

1. Experimental purposes

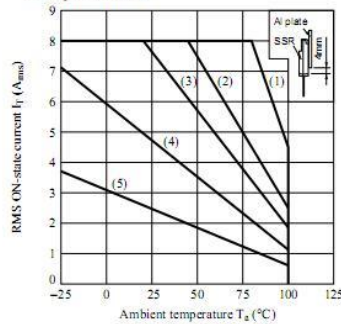
- 1) Thermal performance of Grove – SSR (S208T02)
- 2) Limit load current of Grove – SSR
- 3) Measures to improve the limit load current

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 (200x200x2mm Al plate)
 - (3) With heat sink (100x100x2mm Al plate)
 - (4) With heat sink (50x50x2mm 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.)

Figure1 RMS ON-state Current vs Ambient Temperature

To get the temperature of the chip, we need a temperature sensor, I use DS18B20, which detection range is -25-125 and 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. So that the temperature of the 18b20 is equal to the temperature of SSR



Figure 2.

3. Experimental data

Table 1 time vs temperature

| | 1min | 5 min | 10 min | 20 min | Stable time |
|------------|-------|-------|--------|--------|-------------|
| 0.5A (0.7) | 31.40 | 33.75 | 34.75 | 35.00 | 15min |
| 1A (1.2) | 31.80 | 36.75 | 39.06 | 40.56 | 18min |
| 2A (2.2) | 34.50 | 46.06 | 48.88 | 51.13 | 20- |
| 3A (3.2) | 35.56 | 52.81 | 58.88 | 60.06 | 17min |
| 4A (4.0) | 38.00 | 57.88 | 63.88 | 67.00 | 19min |
| 5A (5.0) | 44.00 | 66.00 | 73.12 | 75.37 | 19min |
| 6A (6.1) | 53.19 | 77.25 | — | — | — |

Note 1: The unit of temperature in the table is °C

Note 2: When tested room temperature is 28 °C

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.

Cuz I hadn't a more large 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.



Figure 3. Expansion experiment

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

Table 2. Stable time of expansion experiment

| | 6.0A | 6.5A | 7.0A | 7.5A |
|-------------|---------|---------|---------|---------|
| Stable time | 54.44°C | 57.63°C | 60.06°C | 62.38°C |

5. Experimental conclusions

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 that 50 °C, and if you touch the heat sink carelessly you will be a hot feeling. So, when the SSR work, you should touch it.
- 2) Combined with Figure 1 and our data, I consider that the Grove – SSR can operator 5A load current at max.
- 3) If load current larger than 5A, such as 7A, you should install a fan above it , or other cooling measures, but it's not recommended.