Datasheet

HPSD 8200 Miniature Pressure Transducer

General description

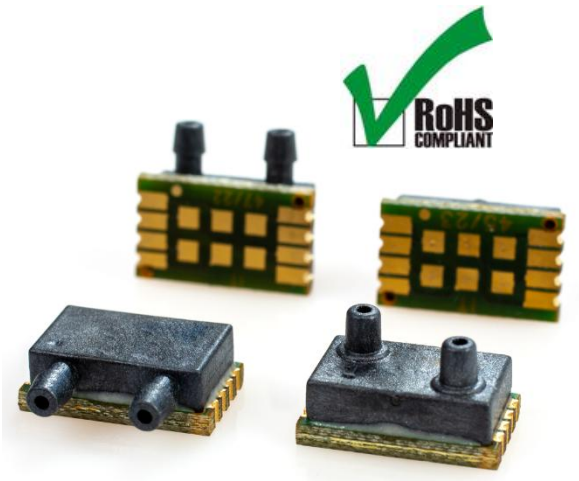
Pressure transducer HPSD 8200 is a pressure and temperature sensing device specially developed for ultra-low pressure ranges and demanding space constrictions. High performance and accuracy enable the use of this transducer in many applications, including differential pressure measurements. Standard 2nd order temperature and pressure compensation provides 0,5% FS total error over the 0°C to 70°C temperature range. Single power supply (3V – 5,5V), customized compensated pressure and temperature ranges, standard digital I²C, SPI, one-wire interfaces, or analog voltage output provide OEM users maximum freedom for any type of application with dry air or non-corrosive gases or liquids. Family HPSD 8200 provides easy integration using a small SMD package with footprint pads on short edges, leaving enough room for easier routing for the end application. SMD housing is reflow mountable with fast stabilization after the soldering process. Pressure ports with their flexibility in different options can accept standard pneumatic tubes or can be customized for integration into end customer housings with straight pressure ports. Different pressure ranges are available for this group, starting from 1 mbar up to 10 bar.

Applications

- Sleep Apnea, CPAP
- Ventilators / Respirators
- HVAC
- Medical instrumentation
- Air/gas flow monitoring
- Sport equipment
- Process control
- Pneumatics control
- Leak detection
- Consumer devices

Features

- Supply voltage from 3 to 5,5 V
- Pressure ranges from 0-1 mbar to 0-10 bar
- Ratiometric voltage output (10% to 90% of supply voltage)
- Digital I²C and SPI output (pressure + temperature)
- Standard temperature compensated range (0-70 °C), other possible
- Operating temperature range -40 ... +85 °C
- Total accuracy down to 0,5% FS over 0 to 70°C, all effects included (maximum)
- Total temperature accuracy typ. 0,5 °C (within compensated temp. range).
- Outstanding offset stability
- Small footprint: 8 mm x13 mm
- Low profile: only 9 mm in height



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Available types overview

T_{AMB}=25°C, Vcc = from 3 to 5,5 V (unless otherwise stated)

Ultra low pressure range

Pressure range	1 mbar (100 Pa)	2,5 mbar (250 Pa)	5 mbar (500 Pa)	10 mbar (1000 Pa)
ID group	HPSD 8200-001M	HPSD 8200-2P5M	HPSD 8200-005M	HPSD 8200-010M
Pressure types	differential/ bidirectional differential	differential/ bidirectional differential	differential/ bidirectional differential	differential/ bidirectional differential
V_{OUT}	10 to 90% of V_{CC}			
Temperature ranges	Operating: -25 to 85°C, Compensated: 0 to 70 °C, Storage: -40 to 125 °C			
Over pressure [1]	100 mbar	100 mbar	150 mbar	150 mbar
Burst pressure [2]	150 mbar	150 mbar	200 mbar	200 mbar

Low pressure range

Pressure range	20 mbar (0,3 psi)	50 mbar (0,8 psi)	100 mbar (1,5 psi)	350 mbar (5 psi)
ID group	HPSD 8200-020M	HPSD 8200-050M	HPSD 8200-100M	HPSD 8200-350M
Pressure types	differential/ bidirectional differential	differential/ bidirectional differential	differential/ bidirectional differential	differential/ bidirectional differential
V_{OUT}	10 to 90% of V_{CC}			
Temperature ranges	Operating: -25 to 85°C, Compensated: 0 to 70°C, Storage: -40 to 125°C			
Over pressure [1]	200 mbar	500 mbar	1000 mbar	1 bar
Burst pressure [2]	300 mbar	750 mbar	1500 mbar	1,7 bar

