There are no translations available.

Introduction

Starting with the CS4398 DAC project and during prototyping of the Preamplifier V2 project I made my first steps into the wonderful world of SMD (surface mounted) components. Since then I have tried several ways of mounting them (using a standard soldering iron, hot air station, reflow oven). I have found that the best and fastest results were obtained with a reflow oven. With this project I would like to share my experience how to setup a SMD workstation to obtain professional results with cheap components, so SMD electronics comes within reach for small series and prototypes.

Process

This is a list of the equipment that I use:

- Solder paste (lead-free)
- PCB stencil (0.1mm polyester)
- Vacuum Tweezers (diy, see below)
- Reflow Controller (diy, see below)
- Toaster Oven (off-the-shelf)

The next photos show the process of SMD soldering:

Fit SMD stencil

Solder paste can be applied manually with a syringe or a manual dispenser. That works ok for larger components (1206, SOIC), but with smaller components a lot of rework was needed because the applied layer of solder paste was too thick resulting in solder bridges. An easier and faster way to apply just the right amount of solder paste is to use a stencil. Since for small prototypes a metal stencil is unaffordable, I ordered a polyester stencil at:

http://www.smtstencil.co.uk

You can combine multiple designs on one A4 stencil, which makes the price very affordable. The standard thickness is 0.1mm, which seems ok for the components sizes I use.
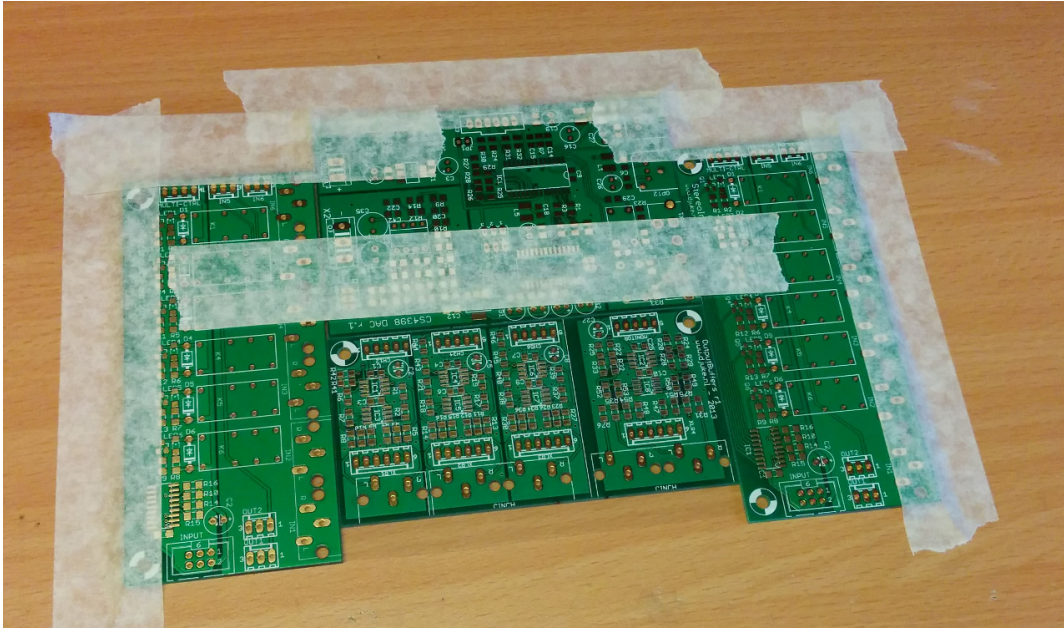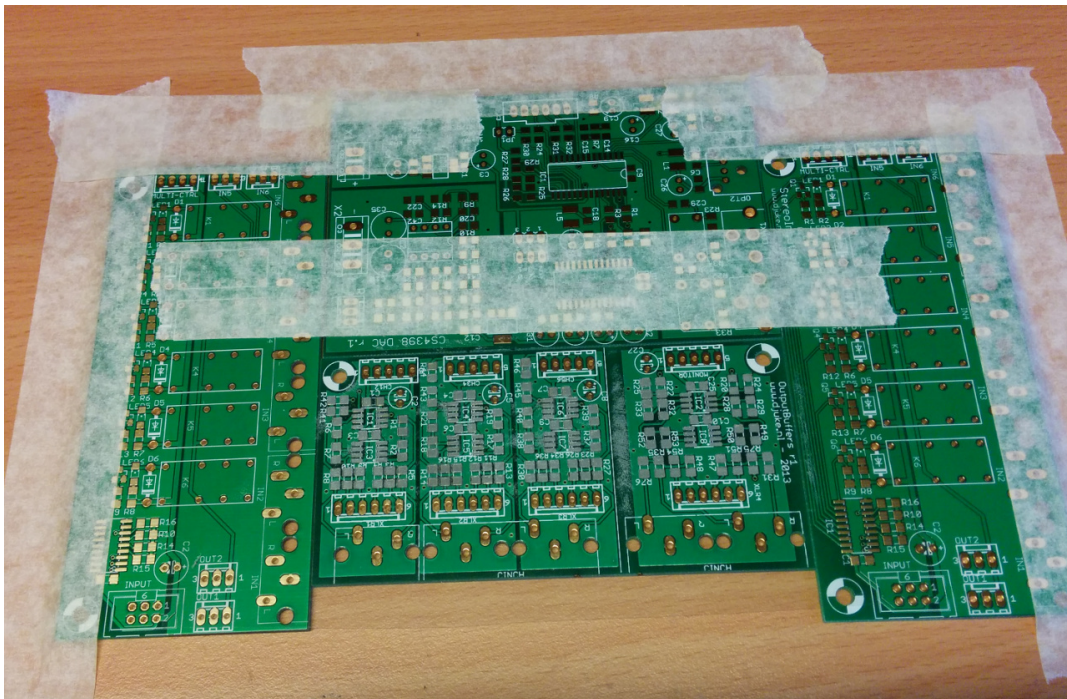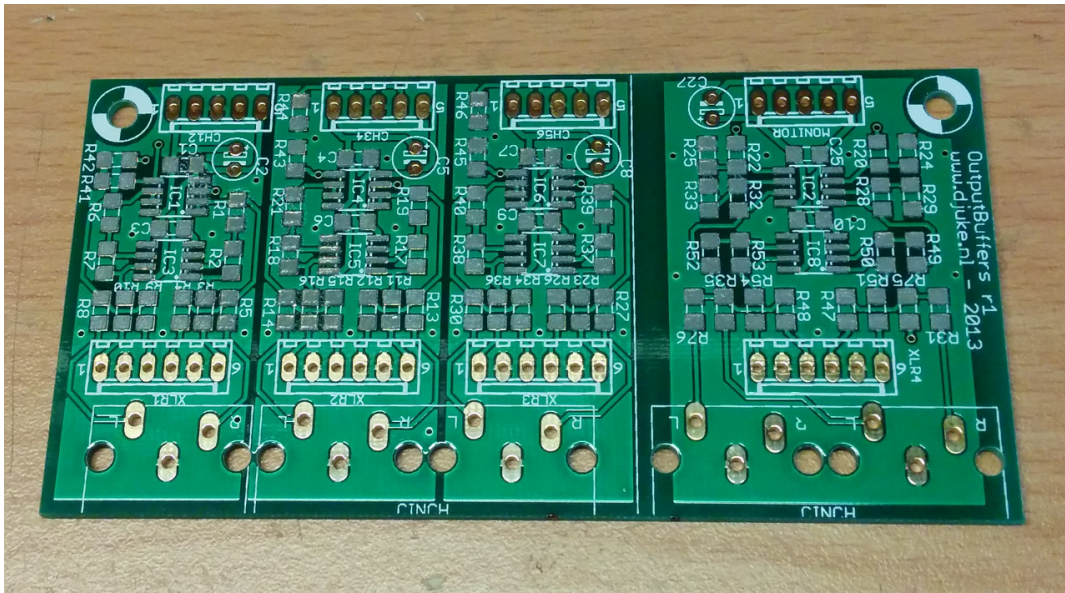
Photo shows some spare pcb to form a kind of mold to fit the pcb. The polyester stencil is hardly visible but is fitted on top of the pcb that will get the solder paste.
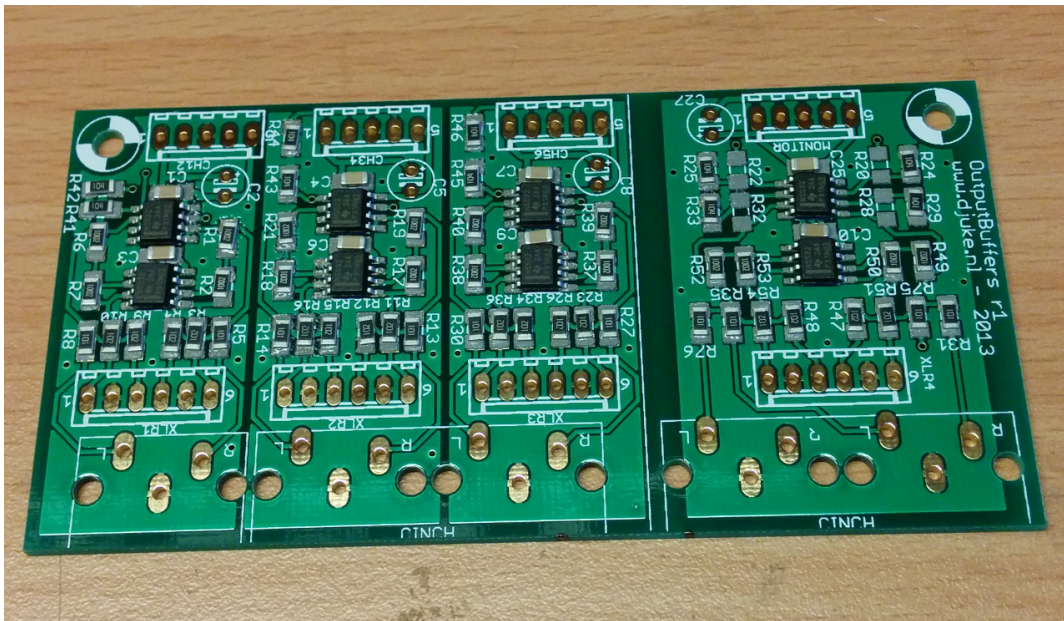
Apply solder paste

