GT's quick guide to soldering.

A few slides to get you up and running so that you can do Club projects.

Or here are a couple of youTubes that I like.

- https://www.youtube.com/watch?v=Qps9woUGkvI
- https://www.youtube.com/watch?v=6rmErwU5E-k

It's all about heat transfer.

Soldering iron

- Left – Hakko FX-888D. Digital temp display. Comes with a sponge and copper wool for tip cleaning
- Right – Weller WES51. WE101NA has digital display. Also has auto shut-off.
- Both around $100.

Tip

- Chisel tip, 1/32 inch or 1/16 inch.
- “Pointier” tips don’t work well — they don’t transfer heat as effectively.

Solder and flux

- Tin - lead composition, 60%-40% or 63%-37% alloys are common.
- (Lead-free solders are difficult to use. Probably should be avoided by rookies new to soldering.
- Most solder wire has “flux” incorporated. Flux is an acid that dissolved oxides that form on the surface of copper and other metals.
- Kester is common brand. Check out their website. (kester.com) for lots of into.
- Flux can also be applied manually, if needed.

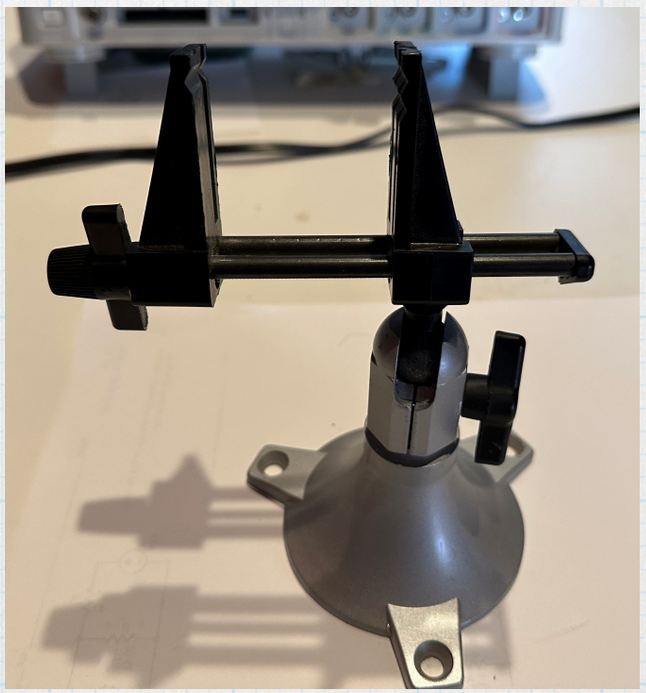
Hand tools

- Wire cutters.
- Needle-nosed pliers.

For small parts (or old eyes):

- Tweezers.
- Magnifying glass.
- Good light.

A vise can be helpful to provide a “third hand”.

