Grove - 16 Channel PWM Driver (PCA9685)

The Grove - 16-Channel PWM Driver is based on NXP PCA9685, which is a 16-Channel, 12 bit I2C PWM driver. This board can drive up to 16 servos with the external power supply. You can control this board with Arduino easily via the I2C Grove interface. In addition, you can use this board as a LED controller.

[https://www.seeedstudio.com/Grove-16-Channel-PWM-Driver-(PCA9685)-p-3221.html]

Version

Product Version	Changes	Released Date
Grove - 16-Channel PWM Driver (PCA9685)	Initial	Sep 2018

Feature

- 1 MHz Fast-mode Plus compatible I2C-bus

- 6 hardware address pins allow 62 PCA9685 devices to be connected to the same I2C-bus

- Low standby current

- Noise filter on SDA/SCL inputs

Specification

Item	Value
MCU Operating Voltage	3.3V / 5V
PWM Supply Voltage	2.3V ~ 5.5V
Tolerant Inputs	5.5V
Output Current on pin LEDn	25mA
Ground Supply Current	400mA
Operating temperature	-40 ~ 85℃
Interface	I2C
I2C Address Range	0x40 ~ 0x7f(default)
Size	L: 60mm W: 40mm H: 18mm
Weight	14.3g
Package size	L: 135mm W: 85mm H: 19mm
Gross Weight	21g

Typical applications

- Servos driver
- RGB or RGBA LED driver

Hardware Overview

Pin Out
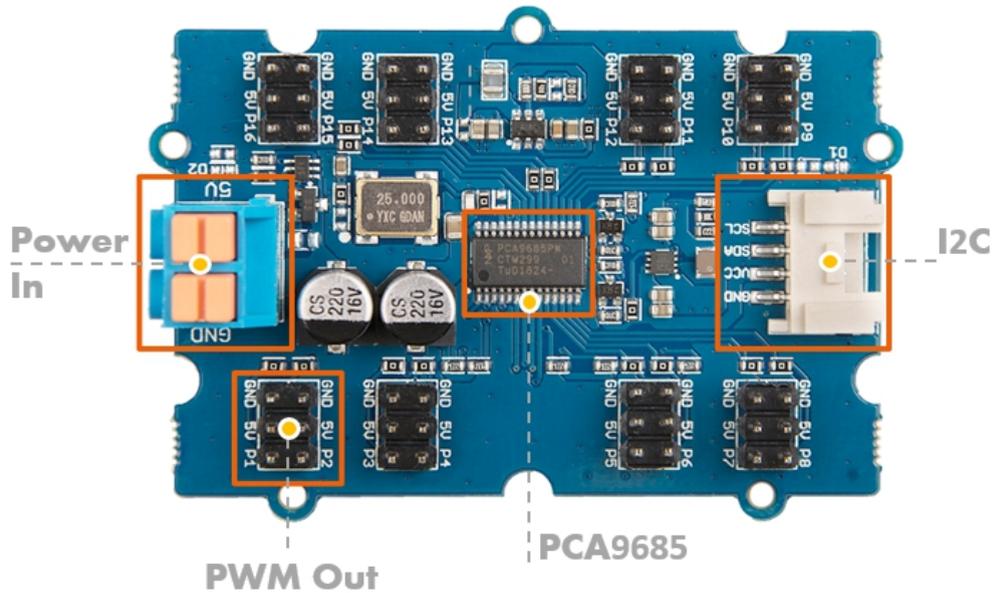
> ⚠️ **Warning**
>
> Hot swap is not supported, you may want to disconnect arduino from the power source before any replacement or change.

Hardware Detail

I2C Interface

This board uses the I2C interface to allow the on-board MCU to communicate with the host computer.

