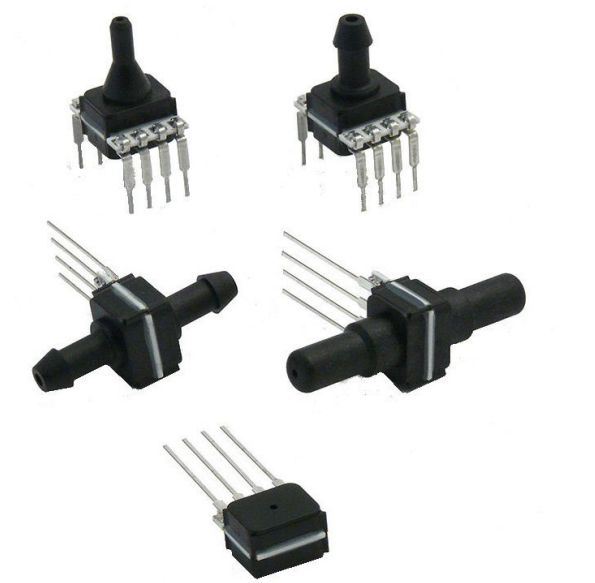


## HMA series – amplified pressure sensors

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The HMA pressure sensors provide amplified analog output signals and utilize precision digital signal conditioning to achieve high accuracies. The sensors offer an increased media compatibility to measure gases and liquids. 5 V and 3 V supply versions are available. Very small SIL and DIP housings allow for space-saving PCB-mounting. All HMA pressure sensors can be modified according to customer specific requirements.



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### Features

- Pressure ranges from 2.5 mbar to 1 bar, 1 psi to 150 psi gage or differential pressure
- Increased media compatibility<sup>(1)</sup>
- Analog output
- Precision ASIC signal conditioning
- Calibrated and temperature compensated<sup>(2)</sup>
- SIL and DIP housings

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### Certificates

- Quality Management System according to EN ISO 13485:2003 and EN ISO 9001:2008
- RoHS and REACH compliant

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### Media compatibility<sup>(1), (2)</sup>

#### High pressure port:

To be used with gases and liquids which are compatible with the wetted materials (high temperature polyamide, ceramic  $Al_2O_3$ , epoxy, fluorosilicone, glass, silicon).

#### Low pressure port:

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

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### Applications

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

#### Specification notes

(1) All wetted materials are selected to give a high level of media compatibility. Media compatibility refers to media inside the pressure port and lid. Improved media compatibility on high pressure port (backward side of sensor chip) since media has no contact to electronic components. Nevertheless tests with the media used in the specific application are recommended.

(2) Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.

## HMA series – amplified pressure sensors

### Maximum ratings

| Parameter                                       |                                      | Min. | Typ. | Max. | Unit            |
|-------------------------------------------------|--------------------------------------|------|------|------|-----------------|
| Supply voltage (V <sub>S</sub> ) <sup>(3)</sup> | HMA...3                              | 2.7  | 3.0  | 4.2  | V <sub>DC</sub> |
|                                                 | HMA...5                              | 4.2  | 5.0  | 5.5  |                 |
| Output current                                  | Sink                                 |      | 1    |      | mA              |
|                                                 | Source                               |      | 1    |      |                 |
| Temperature ranges                              | Compensated                          | -20  |      | +85  | °C              |
|                                                 | Operating                            | -20  |      | +85  |                 |
|                                                 | Storage <sup>(4)</sup>               | -40  |      | +125 |                 |
| Humidity limits (non-condensing) <sup>(5)</sup> |                                      |      |      | 95   | %RH             |
| Vibration                                       | 10...2000 Hz, random (EN 60068-2-64) |      |      | 10   | g               |
| Mechanical shock                                | 11 ms (EN60068-2-27)                 |      |      | 50   |                 |
| Lead solder temperature                         | (JESD22-B106D)                       |      |      | 270  | °C              |

### Pressure sensor characteristics

| Part no.    | Operating pressure | Proof pressure <sup>(6)</sup> |
|-------------|--------------------|-------------------------------|
| HMAM2x5U... | 0...2.5 mbar       | 100 mbar                      |
| HMAM2x5B... | 0...±2.5 mbar      |                               |
| HMAM005U... | 0...5 mbar         |                               |
| HMAM005B... | 0...±5 mbar        |                               |
| HMAM010U... | 0...10 mbar        |                               |
| HMAM010B... | 0...±10 mbar       | 300 mbar                      |
| HMAM020U... | 0...20 mbar        |                               |
| HMAM020B... | 0...±20 mbar       |                               |
| HMAM050U... | 0...50 mbar        |                               |
| HMAM050B... | 0...±50 mbar       |                               |
| HMAM100U... | 0...100 mbar       | 2 bar                         |
| HMAM100B... | 0...±100 mbar      |                               |
| HMAM250U... | 0...250 mbar       | 10 bar                        |
| HMAM250B... | 0...±250 mbar      |                               |
| HMAB001U... | 0...1 bar          | 5 bar                         |
| HMAB001B... | 0...±1 bar         |                               |
| HMAB2x5U... | 0...2.5 bar        | 14 bar                        |
| HMAB005U... | 0...5 bar          |                               |
| HMAB010U... | 0...10 bar         | 200 psi                       |
| HMAP001U... | 0...1 psi          |                               |
| HMAP001B... | 0...±1 psi         |                               |
| HMAP100U... | 0...100 psi        |                               |

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

#### Specification notes

(3) The sensor might not function or be operable above an absolute maximum rating of V<sub>S</sub>=6.5 V.

