Soldering Workshop

DroidCON Style

Overview

- Safety, Safety, Safety
- Basic Tools, Materials
- Work Area & Tool Setup
- Procedures
  - Cleaning, Wetting and Pre-Heating
  - Solder Flow
  - Iron Contact
  - Solder Fillet
  - Solder Bridges
  - Vias
- Workshop Project - A DroidCON Exclusive
- Have Fun!

Safety, Safety, Safety

- Two words: MOLTEN METAL
- It's seriously HOT!!! (Up to 850^{o}F or 455^{o}C)
  - Don't pick up like a Pencil... you will only do this once
  - Only touch the plastic handle of the iron
  - Keep hair and skin away from the soldering iron
- Lead Solder
  - Melting not the issue
  - Handling lead is the issue
  - Use Lead Free if possible - RoHS
- Solder Fumes
  - Flux or Rosin vapor - Not LEAD
  - Ventilation and/or fume extractor
  - It's addicting, you'll get to love it!

Basic Tools and Materials

- Soldering Pen 20W to 40W
- Small conical or chisel tip
- Holder
- Sponge or Brass Sponge
- Solder
  - 64/37 (Tin/Lead*) Best
  - 60/40 Good, but careful about movement while solder is still fluid, it can result in cold joint.
  - No Clean Flux or Water Soluble
  - Lead Free RoHS
  - .31 to .20 diameter
- Flush Cutters better than Diagonal Cutters

Setup Your Work Area & Tools

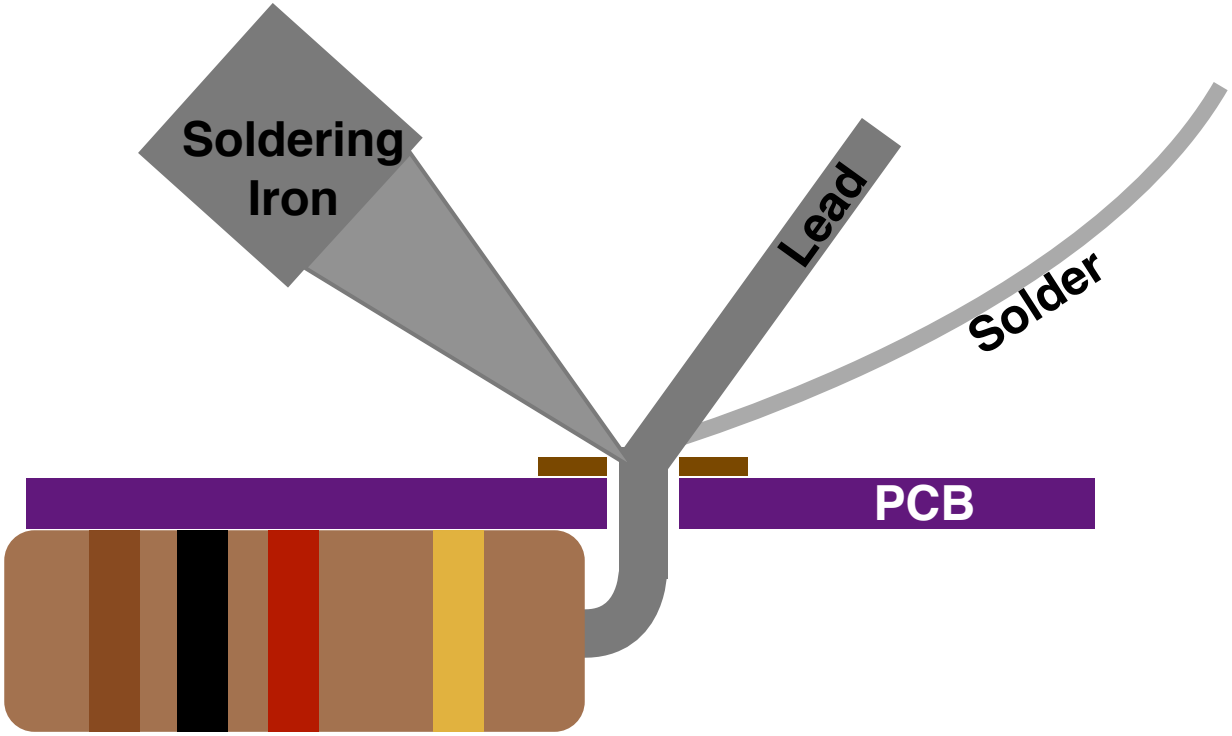
- Flush Cutters
- Solder
- Solder Wick
- Soldering Iron Stand
- Sponge Well Wet
- Soldering Iron in stand?
- Soldering Iron Plugged In?
- Soldering Iron Hot?

Basic Procedure

- Make sure the soldering area is clean
  - No grease, no oxide, no oils
- Put the items together
- Wet the area with flux if needed
  - Flux- Latin *fluxus* for FLOW, cleans, protects copper against oxidation while. If you burn off the Flux = poor solder
- Clean tip of iron on wet sponge or brass “sponge”
- Pre-heat the area with soldering iron
- Apply and feed solder at the joint
- Remove solder when sufficient solder has been applied
- Then remove the iron.
- Get in, get it on, get out...

