

# Switches

Networks and Embedded Software

First Grade Level

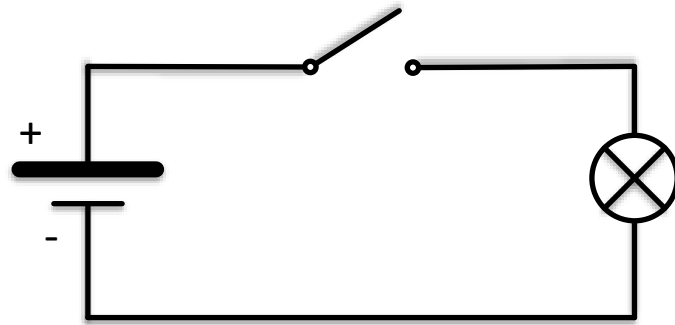
by Wolfgang Neff

# Switches (1)

- Electric Control Component

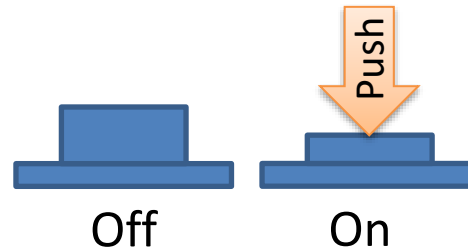
- In general

- Circuit breaker
    - Opens or closes an electric circuit



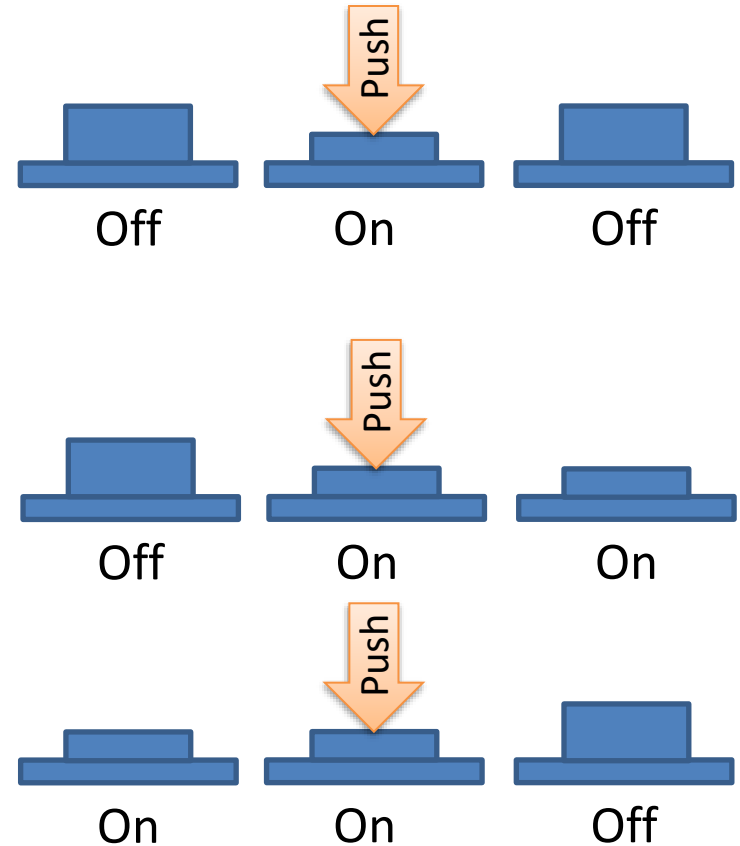
- In particular

- Switches a device on or off



# Switches (2)

- Push Button
  - On/off when pressed
  - Off/on when released
- Switch
  - Button with locking
  - On/off when pressed
  - Off/on when pressed again



# Switches (3)

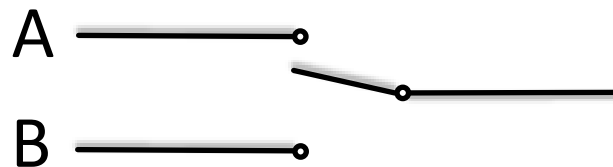
- Implementations

- Single pole, single throw (SPST)



