

TGS 4161 - for the detection of Carbon Dioxide

Features:

- * High selectivity to CO₂
- * Compact size
- * Low dependency on humidity
- * Long life and low cost
- * Low power consumption

Applications:

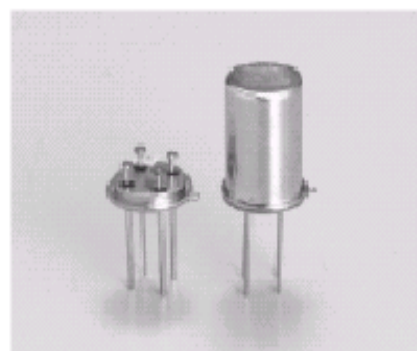
- * Indoor air quality control

TGS4161 is a new solid electrolyte CO₂ sensor which offers miniaturization and low power consumption. A range of 350~5,000ppm of carbon dioxide can be detected by TGS4161, making it ideal for indoor air control applications.

The CO₂ sensitive element consists of a solid electrolyte formed between two electrodes, together with a printed heater (RuO₂) substrate. By monitoring the change in electromotive force (EMF) generated between the two electrodes, it is possible to measure CO₂ gas concentration.

The top of the sensor cap contains adsorbent (zeolite) for the purpose of reducing the influence of interference gases.

TGS4161 exhibits a linear relationship between Δ EMF and CO₂ gas concentration on a logarithmic scale. The sensor displays good long term stability and shows excellent durability against the effects of high humidity.



The figure below represents typical sensitivity characteristics of TGS4161. The Y-axis is indicated as Δ EMF which is defined as follows:

$$\Delta \text{EMF} = \text{EMF}_1 - \text{EMF}_2$$

where

EMF₁ = EMF in 350 ppm CO₂

EMF₂ = EMF in listed gas concentration

The figure below shows typical humidity dependency of TGS4161. Again, the Y-axis is indicated as Δ EMF which is defined as follows:

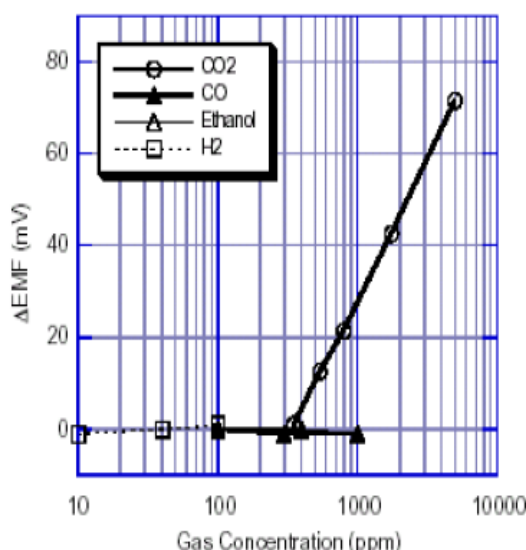
$$\Delta \text{EMF} = \text{EMF}_1 - \text{EMF}_2$$

where

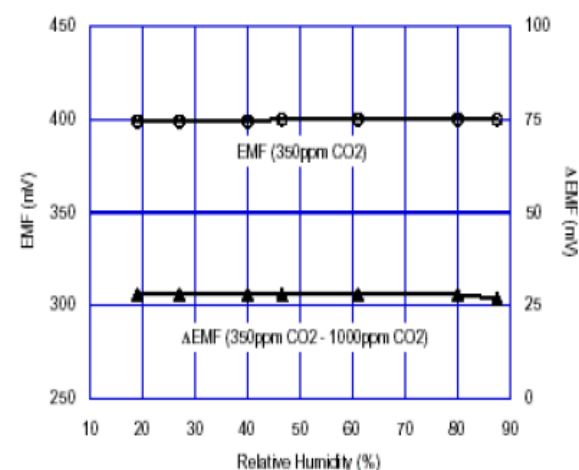
EMF₁ = EMF in 350 ppm CO₂

EMF₂ = EMF in 1000 ppm CO₂

Sensitivity Characteristics:



