te.com



HCLA SERIES – MINIATURE COMPENSATED LOW PRESSURE SENSORS

The HCLA pressure sensors perform precision digital signal conditioning and provide analog and digital output at the same time. The sensors are calibrated, temperature compensated and linearized and use a special compensation technique to achieve very high offset stability and virtually no position sensitivity. They are intended to be used with dry and non-corrosive gases. Miniature SMT and SIL housings allow for space-saving PCB-mounting and maximum OEM design flexibility. All HCLA pressure sensors can be modified according to customer specific requirements.

Features

- Pressure ranges from 0 to 2.5 up to 0 to 75 mbar, 0 to ±2.5 up to 0 to ±75 mbar, differential or gage
- Output: 0.25 to 4.25 V and I²C-bus (SPI optional)
- Precision ASIC conditioning
- Calibrated and temperature compensated
- Miniature SMT and SIL housings

Applications

- Medical devices
- Instrumentation
- HVAC
- Industrial controls
- Pneumatic controls
- Environmental controls

Certificates

- RoHS and REACH compliant

Media compatibility

To be used with non-corrosive, non-ionic working fluids such as clean dry air, dry gases and the like.

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Maximum ratings

Parameter		Min.	Typ.	Max.	Unit
Supply voltage V_S	HCLAxxx	4.5		5.5	V_{DC}
	(optional)	2.7		3.3	
Output current	Sink			1	mA
	Source			1	
Lead specifications	Average preheating temperature gradient			2.5	K/s
	Soak time			approx. 3	min.
	Time above 217 °C			50	s
	Time above 230 °C			40	
	Time above 250 °C			15	
	Peak temperature			260	°C
	Cooling temperature gradient			-3.5	K/s
Temperature ranges[1]	Compensated	-25		+85	°C
	Operating	-25		+85	
	Storage	-40		+125	
Humidity limits (non-condensing)		0		95	%RH

Pressure sensor characteristics

Part no.	Operating pressure	Proof pressure[1,3]	Burst pressure[2,3]	Unit	Output signal
HCLA02X5xxxB	0 to ±2.5	250	500	mbar	2.25 ± 2 V
HCLA12X5xxxB	0 to ±12.5	250	500		
HCLA0025xxxB	0 to ±25	500	750		
HCLA0050xxxB	0 to ±50	750	1200		
HCLA0075xxxB	0 to ±75	1200	2000		
HCLA02X5xxxU	0 to 2.5	250	500	mbar	0.25 to 4.25 V
HCLA12X5xxxU	0 to 12.5	250	500		
HCLA0025xxxU	0 to 25	500	750		
HCLA0050xxxU	0 to 50	750	1200		
HCLA0075xxxU	0 to 75	1200	2000		

Performance characteristics

(V_S=5.0 V_{DC}, T_A=25 °C; analog output signal is ratiometric to V_S, digital output signal is not ratiometric to V_S, pressure applied to high pressure port)

HCLA02X5xxx

Characteristics		Min.	Typ.	Max.	Unit
Non-linearity and hysteresis (BSL)[4]			±0.05	±0.25	%FSS
Thermal effects (-25 to 85°C)[5]	Offset			±1.5	%FSS
	Span			±2.0	%FSS
Response delay[6,7]			0.5		ms
A/D resolution[7]			12		bit
D/A resolution				11	bit
Current consumption (no load)[8]			5		mA
Digital performance characteristics					
Offset warm up shift[9]			±0042		Count Hex
Offset position sensitivity (±1 g)			±0063		Count Hex
Offset long term drift (one year)			±0042		Count Hex
Analog performance characteristics					
Offset warm up shift[9]			±10		mV
Offset position sensitivity (±1 g)			±15		mV
Offset long term drift (one year)			±10		mV

HCLA02X5xxxB

Operating pressure range		-2.5		+2.5	mbar
Digital performance characteristics					
Zero pressure offset		370A	3999	3C28	Count Hex
Full scale span FSS[10]		63D6	6666	68F5	Count Hex
Output	@ +2.5 mbar		6CCC		Count Hex
	@ -2.5 mbar		0666		Count Hex
Analog performance characteristics					
Zero pressure offset		2.15	2.25	2.35	V
Full scale span FSS[10]		3.90	4.00	4.10	V
Output	@ +2.5 mbar		4.25		V
	@ -2.5 mbar		0.25		V

HCLA02X5xxxU

Operating pressure range	0		+2.5	mbar
Digital performance characteristics				
Zero pressure offset	03D7	0666	08F6	Count Hex
Full scale span FSS[10]	63D6	6666	68F5	Count Hex
Full scale output		6CCC		Count Hex
Analog performance characteristics				
Zero pressure offset	0.15	0.25	0.35	V
Full scale span FSS[10]	3.90	4.00	4.10	V
Full scale output		4.25		V

Performance characteristics

(V_S=5.0 V_{DC}; T_A=25 °C; analog output signal is ratiometric to V_S, digital output signal is not ratiometric to V_S , pressure applied to high pressure port)

