Welcome

Soldering Training

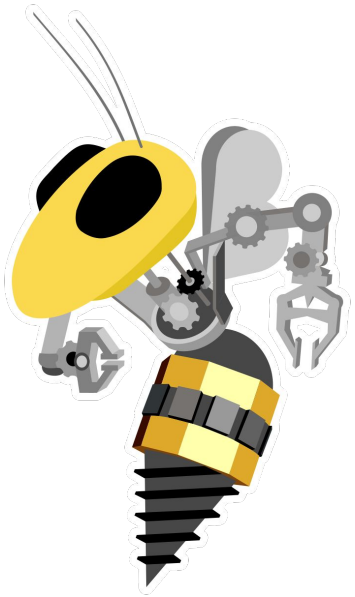
RoboJackets

Competitive Robotics at Georgia Tech

www.robojackets.org

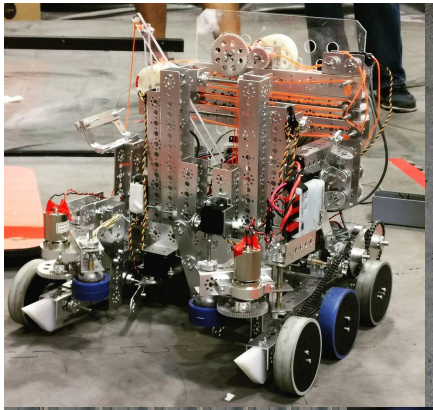
Agenda

- Introduction
- Board overview - what are we soldering?
- How to Solder
  - Basics
  - Tools
  - Component Types
- Soldering Instructions



Introduction

What is RoboJackets?

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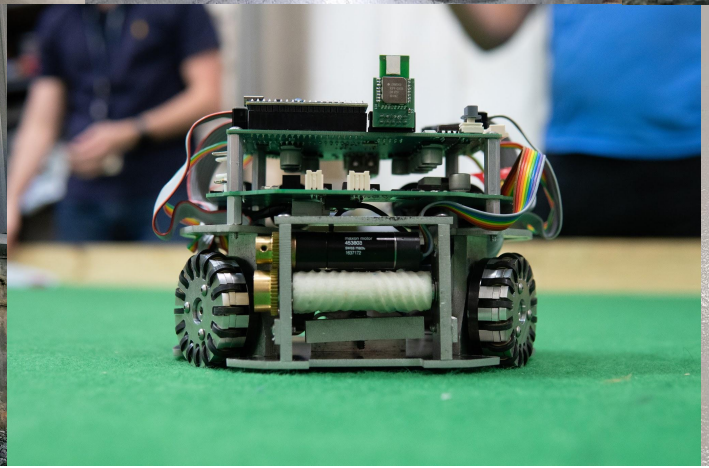


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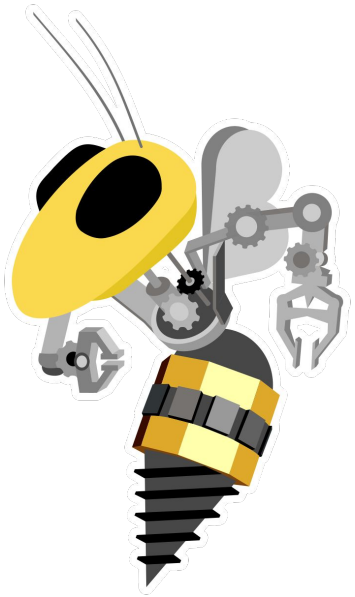
RoboJackets Electrical

