Grove - Solid State Relay

Release date ： 9/20/2015

Version ： 1.0

Wiki: http://www.seeedstudio.com/wiki/Grove_-_Solid_State_Relay

Bazaar: http://www.seeedstudio.com/depot/Grove-Solid-State-Relay-p-1359.html

Document Revision History

Revision	Date	Author	Description
1.0	Sep 21, 2015	Victor.He	Create file

Document Revision History

Contents

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For physical injuries and possessions loss caused by those reasons which are not related to product quality, such as operating without following manual guide, natural disasters or force majeure, we take no responsibility for that.

Under the supervision of Seeed Technology Inc., this manual has been compiled and published which covered the latest product description and specification. The content of this manual is subject to change without notice.

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1. Introduction

Grove – Solid State Relay is a non-contact electronic switch module that has relay features. Based on S208T02, it has a maximum output of 250VAC/4A, with a switching speed less than 10ms. This module is equipped with acrylic base and a 3D-printed protection insulation shield, for user's safety. The featured LED indicates that the relay is on. It can be widely used in various areas such as computer peripheral interfaces, temperature/speed/light adjustment, servo control, petrochemical, medical instrumentations, financial devices, coal, meters, traffic signals, etc. External Links

Links to external webpages which provide more application ideas, documents/datasheet or software libraries

2. Features

- 3D-printed protection insulation shield

- Compatible with both 3.3V and 5V control level

- Low switching latency (≤10ms)

- LED on-state indicator

- Featured radiator provide better stability

- Acrylic base and insulation paper increase safety performance

- Grove compatible

3. Application ideas

- Operations that require low-latency switching, e.g. stage light control

- Devices that require high stability, e.g. medical devices, traffic signals

- Situations that require explosion-proof, anticorrosion, moisture-proof, e.g. coal, chemical industries.

4. Specifications

Item	Min	Typical	Max	Uint
Input Voltage	3.0	3.3	5.0	VDC
Input Current	16	20	50	mA
Output Voltage	--	220	250	VAC
Output Current	--	--	4.0	A
Operating frequency	45	50	65	Hz
Operating temperature	-25	25	85	℃
Turn-on time	--	10	--	ms
Turn-off time	--	10	--	ms
Dimension	44x44x32		mm	
Net Weight	25.5		Gram	

