# HV Series

Differential Low Pressure Sensors
HVAC Applications

- Highly integrated sensor with ADC and DSP
- Selectable pressure range from 0.1 to 20 inH$_2$O
- Integrated 50/60Hz Notch Filter
- Selectable Bandwidth Filter from 0.1Hz to 10Hz
- Very High Accuracy +/- 0.1% of Selected Range
- Long Term Stability +/- 0.1% FSS
- Temperature Compensated 0°C to 50°C
- Supply Voltage Compensation
- Fully Integrated Compensation Math
- Standard I^{2}C and SPI Interface
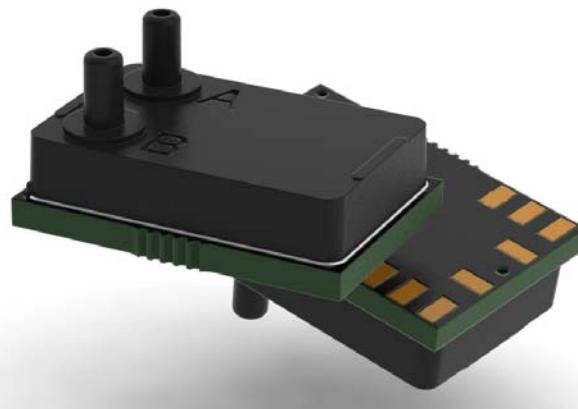
Product Summary

Superior Sensor Technology's HV Series Family offers the industry's highest performing and most flexible Differential Low Pressure Sensors for HVAC (Heating, Ventilation, and Air Conditioning) applications. Targeting pressure ranges from as low as 0.1" inH$_2$O (Water Column) to 20" inH$_2$O with industry leading 16 bits of resolution for each range supported. Competing solutions degrade as the pressure range is lowered; but, Superior's HV Series with the Multi-Range capability enabled maintains optimal performance from 20" inH$_2$O down to even 0.1" inH$_2$O.

The HV Series family employs Superior's proprietary NimbleSense™ architecture to create the industry's first generation of "Smart Sensors."   NimbleSense™ provides very high dynamic range to enable a single device to cover the entire range of HVAC pressure requirements.   For example, one Multi-Range enabled Superior Sensor device can replace three to five (or more) competing products greatly simplifying installation requirements and significantly lowering inventory costs.   As an example, an HV Series device installed in the ceiling vent can now be programmed to accommodate any pressure requirement without additional installation charges. For added performance, the HV Series has incorporated a 50/60Hz notch filter to minimize the impact of power noise spikes. The HV Series family provides a new level of integration combining an advanced piezoresistive sensing element with integrated amplification, ADC, DSP and digital interface which greatly simplifies customer integration efforts. The incorporation of advanced digital signal processing enables new functionality thus simplifying system development, manufacturing ease and increased reliability.

Constructed with a high reliability plastic enclosure, the HV Series family provides the ideal combination of very high performance and reliability while ensuring customers have a high volume cost effective solution optimized for their HVAC requirements.

HV Series
Differential Low Pressure Sensors

Superior SENSOR TECHNOLOGY

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 $V_{DD} > 3.3V$ $V_{DD} \leq 3.3V$	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}	0 -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}	1M	-	Cycles

4 Equivalent Circuit

HV-Series Equivalent Circuit

HV Series
Differential Low Pressure Sensors
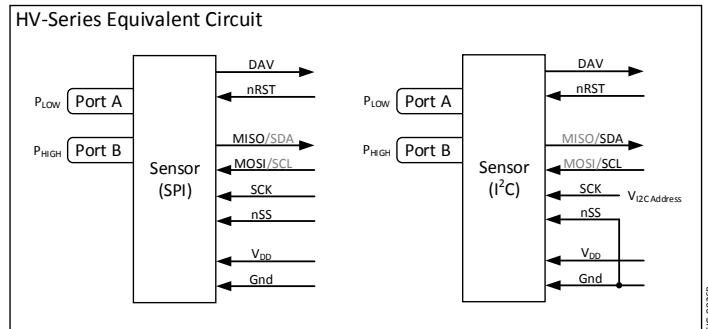
5 Feature List

Parameter	Sym	HV120	HV110	HV210	Units	Notes
Number of FS Pressure Ranges	P_{NUM}	4	5	7	Each	
Specified FS Range Extents	P_{EXT}	±2.5 to ±20	±0.5 to ±10	±0.1 to ±10	inH$_2$O	
Number of BW Filter Corners	BW_{NUM}	7			Each	
BW Corner Frequency Extents	f_{BWEXT}	0.1 to 10			Hz	
Common Mode Pressure	P_{CM}	500	500	500	inH$_2$O	1
Proof Pressure	P_{PROOF}	40	40	40	inH$_2$O	2
Burst Pressure	P_{BURST}	120	120	120	inH$_2$O	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.

6 Performance Characteristics

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

Parameter	Sym	HV120			HV110			HV210			Units	Notes
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Accuracy	P_{ACC}	-	-	0.1	-	-	0.1	-	-	0.1	% RNG	1, 2
Total Error Band	TEB	-	-	0.3	-	-	0.3	-	-	0.15	% FSS	3
Long Term Stability	LTS	-	0.1	0.25	-	0.1	0.25	-	0.05	0.1	% FSS/Yr	
Thermal Hysteresis	T_{HYS}	-	0.05	-	-	0.05	-	-	0.025	-	% FSS	
Pressure Hysteresis	P_{HYS}	-	0.05	-	-	0.05	-	-	0.05	-	% RNG	1
Position Sensitivity	P_{PS}	-	2.0	-	-	2.0	-	-	0.25	-	Pa	
Supply Rejection	P_{SR}	-	0.0005	-	-	0.0005	-	-	0.0005	-	Pa/mV	
Resolution	RES	-	16	-	-	16	-	-	16	-	bit	4
System ENOB	ENOB	-	19	-	-	19	-	-	19	-	Bit$_{RMS}$	5
Data Update Rate	f_{UPDATE}	108	111	114	108	111	114	108	111	114	Hz	6

1) Percentage of selected range.
2) Uncertainty limited by system noise for ranges of 0.5 inH$_2$O and below.
3) Includes errors of offset, span and thermal effects.
4) Each selected range has the specified resolution
5) ENOB stated for f_{BW} set to 0.1 Hz.
6) 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 3x the set f_{BW} frequency.

