

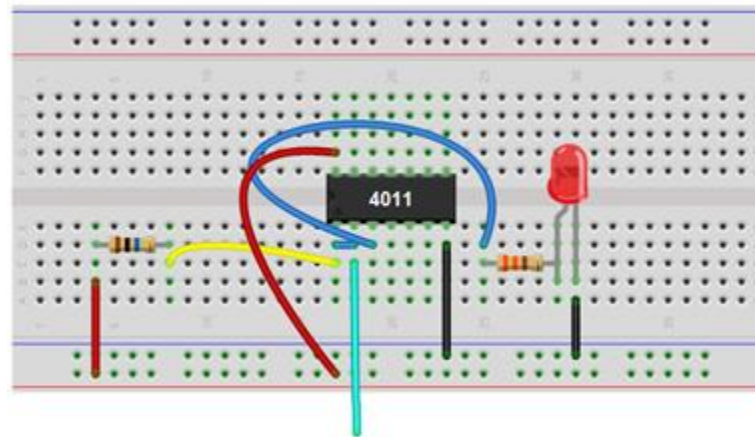


# Lab 1

## Digital Circuits Lab

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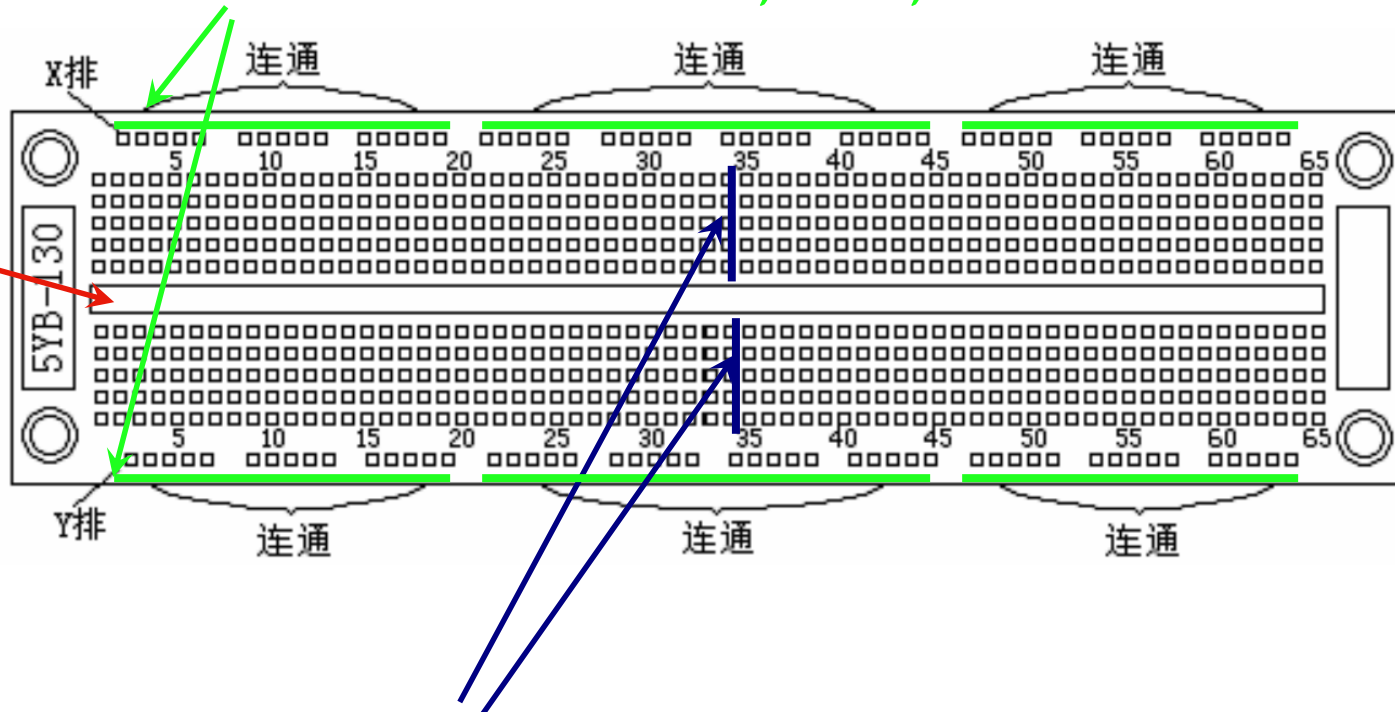