Solder paste is applied with an old bank card. Below shows how accurate this can be done.

Mount components

Components were positioned on the pcb using in expensive vacuum tweezers tool. See below for the description how I made this from a 10 euro aquarium air pump.

Reflowing

With the components fitted to the solder paste you can use a hot air soldering station to solder them. However it is faster to use a reflow oven and also the temperature profile is better controlled which reduces the risk of damaging components. Professional hot air reflow ovens cost a fortune, but even smaller infrared reflow ovens priced at around 500 euros are too expensive for small series and prototypes. I bought an off-the-shelf toaster oven for 50 euros and designed a Reflow Controller to control the time and temperature of the reflow process. More information on the design of the Reflow Controller can be found below.
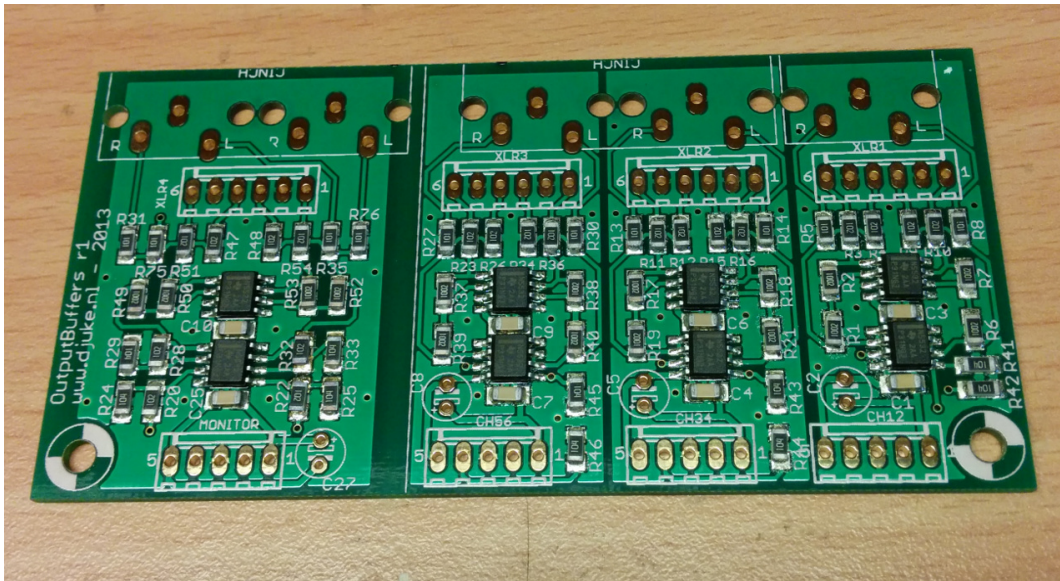
The result of my first attempt is shown in the picture above. All components are nicely reflowed, no bridges were seen around the ICs. The joints look smooth. I used lead-free solder paste, with a soak phase of 90s at 180 deg, then temperature was increased to 240 deg for reflowing. Visual observation showed that the solder paste started to reflow around 220 deg.
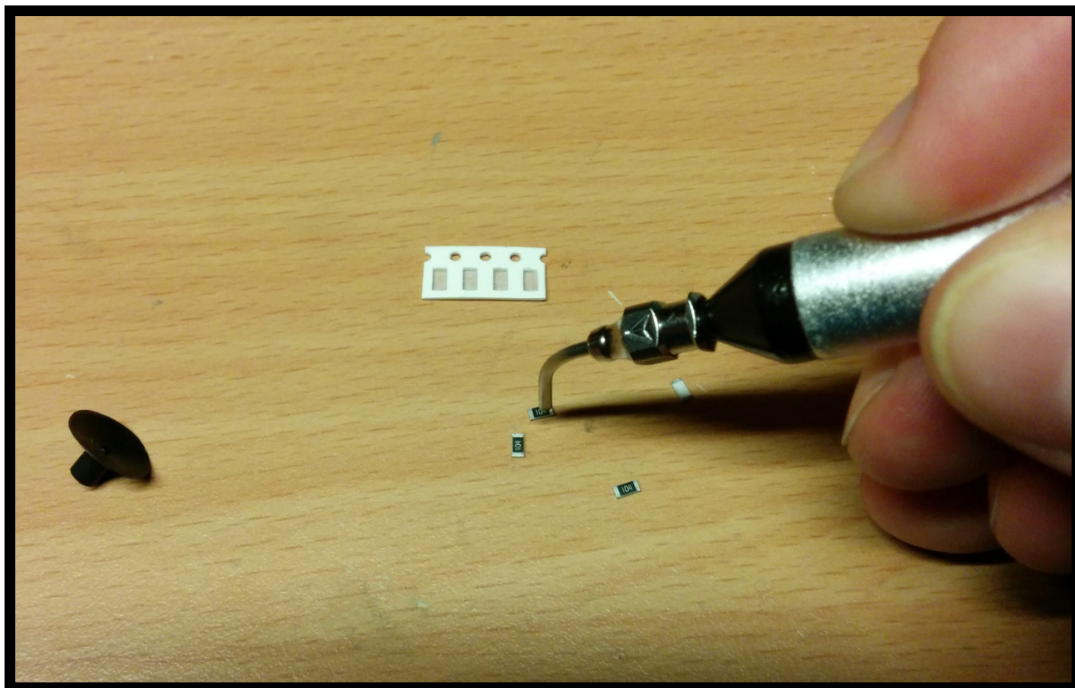
Vacuum Tweezers

One of the time-consuming parts of putting SMD parts on you pcb with tweezers is that you have to put them on the table first and 50% of them will fall upside down. The following link inspired me to build a set of vacuum tweezers, so the components can be picked directly from the packaging tape.

