How to build a Solid State Relay for DC.

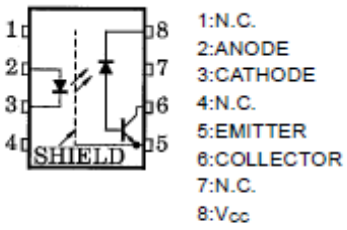

Fig. 1. Opto-coupler top view

You will need a TLP559 opto-coupler, made by Toshiba, or equivalent. The function of the opto-coupler is to act as a "coil" for the relay; you apply 12 volts to the input of the TLP559 (pins 2 and 3 of the opto-coupler) and a small "switch" closes (pins 5 and 6 of the opto-coupler). This in turn will drive the FET (Field Effect Transistor) which will be the normally open contact for your motor, light or whatever you wish to turn on or off with your relay.

Now, we need an FET, I used a SUB60N06-18, made by VISHAY.

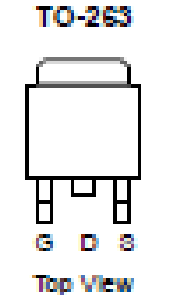

Fig. 2. FET

Looking from the top, you will have your electrodes G (gate) D (drain) and S (source). The center electrode D, is also connected to the heat sink, that is, the aluminum fin protruding up in the figure.

Now all we have to do is get ourselves a piece of perf board, in order to assemble our relay. I used the type which has no copper pads on it, just the holes, but you can use whatever you feel more comfortable with.

It is advisable to mount the cooling fin on a piece of aluminum sheet, about 2 inches square, just to make sure there will be no detrimental heating for the FET.

Next, we must connect the opto-coupler to the FET. See Figure 3. Operation is as follows: Inside the opto-coupler there are three components: a photo-diode, an NPN transistor, and an LED. When 12 volts are applied to input (positive up, negative down), the LED inside opto-coupler lights up. When the internal photo-diode is hit by light from the LED, the diode conducts and causes the transistor to conduct and send some voltage from the +12-volt line, through the 2.2K resistor, to the gate of the FET, thus making the FET conduct heavily, thus switching on the motor, or whatever device is being controlled. As the 12-volt signal is removed from the input of the opto-coupler, the LED goes out, the photo-diode no longer receives any light, so it does not conduct, thus the transistor inside the opto-coupler ceases conducting, and the 100K resistor takes away the voltage from the gate electrode of the FET; the FET then does not conduct anymore, thus the motor or device is turned off. Remember to use a "free-wheeling diode across inductive loads, with polarity reversed to voltage applied.

I originally used this solid state relay to replace an electro-mechanical relay which had to be constantly turning on and off, and the contacts would not last. Good luck!

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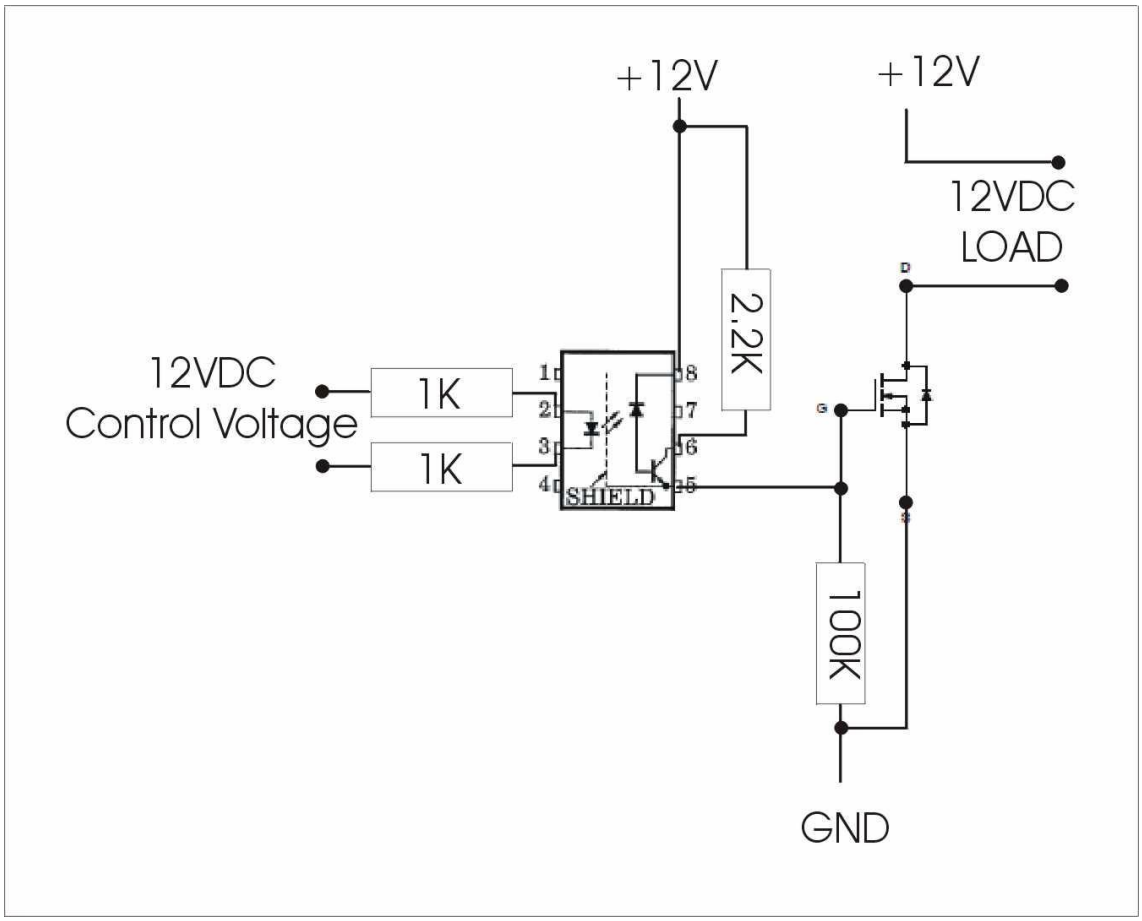

Fig. 3. Solid State Relay for DC circuits.