

# MiCS5524 Gas Sensor

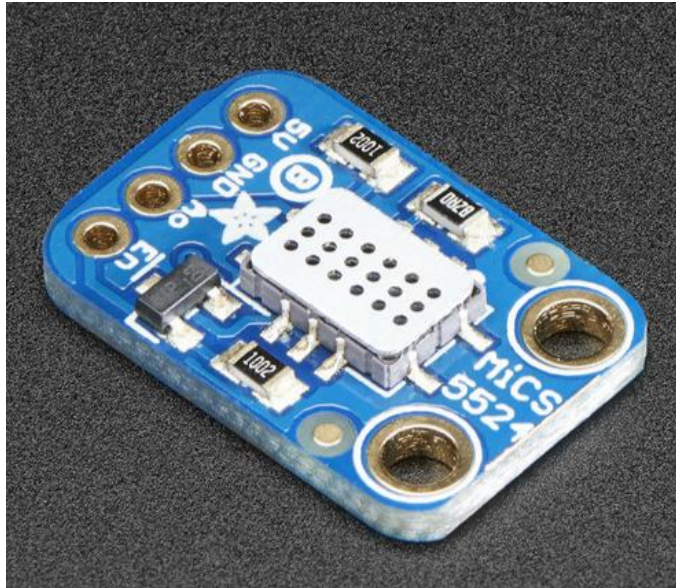


Figure 1: MiCS5524 sensor

The MiCS5524 sensor is used to detect CO (1 to 1000ppm), NH<sub>3</sub> (1 to 500ppm), Ethanol (10 to 500ppm), H<sub>2</sub> (1 to 1000ppm), and methane/propane/ iso-butane (>1000ppm). However, it cannot tell the analytes apart. It is useful for detecting CO and natural gas leaks in an indoor setting. It is also suitable for breath checking and early fire detection.<sup>1</sup>

## How does the MiCS5524 work?

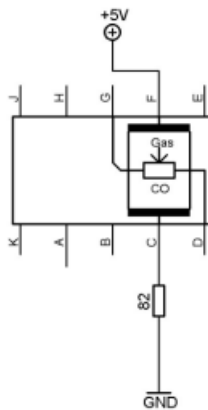


Figure 2: MiCS5524 circuit diagram

The MiCS5524 sensor is comprised of a silicon gas sensor with a micro machined diaphragm with an embedded heating resistor. The sensing layer is on top of this unit. The sensor is put together using MEMS (microelectromechanical systems) technology.<sup>2</sup> This means that the heating and sensing elements are applied by thin film fabrication. The elements work

like a MOS (metal oxide semiconductor). MOS sensors work by sensing the change in resistance when gas is present versus clean/fresh air.<sup>3</sup>

### Connecting the MiCS5524

Solder the pins to the sensor before connecting to the raspberry pi.

In order to connect the MiCS5524 sensor to the Raspberry Pi, two other sensors are needed. A level converter is needed to take the 5V output signal to a 3.3V signal and an A/D converter to be able to read the signal in digital form. It is necessary to step the voltage down because a raspberry pi can only read signals at 3.3V without potential for damage. The A/D converter changes the analog signal to a digital signal in order to calculate the concentration of gas from the signal instead of just a detection.



Figure 3: MCP3008 ADC converter

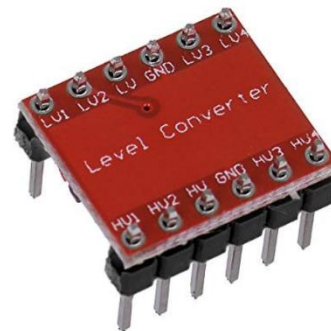


Figure 4: CYT1076 level converter

The sensor was connected to the raspberry pi as follows:<sup>4</sup>

#### MCP3008

- Pin 16 (V<sub>DD</sub>)** connects to your **positive rail**
- Pin 15 (V<sub>REF</sub>)** connects to your **positive rail**
- Pin 14 (AGND)** connects to your **ground rail**
- Pin 13 (CLK)** connects to **SCLK** on your Pi cobbler
- Pin 12(D<sub>OUT</sub>)** connects to **MISO** on your Pi cobbler
- Pin 11(D<sub>IN</sub>)** connects to **MOSI** on your Pi cobbler
- Pin 10 (CS)** connects to **CE0** on your Pi cobbler
- Pin 9(D<sub>GND</sub>)** connects to your **ground rail**.

