Air Quality(TVOC) Sensor

SMD1013B Product Datasheet

1. Product Introduction

The SMD1013B air quality sensor (TVOC) is a miniature gas sensor developed based on MEMS semiconductor materials and can be used to detect TVOC gas content in different scenarios.

The sensor is a VOC gas sensitive material and sensor electrodes are developed independently. When organic volatile gas contacts the sensing material, the conductivity of the material will change. A specific test circuit can be used to convert the change into an output voltage signal corresponding to the gas concentration.

2. Sensor Characteristics

- Very small size
- Low power consumption
- High sensitivity
- Fast response and recovery time
- Simple test circuit
- Good stability
- Long life time

3. Main Application

- Air purifier
- Air conditioning ventilation
- Smart wearable detector
- Portable detector

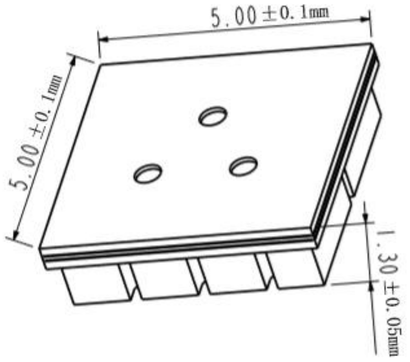
4. Product Description

4.1 Technical parameters

Table 1

Product Number			SMD1013B
product Type			MEMS Semiconductor Sensors
Standard Package			Ceramic Package
Target Gas			Alcohol, smoke, toluene, acetone, formaldehyde, etc.
Measurement Range			0 ～100 ppm ethanol
Resolution			0.2ppm ethanol
Standard Circuit Conditions	Sensor Voltage	V_C	≤5 V or 3.3 V DC
	Heating Voltage	V_H	1.8 ±0.1 V AC or DC
	Load Resistance	R	Adjustable (subject to shipping sheet)
Gas Sensor Characteristics Under Standard Test Conditions	Heater resistance	R_H	45 ± 5 Ω (measured at room temperature)
	Heating power	P_H	≤ 43 mW
	Sensitive resistance	R_S	10 ~ 300 KΩ (tested in air)
	Sensitivity	S	R0 (in air)/Rs (in 10 ppm ethanol) ≥ 6
	Response Ratio	α	≤ 0.3 (R 10ppm / R 1ppm ethanol)
Standard Test Conditions	Temperature Humidity		20±2 ℃ 55±5%RH
	Preheat Time		3-5 min
Response Time (T_{90})			< 30 s
Recovery Time (T_{10})			<60 s
Life Time			≥ 3 years

4.2 Sensor structure and pin definition



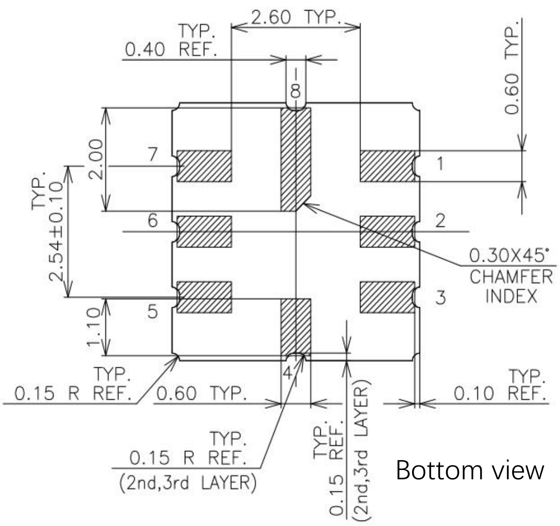


Table 2

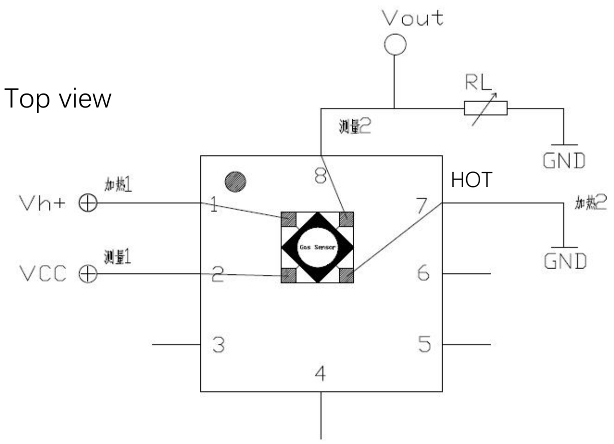
Pin Number	Name	Definition
1	VH+	Heating voltage supply
2	VCC	Sensor voltage supply
3	NG	/
4	NG	/
5	NG	/
6	NG	/
7	HOT	Heating GND
8	VOUT	Sensor ouput voltage

Note: in following sections, if the unit is resistance, it is calculated by this formula:

$$R = \frac{R_L(V_{CC} - V_{OUT})}{V_{OUT}}$$

Each item definition refer table1

4.3 Basic Circuit



The figure shows the basic test circuit of the SMD1013B sensor. The sensor needs to apply two voltages: heater voltage and test voltage. Vh+ is used to provide a specific voltage for the heating. Vout is output test voltage which need connect with a load resistor (RL) in series. Vcc is sensor working voltage. These two voltages need set in right value according to datasheet, otherwise measurement performance will reduce and even damage the sensor.

