

Fig.1: Here is the board-to-be-assembled. Note all the surface mount pads and the tight pitch on the ADC package at the top right.

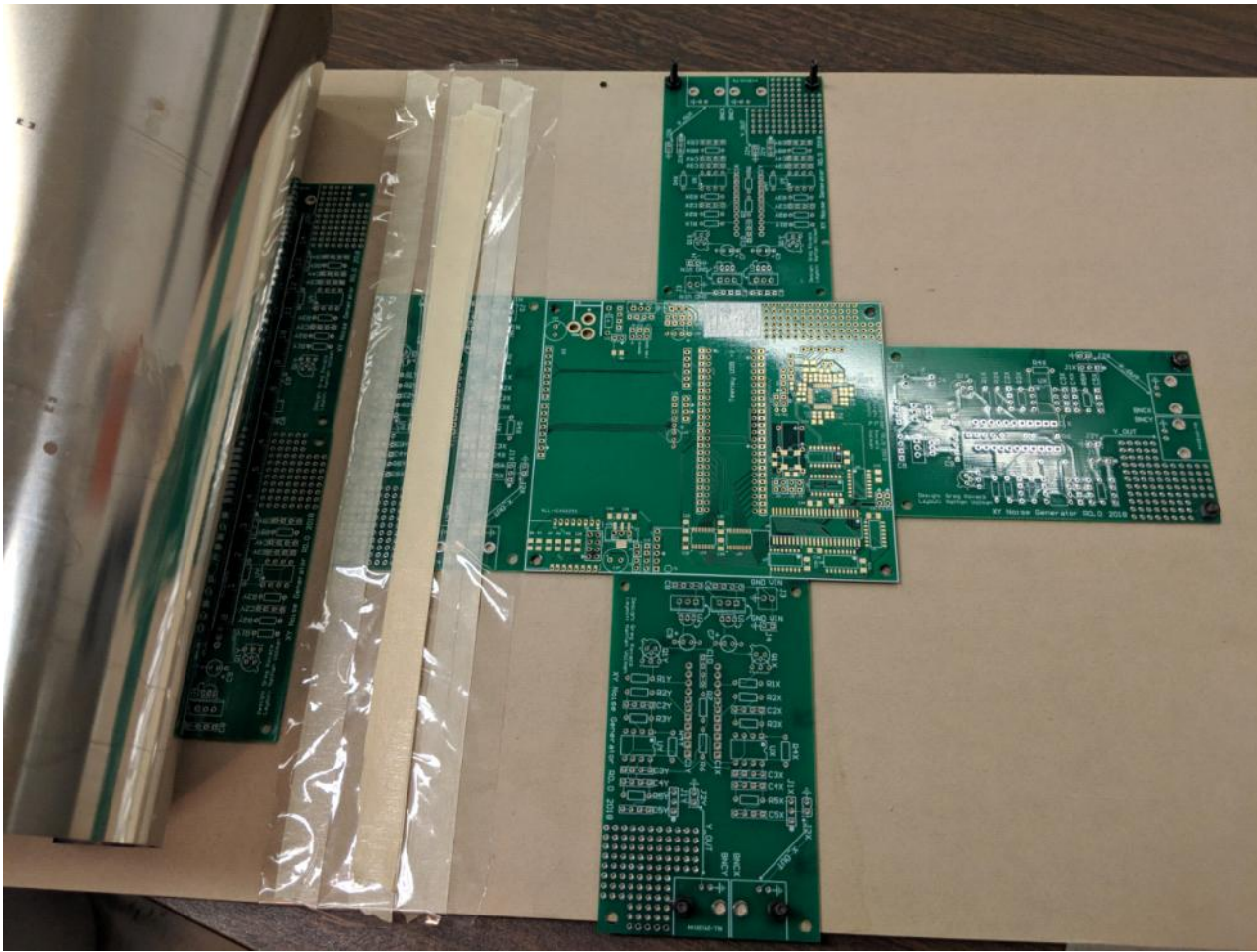


Fig.2: Using a piece of rigid and easily workable plastic, the board-to-be-assembled is mounted approximately in the middle and surrounded on all four sides with scrap boards of identical height. Holes are then drilled and those surrounding boards screwed firmly in place making sure that the screws will not interfere mechanically with the SMD stencil being used. The only thing holding the board to be assembled in place is pressure on all four sides from the scrap boards. Where screws cannot be used (as on the leftmost donor board), generous amounts of low-profile tape are used to secure it while making sure to press the tape down very firmly on all sides.

