Semiconductor gas-sensitive element instructions

Model: MQ-D4B

Version: 1.4

Date: Apl.27th, 2018

Shanxi　Tengxing sensor technology Co., Ltd

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1. Performance

The MQ-D4B combustible gas sensor adopts a multi-layer thick film manufacturing process. A heater and a metal oxide semiconductor gas-sensitive layer are made on both sides of a micro-Al_2O_3 ceramic substrate and encapsulated in a metal shell. The conductivity of the sensor changes when the detected gas exists in the ambient air. The higher the concentration of the gas, the higher the conductivity of the sensor. This conductivity change can be converted into an output signal corresponding to the gas concentration using a simple circuit.

Characteristic:

This product has good sensitivity to methane in a wide concentration range.

(1) strong anti-interference ability

(2) low power consumption

(3) good stability

(4) long life

(5) low cost

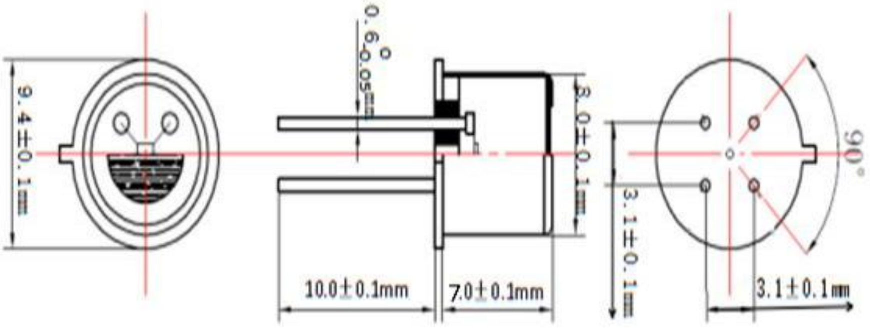
(6) simple driving circuit

2. Main applications:

①Combustible gas leakage monitoring device and fire/safety detection system for households, factories and commercial uses

②Combustible gas leakage alarm, gas leak detector

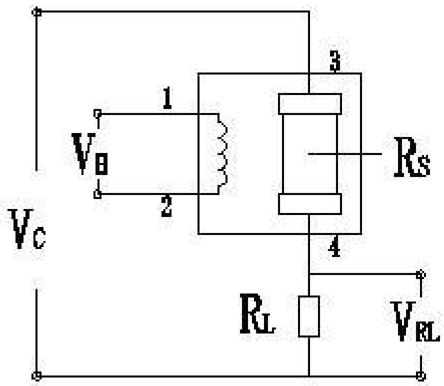
3. Appearance and dimension



4. Specifications

Product model			MQ-D4B
Product type			Flat semiconductor sensor
Standard packaging			Metal encapsulation
Detect gas			Methane, natural gas, biogas
Detect concentration			300~10000ppm(Methane, natural gas)
Standard circuit conditions	Heat voltage (DC)	VH	5.0V±0.1V AC or DC
	Circuit voltage(Dc)	Vc	≤24V DC
	Load resistance	RL	adjustable
Characteristics of gas sensing components under standard testing conditions	Heating resistor	RH	85Ω±15Ω(indoor temperature)
	Heating power	PH	≤350mW
	Sensitive body resistance	RS	1KΩ~20KΩ(in 5000ppm methane)
	Sensitivity	S	Rs(in air)/Rs(in 5000ppm methane)≥5
	Concentration slope	α	≤0.6(R5000ppm/R1000ppm methane)
Standard testing conditions	Temperature/humidity		20℃±2℃; 55%±5%RH
	Standard Test Circuit		VC: 5V±0.1V; VH: 5V±0.1V
	Warm-up time		no less than 48 hours
	Oxygen concentration		21% (not less than 18%) (Oxygen concentration will affect the initial value, sensitivity, and repeatability of the sensor. Please consult for use when using at low oxygen concentrations)
Product Life			10 years

