CP201

Dual Low Pressure Sensor
CPAP, BiPAP, APAP Applications

- Highly integrated dual sensors with ADC and DSP
- Combined Differential and Gage Sensors in one device
- 4 Differential Pressure Ranges per device (±250 Pa to ±2.5k Pa)
- 4 Gage Pressure Ranges per device (±2k Pa to ±6k Pa)
- 16-bit resolution each channel range
- Ultra low noise, 17.5 bit Effective Resolution
- Selectable Bandwidth Filter from 25Hz to 250Hz
- Very High Accuracy ±0.05% of Selected Range
- Excellent Long Term Stability
- Output Update Rate up to 500Hz
- Temperature Compensated 5°C to 50°C
- Supply Voltage Compensation
- Standard I^{2}C and SPI Interface

Product Summary

Superior's CP201 low pressure sensor module for CPAP applications employs *NimbleSense™*, a proprietary architecture achieving very high dynamic range to create the industry's best performing pressure sensing for CPAP devices. Incorporating both differential and gage pressure sensors in the same package, the CP201 supports four programmable pressure ranges for each embedded sensor. The differential pressure sensor can be user programmed from ±250 to 2.5k Pa (±1 to 10 inH$_2$O) full scale ranges while the gage pressure sensor is programmable from ±2, to 6k Pa (±8 to 24 inH$_2$O) full scale ranges.

The CP201 family provides a new level of sensor integration into the CPAP market by combining two advanced piezoresistive sensing elements with integrated amplification, ADC, DSP and processor intelligence to greatly simplify customer integration efforts. The CP201 leverages floating point technology to provide a highly precise digital output. Advanced digital processing enables new functionality thus simplifying system development, adding manufacturing ease and increasing reliability. The CP201 optimizes performance, reliability and system cost for the challenging CPAP market.

Industry leading accuracy – The CP201 measures dry air and non-aggressive gas pressure with very high accuracy typically within 0.05% of the selected range and Total Error Band that is typically within 0.15% FSS.

Constructed with a high reliability plastic enclosure, the CP201 provides the ideal combination of very high performance and reliability while ensuring customers have a high volume, cost effective solution optimized for a wide array of CPAP devices.

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Table of Contents

1 Maximum Ratings

Parameter	Sym	Min	Max	Units
Supply Voltage	V_{DDM}	Gnd-0.3	4.0	V
Voltage on I/O Pins $V_{DD} > 3.3V$ $V_{DD} \le 3.3V$	V_{IOML} V_{IOMH}	Gnd-0.3 Gnd-0.3	5.8 V_{DD}+2.5	V V
I/O Current	I_{IOM}	-25	25	mA

2 Suggested Operating Conditions

Parameter	Sym	Min	Max	Units
Supply Voltage	V_{DDOP}	2.8	3.5	V
Temperature	T_A	0	50	°C

3 Environmental

Parameter	Sym	Min	Max	Units
Temperature Range Compensated Operating Storage	T_{CMP} T_{OP} T_{STG}	5 -20 -40	50 85 85	°C °C °C
Humidity (Non-condensing)	RH_{OP}	0	95	% RH
Vibration (10Hz-2kHz)	G_{VIBE}	-	15	g
Shock (6 ms)	G_{SHOCK}	-	100	g
Life	CY_{LIFE}	100M	-	Pressure Cycles

4 Equivalent Circuit

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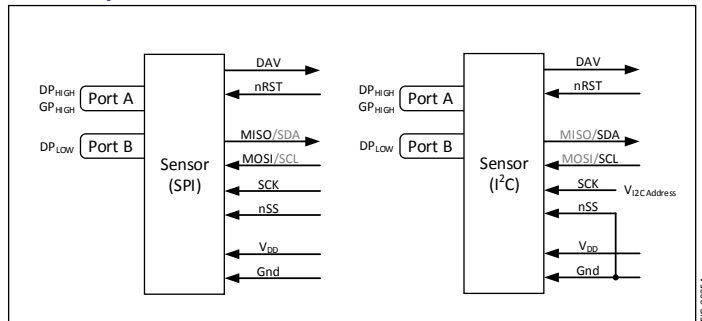
5 Feature List

Parameter	Sym	DP Sensor	GP Sensor	Units	Notes
Programmable FS Pressure Ranges	P_{NUM}	4		Each	
Programmable FS Range Extents	P_{EXT}	±250 to ±2.5k (±1.0 to ±10)	±2.0 to ±6.0k (±8.0 to ±24)	Pa (inH$_2$O)	4
Programmable BW Filter Corners	BW_{NUM}	4		Each	
BW Corner Frequency Extents	f_{BWEXT}	25 to 250		Hz	
Common Mode Pressure	P_{CM}	125	125	kPa	1
Proof Pressure	P_{PROOF}	10	250	kPa	2
Burst Pressure	P_{BURST}	30	750	kPa	3

1) Pressure applied to both ports simultaneously without incurring part damage.
2) Pressure at which the sensor will not suffer permanent damage.
3) Pressure if exceeded could cause permanent damage to the sensor.
4) Full scale units are in Pa. Units of inH2O are approximate and for reference only.

6 Performance Characteristics

Note: Unless otherwise specified, characteristics specified with V_{DD} = 3.3V, T_A = 25C

Parameter	Sym	DP Sensor			GP Sensor			Units	Notes
		Min	Typ	Max	Min	Typ	Max		
Accuracy	P_{ACC}	-	0.05	0.1	-	0.05	0.1	% RNG	1
Total Error Band	TEB	-	0.1	0.3	-	0.15	0.5	% FSS	2
Long Term Stability	LTS	-	0.1	0.25	-	0.15	0.4	% FSS/Yr	
Thermal Hysteresis	T_{HYS}	-	0.05	-	-	0.15	-	% FSS	
Pressure Hysteresis	P_{HYS}	-	0.05	-	-	0.05	-	% RNG	1
Position Sensitivity	P_{PS}	-	2.0	-	-	2.0	-	Pa	
Supply Rejection	P_{SR}	-	0.0005	-	-	0.005	-	Pa/mV	
Resolution	RES	-	16	-	-	16	-	bit	3
System ENOB	ENOB	-	15.7	-	-	15.7	-	Bit	4
Data Update Rate	f_{UPDATE}	485	498	512	485	498	512	Hz	5

1) Percentage of selected range.
2) Includes errors of offset, span and thermal effects.
3) Each of programmable range has the specified resolution.
4) ENOB stated for f_{BW} set to 25 Hz.
5) The internal update rate is fixed and does not change with range or filter settings. Sampling at lower data rates are possible provided the Nyquist frequency is observed. It is suggested to sample at least 2x the set f_{BW} frequency.

