Supertex

HV9901DB1
Universal Relay Driver

Introduction

The HV9901 is a universal relay driver employing PWM switching techniques utilizing the relay coil's inductance to provide efficient operation over a wide supply voltage range. Relay drive is constant-current. Pull-in current, pull-in time, and hold current are all programmable via 2 resistors and a capacitor. An adjustable regulator provides 1mA for external circuitry.

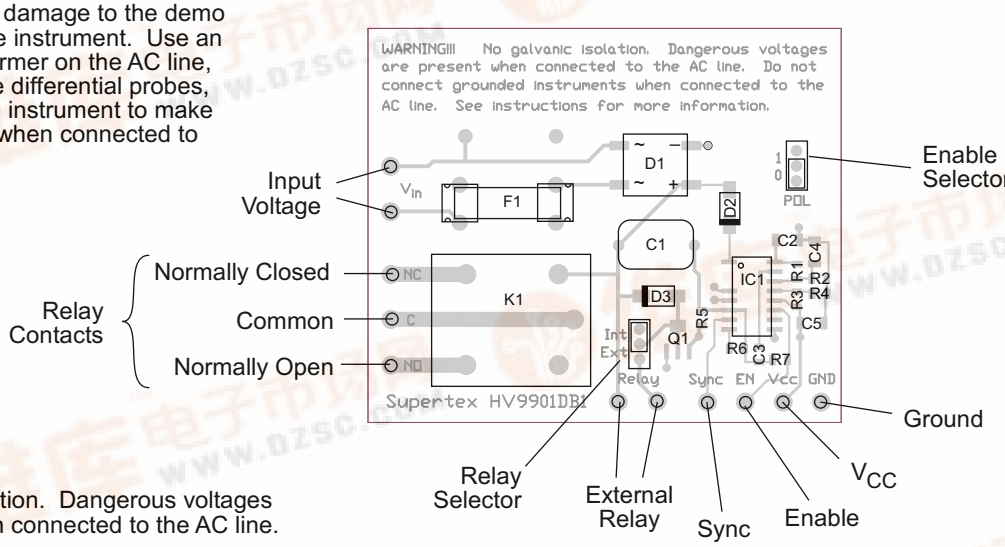
The HV9901DB1 demo board contains all the circuitry necessary to demonstrate the operation of the HV9901. Included on-board are a full-wave input rectifier, fuse, the HV9901, and a 10A relay. Provisions for connecting an external relay are available. The circuit may be modified to accomodate the drive requirements of other relays.

Specifications

Input Voltage	10–400VDC, 24–277VAC
Relay Drive Current	72mA pull-in, 24mA hold
Pull-in Time	20ms
Contact Form	SPDT (1FormC)
Contact Rating	10A@125VAC, 6A@277VAC
Auxillary Regulator (V_{CC})	5.0V@1mA
Enable	<1.5V off, >3.5V on
Switching Frequency	21kHz

Board Layout and Connections

WARNING!!!
Do not connect earth-grounded instruments when connected to the AC line. Doing so will short the AC line, resulting in damage to the demo board and/or the instrument. Use an isolation transformer on the AC line, use high voltage differential probes, or use a floating instrument to make measurements when connected to the AC line.



WARNING!!!
No galvanic isolation. Dangerous voltages are present when connected to the AC line.

Input Voltage

Supply voltage. May be a DC source in the range of 10–400VDC, or an AC source in the range of 24–277VACrms. A full-wave bridge rectifier on board rectifies the AC. Also included is a 250mA 2AG fuse.

Relay Contacts

For connecting an external load. The PCB traces are rated at 10A for a 20°C rise.

Relay Selector

In the **Int** position, the on-board relay is operated. In the **Ext** position, a relay connected to the External Relay terminals is operated.

External Relay

For connection of an off-board relay.

Sync

Synchronizes multiple HV9901s to the same frequency or to a master clock. Frequency will be the highest independent frequency. Connect to the Sync pins of other HV9901s or to a master clock.

Enable

Logic-level enable for relay operation. See *Enable Polarity Selector* for polarity.

V_{CC}

Supplies 5V at 1mA for external circuitry.

