

How to Solder

by Alpenglow Industries

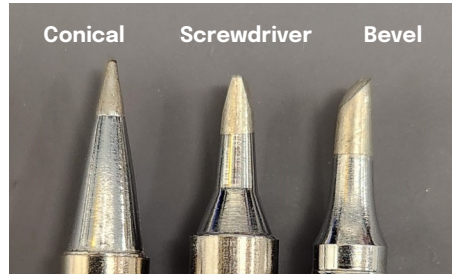


This one skill can open up a world of creating and making, either as a hobby or for a job. Are you ready to build a circuit board? Keep our online Guide to Supplies & Safety handy to learn more as you go.



- Important Safety Tips:**
- ◇ Always wash your hands after soldering
 - ◇ Wear eye protection
 - ◇ Avoid burns, don't touch hot metal iron parts
 - ◇ Have good ventilation
 - ◇ No flammable surfaces or objects nearby

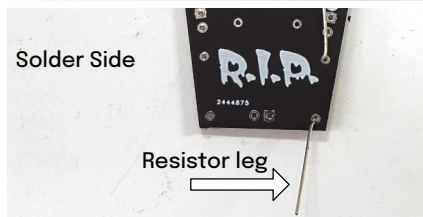
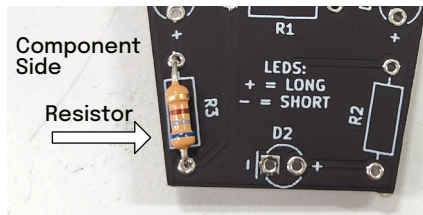
- 1 Make sure the proper tip is installed in your soldering iron. A small screwdriver or bevel tip (also called chisel tips) are good choices, though a conical tip that is not too pointy is OK too.



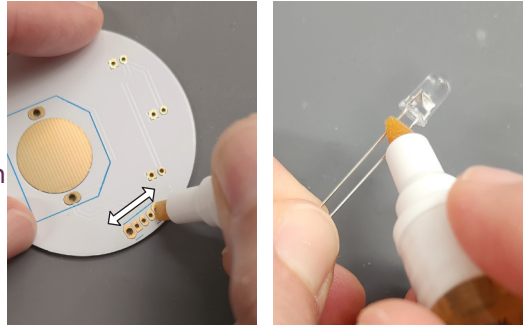
- 2 Turn your soldering iron on and set it to 750F or 400C (for lead-free solder)



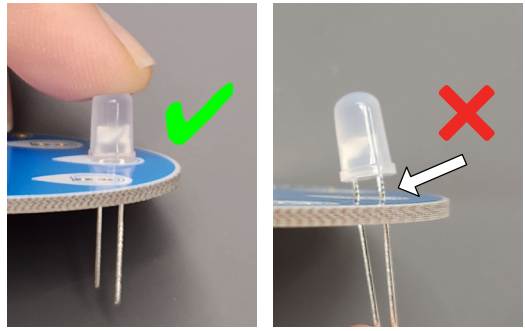
- 3 Follow the instructions on your kit to see which component you should place and solder first. The component will go on the side of the board with the outline and number (called a reference designator). Its legs will go through the board, and you'll solder them to the opposite side.



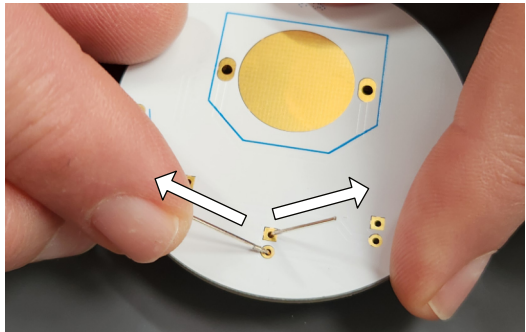
- 4 Paint a small amount of flux on the pads for the component you are about to solder. For through-hole components, you can also flux the leads where they'll contact the board.



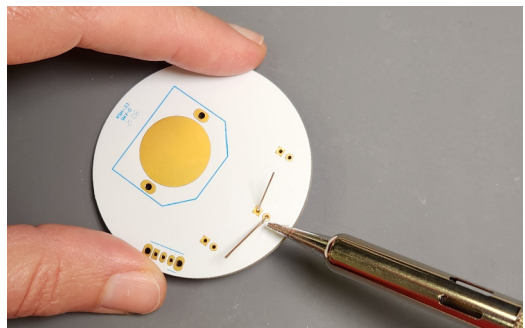
- 5 Place the component through the board, and make sure it's sitting flush or as close to the board as possible. Direction matters with some components like LEDs, read the instructions for your kit!



