Overview

SKU 26169

Product type: MQ-3 semiconductor alcohol gas sensor

- Designed for detecting alcohol vapor over a low-to-medium concentration range.
- Sensitive material is tin dioxide (SnO_2), with conductivity increasing as alcohol gas concentration rises.
- High sensitivity to alcohol and reduced interference from gasoline, smoke, and vapor compared with general-purpose combustible-gas sensors.
- Requires a heater supply and an external sensing/load-resistor circuit for analog output.
- Suitable for alcohol detectors, alcohol gas alarms, and educational gas-sensing projects.

Product description

The MQ-3 is a semiconductor gas sensor element intended for alcohol vapor detection. Its sensing material is tin dioxide (SnO_2), which has relatively low conductivity in clean air. In the presence of alcohol gas, the sensor conductivity increases with concentration. A simple external circuit converts this conductivity change into a voltage signal that can be evaluated by analog electronics or by a microcontroller ADC.

This datasheet focuses on the bare MQ-3 sensor element and its electrical use. Finished MQ-3 sensor modules may include an adjustable comparator, indicator LEDs, a digital threshold output, or other board-level circuitry. Always verify the pin labels and circuit of the actual module or PCB before wiring.

Key specifications

Item	Specification	Item	Specification
Product model	MQ-3	**Sensor type**	Semiconductor gas-sensitive element
Standard encapsulation	Plastic cap	**Target gas**	Alcohol gas
Detection range	25-500ppm alcohol	**Loop voltage VC**	<=24V DC
Heater voltage VH	5.0V +/-0.1V AC or DC	**Load resistance RL**	Adjustable; application dependent
Heater resistance RH	29Ohm +/-3Ohm at room temperature	**Heater power PH**	<=900mW
Sensitivity S	R0(air)/Rs(125ppm C2H5OH) >=5	**Output voltage VS**	2.5V-4.0V in 125ppm C2H5OH
Concentration slope alpha	<=0.6, R300ppm/R50ppm C2H5OH	**Standard test condition**	20C +/-2C, 55%RH +/-5%RH
Standard test circuit	VC = 5.0V +/-0.1V; VH = 5.0V +/-0.1V	**Preheat before use**	Over 48 hours

Typical applications

- Portable alcohol detectors and breath/alcohol sensing experiments.
- Domestic or industrial alcohol gas alarm equipment.
- Alcohol vapor detection in hobby, educational, and prototype electronics projects.
- Analog gas-sensing demonstrations with Arduino, ESP32, Raspberry Pi Pico/RP2040, STM32, and similar controllers using an external ADC or analog input.

Electrical connection and basic circuit

The MQ-3 requires two applied voltages: VH for the internal heater and VC for the sensing/load-resistor circuit. VH provides the standard working temperature for the sensing element and may be AC or DC. VC must be DC and supplies the load-resistor sensing circuit. VRL is the voltage across RL and is commonly used as the analog sensor output signal.

Basic Circuit

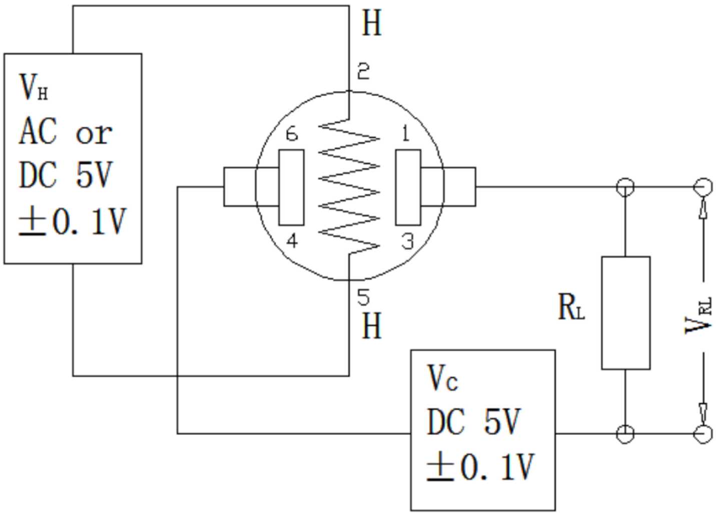


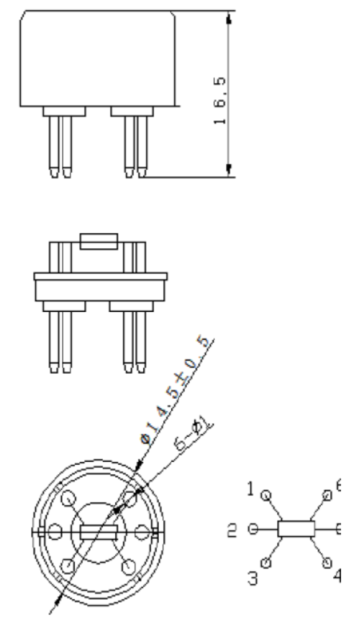
Fig2. MQ-3 Test Circuit

Basic MQ-3 test circuit with heater supply VH, sensing circuit voltage VC, load resistor RL, and output voltage VRL.

Pin functions

Pin(s)	Function	Notes
2, 5	Heater electrodes	Connect to VH = 5.0V +/-0.1V AC or DC. Do not apply excessive voltage.
1, 3	Sensing electrode pair A	Pins 1 and 3 are internally connected and form one sensing electrode.
4, 6	Sensing electrode pair B	Pins 4 and 6 are internally connected and form the opposite sensing electrode.
VRL	Output signal	The usable analog signal is the voltage across the load resistor RL in the sensing circuit.

