



**MEMS VOC Gas Sensor**  
**(Model No.:GM-502B)**

# **Manual**

Version: 1.1

Valid from: 2017.5.10

Zhengzhou Winsen Electronics Technology Co., Ltd

# Statement

This manual copyright belongs to Zhengzhou Winsen Electronics Technology Co., LTD. Without the written permission, any part of this manual shall not be copied, translated, stored in database or retrieval system, also can't spread through electronic, copying, record ways.

Thanks for purchasing our product. In order to let the customer use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes & etc..., please in kind prevail.

We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users' comments on optimized using way are welcome.

Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD

# GM-502B MEMS VOC Gas Sensor

## Product description

MEMS combustible gas sensor is using MEMS micro-fabrication hot plate on a Si substrate base, gas-sensitive materials used in the clean air with low conductivity metal oxide semiconductor material. When the sensor exposed to gas atmosphere, the conductivity is changing as the detected gas concentration in the air. The higher the concentration of the gas, the higher the conductivity. Use simple circuit can convert the change of conductivity of the gas concentration corresponding to the output signal.



## Character:

- MEMS technology, strong structure
- Low power consumption
- High sensitivity
- Fast response and resume
- Simple drive circuit

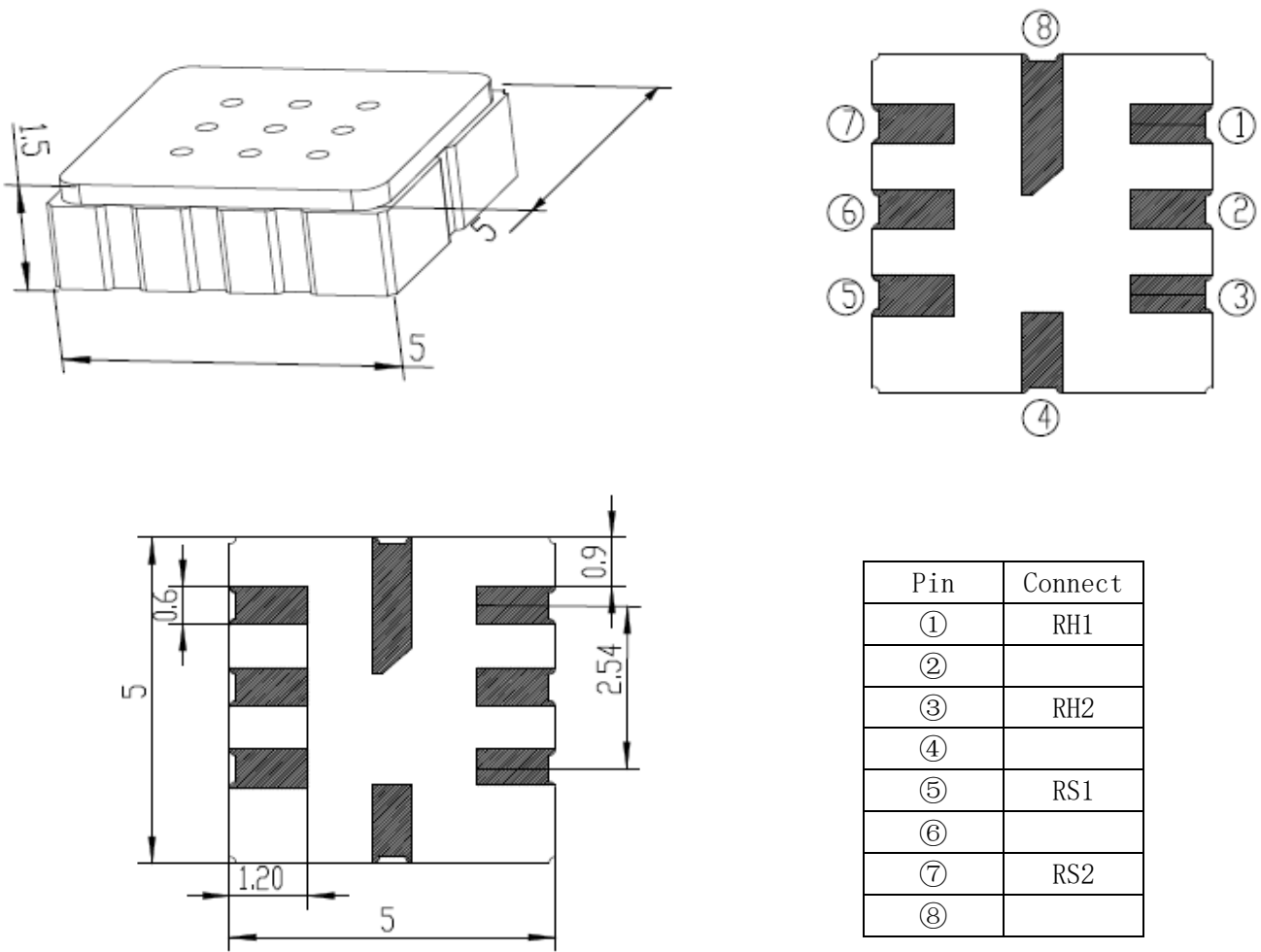
## Application

Gas leak detection for mobile phones, computers and other consumer electronics applications, also for breathing gas detection control, smoke alarm indoor & etc.

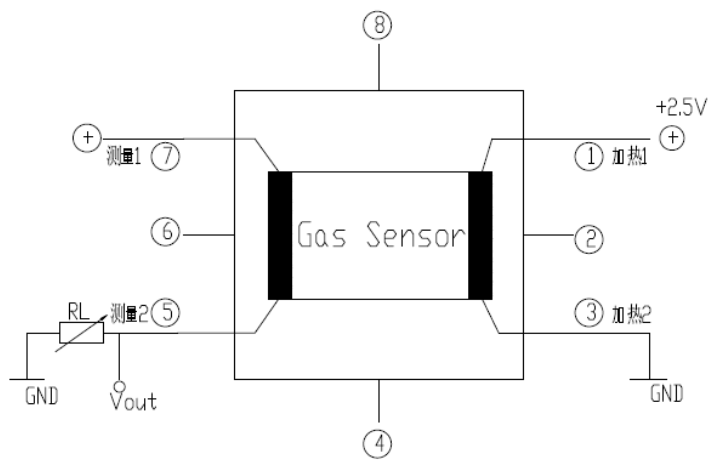
## Main Parameter:

Part No.		GM-502B	
Sensor Type		MEMS VOC Sensor	
Standard Encapsulation		Ceramic	
Detection Gas		Ethanol, formaldehyde, toluene &etc.	
Detection Range		1~500ppm	
Standard Circuit Conditions	Loop Voltage	$V_C$	$\leq 24V$ DC
	Heater Voltage	$V_H$	2.5V±0.1V AC or DC
	Load Resistance	$R_L$	Adjustable
Sensor character under standard test conditions	Heater Resistance	$R_H$	80Ω±20Ω (room temperature)
	Heater consumption	$P_H$	≤50mW
	sensitive materials resistance	$R_S$	1KΩ~30KΩ(in 50ppm ethanol)
	Sensitivity	S	$R_0(\text{in air})/R_S(\text{in 50ppm ethanol}) \geq 3.0$
Standard test conditions	Temp. Humidity	20°C±2°C; 55%±5%RH	
	Standard test circuit	$V_H: 2.5V \pm 0.1V$ ; $V_C: 5.0V \pm 0.1V$	

