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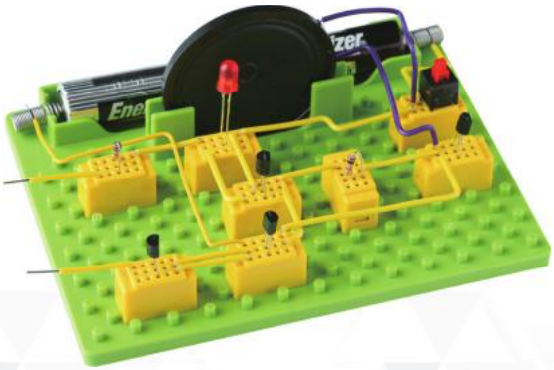
You can easily create electronic circuits!

NEO CIRCUIT

··· Electronic Block Kit ···

14 in 1



neopia

What is the Neo Circuit

Electronic engineering is leading the technological advancement of computers, semiconductors, wired and wireless communications, home appliances, robotics, etc., and is making the world easier and smarter with home appliances for cellphone, game consoles, and televisions that we use.
Neopia has developed a product that anyone can easily and safely conduct electronic education with a electronic block which has a patent application for the first time in the world.
[Neo Circuit 14 in 1] It is a 'Educational Electronic Experiment Kit' that collects 14 of several previously developed contents and makes you to learn electronics easy and fun way.

First,

It has an excellent learning effect in understanding the configuration of circuits and the principles of electronics.
Neo Circuit can be configured the same way of the circuit diagram, and it is most suitable for electronic education because you can easy to recognize the created circuit.

Second,

Easy and safe block type to assemble.
It is easy for beginners to learn because it works by plugging the part into the block without using soldering or other tools.

Third,

Easily transformed the wrong part of the electronic circuit, and can be used repeatedly.
It is easy to assemble and review circuits with a real "Pictorial diagram" that marked the numbers of electronic parts and wires together with "Circuit diagram".
It can be modified immediately and also several times with a block method.

Fourth,

The circuit is described by the flow of current.
Since we aimed at "Easy Electronics", we changed the difficult electronic terms to simple terms. However, in electronic circuits, all phenomena occur simultaneously, so the description of the current flow can be 'circuit description for understanding'.

Fifth,

It configured for students of elementary / secondary school to learn electronics easily and fun.
You can learn from the basics of electronic parts to amplifying circuits and oscillating circuits (circuits that make vibrations of current).

* NEO Circuit : Neo(=new) + Circuit

NEO CIRCUIT

Contents

NEO Circuit 14 in 1

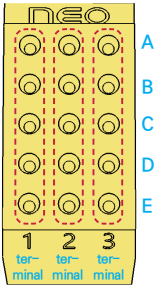
Understanding of electronic parts

Basic electronic parts

* One experiment does not mean the first experiment.

Understanding of the parts

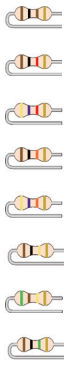
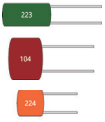
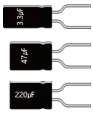
NEO-Block



NEO-Block is made to divide the breadboard by parts and a small 2cm yellow block can be made circuit easy. Using NEO-blocks, the beginner can easily understand because circuits can be unfolded as it is and configured. There are three terminals (1/2/3) that are not connected to each other in the NEO-block, and each terminal has 5 holes (A/B/C/D/F). Normally the part is plugged into the center of the block (C), the part with two-leads connect to terminal 1 and 3, and the part with three-leads connect to terminal 1/2/3.

***Breadboard** : A product used to make electronic circuits without soldering as like the electronic block. However, there is a difference of manufacturing between the electronic block to make a circuit by unfolding in the same configuration as the circuit diagram and the breadboard to make it by integrating circuit (collecting parts in a small space).

NAME	SHAPE	SYMBOL	STABNDARD	Q'TY	FUNCTION
NEO-Block			3ROW	9	Connect electronic parts and wire
Base-plate			130x95mm	1	Fix the electronic block.
Spring			⊕ Pole	1	Fixed battery and connect wire.
			⊖ Pole	1	
Wire			Yellow 70mm	12	Connect electronic parts to allow the current to flow.
			Orange 100mm	8	
LED			Green	2	It glows green.
			Red	2	It glows red.
High-brightness LED			Transparency Red	1	It emits brighter light than regular LED.

NAME	SHAPE	SYMBOL	STABNDARD	Q'TY	FUNCTION
Resistor			100Ω (Br Bl Br G)	2	Controls the flow of electric current. * Color : Black: Bl, Brown:Br, Gold: G, Green: Gr, Gray: Ga, Violet: V, Orange: O, Red: R, Yellow: Y.
			1kΩ (Br Bl R G)	2	
			4.7kΩ (Y V R G)	2	
			10kΩ (Br Bl O G)	2	
			47kΩ (Y V O G)	2	
			100kΩ (Br Bl Y G)	2	
			510kΩ (Gr Br Y G)	2	
			1MΩ (Br Bl Gr G)	2	
CdS			Cadmium sulfide cell	1	The resistance value varies depending on the brightness of surrounding.
Switch			On / Off	1	Connecting or cutting of the circuit.
			Push	1	
Melody IC			66T11L	1	A device with melody embedded in. * The melody IC can be changed depending on the parts supply and demand.
			66T32L	1	
Speaker			8Ω / 0.5W	1	The outputs an electric signal into sound.
Transistor			D227	3	Amplifies or switches the electric current.
			A642	1	
Mylar Capacitor			0.022μF (223)	1	Holds electricity temporarily and let it flow.
			0.1μF (104)	1	
			0.22μF (224)	1	
Electrolytic Capacitor			3.3μF	2	Holds electricity temporarily and let it flow. * The lead on the side marked with ⊖ band is ⊖ pole. 
			47μF	2	
			220μF	2	

* The color of the capacitor may change depending on the supply and demand of parts.

Making circuit

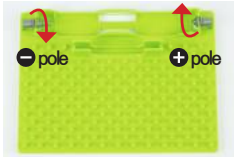
1. Placement spring to fixed position

- The spring ⊕/⊖ polarity is different. Place '⊖ pole spring' on the left and '⊕ pole spring' on the right.
- Hold the spring with the thumb and forefinger of both hands, spread it to the left and right, and then insert the point where the gap of the spring into the base-plate.

⊖ pole spring

⊕ pole spring

- Turn the spring a little clockwise (right) and press it from the top to fix it firmly to the base-plate.



* The spring only needs to be connected when first used.

2. Placement of battery

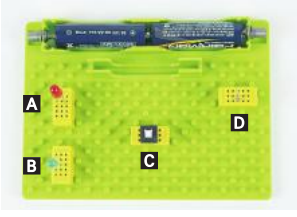
- The left side of the base-plate for battery is ⊖ pole and the right side is ⊕ pole.
- You can easily place by pressing the center after fixing 2 dry cells at both ends.

3. Placement of NEO-blocks

- Place NEO-blocks on the base-plate by referring to the pictorial diagram.
- Fix it in a similar location.

4. Placement of electronic parts

- Insert into the NEO-blocks in the order of the electronic parts. (A → D)
- Use tweezers to pick up electronic parts.
- Normally the part with two-leads connect to terminal 1 and 3, and the part with three-leads connect to terminal 1/2/3.



5. Connecting wires

- Insert it in order so that each part is connected. (❶ → ❻)
- Connect the power wires last.

6. Confirming the operation

- Operate the circuit by pressing the switch.
- Depending on the circuit, it may operate by inserting or removing wire instead of pressing a switch.

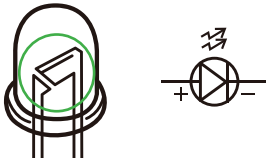
* If the circuit does not work, check the parts and wires one by one in numerical order whether connected them properly.

01_Light Emitting Diode(LED) and Resistor

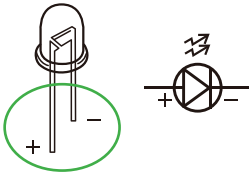
When the circuit is completed, the LED lights up.

1. Light Emitting Diode

- The meaning of LED is a 'Light Emitting Diode'.
- Diodes are electronic parts to allow the current flows only one way.
- In other words, a light-emitting diode is an electronic part that emits light if it is connecting to match the flow of current. (Only on one side = To match polarity)
- 'High-brightness LED' refers to an LED that is much brighter of brightness than ordinary LEDs.
- The LED is a parts that must be connected according to the polarity (⊕/⊖), and the polarity classification method is as below.



① Check by the shape of the parts inside



② Check by length of each lead

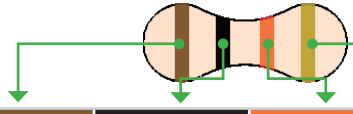
2. Resistor

- Resistors are electronic parts to interfere the flow of current.
- To be more precise, it is an 'electrical resistance'
- Although the meaning of "Interference" may feel negative, it plays a very important role in electronic circuits because it is a part to control the flow of current.

① Resistor has 4 different colored bands (looks similar rainbow color) and each color has a unique number.