HCLA12X5xxx

Characteristics		Min.	Typ.	Max.	Unit
Non-linearity and hysteresis (BSL)[4]			±0.05	±0.25	%FSS
Thermal effects -25 to 85°C[5]	Offset			±1.0	%FSS
	Span			±1.0	%FSS
Response delay[6,7]			0.5		ms
A/D resolution[7]			12		bit
D/A resolution				11	bit
Current consumption (no load)[8]			5		mA
Digital performance characteristics					
Offset warm up shift[9]			±0021		Count Hex
Offset position sensitivity (±1 g)			±0021		Count Hex
Offset long term drift (one year)			±0021		Count Hex
Analog performance characteristics					
Offset warm up shift[9]			±5		mV
Offset position sensitivity (±1 g)			±5		mV
Offset long term drift (one year)			±5		mV

HCLA12X5xxxB

Operating pressure range		-12.5		+12.5	mbar
Digital performance characteristics					
Zero pressure offset		370A	3999	3C28	Count Hex
Full scale span FSS[10]		63D6	6666	68F5	Count Hex
Output	@ +12.5 mbar		6CCC		Count Hex
	@ -12.5 mbar		0666		Count Hex
Analog performance characteristics					
Zero pressure offset		2.15	2.25	2.35	V
Full scale span FSS[10]		3.90	4.00	4.10	V
Output	@ +12.5 mbar		4.25		V
	@ -12.5 mbar		0.25		V

HCLA12X5xxxU

Operating pressure range	0		+12.5	mbar
Digital performance characteristics				
Zero pressure offset	03D7	0666	08F6	Count Hex
Full scale span FSS[10]	63D6	6666	68F5	Count Hex
Full scale output		6CCC		Count Hex
Analog performance characteristics				
Zero pressure offset	0.15	0.25	0.35	V
Full scale span FSS[10]	3.90	4.00	4.10	V
Full scale output		4.25		V

Performance characteristics

(V_S=5.0 V_{DC}; T_A=25 °C; analog output signal is ratiometric to V_S, digital output signal is not ratiometric to V_S , pressure applied to high pressure port)

HCLA0025

Characteristics		Min.	Typ.	Max.	Unit
Non-linearity and hysteresis (BSL)[4]			±0.05	±0.25	%FSS
Thermal effects -25 to 85°C[5]	Offset			±0.5	%FSS
	Span			±1.0	%FSS
Response delay[6,7]			0.5		ms
A/D resolution[7]			12		bit
D/A resolution				11	bit
Current consumption (no load)[8]			5		mA
Digital performance characteristics					
Offset warm up shift[9]			±0021		Count Hex
Offset position sensitivity (±1 g)			±0021		Count Hex
Offset long term drift (one year)			±0021		Count Hex
Analog performance characteristics					
Offset warm up shift[9]			±5		mV
Offset position sensitivity (±1 g)			±5		mV
Offset long term drift (one year)			±5		mV

HCLA0025xxxB

Operating pressure range		-25		+25	mbar
Digital performance characteristics					
Zero pressure offset		370A	3999	3C28	Count Hex
Full scale span FSS[10]		63D6	6666	68F5	Count Hex
Output	@ +25 mbar		6CCC		Count Hex
	@ -25 mbar		0666		Count Hex
Analog performance characteristics					
Zero pressure offset		2.15	2.25	2.35	V
Full scale span FSS[10]		3.90	4.00	4.10	V
Output	@ +25 mbar		4.25		V
	@ -25 mbar		0.25		V

HCLA0025xxxU

Operating pressure range	0		+25	mbar
Digital performance characteristics				
Zero pressure offset	03D7	0666	08F6	Count Hex
Full scale span FSS[10]	63D6	6666	68F5	Count Hex
Full scale output		6CCC		Count Hex
Analog performance characteristics				
Zero pressure offset	0.15	0.25	0.35	V
Full scale span FSS[10]	3.90	4.00	4.10	V
Full scale output		4.25		V

Performance characteristics

(V_S=5.0 V_{DC}; T_A=25 °C; analog output signal is ratiometric to V_S, digital output signal is not ratiometric to V_S , pressure applied to high pressure port)

HCLA0050

Characteristics		Min.	Typ.	Max.	Unit
Non-linearity and hysteresis (BSL)[4]			±0.05	±0.25	%FSS
Thermal effects -25 to 85°C[5]	Offset			±0.5	%FSS
	Span			±1.0	%FSS
Response delay[6,7]			0.5		ms
A/D resolution[7]			12		bit
D/A resolution				11	bit
Current consumption (no load)[8]			5		mA
Digital performance characteristics					
Offset warm up shift[9]			±0021		Count Hex
Offset position sensitivity (±1 g)			±0021		Count Hex
Offset long term drift (one year)			±0021		Count Hex
Analog performance characteristics					
Offset warm up shift[9]			±5		mV
Offset position sensitivity (±1 g)			±5		mV
Offset long term drift (one year)			±5		mV

