MQ-7 Carbon Monoxide Gas Sensor Module

Overview

SKU: 26168

- Semiconductor gas sensor for carbon monoxide (CO) detection.
- Specified detecting range: 20ppm to 2000ppm carbon monoxide.
- Requires a controlled heater cycle: 5V high heat and 1.4V low heat.
- Analog output is generated through an external load resistor and measuring circuit.
- Suitable for hobbyist, educational, prototype, and alarm-circuit experiments.

Product description

The MQ-7 is a heated semiconductor gas sensor intended for detecting carbon monoxide (CO). Its sensitive material is tin dioxide (SnO2), and the sensor resistance changes when exposed to carbon monoxide. In a typical application circuit, this resistance change is converted into a measurable voltage across a load resistor.

Unlike some simpler MQ-series sensors, the MQ-7 is designed around a repeating heater cycle. A high heater voltage cleans and activates the sensing element, while a lower heater voltage is used during the measurement phase where the CO response is evaluated. Correct heater timing is important for stable and repeatable readings.

Key specifications

Product type	MQ-7 carbon monoxide semiconductor gas sensor
Target gas	Carbon monoxide (CO)
Detecting range	20ppm-2000ppm carbon monoxide
Sensitive material	Tin dioxide (SnO2)
Circuit voltage VC	5V +/-0.1V AC or DC
Heater voltage - high phase	5V +/-0.1V AC or DC
Heater voltage - low phase	1.4V +/-0.1V AC or DC
Heating cycle	60s high-voltage phase, then 90s low-voltage phase
Load resistance RL	Adjustable; 10kΩ typical, 5kΩ-47kΩ usable
Heater resistance RH	33Ω +/-5% at room temperature
Heater consumption	Approx. 350mW
Sensor resistance RS	2kΩ-20kΩ in 100ppm carbon monoxide
Concentration slope	RS(300ppm) / RS(100ppm) less than 0.5
Operating temperature	-20°C to +50°C
Relative humidity	Less than 95%RH
Preheat time	No less than 48 hours before stable use

Typical applications

- Carbon monoxide sensing and alarm-circuit experiments for hobby, education, and prototypes.
- Indoor air safety demonstrations and gas sensor training experiments.
- Arduino, ESP32, Raspberry Pi Pico, STM32, and similar microcontroller projects with analog measurement.
- Automotive, workshop, and industrial CO detection experiments when used as part of a properly designed detector.
- Comparative gas-sensing experiments with other MQ-series sensors.

Module connections and sensor pins

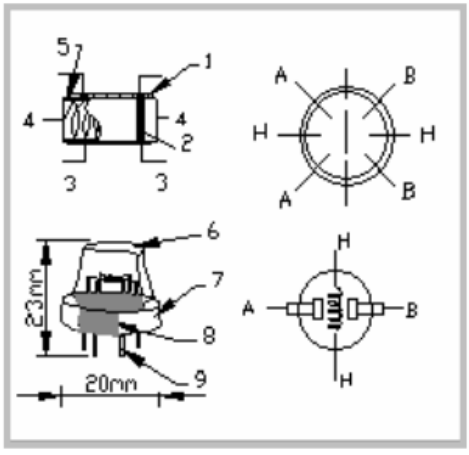
Pin group	Function	Notes
Heater pins H/H	Heater supply	Driven with the required 5V / 1.4V timing cycle.
Electrode group A	Sensing electrode	One side of the sensing element; internally connected between paired pins.
Electrode group B	Sensing electrode	The other side of the sensing element; used with RL and VC to create output voltage.
RL	Load resistance	Sets the voltage conversion from sensor resistance to VRL; calibration is required.
VRL	Analog signal output	Measured at the load resistor. Sampling is normally taken during the low heater phase.

Important electrical notes

- The MQ-7 requires heater control. A constant 5V heater supply does not follow the intended measuring method.
- Use a stable 5V supply for VC and for the high heater phase, and a controlled 1.4V supply or equivalent heater drive for the low phase.
- Common hobby modules may include additional circuitry, but the raw MQ-7 sensor element itself is not a digital sensor and does not provide calibrated ppm output directly.
- Always share ground between the sensor circuit and the microcontroller analog input circuit.
- Use the sensor only in ventilated testing conditions and do not treat an uncalibrated hobby circuit as a certified life-safety alarm.