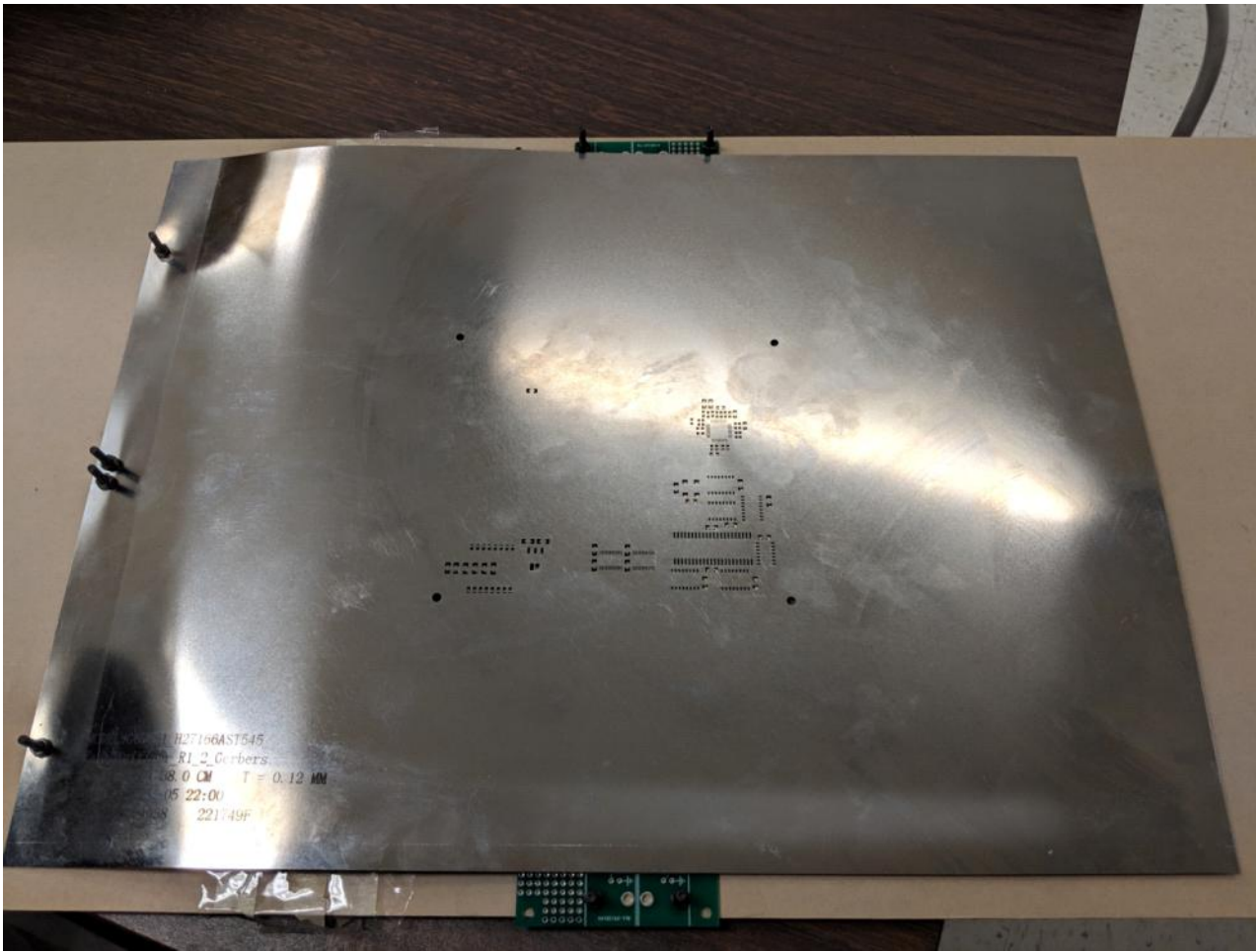


Fig.3: The stencil is then positioned over the assembly and aligned by hand. It is easy to know when it is aligned properly because the shiny gold pads will be visible through every hole when finished. After gross alignment is complete, mounting holes are drilled through the thin metal stencil and plastic mounting board. Scrap boards (again of identical height) are placed between the stencil and the plastic mounting board (see Fig. 2 on the left). This will ensure that there is a consistent height across the entire stencil which will be critical for proper solder paste application later.

Importantly, the screw diameter used for mounting *must* be smaller than the mounting holes drilled for them. The play between the mounting holes and the screws comprise the only X -Y adjustment in this assembly. Each board to be assembled will have some tolerance in X and Y in the distance of the pads to the edges of the board. This is due to the boards being routed out slightly unevenly with a typically up-to ten mil difference in either direction. To account for this, for every board to be assembled, the alignment of the stencil to the pads on that board must be checked. If the alignment is slightly off due to routing tolerances (as described earlier), the screws on the left of the assembly must be loosened. This will allow for small adjustments to be made. Once the alignment is again perfect, the nuts must be tightened down again to secure the stencil position.



