

# USB FlexCharger

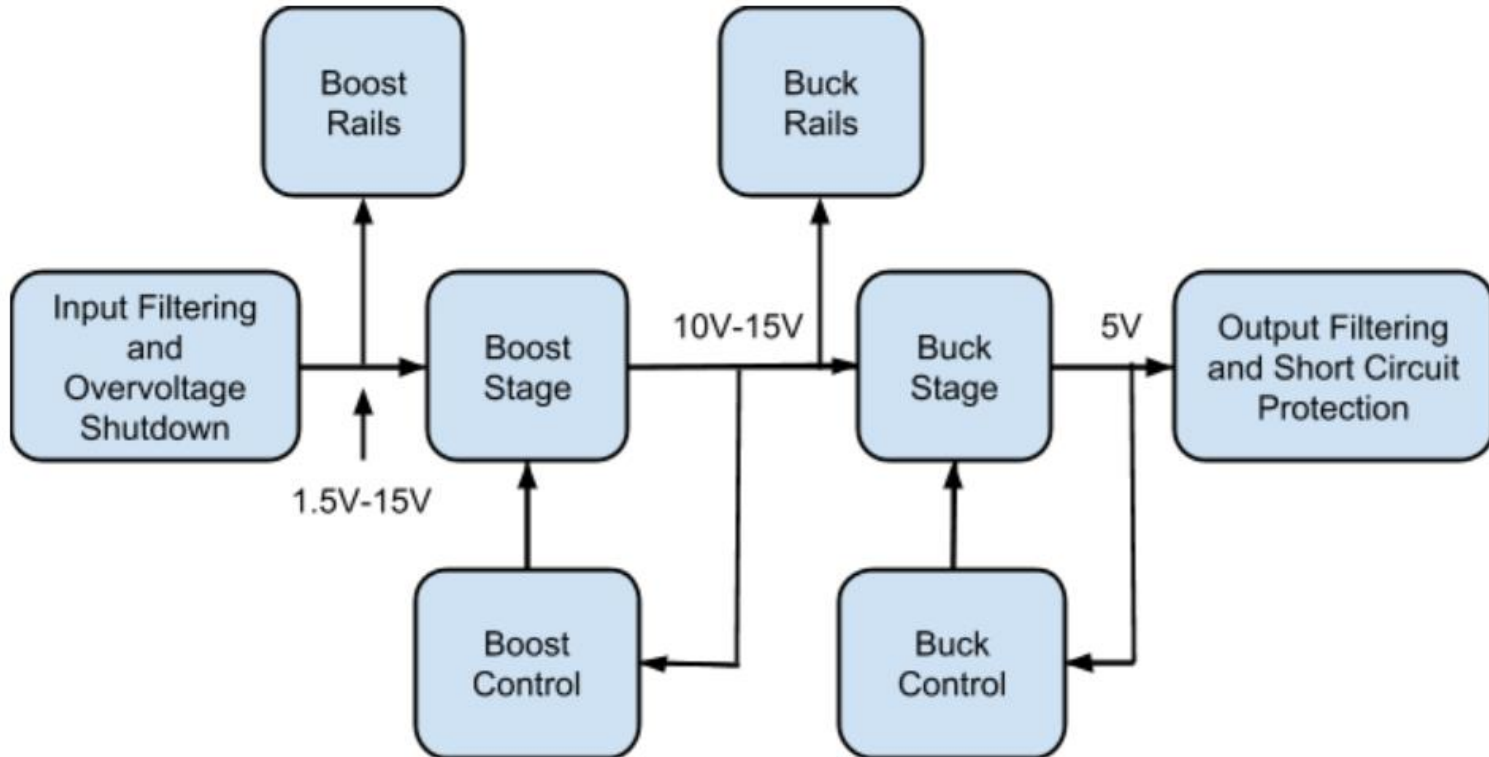
Alex Sloboda and Fiona Paine

# Why a USB Charger?

- Common need
- Multitude of power sources
- Challenging design problem



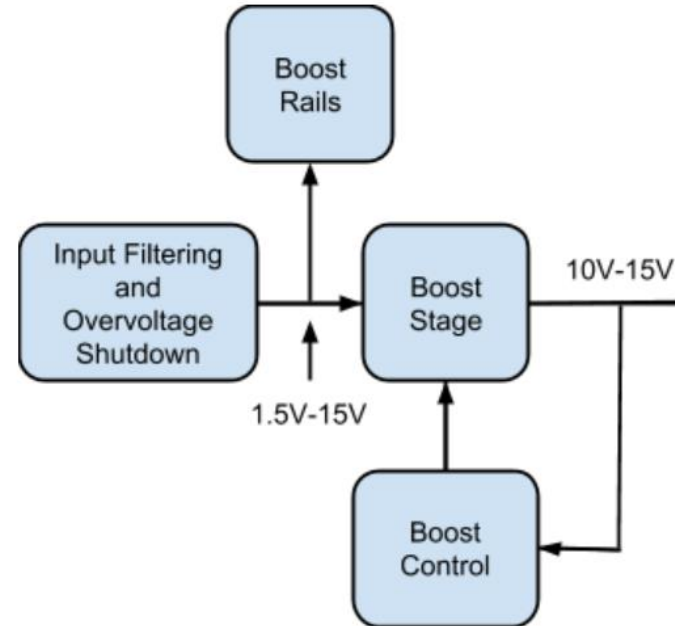
# Overview



# Input and Boost Stage

Goal: Provide stable higher end voltage inputs for buck stage.

- Specifications:
  - Input voltages: 1.5-15 V
  - Input currents: 100mA - 9A pulsed
