Electrical Training

Week 6: Soldering

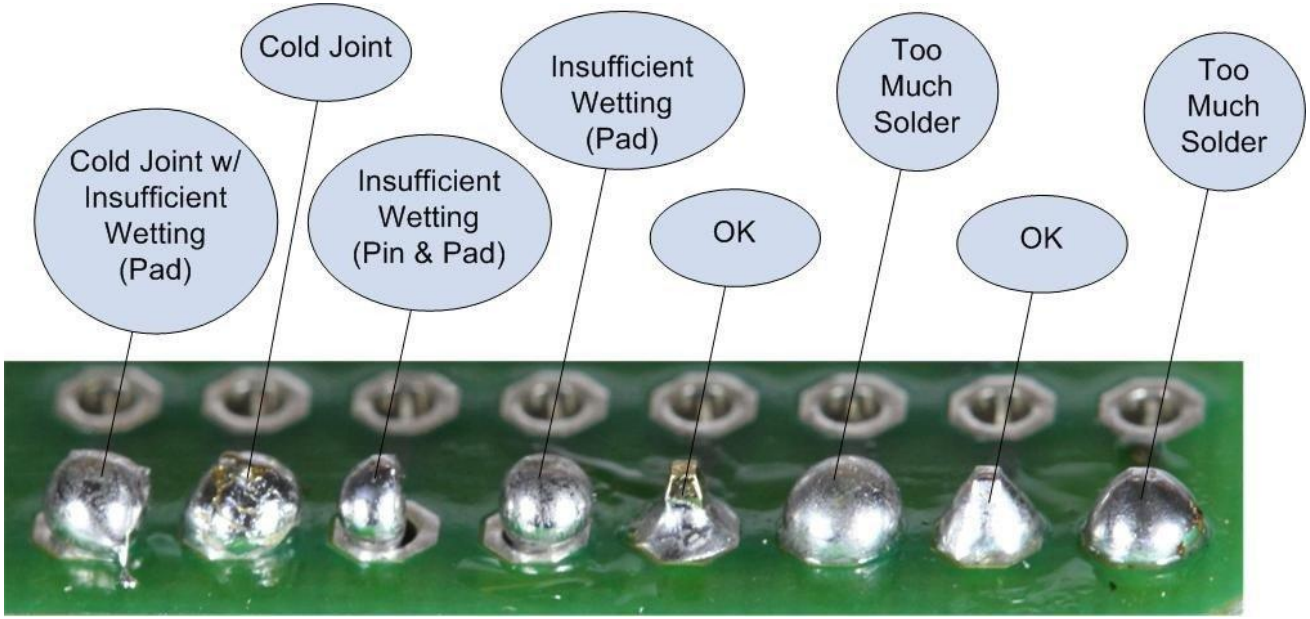
Agenda

- Basics of Soldering
- Soldering with an Iron
- Soldering with Hot Air Gun
- Soldering with Reflow Oven

