CK1619 - DUAL HI/LO SWITCHED RELAY BOARD

There are many applications where you need quick availability of a relay for connection to a particular piece of apparatus. We found in developing our kits that we always needed to have a relay mounted on a PCB within arms reach. So we thought if we need it then many others probably do too.

But there are problems. Relay pinouts and packages are not standardized. And then what voltage of relay should we use - 3V, 6V, 9V, 12V or 24V. So we chose a commonly available miniature relay, and we have supplied a 12V version of it here.

We have used two Goodsky RWH-SH-112D 12V relays, coil resistance 400 ohm. It is rated to switch 250VAC at 12A. However, because of the PCB track thickness and width we do not recommend using the relay to switch more than 5A. If you want to switch more current then we suggest you solder some heavy duty wire links, on the bottom of the PCB, from the relay contacts to the screw terminal block (effectively in parallel with the PCB track).

The terminals blocks are rated 300V / 10A.

Assembly. Follow the overlay. Solder the resistors first. Make sure to get the diode and the IC around the correct way.

How it Works. The kit is based around the ULN2003A IC, a 7-channel high voltage, high current relay driver. The inputs are TTL compatible, allowing them to be directly connected to logic circuits operating from a supply voltage of 5V.

Each driver is effectively a logic inverter with an open collector output, meaning the 'load' is connected between the output pin and V+.

Looking at the schematic we see that there are two identical circuits, one for each relay. Operation is the same for both so we will refer to the RL1 circuit only in the following explanation.

There are two inputs that can be used to operate the relay, marked LO and HI. As the names suggest a low on the LO input will operate the relay. Similarly a high on the HI input will also operate the relay.

The LO input operates the relay via IC1:A and IC1:B. A low level input will be inverted by IC1:A and its output will be high. Then this high is inverted again by IC1:B to give a low output to operate the relay. Resistor R1 holds the input high when not used.

Now 'hang on' you might say – why invert a low to a high then just invert it low again? Why not connect the LO input direct to the relay and forget about using IC1:A and IC1:B? Good question. The answer is that if you connect the LO direct to the relay you lose all control about what voltage the LO input can be. An input of 3V for example, will trigger the relay closed. This will probably be quite undesired. By using the two relay drivers to process the signal the LO must be no more than 0.8V. Anything over that will not trip the relay and you have full control.

The relay can also be operated via the single inverter IC1:C. In this case a high level on the HI input is inverted by IC1:C and the resulting low output will operate the relay. Resistor R3 holds the input low when it is not used.

So, the relay will be operated when either the LO input is low (0 – 0.8V) or the HI input is high (2.4V – 12V.).

Note that the outputs of IC1:B and IC1:C are connected together. At first glance it might seem that they would destroy each other if one was high and the other low. This cannot happen because the outputs are 'open collector', meaning that the inverter can drive the output low but it relies on an external device to pull the output high. In this case the external device is the relay.

Tying open collector outputs together like this is known as a "wire OR' configuration. It means that the relay is operated when either the IC1:B output **OR** IC1:C output is low.

Diode D1 provides reverse polarity protection in case the power supply to the kit is connected the wrong way around.

Specifications.

Operating voltage:	12V DC
Input low voltage:	0 – 0.8V
Input high voltage:	2.4 – 12V

COMPONENTS	
10K resistor 5% 1/4W brown black orange	6
1N4004 diode	1
3 pole terminal block	4
ULN2003A IC	1
16 pin IC socket	1
RWH-SH-112D 12V relay	2
K156 PCB	1

See out website at http://www.ElectronicKits.com/

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