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**MiCS – 3110**

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## C<sub>2</sub>H<sub>5</sub>OH Gas Sensor

This datasheet describes the use of the MiCS-3110 in ethanol detection applications. The package and the mode of operation described in this document target the detection of ethanol vapors in air. In breathalyzer applications for example, small traces of ethanol can be measured in human breath to calculate the alcohol concentration in the blood.

### 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 Preliminary Data Sheet accompanies MicroChemical Systems MiCS-3110 sensors for C<sub>2</sub>H<sub>5</sub>OH gas. 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-3110 sensor described in this document to avoid erroneous readings and to prevent the device from permanent damage.

- Tin oxide (SnO<sub>2</sub>) gas sensors require a warm up period before correct ethanol (C<sub>2</sub>H<sub>5</sub>OH) measurements can be taken. It is important to follow the limits in the specifications (see Table 1) and to keep the sensor in the recommended powered operating mode until the signal reaches a stable level. After exposing the sensor to high concentrations of C<sub>2</sub>H<sub>5</sub>OH, make sure the sensor is given enough time to recover before taking new measurements.
- The sensor must not be wave-soldered without protection or exposed to high concentrations of organic solvents or corrosive gases in order to avoid poisoning the sensitive layer. Use humidified gas for testing and calibration.
- Heater voltages above the specified maximum rating of 2.5 V will destroy the sensor. An increase of 0.5 V at 2.35 V causes an increase of the heater temperature of about 100°C. The correct operating temperature is obtained by applying a heater voltage of 2.35 ± 0.05 V.
- We strongly recommend using the operating mode and measurement circuit described in this document and referring to the heater voltage in the "Electric Specifications" section. Deviating from these procedures may produce varying results or damage the sensor.
- For any additional questions, please contact us at: \_\_\_\_\_

## Operating Mode:

The recommended mode of operation is a constant voltage mode. A heater voltage of V<sub>H</sub> = 2.4 V is applied. This causes the temperature of the sensing resistor (R<sub>S</sub>) to reach about 430°C.

Detection of the C<sub>2</sub>H<sub>5</sub>OH concentration is achieved by measuring the sensing resistor R<sub>S</sub> during operation.

## Sensor Response:

The sensor response to C<sub>2</sub>H<sub>5</sub>OH in air is represented in Figure 1. The sensor resistance R<sub>S</sub> is normalized to the resistance under 10 ppm of C<sub>2</sub>H<sub>5</sub>OH (R<sub>10ppm</sub>).

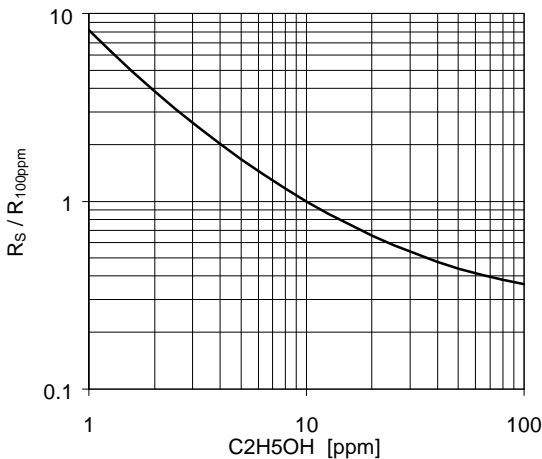


Figure 1: R<sub>S</sub> / R<sub>10ppm</sub> as a function of gas concentration at 20% RH and 23°C.

## Measurement Circuit:

Figure 2 shows the pin connections of the MiCS-3110 ethanol sensor. A simple circuit to measure the C<sub>2</sub>H<sub>5</sub>OH concentration is proposed in Figure 3. The heating voltage V<sub>H</sub> is applied to pins 3 and 1. A load resistor R<sub>L</sub> is connected in series with R<sub>S</sub> to convert the resistance R<sub>S</sub> to a voltage V<sub>S</sub> between pins 2 and 4. R<sub>S</sub> can then be calculated by the following expression:

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

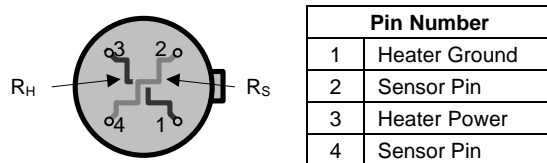


Figure 2: Equivalent circuit (top view) of MiCS 3110.

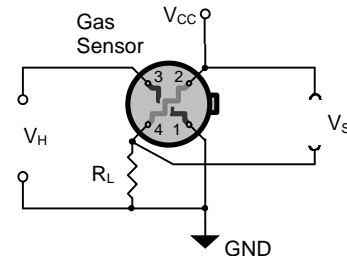


Figure 3: Measurement circuit for C<sub>2</sub>H<sub>5</sub>OH detection.



## Electrical Specifications

### Maximum Ratings:

Rating	Symbol	Value / Range	Unit
Maximum Heater Voltage	V <sub>H</sub>	2.5	V
Maximum Sensor Supply Voltage	V <sub>CC</sub>	5	V
Maximum Heater Power Dissipation	P <sub>H</sub>	90	mW
Maximum Sensor Power Dissipation	P <sub>S</sub>	1	mW
Relative Humidity Range	R <sub>H</sub>	15 – 95	%RH
Ambient Operating Temperature	T <sub>amb</sub>	0 – 50	°C
Storage Temperature Range	T <sub>sto</sub>	-40 – +70	°C
Storage Humidity Range	RH <sub>sto</sub>	15 – 95	%RH

Table 1

### Operating Conditions:

Parameter	Symbol	Typ	Min	Max	Unit
Heating Voltage,	V <sub>H</sub>	2.4	2.35	2.45	V
Heating Current,	I <sub>H</sub>	34	28	36	mA
Heating Power, <sup>[1]</sup>	P <sub>H</sub>	80	65	87	mW
Heating Resistance,	R <sub>H</sub>	69	66	81	Ω

Table 2

<sup>[1]</sup> Min and Max values for the heating power are obtained by combining V<sub>H, min</sub> with R<sub>H, max</sub> and V<sub>H, max</sub> with R<sub>H, min</sub>, respectively.

