

INTERNSHIP TASKS

BY

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PROJECTS

1. Designing a PCB for 32 bit ADC board using ADS1263
2. Designing the circuit to measure AQI and find sensors for parameters ,integrating with ESP32.

PROJECT 1

- To design and implement a high-precision analog-to-digital conversion system using a 32-bit ADC.
- To achieve accurate measurement of very small voltage signals with minimal noise.
- Analyzing the performance parameters such as resolution, sampling rate, noise level, and accuracy.

METHODOLOGY

PCB Designed with the IC ADS1263 and a LDO NCP1117ST33T3G for a fixed 3.3V

The input analog signal first passes through a Low Pass Filter to remove high frequency noise and fed to the ADC input.

Configured and used the ADC's digital interface pins(CS,SCLK,DIN,DOUT) to enable device control and digital data output.

KEY COMPONENTS

ADS1263

Has 32 bit Primary converter and a 24 bit Secondary Converter.

A high resolution 32 bit Delta Sigma Analog to Digital converter for precise measurements.

NCP1117ST33T3G

Produces less ripple and fixed output voltage.

RESOLUTION FOR 32 BIT

RESOLUTION CALCULATION

Total count for a 32 bit ADC = $2^{32} = 4,294,967,296$

Maximum resolution is approximately 4.3 billion.

To calculate digital output code:

$$\text{ADC code} = \text{VIN}/\text{VFS} \times 2^N$$

VIN - 0.3V(consider)

VFS - Full Scale range of ADC(5V)

