

### Adjustable Power Supply (David Yamnitsky)

- Functioning Rectifier with smoothing capacitor for nominal 16 volt DC output.
- Functional shoot-through protection circuit. Single PWM input produces two complementary output waveforms that guarantee neither waveform goes high before the other first goes low.
- Functioning half-bridge. Complementary PWM input, high and low side gate drive, amplified PWM output.
- Functioning Buck Converter. PWM input, adjustable DC output.
- Functioning 555 triangle wave generator.
- Functioning differential amplifier. Input from potentiometer and DC voltage source produce voltage output which is the difference between the two signals multiplied by an adjustable gain.
- Functioning PWM generator. Triangle and adjustable DC input, adjustable duty cycle PWM output.
- Bringing it all together: functional closed loop buck converter control. Demonstrate that adjusting output current does not appreciably change output voltage.

### Wireless Battery Charger (Joseph Driscoll)

- Wireless power transmitter converts DC to AC, sends AC through inductor
- Wireless power receiver acquires power from transmitter
- Wireless power receiver rectifies voltage with a functioning bridge rectifier
- Wireless power receiver regulates output voltage to 10 V DC (reach to do so without IC)
- Battery charger sends current through the battery
- Battery charger regulates current based on batteries charge
- Battery charger indicates when charging a battery (reach)
- This smart charging feature can be adjusted to work on batteries from 1.5 to 9 V
- Functioning wireless battery charger with input from a lab bench top power supply

### USB Charger (Paul Hemberger)

- Functioning LT IC boost converter circuit, outputs 12V from wide input range
- Functioning 555 triangle wave generator, outputs ~80kHz signal
- Functioning error amplifier, outputs signal at the midpoint of triangle wave when  $V_{out} == V_{ref}$ , and increases / decreases output correctly depending on  $V_{out}$
- PWM comparator has adjustable duty cycle depending on triangle and DC input
- Functioning gate driver, can power MOSFET on and off at ~80kHz
- Functioning buck-boost, can create output above and below input voltage
- Integration part 1: PWM comparator output into gate driver can drive MOSFET
- Integration part 2: circuit outputs 5V when the 12V rails are from a bench supply, and input voltage is 1.5V
- Integration part 3: circuit outputs 5V when the 12V rails and input voltage are from a 1.5V battery

- Integration part 4: circuit outputs 5V when the 12V supply rails and input voltage are from a 14V battery
- Final: circuit can charge a phone from a battery!