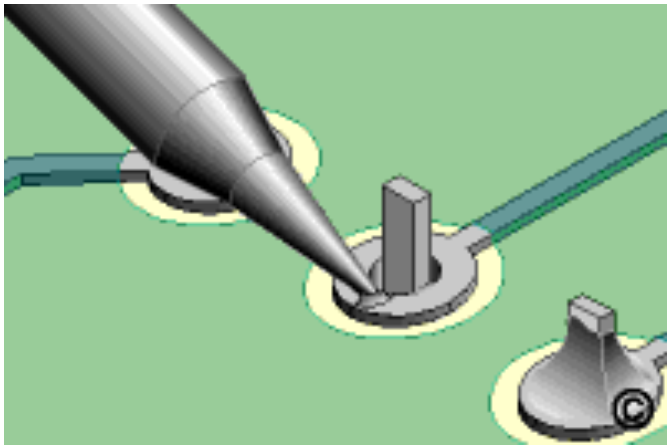
  Yes we are still talking about Soldering!

Basic Procedure - cont.

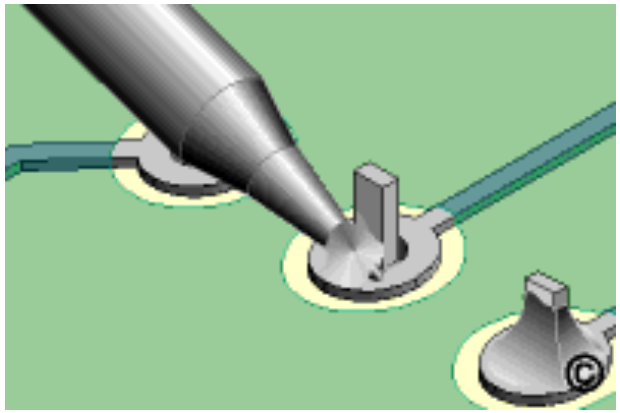


Iron Contact Area

- Pre-Heating is critical and only takes a half second or so.
- Iron tip needs good contact with BOTH parts
- Trace and Component Leads
- Heat transfer with small solder bridge works well



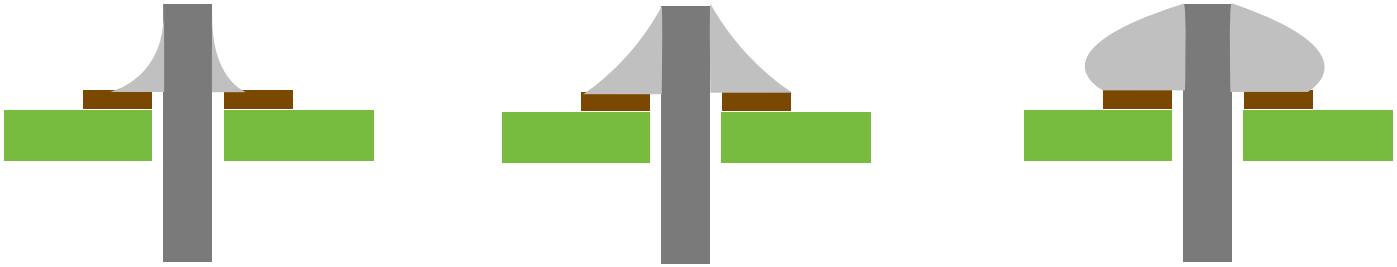
Not enough



Good

Solder Fillet Flow

- Minimum solder will not withstand stress
- Excessive solder can lead to stressed and cold joints
- Optimal solder joints looks neat, clean and professional
- Smoke & fumes are from the Flux/Rosin not lead.

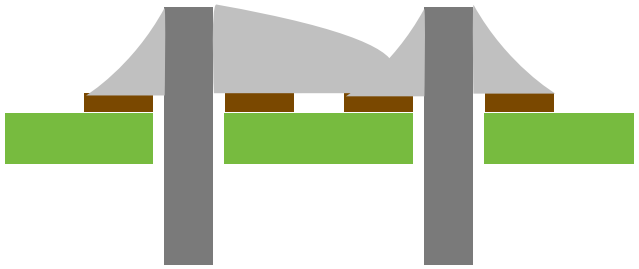


Minimum Optimal Excessive

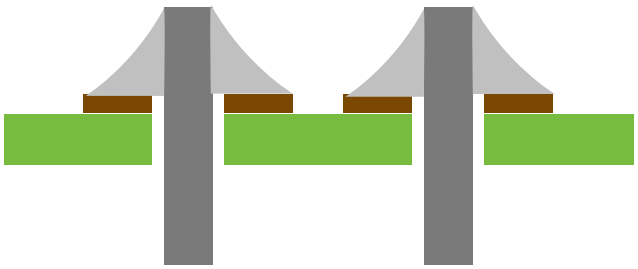
- Remember: Flux- Latin *fluxus* for FLOW, cleans, protects copper against oxidation while. If you burn off the Flux = poor solder

Solder Bridge

- Too much solder
- Easy to create on densely populated PCBS
- Can be hard to troubleshoot
- Watch out for those Vias!
- Fix with Solder Wick or Solder Sucker



