



Surface Mount Device Soldering Reflow at Home

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Abstract

As through hole devices become harder to find and more expensive, surface mount devices will become the only choice for building home projects.

In this talk, I introduce the process of assembling a circuit board that contains surface mount devices. I list component sizes that make sense, tools you'll need, and an easy-to-build reflow controller and oven. I will include links to on-line resources that will reinforce what you were introduced to here, and examples of making boards that come out great every time.



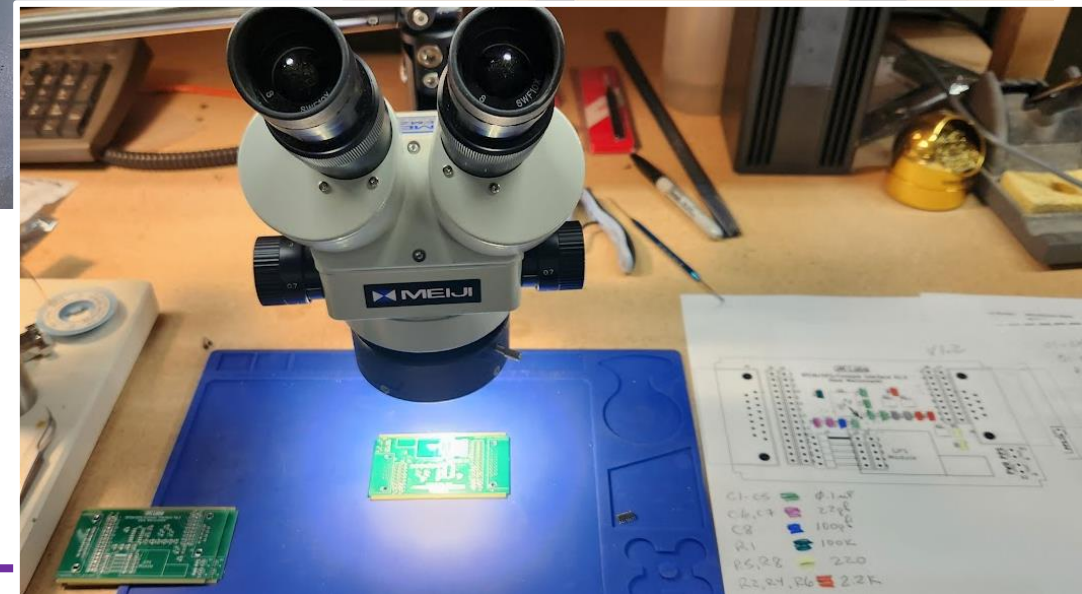
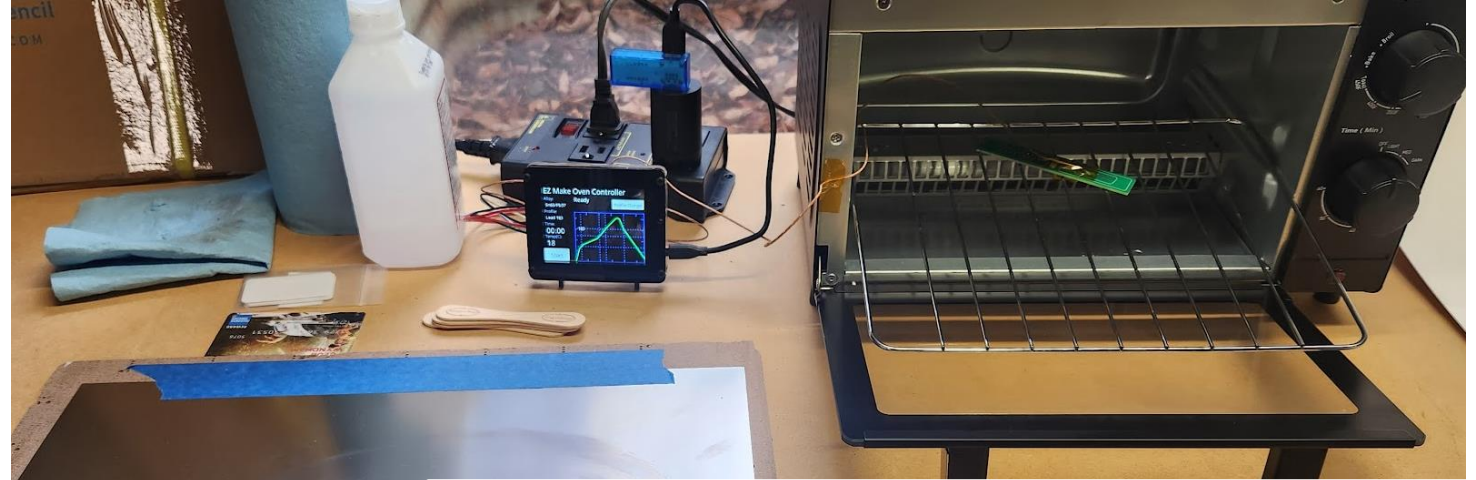
Topics

- Equipment Overview
- Temperature Profile Explained
- Component Size Selection
- Reflow Process Step-by-Step
- References



Equipment Summary

- Adafruit EZ Make Oven
 - Tutorial and Instructions
 - Uses \$20 Walmart Toaster Oven
- Stencil
 - Order with the Board from the Board Vendor, e.g. JLCPCB.com
- Solder Paste
 - ChipQuik SMD291AX50T3, No-Clean, Sn63/Pb37
- Microscope
 - For Placement and Inspection
 - Inexpensive USB Microscope Works
- Tweezers – Good Ones!





