

HDI Series

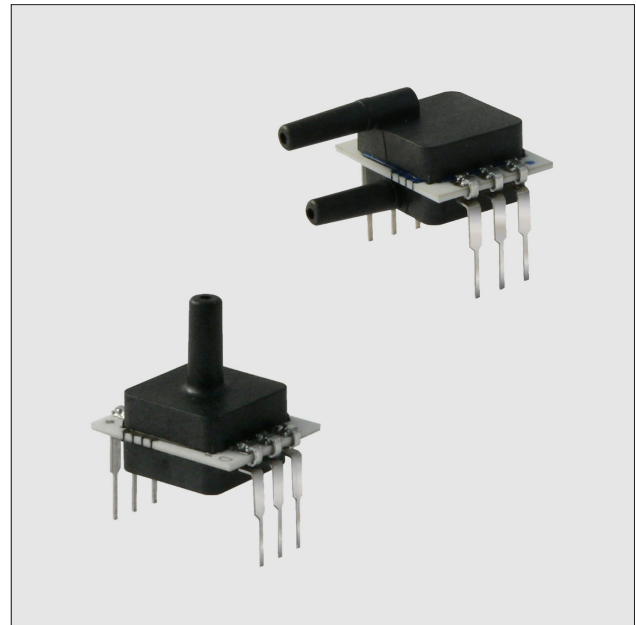
Amplified pressure sensors

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

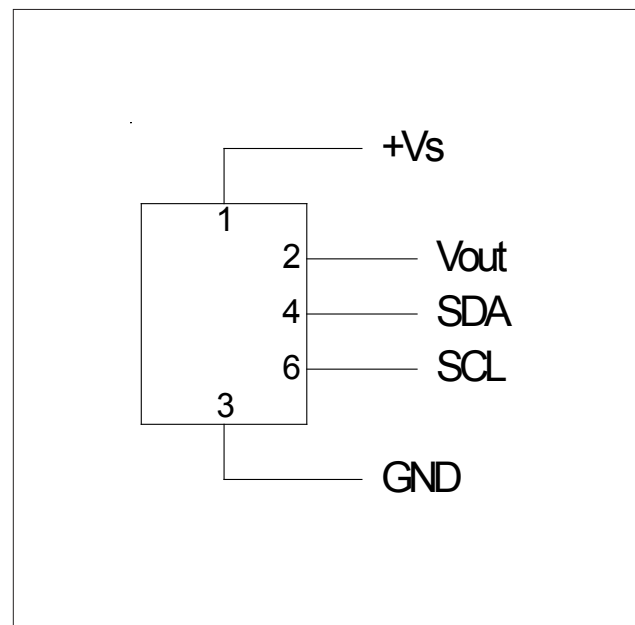
| | |
|----------------------|--|
| Supply voltage V_s | |
| HDI...3 | 2.7 ... 3.3 V_{DC} |
| HDI...5 | 4.5 ... 5.5 V_{DC} max. 6.50 V_{DC} |

| | |
|----------------|------|
| Output current | |
| Sink | 1 mA |
| Source | 1 mA |

| | |
|---|-----------|
| Lead specifications | |
| Average preheating temperature gradient | 2.5 K/s |
| 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 ranges ⁵ | |
| Compensated | 0 ... +85 °C |
| Operating | -20 ... +85 °C |
| Storage | -40 ... +125 °C |

ELECTRICAL CONNECTION



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PRESSURE SENSOR CHARACTERISTICS

(T_A=25 °C, RH=50 %)

| Part no. | Operating pressure | Proof pressure ¹ | Burst pressure ² |
|----------------|--------------------|-----------------------------|-----------------------------|
| HDIM010...B... | 0...±10 mbar | 150 mbar | 200 mbar |
| HDIM020...B... | 0...±20 mbar | 150 mbar | 200 mbar |
| HDIM050...B... | 0...±50 mbar | 550 mbar | 800 mbar |
| HDIM100...B... | 0...±100 mbar | 1 bar | 1.5 bar |
| HDIM200...B... | 0...±200 mbar | 1 bar | 1.5 bar |
| HDIM500...B... | 0...±500 mbar | 1 bar | 1.5 bar |
| HDIB001...B... | 0...±1 bar | 2 bar | 3 bar |
| HDIM010...U... | 0...10 mbar | 150 mbar | 200 mbar |
| HDIM020...U... | 0...20 mbar | 150 mbar | 200 mbar |
| HDIM050...U... | 0...50 mbar | 550 mbar | 800 mbar |
| HDIM100...U... | 0...100 mbar | 1 bar | 1.5 bar |
| HDIM200...U... | 0...200 mbar | 1 bar | 1.5 bar |
| HDIM500...U... | 0...500 mbar | 1 bar | 1.5 bar |
| HDIB001...U... | 0...1 bar | 2 bar | 3 bar |
| HDIB002...U... | 0...2 bar | 4 bar | 6 bar |
| HDIB005...U... | 0...5 bar | 7 bar | 7 bar |
| HDI0611AR... | 600...1100 mbar(a) | 2 bara | 3 bara |
| HDI0811AR... | 800...1100 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 response 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.

