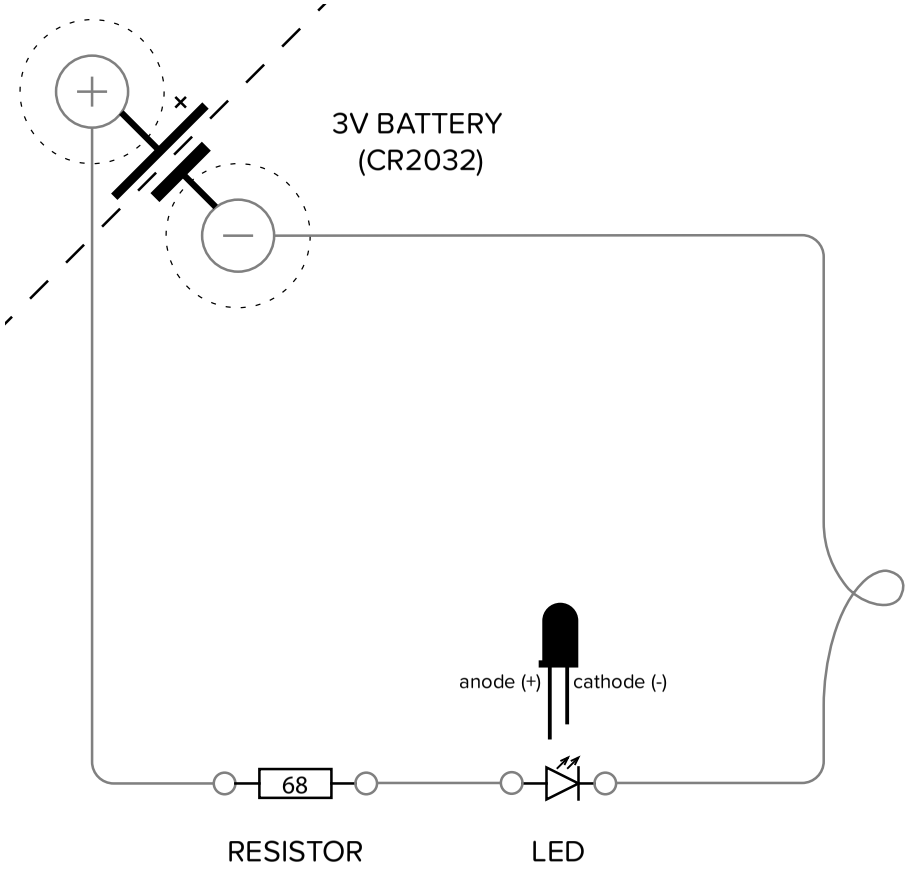
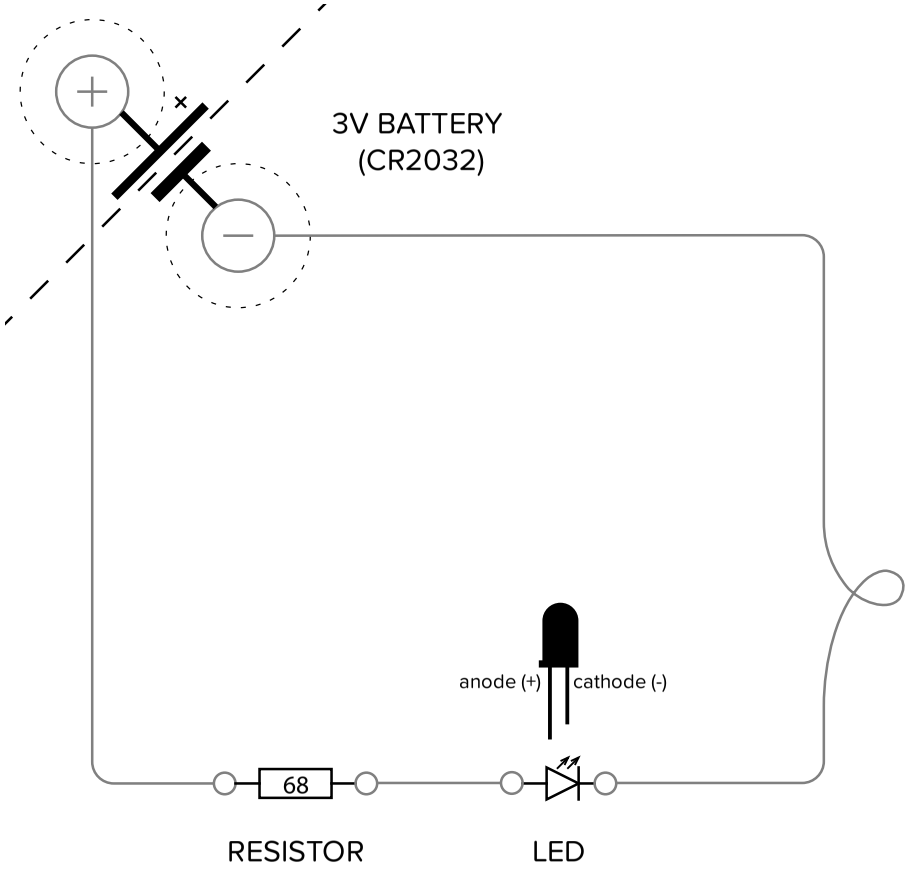