N = 32

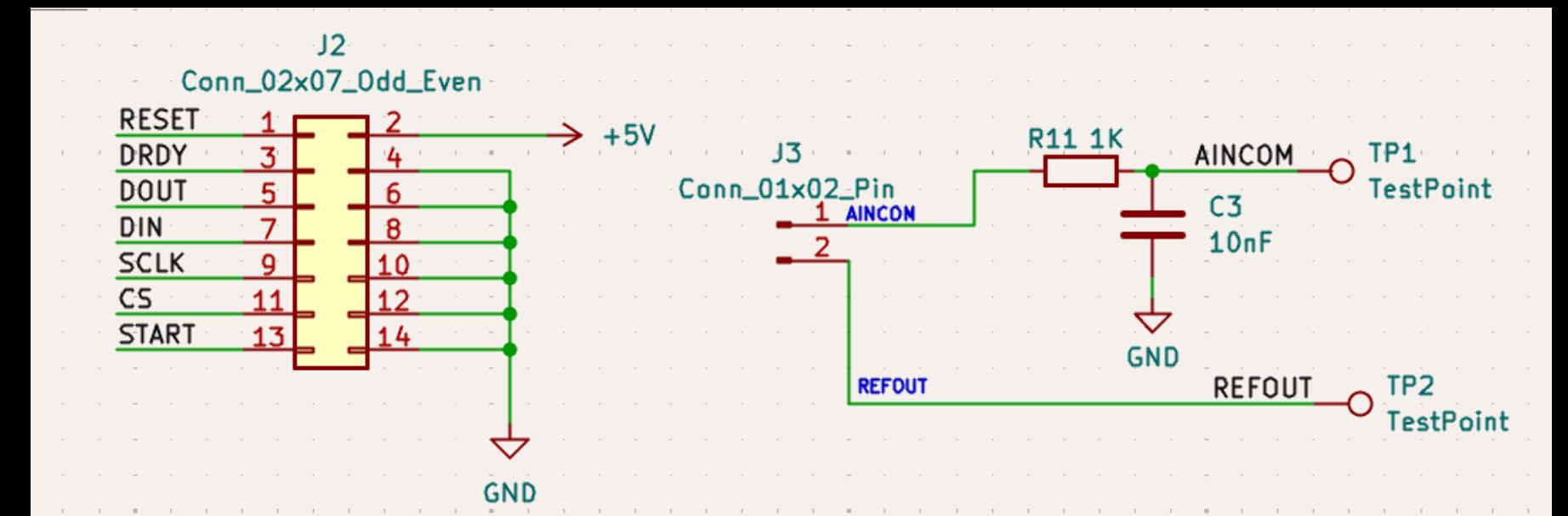
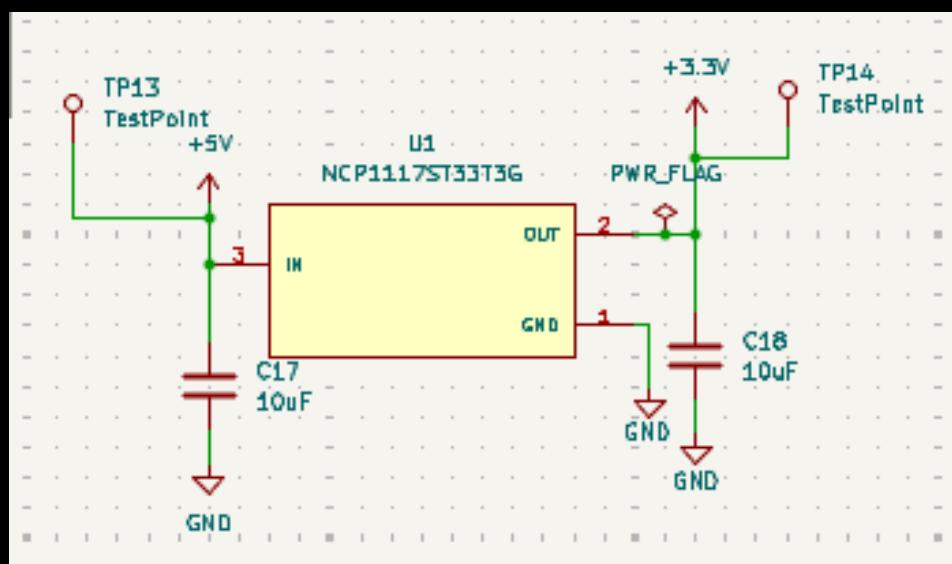
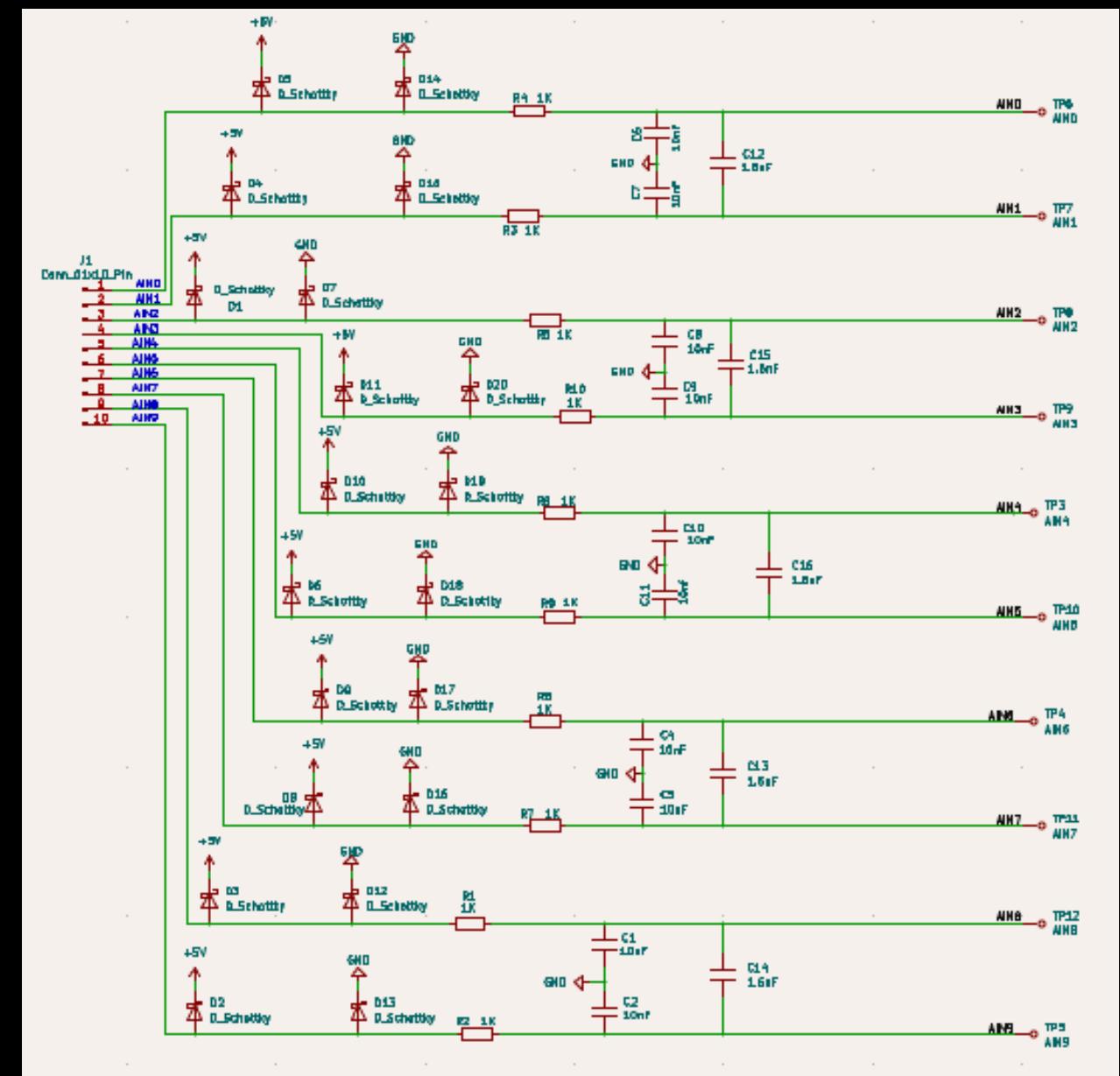
