

## FIS GAS SENSOR SP3S-AQ2 for AIR QUALITY CONTROLS (VOCs)

The SP3S-AQ2 series is a tin dioxide semi conductor gas sensor which has a high sensitivity to various air pollution sources (e.g. VOCs) with quick response speed. This series uses a compact plastic housing with 3 pins configuration achieving an excellent gas sensing performance with low cost. This model is ideal for various design of automatic air quality control systems; Ventilation Fans, air purifiers.

### Structure

Gas sensitive semiconductor material is formed on the alumina substrate on which the gold electrodes are printed. A thick film heater of ruthenium oxide is printed on the reverse of the substrate and placed in the compact plastic housing (Fig 1).

### Operating conditions

Fig 2 shows the standard operating circuit for this model. The change of the sensor resistance ( $R_S$ ) is obtained as the change of the output voltage across the fixed or variable resistor ( $R_L$ ). In order to obtain the best performance and specified characteristics, the values of the heater voltage ( $V_H$ ) circuit voltage ( $V_C$ ) and load resistance ( $R_L$ ) must be within the range of values given in the standard operating conditions shown in the Specification table on the next page.

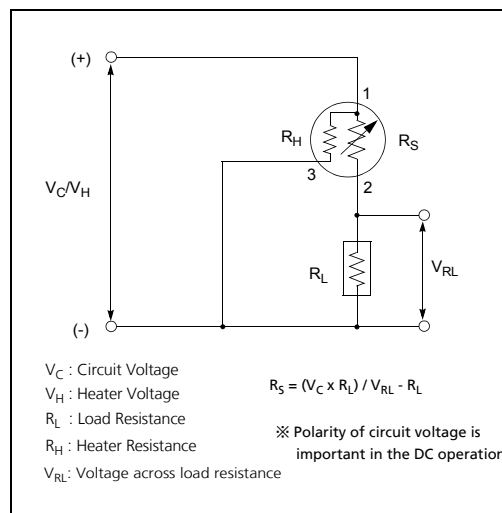


Fig 2. Standard circuit

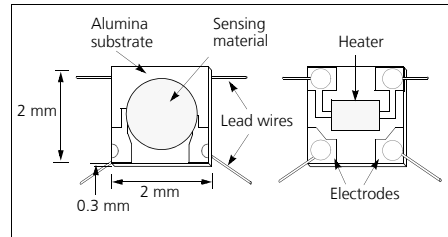


Fig 1a. Sensing element

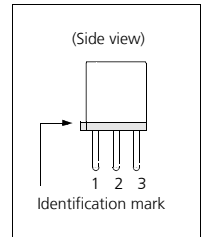


Fig 1c. Pin Layout

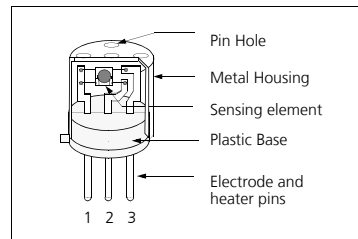


Fig 1b. Configuration

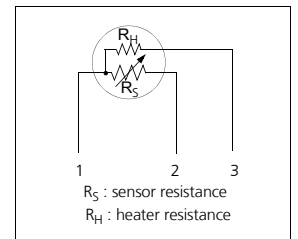


Fig 1d. Equivalent circuit

### Sensitivity characteristics

Fig 3 shows the sensitivity characteristics curves of the SP3S-AQ2 (typical data). Sensitivity characteristics of the FIS gas sensors are expressed by the relationship between the sensor resistance and gas concentration. The sensor resistance decreases with an increase of gas concentration based on a logarithmic function.

The sensitivity characteristics of the SP3S-AQ2 are specified by the following parameters.

- Sensor resistance level: in air
- Sensor resistance change ratio: between hydrogen 10 ppm and in air

Please see the Specification table on the back page for further details.

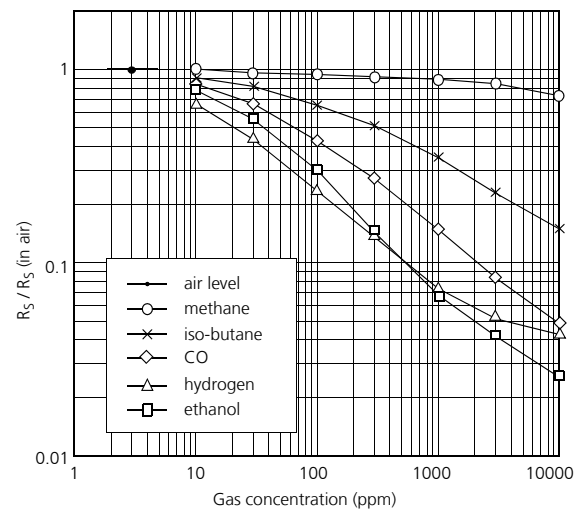


Fig 3. Sensitivity characteristics

# Specifications

## A. Standard Operating conditions

Symbol	Parameter	Specification	Conditions etc.
$V_H$	Heater voltage	$5.0\text{ V} \pm 4\%$	AC or DC
$V_C$	Circuit voltage	$5.0\text{ V} \pm 4\%$	AC or DC
$R_L$	Load resistance	Variable	$P_S < 15\text{ mW}$
$R_H$	Heater resistance	$86\ \Omega \pm 5\%$	at room temperature
$P_H$	Heater power consumption	210mW (Typical value)	$P_H = V_H^2 / R_H$
$P_S$	Power dissipation of sensing element	Less than 15 mW	$P_S = \frac{(V_C - V_{RL})^2}{R_S}$