5. Interface functions
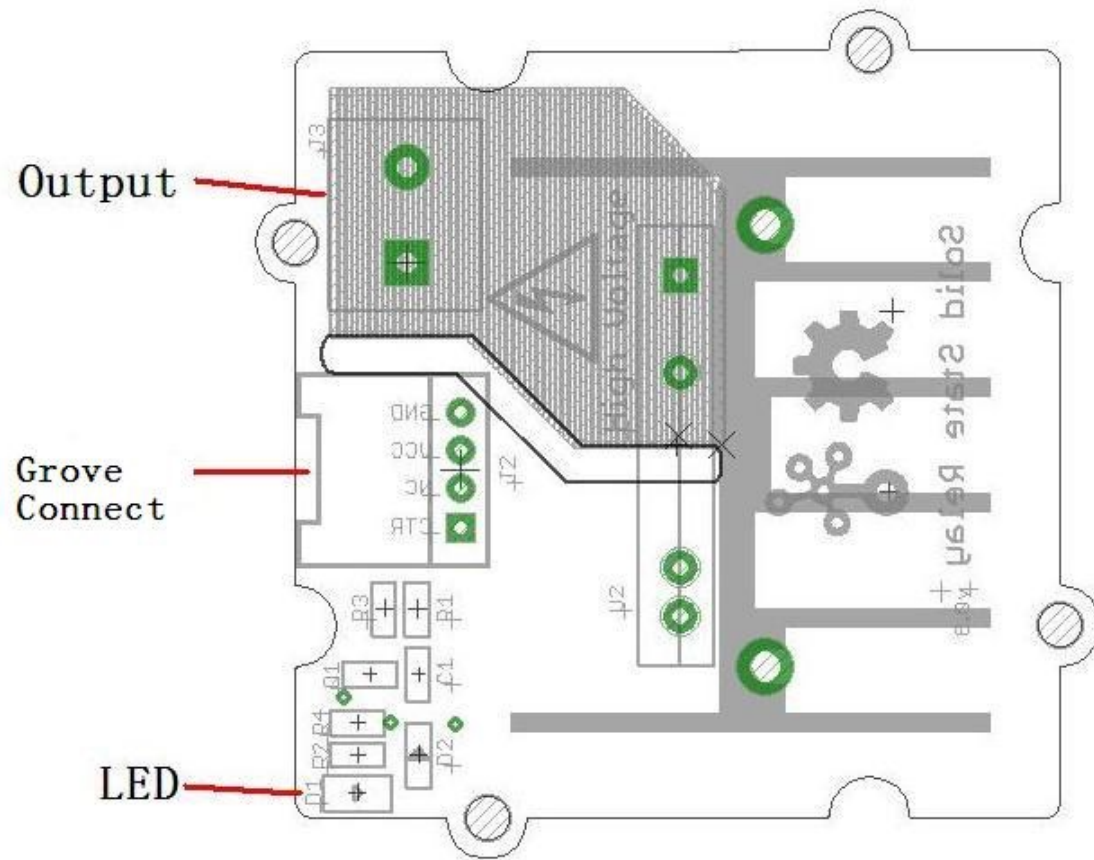
6. Cautions

- If the output voltage is higher than 36V, you need to ensure the module is in the off state before you operate with the screws.

- The heat sink can be in very high temperature, do not touch it during use.

7. Usage

7.1   With **Arduino**

The Grove - Solid State Relay has a variety of applications. Here we elaborate on how to use it to control a bulb.

First off, you'll need to connect it to the Arduino like so:

1.   Connect the Grove - Solid State Relay to Digital 13 of Grove-Base Shield via a Grove 4 pin wire.

2.   Plug Grove-Base Shield onto Arduino and connect Arduino to PC via a USB cable.

3.   Connect the bulb to OUTPUT of Grove - Solid State Relay.
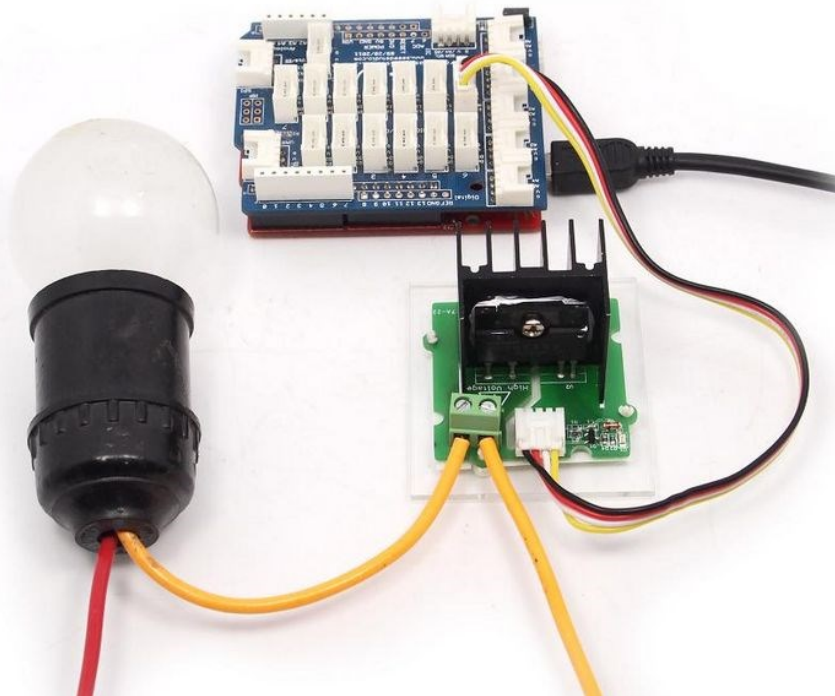
You need upload the below code. Please click here if you do not how to upload.

```
/*
Grove - Solid State Relay Demo Code
The ssr will turn on for 5s and then turn off for 5s, and so on.
http://www.seeedstudio.com
*/


int ssrControlPin = 13;
void setup() {
    // initialize the digital pin as an output.
    pinMode(ssrControlPin, OUTPUT);
}
```

```
void loop() {
   digitalWrite(ssrControlPin, HIGH);     // set the SSR on
   delay(5000);                           // wait for 5 second
   digitalWrite(ssrControlPin, LOW);      // set the SSR off
   delay(5000);                           // wait for 5 second
```

After uploading the code, you can see the bulb will light 5s and then turn off for 5s, and so on.

