# DRIVER50

**C R H Electronics Design**

# DRIVER50

## 5A Stepper motor drive board

## C R H Electronics Design

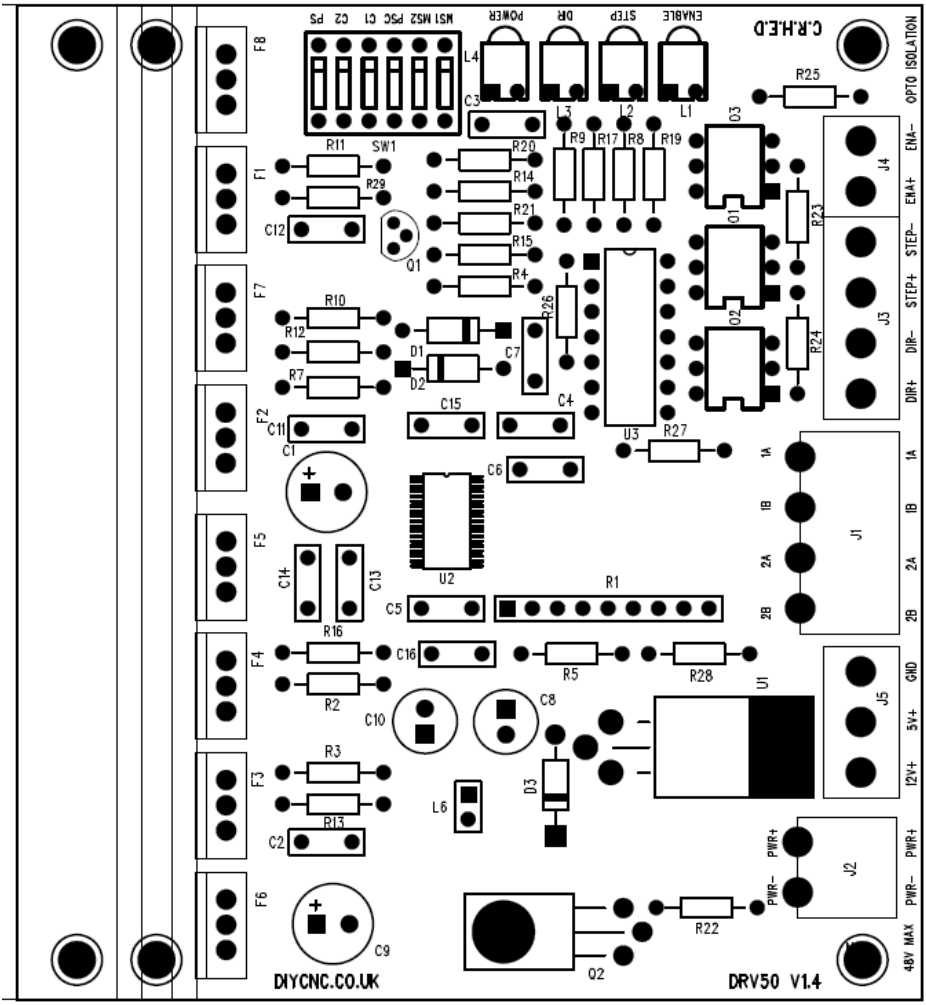
## Specifications

### Features

- Two phase PWM operation.
- Uses internal synchronous rectification to reduce board size and heat dissipation.
- Includes thermal shutdown, UVLO and crossover current protection.
- 1/16, 1/4, 1/2 or full Step selectable.
- Works direct from PC Parallel port connections
- 2, 3, 4 & 5Amp switch selectable max stepper current.
- Opto isolated inputs, Step, Direction and Disable.
- On board 5V & 12V regulators with spare output connections, uses single supply line (36V-40V DC regulated supply recommended)
- Maximum 48V @ 5A per phase motor output.
- LED indicator display of Step, Direction, Enable and Power.
- Board size 91 X 100 mm. FR4, immersion gold, 2oz copper, RoHS compliant.
- Automatic current reduction circuit that can be disabled if required.
- Motor and power connectors are un-pluggable.
- Dimensions 123 mm X 100 mm

**Manual V1.0 Dec 08**
**Hardware V1.4 Dec 08**

Board layout, of Driver50




The DRIVER50 is a new high power stepper motor drive board. The board layout has all connections down one side, while a second side contains the dipswitch settings and display LED's. The board has four 3.2 mm fixing holes for mounting. All three signal inputs which are all independent of each other have optical isolation and allow positive or negative drive of each signal. The board also incorporates an automatic power save function which more than quarters the power consumption of the board when there are no stepper signals present. As soon as a step signal is detected the board returns to normal power conditions.

