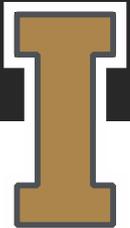


BATTERY ULTRACHARGER

Keith Leitner and Robert Prew



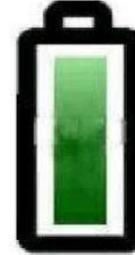
HAVE TO LEAVE THE HOUSE



MY CELL PHONE BATTERY IS LOW

quickmeme.com

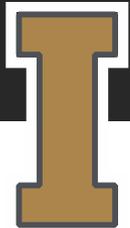
Cell phone battery



when I don't really need it



when I really need it



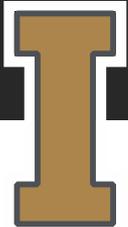


GOAL:

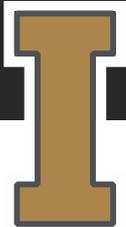
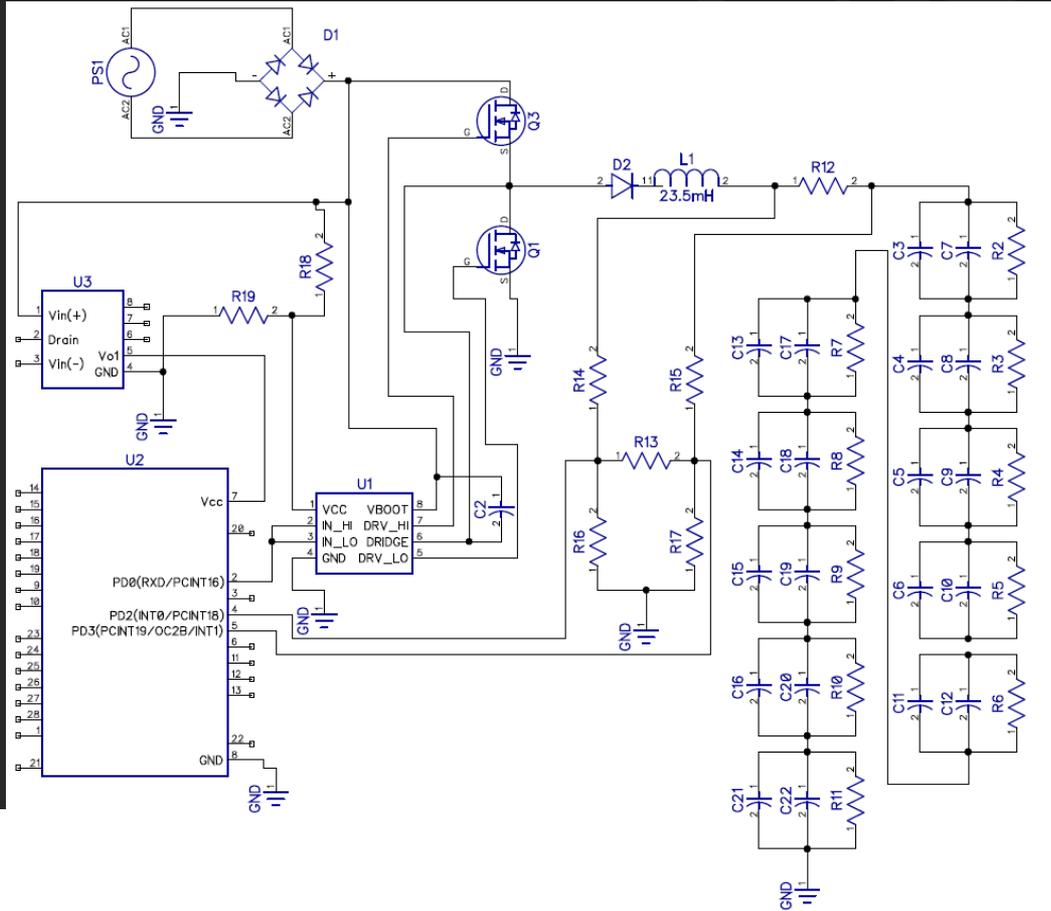
To create a device that can gather enough energy in two minutes or less that can then charge a cell phone. This product is intended for travelers who are short on time and need to recharge their devices.