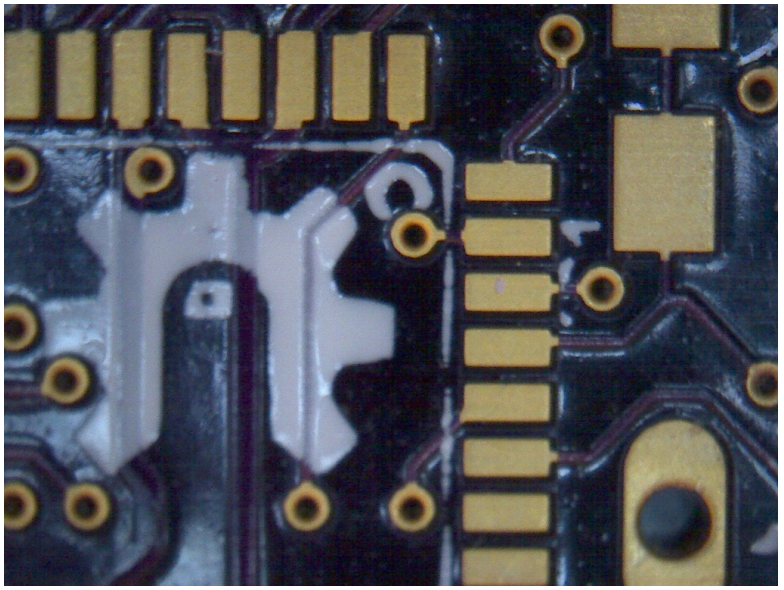
Solder Bridge



Good

Oye Como Vias

- Pathways for signals to move to other layers of the PCB
- Barrel - The tube or rivet
- Pad - Connects the barrel to the trace paths
- Typically very small “hole” or barrel compared to a pad
- Sometimes covered by PCB coating
- Great test points, if not tented
- Can be rather close tolerances
- Thermal Vias
- Avoid creating solder bridges!



Tips and Techniques

- Use Breadboard to place and hold headers for you
- Use Solder bridge to get heat into the lead and pad
- Get it hot enough.
- Use appropriate temperature
- Use appropriate soldering pen tip for the job.
- Keep the tip clean, allows for rapid heat transfer
- Don’t have sponge and brass sponge? Wet paper towel
- Clean the rosin from the PCB with IPA 90%+ or water
- Headers - solder 1 pin first, then heat and adjust by others
- Practice on old boards or bad PCBs... got plenty of them.
- Workmanship
- Never use a SOLDER CANNON on PCBs.

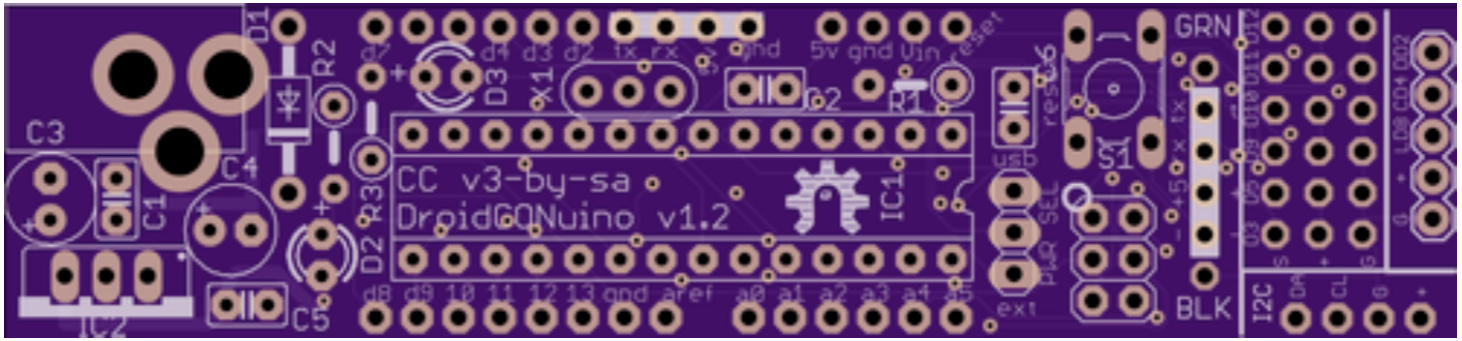
Solder Cannons

Workshop Project

- DroidCON Exclusive
- Simple Through-Hole (PTH) Kit
- Lots of typical solder joints
- It’s a densely populated PCBs
- Vias close to Pads
- Avoid creating solder bridges.
- Takes about 30 to 60 minutes to build
- Ask questions about soldering!
- Have Fun!

So what are we going to build?

