

Stepper Motor Control for Motorized Z and Theta Stage Applications

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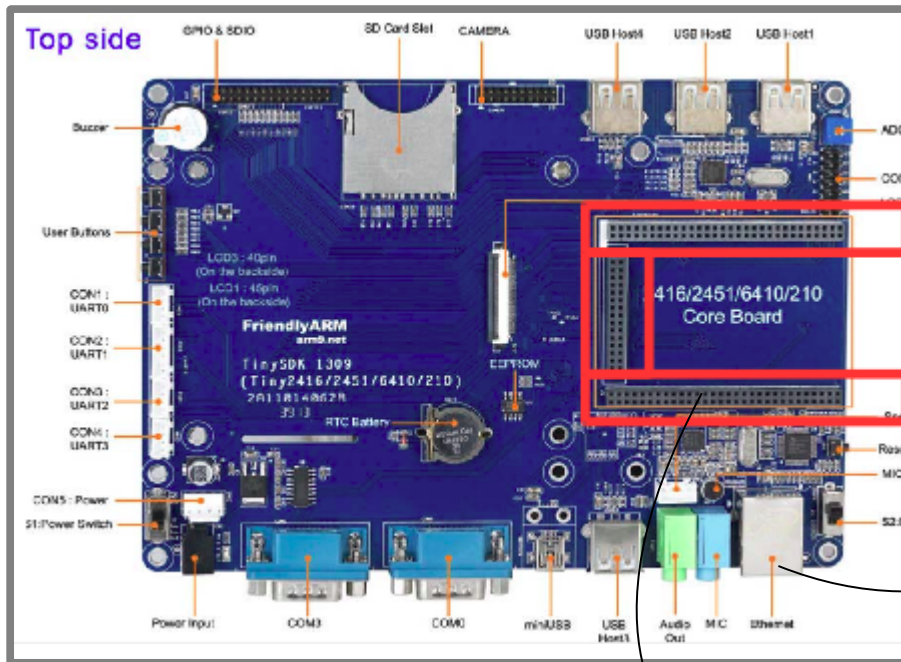
Version 1.0 Jan 2017

Version 0.1 Oct 2011

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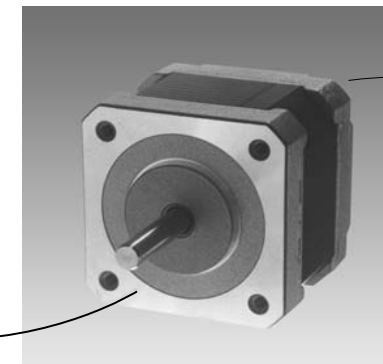
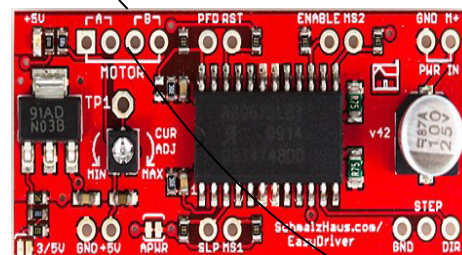
GPP Applications

For Controlling Motor Directions



Note: GPP enables the motor drive board and controls direction of the motor, PWM controls the speed of the motor.

Example:
GPP from ARM11
embedded system to
driver stepper motors

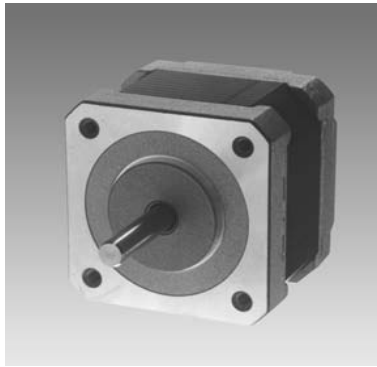


Optic Encoder OMron
E69-C04B



https://www.mouser.com/ProductDetail/Omron/E69-C04B/?qs=TwPrcXezm73lZHV01Vh9XA%3D%3D&gclid=EAIaIqobChMI-5bl0O-l2QIVR2t-Ch07HAMzEAQYBCABEGlHGPD_BwE

Standard Stepper Motor



Stepper Motors

Note:

1. One revolution (360 degree) = 200 steps;
2. 1.8 degree per step;
3. Four wire stepper motor can provide

A full step:	1.8 degree;
A half step:	1.8/2 degree;
A quarter step:	1.8/4 degree;
One eighth step:	1.8/8 degree.