High pressure range

Pressure range	1 bar (15 psi)	2 bar (30 psi)	5 bar (70 psi)	10 bar (150 psi)
ID group	HPSD 8200-001B	HPSD 8200-002B	HPSD 8200-005B	HPSD 8200-010B
Pressure types	differential/ bidirectional differential absolute	differential/ bidirectional differential absolute	differential/ bidirectional differential absolute	differential/ bidirectional differential absolute
V_{OUT}	10 to 90% of V_{CC}			
Temperature ranges	Operating: -25 to 85°C, Compensated: 0 to 70°C, Storage: -40 to 125°C			
Over pressure [1]	3 bar	6 bar	15 bar	25 bar
Burst pressure [2]	5 bar	10 bar	25 bar	25 bar

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Performance characteristics

T_{AMB}=25°C (unless otherwise noted)

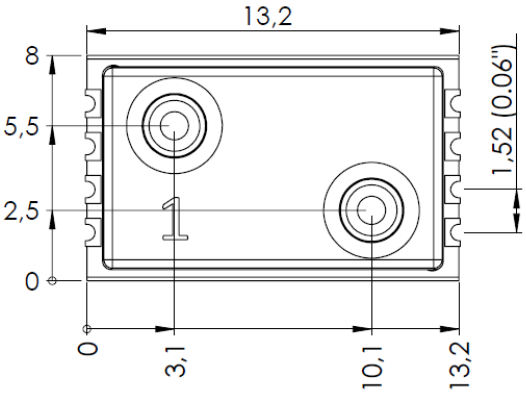
Parameter	Symbol	Min.	Type	Max.	Unit
Power supply					
Supply voltage	V_{CC}	3		5,5	V
Current consumption	I_{CC}		4,6	5,5	mA
Analog output (pressure) [3]					
Offset voltage [4]	V_O		10		% V_{CC}
Full scale output (FSO) [5]	V_{FSO}		90		% V_{CC}
Full scale span (FSS) [6]	V_{FSS}		80		% V_{CC}
Offset voltage (bidirectional devices)	V_O		50		% V_{CC}
Digital output (pressure), 15 bits [3]					
Offset voltage [4]	V_O		3277		counts
Full scale output (FSO) [5]	V_{FSO}		29491		counts
Full scale span (FSS) [6]	V_{FSS}		26214		counts
Offset voltage (bidirectional devices)	V_O		16384		counts
Digital output (temperature), 15 bits [7]					
Temperature output @ 0°C	T_0		8192		counts
Temperature output @ 70°C	T_s		24576		counts
Accuracy (pressure) @ 25°C [8]					
Ultra low pressure (1 to 5 mbar)	E_a		±1	±2,5	% FSO
Low pressure (10 to 100 mbar)	E_a		±0,5	±1	% FSO
Standard pressure (all other)	E_a		±0,1	±0,5	% FSO
Total accuracy (pressure) @ 0 to 70°C [9]					
Ultra low pressure (1 to 5 mbar)	E_{ta}		±1,5	±4	% FSO
Low pressure (10 to 100 mbar)	E_{ta}		±0,75	±1,5	% FSO
Standard pressure (all other)	E_{ta}		±0,25	±0,75	% FSO
Long-term drift (pressure) [10]					
Ultra low pressure (1 to 5 mbar)	E_d		±0,5		% FSO/year
Low pressure (10 to 100 mbar)	E_d		±0,1		% FSO/year
Standard pressure (all other)	E_d		±0,05		% FSO/year
Resolution					
A/D converter	D_i			16	bit
D/A converter	D_O		16		bit
Response time [11]	E_{rt}		1,3		ms
Repeatability time [12]	E_r		±0,05		% FSO
Nonlinearity & pressure hysteresis (BFSL) [13]	E_l		±0,1	±0,3	% FSO
Load resistance	R_L	2		∞	kΩ
Media compatibility		See spec. note [14], [15]			
Weight	W		0,6		g

