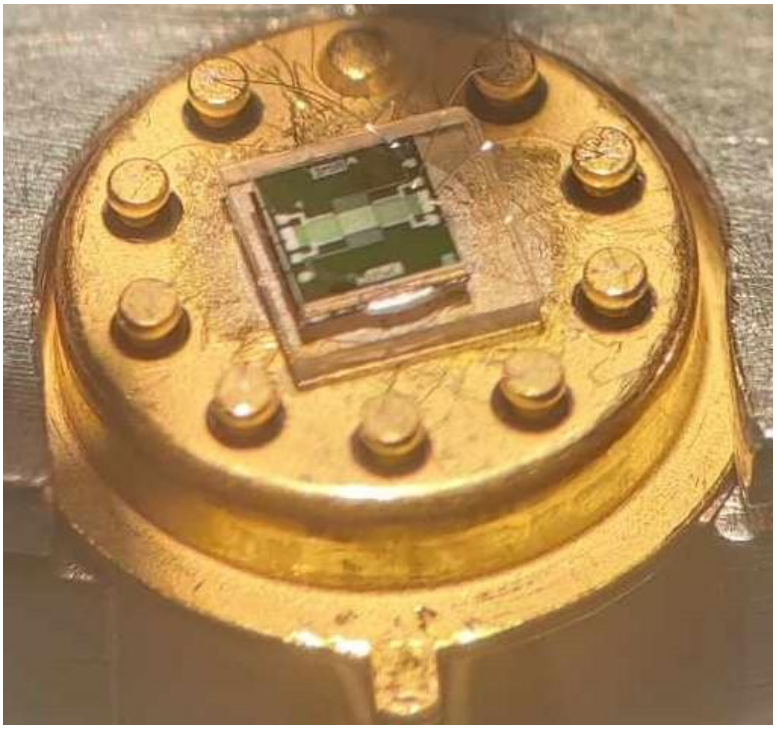
INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

AIME Micro-Nano
Pôle CNFM de Toulouse

Gas Sensor based on tungsten trioxide nanoparticles



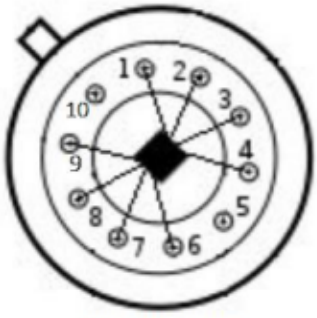
Main features

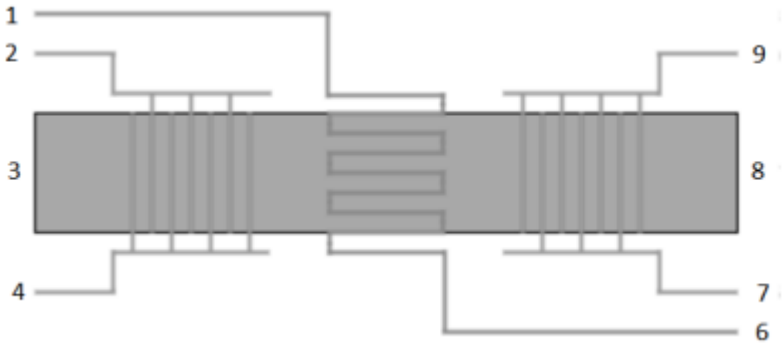
- Small size
- Short response time
- Low Cost
- Detect NH_3
- Detect C_2H_6O
- Integrated temperature sensor
- Integrated Heater

Description

This gas sensor is designed to detect the presence of NH_3 and C_2H_6O in the air. It is a passive element that uses the variation of its internal resistance to detect the presence of a gas. The presence of tungsten trioxide nanoparticles changes the conductivity of the aluminum interdigitated combs depending on the composition of the gas in contact with the sensor. The temperature of the sensor is up to 250°C thanks to an internal heater in order to maximize the sensitivity of the nanoparticles and to avoid the interferences caused by the humidity of the air. The sensor also includes an aluminum resistor to measure the temperature of the gas sensor for better control and to add the possibility of autoregulation of the temperature.

