MQ136 Semiconductor Sensor for Sulfur Dioxide

Sensitive material of MQ136 gas sensor is SnO$_2$, which with lower conductivity in clean air. When the target SO$_2$ gas exist, the sensor’s conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.

MQ136 gas sensor has high sensitivity to SO$_2$, also could be used to detect other vapor which contains Sulfur. It has low sensitivity to normal combustible gases, which is with low cost and suitable for different application.

**Character**
- Good sensitivity to SO$_2$
- Long life and low cost
- Simple drive circuit

**Application**
- Domestic SO$_2$ concentration detector
- Industrial SO$_2$ leakage detector
- Portable SO$_2$ detector

**Technical Data**

**Basic test loop**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop Voltage</td>
<td>V$_c$ ≤24V DC</td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>V$_H$ 5.0V±0.2V ACorDC</td>
</tr>
<tr>
<td>Load Resistance</td>
<td>R$_L$ Adjustable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Character</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Resistance</td>
<td>R$_H$ 31Ω±3Ω (Room Tem.)</td>
</tr>
<tr>
<td>Heater consumption</td>
<td>P$_H$ ≤900mW</td>
</tr>
<tr>
<td>Sensing Resistance</td>
<td>R$_s$ 2KΩ-20KΩ(in 50ppm SO$_2$)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>S Rs(in air)/Rs(50ppm SO$_2$) ≥3</td>
</tr>
<tr>
<td>Slope</td>
<td>α≤0.6(R$<em>{room}$/R$</em>{room}$ SO$_2$)</td>
</tr>
</tbody>
</table>

**Condition**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tem. Humidity</td>
<td>20°C±2°C; 65%±5%RH</td>
</tr>
<tr>
<td>Standard test circuit</td>
<td>V$_c$: 5.0V±0.1V; V$_H$: 5.0V±0.1V</td>
</tr>
<tr>
<td>Preheat time</td>
<td>Over 48 hours</td>
</tr>
</tbody>
</table>

Power of Sensitivity body(Ps): $Ps=Vc^2×Rs/(Rs+RL)^2$

The above is basic test circuit of the sensor. The sensor need to be put 2 voltage, heater voltage(VH) and test voltage(VC). VH used to supply certified working temperature to the sensor, while VC used to detect voltage (VRL) on load resistance (RL) whom is in series with sensor. The sensor has light polarity. Vc need DC power. VC and VH could use same power circuit with precondition to assure performance of sensor. In order to make the sensor with better performance, suitable RL value is needed:
Resistance of sensor (Rs): \( Rs = \frac{Vc}{VRL-1} \times RL \)

Sensitivity Characteristics

Influence of Temperature/Humidity

Fig. 1 shows the typical sensitivity characteristics of the MQ136, ordinate means resistance ratio of the sensor \((Rs/Ro)\), abscissa is concentration of gases. Rs means resistance in different gases, Ro means resistance of sensor in 50ppm SO2. All test are under standard test conditions.

Fig. 2 shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor \((Rs/Ro)\), Rs means resistance of sensor in 50ppm SO2 under different tem. and humidity.
Ro means resistance of the sensor in environment of 50ppm SO2, 20°C/65%RH

Structure and configuration

Structure and configuration of MQ136 gas sensor is shown as Fig. 3, sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-4 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current.
Notification

1 Following conditions must be prohibited

1.1 Exposed to organic silicon steam
   Organic silicon steam cause sensors invalid, sensors must be avoid exposing to silicon bond, fixature, silicon latex, putty or plastic contain silicon environment

1.2 High Corrosive gas
   If the sensors exposed to high concentration corrosive gas (such as H₂Sz, SOₓ, Cl₂, HCl etc), it will not only result in corrosion of sensors structure, also it cause sincere sensitivity attenuation.

1.3 Alkali, Alkali metals salt, halogen pollution
   The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorin.

1.4 Touch water
   Sensitivity of the sensors will be reduced when spattered or dipped in water.

1.5 Freezing
   Do avoid icing on sensor's surface, otherwise sensor would lose sensitivity.

1.6 Applied voltage higher
   Applied voltage on sensor should not be higher than stipulated value, otherwise it cause down-line or heater damaged, and bring on sensors' sensitivity characteristic changed badly.

