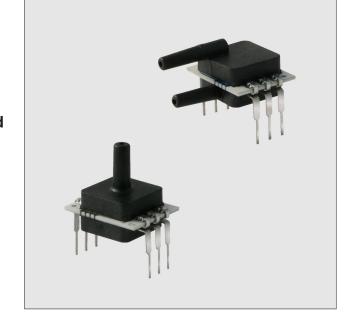
FEATURES

- 10 mbar to 5 bar, absolute, gage or differential pressure
- · Digital I2C-bus and analog output
- · Precision ASIC signal conditioning
- · Calibrated and temperature compensated
- · SMT and DIP housings
- · RoHS compliant



MEDIA COMPATIBILITY

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

SPECIFICATIONS

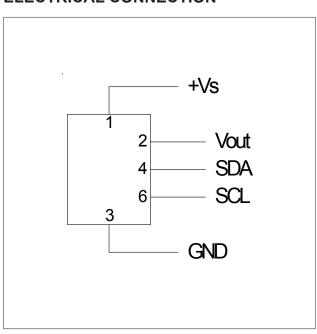
Maximum ratings Supply voltage V_s

Operating

Storage

HDI3	2.7 3.3 V _{DC}
HDI5	4.5 5.5 V _{DC}
	max. $6.50 V_{DC}$
Output current	
Sink	1 mA
Source	1 mA
Lead specifications	a aradiant 2 F K/a
Average preheating temperature	•
Soak time	ca. 3 min
Time above 217°C	50 s
Time above 230°C	40 s
Time above 250°C	15 s
Peak temperature	260°C
Cooling temperature gradient	-3.5 K/s
Temperature ranges⁵	
Compensated	0 +85 °C

ELECTRICAL CONNECTION



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-20 ... +85 °C -40 ... +125 °C

PRESSURE SENSOR CHARACTERISTICS

 $(T_{\Delta}=25 \, ^{\circ}\text{C}, RH=50 \, \%)$

Part no.	Operating pressure	Proof pressure ¹	Burst pressure ²
HDIM010B	0±10 mbar	150 mbar	200 mbar
HDIM020B	0±20 mbar	150 mbar	200 mbar
HDIM050B	0±50 mbar	550 mbar	800 mbar
HDIM100B	0±100 mbar	1 bar	1.5 bar
HDIM200B	0±200 mbar	1 bar	1.5 bar
HDIM500B	0±500 mbar	1 bar	1.5 bar
HDIB001B	0±1 bar	2 bar	3 bar
HDIM010U	010 mbar	150 mbar	200 mbar
HDIM020U	020 mbar	150 mbar	200 mbar
HDIM050U	050 mbar	550 mbar	800 mbar
HDIM100U	0100 mbar	1 bar	1.5 bar
HDIM200U	0200 mbar	1 bar	1.5 bar
HDIM500U	0500 mbar	1 bar	1.5 bar
HDIB001U	01 bar	2 bar	3 bar
HDIB002U	02 bar	4 bar	6 bar
HDIB005U	05 bar	7 bar	7 bar
HDI0611AR	6001100 mbar(a)	2 bara	3 bara
HDI0811AR	8001100 mbar(a)	2 bara	3 bara

Other pressure ranges are available on request. Please contact First Sensor.

- 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. Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.
- 4. Total accuracy is the combined error from offset and span calibration, linearity, pressure hysteresis, and temperature effects. Linearity is the measured deviation based on a straight line. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure. Calibration errors include the deviation of offset and full scale from nominal values.
- 5. Extended temperature ranges on request. Please contact First Sensor.
- 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 reponse time 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.

First Sensor 6

PERFORMANCE CHARACTERISTICS

 $(V_{\rm S} = 5.0 \ V_{\rm DC}, T_{\rm A} = 25 \ ^{\circ}\text{C}, \text{RH} = 50 \ \%, \text{ analog output signal is } \underline{\textbf{ratiometric}} \text{ to } V_{\rm S}, \text{ digital output signal is } \underline{\textbf{not ratiometric}} \text{ to } V_{\rm S})$

All HDI...P5 devices ($V_s = 5.0$)

Characteristics		Min.	Тур.	Max.	Units
Total accuracy (085°C) ⁴ all barometric devices all other devices				±1.0	%FSS
				±0.5	
Response delay ^{6, 7}			0.5	0.5 ms	
A/D resolution ⁷	12		l- :4		
D/A resolution				11	bit
Current consumption8			5 m/		mA

All HDI...R...P5 (barometric devices)

Characteristics	Min.	Тур.	Max.	Units
ANALOGUE PERFORMANC	ANALOGUE PERFORMANCE CHARACTERISTIC			
Output at min. specified pressure	0.46	0.50	0.54	
Full scale span (FSS) ³		4.00		V
Full scale output	4.46	4.50	4.54	
DIGITAL PERFORMANCE	CHARACTER	RISTIC		
Output at min. specified pressure		3277	3539	
Full scale span (FSS) ³		26214		counts
Full scale output	29228	29490	29752	