# Breadboard

## SYB-130

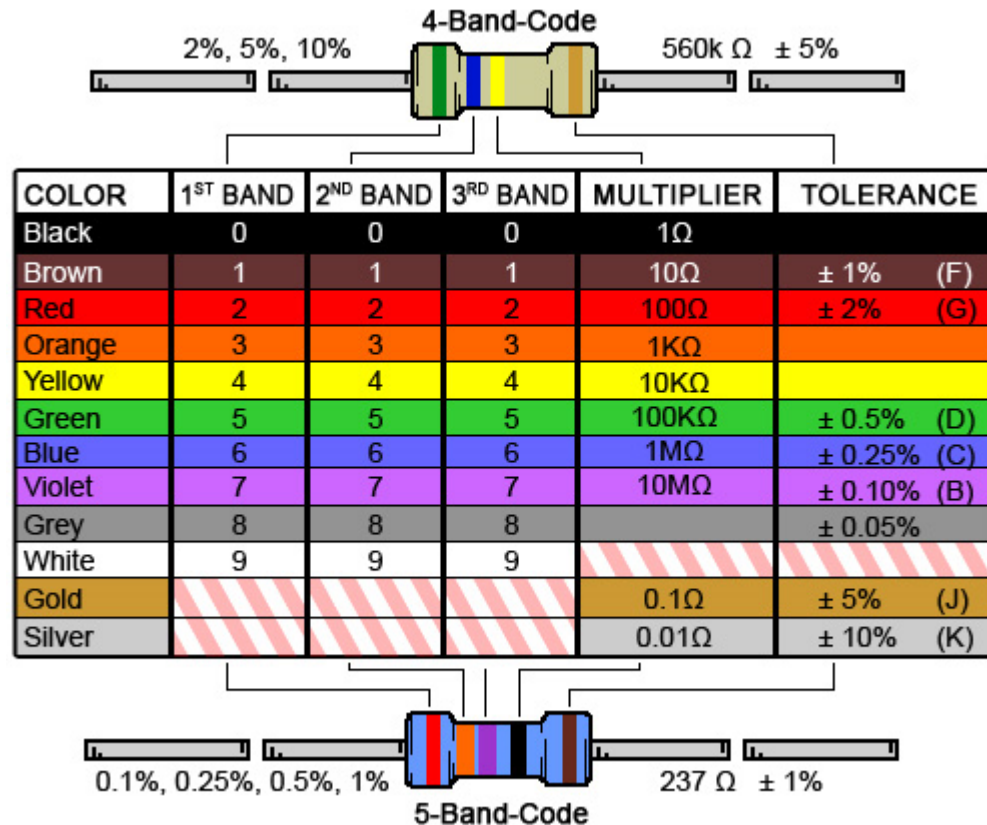
Rows X&Y: holes 1-15, 16-35, and 36-50 interconnected

Dent



65 columns, 5 holes within each column interconnected

# Resistor Color Codes

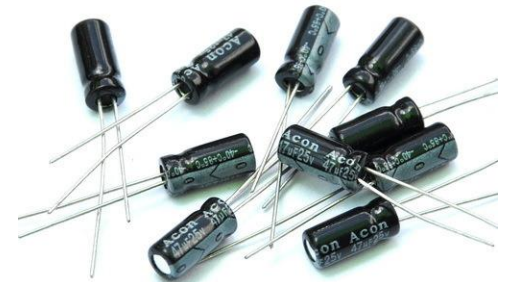
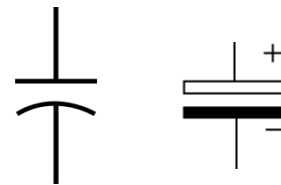


<http://www.digikey.com/en/resources/conversion-calculators/conversion-calculator-resistor-color-code-5-band>