HCLA0050xxxB

Operating pressure range		-50		+50	mbar
Digital performance characteristics					
Zero pressure offset		370A	3999	3C28	Count Hex
Full scale span FSS[10]		63D6	6666	68F5	Count Hex
Output	@ +50 mbar		6CCC		Count Hex
	@ -50 mbar		0666		Count Hex
Analog performance characteristics					
Zero pressure offset		2.15	2.25	2.35	V
Full scale span FSS[10]		3.90	4.00	4.10	V
Output	@ +50 mbar		4.25		V
	@ -50 mbar		0.25		V

HCLA0050xxxU

Operating pressure range	0		+50	mbar
Digital performance characteristics				
Zero pressure offset	03D7	0666	08F6	Count Hex
Full scale span FSS[10]	63D6	6666	68F5	Count Hex
Full scale output		6CCC		Count Hex
Analog performance characteristics				
Zero pressure offset	0.15	0.25	0.35	V
Full scale span FSS[10]	3.90	4.00	4.10	V
Full scale output		4.25		V

Performance characteristics

(V_S=5.0 V_{DC}; T_A=25 °C; analog output signal is ratiometric to V_S, digital output signal is not ratiometric to V_S , pressure applied to high pressure port)

HCLA0075xxx

Characteristics		Min.	Typ.	Max.	Unit
Non-linearity and hysteresis (BSL)[4]			±0.05	±0.25	%FSS
Thermal effects -25 to 85°C[5]	Offset			±0.5	%FSS
	Span			±1.0	%FSS
Response delay[6,7]			0.5		ms
A/D resolution[7]			12		bit
D/A resolution				11	
Current consumption (no load)[8]			5		mA
Digital performance characteristics					
Offset warm up shift[9]			±0021		Count Hex
Offset position sensitivity (±1 g)			±0021		Count Hex
Offset long term drift (one year)			±0021		Count Hex
Analog performance characteristics					
Offset warm up shift[9]			±5		mV
Offset position sensitivity (±1 g)			±5		mV
Offset long term drift (one year)			±5		mV

HCLA0075xxxB

Operating pressure range		-75		+75	mbar
Digital performance characteristics					
Zero pressure offset		370A	3999	3C28	Count Hex
Full scale span FSS[10]		63D6	6666	68F5	Count Hex
Output	@ +75 mbar		6CCC		Count Hex
	@ -75 mbar		0666		Count Hex
Analog performance characteristics					
Zero pressure offset		2.15	2.25	2.35	V
Full scale span FSS[10]		3.90	4.00	4.10	V
Output	@ +75 mbar		4.25		V
	@ -75 mbar		0.25		V

HCLA0075xxxU

Operating pressure range	0		75	mbar
Digital performance characteristics				
Zero pressure offset	03D7	0666	08F6	Count Hex
Full scale span FSS[10]	63D6	6666	68F5	Count Hex
Full scale output		6CCC		Count Hex
Analog performance characteristics				
Zero pressure offset	0.15	0.25	0.35	V
Full scale span FSS[10]	3.90	4.00	4.10	V
Full scale output		4.25		V

I²C Bus

Introduction

The HCLA is capable to generate a digital output signal. The device runs a cyclic program, which will store a corrected pressure value with 12 bit resolution about every 250 µs within the output registers of the internal ASIC. In order to use the sensor for digital signal readout, it should be connected to a bidirectional I²C-bus.

According to the I²C-bus specification, the bus is controlled by a master device, which generates the clock signal, controls the bus access and generates START and STOP conditions. The HCLA is designed to work as a slave, hence it will only respond to requests from a master device.

Digital I²C interface

The HCLA complies with the following protocol (Fig. 1):

Bus not busy: During idle periods both data line (SDA) and clock line (SCL) remain HIGH.

START condition (S): HIGH to LOW transition of SDA line while clock (SCL) is HIGH is interpreted as START condition. START conditions are always generated by the master. Each initial request for a pressure value has to begin with a START condition.

STOP condition (P): LOW to HIGH transition of SDA line while clock (SCL) is HIGH determines STOP condition. STOP conditions are always generated by the master. More than one request for the current pressure value can be transmitted without generation of intermediate STOP condition.

DATA valid (D): State of data line represents valid data when, after START condition, data line is stable for duration of HIGH period of clock signal. Data on line must be changed during LOW period of clock signal. There is one clock pulse per bit of data.

Acknowledge (A): Data is transferred in pieces of 8 bits (1 byte) on serial bus, MSB first. After each byte receiving device whether master or slave – is obliged to pull data line LOW as acknowledge for reception of data. Master must generate an extra clock pulse for this purpose. When acknowledge is missed, slave transmitter becomes inactive. It is on master either to send last com-mand again or to generate STOP condition in that case.

Slave address: The I²C-bus master-slave concept requires a unique address for each device. The HCLA has a preconfigured slave address (1111000xb). By factory programming it is possible to define a

secondary slave address additional to the general one. According to I²C specification 127 different addresses are available. The sensor will then listen to both slave addresses. After generating a START condition the master sends the address byte containing a 7 bit address followed by a data direction bit (R/W). A "0" indicates a transmission from master to slave (WRITE), a "1" indicates a data request (READ).

