EECS192 Lecture 4
Feb. 7, 2017

Notes:
Check off-
- 2/10: Motor drive/stall, steering servo
- Quiz 2: power MOSFET/motor drive Tues 2/14

Topics
- Polarized capacitor
- Project proposal feedback
- Quiz 1
- RC servo basics
- PWM and motor drive
- Power supplies
- Boost converter
- Buck Converter

47uF, 16V electrolytic, **polarized**
Not all same- ESR…

Project proposal feedback

Motor Driver

Schematic

- Estop: what to switch?
- Motor drive from battery, not voltage regulator
- Snubbing capacitors and diode
- Drive/brake/enable/dir- shoot through protection
- Conventions: L->R, top to bottom

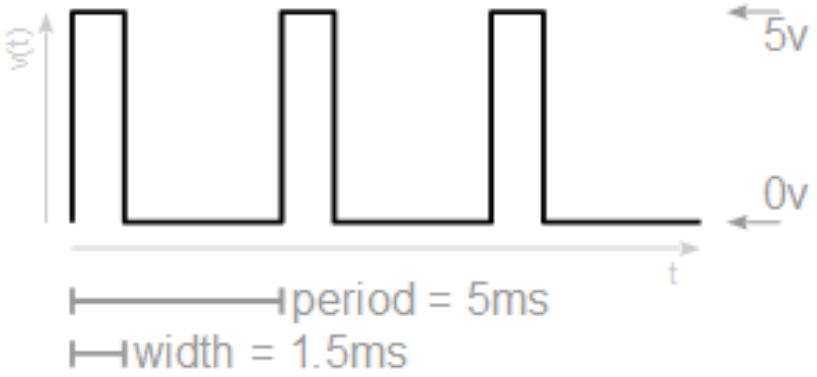
Circuit Layout

- Mounting holes
- Big wires, short distances
- QFN vs SOIC package
- Heat sinks
- Estop switch
- Signal connectors- include ground
- Power connectors

Software

- Threads vs interrupts vs main() vs RtosTimer

PWM for Steering Servo



Gotchas:

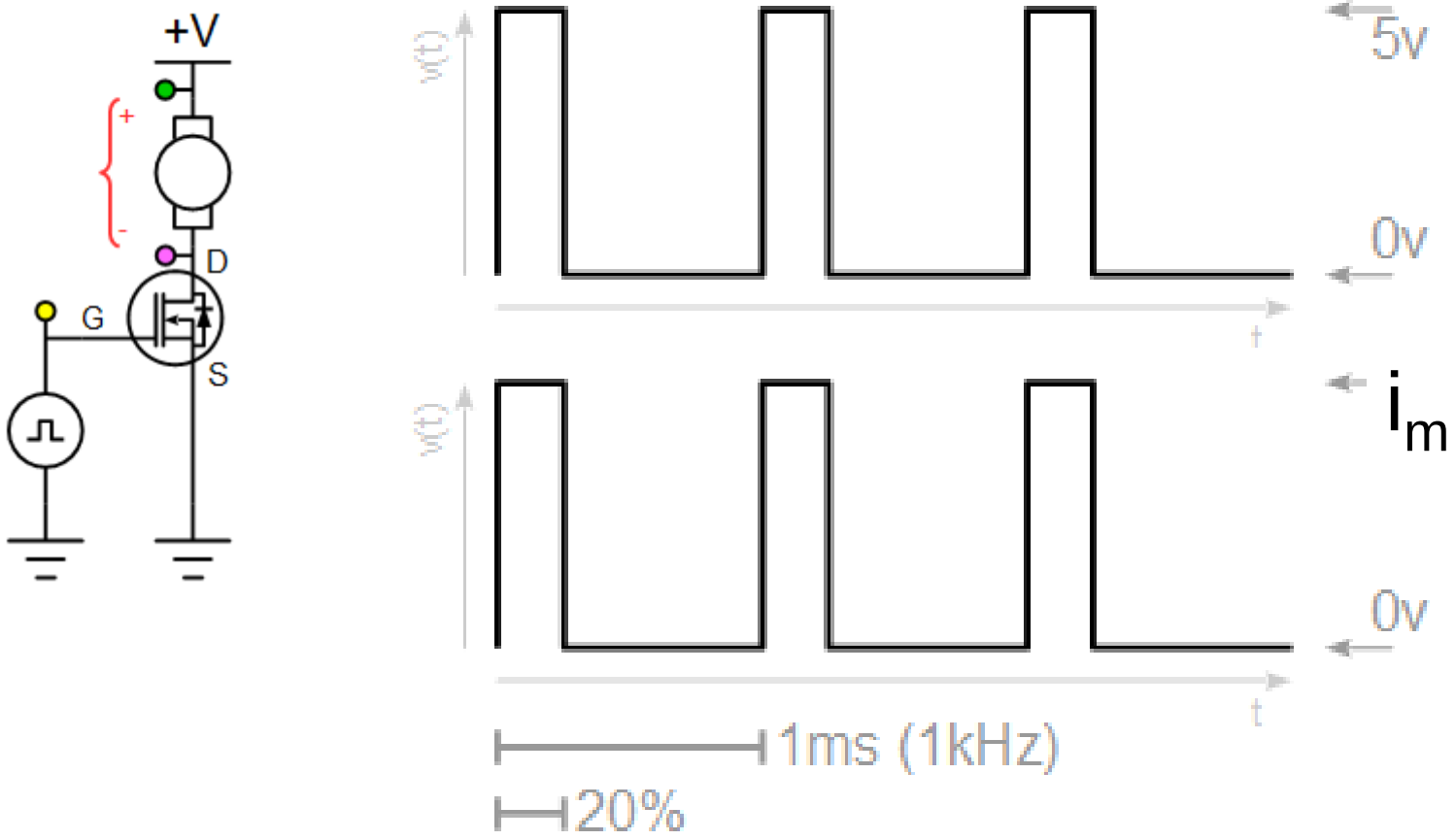
- 4.8 or 6V, (Not 7.2V!)
- max current 2A
- May be sensitive to noise on supply line
- Performance depends on voltage

PWM

https://developer.mbed.org/handbook/PwmOut

	PwmOut (PinName pin) Create a **PwmOut** connected to the specified pin.
void	**write** (float value) Set the ouput duty-cycle, specified as a percentage (float)
float	**read** () Return the current output duty-cycle setting, measured as a percentage (float)
void	**period** (float seconds) Set the PWM period, specified in seconds (float), keeping the duty cycle the same.
void	**period_ms** (int ms) Set the PWM period, specified in milli-seconds (int), keeping the duty cycle the same.
void	**period_us** (int us) Set the PWM period, specified in micro-seconds (int), keeping the duty cycle the same.
void	**pulsewidth** (float seconds) Set the PWM pulsewidth, specified in seconds (float), keeping the period the same.
void	**pulsewidth_ms** (int ms) Set the PWM pulsewidth, specified in milli-seconds (int), keeping the period the same.
void	**pulsewidth_us** (int us) Set the PWM pulsewidth, specified in micro-seconds (int), keeping the period the same.
PwmOut &	**operator=** (float value) A operator shorthand for **write()**
	operator float () An operator shorthand for **read()**

PWM for Main Motor control



$\langle i_m \rangle = (T/T_o)\, i_{max}$

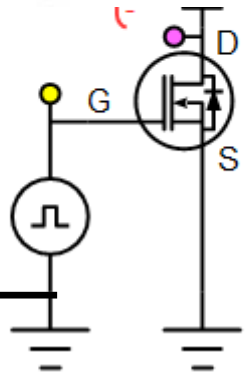
Is i_{max} constant?

Power supply wiring- BAD!