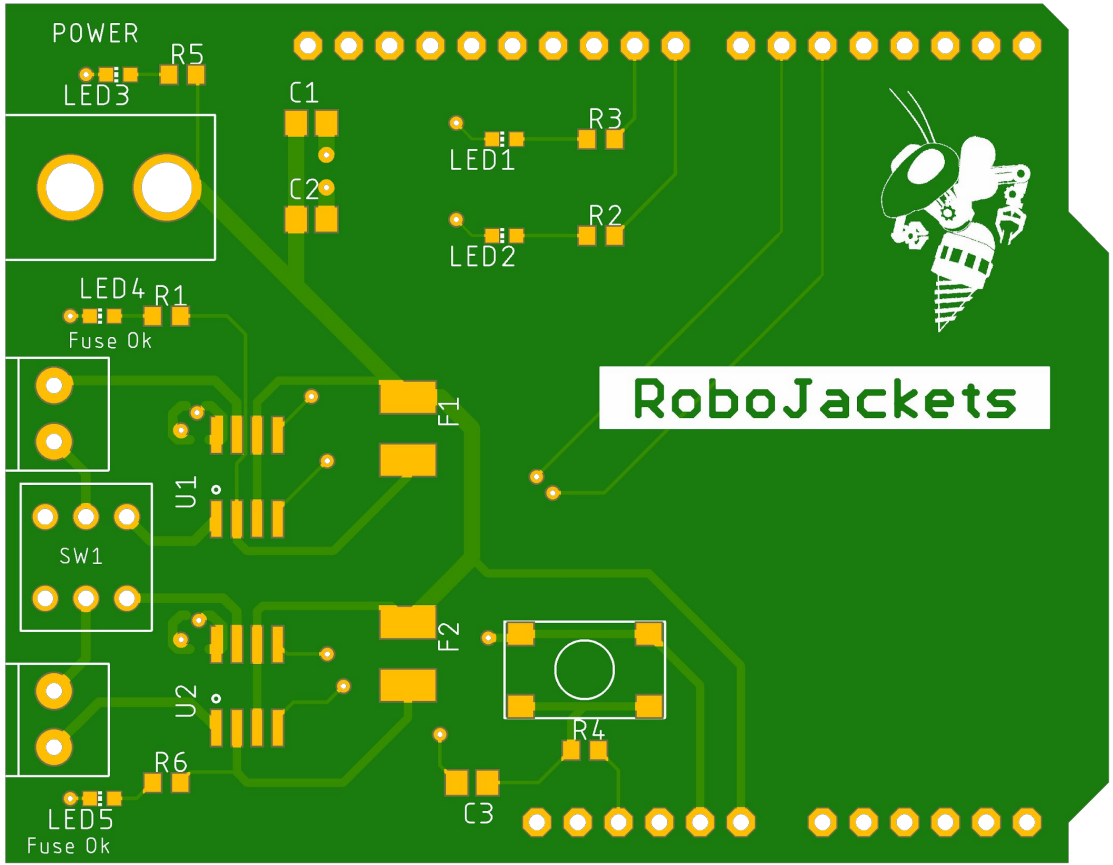
- Embedded System Design
  - Printed Circuit Board design
    - Analog and Digital Circuitry
  - Microcontroller firmware programming
- Mechatronic Design
  - Mechanical systems and actuators
  - Control system design and implementation



Training Board Overview

RoboJackets
Competitive Robotics at Georgia Tech

The Board

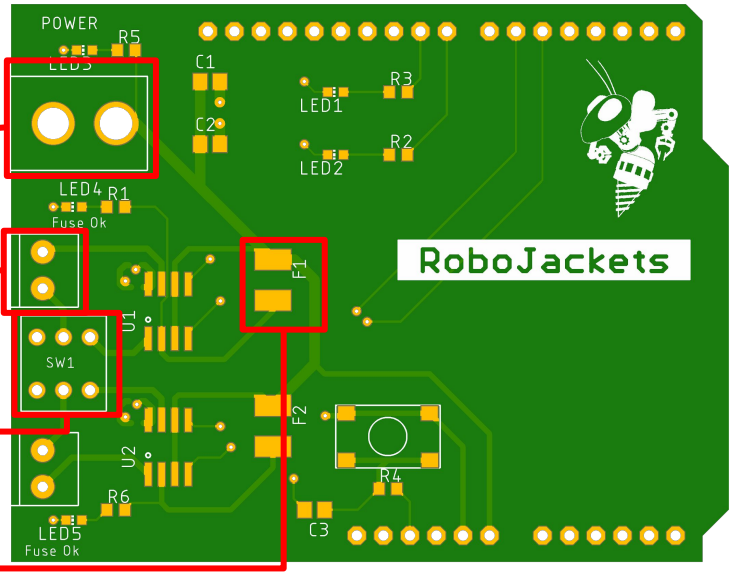


Purpose

- Control two separate brushed DC motors using an Arduino Uno
  - Pair of Motor Driver chips controlled with logic/PWM signals from Arduino
- Source power from 12V DC Barrel Jack

