

Lecture #19

Power supplies Continued.

Power sources:

Battery

Bench supply

DC adaptors (wall-warts)

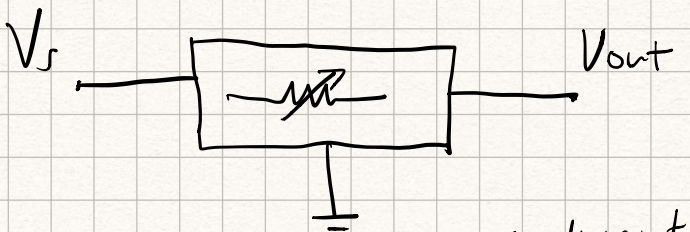
OEM supplies.

- Varying Output

- Output Vary because of cabling

Voltage regulators

Linear Voltage Regulator



2V drop out

LM7805 — 5V regulator

LM 1117 - 5V - 5V reg.

→ $\sim 1V$ dropout.

- Effectively a resistor between V_s & V_{out}

V_{DO} - Drop out Voltage

—min. diff. between

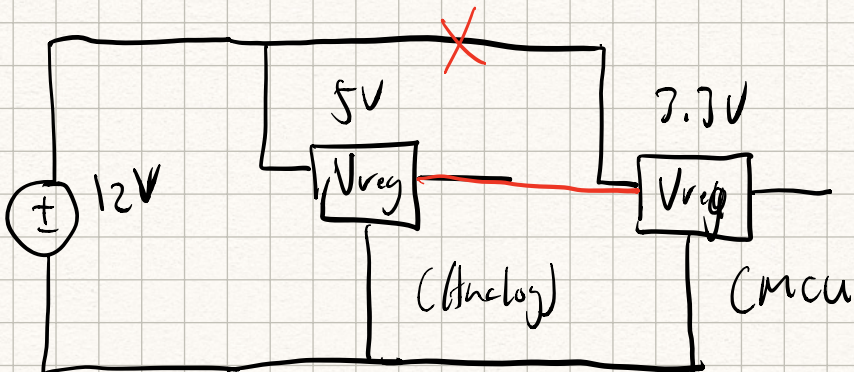
V_s & V_{out} for regulation

If $V_s > V_{SD} + V_{DO} \Rightarrow V_{out} = V_{S_0}$
 $\quad\quad\quad \sqsubset$ specified output

If $V_s < V_{s0} + V_{D0} \rightarrow V_{out} = V_s - V_D$

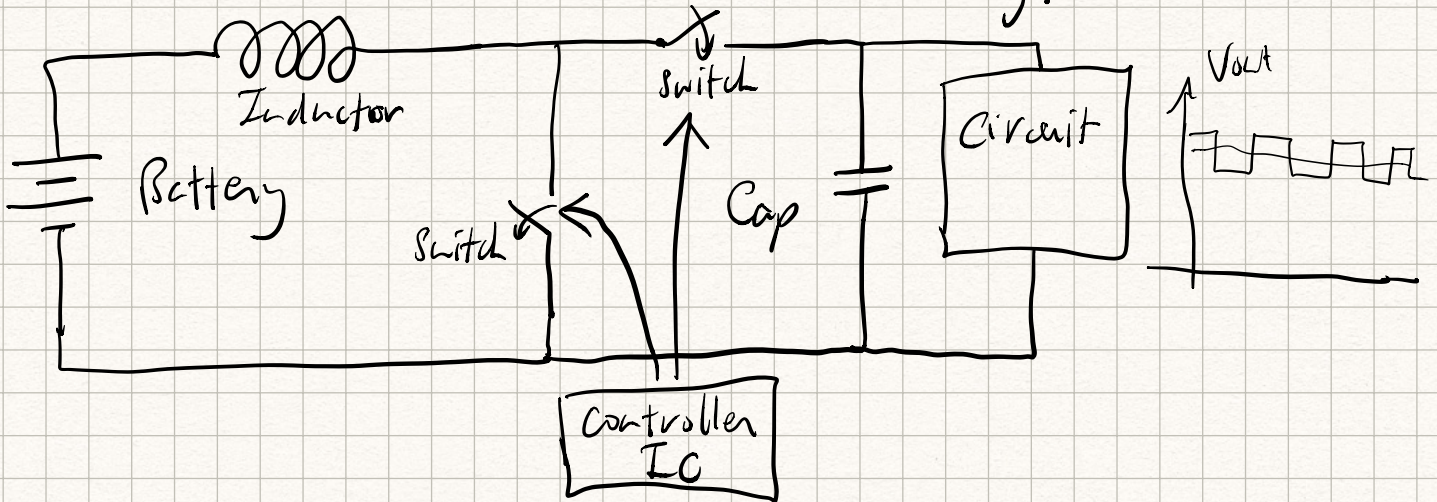
⇒ Low dropout regulator (LDOs)

