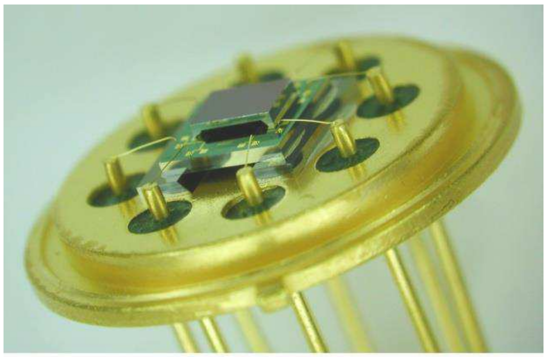

RoHS

TCS208F
TCS208F3

Vacuum Pressure Sensor

Product Description

The sensor element consists of a silicon chip with a thin membrane approximately 1mm² 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 thermal conductivity λ of the 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 ΔT 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 ϑ.

Features

- Measuring hydrogen content thermal conductivity
- Analyzing binary gas by evaluating
- Determination of CO_2 vs. Methane
- Discrimination of natural gas
- Measurement of Helium or Xenon contents

Applications

- Industrial application
- Monitoring of gas characteristic
- Determining gas concentration
- Landfill or digestor gas
- Different origin gas or compositions gas

Specifications

Absolute Maximum Ratings

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

Recommended Operating Conditions

Heating power	$P\ (R_{m1}+R_{m2})$	5 mW		
Membrane excess temperature	$\Delta T = T_m - \vartheta$	min. +30 °C	typ. +50 °C	max. +70 °C

The minimum ΔT for any application is determined by the resolution of thermal conductivity λ required in combination with the noise of the amplifier circuit used. A very low ΔT 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 Ω	at +25 °C
Resistances Difference Heaters	$\lvert R_{m1} - R_{m2}\rvert$	max. 2.00 Ω	at +25 °C
Resistances Ambient Temperature Sensor	R_{t1} ; R_{t2}	240 +35/-20 Ω	at +25 °C
Resistance Ration	$R_{ty}/(R_{m1}+R_{m2})$	1.20 ± 0.07	$y \in \{1;2\}$
Temperature Coefficient of Resistance R_{tx} ; R_{mx}	α	5500 +400/-700 ppm/K	at 20 °C ↔ 100 °C
Geometry Factor	G	3.6 mm	The factor G is determined by the internal sensor geometry.
Membrane thermal time constant	τ_m	<5 ms	
Time constant for gas exchange	$\tau_{Diffusion}$	<100 ms	
Volume of diffusion chamber Structure	$V_{DiffusionChamber}$	0.2 mm^3	
Sourrounding volume to be kept clear	$V_{Sourround}$	100 mm^3	
Base Material		Base material for the dies is silicon.	
Materials exposed to gas		Silicon, Silicon nitride, Gold, Epoxy, SAC solder.	

Stress Testing

Vibration	in accordance with IEC 68-2-6 Appendix B (1982) 10 cycles; ±1.5mm; 20g; 10...2000Hz; 1octave/min
Mechanical Shock	in accordance with IEC 68-2-27 Amendment #1 (Oct.82) 10 shocks each radial and axial; 100g; 7.5ms / 300g; 2.5ms / 900g; 1.2ms

Stress testing is performed only on initial qualification. No regular retesting is scheduled.

