App Note:
Soldering 101
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I. Objective

The purpose of this app note is to explain how to solder components onto a printed circuit board, PCB. for the frequency modulated continuous wave radar, also known as FMCW. In this app note, how to solder and tips will be provided.

II. Introduction

For the FMCW radar system, soldering is important for the PCBs. In this app note, various ways to solder the radar are the following: soldering iron, soldering using protoplace, and soldering using solder paste. The soldering iron is used to solder ICs and other components onto PCBs or antennas. Soldering using protoplace is used to solder smaller surface components onto the PCB. Soldering using solder paste is used to solder components too small for the protoplace such as 0402 components. For our radar system, we planned to have the RF and the baseband board separately. After completely soldering our RF and baseband board, we tested them and figured out the baseband board was shorting and current is building up somewhere along the board.

In Figure 1 below is a picture of our baseband board. In our baseband PCB, we included everything from lab 1 onto the baseband board. Whereas, in Figure 2, the RF PCB, we included the VCO, mixer, attenuator, LNA, power splitter, and antennas.

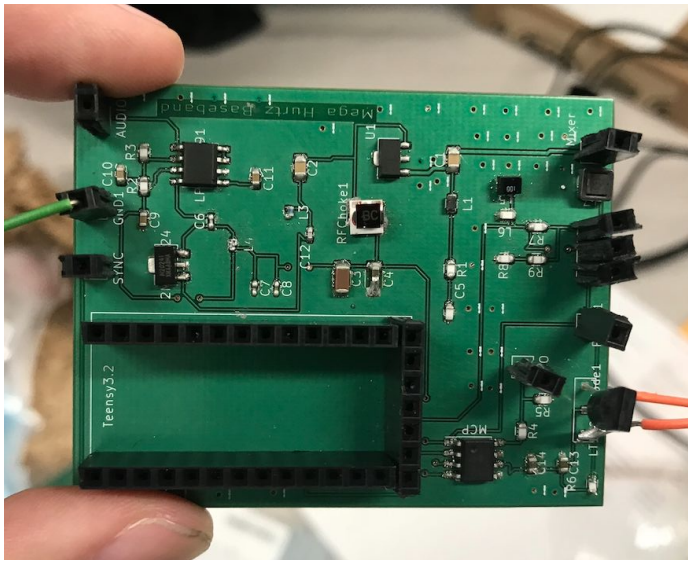

Figure 1: Baseband PCB

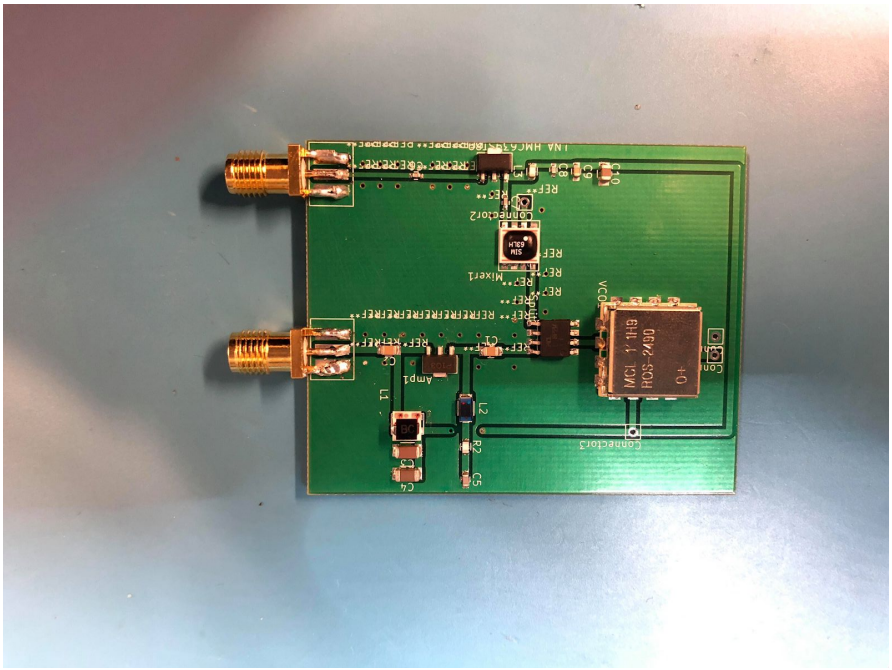

Figure 2: RF PCB

III. Soldering Methods

There are multiple soldering methods that are useful when soldering the radar system. To solder our PCBs, we mainly used the soldering protoplace and protoflow. Then we used soldering paste to solder on components that fell off after using the protoflow. For soldering the antenna, we used the soldering iron as it is much easier.