### Sensor Structure Diagram

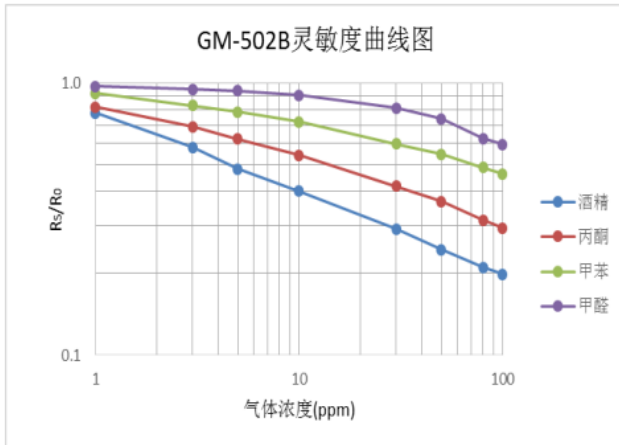


### Recommend Circuit



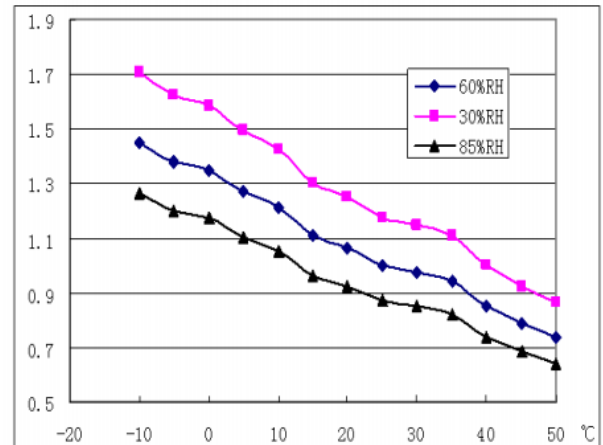
Instructions: The above fig is the basic test circuit of GM-502B. The sensor requires two voltage inputs: heater voltage ( $V_H$ ) and circuit voltage ( $V_C$ ).  $V_H$  is used to supply specific working temperature to the sensor and it can adopt DC or AC power.  $V_{out}$  is the voltage of load resistance  $R_L$  which is in series with sensor.  $V_C$  supplies the detect voltage to load resistance  $R_L$  and it should adopt DC power.

**Sensitivity Characteristics:**



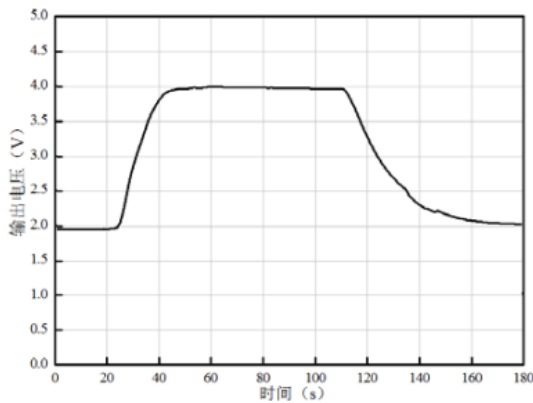
**Fig3. Typical Sensitivity Curve**

$R_s$  means resistance in target gas with different concentration,  $R_0$  means resistance of sensor in clean air. All tests are finished under standard test conditions.



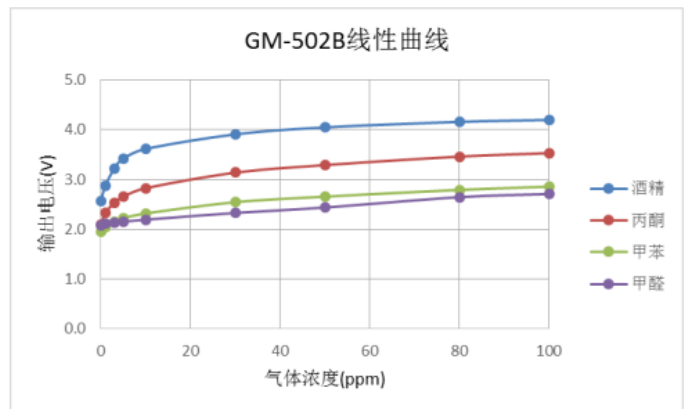
**Fig4. Typical temperature/humidity characteristics**

$R_s$  means resistance of sensor in 150ppm CO gas under different temp. and humidity.  $R_{s0}$  means resistance of the sensor in 150ppm CO gas under 20°C/55%RH.