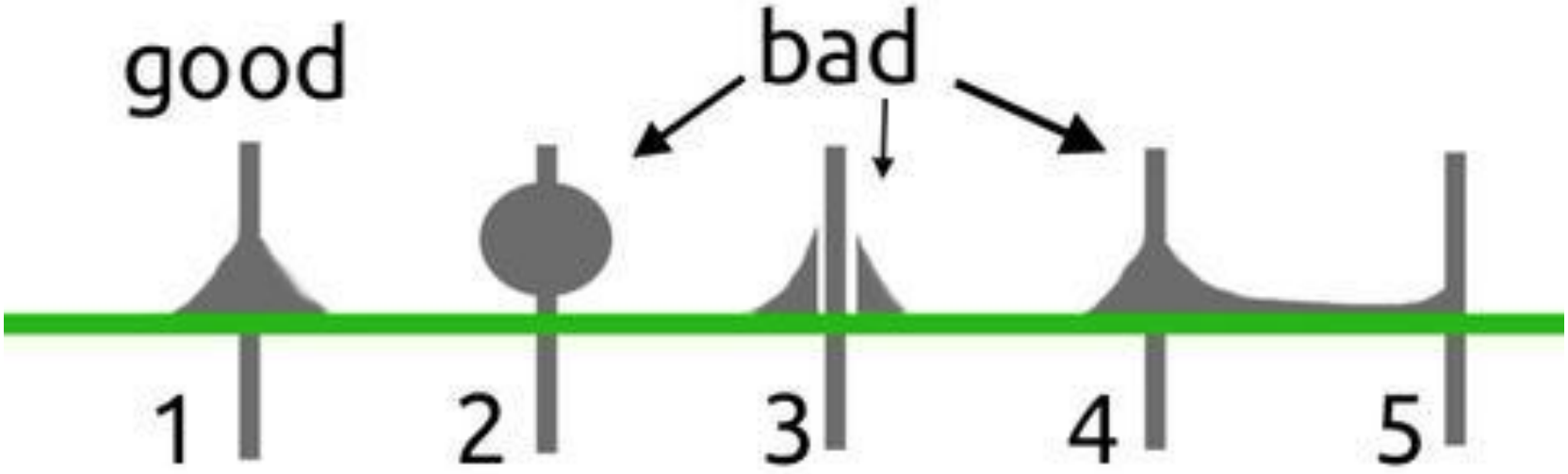
Basics of Soldering

How Solder Works

- Wetting
- Attracts to hottest part



Good Solder Joints



Tools

- Soldering Iron
- Hot Air Gun
- Reflow Oven
- Flux
  - Remove oxides to allow better solder components
- Tweezers
  - Hold small components when soldering

Soldering with Iron

Soldering Iron

Soldering Iron Safety

- Hold the iron like a pencil
- Entire metal end gets hot (don't touch)
- Always assume iron is hot
- When not in use put back in holder