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PERFORMANCE CHARACTERISTICS

($V_S=5.0 V_{DC}$, $T_A=25\text{ }^\circ\text{C}$, $RH=50\%$, analog output signal is **ratiometric** to V_S , digital output signal is **not ratiometric** to V_S)

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

| Characteristics | Min. | Typ. | Max. | Units |
|--|------------------------|------|------|-------|
| Total accuracy (0...85°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 | |
| Current consumption ⁸ | | 5 | | mA |

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

| Characteristics | Min. | Typ. | Max. | Units |
|-------------------------------------|-------|-------|-------|--------|
| ANALOGUE PERFORMANCE CHARACTERISTIC | | | | |
| Output at min. specified pressure | 0.46 | 0.50 | 0.54 | V |
| Full scale span (FSS) ³ | | 4.00 | | |
| Full scale output | 4.46 | 4.50 | 4.54 | |
| DIGITAL PERFORMANCE CHARACTERISTIC | | | | |
| Output at min. specified pressure | 3015 | 3277 | 3539 | counts |
| Full scale span (FSS) ³ | | 26214 | | |
| Full scale output | 29228 | 29490 | 29752 | |

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

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

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

| Characteristics | Min. | Typ. | Max. | Units | |
|------------------------------------|----------------------------|-------|-------|--------|-------|
| ANALOG PERFORMANCE CHARACTERISTIC | | | | | |
| Zero pressure offset | 2.48 | 2.50 | 2.52 | V | |
| Full scale span (FSS) ³ | | 4.00 | | | |
| Output | at max. specified pressure | 4.48 | 4.50 | | 4.52 |
| | at min. specified pressure | 0.48 | 0.50 | | 0.52 |
| DIGITAL PERFORMANCE CHARACTERISTIC | | | | | |
| Zero pressure offset | 16252 | 16384 | 16515 | counts | |
| Full scale span (FSS) ³ | | 26214 | | | |
| Output | at max. specified pressure | 29359 | 29490 | | 29621 |
| | at min. specified pressure | 3146 | 3277 | | 3408 |

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PERFORMANCE CHARACTERISTICS

($V_S=3.0 V_{DC}$, $T_A=25\text{ }^\circ\text{C}$, $RH=50\%$, analog output signal is **ratiometric** to V_S , digital output signal is **not ratiometric** to V_S)

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

| Characteristics | Min. | Typ. | Max. | Units |
|--|------------------------|------|------|-------|
| Total accuracy (0...85°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 | |
| Current consumption ⁸ | | 3 | | mA |

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

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

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

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

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

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

I²C Interface Parameters

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--|---------------------|------|------|------|---------------------|
| Input high level | | 90 | | 100 | % of V _s |
| 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: First Sensor recommends communication speeds of at least 100 kHz (max. 400 kHz). Please contact us for further information.