HV Series
Differential Low Pressure Sensors

7 Electrical Characteristics

7.1 Supply Characteristics

Parameter	Sym	HV120			HV110			HV210			Units	Notes
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Supply Current	I_{DD}	-	3.5	3.8	-	3.5	3.8	-	4.5	4.8	mA	
Supply Capacitance	C_{DD}	-	10	-	-	10	-	-	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	HV120 / HV110 / HV210			Units	Notes
			Min	Typ	Max		
Power-On Reset Threshold	V_{PORR}	Rising Voltage on V_{DD}	-	1.4	-	V	
	V_{PORF}	Falling Voltage on V_{DD}	0.75	-	1.36	V	
Interface Detect Delay	t_{IOD}	From POR or External Reset	-	-	40	ms	
First Response Settling Time	t_{FRD}	From POR or External Reset	-	-	150	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	HV120 / HV110 / HV210			Units	Notes
			Min	Typ	Max		
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	HV120 / HV110 / HV210			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}		150	-	-	us	
Clock Cycle Time	t_{CC}		8	-	-	us	
Byte to Byte Cycle Time	t_{BC}		150	-	-	us	
Time Last Clock to nSS High	t_{CN}		25	-	-	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^{2}C Characteristics

Parameter	Sym	Condition	HV120 / HV110 / HV210			Units	Notes
			Min	Typ	Max		
SCL Clock Frequency	f_{SCL}		100	-	400	kHz	
Clock Stretch Time	t_{CKSTR}		-	15	150	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	HV120		HV110		HV210		Units	Notes
		P_A	P_B	P_A	P_B	P_A	P_B		
Wetted Materials	MAT_{WET}	Epoxy Nylon RTV Silicon	Epoxy Nylon RTV Silicon Gold Aluminum	Epoxy Nylon RTV Silicon	Epoxy Nylon RTV Silicon Gold Aluminum	Epoxy Nylon RTV Silicon Gold Aluminum	Epoxy Nylon RTV Silicon Gold Aluminum		

8.2 Material Compliance

| Parameter	Sym	HV120		HV110		HV210		Units	Notes
		P_A	P_B	P_A	P_B	P_A	P_B		
RoHS	REG_{RoHS}	RoHS Compliant							
REACH	REG_{REAC}	REACH Compliant							

9 System Overview

The HV Series pressure sensor is a fully integrated pressure acquisition system in a sensor module. The acquisition system includes anti-alias filters, data acquisition, 50/60Hz notch filter, sensor compensation, bandwidth limiting and I/O functions. Refer to the figure below for the HV Series block diagram.
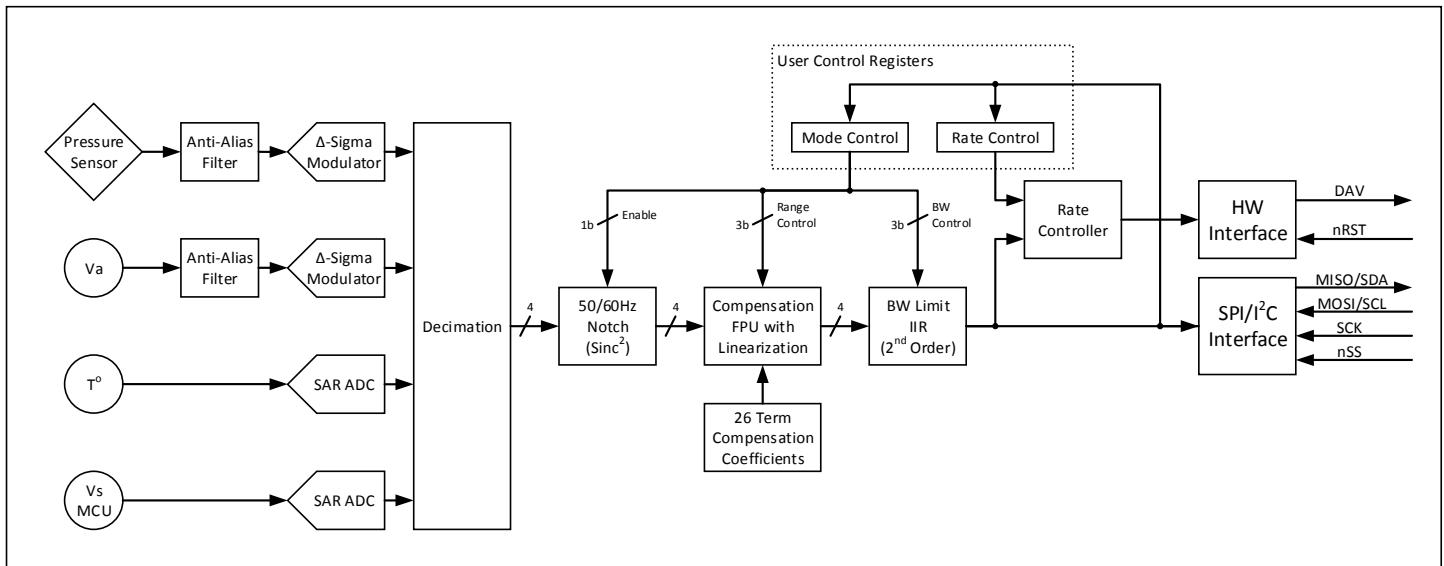
There are also two user controlled registers that tune the sensor to the specific user requirements. The first register is the Mode Control register that determines the output pressure range, the corner frequency of the bandwidth limiting filter and enables or disables the 50/60Hz notch filter.

