

## Features

- Measuring range of atmosphere to  $10^{-4}$  mbar
- Silicon Micromachining Technology
- TO-5 Housing
- Small Time Constant
- For use in reactive gas atmosphere there is a version with protective coating available

## Applications

- Pirani Gauges
- Industrial Application
- Gas Analysis – Mass Spectrometry
- Vacuum Pumping Systems

# VPS025A VPS025P

## Vacuum Pressure Sensor

### Product Description

The sensor element consists of a silicon chip with a thin membrane approximately  $1\text{mm}^2$  in size of a material with extremely good electrical and thermal insulating properties. On the membrane are two thin film resistors ( $R_{m1}$ ,  $R_{m2}$ ) which are both used for heating the membrane and for measurement of membrane temperature  $T_m$ . The resistors are passivated to protect them from the effects of the gas. The membrane is completely covered by a second small silicon chip with a rectangular cavity etched in. The hollow space thus formed above the membrane is the thermal conductivity section. The gas comes to the measuring section through a small lateral opening in the membrane cover by diffusion only, and not by flow.

The sensor chip and its cover are attached to a silicon support which also permits gas exchange to the lower side of the membrane. The sensor is electrically connected to an eight-pin base by gold wire bonding.

Due to the residual gas surrounding the membrane, thermal energy is dissipated from the membrane held at higher temperature  $T_m$ . Measured is the signal needed in a temperature stabilization circuit to keep the excess temperature of the membrane  $\Delta T$  constant.

On the solid part of the chip are two more resistors ( $R_{t1}$ ,  $R_{t2}$ ) to measure and compensate for the effect of the ambient temperature  $\vartheta$ .

The die stack is mounted on top of a TO-39 header with welding projection flange to be welded directly inside a third-party housing.

For use in reactive gas atmosphere there is the version of VPS025P. The whole silicon stack is covered with a thin film of special coating to make it robust against silicon etching gases.

## VACUUM PRESSURE SENSOR

VPS025 Family

### Specifications

#### Absolute Maximum Ratings

Heating power	$P (R_{m1}+R_{m2})$	max. 30 mW
Membrane temperature	$T_M$	max. +180 °C
Ambient temperature	$\vartheta$	-20 °C to +85 °C

#### Recommended Operating Conditions

Heating power	$P (R_{m1}+R_{m2})$	5 mW
Membrane excess temperature	$\Delta T = T_M - \vartheta$	+50 °C

The minimum  $\Delta T$  for any application is determined by the resolution of thermal conductivity  $\lambda$  required in combination with the noise of the amplifier circuit used. A very low  $\Delta T$  has advantages in terms of linearity, low drift and better long-term stability of the sensor.

#### Parameter Specifications

Resistances Heater	$R_{m1}; R_{m2}$	100 +15/-8 $\Omega$	at +25 °C
Resistances Difference Heaters	$R_{m1} - R_{m2}$	+2.00 $\Omega$	at +25 °C
Resistances Ambient Temperature Sensor	$R_{t1}; R_{t2}$	240 +35/-20 $\Omega$	at +25 °C
Resistance Ration	$R_{tx}/(R_{m1}+R_{m2})$	1.20 $\pm$ 0.07	$x \in \{1;2\}$
Temperature Coefficient of Resistance $R_{tx}; R_{mx}$	$\alpha$	5500 +400/-700 ppm/K	at 20 °C $\leftrightarrow$ 100 °C
Geometry Factor	G	3.6 mm	The factor G is determined by the internal sensor geometry.
Membrane thermal time constant	$\tau_M$	<5 ms	
Protective Coating Thickness		1.20 $\pm$ 0.12 $\mu$ m	for G-VPSCO-004 "VPS025P" only
Non Coated Area		1.8 mm	pins from bottom of sensor base downwards; for G-VPSCO-004 "VPS025P" only
Distance between membrane and cover cap	G <sub>VPS025A</sub>	24.0 $\pm$ 2.0 $\mu$ m	for G-VPSCO-005 "VPS025A"
	G <sub>VPS025P</sub>	21.6 $\pm$ 2.0 $\mu$ m	for G-VPSCO-004 "VPS025P"
Sensor Dimension		3.5 mm $\times$ 3.5 mm $\times$ 1.2 mm	Die Stack (excluding Base)
		Ø9.13 mm $\times$ 16.5 mm	including Base
Base Material		Base material for the dies is silicon.	

Electrical Connections

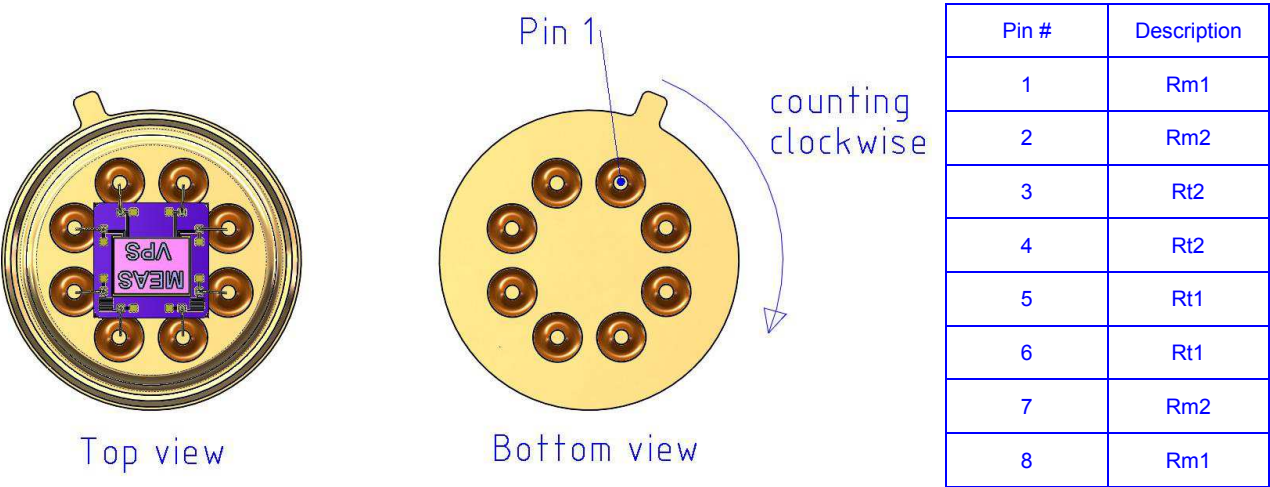


Figure 1: Pin assignment of electrical connections to top and bottom view of sensor

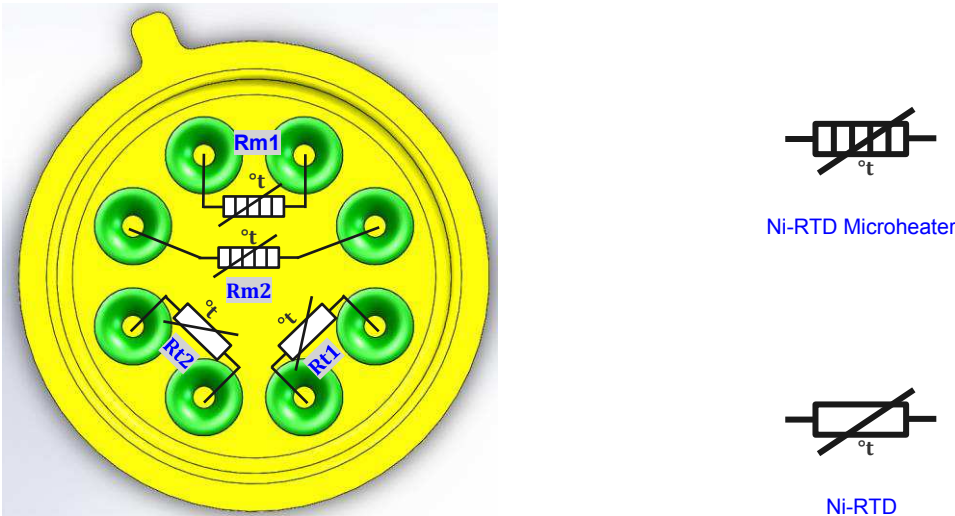


Figure 2: Equivalent Circuit Diagramm

## VPS025 Family

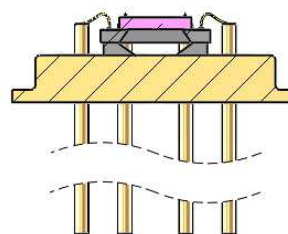
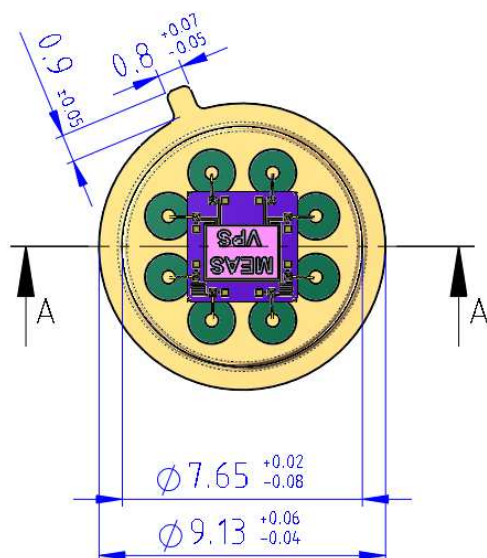
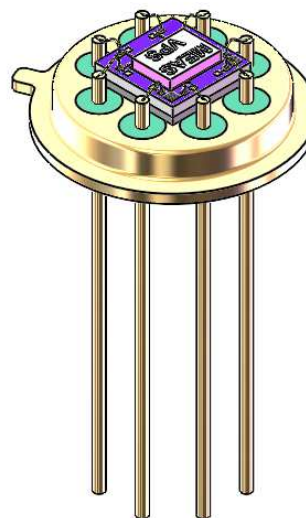
Technical drawing of a circular component with a central hole and eight surrounding holes. The drawing includes a top view and a side view.

**Top View:**

- Central hole diameter:  $\varnothing 5.08$
- Surrounding holes diameter:  $8 \times \varnothing 0.43$
- Material hardness:  $8 \times 45^\circ$

**Side View:**

- Total height:  $13.7 \pm 0.50$
- Central hole depth:  $1.22^{+0.11}_{-0.04}$
- Surrounding holes depth:  $1^{+0.20}_{-0.10}$
- Base thickness:  $0.4 \pm 0.07$
- Overall height including base:  $1.5^{+0.10}_{-0.05}$



A-A

Figure 3: Mechanical dimensions of sensor – all dimensions in mm

## VACUUM PRESSURE SENSOR

VPS025 Family

### Ordering Information

Description	Part Number
VPS025A	G-VPSCO-005
VPS025P	G-VPSCO-004

VPS025A is the standard version.

VPS025P is the version with protective coating.

#### NORTH AMERICA

Tel +1 800 522 6752

#### EUROPE

Tel +31 73 624 6999

#### ASIA

Tel +86 0400 820 6015

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