电学原理，电子元器件&电路
ELECTRICITY, ELECTRICAL COMPONENTS & CIRCUITS

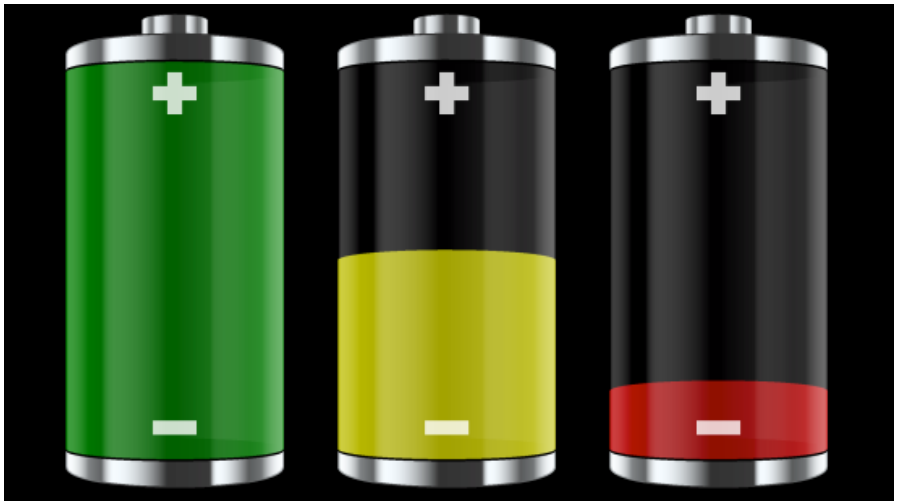
Day_01_2


电学原理
ELECTRICITY

电｜ELECTRICITY

Electricity is The flow of electrical energy through a conductive material.
Electricity always flows from an area of higher potential energy to an area of lower potential energy (i.e. from positive to negative).

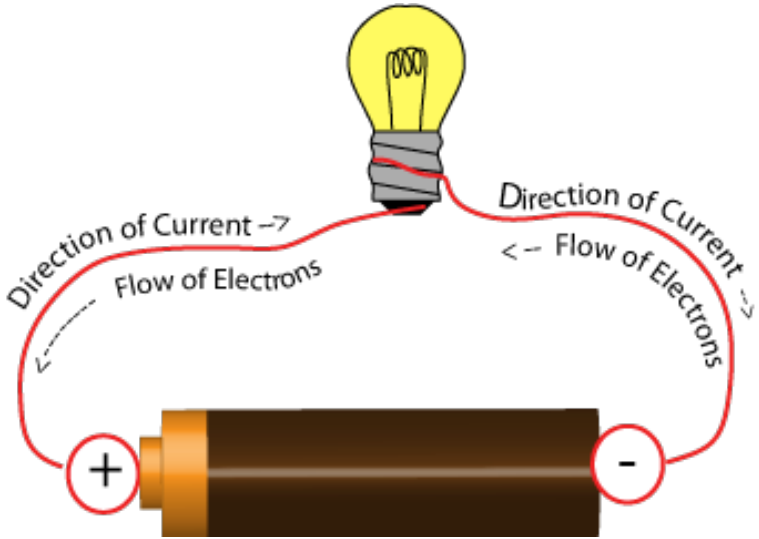
“电”就是电能在导电材料中的流动
电和其他所有能量类似，总是从高势能区流向低势能区，比如从正极到负极



电流｜CURRENT

Current is a measure of the flow of electrons in a circuit.
It is measured in Amperes, or Amps (Symbolized A, or sometimes I for Intensity).

“电流”是对电子在电路中流动这一过程的量化单位是安培（Amperes｜Amps），简写A或者安，常用 I 代指电流强度



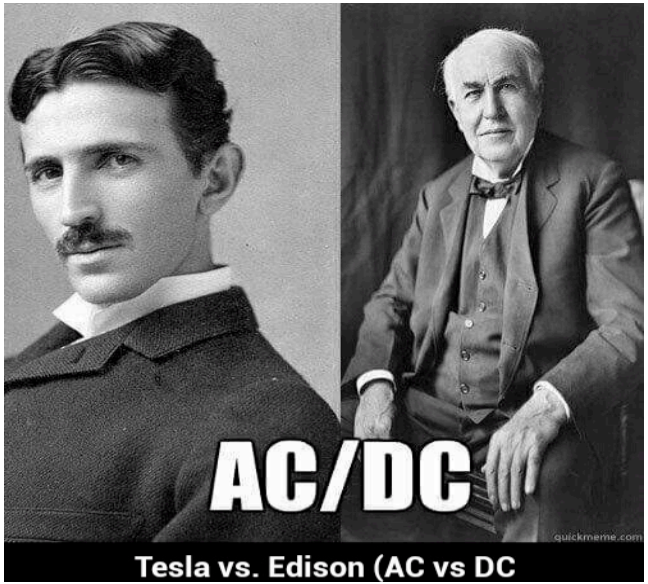
电流｜CURRENT

Many people explain electrical flow by using water flow as an analogy. Following that analogy, current would be how much water or electricity is flowing past a certain point.
The higher the amperage, the more electricity is flowing.
将电流解释作水流是最常见的类比，电流或水流就是单位时间内流经某个点（截面）的电或水的多少，电流（I，单位A / 安培 / 安）越高，流过的电就越多

直流VS. 交流 |DIRECT VS. ALTERNATING CURRENT

Electricity comes in two varieties.
Direct Current (DC) flows in one direction, while alternating current (AC) periodically reverses direction. AC is easier to deliver across long distances. For that reason national power grids deliver electricity to users in this manner.
“电”有两种形式：直流电单方向流动而交流电是周期性地变化方向。交流电更适宜长距离传输（发热、能耗），所有电网都是采用的这种形式

电流战争｜BATTLE OF CURRENTS



The War of Currents describes the nasty rivalry between competing businessmen, Thomas Edison and George Westinghouse, over contracts to produce power distribution systems using either Edison's DC or Westinghouse's AC methods.