> GND: connect this module to the system GND
> VCC: you can use 5V or 3.3V for this module
> SDA: I2C serial data
> SCL: I2C serial clock
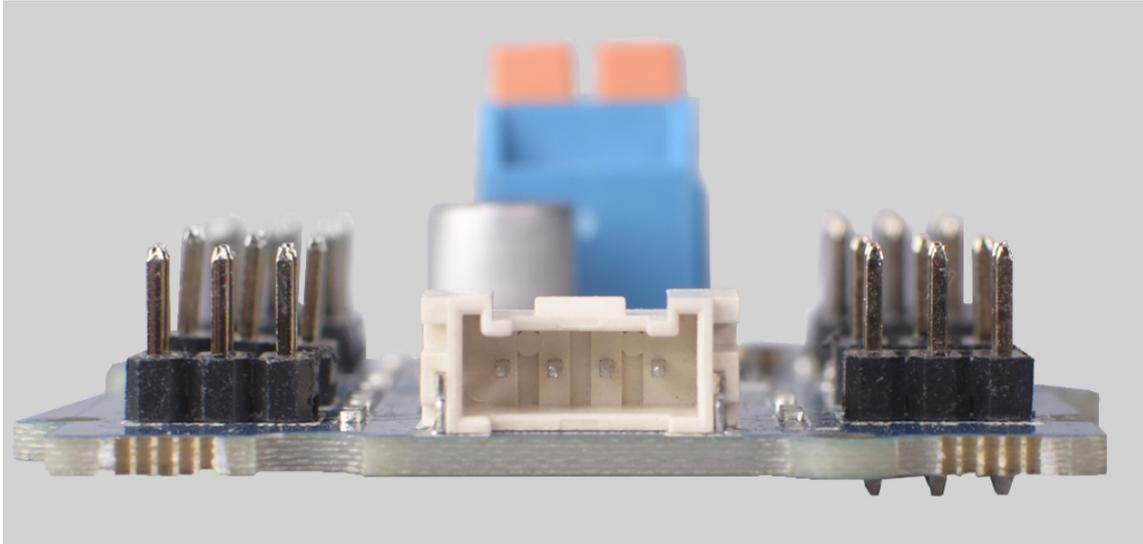
Power In

Provide 5V DC power for the servo.
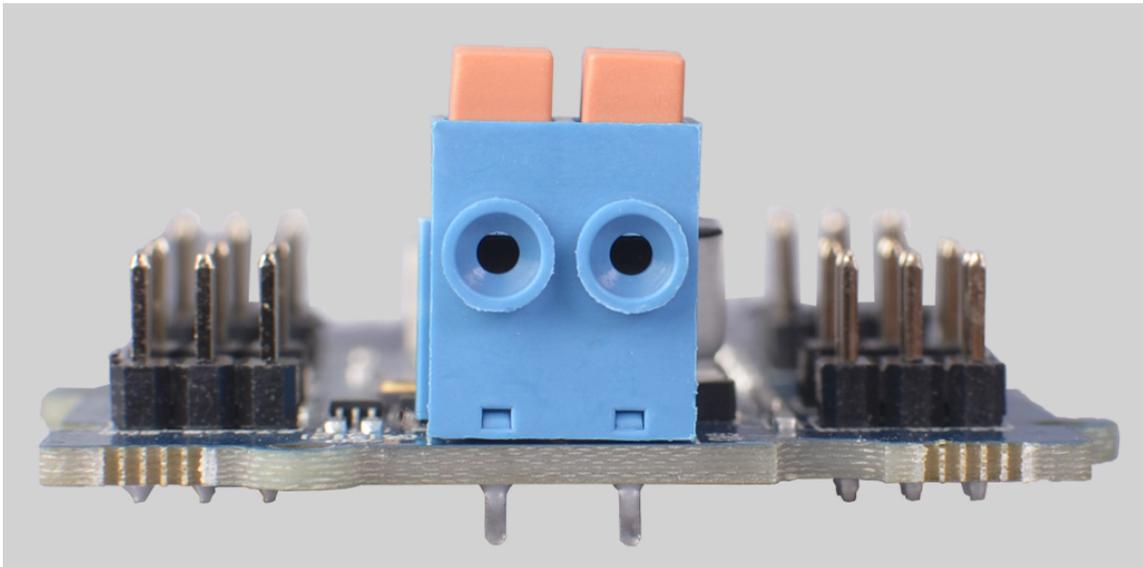
PWM Out

There are 16 groups of Pins(1 - 16) on this board, each group of pins contains one PWM signal pin, one 5V power supply pin and one pin for

ground.
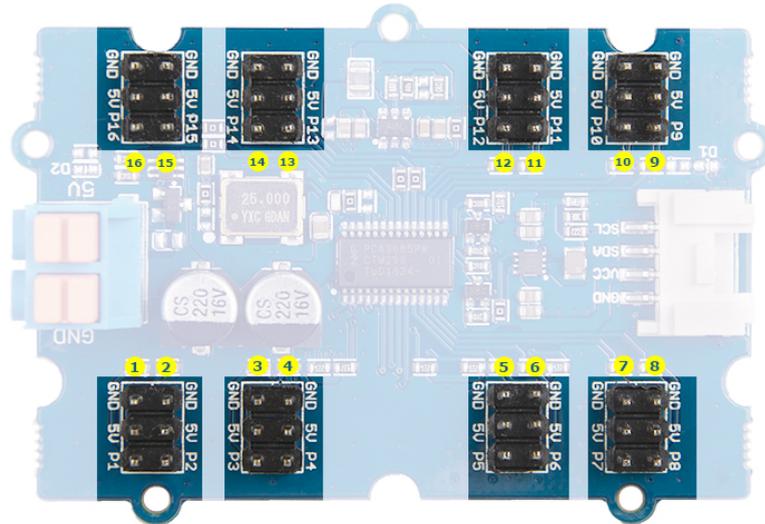
I2C Address

you can click the following figure to view the origin file

The 6 selectable pads on the back of this board, all have 64 optional I2C addresses.
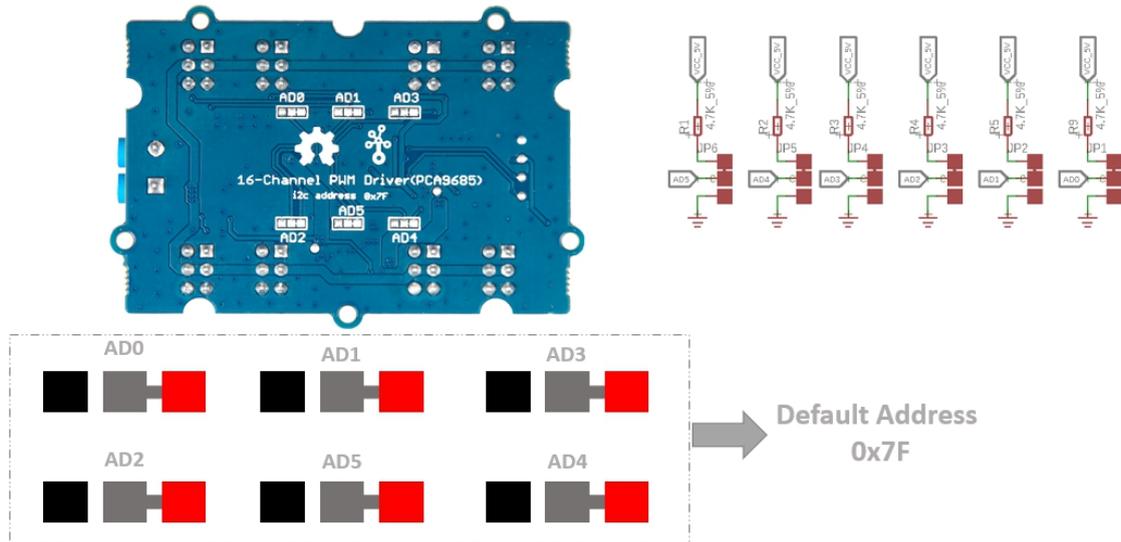
[https://files.seeedstudio.com/wiki/Grove-16-Channel_PWM_Driver-PCA9685/img/i2c_ad.jpg]

As shown in the figure above, all address pads are connected to the high level by default. The address rules are as shown below:
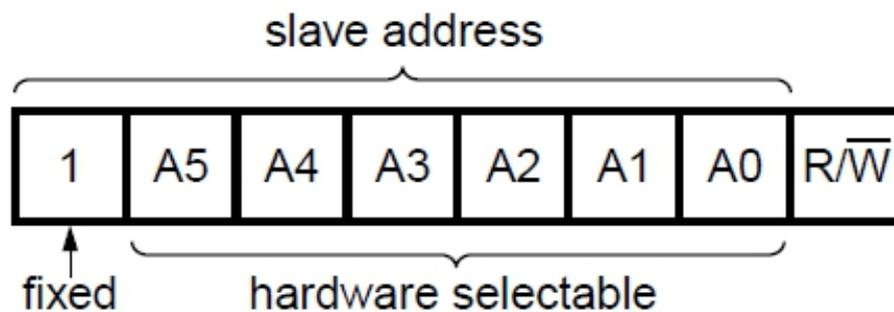
The address consists of 7 bits and the highest bit is fixed at 1. When we are converting the address to a hexadecimal number, we need to add a 0 to the left of the highest bit.

So the default address is **111 1111**, when we add a 0, it becomes **0111 1111** which is 0x7f.
And if we connect all the address pads to the ground, it turns to be **100 0000**, when we add a 0, it becomes **0100 0000**. Which is 0x40.