(4) Storage temperature of the sensor without package.

(5) Tested 1h, up to 85 °C. 100 % condensing or direct liquid media on high pressure port.

(6) Proof pressure is the maximum pressure which may be applied without causing durable shifts of the electrical parameters of the sensing element.

## HMA series – amplified pressure sensors

### Performance characteristics – 5 V devices<sup>(7)</sup>

( $V_S = 5.0 V_{DC}$ ,  $T_A = 25^\circ C$ , RH=50 %, analog output signal is ratiometric to  $V_S$  in the range of  $V_S = 4.2...5.5 V$ )

| Parameter                                    | Min.                       | Typ. | Max.  | Unit |
|----------------------------------------------|----------------------------|------|-------|------|
| Non-linearity (-20...85 °C) <sup>(8)</sup>   |                            |      | ±0.25 |      |
| Accuracy <sup>(9)</sup>                      |                            |      | ±0.25 |      |
| Total accuracy (-20...85 °C) <sup>(10)</sup> | up to 5 mbar               |      | ±2    | %FSS |
|                                              | 10 mbar to 50 mbar / 1 psi |      | ±1.25 |      |
|                                              | all others                 |      | ±0.75 |      |
| Response delay <sup>(11)</sup>               |                            | 0.5  |       | ms   |
| A/D resolution                               |                            | 12   |       | bit  |
| D/A resolution                               |                            |      | 11    |      |
| Current consumption                          | <1 bar                     | 4.2  |       | mA   |
|                                              | all others                 | 5.3  |       |      |

### Pressure ranges up to 5 mbar

#### Unidirectional devices

| Parameter                             | Min. | Typ. | Max. | Unit |
|---------------------------------------|------|------|------|------|
| Zero pressure offset                  | 0.42 | 0.50 | 0.58 |      |
| Full scale span (FSS) <sup>(12)</sup> |      | 4.00 |      | V    |
| Full scale output                     | 4.42 | 4.50 | 4.58 |      |

#### Bidirectional devices

| Parameter                             | Min.                      | Typ. | Max. | Unit |
|---------------------------------------|---------------------------|------|------|------|
| Zero pressure offset                  | 2.42                      | 2.50 | 2.58 |      |
| Full scale span (FSS) <sup>(12)</sup> |                           | 4.00 |      | V    |
| Full scale output                     | @ max. specified pressure | 4.42 | 4.50 |      |
|                                       | @ min. specified pressure | 0.42 | 0.50 |      |

#### Specification notes (cont.)

(7) Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.

(8) Non-linearity is the measured deviation based on Best Fit Straight Line (BFSL).

(9) Accuracy is the combined error from non-linearity and hysteresis. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure.

(10) Total accuracy is the combined error from offset and span calibration, non-linearity, pressure hysteresis, and temperature effects. Calibration errors include the deviation of offset and full scale from nominal values.

(11) Max. delay time between pressure change at the pressure die and signal change at the output.

(12) Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.

## HMA series – amplified pressure sensors

### Performance characteristics – 5 V devices (cont.)<sup>(7)</sup>

( $V_S = 5.0 V_{DC}$ ,  $T_A = 25^\circ C$ , RH=50 %, analog output signal is ratiometric to  $V_S$  in the range of  $V_S = 4.2...5.5 V$ )

#### Pressure ranges from 10 mbar to 50 mbar / 1 psi

##### Unidirectional devices

| Parameter                             | Min. | Typ. | Max. | Unit |
|---------------------------------------|------|------|------|------|
| Zero pressure offset                  | 0.45 | 0.50 | 0.55 | V    |
| Full scale span (FSS) <sup>(12)</sup> |      | 4.00 |      |      |
| Full scale output                     | 4.45 | 4.50 | 4.55 |      |

##### Bidirectional devices

| Parameter                             | Min.                      | Typ. | Max. | Unit |
|---------------------------------------|---------------------------|------|------|------|
| Zero pressure offset                  | 2.45                      | 2.50 | 2.55 | V    |
| Full scale span (FSS) <sup>(12)</sup> |                           | 4.00 |      |      |
| Full scale output                     | @ max. specified pressure | 4.45 | 4.50 |      |
|                                       | @ min. specified pressure | 0.45 | 0.50 |      |

#### All other pressure ranges

##### Unidirectional devices

| Parameter                             | Min. | Typ. | Max. | Unit |
|---------------------------------------|------|------|------|------|
| Zero pressure offset                  | 0.47 | 0.50 | 0.53 | V    |
| Full scale span (FSS) <sup>(12)</sup> |      | 4.00 |      |      |
| Full scale output                     | 4.47 | 4.50 | 4.53 |      |

##### Bidirectional devices

| Parameter                             | Min.                      | Typ. | Max. | Unit |
|---------------------------------------|---------------------------|------|------|------|
| Zero pressure offset                  | 2.47                      | 2.50 | 2.53 | V    |
| Full scale span (FSS) <sup>(12)</sup> |                           | 4.00 |      |      |
| Full scale output                     | @ max. specified pressure | 4.47 | 4.50 |      |
|                                       | @ min. specified pressure | 0.47 | 0.50 |      |

#### Specification notes (cont.)

(7) Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.