1.7 Voltage on wrong pins
   For 6 pins sensor, if apply voltage on 1 ǃ 3 pins or 4 ǃ 6 pins, it will make lead broken, and without signal when apply on 2 ǃ 4 pins

2 Following conditions must be avoided

2.1 Water Condensation
   Indoor conditions, slight water condensation will effect sensors performance lightly. However, if water condensation on sensors surface and keep a certain period, sensor' sensitivity will be decreased.

2.2 Used in high gas concentration
   No matter the sensor is electrified or not, if long time placed in high gas concentration, if will affect sensors characteristic.

2.3 Long time storage
   The sensors resistance produce reversible drift if it's stored for long time without electrify, this drift is related with storage conditions. Sensors should be stored in airproof without silicon gel bag with clean air. For the sensors with long time storage but no electrify, they need long aging time for stability before using.

2.4 Long time exposed to adverse environment
   No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc, it will effect the sensors performance badly.

2.5 Vibration
   Continual vibration will result in sensors down-lead response then rupture. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

2.6 Concussion
   If sensors meet strong concussion, it may lead its lead wire disconnected.

2.7 Usage
   For sensor, handmade welding is optimal way. If use wave crest welding should meet the following conditions:

   2.7.1 Soldering flux: Rosin soldering flux contains least chlorine
   2.7.2 Speed: 1-2 Meter/ Minute
   2.7.3 Warm-up temperature: 100±20℃
   2.7.4 Welding temperature: 250±10℃
   2.7.5 1 time pass wave crest welding machine

   If disobey the above using terms, sensors sensitivity will be reduced.
MQ137 Semiconductor Sensor for Ammonia

Sensitive material of MQ137 gas sensor is SnO$_2$, which with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.

MQ137 gas sensor has high sensitivity to Ammonia, also to other organic amine. The sensor could be used to detect different gas which contains Ammonia, it is with low cost and suitable for different application.

**Character**
- Good sensitivity to Ammonia
- Long life and low cost
- Simple drive circuit

**Application**
- Domestic Ammonia detector
- Industrial Ammonia gas detector
- Portable gas detector

**Technical Data**

**Basic test loop**

<table>
<thead>
<tr>
<th>Character</th>
<th>Model No.</th>
<th>MQ137</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Type</td>
<td>Semiconductor</td>
<td></td>
</tr>
<tr>
<td>Standard Encapsuliation</td>
<td>Bakelite (Black Bakelite)</td>
<td></td>
</tr>
<tr>
<td>Detection Gas</td>
<td>Ammonia</td>
<td></td>
</tr>
<tr>
<td>Concentration</td>
<td>5-500ppm (Ammonia)</td>
<td></td>
</tr>
<tr>
<td>Loop Voltage</td>
<td>$V_c$ ≤24V DC</td>
<td></td>
</tr>
<tr>
<td>Heater Voltage</td>
<td>$V_H$ 5.0V±0.2V ACorDC</td>
<td></td>
</tr>
<tr>
<td>Load Resistance</td>
<td>$R_L$ Adjustable</td>
<td></td>
</tr>
<tr>
<td>Heater Resistance</td>
<td>$R_H$ 31Ω±3Ω (Room Tem.)</td>
<td></td>
</tr>
<tr>
<td>Heater consumption</td>
<td>$P_H$ ≤900mW</td>
<td></td>
</tr>
<tr>
<td>Sensing Resistance</td>
<td>$R_s$ 2KΩ-15KΩ (in 50ppm NH$_3$)</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>S Rs(in air)/Rs(5000ppm CH$_4$)≥5</td>
<td></td>
</tr>
<tr>
<td>Slope</td>
<td>$\alpha$ ≤0.6 ($R_{100ppm}$/Rs NH$_3$)</td>
<td></td>
</tr>
<tr>
<td>Tem. Humidity</td>
<td>20℃±2℃; 65%±5%RH</td>
<td></td>
</tr>
<tr>
<td>Standard test circuit</td>
<td>$V_c$: 5.0V±0.1V; $V_H$: 5.0V±0.1V</td>
<td></td>
</tr>
<tr>
<td>Preheat time</td>
<td>Over 48 hours</td>
<td></td>
</tr>
</tbody>
</table>

Power of Sensitivity body ($P_s$): $P_s=V_c^2\times R_s/(R_s+R_L)^2$

The above is basic test circuit of the sensor. The sensor need to be put 2 voltage, heater voltage ($V_H$) and test voltage ($V_C$). VH used to supply certified working temperature to the sensor, while VC used to detect voltage (VRL) on load resistance ($R_L$) whom in series with sensor. The sensor has light polarity. Vc need DC power. VC and VH could use same power circuit with precondition to assure performance of sensor. In order to make the sensor with better performance, suitable RL value is needed.
Resistance of sensor (Rs): \( Rs = \frac{V_c}{V_{RL}} - 1 \times RL \)

### Sensitivity Characteristics

Fig. 1 shows the typical sensitivity characteristics of the MQ137. Ordinate means resistance ratio of the sensor \( (Rs/Ro) \), abscissa is concentration of gases. Rs means resistance in different gases, Ro means resistance in 50ppm ethanol. All tests are under standard test conditions.