Working Principle

Platforms Supported

Arduino	Raspberry Pi	

Getting Started

Play With Arduino

Hardware

Materials required

Seeeduino V4.2	Base Shield
Get ONE Now [https://www.seeedstudio.com/Seeeduino-V4.2-p-2517.html]	Get ONE Now [https://www.seeedstudio.com/Base-Shield-V2-p-1378.html]

> **Note**
> **1** Please plug the USB cable gently, otherwise you may damage the port. Please use the USB cable with 4 wires inside, the 2 wires cable can't transfer data. If you are not sure about the wire you have, you can click here [https://www.seeedstudio.com/Micro-USB-Cable-48cm-p-1475.html] to buy
>
> **2** Each Grove module comes with a Grove cable when you buy. In case you lose the Grove cable, you can click here [https://www.seeedstudio.com/Grove-Universal-4-Pin-Buckled-20cm-Cable-%285-PCs-pack%29-p-936.html] to buy.
>
> **3** You also need prepare at least 2 jumper wires, in case you do not have, you can click here [https://www.seeedstudio.com/20-pin-dual-female-splittable-jumper-wire-300mm-p-629.html] to buy.

- **Step 1.** Connect red LED to GND and P1 by using dual-female jumper wires.

- **Step 2.** Connect the Grove - 16-Channel PWM Driver to port **I^{2}C** of Grove-Base Shield.

- **Step 2.** Plug Grove - Base Shield into Seeeduino.

- **Step 3.** Connect Seeeduino to PC via a USB cable.
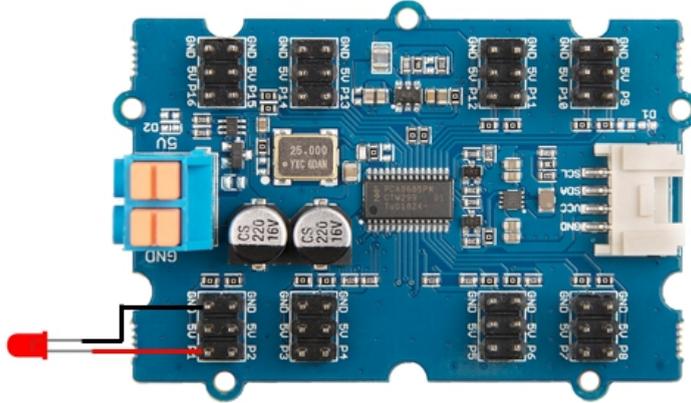
> ✏️ **Note**
>
> In this example for LED, as we are not using pin '5V' in output group we do not need to power up the power input port. If you want to use servo, you need to connect the 5V pin to the power pin of servo, and you need to offer external power for **Power In** port.

If you want to use servo, you can connect as shown below:
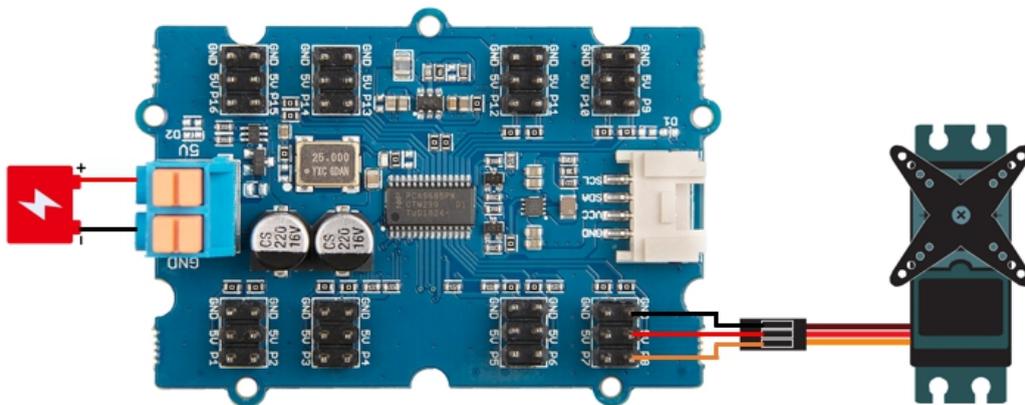
Software

> ⚠️ **Attention**

If this is the first time you work with Arduino, we strongly recommend you to see Getting Started with Arduino [https://wiki.seeedstudio.com/Getting_Started_with_Arduino/] before the start.

- **Step 1.** Download the Grove-16-Channel_PWM_Driver-PCA9685 [https://github.com/Seeed-Studio/Seeed_PCA9685/archive/master.zip] Library from Github.

- **Step 2.** Refer to How to install library [https://wiki.seeedstudio.com/How_to_install_Arduino_Library] to install library for Arduino.