# Capacitor

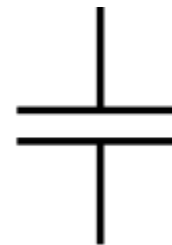
## Electrolytic Capacitor

- » Capacitance printed
- » Voltage rating printed
- » Polarized (long lead =>positive! )



## Ceramic Capacitor

- » 3 digit code
  - 103  $\Leftrightarrow 10 \cdot 10^3 \text{pF} = 0.01 \mu\text{F}$
- » If only 2 digits, then that is the value in pF
  - 30  $\Leftrightarrow 30 \text{pF}$
- » Non-Polarized

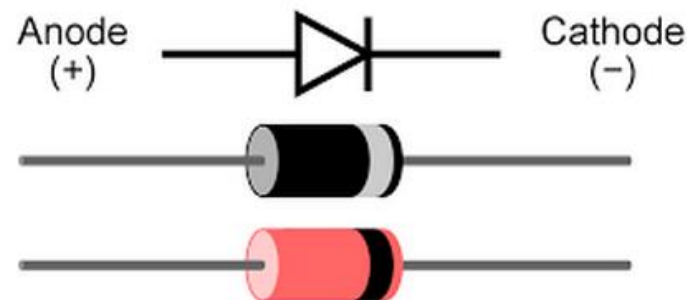


# Diode

## Passive switch

- » If  $V_{\text{Anode}} > V_{\text{Cathode}}$ 
  - diode is on
- » If  $V_{\text{Anode}} < V_{\text{Cathode}}$ 
  - diode is off

The circle represents  
the cathode!



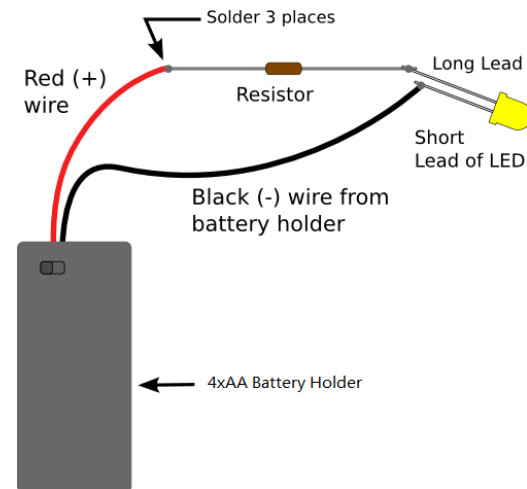
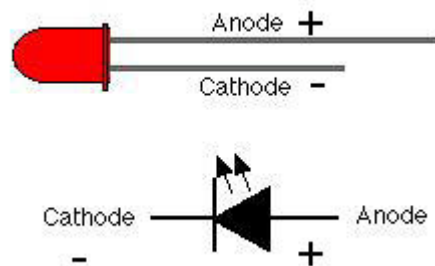
# LED (light emitting diode)

Long lead=> Anode!

When there is a current, the light will be emitted

Do not connect the diode with the battery directly!

» A resistor must be in series with the diode.

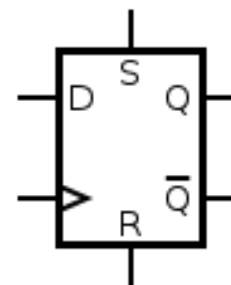




# D Flip-Flop

Truth Table of D Flip-Flop

| CP | D | R | S | Q | Q' |
|----|---|---|---|---|----|
| ↑  | 0 | 0 | 0 | 0 | 1  |
| ↑  | 1 | 0 | 0 | 1 | 0  |
| ↓  | X | 0 | 0 | Q | Q' |
| X  | X | 1 | 0 | 0 | 1  |
| X  | X | 0 | 1 | 1 | 0  |
| X  | X | 1 | 1 | 1 | 1  |