DESIGN SPECIFICATIONS:

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

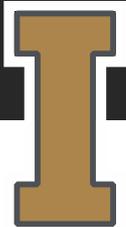
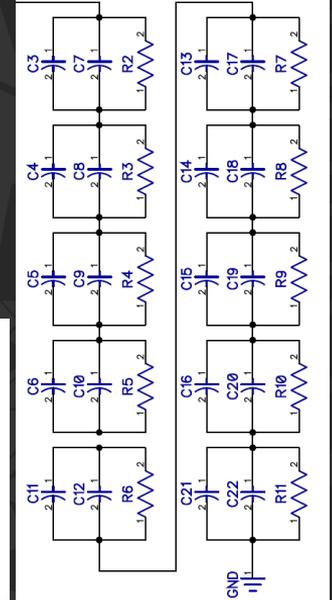
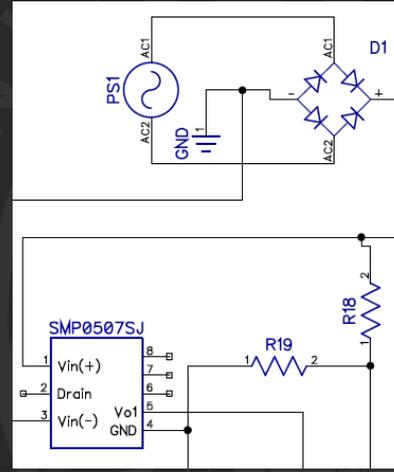
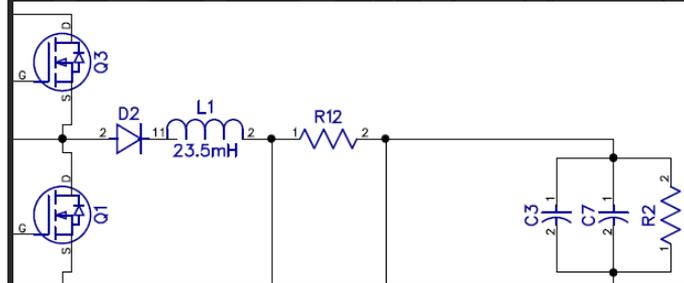
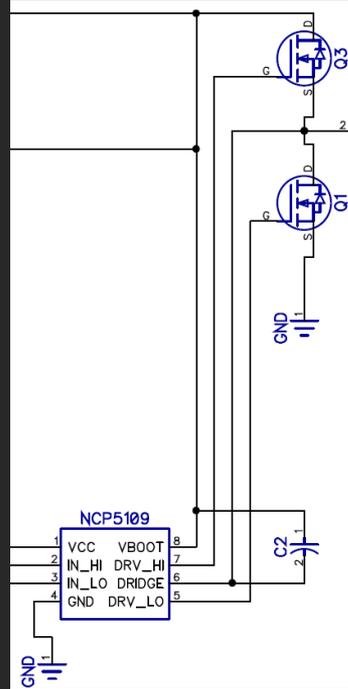


OVERVIEW DESIGN



CIRCUITRY BREAKDOWN

- AC to DC conversion
- Switching Circuit
- Capacitor Bank
- Microcontroller
- House Keeping Power Supply



SUPER CAPACITOR BANK

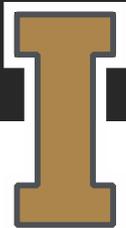
- Maxwell Super Caps
 - 350 Farads at 2.7 V
- 2 in parallel with 33 Ω resistor
 - 700 F
- Ten in series
 - 70 F and 330 Ω at 27 V