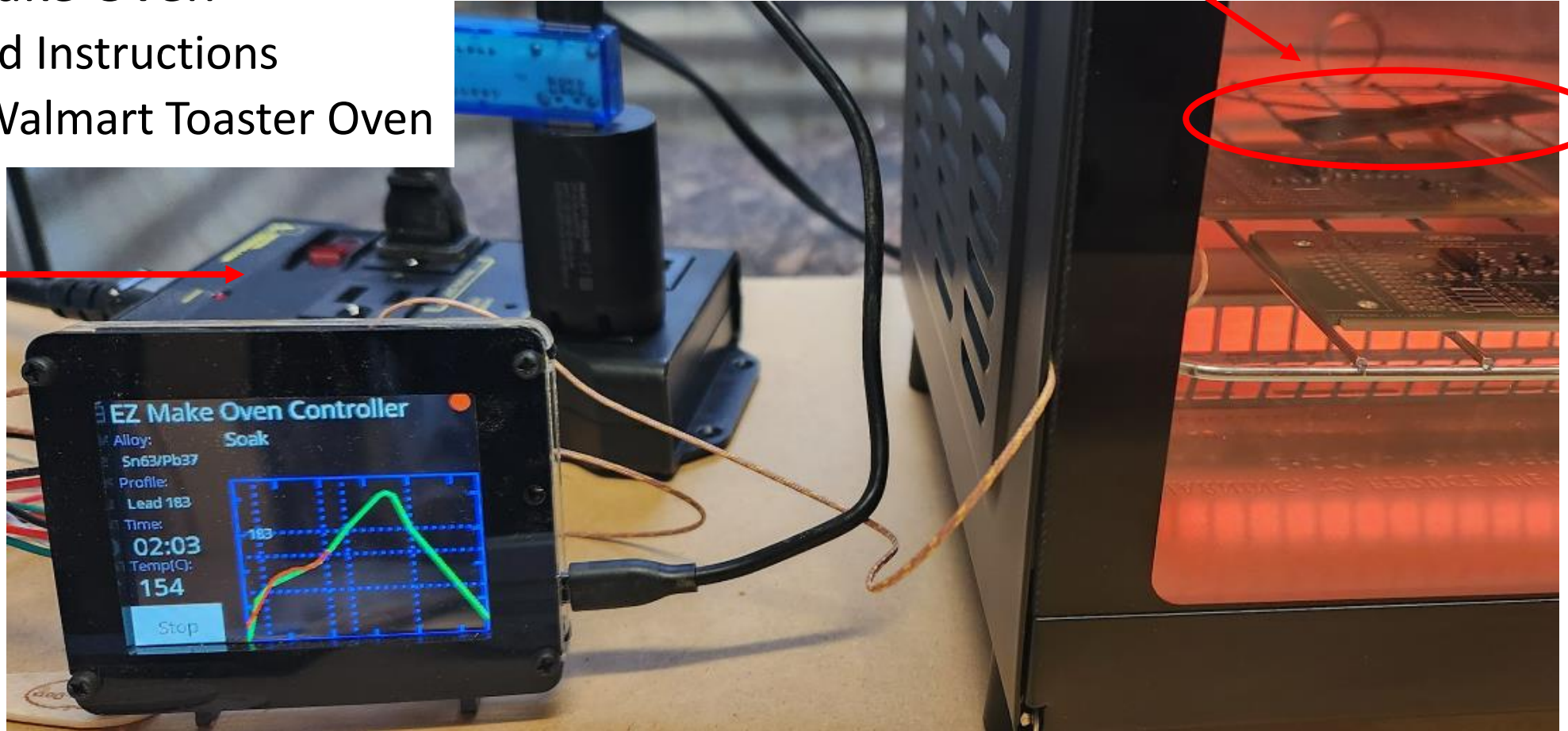
Equipment Summary

Adafruit EZ Make Oven

- Tutorial and Instructions
- Uses \$20 Walmart Toaster Oven

Thermocouple

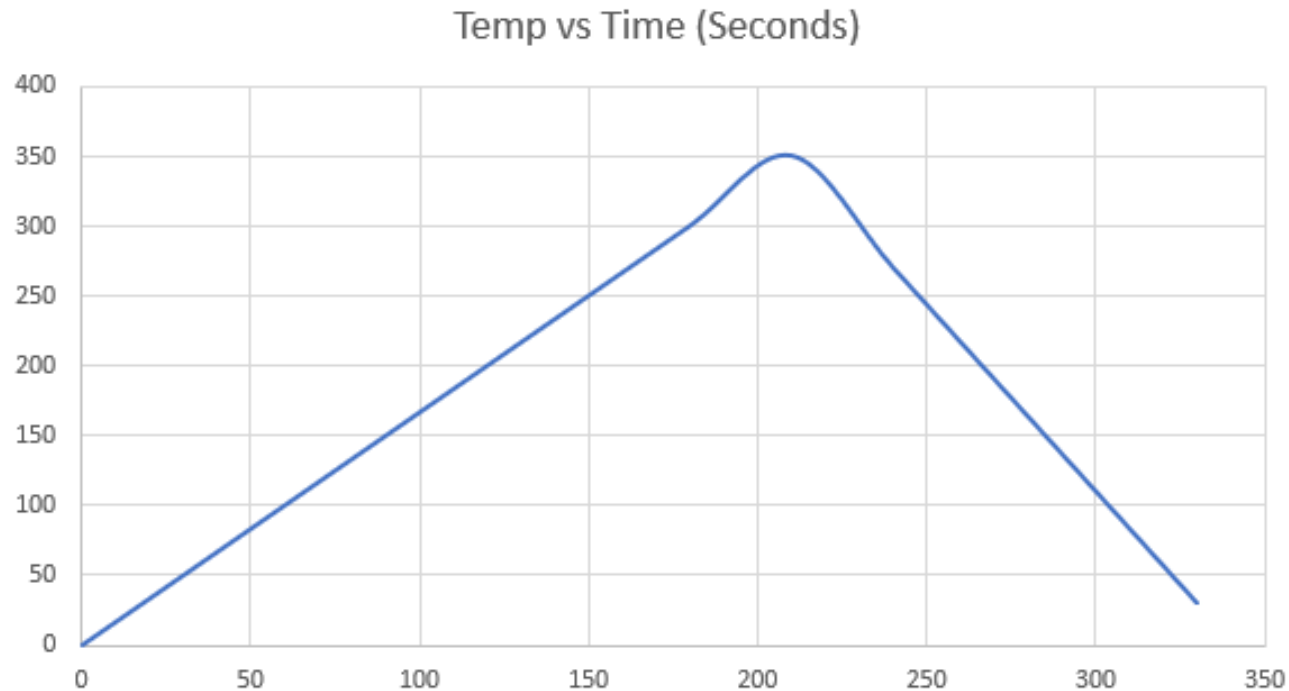
Relay Module





Soldering Temperature Profile Explained

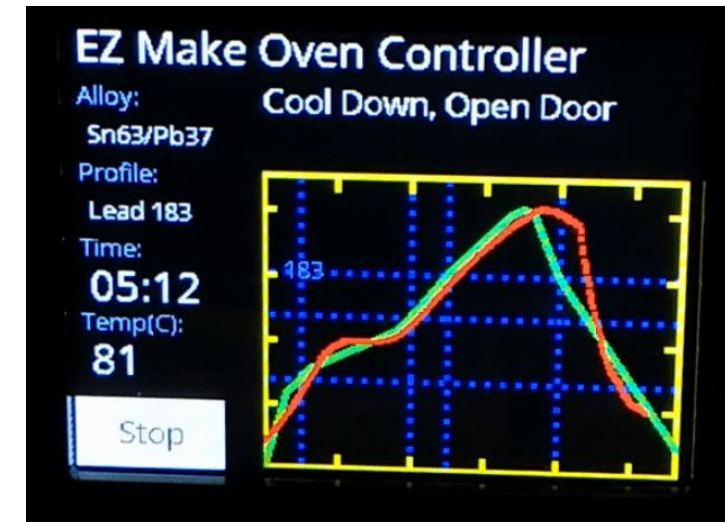
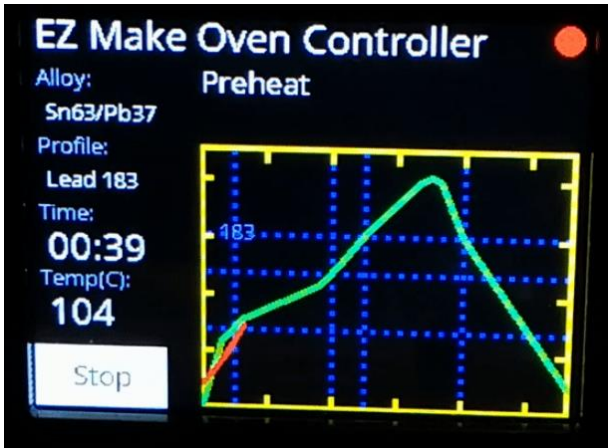
- What's the Temperature Profile to Cook Toast?
 - Turn on Oven at Full Temperature for a Fixed Time
 - The Selected Fixed Time Turns Off the Oven at $\sim 350^{\circ}$ F