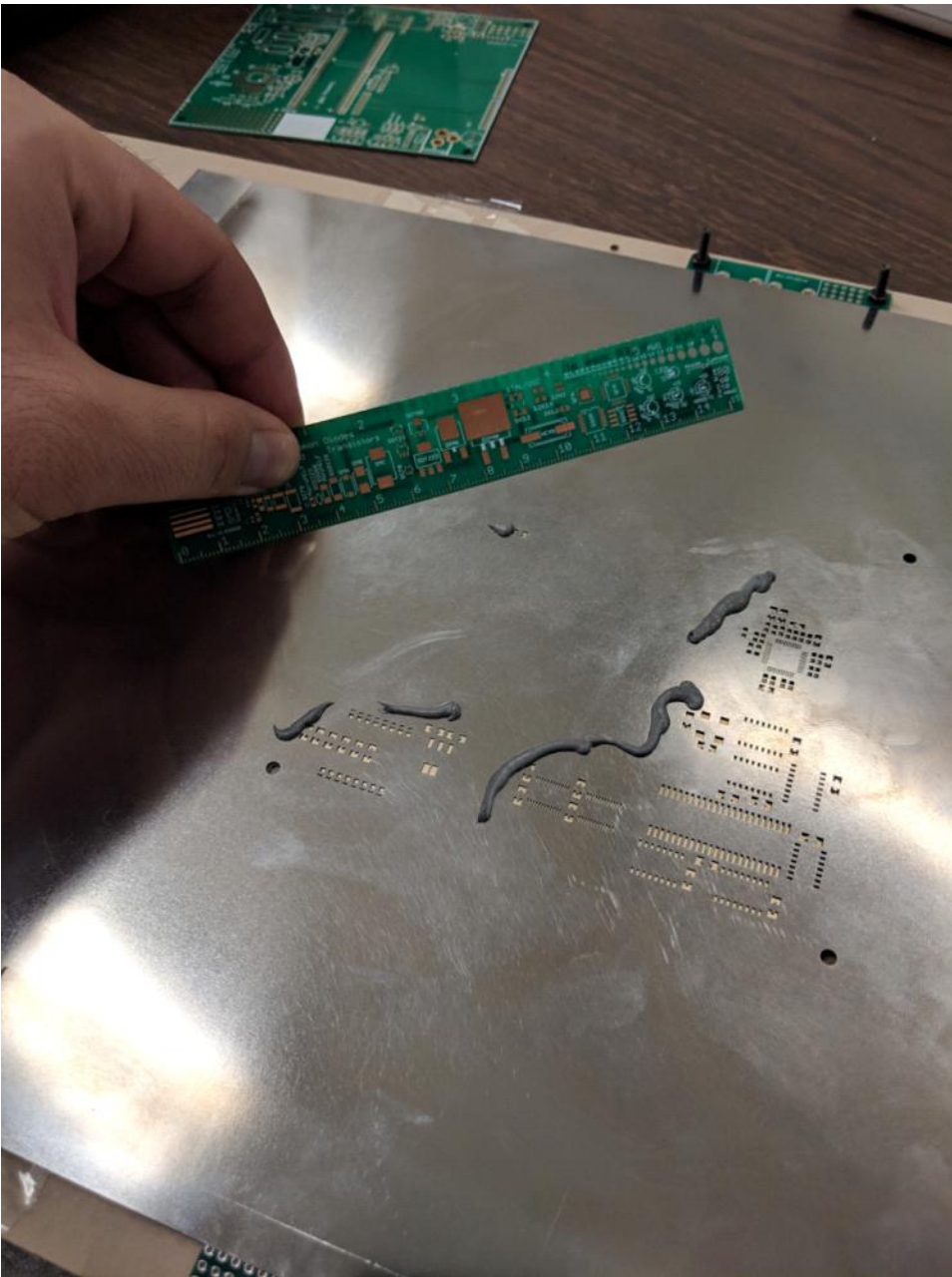


Fig.4: With the board held securely in place and the stencil aligned perfectly to the pads, it is now time to apply the solder paste. An ample amount of fresh solder paste is applied to the stencil to the left and up from the pads to be covered. Then, while holding the stencil tight to the board-to-be-assembled with your non-squeegee hand, squeegee the solder paste into the pads at a 45 degree angle relative to the pads. The squeegee must be thin, flexible, and straight. Here, a 0.8mm thick PCB ruler is used. Important to note is that the bottom edge of the squeegee should be held at a shallow (~30 degree angle) to the stencil such that the bottom edge trails the top edge. This will prevent the squeegee from pulling paste out of the pads once it has been applied. It is critical to hold the stencil flush against the board the entire time that paste is being applied as the distance between the pads and the top of the stencil determines the dose of paste that will be present on each pad. Too high of a dose will lead to solder bridges and short circuits.

