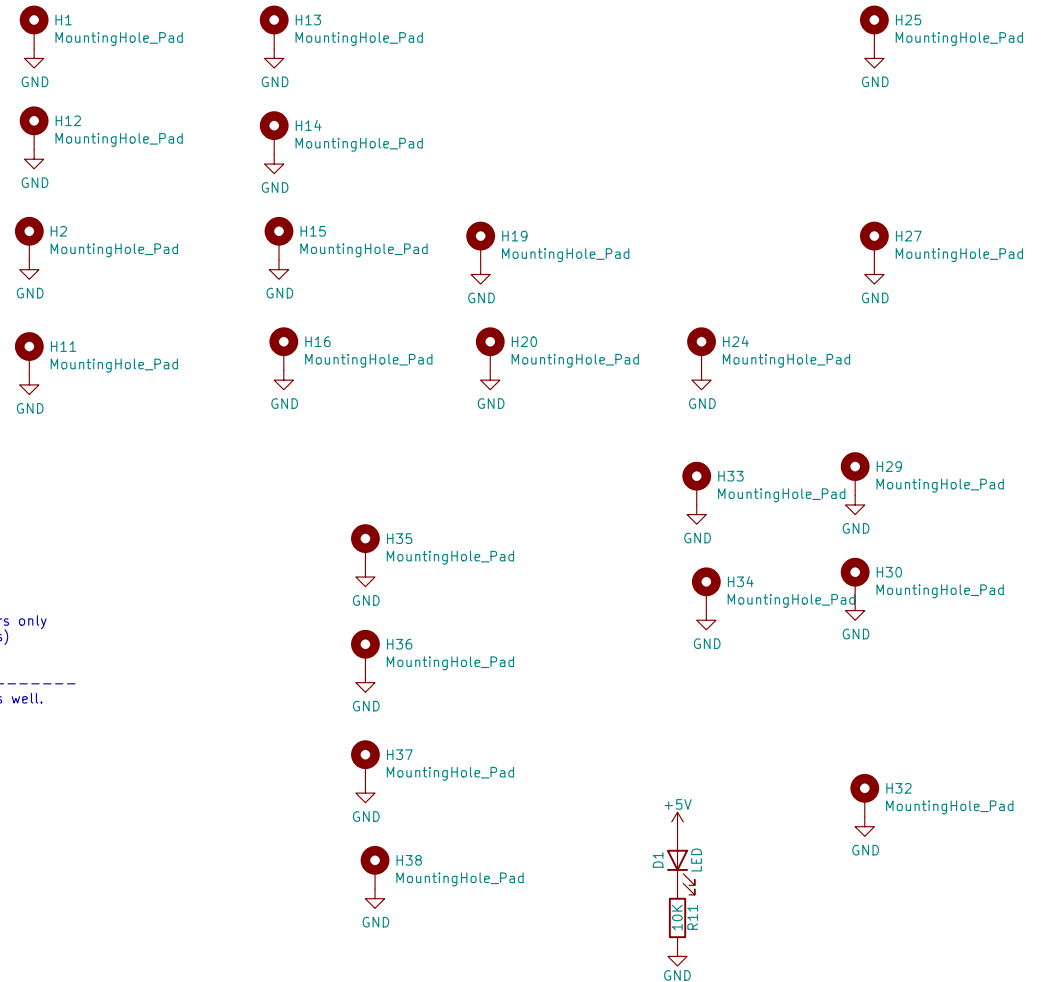


Voltage Rails:
 24V General supply,
 12V Supply for stepper controllers only
 12L (External supply for steppers)
 5V uC and some circuits
 3v3 uC and support

 48V only spindle, accepts 24V as well.

Power budget:
 24V => TODO
 12V steppers < 500mA
 5V uC < 1A
 3v3 < 0.5 A
 12V steppers 3Ax2x4 => 24A (trace widths!!)
 24V stepper alt: 12A width
 24V 8A (trace widths)
 PWM Spindle IO 10A traces!

Stepper paths may allow for 20 A per coil.
 Total supply 20A x 2 x 4 => 160A (1KW!!) Does not consider actual stepper motor being below 12V Nominally.