[DIY manual SMD pick and place machine for $20](#)

After watching the video of Felix Rusu, I immediately ordered a cheap aquarium air pump set, it was 10 euros for the pump, 10m hose and a air divider for in the water which I did not need. The pump has a capacity of 80 l/h, which is just about ok, but I had to make all connections nicely air tight for it to work properly. The type of air pump I used did not have the opportunity to easily invert the valve, so I had to drill an extra hole to reach the air inlet. The hose was put in the hole and everything made air tight with hard plastic glue and sylicone glue. I used a comfortable 2m of the hose and instead of the syringe that Felix used I modified a hand pick and place tool (Aoyue 939) that I bought before. The hand tool did not work at all when used on its own, but in combination with the air pump it worked like a charm. Also it had 3 extra rubber parts for picking larger ICs. The hose was connected to the hand tool, made air tight and I drilled an extra hole inside to apply and remove the vacuum with my finger.

The next picture shows how to use the tool to pick a 1206 resistor. The standard needle size is ok for 1206 and 0805 components, you might have to use a thinner needle for 0603 size or smaller. The suction capacity is about perfect, it can pick 1206, 0805 sizes nicely, but also ICs (LQFP-44, SOIC-18, TSSOP-18). But the suction is not too strong, which allows to place components very accurately by removing your finger from the hole. To conclude: this tool gives a huge boost to the time-consuming process of manual placement of SMD components, so highly recommended.

ReflowController

TODO