1. SIMPLE LED CIRCUIT

Lessons:

*Symbols: electronic components can be represented by symbols.
*Schematic: symbols can be used to draw a 'schematic'; a 'plan' for a circuit.
*Circuit: a circuit is a closed loop that allows electrons to flow.
*Values: symbols provide information on components 'values'.
*Resistor codes: the colored bands on a resistor are a code for it's value.
(The code for a 68 ohms resistor is: blue - grey - black)
*Polarity: some components have a positive pole(+) and a negative pole(+).
(For example a battery and an LED)
*LED: the positive pole of an LED goes to the positive pole of the battery and the negative pole of the LED goes to the negative pole of the battery. If an LED is reversed the circuit won't work.
*Battery: if a battery is reversed you may damage components, so carefully pay attention to its polarity.



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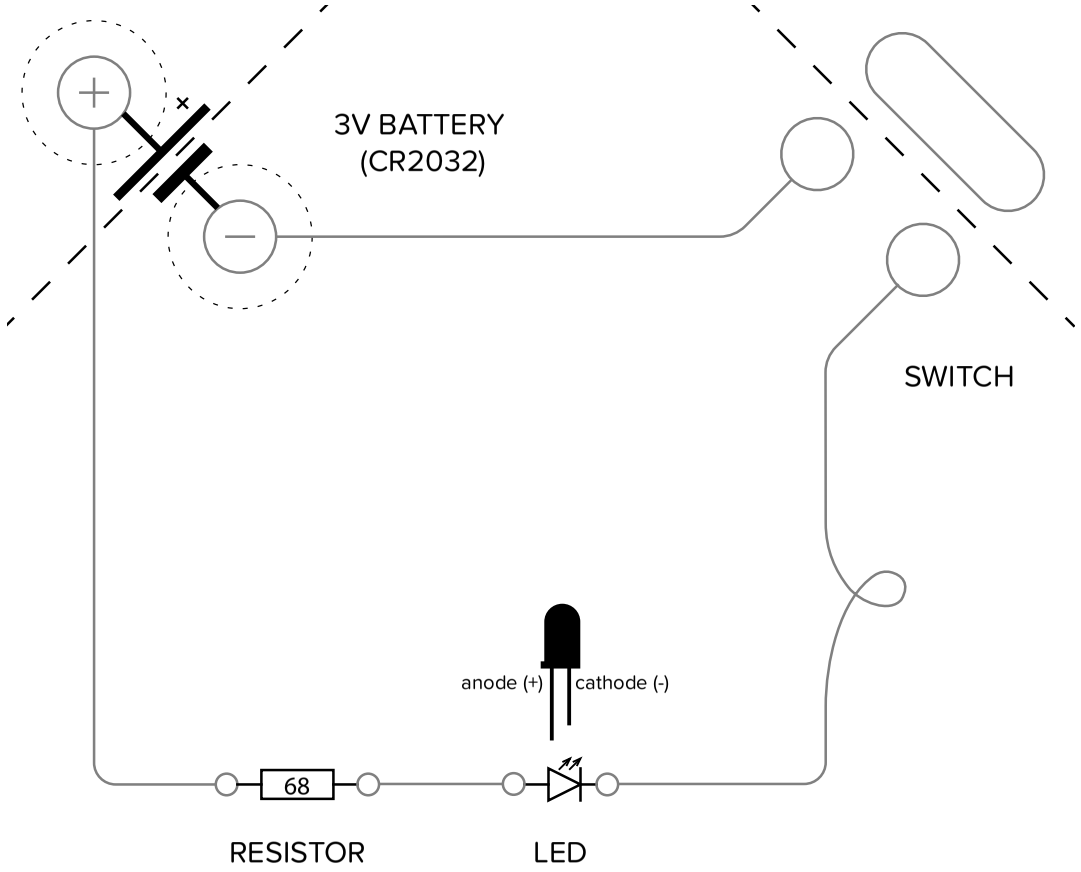