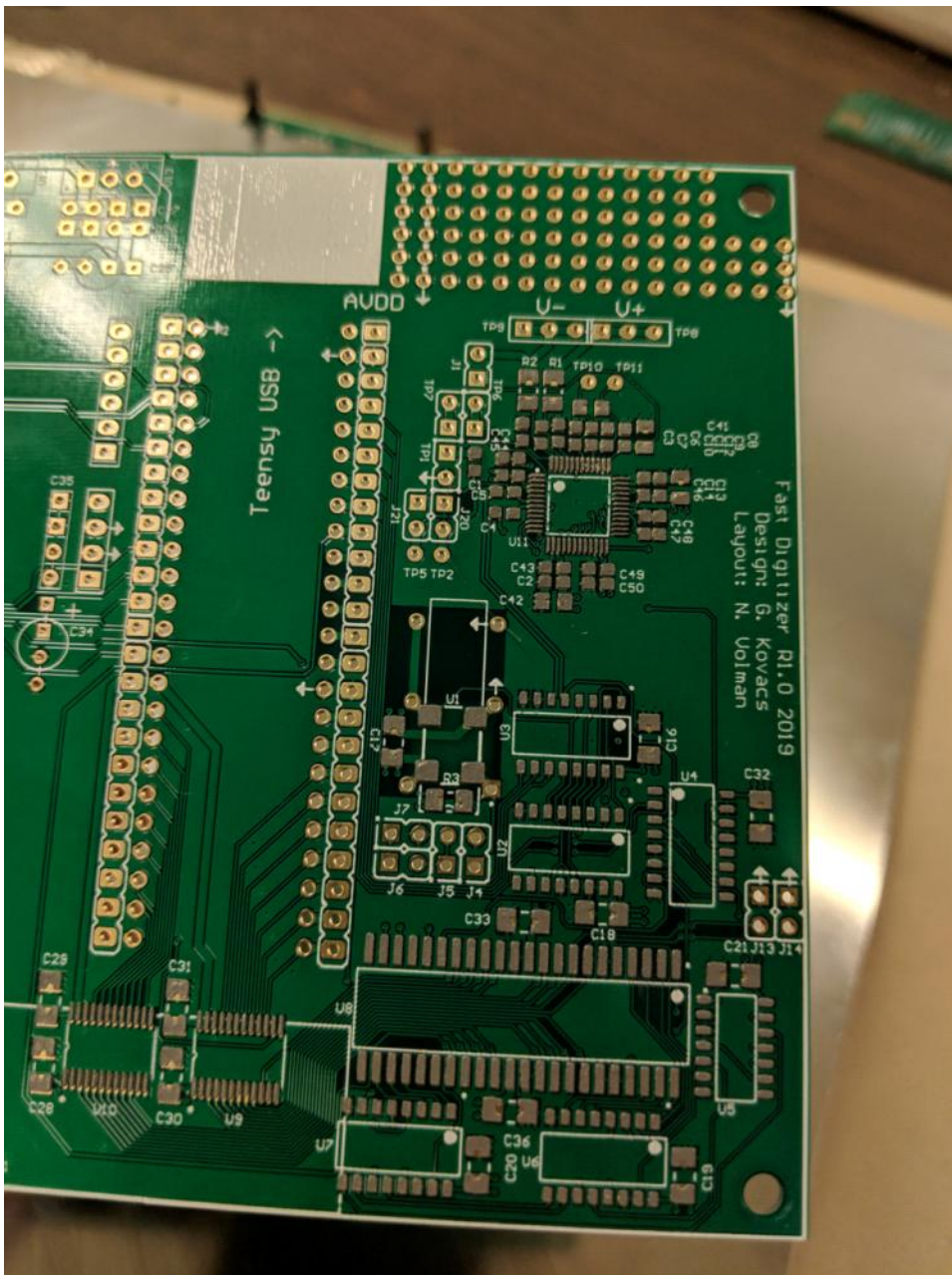


Fig.5: Once the paste has been applied, the stencil should be very carefully peeled back from the board - to-be-assembled. A visual inspection should then be performed to ensure that the alignment and the dose was correct. Special attention should be paid to any small features such as the pads on the Quad Flat Package (QFP) on the top right of the board. If the paste application was not successful then all paste should be removed with isopropyl alcohol and paper towels and the process restarted.