Black	Brown	Red	Orange	Yellow	Green	Blue	Violet	Gray	White
0	1	2	3	4	5	6	7	8	9

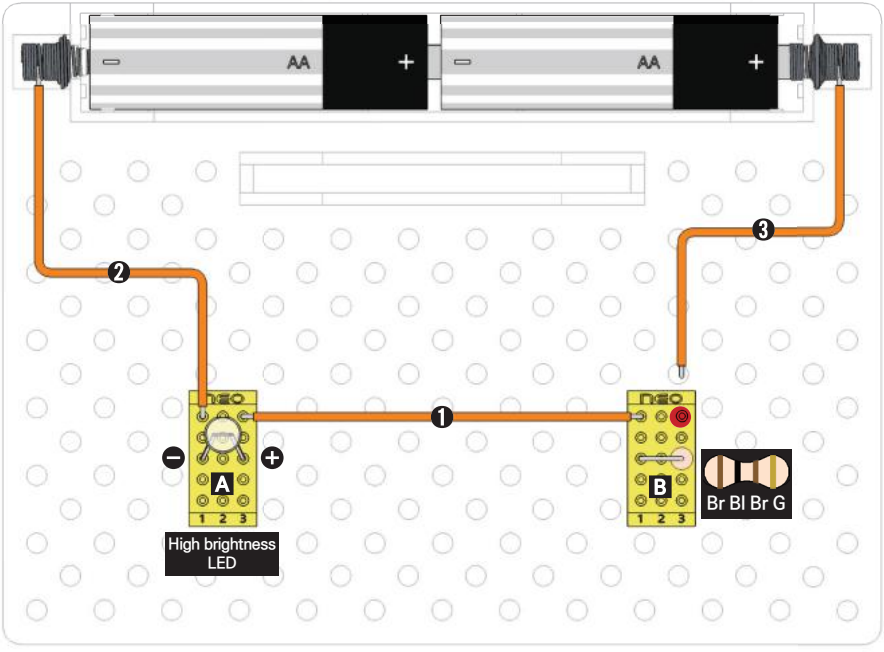
② To find correct resistor, Place gold(or silver) color on the far right side and read the colors in order.
-The first two colors are converted to numbers as they are, and the third color is counted as 0.



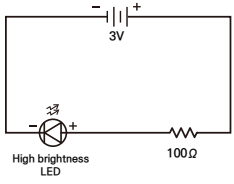
Color	Brown	Black	Orange	Gold
Number conversion	1	0	3	5%

☞ Br/Bl/O/G= Add 3 zeros to 10 = 10,000 ohms (within 5% error range) = 10 killohms = 10 kΩ

[Pictorial diagram]



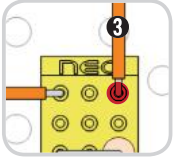
[Circuit diagram]



Understanding of the circuit

It is much simpler to turn on the LED by connecting it directly to the battery, but since the rated voltage of the LED is usually 2.2V (Volts), connecting directly to a 3V battery can damage the LED. The LED can be stably turned on by connecting a resistor of 100Ω (ohm) together.

[Experiment]



1. Plug one side of the power wires (wire ❸) into the ● and the LED lights on.
   : Since it is a circuit without a switch, you need to control it manually by plugging in and unplugging the wire.
2. It can be changed the LED (part **A**) to another colored LED or High-brightness LED.
   : When plugging in the LED, it has to be connected according to the polarity.
3. Changing the resistor (part **B**) to a different value will cause the brightness of the LED to change.
   : If a resistor with a small resistance value is plugged, the LED becomes bright, and if a resistor with a large resistance value is plugged, the LED darkens or does not turn on at all.

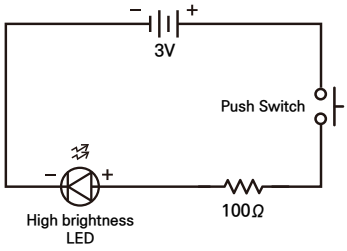
02_Switch

Two LEDs can be turned on and off by switching.

1. Push Switch

- Turns on while pressed down, turns off when released.
- Applying the push switch to the lecture '01_LED and resistance' circuit is as follows.

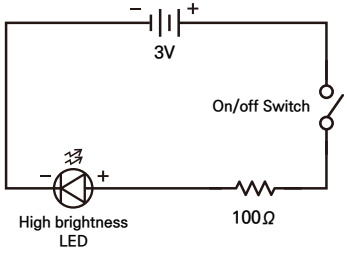
Push Switch



2. On/Off Switch

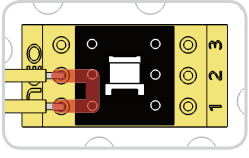
- As the most common switch, it turns on when pressed (circuit short), and turns off when pressed again (circuit open).
- Applying the On/Off switch to the lecture '01_LED and resistance' circuit is as follows.

ON / OFF Switch

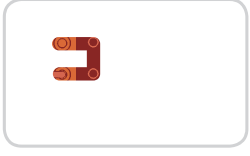


- In this content, we will try to create a circuit in which different LED alternately turns on according to the pressing of the switch. (On/Off)

* Switches used in the neo-circuit has a different connecting method in accordance with the left-right direction. Check the shape when viewed from above. If the direction is different, the operation will be reversed, but there is no big problem even if you use it in reverse.

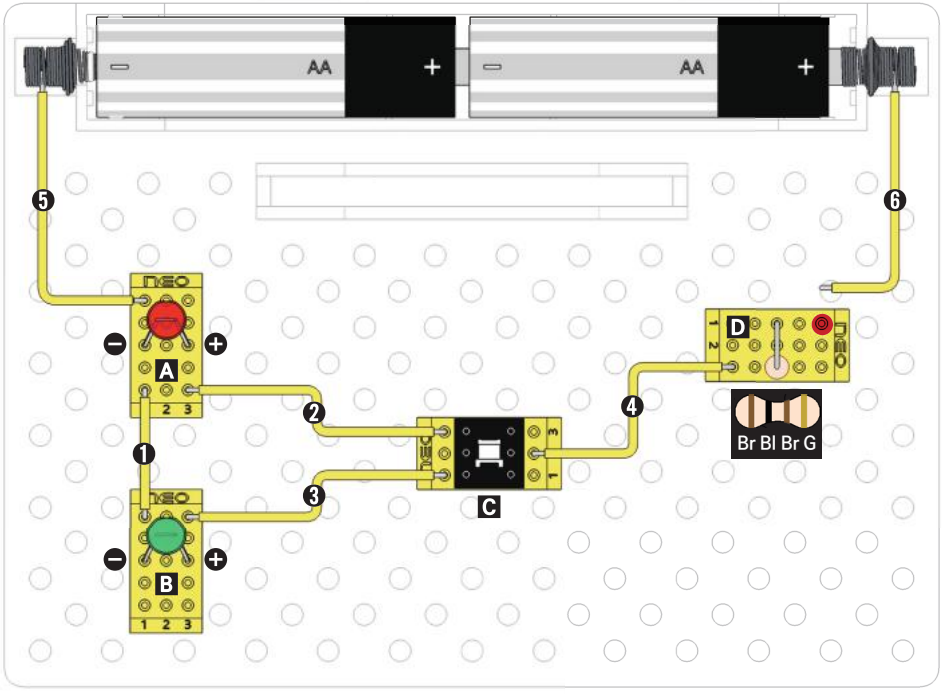


- Circuit connection when switch is ON -

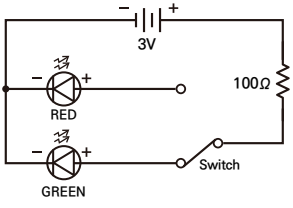


- Circuit connection when switch is OFF -

[Pictorial diagram]



[Circuit diagram]

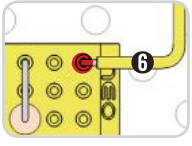


Understanding of the circuit

When the On/Off switch is pressed (when it is fixed down), the 1st and 2nd lead of the switch are connected (short), and when it is pushed up again, the 2nd and 3rd lead are connected to each other and used as a switching (conversion) circuit.

[Experiment]

1. Plug one side of the power wires (wire ❻) into the ● and one LED lights on.
2. Each time the switch (part **C**)is pressed, the LED lights alternately.

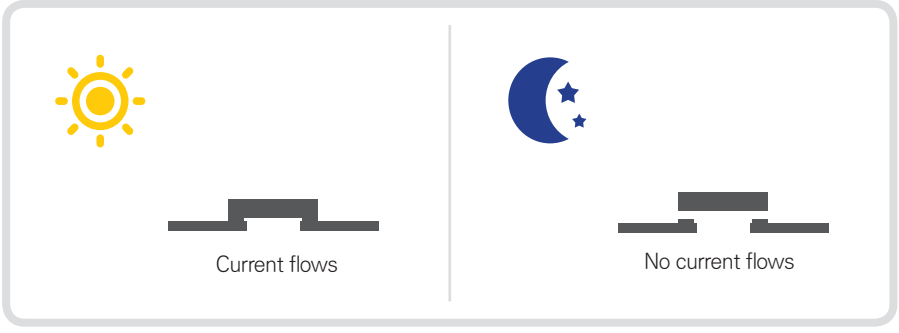


03_CdS Cell

The brightness of the LED changes depending on the surrounding brightness.

