SENSORALL

PRESSURE SENSORS
FORCE SENSORS
TRANSDUCERS
APPLICATION NOTES

2024 Product manual

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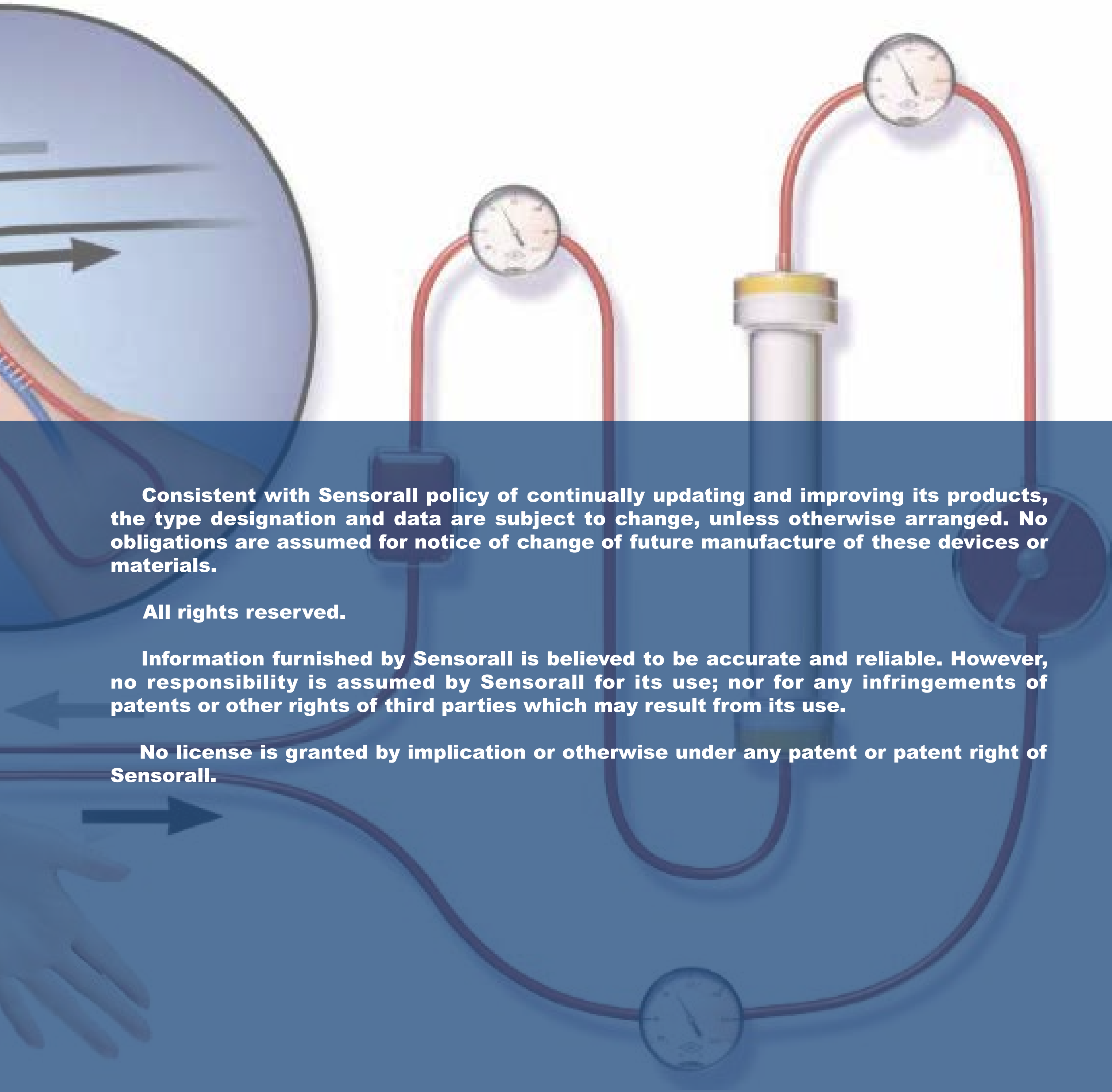

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OVERVIEW

Hong Kong Sensorall International Limited Profile

Hong Kong Sensorall International Limited utilizes state-of-the-art silicon micromachining technology to manufacture OEM/ODM components for physical measurement and control.

These products include pressure sensors,force sensors, transducers and custom design for one stop solutions. Silicon's excellent semiconductor properties have made it the basic building material of the electronics industry. But silicon also has excellent physical properties that make it an ideal building material for mechanical devices. Silicon has a tensile strength greater than steel and is almost perfectly elastic, making it a wonderful material for use in MEMS products. It is free of hysteresis, and its crystalline structure is wellsuited to the fabrication of miniature precision products. These silicon micromachined products have several advantages over their conventionally manufactured counterparts: they are generally much smaller, their performance is higher due to the precise dimensional control in the fabrication, and costs are lower because thousands can be produced at one time.

While Sensorall products have been technology leaders, the Company's real strength has been in bringing products to market. Today, Sensorall offers the broadest line of micromachined pressure sensors, force sensors, tranducers and custom design in the industry.

Silicon micromachining is a powerful outgrowth of semiconductor process technology. Integrated circuit manufacturing techniques are supplemented by silicon etching processes to create very precise,miniature mechanical structures. These silicon microstructures can have electronicfeatures that allow physical inputs to be converted into electrical signals. Similarly, electronic signals can be applied tothese devices to provide control functions.

Silicon is the material of choice due to its unique combination of excellent electronic and mechanical properties. Silicon has the hardness of steel, the thermal conductivity of diamond, exhibits piezoresistive properties, is lightweight, has low thermal expansion, and is relatively inert.

Unprecedented dimensional control can be achieved through the use of conventional processing techniques, which also open up the possibility of large scale batch manufacturing, enabling very low cost devices to achieve extraordinary performance levels. Structures that can be fabricated with silicon micromachining include purely mechanical structures in addition to sensors and transmiters. Silicon micromachining provides a higher level of dimensional control than can be obtained from traditional machining or molding technologies. The most significant benefit, however, is the capability to combine these precise mechanical structures with electronic features to create sensors and transmitters.The capability to design new devices and processes using this base technology is our primary strength. Our experience in transferring state-of-the-art designs into manufacturing is excellent in the world.

UNMATCHED BREADTH OF PRODUCT LINES

Sensorall has developed and commercialized three product areas based on silicon micromachining technology, offering an unmatched range of standard products with a strong custom design capability.Pressure sensors were the first products produced by the Company. A broad range of package styles is available,including PC Board mountable versions, stainless steel housings, disposable medical devices, and complete industrial transmitters.

The second product area for Sensorall involves force sensors. This is the product customized for infusion pumps, syringe pumps,robots, catheters and etc.

The third product line for Sensorall involves custom silicon micromachining. Micromachining technology is applied to meet specific customer requirements.

The advantages of silicon microstructures compared to alternate technologies such as plastic molding, metal machining, or glass drilling are the precision of the etched features, the cost of the batch fabricated component, and the repeatability of the dimensions from part-to-part.

PRESSURE
PC Mountable Pressure Selection Guide

Medical Pressure Sensor Guide

PRESSURE
PC Mountable Pressure Selection Guide

Oil Filled Pressure Sensor Guide

Silicon On Metal Pressure Sensor Guide

PRESSURE

PC Mountable Pressure Selection Guide

Pressure Transducers

Pressure Transducer Guide

FORCE

Force Sensor Guide

Application Notes

Products overview

Preliminary Selection Guide

Model	Power	Output	Outline	Package
SA141	1.8-10Volts	millivolts	7.6*7.6*9mm	SMT
SA142	1.8-10Volts	millivolts	7.6*7.6*9mm	SMT
SA1210	1.5mA	millivolts	14.7*15.2*16.6mm	DIP
SA1220	3-5Volts	millivolts	14.7*15.2*16.6mm	DIP
SA5652	10Volts	millivolts	14.7*15.2*16.6mm	DIP
SA1210VI	16-32Volts	0-10V/4-20mA	14.7*15.2*16.6mm	DIP
SA13	2.7-5.5Volts	Analog/I2C/SPI-14bits	14.7*15.2*16.6mm	DIP
SA5852	2.7-5.5Volts	Analog/I2C/SPI-14bits	14.7*15.2*16.6mm	DIP
SA16	1.5mA	millivolts	12.7*12.7*20.4mm	TO8
SA26	1.5mA	millivolts	12.7*12.7*30.3mm	TO8
SA36	1.8-10Volts	millivolts	12.7*12.7*42.2mm	SMT
SA46	1.8-10Volts	millivolts	12.7*12.7*42.2mm	SMT
SA18	2.7-5.5Volt	Analog/I2C/SPI-14bits	19.5*16.3*10mm	SMT/DIP
SA18HD	1.8-3.6Volts	I2C/SPI-24bits	19.5*16.3*10mm	SMT/DIP
SA18E	2.7-5.5Volts	Analog/I2C/SPI-16bit	14.7*15.2*16.6mm	SMT/DIP
SA19	2.7-5.5Volts	Analog/I2C/SPI-14bits	17.4*12.4*7.2mm	SMT/DIP
SA19HD	1.8-3.6Volt	I2C/SPI-24bits	17.4*12.4*7.2mm	SMT/DIP
SA19E	2.7-5.5Volts	Analog/I2C/SPI-16bits	17.4*12.4*7.2mm	SMT/DIP
SAABP	2.7-5.5Volts	Analog/I2C/SPI-14bits	11*8*3mm	SMT/DIP
SAABPH	1.8-3.6Volts	I2C/SPI-24bits	11*8*3mm	SMT/DIP
SA55	2.7-5.5Volts	Analog/I2C/SPI-14bits	10.3*10.3*10.3mm	SMT
SA54	1.8-3.6Volt	I2C/SPI-24bits	10.3*10.3*10.3mm	SMT
SA57	2.7-5.5Volts	Analog/I2C/SPI-16bits	10.3*10.3*10.3mm	SMT
SA1620	1-10Volts	millivolt	10.5*8.1*4.2mm	SMT
SA1620HD	1.8-3.6Volts	I2C/SPI-24bit	10.5*8.1*4.2mm	SMT
SA5660HD	1.8-3.6Volts	I2C/SPI-24bit	25*47*8mm	Connecto
SA5660VI	16-32Volts	0-10V/4-20mA	25*47*8mm	Connecto
SACP800	3-5Volts	millivolts	1*1*4mm	Connector
SA154	1.5mA	millivolts	D19*14mm	Cable

Products overview

Preliminary Selection Guide

Model	Power	Output	Outline	Package
SA154BSD	2.7-5.5Volts	I2C/SPI-14bit	D19*14mm	Cable
SA154A	2.7-5.5Volts	Analog	D19*14mm	Cable
SA154VI	16-32Volts	0-10V/4-20mA	D19*14mm	Cable
SA85	1.5mA	millivolts	D12.5*11.4mm	Cable
SA85BSD	2.7-5.5Volts	I2C/SPI-14bits	D12.5*11.4mm	Cable
SA85A	2.7-5.5Volts	Analog	D12.5*11.4mm	Cable
SA85VI	16-32Volts	0-10V/4-20mA	D12.5*11.4mm	Cable
SA86	1.5mA	millivolts	D15.8*11.4mm	Cable
SA86BSD	2.7-5.5Volts	I2C/SPI-14bits	D15.8*11.4mm	Cable
SA86A	2.7-5.5Volts	Analog	D15.8*11.4mm	Cable
SA86VI	16-32Volts	0-10V/4-20mA	D15.8*11.4mm	Cable
SA87	1.5mA	millivolts	D9.4*10.6mm	Cable
SA87BSD	2.7-5.5Volts	I2C/SPI-14bits	D9.4*10.6mm	Cable
SA87A	2.7-5.5Volts	Analog	D9.4*10.6mm	Cable
SA87VI	16-32Volts	0-10V/4-20mA	D9.4*10.6mm	Cable
SA89	1.5mA	millivolts	D6.8*7.5mm	Cable
SA89BSD	2.7-5.5Volts	I2C/SPI-14bits	D6.8*7.5mm	Cable
SA89VI	16-32Volts	0-10V/4-20mA	D6.8*7.5mm	Cable
SA89A	2.7-5.5Volts	Analog	D6.8*7.5mm	Cable
SA32	16-32Volts	0-10V/4-20mA	D22*58mm	Connector
SA51	16-32Volts	0-10V/4-20mA	D22*71mm	Connector
SA69	16-32Volts	0-10V/4-20mA	D22*38mm	Cable
SA71	16-32Volts	0-10V/4-20mA	D22*31mm	Cable
SA98	16-32Volts	0-10V/4-20mA	D22*45mm	Cable
SA730	16-32Volts	0-10V/4-20mA/RS485	90*90*50mm	Cable
SA730DI	16-32Volts	4-20mA/LCD	90*90*50mm	Cable
SA810	16-32Volts	0-10V/4-20mA/RS485	90*75*50mm	Cable
SA950W	9Volts	4-20mA/RS485/LED	80*140*40mm	Cable
SA1900	5Volts	millivolts	D19.2*5.5mm	Cable
SA2900	5Volts	millivolts/Analog	D19.1*5.3mm	Cable

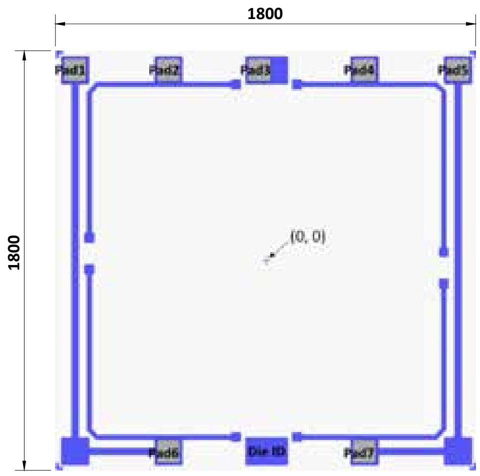
MODEL SAXXXX-X

Part ID		SA001K-G	SA002K-G	SA007K-G	SA050Tr-G	SA040k-G	SA7K5P-A	Note
Parameter	Units	Value						
Pressure Range	Psi	0.15	0.3	1.0	1.0	5.8	7500	
Excitation	V	5	5	5	5	5	5	
Bridge Resistance	kΩ	5±0.5	5±0.5	5±0.5	5±0.5	5±0.5	5±0.5	
Operating Temperature	°C	-40~+125	-40~+125	-40~+125	-40~+125	-40~+125	-40~+125	
Zero Offset	mV	10±30	10±30	±20	±20	±20	±30	
Full Scale Span	mV	25±10	40±10	23±5	28±5	60±15	100±15	(1)
FS Non-linearity	%Span	0.4±0.2	0.7±0.5	±0.3	±0.5	±0.5	±0.3	(2)
Pressure Hysteresis	%Span	±0.2	±0.2	±0.2	±0.3	±0.2	±0.1	
TC Offset (TCO)	%Span/°C	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	(3)
TC Span (TCS) @ constant voltage	%Span/°C	-0.25±0.04	-0.24±0.04	-0.22±0.04	-0.22±0.04	-0.22±0.04	-0.2±0.04	(3)
TC Resistance (TCR)	%/°C	0.38±0.05	0.38±0.05	0.1±0.04	0.1±0.04	0.1±0.04	0.2±0.04	(3)
Burst Pressure	Rated	>=30X	>=30X	>=10X	>=10X	>=3X	>=3X	

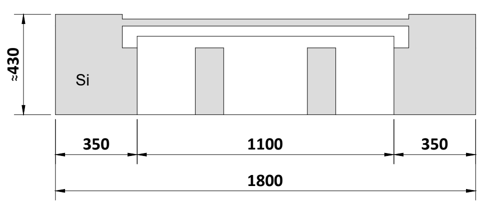
Notes :
(1) All values are Min./Max. and measured at 5V and 25°C unless other specified.
(2) Best fit straight line.
(3) Between -125°C and 125°C. Temperature coefficients are typical values at 5V.

MODEL SA001K-G/SA002K-G

Top View



Cross Section



Pin Assignment

Pad	Function	X-location	Y-location
1	S+	-820	820
2	V-	-420	820
3	Vsub	-30	820
4	S-	420	820
5	V+	820	820
6	S+	-420	820
7	V+	420	820

*Pad size = 100 X 100um²
*Pressure applied from backside

Wafer OQC

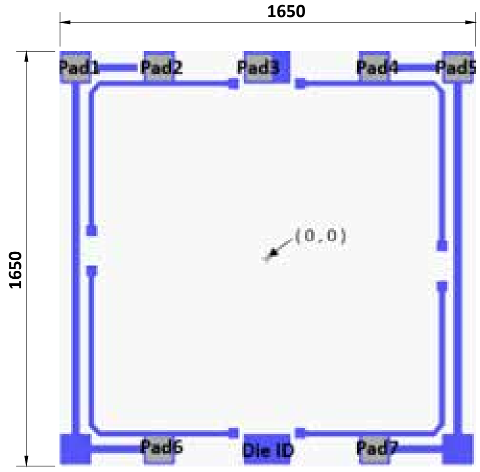
(1) Sampling die's front-side visual inspection is performed on each wafer following ANSI/ASQC Z1.4 GII AQL 4.0 standard to investigate the defect on metal trace, membrane, and pad areas for quality insurance.

(2) Full wafer probing test is performed on each wafer to test bridge resistance and offset voltage at 1 atmospheric pressure and room temperature. Either electronic format of wafer map or bad die inking can be provided.

MODEL SAXXXX-X

MODEL SA007K-G/SA040K-G

Top View



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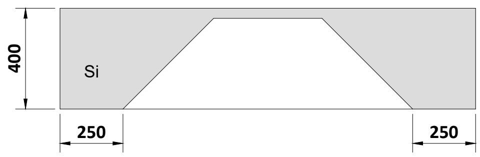


Pin Assignment

Pad	Function	X-location	Y-location
1	S+	-745	745
2	V-	-420	745
3	Vsub	-30	745
4	S-	420	745
5	V+	745	745
6	S+	-420	-745
7	V+	420	-745

*Pad size = 100 X 100um²
*Pressure applied from backside

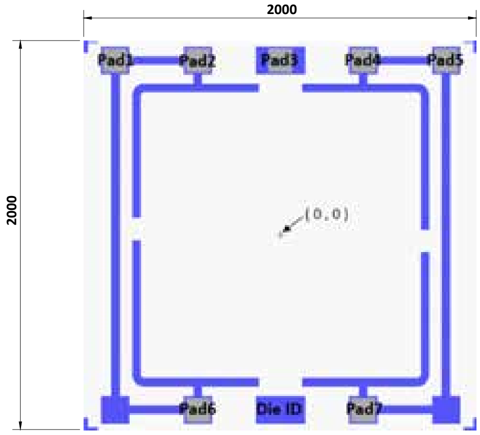
Wafer OQC

(1) Sampling die's front-side visual inspection is performed on each wafer following ANSI/ASQC Z1.4 GII AQL 4.0 standard to investigate the defect on metal trace, membrane, and pad areas for quality insurance.

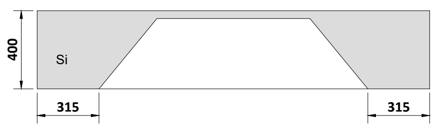
(2) Full wafer probing test is performed on each wafer to test bridge resistance and offset voltage at 1 atmospheric pressure and room temperature. Either electronic format of wafer map or bad die inking can be provided.

MODEL SA050Tr-G

Top View



Cross Section



Pin Assignment

Pad	Function	X-location	Y-location
1	S+	-840	890
2	V-	-420	890
3	Vsub	0	890
4	S-	420	890
5	V+	840	890
6	S+	-420	-890
7	V+	420	-890

*Pad size = 120 X 120um²
*Pressure applied from backside

Wafer OQC

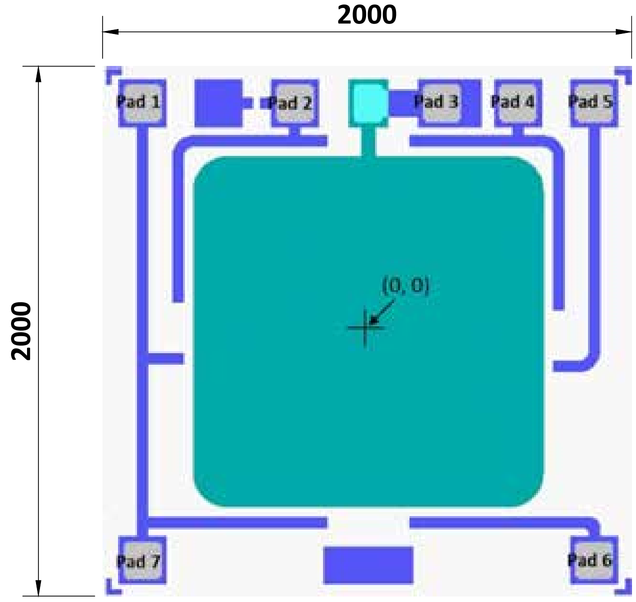
(1) Sampling die's front-side visual inspection is performed on each wafer following ANSI/ASQC Z1.4 GII AQL 4.0 standard to investigate the defect on metal trace, membrane, and pad areas for quality insurance.

(2) Full wafer probing test is performed on each wafer to test bridge resistance and offset voltage at 1 atmospheric pressure and room temperature. Either electronic format of wafer map or bad die inking can be provided.

MODEL SAXXXX-X

MODEL SA7K5P-A

Top View



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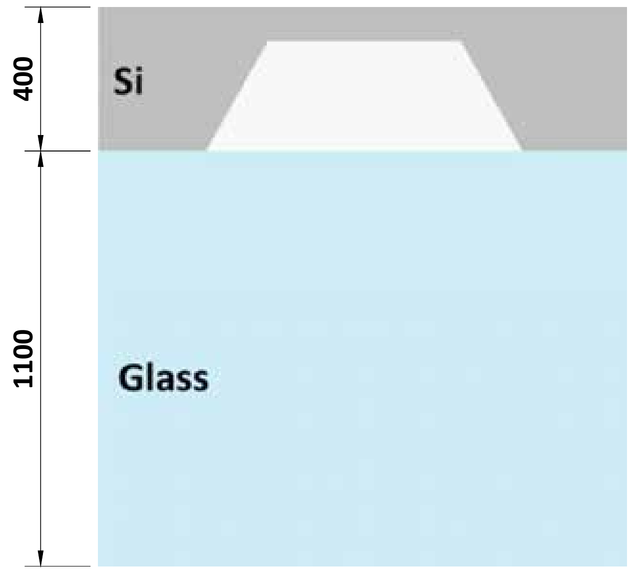
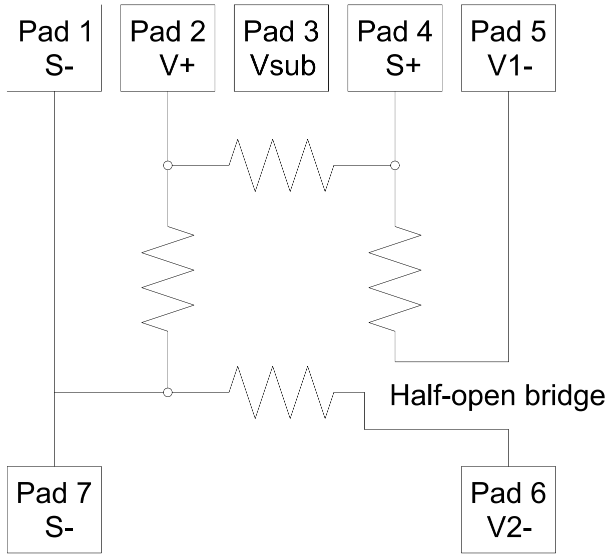


Pin Assignment

Pad	Function	X-location	Y-location
1	S-	-860	870
2	V+	-280	870
3	Vsub	280	870
4	S+	570	870
5	V1-	860	870
6	V2-	860	-870
7	S-	-860	-870

*Pad size = 140 X 140um²



Wafer OQC

(1) Sampling die's front-side visual inspection is performed on each wafer following ANSI/ASQC Z1.4 GII AQL 4.0 standard to investigate the defect on metal trace, membrane, and pad areas for quality insurance.

(2) Full wafer probing test is performed on each wafer to test bridge resistance and offset voltage at 1 atmospheric pressure and room temperature. Either electronic format of wafer map or bad die inking can be provided.

PRESSURE
Model SA141

Small size
InH20 or PSI Ranges
Wide selection of ports

- Absolute or gage pressures
- High-impedance bridge
- Low power consumption

DESCRIPTION

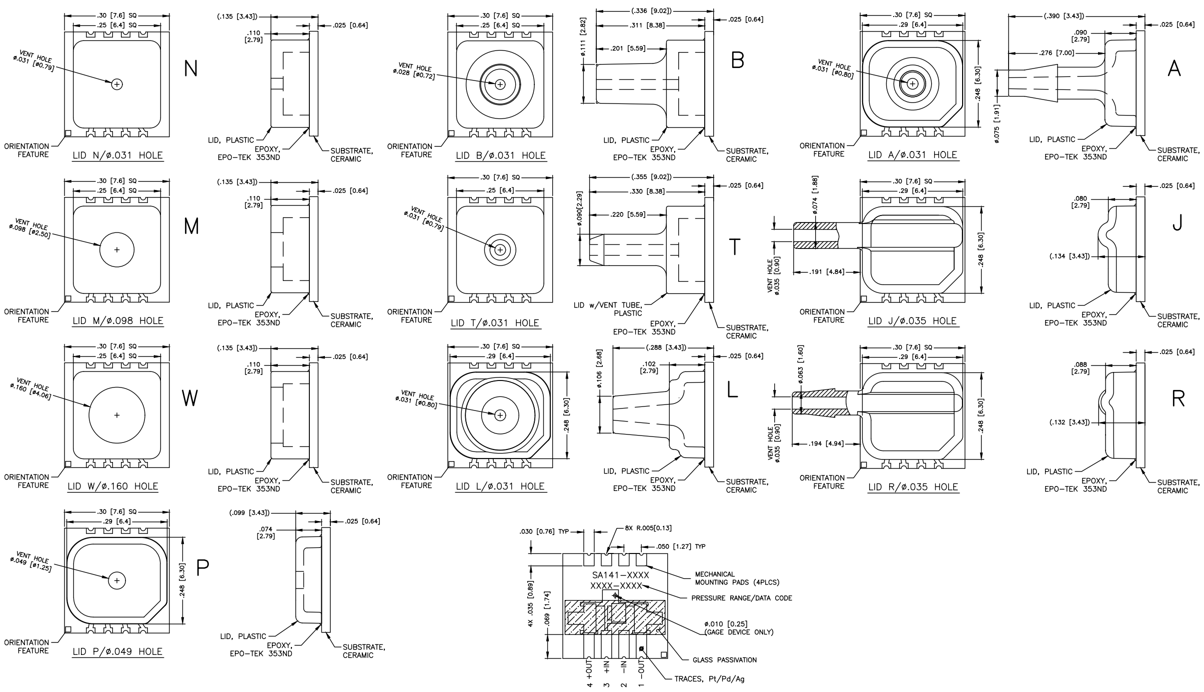
The Model SA141 is a piezoresistive silicon pressure sensor packaged in a surface mount configuration. It is intended for high volume applications where small size, light weight, low cost, and compatibility with automated assembly equipment are required.

The pressure sensor is available with a gage or absolute pressure sensing chip that is attached to a surface mountable ceramic substrate. A cap is attached to the ceramic substrate, protecting the chip and providing the pressure port.

The devices are shipped in plastic anti-static shipping tubes for use with automated production equipment. The drawing shows a standard tube version. Caps are also available with a narrow hole or a large hole to interface with the pressure media.

FEATURES

- Small size
- inH20 or PSI Ranges
- Wide selection of ports
- Solid State Reliability
- Absolute or gage pressures
- High-impedance bridge
- Low power consumption



PC Board Mountable Pressure Sensor

Model SA141

PERFORMANCE SPECIFICATIONS

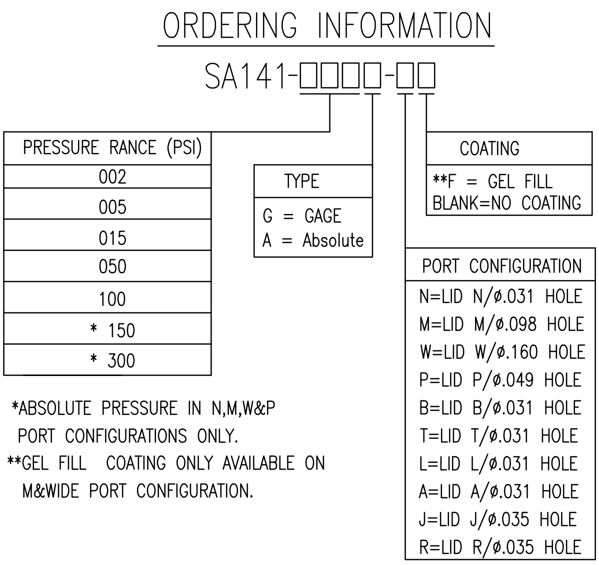
Vsupply: 3.00Vdc, Ta=25°C
Ambient Temperature: 25°C (Unless otherwise specified)

SPECIFICATIONS	MIN	TYP	MAX	UNIT	NOTE
SUPPLY VOLTAGE	1.8	3.0	12	V	
BRIDGE RESISTANCE	2200	-	6100	Ω	
ZERO PRESSURE OUTPUT	-30	-	+30	mV	
PRESSURE NONLINEARITY	-0.1	0	+0.1	%FSS	2
PRESSURE HYSTERESIS	-0.1		+0.1	%FSS	
FULL SPAN	SEE TABLE 1				4
TEMPERATURECOEFFICIENT RESISTANCE	+2300	+2800	+3100	PPM/°C	3
TEMPERATURE COEFFICIENT SENSITIVITY	-2100	-1800	-1400	ppm/°C	3
TEMPERATURE COEFFICIENT OFFSET		±0.10		%FSS/°C	3
TEMPERATURE HYSTERESIS OFFSET@ SPAN	-0.2	-	+0.2	%FSS	3
LONG TERM STABILITY (OFFSET&SPAN)	-0.40	-	+0.40	%FSS	4
PRESSURE OVERLOAD	-	-	5X	RATED	
PRESSURE BURST	-	-	10X	RATED	
OPERATING TEMPERATURE	-40		+125	°C	
STORAGE TEMPERATURE	-50		+150	°C	
WEIGHT		0.3		GRAMS	
SOLDER TEMPERATURE	250°C MAX 5 SEC.				
MEDIA	NON-CORROSIVE DRY GASES COMPATIBLE WITH SILICON, PYREX, RTV, GOLD, CERAMIC, LCP (LIQUID CRYSTAL POLYMER), AND ALUMINUM				

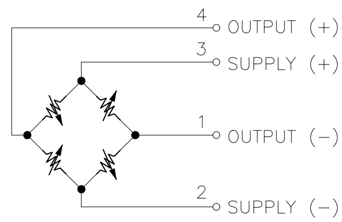
Notes

1.ALL SPECIFICATION AT REFERENCE CONDITIONS UNLESS OTHERWISE NOTED. OUTPUT IS RATIO METRIC TO SUPPLY VOLTAGE.
2. ½ TERMINAL BASE NON LINEARITY (MEASURED AT 0, 50% AND 100% FS).
3. DEVIATION BETWEEN 70°C AND 0°C EXPRESSED AS PERCENTAGE OF READING AT 25°C.
4. DEVIATION AFTER 1 YEAR PERIOD MEASURED AT REFERENCE CONDITIONS.
5. MEASURED OVER THE TEMPERATURE RANGE OF 70°C AND 0°C.
6. EXCEEDING ABSOLUTE MAXIMUM SPECIFICATION MAY DAMAGE THE DEVICE. EXTENDED EXPOSURE BEYOND THE OPERATING CONDITIONS MAY AFFECT DEVICE RELIABILITY.

ORDERING INFORMATION



APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

SPECIFICATIONS	RANGE	MIN	TYP	MAX	UNITS
FULL SCALE SPAN (INH2O RANGES)	5	18.0	33.0	50.0	mV
	10	18.0	33.0	50.0	mV
	20	18.0	33.0	50.0	mV
	30	60.0	90.0	120.0	mV
FULL SCALE SPAN (PSI RANGES)	5	54.0	66.0	80.0	mV
	15	54.0	66.0	80.0	mV
	30	57.0	69.0	80.0	mV
	50	60.0	75.0	90.0	mV
	100	75.0	96.0	108.0	mV
	150	60.0	75.0	90.0	mV
	300	75.0	96.0	108.0	mV

PRESSURE
Model SA142

Small size
InH20 or PSI Ranges
Wide selection of ports

• Absolute or gage pressures
• High-impedance bridge
• Low power consumption

FEATURES

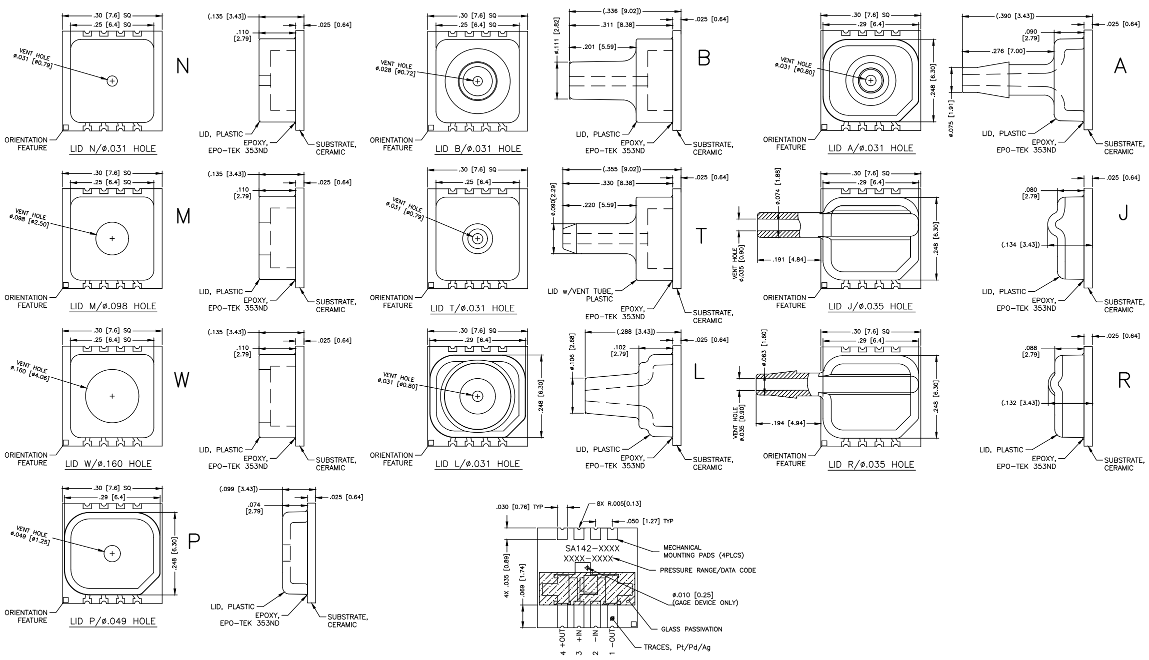
• Small size
• inH20 or PSI Ranges
• Wide selection of ports • Solid State Reliability
• Absolute or gage pressures Power
• High-impedance bridge
• Low power consumption

DESCRIPTION

The Model SA142 is a piezoresistive silicon pressure sensor packaged in a surface mount configuration. It is int ended for high volume applications where small size, light weight, low cost, and compatibility with automated assembly equip ment are required.

The pressure sensor is available with a gage or absolute pressure sensing chip that is attached to a surface mountable ceramic substrate. A cap is attached to the ceramic substrate, protecting the chip and providing the pressure port.

The devices are shipped in plastic anti-static shipping tubes for use with automated production equipment. The drawing shows a standard tube version. Caps are also available with a narrow hole or a large hole to interface with the pressure media.



PC Board Mountable Pressure Sensor
Model SA142

PERFORMANCE SPECIFICATIONS

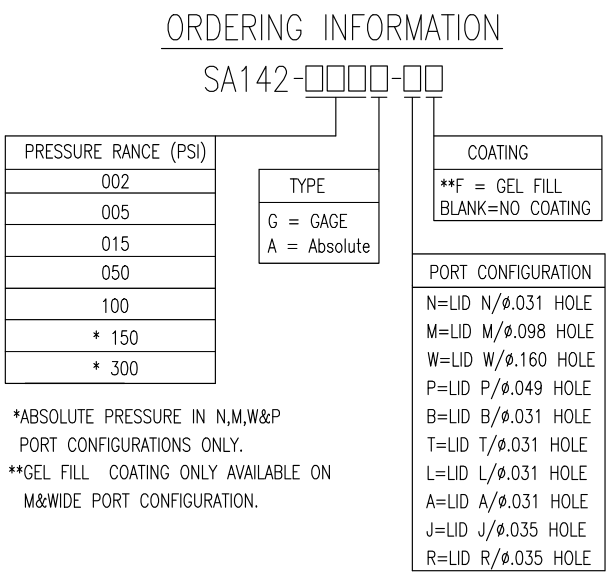
Vsupply: 3.00Vdc, Ta=25°C
Ambient Temperature: 25°C (Unless otherwise specified)

SPECIFICATIONS	MIN	TYP	MAX	UNIT	NOTE
SUPPLY VOLTAGE	1.8	3.0	12	V	
BRIDGE RESISTANCE	2200	-	6100	Ω	
ZERO PRESSURE OUTPUT	-2	-	+2	mV	
PRESSURE NONLINEARITY	-0.1	0	+0.1	%FSS	2
PRESSURE HYSTERESIS	-0.1		+0.1	%FSS	
FULL SPAN	SEE TABLE 1				4
TEMPERATURE COEFFICIENT RESISTANCE	+2300	+2800	+3100	PPM/°C	3
TEMPERATURE COEFFICIENT SENSITIVITY	-2100	-1800	-1400	ppm/°C	3
TEMPERATURE COEFFICIENT OFFSET		±0.10		%FSS/°C	3
TEMPERATURE HYSTERESIS OFFSET@SPAN	-0.2	-	+0.2	%FSS	3
LONG TERM STABILITY (OFFSET&SPAN)	-0.40	-	+0.40	%FSS	4
PRESSURE OVERLOAD	-	-	5X	RATED	
PRESSURE BURST	-	-	10X	RATED	
OPERATING TEMPERATURE	-40		+125	°C	
STORAGE TEMPERATURE	-50		+150	°C	
WEIGHT		0.3		GRAMS	
SOLDER TEMPERATURE	250°C MAX 5 SEC.				
MEDIA	NON-CORROSIVE DRY GASES COMPATIBLE WITH SILICON, PYREX, RTV, GOLD, CERAMIC, LCP (LIQUID CRYSTAL POLYMER), AND ALUMINUM				

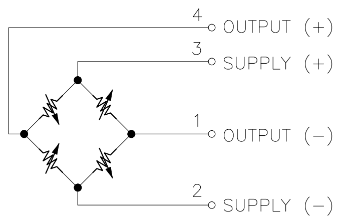
Notes

1.ALL SPECIFICATION AT REFERENCE CONDITIONS UNLESS OTHERWISE NOTED. OUTPUT IS RATIO METRIC TO SUPPLY VOLTAGE.
2. ½ TERMINAL BASE NON LINEARITY (MEASURED AT 0, 50% AND 100% FS).
3. DEVIATION BETWEEN 70°C AND 0°C EXPRESSED AS PERCENTAGE OF READING AT 25°C.
4. DEVIATION AFTER 1 YEAR PERIOD MEASURED AT REFERENCE CONDITIONS.
5. MEASURED OVER THE TEMPERATURE RANGE OF 70°C AND 0°C.
6. EXCEEDING ABSOLUTE MAXIMUM SPECIFICATION MAY DAMAGE THE DEVICE. EXTENDED EXPOSURE BEYOND THE OPERATING CONDITIONS MAY AFFECT DEVICE RELIABILITY.

ORDERING INFORMATION



APPLICATION SCHEMATIC



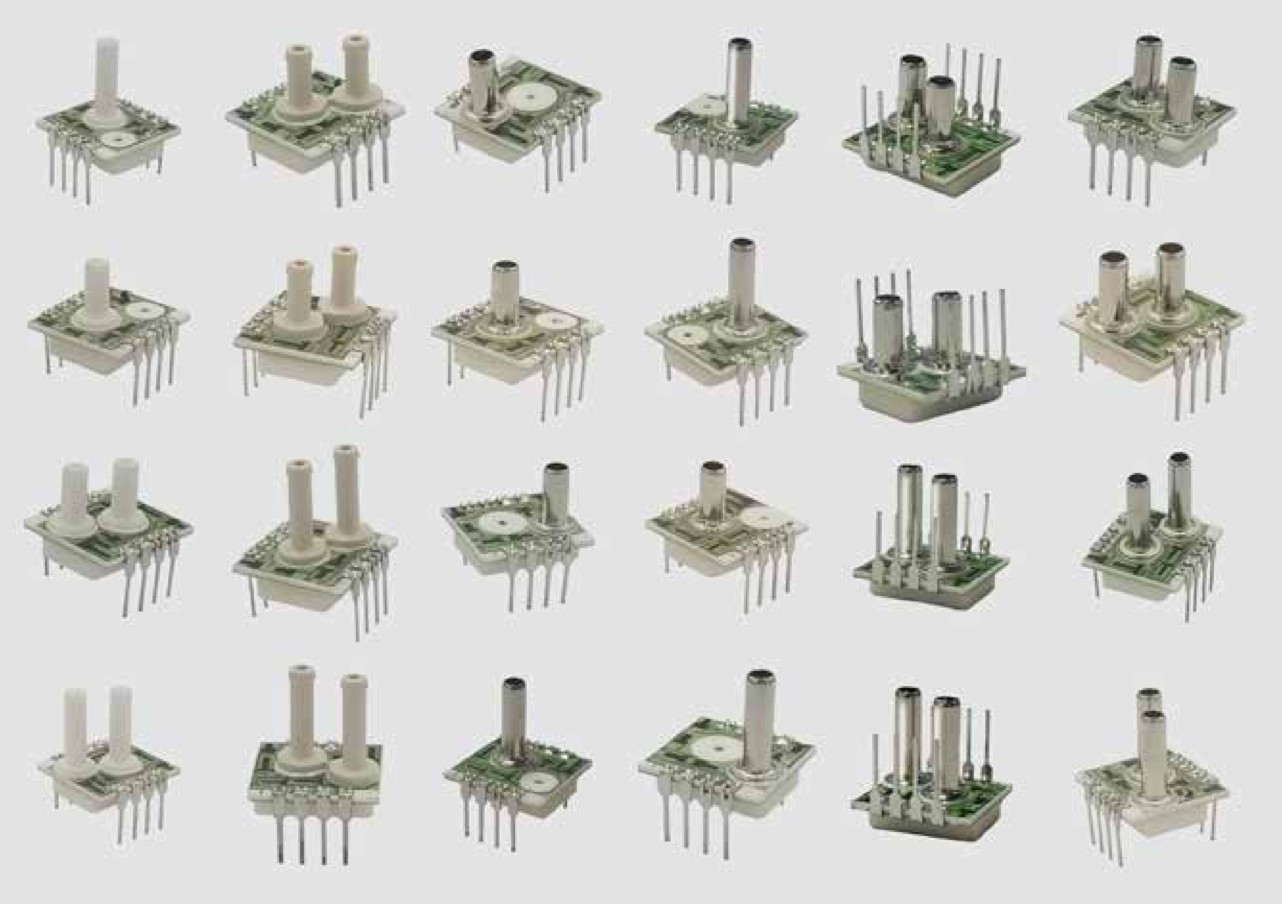
APPLICATION SCHEMATIC

SPECIFICATIONS	RANGE	MIN	TYP	MAX	UNITS
FULL SCALE SPAN (INH2O RANGES)	5	18.0	33.0	50.0	mV
	10	18.0	33.0	50.0	mV
	20	18.0	33.0	50.0	mV
	30	60.0	90.0	120.0	mV
FULL SCALE SPAN (PSI RANGES)	5	54.0	66.0	80.0	mV
	15	54.0	66.0	80.0	mV
	30	57.0	69.0	80.0	mV
	50	60.0	75.0	90.0	mV
	100	75.0	96.0	108.0	mV
	150	60.0	75.0	90.0	mV
	300	75.0	96.0	108.0	mV

PRESSURE
Model SA1210

100% Field Interchangeability
Constant Current
Wide selection of port

- Absolute, Differential or Gage pressures
- Temperature Compensated
- 0.2% Pressure Non Linearity



DESCRIPTION

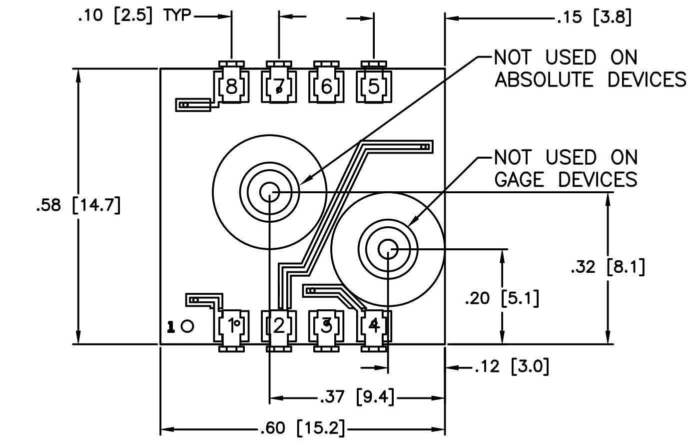
Sensorall International SA1210 Series is a temperature compensated, mV output, ceramic mounted pressure sensor packaged in a rugged Dual In Line package. SA1210 uses a silicon MEMS pressure sensor bonded to a ceramic substrate containing thick film resistors that are uniquely laser trimmed for each sensor.

Incorporating a flexible design, the SA1210 Series is available with no, short or long metal or plastic or ceramic tubes and can be mounted pin up or pins down to allow OEMs to optimize their board design. The SA1210 series is powered using constant current and when configured as in the application note, the integrated gain set resistor will ensure sensor field interchangeability.

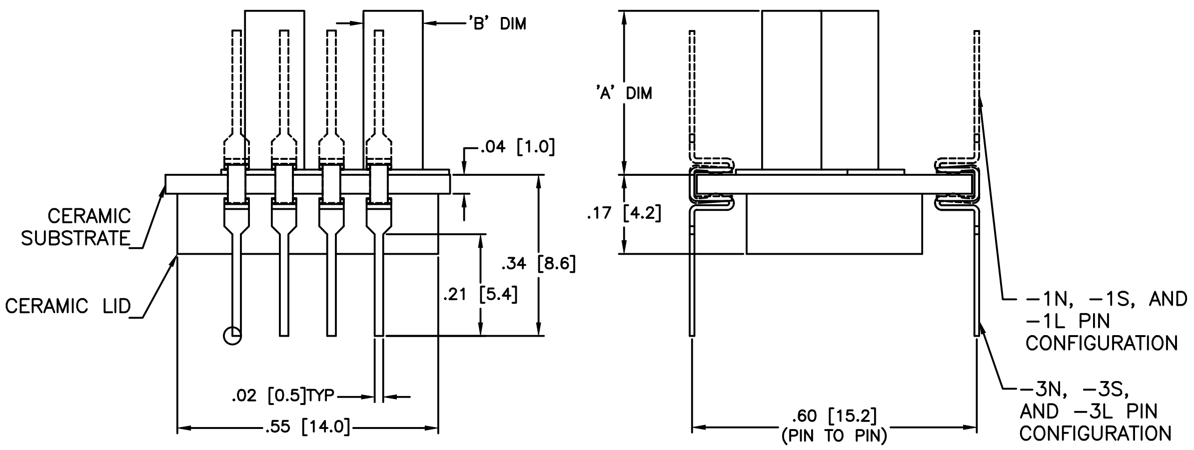
The SA1210 series superior die performance, coupled with rugged ceramic substrate ensures long term stability with superior temperature performance over wide operating range.

PRESSURE
MODEL SA1210

DIMENSIONS

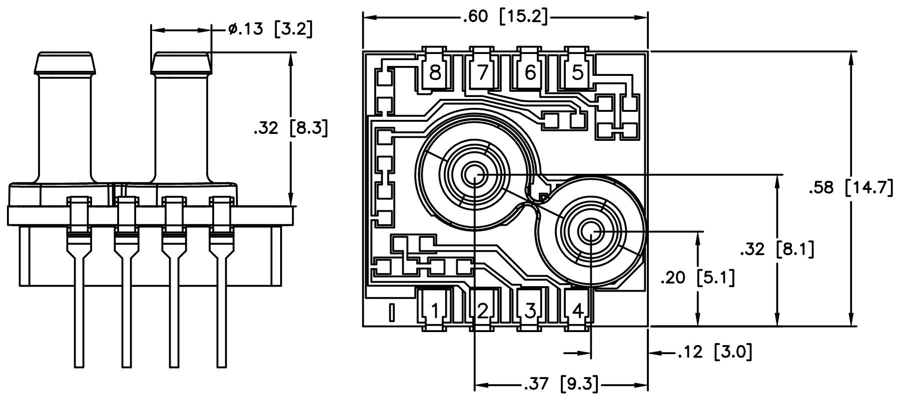


PAD NO	FUNCTION
1	-OUT
2	-EX
3	+OUT
4	+EX
5,6	GAIN
7,8	TEST



PACKAGE: M (CERAMIC + METAL TUBE)
PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)



PC Board Mountable Pressure Sensor

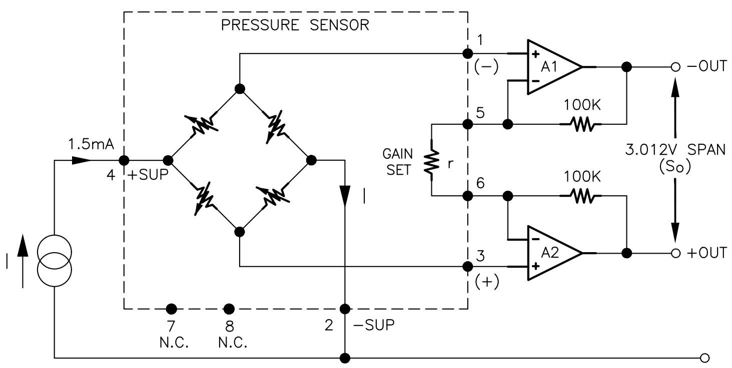
MODEL SA1210

PERFORMANCE SPECIFICATIONS

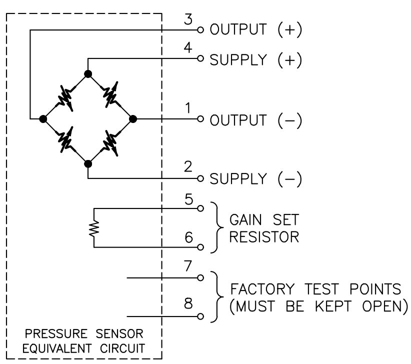
Vsupply: 1.500mA, Ta=25°C.
Ambient Temperature: 25°C (Unless otherwise specified)

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Performance Characteristics						
Supply current		0.5	1.5	+2.0	mA	1
Bridge Resistance, Input & Output		1800		3800	Ω	
Zero Pressure Offset				+2.0	mV	
Pressure Non Linearity				+0.2	%FSS	2
Hysteresis & Repeatability		-0.3	±0.15	+0.3	%FSS	4
Full Scale Span (Constant Current)	FSS	75	100	150	mV	
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	
Thermal Error of Span		-1.0		+1.0	%FSS	3
Thermal Error of Offset		-1.0		+1.0	%FSS	3
Response Time			100		µS	6
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5	0.3	grams	
Compensated Temperature		0 TO 50			°C	
Absolute Maximum Conditions						
Supply Voltage				3	mA	
Storage Temperature		-50		150	°C	
Overage Pressure			3X			7
Burst, Differential Pressure				5X	Range	
Burst, Gauge & Absolute Pressure				10X	Range	
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Ceramic, Epoxy, RTV, Silicon, Gold, Aluminum, Palladium Silver				

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC



PC Board Mountable Pressure Sensor

MODEL SA1210

ORDERING INFORMATION

SA1210 - XXXX X - X X X - RM

SA1210 = CONSTANT CURRENT CALIBRATION 0-50°C

PRESSURE RANGE

001P=1Psi	001K=1Kpa	001W=1inH2O
002P=2Psi	002K=2Kpa	004W=3inH2O
005P=5Psi	005K=5Kpa	010W=10inH2O
015P=15Psi	010K=10Kpa	030W=30inH2O
030P=30Psi	050K=50Kpa	001B=1Bar
050P=50Psi	100K=100Kpa	002B=2Bar
100P=100Psi	200K=200Kpa	010B=10Bar
150P=150Psi	500K=500Kpa	
300P=300Psi		

PRESSURE TYPE

G = GAGE
D = DIFFERENTIAL
A = ABSOLUTE

LEAD CONFIGURATION

1 = SAME SIDE AS VENT TUBE
3 = OPPOSITE SIDE AS VENT TUBE

PRESSURE TUBE TYPE

L = LONG TUBE
S = SHORT TUBE
N = NO TUBE

PACKAGE

P = PPS TUBE
M = METAL TUBE
C = CERAMIC TUBE

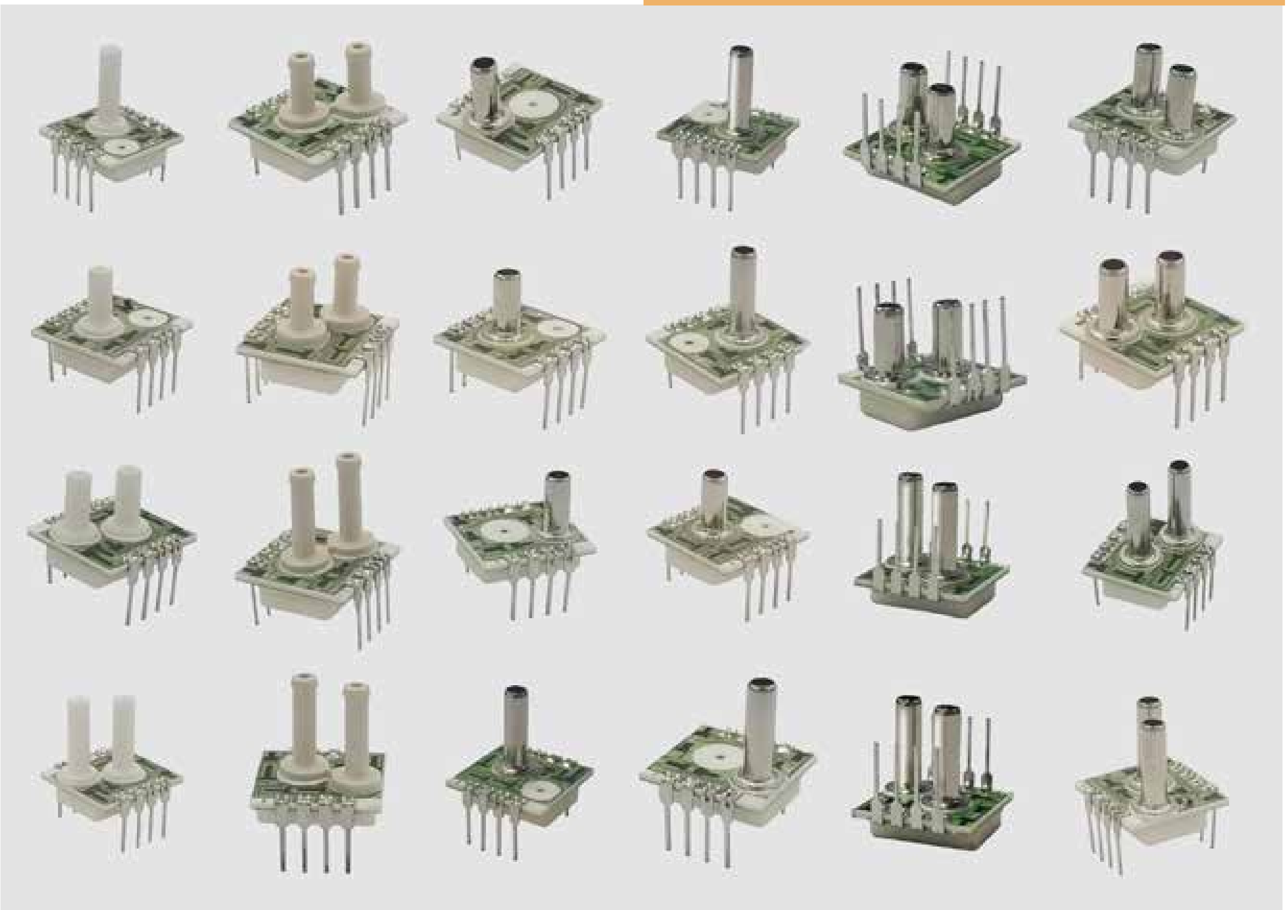
Notes

1.RATIOMETRIC TO SUPPLY CURRENT
2.BEST FIT STRAIGHT LINE.
3.MAXIMUM TEMPERATURE ERROR BETWEEN 0C AND 50C WITH RESPECT TO 25C.
4.SHORT TERM STABILITY OVER 7 DAYS WITH CONSTANT CURRENT AND TEMPERATURE.
5.LONG TERM STABILITY OVER A ONE YEAR PERIOD WITH CONSTANT CURRENT AND TEMPERATURE.
6.FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
7.2X MAXIMUM FOR 100PSI DEVICE.

PRESSURE
MODEL SA1220

100% Field Interchangeability
Constant Voltage
Wide selection of port

- **Absolute, Differential or Gage pressures**
- **Temperature Compensated**
- **0.1% Pressure Non Linearity**



DESCRIPTION

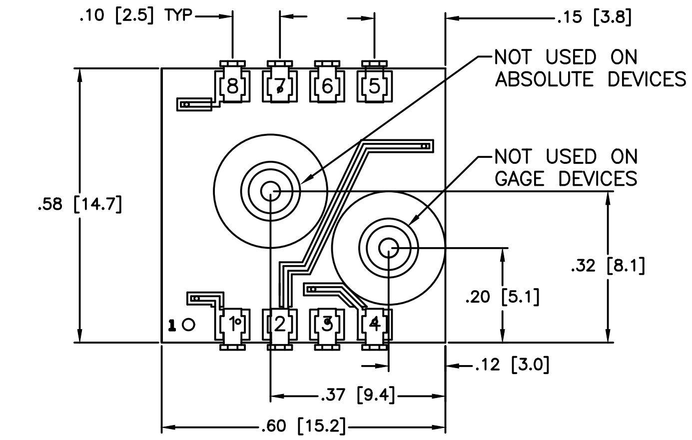
Sensorall International SA1220 Series is a temperature compensated, mV output, ceramic mounted pressure sensor packaged in a rugged Dual In Line package. SA1220 uses a silicon MEMS pressure sensor bonded to a ceramic substrate containing thick film resistors that are uniquely laser trimmed for each sensor.

Incorporating a flexible design, the SA1220 Series is available with no, short or long metal or plastic or ceramic tubes and can be mounted pin up or pins down to allow OEMs to optimize their board design. The SA1220 series is powered using constant voltage and when configured as in the application note, the integrated gain set or current set resistor will ensure sensor field interchangeability.

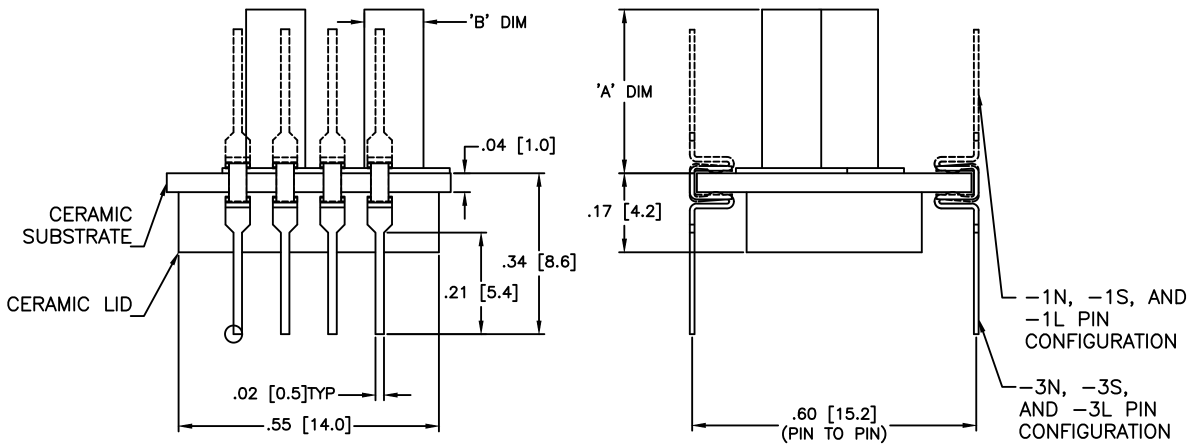
The SA1220 series superior die performance, coupled with rugged ceramic substrate ensures long term stability with superior temperature performance over wide operating range.

MODEL SA1220

DIMENSIONS



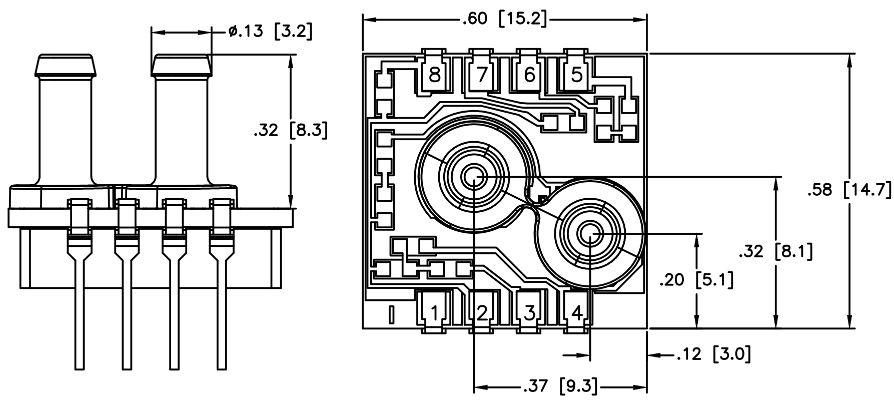
PAD NO	FUNCTION
1	-OUT
2	-EX
3	+OUT
4	+EX
5,6	GAIN
7,8	TEST



PACKAGE: M (CERAMIC + METAL TUBE)

PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)



PC Board Mountable Pressure Sensor
MODEL SA1220

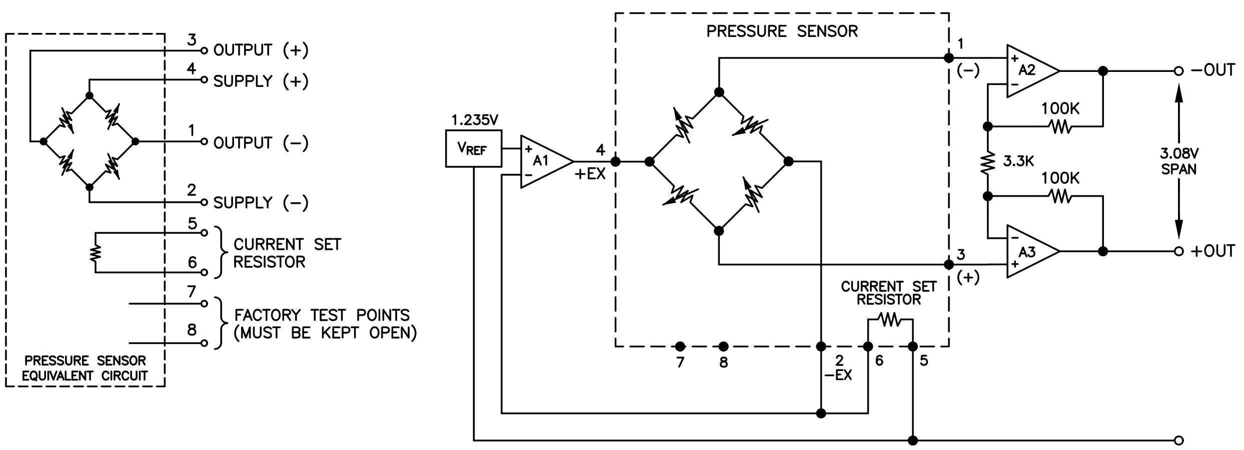
PERFORMANCE SPECIFICATIONS

Vsupply: 1.500mA, Ta=25°C.
Ambient Temperature: 25°C (Unless otherwise specified)

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Performance Characteristics						
Supply voltage		1.235, Refer to Schematic			Volt	
Bridge Resistance, Input & Output		1800		3800	Ω	
Zero Pressure Offset				+2.0	mV	
Pressure Non Linearity				+0.2	%FSS	2
Hysteresis & Repeatability		-0.3	±0.15	+0.3	%FSS	4
Full Scale Span (Constant Current)	FSS	49.5	50	50.5	mV	
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	4
Thermal Error of Span		-1.0		+1.0	%FSS	3
Thermal Error of Offset		-1.0		+1.0	%FSS	3
Response Time			100		μS	6
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5		grams	
Compensated Temperature		0 TO 50			°C	
Absolute Maximum Conditions						
Storage Temperature		-50		150	°C	
Overage Pressure			3X			7
Burst, Differential Pressure				5X	Range	
Burst, Gauge & Absolute Pressure				10X	Range	
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Ceramic, Epoxy, RTV, Silicon, Gold, Aluminum, Palladium Silver				

APPLICATION SCHEMATIC

CONSTANT VOLTAGE



PRESSURE

MODEL SA1220

ORDERING INFORMATION

SA1220 - XXXX X - X X X - RM

SA1220 = CONSTANT VOLTAGE CALIBRATION 0-50°C

PRESSURE RANGE		
001P=1Psi	001K=1Kpa	001W=1inH2O
002P=2Psi	002K=2Kpa	004W=3inH2O
005P=5Psi	005K=5Kpa	010W=10inH2O
015P=15Psi	010K=10Kpa	030W=30inH2O
030P=30Psi	050K=50Kpa	001B=1Bar
050P=50Psi	100K=100Kpa	002B=2Bar
100P=100Psi	200K=200Kpa	010B=10Bar
150P=150Psi	500K=500Kpa	
300P=300Psi		

PRESSURE TYPE

G = GAGE
D = DIFFERENTIAL
A = ABSOLUTE

LEAD CONFIGURATION

1 = SAME SIDE AS VENT TUBE
3 = OPPOSITE SIDE AS VENT TUBE

PRESSURE TUBE TYPE

L = LONG TUBE
S = SHORT TUBE
N = NO TUBE

PACKAGE

P = PPS TUBE
M = METAL TUBE
C = CERAMIC TUBE

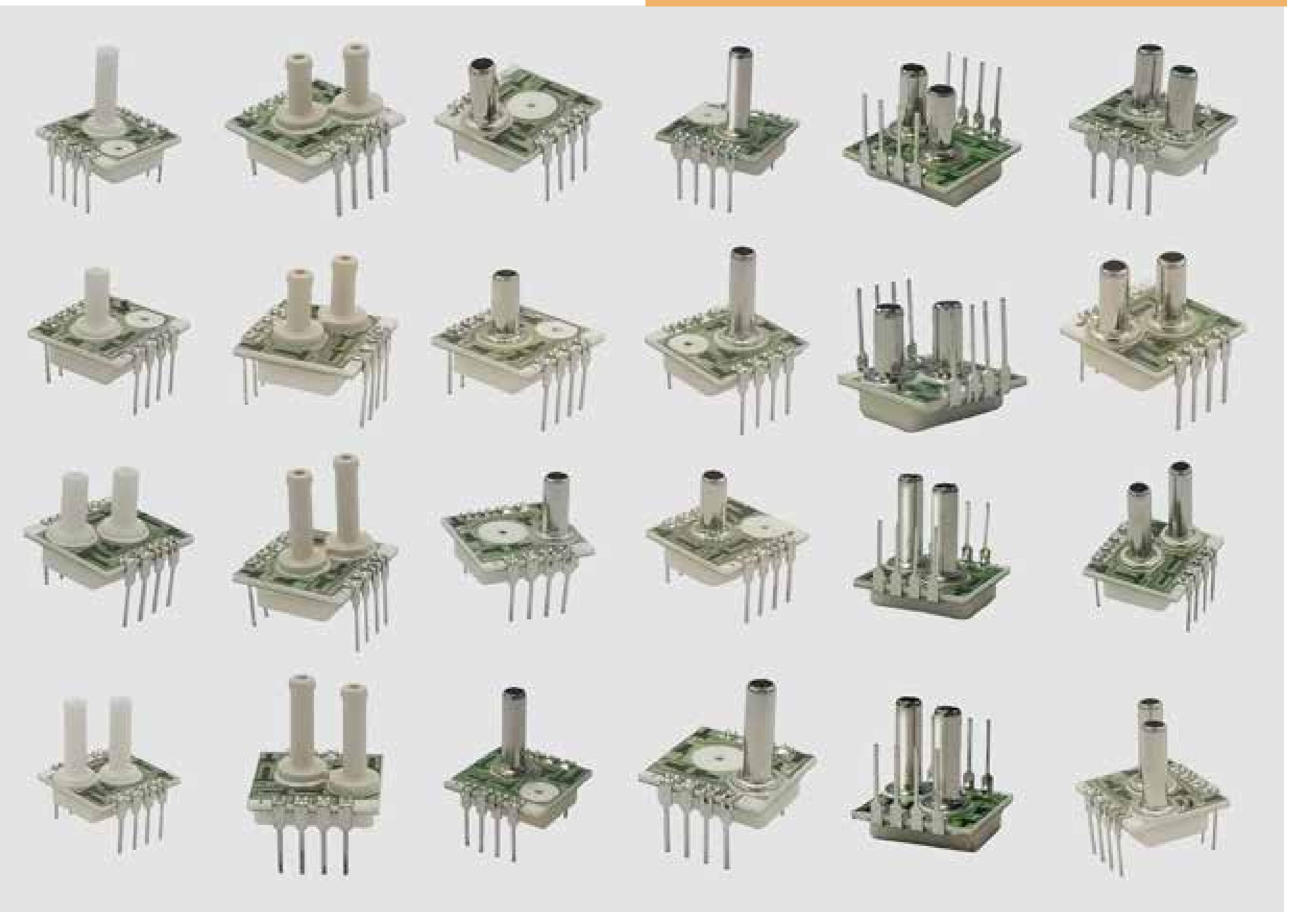
Notes

1.RATIOMETRIC TO SUPPLY CURRENT
2.BEST FIT STRAIGHT LINE.
3.MAXIMUM TEMPERATURE ERROR BETWEEN 0C AND 50C WITH RESPECT TO 25C.
4.SHORT TERM STABILITY OVER 7 DAYS WITH CONSTANT CURRENT AND TEMPERATURE.
5.LONG TERM STABILITY OVER A ONE YEAR PERIOD WITH CONSTANT CURRENT AND TEMPERATURE.
6.FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
7.2X MAXIMUM FOR 100PSI DEVICE.

PRESSURE
MODEL SA1230

100% Field Interchangeability
Constant Current
Wide selection of port

- **Absolute, Differential or Gage pressures**
- **Temperature Compensated**
- **0.1% Pressure Non Linearity**



DESCRIPTION

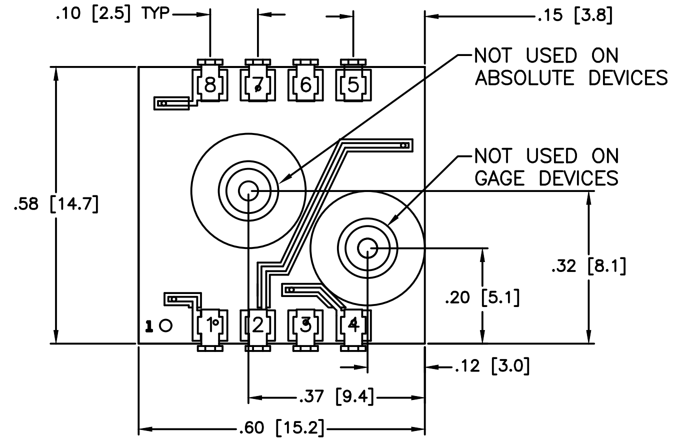
Sensorall International SA12130 Series is a temperature compensated, mV output, ceramic mounted pressure sensor packaged in a rugged Dual In Line package. SA1230 uses a silicon MEMS pressure sensor bonded to a ceramic substrate containing thick film resistors that are uniquely laser trimmed for each sensor.

Incorporating a flexible design, the SA1230 Series is available with no, short or long metal or plastic or ceramic tubes and can be mounted pin up or pins down to allow OEMs to optimize their board design.
The SA1230 series is powered using constant current and when configured as in the application note, the integrated gain set resistor will ensure sensor field interchangeability.

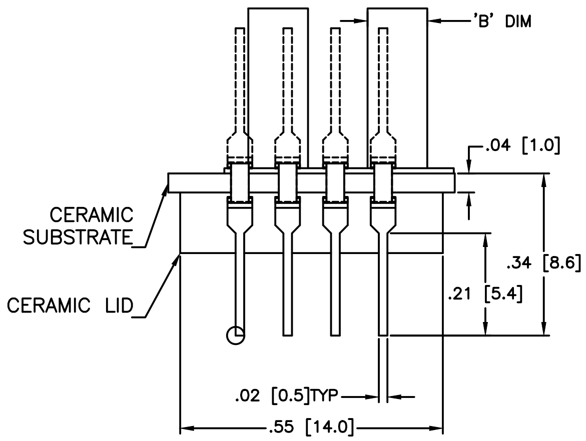
The SA1230 series superior die performance, coupled with rugged ceramic substrate ensures long term stability with superior temperature performance over wide operating range.

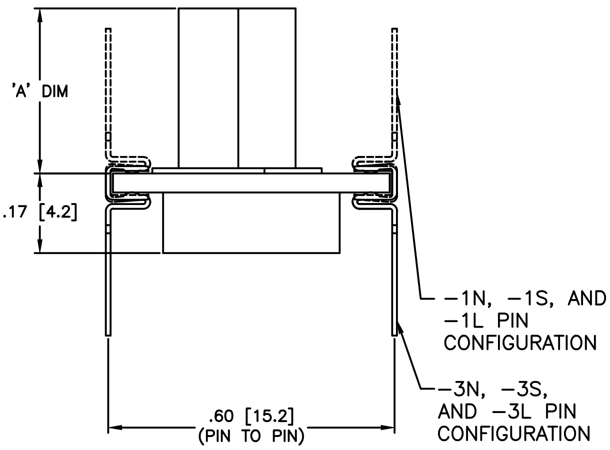
PRESSURE
MODEL SA1230

DIMENSIONS



PAD NO	FUNCTION
1	-OUT
2	-EX
3	+OUT
4	+EX
5,6	GAIN
7,8	TEST

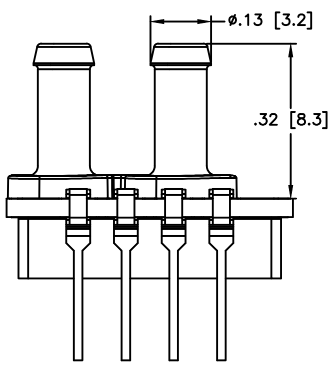


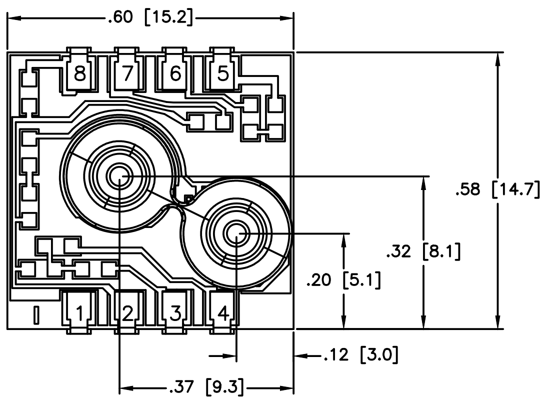


PACKAGE: M (CERAMIC + METAL TUBE)

PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)





PC Board Mountable Pressure Sensor

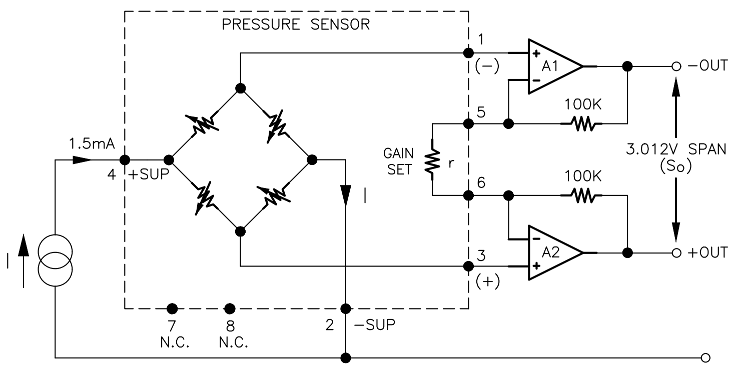
MODEL SA1230

PERFORMANCE SPECIFICATIONS

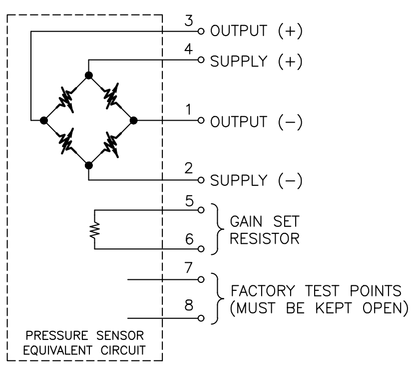
Vsupply: 1.500mA, Ta=25°C.
Ambient Temperature: 25°C (Unless otherwise specified)

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Performance Characteristics						
Supply current		0.5	1.5	+2.0	mA	1
Bridge Resistance, Input & Output		1800		3800	Ω	
Zero Pressure Offset				+2.0	mV	
Pressure Non Linearity			±0.1	+0.2	%FSS	2
Hysteresis & Repeatability		-0.3	±0.15	+0.3	%FSS	4
Full Scale Span (Constant Current)	FSS	75	100	150	mV	
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	
Thermal Error of Span		-0.5		+0.5	%FSS	3
Thermal Error of Offset		-0.5		+0.5	%FSS	3
Response Time			100		μS	6
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5	0.3	grams	
Compensated Temperature		-20 TO 80			°C	
Absolute Maximum Conditions						
Supply Voltage				3	mA	
Storage Temperature		-50		150	°C	
Overage Pressure			3X			7
Burst, Differential Pressure				5X	Range	
Burst, Gauge & Absolute Pressure				10X	Range	
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Ceramic, Epoxy, RTV, Silicon, Gold, Aluminum, Palladium Silver				

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC



PRESSURE

MODEL SA1230

ORDERING INFORMATION

SA1230 - XXXX X - X X X - RM

SA1230 = CONSTANT CURRENT CALIBRATION -20-80°C

PRESSURE RANGE

001P=1Psi	001K=1Kpa	001W=1inH2O
002P=2Psi	002K=2Kpa	004W=3inH2O
005P=5Psi	005K=5Kpa	010W=10inH2O
015P=15Psi	010K=10Kpa	030W=30inH2O
030P=30Psi	050K=50Kpa	001B=1Bar
050P=50Psi	100K=100Kpa	002B=2Bar
100P=100Psi	200K=200Kpa	010B=10Bar
150P=150Psi	500K=500Kpa	
300P=300Psi		

PRESSURE TYPE

G = GAGE
D = DIFFERENTIAL
A = ABSOLUTE

LEAD CONFIGURATION

1 = SAME SIDE AS VENT TUBE
3 = OPPOSITE SIDE AS VENT TUBE

PRESSURE TUBE TYPE

L = LONG TUBE
S = SHORT TUBE
N = NO TUBE

PACKAGE

P = PPS TUBE
M = METAL TUBE
C = CERAMIC TUBE

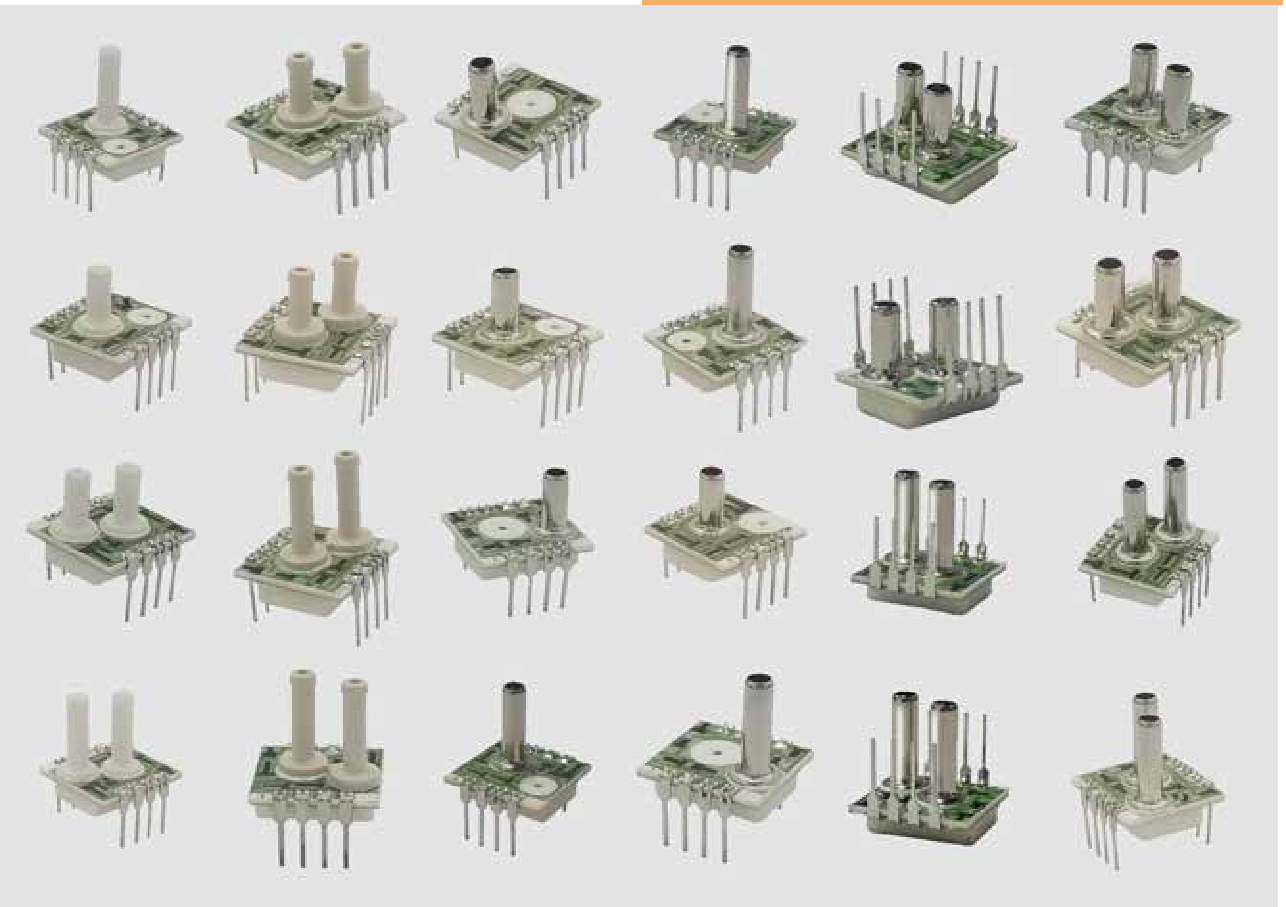
Notes

1.RATIOMETRIC TO SUPPLY CURRENT
2.BEST FIT STRAIGHT LINE.
3.MAXIMUM TEMPERATURE ERROR BETWEEN 0C AND 50C WITH RESPECT TO 25C.
4.SHORT TERM STABILITY OVER 7 DAYS WITH CONSTANT CURRENT AND TEMPERATURE.
5.LONG TERM STABILITY OVER A ONE YEAR PERIOD WITH CONSTANT CURRENT AND TEMPERATURE.
6.FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
7.2X MAXIMUM FOR 100PSI DEVICE.

PRESSURE
MODEL SA1240

100% Field Interchangeability
Constant Voltage
Wide selection of port

- **Absolute, Differential or Gage pressures**
- **Temperature Compensated**
- **0.1% Pressure Non Linearity**



DESCRIPTION

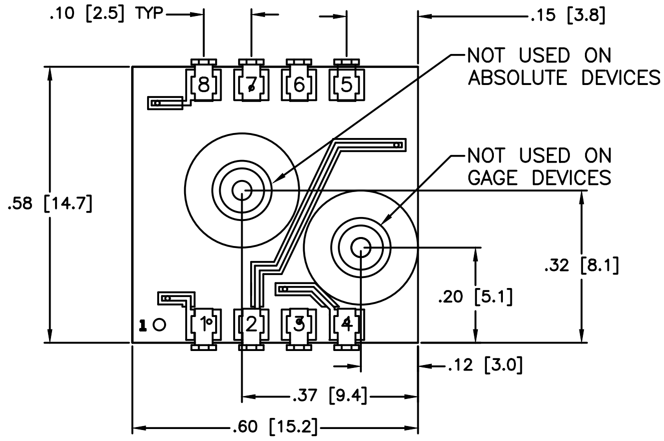
Sensorall International SA1240 Series is a temperature compensated, mV output, ceramic mounted pressure sensor packaged in a rugged Dual In Line package. SA1240 uses a silicon MEMS pressure sensor bonded to a ceramic substrate containing thick film resistors that are uniquely laser trimmed for each sensor.

Incorporating a flexible design, the SA1240 Series is available with no, short or long metal or plastic or ceramic tubes and can be mounted pin up or pins down to allow OEMs to optimize their board design. The SA1240 series is powered using constant voltage and when configured as in the application note, the integrated gain set or current set resistor will ensure sensor field interchangeability.

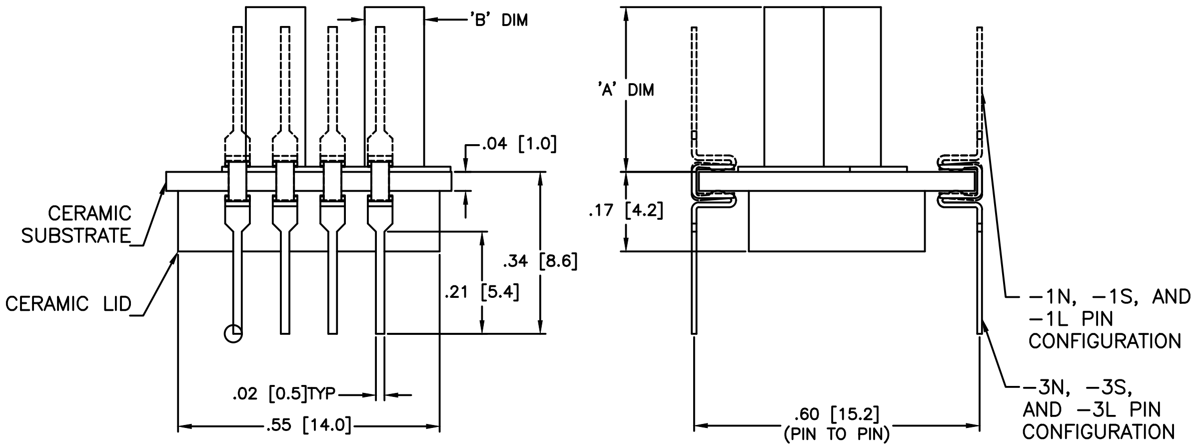
The SA1240 series superior die performance, coupled with rugged ceramic substrate ensures long term stability with superior temperature performance over wide operating range.

PRESSURE
MODEL SA1240

DIMENSIONS

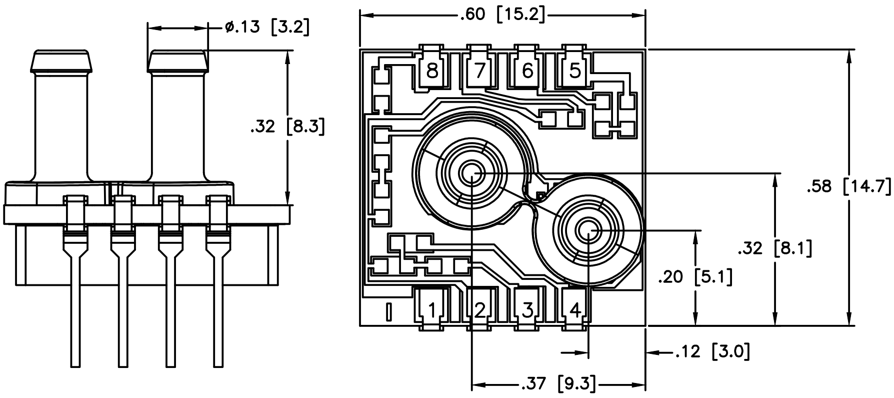


PAD NO	FUNCTION
1	-OUT
2	-EX
3	+OUT
4	+EX
5,6	GAIN
7,8	TEST



PACKAGE: M (CERAMIC + METAL TUBE)
PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)



PC Board Mountable Pressure Sensor
MODEL SA1240

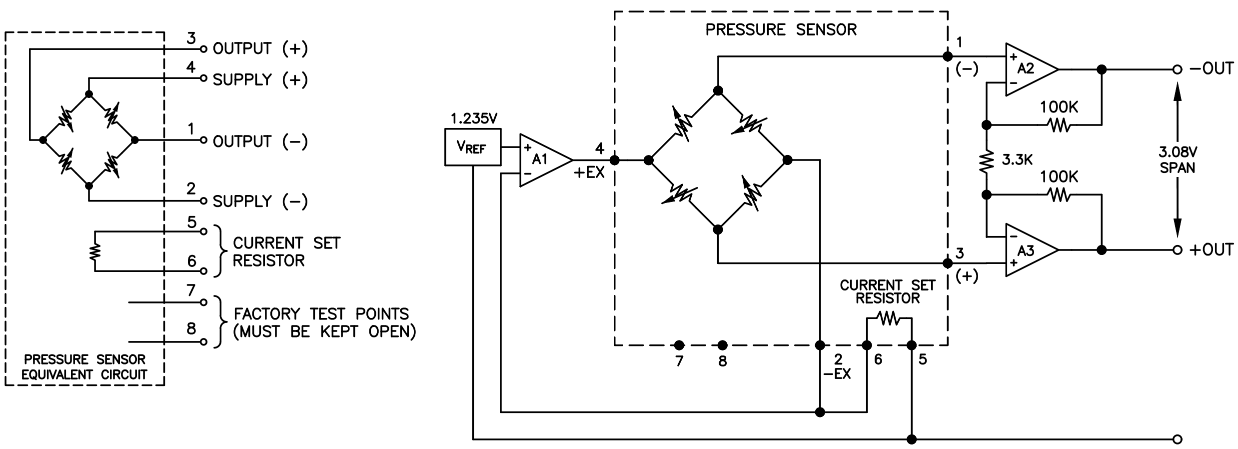
PERFORMANCE SPECIFICATIONS

Vsupply: 1.500mA, Ta=25°C.
Ambient Temperature: 25°C (Unless otherwise specified)

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Performance Characteristics						
Supply voltage		1.235, Refer to Schematic			Volt	
Bridge Resistance, Input & Output		1800		3800	Ω	
Zero Pressure Offset				+2.0	mV	
Pressure Non Linearity				+0.2	%FSS	2
Hysteresis & Repeatability		-0.3	±0.15	+0.3	%FSS	4
Full Scale Span (Constant Current)	FSS	49.5	50	50.5	mV	
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	4
Thermal Error of Span		-0.5		+0.5	%FSS	3
Thermal Error of Offset		-0.5		+0.5	%FSS	3
Response Time			100		μS	6
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5		grams	
Compensated Temperature		-20 TO 80			°C	
Absolute Maximum Conditions						
Storage Temperature		-50		150	°C	
Overage Pressure			3X			7
Burst, Differential Pressure				5X	Range	
Burst, Gauge & Absolute Pressure				10X	Range	
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Ceramic, Epoxy, RTV, Silicon, Gold, Aluminum, Palladium Silver				

APPLICATION SCHEMATIC

CONSTANT VOLTAGE



PRESSURE
MODEL SA1240

ORDERING INFORMATION

SA1240 - XXXX X - X X X - RM

SA1240 = CONSTANT VOLTAGE CALIBRATION -20-80°C

PRESSURE RANGE		
001P=1Psi	001K=1Kpa	001W=1inH2O
002P=2Psi	002K=2Kpa	004W=3inH2O
005P=5Psi	005K=5Kpa	010W=10inH2O
015P=15Psi	010K=10Kpa	030W=30inH2O
030P=30Psi	050K=50Kpa	001B=1Bar
050P=50Psi	100K=100Kpa	002B=2Bar
100P=100Psi	200K=200Kpa	010B=10Bar
150P=150Psi	500K=500Kpa	
300P=300Psi		

PRESSURE TYPE
G = GAGE
D = DIFFERENTIAL
A = ABSOLUTE

LEAD CONFIGURATION
1 = SAME SIDE AS VENT TUBE
3 = OPPOSITE SIDE AS VENT TUBE

PRESSURE TUBE TYPE
L = LONG TUBE
S = SHORT TUBE
N = NO TUBE

PACKAGE
P = PPS TUBE
M = METAL TUBE
C = CERAMIC TUBE

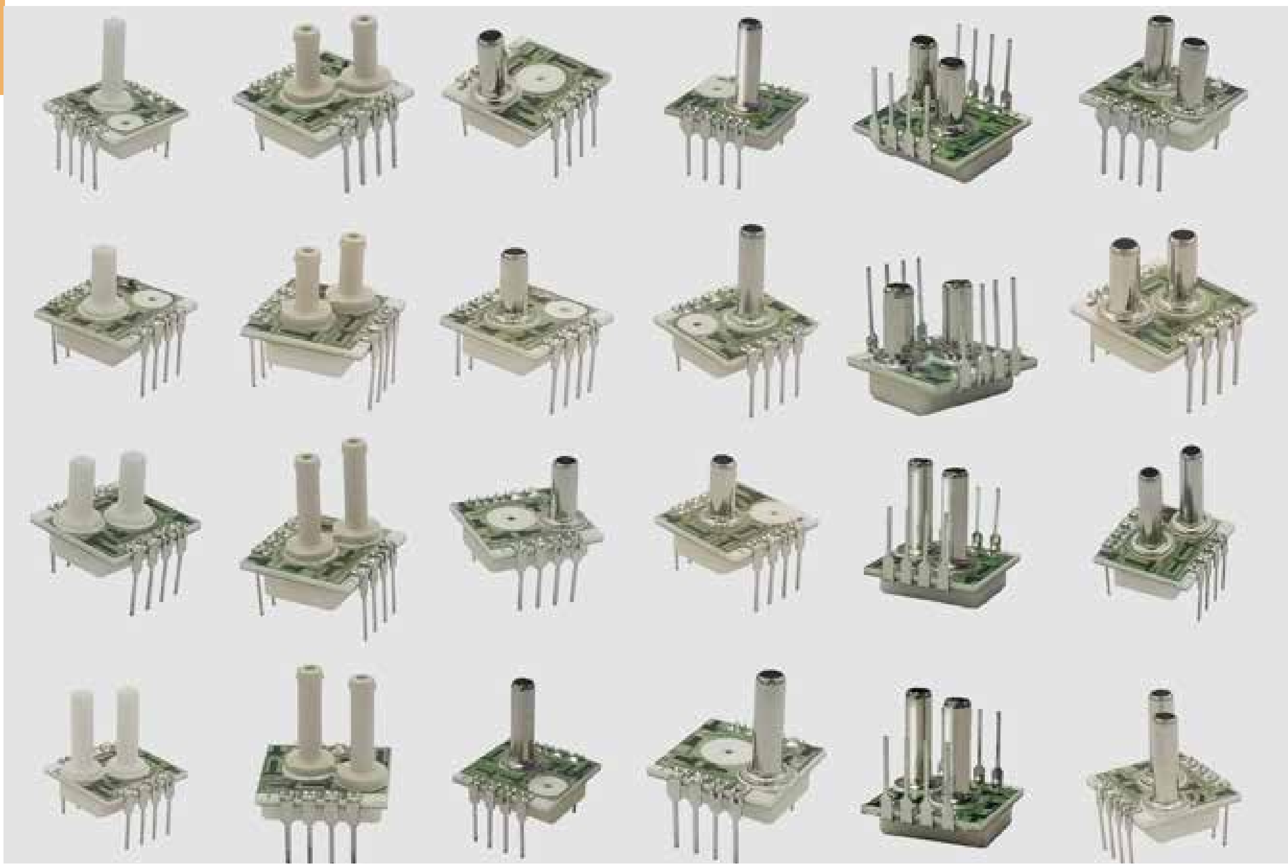
Notes

1.RATIOMETRIC TO SUPPLY CURRENT
2.BEST FIT STRAIGHT LINE.
3.MAXIMUM TEMPERATURE ERROR BETWEEN 0C AND 50C WITH RESPECT TO 25C.
4.SHORT TERM STABILITY OVER 7 DAYS WITH CONSTANT CURRENT AND TEMPERATURE.
5.LONG TERM STABILITY OVER A ONE YEAR PERIOD WITH CONSTANT CURRENT AND TEMPERATURE.
6.FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
7.2X MAXIMUM FOR 100PSI DEVICE.

PRESSURE
MODEL SA5652

HM5652 Series
Dual In Line Package
mV Output, Temperature Compensated
Constant Voltage

- Pneumatic controls
- Automotive diagnostics
- Medical equipment/instrumentation
- Air Speed and Altitude
- Environmental controls
- Barometric pressure measurement
- Factory Automation
- Process Controls



DESCRIPTION

SQMEAS SA5652 Series is a temperature compensated, mV output, ceramic mounted pressure sensor packaged in a rugged Dual In Line package. SA5652 uses a silicon MEMS pressure sensor bonded to a ceramic substrate containing thick film resistors that are uniquely laser trimmed for each sensor.

Incorporating a flexible design, the SA5652 Series is available with no, short or long tubes and can be mounted pin up or pins down to allow OEMs to optimize their board design. The SA5652 series is powered using constant voltage..

The SA5652 series superior die performance, coupled with rugged ceramic substrate ensures long term stability with superior temperature performance over wide operating range.

PC Board Mountable Pressure Sensor
MODEL SA5652

PERFORMANCE SPECIFICATIONS

Supply Voltage: See application schematic.
Ambient Temperature: 25°C (Unless otherwise specified)

PARAMETERS	Symbol	MIN	TYP	MAX	UNITS	NOTES
Supply voltage		1	10	20	Volts	
Bridge Resistance, Input & Output		2500		8500	Ω	
Zero Pressure Offset		-2.0	±0.5	+2.0	mV	
Pressure Non Linearity		-0.2	0.1	+0.2	%FSS	2
Hysteresis & Repeatability			0.15		%FSS	
Full Scale Span (Constant Voltage)	FSS	39	40	40	mV	3
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	4
Thermal Error of Span		-1.0		+1.0	%FSS	
Thermal Error of Offset		-1.0		+1.0	%FSS	
Response Time			100		μS	
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5		grams	
Compensated Temperature		0 to 50			°C	
Operating Temperatures		-40 to 125			°C	
Absolute Maximum Conditions						6
Supply Voltage				20	Volts	
Storage Temperature		-50		150	°C	
Overage Pressure			3X			
Burst, Differential Pressure				5X		
Burst, Gauge & Absolute Pressure				10X		
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Ceramic, Epoxy, RTV, Silicon, Gold, Aluminum, Palladium Silver				

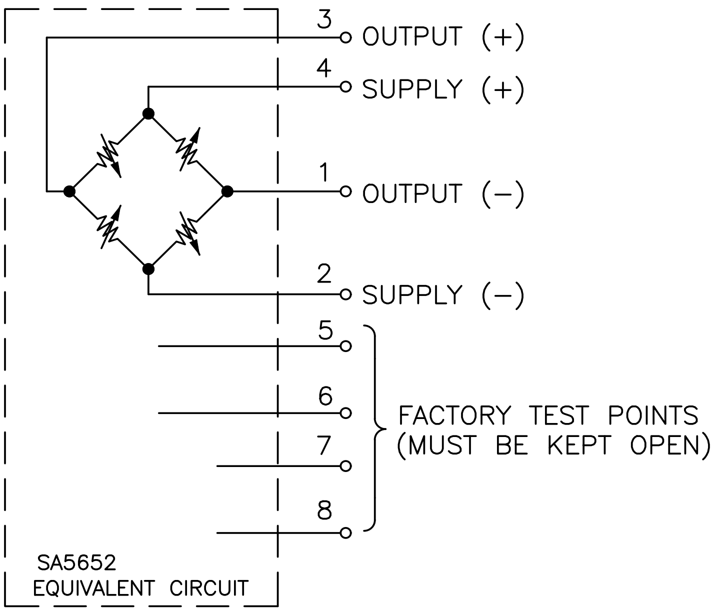
Notes

1. All specification at reference conditions unless otherwise noted. Output is ratio metric to supply voltage.
2. ½ Terminal Base Non Linearity (Measured at 0, 50% and 100% FS). 0.1% for pressure above 1psi, 0.5% for pressure below 1psi, the PNL is tested from the top side of the MEMS.
3. Full Scale Span output with sensor only. Field Interchangeability of 1% is guaranteed. Span is 40mV+ for products over 1psi pressure range (include 1psi). Span is 25mV for 1psi below pressure range.
4. Deviation between 50°C and 0°C expressed as percentage of reading at 25°C.
5. Deviation after 1 year period measured at reference conditions.
6. Exceeding Absolute Maximum Specification may damage the device. Extended exposure beyond the operating conditions may affect device reliability.

PC Board Mountable Pressure Sensor

MODEL SA5652

EQUIVALENT CIRCUIT & PIN DEFINITION



Pin	Definition
1	O-
2	E-
3	O+
4	E+

ORDERING INFORMATION

SA5652 - XXXX X - X X X - M

SA5652 = MODEL NUMBER

PRESSURE RANGE

001P=1Psi	001K=1Kpa	001W=1inH2O
002P=2Psi	002K=2Kpa	004W=3inH2O
005P=5Psi	005K=5Kpa	010W=10inH2O
015P=15Psi	010K=10Kpa	030W=30inH2O
030P=30Psi	050K=50Kpa	001B=1Bar
050P=50Psi	100K=100Kpa	002B=2Bar
100P=100Psi	200K=200Kpa	010B=10Bar
150P=150Psi	500K=500Kpa	
300P=300Psi		

PRESSURE TYPE

G = GAGE
D = DIFFERENTIAL
A = ABSOLUTE

LEAD CONFIGURATION

1 = SAME SIDE AS VENT TUBE
3 = OPPOSITE SIDE AS VENT TUBE

PRESSURE TUBE TYPE

L = LONG TUBE
S = SHORT TUBE
N = NO TUBE

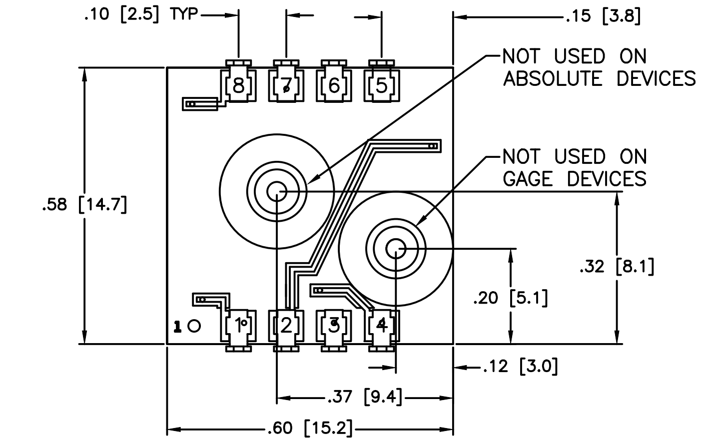
PACKAGE

P = PPS TUBE
M = METAL TUBE
C = CERAMIC TUBE

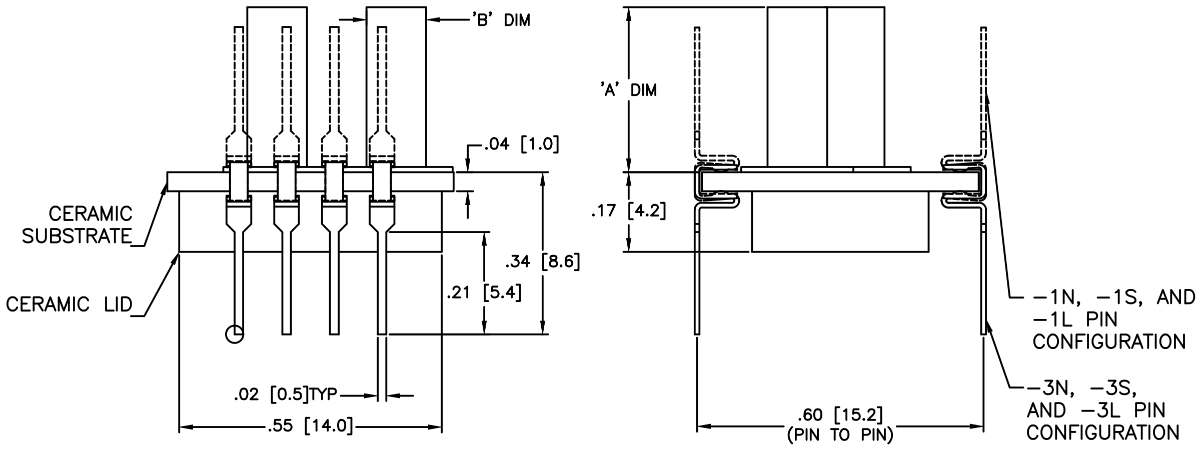
PC Board Mountable Pressure Sensor

MODEL SA5652

DIMENSIONS



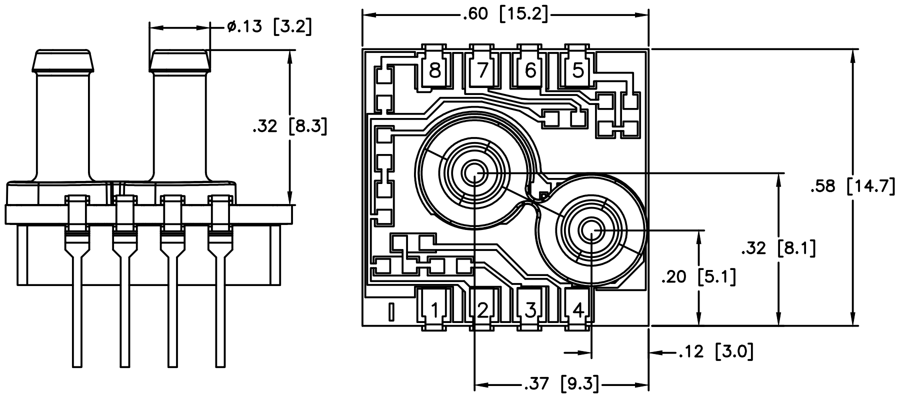
PAD NO	FUNCTION
1	-OUT
2	-EX
3	+OUT
4	+EX



PACKAGE: M (CERAMIC + METAL TUBE)

PACKAGE: C (Ceramic Substrate + Ceramic Tube)

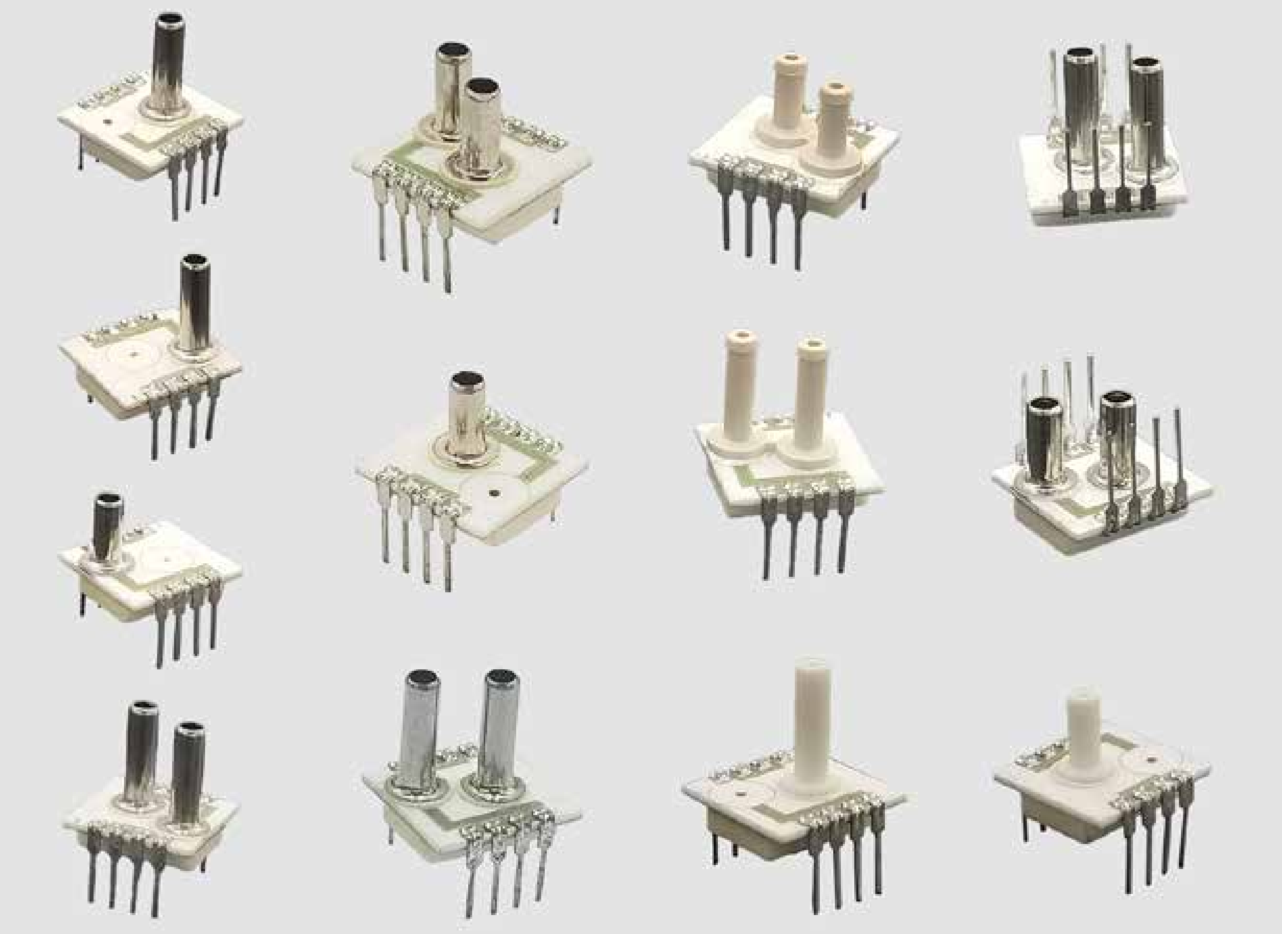
PACKAGE: P (FR4 + PPS TUBE)



PRESSURE
MODEL SA13

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection



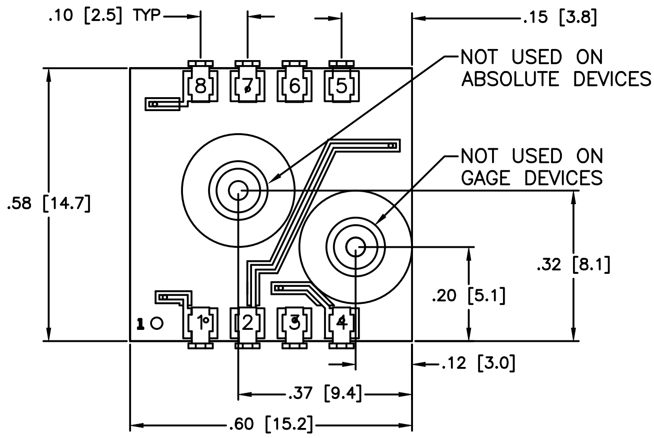
DESCRIPTION

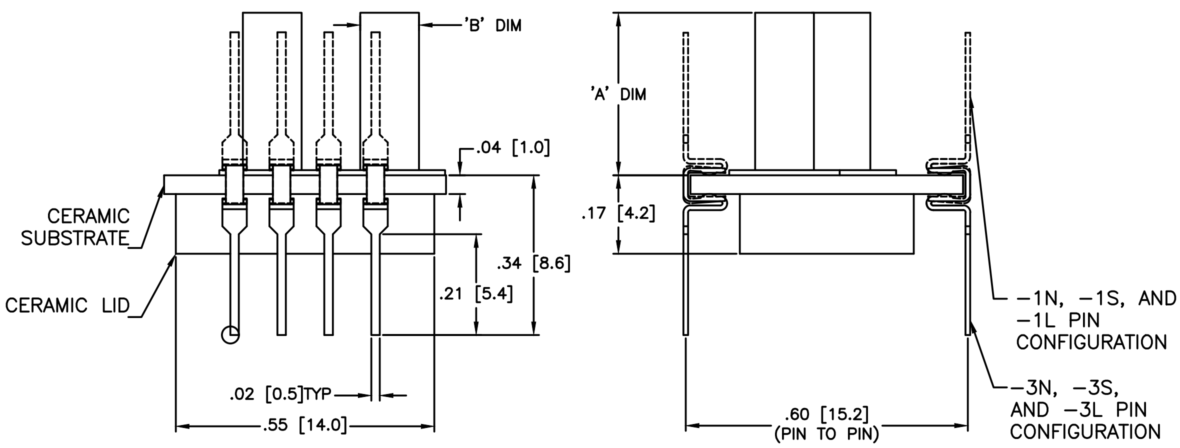
SA13 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/ digital output for reading pressure over the specified full-scale pressure span and temperature range. SA13 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz.

SA13 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA13 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PRESSURE
MODEL SA13

DIMENSIONS

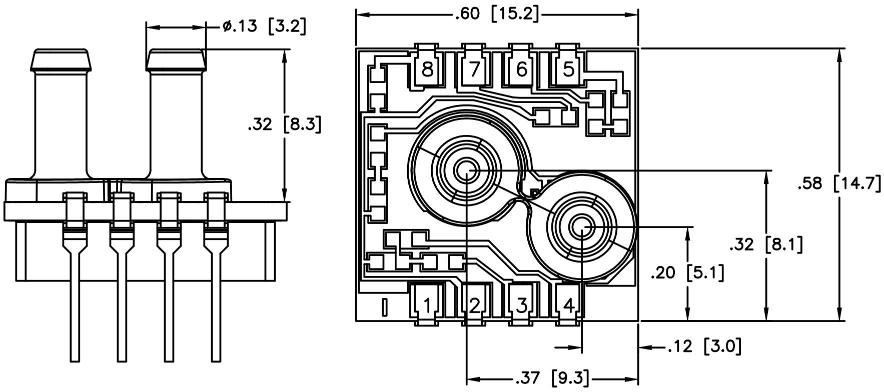




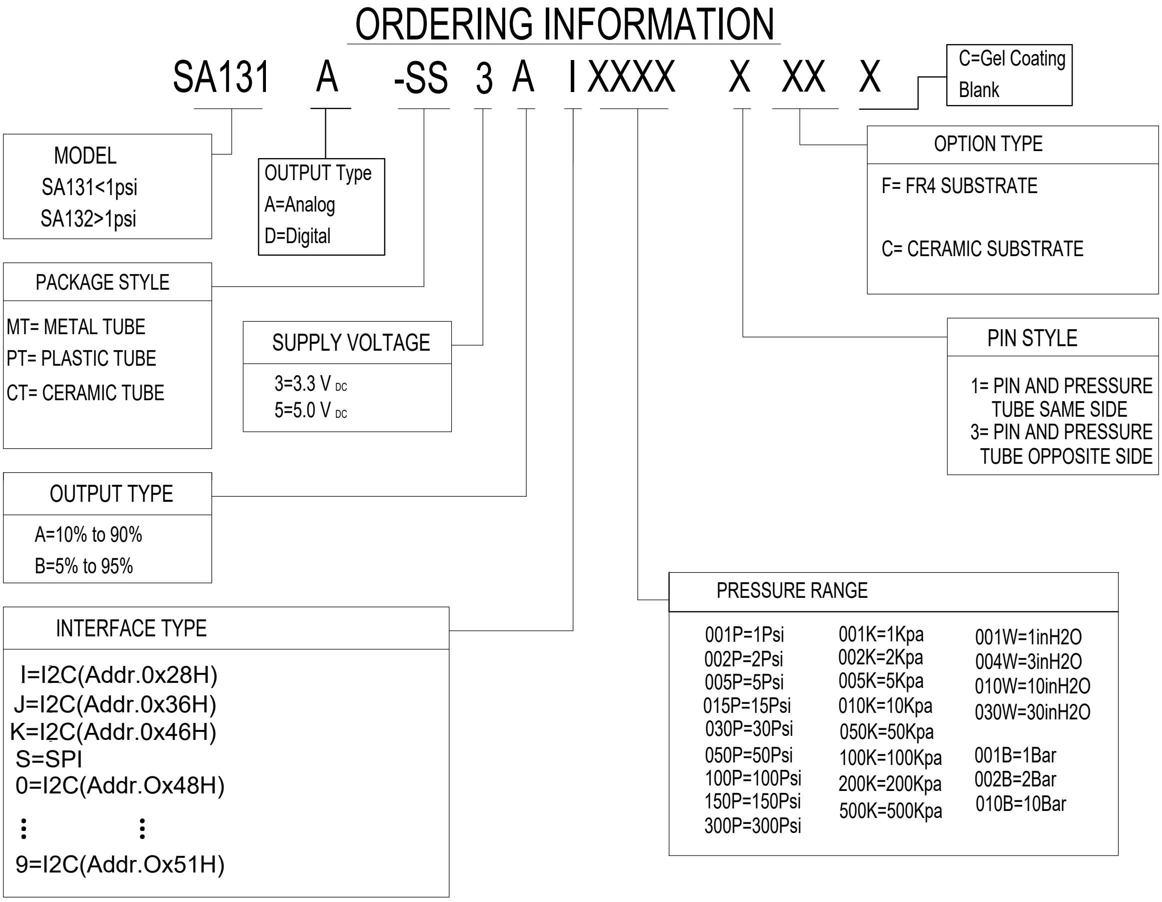
PACKAGE: M (CERAMIC + METAL TUBE)

PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)



ORDERING INFORMATION



FEATURES

• Various package: SA13 series pressure sensor is designed with various package. Basis substrate is optional with ceramic or FR4 PCB. Pressure port is optional with either ceramic or PPS or metal material.• -20°C to +85°C Compensated Temperature Range
• Small size: 15mm*15mm compact package.
• Energy efficient: Extremely low power consumption,Supply voltage is 3.3 or 5Volts
• RoHS compliant.(provided by gain set resistor)
• Absolute, Differential and Gage pressure type.
• Wide variety of pressure ranges: Low pressure from ±1 mbar to±75 mbar, medium pressure from 1psi to 300psi, provide support for many unique applications.
• The 1/8” barbed pressure ports mate securely with 3/32” ID tubing.
• Customer orientation: Accuracy, Total error band and compensated temperature can be customized.
• Provides the sensor’s true accuracy over a compensated range of -10 °C to 60 °C.
• Industry-leading long-term stability: Even after long-term use and thermal extremes, these sensors perform substantially better relative to stability than any other pressure sensor available in the industry today.
• Industry-leading accuracy: Extremely tight accuracy of ±0.25 %FSS BFSL (Full Scale Span Best Fit Straight Line)
• Industry-leading Total Error Band (TEB): Sensorall International specifies TEB—the most comprehensive, clear, and meaningful measurement—that provides the sensor’s true accuracy over a compensated range of -10 °C to 60 °C.
• I2C- or SPI-compatible 14-bit digital output (min. 12-bit sensor resolution) accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors or microcontrollers;
• Digital output types can offer 10%~90% output or 5%~95% output for optional.

Pressure and Temperature transfer

MODEL SA13

PARAMETERS	MIN	TYP	MAX	UNIT
Supply Voltage (Vsupply) 3.3 5.0 Sensors are either 3.3 Vdc or 5.0 Vdc based on listing selected	 3.0 4.75	 3.3² 5.0²	 3.6 5.25	 Vdc Vdc
Supply current 3.3 Vdc supply 5.0 Vdc supply	 2.1 3			 mA mA
Compensated temperature range3	-10	-	60	℃
Operating temperature range 4	-40	-	125	℃
Startup time（power up to data ready）	-	2.8	7.3	ms
Response time	-	0.46	-	ms
I 2C/SPI voltage level low	-	-	0.2	Vsupply
I 2C/SPI voltage level low	0.8	-	-	Vsupply
Pull up on SDA/MISO, SCL/SCLK, SS	1	-	-	Kohm
Accuracy 5	-	-	±0.25	%FSS 7
Orientation Sensitivity6	-	-	±0.15	%FSS 8
Total Error Band (TEB)7	-1%	-	1%	%FSS
Over Pressure		>3		Times
Burst Pressure		>5		Times
OUTPUT RESOLUTION	11	-	14	Bits

Notes

1.Maximum ratings are the extreme limits the device can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

2.The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

3.The compensated temperature range is the temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

4.The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.

5.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.

6.Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth’s gravitational field.

7.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

8.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.

9.Life may vary depending on specific application in which sensor is utilized.