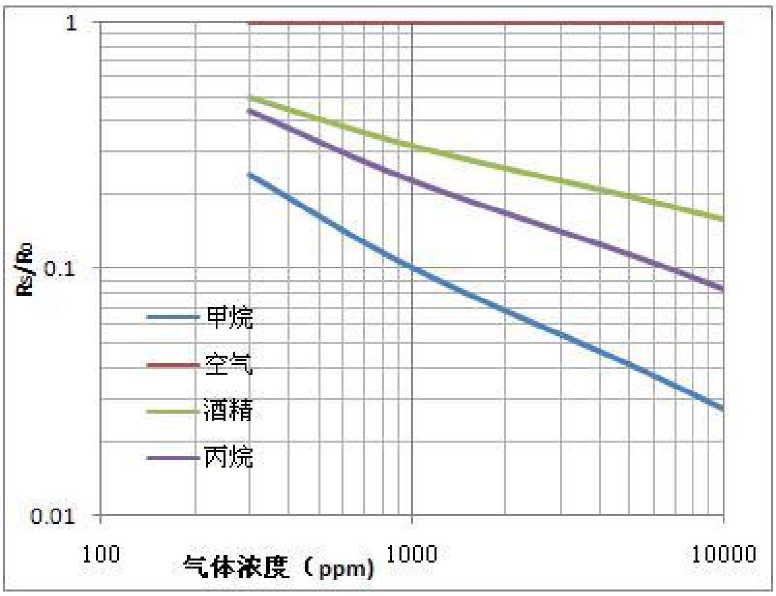
5. Test circuit



Notes: The figure above shows the basic test circuit of the MP-4 sensor. The sensor needs to apply 2 voltages: heater voltage (VC). VH is used to provide a specific operating temperature for the sensor, and can be powered by a DC power supply or an AC power supply. VRL is the voltage on the load resistor (RL) in the center of the sensor. VC provides the test voltage for the load resistor RL, and a DC power supply must be used.