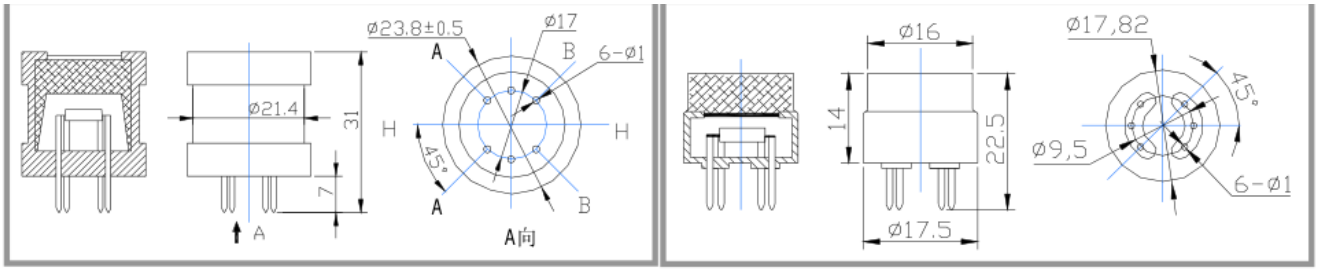
Structure and dimensions

The drawings below show the internal construction, material stack, pin arrangement, and mechanical dimensions. The sensor uses a heated ceramic tube with a SnO2 sensing layer, electrodes, heater coil, stainless-steel gauze, resin base, and plated pins.



	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

Fig.1



Basic measuring circuit

The standard measuring circuit consists of a heater circuit with timing control and a signal circuit that converts the changing sensor resistance into a voltage across the load resistor. The relationship is: RS/RL = (VC - VRL) / VRL.

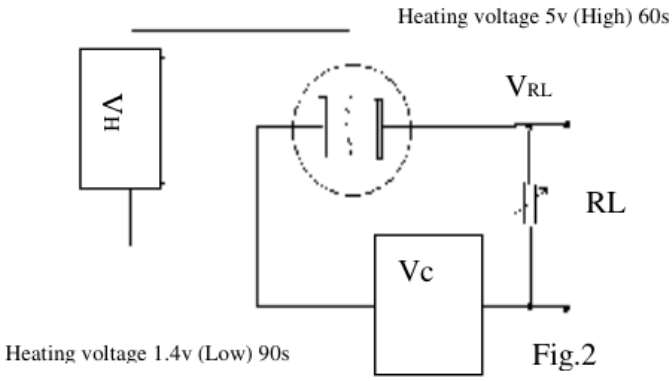


Fig.2

Heater timing and measurement cycle

Phase	Heater voltage	Duration	Purpose
High phase	5V +/-0.1V	60s	Heat/clean the sensing element and prepare the sensor cycle.
Low phase	1.4V +/-0.1V	90s	Measurement phase for carbon monoxide response.
Full cycle	Alternating high and low phase	150s total	One complete cycle is 2.5 minutes.

