

## 2. ELECTRONIC COMPONENTS

### 2.1. Components and Their Symbols

### 2.2. Describing Components and Their Functions

#### 2.1. Components and Their Symbols

An **electronic component** is a basic electronic element and may be available in a discrete form (a **discrete device** or **discrete component**) having two or more electrical terminals (or *leads*). These are intended to be connected together, usually by soldering to a printed circuit board, in order to create an electronic circuit (a discrete circuit) with a particular function (for example an amplifier, radio receiver, or oscillator). Basic electronic components may be packaged discretely, as arrays or networks of like components, or integrated inside of packages such as semiconductor integrated circuits, hybrid integrated circuits, or thick film devices.

#### Classification

A component may be classified as **passive** or **active**.

**Passive components** are those which cannot introduce net energy into the circuit they are connected to. They also cannot rely on a source of power except for what is available from the (AC) circuit they are connected to. As a consequence they are unable to amplify (increase the power of a signal), although they may well increase a voltage or current such as is done by a transformer or resonant circuit. Passive components are two-terminal components such as resistors, capacitors, inductors, and transformers.

**Active components** rely on a source of energy (usually from the DC circuit, and are usually able to inject power into a circuit. This includes amplifying components such as transistors, triode vacuum tubes (valves), and tunnel diodes.

<http://www.answers.com/library/Sci%252DTech+Dictionary-letter-1R>

#### Examples of Pronunciation (Evolution of Electricity)

<p>An <b>electronic component</b> is a basic electronic element and may be available in a discrete form (a <b>discrete device</b> or <b>discrete component</b>) having two or more electrical terminals (or <i>leads</i>).</p>	<p>ən ɪˌlɛkˈtrɒnɪk kəmˈpəʊnənt əz əˈbeɪsɪk ɪˌlɛkˈtrɒnɪk ˈeləmənt ənd meɪ bi əˈveɪləbəl ɪn ə dɪˈskrɪt fɔrm (ə dɪˈskrɪt dɪˈvaɪs ɔr dɪˈskrɪt kəmˈpəʊnənt) ˈhævɪŋ tu ɔr mɔr ɪˌlɛktrɪkəl ˈtɜrmənəlz (ɔr lɪdz).</p>
<p><b>Passive components</b> are those which cannot introduce net energy into the circuit they are connected to. They also cannot rely on a source of power except for what is available from the (AC) circuit they are connected to.</p>	<p>ˈpæsɪv kəmˈpəʊnənts ər ðəʊz wɪtʃ ˈkænət ˌɪntrəˈdʊs net ˈenərdʒi ɪntə ðə ˈsɜrkət ðeɪ ər kəˈnektəd tu. ðeɪ ˈɔlsəʊ ˈkænət rɪˈlaɪ ɔn ə sɔrs əv ˈpaʊə ɪkˈsept fər wɒt əz əˈveɪləbəl frəm ði (ˈeɪˈsi) ˈsɜrkət ðeɪ ər kəˈnektəd tu.</p>

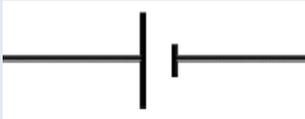
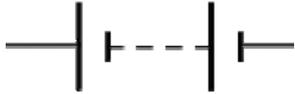
**Active components** rely on a source of energy (usually from the DC circuit, and are usually able to inject power into a circuit. This includes amplifying components such as transistors, triode vacuum tubes (valves), and tunnel diodes.

'æktiv kəm'pəʊnənts rɪ'laɪ ɒn ə sɔrs əv 'enədʒi ('ju:zəli frəm ðə di-si 'sɜrkət, ənd əv 'ju:zəli 'eɪbəl tʊ ɪn'dʒekt 'paʊə 'ɪntə ə 'sɜrkət. ðɪs ɪn'klʌdz 'æmplə'faɪɪŋ kəm'pəʊnənts sʌtʃ əz træn'zɪstəz, tr'aɪəʊd 'vækjʊm tubz (vælvz), ənd 'tʌnəl 'daɪ.əʊdz.

Table 2.1. Wires and Connections

Component	Circuit Symbol	Function of component
Wire		To pass current very easily from one part of a circuit to another.
Wires joined		A 'blob' should be drawn where wires are connected (joined), but it is sometimes omitted. Wires connected at 'crossroads' should be staggered slightly to form two T-junctions, as shown on the right.

Table 2.2. Power Supplies

Component	Circuit Symbol	Function of component
Cell		Supplies electrical energy. The larger terminal (on the left) is positive (+). A single cell is often called a battery, but strictly a battery is two or more cells joined together.
Battery		Supplies electrical energy. A battery is more than one cell. The larger terminal (on the left) is positive (+).
DC supply		Supplies electrical energy. DC: Direct Current, always flowing in one direction.
AC supply		Supplies electrical energy. AC: Alternating Current, continually changing direction.
Fuse		A safety device which will 'blow' (melt) if the current flowing through it exceeds a specified value.

