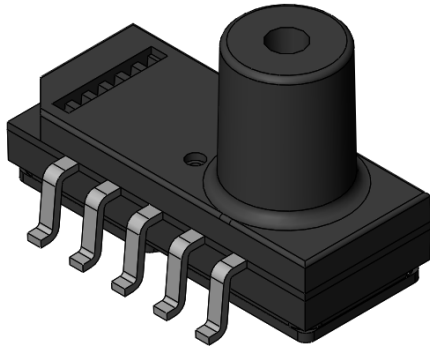


# Low Pressure Digital Sensor

## SM4291-HGC-S-300-000 Gauge Pressure Sensor



### DESCRIPTION

The SM4291 is a digital, low pressure MEMS sensor, with an optional analog output, offering state-of-the-art pressure transducer technology and CMOS mixed signal processing technology to produce a digital or analog, fully conditioned, pressure and temperature compensated sensor in JEDEC standard SOIC-10 package with vertical port. It is a gauge pressure sensor.

### FEATURES

- Pressure range of 0 to 300 mm Hg (0-5.8 PSI) gauge output
- Digital Output Accuracy:  $\pm 1\%$  full scale
- 16-bit digital, pressure calibrated and temperature compensated output
- I<sup>2</sup>C Digital and Analog Interface
- Compensated temperature range: -5 to +65 °C
- Insensitive to mounting orientation
- Robust JEDEC SOIC-10 package for automated assembly
- Manufactured according to ISO9001 and ISO/TS 16949 standards

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 output interface. This eliminates the need for additional circuitry, such as a compensation network or microcontroller containing a custom correction algorithm.

The SM4291 is available for shipment in sticks or tape & reel.

### 1. Absolute Maximum Ratings

No.	Characteristic	Symbol	Minimum	Maximum	Units
1	Supply Voltage	V <sub>DD</sub>	-0.3	6.0	V
2	Digital IO Voltage	V <sub>IO,DIG</sub>	-0.3	VDD+0.3	V
3	Max. Digital IO Current (DC)	I <sub>IO,DIG</sub>	-10	+10	mA
4	Storage Temperature <sup>(a)</sup>	T <sub>STG</sub>	-40	+125	°C

No.	Characteristic	Symbol	Minimum
5	Proof Pressure <sup>(a, b, c)</sup>	P <sub>Proof</sub>	1293 mm Hg (25 PSI)
6	Burst Pressure <sup>(a, b, d)</sup>	P <sub>Burst</sub>	2069 mm Hg (40 PSI)

**Notes:**

- a. Tested on a sample basis.
- b. Clean, dry gas compatible with wetted materials. Wetted materials include plastic, silicon and RTV.
- 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

No.	Description	Symbol	Minimum	Maximum	Units
1	ESD HBM Protection at all Pins	V <sub>ESD(HBM)</sub>	-2	2	kV

### 3. External Components

No.	Description	Symbol	Min.	Typ.	Max.	Units
1	Supply bypass capacitor*	C <sub>VDD</sub>		100		nF
2	Pull Up Resistance at Analog Out Pin*	R <sub>LP</sub>	2			kOhm
3	Pull Down Resistance at Analog Out Pin*	R <sub>LU</sub>	2			kOhm
4	Load Capacitance at Analog Out Pin*	CL			22	nF
5	I2C Data and clock pull up resistors*	R <sub>p</sub>		4.7		kOhm

\* Not tested in production

#### 4. Recommended Operating Conditions

The recommended operating conditions must not be exceeded in order to ensure proper functionality of the device. All parameters specified in the following sections refer to these recommended operating conditions unless stated otherwise.