(12) Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.

## HMA series – amplified pressure sensors

### Performance characteristics – 3 V devices<sup>(7)</sup>

( $V_S = 3.0 V_{DC}$ ,  $T_A = 25^\circ C$ , RH=50 %, analog output signal is ratiometric to  $V_S$  in the range of  $V_S = 2.7...4.2 V$ )

| Parameter                                    | Min.                       | Typ. | Max.  | Unit |
|----------------------------------------------|----------------------------|------|-------|------|
| Non-linearity (-20...85 °C) <sup>(8)</sup>   |                            |      | ±0.25 |      |
| Accuracy <sup>(9)</sup>                      |                            |      | ±0.25 |      |
| Total accuracy (-20...85 °C) <sup>(10)</sup> | up to 5 mbar               |      | ±2    | %FSS |
|                                              | 10 mbar to 50 mbar / 1 psi |      | ±1.25 |      |
|                                              | all others                 |      | ±0.75 |      |
| Response delay <sup>(11)</sup>               |                            | 0.5  |       | ms   |
| A/D resolution                               |                            | 12   |       | bit  |
| D/A resolution                               |                            |      | 11    |      |
| Current consumption                          | <1 bar                     | 3.7  |       | mA   |
|                                              | all others                 | 4.5  |       |      |

### Pressure ranges up to 5 mbar

#### Unidirectional devices

| Parameter                             | Min.  | Typ. | Max.  | Unit |
|---------------------------------------|-------|------|-------|------|
| Zero pressure offset                  | 0.252 | 0.30 | 0.348 |      |
| Full scale span (FSS) <sup>(12)</sup> |       | 2.40 |       | V    |
| Full scale output                     | 2.652 | 2.70 | 2.748 |      |

#### Bidirectional devices

| Parameter                             | Min.                      | Typ.  | Max.  | Unit |
|---------------------------------------|---------------------------|-------|-------|------|
| Zero pressure offset                  | 1.452                     | 1.50  | 1.548 |      |
| Full scale span (FSS) <sup>(12)</sup> |                           | 2.40  |       | V    |
| Full scale output                     | @ max. specified pressure | 2.652 | 2.70  |      |
|                                       | @ min. specified pressure | 0.252 | 0.30  |      |

#### Specification notes (cont.)

(7) Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.

(8) Non-linearity is the measured deviation based on Best Fit Straight Line (BFSL).

(9) Accuracy is the combined error from non-linearity and hysteresis. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure.

(10) Total accuracy is the combined error from offset and span calibration, non-linearity, pressure hysteresis, and temperature effects. Calibration errors include the deviation of offset and full scale from nominal values.

(11) Max. delay time between pressure change at the pressure die and signal change at the output.

(12) Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.

## HMA series – amplified pressure sensors

### Performance characteristics – 3 V devices (cont.)<sup>(7)</sup>

( $V_S = 3.0 V_{DC}$ ,  $T_A = 25^\circ C$ , RH=50 %, analog output signal is ratiometric to  $V_S$  in the range of  $V_S = 2.7...4.2 V$ )

#### Pressure ranges from 10 mbar to 50 mbar / 1 psi

##### Unidirectional devices

| Parameter                             | Min. | Typ. | Max. | Unit |
|---------------------------------------|------|------|------|------|
| Zero pressure offset                  | 0.27 | 0.30 | 0.33 |      |
| Full scale span (FSS) <sup>(12)</sup> |      | 2.40 |      | V    |
| Full scale output                     | 2.67 | 2.70 | 2.73 |      |

##### Bidirectional devices

| Parameter                                   | Min. | Typ. | Max. | Unit |
|---------------------------------------------|------|------|------|------|
| Zero pressure offset                        | 1.47 | 1.50 | 1.53 |      |
| Full scale span (FSS) <sup>(12)</sup>       |      | 2.40 |      | V    |
| Full scale output @ max. specified pressure | 2.67 | 2.70 | 2.73 |      |
| @ min. specified pressure                   | 0.27 | 0.30 | 0.33 |      |

#### All other pressure ranges

##### Unidirectional devices

| Parameter                             | Min.  | Typ. | Max.  | Unit |
|---------------------------------------|-------|------|-------|------|
| Zero pressure offset                  | 0.282 | 0.30 | 0.318 |      |
| Full scale span (FSS) <sup>(12)</sup> |       | 2.40 |       | V    |
| Full scale output                     | 2.682 | 2.70 | 2.718 |      |

##### Bidirectional devices

| Parameter                                   | Min.  | Typ. | Max.  | Unit |
|---------------------------------------------|-------|------|-------|------|
| Zero pressure offset                        | 1.482 | 1.50 | 1.518 |      |
| Full scale span (FSS) <sup>(12)</sup>       |       | 2.40 |       | V    |
| Full scale output @ max. specified pressure | 2.682 | 2.70 | 2.718 |      |
| @ min. specified pressure                   | 0.282 | 0.30 | 0.318 |      |

#### Specification notes (cont.)

(7) Sensor is calibrated in air, changes in sensor behaviour based on physical effects caused by the specific media can occur. Weight of the media and wetting forces can influence the sensor characteristics.