  - Output voltages: 10-15 V
  - Output currents: 100mA-2A



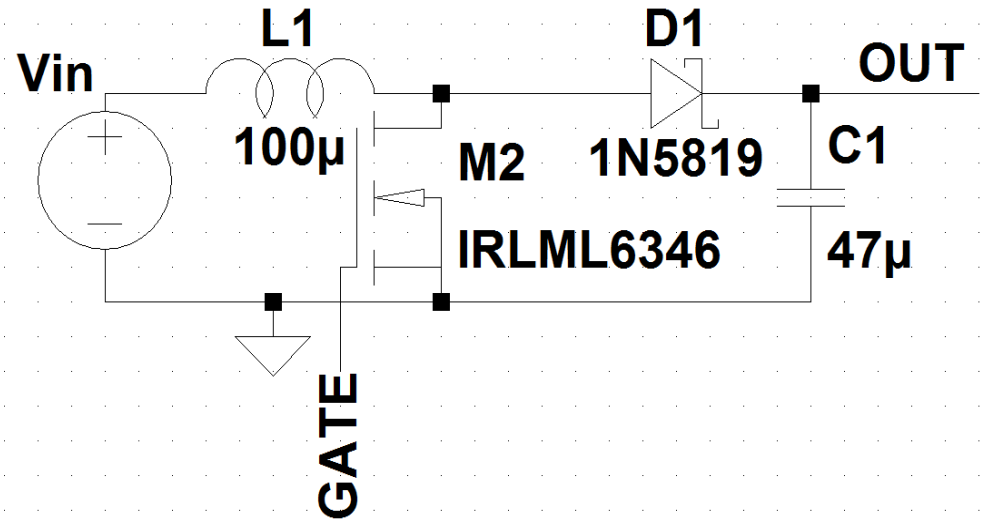
# Boost Converter

General operation:

Inductor stores and releases energy between two states

MOSFET On/Inductor Charging

MOSFET Off/Inductor Discharging



# Boost Stage Power Rails

Why necessary?

Specifications:

Input 1.5-15 Volts

Output 3 - 15 Volts

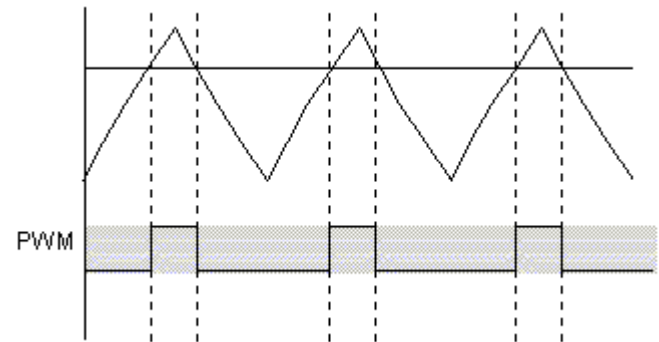
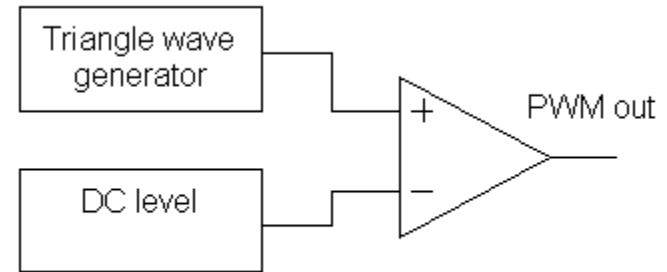