## B. Environmental conditions

Symbol	Parameter	Specification	Conditions etc.
$T_{ao}$	Operating temperature	$0\text{ }^\circ\text{C}$ to $40\text{ }^\circ\text{C}$	Recommended range
$T_{as}$	Storage temp	$-10\text{ }^\circ\text{C}$ to $70\text{ }^\circ\text{C}$	
RH	Relative humidity	Less than 95% RH	
$(O_2)$	Oxygen concentration	21% (Typical value) The sensitivity characteristics are influenced by the variation in oxygen concentration.	Absolute minimum level: more than 18%

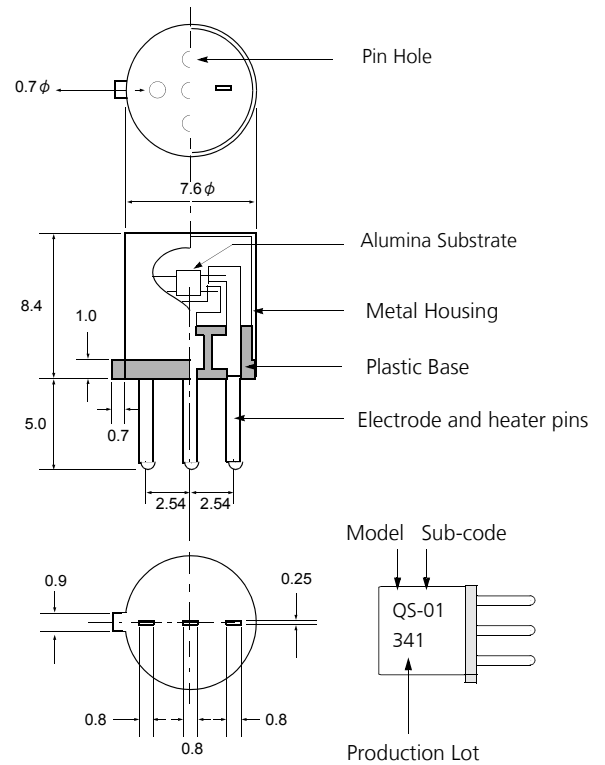
## C. Sensitivity characteristics

Model	SP3S-AQ2-01		
Symbol	Parameter	Specification	Conditions etc.
$R_S$	Sensor resistance	$5\text{ k}\Omega$ to $20\text{ k}\Omega$	in air
$\beta$	Sensitivity slope	0.15 to 0.45	$\frac{R_S \text{ in } 10\text{ ppm hydrogen}}{R_S \text{ in air}}$
Standard Test Conditions:		Temp : $20\text{ }^\circ\text{C} \pm 2\text{ }^\circ\text{C}$ Humidity : $65\% \pm 5\%$ (in clean air)	$V_C : 5.0\text{ V} \pm 1\%$ $V_H : 5.0\text{ V} \pm 1\%$ $R_L : 10\text{ k}\Omega \pm 5\%$
Pre-heating time: more than 48 hours			

## E. Mechanical characteristics

Items	Conditions	Specifications
Vibration	Frequency: 100 cpm	Should satisfy the specifications shown in the sensitivity characteristics.
	Vertical amplitude: 4 mm	
	Duration: 1 hour	
Shock	Acceleration: 100 G	
	Number of impacts: 5 times	

## Dimensions



Scale: mm

Weight : 0.6g

## F. Parts and Materials

No.	Parts	Materials
1	Sensing element	Tin dioxide ( $\text{SnO}_2$ )
2	Substrate	Alumina ( $\text{Al}_2\text{O}_3$ )
3	Lead wire	Gold alloy (Au-Pd-Mo)
4	Heater	Ruthenium oxide ( $\text{RuO}_2$ )
5	Electrode	Gold (Au)
6	Metal housing	Nickel plated brass
7	Plastic base	PBT (Poly butylene terephthalate)
8	Heater/electrode pins	Iron-nickel alloy

Please contact

March 2010

FIS Inc.  
3-36-3, Kitazono  
Itami, Hyogo  
664-0891 Japan  
Tel: +81-72-780-1800  
Fax: +81-72-785-0073  
<http://www.fisinc.co.jp>