

MS7204-A2

PRESSURE SENSOR DIE (0-4 BAR) FOR HARSH ENVIRONMENT



- 0 to 400 kPa range (4 bar or 58 PSI)
- Uncompensated absolute pressure sensor die
- Piezoresistive silicon micromachined sensor
- Hermetic sensor, temperature up to 150°C
- Pads on one side
- RoHS-compatible & Pb-free¹

DESCRIPTION

The MS7204-A2 is an absolute silicon micro-machined pressure sensor for harsh environment, with the pads on one side. A vacuum reference cavity is sealed on top of the sensitive silicon membrane by the anodic bonding of a glass cap. The pressure, applied on the backside, is converted in electrical signal by piezo-resistors implanted in the silicon membrane. To improve the sensor stability, a drilled glass is bonded on the backside. As the pressure port consists of glass and silicon, both stable in most of the chemicals, the MS7204-A2 is suitable for media-resistive applications.

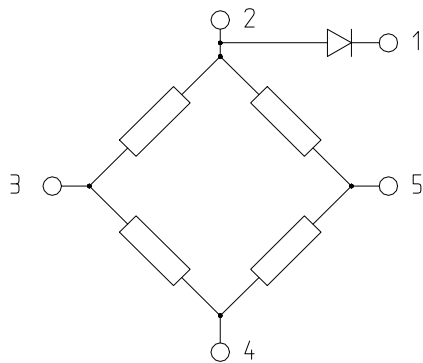
FEATURES

- Media resistive pressure sensor die
- Typical output Span 150mV @ 5 V
- Temperature range -40°...+150°C
- Linearity 0.15% (typical)
- Die size 1.35 x 1.79 mm²
- Low cost, high reliability & stability

APPLICATION

- Harsh environments
- Absolute pressure sensor systems

ELECTRICAL CONNECTIONS

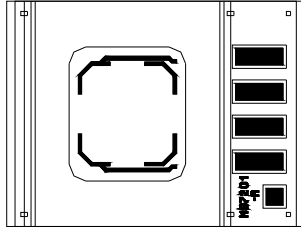


| Pin | Symbol | Description |
|-----|-------------------|-------------------------------------|
| 1 | EPI / I diode (-) | Epi contact / Cathode of diode (n) |
| 2 | Vs+ / I diode (+) | Supply voltage / Anode of diode (p) |
| 3 | Out+ | Positive output* |
| 4 | GND | Ground |
| 5 | Out- | Negative output* |

*Positive output for pressure applied backside

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BOND PAD CONFIGURATION



Out-
GND
Out+
Vs+ / I diode (+)
Epi / I diode (-)

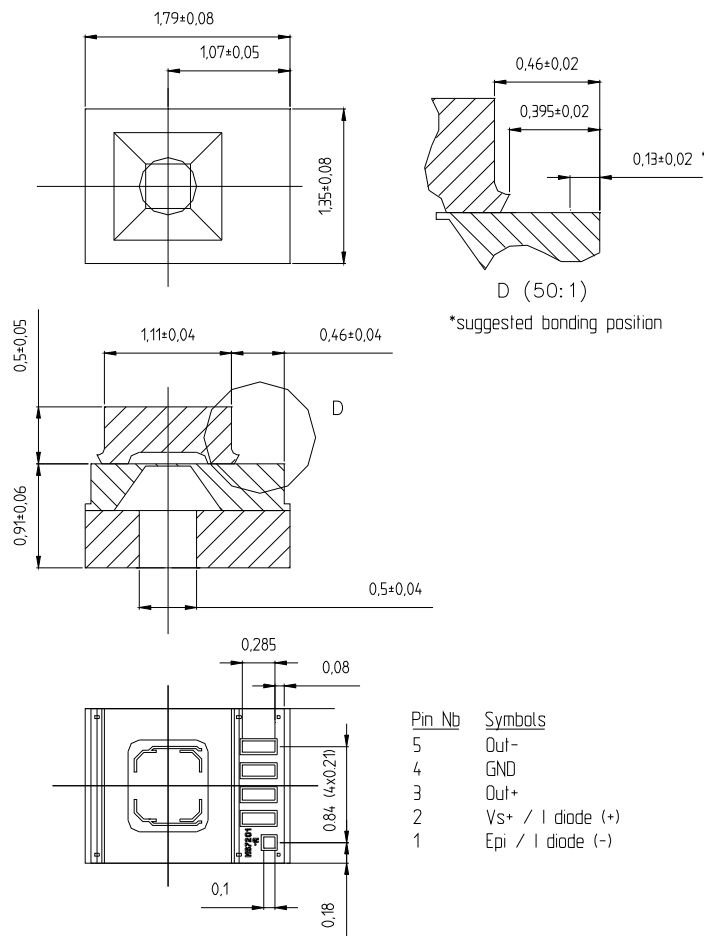
Important remarks:

The epitaxial layer is not connected to the Vs+ pin on the die, this is to allow temperature measurement with the diode. The epi contact and the cathode of the diode have the same electrical potential. To avoid bias effects, diode and bridge cannot be used simultaneously.