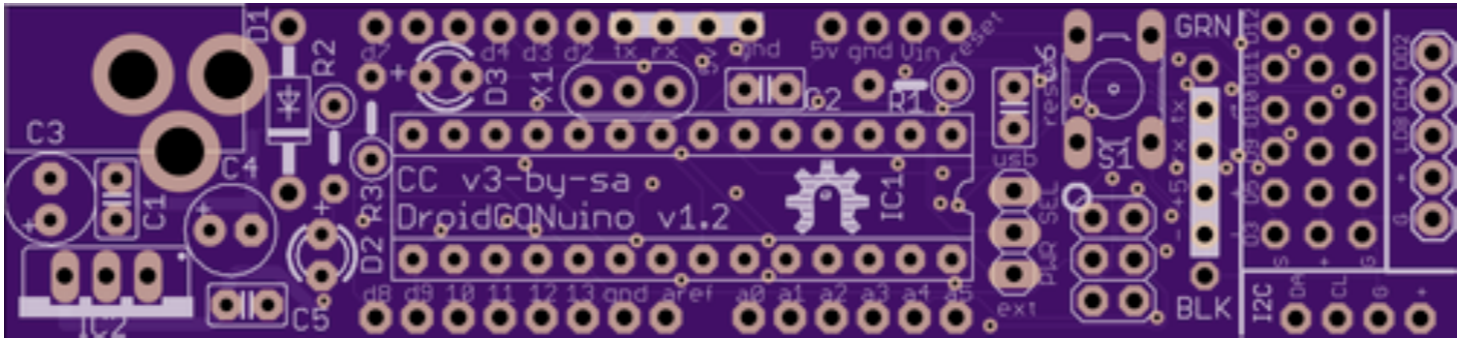
DroidCONuino



- Arduino Uno Compatible MicroController w UNO bootloader
- Atmel 328P 28DIP or SMD
- 6 Servos
- Teeces 7219/7221 Logics Control
- 1 x i2c Bus
- 1 amp 5v regulator
- External Power Input (<15 volt)
- Bread Board Compatible
- FTDI & ICSP Connections
- Based on AdaFruit's Boarduino DC design!

