∇ Struggle DVC

Low energy semiconductor gas sensor

Features

- High sensitivity to a wide range of gases
- State-of-the-art nanoparticles technology
- Conditioner is not integrated in the package : power efficiency can be optimized to the application
- Long lifetime
- Short to instance response-time
- Environmentally safe
- Low cost at high volume

Figure 2: Gas Sensor AIME

Description

The AIME GASNP-2024 is a high-sensitivity gas sensor based on WO3 nanoparticules designed to detect oxydable-gases in the air such as ethanol or ammonia.

It features a sensitive layer of nanoparticles deposited on interdigitated aluminuim combs on a doped silicon substrate. A polysilicon heating element ensures thermal control of the sensing area.

Pins configuration

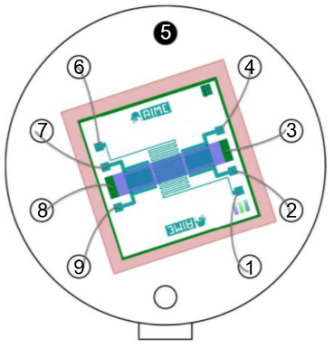

Figure 1: Sensor Pin Layout

Pin number	Function
1-6	Temperature sensor (Aluminum resistor)
2-4	Gas sensor #1
3-8	Thermal resistor (Polysilicon resistor)
7-9	Gas sensor #2
5	NC
10	NC

GENERAL CHARACTERISTICS

Type	Chemical sensor
Materials	• Silicon • N-doped poly-silicon (heater) • Aluminum (temperature measurements) • Nanoparticles of Tungsten Trioxide (WO_3)
Sensor Type	Active (power supply required)
Gas Measurement	Resistive measure
Temperature Measurement	Resistive measure
Detectable Gases	• Alcohols (-OH) • Ammonia (NH_3) • Carbon Monoxide (CO) • Dihydrogen (H_2) • Ethanol (C_2H_6O) • Hydrogen Sulfide (SO_2) • Methane (CH_4) • Nitrogen Dioxide (NO_2)
Typical Detection Range	$> 1\,ppm$
Package	TO-5-10 (10 pins)
Head Diameter	9.5 mm
Head Height	4.7 mm
Package Height	25 mm
Pin Diameter	0.6 mm
Mounting	Through hole fixed (THT)

GAS SENSOR CHARACTERISTICS

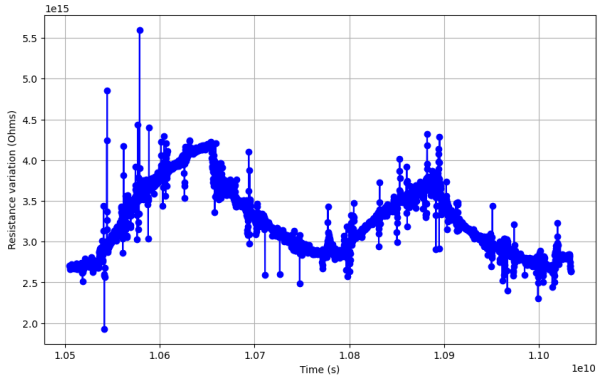

Figure 3: Gas Sensor exposed to ethanol

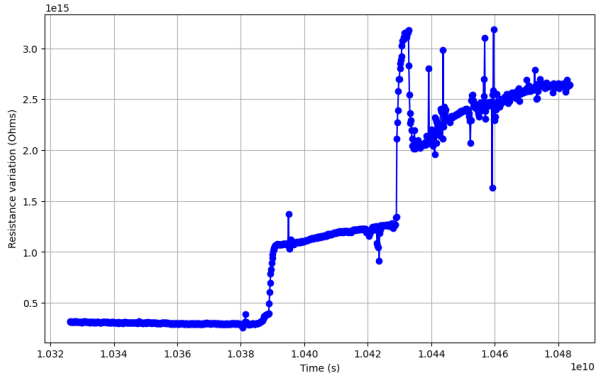

Figure 4: Gas Sensor exposed to ammoniac

ELECTRICAL CHARACTERISTICS

Parameter	Units	Min	Typical	Max
Voltage	V	-	3.3	-
$R_{Aluminium}$	Ω	80.02	84.3	107.53
$R_{Polysilicon}$	Ω	79.1	94.1	100
R_{Sensor}	GΩ	10	20	20
$S_{Ethanol}$	Ω/ppm	0.00225	150000	-
S_{NH_3}	Ω/ppm	0.13	1412135	-
S_{NO_2}	Ω/ppm	0.017	4520000	-
Temperature	K	410	550	600
Relative variation NO_2	%	55.7	110	400
Relative variation Ethanol	%	35	53	237