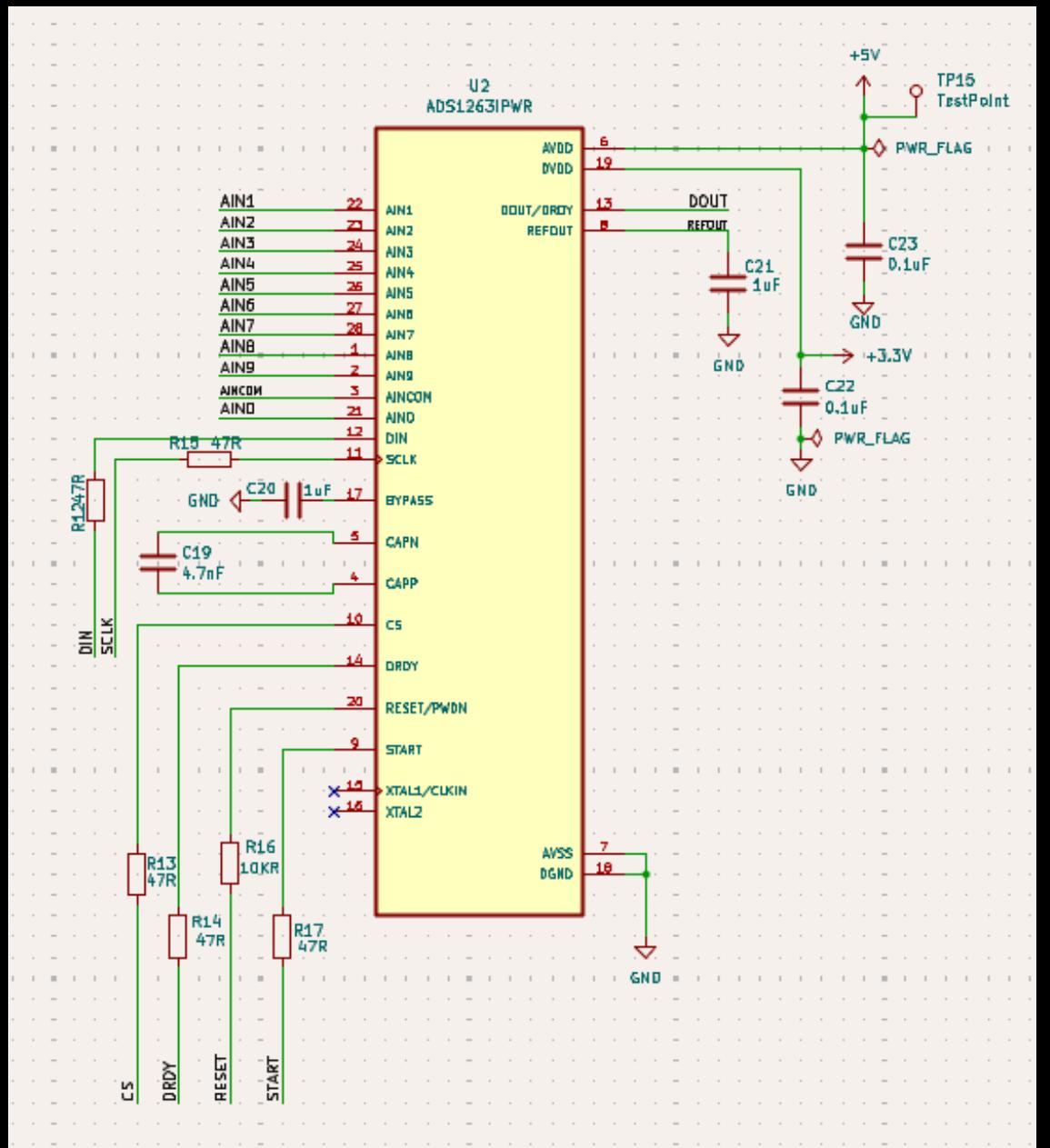
$$\begin{aligned}\text{ADC code} &= 0.3/5 \times 2^{32} \\ &= 257698037.76(\text{Decimal})\end{aligned}$$

