MQ-2 Combustible Gas Sensor

Overview

SKU 26170

Product type: MQ-2 semiconductor combustible gas sensor

- Detects combustible gases and smoke over a broad concentration range.
- High sensitivity to propane and smoke; also suitable for natural gas and other flammable vapors.
- Tin dioxide (SnO2) sensing layer with lower conductivity in clean air and higher conductivity in combustible gas.
- Requires a heater supply and a sensing/load-resistor circuit for analog output.
- Typical applications include gas leak alarms, combustible gas detectors, and portable gas sensing equipment.

Product description

The MQ-2 is a semiconductor gas sensor element for detecting combustible gases and smoke. Its sensing material is tin dioxide (SnO2), which has relatively low conductivity in clean air. When combustible gas is present, the sensor conductivity increases with gas concentration. A simple external circuit converts this resistance change into a voltage signal that can be read by analog electronics or a microcontroller ADC.

This document focuses on the sensor element and its electrical use. Finished MQ-2 modules may add a comparator, potentiometer, power LED, digital output pin, or other board-level circuitry. For module wiring, always verify the PCB pin labels and schematic of the specific module.

Key specifications

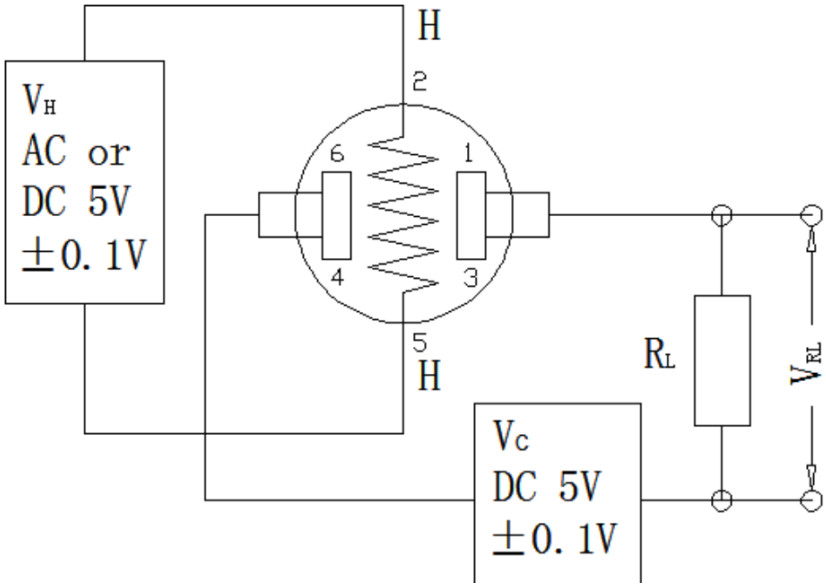
Item	Specification	Item	Specification
Product model	MQ-2	**Sensor type**	Semiconductor gas-sensitive element
Package	Bakelite base, metal cap / mesh cover	**Target gases**	Combustible gas and smoke
Detection range	300-10000ppm combustible gas	**Loop voltage VC**	<=24V DC
Heater voltage VH	5.0V +/-0.1V AC or DC	**Load resistance RL**	Adjustable; application dependent
Heater resistance RH	29Ohm +/-3Ohm at room temperature	**Heater power PH**	<=950mW
Sensitivity S	Rs(air)/Rs(2000ppm propane) >=5	**Output voltage VS**	2.5V-4.0V in 2000ppm propane
Concentration slope alpha	<=0.6, R3000ppm/R1000ppm propane	**Standard test condition**	20C +/-2C, 55%RH +/-5%RH
Preheat before use	At least 48 hours	**Expected sensor life**	Up to 10 years under suitable conditions

Typical applications

- Household gas leakage alarm devices.
- Industrial combustible gas alarm equipment.
- Portable combustible gas detection instruments.
- Educational gas-sensing demonstrations and prototyping projects where a low-cost analog sensor is acceptable.

Electrical connection and basic circuit

The MQ-2 requires two applied voltages: VH for the internal heater and VC for the sensing/load-resistor circuit. VH provides the operating temperature of the sensing element and may be AC or DC. VC must be DC and is applied through the load-resistor circuit. VRL is the voltage across RL and is commonly used as the sensor output signal.

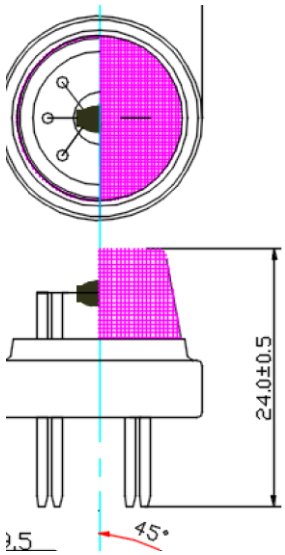


Basic MQ-2 test circuit with heater supply VH, sensing circuit voltage VC, load resistor RL, and output voltage VRL.

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

- Metal cap diameter is approximately 19-20mm, depending on the referenced drawing and measurement point.
- Total height is approximately 23-24mm including pins. Supplier drawings may differ slightly from the sensor datasheet package drawing.
- Unmarked dimensions are in millimetres. Verify the actual supplied part before final enclosure or PCB mechanical design.
- Use the pin numbering and electrode grouping above when designing a bare-sensor circuit.

Design and calibration notes

- MQ-series semiconductor sensors are not precision gas analyzers. The output depends on temperature, humidity, oxygen level, aging, calibration method, load resistor, and target gas mixture.
- Use a proper warm-up period before measurements. The source datasheet specifies at least 48 hours preheating under standard conditions, especially before characterization.
- For alarm products, calibrate the threshold in the actual circuit and intended environment. Do not rely only on raw ADC numbers from a generic example sketch.
- Sensor resistance and output voltage are relative indicators of gas concentration. For quantitative ppm readings, a calibrated test setup and suitable correction method are required.
- The sensor 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 volatile silicone compounds	Exposure to silicone adhesives, silicone rubber, hair spray, putty, and similar materials can contaminate the sensing surface and may cause irreversible sensitivity loss.
Avoid corrosive atmospheres	High concentrations of corrosive gases such as H2S, SOx, Cl2, and HCl can damage the heater, leads, and sensing material.
Avoid alkali, salts, and halogens	Contamination by alkali metals, salt spray, or halogen compounds can degrade sensor performance.
Avoid water and freezing	Splashing, immersion, condensation on the sensing layer, or freezing can reduce or destroy sensitivity.
Do not exceed voltage ratings	Excess heater or circuit voltage can damage the heater, internal leads, or sensing characteristics even if the part still appears physically intact.
Avoid wrong pin wiring	Applying voltage to the wrong electrode pins may burn internal leads or produce no usable signal.
Avoid heavy shock and vibration	Strong impact, dropping, excessive vibration, ultrasonic welding vibration, or pneumatic tool vibration can break internal wires.
Avoid long storage without conditioning	Long storage can cause reversible drift. After storage, operate the sensor long enough to stabilize before calibration or 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.

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

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 or life-safety device.

Disclaimer

This datasheet is provided for general product information only. While reasonable care has been taken to translate, summarize, and format the available technical information, all information is provided without warranty and is subject to change without notice. The user is responsible for verifying suitability, electrical compatibility, calibration, and safe use in the intended application. Universal-Solder assumes no liability for damage or loss resulting from improper use, incorrect wiring, inadequate calibration, or reliance on this document alone.