P.S.: Sensitivity to smoke is ignite 10pcs cigarettes in 8m\(^3\) room, and the output equals to 10ppm NH3

### Influence of Temperature/Humidity

Fig. 2 shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor \( (Rs/Ro) \), Rs means resistance of sensor in 50ppm NH3, Ro means resistance of the sensor in environment of 50ppm MH3, 20\(^\circ\)C/65%RH.

### Structure and Configuration

Structure and configuration of MQ137 gas sensor is shown as Fig. 3. The sensor is composed of a micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater, all fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ4 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current.
**Notification**

1. **Following conditions must be prohibited**

   1.1 Exposed to organic silicon steam
   
   Organic silicon steam cause sensors invalid, sensors must be avoid exposing to silicon bond, fixature, silicon latex, putty or plastic contain silicon environment

   1.2 High Corrosive gas
   
   If the sensors exposed to high concentration corrosive gas (such as H\textsubscript{2}Sz, SO\textsubscript{x}, Cl\textsubscript{2}, HCl etc), it will not only result in corrosion of sensors structure, also it cause sincere sensitivity attenuation.

   1.3 Alkali, Alkali metals salt, halogen pollution
   
   The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorin.

   1.4 Touch water
   
   Sensitivity of the sensors will be reduced when spattered or dipped in water.

   1.5 Freezing
   
   Do avoid icing on sensor surface, otherwise sensor would lose sensitivity.

   1.6 Applied voltage higher
   
   Applied voltage on sensor should not be higher than stipulated value, otherwise it cause down-line or heater damaged, and bring on sensors' sensitivity characteristic changed badly.

   1.7 Voltage on wrong pins
   
   For 6 pins sensor, if apply voltage on 1, 3 pins or 4, 6 pins, it will make lead broken, and without signal when apply on 2, 4 pins

2. **Following conditions must be avoided**

   2.1 Water Condensation
   
   Indoor conditions, slight water condensation will effect sensors performance lightly. However, if water condensation on sensors surface and keep a certain period, sensor' sensitivity will be decreased.

   2.2 Used in high gas concentration
   
   No matter the sensor is electrified or not, if long time placed in high gas concentration, if will affect sensors characteristic.

   2.3 Long time storage
   
   The sensors resistance produce reversible drift if it’s stored for long time without electrify, this drift is related with storage conditions. Sensors should be stored in airproof without silicon gel bag with clean air. For the sensors with long time storage but no electrify, they need long aging time for stability before using.

   2.4 Long time exposed to adverse environment
   
   No matter the sensors electrified or not, if exposed to adverse environment for long time, such as high humidity, high temperature, or high pollution etc, it will effect the sensors performance badly.

   2.5 Vibration
   
   Continual vibration will result in sensors down-lead response then rupture. In transportation or assembling line, pneumatic screwdriver/ultrasonic welding machine can lead this vibration.

   2.6 Concussion
   
   If sensors meet strong concussion, it may lead its lead wire disconnected.

2.7 **Usage**

   For sensor, handmade welding is optimal way. If use wave crest welding should meet the following conditions:

   2.7.1 Soldering flux: Rosin soldering flux contains least chlorine

   2.7.2 Speed: 1-2 Meter/ Minute

   2.7.3 Warm-up temperature: 100±20°C

   2.7.4 Welding temperature: 250±10°C

   2.7.5 1 time pass wave crest welding machine

If disobey the above using terms, sensors sensitivity will be reduced.
MQ138 Semiconductor Sensor for Organic Steam

Sensitive material of MQ138 gas sensor is SnO$_2$, which with lower conductivity in clean air. When the target Organic Steam exist, The sensor’s conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.

MQ138 gas sensor has high sensitivity to Toluene, Acetone, Ethanol and Formaldehyde, also to other organic steam. The sensor could be used to detect different organic steam, it is with low cost and suitable for different application.