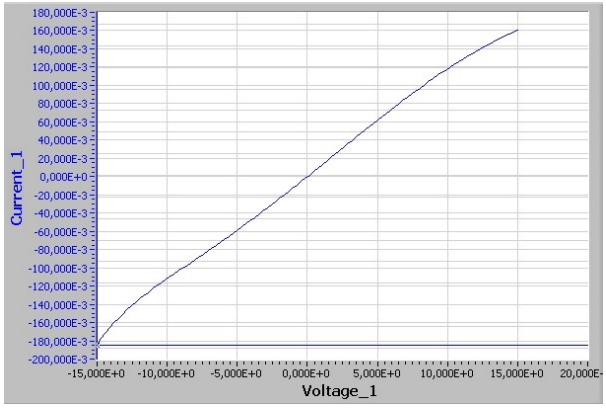

Figure 5: Characteristics of the Poly-silicon resistor

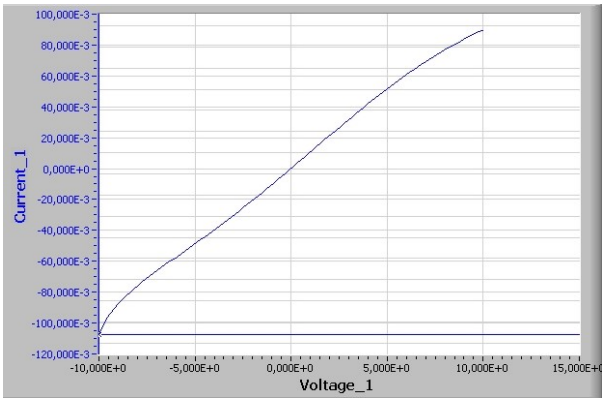

Figure 6: Characteristics of the Aluminium resistor

CONFIGURATION

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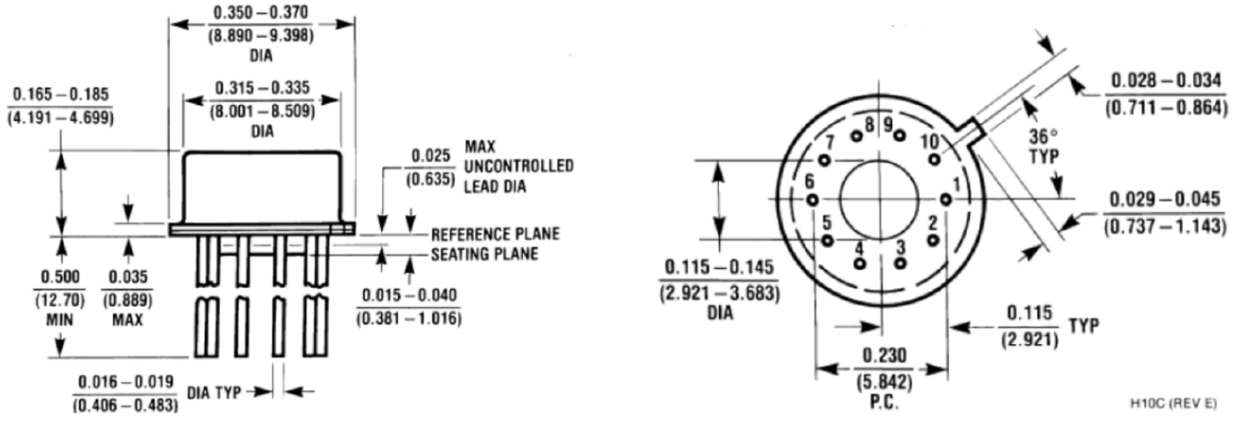

Figure 7: Package Configuration

Application

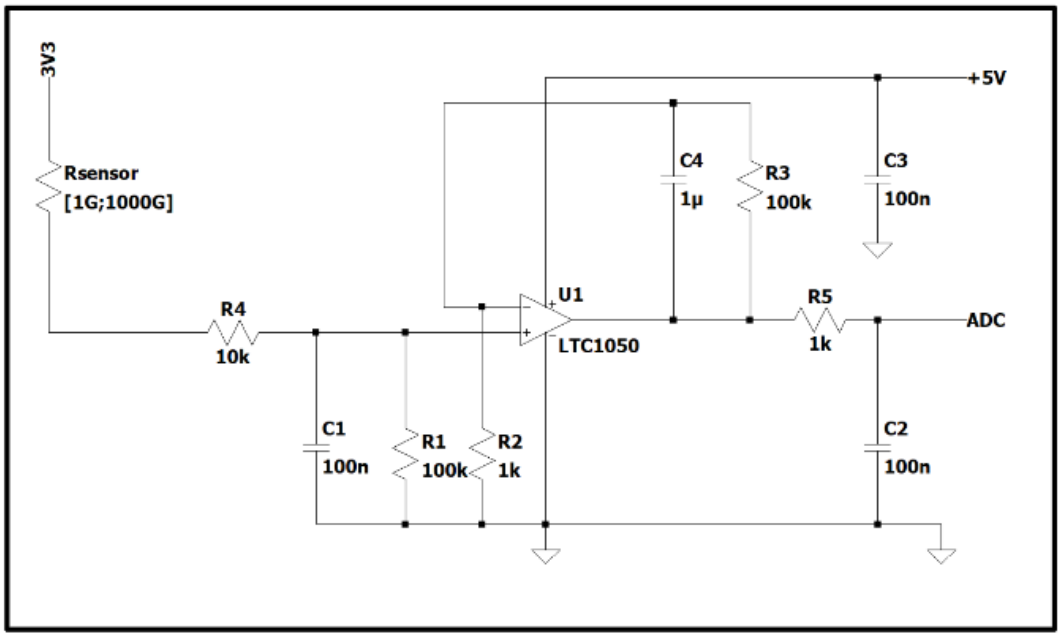

Figure 8: Application example

The resistance of the sensor has a magnitude of Giga Ohm. This means that a voltage divider is not efficient to measure the voltage. The figure above shows the circuit that uses an operational amplifier with a low offset voltage. Therefore, it is not possible to convert the current of the sensor into its resistance using the following formula:

$$R_{sensor} = \left(1 + \frac{R_3}{R_2}\right) \cdot R_1 \cdot \frac{V_{cc}}{V_{adc}} - R_1 - R_5$$