Specification notes

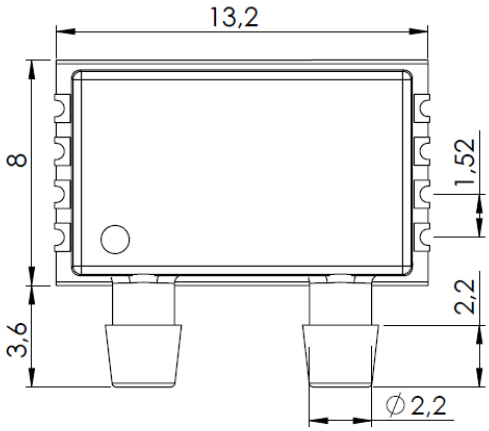
1) Over pressure is the maximum pressure that may be applied without causing damage to the sensing element.
2) Burst pressure is the maximum pressure that may be applied without causing leakage damage to the sensing element.
3) Analog output signal is ratiometric to the power supply V_S, digital signal is not ratiometric to the power supply.
4) Offset voltage is the voltage output at zero pressure.
5) Full scale output is the voltage output at full pressure range.
6) Full scale span is the algebraic difference between the output at full scale pressure range and offset.
7) Digital output signal (temperature) is not ratiometric to the power supply V_S. Temperature data are read directly on the sensing element.
8) Accuracy includes all effects (offset, span, nonlinearity, pressure hysteresis, and repeatability) at room temperature and represents a maximum deviation of the transducer signal from the ideal characteristic.
9) Total accuracy accounts for all contributing factors, offset, span, nonlinearity, pressure hysteresis, and repeatability, as well as temperature effects on offset and span. It represents the maximum deviation of the transducer signal from the ideal characteristic within the compensated temperature range of 0 to 70°C.
10) The gradual change in the sensor's offset and span over time, caused by factors such as aging, material stress, and environmental conditions.
11) Response time depends on preset A/D resolution, sample rate, and filter setting.
12) Repeatability is defined as the typical deviation of the output signal after 10 pressure cycles.
13) Nonlinearity is defined as the BFSL (best fit straight line) across the entire pressure range.
14) Media compatibility on pressure port P1: noncorrosive gases to silicon, RTV, ceramics Al_2O_3, Pyrex, LCP plastics.
15) Media compatibility on pressure port P2: noncorrosive gases to silicon, Pyrex, RTV, ceramics Al_2O_3, epoxy, FR4.
16) Position sensitivity: typ. ±0,25%FS for 1mbar devices.

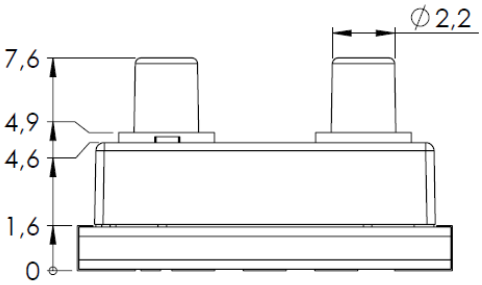
Outline dimensions

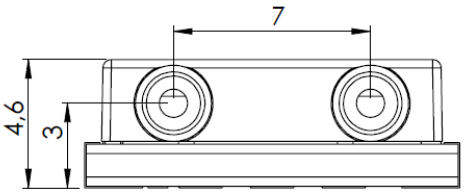
Straight vertical (manifold) pressure port
(HPSD 8200-xxxx-x-**S**-x):

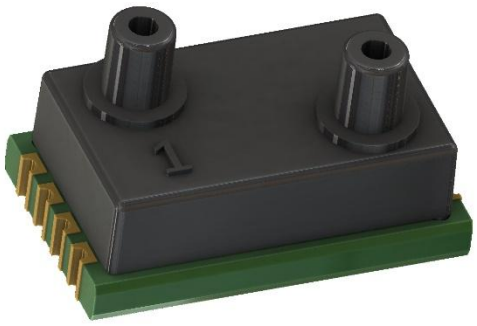


Horizontal pressure port
(HPSD 8200-xxxx-x-**E**-x):









