

# Lesson 8 4N35

## Introduction

The 4N35 is an optocoupler for general purpose application. It consists of gallium arsenide infrared LED and a silicon NPN phototransistor. When the input signal is applied to the LED in the input terminal, the LED lights up. After receiving the light signal, the light receiver then converts it into electrical signal and outputs the signal directly or after amplifying it into a standard digital level. Thus, the transition and transmission of electricity-light-electricity is completed. Since light is the media of the transmission, meaning the input terminal and the output one are isolated electrically, this process is also be known as electrical isolation.

## Components

- 1 \* Raspberry Pi
- 1 \* 4N35
- 1 \* LED
- 1 \* 220 Ohm Resistor
- 1\* 1k Ohm Resistor
- Some jump wires
- 1 \* T-Extension Board
- 1 \* 40-Pin GPIO Cable

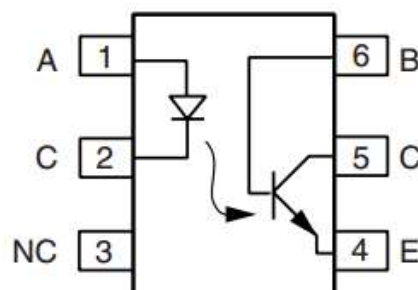
## Principle

### 4N35



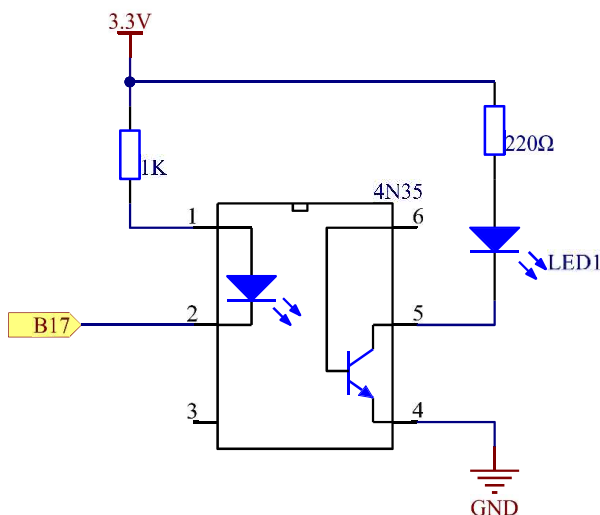
The 4N35 is an optocoupler for general purpose application. It consists of gallium arsenide infrared LED and a silicon NPN phototransistor.

What an optocoupler does is to break the connection between signal source and signal receiver, so as to stop electrical interference. In other words, it is used to prevent interference from external electrical signals. 4N35 can be used in AV conversion audio circuits. Broadly it is widely used in electrical insulation for a general optocoupler.



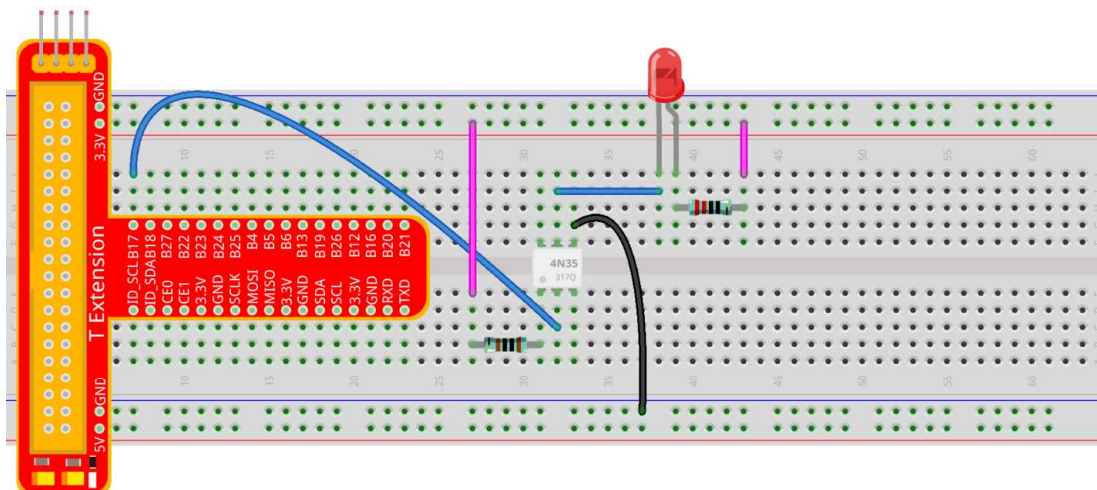
See the internal structure of 4N35 above. Pin 1 and 2 are connected to an infrared LED. When the LED is electrified, it'll emit infrared rays. To protect the LED from burning, usually a resistor (about 1K) is connected to pin 1. Then the NPN phototransistor is power on when receiving the rays. This can be done to control the load connected to the phototransistor. Even when the load short circuit occurs, it won't affect the control board, thus realizing good electrical isolation.

The schematic diagram:



**Principle:** In this experiment, use an LED as the load connected to the NPN phototransistor. Connect pin 2 of 4N35 to pin B17, pin 1 connects a 1K current-limiting resistor and then a 3.3V. Connect pin 4 to GND, and pin 5 to the cathode of the LED. Then hook the anode of the LED to 3.3V after connecting with a 220 Ohm resistor. When in program, a LOW level is given to pin B17, the infrared LED will emit infrared rays. Then the phototransistor receives infrared rays and gets electrified, and the LED cathode is LOW, thus turning on the LED. Also you can control the LED by circuits only – connect pin 2 to ground and it will brighten.

