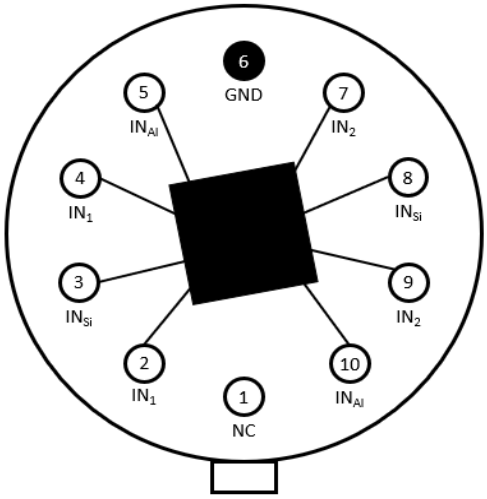
Low Power Gas Sensor based on tungsten trioxide nanoparticles

The internet of things field knows an exponential growth and the application are numerous, especially in public health-care. The development of high sensitivity and accuracy sensors are a huge interest for gas pollution detection. This sensor was developed using the INSA Toulouse AIME (Atelier Interuniversitaire de Micro-nano Electronique) facilities and based on the Jeremie Grisolia's work. It is composed of silicon rods and WO3 nanoparticles sensitive to gas and a heating resistor.

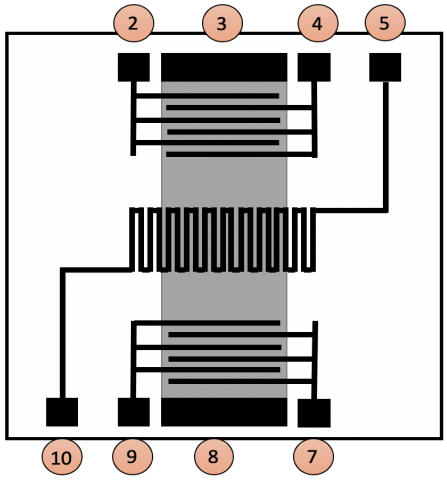
General features

- Low power consumption
- Easy-to-use
- Small size
- Low Cost
- Short response time
- Detection of NH3
- Detection of C2H6O
- Temperature sensor included
- 2 Integrated gas sensors
- Heater included (resistor)



Pin description

Pin Number	Uasge
1/6	Temperature sensor (Aluminium resistor)
2/4	Gas sensor(WO3 nanoparticles integrated on aluminium interdigital combs)
3/8	Heater resister (Polysilicon resistor)
7/9	Gas sensor(WO3 nanoparticles integrated on aluminium interdigital combs)
5	Not connected
10	Not connected



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Specifications

Type	Nanoparticle based sensor
Materials	• Silicon • N-doped poly-silicon (heater) • Aluminum (temperature measurement) • Nanoparticles of tungsten trioxide (WO3)
Sensor type	Active (power supply required)
Gas measurement	Resistive measure
Temperature measurement	Resistive measure
Detectable gaz	• Ammonia (NH3) • Ethanol (C2H6O)
Package	10-Lead TO-5 metal
Diameter	9.5mm
Mountig	Through hole fixed
Time response	• Ethanol <30s • Ammonia <15s

Standard use condition

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

Electronical characterisation

	Unit	Min	Typical	Max
Gas sensor resistance	MΩ	0.01	1	100
Temperature sensor resistance	Ω	150	151	350
Heater resistance	Ω	70	86	100
Gas sensor voltage	V	-	3.3	-
Temperature sensor	V	3.3	5	-
Heater	V	10	15	20