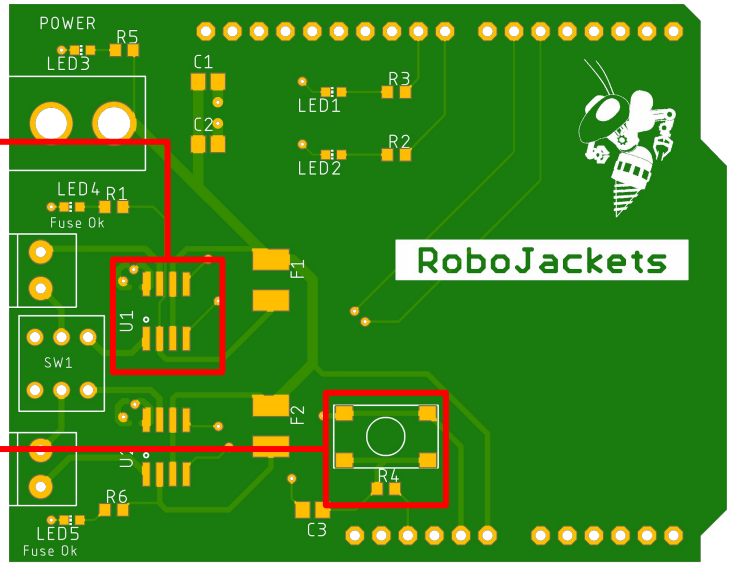
Components

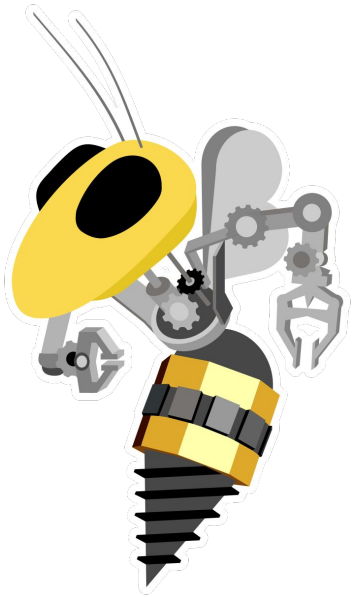
- DC Barrel Jack
  - Source power
- Screw Terminals
  - To attach motor wires
- Power Switch
  - Turn motors on or off
- Fuse
  - Overcurrent protection



Components

- ZXBM5210 Motor Driver
  - Converts logic signals to motor power
- Reset Button
  - Reboots Microcontroller
- Indication LEDs
  - Visually indicate power, fuse, and status of system





Soldering

I suppose this is what you actually came here for...

Safety

- Hold like a pencil from plastic grip area
- Entire metal gets hot (not just the tip!)
- Make sure iron is in holder when not in use

Supplies

Solder

Metal that is melted to form joints

Sponge

For cleaning iron tip

Flux

Helps solder to flow more easily

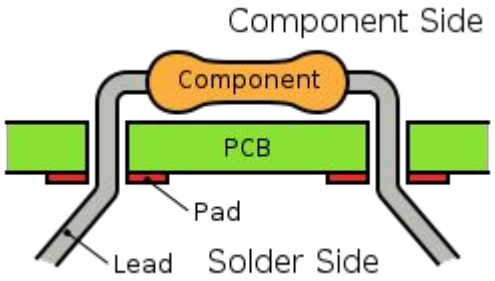
Supplies

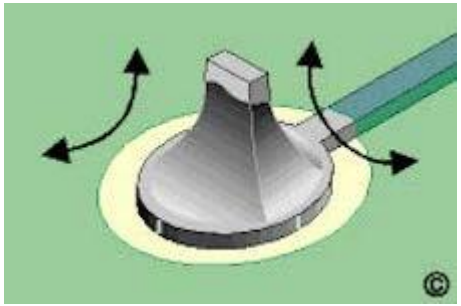
Iron Tips - Choose based on desired precision and heat transfer capability