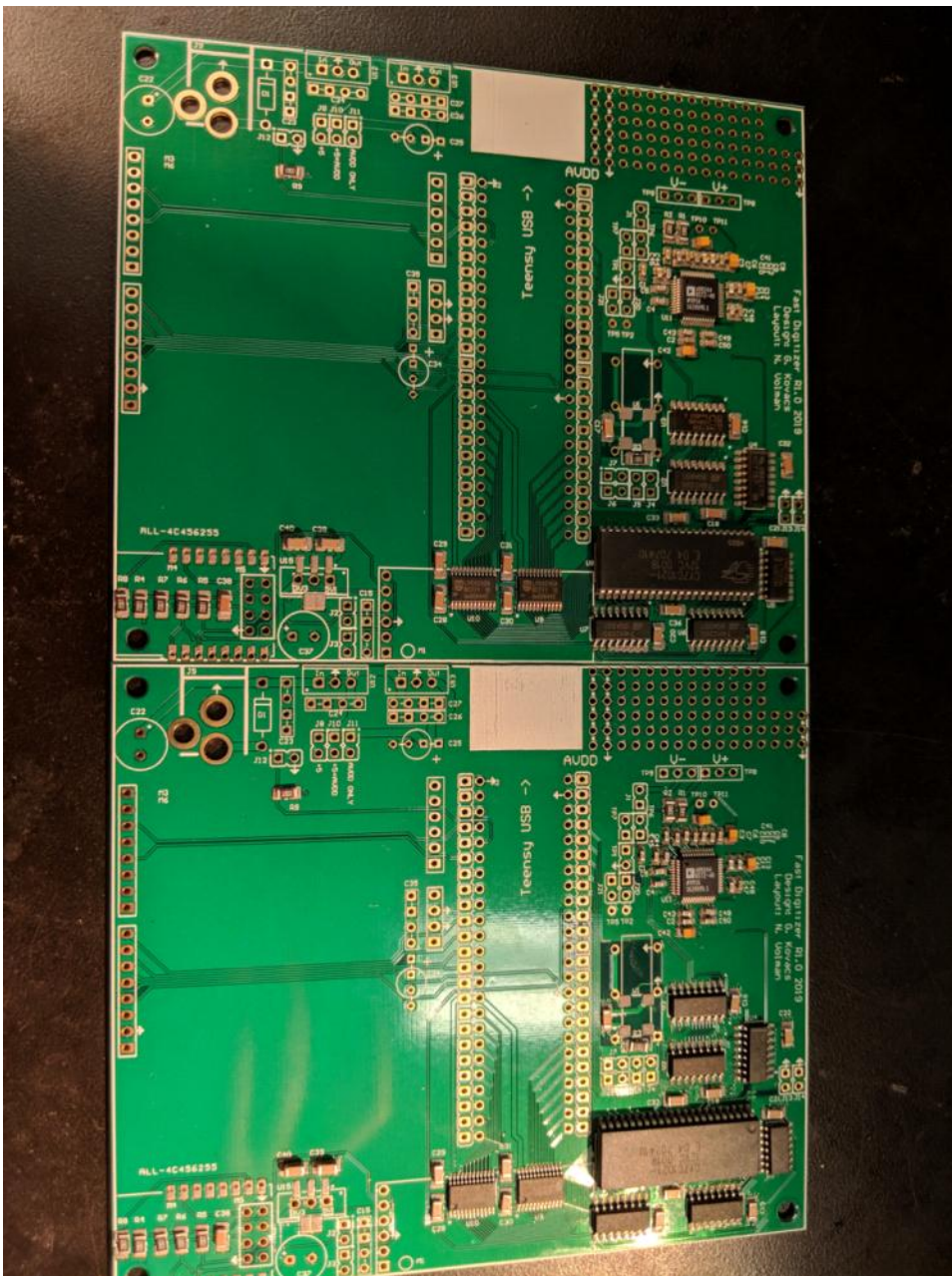


Fig.6: Once the board-to-be-assembled has successfully had solder paste applied, it is then time to place all SMD parts onto it. Batching this step saves a lot of time as the most time consuming part of board assembly is retrieving each individual SMD part from its respective bag and tape. The more boards being populated with parts at once, the faster assembly will go. It is important at this time not to touch or smear the solder paste that has been applied to the boards. Tweezers can be used for proper positioning of SMD parts (as shown above).



