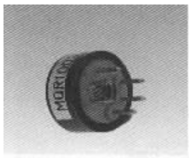
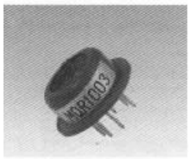
MQR1003 Combustible Gas Sensor

General Description



MQR003-A

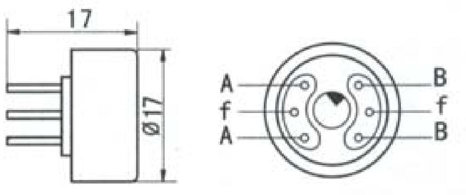


MQR1003-B

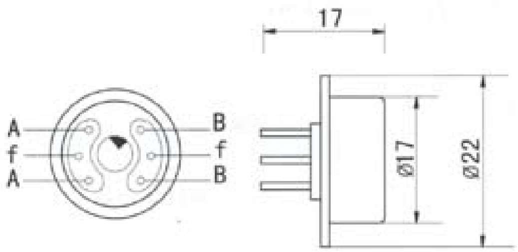
The MQR1003 is a kind of n-type semiconductor gas sensor based on tin dioxide (SnO_2). When this sensor is powered on, and it is exposed to a combustible gas, the resistance between A and B will reduce, and the variation is related to the concentration of combustible gas. Because of its especially high sensitivity to methane, propane and butane, the MQR1003 is very practical for Natural Gas and LPG monitoring.

The MQR1003 is most practically employed in a circuit design, which maintains circuit voltages at fixed values under 15V and with the heater voltage stabilized at 5V. These voltage ratings are very practical when determining your design specifications because of the wide range of available components. This makes the use of the MQR1003 an especially way to design low-cost, highly reliable gas detection circuits.

Structure and Configuration



MQR1003-A



MQR1003-B

Figure 1. The structure of MQR1003

Figure 1 shows the structure of MQR1003. The sensor base and cover are made of PBT and the deformation temperature for this material is excess of 240℃. The upper and lower openings in the sensor case are covered with a flameproof double layer of 100-mesh stainless steel gauze conforming to SUS 316. Independent tests confirm that this mesh will prevent a spark produced inside the flameproof cover from igniting an explosive 2:1 mixture of hydrogen/oxygen.

The MQR1003 contains six pins that are arranged to fit a 7-pin miniature tube socket. These pins can withstand a withdrawal force in excess of 5Kg; they are described as following:

Pin	Description
A,A	measuring electrode, they are connected internally
B,B	another measuring electrode, they are connected internally
f, f	heater, it has a resistance of 30 Ω

The MQR1003 meets the mechanical requirements listed in Table I.

Table I Vibration and Shock Test

1. Vibration Test		**2. Shock Test**	
Conditions:		**Conditions:**	
Frequency	50±10Hz	Acceleration	490 m/S^2
Acceleration	49m/S^2	Number of tests	100
Duration	1hr.		
Direction of vibration	Vertical		

Basic Measuring Circuit

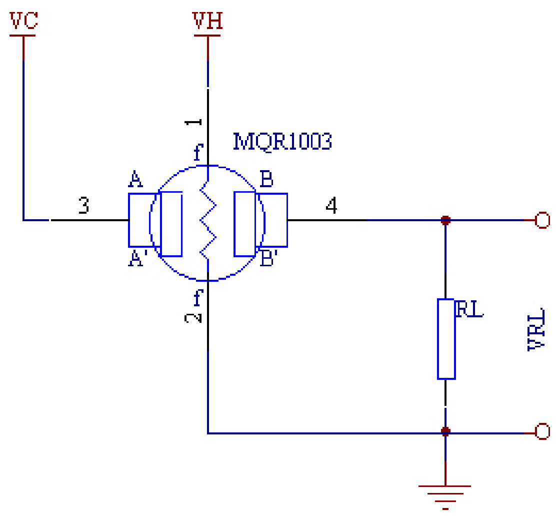


Figure 2. Basic measuring circuit with MQR1003

Figure 2 shows the basic test circuit for use MQR1003. The variation in resistance of the sensor is measured indirectly as a change in voltage appearing across the load resistor R_L. In fresh air the current passing through the sensor and R_L in series is steady, but when a combustible gas such as methane etc. comes in contact with the sensor surface, the sensor resistance decreases in accordance with the gas concentration present. The voltage change across R_L is the same when V_C and V_H are supplied from AC or DC sources. When the output signal (V_{RL}) is measured, R_S (sensor resistance) is convert by means of the following formula:

$$R_S = \frac{V_C * R_L}{V_{RL}} - R_L$$

Sensor Characteristics

1. Sensitivity to various gases

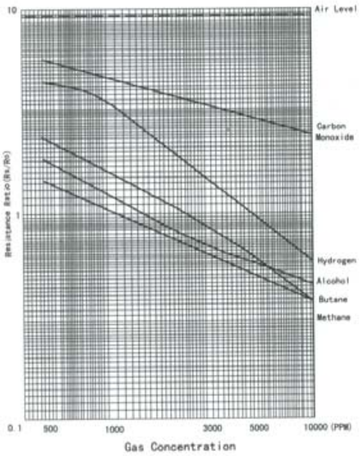


Figure 3. Ratio of resistance [Rs/Ro] vs. concentration for MQR1003

Remarks: Ro: Sensor resistance in air containing 1000ppm of Methane.

Rs: Sensor resistance at different concentrations of gases.

Figure 3 shows the sensor's relative sensitivity to various gases. The Y-axis shows the ratio of sensor resistance in various (Rs) to the sensor resistance in 1000ppm of CH_4 (Ro).