电流战争是19世纪80年代后期，托马斯·爱迪生推广的直流输电系统，与乔治·威斯汀豪斯（总部设在宾夕法尼亚州匹兹堡的西屋公司的老板）以及几家欧洲公司所倡导的交流输电系统之间的一场商业斗争。

变压器｜TRANSFORMER

transformer is then used to convert the electricity to lower voltage DC for use in most consumer electronic devices. DC is also naturally produced by power sources such as batteries.

变压器（这堂课中）通常用作将交流电转化为低压直流电作为电源接入电路；
电池也可以起到相同作用

电压｜VOLTAGE

Measured in volts (symbolized V), voltage is the measure of the electrical energy of a circuit. In the water analogy, voltage is equivalent to water pressure. Think of a geyser as high voltage and your shower as low voltage.
电压：单位是伏特（伏 / V），回到将电比作水的比喻中，电压相当于水压。比如莲蓬头，水压越大，水流越强蕴含的能量也更大。

电压标准 | VOLTAGE STANDARDS

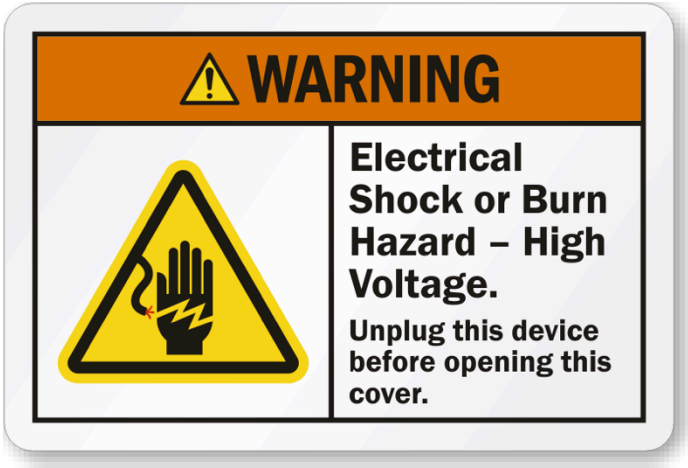
Most of the world has adopted a standard for electricity delivery that is between 220–240 volts AC at 50 Hz.
The North American and Japanese standard differs at 120 volts AC at a frequency of 60 Hz.
Most consumer electronic items, such computers and smart phones, use between 3.3 AND 18 volts dc.

世界上大部分地区标准电压都是220V～240V，频率为50赫兹的交流电，只有北美和日本使用120V，60赫兹交流电作为标准电压而大多数的设备使用的都是3.3V到18V之间的电压

电压标准 | VOLTAGE STANDARDS

Many modern electronic devices can safely be used with either 110 OR 220 volt systems. However, it’s always a good idea to make sure the power supply you are using is appropriate for your needs and environment.

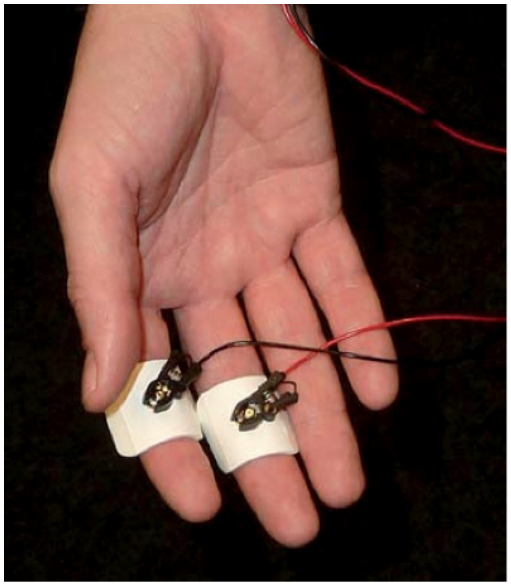
基本上现在大多数设备电压要求区间都为110V～240V之间（同时适应美标和国标），但是无论什么时候请注意核查要求输入电压和实际输入电压是否匹配



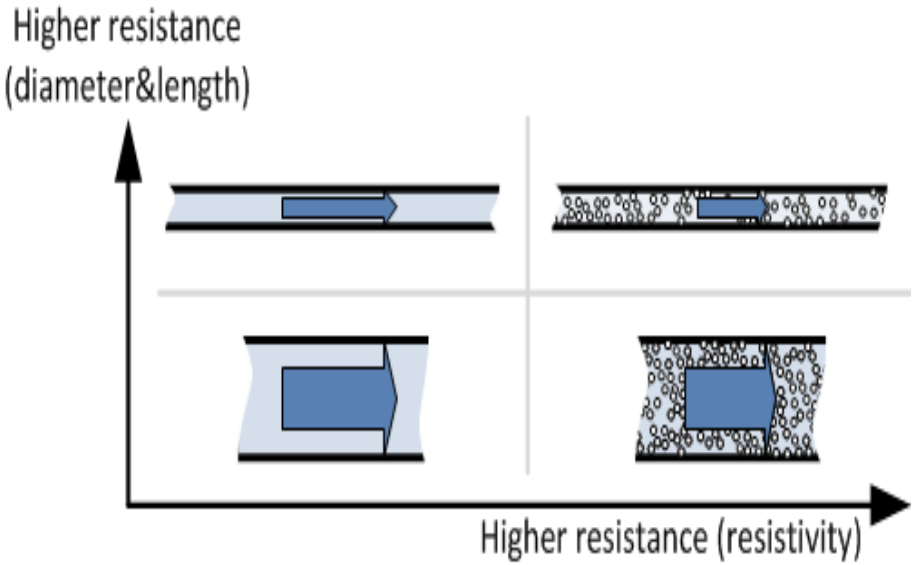
导电性｜CONDUCTANCE

Conductance is the ease with which an electric current passes through a material. Substances through which electricity can flow are called conductors. Metals, in particular copper and aluminum,make great conductors.