10.Contact Sensorall International Sales and Service for detailed material information.

11.Total Error Band After Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

12.Working Pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until pressure is returned to within the operating pressure range. Tested to 1 million cycles, min.

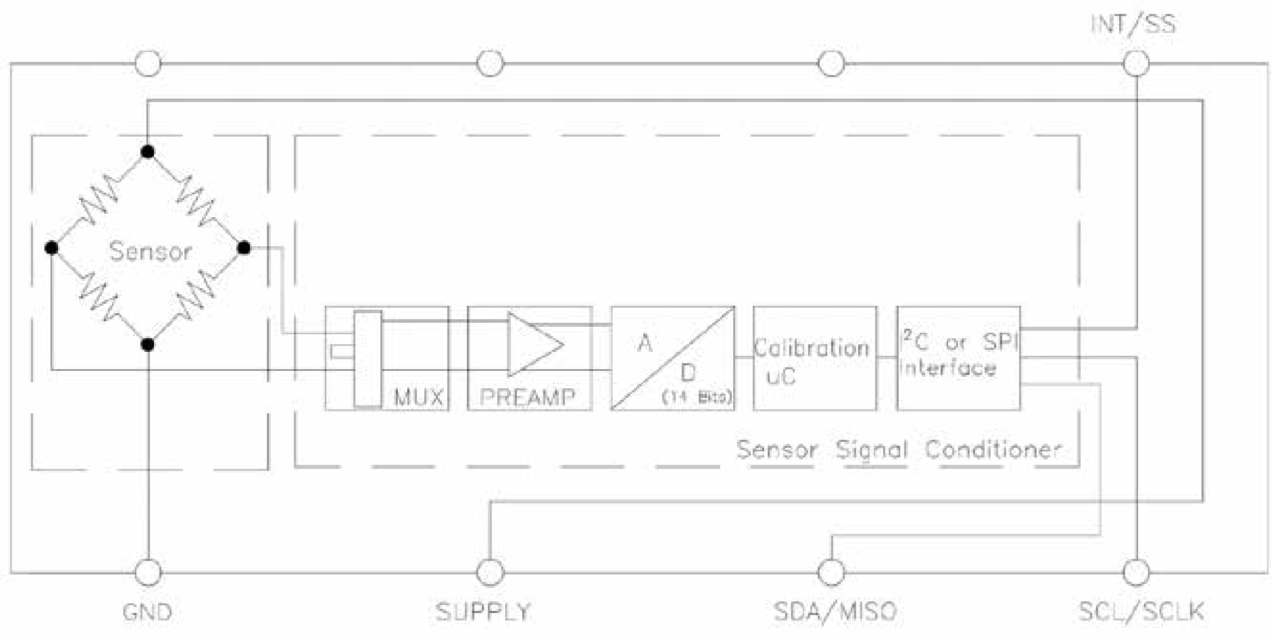
13.Overpressure: The absolute maximum rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range. Tested to 10,000 cycles, minimum.

14.Burst Pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

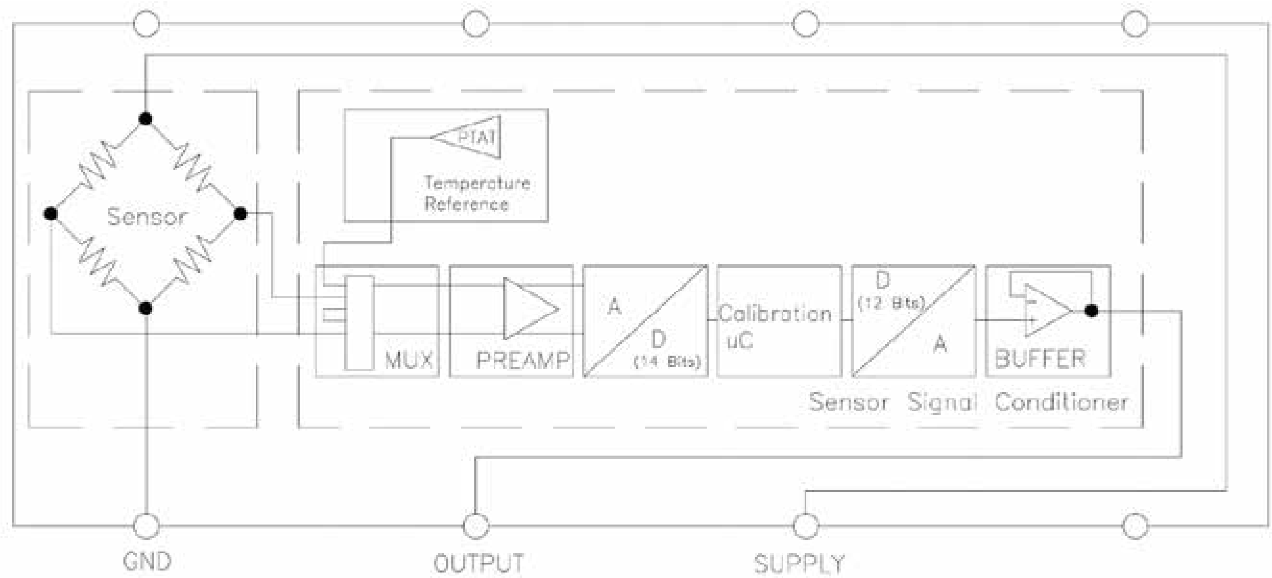
15.Common Mode Pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.

16.Customized design please contact Sensorall International sales.

Block Diagram



SA13 Digital output

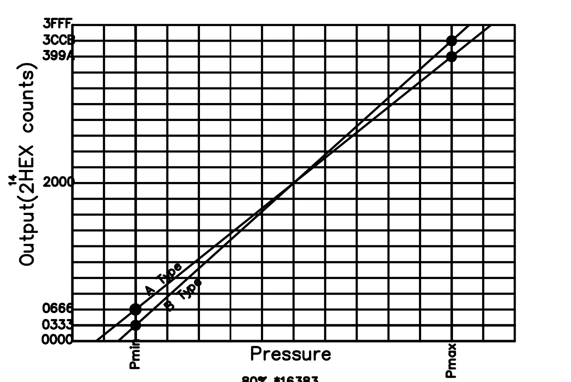


SA13 Analog output

Pressure and Temperature transfer

MODEL SA13

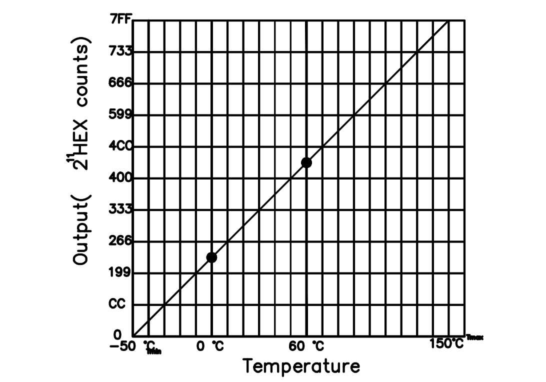
Pressure Transfer Functions



A Type: $\text{Output(Decimal counts)} = \frac{80\% * 16383}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 10\% * 16383$

B Type: $\text{Output(Decimal counts)} = \frac{90\% * 16383}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 5\% * 16383$

Temperature Transfer Functions



$\text{Output (Decimal Counts)} = \frac{(\text{Output} - (℃ - 50℃)_{\text{Tmin}} * \ 20)47}{(150℃_{\text{Tmax}} - (-50℃)_{\text{Tmin}})}$

Sensor Output at Significant Percentages

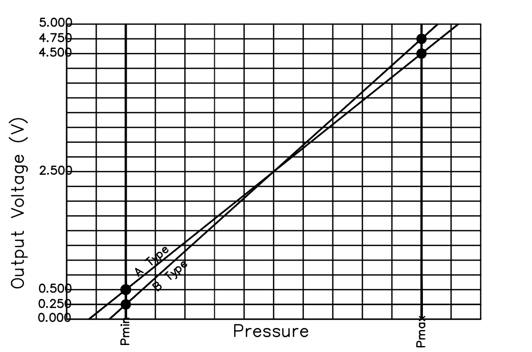
% of Counts	Output Type A (inH20)	Output Type B (inH20)	Digital Counts (decimal)	Digital Counts (hex)
0	Pmin-(Pmax-Pmin)*1/8	Pmin-(Pmax-Pmin)*5/90	0	0 X 0000
5		Pmin	819	0 X 0333
10	Pmin		1638	0 X 0666
50			8192	0 X 2000
90	Pmax		14746	0 X 399A
95		Pmax	15563	0 X 3CCB
100	Pmax+(Pmax-Pmin)*1/8	Pmax+(Pmax-Pmin)*5/90	16383	0 X 3FFF

Temperature Output vs Counts

Output °C	Digital Counts (decimal)	Digital Counts (hex)
-50	0	0 X 0000
0	511	0 X 01FF
10	614	0 X 0266
25	767	0 X 02FF
50	1023	0 X 03FF
85	1381	0 X 0565
150	2047	0 X 07FF

Digital Output

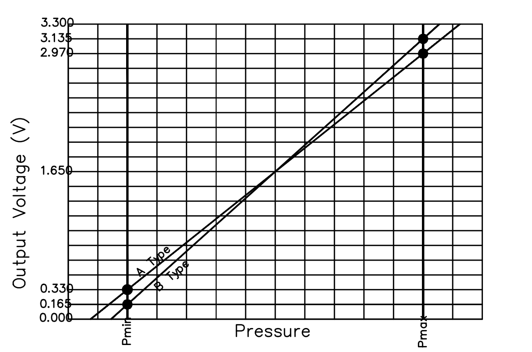
Pressure Transfer Functions, Supply=5V



A Type: $\text{Output Voltage} = \frac{80\% * \text{Supply Voltage}}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 0.500$

B Type: $\text{Output Voltage} = \frac{90\% * \text{Supply Voltage}}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 0.250$

Pressure Transfer Functions, Supply=3.3V



A Type: $\text{Output Voltage} = \frac{80\% * \text{Supply Voltage}}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 0.330$

B Type: $\text{Output Voltage} = \frac{90\% * \text{Supply Voltage}}{\text{Pmax} - \text{Pmin}} * (\text{Pressure}_{\text{applied}} - \text{Pmin}) + 0.165$

Sensor Output at Significant Percentages (Supply=5.000V)

% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.250
10	Pmin		0.500
50			2.500
90	Pmax		4.500
95		Pmax	4.750
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	5.000

Sensor Output at Significant Percentages (Supply=3.300V)

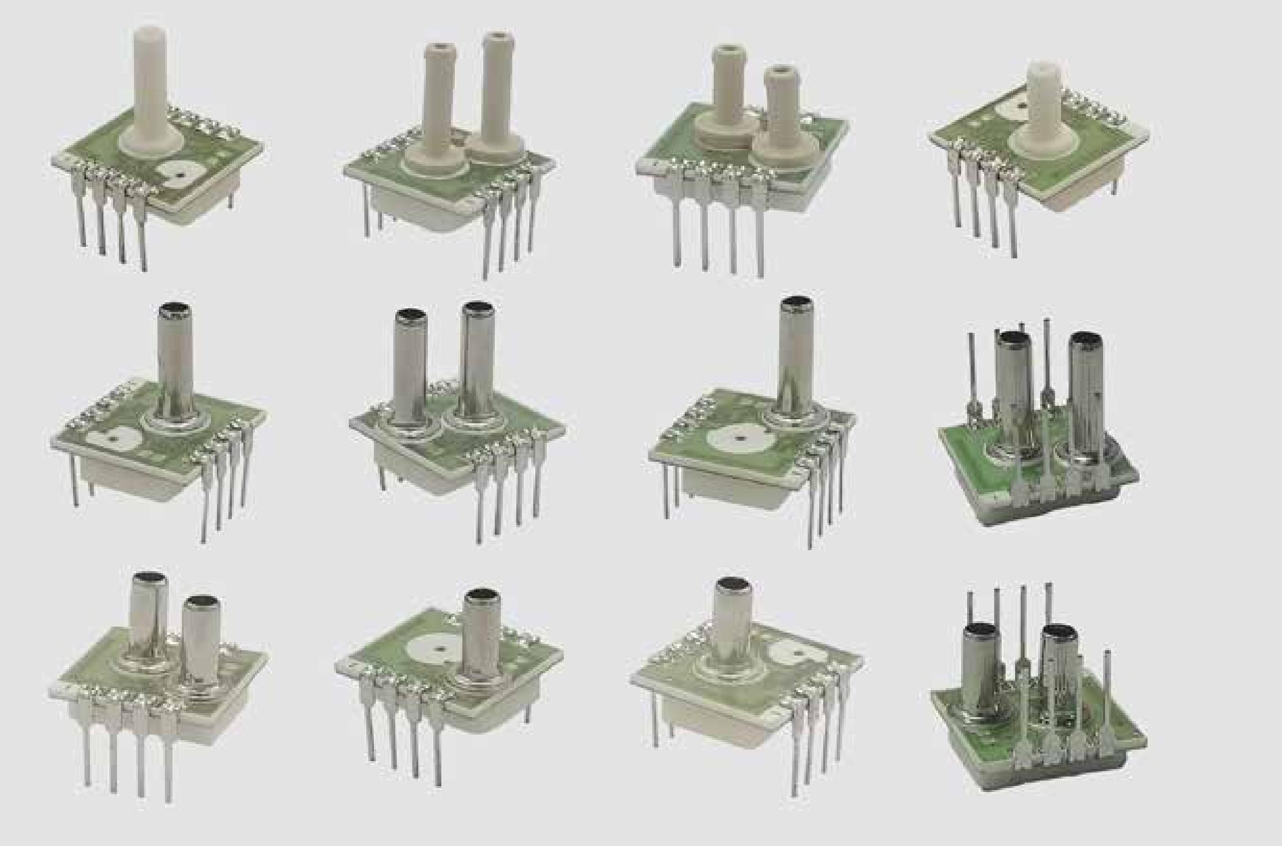
% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.165
10	Pmin		0.330
50			1.650
90	Pmax		2.970
95		Pmax	3.135
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	3.300

Analog Output

PRESSURE
MODEL SA5852

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection



DESCRIPTION

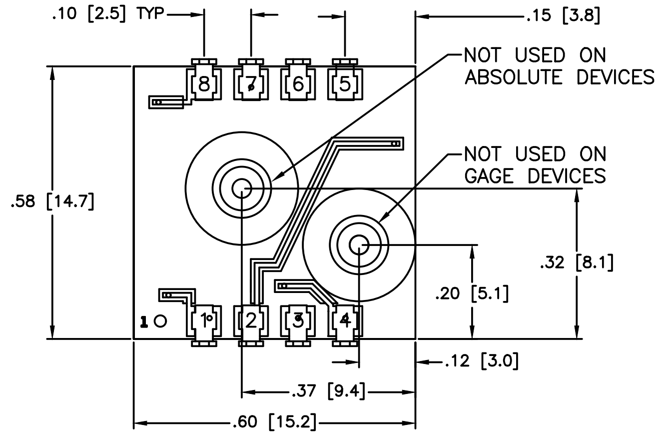
SA5852 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog and digital output for reading pressure over the specified full-scale pressure span and temperature range. SA5852 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 2 kHz.

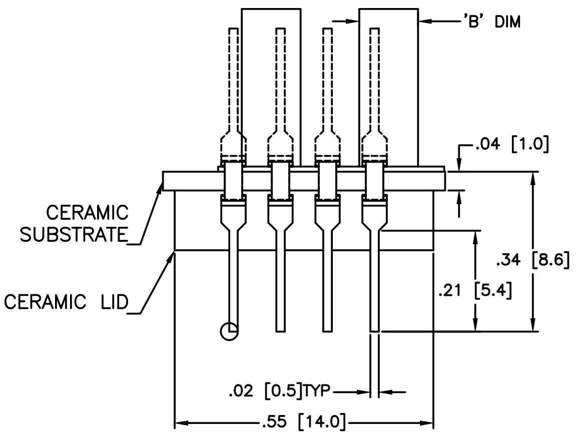
SA5852 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA5852 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

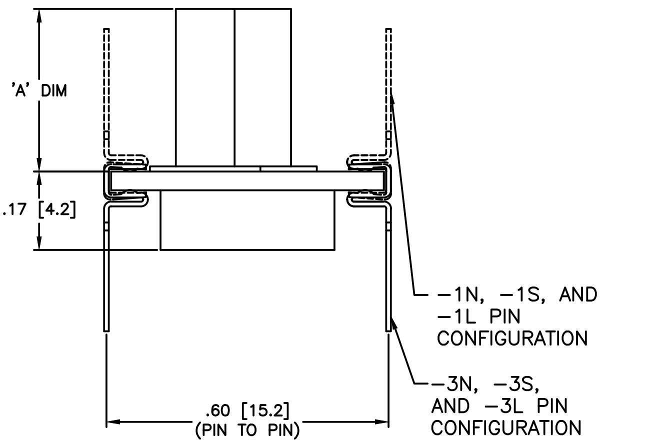
MODEL SA5852

DIMENSIONS

PIN	DESCRIPTION
1	MOSI
2	GND
3	NCS/SAO
4	SDA
5	SCL
6	EOC
7	VDD
8	Vout

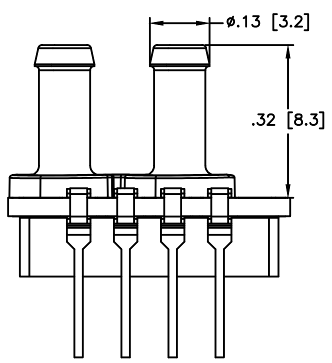


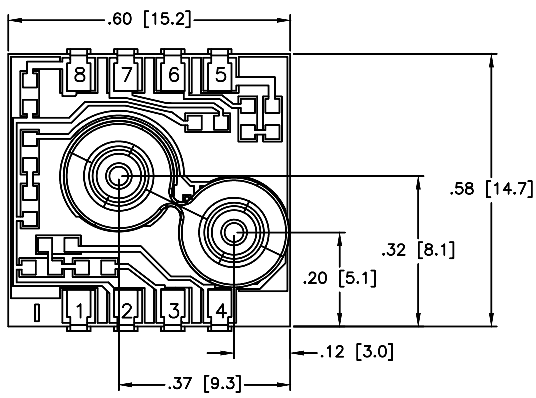




PACKAGE: M (CERAMIC + METAL TUBE)
PACKAGE: C (Ceramic Substrate + Ceramic Tube)

PACKAGE: P (FR4 + PPS TUBE)

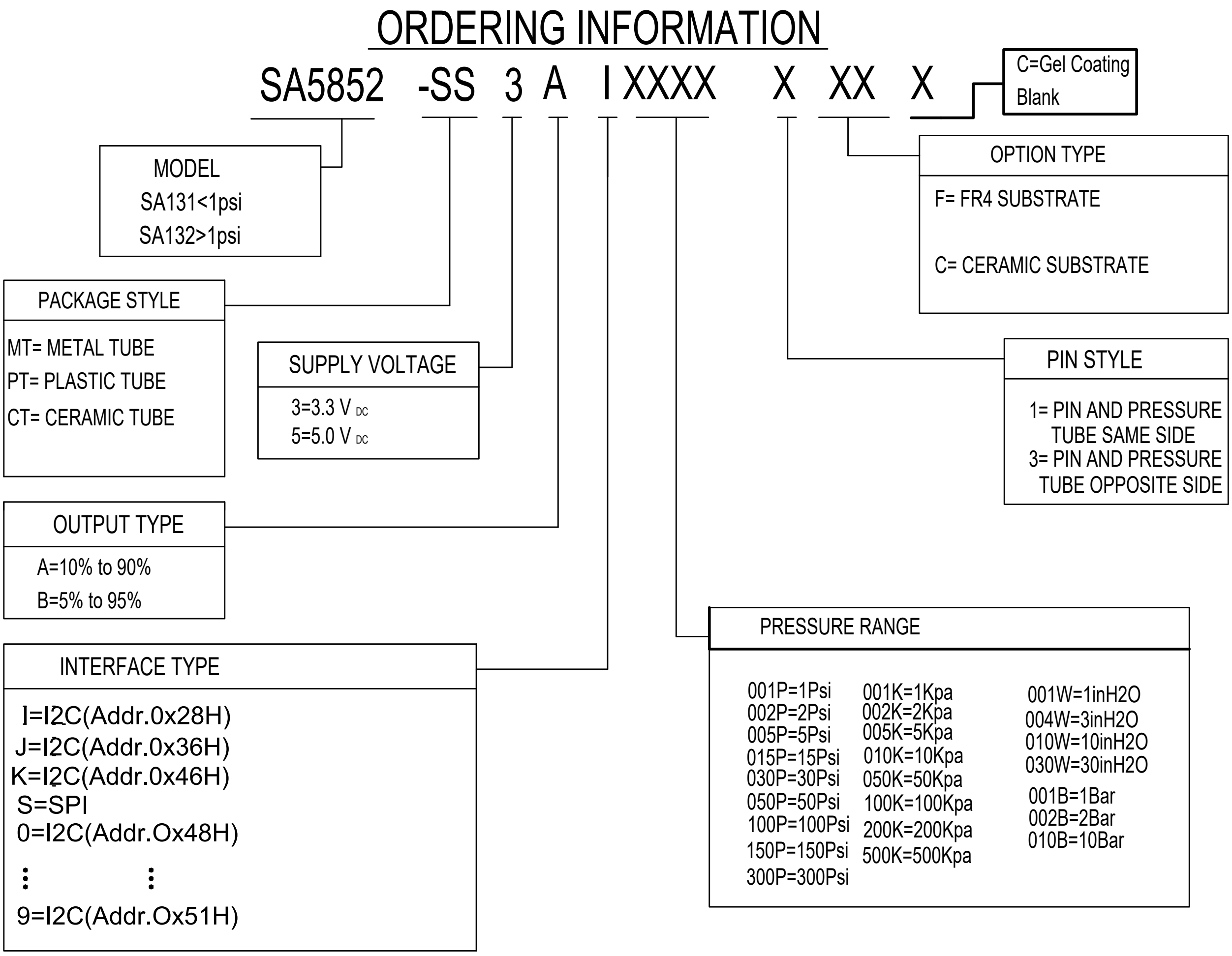




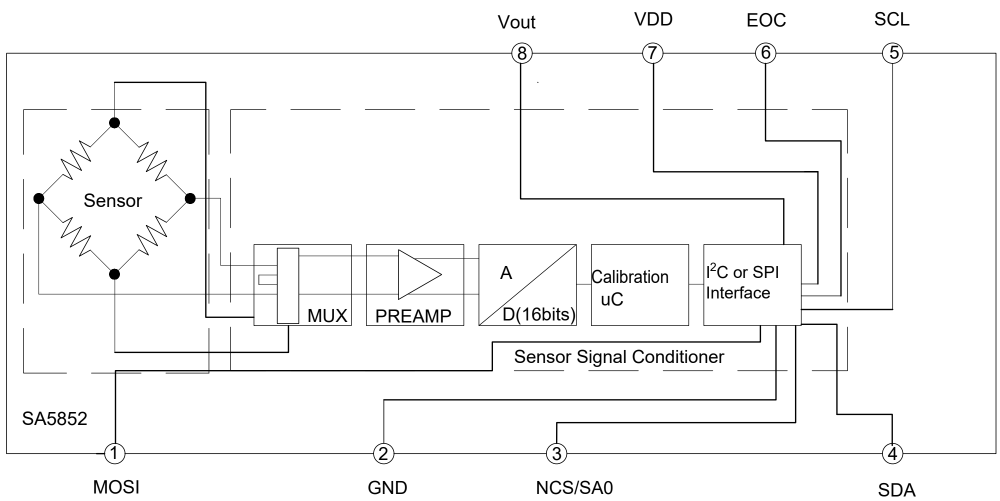
PRESSURE

MODEL SA5852

ORDERING INFORMATION



CONNECTIONS



PC Board Mountable Pressure Sensor
MODEL SA5852

PARAMETERS	MIN	TYP	MAX	UNIT
Supply Voltage (Vsupply) 3.3 5.0 Sensors are either 3.3 Vdc or 5.0 Vdc based on listing selected	 3.0 4.75	 3.3² 5.0²	 3.6 5.25	 Vdc Vdc
Supply current 3.3 Vdc supply 5.0 Vdc supply	 5 7			 mA mA
Compensated temperature range3	-10	-	60	℃
Operating temperature range 4	-40	-	125	℃
Startup time（power up to data ready）	-	2.8	7.3	ms
Response time	-	1.0	-	ms
I 2C/SPI voltage level low	-	-	0.2	Vsupply
I 2C/SPI voltage level low	0.8	-	-	Vsupply
Pull up on SDA/MISO, SCL/SCLK, SS	1	-	-	Kohm
Accuracy 5	-	-	±0.25	%FSS 7
Orientation Sensitivity6	-	-	±0.15	%FSS 8
Total Error Band (TEB)7	-1%	-	1%	%FSS
Over Pressure		>3		Times
Burst Pressure		>5		Times
OUTPUT RESOLUTION	12	-	16	Bits

Notes

1.Maximum ratings are the extreme limits the device can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

2.The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

3.The compensated temperature range is the temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

4.The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.

5.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.

6.Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

7.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

8.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.

9.Life may vary depending on specific application in which sensor is utilized.

10.Contact Sensorall International Sales and Service for detailed material information.

11.Total Error Band After Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

12.Working Pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until pressure is returned to within the operating pressure range. Tested to 1 million cycles, min.

13.Overpressure: The absolute maximum rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range. Tested to 10,000 cycles, minimum.

14.Burst Pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

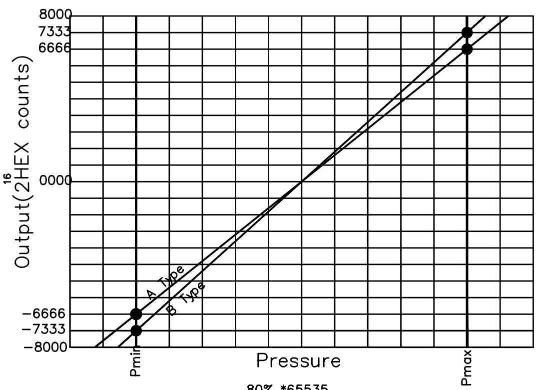
15.Common Mode Pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.

16.Customized design please contact Sensorall International sales.

PC Board Mountable Pressure Sensor

MODEL SA5852

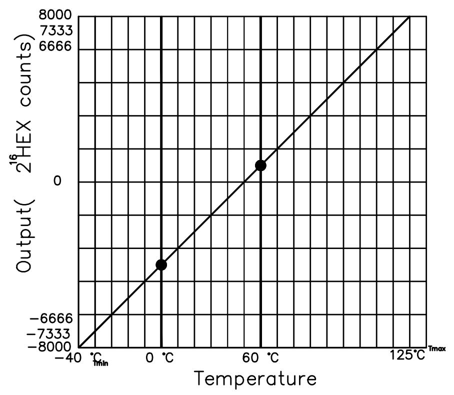
Pressure Transfer Functions



A Type: Output(Decimal counts) $= \frac{80\% * 65535}{Pmax - Pmin} * (Pressure_{applied} - Pmin) - 26214$

B Type: Output(Decimal counts) $= \frac{90\% * 65535}{Pmax - Pmin} * (Pressure_{applied} - Pmin) - 29491$

Temperature Transfer Functions



Output (Decimal Counts) $= \frac{(Output℃ - (-40℃)_{Tmin} * 65535)}{(125℃_{Tmax} - (-40℃)_{Tmin})}$

Sensor Output at Significant Percentages

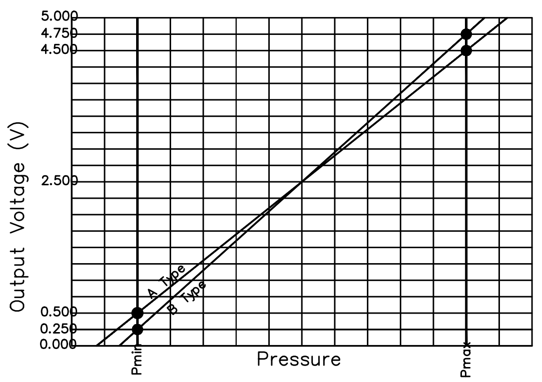
% of Counts	Output Type A (inH20)	Output Type B (inH20)	Digital Counts (decimal)	Digital Counts (hex)
0	Pmin-(Pmax-Pmin)*1/8	Pmin-(Pmax-Pmin)*5/90	-32768	0 X -8000
5		Pmin	-29491	0 X -7333
10	Pmin		-26214	0 X-6666
50			0	0 X0000
90	Pmax		26214	0 X 6666
95		Pmax	29491	0 X 7333
100	Pmax+(Pmax-Pmin)*1/8	Pmax+(Pmax-Pmin)*5/90	32768	0 X 8000

Temperature Output vs Counts

Output °C	Digital Counts (decimal)	Digital Counts (hex)
-40	-32768	0 X -8000
-31.75	-29491	0 X-7333
-23.5	-26214	0 X -6666
42.5	0	0 X 0000
108.5	26214	0 X 6666
116.75	29491	0 X 7333
125	32768	0 X 8000

I2C or SPI Output

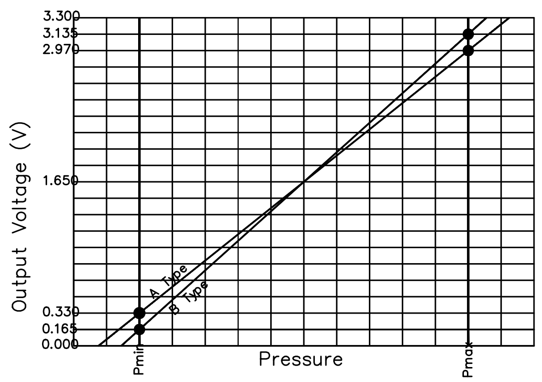
Pressure Transfer Functions, Supply=5V



A Type: Output Voltage $= \frac{80\% * Supply\ Voltage}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.500$

B Type: Output Voltage $= \frac{90\% * Supply\ Voltage}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.250$

Pressure Transfer Functions, Supply=3.3V



A Type: Output Voltage $= \frac{80\% * Supply\ Voltage}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.330$

B Type: Output Voltage $= \frac{90\% * Supply\ Voltage}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.165$

Sensor Output at Significant Percentages (Supply=5.000V)

% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.250
10	Pmin		0.500
50			2.500
90	Pmax		4.500
95		Pmax	4.750
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	5.000

Sensor Output at Significant Percentages (Supply=3.300V)

% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.165
10	Pmin		0.330
50			1.650
90	Pmax		2.970
95		Pmax	3.135
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	3.300

Analog Output

PRESSURE
MODEL SA5803

Diving computers
Mobile water depth measurement
Adventure or multi-mode watches

High resolution module, 0.2mbar
Fast conversion down to 1 ms
Low power, 1 µA (standby < 0.15 µA)
Integrated digital pressure sensor (24 bit ΔΣ ADC)
Supply voltage 1.8 to 3.6 V
Operating pressure range: 0 to 30bar
I2C and SPI interface
Excellent long term stability
Hermetically sealable for outdoor devices
High Endurance

DESCRIPTION

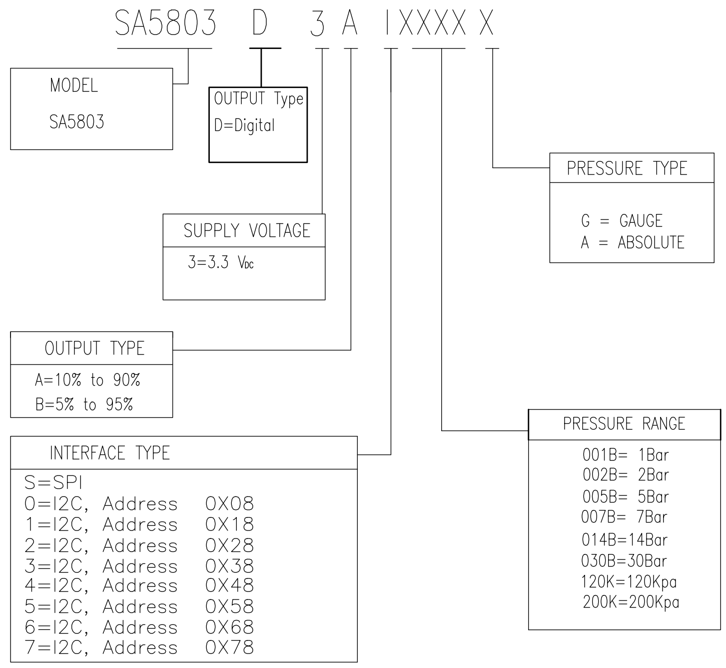
SA5803 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor, offering an 24bits digital output for reading pressure over the specified full scale pressure span and temperature range. SA5803 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50 Hz. SA5803 Series is calibrated over the temperature range of -10° C to 60 ° C. The sensor is characterized for operation from a single power supply from 1.8 to 3.6 Vdc.

These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA5803 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PRESSURE
MODEL SA5803

ORDERING INFORMATION

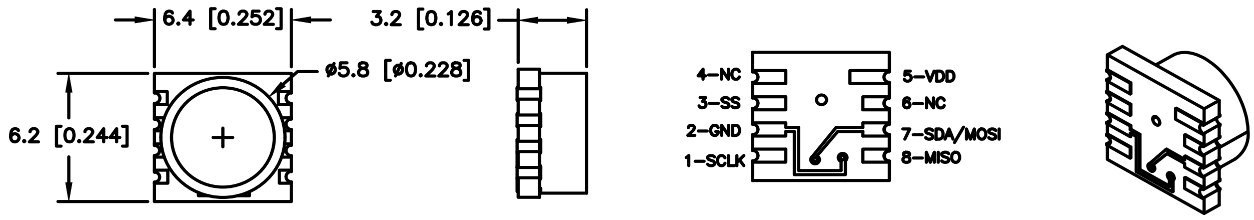
NOMENCLATURE AND ORDER GUIDE



Custom pressure ranges and I2C address are available. Contact Sensorall Customer Service for more information.

DIMENSIONS

DIMENSIONAL DRAWINGS & PIN OUT DEFINITION



Notes

1. Sensors are 3.3 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

PC Board Mountable Pressure Sensor

MODEL SA5803

TABLE 1. OPERATING SPECIFICATIONS

CHARACTERISTIC		DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	Vdc	1,2,3
Supply current	I2C/sleep/Standby Mode	3.0	33.8	211	uA	
	SPI/sleep/Standby Mode	13	43.8	211	uA	
Operating temperature range		-40	-	85	°C	4
Compensated temperature range		-10	-	50	°C	4
Temperature output option		-	±4	-	°C	6
Startup time (power up to data ready)		-	-	3	mS	
Response time		2	7	10	mS	
I²C/SPI voltage level	low	-	-	20	%Vsupply	
	high	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		1	-	-	kOhm	
Total Error Band		-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		-	-	-	%FSS	
		12	-	24	bits	

TABLE 2. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS)

% OUTPUT	DIGITAL COUNTS DECIMAL	DIGITAL COUNTS HEX
0	0	0X0000
10	1677722	0X19999A
50	8388608	0X800000
90	15099494	0XE66666
100	16777215	0XFFFFFF

TABLE 3. *WETTED MATERIALS

Port	SS316L	
Substrate	alumina ceramic	-
Adhesives	epoxy, silicone gel	epoxy, silicone gel

TABLE 4. *ABSOLUTE MAXIMUM RATINGS

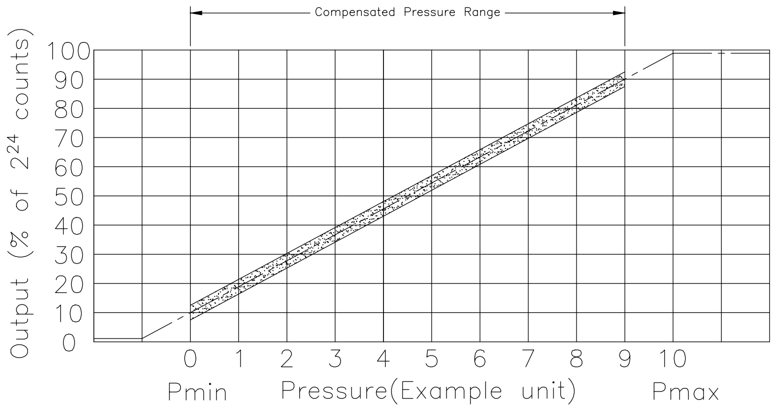
CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	3.6	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	kV
ESD susceptibility (human body model)		2	-	
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

PC Board Mountable Pressure Sensor
MODEL SA5803

PRESSURE FUNCTION
TYPE A EXAMPLE

—·—·—·— Ideal   ▒▒▒▒ 1% Total Error Band



TRANSFER FUNCTION		
Variable	A	B
M	0.8	0.9
N	0.1	0.05

$$\text{Output (\% of } 2^{24} \text{ counts)} = \frac{M*16777215}{Pmax-Pmin} * (Papplied-Pmin)+N*16777215$$

TABLE 5. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.

TABLE 6. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

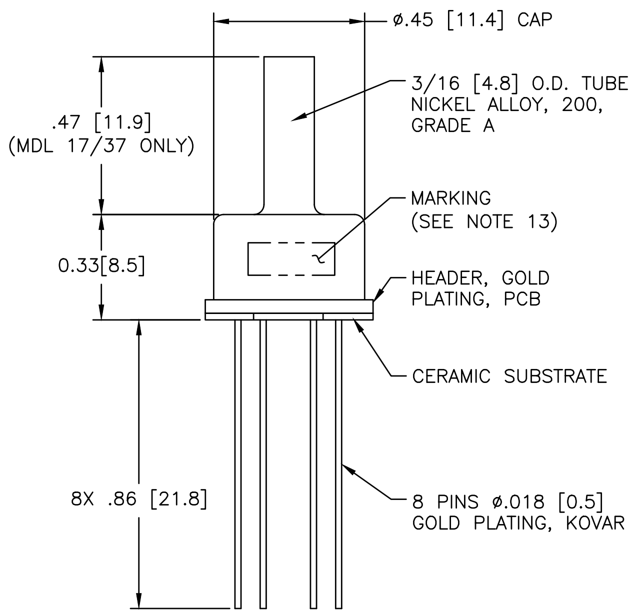
*Life may vary depending on specific application in which the sensor is used.

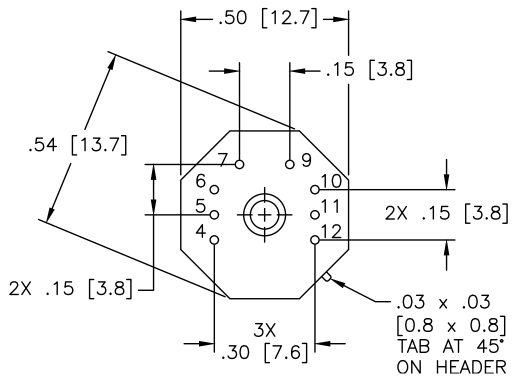
PRESSURE
MODEL SA16

PC Board Mountable Pressure Sensor
1-250 PSI
0-100 mV Output
Temperature Compensated
Low Cost

- Medical Instrumentation
- HVAC
- Factory Automation
- Process Control
- Avionics
- Air Flow Management

DIMENSIONS





DESCRIPTION

The Model SA16 is a temperature compensated, piezoresistive silicon pressure sensor packaged in TO-8 configurations. It provides excellent performance and long-term stability.

Gage and absolute pressure ranges from 0-1 PSI to 0-250 PSI are available. Integral temperature compensation is provided over a range of 0-50°C using laser-trimmed resistors.

An additional laser-trimmed resistor is included to normalize pressure sensitivity variations by programming the gain of an external differential amplifier. This provides sensitivity interchangeability of ±1%.

PC Board Mountable Pressure Sensor
MODEL SA16

PERFORMANCE SPECIFICATIONS

SUPPLY CURRENT: 1.5mA, AMBIENT TEMPERATURE: 25°C (UNLESS OTHERWISE SPECIFIED)

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
FULL SCALE OUTPUT, SPAN	75	100	150	mV	1
ZERO PRESSURE OUTPUT, OFFSET	-	-	2	±mV	
PRESSURE NON-LINEARITY	-	0.1	0.2	%SPAN	2
PRESSURE HYSTERESIS	-	0.05	0.1	%SPAN	
INPUT RESISTANCE	2.5K	4.5K	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-	0.3	0.8	%SPAN	3
TEMPERATURE ERROR, ZERO	-	0.3	0.8	%SPAN	3
TEMPERATURE COEFFICIENT, RESISTANCE	-	0.145	-	%/°C	3
THERMAL HYSTERESIS, ZERO	-	0.05	0.1	%SPAN	3
SHORT TERM STABILITY OF OFFSET	-	0.05	-	%SPAN	4
SHORT TERM STABILITY OF SPAN	-	0.05	-	%SPAN	4
LONG TERM STABILITY OF OFFSET	-	0.2	-	%SPAN	5
LONG TERM STABILITY OF SPAN	-	0.2	-	%SPAN	5
SUPPLY CURRENT	0.5	1.5	2	mA	6
RESPONE TIME (10% TO 90%)	-	1.0	-	msec	7
OUTPUT NOISE	-	1.0	-	μVp-p	8
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	9
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	10
PRESSURE OVERLOAD	-	-	3X	RATED	11
OPERATING TEMPERATURE RANGE	-40	-	125	°C	
STORAGE TEMPERATURE	-50	-	150	°C	
MEDIA	NON-CORROSIVE GASES COMPATIBLE WITH WETTED MATERIALS				12
WEIGHT	3 GRAMS				

Notes

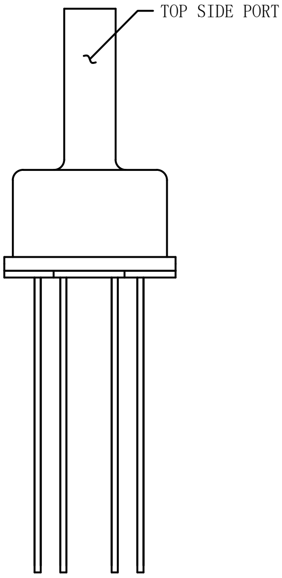
1. OUTPUT SPAN OF UNAMPLIFIED SENSOR FOR 5PSI ABOVE,25-90MV FOR 5PSI BELOW RANGE.
2. BEST FIT STRAIGHT LINE, TOPSIDE PRESSURE. FOR 5 PSI BELOW DEVICES, NON-LINEARITY IS ±0.5%
3. TEMPERATURE RANGE (IN REFERENCE TO 25°C); FOR 5 PSI DEVICES: 0° TO +50°C; FOR 15 PSI (OR GREATER) DEVICES: -20° TO +85°C
4. NORMALIZED OFFSET BRIDGE VOLTAGE: 7 DAYS.
5. ONE (1) YEAR.
6. GUARANTEES INPUT/OUTPUT RATIOMETRICITY FOR SPAN.
7. FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
8. 10 Hz TO 1k Hz.
9. PREVENTS INCREASE OF TC SPAN DUE TO OUTPUT LOADING.
10. BETWEEN CASE AND SENSING ELEMENT.
11. FOR TOPSIDE APPLICATION: 3X OR 500 PSI MAXIMUM, WHICHEVER IS LESS.
    FOR BACKSIDE APPLICATION: 3X OR 100 PSI MAXIMUM, WHICHEVER IS LESS.
12. WETTED MATERIALS: GLASS, CERAMIC, SILICON, RTV, NICKEL, ALUMINUM AND GOLD.
13. DEVICE MARKING: EACH DEVICE IS MARKED WITH COMPANY NAME (HM), MODEL NUMBER, PRESSURE RANGE, DEVICE TYPE ('A' FOR ABSOLUTE, 'G' FOR GAGE, OR 'D' FOR DIFFERENTIAL), LOT AND SERIAL NUMBERS.

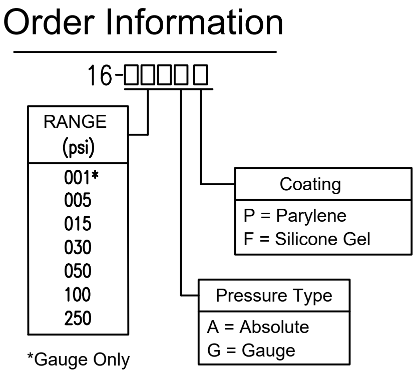
PC Board Mountable Pressure Sensor

MODEL SA16

ORDERING INFORMATION

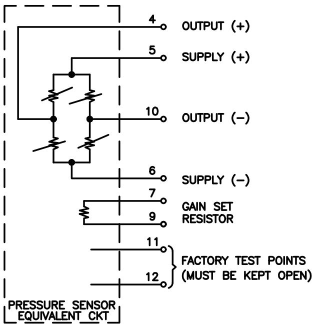
MODEL 16-xxxA/G



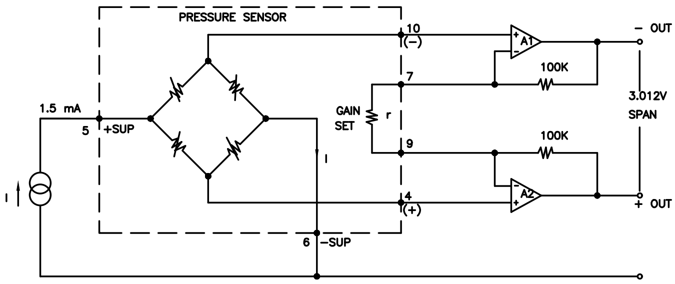


APPLICATION SCHEMATIC

TOPSIDE APPLICATION CONNECTIONS AND SCHEMATIC



CONNECTIONS



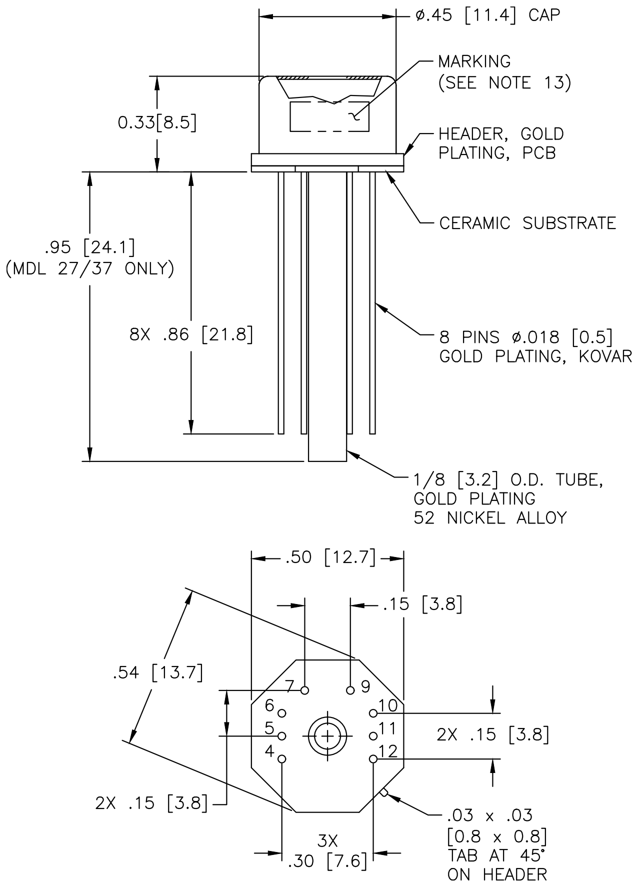
APPLICATION SCHEMATIC

PRESSURE
MODEL SA26

PC Board Mountable Pressure Sensor
1-250 PSI
0-100 mV Output
Low Cost
Temperature Compensated

- **Medical Instrumentation**
- **HVAC**
- **Factory Automation**
- **Process Control**
- **Avionics**
- **Air Flow Management**

DIMENSIONS



DESCRIPTION

The Model 26 is a temperature compensated, piezoresistive silicon pressure sensor packaged in TO-8 configurations. It provides excellent performance and long-term stability.

Integral temperature compensation is provided over a range of 0-50°C using a laser-trimmed ceramic compensation board.

An additional laser-trimmed resistor is included which can be used to adjust the gain of an external differential amplifier and provide sensitivity interchangeability of ±1%.

The Model 26 is available in ranges up to 0-250 PSI. For additional information regarding uncompensated sensors, please contact the factory.

PC Board Mountable Pressure Sensor
MODEL SA26

PERFORMANCE SPECIFICATIONS

SUPPLY CURRENT: 1.5mA, AMBIENT TEMPERATURE: 25°C (UNLESS OTHERWISE SPECIFIED)

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
FULL SCALE OUTPUT, SPAN	75	100	150	mV	1
ZERO PRESSURE OUTPUT, OFFSET	-	-	2	±mV	
PRESSURE NON-LINEARITY	-	0.1	0.2	%SPAN	2
PRESSURE HYSTERESIS	-	0.05	0.1	%SPAN	
INPUT RESISTANCE	2.5K	4.5K	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-	0.3	0.8	%SPAN	3
TEMPERATURE ERROR, ZERO	-	0.3	0.8	%SPAN	3
TEMPERATURE COEFFICIENT, RESISTANCE	-	0.145	-	%/°C	3
THERMAL HYSTERESIS, ZERO	-	0.05	0.1	%SPAN	3
SHORT TERM STABILITY OF OFFSET	-	0.05	-	%SPAN	4
SHORT TERM STABILITY OF SPAN	-	0.05	-	%SPAN	4
LONG TERM STABILITY OF OFFSET	-	0.2	-	%SPAN	5
LONG TERM STABILITY OF SPAN	-	0.2	-	%SPAN	5
SUPPLY CURRENT	0.5	1.5	2	mA	6
RESPONE TIME (10% TO 90%)	-	1.0	-	msec	7
OUTPUT NOISE	-	1.0	-	μVp-p	8
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	9
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	10
PRESSURE OVERLOAD	-	-	3X	RATED	11
OPERATING TEMPERATURE RANGE	-40	-	125	°C	
STORAGE TEMPERATURE	-50	-	150	°C	
MEDIA	NON-CORROSIVE GASES COMPATIBLE WITH WETTED MATERIALS				12
WEIGHT	3 GRAMS				

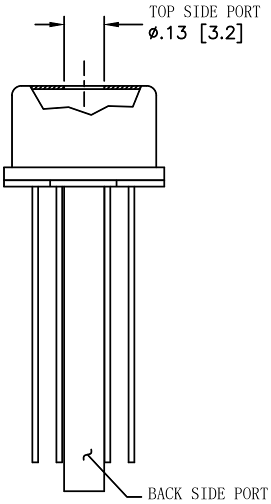
Notes

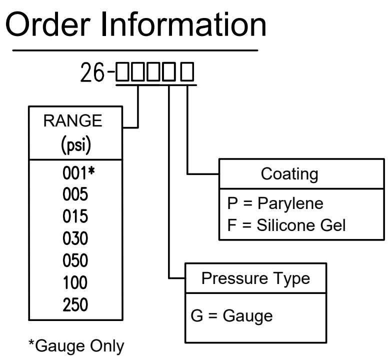
1. OUTPUT SPAN OF UNAMPLIFIED SENSOR FOR 5PSI ABOVE,25-90MV FOR 5PSI BELOW RANGE.
2. BEST FIT STRAIGHT LINE, TOPSIDE PRESSURE. FOR 5 PSI BELOW DEVICES, NON-LINEARITY IS ±0.5%
3. TEMPERATURE RANGE (IN REFERENCE TO 25°C); FOR 5 PSI DEVICES: 0° TO +50°C; FOR 15 PSI (OR GREATER) DEVICES: -20° TO +85°C
4. NORMALIZED OFFSET BRIDGE VOLTAGE: 7 DAYS.
5. ONE (1) YEAR.
6. GUARANTEES INPUT/OUTPUT RATIOMETRICITY FOR SPAN.
7. FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
8. 10 Hz TO 1k Hz.
9. PREVENTS INCREASE OF TC SPAN DUE TO OUTPUT LOADING.
10. BETWEEN CASE AND SENSING ELEMENT.
11. FOR TOPSIDE APPLICATION: 3X OR 500 PSI MAXIMUM, WHICHEVER IS LESS.
    FOR BACKSIDE APPLICATION: 3X OR 100 PSI MAXIMUM, WHICHEVER IS LESS.
12. WETTED MATERIALS: GLASS, CERAMIC, SILICON, RTV, NICKEL, ALUMINUM AND GOLD.
13. DEVICE MARKING: EACH DEVICE IS MARKED WITH COMPANY NAME (HM), MODEL NUMBER, PRESSURE RANGE, DEVICE TYPE ('A' FOR ABSOLUTE, 'G' FOR GAGE, OR 'D' FOR DIFFERENTIAL), LOT AND SERIAL NUMBERS.

PC Board Mountable Pressure Sensor
MODEL SA26

ORDERING INFORMATION

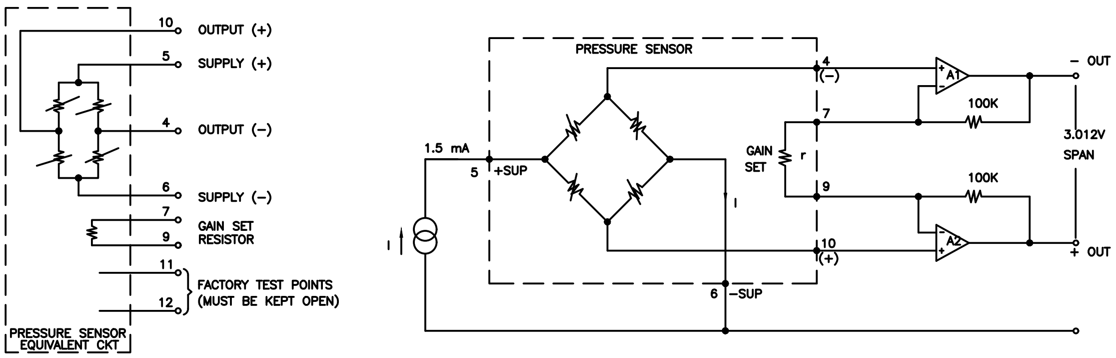
MODEL 26-xxxA/G





APPLICATION SCHEMATIC

BACKSIDE APPLICATION CONNECTIONS AND SCHEMATIC



CONNECTIONS

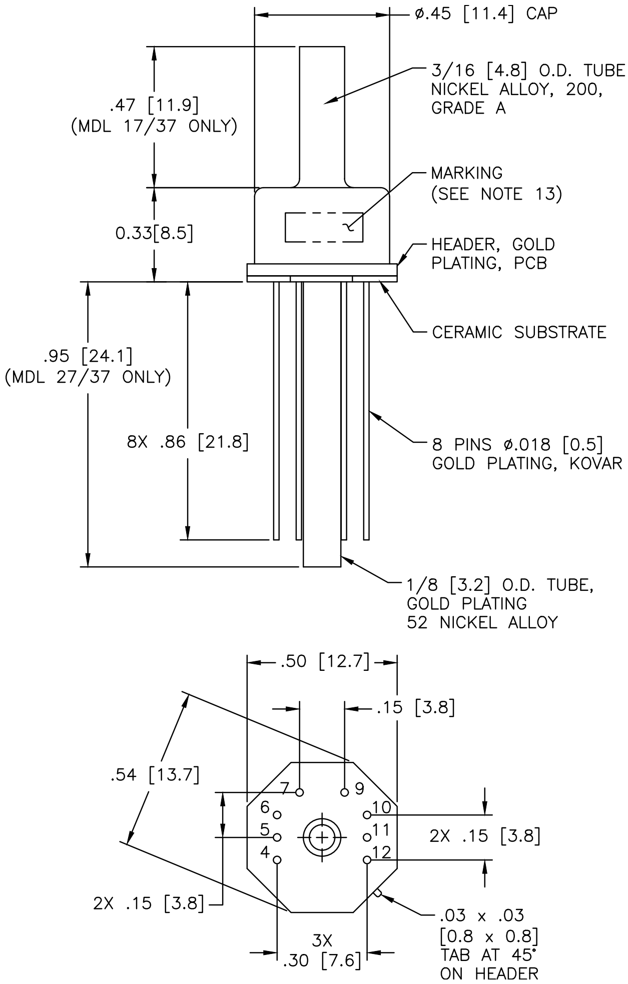
APPLICATION SCHEMATIC

PRESSURE
MODEL SA36

PC Board Mountable Pressure Sensor
1-250 PSI
0-100 mV Output
Low Cost
Temperature Compensated

- Medical Instrumentation
- HVAC
- Factory Automation
- Process Control
- Avionics
- Air Flow Management

DIMENSIONS



DESCRIPTION

The Model 36 is a temperature compensated, piezoresistive silicon pressure sensor packaged in TO-8 configurations. It provides excellent performance and long-term stability.

Integral temperature compensation is provided over a range of 0-50°C using a laser-trimmed ceramic compensation board. An additional laser-trimmed resistor is included which can be used to adjust the gain of an external differential amplifier and provide sensitivity interchangeability of ±1%. regarding uncompensated sensors, please contact the factory

PC Board Mountable Pressure Sensor
MODEL SA36

PERFORMANCE SPECIFICATIONS

SUPPLY CURRENT: 1.5mA, AMBIENT TEMPERATURE: 25°C (UNLESS OTHERWISE SPECIFIED)

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
FULL SCALE OUTPUT, SPAN	75	100	150	mV	1
ZERO PRESSURE OUTPUT, OFFSET	-	-	2	±mV	
PRESSURE NON-LINEARITY	-	0.1	0.2	%SPAN	2
PRESSURE HYSTERESIS	-	0.05	0.1	%SPAN	
INPUT RESISTANCE	2.5K	4.5K	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-	0.3	0.8	%SPAN	3
TEMPERATURE ERROR, ZERO	-	0.3	0.8	%SPAN	3
TEMPERATURE COEFFICIENT, RESISTANCE	-	0.145	-	%/°C	3
THERMAL HYSTERESIS, ZERO	-	0.05	0.1	%SPAN	3
SHORT TERM STABILITY OF OFFSET	-	0.05	-	%SPAN	4
SHORT TERM STABILITY OF SPAN	-	0.05	-	%SPAN	4
LONG TERM STABILITY OF OFFSET	-	0.2	-	%SPAN	5
LONG TERM STABILITY OF SPAN	-	0.2	-	%SPAN	5
SUPPLY CURRENT	0.5	1.5	2	mA	6
RESPONE TIME (10% TO 90%)	-	1.0	-	msec	7
OUTPUT NOISE	-	1.0	-	μVp-p	8
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	9
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	10
PRESSURE OVERLOAD	-	-	3X	RATED	11
OPERATING TEMPERATURE RANGE	-40	-	125	°C	
STORAGE TEMPERATURE	-50	-	150	°C	
MEDIA	NON-CORROSIVE GASES COMPATIBLE WITH WETTED MATERIALS				12
WEIGHT	3 GRAMS				

Notes

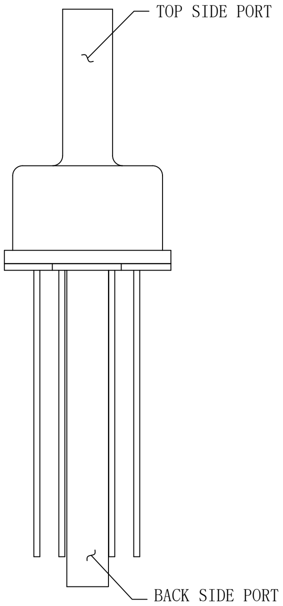
1. OUTPUT SPAN OF UNAMPLIFIED SENSOR FOR 5PSI ABOVE,25-90MV FOR 5PSI BELOW RANGE.
2. BEST FIT STRAIGHT LINE, TOPSIDE PRESSURE. FOR 5 PSI BELOW DEVICES, NON-LINEARITY IS ±0.5%
3. TEMPERATURE RANGE (IN REFERENCE TO 25°C); FOR 5 PSI DEVICES: 0° TO +50°C; FOR 15 PSI (OR GREATER) DEVICES: -20° TO +85°C
4. NORMALIZED OFFSET BRIDGE VOLTAGE: 7 DAYS.
5. ONE (1) YEAR.
6. GUARANTEES INPUT/OUTPUT RATIOMETRICITY FOR SPAN.
7. FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
8. 10 Hz TO 1k Hz.
9. PREVENTS INCREASE OF TC SPAN DUE TO OUTPUT LOADING.
10. BETWEEN CASE AND SENSING ELEMENT.
11. FOR TOPSIDE APPLICATION: 3X OR 500 PSI MAXIMUM, WHICHEVER IS LESS.
    FOR BACKSIDE APPLICATION: 3X OR 100 PSI MAXIMUM, WHICHEVER IS LESS.
12. WETTED MATERIALS: GLASS, CERAMIC, SILICON, RTV, NICKEL, ALUMINUM AND GOLD.
13. DEVICE MARKING: EACH DEVICE IS MARKED WITH COMPANY NAME (HM), MODEL NUMBER, PRESSURE RANGE, DEVICE TYPE ('A' FOR ABSOLUTE, 'G' FOR GAGE, OR 'D' FOR DIFFERENTIAL), LOT AND SERIAL NUMBERS.

PC Board Mountable Pressure Sensor

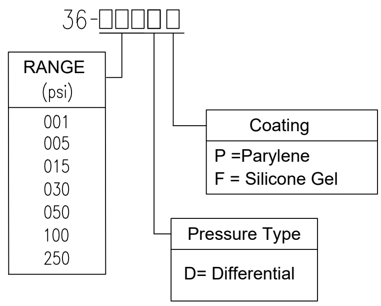
MODEL SA36

ORDERING INFORMATION

MODEL 36-xxxD

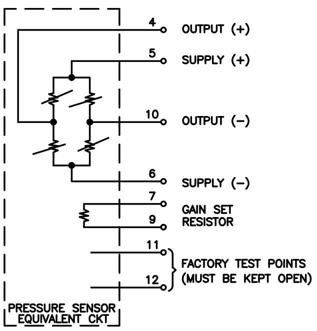


Order Information

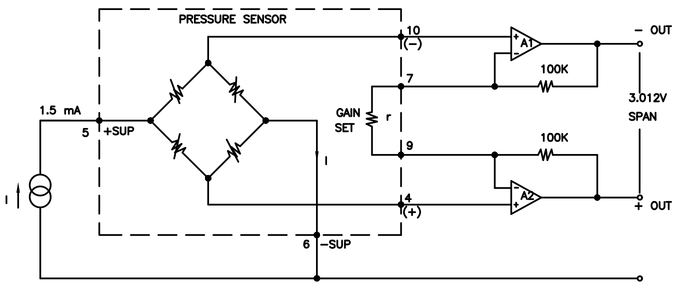


APPLICATION SCHEMATIC

TOPSIDE APPLICATION CONNECTIONS AND SCHEMATIC

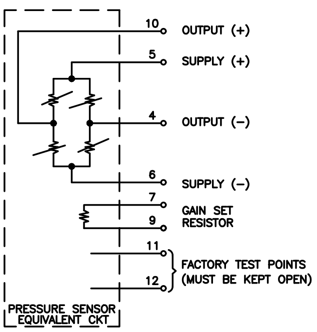


CONNECTIONS

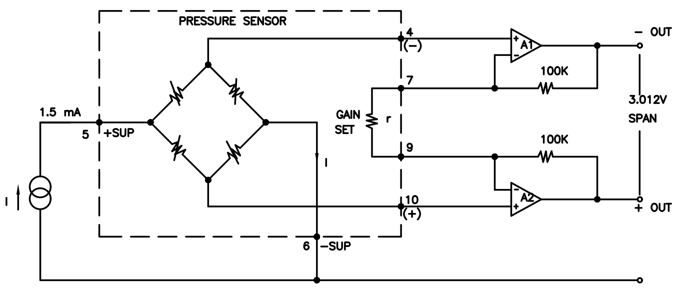


APPLICATION SCHEMATIC

BACKSIDE APPLICATION CONNECTIONS AND SCHEMATIC



CONNECTIONS



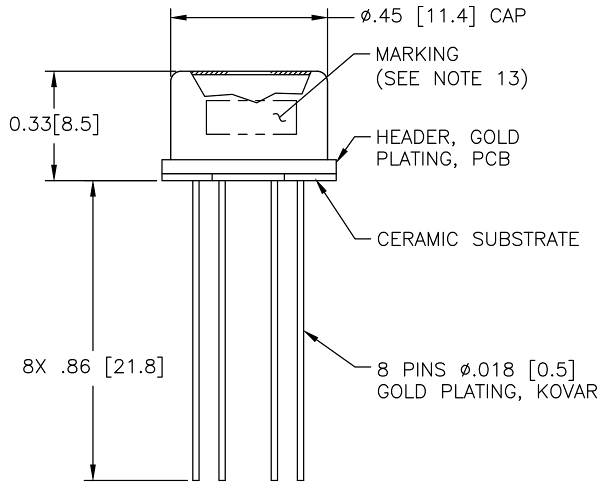
APPLICATION SCHEMATIC

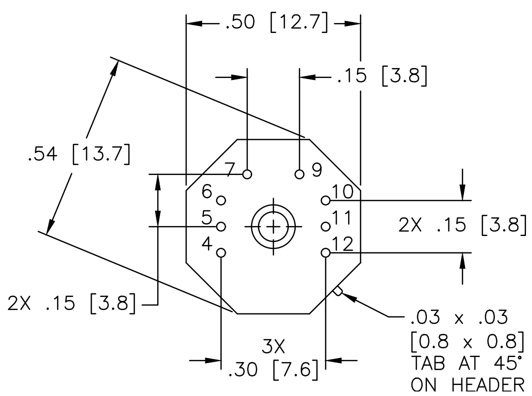
PRESSURE
MODEL SA46

PC Board Mountable Pressure Sensor
1-250 PSI
0-100 mV Output
Low Cost
Temperature Compensated

- **Medical Instrumentation**
- **HVAC**
- **Factory Automation**
- **Process Control**
- **Avionics**
- **Air Flow Management**

DIMENSIONS





DESCRIPTION

The Model 46 is a temperature compensated, piezoresistive silicon pressure sensor packaged in TO-8 configurations. It provides excellent performance and long-term stability.

Integral temperature compensation is provided over a range of 0-50°C using a laser-trimmed ceramic compensation board. An additional laser-trimmed resistor is included which can be used to adjust the gain of an external differential amplifier and provide sensitivity interchangeability of ±1%.

PC Board Mountable Pressure Sensor

MODEL SA46

PERFORMANCE SPECIFICATIONS

SUPPLY CURRENT: 1.5mA, AMBIENT TEMPERATURE: 25°C (UNLESS OTHERWISE SPECIFIED)

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
FULL SCALE OUTPUT, SPAN	75	100	150	mV	1
ZERO PRESSURE OUTPUT, OFFSET	-	-	2	±mV	
PRESSURE NON-LINEARITY	-	0.1	0.2	%SPAN	2
PRESSURE HYSTERESIS	-	0.05	0.1	%SPAN	
INPUT RESISTANCE	2.5K	4.5K	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-	0.3	0.8	%SPAN	3
TEMPERATURE ERROR, ZERO	-	0.3	0.8	%SPAN	3
TEMPERATURE COEFFICIENT, RESISTANCE	-	0.145	-	%/°C	3
THERMAL HYSTERESIS, ZERO	-	0.05	0.1	%SPAN	3
SHORT TERM STABILITY OF OFFSET	-	0.05	-	%SPAN	4
SHORT TERM STABILITY OF SPAN	-	0.05	-	%SPAN	4
LONG TERM STABILITY OF OFFSET	-	0.2	-	%SPAN	5
LONG TERM STABILITY OF SPAN	-	0.2	-	%SPAN	5
SUPPLY CURRENT	0.5	1.5	2	mA	6
RESPONE TIME (10% TO 90%)	-	1.0	-	msec	7
OUTPUT NOISE	-	1.0	-	μVp-p	8
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	9
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	10
PRESSURE OVERLOAD	-	-	3X	RATED	11
OPERATING TEMPERATURE RANGE	-40	-	125	°C	
STORAGE TEMPERATURE	-50	-	150	°C	
MEDIA	NON-CORROSIVE GASES COMPATIBLE WITH WETTED MATERIALS				12
WEIGHT	3 GRAMS				

Notes

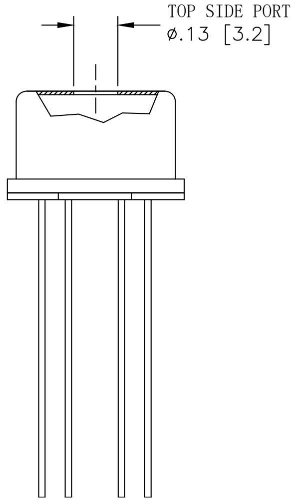
1. OUTPUT SPAN OF UNAMPLIFIED SENSOR FOR 5PSI ABOVE,25-90MV FOR 5PSI BELOW RANGE.
2. BEST FIT STRAIGHT LINE, TOPSIDE PRESSURE. FOR 5 PSI BELOW DEVICES, NON-LINEARITY IS ±0.5%
3. TEMPERATURE RANGE (IN REFERENCE TO 25°C); FOR 5 PSI DEVICES: 0° TO +50°C; FOR 15 PSI (OR GREATER) DEVICES: -20° TO +85°C
4. NORMALIZED OFFSET BRIDGE VOLTAGE: 7 DAYS.
5. ONE (1) YEAR.
6. GUARANTEES INPUT/OUTPUT RATIOMETRICITY FOR SPAN.
7. FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
8. 10 Hz TO 1k Hz.
9. PREVENTS INCREASE OF TC SPAN DUE TO OUTPUT LOADING.
10. BETWEEN CASE AND SENSING ELEMENT.
11. FOR TOPSIDE APPLICATION: 3X OR 500 PSI MAXIMUM, WHICHEVER IS LESS. FOR BACKSIDE APPLICATION: 3X OR 100 PSI MAXIMUM, WHICHEVER IS LESS.
12. WETTED MATERIALS: GLASS, CERAMIC, SILICON, RTV, NICKEL, ALUMINUM AND GOLD.
13. DEVICE MARKING: EACH DEVICE IS MARKED WITH COMPANY NAME (HM), MODEL NUMBER, PRESSURE RANGE, DEVICE TYPE ('A' FOR ABSOLUTE, 'G' FOR GAGE, OR 'D' FOR DIFFERENTIAL), LOT AND SERIAL NUMBERS.

PC Board Mountable Pressure Sensor

MODEL SA46

ORDERING INFORMATION

MODEL 46-xxxA/G



Order Information

46-□□□□□

RANGE (psi)
001*
005
015
030
050
100
250

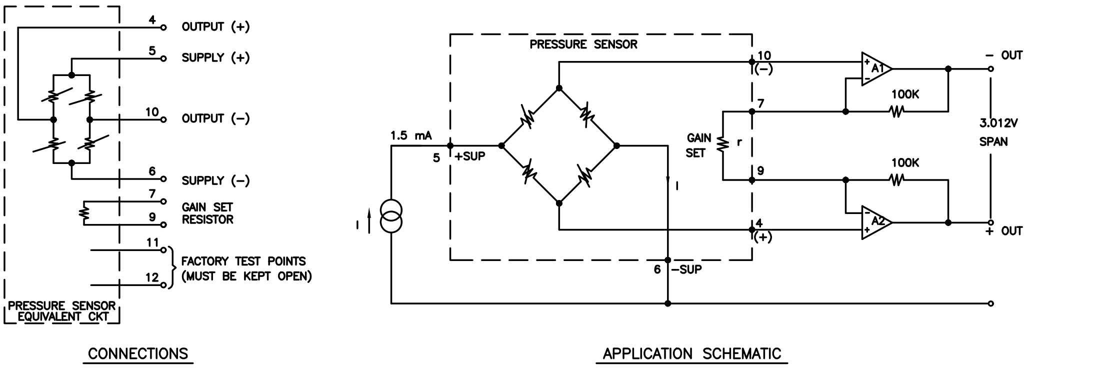
*Gauge Only

Coating
P =Parylene
F = Silicone Gel

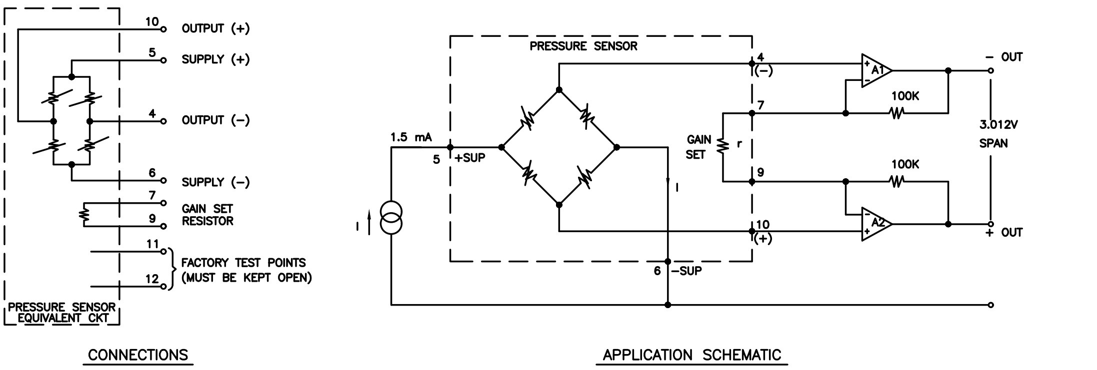
Pressure Type
A = Absolute
G = Gauge

APPLICATION SCHEMATIC

TOPSIDE APPLICATION CONNECTIONS AND SCHEMATIC



BACKSIDE APPLICATION CONNECTIONS AND SCHEMATIC



PRESSURE
MODEL SA18

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

DESCRIPTION

SA18 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full-scale pressure span and temperature range. SA18 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz.

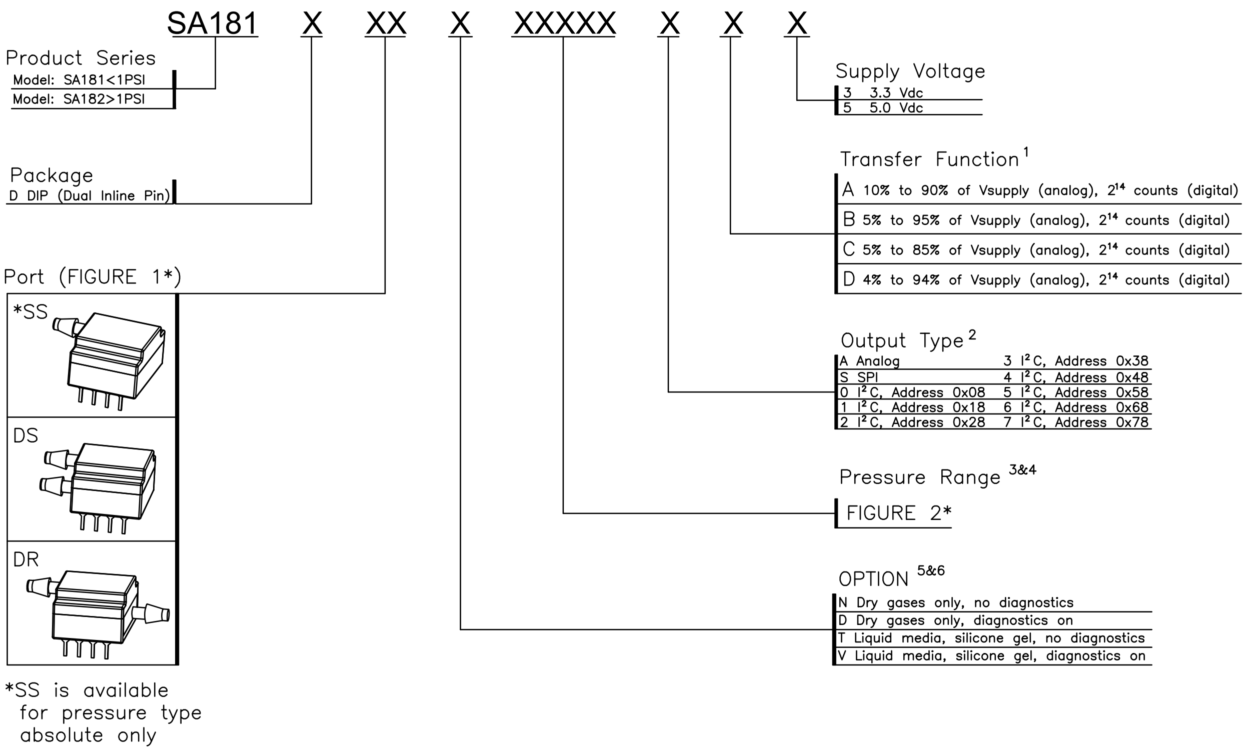
SA18 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA18 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 90corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor

MODEL SA18

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE



1. The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact SENSORALL Customer Service.
2. Custom pressure ranges are available. Contact SENORALL Customer Service for more information.
3. See the explanation of sensor pressure types in Table 4.
4. See the CAUTION in this document.
5. Options T and V are only available on pressure ranges ±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor

MODEL SA18

FIGURE 1:

SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	DR	Dual radial barbed ports, (Ø3.0mm) oposite side

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

PC Board Mountable Pressure Sensor
MODEL SA18

TABLE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	6.0	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact Sensorall Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

PC Board Mountable Pressure Sensor
MODEL SA18

TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		ANALOG			DIGITAL			UNITS	NOTES
		MIN	TYP	MAX	MIN	TYP	MAX		
Supply voltage	3.3 Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0 Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3 Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0 Vdc	-	2.7	3.8	-	3.7	4.6	mA	
	sleep mode option	-	-	-	-	1	10	uA	
Operating temperature range		-40	-	+85	-40	-	85	°C	4
Compensated temperature range		0	-	50	0	-	50	°C	4
Temperature output option		-	-	-	-	±4	-	°C	6
Startup time (power up to data ready)		-	-	5	-	-	3	mS	
Response time		-	1	-	-	0.46	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I²C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		-	-	-	1	-	-	kOhm	
Total Error Band		-	±1	±1.5	-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	12	-	14	bits	

Notes

Notes:

1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
   Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

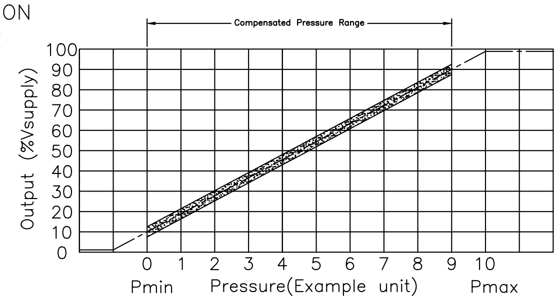
TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS	
	DECIMAL	HEX
0	0	0X0000
10	1638	0X0666
50	8192	0X2000
90	14746	0X399A
100	16383	0X3FFF

PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE

Analog Versions



Ideal

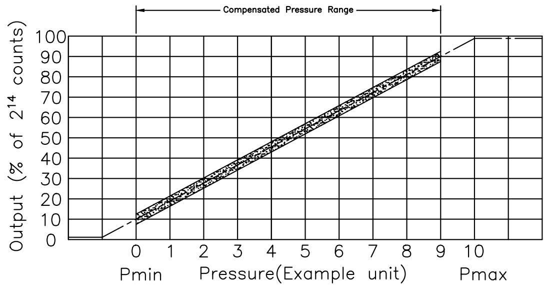
1% Total Error Band

$$\text{Output(V)} = \frac{M*\text{Vsupply}}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin}) + N*\text{Vsuuply}$$

TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

TYPE A EXAMPLE

Digital Versions



Ideal

1% Total Error Band

$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{M*16383}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin}) + N*16383$$

$$\text{TOutput (Decimal Counts)} = \frac{(\text{Output}-{}^{\circ}\text{C } (-50^{\circ}\text{C})_{Tmin} * 2047)}{(150^{\circ}\text{C}_{Tmax} - (-50^{\circ}\text{C})_{Tmin})}$$

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
Differential										
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	100000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH $_2$ O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH $_2$ O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH $_2$ O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH $_2$ O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH $_2$ O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH $_2$ O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

PC Board Mountable Pressure Sensor

MODEL SA18

Table 9.1 Pressure Range Specifications for 0.5 inH$_2$O to 150 psi

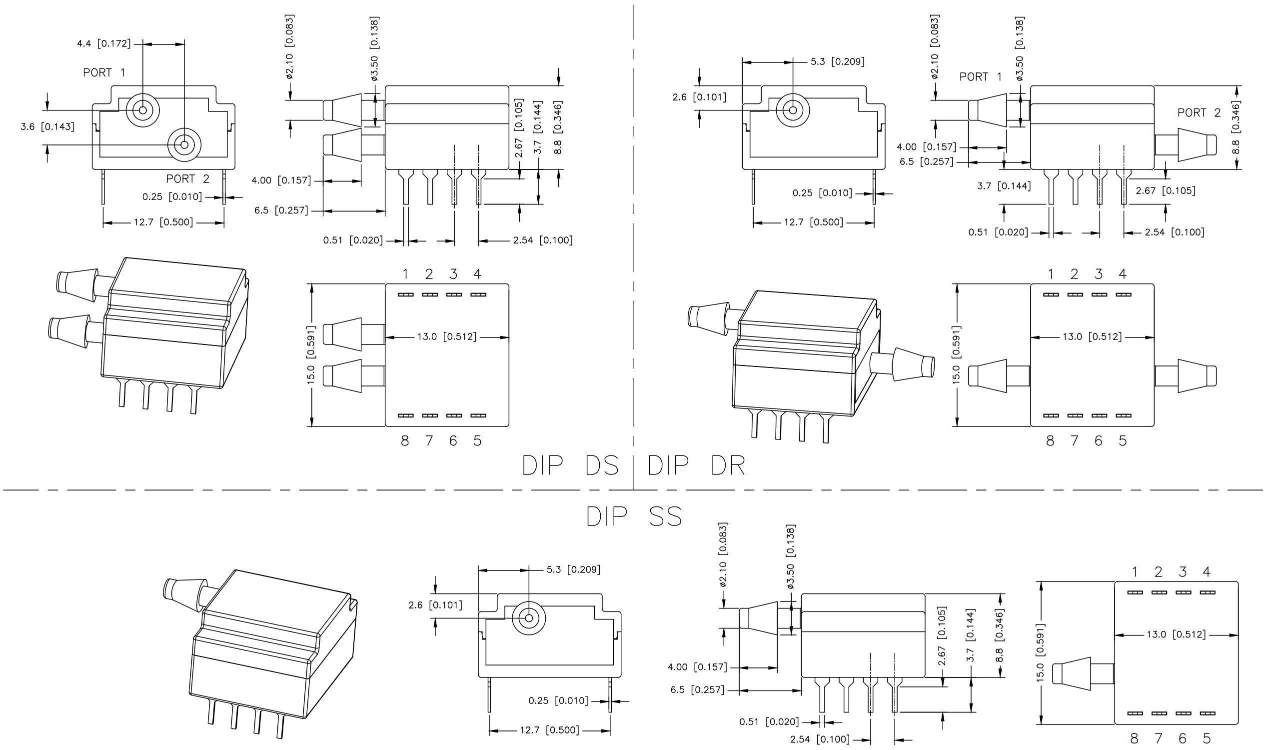
Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH$_2$O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH$_2$O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH$_2$O	35	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH$_2$O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

PC Board Mountable Pressure Sensor
MODEL SA18

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS



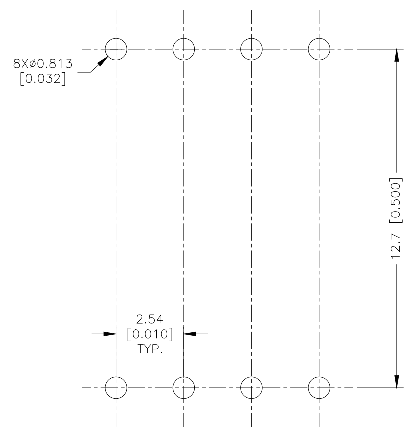
PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	NC	NC	NC	NC
SPI	GND	Vsupply	MISO	SCLK	SS	NC	NC	NC
ANALOG	NC	Vsupply	Vout	GND	NC	NC	NC	NC

PINOUTS,PCB PAD LAYOUT

RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SA18HD

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- **Variable Air Volume control**
- **Static duct pressure**
- **HVAC transmitters**
- **Clogged HVAC filter detection**

DESCRIPTION

SA18HD High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full-scale pressure span and temperature range. SA18HD Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

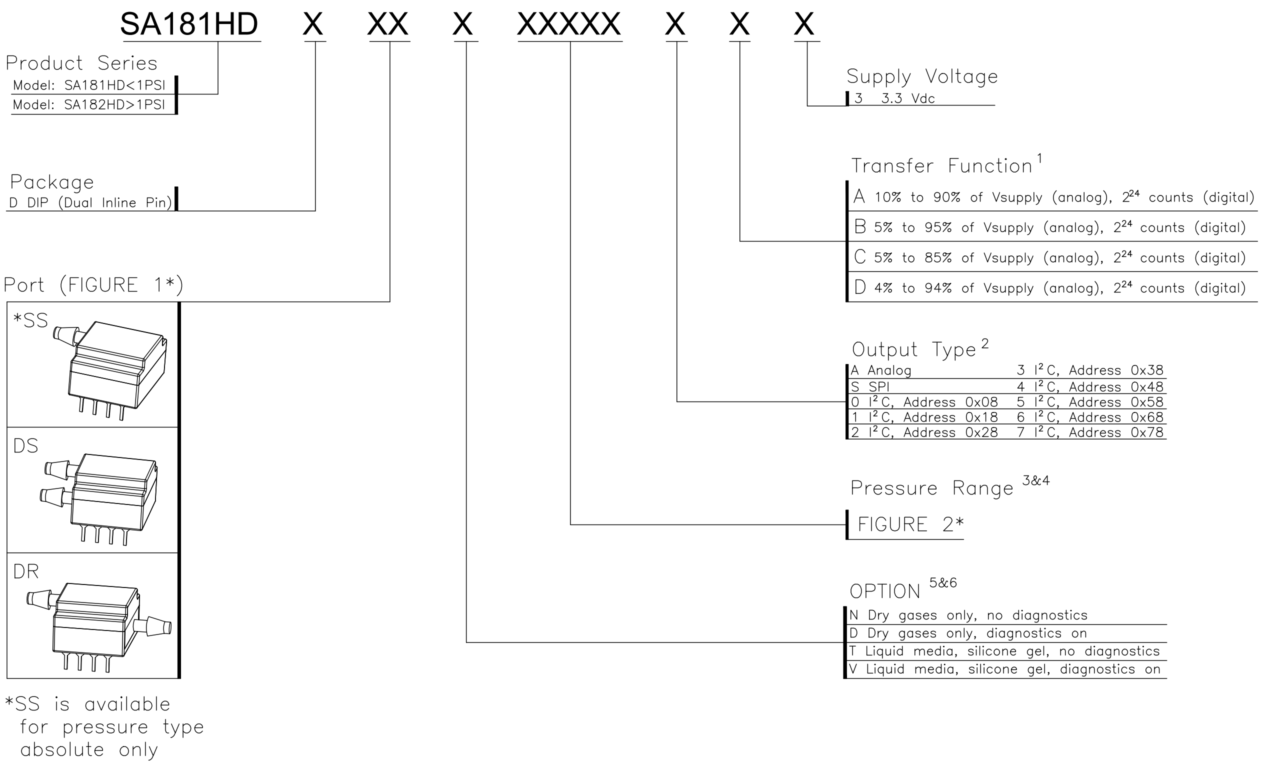
SA18HD Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA18HD Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor

MODEL SA18HD

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE



1. The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact SENSORALL Customer Service.
2. Custom pressure ranges are available. Contact SENORALL Customer Service for more information.
3. See the explanation of sensor pressure types in Table 4.
4. See the CAUTION in this document.
5. Options T and V are only available on pressure ranges ±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor
MODEL SA18HD

FIGURE 1:

SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	DR	Dual radial barbed ports, (Ø3.0mm) oposite side

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

PC Board Mountable Pressure Sensor
MODEL SA18HD

TABLE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	3.6	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact Sensorall Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

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TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	Vdc	1,2,3
Supply current	I2C/sleep/Standby Mode	3.0	33.8	211	uA	
	SPI/sleep/Standby Mode	13	43.8	211	uA	
Operating temperature range		-40	-	85	°C	4
Compensated temperature range		-10	-	50	°C	4
Temperature output option		-	±4	-	°C	6
Startup time (power up to data ready)		-	-	3	mS	
Response time		2	7	10	mS	
I²C/SPI voltage level	low	-	-	20	%Vsupply	
	high	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		1	-	-	kOhm	
Total Error Band		-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		-	-	-	%FSS	
		12	-	-	bits	

Notes

1. Sensors are 3.3 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS DECIMAL	DIGITAL COUNTS HEX
0	0	0X0000
10	1677722	0X19999A
50	8388608	0X800000
90	15099494	0XE66666
100	16777215	0XFFFFFF

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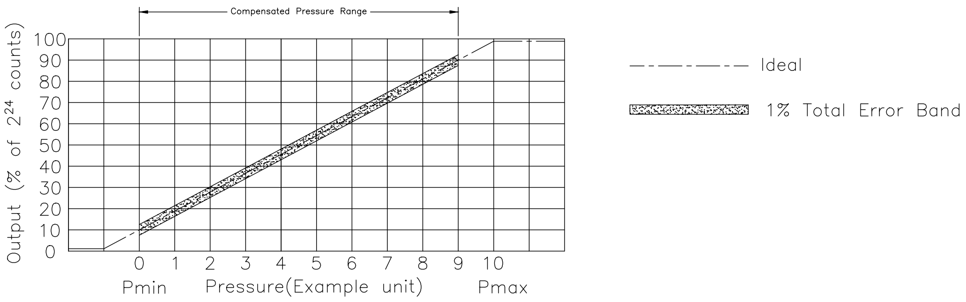
PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE



$$\text{Output (\% of } 2^{24} \text{ counts)} = \frac{M*16777215}{Pmax-Pmin} * (Papplied-Pmin)+N*16777215$$

$$\text{Temperature Output (Decimal Counts)} = \frac{(\text{Output } ^\circ C - (-40^\circ C)_{Tmin}) * 16777215}{(85^\circ C_{Tmax} - (-40^\circ C)_{Tmin})}$$

TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
					Absolute					
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
					Differential					
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

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Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	100000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH $_2$O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH $_2$O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH $_2$O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH $_2$O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH $_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH $_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH $_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH $_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH $_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

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Table 9.1 Pressure Range Specifications for 0.5 inH $_2$O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH $_2$O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH $_2$O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH $_2$O	35	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH $_2$O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH $_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH $_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH $_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

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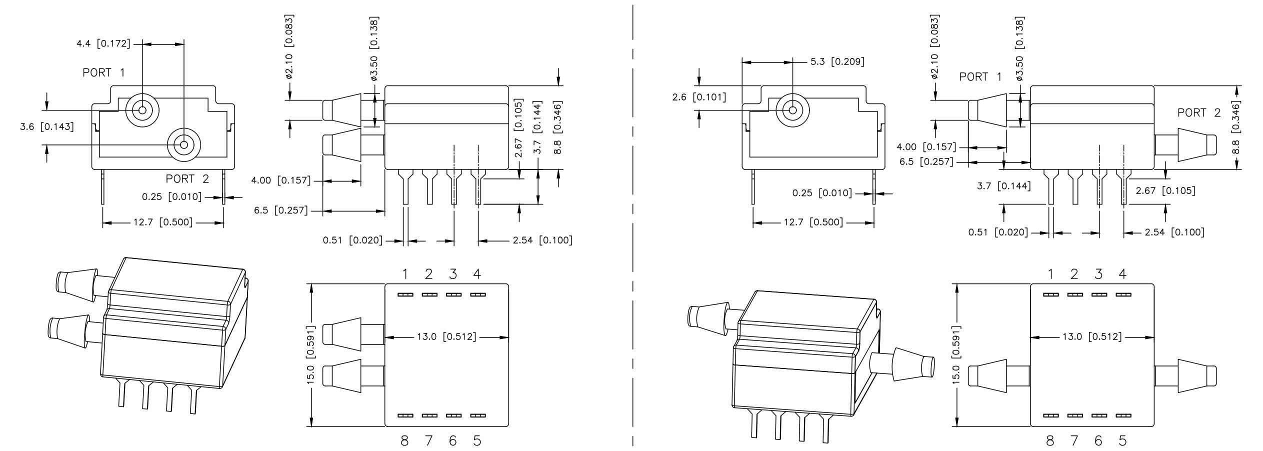
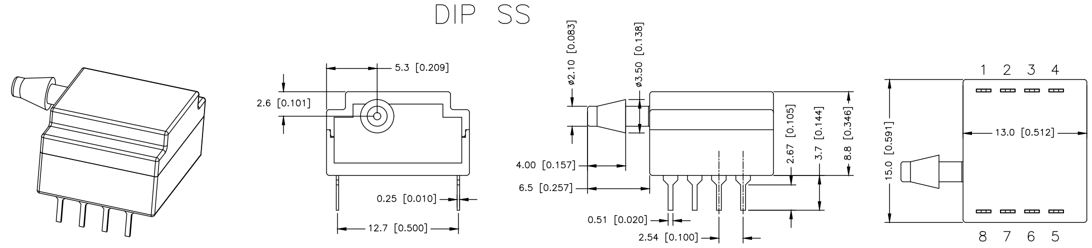
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS



DIP DS | DIP DR

DIP SS



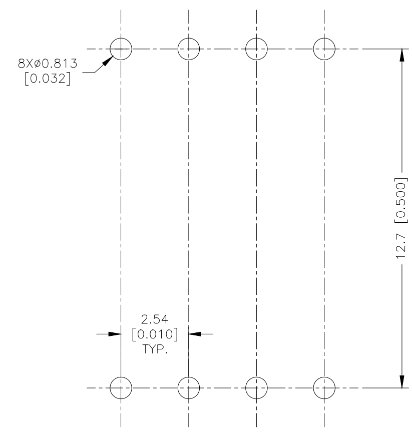
PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	NC	NC	NC	NC
SPI	GND	Vsupply	MISO	SCLK	SS	NC	NC	NC
ANALOG	NC	Vsupply	Vout	GND	NC	NC	NC	NC

PINOUTS,PCB PAD LAYOUT

RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SA18EC

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

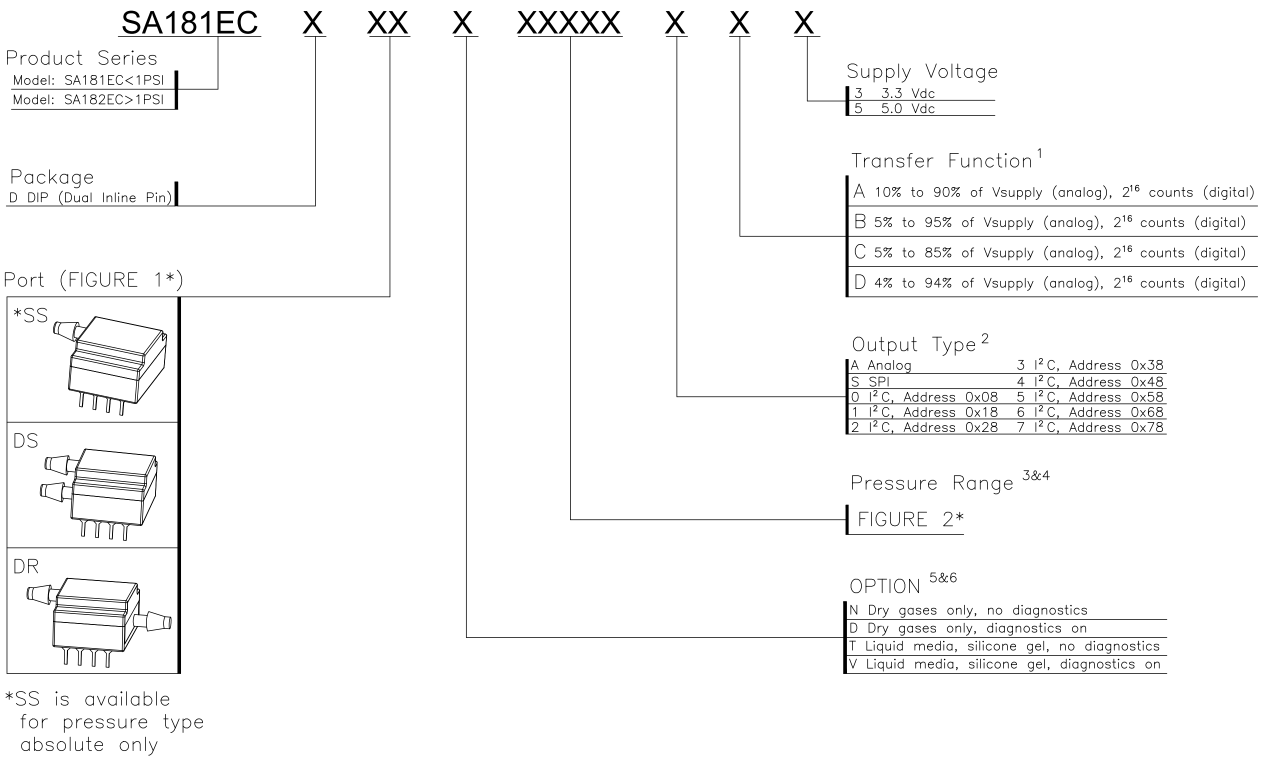
DESCRIPTION

SA18EC High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full-scale pressure span and temperature range. SA18EC Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 2K Hz.

SA18EC Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc or 5.0Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA18EC Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE



1. The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact SENSORALL Customer Service.
2. Custom pressure ranges are available. Contact SENORALL Customer Service for more information.
3. See the explanation of sensor pressure types in Table 4.
4. See the CAUTION in this document.
5. Options T and V are only available on pressure ranges ±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor
MODEL SA18EC

FIGURE 1:

SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	DR	Dual radial barbed ports, (Ø3.0mm) oposite side

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

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FIGURE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	6.0	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact SQMEAS Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

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TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		ANALOG			DIGITAL			UNITS	NOTES
		MIN	TYP	MAX	MIN	TYP	MAX		
Supply voltage	3.3 Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0 Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3 Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0 Vdc	-	2.7	3.8	-	3.7	4.6	mA	
Operating temperature range		-40	-	+85	-40	-	85	°C	4
Compensated temperature range		-10	-	60	-10	-	50	°C	4
Temperature output option		-	-	-	-	±4	-	°C	6
Startup time (power up to data ready)		-	-	5	-	-	5	mS	
Response time		-	1	-	-	2	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I²C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		-	-	-	1	-	-	kOhm	
Total Error Band		-	-	±1.5	-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	12	-	16	bits	

Notes

1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C.
   Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS	
	DECIMAL	HEX
0	-32768	(0X8000)
10	-26214	(0X6666)
50	0	0X0000
90	26214	0X6666
100	32768	0X8000

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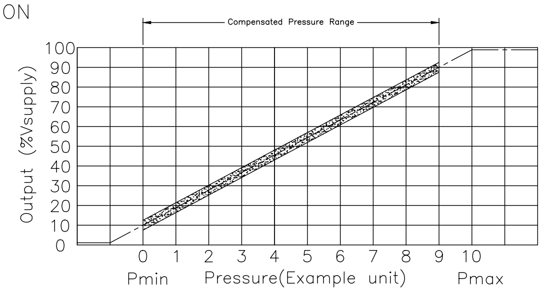
PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE

Analog Versions



—·—·—·— Ideal

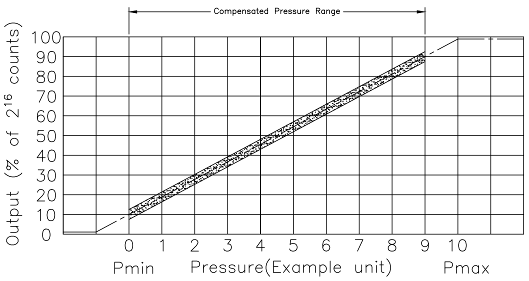
1% Total Error Band

$$Output(V)=\frac{M*Vsupply}{Pmax-Pmin} * (Papplied-Pmin)+N*Vsuuply$$

TRANSFER FUNCTION		
Variable	A	B
M	0.9	0.95
N	0.1	0.05

TYPE A EXAMPLE

Digital Versions



—·—·—·— Ideal

1% Total Error Band

$$Output\ (\%\ of\ 2^{16}\ counts)=\frac{(M-N)*65535}{Pmax-Pmin} * (Papplied-Pmin)-2\hat{}15*(M-N)$$

$$Output\ (Decimal\ Counts)=\frac{(Output-°C\ (-40°C)_{Tmin} * 65535\ )}{(125°C_{Tmax}-(-40°C)_{Tmin}\ )}$$

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure¹	Over Pressure²	Burst Pressure³	Common Mode Pressure⁴	Total Error Band⁵ (%FSS)	Total Error Band after Auto-Zero⁶ (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
Differential										
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

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Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	100000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH$_2$O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH$_2$O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH$_2$O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH$_2$O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

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Table 9.1 Pressure Range Specifications for 0.5 inH_2O to 150 psi

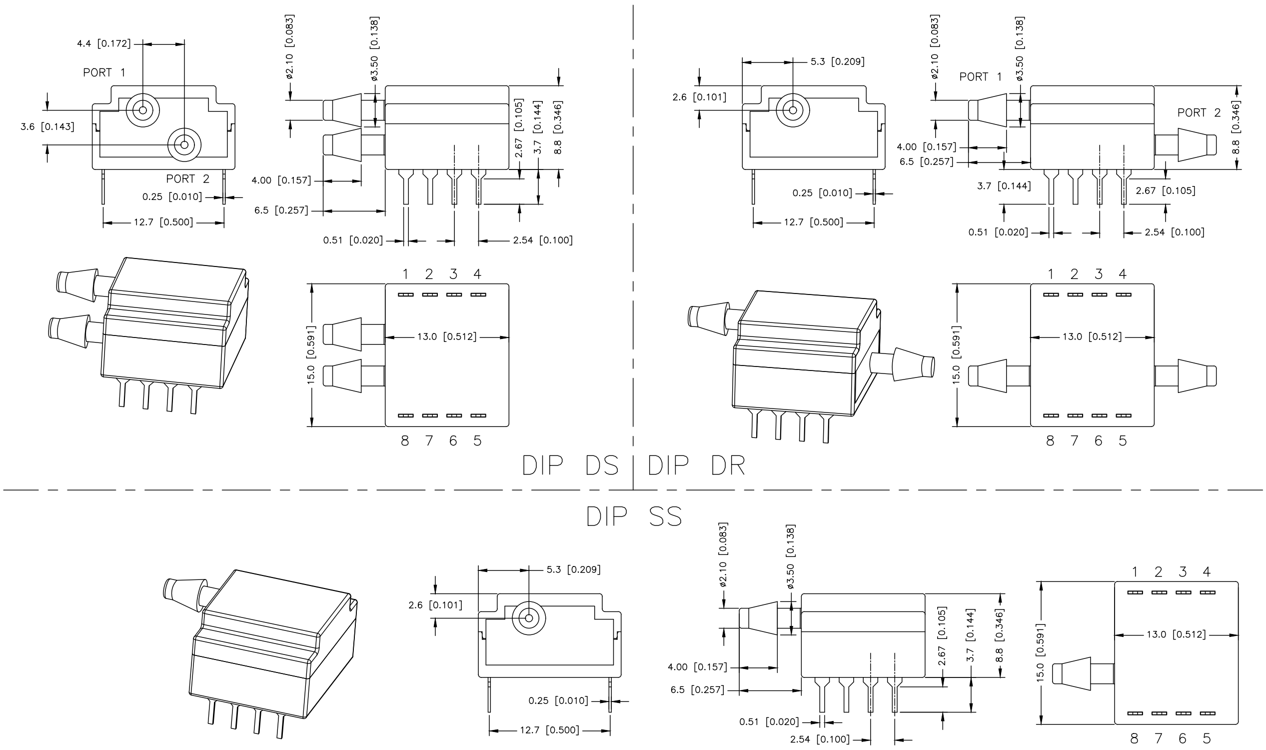
Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH_2O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH_2O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH_2O	35	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH_2O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH_2O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

MODEL SA18EC

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS



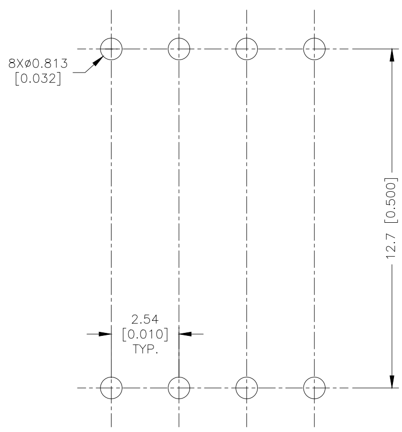
PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	NC	NC	NC	NC
SPI	GND	Vsupply	MISO	SCLK	SS	NC	NC	NC
ANALOG	NC	Vsupply	Vout	GND	NC	NC	NC	NC

PINOUTS,PCB PAD LAYOUT

RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SA19

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

DESCRIPTION

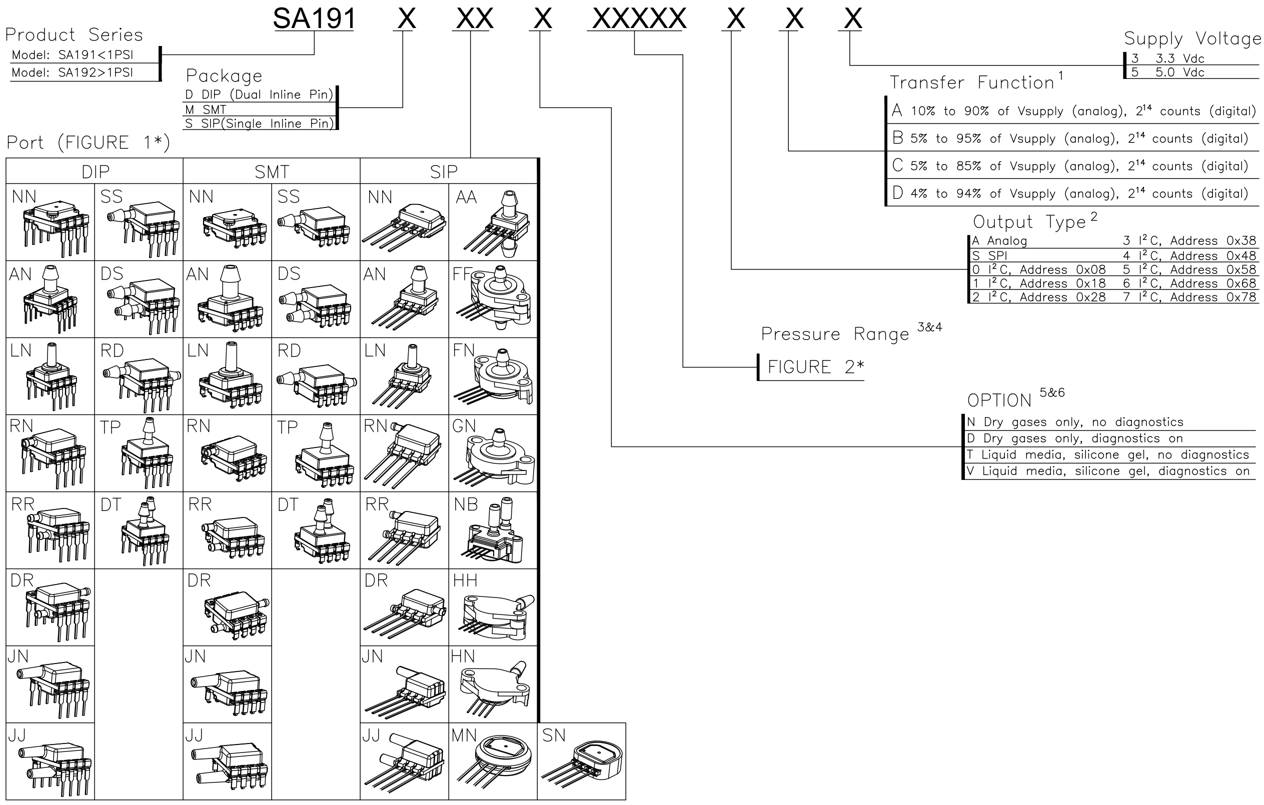
SA19 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/ digital output for reading pressure over the specified full scale pressure span and temperature range. SA19 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz.