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 111 Hz. This is generally much faster than the requirements of an HVAC transmitter so the Rate Control register will throttle down the rate at which the Data Available pin (DAV) is asserted. 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.
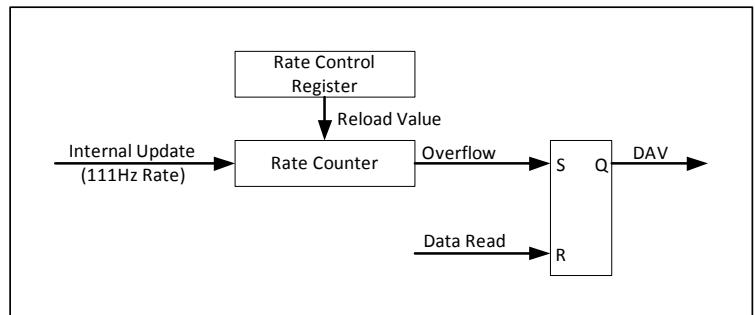
10 Interface

10.1 Reset

Reset timing is shown in the diagram below.

The communications method (SPI or I^{2}C) 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.


Reset Timing Diagram
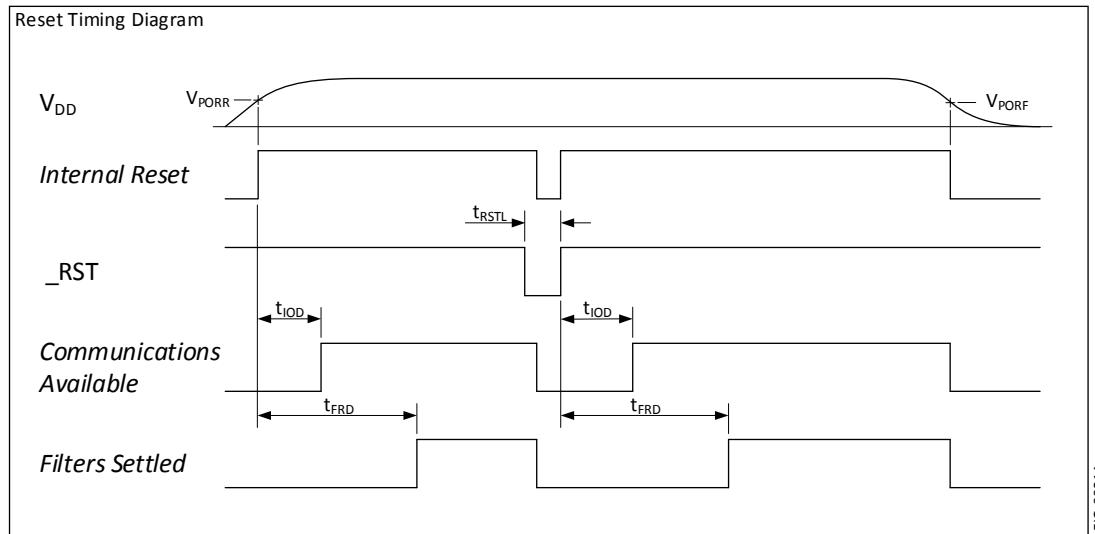
10.2 Communication Interface Selection

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 I^{2}C interface will be selected. Grounding the nSS pin is an acceptable method for selecting the I^{2}C interface.

10.3 SPI Interface

The SPI interface uses a 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.

SPI Timing Diagram
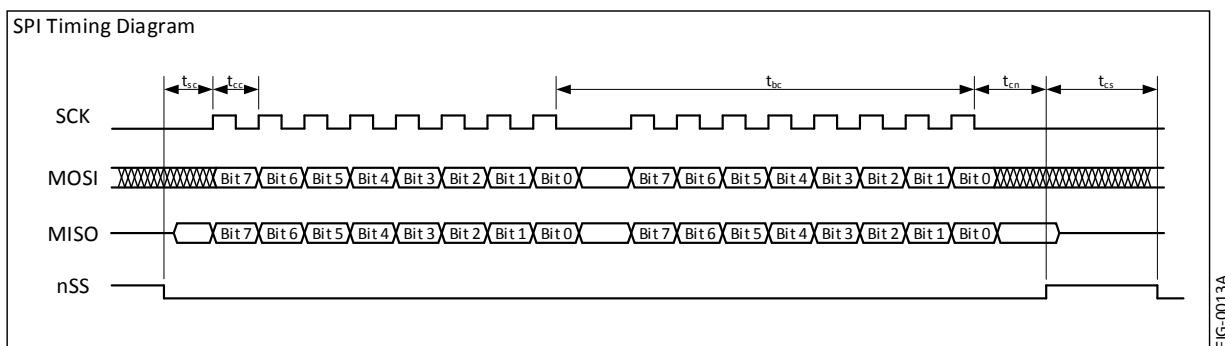
The data communications has been reduced to a simple 16 bit transfer model for reading the pressure output. Each communication cycle consists of master sending the Mode and Rate data to be placed into the sensor Mode Register and Rate Registers respectively. Simultaneously, the sensor sends the pressure data for the master to receive. Refer to the figure below for the data communication model of the HV Series 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.
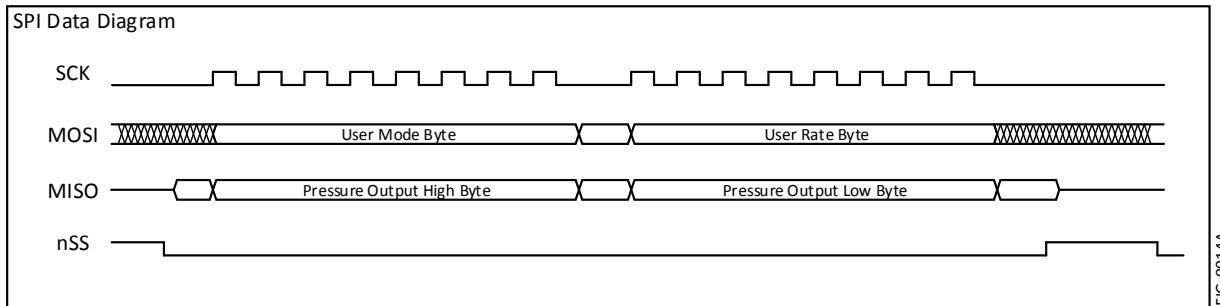
10.4 I²C Interface

