

A.1 – Basic Electronics

Ohm's Law

- **Formula:** $V=I \times R$
- **Voltage (V):** Push of electricity (Volts) or Potential Difference per unit charge.
- **Current (I):** Flow of electrons (Amps)
- **Resistance (R):** Opposition to current flow (Ohms)
- **Why important:** Lets you calculate resistor values for LEDs, pull-ups, current limiting.

Example:

Supply=5V, LED drop=2V, Desired current=10mA(0.01A) $R=(5-2)/0.01=300\Omega$ $R = (5 - 2) / 0.01 = 300 \Omega$ $R=(5-2)/0.01=300\Omega \rightarrow$ choose **330 Ω** standard value.

- **Ohm's Law (practice / video):** Khan Academy. [Khan AcademyYouTube](#)

Pull-up / Pull-down Resistors

- Keep input pins at a defined logic level when switches are open.
- **Pull-up:** Connect pin to Vcc via resistor \rightarrow reads HIGH when open.
- **Pull-down:** Connect pin to GND via resistor \rightarrow reads LOW when open.
- Typical: 4.7 k Ω – 10 k Ω .
- **Pull-ups (SparkFun + calc):** when/how and choosing values. [learn.sparkfun.com+1](#)

Decoupling Capacitors

- Placed near MCU power pins.
- **Small cap (0.1 μ F):** removes high-frequency noise.
- **Big cap (10 μ F+):** stabilizes voltage during sudden current spikes.
- **Decoupling caps (TI video):** how placement & parasitics matter. [Texas Instruments](#)

LDO vs Switching Regulators

- **LDO:** Low noise, simple, less efficient at big voltage drops.
- **Switching Regulator:** High efficiency, more complex, can introduce ripple.
- **LDO vs Switcher:** tradeoffs (ADI article + overview video). [Analog DevicesYouTube](#)

Practical

- Build LED + Button + Debounce circuit on breadboard.
- Measure voltage & current with multimeter.
- Add pull-up resistor to button.
- MCU: STM32 Nucleo / Arduino Uno.

Summary

- Ohm's Law is the foundation for sizing resistors.
- Pull-ups/pull-downs prevent floating inputs.
- Decoupling capacitors improve power stability.
- Choose regulator based on efficiency vs. noise.

References

- **Web:**
 - SparkFun Electronics Basics
 - All About Circuits – Basic Concepts
- **YouTube:**
 - [Electronics Basics – GreatScott!](#)
 - [Pull-up & Pull-down Explained](#)