A.2 – Digital Logic & Signal Basics

Logic Levels

- **TTL (5V logic):** HIGH ≥ 2.0V, LOW ≤ 0.8V
- **CMOS (3.3V logic):** HIGH ~ 0.7 × Vcc, LOW ~ 0.3 × Vcc
- Always check datasheet for VIH (min high) & VIL (max low).

- https://www.geeksforgeeks.org/digital-logic/introduction-to-logic-family/
- **Logic levels** TI FAQ + overview. TI E2E

Analog vs Digital

- **Analog:** Continuous values (e.g., sensor voltage)
- **Digital:** Only two states (0 or 1)

- https://www.geeksforgeeks.org/digital-logic/difference-between-digital-and-analog-system/

Schmitt Trigger

- Adds hysteresis — two thresholds (one for rising, one for falling).
- Prevents multiple triggers from noisy or slow signals.
- **Schmitt:** Wikipedia

Level Shifting

- Required when devices use different voltages.
- Methods:
    - Resistor divider (simple, slow)
    - MOSFET-based shifter (I²C/SPI)
    - Dedicated level translator IC
- **Level shifting basics:** SparkFun guide. learn.sparkfun.com

Practical

- Make AND, OR, NOT truth tables.
- Build MOSFET-based I²C level shifter.
- Test with mixed-voltage devices.

Summary

- Logic thresholds differ — always match devices.
- Schmitt triggers improve signal stability.
- Level shifting protects components from over-voltage.

References

- **Web:**
  - Logic Gate Basics
  - Level Shifting Guide
- **YouTube:**
  - Logic Gates Explained
  - Level Shifting for MCUs