#### CYT1076 Red level converter

- LV** to Pi **3.3V Positive Rail**
- HV** to Pi **5V Positive Rail**
- HV side GND** to **GND on Pi**
- LV side GND** to **GND on Pi**
- LV1** to **Channel 0** on MCP3008

MiCS5524

**5V to 5V** on raspberry pi

**GND to GND** on raspberry pi

**A0 to HV1** on CYT1076

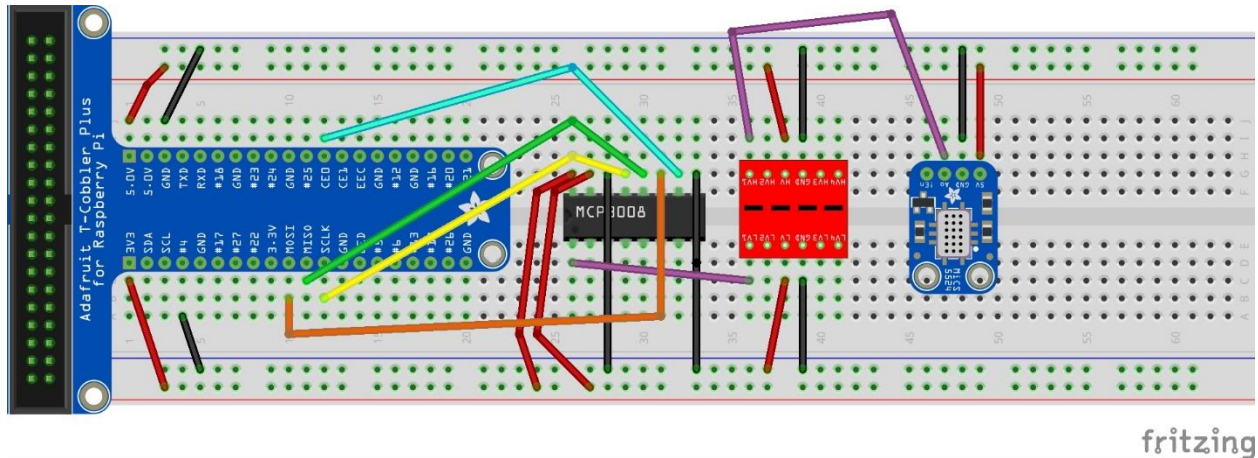


Figure 5: Raspberry Pi hookup for MiCS5524

## Coding the MiCS5524

Run the following code in the Thonny IDE.<sup>4</sup>

```
import time
import math
from gpiozero import MCP3008

#location of analog signal from MiCS5524 sensor
adc0 = MCP3008(channel=0)

while True:

    print(adc0.value)
    time.sleep(5)
```

The ADC signal increases in the presence of CO, Ammonia, Ethanol, Methane, Propane, and Iso-Butane.

## References

- (1) Overview | Adafruit MiCS5524 CO / Alcohol / VOC Gas Sensor Breakout | Adafruit Learning System <https://learn.adafruit.com/adafruit-mics5524-gas-sensor-breakout/overview> (accessed Mar 20, 2019).
- (2) Downloads | Adafruit MiCS5524 CO / Alcohol / VOC Gas Sensor Breakout | Adafruit Learning System <https://learn.adafruit.com/adafruit-mics5524-gas-sensor-breakout/downloads> (accessed Mar 20, 2019).
- (3) Metal Oxide Gas Sensing Material and MEMS Process | Sensors Magazine [/components/metal-oxide-gas-sensing-material-and-mems-process](https://www.sensorsmag.com/components/metal-oxide-gas-sensing-material-and-mems-process) (accessed Mar 20, 2019).
- (4) Usage | Adafruit MiCS5524 CO / Alcohol / VOC Gas Sensor Breakout | Adafruit Learning System <https://learn.adafruit.com/adafruit-mics5524-gas-sensor-breakout/usage> (accessed Mar 20, 2019).