**Soldering and Part Placement**

See the Chapter 3 of the MIT 6270 Manual for information on electronic assembly, including soldering techniques and component mounting.

**Construction Information**

- All solder connections are through-hole, which means that the components go through the small holes and are soldered on the reverse side.
- An assembled board is shown in Figure 0. Side views are shown in Figures 1 and 2. A bottom view is shown in Figure 3.
- Make sure to solder the LED, diodes, resistors, capacitors, headers, etc., flush to the board, as shown in Figure 4 (not as shown in Figures 1 and 2).
- All components should be placed inside their outlines. Outlines are shown clearly in the PCB layout in Figure 5.
- Practice soldering before soldering the parts onto your board.
- All components are placed on top of the board **EXCEPT the long 3-pin and 2-pin single row headers** (shown in Figures 8 and 9) and the banana plugs shown in Figure 3.
- Do not directly touch the solder to the iron; instead, indirectly melt the solder through the lead of component.
- Never rest the soldering iron on the bench top. Instead, always use the soldering iron holder.
- When you are done soldering, cover the soldering iron tip in solder. This will prevent tip oxidation and will lengthen the life of the soldering iron tip.
- If you are ever unsure of a capacitor value, go to a capacitor calculator website and type in the numbers on the capacitor to determine its value.

**Figure 0:** Picture of assembled board. Parts are on top.

**Figure 1:** Front view of the assembled board.

**Figure 2:** Back of the assembled board.

**Figure 4:** Part placement should be flush with the board.

**Figure 3:** Bottom view of the assembled board.

**Figure 5:** Board layout with component labels.
Construction Procedure

1. See Figure 6 for a (repeated) layout (shown in two orientations) with component labeled.

2. Insert the mini USB port into the top of the board into the hole labeled P2 see Figure 7. Solder this connector from the bottom of the board. **Have the TA check your soldering.**

3. Insert (from the top) the 1N5817 diode into holes marked D1 and the 1N4002 into D2 (verify with your TA that the diode line (marking the cathode) matches up with the line on the PCB. Solder and then clip.

4. Insert (from the top) the 330Ω resistor through the holes labeled R1. Solder the resistor in place on the bottom of the PCB and then clip the leads.

5. Insert the DC-to-DC Converter (TPS67351 8-pin dip) the hole labeled U1. Before soldering ensure that the dot on the chip corresponds to the dot on the PCB layout in Figures 5 and 6. Solder from the bottom.

6. Insert the LED into holes marked D3. The long leg goes into the hole closer to the mini USB port and the short leg goes through the hole on the side of the image with the line. (The flat side of the LED lines up with the flat side of the image. If you are unsure, have your TA check the position of your LED before soldering.)

7. Insert and then solder the 1μF capacitor into holes C2, the 82 pF capacitor into holes C5, and the 0.1 μF capacitor into holes C6. The orientation of these capacitors does not affect the circuit because they are ceramic (non-polarized) capacitors.

8. Insert and then solder the 47 μF tantalum (polarized) capacitor into holes C1 such that the + is in the hole on the board that has a + symbol (not the – symbol) and solder on the bottom. Repeat with the 100 μF capacitor in holes C3.

9. Insert and solder the 100 μH inductor into the holes marked L1.

10. Insert and then solder one of the 10 μF (polarized) capacitor into holes C4 in the proper orientation. (The negative side if this capacitor is the side with the gray stripe, as can be seen in Figure 0). Repeat with a second 10 μF (polarized) capacitor in holes C7.

11. Insert one of the 3-pin single row headers into holes marked S1. **Make sure to insert the short ends through the top of the board so that you can solder the short pins from the bottom and the long pins are on top.** See Figure 8 for a picture of the single row headers:
installed on the PCB. Solder the pins in place from the bottom of the board.

12. Cut the other 3-pin header to make it into a 2-pin header and insert and solder it into S2, as you did with S1 (on the middle top of Figure 9).

13. Insert and then solder the (non-polarized) resettable fuse (i.e., the part labeled x50) into holes marked PTC1.

14. Insert 4-pin sockets into each of the holes marked J2 and J4 on the corners of the PCB. Solder the sockets in place from the bottom of the board. (J1 and J3 can be soldered, but will not be used in 3701.)

15. Insert the USB connector into holes marked P1. The opening of the port should be hanging off of the edge of the board. This set up can be seen in Figure 10.

16. Insert the voltage regulator (from the top) into holes marked U2. The voltage regulator is a 3-pin device with a metal heat sink on its back. The metal heat sink should be adjacent to D2 part, i.e., facing the inside of the PCB.

17. Ask your TA for 2 jumpers. One will be used to connect pins 2 and 3 of S1 (the center pin and the pin marked WALL) and the pins of S2 as seen in Figure 11. Note the red circled part in Figure 9. The WALL/USB labels are reversed in this figure.

18. Use one of each of a screw, a washer, and a banana plug to assemble the mechanical (and possible electrical) connections to your breadboard. (In 3701, we will NOT use the banana plugs for electrical connections to the breadboard.) Insert the screw through the nut and then into one of the large holes on the top of your PCB. Screw in the banana plug from the bottom of the board (see Figure 12). Assemble the second banana plug connection through the second large PCB hole.

19. When you are done soldering (not just today, but each time you solder), cover the soldering iron tip in solder. This will prevent tip oxidation and will lengthen the life of the soldering iron tip.

**Testing**

Your TA will test your board for you. Bring your TA your completed board. Your TA will do the following:

1. Plug the board into your computer using a USB to mini USB cable. The LED should turn on.
2. Verify that the proper voltage is available at each of the sockets (J1 through J4).

**Schematic**

The schematic for the Power Board is shown in Figure 13.
Figure 13: Power Board schematic.
Using the Power Board
Figures 14 through 16 show the Power Board and CPLD Board mounted on a breadboard.

Wall power should **NOT** be fed to the breadboard without first modifying the jumpers. The jumper labels on S1 are reversed, i.e., when the jumper is on “WALL” it means that the power comes from the computer’s USB; when the jumper is on “USB” it means that the power is coming from the “WALL” (through a connection to the banana plugs). The S2 jumper is used as a power switch to the Power Board. The S2 jumper should be off when you want power off and on when you want power.

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*Figure 14:* Side view of proper placement of Power Board and CPLD Board, with proper breadboard power connections.

*Figure 15:* Top view of proper placement of Power Board and CPLD Board, with proper breadboard power connections.

*Figure 16:* Top view of proper placement of Power Board, CPLD Board, USB Blaster, with proper breadboard power connections.