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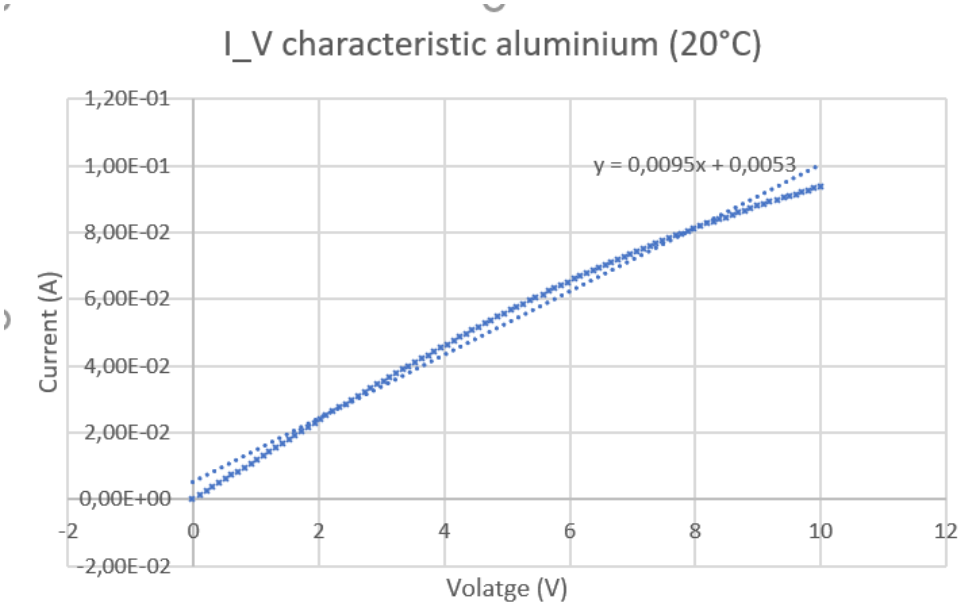
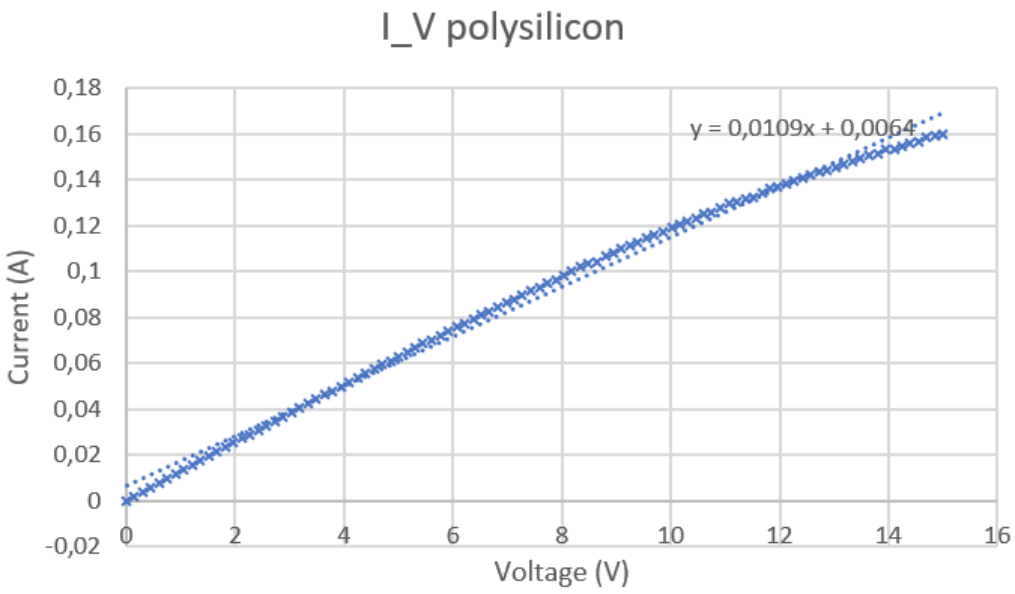
1. Sensor resistor Aluminium



R≈105Ω

2. Sensor resistor Polysilicium



R≈92Ω

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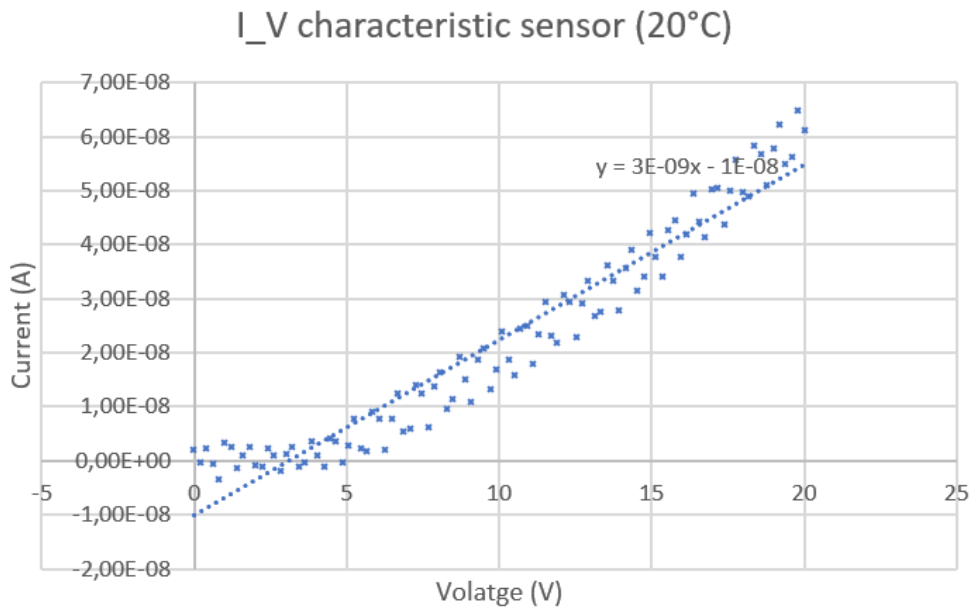
3. Sensibility



$R_S \approx 333M\Omega$

I-V polysilicium	I-V Aluminium	I-V Sensor before depositon	I-V Sensor	Gas Ammoniac NH3	I-V Ethanol C2H6O
R_{poly}=105Ω	R_{alu}= 92Ω		R_s=333MΩ (de 5 à 20V)	T=200°C	T=200°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.