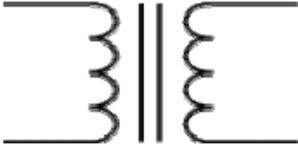
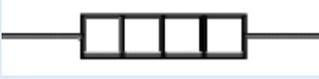
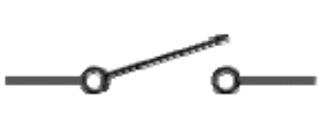
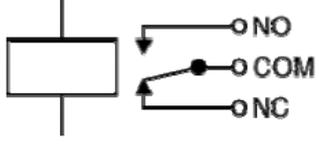
Transformer		<p>Two coils of wire linked by an iron core. Transformers are used to step up (increase) and step down (decrease) AC voltages. Energy is transferred between the coils by the magnetic field in the core. There is no electrical connection between the coils.</p>
Earth (Ground)		<p>A connection to earth. For many electronic circuits this is the 0V (zero volts) of the power supply, but for mains electricity and some radio circuits it really means the earth. It is also known as ground.</p>

Table 2.3. Output Devices

Component	Circuit Symbol	Function of component
Lamp (lighting)		<p>A transducer which converts electrical energy to light. This symbol is used for a lamp providing illumination, for example a car headlamp or torch bulb.</p>
Lamp (indicator)		<p>A transducer which converts electrical energy to light. This symbol is used for a lamp which is an indicator, for example a warning light on a car dashboard.</p>
Heater		<p>A transducer which converts electrical energy to heat.</p>
Motor		<p>A transducer which converts electrical energy to kinetic energy (motion).</p>
Bell		<p>A transducer which converts electrical energy to sound.</p>
Buzzer		<p>A transducer which converts electrical energy to sound.</p>
Inductor (Coil, Solenoid)		<p>A coil of wire which creates a magnetic field when current passes through it. It may have an iron core inside the coil. It can be used as a transducer converting electrical energy to mechanical energy by pulling on something.</p>

**Table 2.4. Switches**

Component	Circuit Symbol	Function of component
Push Switch (push-to-make)		A push switch allows current to flow only when the button is pressed. This is the switch used to operate a doorbell.
Push-to-Break Switch		This type of push switch is normally closed (on), it is open (off) only when the button is pressed.
On-Off Switch (SPST)		SPST: Single Pole, Single Throw. An on-off switch allows current to flow only when it is in the closed (on) position.
Relay		An electrically operated switch, for example a 9V battery circuit connected to the coil can switch a 230V AC mains circuit. NO: Normally Open, COM: Common, NC: Normally Closed.

**Table 2.5. Resistors**

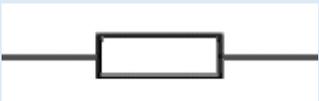
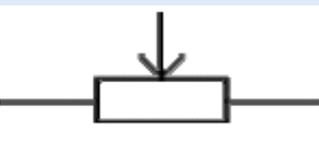
Component	Circuit Symbol	Function of component
Resistor		A resistor restricts the flow of current, for example to limit the current passing through an LED.
Variable Resistor (Rheostat)		This type of variable resistor with 2 contacts ( is usually used to control current. Examples include: adjusting lamp brightness, adjusting motor speed, adjusting the rate of charge flow into a capacitor in a timing circuit.
Variable Resistor (Potentiometer)		This type of variable resistor with 3 contacts (a potentiometer) is usually used to control voltage. It can be used like this as a transducer converting position (angle of the control spindle) to an electrical signal.

Table 2.6. Capacitors

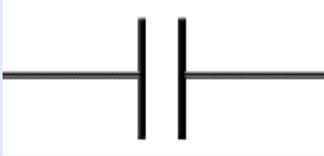
Component	Circuit Symbol	Function of component
Capacitor		A capacitor stores electric charge. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals.
Capacitor, polarised		A capacitor stores electric charge. This type must be connected the correct way round. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals.
Variable Capacitor		A variable capacitor is used in a radio tuner.

Table 2.7. Diodes

Component	Circuit Symbol	Function of component
Diode		A device which only allows current to flow in one direction.
LED Light Emitting Diode		A transducer which converts electrical energy to light.
Zener Diode		A special diode which is used to maintain a fixed voltage across its terminals.
Photodiode		A light-sensitive diode.