SA19 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA19 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

MODEL SA19

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE



Notes

1. The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact SQMEAS Customer Service.
2. SPI output function is not available in SIP package.
3. Custom pressure ranges are available. Contact SQMEAS Customer Service for more information.
4. See the explanation of sensor pressure types in Table 4.
5. See the CAUTION in this document.
6. Options T and V are only available on pressure ranges ±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor

MODEL SA19

FIGURE 1:

NN	No ports	AN	Single axial barbed port	LN	Single axial barbless port	RN	Single radial barbed port	RR	Dual radial barbed ports, same side	DR	Dual radial barbed ports, opposite sides	JN	Single radial barbless port	JJ	Dual radial barbless ports, same side
SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	RD	Dual radial barbed ports, (Ø3.0mm) oposite side	TP	Single radial barbed ports, (Ø3.0mm) top side	DT	Dual radial barbed ports, (Ø3.0mm) top side	AA	Dual axial barbed ports, opposite sides	FF	Fastener mount, dual axial barbed ports,opposite sides	FN	Fastener mount, single axial barbed port
GN	Ribbed fastener mount, single axial barbed port 008B	NB	Fastener mount, dual axial ports, same side	HH	Fastener mount, dual radial barbed ports, same side	HN	Fastener mount, single radial barbed port	MN	Manifold mount, outer diameter seal	SN	Manifold mount, inner diameter seal				

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

PC Board Mountable Pressure Sensor
MODEL SA19

TABLE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	6.0	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact SQMEAS Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

PC Board Mountable Pressure Sensor
MODEL SA19

TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		ANALOG MIN	ANALOG TYP	ANALOG MAX	DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0 Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3 Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0 Vdc	-	2.7	3.8	-	3.7	4.6	mA	
	sleep mode option	-	-	-	-	1	10	uA	
Operating temperature range		-40	-	+85	-40	-	85	°C	4
Compensated temperature range		0	-	50	-	-	50	°C	4
Temperature output option		-	-	-	-	±4	-	°C	6
Startup time (power up to data ready)		-	-	5	-	-	3	mS	
Response time		-	1	-	-	0.46	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I²C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		-	-	-	1	-	-	kOhm	
Total Error Band		-	-	±1.5	-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	12	-	14	bits	

Notes
1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C.
Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

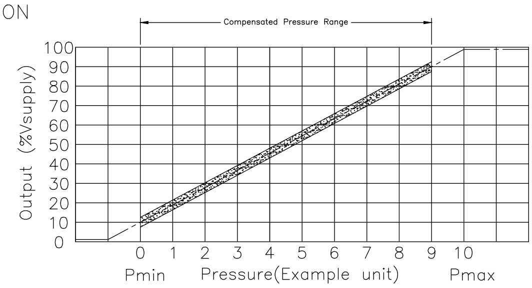
% OUTPUT	DIGITAL COUNTS DECIMAL	DIGITAL COUNTS HEX
0	0	0X0000
10	1638	0X0666
50	8192	0X2000
90	14746	0X399A
100	16383	0X3FFF

PC Board Mountable Pressure Sensor
MODEL SA19

PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE

Analog Versions



Ideal

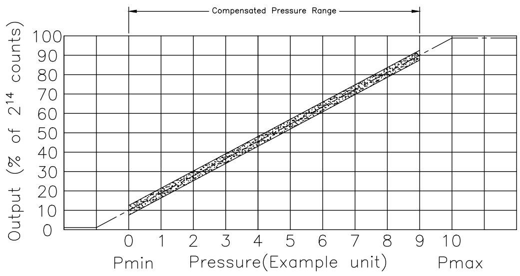
1% Total Error Band

$$Output(V)=\frac{M*Vsupply}{Pmax-Pmin} * (Papplied-Pmin)+N*Vsuuply$$

TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

TYPE A EXAMPLE

Digital Versions



Ideal

1% Total Error Band

$$Output\ (\%\ of\ 2^{14}\ counts)=\frac{M*16383}{Pmax-Pmin} * (Papplied-Pmin)+N*16383$$

$$TOutput\ (Decimal\ Counts)=\frac{(Output-°C\ (-50°C)_{Tmin} * 2047\ )}{(150°C_{Tmax}-(-50°C)_{Tmin}\ )}$$

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure¹	Over Pressure²	Burst Pressure³	Common Mode Pressure⁴	Total Error Band⁵ (%FSS)	Total Error Band after Auto-Zero⁶ (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
Differential										
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	100000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH$_2$O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH$_2$O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH$_2$O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH$_2$O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

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Table 9.1 Pressure Range Specifications for 0.5 inH_2O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH_2O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH_2O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH_2O	35	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH_2O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH_2O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

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PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

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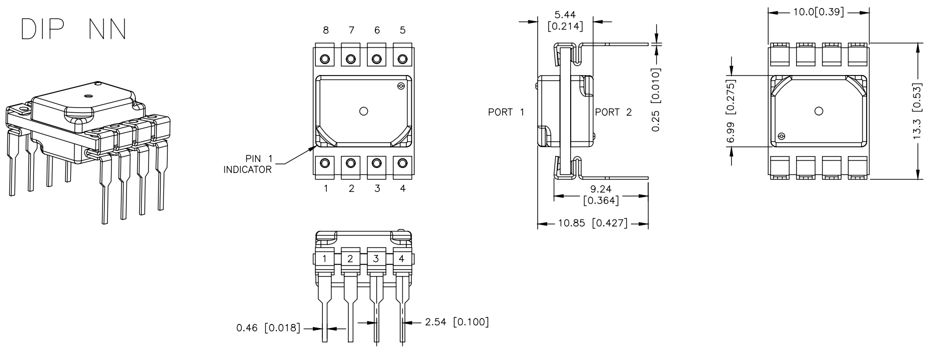

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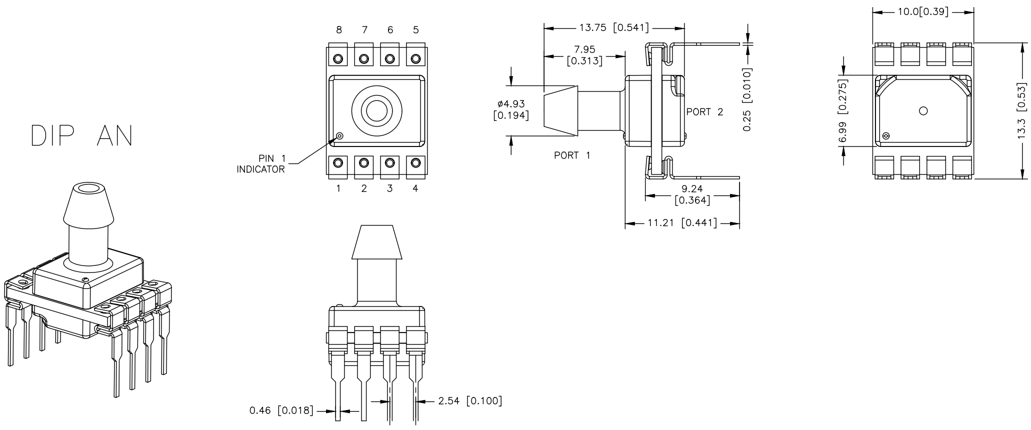

PACKAGE DIMENSIONAL DRAWINGS

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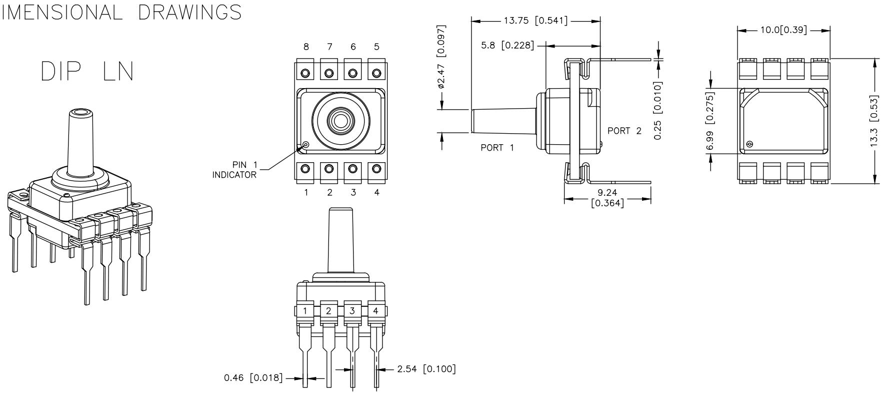

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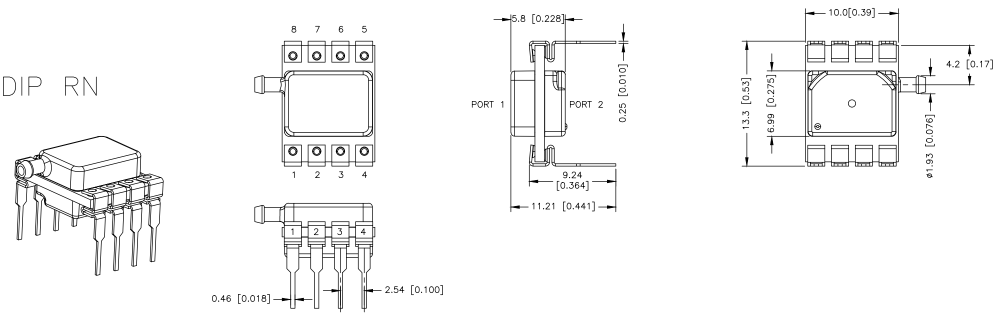

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PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

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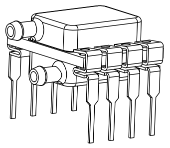

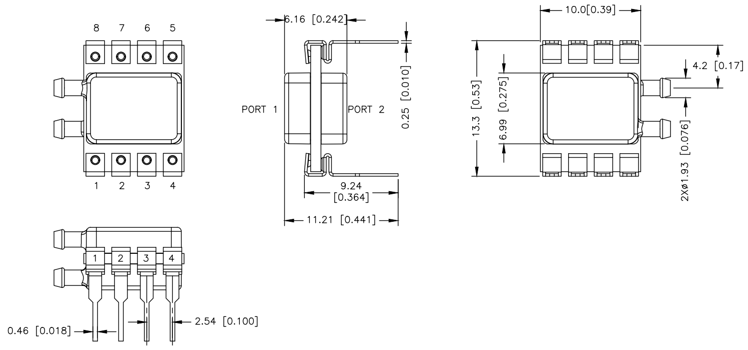

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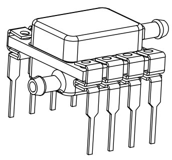

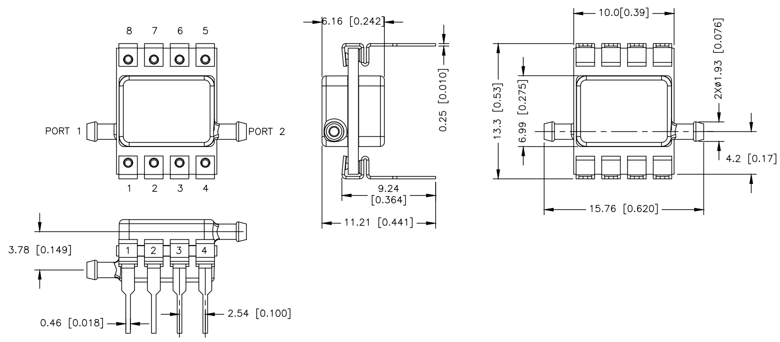

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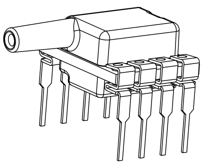

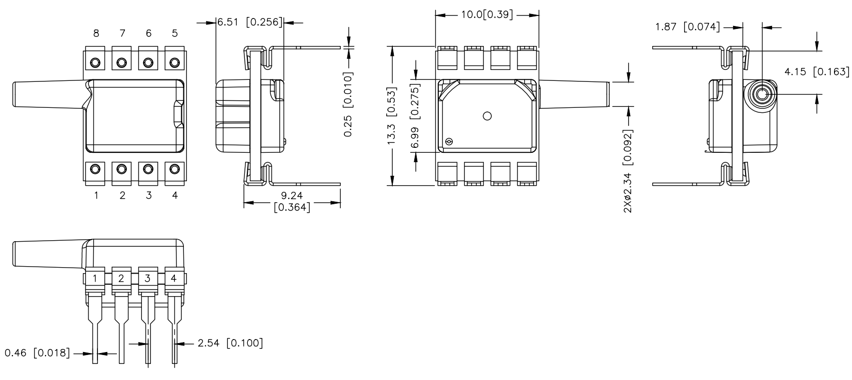

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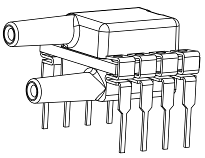

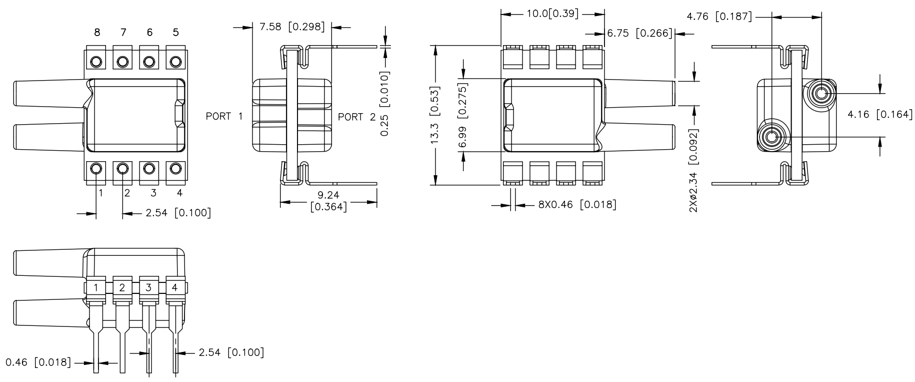

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PACKAGE DIMENSIONAL DRAWINGS

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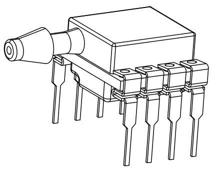

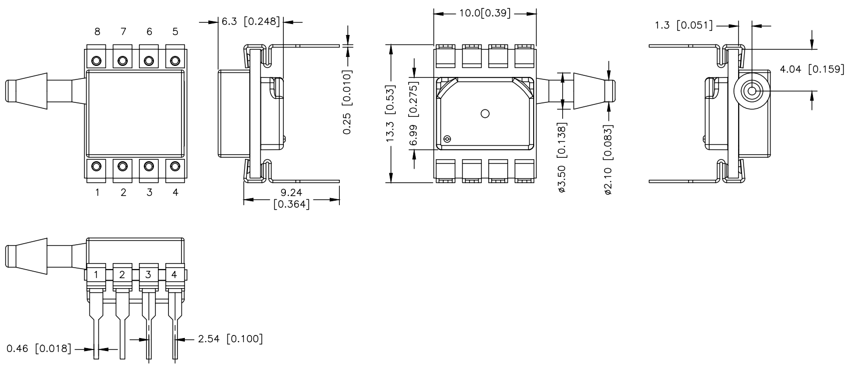

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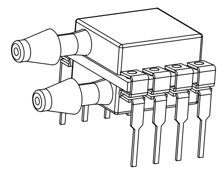

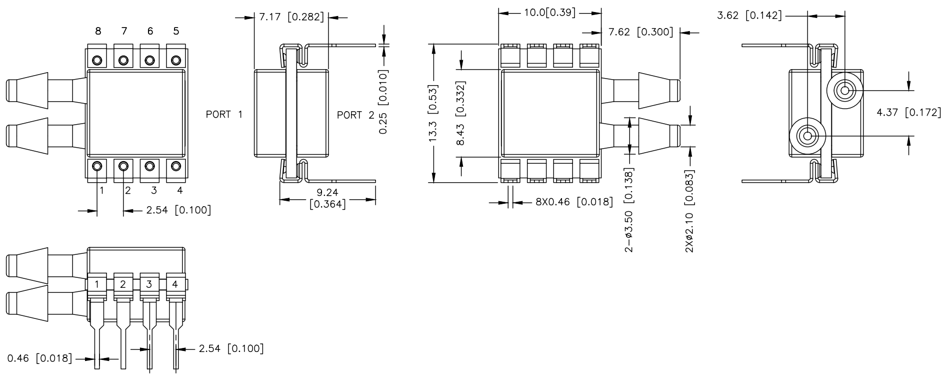

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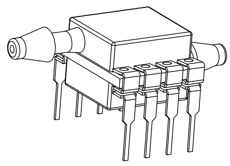

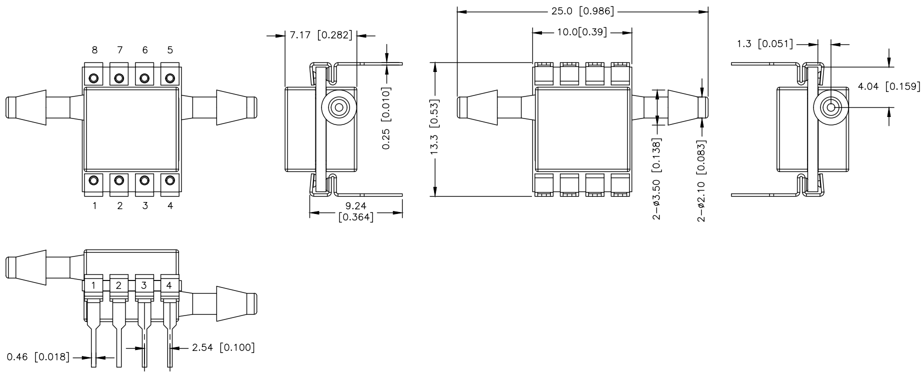

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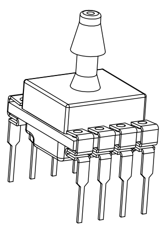

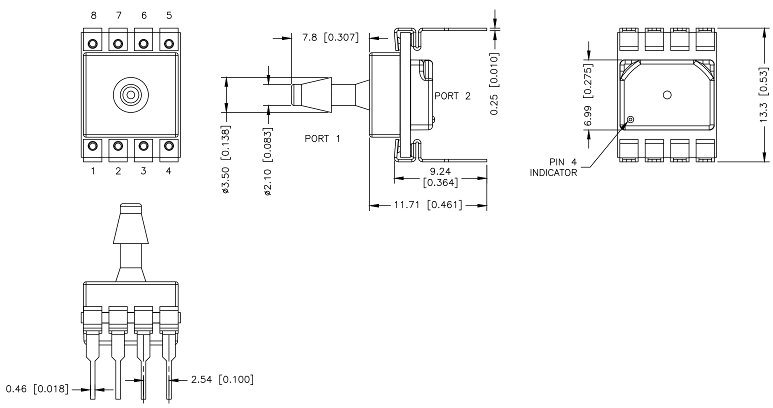

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PACKAGE DIMENSIONAL DRAWINGS

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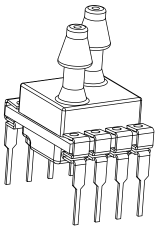

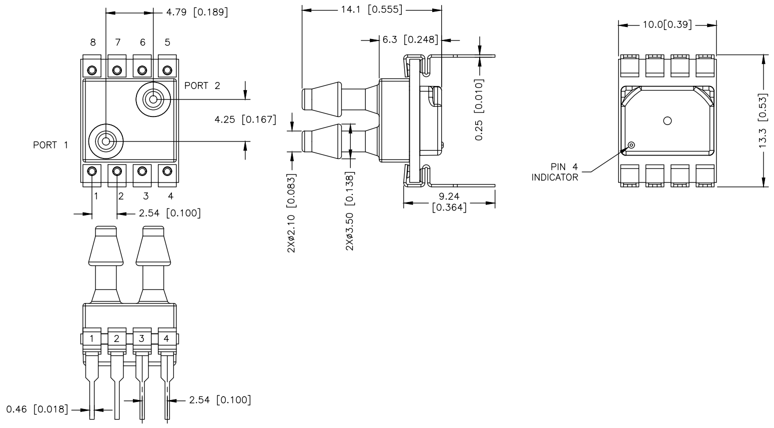

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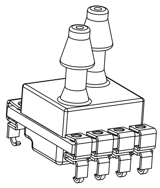

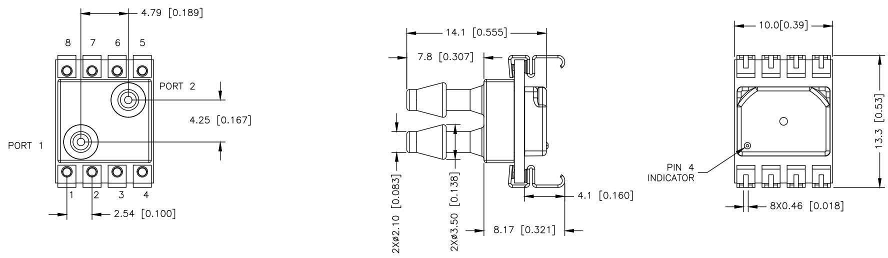

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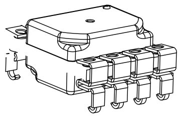

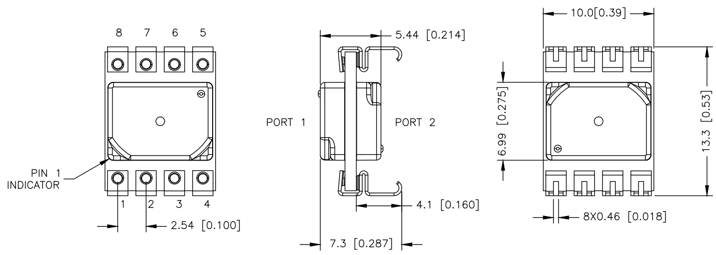

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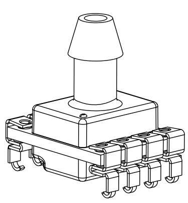

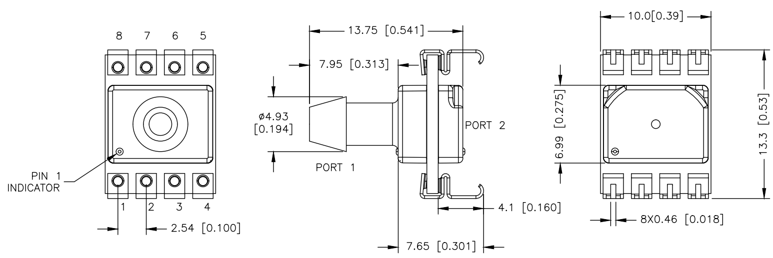

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PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

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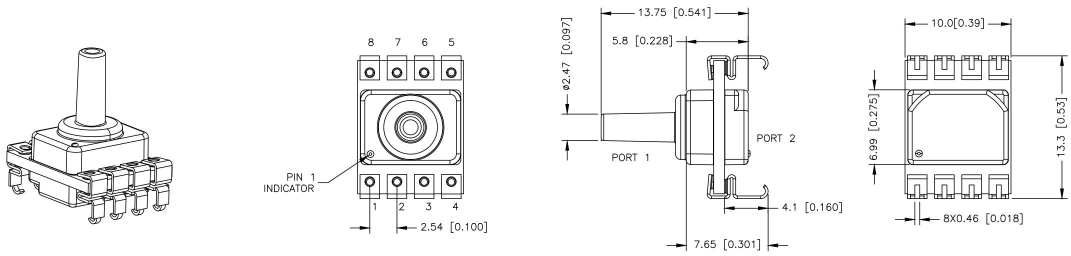

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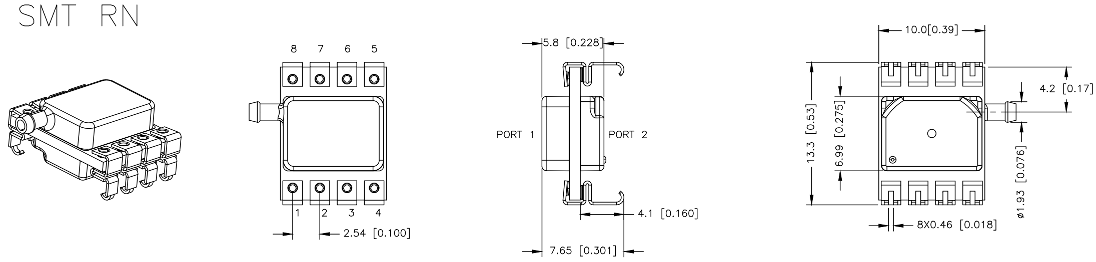

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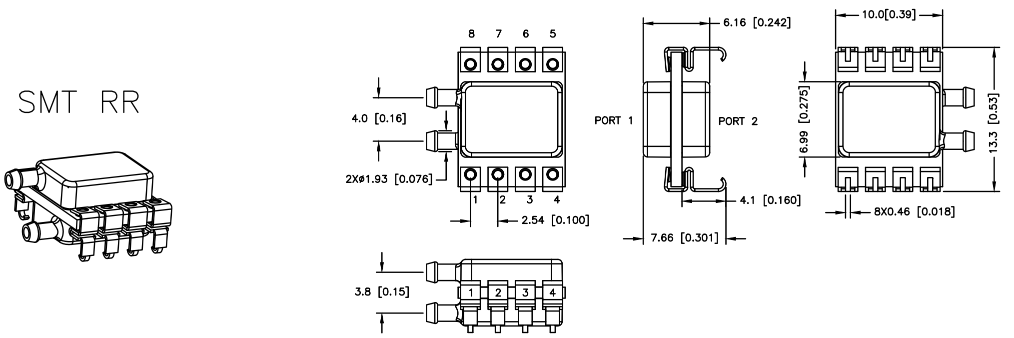

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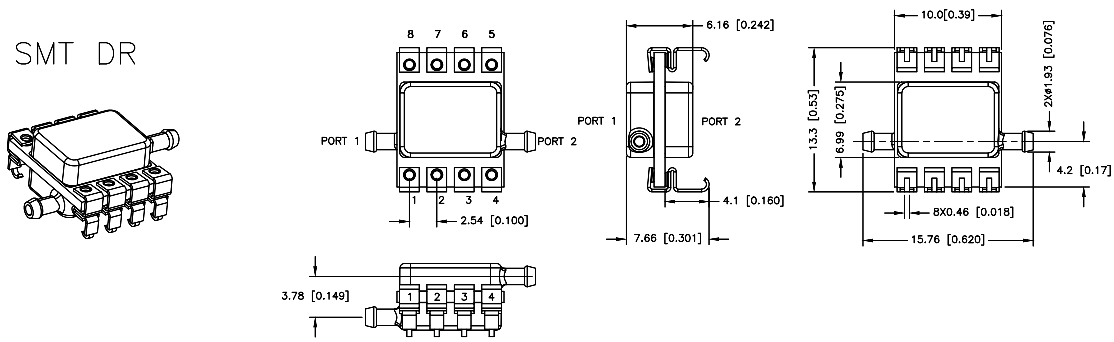

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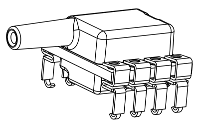
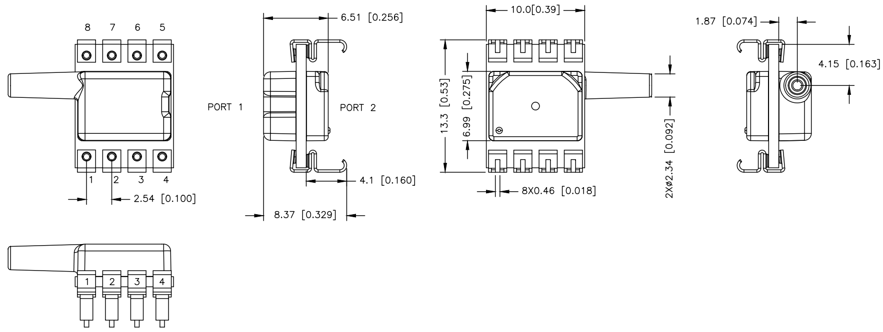
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SMT JN





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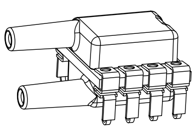

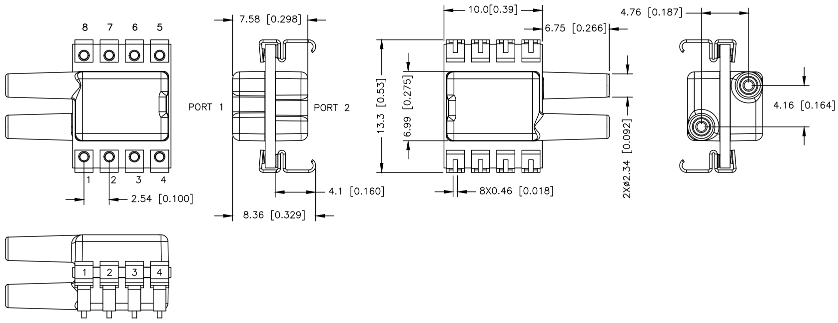

PACKAGE DIMENSIONAL DRAWINGS

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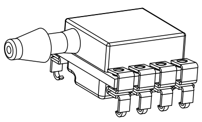

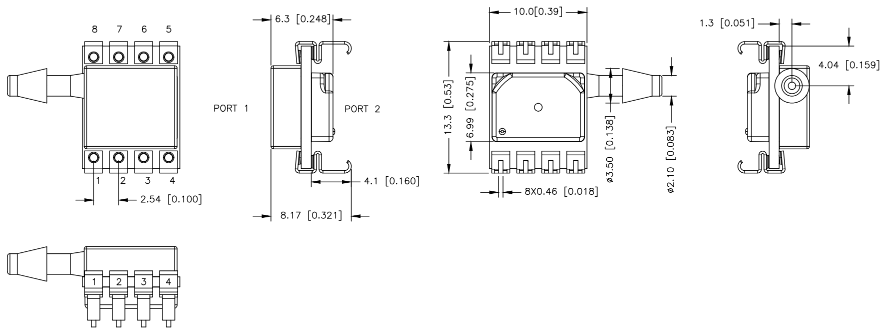

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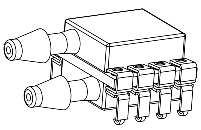

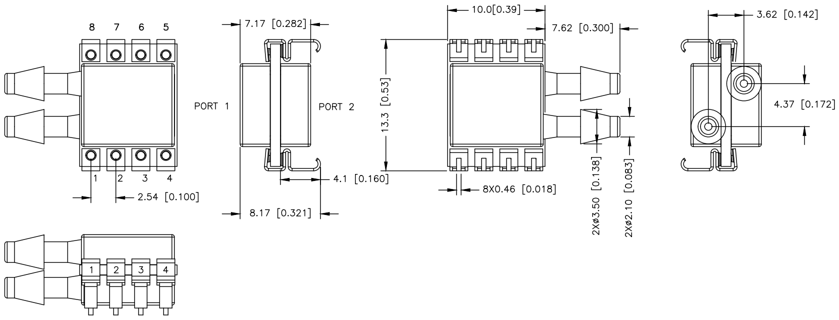

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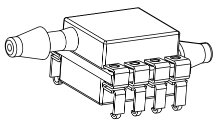
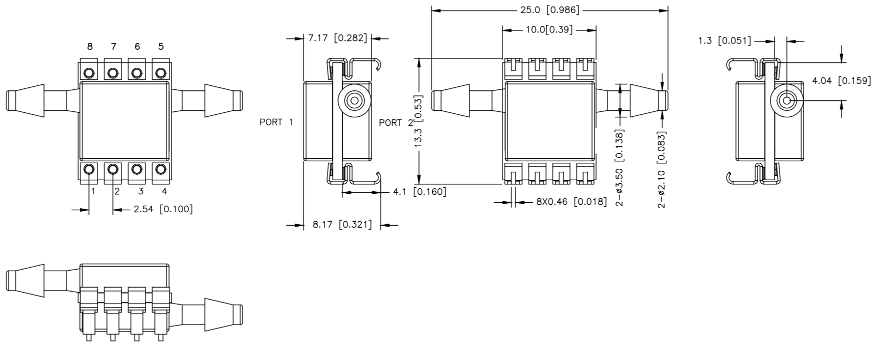
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SMT RD





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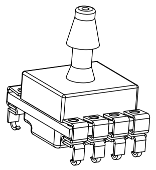

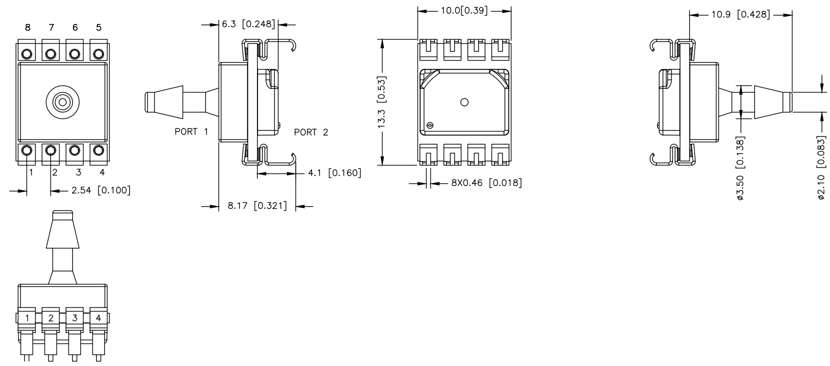

PACKAGE DIMENSIONAL DRAWINGS

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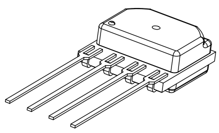

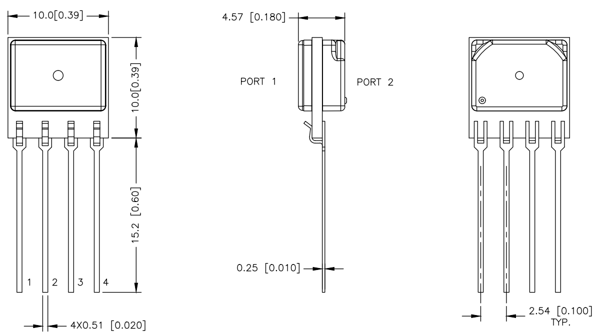

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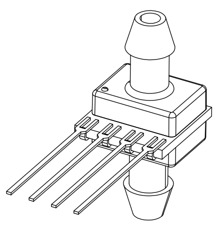

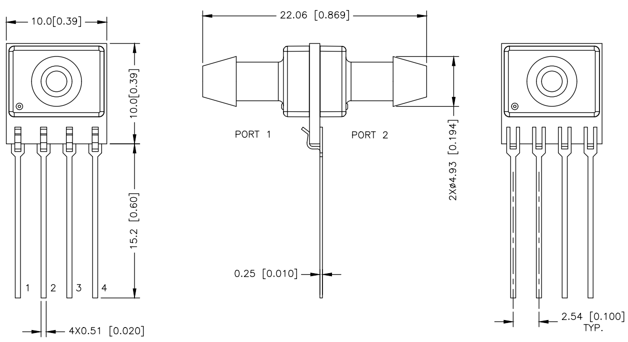

PC Board Mountable Pressure Sensor

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PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

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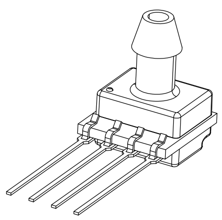

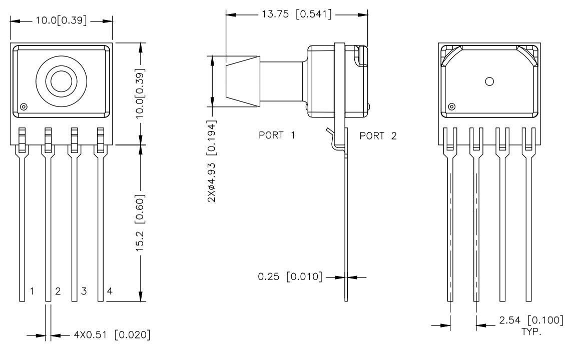

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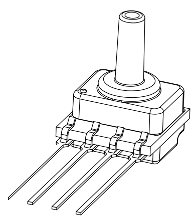
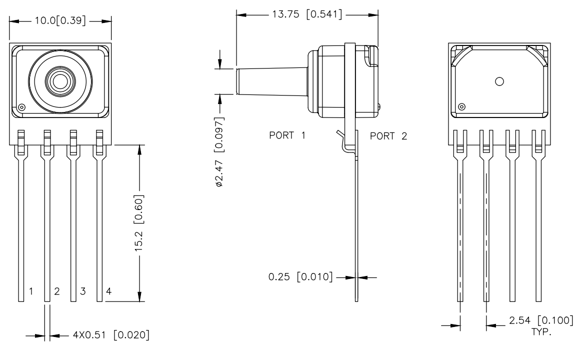
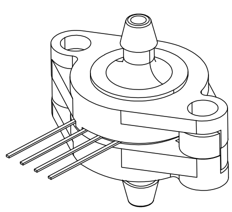
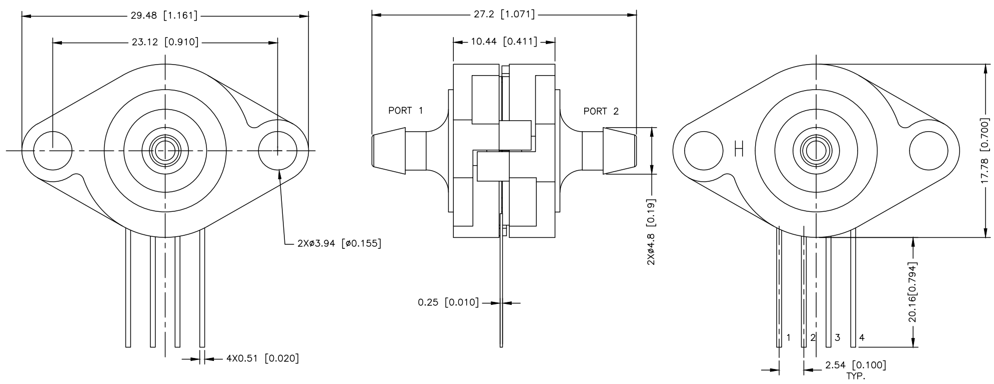




PACKAGE DIMENSIONAL DRAWINGS

SIP FF





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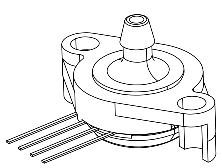
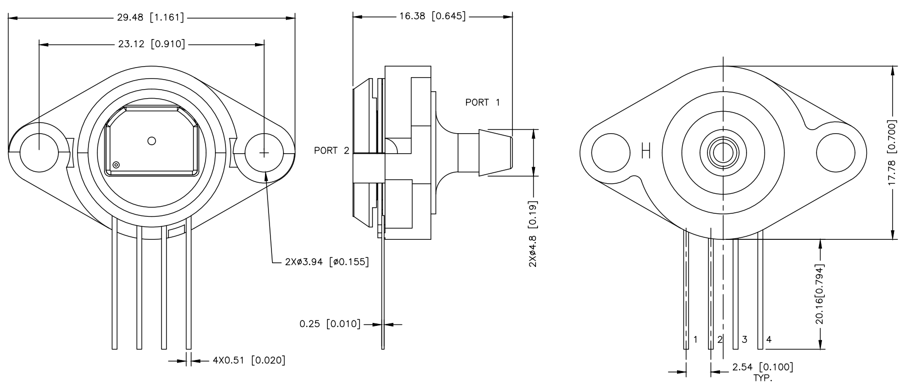


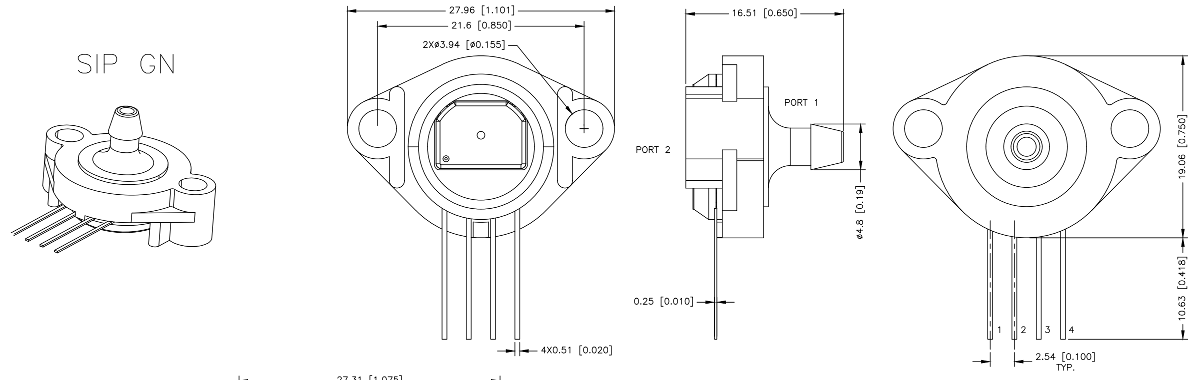


PC Board Mountable Pressure Sensor
MODEL SA19

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP GN



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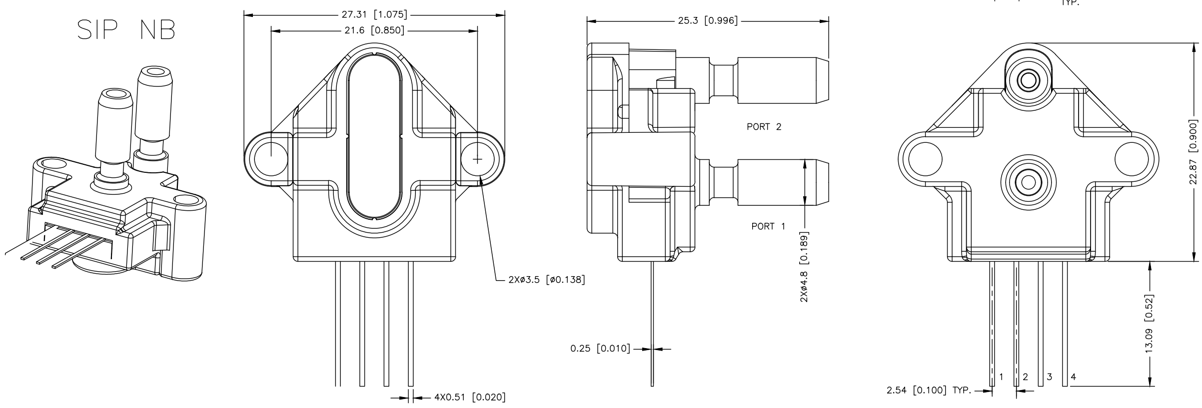

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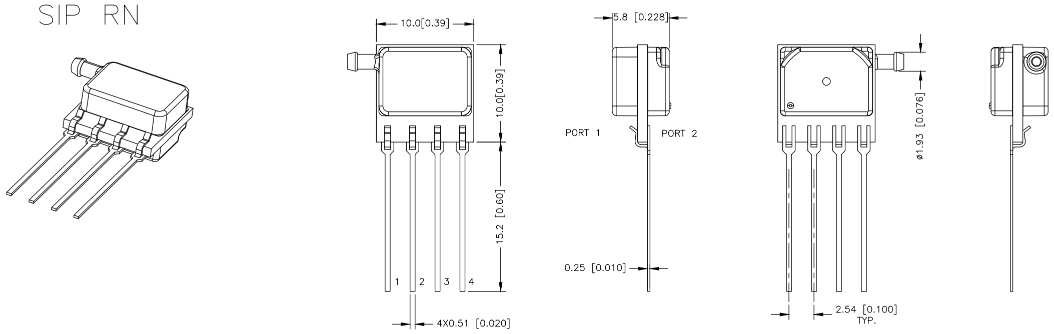

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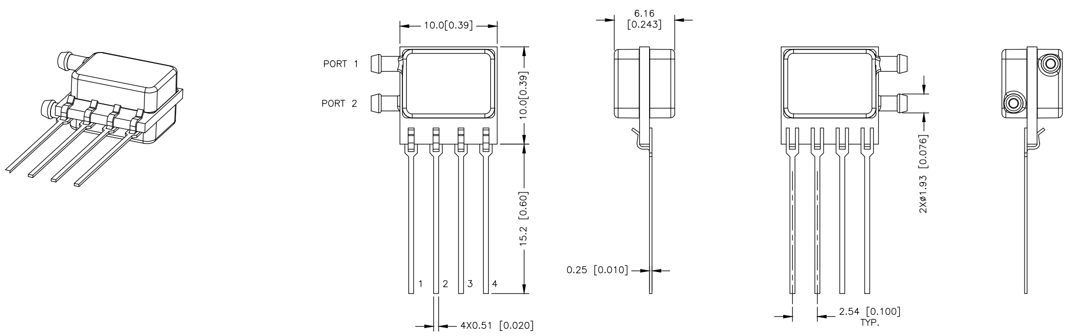

PC Board Mountable Pressure Sensor
MODEL SA19

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

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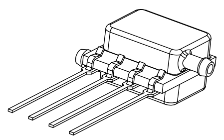

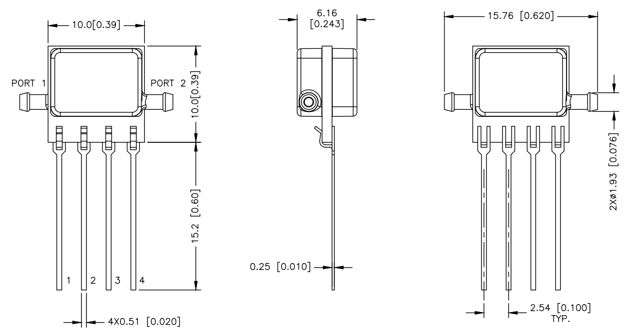

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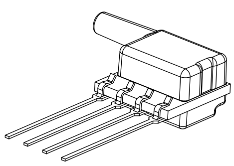

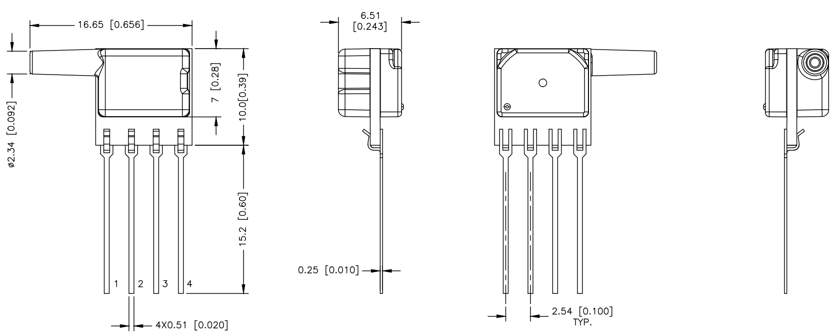

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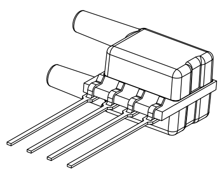

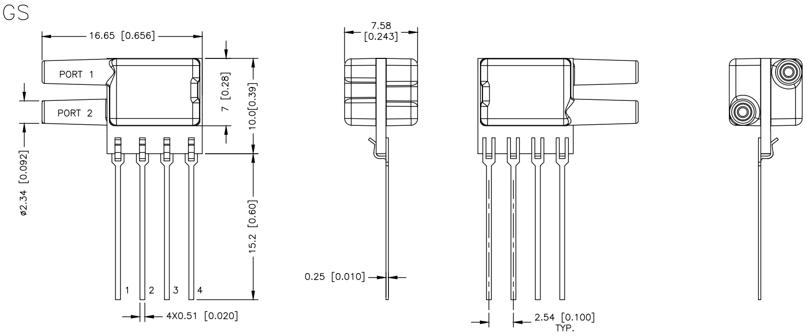

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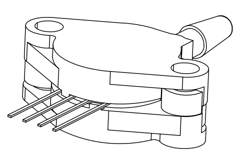
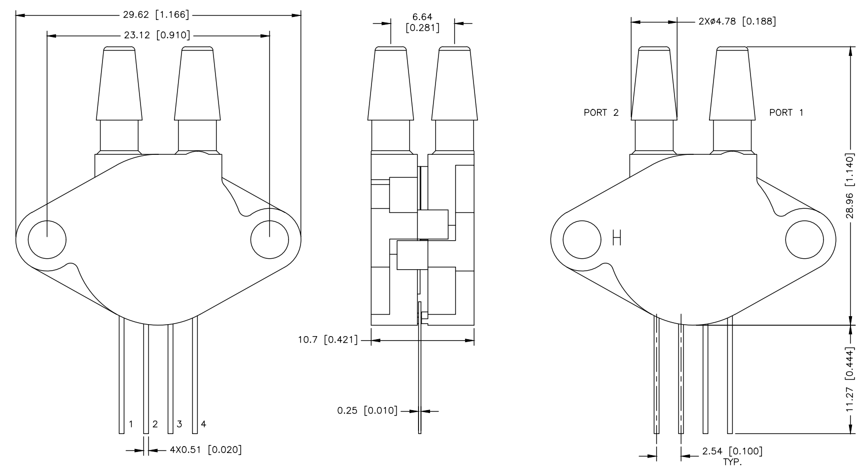


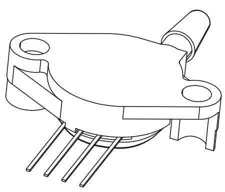


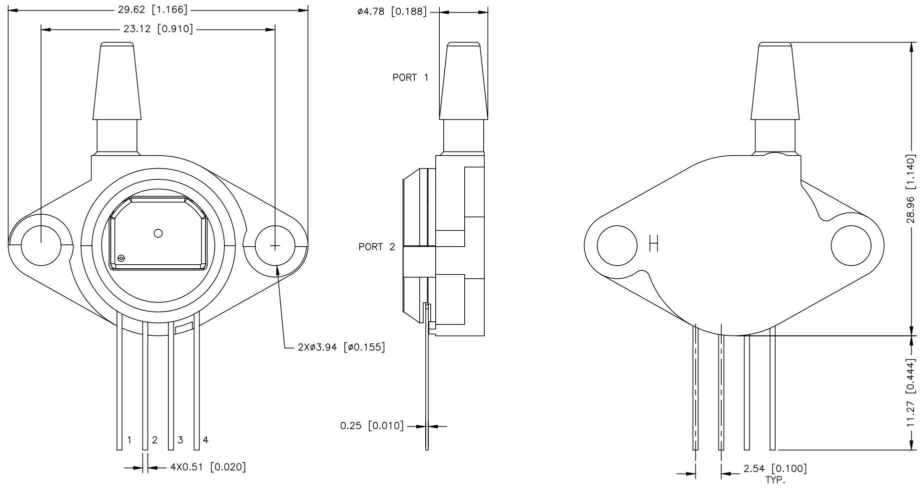
PC Board Mountable Pressure Sensor
MODEL SA19

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

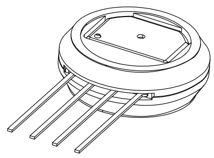
SIP HN

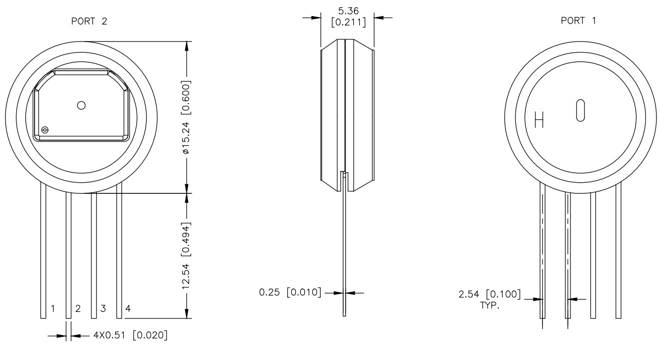




PACKAGE DIMENSIONAL DRAWINGS

SIP MN





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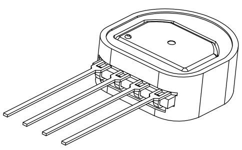
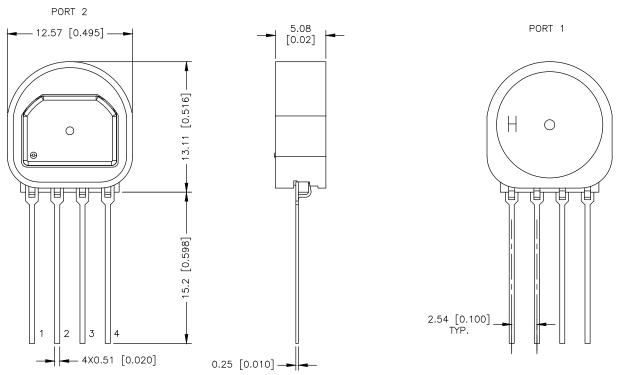




PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

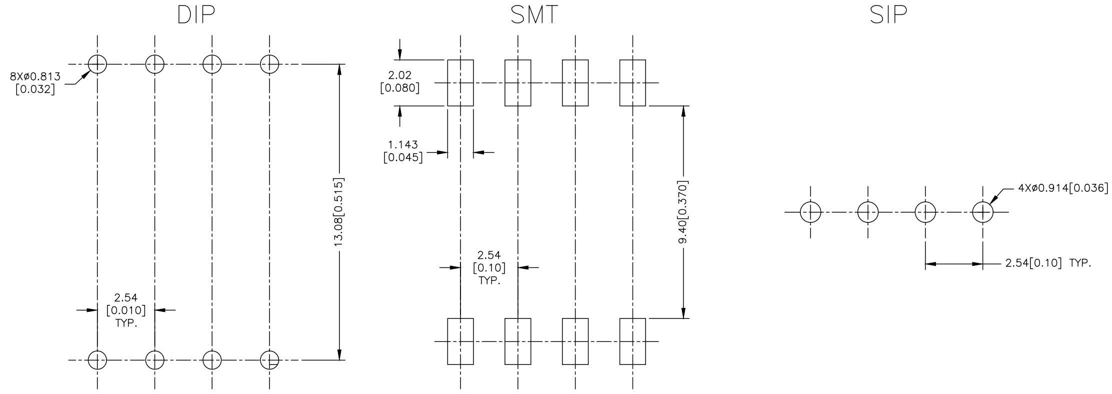
OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	NC	NC	NC	NC
SPI	GND	Vsupply	MISO	SCLK	SS	NC	NC	NC
ANALOG	NC	Vsupply	Vout	GND	NC	NC	NC	NC

PINOUTS FOR SIP

OUTPUT	PIN1	PIN2	PIN3	PIN4
I2C	GND	Vsupply	SDA	SCL
ANALOG	NC	Vsupply	Vout	GND

PINOUTS,PCB PAD LAYOUT

RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SA19HD

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

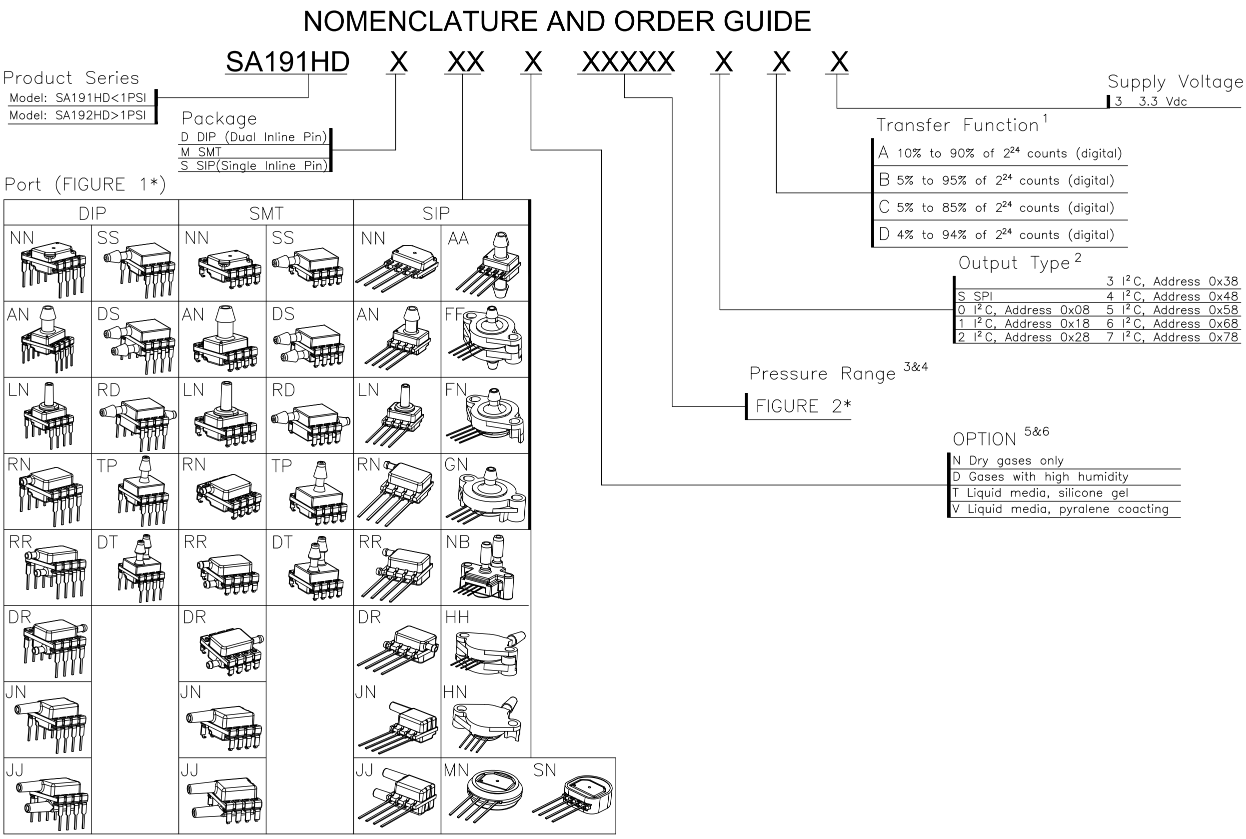
DESCRIPTION

SA19HD High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SA19HD Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

SA19HD Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc . These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA19HD Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor
MODEL SA19HD

ORDERING INFORMATION



Notes

1. The transfer function limits define the output of the sensor at a given pressure input. By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer function of the sensor is defined. See the graphical representations of the transfer function in Figure 2. For other available transfer functions contact SQMEAS Customer Service.
2. SPI output function is not available in SIP package.
3. Custom pressure ranges are available. Contact SQMEAS Customer Service for more information.
4. See the explanation of sensor pressure types in Table 4.
5. See the CAUTION in this document.
6. Options T and V are only available on pressure ranges ±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor

MODEL SA19HD

FIGURE 1:

NN	No ports	AN	Single axial barbed port	LN	Single axial barbless port	RN	Single radial barbed port	RR	Dual radial barbed ports, same side	DR	Dual radial barbed ports, opposite sides	JN	Single radial barbless port	JJ	Dual radial barbless ports, same side
SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	RD	Dual radial barbed ports, (Ø3.0mm) oposite side	TP	Single radial barbed ports, (Ø3.0mm) top side	DT	Dual radial barbed ports, (Ø3.0mm) top side	AA	Dual axial barbed ports, opposite sides	FF	Fastener mount, dual axial barbed ports,opposite sides	FN	Fastener mount, single axial barbed port
GN	Ribbed fastener mount, single axial barbed port 008B	NB	Fastener mount, dual axial ports, same side	HH	Fastener mount, dual radial barbed ports, same side	HN	Fastener mount, single radial barbed port	MN	Manifold mount, outer diameter seal	SN	Manifold mount, inner diameter seal				

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

PC Board Mountable Pressure Sensor
MODEL SA19HD

TABLE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	3.6	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact SQMEAS Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	Vdc	1,2,3
Supply current	I2C/sleep/Standby Mode	3.0	33.8	211	uA	
	SPI/sleep/Standby Mode	13	43.8	211	uA	
Operating temperature range		-40	-	85	°C	4
Compensated temperature range		-10	-	50	°C	4
Temperature output option		-	±4	-	°C	6
Startup time (power up to data ready)		-	-	3	mS	
Response time		2	7	10	mS	
I²C/SPI voltage level	low	-	-	20	%Vsupply	
	high	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		1	-	-	kOhm	
Total Error Band		-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		-	-	-	%FSS	
		12	-	-	bits	

Notes

Notes:

1. Sensors are 3.3 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

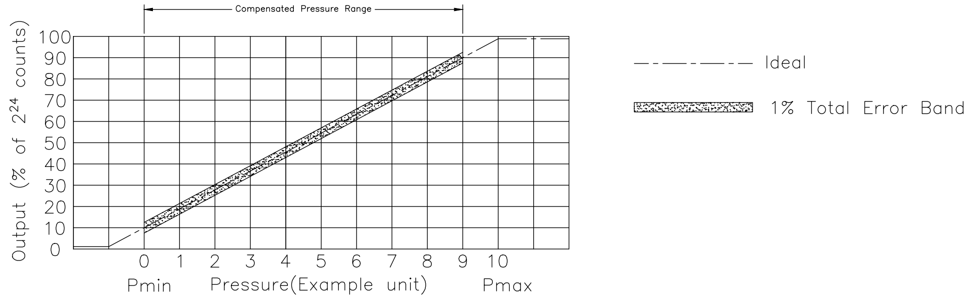
% OUTPUT	DIGITAL COUNTS DECIMAL	DIGITAL COUNTS HEX
0	0	0X0000
10	1677722	0X19999A
50	8388608	0X800000
90	15099494	0XE66666
100	16777215	0XFFFFFF

PC Board Mountable Pressure Sensor

MODEL SA19HD

PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE



$$\text{Output (\% of } 2^{24} \text{ counts)} = \frac{M*16777215}{Pmax-Pmin} * (Papplied-Pmin)+N*16777215$$

$$\text{Temperature Output (Decimal Counts)} = \frac{(\text{Output }^\circ C - (-40^\circ C)_{Tmin}) * 16777215}{(85^\circ C_{Tmax} - (-40^\circ C)_{Tmin})}$$

TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
Differential										
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range Pmin.	Pmax.	Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	100000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

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Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH$_2$O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH$_2$O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH$_2$O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH$_2$O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH$_2$O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH$_2$O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

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Table 9.1 Pressure Range Specifications for 0.5 inH_2O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH_2O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH_2O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH_2O	135	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH_2O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH_2O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

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PACKAGE DIMENSIONAL DRAWINGS

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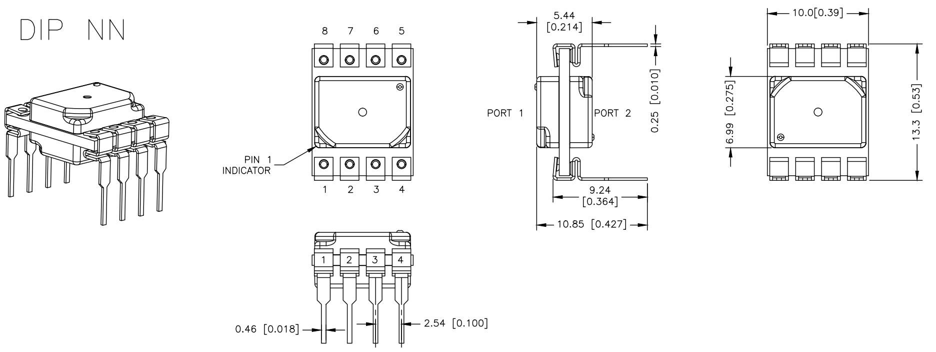

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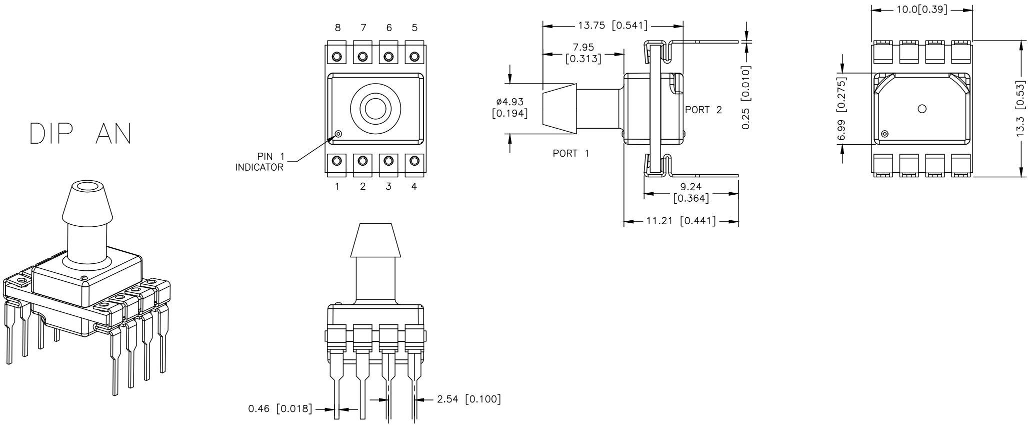

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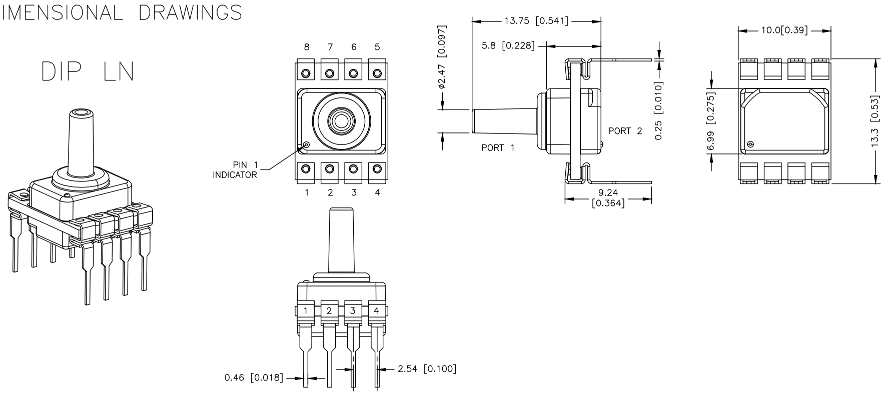

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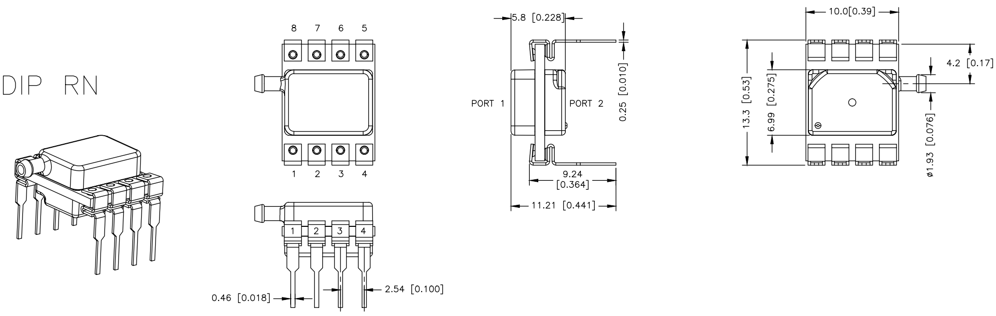

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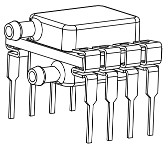

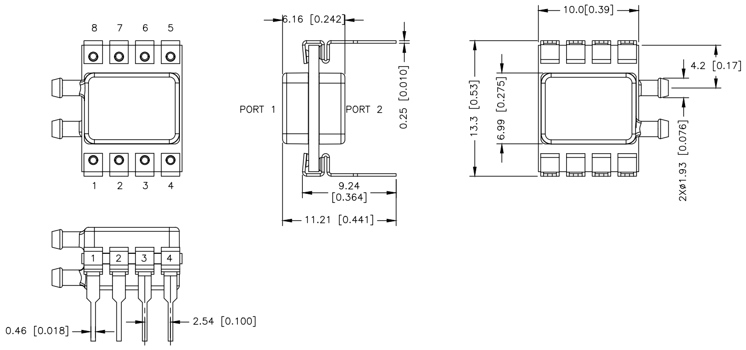

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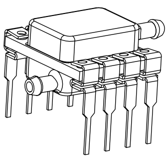

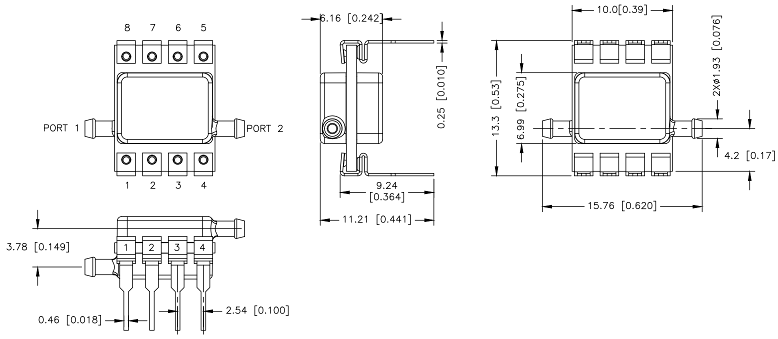

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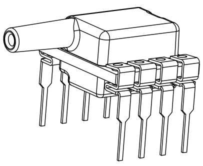

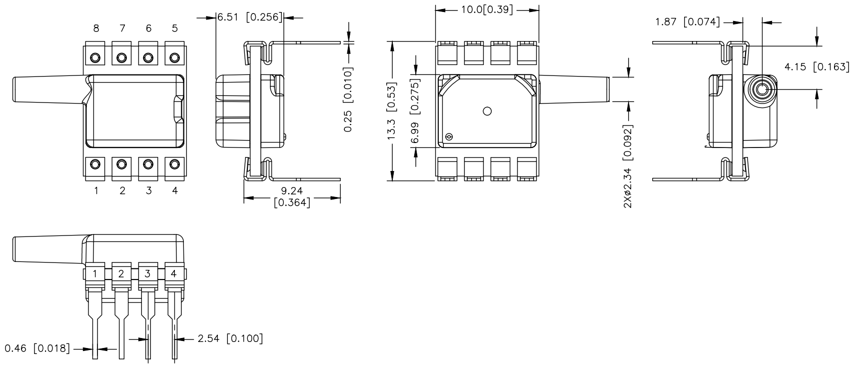

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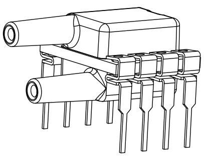

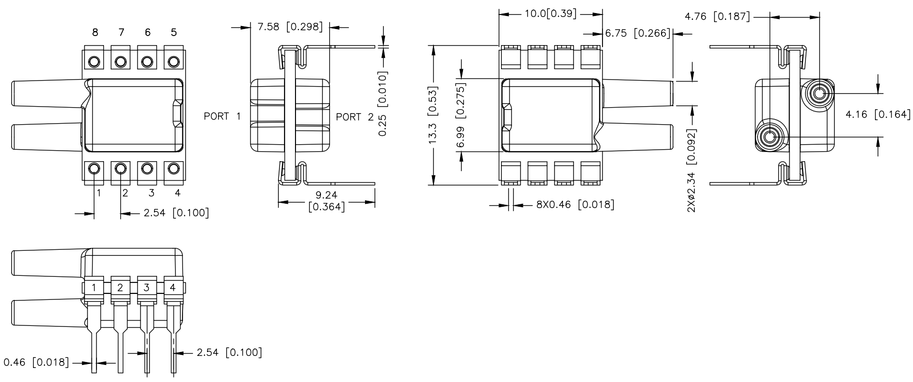

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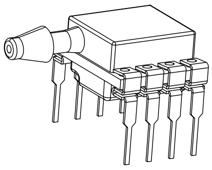

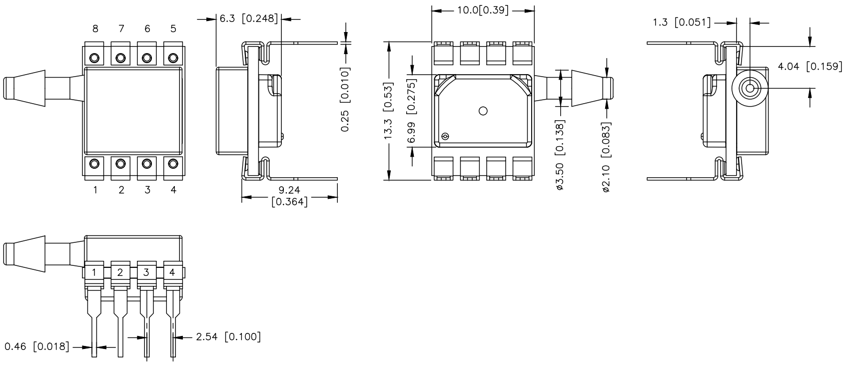

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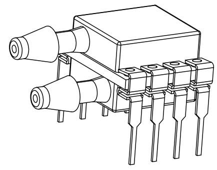

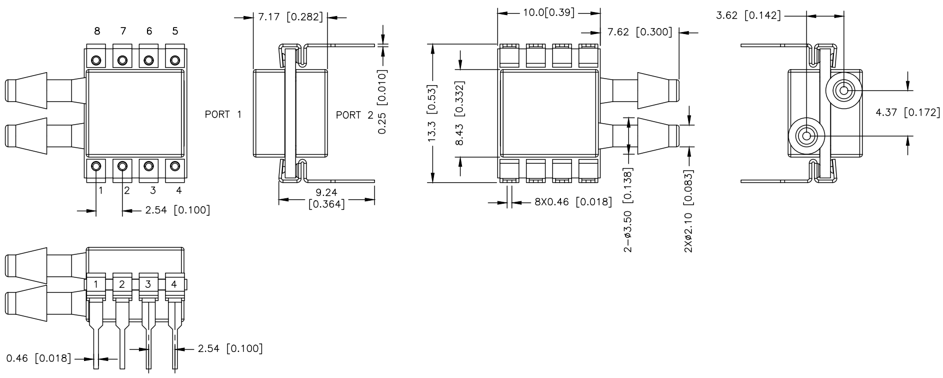

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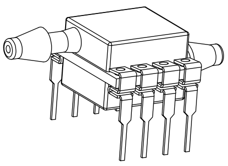

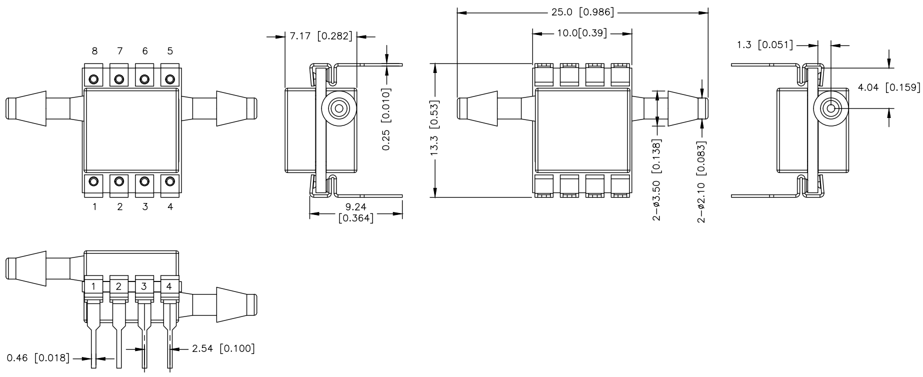

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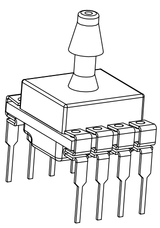

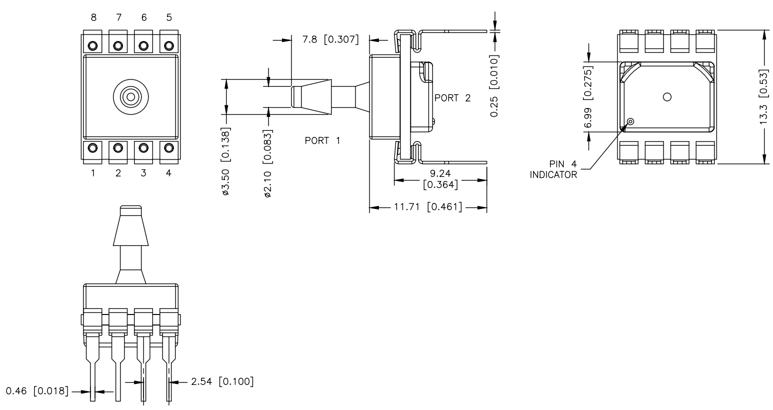

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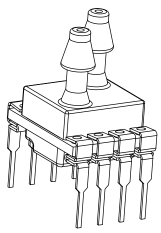

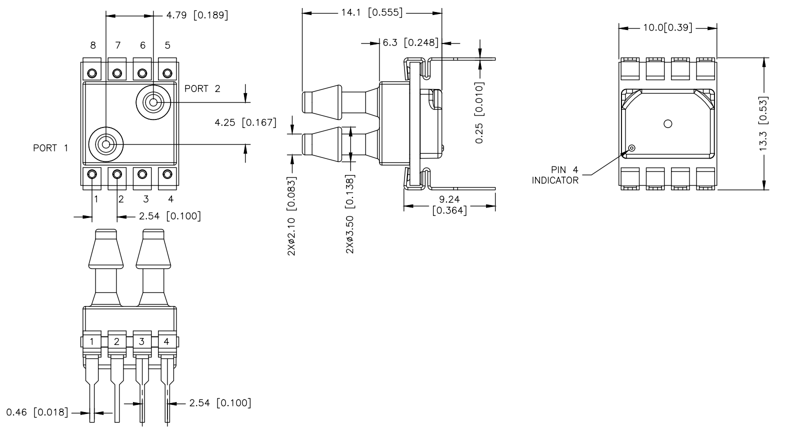

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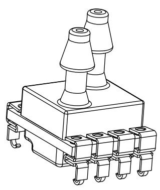

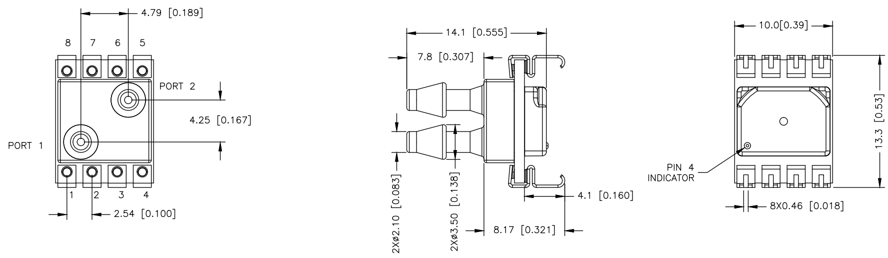

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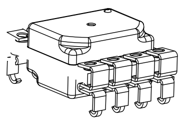

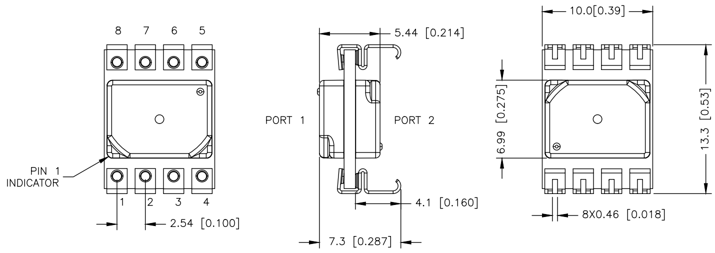

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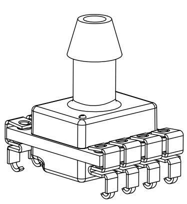

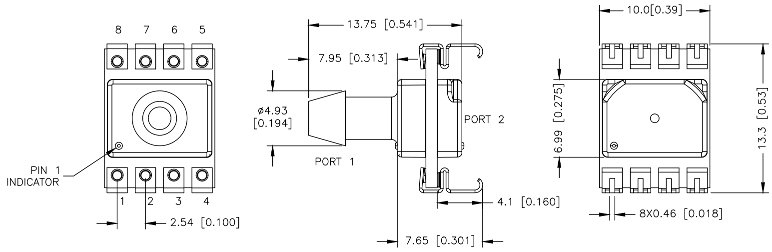

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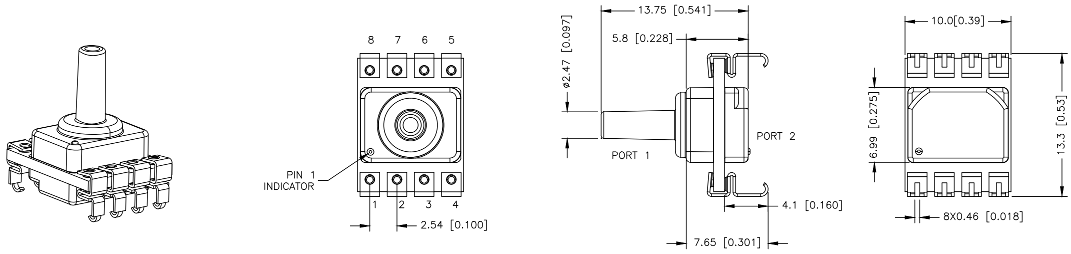

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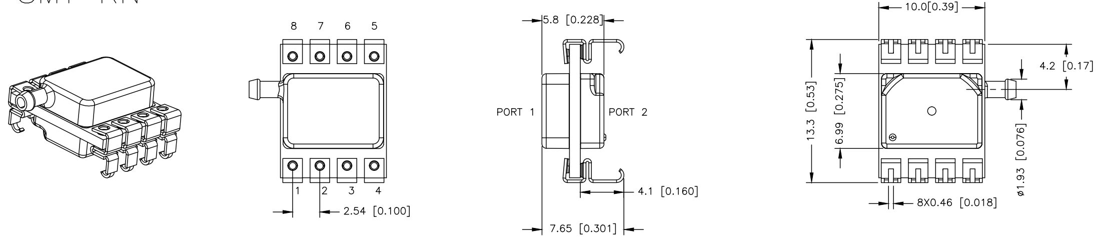

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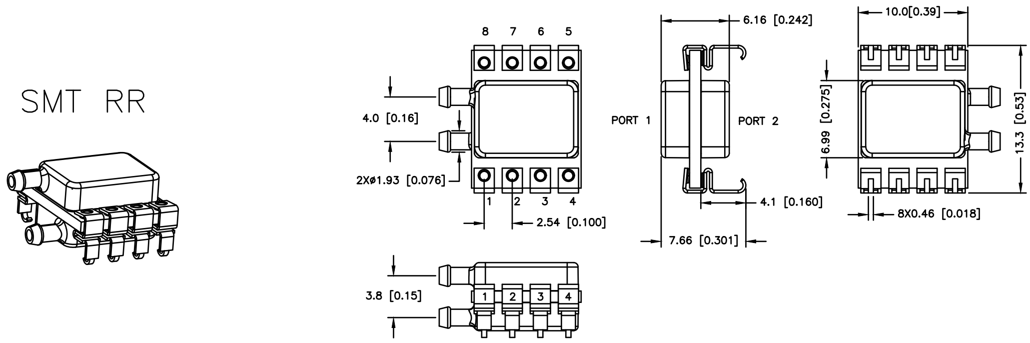

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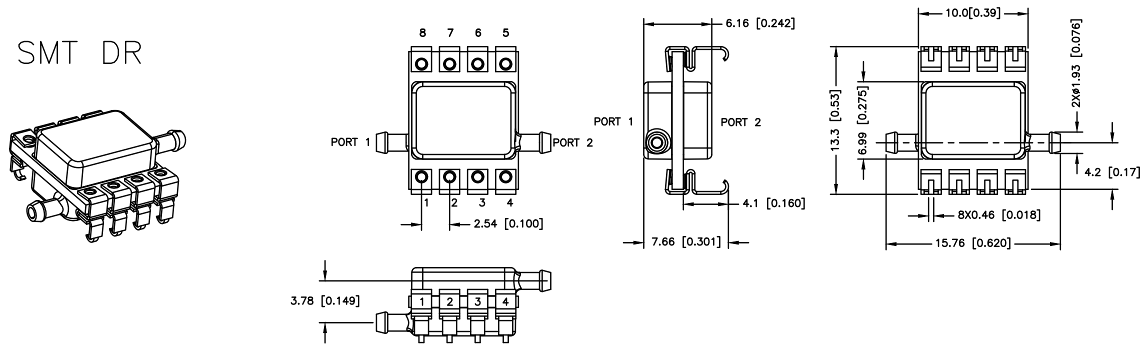

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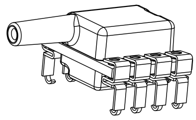

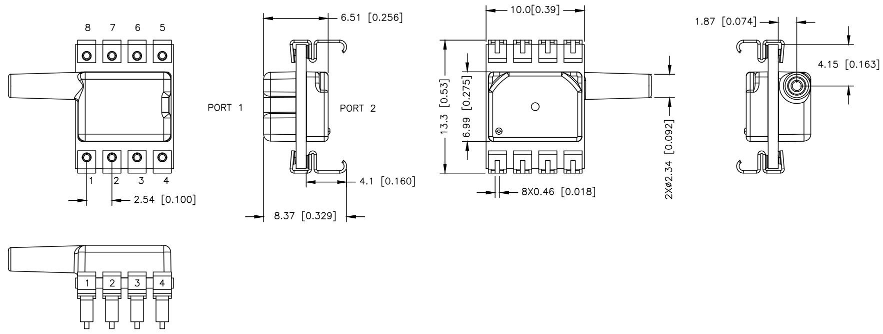

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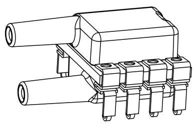
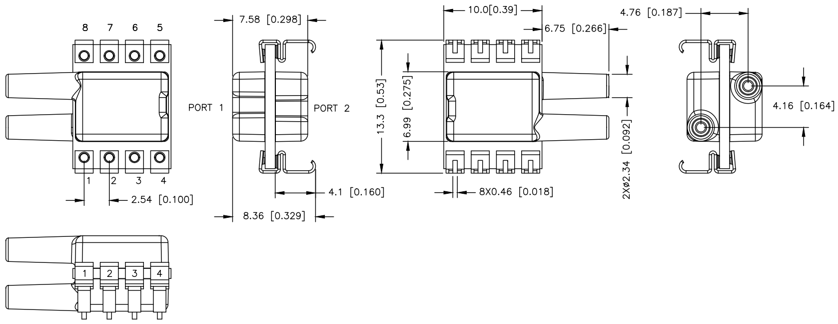
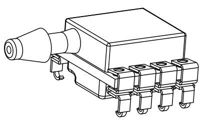
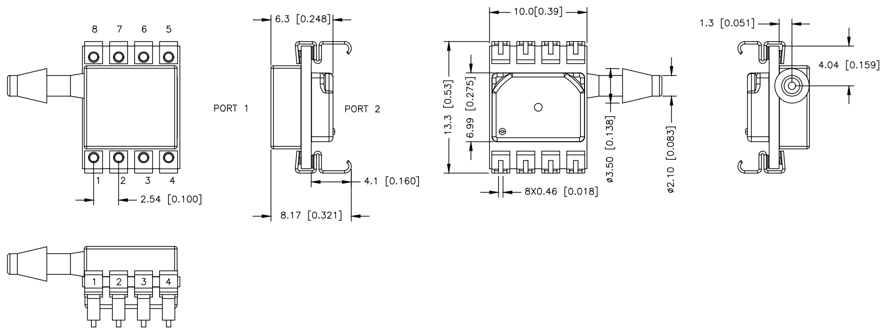




PACKAGE DIMENSIONAL DRAWINGS

SMT SS





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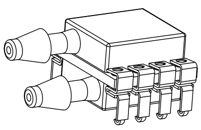
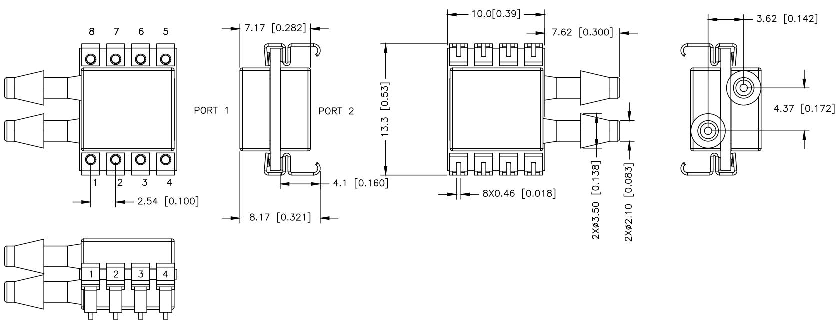


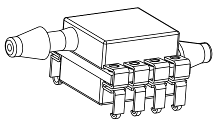


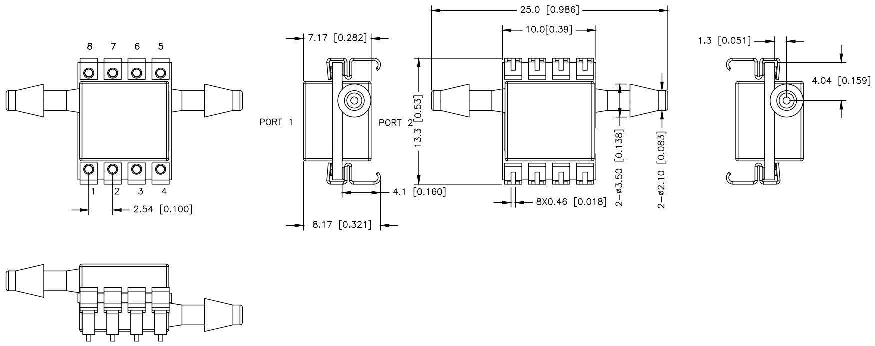
PC Board Mountable Pressure Sensor
MODEL SA19HD

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SMT RD





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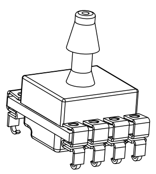

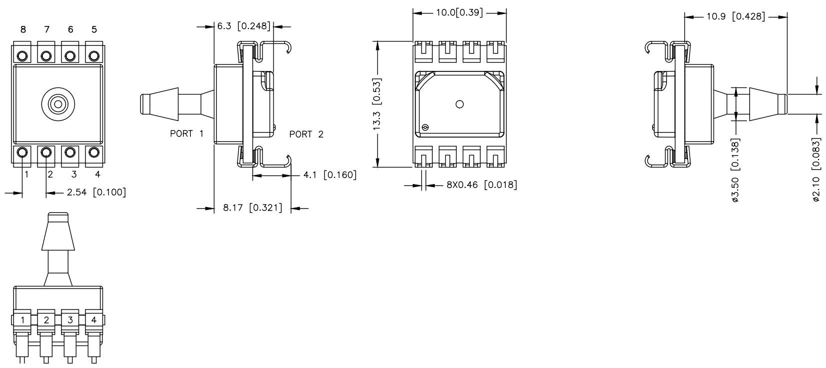

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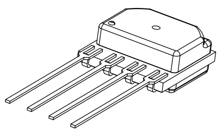
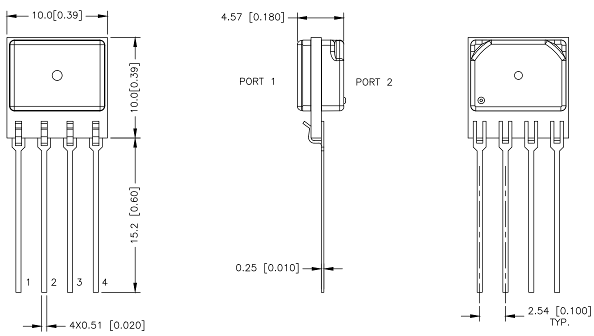
SIP NN





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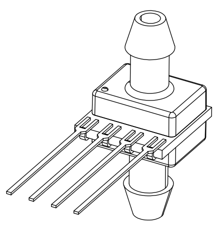
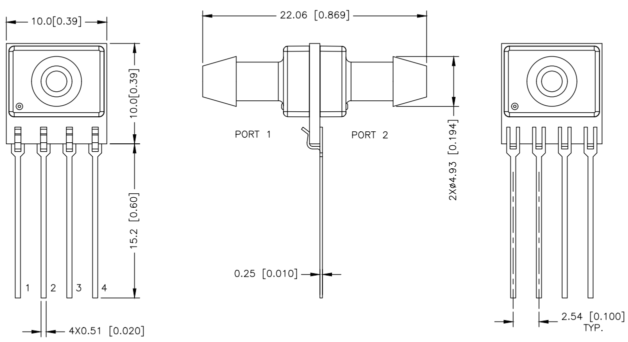


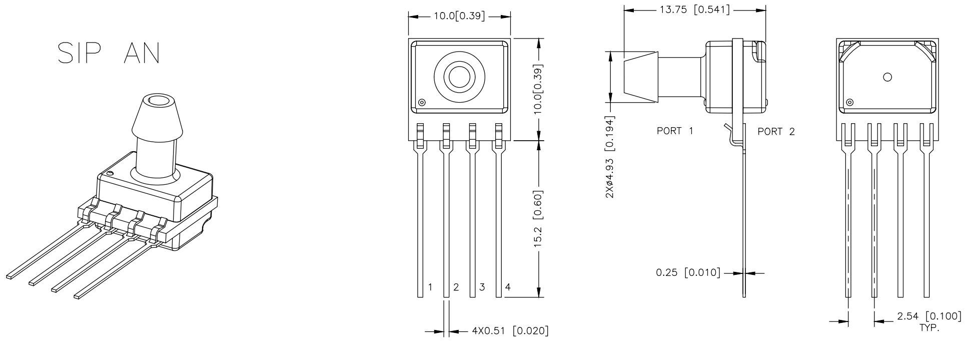


MODEL SA19HD

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP AN



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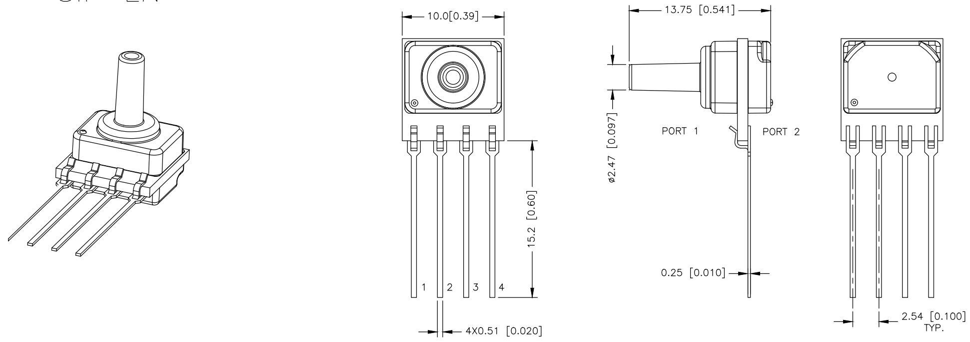

PACKAGE DIMENSIONAL DRAWINGS

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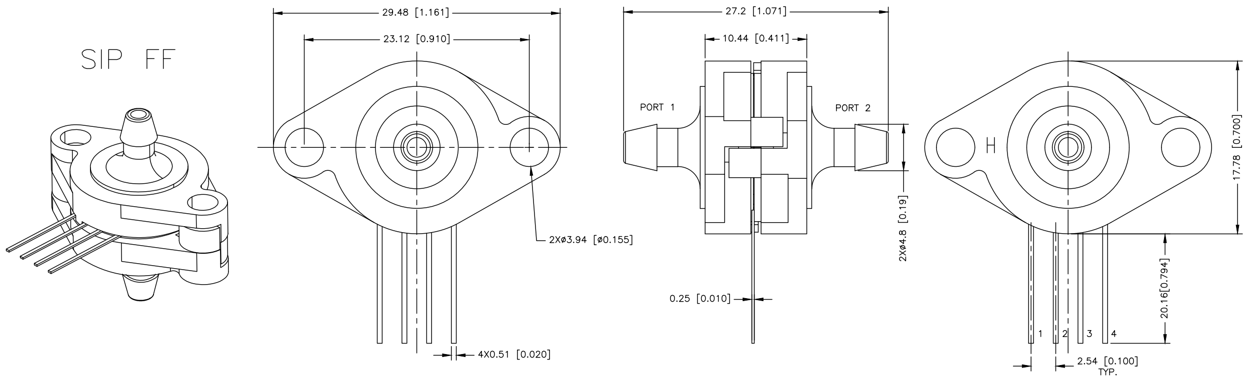

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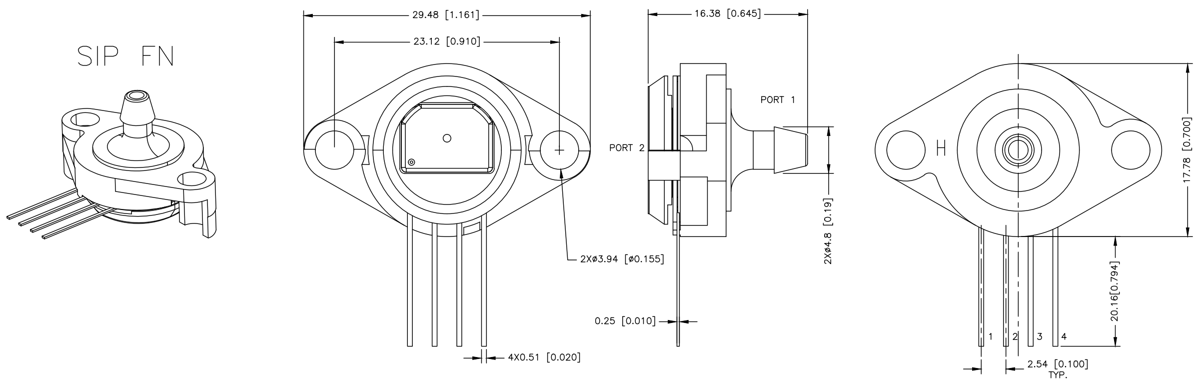


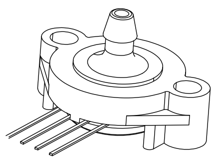
PC Board Mountable Pressure Sensor

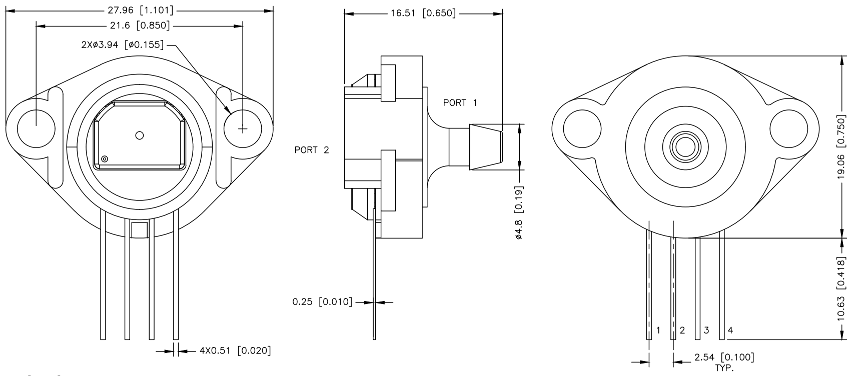
MODEL SA19HD

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP GN





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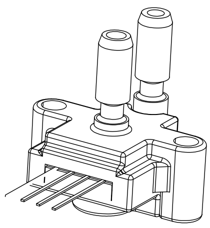
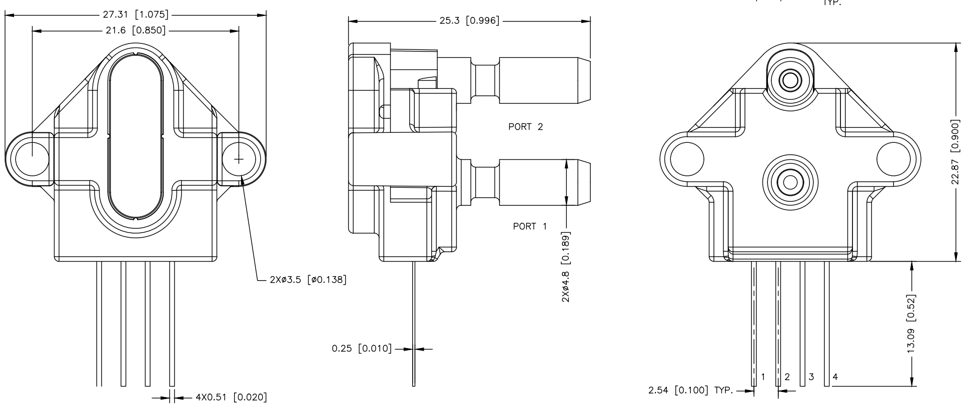
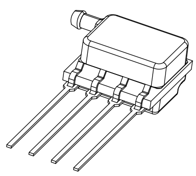
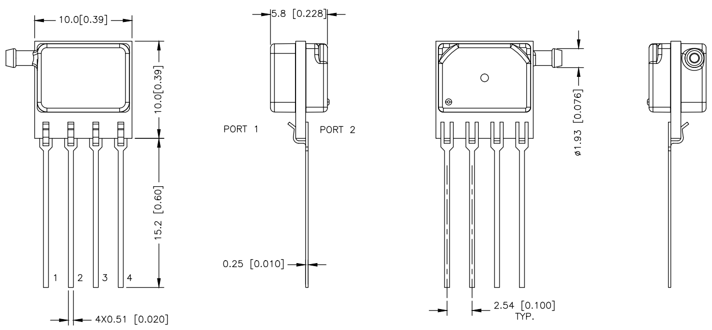




PACKAGE DIMENSIONAL DRAWINGS

SIP RN





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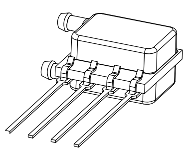
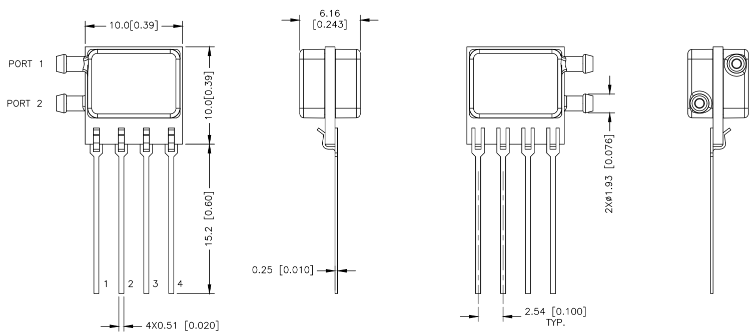




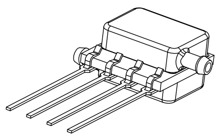
PC Board Mountable Pressure Sensor

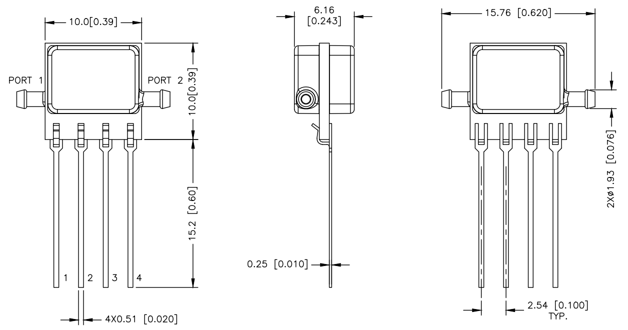
MODEL SA19HD

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP DR





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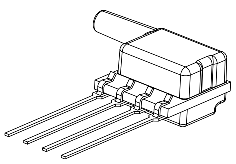

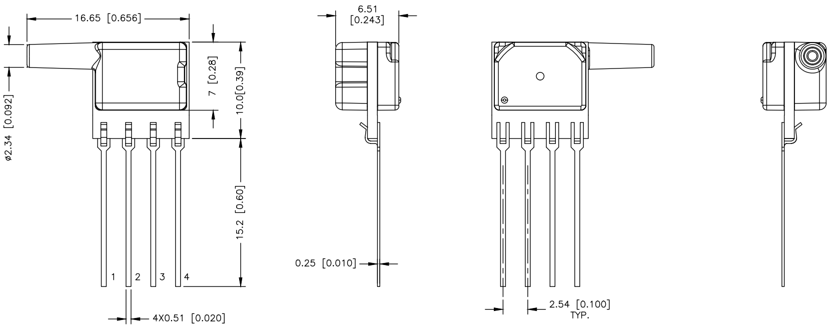

PACKAGE DIMENSIONAL DRAWINGS

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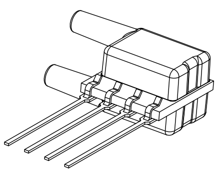

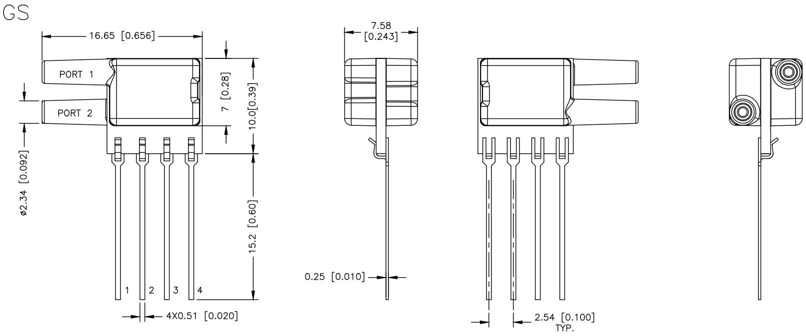

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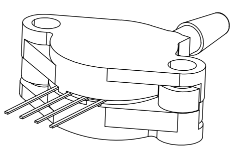
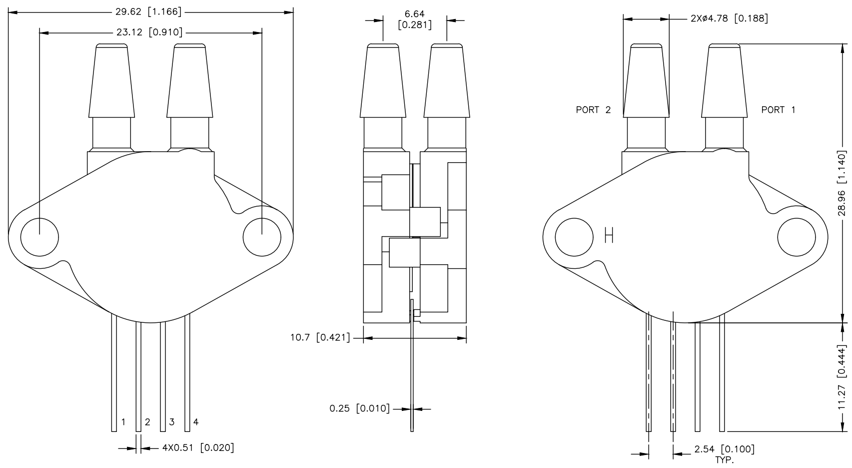


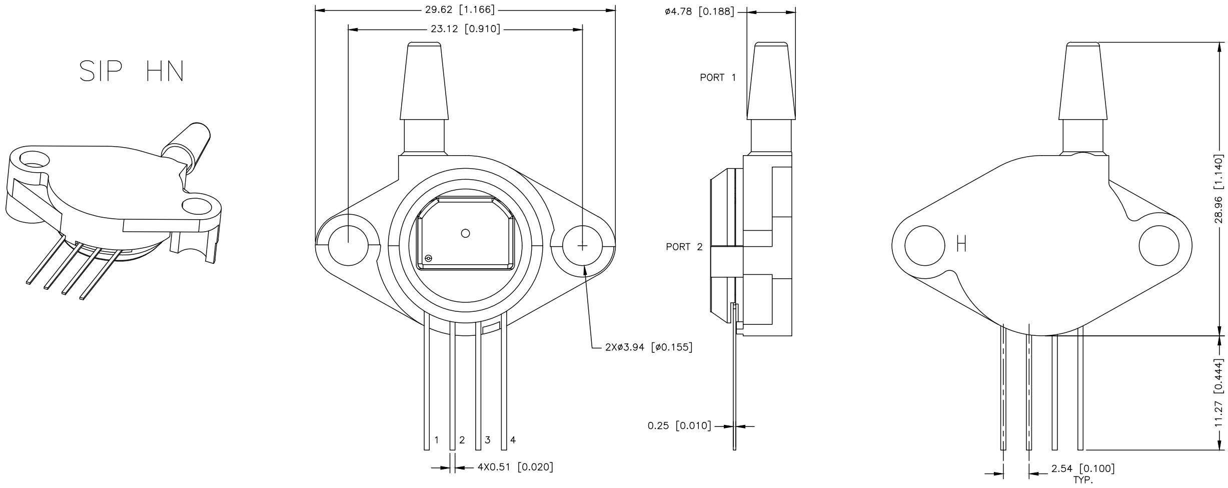


PC Board Mountable Pressure Sensor
MODEL SA19HD

PACKAGE DIMENSIONAL DRAWINGS

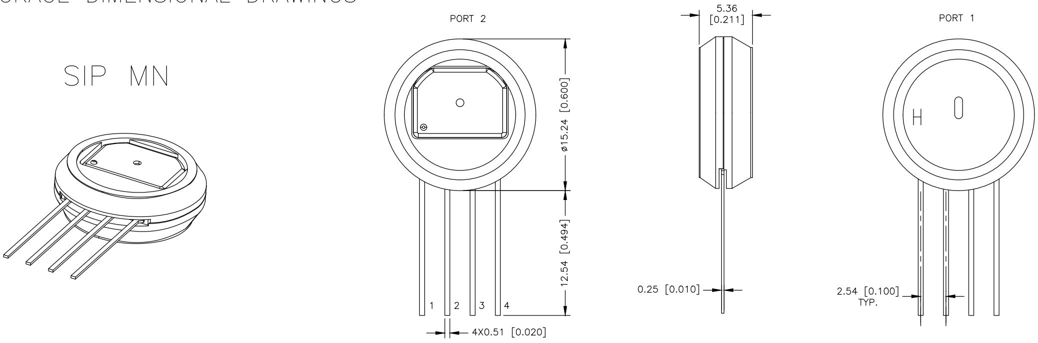
PACKAGE DIMENSIONAL DRAWINGS

SIP HN

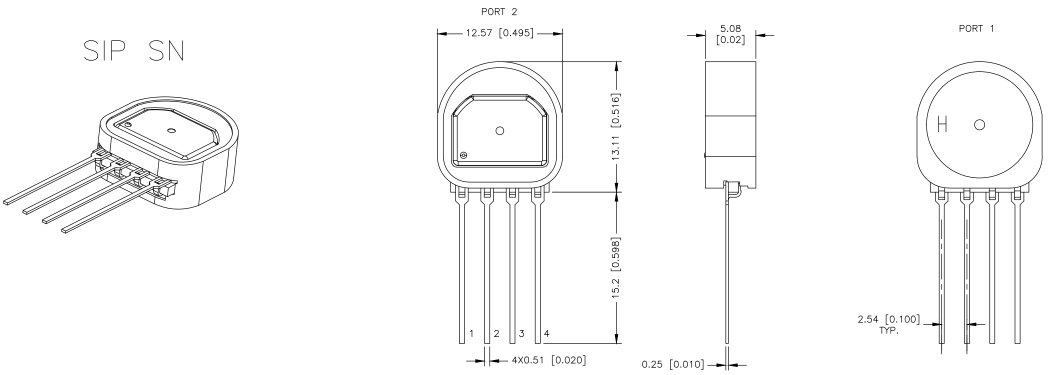


PACKAGE DIMENSIONAL DRAWINGS

SIP MN



SIP SN



PC Board Mountable Pressure Sensor

MODEL SA19HD

PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

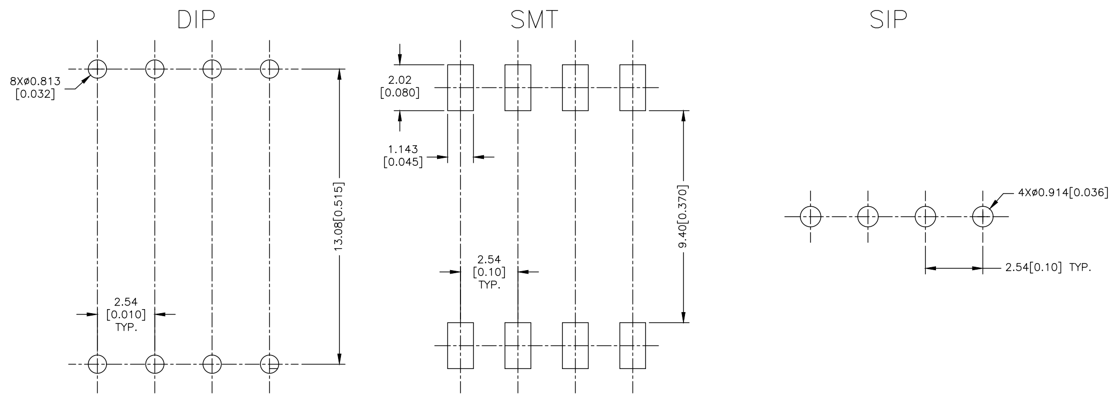
OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	NC	NC	NC	NC
SPI	GND	Vsupply	MISO	SCLK	SS	NC	NC	MISO

PINOUTS FOR SIP

OUTPUT	PIN1	PIN2	PIN3	PIN4
I2C	GND	Vsupply	SDA	SCL

PINOUTS,PCB PAD LAYOUT

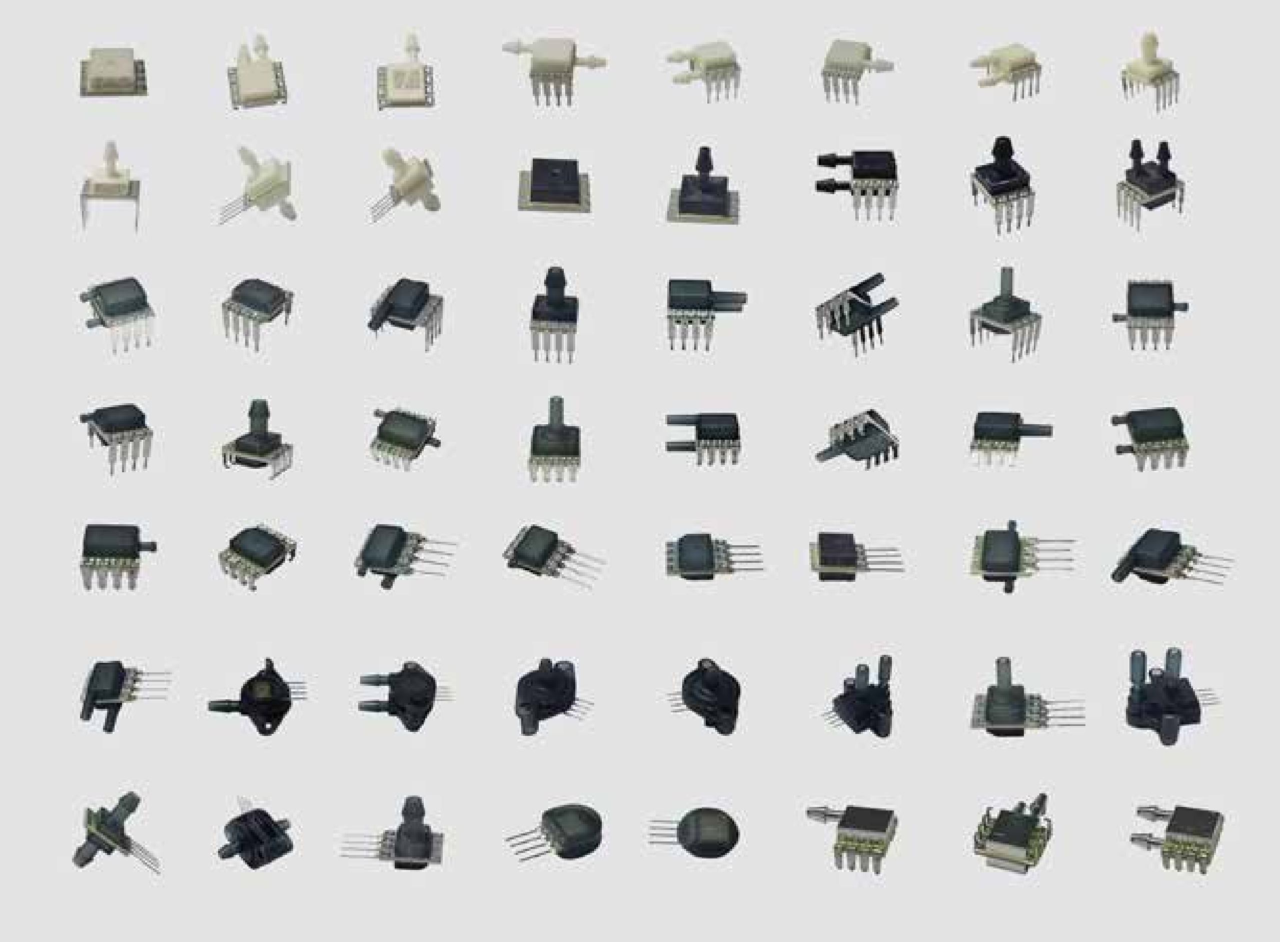
RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SA19EC

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection



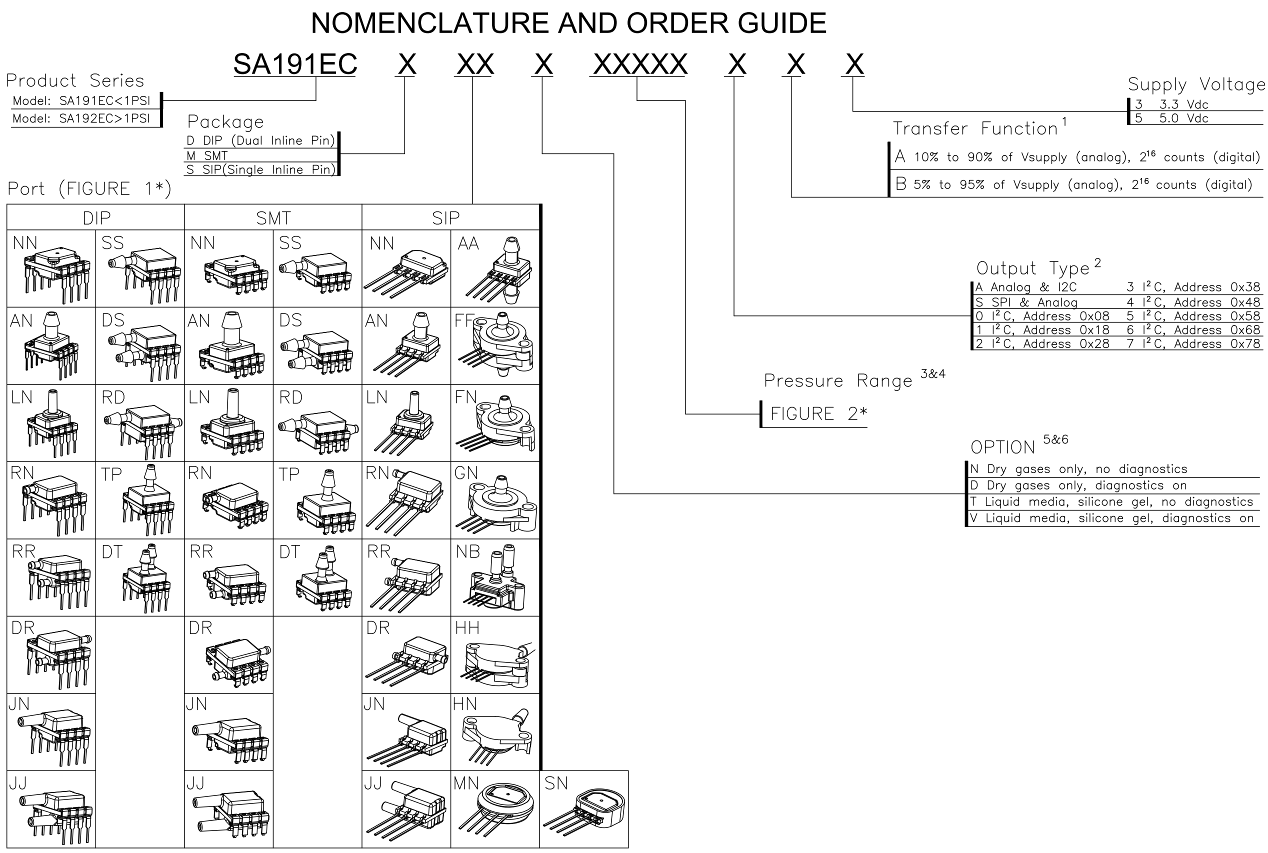
DESCRIPTION

SA19EC High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SA19EC Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 2 kHz.

SA19EC Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA19EC Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor
MODEL SA19EC

ORDERING INFORMATION



1. The transfer function limits define the output of the sensor at a given pressure input.

By specifying Pmin. and Pmax., the output at Pmin. and Pmax., the complete transfer

function of the sensor is defined. See the graphical representations of the transfer

function in Figure 2. For other available transfer functions contact SQMEAS Customer Service.

2. SPI output function is not available in SIP package.

3. Custom pressure ranges are available. Contact SQMEAS Customer Service for more information.

4. See the explanation of sensor pressure types in Table 4.

5. See the CAUTION in this document.

6. Options T and V are only available on pressure ranges

±60mbar to ±10bar/±6kPa to ±1MPa/±1psi to ±150psi

PC Board Mountable Pressure Sensor

MODEL SA19EC

FIGURE 1:

NN	No ports	AN	Single axial barbed port	LN	Single axial barbless port	RN	Single radial barbed port	RR	Dual radial barbed ports, same side	DR	Dual radial barbed ports, opposite sides	JN	Single radial barbless port	JJ	Dual radial barbless ports, same side
SS	Single radial barbed ports, (Ø3.0mm)	DS	Dual radial barbed ports, (Ø3.0mm) same side	RD	Dual radial barbed ports, (Ø3.0mm) oposite side	TP	Single radial barbed ports, (Ø3.0mm) top side	DT	Dual radial barbed ports, (Ø3.0mm) top side	AA	Dual axial barbed ports, opposite sides	FF	Fastener mount, dual axial barbed ports,opposite sides	FN	Fastener mount, single axial barbed port
GN	Ribbed fastener mount, single axial barbed port 008B	NB	Fastener mount, dual axial ports, same side	HH	Fastener mount, dual radial barbed ports, same side	HN	Fastener mount, single radial barbed port	MN	Manifold mount, outer diameter seal	SN	Manifold mount, inner diameter seal				

FIGURE 2:

±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 PSI		±1.6 mbar to ±10 bar		±160 Pa to ±1 MPa		±0.5 inH2O to ±150 psi	
Absolute		Absolute		Absolute		Gage		Gage		Gage	
001BA	0 bar to 1 bar	100KA	0 kPa to 100 kPa	015PA	0 psi to 15 psi	2.5MG	0 mbar to 2.5 mbar	250LG	0 Pa to 250 Pa	001NG	0 inH2O to 1 inH2O
1.6BA	0 bar to 1.6 bar	160KA	0 kPa to 160 kPa	030PA	0 psi to 30 psi	004MG	0 mbar to 4 mbar	400LG	0 Pa to 400 Pa	002NG	0 inH2O to 2 inH2O
2.5BA	0 bar to 2.5 bar	250KA	0 kPa to 250 kPa	060PA	0 psi to 60 psi	006MG	0 mbar to 6 mbar	600LG	0 Pa to 600 Pa	004NG	0 inH2O to 4 inH2O
004BA	0 bar to 4 bar	400KA	0 kPa to 400 kPa	100PA	0 psi to 100 psi	010MG	0 mbar to 10 mbar	001KG	0 kPa to 1 kPa	005NG	0 inH2O to 5 inH2O
006BA	0 bar to 6 bar	600KA	0 kPa to 600 kPa	150PA	0 psi to 150 psi	016MG	0 mbar to 16 mbar	1.6KG	0 kPa to 1.6 kPa	010NG	0 inH2O to 10 inH2O
010BA	0 bar to 10 bar	001GA	0 kPa to 1 MPa			025MG	0 mbar to 25 mbar	2.5KG	0 kPa to 2.5 kPa	020NG	0 inH2O to 20 inH2O
						040MG	0 mbar to 40 mbar	004KG	0 kPa to 4 kPa	030NG	0 inH2O to 30 inH2O
Differential		Differential		Differential		060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0 psi to 1 psi
001MD	±1 mbar	100LD	±100 Pa	0.5ND	±0.5 inH2O	100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0 psi to 5 psi
1.6MD	±1.6 mbar	160LD	±160 Pa	001ND	±1 inH2O	160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0 psi to 15 psi
2.5MD	±2.5 mbar	250LD	±250 Pa	002ND	±2 inH2O	250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0 psi to 30 psi
004MD	±4 mbar	400LD	±400 Pa	004ND	±4 inH2O	400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0 psi to 60 psi
006MD	±6 mbar	600LD	±600 Pa	005ND	±5 inH2O	600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0 psi to 100 psi
010MD	±10 mbar	001KD	±1 kPa	010ND	±10 inH2O	001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0 psi to 150 psi
016MD	±16 mbar	1.6KD	±1.6 kPa	020ND	±20 inH2O	1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
025MD	±25 mbar	2.5KD	±2.5 kPa	030ND	±30 inH2O	2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
040MD	±40 mbar	004KD	±4 kPa	001PD	±1 psi	004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
060MD	±60 mbar	006KD	±6 kPa	005PD	±5 psi	006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
100MD	±100 mbar	010KD	±10 kPa	015PD	±15 psi	010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		
160MD	±160 mbar	016KD	±16 kPa	030PD	±30 psi						
250MD	±250 mbar	025KD	±25 kPa	060PD	±60 psi						
400MD	±400 mbar	040KD	±40 kPa								
600MD	±600 mbar	060KD	±60 kPa								
001BD	±1 bar	100KD	±100 kPa								
1.6BD	±1.6 bar	160KD	±160 kPa								
2.5BD	±2.5 bar	250KD	±250 kPa								
004BD	±4 bar	400KD	±400 kPa								

PC Board Mountable Pressure Sensor
MODEL SA19EC

TABLE 1:

CHARACTERISTIC		MIN	MAX	UNITS
Supply voltage (Vsupply)		-0.3	6.0	Vdc
Voltage on any pin		-0.3	Vsupply+0.3	V
Digital interface clock frequency:	I²C	100	400	KHz
	SPI	50	800	
ESD susceptibility (human body model)		2	-	kV
Storage temperature		-40[-40]	85[185]	°C[°F]
Soldering time and temperature:				
lead solder temperature (DIP)		4 s max. at 250°C [482°F]		
peak reflow temperature (Leadless SMT, SMT)		15 s max. at 250°C [482°F]		

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity:	
all external surfaces	0 %RH to 95 %RH, non-condensing
internal surfaces of Liquid Media Option (T, V, F, G)	0 %RH to 100 %RH, condensing
internal surfaces of Dry Gases Option (N, D)	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum
Solder reflow	J-STD-020-D.1 Moisture Sensitivity Level 1 (unlimited shelf life when stored at <30°C/85 %RH)

*Life may vary depending on specific application in which the sensor is used.

TABLE 3. *WETTED MATERIALS

COMPONENT	PRESSURE PORT 1 (P1)		PRESSURE PORT 2 (P2)
	DRY GAS OPTION	LIQUID MEDIA OPTION	
Ports and covers	high temperature polyamide/alumina ceramic		
Substrate	alumina ceramic	-	alumina ceramic
Adhesives	epoxy, silicone	epoxy, silicone gel	epoxy, silicone
Electronic components	silicon, glass, solder gold,alumina	304 SST	silicon

*Contact SQMEAS Customer Service for detailed material information.

TABLE 4. SENSOR PRESSURE TYPES

PRESSURE TYPE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in vacuum reference.
Gage	Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure.
Differential	Output is proportional to the difference between the pressures applied to each port (Port 1 - Port 2).

