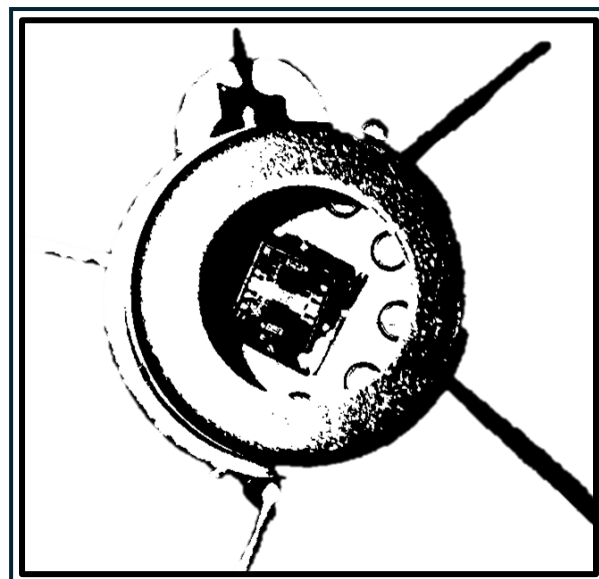


Low Power Gas sensor based on tungsten trioxide (WO₃) nanoparticles

1. Features

- Nano-structured WO₃ (tungsten oxide) sensing layer for high sensitivity to reducing gases (e.g. NH₃, ethanol)
- Integrated buried polysilicon micro-heater for precise operating temperature control
- Additional aluminum track usable as heater or on-chip thermistor for temperature monitoring
- Interdigitated electrode structure for improved interaction between gas and sensing film
- Fast response and recovery time thanks to high surface area nanoparticles
- Compatible with standard microelectronic fabrication processes
- Low footprint, suitable for multi-sensor arrays and portable devices
- Operation in controlled or ambient atmosphere
- Suitable for batch fabrication and low-cost production



- Smart building and HVAC monitoring systems
- Portable and wearable gas detection equipment
- Educational and research demonstrators for nano-based gas sensing

2. Applications

- Environmental air quality monitoring (indoor and outdoor)
- Industrial safety and leak detection (ammonia, alcohol vapors, etc.)
- Process control in the chemical, food, and automotive industries
- Laboratory gas analysis and sensing platforms

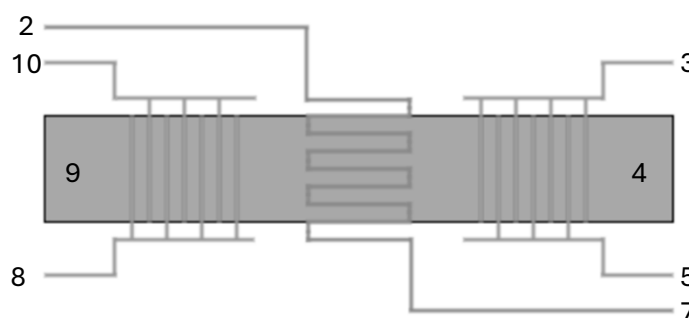
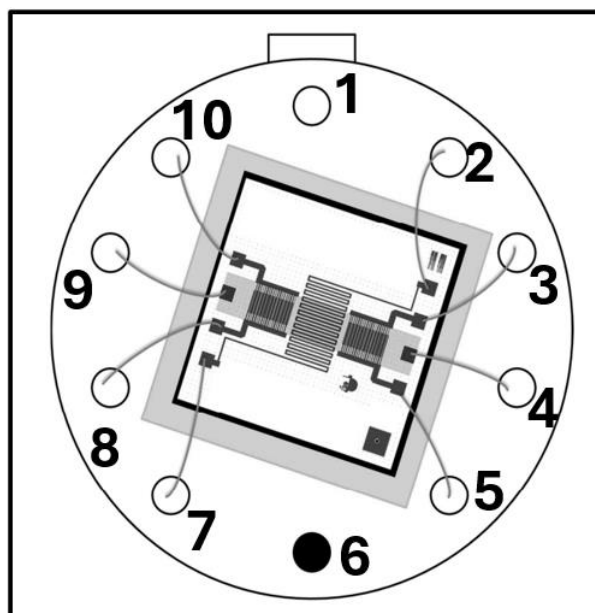
3. Description

The GQ32107 is a nano-based metal-oxide gas sensor designed for the detection of reducing gases such as ammonia (NH₃) and ethanol vapors. The sensing element is a layer of WO₃ nanoparticles / nanowires integrated on a microfabricated chip that combines a buried n-doped polysilicon heater, an optional aluminum heating/thermistor track, and interdigitated electrodes.