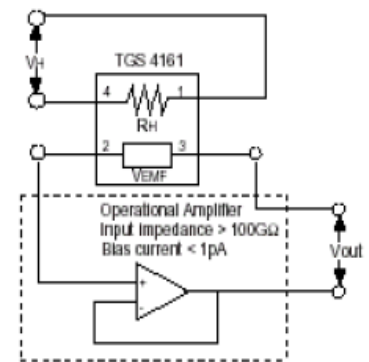
Humidity Dependency:



Basic Measuring Circuit:

The TGS4161 sensor requires heater voltage (V_H) input. The heater voltage is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Electromotive force (EMF) of the sensor should be measured using a high impedance (>100G Ω) operational amplifier with bias current < 1pA (e.g. Texas Instruments' model #TLC271). Since the solid electrolyte type sensor

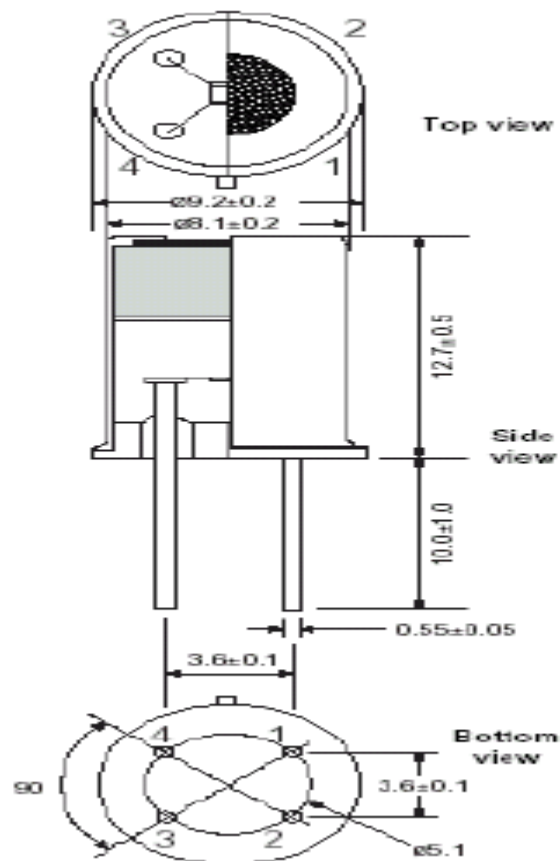
functions as a kind of battery, the EMF value itself would drift using this basic measuring circuit. However, the change of EMF value (Δ EMF) shows a stable relationship with the change of CO₂ concentration. Therefore, in order to obtain an accurate measurement of CO₂, a special microprocessor or signal processing should be used with TGS4161. Figaro can provide a special evaluation sensor module (AM-4) for TGS4161.



Specifications:

Model number			TGS 4161	
Sensing element type			Solid electrolyte	
Target gases			Carbon dioxide	
Typical detection range			350 ~ 5000 ppm	
Electrical characteristics	Heater resistance	R _H	70 ± 7Ω at room temp.	
	Heater current	I _H	approx. 50mA	
	Heater power consumption	P _H	approx. 250mW	
	Electromotive force	EMF	220~490mV in 350ppm CO ₂	
	Sensitivity	ΔEMF	44~72mV	EMF(350ppm CO ₂) - EMF(3500ppm CO ₂)
	Heater voltage	V _H	5.0 ± 0.2V (DC)	
Sensor characteristics	Response time		approx. 1.5 min. (to 91% of final value)	
	Measurement accuracy		approx. ±20% at 1,000ppm CO ₂	
Operating conditions			-10~50°C, 5~95%RH	
Storage conditions			-20~60°C, 5~90%RH (store in moisture proof bag with silica gel)	
Standard test conditions	Test gas condition		CO ₂ in air at 20±2°C, 65±5%RH	
	Circuit condition		V _H = 5.0±0.05V DC	
	Conditioning period before test		2 days	

Structure and Dimensions:



Sensing Element Structure:

