



# Grove - Chainable RGB LED User Manual

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Wiki: [http://www.seeedstudio.com/wiki/index.php?title=Twig\\_-\\_Chainable\\_RGB\\_LED](http://www.seeedstudio.com/wiki/index.php?title=Twig_-_Chainable_RGB_LED)

Bazaar: [http://www.seeedstudio.com/depot/Grove-Chainable-RGB-LED-p-850.html?cPath=81\\_35](http://www.seeedstudio.com/depot/Grove-Chainable-RGB-LED-p-850.html?cPath=81_35)

## Document Revision History

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Revision	Date	Author	Description
1.0	Sep 22, 2015	Loovee	Create file

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## 1. Introduction

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Chainable RGB LED is based on P9813 chip which is a full-color light source LED driver chip, and can provide constant current drive and modulated output of 256 gray. Transmission by wire (DATA and CLK), built-in recycling, can enhance the transmission distance.



## 2. Specification

---

- Operating Voltage: 5V
- Operating Current: 20mA
- Communication Protocol: Serial

## 3. Usage

---

### 3.1 With Arduino

When you get Grove - Chainable RGB LED, you may think how I can light up it. Now we will show you this demo: all colors of RGB cycles in a uniform way.

The hardware installation like this:

#### Picture

To complete this demo, you can use one or more Grove - Chainable RGB LED. Note that the IN interface of one Grove - Chainable RGB LED should be connect to D7/D8 of [Grove - Base Shield](#) and its OUT interface connect to IN interface of another Grove - Chainable RGB LED, chainable more LED in this way. [Jasa seo](#), [Jasa seo jakarta](#).

- Download [Chainable LED Library](#) and install it to Arduino Library. There is the course about [how to install Arduino Library](#) in wiki page.
- Open the example CycleThroughColors by the path:File->Examples->ChainableLED\_master and upload it to Seeeduino.

```
/*
 * Example of using the ChainableRGB library for controlling a Grove RGB.
 * This code cycles through all the colors in an uniform way. This is accomplished using a HSB color
 * space.
 */
#include <ChainableLED.h>

#define NUM_LEDS 5

ChainableLED leds(7, 8, NUM_LEDS);

void setup()
{
}

float hue = 0.0;
boolean up = true;

void loop()
```

```
{
  for (byte i=0; i<NUM_LEDS; i++)
    leds.setColorHSB(i, hue, 1.0, 0.5);

  delay(50);

  if (up)
    hue+= 0.025;
  else
    hue-= 0.025;

  if (hue>=1.0 && up)
    up = false;
  else if (hue<=0.0 && !up)
    up = true;
}
```

You can observe this scene: colors of two LED will gradient consistently.

### ***Extend application:***

Based on [Chainable LED Library](#), we have designed this demo: RGB color varies with the temperature measured by Grove - temperature. The RGB color vary from green to red when the temperature is from 25 to 32. The test code is shown below. Do it if you are interested in it.

```
// demo of temperature -> rgbLED
// temperature form 25 - 32, rgbLed from green -> red
// Grove-temperature plu to A0
// LED plug to D7,D8

#include <Streaming.h>
#include <ChainableLED.h>

#define TEMPUP 32
#define TEMPDOWN 25

ChainableLED leds(7, 8, 1); // connect to pin7 and pin8 , one led

int getAnalog() // get value from A0
{
  int sum = 0;
  for(int i=0; i<32; i++)
  {
    sum += analogRead(A0);
  }
}
```



```

    return sum>>5;
}

float getTemp() // get temperature
{
    float temperature = 0.0;
    float resistance = 0.0;
    int B = 3975; //B value of the thermistor

    int a = getAnalog();

    resistance = (float)(1023-a)*10000/a; //get the resistance of the sensor;
    temperature = 1/(log(resistance/10000)/B+1/298.15)-273.15; //convert to temperature via
datasheet ;
    return temperature;
}

void ledLight(int dta) // light led
{

    dta = dta/4; // 0 - 255

    int colorR = dta;
    int colorG = 255-dta;
    int colorB = 0;

    leds.setColorRGB(0, colorR, colorG, colorB);
}

void setup()
{
    Serial.begin(38400);
    cout << "hello world !" << endl;
}

void loop()
{
    float temp = getTemp();
    int nTemp = temp*100;

    nTemp = nTemp > TEMPUP*100 ? TEMPUP*100 : (nTemp < TEMPDOWN*100 ? TEMPDOWN*100 : nTemp);
    nTemp = map(nTemp, TEMPDOWN*100, TEMPUP*100, 0, 1023);
    ledLight(nTemp);
}