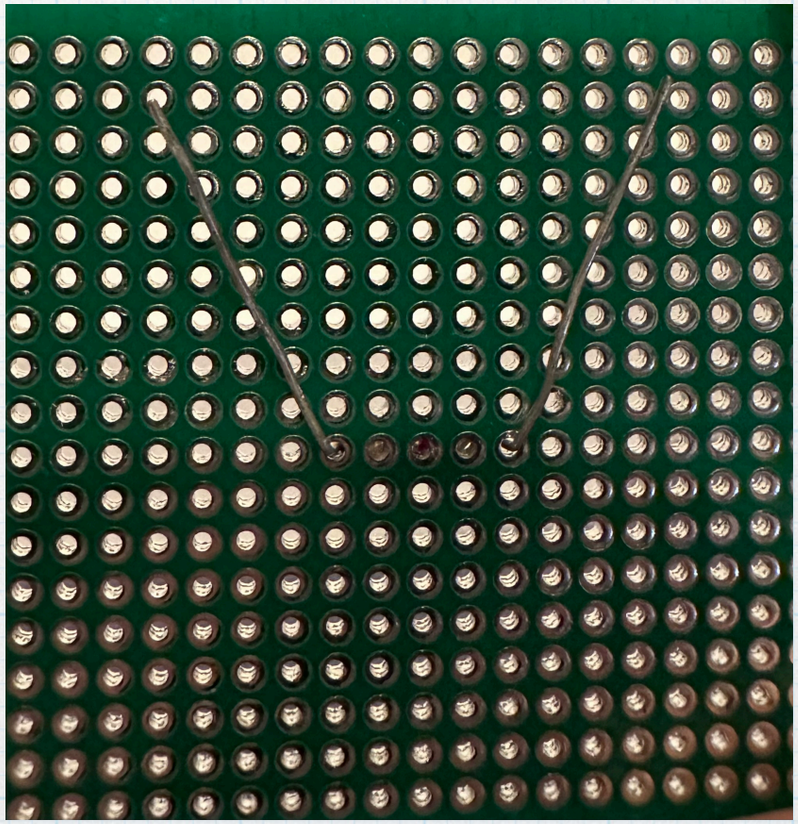


Keep the soldering-iron tip clean

- The soldering iron is made with iron (duh) and it is hot. Therefore, it tends to oxidize rapidly.
- Oxides on the tip will inhibit the flow of heat.
- An oxidized tip will have a dull gray appearance, and it will be difficult to heat the leads sufficiently to melt the solder.
- To keep it clean, wipe the tip on the wet sponge. Or scrub it in cooper wool, if available. This will break up the oxide and keep the tip clean and shiny. Do this frequently.
- If the tip is especially grungy (or brand new), it may be necessary to "tin" it by melting some solder directly onto it. Then wipe it on the sponge to get the desired smooth and shiny appearance.

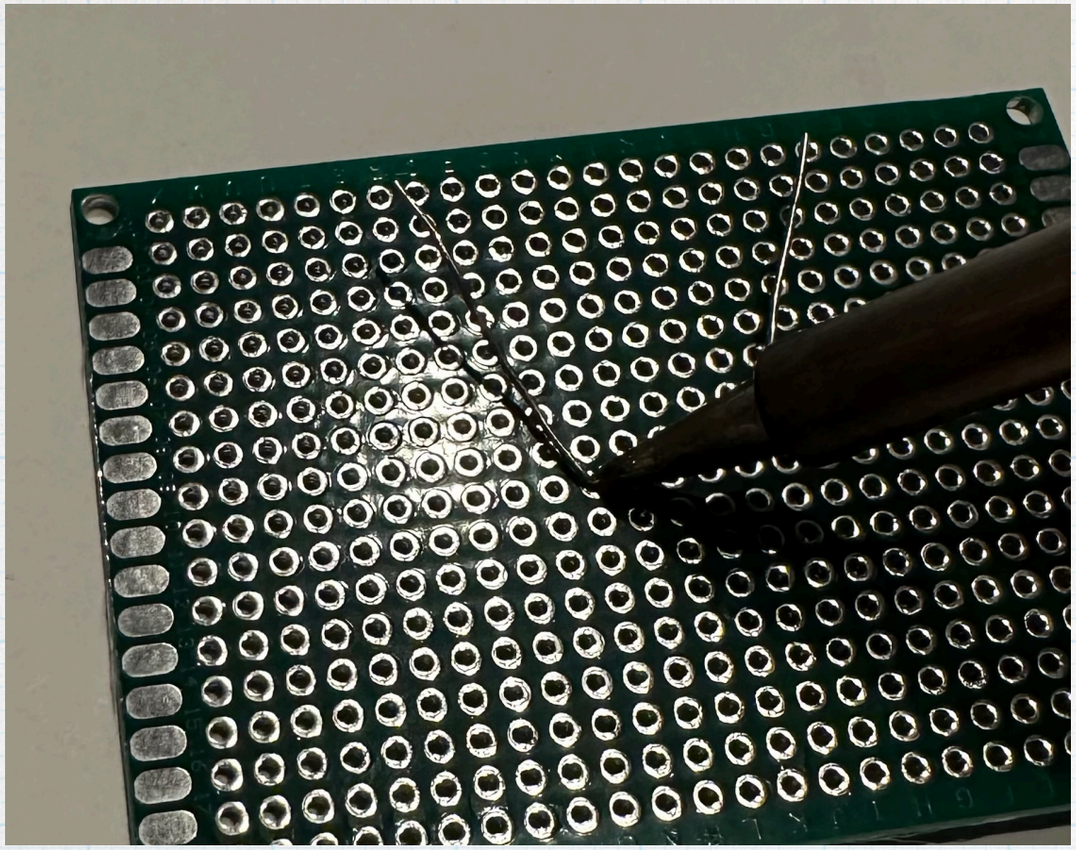
Get Ready

- A good starting temperature for the soldering-iron tip is about 650°C. Give the iron a minute or two to get up to temperature.
- Put the component leads through the vias from the front side of the board.
- On the back side, bend the leads to help hold the component in place.
- Use the sponge or copper wool to make sure the tip is clean.