Soldering Iron Tools

Solder

What you heat up

Sponge

How you clean your iron

Flux

Removes oxidation

Other Soldering Iron Tools

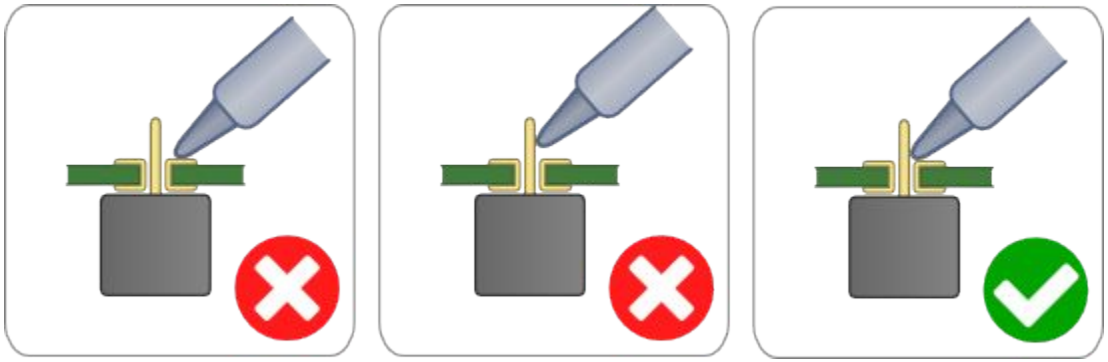
- Iron Tips

  - Bigger tips, more heat
  - Smaller tips, more precision, easier to break

Other (other) Soldering Iron Tools

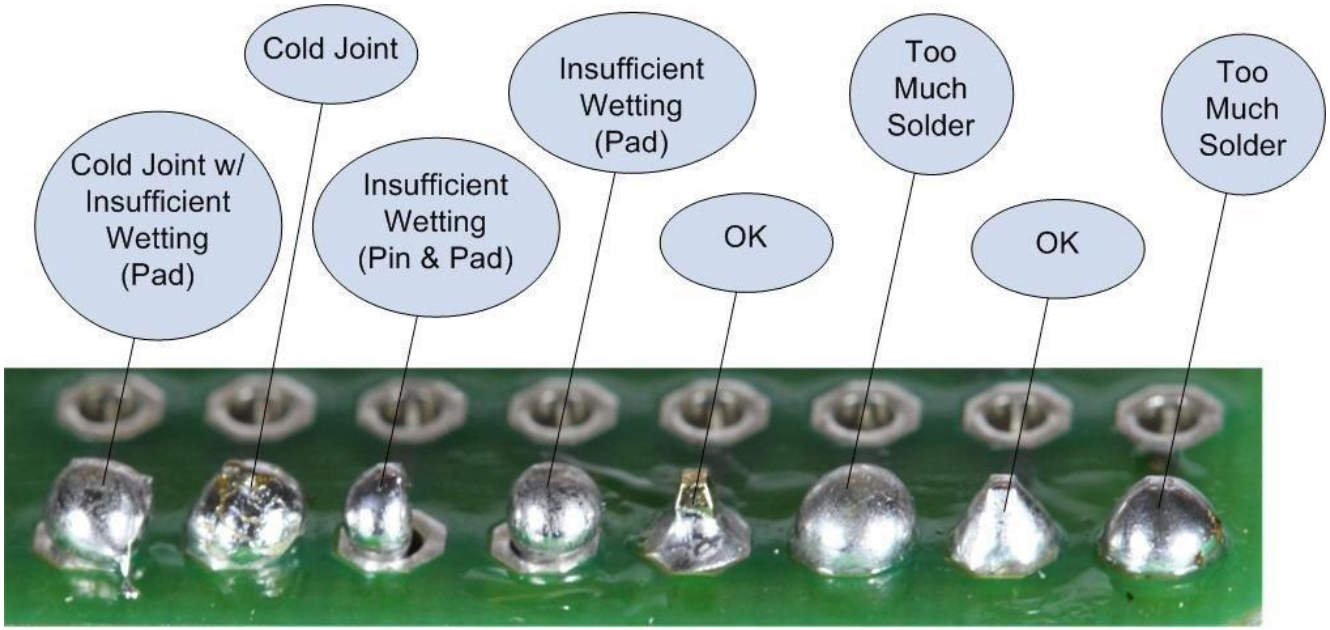
- Exhaust fan
  - Filter fumes while working
- Desoldering wick
  - Copper mesh to remove solder
- Desoldering pump
  - Pump to suck solder out of holes

