

# BATTERY ULTRACHARGER

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# GOAL:

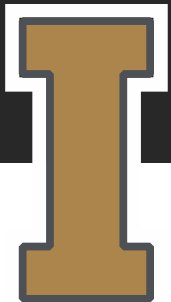
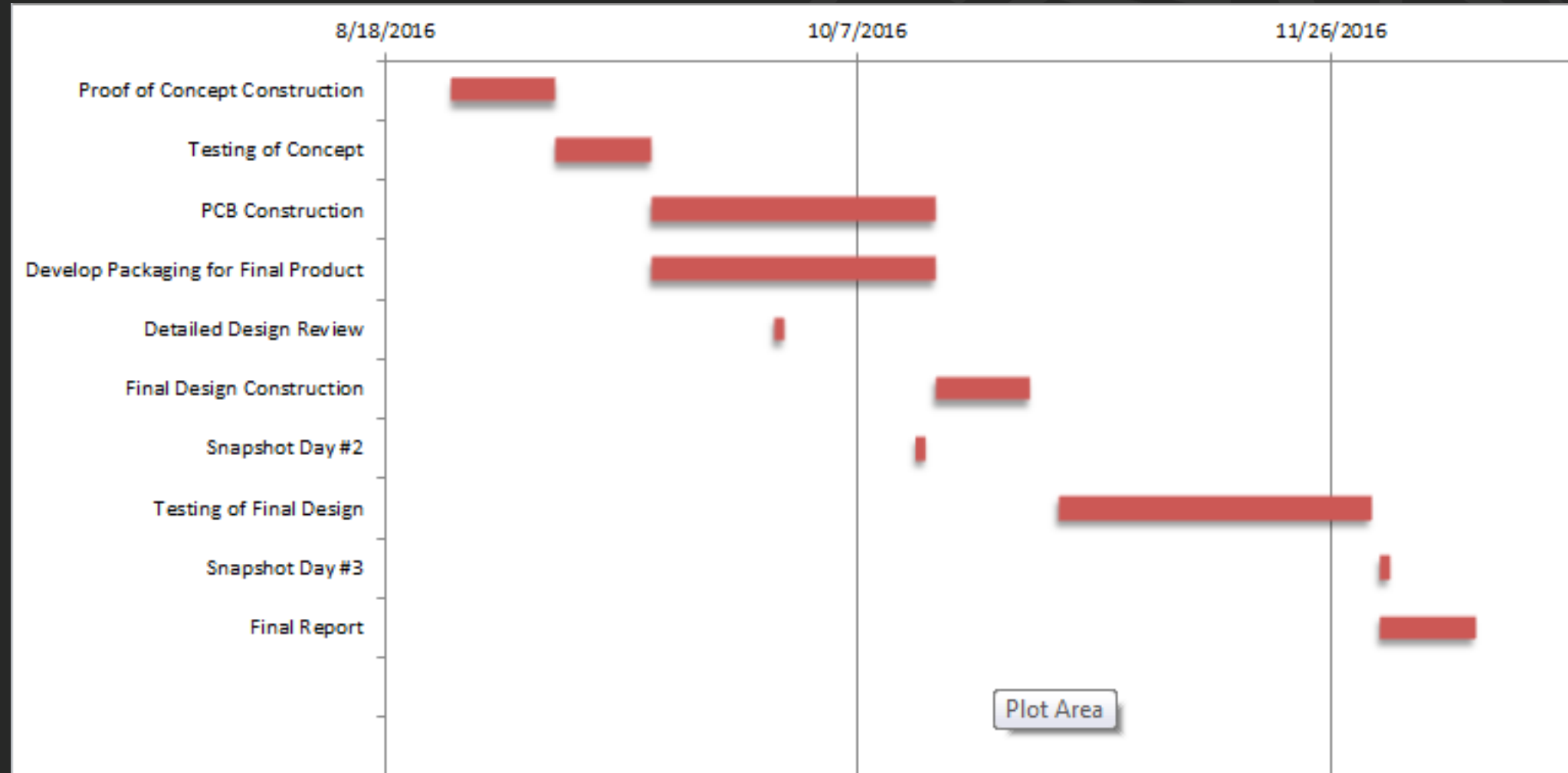
To create a device that can gather enough energy in two minutes or less that can then charge a cell phone. This product is intended for travelers who are short on time and need to recharge their devices.