DATA operation: The sensor starts to send 2 data bytes containing the current pressure value as a 15 bit information placed in the output registers.

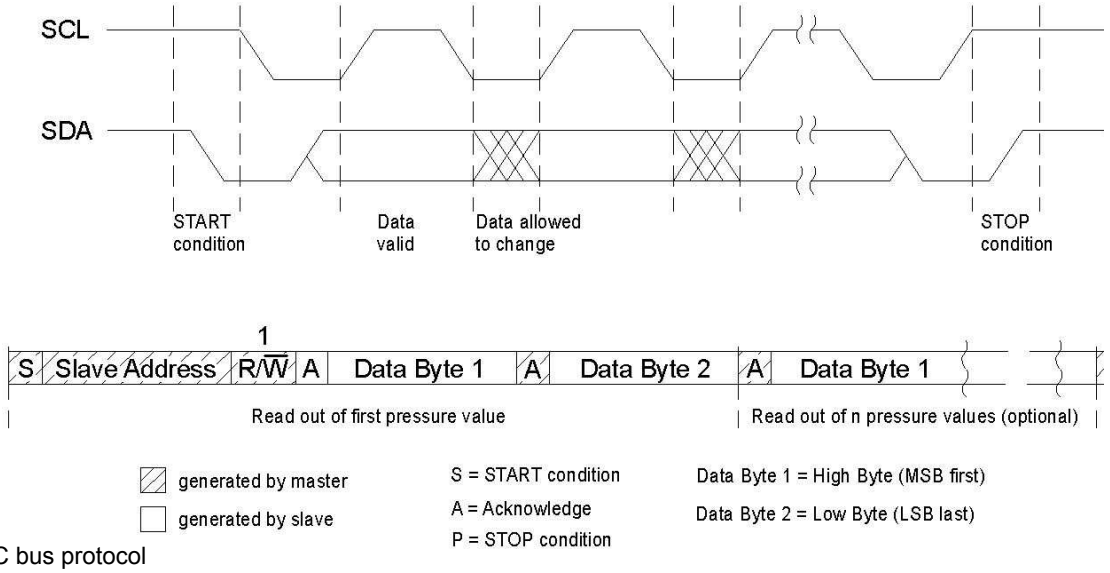


Fig. 1: I²C bus protocol

I²C Interface parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input high level		90		100	% of Vs
Input low level		0		10	
Output low level				10	
Pull-up resistor		500			Ω
Load capacitance @ SDA	C_{SDA}			400	pF
Input capacitance @ SDA/SCL	C_{I2C_IN}			10	
SCL clock frequency	F_{SCL}	100*		400	kHz
Bus free time between STOP and START condition	t_{BUF}	1.3			µs
Hold time (repeated) START condition, to first clock pulse	$t_{HD.STA}$	0.8			
LOW period of SCL	t_{LOW}	1.3			
HIGH period of SCL	t_{HIGH}	0.6			
Setup time repeated START condition	$t_{SU.STA}$	1			
Data hold time	$t_{HD.DAT}$	0			
Data setup time	$t_{SU.DAT}$	0.2			
Rise time of both SDA and SCL	t_R			0.3	
Fall time of both SDA and SCL	t_F			0.3	
Setup time for STOP condition	$t_{SU.STO}$	0.6			

*recommended

Note: TE Connectivity recommends communication speeds of at least 100 kHz (max. 400 kHz). Please contact us for further information.