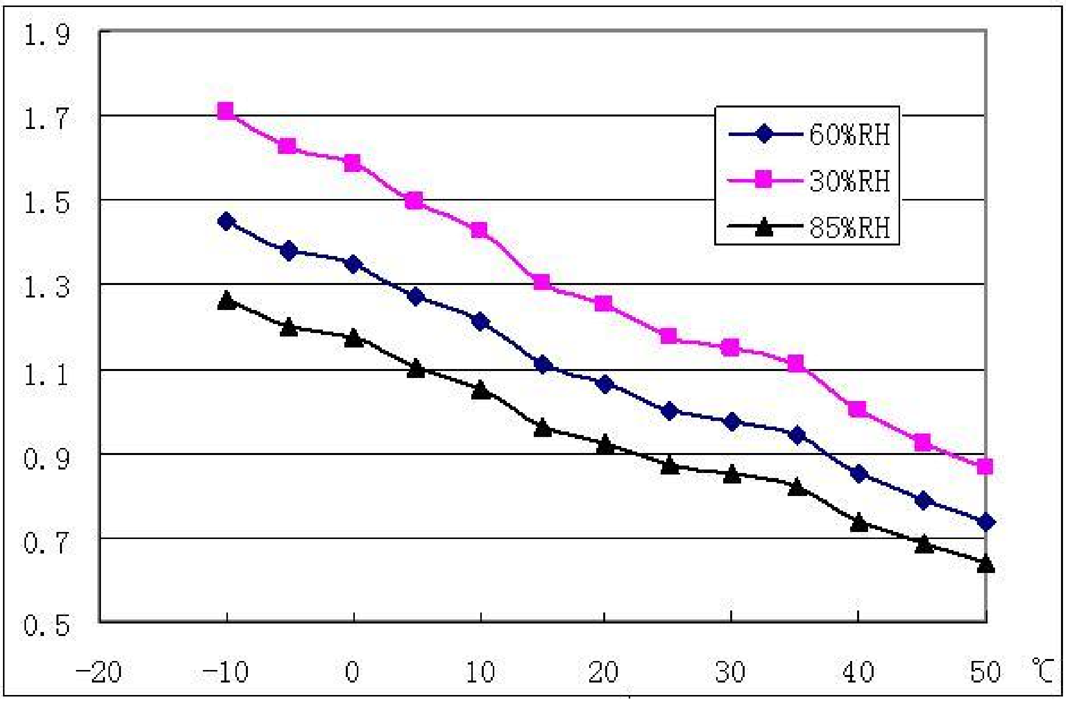
6. Characteristic details of sensor

（1）Typical sensitivity characteristic curve for a sensor



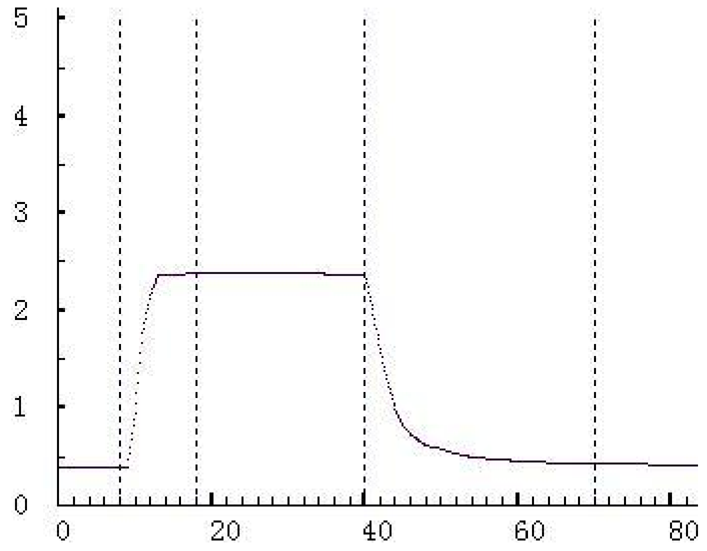
The ordinate is the resistance ratio of the sensor (RS/R0) and the abscissa is the gas concentration. RS represents the resistance value of the sensor in different concentrations of gas, and R0 represents the resistance value of the sensor in clean air. All tests shown in the diagram were performed under standard test conditions.