**Fig5. Response and Resume**

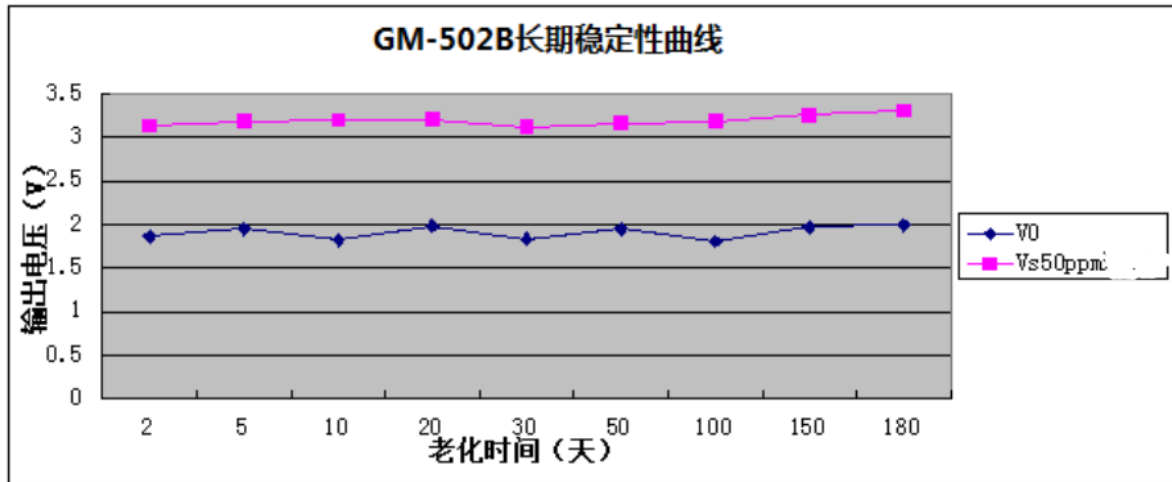
The output in above Fig is the voltage of  $R_L$  which is in series with sensor. All tests are finished under standard test conditions and the test gas is 150ppm CO gas.



**Fig6. Linearity character**

The output in above Fig is the voltage of  $R_L$  which is in series with sensor. All tests are finished under standard test conditions.

**Long-term stability:**



**Fig7.long-term Stability**

Test is finished in standard test conditions, the abscissa is observing time and the ordinate is voltage output of RL.

**Instructions:**

**1. Preheating time**

Sensor’s resistance may drift reversibly after long-term storage without power. It need to preheat the sensor to reach inside chemical equilibrium. Preheating voltage is same with heating voltage  $V_H$ . The suggested preheating time as follow:

Storage Time	Suggested aging time
Less than one month	No less than 48 hours
1 ~ 6 months	No less than 72 hours
More than six months	No less than 168 hours

**2. Calibration**

Sensor’s accuracy is effected by many factors such as reference resistance’s difference, the sensitivity difference, temperature, humidity, interfering gases, preheating time, the relationship between input and output is not linear, hysteretic and non-repetitive. For absolute concentration measurement, they need regular calibration (one-point calibration / multi-points calibration for full scale) to ensure that the measuring value is accurate. For relative measurement calibration is not required.

**Cautions**

**1. Following conditions must be prohibited**

1.1 Exposed to organic silicon steam

Sensing material will lose sensitivity and never recover if the sensor absorbs organic silicon steam. Sensors must be avoid exposing to silicon bond, fixture, silicon latex, putty or plastic contain silicon environment.

1.2 High Corrosive gas

If the sensors are exposed to high concentration corrosive gas (such as H<sub>2</sub>S, SO<sub>2</sub>, Cl<sub>2</sub>, HCL etc.), it will not only result in corrosion of sensors structure, also it causes sincere sensitivity attenuation.

### 1.3 Alkali, Alkali metals salt, halogen pollution

The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorine.

### 1.4 Touch water

Sensitivity of the sensors will be reduced when spattered or dipped in water.

### 1.5 Freezing

Do avoid icing on sensor's surface, otherwise sensing material will be broken and lost sensitivity.

### 1.6 Applied voltage

Applied voltage on sensor should not be higher than 120mW, it will cause irreversible heater damaged, also hurt from static, so anti-static precautions should be taken when touching sensors.

## 2. Following conditions must be avoided

### 2.1 Water Condensation

Indoor conditions, slight water condensation will influence sensors' performance lightly. However, if water condensation on sensors surface and keep a certain period, sensors' sensitive will be decreased.

### 2.2 Used in high gas concentration

No matter the sensor is electrified or not, if it is placed in high gas concentration for long time, sensors characteristic will be affected. If lighter gas sprays the sensor, it will cause extremely damage.