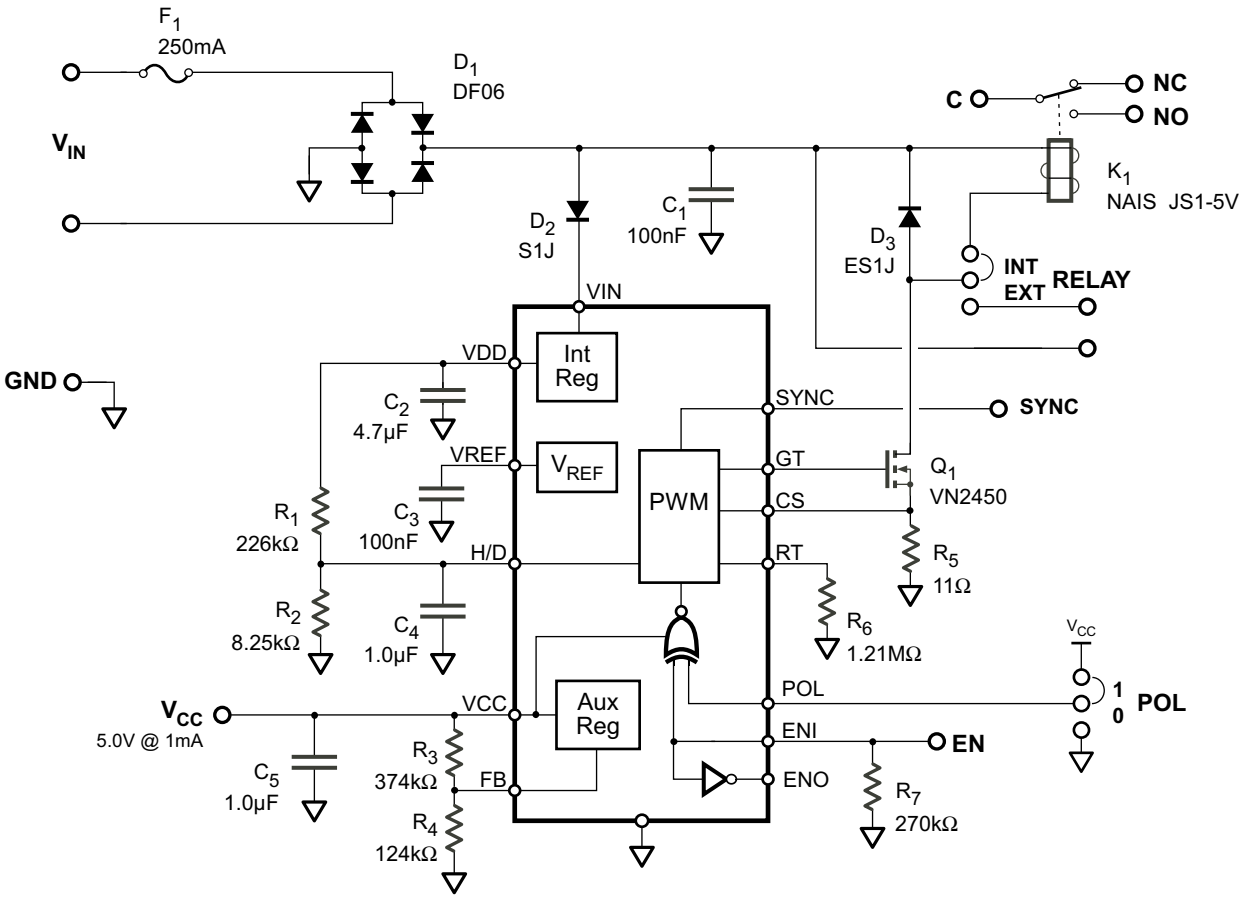
Ground

Circuit common. ***Since galvanic isolation is not provided, ground will be at the AC line potential!***

Enable Polarity Selector

Sets Enable polarity. In the **0** position, Enable is active low. In the **1** position, Enable is active high.

HV9901DB1 Schematic



Modifications

External Relay

Connect the coil of the external relay to the **External Relay** terminals and move the **Relay Selector** shunt to the **Ext** position.

Pull-in Current, Pull-in Time, and Hold Current

For use with other relays, these parameters may be changed via resistors R_1 and R_2 and capacitor C_4. Refer to the HV9901 data sheet for details.

Monitoring Relay Current

For the on-board relay, coil current may be monitored by replacing the **Relay Selector** shunt with either a wire loop (for current probe use) or with a low value sense resistor (for voltage probe use). Remember that galvanic isolation is not provided! See warnings on the first page.

Switching Frequency

To change the PWM switching frequency, change R_6 according to the following equation:

$$f_{PWM} = 3.23\text{kHz} + \frac{21.8\text{GHz} \cdot \Omega}{R_6}$$

This equation is valid for frequencies 25kHz and above. Be advised that frequencies below 20kHz may cause the relay coil to emit audible noise. And avoid higher frequencies that approach the coil's resonant frequency.

V_{CC}

As provided, the HV9901DB1 supplies 5V for external circuitry. Other volltages in the range 2.0V to 5.5V may be obtained by changing R_3. Current rating remains at 1mA.

$$V_{CC} = 1.25\text{V}\left(1 + \frac{R_3}{R_4}\right)$$

Note that changing V_{CC} also changes the Enable logic levels.

$$V_{EN(lo)} < 0.3V_{CC}$$

$$V_{EN(hi)} > 0.7V_{CC}$$