- 6 Turn the board over. On some components, you can bend the legs about 45°, to keep them from falling out.



- 7 Rotate the board so that the component is at a comfortable angle to your soldering hand. You may want to tape the board down to the table to keep it from moving while you're soldering.



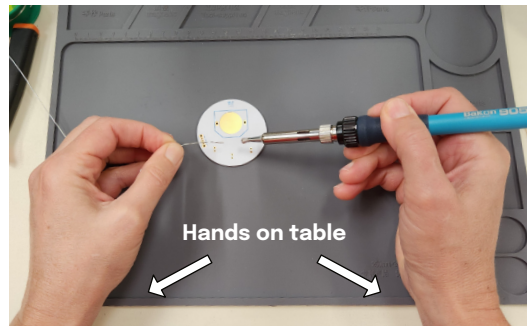
- 8** Pick up the iron with your dominant hand and hold it like you would a pencil. You'll have better control when you hold it as close to the tip as you can. It's OK if it feels a little warm!



- 9** Wipe off the tip with brass wool using a firm backwards pull, repeat 2-3 times. There should be no chunks of solder on the tip, and the tip should be shiny.

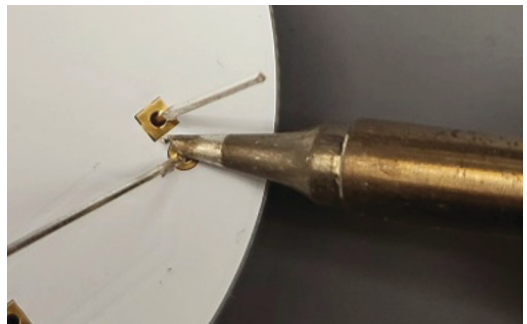


- 10** Pick up a strand of solder with your other hand. Lead-free solder with silver content is best, it will be marked "SAC: or "Sn/Ag/Cu".

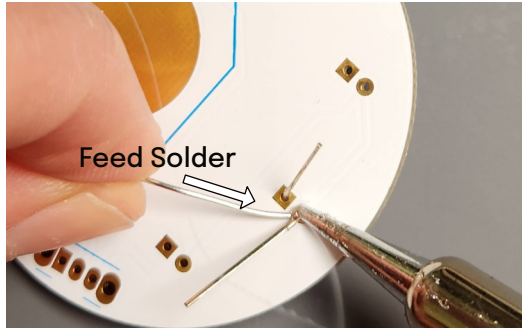


- 11** Place the sides of both hands on the table for stability. If you try to solder with both hands in the air, your hands will shake more and it'll be harder.

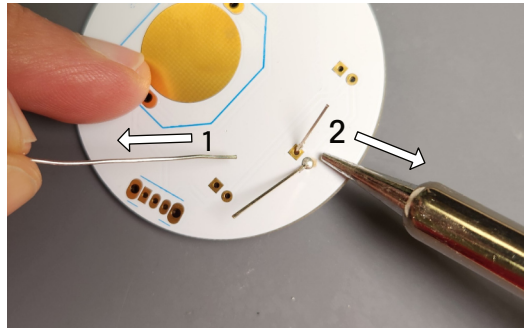
- 12** Touch the side of the tip of the iron to both the pad and the component. Use gentle but firm pressure.



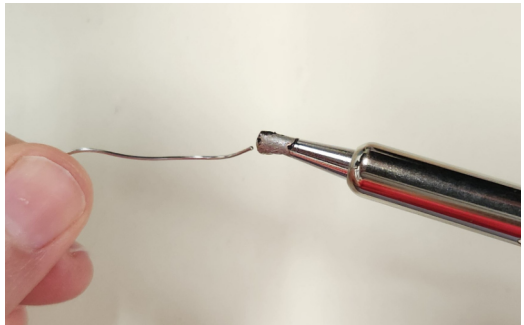
- 13** Touch the solder to the tip of the soldering iron, as close as you can to where the tip, pad, and component meet. Feed solder in as it melts, it should flow to the pad and around the component legs.



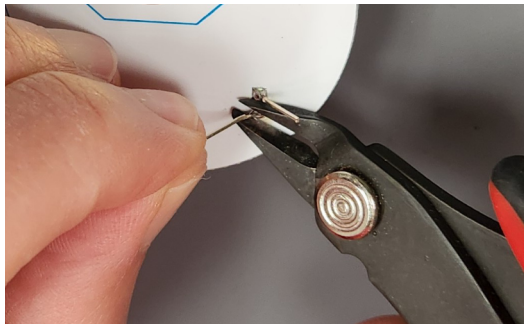
- 14** Pull the solder away, then remove the iron. A light swipe up the leg as you take the iron away will result in a nice, smooth fillet.