**Dip switch settings**

MS2 & MS1 Adjust Step rate
(MS2 on MS1 on) Full Step
(MS2 on MS1 off) ½ Step
(MS2 off MS1 on) ¼ Step
(MS2 off MS1 off) 1/16 Step

PS (ON enables power save mode)
PSC (ON further reduces power save current)

C1 & C2 Control maximum stepper current
(C1 on C2 on) 2A
(C1 off C2 on) 3A
(C1 on C2 off) 4A
(C1 off C2 off) 5A

**Power Input**

Maximum input voltage 48V, recommended regulated voltage 24-40V although the board will actually run down to 15Volts this will impair performance at higher step rates.
If using an unregulated power supply, check peak voltage across output before connecting Driver50 board. A 40V unregulated supply can have 56V peak unloaded output. Power is supplied to the board via it own supply plug and it is recommended that this is wired directly to the power supply for each axis.

**Signal Inputs**

The board has three inputs, Step, Direction and Disable.
**Enable:** It is not necessary to connect this input for the board to work. Applying a signal to this input disables output to the stepper motors.
**Step**: Takes pulses from the computer or controller to initiate rotation of the motor.
**Direction:** Is a logic level that alters the direction of motor rotation.

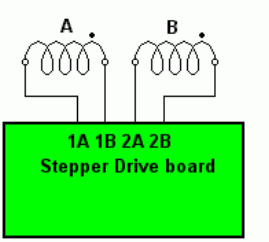
**Stepper motor connections**

The following diagrams show typical connections for a range of different motors. If your motor rating is in excess of the 5A maximum current limit then you should use the windings in serial connection for maximum efficiency.

## 4 leads - Bipolar Drive

**4 Leads**
The standard connection for a four lead motor.

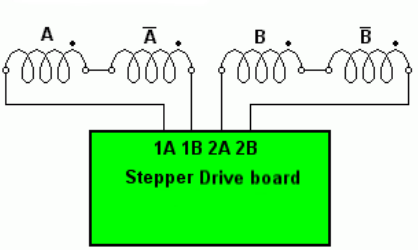
This is the standard connection for a bipolar drive. There are still four windings and, depending on motor type, they are in series or parallel. Most manufacturers makes two models with the same winding, but one time connected is series and one time in parallel.




## Bipolar Drive - Serial Connection

**6 Leads**
The windings are connected in serial. Since most 6 lead motors are wound bifilar - link -, so the inductance will be quadruple of the single winding value.

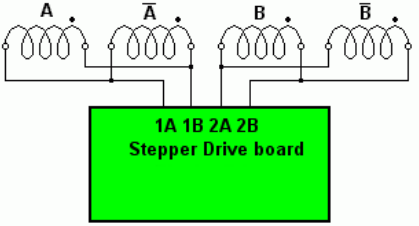
**8 Leads**
The windings are connected in serial. Since most 8 lead motors are wound monofilar - link -, then the inductance will be double. If the motor was wound bifilar - link -,the inductance will be quadruple .