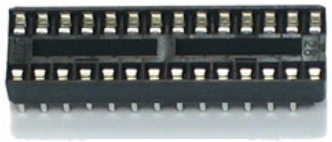
Part Inventory & Identification

PCB



IC1

SOC

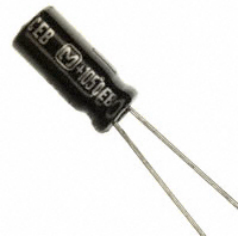


X1

JACK

IC2

C1,C2
C5, C6



C3

C4

R1

R2, R3

SWITCH

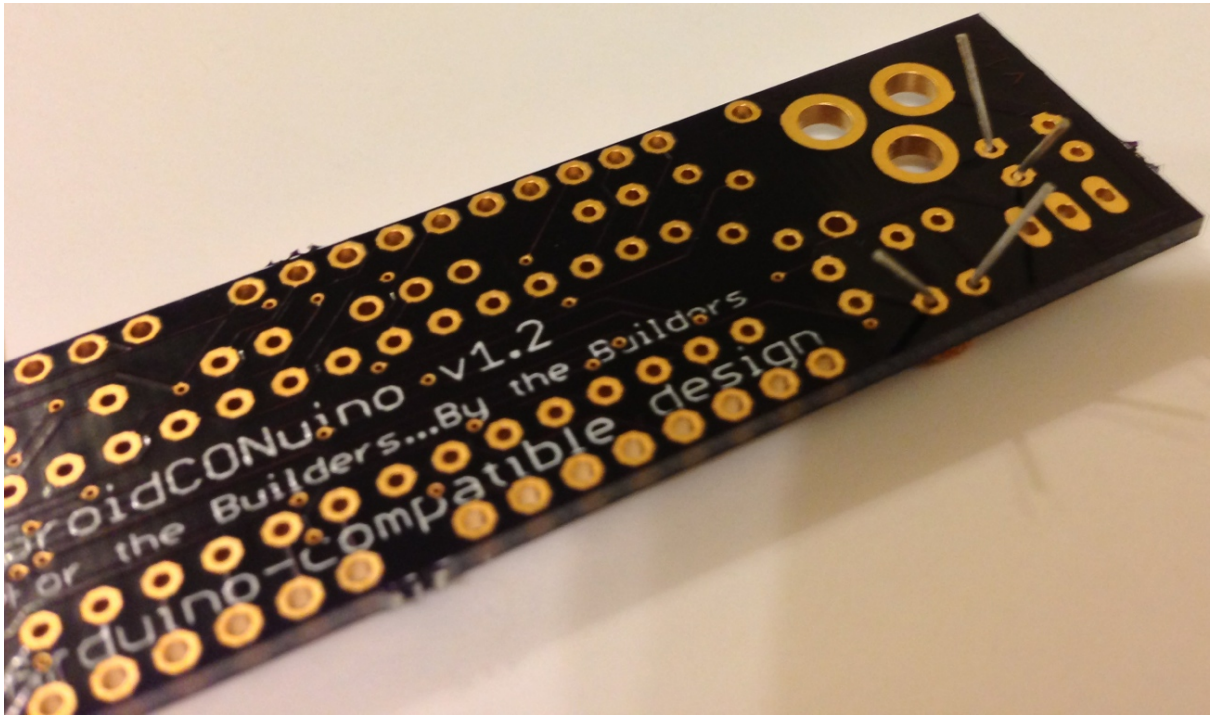
JUMPER

D1

D2

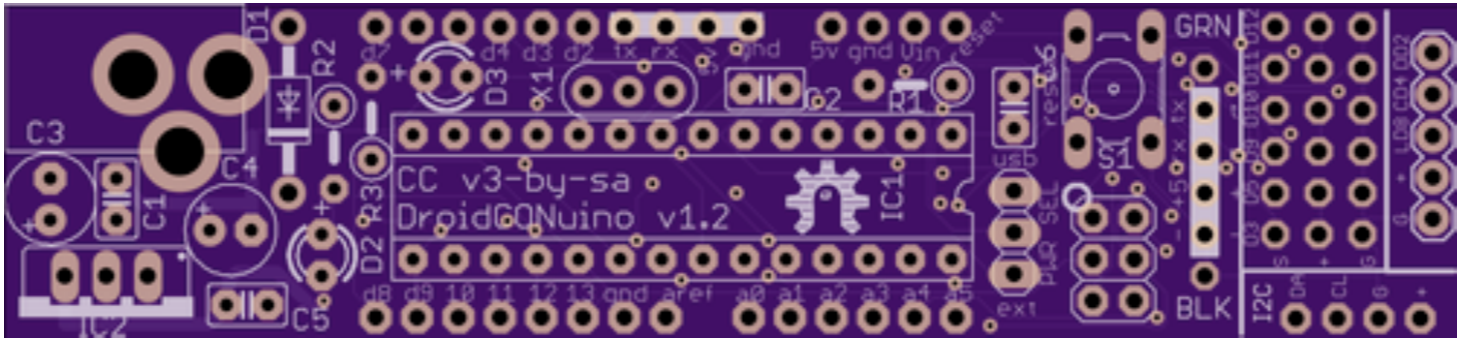
D3

Installing Components



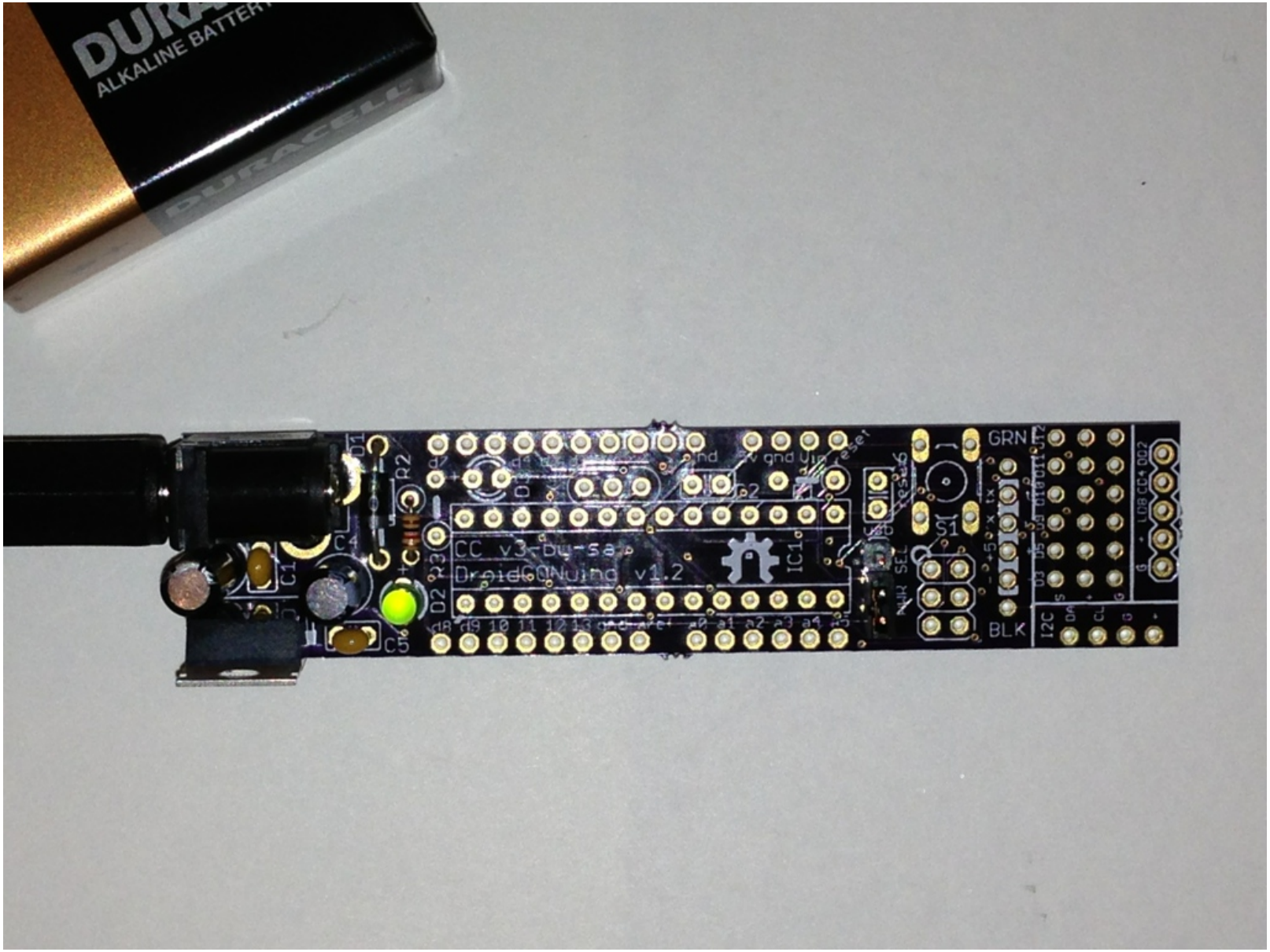
- Components with long legs, once inserted into the PCB, you should bend the legs out to hold part into the PCB when soldering.
- Cut long component legs AFTER soldering that component
- Don’t try to do more than one component at a time for now
- Solder one pad, ensure that part is aligned and flush, then continue
- Use the BreadBoard to help with the Headers