- 15** Coat the tip of the soldering iron with solder before putting it back in the holder. This prevents tips from oxidizing and going bad quickly,

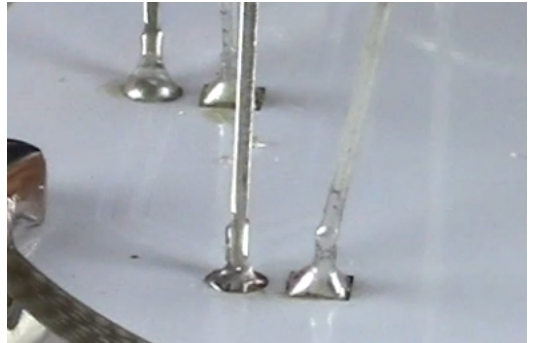
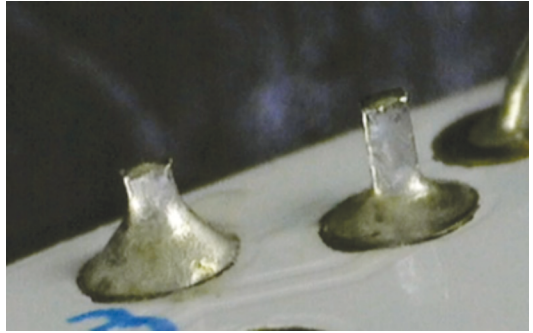


- 16** Clip any long leads, making sure to hold them as you clip so they don't fly into someone's eye.



GOOD JOINTS

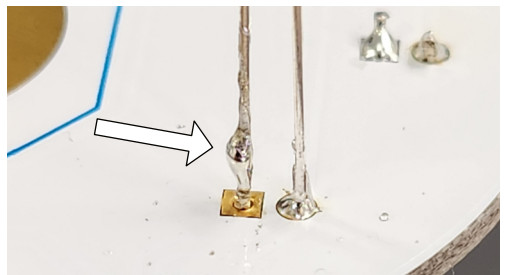
A perfect solder joint looks like the tip of a teardrop. Don't worry if yours is a little blobby, as long as it isn't close to touching another pad or leg next to it, it will work!



BAD JOINTS – *Not Enough Solder*

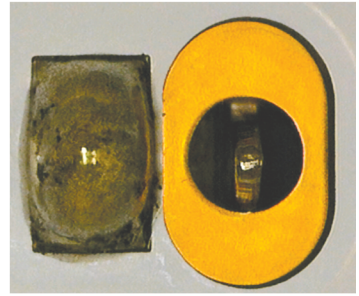
The photos to the right show solder not flowed to the component leg, and solder not flowed completely around the pad. The solution is to add more solder.

The left leg below has solder balled up on it, but not flowed to the pad. You can try adding flux, then reflowing the solder ball on the leg, and then dragging it down to the pad. Or you can make sure your soldering iron is firmly touching the pad, then add solder at the level of the pad.

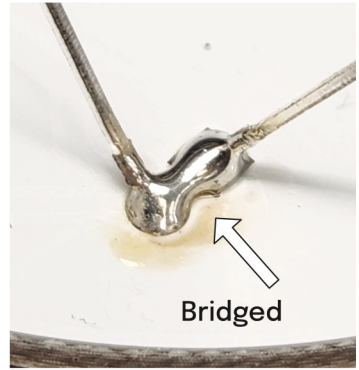


BAD JOINTS – *Too Much Solder*

In the top image, the left pad has too much solder and is in danger of touching the pad next to it, causing an electrical short circuit. You may be able to remove a small amount of solder by wiping upward with the tip of the iron, then wiping the excess off the tip with brass wool. Repeat a few times.



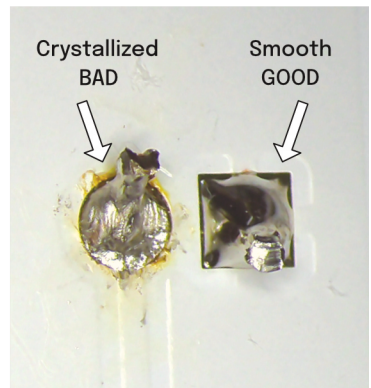
In the bottom image, the pads are "bridged" by solder and definitely causing a short circuit. You can try the wiping technique, but you'll probably need to use solder wick. We have tips on using solder wick at the QR code on the cover of this pamphlet.



