

# GAS SENSOR X PRO

## General Features

- Low-power gas sensor
- Power supplied at 3.3V
- Analog output
- High sensitivity and Fast response
- Stable and long life
- Small footprint
- Easy to integrate on PCB or breadboard
- Detection of many gases
  - Carbon Monoxide  $\text{CO}_2$
  - Dihydrogen  $\text{H}_2$
  - Methane  $\text{CH}_4$
  - Alchohol  $\text{C}_2\text{H}_5\text{OH}$
  - Nitrogen dioxide  $\text{NO}_2$



## 1 Description

Developped at the *Interuniversity Workshop of Micro-nano Electronics* (AIME) of INSA Toulouse, the TGS5001 gas sensor is based on tungsten trioxide nanoparticles interdigitated into aluminium combs. This technology allows a high precision of measurement for different types of gas. Being in contact with gas molecules, the nanoparticles  $\text{WO}_3$  will change the conductivity of the sensor according to the applied gas concentration.

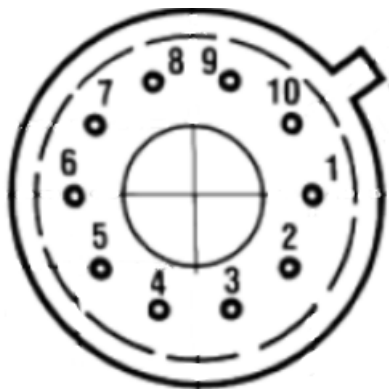
As a complement, a temperature sensor (through an aluminium resistor) and a heater (formed on a wide N-doped poly-silicon layer) are added inside of the component to have a full control on the sensor. Its pinout is Breadboard compatible and can be easily implemented on PCB thanks to a TO-5 package.

## Applications

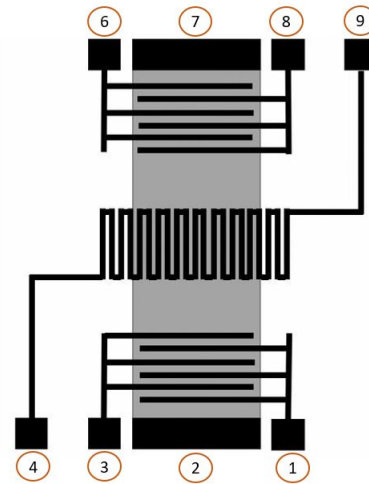
- Environnement analysis
- Pollution observation
- Detection of fire
- Gas leakage detection
- Household CO sensing
- Building Technology and Comfort

## 2 Pin Description

| Pin Number | Usage  |
|------------|--|
| 1 & 3      | Gaz sensor (1) - WO <sub>3</sub> nanoparticles interdigitated into aluminium combs |
| 2 & 7      | Heater (Polysilicon resistor)  |
| 4 & 9      | Temperature sensor (aluminium resistor)  |
| 5 & 10     | NC   |
| 6 & 8      | Gaz sensor (2) - WO <sub>3</sub> nanoparticles interdigitated into aluminium combs |



Physical pinout



Physical pinout

## 3 Specifications

|                                |  |
|--------------------------------|--|
| Type                           | Nanoparticle based gas sensor  |
| Material                       | <ul style="list-style-type: none"> <li>• Silicon</li> <li>• N-doped poly-silicon</li> <li>• Aluminum</li> <li>• Tungsten trioxide WO<sub>3</sub> nanorods</li> </ul> |
| Type of sensor                 | Active   |
| Gas measurement method         | Resistive  |
| Temperature measurement method | Resistive  |
| Type of detectable gases       | <ul style="list-style-type: none"> <li>• Carbon Monoxide</li> <li>• Dihydrogen</li> <li>• Methane</li> <li>• Alchohol</li> <li>• Nitrogen dioxide</li> </ul>         |
| Package                        | 10-Lead TO-5 metal   |
| Diameter                       | 9.5mm  |

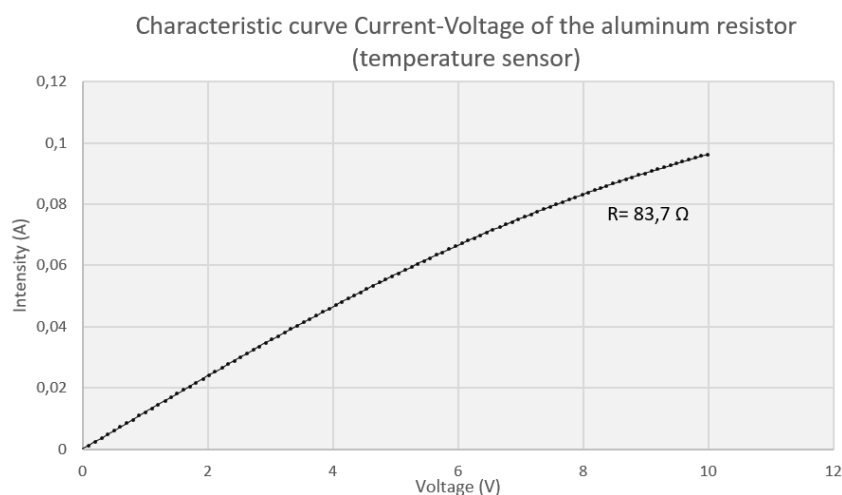
## 4 Standard use conditions

|               | Minimal Value | Maximal value | Unit |
|---------------|---------------|---------------|------|
| Température   | -15           | 50            | °C   |
| Humidity      | 45            | 75            | %    |
| Voltage Input | 2.8           | 3.6           | V    |

