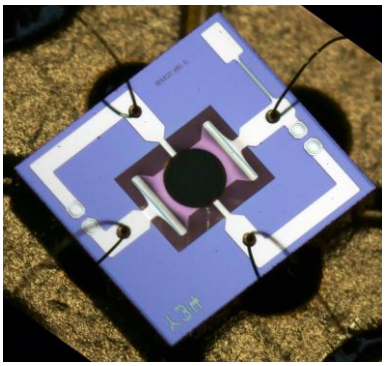
MICROSENS

Product Data Sheet

MSGS 5000i

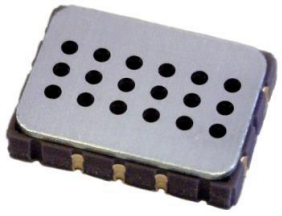
MICROSENS Semiconductor Gas Sensor

MSGS-5000i Carbon Monoxide/VOC Gas Sensor



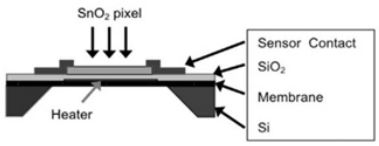
MSGS-5000i integrated semi-conductor gas sensors manufactured using standard microelectronic technology and silicon micromachining techniques.

Detection of reducing gases such as carbon monoxide (CO), hydrocarbons (HC), ethanol, and volatile organic compounds (VOC).



Sensing Principle

The MSGS-5000i structure consists of a thin-film, doped tin-oxide (SnO_2) layer over an embedded heater layer. This integrated heater allows to raise the temperature of the sensitive layer necessary for the Chemisorption/Reaction mechanisms to occur.



Applications

- Indoor air quality
- Industrial process control
- Combustion control
- Environmental monitoring
- Security:
  - Toxic gases
  - Explosive gases

Key Features

- Small footprint for compact designs
- Robust MEMS sensor for harsh environments
- High-volume manufacturing for low-cost applications
- Short lead-times

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Specifications

Maximum Ratings

Rating	Symbol	Value/ Range	Unit
Maximum sensor supply voltage	V_{CC}	5	V
Maximum heater power	P_H	88	mW
Maximum sensor power	P_S	8	mW
Relative humidity range	R_H	5 − 95	%RH
Ambient operating temperature	T_{amb}	-30 − 85	°C
Storage temperature range	T_{sto}	-40 − 120	°C
Storage humidity range	RH_{sto}	5 − 95	%RH

Operating Conditions

Parameter	Symbol	Typ	Min	Max	Unit
Heating power (see note 1)	P_H	76	71	81	mW
Heating voltage	V_H	2.4	-	-	V
Heating resistance at heating power (see note 2)	R_H	74	66	82	Ω

Sensitivity Characteristics

Characteristic	Symbol	Typ	Min	Max	Unit
CO detection range	FS		1	1000	ppm
Sensing resistance in air (see note 3)	R_0		100	1500	kΩ
Sensitivity factor (see note 4)	S_R		1.2	50	-

Notes:

1. A power of 85mW might provide sufficient sensitivity to certain gases. Heating powers above 120mW can cause permanent damage to the sensor when ambient temperatures exceed 120 °C.
2. Heating resistor values from sensors out of production range between 75 and 110 Ω. Due to material properties of the heating resistor, its value increases during operating life. This behaviour has to be taken into account in the application design.
3. Sensing resistance in air (R_0) is measured under ambient air at 23 ± 5 °C and 50 ± 10%RH. These values are representative of most sensors, but some sensors could present R_0 from 1 kΩ to 1 MΩ.
4. Sensitivity factor (S_R) is defined as R_S at 60 ppm of CO. Test conditions are 23 ± 5 °C and 50 ± 10% RH. The S_R values are indicative values only.