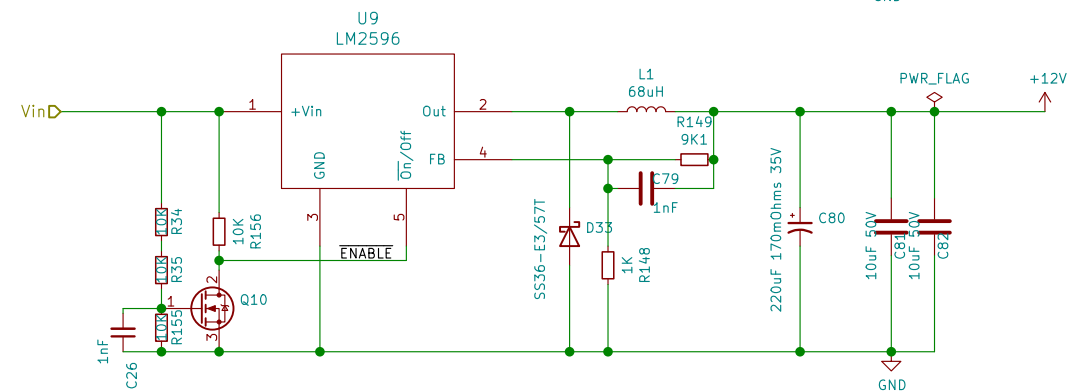
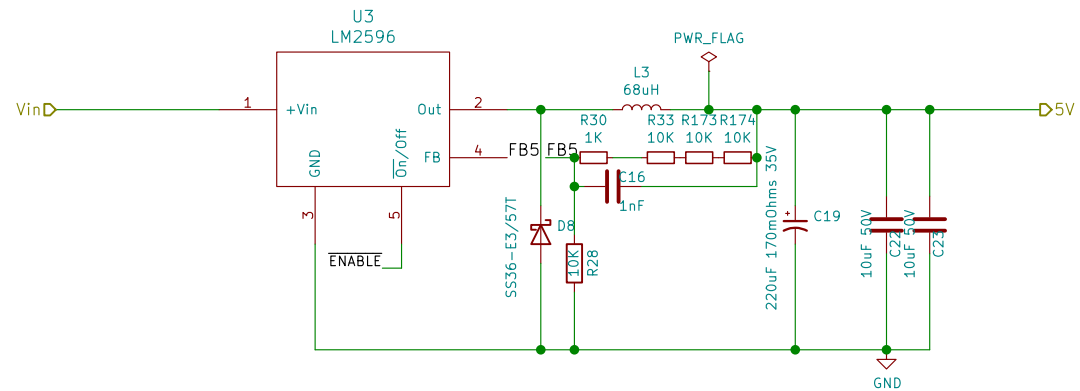
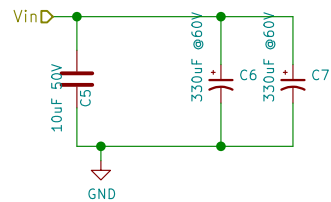
Sheet: Reverse polarity protection

File: psu_reverse_polarity.sch

Sheet: /PSU/
 File: psu.sch

Title: Trinamic FluidNC CNC Controller

Size: A4	Date: 2022-01-27	Rev: 1.0.0
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 2/17