(2).Typical temperature and humidity characteristic curves of a sensor

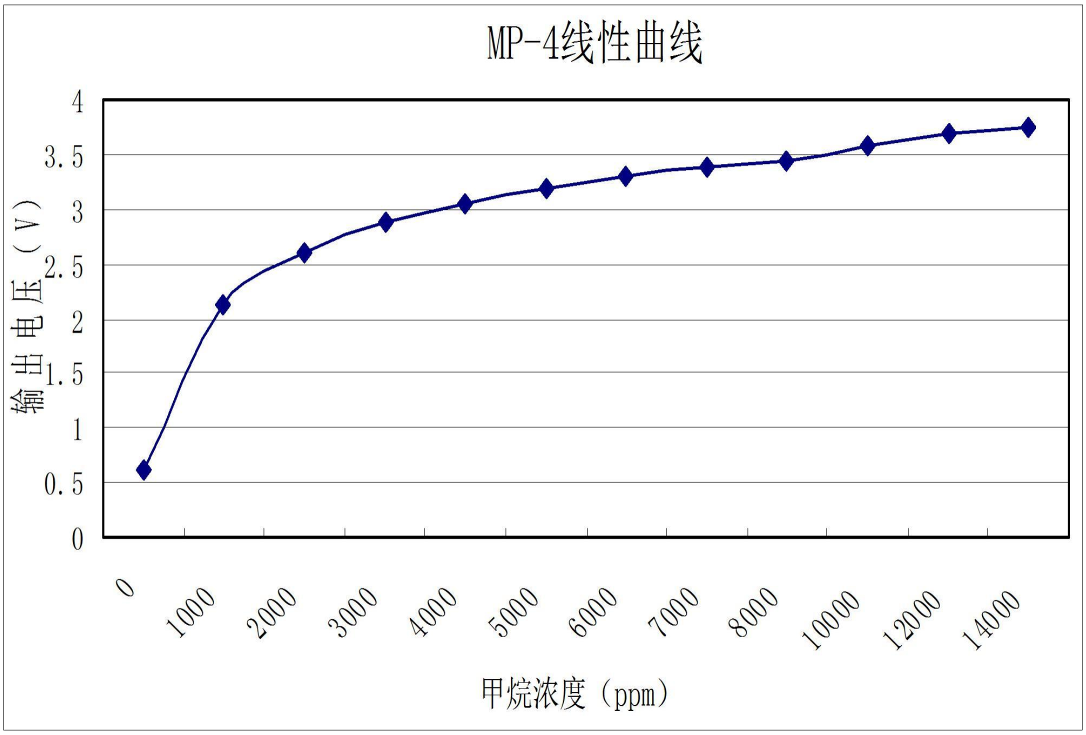


The vertical axis in the figure is the resistance ratio of the sensor (RS/RS0). RS represents the resistance value of the sensor under different temperatures/humidities with 5000ppm methane. RS0 represents the resistance value of the sensor under 5000ppm methane and 20℃/55%RH environment conditions.

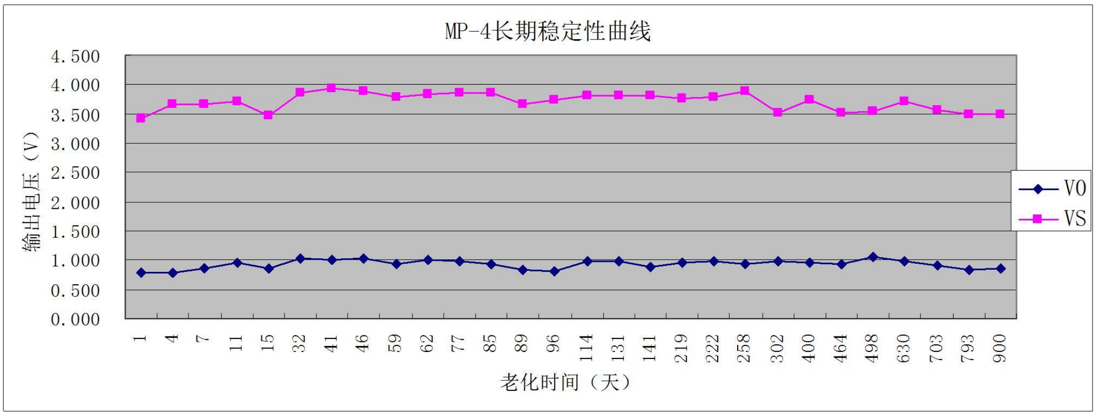
(3). Response recovery graph



(4). Sensor linearity curve



7. Long-term Stability



Note: All tests in the figure were performed under standard test conditions, with the abscissa being the observation time and the ordinate being the VRL value.

8. Attention:

1. Situations that must be avoided

1.1 Exposure to volatile silicon compound vapor

The sensor should avoid exposure to silicone adhesives, hair spray, silicone rubber, putty or other places where volatile silicon compounds exist. If the surface of the sensor is adsorbed with silicon compound vapor, the sensitive material of the sensor will be wrapped by silicon dioxide formed by the decomposition of the silicon compound, which will inhibit the sensitivity of the sensor and cannot be restored.

1.2 Highly corrosive environment

When the sensor is exposed to high concentrations of corrosive gases (such as H_2S, SO_X, Cl_2, HCl, etc.), it will not only cause corrosion or damage to the heating material and sensor leads, but also cause irreversible deterioration of the performance of the sensitive material.

1.3 Alkali, alkali metal salts, halogen pollution

When the sensor is contaminated by alkali metals, especially salt water spray, or exposed to halogens such as Freon, it will also cause performance deterioration.

