

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
- * CO₂ monitors

TGS4161 is a new solid electrolyte CO₂ sensor which offers miniaturization and low power consumption. A range of 350~10,000ppm 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:

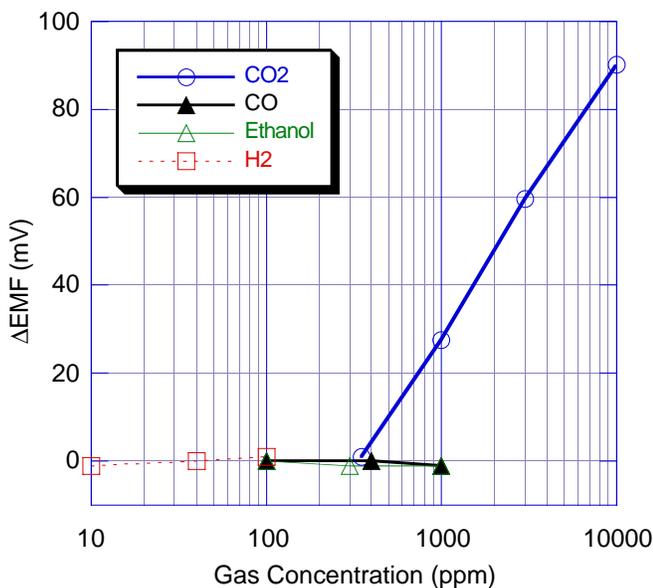
$$\Delta\text{EMF} = \text{EMF}_1 - \text{EMF}_2$$

where

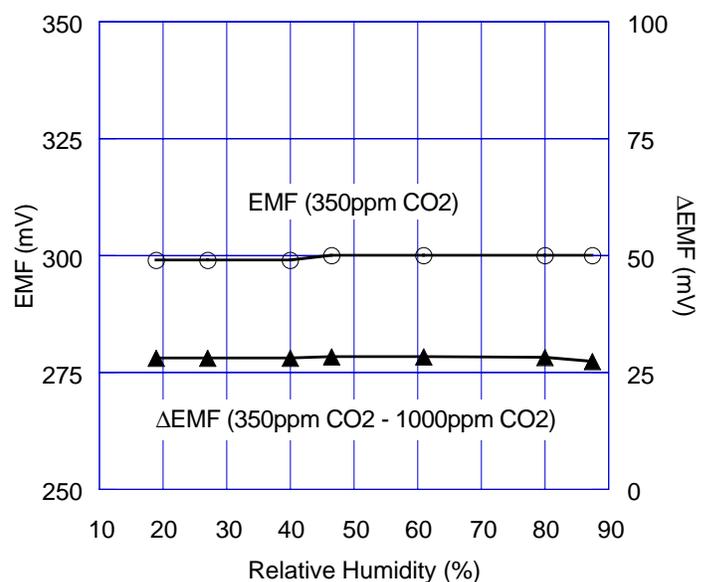
EMF₁ = EMF in 350 ppm CO₂

EMF₂ = EMF in 1000ppm CO₂

Sensitivity Characteristics:



Humidity Dependency:



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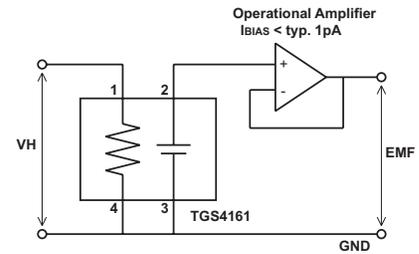
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Basic Measuring Circuit:

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 ($>100\text{ G}\Omega$) operational amplifier with bias current $< 1\text{ pA}$ (e.g. Texas Instruments' model #TLC271). Since the solid electrolyte type sensor