+7.2V

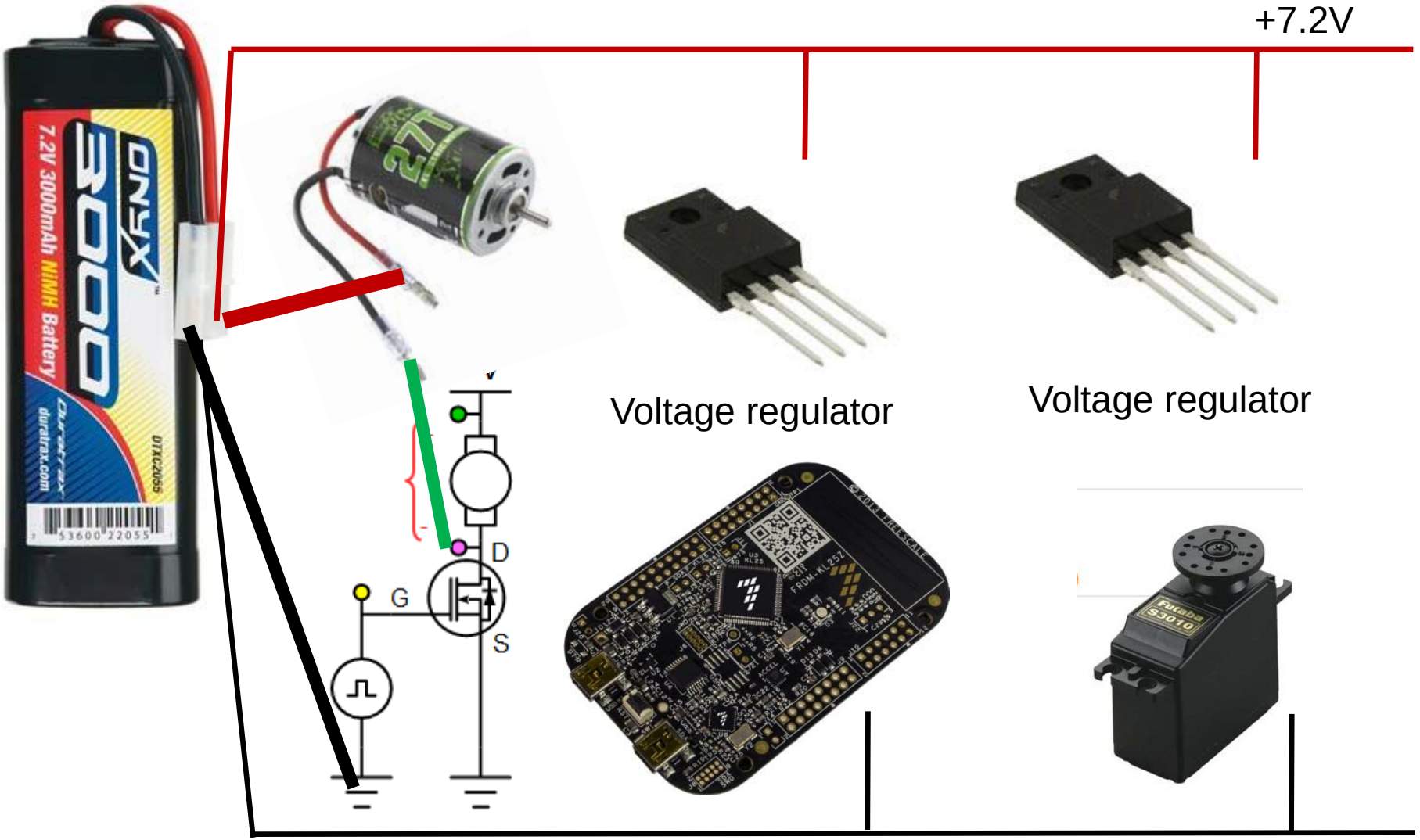
Voltage regulator

Voltage regulator



On board: what does this look like electrically (as a schematic)?

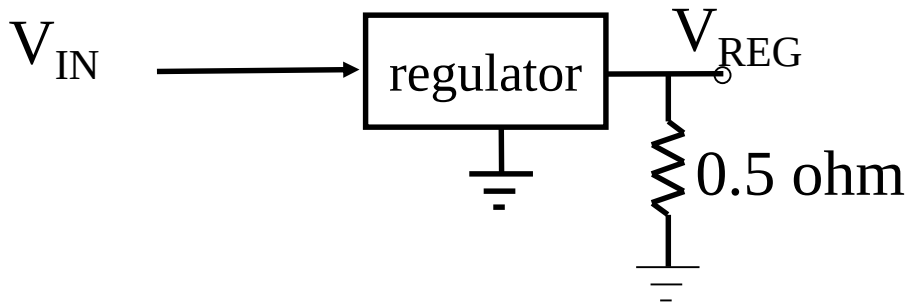
Power supply wiring- Star is better!



