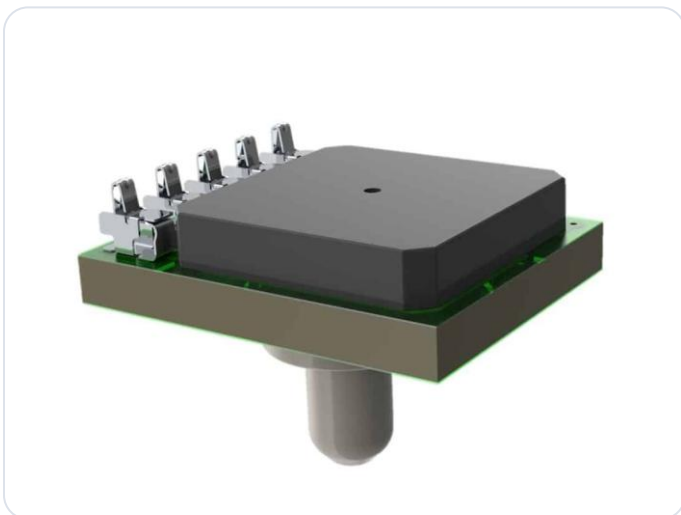


# PPS52 Harsh-Media Board-Mount Pressure Sensor

Fully compensated MEMS sensing with I<sup>2</sup>C and 0.5–4.5 V ratiometric outputs



MADE IN USA

ROHS

## FEATURES

- Dual output: I<sup>2</sup>C (15-bit) and 0.5–4.5 V ratiometric analog
- Standard ranges 15, 100, 300 and 500 PSI
- Absolute or gauge pressure reference
- Accuracy options  $\pm 2.5\%$ ,  $\pm 1.0\%$  and  $\pm 0.25\%$  FS
- Operating temperature  $-40$  to  $150$  °C
- Harsh-media wetted path: silicon, glass and ceramic only
- Five spring contacts for fast, solderless assembly
- Supply overvoltage and reverse-polarity protection to 40 V
- 4 kV ESD protection (Human Body Model)

## DESCRIPTION

The PPS52 is a fully compensated, harsh-media pressure sensor package with simultaneous I<sup>2</sup>C and ratiometric analog outputs. It is built for demanding pressure-sensing environments across a  $-40$  to  $150$  °C operating range.

A ceramic pressure port isolates the on-board electronics from the media, and the sensing element is mechanically decoupled from the high-Tg FR-4 substrate to prevent offset shifts during assembly. Spring contacts mate directly to the customer board, simplifying and speeding up assembly.

## APPLICATIONS

- Pneumatic systems and industrial automation
- Water level and water pressure monitoring
- HVAC, air-conditioning and refrigerant systems
- Portable measurement and analysis instruments
- Automotive: transmission, fuel, oil, exhaust gas and air brake
- Medical diagnostic and analysis equipment

## MAXIMUM RATINGS

|                              |                                                                                       |                |                      |
|------------------------------|---------------------------------------------------------------------------------------|----------------|----------------------|
| Operating Temperature        | <b><math>-40</math> to <math>150</math> °C • <math>-40</math>–<math>302</math> °F</b> | Proof Pressure | <b>2× full scale</b> |
| Storage Temperature          | <b><math>-55</math> to <math>150</math> °C • <math>-67</math>–<math>302</math> °F</b> | Burst Pressure | <b>5× full scale</b> |
| Supply Overvoltage / Reverse | <b><math>+40</math> V / <math>-40</math> V</b>                                        | Pressure Range | <b>15 to 500 PSI</b> |