As the sensing elements are diffused resistances, the voltage applied on the ground pads (GND) and on the supply voltage (Vs+) have to be lower or equal than the voltage applied on the epi contact (EPI). For better stability it is good to define the potential of the EPI.

Gold ball bonding or aluminum wedge bonding can be used to wire-bond the sensor. The quality of the wire-bonding is equipment and process dependant. For this reason, it is strongly recommended that a thorough wire-bonding qualification is made by the end user if the sensor is going to be operated over an extended temperature range.

LAYOUT



Bond Pads: Aluminium, 100 um in width
Cavity depth: 100 um

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FULL SCALE PRESSURE

| kPa | bar | mbar | PSI | atm | mm Hg | m H ₂ O | Inches H ₂ O |
|-----|-----|------|-----|-------|---------|--------------------|-------------------------|
| 400 | 4 | 4000 | 58 | 3.948 | 3000.24 | 40 | 1607 |

ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Conditions | Min | Max | Unit |
|------------------------|-----------------|------------------------|-----|------|------|
| Supply voltage, bridge | V _{s+} | T _a = 25 °C | | 12 | V |
| Supply current diode | I diode (+) | | | 100 | μA |
| Storage temperature | T _s | | -40 | +150 | °C |
| Pressure overload | | | | 5 | Bar |

ELECTRICAL CHARACTERISTICS

(Reference conditions: Supply Voltage V_{S+} = 5 Vdc; Ambient Temperature T_a = 25 °C)

| Parameter | Min | Typ | Max | Unit | Notes |
|---|--------|--------|--------|--------|-------|
| Operating Pressure Range | 0 | | 4 | Bar | |
| Operating Temperature Range | -40 | | 150 | °C | |
| Bridge Resistance | 3.0 | 3.4 | 3.8 | kΩ | |
| Full-scale span (FS) | 120 | 150 | 180 | mV | |
| Zero Pressure Offset | -40 | 0 | 40 | mV | |
| Linearity | | ± 0.15 | ± 0.3 | % FS | 1 |
| Diode forward voltage (V _F) | | 0.550 | | V | 2 |
| Temperature Coefficient of Resistance | + 2700 | + 3100 | + 3400 | ppm/°C | 3 |
| Span | - 1700 | - 2100 | - 2400 | ppm/°C | |
| Offset | - 80 | | + 80 | μV/°C | |
| Diode | | -2.2 | | mV/°C | 2 |
| Pressure Hysteresis | -0.2 | | 0.2 | % FS | 4 |
| Repeatability | -0.2 | | 0.2 | % FS | 5 |
| Temperature Hysteresis | -0.15 | | 0.15 | % FS | 6 |

NOTES

- 1) Deviation at one half full-scale pressure from the least squares best line fit over pressure range (0 to 4bar).
- 2) The forward voltage of the diode is measured when driving it with a typical value of 40 μA.
- 3) Slope of the endpoint straight line from 25 °C to 60 °C.
- 4) Output deviation at any pressure within the specified range, when this pressure is cycled to and from the minimum or maximum rated pressure, at 25 °C.
- 5) Same as 4) after 10 pressure cycles.
- 6) Maximum difference in offset after one thermal cycle from -40 °C to +150 °C.

TEMPERATURE COMPENSATION

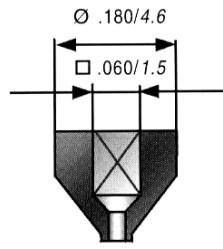
The diode between the piezo diffusion and the epi contact can be used for temperature measurement. The forward voltage of the diode is measured on I diode (-) when a typical current of 40 μA fed in I diode (+). Temperature measurement cannot be done at the same time as pressure sensing due to bias effects.

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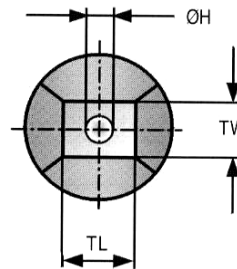
PICKING TOOLS

The MS7204 sensors have a topside glass cap ($1.11 \times 1.35 \text{ mm}^2$) and a backside glass ($1.79 \times 1.35 \text{ mm}^2$). The pick and place tool has to be of a soft material such as rubber (Hardness 78-97 Shore A). Its external size must fit the glass cap. Successful tests were done with some tools of SPT (see SPT drawing and references below).

| | |
|---------------------|-------------------------------|
| SPT references | RTR-A2-045x045 |
| External dimension | TL & TW: 0.045 inch / 1.14 mm |
| Internal dimensions | ØH: 0.025 inch / 0.63 mm |



Type A



WIRE BONDING

The bondable area is $100 \times 100 \mu\text{m}^2$ for the EPI pad and $100 \times 285 \mu\text{m}^2$ for the other pads. The location of the bonding pads is close to the top Pyrex glass edge reducing the possible size and angle of the bonding capillary. Refer to the detail view *D* on the layout for more precision.

ORDERING INFORMATION

| Product Code | type | Product | Art.-Nr. |
|--------------|----------|---|-----------|
| MS7204-A2 | Absolute | 4 bar pressure sensor die for harsh environment sawn on b/f | 720425021 |

The MS7204-A2 dice are supplied sawn on blue foil, mounted on plastic rings

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