# Flammable Gas Sensor

## （Model：MQ-2）

# Manual

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# MQ-2 Semiconductor Sensor for Flammable Gas

## Profile

Sensitive material of MQ-2 gas sensor is $SnO_2$, which with lower conductivity in clean air. When the target flammable gas exist, the sensor's conductivity gets higher along with the gas concentration rising. Users can convert the change of conductivity to correspond output signal of gas concentration through a simple circuit.

MQ-2 gas sensor has high sensitivity to propane and smoke, also can detect the natural gas and other flammable steam well. It is with low cost and suitable for different applications of detecting kinds of flammable gases.

## Features

It has good sensitivity to propane, smoke &etc in wide range, and has advantages such as long lifespan, low cost and simple drive circuit &etc.

## Main Applications

It is widely used in domestic gas leakage alarm, industrial flammable gas alarm and portable gas detector.

## Technical Parameters        Stable.1

| Model | | MQ-2 |
|---|---|---|
| Sensor Type | | Semiconductor |
| Standard Encapsulation | | Bakelite, Metal cap |
| Target Gas | | Flammable gas, smoke |
| Detection range | | 300～10000ppm(flammable gas) |
| Standard Circuit Conditions | Loop Voltage　　$V_c$ | ≤24V DC |
| | Heater Voltage　$V_H$ | 5.0V±0.1V AC or DC |
| | Load Resistance　$R_L$ | Adjustable |
| Sensor character under standard test conditions | Heater Resistance　$R_H$ | 29Ω±3Ω（room tem.） |
| | Heater consumption　$P_H$ | ≤950mW |
| | Sensitivity　　　$S$ | Ro(in air)/Rs(2000ppm $C_3H_8$)≥5 |
| | Output Voltage　$Vs$ | 2.5V～4.0V（in 2000ppm$C_3H_8$） |
| | Concentration Slope　$\alpha$ | ≤0.6($R_{3000ppm}$/$R_{1000ppm}$ $C_3H_8$) |
| Standard test conditions | Tem.　Humidity | 20℃±2℃；55%±5%RH |
| | Standard test circuit | Vc:5.0V±0.1V；$V_H$:5.0V±0.1V |
| | Preheat time | Over 48 hours |
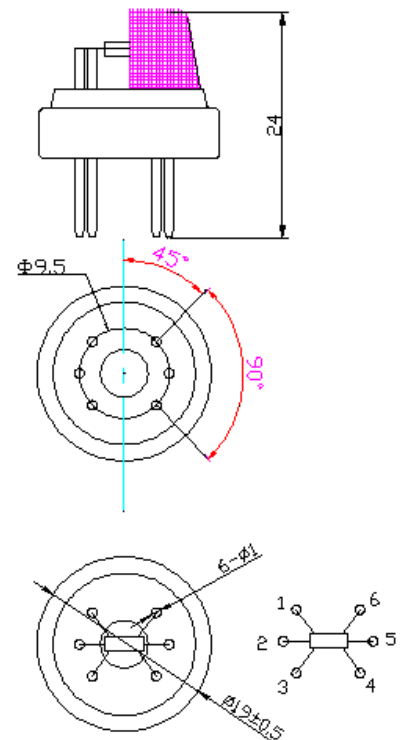
Fig1.Sensor Structure
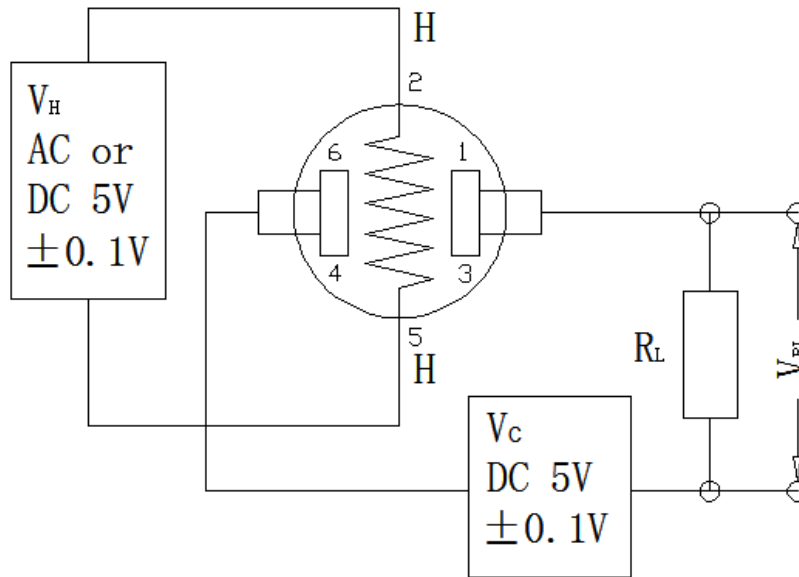
Unit: mm