Sheet: /PSU/Step down converters/
File: psu5v.sch

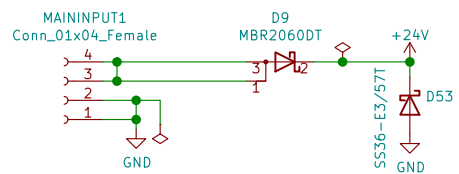
Title: Trinamic FluidNC CNC Controller

Size: A4 Date: 2022-01-27

KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

Rev: 1.0.0

Id: 3/17



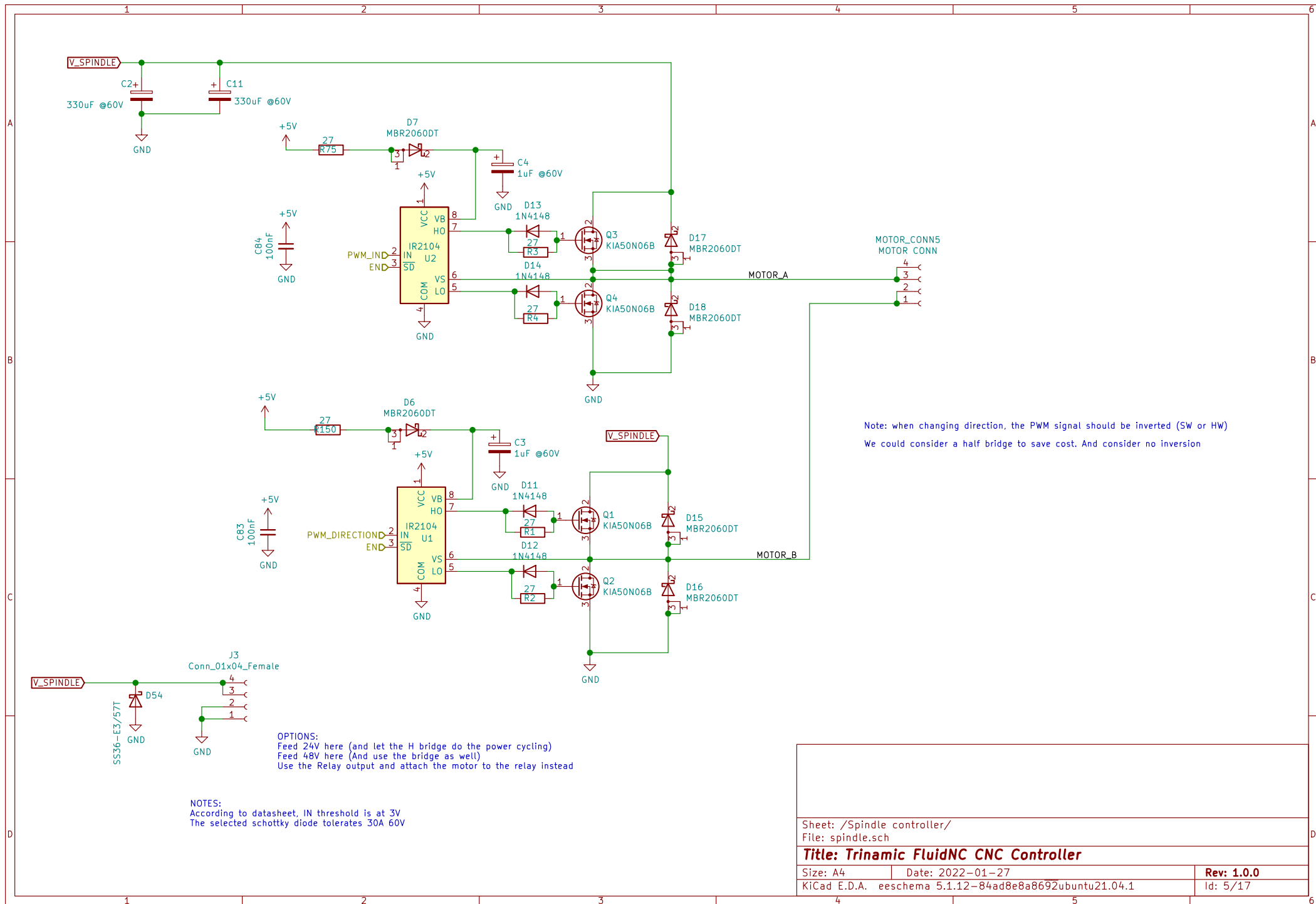
Sheet: /PSU/Reverse polarity protection/
File: psu_reverse_polarity.sch