# DESIGN SPECIFICATIONS:

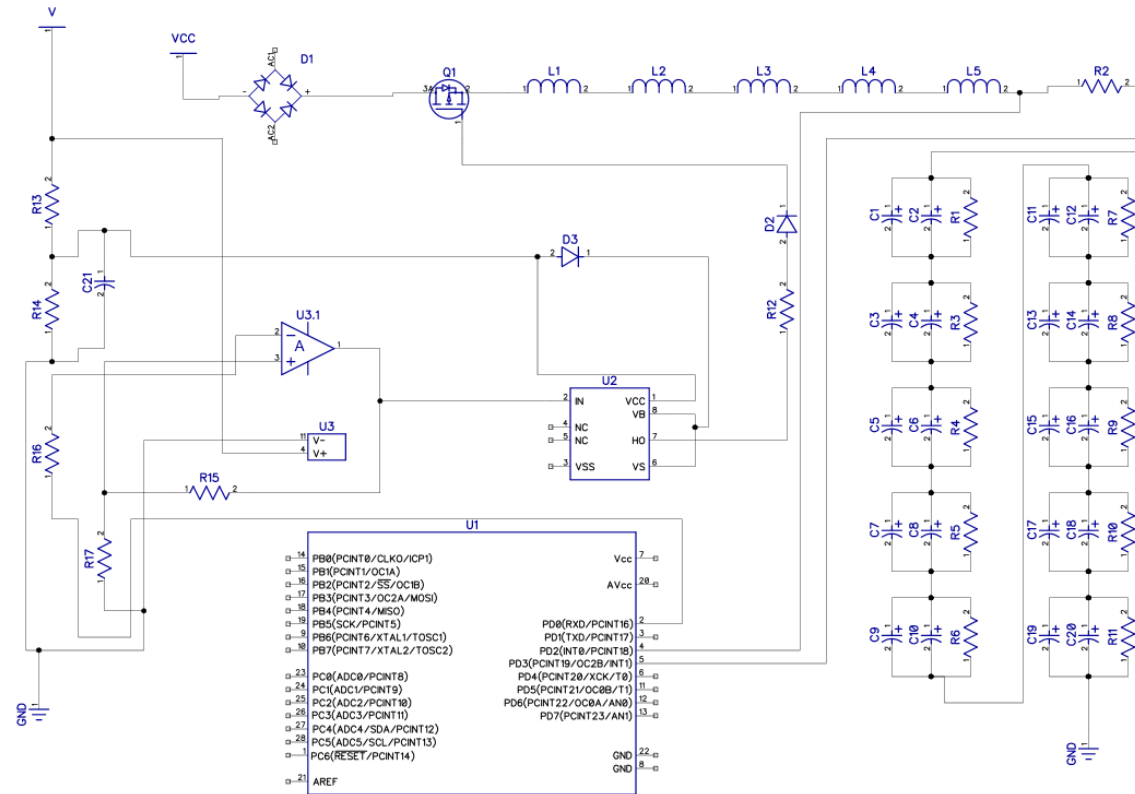
- Must fit in a carry-on luggage.
- Charge in two minutes or less
- Hold enough charge to charge a cellphone
  - Deliver that charge without damaging devices



# GANTT CHART



# INITIAL DESIGN



# SUPER CAPACITOR BANK

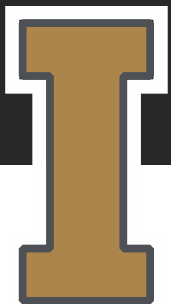
- Maxwell Super Caps
  - 350 Farads at 2.7 V
- 2 in parallel with 33  $\Omega$  resistor
  - 700 F
- Ten in series
  - 70 F and 330  $\Omega$  at 27 V