DroidCONuino - Power Supply

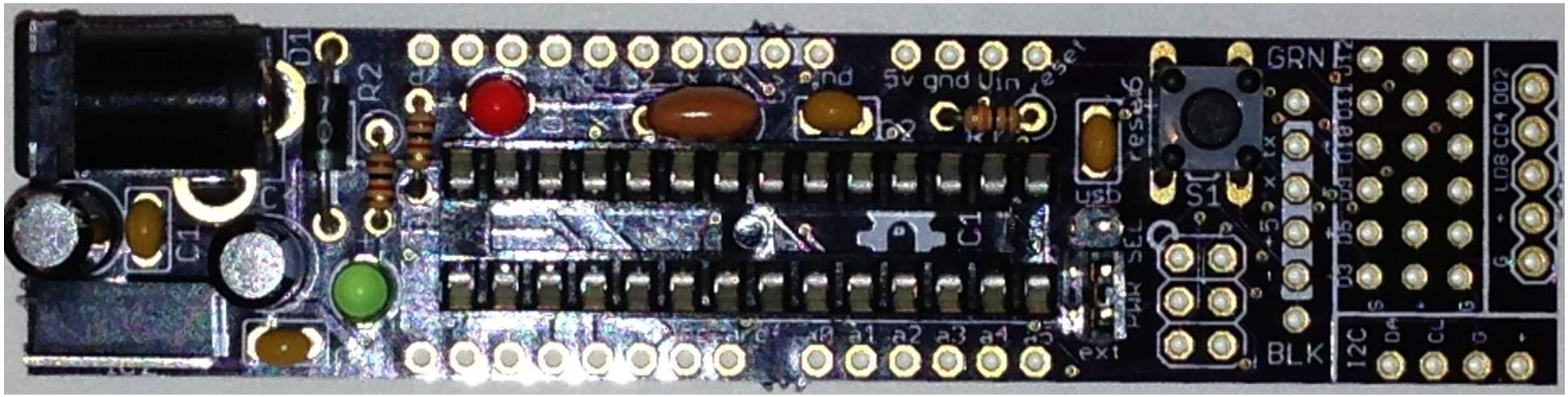


- Install Capacitors C1 & C5 (.1uf 50V - Little & beige)
- Install Capacitor C4 (100uf 6.3v - rather short) LONG LEG goes into +
- Install Capacitor C3 (47uf 25v - Tallest) LONG LEG goes into +
- Install Diode D1 (1N4001)... notice the polarity Band matches Band
- Install 7805C 5V Regulator IC2. Match orientation with diagram
- Install Resistor R2 (1k Ohm Brown-Black-RED-Gold)
- Install LED D2 (3mm Green) LONG LEG goes into +
- Install Power JACK - Will fit one way into top of PCB
- Install 1x3 Header & then place JUMPER on pin marked EXT & center
- Smoke Test it!!!