Circuit breaker

- Single pole, double throw (SPDT)



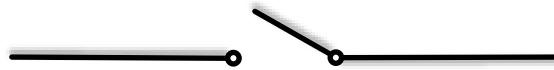
Line selector

# Switches (4)

- Implementations (finished)

- “a” Contact

- Closes the circuit if pressed



- “b” Contact

- Opens the circuit if pressed




# Switches (5)


- Undefined Voltage Levels
  - SPST can produce undefined voltage levels



– This is a problem for digital circuits

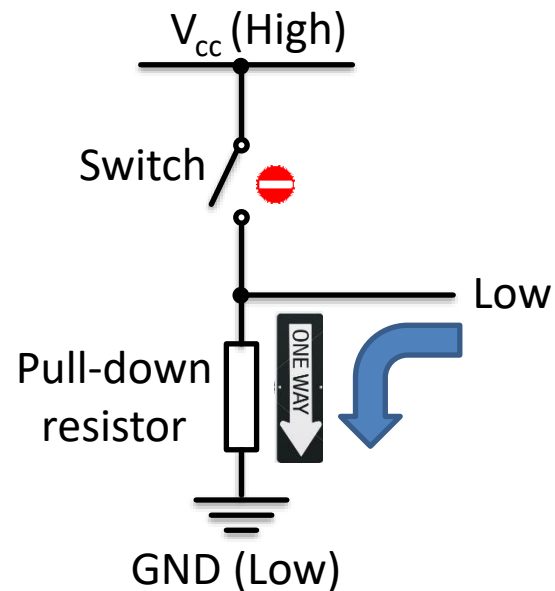
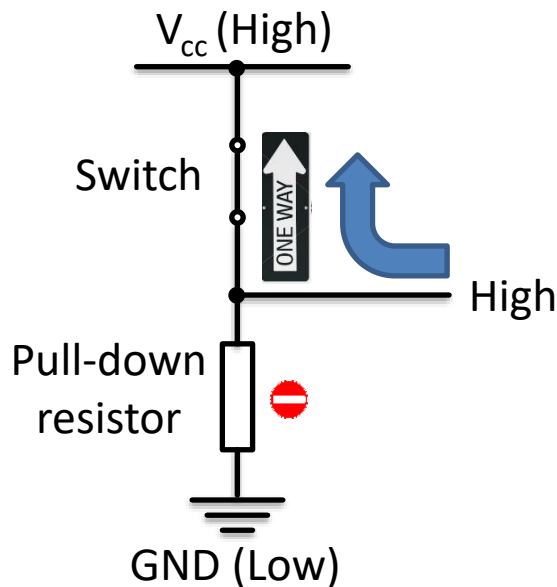
- High      → 1      
- Low      → 0

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- Undefined → ?      

