



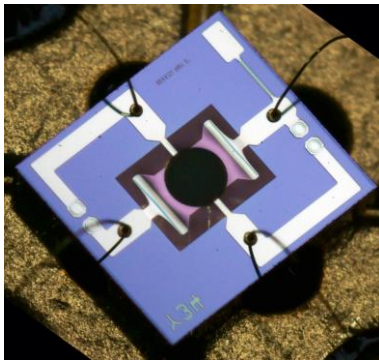
M I C R O S E N S

Product Data Sheet

## MSGS 5000i

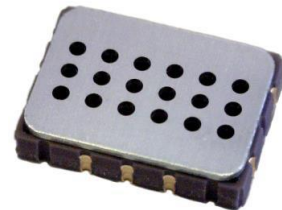
### MICROSENS Semiconductor Gas Sensor

#### MSGS-5000i Carbon Monoxide/VOC Gas Sensor



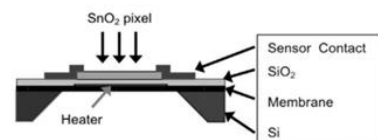
MSGS-5000i integrated semiconductor gas sensors manufactured using standard microelectronic technology and silicon micromachining techniques.

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 ( $\text{SnO}_2$ ) 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	$\Omega$

### 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	k $\Omega$
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  $\Omega$ . 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  $23 \pm 5$  °C and  $50 \pm 10\%$  RH. These values are representative of most sensors, but some sensors could present  $R_0$  from 1 k $\Omega$  to 1 M $\Omega$ .
4. Sensitivity factor ( $S_R$ ) is defined as  $R_S$  at 60 ppm of CO. Test conditions are  $23 \pm 5$  °C and  $50 \pm 10\%$  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

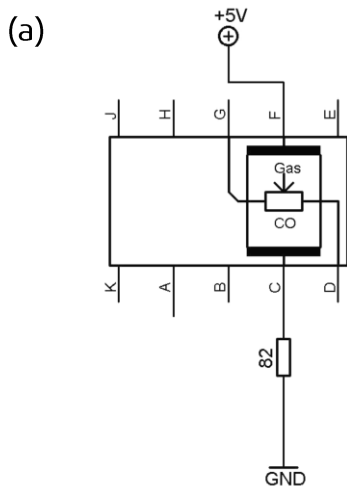
**Detectable Gases and Range**

- Carbon monoxide CO: 1 – 1000ppm
- Ethanol C<sub>2</sub>H<sub>5</sub>OH: 10 – 500ppm
- Hydrogen H<sub>2</sub>: 1 – 1000ppm
- Ammonia NH<sub>3</sub>: 1 – 500ppm
- Methane CH<sub>4</sub>: >1000ppm

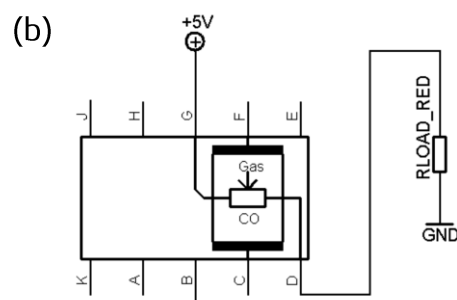
**Recommended measurement circuit**

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:

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

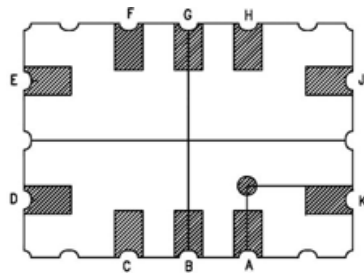


MSG5-5000i with recommended supply circuit (top view)  
 R is 82Ω. This resistor is necessary to obtain the right temperature on the heater while using a single 5V power supply. The resulting voltage is typically  $V_H = 2.4V$ .



MSG5-5000i 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**



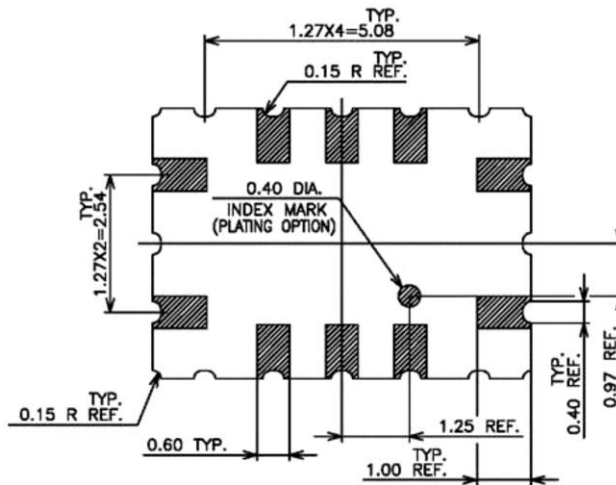
Pin	Connection
C	Rh1 Heater ground
D	Rs1 Sensor pin
F	Rh2 Heater pin
G	RS2 Sensor pin

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:  $\varnothing \sim 300\mu\text{m}$
- Chip thickness: ~300  $\mu\text{m}$
- Overall dimension of SMD package: 5.1 x 7.6 x 2mm