How to Heat Parts



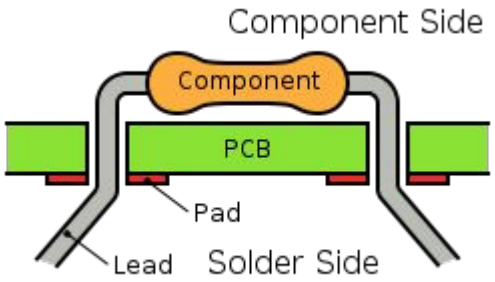
- Touch the iron to the pad and the pin so both heat up
- Apply solder to the pad and pin, not the iron
  - Pull solder away before iron

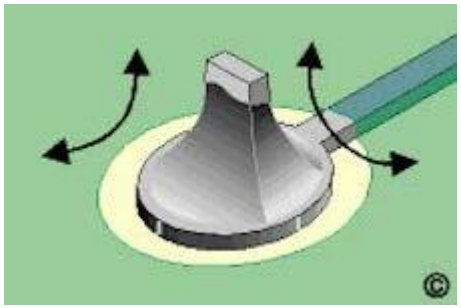
How Much Solder to Apply



- Enough to cover the pad, but not so much that it makes a bubble

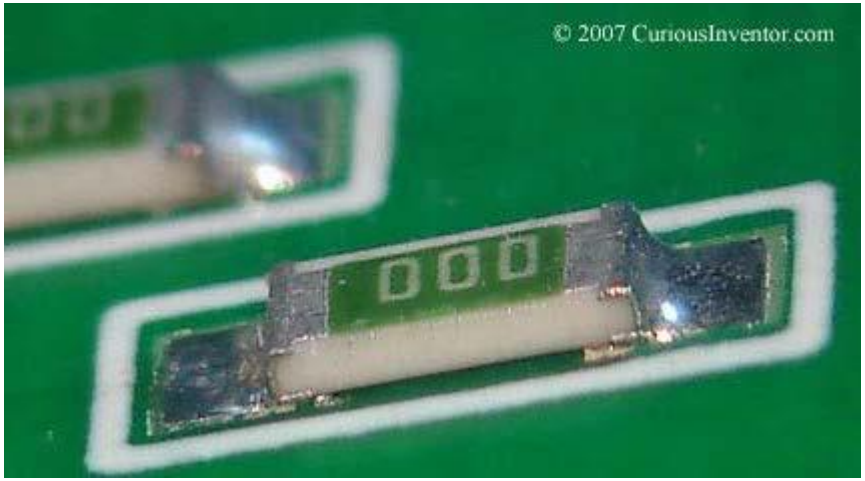
Through Hole Soldering

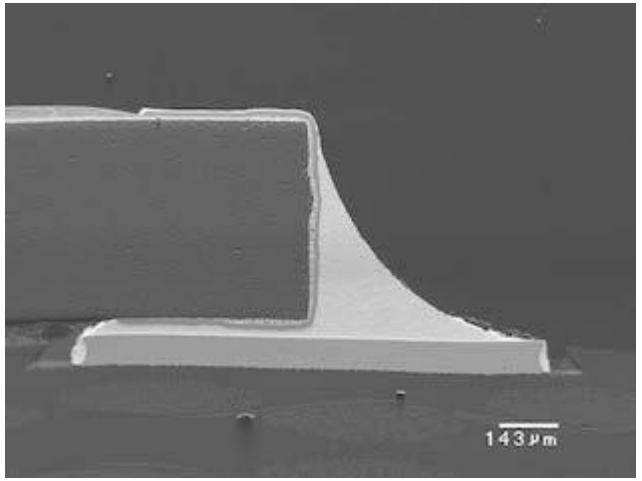




- Bend pins slightly outward to hold in place
- Touch iron to pin and pad
- Apply solder to the opposite side of the pin
- Clip excess pins when you are done

Surface Mount Soldering



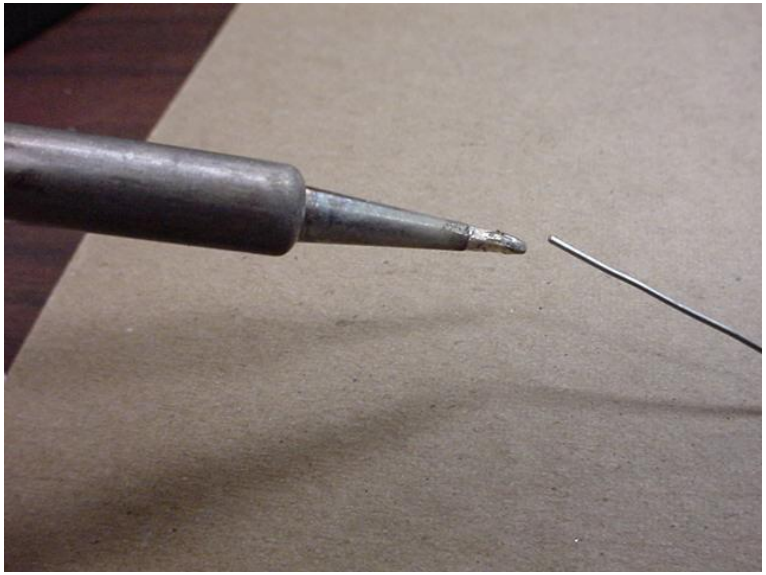


- Apply solder to one pad (a corner if many pins)
- Place components (with tweezers) and solder first pin to the pad
- Solder pin on opposite corner then rest

Cleaning Your Iron

- Wet sponge and brass sponge to clean solder from iron
  - Wet sponge cools iron (have to wait to heat back up)
  - Do not hold on sponge

Cleaning Your Iron Cont.



- Tin the iron when done soldering
  - Clean top, cover tip in solder, clean again
  - Prevent oxidation and corrosion

Soldering with Hot Air Gun

Hot Air Gun

Hot Air Gun

- Deals with certain footprints that are either hard or near impossible to solder using soldering iron
- Melt solder attracted by heated metal; surface tension automatically aligns components

