



MiCS – 5131

Automotive Pollution Gas Sensor

This datasheet describes the use of the MiCS-5131 in automotive applications. The package and the mode of operation illustrated in this document target the detection of reducing gases like carbon monoxide (CO), hydrocarbons (HC), and volatile organic compounds (VOC). These gases reach significant concentrations in heavy traffic and are responsible for poor cabin air quality.

Features:

- Low heater current
- Wide detection range
- High sensitivity
- Fast thermal response
- Electro-Static Discharge protected
- Miniature dimensions
- High resistance to shocks and vibrations



This Product Data Sheet accompanies MicroChemical Systems MiCS-5131 sensors for CO, HC, and VOC. Reproduction and distribution of this document is restricted by MicroChemical Systems. The following specifications are subject to change to accommodate continuous improvement.



Sensor Characteristics

Important Precautions:

Please read the following instructions carefully before using the MiCS-5131 sensor described in this document to avoid erroneous readings and to prevent the device from permanent damage.

- The sensor must not be wave soldered without protection or exposed to high concentrations of organic solvents or ammonia in order to avoid poisoning the sensitive layer.
- Heating powers above the specified maximum rating of 120mW 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.
- For any additional questions, please contact us at: _____

Operating Mode:

The recommended mode of operation is a constant power mode. A heater power of $P_H = 102 \text{ mW}$ is applied. This causes the temperature of the sensing resistor (R_S) to reach about 450°C .

Detection of the pollution gases is achieved by measuring the sensing resistor R_S during operation.

Measurement Circuit:

Figure 2 shows the pin connections of the MiCS-5131 gas sensor. A simple circuit to measure the pollution level is proposed in Figure 3. The heating voltage V_H is applied to pins 3 and 1. 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 2 and 4. R_S can then be calculated by the following expression:

$$R_S = R_L / (V_{CC} - V_S) \cdot V_S$$

Sensor Response:

The sensor response to CO in air is represented in Figure 1. The sensor resistance R_S is normalized to the resistance under air (R_0).

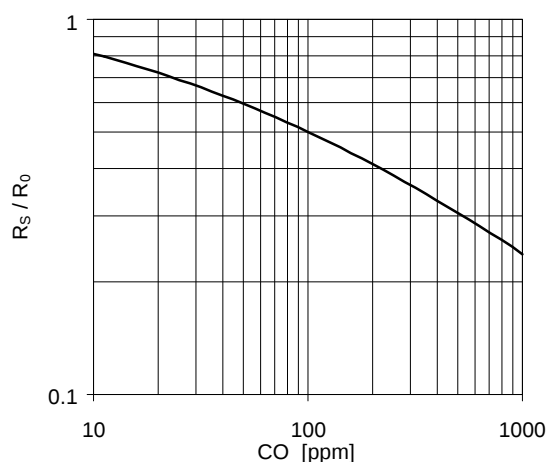


Figure 1: R_S / R_0 as a function of gas concentration at 50% RH and 25°C .

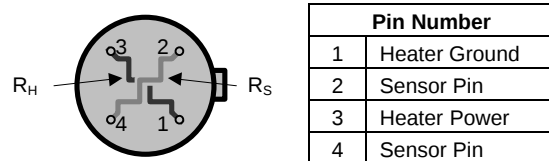


Figure 2: Equivalent circuit (top view) of MiCS 5131.

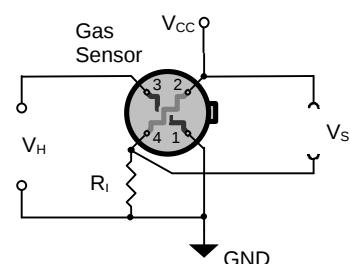


Figure 3: Measurement circuit for pollution gas detection.



Electrical Specifications

Maximum Ratings:

Rating	Symbol	Value / Range	Unit
Maximum Sensor Supply Voltage	V_{CC}	5	V
Maximum Heater Power Dissipation	P_H	120	mW
Maximum Sensor Power Dissipation	P_S	1	mW
Relative Humidity Range	R_H	5 – 95	%RH
Ambient Operating Temperature	T_{amb}	-40 – 120	°C
Storage Temperature Range	T_{sto}	-40 – 120	°C
Storage Humidity Range	RH_{sto}	5 – 95	%RH

Table 1

Operating Conditions:

Parameter	Symbol	Typ	Min	Max	Unit
Heating Power, ^[1]	P_H	102	85	120	mW
Heating Voltage,	V_H	3.2	-	-	V
Heating Current,	I_H	32	-	-	mA
Heating Resistance, ^[2]	R_H	100	90	110	Ω

Table 2

^[1] A minimum value of 85mW ensures sufficient sensitivity to pollution 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 90 and 110 Ohm. Due to material properties of the heating resistor its value increases during operating life. This behavior is described in the „Application Note 1 MiCS-5131“ and has to be taken into account in the application design.