$$\text{Joules} = \frac{1}{2} V^2 * C$$

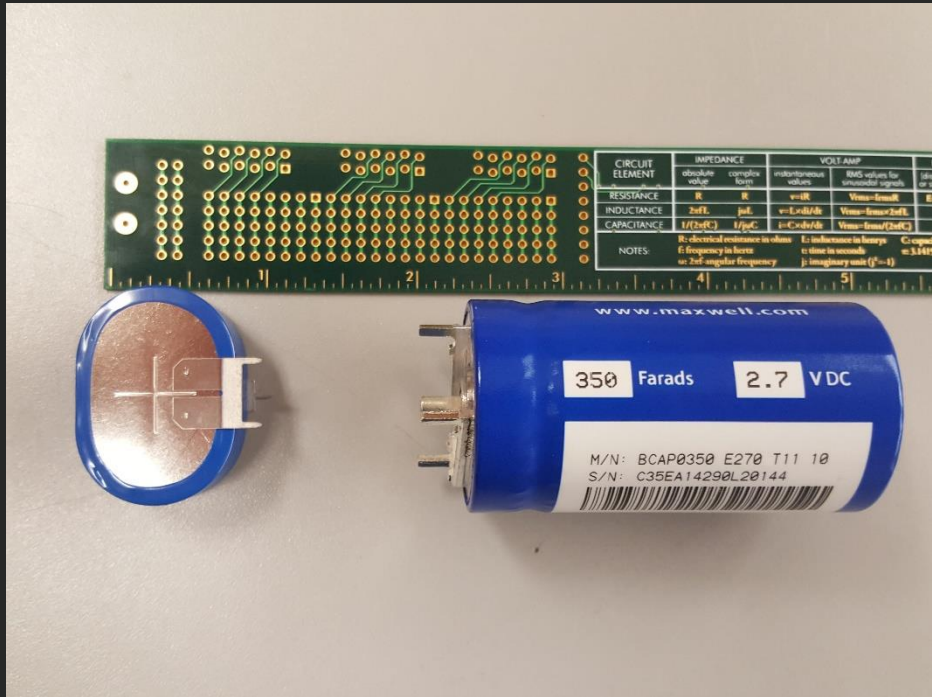
25.515 Kilojoules

7.088 WattHr

Goal of 11 WattHr



# SUPER CAPACITOR BANK



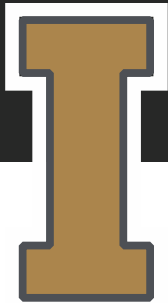
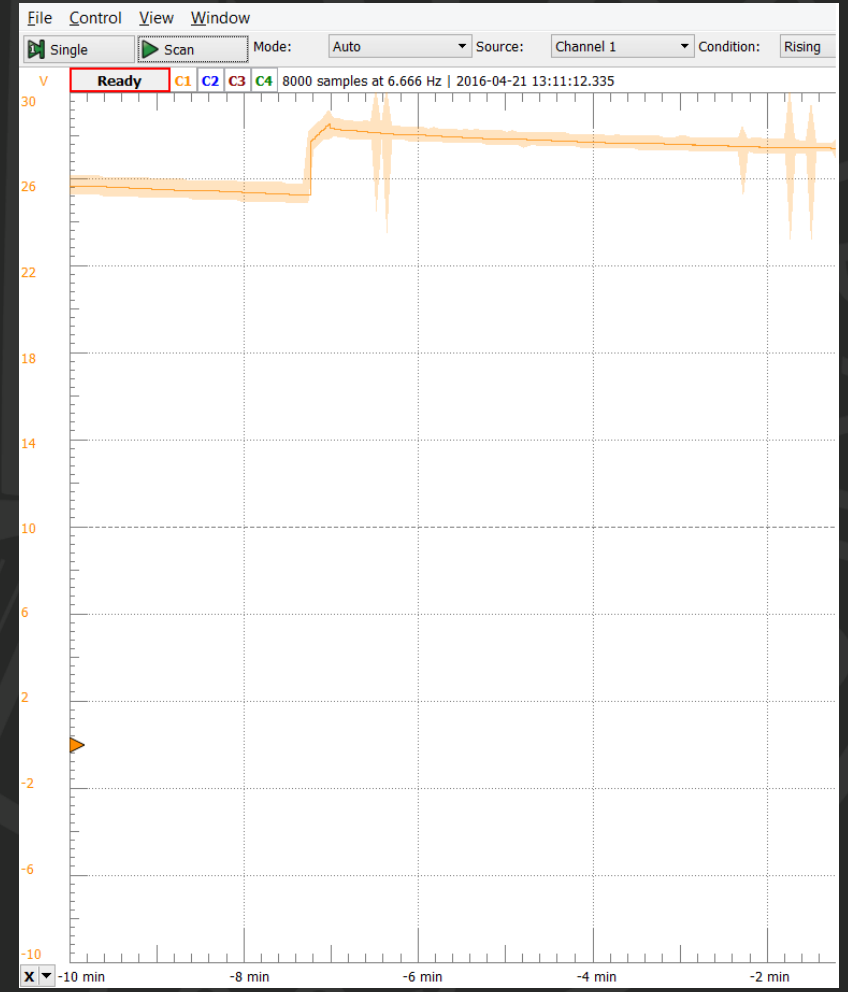
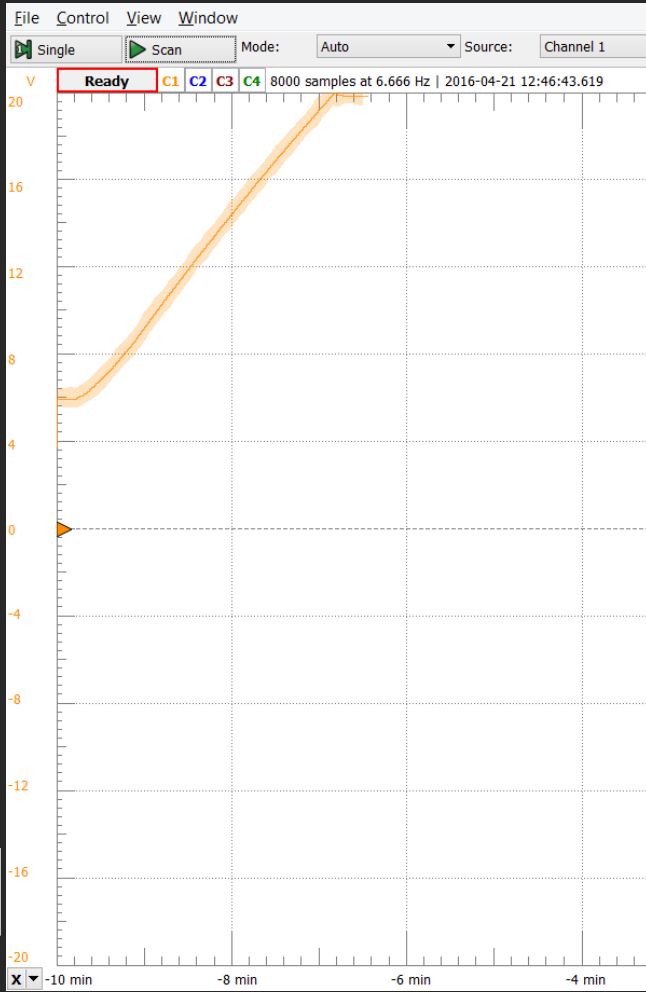
- Vishay Capacitors
  - 90 F at 5.6 V
- 11.31 WHr
- Low Current Rating



# CAPACITOR BANK TESTING

## CHARGING THE BANK

Charge time was around 3 -4 minutes at 6 Amps.



