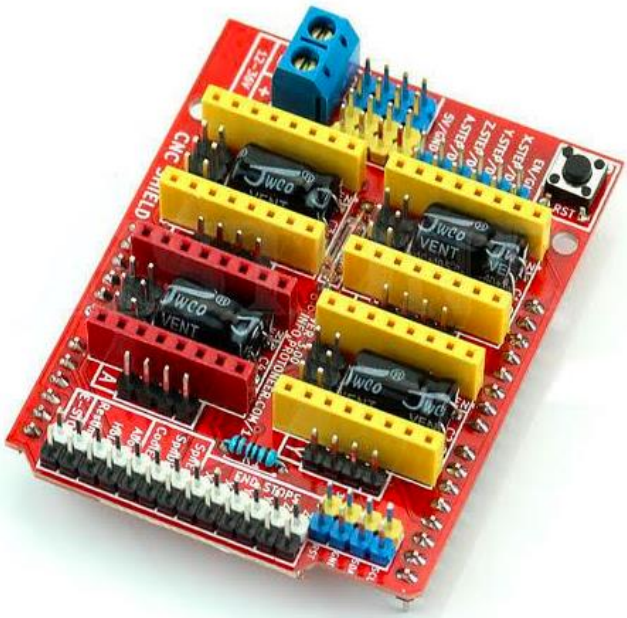
CNC Shield For A4988



The CNC Shield V3.0 allows to build a engraving machine, 3D printer, mini CNC and other similar devices using your Arduino. It is designed as a shield and can plug on top of an Arduino requiring no external connections and wiring. There are 4 slots on the board for plugging in stepper motor drive module which can drive 1 stepper motor each. Controlling each step stepper motor requires only two IO pins on the Arduino. Just insert this Arduino CNC Shield V3.0 onto an Arduino UNO, and install the GRBL firmware, so it can quickly build a DIY CNC engraving machine.

FEATURES:

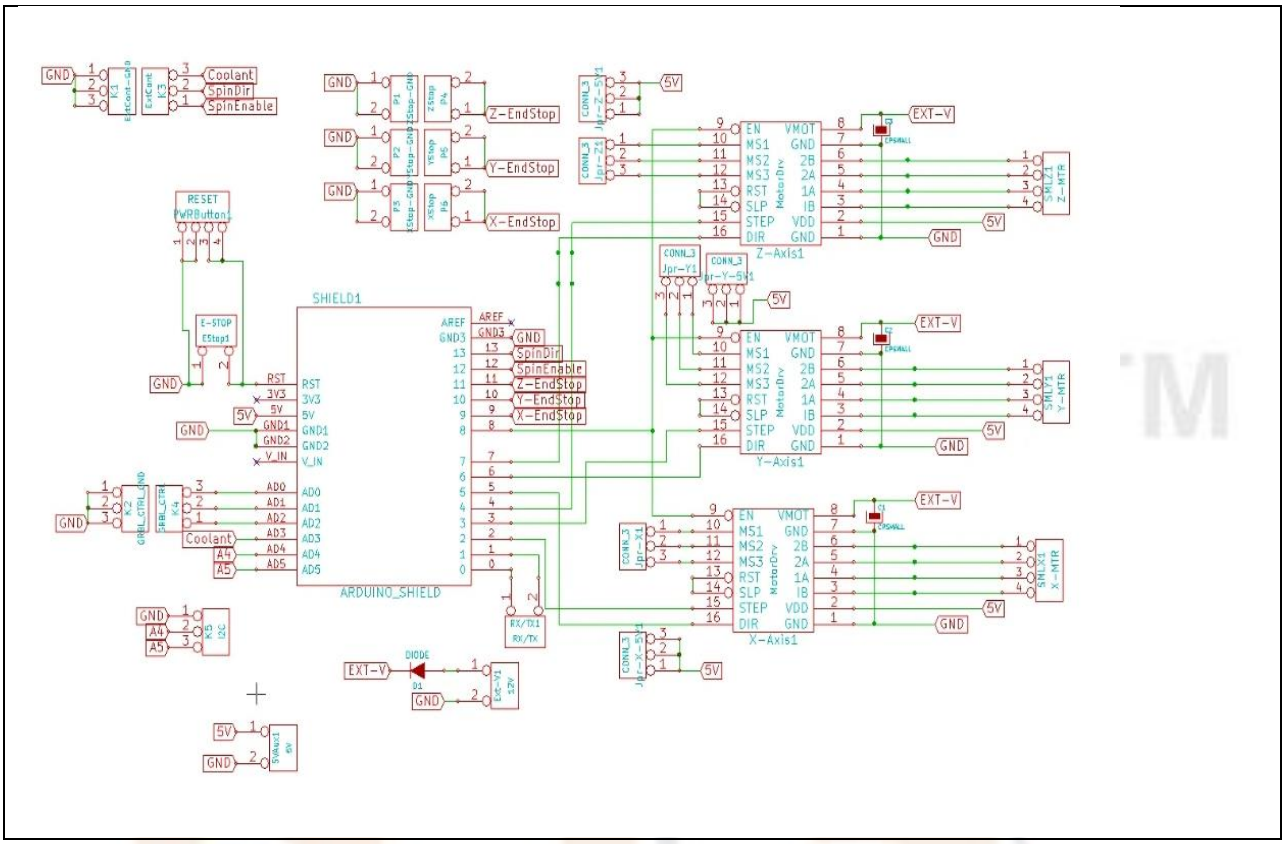
- The extension board can be used for Small CNC routers, Carving Machine, 3D Printers, DIY Laser Cutters, and almost any project where you need to control a stepper motors with high precision
- This shield allows you to control upto 4 stepper motors
- Controller each stepper motor requires 2 IO Pins only, which saves a lot of IO Pins for other purposes