Temperature Profile Explained

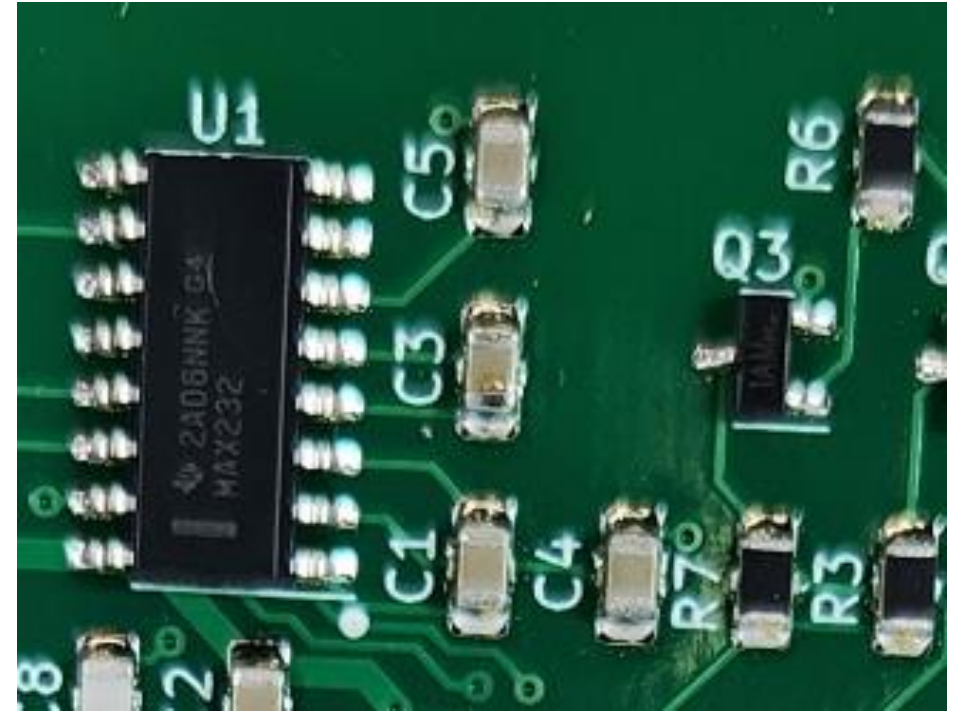
- Sn63/Pb37 Profile





Component Size Selection

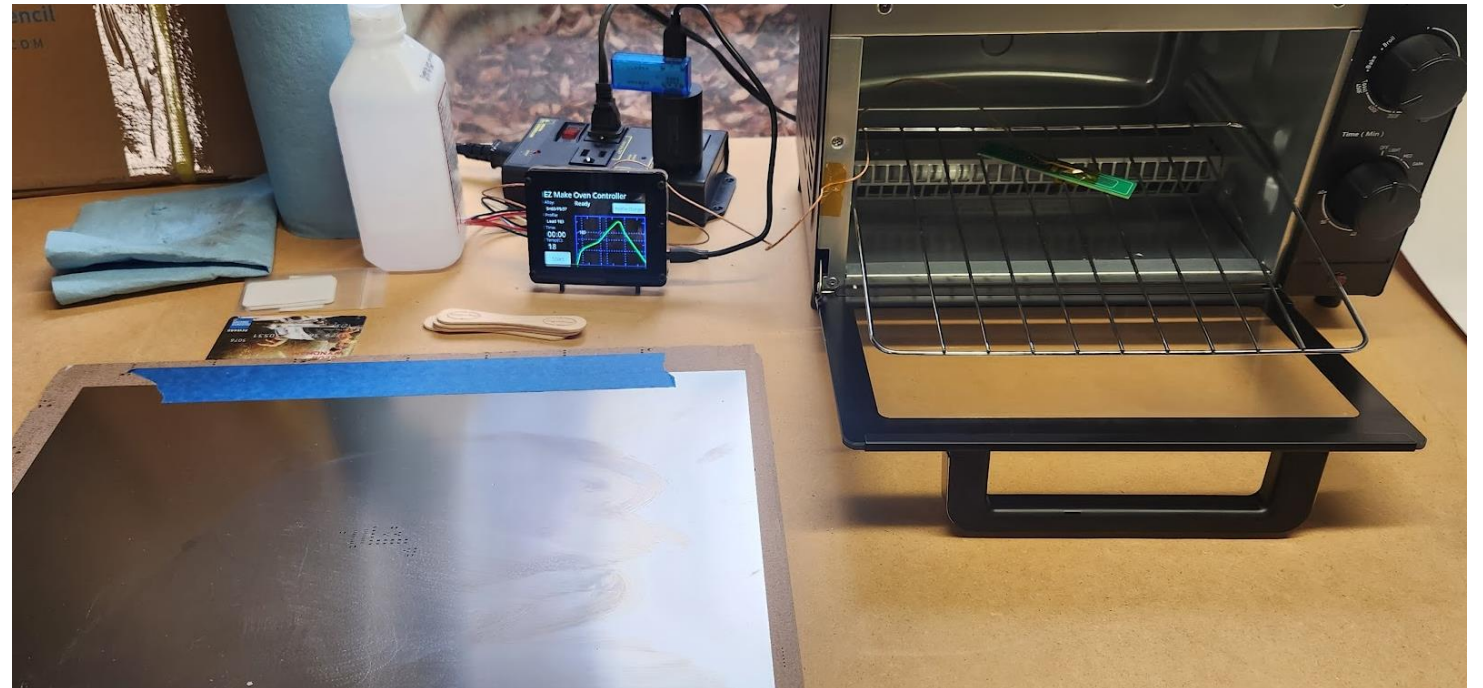
- Resistors, Capacitors, Inductors
 - 0805 is the smallest reasonable size to install by hand.
 - Large Capacitors are 1206 or larger
- Transistors, FETs
 - SOT23 is reasonable
- IC's
 - SO and SOT23 packages are easy. As the pin spacing becomes closer, placement becomes more critical.
- LEDs
 - I still like Through Hole for LEDs. Getting a surface mount LED to shine thru a front panel can be mechanically complicated.