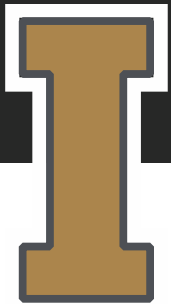
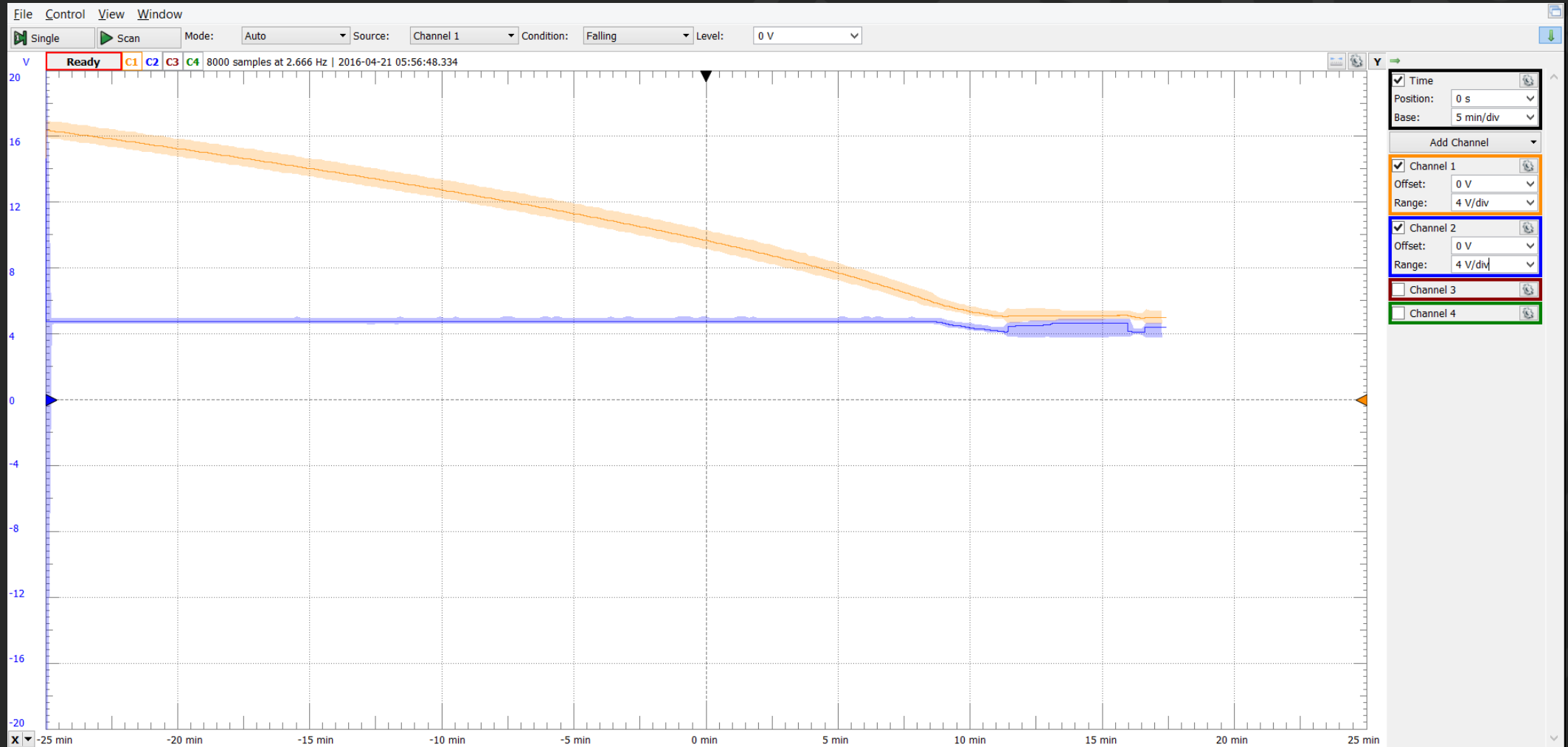
# CAPACITOR BANK TO PHONE