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7 Electrical Characteristics

7.1 Supply Characteristics

Parameter	Sym	CP201 Min	CP201 Typ	CP201 Max	Units	Notes
Supply Current	I_{DD}	-	6.5	7.0	mA	
Supply Capacitance	C_{DD}	-	10	-	uF	1

1) Supply capacitance is provided within the part however it is recommended to include a 0.1 uF decoupling cap near the supply pads.

7.2 Reset Characteristics

Parameter	Sym	Condition	CP201 Min	CP201 Typ	CP201 Max	Units	Notes
Power-On Reset Threshold	V_{PORR} / V_{PORF}	Rising Voltage on V_{DD} / Falling Voltage on V_{DD}	- / 0.75	1.4 / -	- / 1.36	V / V	
Interface Detect Delay	t_{IOD}	From POR or External Reset	-	-	40	ms	
First Response Settling Time	t_{FRD}	From POR or External Reset	-	-	60	ms	1
External Reset Low	t_{RSTL}		15	-	-	us	
Input High Voltage	V_{IH}		V_{DD}-0.6	-	-		2
Input Low Voltage	V_{IL}		-	-	0.6		2
Internal Pull-Up Current	I_{PU}	V_{IN} = 0V	-	-10	-30	uA	2
Input Capacitance	C_{IN}		-	7	-	pF	2

1) The filter settling time to ensure the first reading is completely settled.
2) Input nRST

7.3 DAV Characteristics

Parameter	Sym	Condition	CP201 Min	CP201 Typ	CP201 Max	Units	Notes
Output High Voltage	V_{OH}	I_O = -3 mA	V_{DD}-0.7	-	-	V	
Output Low Voltage	V_{OL}	I_O = 8 mA	-	-	0.6	V	

7.4   SPI Characteristics

Parameter	Sym	Condition	CP201			Units	Notes
			Min	Typ	Max		
Output High Voltage	V_{OH}	I_O = -3 mA	V_{DD}-0.7	-	-	V	1
Output Low Voltage	V_{OL}	I_O = 8 mA	-	-	0.6	V	1
Input High Voltage	V_{IH}		V_{DD}-0.6	-	-		2, 3
Input Low Voltage	V_{IL}		-	-	0.6		2, 3
Internal Pull-Up Current	I_{PU}	V_{IN} = 0V	-	-10	-30	uA	2, 3
Time nSS to First SCK Edge	t_{SC}		100	-	-	us	
Clock Cycle Time	t_{CC}		8	-	-	us	
Byte to Byte Cycle Time	t_{BC}		100	-	-	us	
Time Last Clock to nSS High	t_{CN}		20	-	-	us	
Cycle Time nSS	t_{CS}		8	-	-	us	
Input Capacitance	C_{IN}		-	7	-	pF	2

1) Output MOSI
2) Inputs MISO, SCK, nSS
3) Inputs are 5V compliant.

7.5 I^2C Characteristics

Parameter	Sym	Condition	CP201			Units	Notes
			Min	Typ	Max		
SCL Clock Frequency	f_{SCL}		100	-	400	kHz	
Clock Stretch Time	t_{CKSTR}		-	15	100	us	
Input High Voltage	V_{IH}		V_{DD}-0.6	-	-		
Input Low Voltage	V_{IL}		-	-	0.6		
Output Low Voltage	V_{OL}	I_O = 8 mA	-	-	0.6	V	
Input Capacitance	C_{IO}		-	7	-	pF	

8   Materials

8.1   Wetted Materials

Parameter	Sym	CP201		Units	Notes
		P_A	P_B		
Wetted Materials	MAT_{WET}	Epoxy Nylon RTV Silicon Gold Aluminum	Epoxy Nylon RTV Silicon Gold Aluminum		

8.2   Material Compliance

| Parameter	Sym	CP201		Units	Notes
		P_A	P_B		
RoHS	REG_{RoHS}	RoHS Compliant			
REACH	REG_{REAC}	REACH Compliant			

9   System Overview

The SP Series pressure sensor is a fully integrated pressure acquisition system in a sensor module. The acquisition system includes anti-alias filters, data acquisition, sensor(s) compensation, bandwidth limiting and I/O functions. Refer to the figure below for the CP201 block diagram.
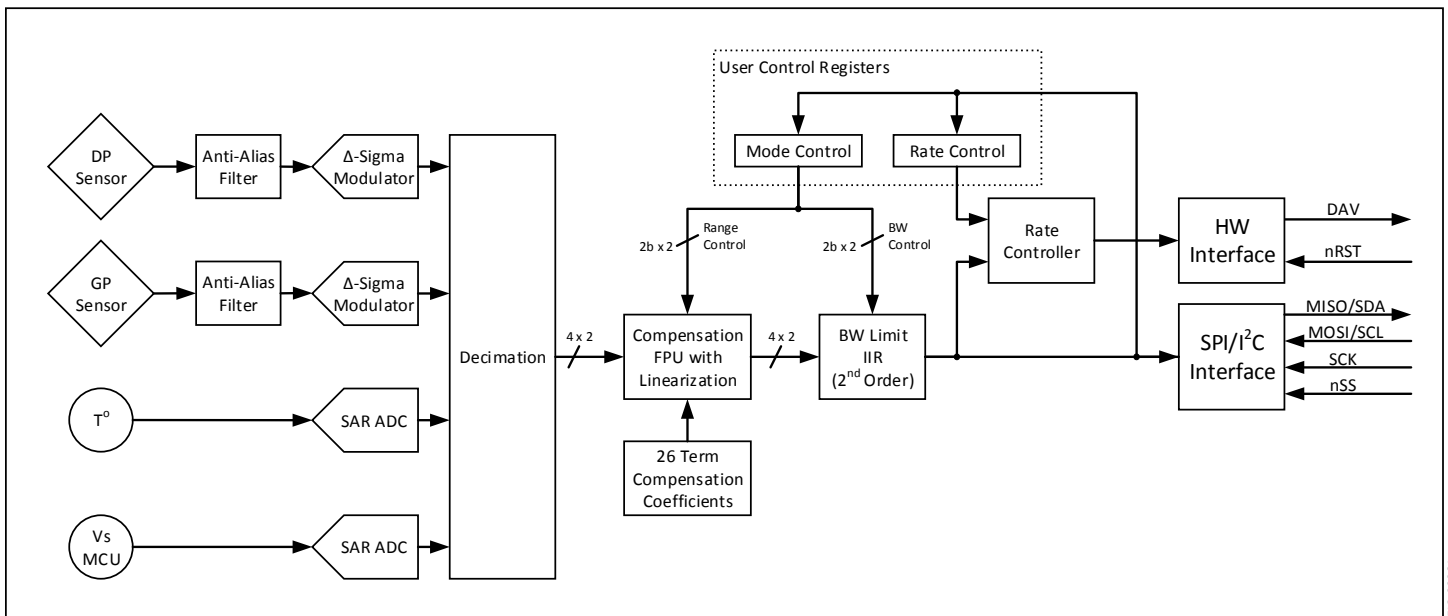
There are also two user controlled registers that tune the sensor to the specific user requirements. The first register is the Mode Control register that determines the output pressure range, the corner frequency of the bandwidth limiting filter, enables or disables the noise suppression filter and controls the Auto-Zero block with Z-Track™.