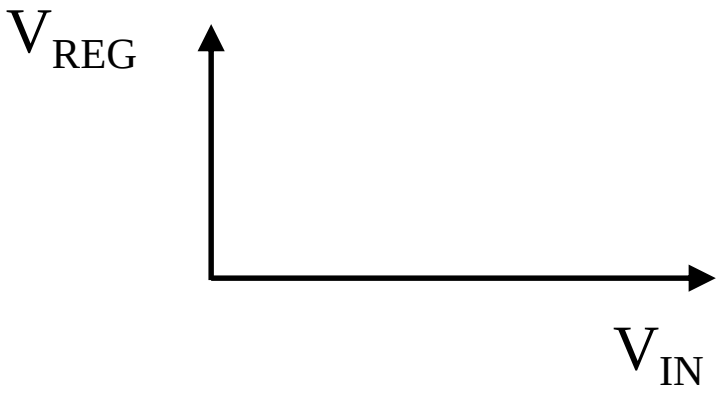
On board: what does this look like electrically (as a schematic)?

``7.2V'' supply waveforms with motor PWM

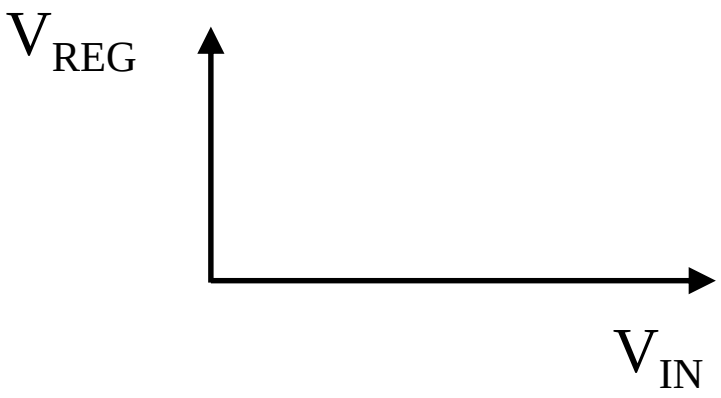
- Battery model
- Waveforms on board
- Wiring to reduce voltage resistance effects of wiring