During operation, the integrated heater sets the sensor to an elevated temperature, enhancing surface reactions between the target gas and the WO_3 layer. These reactions induce a change in the electrical resistance measured across the interdigitated electrodes, which can be monitored using a simple bias and readout circuit. The on-chip structure allows fast thermal cycling, reduced power consumption, and a compact form factor suitable for multi-sensor modules and portable instruments. Designed to be compatible with standard microelectronics and thin-film processing, the GQ32107 offers an ideal platform for environmental monitoring, safety systems, and academic research on gas sensing with nanostructured metal oxides.

4. Pin description

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



5. Specifications

Type	Active Nanoparticle base sensor
Materials	<ul style="list-style-type: none"> ➤ Silicon ➤ N-doped poly-silicon (heater) ➤ Aluminium (temp sensor) ➤ Nanoparticle (WO₃)
Measurment	Resistive measure
Detectable gaz	<ul style="list-style-type: none"> ➤ Air (N₂O₂) ➤ Methane (CH₄) ➤ Ethanol (C₂H₆O)
Package	10-Lead TO-5 metal
Diameter	9.5mm
Mouting	Through hole THT
Time response (1τ)	<ul style="list-style-type: none"> ➤ Dry air : 0,0825s ➤ Ethanol : 0,0942s ➤ Methane : 0,0557s ➤ Overall responce time ~10s (5τ)

a. Standard work condition

Symbol	Parameter name	Technical conditions	Units	Remarks
V_{Ts}	Temperature nominal sensing voltage	[0, 4]	V	
V_{Ts_ND}	Temperature non-degradation sensing voltage]4; 9]	V	Non linear working condition without damaging sensor
V_H	Nominal heating voltage	[10,15]	V	
V_{H_ND}	Non degradation heating voltage]5, 9]	V	Non linear working conditions without damaging sensor
R_S	Sensing resistor	79, 5	Ω	
R_H	Heating resistor	98, 9	Ω	Room temps
T_o	Operating temperature	250	°C	

b. Environment condition

Symbol	Parameter name	Technical conditions	Units	Remarks
T_{op}	Operating temps	25 ± 5	$^{\circ}\text{C}$	
H_{op}	Humidity	60 ± 5	%	
A_{CN}	Nominal air quality	80, 20	% N_2O_2	

c. Sensitivity characteristic

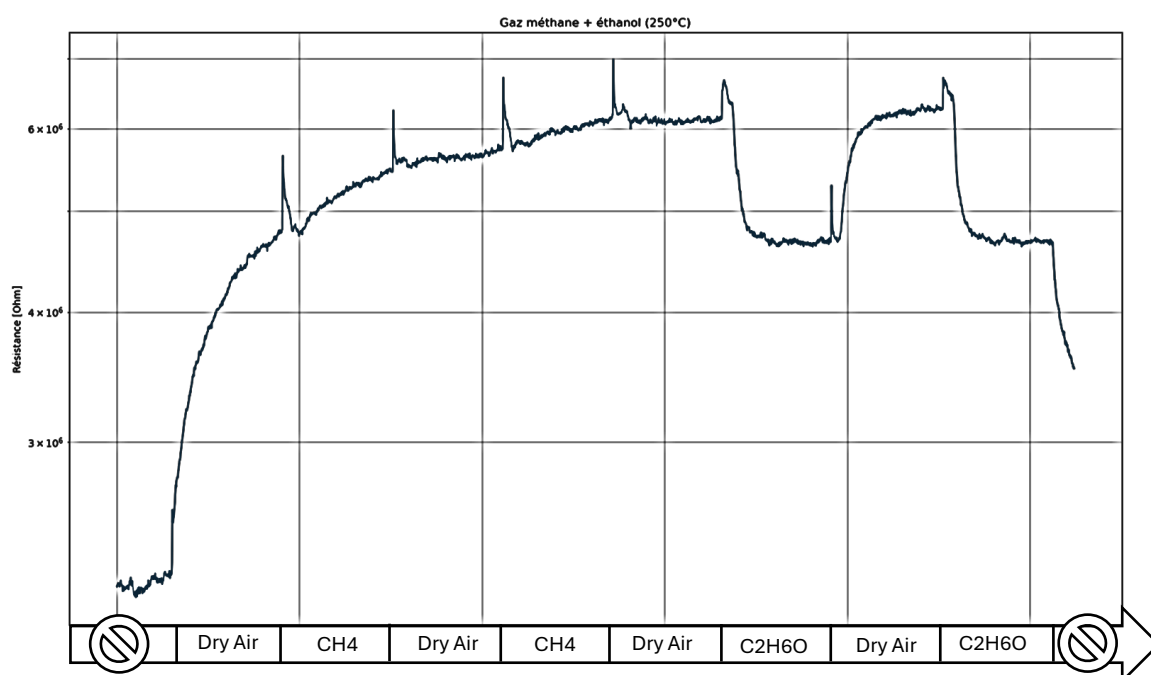
Symbol	Parameter name	Technical conditions	Units	Remarks
S_n	Nominal sensisitivity	Air : 17 Ethanol : 1396	Ω/ppm	Tested with 1000ppm concentrations. Methane couldn't be computed.
S_{lim}	Sensitivity limit	Air : 14, 71 Ethanol : 35, 82	ppm	Methane couldn't be computed
P_T	Preheat time	60	s	