Title: Trinamic FluidNC CNC Controller

Size: A4 Date: 2022-01-27 Rev: 1.0.0

KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

Id: 4/17



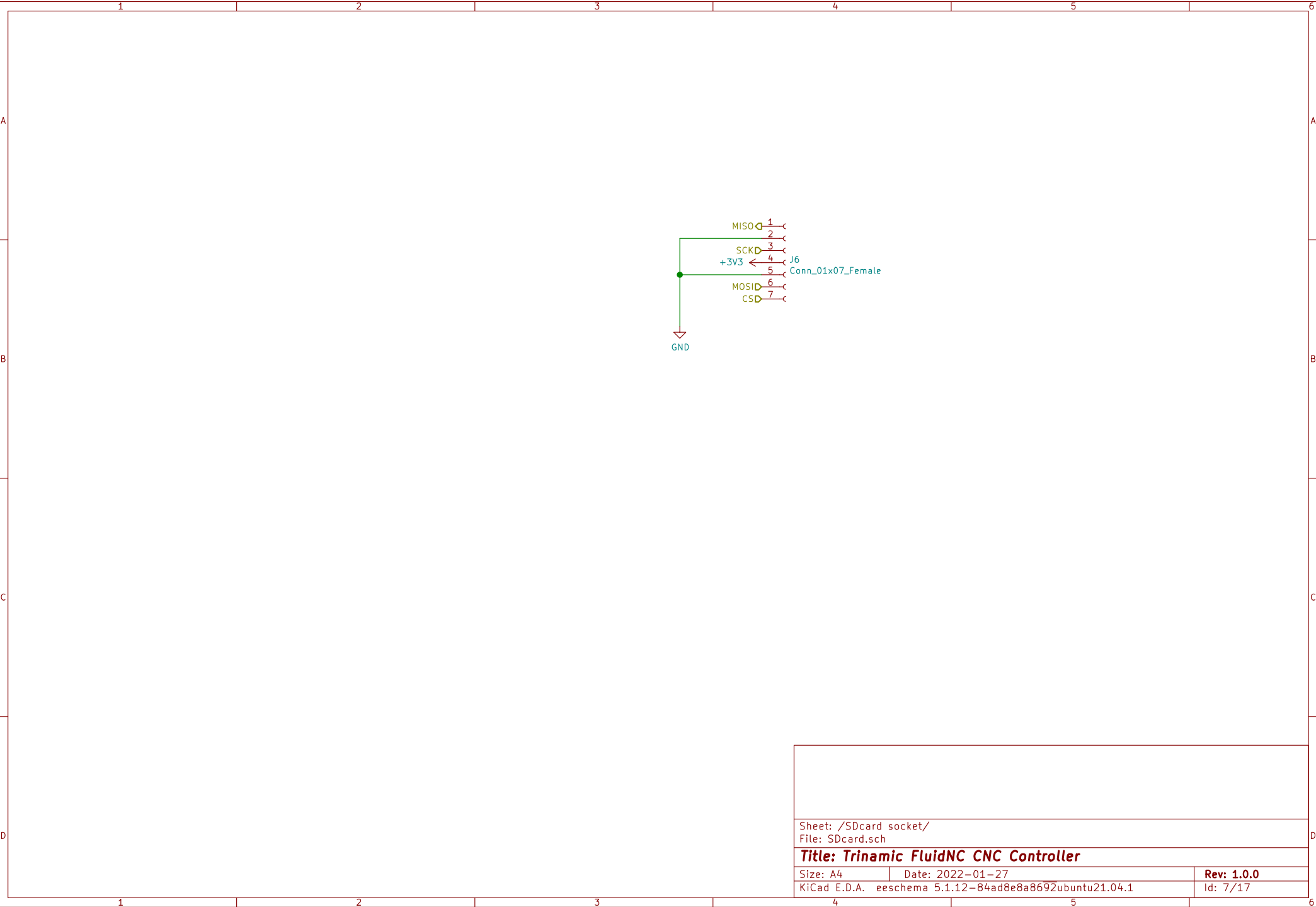
A	
B	
C	
D	



D



Id: 6/17



Sheet: /SDcard socket/ File: SDcard.sch		
Title: Trinamic FluidNC CNC Controller		
Size: A4	Date: 2022-01-27	Rev: 1.0.0
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 7/17

123456

A

A power step up circuit
can be assembled here.