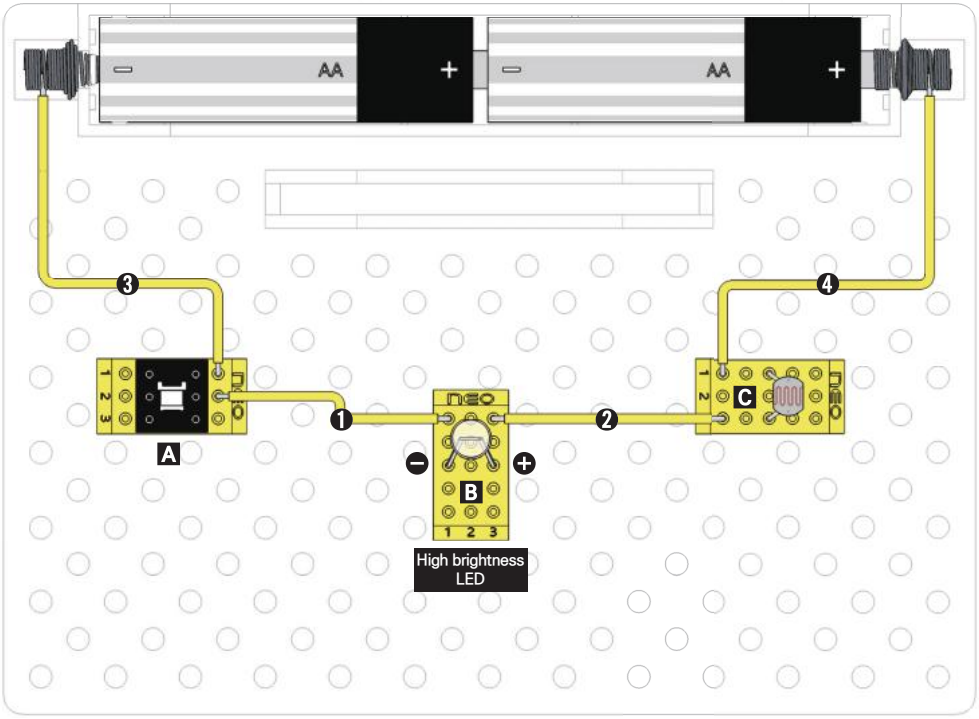
1. CdS Cell

- CdS cell is a part mainly composed of cadmium sulfide (CdS). (Cd: Cadmium + S: Sulfur)
- CdS is a type of variableness resistor as a part which is the resistance value changes according to the amount of light.
- It is a part that the resistance decreases or increases much according to the brightness of surrounding. Due to this feature, it is used as a sensor to detect light.

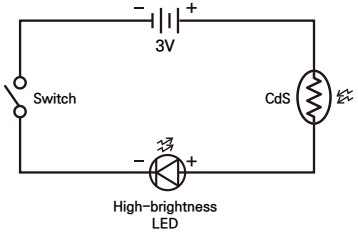


- By applying the function of CdS in reverse, it is using for street lights, night security lights, and car auto lights that automatically turn on when dark.

[Pictorial diagram]



[Circuit diagram]



Understanding of the circuit

When the surroundings are dark, the resistance of the CdS cell increases much, so current can't flow and the LED will be darken and or can't turn on.

Conversely, if the surroundings are bright, the resistance of the CdS cell decreases, causing current to flow and LED light turns on.

[Experiment]

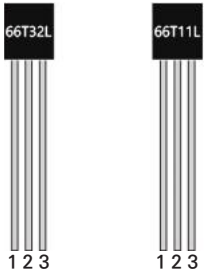
1. Turns on the power by pressing the switch (part **A**).
2. When the CdS (part **C**) is blocked with a hand, the LED dims or turns off.
   - When blocking the CdS with your hand, you must be wrapped it to block the light where it enters from all places.
3. If the LED (part **B**) does not light up well, try shining the cellphone flash to the CdS (part **C**) to make it bright more.

04_Melody IC

As an integrated circuit (IC) in which the melody signal embedded in, sound comes when a speaker is connected.

1. Melody IC

- It looks almost similar to the transistor.
- The part name is written on the flat side, and the melody signal is classified by the number in the middle.
  : 66T stands for Melody IC, the number after behind that is the kinds of song.
- Based on the flat side where the letters are visible, if you connect ⊖ power to 1st lead and ⊕ power to 2nd lead, the melody signal is output through 3rd lead.

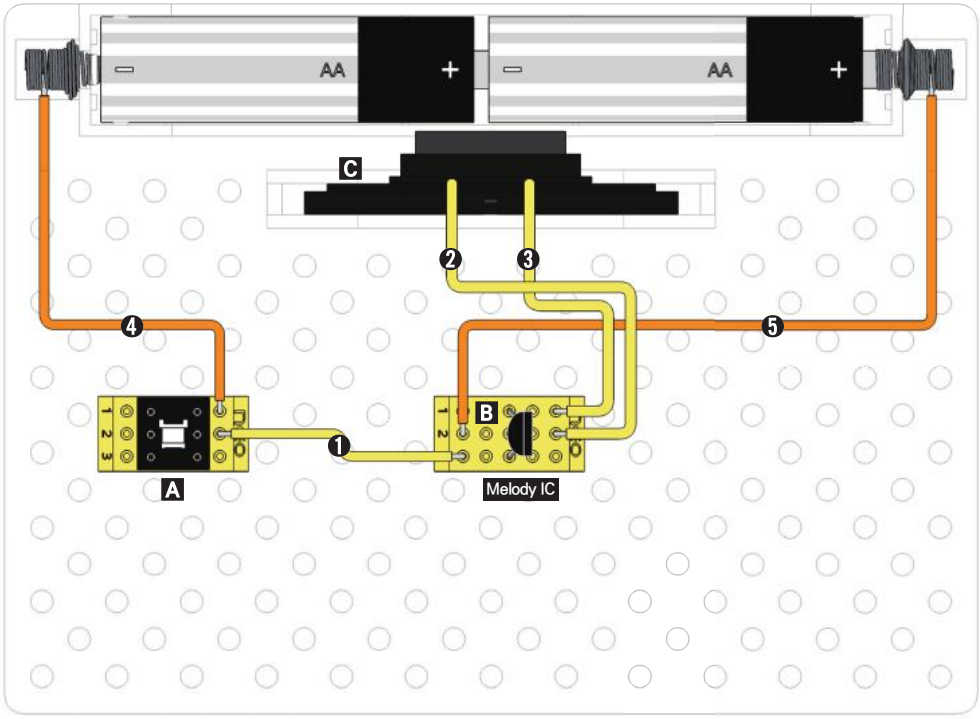


2. The kinds of Song according to melody IC parts

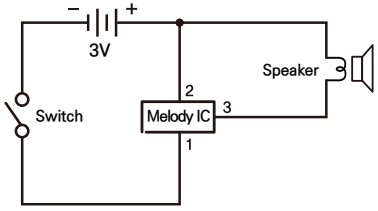
Part No.	Song Name
UM66T**01**	Jingle bells + Santa is coming to town + We wish you a merry xmas
UM66T**02**	Jingle Bells
UM66T**04**	Jingle Bells + Rudolph the red nosed reindeer + Joy to the world
UM66T**05**	Home sweet home
UM66T**06**	Let me call you Sweetheart
UM66T**08**	Happy Birthday to you
UM66T**09**	Wedding march
UM66T**11**	Love Me Tender, Love me True
UM66T**13**	Easter Paradise
UM66T**19**	For Elise
UM66T**32**	Waltz
UM66T**33**	Mary Had a little Lamb
UM66T**34**	The train is Running fast
UM66T**68**	Its a small world

※ Integrated Circuit (IC) : An electronic part that combines (collects) many devices into one chip to perform complex functions.
※ Melody IC : An integrated circuit made to generate Melody signals

[Pictorial diagram]



[Circuit diagram]



Understanding of the circuit

When the 1st lead is connected to ⊖ power and the 2nd lead is connected to ⊕ power, the melody signal is output through the 3rd lead and played through the speaker. It's a simple circuit to understand electronic parts, so the sound is not loud. Connect the transistors you will learn in the next experiment, the sound will be louder.

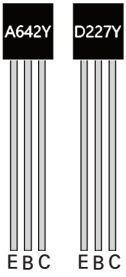
[Experiment]

1. Press the switch (part **A**) to hear a melody.
   -The sound may be less than expected.
2. Change the melody IC (part **B**) to another melody IC and the melody changes.

05_Transistor

By connecting a transistor, you can hear the melody louder.

1.Transistor

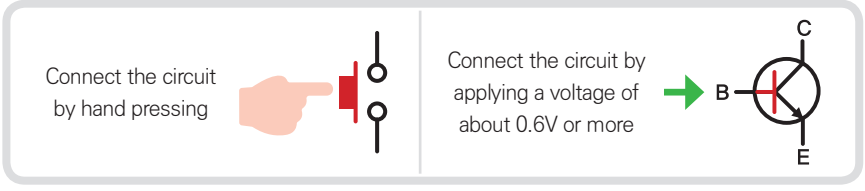


- Transistors are parts to “switch” and “amplify” for electrical signals.
- The name of parts such as A642 and D227 are written on the flat side.
  : The letter of A, B, C, D written on the transistor indicate the type of transistor. A and B are PNP type transistor, C and D are NPN-type transistor.
- Although it is slightly different for each transistor, in general, the first lead from the left is called the emitter (E), the second lead is the base (B), and the third lead is called the collector (C) based on the flat side where the letters are visible.

2. Transistor features

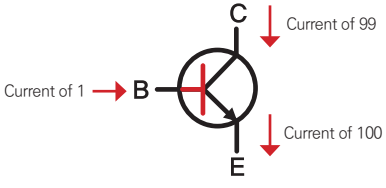
① Switching

Transistors role similar like switches. However, it is not a switch to press directly by hand, but it automatically works according to an electric signal. Applying a voltage of about 0.6~0.7V or more to the base of general transistors has the same effect as pressing a switch.

