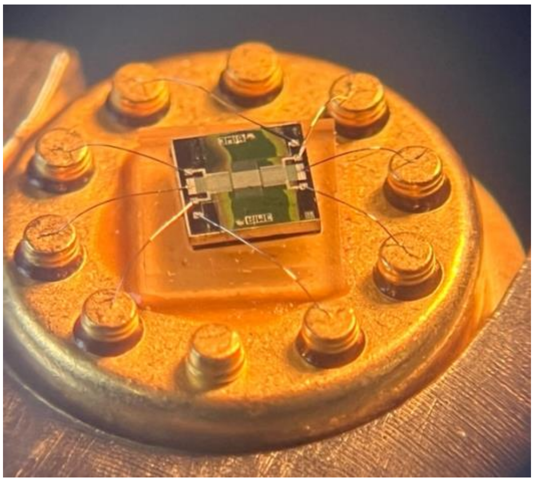
GSWO3AIME

Low Power Gas Sensor based on tungsten trioxide nanoparticles



General features

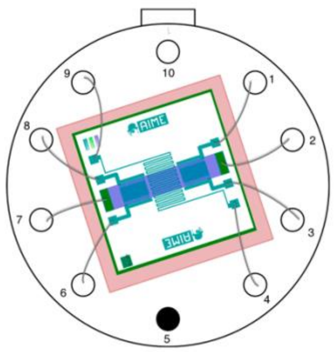
- Low power consumption
- Easy-to-use
- Small size
- Low Cost
- Short response time
- Detection of NH_3
- Detection of C_2H_6O
- Temperature sensor included
- 2 Integrated gas sensors
- 3 Heater included (resistor)

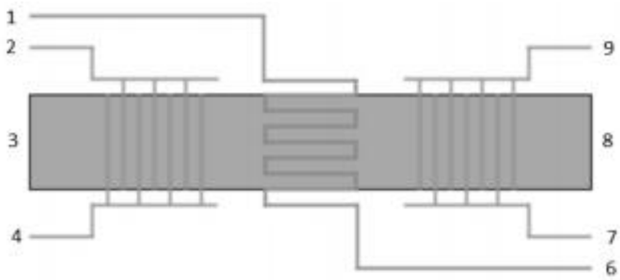
Description

This gas sensor for monitoring air quality (developed at the AIME laboratory of Toulouse) is based on tungsten trioxide nanoparticles. The sensor is composed of two identical sensing elements for gas measurement. Those are interdigitated combs of silicon substrate with a thin tungsten trioxide nanoparticles (WO_3) deposit. A heater formed on a wide N-doped poly-silicon layer is integrated to permit heating the sensor up to 300°C. Besides, an aluminum resistor acts as a thermic sensor varying its impedance depending on the temperature. Both sensors, for the gas concentration and the temperature, can be considered as resistances, their capacitance changes in an unimportant way. So, they can be used as variables resistances in basic analog dividing bridges. This sensor has a high sensitivity and selectivity which can be adjusted by controlling the temperature via the aluminum resistor.

Pin Descritpion

Pin number	Usage
1/6	Temperature sensor (Aluminium resistor)
2/4	Gas sensor (WO_3 nanoparticles integrated on aluminium interdigital combs)
3/8	Heater resistor (Polysilicon resistor)
7/9	Gas sensor (WO_3 nanoparticles integrated on aluminium interdigital combs)
5	Not Connected
10	Not Connected





Specifications

Type	Nanoparticle based sensor
Materials	• Silicon • N-doped poly-silicon (heater) • Aluminum (temperature measurement) • Nanoparticles of tungsten trioxide (WO_3)
Sensor type	Active (power supply required)
Gas measurement	Resistive measure
Temperature measurement	Resistive measure
Detectable gaz	• Ammonia (NH_3) • Ethanol (C_2H_6O)
Package	10-Lead TO-5 metal
Diameter	9.5mm
Mountig	Through hole fixed
Time response	• Ethanol < 30 s • Ammonia < 15 s