PC Board Mountable Pressure Sensor
MODEL SA19EC

TABLE 5. OPERATING SPECIFICATIONS

CHARACTERISTIC		ANALOG MIN	ANALOG TYP	ANALOG MAX	DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0 Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3 Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0 Vdc	-	2.7	3.8	-	3.7	4.6	mA	
Operating temperature range		-40	-	+85	-40	-	85	°C	4
Compensated temperature range		-10	-	60	-10	-	50	°C	4
Temperature output option		-	-	-	-	±4	-	°C	6
Startup time (power up to data ready)		-	-	5	-	-	5	mS	
Response time		-	1	-	-	2	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I²C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		-	-	-	1	-	-	kOhm	
Total Error Band		-	-	±1.5	-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	12	-	16	bits	

Notes

1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C.
Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

TABLE 6. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES (DIGITAL VERSIONS ONLY)

% OUTPUT	DIGITAL COUNTS DECIMAL	DIGITAL COUNTS HEX
0	-32768	(0X8000)
10	-26214	(0X6666)
50	0	0X0000
90	26214	0X6666
100	32768	0X8000

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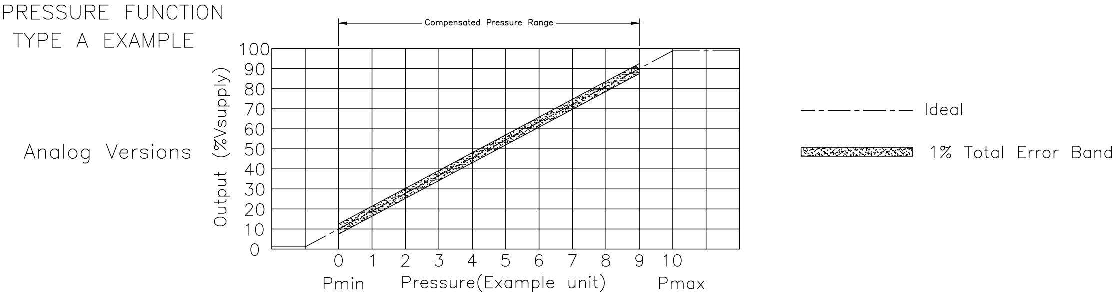
PRESSURE FUNCTION

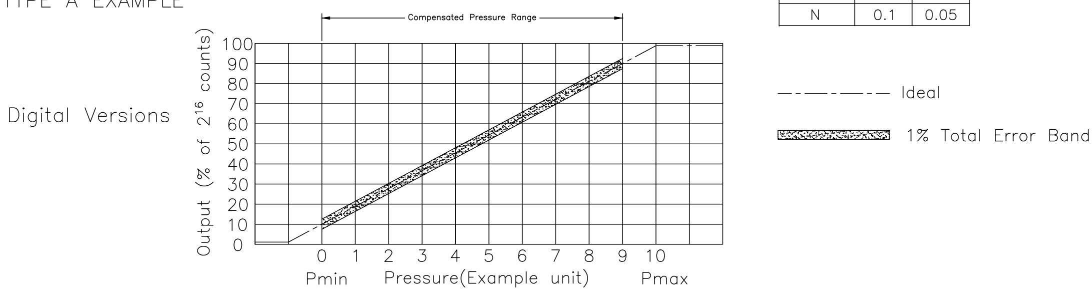
PRESSURE FUNCTION
TYPE A EXAMPLE



$$\text{Output(V)} = \frac{\text{M*Vsupply}}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin})+\text{N*Vsuuply}$$

TRANSFER FUNCTION		
Variable	A	B
M	0.9	0.95
N	0.1	0.05

TYPE A EXAMPLE



$$\text{Output (\% of } 2^{16} \text{ counts)} = \frac{\text{(M}-\text{N)*65535}}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin})-2\text{\^{}}15\text{*(M}-\text{N)}$$

$$\text{Output (Decimal Counts)} = \frac{(\text{Output}-{}^\circ\text{C } (-40^\circ\text{C})_{Tmin} * 65535)}{(125^\circ\text{C}_{Tmax} - (-40^\circ\text{C})_{Tmin})}$$

Table 7.1 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure¹	Over Pressure²	Burst Pressure³	Common Mode Pressure⁴	Total Error Band⁵ (%FSS)	Total Error Band after Auto-Zero⁶ (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
001BA	0	1	bar	-	2	4	-	±1%	-	±0.25%
1.6BA	0	1.6	bar	-	4	8	-	±1%	-	±0.25%
2.5BA	0	2.5	bar	-	6	8	-	±1%	-	±0.25%
004BA	0	4	bar	-	8	16	-	±1%	-	±0.25%
006BA	0	6	bar	-	17	17	-	±1%	-	±0.25%
010BA	0	10	bar	-	17	17	-	±1%	-	±0.25%
Differential										
001MD	-1	1	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
1.6MD	-1.6	1.6	mbar	20	40	60	100	±2.5%	±1.75%	±0.5%
2.5MD	-2.5	2.5	mbar	20	40	60	100	±2%	±1.25%	±0.35%
004MD	-4	4	mbar	20	40	60	100	±1.5%	±0.75%	±0.35%
006MD	-6	6	mbar	50	80	100	200	±1%	±0.75%	±0.35%
010MD	-10	10	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
016MD	-16	16	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
025MD	-25	25	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
040MD	-40	40	mbar	435	850	1350	10450	±1%	±0.5%	±0.25%
060MD	-60	60	mbar		850	1000	10000	±1%	-	±0.25%
100MD	-100	100	mbar		1400	2500	10000	±1%	-	±0.25%
160MD	-160	160	mbar		1400	2500	10000	±1%	-	±0.25%
250MD	-250	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MD	-400	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MD	-600	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BD	-1	1	bar		4	8	10	±1%	-	±0.25%
1.6BD	-1.6	1.6	bar		8	16	10	±1%	-	±0.25%
2.5BD	-2.5	2.5	bar		8	16	10	±1%	-	±0.25%
004BD	-4.0	4.0	bar		16	17	10	±1%	-	±0.25%

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Table 7. 2 Pressure Range Specifications for ±1.6 mbar to ±10 bar

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
2.5MG	0	2.5	mbar	335	675	1000	3450	±3%	±2%	±0.5%
004MG	0	4	mbar	335	675	1000	3450	±2%	±1.25%	±0.5%
006MG	0	6	mbar	335	675	1000	3450	±2%	±1%	±0.35%
010MG	0	10	mbar	335	675	1000	3450	±1.5%	±0.75%	±0.35%
016MG	0	16	mbar	335	675	1000	3450	±1%	±0.75%	±0.25%
025MG	0	25	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
040MG	0	40	mbar	375	750	1250	5450	±1%	±0.5%	±0.25%
060MG	0	60	mbar		850	1000	5450	±1%	-	±0.25%
100MG	0	100	mbar		850	1000	10000	±1%	-	±0.25%
160MG	0	160	mbar		850	1000	10000	±1%	-	±0.25%
250MG	0	250	mbar		1400	2500	10000	±1%	-	±0.25%
400MG	0	400	mbar		2000	4000	10000	±1%	-	±0.25%
600MG	0	600	mbar		2000	4000	10000	±1%	-	±0.25%
001BG	0	1	bar		2	4	10	±1%	-	±0.25%
1.6BG	0	1.6	bar		4	8	10	±1%	-	±0.25%
2.5BG	0	2.5	bar		8	16	10	±1%	-	±0.25%
004BG	0	4	bar		8	16	16	±1%	-	±0.25%
006BG	0	6	bar		17	17	17	±1%	-	±0.25%
010BG	0	10	bar		17	17	17	±1%	-	±0.25%

Table 8.1 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
100KA	0	100	kPa	-	200	400	-	±1%	-	±0.25%
160KA	0	160	kPa	-	400	800	-	±1%	-	±0.25%
250KA	0	250	kPa	-	600	800	-	±1%	-	±0.25%
400KA	0	400	kPa	-	800	1600	-	±1%	-	±0.25%
600KA	0	600	kPa	-	1700	1700	-	±1%	-	±0.25%
001GA	0	1	MPa	-	1700	1700	-	±1%	-	±0.25%
Differential										
100LD	-100	100	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
160LD	-160	160	Pa	2000	4000	6000	100000	±2.5%	±1.75%	±0.5%
250LD	-250	250	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.35%
400LD	-400	400	Pa	2000	4000	6000	100000	±1.5%	±0.75%	±0.35%
600LD	-600	600	Pa	5000	10000	20000	200000	±1%	±0.75%	±0.35%
001KD	-1	1	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
1.6KD	-1.6	1.6	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
2.5KD	-2.5	2.5	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
004KD	-4	4	kPa	43.5	85	135	1045	±1%	±0.5%	±0.25%
006KD	-6	6	kPa		85	100	1000	±1%	-	±0.25%
010KD	-10	10	kPa		140	250	1000	±1%	-	±0.25%
016KD	-16	16	kPa		140	250	1000	±1%	-	±0.25%
025KD	-25	25	kPa		140	250	1000	±1%	-	±0.25%
040KD	-40	40	kPa		200	400	1000	±1%	-	±0.25%
060KD	-60	60	kPa		200	400	1000	±1%	-	±0.25%
100KD	-100	100	kPa		400	800	1000	±1%	-	±0.25%
160KD	-160	160	kPa		800	1600	1000	±1%	-	±0.25%
250KD	-250	250	kPa		800	1600	1000	±1%	-	±0.25%
400KD	-400	400	kPa		1600	1700	1000	±1%	-	±0.25%

Table 8.2 Pressure Range Specifications for ±160 Pa to ±1 MPa

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
250LG	0	250	Pa	2000	4000	6000	100000	±3%	±2%	±0.5%
400LG	0	400	Pa	2000	4000	6000	100000	±2%	±1.25%	±0.5%
600LG	0	600	Pa	2000	4000	6000	100000	±2%	±1%	±0.35%
001KG	0	1	kPa	33.5	67.5	100	345	±1.5%	±0.75%	±0.35%
1.6KG	0	1.6	kPa	33.5	67.5	100	345	±1%	±0.75%	±0.25%
2.5KG	0	2.5	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
004KG	0	4	kPa	37.5	75	125	545	±1%	±0.5%	±0.25%
006KG	0	6	kPa		85	100	545	±1%	±0.5%	±0.25%
010KG	0	10	kPa		85	100	1000	±1%	-	±0.25%
016KG	0	16	kPa		85	100	1000	±1%	-	±0.25%
025KG	0	25	kPa		140	250	1000	±1%	-	±0.25%
040KG	0	40	kPa		200	400	1000	±1%	-	±0.25%
060KG	0	60	kPa		200	400	1000	±1%	-	±0.25%
100KG	0	100	kPa		200	400	1000	±1%	-	±0.25%
160KG	0	160	kPa		400	800	1000	±1%	-	±0.25%
250KG	0	250	kPa		800	1600	1000	±1%	-	±0.25%
400KG	0	400	kPa		800	1600	1600	±1%	-	±0.25%
600KG	0	600	kPa		1700	1700	1700	±1%	-	±0.25%
001GG	0	1	MPa		1.7	1.7	1.7	±1%	-	±0.25%

Table 9.1 Pressure Range Specifications for 0.5 inH $_2$ O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Absolute										
015PA	0	15	psi	-	30	60	-	±1%	-	±0.25%
030PA	0	30	psi	-	60	120	-	±1%	-	±0.25%
060PA	0	60	psi	-	120	240	-	±1%	-	±0.25%
100PA	0	100	psi	-	250	250	-	±1%	-	±0.25%
150PA	0	150	psi	-	250	250	-	±1%	-	±0.25%
Differential										
0.5ND	-0.5	0.5	inH $_2$ O	35	70	200	1000	±3%	±2%	±0.5%
001ND	-1	1	inH $_2$ O	35	70	200	1000	±2%	±1.25%	±0.35%
002ND	-2	2	inH $_2$ O	35	70	200	1000	±1%	±0.75%	±0.35%
004ND	-4	4	inH $_2$ O	150	300	500	2200	±1%	±0.5%	±0.25%
005ND	-5	5	inH $_2$ O	150	300	500	2200	±1%	±0.5%	±0.25%
010ND	-10	10	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
020ND	-20	20	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
030ND	-30	30	inH $_2$ O	175	350	550	4200	±1%	±0.5%	±0.25%
001PD	-1	1	psi		10	15	150	±1%		±0.25%
005PD	-5	5	psi		30	40	150	±1%	-	±0.25%
015PD	-15	15	psi		60	120	150	±1%	-	±0.25%
030PD	-30	30	psi		120	240	150	±1%	-	±0.25%
060PD	-60	60	psi		250	250	250	±1%	-	±0.25%

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Table 9.1 Pressure Range Specifications for 0.5 inH_2O to 150 psi

Pressure Range (see Figure 4)	-Pressure Range		Unit	Working Pressure[1]	Over Pressure[2]	Burst Pressure[3]	Common Mode Pressure[4]	Total Error Band[5] (%FSS)	Total Error Band after Auto-Zero[6] (%FSS)	Long-term Stability 1000 hr, 25 °C (%FSS)
	Pmin.	Pmax.								
Gage										
001NG	0	1	inH_2O	35	70	100	400	±3%	±2%	±0.5%
002NG	0	2	inH_2O	35	70	100	400	±2%	±1.25%	±0.35%
004NG	0	4	inH_2O	135	270	415	1400	±1.5%	±0.75%	±0.35%
005NG	0	5	inH_2O	135	270	415	1400	±1%	±0.75%	±0.25%
010NG	0	10	inH_2O	150	300	500	2200	±1%	±0.5%	±0.25%
020NG	0	20	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
030NG	0	30	inH_2O	175	350	550	4200	±1%	±0.5%	±0.25%
001PG	0	1	psi		10	15	150	±1%	-	±0.25%
005PG	0	5	psi		30	40	150	±1%	-	±0.25%
015PG	0	15	psi		30	60	150	±1%	-	±0.25%
030PG	0	30	psi		60	120	150	±1%	-	±0.25%
060PG	0	60	psi		120	240	250	±1%	-	±0.25%
100PG	0	100	psi		250	250	250	±1%	-	±0.25%
150PG	0	150	psi		250	250	250	±1%	-	±0.25%

1. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range mits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
2. Overpressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
3. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
4. Common mode pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.
5. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
6. Total Error Band after Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

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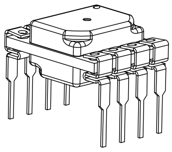
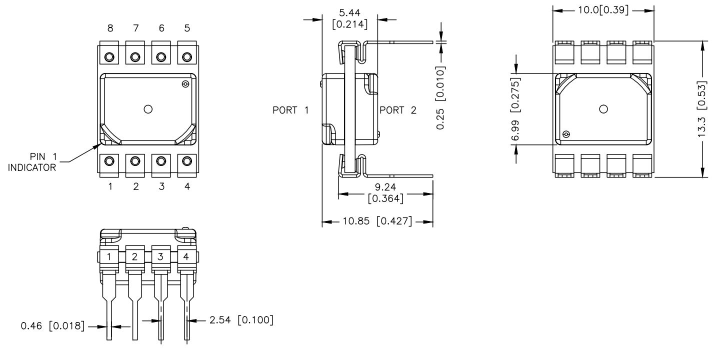
DIP NN





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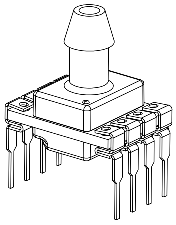

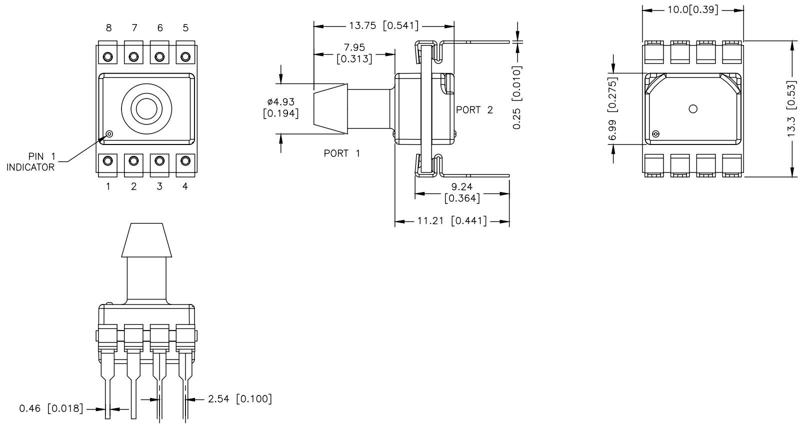

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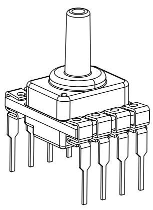

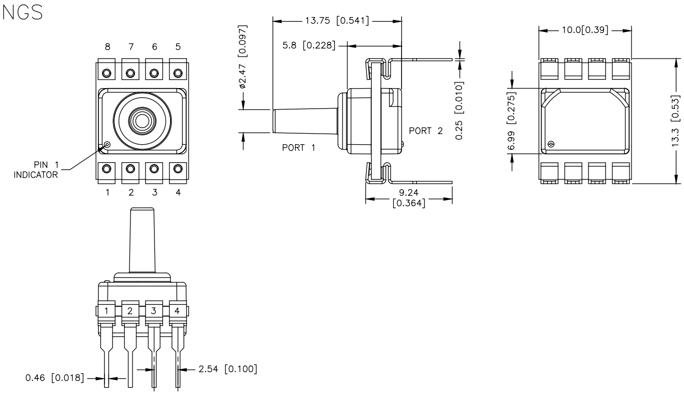

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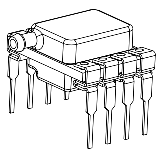

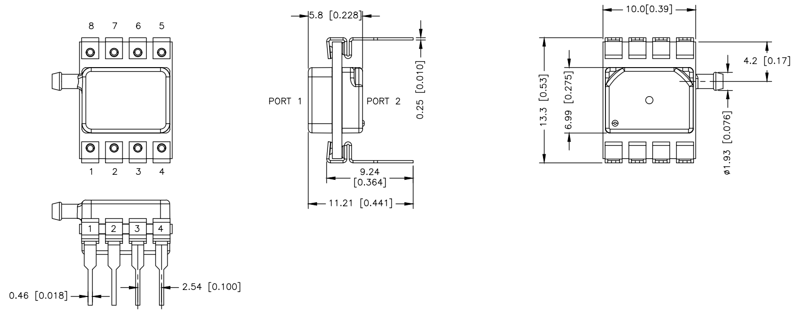

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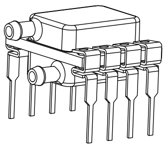
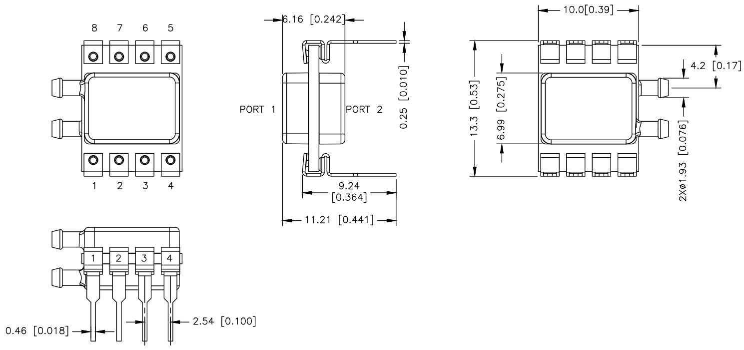
DIP RR





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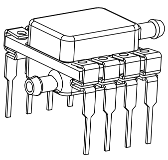

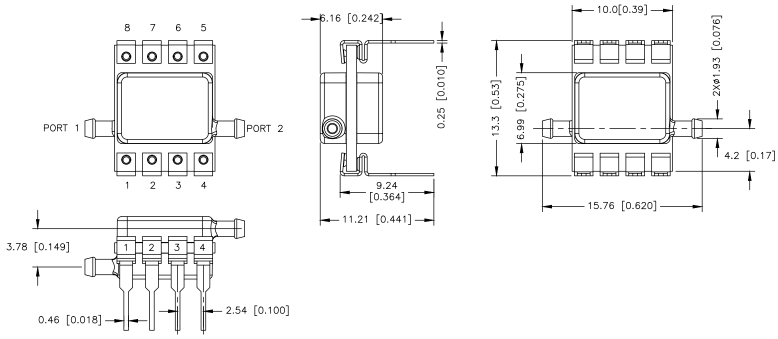

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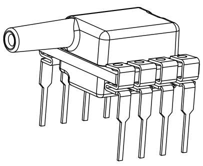

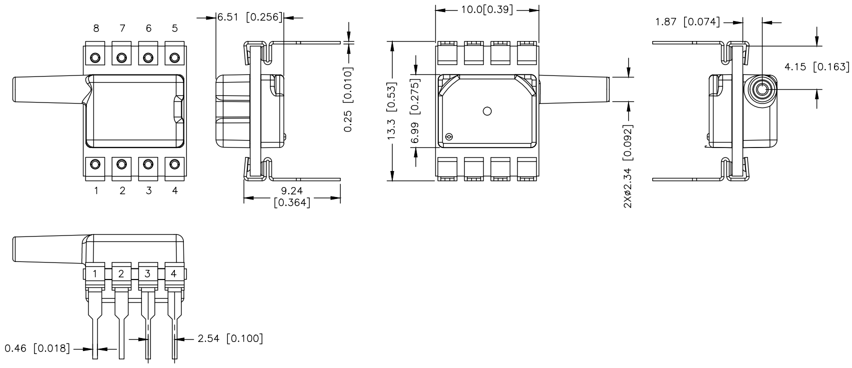

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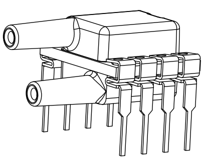

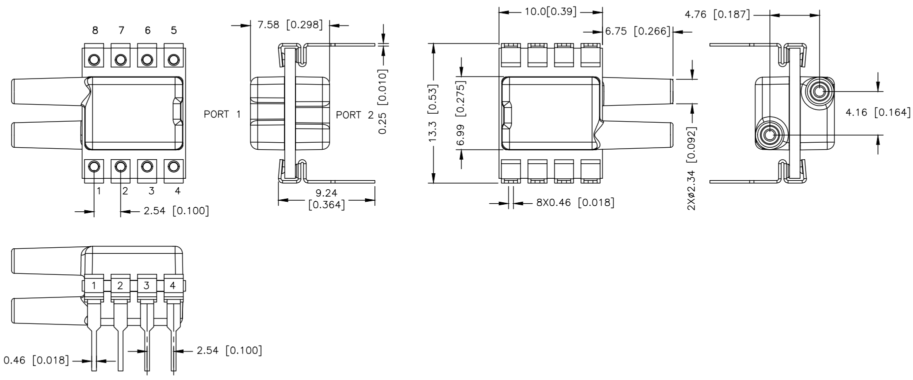

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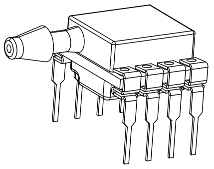
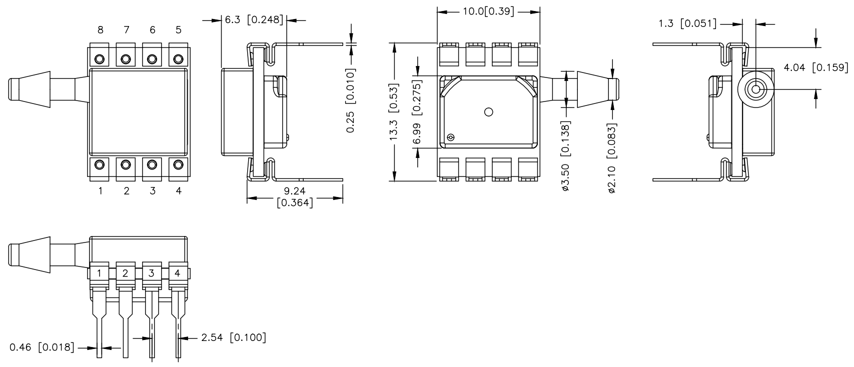
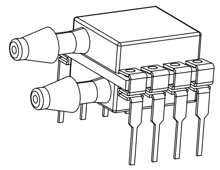
PACKAGE DIMENSIONAL DRAWINGS

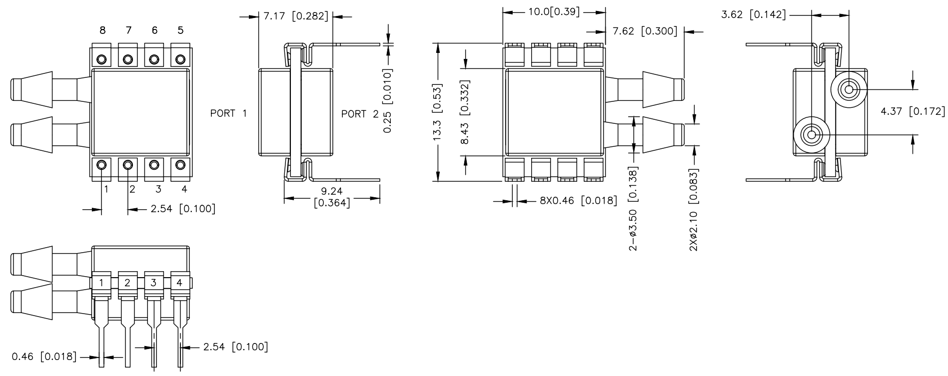
DIP SS



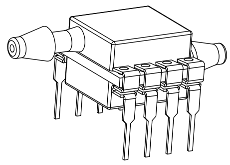


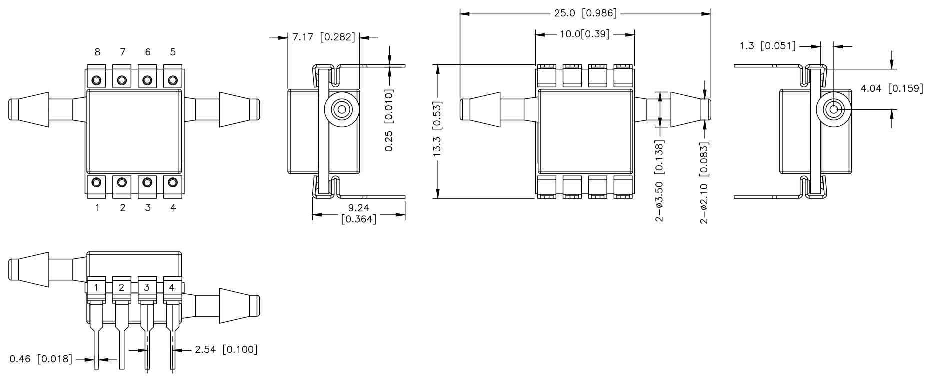
DIP DS



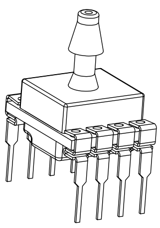


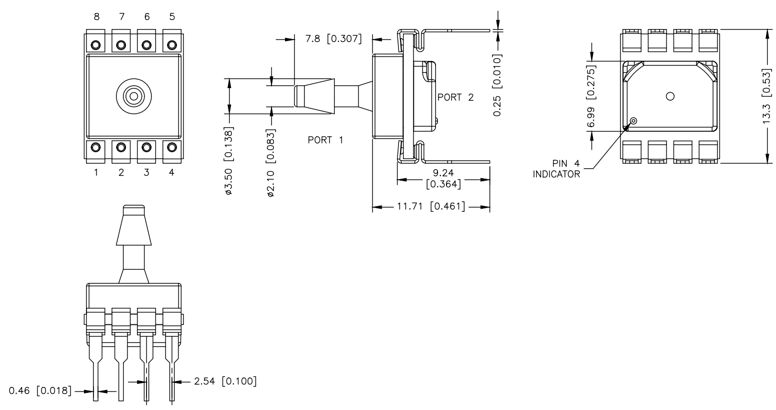
DIP RD





DIP TP

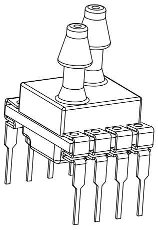


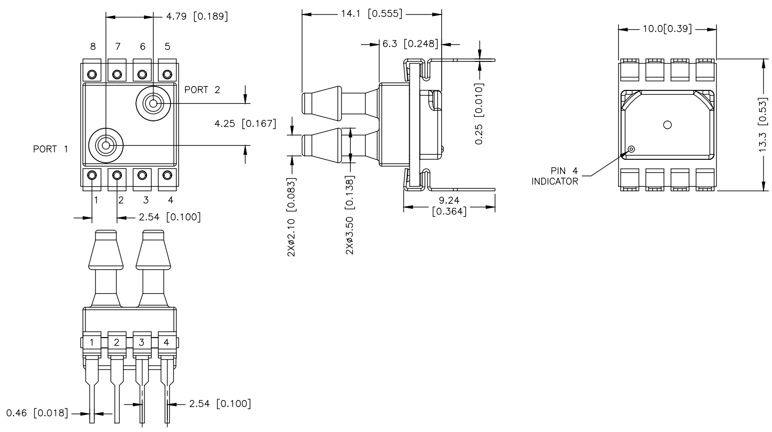


PC Board Mountable Pressure Sensor
MODEL SA19EC

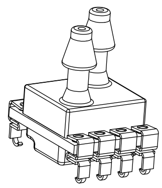
PACKAGE DIMENSIONAL DRAWINGS

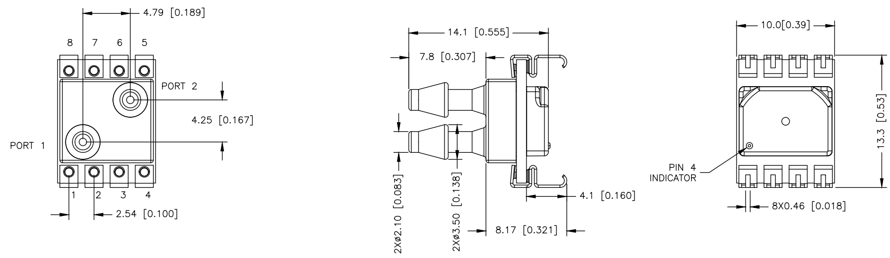
DIP DT





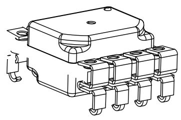
SMT DT

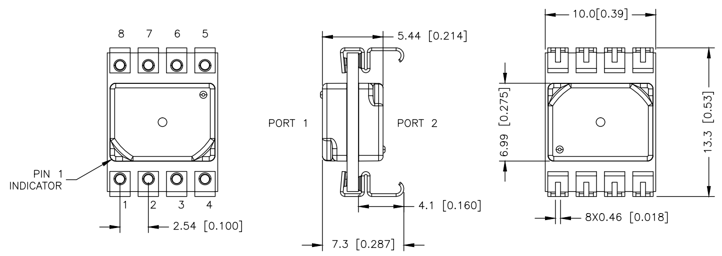




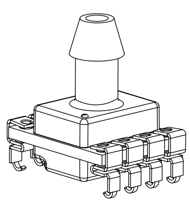
PACKAGE DIMENSIONAL DRAWINGS

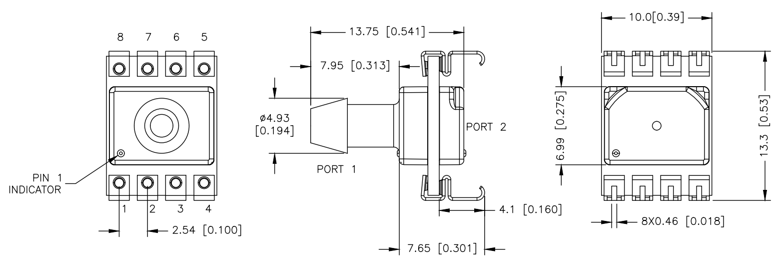
SMT NN





SMT AN





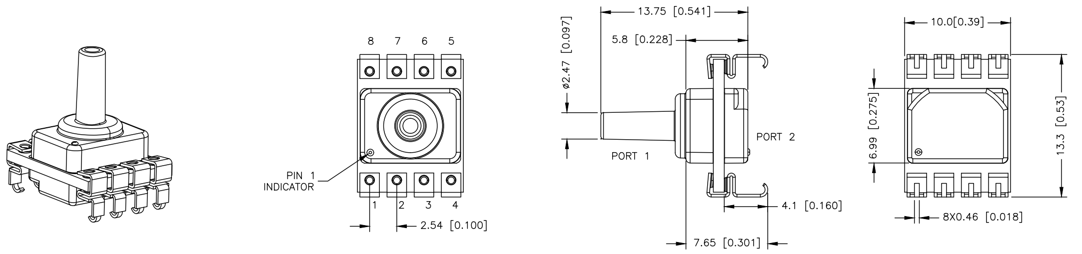
PC Board Mountable Pressure Sensor

MODEL SA19EC

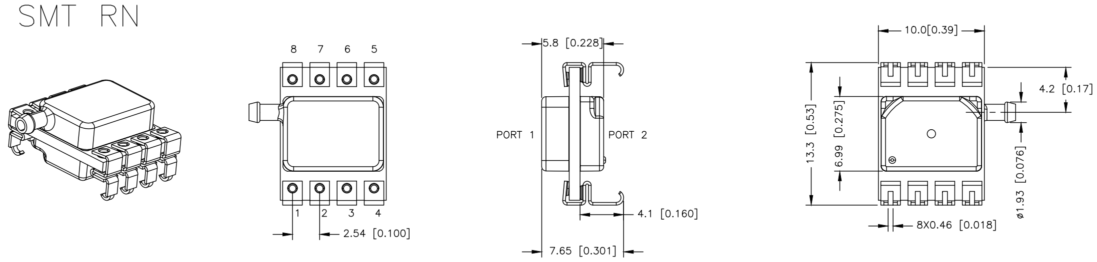
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

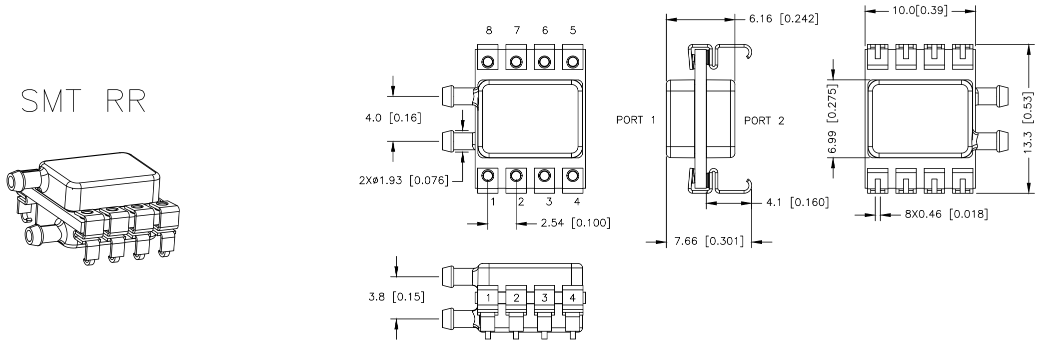
SMT LN



SMT RN



SMT RR



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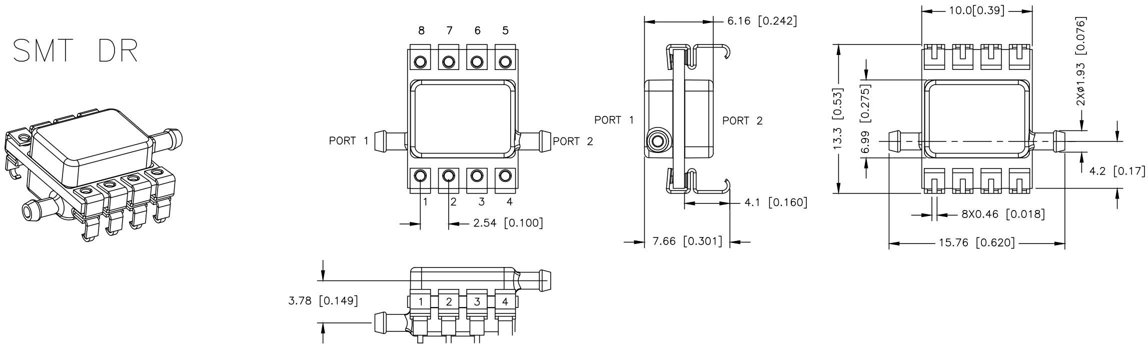


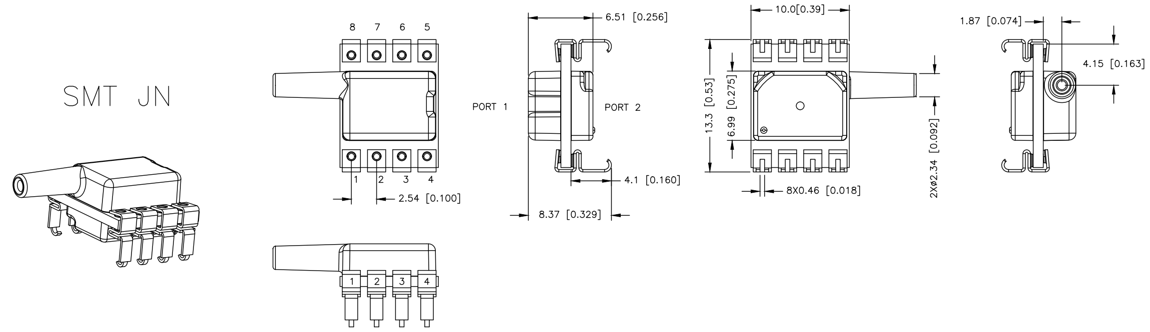
PC Board Mountable Pressure Sensor

MODEL SA19EC

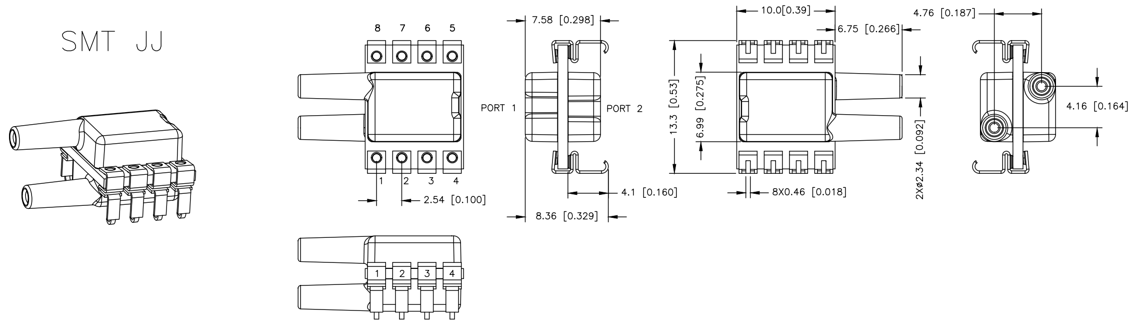
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SMT JN

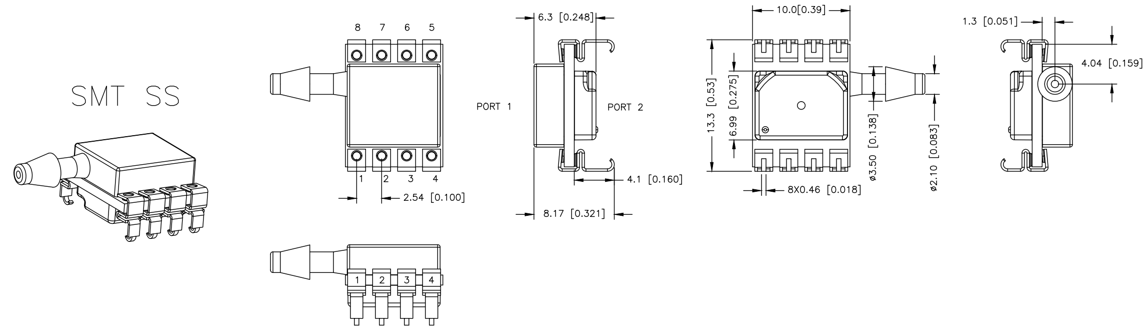


SMT JJ

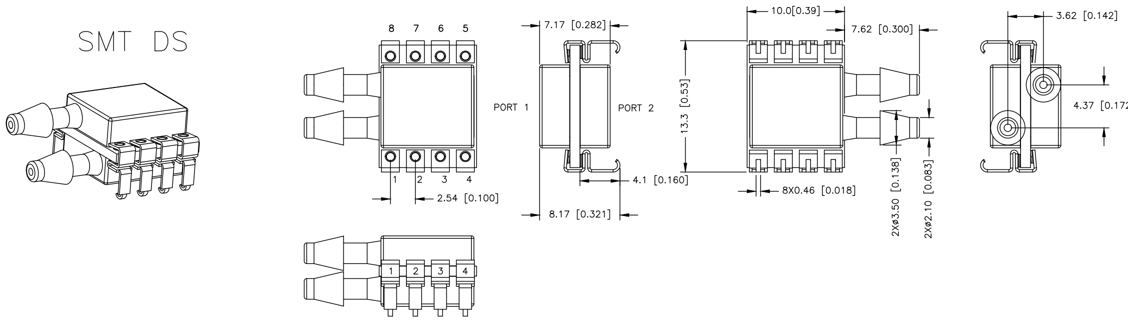


PACKAGE DIMENSIONAL DRAWINGS

SMT SS



SMT DS

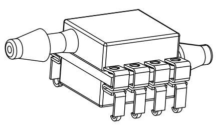


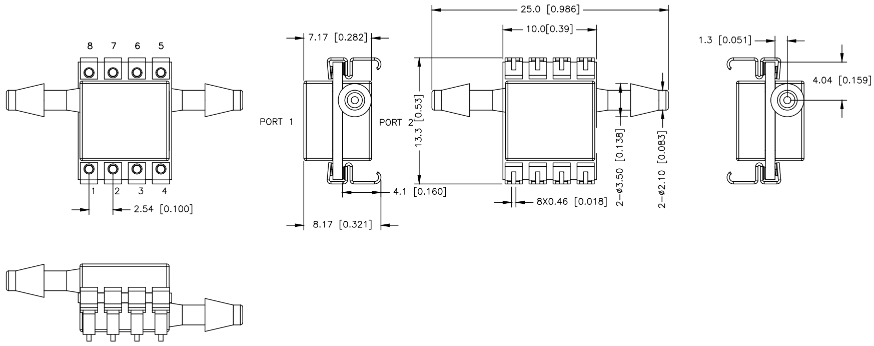
PC Board Mountable Pressure Sensor
MODEL SA19EC

PACKAGE DIMENSIONAL DRAWINGS

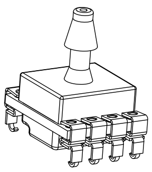
PACKAGE DIMENSIONAL DRAWINGS

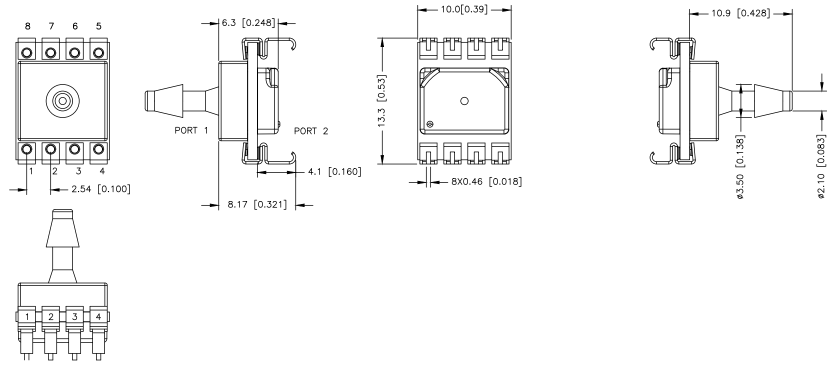
SMT RD





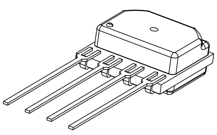
SMT TP

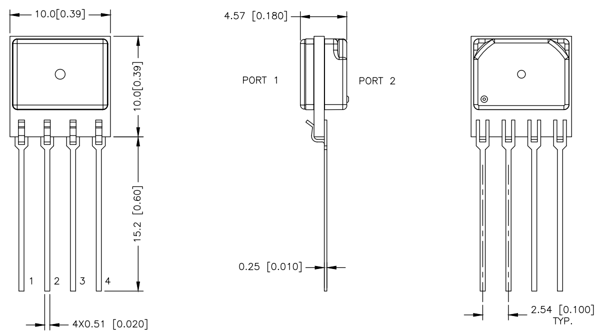




PACKAGE DIMENSIONAL DRAWINGS

SIP NN





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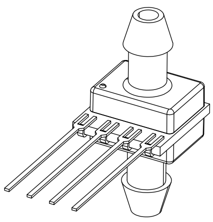
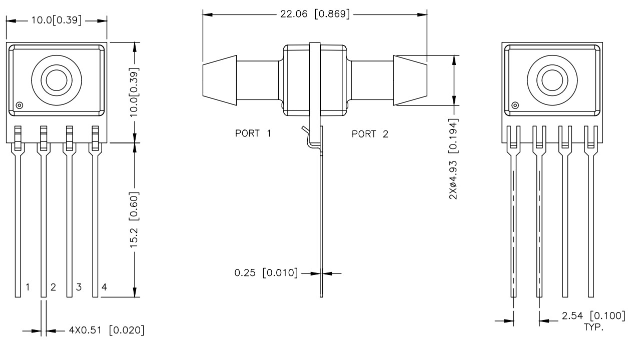


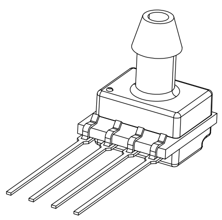


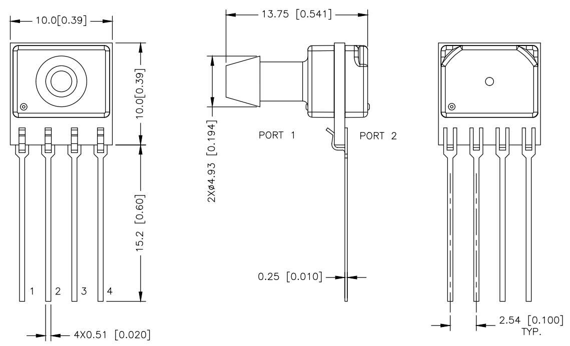
PC Board Mountable Pressure Sensor
MODEL SA19EC

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP AN





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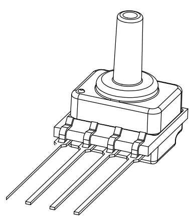

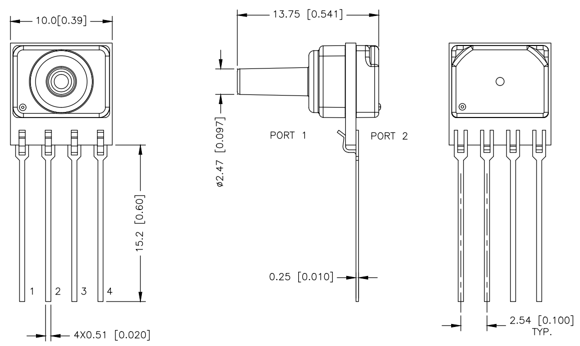

PACKAGE DIMENSIONAL DRAWINGS

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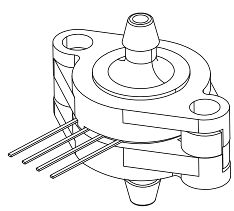

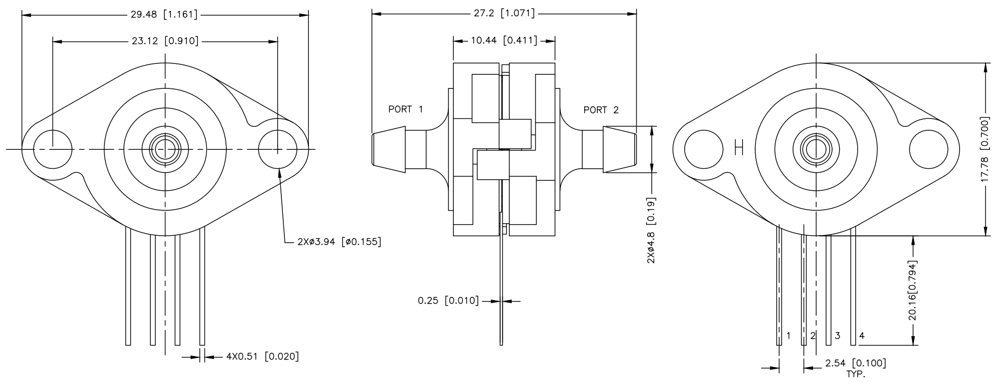

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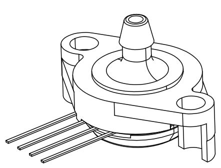
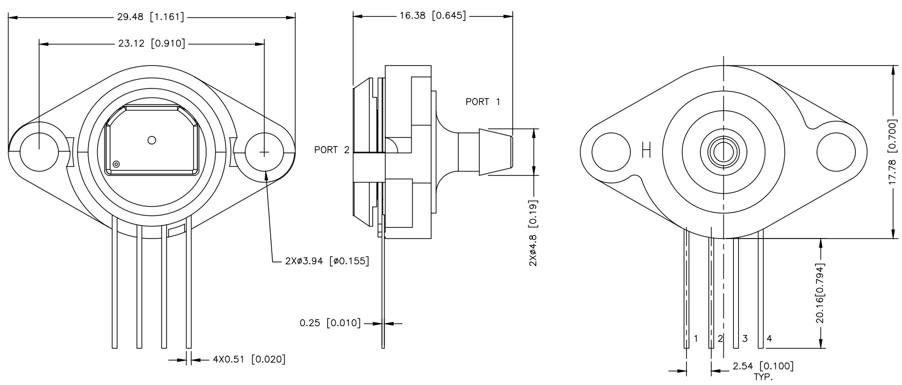




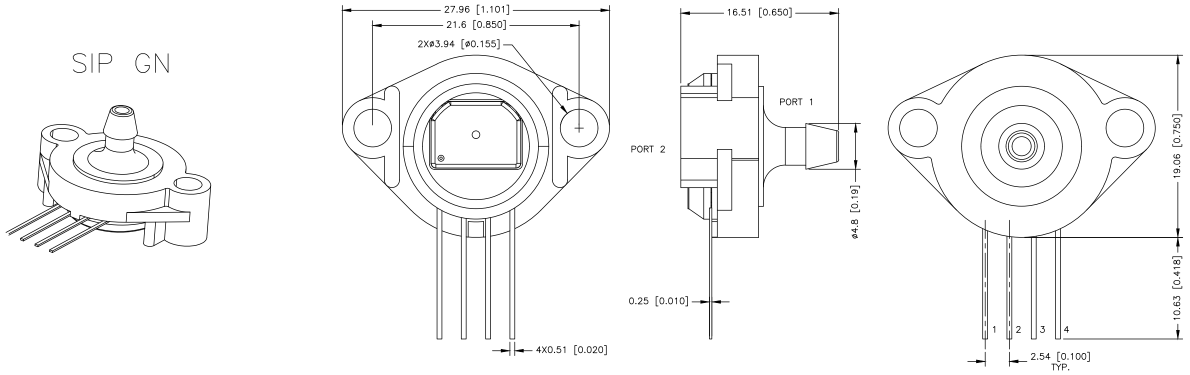
PC Board Mountable Pressure Sensor

MODEL SA19EC

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP GN



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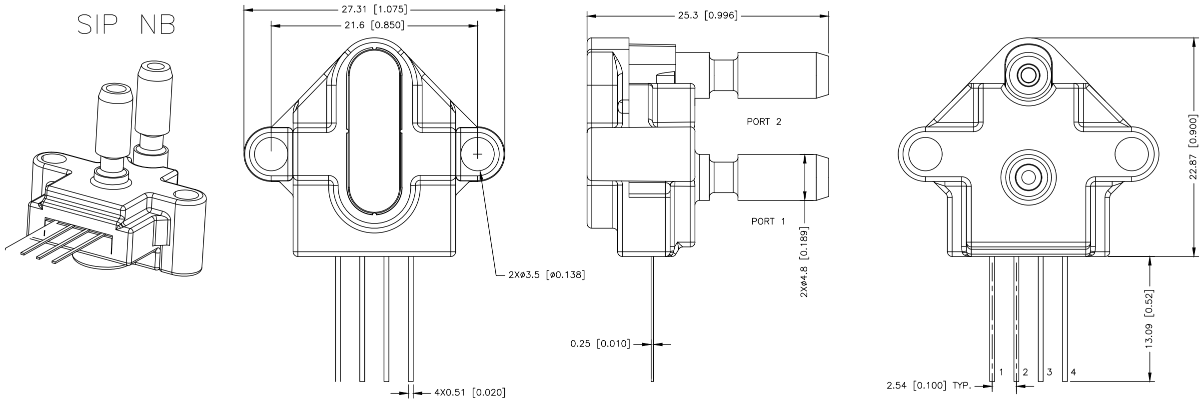

PACKAGE DIMENSIONAL DRAWINGS

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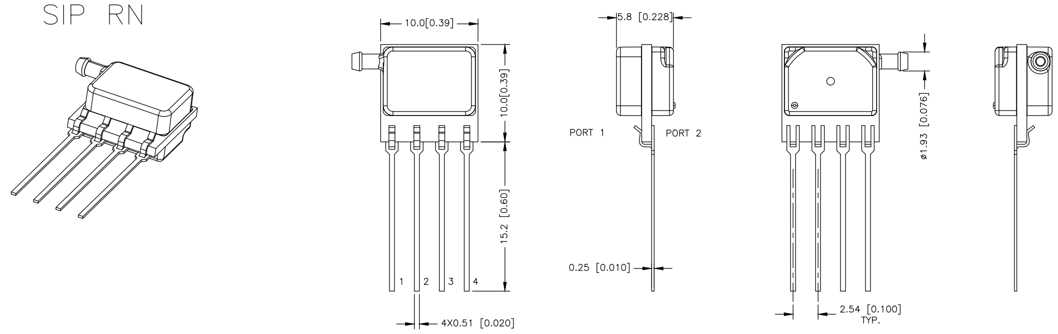

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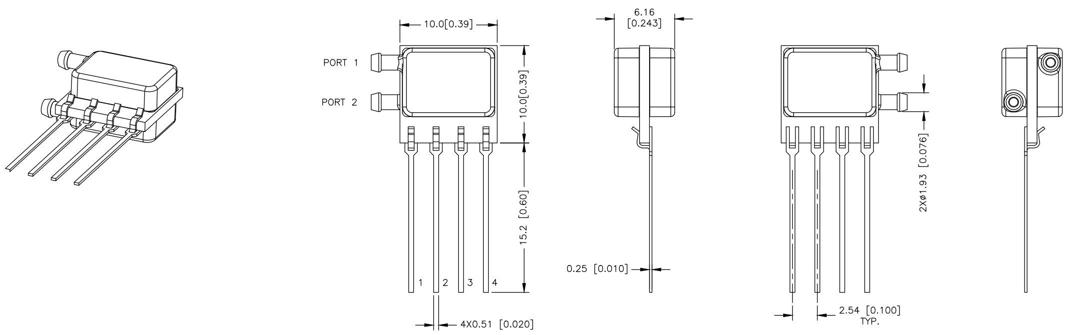
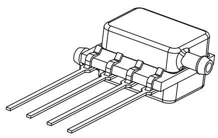


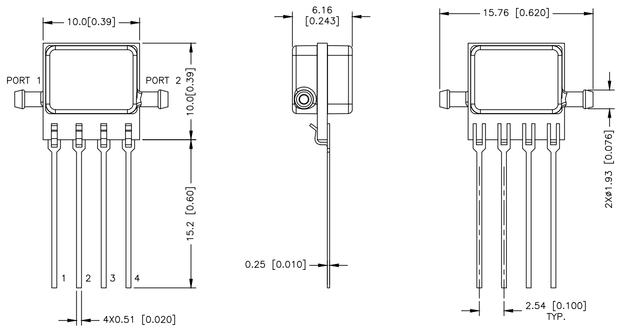
MODEL SA19EC

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

SIP DR





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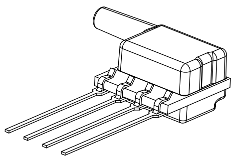
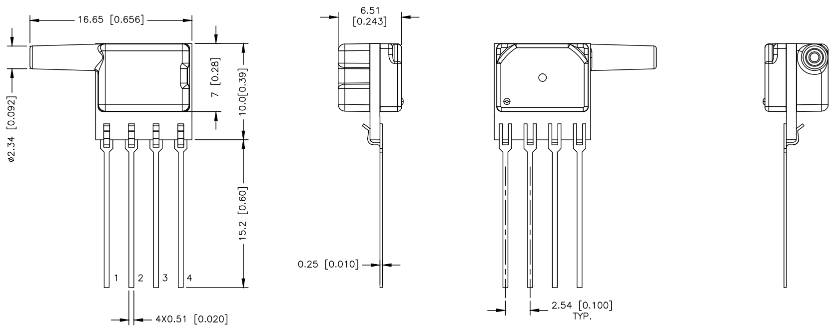
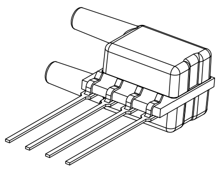
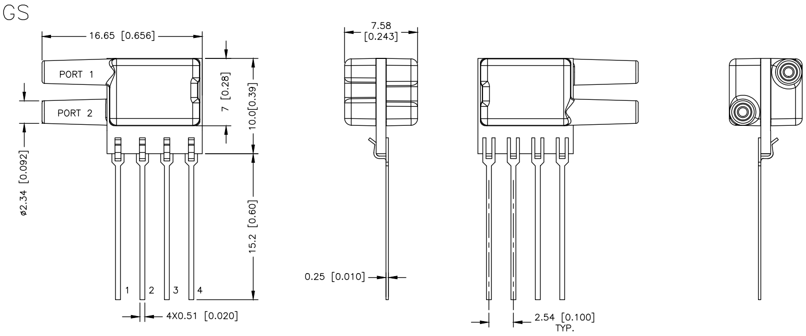




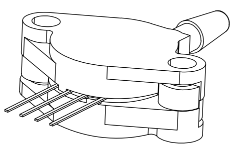
PACKAGE DIMENSIONAL DRAWINGS

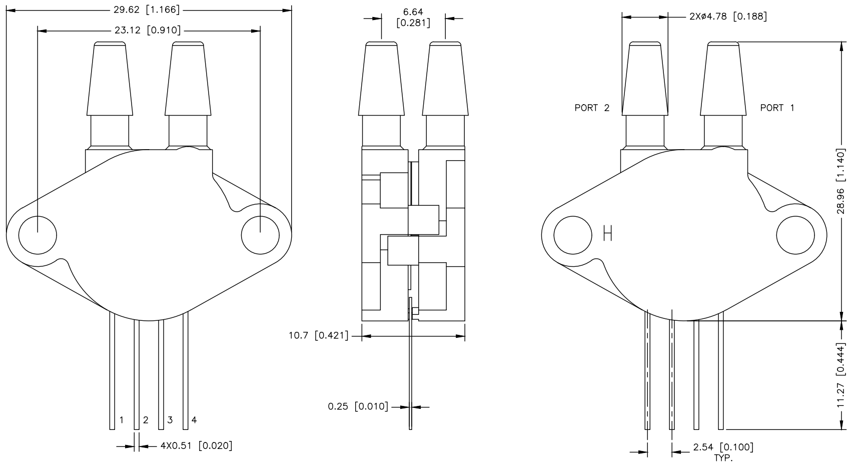
SIP JJ





SIP HH



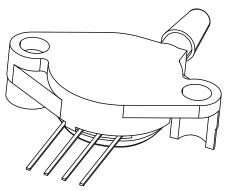


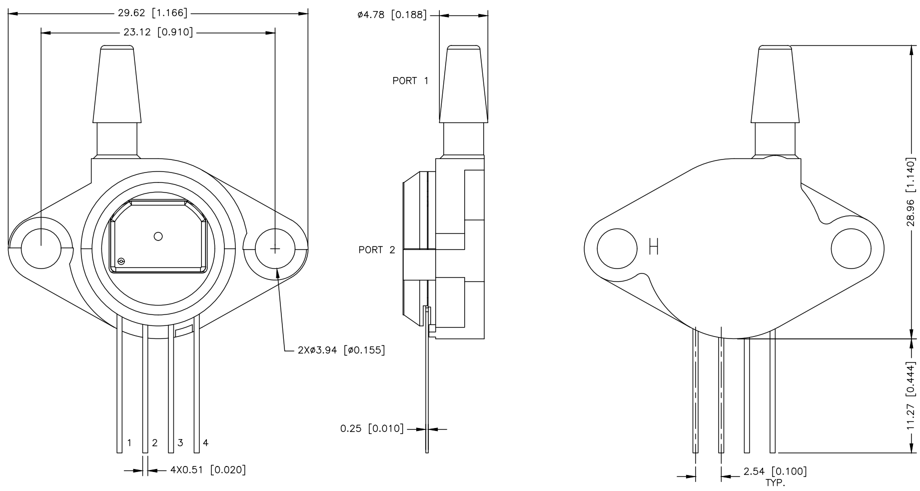
PC Board Mountable Pressure Sensor
MODEL SA19EC

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

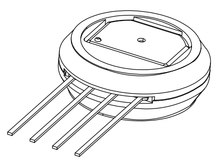
SIP HN

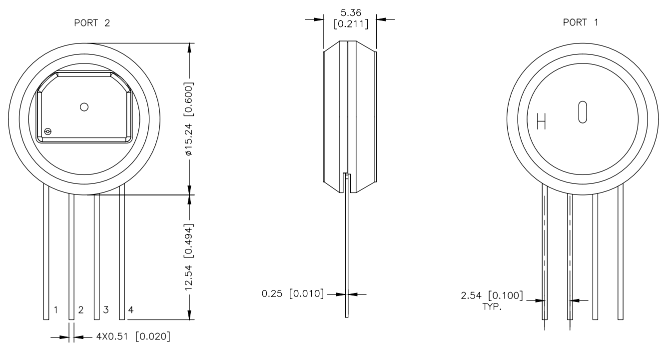




PACKAGE DIMENSIONAL DRAWINGS

SIP MN





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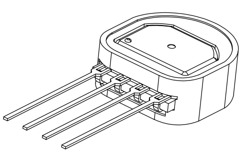
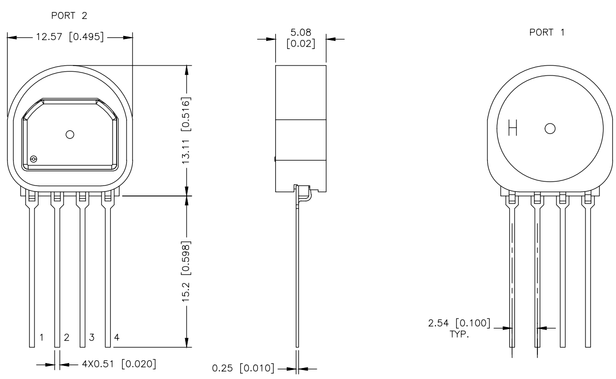




PC Board Mountable Pressure Sensor

MODEL SA19EC

PINOUTS,PCB PAD LAYOUT

PINOUTS FOR DIP AND SMT PACKAGE

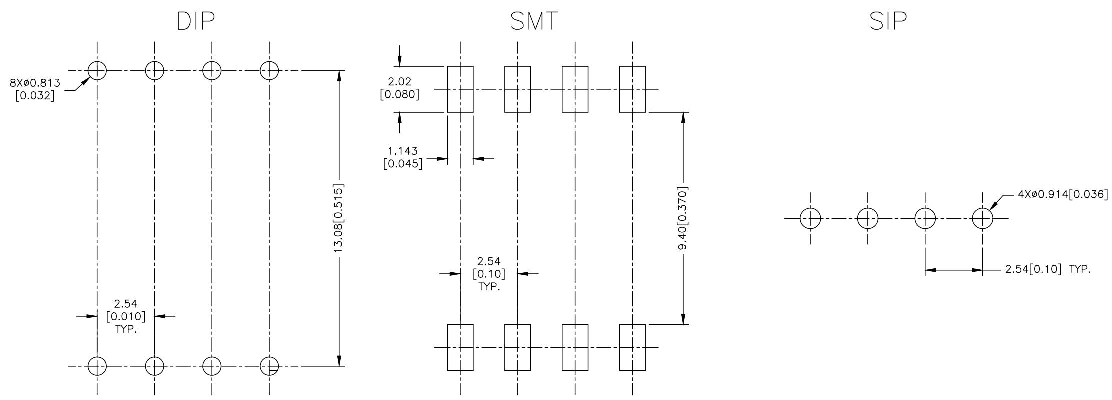
OUTPUT	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6	PIN7	PIN8
I2C	GND	Vsupply	SDA	SCL	SS	MOSI	EOC	VOUTA
SPI	GND	Vsupply	MISO	SCLK	SS	MOSI	EOC	VOUTA
ANALOG	GND	Vsupply	SDA	SCL	SS	MOSI	EOC	VOUTA

PINOUTS FOR SIP

OUTPUT	PIN1	PIN2	PIN3	PIN4
I2C	GND	Vsupply	SDA	SCL
ANALOG	NC	Vsupply	Vout	GND

PINOUTS,PCB PAD LAYOUT

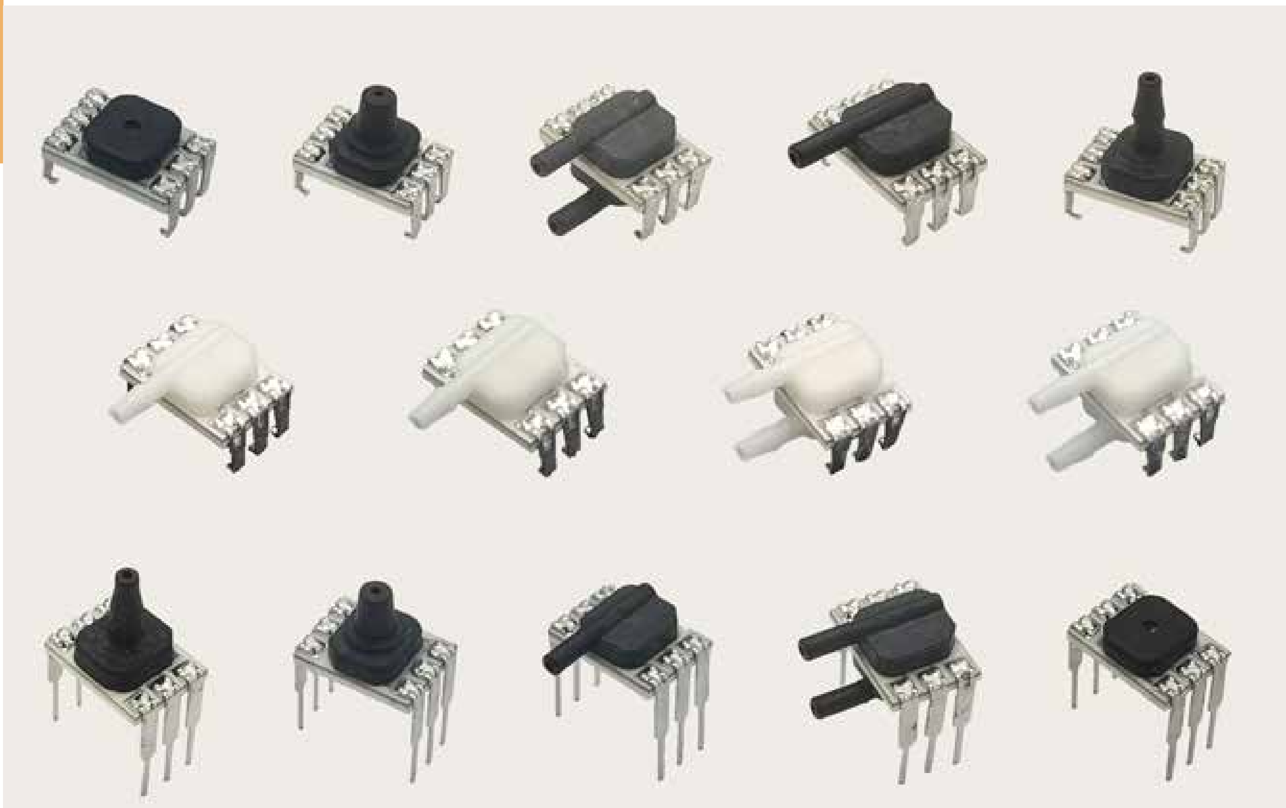
RECOMMENDED PCB LAYOUTS



PRESSURE
MODEL SAABPH

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection



DESCRIPTION

SAABPH High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SAABPH Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

SAABPH Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc . These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SAABPH Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor
MODEL SAABPH

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE

SA ABPH X XX X XXXXX X X X

Product Series

ABPH Amplified Basic

Package

- D DIP (Dual Inline Pin)
- M SMT
- L Leadless SMT

Port

No port

Single axial barbless port

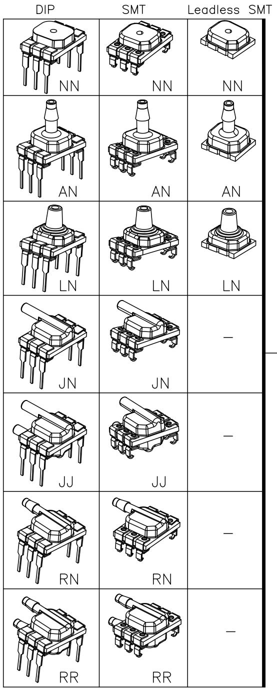
Single axial barbless port

Single radial barbless port

Dual radial barbless port same side

Single radial barbed port

Dual radial barbed port same side



Supply Voltage

3 3.3 Vdc

Transfer Function

- A 10% to 90% of 2^{24} counts (digital)
- B 5% to 95% of 2^{24} counts (digital)
- C 5% to 85% of 2^{24} counts (digital)
- D 4% to 94% of 2^{24} counts (digital)

Output Type

S SPI	4 I^2C, Address 0x48
0 I^2C, Address 0x08	5 I^2C, Address 0x58
1 I^2C, Address 0x18	6 I^2C, Address 0x68
2 I^2C, Address 0x28	7 I^2C, Address 0x78
3 I^2C, Address 0x38	

Pressure Range

60 mbar to 10 bar		6 kPa to 1 MPa		1 psi to 150 psi	
Differential		Differential		Differential	
060MD	±60 mbar	006KD	±6 kPa	001PD	±1Psi
100MD	±100 mbar	010KD	±10 kPa	005PD	±5psi
160MD	±160 mbar	016KD	±16 kPa	015PD	±15psi
250MD	±250 mbar	025KD	±25 kPa	030PD	±30Psi
400MD	±400 mbar	040KD	±40 kPa	060PD	±60Psi
600MD	±600 mbar	060KD	±60 kPa		
001BD	±1 bar	100KD	±100 kPa		
1.6BD	±1.6 bar	160KD	±160 kPa		
2.5BD	±2.5 bar	250KD	±250 kPa		
004BD	±4 bar	400KD	±400 kPa		
Gage		Gage		Gage	
060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0Psi to 1Psi
100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0Psi to 5Psi
160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0Psi to 15Psi
250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0Psi to 30Psi
400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0Psi to 60Psi
600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0Psi to 100Psi
001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0Psi to 150Psi
1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		

*FIGURE 1

OPTION

- N Dry gases only, no diagnostics
- D Dry gases only, diagnostics on
- T Liquid media, silicone gel, no diagnostics
- V Liquid media, silicone gel, diagnostics on
- F Liquid media, flourosilicone gel, diagnostics on
- F Liquid media, flourosilicone gel, no diagnostics

PC Board Mountable Pressure Sensor
MODEL SAABPH

PERFORMANCE SPECIFICATIONS

Ambient Temperature: 25°C (Unless otherwise specified)

CHARACTERISTIC		DIGITAL MIN	DIGITAL TYP	DIGITAL MAX	UNITS	NOTES
Supply voltage	3.3 Vdc	3.0	3.3	3.6	Vdc	1,2,3
Supply current	I2C/sleep/Standby Mode	3.0	33.8	211	uA	
	SPI/sleep/Standby Mode	13	43.8	211	uA	
Operating temperature range		-40	-	85	°C	4
Compensated temperature range		-10	-	50	°C	4
Temperature output option		-	±4	-	°C	6
Startup time (power up to data ready)		-	-	3	mS	
Response time		2	7	10	mS	
I²C/SPI voltage level	low	-	-	20	%Vsupply	
	high	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		1	-	-	kOhm	
Total Error Band		-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		-	-	-	%FSS	
		12	-	-	bits	

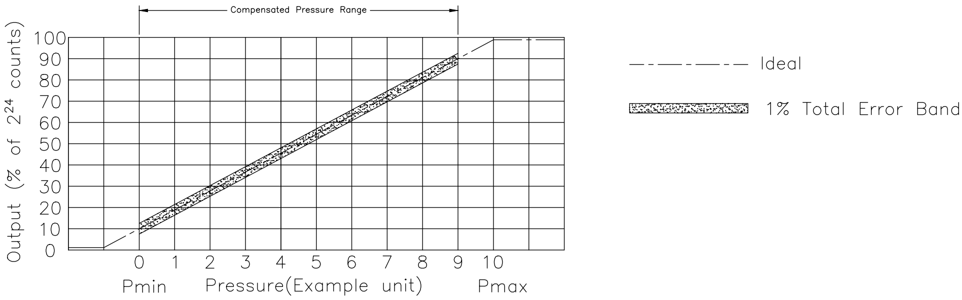
Notes

1. Sensors are 3.3 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

PC Board Mountable Pressure Sensor
MODEL SAABPH

Model SAABBPH SERIES

PRESSURE FUNCTION
TYPE A EXAMPLE



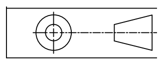
$$\text{Output (\% of } 2^{24}\text{ counts)} = \frac{M*16777215}{Pmax-Pmin} * (Papplied-Pmin)+N*16777215$$

$$\text{Temperature Output (Decimal Counts)} = \frac{(\text{Output }^{\circ}C-(-40^{\circ}C)_{Tmin}) * 16777215}{(85^{\circ}C_{Tmax}-(-40^{\circ}C)_{Tmin})}$$

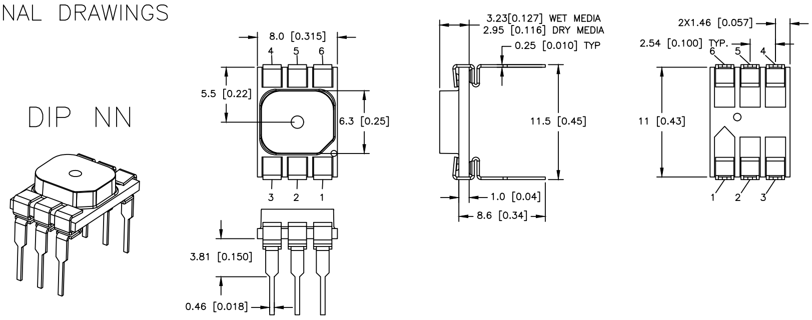
TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

PACKAGE DIMENSIONAL DRAWINGS

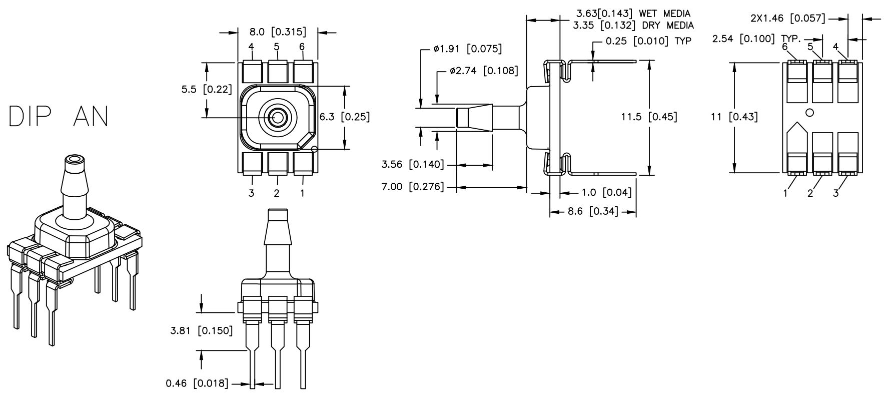
PACKAGE DIMENSIONAL DRAWINGS



DIP NN



DIP AN



[DIMENSIONS] ARE IN INCHES
TOLERANCES (UNLESS SPECIFIED)
.XX=.01 .XXX=.005 ANGLES=1/2°

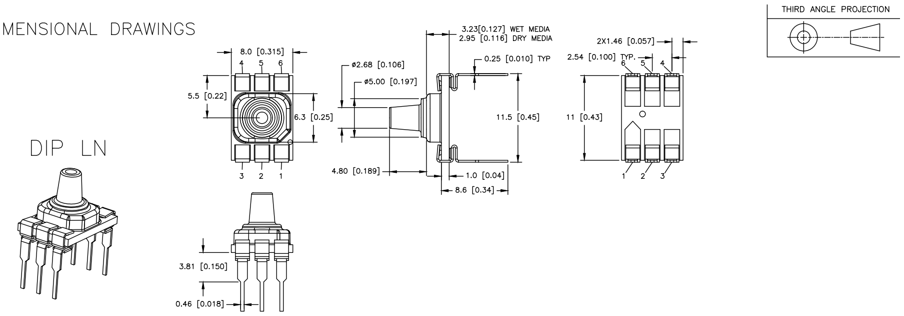
PC Board Mountable Pressure Sensor

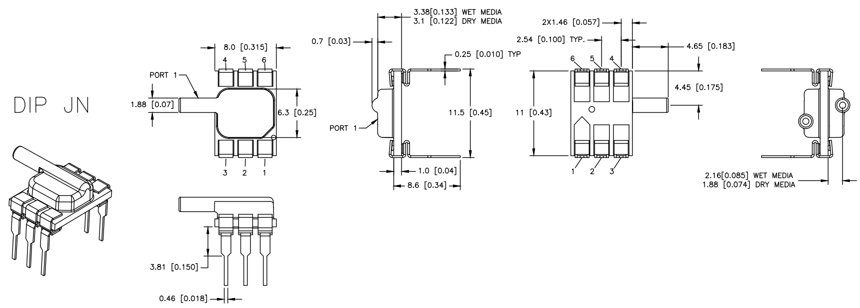
MODEL SAABPH

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

THIRD ANGLE PROJECTION





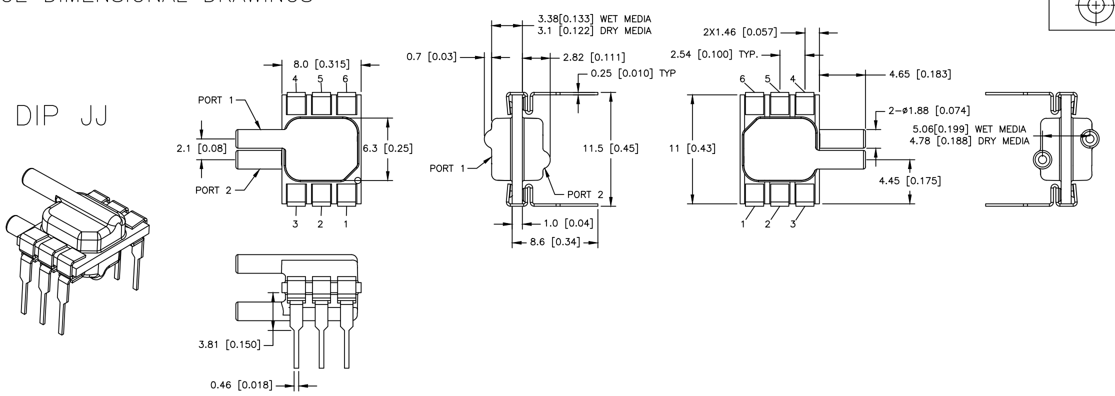
[DIMENSIONS] ARE IN INCHES

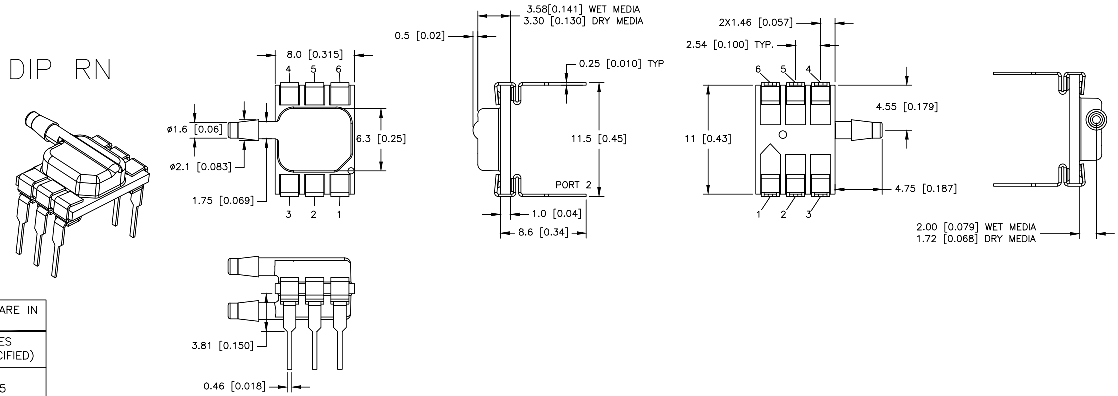
TOLERANCES (UNLESS SPECIFIED)

.XX=.01
.XXX=.005
ANGLES=1/2°

PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS





DIMENSIONS] ARE IN INCHES

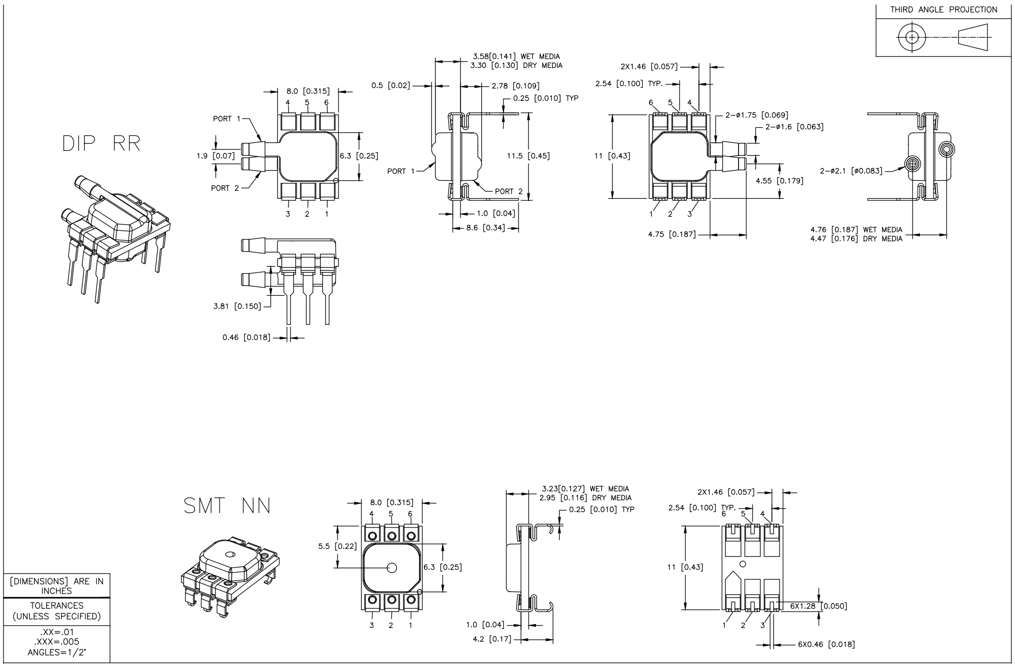
TOLERANCES (UNLESS SPECIFIED)

.XX=.01
.XXX=.005
ANGLES=1/2°

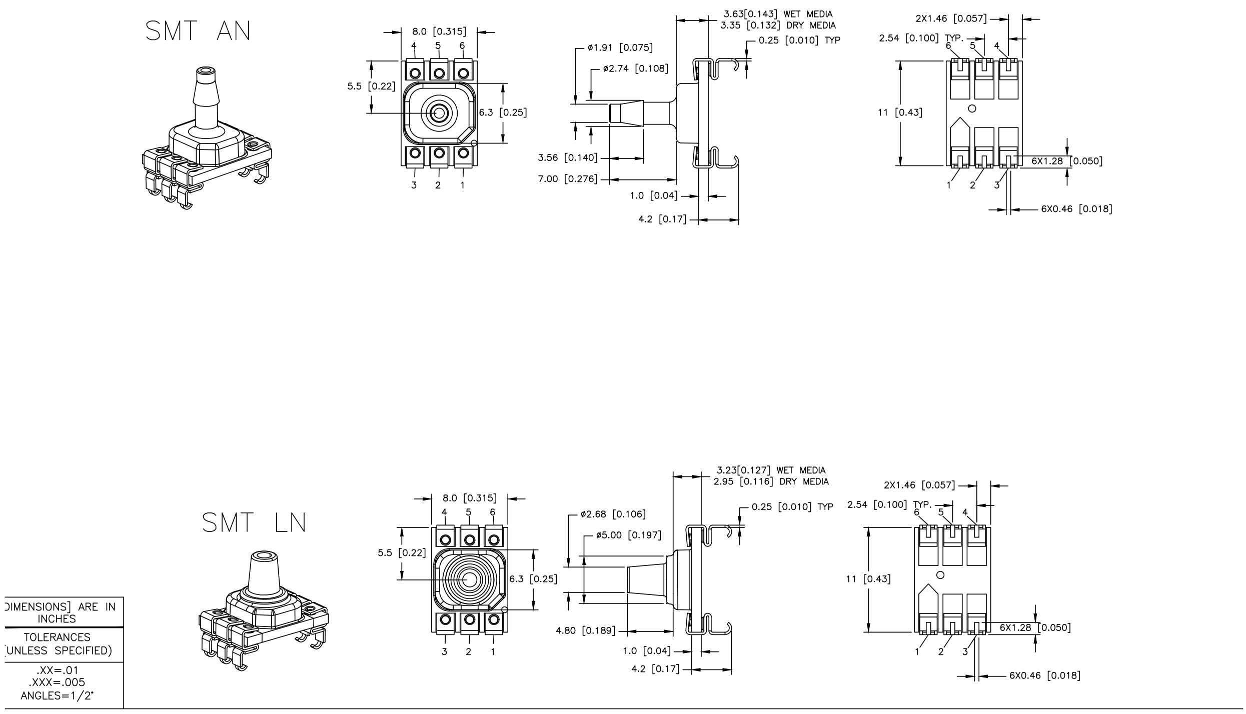
PC Board Mountable Pressure Sensor

MODEL SAABPH

PACKAGE DIMENSIONAL DRAWINGS



PACKAGE DIMENSIONAL DRAWINGS

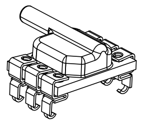


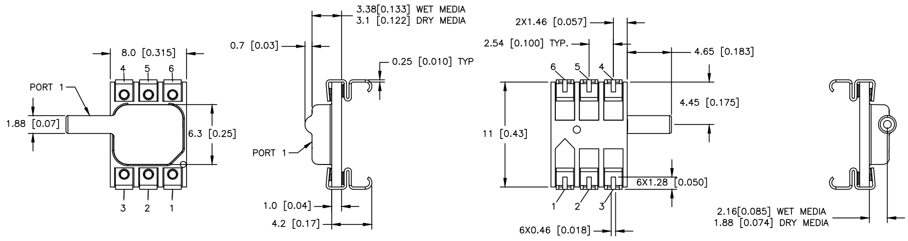
PC Board Mountable Pressure Sensor

MODEL SAABPH

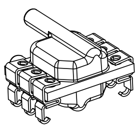
PACKAGE DIMENSIONAL DRAWINGS

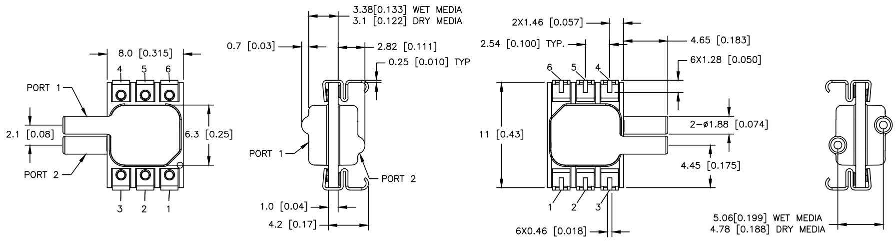
SMT JN





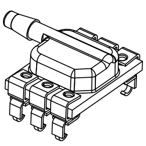
SMT JJ

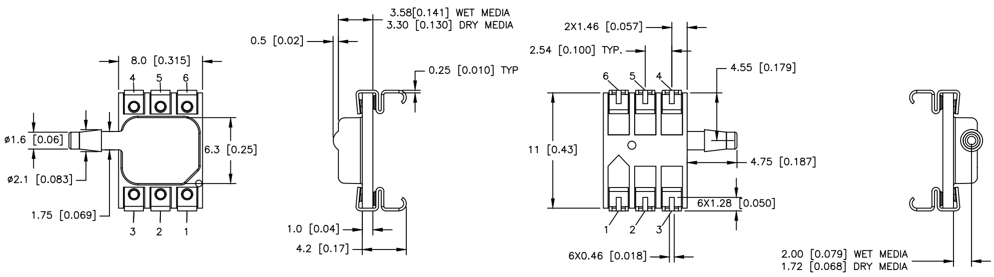




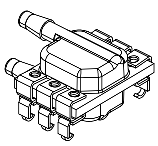
PACKAGE DIMENSIONAL DRAWINGS

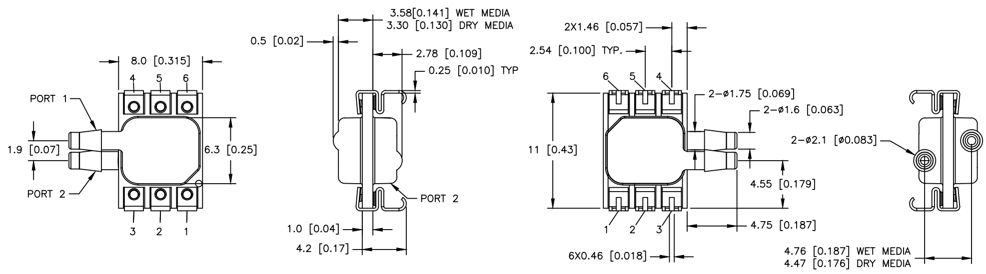
SMT RN





SMT RR



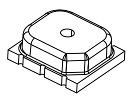


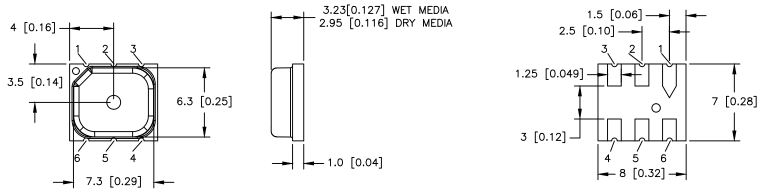
PC Board Mountable Pressure Sensor

MODEL SAABPH

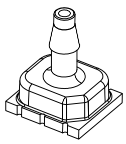
PACKAGE DIMENSIONAL DRAWINGS

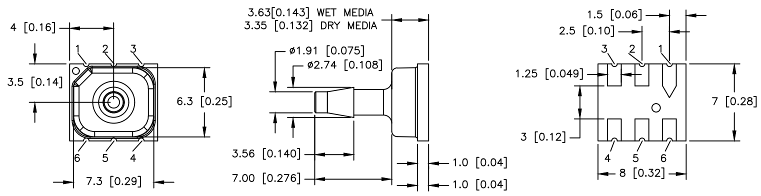
Leadless SMT NN



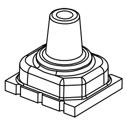


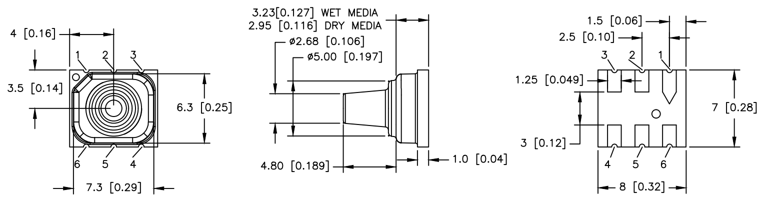
Leadless SMT AN





Leadless SMT LN





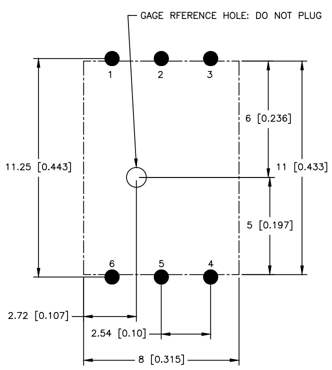
PACKAGE DIMENSIONAL DRAWINGS

PINOUTS

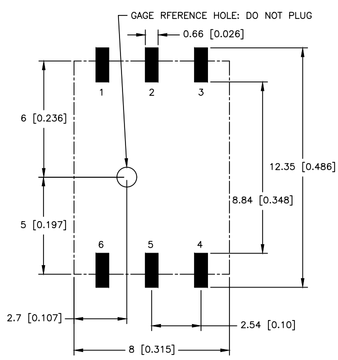
OUTPUT	PAD 1	PAD 2	PAD 3	PAD 4	PAD 5	PAD 6
I2C	GND	Vsupply	NC	NC	SDA	SCL
SPI	GND	Vsupply	SS	MISO	MOSI	SCLK

RECOMMENDED PCB LAYOUTS

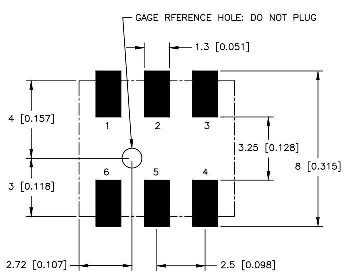
DIP



SMT



Leadless SMT



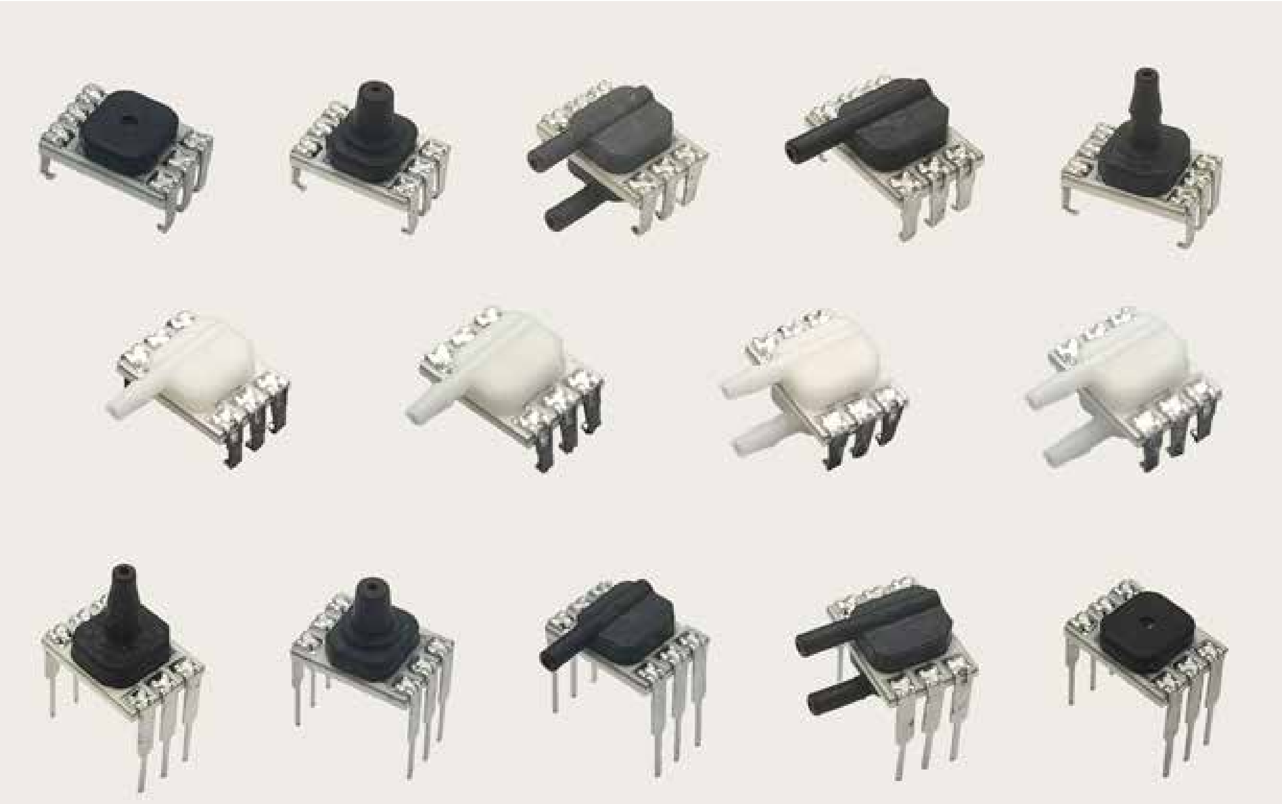
[DIMENSIONS] ARE IN INCHES
TOLERANCES (UNLESS SPECIFIED)
.XX=.01 .XXX=.005 ANGLES=1/2°

PRESSURE

MODEL SAABPC

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- **Variable Air Volume control**
- **Static duct pressure**
- **HVAC transmitters**
- **Clogged HVAC filter detection**



DESCRIPTION

SAABPC High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SAABPC Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at appro ximately 1 kHz.

SAABPC Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SAABPC Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

PC Board Mountable Pressure Sensor
MODEL SAABPC

NOMENCLATURE AND ORDER GUIDE

THIRD ANGLE PROJECTION

SA ABPC X XX X XXXXX X X X

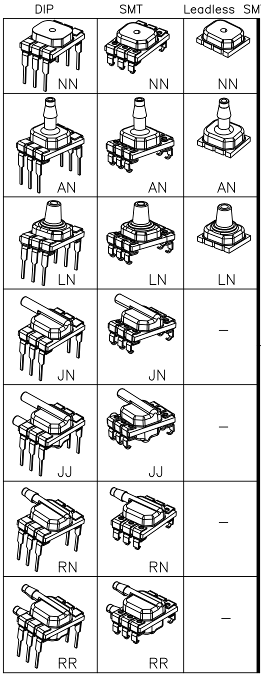
Product Series

ABPC Amplified Basic

Package

D	DIP (Dual Inline Pin)
M	SMT
L	Leadless SMT

Port



Port	DIP	SMT	Leadless SMT
No port	NN	NN	NN
Single axial barbless port	AN	AN	AN
Single axial barbless port	LN	LN	LN
Single radial barbless port	JN	JN	–
Dual radial barbless port same side	JJ	JJ	–
Single radial barbed port	RN	RN	–
Dual radial barbed port same side	RR	RR	–

Supply Voltage

3	3.3 Vdc
5	5.0 Vdc

Transfer Function

A	10% to 90% of Vsupply (analog), 2^{14} counts (digital) no temperature output, no sleep mode
D	10% to 90% of 2^{14} counts (digital only) temperature output enabled, sleep mode enabled
S	10% to 90% of 2^{14} counts (digital only) no temperature output, sleep mode enabled
T	10% to 90% of 2^{14} counts (digital only) temperature output enabled, no sleep mode

Output Type

A Analog	3 I^2C, Address 0x38
S SPI	4 I^2C, Address 0x48
0 I^2C, Address 0x08	5 I^2C, Address 0x58
1 I^2C, Address 0x18	6 I^2C, Address 0x68
2 I^2C, Address 0x28	7 I^2C, Address 0x78

Pressure Range

60 mbar to 10 bar		6 kPa to 1 MPa		1 psi to 150 psi	
Differential		Differential		Differential	
060MD	±60 mbar	006KD	±6 kPa	001PD	±1Psi
100MD	±100 mbar	010KD	±10 kPa	005PD	±5psi
160MD	±160 mbar	016KD	±16 kPa	015PD	±15psi
250MD	±250 mbar	025KD	±25 kPa	030PD	±30Psi
400MD	±400 mbar	040KD	±40 kPa	060PD	±60Psi
600MD	±600 mbar	060KD	±60 kPa		
001BD	±1 bar	100KD	±100 kPa		
1.6BD	±1.6 bar	160KD	±160 kPa		
2.5BD	±2.5 bar	250KD	±250 kPa		
004BD	±4 bar	400KD	±400 kPa		
Gage		Gage		Gage	
060MG	0 mbar to 60 mbar	006KG	0 kPa to 6 kPa	001PG	0Psi to 1Psi
100MG	0 mbar to 100 mbar	010KG	0 kPa to 10 kPa	005PG	0Psi to 5Psi
160MG	0 mbar to 160 mbar	016KG	0 kPa to 16 kPa	015PG	0Psi to 15Psi
250MG	0 mbar to 250 mbar	025KG	0 kPa to 25 kPa	030PG	0Psi to 30Psi
400MG	0 bar to 400 mbar	040KG	0 kPa to 40 kPa	060PG	0Psi to 60Psi
600MG	0 bar to 600 mbar	060KG	0 kPa to 60 kPa	100PG	0Psi to 100Psi
001BG	0 bar to 1 bar	100KG	0 kPa to 100 kPa	150PG	0Psi to 150Psi
1.6BG	0 bar to 1.6 bar	160KG	0 kPa to 160 kPa		
2.5BG	0 bar to 2.5 bar	250KG	0 kPa to 250 kPa		
004BG	0 bar to 4 bar	400KG	0 kPa to 400 kPa		
006BG	0 bar to 6 bar	600KG	0 kPa to 600 kPa		
010BG	0 bar to 10 bar	001GG	0 kPa to 1 MPa		

*FIGURE 1

OPTION

N	Dry gases only, no diagnostics
D	Dry gases only, diagnostics on
T	Liquid media, silicone gel, no diagnostics
V	Liquid media, silicone gel, diagnostics on
F	Liquid media, flourosilicone gel, diagnostics on
F	Liquid media, flourosilicone gel, no diagnostics

PC Board Mountable Pressure Sensor
MODEL SAABPC

PERFORMANCE SPECIFICATIONS

Ambient Temperature: 25°C (Unless otherwise specified)

		ANALOG			DIGITAL				
CHARACTERISTIC		**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**	**NOTES**
Supply voltage	3.3Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0Vdc	-	2.7	3.8	-	3.7	4.6	mA	
	sleep mode option	-	-	-	-	1	10	uA	
Operating temperature range		-40	-	+85	-	-	85	℃	4
Compensated temperature range		-	-	50	-	-	50	℃	5
Temperature output option		-	-	-	-	±4	-	℃	6
Startup time(power up to data ready)		-	-	5	-	-	3	mS	
Response time		-	1	-	-	0.46	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I^{2}C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MOSO,SCL/SCLK,SS		-	-	-	-	-	-	kOhm	
Total Error Band		-	-	±1.5	-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr,25℃)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	11	-	14	bits	

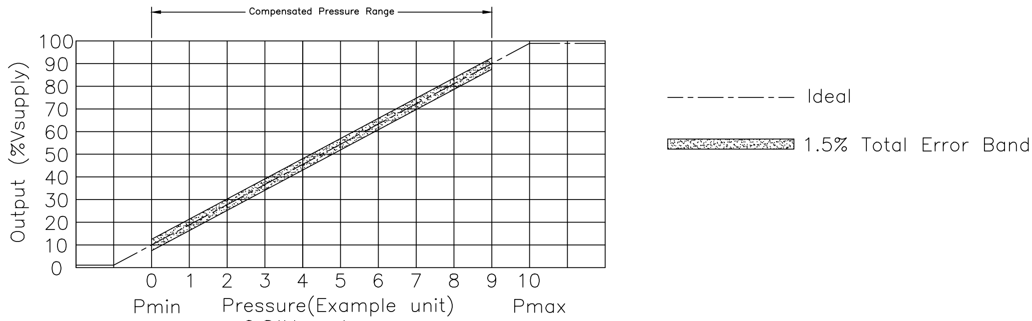
Notes

1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C.
   Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range. (See Figure 1.)
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

Model SAABBPH SERIES

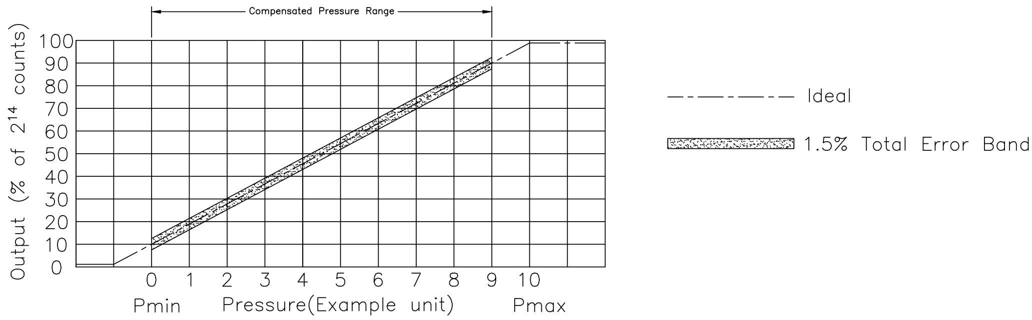
FIGURE 1. PRESSURE FUNCTION

Analog Versions



$$\text{Output(V)} = \frac{0.8*\text{Vsuuply}}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin}) + 0.1*\text{Vsuuply}$$

Digital Versions

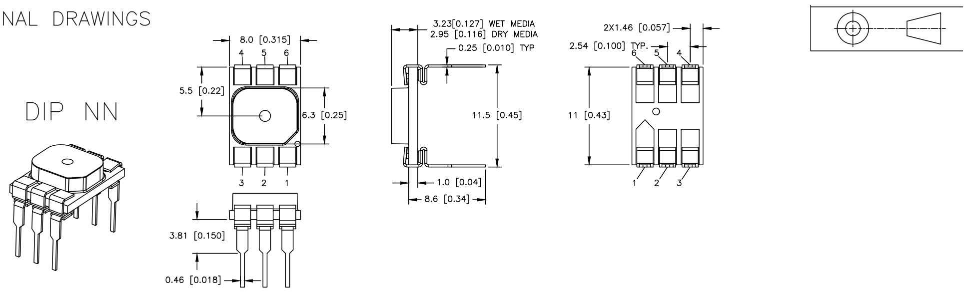


$$\text{Output (\% of } 2^{14} \text{ counts)} = \frac{80\%}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin}) + 10\%$$

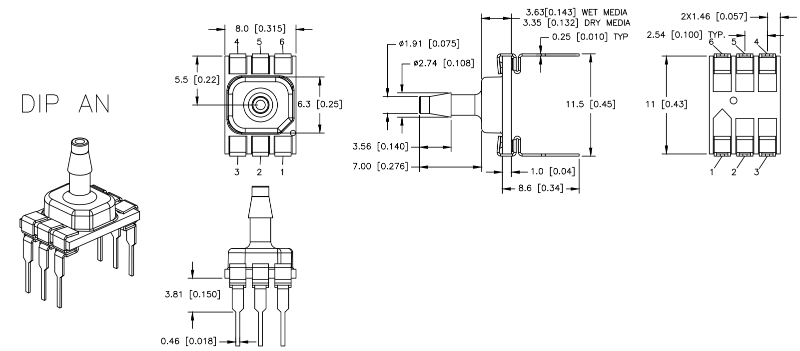
PACKAGE DIMENSIONAL DRAWINGS

PACKAGE DIMENSIONAL DRAWINGS

DIP NN



DIP AN

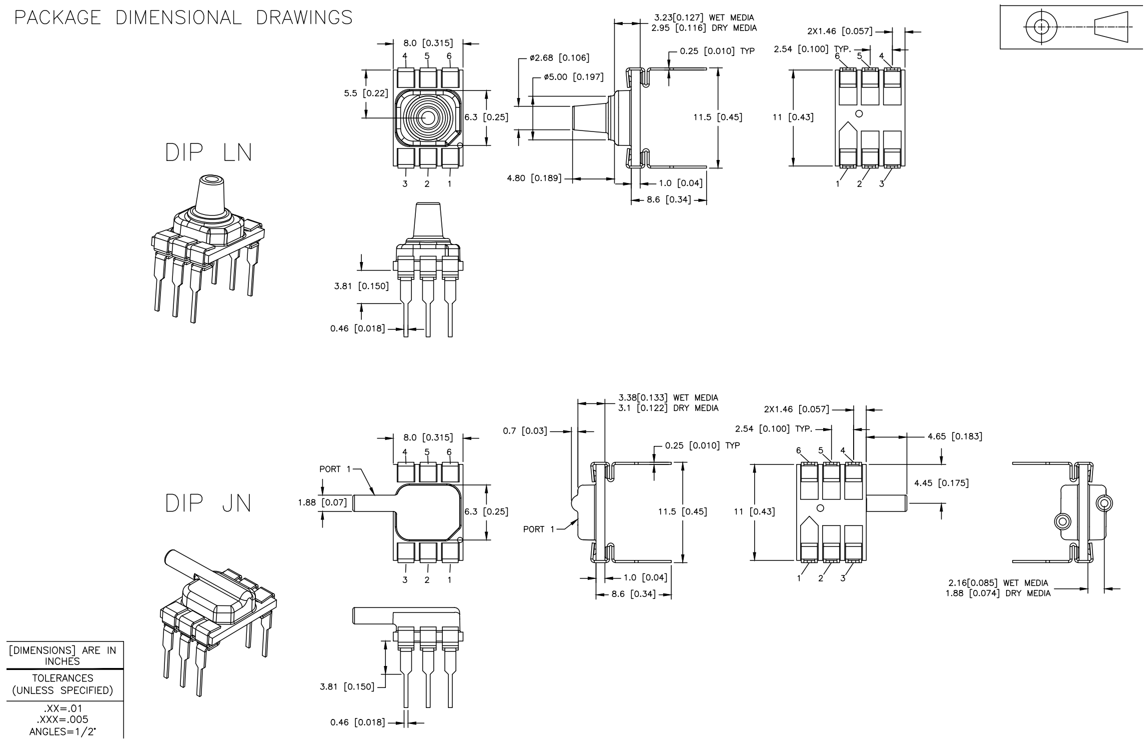


[DIMENSIONS] ARE IN INCHES
TOLERANCES (UNLESS SPECIFIED)
.XX=.01 .XXX=.005

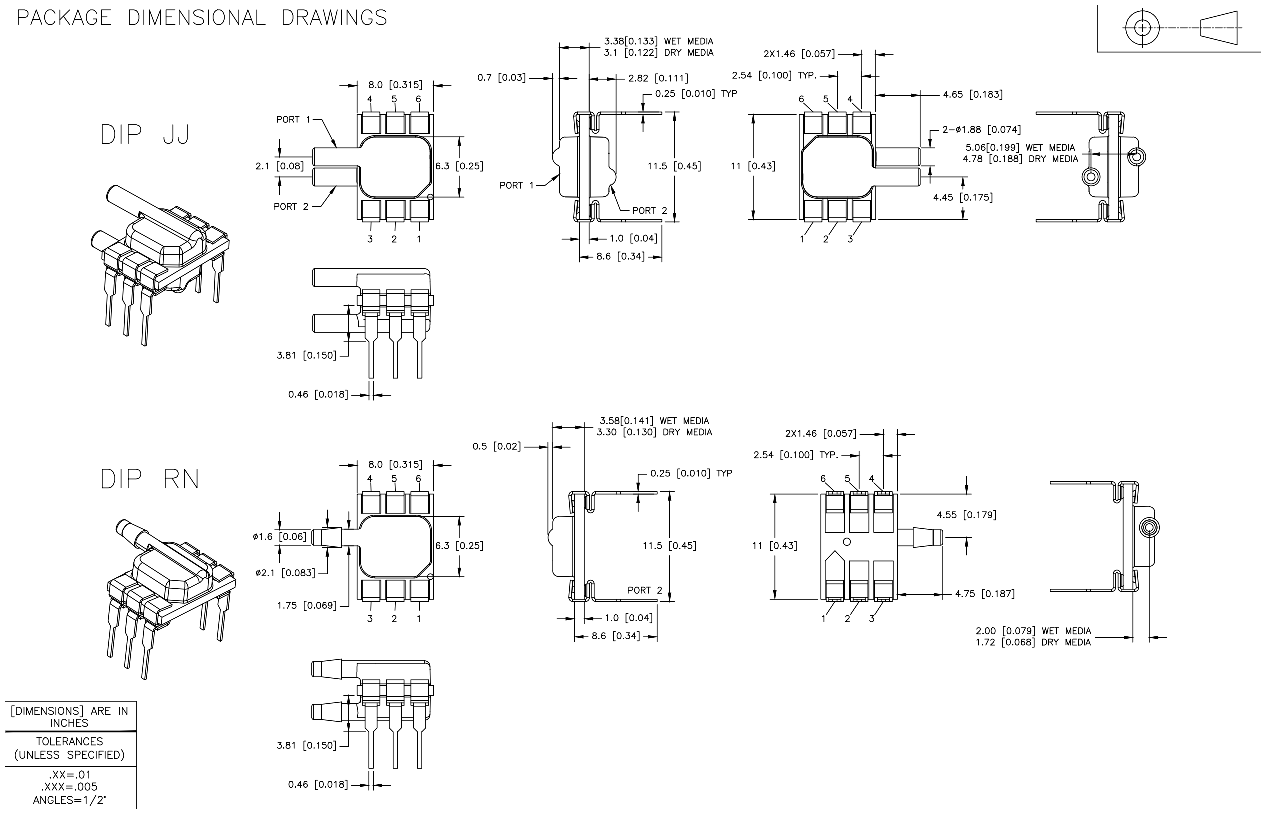
PC Board Mountable Pressure Sensor

MODEL SAABPC

PACKAGE DIMENSIONAL DRAWINGS



PACKAGE DIMENSIONAL DRAWINGS

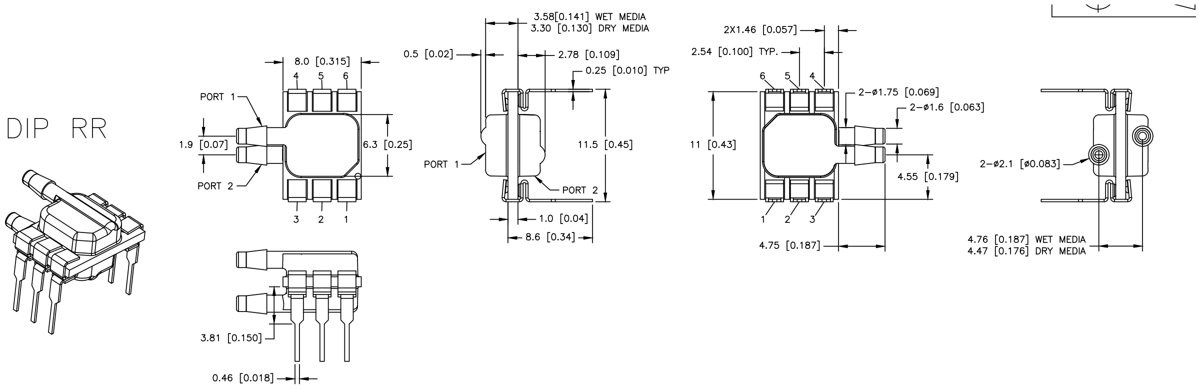


PC Board Mountable Pressure Sensor

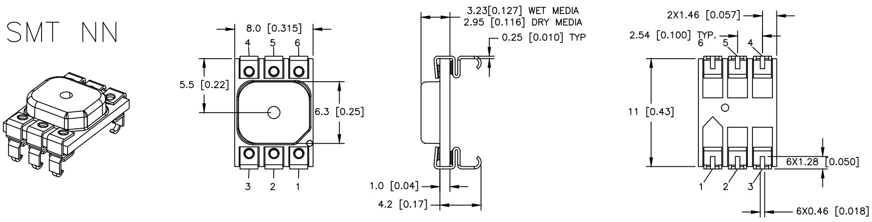
MODEL SAABPC

PACKAGE DIMENSIONAL DRAWINGS

DIP RR



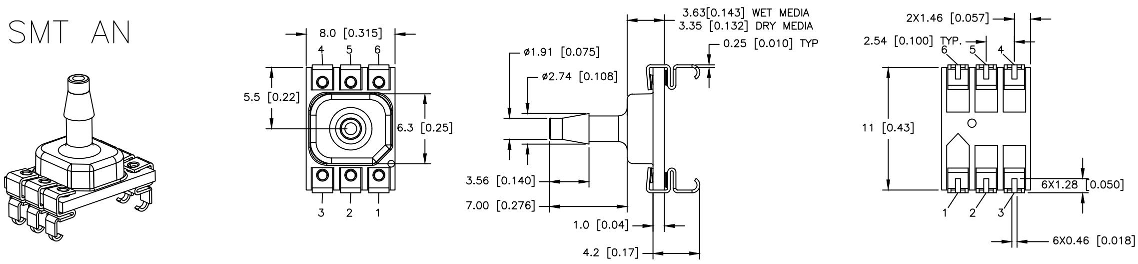
SMT NN



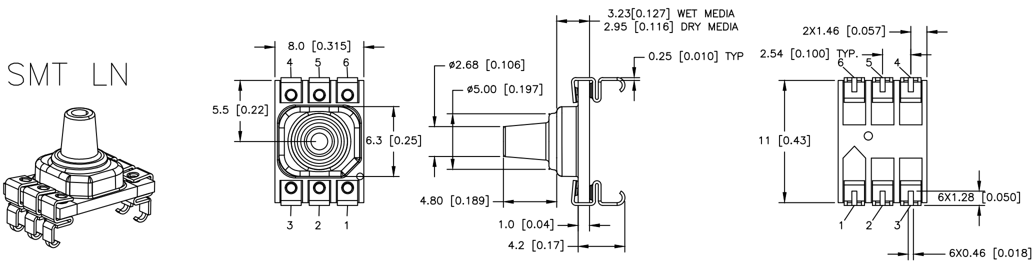
[DIMENSIONS] ARE IN INCHES
TOLERANCES (UNLESS SPECIFIED)
.XX=.01 .XXX=.005 ANGLES=1/2°

PACKAGE DIMENSIONAL DRAWINGS

SMT AN



SMT LN

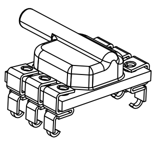


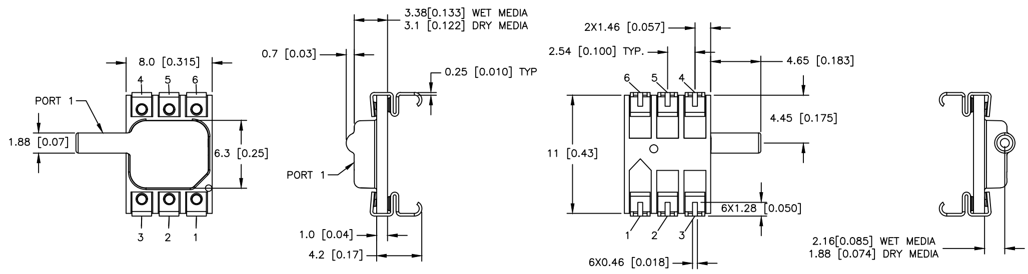
PC Board Mountable Pressure Sensor

MODEL SAABPC

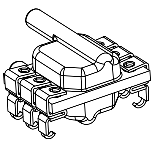
PACKAGE DIMENSIONAL DRAWINGS

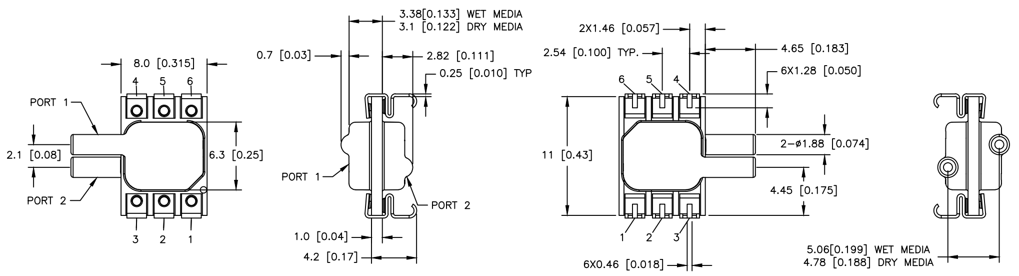
SMT JN





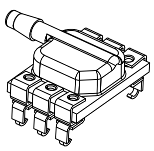
SMT JJ

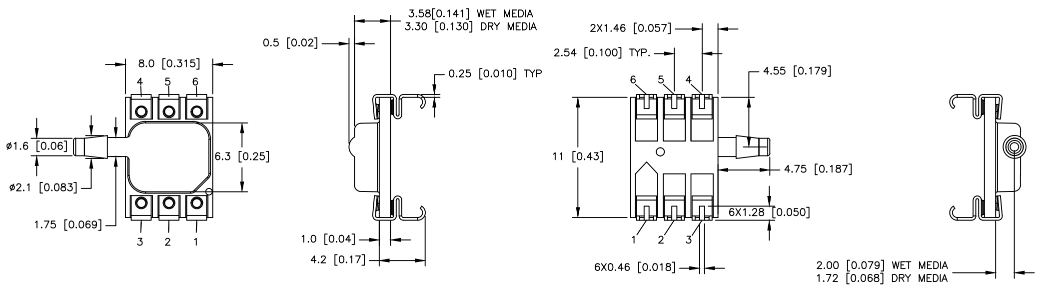




PACKAGE DIMENSIONAL DRAWINGS

SMT RN





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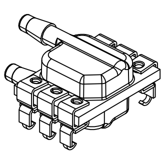
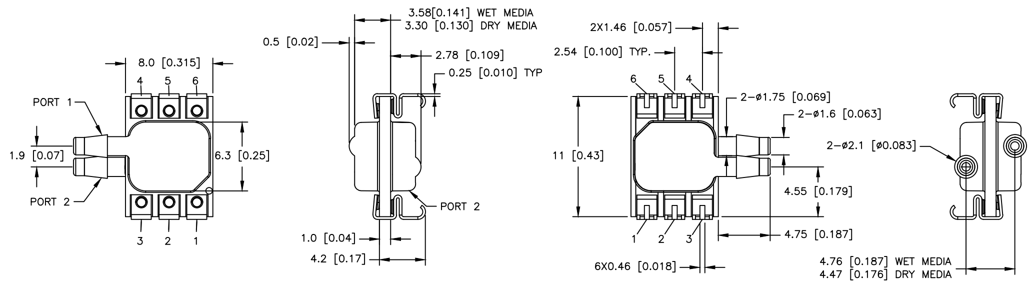


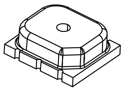


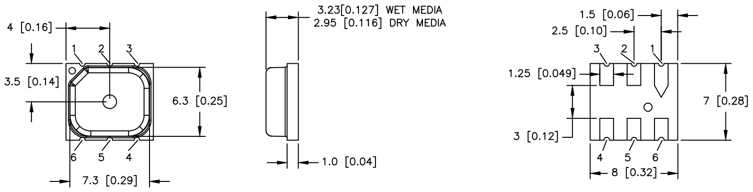
PC Board Mountable Pressure Sensor

MODEL SAABPC

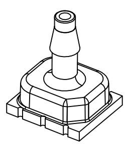
PACKAGE DIMENSIONAL DRAWINGS

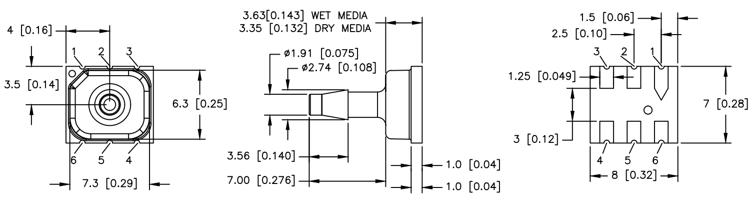
Leadless SMT NN



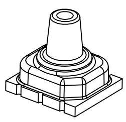


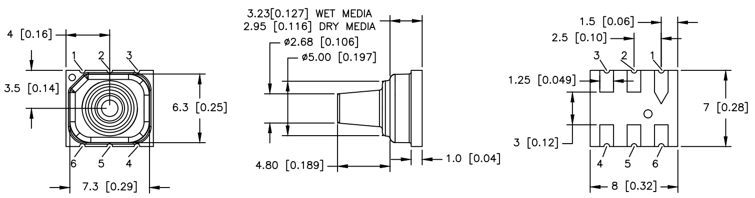
Leadless SMT AN





Leadless SMT LN



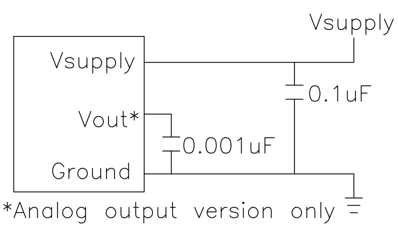


PACKAGE DIMENSIONAL DRAWINGS

PINOUTS

OUTPUT	PAD 1	PAD 2	PAD 3	PAD 4	PAD 5	PAD 6
I2C	GND	Vsupply	INT	NC	SDA	SCL
SPI	GND	Vsupply	SS	NC	MISO	SCLK
ANALOG	GND	NC	Vout	NC	NC	Vsupply

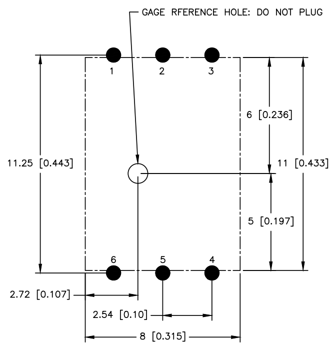
RECOMMENDED FILTER CAP



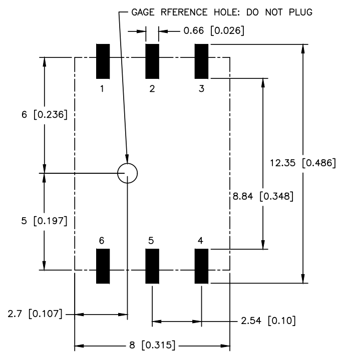
*Analog output version only

RECOMMENDED PCB LAYOUTS

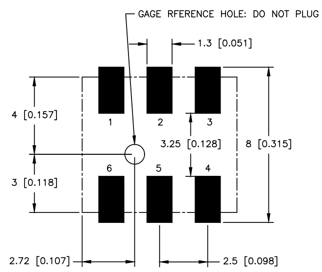
DIP



SMT



Leadless SMT



[DIMENSIONS] ARE IN INCHES
TOLERANCES (UNLESS SPECIFIED)
.XX=.01
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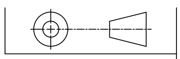
ANGLES=1/2°



PRESSURE
MODEL SA55

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

DESCRIPTION

SA55 High Accuracy Silicon Ceramic sensor is apiezoresistive silicon pressure sensor,offerin g an analog/digital output for reading pressure over the specified full-scale pressure span and temperature range. SA55 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperatue effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 1 kHz.