2. SIMPLE SWITCH

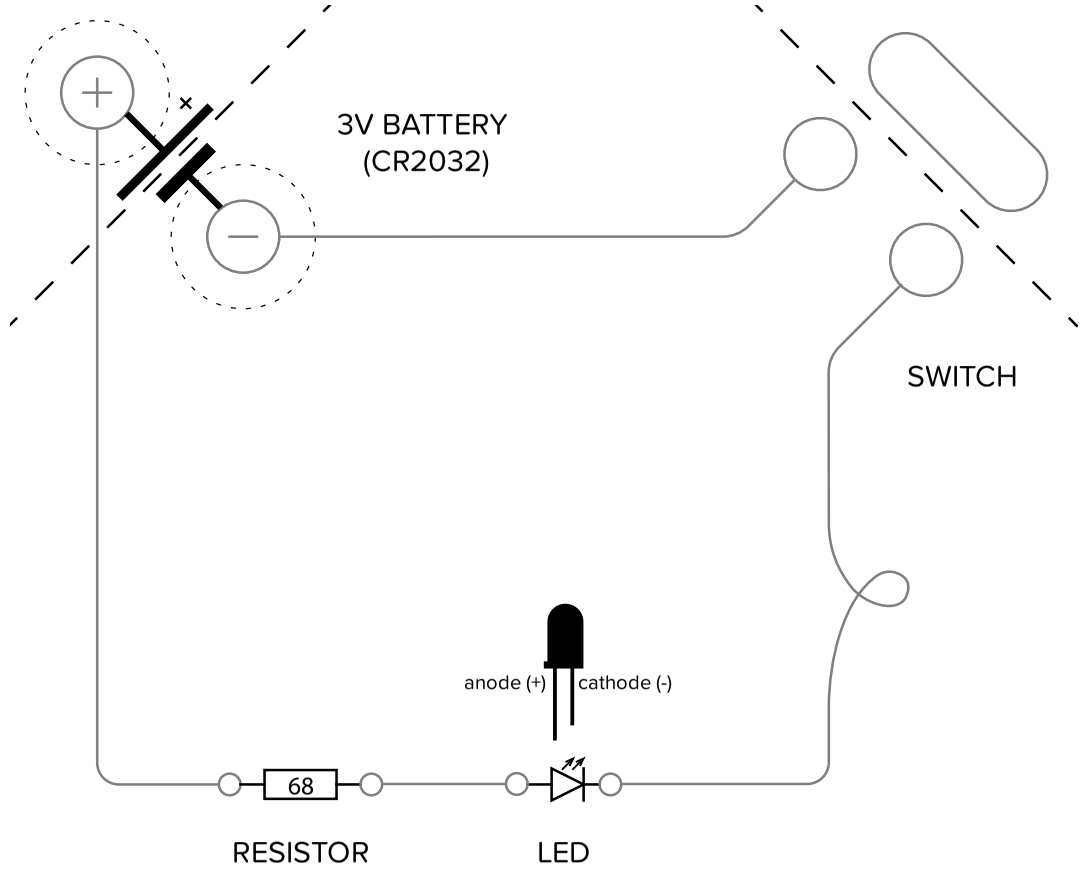
Lessons:

*Open circuit: if a circuit is not a closed loop it's called an 'open circuit'. An open circuit prevents the flow of electrons

*Switch: a 'switch' or 'circuit breaker' is a device that 'breaks' or 'closes' a circuit. It can be used to 'open' or 'close' a circuit; turning it 'on' or 'off'.

*Conductivity: to allow the flow of electrons, the material used to create a circuit and/or switch needs to be 'conductive'. The measure for how easy electrons can flow in a material is called 'conductivity'. Metals like copper or silver are good conductors, therefore electronic circuits often use copper or silver wires.

*Isolation: if a material 'conducts' electricity very badly or not at all: we call it an 'isolator'. Isolators can be used to prevent electricity from 'leaking' out of a circuit. (paper is an isolator).



