
- 16-bit digital, pressure calibrated and temperature compensated output
- I^2C interface
- Compensated temperature range: -20 to 85°C
- Robust JEDEC SOIC-16 package for automated assembly
- Manufactured according to ISO9001 and ISO/TS 16949 standards

DESCRIPTION

The SM7X31 series are a low pressure MEMS sensor family offers state-of-the-art pressure transducer technology and CMOS mixed signal processing technology to produce a Digital output, fully conditioned, multi-order pressure and temperature compensated outputs. This series provides JEDEC standard SOIC-16 package with a dual vertical or horizontal ports options. It is available in gauge, differential, asymmetric differential configurations. With the dual porting, a reference measurement is possible to minimize errors due to changes in ambient pressure.

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

Customer-specified pressure ranges and supply voltages are available.

The SM7231, SM7331 and SM7431 series shipped in sticks or tape & reel.

Medical	Industrial	Consumer
Sleep Apnea	Airflow Measurement	Sports Equipment
CPAP	Pneumatic Gauges	Appliances
Ventilators	Pressure Switches	
Gas Flow Instrumentation	Safety Cabinets	
Air Flow Monitors	Life Sciences	
Negative Pressure Wound Therapy	Gas Flow Instrumentation	

1. Absolute Maximum Ratings

All parameters are specified at VDD = 3.3 V / 5.0 V supply voltage at 25°C, unless otherwise noted.

No.	Characteristic	Symbol	Minimum	Maximum	Units
1	Compensated Temperature	T_{COMP}	-20	85	°C
2	Operating Temperature[a]	T_{OP}	-40	105	°C
3	Storage Temperature[a]	T_{STG}	-40	125	°C
4	Proof Pressure[a, c]	P_{Proof}		1.5	psi
5	Burst Pressure[a, d]	P_{Burst}		3	psi
6	Supply voltage	$VDD_{MIN/MAX}$	-0.3	6	V
7	Media Compatibility[a, b]				

Notes:

a. Tested on a sample basis.

b. Clean, dry gas compatible with wetted materials. Wetted materials include silicon, epoxy, RTV, gold and aluminum.

c. Proof pressure is defined as the maximum pressure to which the device can be taken and still perform within specifications after returning to the operating pressure range

d. Burst pressure is the pressure at which the device suffers catastrophic failure resulting in pressure loss through the device.

2. ESD

All parameters are specified at VDD = 3.3 V / 5.0 V supply voltage at 25°C, unless otherwise noted.

No.	Description	Condition	Symbol	Min.	Typ.	Max.	Units
8	ESD HBM Protection at all Pins	AEC Q100-002 (HBM) chip level test	$V_{ESD(HBM)}$	-2		+2	kV

3. Electrical Characteristics

All parameters are specified at VDD = 5.0 V / 3.3 V DC supply voltage at 25°C, unless otherwise noted.

No.	Description	Symbol	Min.	Typ.	Max.	Units
9	Supply Voltage	V_{DD}	4.75	5.0	5.25	V
			3.0	3.3	3.6	
10	Low level input voltage at Digital I/O	$V_{IN,I2C,lo}$	-0.3		0.9	V
11	High level input voltage at Digital I/O	$V_{IN,I2C,hi}$	0.8*VDD		VDD + 0.3	V
12	Current Consumption			3.0		mA

4. External Components

No.	Description	Symbol	Min.	Typ.	Max.	Units
13	Supply bypass capacitor	C_{VDD}		100		nF

5. OPERATING CHARACTERISTICS TABLE

All parameters are specified at VDD = 5.0 V / 3.3 V DC supply voltage at 25°C, unless otherwise noted.