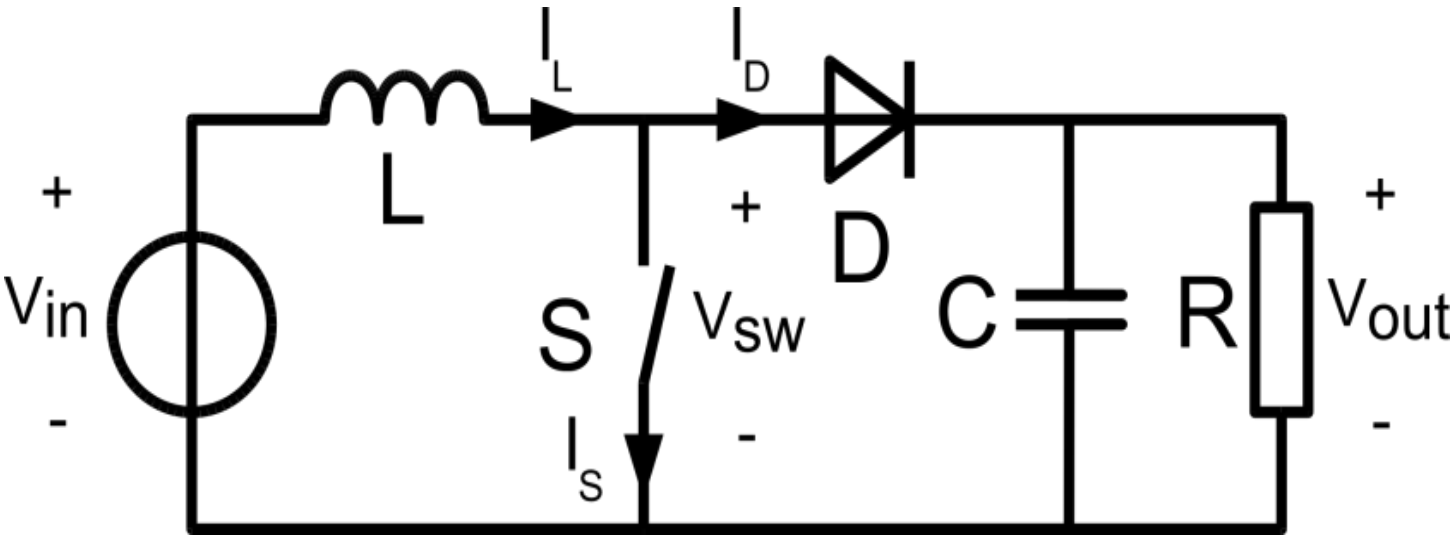
Linear Regulator $V_{IN} > V_{REG}$



Boost Converter $V_{IN} < V_{REG}$



Boost Converter

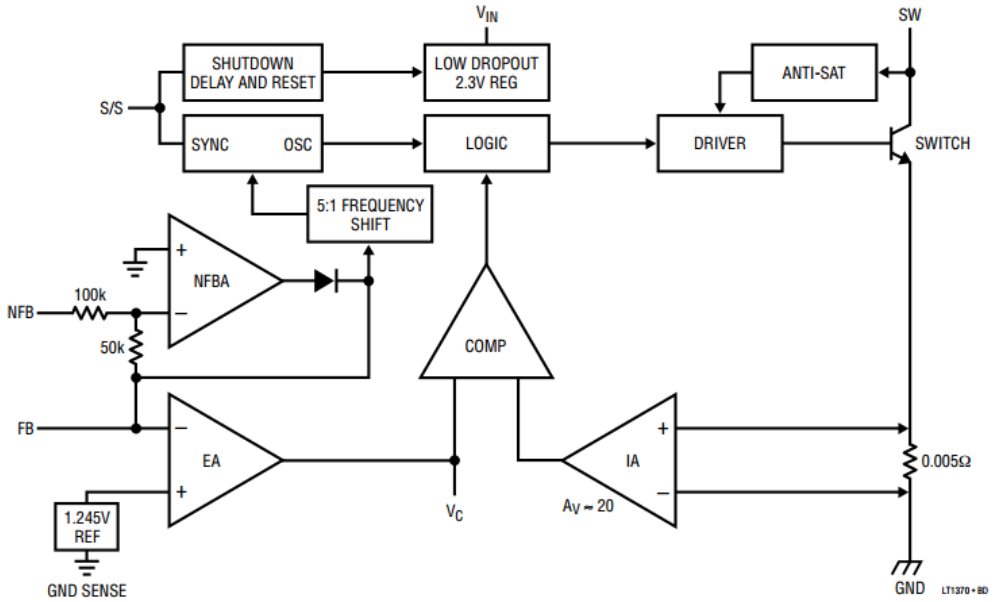


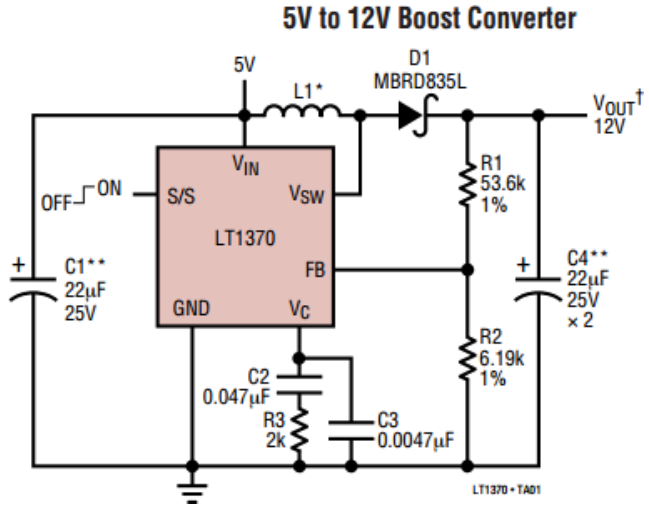
Waveforms on board
(also see boost
converter notes)