Supplies

- Exhaust Fan
  - Keep solder fumes out of your lungs
- Desoldering Wick
  - Copper mesh to remove solder
- Desoldering Pump
  - Sucks out undesired solder

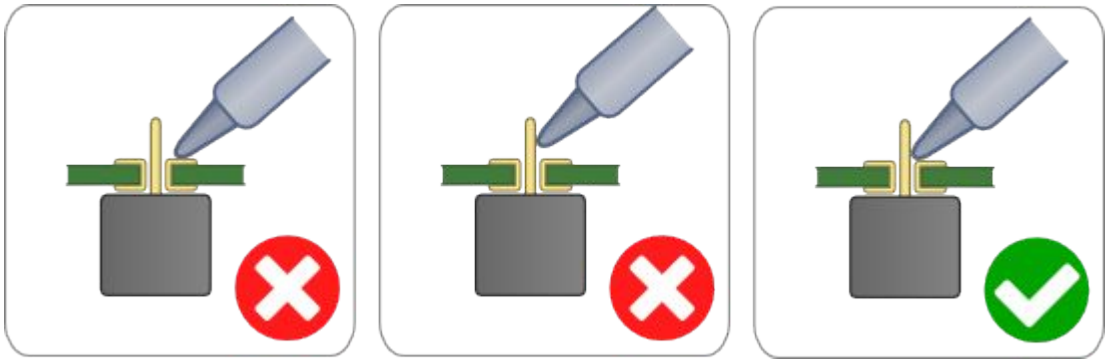
Through-Hole Soldering





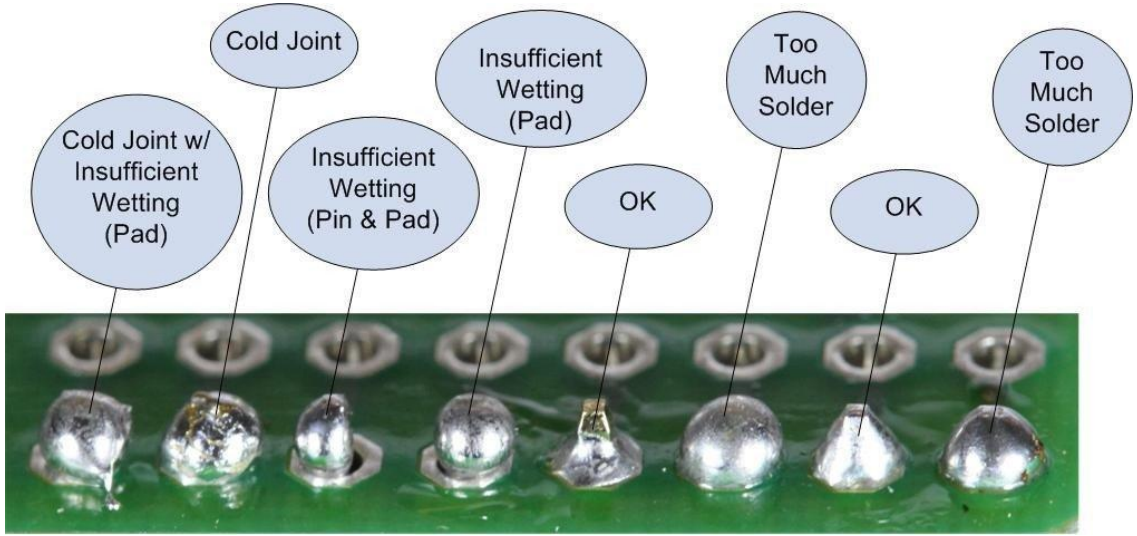
- Place pins in hole
- Touch iron to both pin and pad simultaneously
- Apply solder to pad at opposite side of iron
- Remove solder, then iron, then clip excess