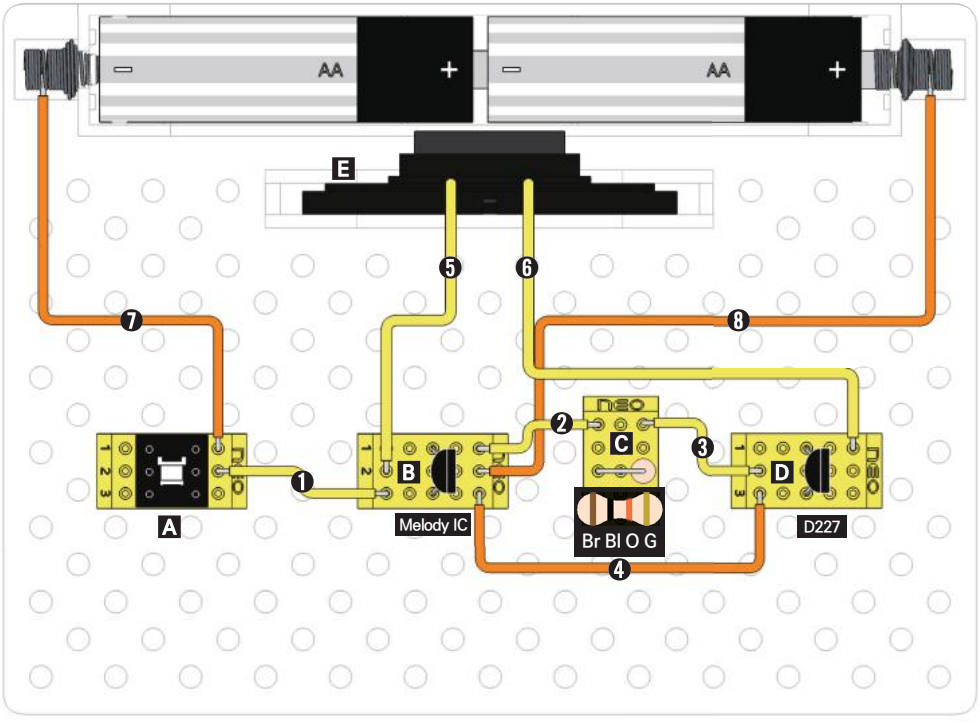


② Amplification

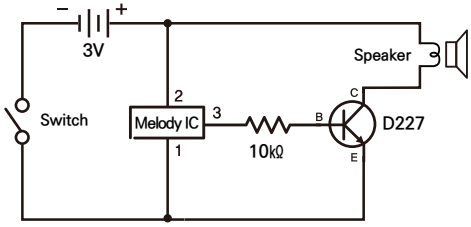
The difference between transistors and general switches is because transistors are used for amplification function of electrical signals. Basically, when a current of 1 is input to the Base (B) of a transistor, current of 99 flows through the Collector (C) and current of 100 flows to the Emitter (E). Using this principle, when a signal such as melodies are input to the Base (B), this is amplified through the Collector (C) output, which is called ‘It was amplified about 100 times by the amplification of the transistor.’



[Pictorial diagram]



[Circuit diagram]



Understanding of the circuit

The sound signal was amplified even more by adding a transistor to the circuit manufactured by '04_Melody IC'. To control the voltage input to the Base(B) of the transistor, a resistor was put between melody IC and transistor.

[Experiment]

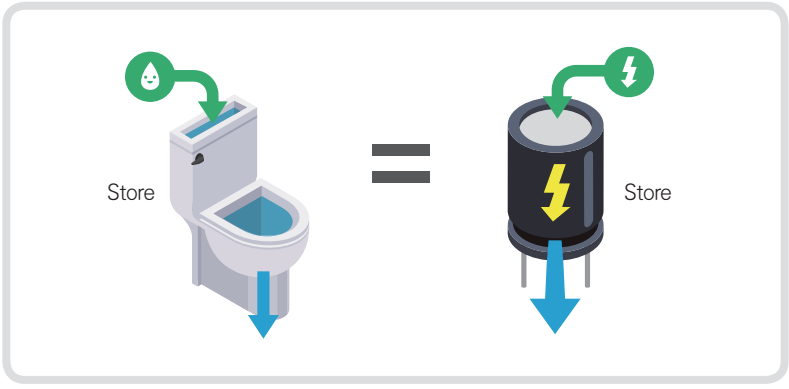
1. Press the switch (part **A**) and you will hear a melody.
   : You can hear that the sound is louder (amplified) compared to '04_melody IC'.

06_Capacitor

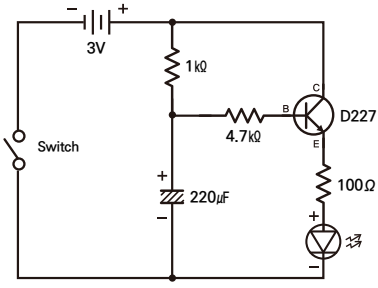
When the power is turned on and off due to the charging and discharging effect of the capacitor, the LED will light on slowly and light off slowly.

1. Capacitor

- It is an electric part can store electricity and send it out at once as like the toilet bowl is storing water in tank and discharges water at once when the lever is pushed.
- The larger the capacity of the capacitor, the more electricity can be stored.



[Circuit diagram]



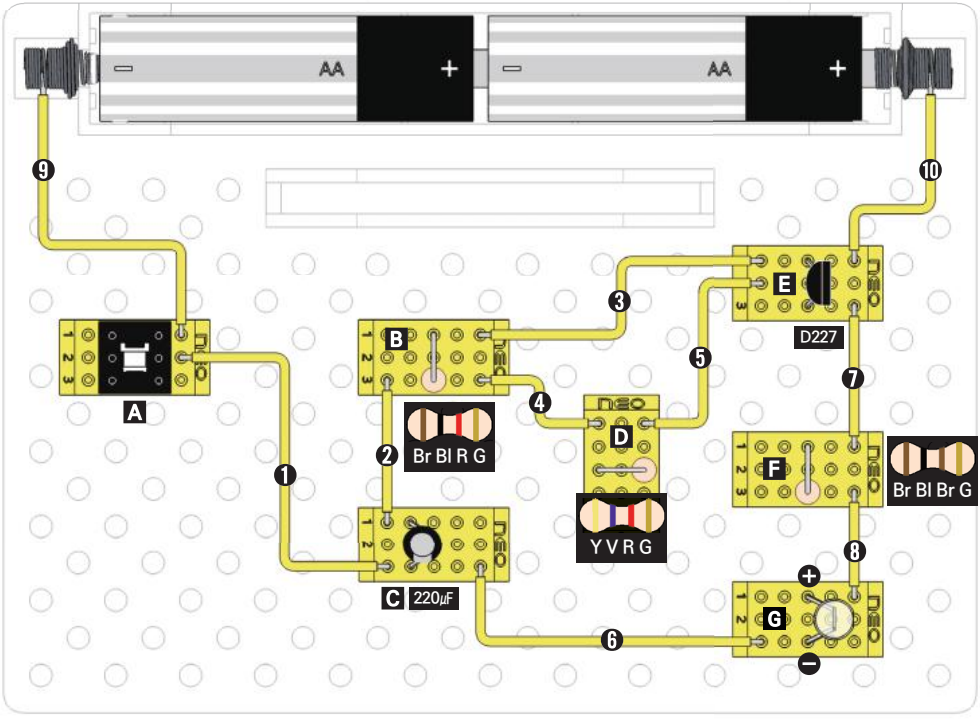
Understanding of the circuit

Let's say that the LED is turned on with brightness of 100% when a current of 1 to flow the Base (B) of the transistor in this circuit. If the switch is turned on without capacitor, the transistor will be switching and the LED will turn on at 100% brightness. However, due to the capacitor, most of the electricity that must be flown to the Base (B) of the transistor is taken away by the capacitor.

When a small amount of electricity (assuming 0.1) not current of 1 is input to the Base (B) when a capacitor is charging, the LED turns on with 10% brightness, and as the capacitor charging, the remaining (or overflowing) electricity increases gradually (0.1~1), and the brightness of the LED becomes brighter accordingly.

When the switch is turned off, the LED turns on with only the electricity that remaining in the capacitor, but the power capacity gradually decreased, the LED will be slowly turned off.

[Pictorial diagram]

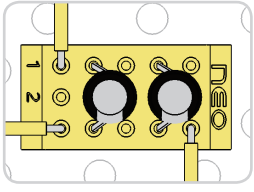


[Experiment]

1. Press the switch (part **A**) to turn the power on and off, and look at the LEDs.
   - The LED turns on and off slowly.