导电性指的是电流通过特定材料的难易程度，电流能够通过的物体叫做导体，金属尤其铜和铝是很好的导电材料



电阻值｜RESISTANCE



The opposition of electric current through a material is referred to as resistance. Substances that oppose the flow of electricity are called resistors. Materials such as ceramic, plastics and fiberglass make great resistors. Resistance is measured in ohms (symbolized R or Ω).

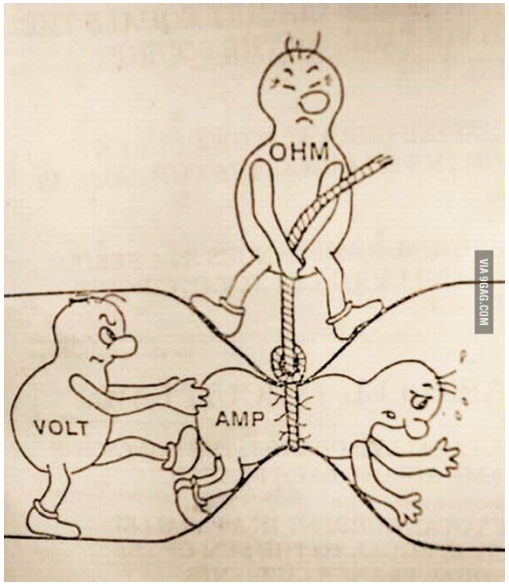
电阻是一个物体对于电流通过的阻碍能力，单位为欧

绝缘体 | INSULATORS

Substances that do not conduct electricity, such as plastics, glass and paper are called insulators.

不导电的物体比如（普通）塑料、玻璃和（普通）纸张都是绝缘体

欧姆定律｜OHM’S LAW



Developed by German scientist Georg Ohm, Ohm’s Law is a mathematical equation that describes the relationship between electrical properties. Voltage (V), Current (I) and Resistance (R) are all related through the following formulas:

V = I x R

I = V / R

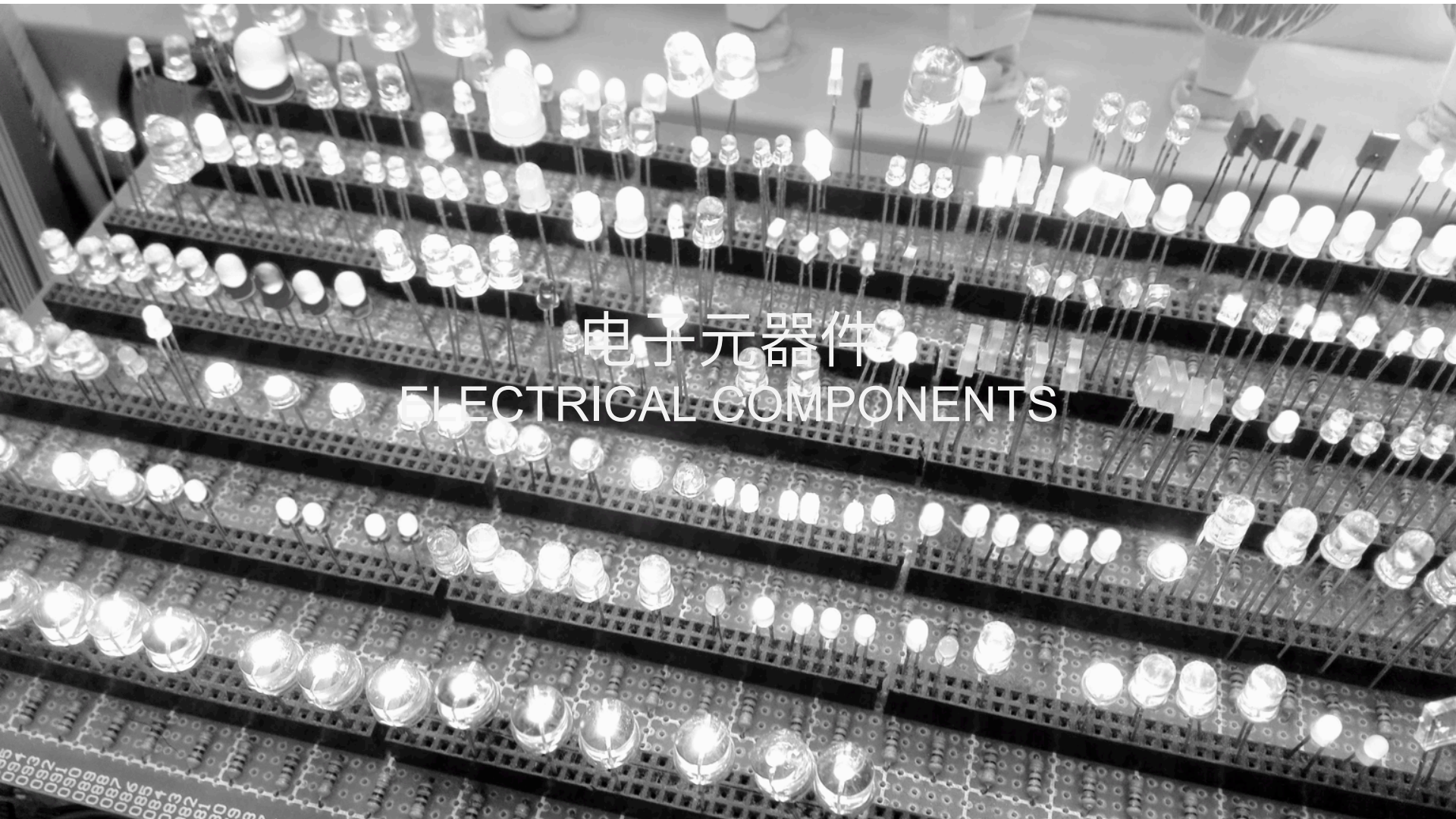
R = V / I

在电路学里，欧姆定律表明，导电体两端的电压与通过导电体的电流成正比以方程表示：R = V / I。不论电流、电压为何，电阻定义为电压除以电流。在欧姆定律里，电阻与电流、电压无关，并不是每一种元件都遵守欧姆定律。

瓦特 | WATT

Watts are another common unit of measure for electricity.The current in amps and the voltage in volts multiplied is equal to the power draw in watts. Current (I) and voltage (V) are also related to electrical power (measured in watts), using the following formula:
W = V x I

瓦特（符号：W）是国际单位制的功率单位。瓦特的定义是1焦耳/秒（1 J/s），即每秒钟转换、使用或耗散的能量的速率。
瓦特相等于1伏特·安培


电子元器件
ELECTRICAL COMPONENTS

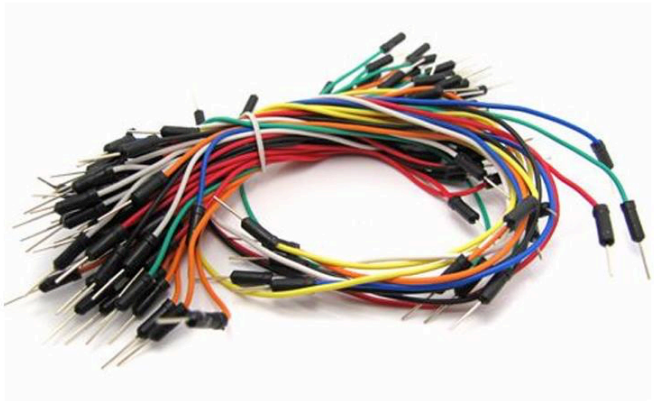
极性 | POLARITY (POLARIZED VS. UNPOLARIZED)

Polarity expresses the orientation or direction of an electric or magnetic field. If an electrical component is polarized, it will only conduct electricity across itself in one direction. Unpolarized electrical components will conduct electricity in either direction.

极性描述的是一个电子元件或电场的“方向”，如果某电子元件是极性（相对于非极性）元件，电流只能从特定方向流经该元件，反之，非极性元件在在导电性上两个方向没有差异

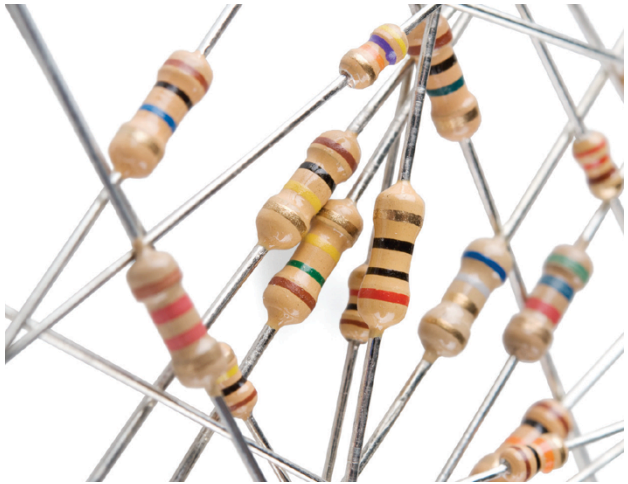
导线 | WIRE

Wire is commonly used to carry electricity from one point to another in a circuit. Wires are usually made from solid or stranded metal, and covered with an insulating layer, often plastic.Wire gauge is used to determine the diameter of the wire. 22 American Wire Gauge (AWG) is the most common size used in electronics prototyping. Wire is unpolarized
导线用以连接不同电子元件并让电流通过，理论上导线不产生能量消耗。如图所示，跳线将是本课程主要用线，和面包板组合使用快速搭建电路



电阻 | RESISTORS

A resistor is a two-terminal electrical component that resists the flow of electricity, and can be used to control the flow of current.
Resistors are marked with a series of colored stripes which indicate their amount of resistance.
Resistors are unpolarized.



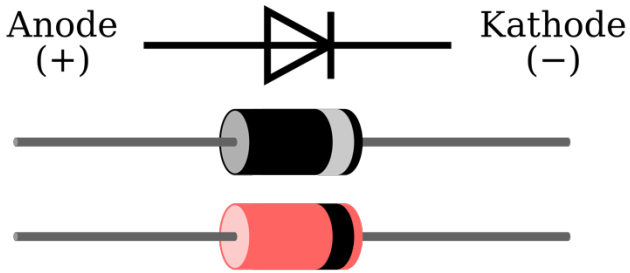
电阻对电流有阻碍作用，可以用来控制电路中电流大小，电阻上不同颜色圆环排列代表其阻值，实际使用建议使用万用表实测

可变电阻｜VARIABLE RESISTORS

A resistor with an adjustable or varying amount of resistance is called a variable resistor.
One type of variable resistor, a potentiometer, is a resistor with a sliding contact attached to a knob that outputs an adjustable voltage.
Another variable resistor, A thermistor, has a resistance which varies with temperature.

