

TP-401A Indoor air quality gas sensor

1) Usage of sensor:

- ◇ Monitoring indoor air quality

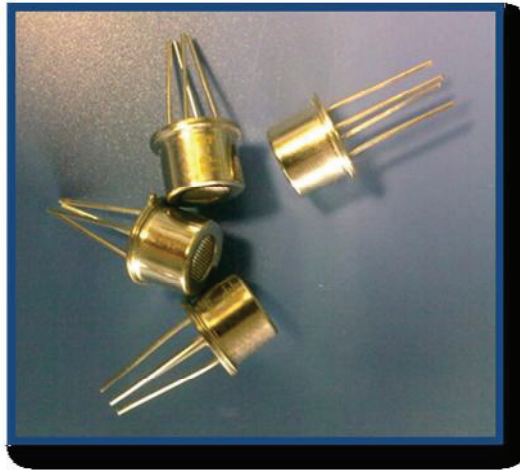


Figure 1. photo of TP-401A indoor air quality gas sensors.

2) Applications:

- ◇ Automatic air refreshing module in air conditioner;
- ◇ Exhaust fan or ventilating instrument automatic management;
- ◇ Perfume sprayers;
- ◇ Air purifier, plasma purification machine.

3) Characteristic:

- ◇ Low power consumption;
- ◇ Very sensitive to low concentration of contaminating gas;
- ◇ Long life time, low cost;
- ◇ Small size;
- ◇ Easy to be used in electric circuit.

4) Introduction

TP-401A Indoor air quality sensor has many advantages such as high sensitive, low cost, long life time and low power consumption. The gas sensor is very sensitive to many air-contaminating gases (or toxic gases) of low concentrations. These gases are secondhand smoke, carbon monoxide (CO), wine (alcohol), volatiles of cosmetics, acetone, thinner, insecticide, correction fluid, benzene, formaldehyde and so on.

TP-401A Indoor air quality sensor is composed of nano-SnO₂ materials doped with catalyst, which belongs to metal oxide semiconductor type of gas sensor. It has a plane structure. Resistance of gas sensor will decrease, when contaminating gases present in the air. The variation of resistance will be increased with concentration of gases. When contaminating gases are evacuated, the gas sensor re-exposes to fresh air and resistance increase to its origin state reversely. According to the variation of resistance, the sensor can monitor the extent of air contamination. For example, the resistance of gas sensor will be reduced when secondhand smoke presents indoor. And by using sample single chip microprocessor, the ventilation or air purifying instruments can be automatically turned on. Then the indoor air can be refreshed by such smart device.

TP-401A Indoor air quality sensors can be widely used in hospital, restaurant, hotel, meeting room, the waiting room of railway or bus station, club and so on. Many air-contaminates like secondhand smoke, wine, volatile of cosmetics, unusual smell of human breath always present in these occasions. The *TP-401A Indoor air quality sensor* is capable in managing the air purifying system to turn on smartly. *TP-401A Indoor air quality sensors* have potential in the application of the Internet of Things. They can be used to monitor the air quality in a particular area, and control the air quality in their internet.

5) Typical Specifications

Model			TP-401A
Packaging			TO-5 Cap
Target Gases			secondhand smoke, smoke generated from burning of wood and paper, volatiles of wine (alcohol) and cosmetics, ammonia, hydrogen sulfide, hydrogen, carbon monoxide, propane, methane, styrene, propylene glycol, phenol, acetone, thinner, insecticide, correction fluid, benzene, formaldehyde and so on.
Typical electric specifications	Voltage for circuit	V_C	$5 \pm 0.1V$ DC
	Load resistor	R_L	10 K Ω (typical)
	voltage for heater	V_H	5 V
	Current of heater	I_H	40~60 mA
	Power consumption		$P_W \leq 0.3$ W
	Typical response towards 20 ppm of CO in 25 °C (the voltage variation of R_L)		0.25 ~ 0.6 V

6) Structure and size of the sensor.

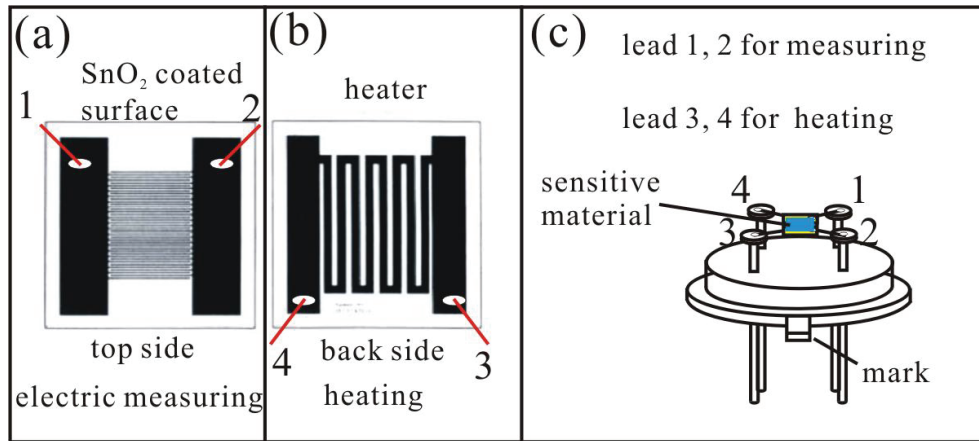


Figure 2. sketch of the gas sensor with ceramic plane structure, (a) top side and (b) back side; (c) sketch of the lead wires between encapsulation and ceramic tube (with its TO-5 Cap removed).