The second register is the Rate Control register which controls the rate at which the Data Available (DAV) pin is asserted. The internal sensor data update rate is 498 Hz. The Rate Control register will throttle down the rate at which the Data Available pin (DAV) is asserted by counting down from the value set in the Rate Control Register and setting the DAV pin upon reaching zero in the down counter. The DAV is reset upon each read of the pressure sensor. An internal model of the Rate Controller is illustrated in the figure to the right. In the event the Rate Control Register is set to zero, the sensor

will automatically select a Rate Control Register value that is determined by the currently selected bandwidth. Refer to Section 10.6.2 for details on the rate control register functionality.
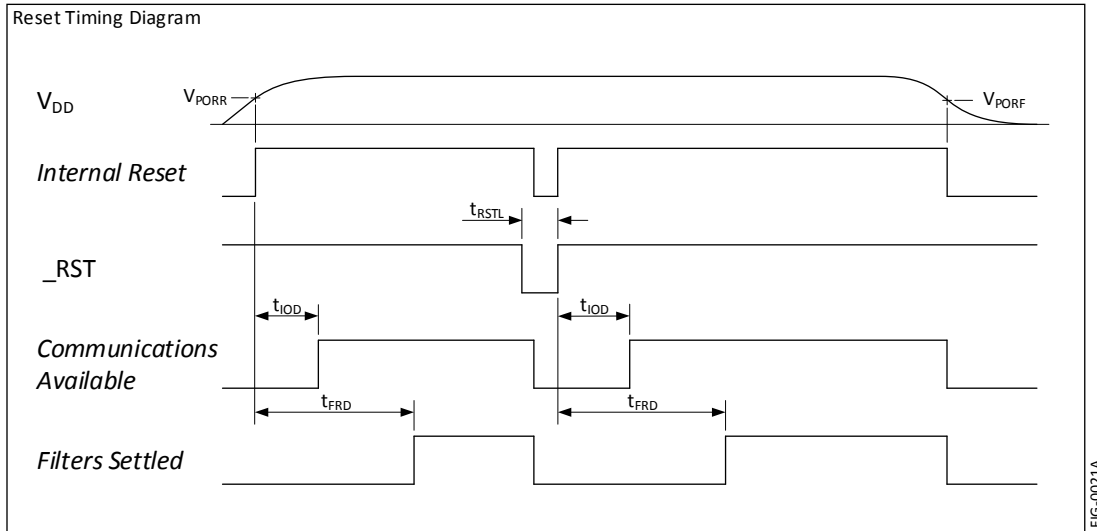
CP201
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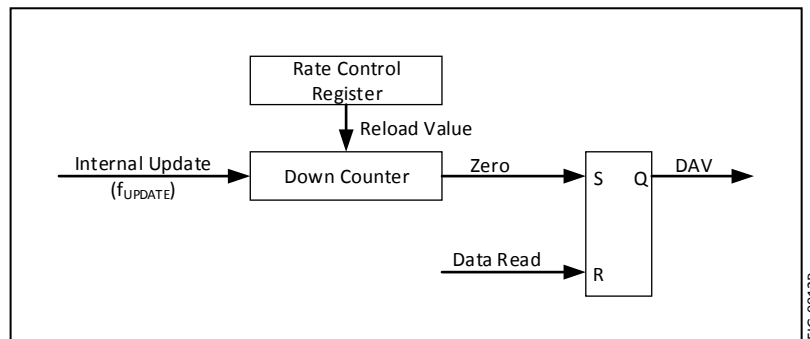
10 Interface

10.1 Reset

Reset timing is shown in the diagram below.

The communications method (SPI or I²C) is established during the time just after rest. During this time (t$_{IOD}$), no communications should take place.

Also, the internal filters are settling during the time t$_{FRD}$ and data acquired during this time may not be fully settled.

10.2 Communication Interface Selection

The communications interface is selected by interrogating the nSS pin after the internal power on reset delay. If nSS is high, the SPI interface will be selected otherwise (if low) the I²C interface will be selected. Grounding the nSS pin is an acceptable method for selecting the I²C interface.

10.3 SPI Interface

The SPI interface uses a minimum of 16-bit transfer for all communications. Data is MSB first for both MOSI and MISO data transfers. Refer to the figure below for specific timing requirements.
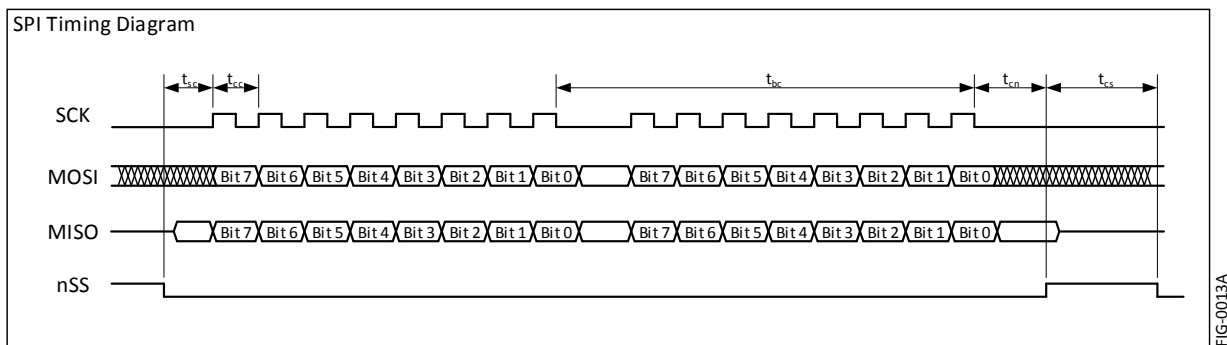
The data communications has been reduced to a simple 16 bit transfer model for reading the DP pressure output. The GP pressure sensor can be read via the extended data acquisition (Section 10.5). Each communication cycle consists of master sending the Mode and Rate data to be placed into the sensor Mode Register and Rate Registers respectively. Simultaneously, the sensor sends the pressure data for the master to receive. Refer to the figure below for the data communication model of the sensor.