```

```
    delay(100);  
}
```

## 3.2 With Raspberry Pi

1. You should have got a raspberry pi and a grovepi or grovepi+.
2. You should have completed configuring the development enviroment, otherwise follow [here](#).

### 3. Connection

- Plug the sensor to grovepi socket D7 by using a grove cable.

### 4. Navigate to the demos' directory:

```
cd yourpath/GrovePi/Software/Python/
```

- To see the code

```
nano grove_chainable_rgb_led.py  # "Ctrl+x" to exit #  
import time  
import grovepi  
  
# Connect first LED in Chainable RGB LED chain to digital port D7  
# In: CI,DI,VCC,GND  
# Out: CO,DO,VCC,GND  
pin = 7  
  
# I have 10 LEDs connected in series with the first connected to the GrovePi and the last not  
connected  
# First LED input socket connected to GrovePi, output socket connected to second LED input and so on  
numleds = 1  
  
grovepi.pinMode(pin,"OUTPUT")  
time.sleep(1)  
  
# Chainable RGB LED methods  
# grovepi.storeColor(red, green, blue)  
# grovepi.chainableRgblEd_init(pin, numLeds)  
# grovepi.chainableRgblEd_test(pin, numLeds, testColor)  
# grovepi.chainableRgblEd_pattern(pin, pattern, whichLed)  
# grovepi.chainableRgblEd_modulo(pin, offset, divisor)  
# grovepi.chainableRgblEd_setLevel(pin, level, reverse)
```

```
# test colors used in grovepi.chainableRgbLed_test()
testColorBlack = 0    # 0b000 #000000
testColorBlue = 1     # 0b001 #0000FF
testColorGreen = 2    # 0b010 #00FF00
testColorCyan = 3     # 0b011 #00FFFF
testColorRed = 4      # 0b100 #FF0000
testColorMagenta = 5  # 0b101 #FF00FF
testColorYellow = 6   # 0b110 #FFFF00
testColorWhite = 7    # 0b111 #FFFFFF

# patterns used in grovepi.chainableRgbLed_pattern()
thisLedOnly = 0
allLedsExceptThis = 1
thisLedAndInwards = 2
thisLedAndOutwards = 3

try:

    print "Test 1) Initialise"

    # init chain of leds
    grovepi.chainableRgbLed_init(pin, numleds)
    time.sleep(.5)

    # change color to green
    grovepi.storeColor(0,255,0)
    time.sleep(.5)

    # set led 1 to green
    grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 0)
    time.sleep(.5)

    # change color to red
    grovepi.storeColor(255,0,0)
    time.sleep(.5)

    # set led 10 to red
    grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 9)
    time.sleep(.5)

    # pause so you can see what happened
    time.sleep(2)
```

```
# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 2a) Test Patterns - black"

# test pattern 0 - black (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(1)

print "Test 2b) Test Patterns - blue"

# test pattern 1 blue
grovepi.chainableRgbLed_test(pin, numleds, testColorBlue)
time.sleep(1)

print "Test 2c) Test Patterns - green"

# test pattern 2 green
grovepi.chainableRgbLed_test(pin, numleds, testColorGreen)
time.sleep(1)

print "Test 2d) Test Patterns - cyan"

# test pattern 3 cyan
grovepi.chainableRgbLed_test(pin, numleds, testColorCyan)
time.sleep(1)

print "Test 2e) Test Patterns - red"

# test pattern 4 red
grovepi.chainableRgbLed_test(pin, numleds, testColorRed)
time.sleep(1)

print "Test 2f) Test Patterns - magenta"

# test pattern 5 magenta
grovepi.chainableRgbLed_test(pin, numleds, testColorMagenta)
```

```
time.sleep(1)

print "Test 2g) Test Patterns - yellow"

# test pattern 6 yellow
grovepi.chainableRgbLed_test(pin, numleds, testColorYellow)
time.sleep(1)

print "Test 2h) Test Patterns - white"

# test pattern 7 white
grovepi.chainableRgbLed_test(pin, numleds, testColorWhite)
time.sleep(1)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 3a) Set using pattern - this led only"

# change color to red
grovepi.storeColor(255, 0, 0)
time.sleep(.5)