d. Absolute maximum rating

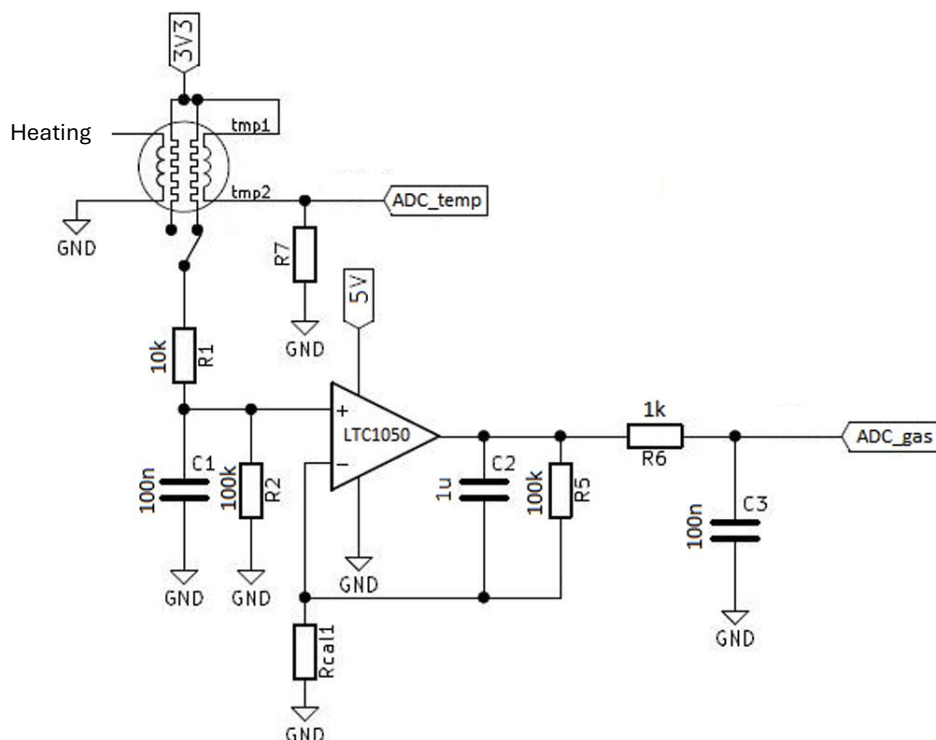
Symbol	Parameter name	Rating	Units	Remarks
V_{Tmax}	Maximum temperature sensing voltage	9 >	V	
V_{Hmax}	Maximum heating voltage	9 >	%	

6. Gaz sensor characteristics

The gas sensor characteristic is determined by measuring the resistance evolution in presence of different gases. In order to determine the sensed gas we can measure the time constant of the exponential growth. A resistance spike reveals a change in gas.



7. Typical applications



Above is a typical application of the sensor in an analogue circuit. One of the two gas sensors is connected in series with two resistors in a voltage divider. The resulting voltage is filtered in order to keep only the DC value amplified by an LTC1050 operational amplifier before being filtered by a low-pass filter to prevent aliasing. The voltage from the ADC_gas label can be connected to a 5 V ADC (an Arduino, for example). The temperature sensor (tmp1 – tmp2) is also used as a resistor in a divider bridge and the voltage can be converted by an ADC.