4. Stepper drive circuit provide 4 wires output to connect to the 4-wire (A1, A2, B1, B2) stepper motor, by modulation of the base band signal of each wire, the above step size can be achieved.



Motorized xy stage



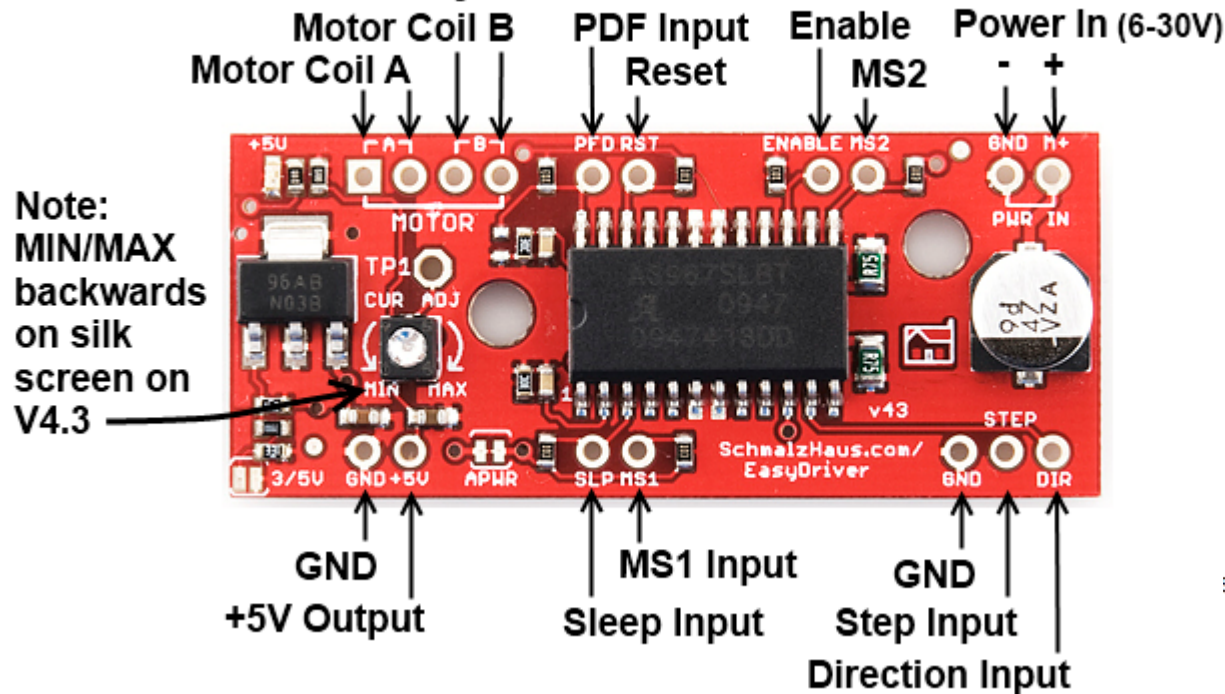
Witbot NEMA17
Stepper Motor ...
\$9.59
[Amazon.com](https://www.amazon.com)

Brushed DC motors are ubiquitous, representing a mature technology invented in the 19th century. Brushless DC motors are a relatively recent advance, made possible by the development of solid state electronics in the 1960s[2] with further improvements in the 1980s thanks to better permanent magnet materials.