The requirement to send the Mode and Rate bytes on each data read cycle is intentional. The purpose is to force the master to send specific data for each communication and prevent inadvertent data from being sent to the sensor. Since a SPI interface will generally re-circulate data through its shift register, the intention is to prevent the pressure output from the sensor from being re-circulated back to the sensor and potentially causing unintended corruption of manufacturing data. Note: The first two bytes out are the DP pressure sensor. To receive the data from the GP and extended data, continue to read bytes from the sensor (see Section 10.5). Data sent to the sensor (MOSI), after the first two bytes of the transaction, is ignored.

SPI Data Diagram
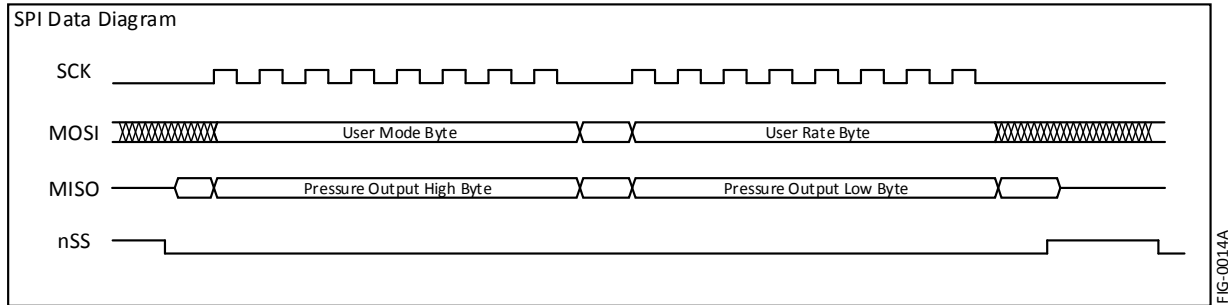
10.4 I^{2}C Interface

The CP201 is compatible with the I^{2}C protocol. For detailed information regarding the I^{2}C protocol, please refer to the Philips I^{2}C Bus Specification, Version 2.

10.4.1 I^{2}C Address

| I2C Address Selection Table			
R1 (kΩ)	R2 (kΩ)	Address (decimal)	Address (hex)
120	5.6	49	0x31
120	12	48	0x30
120	27	47	0x2F
120	51	46	0x2E
120	100	45	0x2D
56	100	44	0x2C
30	100	43	0x2B
15	100	42	0x2A
5.6	100	41	0x29
0	NoPop	40	0x28

The I^{2}C address is set to 0x28 by grounding the SCK line. Other I^{2}C addresses can be established by applying a voltage to the SCK line by use of a resistor divider across the sensor supply voltage. The suggested resistor values and the respective I^{2}C address are shown in the table to the left.

Note: R1 is the lower resister of the divider where R2 is the upper resister of the divider.

10.4.2 I^{2}C Communications Model

The sensor is configured as a slave device and as such, the communicating host must be configured as a master. There are two types of possible data transfers, data transfers from the master transmitter to an addressed sensor (WRITE), and data transfers from an addressed sensor to a master receiver (READ). The master device initiates both types of data transfers and provides the serial clock pulses on SCL.

The communications model for I^{2}C is similar to that of SPI however, since I^{2}C is a half-duplex protocol, the transfer of information to and from the sensor is separated into two separate communications. This is in contrast to the SPI interface where the transmitted and received data occurs simultaneously to and from the host. Refer to the figure to the right for the data communication model for the CP201 sensor.

I^{2}C Communication Model
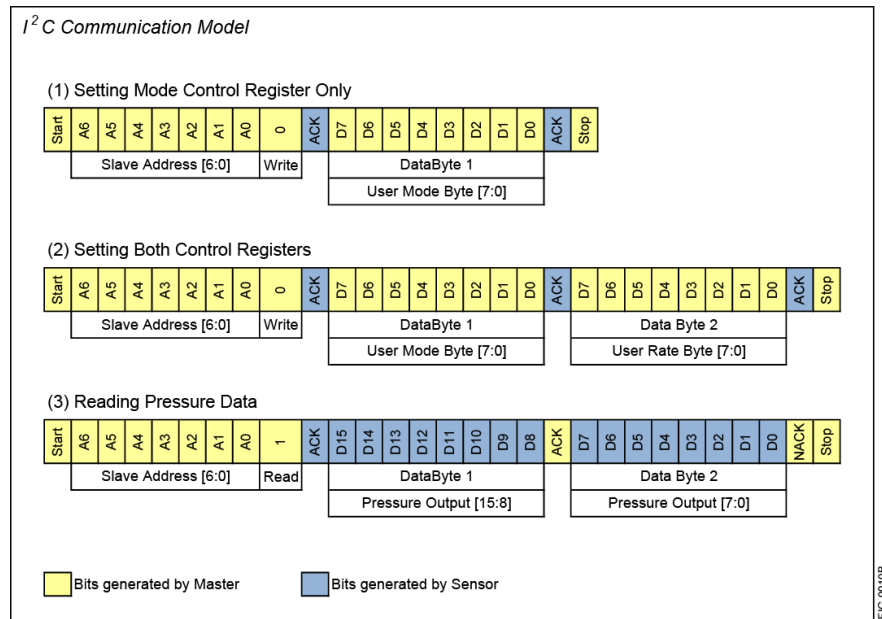
10.4.3 I²C Clock Stretching