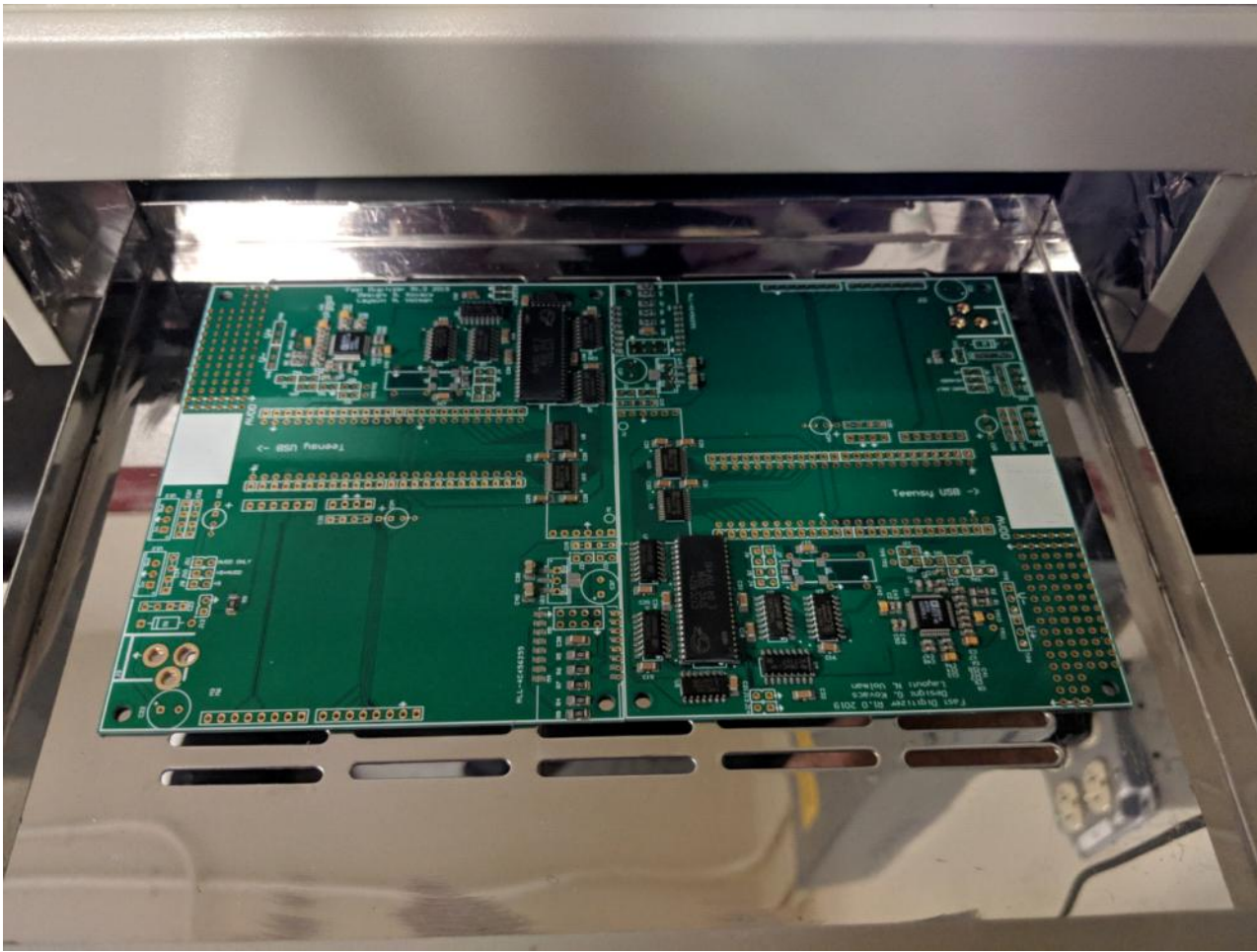


Fig.7: Once the boards have been populated entirely with their SMD components, they should be placed inside the reflow oven. The closer to the center of the oven the better as that is often where the temperature is most even.