## Basic Circuit



**Fig2. MQ-2 Test Circuit**

Instructions: The above fig is the basic test circuit of MQ-2.The sensor requires two voltage inputs: heater voltage($V_H$) and circuit voltage($V_C$). $V_H$ is used to supply standard working temperature to the sensor and it can adopts DC or AC power, while $V_{RL}$ is the voltage of load resistance $R_L$ which is in series with sensor. Vc supplies the detect voltage to load resistance $R_L$ and it should adopts DC power.
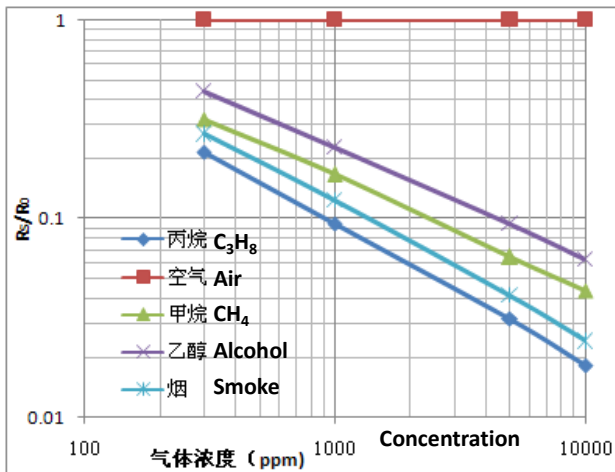
## Description of Sensor Characters



**Fig3.Typical Sensitivity Curve**

The ordinate is resistance ratio of the sensor (Rs/$R_0$), the abscissa is concentration of gases. Rs 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.
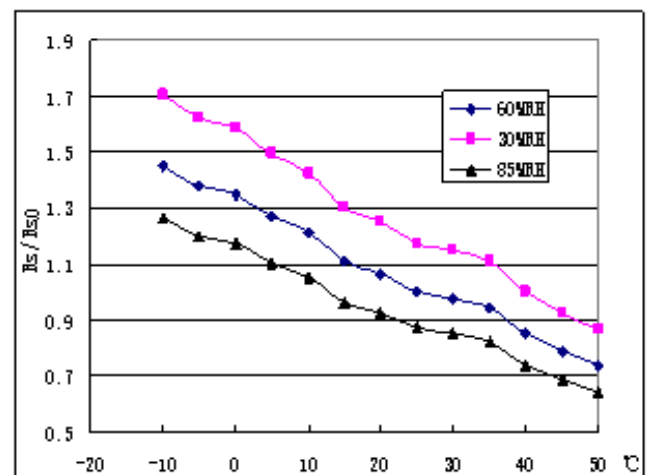


**Fig4.Typical temperature/humidity characteristics**

The ordinate is resistance ratio of the sensor (Rs/Rso).Rs means resistance of sensor in 2000ppm propane($C_3H_8$) under different tem. and humidity. Rso means resistance of the sensor in 2000ppm propane under 20℃/55%RH.
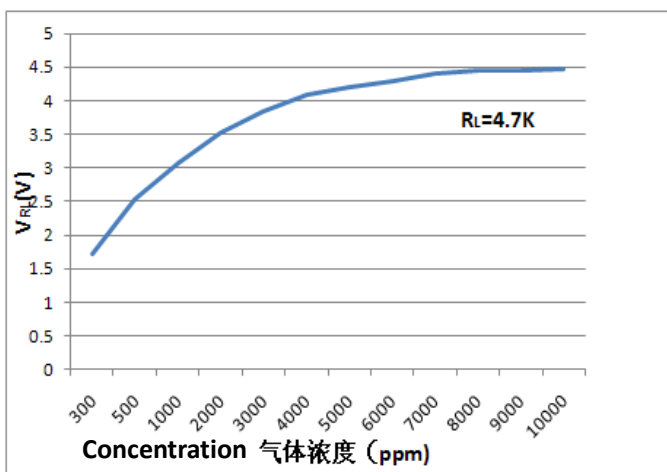
**Fig5.Sensity Curve**