具备可调节电阻值的电阻，典型代表是电位器，可通过旋转旋钮调节实际阻值，其他如热敏电阻和光敏电阻则可以随温度和光线强度改变电阻值

二极管｜DIODES



A diode is a two-terminal electronic component with asymmetric conductance, meaning that electricity will only flow in one direction through them.
Diodes are polarized.

二极管是一种具有不对称电导的双电极电子元件。理想的二极管在正向导电时它的两个电极间拥有无穷小电阻，而反向时则有无穷大电阻，即电流只允许由单一方向流过二极管。

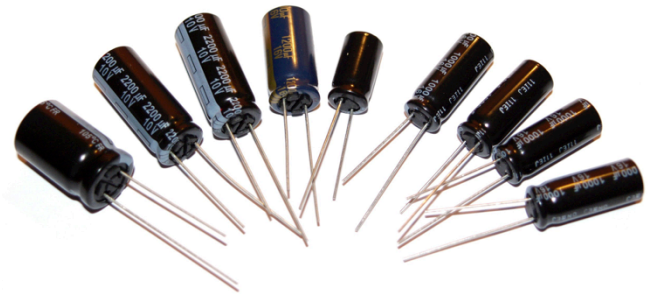
发光二极管 | LIGHT EMITTING DIODES (LEDS)

Light emitting diodes are a type of diode which can act as a visible or invisible light source.
They are frequently used as indicator lamps in many electronic devices, or collectively as a display.
They are increasingly used for general purpose lighting because they are highly efficient and long lasting.
LEDs are polarized.
发光二极管是一种能发出可见（或不可见）光的半导体电子元件，只能够往一个方向导通（通电），当电流流过时，电子与空穴在其内重合而发出单色光，由于其低能耗高转化率，被广泛使用

电容｜CAPACITORS

Capacitors store electricity while current is flowing into them, then release the energy when the incoming current is removed. Capacitors can also be used to stabilize and smooth the flow of electricity. Capacitors can be polarized or unpolarized.

电容器是两金属板之间存在绝缘介质的一种电路元件。
单位为法拉，符号为F。
电容器利用二个导体之间的电场来储存能量，二导体所带的电荷大小相等，但符号相反。



开关 | SWITCHES

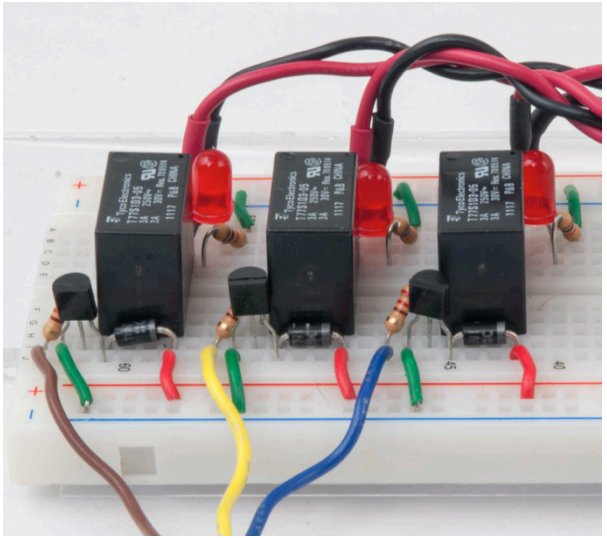
Switches are a control that can be used to interrupt the flow of current through a circuit. A pair of contacts within the switch are made to touch each other or not depending on the physical position of the switch. A switch is said to be "closed" when current can flow from one contact to the other and "open" when no current can flow between contacts.

开关：闭合&断开

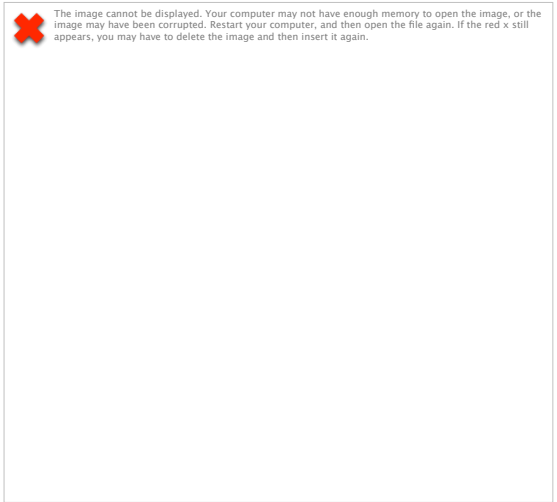
晶体管&继电器 | TRANSISTORS & RELAYS

A transistor is a three or more terminal device used to switch and / or amplify electricity. A voltage or current applied to one pair of terminals affects the voltage or current going through another pair of terminals.