# set led 3 to red
grovepi.chainableRgbLed_pattern(pin, thisLedOnly, 2)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 3b) Set using pattern - all leds except this"
```

```
# change color to blue
grovepi.storeColor(0,0,255)
time.sleep(.5)

# set all leds except for 3 to blue
grovepi.chainableRgbLed_pattern(pin, allLedsExceptThis, 3)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 3c) Set using pattern - this led and inwards"

# change color to green
grovepi.storeColor(0,255,0)
time.sleep(.5)

# set leds 1-3 to green
grovepi.chainableRgbLed_pattern(pin, thisLedAndInwards, 2)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 3d) Set using pattern - this led and outwards"

# change color to green
grovepi.storeColor(0,255,0)
time.sleep(.5)

# set leds 7-10 to green
grovepi.chainableRgbLed_pattern(pin, thisLedAndOutwards, 6)
time.sleep(.5)
```

```
# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 4a) Set using modulo - all leds"

# change color to black (fully off)
grovepi.storeColor(0,0,0)
time.sleep(.5)

# set all leds black
# offset 0 means start at first led
# divisor 1 means every led
grovepi.chainableRgbLed_modulo(pin, 0, 1)
time.sleep(.5)

# change color to white (fully on)
grovepi.storeColor(255,255,255)
time.sleep(.5)

# set all leds white
grovepi.chainableRgbLed_modulo(pin, 0, 1)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 4b) Set using modulo - every 2"

# change color to red
grovepi.storeColor(255,0,0)
time.sleep(.5)

# set every 2nd led to red
```

```
grovepi.chainableRgbLed_modulo(pin, 0, 2)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

print "Test 4c) Set using modulo - every 2, offset 1"

# change color to green
grovepi.storeColor(0,255,0)
time.sleep(.5)

# set every 2nd led to green, offset 1
grovepi.chainableRgbLed_modulo(pin, 1, 2)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 4d) Set using modulo - every 3, offset 0"

# change color to red
grovepi.storeColor(255,0,0)
time.sleep(.5)

# set every 3nd led to red
grovepi.chainableRgbLed_modulo(pin, 0, 3)
time.sleep(.5)

# change color to green
grovepi.storeColor(0,255,0)
time.sleep(.5)

# set every 3nd led to green, offset 1
grovepi.chainableRgbLed_modulo(pin, 1, 3)
time.sleep(.5)

# change color to blue
```



```
grovepi.storeColor(0,0,255)
time.sleep(.5)

# set every 3nd led to blue, offset 2
grovepi.chainableRgbLed_modulo(pin, 2, 3)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 4e) Set using modulo - every 3, offset 1"

# change color to yellow
grovepi.storeColor(255,255,0)
time.sleep(.5)

# set every 4nd led to yellow
grovepi.chainableRgbLed_modulo(pin, 1, 3)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

print "Test 4f) Set using modulo - every 3, offset 2"

# change color to magenta
grovepi.storeColor(255,0,255)
time.sleep(.5)

# set every 4nd led to magenta
grovepi.chainableRgbLed_modulo(pin, 2, 3)
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
```

```

time.sleep(.5)

print "Test 5a) Set level 6"

# change color to green
grovepi.storeColor(0,255,0)
time.sleep(.5)

# set leds 1-6 to green
grovepi.write_i2c_block(0x04,[95,pin,6,0])
time.sleep(.5)

# pause so you can see what happened
time.sleep(2)

# reset (all off)
grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
time.sleep(.5)

print "Test 5b) Set level 7 - reverse"

# change color to red
grovepi.storeColor(255,0,0)
time.sleep(.5)

# set leds 4-10 to red
grovepi.write_i2c_block(0x04,[95,pin,7,1])
time.sleep(.5)

except KeyboardInterrupt:
    # reset (all off)
    grovepi.chainableRgbLed_test(pin, numleds, testColorBlack)
    break
except IOError:
    print "Error"