No.	Characteristic	Symbol	Minimum	Typical	Maximum	Units
15	Digital Pressure Output @ P_{MIN} (e)	$DOUT_{MIN}$		-26214		Counts
16	Digital Pressure Output @ P_{MAX} (e)	$DOUT_{MAX}$		26214		Counts
17	Digital Full Scale Span (e)	DFS		52428		Counts
18	Resolution				16	Bits
19	Digital Output Accuracy (f,g,h)	DACC	-1		+1	%FS

Calibrated Pressure Ranges				
No.	Device Type	P_{MIN} (psi)	P_{MAX} (psi)	Comment
24	SM7231– Gauge	0	+0.07 to +0.29	
25	SM7331 – Differential	-0.29 to -0.07	+0.07 to +0.29	Absolute value of P_{MIN} must match absolute value of P_{MAX}
26	SM7431 -- Asymmetric	-0.29 to 0	0 to +0.29	Delta between P_{MAX} and P_{MIN} must be at least 0.14 psi

Notes:

e. Only the typical values are shown here. However, the digital output values can be customized or changed upon request. Please refer to the tear sheet for the specific product to get updated information.

f. The accuracy specification applies across the compensated temp range. This specification includes the combination of linearity, repeatability, and hysteresis errors over pressure, temperature, and voltage.

g. Maximum 10-year zero pressure offset shift < ±2%FS based on 1000 hours of HTOL,TC and THB testing.

h. For less demanding applications, devices with relaxed accuracy specifications are available.

***Custom calibration pressures and voltages are available to meet specific customer demands.**

5. Sensor Transfer Function

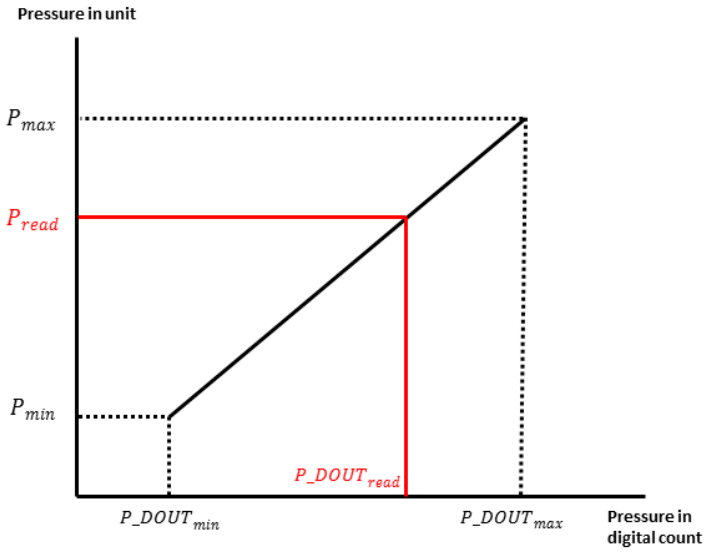
Digital Pressure Transfer Function

$$P_{read} = P_{min} + \frac{P\_DOUT_{read} - P\_DOUT_{min}}{P\_DOUT_{max} - P\_DOUT_{min}} (P_{max} - P_{min})$$

P_{min} and P_{max} are minimum and maximum rating pressure in specified pressure unit on the specification.

P_DOUT_{min} and P_DOUT_{max} are minimum and maximum digital counts on the specification.

P_DOUT_{read} is digital reading from the output and P_{read} is the converted pressure output based on P_DOUT_{read}.

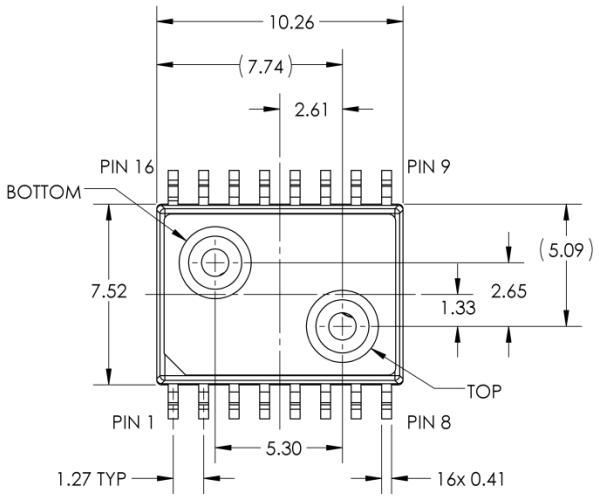


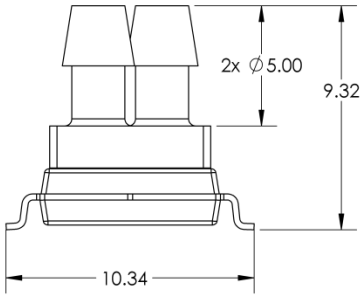
For example, the P_{min} and P_{max} for the sensor are specified as -0.1 and +0.1 psi. The $DOUT_{min}$ and $DOUT_{max}$ are -26214 and +26214. So,

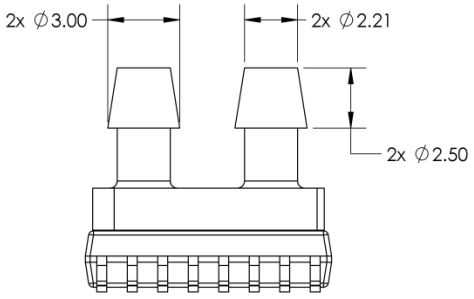
$$P_{read} = -0.1 + \frac{DOUT_{read} + 26214}{52428} \times 0.2 \text{ psi}$$

6. Package Dimensions

SOIC-16 (C) Vertical Package Dimensions



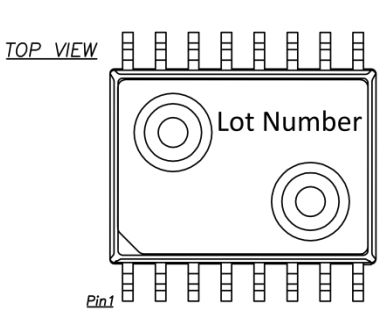


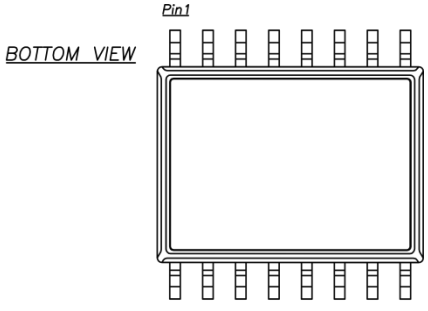


Notes:

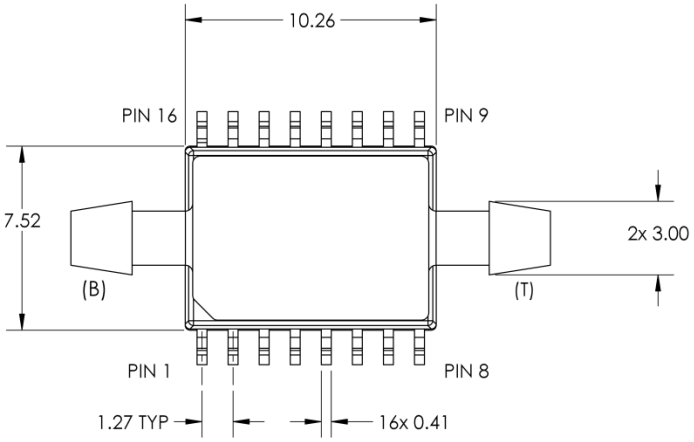
- All dimensions in units of [mm]
- Moisture Sensitivity Level (MSL): Level 3
- Wetted materials: Silicon, glass, gold, aluminum, copper, stainless, epoxy, mold compound.
- [B] is tube connected to bottom side of sensor die.
- [T] is tube connected to top side of sensor die. Topside pressure is positive pressure. An increase in topside pressure will result in an increase in sensor output unless otherwise noted on the tear sheet.