The HV Series is compatible with the I²C protocol. For detailed information regarding the I²C protocol, please refer to the Philips I²C Bus Specification, Version 2.

10.4.1   I²C Address

| I2C Address Selection Table		
R1 (kΩ)	R2 (kΩ)	Address
100	5.6	0x37
100	15	0x36
100	30	0x35
100	56	0x34
100	100	0x33
56	100	0x32
30	100	0x31
15	100	0x30
5.6	100	0x29
0	NoPop	0x28

The I²C address is set to 0x28 by grounding the SCK line. Other I²C 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 I²C address are shown in the table to the left.

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

10.4.2   I²C 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 I²C is similar to that of SPI however, since I²C 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 HV Series sensors.

HV Series
Differential Low Pressure Sensors
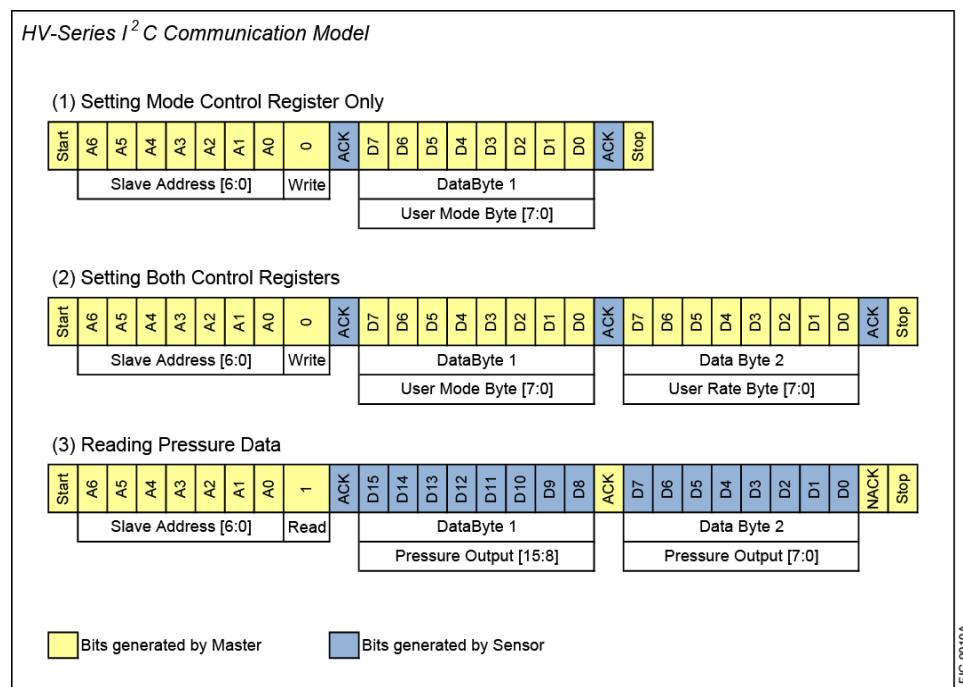
10.4.3 I²C Clock Stretching

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.
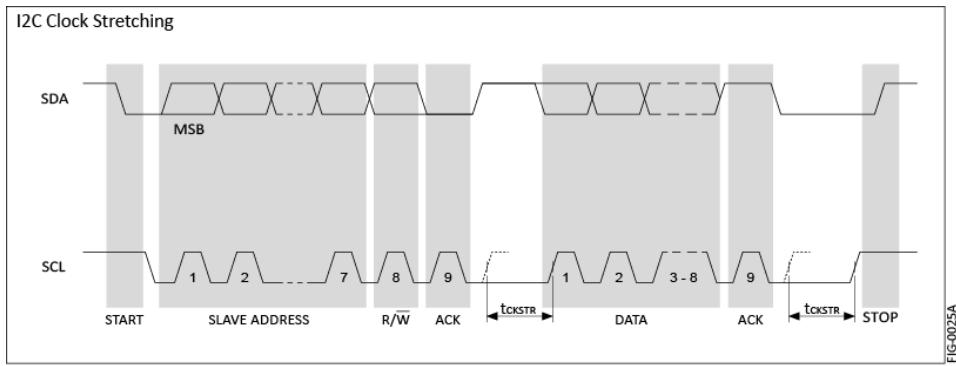
10.4.4 I²C Bus Compatibility

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	1-2	2 byte, Signed Int	See Section 10.7	See Section 10.7
Temperature	3-4	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	5-10	6 byte, ASCII, null terminated	Right reading ASCII with null termination	48H,56H,32H,31H,30H,00H = HV210
Serial Number	11-14	4 byte, Hex	Unique 4 byte serial for each part	2FD627A4H
Software Number	15-20	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 I²C Extended Data Read

Reading the extended data via the I²C interface is similar to using the SPI interface where the master can simply continue to 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

Default Value: 0xF6

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

Bits 0-2 control the output pressure range.