晶体管是一种电子元件，它是通过基极电流来控制集电极与发射极的导通。
继电器是一种电子控制器件，它具有控制系统（又称输入回路）和被控制系统（又称输出回路），实际上是用较小的电流去控制较大电流的一种“自动开关”。



集成电路IC｜INTEGRATED CIRCUITS

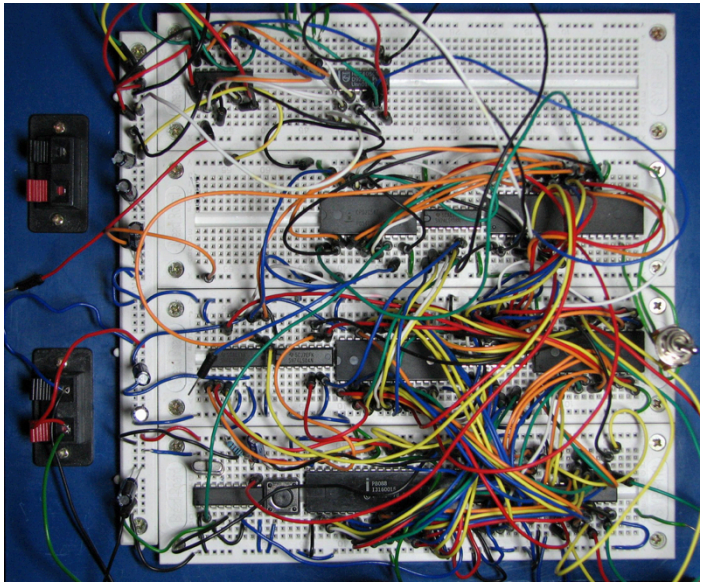


An integrated circuit (IC) is a group of electronic circuits housed within one small microchip. Thousands of transistors and other electronic components can be contained within something the size of a grain of rice. The central processing unit (CPU) within a personal computer or smart phone is an example of an IC.
集成电路或称微电路（microcircuit）芯片（chip）在电子学中是一种把电路（主要包括半导体设备，也包括被动组件等）小型化的方式，将电路制造在半导体芯片表面集成或由独立半导体设备和被动组件集成到衬底或线路板所构成的小型化电路

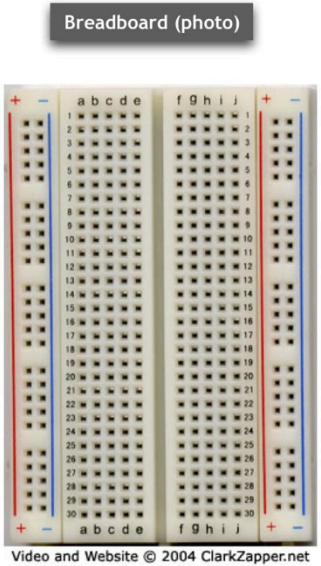
面包板｜SOLDERLESS BREADBOARD

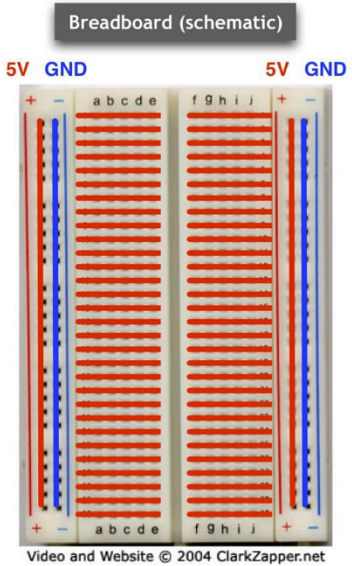
Solders breadboards provide a base for making electronic connections and aid in the prototyping of circuits. Holes in the breadboard surface grip wires and other electronic components.

面包板或叫免焊万用电路板，是电子电路设计中所常用的基底。不需要焊接钎焊，修改时方便，主要用于快速构造电子原型。



面包板｜SOLDERLESS BREADBOARD





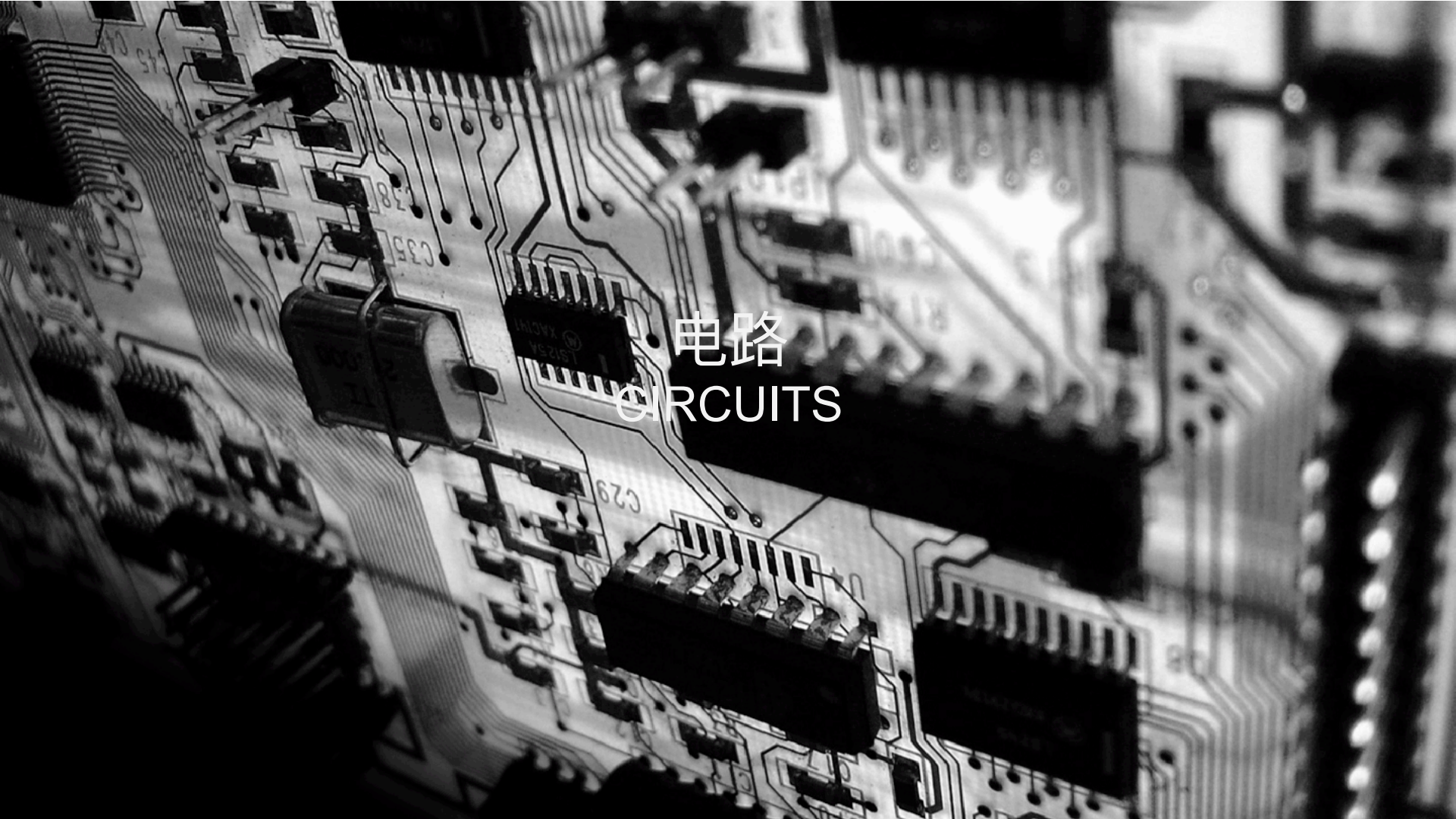
Organized into many short rows down the center and long rows down the sides, breadboard holes are connected in a pattern that allows for electrical connections to be established or not depending on the position of the component in the breadboard.