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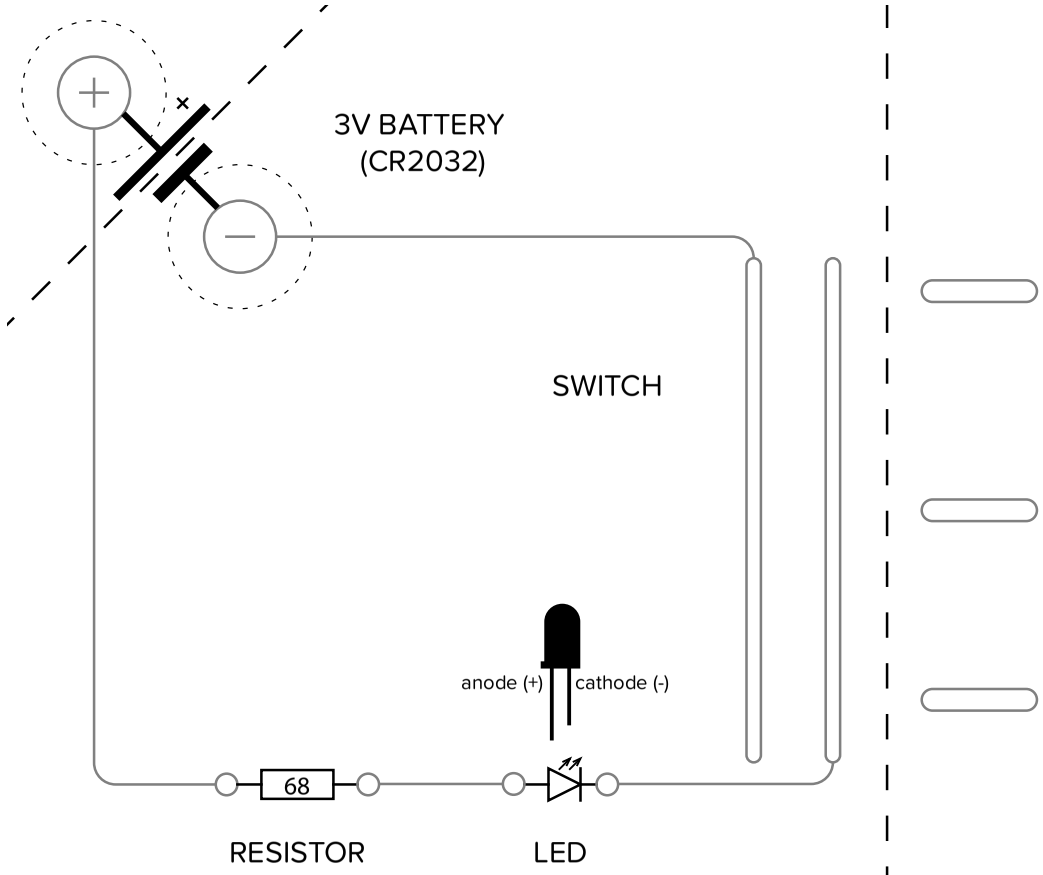
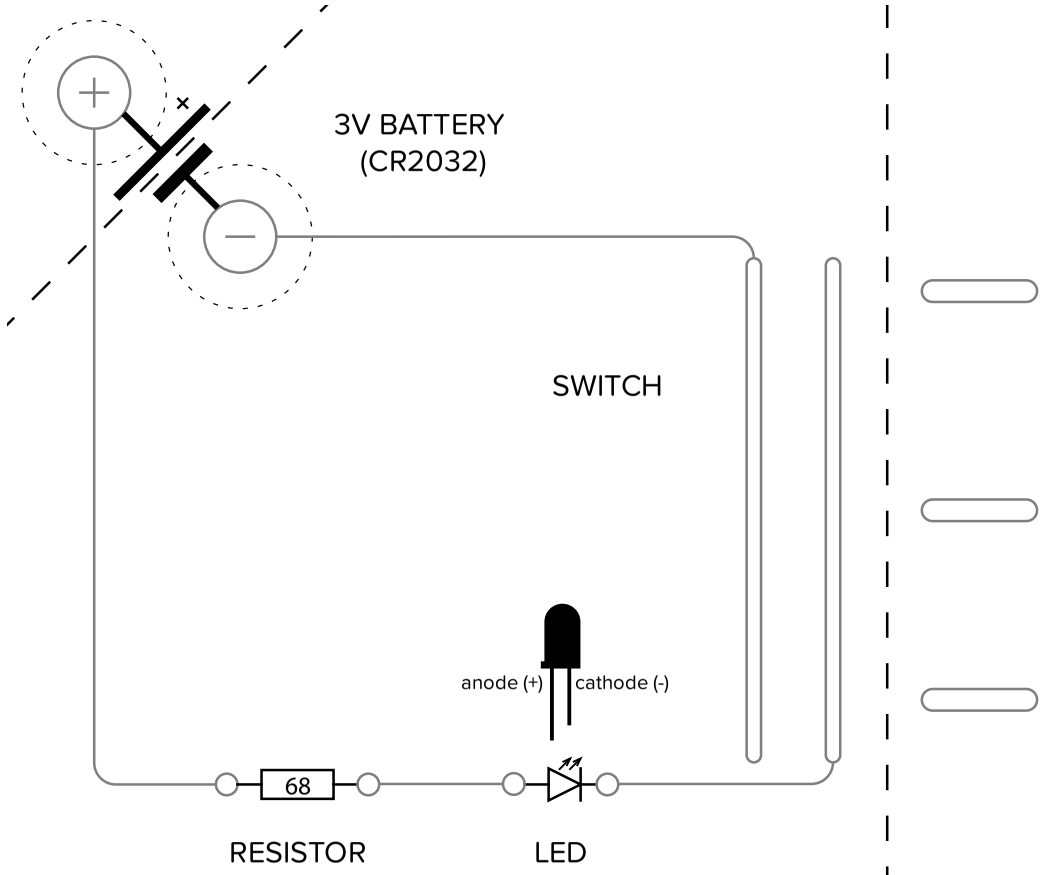


3. MORE COMPLICATED SWITCH

Lessons:

*States: a normal switch has two states: ‘on’ and off’. By moving your finger across this switch, the circuit alternates between ‘on’ and ‘off’ multiple times - making the LED blink.