$$\text{Wasted power} = (V_s - V_{out}) I$$

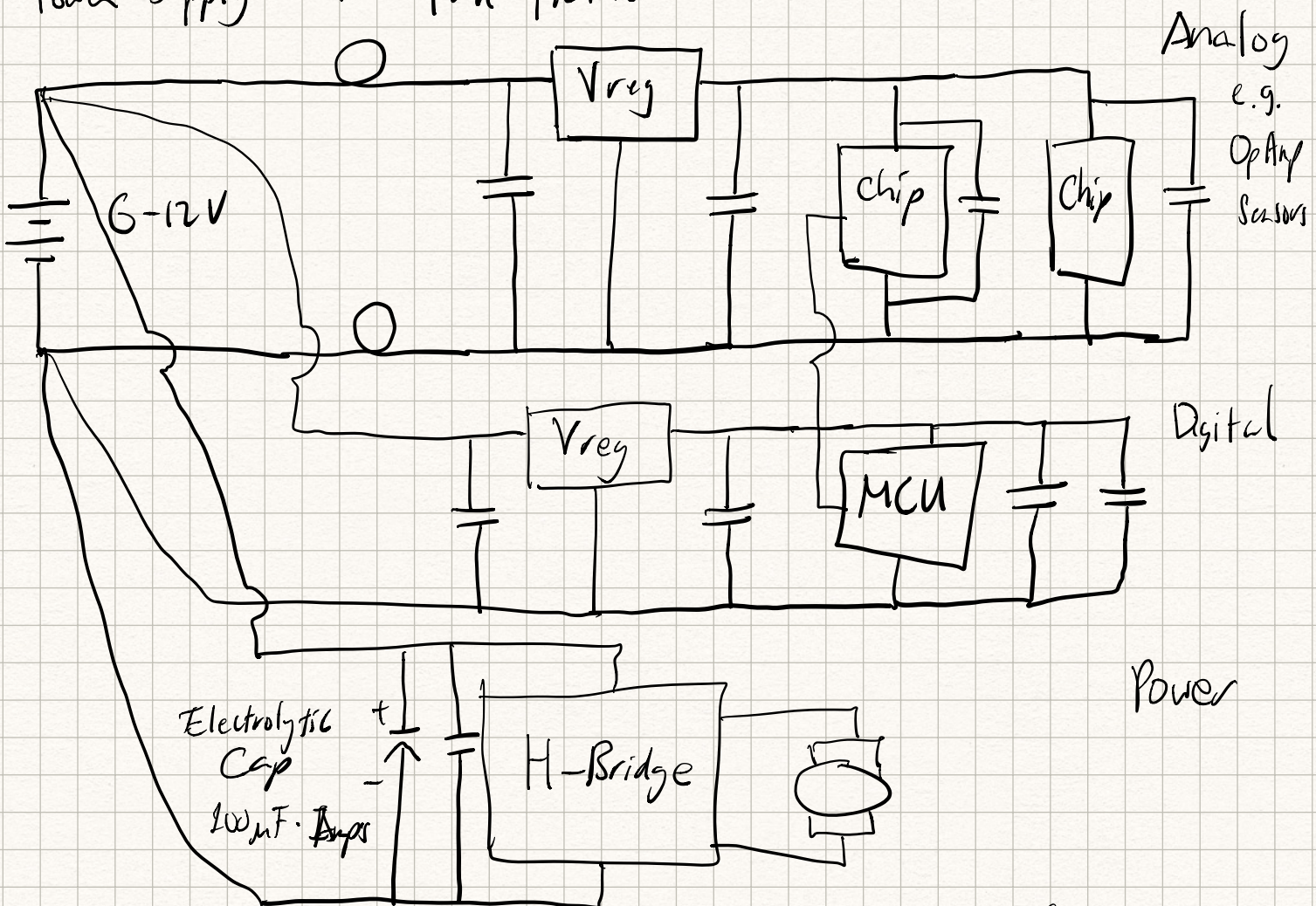


Switching Regulators

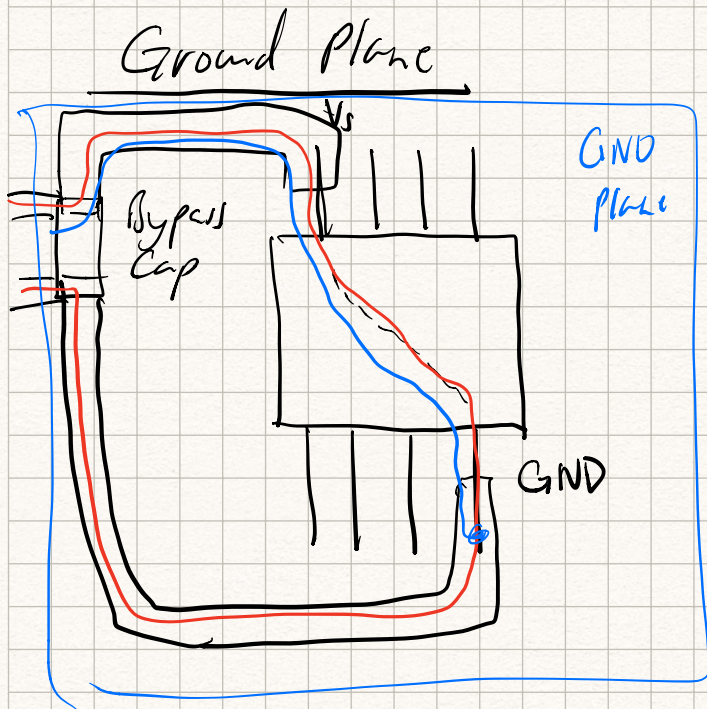
- Step up or step down.
 - 75-90% efficient
 - Difficult to use → Require a PCB
 - Output is noisy — fix using a linear reg.