- Arduino compatible
- Latest Arduino CNC Shield Version 3.10
- GRBL 0.9 compatible. (Open source firmware that runs on an Arduino UNO that turns G-code commands into stepper signals)
- Supports PWM Spindle and direction pins
- 4-Axis support (X, Y, Z , A-Can duplicate X,Y,Z or do a full 4th axis with custom firmware using pins D12 and D13)
- Supports Coolant enable
- Supports removable A4988 compatible stepper drivers.
- Jumpers to set the Micro-Stepping for the stepper drivers. (Some drivers like the DRV8825 can do up to 1/32 micro-stepping)
- Compact design.
- Stepper Motors can be connected with 4 pin molex connectors or soldered in place.
- Runs on 12-36V DC. (At the moment only the DRV8825 drivers can handle up to 36V so please consider the operation voltage when powering the board.)
- Uses removable A4988 or DRV8825 compatible stepping driver.

SPECIFICATIONS:

- Motor Voltage: 8 V to 35 V
- Logic Circuits Voltage: 3 V to 5.5 V
- Current: 2 A (MAX)
- Five step resolutions: full, 1/2, 1/4, 1/8 and 1/16
- Protection: under-voltage, over-current and over-temperature
- External resources

SCHEMATIC DIAGRAM:

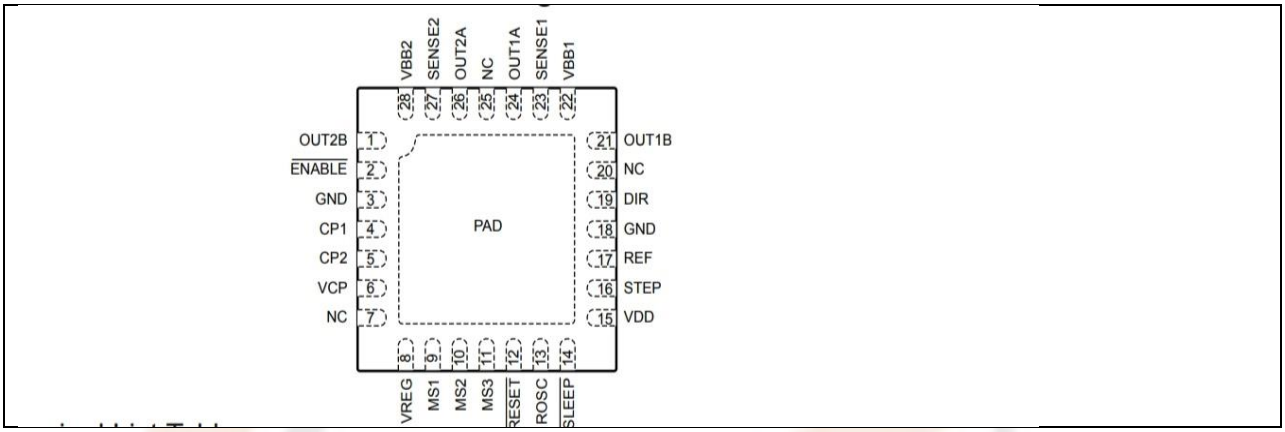


The schematic diagram of CNC Shield for A4988 is as shown above

- The A4988 is a complete microstepping motor driver with a built-in translator for easy operation with minimal control lines. It is designed to operate bipolar stepper motors in full-, half-, quarter-, eighth, and sixteenth-step modes.
- The currents in each of the two output full-bridges and all of the N-channel DMOS FETs are regulated with fixed off-time PWM (pulse width modulated) control circuitry.
- At each step, the current for each full-bridge is set by the value of its external current-sense resistor (RS1 and RS2), a reference voltage (VREF), and the output voltage of its DAC (which in turn is controlled by the output of the translator).
- At power-on or reset, the translator sets the DACs and the phase current polarity to the initial Home state , and the current regulator to Mixed Decay Mode for both phases. When a step command signal occurs on the STEP input, the translator automatically sequences the DACs to the next level and current polarity.