- Step down stored charge to 5 volts
- 5 volts to USB to phone



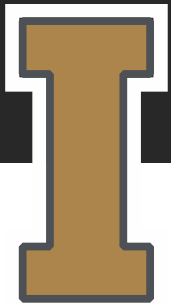
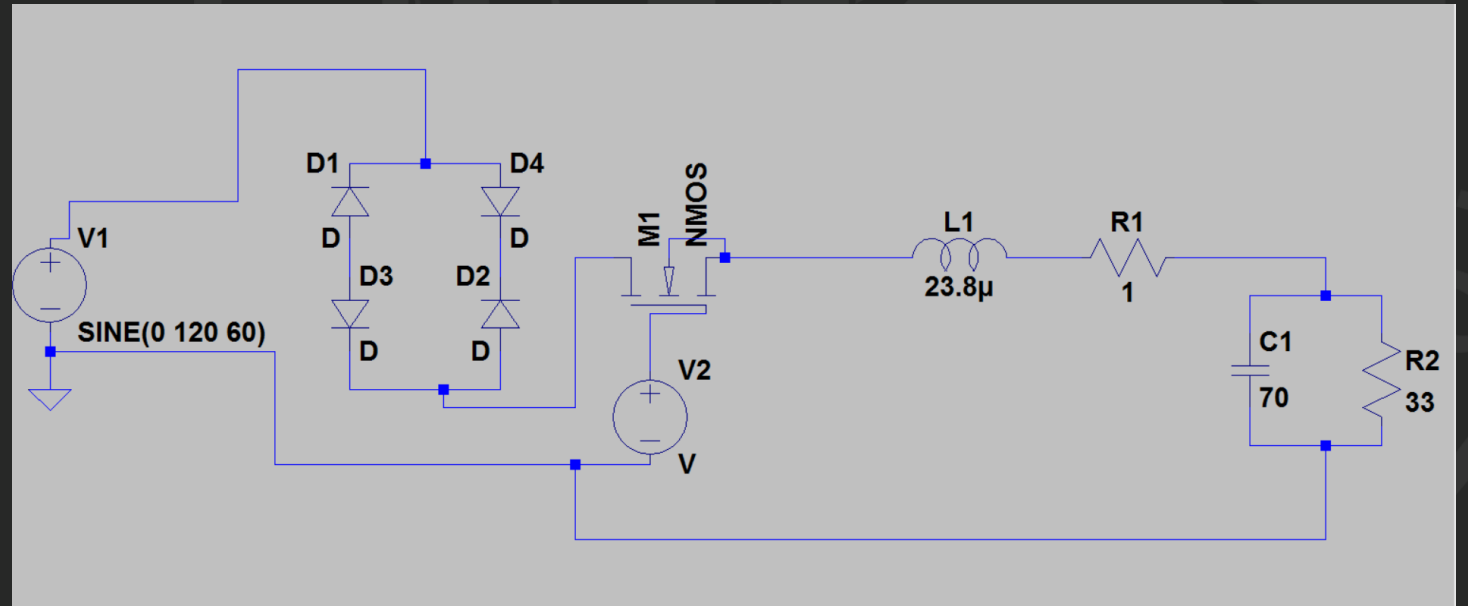


# CHARGING A PHONE



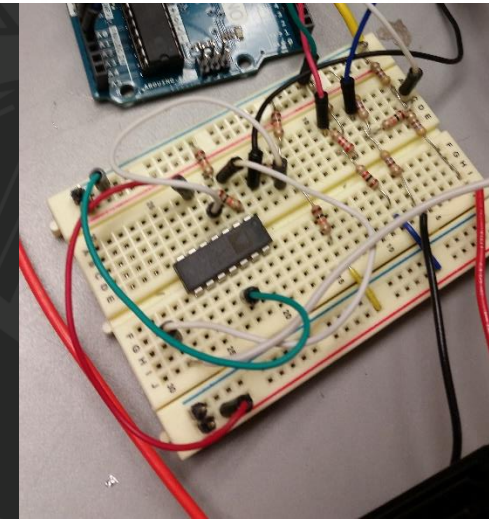
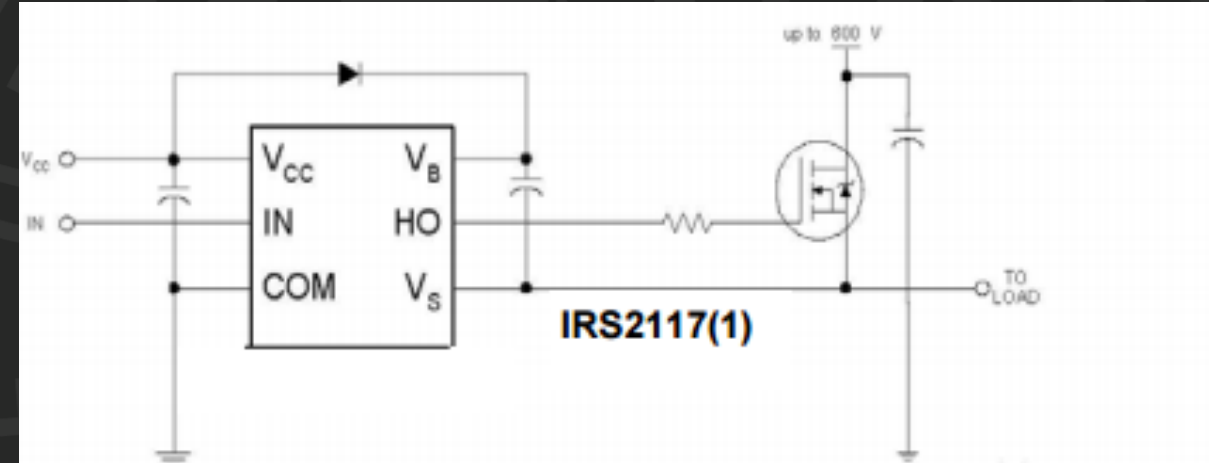
# AC TO DC TO CAPACITOR BANK