2. Initial action

When the MQR1003 is energized after a long storage period without energizing, the sensor resistance plunges in about twenty seconds, and then reaches a stable level according to the ambient atmosphere. Such behavior is called "Initial action" which depends on atmospheric conditions during storage. Generally the period of "Initial action" increases the longer the storage period is. When designing a circuit, this "Initial action" should be taken into consideration.

3. Temperature and humidity dependency

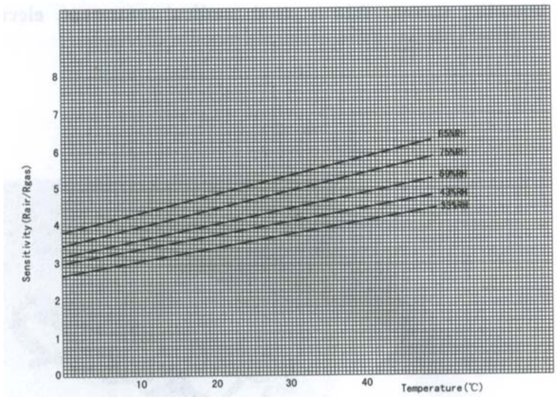


Figure 4. Dependency on temperature and humidity

As shown by Figure 4, the ambient temperature and humidity affects the sensitivity characteristics of the sensor because the detection principles of MQR1003 is based on chemical adsorption and desorption of gases on the sensor's surface. When designing equipment, a compensation circuit with thermistors can be used for better accuracy.

4. Long-term stability

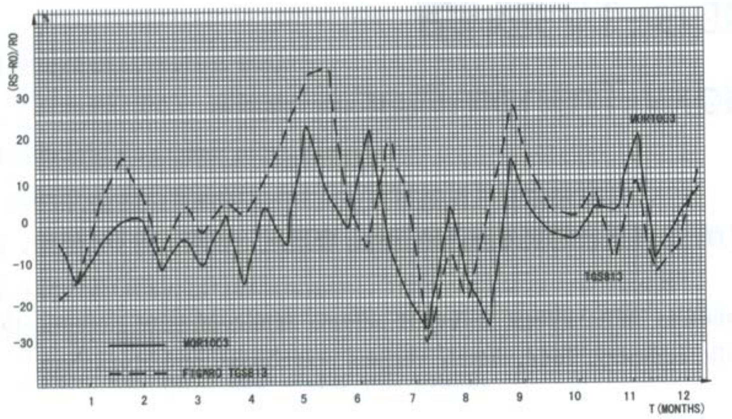


Figure 5. Long term stability

Figure 5 shows MQR1003 typical long-term stability characteristics. This result is gained by measuring 5 samples in natural condition for 12 months.

An example circuit

Next page shows an example circuit using MQR1003 sensor for a domestic gas leak detectors.

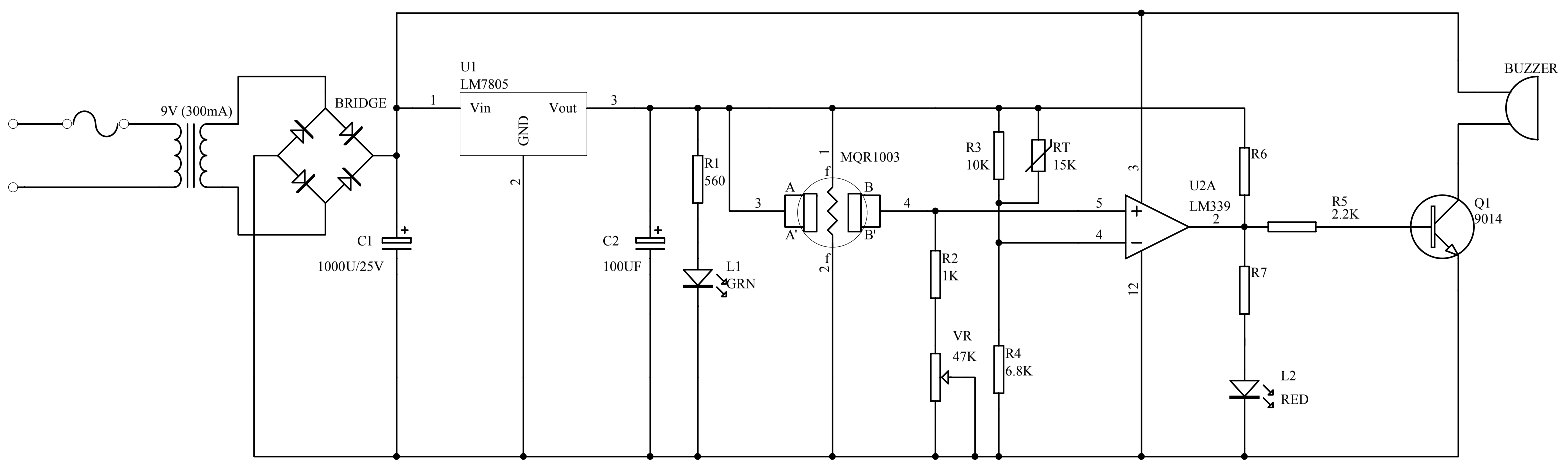


Figure 6. An example circuit using MQR1003

Note 1: All resistors are of 1/4W

Note 2: It is necessary to use a heat sink (aluminum plate) for voltage retulator U1

Ordering Information

Part	Package	Features
MQR1003-A-G	A	Detects general combustible gas
MQR1003-A-L	A	Detects LPG
MQR1003-A-M	A	Detects methane
MQR1003-A-H	A	Detects hydrogen
MQR1003-B-G	B	Detects general combustible gas
MQR1003-B-L	B	Detects LPG
MQR1003-B-M	B	Detects methane
MQR1003-B-H	B	Detects hydrogen