https://en.wikipedia.org/wiki/Brushless_DC_electric_motor

Motor Drive Board

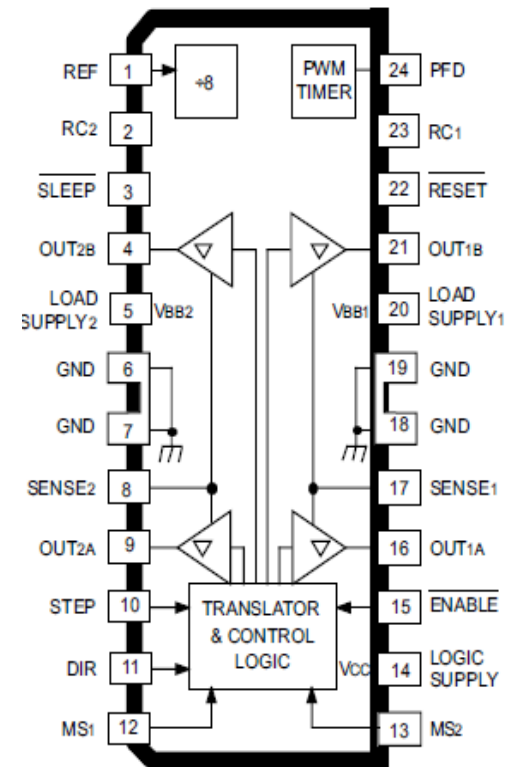
EasyDriver v4.3 Pins



Configure the drive chip

MS ₁	MS ₂	Resolution
L	L	Full step (2 phase)
H	L	Half step
L	H	Quarter step
H	H	Eighth step

See design schematics, MS1 and MS2 are tied to Vcc so pre-configured to 1/8 step



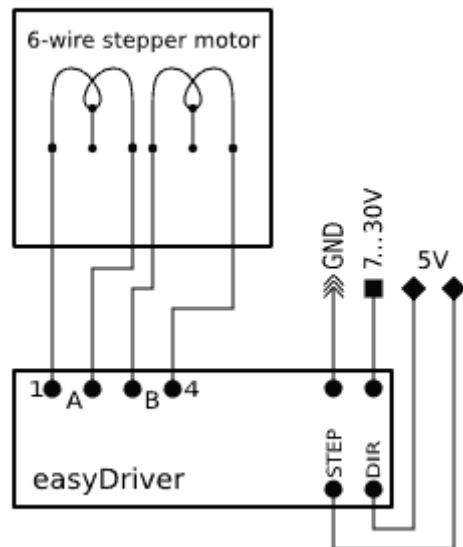
<http://www.schmalzhaus.com/EasyDriver/>

Control Bipolar Motors

Q) What kind of stepper motors can I use EasyDriver with?

A) The Allegro 3967 driver chip that the EasyDriver is based off of is a bi-polar driver. This means it has a true H-bridge design internally, and sends current both ways through each of the two coils. You can use 4-wire, 6-wire or 8-wire stepper motors. The only kind you can't use is 5-wire stepper motors. (They need uni-polar drivers.)

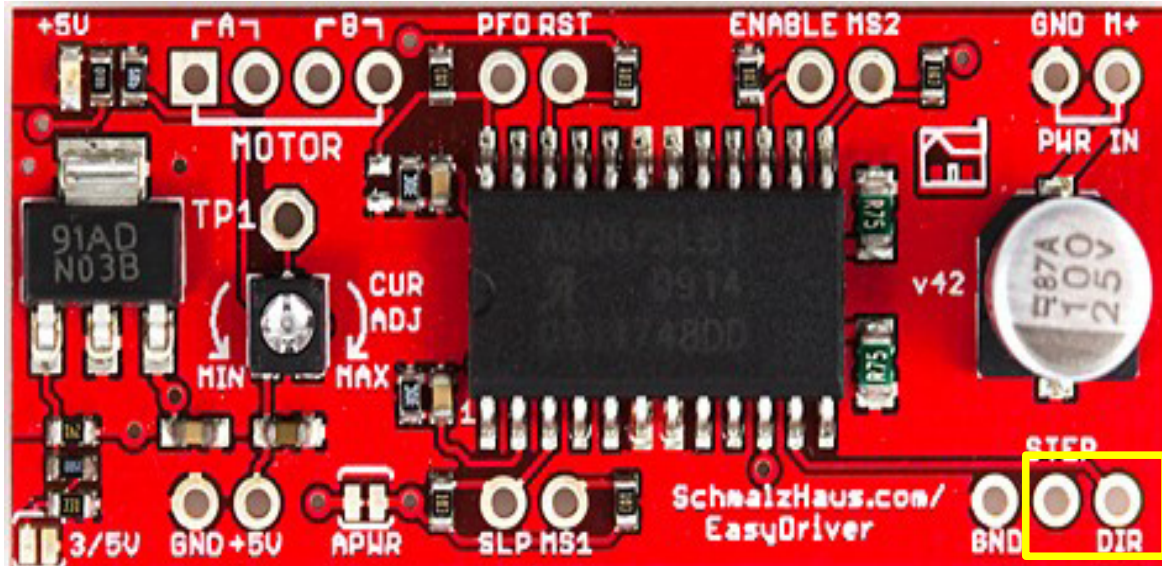
Here's a little drawing on one way to hook up a six wire stepper motor to the EasyDriver.