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

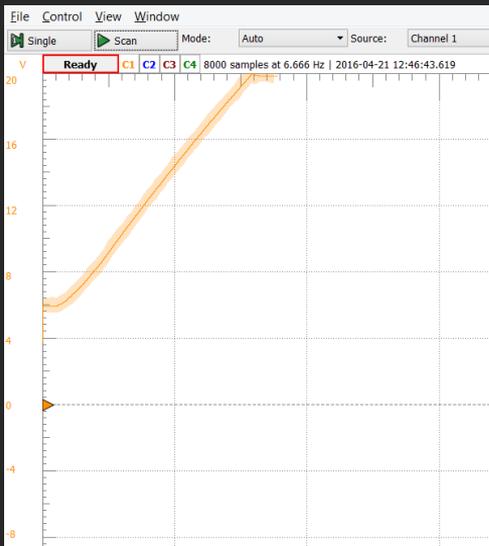
25.515 Kilojoules

7.088 WattHr

Goal of 11 WattHr

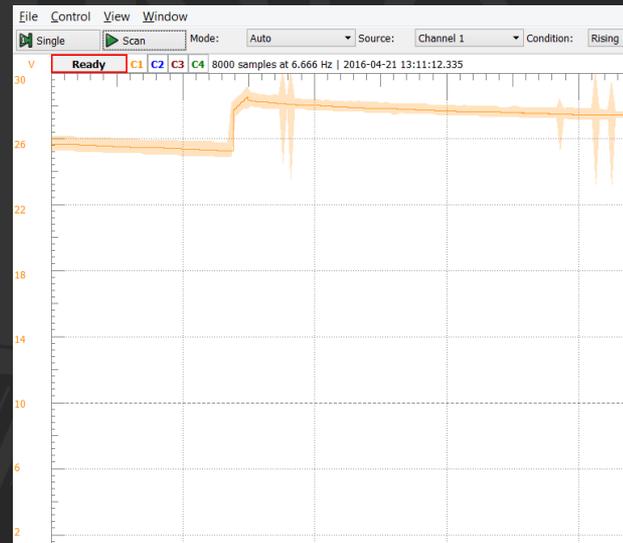


CAPACITOR BANK TESTING



CHARGING THE BANK

Charge time was
around 3 4 minutes
at 6 Amps.
At 12 Amps this
will be about 2
minutes

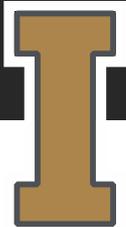
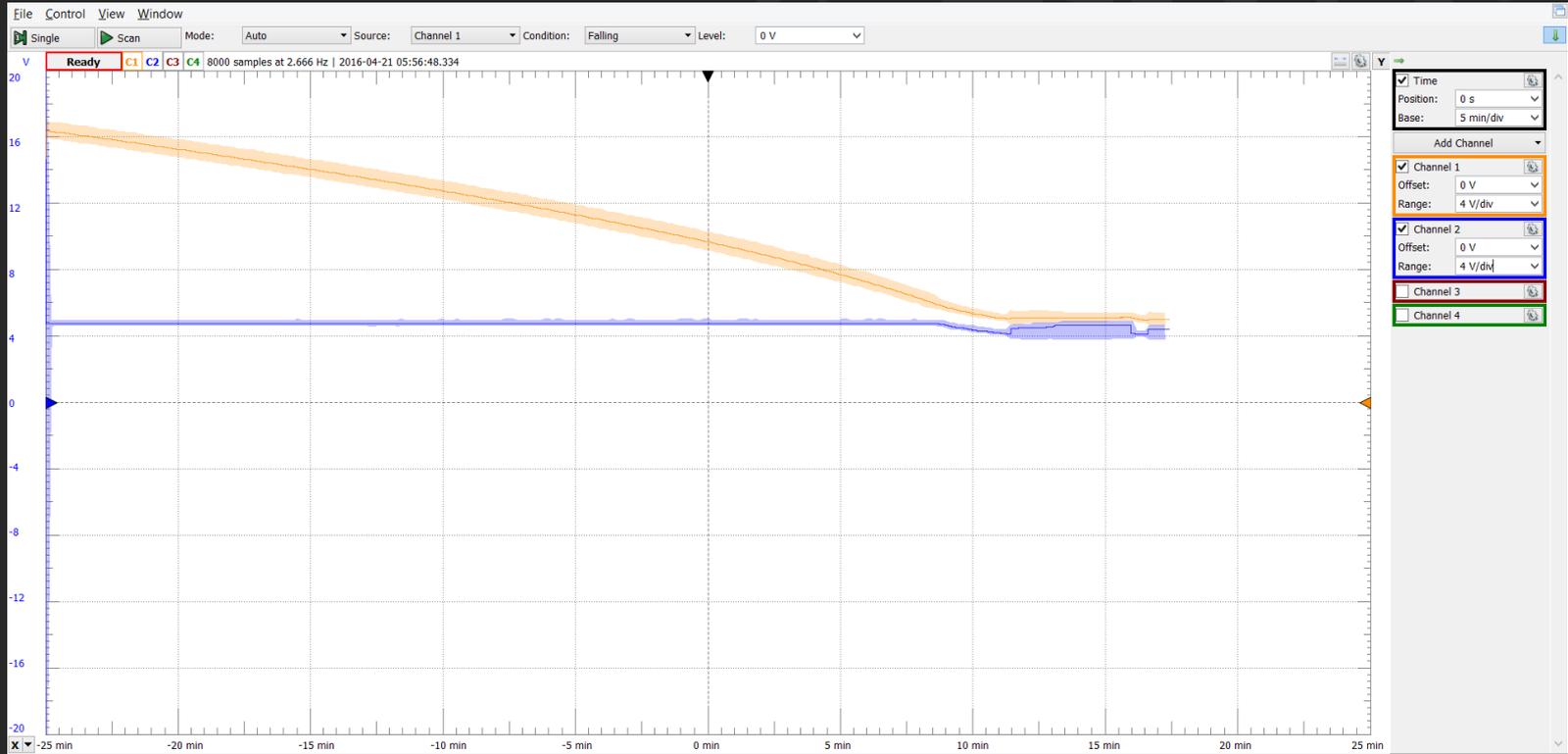