### 2.3 Long time exposed to extreme environment

No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc., it will influence the sensors' performance badly.

### 2.4 Vibration

Continual vibration will result in sensors down-lead response then break. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

### 2.5 Concussion

If sensors meet strong concussion, it may lead its lead wire disconnected.

### 2.6 Soldering

Soldering flux: Rosin soldering flux contains least chlorine and safeguard procedures.

If disobey the above using terms, sensors sensitivity will be reduced.

**Zhengzhou Winsen Electronics Technology Co., Ltd**

**Add:** No.299, Jinsuo Road, National Hi-Tech Zone, Zhengzhou 450001 China

**Tel:** +86-371-67169097/67169670

**Fax:** +86-371-60932988

**E-mail:** [sales@winsensor.com](mailto:sales@winsensor.com)

**Website:** [www.winsen-sensor.com](http://www.winsen-sensor.com)



## **Manual:**

### **1. Preheating time**

Sensor needs some time to reach inside chemical equilibrium so it takes some preheating time. Generally, the sensor at a relatively high temperature will reach equilibrium faster, so you can boot in the first tens of seconds, it can give a higher voltage sensor to warm up. For C<sub>2</sub>H<sub>5</sub>OH working at 50mW, the first 30 seconds use 80mw heating. In general, the longer the preheating time, the better the accuracy of the sensor.



## 2. Sensor Calibration

For absolute concentration measurement, sensors accuracy can be affected by many factors such as reference resistance difference, the sensitivity difference, temperature, humidity, interfering gases, aging time, therefore they need regular calibration. For relative measurement calibration is not required. Because the sensor characteristic curve is not linear, it is recommended in the whole range of multi-point calibration and consider the influence of temperature and humidity. Once the calibration data obtained can be linear or polynomial fit to organize the data.

### Cautions

#### 1 .Following conditions must be prohibited

##### 1.1 Exposed to organic silicon steam

Sensing material will lose sensitivity and never recover if the sensor absorbs organic silicon steam. Sensors must be avoid exposing to silicon bond, fixture, silicon latex, putty or plastic contain silicon environment.

##### 1.2 High Corrosive gas

If the sensors are exposed to high concentration corrosive gas (such as H<sub>2</sub>S, SO<sub>2</sub>, Cl<sub>2</sub>, HCL etc.), it will not only result in corrosion of sensors structure, also it cause sincere sensitivity attenuation.

##### 1.3 Alkali, Alkali metals salt, halogen pollution

The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorine.

##### 1.4 Touch water

Sensitivity of the sensors will be reduced when spattered or dipped in water.

##### 1.5 Freezing

Do avoid icing on sensor's surface, otherwise sensing material will be broken and lost sensitivity.

##### 1.6 Applied voltage

Applied voltage on sensor should not be higher than 120mW, it will cause irreversible heater damaged, also hurt from static, so anti-static precautions should be taken when touching sensors.

#### 2 .Following conditions must be avoided

##### 2.1 Water Condensation

Indoor conditions, slight water condensation will influence sensors' performance lightly. However, if water condensation on sensors surface and keep a certain period, sensors' sensitive will be decreased.

##### 2.2 Used in high gas concentration

No matter the sensor is electrified or not, if it is placed in high gas concentration for long time, sensors characteristic will be affected. If lighter gas sprays the sensor, it will cause extremely damage.

##### 2.3 Long time exposed to adverse environment

No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc., it will influence the sensors' performance badly.

##### 2.4 Vibration

Continual vibration will result in sensors down-lead response then break. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

##### 2.5 Concussion

If sensors meet strong concussion, it may lead its lead wire disconnected.

## 2.6 Soldering

Soldering flux: Rosin soldering flux contains least chlorine and safeguard procedures.

If disobey the above using terms, sensors sensitivity will be reduced.

**Zhengzhou Winsen Electronics Technology Co., Ltd**

**Add:** No.299, Jinsuo Road, National Hi-Tech Zone, Zhengzhou 450001 China

**Tel:** +86-371-67169097/67169670

**Fax:** +86-371-60932988

**E-mail:** [sales@winsensor.com](mailto:sales@winsensor.com)

**Website:** [www.winsen-sensor.com](http://www.winsen-sensor.com)