Heating Technique



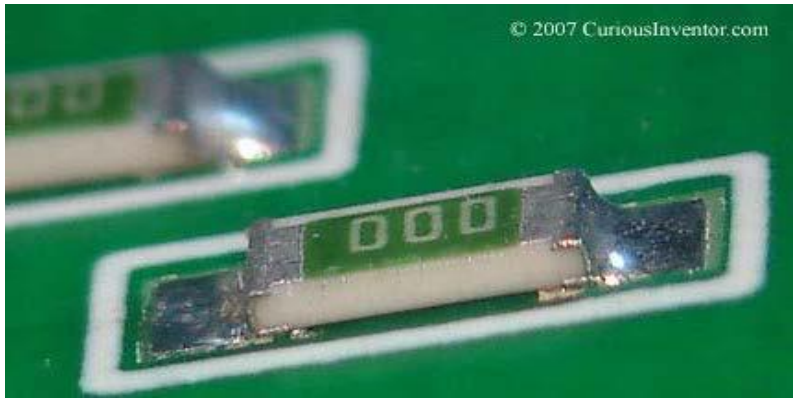
- Touch both the component and the pad at the **same time**
- Make sure to apply solder to the pad, not the iron
  - Remove solder before removing iron

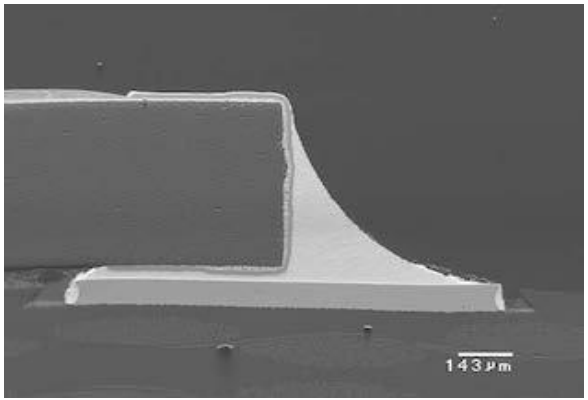
How much Solder?



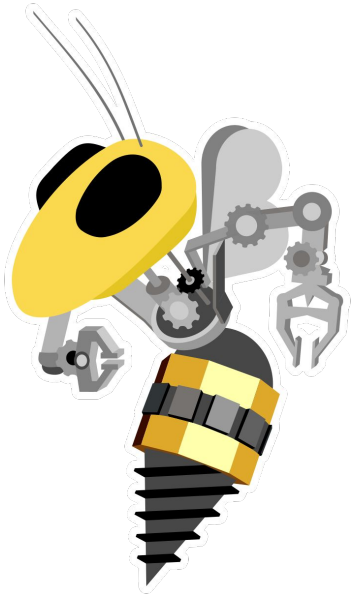
- Fully cover the pad, but don’t form a bubble

Surface Mount Components





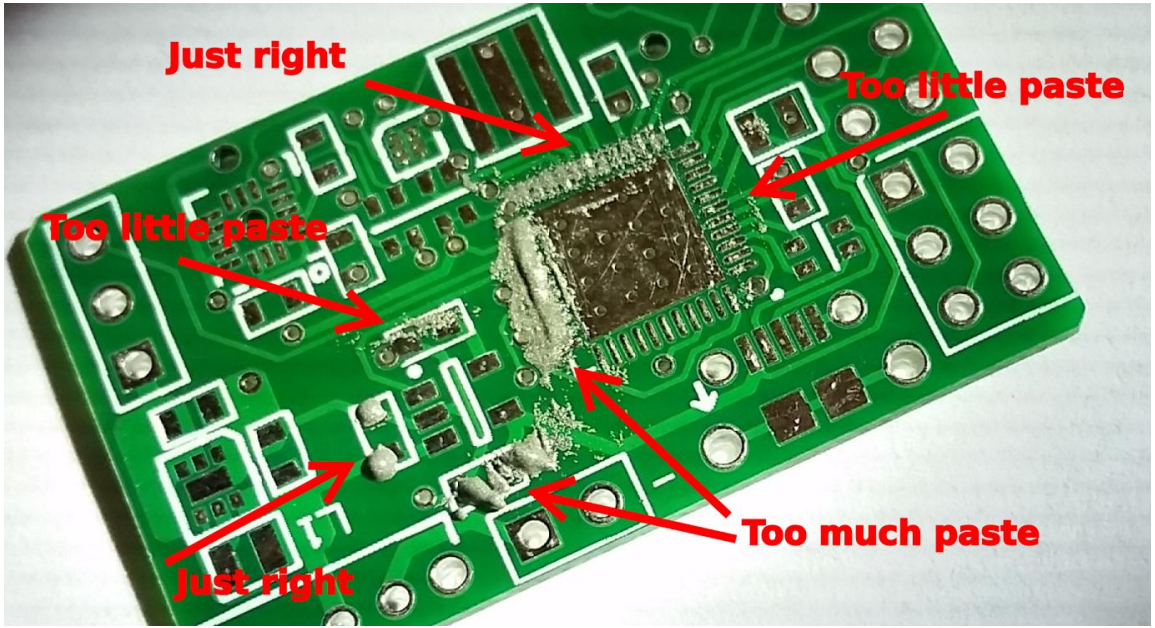
- Wet one pad with Solder
- Place component on pad and remove iron
- Solder remaining pads before reflowing first pad