## Bipolar Drive- 8 leads - Windings Parallel

**8 Leads**
This is the standard high speed connection for an eight lead motor.

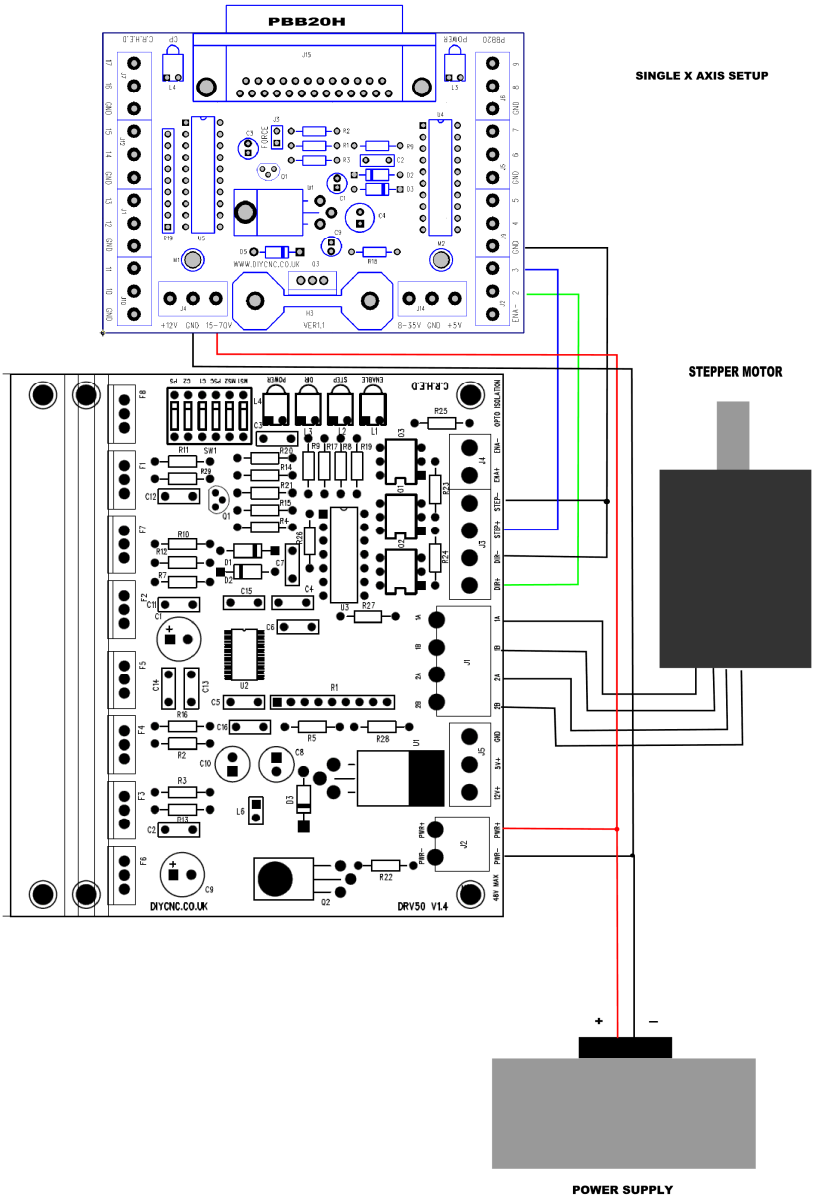
With the windings in parallel, the motor current can be higher whilt the inductance is lower. This is a typical connection for a motor that need to run at a high speed..




---

**IMPORTANT:**
Double check that connections are correct before applying power to the board, windings connected out of phase may cause damage to the board. Do not connect or disconnect wires with the power on. It is a good idea to temporally set the current switch settings to minimum, to limit the current if you are in any doubt of the connections.
**The PCB Stepper outputs on the Driver50 board are marked 1A &1B this represents one winding. Outputs 2A & 2B are the other winding.**

## Connecting the Stepper motors



The connection diagram is a simple computer connection to a single stepper motor on the X axis. Simply repeat these connections for Y, Z as required. It should be noted that if you are connecting the enable lines to multiple boards in parallel, you will need a buffered interface board as the standard computer breakout parallel interface may not have enough drive capacity.

**Outputs**

**5V+:** Power output from the onboard regulator. To power other circuit boards, sensors, etc.

**12V+:** Power output from the pre regulator. This can be used to power other circuit boards, relays etc.

**Note:** Maximum external load for these outputs depends on the main power supply voltage.

**For input voltages between 20-30V, 150mA and only 100mA between 30-48V. This is total current for both 5&12V supplies combined.**

