Mosaic Industries

Driving a Relay and a Relay Contact Snubbing

APPLICATION NOTE
MI-AN-040

Summary:

The following schematic illustrates the following circuit ideas:

1. Driving a relay from the QED Board.
2. Driving inductive loads.
3. Turning on a transistor with a QED digital output pin.
4. Snubbing relay contacts.

Referring to the schematic on the next page, each of these points is discussed in turn:

1. Driving a relay from the QED Board.

There are several ways to drive a relay from the QED Board. First, QED Boards versions 3 and above include four high current driver MOSFETs that may be connected directly a relay's coil without requiring the transistor shown above. In that case, the relay coil terminal that is connected to the transistor in the above schematic can be directly connected to the QED's high current output. Secondly, a QED Digital Output Board provides high current outputs that can sink current through a relay coil, and can be connected identically as the high high current drivers on the QED Board itself. Finally, the above schematic shows how to connect a relay (of up to100mA coil current, up to 500 ma if the base resistor is reduced to appx. 400 ohms) to any of the QED Board's digital output pins. The circuit shows a 5V coil relay, but any voltage up to 36V may be used instead. The PN2222A can switch up to 40VDC.

2. Driving inductive loads.

The above schematic also shows that when driving inductive loads (the relay coil in this case) as snubber diode should be used to prevent inductive kick back. This diode, shown across the relay coil, provides a current path for the decaying coil current when the relay is switched off, thereby preventing a voltage spike on the transistor's collector. If the relay were to be driven directly from the QED Board's high current driver, or from the Digital Output Board, those output pins already provide snubbing diodes so the diode directly across the relay coil is not needed. Even so, for fail-safe fault tolerance, it is always a good idea to solder a snubbing diode directly across the relay coil.

3. Turning on a transistor with a QED digital output pin.

The schematic also shows how to turn on a transistor from a QED output pin. The transistor can then be used to drive a relay, lamp, solenoid valve, or any other load that is within its current capability. The 2N2222A will handle collector currents to 500 ma. Its current gain is nominally 100, but we'll use a worst case value of 50. The base resistor should be sized to guarantee that at the maximum collector current, Imax, the transistor is fully saturated. The required resistance is given by

$$R = 50 * (5.0-0.7)/Imax - 45 \text{ ohms}$$

where 0.7 is the Vbe of the transistor, and 45 ohms is the effective output resistance of a QED output pin. For more information about driving transistors and other devices from the 6hHC11 output pins see the application note "MI-AN-060 68HC11 Output Drive Capability".

4. Snubbing relay contacts.

The relay contacts may be used to turn on and off inductive loads using either AC or DC. In either case, when the relay opens, the inductive load can cause arcing at the relay contacts. For this reason the contacts should be snubbed with an RC network and a voltage clamping device. The RC snubber in parallel with a diode or TVS (transient voltage suppressor) in the above schematic very effectively clamps voltage spikes from inductive AC or DC loads.

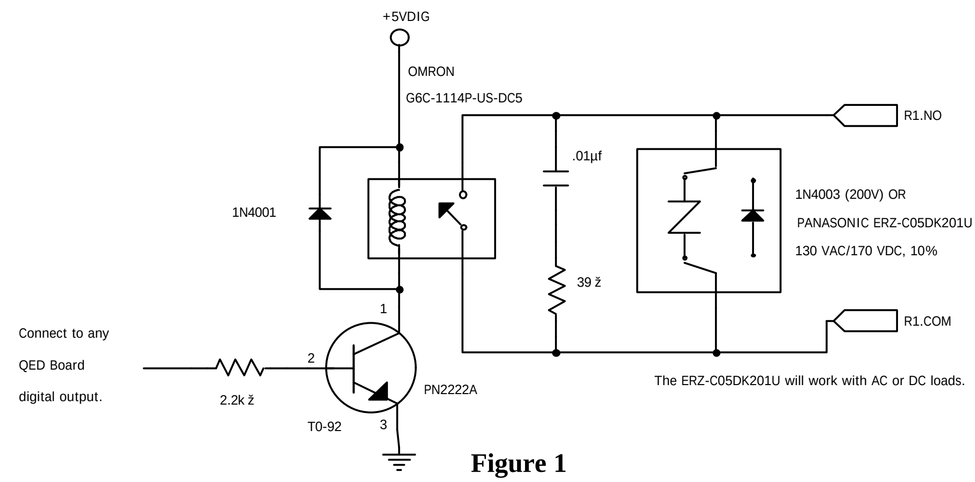

Figure 1

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