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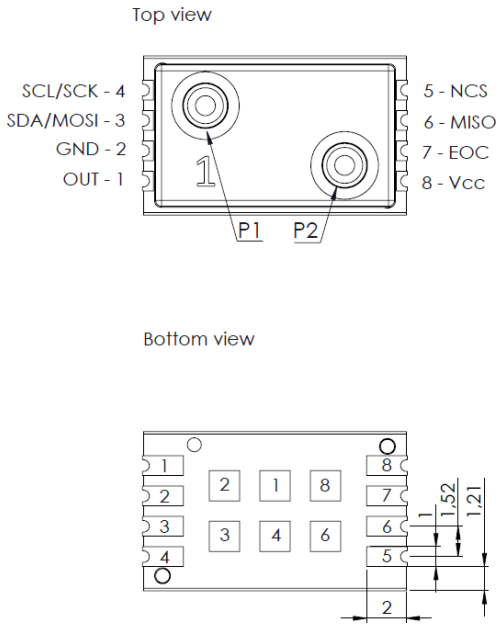
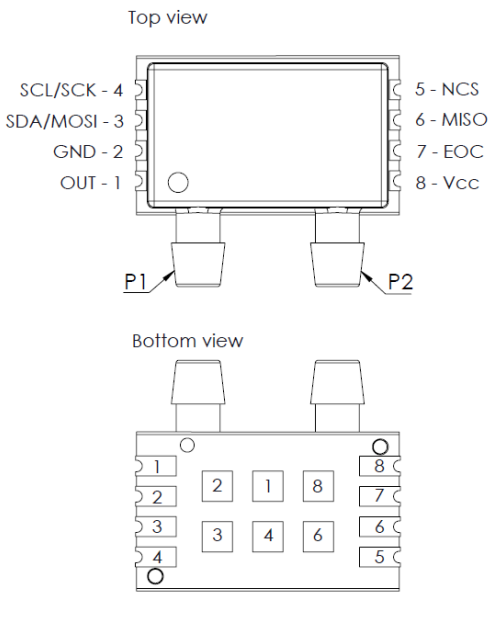
Pinout

Vertical pressure port
(HPSD 8200-xxxx-x-**S**-x):



Horizontal pressure port
(HPSD 8200-xxxx-x-**E**-x):



Pin assignment with alternate functions		
Pin	**Name**	**Function**
1	OUT	Ratiometric analog voltage output, 1-wire interface I/O, Digital PWM output, Digital FM output, Digital ALARM output
2	GND	Ground
3	SDA/MOSI	I^2C data I/O (SDA) or SPI data in (MOSI)
4	SCL/SCK	I^2C clock (SCL) or SPI clock (SCK)
5	NCS	SPI chip select
6	MISO	SPI data out
7	EOC	End of conversion or status output
8	V_{CC}	Positive power supply

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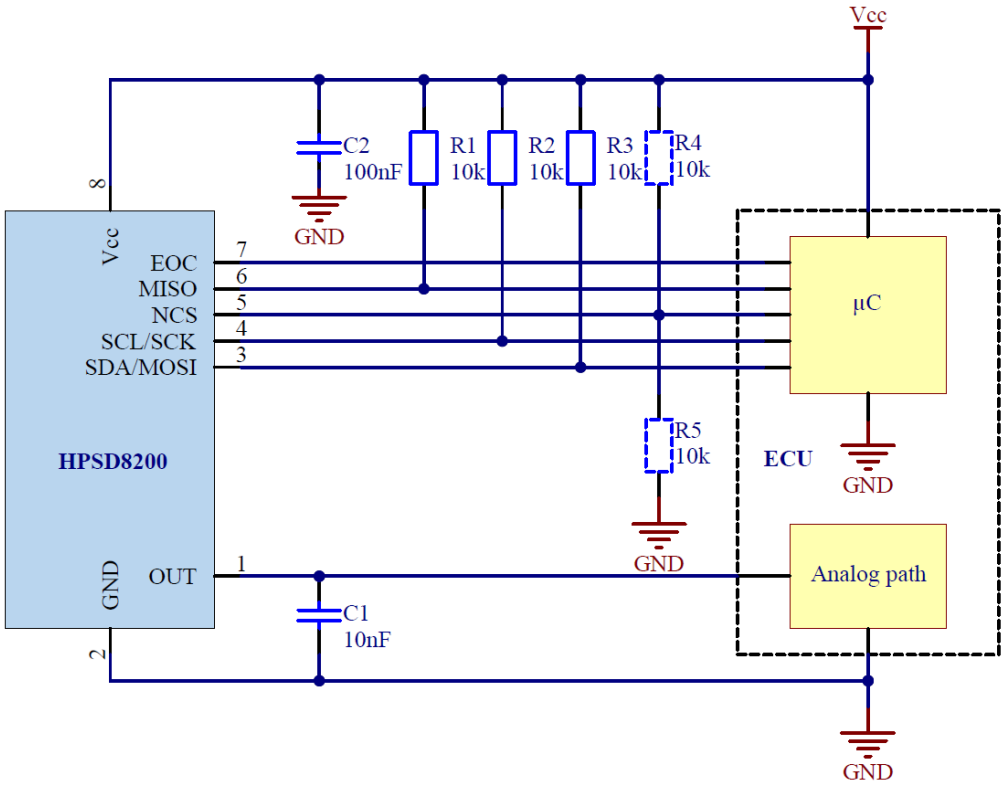
Typical Operating Circuit