*Contacts: ‘contacts’ are elements of a component creating an electrical connection with the circuit. Different designs for the contacts of this switch will create differt blinking patterns of the LED.



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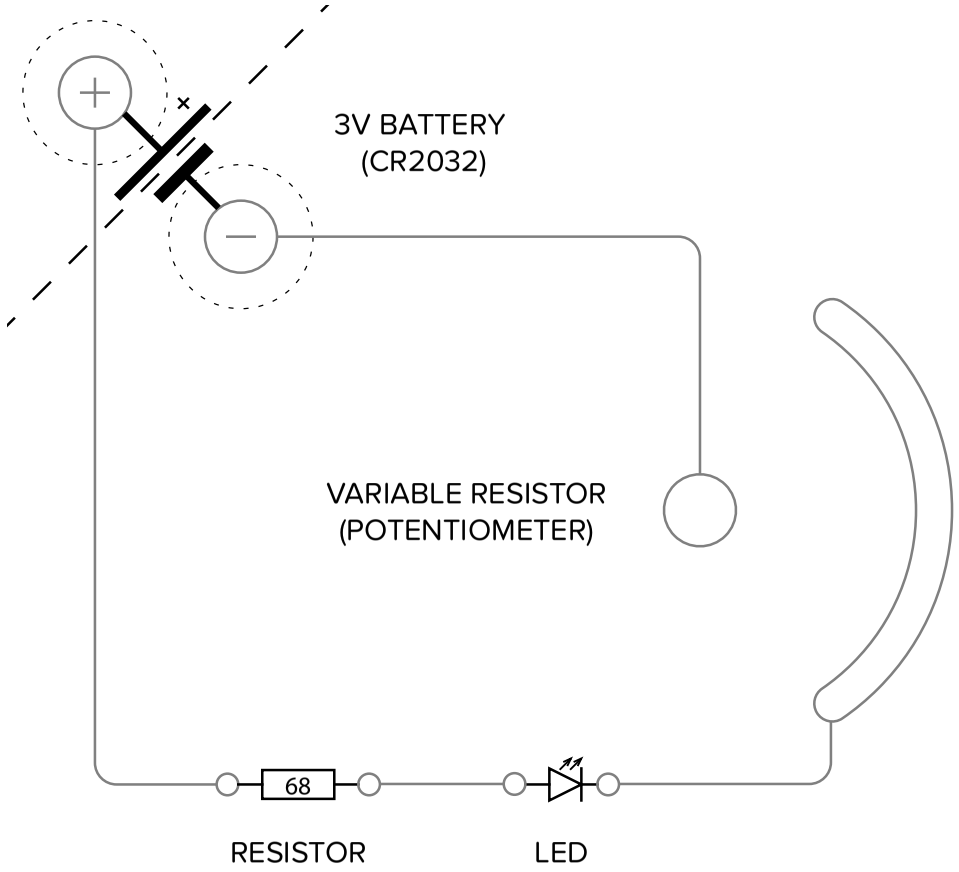


4. (VARIABLE) RESISTANCE

Lessons:

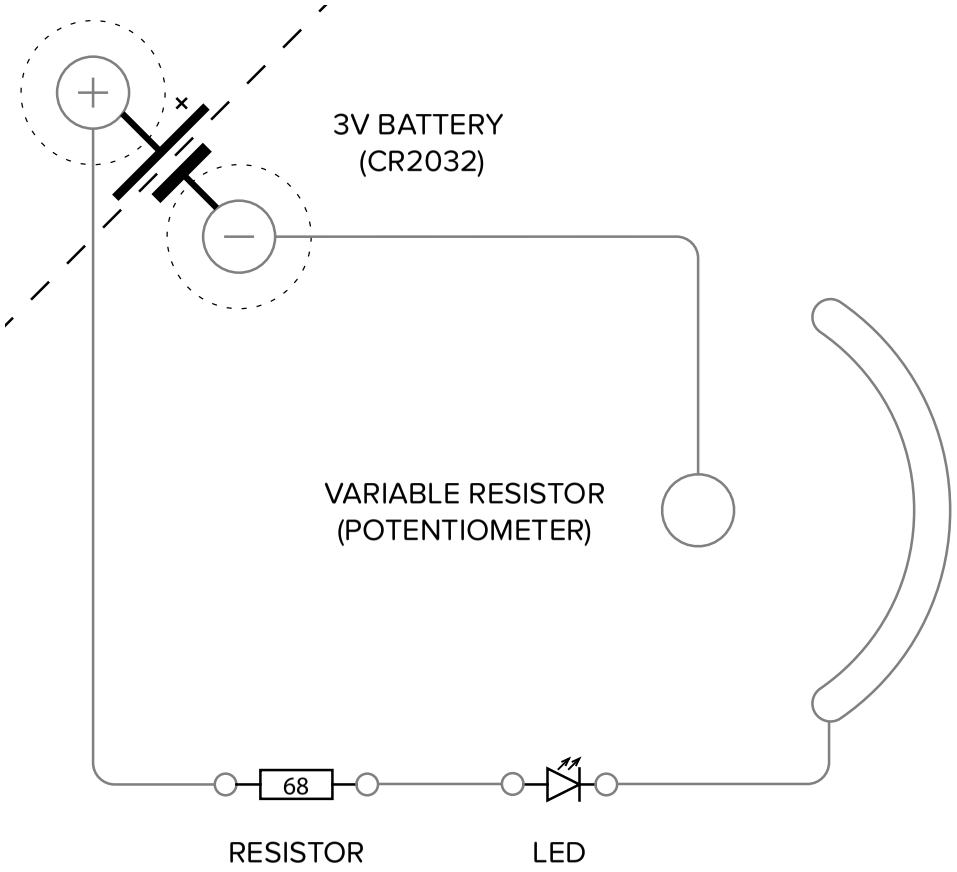
*Current: is the flow of electrons - and is measured in 'ampere's' or 'amps' (A). Components require a certain current (or a certain amount of 'amps') to operate properly.

*Resistance: is the 'opposition' a material offers to the flow of electrons. 'Resistance' can be used to limit the current flowing in a circuit. Resistance (R) is measured in Ohms's (Ω).

*Variable Resistors: can be used to control for example the brightness of an LED by 'limiting' the current flowing through it.

**Go back to circuit 2. and close the circuit with a 'photoresistor' - see how the circuit reacts under different light circumstances. the resistance of a photoresistor is another type of variable resistor that changes resistance under the influence of light.*

*Sensors: variable resistors are a type of 'sensor'. They can be used to measure things (temperature, humidity, angles, etc.).



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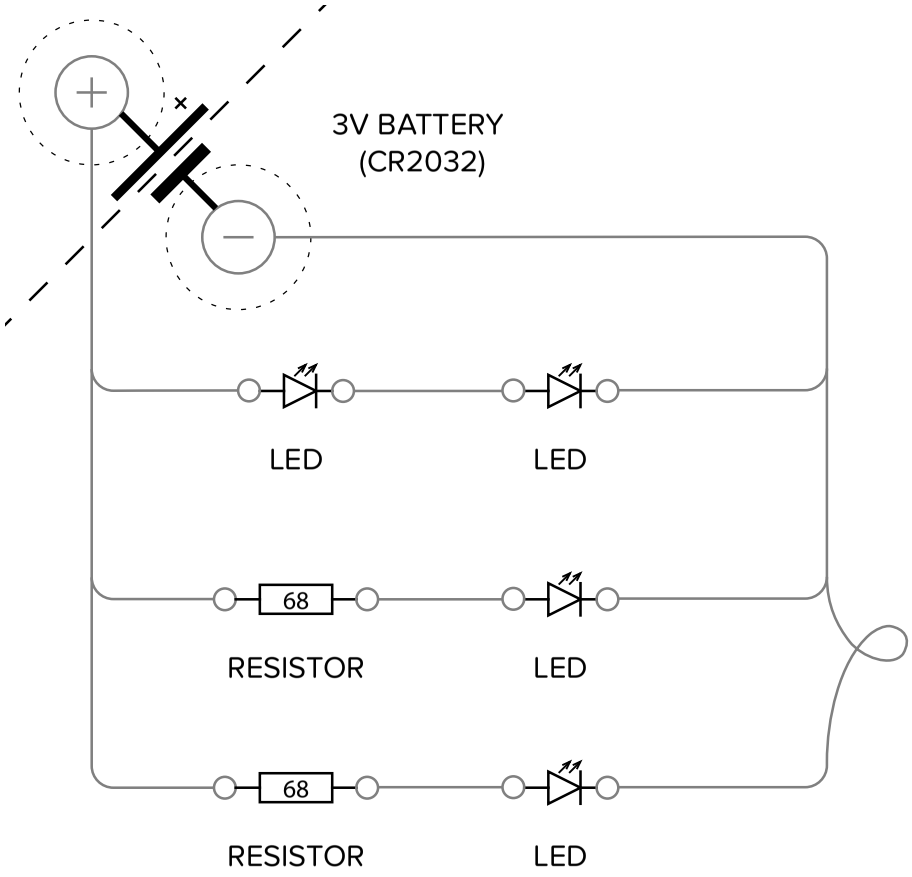