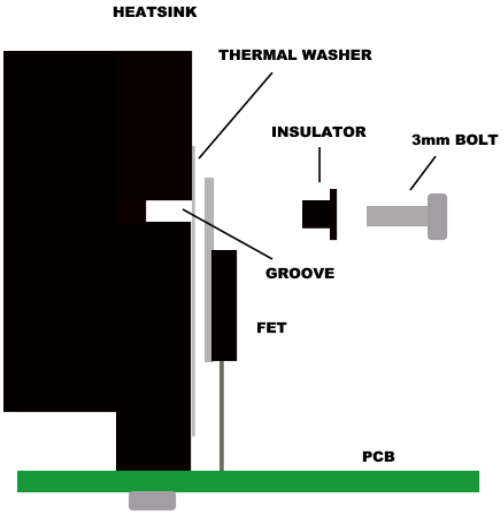
## KIT CONSTRUCTION

Building the DRV50 stepper board kit should take about one hour. You will need a good soldering iron, preferably temperature controlled and set to 400-450 degrees. The solder provided is lead free with a mild active flux. This helps it to flow easily but you need an extra 50 degrees higher temperature compared to lead solders. As the driver chip is a surface mount device the PCB is supplied with it ready mounted into position. With reference to the board layout diagram, start by placing the components with the longest leads that will need cropping after soldering. I find that the best way is to push the component through the holes until it is in contact with the board and then bending the leads at 45 degrees on the underside to stop the component moving while soldering. Using this technique you can place several components before soldering. After soldering and cropping the long leaded components next place the small capacitors which have fairly short leads. The LED's are mounted at right angles with the plastic housings provided. Slide the LED legs through the housing before bending the legs at 90 degrees. The longer of the two leads on the LED's is the anode or positive and goes to the square pad. Solder one leg first and then position square with the board before soldering the other leg. The 7805 regulator needs the centre leg bending slightly forward before bending all the legs back and fitting a bolt though the metal tag to secure. Fit the DIP Switch and the set of connector blocks. The blocks are manufactured in either a three or two terminals but there is an interlocking system built into their sides for multiplying the amount of terminals needed. Make sure that they are slid together before fitting to the PCB. The heat-sink has serrated edges to accept the 3mm screws directly without drilling and tapping. The 8 MOSFET are fitted after fitting the heat-sink to the PCB see fig 1. This will ensure they align correctly. Each MOSFET must have an insulator and thermal washer fitted. There is no need to add silicon grease with these washers.

After screwing all the MOSFET's into position you can solder their legs. If available you could clean up the flux residue on the board with a proprietary flux cleaner when complete. I have found the SERVISOL DE-FLUX 160 flux remover / PCB cleaner is very effective.
Notes:

- L6 is a wire link used to couple the analogue and digital ground planes, use a chopped resistor lead.
- Long lead on LED is anode (goes to square pad)
- Long lead on electrolytic caps is positive (goes to square pad)

**Fig1**




**Component parts list for DRV50**

| | |
|---|---|
| **Resistors all ¼ W 5%** | |
| **R1** | **10K Sip Network** |
| **R2, R3, R7, R10, R11, R12, R13, R16** | **100 ohm** |
| **R4** | **1 M ohm** |
| **R5, R15** | **10K ohm** |
| **R8, R9, R17, R19** | **470 ohm** |
| **R21, R26, R27, R29** | **1k ohm** |
| **R28** | **2.2k ohm** |
| **R14, R22** | **3.3K ohm** |
| **R23, R24, R25** | **270 ohm** |
| **R20** | **4.7k ohm** |
| | |
| **Capacitors** | |
| **C1, C9** | **100uF 63V** |
| **C2, C3, C4. C5, C12, C16** | **100nF 100V** |
| **C6, C7, C11, C13, C14** | **10nF 100V** |

| | |
|---|---|
| **C8, C9, C10,** | **100uF 16V** |
| **C15** | **220nF 63V** |

**Semiconductors**

| | |
|---|---|
| **D1, D2** | **1N4148 Diodes** |
| **D3** | **13V Zener Diode** |
| **F1, F2, F3, F4, F5, F6, F7, F8** | **POWER MOSFET** |
| **U2** | **A3986 Driver** |
| **O1, O2, O3** | **CNY75 Opto** |
| **U1** | **7805 Regulator** |
| **U3** | **74HC04** |
| **Q1** | **BC182 Transistor** |
| **Q2** | **BD679 Darlington** |
| **L1** | **LED Red** |
| **L2** | **LED Green** |
| **L3** | **LED Orange** |
| **L4** | **LED Blue** |

**Hardware**

| | |
|---|---|
| **J1** | **4 way 5mm socket** |
| **J2** | **2 way 7.5mm socket** |
| **J3, J4, J5** | **3 way 5mm Terminal blocks** |
| **SW1** | **6 way Dipswitch** |
| **H1** | **100mm Heat sink** |

**8 off Thermal insulating pads**
**8 off plastic insulating washers**
**12 off 6X3mm screws**
**2 off 3mm nuts**

## Contact Details

J Harding
12 Herm Close
Seabridge
Newcastle-under-Lyme.
ST5 3LL.
England

Email roy@diycnc.co.uk

Dimensions for board and fixing holes. Diameters are 3.2mm for M3 bolts