5. Sensor Characterization

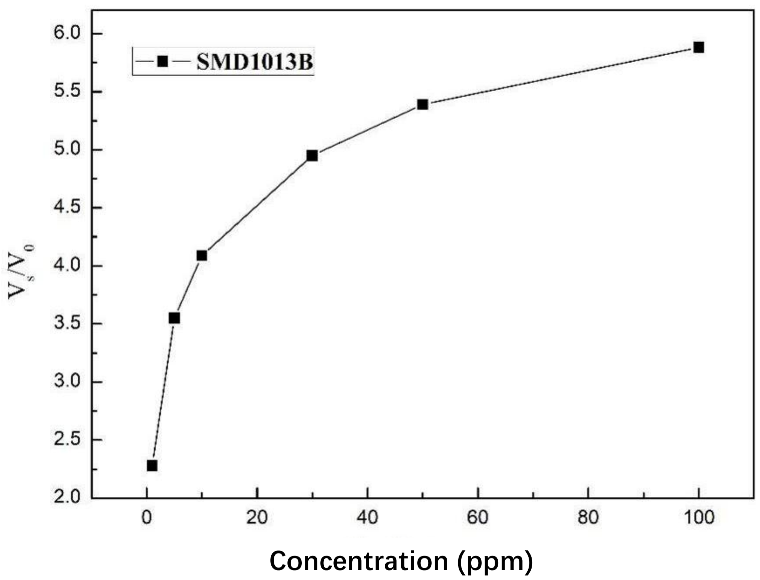


Figure 1 Sensor sensitivity characteristic curve

The test was completed under standard test conditions, and the load resistance used was 2kΩ. In the figure, V0 represents the test voltage of the sensor in clean air , and Vs represents the test voltage of the sensor in target gas by different concentrations .

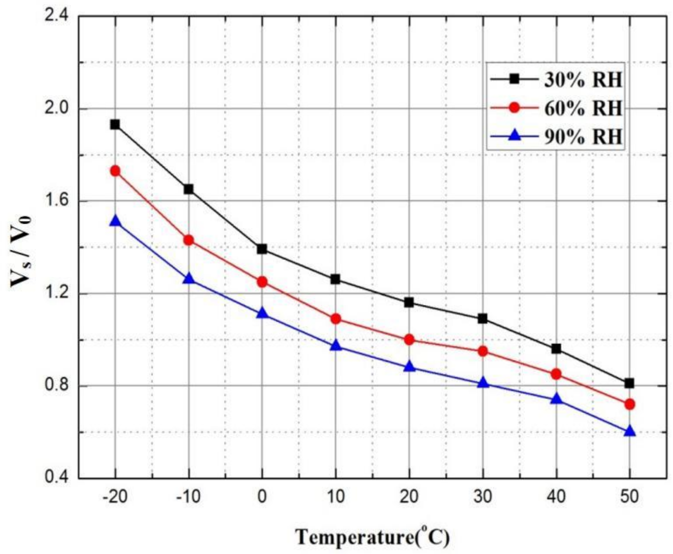


Figure 2 Sensor temperature and humidity characteristic curve

Above figure shows the temperature and humidity effect curves, Vs represents the response voltage in 10 ppm ethanol gas under different temperature and humidity conditions, and V0 represents the response voltage value in clean air under correspond temperature and humidity conditions.