Notes:

- The load capacitance (C1) at pin OUT is 22 nF max.
- The external decoupling capacitor 100nF (C2) must be connected between pins V_{CC} and GND.
- Signal lines of I^2C and SPI must be connected to the external pull-up resistors (R1, R2, R3 ≥2 kΩ).
- The communication protocols I^2C and SPI are explained in Application Note 005.
- When communication »I2C with two slave addresses« is chosen (HPSD 8200-xxxx-x-x-T), ensure that a pull-up (R4) or pull-down resistor (R5) is connected to the NCS pin. If NCS is low, the primary slave address (0x6C) is active; if the NCS is high, a secondary address (0x6E) is active.
- The communication protocols I^2C and SPI are explained in Application Note 005.

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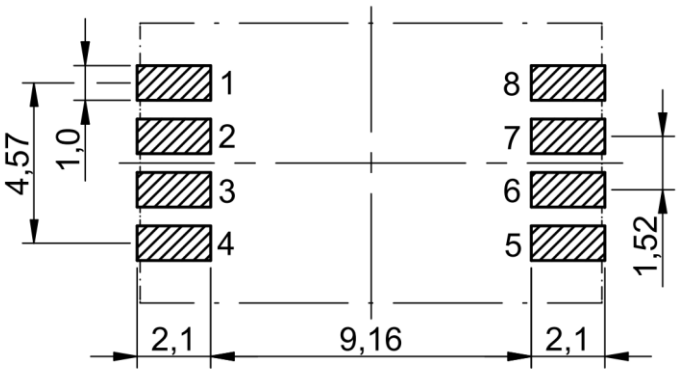
Recommended soldering footprint



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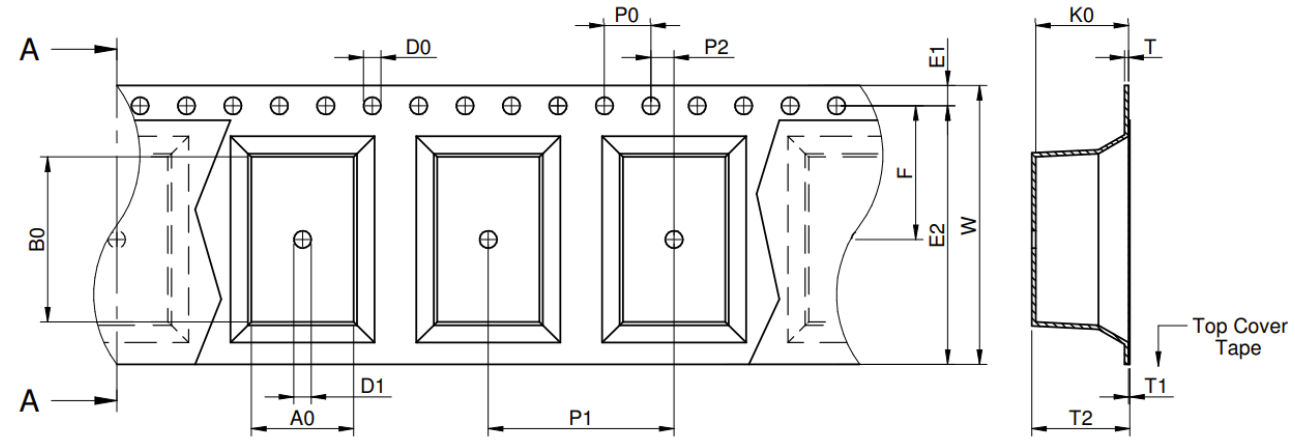
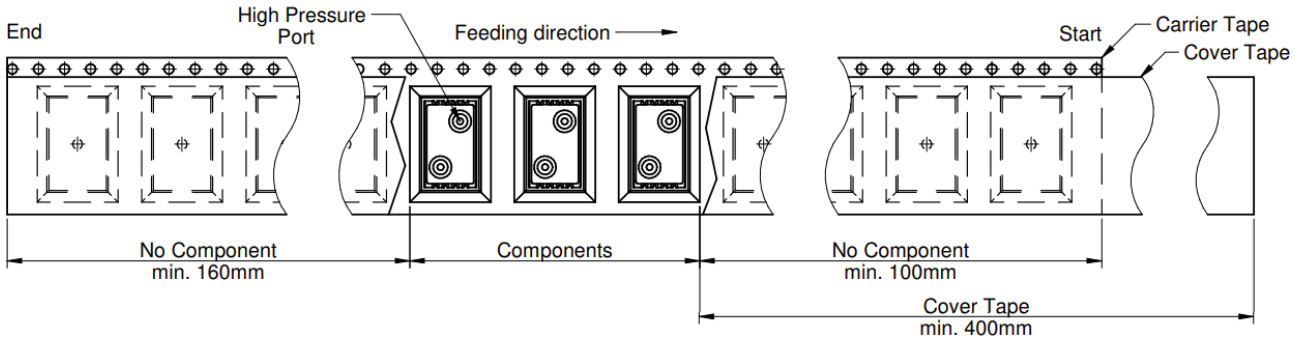
Packaging specification - Tape for vertical pressure port