- Full Wave Bridge Rectifier
  - 120 V AC @ 60 Hz => 169 V DC
- 169 V passes through Mosfet
  - Acts as a switch
    - Activated by the Isolated Gate Driver
  - Passes through Inductors



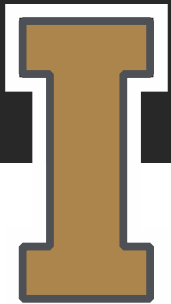
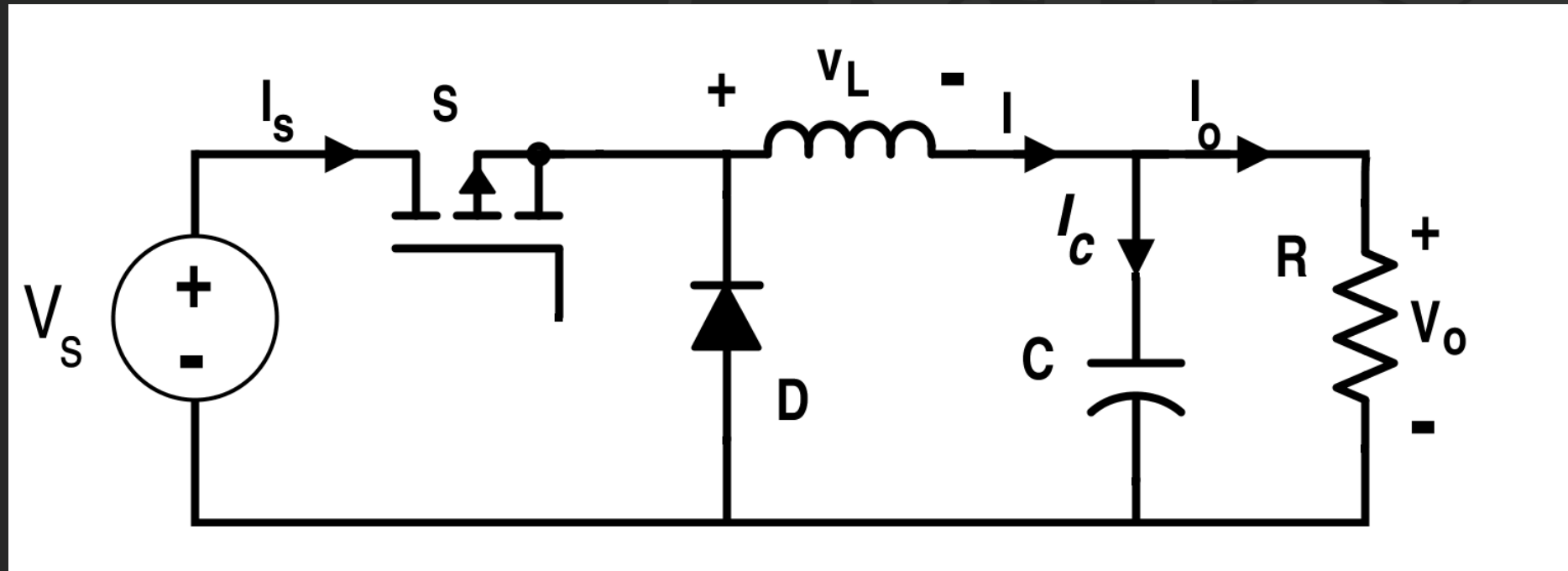
# MICROCONTROLLER AND GATE DRIVER

```
void loop() {  
  
  double voltage1 = analogRead(input0) - analogRead(input1);  
  double voltage2 = analogRead(input1);  
  double voltagew = voltage1;  
  if (110 > voltage1){  
    digitalWrite(output, HIGH);  
  }  
  else if (voltage1 > 110){  
    digitalWrite(output, LOW);  
    while(voltagew > 60){  
      voltagew = analogRead(input0) - analogRead(input1);  
      digitalWrite(output, LOW);  
    }  
  }  
  //else if (voltage1 > 2.8){  
  //digitalWrite(output, LOW);  
  //}  
  else{  
    digitalWrite(output, LOW);  
  }  
  Serial.println(voltage1);  
  delay(500);  
}
```