- Buy module
design your own.



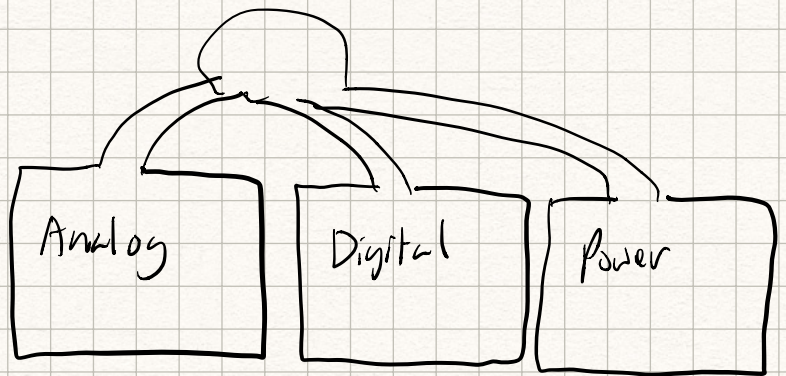
Power Supply — The full picture



* Use a star connection instead of ladder

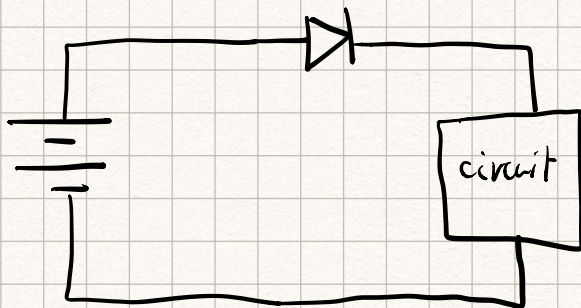


* On a PCB
- separate ground planes for Analog, Digital, & Power sections.