- The microstep resolution is set by the combined effect of the MSx inputs. When stepping, if the new output levels of the DACs are lower than their previous output levels, then the decay mode for the active full-bridge is set to Mixed. If the new output levels of the DACs are higher than or equal to their previous levels, then the decay mode for the active full-bridge is set to slow.
- This automatic current decay selection improves microstepping perfor-mance by reducing the distortion of the current waveform that results from the back EMF of the motor.
- This stepper motor driver lets you control one bipolar stepper motor at up to 2 A output current per coil . Here are some of the driver's key features:
- Simple step and direction control interface
- Five different step resolutions: full-step, half-step, quarter-step, eighth-step, and sixteenth-step
- Adjustable current control lets you set the maximum current output with a potentiometer, which lets you use voltages above your stepper motor's rated voltage to achieve higher step rates
- Intelligent chopping control that automatically selects the correct current decay mode (fast decay or slow decay)
- Over-temperature thermal shutdown, under-voltage lockout, and crossover-current protection
- Short-to-ground and shorted-load protection

PIN FUNCTION:



Name	Number	Description
CP1	4	Charge pump capacitor terminal
CP2	5	Charge pump capacitor terminal
VCP	6	Reservoir capacitor terminal
VREG	8	Regulator decoupling terminal
MS1	9	Logic Input
MS2	10	Logic Input
MS3	11	Logic Input
Reset	12	Logic Input
ROSC	13	Timing Set
Sleep	14	Logic Input
VDD	15	Logic Supply
STEP	16	Logic input
REF	17	Gm reference voltage input
GND	3,18	Ground
DIR	19	Logic Input
OUT1B	21	DMOS Full Bridge 1 Output B
VBB1	22	Load supply
SENSE1	23	Sense resistor terminal for Bridge 1
OUT1A	24	DMOS Full Bridge 1 Output A
OUT2A	26	DMOS Full Bridge 2 Output A
SENSE2	27	Sense resistor terminal for Bridge 2
VBB2	28	Load Supply
OUT2B	1	DMOS Full Bridge 2 Output B
ENABLE	2	Logic Input
NC	7,20,25	No connection
PAD	-	Exposed pad for enhanced thermal dissipation*

- **Step Input (STEP):** A low-to-high transition on the STEP input sequences the translator and advances the motor one incre-ment. The translator controls the input to the DACs and the direction of current flow in each winding. The size of the increment is determined by the combined state of the MSx inputs.
- **Direction Input (DIR):** This determines the direction of rotation of the motor. Changes to this input do not take effect until the next STEP rising edge.
- **Internal PWM Current Control**: Each full-bridge is controlled by a fixed off-time PWM current control circuit that limits the load current to a desired value, ITRIP . Initially, a diagonal pair of source and sink FET outputs are enabled and current flows through the motor winding and the current sense resistor, RSx. When the voltage across RSx equals the DAC output voltage, the current sense comparator resets the PWM latch. The latch then turns off the appropriate source driver and initiates a fixed off time decay mode.
- **Fixed Off-Time:** The internal PWM current control circuitry uses a one-shot circuit to control the duration of time that the DMOS FETs remain off. The off-time, tOFF, is determined by the ROSC terminal.
- **Blanking:** This function blanks the output of the current sense comparators when the outputs are switched by the internal current control circuitry. The comparator outputs are blanked to prevent false overcurrent detection due to reverse recovery currents of the clamp diodes, and switching transients related to the capacitance of the load. The blank time, tBLANK (μs), is approximately

  tBLANK ≈ 1 μs
- **Shorted-Load and Short-to-Ground Protection:** If the motor leads are shorted together, or if one of the leads is shorted to ground, the driver will protect itself by sensing the overcurrent event and disabling the driver that is shorted, protect-ing the device from damage. In the case of a short-to-ground, the device will remain disabled (latched) until the SLEEP input goes high or VDD power is removed.
- **VREG (VREG):** This internally-generated voltage is used to operate the sink-side FET outputs. The nominal output voltage of the VREG terminal is 7 V. The VREG pin must be decoupled with a 0.22 μF ceramic capacitor to ground. VREG is internally monitored. In the case of a fault condition, the FET outputs of the A4988 are disabled. Capacitor

values should be Class 2 dielectric ±15% maximum, or tolerance R, according to EIA (Electronic Industries Alliance) specifications.

- **Enable Input:** This input turns on or off all of the FET outputs. When set to a logic high, the outputs are disabled. When set to a logic low, the internal control enables the outputs as required. The translator inputs STEP, DIR, and MSx, as well as the internal sequencing logic, all remain active, independent of the enable input state.

PACKAGE INCLUDE :

1 x CNC shield V3 engraving