All HDI...U...P5 (unidirectional devices)

Characteristics	Min.	Тур.	Max.	Units
ANALOG PERFORMANCE	CHARACTE	RISTIC		
Zero pressure offset	0.48	0.50	0.52	
Full scale span (FSS) ³		4.00		V
Full scale output	4.48	4.50	4.52	
DIGITAL PERFORMANCE	CHARACTER	RISTIC		
Zero pressure offset	3146	3277	3408	
Full scale span (FSS) ³		26214		counts
Full scale output	29359	29490	29621	

All HDI...B...P5 (bidirectional devices)

Characteristics		Min.	Тур.	Max.	Units
	ANALOG PERFORMANCE	CHARACTE	RISTIC		
Zero pressure offset		2.48	2.50	2.52	
Full scale span (FSS)3			4.00		.,,
Output at max. specified pressure		4.48	4.50	4.52	V
	at min. specified pressure	0.48	0.50	0.52	
	DIGITAL PERFORMANCE	CHARACTER	RISTIC		
Zero pressure offset		16252	16384	16515	
Full scale span (FSS) ³			26214		a a
Output	at max. specified pressure		29490	29621	counts
	at min. specified pressure	3146	3277	3408	

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PERFORMANCE CHARACTERISTICS

 $(V_{\rm S}=3.0\,V_{\rm DC},T_{\rm A}=25\,^{\circ}\rm C,\,RH=50\,\%,\,analog\,output\,signal\,is\,\underline{\it ratiometric}\,to\,V_{\rm S},digital\,output\,signal\,is\,\underline{\it not\,ratiometric}\,to\,V_{\rm S})$

All HDI...P3 devices ($V_s = 3.0$)

Characteristics		Min.	Тур.	Max.	Units
Total accuracy (085°C) ⁴ all barometric devices				±1.0	%FSS
all other devices				±0.5	
Response delay ^{6, 7}	0.5		ms		
A/D resolution ⁷		12		bit	
D/A resolution				11	bit
Current consumption8		3		mA	

All HDI...R...P3 (barometric devices)

Characteristics	Min.	Тур.	Max.	Units	
ANALOGUE PERFORMANC	ANALOGUE PERFORMANCE CHARACTERISTIC				
Output at min. specified pressure	0.23	0.25	0.27		
Full scale span (FSS) ³		2.00		V	
Full scale output	2.23	2.25	2.27		
DIGITAL PERFORMANCE	CHARACTER	RISTIC			
Output at min. specified pressure	2512	2731	2949		
Full scale span (FSS) ³		21845	5 counts		
Full scale output	24357	24575	24794		

All HDI...U...P3 (unidirectional devices)

Characteristics	Min.	Тур.	Max.	Units	
ANALOG PERFORMANCE	ANALOG PERFORMANCE CHARACTERISTIC				
Zero pressure offset	0.24	0.25	0.26		
Full scale span (FSS) ³		2.00		V	
Full scale output	2.24	2.25	2.26		
DIGITAL PERFORMANCE	CHARACTER	RISTIC			
Zero pressure offset	2621	2731	2840		
Full scale span (FSS) ³		21845		counts	
Full scale output	24466	24575	24684		

All HDI...B...P3 (bidirectional devices)

Characteristics		Min.	Тур.	Max.	Units
	ANALOG PERFORMANCE	CHARACTE	RISTIC		
Zero pressure offset		1.24	1.25	1.26	
Full scale span (FSS)3			2.00		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
Output at max. specified pressure		2.24	2.25	2.26	V
	at min. specified pressure	0.24	0.25	0.26	
	DIGITAL PERFORMANCE	CHARACTER	RISTIC		
Zero pressure offset		13545	13653	13762	
Full scale span (FSS) ³			21845		oounto
Output	at max. specified pressure	24466	24575	24684	counts
	at min. specified pressure	2621	2731	2840	

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I²C BUS

Introduction

The HDI 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 μ s 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 HDI is designed to work as a slave, hence it will only respond to requests from a master device.

Digital I²C interface

The HDI 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 command 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 HDI 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.

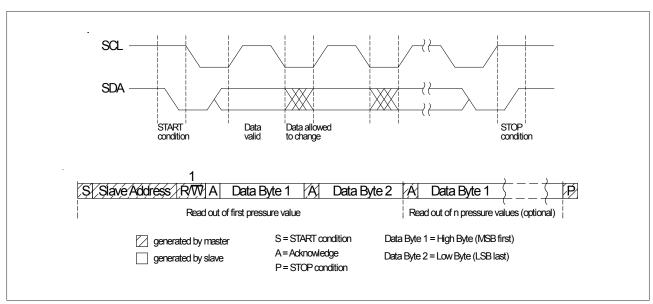


Fig. 1: I²C bus protocol

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I²C Interface Parameters

Parameter	Symbol	Min.	Тур.	Max.	Unit
Input high level		90		100	
Input low level		0		10	% of Vs
Output low level				10	
Pull-up resistor		500			Ω
Load capacitance @ SDA	C _{SDA}			400	ηE
Input capacitance @ SDA/SCL	C _{I2C_IN}			10	pF
SCL clock frequency	F _{SCL}	100*		400	kHz
Bus free time between STOP and START condition	t _{BUF}	1.3			
Hold time (repeated) START condition, to first clock pulse	t _{HD.STA}	8.0			
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			μs
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: First Sensor recommends communication speeds of at least 100 kHz (max. 400 kHz). Please contact us for further information.