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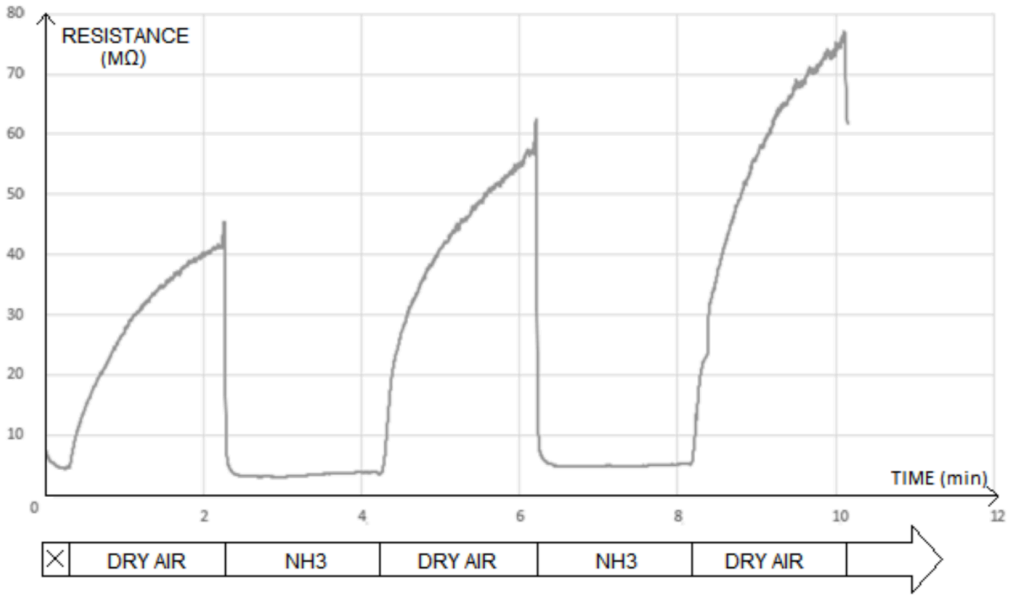
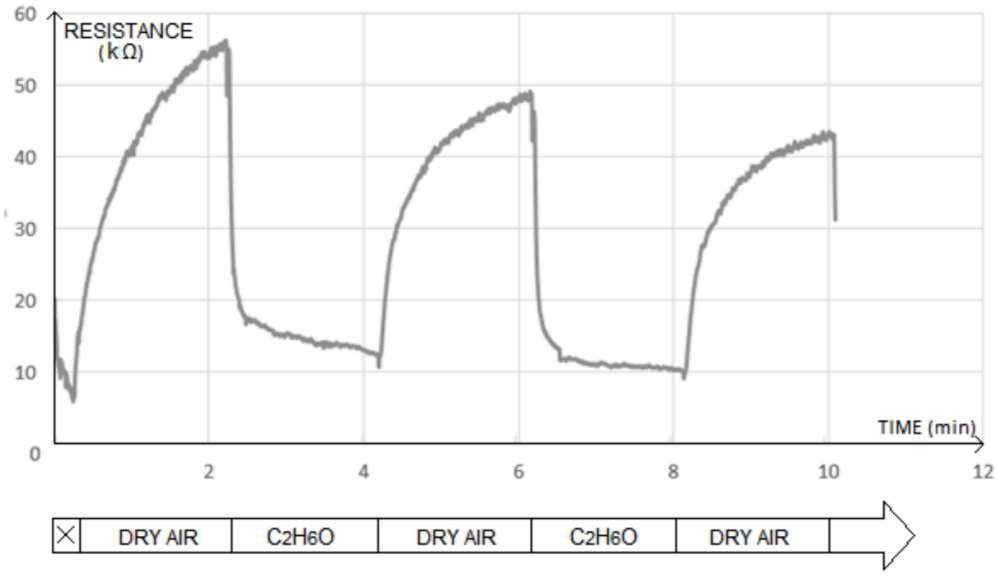
1. Resistance dynamic in presence of Amonia



2. Resistance dynamic in presence of Ethano



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DIMENSIONS

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