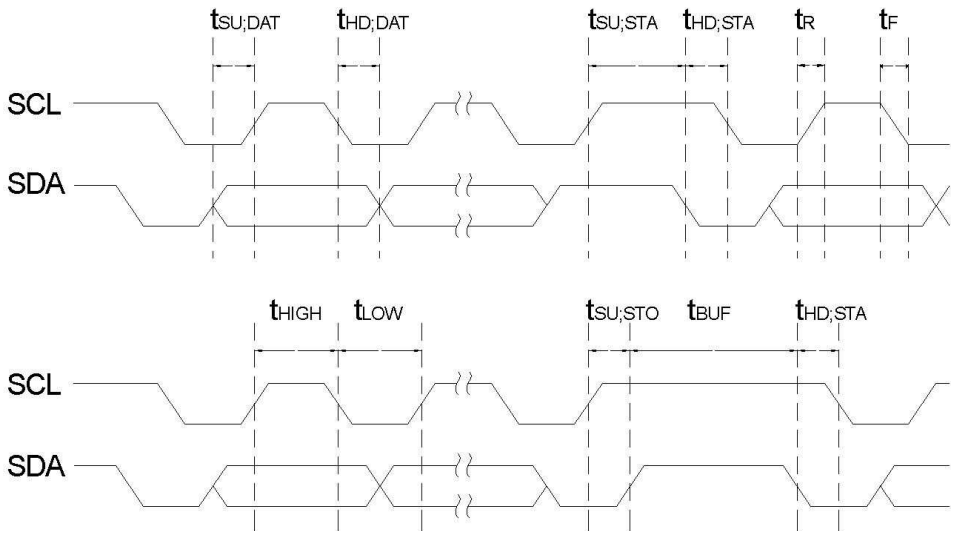
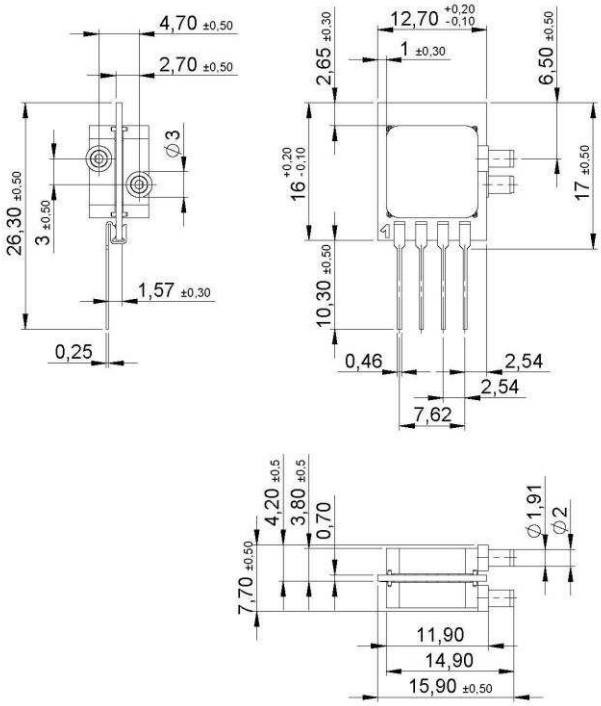
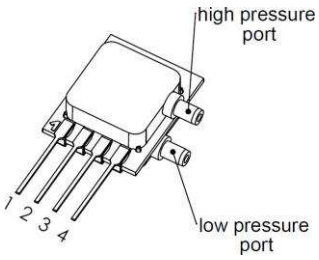


Fig. 2: Timing characteristics

Dimensional drawing

HCLAxxxDxxx (SIL, 2 ports same side)





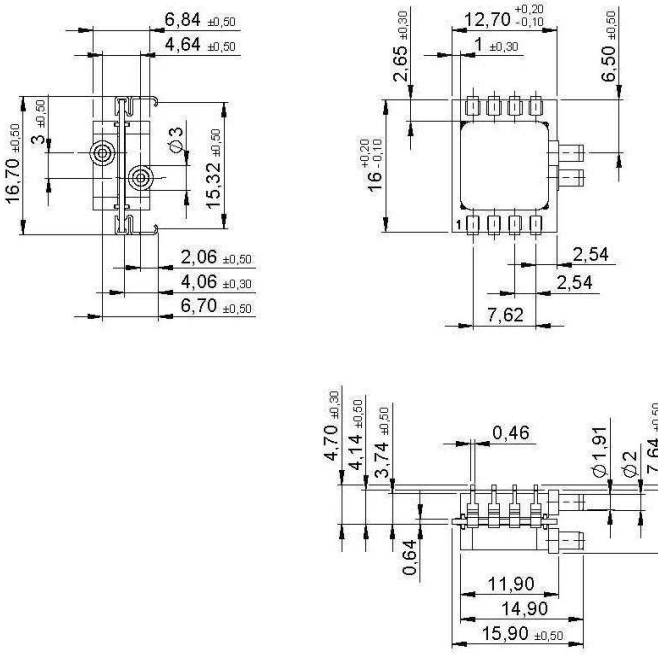
Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *

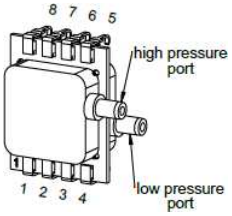
* Internal connection. Do not connect for any reason



first angle projection
dimensions in mm

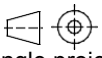
HCLAxxxExxx (SMD, 2 ports same side)





Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *
5	SCL
6	I / C *
7	
8	SDA

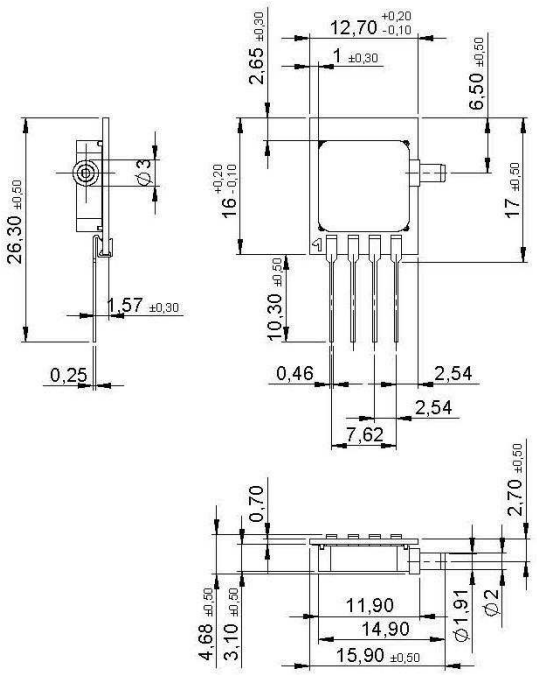
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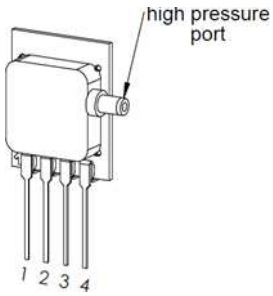


first angle projection
dimensions in mm

Dimensional drawing

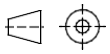
HCLAxxxGxxx (SIL, single port)





