

How to assemble a small SMD board using a cheap hot-plate

What follows is the build process I followed to assemble a PCB design shared by designer LeKos for repair of Sony WM-D6C units that have a dead CX20084 speed control chip. I hope this is useful to anyone building that board or another small PCB with surface mount devices.

Alongside this README I have uploaded a number of files to go with the LeKos board I built including a Mouser Electronics BOM and a solder paste stencil. I am NOT distributing the Gerber files etc. Always get the latest. The diagrams I am including are just for reference, GET THE LATEST from the Stereo2Go thread.

What you need:

Amazon links in the text below are for example. They are NOT affiliate links, I am not saying you must buy this, it's just what I used.

1. Printed circuit board. LeKos shared his Gerber files and I was able to upload them to PCBWay and order 5 boards for about \$1 each. You can also order a stencil at this time but see point 6 below. Clean your target PCB with IPA (Isopropyl Alcohol) to remove finger print oils before starting.
2. As part of the design you should receive a BOM (bill of materials) for the design. Be sure to order exactly the components specified. If you must make a substitution be certain that the new component has the same footprint. There are lots of SMD feature sizes, for the LeKos PCB they were 0803 but I accidentally ordered one component in a larger size and had to re-order.
3. Your design files should also include layout diagrams showing where to place the components on the board. Follow this carefully.
4. Solder paste: Think microscopic balls of solder in a paste with flux. I said paste, it should not be too runny. Usually comes in a syringe for easy use. Available on Amazon for about \$10. There are various formulations and melting temperatures. I recommend lead-free solder paste with a melting point of 183C. Note that this has a very short shelf-life so unless this is to

be a major hobby for you order the smallest quantity you can. If yours goes hard you can scoop it from the syringe and mix it with a small amount of liquid solder flux to restore the pastiness.

5. A hot-plate. This is a temperature controlled aluminum plate on which to place your assembled PCB. As it heats to just above the melting point, the solder paste will miraculously turn to shiny solder and assemble your circuit. It's very satisfying :-). I ordered the cheapest I could find on Amazon. It is very small, just a 5cmx5cm surface and it cost about \$20. A PD USB charger is required to power it. An ordinary phone charger doesn't have the oomph, look for 64W or even 100W. Some USB-based laptop chargers work well.

Here is a [video](#) that shows the hot-plate in action.

Be sure to familiarize yourself with the instructions and the hot-plate before using it. The one I linked to has two buttons on the rear and short pressing both buttons at the same time turns it on/off. There are lots of menus (including one to change to English if yours ships in Chinese) that you may want to play with but the default behavior worked for me.

Your hot-plate should be set to heat to 10-20 degrees above the melting point of your solder paste. There is a menu for this.

Be careful, the hint is in the name: HOT-PLATE... this will burn you if you touch the top surface.

6. A solder stencil. This is usually made of steel and provided by your board supplier. If they charge too much I have had great success with card-stock paper cut on any laser cutter. I have provided the cut file I used. Incidentally I made this file from the Gerber files for the PCB. Capture all the solder points of the board and delete everything but the SMD component pads. Then laser cut it from card-stock. I found a plastic coated cardstock in a craft shop that didn't absorb the flux in the paste but ordinary card works too for a single build. Cut the pattern in the center of a piece of card that will cover your target PCB with room to spare.

If you don't have a laser cutter you should make friends with someone who does, they are so useful.

7. Basic tools like latex gloves and lots of paper towels to clean up any mess. You will need a pair of tweezers (I recommend curved ones like [these](#)) to pick up tiny components. Be sure to cover your table surface before starting to mess with chemicals like solder paste. Do not leave any of it

where it could come into contact with food, pets or tiny humans.

8. Fume extraction. Solder gives off nasty fumes when it melts. You do NOT want to breathe it especially for lead-based solders. If you do a lot of soldering you want to invest in a fume extractor but for a one off I suggest at least a small fan next to your hot-plate blowing AWAY from you. It should suck in the fumes and blow them towards an open window etc. Work in a well ventilated room with doors/windows open.