Sensitivity Characteristics:

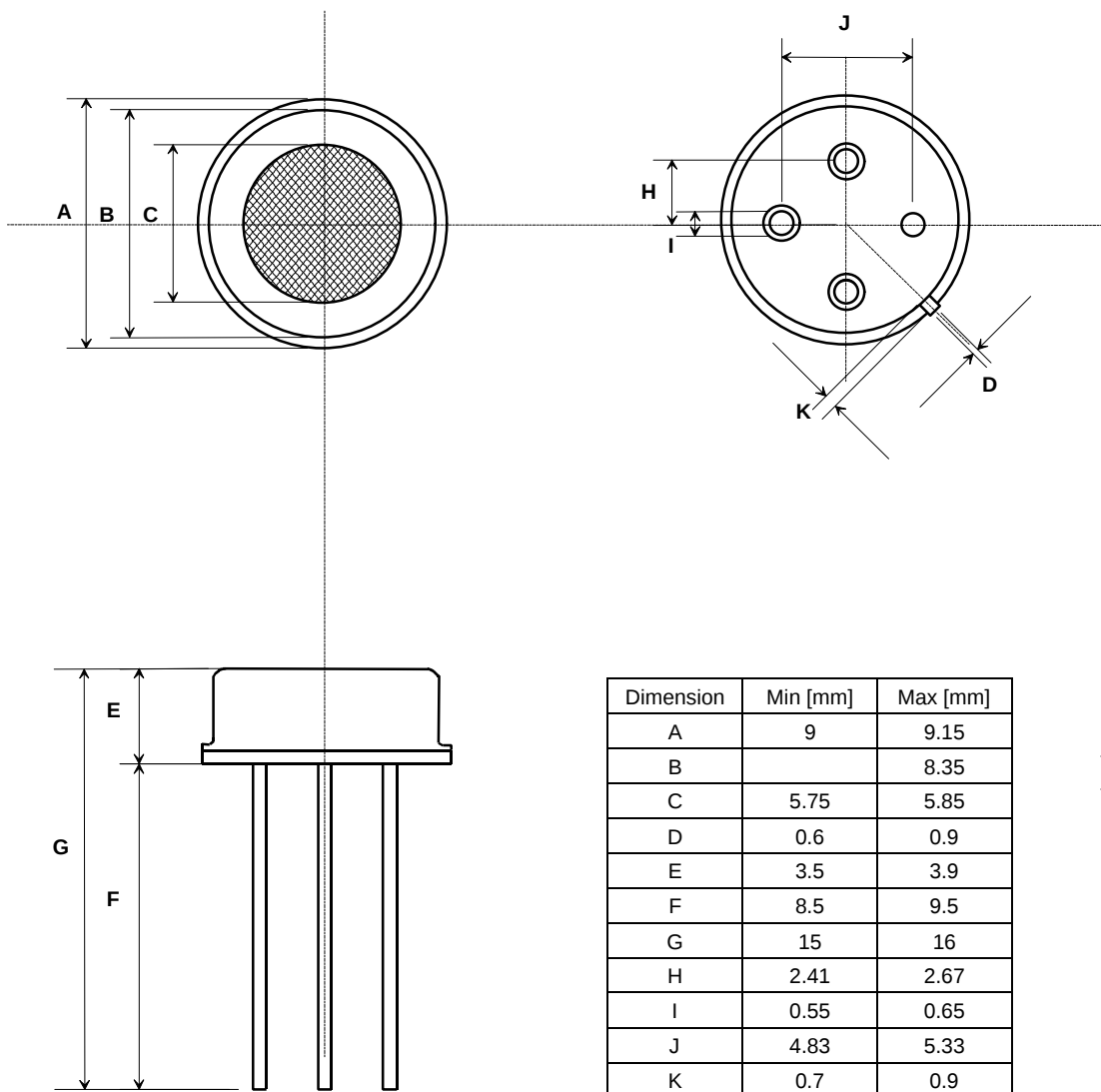
Characteristic	Symbol	Typ	Min	Max	Unit
CO Detection Range	FS		10	1000	ppm
Sensing Resistance in air	R_0	24	18	180	$k\Omega$
Sensitivity Factor ^[3]	S_R	1.4	1.3	1.8	-

Table 3

^[3] Sensitivity Factor S_R is defined as R_S at 60ppm of CO divided by R_S at 200ppm of CO. Test conditions are 50±5 %RH and 23±2°C.



Package Dimensions and Filter



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