Standard use condition

	Unit	Typical value
Temperature	°C	20 ± 5
Humidity	%	60 ± 5
Air quality	$\%N_2/O_2$	80/20

Electrical characteristics

	Unit	Value		
		Min	Typical	Max
Gas sensor resistance	MΩ	0.01	1	100
Temperature sensor resistance	Ω	58	65	73
Heater resistance	Ω	80	85	90
Gas sensor voltage	V	-	3.3	-
Temperature sensor	V	0	5	10
Heater	V	0	7.5	15

Temperature sensor characteristics

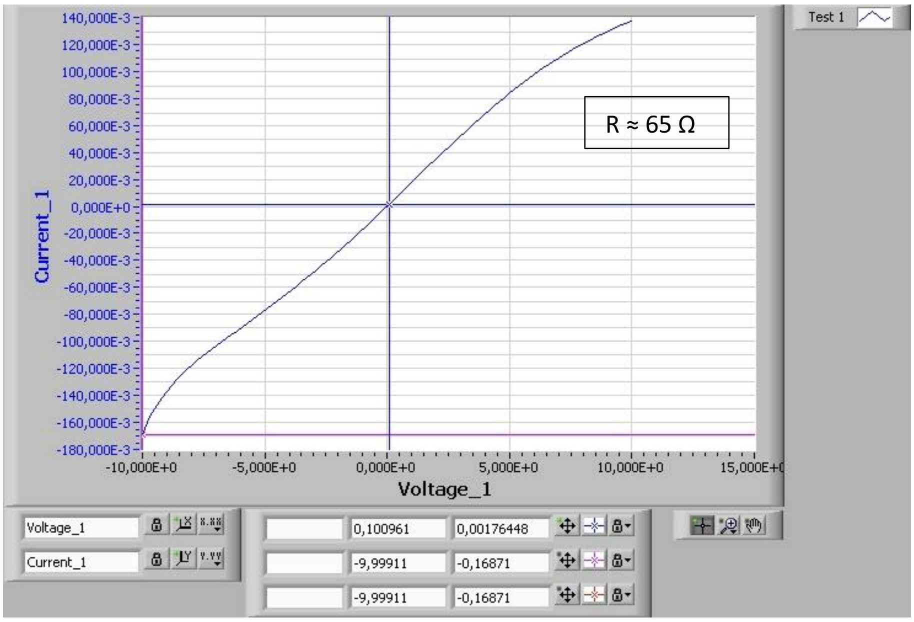


Fig 2 : Current/Voltage characteristic of the sensor resistor (aluminium) at 20°C