Instructions:

1. This can be a messy job and solder paste is probably toxic, so wear gloves but don't be intimidated, it really is a simple mechanical technique and works amazingly well. And don't worry, you can do-over if you mess up first time. IPA and paper towels will clean up most messes.
2. There are literally dozens of tutorials on YouTube but here is a quick example of the technique. He uses a steel stencil but a card-stock one works fine for small runs.
3. Notice how important it is to anchor the board to the surface first. You don't want it moving. I recommend taping down a few of the unused PCBs so they hold your target board steady and provide a flat surface around the target as you spread the paste. Once you have aligned the stencil with the solder pads on the board tape it on one side so it can be raised vertically when you are done to avoid smearing the paste.

You don't need a mountain of paste on the stencil, especially on smaller boards and I find an old credit card is good as a spreader. If you mess up, no big deal, just clean the board (and stencil) with IPA to remove the paste and start over.

One more point, if you use a card stencil don't tear it with your spreader. Keep the spreader at say 45 degrees when using it.

4. You should now have a board with a thin covering of paste on all the mounting pads for the components. Obviously, be careful not to smudge the paste but if you do, just clean and start over.
5. Now we come to the hardest part for many people, especially if you are over 60 like me and have less than rock steady hands. We need to place all the SMD components onto the board according to the layout diagrams.

The LeKos board uses truly tiny 0803 parts which demand that you use a fine pair of tweezers. So, just use your shaky hands to position the microscopic components on the microscopic solder pads. What could go wrong?

6. Just kidding, it's really not hard. Here are some hints to help:

- Work through the BOM one component at a time and mark each one as you go. NEVER open multiple component packages at the same time, it is too easy to confuse them.

- SMD components are distributed in large reels with thousands of components located along the length of a plastic tape and with clear plastic on top so they don't fall out. You will almost certainly have received a short length of that tape cut from a reel.

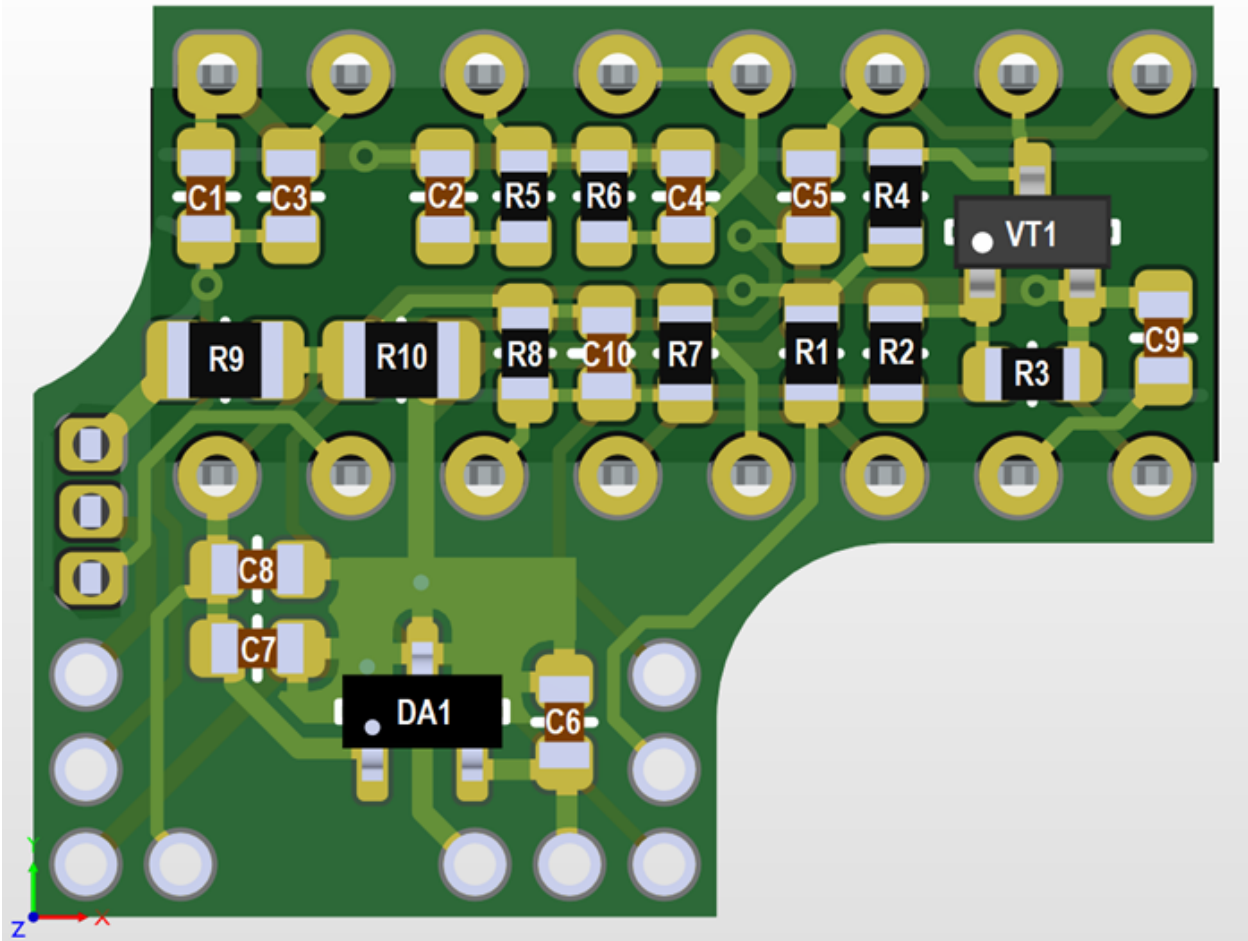
- Using a magnifier (if you are old like me) and your tweezers, peel back the clear plastic above a single component at a time and tip that component gently onto your clean work surface. Don't breathe too hard they WILL blow away.