The figure to the right illustrates the I²C clock stretching by the sensor. At times, the sensor requires additional time to respond to the host and utilizes the clock stretching feature of the I²C protocol. This is accomplished by holding the SCL low after the ACK cycle of a data transfer. Refer to Section 7.5 for the clock stretching timing. Note, the maximum clock stretch time will generally only occur once during the three ACK cycles of a two byte transfer. That is, the balance of ACK's during a multi-byte transfer will generally include the typical clock stretching time.
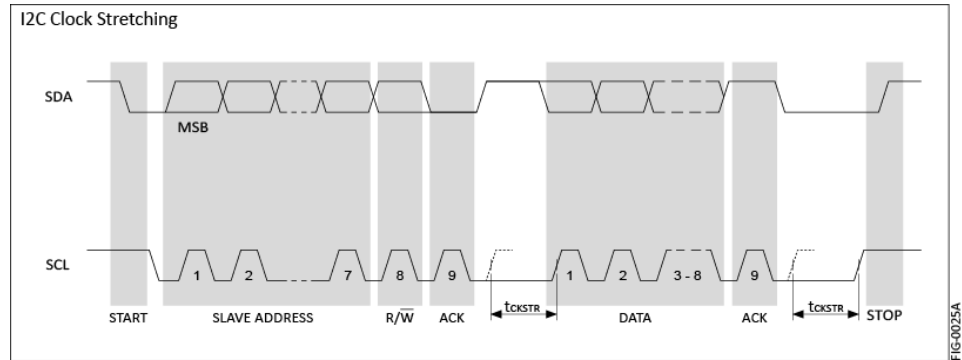
10.4.4 I²C Bus Compatibility

The I²C specification allows any recessive voltage between 3.0 and 5.0 V. Different devices on the bus may operate at different voltage levels. However, the maximum voltage on any port pin must conform to the electrical characteristics specifications (See section 1). The bi-directional SCL (serial clock) and SDA (serial data) lines must be connected to a positive power supply voltage through a pull-up resistor or similar circuit. Every device connected to the bus must have an open-drain or open-collector output for both the SCL and SDA lines, so that both are pulled high (recessive state) when the bus is free.

10.5 Extended Data Acquisition

10.5.1 Available Extended Data

For either the SPI or I²C interface, additional data is available beyond the pressure. The means to access this extended data is to continue reading data (either SPI or I²C) beyond the first 16 bits of pressure information. The following table defines the order of the available data and respective format.

Data	Bytes	Format	Interpretation	Example
Pressure (DP)	1-2	2 byte, Signed Int	See Section 10.7	See Section 10.7
Pressure (GP)	3-4	2 byte, Signed Int	See Section 10.7	See Section 10.7
Mode Byte	5	1 byte, Unsigned	Mode byte used to compute this transaction	69H = DP(FS = 500Pa, BW = 100Hz) GP(FS = 4 kPa, BW = 50Hz)
Temperature	6-7	2 byte, Signed Int	Fixed Decimal [8.8 bits], Upper 8 bits integer, lower 8 bits fractional. Temperature in °C	1880H (18.80H) = 24.5°C
Model	8-13	6 byte, ASCII, null terminated	Right reading ASCII with null termination	42H,50H,32H,30H,31H,00H = CP201
Serial Number	14-17	4 byte, Hex	Unique 4 byte serial for each part	2FD627A4H
Build Number	18-23	6 byte, ASCII, null terminated	Right reading ASCII with null termination	30H,30H,30H,33H,43H,00H = 0003C

10.5.2 SPI Extended Data Read

Reading the extended data while using the SPI interface is the same as shown in Section 10.3 with exception that the master continues to read during the same nSS sequence to read all 20 bytes of the extended data. Any portion of the 20 bytes can be read during the transfer. That is, for example, 4 bytes could be read to acquire only the pressure and temperature information. When reading the extended data, only the first two bytes sent to the sensor (User Mode and User Rate) are used to set the internal registers. The subsequent bytes (bytes 5 through 20) are ignored. Data read following the first 20 bytes is undefined.

10.5.3   I^{2}C Extended Data Read

Reading the extended data via the I^{2}C interface is similar to using the SPI interface where the master can simply continue reading the sensor during the pressure reading transfer. The master continues Ack'ing until the number of desired bytes are read.

10.6 Control Registers

10.6.1   Mode Control Register

<u>Default Value: 0xBB</u>

Details of the Mode Control register are illustrated in the figure to the right.

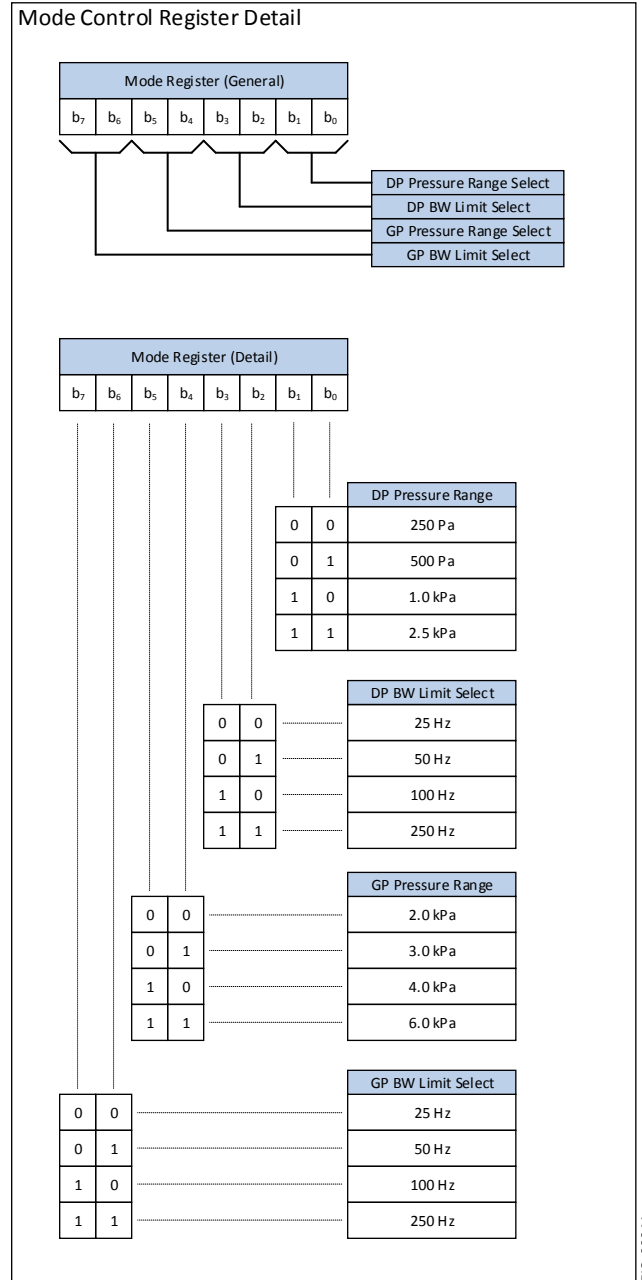<u>Bits 0-1</u> control the DP output pressure range.