The *TP-401A Indoor air quality sensor* has ceramic plane structure, and it's sketched in figure 2. A pair of gold electrodes are printed on the front size of plane with area of $2 \times 2 \text{ mm}^2$ (or $1 \times 1 \text{ mm}^2$) (as shown in figure 2 (a)), and sensitive materials are covered between electrodes. Heater coil is fabricated on the back side of the ceramic plane (figure 2 (b)). The heater coil can heat the ceramic plane up to an elevated temperature ($200\text{-}400 \text{ }^\circ\text{C}$), at which the sensing material has great reactivity. Electric characteristics of the sensitive material are measured by the pair electrodes. Figure 2 (c) demonstrates the sketch of lead wires between encapsulation and ceramic tube. The details of size of *TP-401A Indoor air quality sensor* are shown in figure 3.

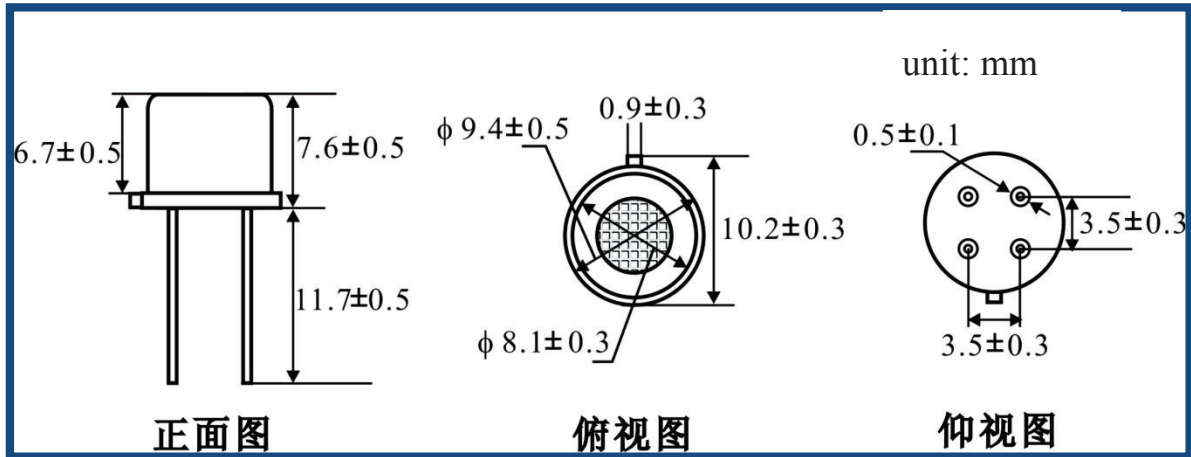


Figure 3. dimensional size sketch of *TP-401A Indoor air quality sensor*.

7) circuit of basic measurement

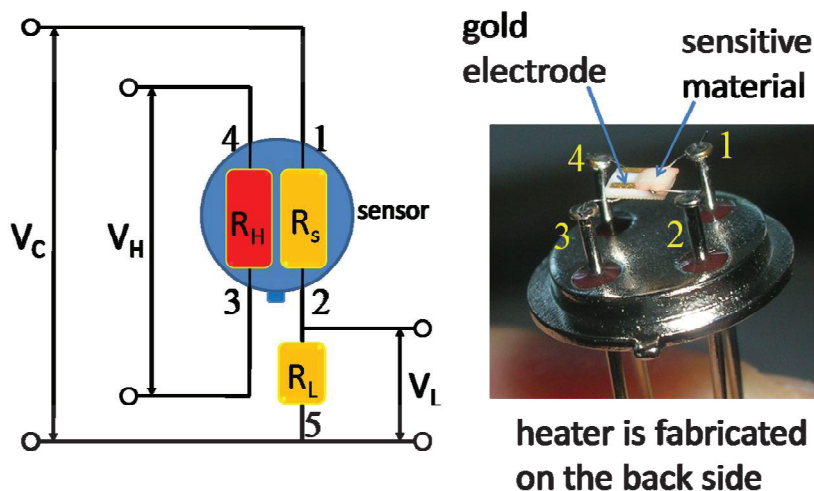


Figure 4. circuit diagram of *TP-401A Indoor air quality sensor* for measurement.

As shown in figure 4, a direct current voltage source is connected to the heater lead of gas sensor (lead 3 and lead 4). In order to provide an elevated operating temperature for gas sensor, voltage of 5V is applied to them. After the sensor is heated for 3~5 min, the sensor is warmed up and sensitive. The circuit leads (lead 1 and lead 2) is connected with a load resistor (R_L), typically 10 K Ω . Voltage of 5V DC is applied to lead 1 and lead 5. When sensor is exposed to small amount



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of reducing gases, resistance of the sensor will decrease. And voltage (V_L) between the R_L will increase. By monitoring the V_L , air quality can be detected.