- Headers, Connectors
 - Always Use Through Hole Parts. Mechanically more stable.





Reflow Process Overview

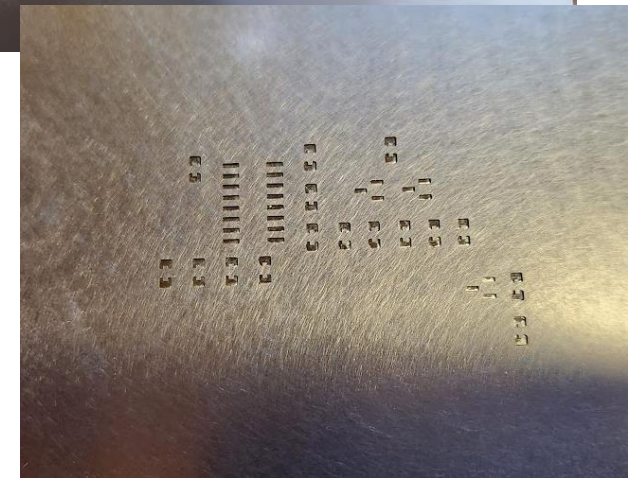
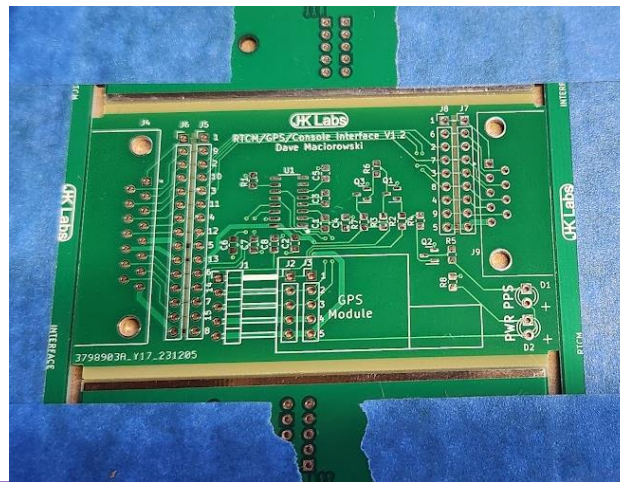
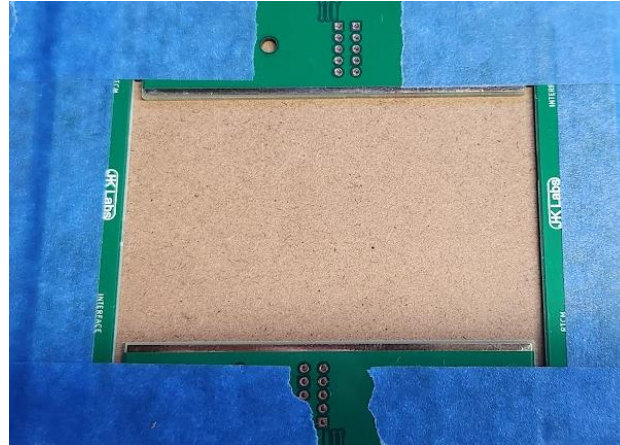
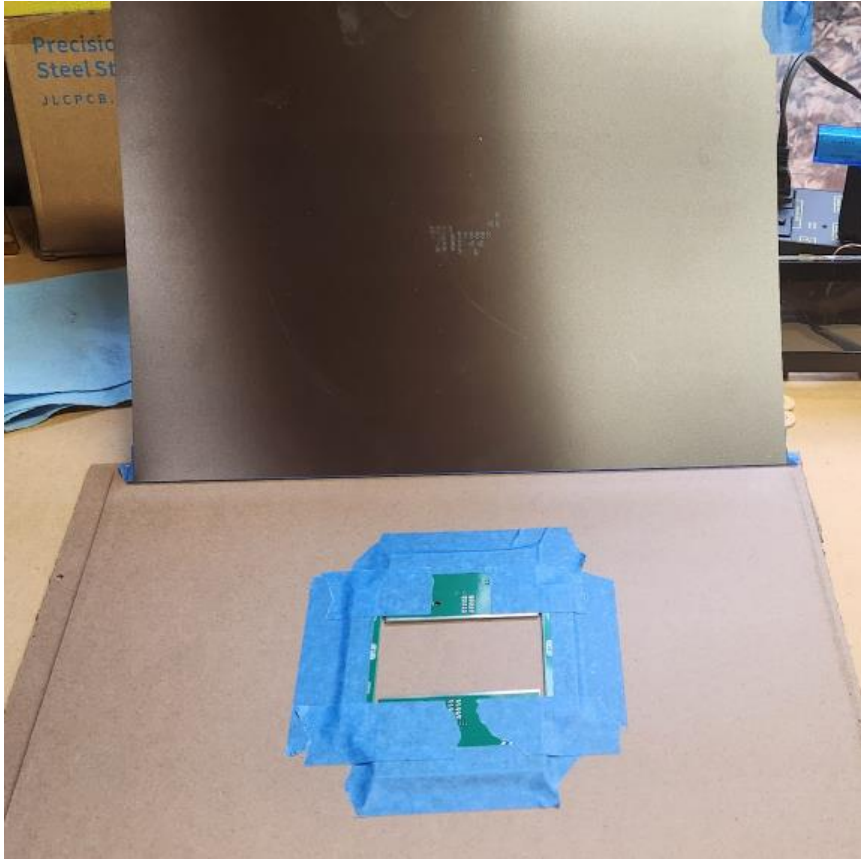
- Bare Board and Matching Stencil Setup for Screening
- Screen Solder Paste on Board Using Stencil
- Place Parts in the Solder Paste
- Solder the Parts
- Cool Down
- Inspect
- Cleanup