Heating resistor characteristics

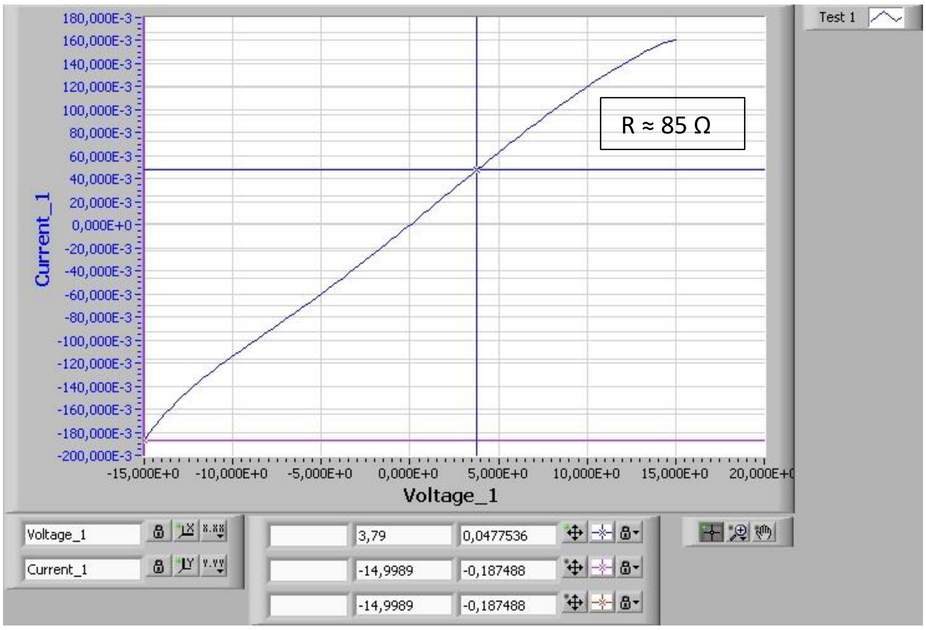


Fig 3 : Current/Voltage characteristic of the Heating resistor (polysilicon) at 20°C

Gas sensor characteristics

The gas sensor characteristic is determined by measuring the resistance evolution in presence of different gases. A resistance drop reveals gas presence and the gap is proportionnal to the concetration. The shape of the evolution (time response) permits to determine the nature of the gas.