Boost Converter- LT1370

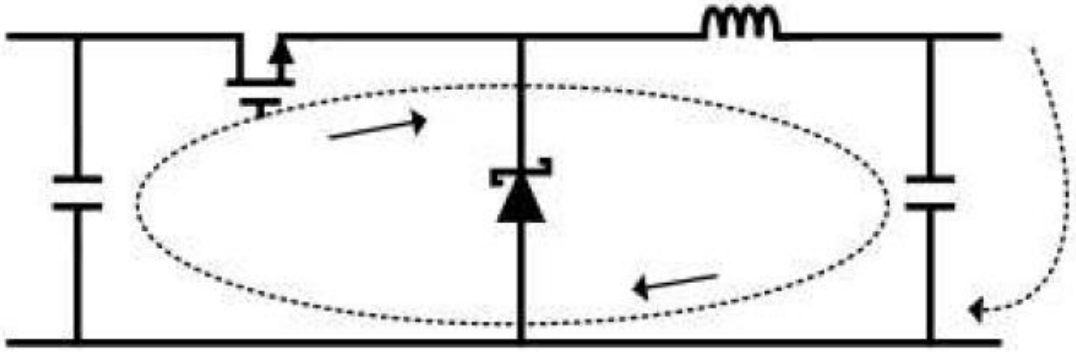
LT1370

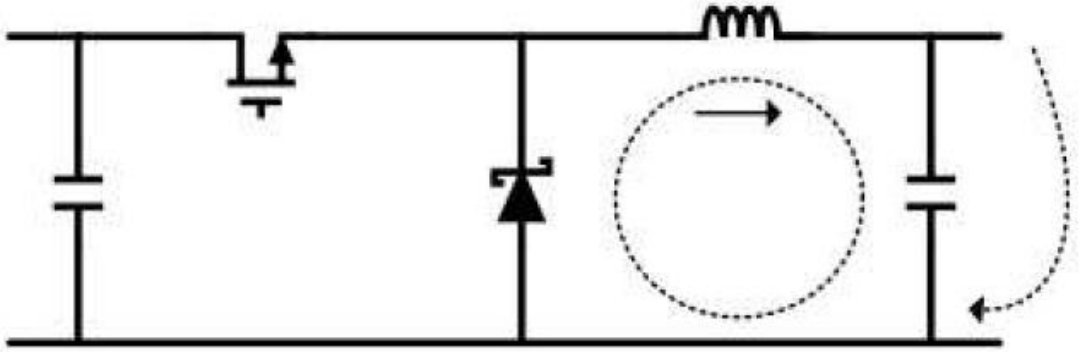
BLOCK DIAGRAM

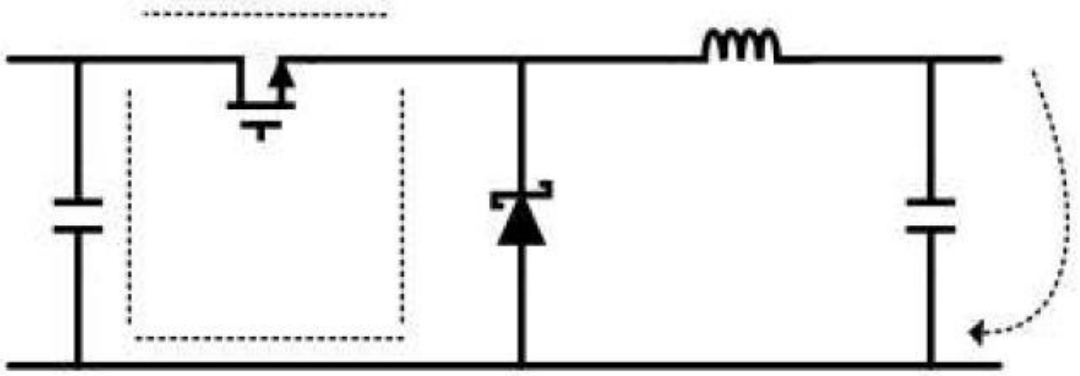




Buck Converter LM2678

