MPXHZ6130A, 15 to 130 kPa, Absolute, Integrated Pressure Sensor

The MPXHZ6130A series sensor integrates on-chip, bipolar op amp circuitry and thin film resistor networks to provide a high output signal and temperature compensation. The sensor’s packaging has been designed to provide resistance to high humidity conditions as well as common automotive media. The small form factor and high reliability of on-chip integration make this pressure sensor a logical choice for the system designer.

The MPXHZ6130A series piezoresistive transducer is a state-of-the-art, monolithic, signal conditioned, silicon pressure sensor. This sensor combines advanced micromachining techniques, thin film metallization, and bipolar semiconductor processing to provide an accurate, high level analog output signal that is proportional to applied pressure.

Features
- 1.5% maximum error over 0 °C to 85 °C
- Resistant to high humidity and common automotive media
- Improved accuracy at high temperature
- Ideally suited for microprocessor or microcontroller-based systems
- Temperature compensated from -40 °C to +125 °C
- Durable thermoplastic (PPS) surface mount package

Typical applications
- Aviation altimeters
- Industrial controls
- Engine control/manifold absolute pressure (MAP)
- Weather stations and weather reporting devices

<table>
<thead>
<tr>
<th>Ordering information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part number</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>MPXHZ6130A6U</td>
</tr>
<tr>
<td>MPXHZ6130AC6U</td>
</tr>
</tbody>
</table>
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Related Documentation

The MPXHZ6130A device features and operations are described in a variety of reference manuals, user guides, and application notes. To find the most-current versions of these documents:

1. Go to the Freescale homepage at:  
   http://www.freescale.com/
2. In the Keyword search box at the top of the page, enter the device number MPXHZ6130A.
3. In the Refine Your Result pane on the left, click on the Documentation link.
1 General Description

1.1 Block diagram

Figure 1 shows a block diagram of the internal circuitry integrated on a pressure sensor chip.

Figure 1. Fully integrated pressure sensor schematic

1.2 Pinout

Table 1. Pin functions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DNC</td>
<td>Do not connect to external circuitry or ground. Pin 1 is denoted by chamfered corner.</td>
</tr>
<tr>
<td>2</td>
<td>VS</td>
<td>Voltage supply</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>VOUT</td>
<td>Output voltage</td>
</tr>
<tr>
<td>5</td>
<td>DNC</td>
<td>Do not connect to external circuitry or ground.</td>
</tr>
<tr>
<td>6</td>
<td>DNC</td>
<td>Do not connect to external circuitry or ground.</td>
</tr>
<tr>
<td>7</td>
<td>DNC</td>
<td>Do not connect to external circuitry or ground.</td>
</tr>
<tr>
<td>8</td>
<td>DNC</td>
<td>Do not connect to external circuitry or ground.</td>
</tr>
</tbody>
</table>
2 Mechanical and Electrical Specifications

2.1 Maximum ratings

Table 2. Maximum ratings

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum pressure ((P1 &gt; P2))</td>
<td>(P_{\text{max}})</td>
<td>400</td>
<td>kPa</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>(T_{\text{stg}})</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>(T_A)</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Output source current @ full-scale output</td>
<td>(I_{O^+})</td>
<td>0.5</td>
<td>mAdc</td>
</tr>
<tr>
<td>Output sink current @ minimum pressure offset</td>
<td>(I_{O^-})</td>
<td>-0.5</td>
<td>mAdc</td>
</tr>
</tbody>
</table>

1. Exposure beyond the specified limits may cause permanent damage or degradation to the device.
2. Maximum output current is controlled by effective impedance from \(V_{\text{OUT}}\) to Gnd or \(V_{\text{OUT}}\) to \(V_S\) in the application circuit.

2.2 Operating characteristics

Table 3. Operating characteristics \((V_S = 5.0 \text{ Vdc}, T_A = 25 \degree \text{C} \text{ unless otherwise noted}, P1 > P2)\).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>(P_{\text{OP}})</td>
<td>15</td>
<td>—</td>
<td>130</td>
<td>kPa</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>(V_S)</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>Vdc</td>
</tr>
<tr>
<td>Supply current</td>
<td>(I_O)</td>
<td>—</td>
<td>6.0</td>
<td>10</td>
<td>mAdc</td>
</tr>
<tr>
<td>Minimum pressure offset</td>
<td>(V_{\text{off}})</td>
<td>0.132</td>
<td>0.200</td>
<td>0.268</td>
<td>Vdc</td>
</tr>
<tr>
<td>Full-scale output</td>
<td>(V_{\text{FSO}})</td>
<td>4.632</td>
<td>4.700</td>
<td>4.768</td>
<td>Vdc</td>
</tr>
<tr>
<td>Full-scale span</td>
<td>(V_{\text{FSS}})</td>
<td>4.365</td>
<td>4.500</td>
<td>4.635</td>
<td>Vdc</td>
</tr>
<tr>
<td>Accuracy</td>
<td>(%V_{\text{FSS}})</td>
<td>—</td>
<td>—</td>
<td>±1.5</td>
<td>%</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>(V/\text{P})</td>
<td>—</td>
<td>39.2</td>
<td>—</td>
<td>mV/kPa</td>
</tr>
<tr>
<td>Response time</td>
<td>(t_R)</td>
<td>—</td>
<td>1.0</td>
<td>—</td>
<td>ms</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>—</td>
<td>—</td>
<td>20</td>
<td>—</td>
<td>ms</td>
</tr>
<tr>
<td>Offset stability</td>
<td>—</td>
<td>—</td>
<td>±0.25</td>
<td>—</td>
<td>%</td>
</tr>
</tbody>
</table>

