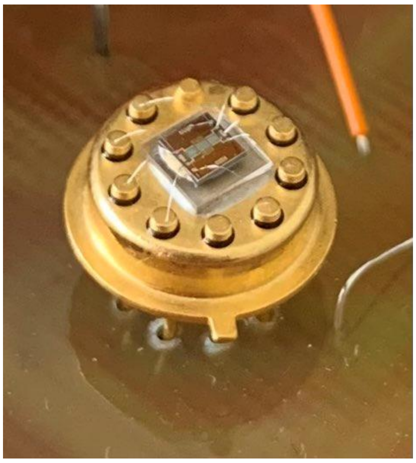
INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Datasheet

SGS24ISS

Low power smart sensor for gas detection



Features

- 2 gas sensors
- Gas detection: NH3 and C2H6O
- Short response time
- Integrated temperature sensor and heater
- Low power
- Low cost
- Small size

Application

- Gas leak detection
- Gas measurements in medical and agricultural applications
- Environmental monitoring
- Smart homes and Internet of Things

Description

The SGS24ISS gas sensor developed at AIME laboratory in Toulouse is based on tungsten trioxide (W03) nanoparticles. The sensor is composed of two identical sensing elements for gas measurement. They consist of interdigitated combs of silicon substrate with a thin W03 nanoparticles deposit. A N-doped polysilicon heater is integrated to enable sensor heating up to 300°C. A temperature sensor based on an aluminum resistor is placed right next to the gas sensors, with a varying impedance depending on temperature. The SGS24ISS has a high sensitivity and selectivity, easily adjustable by controlling the temperature using the aluminum resistor.

Contents

Pin description and connection diagram

Figure 1. Pin connection (top view)

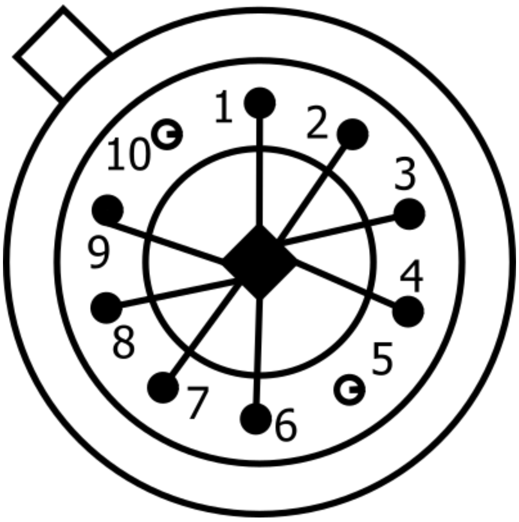


Table 1. Pin description

Pin number	Pin name	Function
1	TempA	Temperature sensor
2	Gas1A	Gas sensor 1
3	HeatA	Heater
4	Gas1B	Gas sensor 1
5	NC	Not connected
6	TempB	Temperature sensor
7	Gas2A	Gas sensor 2
8	HeatB	Heater
9	Gas2B	Gas sensor 2
10	NC	Not connected

Electrical data

Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Min.	Max.	Unit
V_H	Heater voltage	-15	15	V
V_T	Temperature sensor voltage	-10	10	V
V_G	Gas sensor(s) voltage	0	5	V

Typical characteristics

Table 3. Recommanded operating conditions

Symbol	Parameter	Nom.	Unit
V_H	Heater voltage	12	V
V_G	Gas sensor(s) voltage	5	V

Table 4. Typical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
R_H	Heater resistance	T=25°C	-	126	-	Ω
R_T	Temperature sensor resistance	T=25°C	-	61	-	Ω
R_G	Gas sensor(s) resistance	T=25°C	0.01	1	1000	MΩ
t_{NH3}	Response time for ammonia	T=200°C	-	23.6	-	s
dR_G/dt	Gas sensor(s) resistance variation over time during gas detection	T=200°C		44		MΩ/s