Tutorial

<http://www.schmalzhaus.com/EasyDriver/>

Motor Drive Input and Output

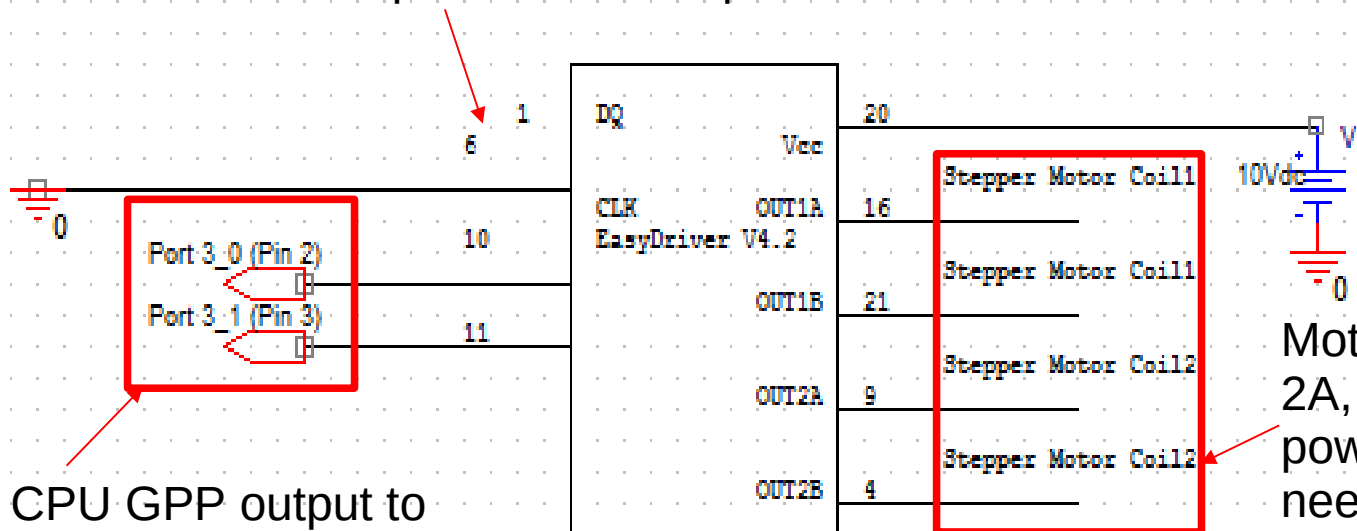


DIR is level sensitive
A rising edge on STEP
causes a step
Both take 0V to Vcc



CPU GPP output to
motor drive DIR and
STEP pins

These are CPU pins, not board pins



CPU GPP output to
motor drive DIR and
STEP pins

Motor drive output (4): 1A, 1B,
2A, and 2B connect to MOSFET
power amp circuit, so there is a
need for 4 MOSFET power amp
devices