2. Remove the capacitor (part **C**) and turn the power on and off.
   - The LED turns on and off immediately.

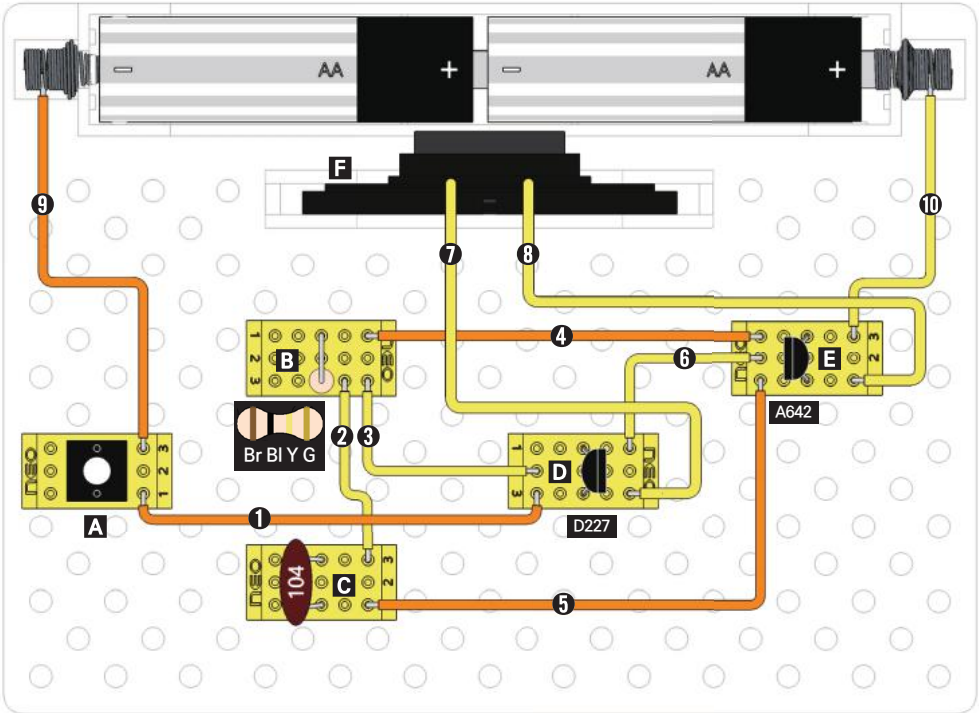
3. Add another capacitor of the same capacity (220μF+220μF=440μF) right next to the capacitor (part **C**) and try to compare the time the LED turns on and off.

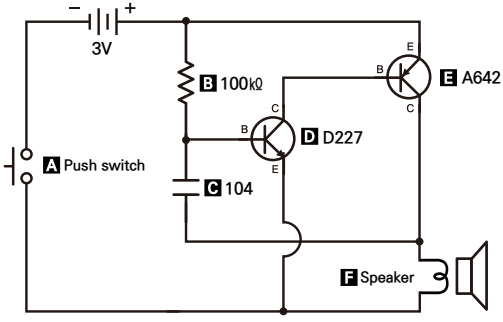


07_Electronic Buzzer

Press the switch, It can make a buzzer sound “Boo~ Boo~”.

[Pictorial diagram and Circuit diagram]

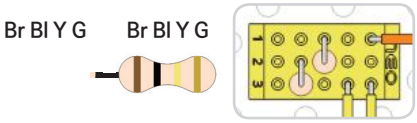




[Experiment]

1. Each time the switch (part **A**) is pressed, a “boo” buzzer sounds.
   – Press repeatedly.

2. Add another 100kΩ of resistor
   (total of 200kΩ) and listen to the sound.



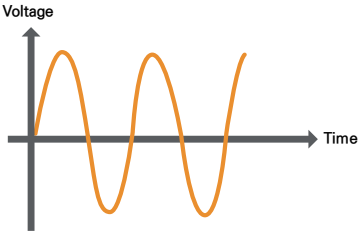
3. Remove the resistor (part **B**), change
   it to 47kΩ, and listen to the sound.

[Understanding of the circuit]

When holding down the switch (part **A**), the signal amplified by two transistors (part **D** & part **E**) is input again to the first transistor (part **D**) through a capacitor (part **C**). The output is repeatedly input again, and makes oscillation (makes vibration), and this oscillated electronic signal is reproduced as sound through the speaker.

[Oscillation circuit]

It is a circuit that generates continuous electric vibration from the power source without being applied by external signals.



– Resonance frequency –

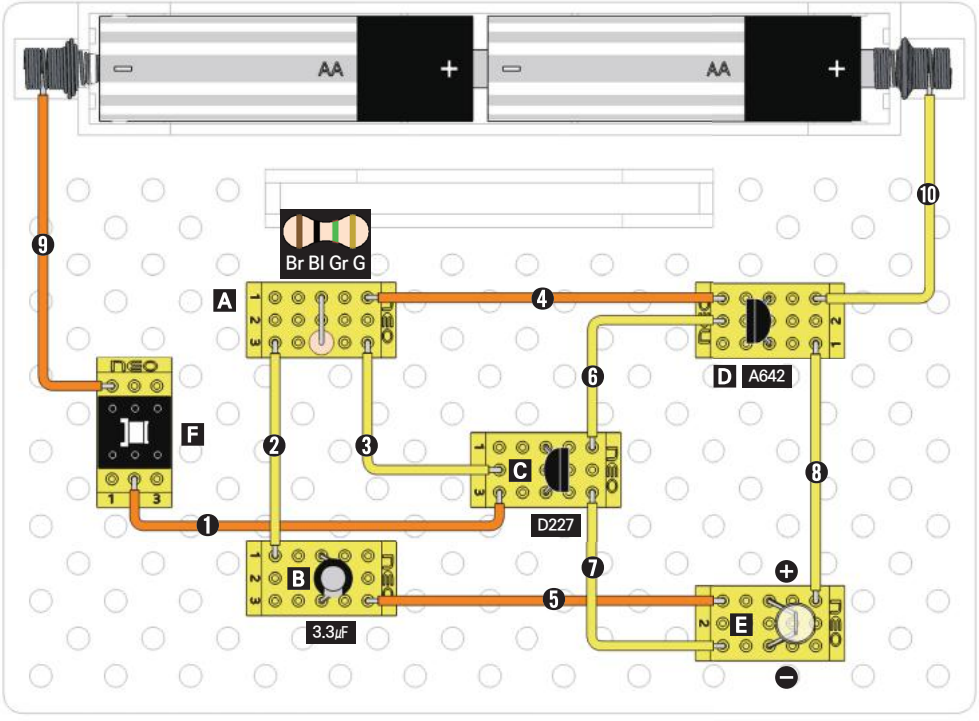
[Oscillation principle]

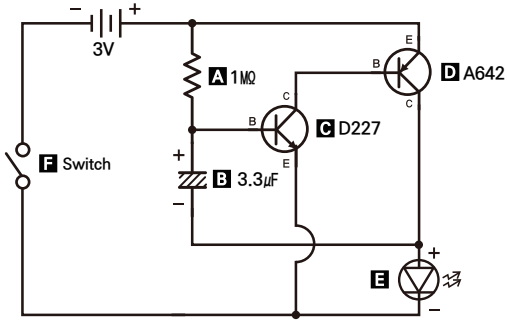
① The power is on, the signal is amplified through the transistor.
② The remain amplified signal is input again to the input side
[part **D** & part **E** (input again to the amplifier circuit)].
③ This input is amplified again and output again.
④ Some part of remain signal from the output is input again to the input side.
(part **D** & part **E**).
⑤ By repeating this action. It can be obtained output of certain frequency continuously.

08_Blinking LED

This is a circuit in which the LED produces a blinking effects.

[Pictorial diagram and Circuit diagram]

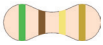




[Experiment]

1. Pressed the switch (part **F**), the LED produces a blinking effect approximately 1 second intervals.
2. When changed the resistor (part **A**) to 510㏀, the interval of the LED blinking is reduced to about 0.5 seconds.

Gr Br Y G

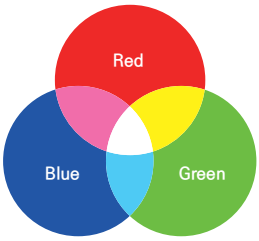


[Understanding of the circuit]

Pressing the switch (part **F**), the output signal of the two connected transistors (part **C** & part **D**) is input again to the first transistor (part **C**) through the capacitor (part **B**). The output is repeatedly input again and make oscillation (makes vibration), and the light blinks approximately 1 second intervals whenever the oscillated electronic signal passing the LED.

[LED lighting]

Creating white light with LEDs, the three primary colors of lights which are red, green, and blue LEDs are required. The red LED was first developed in the US in 1964, and green LED was developed five years later, but the development of blue LED was not easy. Then, in 1991, three Japanese physics professors developed a blue LED using gallium nitrate.They won the Nobel Prize for inventing an effective blue LED which can be possible to produce a bright and energy-saving type of white light source. The screens of TVs, monitors, and cellphones next to us are also implemented with LEDs.