Should Look Like This

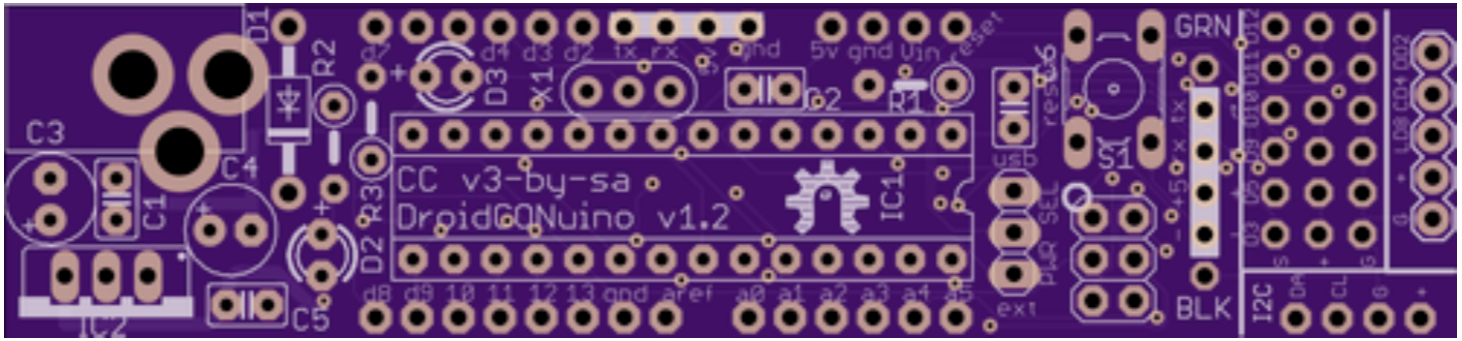


DroidCONuino - MCU Section



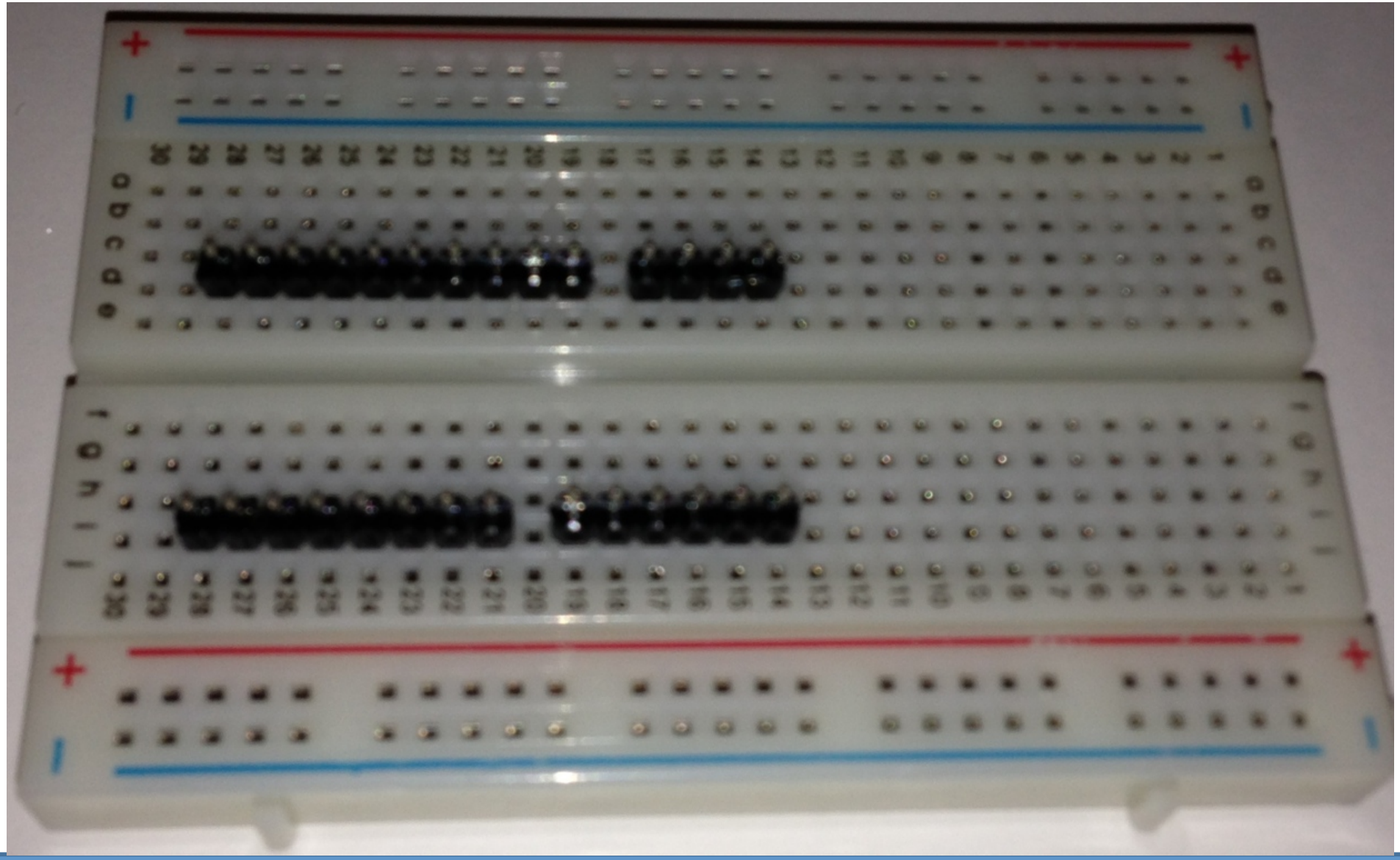
- Install Resistor R3 (1k Ohm Brown-Black-RED-Gold)
- Install LED D3 (3mm RED). LONG LEG goes into +
- Install X1 (16 MHz Ceramic Resonator) Notice it has 3 leads and no polarity
- Install Resistor R1 (10k Ohm Brown-Black-ORANGE-Gold)
- Install Capacitor C2 & C6 (.1uf 50V - Little & beige)
- Install SWITCH for Reset into top of PCB. Careful of the pins
- Install IC1 SOCKET into top of PCB.

DroidCONuino - Headers

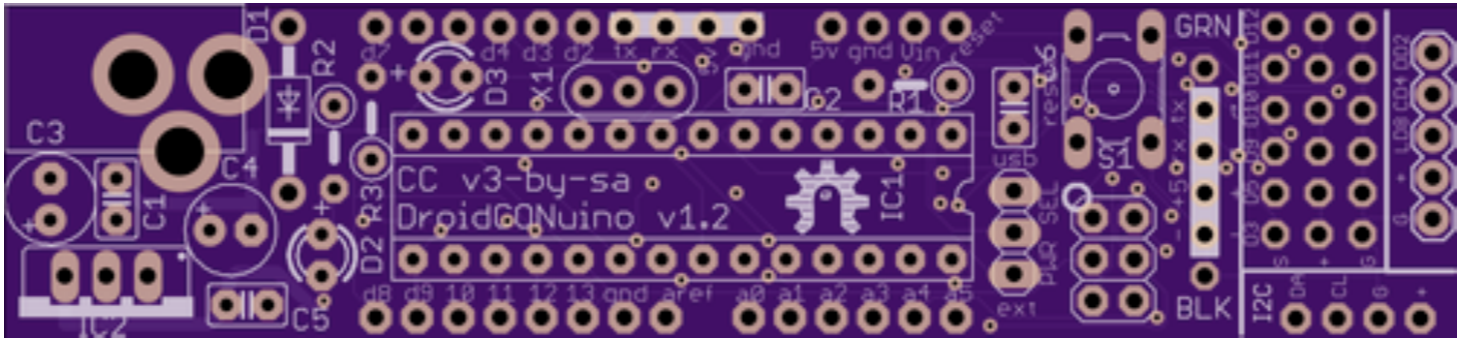


- Install 2x3 header into ISCP, beside the reset SWITCH
- Install 1x6 header into the USB/FTDI section into the TOP of PCB
- Install 3x6 header into SERVO section into the TOP of the PCB
- Install 1x4 header into the I2C section, TOP of the PCB
- Install 1x5 header into the LOGICS section, TOP of the PCB
- (OPTIONAL) If your going to use with a BREADBOARD, install headers onto the BREADBOARD, LONG legs into BREADBOARD.