No.	Description	Symbol	Min.	Typ.	Max.	Units
1	Supply Voltage	$V_{VDD}$	3.0	3.3	5.5	V
2	Low level input voltage at SDA, SCL	$V_{IN,I2C,lo}$	-0.3		0.9	V
3	High level input voltage at SDA, SCL	$V_{IN,I2C,hi}$	$0.8 * V_{VDD}$		$V_{VDD}+0.3$	V
4	Compensated Temperature	$T_{COMP}$	-5		+65	°C
5	Operating Temperature	$T_A$	-5		65	°C

#### 5. Operating Characteristics Table

All parameters are specified at  $V_{DD} = 3.3$  V DC supply voltage at 25°C, unless otherwise noted.

No.	Characteristic	Symbol	Minimum	Typical	Maximum	Units
6	Current Consumption	$I_{VDD}$		4.5	5.6	mA
7	Pressure Output @ $P_{MIN} = 0$ mm HG	$OUT_{MIN}$		-26,214		Counts
				10%		$V_{DD}$
8	Pressure Output @ $P_{MAX} = 300$ mm HG	$OUT_{MAX}$		+26,214		Counts
				90%		$V_{DD}$
9	Full Scale Span	FSS		52,428		Counts
				80%		$V_{DD}$
10	Resolution			16		Bits
11	Update Rate			2000		Hz
12	Bandwidth			20		Hz
13	Digital Accuracy <sup>(e)</sup>	D ACC	-1	± 0.4	1	%FS
14	Analog Accuracy <sup>(e)</sup>	A ACC		± 0.4		%FS

#### Notes:

- e. The accuracy specification applies over all operating conditions. This specification includes the combination of linearity, repeatability, and hysteresis errors over pressure, temperature, and voltage.

## 6. I<sup>2</sup>C Interface

No.	Description	Condition	Symbol	Min.	Typ.	Max.	Units
1	SDA output low voltage*	I <sub>SDA</sub> = 3 mA	V <sub>SDA,OL</sub>	0		0.4	V
2	Low-to-High transition threshold*	pins SA0, SCL	V <sub>SDA,LH</sub>	50	60	70	%VDD
3	High-to-Low transition threshold*	pins SA0, SCL	V <sub>SDA,HL</sub>	30	40	50	%VDD
4	I <sup>2</sup> C clock frequency*		f <sub>SCL</sub>			400	kHz
5	Bus free time between a START and STOP condition*		t <sub>BUSF</sub>	1300			ns
6	Clock low time*		t <sub>LO</sub>	1300			ns
7	Clock high time*		t <sub>HI</sub>	600			ns
8	START condition hold time*		t <sub>SH</sub>	100			ns
9	Data setup time*		t <sub>SU</sub>	100			ns
10	Data hold time*		t <sub>H</sub>	0			ns
11	Setup time for repeated START condition*		t <sub>RSH</sub>	600			ns
12	Setup time for STOP condition*		t <sub>PSU</sub>	600			ns
13	Rise time of SDA and SCL signals*		t <sub>R</sub>			300	ns
14	Fall time of SDA and SCL signals*		t <sub>F</sub>			300	ns