Figure 2. Heater characteristics and sensitivity

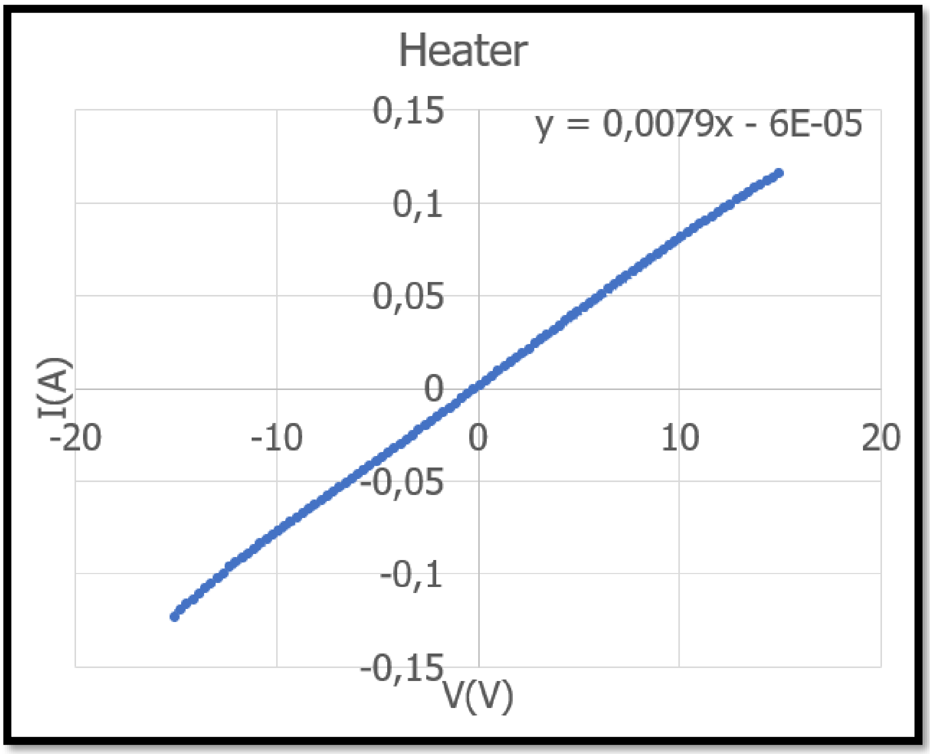
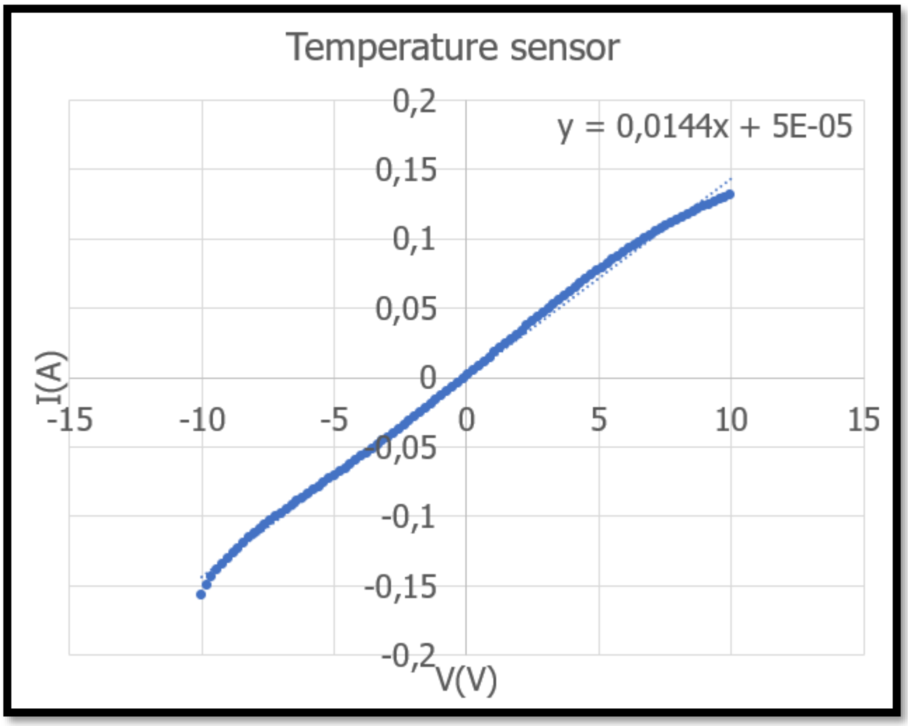


Figure 3. Temperature sensor characteristics and sensitivity



Typical application diagram

In a typical application, the following layout should be respected.

