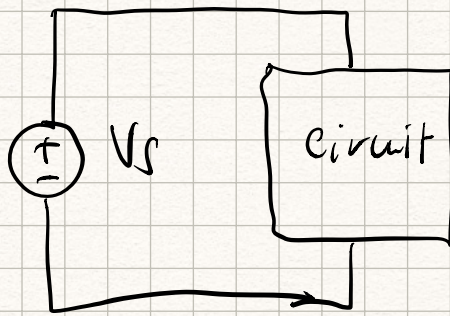


MECH 423 Lecture 17

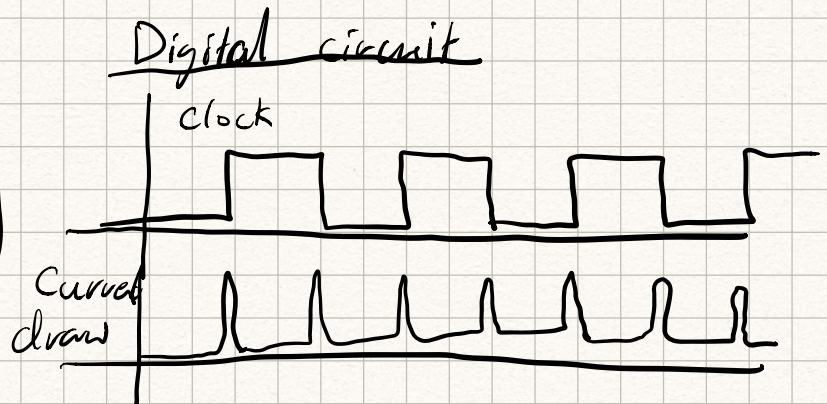
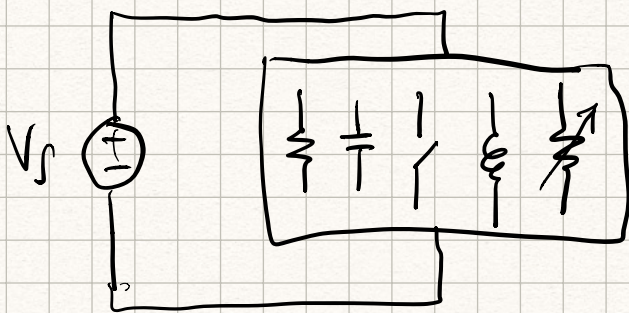


Ideal Voltage source:

- Keep output voltage constant regardless of load.
- Zero output resistance.

Circuit debugging mantra: If your circuit doesn't work, check the power supply!

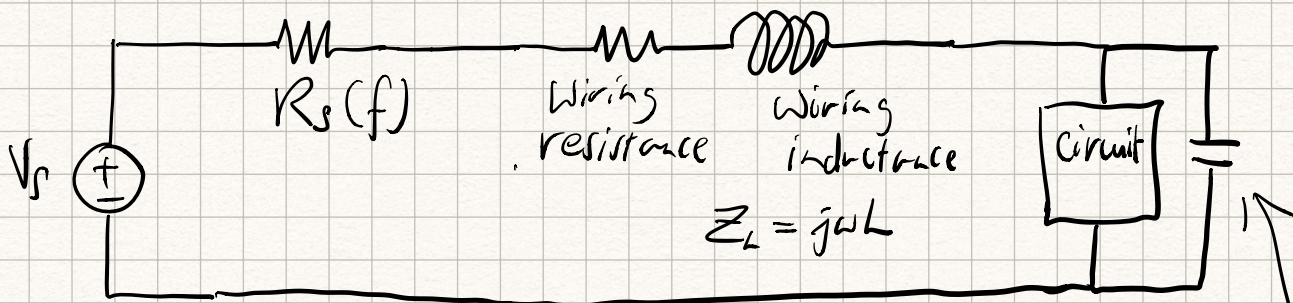
Power supply problem #1: Current draw is not constant.



Problem #2: Source resistance > 0 & freq dependent.