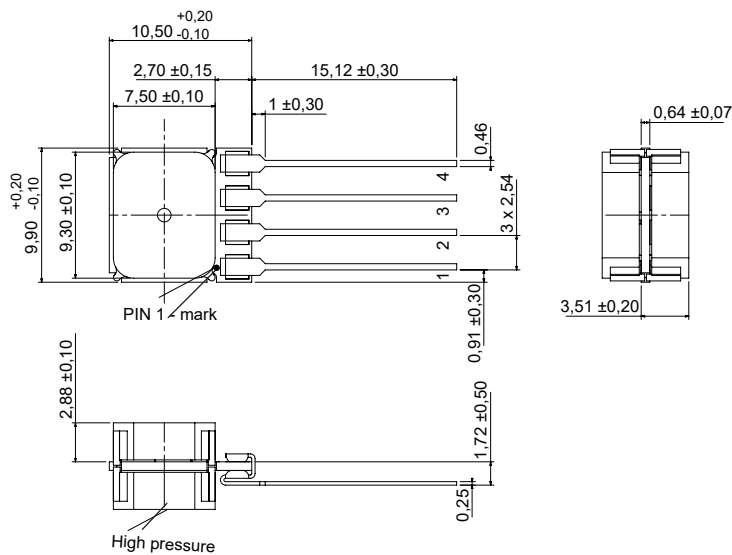
(12) Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.

HMA series – amplified pressure sensors

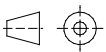
Dimensional drawing

Electrical connection

HMA...U1... (SIL, axial no ports)

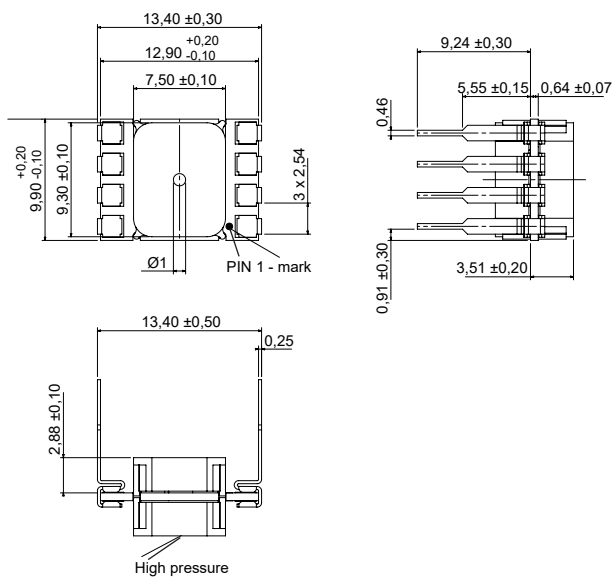


| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |



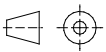
first angle projection  
dimensions in mm

HMA...W1... (DIP, axial no ports)



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

\* internal connection. Do not  
connect for any reason

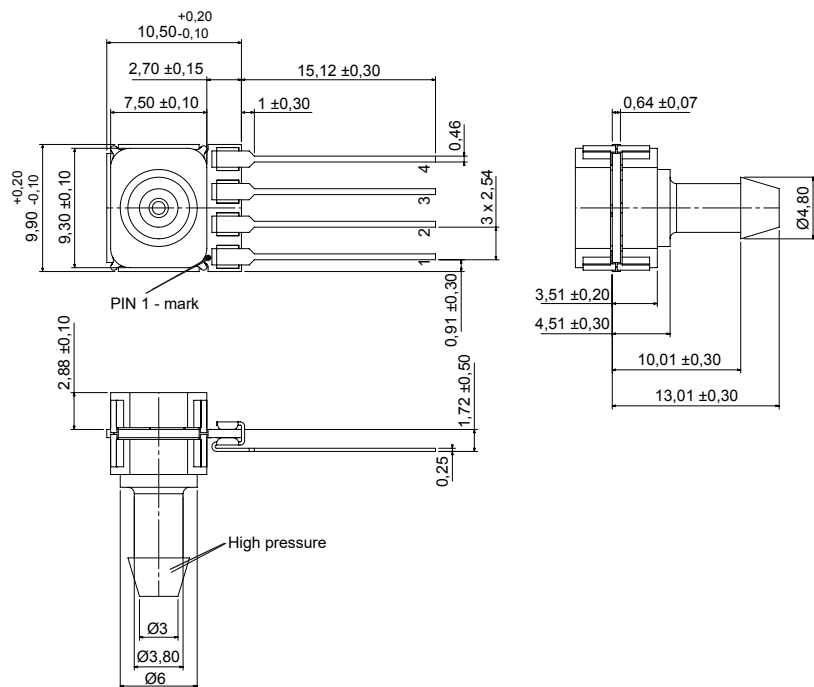


first angle projection  
dimensions in mm

HMA series – amplified pressure sensors

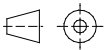
Dimensional drawing

HMA...X7... (SIL, 1 port axial, barbed)