7.2   With Raspberry Pi

1.   You should have got a raspberry pi and a grovepi or grovepi+.

2.   You should have completed configuring the development environment, otherwise follow here.

3.   Connection. Plug the sensor to grovepi socket D4 by using a grove cable.

4.   Navigate to the demos' directory:

cd yourpath/GrovePi/Software/Python/

To see the code

nano grove_solid_state_relay.py   # "Ctrl+x" to exit #

```python
import time
import grovepi

# Connect the Grove Solid State Relay to digital port D4
# CTR,NC,VCC,GND
relay = 4

grovepi.pinMode(relay,"OUTPUT")

while True:
    try:
        # switch on for 5 seconds
        grovepi.digitalWrite(relay,1)
        print "on"
        time.sleep(5)

        # switch off for 5 seconds
        grovepi.digitalWrite(relay,0)
        print "off"
        time.sleep(5)
```

```
        except KeyboardInterrupt:
            grovepi.digitalWrite(relay,0)
            break
        except IOError:
            print "Error"}
```

5. Run the demo.

```
sudo python grove_solid_state_relay.py
```

8. Test Report

8.1   Experimental purposes

1)   Thermal performance of Grove – Solid State Relay（S208T02）

2)   Limit load current of Grove – SSR

3)   Measures to improve the limit load current

8.2   Experimental Principle

By recording SSR chip temperature at different current and different time points, analysis the data and draw conclusions.

Figure 1 is screenshot from S208T02 datasheet, we can see that at different heat sink and different temperature, SSR's current is different.

Fig.2 RMS ON-state Current vs. Ambient Temperature
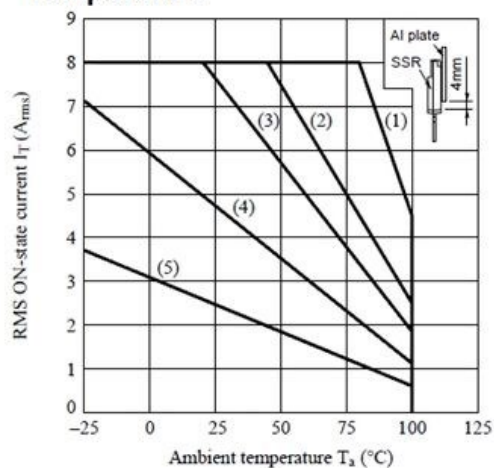
(1) With infinite heat sink
(2) With heat sink (200×200×2mm Al plate)
(3) With heat sink (100×100×2mm Al plate)
(4) With heat sink (50×50×2mm Al plate)
(5) Without heat sink
(Note) With the Al heat sink set up vertically, tighten the device with a torque of 0.4N•m and apply thermal conductive silicone grease on the mounting face of heat sink. Forced cooling shall not be carried out. (Please use an isolation sheet if necessary.)

There needs a temperature sensor to get the temperature of the chip. I use DS18B20 whose detection range is -25-125℃ to meet the requirements.

Figure 2 shows the experimental equipment and installation plans, the temperature sensor is tied to the right side of the heat sink, to make the temperature that 18b20 detects as close as possible to the heat sink temperature, smear between the sensor and the heat sink thermal plastic. Between the heat sink and SSR coated thermal plastic. Therefore, the temperature of the 18b20 is equal to the temperature of SSR.

8.3   Experimental data

Table1: time vesus temperature

	1min	5min	10min	20min	stable time
0.5A	31.40	33.75	34.75	35.00	15min
1A	31.8	36.75	39.6	40.56	18min
2A	34.5	46.6	48.88	51.13	20min
3A	35.56	52.81	58.88	60.06	17min
4A	38.00	57.88	63.88	67.00	19min
5A	44.00	66.00	73.12	75.37	19min

Note 1: The unit of temperature in the table is ℃

Note 2: When tested room temperature is 28 ℃

8.4   Expansion experiment

In order to prove that improve the level of heat sink will improve the SSR limit operating current, I did an expansion experiment.

Since I had not a larger heat sink on hand, so I installed a fan (which I take for my PC's CPU) above the SSR. As shown in Figure 3.

I just test the stable time of different operating current, as shown in Table 2.

Table2: Stable time of expansion experiment

	6.0A	6.5A	7.0A	7.5A
Stable time	54.44℃	57.63℃	60.06℃	62.38℃

9. Expansion experiment

From the above experimental results, the following conclusions can be drawn:

1) When current is fixed, with the passage of time, the temperature will stabilize at a certain value. This value is related with the current, the current increases, the stable temperature are greater. At 2A, stable temperature will be more than 50 ℃, So, when the SSR work, you should not touch it.

2) Combined with Figure 1 and our data, I consider that the Grove – SSR can operator 4A load current at max.

3) If load current larger than 5A, such as 7A, you should install a fun on it , or other cooling measures, but it's not recommended.

10.Support

Ask questions on Seeed forum.

11. Resources

Grove - Solid State Relay Eagle File

Grove - Solid State Relay Demo Code

S208T02 Datasheet

Grove - Solid State Relay in PDF

Grove - Solid State Relay Test Report

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