Bit 3 is the I/O Watchdog Enable bit. When set, the I/O watchdog is enabled. When enabled, the I/O watchdog will monitor the I/O activity. If I/O activity is not detected for the I/O Watchdog timeout time, the pressure sensor will reset itself. The I/O watchdog timeout time is determined by the currently active bandwidth setting. This is whether the bandwidth is selected directly or by using the Auto Select bandwidth.

Bits 4-6 control the BW Limit Filter. Note: When the BW bits are all set, the BW is automatically selected according to the selected pressure range (see table to right).

Bit 7 is the Notch Filter Enable bit. When enabled, the 50/60Hz notch filter is active.

Please note the available pressure ranges for the different sensor models are indicated in the table. For values where the pressure range is not available for the given sensor (high or low), the table is highlighted in light orange and indicates the given full scale value to use for pressure conversion. It is possible to use these values however, since they do effect the set sensor bandwidth when the Auto Select bandwidth value (BW Limit Select = 111b) is used.

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

- Pressure Range Select
- I/O Watchdog Enable
- BW Limit Select
- Notch Enable

Mode Register (Detail)

b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0

Pressure Range Select (by Model)

			HV120	HV110	HV210	Auto Select BW Limit
0	0	0	2.5 inH_2O	0.5 inH_2O	0.1 inH_2O	0.1 Hz
0	0	1	2.5 inH_2O	0.5 inH_2O	0.25 inH_2O	0.25 Hz
0	1	0	2.5 inH_2O	0.5 inH_2O	0.5 inH_2O	0.5 Hz
0	1	1	2.5 inH_2O	1.0 inH_2O	1.0 inH_2O	1.0 Hz
1	0	0	2.5 inH_2O	2.5 inH_2O	2.5 inH_2O	2.5 Hz
1	0	1	5.0 inH_2O	5.0 inH_2O	5.0 inH_2O	5.0 Hz
1	1	0	10.0 inH_2O	10.0 inH_2O	10.0 inH_2O	10.0 Hz
1	1	1	20.0 inH_2O	10.0 inH_2O	10.0 inH_2O	10.0 Hz

I/O Watchdog Enable

0	Disabled
1	Enabled

			BW Limit Select	I/O Watchdog Timeout
0	0	0	0.1 Hz	10 sec
0	0	1	0.25 Hz	4 sec
0	1	0	0.5 Hz	2 sec
0	1	1	1.0 Hz	1 sec
1	0	0	2.5 Hz	400 ms
1	0	1	5.0 Hz	200 ms
1	1	0	10.0 Hz	100 ms
1	1	1	Auto Select	

Notch Enable

0	Notch Filter Disabled
1	Notch Filter Enabled

FIG-0023B

10.6.2 Rate Control Register

<u>Default Value: 0x00</u>

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) since the general HVAC requirement is less than the internal 111Hz update rate.

The function of this register is that it is the reload value of a data rate counter. The value of the Rate Control Register is the divisor of the 111 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 bandwidth limit. The auto rate value is 11.1 times the corner frequency of the bandwidth limit in all auto selected rates.

Note: Start-up time for the sensor is approximately 250ms 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	111 Hz
0	0	0	0	0	0	1	0	55.5 Hz
0	0	0	0	0	0	1	1	37 Hz
1	1	1	1	1	1	1	0	0.437 Hz
1	1	1	1	1	1	1	1	0.435 Hz

Selected BW Limit	Auto Select Rate
0.1 Hz	1.11 Hz
0.25 Hz	2.77 Hz
0.5 Hz	5.55 Hz
1.0 Hz	11.1 Hz
2.5 Hz	27.7 Hz
5.0 Hz	55.5 Hz
10.0 Hz	111 Hz

FIG-0024A

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 1.0 inH_2O, then the output pressure is 0.124 inH_2O. Conversely, for a -3,647 count with the selected pressure range of 1.0 inH_2O, the computed output pressure is -0.124 inH_2O. Refer to Example 1 (below) for the specific example computation.

$$Eq\ 1: P_{inH_2O} = \frac{Out_{DIGITAL}}{90\% * 2^{15}} * Range_{SELECTED}$$

$$Example\ 1: P_{inH_2O} = \frac{3,647}{90\% * 2^{15}} * 1\ inH_2O = 0.124\ inH_2O$$