# Boost Stage Control Circuitry

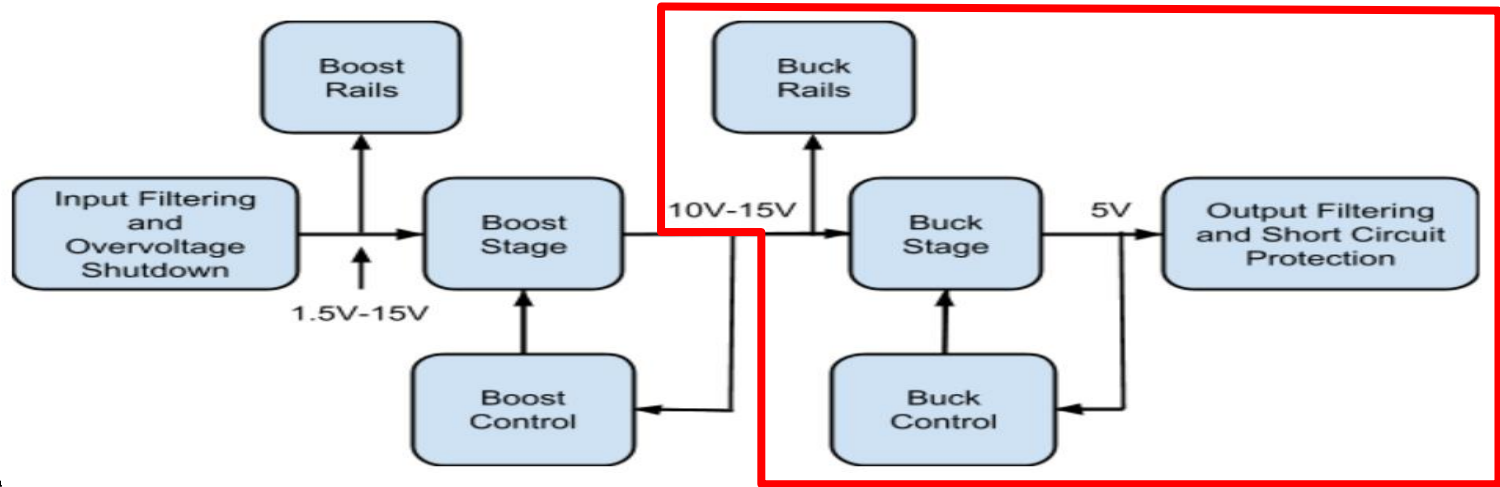
Pulse width module controls switching

Input controlled duty cycle

Burst PWM



# Buck and Output Stage



Specifications:

Input Voltage: 10-15  
Volts

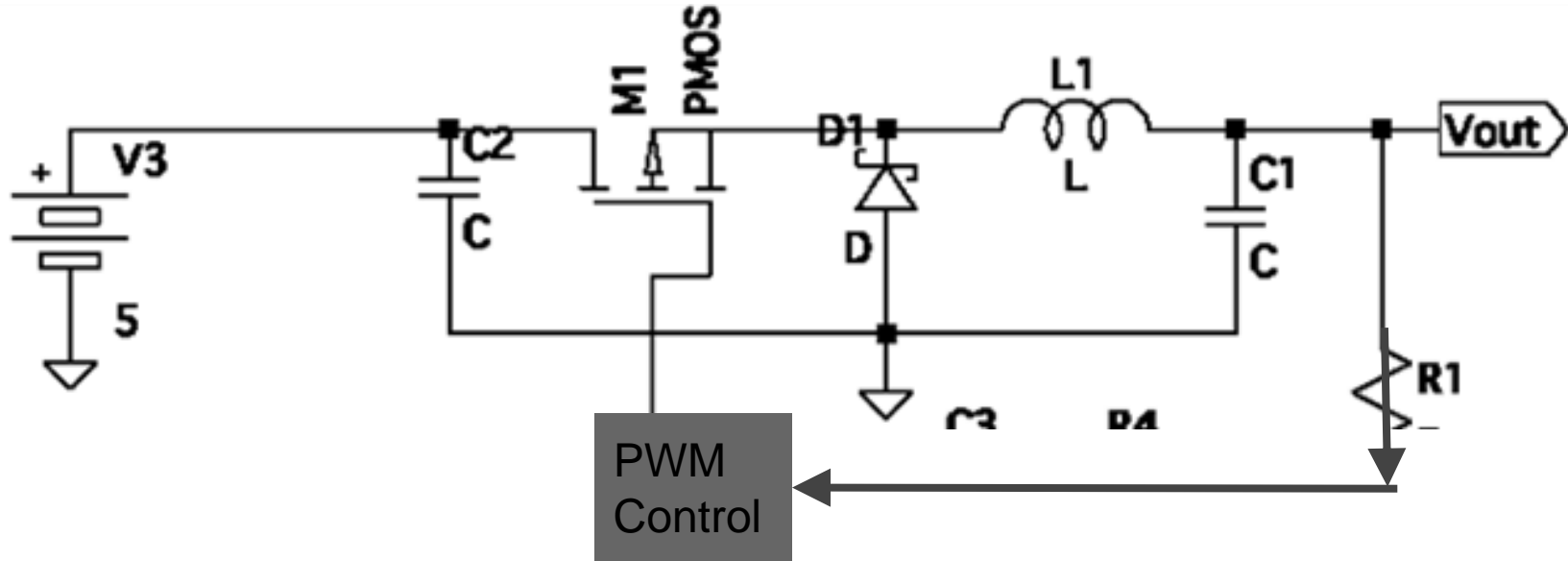
Output (USB Standard):