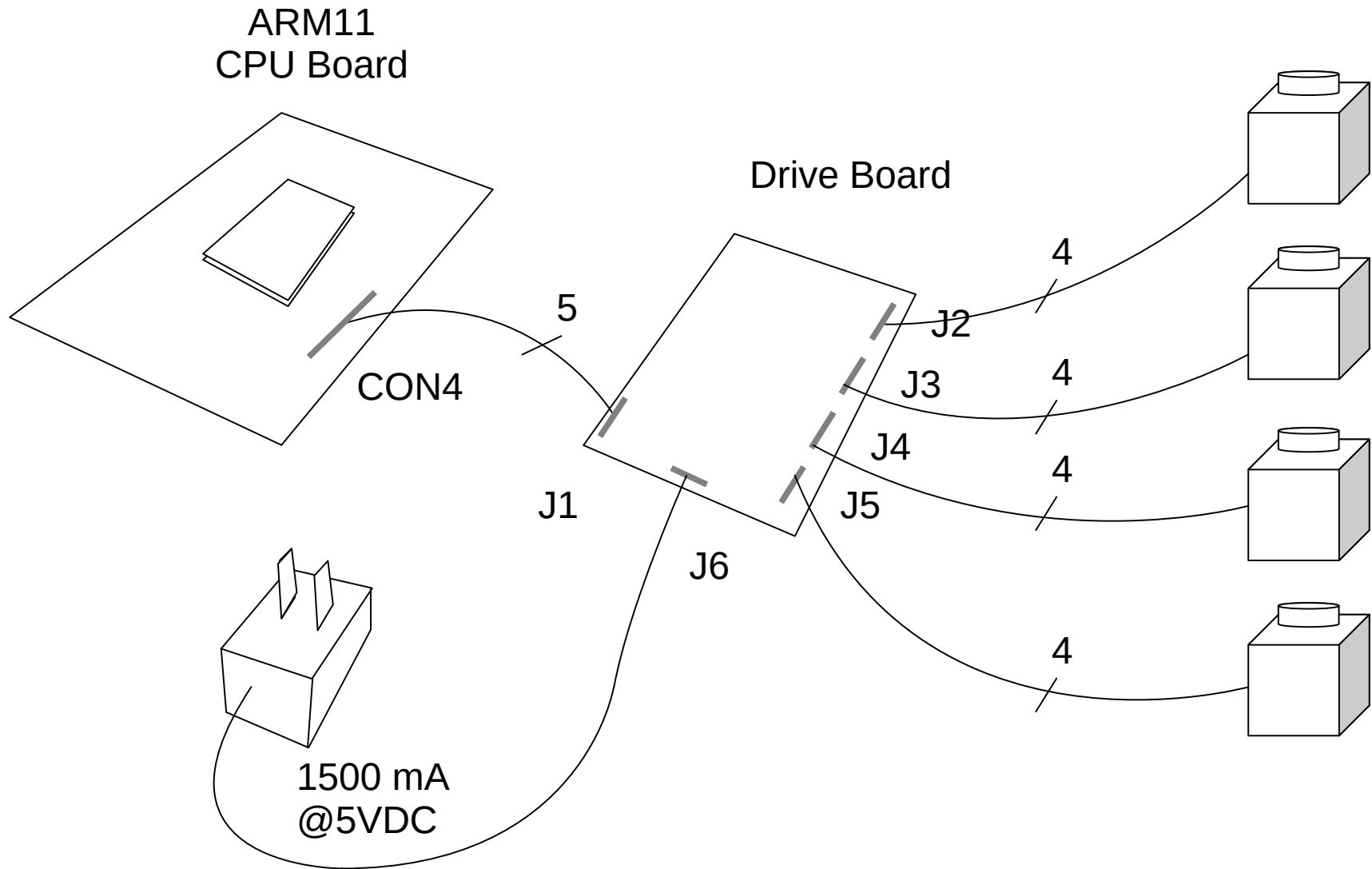
Simple Test on the Drive Board

What hardware/software can I use to test my EasyDriver?