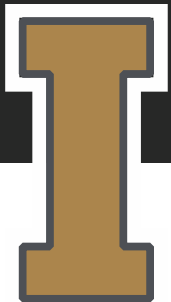
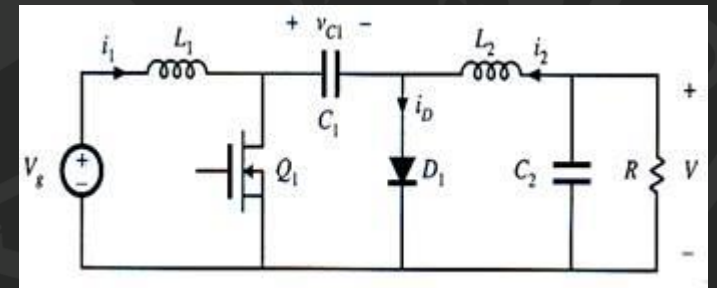
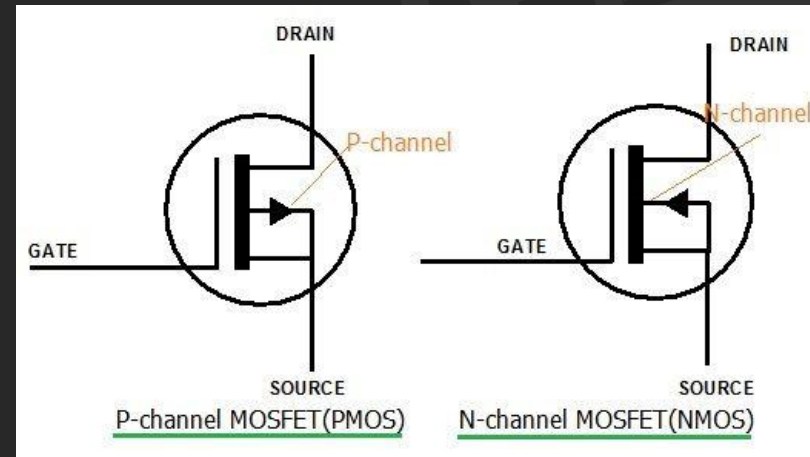
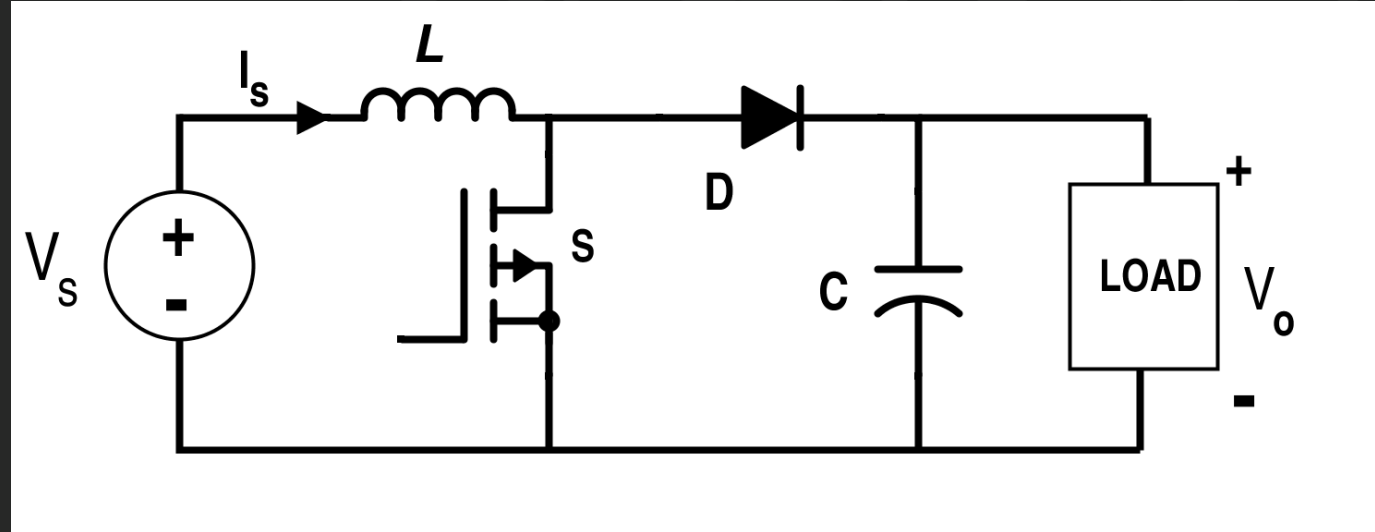
# PREVIOUS DESIGN PROBLEM

