Building and Soldering Tips[1]

Thanks for buying a CPUville kit. Here is what you need to build it:

1. Soldering iron. I strongly recommend a pencil-tip type of iron, from 15 to 30 watts.
2. Solder. Use rosin core solder. Lead-free or lead-containing solders are fine. I have been using Radio Shack Standard Rosin Core Solder, 60/40, 0.032 in diameter. Use eye protection when soldering, and be careful, you can get nasty burns even from a 15-watt iron.
3. Tools. You will need needle nose pliers to bend leads. You will need wire cutters to cut leads after soldering, and possibly wire strippers if you want to solder power wires directly to the board. I find a small pen knife useful in prying chips or connectors from their sockets. A voltmeter is useful for testing continuity and voltage polarity. A logic probe is useful for checking voltages on IC pins while the computer is running, to track down signal connection problems.
4. De-soldering tool. Hopefully you will not need to remove any parts from the board, but if you do, some kind of desoldering tool is needed. I use a “Soldapullt”, a kind of spring-loaded syringe that aspirates melted solder quickly. Despite using this, I destroy about half the parts I try to take off, so it is good to be careful when placing the parts in the first place, so you don't have to remove them later.

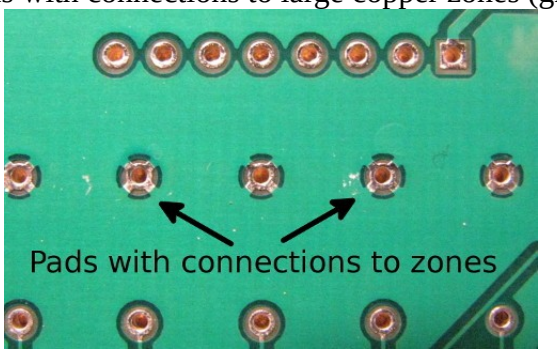
Soldering tips:

1. Before you plug in the iron, clean the tip with something mildly abrasive, like steel wool or a 3M Scotchbrite pad (plain ones, not the ones with soap in them).
2. Let the iron get hot, then tin the tip with lots of solder (let it drip off some). With a fresh coat of shiny solder the heat transfer is best.
3. Wipe the tinned tip on a wet sponge briefly to get off excess solder. Wipe it from time to time while soldering, so you don't get a big solder drop on it.
4. All CPUville kits have through-hole parts (no surface-mounted devices). This makes it easy for even inexperienced hobbyists to be successful.
5. The basic technique of soldering a through-hole lead is as follows:
    1. Apply the soldering iron tip so that it heats both the lead and the pad on the circuit board
    2. Wait a few seconds (I count to 4), then apply the solder.
    3. Apply only the minimum amount of solder to make a small cones around the leads, like this:

1 These are generic building tips that apply to all CPUville kits. The photos may not be from the same kit you have purchased.

This is only about 1/8th inch of the 0.032 inch diameter solder that I use. If you keep applying the solder, it will drip down the lead to the other side of the board, and you can get shorts. Plus, it looks bad.

4. Remove the solder first, wait a few seconds, then remove the soldering iron. Pull the iron tip away at a low angle so as not to make a solder blob.
5. There are some pads with connections to large copper zones (ground planes) like these:

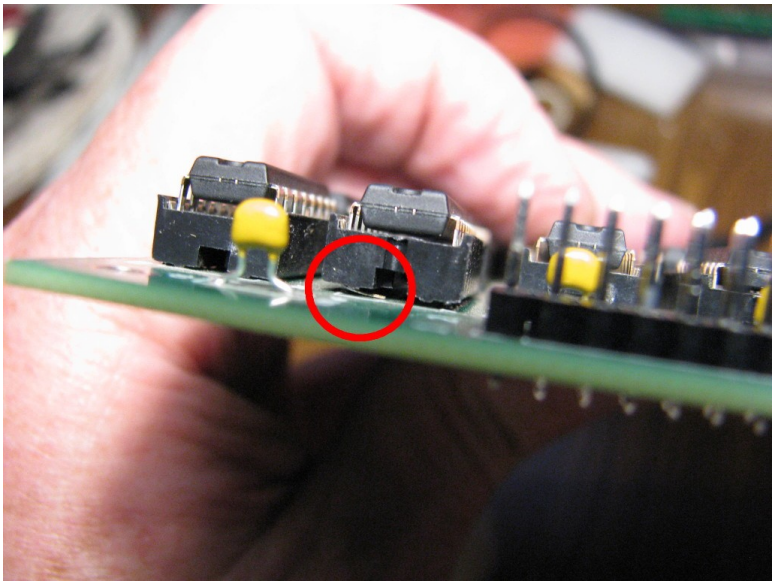


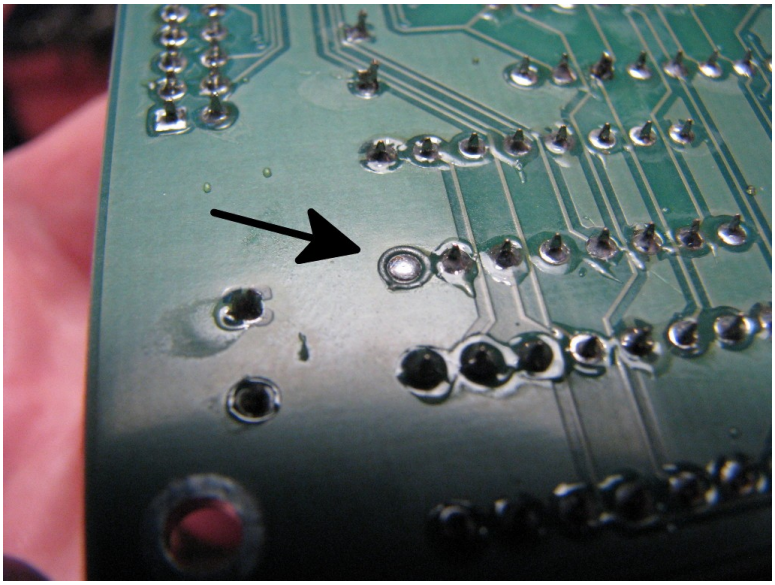
These require extra heat to make good connections, because the zones wick away the soldering iron heat. You will usually need to let a 15-watt iron rest on the pin and pad for more time before applying the solder (count to 10). You also can use a more powerful (30 watt) soldering iron. **Failure to make a good connection to one of these zone pads is probably the most common soldering error seen with the CPUville kits.**

6. The four main errors one might make are these:
    1. Cold joint. This happens when the iron heats only the pad, leaving the lead cold. The solder sticks to the pad, but there is no electrical connection with the lead. If this happens, you can usually just re-heat the joint with the soldering iron in the proper way (both the lead and the pad), and the electrical connection will be made.
    2. Solder blob. This happens if you heat the lead and not the pad, or if you pull the iron up the lead, dragging solder with it. **This is the error that results from inadequate heating of a zone pad.** If this happens, you can probably pick up the blob with the hot soldering iron tip, and either wipe it off on your sponge and start again, or carry it down to the joint and make a proper connection, using enough heat so that the solder flows onto the pad.
    3. Solder bridge. This happens if you use too much solder, and if flows over to another pad. This is bad, because it causes a short circuit, and can damage parts.

If this happens, you have to remove the solder with a desoldering tool, and re-do the joints.

    4. Solder dome. This happens when you solder a pad but there is no pin sticking through the hole, because it is folded under:



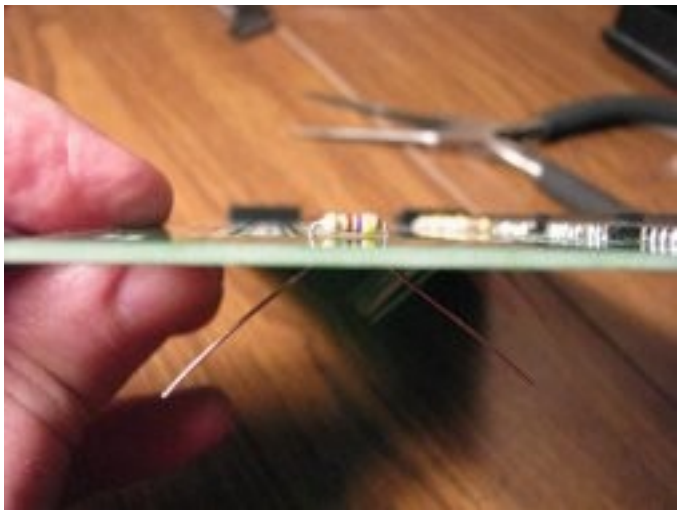


Other tips:

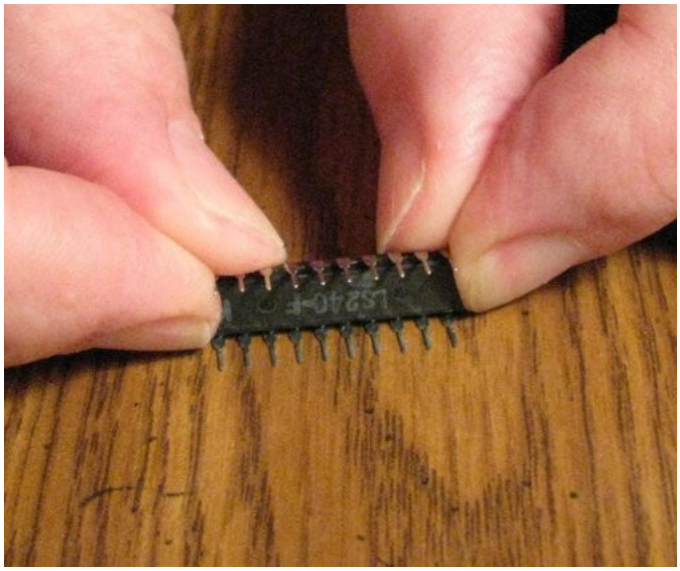
1. Be careful not to damage the traces on the board. They are very thin copper films, just under a thin plastic layer of solder mask (the green stuff). If you plop the board down on a hard surface that has hard debris on it (like ICs, screws etc.) it is easy to cut a trace. Such damage can be fixed, if you can find it, but try to avoid it in the first place.
2. When soldering multi-pin components, like the ICs or IC sockets, it is important to hold the parts against the board when soldering so they aren't “up in the air” when the solder hardens. The connections might work OK, but it looks terrible. If you make a lot of connections on a part while it is up in the air it is very difficult to get it to sit back down, because you cannot heat all the connections at the same time. To prevent this, I like to solder the lowest profile parts first, like resistors, because when the board is upside down they will be pressed against the top of the board by the surface of the table I am working on. Then, I solder the taller parts, like the LEDs, sockets, and capacitors. Sometimes, I need to put something beneath the component to support it while the board is upside down to be

soldered, like a rolled-up piece of paper or the handle of a tool. Another technique is to put a tiny drop of solder on the tip of the iron, press the part against the board with one hand, and apply the drop of solder to one of the leads. When the solder hardens, it holds the chip in place. Solder the other leads, then come back and re-solder the one you used to hold it. It is good to re-solder it because the original solder drop will not have had any rosin in it. The rosin in the cold solder helps the electrical connection to be clean.

3. The components with long bendable leads (capacitors, resistors, and LEDs) can be inserted, and then the leads bent to hold them in place:

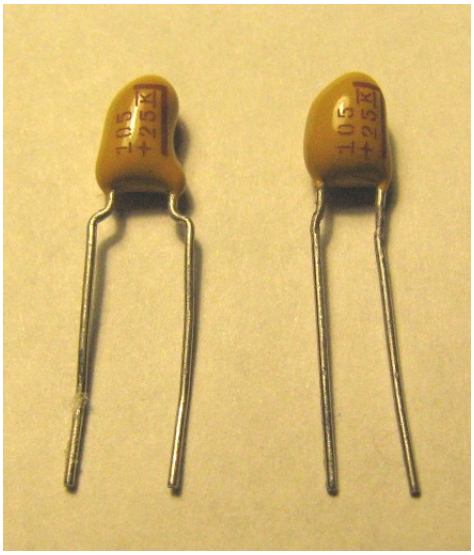


4. You might have to bend the leads on components, ICs or IC sockets to get them to fit into the holes on the boards. For an IC, place the part on the table and bend the leads all at once, like this:



Bending the leads one-by-one or all together with the needle nose pliers doesn't work as well for some reason.

Also, some components have leads bent outward to fit in a certain printed circuit board footprint, but will fit a smaller footprint if you bend the leads in with a needle-nosed pliers. Here is a tantalum capacitor, one with wide leads, the other with narrow leads, from bending the wide leads in:



5. After you have soldered a row or two check the joints with a magnifying glass. These kits have small leads and pads, and it can be hard to see if you got the solder on correctly by naked eye. You can miss tiny hair-like solder bridges unless you inspect carefully. It is good to brush off the bottom of the board from time to time with something like a dry paintbrush or toothbrush, to get off any small solder drops that are sitting there.
6. The connectors, like the 40-pin IDE drive connector and the system connector in this kit have pins that are a little more massive than the IC socket or component pins. This means that more time, or perhaps more wattage, will be required to heat these pins with the soldering iron, to ensure good electrical connections.