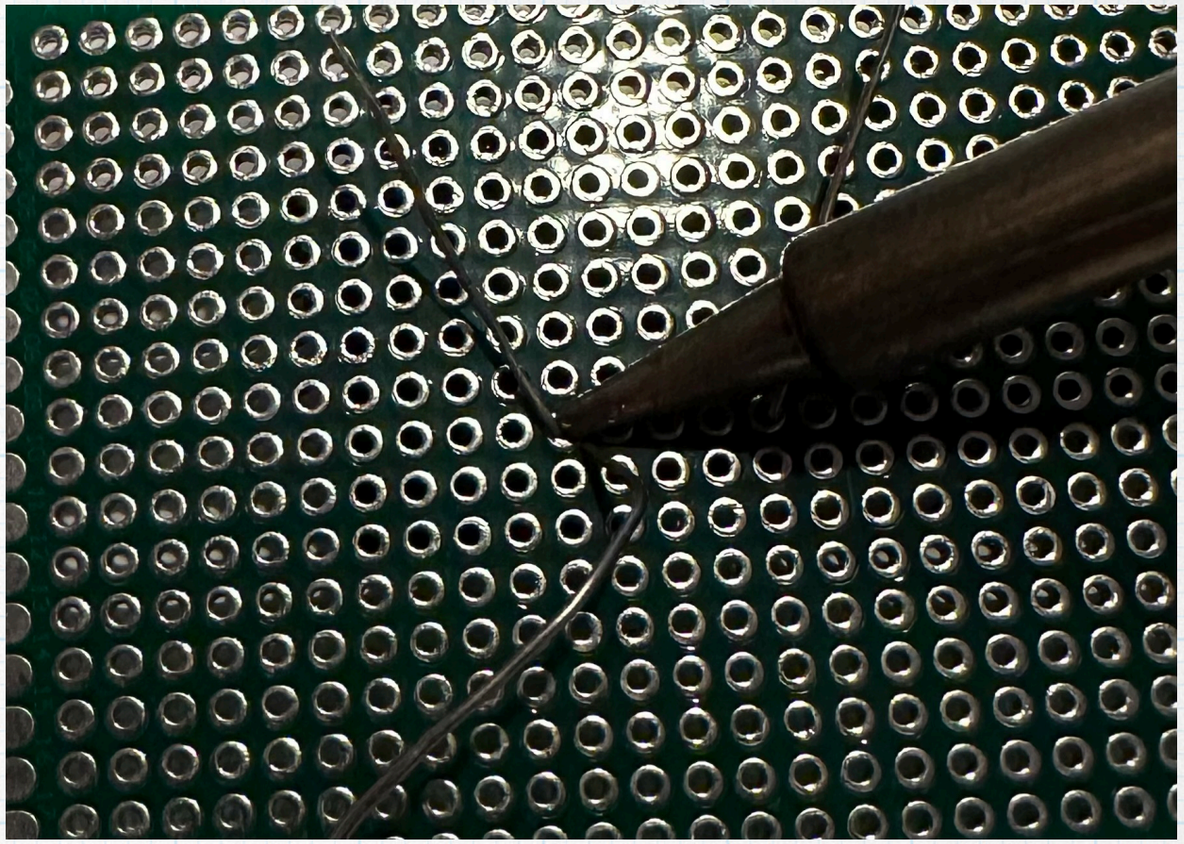


Basic approach

- The goal is to get liquid solder to flow onto and around leads that are be joined.
- To do that, you heat the leads, not the solder.
- Place the soldering-iron tip in solid contact with the lead and the metal on the via. Hold in place for several seconds to heat the lead for several seconds.
- Then touch the solder wire to the heated lead. If it is hot enough, the solder will melt and the liquid will flow around the leads. Add enough solder so that the via appears to be “filled”.
- Remove the solder wire, and then remove the soldering iron. Don’t let the lead shift or contact may be broken.
- Wait a few seconds for the solder to cool. (Don’t blow on it.)
- If the soldering was successful, there should be a conical of “shoulder” of solder around the lead. If the solder balls into a shiny spherical blob, the process has probably failed with insufficient contact between the metal leads and the solder. Try again.