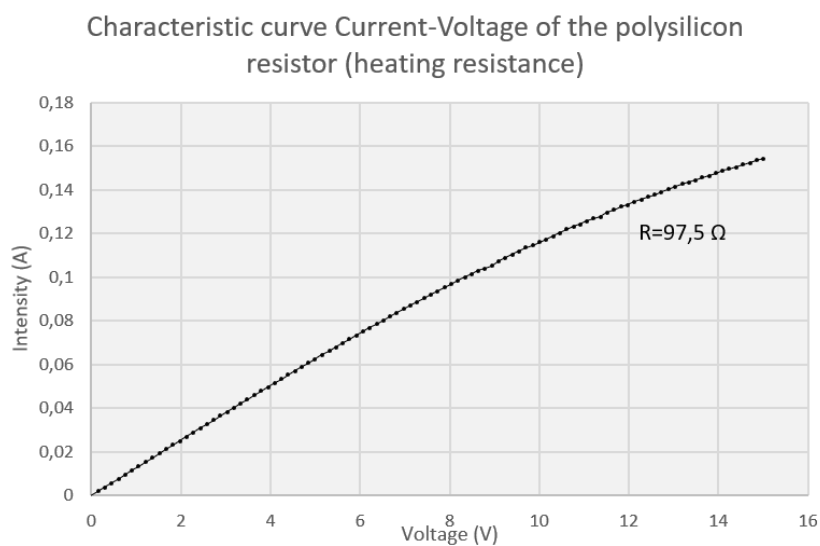
## 5 Electrical characteristics

|                          | Voltage (max) | Current (max) |
|--------------------------|---------------|---------------|
| Nominal Domain           | $\pm 10V$     | 100 mA        |
| Non-Deterioration Domain | $\pm 20V$     | 200 mA        |

### 5.1 Temperature sensor characterization



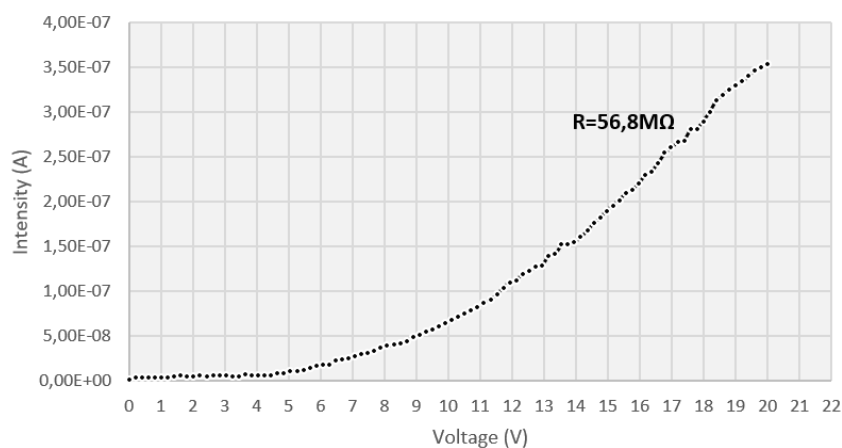
### 5.2 Heater characterization



## 5.3 Gas sensor characterization

### 5.3.1 Variation with the voltage

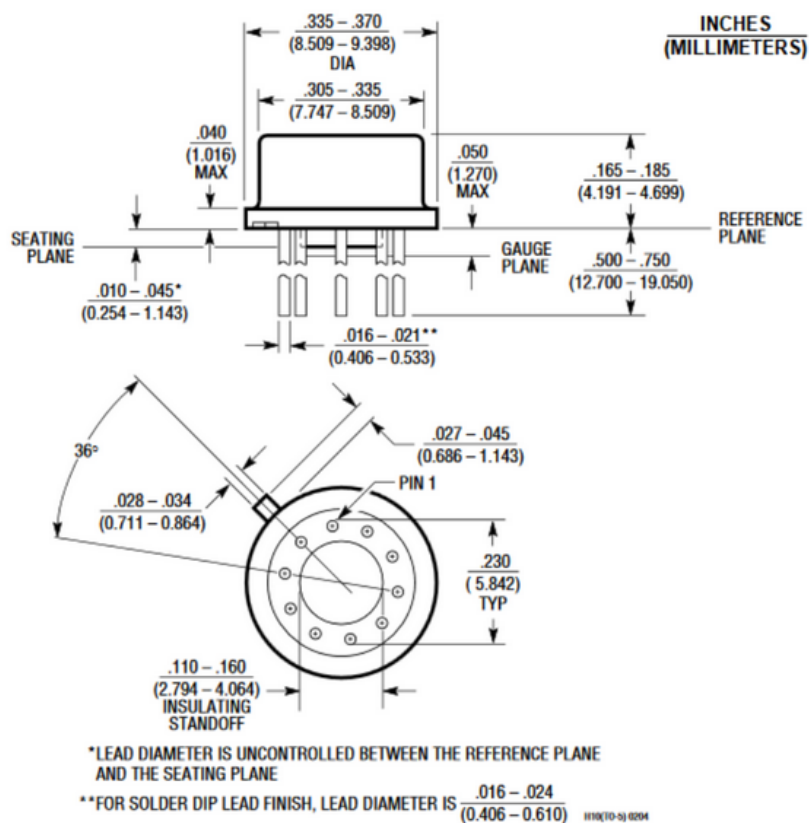
Variation of the current of the sensitive layer as a function of the voltage



### 5.3.2 Variation with the Ethanol debit (D)

|           |         |         |         |
|-----------|---------|---------|---------|
| T = 300°K | D = 0,5 | D = 1,5 | D = 2,5 |
| R (kohms) | 11,618  | 34,001  | 34,637  |

## 6 Dimensions



## 7 Typical Application

It is possible to have a complete system to retrieve the gas sensor data through an operational amplifier. This system could be implemented on a board (like Arduino shield) and according to this schematic, the output is analogic.