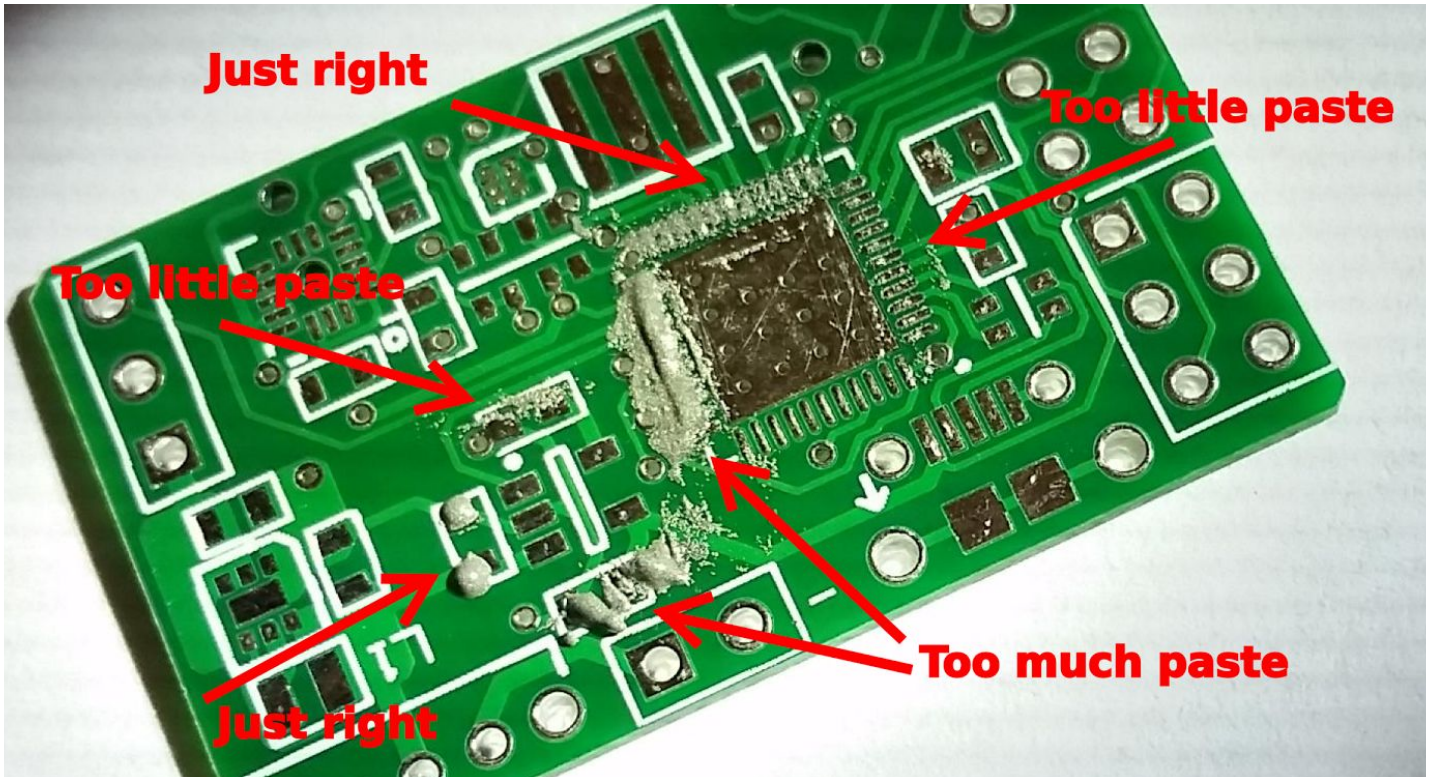
Tools

- Hot air gun
- Wire rack to place board on (so you don't burn the table)
- Solder paste
- Small beads of solder held together with flux

Applying Solder Paste

- Apply small amount of solder paste to all pads of component
- Solder will attract to pads so don't have to be exact
- Use tweezers or syringe to make sure paste is spread evenly over pads
- Place component on top of solder paste
- For complex boards stencils exist to help place paste

Amount of Solder Paste



Heating the Component

- Turn on and flip switch to reworking state
- Set temperature to ~340ºC and airspeed to ~66
- Hold tip a distance away to slowly heat up the part
- Bring tip closer and heat all pads evenly until all is melted
- Flip switch to cool down and hold tip at component until hot air gun turns off

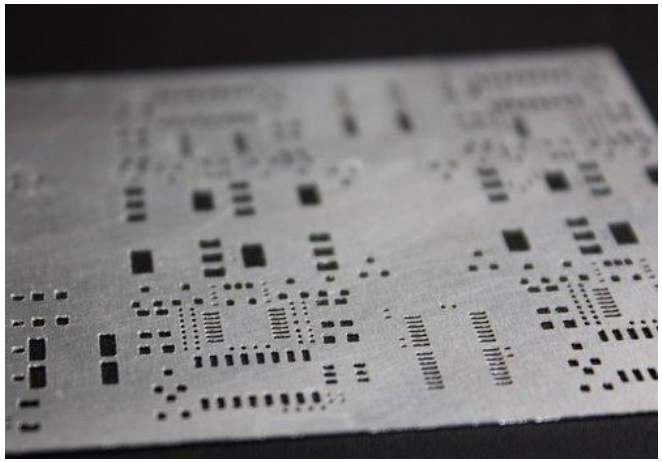
Hot Air Gun Safety

- Air coming out of hot air gun is very hot
- Do not set temperature above 400ºC
  - Can cause damage to parts
  - Make sure all parts on your board can handle heat (many connectors cannot and will melt)
- Turn off before putting back in holder

Soldering with Reflow Oven

Reflow Oven

Reflow Oven



- Reflow oven
- Solder paste
- Using solder paste the same way as with hot air
- Stencil for applying solder paste.