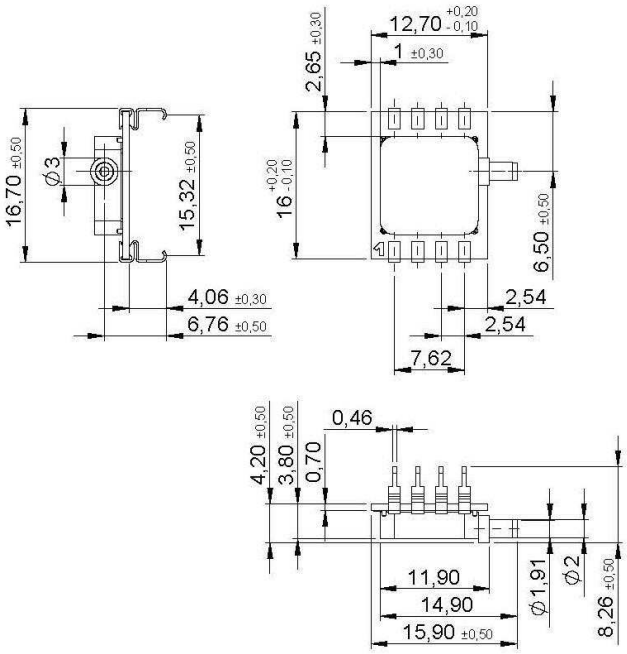
Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *

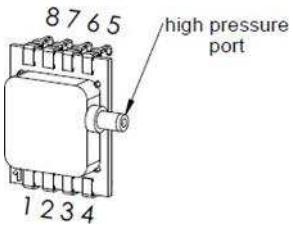
* Internal connection. Do not connect for any reason



first angle projection
dimensions in mm

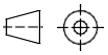
HCLAxxxHxxx (SMD, single port)





Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *
5	SCL
6	I / C *
7	

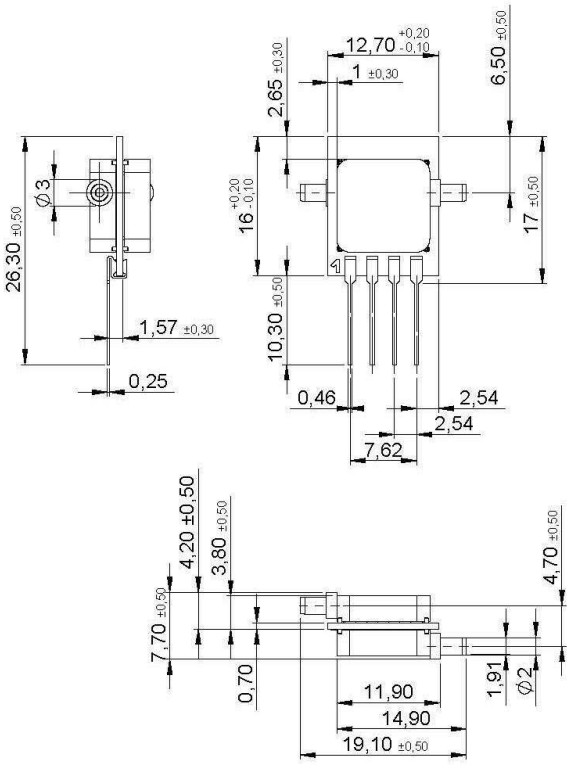
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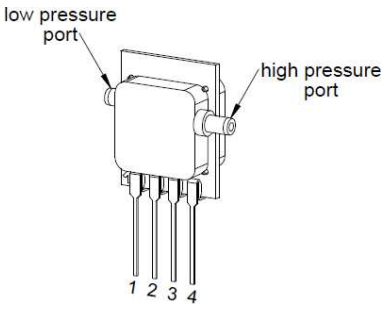


first angle projection
dimensions in mm

Dimensional drawing

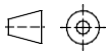
HCLAxxxPxxx (SIL, 2 ports opposite side)