B

C

D

Sheet: /Spindle PSU/
File: spindlePSU.sch

Title: Trinamic FluidNC CNC Controller

Size: A4

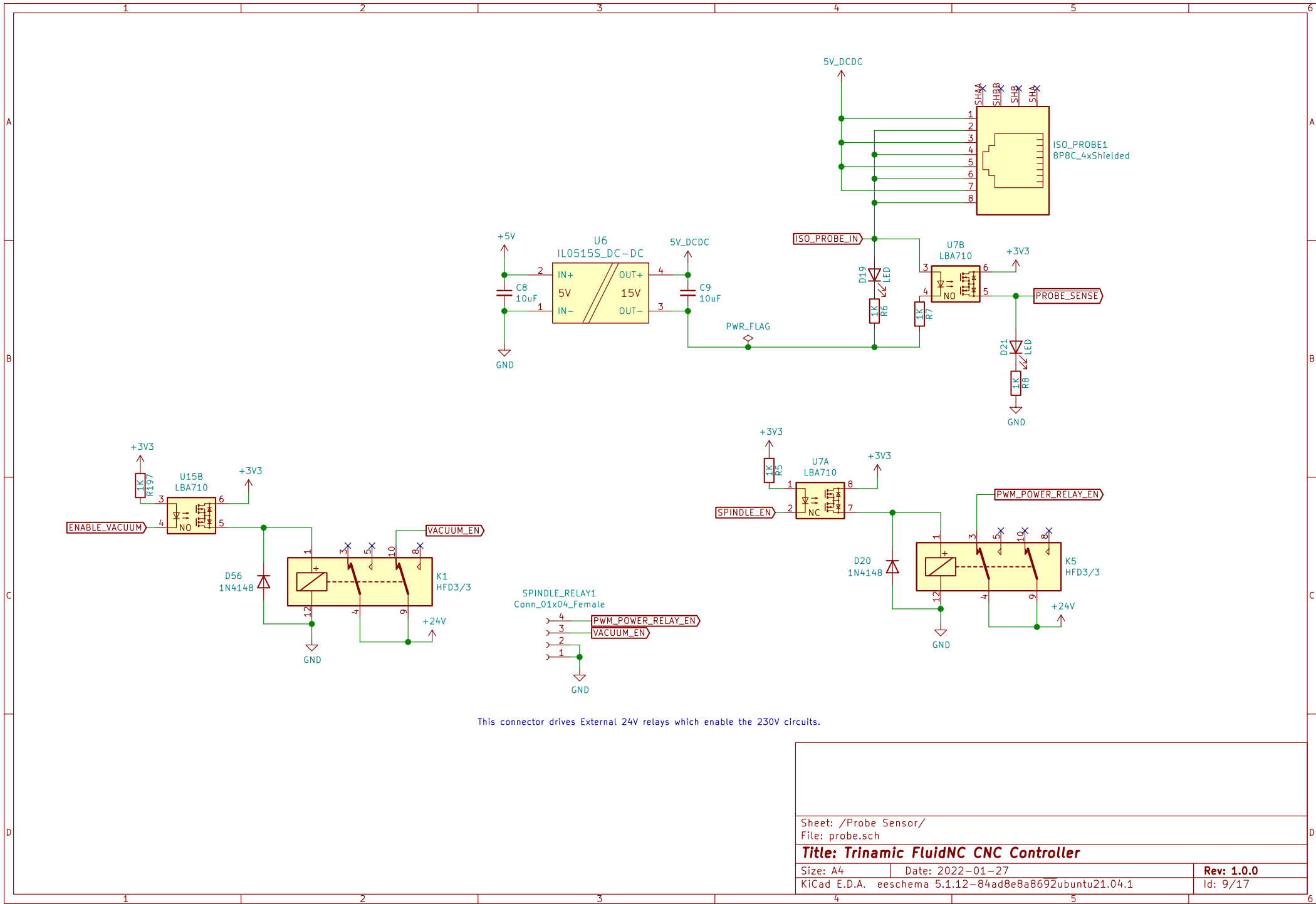
Date: 2022-01-27

Rev: 1.0.0

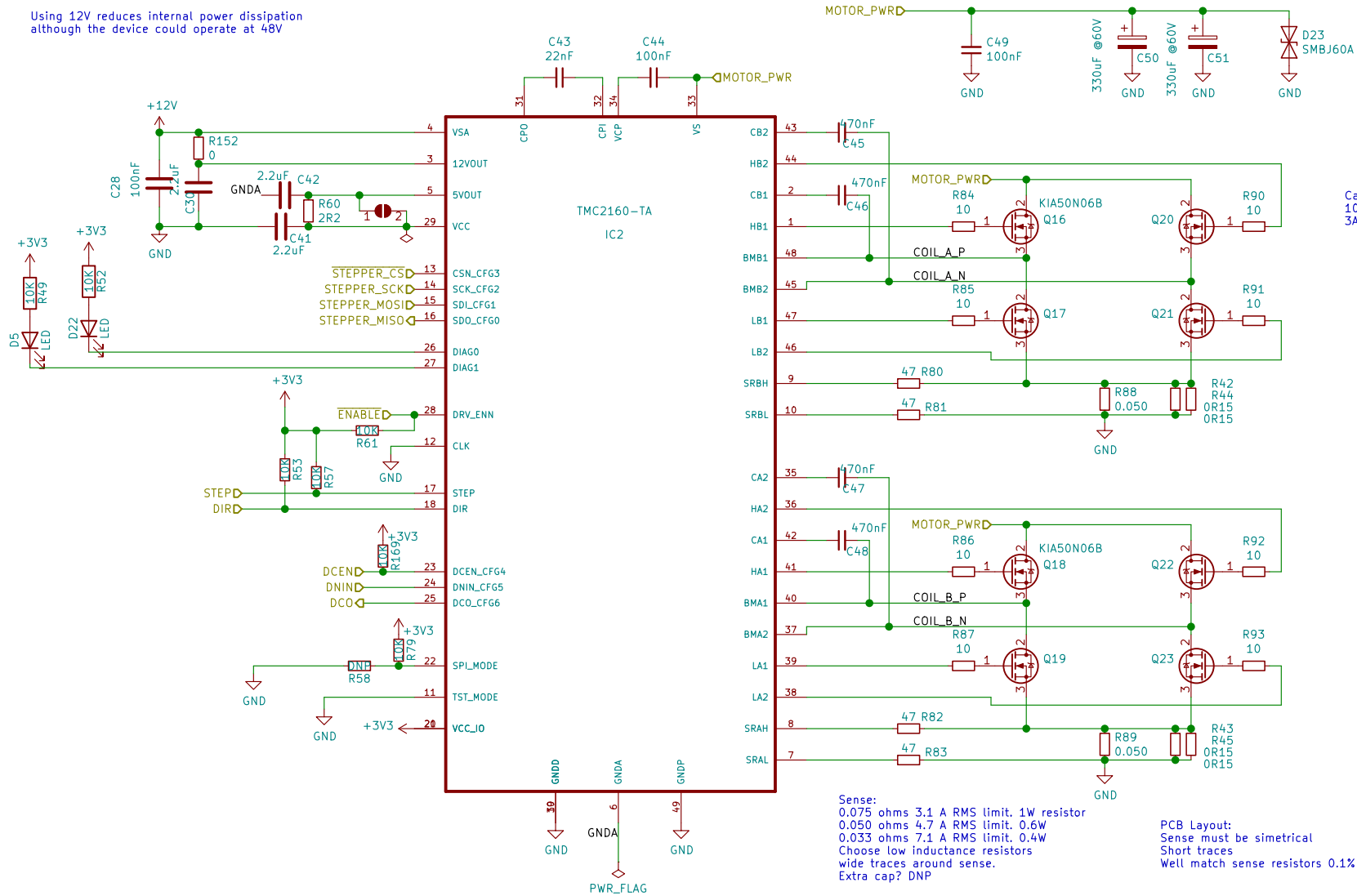
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

Id: 8/17

123456



Using 12V reduces internal power dissipation
although the device could operate at 48V

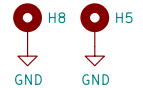


Capacitors need to take ripple
100uF per ampere coil
3A x 2 => 600uF min

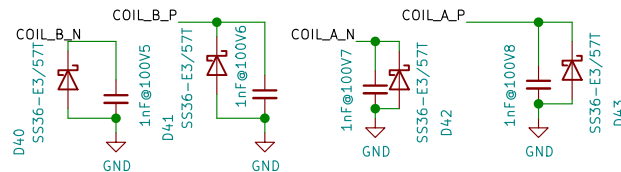
MOTOR_CONN2
MOTOR_CONN
COIL_B_P 4
COIL_B_N 3
COIL_A_N 2
COIL_A_P 1

Sense:
0.075 ohms 3.1 A RMS limit. 1W resistor
0.050 ohms 4.7 A RMS limit. 0.6W
0.033 ohms 7.1 A RMS limit. 0.4W
Choose low inductance resistors
wide traces around sense.
Extra cap? DNP