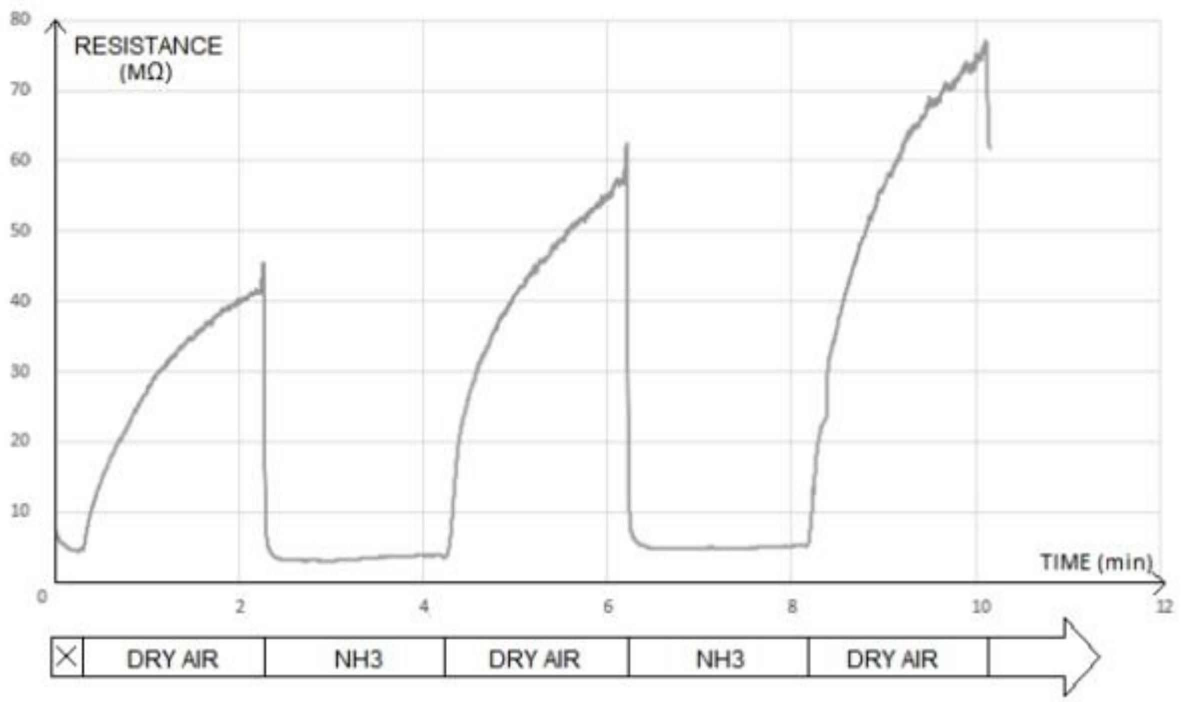


Fig 4 : Resistance dynamic in presence of Amonia at 180°C

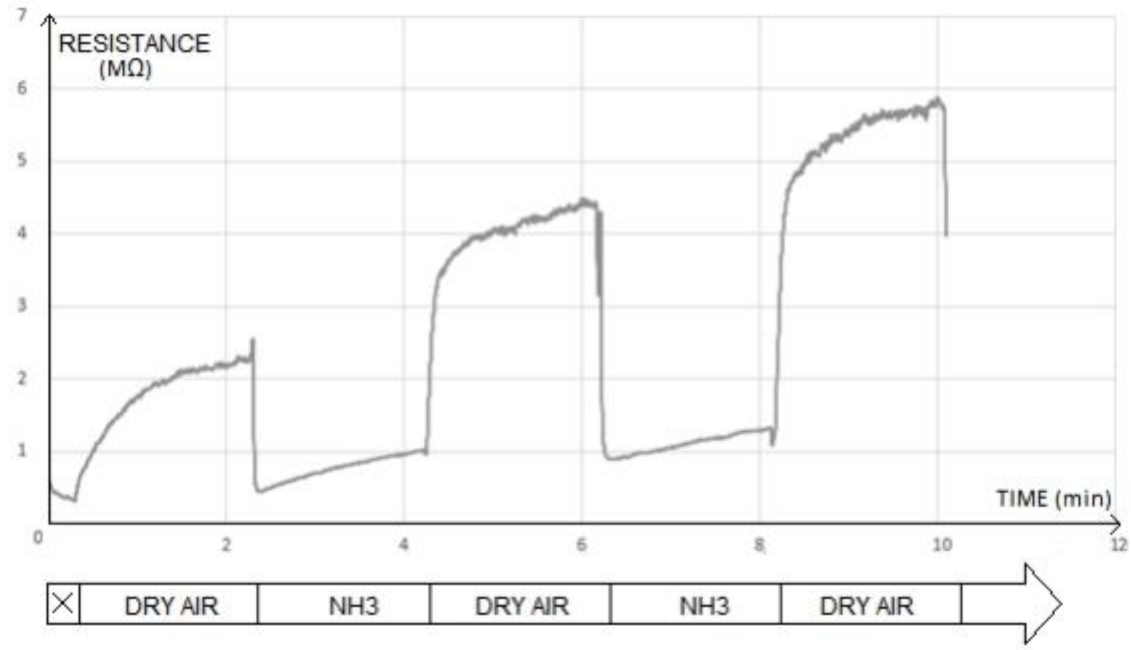