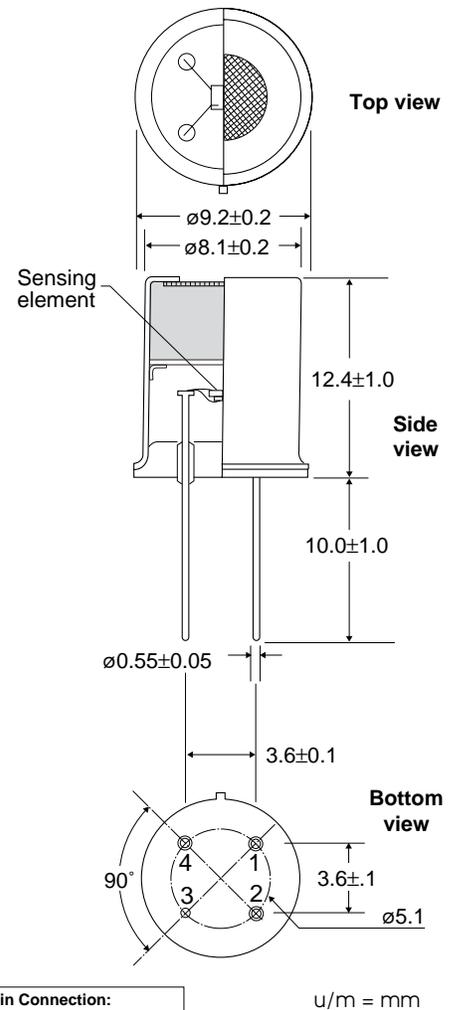
functions as a kind of battery, the EMF value itself would drift using this basic measuring circuit. However, the change of EMF value (ΔEMF) shows a stable relationship with the change of CO_2 concentration. Therefore, in order to obtain an accurate measurement of CO_2 , a special microprocessor for signal processing should be used with TGS4161. Figaro can provide a special evaluation sensor module (AM-4-4161) for TGS4161.



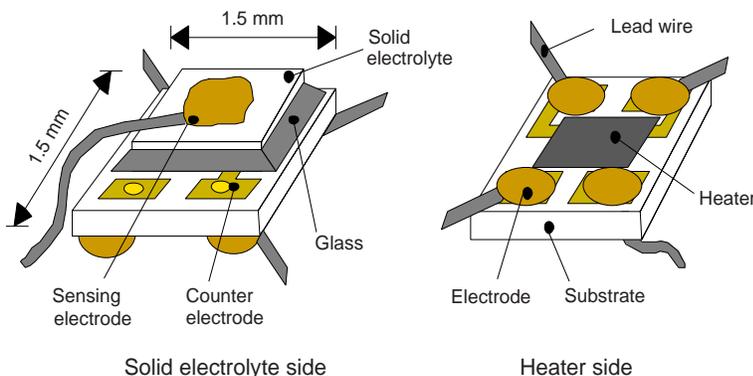
Specifications:

Model number		TGS 4161		
Sensing element type		Solid electrolyte		
Target gases		Carbon dioxide		
Typical detection range		350 ~ 10,000 ppm		
Electrical characteristics	Heater resistance	R_H	$70 \pm 7\Omega$ 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(350ppm CO_2)
	Heater voltage	V_H	$5.0 \pm 0.2\text{V}$ (DC)	
Sensor characteristics	Response time	approx. 1.5 min. (to 90% of final ΔEMF value)		
	Measurement accuracy	approx. $\pm 20\%$ at 1,000ppm CO_2		
Operating conditions		$-10\sim 50^\circ\text{C}$, 5~95%RH		
Storage conditions		$-20\sim 60^\circ\text{C}$, 5~90%RH (store in moisture proof bag with silica gel)		
Standard test conditions	Test gas condition	CO_2 in air at $20 \pm 2^\circ\text{C}$, 65 \pm 5%RH		
	Circuit condition	$V_H = 5.0 \pm 0.05\text{V}$ DC		
	Conditioning period before test	12 hours or longer		

Structure and Dimensions:



Sensing Element Structure:



Pin Connection:
 1. Heater (+)
 2. Counter electrode (+)
 3. Sensing electrode (-)
 4. Heater (-)

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