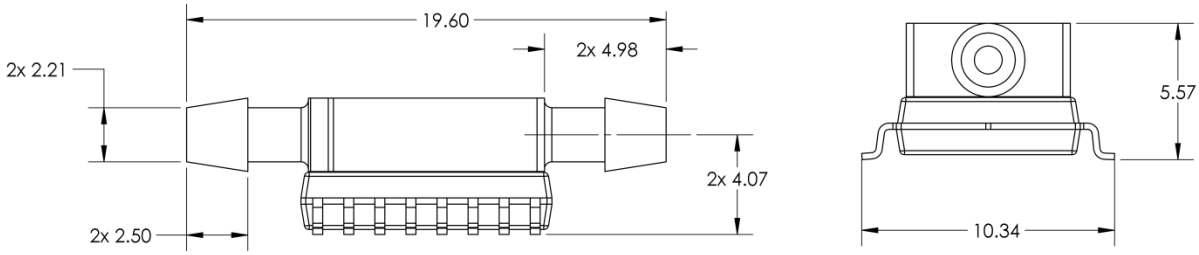
Part & Lot Number Identification





SOIC-16 Horizontal (B) Package Dimensions

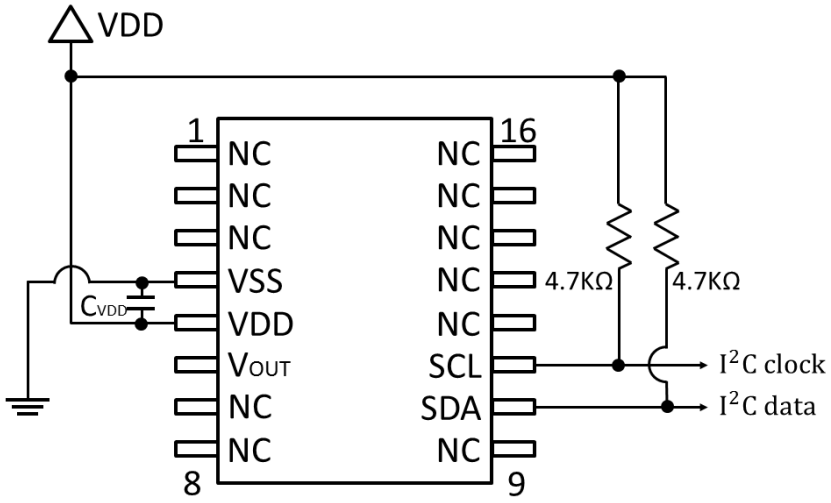




Qualification Standards

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

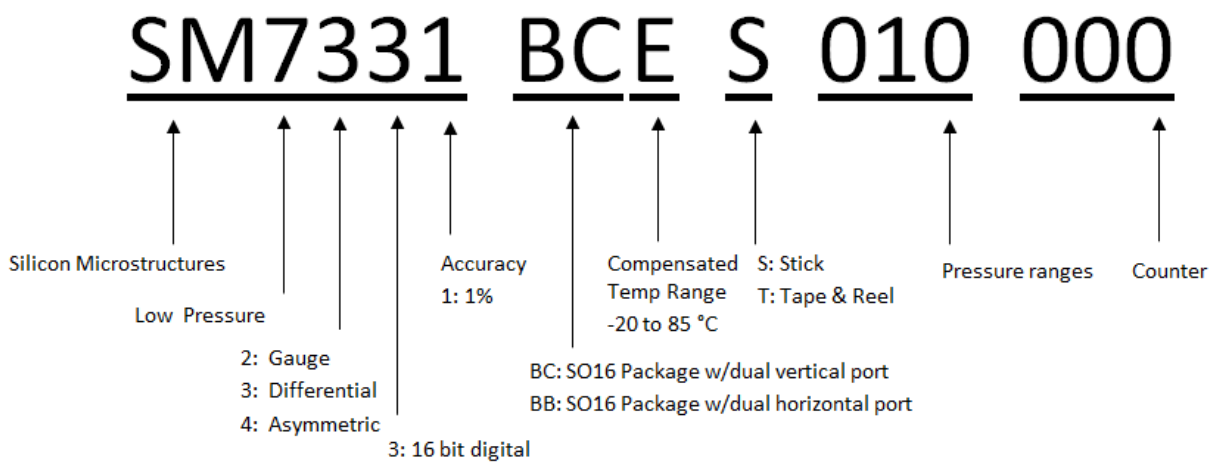
SM7X31+ Family Applications Circuit



Pin No.	Pin function	Pin No.	Pin function
1	NC	9	NC
2	NC	10	SDA
3	NC	11	SCL
4	VSS	12	NC
5	VDD	13	NC
6	NC	14	NC
7	NC	15	NC
8	NC	16	NC

Ordering Information: Specific part number information is provided on a separate tear sheet for each product. The general part number ordering information is provided below:

Part Number Legend



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