The primary colors of lights

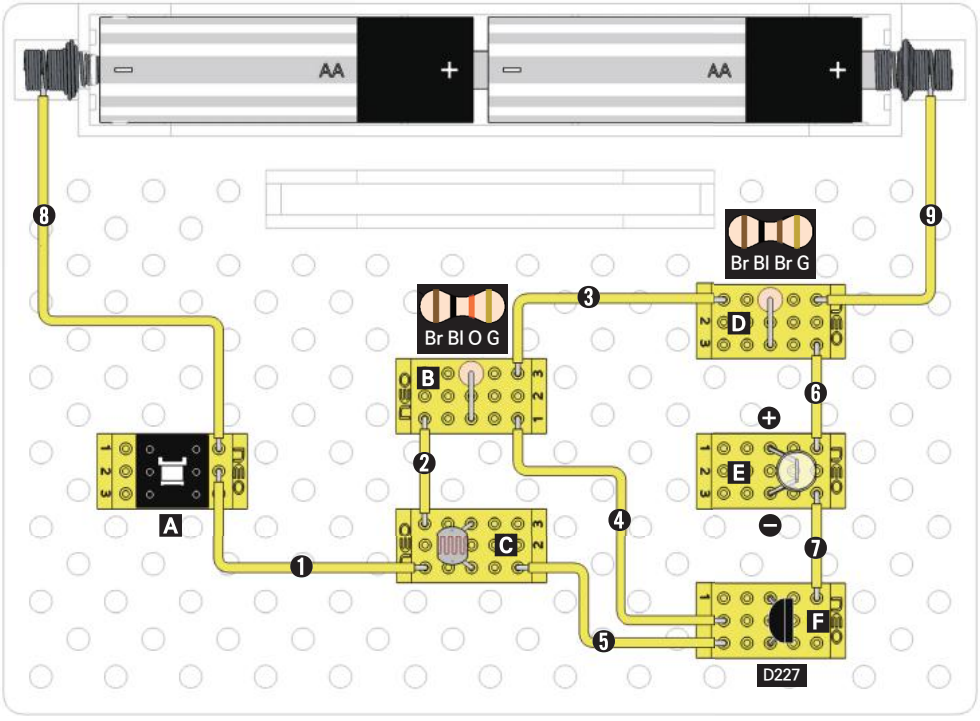
Lighting by the era

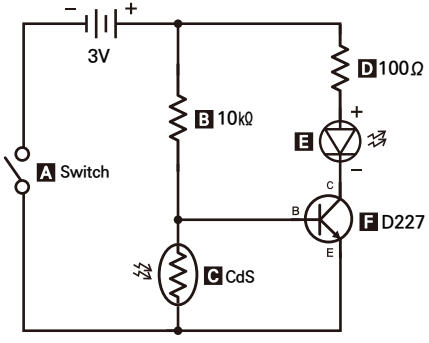
	19C	20C	21C
			
	Incandescent lamp	Fluorescent lamp	White LED
Brightness efficiency	16㏐/w	70㏐/w	300㏐/w
Lighting life	About 1,000hours	About 10,000hours	About 100,000hours

09_Sensing Lighting

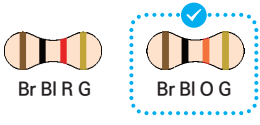
The LED turns on when the surroundings are dark, and turns off when it is bright.

[Pictorial diagram and Circuit diagram]





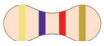
B Do not confusing!



[Experiment]

1. Press the switch (part **A**) to turn on the power.
2. Block the CdS (part **C**) by hand and watch the LED change.
   - When blocking the CdS with your hand, you must be wrapped it to block the light where it enters from all place as like the top, bottom, left, and right.
   - The effect is better if you make a test after putting it inside of your clothes or in a completely dark place.
3. The LED may turn on immediately in a slightly dark place.
   - Try changing the resistor (part **B**) to 47kΩ in dark places.

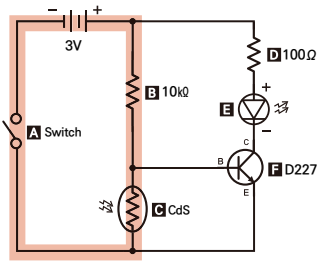
YVOG



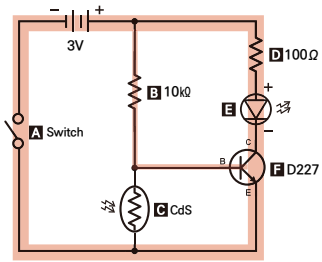
[Understanding of the circuit]

To turn on the LED (part **E**), the transistor must be operated by flowing current into the base of the transistor (part **F**). However, when the surroundings are bright, the resistance of CdS (part **C**) decreases much, so all current flows toward CdS. So the transistor can't switching and the LED does not light up.

When the surroundings get dark, the resistance of CdS (part **C**) increases much, so current flows into the base of the transistor (part **F**). After that, the LED turns on as the main current flow is changed through the switching action of the transistor.



Current flow when
the surroundings are bright

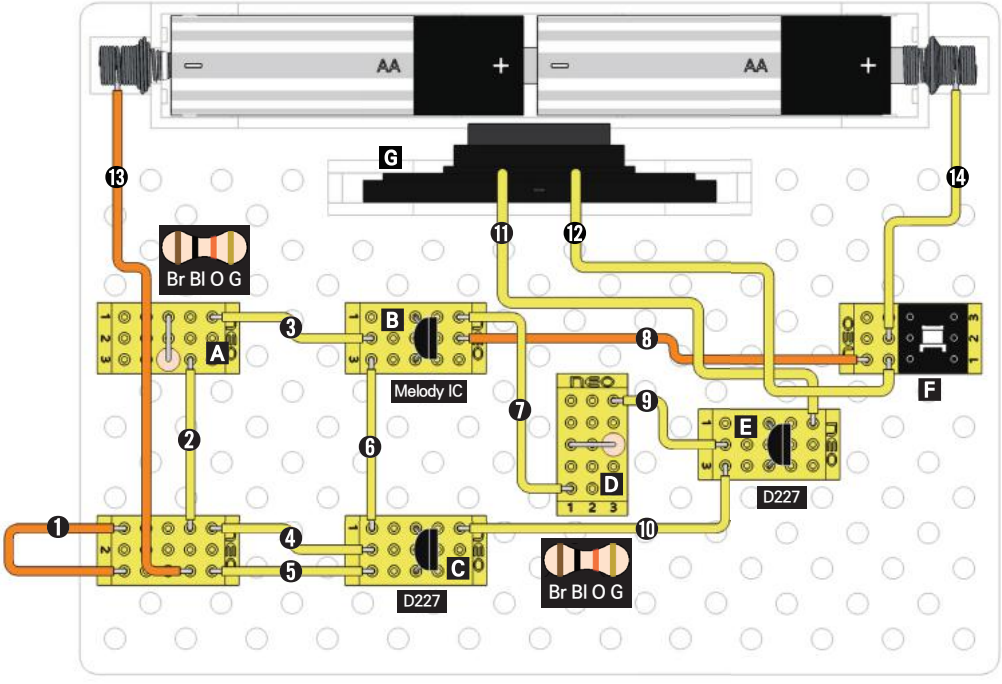


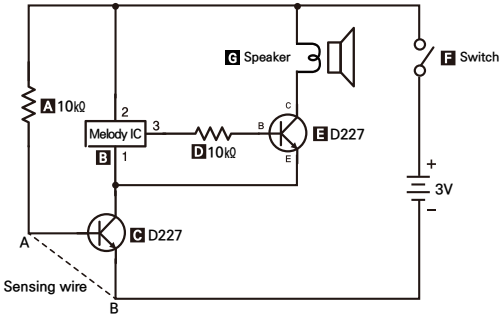
Current flow when
the surroundings are dark

10_Burglar Alarm

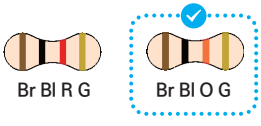
An alarm sounds when the sensing wire connected to the circuit is disconnected.

[Pictorial diagram and Circuit diagram]





A D Distinguish it well against Br Bl R G



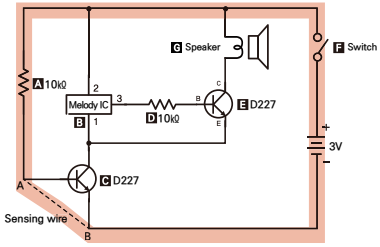
[Experiment]

1. Press the switch (part F) to turn on the power.
2. Assuming that the sensing wire (wire ❶) is attached to the door or drawer.
   – Fix the door or drawer with a scotch tape and connect it to the sensing wire.
3. When the sensing wire (wire ❶) is disconnected (one or both of them are disconnected from the circuit), the alarm becomes sound.

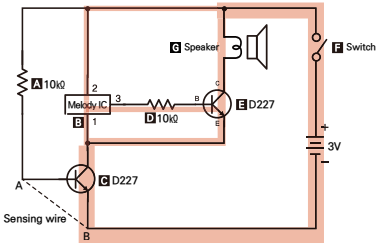
* The melody sound does not seem to be suitable for using as an alarm sound, but it is composed of a minimum circuit for understanding the principle.

[Understanding of the circuit]

If the sensing wire is connected, most of the current will be flown as shown on the left below.
The sound does not play because a current to the melody IC (part B) and speaker (part G) did not flow.



