

Skills: Fundamentals of Soldering

A skill you will learn during this lab activity is how to safely use a soldering iron to assemble an electronic circuit. **Soldering** is a method of connecting electronic components to a circuit board (Figure 1) without discrete wires. An **electronic component** is a device that performs some function in a circuit. A **circuit board** is a piece of laminated fiberglass with copper trace on either one or both sides (sometimes on the inside, too). The copper traces act as conductors and connect our components together. The circuit board is designed based upon a schematic which is a symbolic representation of our circuit.

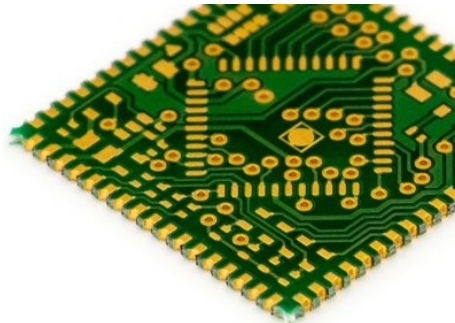


Figure 1: A printed circuit board

Soldering uses a wire composed of lead and tin (refer to Figure 2: Solder wire) which melts at a high temperature, around 190°C, to join the components to the circuit board.



Figure 2: Soldering station set up

The soldering iron heats up both the component and the board to temperatures well above the melting point of our solder wire. Then, the solder is manually fed to the joint between the circuit board and component so that it melts and surrounds the joint. (Refer to Figure 3).

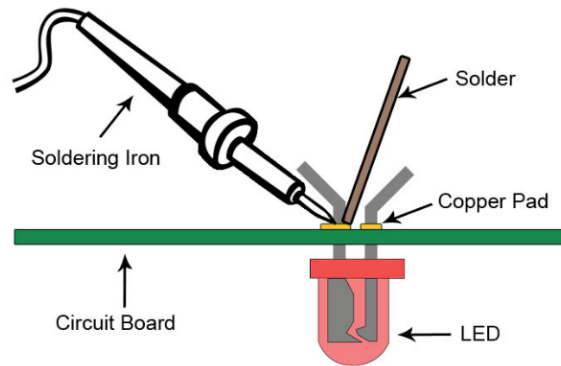


Figure 3: How to solder

Once the solder cools down and solidifies, the joint is secure both mechanically and electrically. Soldering is a semi-permanent method of joining components. When a component needs to be replaced the solder can be reheated, melted and the component removed. The ability for soldering to be both mechanically and electrically secure as well as non-permanent makes it the best method for joining components to a printed circuit board.

Soldering is very much a skill and requires practice. A good joint needs to be clean and hot. Refer to Figure 4 below to see the difference between various joints.

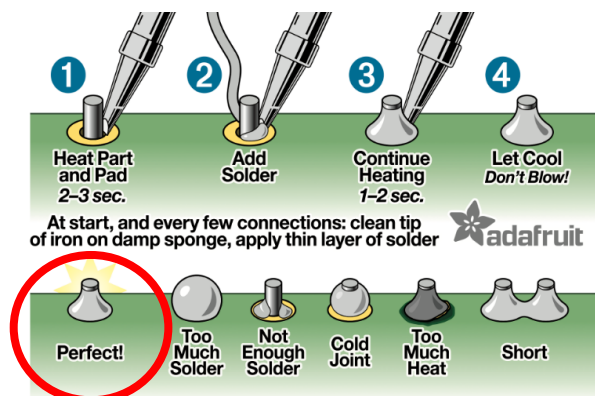


Figure 4: Top. How to solder; Bottom: Different joints

A bad joint looks crusty, non-uniform and won't provide a good electrical connection. We aim for the perfect joint as shown in the figure above. **Avoid any of the other joints.** Ask for help if needed.

If you have trouble making a good joint, either there are contaminants or the joint is not hot enough. Every metal in an oxygen environment oxidizes so your circuit board and components will be covered in a thin layer of oxide which prevents the solder from "sticking" to them. Rosin core solder wire has a core of rosin flux which is a compound that removes the layer of metal oxide when heated. With the oxide removed, the solder will more easily flow into the joint forming a good connection. Once the surface is clean and hot the solder will form a good connection due to the surface tension and attraction to the clean surfaces.

Please watch this video on soldering prior to doing a soldering lab:

<https://tinyurl.com/y8qtcc7p>

Please refer to the safety manual before you start soldering.