	A0 (mm)	B0 (mm)	W (mm)	T (mm)	T1 (mm)	T2 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	D0 (mm)	D1 (mm)	E1 (mm)	E2 (mm)	F (mm)
Tol.	typ.	typ.	+0,3/ -0,1	ref.	ref.	typ.	typ.	±0,1	±0,1	±0,1	+0,1/ -0,0	min.	±0,1	min.	±0,1
Value	8,80	14,20	24,00	0,35	0,10	8,22	8,00	4,00	16,00	2,00	1,50	1,50	1,75	22,25	11,50

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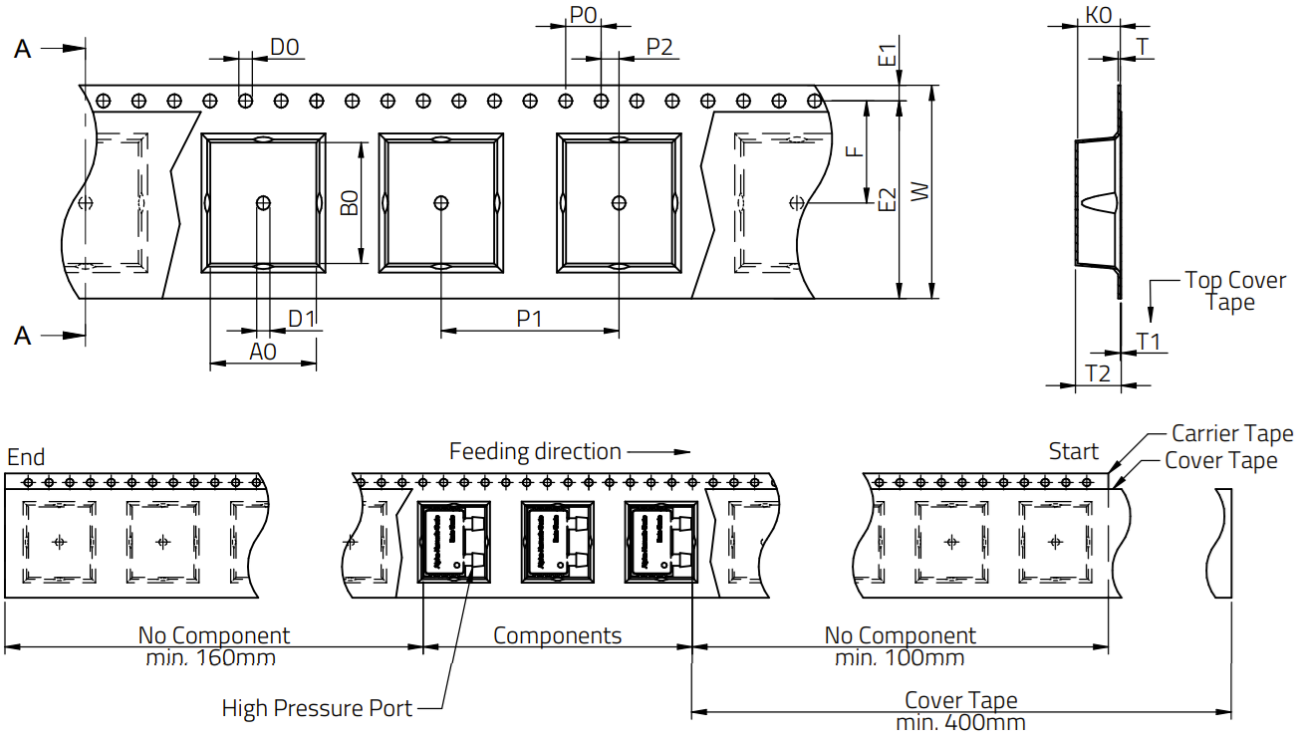
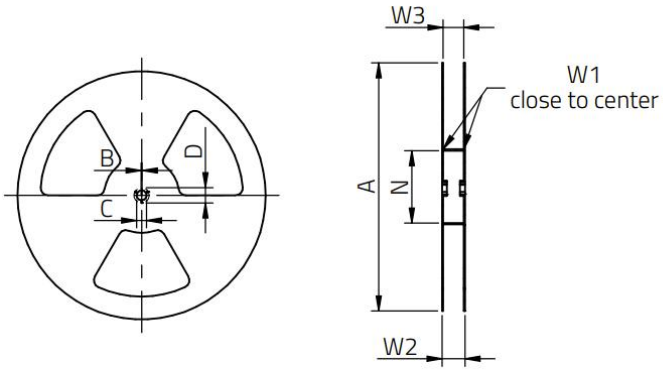
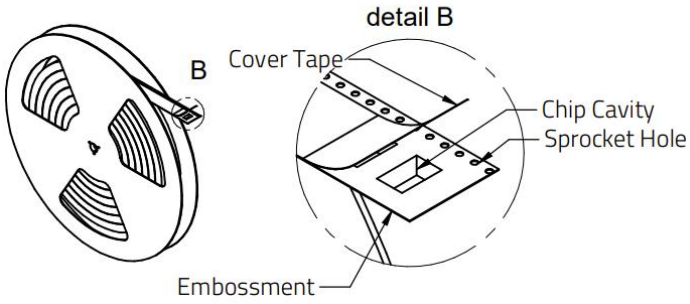
Packaging specification - Tape for horizontal pressure port