```

- Notice that there's something you have to concern of:

```

pin = 7          #setting up the output pin
numleds = 1      #how many leds you plug

```

- Also all methods you can see in grovepi.py is:

```
storeColor(red, green, blue)
chainableRgbLed_init(pin, numLeds)
chainableRgbLed_test(pin, numLeds, testColor)
chainableRgbLed_pattern(pin, pattern, whichLed)
chainableRgbLed_modulo(pin, offset, divisor)
chainableRgbLed_setLevel(pin, level, reverse)
```

5. Run the demo.

```
sudo python grove_chainable_rgb_led.py
```

6. This demo may not work if your grovepi doesn't have the newest firmware, update the firmware.

```
cd yourpath/GrovePi/Firmware
sudo ./firmware_update.sh
```

### 3.3 With Beaglebone Green

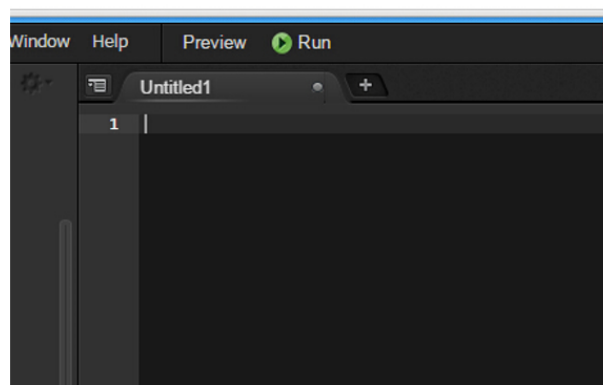
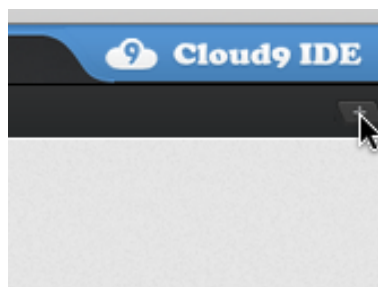
To begin editing programs that live on BBG, you can use the Cloud9 IDE.

As a simple exercise to become familiar with Cloud9 IDE, creating a simple application to blink one of the 4 user programmable LEDs on the BeagleBone is a good start.

If this is your first time to use Cloud9 IDE, please follow this [link](#).