Electrical Connections

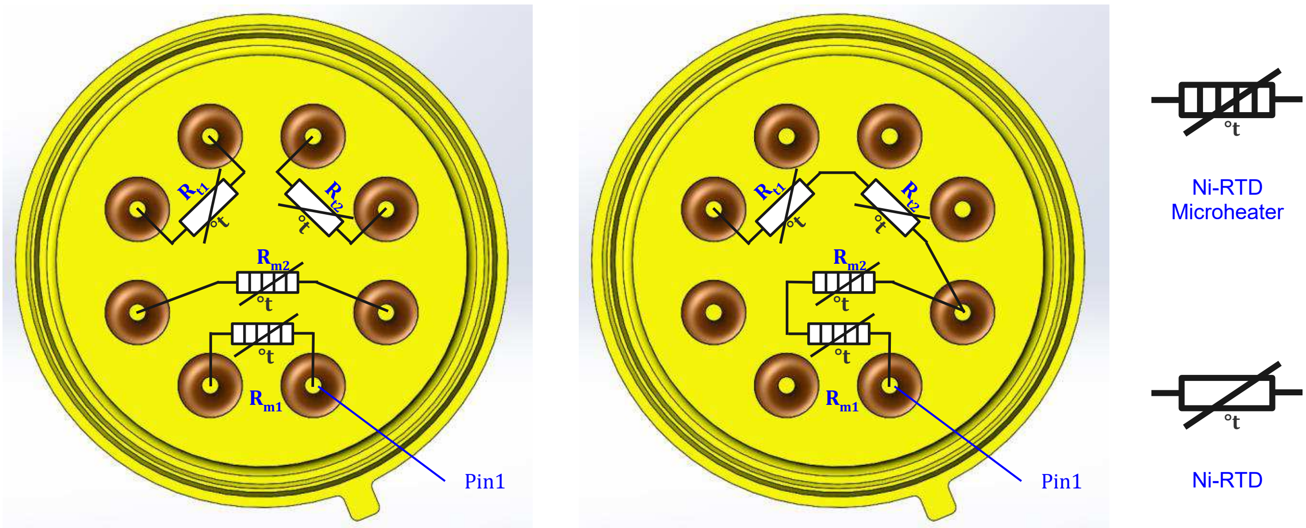

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Figure 1: Equivalent Circuit Diagram

Effect of ambient temperature

A given heating power in the membrane resistors produces an excess temperature ΔT in the membrane compared with the solid part of the sensor chip which depends on the absolute ambient temperature only very little through the temperature coefficient of the thermal conductivity of the gases (typically 10^{-3}/K). The absolute resistance values however vary with the ambient temperature just as they do with changing thermal conductivity. Therefore in general temperature compensation will have to be implemented.

Mechanical Dimensions

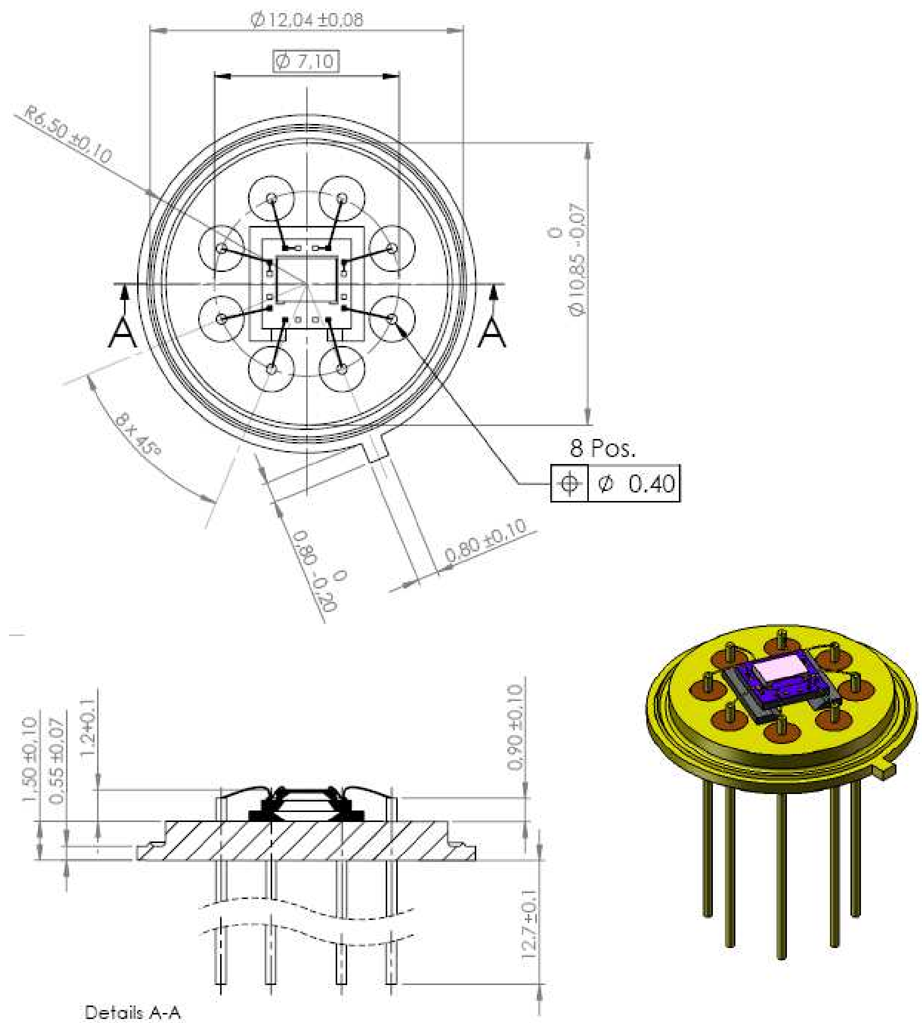

Figure 2: Mechanical dimensions of sensor – all dimensions in mm