Fig 5 : Resistance dynamic in presence of Amonia at 250°C

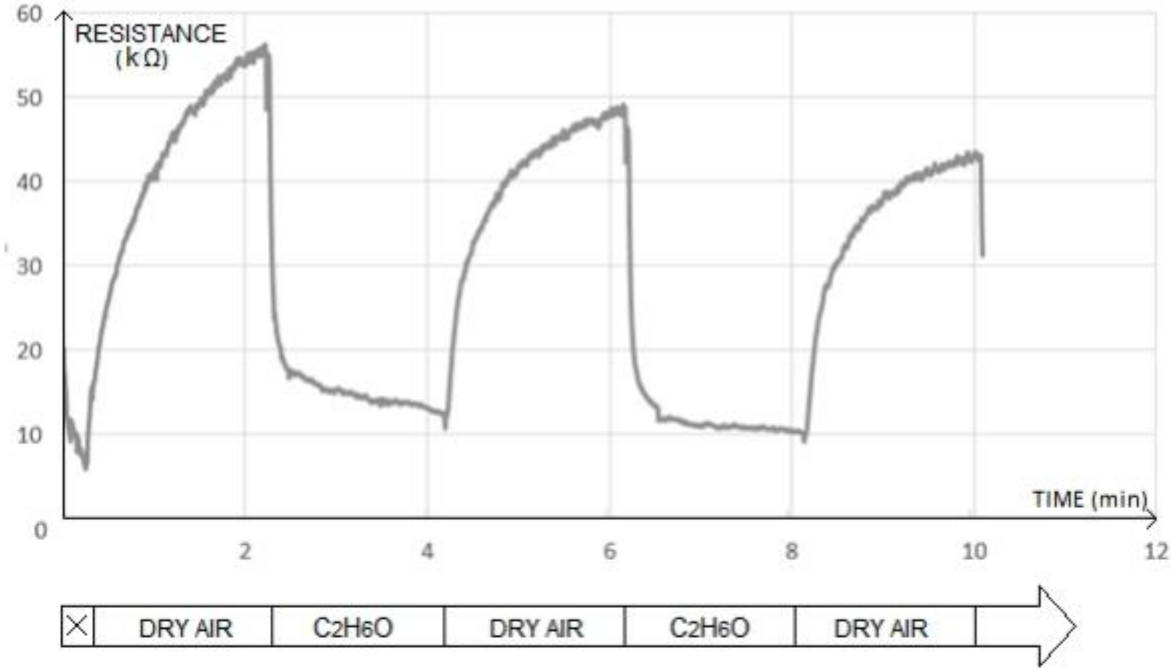
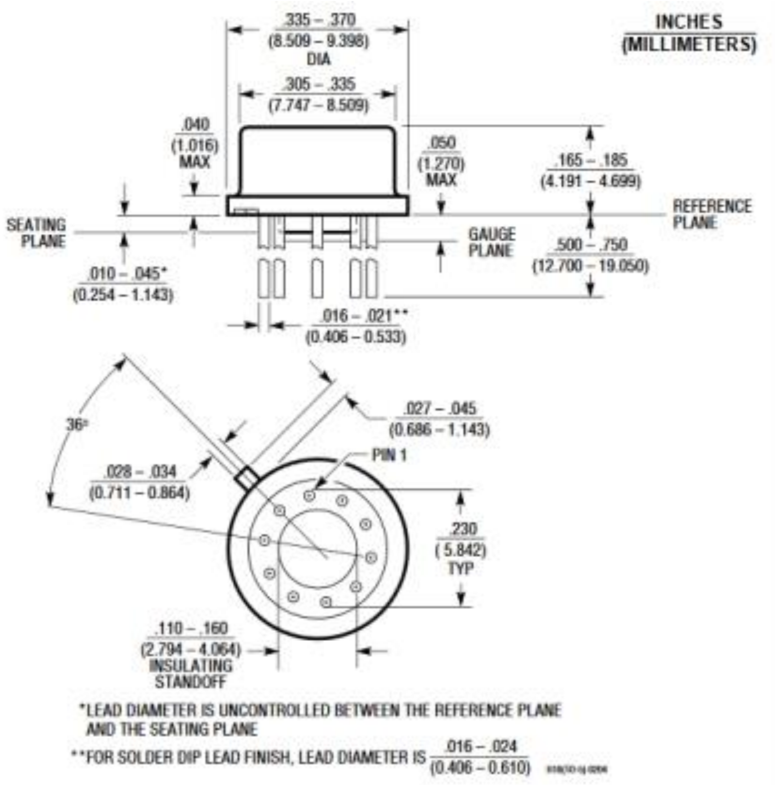