5. MULTIPLE LEDS: SERIES & PARALLEL

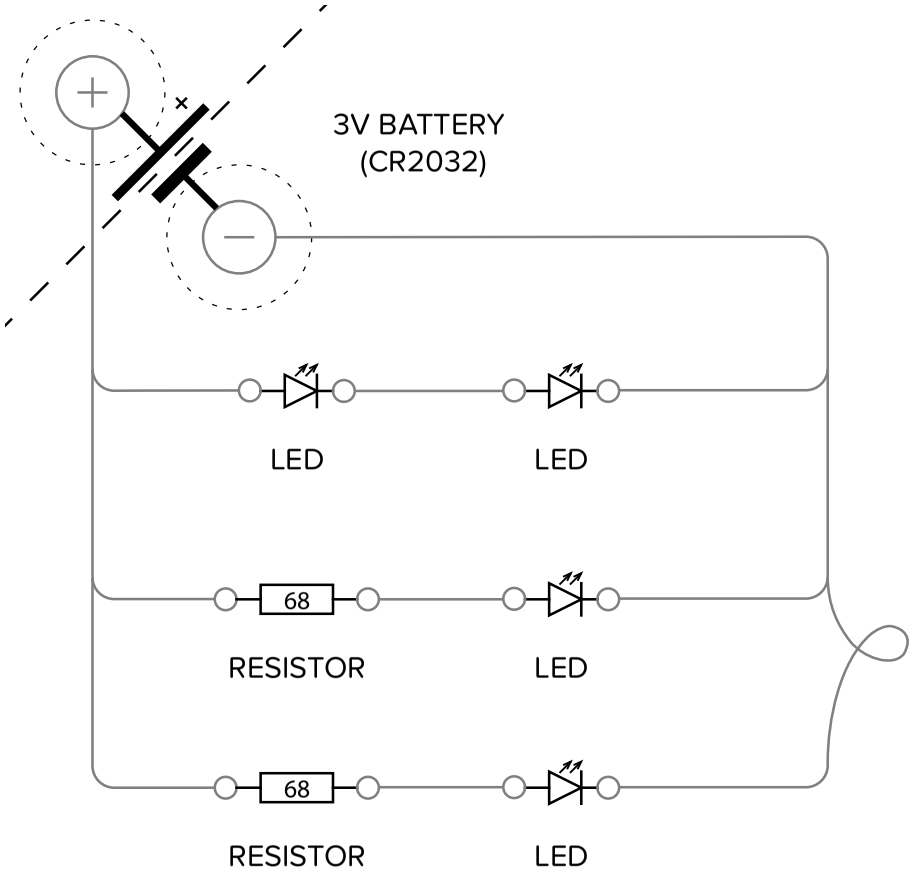
Lessons:

*Electrical potential: is a type of 'potential energy', and refers to the energy that could be released if 'electric current' is allowed to flow. 'Potential' (U) is measured in 'Volts' (V). (The electric potential of our battery is '3V')

*Series circuit: sofar we have been using components in 'series' meaning all components are part of the same 'loop' in the circuit. Because a LED 'uses' a certain amount of 'volts' (~1.8V) if we place a 2nd led in 'series' to the first led the battery cannot provide enough potential energy to light both LEDS to their maximum output.

*Parallel circuit: to connect multiple leds to a 3V circuit we need to put the led's in 'parallel' to each other. This effectively creates multiple 'loops' in the circuit that the current will flow through. this way all LEDS will get the same voltage but the current the whole circuit uses will multiply as well.

*Ohms Law: The relations between Potential, Resistance and Current can be derived from 'Ohms law' (U = I * R) but this is beyond the scope of this tutorial.