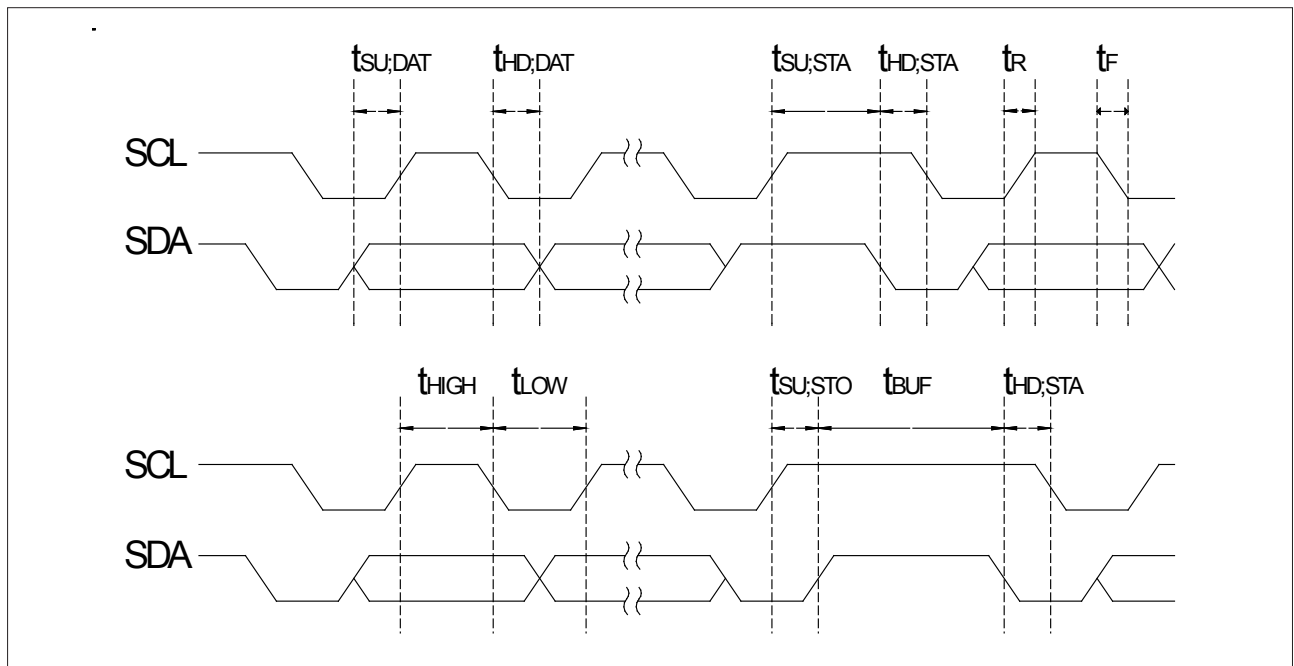


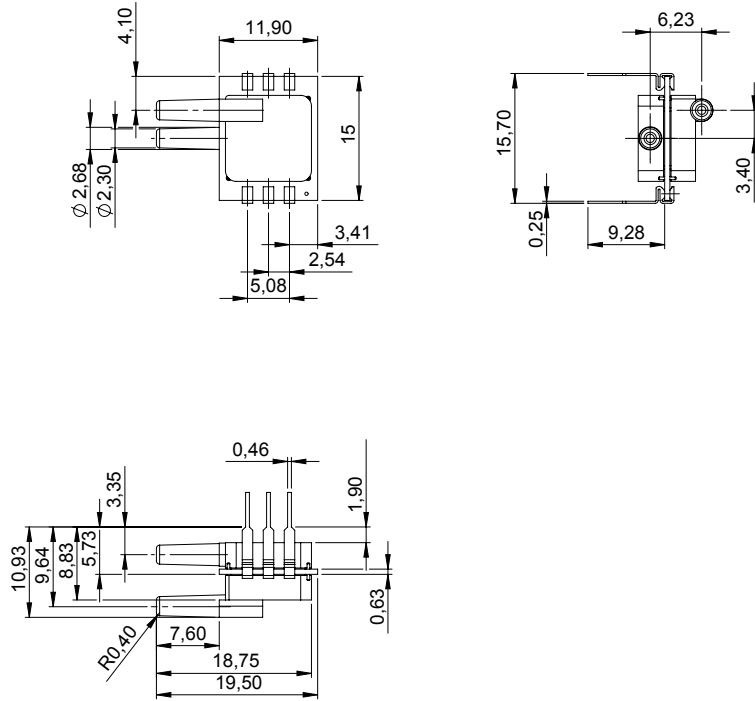
Fig. 2: Timing characteristics

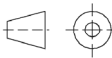
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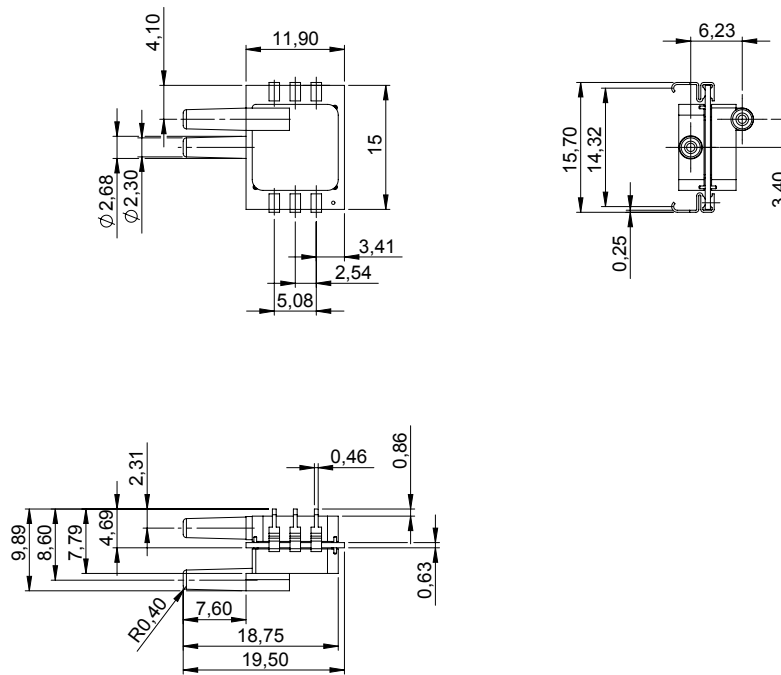
PHYSICAL DIMENSIONS