<u>Bits 2-3</u> control the DP BW Limit Filter.

<u>Bits 4-5</u> control the GP output pressure range.

<u>Bits 6-7</u> control the GP BW Limit Filter.

It should also be noted that upon changing the Mode Control value, there is a one cycle latency before the new Mode Control value becomes valid. That is, the data of the communication cycle following a change to the Mode Control register will not reflect the change. It is not until the second communication cycle that the change in the Mode Control register will be reflected in the output data.

Mode Control Register Detail

Mode Register (General)

b$_7$	b$_6$	b$_5$	b$_4$	b$_3$	b$_2$	b$_1$	b$_0$

DP Pressure Range Select
DP BW Limit Select
GP Pressure Range Select
GP BW Limit Select

Mode Register (Detail)

b$_7$	b$_6$	b$_5$	b$_4$	b$_3$	b$_2$	b$_1$	b$_0$

DP Pressure Range

0	0	250 Pa
0	1	500 Pa
1	0	1.0 kPa
1	1	2.5 kPa

DP BW Limit Select

0	0	25 Hz
0	1	50 Hz
1	0	100 Hz
1	1	250 Hz

GP Pressure Range

0	0	2.0 kPa
0	1	3.0 kPa
1	0	4.0 kPa
1	1	6.0 kPa

GP BW Limit Select

0	0	25 Hz
0	1	50 Hz
1	0	100 Hz
1	1	250 Hz

FIG-0094A

10.6.2 Rate Control Register

Default Value: 0x00

The Rate Control Register controls the rate at which the DAV pin is asserted indicating new data is available. This register is primarily used to throttle down the actual data transfer rate (when using the DAV as the trigger to sample data).

The function of this register is that it is the reload value of a data rate down-counter. The value of the Rate Control Register is the divisor of the 498 Hz internal data rate. Since a divisor of zero is not possible, a zero value will select the auto-select rate mode. In this mode, the rate is selected based on the selected DP bandwidth limit. The auto rate value is roughly two times the corner frequency of the currently selected bandwidth limit in all auto selected rates.

Note: Start-up time for the sensor is approximately 60ms for the first sample to be settled. Requesting data during this time will result in invalid information. However, this start-up time can be used for configuring the Mode and Rate registers by performing a transfer with the desired Mode and Rate register values and discarding the received pressure data. After waiting the required start-up time, the sensor will respond with desired data since the Mode and Rate registers have been pre-established.

Rate Control Register Detail

Rate Control Register

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0	
0	0	0	0	0	0	0	0	Auto Select
0	0	0	0	0	0	0	1	498.5 Hz
0	0	0	0	0	0	1	0	249.2 Hz
0	0	0	0	0	0	1	1	166.2 Hz
1	1	1	1	1	1	1	0	1.96 Hz
1	1	1	1	1	1	1	1	1.95 Hz

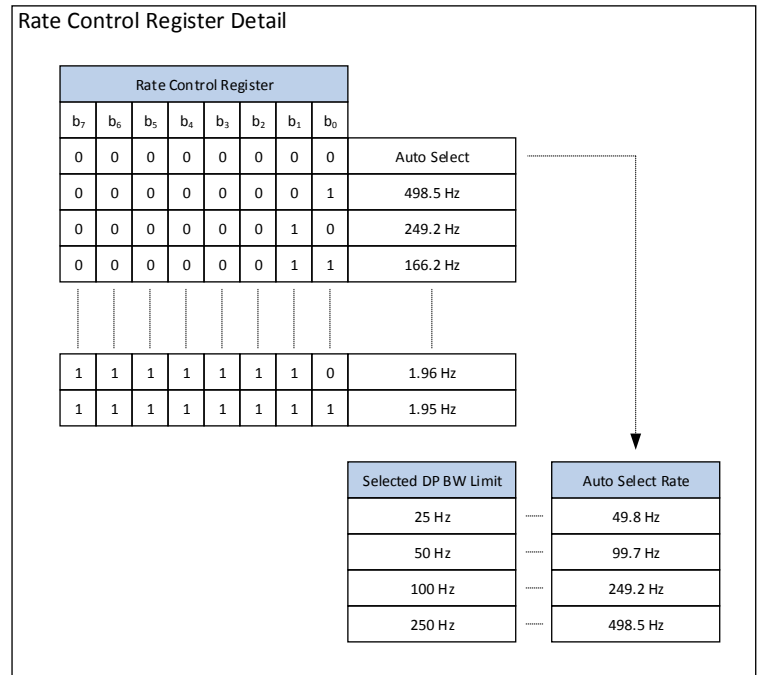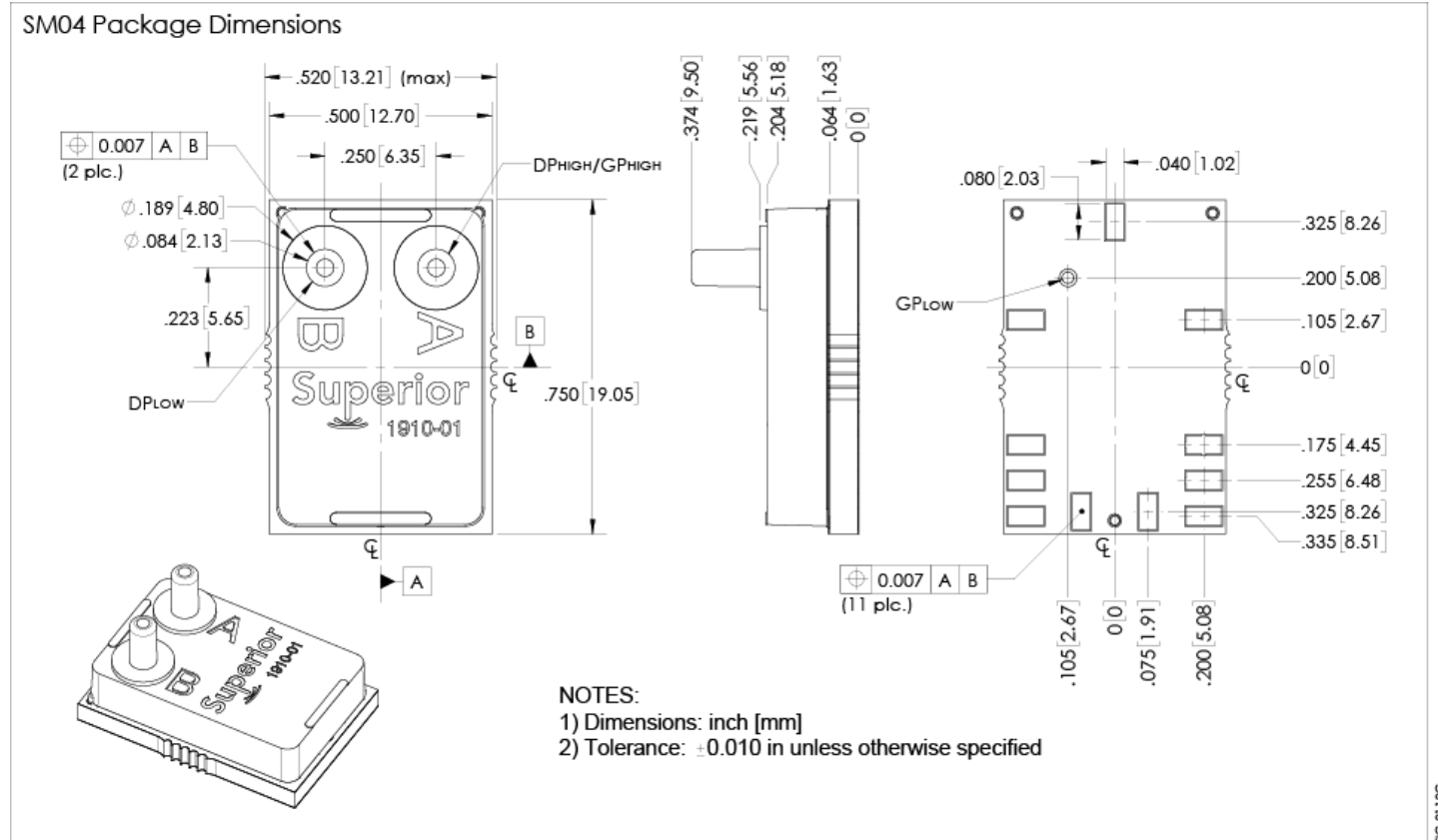| Selected DP BW Limit	Auto Select Rate
25 Hz	49.8 Hz
50 Hz	99.7 Hz
100 Hz	249.2 Hz
250 Hz	498.5 Hz