Current flow when the sensing wire is connected



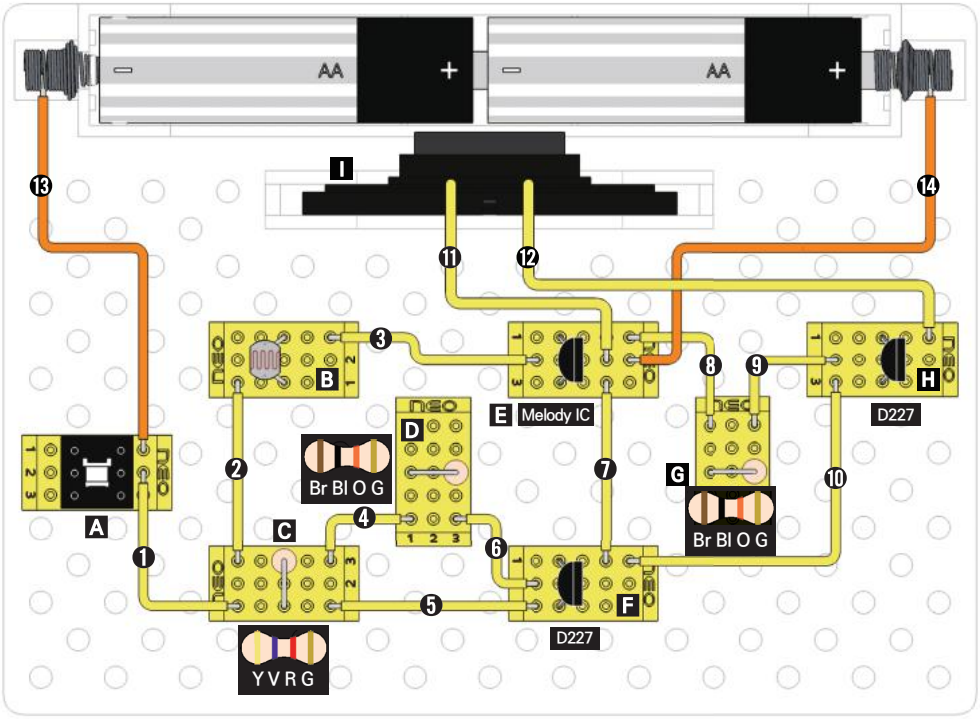
Flow of 'main current' when the sensing wire is disconnected

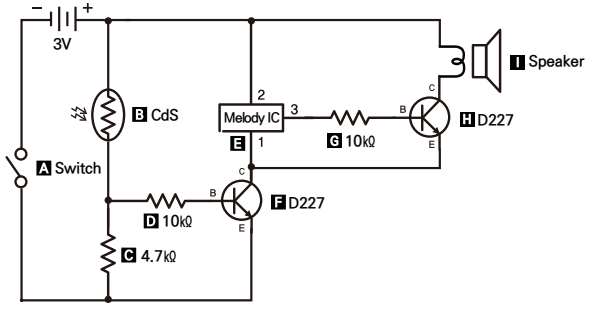
Assuming the condition that the sensing wire is fixed on the door, if the door opened, and the sensing wire (wire ❶) is extracted from the block, the transistor (part C) connected together operates to flow current to the 1st and 2nd lead of the melody IC (part B) This is a principle that the signal is output to 3rd lead and then the transistor (part E) connected to the speaker operates and the melody is played in the speaker.

11_ Auto Alarm

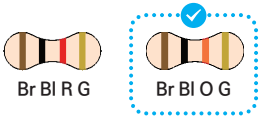
When the surroundings become bright (in the morning), the alarm sounds.

[Pictorial diagram and Circit diagram]





D G Distinguish it well against Br Bl R G



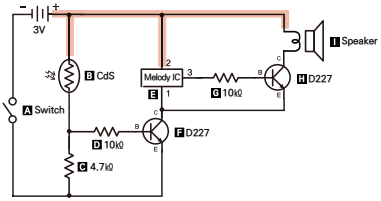
[Experiment]

* Do not turn on the switch first.

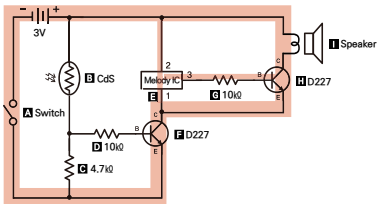
1. Block the CdS (part **B**) by hand to create a dark environment like a night.
   - When blocking the CdS with your hand, you must be wrapped it to block the light where it enters from all place as like the top, bottom, left, and right.
   - The effect is better if you make a test by putting it inside your clothes or in a completely dark place.
2. Press the switch (part **A**) to turn on the power.
3. Remove your hand from CdS to create a morning environment.
   - Check whether the alarm is ringing or not.
4. To turn off the alarm, press the switch to turn off the circuit.

[Understanding of the circuit]

To play the melody in the speaker, the signal from the 3rd lead of the Melody IC (part **E**) must be input to the speaker (part **I**).



The picture that the flow of current is blocking when the surroundings are dark



Flow of **"Main current"** when the surroundings are bright

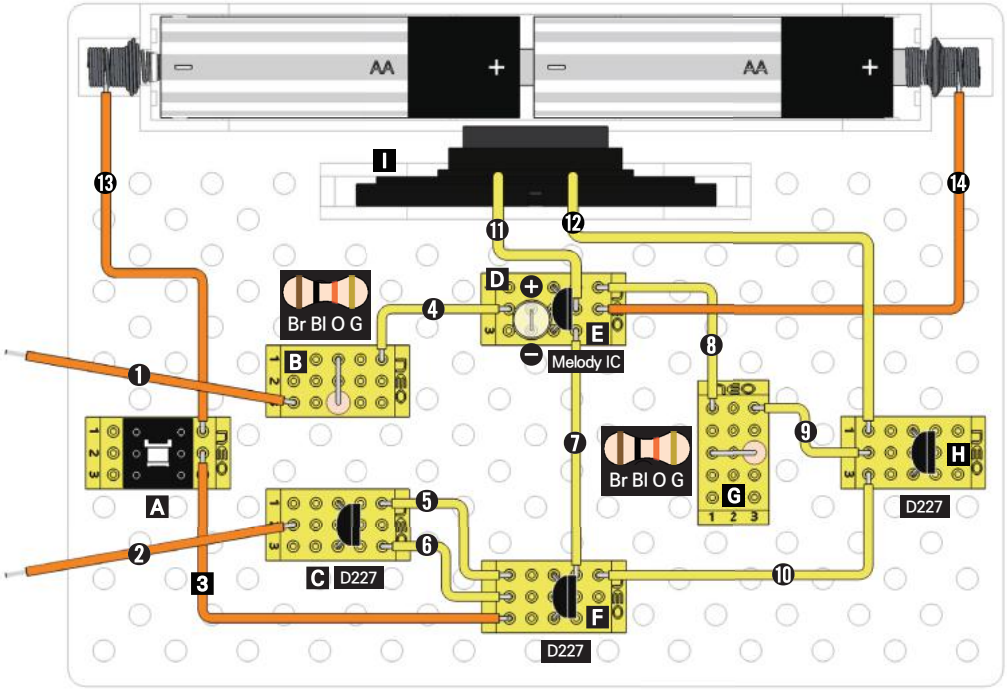
In order for the sound signal to be output through 3rd lead of the Melody IC (part **E**), the transistor (part **F**) located below must be switching but if the surroundings is dark, the current cannot flow because the resistance of the CdS (part **B**) is very high. (Left picture)

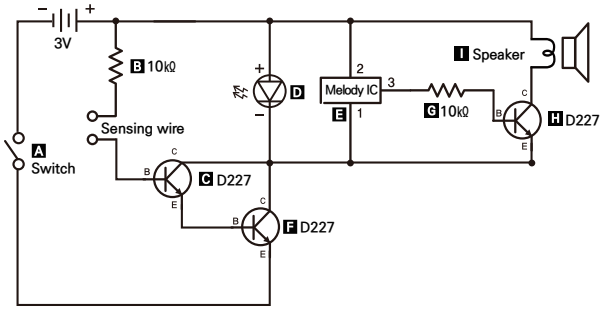
When the surroundings is bright, the transistor (part **F**) switches, and current flows to the melody IC and the speaker to play an alarm. A transistor (part **H**) connected to the speaker side was used to amplify the melody signal and play a louder. (Right picture)

12_Love Chain

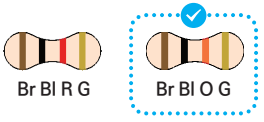
When holding the sensing wire with your hand, the melody is played.

[Pictorial diagram and Circuit diagram]

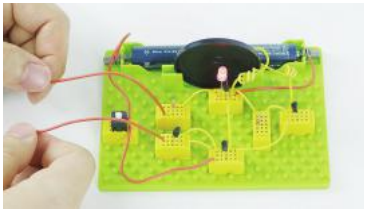




B **G** Distinguish it well against Br Bl R G



[Experiment]



1. Press the switch (part A) to turn on the power.
2. Try to operate the circuit by holding both sensing wires (wire ❶ and wire ❷) with your left and right hand.
   - The sound is louder when you hold it tightly.
3. Even if several people hold hands and the people at both ends hold each sensing line, a melody sounds.
   - Try to see how many people will be needed until the circuit stops to work.
   - Likewise, the tighter you hold hands, the better the effect.

* Reference

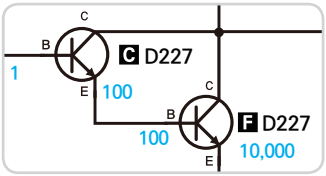
- When the sensing wires (wire ❶ & wire ❷) touch each other, the circuit works naturally.
- People with dry hands may not work well.It becomes better effect if your hands are moisture a little.
- It can be used as a water level detector that an alarm when the water reaches a certain level.
- It can be used to detect the proper amount of moisture of the flowerpot by installing it on a flowerpot that should not be watered much.

[Understanding of the circuit]

In the human body, a minute current flows even at low voltage. When touching the ⊕ and ⊖ pole of the battery, we can't feel anything but in fact, a minute current flows through our body. 'Love chain' is a circuit that uses this point.

A minute current flows even when touching the battery

It uses the principles of the transistor's amplification to use a very fine-flowing current. One transistor is said to have a 100 times amplification effect in theory, but using two transistors will amplify about 10,000 times. Since then, please refer to the switching principle of the transistor as seen in the previous experiment (Lecture 10 & 11) for the principle of operation of the LED, melody IC, and speaker.