Power Supply Protection

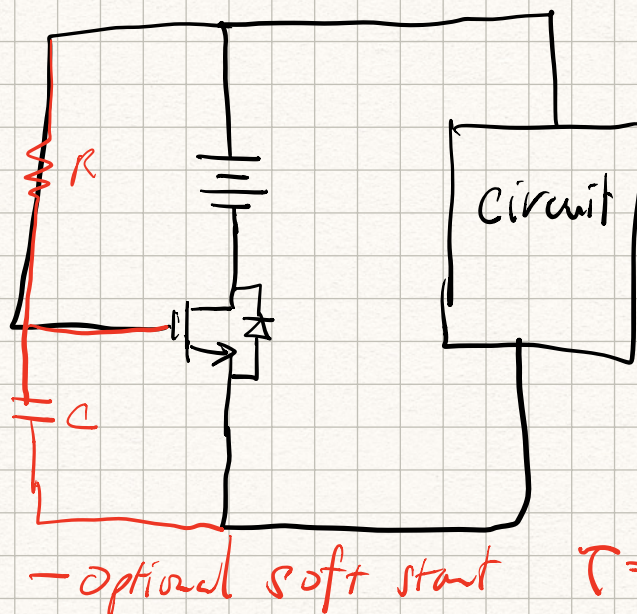
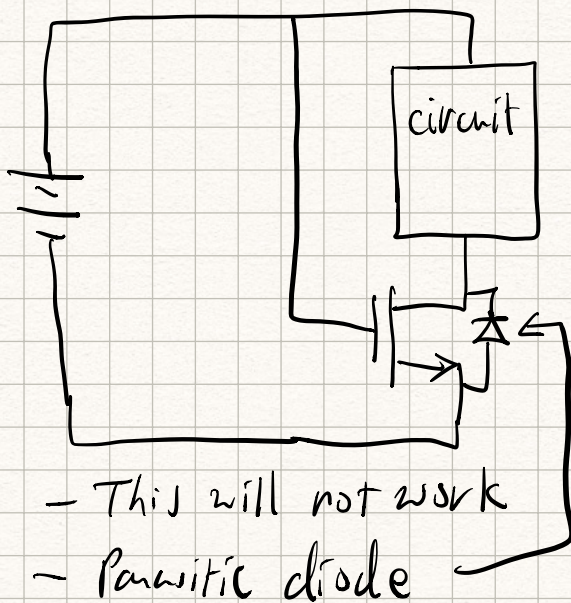
Reverse Battery Protection



Silicon diode — 0.7V drop

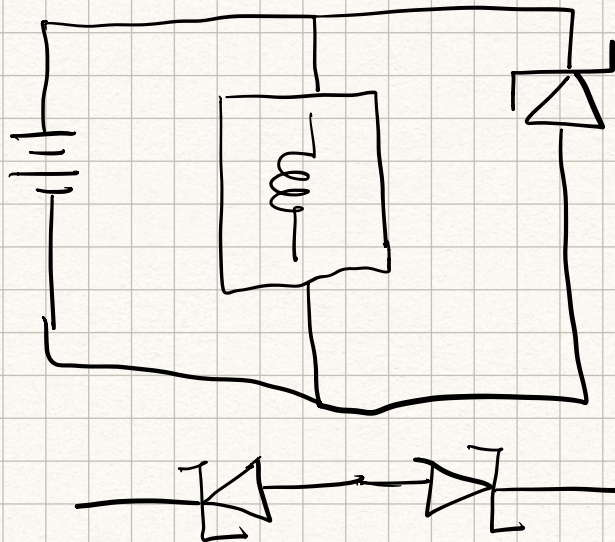
Schottky diode — 0.3V drop

Use a MOSFET:



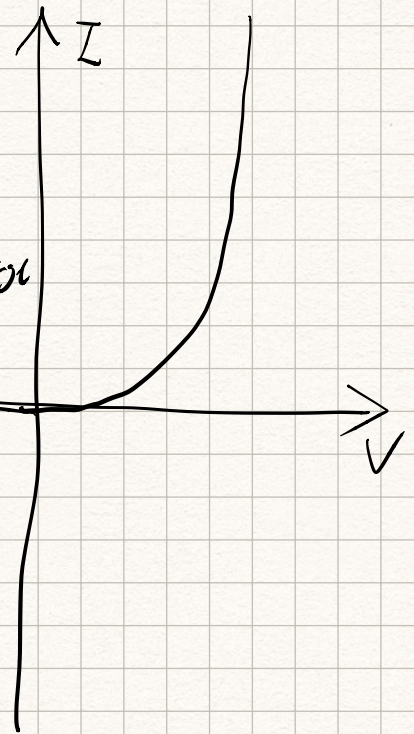
Over-voltage Protection

- For motor circuits
- Use a Zener diode



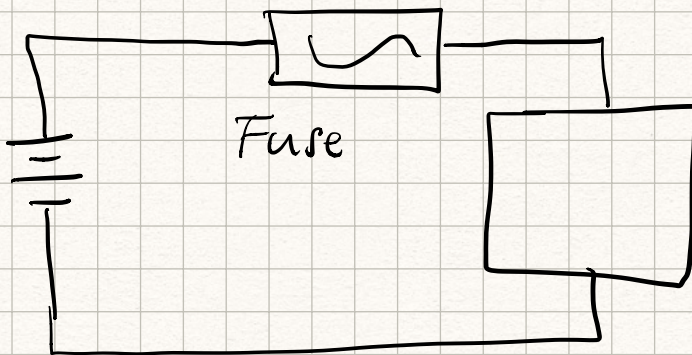
Zener knee voltage

Stand-off Voltage.



Transient Voltage Suppressors

Over-current protection



- PTC fuse
 - Resettable fuse
 - Positive Temp Coefficient