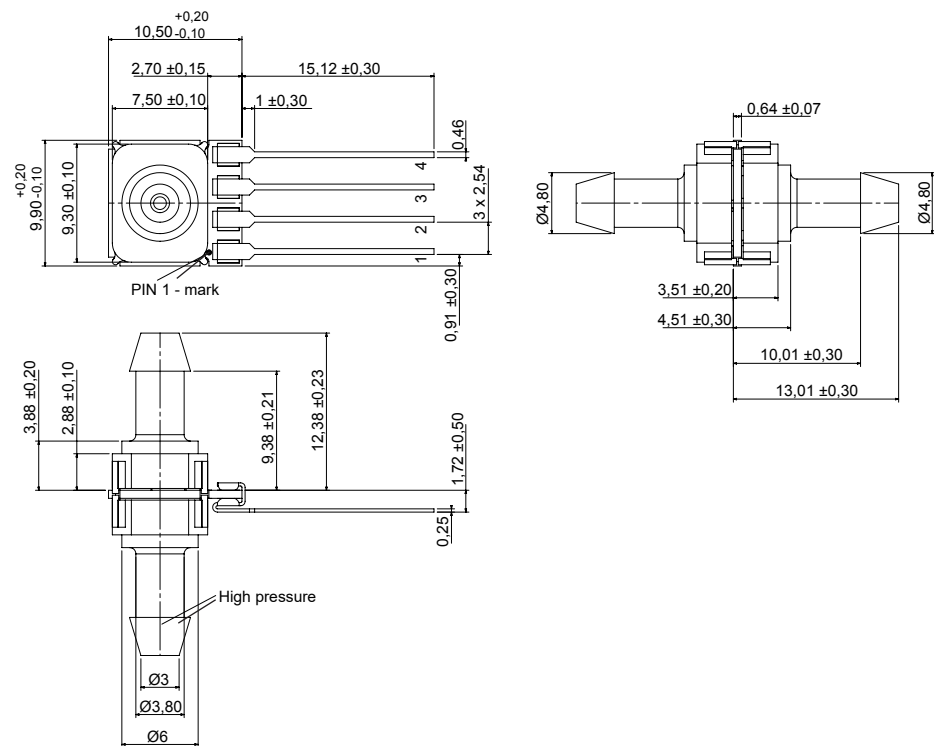
Electrical connection

| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |

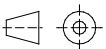


first angle projection  
dimensions in mm

HMA...U7... (SIL, 2 ports axial, opposite side, barbed)



| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |

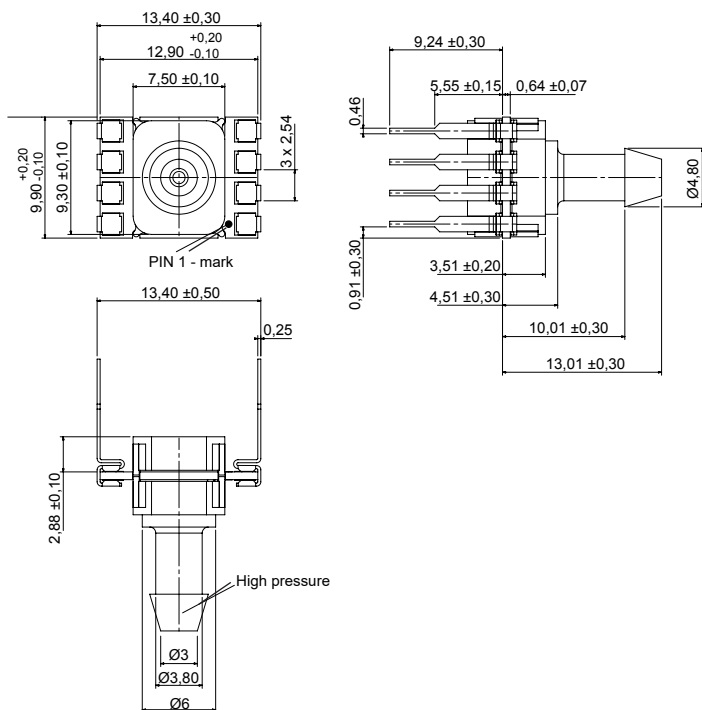


first angle projection  
dimensions in mm

HMA series – amplified pressure sensors

Dimensional drawing

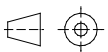
HMA...Z7... (DIP, 1 port axial, barbed)



Electrical connection

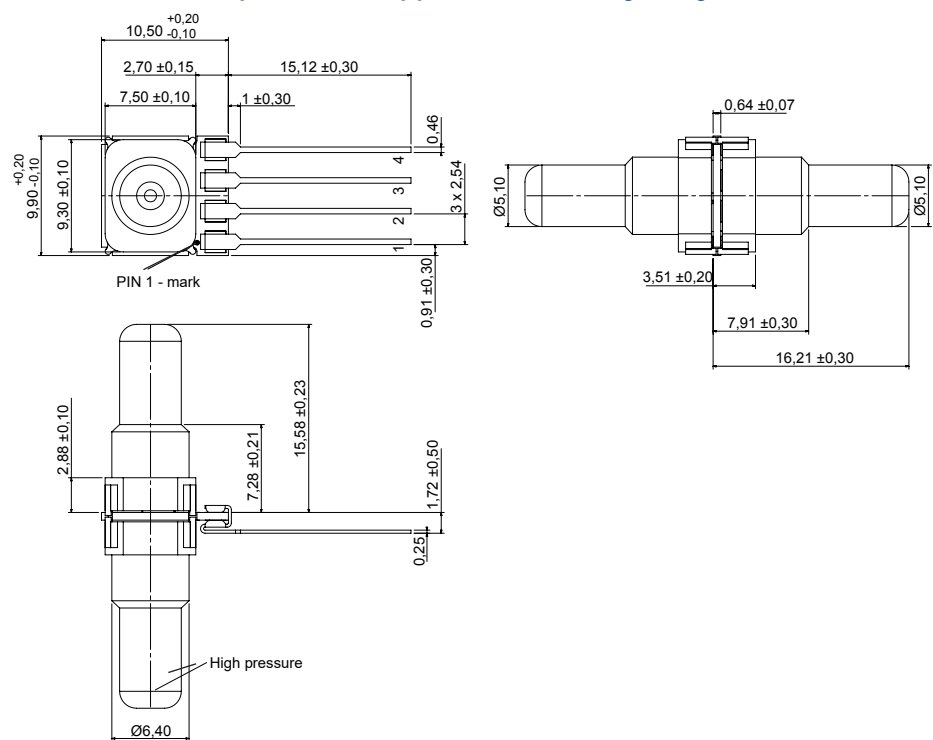
| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |
| 5   | I/C*       |
| 6   | I/C*       |
| 7   | I/C*       |
| 8   | I/C*       |