**Step1:** Set the Grove - UART socket as a Grove - GPIO Socket, just follow this [link](#).

**Step2:** Click the "+" in the top-right to create a new file.



### Step3: Copy and paste the following code into the new tab

```
import time
import Adafruit_BBIO.GPIO as GPIO

CLK_PIN = "P9_22"
DATA_PIN = "P9_21"
NUMBER_OF_LEDS = 1

class ChainableLED():
    def __init__(self, clk_pin, data_pin, number_of_leds):
        self.__clk_pin = clk_pin
        self.__data_pin = data_pin
        self.__number_of_leds = number_of_leds

        GPIO.setup(self.__clk_pin, GPIO.OUT)
        GPIO.setup(self.__data_pin, GPIO.OUT)

        for i in range(self.__number_of_leds):
            self.setColorRGB(i, 0, 0, 0)

    def clk(self):
        GPIO.output(self.__clk_pin, GPIO.LOW)
        time.sleep(0.00002)
        GPIO.output(self.__clk_pin, GPIO.HIGH)
        time.sleep(0.00002)

    def sendByte(self, b):
        "Send one bit at a time, starting with the MSB"
        for i in range(8):
            # If MSB is 1, write one and clock it, else write 0 and clock
            if (b & 0x80) != 0:
                GPIO.output(self.__data_pin, GPIO.HIGH)
            else:
                GPIO.output(self.__data_pin, GPIO.LOW)
            self.clk()

            # Advance to the next bit to send
            b = b << 1

    def sendColor(self, red, green, blue):
        "Start by sending a byte with the format '1 1 /B7 /B6 /G7 /G6 /R7 /R6' "
        #prefix = B11000000
        prefix = 0xC0
```

```

    if (blue & 0x80) == 0:
        #prefix |= B00100000
        prefix |= 0x20
    if (blue & 0x40) == 0:
        #prefix |= B00010000
        prefix |= 0x10
    if (green & 0x80) == 0:
        #prefix |= B00001000
        prefix |= 0x08
    if (green & 0x40) == 0:
        #prefix |= B00000100
        prefix |= 0x04
    if (red & 0x80) == 0:
        #prefix |= B00000010
        prefix |= 0x02
    if (red & 0x40) == 0:
        #prefix |= B00000001
        prefix |= 0x01
    self.sendByte(prefix)

    # Now must send the 3 colors
    self.sendByte(blue)
    self.sendByte(green)
    self.sendByte(red)

def setColorRGB(self, led, red, green, blue):
    # Send data frame prefix (32x '0')
    self.sendByte(0x00)
    self.sendByte(0x00)
    self.sendByte(0x00)
    self.sendByte(0x00)

    # Send color data for each one of the leds
    for i in range(self.__number_of_leds):
        ,,,
        if i == led:
            _led_state[i*3 + _CL_RED] = red;
            _led_state[i*3 + _CL_GREEN] = green;
            _led_state[i*3 + _CL_BLUE] = blue;
            sendColor(_led_state[i*3 + _CL_RED],
                      _led_state[i*3 + _CL_GREEN],
                      _led_state[i*3 + _CL_BLUE]);
            ,,,
        self.sendColor(red, green, blue)

```

```

    # Terminate data frame (32x "0")
    self.sendByte(0x00)
    self.sendByte(0x00)
    self.sendByte(0x00)
    self.sendByte(0x00)

# Note: Use P9_22(UART2_RXD) and P9_21(UART2_TXD) as GPIO.
# Connect the Grove - Chainable RGB LED to UART Grove port of Beaglebone Green.
if __name__ == "__main__":
    rgb_led = ChainableLED(CLK_PIN, DATA_PIN, NUMBER_OF_LEDS)

    while True:
        # The first parameter: NUMBER_OF_LEDS - 1; Other parameters: the RGB values.
        rgb_led.setColorRGB(0, 255, 0, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 255, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 0, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 0, 255, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 0, 255)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 255, 0)
        time.sleep(2)
        rgb_led.setColorRGB(0, 255, 255, 255)
        time.sleep(2)

```

**Step4:** Save the file by clicking the disk icon and giving the file a name with the .py extension.

**Step5:** Connect Grove Chainable RGB LED to Grove UART socket on BBG.

**Step6:** Run the code. You'll find the RGB LED is changing color every 2 seconds.

## 4. Resources

---

- [Chainable RGB LED eagle file](#)
- [P9813 datasheet](#)
- [Chainable RGB LED Library for the P9813](#)
- [Github repository for Chainable RGB LED Library \(new\)](#)