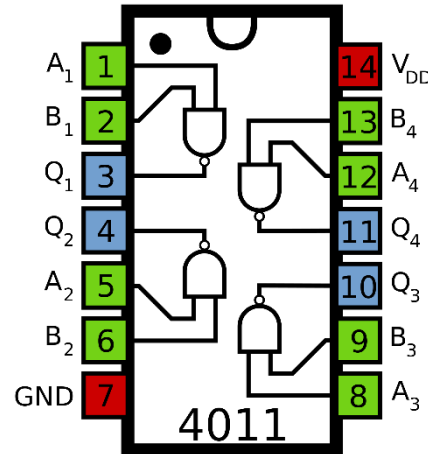


↑: Rising edge, ↓: Falling edge  
S: Set, R: Reset; X: Don't care

# IC (integrated circuits)

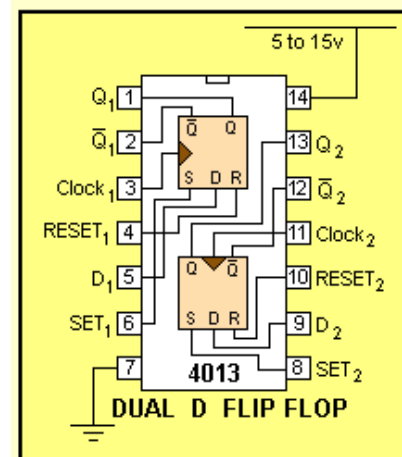
## 4011

- » 4 NAND gates
- » Pin 7 =>GND
- » Pin 14 => $V_{DD}$



## 4013

- » 2 D flip-flops
- » Pin 7 =>GND
- » Pin 14 => $V_{DD}$





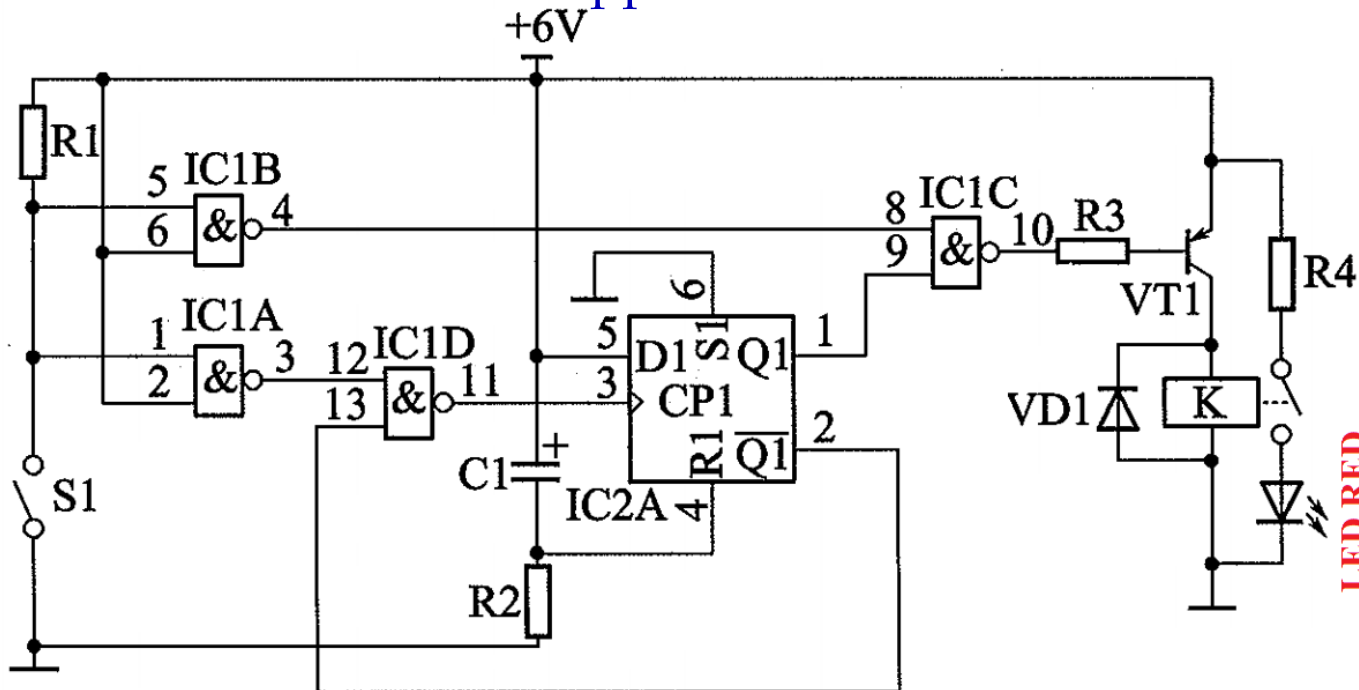
## Power failure self-locking switch (停电自锁开关)