CAPACITOR BANK TO PHONE

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

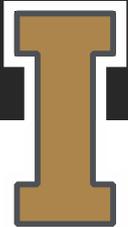
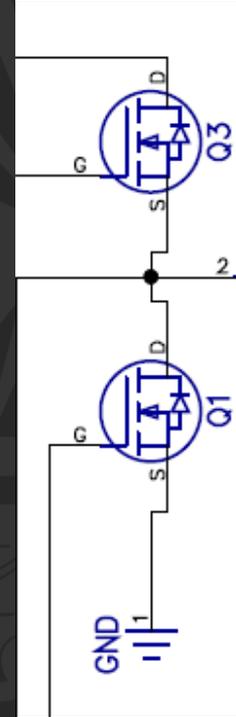
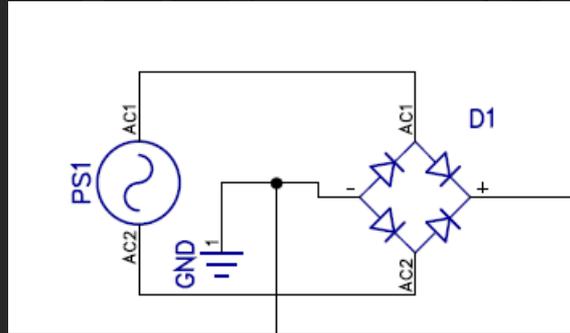


CHARGING A PHONE



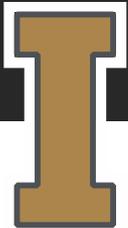
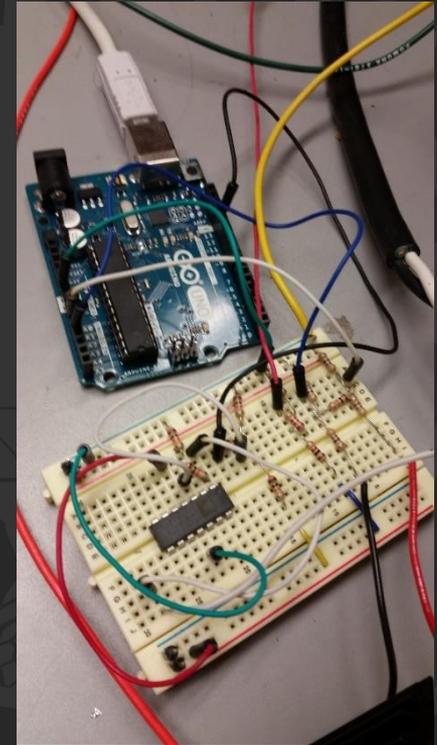
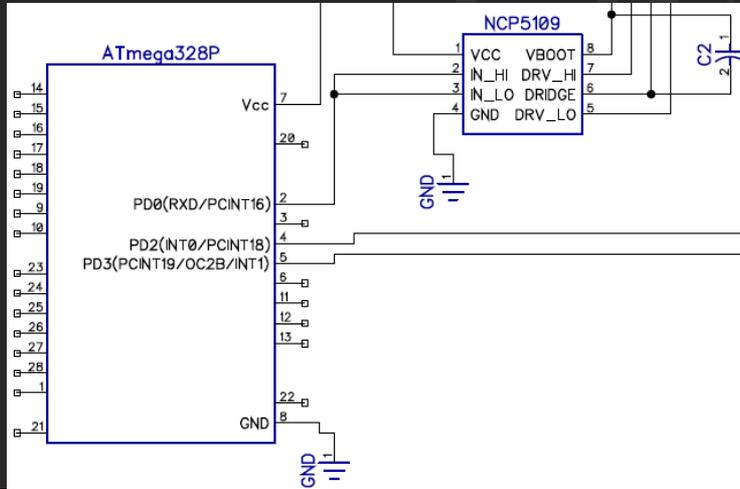
VOLTAGE CONVERSION