## Electrical, performance & environmental specifications

| PARAMETER                          | MIN             | TYP   | MAX   | UNITS  | NOTES                         |
|------------------------------------|-----------------|-------|-------|--------|-------------------------------|
| <b>ELECTRICAL</b>                  |                 |       |       |        |                               |
| Supply voltage (Vs)                | 4.5             | 5.0   | 5.5   | V      |                               |
| Supply current                     | –               | 7     | –     | mA     | At 5.00 V and 25 °C           |
| Supply overvoltage protection      | –               | –     | 40    | V      | Operation ceases during fault |
| Reverse polarity protection        | –40             | –     | –     | V      | Operation ceases during fault |
| Output overvoltage protection      | –40             | –     | 40    | V      | Operation ceases during fault |
| ESD protection                     | –               | –     | 4000  | V      | Human Body Model              |
| <b>PERFORMANCE</b>                 |                 |       |       |        |                               |
| Analog output range (Vout)         | 10              | –     | 90    | %Vs    | 0.5–4.5 V at 5 V supply       |
| Analog output clipping             | 5               | –     | 95    | %Vs    | Custom limits on request      |
| Analog resolution                  | –               | 0.024 | –     | %FS    | 12-bit                        |
| Digital output (I <sup>2</sup> C)  | 0               | –     | 32768 | counts | 15-bit                        |
| Accuracy — Standard, –15 to 125 °C | –2.5            | –     | 2.5   | %FS    | See note 1                    |
| Accuracy — Standard, extended temp | –5.0            | –     | 5.0   | %FS    | See note 2                    |
| Accuracy — High, –15 to 125 °C     | –1.0            | –     | 1.0   | %FS    | See note 1                    |
| Accuracy — High, extended temp     | –2.0            | –     | 2.0   | %FS    | See note 2                    |
| Accuracy — Ultra, –15 to 125 °C    | –0.25           | –     | 0.25  | %FS    | See note 1                    |
| Accuracy — Ultra, extended temp    | Consult factory |       |       | %FS    | See note 2                    |
| Lifetime drift                     | –0.8            | –     | 0.8   | %FS    | 1000 h at 150 °C              |
| Proof pressure                     | 2×              | –     | –     | FS     | Static                        |
| Burst pressure                     | 5×              | –     | –     | FS     |                               |
| <b>ENVIRONMENTAL</b>               |                 |       |       |        |                               |
| Operating temperature              | –40             | –     | 150   | °C     |                               |
| Storage temperature                | –55             | –     | 150   | °C     |                               |

1) Accuracy includes all pressure and thermal hysteresis and linearity errors across the stated temperature range. It excludes lifetime drift. 2) Extended temperature range: –40 to –15 °C and 125 to 150 °C.

### Electrical connections — 5 spring contacts

| PIN | SIGNAL | FUNCTION                             |
|-----|--------|--------------------------------------|
| 1   | A_Out  | Analog output, 0.5–4.5 V ratiometric |
| 2   | SDA    | I <sup>2</sup> C serial data         |
| 3   | GND    | Ground                               |
| 4   | SCL    | I <sup>2</sup> C serial clock        |
| 5   | Vs     | Supply voltage, 5 V nominal          |

### Media & materials

| ITEM             | DETAIL                  |
|------------------|-------------------------|
| Compatible media | Liquid, air and gas     |
| Wetted materials | Silicon, glass, ceramic |
| Pressure port    | Ceramic button          |
| Substrate        | FR-4, high Tg           |
| Weight           | 1.35 g typical          |

Power-supply decoupling and output filtering are built in. Pins are numbered left to right in the top view on page 4.

## I<sup>2</sup>C interface & transfer functions

| I <sup>2</sup> C PARAMETER   | SYM                 | MIN  | MAX  | UNIT            |
|------------------------------|---------------------|------|------|-----------------|
| Voltage level HIGH           | V <sub>IH</sub>     | 0.8× | —    | V <sub>DD</sub> |
| Voltage level LOW            | V <sub>IL</sub>     | —    | 0.2× | V <sub>DD</sub> |
| SCL clock frequency          | f <sub>SCL</sub>    | —    | 400  | kHz             |
| Bus free time, stop to start | t <sub>BF</sub>     | 1.3  | —    | μs              |
| Hold time, start condition   | t <sub>HD_STA</sub> | 0.6  | —    | μs              |
| Setup time, repeated start   | t <sub>SU_STA</sub> | 0.6  | —    | μs              |
| Low period SCL/SDA           | t <sub>L</sub>      | 1.3  | —    | μs              |
| High period SCL/SDA          | t <sub>H</sub>      | 0.6  | —    | μs              |
| Data hold time               | t <sub>HD_DAT</sub> | 0.1  | —    | μs              |
| Data setup time              | t <sub>SU_DAT</sub> | 0.1  | —    | μs              |
| Rise time SCL/SDA            | t <sub>R</sub>      | —    | 0.3  | μs              |
| Fall time SCL/SDA            | t <sub>F</sub>      | —    | 0.3  | μs              |
| Setup time, stop condition   | t <sub>SU_STO</sub> | 0.6  | —    | μs              |
| Noise suppression SDA/SCL    | t <sub>NI</sub>     | —    | 50   | ns              |