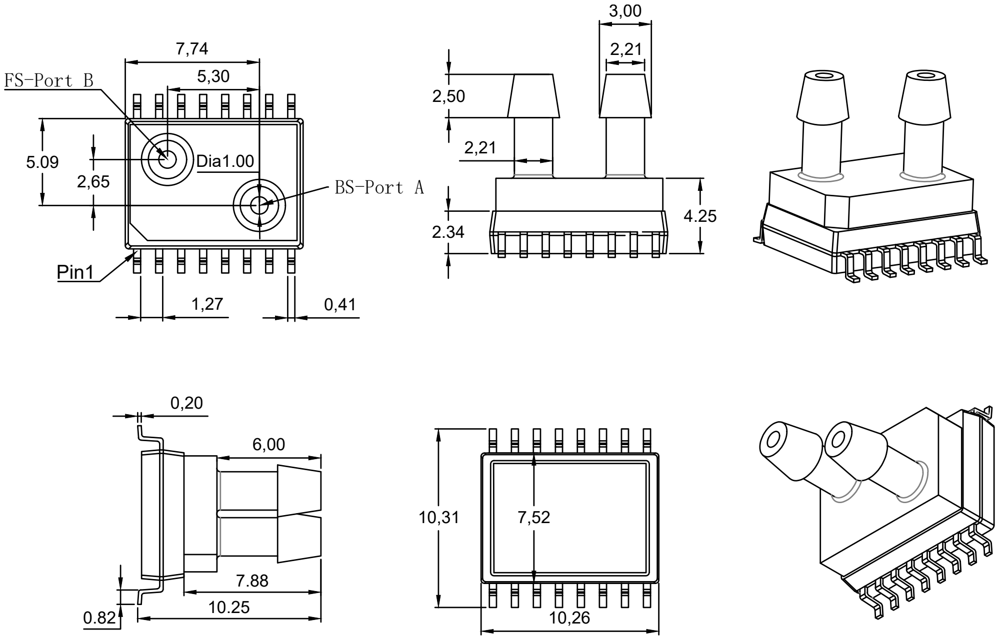
SA55 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA55 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

FEATURES

- Leak proof package:SA55 series pressure sensor is designed with leak proof package with side port and DIP. Basis substrate is optional with ceramic or FR4 PCB. Pressure port is optional with either ceramic or PPS material.
- Small size:10.3mm*10.3mm compact package.
- Energy efficient: Extremely low power consumption:Supply voltage is 3.3 or 5Volts
- RoHS compliant.
- Absolute, Differential and Gage pressure type.
- Wide variety of pressure ranges: Low pressure from ±1 mbar to±75 mbar, medium pressure from 1psi to 30psi, provide support for many unique applications.
- The 1/8” barbed pressure ports mate securely with 3/32” ID tubing.
- Customer orientation:Accuracy, Total error band and compensated temperature can be customized.
- Provides the sensor’s true accuracy over a compensated range of -10 °C to 60 °C.
- Industry-leading long-term stability:Even after long-term use and thermal extremes, these sensors perform substantially better relative to stability than any other pressure sensor available in the industry today.
- Industry-leading accuracy: Extremely tight accuracy of ±0.25 %FSS BFSL (Full Scale Span Best Fit Straight Line)
- Industry-leading Total Error Band (TEB): Sensorall International specifies TEB—the most comprehensive, clear, and meaningful measurement—that provides the sensor’s true accuracy over a compensated range of -10 °C to 60 °C.
- I2C- or SPI-compatible 14-bit digital output (min. 12-bit sensor resolution) accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors or microcontrollers;
- Digital output types can offer 10%~90% output or 5%~95% output for optional.

PRESSURE
MODEL SA55

DIMENSIONS



CONNECTION DIAGRAM									
Output type	Pin1-5	Pin6	Pin7	Pin8-9	Pin10	Pin11	Pin12	Pin13	Pin14-16
Analog	Blank	Blank	Blank	Blank	Blank	GND	Sig	V+	Blank
Digital	Blank	GND	V+	Blank	SDA	SCL	Blank	Blank	Blank

Notes

1.Maximum ratings are the extreme limits the device can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

2.The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

3.The compensated temperature range is the temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

4.The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.

5.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.

6.Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

7.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

8.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.

9.Life may vary depending on specific application in which sensor is utilized.

10.Contact Sensorall International Sales and Service for detailed material information.

11.Total Error Band After Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

12.Working Pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until pressure is returned to within the operating pressure range. Tested to 1 million cycles, min.

13.Overpressure: The absolute maximum rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range. Tested to 10,000 cycles, minimum.

14.Burst Pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

15.Common Mode Pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.Customized design please contact Sensorall International sales.

PC Board Mountable Pressure Sensor

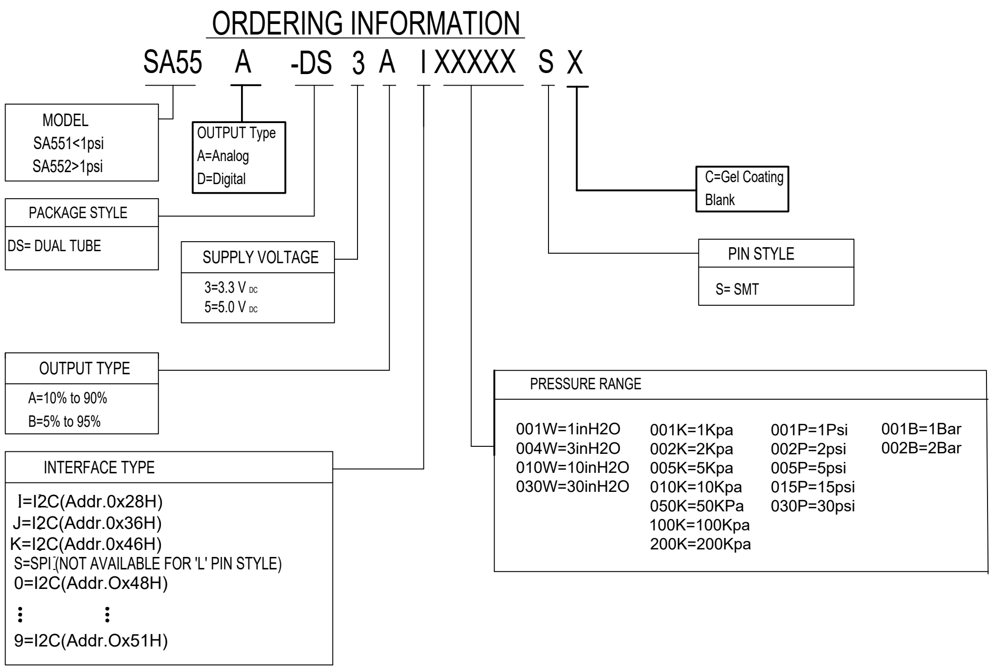
MODEL SA55

PERFORMANCE SPECIFICATIONS

Ambient Temperature: 25°C (Unless otherwise specified)

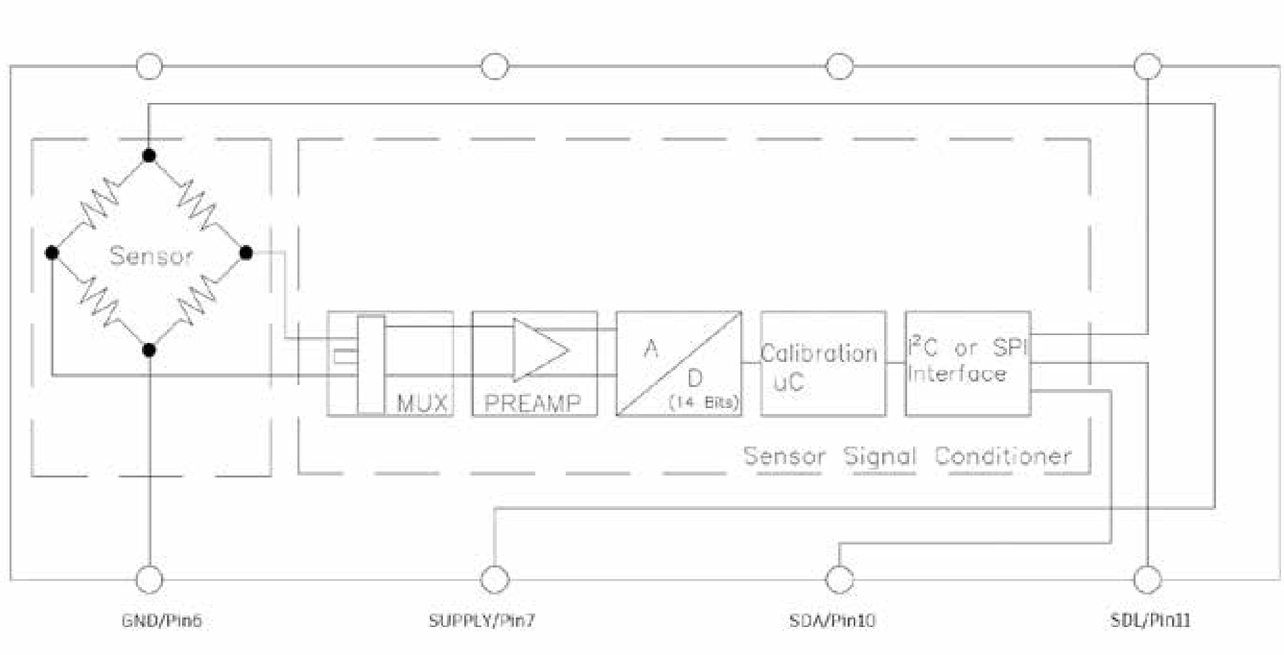
Parameter	MIN	TYP	MAX	UNITS
Supply Voltage (Vsupply) 3.3 5.0 Sensors are either 3.3 Vdc or 5.0 Vdc based on listing selected	3.0 4.75	3.3 [2] 5.0 [2]	3.6 5.25	Vdc Vdc
Supply current 3.3 Vdc supply 5.0 Vdc supply	2.1 3			mA mA
Compensated temperature range3	-10	-	60	℃
Operating temperature range 4	-40	-	125	℃
Startup time(power up to data ready)	-	2.8	7.3	ms
Response time	-	0.46	-	ms
I 2C/SPI voltage level low	-	-	0.2	Vsupply
I 2C/SPI voltage level low	0.8	-	-	Vsupply
Pull up on SDA/MISO, SCL/SCLK, SS	1	-	-	Kohm
Accuracy 5	-	-	±0.25	%FSS [7]
Orientation Sensitivity6	-	-	±0.15	%FSS [8]
Total Error Band (TEB)7	-1%	-	1%	%FSS
Over Pressure		>3		Times
Burst Pressure		>5		Times
OUTPUT RESOLUTION	11	-	14	Bits

Ordering Information

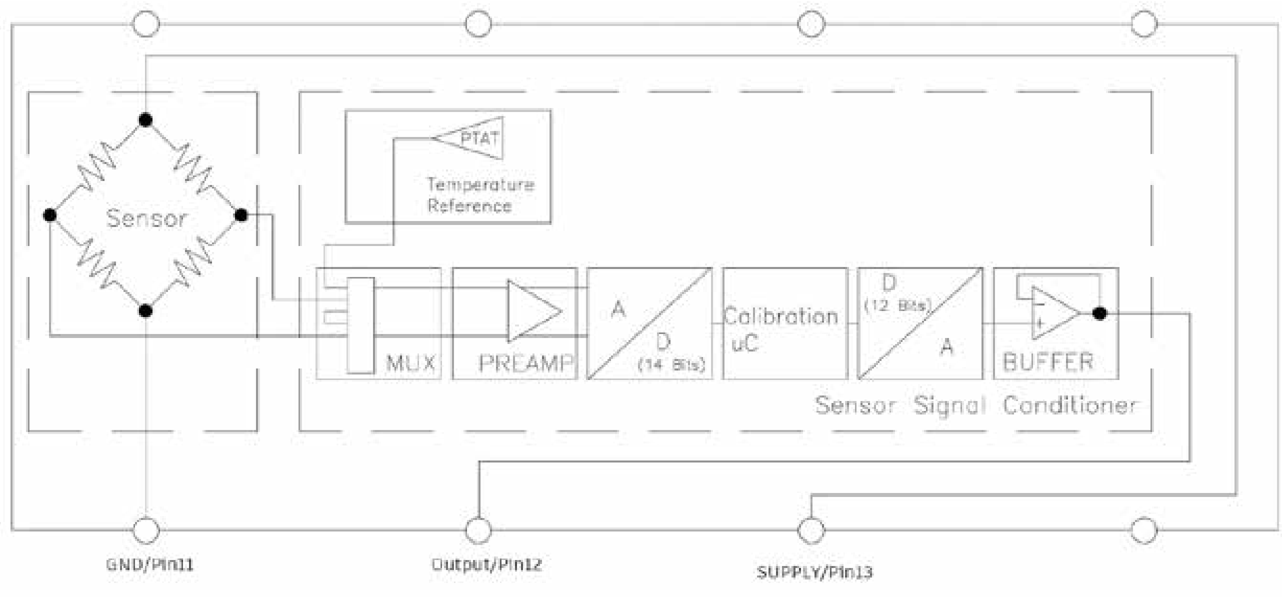


PC Board Mountable Pressure Sensor
MODEL SA55

Block Diagram



SA55 Digital output



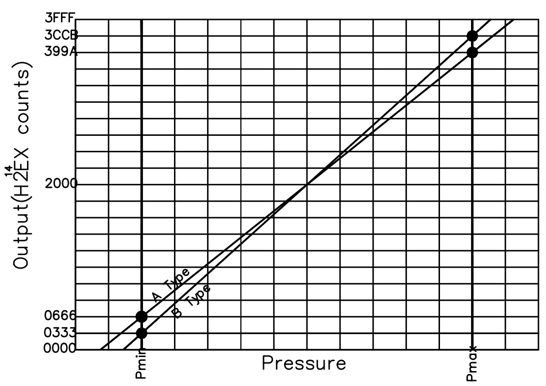
SA55 Analog output

PC Board Mountable Pressure Sensor

MODEL SA55

Pressure and Temperature transfer

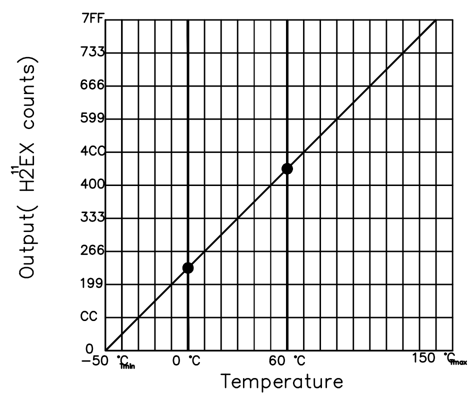
Pressure Transfer Functions



$$\text{A Type: Output(Decimal counts)} = \frac{80\% * 16383}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 10\% * 16383$$

$$\text{B Type: Output(Decimal counts)} = \frac{90\% * 16383}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 5\% * 16383$$

Temperature Transfer Functions



$$\text{Output (Decimal Counts)} = \frac{(Output - °C\ (-50°C)_{Tmin} * 2047)}{(150°C_{Tmax} - (-50°C)_{Tmin})}$$

Sensor Output at Significant Percentages

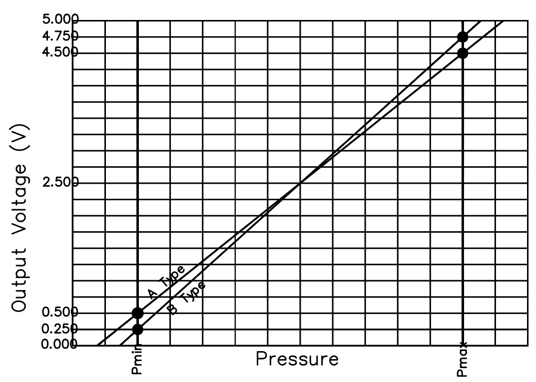
% of Counts	Output Type A (inH20)	Output Type B (inH20)	Digital Counts (decimal)	Digital Counts (hex)
0	Pmin-(Pmax-Pmin)*1/8	Pmin-(Pmax-Pmin)*5/90	0	0 X 0000
5		Pmin	819	0 X 0333
10	Pmin		1638	0 X 0666
50			8192	0 X 2000
90	Pmax		14746	0 X 399A
95		Pmax	15563	0 X 3CCB
100	Pmax+(Pmax-Pmin)*1/8	Pmax+(Pmax-Pmin)*5/90	16383	0 X 3FFF

Temperature Output vs Counts

Output °C	Digital Counts (decimal)	Digital Counts (hex)
-50	0	0 X 0000
0	511	0 X 01FF
10	614	0 X 0266
25	767	0 X 02FF
50	1023	0 X 03FF
85	1381	0 X 0565
150	2047	0 X 07FF

Digital Output

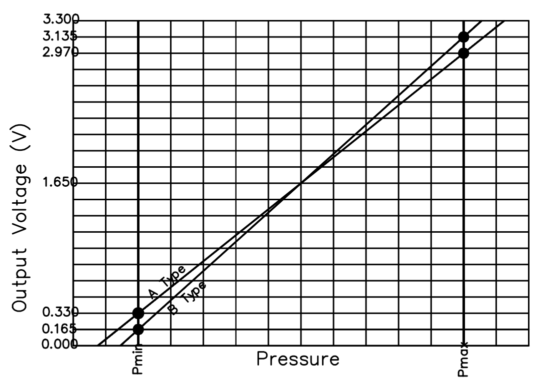
Pressure Transfer Functions, Supply=5V



$$\text{A Type: Output Voltage} = \frac{80\% \text{ *Supply Voltage}}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.500$$

$$\text{B Type: Output Voltage} = \frac{90\% \text{ *Supply Voltage}}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.250$$

Pressure Transfer Functions, Supply=3.3V



$$\text{A Type: Output Voltage} = \frac{80\% \text{ *Supply Voltage}}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.330$$

$$\text{B Type: Output Voltage} = \frac{90\% \text{ *Supply Voltage}}{Pmax - Pmin} * (Pressure_{applied} - Pmin) + 0.165$$

Sensor Output at Significant Percentages (Supply=5.000V)

% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.250
10	Pmin		0.500
50			2.500
90	Pmax		4.500
95		Pmax	4.750
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	5.000

Sensor Output at Significant Percentages (Supply=3.300V)

% Output	Output Type A (inH20)	Output Type B (inH20)	Voltage(V)
0	Pmin-(Pmax-Pmin)*10/80	Pmin-(Pmax-Pmin)*5/90	0.000
5		Pmin	0.165
10	Pmin		0.330
50			1.650
90	Pmax		2.970
95		Pmax	3.135
100	Pmax+(Pmax-Pmin)*10/80	Pmax+(Pmax-Pmin)*5/90	3.300

Analog Output

PRESSURE
MODEL SA54

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

DESCRIPTION

SA54 High Accuracy leadframe sensor is a piezoresistive silicon pressure sensor, offering an 24bits digital output for reading pressure over the specified full scale pressure span and temperature range. SA54 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50 Hz. SA54 Series is calibrated over the temperature range of 0 °C to 50 °C. The sensor is characterized for operation from a single power supply from 1.68 to 3.6 Vdc.

These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA54 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

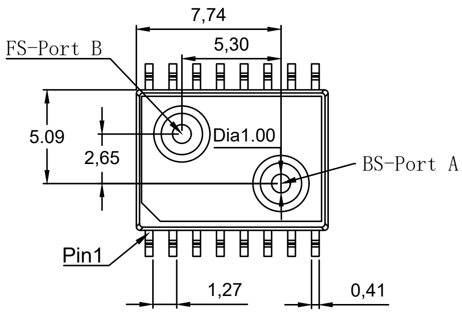
FEATURES

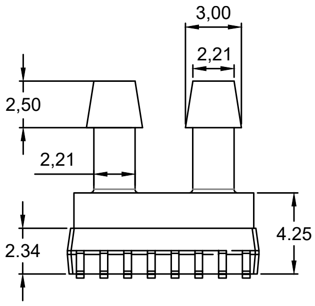
- Energy efficient: Extremely low power consumption:Supply voltage is from 1.68 to 3.6Volts
- RoHS compliant.
- Absolute, Differential and Gage pressure type.
- Wide variety of pressure ranges: Low pressure from ±1 mbar to±75 mbar, medium pressure from 1psi to 30psi, provide support for many unique applications.
- The 1/8” barbed pressure ports mate securely with 3/32” ID tubing.
- Customer orientation:Accuracy, Total error band and compensated temperature can be customized.
- Provides the sensor’s true accuracy over a compensated range of 0 °C to 50 °C.
- Industry-leading long-term stability:Even after long-term use and thermal extremes, these sensors perform substantially better relative to stability than any other pressure sensor available in the industry today.
- Industry-leading accuracy: Extremely tight accuracy of ±0.25 %FSS BFSL (Full Scale Span Best Fit Straight Line)
- Industry-leading Total Error Band (TEB): Sensorall International specifies TEB—the most comprehensive, clear, and meaningful measurement—that provides the sensor’s true accuracy over a compensated range of 0 °C to 50 °C.
- I2C compatible 24-bit digital output (min. 18-bit sensor resolution) accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors or microcontrollers;
- Digital output types can offer 10%~90% output or 5%~95% output for optional.

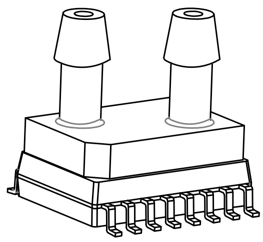
PRESSURE

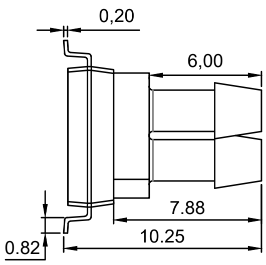
MODEL SA54

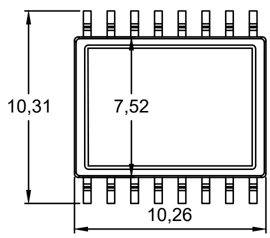
DIMENSIONS

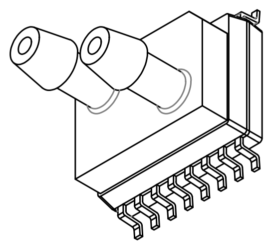












CONNECTION DIAGRAM

Pin	Pin1-3	Pin4	Pin5	Pin6	Pin8-9	Pin10	Pin11	Pin12	Pin13-16
I2C Output	Blank	SDA	SCL	Blank	Blank	VSS	VDD	Blank	Blank

Notes

1.Maximum ratings are the extreme limits the device can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

2.The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

3.The compensated temperature range is the temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

4.The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.

5.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.

6.Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

7.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

8.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.

9.Life may vary depending on specific application in which sensor is utilized.

10.Contact Sensorall International Sales and Service for detailed material information.

11.Total Error Band After Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span

12.Working Pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until pressure is returned to within the operating pressure range. Tested to 1 million cycles, min.

13.Overpressure: The absolute maximum rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range. Tested to 10,000 cycles, minimum.

14.Burst Pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

15.Common Mode Pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.

16.Customized design please contact Sensorall International sales.

PC Board Mountable Pressure Sensor

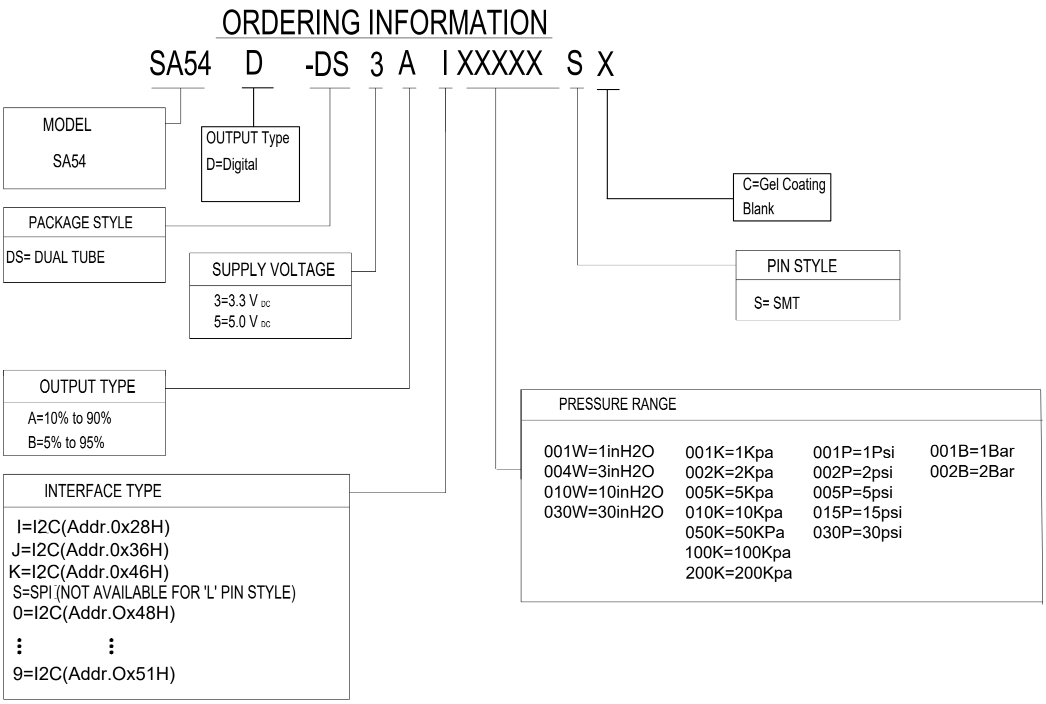
MODEL SA54

PERFORMANCE SPECIFICATIONS

Supply Current: 1.5mA
Ambient Temperature: 25°C (Unless otherwise specified)

Parameter	MIN	TYP	MAX	UNITS
Supply Voltage (Vsupply) 3.3	1.68	3.3 [2]	3.6	Vdc
Supply current 3.3 Vdc	3			mA
Compensated temperature range3	0	-	60	℃
Operating temperature range 4	-40	-	125	℃
Startup time(power up to data ready)	-	7	10	ms
Response time	-	1	-	ms
I^2C/SPI voltage level low	-	-	0.2	Vsupply
I^2C/SPI voltage level low	0.8	-	-	Vsupply
Pull up on SDA/MISO, SCL/SCLK, SS	1	-	-	Kohm
Accuracy 5	-	-	±0.25	%FSS
Orientation Sensitivity6	-	-	±0.15	%FSS [8]
Total Error Band (TEB)7	-1%	-	1%	%FSS
Over Pressure		>3		Times
Burst Pressure		>5		Times
OUTPUT RESOLUTION	12	-	24	Bits

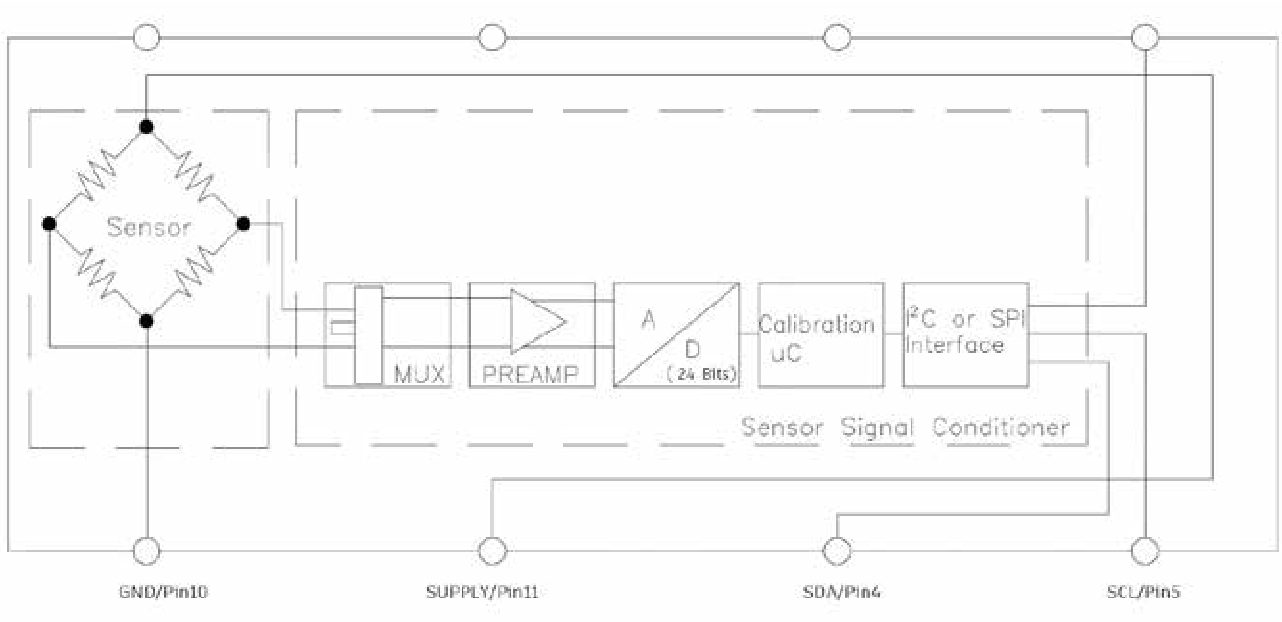
Ordering Information



PC Board Mountable Pressure Sensor

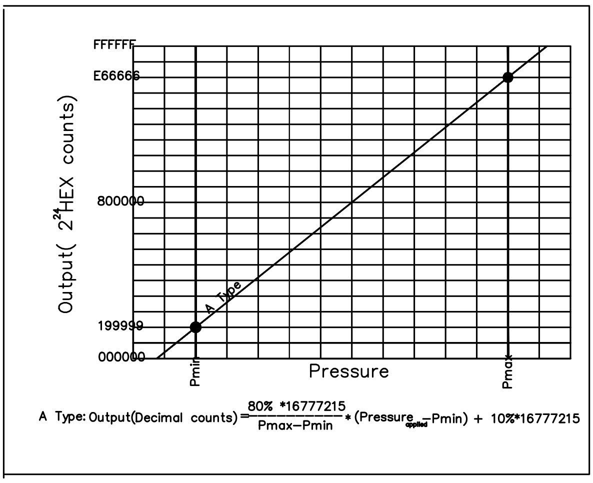
MODEL SA54

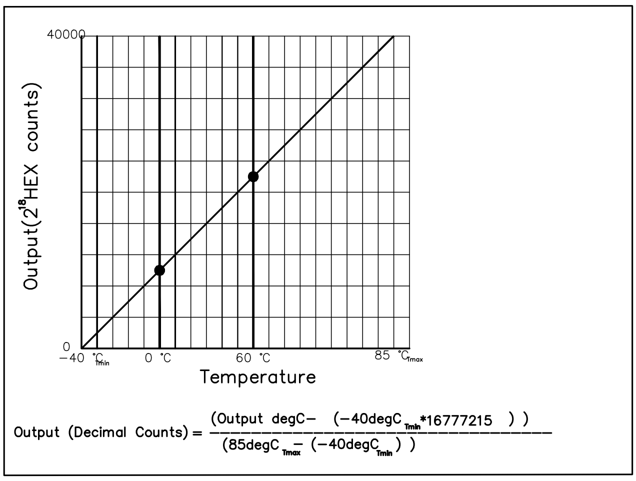
Block Diagram



SA54 Digital output

Pressure and Temperature transfer





PRESSURE
Model SA57

Anesthesia machines
Spirometers
Nebulizers
Hospital room air pressure

- Variable Air Volume control
- Static duct pressure
- HVAC transmitters
- Clogged HVAC filter detection

DESCRIPTION

SA57 High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor:offering an analog and digital output for reading pressure over the specified full-scale pressure span and temperature range. SA57 Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 2 kHz.

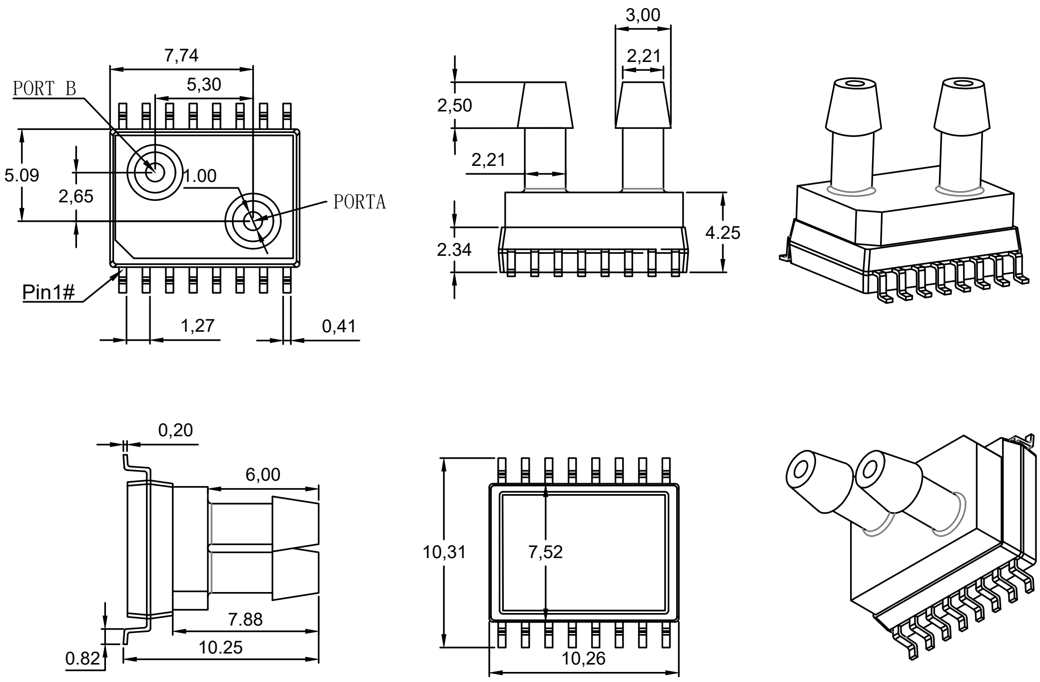
SA57 Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of either 3.3 Vdc or 5.0 Vdc. These sensors measure differential and gage pressures. Differential versions allow application of pressure to either side of the sensing diaphragm. Gage versions are referenced to atmospheric pressure and provide an output proportional to pressure variations from atmosphere. SA57 Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

FEATURES

- Leak proof package:SA57 series pressure sensor is designed with lead frame package with SO16 pin.
- Small size:10.3mm*10.3mm compact package.
- Energy efficient: Extremely low power consumption:Supply voltage is 3.3 or 5Volts
- RoHS compliant.
- Absolute, Differential and Gage pressure type.
- Wide variety of pressure ranges: Low pressure from ±1 mbar to±75 mbar, medium pressure from 1psi to 30psi, provide support for many unique applications.
- The 1/8” barbed pressure ports mate securely with 3/32” ID tubing.
- Customer orientation:Accuracy, Total error band and compensated temperature can be customized.
- Provides the sensor’s true accuracy over a compensated range of -20 °C to 85 °C.
- Industry-leading long-term stability:Even after long-term use and thermal extremes, these sensors perform substantially better relative to stability than any other pressure sensor available in the industry today.
- Industry-leading accuracy: Extremely tight accuracy of ±0.25 %FSS BFSL (Full Scale Span Best Fit Straight Line)
- Industry-leading Total Error Band (TEB): Sensorall International specifies TEB—the most comprehensive, clear, and meaningful measurement—that provides the sensor’s true accuracy over a compensated range of -10 °C to 60 °C.
- I2C- or SPI-compatible 16-bit digital output (min. 12-bit sensor resolution) accelerates performance through reduced conversion requirements and the convenience of direct interface to microprocessors or microcontrollers;
- Digital output types can offer 10%~90% output or 5%~95% output for optional.

PRESSURE
Model SA57

DIMENSIONS



CONNECTION DIAGRAM									
Pin	Pin1-3	Pin4	Pin5	Pin6	Pin8-9	Pin10	Pin11	Pin12	Pin13-16
Analog	Blank	Vss	Vdd	Sig	Blank	Blank	Blank	Blank	Blank
Digital(SPI)	Blank	Vss	Vdd	Blank	MOSI	MISO	SCLK	SS	Blank
Digital(I2C)	Blank	Vss	Vdd	Blank	Blank	SDA	SCL	Blank	Blank

Notes

1.Maximum ratings are the extreme limits the device can withstand without damage to the product. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.

2.The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.

3.The compensated temperature range is the temperature range over which the sensor will produce an output proportional to pressure within the specified performance limits.

4.The operating temperature range is the temperature range over which the sensor will produce an output proportional to pressure but may not remain within the specified performance limits.

5.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.

6.Orientation sensitivity: The maximum change in offset of the sensor due to a change in position or orientation relative to Earth's gravitational field.

7.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.

8.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.

9.Life may vary depending on specific application in which sensor is utilized.

10.Contact Sensorall International Sales and Service for detailed material information.

11.Total Error Band After Auto-Zero: The maximum deviation from the ideal transfer function over the entire compensated pressure range at a constant temperature and supply voltage for a minimum of 24 hours after an auto-zero operation. Includes all errors due to full scale span, pressure non-linearity, pressure hysteresis, and thermal effect on span.

12.Working Pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until pressure is returned to within the operating pressure range. Tested to 1 million cycles, min.

13.Overpressure: The absolute maximum rating for pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range. Tested to 10,000 cycles, minimum.

14.Burst Pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.

15.Common Mode Pressure: The maximum pressure that can be applied simultaneously to both ports of a differential pressure sensor without causing changes in specified performance.

16.Customized design please contact Sensorall International sales.

PC Board Mountable Pressure Sensor
Model SA57

PERFORMANCE SPECIFICATIONS

Ambient Temperature: 25°C (Unless otherwise specified)

CHARACTERISTIC		ANALOG			DIGITAL			UNITS	NOTES
		MIN	TYP	MAX	MIN	TYP	MAX		
Supply voltage	3.3 Vdc	3.0	3.3	3.6	3.0	3.3	3.6	Vdc	1,2,3
	5.0 Vdc	4.75	5.0	5.25	4.75	5.0	5.25		
Supply current	3.3 Vdc	-	2.1	2.8	-	3.1	3.9	mA	
	5.0 Vdc	-	2.7	3.8	-	3.7	4.6	mA	
Operating temperature range		-40	-	+85	-40	-	85	°C	4
Compensated temperature range		-10	-	60	-10	-	50	°C	4
Temperature output option		-	-	-	-	±4	-	°C	6
Startup time (power up to data ready)		-	-	5	-	-	5	mS	
Response time		-	1	-	-	2	-	mS	
Clipping limit	upper	-	-	97.5	-	-	-	%Vsupply	
	lower	2.5	-	-	-	-	-		
I²C/SPI voltage level	low	-	-	-	-	-	20	%Vsupply	
	high	-	-	-	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		-	-	-	1	-	-	kOhm	
Total Error Band		-	-	±1.5	-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	-	-	±0.25	%FSS	
Output resolution		0.3	-	-	-	-	-	%FSS	
		-	-	-	12	-	16	bits	

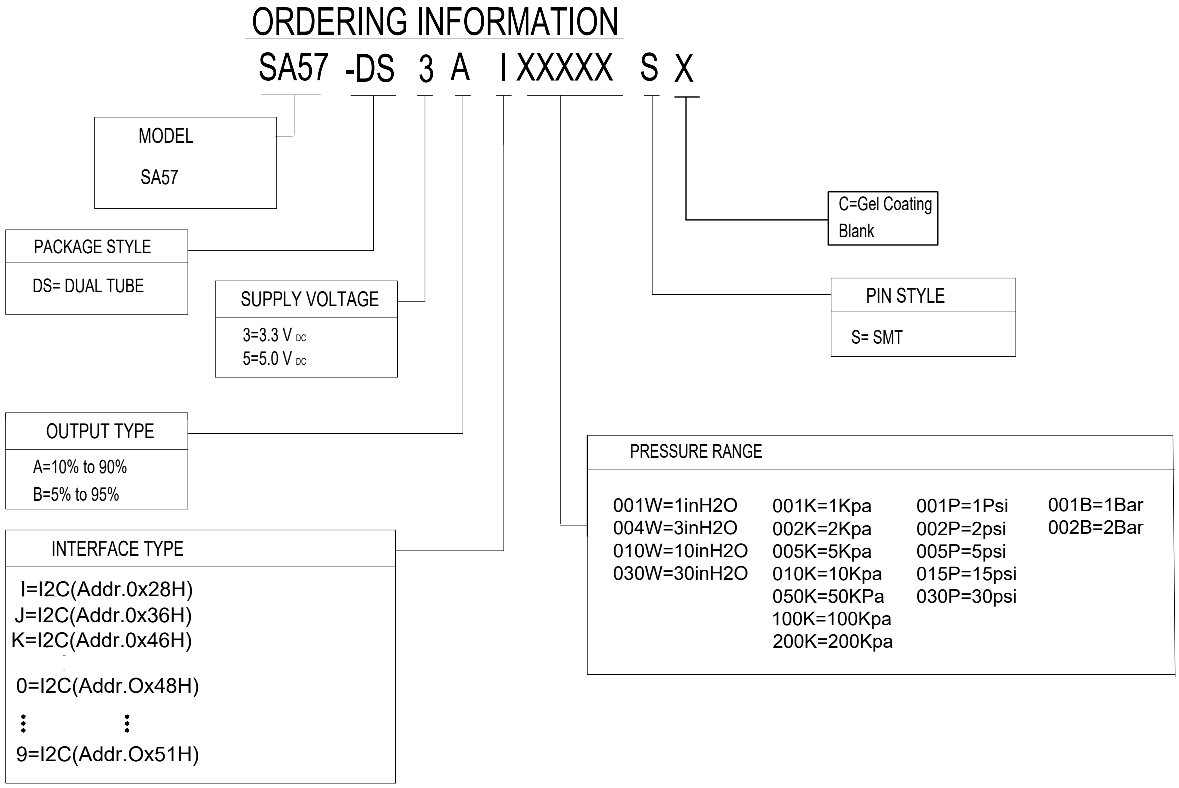
Notes

1. Sensors are either 3.3 Vdc or 5.0 Vdc based on the catalog listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of 0°C to 50°C.
   Operation in Sleep Mode may affect temperature output error depending on duty cycle.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

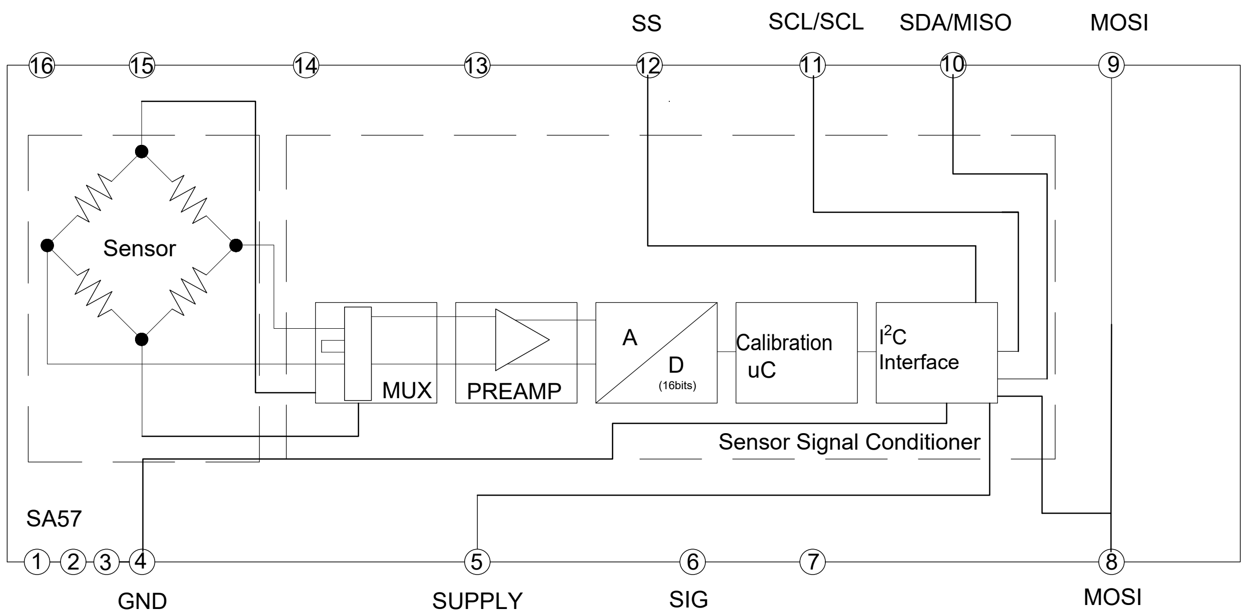
PC Board Mountable Pressure Sensor

Model SA57

Ordering Information



Block Diagram



MODEL SA1620

Disposable Medical Sensor

Disposble Blood Pressure Sensor
AAMI Specification
Low Cost
Multiple Configurations

- **Disposable Blood Pressure**
- **Kidney Dialysis Machines**
- **Medical Instrumentation**

DESCRIPTION

The Model SA1620 is a fully piezoresistive silicon pressure sensor for use in invasive blood pressure monitoring. The sensor is designed to be used with automated assembly equipment and can be dropped directly into a customer's disposable blood pressure housing. The sensor is designed to meet the requirements as described in the Association for the Advancement of Medical Instrumentation (AAMI) specification for Blood Pressure Transducers.

The pressure sensor consists of a pressure sensing element mounted on a ceramic substrate. Thick-film resistors on the ceramic substrate are laser-trimmed for compensation and calibration.

A plastic cap is attached to the ceramic substrate to provide an easy method of attachment to the customers assembly and protection for the sensing element. A dielectric gel is placed over the sensor to provide electrical and fluid isolation.

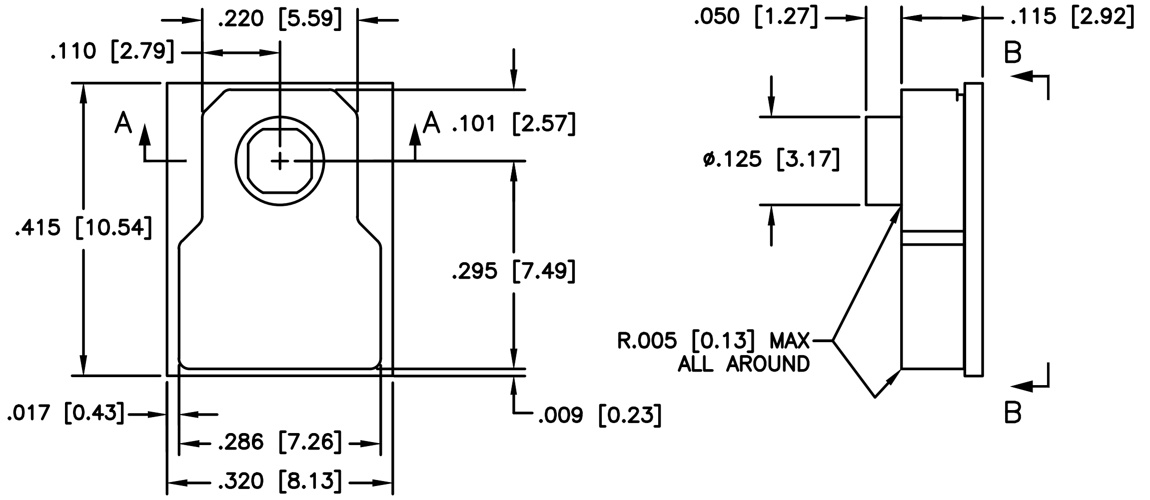
The Model SA1620 pressure sensors are batch manufactured in a 10 x 5 element array on a ceramic substrate (50 units per substrate). The products are shipped in anti-static shipping containers. Performance characteristics and packaging can be easily tailored on a special order basis to meet the requirements of specific customers.

FEATURES

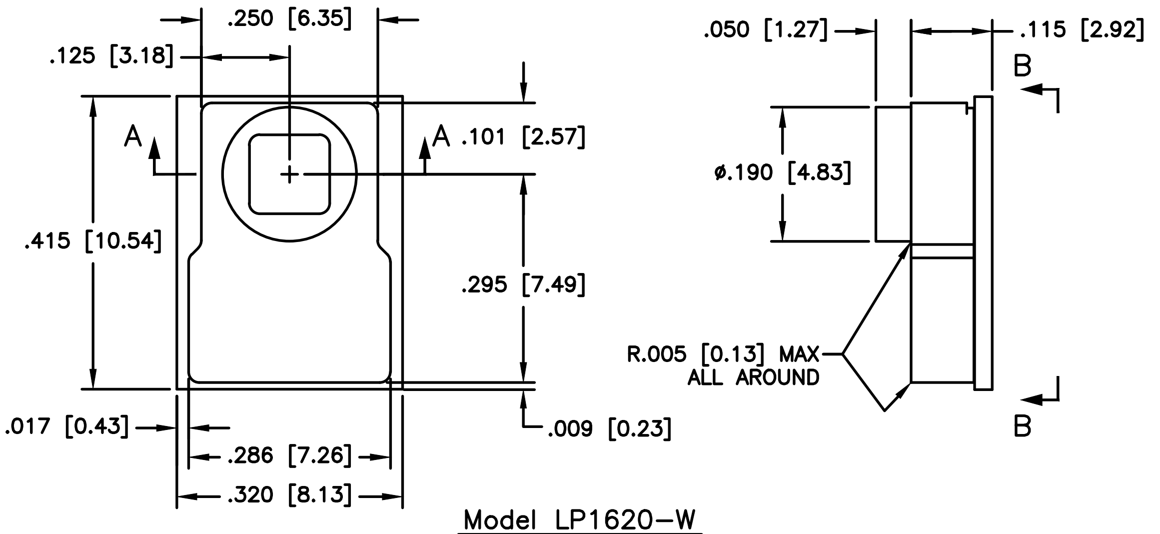
- Low Cost Disposable Design
- Solid State Piezoresistive Sensor
- Top Side Pressure Entry
- Compatible with Automated Assembly Equipment
- Integral Dielectric Gel Barrier
- Fully Tested and Compensated

MODEL SA1620

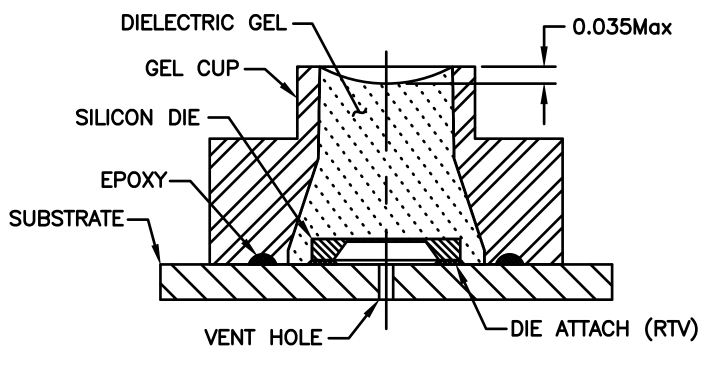
DIMENSIONS



Model LP1620–N



Model LP1620–W



SECTION A–A

MODEL SA1620

PERFORMANCE SPECIFICATIONS

PARAMETERS	MIN	TYP	MAX	UNITS
Power Supply (Vsupplly)	1	6	10	Vdc
Operating Pressure Range Custom Pressure Range selectable	-50 1	-	300 100	mmHg PSI
Overpressure	125	-	-	PSI
Dielectric Breakdown	-	10000		Vdc
Risk Current	-	-	2	uA
Standard Input Impedance Custom Input Impedance	1200 2000	-	3300 6000	Ohm
Standard Output impedance Custom Output Impedance	285 2000	-	315 6000	Ohm
Operating Temperature	10	-	40	℃
Storage Temperature	-25	-	70	℃
Humidity (External)	10	-	90	%RH
Light Sensitivity	-	-	1	mmHg
Operating Product Life	-	168		Hour
Shelf Life	-	5	-	Year
Weight		2		Gram
Volume Displacement			0.02	Mm^3
Offset	-20	-	20	mmHg
Standard Sensitivity Custom Sensitivity	4.95 39.6	5 40	5.05 40.4	uV/V/mmHg
Output Symmetry	-5		5	%
Linearity (-50-100mmHg)	-	-	1	mmHg
Linearity (100-200mmHg)	-	-	1	%Output
Linearity (200-300mmHg)	-	-	1.5	%Output
Thermal Offset Shift	-0.3	-	+0.3	mmHg/℃
Thermal Span Shift	-0.1	-	0.1	%/℃
Frequency Response	1200			Hz
Phase Shift	-	-	5	℃
Offset Stability			1	mmHg/8hrs
Media Interface	Dielectric Gel			
Gel Cup	PSU			

Notes

1. Output of sensor with no pressure applied and a 150kΩ resistor shorted across +VIN to +OUT.
2. For input impedance of 350 Ohms ± 5% select pad configuration 1.
3. Over an 8 hour time period and after warm-up.
4. Over operating temperature range (+10°C to +40°C).
5. One discharge per minute performed by customer.
6. Sterilization performed by customer.
7. Defined as common mode symmetry between signal output and either excitation terminal.
8. Best fit straight line.

Ordering Information

SA1620 - X - Y - T

MODEL：SA1620

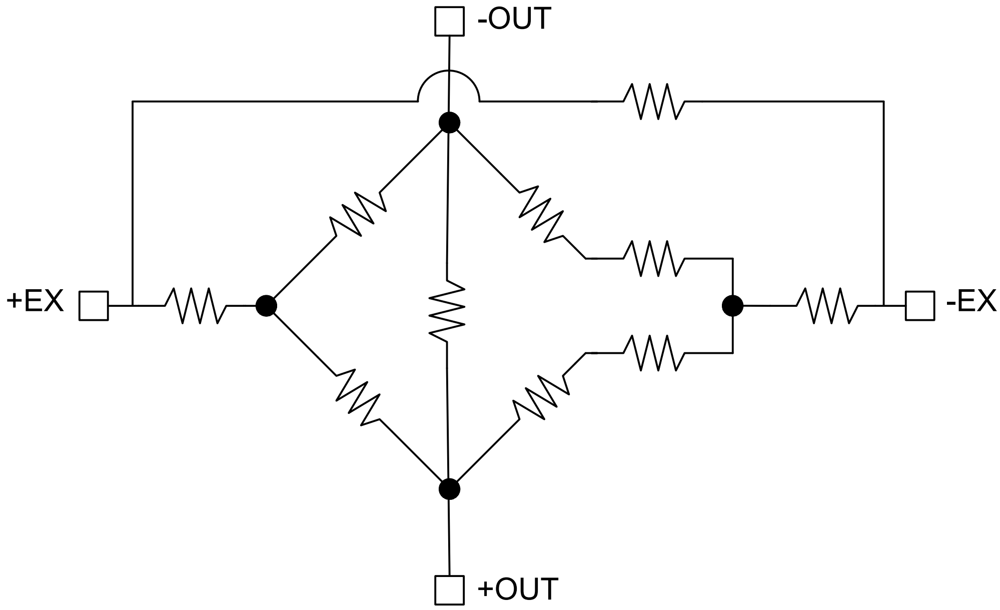
X: H=300mmHg, 3=30PSI, 6=60PSI, A=100PSI

Y: N= Narrow, W=Wide

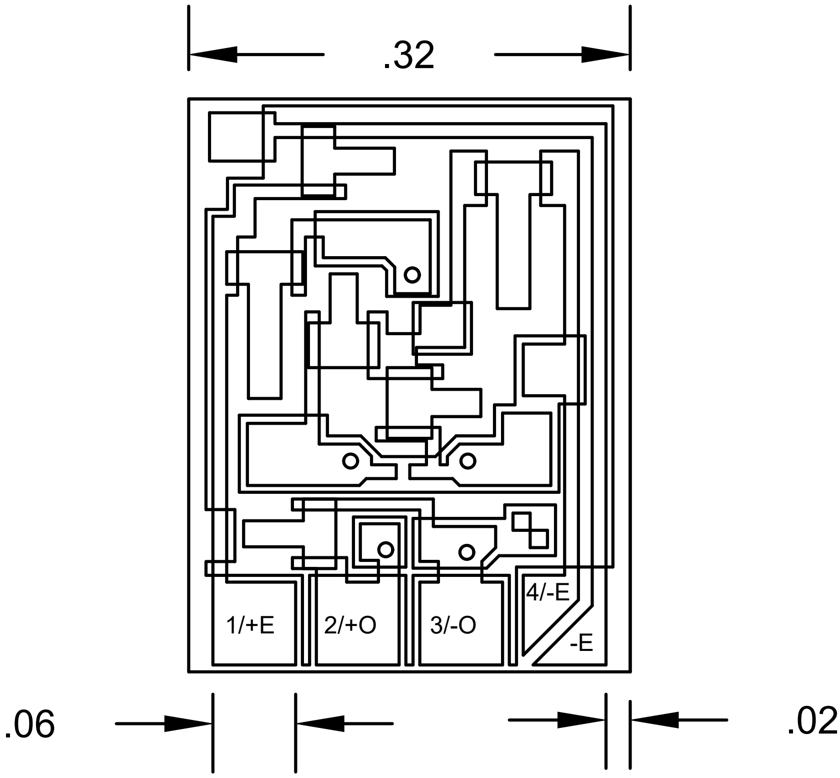
T= Tape & Reel

MODEL SA1620

Equivalent Circuits



PAD DEFINITION



1： E+

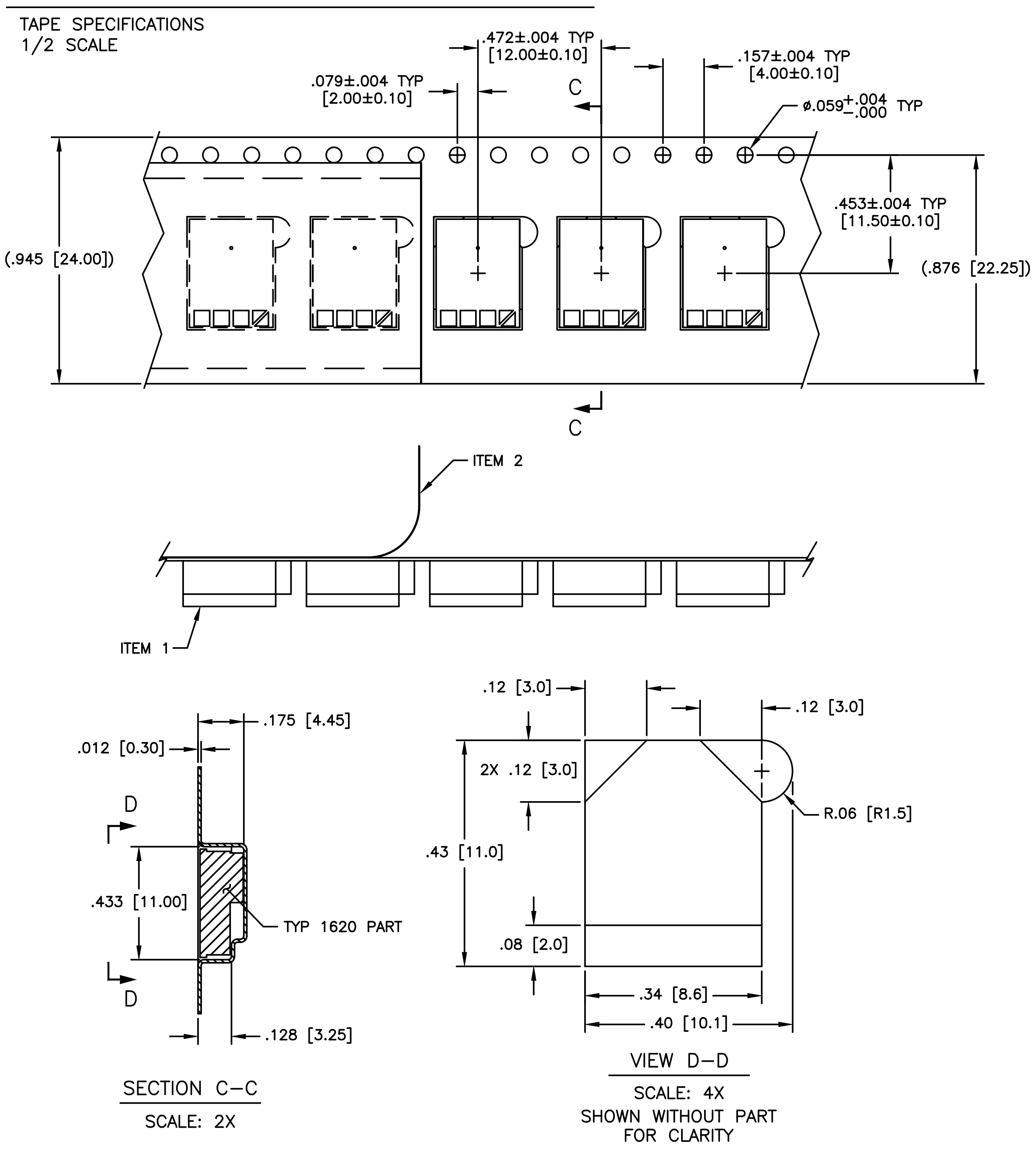
2： O+

3： O−

4： E−

MODEL SA1620

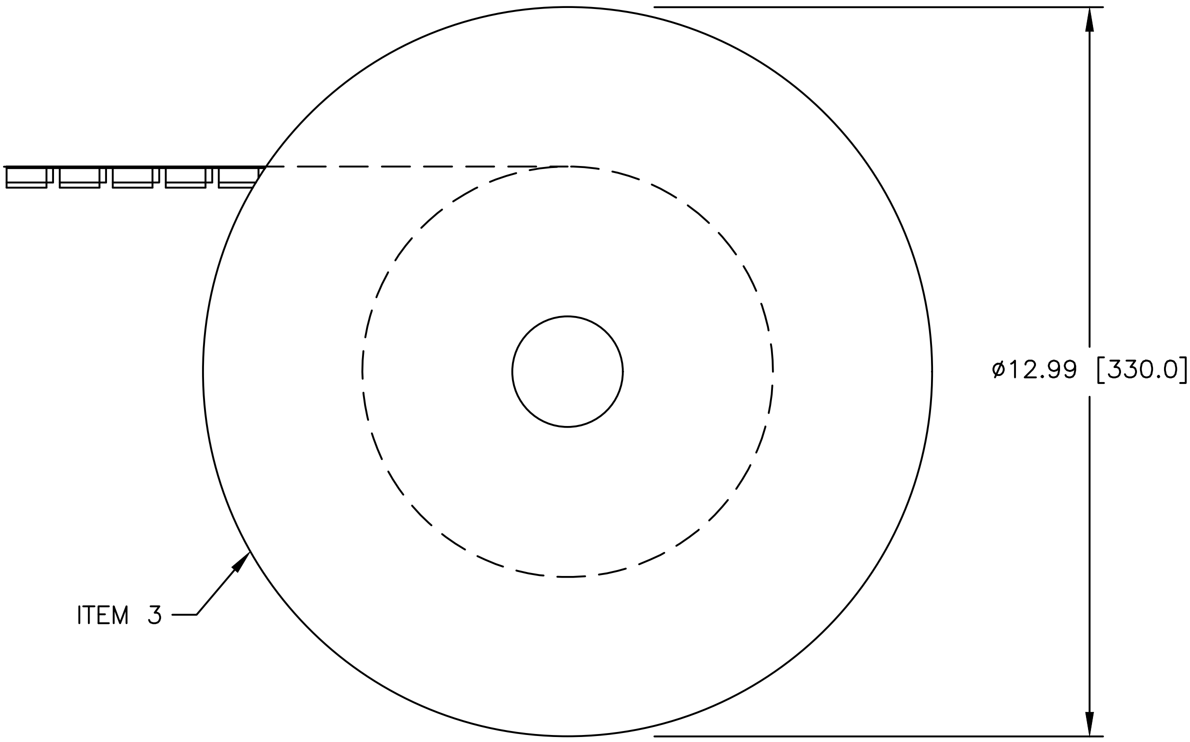
PACKAGING



MODEL SA1620

PACKAGING

REEL SPECIFICATIONS
1/8 SCALE



TAPE AND REEL INFO

A) MATERIAL:

ITEM 1, CARRIER TAPE: POLYCARBONATE

ITEM 2, COVER TAPE: POLYCARBONATE, HEAT PRESSURE SEAL

ITEM 3, PACKAGING TRAY: PLASTIC

B). TOTAL PEEL STRENGTH SHOULD BE 10 TO 130 GRAMS.

C). REFERENCE DOC: ANSI/EIA-481-C: 8mm THROUGH 200mm EMBOSSED CARRIER TAPING, 8mm AND 12mm PUNCHED CARRIER TAPING OF SURFACE MOUNT COMPONENTS FOR AUTOMATIC HANDLING.

Disposable Medical Sensor

MODEL SA1620HD

Disposble Blood Pressure Sensor
AAMI Specification
Low Cost
Multiple Configurations

- **Disposable Blood Pressure**
- **Kidney Dialysis Machines**
- **Medical Instrumentation**

FEATURES

- Low Cost Disposable Design
- Solid State Piezoresistive Sensor
- Top Side Pressure Entry
- Compatible with Automated Assembly Equipment
- Integral Dielectric Gel Barrier
- Fully Tested and Compensated

DESCRIPTION

The Model SA1620HD is a fully piezoresistive silicon pressure sensor for use in invasive blood pressure monitoring. The sensor is designed to be used with automated assembly equipment and can be dropped directly into a customer's disposable blood pressure housing. The sensor is designed to meet the requirements as described in the Association for the Advancement of Medical Instrumentation (AAMI) specification for Blood Pressure Transducers.

SA1620HD High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SA1620HD Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

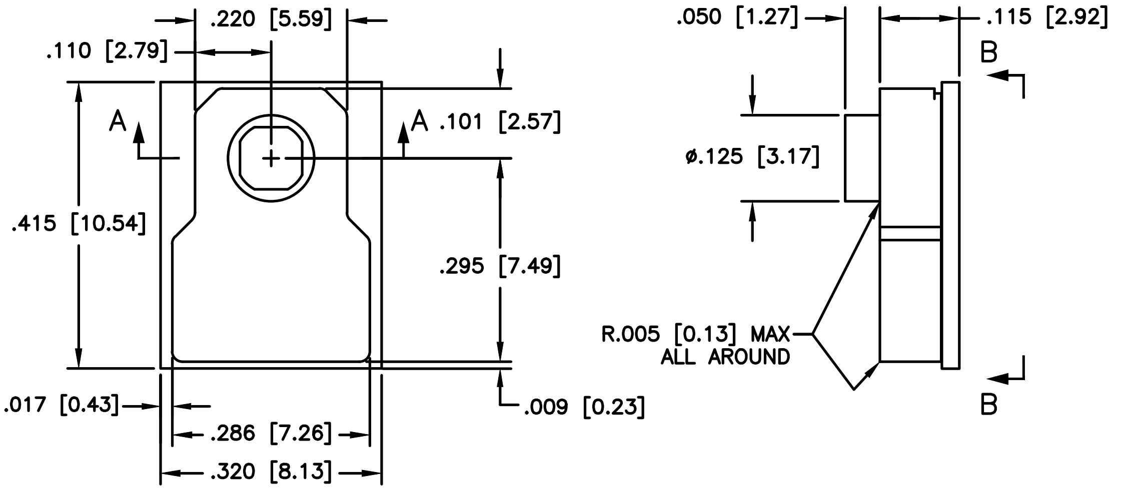
SA1620HD Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc . SA1620HD Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

A plastic cap is attached to the ceramic substrate to provide an easy method of attachment to the customers assembly and protection for the sensing element. A dielectric gel is placed over the sensor to provide electrical and fluid isolation.

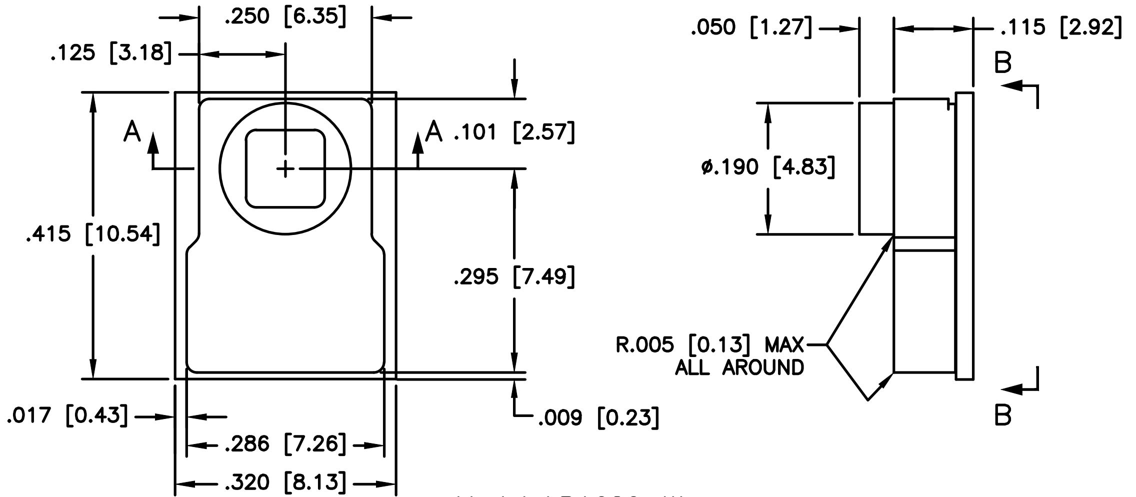
The Model SA1620HD pressure sensors are batch manufactured in a 10 x 5 element array on a ceramic substrate (50 units per substrate). The products are shipped in anti-static shipping containers. Performance characteristics and packaging can be easily tailored on a special order basis to meet the requirements of specific customers.

MODEL 1620HD

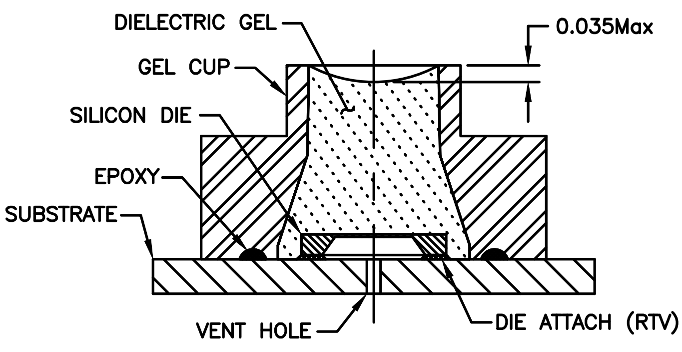
DIMENSIONS



Model LP1620–N



Model LP1620–W



SECTION A–A

Disposable Medical Sensor

MODEL SA1620HD

PERFORMANCE SPECIFICATIONS

PARAMETERS		MIN	TYP	MAX	UNITS	NOTES
Power Supply (Vsupplly)		3.0	3.3	3.6	Vdc	1,2,3
Operating Pressure Range Custom Pressure Range selectable		-50 1	-	300 100	mmHg PSI	
Supply current	I2C/sleep/Standby Mode	3.0	33.8	211	uA	
	SPI/sleep/Standby Mode	13	43.8	211	uA	
Overpressure		125	-	-	PSI	
Compensated temperature range		-10	-	50	°C	4
Temperature output option		-	±4	-	°C	6
Startup time (power up to data ready)		-	-	3	mS	
Response time		2	7	10	mS	
I^{2}C/SPI voltage level	low	-	-	20	%Vsupply	
	high	80	-	-		
Pull up on SDA/MISO, SCL/SCLK, SS		1	-	-	kOhm	
Total Error Band		-	±1	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		-	-	-	%FSS	
		12	-	-	bits	
Dielectric Breakdown		-	10000		Vdc	
Risk Current		-	-	2	uA	
Operating Temperature		10	-	40	℃	
Storage Temperature		-25	-	70	℃	
Humidity (External)		10	-	90	%RH	
Light Sensitivity		-	-	1	mmHg	
Operating Product Life		-	168		Hour	
Shelf Life		-	5	-	Year	
Weight			2		Gram	
Volume Displacement				0.02	Mm^3	
Offset		-20	-	20	mmHg	
Thermal Offset Shift		-0.3	-	+0.3	mmHg/℃	
Thermal Span Shift		-0.1	-	0.1	%/℃	
Frequency Response		1200			Hz	
Phase Shift		-	-	5	℃	
Offset Stability				1	mmHg/8hrs	
Media Interface		Dielectric Gel				
Gel Cup		PSU				

MODEL SA1620HD

Notes

1. Sensors are 3.3 Vdc based on the specification listing selected.
2. Ratiometricity of the sensor (the ability of the device output to scale to the supply voltage) is achieved within the specified rating voltage.
3. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
4. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
5. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
6. Temperature output option: Typical temperature output error over the compensated temperature range of -10°C to 60°C.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE

SA1620HD X X X X X

Product Series
- Model: SA1620HD

Pressure Range
- 5−=300mmHg
- 6=60psi
- A=100psi
- B =150psi

PORT
- N= Narrow
- W= Wide

Output Address
- 0 I²C, Address 0x08
- 1 I²C, Address 0x18
- 2 I²C, Address 0x28
- 3 I²C, Address 0x38
- 4 I²C, Address 0x48
- 5 I²C, Address 0x58
- 6 I²C, Address 0x68
- 7 I²C, Address 0x78

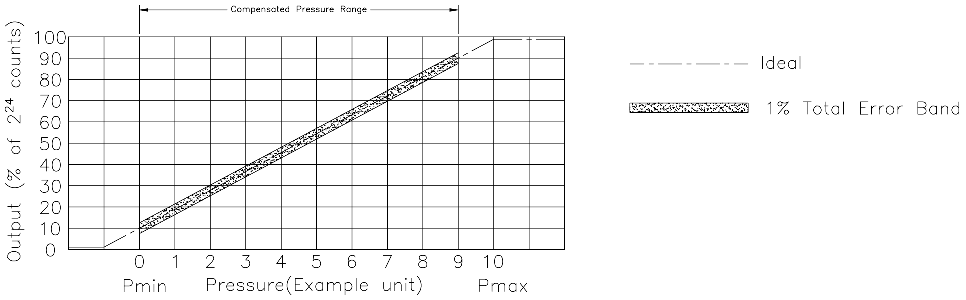
Transfer Function[1]
- A 10% to 90% of Vsupply (analog), 2^{24} counts (digital)
- B 5% to 95% of Vsupply (analog), 2^{24} counts (digital)
- C 5% to 85% of Vsupply (analog), 2^{24} counts (digital)
- D 4% to 94% of Vsupply (analog), 2^{24} counts (digital)

Supply Voltage
- 3 3.3 Vdc

MODEL 1620HD

PRESSURE FUNCTION

PRESSURE FUNCTION
TYPE A EXAMPLE

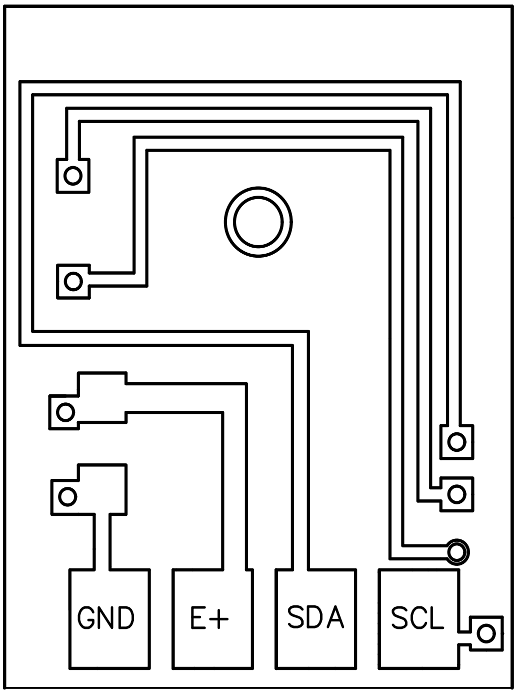


$$\text{Output (\% of } 2^{24} \text{ counts)} = \frac{M*16777215}{Pmax-Pmin} * (Papplied-Pmin)+N*16777215$$

$$\text{Temperature Output (Decimal Counts)} = \frac{(\text{Output } ^\circ C - (-40^\circ C)_{Tmin}) * 16777215}{(85^\circ C_{Tmax} - (-40^\circ C)_{Tmin})}$$

TRANSFER FUNCTION				
Variable	A	B	C	D
M	0.8	0.9	0.8	0.9
N	0.1	0.05	0.05	0.04

PAD DEFINITION



1： GND

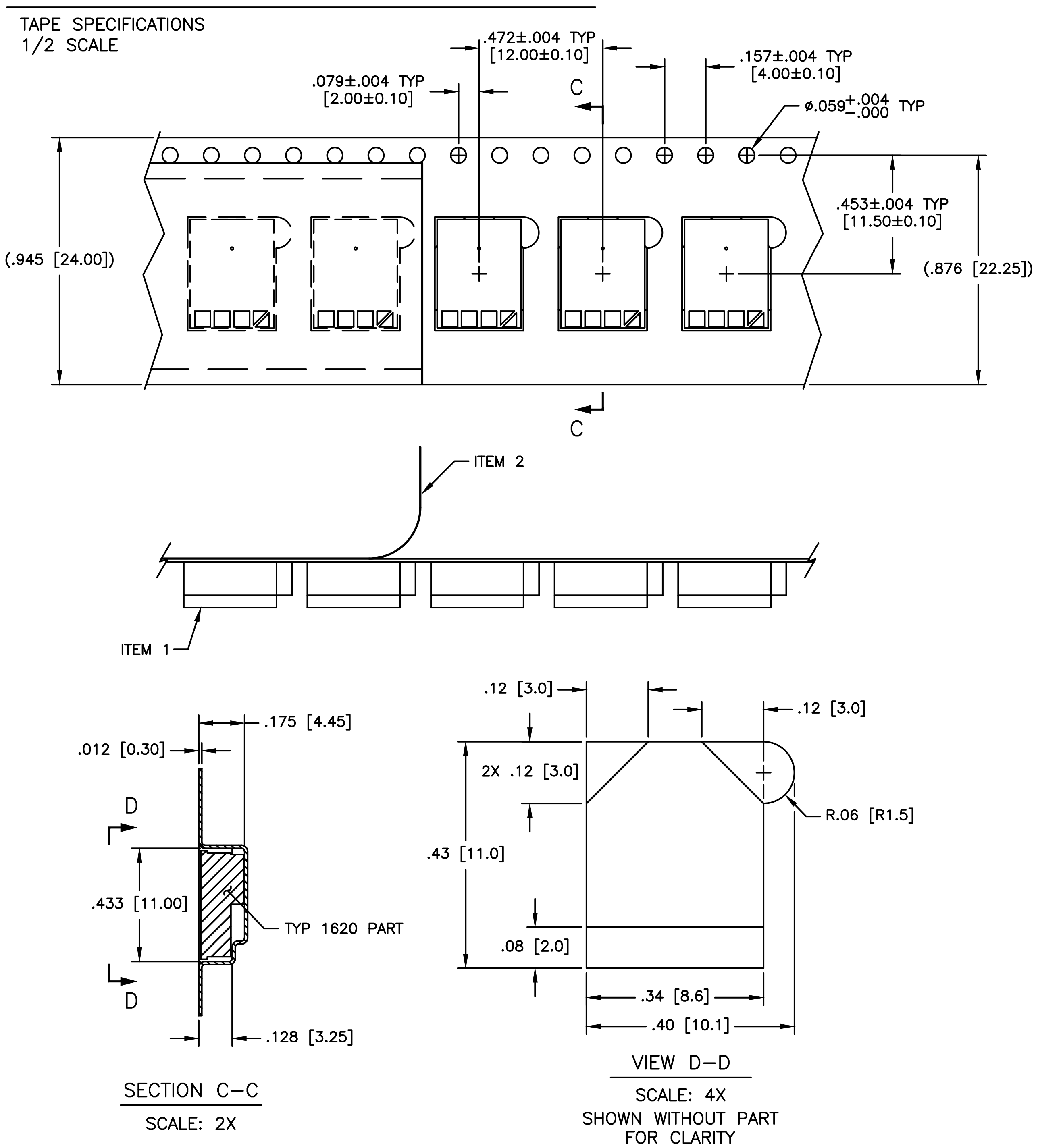
2： E+

3： SDA

4： SCL

MODEL SA1620HD

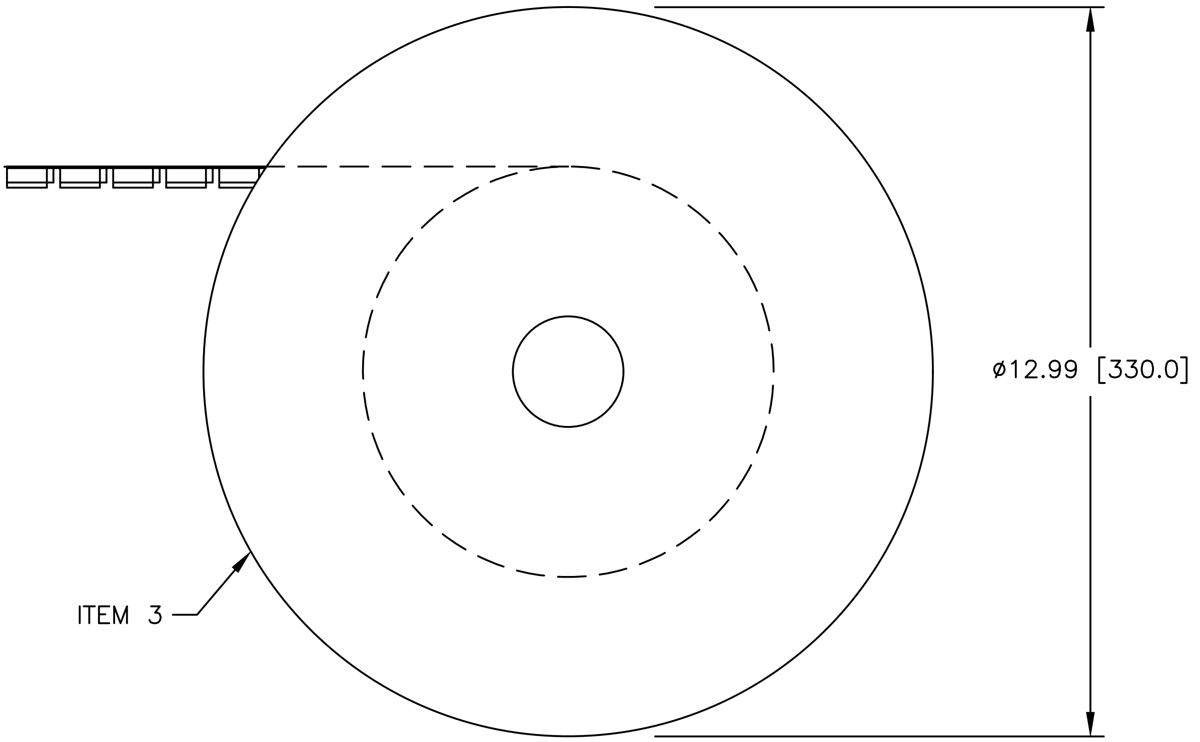
PACKAGING



MODEL 1620HD

PACKAGING

REEL SPECIFICATIONS
1/8 SCALE



TAPE AND REEL INFO

A) MATERIAL:

ITEM 1, CARRIER TAPE: POLYCARBONATE

ITEM 2, COVER TAPE: POLYCARBONATE, HEAT PRESSURE SEAL

ITEM 3, PACKAGING TRAY: PLASTIC

B). TOTAL PEEL STRENGTH SHOULD BE 10 TO 130 GRAMS.

C). REFERENCE DOC: ANSI/EIA-481-C: 8mm THROUGH 200mm EMBOSSED CARRIER TAPING, 8mm AND 12mm PUNCHED CARRIER TAPING OF SURFACE MOUNT COMPONENTS FOR AUTOMATIC HANDLING.

MODEL SA5660HD

Disposible Pressure Sensor
I2C/SPI 24bits Output
Gage and Absolute
Temperature Compensated

- **Invasive Blood Pressure**
- **Hemodialysis**
- **Biochemical Analyzer**
- **Urodynamics**
- **Intrauterine Pressure**
- **Intracranial Pressure**

FEATURES

- I2C or SPI selectable
- ±0.1% Pressure Non-linearity
- -10ºC To +60ºC Compensated Temperature Range
- 0.5% Interchangeable
- Solid State Reliability
- Low Power

DESCRIPTION

The Model SA5660HD is a fully piezoresistive silicon pressure sensor with polysulfone plastic housing for use in invasive blood pressure or other disposable pressure monitoring.The sensor is designed to meet the requirements as described in the Association for the Advancement of Medical Instrumentation (AAMI) specification for Blood Pressure Transducers.

SA5660HD High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an analog/digital output for reading pressure over the specified full scale pressure span and temperature range. SA5660HD Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

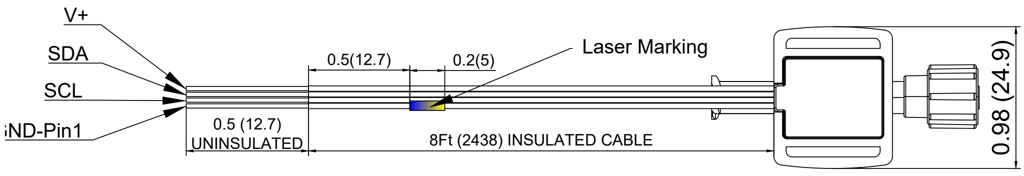
SA5660HD Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 3.3 Vdc . SA5660HD Series sensors are intended for use with non-corrosive, non-ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

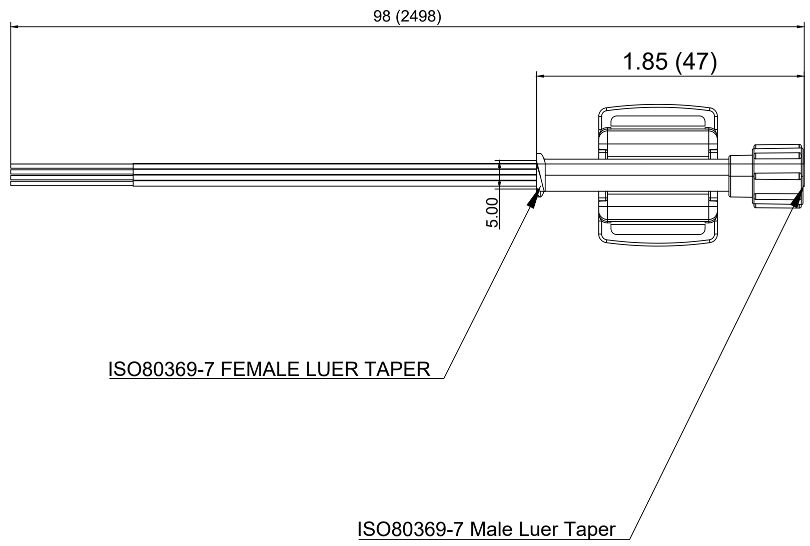
A dielectric gel is placed over the sensor to provide electrical and fluid isolation.

The products are shipped in anti-static shipping containers. Performance characteristics and packaging can be easily tailored on a special order basis to meet the requirements of specific customers.

MODEL SA5660HD

DIMENSIONS





STANDARD RANGES

Range	psig	psia
0to5	•	•
0to15	•	•
0to30	•	•
0to50	•	•
0to100	•	•
0to300	•	•

MODEL SA5660HD

PERFORMANCE SPECIFICATIONS

All parameter measured at 1.5 mA and at 25∞C, after 10 second warm up, unless otherwise specified.

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
Operating Pressure Range	0	-	300	PSI	
Overpressure	-	-	500	PSI	
Offset:0 PSI Digital Output	170A3D	19999A	1C28F6	COUNT HEX	
Full scale: 110PSI Digital Output	E3D70A	E66666	E8F5C3	COUNT HEX	
Span	CA3D71	CCCCCD	CF5C29	COUNT HEX	
Sensitivity	1D7CC	1DCA0	1E164	COUNT HEX PER PSI	
Total Error Band	-1	-	1	SPAN%	
Input Voltage Range	-0.3	3.3	3.6	VDC	
Supply Current	0.2	-	1.3	mA	
Burst Pressure	-	3X	-	PSI	
Long Term Stability	-	+/-0.5	-	SPAN%	
Compensated Temperature	-10	-	60	℃	
Operating Temperature	0	-	50	℃	
Storage Temperature	-25	-	70	℃	
Accuracy	-	-	0.5	SAPN%	
Weight	-	10	-	GRAm	
Light Sensitivity(3000 Foot Candle)	-	0.3	-	PSI	
DefibriLLator Withstand(400Joules)	-	-	5	DiSCHARGES	
Sterilization(ETO)	-	-	3	CYCLES	
Humidity(External)	10-90%(NON-CONDENSING)				
Operating Product Life Shelf Life	3 Hours Liquid Media Pressuer Over 100PSI				
	24 Hours Liquid Media Pressuer Over 30PSI				
	96 Hours Liquid Media Pressuer Less 30PSI				
	3Years Clean Dry Gas Media				
Dielectric Breakdown	8,000VDC				
Mediainterface	Dielectric GEL				

Notes

1. Contact Factory for other tolerance total pressure error band in cludes all accuracy errors,thermal errors over the com pensated tempera ture range and span and offset calibration tolerances.
2.Exceed rated voltagemay cause sensor damage.
3.Offset and span within a year.
4.The maximum deviation from a best fit straight line(bfst)fitted to the output measured over the pressure range at 25C.
5.One discharge per minute performed by cusatomer.
6.Sterilization shall be perfomed by customer.Tested with ETO,material are compatiblewith ETO,gamma,or E-BEAM sterilization,did not verity gamma or E-BEAM sterilization.
7.Output t I2C output,address 0X28,contact factory for different address setting
8.Fluid psth msterial used:Houaing and sensor gel cup,polysulphone udel 1700,dielectric gel,KE1052AB,epoxy between gel cup and housing,Loctite 4860.
9.Contact factory for communica tion protocol and code example.

MODEL SA2630

ORDERING INFORMATION

NOMENCLATURE AND ORDER GUIDE

SA 2630 - XXX X - X

MODEL No.

PRESSURE RANGE (psi)
015
030
050
100

PRESSURE TYPE
A = ABSOLUTE
G = GAGE

INSTALLATION
B = BARDED PORT
S = THREAD PORT

OPERATING SPECIFICATIONS: 10VDC&25° (UNLESS OTHERWISE SPECIFIED)

PARAMETERS	0-15PSI		0-30PSI		0-50PSI		0-100PSI		UNITS	NOTES
	TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX		
SPAN		100±3		100±3		100±3		100±3	mV	
ZERO PRESSURE OUTPUT		±2.5		±2.5		±2.5		±2.5	mV	
PRESSURE NONLINEARITY	±0.1	±0.2	±0.1	±0.2	±0.1	±0.2	±0.1	±0.2	%SPAN	
TEMPERATURE ERROR-SPAN	±0.6	±1	±0.6	±1	±0.6	±1	±0.6	±1	mV	
TEMPERATURE ERROR-ZERO	±0.6	±1.5	±0.6	±1.5	±0.6	±1.5	±0.6	±1.5	%SPAN	
REPEATABILITY PRESSURE & HYSTERESIS	-0.50	±0.10	-0.50	±0.10	-0.50	±0.10	-0.50	±0.10	%SPAN	
PROOF PRESSURE		45		90		150		300	Psi	

MODEL SA2630

OPERATING SPECIFICATIONS

TABLE 1. ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	MIN	TYP	MAC	UNITS
SUPPLY VOLTAGE	2.5	10	15	Vdc
INPUT RESISTANCE	2.5K	4.4K	6.0K	Ω
OUTPUT RESISTANCE	-	4.2K	-	Ω
RESPONSE TIME (10% TO 90%)		2		mS

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
OPERATING TEMPERATURE	-40°C ~ 125°C
COMPENSATED TEMPERATURE	0°C ~ 50°C
STORAGE TEMPERATURE	-50°C ~ 125°C
VIBRATION	MIL-STD-202F,METHOD 214,CONDITION F
SHOCK	MIL-STD-202F,METHOD 213B,CONDITION F
LIFE	1 MILLION PRESSURE CYCLES MINIMUM
SOLDER	315°C MAX 10 SEC.

TABLE 3. *WETTED MATERIALS

COMPONENT	MATERIALS
PORTS AND COVERS	HIGH TEMPERATURE PPS
SUBSTRATE	ALUMINA CERAMIC
ADESIVES	EPOXY, SILICONE GEL
ELECTRONIC COMPONENTS	SILICON,GLASS,SOLDER,GOLD,ALUMINA

CONTACT SQMEAS CUSTOMER SERVICE FOR DETAILED MATERAIL INFORMATION.

Notes

1. ABSOLUTE MAXIMUM RATINGS ARE THE EXTREMEM LIMITS THE SENSOR WILL WITHSTAND WITHOUT DAMAGE.
2. THE SENSOR IS NOT REVERSE POLARITY PROTECTED. INCORRECT APPLICATION OF SUPPLY VOLTAGE OR GROUND TO THE WRONG PIN MAY CAUSE ELECTRICAL FAILURE.
3. OPERATING TEMPERATURE RANGE: THE TEMPERATURE RANGE OVER WHICH THE SENSOR WILL PRODUCE AN OUTPUT PROPORATIONALL TO PRESSURE.
4. COMPENSATED TEMPERATURE RANGE: THE TEMPERATURE RANGE OVER WHICH THE SENSOR WILL PRODUCE AN OUTPUT PROPORATIONALL TO PRESSURE WITHIN THE SPECIFIED PERFORMANCE LIMITS.

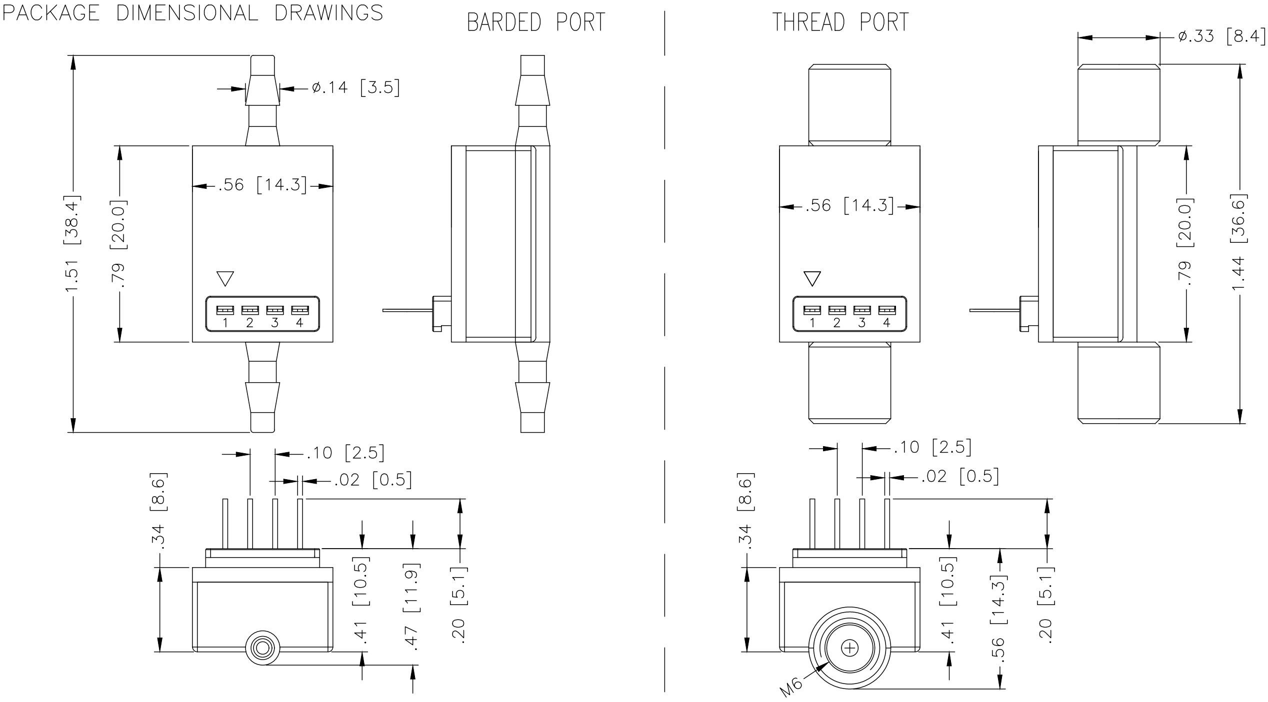
MODEL SA2630

DIMENSIONS

ELECTRICAL CONNECTIONS

PIN	1	2	3	4
FUNCTION	+EX	−OUT	+OUT	−EX

PACKAGE DIMENSIONAL DRAWINGS



MODEL SA154C

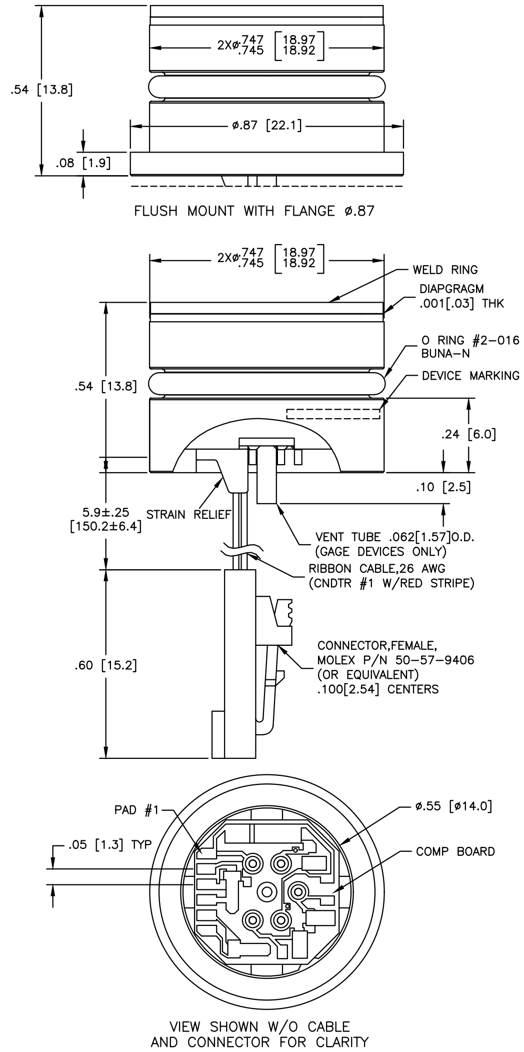
316 SS Pressure Sensor
High Performance, 19 mm
0-100 mV Output
Absolute and Gage
Constant Current

- Hydraulic Controls
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DESCRIPTION

The Model SA154C is a 19 mm small profile, media compatible piezoresistive silicon pressure sensor packaged in a 316L stainless steel housing. The Model SA154C is designed for O-ring mounting. The sensing package utilizes silicon oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element.

DIMENSIONS



PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	

MODEL SA154C

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	50	100	150	75	100	150	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.0	0	+1.0	mV	2
PRESSURE NON-LINEARITY	1PSI:±0.30; 5PSI: ±0.20			-0.20	±0.1	+0.20	%SPAN	3
PRESSURE HYSTERESIS	-0.10	±0.05	+0.10	-0.08	±0.04	+0.08	%SPAN	
REPEATABILITY	-	±0.05	-	-	±0.05	-	%SPAN	
INPUT RESISTANCE	2.0K	3.5K	6.5K	2.0K	3.5K	4.5K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	-0.75	-	+0.75	%SPAN	4
TEMPERATURE ERROR, OFFSET	1PSI:±1.5; 5PSI: ±1.0			15PSI:±1; >15PSI: ±0.8			%SPAN	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.10	-	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.25	-	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	0.5	1.5	2.0	mA	5
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	6
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	7
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	1PSI:10X MAX; 5PSI: 3MAX			-	-	3X	RATED	
BURST PRESSURE	1PSI:12X MAX; 5PSI: 4MAX			-	-	4X	RATED	8
COMPENSATED TEMPERATURE	1PSI: 0 TO 50; 5PSI: 0 TO 70			-10	-	+75	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	9
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	9
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL & O RING BUNA-N							

Notes

1. For amplified output circuits, 3.012V ±1% interchangeability with gain set resistor. See application schematic.
2. Measured at vacuum for absolute (A), ambient for gage (G).
3. Best fit straight line.
4. Over the compensated temperature range with respect to 25°C.
5. Guarantees output/input ratiometricity.
6. Load resistance to reduce measurement errors due to output loading.
7. Between case and sensing element.
8. The maximum pressure that can be applied to a transducer without rupture of either the sensing element or transducer.
9. Maximum temperature range for product with standard cable and connector is -20°C to +105°C.
10. Standard gage units are not recommended for vacuum applications. For vacuum applications below 1/2 atmosphere, consult factory.
11. Device Marking: Each part shall be identified with Model Number, Pressure Range, Type, Lot Number, Serial Number and Date Code.
12. Shipping/Packaging requirements:
    The stainless steel diaphragm is protected by a plastic CAP. Each unit will be packaged individually in a plastic vial with anti-static foam.
13. Direct mechanical Contact with diaphragm is prohibited. Diaphragm surface must remain free of defects (scratches, punctures, dents, fingerprints, etc) for device to operate properly. Caution is advised when handling parts with exposed diaphragms. Use protective cap whenever devices are not in use.

MODEL SA154C

ORDERING INFORMATION

ORDERING INFORMATION

SA154C–XXX X – X X X

PRESSURE RANGE(PSI)
001 (GAGE ONLY)
005
015
030
050
100
300
500

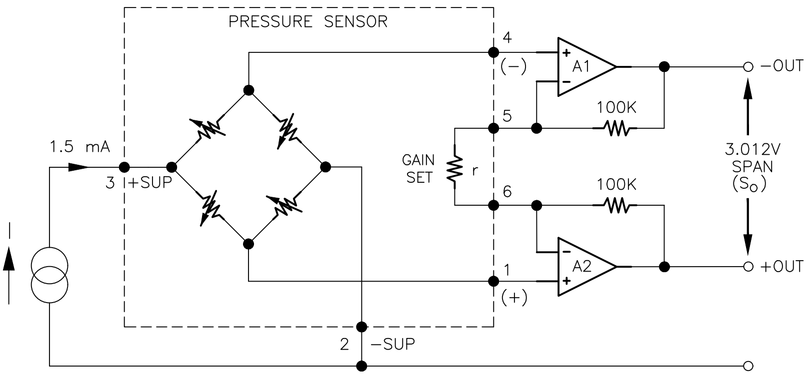
PRESSURE TYPE
A=ABSOLUTE
G=GAGE

ELECTRICAL
P=SOLDRER PADS
R=RIBBON CABLE
C=CABLE W/CONNECTOR

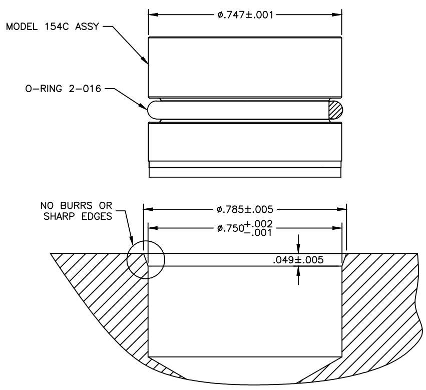
VENT
T=TUBE
BLANK=NO TUBE

FLANGE
F=FLANGE
BLANK=NO FLANGE

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC



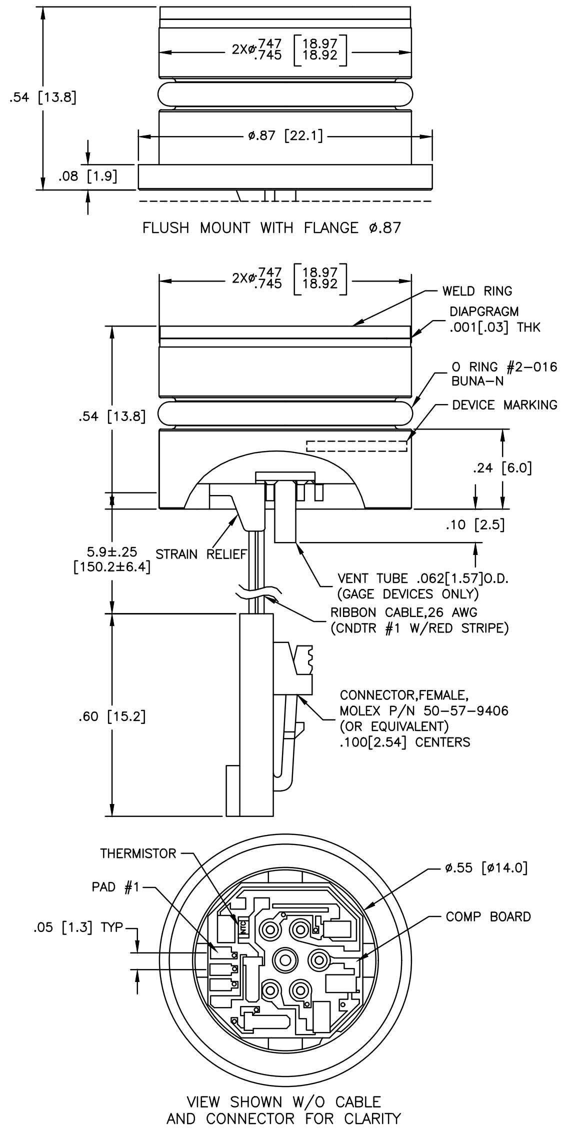
RECOMMENDED MOUNTING DIMENSIONS

MODEL SA154CV

316 SS Pressure Sensor
High Performance, 19 mm
0-100 mV Output
Absolute and Gage
Constant Voltage

- Medical Instruments
- Process Control
- Fresh & Waste Water Measurement
- Partial Vacuum Gas Measurement
- Pressure Transmitters
- Tank Level Systems (RV, Marine & Industrial)

DIMENSIONS



DESCRIPTION

The Model SA154CV is a 19 mm small profile, media compatible,piezoresistive silicon pressure sensor packaged in a 316L stainless steel housing. The Model SA154CV is designed for O-ring mounting. The sensing package utilizes silicon oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element.

PAD/CNDTR	FUNCTION
1	-OUT
2	+OUT
3	-EX
4	+OUT

MODEL SA154CV

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10 VDC AND AT 25°C AFTER 10 SEC WARM UP

PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	98	100	102	99	100	101	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.5	0	+1.5	mV	2
PRESSURE NON-LINEARITY	-0.20		+0.20	-0.2	±0.1	+0.20	%SPAN	3
PRESSURE HYSTERESIS	-0.10	±0.02	+0.10	-0.05	±0.02	+0.05	%SPAN	
REPEATABILITY	-	±0.02	-	-	±0.02	-	%SPAN	
INPUT RESISTANCE	5.5K	3.5K	12.5K	5.5K	9.0K	12.5K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.5	-	+1.5	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-2.5	-	+2.5	-1.0	-	+1.0	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.10	-	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.25	-	-	±0.10	-	%SPAN/YR	
SUPPLY VOLTAGE	-	10	14	-	10	2.0	VDC	4
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	5
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	6
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	-	-	3X	RATED	
BURST PRESSURE	-	-	4X	-	-	4X	RATED	7
COMPENSATED TEMPERATURE	0	-	+50	-10	-	+75	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL & O RING BUNA-N							

Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).
2. BEST FIT STRAIGHT LINE.
3. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
4. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
5. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
6. BETWEEN CASE AND SENSING ELEMENT.
7. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. STANDARD GAGE UNITS ARE NOT RECOMMENDED FOR VACUUM APPLICATIONS.
   FOR VACUUM APPLICATIONS BELOW 1/2 ATMOSPHERE, CONSULT FACTORY.
   SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
10. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
    LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL
    WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES,
    DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM.
    USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA154CV

ORDERING INFORMATION

ORDERING INFORMATION

SA154CV–XXX X – X X X

PRESSURE RANGE(PSI)
001 (GAGE ONLY)
005
015
030
050
100
300
500

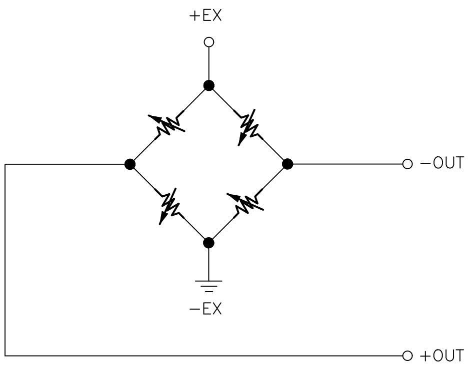
PRESSURE TYPE
A=ABSOLUTE
G=GAGE

ELECTRICAL
P=SOLDRER PADS
R=RIBBON CABLE
C=CABLE W/CONNECTOR

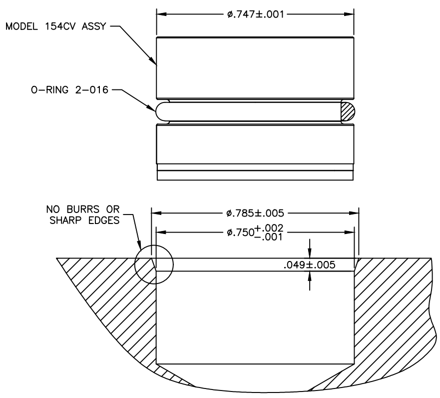
VENT
T=TUBE
BLANK=NO TUBE

FLANGE
F=FLANGE
BLANK=NO FLANGE

APPLICATION SCHEMATIC



EQUIVALENT SCHEMATIC



RECOMMENDED MOUNTING DIMENSIONS

MODEL SA154A

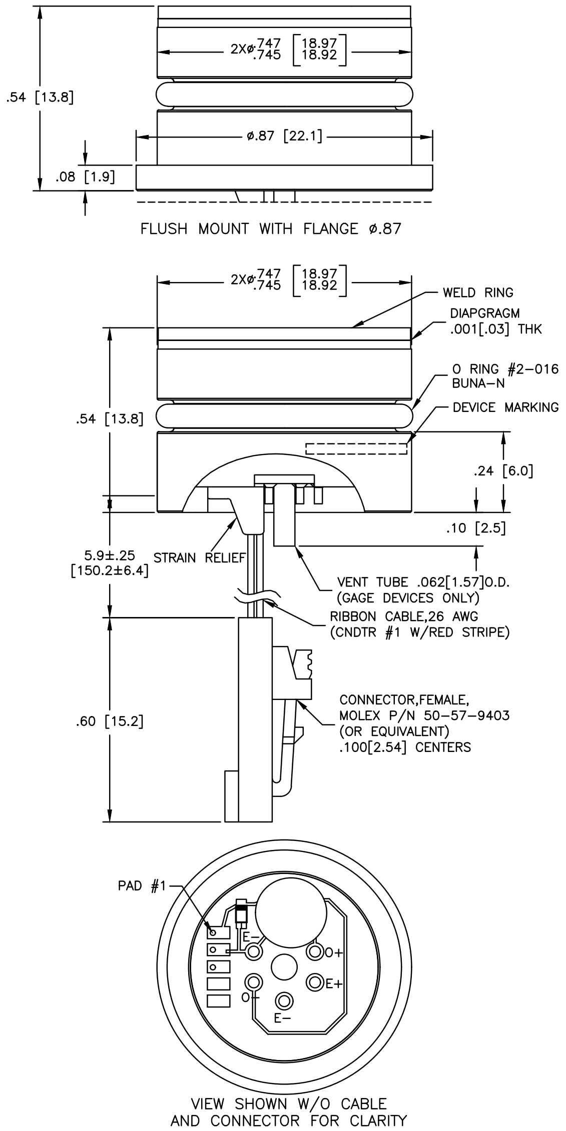
316 SS Pressure Sensor
High Performance, 19 mm
0.5-4.5Vdc Output
Absolute and Gage
Low Pressure

- Medical Instruments
- Process Control
- Fresh & Waste Water Measurement
- Partial Vacuum Gas Measurement
- Pressure Transmitters
- Tank Level Systems (RV, Marine & Industrial)

DESCRIPTION

The Model SA154A is a 19 mm small profile, media compatible,piezoresistive silicon pressure sensor packaged in a 316Lstainless steel housing. The Model SA154A is designed for O-ring mounting. The sensing package utilizes silicon oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element.

DIMENSIONS



PAD/CNDTR	FUNCTION
1	+Vin
2	GND
3	+Vout

MODEL SA154A

PERFORMANCE SPECIFICATIONS

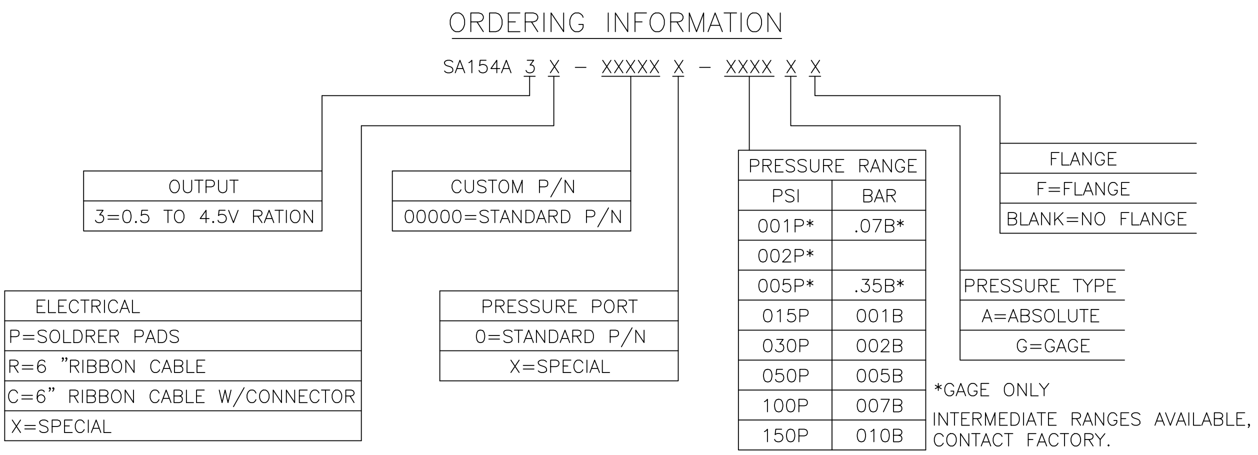
UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 5.0VDC AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	4.5			V	
ZERO PRESSURE OUTPUT	0.5			V	
PRESSURE NON-LINEARITY	-1.0	±0.3	+1.0	%SPAN	1
PRESSURE HYSTERESIS	-0.10		+0.10	%SPAN	
REPEATABILITY	-	±0.02	-	%SPAN	
TEMPERATURE ERROR, SPAN (O° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
TEMPERATURE ERROR, ZERO(0° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
ACCURACY (COMBINED LINAEARITY, HYSTERESIS & REPEATABILITY)	±0.25			%SPAN	1
TOTAL ERROR BAND (INCLUDES CALIBRATION ERRORS & TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE)	1.2PSI AND 0.07BAR: ±7.0; 5PSI OR .35BAR: ±5 >5PSI OR >.35BAR: ±5			%SPAN	
SUPPLY VOLTAGE	4.75	5.0	5.25	V	3
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	4
PRESSURE OVERLOAD			3X	RATED	
COMPENSATED TEMPERATURE	0	-	+50	℃	
OPERATING TEMPERATURE	-20	-	+125	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

Notes

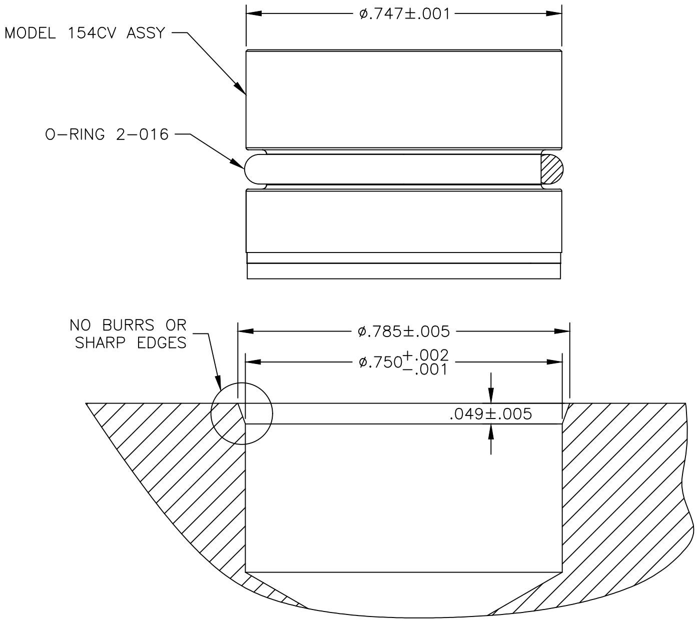
1. BEST FIT STRAIBHT LINE.
2. OVER THE COMPENSATED TEMPETATURE RANGE WITH RESPECT TO 25°C.
3. GUARANTEES OUTPUT/INPUT RATIONMETRICITY.
4. BETWEEN CASE AND SENSING ELEMENT.
5. THE MAXMIUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.

ORDERING INFORMATION



MODEL SA154A

APPLICATION SCHEMATIC



RECOMMENDED MOUNTING DIMENSIONS

Notes

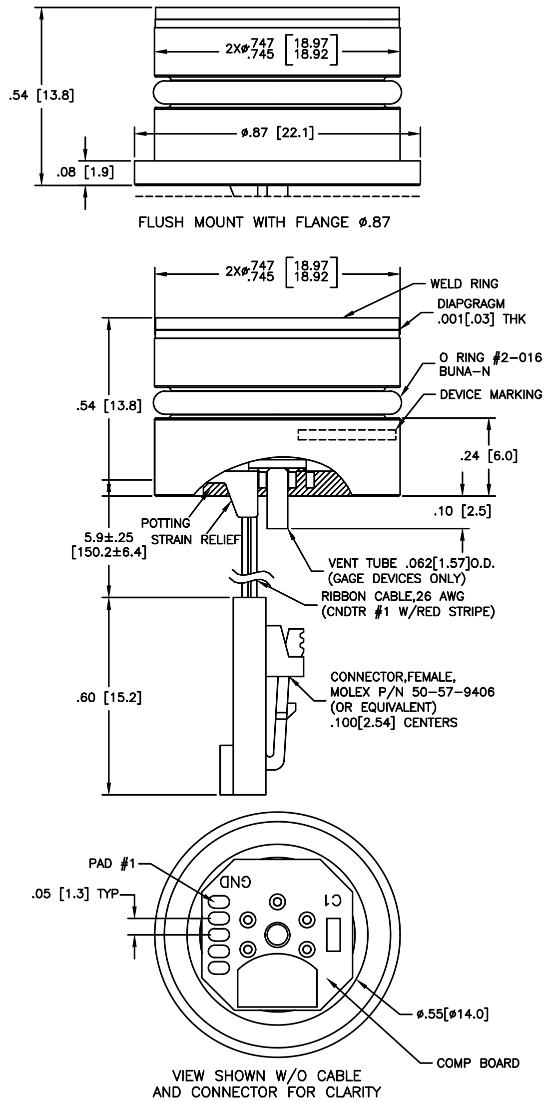
1. BEST FIT STRAIBHT LINE.
2. OVER THE COMPENSATED TEMPETATURE RANGE WITH RESPECT TO 25°C.
3. GUARANTEES OUTPUT/INPUT RATIONMETRICITY.
4. BETWEEN CASE AND SENSING ELEMENT.
5. THE MAXMIUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
6. DEVICE MARKING:
   EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
   LOT NUMBER, SERIAL NUMBER AND DATE CODE.
7. SHIPPING/PACKAGING REQUIREMENTS:
   THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL
   WITH ANTI-STATIC FOAM.
8. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM.
   USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA154BSD

316 SS Pressure Sensor
High Performance, 19 mm
14bits I2C/SPI Output
Absolute and Gage
Low Pressure

- **Medical Instruments**
- **Process Control**
- **Fresh & Waste Water Measurement**
- **Partial Vacuum Gas Measurement**
- **Pressure Transmitters**
- **Tank Level Systems (RV, Marine & Industrial)**

DIMENSIONS



DESCRIPTION

The Model SA154BSD is a 19 mm small profile, media compatible, piezoresistive silicon pressure sensor packaged in a 316L stainless steel housing. The Model SA154BSD is designed for O-ring mounting. The sensing package utilizes silicon oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element.

PAD/CNDTR	FUNCTION
1	GND
2	+EX
3	SDA/MISO
4	SCL/SCLK
5	INT/SS

Stainless Steel Pressure Sensor

MODEL SA154BSD

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
ZERO PRESSURE OUTPUT (10% ~ 90%)	-	666	-	COUNT HEX	1
ZERO PRESSURE OUTPUT (5% ~ 95%)	-	333	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (10% ~ 90%)	-	399A	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (5% ~ 95%)	-	3CCB	-	COUNT HEX	1
PRESSURE ACCURACY	-0.25	-	+0.25	%SPAN	2
TOTAL ERROR BAND	-1	-	+1	%SPAN	3
PRESSURE RESOLUTION	0.008	-	-	%SPAN	
TEMPERATURE ACCURACY	-1.5	-	+1.5	℃	4
TEMPERATURE RESOLUTION	-	0.1	-	℃	
INPUT VOLTAGE RANGE	2.7	3.3	5.5	V	1
SUPPLY CURRENT	-	3	-	mA	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	5
PROOF PRESSURE	-	-	2X	RATED	6
BURST PRESSURE	-	-	3X	RATED	7
LOAD RESISTANCE	10K	-	-	Ω	
LONG TERM STABILITY, (OFFSET&SPAN)	-	±0.5	-	%SPAN/YR	
COMPENSATED TEMPERATURE (<5PSI)	0	-	+50	℃	
COMPENSATED TEMPERATURE (>15PSI)	-20	-	+85	℃	
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-40	-	+125	℃	8
OUTPUT PRESSURE RESOLUTION	-	-	14	BIT	
OUTPUT TEMPERATURE RESOLUTION	8	-	11	BIT	
START TIME TO DATA READY	-	-	8.4	mS	9
OUTPUT TYPE	10% to 90% OR 5% to 95%				
INTERFACE TYPE	I C (ADDRESS: 0X28H;0X36H;0X46H); SPI				
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L SS STL & O RING BUNA-N				

ORDERING INFORMATION

ORDERING INFORMATION: SA154BSD-XXXX X - X X X X XX X

PRESSURE RANGE	
PSI	BAR
005P*	.35B*
015P	001B
030P	002B
050P	3.5B
100P	005B
200P	014B
300P	020B

*005P(.35B) IS FOR GAGE PRESSURE ONLY.
*INTERMEDIATE PRESSRE RANGES AVALIABLE.