BAD JOINTS – *"Cold" or Crystallized*

This is the most common type of bad solder joint. When solder is heated for an extended time, or heated and cooled over and over again, all of the flux can boil off and the joint can become crystallized. This is known as a "cold" solder joint because it can also happen when the iron temperature is set too low. A cold solder joint won't be as strong, it won't conduct electricity as well, and it can crack and cause your circuit to be intermittent or not work at all.

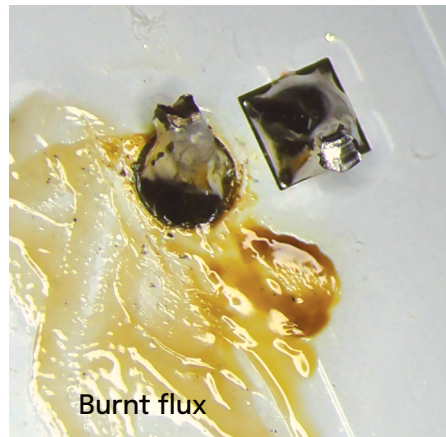
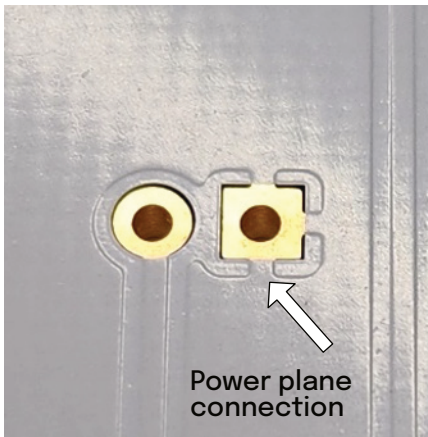
With lead-free solder, the solder should look very shiny when it first flows, then when the iron is taken away, it'll cool and turn cloudy. As long as the joint is smooth and curvy, this is a good joint. But if the solder never gets shiny when heated, or if it looks blocky and jagged when cooled, this is a cold solder joint. To fix a cold solder joint, just add flux and reflow it.



TROUBLESHOOTING

If your solder just won't flow, review these things:

- ◇ Check your iron to make sure it didn't go to sleep and that it's at the proper temperature.
- ◇ Check your tip and see if it's overly oxidized (black that won't come off), it may need to be replaced. If you have a hard time melting solder directly onto the tip (if it just forms a ball on the end of the solder wire), this is likely.
- ◇ Check your lead-free solder label and make sure it contains Silver (Ag).
- ◇ Try adding more flux. Rosin RMA may work better than No-Clean.
- ◇ If there's burnt flux residue around your joint, you may need to clean it with isopropyl alcohol and start over with fresh flux.
- ◇ The pad may be connected to a power plane and simply need more time with the iron on it to heat up. If there's a "+" shape extended from the edges of the pad, this is the case. A clean surface and fresh flux is helpful.

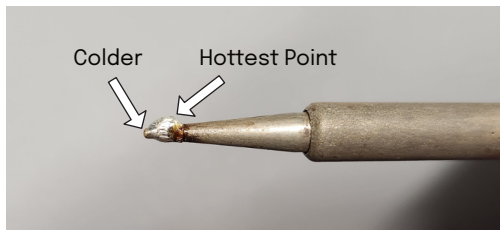


Also check out our **Learn to Solder** video on our **YouTube channel**:
<https://www.youtube.com/@alpenglowind>



TIPS & TRICKS

- ◇ Solder always flows to the hottest part of the iron, which is why solder forms a ball just before the tip. Use the side of the tip to solder, not the very point of the tip. It will flow more quickly and smoothly.
- ◇ If the solder is in the wrong place on your component or pad, you can always reflow it. Just add flux, then reheat the solder using the iron tip to guide it to where you want it to go. If solder is too far up on a component leg, you can drag it down to the pad. You don't need to add more solder unless there's not enough there in the first place.
- ◇ If you find your hands are in an awkward position, rotate the board to a position that's more comfortable. Remember to stabilize your hands by resting them on the table. If your board is wiggling around on you, tape it down.



As with any new skill, it takes practice to get good at it! Get several soldering kits, starting with simple ones so you can finish a project quickly and successfully. Then build ones with a lot of components so that you get a lot of practice. After you've gotten good at through-hole kits, try a surface mount soldering kit and challenge yourself with smaller and smaller components.

We hope you'll solder awesome projects together for years to come! Show us what you've made on social media, follow us, and join our newsletter for more great kit and project ideas.

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