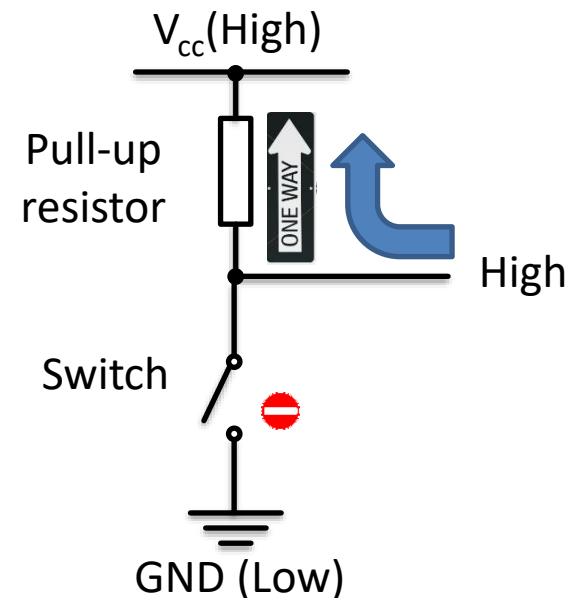
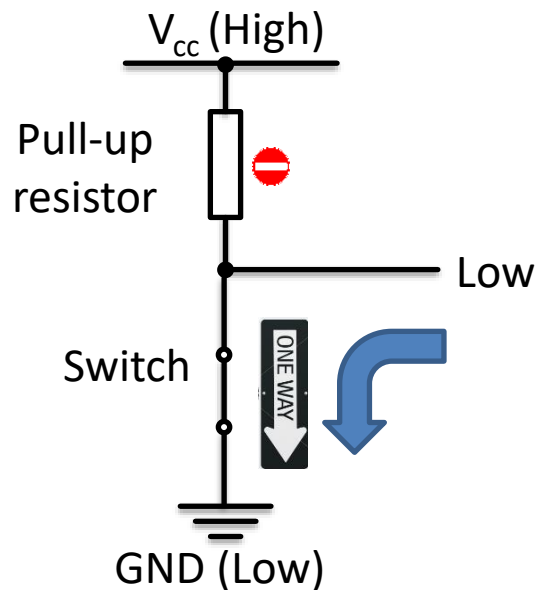
# Switches (6)

- Pull-down Resistors
  - Prevent undefined voltage levels



# Switches (7)

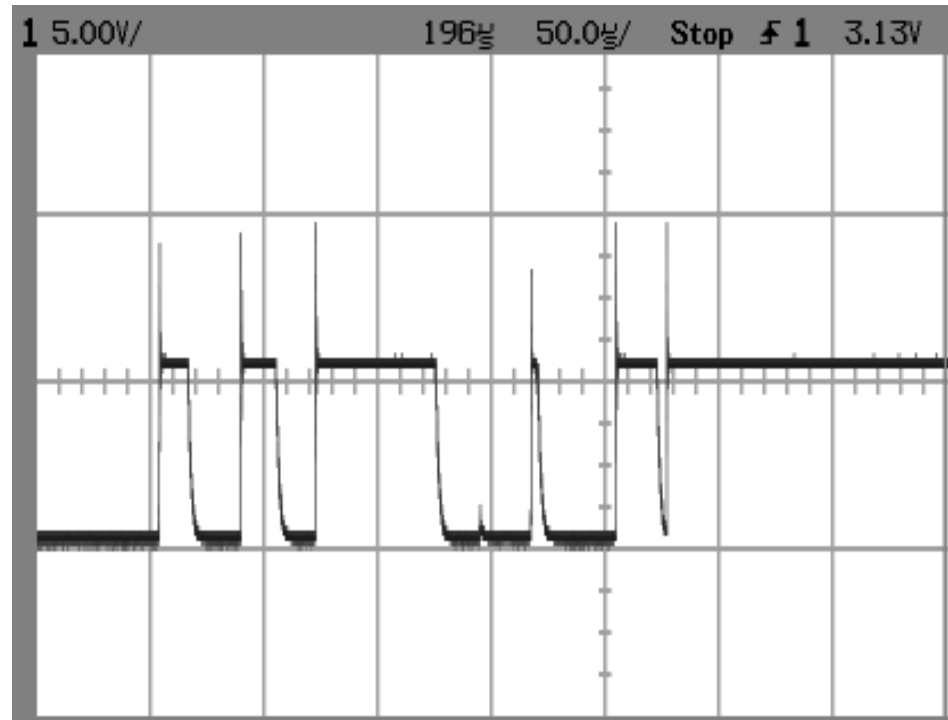
- Pull-up Resistors
  - Prevent undefined voltage levels





# Switches (8)

- Contact Bounce
  - Mechanical switches bounce



# Switches (9)

- Contact Bounce (continued)

- Is the button pressed?

- Yes, it is
    - Without doubt

- How many times?

- 4, 5 or 6? 🤪
    - Debounce required
      - By hardware
      - By software