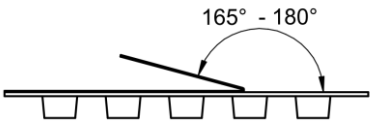
	A0 (mm)	B0 (mm)	W (mm)	T (mm)	T1 (mm)	T2 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	D0 (mm)	D1 (mm)	E1 (mm)	E2 (mm)	F (mm)
Tol.	typ.	typ.	+0,3/ -0,1	ref.	ref.	typ.	typ.	±0,1	±0,1	±0,1	+0,1/ -0,0	min.	±0,1	min.	±0,1
Value	11,90	13,60	24,00	0,40	0,10	5,20	4,80	4,00	20,00	2,00	1,50	1,50	1,75	22,25	11,50

Packaging specification - Reel





	A (mm)	B (mm)	C (mm)	D (mm)	N (mm)	W1 (mm)	W2 (mm)	W3 (mm)	W3 (mm)	Quantity (pcs/reel)
Tol.	±2,0	min.	min.	min.	min.	+2,0	max.	min.	max.	nom.
Value	330,00	1,50	12,80	20,20	60,00	24,40	30,40	23,90	27,40	500



Pull-off force: 0,1 - 1,3 N

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Ordering guide

Transducer type	Pressure range	Pressure type/ direction	Package type	Communication
HPSD 8200	001M	U	S	R
	2P5M	B	E	T
	005M	A		Y
	010M			
	020M			
	050M			
	100M			
	350M			
	001B			
	002B			
	005B			
	010B			

Pressure range	
001M	1 mbar
2P5M	2,5 mbar
005M	5 mbar
010M	10 mbar
020M	20 mbar
050M	50 mbar
100M	100 mbar
350M	350 mbar
001B	1 bar
002B	2 bar
005B	5 bar
010B	10 bar

Pressure type/direction	
U	Unidirectional differential (positive press. on P1)
B	Bidirectional differential (positive press. on P1)
A	Absolute (pressure on P1)

Communication	
R	I^2C
T	I^2C with two slave addresses
Y	SPI

Package type	
S	Straight vertical (manifold)
E	Horizontal (barbed)

Other configurations are possible on special request!

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