Digital interface values are for reference only.

### Analog transfer function

$$P_{\text{psi}} = (P_{\text{max}} - P_{\text{min}}) \cdot (V_{\text{out}} - V_{\text{min}}) / (V_{\text{max}} - V_{\text{min}}) + P_{\text{min}}$$

V<sub>min</sub> = 0.5 V and V<sub>max</sub> = 4.5 V (typical). V<sub>out</sub> = measured output voltage.

### Sensor construction & typical installation

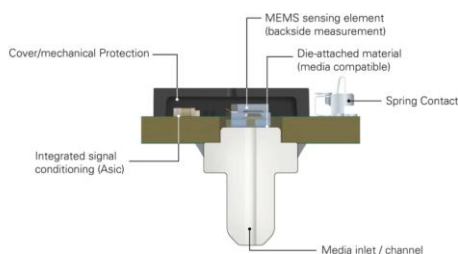


Fig. 1 – Construction. The MEMS element senses from the backside through a media-isolated inlet. The signal-conditioning ASIC sits under a protective cover.

### I<sup>2</sup>C addressing & data read

The default slave address is **0x28**. Addresses 0x29, 0x2A and 0x2B are available on request. Parts with an alternate address respond to both that address and 0x28.

To set up data reads, write **0x2E 0x21 0x00** once. This interrupts normal processing and activates the pressure-data register. Send it only once. After that, each read returns data from that register without interrupting processing.

Read three bytes. Byte 1 echoes the command (0x2E), and bytes 2–3 hold the pressure output in counts.

### Digital (I<sup>2</sup>C) transfer function

$$P_{\text{psi}} = (P_{\text{max}} - P_{\text{min}}) \cdot (P_{\text{counts}} - 0.1 \cdot \text{MAX}) / (0.8 \cdot \text{MAX}) + P_{\text{min}}$$

MAX = 32768 (15 bits). P<sub>counts</sub> = pressure output in counts. P<sub>min</sub> / P<sub>max</sub> = calibrated range end points.

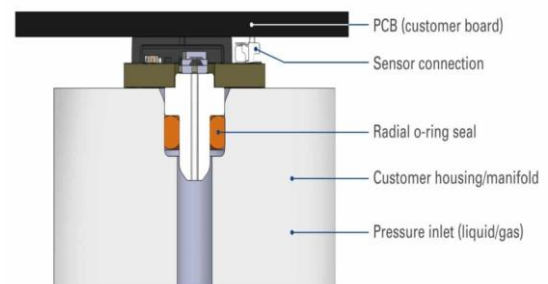


Fig. 2 – Typical installation. Spring contacts mate to the customer PCB, and a radial O-ring seals the inlet into the customer housing or manifold.