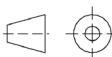
HDI...F... (DIP, 2 ports same side)




 first angle projection
 dimensions in mm

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



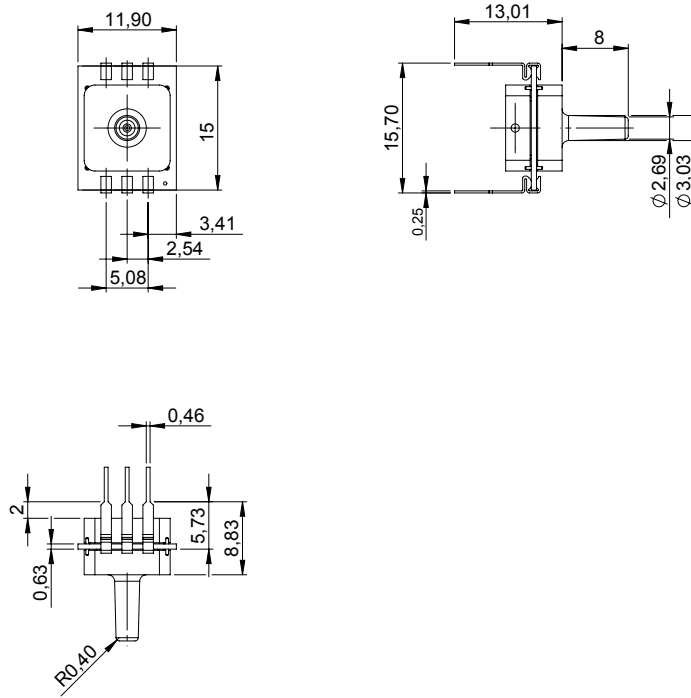

 first angle projection
 dimensions in mm

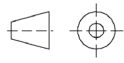
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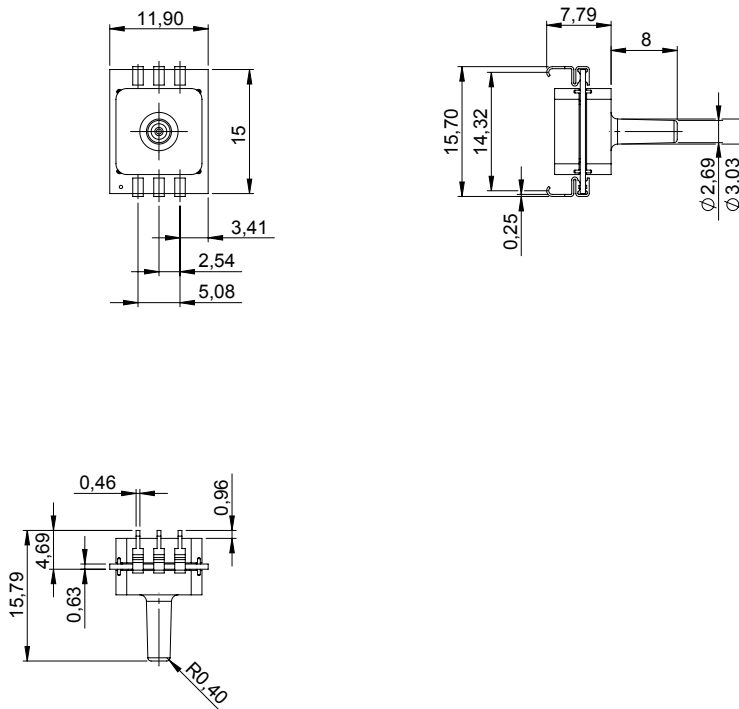
PHYSICAL DIMENSIONS (cont.)

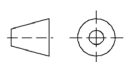
HDI...Z... (DIP, 1 port axial)




 first angle projection
 dimensions in mm

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




 first angle projection
 dimensions in mm