A. Soldering Iron

The solder iron is useful for larger ICs, wires, and antennas. Soldering wire is necessary when using the solder iron as well. We soldered on the two coaxial connectors to the RF PCB. Using the soldering iron is better than the solder paste as it is a bigger component.

For our radar system, we used the soldering iron to ground our baseband wires that weren't properly grounded in the PCB. On Figure 2, you can see the coaxial connectors that were soldered on.

B. Soldering using Protoplace and Protoflow

In order to use the Protoplace, solder paste, in the ESDC, is necessary. When using the protoplace, it is important to receive training from a staff beforehand in order to get practice and be more accustomed to soldering this way. Soldering paste for the Protoplace is located in the refrigerator to the left of you. If it is out, inform one of the staff to replace it.

When using the Protoplace, it is helpful to have one of your team member present to help you with separating the components and helping you. Having

help on this step will decrease the time you are soldering by half. Some tools that are handy are the following: fine pointed tweezer and napkins. Turn on the Protoplace machine as taught by a staff member and place the solder paste onto the machine. Once the Protoplace machine is on and everything is properly connected, you can begin soldering. Place a good amount of solder onto the surface mount on the PCB; however, make sure the solder paste on the surface mount connections are touching that may affect the connection between the surface mounts. When using the Protoplace, it is recommended to have the dispensing on lock so that the machine is not easily moved. Also, I recommend applying soldering paste throughout the entire PCB before you start placing surface mounts since the solder paste does not dry up. Once you have finished applying solder on the PCB, use the Protoplace to place the components onto the PCB. The Protoplace is handy when applying the surface mounts as the metal tube acts a suction to place the surface mounts on. For smaller components, such as 0402, use tweezers since the Protoplace machine can suck up the components, which occurred to our group. After finishing up on the PCB, place the PCB in the Protoflow, the oven to bake the PCB. First, turn on the machine and set it to the required temperature, as taught by the staff. Place the PCB inside the oven and wait until the machine beeps to indicate the solder has completely dried up. Once the oven opens, wait a couple minutes as the PCB is really hot. Inspect the PCB to see if every component is properly soldered on. If some components are not, the section below will inform you how to fix the component.

C. Soldering using solder paste

Soldering using solder paste is similar to soldering free hand. This method of soldering is useful for components that were misplaced during baking or other components that were left off. Grab the solder paste in the refrigerator and a toothpick located above the soldering iron. Also, if flux is available, using it will be helpful. First, inspect the component that needs to be fixed. Use the machine next to the solder iron to melt the solder on the PCB. If you do not know how to use this equipment, ask a staff to receive proper training as applying too much direct heat may affect the PCBs. After using the hot air to remove the solder, use a tweezer to grab the component. After the component is removed, use the solder paste syringe and toothpick to apply solder onto the PCB. It is important to not apply too much solder paste on the PCB. As a reminder, apply flux onto the PCB before applying solder paste. After the solder and flux is on the PCB, use the tweezers to place the surface mount onto the PCB. Use the hot air machine to dry the solder. It is important to keep the air at 20% and the temperature around 650 - 700 fahrenheit. A helpful tip is to apply the hot air directly on top on the component so that the component does not move. After the component is fully dry, inspect it to ensure it is properly placed.

IV. Tips

Now that you have been introduced to the three different soldering methods, I will provide some useful tips next that my group used when soldering. When using the Protoplace, apply solder onto the entire PCB before placing the component. Have a team member present when soldering so that they can assist you with the components and where to place the component. For smaller components such as 0402, use solder paste and tweezer instead of the machine as it is much easier. Flux is useful when soldering as well. Do not use the Protoflow

multiple times as the constant heat may damage the PCB. These are some useful tips that were helpful for my group.

V. Next Step

After finishing soldering, testing the PCB is the next step. Testing each component and the PCB is important because the component may not be properly soldered on even though it appears as so. If some components are not properly soldered on, I recommend using the third method.