**Step 1:** Build the circuit



## 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 08_4N35
```

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

```
sudo ./08_4N35
```

## Code Explanation

```
digitalWrite(_4N35Pin, LOW); // set the I/O port as low level (0V), thus the optocoupler
is energized, and the pin connected to LED conducts to the 0V. Then the LED lights up.
delay(500); // optocoupler is a kind of electronic device and there is no limitation on
its on-off frequency.
digitalWrite(_4N35Pin, HIGH); // set I/O port as high level (3.3V), thus the optocoupler
is not energized ,and the pin connected to LED cannot conduct to the 0V. Then the LED
goes out.
```

## For Python users:

**Step 2:** Open the code file

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

**Step 3:** Run

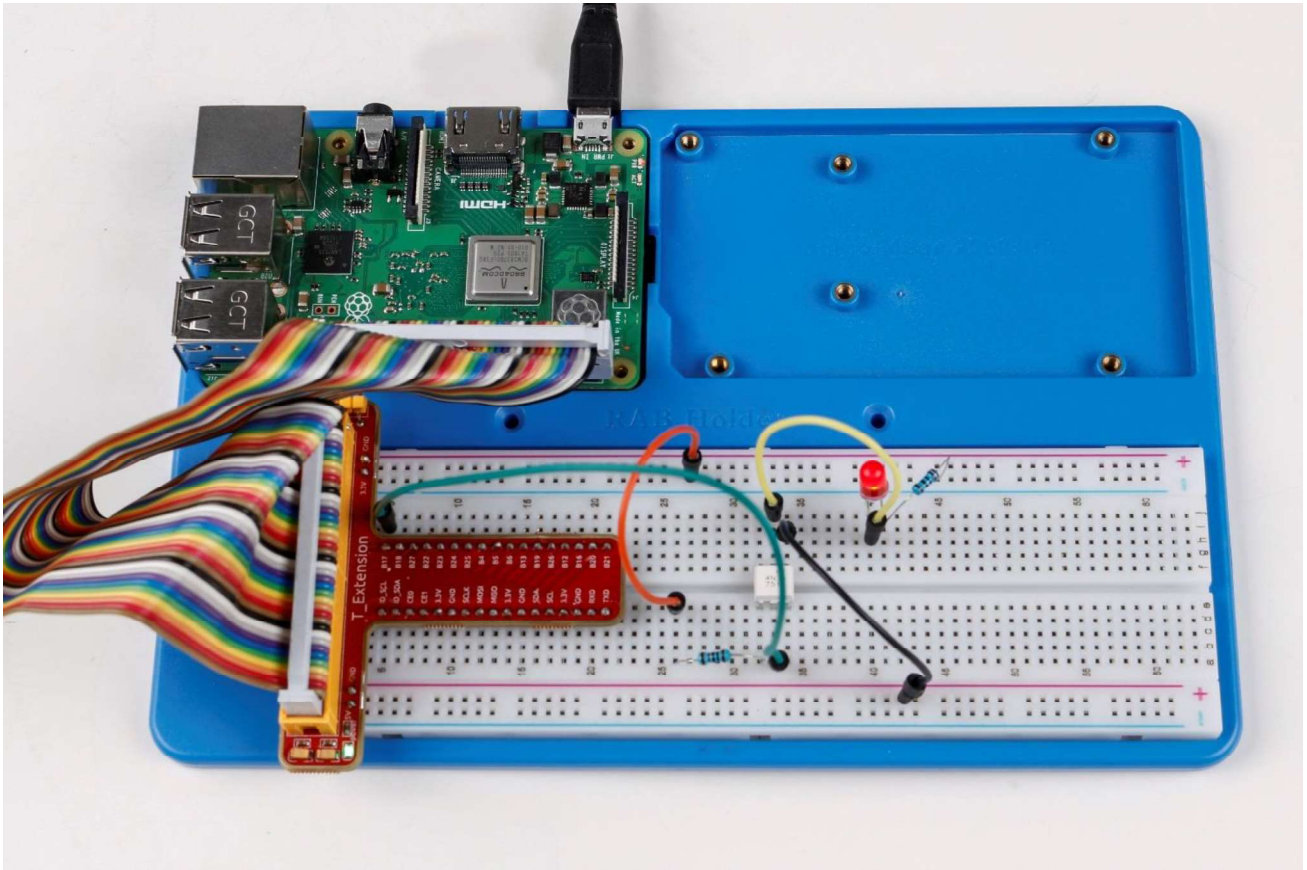
```
sudo python 08_4N35.py
```

## Code Explanation

```
GPIO.output(Pin_4N35, GPIO.LOW) # set the pins of optocoupler as low level, thus the
optocoupler is energized, and the pin connected to LED conducts to the 0V.Then the LED
lights up.

time.sleep(0.5) #wait for 0.5 second. The on-off frequency of the
optocoupler can be changed by modifying this parameter.
GPIO.output(Pin_4N35, GPIO.HIGH) # set the pins of optocoupler as high level, thus the
optocoupler is disconnected, and the pin connected to LED break the connection to the
0V. Then the LED goes out.
time.sleep(0.5)
```

You will see the LED blinks.



## Exploration

4N35 is an optocoupler that usually used for driving relay as well as motor circuits. As there is no direct connection between the input and output, even if a short circuit at the output end occurs, the control board will not be burnt. Have a try!