11 Mechanical and Manufacturing

11.1 Package Dimensions

SM02 Package Dimensions

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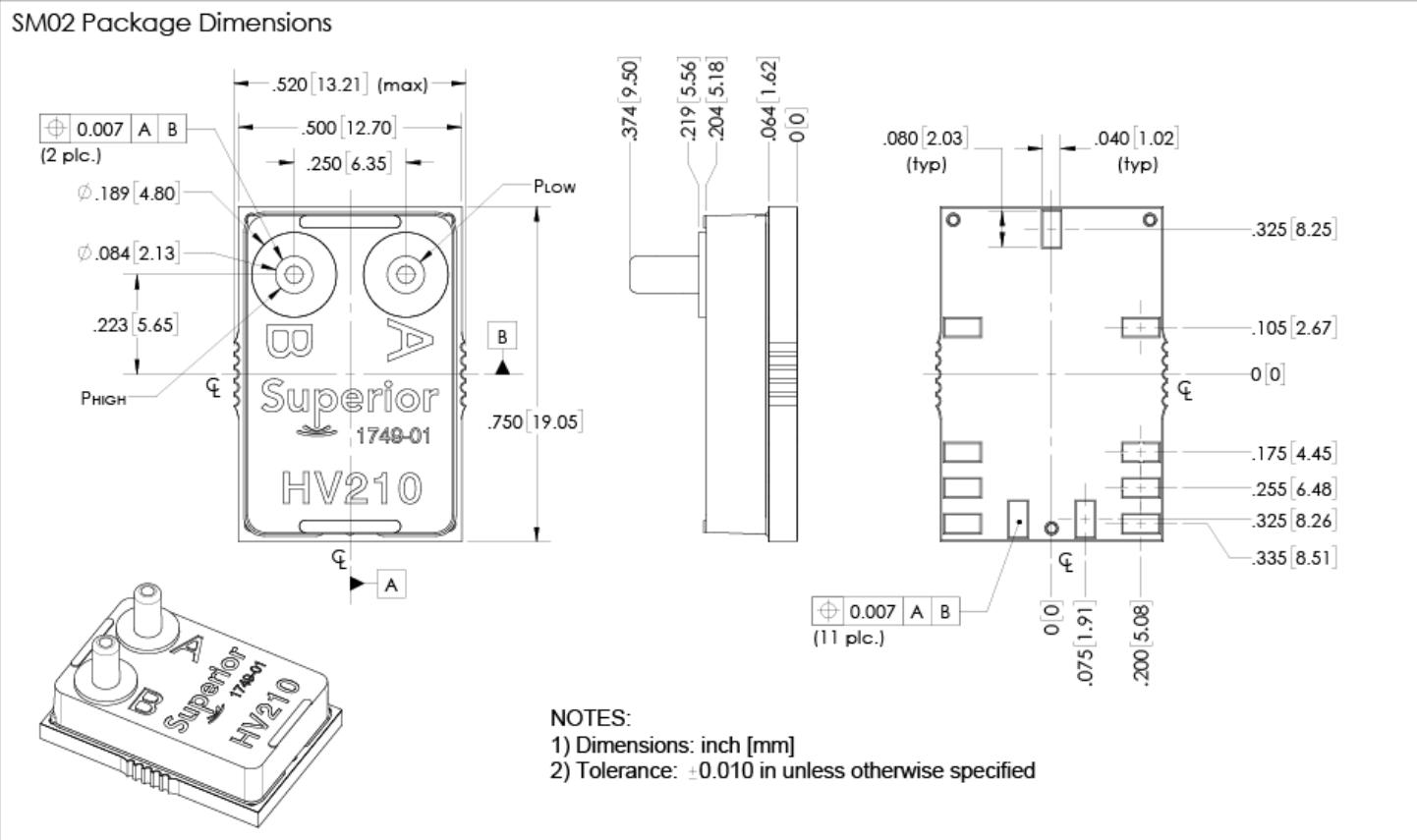
11.2 Suggested Pad Layout

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.


SM02 Suggested Pad Layout

Suggested Pad Layout
(Top View)
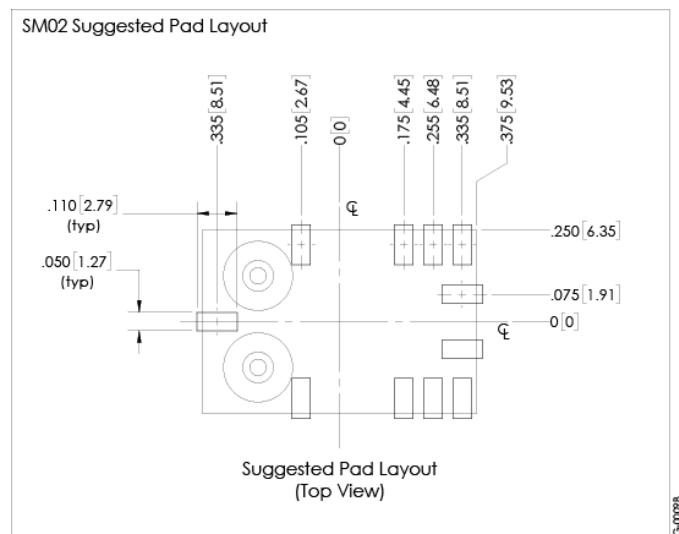
11.3 Pinout

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	

SM02 Package Pinout — Pin Numbers (Top View)
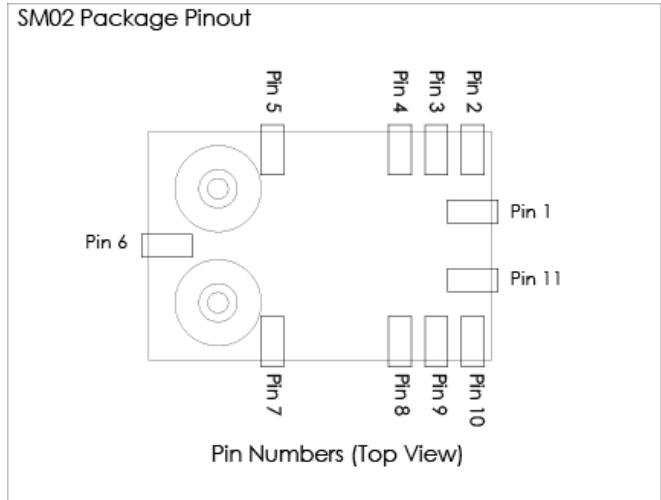
11.4 Reflow Soldering and Handling Conditions