Other Soldering Techniques

Hot Air Gun

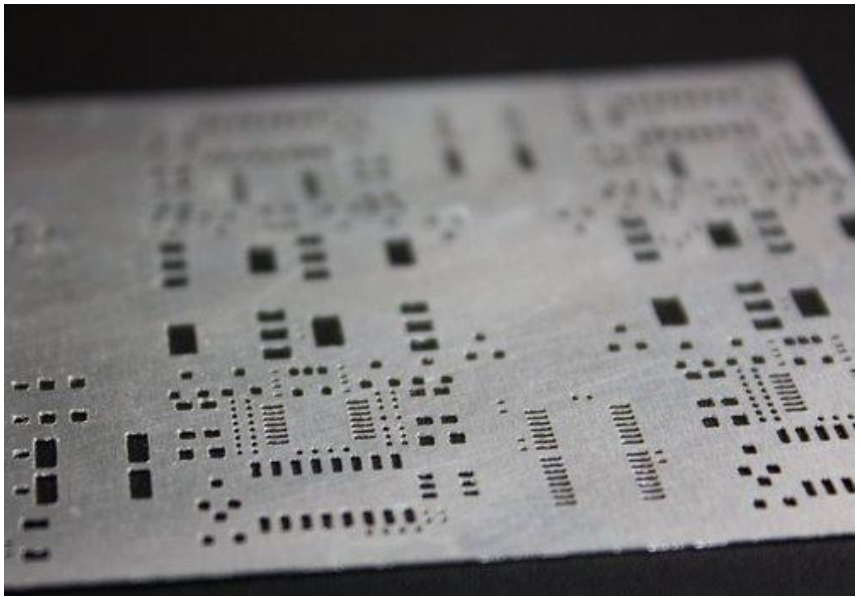
Solder Paste



Reflow Oven

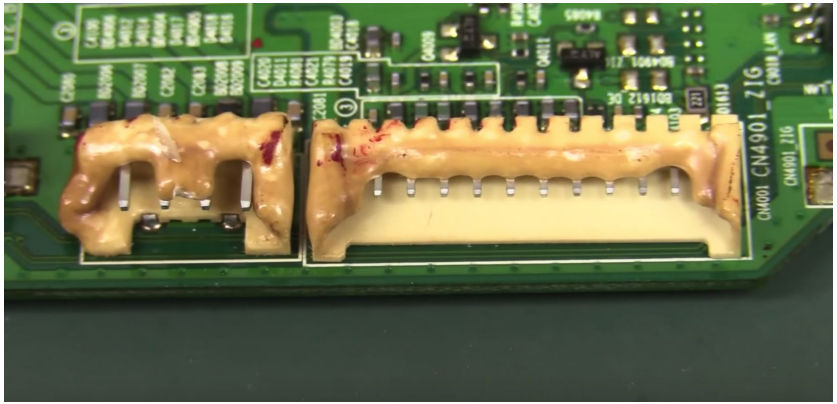
Soldering Stencil

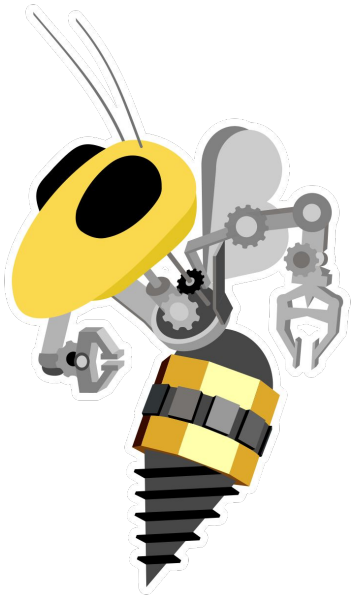
- Apply paste using stencil
- Remove stencil and place all components
- Place circuit board in reflow oven



Tips

- Previously mentioned techniques heat up entire circuit board
- Some components cannot stand the heat
  - Make sure your components (especially connectors) can take the heat





Today's Activity

Solder the training board

Step 1 - Open BOM

- Checkout master branch of electrical-training repo
- Open board/training_board.sch and click File > Export > BOM
- The new window has a bill of materials, with every component’s value and designator
- Alternatively look at Board_Components.csv on GitHub

Step 2- Gather Materials

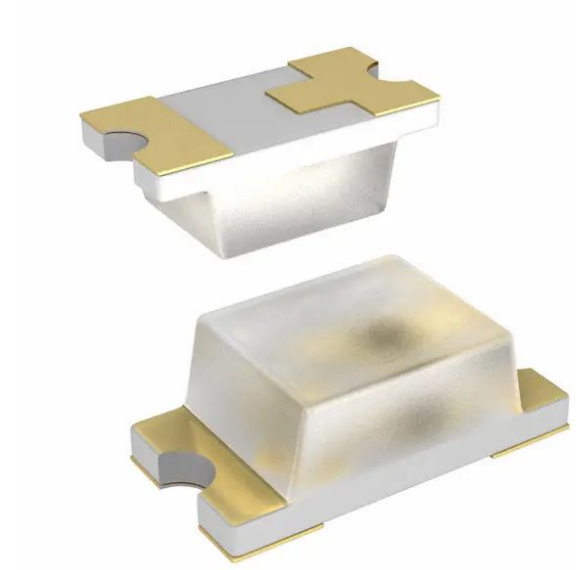
- Grab a bag and a row of male header pins
- **Note** we are missing power switch (SW1)
  - Please put two male header pins on the right-side switch pins, this will enable us to use a jumper to connect the two