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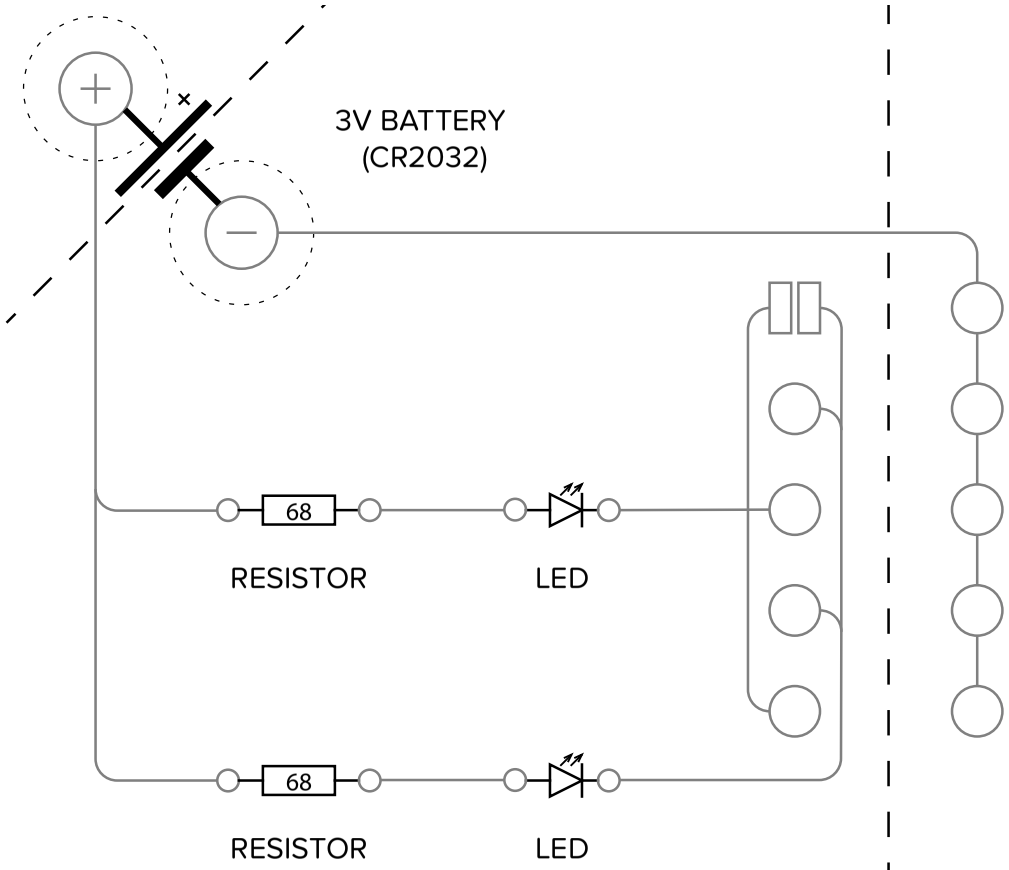
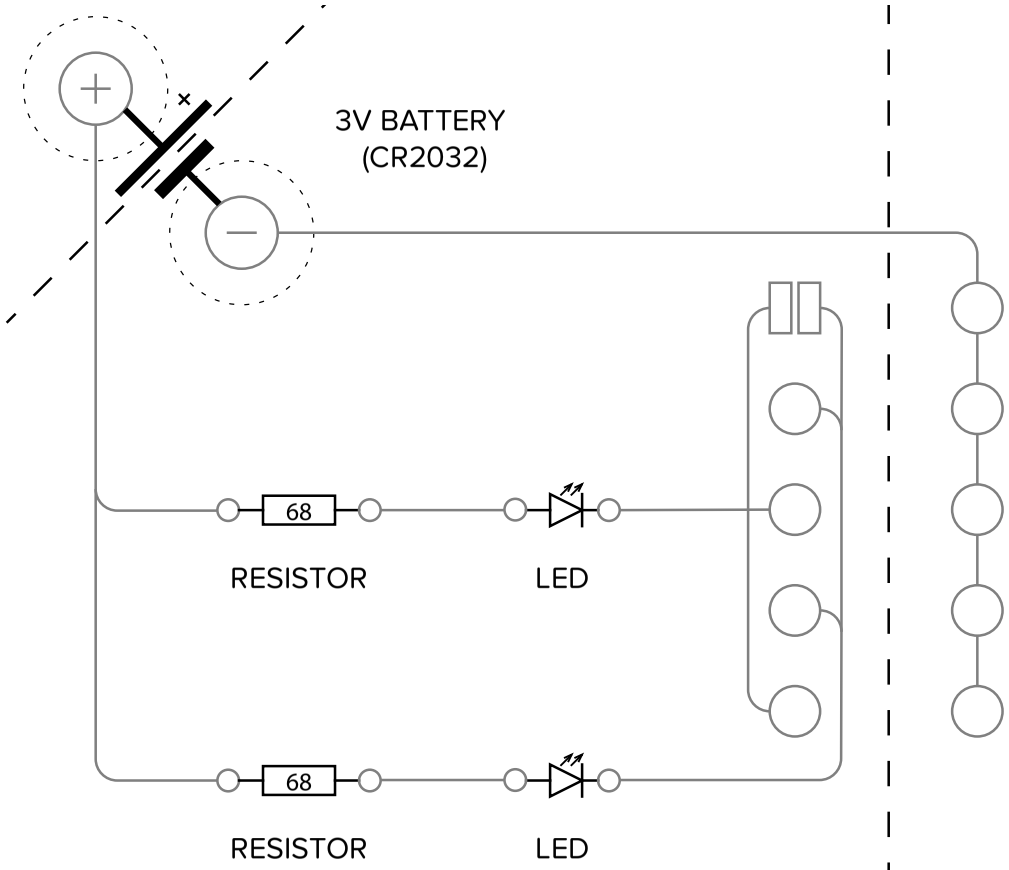


6. COMBINATIONS



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