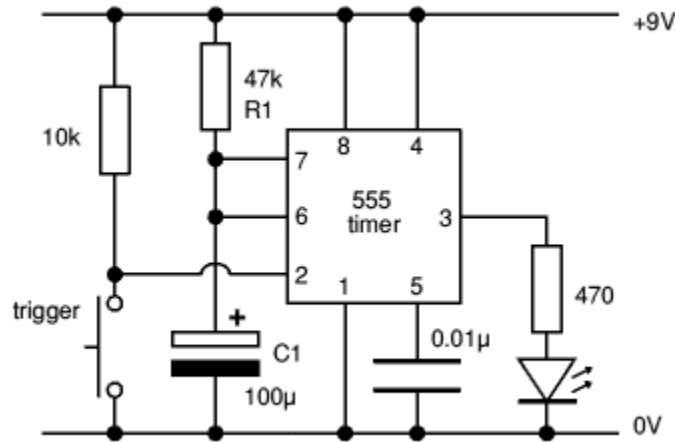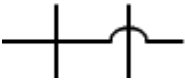# Circuit Symbols

Circuit symbols in diagrams

Circuit symbols are used in circuit diagrams showing how a circuit is connected together. The actual layout of the components is usually quite different from the circuit diagram.
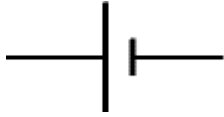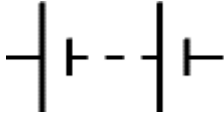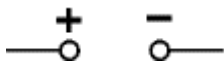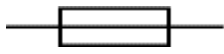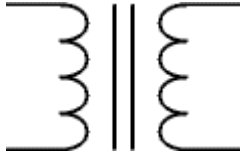

A circuit diagram

Wire and connection symbols

	Wire	Connects components and passes current 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.
	Wires not joined	In complex diagrams it is often necessary to draw wires crossing even though they are not connected. The simple crossing on the left is correct but may be misread as a join where the 'blob' has been forgotten. The bridge symbol on the right leaves no doubt!

Circuit Symbols

Power supply symbols

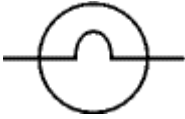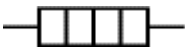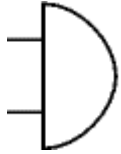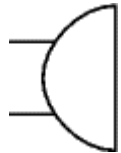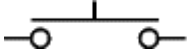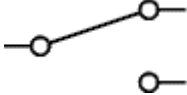|		
	Cell	Supplies electrical energy. The larger line is positive (+). A single cell is often called a battery, but strictly speaking a battery is two or more cells joined together.
	Battery	Supplies electrical energy. A battery is more than one cell. The larger line is positive (+).
	Solar Cell	Converts light to electrical energy. The larger line 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	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.
	Earth (Ground)	A connection to earth. For some electronic circuits this symbol is used for 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.
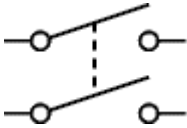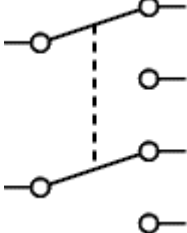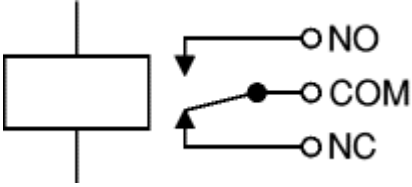
Circuit Symbols

Output device symbols

	Lamp (lighting)	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.
	Lamp (indicator)	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.
	Heater	A transducer which converts electrical energy to heat.
	Motor	A transducer which converts electrical energy to kinetic energy (motion).
	Bell	A transducer which converts electrical energy to sound.
	Buzzer	A transducer which converts electrical energy to sound.
	Inductor, Coil, Solenoid	A coil of wire which creates a magnetic field when current passes through it. There may be an iron core inside the coil. It can be used as a transducer converting electrical energy to mechanical energy by pulling on something magnetically.

Circuit Symbols

Switch symbols

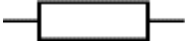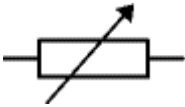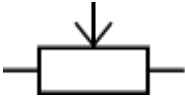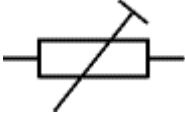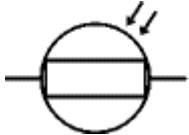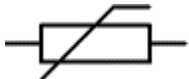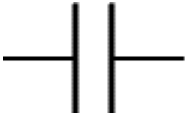|		
	Push-to-make switch	A push switch allows current to flow only when the button is pressed. This is the switch used to operate a doorbell.
	Push-to-break switch	This type of push switch is normally closed = on, it is open = off only when the button is pressed.
	SPST, on-off switch	SPST = Single Pole, Single Throw. Current flows only when the switch is in the closed =on position.
	SPDT, 2-way switch	SPDT = Single Pole, Double Throw. A 2-way changeover switch directs the flow of current to one of two routes according to its position. Some SPDT switches have a central off position and are described as 'on-off-on'.
	DPST switch	DPST = Double Pole, Single Throw. A dual on-off switch which is often used to switch mains electricity because it can isolate both the live and neutral connections.
	DPDT switch	DPDT = Double Pole, Double Throw. This switch can be wired up as a reversing switch for a motor. Some DPDT switches have a central off position.
	Relay	An electrically operated switch, for example a 9V battery circuit connected to the coil can switch an AC mains circuit. The rectangle represents the coil. NO = Normally Open, COM = Common, NC = Normally Closed.