**Functionality:** Appliance is locked to the off state after the power failure.

**Significance:** Energy efficient, low carbon emission

**Key components:** 4 NAND gates, 1 D flip-flop, 1 BJT

**Note:** The LED emulates the appliance.



Schematic

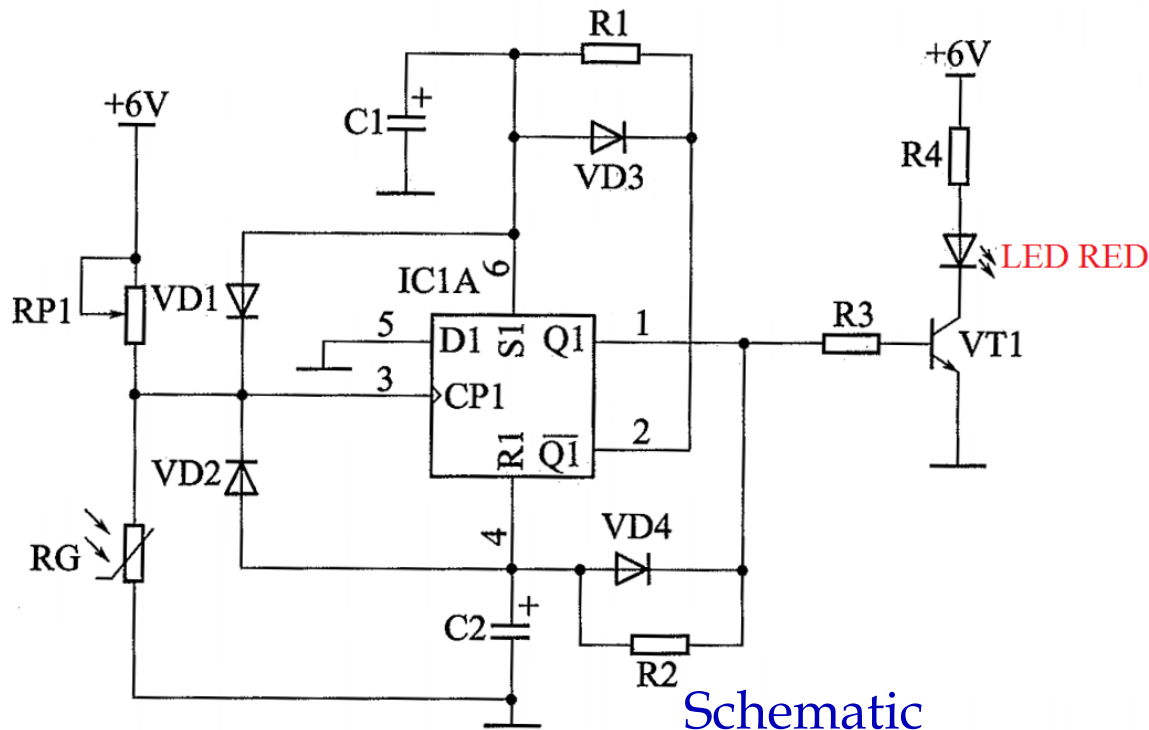
# Light sensitive hazard light (光控路障闪烁警示灯)

**Functionality:** Light sensitive hazard light .

**Significance:** In the darkness, hazard light twinkles.

**Key components:** 1 D flip-flop, 1 LDR, 1 BJT.

**Note:** The LED emulates the hazard light





# Campus Open Day Demonstration

Date: TBD

Select 2~4 teams to demonstrate your circuits to the 2017 applicants.

Tasks:

- » 1. Demonstrate the circuit.
- » 2. Design a poster to explain your circuit to the audience.
- » 3. Each day, among those 2-4 teams, at least one representative needs to appear onsite to present the circuits.
- » 4. The participants win **5% extra credit** for the SI100- Electronics part.

If you are interested, tell the TA when you submit your circuit or talk to me directly.