Application Note

Connecting a Solid State Relay for DC Switching

Introduction

In a MOSFET based relay, both AC and DC signals can be switched. The output utilizes two n-channel type MOSFETs. When controlling an AC load, one of the MOSFETs is used to switch the positive phase of the AC cycle while the other is used to switch the negative phase. When controlling a DC load, only one MOSFET is needed, and the relay can be configured to enhance switching characteristics.

Output Configurations

Figures 01 through 03 show typical output wiring diagrams for the AD6C111 device from Solid State Optronics. The AD6C111 is a 6 pin DIP/SMD, 1 Form A solid state relay. The device has a typical On Resistance (@ 25°C) of 17Ω, a maximum continuous rated load current of 120mA and a package power dissipation of 800mW.

Figure 01 shows the load connected across pins 4 and 6. This option allows for both AC and DC signal switching. Whether switching AC or DC signals, the On Resistance and Continuous Load Current of the relay will be 17Ω (typical) and 120mA respectively.

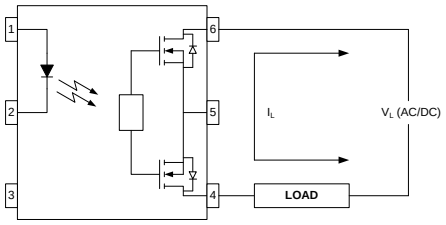

Figure 01: *AC/DC Configuration*

Figure 02 shows the load connected across pins 4 and 5 (or pins 6 and 5). By wiring the relay in this configuration the user bypasses the second MOSFET, and will find that the On Resistance is on the order of 11-13Ω typically instead of 17Ω.

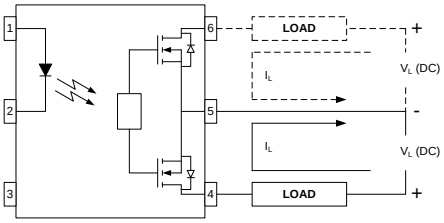

Figure 02: *Single MOSFET DC Configuration*

It is possible to actually connect two loads to the relay utilizing this configuration as long as the loads share a common ground. If the relay is used in this manner (2 Form A) two items must be taken into consideration. First, both loads must be only DC and share a common ground. Second, the total power dissipated to the relay from both loads must not exceed the Package Power Dissipation of 800mW. For example, if the relay is used to switch two 100mA DC loads at room temperature (25°C), the total power dissipated through the package would be:

$$\mathbf{P} = [(0.100A)^2 * 13\Omega] * 2 = 260mW$$

This value is well below the maximum of 800mW allowable, and the relay would function normally. For loads greater than about 170mA, the relay would be dissipating over 800mW and normal performance is no longer guaranteed.

Figure 03 shows a third option for DC signal switching. By shorting pins 6 and 4, then connecting the load across pins 6 and 5, the On Resistance is reduced significantly.

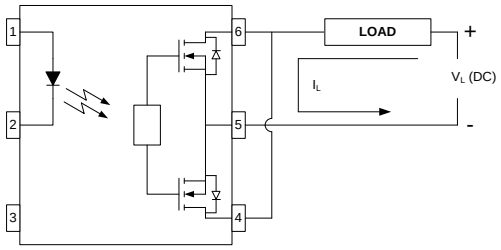

Figure 03: *Dual MOSFET DC Configuration*

In this configuration, the On Resistance drops down to below 7Ω. The advantage of the lower On Resistance means that a higher load current may be dissipated by the package.

Conclusion

Any MOSFET based relay can switch a DC load. Through various configurations, the DC switching characteristics of the relay can be enhanced, even to the point of creating a 2 Form A relay.

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