面包板原理

万用表｜MULTIMETER

A multimeter is an electronic device with the ability to measure the electrical properties of voltage, current and resistance, among other things.They are useful for testing circuits and can help you to determine the cause of electrical problems within a circuit.

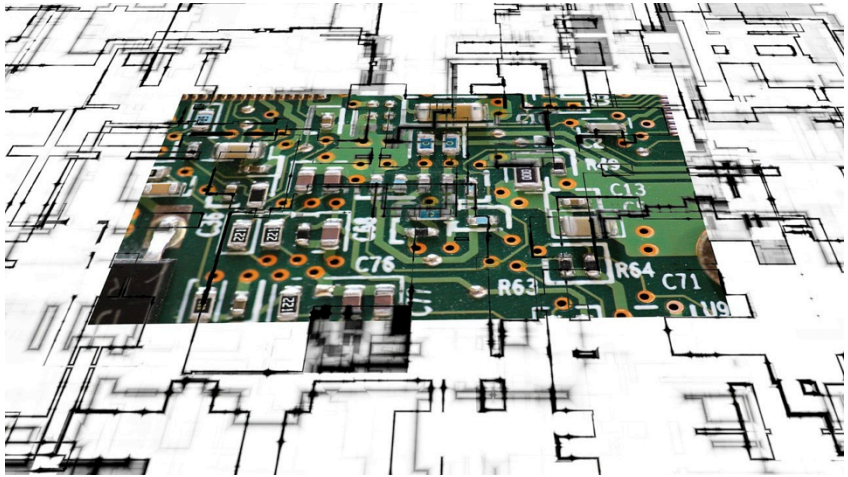
一种多用途电子测量仪器，主要用于物理、电气、电子等测量领域，一般包含电流表(安培计)、电压表(伏特计)、电阻表(欧姆计)等功能，也称为万用计、多用计、多用电表、万用电表或万用表。


电路
CIRCUITS

电路｜CIRCUIT

A circuit is a closed loop containing a source of electrical energy and a load. The load converts the electrical energy to some other form of energy (such as kinetic or heat). All of the electrical energy in a circuit must get used by the load.

电路指连接电源和荷载的闭合回路，荷载讲电能转换成其他形式能，比如功能和热。电路中的能量全部被荷载消耗



荷载 | LOAD

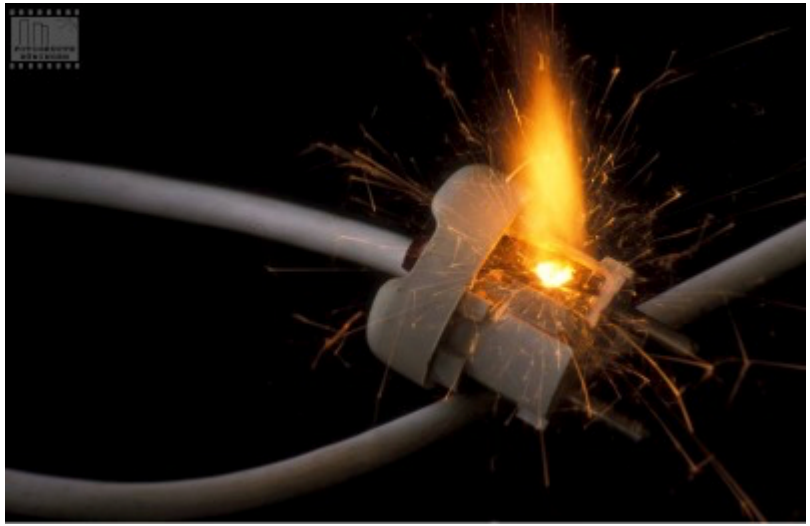
A load is any device connected to the output of a circuit (such as a lamp, motor,microcontroller or sensor).