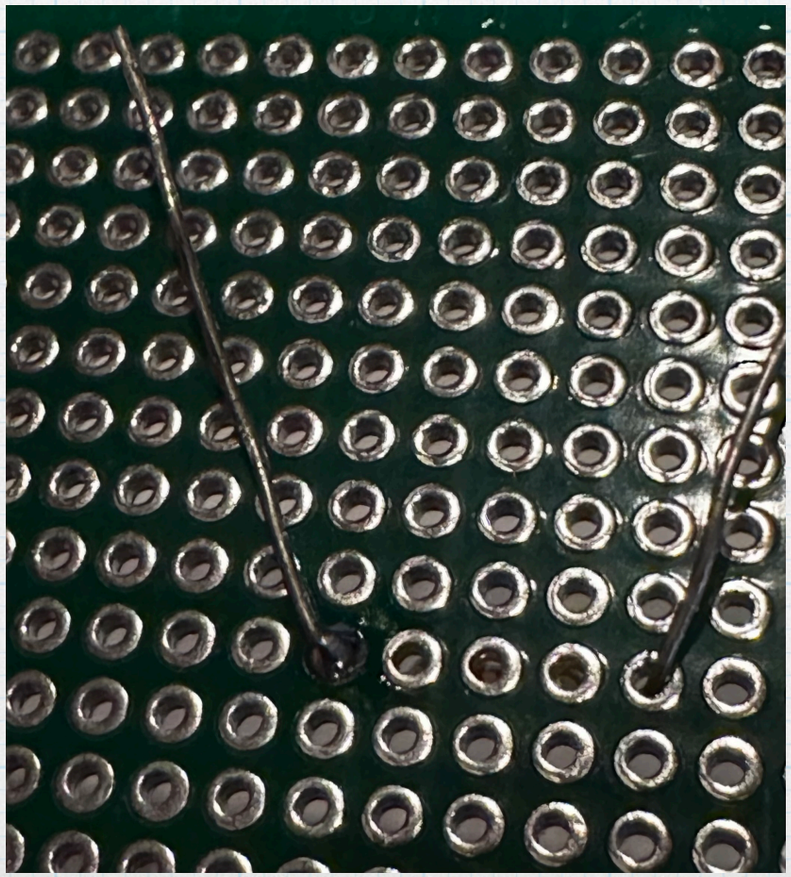


Heat



Solder

Cool



It takes a bit of practice, but once you get the hang of it, you should be able complete each solder joint quickly in a few seconds.

Ground planes & thermals

Many of our project PCB used ground planes, and these can cause a bit of difficulty when soldering. Having ground planes means that the two sides of the board are mostly covered with a layer of copper that serves as ground in the circuit. Being relatively large, the ground planes are good conductors for current. However, that means that they are also good conductors for heat, which causes some problems with soldering. When trying to solder a lead to the ground plane, the thermal energy from the soldering iron quickly diffuses away into the surrounding copper, making it more difficult to heat the lead to a high enough temperature to melt the solder.

Thermals

A partial solution to the soldering problem is to reduce the area of contact between the ground plane and the metal of the through-hole, as shown at right. Basically, instead of having contact around the entire periphery of the through-hole opening, smaller “fingers” are used. This is a trade-off between maintaining good electrical conduction while reducing heat conduction. In PCB jargon, this arrangement is known as a “thermal”.

The thermals help, but it will still be more difficult to make solder connections to the ground plane. It will be necessary to get more heat into the connection to melt the solder. Things to do:

1. Hold the soldering iron tip on the lead longer before trying to melt the solder into the joint. It may take 2 or 3 times longer to heat up.
2. Increase the temperature of the soldering iron. Bump up by 25°C, 50°C, or even 100°C.
3. Use a bigger soldering iron tip to get better thermal contact.

But mainly, be patient.