PGS4100 Series
MEMS THERMAL CONDUCTIVITY HYDROGEN SENSOR

DESCRIPTION

The PGS4100 series of hydrogen sensor detects hydrogen concentration in air by measuring the change in thermal conductivity of the gas mixture. Hydrogen and air have very different thermal conductivity. Variations in hydrogen concentration result in significant changes in the thermal conductivity of the gas mixture.

The PGS4100 series has incorporated a relative humidity sensor and a barometric pressure sensor to compensate for thermal conductivity changes caused by the presence of humidity in air and by elevation. Humidity and pressure compensation make the PGS4100 more accurate in hydrogen concentration measurement, allowing it to comply with industry standards for flammable gas detection.

The PGS4100 series uses Posifa's second-generation thermal conductivity die, packaged in an SMD form factor. The sensor is excited with a pulsed waveform (400ms on and 1000ms off), resulting in a heater temperature that is almost the same as the ambient, lending intrinsic safety to the sensor. Posifa's thermal conductivity sensor has been tested with long term exposure to harsh environments, including hundreds of thermal cycles and freezing. It has shown excellent stability and robustness.

The PGS4100 series supports voltage analog and I²C digital output. In the future it will support MODBUS/RS485 and CAN bus. The PGS4100 is housed in a IP6K9 compliant enclosure with a wire harness that is terminated with an automotive-grade connector for enhanced durability.

FEATURES

- Humidity and pressure compensated.
- Remains accurate in harsh environments
- Non-reactive to "poisons" or contaminants
- Long term stability

APPLICATIONS

- Hydrogen leak detection
- Battery thermal runaway early detection
- Process monitoring

ABSOLUTE MAXIMUM RATINGS

- Operating temperature: -40 °C to 85 °C
- Storage temperature: -40 °C to 90 °C
- Supply voltage: 5.5 Vdc
## GENERAL SPECIFICATION

### ELECTRICAL

<table>
<thead>
<tr>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>4.75</td>
<td>5</td>
<td>5.5</td>
<td>Vdc</td>
<td></td>
</tr>
<tr>
<td>I²C Pullup Voltage</td>
<td>3</td>
<td></td>
<td></td>
<td>Vdc</td>
<td></td>
</tr>
<tr>
<td>Power - Peak</td>
<td>190</td>
<td></td>
<td></td>
<td>mW</td>
<td>5 Vdc and TC sensors are turned on</td>
</tr>
<tr>
<td>Power - Average</td>
<td>50</td>
<td></td>
<td></td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td>0.5</td>
<td>4.5</td>
<td></td>
<td>Vdc</td>
<td>0 - F.S. concentration</td>
</tr>
</tbody>
</table>

### ENVIRONMENTAL

<table>
<thead>
<tr>
<th>Conditions</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-40</td>
<td></td>
<td>85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40</td>
<td></td>
<td>90</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating Relative Humidity</td>
<td>0</td>
<td></td>
<td>100</td>
<td>%RH</td>
<td>Resistant to condensation</td>
</tr>
<tr>
<td>Operating Pressure</td>
<td>30</td>
<td></td>
<td>120</td>
<td>kPa</td>
<td></td>
</tr>
</tbody>
</table>
## HYDROGEN DETECTION, Vdd = 5 Vdc

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
<th>CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hydrogen in air</td>
</tr>
<tr>
<td>Principle of Detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thermal conductivity</td>
</tr>
<tr>
<td>Measurement Range</td>
<td>0 to 4</td>
<td></td>
<td></td>
<td>Vol % H₂ in air</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Resolution - Analog</td>
<td>10</td>
<td></td>
<td></td>
<td>ppm</td>
<td></td>
</tr>
<tr>
<td>Resolution - Digital</td>
<td>2</td>
<td></td>
<td></td>
<td>ppm</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>1200</td>
<td></td>
<td></td>
<td>ppm</td>
<td>0 to 20000 ppm H₂ in air at 25 ºC</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td>% reading</td>
<td>Above 20000 ppm H₂ in air at 25 ºC</td>
</tr>
<tr>
<td>Temperature Drift</td>
<td>1000</td>
<td></td>
<td></td>
<td>ppm</td>
<td>From 25 to 85 ºC, or from 25 to -40 ºC</td>
</tr>
<tr>
<td>Long-Term Stability</td>
<td>1200</td>
<td></td>
<td></td>
<td>ppm</td>
<td>Over 5 years</td>
</tr>
<tr>
<td>Response Time t(90)</td>
<td>1</td>
<td></td>
<td></td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>Warm-up Time</td>
<td>1</td>
<td></td>
<td></td>
<td>s</td>
<td></td>
</tr>
</tbody>
</table>

1. Errors include effects of pressure variation from 50 to 101 KPa, and relative humidity variation from 0 to 100% RH.
2. Customization for faster response time and warm-up time is available.
OUTPUT DESCRIPTION

Analog Output (Volt)
Hydrogen concentration in ppm = (Vout - 0.5) * 10000
For example, when the output voltage = 1 V, the hydrogen concentration is 5000 ppm (or 0.5 % vol).

Digital Output (Count)
Hydrogen concentration in ppm = Count
For example, when the output cout = 5000, the hydrogen concentration is 5000 ppm (or 0.5 % vol).
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CONNECTION INTERFACE

PGS4100-T
Connector: 1-967587-1 (TE)
Wire: AESSX 0.3f (Sumitomo)
Wire length: 75 mm

Connector Specification

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5Vdc</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>SCL</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>SDA</td>
<td>Yellow</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Signal</td>
<td>Blue</td>
</tr>
</tbody>
</table>

PGS4100/PGS4100D
Wire length: 75 mm
Connector Specification

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5Vdc</td>
<td>Red</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>SDA</td>
<td>Yellow</td>
</tr>
<tr>
<td>4</td>
<td>SCL</td>
<td>Green</td>
</tr>
<tr>
<td>5</td>
<td>Signal</td>
<td>Blue</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
<td></td>
</tr>
</tbody>
</table>
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INSTALLATION

The PGS4100 must be exposed to measured air at all times. The location must be chosen so as to maximize air exchange; dead spaces must be avoided. Preferably, the vent in the module should be facing downward. If this is not possible, it should be vertical, but should never be facing upward, to prevent accumulation of dirt, and water.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGS4104-T</td>
<td>0 to 4 % vol, analog and I²C output, TE connector terminated</td>
</tr>
<tr>
<td>PGS4104</td>
<td>0 to 4 % vol, analog 0.5 to 4.5V, pigtail terminated</td>
</tr>
<tr>
<td>PGS4104D</td>
<td>0 to 4 % vol, analog 0.5 to 4.5V and I²C digital, pigtail terminated</td>
</tr>
</tbody>
</table>