FIG-0097A

10.7 Computing Pressure

The pressure data is in the form of 16-bit signed integer sent in high byte then low byte order. This is a differential output by definition and the data range is $\pm 2^{15}$. There is a 10% margin in the output scaling and the selected full scale will reside in the 90% band of the total available output data range. Refer to Equation 1 (below) for the general model for computing the output pressure. As an example, if the sensor output is 3,647 counts and the selected pressure range is 500 Pa, then the output pressure is 61.832 Pa. Conversely, for a -3,647 count with the selected pressure range of 500 Pa, the computed output pressure is -61.832 Pa. Refer to Example 1 (below) for the specific example computation.

$$Eq\ 1: P_{Pa} = \frac{Out_{DIGITAL}}{90\% * 2^{15}} * Range_{SELECTED}$$

$$Example\ 1: P_{Pa} = \frac{3,647}{90\% * 2^{15}} * 500\ Pa = 61.832\ Pa$$

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11 Mechanical and Manufacturing

11.1 Package Dimensions

SM04 Package Dimensions

NOTES:
1) Dimensions: inch [mm]
2) Tolerance: ±0.010 in unless otherwise specified

11.2 Suggested Pad Layout

The suggested pad layout is shown in the figure below. An Eagle PCB symbol library is available with the shown pad dimensions. Please consult the factory to obtain the library.
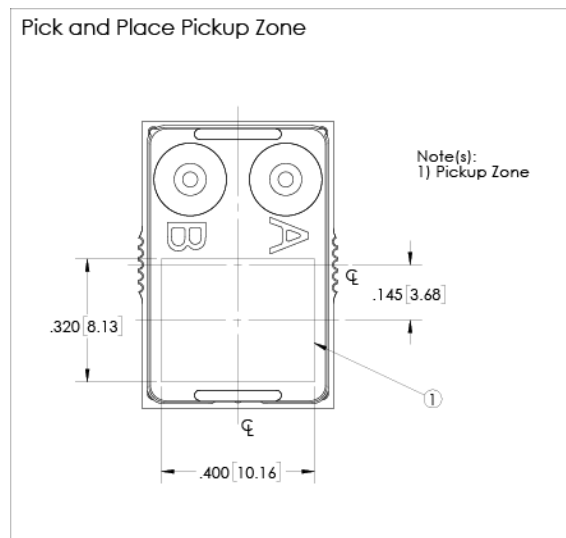

Suggested Pad Layout
(Top View)

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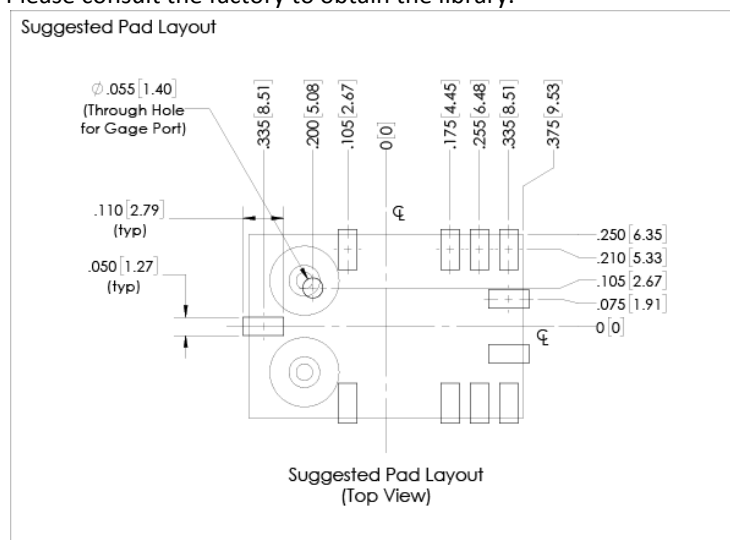
11.3 Pinout

Pin	Sym	SPI	I^{2}C
1	nSS	Slave Select (active low)	Tie to Ground
2	MOSI/SCL	MOSI	SCL
3	MISO/SDA	MISO	SDA
4	SCK	Serial Clock	See Section 10.4.1
5	DNC	Do Not Connect	
6	DNC	Do Not Connect	
7	DNC	Do Not Connect	
8	Gnd	Ground	
9	V$_{DD}$	Sensor Supply	
10	nRST	Reset (active low)	
11	DAV	Data Available	