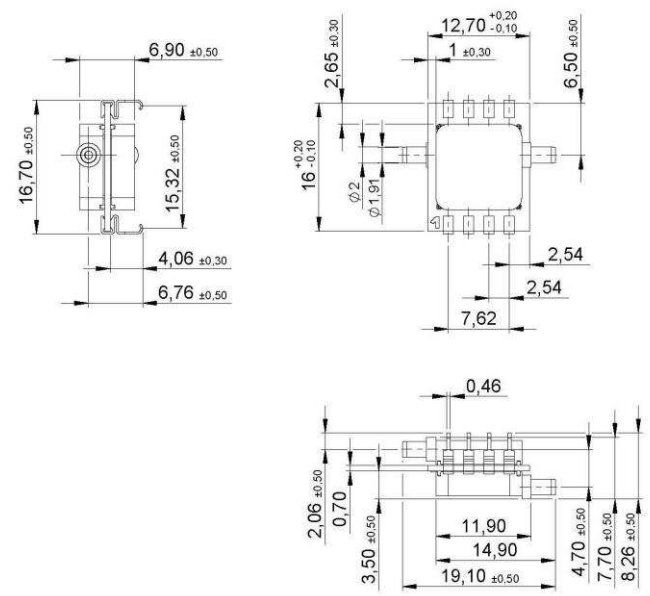
Pin	connection
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2	GND
3	Vout
4	I / C *

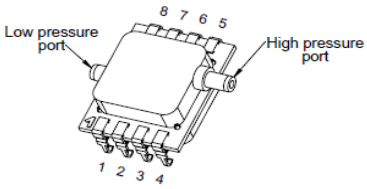
* Internal connection. Do not connect for any reason



first angle projection
dimensions in mm

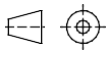
HCLAxxxQxxx (SMD, 2 ports opposite side)





Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *
5	SCL
6	I / C *
7	
8	SDA

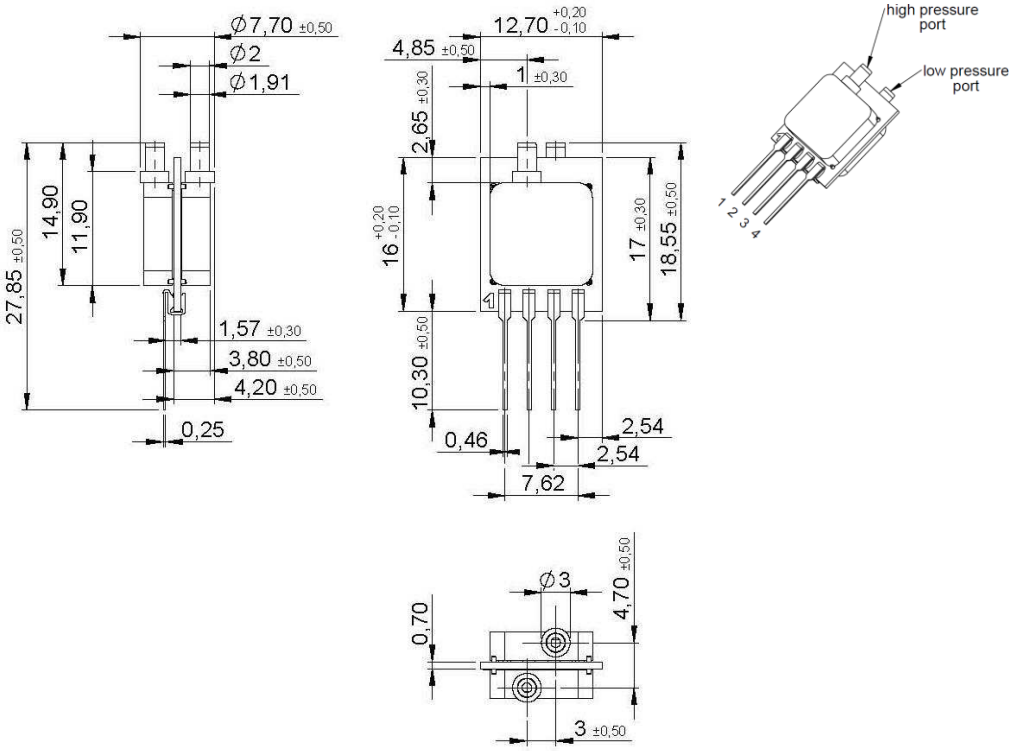
* Internal connection. Do not connect for any reason



first angle projection
dimensions in mm

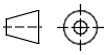
Dimensional drawing

HCLAxxxTxxx (SIL, 2 ports top side)