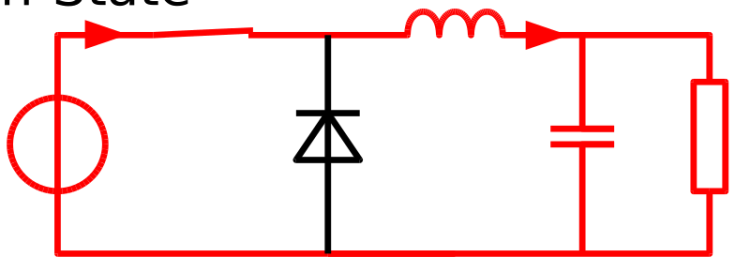




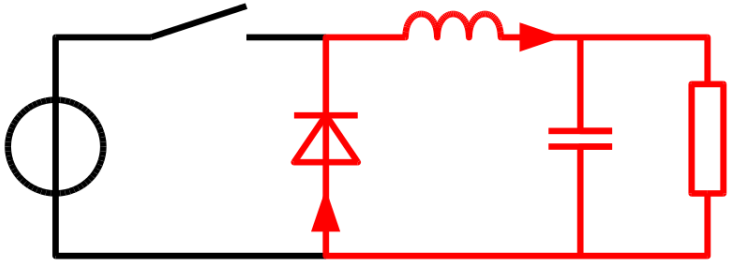


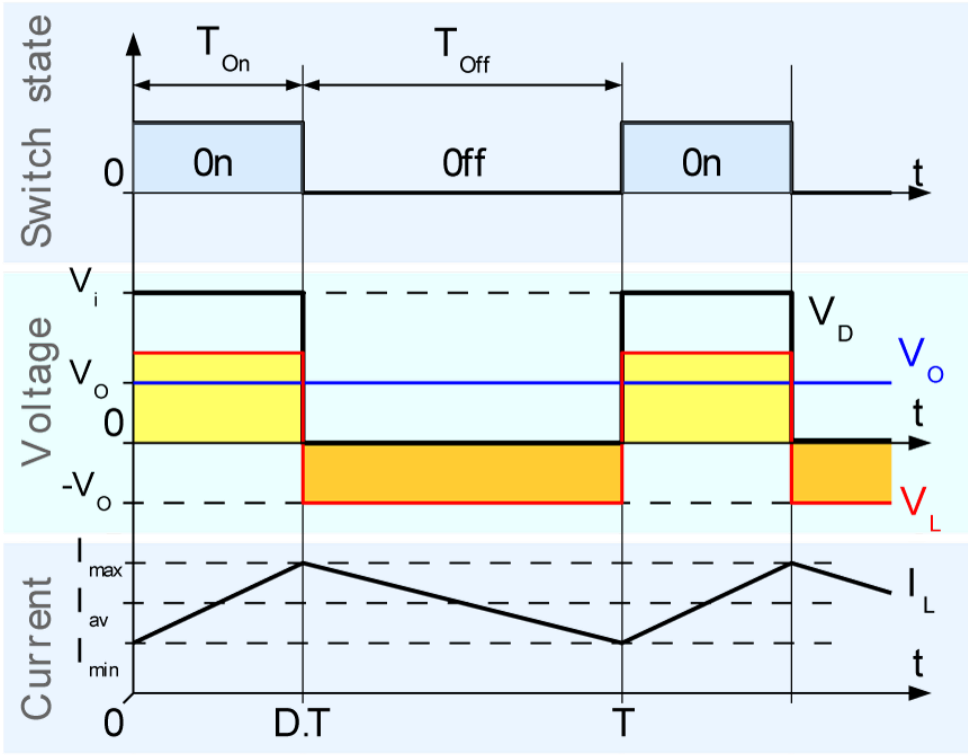
Buck Converter

On-State



Off-State





https://en.wikipedia.org/wiki/Buck_converter