Reflow Process Overview

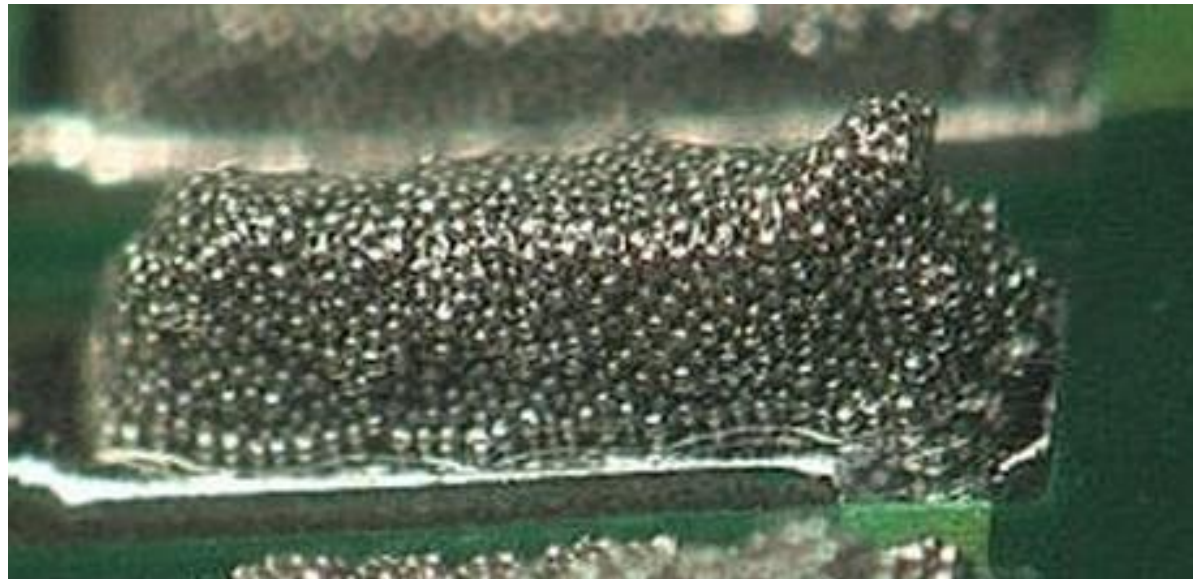
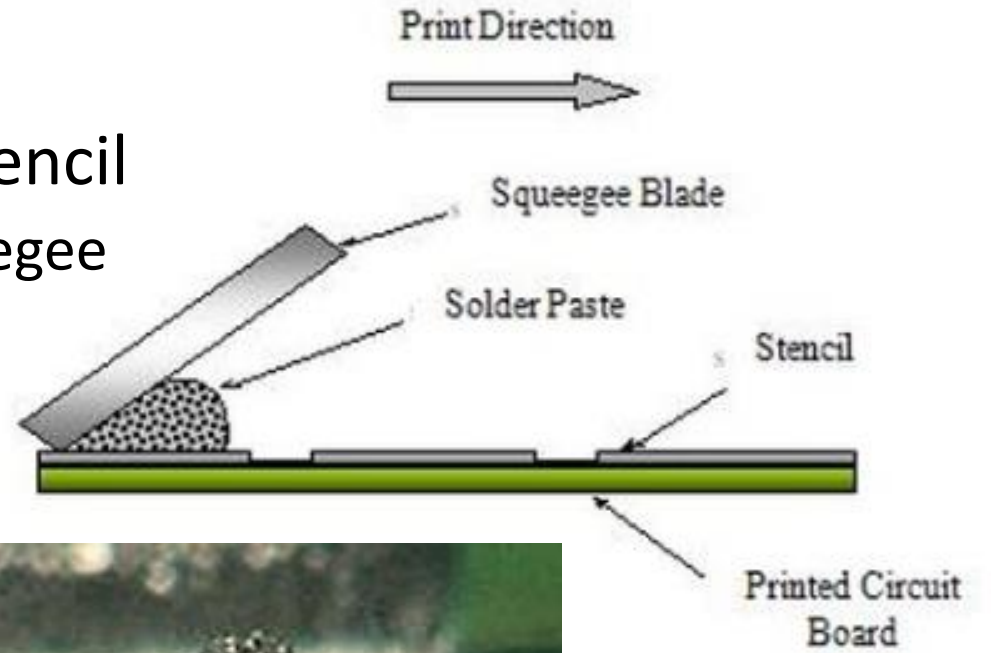
- Bare Board and Matching Stencil Setup for Screening