PRESSURE TYPE
A=ABSOLUTE
G=GAGE

SUPPLY VOLTEGE
3=3.3VDC
5=5.0VDC

OUTPUT
A=10%–90%
B=5%~95%

INTERFACE
I=I²C(ADDR: 0X28H)
J=I²C(ADDR: 0X36H)
K=I²C(ADDR: 0X46H)
S=SPI

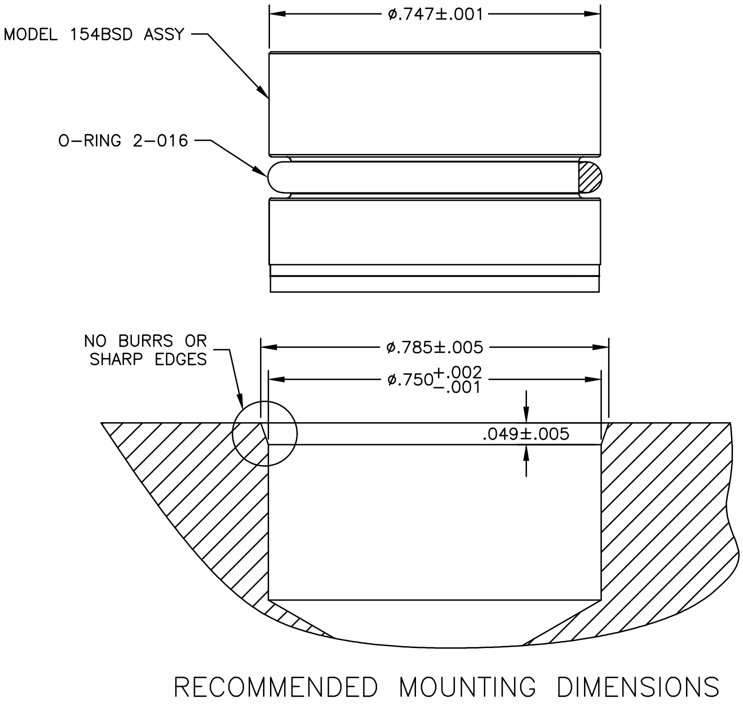
ELECTRICAL
P=PAD
R=RIBBON CABLE
C=CABLE W/CONNECTOR

FLANGE
F=FLANGE
BLANK=NO FLANGE

VENT
LT=LOW POWER W/TUBE
L=LOWER POWER W/O TUBE
T=STANDARD W/TUBE
BLANK=STANDARD W/O TUBE

MODEL SA154BSD

APPLICATION SCHEMATIC

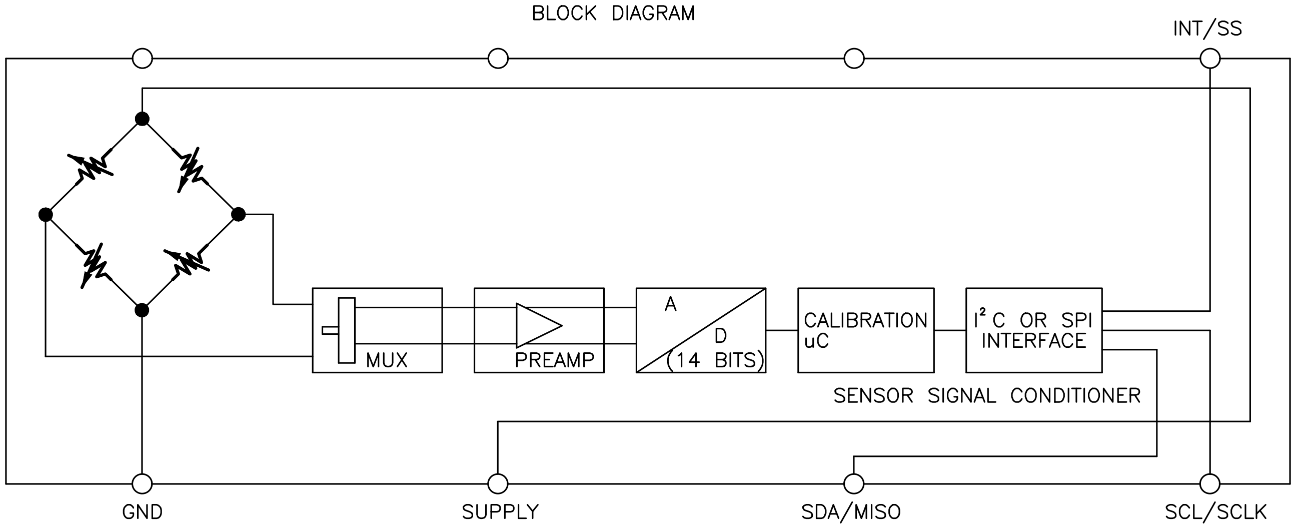


Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).OUTPUT IS NOT RATIONMETRIC TO SUPPLY VOLTAGE.
2. ACCURACY : COMBINED LINEARITY,HYSTERESIS AND REPEATILITY.
3. TOTAL BAND: INCLUDES CALIBRATION ERRORS AND TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE. SEE FIG 2 OF SHEET 8.
4. THE DEVIATION FROM A BEST FIT FIT STRAIGHT LINE(BFSL) FITTED TO THE OUTPUT MEASURED OVER THE COMPENSATED TEMPERAURE RAGE. FOR ERRORS BEYOND THE COMPENSATED TEMPERATURE RANGE, SEE FIG 1 OF SHEET 8.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 2X OR 400PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OF ACCURACY.
7. 3X OR 600PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. START TIME TO DATA RADY IS THE TIME TO GET VALID DATA AFTER POR (POWER ON RESET). THE TIME TO GET SUBSEQUENT VALID DATA IS THEN SPECIFIED BY THE RESPONSE TIME SPECIFICATION.
10. DEVICE MARKING: EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA154BSD

APPLICATION SCHEMATIC



I C INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	100		400	KHz
START CONDITION HOLD TIME RELATIVE TO SCL EDGE	tHDSTA	0.1			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
START CONDITION SETUP TIME RELATIVE TO SCL EDGE	tSUSTA	0.1			μS
DATA HOLD TIME ON SDA RELATIVE TO SCL EDGE	tHDDAT	0			μS
DATA SETUP TIME ON SDA RELATIVE TO SCL EDGE	tSUDA	0.1			μS
STOP CONDITION SETUP TIME ON SCL	tSUSTO	0.1			μS
BUS FREE TIME BETWEEN STOP AND START CONDITION	tBUS	2			μS

SPI INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	50		800	KHz
SS DROP TO FIRST CLOCK EDGE	tHDSS	2.5			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
CLOCK EDGE TO DATA TRANSITION	tCLKD	0		0.1	μS
RISE OF SS RELATIVE TO LAST CLOCK EDGE	tSUSS	0.1			μS
BUS FREE TIME BETWEEN RISE AND FALL OF SS	tBUS	2			μS

@1 COMBINED LOW AND HIGH WIDTHS MUST EQUAL OR EXCCED MINIMUM SCL PERIOD.

MODEL SA154BSD

CONNECTIONS

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

FIG 1

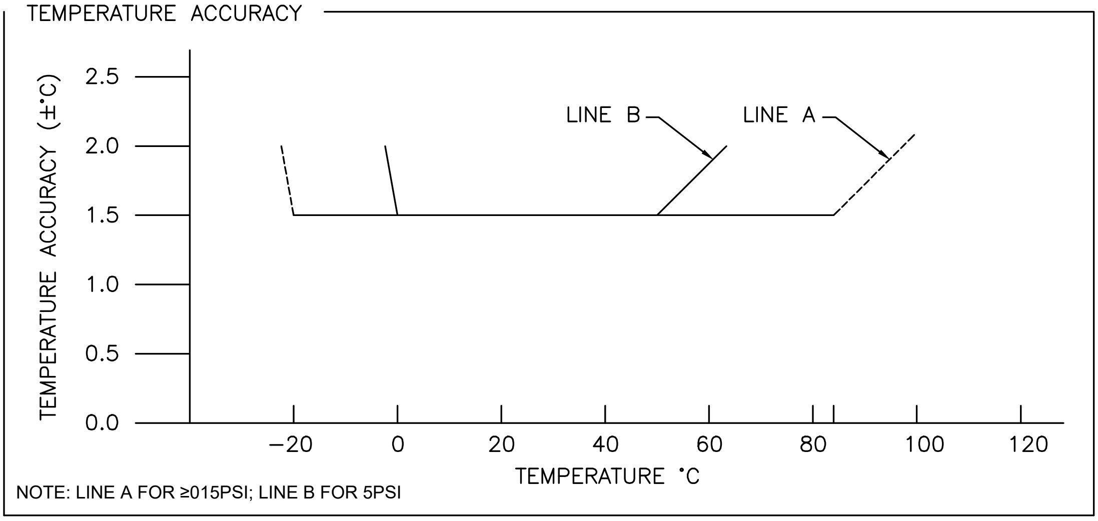
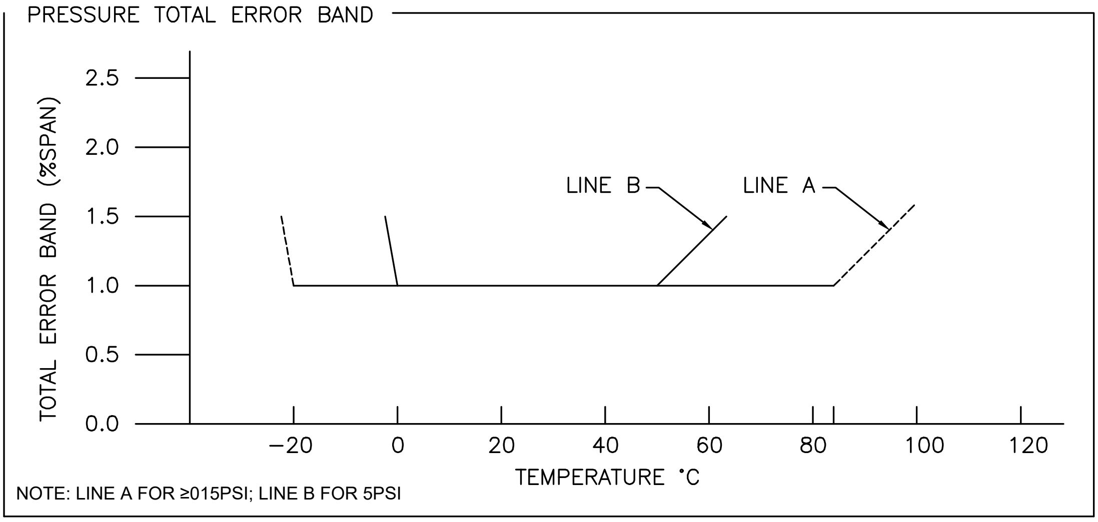
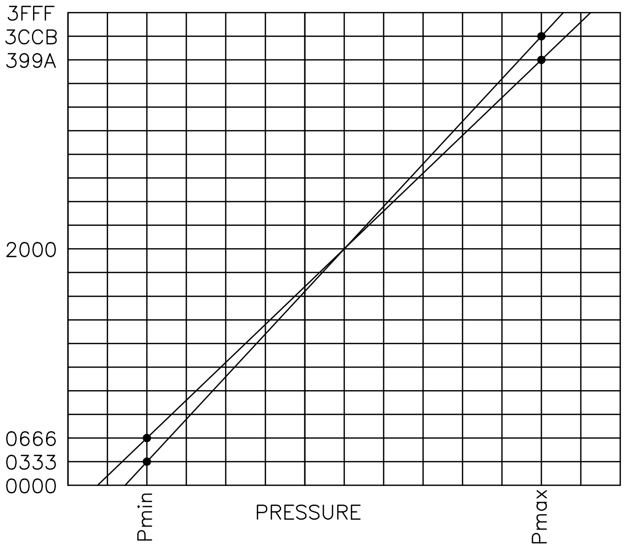


FIG 2



MODEL SA154BSD

TEMPERATURE FUNCTION



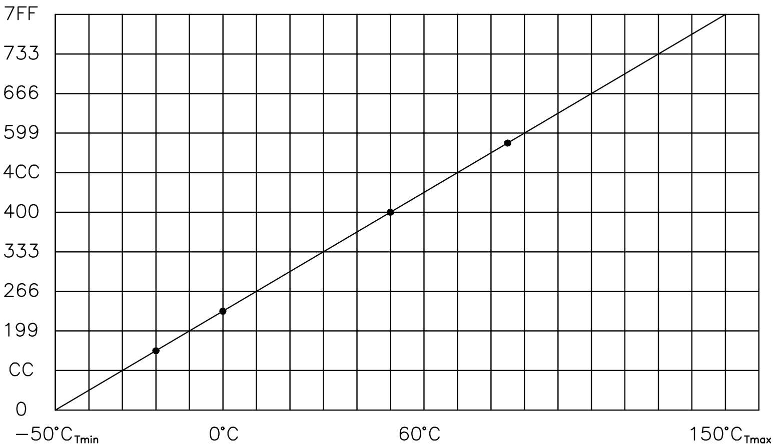
SENSOR OUPUT AT SIGNIFIANT PERCENTAGES

%OUTPUT	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0	0	0 X 0000
5	819	0 X 0333
10	1638	0 X 0666
50	8192	0 X 2000
90	14746	0 X 399A
95	15563	0 X 3CCB
100	16383	0 X 3FFF

$$\text{A TYPE: OUT (DECIMAL COUNTS)} = \frac{80\%*16388}{Pmax-Pmin} * (Papplied-Pmin)+10\%*16383$$

$$\text{B TYPE: OUT (DECIMAL COUNTS)} = \frac{90\%*16388}{Pmax-Pmin} * (Papplied-Pmin)+5\%*16383$$

TEMPERATURE FUNCTION



DIGITAL TEMPERATURE OUTPUT

OUTPUT°C	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
−50	0	0 X 0000
−20	317	0 X 0133
0	512	0 X 0200
25	767	0 X 02FF
50	1024	0 X 0400
85	1381	0 X 0565
150	2047	0 X 07FF

$$\text{OUT (DECIMAL COUNTS)} = \frac{(OUTPUT°C-(-50°C_{Tmin}) \; *2047}{150°C_{Tmax}-(-50°C_{Tmin})}$$

MODEL SA85U

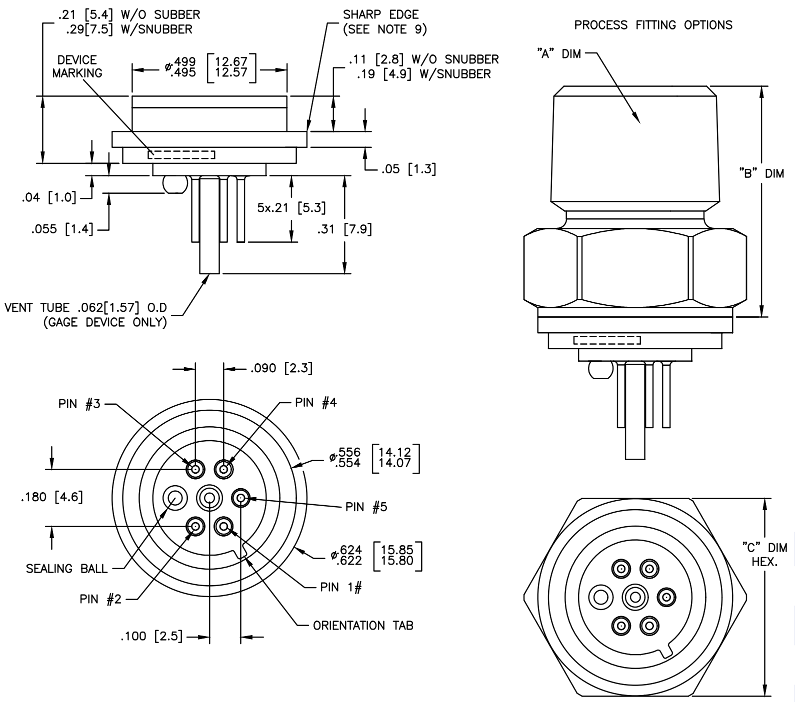
316L SS Pressure Sensor
High Performance, Small Profile
Millivolts Output,uncompensated
Absolute and Gage
Low Pressure

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DESCRIPTION

SA85U is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



CONNECTIONS

PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	GAIN

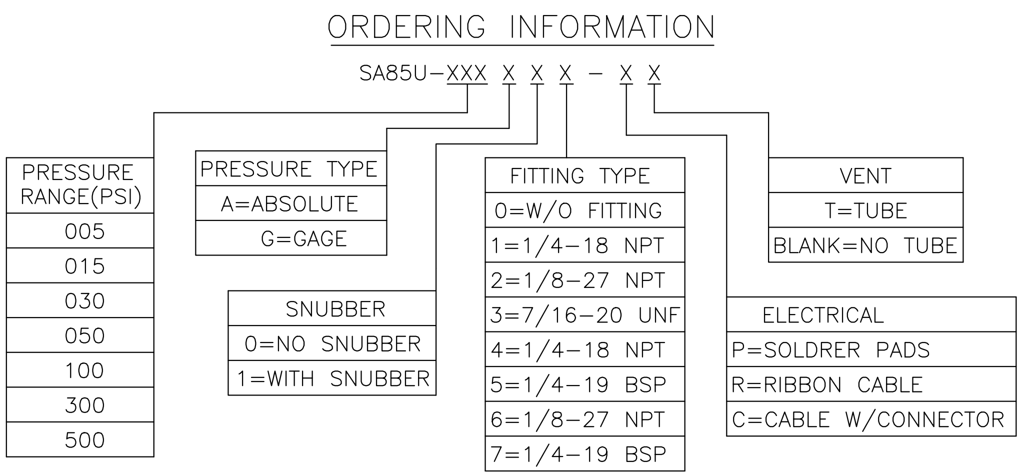
MODEL SA85U

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

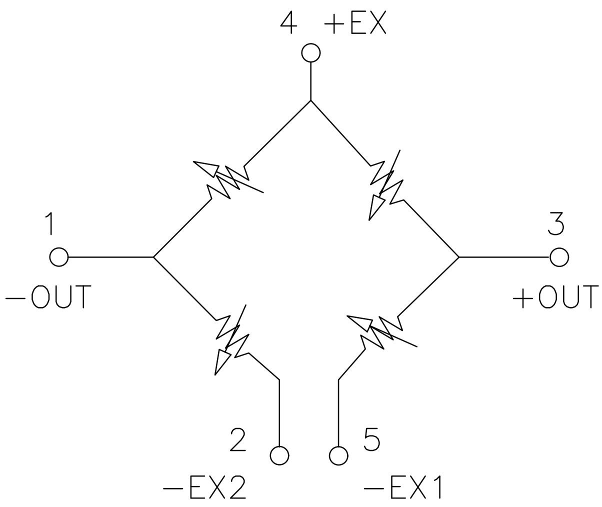
PARAMETERS	MIN	YTP	MAX	UNITS	NOTES
SENSITIVITY	12	-	27	mV/V@SPAN	
ZERO PRESSURE OUTPUT	-6.0	-	+8.0	mV/V	1
PRESSURE NON-LINEARITY	-0.30	-	+0.30	% SPAN	2
PRESSURE HYSTERESIS	-0.25	±0.05	+0.25	% SPAN	3
REPEATABILITY	-	±0.02	-	% SPAN	
BRIDGE RESISTANCE	3.8K	-	6.0K	Ω	4
TEMPERATURE ERROR-SPAN	-0.35	±0.10	+0.35	% SPAN	5
TEMPERATURE ERROR-OFFSET	-0.35	±0.10	+0.35	% SPAN	5
TEMPERATURE COEFFICIENT, RESISTANCE	1.3K	1.51K	1.75K	PPM/°C	5
TEMPERATURE COEFFICIENT, SPAN	-1.45K	-1.25K	-1.0K	PPM/°C	5,6
TEMPERATURE COEFFICIENT, OFFSET	-30	-	+30	μV/V/°C	5
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	% SPAN	
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	% SPAN	
LONG TERM STABILITY, SPAN	-0.2	±0.10	+0.2	% SPAN/YR	
LONG TERM STABILITY, OFFSET	-0.3	±0.10	+0.3	% SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	
SUPPLY VOLTAGE	-	5	12	V	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	7
OUTPUT NOISE (10Hz TO 1KHz)	-	1.0	-	μV P-P	
RESPONSE TIME (10% TO 90%)	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	RATED	
BURST PRESSURE			4X	RATED	8
OPERATING TEMPERATURE	-40	-	+125	°C	
STORAGE TEMPERATURE	-50	-	+125	°C	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

ORDERING INFORMATION



MODEL SA85U

APPLICATION SCHEMATIC



CONNECTIONS

Notes

1.MEASURED AT VACUUM FOR ABSOLUTE (A) AND AT AMBIENT FOR GAGE (G).
2.BEST FIT STRAIGHT LINE. NON LINEARITY IS ±0.35% MAX FOR 5PSIG DEVICES.
3.PRESSURE HYSTERESIS IS MIN -0.1 TO MAX 0.3 FOR 5PSI ABSOLUTE.
4.BRIDGE RESISTANCE IS MEASURED WITH BOTH –E PINS SHORTED TOGETHER.
5.TC VALUES ARE FIRST ORDER COEFFICIENTS TO A QUADRATIC FIT OVER A TEMPERATURE RANGE OF -20 TO +85°C (0 TO +50°C FOR 5PSI).
6.5PSIA IS -1.7K ~ -1.0K PPM/°C.
7.BETWEEN CASE AND SENDING ELEMENT.
8.THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
9.SHARP EDGE STRONGLY RECOMMENDED FOR WELDING APPLICATION. OPTIUM WELD PARAMETERS WILL REDUCE THE EFFECT OF WELD HEAT ON SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
10. STANDARD GAGE UNITS ARE NOT RECOMMENDED FOR VACUUM APPLICATIONS.FOR VACUUM APPLICATIONS BELOW 1/2 ATMOSPHERE, CONSULT FACTORY.
11. DEVICE MARKING: EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
12. SHIPPING/PACKAGING REQUIREMENTS: THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
13 DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85C

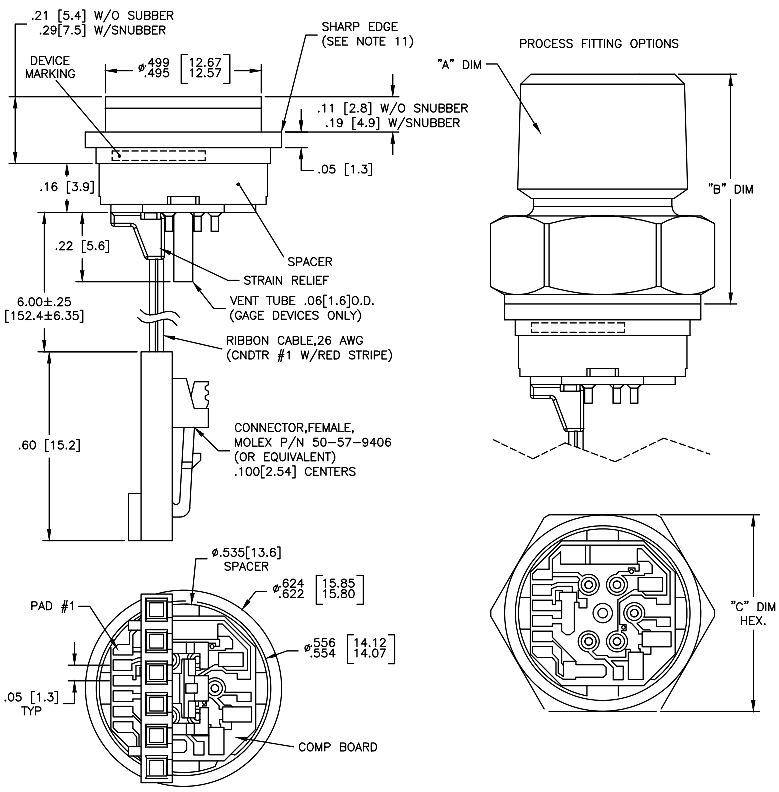
316L SS Pressure Sensor
High Performance, Small Profile
0-150 mV Output
Absolute and Gage
Constant Current

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DESCRIPTION

SA85C is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. A thick film ceramic compensation board with laser-trimmed resistors, and an additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



CONNECTIONS

PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	GAIN

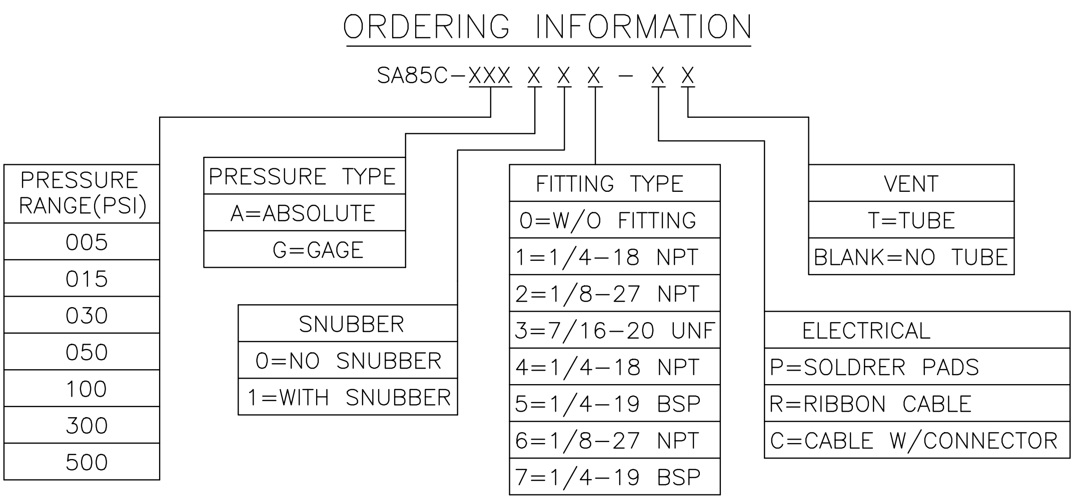
MODEL SA85C

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

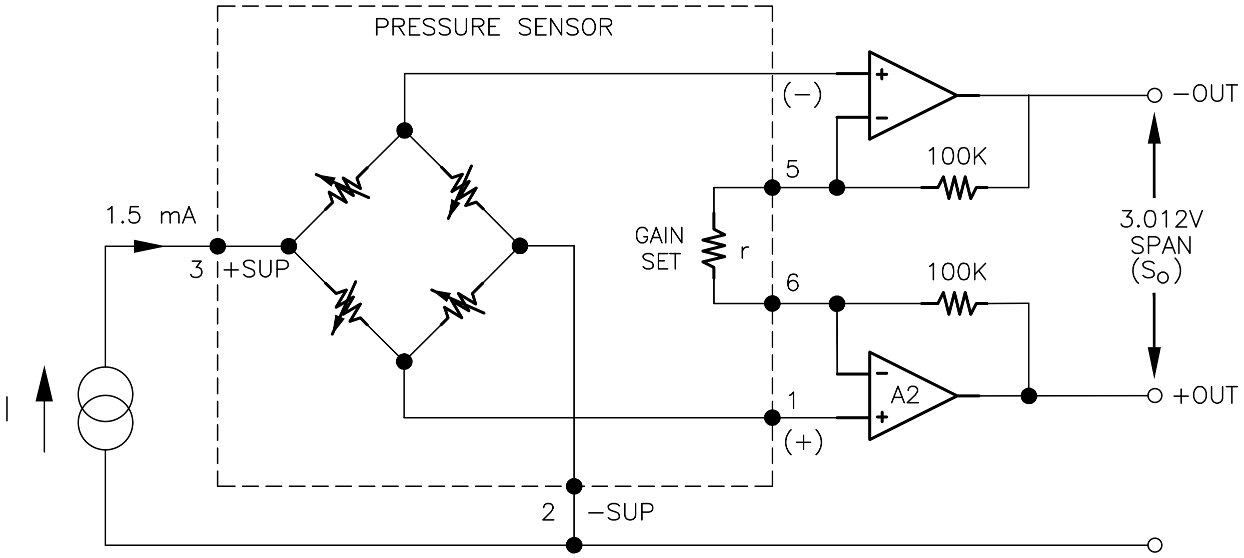
PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	50	100	150	75	100	150	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.0	0	+1.0	mV	2
PRESSURE NON-LINEARITY	-0.30	-	+0.30	-0.25	-	+0.25	%SPAN	3
PRESSURE HYSTERESIS	-0.30	±0.05	+0.30	-0.25	±0.05	+0.25	%SPAN	
REPEATABILITY	-	±0.02	-	-	±0.02	-	%SPAN	
INPUT RESISTANCE	2.5K	5.0K	6.5K	2.0K	3.5K	5.8K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.5	-	+1.5	-1.0	-	+1.0	%SPAN	4
TEMPERATURE ERROR, OFFSET	-2.5	-	+2.5	-1.0	-	+1.0	%SPAN	4,5
THERMAL HYSTERESIS, SPAN	-0.35	±0.10	+0.25	-0.30	±0.10	+0.30	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.35	±0.10	+0.25	-0.30	±0.10	+0.30	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.20	-	-	±0.15	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.35	-	-	±0.30	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	0.5	1.5	2.0	mA	6
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	7
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	8
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	-	-	3X	RATED	
BURST PRESSURE	-	-	4X	-	-	4X	RATED	9
COMPENSATED TEMPERATURE	0	-	+50	-20	-	+70	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	10
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	10
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL							
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL							

ORDERING INFORMATION



MODEL SA85C

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

1. FOR AMPLIFIED OUTPUT CIRCUITS, 3.012V ±1% INTERCHANGEABILITY WITH GAIN SET RESISTOR. SEE APPLICATION SCHEMATIC.
2. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).
3. BEST FIT STRAIGHT LINE.
4. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
5. 15 PSI RANGES SENSORS HAVE A TEMPERATURE ERROR- OFFSET AS ± 1.5% (MAX).
6. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
7. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
8. BETWEEN CASE AND SENSING ELEMENT.
9. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER
10. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
11. SHARP EDGE STRONGLY RECOMMENDED FOR WELDING APPLICATION. OPTIUM WELD PARAMETERS WILL REDUCE THE EFFECT OF WELD HEAT ON SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
12. STANDARD GAGE UNITS ARE NOT RECOMMENDED FOR VACUUM APPLICATIONS. FOR VACUUM APPLICATIONS BELOW 1/2 ATMOSPHERE, CONSULT FACTORY.
13. DEVICE MARKING:
EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
14. SHIPPING/PACKAGING REQUIREMENTS:
THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
15. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM.
USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85CV

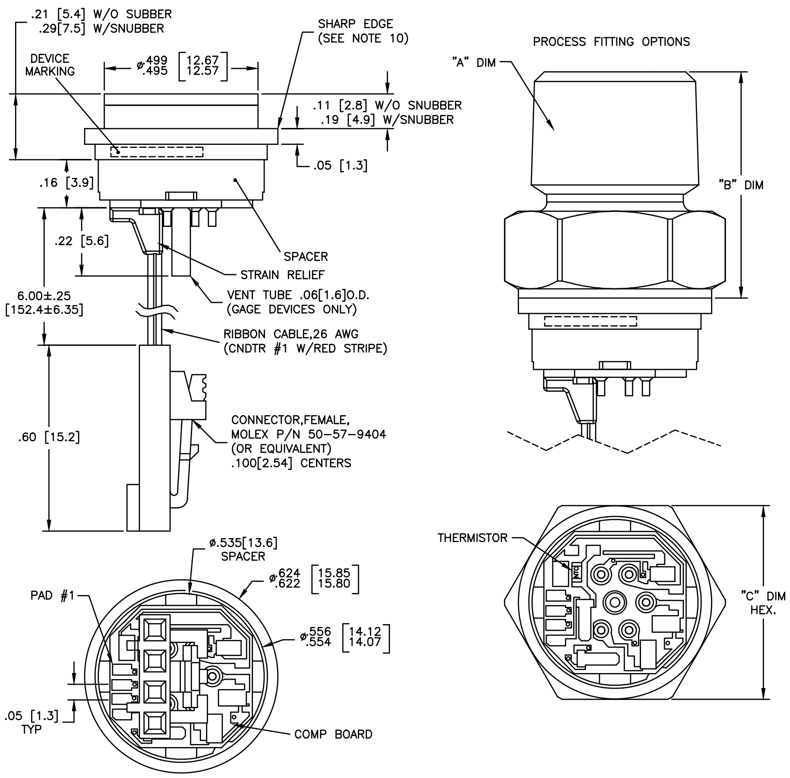
316L SS Pressure Sensor
High Performance, Small Profile
0-100 mV Output
Absolute and Gage
Low Pressure

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DESCRIPTION

SA85CV is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. A thick film ceramic compensation board with laser-trimmed resistors, and an additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



CONNECTIONS

PAD/CNDTR	FUNCTION
1	-OUT
2	+OUT
3	-EX
4	+EX

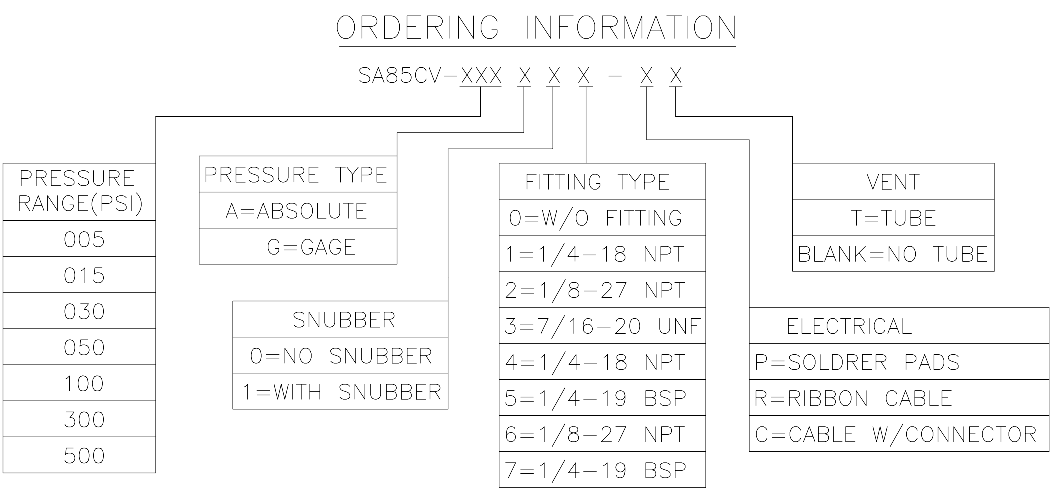
MODEL SA85CV

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10 VDC AND AT 25°C AFTER 10 SEC WARM UP

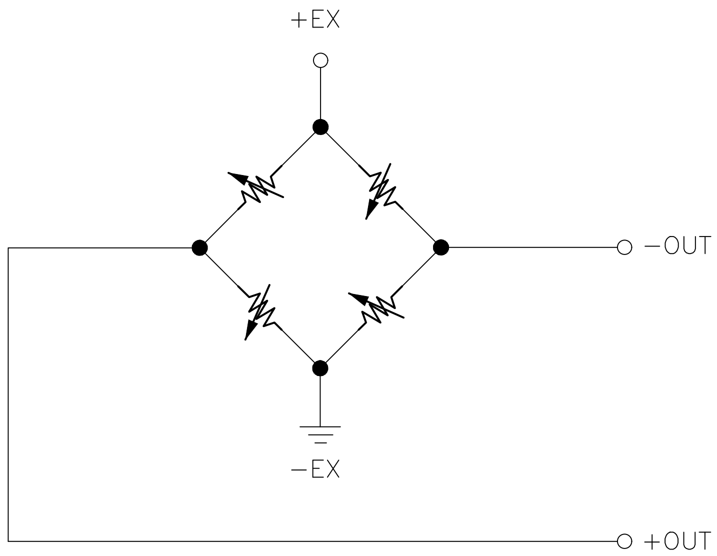
PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	98	100	102	99	100	101	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.0	0	+1.0	mV	2
PRESSURE NON-LINEARITY	-0.30	-	+0.30	-0.25	-	+0.25	%SPAN	3
PRESSURE HYSTERESIS	-0.30	±0.05	+0.30	-0.25	±0.05	+0.25	%SPAN	
REPEATABILITY	-	±0.02	-	-	±0.02	-	%SPAN	
INPUT RESISTANCE	5.5K	9.0K	12.5K	5.5K	9.0K	12.5K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.5	-	+1.5	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-2.5	-	+2.5	-1.25	-	+1.25	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.35	±0.10	+0.35	-0.30	±0.05	+0.30	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.35	±0.10	+0.35	-0.30	±0.05	+0.30	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.20	-	-	±0.15	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.35	-	-	±0.30	-	%SPAN/YR	
SUPPLY VOLTAGE	-	10	14	-	10	14	mA	4
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	5
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	6
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	-	-	3X	RATED	
BURST PRESSURE	-	-	4X	-	-	4X	RATED	7
COMPENSATED TEMPERATURE	0	-	+50	-20	-	+70	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL							
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL							

ORDERING INFORMATION



MODEL SA85CV

APPLICATION SCHEMATIC



EQUIVALENT SCHEMATIC

Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).
2. BEST FIT STRAIGHT LINE.
3. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
4. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
5. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
6. BETWEEN CASE AND SENSING ELEMENT.
7. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. STANDARD GAGE UNITS ARE NOT RECOMMENDED FOR VACUUM APPLICATIONS.
   FOR VACUUM APPLICATIONS BELOW 1/2 ATMOSPHERE, CONSULT FACTORY.
10. SHARP EDGE STRONGLY RECOMMENDED FOR WELDING APPLICATION. OPTIUM WELD PARAMETERS WILL REDUCE THE EFFECT OF WELD HEAT ON
    SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
11. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
    LOT NUMBER, SERIAL NUMBER AND DATE CODE.
12. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
13. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES,
    DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM.
    USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85A

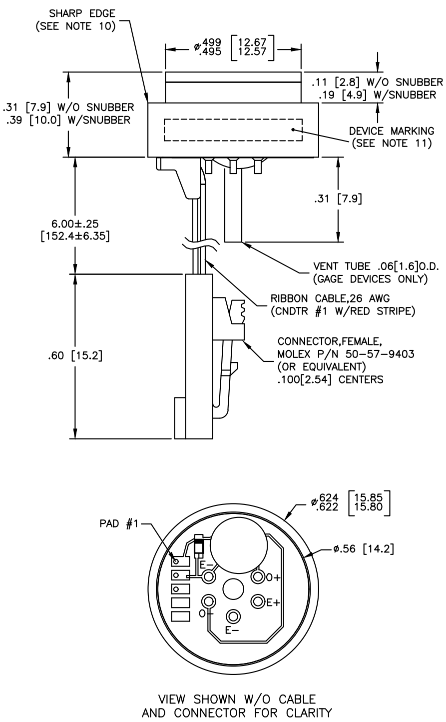
316L SS Pressure Sensor
High Performance, Small Profile
0.5-4.5Vdc Output
Absolute and Gage
Low Pressure

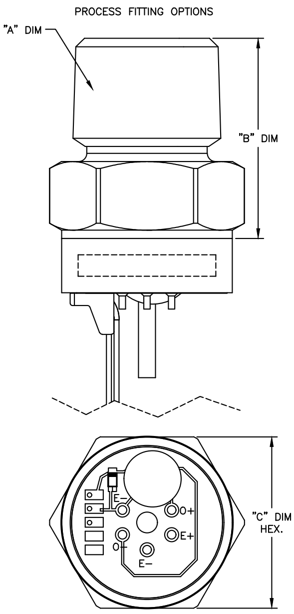
- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DESCRIPTION

SA85A is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS





CONNECTIONS

PAD/CNDTR	FUNCTION
1	+Vin
2	GND
3	+Vout

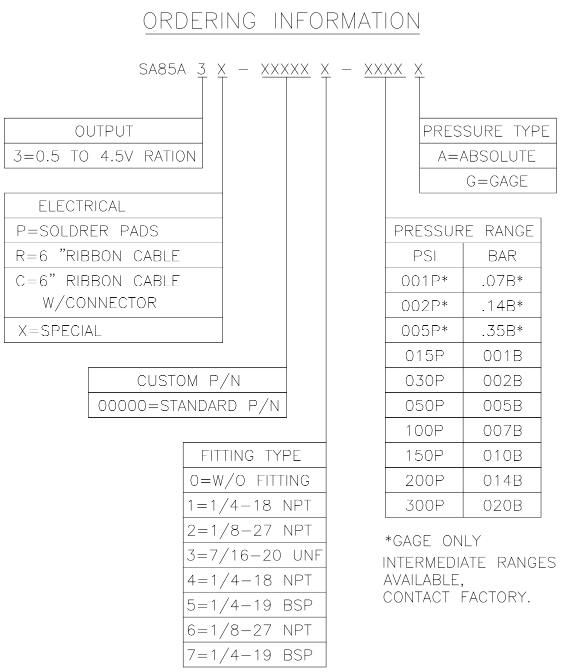
MODEL SA85A

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10 VDC AND AT 25°C AFTER 10 SEC WARM UP

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	4.5			V	
ZERO PRESSURE OUTPUT	0.5			V	
PRESSURE NON-LINEARITY	-1.0	±0.3	+1.0	%SPAN	1
PRESSURE HYSTERESIS	-0.10		+0.10	%SPAN	
REPEATABILITY	-	±0.02	-	%SPAN	
TEMPERATURE ERROR, SPAN (O° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
TEMPERATURE ERROR, ZERO(0° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
ACCURACY (COMBINED LINAEARITY, HYSTERESIS & REPEATABILITY)	±0.25			%SPAN	1
TOTAL ERROR BAND (INCLUDES CALIBRATION ERRORS & TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE)	1.2PSI AND 0.07BAR: ±7.0; 5PSI OR .35BAR: ±5 >5PSI OR >.35BAR: ±5			%SPAN	
SUPPLY VOLTAGE	4.75	5.0	5.25	V	3
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	4
PRESSURE OVERLOAD	3X			RATED	
COMPENSATED TEMPERATURE	0	-	+50	℃	
OPERATING TEMPERATURE	-20	-	+125	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

ORDERING INFORMATION



Notes

1. BEST FIT STRAIBHT LINE.
2. OVER THE COMPENSATED TEMPETATURE RANGE WITH RESPECT TO 25°C.
3. GUARANTEES OUTPUT/INPUT RATIONMETRICITY.
4. BETWEEN CASE AND SENSING ELEMENT.
5. THE MAXMIUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
6. DEVICE MARKING:
   EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
   LOT NUMBER, SERIAL NUMBER AND DATE CODE.
7. SHIPPING/PACKAGING REQUIREMENTS:
   THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
8. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85BSD

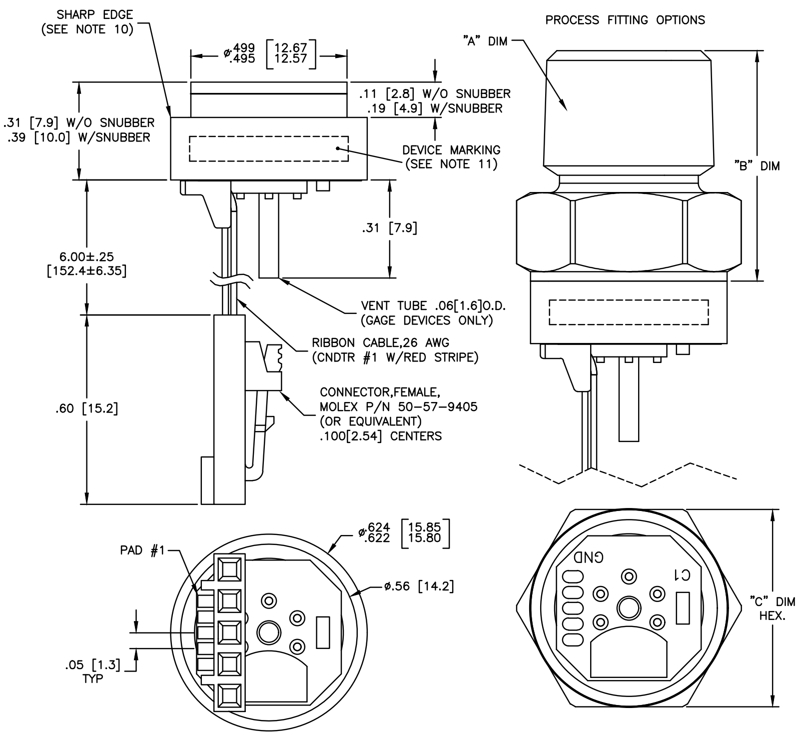
316L SS Pressure Sensor
High Performance, Small Profile
14bits I2C/SPI Output
Absolute and Gage
Low Pressure

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DESCRIPTION

SA85BSD is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



CONNECTIONS

PAD/CNDTR	FUNCTION
1	GND
2	+EX
3	SDA/MISO
4	SCL/SCLK
5	INT/SS

MODEL SA85BSD

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
ZERO PRESSURE OUTPUT (10% ~ 90%)	-	666	-	COUNT HEX	1
ZERO PRESSURE OUTPUT (5% ~ 95%)	-	333	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (10% ~ 90%)	-	399A	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (5% ~ 95%)	-	3CCB	-	COUNT HEX	1
PRESSURE ACCURACY	-0.25	-	+0.25	%SPAN	2
TOTAL ERROR BAND	-1	-	+1	%SPAN	3
PRESSURE RESOLUTION	0.008	-	-	%SPAN	
TEMPERATURE ACCURACY	-1.5	-	+1.5	℃	4
TEMPERATURE RESOLUTION	-	0.1	-	℃	
INPUT VOLTAGE RANGE	2.7	3.3	5.5	V	1
SUPPLY CURRENT	-	3	-	mA	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	5
PROOF PRESSURE	-	-	2X	RATED	6
BURST PRESSURE	-	-	3X	RATED	7
LOAD RESISTANCE	10K	-	-	Ω	
LONG TERM STABILITY, (OFFSET&SPAN)	-	±0.5	-	%SPAN/YR	
COMPENSATED TEMPERATURE (≤5PSI)	0	-	+50	℃	
COMPENSATED TEMPERATURE (≥15PSI)	-20	-	+85	℃	
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-40	-	+125	℃	8
OUTPUT PRESSURE RESOLUTION	-	-	14	BIT	
OUTPUT TEMPERATURE RESOLUTION	8	-	11	BIT	
START TIME TO DATA READY	-	-	8.4	mS	9
OUTPUT TYPE	10% to 90% OR 5% to 95%				
INTERFACE TYPE	I C (ADDRESS: 0X28H;0X36H;0X46H); SPI				
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

MODEL SA85BSD

ORDERING INFORMATION

ORDERING INFORMATION: SA85BSD–XXXX X X X – X X X X (XX)

PRESSURE RANGE	
PSI	BAR
005P*	.35B*
015P	001B
030P	002B
050P	3.5B
100P	005B
200P	014B
300P	020B

*005P(.35B) IS FOR GAGE PRESSUURE ONLY.
*INTERMEDIATE PRESSRE RANGES AVALIABLE.

PRESSURE TYPE
A=ABSOLUTE
G=GAGE

SNUBBER
0=NO SNUBBER
1=WITH SNUBBER

FITTING TYPE
0=W/O FITTING
1=1/4–18 NPT
2=1/8–27 NPT
3=7/16–20 UNF
4=1/4–18 NPT
5=1/4–19 BSP
6=1/8–27 NPT
7=1/4–19 BSP

SUPPLY VOLTEGE
3=3.3VDC
5=5.0VDC

OUTPUT
A=10%–90%
B=5%~95%

INTERFACE
I=I^{2}C(ADDR: 0X28H)
J=I^{2}C(ADDR: 0X36H)
K=I^{2}C(ADDR: 0X46H)
S=SPI

ELECTRICAL
P=PAD
R=RIBBON CABLE
C=CABLE W/CONNECTOR

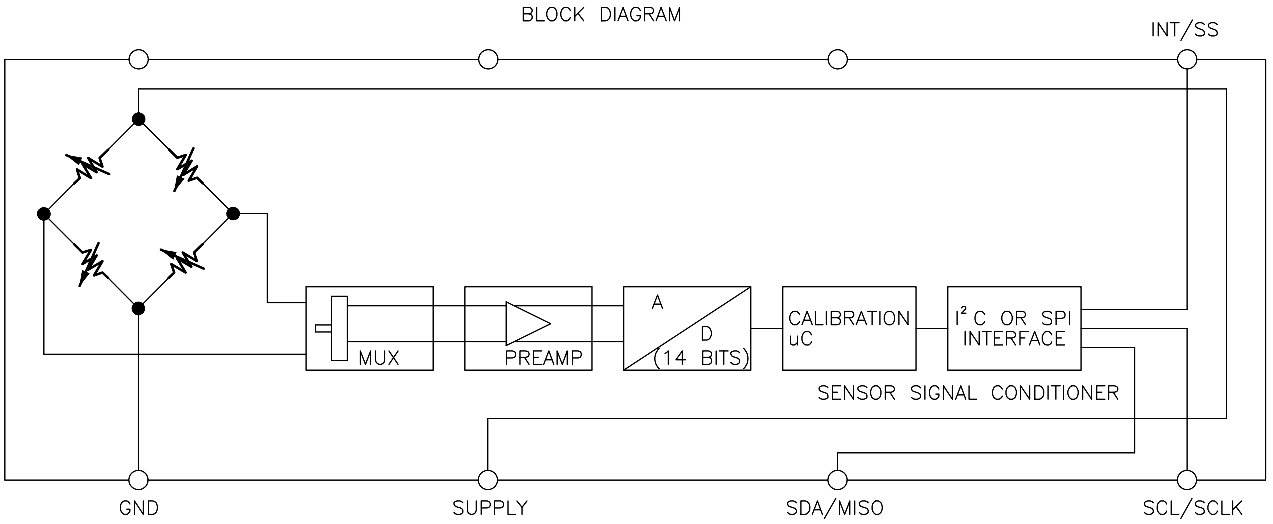
VENT
LT=LOW POWER W/TUBE
L=LOWER POWER W/O TUBE
T=STANDARD W/TUBE
BLANK=STANDARD W/O TUBE

Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).OUTPUT IS NOT RATIONMETRIC TO SUPPLY VOLTAGE.
2. ACCURACY : COMBINED LINEARITY,HYSTERESIS AND REPEATILITY.
3. TOTAL BAND: INCLUDES CALIBRATION ERRORS AND TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE. SEE FIG 2 OF SHEET 10
4. THE DEVIATION FROM A BEST FIT FIT STRAIGHT LINE(BFSL) FITTED TO THE OUTPUT MEASURED OVER THE COMPENSATED TEMPERAURE RAGE. FOR ERRORS BEYOND THE COMPENSATED TEMPERATURE RANGE, SEE FIG 1 OF SHEET 10.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 2X OR 400PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OF ACCURACY.
7. 3X OR 600PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. START TIME TO DATA RADY IS THE TIME TO GET VALID DATA AFTER POR (POWER ON RESET). THE TIME TO GET SUBSEQUENT VALID DATA IS THEN SPECIFIED BY THE RESPONSE TIME SPECIFICATION.
10. SHARP EDGE STRONGLY RECOMMENDED FOR WELDING APPLICATION. OPTIUM WELD PARAMETERS WILL REDUCE THE EFFECT OF WELD HEAT ON SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
11. DEVICE MARKING:
EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
12. SHIPPING/PACKAGING REQUIREMENTS:
THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
13. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85BSD

APPLICATION SCHEMATIC



I C INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	100		400	KHz
START CONDITION HOLD TIME RELATIVE TO SCL EDGE	tHDSTA	0.1			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
START CONDITION SETUP TIME RELATIVE TO SCL EDGE	tSUSTA	0.1			μS
DATA HOLD TIME ON SDA RELATIVE TO SCL EDGE	tHDDAT	0			μS
DATA SETUP TIME ON SDA RELATIVE TO SCL EDGE	tSUDA	0.1			μS
STOP CONDITION SETUP TIME ON SCL	tSUSTO	0.1			μS
BUS FREE TIME BETWEEN STOP AND START CONDITION	tBUS	2			μS

SPI INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	50		800	KHz
SS DROP TO FIRST CLOCK EDGE	tHDSS	2.5			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
CLOCK EDGE TO DATA TRANSITION	tCLKD	0		0.1	μS
RISE OF SS RELATIVE TO LAST CLOCK EDGE	tSUSS	0.1			μS
BUS FREE TIME BETWEEN RISE AND FALL OF SS	tBUS	2			μS

@1 COMBINED LOW AND HIGH WIDTHS MUST EQUAL OR EXCCED MINIMUM SCL PERIOD.

MODEL SA85BSD

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

FIG 1

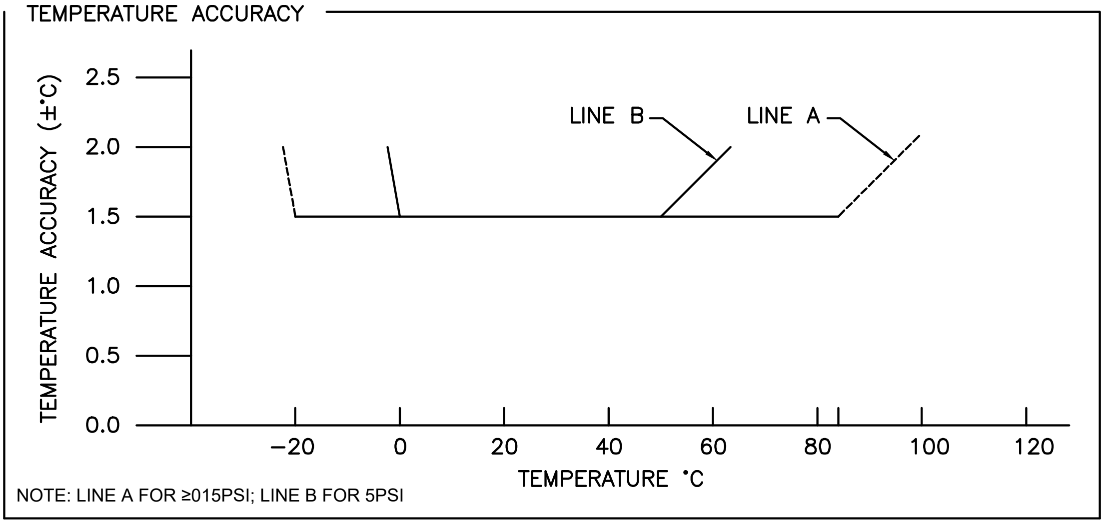
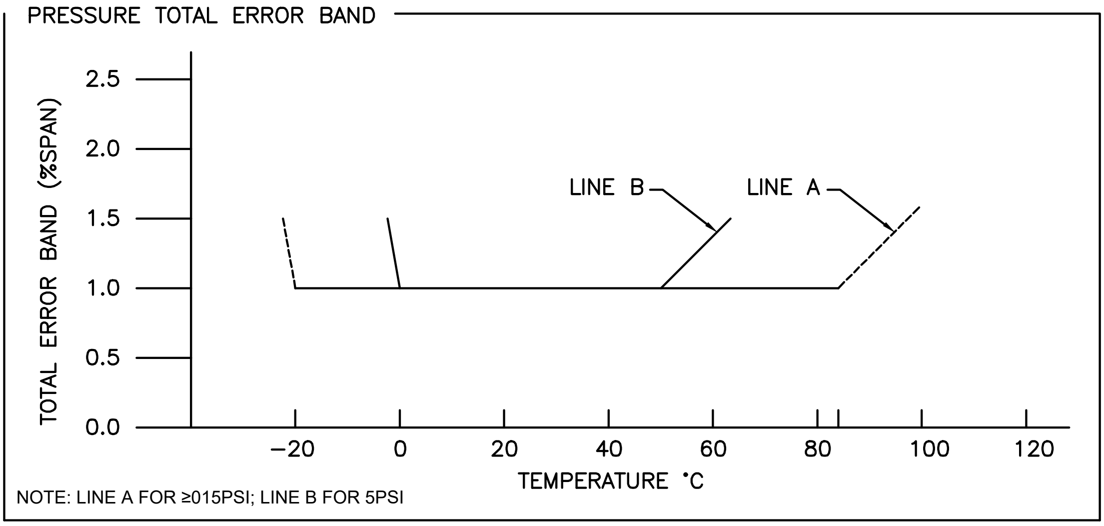


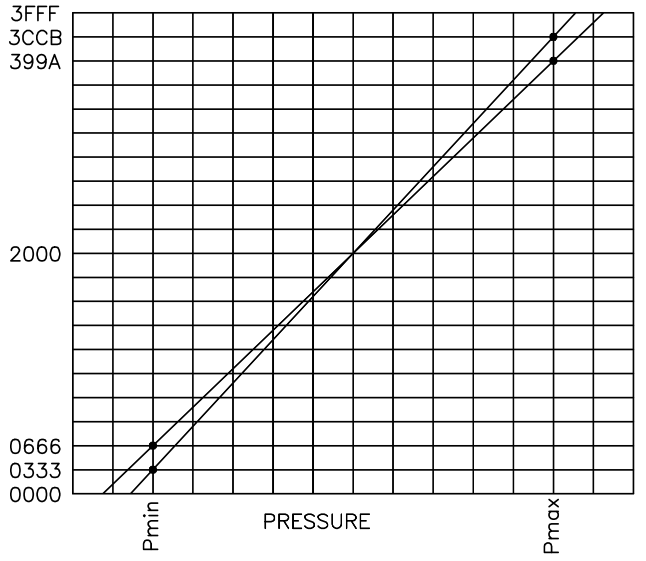
FIG 2



MODEL SA85BSD

PRESSURE FUNCTION

PRESSURE FUNCTION

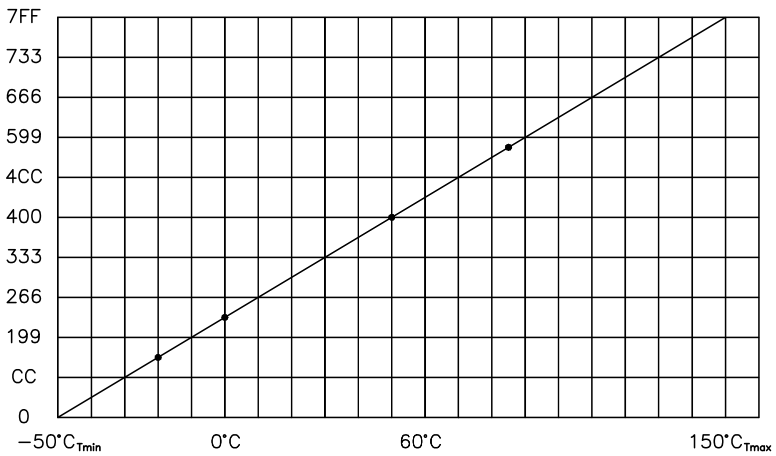


SENSOR OUPUT AT SIGNIFIANT PERCENTAGES

%OUTPUT	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0	0	0 X 0000
5	819	0 X 0333
10	1638	0 X 0666
50	8192	0 X 2000
90	14746	0 X 399A
95	15563	0 X 3CCB
100	16383	0 X 3FFF

TEMPERATURE FUNCTION

TEMPERATURE FUNCTION



DIGITAL TEMPERATURE OUTPUT

OUTPUT°C	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
−50	0	0 X 0000
−20	317	0 X 0133
0	512	0 X 0200
25	767	0 X 02FF
50	1024	0 X 0400
85	1381	0 X 0565
150	2047	0 X 07FF

MODEL SA85RID

316L SS Pressure Sensor
High Performance, Small Profile
RS485 or I2C Output
Absolute and Gage
Low Pressure

- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

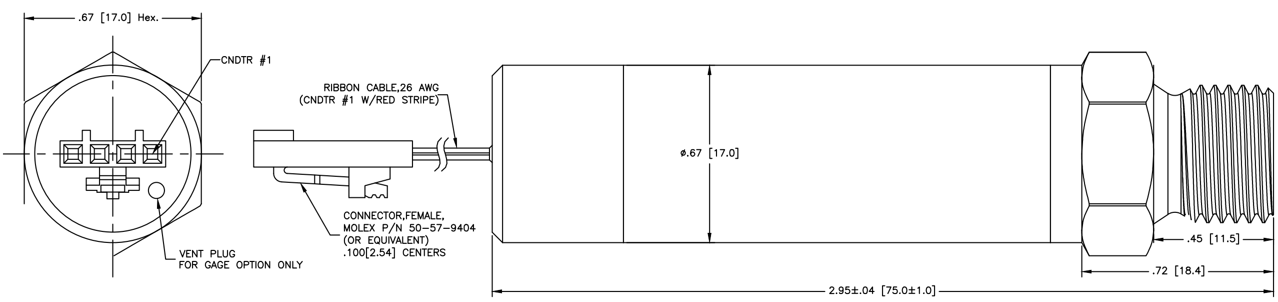
DESCRIPTION

SA85RID is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION	I²C
1	E+	E+
2	E-	E-
3	R-/B-	SCL
4	R+/B+	SDA

DIMENSIONS



MODEL SA85RID

PERFORMANCE SPECIFICATIONS

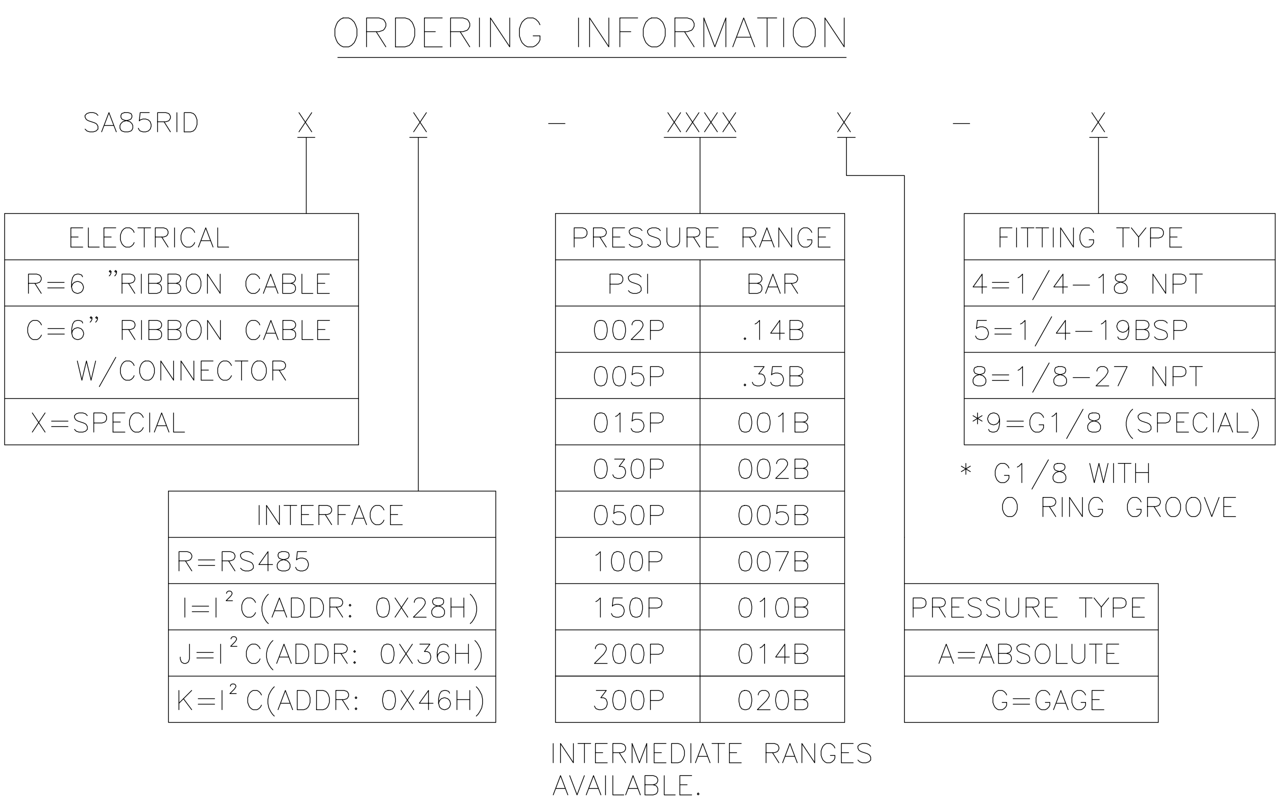
ALL PARAMETERS ARE MEASURED AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SIGNAL	RS485; I² C				
SUPPLY VOLTAGE	5-30 (RS4850; 2.2V-3.6 (I² C)				
OPERATING CURRENT	<5mA(RS485);<1.0mA(I C);<20 A(I C SLEEP CONDITION)			%SPAN	
ACCURACY	-0.10	-0.05	+0.10	%SPAN	1
SENSITIVITY	0.002%FS (PRESSURE); 0.1°C(TEMPERATURE)				
PROOF PRESSURE	3X			RATED	
BURST PRESSURE	4X			RATED	
STABILITY(1YEAR)	-0.1		+0.1	%SPAN	
TOTAL ERROR BAND	-0.25	±0.1	+0.25	%SPAN	
COMPENSATED TEMPERATURE	-20	-	+85	℃	2
OPERATING TEMPERATURE	-40	-	+105	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316L ST STL/EPOXY/SILICON			RATED	

Notes

1. BEST FIT STRAIBHT LINE.
2. OVER THE COMPENSATED TEMPETATURE RANGE WITH RESPECT TO 25°C.

ORDERING INFORMATION

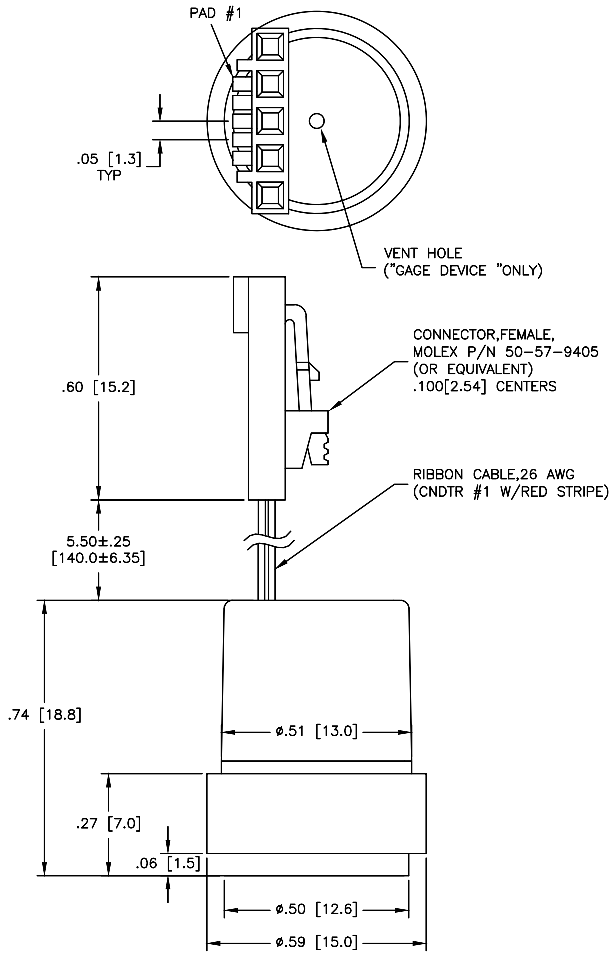


MODEL SA85ESBSD

316L SS Pressure Sensor
Flush Mount
14bits I2C/SPI Output
Absolute and Gage
Low Pressure

- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DIMENSIONS



DESCRIPTION

SA85ESBSD is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	GND
2	+EX
3	SDA/MISO
4	SCL/SCLK
5	INT/SS

MODEL SA85ESBSD

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C(UNLESS OTHERWISE SPECIFIED):

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
ZERO PRESSURE OUTPUT (10% ~ 90%)	-	666	-	COUNT HEX	1
ZERO PRESSURE OUTPUT (5% ~ 95%)	-	333	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (10% ~ 90%)	-	399A	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (5% ~ 95%)	-	3CCB	-	COUNT HEX	1
PRESSURE ACCURACY	-0.25	-	+0.25	%SPAN	2
TOTAL ERROR BAND	-1	-	+1	%SPAN	3
PRESSURE RESOLUTION	0.008	-	-	%SPAN	
TEMPERATURE ACCURACY	-1.5	-	+1.5	℃	4
TEMPERATURE RESOLUTION	-	0.1	-	℃	
INPUT VOLTAGE RANGE	2.7	3.3	5.5	V	1
SUPPLY CURRENT	-	3	-	mA	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	5
PROOF PRESSURE	-	-	2X	RATED	6
BURST PRESSURE	-	-	3X	RATED	7
LOAD RESISTANCE	10K	-	-	Ω	
LONG TERM STABILITY, (OFFSET&SPAN)	-	±0.5	-	%SPAN/YR	
COMPENSATED TEMPERATURE	0	-	+50	℃	
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-40	-	+125	℃	8
OUTPUT PRESSURE RESOLUTION	-	-	14	BIT	
OUTPUT TEMPERATURE RESOLUTION	8	-	11	BIT	
START TIME TO DATA READY	-	-	8.4	mS	9
OUTPUT TYPE	10% to 90% OR 5% to 95%				
INTERFACE TYPE	I² C (ADDRESS: 0X28H;0X36H;0X46H); SPI				
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL AND RUBBER FKM/EPDM/NBR/VMQ/HNBR				

MODEL SA85ESBSD

ORDERING INFORMATION

ORDERING INFORMATION SA85ESBSD – XXX X – X X X X X

INTERMEDIATE PRESSURE RANGES AVALIABLE.

PRESSURE RANGE	
BAR	
002B	2Bar
005B	5Bar
006B	6Bar
007B	7Bar
008B	8Bar
009B	9Bar
010B	10Bar
012B	12Bar
014B	14Bar
018B	18Bar
020B	20Bar

PRESSURE TYPE
A=ABSOLUTE
S=SEALED GAGE
S=GAGE

SUPPLY VOLTEGE
3=3.3VDC
5=5.0VDC

OUTPUT
A=10%–90%
B=5%~95%

INTERFACE
I=I²C(ADDR: 0X28H)
J=I²C(ADDR: 0X36H)
K=I²C(ADDR: 0X46H)
S=SPI

ELECTRICAL
R=RIBBON CABLE
C=CABLE W/CONNECTOR

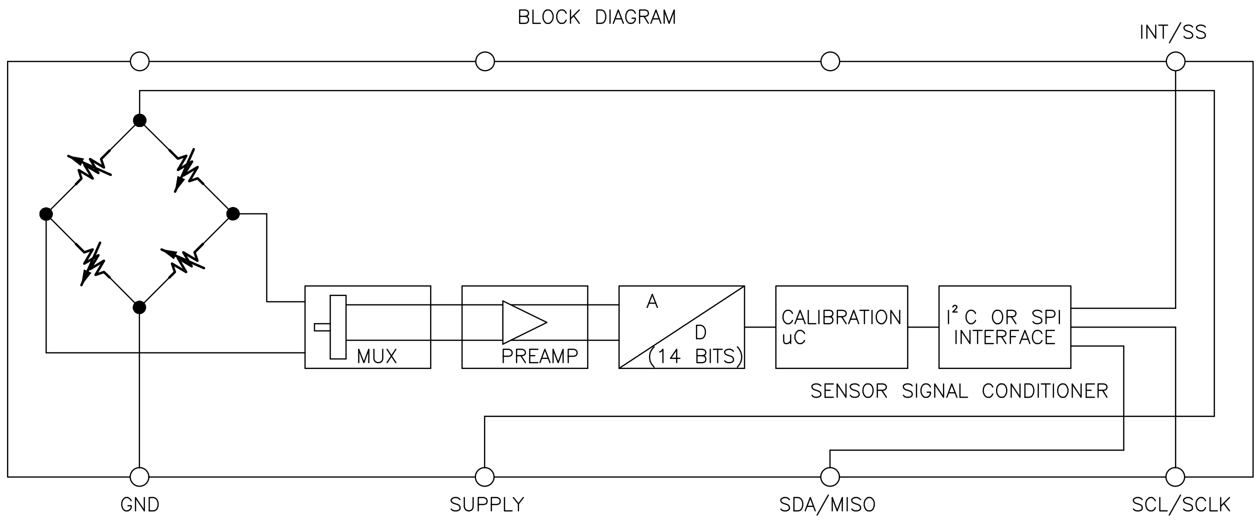
SEALING TYPE
1=O RING FKM
2=O RING EPDM
3=O RING NBR
4=O RING VMQ
5=O RING HNBR

Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR SEALED GAGE (S) AND GAGE (G), OUTPUT IS NOT RATIONMETRIC TO SUPPLY VOLTAGE.
2. ACCURACY : COMBINED LINEARITY,HYSTERESIS AND REPEATILITY.
3. TOTAL BAND: INCLUDES CALIBRATION ERRORS AND TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE. SEE FIG 2 OF SHEET 17.
4. THE DEVIATION FROM A BEST FIT FIT STRAIGHT LINE(BFSL) FITTED TO THE OUTPUT MEASURED OVER THE COMPENSATED TEMPERAURE RAGE. FOR ERRORS BEYOND THE COMPENSATED TEMPERATURE RANGE, SEE FIG 1 OF SHEET 17.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 2X OR 400PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OF ACCURACY.
7. 3X OR 600PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. START TIME TO DATA RADY IS THE TIME TO GET VALID DATA AFTER POR (POWER ON RESET). THE TIME TO GET SUBSEQUENT VALID DATA IS THEN SPECIFIED BY THE RESPONSE TIME SPECIFICATION.
10. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (SEALED GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA85ESBSD

APPLICATION SCHEMATIC



I ²C INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	100		400	KHz
START CONDITION HOLD TIME RELATIVE TO SCL EDGE	tHDSTA	0.1			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
START CONDITION SETUP TIME RELATIVE TO SCL EDGE	tSUSTA	0.1			μS
DATA HOLD TIME ON SDA RELATIVE TO SCL EDGE	tHDDAT	0			μS
DATA SETUP TIME ON SDA RELATIVE TO SCL EDGE	tSUDA	0.1			μS
STOP CONDITION SETUP TIME ON SCL	tSUSTO	0.1			μS
BUS FREE TIME BETWEEN STOP AND START CONDITION	tBUS	2			μS

SPI INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	50		800	KHz
SS DROP TO FIRST CLOCK EDGE	tHDSS	2.5			μS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			μS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			μS
CLOCK EDGE TO DATA TRANSITION	tCLKD	0		0.1	μS
RISE OF SS RELATIVE TO LAST CLOCK EDGE	tSUSS	0.1			μS
BUS FREE TIME BETWEEN RISE AND FALL OF SS	tBUS	2			μS

@1 COMBINED LOW AND HIGH WIDTHS MUST EQUAL OR EXCCED MINIMUM SCL PERIOD.

MODEL SA85ESBSD

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

FIG 1

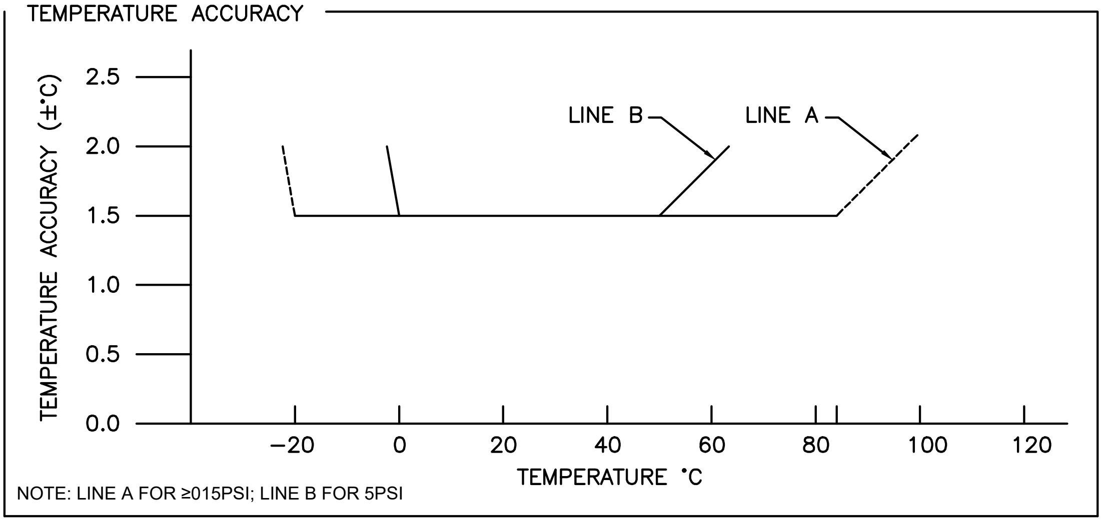
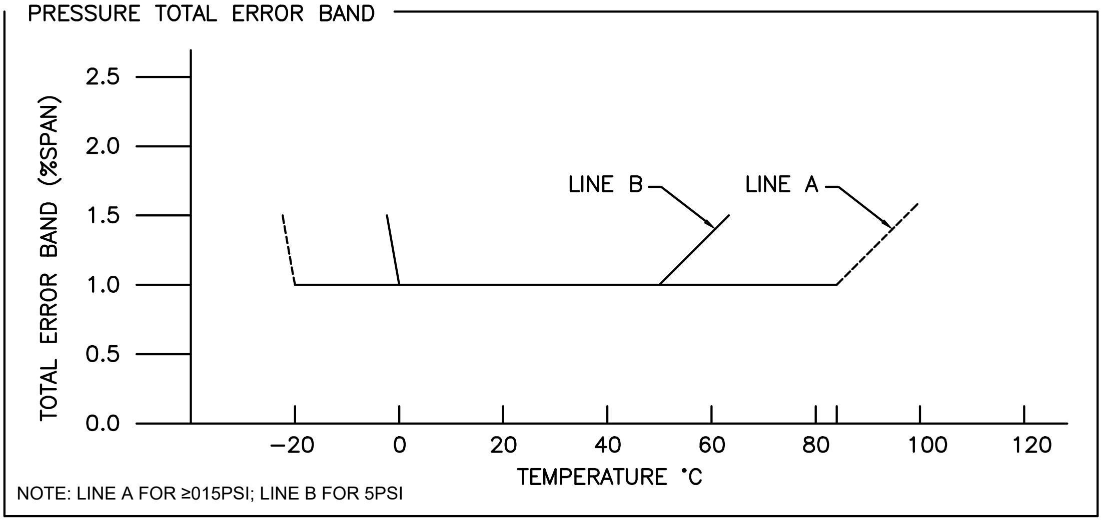


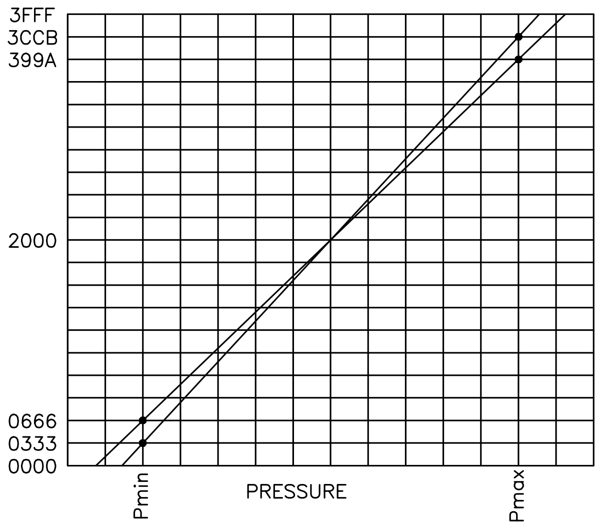
FIG 2



MODEL SA85ESBSD

PRESSURE FUNCTION

PRESSURE FUNCTION



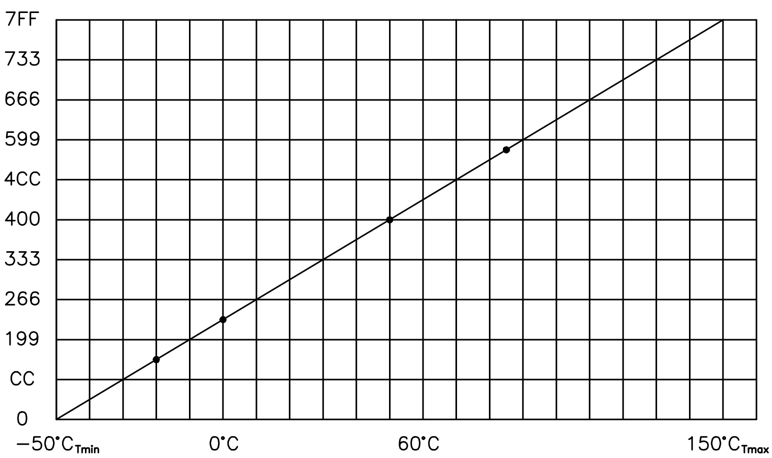
SENSOR OUPUT AT SIGNIFIANT PERCENTAGES

%OUTPUT	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0	0	0 X 0000
5	819	0 X 0333
10	1638	0 X 0666
50	8192	0 X 2000
90	14746	0 X 399A
95	15563	0 X 3CCB
100	16383	0 X 3FFF

A TYPE: $\text{OUT (DECIMAL COUNTS)} = \frac{80\%*16383}{Pmax-Pmin} * (Papplied-Pmin)+10\%*16383$

TEMPERATURE FUNCTION

TEMPERATURE FUNCTION



DIGITAL TEMPERATURE OUTPUT

OUTPUT˚C	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
−50	0	0 X 0000
−20	317	0 X 0133
0	512	0 X 0200
25	767	0 X 02FF
50	1024	0 X 0400
85	1381	0 X 0565
150	2047	0 X 07FF

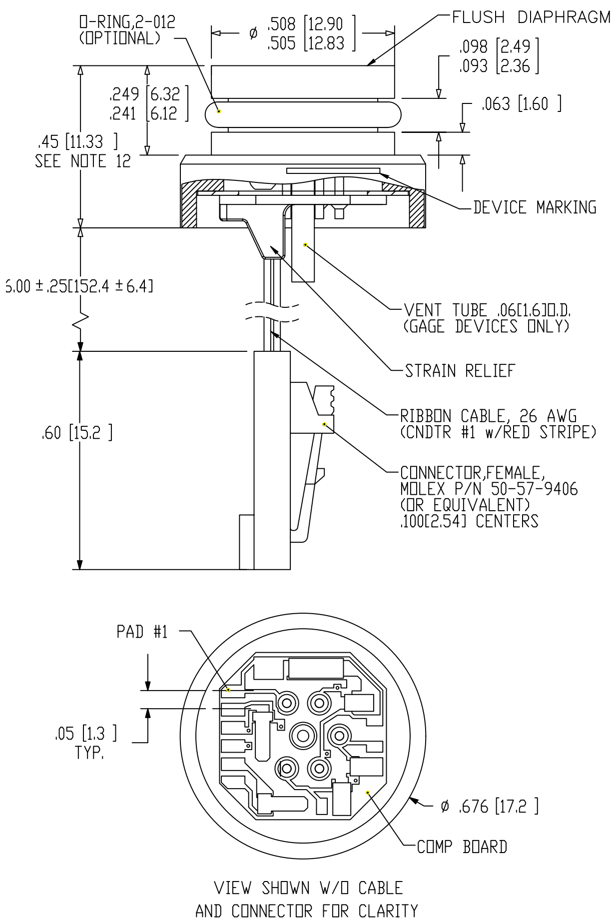
$$\text{OUT (DECIMAL COUNTS)} = \frac{(\text{OUTPUT˚C} - (-50˚C_{Tmin}))*2047}{150˚C_{Tmax} - (-50˚C_{Tmin})}$$

MODEL SA85F

316L SS Pressure Sensor
Flush Mount
0-150 mV Output
Absolute and Gage
Constant Current

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DIMENSIONS



DESCRIPTION

SA85F is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

<table>
<tr><th>PAD/CNDTR</th><th>FUNCTION</th></tr>
<tr><td>1</td><td>+OUT</td></tr>
<tr><td>2</td><td>-EX</td></tr>
<tr><td>3</td><td>+EX</td></tr>
<tr><td>4</td><td>-OUT</td></tr>
<tr><td>5</td><td rowspan="2">GAIN</td></tr>
<tr><td>6</td></tr>
</table>

PC Board Mountable Pressure Sensor

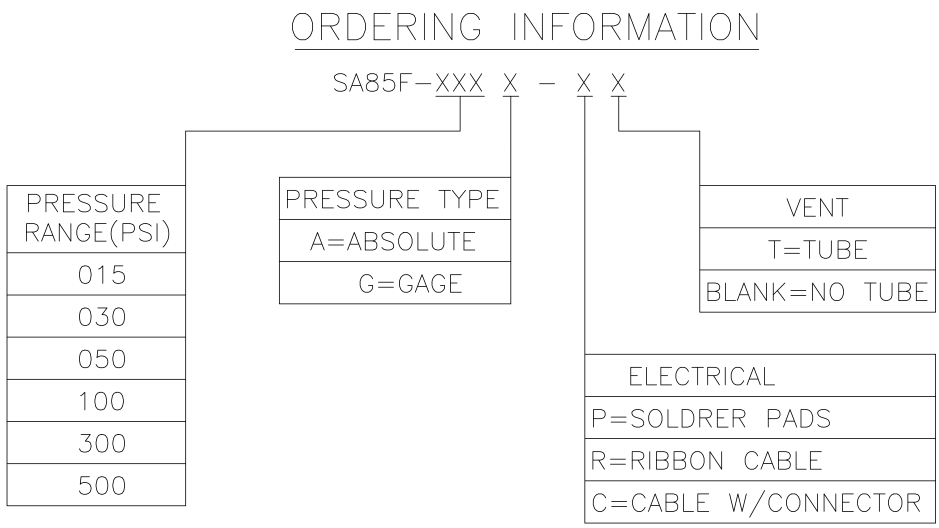
MODEL SA85F

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C(UNLESS OTHERWISE SPECIFIED):

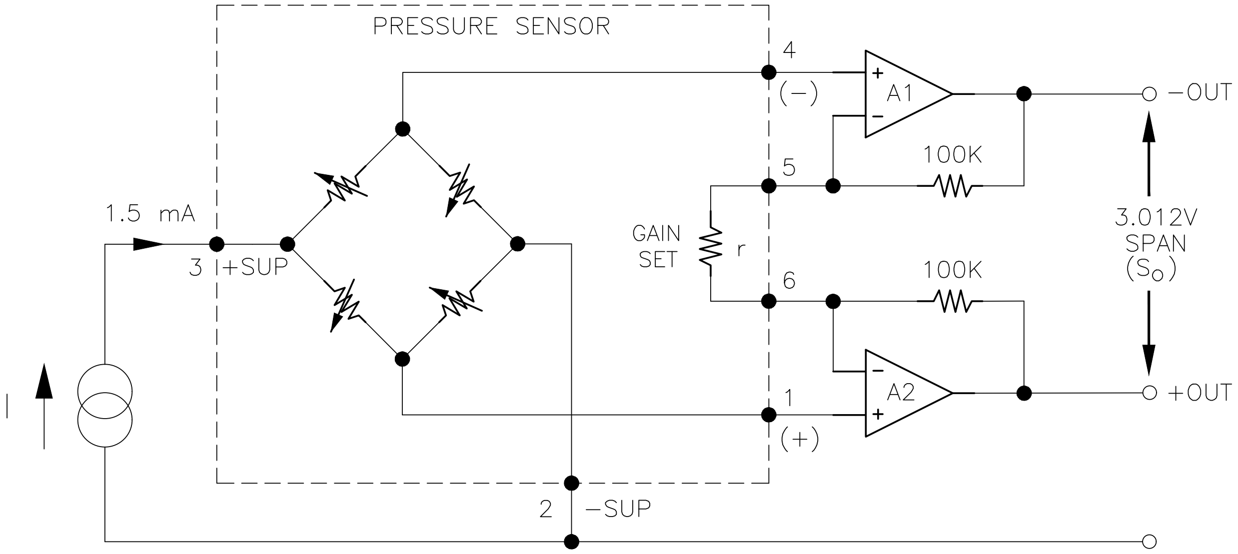
PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	65	100	150	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	mV	2
PRESSURE NON-LINEARITY	-0.20	±0.1	+0.20	%SPAN	3
PRESSURE HYSTERESIS	-0.05	±0.02	+0.05	%SPAN	
REPEATABILITY	-	±0.02	-	%SPAN	
INPUT RESISTANCE	2.0K	3.5K	5.8K	Ω	
OUTPUT RESISTANCE	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	4
TEMPERATURE ERROR, OFFSET	-0.80	-	+0.80	%SPAN	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	5
OUTPUT LOAD RESISTANCE	5M	-	-	Ω	6
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	7
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	μVp-p	
RISE TIME (10% to 90%)	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	RATED	8
BURST PRESSURE	-	-	4X	RATED	9
COMPENSATED TEMPERATURE	0	-	70	℃	
OPERATING TEMPERATURE	-20	-	+125	℃	10
STORAGE TEMPERATURE	-50	-	+125	℃	10
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

ORDERING INFORMATION



MODEL SA85F

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

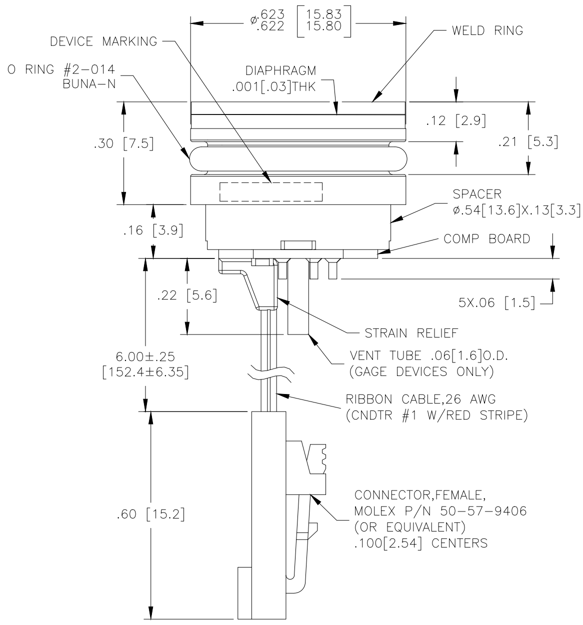
1. FOR AMPLIFIED OUTPUT CIRCUITS, 3.012V ±1% INTERCHANGEABILITY WITH GAIN SET RESISTOR. SEE APPLICATION SCHEMATIC.
2. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).
3. BEST FIT STRAIGHT LINE.
4. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
5. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
6. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
7. BETWEEN CASE AND SENSING ELEMENT.
8. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OR ACCURACY.
9. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
10. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
11. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
12. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
13. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

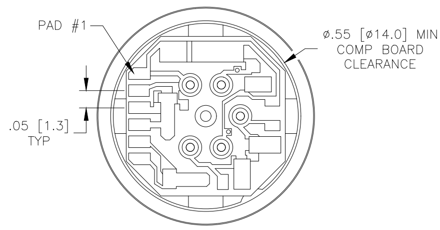
MODEL SA86C

316L SS Pressure Sensor
High Performance, Small Profile
0-150 mV Output
Absolute and Gage
Constant Current

- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DIMENSIONS





VIEW SHOWN W/O CABLE AND CONNECTOR FOR CLARITY

DESCRIPTION

SA86C is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filledilled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	GAIN

MODEL SA86C

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	50	100	150	75	100	150	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.0	0	+1.0	mV	2
PRESSURE NON-LINEARITY	1PSI:±0.30; 5PSI: ±0.20			-0.2	±0.1	+0.2	%SPAN	3
PRESSURE HYSTERESIS	-0.10	±0.02	+0.10	-0.05	±0.02	+0.05	%SPAN	
REPEATABILITY	-	±0.02	-	-	±0.02	-	%SPAN	
INPUT RESISTANCE	2.0K	3.5K	6.5K	2.0K	3.5K	5.8K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	-1.0	-	+1.0	%SPAN	4
TEMPERATURE ERROR, OFFSET	1PSI:±1.5; 5PSI: ±1.0			15PSI:±1.0; >15PSI: ±0.8			%SPAN	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.10	-	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.25	-	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	0.5	1.5	2.0	mA	5
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	6
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	7
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	1PSI:10X MAX; 5PSI: 3MAX			-	-	3X	RATED	
BURST PRESSURE	1PSI:12X MAX; 5PSI: 4MAX			-	-	4X	RATED	8
COMPENSATED TEMPERATURE	1PSI: 0 TO 50; 5PSI: 0 TO 70			-20	-	+85	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	9
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	9
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL & O RING BUNA-N							

Notes

1. For amplified output circuits, 3.012V ±1% interchangeability with gain set resistor.
   See application schematic.
2. Measured at vacuum for absolute (A), ambient for gage (G) and compound (C).
3. Best fit straight line.
4. Over the compensated temperature range with respect to 25°C.
5. Guarantees output/input ratiometricity.
6. Load resistance to reduce measurement errors due to output loading.
7. Between case and sensing element.
8. The maximum pressure that can be applied to a transducer without rupture of either the sensing element or transducer.
9. Maximum temperature range for product with standard cable and connector is -20°C to +105°C.
10. Standard gage units are not recommended for vacuum applications. For vacuum applications below 1/2 atmosphere, consult factory.
11. Device Marking:
    Each part shall be identified with Model Number, Pressure Range, Type, Lot Number, Serial Number and Date Code.
12. Shipping/Packaging requirements:
    The stainless steel diaphragm is protected by a plastic CAP. Each unit will be packaged individually in a plastic vial with anti-static foam.
13. Direct mechanical Contact with diaphragm is prohibited. Diaphragm surface must remain free of defects (scratches, punctures, dents, fingerprints, etc) for device to operate properly. Caution is advised when handling parts with exposed diaphragms. Use protective cap whenever devices are not in use.

MODEL SA86C

ORDERING INFORMATION

ORDERING INFORMATION

SA86C−XXX X − X X

PRESSURE RANGE(PSI)
001 (GAGE ONLY)
005
015
030
050
100
300
500

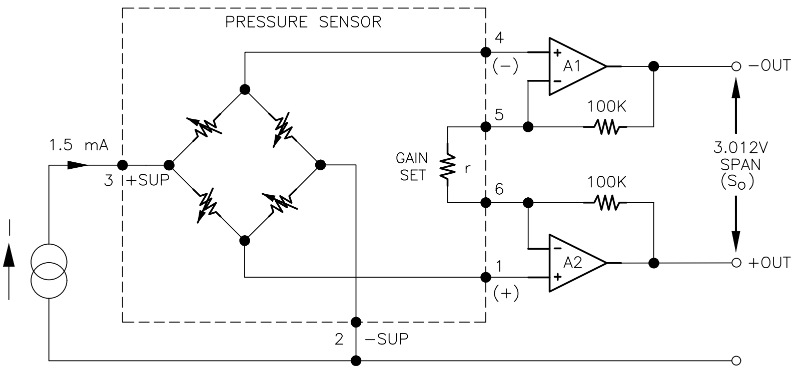
PRESSURE TYPE
A=ABSOLUTE
G=GAGE
*C=COMPOUND

*COMPOUND PRESSURE RANGE IS −14.5 TO XXXPSIG

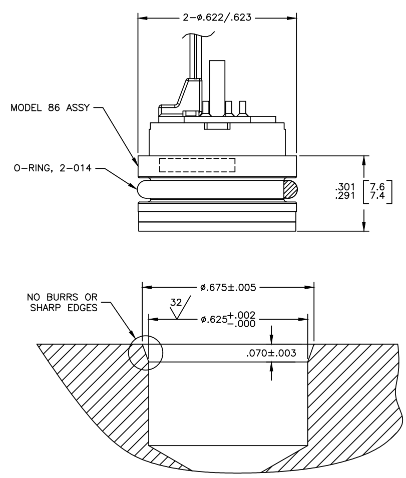
ELECTRICAL
P=SOLDRER PADS
R=RIBBON CABLE
C=CABLE W/CONNECTOR

VENT
T=TUBE
BLANK=NO TUBE

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC



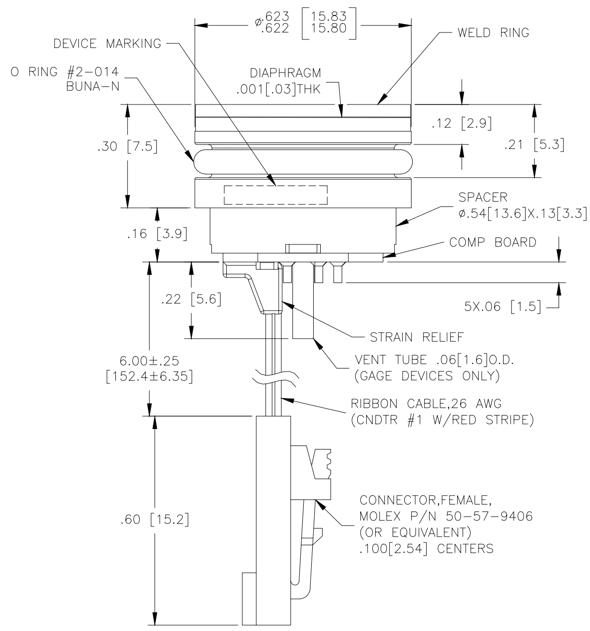
RECOMMENDED MOUNTING DIMENSIONS

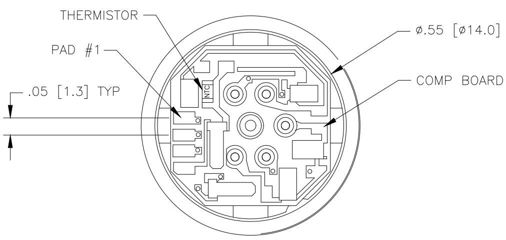
MODEL SA86CV

316L SS Pressure Sensor
High Performance, Small Profile
0-100 mV Output
Absolute and Gage
Constant Voltage

- **Medical Instruments**
- **Process Control**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**
- **Level Systems**

DIMENSIONS





VIEW SHOWN W/O CABLE AND CONNECTOR FOR CLARITY

DESCRIPTION

SA86CV is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filledlled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. A thick film ceramic compensation board with laser-trimmed resistors, and an additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	-OUT
2	+OUT
3	-EX
4	+EX

MODEL SA86CV

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10 VDC AND AT 25°C AFTER 10 SEC WARM UP

PARAMETERS	005 PSI			≥015PSI			UNITS	NOTES
	MIN	YTP	MAX	MIN	YTP	MAX		
SPAN	98	100	102	99	100	101	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	-1.0	0	+1.0	mV	2
PRESSURE NON-LINEARITY	-0.20	-	+0.20	-0.20	±0.1	+0.20	%SPAN	3
PRESSURE HYSTERESIS	-0.10	±0.02	+0.10	-0.05	±0.02	+0.05	%SPAN	
REPEATABILITY	-	±0.02	-	-	±0.02	-	%SPAN	
INPUT RESISTANCE	5.5K	9.0K	12.5K	5.5K	9.0K	12.5K	Ω	
OUTPUT RESISTANCE	4.0K	-	7.0K	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.5	-	+1.5	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-2.5	-	+2.5	-1.0	-	+1.0	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	-0.25	±0.05	+0.25	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.10	-	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.25	-	-	±0.10	-	%SPAN/YR	
SUPPLY VOLTAGE	-	10	14	-	10	14	XDC	4
OUTPUT LOAD RESISTANCE	5M	-	-	5M	-	-	Ω	5
INSULATION RESISTANCE (50 VDC)	50M	-	-	50M	-	-	Ω	6
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	-	1.0	-	μV p-p	
RISE TIME (10% to 90%)	-	-	0.1	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	-	-	3X	RATED	
BURST PRESSURE	-	-	4X	-	-	4X	RATED	7
COMPENSATED TEMPERATURE	0	-	+50	-20	-	+85	℃	
OPERATING TEMPERATURE	-20	-	+70	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L SS STL & O RING BUNA-N							

ORDERING INFORMATION

ORDERING INFORMATION

SA86CV–XXX X – X X

PRESSURE RANGE(PSI)
001 (GAGE ONLY)
005
015
030
050
100
300
500

PRESSURE TYPE
A=ABSOLUTE
G=GAGE
*C=COMPOUND

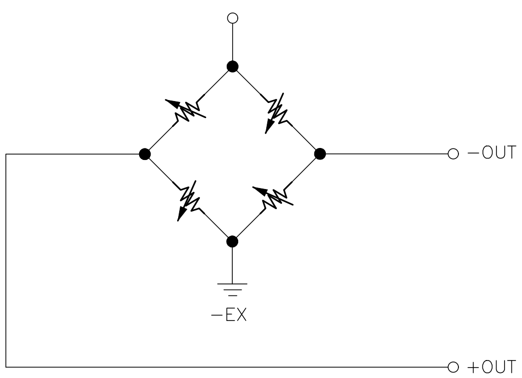
*COMPOUND PRESSURE RANGE IS –14.5 TO XXXPSIG

VENT
T=TUBE
BLANK=NO TUBE

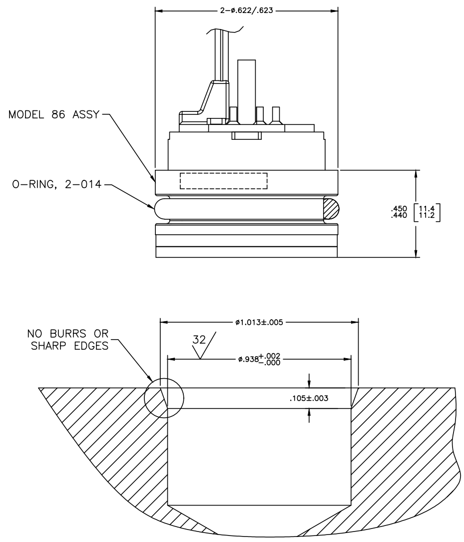
ELECTRICAL
P=SOLDRER PADS
R=RIBBON CABLE
C=CABLE W/CONNECTOR

MODEL SA86CV

APPLICATION SCHEMATIC



EQUIVALENT SCHEMATIC



RECOMMENDED MOUNTING DIMENSIONS

Notes

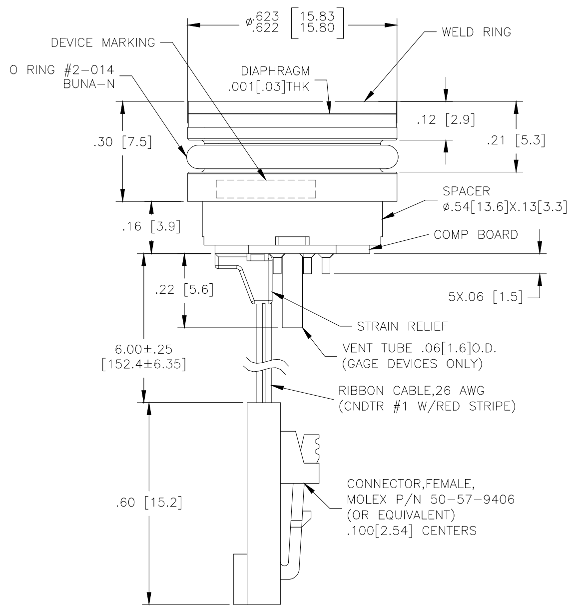
1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).
2. BEST FIT STRAIGHT LINE.
3. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
4. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
5. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
6. BETWEEN CASE AND SENSING ELEMENT.
7. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. STANDARD GAGE UNITS ARE NOT RECOMMENDED FOR VACUUM APPLICATIONS.
   FOR VACUUM APPLICATIONS BELOW 1/2 ATMOSPHERE, CONSULT FACTORY.
   SENSOR PERFORMANCE. DEVICES WITH LOWER PRESSURE RANGES HAVE GREATER SUSCEPTIBILITY TO HEAT GENERATED DURING THE WELD PROCESS.
10. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
    LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL
    WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES,
    DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM.
    USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

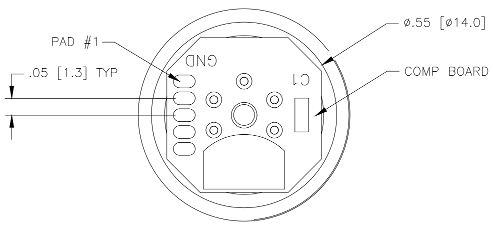
MODEL SA86BSD

316L SS Pressure Sensor
High Performance, Small Profile
14bits I2C/SPI Output
Absolute and Gage
Low Pressure

- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DIMENSIONS





VIEW SHOWN W/O CABLE AND CONNECTOR FOR CLARITY

DESCRIPTION

SA86BSD is a micromachined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filledlled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	GND
2	+EX
3	SDA/MISO
4	SCL/SCLK
5	INT/SS

MODEL SA86BSD

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
ZERO PRESSURE OUTPUT (10% ~ 90%)	-	666	-	COUNT HEX	1
ZERO PRESSURE OUTPUT (5% ~ 95%)	-	333	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (10% ~ 90%)	-	399A	-	COUNT HEX	1
FULL SCALE PRESSURE OUTPUT (5% ~ 95%)	-	3CCB	-	COUNT HEX	1
PRESSURE ACCURACY	-0.25	-	+0.25	%SPAN	2
TOTAL ERROR BAND	-1	-	+1	%SPAN	3
PRESSURE RESOLUTION	0.008	-	-	%SPAN	
TEMPERATURE ACCURACY	-1.5	-	+1.5	℃	4
TEMPERATURE RESOLUTION	-	0.1	-	℃	
INPUT VOLTAGE RANGE	2.7	3.3	5.5	V	1
SUPPLY CURRENT	-	3	-	mA	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	5
PROOF PRESSURE	-	-	2X	RATED	6
BURST PRESSURE	-	-	3X	RATED	7
LOAD RESISTANCE	10K	-	-	Ω	
LONG TERM STABILITY, (OFFSET&SPAN)	-	±0.5	-	%SPAN/YR	
COMPENSATED TEMPERATURE (≤5PSI)	0	-	+50	℃	
COMPENSATED TEMPERATURE (≥15PSI)	-20	-	+85	℃	
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-40	-	+125	℃	8
OUTPUT PRESSURE RESOLUTION	-	-	14	BIT	
OUTPUT TEMPERATURE RESOLUTION	8	-	11	BIT	
START TIME TO DATA READY	-	-	8.4	mS	9
OUTPUT TYPE	10% to 90% OR 5% to 95%				
INTERFACE TYPE	I C (ADDRESS: 0X28H;0X36H;0X46H); SPI				
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

Notes

1. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G).OUTPUT IS NOT RATIONMETRIC TO SUPPLY VOLTAGE.
2. ACCURACY : COMBINED LINEARITY,HYSTERESIS AND REPEATILITY.
3. TOTAL BAND: INCLUDES CALIBRATION ERRORS AND TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE. SEE FIG 2 OF SHEET 8.
4. THE DEVIATION FROM A BEST FIT FIT STRAIGHT LINE(BFSL) FITTED TO THE OUTPUT MEASURED OVER THE COMPENSATED TEMPERAURE RAGE. FOR ERRORS BEYOND THE COMPENSATED TEMPERATURE RANGE, SEE FIG 1 OF SHEET 8.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 2X OR 400PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OF ACCURACY.
7. 3X OR 600PSI, WHICHEVER IS LESS, THE MAX PRESSURE THAT CAB BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. START TIME TO DATA RADY IS THE TIME TO GET VALID DATA AFTER POR (POWER ON RESET). THE TIME TO GET SUBSEQUENT VALID DATA IS THEN SPECIFIED BY THE RESPONSE TIME SPECIFICATION.
10. DEVICE MARKING: EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA86BSD

ORDERING INFORMATION

ORDERING INFORMATION: SA86BSD−XXXX X − X X X X (XX)

PRESSURE RANGE	
PSI	BAR
005P*	.35B*
015P	001B
030P	002B
050P	3.5B
100P	005B
200P	014B
300P	020B

*005P(.35B) IS FOR GAGE PRESSUURE ONLY.
*INTERMEDIATE PRESSRE RANGES AVALIABLE.

PRESSURE TYPE
A=ABSOLUTE
G=GAGE

SUPPLY VOLTEGE
3=3.3VDC
5=5.0VDC

OUTPUT
A=10%−90%
B=5%~95%

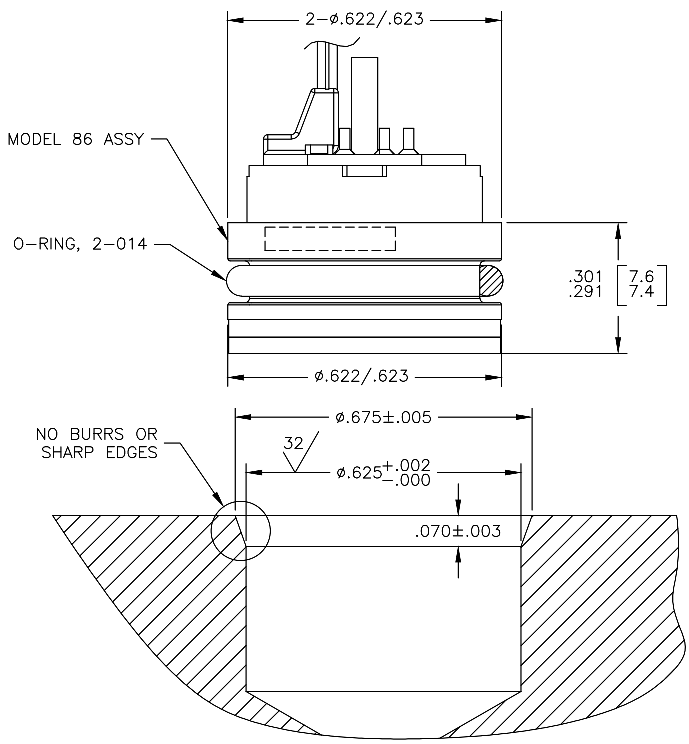
INTERFACE
I=I²C(ADDR: 0X28H)
J=I²C(ADDR: 0X36H)
K=I²C(ADDR: 0X46H)
S=SPI

ELECTRICAL
P=PAD
R=RIBBON CABLE
C=CABLE W/CONNECTOR

VENT
LT=LOW POWER W/TUBE
L=LOWER POWER W/O TUBE
T=STANDARD W/TUBE
BLANK=STANDARD W/OTUBE

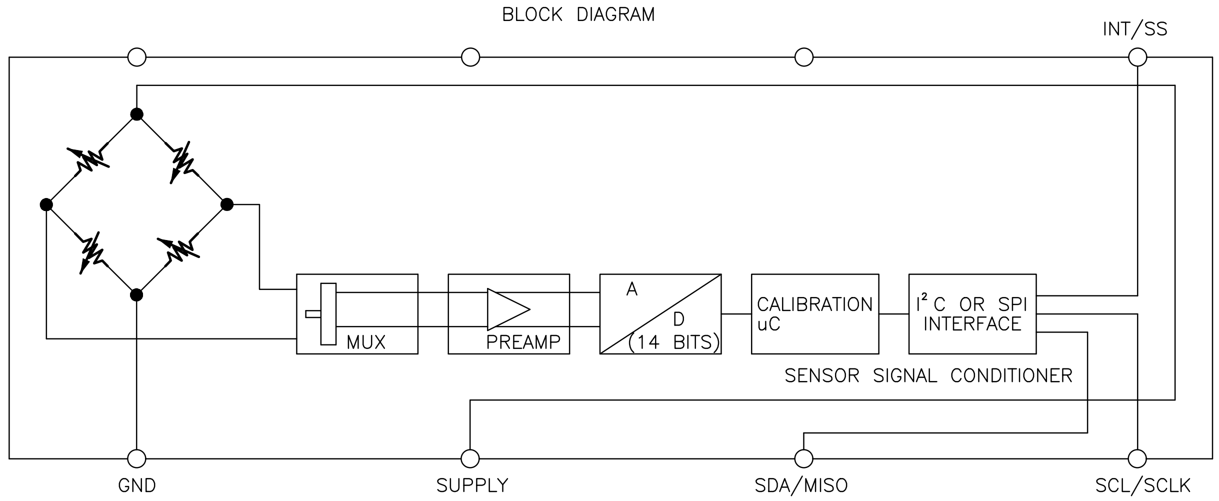
APPLICATION SCHEMATIC

RECOMMENDED MOUNTING DIMENSIONS



MODEL SA86BSD

APPLICATION SCHEMATIC



I ²C INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	100		400	KHz
START CONDITION HOLD TIME RELATIVE TO SCL EDGE	tHDSTA	0.1			µS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			µS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			µS
START CONDITION SETUP TIME RELATIVE TO SCL EDGE	tSUSTA	0.1			µS
DATA HOLD TIME ON SDA RELATIVE TO SCL EDGE	tHDDAT	0			µS
DATA SETUP TIME ON SDA RELATIVE TO SCL EDGE	tSUDA	0.1			µS
STOP CONDITION SETUP TIME ON SCL	tSUSTO	0.1			µS
BUS FREE TIME BETWEEN STOP AND START CONDITION	tBUS	2			µS

SPI INTERFACE PARAMETERS

PARAMETERS	SYMBOL	MIN	TYPE	MAX	UNITS
SCLK CLOCK FREQUENCY	FSCL	50		800	KHz
SS DROP TO FIRST CLOCK EDGE	tHDSS	2.5			µS
MINIMUM SCL CLOACK LOW WIDTH @1	tLOW	0.6			µS
MINIMUM SCL CLOACK HIGH WIDTH @1	tHIGH	0.6			µS
CLOCK EDGE TO DATA TRANSITION	tCLKD	0		0.1	µS
RISE OF SS RELATIVE TO LAST CLOCK EDGE	tSUSS	0.1			µS
BUS FREE TIME BETWEEN RISE AND FALL OF SS	tBUS	2			µS

@1 COMBINED LOW AND HIGH WIDTHS MUST EQUAL OR EXCCED MINIMUM SCL PERIOD.

MODEL SA86BSD

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

TEMPERATURE ACCURACY AND TOTAL ERROR BAND

FIG 1

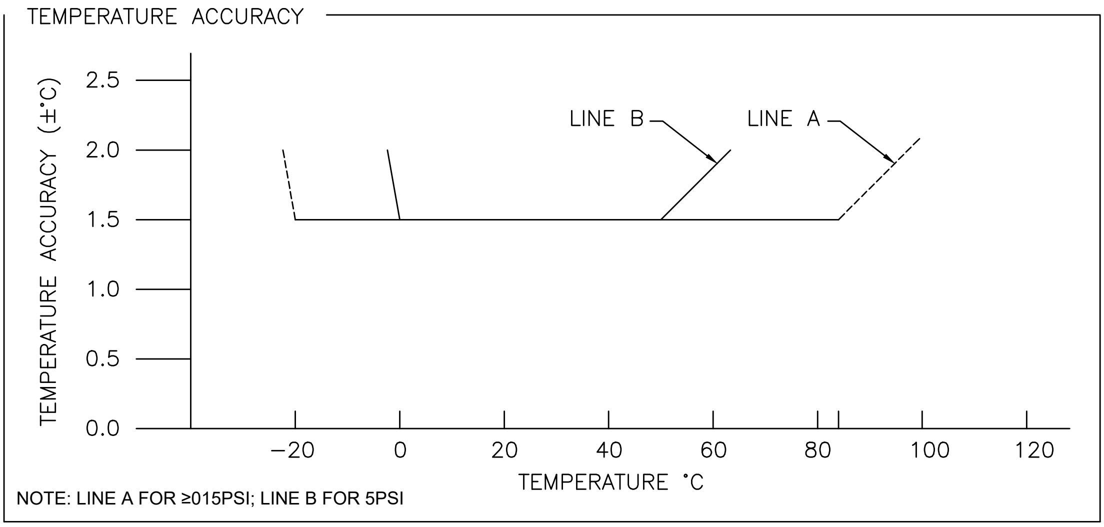
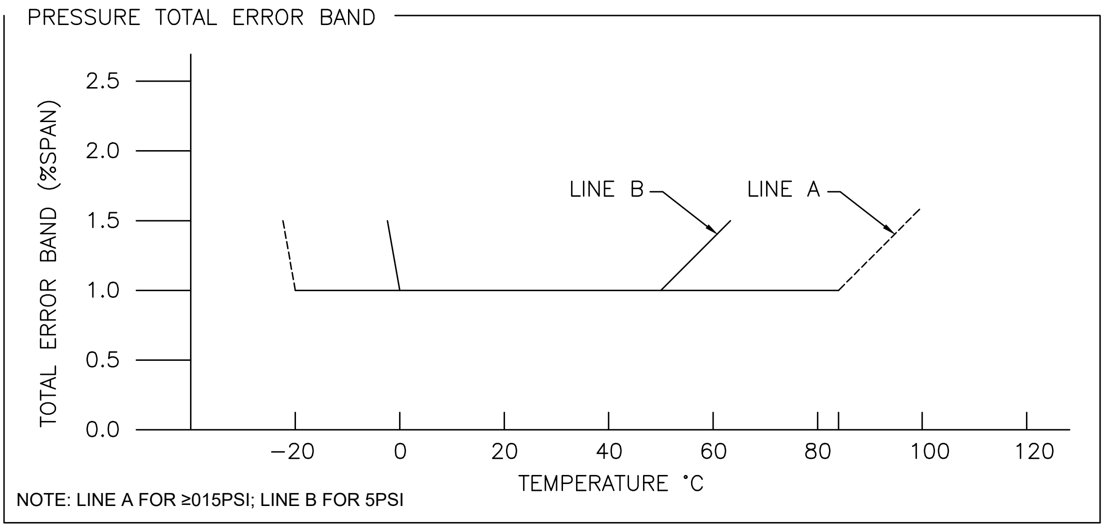
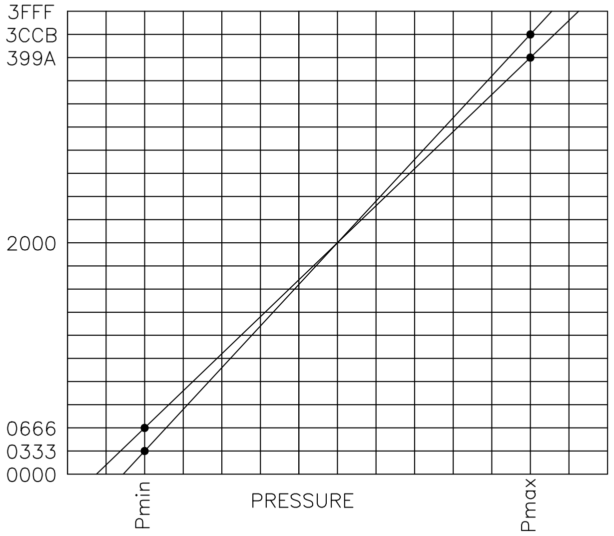


FIG 2



MODEL SA86BSD

PRESSURE FUNCTION



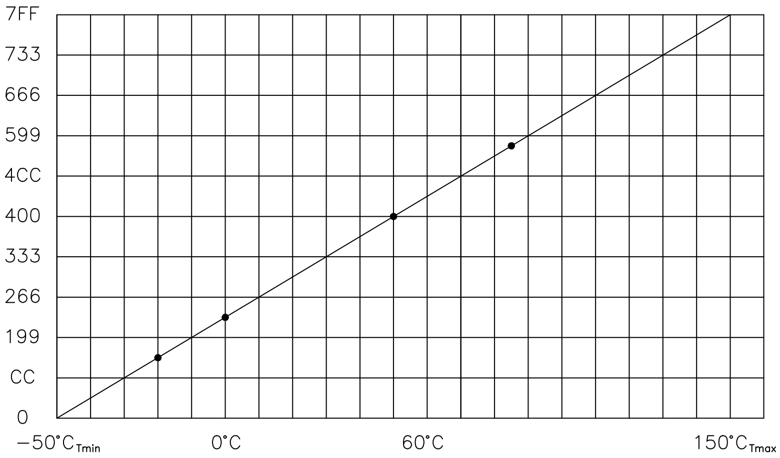
SENSOR OUPUT AT SIGNIFIANT PERCENTAGES

%OUTPUT	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0	0	0 X 0000
5	819	0 X 0333
10	1638	0 X 0666
50	8192	0 X 2000
90	14746	0 X 399A
95	15563	0 X 3CCB
100	16383	0 X 3FFF

$$\text{A TYPE: OUT (DECIMAL COUNTS)} = \frac{80\%*16388}{Pmax-Pmin} * (Papplied-Pmin)+10\%*16383$$

$$\text{B TYPE: OUT (DECIMAL COUNTS)} = \frac{90\%*16388}{Pmax-Pmin} * (Papplied-Pmin)+5\%*16383$$

TEMPERATURE FUNCTION



DIGITAL TEMPERATURE OUTPUT

OUTPUT°C	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
−50	0	0 X 0000
−20	317	0 X 0133
0	512	0 X 0200
25	767	0 X 02FF
50	1024	0 X 0400
85	1381	0 X 0565
150	2047	0 X 07FF

$$\text{OUT (DECIMAL COUNTS)} = \frac{(\text{OUTPUT}°C-(-50°C_{Tmin}))\ *2047}{150°C_{Tmax}-(-50°C_{Tmin})}$$

MODEL SA87F

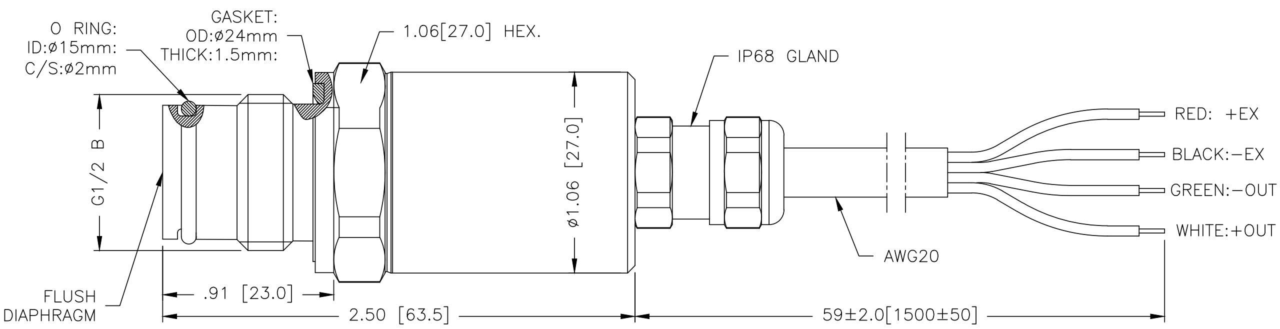
316 SS Pressure Sensor
Flush Mount
0-200 mV Output
Temperature Compensated
Absolute and Sealed Gage

- Hydraulic Controls
- Process Control
- Robotics
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters

DESCRIPTION

SA87F is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



MODEL SA87F

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	65	100	200	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	mV	2
PRESSURE NON-LINEARITY	-0.50	-	+0.50	%SPAN	3
PRESSURE HYSTERESIS	-0.25	±0.02	+0.25	%SPAN	
REPEATABILITY	-	±0.25	-	%SPAN	
INPUT RESISTANCE	2.0K	3.5K	5.8K	Ω	
OUTPUT RESISTANCE	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	4
TEMPERATURE ERROR, OFFSET	-1.0	-	+1.0	%SPAN	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	5
OUTPUT LOAD RESISTANCE	5M	-	-	Ω	6
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	7
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	μVp-p	
RISE TIME (10% to 90%)	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	RATED	8
BURST PRESSURE	-	-	4X	RATED	9
COMPENSATED TEMPERATURE	0	-	50	℃	
OPERATING TEMPERATURE	-20	-	+80	℃	
STORAGE TEMPERATURE	-20	-	+105	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

ORDERING INFORMATION

ORDERING INFORMATION

SA87F–XXXX X X

PRESSURE RANGE	
PSI	BAR
300P	020B
500P	035B
01KP	070B
1K5P	100B
03KP	200B
05KP	350B
10KP	700B

PRESSURE TYPE
A=ABSOLUTE
G=GAGE
*C=COMPOUND

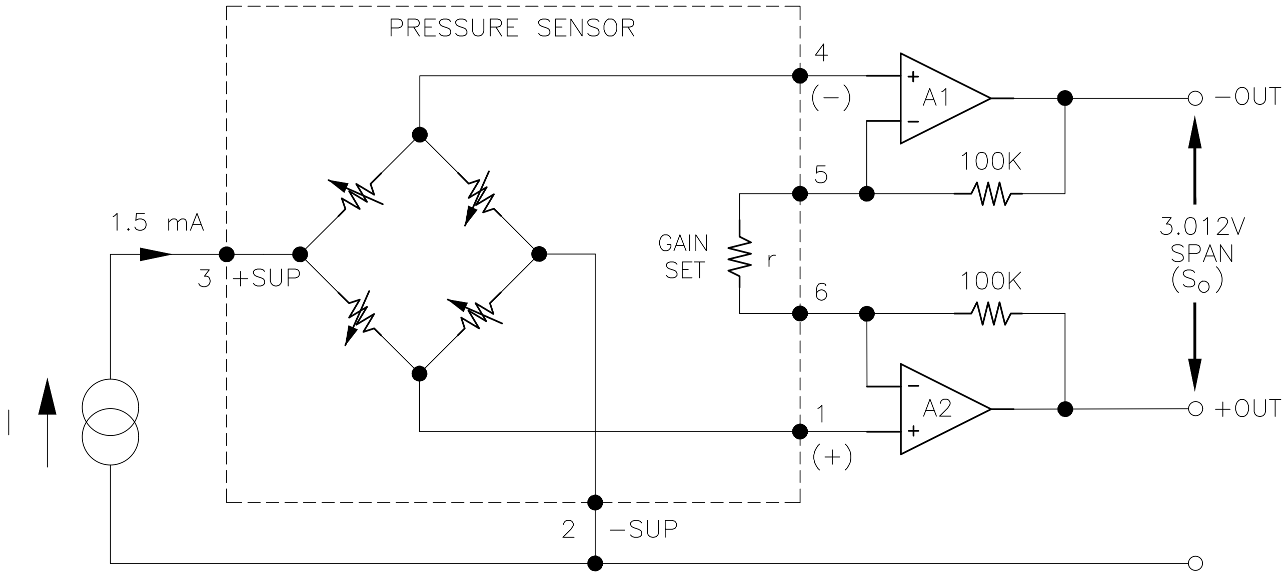
*COMPOUND PRESSURE RANGE
IS –14.7 TO XXXPSIG
OR –1 TO XXXBG

SEAL MATERIAL
N=NBR
F=FKM
E=EPDM

*CUSTOMIZATION FOR SPECIAL REQUIREMENTS (NEW PRESSURE, ELECTRICAL CONNECTORS, SPECIALOUTPUTS, WIRING CODES, CALIBRATIONS, NEW MECHANICAL STRUCTURES).

