

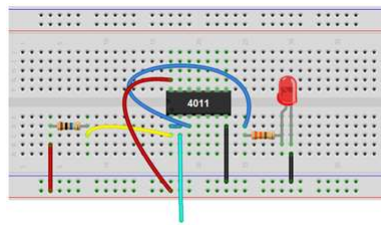
# Lab 1



信息科学与技术学院  
School of Information Science and Technology

## Digital Circuits Lab

Haoyu Wang  
ShanghaiTech University



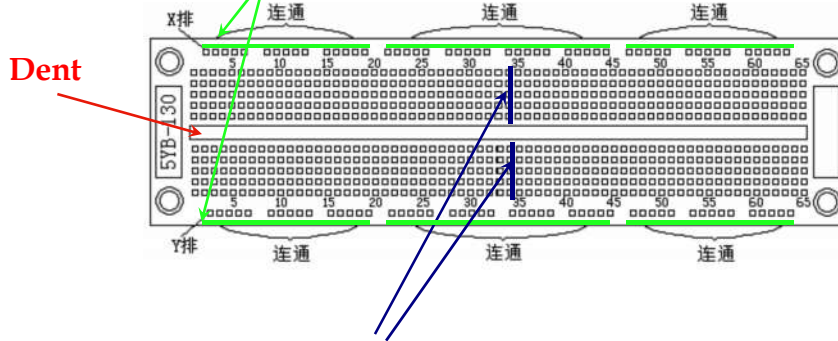
## Breadboard



信息科学与技术学院  
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### ● SYB-130

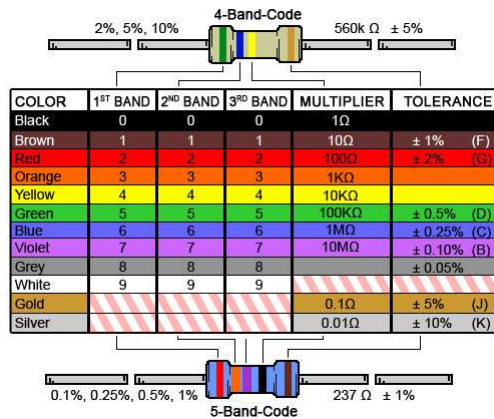
Rows X&Y: holes 1-15, 16-35, and 36-50 interconnected



65 columns, 5 holes within each column interconnected



# Resistor Color Codes



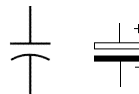
<http://www.digikey.com/en/resources/conversion-calculators/conversion-calculator-resistor-color-code-5-band>



# Capacitor

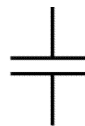
## ● Electrolytic Capacitor

- » 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  $\Leftrightarrow$  30pF
- » Non-Polarized





## Diode

- Passive switch

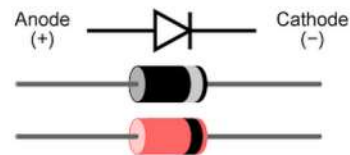
- » If  $V_{\text{Anode}} > V_{\text{Cathode}}$

- diode is on

- » If  $V_{\text{Anode}} < V_{\text{Cathode}}$

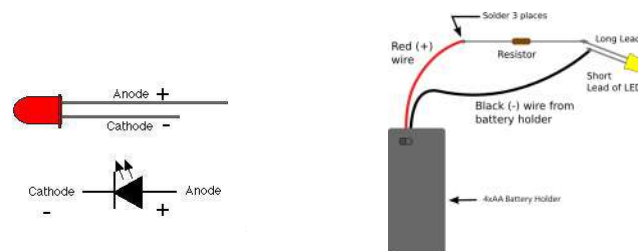
- diode is off

- 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.

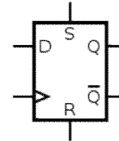




## D Flip-Flop

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

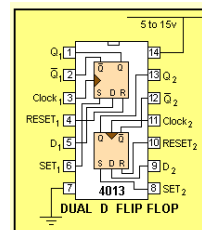
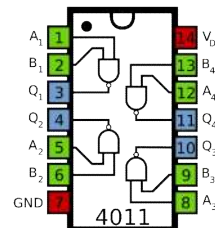


↑: Rising edge, ↓: Falling edge  
S: Set, R: Reset; X: Don't care



## IC (integrated circuits)

- 4011
  - » 4 NAND gates
  - » Pin 7 =>GND
  - » Pin 14 =>V<sub>DD</sub>
- 4013
  - » 2 D flip-flops
  - » Pin 7 =>GND
  - » Pin 14 =>V<sub>DD</sub>





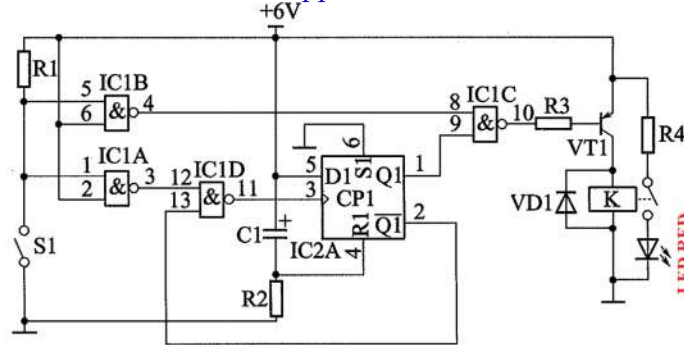
## Power failure self-locking switch (停电自锁开关)

**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



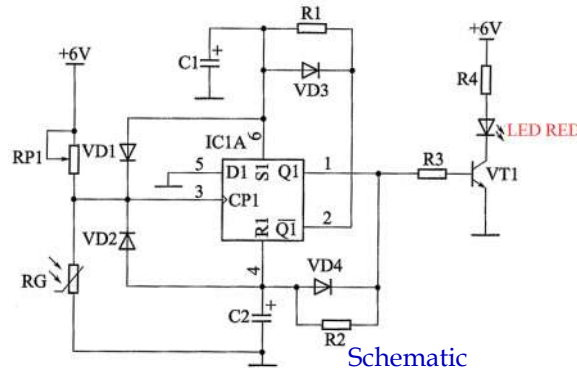
## Light sensitive hazard light (光控路障闪烁警示灯)

**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



Schematic



## Campus Open Day Demonstration

- Date: June 16<sup>th</sup> & 17<sup>th</sup> (Tuesday & Wednesday)
- Select 2~4 teams to demonstrate your circuits to the 2015 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 EE100- Electronics part.
- If you are interested, tell the TA when you submit your circuit or talk to me directly.