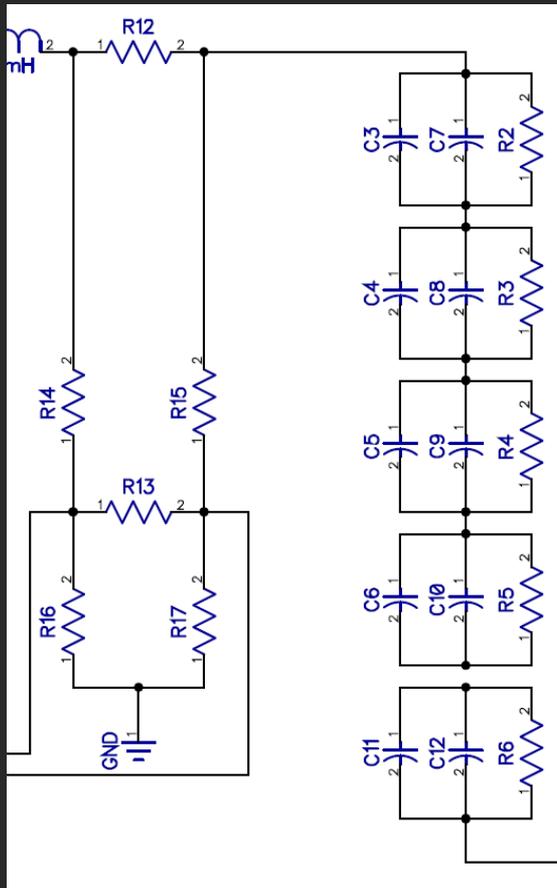
- Full Wave Bridge Rectifier
 - 120 V AC @ 60 Hz => 169 V DC
- 169 V passes through Mosfets
 - Acts as a switch
 - Activated by the Isolated Gate Driver
 - Passes through Inductors
- SMP0507SJ Microcontroller House keeping
 - 169V DC to 5V DC



MICROCONTROLLER PWM

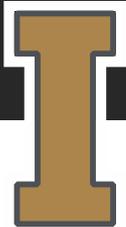
- Senses the capacitor bank's charge
- Controls the MOSFET's switching based on that charge





```
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);
}
```



MOSFET DRIVER

NCP5109 Gate Driver

- Able to supply high voltage to Nchannel Mosfet

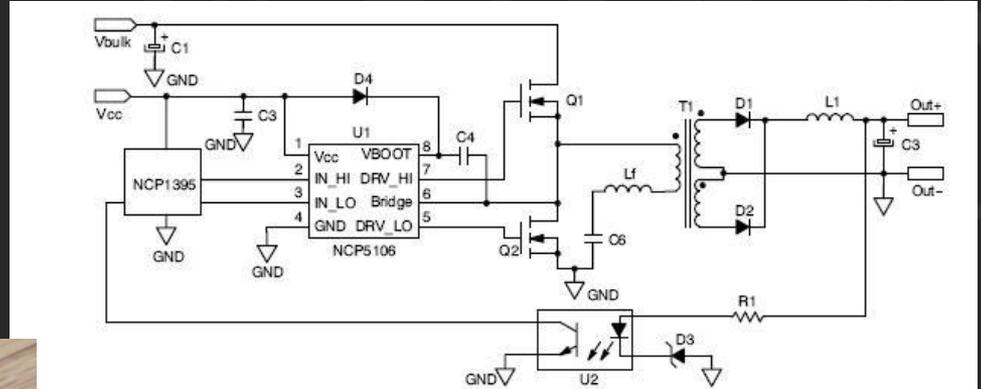
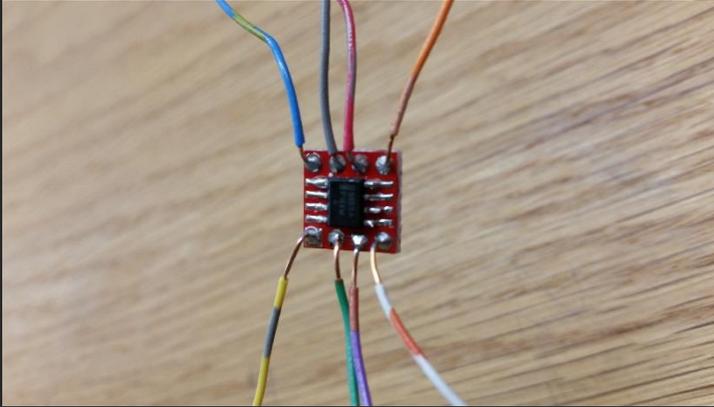
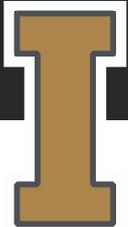


Figure 1. Typical Application Resonant Converter (LLC type)



CONCLUSION

Takeaways from the year:

- Research and analysis of new parts
- Creative thinking and design work
- Troubleshooting the testing of the design