MODEL SA87F

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

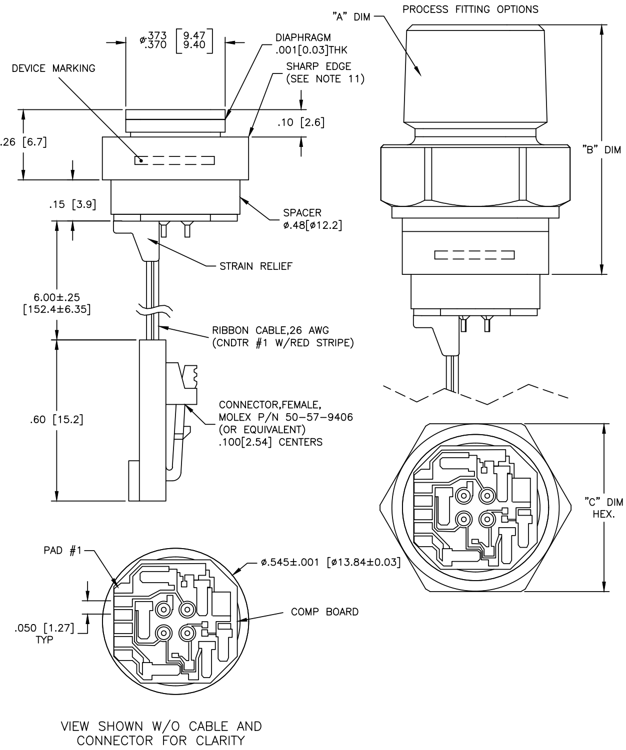
1. FOR AMPLIFIED OUTPUT CIRCUITS, 3.012V ±1% INTERCHANGEABILITY WITH GAIN SET RESISTOR. SEE APPLICATION SCHEMATIC.
2. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAGE (G), COMPOUND (C).
3. BEST FIT STRAIGHT LINE.
4. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
5. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
6. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
7. BETWEEN CASE AND SENSING ELEMENT.
8. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OR ACCURACY.
9. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
10. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE ,ABSOLUTE, COMPUND), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES,
    DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA87N

316 SS Pressure Sensor
High Performance, Small Profile
0-200 mV Output
Temperature Compensated
Absolute and Sealed Gage

- **Hydraulic Controls**
- **Process Control**
- **Robotics**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**

DIMENSIONS



DESCRIPTION

SA87N is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	

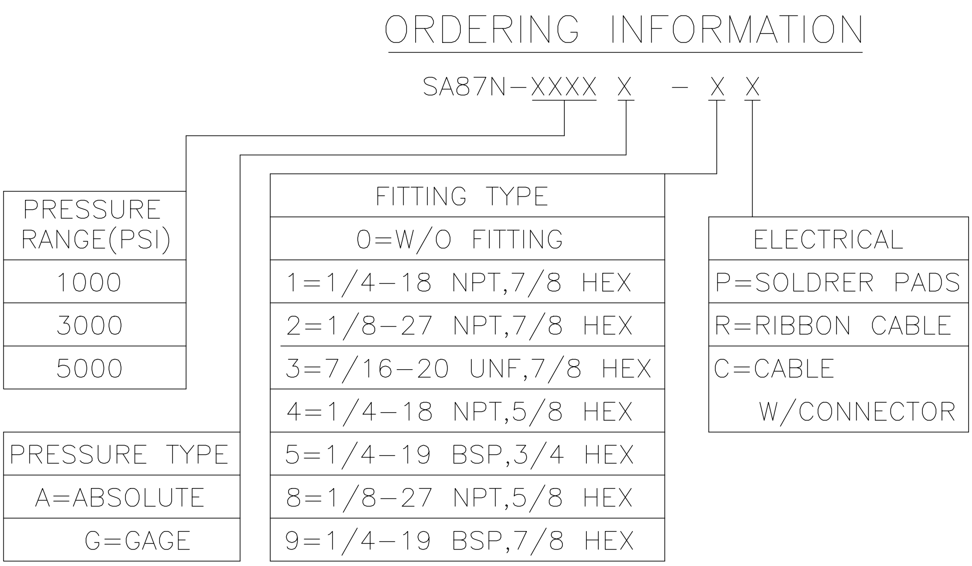
MODEL SA87N

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

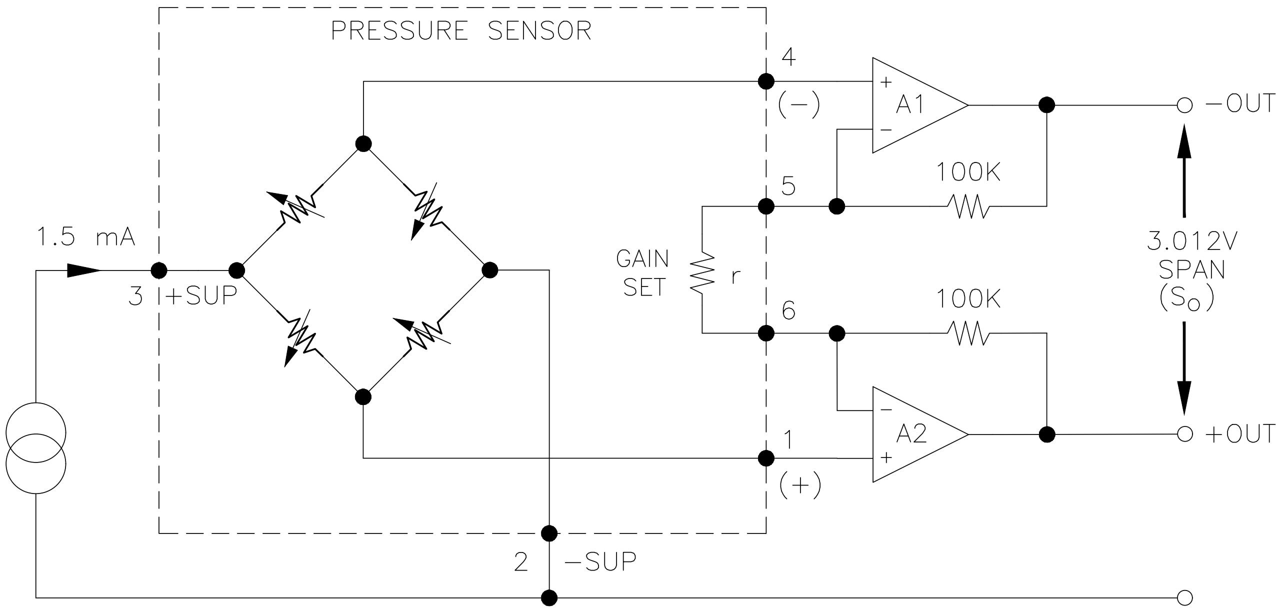
PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	75	150	210	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	mV	
PRESSURE NON-LINEARITY	-0.25	-	+0.25	%SPAN	2
PRESSURE HYSTERESIS	-	±0.05	-	%SPAN	
REPEATABILITY	-	±0.02	-	%SPAN	
INPUT RESISTANCE	3.0	4.0	5.0	KΩ	
OUTPUT RESISTANCE	4.0	-	25.0	KΩ	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-1.0	-	+1.0	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	4
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	5
PROOF PRESSURE	-	-	15000	PSI	
BURST PRESSURE	-	-	20000	PSI	6
COMPENSATED TEMPERATURE	-20	-	+85	℃	7
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

ORDERING INFORMATION



MODEL SA87N

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

1. Measured at vacuum for absolute (A) and ambient for sealed gage (S).
   for amplified output circuits, 3.012v ±1% interchangeability with gain set resistor.
2. Best fit straight line
3. Over temperature range -20°C to +85°C, with respect to +25°C.
4. Load resistance to reduce measurement errors due to output loading.
5. Between case and sensing element.
6. Pressure overload 3x or 15,000 psi, whichever is less.
   The maximum pressure that can be applied without changing the transducer's performance or accuracy.
7. Pressure burst 4x or 15,000 psi, whichever is less.
   The maximum pressure that can be applied to a transducer without rupture of either the sensing element or transducer.
8. Maximum temperature range for product with standard cable and connector is -20°C to +105°C.
9. Testing:
   All 3000 and 5000 psi parts are tested at 2500 psi and calculated to full scale pressure respective.
10. Marking:
    Parts are marked with model number, pressure range, type ("A" for absolute or "S" for sealed gage),
    Lot number, serial number and date code.
11. Sharp edge strongly recomended for welding application. Optium weld parameters will reduce the effect of weld heat on sensor performance.
12. Direct mechanical contact with diaphragm is prohibited. Diaphragm surface must remain free of defects (scratches, punctures, fingerprints, etc.) for device to operate properly. Caution is advised when handling parts with exposed diaphragms.
    Use protective cap whenever devices are not in use.

MODEL SA87FK

316 SS Pressure Sensor
Flush Mount
0-200 mV Output
Temperature Compensated
Absolute and Sealed Gage

- **Hydraulic Controls**
- **Process Control**
- **Robotics**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**

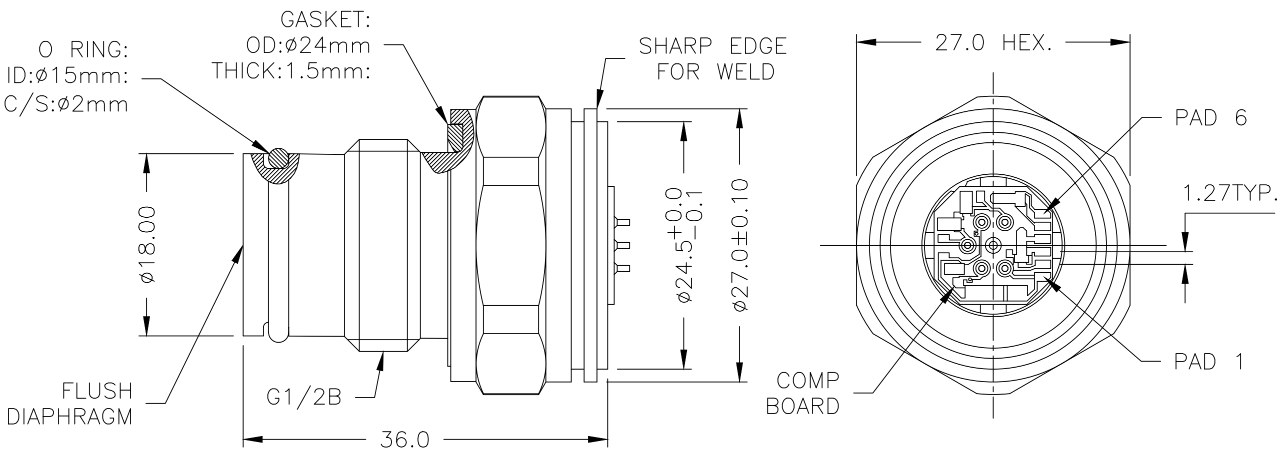
DESCRIPTION

SA87FK is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip.The oil filled pressure housing utilizes the oil cooil filled to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

<table>
<tr><th>PAD</th><th>FUNCTION</th></tr>
<tr><td>1</td><td>+OUT</td></tr>
<tr><td>2</td><td>-EX</td></tr>
<tr><td>3</td><td>+EX</td></tr>
<tr><td>4</td><td>-OUT</td></tr>
<tr><td>5</td><td rowspan="2">GAIN</td></tr>
<tr><td>6</td></tr>
</table>

DIMENSIONS



MODEL SA87FK

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	65	100	200	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	mV	2
ACCURACY	-0.50	±0.25	+0.50	%SPAN	3
PRESSURE NON-LINEARITY	-0.50	±0.25	+0.50	%SPAN	3
PRESSURE HYSTERESIS	-0.50	±0.25	+0.50	%SPAN	
REPEATABILITY	-0.50	±0.25	+0.50	%SPAN	
INPUT RESISTANCE	2.0K	3.5K	5.8K	Ω	
OUTPUT RESISTANCE	4.0K	-	6.0K	Ω	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	4
TEMPERATURE ERROR, OFFSET	-1.0	-	+1.0	%SPAN	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	%SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	%SPAN	4
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	5
OUTPUT LOAD RESISTANCE	5M	-	-	Ω	6
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	7
OUTPUT NOISE (10Hz to 1kHz)	-	1.0	-	μVp-p	
PROOF PRESSURE	-	-	3X	RATED	8
BURST PRESSURE	-	-	4X	RATED	9
COMPENSATED TEMPERATURE	0	-	50	℃	
OPERATING TEMPERATURE	-25	-	+80	℃	
STORAGE TEMPERATURE	-50	-	+125	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				
MEDIA, REFERENCE PORT	LIQUIDS AND GASES COMPATIBLE WITH SILICONE, PYREX, GOLD, FLUOROSILICONE RUBBER AND 316/316L ST STL				

ORDERING INFORMATION

ORDERING INFORMATION

SA87FK–X X X

PRESSURE TYPE*	
1	0~1 BAR
2	0~2.5 BAR
3	0~6 BAR
4	0~16 BAR
5	0~25 BAR
6	0~100 BAR
7	0~160 BAR
8	0~250 BAR
9	0~400 BAR
A	0~600 BAR
B	–1~0 BAR
C	–1~1 BAR
D	–1~2.5 BAR
E	–1~6 BAR
F	–1~10 BAR
G	–1~16 BAR
H	–1~25 BAR

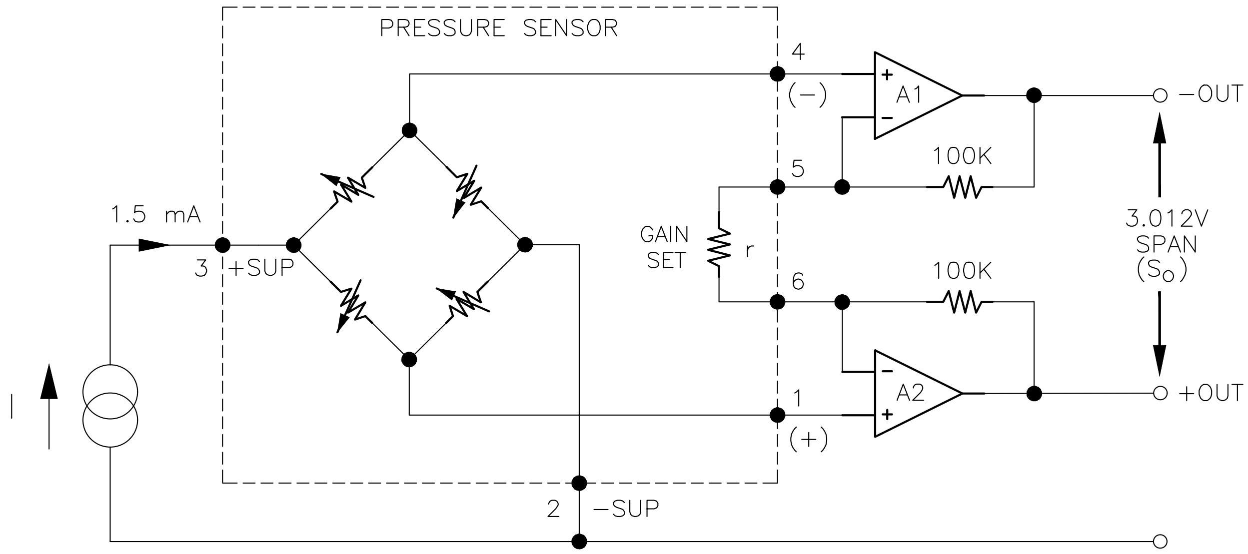
*1~A: GAUGE
B~H: ABSOLUTE

PRESSURE TYPE
A=ABSOLUTE
G=GAUGE

SEAL MATERIAL
N=NBR
F=FKM
E=EPDM

MODEL SA87FK

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

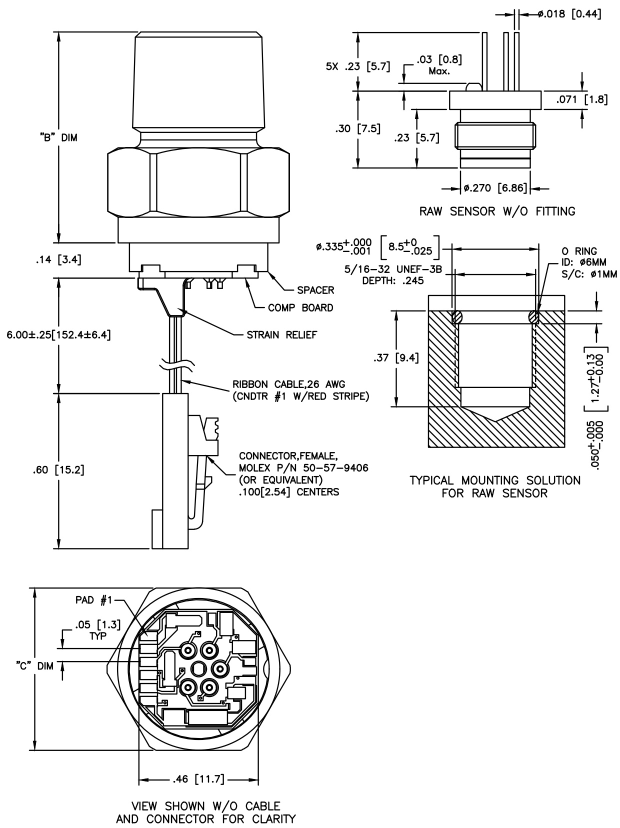
1. FOR AMPLIFIED OUTPUT CIRCUITS, 3.012V ±1% INTERCHANGEABILITY WITH GAIN SET RESISTOR. SEE APPLICATION SCHEMATIC.
2. MEASURED AT VACUUM FOR ABSOLUTE (A), AMBIENT FOR GAUGE (G).
3. BEST FIT STRAIGHT LINE.
4. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO 25°C.
5. GUARANTEES OUTPUT/INPUT RATIOMETRICITY.
6. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
7. BETWEEN CASE AND SENSING ELEMENT.
8. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT CHANGING THE TRANSDUCER'S PERFORMANCE OR ACCURACY.
9. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
10. DEVICE MARKING:
    EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE ,ABSOLUTE),
    LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING/PACKAGING REQUIREMENTS:
    THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL WITH ANTI-STATIC FOAM.
12. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES,
    DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA89C

316 SS Pressure Sensor
High Performance, Small Profile
0-210 mV Output
Temperature Compensated
Absolute and Sealed Gage

- Hydraulic Controls
- Process Control
- Robotics
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters

DIMENSIONS



DESCRIPTION

SA89C is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip.The oil filled pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	+OUT
2	-EX
3	+EX
4	-OUT
5	GAIN
6	

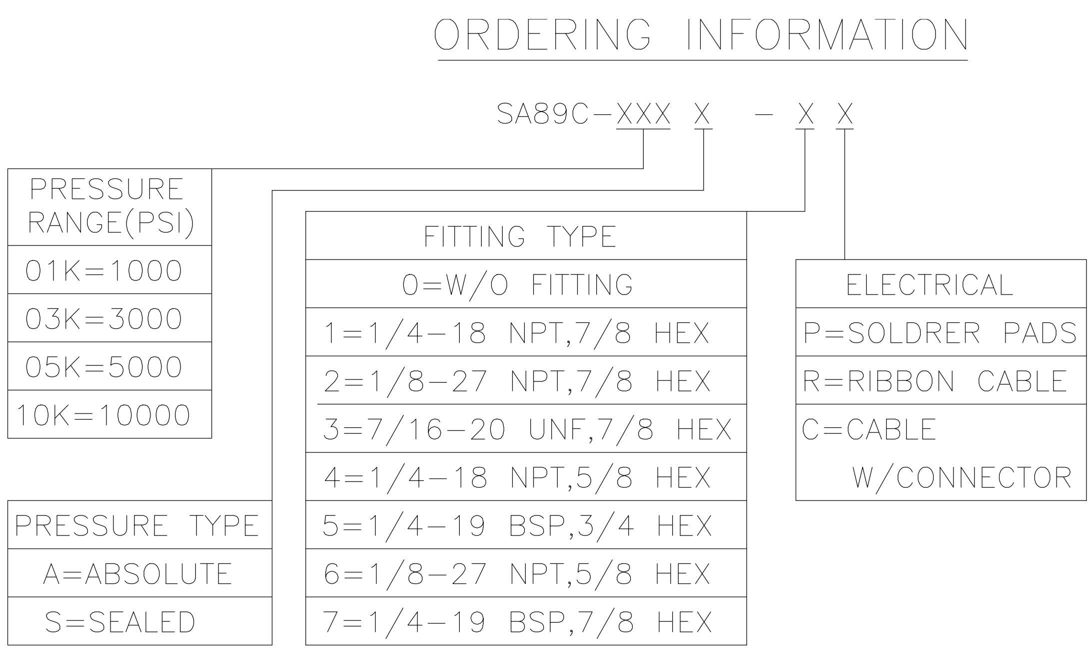
MODEL SA89C

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

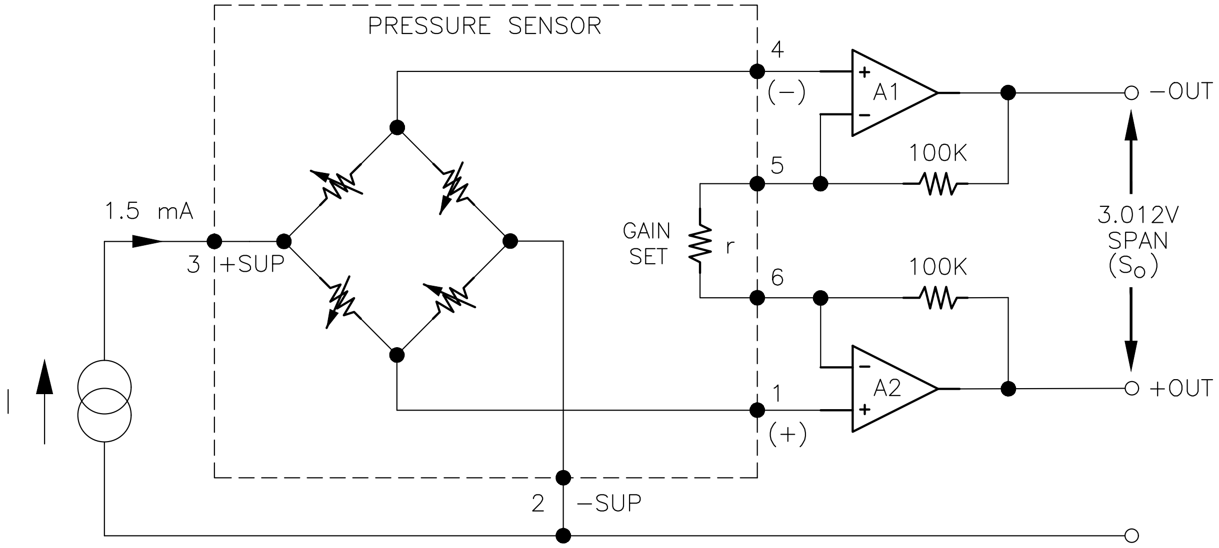
PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	75	125	210	mV	1
ZERO PRESSURE OUTPUT	-2.0	0	+2.0	mV	
PRESSURE NON-LINEARITY	-0.3	-	+0.3	%SPAN	2
PRESSURE HYSTERESIS	-0.1	-	+0.1	%SPAN	
INPUT RESISTANCE	3.0	4.0	5.0	KΩ	
OUTPUT RESISTANCE	4.0	-	6.0	KΩ	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-1.0	-	+1.0	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.25	-	+0.25	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.25	-	+0.25	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	4
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	5
PROOF PRESSURE	-	-	3X	RATED	6
BURST PRESSURE	-	-	4X	RATED	7
COMPENSATED TEMPERATURE	-20	-	+85	℃	3
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

ORDERING INFORMATION



MODEL SA89C

APPLICATION SCHEMATIC



APPLICATION SCHEMATIC

Notes

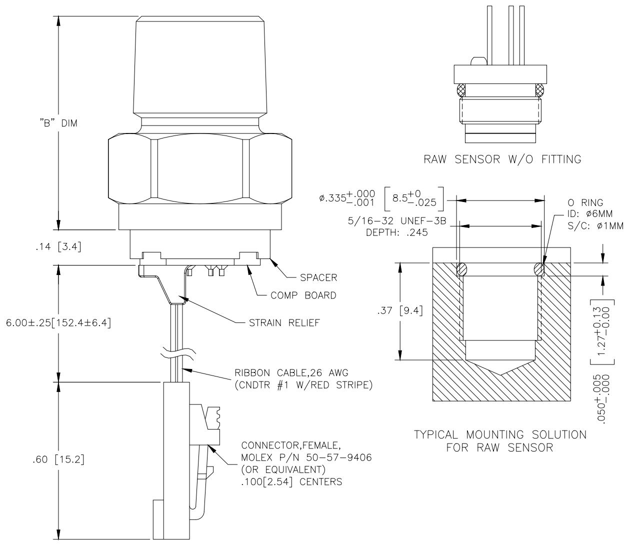
1. CALCULATED AT FSP, 3000PSI AND 5000PSI PARTS ARE TESTED AT 2500PSI.
2. BEST FIT STRAIGHT LINE BETWEEN 0 AND FSP.
3. OVER THE COMPENSATED TEMPERATURE RANGE WITH RESPECT TO +25°C.
4. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 3X OR 20,000PSI, WHICHEVER IS LESS.
7. 4X OR 30,000PSI, WHICHEVER IS LESS.
   THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR THIS PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.

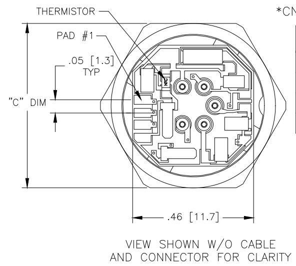
MODEL SA89CV

316 SS Pressure Sensor
High Performance, Small Profile
0-100mV Output
Temperature Compensated
Absolute and Sealed Gage
Constant voltage

- Hydraulic Controls
- Process Control
- Robotics
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters

DIMENSIONS





*CNDTR #1 W/RED STRIPE

CNDTR	FUNCTION
1	−OUT
2	+OUT
3	−EX
4	+EX

DESCRIPTION

SA89CV is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip.The oil filled pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

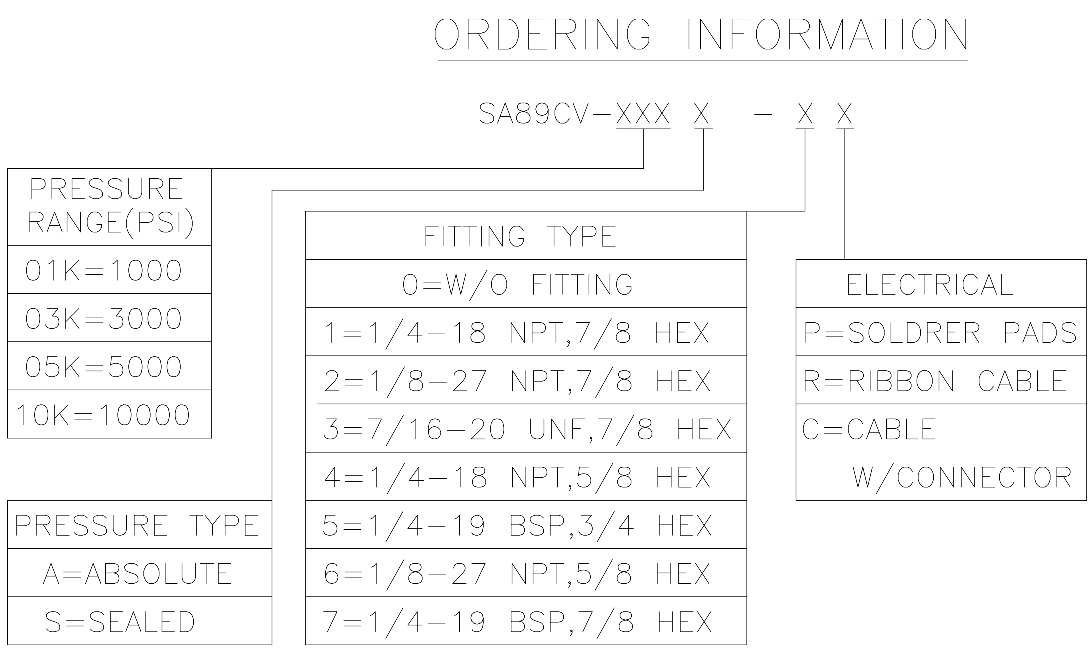
MODEL SA89CV

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10V AND AT 25°C

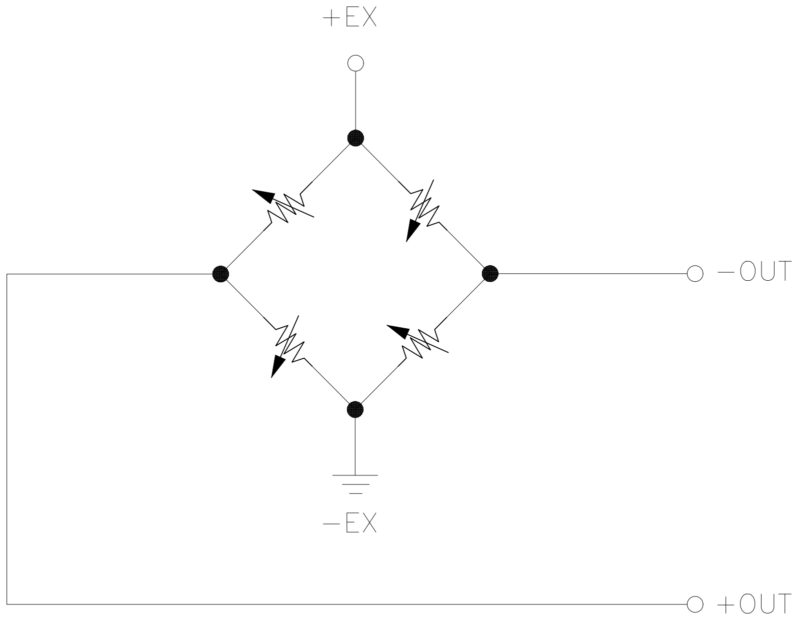
PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	98	100	102	mV	1
ZERO PRESSURE OUTPUT	-1.0	0	+1.0	mV	
PRESSURE NON-LINEARITY	-0.25	-	+0.25	%SPAN	2
PRESSURE HYSTERESIS	-0.1	-	+0.1	%SPAN	
INPUT RESISTANCE	5.5	9.0	125	KΩ	
OUTPUT RESISTANCE	4.0	-	6.0	KΩ	
TEMPERATURE ERROR, SPAN	-1.0	-	+1.0	%SPAN	3
TEMPERATURE ERROR, OFFSET	-1.0	-	+1.0	%SPAN	3
THERMAL HYSTERESIS, SPAN	-0.25	-	+0.25	%SPAN	3
THERMAL HYSTERESIS, OFFSET	-0.25	-	+0.25	%SPAN	3
LONG TERM STABILITY, SPAN	-	±0.10	-	%SPAN/YR	
LONG TERM STABILITY, OFFSET	-	±0.10	-	%SPAN/YR	
SUPPLY CURRENT	-	10	14	V	
OUTPUT LOAD RESISTANCE	5	-	-	MΩ	4
INSULATION RESISTANCE (50 VDC)	50	-	-	MΩ	5
PROOF PRESSURE	-	-	3X	RATED	6
BURST PRESSURE	-	-	4X	RATED	7
COMPENSATED TEMPERATURE	-20	-	+85	℃	
OPERATING TEMPERATURE	-40	-	+125	℃	8
STORAGE TEMPERATURE	-50	-	+125	℃	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

ORDERING INFORMATION



MODEL SA89CV

APPLICATION SCHEMATIC



EQUIVALENT SCHEMATIC

Notes

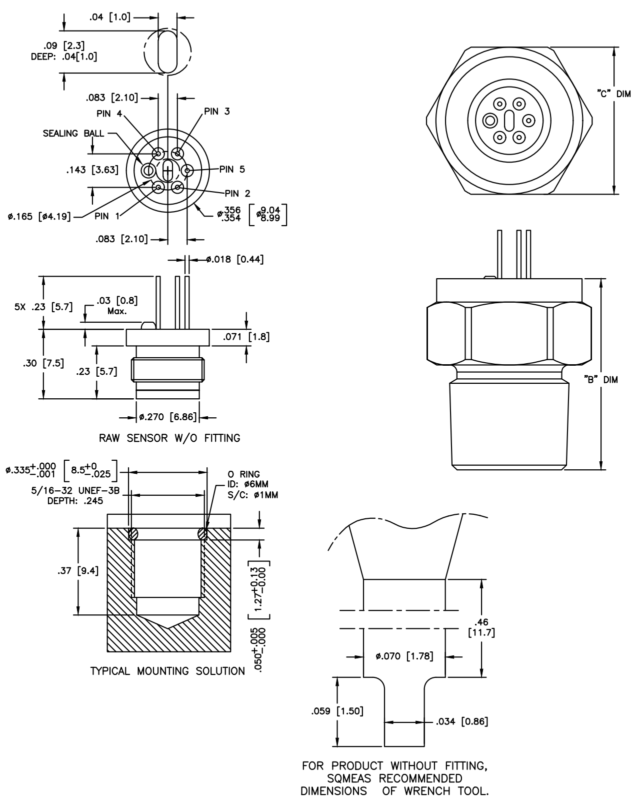
1. MEASURED AT VACUUM FOR ABSOLUTE (A) AND AMBIENT FOR SEALED GAGE (S).
2. BEST FIT STRAIGHT LINE
3. OVER TEMPERATURE RANGE -20°C TO +85°C, WITH RESPECT TO +25°C.
4. LOAD RESISTANCE TO REDUCE MEASUREMENT ERRORS DUE TO OUTPUT LOADING.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 3X OR 20,000 PSI, WHICHEVER IS LESS.
7. 4x OR 30,000 PSI, WHICHEVER IS LESS. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. MAXIMUM TEMPERATURE RANGE FOR PRODUCT WITH STANDARD CABLE AND CONNECTOR IS -20°C TO +105°C.
9. TESTING:
   ALL 3,000, 5,000 & 10,000 PSI PARTS ARE TESTED AT 2500 PSI AND CALCULATED TO FULL SCAEL PRESSURE RESPECTIVE.
10. MARKING:
   PARTS ARE MARKED WITH MODEL NUMBER, PRESSURE RANGE, TYPE("A" FOR ABSOLUTE OR "S" FOR SEALED GAGE), LOT NUMBER, SERIAL NUMBER AND DATE CODE.
11. SHIPPING:
   SHIPPED IN A PLASTIC CONTAINER WITH ANTI-STATIC FOAM.

MODEL SA89U

316 SS Pressure Sensor
High Performance, Small Profile
mV Output
Uncompensated
Absolute and Sealed Gage

- Hydraulic Controls
- Process Control
- Robotics
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters

DIMENSIONS



DESCRIPTION

SA89U is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The ISO pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. A thickfilm ceramic compensation board with laser trimmed resistors, and additional gain set resistor to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

CONNECTIONS

PAD/CNDTR	FUNCTION
1	-OUT
2	-EX1
3	+OUT
4	-Ex
5	-EX2

MODEL SA89U

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 1.5mA AND AT 25°C

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SENSITIVITY	12	-	27	mV/V@SPAN	1
ZERO PRESSURE OUTPUT	-6.0	-	+8.0	mV/V	1
PRESSURE NON-LINEARITY	-0.25	-	+0.25	% SPAN	2
PRESSURE HYSTERESIS	-0.10	±0.05	+0.10	% SPAN	
REPEATABILITY	-	±0.02	-	% SPAN	
INPUT/OUTPUT RESISTANCE	3.8K	-	6.0K	Ω	1,3
THERMAL HYSTYERESIS - SPAN	-0.25	±0.10	+0.25	% SPAN	
THERMAL HYSTYERESIS - OFFSET	-0.25	±0.10	+0.25	% SPAN	
TEMPERATURE COEFFICIENT, RESISTANCE	1.30K	1.51K	1.75K	PPM/°C	4
TEMPERATURE COEFFICIENT, SPAN	-1.45K	-1.25K	-1.0K	PPM/°C	4
TEMPERATURE COEFFICIENT, OFFSET	-30	-	+30	μV/V/°C	4
THERMAL HYSTERESIS, SPAN	-0.25	±0.05	+0.25	% SPAN	4
THERMAL HYSTERESIS, OFFSET	-0.25	±0.05	+0.25	% SPAN	4
LONG TERM STABILITY, SPAN	-0.10	-	+0.10	% SPAN/YR	
LONG TERM STABILITY, OFFSET	-0.10	-	+0.10	% SPAN/YR	
SUPPLY CURRENT	0.5	1.5	2.0	mA	
SUPPLY VOLTAGE	-	5	12	V	
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	5
OUTPUT NOISE (10Hz TO 1KHz)	-	1.0	-	μV P-P	
RESPONSE TIME (10% TO 90%)	-	-	0.1	mS	
PROOF PRESSURE	-	-	3X	RATED	6
BURST PRESSURE			4X	RATED	7
OPERATING TEMPERATURE	-40	-	+125	°C	
STORAGE TEMPERATURE	-50	-	+125	°C	
TORQUE	154	-	180	In-lb	8
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

ORDERING INFORMATION

ORDERING INFORMATION

SA89U–XXX X – X

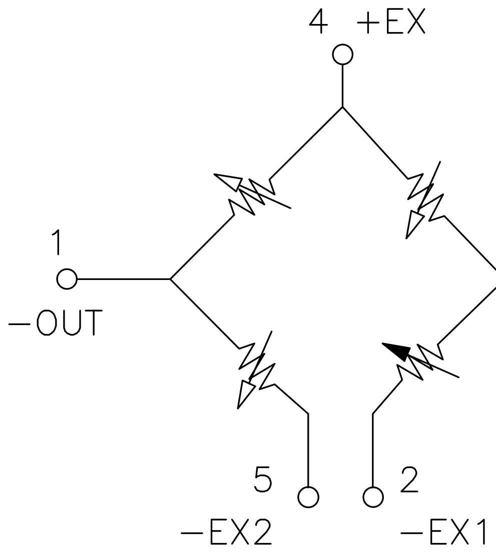
PRESSURE RANGE(PSI)
01K=1000
03K=3000
05K=5000
10K=10000

PRESSURE TYPE
A=ABSOLUTE
S=SEALED

FITTING TYPE
0=W/O FITTING
1=1/4–18 NPT,7/8 HEX
2=1/8–27 NPT,7/8 HEX
3=7/16–20 UNF,7/8 HEX
4=1/4–18 NPT,5/8 HEX
5=1/4–19 BSP,3/4 HEX
6=1/8–27 NPT,5/8 HEX
7=1/4–19 BSP,7/8 HEX

MODEL SA89U

APPLICATION SCHEMATIC



CONNECTIONS

Notes

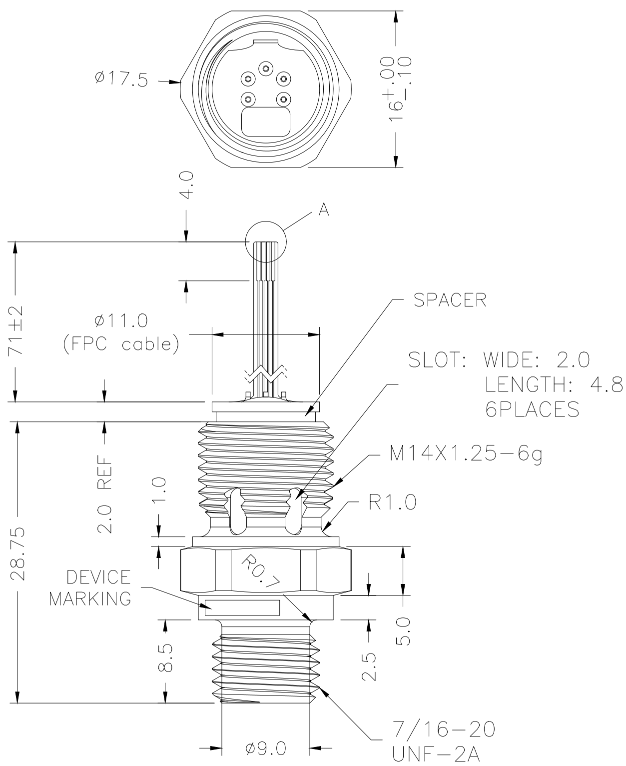
1. MEASURED AT AMBIENT TEMPERATURE.
2. BEST FIT STRAIGHT LINE.
3. MEASURED WITH BOTH -E PINS SHORTED TOGETHER.
4. OVER TEMPERATURE RANGE -20°C TO +70°C, WITH RESPECT TO +25°C.
5. BETWEEN CASE AND SENSING ELEMENT.
6. 3X OR 20,000PSI, WHICHEVER IS LESS. THE MAXIMUM PRESSURE THAT CAN BE APPLIED WITHOUT CHANGING THE TRANSDUCERS PERFORMANCE OR ACCURACY.
7. 4X OR 30,000PSI, WHICHEVER IS LESS. THE MAXIMUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
8. FOR DEVICES WITHOUT FITTINGS; TYPICAL RECEPTACLE 316 ST STL, TENSILE STRENGTH 75,000PSI MIN.
9. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED. DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, FINGERPRINTS, ETC) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGMS. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.
10. TESTING: ALL 03K, 05K AND 10KPSI PARTS ARE TESTED AT 2500PSI AND CALCULATED TO FULL SCALE PRESSURE RESPECTIVELY.
11. MARKING: PARTS ARE MARKED WITH COMPANY NAME, MODEL NUMBER, PRESSURE RANGE, LOT NUMBER, SERIAL NUMBER, AND DATE CODE.
12. SHIPPING: THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A STATIC DISSIPATIVE CAP. EACH UNIT IS PACKAGED INDIVIDUALLY IN A PLASTIC CONTAINER WITH ANTI-STATIC FOAM.

MODEL SA89BSD

316 SS Pressure Sensor
High Performance, Small Profile
24bits I2C/SPI Output
Temperature Compensated
Absolute and Sealed Gage

- **Hydraulic Controls**
- **Process Control**
- **Robotics**
- **Oceanography**
- **Refrigeration/Compressors**
- **Pressure Transmitters**

DIMENSIONS



DESCRIPTION

SA89BSD is a micro machined piezoresistive silicon pressure sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted in a 316 stainless steel package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresisteve sensor to the isolation diaphragm. An ASICcompensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT as well as custom process fittings. Electrical options include cable and connector.

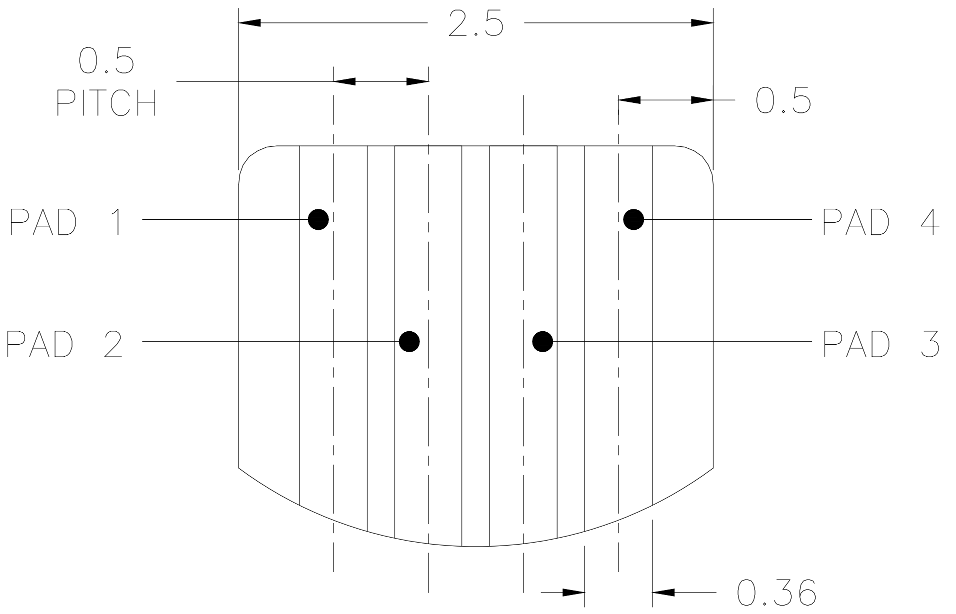
Fitting Type Table

Fitting Type	"A" DIM	"B" DIM	"C" DIM	"D" DIM
4	1/4-18 NPT	.82 [20.8]	5/8 [15.9] HEX	N/A
5	1/4-19 BSP	.82 [20.8]	3/4 [19] HEX	
8	1/8-27 NPT	.71 [18.0]	5/8 [15.9] HEX	
A	No Fitting, Threaded Capsule, 5/16-32 UNEF-3A			5/16-32 UNEF-3B↓.25
B	No Fitting, No Thread Capsule			
NOTE:	Fitting Type '-4' assembly shown All dimensions are for reference only			

MODEL SA89BSD

DIMENSIONS

DETAIL A
RECOMMEND MOLEX CONNECTOR 52746-0471
(OR EQUIVALENT) TO MATE WITH FPC CABLE



PINOUTS

OUTPUT TYPE	PAD 1	PAD 2	PAD 3	PAD 4
I^2C (Address 0x28)	Vsupply	GND	SDA	SCL

TABLE 1. *ABSOLUTE MAXIMUM RATINGS

CHARACTERISTIC	MIN	MAX	UNITS
Supply voltage (Vsupply)	-0.3	3.6	Vdc
Voltage on any pad	-0.3	Vsupply+0.3	V
Digital interface clock frequency:	0.1	3.4	MHz
ESD susceptibility (human body model)	2	-	kV
Storage temperature	-40[-40]	85[185]	°C[°F]

*Absolute maximum ratings are the extreme limits the device will withstand without damage.

TABLE 2. ENVIRONMENTAL SPECIFICATIONS

CHARACTERISTIC	PARAMETERS
Humidity (all external surfaces) :	0 %RH to 95 %RH, non-condensing
Vibration	15 g, 10 Hz to 2 kHz
Shock	100 g, 6 ms duration
*Life	1 million pressure cycles minimum

*Life may vary depending on specific application in which the sensor is used.

MODEL SA89BSD

TABLE 3. OPERATING SPECIFICATIONS(ALL PARAMETERS ARE MEASURED AT 3.3VDC AND AT 25°C)

CHARACTERISTIC		MIN	TYP	MAX	UNITS	NOTES
Supply voltage		3.0	3.3	3.6	Vdc	1
Supply current		-	2.0	2.9	mA	
Working pressure range(absolute)		0	-	350	Bar	2
Over pressure range(absolute)		0	-	700	Bar	3
Burst pressure range(absolute)		0	-	1050	Bar	4
Operating temperature range		-40	-	85	℃	5
Compensated temperature range		-20	-	+85	℃	6
Startup time (power up to data ready)		-	-	17	mS	
Response time		-	12	-	mS	
I C/SPI voltage level	low	-	-	0.2	Volts	
	high	0.8	-	-		
Pull up on SDA/MISO, SCL/SCLK,		1	4.7	10	kOhm	
Total Error Band		-	-	±1.5	%FSS	7,8
Accuracy		-	-	±0.25	%FSS BFSL	9
Long term stability (1000 hr, 25°C)		-	-	±0.25	%FSS	
Output resolution		12	-	24	bits	
Media, pressure port		Fitting: XM-19 (UNS S20910), Non-magnetic Diaphragm: 316L Stainless Steel				

Notes

1. The sensor is not reverse polarity protected. Incorrect application of supply voltage or ground to the wrong pin may cause electrical failure.
2. Working pressure: The maximum pressure that may be applied to any port of the sensor in continuous use. This pressure may be outside the operating pressure range limits (Pmin. to Pmax.) in which case the sensor may not provide a valid output until presssure is returned to within the operating pressure range. Tested to 1 million cycles minimum.
3. Over pressure: The maximum pressure which may safely be applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressures may cause permanent damage to the product. Unless otherwise specified this applies to all available pressure ports at any temperature with the operating temperature range.
4. Burst pressure: The maximum pressure that may be applied to any port of the product without causing escape of pressure media. Product should not be expected to function after exposure to any pressure beyond the burst pressure.
5. Operating temperature range: The temperature range over which the sensor will produce an output proportional to pressure.
6. Compensated temperature range: The temperature range over which the sensor will produce an output proportional to pessure within the specified performance limits.
7. Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pessure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability,thermal effect on offset, thermal effect on span, and thermal hysteresis.
8. Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range. (See Figure 1.)
9. Accuracy: The maximum deviation in output from a Best Fit Straight Line (BFSL) fitted to the output measured over the pressure range at 25°C [77°F]. Includes all errors due to pressure non-linearity, pressure hysteresis, and non-repeatability.

MODEL SA89BSD

ORDERING INFORMATION

ORDERING INFORMATION

SA89BSD — XXXX — X — X X X X

Pressure range [Bar]
006B
012B
018B
028B
030B

*Intermediate Pressure Ranges Available

Pressure Type
A = Absolute
S = Sealed gage

Fitting Type
See Fitting Type Table

Output Type
S=SPI
$0=I^2C$, Address 0x08
$1=I^2C$, Address 0x18
$2=I^2C$, Address 0x28
$3=I^2C$, Address 0x38
$4=I^2C$, Address 0x48
$5=I^2C$, Address 0x58
$6=I^2C$, Address 0x68
$7=I^2C$, Address 0x78

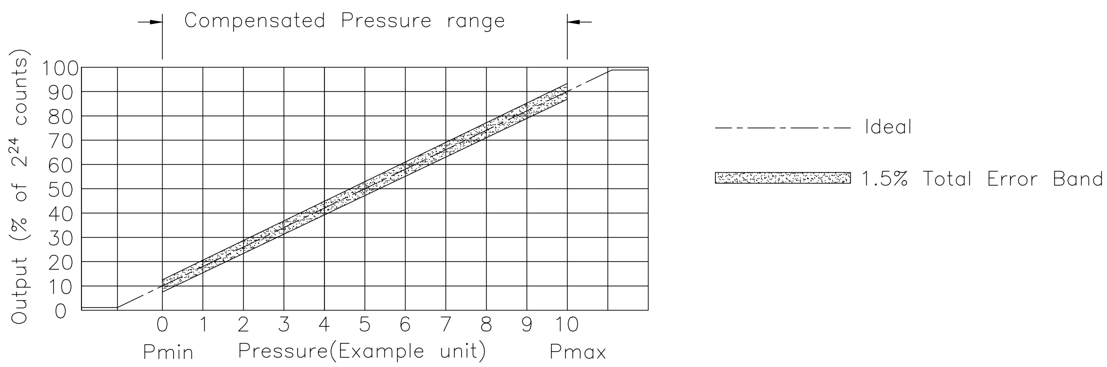
Transfer Function	
A	10% to 90% of 2^{24} counts; no temperature output; no sleep mode.
D	10% to 90% of 2^{24} counts; temperature output enabled; sleep mode enabled.
S	10% to 90% of 2^{24} counts; no temperature output; sleep mode enabled.
T	10% to 90% of 2^{24} counts; temperature output enabled; no sleep mode.

Pressure range
50Bar
100Bar
350Bar
500Bar

TABLE 4. SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES

CHARACTERISTIC	DIGITAL COUNTS	
	DECIMAL	HEX
0	0	0X199999
10	1677722	0X0666
50	8388608	0X80000
90	15099494	0XE66666
100	16777216	0X1000000

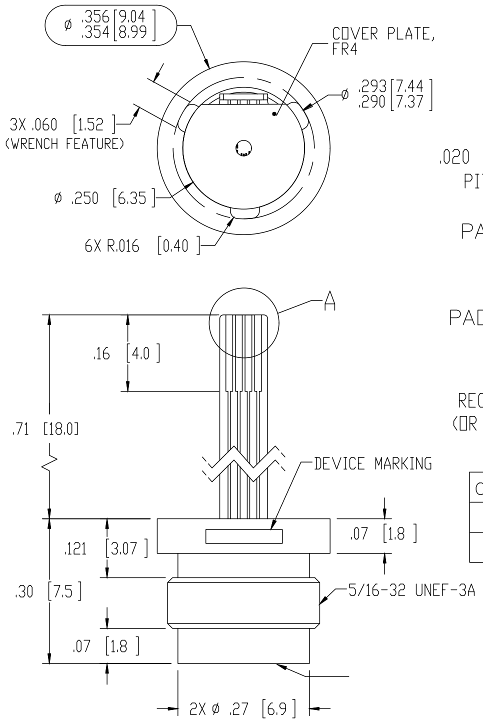
FIGURE 1. PRESSURE FUNCTION



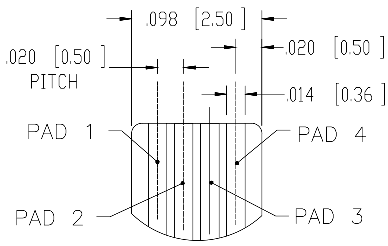
$$\text{Output (\% of } 2^{24} \text{ counts)} = \frac{80\%*16777216}{\text{Pmax}-\text{Pmin}} * (\text{Papplied}-\text{Pmin}) + 10\%*16777216$$

MODEL SA89BSD

DIMENSIONS



89BSD-XXXXX-A

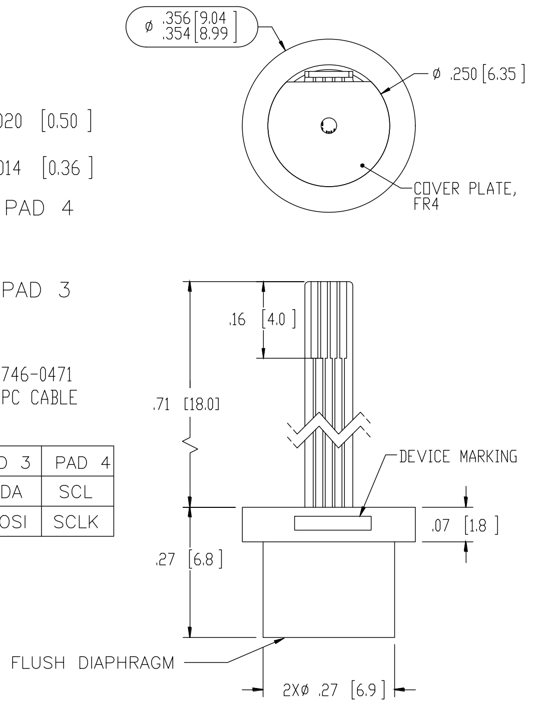


DETAIL A

RECOMMEND MOLEX CONNECTOR 52746-0471
(OR EQUVALENT) TO MATE WITH FPC CABLE

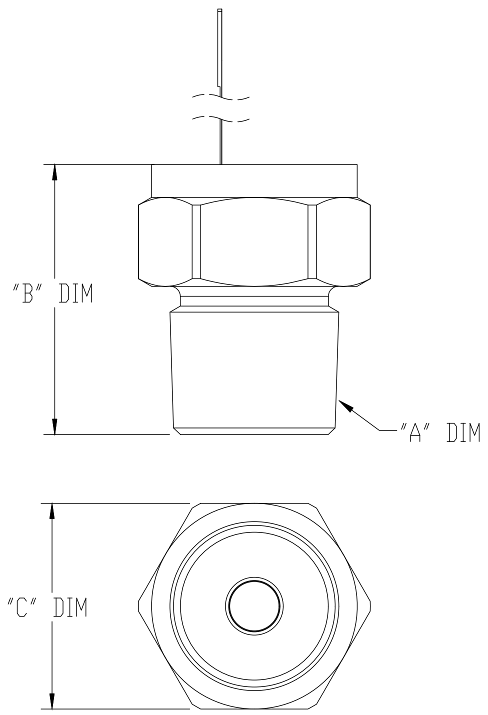
PINOUTS

OUTPUT	PAD 1	PAD 2	PAD 3	PAD 4
I^2C	Vsupply	GND	SDA	SCL
SPI	Vsupply	GND	MOSI	SCLK

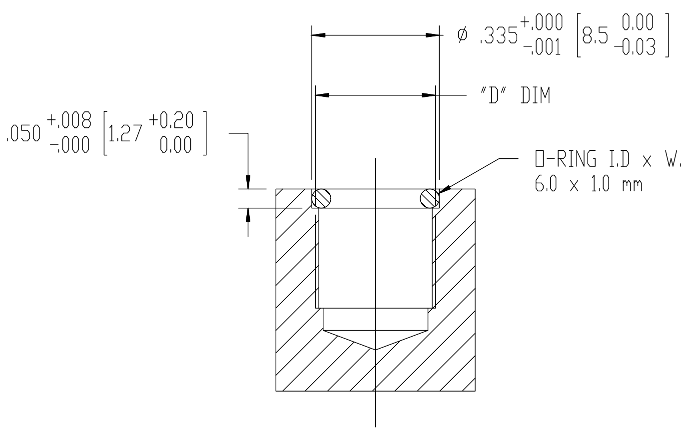


89BSD-XXXXX-B

DIMENSIONS



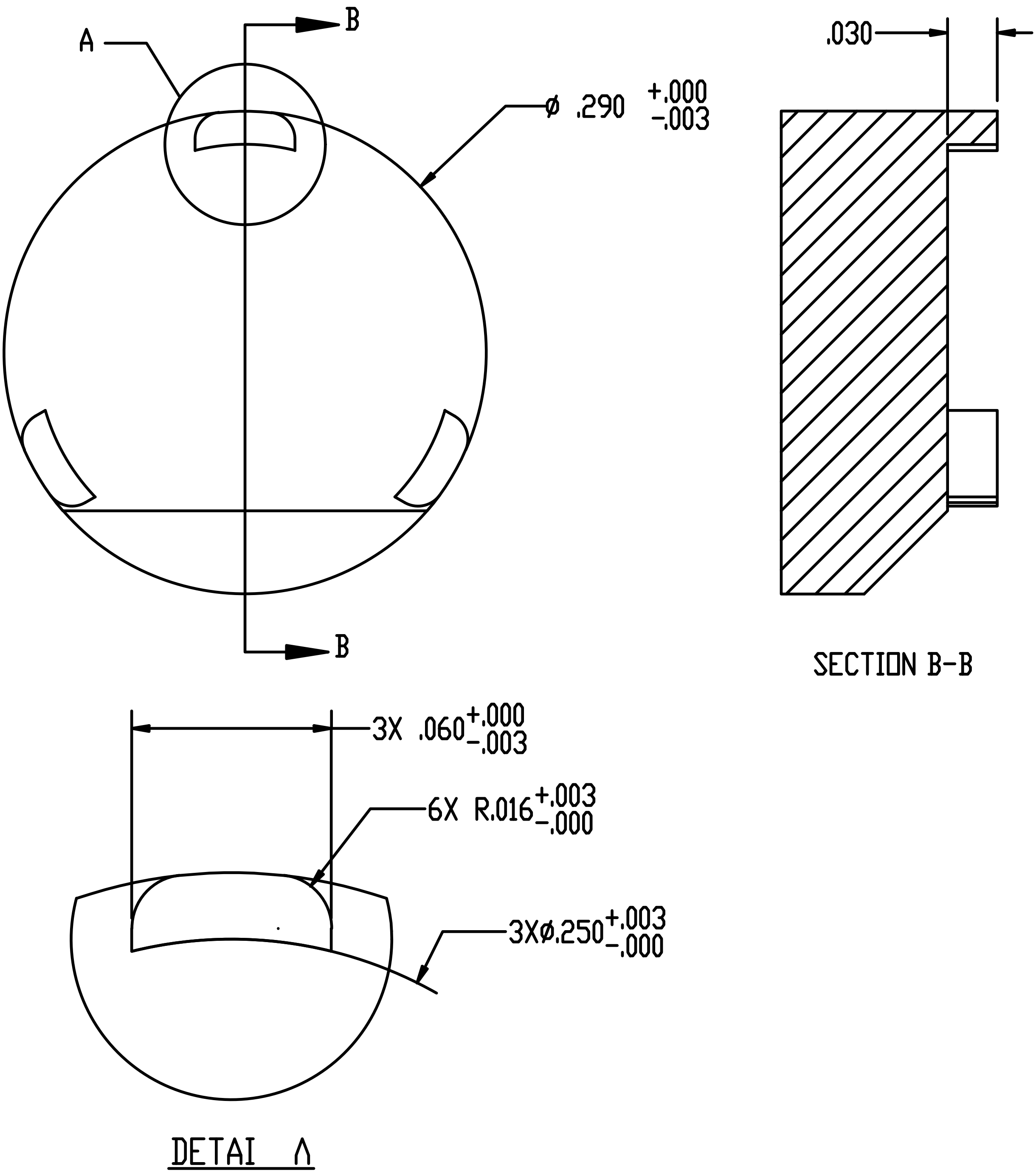
89BSD-XXXX-4, -5, -8



O-RING SEAL MOUNTING
RECOMMENDATIONS
FOR FITTING TYPES A & B

RECOMMENDED WRENCH DIMENSIONS

RECOMMENDED WRENCH DIMENSIONS



MODEL SA89A

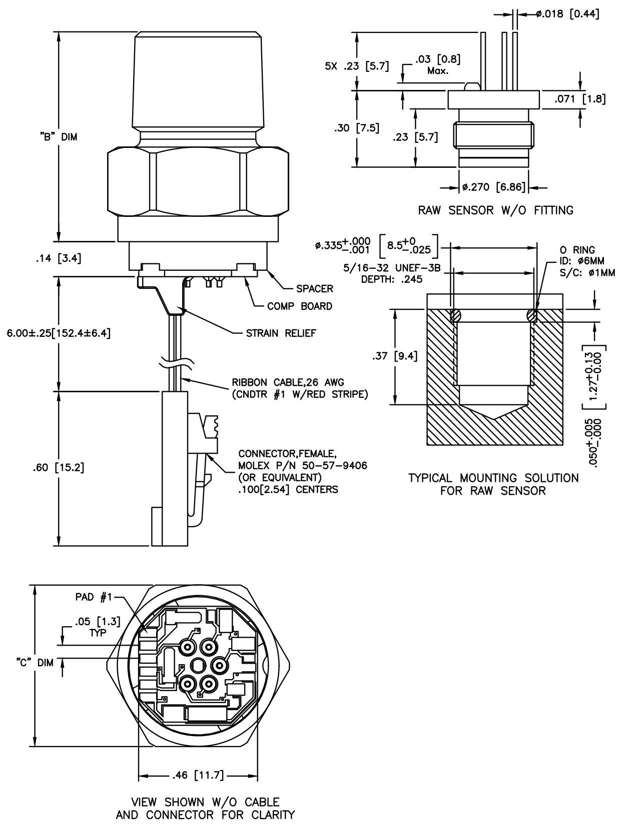
316L SS Pressure Sensor
High Performance, Small Profile
0.5-4.5Vdc Output
Absolute and Gage
Low Pressure

- Medical Instruments
- Process Control
- Oceanography
- Refrigeration/Compressors
- Pressure Transmitters
- Level Systems

DESCRIPTION

SA89A is a micromachined piezoresistive silicon pressu sensor. It is designed for OEM applications where compatibility with corrosive media must be maintained. The sensor chip is mounted on a TO style header, which is resistance welded to a 316 stainless steel package. A 316 stainless steel convoluted isolation diaphragm is welded to the package, sealing a small volume of silicon oil between the diaphragm and the sensor chip. The oil filled pressure housing utilizes the oil column to couple the piezoresistive sensor to the isolation diaphragm. An ASIC compensation board to normalize pressure sensitivity are an integral part of the sensor package. A variety of threaded process fittings are available. Fittings include standards like 1/4 and 1/8 NPT, 1/4 BSP as well as custom process fittings. Electrical options include cable and connector.

DIMENSIONS



CONNECTIONS

PAD/CNDTR	FUNCTION
1	+Vin
2	GND
3	+Vout

MODEL SA89A

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED:
ALL PARAMETERS ARE MEASURED AT 10 VDC AND AT 25°C AFTER 10 SEC WARM UP

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
SPAN	4.5			V	
ZERO PRESSURE OUTPUT	0.5			V	
PRESSURE NON-LINEARITY	-1.0	±0.3	+1.0	%SPAN	1
PRESSURE HYSTERESIS	-0.10		+0.10	%SPAN	
REPEATABILITY	-	±0.02	-	%SPAN	
TEMPERATURE ERROR, SPAN (O° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
TEMPERATURE ERROR, ZERO(0° TO 50°C)	1.2PSI AND 0.07BAR: ±2.0; >5PSI OR >.35BAR: ±1			%SPAN	2
ACCURACY (COMBINED LINAEARITY, HYSTERESIS & REPEATABILITY)	±0.25			%SPAN	1
TOTAL ERROR BAND (INCLUDES CALIBRATION ERRORS & TEMPERATURE EFFECTS OVER THE COMPENSATED RANGE)	1.2PSI AND 0.07BAR: ±7.0; 5PSI OR .35BAR: ±5 >5PSI OR >.35BAR: ±5			%SPAN	
SUPPLY VOLTAGE	4.75	5.0	5.25	V	3
INSULATION RESISTANCE (50 VDC)	50M	-	-	Ω	4
PRESSURE OVERLOAD	3X			RATED	
COMPENSATED TEMPERATURE	0	-	+50	℃	
OPERATING TEMPERATURE	-20	-	+125	℃	
MEDIA, PRESSURE PORT	LIQUIDS AND GASES COMPATIBLE WITH 316/316L ST STL				

ORDERING INFORMATION

ORDERING INFORMATION

SA89A 3 X – XXXXX X – XXXX X

OUTPUT
3=0.5 TO 4.5V RATION

ELECTRICAL
P=SOLDRER PADS
R=6 "RIBBON CABLE
C=6" RIBBON CABLE W/CONNECTOR
X=SPECIAL

CUSTOM P/N
00000=STANDARD P/N

FITTING TYPE
0=W/O FITTING
1=1/4-18 NPT
2=1/8-27 NPT
3=7/16-20 UNF
4=1/4-18 NPT
5=1/4-19 BSP
6=1/8-27 NPT
7=1/4-19 BSP

PRESSURE TYPE
A=ABSOLUTE
G=GAGE

PRESSURE RANGE	
PSI	BAR
006B	.07B*
012B	.14B*
018B	.35B*
028B	001B
030B	002B

*GAGE ONLY
INTERMEDIATE RANGES AVAILABLE,
CONTACT FACTORY.

Notes

1. BEST FIT STRAIBHT LINE.
2. OVER THE COMPENSATED TEMPETATURE RANGE WITH RESPECT TO 25°C.
3. GUARANTEES OUTPUT/INPUT RATIONMETRICITY.
4. BETWEEN CASE AND SENSING ELEMENT.
5. THE MAXMIUM PRESSURE THAT CAN BE APPLIED TO A TRANSDUCER WITHOUT RUPTURE OF EITHER THE SENSING ELEMENT OR TRANSDUCER.
6. DEVICE MARKING:
   EACH PART SHALL BE IDENTIFIED WITH MODEL NUMBER, PRESSURE RANGE, TYPE (GAGE OR ABSOLUTE),
   LOT NUMBER, SERIAL NUMBER AND DATE CODE.
7. SHIPPING/PACKAGING REQUIREMENTS:
   THE STAINLESS STEEL DIAPHRAGM IS PROTECTED BY A PLASTIC CAP. EACH UNIT WILL BE PACKAGED INDIVIDUALLY IN A PLASTIC VIAL
   WITH ANTI-STATIC FOAM.
8. DIRECT MECHANICAL CONTACT WITH DIAPHRAGM IS PROHIBITED, DIAPHRAGM SURFACE MUST REMAIN FREE OF DEFECTS (SCRATCHES, PUNCTURES, DENTS,FINGERPRINTS,ECT) FOR DEVICE TO OPERATE PROPERLY. CAUTION IS ADVISED WHEN HANDLING PARTS WITH EXPOSED DIAPHRAGM. USE PROTECTIVE CAP WHENEVER DEVICES ARE NOT IN USE.

MODEL SA89VI

Disposible Pressure Sensor
0-10Vdc or 4-20mA Output
Gage and Absolute
Temperature Compensated

- **Invasive Blood Pressure**
- **Hemodialysis**
- **Biochemical Analyzer**
- **Urodynamics**
- **Intrauterine Pressure**
- **Intracranial Pressure**

FEATURES

- 0-10V or 4-20mA selectable
- ±0.1% Pressure Non-linearity
- -10ºC To +60ºC Compensated Temperature Range
- 0.5% Interchangeable
- Solid State Reliability
- Low Power

DESCRIPTION

The Model SA89VI is a fully piezoresistive silicon pressure sensor with an ASIC compensation board to normonize the outoput for either 0-10Vdc or 4-20mA output.

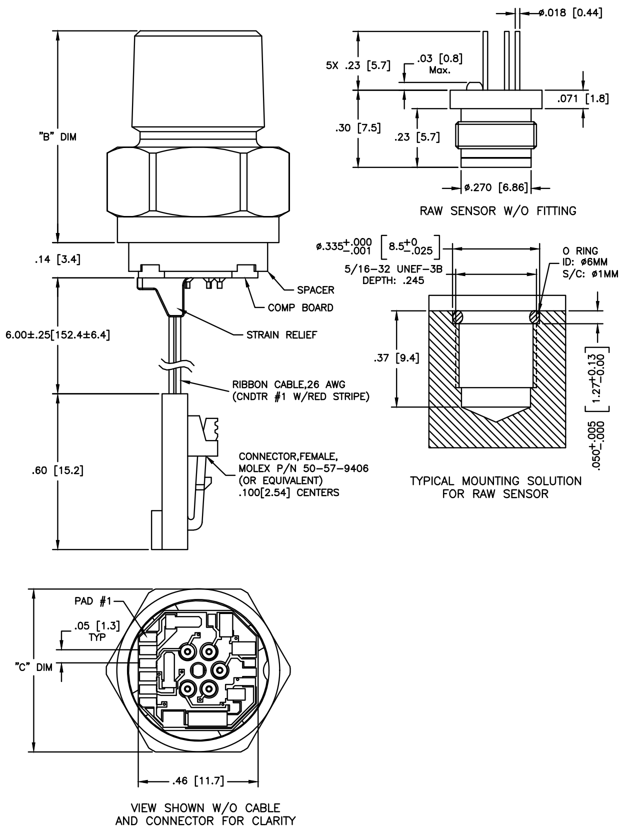
SA89VI High Accuracy Silicon Ceramic sensor is a piezoresistive silicon pressure sensor,offering an 0-10Vdc or 4-20mA output for reading pressure over the specified full scale pressure span and temperature range. SA89VI Series is fully calibrated and temperature compensated for sensor offset, sensitivity, temperature effects, and non-linearity using an on-board Application Specific Integrated Circuit (ASIC). Calibrated output values for pressure are updated at approximately 50Hz.

SA89VI Series is calibrated over the temperature range of -10 °C to 60 °C. The sensor is characterized for operation from a single power supply of 16-32Vdc . SA89VI Series sensors are intended for use with corrosive, ionic working fluids. They are designed and manufactured according to standards in ISO 9001.

The products are shipped in anti-static shipping containers. Performance characteristics and packaging can be easily tailored on a special order basis to meet the requirements of specific customers.

MODEL SA89VI

DIMENSIONS



STANDARD RANGES

Range	psig	psia
0to500	•	•
0to1000	•	•
0to3000	•	•
0to5000	•	•
0to10000	•	•
0to15000	•	•

ORDERING INFORMATION

ORDERING INFORMATION

SA89VI–XXX X – X X

PRESSURE TYPE
SA89VIA=0–10V
SA89VIB=4–20mA

PRESSURE RANGE(PSI)
01K=1000
03K=3000
05K=5000
10K=10000

PRESSURE TYPE
A=ABSOLUTE
S=SEALED

FITTING TYPE
0=W/O FITTING
1=1/4–18 NPT,7/8 HEX
2=1/8–27 NPT,7/8 HEX
3=7/16–20 UNF,7/8 HEX
4=1/4–18 NPT,5/8 HEX
5=1/4–19 BSP,3/4 HEX
6=1/8–27 NPT,5/8 HEX
7=1/4–19 BSP,7/8 HEX

ELECTRICAL
P=SOLDRER PADS
R=RIBBON CABLE
C=CABLE W/CONNECTOR

MODEL SA89VI

PERFORMANCE SPECIFICATIONS

All parameter measured at 1.5 mA and at 25∞C, after 10 second warm up, unless otherwise specified.

PARAMETERS	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Performance Characteristics						
Supply voltage		12	24	36	Vdc	
Zero Pressure Offset (0-10V)		-0.05	±0.02	0.05	Vdc	
Zero Pressure Offset (4-20mA)		-0.15	±0.1	+0.15	mA	
Pressure Non Linearity			±0.1	+0.2	%FSS	2
Hysteresis & Repeatability		-0.3	±0.15	+0.3	%FSS	
Full Scale Span (0-10V)	FSS		10		VDC	3
Full Scale Span (4-20mA)	FSS		16		mA	
Temperature Hysteresis, Offset & Span		-0.20		+0.20	%FSS	4
Thermal Error of Span		-0.5		+0.5	%FSS	
Thermal Error of Offset		-0.5		+0.5	%FSS	
Response Time			100		µS	
Insulation Resistance		50			MΩ	
Long Term Stability, Offset & Span			±0.4		%FSS	5
Weight			2.5		grams	
Compensated Temperature		0 TO 50			°C	
Absolute Maximum Conditions						6
Storage Temperature		-50		150	°C	
Overage Pressure			3X		Range	
Burst, Differential Pressure				5X	Range	
Burst, Gauge & Absolute Pressure				10X	Range	
Media Compatibility		Non Ionic, Non Corrosive Gases				
Wetted Materials		Polysulphone, Silicone Gel, UV epoxy				

Notes

1.RATIOMETRIC TO SUPPLY CURRENT
2.BEST FIT STRAIGHT LINE.
3.MAXIMUM TEMPERATURE ERROR BETWEEN 0C AND 50C WITH RESPECT TO 25C.
4.SHORT TERM STABILITY OVER 7 DAYS WITH CONSTANT CURRENT AND TEMPERATURE.
5.LONG TERM STABILITY OVER A ONE YEAR PERIOD WITH CONSTANT CURRENT AND TEMPERATURE.
6.FOR A ZERO-TO-FULL SCALE PRESSURE STEP CHANGE.
7.2X MAXIMUM FOR 15000PSI DEVICE.

MODEL SA69

Flexible Electrical Outputs
ASIC Compensation
Wide Temperature Range
Hash Media Compatible

- **High Accuracy**
- **Low Overall Errors, 1%TEB**
- **All Welded Design**
- **Custom Outputs and Ranges Available**

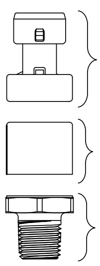
DESCRIPTION

Sensorall SA69 Series incorporates the latest mixed signal ASIC (Application Specific Integrated Circuit) with a bonded silicon gage to provide the standard for Industrial Transducers & Transmitters. The SA69 Series offers current, regulated and ratiometric outputs types along with a wide range of process fittings. The rugged design is compatible with a wide range of harsh media including refrigerants, compressed air, and hydraulic fluids. The designs superior performance provides 1% Total Error across a wide temperature range of -20 to 85°C and overall error of less than 2.5% over -40 to 125C. The flexible design incorporates many connector types making it the ideal choice for OEM customers.

DIMENSIONS

SA69PX2 — Series

SA69PX2	Heavy Duty Pressure Transducer1



X — Electrical Connector Type

A	Metri-Pack 150, Standard (UL 94 HB)[2] (For UL 94 V-0 version, see order code J below.)
B	Micro M12 (IEC 61076-2)
C	DIN (EN 175301-803C)
D	Deutsch (DTM04-3P)
E	Cable harness, 1 meter cable length[3]
F	Cable harness, 2 meter cable length[3]
G	Cable harness, 3 meter cable length[3,4]
H	Cable harness, 5 meter cable length[3,4]

(three -wire) (two -wire)

XX — Pressure Port Type

F1	7/16-20 UNF 1/4 in 45° Flare Female Schrader (SAE J512)
F2	7/16-20 UNF 45° Flare Male (SAE J513)
F3	7/16-20 UNF 37° Flare Male (SAE J514)
G1	G1/4 (ISO 1179-3)
G2	G1/8 (ISO 1179-3)
M1	M12 x 1.5 (ISO 6149-3)
N1	1/4-18 NPT
N2	1/8-27 NPT
S1	9/16-18 UNF (SAE J1926-3)
S2	7/16-20 UNF (SAE J1926-3)

XXXX — Pressure Range

bar		Pa		psi	
001B	1 bar	100K	100 kPa	015P	15 psi
1.6B	1.6 bar	160K	160 kPa	030P	30 psi
002B	2 bar	250K	250 kPa	050P	50 psi
2.5B	2.5 bar	400K	400 kPa	100P	100 psi
004B	4 bar	600K	600 kPa	150P	150 psi
006B	6 bar	001G	1 MPa	200P	200 psi
008B	8 bar	1.6G	1.6 MPa	250P	250 psi
010B	10 bar	2.5G	2.5 MPa	300P	300 psi
016B	16 bar	004G	4 MPa	500P	500 psi
025B	25 bar	4.6G	4.6 MPa	600P	600 psi
040B	40 bar	006G	6 MPa	667P	667 psi
046B	46 bar	007G	7 MPa	750P	750 psi
060B	60 bar			01KP	1000 psi
070B	70 bar				

X — Pressure Reference

A	Absolute
S	Sealed gage[5]
G	Vented gage[6]

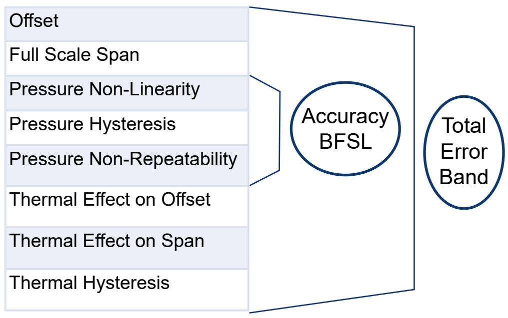
XX — Output Transfer Funct

AA	Ratiometric 5.0 V: 10 %Vs to
AB	Ratiometric 5.0 V: 5 %Vs to 9
AC	Ratiometric 3.3 V: 10 %Vs to
AD	Ratiometric 3.3 V: 5 %Vs to 9
BC	Regulated: 1 Vdc to 6 Vdc
BD	Regulated: 0.25 Vdc to 10.25
BE	Regulated: 0.5 Vdc to 4.5 Vd
BG	Regulated: 1 Vdc to 5 Vdc
CH	Current: 4 mA to 20 mA

MODEL SA69

TABLE 1.

CHARACTERISTIC	PARAMETER
Operating temperature range[2]	-40°C to 125°C [-40°F to 257°F]
Storage temperature range[3]	-40°C to 125°C [-40°F to 257°F]
Compensated temperature range[4]	-40°C to 125°C [-40°F to 257°F]
Overpressure minimum rating[5]	(See Table 3)
Burst pressure minimum rating[6]	(See Table 3)
Long term stability	±0.5 %FSS [9] (1000 hr at 25°C [77°F])
Accuracy[7]	±0.25 %FSS [9] (See Figure 1)
Offset error[8]	±1 %FSS [9]
Total Error Band[10]	±2 %FSS [9] (-40°C to 125°C [-40°F to 257°F]) (See Figure 1.)
Response time[11]	<2 ms
Turn on time[12]	<7 ms
Life[13]	minimum of 10 million cycles to operating pressure



1.All specifications apply at 25°C and under operating conditions unless otherwise noted.
2.Operating Temperature Range: The temperature range over which the product will produce an output proportional to pressure but may not remain within the specified performance limits.
3.Storage Temperature Range: The temperature range over which the product may safely be exposed without excitation or pressure applied. Under these conditions the product will remain in specification after excursion to any temperatures within this range. Exposure to temperatures outside this range may cause permanent damage to the product.
4.Compensated Temperature Range: The temperature range (or ranges) over which the product will produce an output proportional to pressure within the specified performance limits.
5.Overpressure: The absolute maximum rating for pressure which may be safely applied to the product for it to remain in specification once pressure is returned to the operating pressure range. Exposure to higher pressure may cause permanent damage to the product.
6.Burst Pressure: The maximum pressure that may be applied to the product without causing escape of the pressure media. The product should not be expected to function after exposure to any pressure beyond the rated burst pressure. This rating is also the case burst rating of the product.
7.Accuracy: The maximum deviation in output 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, pressure hysteresis, and non-repeatability.
8.Offset Error: the maximum deviation in the output signal obtained when the reference pressure is applied at 25°C relative to the ideal transfer function.
9.Full Scale Span (FSS): The algebraic difference between the output signal measured at the maximum (Pmax.) and minimum (Pmin.) limits of the pressure range.
10.Total Error Band: The maximum deviation from the ideal transfer function over the entire compensated temperature and pressure range. Includes all errors due to offset, full scale span, pressure non-linearity, pressure hysteresis, repeatability, thermal effect on offset, thermal effect on span, and thermal hysteresis.
11.Response Time: The response time of the transducer is the maximum amount of time that the transducer will take for the transducer to output a change from 10% to 90% of full scale in response to a 0% to 100% full scale step input pressure range.
12.Turn On Time: Duration from power applied until first valid output.
13.Life may vary depending on the application in which transducer is used.

MODEL SA69

ELECTRICAL SPECIFICATIONS

TABLE 2.

CHARACTERISTIC		RATIOMETRIC OUTPUT				CURRENT OUTPUT	REGULATED OUTPUT			
		OUTPUT TRANSFER FUNCTION ORDER CODE								
		AA	AB	AC	AD	CH	BC	BD	BE	BG
Output transfer function[1]	null output value	10% of Vs	5% of Vs	10% of Vs	5% of Vs	4 mA	1 V	0.25V	0.5V	1V
	full scale output value	90% of Vs	95% of Vs	90% of Vs	95% of Vs	4 mA	6 V	10.25V	4.5V	5V
	full scale span (FSS)	80% of Vs	90% of Vs	80% of Vs	90% of Vs	16 mA	5 V	10V	4V	4V
	operating supply voltage, min.(Vs)[2]	4.75 V	4.5 V	3.135 V	3.135 V	8 V	9 V	13V	8V	8V
	operating supply voltage, typ.(Vs)[2]	5 V	5 V	3.3 V	3.3 V	-	-	-	-	-
	operating supply voltage, max.(Vs)[2]	5.25 V	5.5 V	3.465 V	3.465 V	30 V[4]	30 V[3]	30 V[3]	30 V[3]	30 V[3]
Supply current (typ.)		5mA		4mA		-	5.5mA			
Output load (pull up or down)	minimum	2kOhm				-	2kOhm			
	maximum	-				(Vs - 8) x50 Ohm	-			
Absolute voltage ratings[5]	minimum[6]	-16V				-16V	-16V			
	maximum[6]	16V				30V	30V			
	maximum applied to output pin (short circuit protection)[7]	Vs				-	12V			
EMC rating[8]	electrostatic discharge	±4 kV contact, ±8 kV air per IEC 61000-4-2								
	radiated immunity	10 V/m (80 MHz to 1000 MHz) per IEC 61000-4-3								
	fast transient burst	±1 kV per IEC61000-4-4								
	immunity to conducted disturbances	3 V per IEC61000-4-6								
	radiated emissions	40 dB 30 MHz to 230 MHz; 47 dB 230 MHz to 1000 MHz per CISPR 11								
	ISO 11452-2 radiated immunity	100 V/m 200 MHz to 2 GHz					20 V/m 200 MHz to 2 GHz			

FIGURE 2.
REGULATED OUTPUT
SUPPLY VOLTAGE

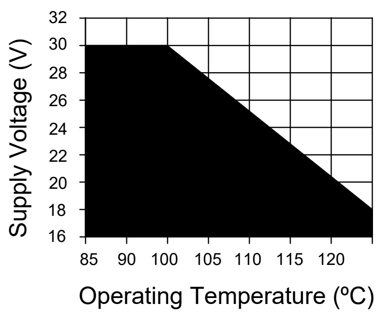
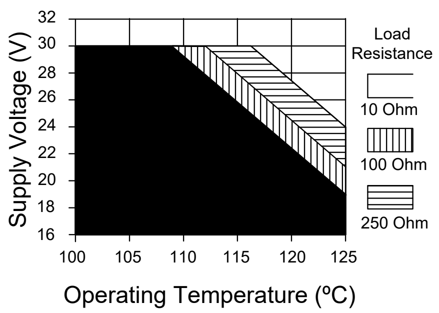


FIGURE 3.
CURRENT OUTPUT
SUPPLY VOLTAGE



1.Output transfer function options are shown in the Nomenclature and Order Guide.
2.Transducer will not produce valid output when supply voltage is outside of operating range.
3.Applies at 25°C. See Figure 2 for Regulated Output Supply Voltage.
4.Applies at 25°C. See Figure 3 for Current Output Supply Voltage.
5.Absolute maximum ratings are the extreme limits the device can withstand without damage to the product. Voltages above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability.
6.Absolute voltage applies to potential across power and ground terminals.
7.Short circuit protection between output pin and ground, and output pin and supply pin.
8.All EMC ratings verified with the Metri-Pack 150 electrical connector type.

MODEL SA69

PRESSURE RATINGS

TABLE3 .

bar			kPa			MPa			psi		
Operating Pressure	Over-pressure	Burst Pressure	Operating Pressure	Over-pressure	Burst Pressure	Operating Pressure	Over-pressure	Burst Pressure	Operating Pressure	Over-pressure	Burst Pressure
1	5	8	100	500	800	1	3.1	5.1	15	70	115
1.6	5	8	160	1000	1700	1.6	5.2	8.6	30	150	250
2	10	17	250	1000	1700	2.5	6.9	10.3	50	250	400
2.5	10	17	400	1700	2700	4	6.9	10.3	100	450	750
4	17	27	600	3100	5100	4.6	6.9	10.3	150	450	750
6	31	51	-	-	-	6	13.8	20.6	200	750	1250
8	31	51	-	-	-	7	13.8	20.6	250	750	1250
10	31	51	-	-	-	-	-	-	300	1000	1500
16	52	86	-	-	-	-	-	-	500	1000	1500
25	69	103	-	-	-	-	-	-	600	1000	1500
34	69	103	-	-	-	-	-	-	667	1000	1500
40	69	103	-	-	-	-	-	-	750	1500	2250
46	69	103	-	-	-	-	-	-	800	1500	2250
60	138	206	-	-	-	-	-	-	850	2000	3000
70	138	206	-	-	-	-	-	-	1000	2000	3000

TABLE3 .

PRESSURE REFERENCE	DESCRIPTION
Absolute	Output is proportional to the difference between applied pressure and a built-in fixed reference to vacuum (zero pressure), where the minimum operating pressure is set to absolute zero pressure (perfect vacuum)
Sealed gage[1]	Output is proportional to the difference between applied pressure and a built-in fixed reference to 1 atmA, where the minimum operating pressure is set to 14.7 psiA (1 atmA)
Vented gage[2]	Sensor measures pressure relative to ambient pressure. Output is proportional to the difference between applied pressure and atmospheric (ambient) pressure, where the minimum operating pressure is set to atmospheric pressure

1.Sealed gage option only available in pressure ranges at or above 100 psi.
2.Vented gage option only available in pressure ranges between 100 psi and 667 psi.

PRESSURE RATINGS

TABLE5 .

CHARACTERISTIC			PARAMETER
Mechanical shock			100 G per MIL-STD-202F, Method 213B, Cond. F (at 25°C [77°F])
Vibration			20 G sweep, 10 Hz to 2000 Hz (at 25°C [77°F])
Enclosure rating			per electrical connector type selection (See Table 6)
Wetted materials:	port		304 stainless steel
	substrate		alumina ceramic
	adhesives		epoxy
	electronics		glass, silicon
External materials:	housing		304 stainless steel
	connector	UL 94 HB (standard)	PBT 30 % GF, black
		UL 94 V-0 (optional)	PBT 30 % GF, natural (beige)
	cable jacket		TPE
Installation torque			per pressure port type (See Table 7)

CAUTION

PRODUCT DAMAGE DUE TO MECHANICAL ISSUES

- Ensure torque specifications are determined for the specific application. Values provided are for reference only. (Mating materials and thread sealants can result in significantly different torque values from one application to the next.)
- When using mating parts made of stainless steel, use a thread sealant with anti-seize properties to prevent thread galling. Ensure the sealant is rated for the application.
- Use appropriate tools (such as an open ended wrench or deep well socket) to install transducers.
- Always hand-start transducers into the hole to prevent cross threading and damage.
- Ensure that torque is not applied to the electrical connector.
- Ensure that the proper mating electrical connector with a seal is used to connect the transducer. Improper or damaged seals can compromise ingress protection, leading to short circuits.

Failure to comply with these instructions may result in product damage.

CAUTION

PRODUCT DAMAGE DUE TO PARTICULATES

- Ensure that a filter is used upstream of the transducer to keep media flow free of larger particulates and increased humidity. All PX2 Series transducers are dead-ended devices; particulate accumulation and condensing moisture may affect sensor output.
- It is recommend that the transducer be positioned with the port facing downwards; any particulates in the system are less likely to enter and settle within the pressure transducer if it is in this position.
- Ensure that the media does not create a residue when dried. Build-up inside the transducer may affect transducer output; rinsing of a dead-ended transducer is potentially difficult and has limited effectiveness in removing residue.

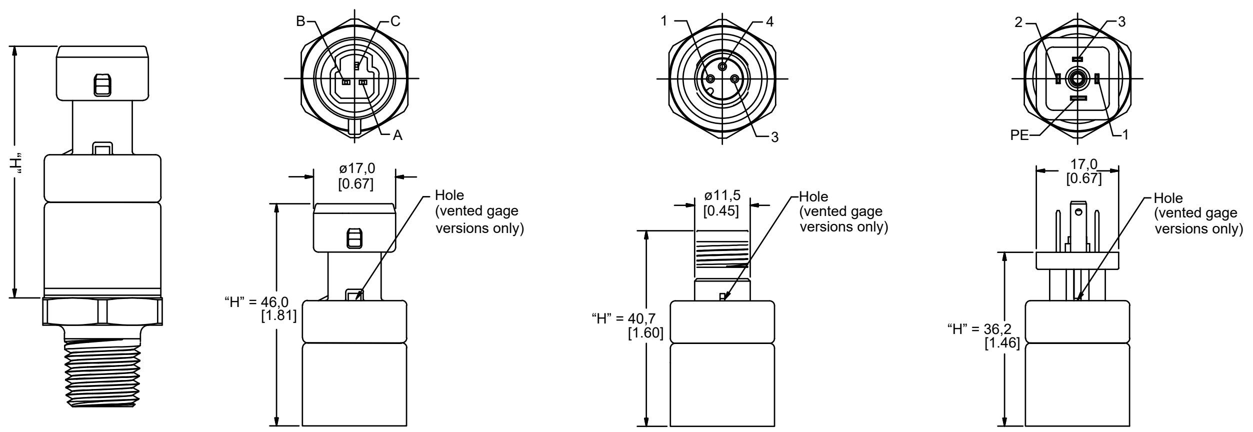
Failure to comply with these instructions may result in product damage.

MODEL SA69

ELECTRICAL CONNECTOR TYPE DIMENSIONS (FOR REFERENCE ONLY)

TABLE6 .

Connector Type	A&J			B			C		
Connector Mating Connector IP Rating	Connector: DELPHI 12078088 Mating Connector: DELPHI 12110192 IP Rating1: IP65 (all versions)			Connector: IEC 61076-2-101 Mating Connector: 4 POS TYPE D IP Rating1: IP65/IP67 (absolute, sealed gage versions) , IP65 (vented gage versions)			Connector: EN 175301-803C Mating Connector: EN 175301-803C DIN 43650C 8MM IP Rating1: IP65 (all versions)		
Funcation	Pin	Voltage Output	Current Output	Pin	Voltage Output	Current Output	Pin	Voltage Output	Current Output
	A	GND	RTN	1	V+	supply	1	GND	RTN
	B	V+	supply	3	GND	RTN	2	V+	supply
	C	Vout	NC	4	Vout	NC	3	Vout	NV
							PE	NC	NC

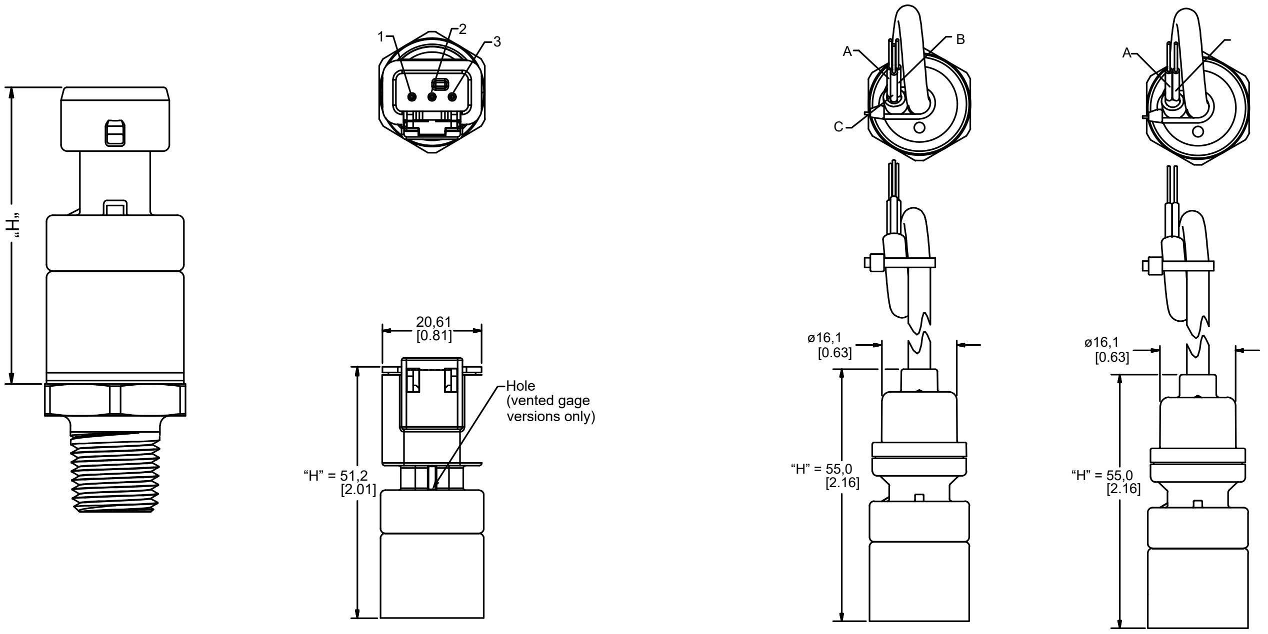


ELECTRICAL CONNECTOR TYPE DIMENSIONS (FOR REFERENCE ONLY)

TABLE6 .

Connector Type	D			M&F&G&H(1/2/3/5 METER)			
Connector Mating Connector IP Rating	Connector: Deutsch DTM04-3P Mating Connector: DTM06-3S IP Rating1: IP65, IP67, IP69K (absolute, sealed gage versions), IP65 (vented gage versions)			Connector: 24 AWG with TPE Jacket Mating Connector: Flying leads IP Rating1: IP65, IP67, IP69K (absolute, sealed gage versions)			
Funcation	Pin	Voltage Output	Current Output	Wire Color	Voltage Output	Wire Color	Current Output Supply
	A	GND	RTN	Red	V+	Red	
	B	Vout	NC	Black	GND	Black	RTN
		V+	supply	White	Vout		

MODEL SA69



PRESSURE PORT TYPE DIMENSIONS (FOR REFERENCE ONLY)

TABLE7 .

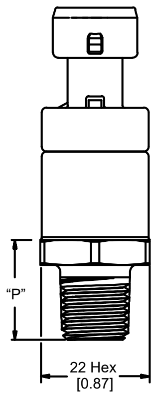
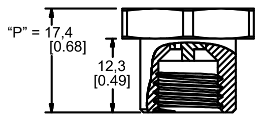
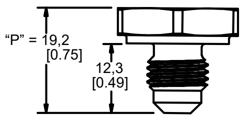
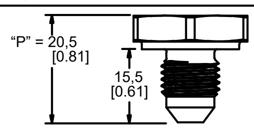
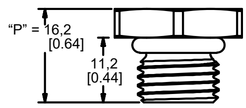
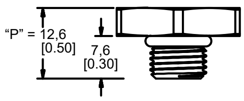
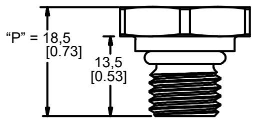
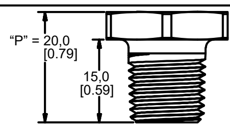
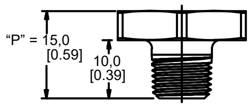
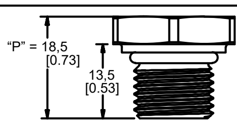
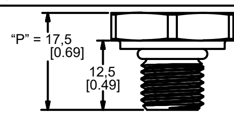


TABLE 7.

F1 7/16-20 UNF 1/4 in 45º Flare Female Schrader (SAE J512)	F2 7/16-20 UNF 45º Flare Male (SAE J513)
Seal: 45º cone Mating geometry: SAE J512 Installation torque: 17 N.m [12.5 ft-lb] 	Seal: 45º cone Mating geometry: SAE J513 Installation torque: 1/4 Turn from finger tight 
F3 7/16-20 UNF 37º Flare Male (SAE J514)	G1 G1/4 (ISO 1179-3)
Seal: 37º cone Mating Geometry: SAE J514 Installation Torque: 16 N.m [11.8 ft-lb] 	Seal: O-ring Mating geometry: ISO 1179-1 Installation torque: 50 N.m [38.9 ft-lb] 
G2 G1/8 (ISO 1179-3)	M1 M12 X 1.5 (ISO 6149-3)
Seal: O-ring Mating geometry: ISO 1179-1 Installation torque: 25 N.m [18.4 ft-lb] 	Seal: O-ring Mating geometry: ISO 6149-1 Installation torque: 25 N.m [18.4 ft-lb] 
N1 1/4–18 NPT	N2 1/8–27 NPT
Seal: pipe thread Mating geometry: ANSI B1.20.1 Installation torque: 2 to 3 turns from finger tight 	Seal: pipe thread Mating geometry: ANSI B1.20.1 Installation torque: 2 to 3 turns from finger tight 
S1 9/16–18 UNF (SAE J1926-3)	S2 7/16–20 UNF (SAE J1926-3)
Seal: O-ring Mating geometry: SAE J1926-1 Installation torque: 30 N.m [22.1 ft-lb] 	Seal: O-ring Mating geometry: SAE J1926-1 Installation torque: 18 N.m [12.3 ft-lb] 

MODEL SA730

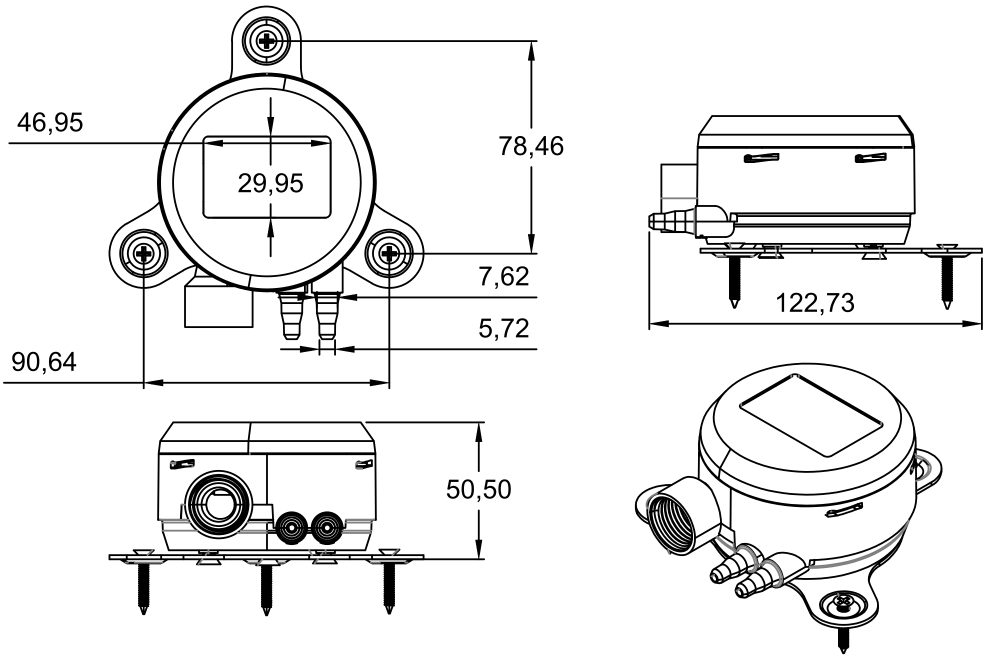
LCD Display
Zero Temperature drift
Auto-Zero with Solenoid Valve
4-20mA or 0-10Vdc or 0-5Vdc
RS485 Output

- **Clean Room/ HVAC**
- **Hospital Operating Room**
- **Environmental Control**
- **Process Automation Control**

Characteristics

- Ranges from 25 Pa to 300psi (or can be customized, contact factory)
- Configurable intermediary ranges
- 0-5 V, 0-10 V,RS485 or active 4-20 mA output, power supply from 15 to 35 Vdc
- WIFI configurable with local server for remote monitoring.
- ABS V0 housing, IP65, with or without display
- “¼ turn” system mounting with wall-mount plate
- Housing with simplified mounting system
- Solenoid valve for auto-calibration
- Relay output, alarm pressure level configurable

FEATURES OF THE HOUSING



MODEL SA730

TECHNICAL PARAMETERS

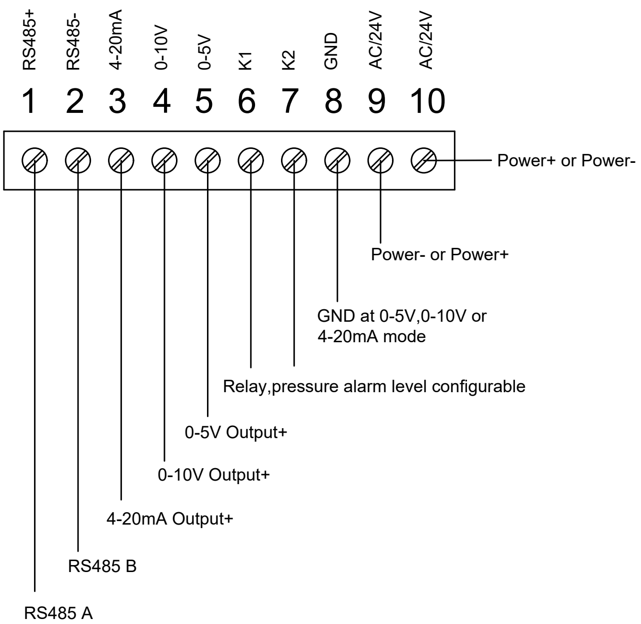
Measurement units	inH20, Kpa, Psi, Bar, Pascal, mmH2O
Accuracy*	SA730 : ±0.5% of reading+/-2Pa ; SA731 : ±0.5% of reading+/-3Pa ; SA732 : ±0.5% of reading+/-3mmH2O
Response time	1/e (63%) 0.3 s
Resolution	0.1Pa; 1Pa; 1Pa
Auto-Zero	Automatic by solenoid valve, this is only for 50Kpa range beow
Type of fluid	Air or neutral gases
Overpressure	SA730: 5Kpa, SA731: 10Kpa; SA732: 100Kpa
Operating Temperature	From 0 to 50°C
Storage Temperature	From -20 to 75°C

*All the accuracies indicated in this technical datasheet were tested in laboratory conditions, and can be guaranteed for measurements carried out in the same conditions, or carried out with calibration compensation

TECHNICAL Specifications

OUTPUT/SUPPLY	Maximum load: 500ohm(4-20mA), Minimum load: 1Kohm (0-10V,0-5V)
POWER CONSUMPTION	2VA(0-5,0-10V), 22mA (4-20mA)
Electromagnetical Compatibility	EN61326
Electrical Connection	Screw terminal block for cables from 0.05 to 2.5 mm2 or from 30 to 14 AWG

CONNECTIONS



PART NUMBER ORDERING

SA730DI-	XXXX -	D
Model Number	Pressure range	Pressure Type
	0100: -100/+100Pascal	D: Differential
	0500: -1000/+1000Pascal	G: Gauge
	010K: -10000/+10000Pascal	A: Absolute
	100K: 100KPa, contact factory for customization if needed	

MODEL SA730

AUTO CALIBRATION

Pressure transmitter has a temperature compensation from 0 to 50°C and an auto calibration process that guarantees excellent stability and perfect reliability of the measurement on low and high ranges over time.

Auto calibration principle: the microprocessor of the transmitter drives a solenoid valve that compensates the possible drifts on the sensitive element over time. The compensation is performed by the permanent adjustment of the zero, so the measurement of the differential pressure is then independent from the environmental conditions of the transmitter.

Advantage: No drift

Frequency of auto-calibration: Resettable from 1min to 60min

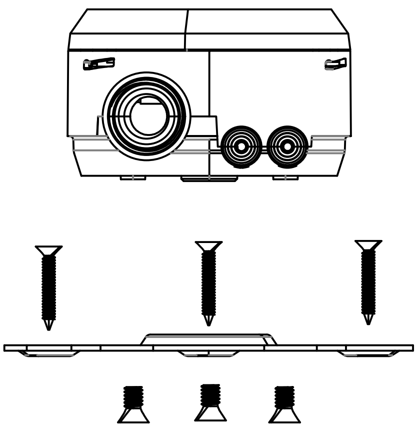
RANGE CONFIGURATION

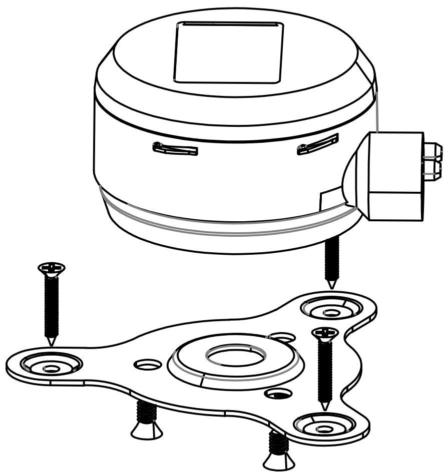
The range of the pressure transmitter can be configured according to user's application. The configurable percentage can be set is 10%,20%,40%,60%,80% within menu.

For example, the original range is +/-1000Pa, if select 10%, the range will change to +/-100Pa, the corresponding 0-5V,0-10V and 4-20mA output will change automatically.

For detailed instruction for the range configuration, consult factory.

Mounting





MODEL SA730DI

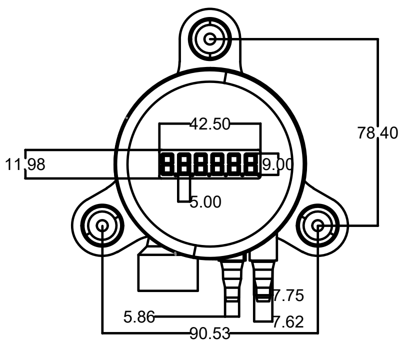
Segment Screen Display
4-20mA Output
Wide Temperature Range
Low temperature to -45degC

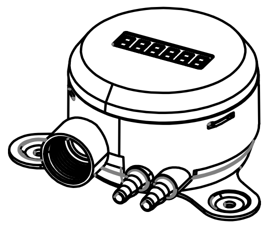
- **Cold storage room**
- **Cold-chain transportation**
- **Clean Room/HVAC**
- **Process Automation**

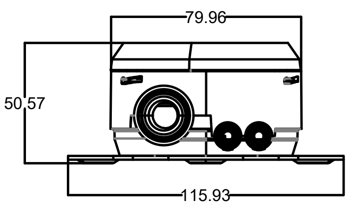
Characteristics

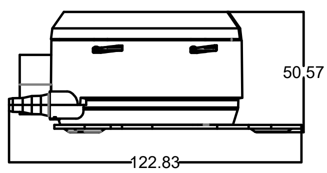
- Ranges from 100 Pa to 150psi (or can be customized, contact factory)
- 2 wires 4-20 mA output, power supply from 12 to 30 Vdc
- ABS V0 housing, IP64, with or without display
- Expansion screw mounting with wall-mount plate
- Housing with simplified mounting plate
- 0.5% Full Scale Span Accuracy
- Operating temperature from -45°C to 70°C with 6 digits segment code screen display
- Storage temperature -55°C to 85°C

FEATURES OF THE HOUSING









MODEL SA730DI

TECHNICAL PARAMETERS

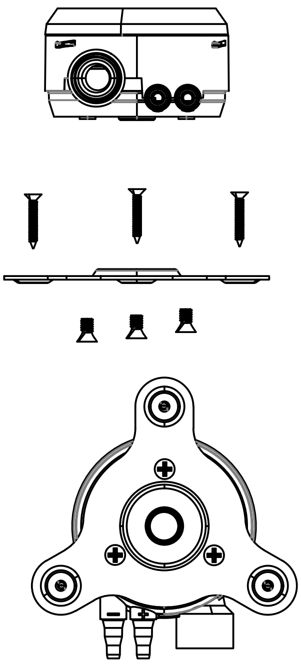
Measurement units	inH20, Kpa, Psi, Bar, Pascal, mmH2O
Accuracy*	SA730 DI: : ±0.5% of reading+/-0.5%FSS
Response time	0.1 s
Resolution	0.1Pa
Type of fluid	Air or neutral gases, if need test liquid, contact factory
Overpressure	3X rated pressure
Operating Temperature	Typical 0 to 50°C, can be customized from -45 to 70°C
Storage Temperature	From -50 to 85°C

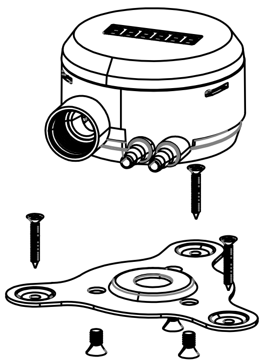
*All the accuracies indicated in this technical datasheet were tested in laboratory conditions, and can be guaranteed for measurements carried out in the same conditions, or carried out with calibration compensation

TECHNICAL Specifications

OUTPUT/SUPPLY	Maximum load: 500ohm(4-20mA), Minimum load: 1Kohm (0-10V,0-5V)
POWER CONSUMPTION	24mA (4-20mA)
Electromagnetical Compatibility	EN61326
Electrical Connection	Screw terminal block for cables from 0.05 to 2.5 mm2 or from 30 to 14 AWG

CONNECTIONS





MODEL SA810

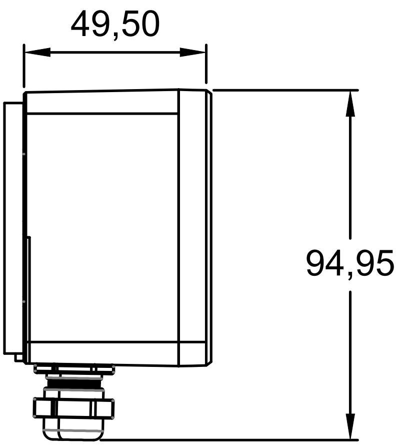
LED Display
Zero Temperature drift
Auto Calibration
Auto Span Configuration
Custom pressrue range

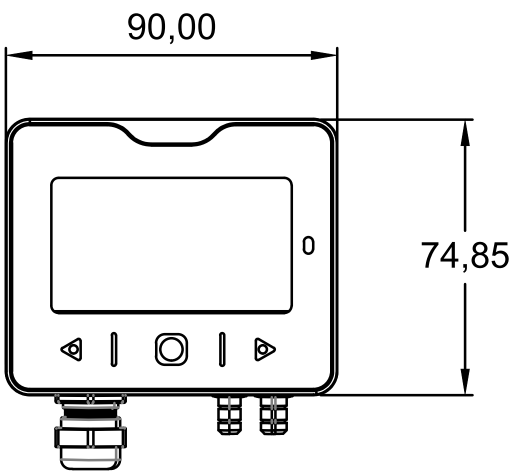
- **Clean Room/ HVAC**
- **Hospital Operating Room**
- **Environmental Control**
- **Process Automation Control**

Characteristics

- Ranges from 25 Pa to 300psi (or can be customized, contact factory)
- Configurable intermediary ranges
- 0-5 V, 0-10 V,RS485 or active 4-20 mA output, power supply from 15 to 35 Vdc
- WIFI configurable with local server for remote monitoring.
- ABS V0 housing, IP65, with or without display
- “¼ turn” system mounting with wall-mount plate
- Housing with simplified mounting system
- Solenoid valve for auto-calibration
- Relay output, alarm pressure level configurable

FEATURES OF THE HOUSING





MODEL SA810

TECHNICAL PARAMETERS

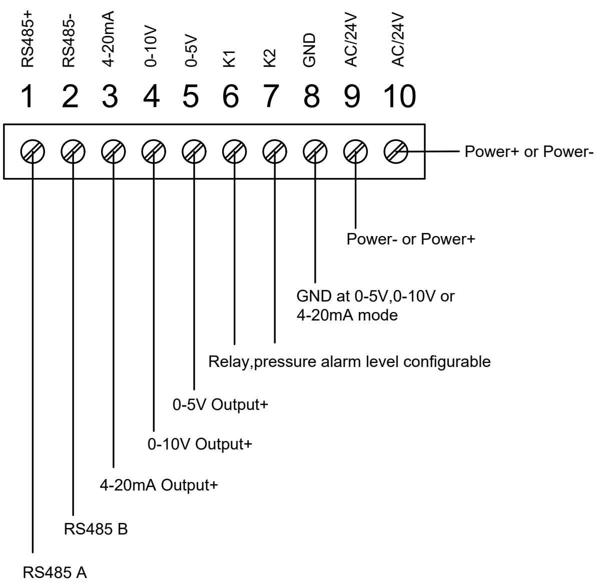
Measurement units	inH20, Kpa, Psi, Bar, Pascal, mmH2O
Accuracy*	SA810 : ±0.5% of reading+/-2Pa ; SA811 : ±0.5% of reading+/-3Pa ; SA812 : ±0.5% of reading+/-3mmH2O
Response time	1/e (63%) 0.3 s
Resolution	0.1Pa; 1Pa; 1Pa
Auto-Zero	Automatic by solenoid valve, this is only for 50Kpa range beow
Type of fluid	Air or neutral gases
Overpressure	SA810: 5Kpa, SA811: 10Kpa; SA812: 100Kpa
Operating Temperature	From 0 to 50°C
Storage Temperature	From -20 to 75°C

*All the accuracies indicated in this technical datasheet were tested in laboratory conditions, and can be guaranteed for measurements carried out in the same conditions, or carried out with calibration compensation

TECHNICAL Specifications

OUTPUT/SUPPLY	Maximum load: 500ohm(4-20mA), Minimum load: 1Kohm (0-10V,0-5V)
POWER CONSUMPTION	2VA(0-5,0-10V), 22mA (4-20mA)
Electromagnetical Compatibility	EN61326
Electrical Connection	Screw terminal block for cables from 0.05 to 2.5 mm2 or from 30 to 14 AWG

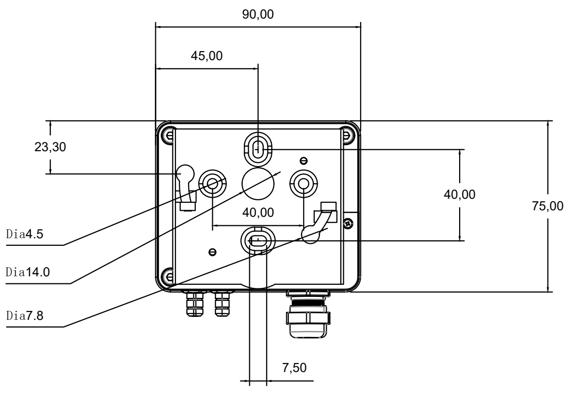
CONNECTIONS



PART NUMBER ORDERING

SA81-	0-	D
Model Number	Pressure range	Display
	0: -100/+100Pascal	D: with display
	1: -1000/+1000Pascal	N: Without display
	2: -10000/+10000Pascal	A: Absolute

Mounting



MODEL SA950W

Pressure generator
High accuracy
Zero calibration
Multiple pressure range

- Hospital blood pressure calibration
- Incoming inspection tool
- Design validation tool
- Production process control

DESCRIPTION

SA 950W is a micro pressure controller with LCD display,it can generate -70 to 200Kpa pressure through its internally embedded pressure pump with accurate pressure sensor. Pressure range can be customized, minimum 2KPa and maximum 200KPa, vacuum pressure can be reached to -70Kpa, pressure unit can be customized also. The internal standard pressure sensor can be used to calibrate the pressure output or as reference.

APPLICATION

SA950 Micro Pressure Controller can be conveniently used within product development, quality control and filed calibration. It is extremely helpful to check the linearity, hysteresis, zero output, full scale output, repeatability and stability of the device under test.
SA950 can also be sued to verify the proper function of blood pressure transducer, reusable cable and monitor integrity during the application in ICU and surgery room.

MODEL SA950W

PRESSURE RANGE:-70 to 200Kpa, Can be customized

OPERATING TEMPERATURE:5°C to 40°C (41°F - 105°F)

STORAGE TEMPERATURE:-20°C to 60°C (-5°F to 140°F)

OPERATING HUMIDITY:RH95% Max.