\* Not tested in production

### Qualification Standards

REACH Compliant

RoHS Compliant

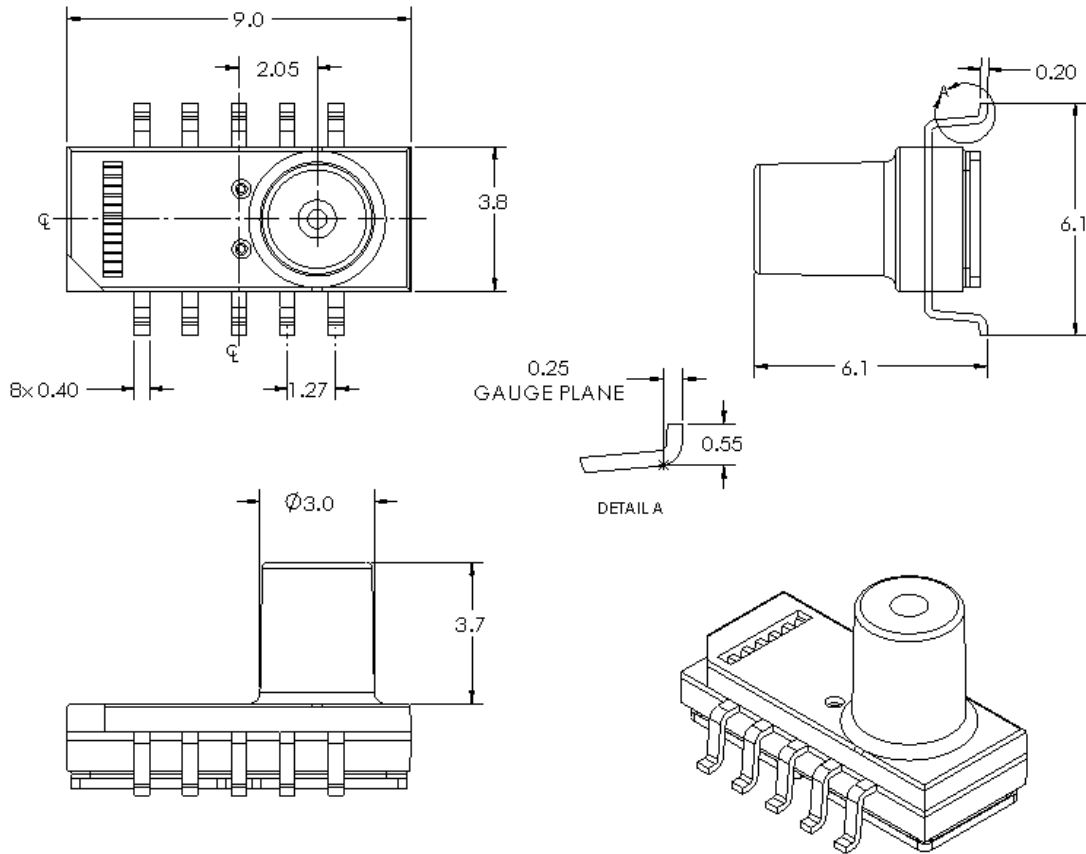
PFOS/PFOA Compliant

For qualification specifications, please contact Sales at sales@si-micro.com



7. Package Reference

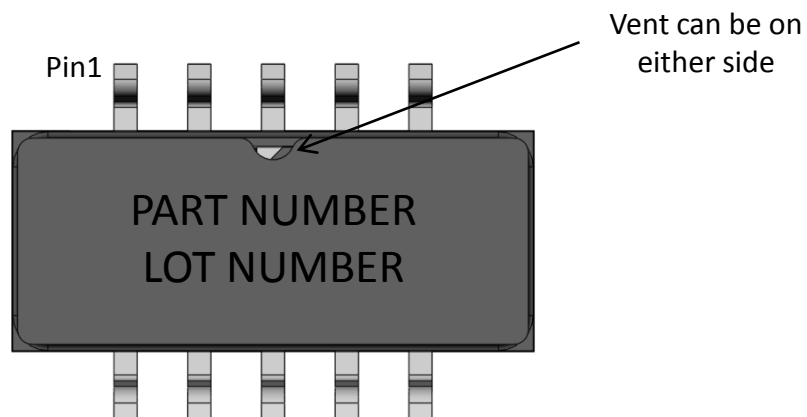
SM4291 Package Dimensions



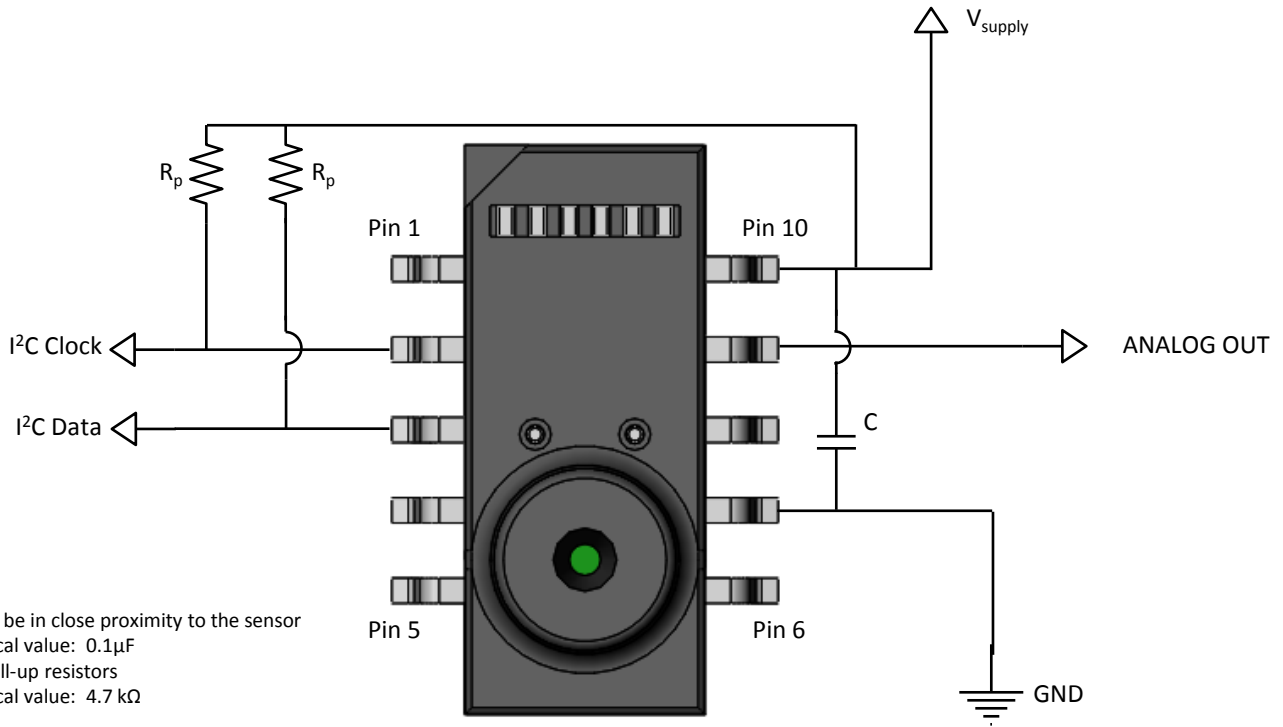