Since the temperature sensor is a variable resistance, the temperature value is acquired by creating a voltage bridge with a given resistor and supply voltage. Here, 5V and 100Ω were picked to stay in the nominal range of the sensor.

The heater is powered by a voltage source supplied by the user, depending on the application. A buck circuit can be used to regulate the temperature of the sensor, or a simple relay that turns off when the sensor is too hot and turns on when the sensor is too cold.

The gas sensor returns a current that can be observed by transforming it into voltage. A transimpedance amplifier circuit is proposed in Figure.

Figure 4. KiCad schematic example

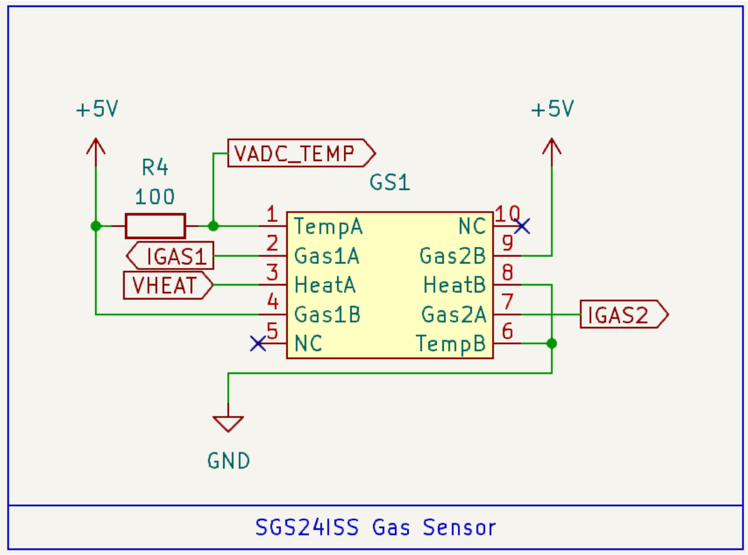
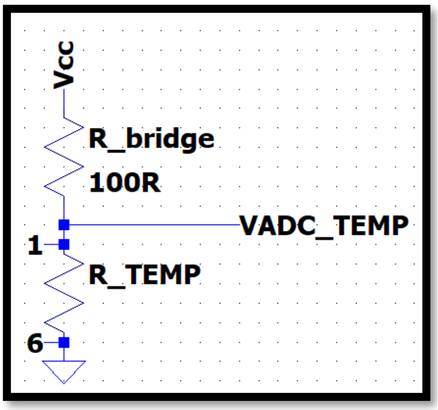
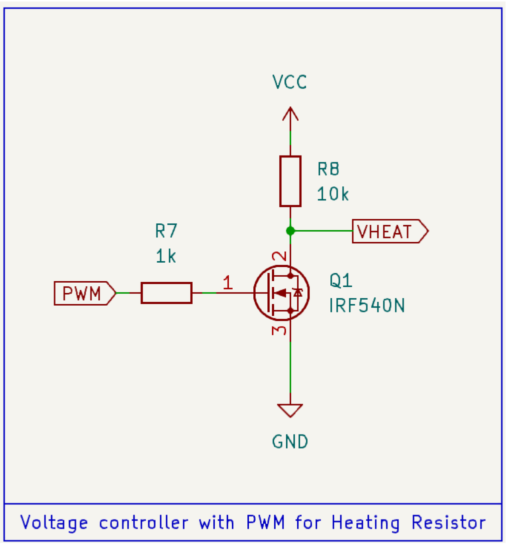