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
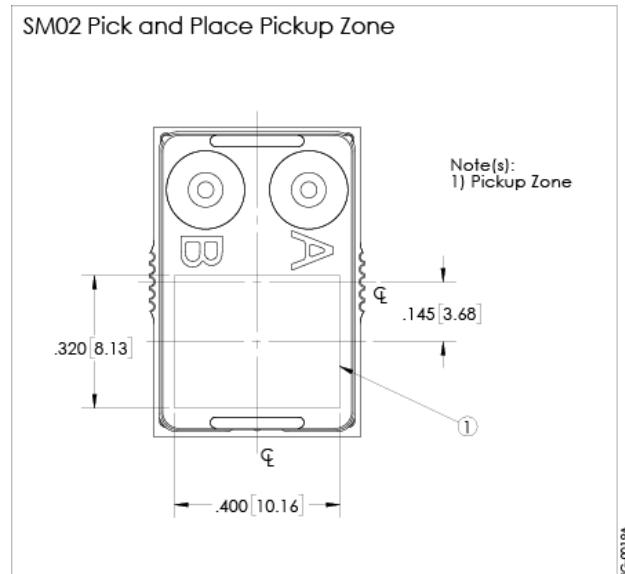
SM02 Pick and Place Pickup Zone
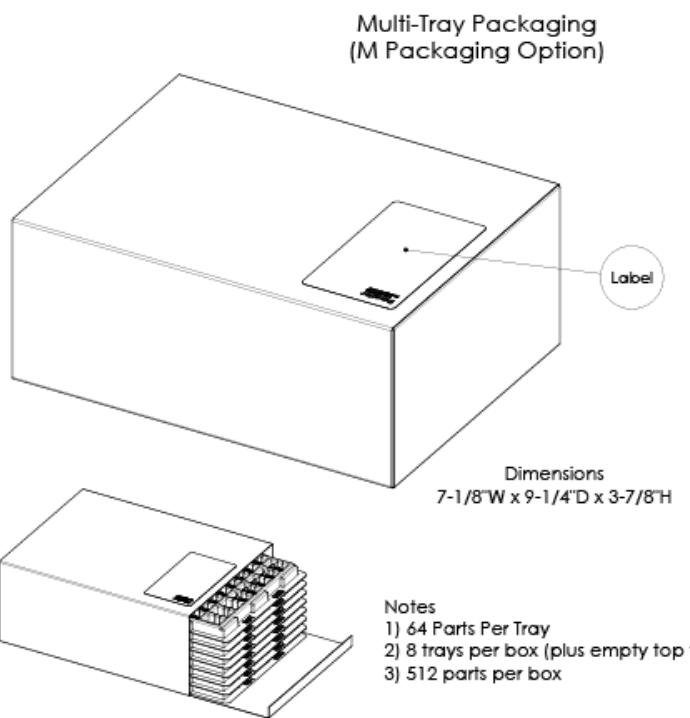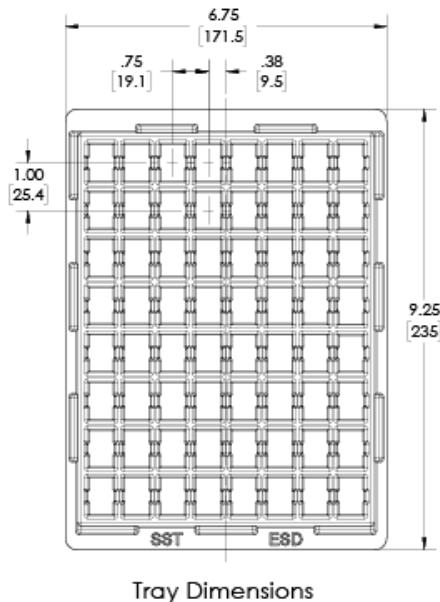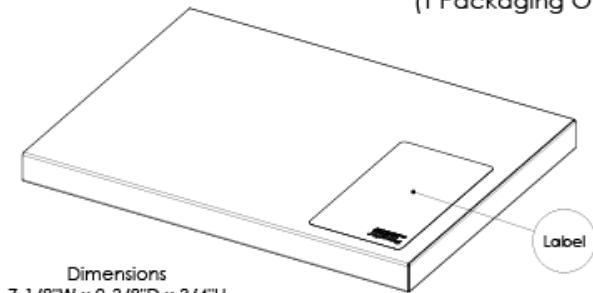
HV Series
Differential Low Pressure Sensors