LCD DISPLAY : 4 DIGITS

DIMENSION : 160mm x 95mm x 35mm

WEIGHT:350 GRAMS

POWER:9VDC Battery(Around 80 Hours Continuously)

STANDARD PRESSURE SENSOR PARAMETERS

- SENSITIVITY: 5 μV/V/mmHg, +/- 1%
- POWER SUPPLY: 2 to 10 vdc, or vac rms to 5 khz
- INPUT RESISTANCE: 2000-4000 Ω
- OUTPUT RESISTANCE: 800-3000 Ω

Warning: Discontinue use if liquid is spilled on device.

Warning: Pressure exceeding 200Kpa will cause leak, unstable pressure output and difficult to achieve the targeted pressure.

Warning: To gain as much as positive pressure capability, move the pressure regulator knob to a starting position which is further away from the housing. To gain as

much as negative pressure capability, move the pressure regulator knob to a starting position which is closer to the housing.

ORDERING INFORMATION

SA950 — XXXK

Model

Pressure range
006K=6Kpa
040K=40Kpa
100K=100Kpa
200K=200Kpa

MODEL SA1901

Small
Low Noise
Robust: High Over-Range
High Reliability
mV Output: 20mV/V Nominal
Low Deflection
Fast
Essentially Unlimited Cycle Life

- Assembly Forces
- Physical Therapy Devices
- Patient Weight
- Hand Tool Forces
- Chiropractic and Exercise Equipment
- Consumables Monitoring: Copy Equipment and Vending systems
- Appliance Payload Monitoring: Washers, Dryers, Water Weight, Extraction Efficiency
- Appliance Unbalance Monitoring

DESCRIPTION

The SA1901 units are intended for OEM use in laboratory, hospital or consumer product applications, establishing a breakthrough price/performance value for silicon on metal force sensors. The SA1901 is a 1% force device with full scale ranges of 10, 25, 50 or 100 and 200lbf compression. This new, low-cost technology enables force sensing in a whole new class of consumer and medical products. Sensorall's silicon on metal MEMS sensing fused with high temperature glass to a high performance stainless steel force measuring flexure. The designed process eliminates age-sensitive organic epoxies used in traditional force sensor designs, providing excellent long term span and zero stability. Operating at very low strains and provides an essentially unlimited cycle life expectancy, superior resolution, high over-range capabilities and a ratiometric span of 20mV/V. The combination of stamped flexures and micro miniaturized MEMs strain gages permits low costs to be achieved in high volume OEM applications ranging from disposable medical devices to durable appliances and exercise equipment.

MODEL SA1901

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED: ALL PARAMETERS ARE MEASURED AT 25°C @5V:

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
RECOMMENDED EXCITATION		5		V	
ZERO OFFSET	-15		15	mV /V	
SPAN	16	20	24	mV /V	RATIOMATRIC
NON-LINEARITY	-1		1	% Span	
HYSTERESIS	-0.8		0.8	% Span	
ZERO REPEATABILITY	-0.8		0.8	% Span	
SPAN REPEATABILITY	-0.8		0.8	% Span	
THERMAL ZERO SHIFT	-0.05		0.05	% Span/°C	
THERMAL SENSITIVITY SHIFT	-0.05		0.05	% Span/°C	
STORAGE TEMPERATURE	-40		85	°C	
OVERLOAD	2X				RATED LOAD
INSULATION RESISTANCE	50			M OHMS	@500VDC
INPUT RESISTANCE	2.4	3.3	4.2	K OHM	
OUTPUT RESISTANCE	1.76	2.2	2.64	K OHM	
HUMIDITY	0		90	%R.H	
ENDURANCE	1E+6				0~FS CYCLES
EXTERIOR MATERIAL	17-4 PH AND 304 STAINLESS STEEL				

ORDERING INFORMATION

SA1901 — XXXX — XXXX — L

RANGE
0010
0025
0050
0100
0200

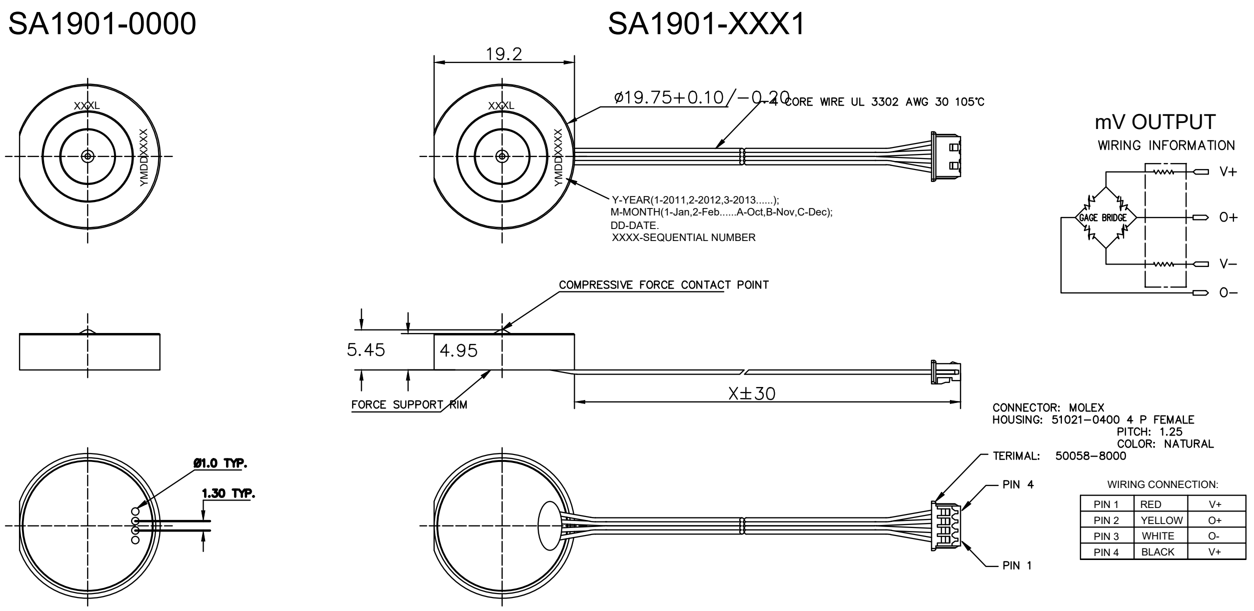
L
LB

CODE	WITH CABLE
0	NO
1	YES

CODE	CABLE LENGTH
XXX	CUSTOMIZE LENGTH
000	FIXED 609.5mm

MODEL SA1901

DIMENSIONS



PIN 1	RED	V+
PIN 2	YELLOW	O+
PIN 3	WHITE	O-
PIN 4	BLACK	V+

MODEL SA2901

Small
Low Noise
Robust: High Over-Range
High Reliability
Analog I2C or SPI Output
Low Deflection
Fast
Essentially Unlimited Cycle Life

- Assembly Forces
- Physical Therapy Devices
- Patient Weight
- Hand Tool Forces
- Chiropractic and Exercise Equipment
- Consumables Monitoring: Copy Equipment and Vending systems
- Appliance Payload Monitoring: Washers, Dryers, Water Weight, Extraction Efficiency
- Appliance Unbalance Monitoring

DESCRIPTION

The SA2901 units are intended for OEM use in laboratory, hospital or consumer product applications, establishing a breakthrough price/performance value for silicon on metal force sensors. The SA1901 is a 1% force device with full scale ranges of 10, 25, 50 or 100 and 200lbf compression. This new, low-cost technology enables force sensing in a whole new class of consumer and medical products. Sensorall's silicon on metal MEMS sensing fused with high temperature glass to a high performance stainless steel force measuring flexure. The designed process eliminates age-sensitive organic epoxies used in traditional force sensor designs, providing excellent long term span and zero stability. Operating at very low strains and provides an essentially unlimited cycle life expectancy, superior resolution, high over-range capabilities and a ratiometric span of 20mV/V. The combination of stamped flexures and micro miniaturized MEMs strain gages permits low costs to be achieved in high volume OEM applications ranging from disposable medical devices to durable appliances and exercise equipment.

MODEL SA2901

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED: ALL PARAMETERS ARE MEASURED AT 25°C @5V:

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES	
RECOMMENDED EXCITATION	4.75	5	5.25	V		
ZERO OFFSET	-15		15	mV /V	mV OUTPUT	
	450	500	550	mV	0.5~4.5V OUTPUT	
SPAN	16	20	24	mV /V	mV OUTPUT	
	3800	4000	4200	mV	0.5~4.5V OUTPUT	
NON-LINEARITY	-1		1	% Span		
HYSTERESIS	-0.8		0.8	% Span		
ZERO REPEATABILITY	-0.8		0.8	% Span		
SPAN REPEATABILITY	-0.8		0.8	% Span		
THERMAL ZERO SHIFT	-0.05		0.05	% Span/°C	mV OUTPUT	REFERENCE TO 25°C, OVER COMPENSATION TEMPERATURE
	-0.05		0.05	% Span/°C	0.5~4.5V OUTPUT	
THERMAL SENSITIVITY SHIFT	-0.05		0.05	% Span/°C	mV OUTPUT	
	-0.05		0.05	% Span/°C	0.5~4.5V OUTPUT	
COMPENSATION TEMPERATURE	0		50	°C	ONLY FOR 0.5~4.5V OUTPUT	
STORAGE TEMPERATURE	-40		85	°C		
OVERLOAD	2X				RATED LOAD	
INSULATION RESISTANCE	50			M OHMS	@250VDC	
INPUT RESISTANCE	2.4	3.3	4.2	K OHM	ONLY FOR mV OUTPUT	
OUTPUT RESISTANCE	1.76	2.2	2.64	K OHM	ONLY FOR mV OUTPUT	
HUMIDITY	0		90	%R.H		
ENDURANCE	1E+6				0~FS CYCLES	
EXTERIOR MATERIAL	17-4 PH AND 304 STAINLESS STEEL					

ORDERING INFORMATION

SA29XX — 0000 — XXXX — X

0	SLEEP
1	NO-SLEEP
ONLY DIGITAL OUTPUT	

RANGE	
LB	N
0010	0050
0025	0125
0050	0250
0100	0500

UNITS
L
N

CODE	DESCRIPTION
0000	STANDARD
SXXX	SPECIAL *
XXXX	CUSTOMIZE

CODE	CABLE LENGTH
0	NO
1	2 FT

CODE	OUTPUT SIGNAL
2	mV
3	0.5~4.5V
J	I^2C
S	SPI

CE COMPLIANCE (ONLY FOR mV OUTPUT)
IEC61000-4-2 (4kV / 4kV (Air/Contact))
IEC61000-4-3 (3V/m)
IEC55022 Class A

Notes

1. SPECIAL IS FOR SMALL DEVIATIONS SUCH AS CABLE LENGTH AND/OR ADDING A CONNECTOR.
2. mV OUTPUT AND VOLTAGE OUTPUT ARE RATIOMETRIC.

MODEL SA2901

PERFORMANCE SPECIFICATIONS

UNLESS OTHERWISE SPECIFIED: ALL PARAMETERS ARE MEASURED AT 25°C @5V:

PARAMETERS	MIN	TYP	MAX	UNITS	NOTES
RECOMMENDED EXCITATION	2.7	3.0	5.5	V	
ZERO OFFSET	720	1000	1280	COUNT	
FULL SCALE OUTPUT	14720	15000	15280	COUNT	
CURRENT CONSUMPTION			3	mA	
NON-LINEARITY	-1		1	% Span	
HYSTERESIS	-0.8		0.8	% Span	
ZERO REPEATABILITY	-0.8		0.8	% Span	
SPAN REPEATABILITY	-0.8		0.8	% Span	
THERMAL ZERO SHIFT	-0.05		0.05	% Span/°C	REFERENCE TO 25°C OVER COMPENSATION TEMP.
THERMAL SENSITIVITY SHIFT	-0.05		0.05	% Span/°C	
COMPENSATION TEMPERATURE	0		50	°C	
STORAGE TEMPERATURE	-40		85	°C	
OVERLOAD	2X				RATED LOAD
INSULATION RESISTANCE	50			M OHMS	@250VDC
HUMIDITY	0		90	%R.H	
ENDURANCE	1E+6				0~FS CYCLES
EXTERIOR MATERIAL	17-4 PH AND 304 STAINLESS STEEL				
A/D RESOLUTION		14		BITS	FORCE SIGNAL
TEMPERATURE ACCURACY	-3		3	°C	NOTE 1
RESPONSE TIME			3	mS@4MHz	NON-SLEEP MODE, NOTE 2
RESPONSE TIME			8.4	mS@4MHz	SLEEP MODE, NOTE 2

Notes

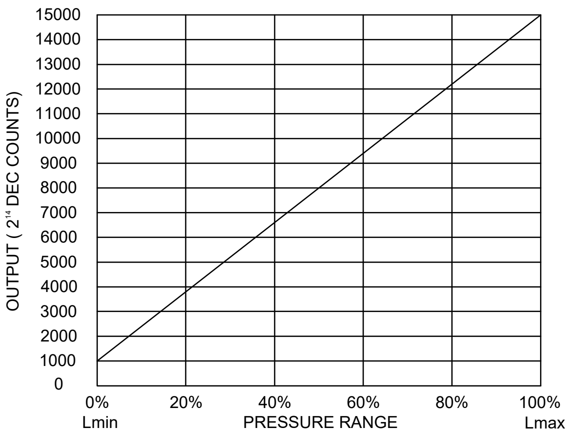
1. REFLECT METAL SUBSTRATE TEMPERATURE OVER THE COMENSATED TEMPERATURE RANGE.
2. RESPONSE TIME IS FROM POWER ON TO READING MEASUREMENT DATA.
3. CABLE LENGTH:
   FOR BEST SIGNAL, ENSURE TOTAL CABLE LENGTH 2 METER MAX FOR SPI AND 10 METER MAX FOR I2C.

MODEL SA2901

DIGITAL OUTPUT CURVE

DIGITAL OUTPUT CURVE

SENSOR OUTPUT AT SIGNIFICANT PERCENTAGES		
% OUTPUT	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0%	1000	0X3E8
5%	1700	0X6A4
10%	2400	0X960
50%	8000	0X1F40
90%	13600	0X3520
95%	14300	0X37DC
100%	15000	0X3A98

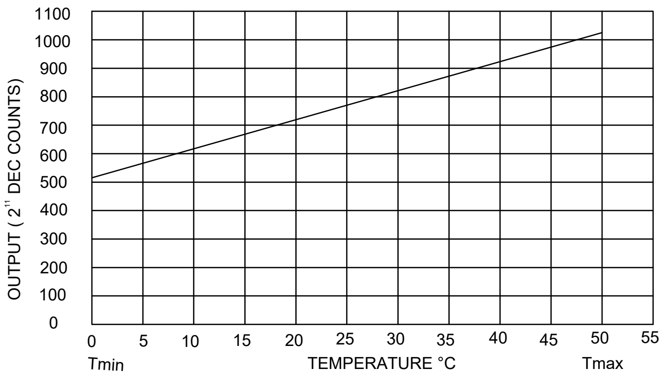


OUTPUT (DECIMAL COUNTS) = $\frac{15000-1000}{Lmax - Lmin}$ × (Lapplied - Lmin)+1000

* 15000,1000 COUNTS ARE NORMAL DIGITAL PRESSURE WITH F.S./ ZERO.

* L: LOAD

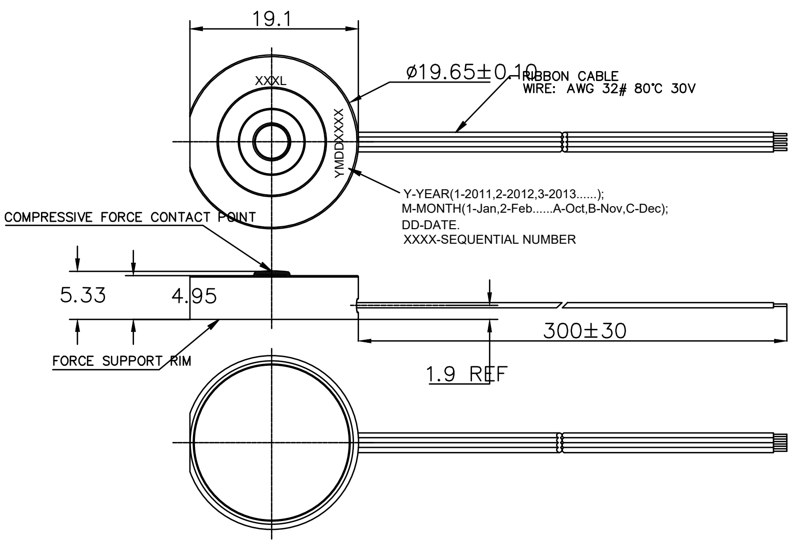
TEMPERATURE OUTPUT		
OUTPUT °C	DIGITAL COUNTS (DECIMAL)	DIGITAL COUNTS (HEX)
0	512	0X200
10	614	0X266
25	767	0X2FF
40	921	0X399
50	1024	0X400



OUTPUT (DECIMAL COUNTS) = $\frac{(OUTPUT°C+50°C) \times 2048}{150□ - (-50℃)}$

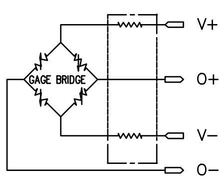
* T: TEMPERATURE

DIMENSIONS



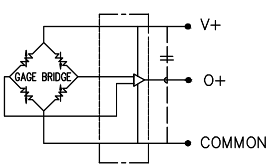
mV OUTPUT

WIRING INFORMATION



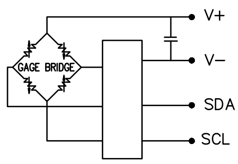
0.5~4.5V OUTPUT

WIRING INFORMATION



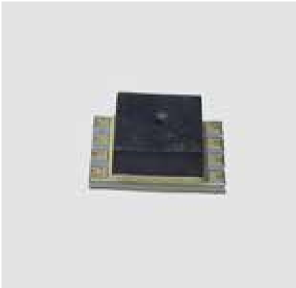
DIGITAL I² C OUTPUT

WIRING INFORMATION



PRESSURE

SA18HD/SA19HD/SA54 Application Notes

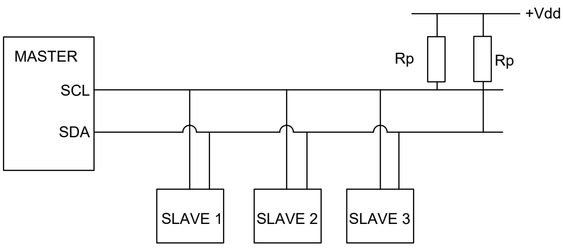



1: I2C Communications

The I2C bus is a simple, serial 8-bit oriented computer bus for effcient I2C (Inter-IC) control. It provides good support for communication between different ICs across short circuit-board distances, such as interfacing microcontrollers with various low speed peripheral devices.

Each device connected to the bus is software addressable by a unique address and a simple Master/Slave relationship that exists at all times. The output stages of devices connected to the bus are designed around an open collector architecture. Because of this, pull-up resistors to +VDD must be provided on the bus. Both SDA and SCL are bidirectional lines, and it is important to system performance to match the capacitive loads on both lines. In addition, in accordance with the I2C specifcation, the maximum allowable capacitance on either line is 400 pF to ensure reliable edge transitions at 400 kHz clock speeds.

When the bus is free, both lines are pulled up to +VDD. Data on the I2C bus can be transferred at a rate up to 100 kbit/s in the standard-mode, or up to 400 kbit/s in the fast-mode.



2: I2C Data Transfer

The 24 bits sensors are designed to work as Slaves and will therefore only respond to requests from a Master device. Following the address and read bit from the Master, the sensors are designed to output up to 7 bytes of data. The first data byte is the Status Byte (8-bit) and the second to seventh bytes are the compensated pressure and temperature output (24-bit).

3: I2C Pressure and Temperature Reading

Each I2C sensor is referenced on the bus by a 7-bit slave address. The default address for the SA18HD or SA19HD or SA54 is 40 (0x28). Other available standard addresses are: 08 (0x08), 40 (0x28), 56 (0x38), 72 (0x48), 88 (0x58), 104 (0x68), 120 (0x78). (Other custom values are available. Please contact Sensorall Customer Service with questions regarding custom Slave addresses.)

4: I2C STATUS BYTE

Bit (Meaning)	STATUS	COMMENT
7	Always 0	-
6 ((Power Indication)	1: Device is powered 0: Device is not powered	Needed for the SPI Mode where the Master reads all zeroes if the device is not powered or in power-on reset (POR).
5 (Busy Flag)	1: Device is busy	Indicates that the data for the last command is not yet available. No new commands are processed if the device isbusy.
4	Always 0	-
3	Always 0	-
2 (Memory Integrity/Error Flag)	0: Integrity Test Passed 1: Integrity Test Failed	Indicates whether the checksum-based integrity check passed or failed; the memory error status bit is calculated only during the power-up sequence
1	Always 0	-
0 (Math Saturation)	1: Internal math saturation has occurred	-

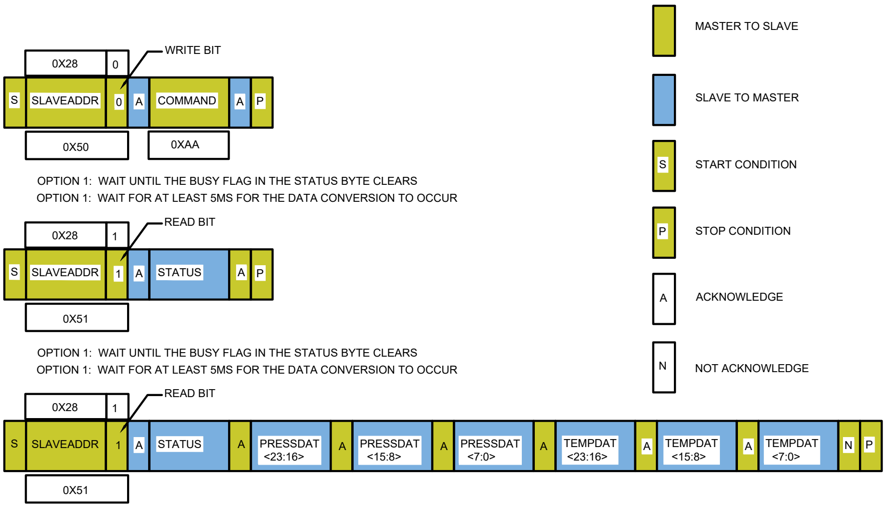
PRESSURE

SA18HD/SA19HD/SA54 Application Notes

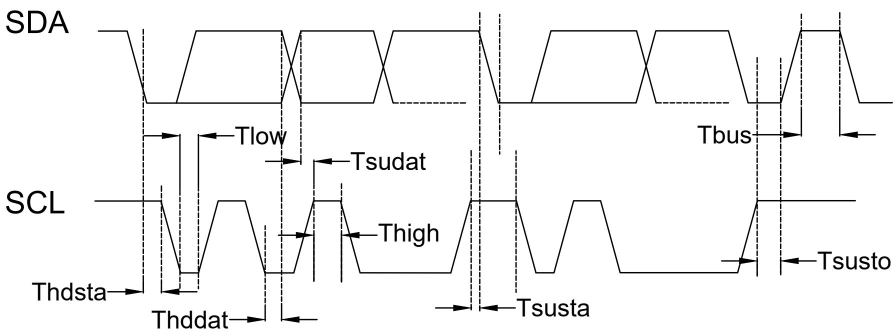
5: I2C communications

5.1 I2C Output Measurement Command

To communicate with the I2C output sensor using an Output Measurement Command of “0xAA”, followed by “0x00”“0x00”, follow the steps shown below. This command will cause the device to exit Standby Mode and enter Operating Mode. At the conclusion of the measurement cycle, the device will automatically re-enter Standby Mode.



5.2 I2C Timing and Level Parameters

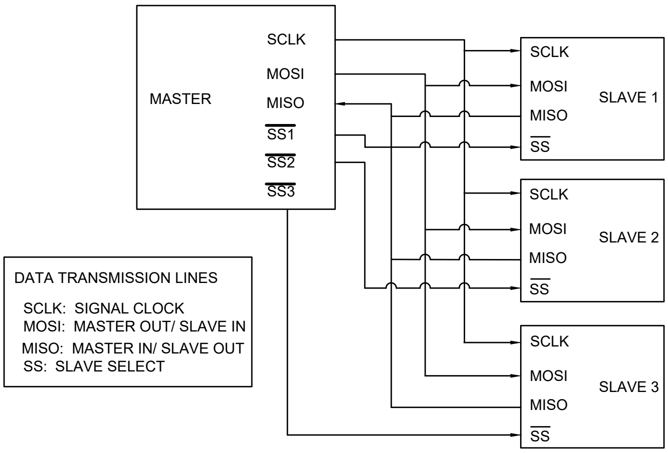


CHARACTERISTIC	Abbreviation	MIN.	TYP.	MAX.	UNITS
SCLK clock frequency	fscl	100	-	400	Khz
Start condition hold time relative to SCL edge	Thdsta	0.1	-	-	uS
Minimum SCLK clock low width	Tlow	0.6	-	-	uS
Minimum SCLK clock high width	Thigh	0.6	-	-	uS
Start condition setup time relative to SCL edge	Tsusta	0.1	-	-	uS
Data hold time on SDA relative to SCL edge	Tsusta	0	-	-	uS
Data setup time on SDA relative to SCL edge	Tsusta	0.1	-	-	uS
Stop condition setup time on SCL	Tsusto	0.1	-	-	uS
Bus free time between stop condition and start condition	Tbus	2	-	-	uS
Output level low	Outlow	-	0	0.2	Vdd
Output level high	Outhigh	0.8	1	-	Vdd
Pull-up resistance on SDA and SCL	Rp	1	-	50	Kohm

6: SPI COMMUNICATIONS

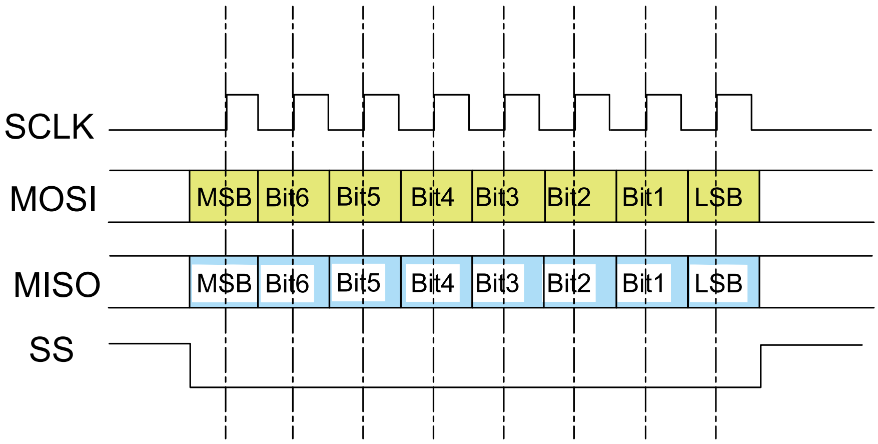
6.1 SPI Definition

The Serial Peripheral Interface (SPI) is a simple bus system for synchronous serial communication between one Master and one or more Slaves. It operates either in full-duplex or half-duplex mode, allowing communication to occur in either both directions simultaneously, or in one direction only. The Master device initiates an information transfer on the bus and generates clock and control signals. Slave devices are controlled by the Master through individual Slave Select (SS) lines and are active only when selected. The SPI sensors operate in full-duplex mode only, with data transfer from the Slave to the Master. This data transmission uses four, unidirectional bus lines. The Master controls SCLK, MOSI and SS; the Slave controls MISO.



7: SPI Data Transfer

Starting communication with the SPI sensors begins by de-asserting the Slave Select (SS) line. At this point, the sensor is no longer idle, and will begin sending data once a clock is received. The SPI sensors are confgured for SPI operation in mode 0 (clock polarity is 0 and clock phase is 0). Once the clocking begins, the SPI sensor is designed to output up to 7 bytes of data. The first data byte is the Status Byte (8-bit) and the second to fourth bytes are the compensated pressure output and the fifth to seventh bytes are the compensated temperature output (24-bit).



8: SPI PRESSURE READING

To read out a compensated pressure and temperature reading, the Master generates the necessary clock signal after activating the sensor with the Slave Select (SS) line. The sensor will transmit up to 7 bytes of data. The first data byte is the Status Byte (8-bit) and the second to fourth bytes are the compensated pressure output and the fifth to seventh bytes are the compensated temperature output (24-bit). The Master can terminate the communication by stopping the clock and deactivating the SS line.

PRESSURE

SA18HD/SA19HD/SA54 Application Notes

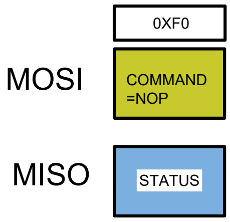
9: SPI communications

To communicate with the SPI output sensor using an Output Measurement Command of “0xAA”, followed by “0x00”“0x00”, follow the steps shown in Table 18 This command will cause the device to exit Standby Mode and enter Operating Mode. At the conclusion of the measurement cycle, the device will automatically re-enter Standby Mode.

OPTION 1: WAIT UNTIL THE BUSY FLAG IN THE STATUS BYTE CLEARS

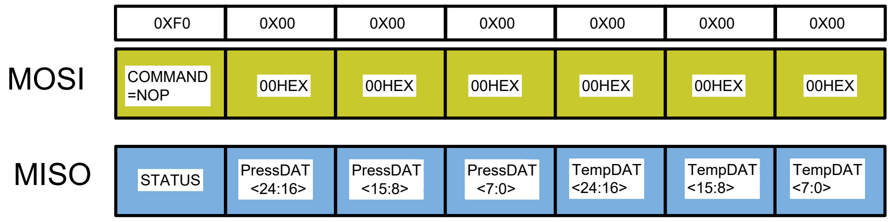
OPTION 2: WAIT FOR AT LEAST 5MS FOR THE DATA CONVERSION TO OCCUR

THE DATA ON MISO DEPENDS ON THE PROCEEDING COMMAND,DISCARD THE DATA ON MISO LINE

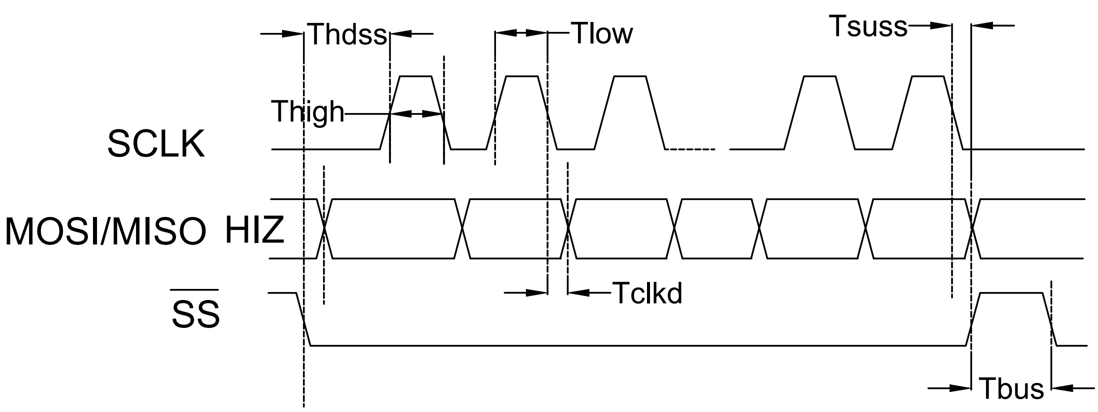


NOP COMMAND IS 0XF0

TO READ 24 BITS of PRESSURE and TEMPERATURE DATA



10: SPI Timing and Level Parameters



SA18HD/SA19HD/SA54 Application Notes

Characteristic	Abbrievation	Min.	TYP.	Max.	Units
SCLK clock frequency	fscl	50	-	800	Khz
SS drop to first clock edge	Thdss	2.5	-	-	uS
Minimum SCLK clock low width	Tlow	0.6	-	-	uS
Minimum SCLK clock high width	Thigh	0.6	-	-	uS
Clock edge to data transition	Tclkd	0	-	-	uS
Rise of SS relative to last clock edge	Tsuss	0.1	-	-	uS
Bus free time between rise and fall of SS	Tsudat	2	-	-	uS
Output level low	Outlow	-	-	0.2	Vdd
Output level high	Outhigh	0.8	-	-	Vdd

11： Sensor output calculation

1：Pressure sensor transfer function

Output= (Outputmax-Outputmin)/(Pmax-Pmin) * (Pressure- Pmin) +Outputmin

2: Rearranging this equation to solve for Pressure, we get Equation

Outputmax= output at maximum pressure [counts]
Outputmin= output at minimum pressure [counts]
Pmax= maximum value of pressure range [bar, psi, kPa, etc.]
Pmin= minimum value of pressure range [bar, psi, kPa, etc.]
Output= pressure reading [bar, psi, kPa, etc.]
Pressure= digital pressure reading [counts]

3：Temperature sensor transfer function

Output= (OutputdegC+40)*2^24/125

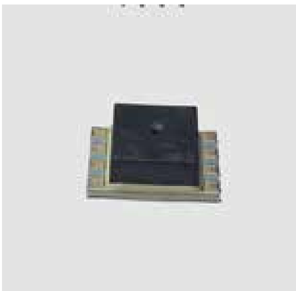
4: Rearranging this equation to solve for Pressure, we get Equation

OutputdegC= 125*Output/2^24 -40

Output= digital temperature reading[counts]
OutputdegC= Temperature reading (degree Celsius)

PRESSURE

SA18/SA19/SA55 14bits Application Notes

1: I2C Commnications

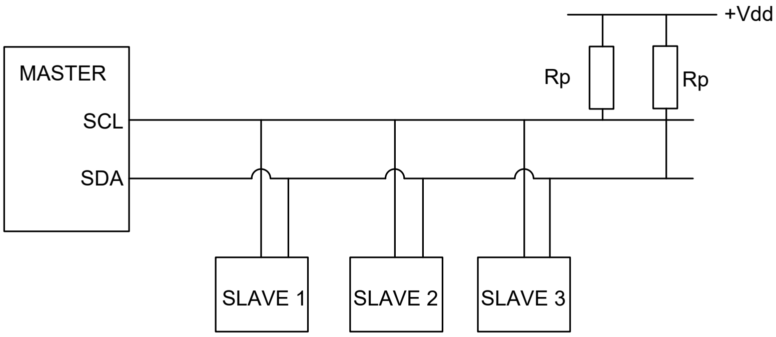
I2C Bus Configurations

The I2C bus is a simple, serial 8-bit oriented computer bus for effcient I2C (Inter-IC) control. It provides good support for communication between different ICs across short circuit-board distances, such as interfacing microcontrollers with various low speed peripheral devices.

Each device connected to the bus is software addressable by a unique address and a simple Master/Slave relationship that exists at all times. The output stages of devices connected to the bus are designed around an open collector architecture. Because of this, pull-up resistors to +VDD must be provided on the bus. Both SDA and SCL are bidirectional lines, and it is important to system performance to match the capacitive loads on both lines. In addition, in accordance with the I2C specifcation, the maximum allowable capacitance on either line is 400 pF to ensure reliable edge transitions at 400 kHz clock speeds.

When the bus is free, both lines are pulled up to +VDD. Data on the I2C bus can be transferred at a rate up to 100 kbit/s in the standard-mode, or up to 400 kbit/s in the fast-mode.

Each I2C sensor is referenced on the bus by a 7-bit slave address. The default address for the SA18 or SA19 or SA55 is 40 (0x28). Other available standard addresses are: 08 (0x08), 40 (0x28), 56 (0x38), 72 (0x48), 88 (0x58), 104 (0x68), 120 (0x78). (Other custom values are available. Please contact Sensorall Customer Service with questions regarding custom Slave addresses.)



2:Retrieving Data

2.1: If applicable, include any necessary libraries for I2C communication or other needed protocol with your microcontroller/device.
2.2: Assign variables and create any setup features.

i2cv.pressure (14 bit Pressure in counts)
i2cv.temperature (11 bit Temperature in counts)
i2cv.status (2 bit Status)
i2c_byte1
i2c_byte2
i2c_byte3
i2c_byte4

2.3: Send I2C initialize command (Initialize I2C bus to set up communication with device)
i2c_init();

2.4: Send I2C start command (Send start I2C condition to begin communication with device)
i2c_start_bus()

2.5: To address and read the Sensorall sensor, the master must write 8 bits total through I2C. The 8 bits consist of the device address and a read command. Send the 7 bit I2C device address command and a least significant bit (LSB) of 1 to tell the master what address to read from. This will give you an 8 bit address with 7 bit part address shifted left and a LSB of 1 added to end of byte. (Please check part data sheet for correct device address.)

```
Device_Read_Byte = (Device Address << 1) + 1;
i2c_write(Device_Read_Byte);
```

2.6: Read the Sensorall part at the device address to gather measurements. This can be done by setting the master into a receiving state. 4 bytes will have to be read to gather all measurement information. An acknowledge will have to be sent after each of the first 3 bytes and not acknowledge on the fourth byte to stop transmission.

```
i2c_byte1 = i2c_read_ack();
i2c_byte2 = i2c_read_ack();
i2c_byte3 = i2c_read_ack();
i2c_byte4 = i2c_read_nack();
```

2.7: Stop bus, this ends communication with bus, this can be a reset if trying to receive multiple readings.

```
stop_i2c_bus();
```

3: Converting Bytes

To collect pressure, temperature, and status, 4 bytes of data have to be read. These bytes will be converted and rearranged to be able to read temperature, pressure, and status of the device. If only 1 or 2 of the 3 device output values are needed, reading less bytes may be sufficient. For example If only pressure is needed, only 2 bytes can be read to obtain the full 14 bit pressure reading.

3.1 Converting Temperature Reading

Temperature conversion consists of a right-shift of the fourth byte by 5 bits (last 5 bits will not contain any data). Then taking the third byte and shifting it left by 3 bits. This is done by multiplying by 8 (8 = 23). Adding both these values together achieves an 11 bit temperature reading.

```
i2c_byte4 >>= 5;
i2cv.temperature = (i2c_byte3 * 8) + i2c_byte4;
```

3.2 Converting Pressure Reading

Pressure conversion consists of left-shifting the first byte by 8, this can be done by multiplying the first byte by 256 (256 = 28), then adding the second byte with eight lower order bits (LSBs) of the full 14 bit pressure reading. A bit-wise AND operation with 3FFF hex is then applied to remove the first two bits that contain part status information by setting those bits to a binary “00”.

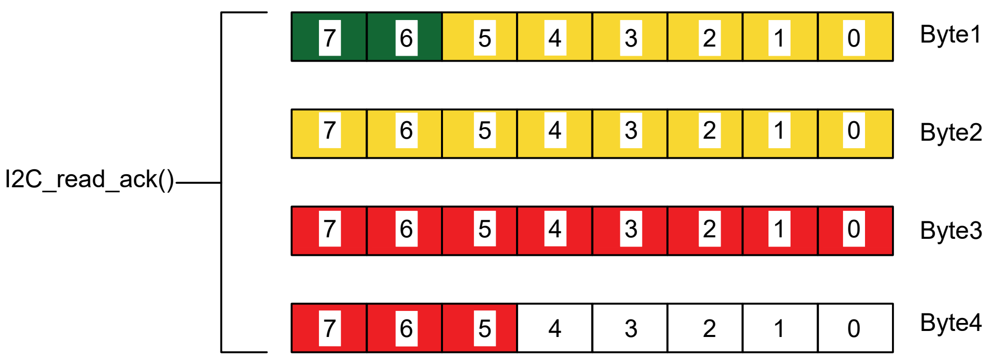
```
i2cv.pressure = 0x3fff & ((i2c_byte1 * 256) +i2c_byte2);
```

3.4 Converting Status Reading

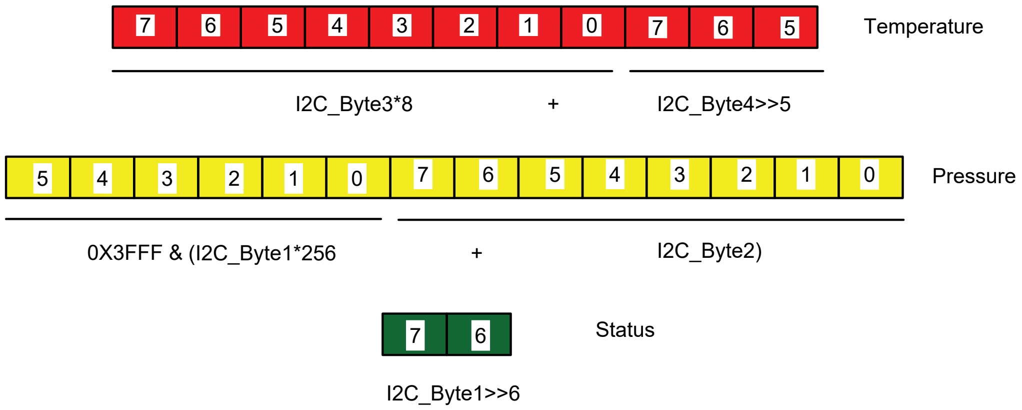
Status conversion consists of a right-shift of the first byte by 6 bits. This will remove pressure data leaving only the relevant two status bits.

```
i2cv.status = i2c_byte_1 >> 6;
```

Below is a visual diagram to aid in the process of converting bytes.
Each color represents a different type of bit. Green bits are Status, yellow bits are Pressure, and red bits are Temperature.



Rearranging these bytes produces 3 outputs, Tempature, Pressure and Status as seen below.



4: Handling Data

Once the 4 bytes of data have been rearranged and converted, extrapolate the bytes to be able to achieve data values for the device. Use i2cv.temperature and i2cv.pressure count values from the Sensorall device to calculate actual temperature and pressure values. These calculated values will give temperature in degrees Celsius and pressure in counts or percent full scale (%FS) of the device will need to be converted into unit based values depending on the model number. Refer to data sheet for exact range and limitations of part.

4.1 Pressure Reading
To convert to pressure in the appropriate pressure unit from the byte counts, a line fit from the target count and pressure values has to be created. Creating a line fit from maximum and minimum device points allows for the extrapolation of data values from all count readings.

Min_Press	Minimum Pressure
Min_Press	Maximum Pressure
Min_Count	Minimum Pressure count reading
Min_Count	Maximum Pressure count reading

Pressure Reading = (((max_press – min_press)/(max_count –min_count))* (i2cv.pressure - min_count) + min_press)

For example using the SA191D-DS5AI-01KDP and inspecting the corresponding data sheet, the maximum and minimum spec count values can be found. The minimum pressure count of 1638 at 10% of the output range and maximum pressure count of 14745 at 90% of the output range. This results in a FS span of 80% of the output range which is equal to 13107 counts. These minimum and maximum relate to -1000Pascal and 1000 Pascal pressure readings for this part, as found in the data sheet. Assuming you receive a count of 8191 from device, the calculations in pascal are as follows.

min_press =-1000
max_press =1000
min_count =1638
max_count =14745

Pressure in Pascal = (1000 – (-1000))/ (14745 - 1638)* (8191– 1638) + (-1000)
Pressure in Pascal =-0.07Pa

4.2 Temperature Reading
To convert to temperature from byte counts, use the equation below and evaluate it using the counts of i2cv.temperature. The resulting temperature will be in degrees Celsius.

Temperature Reading = (i2cv.temperature/ (2048) *200) – 50

Using a count value of 1024 received from the part, the temperature reading of the part can be achieved. The calculations for temperature are as follows.

Temperature in Celsius = (1024/ (2048) *200) - 50
Temperature in Cerlsius = 50

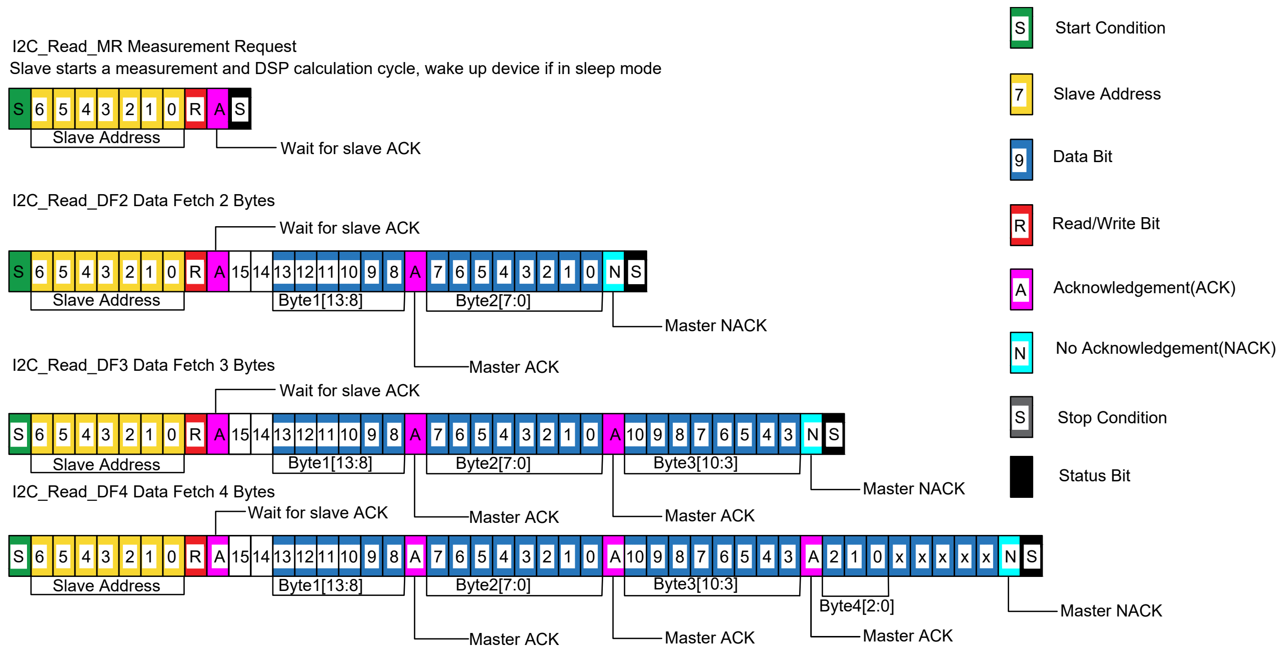
4.3 Status Reading

Sensorall part status consists of 2 bits. These 2 bits gives 4 possible status readings.
The 4 status readings are as follows:

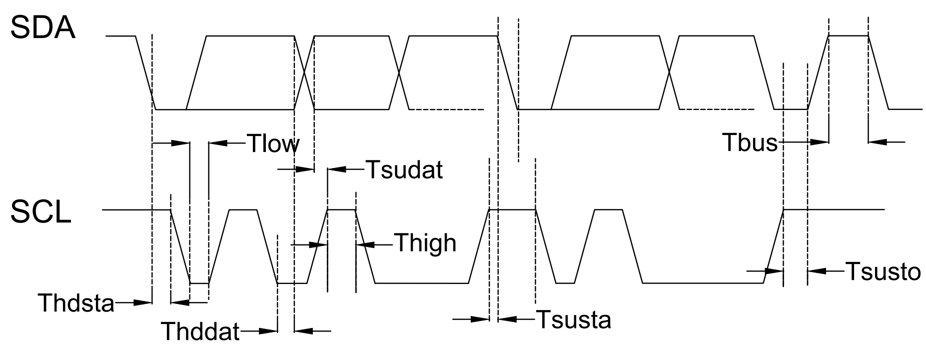
00	Normal Operation
01	Command Mode
10	Stale Data
11	Diagnostic condition exists

5: I2C Communications

5.1 I2C TIMING



5.2 I2C level Parameters

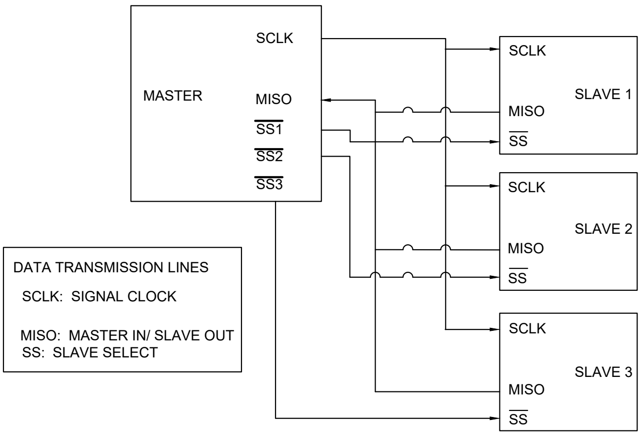


CHARACTERISTIC	Abbreviation	MIN.	TYP.	MAX.	UNITS
SCLK clock frequency	fscl	100	-	400	Khz
Start condition hold time relative to SCL edge	Thdsta	0.1	-	-	uS
Minimum SCLK clock low width	Tlow	0.6	-	-	uS
Minimum SCLK clock high width	Thigh	0.6	-	-	uS
Start condition setup time relative to SCL edge	Tsusta	0.1	-	-	uS
Data hold time on SDA relative to SCL edge	Thddat	0	-	-	uS
Data setup time on SDA relative to SCL edge	Tsudat	0.1	-	-	uS
Stop condition setup time on SCL	Tsusto	0.1	-	-	uS
Bus free time between stop condition and start condition	Tbus	2	-	-	uS
Output level low	Outlow	-	0	0.2	Vdd
Output level high	Outhigh	0.8	1	-	Vdd
Pull-up resistance on SDA and SCL	Rp	1	4.7	10	Kohm

6: SPI COMMUNICATIONS

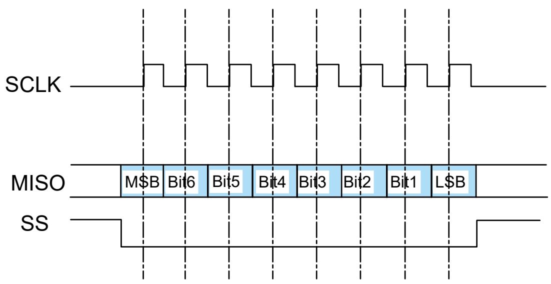
6.1 SPI Definition

The Serial Peripheral Interface (SPI) is a simple bus system for synchronous serial communication between one Master and one or more Slaves. It operates either in full-duplex or half-duplex mode, allowing communication to occur in either both directions simultaneously, or in one direction only. The Master device initiates an information transfer on the bus and generates clock and control signals. Slave devices are controlled by the Master through individual Slave Select (SS) lines and are active only when selected. The SPI sensors operate in full-duplex mode only, with data transfer from the Slave to the Master. This data transmission uses four, unidirectional bus lines. The Master controls SCLK, MOSI and SS; the Slave controls MISO.



7: SPI Data Transfer

Starting communication with the SPI sensors begins by de-asserting the Slave Select (SS) line. At this point, the sensor is no longer idle, and will begin sending data once a clock is received. The SPI sensors are confgured for SPI operation in mode 0 (clock polarity is 0 and clock phase is 0). Once the clocking begins, the SPI sensor is designed to output up to 4 bytes of data. The first data byte is the Status Bits (2-bit) of the first byte and the rest bytes are the compensated pressure output and the third to fourth bytes (first 3 bits) are the compensated temperature output (11-bit).



PRESSURE

SA18/SA19/SA55 14bits Application Notes

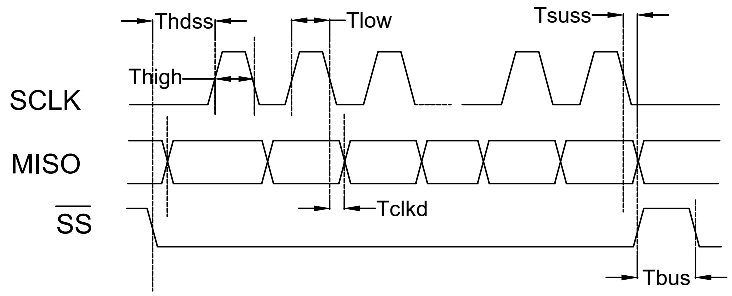
8: SPI Reading

To read out a compensated pressure and temperature reading, the Master generates the necessary clock signal after activating the sensor with the Slave Select (SS) line. The sensor will transmit up to 4 bytes of data. he first data byte is the Status Bits (2-bit) of the first byte and the rest bytes are the compensated pressure output and the third to fourth bytes (first 3 bits) are the compensated temperature output (11-bit). The Master can terminate the communication by stopping the clock and deactivating the SS line.

9: SPI Communications

To read the SPI sensor, just pull SS low for at least 8uS and then pull it high. Pulling SS high will trigger the product to power on and read the data.

10: SPI TIMINg and Leveling Parameters



CHARACTERISTIC	ABBRIEVATION	MIN.	TYP.	MAX.	UNITS
SCLK clock frequency	fscl	50	-	800	Khz
SS drop to first clock edge	Thdss	2.5	-	-	uS
Minimum SCLK clock low width	Tlow	0.6	-	-	uS
Minimum SCLK clock high width	Thigh	0.6	-	-	uS
Clock edge to data transition	Tclkd	0	-	-	uS
Rise of SS relative to last clock edge	Tsuss	0.1	-	-	uS
Bus free time between rise and fall of SS	Tsudat	2	-	-	uS
Output level low	Outlow	-	0	0.2	Vdd
Output level high	Outhigh	0.8	1	-	Vdd
Output level low	Outlow	-	0	0.2	Vdd
Output level high	Outhigh	0.8	1	-	Vdd
Pull-up resistance on SDA and SCL	Rp	1	4.7	10	Kohm

11: Sensor output Caculation

1: Pressure sensor transfer function

Output= (Outputmax-Outputmin)/(Pmax-Pmin) * (Pressure- Pmin) +Outputmin

2: Rearranging this equation to solve for Pressure, we get Equation

Pressure= (Output-Outputmin)*(Pmax-Pmin)/(Outputmax-Outputmin) +Pmin
Outputmax= output at maximum pressure [counts]
Outputmin= output at minimum pressure [counts]
Pmax= maximum value of pressure range [bar, psi, kPa, etc.]
Pmin= minimum value of pressure range [bar, psi, kPa, etc.]
Output= pressure reading [bar, psi, kPa, etc.]
Pressure= digital pressure reading [counts]

3: Temperature sensor transfer function

Output= (OutputdegC+50)*2048/200

4: Rearranging this equation to solve for Pressure, we get Equation

OutputdegC= 150*Output/2^11 -50

Output= digital temperature reading[counts]
OutputdegC= Temperature reading (degree Celsius)

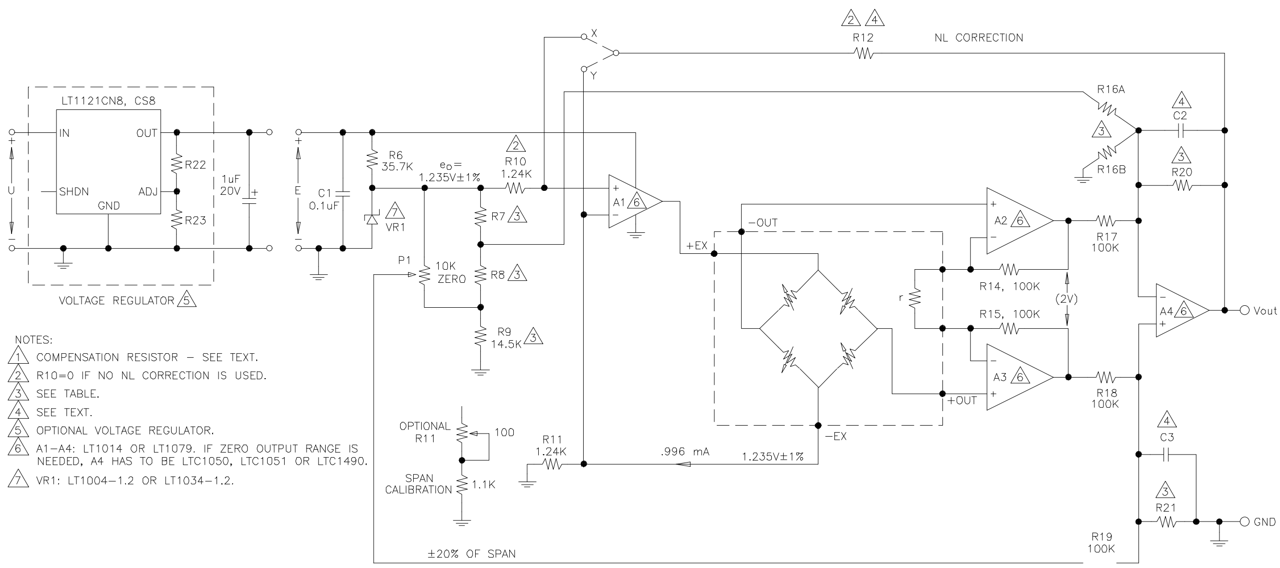
Signal Conditioning for Sensorall Pressure Sensors

INTRODUCTION

Piezoresistive pressure sensors provide an analog output signal that is proportional to input pressure. The typical fullscale span for this type of integrated sensor is 100 mV which is sufficient for many applications. Various applications do exist however, that require higher level (e.g. 5 volt) output span and thus bring about the need for gain stages and other signal conditioning circuitry.

Abasic signal conditioning circuit should provide zero balance adjustment, calibration of pressure sensitiv- ity, temperature compensation of zero and span, signal amplification and voltage regulation. In addition to these basic functions, an active nonlinearity correction and fre- quency response shaping may be required to enhance sensor performance.

This application note describes an amplification cir-cuit for temperature-compensated pressure sensors, shown in Figure 1. It provides noninteracting zero and span calibration with a single power supply for three-wire voltage output and two-wire current output configu-rations. This circuit is appropriate for all compensated IC Sensors pressure sensors which utilize constant current excitation (most HIT, TO-8, and ISO products). Several output signal options are shown including live zero (1V) which allows differentiation between transducer failure and zero pressure signal. The circuit consists of the following functional blocks: sensor assembly, reference voltage source, cur-rent source, differential normalizing amplifier, output amplifier, nonlinearity correction loop, frequency response shaping network and optional voltage regulator.



SENSOR ASSEMBLY

The sensor assembly consists of a compensated silicon pressure sensor and gain-set resistor r. The gain-set resis-tor normalizes the span of the recommended external amplifier, thus creating a low-cost, interchangeable, high level transducer. Please refer to the product data sheet to determine whether a particular model is uncompensated, has temperature compensation on board, or has tempera-ture compensation plus a gain-set resistor on board. For a detailed discussion of passive temperature compensation, please refer to Application Note TN-002, ìTemperature Compensation-IC Pressure Sensors.î For a discussion on interchangeability, see TN-003. ìGain Programming Using an IC Pressure Sensor.î

CONSTANT CURRENT SOURCE

The simplest sensor temperature compensation requires constant current excitation which is built around amplifi-er A1 as shown in Figure 1. The sensor is connected to the feedback loop of the amplifier. The current in this loop is controlled by the reference voltage e0 (neglecting the nonlinearity correction loop) and by resistor R_{11}:

$$I= e_0/R_{11}$$

The compliance voltage of this current source is limited by the supply voltage, the output stage saturation of amplifier A1 and the voltage across resistor R11. The required compliance voltage may be derived based on 6.0 kOhm worst case bridge resistance at 25°C and TCR = +0.22%/°C for the compensated sensor. The reference voltage generator is based on the temper-ature compensated bandgap reference diode VR_1, whose voltage is used to provide a reference for the constant current source. It also provides a reference for the live zero level in the case of 1 to 5Vand 1 to 6Voutput signal levels and a zeroing voltage across potentiometer P_1

DIFFERENTIAL NORMALIZING AMPLIFIER

The zero and span temperature compensation for the sen-sor is calculated based on a no output load condition. Since the bridge resistance changes with temperature, an amplifier input resistance that is too low will introduce an additional temperature error. The differential normal-izing amplifier configuration was selected because of its high input resistance and excellent common mode rejec-tion which is virtually independent of circuit component tolerance.
The maximum output voltage of this stage is limited by the input common mode voltage. The output of amplifier $A_2$is on a common mode voltage level with zero differential input voltage and it can decrease only to the signal common ground level. The worst case com-mon mode voltage at 1.0 mAexcitation current will be about 2.3V in the configuration shown, limiting maxi-mum differential output voltage to about 4.6V. For the circuit shown, a 2.0V span was selected. Gain adjust-ment covers the input signal range from 33 to 115 mV span at 1.0 mAexcitation which corresponds to 50 to 170 mV span at 1.5 mA. Gain K1 is given by:

$$K_1= 1+(R_{14}+R_{15})(R_{13} +P_2)$$

K Denoting minimum required gain by G1, maximum required gain by $G_2$and the available worst case (mini-mum) potentiometer P_2resistance Rp, the value of sym-metrically distributed resistors $R_{14}=R_{15}$as well as gainadjustment stop R_{13}may be calculated as follows:

$$R_{13}= P(G_1-1)/(G_2 -G_1)$$
$$R_{14}= P(G_1-1)/(G_2 -G_1)/2(G_2 -G_1)$$

Common mode rejection (CMR) is relatively impor-tant for this stage. Bridge resistance changes with tem-perature from 0.22%/°C for compensated sensors to 0.27%/°C for uncompensated sensors. Thus, bridge volt-age will change with temperature in the constant current excitation mode. For the worst case condition, including 100°C temperature span, the common mode voltage would change by about 0.66V for compensated sensors. Assuming 90 dB worst case differential CMR for this stage (using LT1014), this change would introduce a sensor span. 0.042%/100°C zero error based on a 50 mV

TRANSDUCER CIRCUIT

The differential offset temperature drift of amplifiers (A_2-A_3)creates an attendant change in the zero tempera-ture error of the transducer. For example, the LT1014 amplifier has a worst case differential offset drift of 5 µV/° C which translates into a 1%/100° C zero error, assuming a minimum span of 50 mV.

SECOND STAGE AMPLIFIER

The fixed gain output amplifier has two differential inputs. The first input (R17, R18) processes the output from the normalizing amplifier. The other input (R16, R19) is used to generate a zero bias level for the output options with live zero and provides fine zeroing adjust-ment of ±20% of the sensor span. Since zeroing is done in the first stage, the change of zero does not affect span.
The gain K_2 of the second stage is set by:

$$K_2 = R_{20}/R_{17} = R_{21}/R_{18}$$

Common mode rejection of this stage is more impor-tant than in the first stage. The common mode voltage change is still 0.66V/100°C worst case at the input(R_{17}/R_{18} resistors). With ±1% tolerance of feedback resistors, about 28 dB CMR may be expected (worst case). That translates to a 1.3%/ 100°C worst case zero drift at the output due to common mode voltage change. With better matching of the feedback resistors, this error decreases and the typical error is about two to four times better than the maximum one. The temperature drift of the offset voltage is not criti-cal here. Assuming 5 μV/°C drift over the 100°C temper-ature range, the output zero change is only 0.025%/100°C based on 2V input span.

NONLINEARITY CORRECTION

The optional nonlinearity correction loop is established by resistor R_{12} . This loop feeds back the output voltage in order to control the bridge voltage, thus creating a sec-ond order pressure related component in the output sig-nal. This feedback is used to compensate for the sensorís pressure nonlinearity. For sensors with positive nonlinearity (Figure 2), the feedback is connected to the noninverting input X of amplifier A_1 . For negative nonlinearity, the feedback is connected to the inverting input Y. The value of the feedback resistor R_{12} may be calcu-lated using the following formula:

$$R_{12} = 4R(10)^A/S(NL)^B$$

where: A=1.9074
B=0.97242
R- value of resistor R_{10} or R_{11}, whichever is connected to resistor R_{12} for given feedback configuration

S - output signal span (V_2-V_0)) driving resistor R_{12} :
4V for 1 to 5V output
5V for 1 to 6V and 0 to 5V outputs
10V for 0 to 10V output
NL- absolute value of terminal based nonlinearity expressed in % of span (Figure 2):

$$NL = \frac{100[V_1-(V_2-V_0)(P_1-P_0)/(P_2-P_0)-V_0]}{(V_2-V_0)}$$

$$NL = \frac{100[V_1-(V_2-V_0)(P_1-P_0)/(P_2-P_0)-V_0]}{(V_2-V_0)}$$

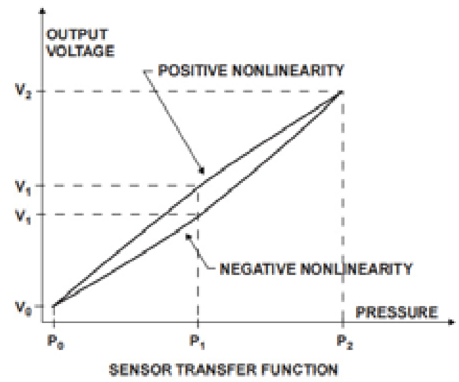


Figure 2. Sensor Transfer Function

FREQUENCY RESPONSE

Frequency response may be shaped by capacitors C2 andC3. The corner frequency for 3 dB drop of sensitivity is given by:

$$f = ½pC_2R_{21}$$

with the assumption that $C_2=C_3$ and $R_{21}=R_{20}$. Shaping the frequency response is commonly used to filter out unwanted high frequency noise.

VOLTAGE REGULATOR

The optional voltage regulator (LT1121) provides protection against reverse polarity connection. The device includes current limiting, thermal limiting and shutdown. It extends the operating voltage range and provides for additional voltage regulation making the output inde-pendent of the amplifiers power supply rejection ratio. The output voltage is set by resistors R_{22} and R_{23} accord-ing to the formula:

$$V_{out} = 3.75V(1+R_{22}/R_{23})$$

APPLICATION NOTES

Temperature Compensation Sensorall Pressure Sensors

RATIOMETRIC APPLICATIONS

For ratiometric applications, the optional voltage regula-tor should not be used, and reference diode VR1 should be replaced by a resistor. The value of this resistor should not deliver a higher voltage than 1.26V across it at maximum operating power supply voltage in order to avoid saturation of the amplifiers. Typical performance when using the LT1014 amplifi-er, is shown in Table 1.

ADDITIONAL INFORMATION

Adetailed discussion on sensor compensation techniques (calculating the temperature compensation resistors and the gain-set resistor) can be found in Application Notes TN-002 and TN-003. For other output options, including 4-20mA, please refer to Application Notes APP103 to APP105.

Table 1. Typical Performance

OUTPUT SIGNAL OPTION	WITHOUT VOLTAGE REGULATOR		WITH VOLTAGE REGULATOR		
	VOLTAGE OUTPUT	4 TO 20 mA	VOLTAGE OUTPUT	4 TO 20 mA	UNITS
Supply Current	2.4 at 15V	2.4 at 15V	2.7	2.7	mA
Zero Range	±20	±20	±20	±20	% of Span
Sensor Span Range (1.0 mA Excitation)	33to115	33to115	33to115	33to115	mA
Output Noise	<0.01	<0.01	<0.01	<0.01	% of Span
Sensor Excitation	1	1	1	1	mA

Note
1 Function of Power Supply Rejection rate for the amplifier

Temperature Compensation Sensorall Pressure Sensors

INTRODUCTION

Advancements in microelectronic technology have pushed silicon sensors not only toward greater sophistication and lower functional cost but also in the direction of higher performance. The major factor affecting high performance applications is temperature dependence of the pressure characteristics. This technical note describes one method of compensa-tion for temperature dependence. Also note that IC Sensors also offers factory compensated versions of several sensor products.

INTEGRATED SENSOR DESIGN

In one of the IC Sensors designs, a mechanical spring element in the form of a rectangular diaphragm, which converts pressure into strain, is integrated into the silicon. To fabricate the diaphragm (Figure 1a), a selective anisotropic etching technique is used which simultaneously produces a large number of diaphragms on a single silicon wafer. In order to isolate the sensing element from package stress, a pyrex constraint plate is bonded to the diaphragm plate. If this constraint plate has an etched hole, then the diaphragm is subjected to the differential input pressure P_1-P_2. If the constraint plate has no hole, then the diaphragm is subjected to the differential pressure P_1-P_2, where $P_2$is the pressure at which both plates were sealed together.

To measure the stress in the N-type silicon diaphragm, four P-type resistors (strain gages) are used.

Strain gages result from a selective diffusion of boron into the silicon diaphragm (Figure 1b), a process used in the fabrication of monolithic integrated circuits. The bonding between the four strain gages and the diaphragm is done through the atomic structure of sili-con. This type of bonding eliminates creep, which is the major source of instability in metallic or bonded types of strain gage sensors.

The interconnections between strain gages is accomplished with low resistivity P+diffused layers. This approach helps minimize thermal hysteresis effects.

The electrical insulation (passivation) of the diffused resistors and protection of the conductive diaphragm from input media is provided by a thin layer of silicon dioxide grown on both sides of the diaphragm.

IC Sensors provides several package styles for mounting the sensors and applying pressure. The HIT and TO-8 products could be mounted to printed circuit boards in applications where dry noncorrosive gases are used as media. The isolated diaphragm (ISO) products may be mounted by O-Ring, welding or standard process fitting in applications where liquids or corrosive media are used. Please see the individual data sheets for media compatibility.

Adifferential pressure across the diaphragm develops a strain field in such a fashion that a part of the diaphragm is in compression and part is in tension. Two of the strain gages are located in an area of compression and the other two in an area of tension. Electrically they are interconnected into a fully active Wheatstone bridge configuration to maximize the output signal (Figure 1c).

Temperature Compensation Sensorall Pressure Sensors

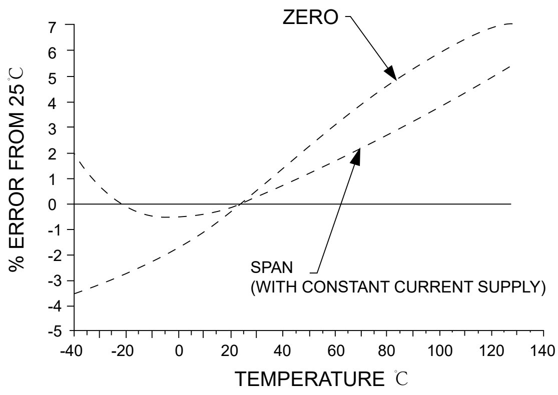
Figure 1. Sensor Structure and Circuit

TEMPERATURE CHARACTERISTICS OF A SENSOR

Change in ambient temperature results in a correspon-ding change in three sensor parameters: zero pressure output voltage, pressure sensitivity (span), and bridge resistance. These characteristics are shown for a typical sensor in Figures 2 and 3 where zero and span errors are expressed in percent of span at 25°C.

Zero pressure output voltage represents the bridge output voltage without any input pressure. Initial polarity of zero at reference temperature usually enforces the slope of the zero change with temperature, e.g. positive offset tends to increase when the temperature increases, but the correlation is not always a strong one.

Figure 2. Temperature Dependence of Zero and Span

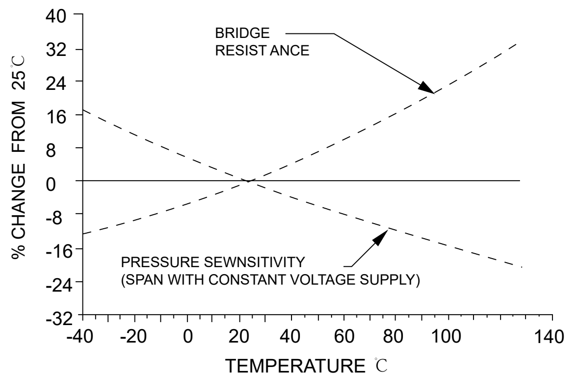


Pressure sensitivity is the normalized span in the voltage excitation mode and is expressed as mV(of span)per one volt (of bridge voltage) per one PSI (of applied pressure). It is independent of the type of supply (voltage or current) or pressure range. This sensitivity or gage factor exhibits a negative temperature slope, decreasing with increasing temperature.

The span is defined as the change of the bridge output voltage from full pressure to low pressure. Span change with temperature is a function of the excitation mode. For a given sensor the span S is a product of normalized pressure sensitivity G, bridge voltage Vb and rated pressure P:

$$S = G.Vb.P$$

Figure 3. Temperature Dependence of Bridge Resistance



and Pressure Sensitivity

In the constant voltage excitation mode the span temperature coefficient is negative (Figure 3) and directly proportional to pressure sensitivity. It is typically -0.21%/°C for IC Sensors'5 kΩ process.

In the constant current (I) excitation mode the bridge voltage is proportional to the bridge resistance Rb and span can be expressed as:

$$S = G.Rb.I.P$$

Since bridge resistance changes with temperature, the span temperature error is a superposition of both the pressure sensitivity and the bridge resistance tempera-ture coefficients (Figure 3). For IC Sensors 5k, process, the bridge resistance temperature coefficient (TCR) prior to compensation is typically +0.26%/°C. Including a negative temperature coefficient of pressure sensitivi-ty (TCG) of -0.21%/°C, a typical constant current span temperature coefficient is about IC Sensors has opti-mized several products for other TCR & TCG values. These values are controlled by the ion implant dosages that are used to created strain gage resistors. Please see the individual product data sheets for more information.

For a compensated sensor, which is discussed in more detail in the zero and span sections, the effective TCR is reduced to TCG in amplitude when resistor R5 is added (Figure 8). The temperature sensitivity of bridge resistance is a key design factor in the tempera-ture compensation of IC Sensor products.

ZERO COMPENSATION

Zero pressure output voltage (offset) compensation includes both initial (25°C) offset compensation and temperature error compensation.

Offset compensation includes resistors R_3 and R_4 (Figure 4). If the offset is positive (+O potential at pin 4 higher than -O potential at pin 10) then insertion of resistor R_4 will bring the offset to zero and resistor R_3 should be shorted. When the offset is negative the reverse is true. These resistors do not change the temperature coefficient of zero in constant current mode (Figure 10).

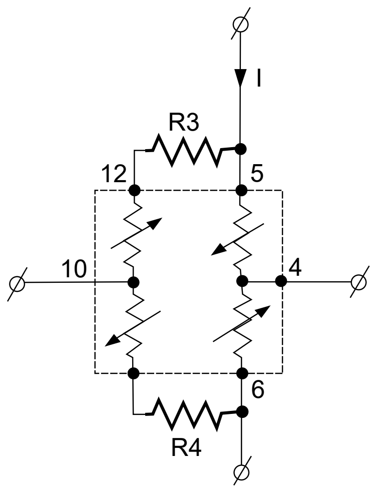


Figure 4. Offset Compensation

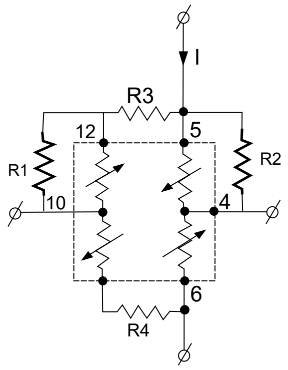


Figure 5. Offset TC

When the temperature coefficient (TC) of offset is positive (+O potential at pin 4 is increasing faster than -O potential at pin 10), a decrease of this TC may be achieved by a decrease of the effective TC of the strain gage connected between +EX pin 12 and -EX pin 10. This may be achieved by a parallel connection of a temperature stable resistor R1 (Figure 5). With a negative coefficient of offset voltage, the decrease of the TC of the other arm will be accomplished by resistor R_2. Only one of these resistors is used for a given sensor, but both of them affect the initial offset, and the value of resistor R_3 or R_4 has to compensate for this change. During standard production testing IC Sensors uses at minimum 3 test temperatures. Based on measured data the computerized sensor model is developed and a set of simultaneous equations is solved which gives the value of the compensating resistors which bring the off-set to zero at reference temperature T r(Figure 6) and equalize the errors at temperatures T c and Th. This error is a function of the temperature nonlinearity of zero.For sensors with perfectly linear temperature coefficient of offset, the errors at T c and T h will also be zero.

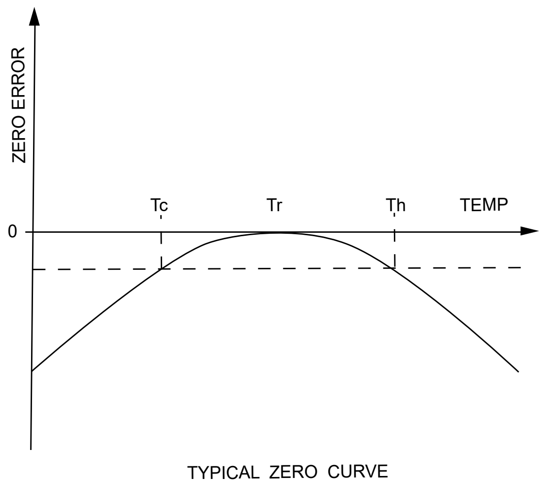


Figure 6. Typical Zero Curve

Temperature Compensation Sensorall Pressure Sensors

For standard TO-8 products, T_c=0°C,T_r =25°C,T_h =50°C. The typical value of zero pressure output error at both cold and hot temperatures is 0.1% of span. Most of it is due to thermal nonlinearity. In practical applications, inaccuracies in the resistors used for compensation contribute at least this amount of error.

It should be noted that the offset voltage of a bridge is not perfectly proportional to the excitation current. Due to self heating effects the change of excitation current may result in a change of zero pressure output voltage, typically a few hundred microvolts, for a compensated unit.

SPAN TEMPERATURE COMPENSATION

The simplest temperature compensation of span can be achieved by a combination of special wafer processing and constant current excitation. In this mode the span change is a superposition of pressure sensitivity and bridge resistance temperature coefficients. Since these coefficients have different polarities, making them equal in amplitude makes the span internally compensated. The processing required for this type of self compensation limits the cold compensated temperature range due to the nonlinearity of bridge resistance at low temperatures.

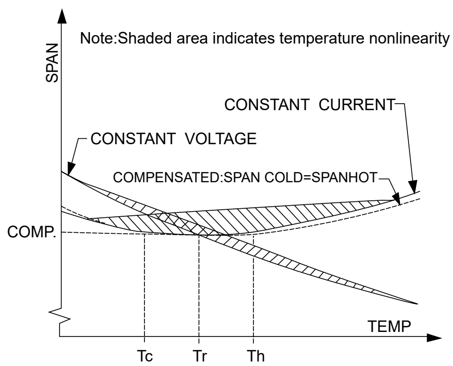


Figure 7. Span vs. Temperature

IC Sensors has developed a process which produces a higher value of bridge resistance temperature coefficient (TCR) than the absolute value of pressure sensitivity temperature coefficient (TCG). Thus in constant voltage mode the span will have a negative TC and in the constant current mode the span will have a positive TC (Figure 7). By decreasing the input resistance of the sensor bridge (Figure 8) with resistor R_5 in parallel to the bridge for constant current operation (or by increasing the input resistance of the sensor bridge with resistor R_5 in series with the bridge for constant voltage operation) the temperature compensation condition can be achieved.

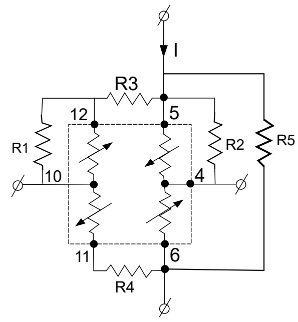


Figure 8. Span TC

The median optimum value of R_5 resistor for IC Sensors 5 kΩ process is equal to 6.6 times the bridge resistance, or 33 kΩ , at 25°C. For a given excitation level this resistor will decrease the output span. For constant current excitation the median loss of uncompensated sen-sor output will be only 13%. For the same condition, con-stant voltage excitation would yield an 87% loss of uncompensated sensor output to achieve temperature com-pensation. This explains why constant current excitation is recommended for this type of sensor.

Temperature nonlinearity of span in constant current mode (Figure 2) is not as good as for constant voltage (Figure 3). IC Sensors standard compensating algorithm was designed to provide equal span at temperatures T_c and T_h (0°C and 50°C for standard TO-8 products). Typical constant current mode span error at -40°C is in the range of +3% of span.

The distribution of span error characteristics from unit to unit is much better than the distribution of zero pressure output temperature errors. Implementation of digital correction, based on the deviation from a typical curve and using bridge voltage as a temperature sensor, would yield an additional major improvement.

REQUIRED PERFORMANCE OF COMPENSATING RESISTORS

The effect of both the tolerance and TCR of these resistors on sensor performance is shown in Figures 9 through 11. A5000 ohm bridge resistance at 25°C with +0.26%/°C temperature coefficient and 15 mV/V/psi pressure sensitivity at 1.5 mAexcitation current with ñ0.21%/°C temperature coefficient is assumed.

The expected resistor ranges are:

R1, R2	100 k to 10 MΩ	Typical: 300 kΩ to 1.5M
R3, R4	0 to 300 Ω	Typical: 0 to 100Ω
R5	10 k to 300 kΩ	Typical: 15 kΩ to 100kΩ

For the majority of ranges, 1%, 100 ppm/°C resistors such as RN55D or similar are sufficient for this application.

As an example, let's assume that the computer print-out calls for:

R1 = 0.5 MΩ
R2 = Open
R3 = 90Ω
R4 = Shorted
R5 = 20 kΩ

The effect of a 1% tolerance for resistor R_1(0.5MΩ) can be estimated from Figure 9. A0.19 mV offset change would occur and a 0.06 mV/50°C offset temperature coefficient would be added. Atemperature coefficient of 100 ppm/°C for this resistor would contribute an additional 0.12 mV/50°C to the offset temperature coefficient.

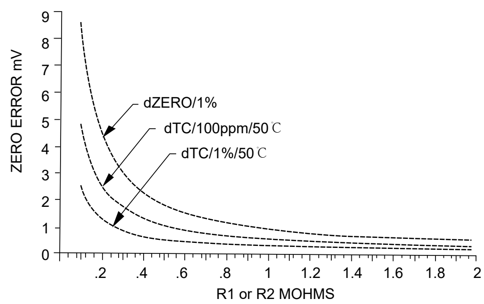


Figure 9. R1 or R2 ResistorTolerance

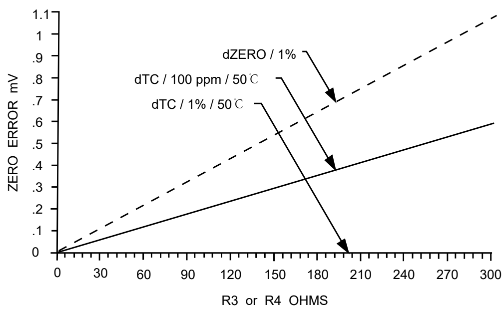


Figure 10. R_3 or R_4 ResistorTolerance

The effect of resistor R_3 (90) can be estimated from Figure 10. The offset would change 0.33 mV for a 1% resistance deviation and 0.17 mV/50°C due to the effect of 100 ppm/°C temperature coefficient. The off-set temperature coefficient is not affected by the toler-ance of this resistor.

Both of these resistors (parallel: R_1 or R_2 and series: R_3 or R_4) affect the span value. Assuming that all strain gages have the same pressure sensitivity, a change of the bridge arm resistance by 1% due to the effect of inserting zero compensation resistors, in turn, changes the span by 0.25%.

Resistor R_5 (20 k) does not effect zero compensation. Span error (Figure 11) introduced by a 1% deviation from the calculated value will be equivalent to a 0.19% span change and 0.02%/50°C of additional span temperature coefficient. Atemperature coefficient of 100 ppm/°C for resistor R5 would introduce an additional span error of 0.15%/50°C.

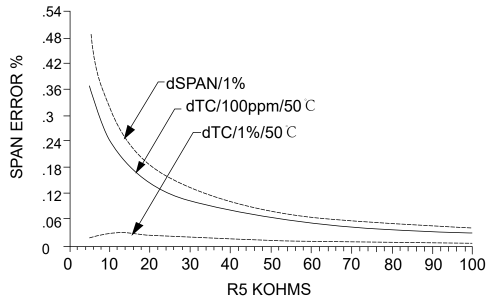


Figure 11. R_5 ResistorTolerance

To minimize the inventory of external compensating resistor values, it is best to calculate the value of the required resistors when a known error can be tolerated. Assume that a 5 mV offset voltage due to tolerance of R1 or R2 resistor can be tolerated. If 0.5 M (R1) is the starting point, with a 0.19 mV/1% offset sensitivity, a 5 mV limit will be reached after 26 increments of 1% (26) (0.19 mV). Raising 1.01 to the 26th power gives a factor of 1.295 which translates to 648 k. At this resistance value the sensitivity of offset to change in R1 is about 0.16 mV/1%, which is equivalent to 31 increments (5 mV/0.16) of 1%. Raising 1.01 to the 31st power gives a 1.361 factor which translates to 882 k (1.361) (648 k). This value would be stocked along with the 499 k resistor for 5 mV zero increments.

This same approach can be applied to all resistors over the entire range and to all specifications including temperature error. In the example above the worst case assumption was made using the highest error for a given resistance range.

Gain Programming Using an Sensorall Pressure Sensor

Using the average error for a given range would be more realistic (0.18 mV/1% over 500 k to 698 k range), but it leaves no room for variations of sensor performance due to processing tolerances.

APPENDIX: CALCULATION OF COMPENSATING RESISTOR VALUES

Values of compensating resistors can be calculated based on the results of pressure-temperature testing. The tests include measurements of output voltage (V) and bridge voltage (E) at two temperatures (Tc and Th) and two pressures (P_1 and P2) with constant current (I) excitation:

	$T=T_c$	$T=T_h$
$P=P_1$	V_{0c}, E_c	V_{0h}, E_h
$P=P_2$	V_{1c}	V_{1h}

Where: V_0c, V_0hó zero pressure output voltage, cold andhot respectively
V_1c, V_1hó full scale pressure output voltage, andhot respectively
Ec,Ehó bridge voltage, respectively cold and hot
P_1, P_2ó input pressure, respectively zero and full scale
Tc,Thó temperature, respectively cold and hot

ZERO COMPENSATING RESISTORS

To calculate zero compensating resistors lets introduce the variables:

$$A = B = A - \frac{V_{0c}+E_c}{I} \qquad \frac{4V_{0c}(V_{0c}+E_c)}{I\,E_c+2V_{0c}}$$

$$C = \frac{V_{0h}+E_h}{I} \qquad D = C - \frac{4V_{0h}(V_{0h}+E_h)}{I\,E_h+2V_{0h}}$$

Asimplified value of offset compensating resistor RS that includes the correction for offset change due to bridge arm loading by resistor R1 or R2 may be calculated now as follows:

$$R_s=(A+C-\sqrt{(A+C)^2-4\frac{AB(D-C)-CD(B-A)}{D-B}})$$

The calculated value of resistor RS may be either positive or negative. The polarity of this value is utilized to define the position of the resistor. As was discussed before, balancing of offset can be realized by R3 or R4 resistor (Figure 4). The truth table for these resistors is as follows:

when Rs 0 then: $R_4=R_s, R_3=0$ (shorted)
Rs < 0 then: $R_3=R_s, R_4=0$ (shorted)

The offset temperature slope compensating resistor Rp may then be calculated as follows:

$$R_p = (AB-BR_s)/(B-A+R_s)$$

As before, there are two possible positions of R_p resistor:

when $R_p \geq 0$ then: $R_2=R_p, R_1=\infty$ (Open)
$R_p < 0$ then: $R_1=R_p, R_2=\infty$ (Open)

SPAN COMPENSATING RESISTOR

Temperature compensation of span requires one resistor only. Calculating both the span cold (S_c) and hot (S_h) and the bridge resistance cold (R_c) and hot (R_h)

$S_c = V_{1c}$ ñ V_{0c} ; $R_c = E_c / I$
$S_h = V_{1h}$ ñ V_{0h} ; $R_h = E_h / I$

We can now calculate the value of span compensating resistor R_5 using the following formula:

$$R_s = -\frac{R_h S_c - R_c S_h}{(S_h - S_c)}$$

It should be noted that the procedure outlined here doesnot include the effects of zero compensating resistors on bridge resistance change, but this effect usually is not critical.

Gain Programming Using an Sensorall Pressure Sensor

INTRODUCTION

IC Sensors offers a broad line of pressure transducers with low level output, temperature compensation, and a built-in gain programming resistor.

This laser trimmed resistor programs the gain of an external (customer provided) amplifier to normalize the pressure sensitivity variation of the sensor. This allows the output of the amplifier to be independent of the sen-sor used, providing interchangeability and high level output at very low cost.

This feature is available on all HIT, TO-8, and isolat-ed diaphragm (ISO) products. Please refer to the indi-vidual product data sheets for more information.

BASIC CIRCUIT

The effective electrical model of the transducer, together with a basic signal conditioning circuit, is shown in Figure 1. The pressure sensor is a fully active Wheatstone bridge which has been temperature com-pensated and offset adjusted by means of thick film, laser trimmed resistors. The excitation to the bridge is a constant current which is supplied through the +EX and -EX pins. The low-level bridge output is at +O and -O, and the amplified span is set by the gain programming resistor (r).

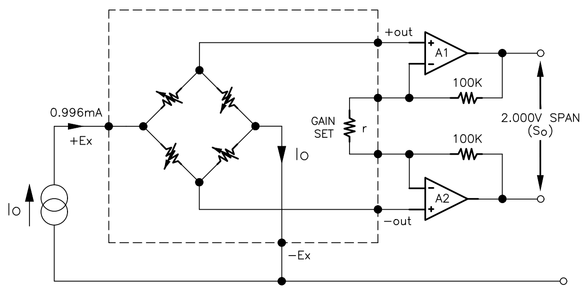


Figure 1. Basic Configuration Gain - Programming Interchangeable Sensor

Resistor r is laser trimmed for each unit using the following algorithm:

$$r = - \frac{200S_i}{2-S_i}$$

where: S_i - sensor span value (V) at a reference excitation current (I_o = 0.996 mA)
r - resistance in (kΩ)

The output span, So, at the differential output of amplifiers A1- A2 (see Figure 1) is then programmed as follows:

$$S_o = AS_i\left(\frac{r+2R}{r}\right) = 2A\left[\frac{R}{100} + \frac{S_iR(100-R)}{200}\right]$$

where: A=I/Io, ratio of excitation current I to reference current Io (Figure 1)
R - feedback resistors, in 【kΩ】
Si - sensor span at the input of the amplifier

If 100k feedback resistors are used, the expression for output span is simplified to:

So=24

and is constant for all sensors independent of sensor span Si. The output span is also independent of the pressure range of the sensor. For other values of the feedback resistors (R), the output span (S o) will vary with the sensor span (S i). Assuming I = Io , we can calculate S o variations.

Table 1. Output Span (SO) Variation

R	SO(Si=40 mV)	SO(Si=90 mV)	SO variation [±%]
75K	1.5100	1.5225	0.41
100K	2.0000	2.0000	0.00
200K	3.9600	3.9100	0.63

Gain Programming Using an Sensorall Pressure Sensor

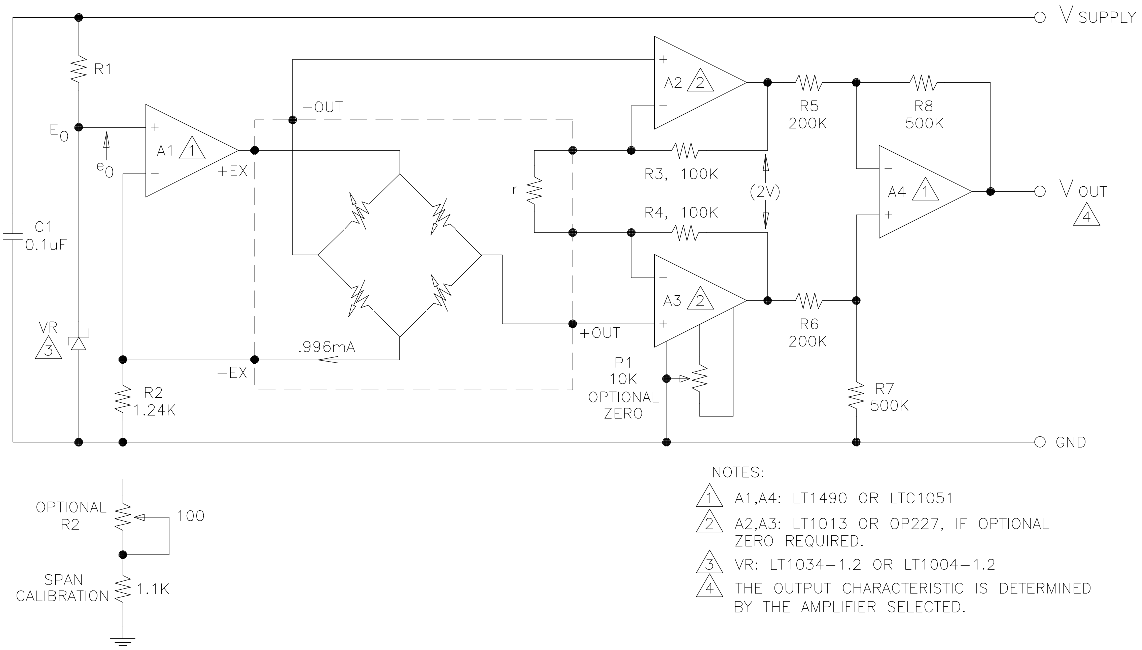


Figure 2. Simple Signal Conditioning Circuit

sAs shown in Table 1, a large deviation from the opti-mum feedback resistance of 100 k can be tolerated while still maintaining transducer interchangeability. For the optimum feedback resistance (100 k), calibration accura-cy is a function of the accuracy of the excitation current, feedback resistors and sensor trimming. The inaccuracy caused by the excitation current and feedback resistors can be made negligible by the use of precision compo-nents. Therefore without pressure testing, a 1% system accuracy can be achieved. The standard gain program-ming resistor, r, has a TCR 50 ppm/°C and a trimming range of 2.5 to 12.5 kΩ. For volume orders, a custom trimming algorithm can be made to achieve any desired output span.

SIMPLE SIGNAL CONDITIONING CIRCUIT

The signal conditioning circuit shown in Figure 2 pro-vides a precision constant current source for sensor exci-tation and an instrumentation amplifier with the gain programmed by sensor feedback resister r. To correct for pressure non-linearity or to generate output options other than 0-5V please refer to Technical Note TN-001, ìSignal Conditioning for IC Pressure Sensors.î

The current source is controlled by the 1% band-gap reference diode, VR. The reference current I o is defined by:

$$I_o=(E_o - e_0)R_2$$

where: **Eo - diode reference voltage: 1.235V ±1% (LT1034-1.2 or LT1004-1.2)**
e_0 - offset of amplifier A_1
R_2 - feedback resistor

Selecting amplifier A1 with an offset voltage below 1 mV and a ±1% tolerance of resister R_2 delivers current I_o = 0.996 mAwith a typical accuracy of 1.08%.

The first differential stage of the instrumentation amplifier A2-A3 may have a zeroing potentiometer (P).For 0P227 amplifiers, the zero range is typically 4 mV in reference to the input with a differential offset below 0.5 mV. This leaves about 3.5 mV zeroing range for the compensation of the sensor offset which typically is below 1 mV.

The second stage of the amplifier provides additional amplification R8/R5 and translates the differential float-ing voltage from the first stage into a single ended output voltage. Modifying equation [3] the expression for over-all span (S) can be found as follows:

$$S=2.A.R_8/R_5=5.000V@A=1$$

The overall accuracy of the span is effected by the accuracy of feedback resisters R_3 through R_8. Using 0.1% resisters such as Mepco/Electra 5063Z, a typical gain error will be about 0.24%. The accuracy error may be decreased when matched thin film resistors are used such as Beckman 694-3-A. The combined span error of the entire signal conditioning circuit at a reference temperature will then typically be about 1.1%

Gain Programming Using an Sensorall Pressure Sensor

without any adjustment or pressure testing. This will be superimposed on the sensor's accuracy of 1%.

If additional calibration and normalization are desired, resister R_2 can be replaced with a series combination of a potentiometer and a resistor (Figure 2). The potentiometer can be adjusted to set the bridge excitation current (I) to achieve the exact span voltage (S)with full scale pressure applied to the sensor.

If no pressure source is available, the gain error of the amplifier can be reduced by using the procedure outlined below. This method may be used instead of using the precision resisters discussed above for R_2 through R_8 . The sensor span error of 1% will remain however.

Calibration procedure:

- replace resistor r with an external resistor 7.50Ωk 0.1%
- check gain K of the instrumentation amplifier and calculate the gain ratio X (in reference to the ideal gain KO = 69.028V/V) where X = K/KO
- set current IO = 0.996/X(mA) by adjusting the potentiometer, thus completing calibration.

Assuming a 6.4 kΩ (50ºC) maximum bridge resistance, a 0.996 mAbridge current and a 1.2V diode reference voltage, it follows that the maximum output voltage of amplifier A_1 can approach 7.7V. Also, the positive saturation voltage at 1 mAoutput current for the LTC1051 amplifier is 0.5V. Therefore, the minimum excitation voltage, which is a function of the current source and amplifiers used, would be 8.2V(7.7V+ 0.5V) for the LTC1051. For the LT1490, the minimum excitation voltage should be 7.9V.

The maximum excitation voltage is limited by the voltage handling characteristics of the specific amplifier used.

ADDITIONAL INFORMATION

For a detailed discussion of the compensation circuit, and for output voltages other than 0-5V, please refer to Application Notes TN-001 and APP-103 to APP-105.

APPLICATION NOTES
A Simple Pressure Sensor Signal Conditioning Circuit

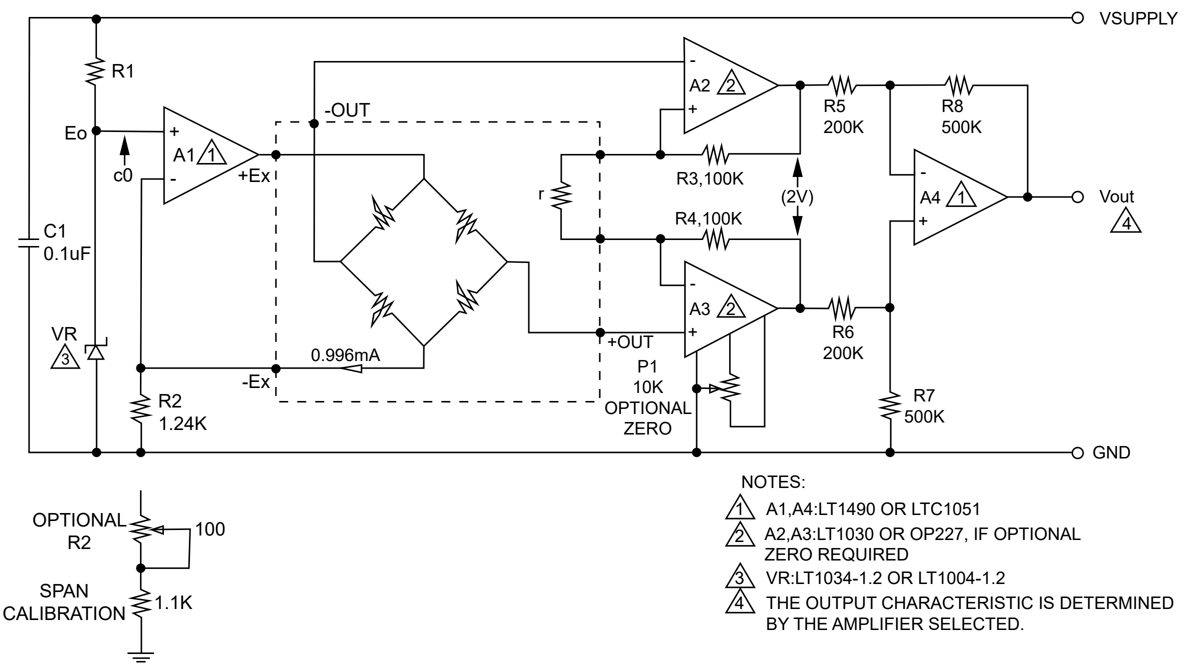
INTRODUCTION

Asimple signal conditioning circuit should allow the output of the amplifier to be independent of the sensor used, providing interchangeability and high level output at very low cost. Alaser trimmed resistor on the sensorís compensation board programs the gain of an external amplifier to normalize the pressure sensitivity variation.

SIMPLE SIGNAL CONDITIONING CIRCUIT

The signal conditioning circuit shown in Figure 1 provides a precision constant current source for sensor excitation and an instrumentation amplifier with the gain programmed by sensor feedback resistor r.

For a detailed discussion of the compensation circuit,and for output voltages other than 0-5V, please refer to Application Notes TN-001 and APP-103 to APP-105.



NOTES:

1. A1,A4:LT1490 OR LTC1051
2. A2,A3:LT1030 OR OP227, IF OPTIONAL ZERO REQUIRED
3. VR:LT1034-1.2 OR LT1004-1.2
4. THE OUTPUT CHARACTERISTIC IS DETERMINED BY THE AMPLIFIER SELECTED.

A Simple Pressure Sensor Signal Conditioning Circuit

CIRCUIT DETAILS

The current source is controlled by the ±1% band-gap reference diode, VR. The reference current IO is defined by:

IO = (EO - eO)/R2

where: EO - diode reference voltage: 1.235V ±1%
(LT1034-1.2 or LT1004-1.2)
eO - offset of amplifier A_1 (~0)
R2 - current set resistor

Selecting amplifier A1 with an offset voltage below 1 mV and a ±1% tolerance of resister R2 delivers current IO = 0.996 mA with typical accuracy of ±1.4%.

The differential input stage of the instrumentation amplifier, A3-A2 has a gain of Gain=1+(R3+R4)/r.
The gain set resistor r is trimmed for R3=R4=100K and a differential output voltage of 2V.

OPTIONAL ZERO ADJUST

If the optional zero adjustment is required, use OP227 amplifiers instead of the LT1013 and add the zeroing potentiometer P1.
The zero range is typically ±4 mV referenced to the input with a differential offset below 0.5 mV. This leaves about a ±3.5 mV zeroing range for the compensation of the sensor offset which is typically below ±1 mV.

OUTPUT

The output stage of the instrumentation amplifier provides additional amplification R8/R5 and translates the differential floating voltage from the first stage into a single ended output voltage. The equation for the overall output voltage is:

Vout = 2•A•R8 / R5 = 5.000V @ A = 1

A is the Ratio between the actual excitation current I_O and the specified current.

ACCURACY AND CALIBRATION

The overall accuracy of the span is effected by the accuracy of feedback resisters R3 through R8. Using ±1% resistors such as Mepco/Electra 5063Z, the typical gain error will be about ±0.24%. The accuracy error may be decreased when matched thin film resisters are used such as Beckman 694-3-A. The combined span error of the entire signal conditioning circuit at a reference temperature will then typically be about 1.1% without any adjustment or pressure testing. This will be superimposed on the sensorís accuracy of ±1%.

OPTIONAL SPAN CALIBRATION

If additional calibration and normalization is desired, resister R2 can be replaced with a series combination of a potentiometer and a resistor (Figure 1). The potentiometer can be adjusted to set the bridge excitation current (I) to achieve the exact span voltage (S) with full scale pressure applied to the sensor.

GAIN ERROR

If no pressure source is available, the gain error of the amplifier can be reduced by using the procedure outlined below. This method may be used instead of using the precision resistors discussed above for R2 through R8. The sensor span error of ±1% will remain, however.

Calibration procedure:

- replace resistor r with an external resistor 7.50Ωk 0.1%
- check gain K of the instrumentation amplifier and calculate the gain ratio X (in reference to the ideal gain KO = 69.028V/V) where X = K/KO
- set current IO = 0.996/X(mA) by adjusting the potentiometer, thus completing calibration.

Assuming a 6.4 kΩ (50°C) maximum bridge resistance, a 0.996 mA bridge current and a 1.2V diode reference voltage, it follows that the maximum output voltage of amplifier A1 can approach 7.4V. Also, the positive saturation voltage at 1 mA out-put current for the LTC1051 amplifier is 0.5V. Therefore, the minimum excitation voltage which is a function of the current source and amplifiers used would be 7.9V (7.4V + 0.5V) for the LTC1051. For the LT1490, the minimum excitation voltage should be 7.6V. The maximum excitation voltage is limited by the voltage handling characteristics of the specific amplifier used.

A Simple Pressure Sensor Signal Conditioning Circuit

OUTPUT SPAN SO VARIATION

Resistor r is laser trimmed for each unit using the following equation:

$$r = \frac{2R_F}{\frac{V_{amp}}{S_i} - 1}$$

where: Si = sensor span value (V) at a reference excitation current (I_O = 0.996 mA)
r = resistance in (k)
R_F = 100K feedback resistor
V_{amp} = amplified output

The output span S_O at the differential output of amplifiers A_3- A_2 (see Figure 1) for any other feedback resistor R in KΩ is given by:

$$SO = AS\left(\frac{r + 2R}{r}\right) = 2A\left[\frac{R}{100} + S_i\frac{(100-R)}{200}\right]$$

where: A = I/IO, ratio of excitation current I to reference current I_O

If 100 kΩ feedback resistors are used, the expression for output span is simplified to:

$$S_C = 2A$$

and is constant for all sensors independent of sensor span S_i. The output span is also independent of the pressure range of the sensor. For other values of the feedback resistors (R), the output span (S_O) will vary with the sensor span (S_i). Assuming I = I_O, we can calculate S_O variations.

Table 1. Output Span (SO) Variation

R	SO(Si=40 mV)	SO(Si=90 mV)	SO variation [±%]
50 K	1.0200	1.0450	1.23
75 K	1.5100	1.5225	0.41
99 K	1.9804	1.9809	0.01
100 K	2.0000	2.0000	0.00
101 K	2.0196	2.0191	0.01
200 K	3.9600	3.9100	0.63
500 K	9.8400	9.6400	1.0

As seen in Table 1, a large deviation from the optimum feedback resistance of 100 k is tolerable while maintaining transducer interchangeability.

For the optimum feedback resistance (100 k), calibration accuracy is a function of the accuracy of the excitation current, feedback resistors and sensor trimming.

The inaccuracy caused by the excitation current and feedback resistors can be made negligible by the use of precision components. Therefore without pressure testing, a 1% system accuracy can be achieved.

The standard gain programming resistor r has a TCR ≤ ±50 ppm/°C and a trimming range of 2.5 to 12.5 k.Ω For volume orders, a custom trimming algorithm can be made to achieve any desired output span.

APPLICATION NOTES
Microprocessor Compatible Circuit

INTRODUCTION

A simple microprocessor compatible circuit is shown in Figure 1. Amplifiers A1 to A4 form a basic signal conditioning circuit similar to that described in Application Note APP-101, “A Simple Pressure Sensor Signal Conditioning Circuit.”

CIRCUIT

To enable the operation of a single 5V power supply, the current through the sensor has been decreased to 0.66 mA. Furthermore, the voltage across R6 has been decreased to 0.2V (from 1.2V in APP-101), thus allowing increased voltage across the bridge which will be reflected in a higher output span.

A/D

The differential output of amplifiers A2 and A3 controls the differential input of analog to digital converter LTC1092.

CALIBRATION

Sensitivity calibration is achieved by adjusting the reference voltage for the A-D converter through amplifier A4. The span between pins 2 and 3 of the converter will be two times the reference voltage at pin 5.

ADDITIONAL INFORMATION

A detailed discussion of the temperature compensation circuit can be found in Application Note TN-001, “Signal Conditioning For IC Pressure Sensors.”

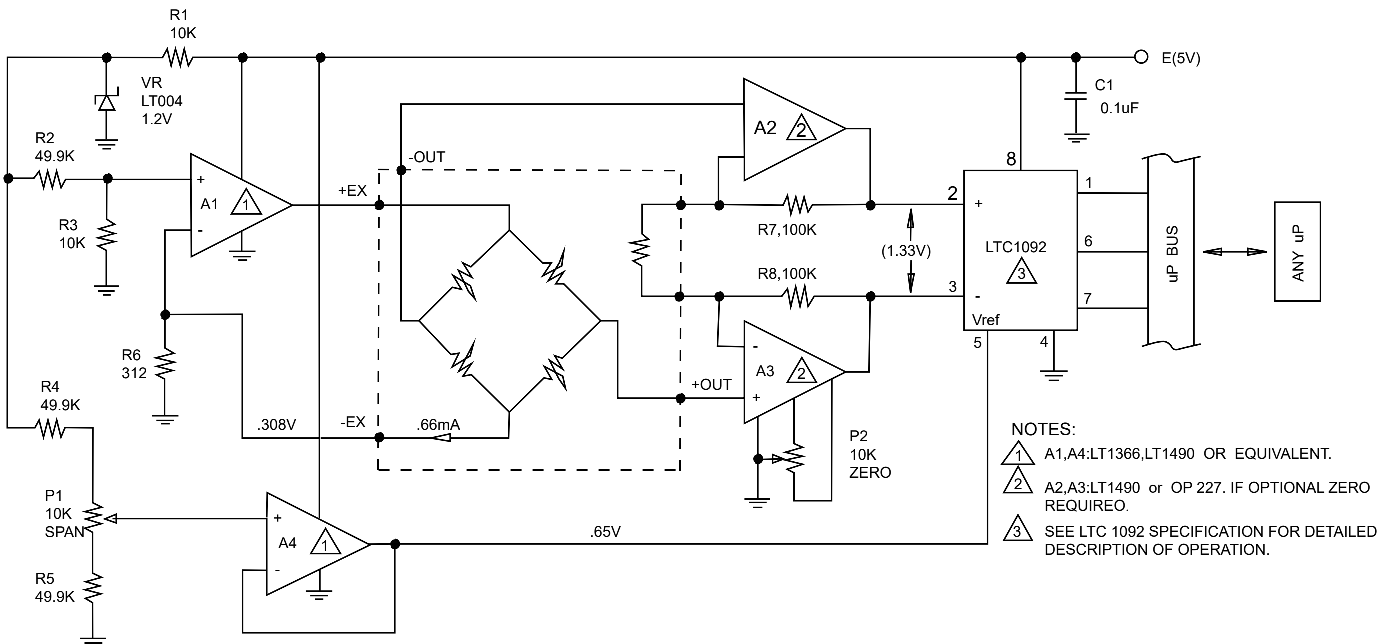


Figure 1. Transducer Circuit - Two Wire Current Transmitter

4-20 mA Circuit

INTRODUCTION

A signal conditioning circuit for a two-wire 4 - 20 mA transmitter is shown in Figure 1. Two-wire transmitters are used when the pressure sensor is far away from its associated display or meter, since transmitters are unaffected by voltage drops along the supply and signal lines.

CIRCUIT DESCRIPTION

The two-wire operation is achieved by referencing all signals to the emitter of transistor Q2. Feedback resistors R11 - R12 control the voltage across resistor R14, drawing a constant current from the input terminals.

CALIBRATION

Zero adjustment is achieved by applying the voltage at the slider of potentiometer P1 to the second differential input of amplifier A4, created by resistors R7 - R10. Span calibration is realized by bridge current change using potentiometer P2.

FREQUENCY RESPONSE

Frequency response may be shaped by capacitors C1, C2 with a 3dB frequency, f=1/(2πR11C2), where C1=C2, R11=R12, and f is measured in Hz

VOLTAGE REGULATOR

Sensitivity calibration is achieved by adjusting the reference voltage for the A-D converter through amplifier A4. The span between pins 2 and 3 of the converter will be two times the reference voltage at pin 5.

ADDITIONAL INFORMATION

A detailed discussion of the temperature compensation circuit can be found in Application Note TN-001, “Signal Conditioning For IC Pressure Sensors.”

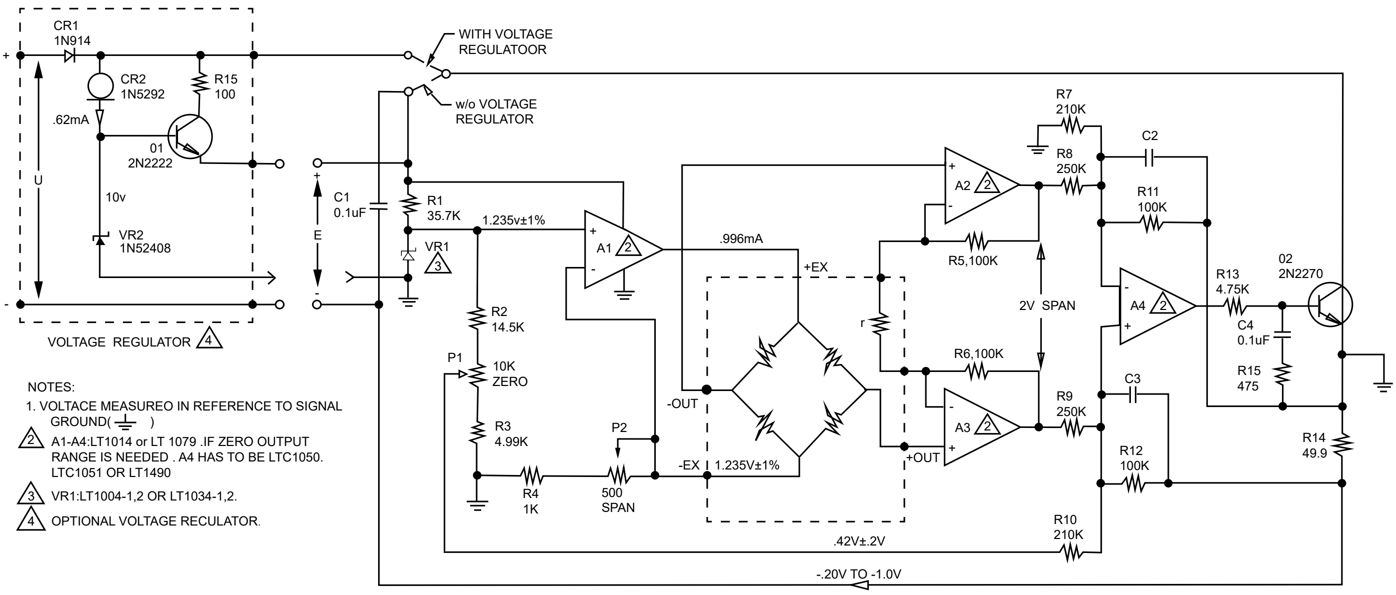


Figure 1. Transducer Circuit - Two Wire Current Transmitter

Low Component Count, Single Supply 0-5V Output, Pressure Amplifier

INTRODUCTION

There are many possible solutions for any given instrumentation amplifier requirement. The circuit in Figure 1 shows a solution that is low in component count, single supply, 0-5 PSI input to 0-5V output, and better than 1% accuracy over 0-50°C.

CIRCUIT DESCRIPTION

The circuit divides into the following blocks: sensor (or bridge), current source, amplifier and offset adjust.

The sensor (X1) chosen is 0-5 PSI, grade A, Model 12 by IC Sensors. It is a compensated (for low offset), current driven, bridge type sensor.

Some of the sensor specs are:
Full Scale Output Span 75 mV to 150 mV
Zero Pressure Output 1 mV Max
Input and Output Resistance 2500Ω to 6000
Temperature Coefficient-Span +0.5% Span Max
Temperature Coefficient-Resistance 0.22%/°C Typ
Supply Current 1.5 mA to 2.0 mA Max

Typically, current driven sensors have better temperature characteristics then voltage driven sensors. The current source comprises Q1, R2, R3, U1, and VR1. R2 biases VR1, a reference. U1 regulates the current through R3 by keeping the voltage across it at VR1 voltage level, namely, 2.5V. The current through R3 is practically the collector current of Q1 and the sensor supply current.

The amplifier comprises R6 to R11, U2A and U2A. The gain of the amplifier is 2(1+Rf/Rs) where Rf=R6+R7+R9+R11 and Rs=R8+R10. R10 is a gain adjustment trim-pot. The gain range reflects the large output range of the sensor.

There are three major offset errors in the circuit: bridge offset, amplifier offset, and amplifier common mode that transforms into offset. The common mode offset error can be the worst of the three. The common mode offset error is lowest when R6 and R11 have the same resistance and when R7 and R9 have the same resistance. Worst case common mode is 41 mV in the output for every volt in the input (all resistors are 1%). Since the input voltage can be as high as (1.5 mA)(6000Ω)/2 = 4.5V, the common mode offset voltage can be (4.5V)(41 mV/V) = 184.5 mV in the output.

The offset is nulled by R4 and R5. R5ís value is calculated for worst case common mode type offset. R4 is connected across the bridge to compensate for drift caused by the temperature coefficient of the bridge and the common mode of the amplifier. If better adjustment resolution is required of R4, it is possible to increase the value of R5. There may be extremely small number of amplifiers that will not calibrate.

Calibration

R12 is added to the circuit for the purpose of calibration. While in operation it can be ignored, in calibration it may bec desired to connect a -0.2 volt source to the Vpin of U2 for adjustment to a true 0V at 0 PSI. Calibrate at room temperature.

The calibration steps are:

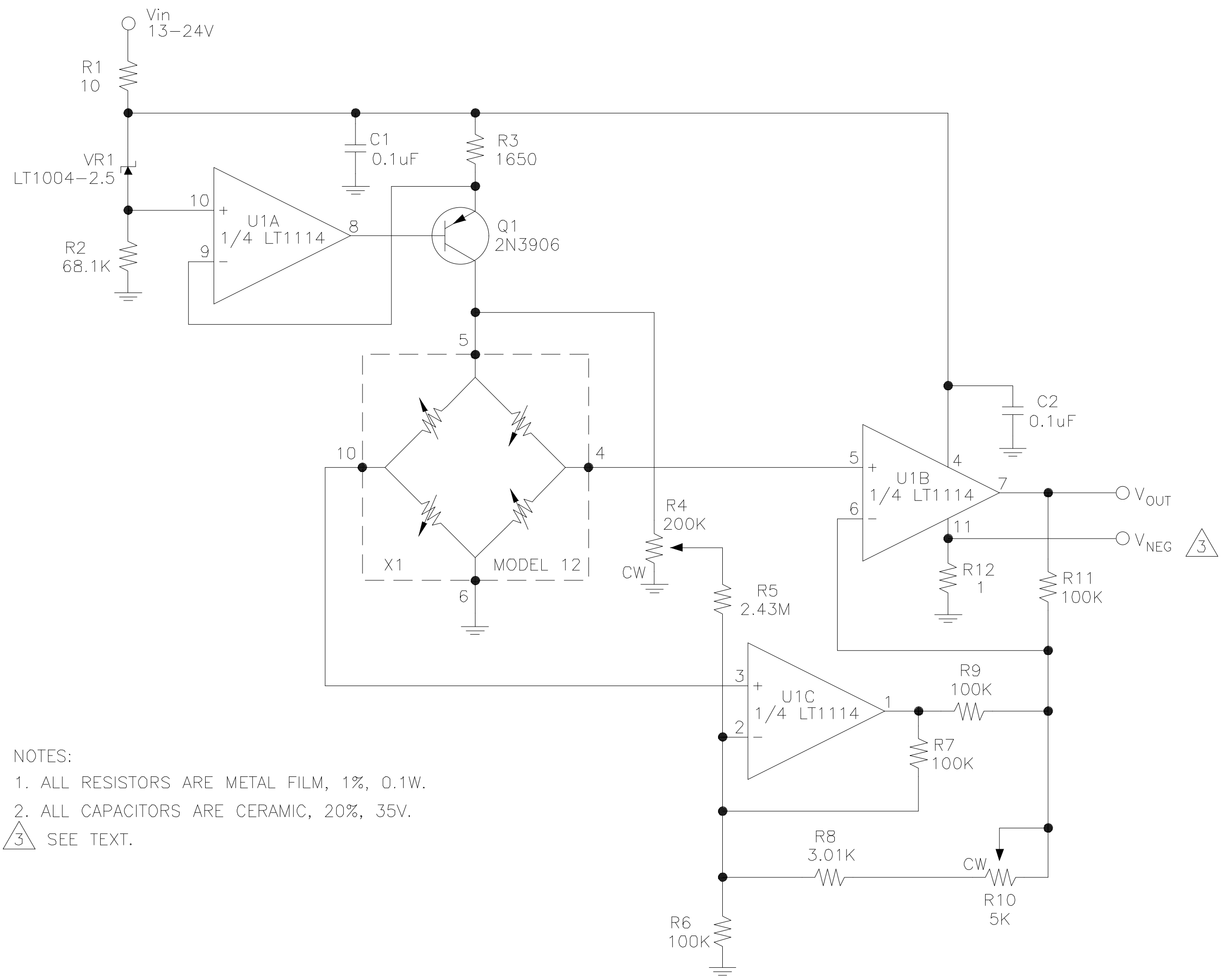
1. Connect VIN and VNEG. VNEG can be a 200 mA current sink or -0.2V voltage source.
2. At 0 PSI (atmospheric pressure) adjust R4 for 0.0V at Vo.
3. Apply 5 PSI pressure source and adjust Vo for 5.0V at Vo.
4. Repeat step s 2 and 3 until output reached the desired level of accuracy.

Testing

The calibration steps are:

1. Connect VIN and VNEG. VNEG can be a 200 mA current sink or -0.2V voltage source.
2. At 0 PSI (atmospheric pressure) adjust R4 for 0.0V at Vo.
3. Apply 5 PSI pressure source and adjust Vo for 5.0V at Vo.
4. Repeat step s 2 and 3 until output reached the desired level of accuracy.

Low Component Count, Single Supply 0-5V Output, Pressure Amplifier



NOTES:
1. ALL RESISTORS ARE METAL FILM, 1%, 0.1W.
2. ALL CAPACITORS ARE CERAMIC, 20%, 35V.
3 SEE TEXT.

Figure 1. Low Component Count Solution