**Character**
* Good sensitivity to Organic Steam
* High sensitivity to Toluene, Acetone and Ethanol
* Long life and low cost
* Simple drive circuit

**Application**
* Domestic Organic steam detector
* Industrial Organic steam detector
* Portable gas detector

**Technical Data**

<table>
<thead>
<tr>
<th>Character</th>
<th>Module No.</th>
<th>MQ138</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Type</td>
<td>Semiconductor</td>
<td></td>
</tr>
<tr>
<td>Standard Encapsulation</td>
<td>Bakelite (Black Bakelite)</td>
<td></td>
</tr>
<tr>
<td>Detection Gas</td>
<td>Toluene, Acetone, Ethanol, H2</td>
<td></td>
</tr>
<tr>
<td>Concentration</td>
<td>5-500ppm</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Loop Voltage</th>
<th>$V_c$</th>
<th>≤24V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Voltage</td>
<td>$V_H$</td>
<td>5.0V±0.2V AC or DC</td>
<td></td>
</tr>
<tr>
<td>Load Resistance</td>
<td>$R_L$</td>
<td>Adjustable</td>
<td></td>
</tr>
</tbody>
</table>

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<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>$R_H$</td>
</tr>
<tr>
<td>Heater consumption</td>
<td>$P_H$</td>
</tr>
<tr>
<td>Sensing Resistance</td>
<td>$R_s$</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>$S$</td>
</tr>
<tr>
<td>Slope</td>
<td>$\alpha$</td>
</tr>
</tbody>
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</table>

Power of Sensitivity body($P_s$): $P_s = V_c^2 \times R_s / [(R_s + RL)^2]$
Resistance of sensor (Rs): $Rs = \frac{(Vc/VRL-1) \times RL}$

### Sensitivity Characteristics

![Graph showing sensitivity characteristics](image1)

Fig. 1 shows the typical sensitivity characteristics of the MQ138, ordinate means resistance ratio of the sensor ($Rs/Ro$), abscissa is concentration of gases. Rs means resistance in different gases, Ro means resistance of sensor in 100ppm Toluene. All tests are under standard test conditions.

### Influence of Temperature/Humidity

![Graph showing temperature and humidity characteristics](image2)

Fig. 2 shows the typical temperature and humidity characteristics. Ordinate means resistance ratio of the sensor ($Rs/Ro$), Rs means resistance of sensor in 100ppm Toluene under different temp. and humidity. Ro means resistance of the sensor in environment of 100ppm Toluene, 20°C/65%RH.

### Structure and Configuration

![Diagram of MQ138 gas sensor structure](image3)

Structure and configuration of MQ138 gas sensor is shown as Fig. 3, sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-4 have 6 pin, 4 of them are used to fetch signals, and other 2 are used for providing heating current.
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The sensors performance will be changed badly if sensors be sprayed polluted by alkali metals salt especially brine, or be exposed to halogen such as fluorin.

1.4 Touch water

Sensitivity of the sensors will be reduced when spattered or dipped in water.

1.5 Freezing

Do avoid icing on sensor’ surface, otherwise sensor would lose sensitivity.

1.6 Applied voltage higher

Applied voltage on sensor should not be higher than stipulated value, otherwise it cause down-line or heater damaged, and bring on sensors’ sensitivity characteristic changed badly.

1.7 Voltage on wrong pins

For 6 pins sensor, if apply voltage on 1 ǃ 3 pins or 4 ǃ 6 pins, it will make lead broken, and without signal when apply on 2 ǃ 4 pins

**2 Following conditions must be avoided**

2.1 Water Condensation

Indoor conditions, slight water condensation will effect sensors performance lightly. However, if water condensation on sensors surface and keep a certain period, sensor' sensitivity will be decreased.

2.2 Used in high gas concentration

No matter the sensor is electrified or not, if long time placed in high gas concentration, if will affect sensors characteristic.

2.3 Long time storage

The sensors resistance produce reversible drift if it’s stored for long time without electrify, this drift is related with storage conditions. Sensors should be stored in airproof without silicon gel bag with clean air. For the sensors with long time storage but no electrify, they need long aging time for stability before using.

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2.7 Usage

For sensor, handmade welding is optimal way. If use wave crest welding should meet the following conditions:

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- 2.7.4 Welding temperature: 250±10℃
- 2.7.5 1 time pass wave crest welding machine

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