Pin Description





Pin	Usage
1 and 6	Temperature Sensor (Aluminium Resistor)
2 and 4	Gas Sensor (WO3 nanoparticles between aluminum interdigitated combs)
3 and 8	Heater Resistor (Polysilicon resistor)
7 and 9	Gas Sensor (WO3 nanoparticles between aluminum interdigitated combs)
5 and 10	NC

Specifications

Type	Passive
Measurement (Gas)	Resistance
Measurement (Temperature)	Resistance
Detectable gas	• Ammonia (NH_3) • Ethanol (C_2H_6O)
Package	10-Lead TO-5 metal
Diameter	9.5mm
Composition	• Silicon • Aluminium • Nanoparticles of tungsten trioxide • N-doped poly-silicon

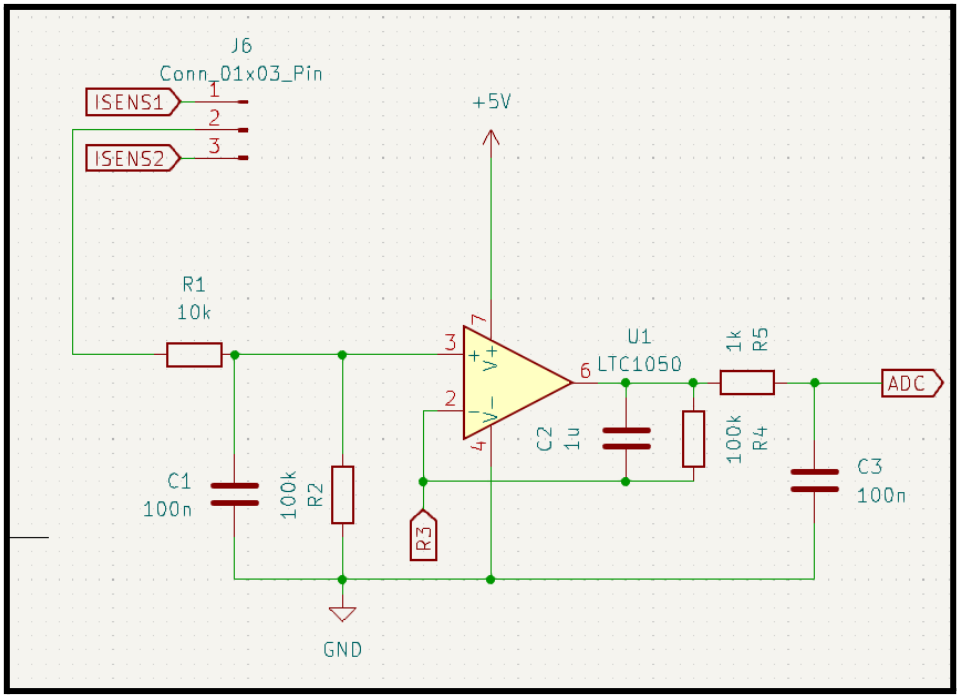
Standard test condition

	Unit	**Value**
Air composition	$\%N_2/O_2$	80/20
Temperature	°C	20
Humidity	%	60

Electrical Specification at standard test conditions

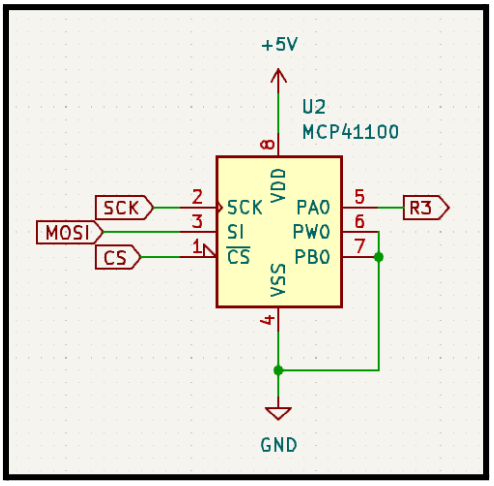
	Unit	**Value**		
		Min	**Typical**	**Max**
Gas Sensor resistance	MΩ	1	10	20
Temperature sensor resistance	Ω	60	64	75
Heater resistance	Ω	80	131	131
Gas Sensor Voltage	V	-	5	-
Temperature Sensor	V	-	5	-
Heater	V	10	12	20