Mechanical information



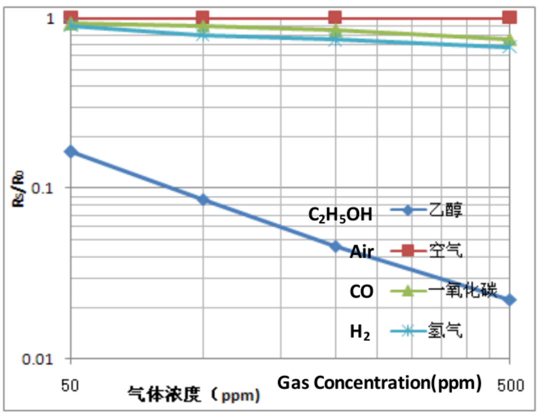
Package notes

- The package drawing shows a compact plastic-capped 6-pin sensor body with dimensions in millimetres.
- The source drawing shows an overall body height of approximately 16.5mm and a pin-circle / base geometry for the six-lead package.
- Pin numbering follows the six-lead MQ-series convention shown in the drawing and in the pin-function table above.
- Verify the actual supplied sensor before final PCB footprint, enclosure, or mechanical design.

Sensor response characteristics

The MQ-3 output is not linear and depends strongly on the selected load resistor, calibration conditions, temperature, humidity, sensor history, and gas mixture. The curves below are typical reference characteristics measured under standard test conditions and should be used as design guidance rather than absolute guaranteed calibration data.

Description of Sensor Characters



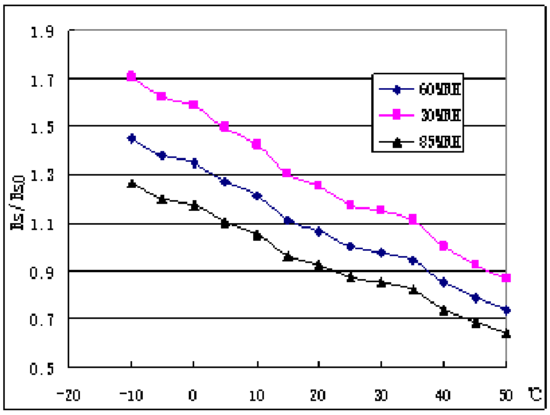


Fig3.Typical Sensitivity Curve

The ordinate is resistance ratio of the sensor (R_s/R_0), the

Fig4.Typical temperature/humidity characteristics

The ordinate is resistance ratio of the sensor (Rs/Rso). Rs

Typical sensitivity curve and temperature/humidity influence for MQ-3 alcohol gas sensing.

Design and calibration notes

- MQ-series semiconductor sensors are not precision analyzers. Sensor output depends on temperature, humidity, oxygen level, aging, calibration method, load resistor, and the actual gas mixture.
- Use a proper warm-up period before evaluation. The source datasheet specifies over 48 hours of preheating under standard conditions before stable characterization.
- For threshold detection, calibrate the switching point in the exact circuit and intended environment rather than relying only on raw ADC examples.
- For quantitative ppm readings, use calibrated reference gas, a controlled test setup, and suitable compensation for temperature and humidity.
- The heater consumes significant power for a small sensor. Ensure the power supply can deliver the required heater current continuously.

Operating precautions

The following handling and operating precautions are important because contamination, moisture, incorrect voltage, and harsh environments can permanently change the sensing characteristics.

Condition	Reason / effect
Avoid organic silicone vapor	Exposure to silicone adhesives, silicone rubber, fixatives, putty, or plastics containing silicone can contaminate the sensing material and may cause irreversible sensitivity loss.
Avoid corrosive gases	High concentrations of corrosive gases such as H_2S, SO_x, Cl_2, and HCl can corrode the sensor structure and seriously reduce sensitivity.
Avoid alkali, salts, and halogens	Pollution by alkali metal salts, brine, fluorine, or other halogen compounds can degrade sensor performance.
Avoid water and freezing	Splashing, immersion, condensation on the sensing layer, or icing can reduce sensitivity or damage the sensing material.
Do not exceed voltage ratings	Excess voltage can damage the heater or internal leads and can permanently alter sensor characteristics.
Avoid wrong pin wiring	Applying voltage to the wrong pins may burn internal leads or produce no usable output signal.
Avoid high gas concentration exposure	Long exposure to high gas concentration can affect sensor characteristics even when the sensor is not powered. Direct lighter-gas exposure can severely damage the sensor.
Avoid shock and vibration	Strong impact, dropping, continual vibration, ultrasonic welding vibration, or pneumatic tool vibration can break internal wires.

Storage and aging guidance

Storage time	Suggested aging time
Less than 1 month	At least 48 hours aging / preheat before stable use
1 to 6 months	At least 72 hours aging / preheat before stable use
More than 6 months	At least 168 hours aging / preheat before stable use

Recommended soldering conditions

Process	Recommended condition
Manual soldering	Rosin flux with minimum chlorine content; soldering iron temperature 250C; maximum soldering time 3 seconds.
Wave soldering	Rosin flux with minimum chlorine content; conveyor speed 1-2m/min; preheat 100C +/-20C; solder temperature 250C +/-10C; one pass only.

Important safety note

Gas sensors used in safety-related alarm equipment require complete system design, calibration, self-test strategy, fault handling, and verification against applicable safety requirements. This component datasheet does not by itself qualify a finished product as a certified gas alarm, breath alcohol instrument, or life-safety device.