**Notes:**

- All dimensions in units of [mm]
- Moisture Sensitivity Level (MSL): Level 1
- Wetted materials: Silicon, RTV, Plastic

Part & Lot Number Identification



SM4291-Pin out Diagram



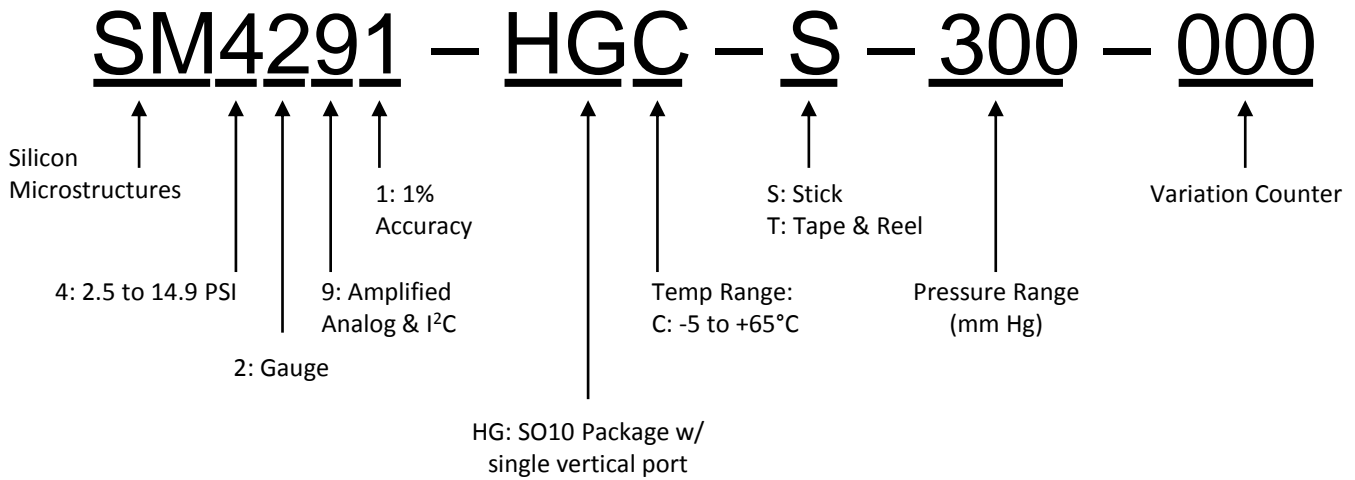
“C” must be in close proximity to the sensor  
 Typical value: 0.1μF  
 Rp are pull-up resistors  
 Typical value: 4.7 kΩ