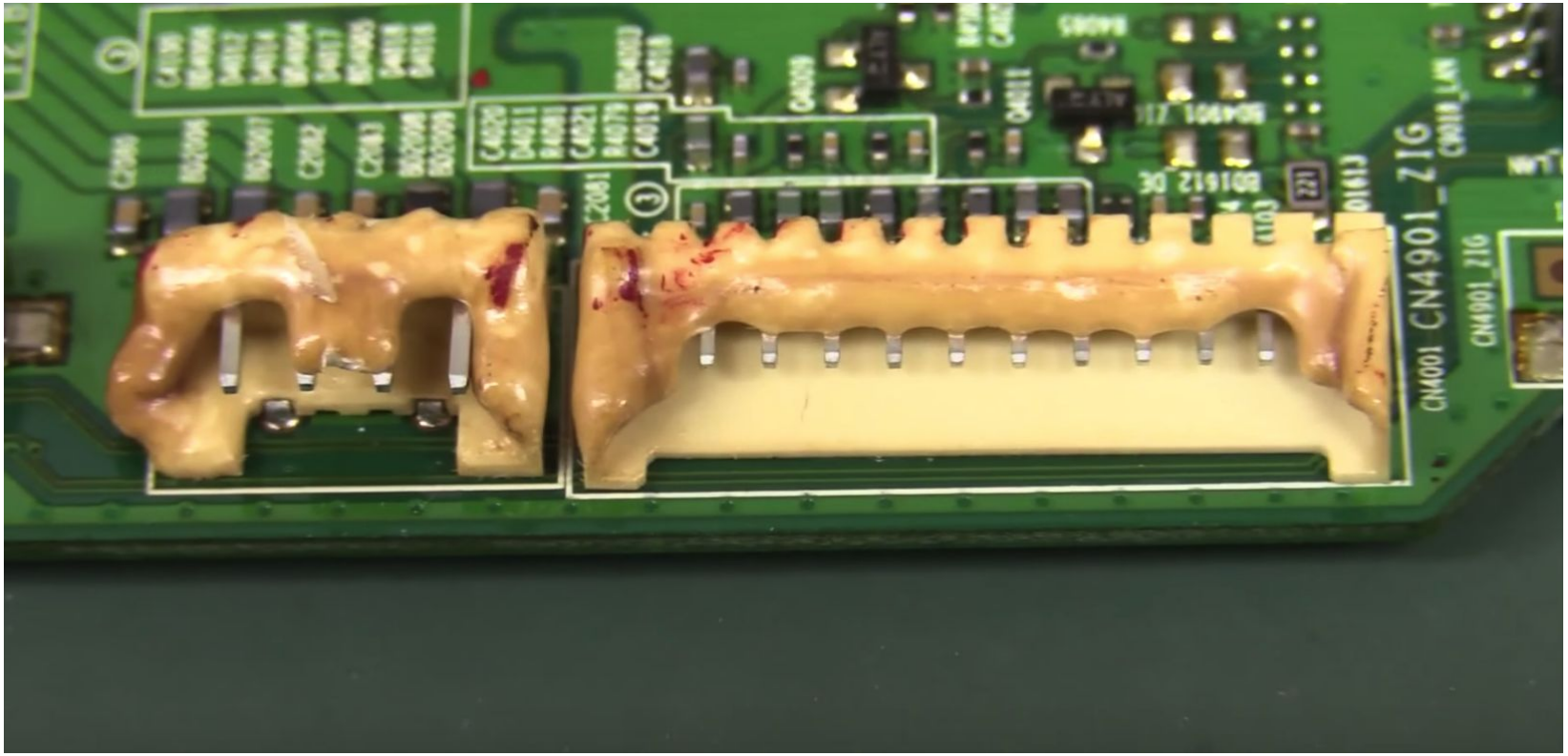
Using the Oven

- Apply solder paste to board same as in hot air
  - Typically apply solder paste to all of board and place all components before putting into oven
  - This is where stencils are more commonly used
- Place board on center of tray and close the oven
- Select correct solder profile wave (varies on type of solder paste being used)
- Start the execution and wait until done (beeps then hit S)

Reflow Oven Safety

- Oven gets hot, be careful touching when on
- Make sure all components you put in oven can stand the heat (many connectors will melt)
  - Surface mount connectors generally have higher heat profile than through-holes
  - But still not advised

Component Melting



Other Resources

- EEV Blog:
  - https://www.youtube.com/playlist?list=PL2862BF3631A5C1AA
- Sparkfun:
  - https://learn.sparkfun.com/tutorials/how-to-solder-through-hole-soldering/all