

# Lesson 6 Buzzer

## Introduction

In this lesson, we will learn how to drive an active buzzer to beep with a PNP transistor.

## Components

- 1 \* Raspberry Pi
- 1 \* Breadboard
- 1 \* Buzzer (Active)
- 1 \* PNP transistor (8550)
- 1 \* Resistor (1K $\Omega$ )
- Jumper wires
- 1 \* T-Extension Board
- 1 \* 40-Pin GPIO Cable

## Principle

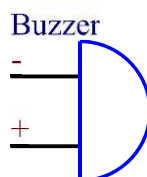
### Buzzer

As a type of electronic buzzer with integrated structure, buzzers, which are supplied by DC power, are widely used in computers, printers, photocopiers, alarms and other electronic products for voice devices. Buzzers can be categorized as active and passive ones (see the following picture). Turn the pins of two buzzers face up, and the one with a green circuit board is a passive buzzer, while the other enclosed with a black tape is an active one.



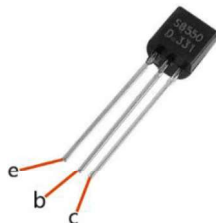
The difference between an active buzzer and a passive buzzer is: An active buzzer has a built-in oscillating source, so it will make sounds when electrified. But a passive buzzer does not have such source, so it will not beep if DC signals are used; instead, you need to use square waves whose frequency is between 2K and 5K to drive it. The active buzzer is often more expensive than the passive one because of multiple built-in oscillating circuits.

The following is the electrical symbol of a buzzer. It has two pins with positive and negative poles. With a + in the surface represents the anode and the other is the cathode.



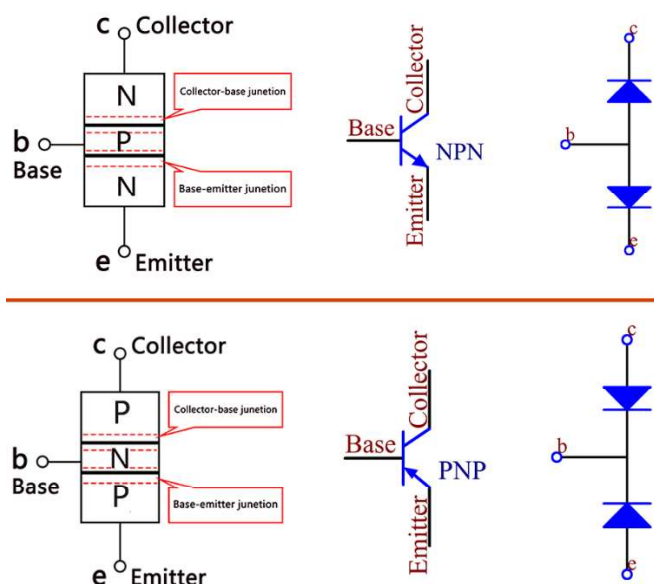
You can check the pins of the buzzer, the longer one is the anode and the shorter one is the cathode. Please don't mix them up when connecting, otherwise the buzzer will not make sound.

## Transistor



The transistor is a semiconductor device that controls current by current. It functions by amplifying weak signal to larger amplitude signal and is also used as a non-contact switch. A transistor is a three-layer structure composed of P-type or N-type semiconductors. They form the three regions internally. The thinner in the middle is the base region; the other two are all N-type or P-type ones – the smaller region with intense majority carriers is the emitter region, when the other one is the collector region. This composition enables the transistor to be an amplifier.

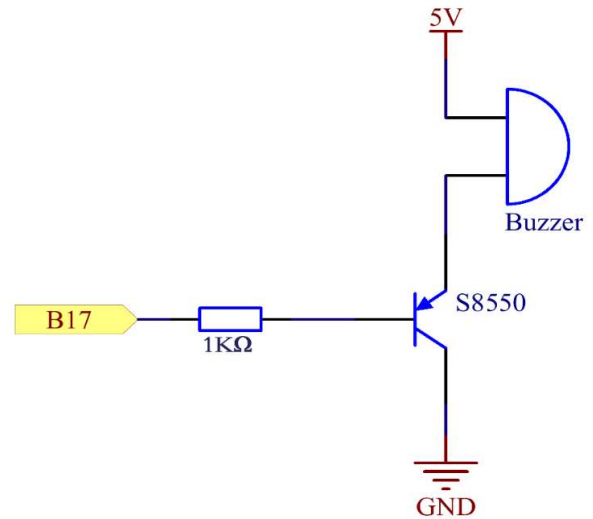
From these three regions, three poles are generated respectively, which are base (b), emitter (e), and collector (c). They form two P-N junctions, namely, the emitter junction and collection junction. The arrow in the circuit symbol indicates the direction of emitter junction. Transistors can be divided into two kinds: the NPN and PNP one. The former is made of two N-type semiconductors and one P-type and that the latter is the opposite. See the figure below.



When a High level signal goes through an NPN transistor, it is energized. But a PNP one needs a Low level signal to manage it. Both types of transistor are frequently used for contactless switches, just like in this experiment.