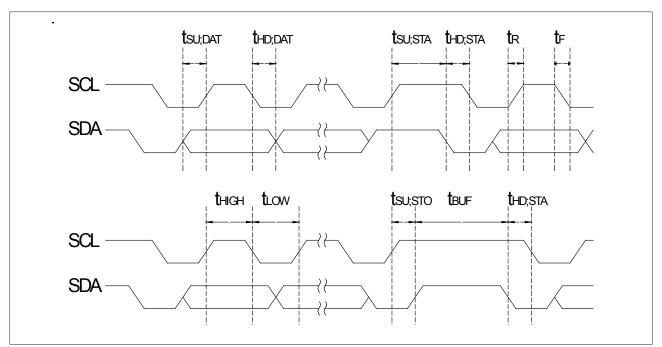


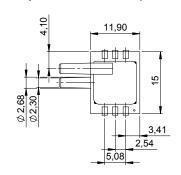
Fig. 2: Timing characteristics

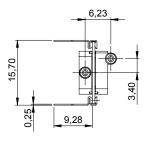
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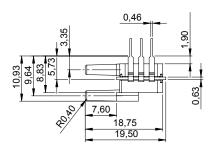


PHYSICAL DIMENSIONS

HDI...F... (DIP, 2 ports same side)

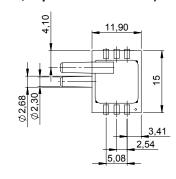


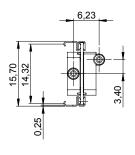


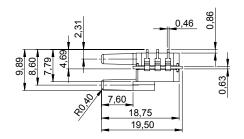


first angle projection dimensions in mm

HDI...E... (SMD, 2 ports same side)







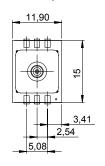
first angle projection
dimensions in mm

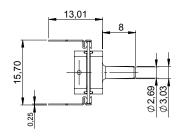
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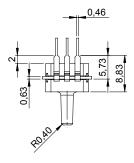


PHYSICAL DIMENSIONS (cont.)

HDI...Z... (DIP, 1 port axial)

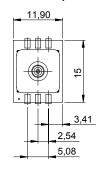


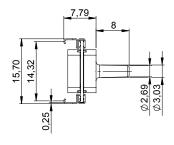


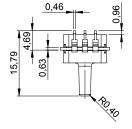


first angle projection
dimensions in mm

HDI...Y... (SMD, 1 port axial)



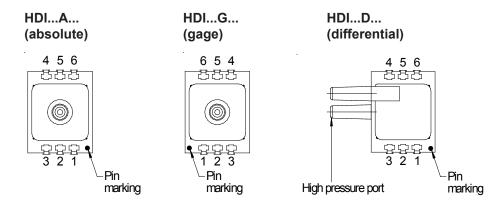




first angle projection dimensions in mm

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ELECTRICAL CONNECTION (cont.)



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

Internal connection.
 Do not connect for any reason

ORDERING INFORMATION

	Series	Pressure range			Pressure mode		Calibration		Housing		Porting		Grade		Voltage	
Options	HDI	0611	6001100 mbar	Α*	Absolute	В*	Bidirectional	F*	DIP, 2 ports	8	Straight	Р	Prime	5	5 V	
		0811	8001100 mbar	D	Differential	U	Unidirectional		same side					3	3 V	
		M010	10 mbar	G	Gage	R**	Barometric	E*	SMD, 2 ports							
		M020	20 mbar						same side							
		M050	50 mbar					Z**	DIP, 1 port							
		M100	100 mbar						axial							
		M200	200 mbar					Y**	SMD, 1 port							
		M500	500 mbar						axial							
		B001	1 bar													
		(B001A)	1 bara													
		B002	2 bar													
		B005	5 bar													
			* only from 1 bar		* only up to 1 bar ** for pressure ranges 0611, 0811		* standard for differential devices, "D" ** standard for absolute and gage devices, "A" and "G"									
Example:	HDI	M050		G		U		Z		8		Р		5		

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 First Sensor for further information.

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TSCSAAN001PDUCV DCAL401DN DCAL401GN XZ202798SSC XZ203676HSC 6407-249V-09343P 6407-250V-17343P SP370-25-1160 81794-B00001200-01 HSCDLNN100PGAA5 82681-B00000100-01 81618-B00000040-05 SSCDJNN015PAAA5 TSCDLNN100MDUCV
TSCSAAN100PDUCV NBPDANN015PGUNV NBPLLNS150PGUNV 142PC100D