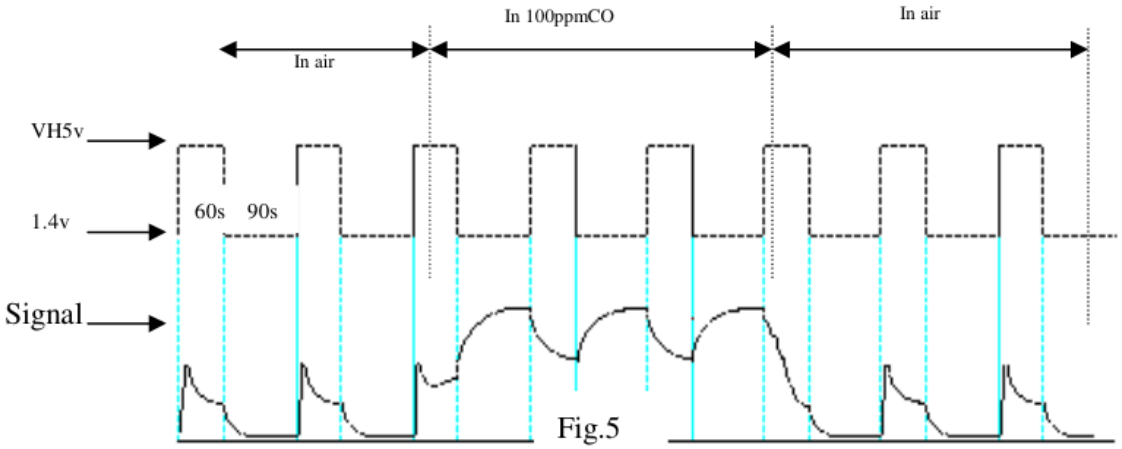


Fig.5

Output measurements are normally evaluated within one or two complete heating periods after the sensor is shifted from clean air to carbon monoxide exposure.

Sensitivity, temperature, and humidity characteristics

The sensitivity curve compares the MQ-7 response for several gases under the stated test conditions: 20°C, 65%RH, 21% oxygen, and RL=10kΩ. Temperature and humidity also affect sensor resistance and must be considered when choosing thresholds.

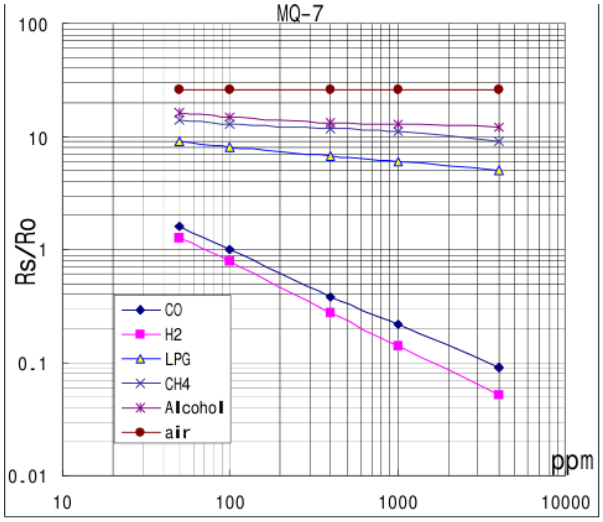
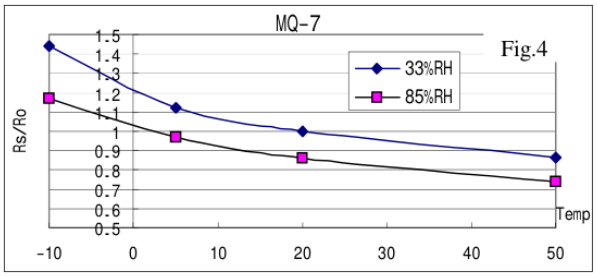


Fig.3 sensitivity characteristics of the MQ-7



Calibration and sensitivity adjustment

Sensor-to-sensor variation is normal for this sensor type. The detector circuit should be calibrated with a known carbon monoxide concentration. The technical data recommends calibrating around 200ppm CO in air and using a load resistance around 10kΩ, with 5kΩ-47kΩ as a usable range depending on the circuit.

Step	Action
1	Connect the sensor to the final application circuit.
2	Power the sensor and allow at least 48 hours of preheating/aging before stable use.
3	Expose the sensor to a known CO concentration in a controlled test setup.
4	Adjust RL or the software conversion until the analog signal matches the chosen calibration point.
5	Evaluate temperature and humidity effects before defining an alarm threshold.

Handling and safety notes

- Preheat the sensor for at least 48 hours before calibration or stable measurements.
- Avoid condensation, water contact, corrosive gases, strong vibration, and mechanical shock.
- Do not exceed the specified voltages on the heater or sensing circuit.
- Long storage without power can cause reversible resistance drift; additional aging time may be required before use.
- This component is intended for sensing and experimental detector circuits. A finished alarm product requires proper enclosure design, calibration, validation, and safety certification.

Source and reference links

- Original MQ-7 technical data sheet
- MQ-series gas sensor application notes and calibration references

Disclaimer

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