Figure 5. Recommended application for temperature sensor



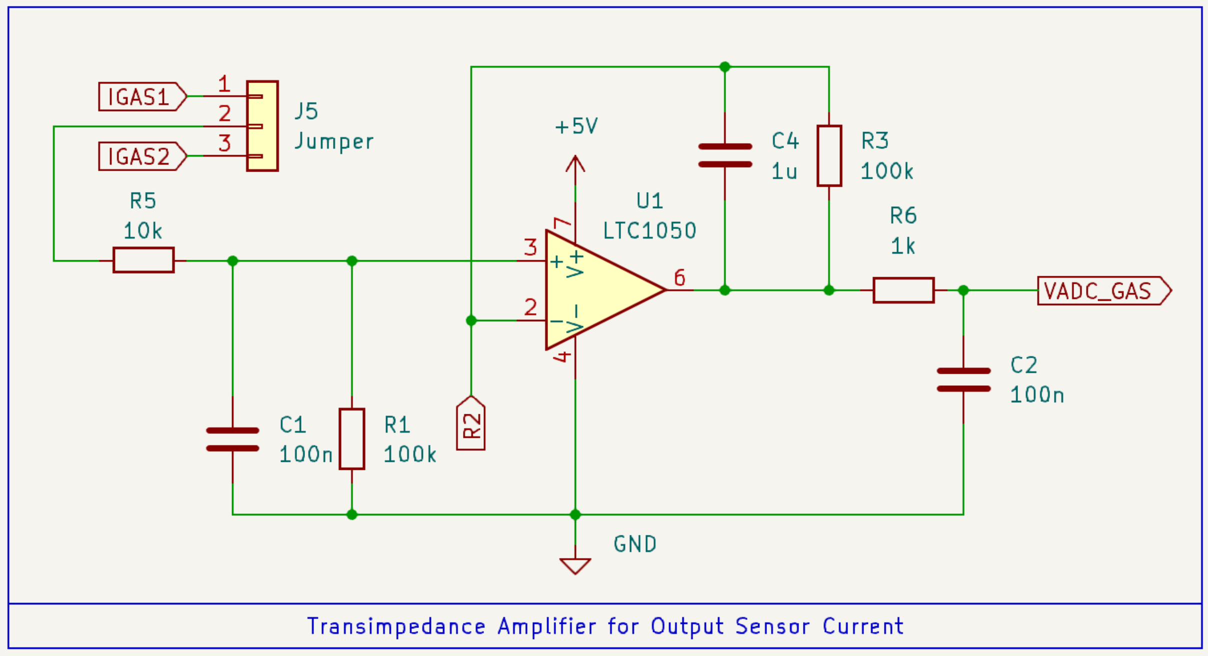
More studies must be conducted to determine a relationship between temperature and R_T.

Figure 6. Recommended application for heater



To control the heater, multiple options exist. The easiest one to set up is using a transistor to short power to the heater. Using digital signals from a MCU (called PWM in Figure 6) (usually 3.3V) can be transformed into an inverted VCC power supply (usually 12V).

Figure 7. Recommended application for gas sensors



As mentioned above, transforming the output current of the sensor is a task that can be performed by several circuits. The transimpedance amplifier allows for impedance matching and filters noise. It is cheap and easy to route, however, the OpAmp requires power.

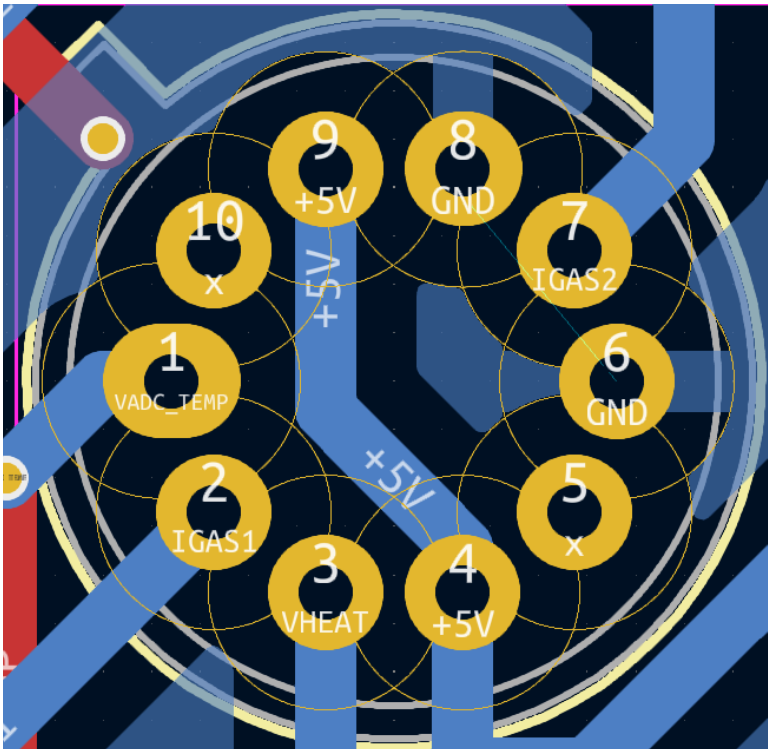
Layout

In order to optimize the PCB layout, the following considerations should be considered:

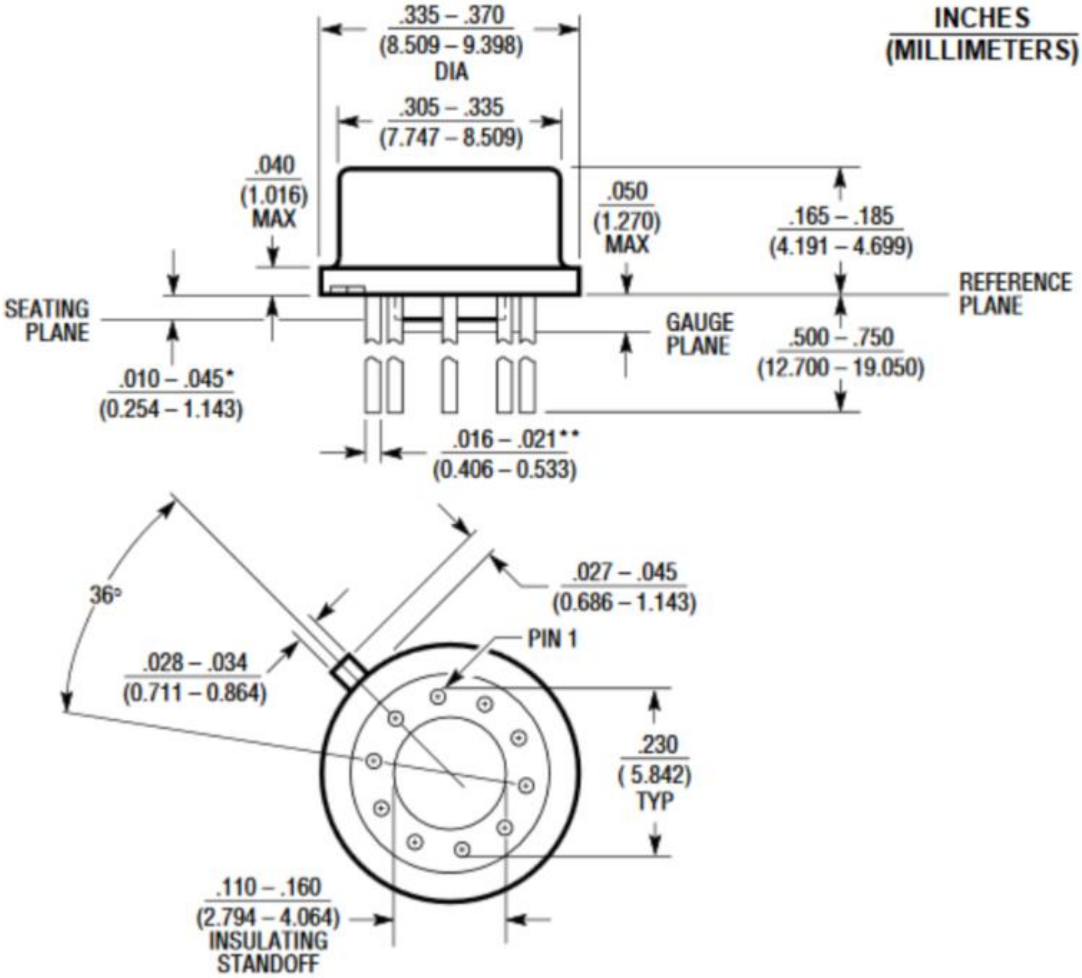
- SMD or THT capacitors must be placed close to each supply line connected indirectly to the component. A 100nF capacitor must be placed between V_{DD} and GND in order to filter high-frequency noise and spikes.
- The acquisition system (MCU pins, transimpedance amplifier…) must be placed close to the pins.

Layout example

Figure 8. Layout example



Package information



*LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND THE SEATING PLANE

**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $\frac{.016 - .024}{(0.406 - 0.610)}$

Revision history

Table 5. Document revision history

Date	Version	Changes
18-Dec-2023	1.0	Initial release.