\* internal connection. Do not connect for any reason

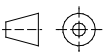


first angle projection  
dimensions in mm

HMA...U6... (SIL, 2 ports axial, opposite side, straight big)



| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |



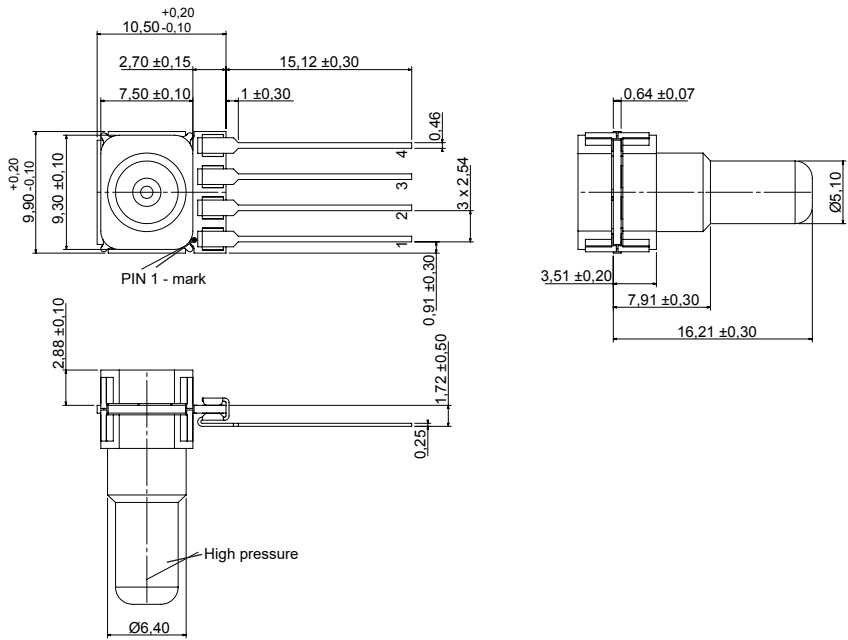
first angle projection  
dimensions in mm

HMA series – amplified pressure sensors

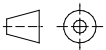
Dimensional drawing

Electrical connection

HMA...X6... (SIL, 1 port axial, straight big)

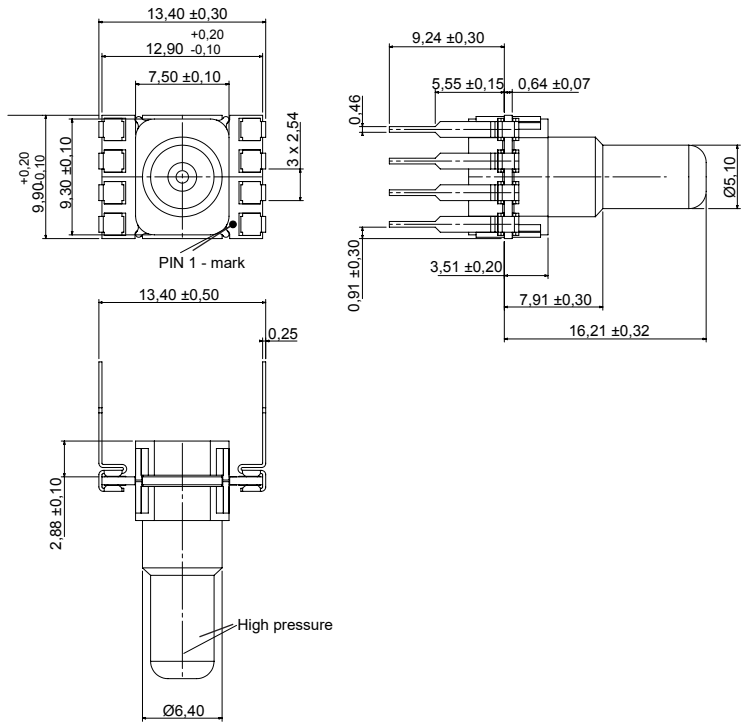


| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |



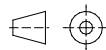
first angle projection  
dimensions in mm

HMA...Z6... (DIP, 1 port axial, straight big)