## Mechanical dimensions — inches

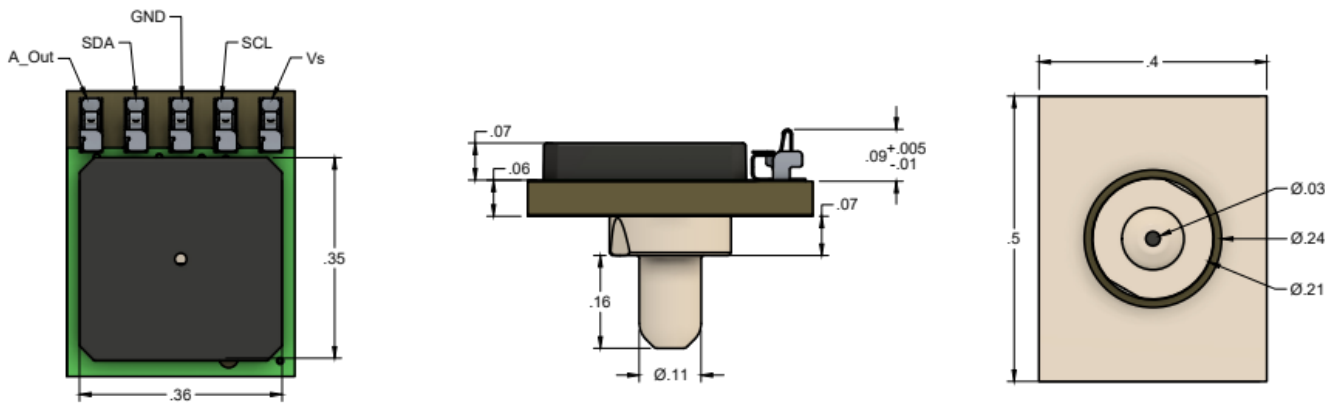


Fig. 3 – PPS52-XXX-YPAE outline and contact layout (top, side and bottom views). Contacts, left to right in top view: A\_Out, SDA, GND, SCL, Vs. Dimensions in inches.

| FEATURE               | DETAIL                                 |
|-----------------------|----------------------------------------|
| Pressure port         | Ceramic button with radial O-ring seal |
| Electrical connection | 5 spring contacts                      |
| Contact deflection    | 0.65 mm $\pm$ 0.25 mm recommended      |
| Normal force          | 0.67 N at 0.65 mm deflection           |
| Mating SMD pad size   | 2.1 $\times$ 1.0 mm                    |
| Weight                | 1.35 g typical                         |

### TOLERANCES (UNLESS NOTED)

X  $\pm$  0.5  $\cdot$  X.X  $\pm$  0.15  $\cdot$  X.XX  $\pm$  0.010  $\cdot$  X.XXX  $\pm$  0.005

- 1) Dimensions are for reference only. Engineering drawings with tolerances are available with your order.
- 2) Mating PCB pads should line up with the spring-contact positions shown above.
- 3) The O-ring seal must be supported by the customer housing or manifold bore.

## Ordering information — part-number configuration



| Model        | Pressure range (XXX)                                           | Pressure type (Y)         | Port (P)           | Accuracy (A)                                                            | Electrical (E)        |
|--------------|----------------------------------------------------------------|---------------------------|--------------------|-------------------------------------------------------------------------|-----------------------|
| <b>PPS52</b> | 15 = 15 PSI<br>100 = 100 PSI<br>300 = 300 PSI<br>500 = 500 PSI | 1 = Absolute<br>2 = Gauge | 0 = Ceramic button | 1 = ±2.5% FS (Standard)<br>2 = ±1.0% FS (High)<br>3 = ±0.25% FS (Ultra) | 0 = 5 spring contacts |

### ORDER NOTES

Custom pressure calibration is available on request. · Alternate I<sup>2</sup>C addresses (0x29, 0x2A, 0x2B) are available on request. · Analog clipping limits can be customized. · Parts ship on tape & reel or in trays; specify the packaging with your order.

### EXAMPLE PART NUMBERS

**PPS52-100-2010** → 0–100 PSI gauge · ceramic button · ±2.5% FS · 5 spring contacts

**PPS52-500-1030** → 0–500 PSI absolute · ceramic button · ±0.25% FS · 5 spring contacts

## Configure your PPS52

### REQUEST A QUOTE

Custom ranges, calibrations, I<sup>2</sup>C addresses and output limits are available for OEM volumes. [sales@phoenixsensors.com](mailto:sales@phoenixsensors.com)  
Talk to an engineer to spec your part.

(480) 462-1810

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