Package Pinout

Pin Numbers (Top View)
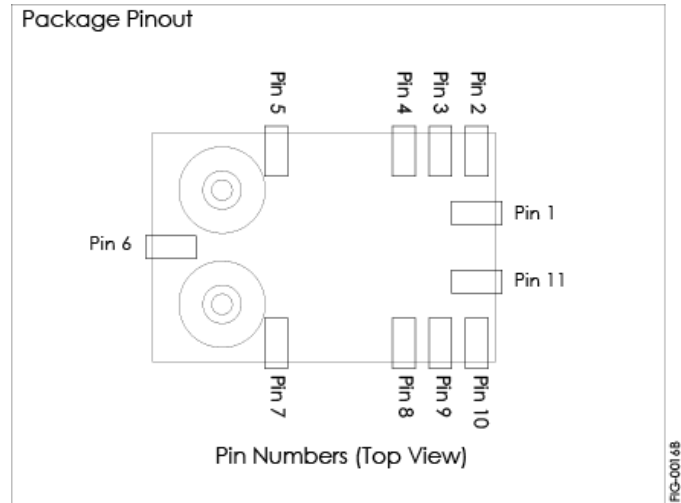
11.4 Reflow Soldering and Handling Conditions

Parameter	Sym	Val	Units
Soldering Specifications (Max)			
Preheat Ramp Rate	t$_{PHRR}$	3	°C/s
Soak Time	t$_{SOAK}$	3	min
Time Above 217C	t$_{GT217}$	50	s
Time Above 230C	t$_{GT230}$	40	s
Time Above 250C	t$_{GT250}$	15	s
Peak Temperature	t$_{PT}$	255	°C
Cooling Ramp Rate	t$_{CRR}$	-4	°C/s
Weight	W$_{PRT}$	3.5	gm
Moisture Sensitivity	MSL	3	
ESD (Human Body Model)	ESD	2	kV

11.5 Pick and Place Pick-up Zone

Pick and Place Pickup Zone

Note(s):
1) Pickup Zone

.145 [3.68]
.320 [8.13]
.400 [10.16]

11.6 Packaging Options

11.6.1 Tray Packaging

Tray Packaging Detail

Tray Dimensions

Multi-Tray Packaging (M Packaging Option)

Dimensions
7-1/8"W x 9-1/4"D x 3-7/8"H

Notes
1) 64 Parts Per Tray
2) 8 trays per box (plus empty top tray)
3) 512 parts per box

Single Tray Packaging (T Packaging Option)

Notes
1) 64 Parts Per Tray
2) 1 trays per box (plus top protection insert)
3) 64 parts per box

Dimensions
7-1/8"W x 9-3/8"D x 3/4"H

11.6.2 Tape and Reel

Tape and Reel Detail

SECTION A-A

DETAIL B

DETAIL C

Label

NOTES:
1) Dimensions: [mm] inch
2) Reel Diameter: [330] 12.99
3) Parts Per Reel: 256
4) Unwind Orientation: Per figure to left

FIG-0015B

11.7 Part Identification

Part Marking

NOTES:
1) SST Logo
2) Lot Number
    Format: YYWW-NN
    Where:
    YY = Last two digits of year
    WW = Week number
    NN = Lot number in given week
3) Part Number

1910-01
Superior
CP201

FIG-0098B

CP201
Dual Low Pressure Sensor
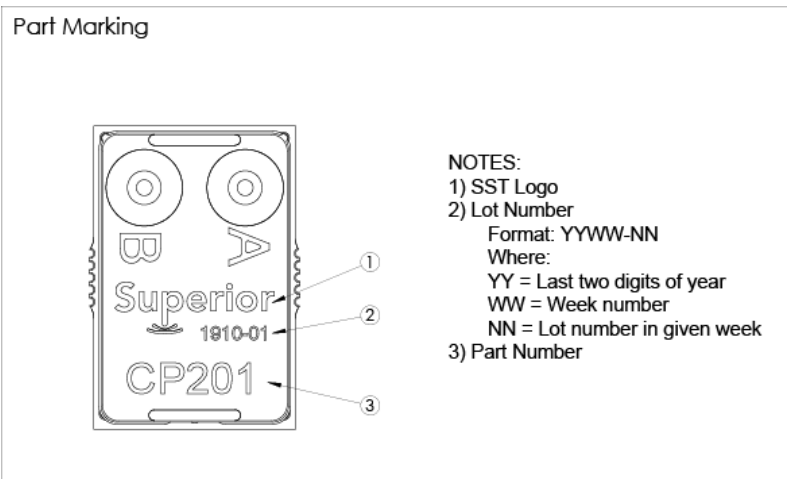
12 Ordering Information

Part Number	Part Package	Packaging	Packaging Qty	Order Number
CP201-SM04	SM04	Tape and Reel Multi-Tray Single Tray Quarter Reel Cut Tape	256 512 64 64 1-63	CP201-SM04-R CP201-SM04-M CP201-SM04-T CP201-SM04-Q CP201-SM04-C

13 Packaging Labeling

Packaging labels are provided with barcode Code 128 symbology. The provided fields are Company Name, Part Number, Packaging ID, Quantity and Country of Origin. The Packaging ID traces back to the Lot Number (or Lot Numbers) contained in the package. The purpose is to eliminate multiple labels (one for each included Lot Number) in the event of multiple Lot Numbers within a single package. This is for ease of customer tracking and maintenance. The Packaging ID is a 24-bit value printed in hexadecimal format.

14 Revisions

Rev	Change Description(s)	Date	By
A	Initial Release	06/09/21	T.S.
B	Revise ENOB value Clarify units in Section 5	9/16/21	T.S.
C	Revise package references	9/24/21	T.S.

15 Warranty

Superior Sensor Technology and its subsidiaries warrant goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. In all cases, Superior Sensor Technology's standard product warranty applies; please refer to your order acknowledgement or consult your local sales office for specific warranty details.

If warranted goods are returned to Superior Sensor Technology during the period of coverage, Superior Sensor Technology will repair or replace, at its option, without charge those items that Superior Sensor Technology, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied. In no event shall Superior Sensor Technology be liable for consequential, special, or indirect damages.**

While Superior Sensor Technology may provide application assistance personally, through literature or the Superior Sensor Technology web site, it is buyer's sole responsibility to determine the suitability of the product in their application. Superior Sensor Technology assumes no liability for applications assistance or customer product design.

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