Features

- Sensitivity range: 5 to over 1000 ppm CO
- Low humidity dependence in recommended operation mode
- Stable long-term operation
- Small size
- Low power consumption

Detectable Gases and Range

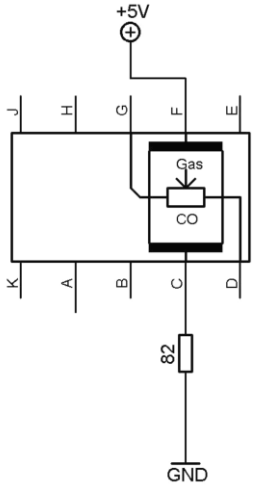
- Carbon monoxide CO: 1 – 1000ppm
- Ethanol C_2H_5OH: 10 – 500ppm
- Hydrogen H_2: 1 – 1000ppm
- Ammonia NH_3: 1 – 500ppm
- Methane CH_4: >1000ppm

Recommended measurement circuit

A simple circuit to measure the pollution level is proposed in Fig.(a) and (b). The heating voltage V_H is applied to pins F and C. A load resistor R_L is connected in series with R_S to convert the resistance R_S to a voltage V_S between pins G and D. R_S can then be calculated by the following expression:

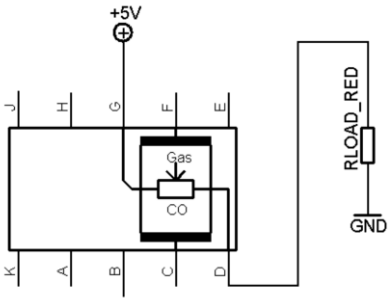
$$R_s = R_L/V_s \cdot (V_{cc} - V_s)$$

(a)



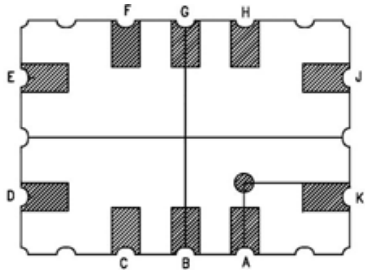
MSGS-5000i with recommended supply circuit (top view)
R is 82Ω. This resistor is necessary to obtain the right temperature on the heater while using a single 5V power supply. The resulting voltage is typically VH = 2.4V.

(b)



MSGS-5000i with measurement circuit (top view)
The voltage measured on the load resistor is directly linked to the resistance of the sensor respectively. R_L must be 820 Ω at the lowest in order not to damage the sensitive layer.

Pin Connections



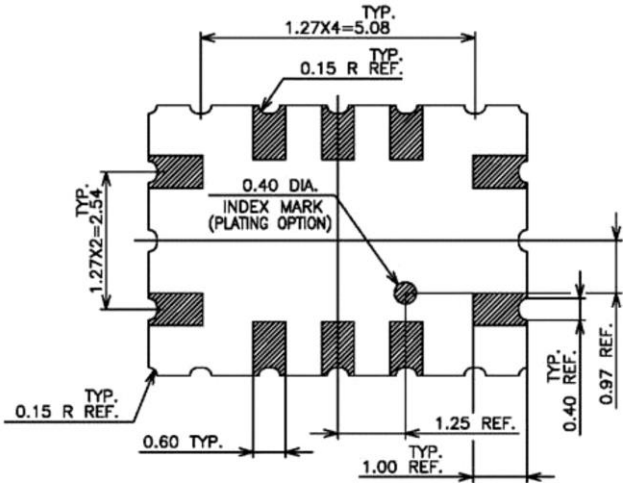
Pin	Connection
C	Rh1 Heater ground
D	Rs1 Sensor pin
F	Rh2 Heater pin
G	RS2 Sensor pin

Figure 1: MSGS-5000i configuration (bottom view)

Precautions

- The sensor must not be wave soldered without protection, or exposed to high concentrations of organic solvents, ammonia, or silicone vapours, to avoid poisoning the sensitive layer.
- Heating powers above the maximum rating of 120 mW can destroy the sensor due to overheating.
- This sensor is to be placed in a filtered package that protects it against any water or dust projection

Packaging



Chip and Package dimensions:

- Chip size: ~2mm x 2mm
- Sensitive area: ø ~ 300µm
- Chip thickness: ~300 µm
- Overall dimension of SMD package: 5.1 x 7.6 x 2mm