# **1.0 Objectives**

In this mini project you will solder the parts on the PCB that you designed in labs 4 and 5.

# **2.0 Parts List**

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| **Quantity** | **Item** | |
| --- | --- | --- |
| 1 | Printed PCB of 8 bit 2 to 1 MUX | |
| 2 | Quad 2-to-1 MUX Chip ([SN74HCT257N](https://www.ti.com/lit/ds/symlink/sn74hct257.pdf)) | |
| 2 | 16 Pin DIP IC Socket | |
| 2 | 0.1 μF Ceramic Capacitor | |
| 1 | 5mm Yellow LED | |
| 1 | 330 Ω THT Resistor | |
| 29 | Breakaway Pin Headers ([PH1-36-UA](https://www.jameco.com/z/PH1-36-UA-Adam-Technologies-Breakaway-Pin-Header-36-Position-Straight-Single-Row-2-54mm-Pitch-6mm-Pins_2288607.html)) | |
| 1 | No-clean Solder Wire | |
| 1 | Soldering Iron | |
| 1 | Copper Desoldering Braid | |
| 1 | Safety Glasses | |
| 1 | Wire Cutters | |

# **3.0 Background**

**3.1 Safety**

* Wear eye protection while soldering.
* Never touch the tip of a soldering iron.
* Don’t put a soldering iron down, put it in its holder.
* Use tweezers or pliers when handling hot solder.
* Make sure you have a wet sponge before beginning.
* Solder on a heat-resistant surface.

Soldering Safety Tips: <https://safety.eng.cam.ac.uk/safe-working/copy_of_soldering-safety>

General ISU Lab Safety: <https://www.ece.iastate.edu/the-department/safety/>

**3.2 Soldering Resources**

There are many videos and guides on the internet on how to solder. Provided are a few web links. It is recommended that you watch/read these before attempting to solder your board.

Article on How to Solder: <https://www.instructables.com/How-to-solder/>

Guide on Soldering: <https://www.youtube.com/watch?v=wTtreODwElc>

Guide on Soldering: <https://www.youtube.com/watch?v=IpkkfK937mU&t=67s>

Desoldering Basics: <https://www.youtube.com/watch?v=bG7yW9FigJA>

**4.0 Activity**

## **4.1 Solder the Capacitors, Resistor, and LED**

Solder the capacitors, resistor and LED into the correct positions. The Capacitors should go in C1 and C2, the Resistor in R1, and LED in D1. Recall that the LED is polarized, which means that it does matter in which direction it is inserted. Ensure that it is in the correct orientation.

## **4.2 Solder the Pin Headers**

Break your pin headers into 3 groups of 8-pins, 1 group of 4-pins, and 1 group of 1-pin. The groups of 8 will go into J1, J2 and J5. The group of 4 will go into J3, and the group of 1 will go into J4. Solder all of these connections in place, ensuring that they are perpendicular to the PCB.

## **4.3 Solder the 16-pin DIP Sockets for the Chips**

Solder the 16-pin DIP sockets to the U1 and U2 sections of the PCB. Remember that the orientation of the chip matters.

If you don’t have sockets you can solder the chips directly to the PCB Just make sure that the divot is oriented towards the capacitor. Make sure that the divot is facing the corresponding capacitor. This will tell you the correct orientation when inserting MUX chips later.

## **4.4 Things to Remember**

* Try to solder each joint in a few seconds. The hot soldering iron may damage your board/component left on your circuit for too long.
* Before soldering any component, double check that it is in the correct orientation. This will save you the trouble of redoing soldering joints.
* If you solder something incorrectly, refer to the background section on how to desolder a joint. There are multiple ways of desoldering. Use whichever one you are most comfortable with.
* Before you put the soldering iron back into the holder, use the sponge to clean the tip.

# **5.0 Testing**

Just because you soldered your PCB does not mean that it is working. There could be design errors, soldering errors, or cold solder joints. You need to test it to verify its functionality.

## **5.1 Create a Testing Circuit**

In previous labs you have used a testing circuit to verify the functionality of your breadboard circuits. Now you will be building one of your own. There are different ways to design your testing circuit, but the basic requirements are listed below.

At the very least, your testing circuit should have:

* two 8-bit inputs and one 8-bit output
* eight LEDs to display the output
* two 8-pin dip switches to provide input values
* a select switch.

## **5.2 Test your Testing Circuit**

Perform some tests to check whether your testing circuit provides correct values. It is recommended that you use a multimeter to ensure that your switches are correctly wired to the buses.

## **5.3 Test your PCB**

Insert your PCB into an empty breadboard. Connect the testing circuit into the PCB. Power the tester circuit using a breadboard power supply

Then, design and perform tests (similar to the ones in lab 3) that verify your PCB version of a bus mux. Power the tester circuit using a breadboard power supply.

For example, ensure that when the select line is low, the output shows the value of input A from the first eight switches. Similarly, when select is high, the output must show the value of input B from the second eight switches.

Once you have completed all tests, show your results to the TA.