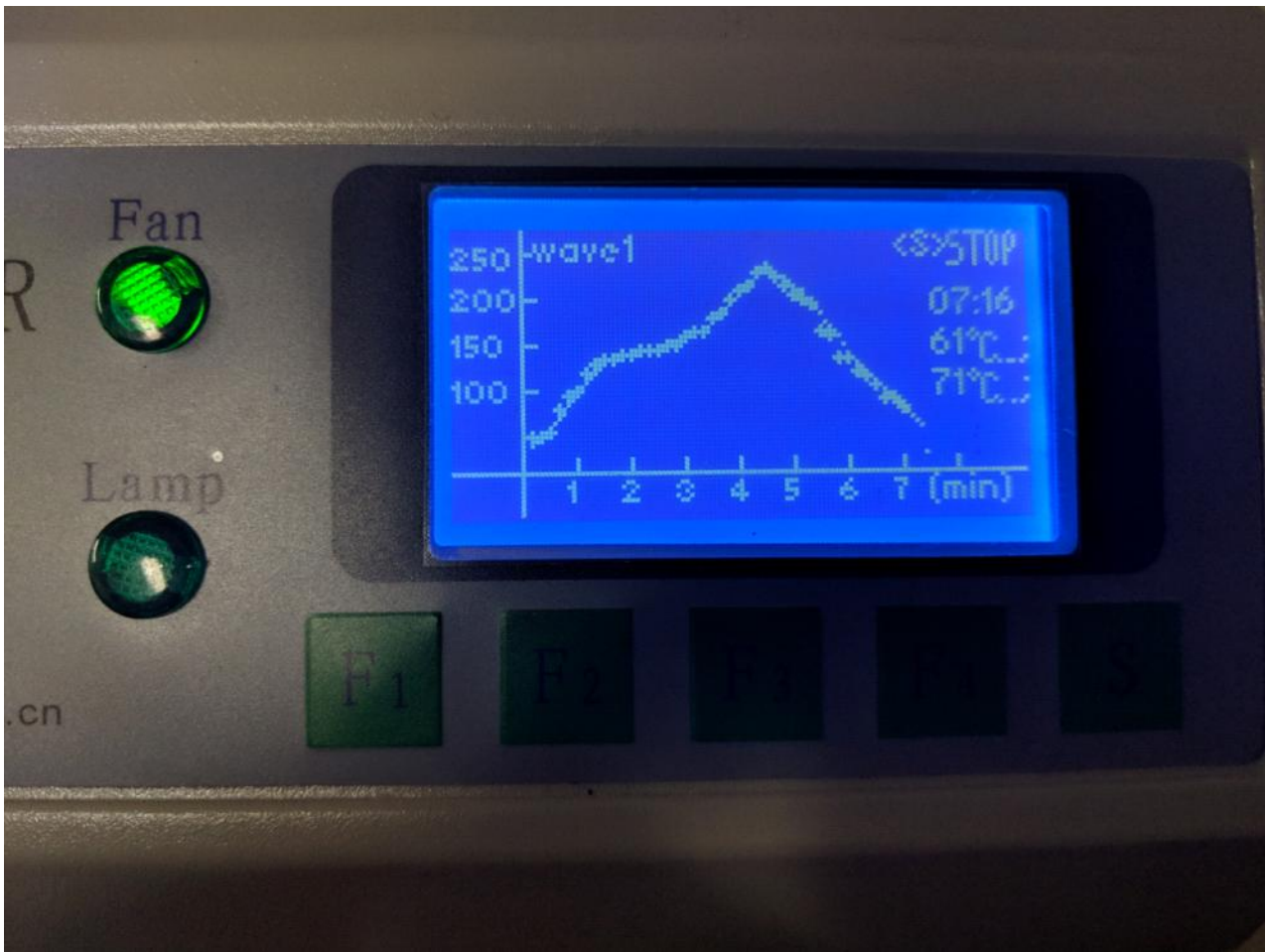


Fig.8: With the boards inside, an appropriate thermal profile should be selected for reflow. In this case, the profile tailored to leaded solder paste was selected. Not all pads successfully reflowed after a single pass so each board inside was rotated 180 degrees and the 'wave 1' profile was re-run for a second time. This led to 100% successful reflow of all pads.