11.6.2   Tape and Reel

SM02 Tape and Reel Detail

SECTION A-A

DETAIL B

DETAIL C

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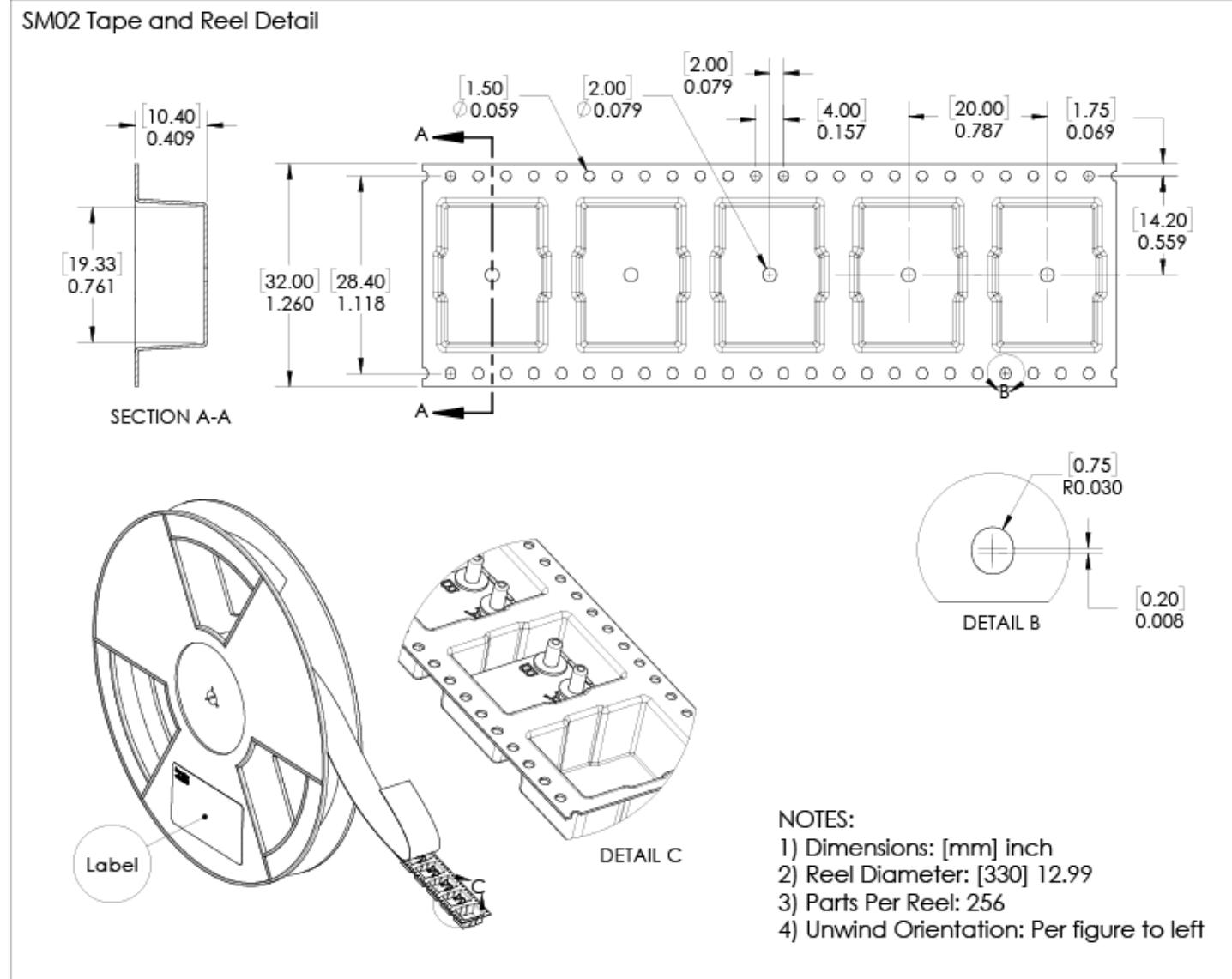
11.7 Part Identification

SM02 Part Marking
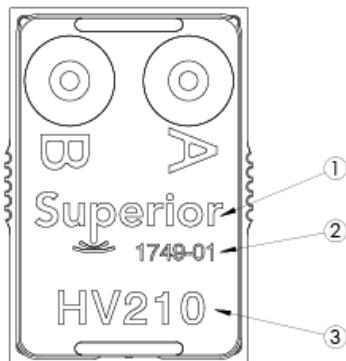
NOTES:
1) SST Logo
2) Lot Number
   Format: YYWW-NN
   Where:
   YY = Last two digits of year
   WW = Week number
   NN = Lot number in given week
3) Part Number

12 Ordering Information

Part Number	Part Package	Packaging	Packaging Qty	Order Number
HV120-SM02	SM02	Tape and Reel Multi-Tray Single Tray Cut Tape	256 512 64 1-63	HV120-SM02-R HV120-SM02-M HV120-SM02-T HV120-SM02-C
HV110-SM02	SM02	Tape and Reel Multi-Tray Single Tray Cut Tape	256 512 64 1-63	HV110-SM02-R HV110-SM02-M HV110-SM02-T HV110-SM02-C
HV210-SM02	SM02	Tape and Reel Multi-Tray Single Tray Cut Tape	256 512 64 1-63	HV210-SM02-R HV210-SM02-M HV210-SM02-T HV210-SM02-C

13 Packaging Labeling

Packaging labels are provided with barcode Code 128 symbology. The provided fields are Company Name, Part Number, Packaging ID and Quantity. 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.

Superior SENSOR TECHNOLOGY

PART NUMBER
HV210-SM02-M

PACKAGING ID
0003FEH

QUANTITY
512

14 Revisions

Rev	Change Description(s)	Date	By
A	Initial Release	3/25/18	T.S.
B	1) Revised web address from SuperiorSensorTechnology.com to SuperiorSensors.com 2) Revise ordering information to include single tray and cut tape 3) Add multiple I2C address feature 4) Add extended data (temperature, model, serial number and software number) availability 5) Add I/O Watchdog feature 6) Revise TEB (all parts) 7) Revise Position Sensitivity (all parts) 8) Revise multi-tray box dimensions 9) Revise packaging label for more reliable barcode reading 10) Correct port pressure assignments in FIG-0026 11) Correct various typo's	1/17/2019	T.S.
C	1) Correction of contact address and typo's. No material change	3/25/2019	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.

Superior Sensor Technology reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

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