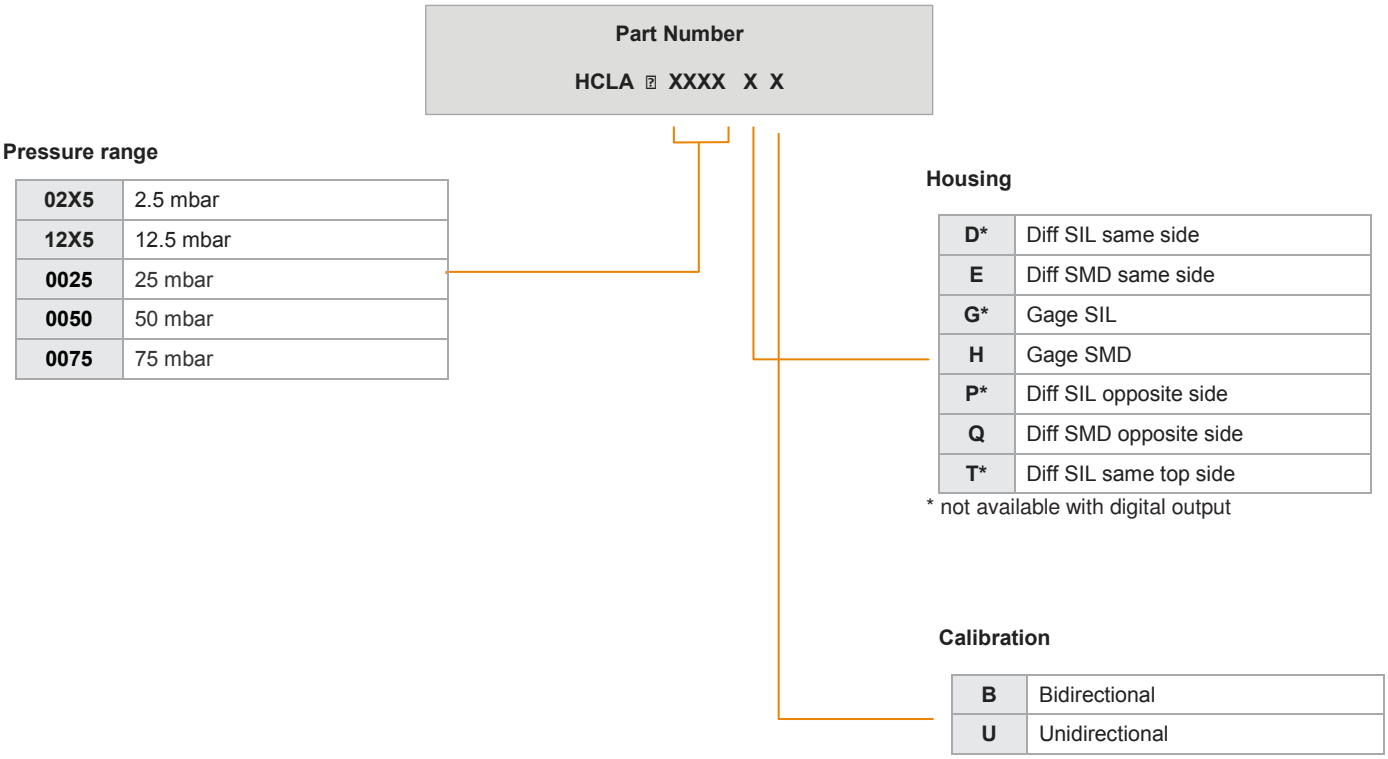
Pin	connection
1	+Vs
2	GND
3	Vout
4	I / C *

* Internal connection. Do not connect for any reason



first angle projection
dimensions in mm

Part numbering key



Order code example: HCLA02X5EB

Note: **Not all possible sensor configurations are active products. MOQ may apply.**

Custom specific pressure ranges and mechanical or electronic sensor modifications are widely available. Please contact your local sensors representative.

Ordering information (standard configurations)

Description	TE Part Number	Pressure Range	Housing	Calibration
HCLA02X5EU	2002984	2.5 mbar	Diff SMD same side	Unidirectional
HCLA02X5QU	2002998	2.5 mbar	Diff SMD opposite side	Unidirectional
HCLA02X5TU	2003030	2.5 mbar	Diff SIL same top side	Unidirectional
HCLA12X5EB	2002983	12.5 mbar	Diff SMD same side	Bidirectional
HCLA0075EB	2003000	75 mbar	Diff SMD same side	Bidirectional

Note:

The above product listings are examples of possible product configurations. More standard product configurations are available on request.

In addition, custom specific pressure and temperature ranges as well as mechanical or electronic sensor modifications are widely available.

Please note, not all possible sensor configurations are active products. MOQ may apply. Please contact your local sensors representative to learn more.

Specification notes

(1) Proof pressure is the maximum pressure which may be applied without causing durable shifts of the electrical parameters of the sensing element
(2) Burst pressure is the maximum pressure which may be applied without causing damage to the sensing element or leaks to the housing.
(3) The common mode pressure for the HCLA series is 2 bar. Common mode pressure is the maximum pressure that can be applied to both ports of a differential pressure sensor simultaneously without damaging the sensor housing.
(4) Non-linearity refers to the Best Straight Line fit, measured for offset pressure, full scale pressure and 1/2 full scale pressure.
(5) Shifts are relative to 25°C.
(6) Max. delay time between pressure change at the pressure die and signal change at the output.
(7) The response time depends on the adjusted internal A/D resolution of the sensor. For 12 bit it is typ. 0.5 ms. Other A/D resolutions and response times are available on request. Please contact First Sensor for further information.
(8) Sensors with lower current consumption are available on request. Please contact First Sensor for further information.
(9) Shift is within in the first hour of excitation.
(10) Full scale span is the algebraic difference between the output voltage at full scale pressure and the output voltage at zero pressure.

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