Table 2.8. Transistors

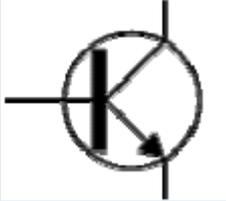
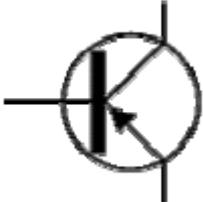
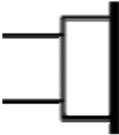
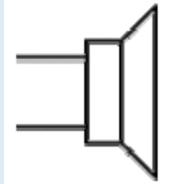
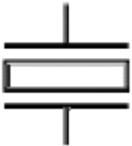
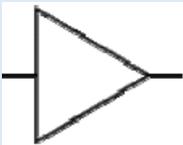
Component	Circuit Symbol	Function of component
Transistor NPN		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.
Transistor PNP		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.

Table 2.9. Audio and Radio Devices

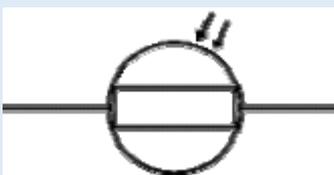
Component	Circuit Symbol	Function of component
Microphone		A transducer which converts sound to electrical energy.
Earphone		A transducer which converts electrical energy to sound.
Loudspeaker		A transducer which converts electrical energy to sound.
Piezo Transducer		A transducer which converts electrical energy to sound.
Amplifier (general symbol)		An amplifier circuit with one input. Really it is a block diagram symbol because it represents a circuit rather than just one component.

Aerial (Antenna)		A device which is designed to receive or transmit radio signals. It is also known as an antenna.
---------------------	---	--

**Table 2.10. Meters and Oscilloscope**

Component	Circuit Symbol	Function of component
Voltmeter		A voltmeter is used to measure voltage. The proper name for voltage is 'potential difference', but most people prefer to say voltage!
Ammeter		An ammeter is used to measure current.
Galvanometer		A galvanometer is a very sensitive meter which is used to measure tiny currents, usually 1mA or less.
Ohmmeter		An ohmmeter is used to measure resistance. Most multimeters have an ohmmeter setting.
Oscilloscope		An oscilloscope is used to display the shape of electrical signals and it can be used to measure their voltage and time period

**Table 2.11. Sensors**

Component	Circuit Symbol	Function of component
LDR		A transducer which converts brightness (light) to resistance (an electrical property). LDR: Light Dependent Resistor
Thermistor		A transducer which converts temperature (heat) to resistance (an electrical property).

**Match the sentences halves.**

- |   |                                |
|---|--------------------------------|
| 1) The terminals of a diode are             | a) three terminals.            |
| 2) A full wave bridge rectifier consists of | b) drain, gate and source.     |
| 3) BJT has                                  | c) anode and cathode.          |
| 4) The terminals of an FET are              | d) emitter, base and collector |
| 5) The terminals of a BJT are               | e) four diodes.                |

1) \_\_\_\_      2) \_\_\_\_      3) \_\_\_\_      4) \_\_\_\_      5) \_\_\_\_

**True, False, Yes or No: Circuits- Circle the correct answer.**

1. Will a light bulb that is a part of a complete circuit light up? Yes or no?
2. An open circuit is a type of circuit. True or false?
3. A series circuit has one path from the source and back to the source again. True or false?
4. A parallel circuit has one path to the source and back to the source. True or false?
5. In a series circuit, the already existing light bulb dims when another light bulb is added. True or false?
6. Will a broken circuit light up? Yes or no?
7. If you take out a bulb on a series circuit, the rest of the bulbs will keep shining. Yes or no?
8. If you unscrew one of the light bulbs in a parallel circuit, the rest will stop lighting. True or false?
9. Impure graphite is a conductor of electricity. Yes or no?
10. Glass is a conductor of electricity. True or false?

[www.funtrivia.com/quizzes/.../electronics](http://www.funtrivia.com/quizzes/.../electronics) (adapted)

**2.2. Describing Components and Their Functions**

We need to be able to

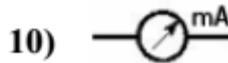
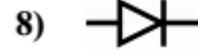
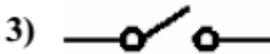
<b>1) label components:</b>	What is it called?
<b>2) describe their functions:</b>	What does it do?

1. We can use two ways of **labelling components**:
  - It is **called** a Zinc-carbon cell.
  - It is **known** as a NiCad cell.

2. **The function can be described** like this:
  - A cell **provides** electricity.
  - Cells **change** chemical energy into electricity.

**Label and describe the function of the following circuit symbols.**

**SYMBOLS:**



**FUNCTIONS:**

a) varies capacitance in a circuit

f) protects a circuit

b) rectifies alternating current

g) varies the current in a circuit

c) adds resistance to a circuit

h) steps AC voltages up & down

d) measures very small currents

i) receives RF signals

e) breaks a circuit

j) measures voltages

e.g.

4) h It's called a transformer. It steps AC voltages up or down.