Reflow Process Overview

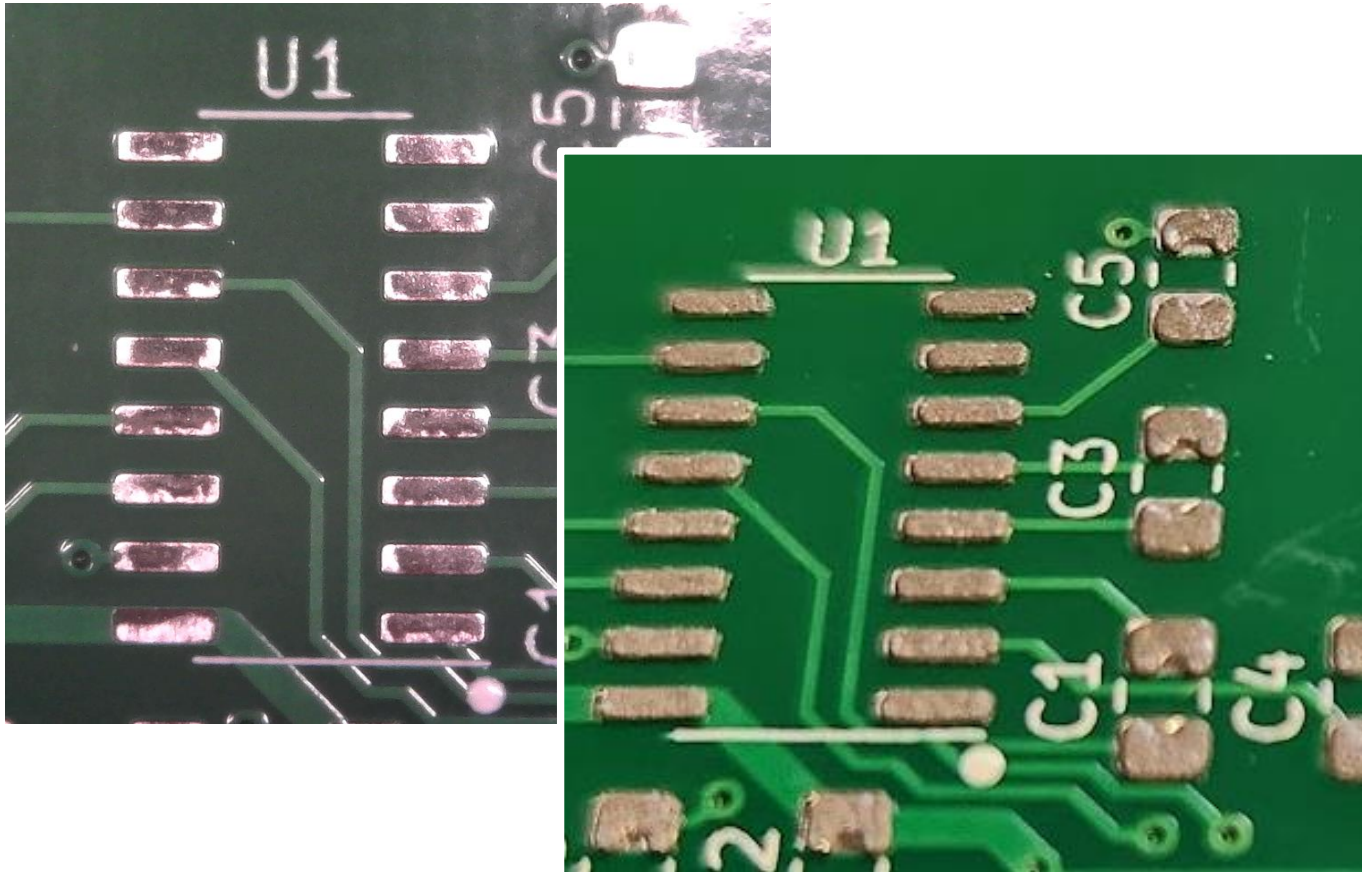
- Screen Solder Paste on Board Using Stencil
 - Use Small Spatula to Load Paste on Squeegee