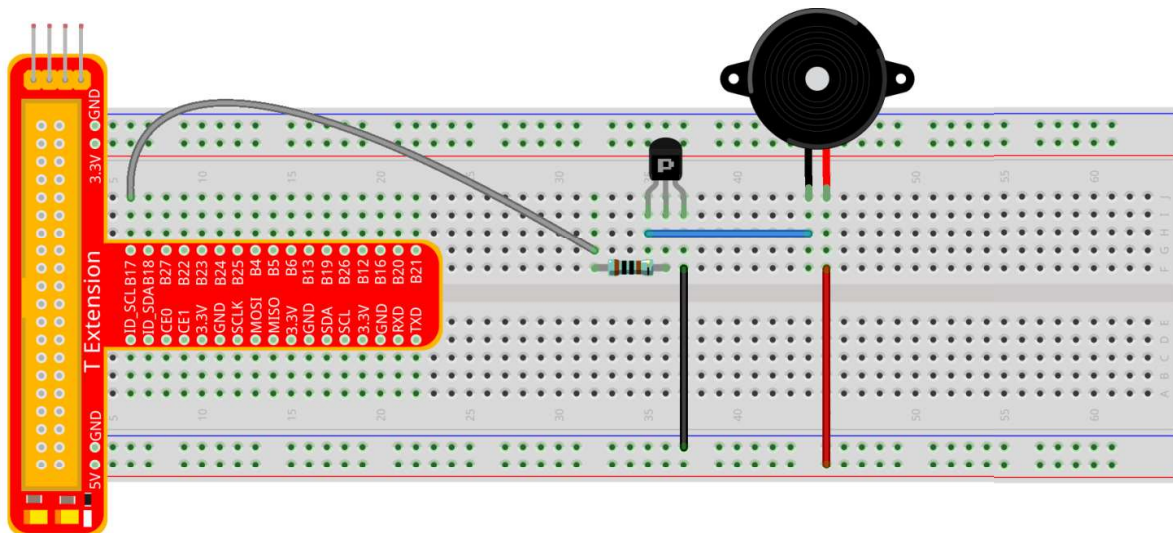
The schematic diagram:

**Principle:** In this experiment, an active buzzer, a PNP transistor and a 1k resistor are used between the base of the transistor and GPIO to protect the transistor. When the B17 of Raspberry Pi output is supplied with low level (0V) by programming, the transistor will conduct because of current saturation and the buzzer will make sounds. But when high level is supplied to the IO of Raspberry Pi, the transistor will be cut off and the buzzer will not make sounds.



## Experimental Procedures

**Step 1:** Build the circuit (Pay attention to poles of the buzzer: The one with + label is the positive pole and the other is the negative.)



**For C language users:**

**Step 2:** Open the code file

```
cd /home/pi/SunFounder_Super_Kit_V3.0_for_Raspberry_Pi/C
```

**Step 3:** Compile the Code

```
make 06_beep
```

**Step 4:** Run the executable file above.

```
sudo ./06_beep
```

## Code Explanation

```
digitalWrite(BeepPin, LOW); // We use an active buzzer in this experiment, so it will
make sound automatically when connecting to the direct current. This sketch is to set
the I/O port as low level (0V), thus to manage the transistor and make the buzzer beep.
digitalWrite(BeepPin, HIGH); // To set the I/O port as high level(5V), thus the
transistor is not energized and the buzzer doesn't beep.
```

### For Python users:

**Step 2:** Open the code file

```
cd /home/pi/SunFounder_Super_Kit_V3.0_for_Raspberry_Pi/Python
```

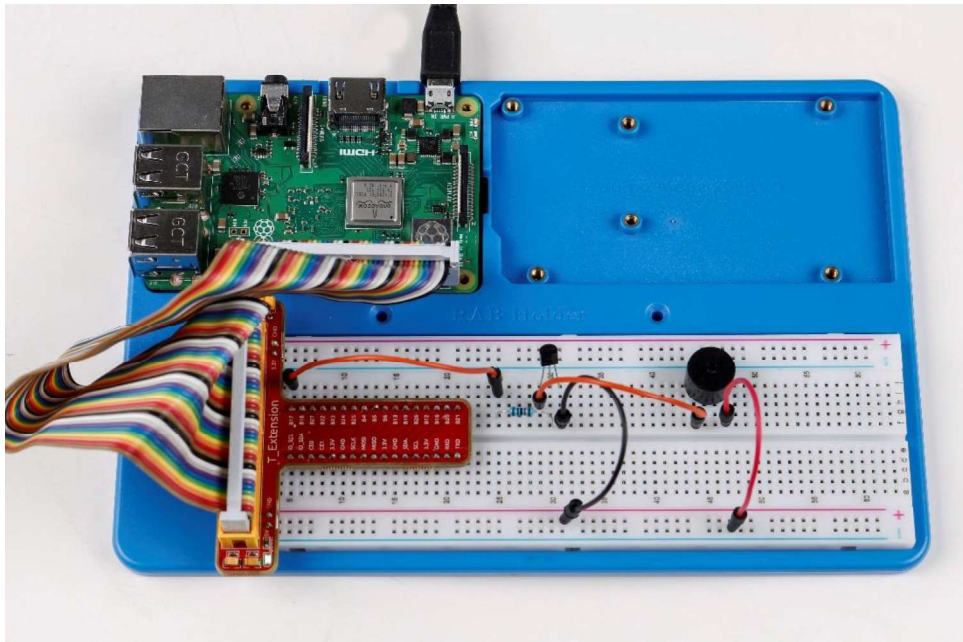
**Step 3:** Run

```
sudo python 06_bEEP.py
```

### Code Explanation

```
GPIO.output(BeepPin, GPIO.LOW)# Set the buzzer pin as low level.
time.sleep(0.1)# Wait for 0.1 second. Change the switching frequency by changing this
parameter. Note: Not the sound frequency. Active Buzzer cannot change sound frequency.
GPIO.output(BeepPin, GPIO.HIGH) # close the buzzer
time.sleep(0.1)
```

Now, you should hear the buzzer make sounds.



### Further Exploration

If you have a passive buzzer in hand, you can replace the active buzzer with it. Now you can make a buzzer sound like “do re mi fa so la si do” with just some basic knowledge of programming. Give a try!