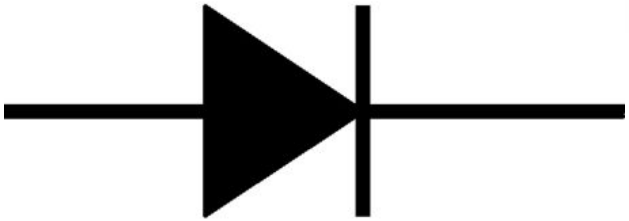
Step 3 - SMD Components

- Start with main chip
  - Wet the top-right (GND) pad and position component first
  - Solder in the direction of your dominant hand!
- Remaining SMD Components
  - Resistors and LEDs on top and right
  - Capacitors around reset button and power jack
- Remember LEDs are directional!

LED Direction

- “Arrow points towards the house”
- LED should point in direction of the via to on board (opposite side of resistor)
  - This is more apparent in the board layout when viewed in EAGLE





Step 4 - Large/Thru-hole

- PTS645 Reset Button
- Power Jack
  - Will take a long time due to the large thermal mass of the GND Plane
- Screw Terminals
- 0.1” Headers
  - Solder the first one, then adjust to make sure everything is straight before soldering the rest

Power Jack Notes

- After soldering Power Jack, snip the legs using large flush cutters
- Put a few layers of electrical tape underneath and make sure there are no extending metal bits