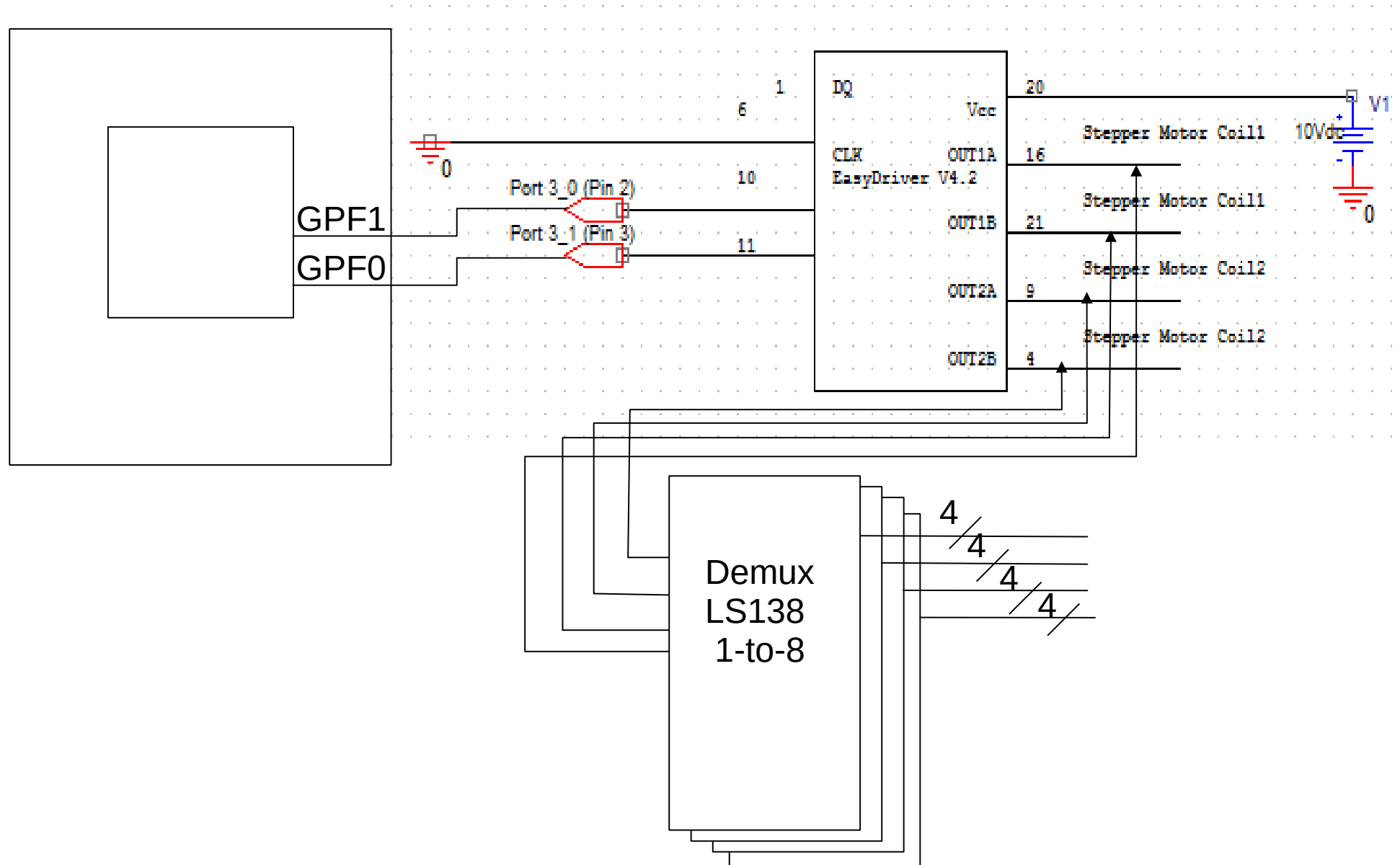
A) Here's what I do. I solder headers in the pins of the EasyDriver and put it into a breadboard. I solder the wires on my stepper motor to a 4-pin .100" male header, and plug that into the breadboard so it connects properly to the EasyDriver. Then I take a PC power supply, and use the 12V from that into the GND and M+ pins on the EasyDriver. Then I tie the DIR pin to Ground with a wire. Then I take a square wave with a frequency of about 500Hz and put it into the STEP pin. This I generate with a signal generator or an Arduino or UBW. The motor should be spinning at this point. You can then take the DIR pin and connect it to +5V to see the motor go in the other direction. As the motor is running, you can slowly adjust the current adjust pot to see the effect that it has on the smoothness of the motor's motion.

<http://www.schmalzhaus.com/EasyDriver/> Tutorial

My Design Example To Drive xyz and Theta Stages



My Design Example Motor Drive Interface

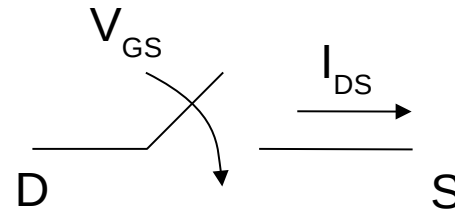
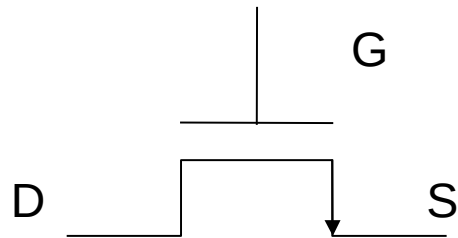


N-channel MOSFET Power Amp

IRF 510

$V_{dss} = 100 \text{ V}$; $I_{gm} = 1500 \text{ mA}$;

V_{gs} controls the flow of I_{ds} current, it is like a switch



Control signal is from CPU's GPP
port output pin [0,3.3V]