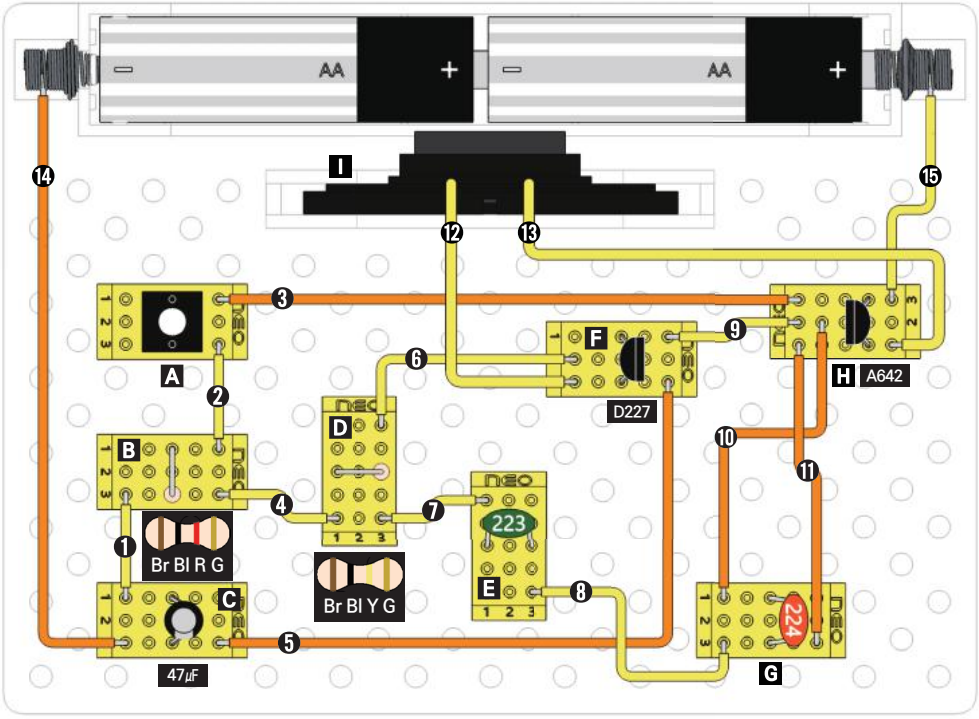


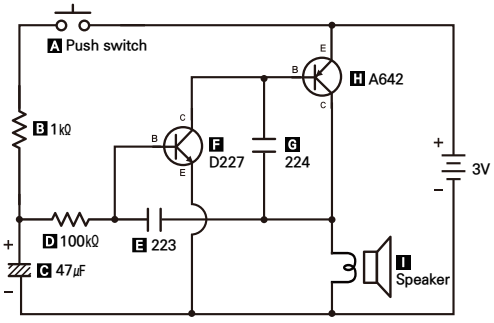
Darlington circuit

13_Electronic Siren

Pressing the switch makes a sound, and releasing it, the sound changes to create a siren effect.

[Pictorial diagram and circuit diagram]





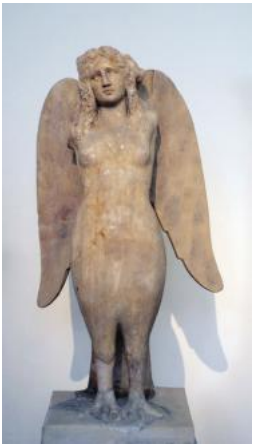
[Experiment]

1. Try to create a siren sound by pressing and releasing the switch (part **A**).
2. Try to create sound by extracting the capacitor (part **E**) and changing it to 0.22μF(104) capacitor.
3. Try to create sound by changing the capacitor (part **C**) to 3.3μF(224).

[Understanding the circuit]

Oscillation becomes through a process that the output of the left transistor (part **F**) is input to the right transistor (part **H**), and the output of the right transistor (part **H**) is input again to the left transistor (part **F**) via the capacitor 223 (part **E**).
This is a circuit that reproduces the oscillated sound when the speaker (part **I**) is connected where the collector (C) of part **H** and part **G** meet. The electrolytic capacitor (part **C**) in the lower left is charged and discharged while pressing & releasing the push switch (part **A**), and it has a role to control the time that the sound tone becomes higher or lower.

[Siren?]

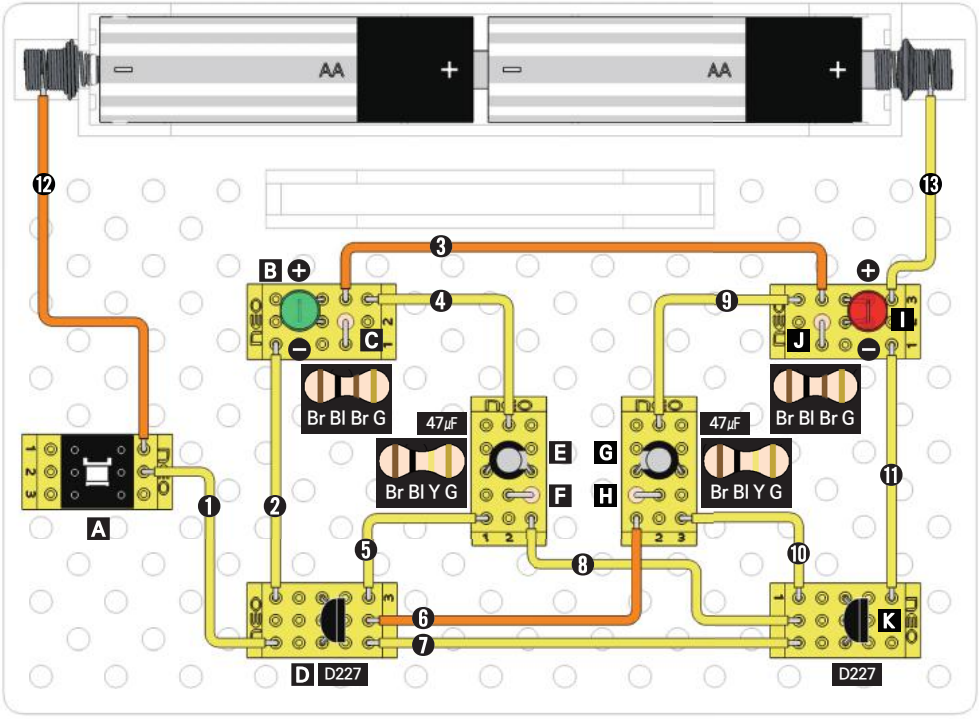


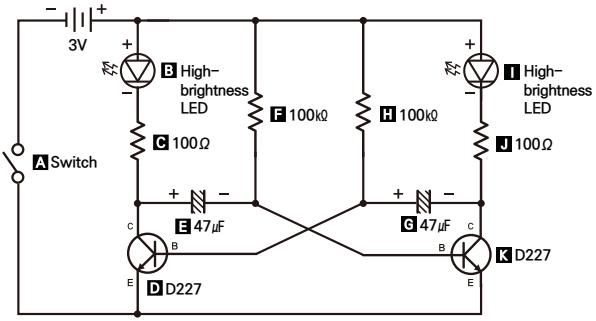
'Siren' is originally the name of a witch in Greek mythology. The siren, whose body is half bird and half human, lured sailors with a beautiful song and wrecked the ship.
As it is today, the siren which is an alarm system produced a sound of a constant pitch is originated by the inventor C.C. Tour of France named it siren in 1819. Based on the idea that a witch named Siren in Greek mythology put people in danger with sound, and it named a siren that alarm system that alerts people of danger by sound. Now, it is widely known as a word referring to an alarm device rather than a mythical character.

14_Electronic Blinker

The two LEDs blinking alternately.

[Pictorial diagram and Circuit diagram]



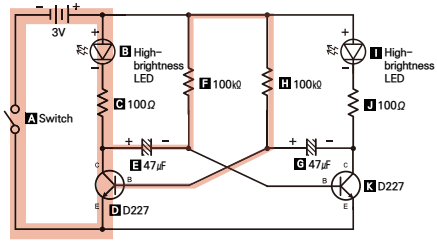


[Experiment]

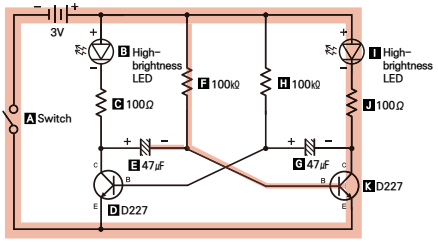
1. Press the switch (part **A**) to turn on the power.
2. Try to extract the capacitor (part **E** & part **G**) and change it to a capacitor with a 3.3μF capacity.
3. Try to extract the capacitor (part **E** & part **G**) and change it to a capacitor with a 220μF capacity.

[Understanding of the circuit]

This is a circuit in which the LED blinks alternately due to the charging and discharging of the capacitor and the switching operation of the transistor.
LED, transistors and capacitor are arranged in two groups (part **B** **D** **G** & part **I** **K** **E**) on the left and right. Assuming that the left LED (part **B**)is turned on first, While the left capacitor (part **E**) is charging, because there is no current flowing to the base of the right transistor (part **K**) and the transistor is not operating (switching), so the right LED (part **I**) does not turn on.



Current flow chart when the left capacitor is charging



Current flow chart when the left capacitor is discharging

When the left capacitor (part **E**) discharges, the right transistor (part **K**) is switching and the right LED (part **I**) turns on. Repeat this process, alternating left and right groups.
If the capacity of the capacitor (part **E** & part **G**) is changed to 3.3μF, the charging and discharging time is faster because the capacity is decreases, so the blinking speed of the LED is also faster.
If the capacity of the capacitor (part **E** & part **G**) is changed to 220μF, the charging and discharging time is slower because the capacity is increases, so the blinking speed of the LED is also slower.

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