Reflow Process Overview

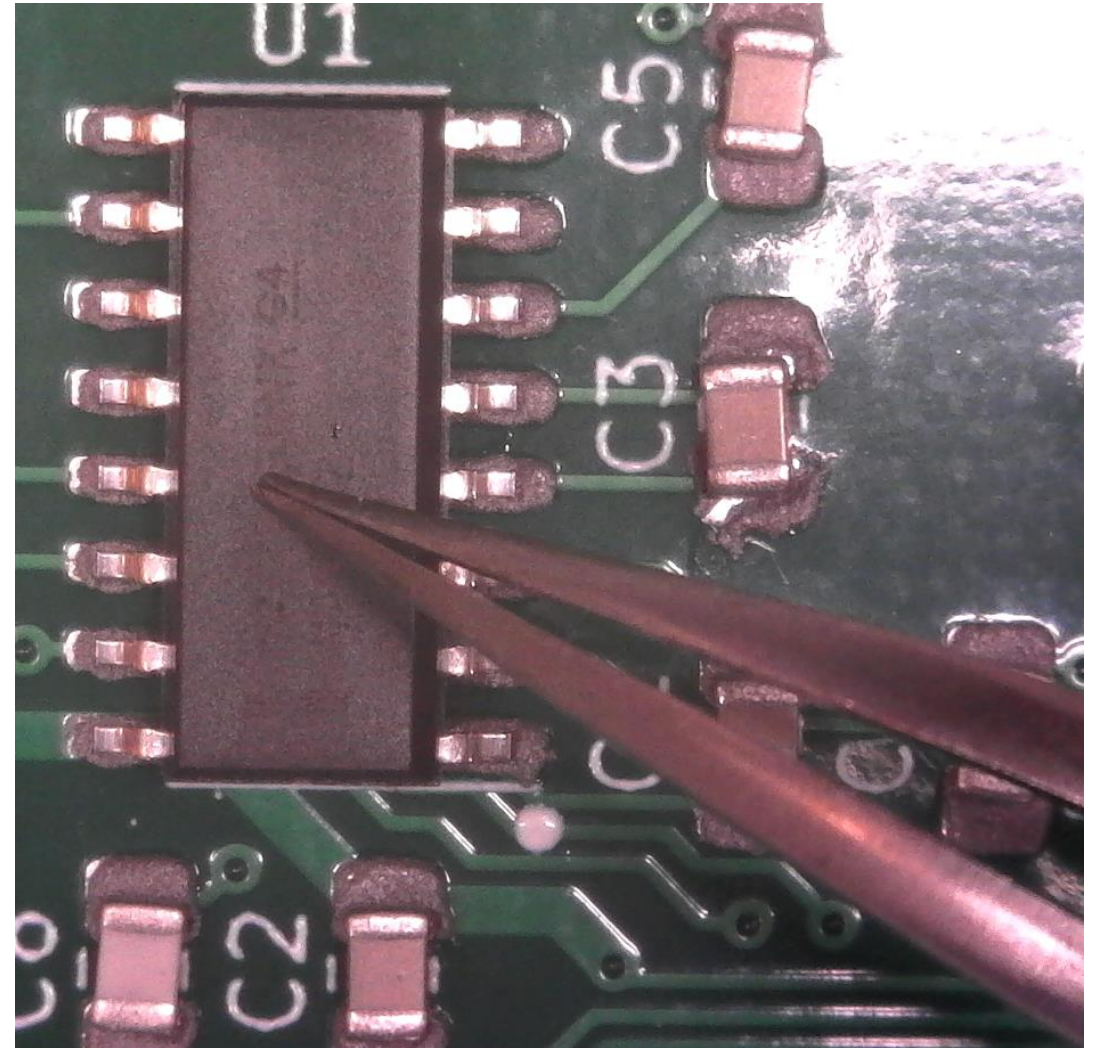
- Screen Solder Paste on Board Using Stencil