Header Setup on BreadBoard

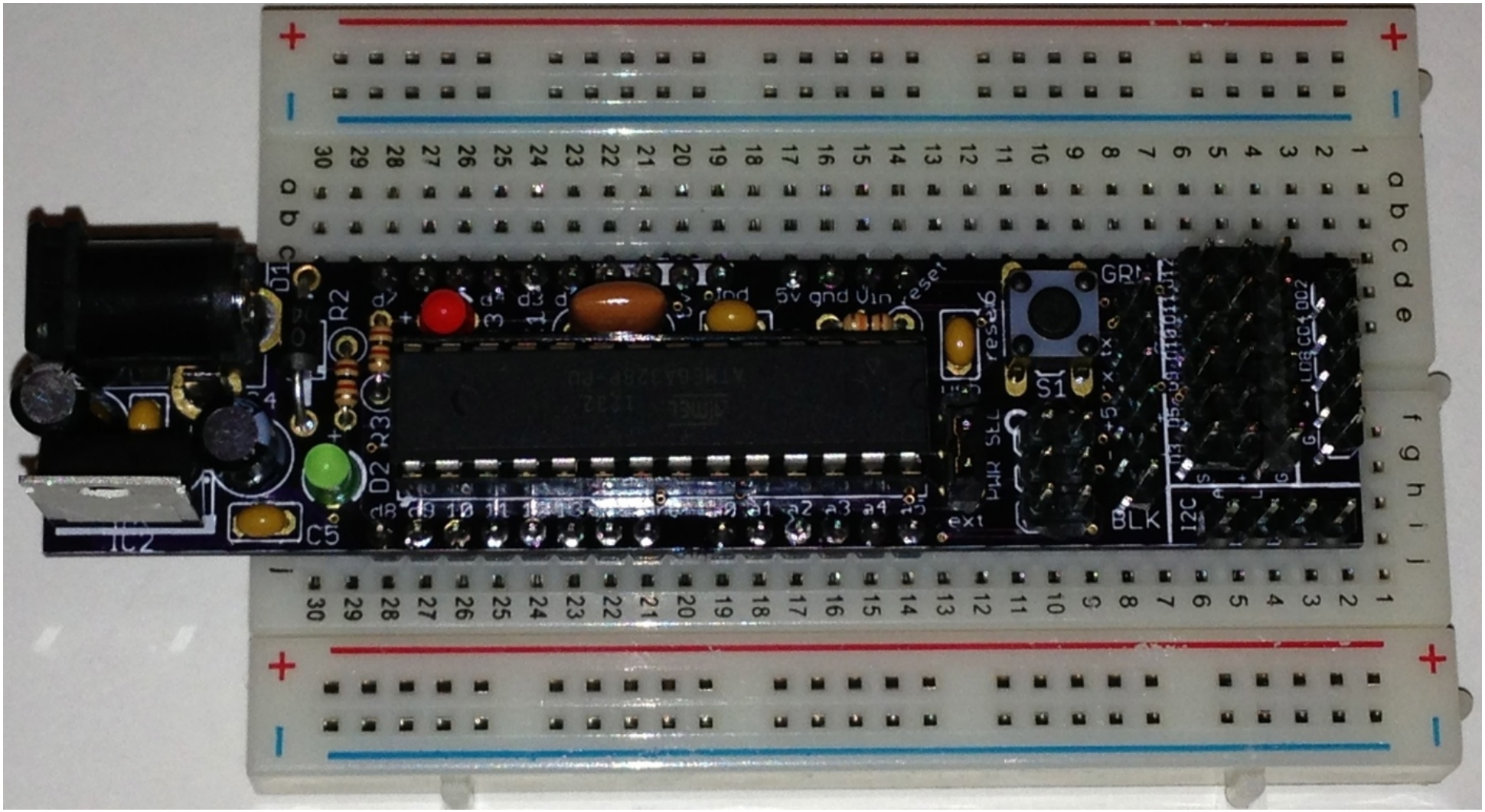


DroidCONuino - Atmel 328P



- STATIC Sensitive... meaning static can kill it.
- Dump static to a ground if possible... touch the metal faucet in the sink
- Align 328P with IC1 Socket indention.
- Gently set 328P onto socket
- Verify the pins are aligned with socket receptacles
- Press 328P into the socket

Completed?



Smoke Test

- Apply 9V DC via Power JACK
- Green LED should turn on.
- Press RESET once
- Red LED D3 should blink on & off.
- If everything is a good...
- Let an Instructor test programming it!
- It will also rotate any SERVOs attached to Servo 1-6
- Test Maxim 72xx Bus
- If it does not blink or if you let the Magic Blue Smoke out
  At DroidCON III we'll learn to troubleshoot!

Q & A