Circuit Symbols

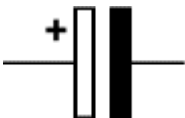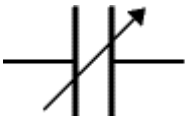## Resistor symbols

	Resistor	A resistor restricts the flow of charge. Uses include limiting the current passing through an LED, and slowly charging a capacitor in a timing circuit. Some publications use the old resistor symbol:
	Rheostat variable resistor	A rheostat has 2 contacts and is usually used to control current. Uses include controlling lamp brightness or motor speed and changing the rate of flow of charge into a capacitor in a timing circuit.
	Potentiometer variable resistor	A potentiometer has 3 contacts and 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.
	Preset variable resistor	A preset is operated with a small screwdriver or similar tool. It is designed to be set when the circuit is made and then left without further adjustment. Presets are cheaper than standard variable resistors so they are sometimes used in projects to reduce the cost.

Sensors (input devices)
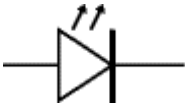
	LDR	A transducer which converts brightness (light) to resistance (an electrical property). LDR = Light Dependent Resistor
	Thermistor	A transducer which converts temperature (heat) to resistance (an electrical property).

Circuit Symbols

Capacitor symbols

	Capacitor, unpolarized	A capacitor stores electric charge. It can be used with a resistor in a timing circuit, for smoothing a supply (it provides a reservoir of charge) and can be used as a filter (blocking DC signals but passing AC signals). Unpolarized capacitors usually have small values, less than 1μF.
	Capacitor, polarized	A capacitor stores electric charge. Polarized capacitors must be connected the correct way round. They usually have larger values, 1μF and greater. See above for uses.
	Variable capacitor	A variable capacitor is used in a radio tuner.
	Trimmer variable capacitor	This type of variable capacitor is designed to be set when a circuit is made and then left without further adjustment.

Diode symbols

	Diode	A device which allows current to flow in only one direction.
	Light Emitting Diode	A transducer which converts electrical energy to light. Usually abbreviated to LED.
	Zener diode	A Zener diode can be used to maintain a fixed voltage.
	Photodiode	A light-sensitive diode.

Circuit Symbols

Meters and Oscilloscope

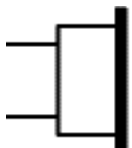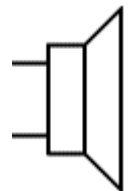|		
	Voltmeter	Measures voltage. The proper name for voltage is 'potential difference' but voltage is more widely used.
	Ammeter	Measures current.
	Galvanometer	A very sensitive meter used to measure tiny currents, usually 1mA or less.
	Ohmmeter	Measures resistance. Most multimeters have an ohmmeter setting.
	Oscilloscope	An oscilloscope is used to display the 'shape' of electrical signals - showing how they vary with time. It can be used to measure voltage and time periods.

Transistor symbols

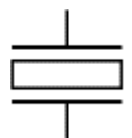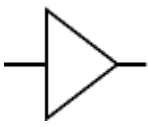|		
	Transistor NPN	A transistor amplifies current and can be used with other components to make an amplifier or switching circuit. This symbol is for a bipolar junction transistor (BJT), the type you are most likely to use at first.
	Transistor PNP	A transistor amplifies current and can be used with other components to make an amplifier or switching circuit. This symbol is for a bipolar junction transistor (BJT), the type you are most likely to use at first.

Circuit Symbols

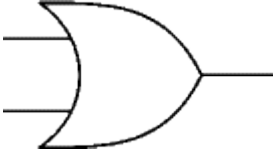|	Phototransistor	A light-sensitive transistor.
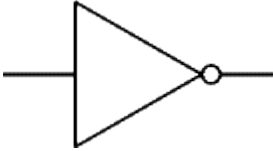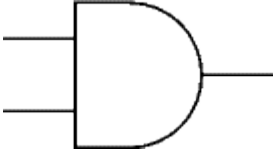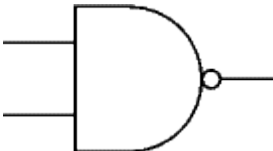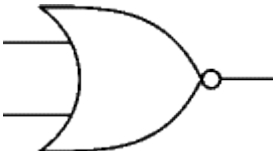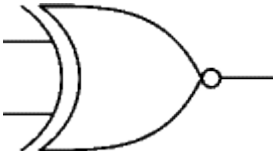
Audio and Radio symbols

	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 this is a block diagram symbol because it represents a circuit rather than just one component.
	Aerial (Antenna)	A device to receive or transmit radio signals. It is also known as an antenna.

Logic gate symbols

Logic gates process signals which represent **true** (1, high, +Vs, on) or **false** (0, low, 0V, off). For more information please see the page on logic gates. The symbols shown here are the traditional ones for logic gates as these are the most widely used symbols.

Circuit Symbols

	NOT	A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.
	AND	An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.
	NAND	A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a **N**ot **AND** gate. The output of a NAND gate is true unless all its inputs are true.
	OR	An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.
	NOR	A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a **N**ot **OR** gate. The output of a NOR gate is true when none of its inputs are true.
	EX-OR	An EX-OR gate can only have two inputs. The output of an EX-OR gate is true when its inputs are different (one true, one false).
	EX-NOR	An EX-NOR gate can only have two inputs. The 'o' on the output means 'not' showing that it is a **N**ot **EX-OR** gate. The output of an EX-NOR gate is true when its inputs are the same (both true or both false).