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

\* internal connection. Do not  
connect for any reason



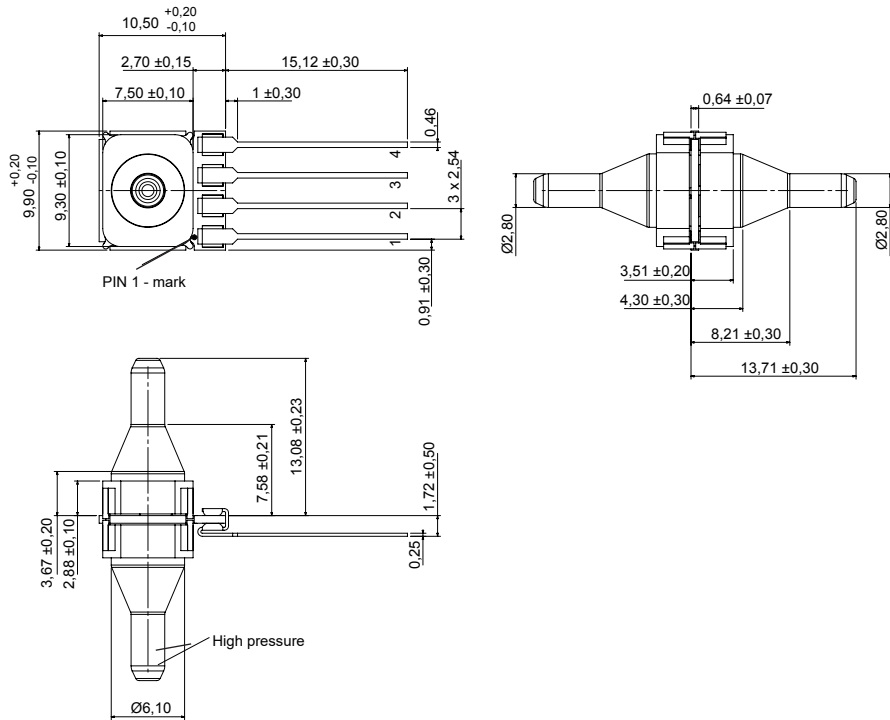
first angle projection  
dimensions in mm

HMA series – amplified pressure sensors

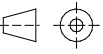
Dimensional drawing

Electrical connection

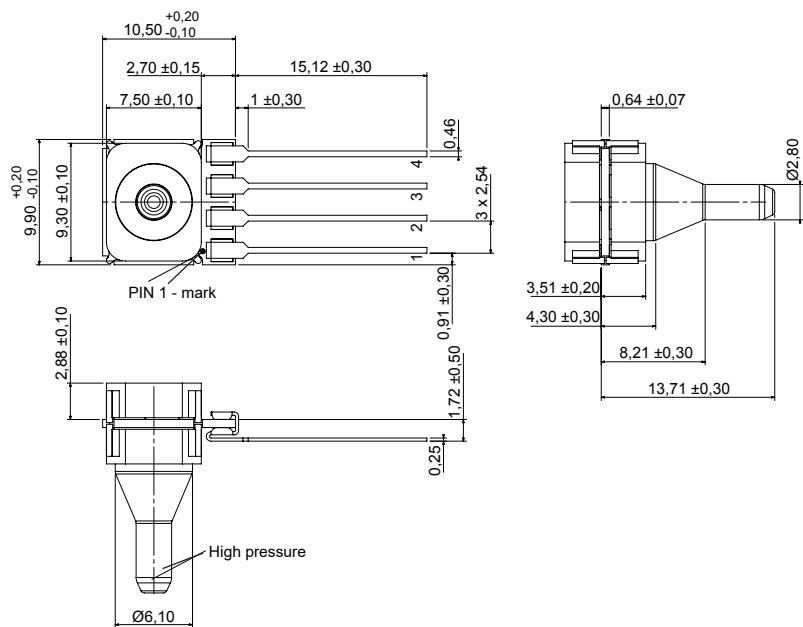
HMA...U5... (SIL, 2 ports axial, opposite side, needle big)



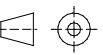
| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |

  
first angle projection  
dimensions in mm

HMA...X5... (SIL, 1 port axial, needle big)



| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |

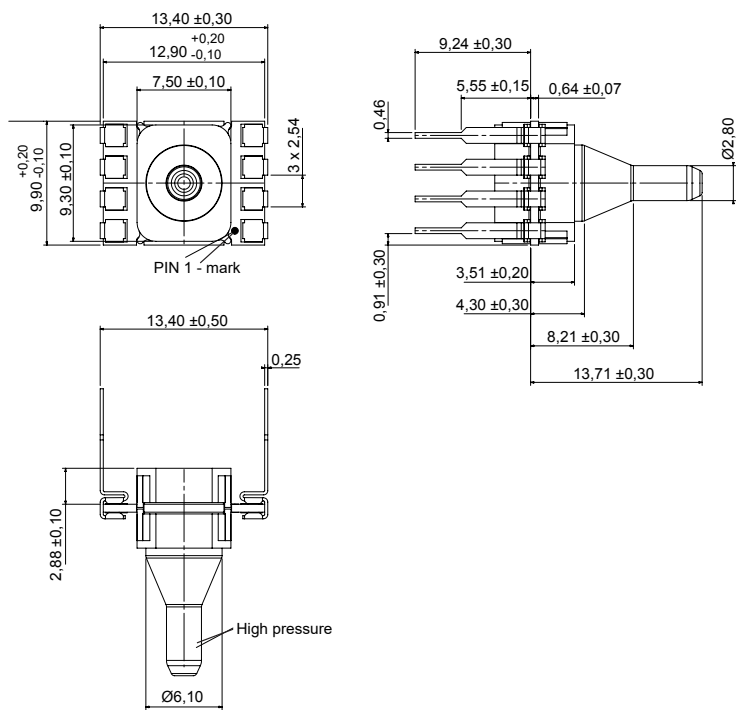
  
first angle projection  
dimensions in mm

HMA series – amplified pressure sensors

Dimensional drawing

Electrical connection

HMA...Z5... (DIP, 1 port axial, needle big)