1.4 Contact with water

Splashing or immersion in water will cause the sensor's sensitivity to decrease.

1.5 Freezing

Water freezing on the surface of the sensor's sensitive material will cause the sensitive layer to break and lose its sensitive characteristics.

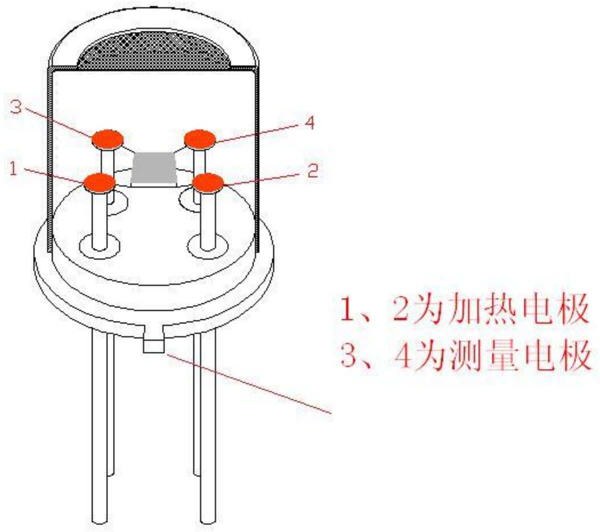
1.6 Excessive applied voltage

If the voltage applied to the sensor or heater is higher than the specified value, even if the sensor is not physically damaged or destroyed, it may cause damage to the lead wire and/or heater and cause the sensor's sensitivity characteristics to deteriorate.

1.7 Voltage applied to wrong pin

As the following picture: Sensor pins 1 and 2 are connected to the heating circuit, and pins 3 and 4 are connected to the measurement circuit; heating and measurement can share the same power supply circuit under the premise of meeting the electrical performance requirements of the sensor.

Note: Please pay attention to the prominent mark on the sensor. The two pins next to the mark are heating electrodes.



2. Situations to avoid as much as possible

2.1 Condensation

Under indoor use conditions, slight condensation will have a slight effect on the performance of the sensor. However, if water condenses on the surface of the sensitive layer and remains for a period of time, the sensor characteristics will decrease.

2.2 In high-concentration gas

Regardless of whether the sensor is powered on or not, long-term placement in high-concentration gas will affect the sensor characteristics. For example, if lighter gas is directly sprayed on the sensor, it will cause great damage to the sensor.

2.3 Long-term storage

If the sensor is stored for a long time without power, its resistance will have a reversible drift, which is related to the storage environment. The sensor should be stored in a sealed bag that does not contain volatile silicon compounds. Sensors that have been stored for a long time need to be powered on for a longer time before use to make them stable.

The storage time and corresponding aging time recommendations are as follows:

Time of storage	Suggested stabilization time
≤1 month	no less than 48h
1-6 months	no less than 72h
≥6 months	no less than 168h

2.4 Long-term exposure to extreme environments

Regardless of whether the sensor is powered or not, long-term exposure to extreme conditions such as high humidity, high temperature or high pollution will seriously affect the performance of the sensor.

2.5 Vibration

Frequent and excessive vibration can cause the internal leads of the sensor to resonate and break. Such vibrations can be generated by using pneumatic screwdrivers/ultrasonic welders during transportation and on the assembly line.

2.6 Impact

If the sensor is subjected to strong impact or falls, its lead wire may break.

2.7 Conditions of use:

2.7.1 Manual soldering is the most ideal soldering method for the sensor.

The recommended soldering conditions are as follows:

Flux: Rosin flux with the least chlorine

Constant temperature soldering iron

Temperature: 250℃

Time: no more than 3 seconds

2.7.2 The following conditions should be met when using wave soldering:

① Flux: Rosin flux with the least chlorine

② Speed: (1-2) m/min

③Preheating temperature: (100±20)℃

④ Soldering temperature: (250±10)℃

⑤1 pass through the wave soldering machine

Violation of the above conditions of use will degrade the sensor characteristics.

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