- Following the assembly diagram (see example below), locate where the component goes on the board. Now take the tweezers in your dominant hand and use your other hand to steady it as you pick up the components and position it on the paste in the correct location. I suggest grabbing the body of the components with the tweezers and not the solder points. This will keep you from getting paste on your tweezers when you place the part. Your superhero strength here is that the paste is sticky and will hold the component. Don't push the component down onto the PCB, just position it on the paste and you are done.

Now would be a good time for a [video](#) of solder paste melting on the hot plate. Not only does it melt like magic but surface tension in the liquid solder sucks the components down to the PCB and even straightens out crooked parts. This video shows solder-paste that was applied by hand, it's all over the place and components are floating on top but because there is just the right amount it ends up looking great and more importantly working great.

- Work through all the SMD components in turn and you should end up with a fully populated board. In the LeKos design there are two non-surface mount devices on the other side of the board. Obviously we solder the

SMD components first and then solder the other components by hand.



7. Now we come to soldering on the hot-plate. First, remember what I said about fumes. Be sure to keep from breathing them.

Carefully place the populated PCB onto the hot plate. Did I mention how sticky the paste is? Moving the PCB is not likely to move tiny components but do avoid touching them. I like to start with a cold hot-plate and watch it carefully as the heat increases.

Remember the video of the soldering process above? There are three stages, preheat, flux activation (ie coating the board) and then solder melt. More sophisticated hot plates let you create timed programs for these 3 stages and more. My small LeKos boards and the cheap hot plate I linked to went through these stages much quicker than the video, much faster. Don't walk away thinking you are baking a cake...

When the solder joints look shiny you're done. Don't leave the board to cook on the plate any longer than you have to, prolonged heat is bad for components. Turn off the plate and carefully remove the board. Solder will still be soft and the board will be hot so pick the board up carefully with tweezers or another tool or perhaps slide the board carefully from the hot-plate onto another flat surface to cool.

8. If you read this far... thanks. I hope you have a cool PCB for your project.

Thanks to LeKos for sharing his design with the Stereo2Go community.