- **Step 3.** Restart the Arduino IDE. Open the example, you can open it in the following three ways：

  a. Open it directly in the Arduino IDE via the path: **File → Examples →Seeed_PCA9685 → led**.
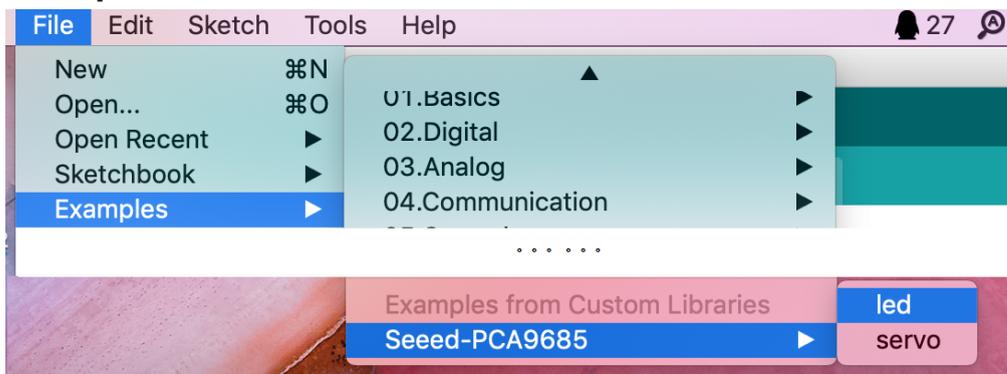
  b. Open it in your computer by click the **basic_demo.ino** which you can find in the folder **XXXX\Arduino\libraries\Seeed_PCA9685\examples\led\led.ino**,

XXXX is the location you installed the Arduino IDE.
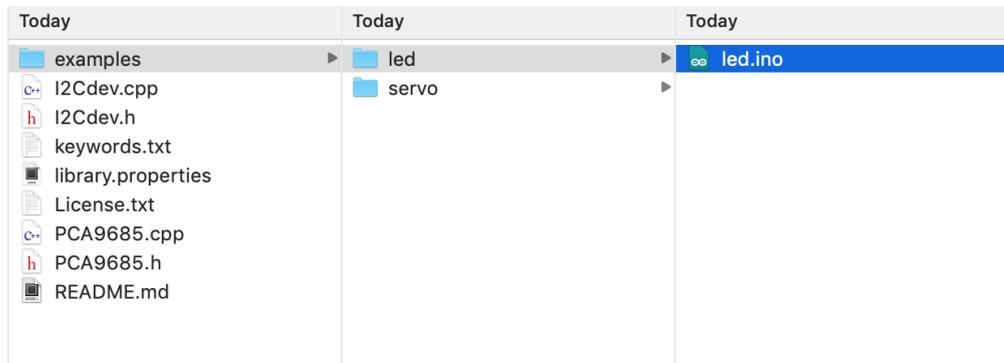
c. Or, you can just click the icon ⬜ in upper right corner of the code block to copy the following code into a new sketch in the Arduino IDE.

```cpp
#include "PCA9685.h"
#include <Wire.h>

PCA9685 led;


void setup()
{
    // join I2C bus (I2Cdev library doesn't do this automat
    Wire.begin();
    Serial.begin(9600);
    led.init(0x7f);
    // Set freq to 100Hz, range from 24Hz~1526hz
    led.setFrequency(100);

    for (int i=1;i<17;i++){
        led.setPwm(i, 0, 1024);
    }
}

void loop()
{
}
```

⚠️ **Attention**

The library file may be updated. This code may not be applicable to the updated library file, so we recommend that you use the first two methods.

Success
If everything goes well, you will be able to see the LED goes on.

Schematic Online Viewer

Resources

- **[Zip]** Grove - 16 Channel PWM Driver (PCA9685) Eagle Files
  [https://files.seeedstudio.com/wiki/Grove-16-
  Channel_PWM_Driver-PCA9685/res/Grove%20-%2016-
  Channel%20PWM%20Driver%20(PCA9685).zip]

- **[Zip]** Seeed_PCA9685 Software Library [https://github.com/Seeed-
  Studio/Seeed_PCA9685/archive/master.zip]

- **[PDF]** Datasheet PCA9685
  [https://files.seeedstudio.com/wiki/Grove-16-
  Channel_PWM_Driver-PCA9685/res/PCA9685.pdf]

Tech Support

Please do not hesitate to submit the issue into our forum
[https://forum.seeedstudio.com/] .

[https://www.seeedstudio.com/act-4.html?
utm_source=wiki&utm_medium=wikibanner&utm_campaign=newprod
ucts]