Pin No.	Pin Function
1	NC
2	SCL
3	SDA
4	NC
5	NC
6	NC
7	GND
8	NC
9	Analog Out
10	Power

**NOTES:**

- Do not connect to NC pins

**8. Part Number Legend**



**Qualification Standards**

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



## Silicon Microstructures Warranty and Disclaimer:

Silicon Microstructures, Inc. reserves the right to make changes without further notice to any products herein and to amend the contents of this data sheet at any time and at its sole discretion.

Information in this document is provided solely to enable software and system implementers to use Silicon Microstructures, Inc. products and/or services. No express or implied copyright licenses are granted hereunder to design or fabricate any silicon-based microstructures based on the information in this document.

Silicon Microstructures, Inc. makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does Silicon Microstructures, Inc. assume any liability arising out of the application or use of any product or silicon-based microstructure, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Silicon Microstructure's data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Silicon Microstructures, Inc. does not convey any license under its patent rights nor the rights of others. Silicon Microstructures, Inc. makes no representation that the circuits are free of patent infringement. Silicon Microstructures, Inc. products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Silicon Microstructures, Inc. product could create a situation where personal injury or death may occur. Should Buyer purchase or use Silicon Microstructures, Inc. products for any such unintended or unauthorized application, Buyer shall indemnify and hold Silicon Microstructures, Inc. and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Silicon Microstructures, Inc. was negligent regarding the design or manufacture of the part.

Silicon Microstructures, Inc. warrants goods of its manufacture as being free of defective materials and faulty workmanship. Silicon Microstructures, Inc. standard product warranty applies unless agreed to otherwise by Silicon Microstructures, Inc. in writing; please refer to your order acknowledgement or contact Silicon Microstructures, Inc. directly for specific warranty details. If warranted goods are returned to Silicon Microstructures, Inc. during the period of coverage, Silicon Microstructures, Inc. will repair or replace, at its option, without charge those items it finds defective. The foregoing is buyer's sole remedy and is in lieu of all warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Silicon Microstructures, Inc. be liable for consequential, special, or indirect damages.

While Silicon Microstructures, Inc. provides application assistance personally, through its literature and the Silicon Microstructures, Inc. website, it is up to the customer to determine the suitability of the product for its specific application. The information supplied by Silicon Microstructures, Inc. is believed to be accurate and reliable as of this printing. However, Silicon Microstructures, Inc. assumes no responsibility for its use. Silicon Microstructures, Inc. assumes no responsibility for any inaccuracies and/or errors in this publication and reserves the right to make changes without further notice to any products or specifications herein

Silicon Microstructures, Inc.™ and the Silicon Microstructures, Inc. logo are trademarks of Silicon Microstructures, Inc. All other service or product names are the property of their respective owners.

© Silicon Microstructures, Inc. 2001-2018. All rights reserved.