Example of integration

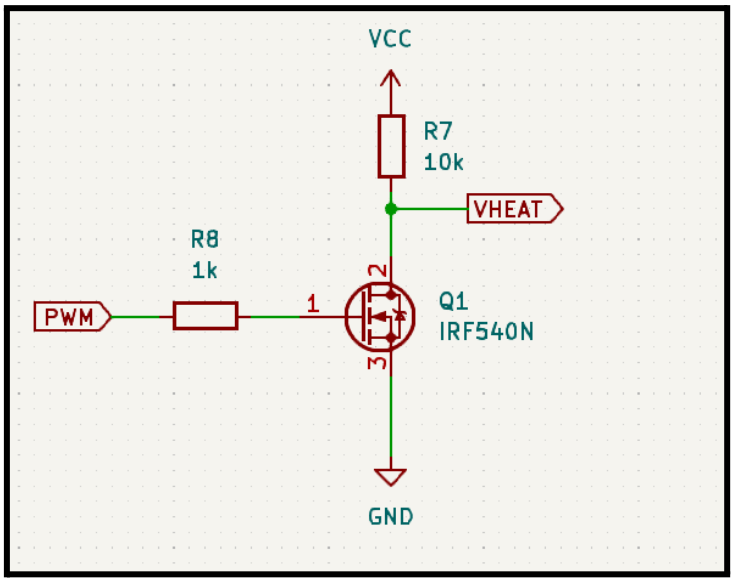


This is an example of a transimpedance amplifier stage that you can use to shape the gas sensor data. We recommend the use of a jumper to be able to choose between the two interdigitated combs of the gas sensor.

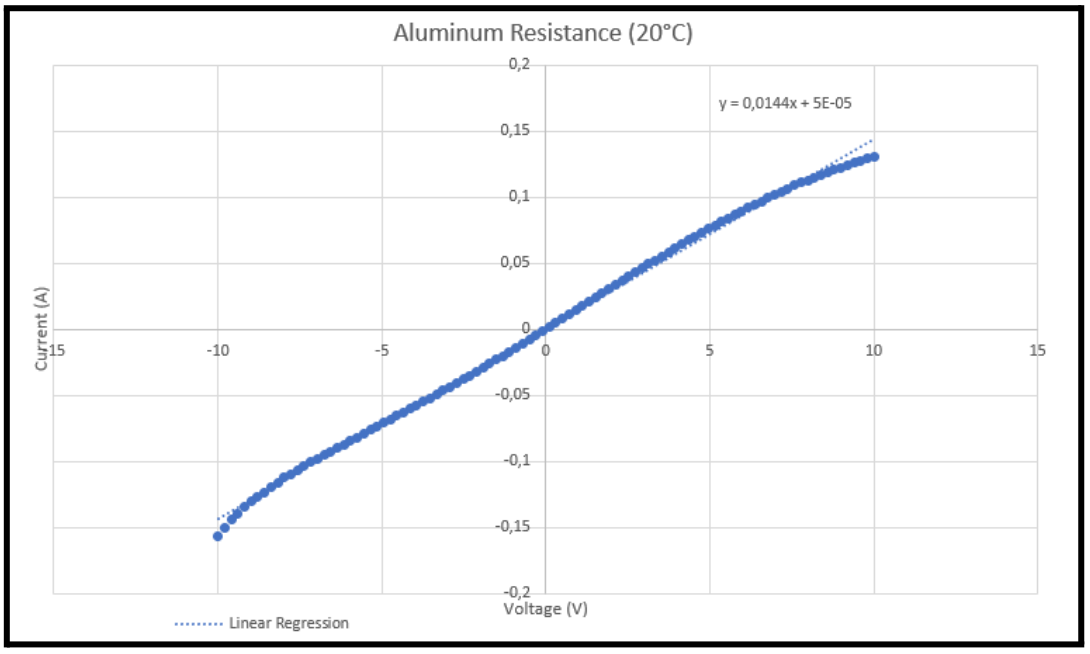
Consider putting a variable resistor onto the reversed input of the AOP to adapt your signal to the microcontroller's ADC, like in the following montage, with a MCP41100 controlled via SPI:



Finally, it can be judicious to control the heating resistor via a PWM. An example of it is featured in the following figure:

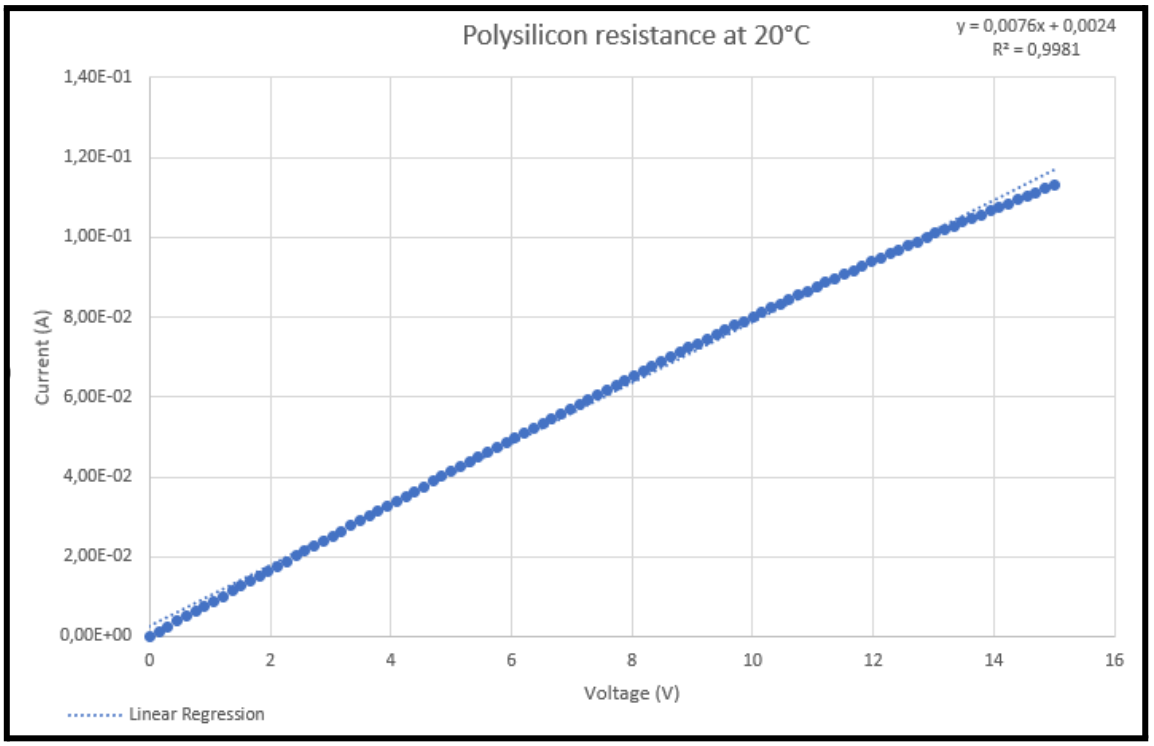


Aluminum Resistance at 20°C (Temperature sensor)



From this graph we get that the resistance is approximately : 1/0.0144 = 69Ω

Polysilicon Resistance at 20°C (Heater)

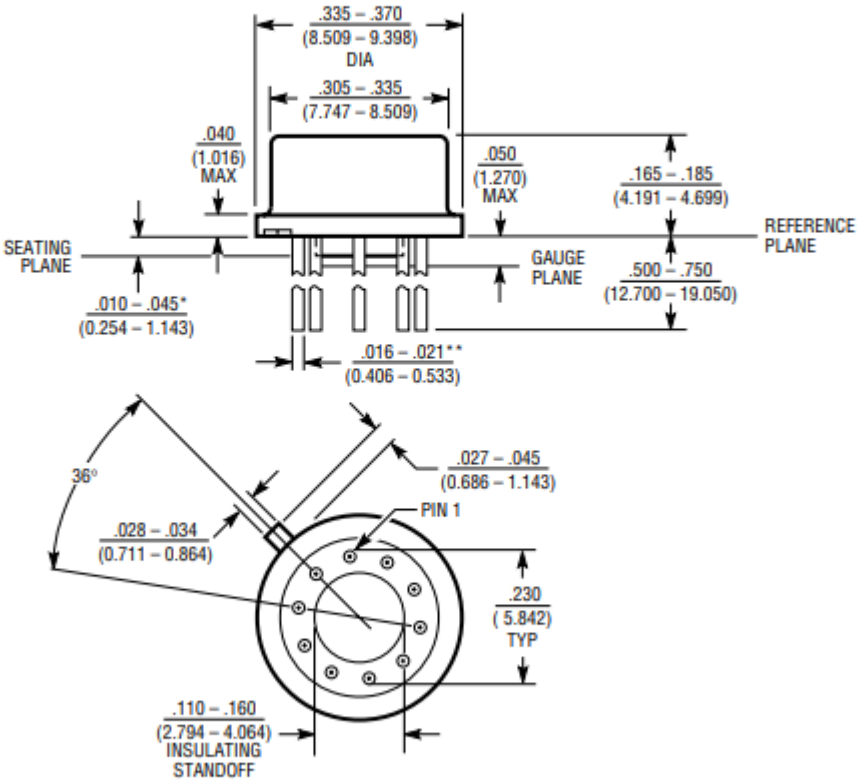


From this graph we get that the resistance is approximately : 1/0.0076 = 131Ω

Package

The gas sensor uses a 10-Lead TO-5 metal package with the following dimensions:

H Package
10-Lead TO-5 Metal Can
(Reference LTC DWG # 05-08-1322)



*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS .016 – .024 (0.406 – 0.610)