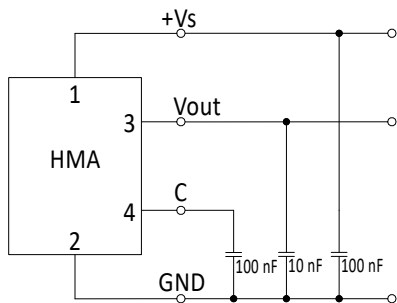


| Pin | connection |
|-----|------------|
| 1   | +Vs        |
| 2   | GND        |
| 3   | +Vout      |
| 4   | C          |
| 5   | I/C*       |
| 6   | I/C*       |
| 7   | I/C*       |
| 8   | I/C*       |

\* internal connection. Do not connect for any reason

first angle projection  
dimensions in mm

Electrical connection (cont.)



## HMA series – amplified pressure sensors

### Ordering information

| Series | Pressure range |          | Calibration |                | Housing |                                     | Porting |              | Grade |      | Voltage |     |
|--------|----------------|----------|-------------|----------------|---------|-------------------------------------|---------|--------------|-------|------|---------|-----|
| HMA    | M2x5           | 2.5 mbar | B           | Bidirectional  | U       | [SIL, 2 ports axial, opposite side] | 1       | no port      | H     | High | 3       | 3 V |
|        | M005           | 5 mbar   | U           | Unidirectional | W       | [DIP, 2 ports axial, opposite side] | 7       | Barbed       |       |      | 5       | 5 V |
|        | M010           | 10 mbar  |             |                | X       | [SIL, 1 port axial]                 | 5       | Needle big   |       |      |         |     |
|        | M020           | 20 mbar  |             |                | Z       | [DIP, 1 port axial]                 | 6       | Straight big |       |      |         |     |
|        | M050           | 50 mbar  |             |                |         |                                     |         |              |       |      |         |     |
|        | M100           | 100 mbar |             |                |         |                                     |         |              |       |      |         |     |
|        | M250           | 250 mbar |             |                |         |                                     |         |              |       |      |         |     |
|        | B001           | 1 bar    |             |                |         |                                     |         |              |       |      |         |     |
|        | B2x5           | 2.5 bar  |             |                |         |                                     |         |              |       |      |         |     |
|        | B005           | 5 bar    |             |                |         |                                     |         |              |       |      |         |     |
|        | B010           | 10 bar   |             |                |         |                                     |         |              |       |      |         |     |
|        | P001           | 1 psi    |             |                |         |                                     |         |              |       |      |         |     |
|        | P100           | 100 psi  |             |                |         |                                     |         |              |       |      |         |     |

Order code example: HMAB001BX7H5

**Note:** Not all possible sensor configurations are active products. MOQ may apply.  
Custom specific pressure and temperature ranges as well as mechanical or electronic sensor modifications are widely available.  
Please contact First Sensor.

### Label information

| Digit | 1      | 2 | 3              | 4                                           | 5        | 6                                     | 7                                      | 8                                 | 9                                 | 10         | 11               | 12 | 13              | 14 |
|-------|--------|---|----------------|---------------------------------------------|----------|---------------------------------------|----------------------------------------|-----------------------------------|-----------------------------------|------------|------------------|----|-----------------|----|
|       | Series |   | Pressure range | Pressure unit / pressure mode / calibration |          | Housing                               | Porting                                | Grade / voltage                   |                                   | Rev        | Date code (year) |    | Production code |    |
| Char  | M      | A | HMA            | 1                                           | 2.5 mbar | U                                     | bar, gage/differential, unidirectional | U                                 | SIL, 2 ports axial, opposite side | 1          | no port          | -  | High, 5 V       |    |
|       |        |   | 2              | 5 mbar                                      |          |                                       |                                        | 7                                 | Barbed                            | /          | High, 3 V        |    |                 |    |
|       |        |   | 3              | 10 mbar                                     | B        | bar, gage/differential, bidirectional | W                                      | DIP, 2 ports axial, opposite side | 5                                 | Needle big |                  |    |                 |    |
|       |        |   | 4              | 20 mbar                                     |          |                                       |                                        | 6                                 | Straight big                      |            |                  |    |                 |    |
|       |        |   | 5              | 50 mbar                                     |          |                                       | X                                      | SIL, 1 port axial                 |                                   |            |                  |    |                 |    |
|       |        |   | 6              | 1 psi                                       |          |                                       | Z                                      | DIP, 1 port axial                 |                                   |            |                  |    |                 |    |
|       |        |   | 7              | 100 mbar                                    |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | 8              | 250 mbar                                    |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | A              | 1 bar                                       |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | B              | 2.5 bar                                     |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | C              | 5 bar                                       |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | L              | 100 psi                                     |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |
|       |        |   | M              | 10 bar                                      |          |                                       |                                        |                                   |                                   |            |                  |    |                 |    |

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