- Buck Converter
  - Too high of a Gate Voltage
  - Isolated Gate Driver

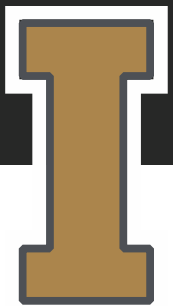
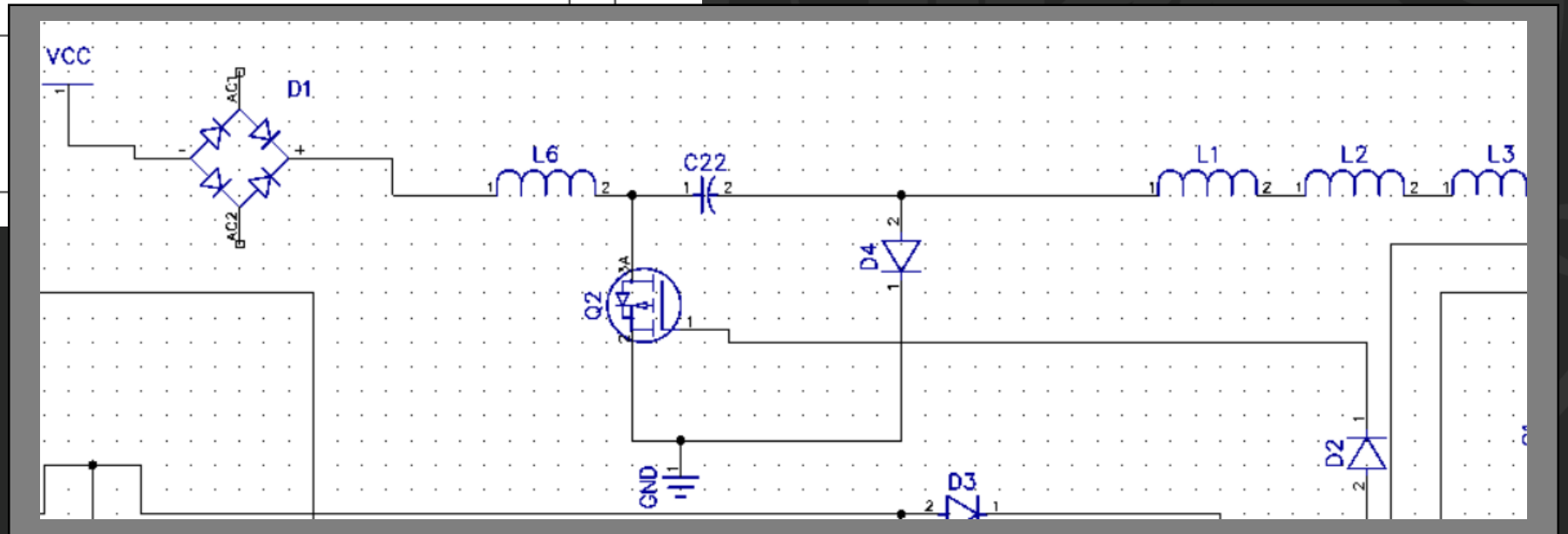
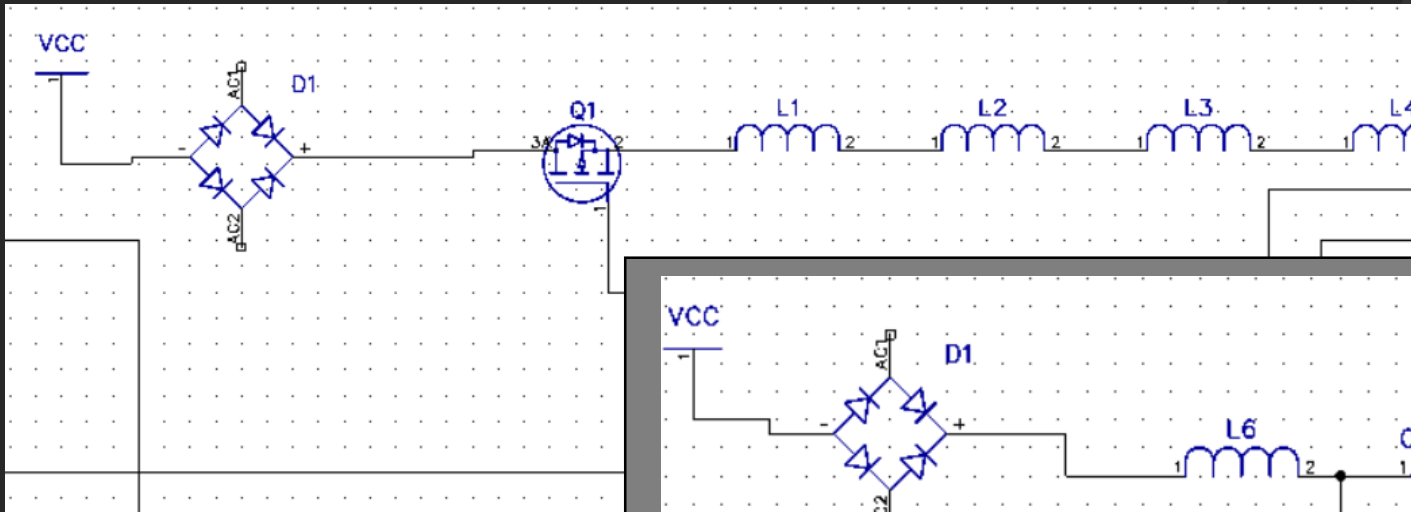


# DC CONVERTER

- Power MOSFET
  - Nmos
  - Pmos
- Converter
  - Buck
  - Boost
  - Cuk



# SOLUTIONS TO PROBLEMS



# RE-CAP:

## WORKING

- Supercapacitor bank does charge
- Buck converter will drop voltage down to a constant 5 V
- Rectifier converts the AC input voltage to DC
- Microcontroller can read the voltage from the H-bridge and output signal to switch the Mosfet
- Op-amp jumps up microcontroller output to be handled by the Isolated Gate Driver

## NEEDS WORK

- Mosfet is not supplied the required Gate voltage to act as a switch
- Isolated Gate Driver is not be performing correctly when sending voltage to the Mosfet's Gate

