**TGS 2201 - for detection of Gasoline and Diesel Exhaust Gas**

**Features:**
- Dual sensor element
- High sensitivity to exhaust gases emitted by both gasoline and diesel-fueled engines
- Long life and low cost
- Uses simple electrical circuit

The sensing element is comprised of a metal oxide semiconductor layer formed on an alumina substrate of a sensing chip together with an integrated heater. In the presence of a detectable gas, the sensor's conductivity changes depending on the gas concentration in the air. A simple electrical circuit can convert the change in conductivity to an output signal which corresponds to the gas concentration.

The **TGS 2201** contains two independent sensing elements on one substrate and produces separate output signals for responding to diesel and gasoline exhaust gases. This feature makes TGS2201 an ideal sensor for application in automatic damper control systems for automobile ventilation.

**Element 1 - Diesel exhaust gas**
A major component of diesel exhaust gas is NOx. The figure below represents typical sensitivity characteristics for Element 1, all data having been gathered at standard test conditions (see reverse side of this sheet). The Y-axis is indicated as sensor resistance ratio (Rs/Ro) which is defined as follows:
- Rs = Sensor resistance in displayed gases at various concentrations
- Ro = Sensor resistance in clean air

**Element 2 - Gasoline exhaust gas**
Gasoline exhaust gas typically contains CO, H2, and uncombusted hydrocarbons. The figure below represents typical sensitivity characteristics for Element 2, all data having been gathered at standard test conditions (see reverse side of this sheet). The Y-axis is indicated as sensor resistance ratio (Rs/Ro) which is defined as follows:
- Rs = Sensor resistance in displayed gases at various concentrations
- Ro = Sensor resistance in clean air

**Sensitivity Characteristics:**

- **NOx**
- **Air**
- **CO**
- **H2**
- **EtOH**

While ethanol is not a component of gasoline exhaust, its sensitivity curve is considered representative of various uncombusted hydrocarbons.

**Applications:**
- Automobile ventilation control

**IMPORTANT NOTE:** OPERATING CONDITIONS IN WHICH FIGARO SENSORS ARE USED WILL VARY WITH EACH CUSTOMER'S SPECIFIC APPLICATIONS. FIGARO STRONGLY RECOMMENDS CONSULTING OUR TECHNICAL STAFF BEFORE DEPLOYING FIGARO SENSORS IN YOUR APPLICATION AND, IN PARTICULAR, WHEN CUSTOMER’S TARGET GASES ARE NOT LISTED HEREIN. FIGARO CANNOT ASSUME ANY RESPONSIBILITY FOR ANY USE OF ITS SENSORS IN A PRODUCT OR APPLICATION FOR WHICH SENSOR HAS NOT BEEN SPECIFICALLY TESTED BY FIGARO.
**Basic Measuring Circuit:**
The sensor requires two voltage inputs: heater voltage ($V_H$) and circuit voltage ($V_C$). The heater voltage ($V_H$) is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. $V_C$ is applied to measure output voltages $V_{RL1}$ and $V_{RL2}$ across $R_{L1}$ and $R_{L2}$ respectively. Each of these load resistors are connected in series to their corresponding sensing elements. A common power supply circuit can be used for both $V_C$ and $V_H$ to fulfill the sensor’s electrical requirements. The value of the load resistor ($R_L$) should be chosen to optimize the alarm threshold value, keeping power dissipation ($P_S$) of the semiconductor below a limit of 15mW. Power dissipation ($P_S$) will be highest when the value of $R_s$ is equal to $R_L$ on exposure to gas.

$$\text{Sensor resistance } (R_s) \text{ is calculated with a measured value of } V_{RL} \text{ by using the following formula:}$$

$$R_s = \frac{V_C - V_{RL}}{R_{L}}$$

$P_S = \left( \frac{V_C - V_{RL}}{R_s} \right)^2$  

For information on warranty, please refer to Standard Terms and Conditions of Sale of Figaro USA Inc.

**Specifications:**

<table>
<thead>
<tr>
<th>Model number</th>
<th>TGS 2201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing element type</td>
<td>S2</td>
</tr>
<tr>
<td>Standard package</td>
<td>Plastic (P3)</td>
</tr>
<tr>
<td>Target gases</td>
<td>Diesel exhaust (NO, NO2)</td>
</tr>
<tr>
<td>Typical detection range</td>
<td>0.1 ~ 10 ppm</td>
</tr>
</tbody>
</table>

**Standard circuit conditions**

| Heater voltage ($V_H$) | 7.0±0.35V DC         |
| Circuit voltage ($V_C$) | 15.0V DC Max., $P_s \leq 15$mW |
| Load resistance ($R_L$) | Variable, $P_s \leq 15$mW |

**Electrical characteristics under standard test conditions**

| Heater resistance ($R_{H}$) | 65 ± 6Ω at room temp. |
| Heater current ($I_{H}$) | 72mA                 |
| Heater power consumption ($P_{H}$) | 505mW V$_H$ = 7.0V DC |
| Sensor resistance ($R_s$) | 250kΩ in air** | 25kΩ in air** |
| Sensitivity (change ratio of $R_s$) | $R_s(0.3ppm \text{ of NO}) - 2.5**$ | $R_s(10ppm \text{ of H2}) - 0.35**$ |

**Test gas conditions**

- Air at 20±2°C, 65±5%RH
- $V_C = 7.0\pm0.2$V DC, $V_H = 7.0\pm0.2$V DC

**Standard test conditions**

- Conditioning period before test: 7 days

**Typical values for reference only - final specifications to be determined.**

**Figure:**

- **Structure and Dimensions:**
  - Unit: mm
  - Stainless steel gauze
  - Plastic cap
  - Sensing element 1
  - Sensing element 2
  - Lead frame

- **Pin connection:**
  1: Sensor electrode 1(-)
  2: Common(+)
  3: Sensor electrode 2(-)
  4: Heater(-)

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**REV: 9/99**