电路中任何耗能设备，能将电能转化成其他形式能

短路｜SHORT CIRCUIT

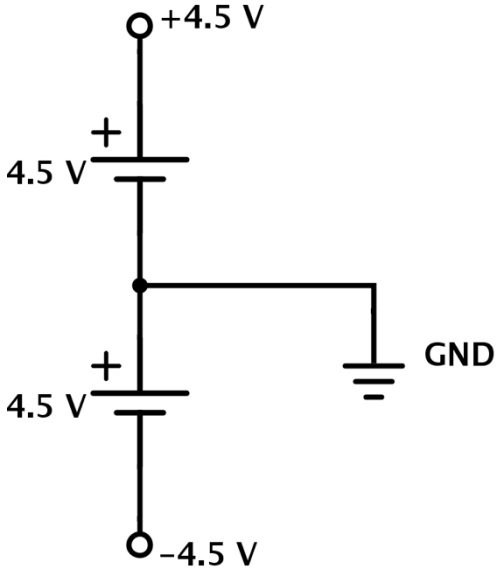
A circuit with no load is called a short circuit. In a short circuit, the power source feeds all of its energy through the wires and back into itself, resulting in disaster.

在没有荷载的情况下，直接连接电源两极，电流从正极直接经过导线流入负极，能量只能通过发热消耗，即会形成通过提及的“烧”坏设备或元器件。



接地｜GROUND

The place in a circuit where the potential energy of the electrons is zero. Current will follow the path of least resistance to ground. In any given circuit, the total voltage around the path of the circuit is zero.
电路中电子势能为0的点，电流流经电阻导向GND
电压 / 电势：电势和能量相关，闭合回路中电势能总和为0
电压是电势差，以－4.5V为GND，＋4.5V处电压为9V

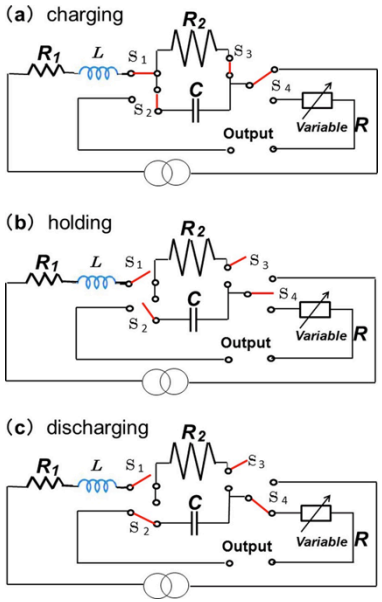


接地｜GROUND

Each component that offers a resistance lowers the voltage.
By the time the electricity reaches the end of the circuit, there will be no voltage remaining.

电路中，电流经各个元件，各元件的电阻使得电压不断减小。
地指的是大地，一切电导向大地之后，大地作为一个巨大的电阻将所有能量消耗，不再有电压（相对）存在。
定大地电压为0，所以电压是一个相对概念。

技术术语｜CIRCUIT TERMINOLOGY



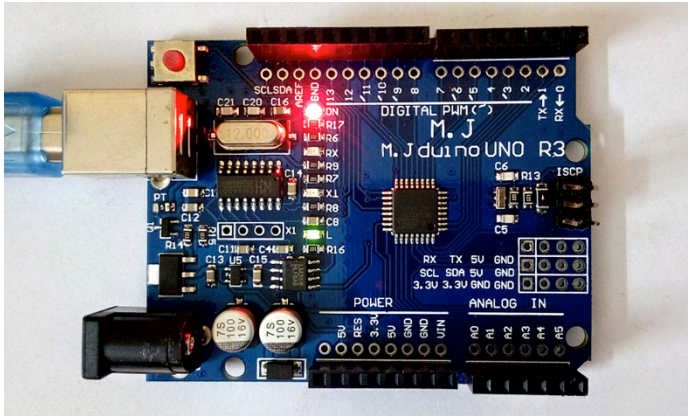
The words high, positive, and the plus sign (+) are all used to signify the point where a circuit is connected to a power source. A specific voltage can also be conveyed in any of the following ways: 12V, +5V, 3.3V, or 3V3 (where the V acts as a decimal point).

正极，＋号在电路中用来表示连接到电源。而对于某一具体（电源）电压表达方式可以是：12V, +5V, 3.3V, or 3V3

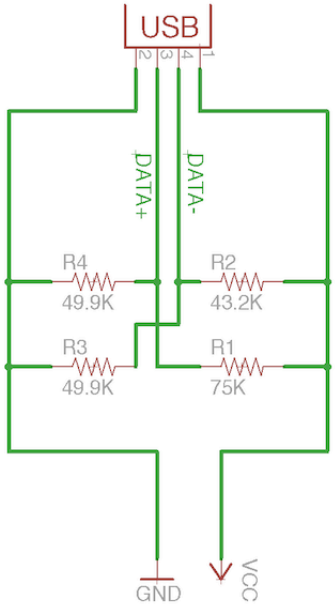
技术术语｜CIRCUIT TERMINOLOGY

The words low, ground (often abbreviated GND), negative, the minus sign (–), and 0v can all be used to signify the point where a circuit is connected to ground.

接地，GND，负极，（－），0V在电路中都能被用作表示接地



电路图｜CIRCUIT DIAGRAMS



A circuit diagram or electronic schematic is a simple drawing or graphic representation of an electrical circuit used to illustrate connections between electrical components. Symbols and Conventions have been established to facilitate understanding and aid in the design and manufacture of electronics.

电路图是电路原理的图示语言，使用一系列元件符号并以导线连接来表达电路设计，是电路设计者和产业制造端的沟通方式

电子元件符号
CIRCUIT DIAGRAM SYMBOLS

Day01_2：

阅读：

1. Voltage, Current, Resistance, and Ohm's Law
2. How to use a breadboard?
3. 電路符號

任务：

给自己的电脑装上Processing和Arduino