1. Device is ratiometric within this specified excitation range.
2. Offset \((V_{\text{off}})\) is defined as the output voltage at the minimum rated pressure.
3. Full-scale output \((V_{\text{FSO}})\) is defined as the output voltage at the maximum or full rated pressure.
4. Full-scale span \((V_{\text{FSS}})\) is defined as the algebraic difference between the output voltage at full-rated pressure and the output voltage at the minimum rated pressure.
5. Accuracy is the deviation in actual output from nominal output over the entire pressure range and temperature range as a percent of span at 25°C due to all sources of error including the following:
   - Linearity: Output deviation from a straight line relationship with pressure over the specified pressure range.
   - Temperature Hysteresis: Output deviation at any temperature within the operating temperature range, after the temperature is cycled to and from the minimum or maximum operating temperature points, with zero differential pressure applied.
   - Pressure Hysteresis: Output deviation at any pressure within the specified range, when this pressure is cycled to and from minimum or maximum rated pressure at 25°C.
   - TcSpan: Output deviation over the temperature range of 0°C to 85°C, relative to 25°C.
   - TcOffset: Output deviation with minimum pressure applied, over the temperature range of 0°C to 85°C, relative to 25°C.
6. Response Time is defined as the time for the incremental change in the output to go from 10% to 90% of its final value when subjected to at specified step change in pressure.
7. Warm-up time is defined as the time required for the product to meet the specified output voltage after the pressure has been stabilized.
8. Offset Stability is the product’s output deviation when subjected to 1000 cycles of pulsed pressure, temperature cycling with bias test.
On-chip Temperature Compensation and Calibration

Figure 5 shows the sensor output signal relative to pressure input. Typical minimum and maximum output curves are shown for operation over 0 to 85°C temperature range. The output will saturate outside of the rated pressure range.

A gel die coat isolates the die surface and wire bonds from the environment, while allowing the pressure signal to be transmitted to the sensor diaphragm. The gel die coat and durable polymer package provide a media resistant barrier that allows the sensor to operate reliably in high humidity conditions as well as environments containing common automotive media. Contact the factory for more information regarding media compatibility in your specific application.

Figure 3. Cross-sectional diagram SSOP (not to scale)

Figure 4. Recommended power supply decoupling and output filtering

Figure 5. Output vs. absolute pressure
Nominal Transfer Value:  
\[ V_{OUT} = V_S \times (0.007826 \times P \text{ (kPa)} - 0.07739) \]  
\[ \pm (\text{Pressure Error} \times \text{Temp. factor} \times 0.007826 \times V_S) \]  
\[ V_S = 5.0 \pm 0.25 \text{ Vdc} \]

**Figure 6. Transfer function**

![Transfer function graph](image)

NOTE: The temperature multiplier is a linear response from 0 °C to -40 °C and from 85 °C to 125 °C

**Figure 7. Temperature error band**

![Temperature error band graph](image)

**Figure 8. Pressure error band**

![Pressure error band graph](image)
4 Package Information

4.1 Minimum recommended footprint for super small packages

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor package must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self-align when subjected to a solder reflow process. It is always recommended to fabricate boards with a solder mask layer to avoid bridging and/or shorting between solder pads, especially on tight tolerances and/or tight layouts.

![Figure 9. SSOP footprint](image-url)
4.2 Package dimensions


Case 98ARH99066A, 8-lead super small outline package
Case 98ARH99066A, 8-lead super small outline package
NOTES:

1. ALL DIMENSIONS IN INCHES.
3. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED .006 INCHES PER SIDE.
4. ALL VERTICAL SURFACES TO BE 5° MAXIMUM.
5. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 INCHES MAXIMUM.

<table>
<thead>
<tr>
<th>MECHANICAL OUTLINE</th>
<th>PRINT VERSION NOT TO SCALE</th>
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</thead>
<tbody>
<tr>
<td>TITLE:</td>
<td>DOCUMENT NO: 98ARH99066A</td>
</tr>
<tr>
<td>8 LEAD SSOP</td>
<td>REV: H</td>
</tr>
<tr>
<td></td>
<td>CASE NUMBER: 1317–04</td>
</tr>
<tr>
<td></td>
<td>13 APR 2012</td>
</tr>
<tr>
<td></td>
<td>STANDARD: NON–JEDEC</td>
</tr>
</tbody>
</table>

Case 98ARH99066A, 8-lead super small outline package
Case 98ARH99089A, 8-lead ported super small outline package
NOTES:
1. ALL DIMENSIONS IN INCHES.
3. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED .006 INCHES PER SIDE.
4. ALL VERTICAL SURFACES TO BE 5° MAXIMUM.
5. DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .008 INCHES MAXIMUM.

Case 98ARH99089A, 8-lead ported super small outline package

MPXHZ6130A


## 5 Revision History

Table 4. Revision history

<table>
<thead>
<tr>
<th>Revision number</th>
<th>Revision date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>05/2012</td>
<td>• Updated package drawing 98ARH99066A was Rev. F, updated to Rev. H.</td>
</tr>
</tbody>
</table>
| 1.2             | 06/2015       | • Updated format.  
• Updated package drawing 98ARH99089A was Rev D, updated to Rev G. |
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