

## 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 is an ideal sensor for application in automatic damper control systems for automobile ventilation.

### Applications:

- \* Automobile ventilation control



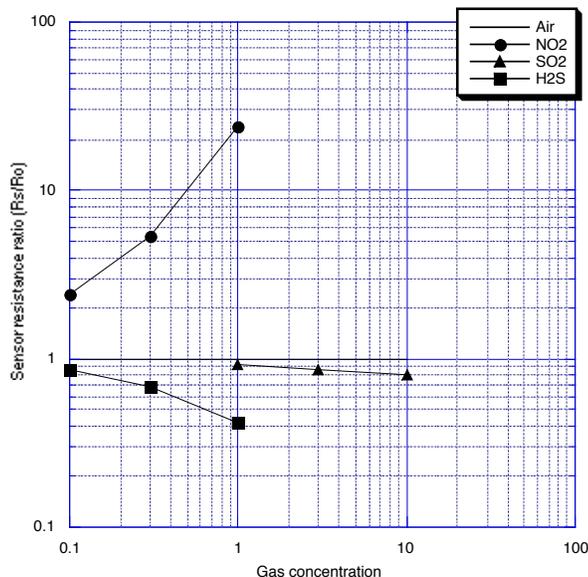
#### Element 1 - Diesel exhaust gas

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 ( $R_s/R_o$ ) which is defined as follows:

$$R_s = \text{Sensor resistance in displayed gases at various concentrations}$$

$$R_o = \text{Sensor resistance in clean air}$$

#### Sensitivity Characteristics:



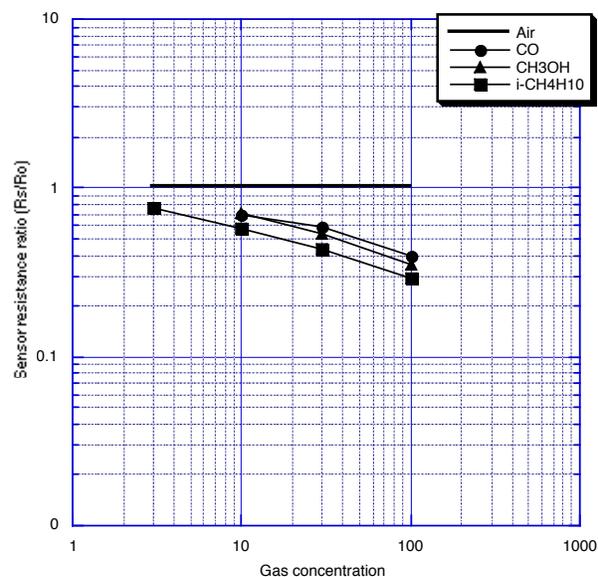
#### Element 2 - Gasoline exhaust gas

Gasoline exhaust gas typically contains CO, H<sub>2</sub>, 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 ( $R_s/R_o$ ) which is defined as follows:

$$R_s = \text{Sensor resistance in displayed gases at various concentrations}$$

$$R_o = \text{Sensor resistance in clean air}$$

#### Sensitivity Characteristics:



**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.

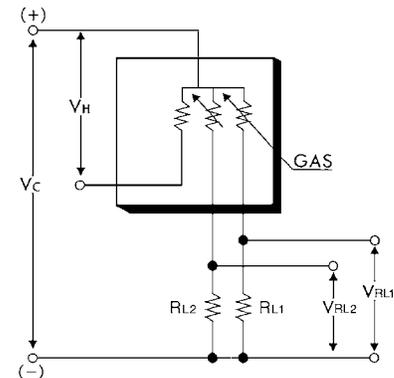
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## Basic Measuring Circuit:

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.



## Specifications:

Model number		TGS 2201		
Sensing element type		S2		
Standard package		Plastic (P3)		
Target gases		Diesel exhaust (NO, NO <sub>2</sub> )	Gasoline exhaust (CO, H <sub>2</sub> , HC)	
Typical detection range		0.1 ~ 10 ppm	10~1,000ppm	
Standard circuit conditions	Heater voltage	$V_H$	5.0V DC±5%	
	Circuit voltage	$V_C$	15.0V DC Max., $P_S \leq 15mW$	
	Load resistance	$R_L$	Variable, $P_S \leq 15mW$	
Electrical characteristics under standard test conditions	Heater resistance	$R_H$	35Ω ± 10% at room temp.	
	Heater current	$I_H$	100mA	
	Heater power consumption	$P_H$	502mW	
	Sensor resistance	$R_S$	0.1~2MΩ in air	10~80kΩ in air
	Sensitivity (change ratio of $R_S$ )		$R_S(0.3ppm \text{ of } NO_2) / R_S(\text{air}) = 12 \pm 8$	$R_S(10ppm \text{ of } CO) / R_S(\text{air}) = 0.65 \pm 0.15$
Standard test conditions	Test gas conditions	Air at 20±2°C, 65±5%RH		
	Circuit conditions	$R_L = 200k\Omega \pm 1\%$	$R_L = 10.0k\Omega \pm 1\%$	
		$V_C = 5.0V \text{ DC} \pm 3\%$ , $V_H = 5.0V \text{ DC} \pm 5\%$		
	Conditioning period before test	2~7 days		

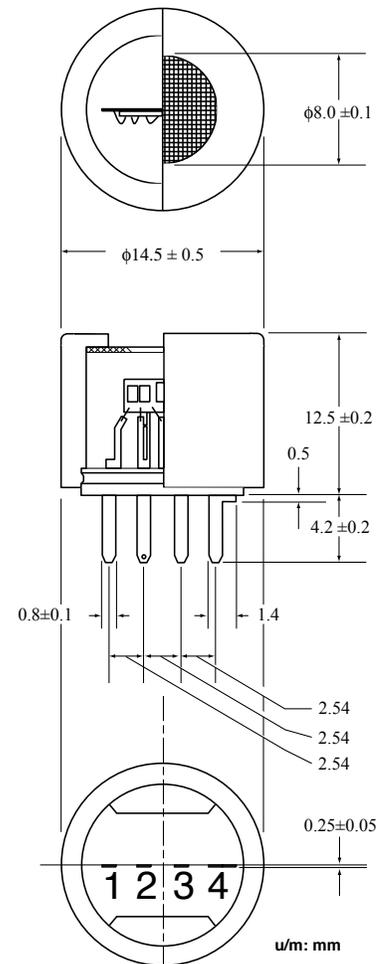
The value of power dissipation ( $P_S$ ) can be calculated by utilizing the following formula:

$$P_S = \frac{(V_C - V_{RL})^2}{R_S}$$

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

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

## Structure and Dimensions:



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

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