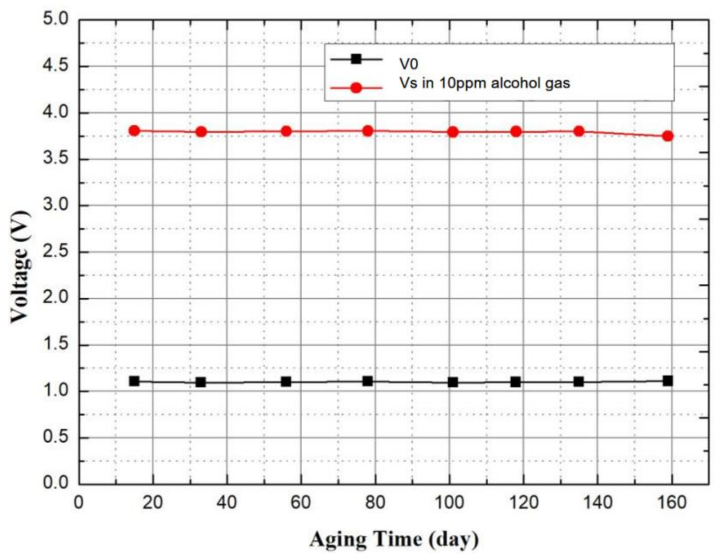


Figure 3 Long-term stability curve of the sensor

The test is completed under standard test conditions. The horizontal axis is test time of the sensor when it is continuously powered on, and the vertical axis is the test voltage value of the sensor. The load resistance used is 2kΩ.

6. Product Shipping Packaging:

Generally shipped in carrier tape packaging. Customer can request other package when place the purchase.

Precautions:

1. Situations must avoid

1.1 Exposure to volatile silicon compound vapor

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

1.2 Highly corrosive environment

The sensor is exposed to high concentration of corrosive gas (such as H2 S, SOX , Cl2 , HCl, etc.), it will not only cause corrosion or damage to the heating material and sensor leads, but may also cause irreversible deterioration of the performance of sensing materials.

1.3 Pollution by alkali, alkali metal salts and halogens

The performance of the sensor may also deteriorate when it is contaminated by alkali metals, especially salt water spray, or exposed to halogens such as Freon.

1.4 Directly touch with water

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

1.5 Freeze

If sensor surface appear with ice, it will cause sensing material crack and lost sensitive property.

1.6 Applied voltage is too high

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 leads and/or heater and cause the sensor's sensitivity characteristics to degrade.

1.7 Voltage pins connect mismatch

If the wrong voltage is applied to the sensor or heating and signal pins, it may cause damage to the leads and/or heater and cause the sensor's sensitivity to deteriorate.

2. Situations need attention

2.1 Condensation

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

2.2 In high concentration gas

Regardless of whether the sensor is powered on or not, long-term exposure to high-concentration gas will affect the sensor's characteristics. For example, spraying lighter gas directly at the sensor 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. After long-term storage, the sensor needs to be powered for a longer time before use to stabilize it. The storage time and corresponding aging time are recommended as following:

Storage time	Recommended preheating time
Less than 1 month	Not less than 6 hours
1-6 months	Not less than 12 hours
More than 6 months	No less than 24 hours

2.4 Long-term exposure to extreme environments

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

2.5 Vibration

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

2.6 Impact

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

2.7 Conditions of assembling:

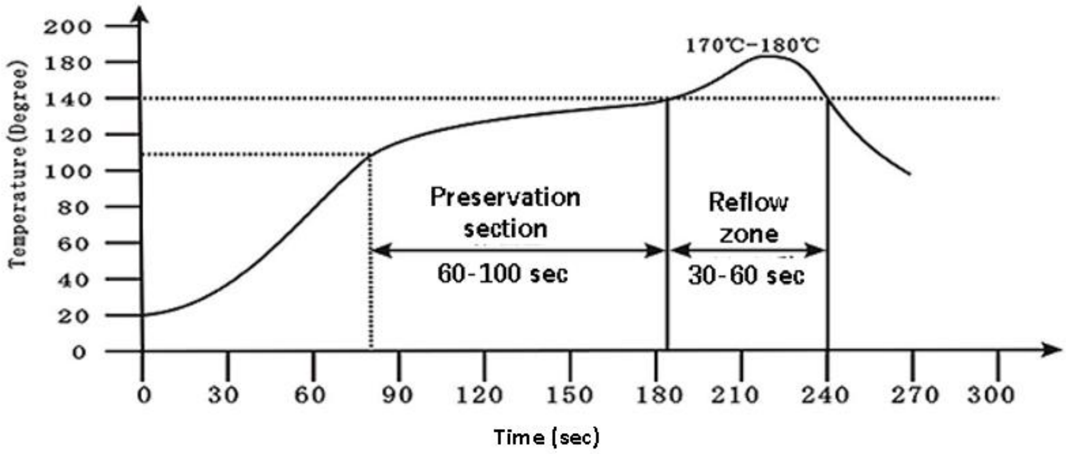
2.7.1 Manual welding is the most ideal welding method for sensors. The recommended welding conditions are as following:

- Flux: Rosin flux with minimal chlorine content
- Constant temperature soldering iron
- Temperature: 250℃
- Time: no more than 3 seconds

2.7.2 The following conditions are recommended when using reflow soldering:

Solder paste: low temperature lead-free solder paste (Sn42Bi58)

The furnace curve is as follows:



2.8 Anti-static

Anti-static bag packaging

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

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