Fig5 shows the $V_{RL}$ in propane with different concentration. The resistance load $R_L$ is 4.7 KΩ and the test is finished in standard test conditions.
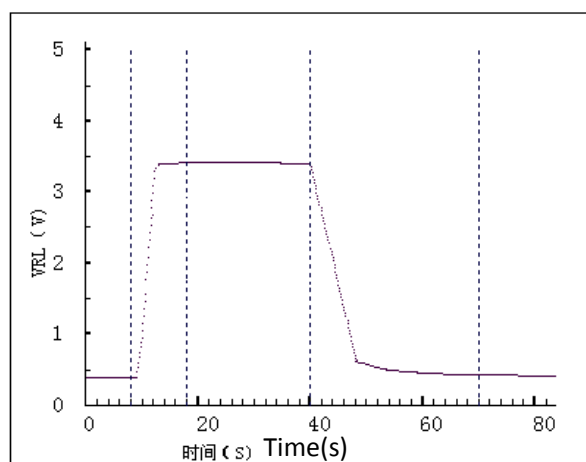


**Fig6.Responce and Resume**

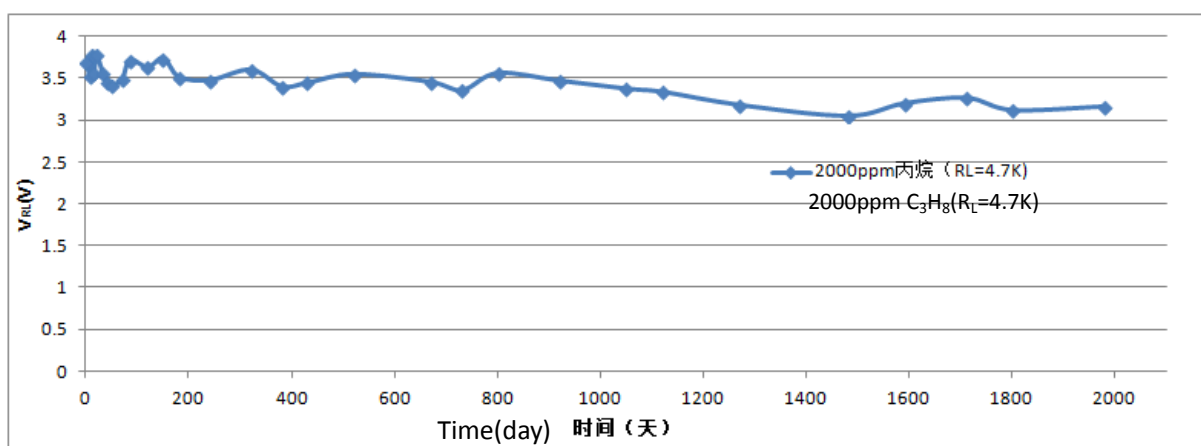Fig5 shows the changing of $V_{RL}$ in the process of putting the sensor into target gas and removing it out.



**Fig7.long-term Stability**

Test is finished in standard test conditions, the abscissa is observing time and the ordinate is $V_{RL}$.

## 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 avoid exposing to silicon bond, fixature, 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 $H_2S$, $SO_X$, $Cl_2$, 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 higher voltage

Applied voltage on sensor should not be higher than stipulated value, even if the sensor is not physically damaged or broken, it causes down-line or heater damaged, and bring on sensors' sensitivity characteristic changed badly.

### 1.7 Voltage on wrong pins
For 6 pins sensor, Pin 2&5 is heating electrodes, Pin (1,3)/(4,6) are testing electrodes (Pin 1 connects with Pin 3, while Pin 4 connects with Pin 6).If apply voltage on Pin 1&3 or 4&6, it will make lead broken; and no signal putout if apply on pins 2&4.
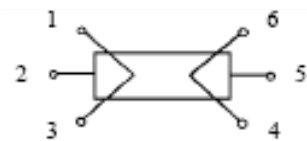


**Fig8. Lead sketch**

## 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 storage
The sensors resistance will drift reversibly if it's stored for long time without electrify, this drift is related with storage conditions. Sensors should be stored in airproof bag without volatile silicon compound. For the sensors with long time storage but no electrify, they need long galvanical aging time for stability before using. The suggested aging time as follow:

**Stable2.**

| 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 |

### 2.4 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.

### 2.5 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.

### 2.6 Concussion

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

2.7 Usage Conditions

2.7.1For sensor, handmade welding is optimal way. The welding conditions as follow:

- Soldering flux: Rosin soldering flux contains least chlorine
- homothermal soldering iron
- Temperature： 250℃
- Time：less than 3 seconds

2.7.1If users choose wave-soldering, the following conditions should be obey:

- Soldering flux: Rosin soldering flux contains least chlorine
- Speed: 1-2 Meter/ Minute
- Warm-up temperature：100±20℃
- Welding temperature：250±10℃
- One time pass wave crest welding machine

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