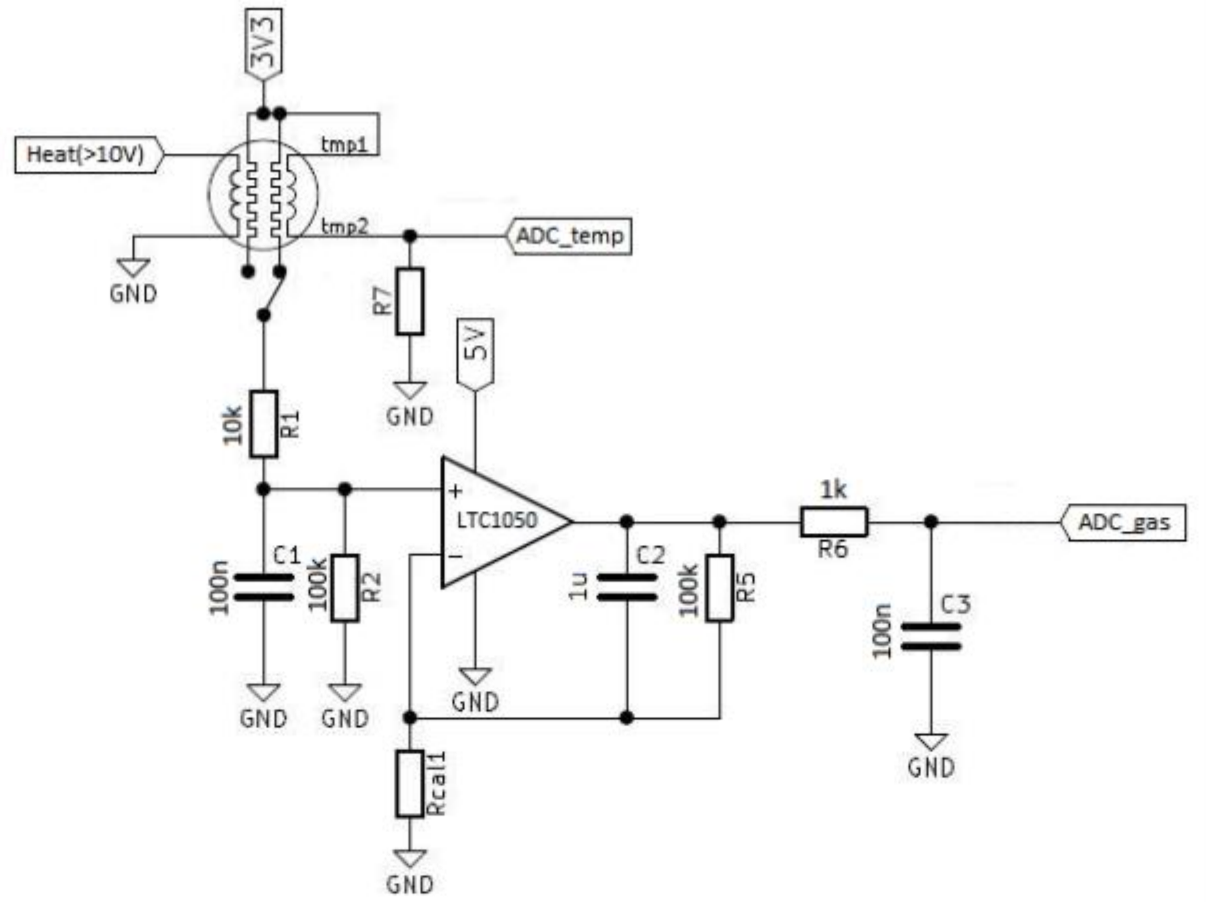
Fig 6 : Resistance dynamic in presence of Ethanol at 250°C

Dimensions

The package is a 10-Lead TO-5 metal :



Typical Applications



Above is typical application of the sensor in an analogic circuit. One of the two gas sensors is connected in series with two resistors of a dividing bridge. The outcoming tension is amplified by a LTC1050 operational amplifier before being filtered by a RC filter (low pass). The tension from the ADC_gas label can be connected to a 5V ADC (an Arduino's for instance). The temperature sensor (tmp1 – tmp2) is also used as a resistor in a dividing bridge and the tension can be converted by an ADC. An up to 10V tension shall be used to heat the sensor during the measurement.