Problem #3: Wiring Inductance



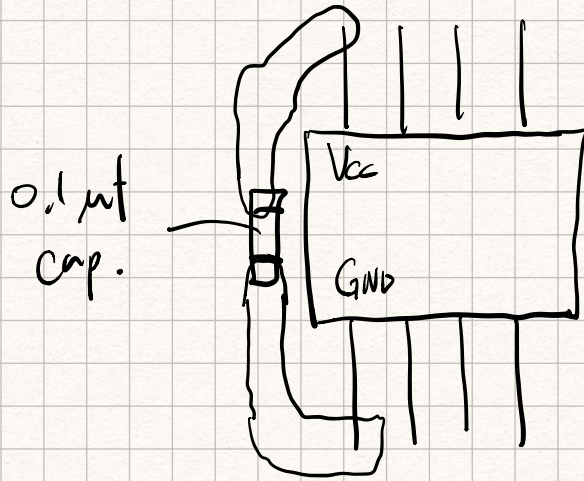
Solution: Add a local supply of charge

Rule of Thumb for bypass capacitors:

* Add one 0.1 μF ceramic capacitor to the power pin of each IC (e.g. OpAmp, MCU)

Bypass capacitor

- Temporarily supply the circuit with charges until the power supply catches up.



* For power circuits: Add one 100 μF electrolytic cap. for each amp of current.

Capacitors

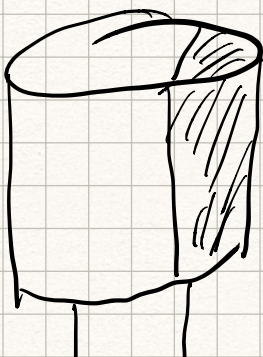
Ceramic:

- $\leq 1 \mu\text{F}$ $\pm 10\%$
- low-cost $< 1\text{¢}$
- Bypass & filtering

Polymer Cap:

- High performance version of ceramic
- Better accuracy
- lower effective series resistance (ESR)

Electrolytic:



- Polarized.
- High capacity $> 10 \mu\text{F}$
- low accuracy $\pm 50\%$ $+80\% - 20\%$
- Poor high freq performance
- Limited life time.

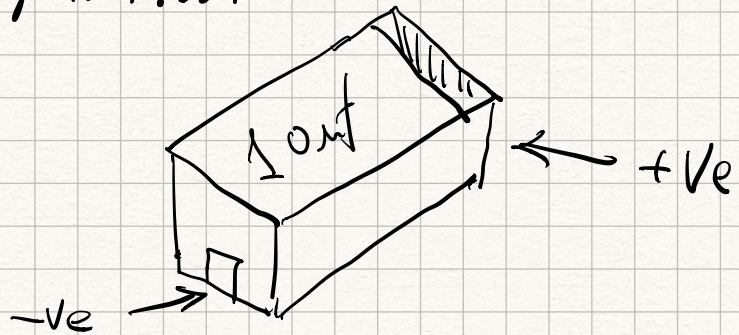
tve -ve

Tantalum cap: 1uf to 10uf
- used in mobile devices
- polarized.

475
↑↑
1st 2 digits
of zeros
to add

Units: pf

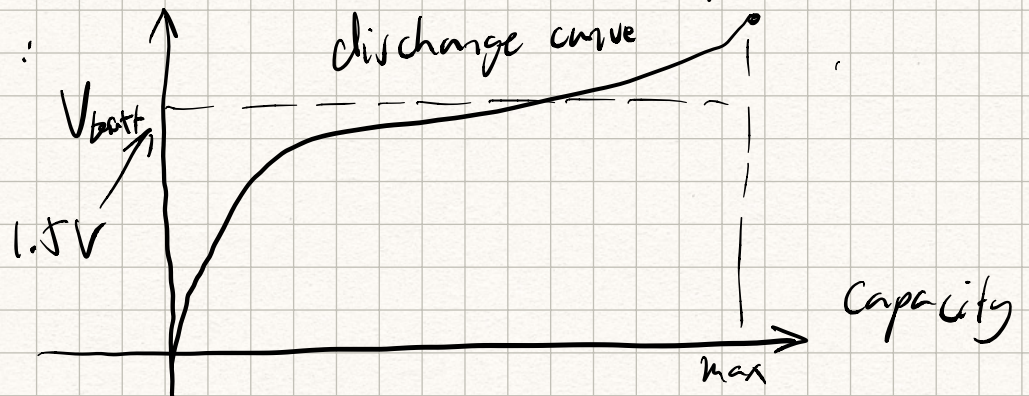
$$4,700,000 \text{ pf} = 4.7 \mu\text{f}$$



Power Sources

Bench supply: eg. AD2 - relatively accurate
- expensive

Batteries:



AC-DC adapters - usually 5V or 12V nominal.
"Wall-warts"

e.g. 12V wall wart
⇒ 11-16V depending on load.

- cable losses may be an issue.

OEM Supplies - eg. Computer power supply

- Highly specialized.

