**ECEN 4730 Board4 Report**

**Chengming Li**

**12/07/2022**

* **Circuit Design**

**Diagram, schematic

Description automatically generated**

* **Schematic and Layout**

Diagram, schematic

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A picture containing text, circuit, electronics

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* **LEDs**

**A picture containing text, electronics, circuit

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* **What worked and what didn’t work**

In this board design, the LEDs and Buzzer work as shown in the picture above. since the audio cannot be included in this document. The demo for the buzzer is not included. And the DAC, MOSFET, ADC, and 3 Power supply are working as expected. I can measure the output impedance given the voltage sources.

What didn’t work initially was the I2C bus on the shield. The DAC is working when the code only runs the DAC. And it stops working when the code runs the ADC as well. It took me a while to figure out the reason. It is because the SCL and SDA on the top side of the board are not connected to the bottom side of the board. And two Pull-up resistors are missing from the design. Thus, when the ADC comes in, the I2C can’t figure out which address it should be communicated with. Then, Arduino can’t control the DAC and ADC.

The way I fixed it was by shorting the SCL and SDA lines between the top and bottom sides of the shield and connecting two 10k resistors to the Vdd (5V).

* **What I learn from this project/ What I will do in the future**

If I get a chance to redesign this board, I will connect the SCL and SDA lines between the top and bottom sides of the shield. And I will also connect two Pull-up resistors to the I2C lines. In the future design, I will definitely have two pull-up resistors connected to I2C lines if the I2C feature is involved.

Also, I managed to solder every component to the PCB board. It was a great experience to practice my soldering skill.

In this design, I don’t have enough test points to test all crucial signals on board and enough isolation switches. Having as many test points as I need provides me a chance to debug the circuit easier and conveniently. Having isolation switched can isolate the root cause of the bugs on board. And it is easy for me to decide the root error of the circuit.

In this design, I realized that the 4-layer board provides me with a good chance to have a clear connection between the pins and have less cross-under on the ground plane.

* **Test Demo**

A screenshot of a computer

Description automatically generated with medium confidence

The above picture shows the output of the DAC when the code changes the current load. The jump of amplitude in each pulse shows the increase in the current load.

Graphical user interface, text

Description automatically generated with medium confidence

The above picture shows the measurement of the output impedance of a voltage source that is plugged into it. The 9V voltage source is connected to a voltage adapter that is connected to the wall power. From the last column, we can tell the output impedance of this voltage source is 0.13 ohm.

Graphical user interface

Description automatically generated with medium confidence

The above picture shows the measurement of the output impedance of a voltage source that is plugged into it. The 7.5voltage source is powered by the power supply from Keysight. From the last column, we can tell the output impedance of this power supply is 0.27 ohm.

Graphical user interface

Description automatically generated with medium confidence

The above picture shows the measurement of the output impedance of a voltage source that is plugged into it. The 11-voltage source is powered by the power supply from Keysight. From the last column, we can tell the output impedance of this power supply is 0.27 ohm. And, this result is pretty consistent with the value I got from the last picture. So, the output impedance of this power supply is roughly 0.27 ohm.