Reflow Process Overview

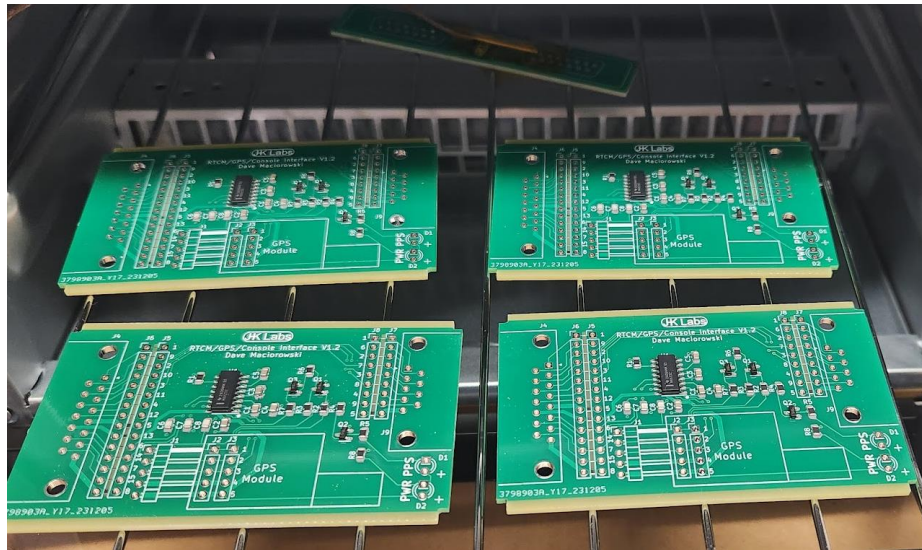
- Place Parts in the Solder Paste





Reflow Process Overview

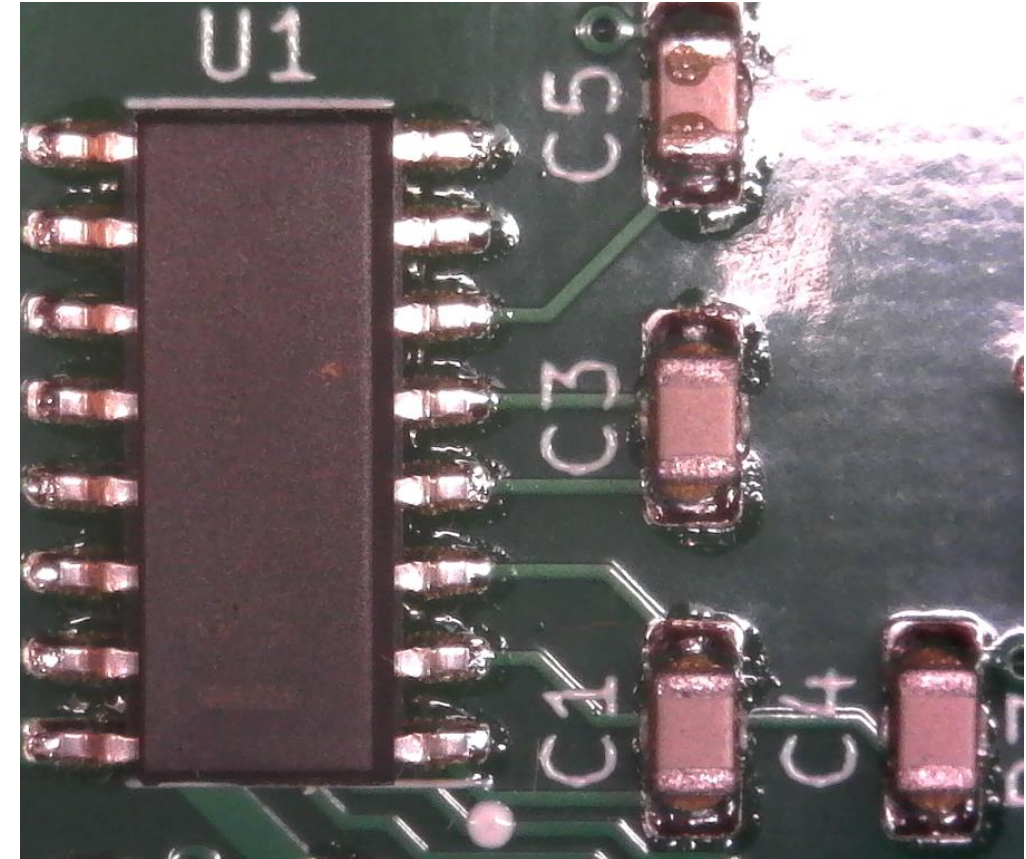
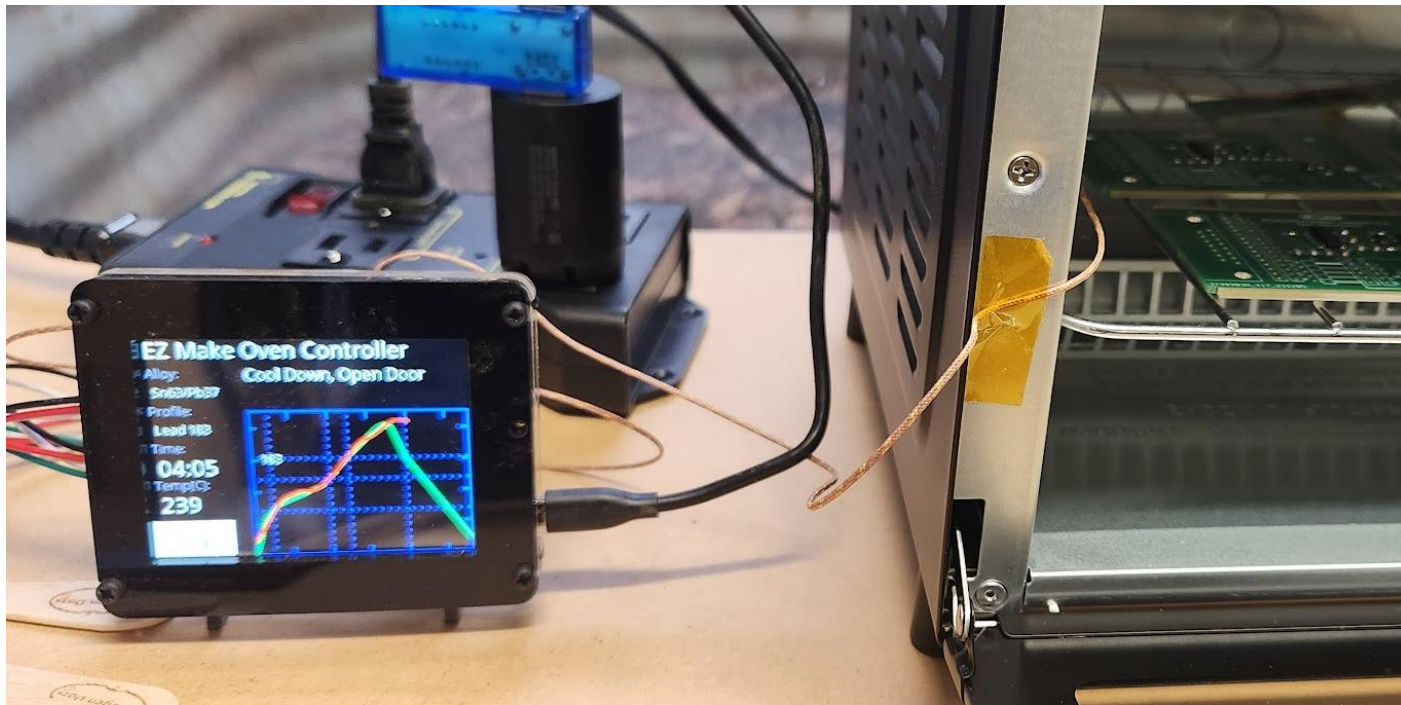
- Boards in the Oven with Temperature Sensor
- Solder the Parts





Reflow Process Overview

- Cool Down
- Inspect





Reflow Process Overview

- Cleanup
 - Use 99% Isopropyl Alcohol
 - Clean the Squeegee
 - Clean the Spatula
 - Clean the Stencil
 - Be Sure to Clean the Holes in the Stencil





Hot Air Reflow

- Cost Effective Hot Air Rework Station
 - Air Flow is Adjustable so Small Parts Don't Blow Away
 - Temperature is Adjustable
 - Optional Nozzles Available
 - <https://www.amazon.com/gp/product/B08B3M6YW>
- Useful for Rework or Small Projects
- Search "Hot Air Reflow" on Youtube





References

- Adafruit EZ Make Oven
 - <https://learn.adafruit.com/ez-make-oven/>
- Plugable USB Camera
 - <https://www.amazon.com/Plugable-Microscope-Flexible-Observation-Magnification/dp/B00XNYXQHE>
- Digital Microscope Comparison
 - <https://www.youtube.com/watch?v=4fkLigX4iIA>
- ChipQuik Solder Paste
 - <https://www.amazon.com/dp/B07BH5LP5G>
- Kapton (Polyimide) Tape
 - <https://www.amazon.com/gp/product/B006ZFN2I>





References

- Reflow Soldering Profiles
 - <https://www.compuphase.com/electronics/reflowsolderprofiles.htm>
- Resistor and Capacitor SMD Sample Book
 - <https://www.ebay.com/itm/285353583035>
- 99% Isopropyl Alcohol for Technical Use
 - <https://www.amazon.com/dp/B07NFSFBXQ>
- Hot Air Pencil
 - <https://www.amazon.com/gp/product/B08BK3M6YW>
 - Extra Nozzles Available
- Youtube – Search for Reflow Soldering
 - <https://www.youtube.com/watch?v=38emi1NsZUs>





Questions?



THANK YOU!!!