Max Output Current: 1.5  
Amps

Output Voltage: 5 Volts



# Buck Converter

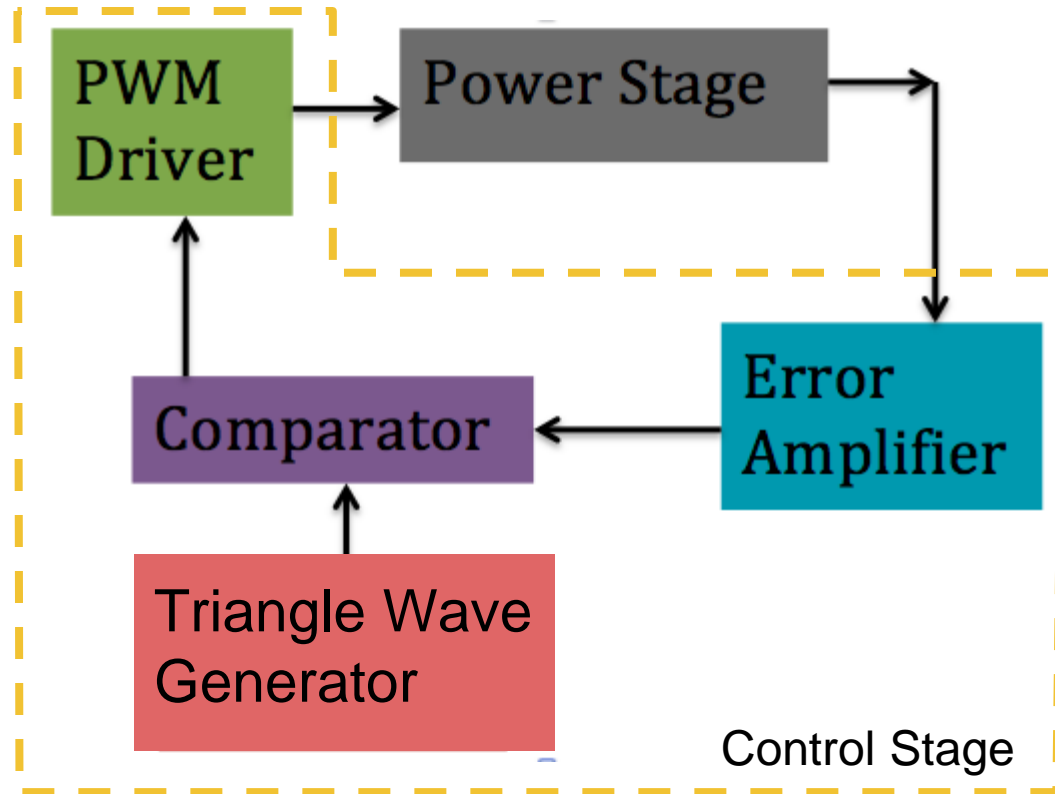
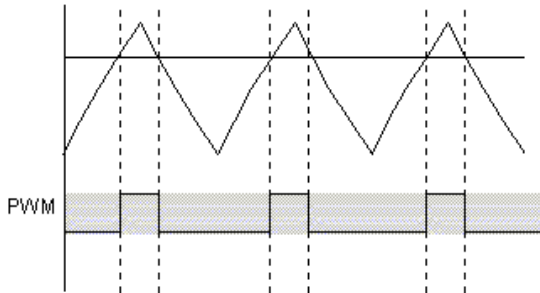


Continuous Mode

$$\text{Duty Cycle} = V_{out}/V_{in}$$

# PWM Based Buck Stage Control

Varying duty cycle of PWM adjusts charge/discharge timing of Buck stage



# Output Protection

Filtering ripple

Safety features:

Current and voltage limiter



# Time Line

By April 12th: Design schematic completed and order parts

April 14th: Project Presentation

By April 16th: Buck and boost modules tested and working

By April 22nd: Control circuitry tested and working

By April 24th: Input and output stages tested and working

April 27th: Project implementation status due

May 5/6: Final presentation and checkoff

# Possible Extensions

Take input from wall adapter

Power specific device such as ECG



# Questions?