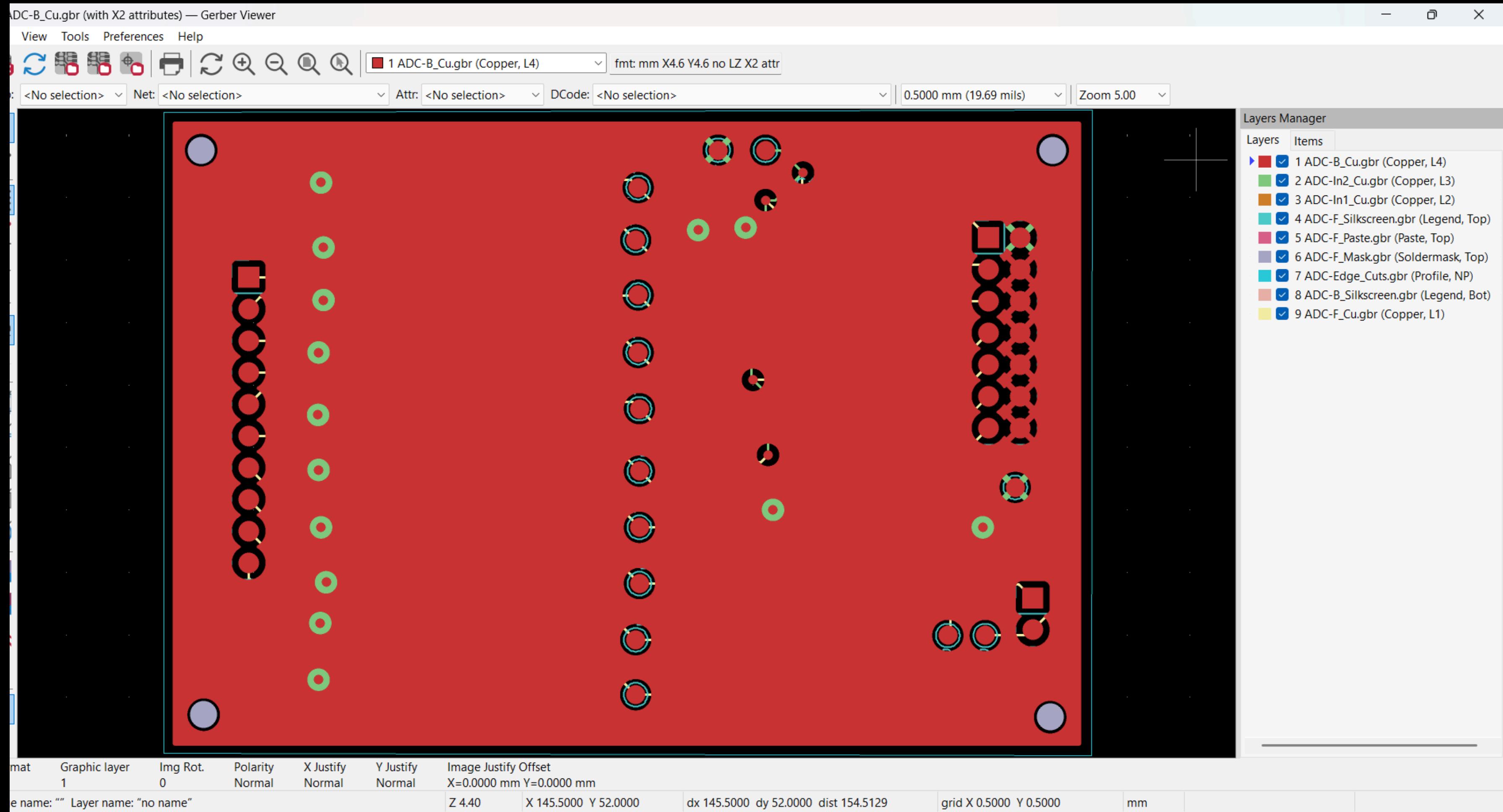
MY UNDERSTANDING

Observed how even small changes in input voltage cause large variations in digital output

Gained knowledge about separating layers on a PCB layout and making a separate layer for the ground and power according to the thermal dissipation on the board.

Understood how the noise and ripples of the voltage may cause variations to the output





PROJECT 2:

- Monitors environmental conditions (temperature, humidity, pressure, altitude) and harmful gases (CO_2 , NH_3 , alcohol, benzene, LPG).
- Uses ESP32 with BME688 and MQ sensors to estimate AQI and provide real-time readings.

METHODOLOGY

This ESP32 based system continuously collects real time air quality data using the connected sensors

AQI value is generated and categorized through the sensor values

Chose BME688 for environmental and IAQ measurement

Added MQ2 and MQ135 for CO₂,NH₃,Alcohol,Benzene,LPG

DEVELOPMENT

BME688 Detects:

- Temperature
- Pressure
- Humidity
- Altitude

This a AI integrated sensor that generates AQI value

Gives a stable AQI value after the observation for a long time

Sensor library : bsec

MY UNDERSTANDING

Understood the importance of the continuous monitoring while using BME688

Learnt about BME688 that supports AI based gas analysis

Learned how the MQ sensor readings are processed and converted into AQI category