### Sensitivity Characteristics:

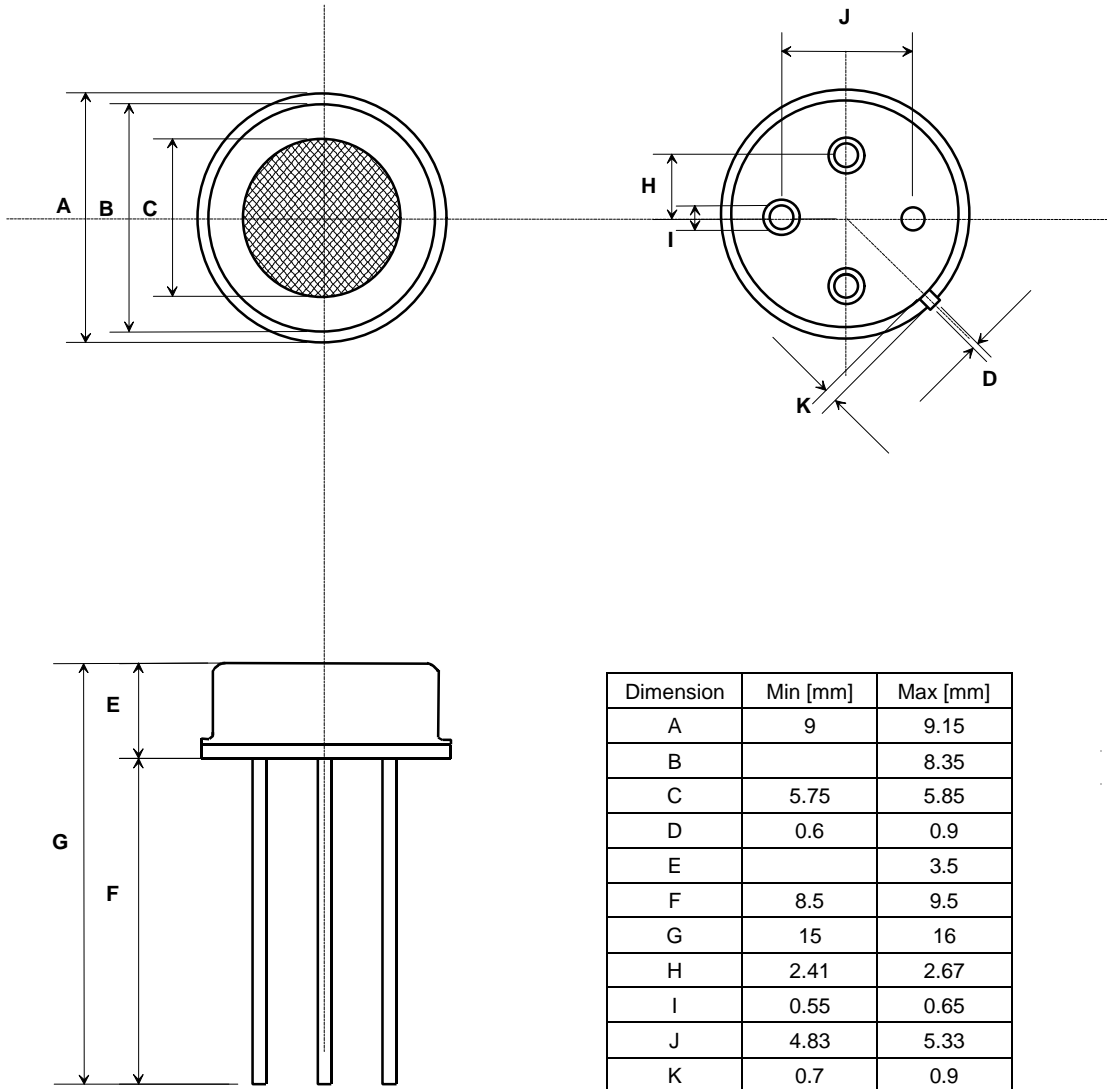
Characteristic	Symbol	Typ	Min	Max	Unit
C <sub>2</sub> H <sub>5</sub> OH Detection Range	FS		1	1000	ppm
Sensing Resistance at 15 ppm	R <sub>S</sub>	1.0*	0.4*	4*	kΩ
Sensing Resistance at 120 ppm	R <sub>S</sub>	0.54*	0.25*	2.5*	kΩ
Sensitivity Factor <sup>[2]</sup>	S <sub>R</sub>	1.7*	1.2*	4.0*	-

Table 3

<sup>[2]</sup> Sensitivity Factor S<sub>R</sub> is defined as R<sub>S</sub> at 15ppm of C<sub>2</sub>H<sub>5</sub>OH divided by R<sub>S</sub> at 120ppm of C<sub>2</sub>H<sub>5</sub>OH. Test conditions are 20±5 %RH and 23±2°C.

\* Values are subject to changes before the final datasheet is published.

## Package Dimensions and Filter



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