PCB Layout:
Sense must be symmetrical
Short traces
Well match sense resistors 0.1%



1nF caps added to reduce ringing



Sheet: /Stepper Y1/
File: tmc2160-stepper.sch

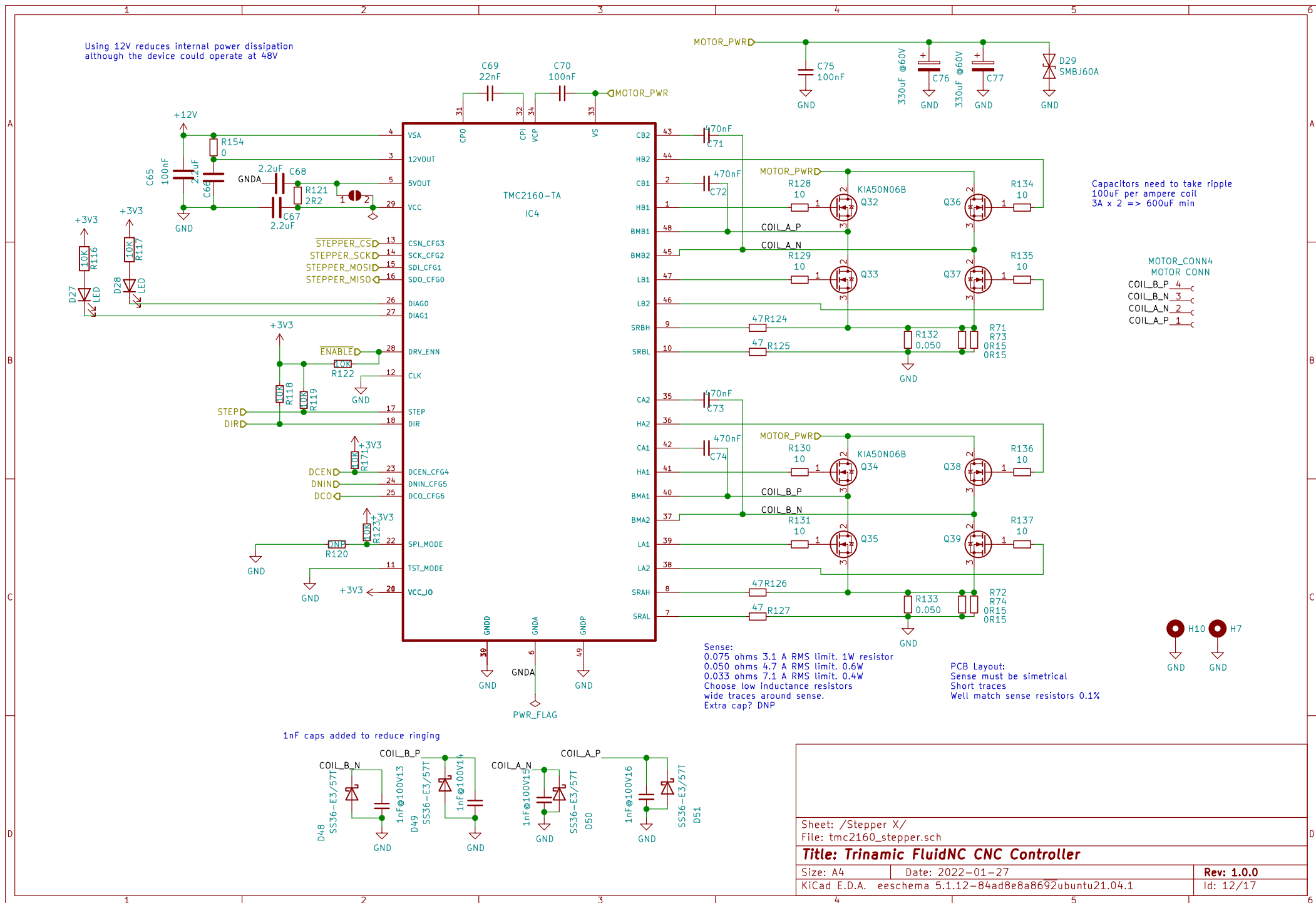
Title: Trinamic FluidNC CNC Controller

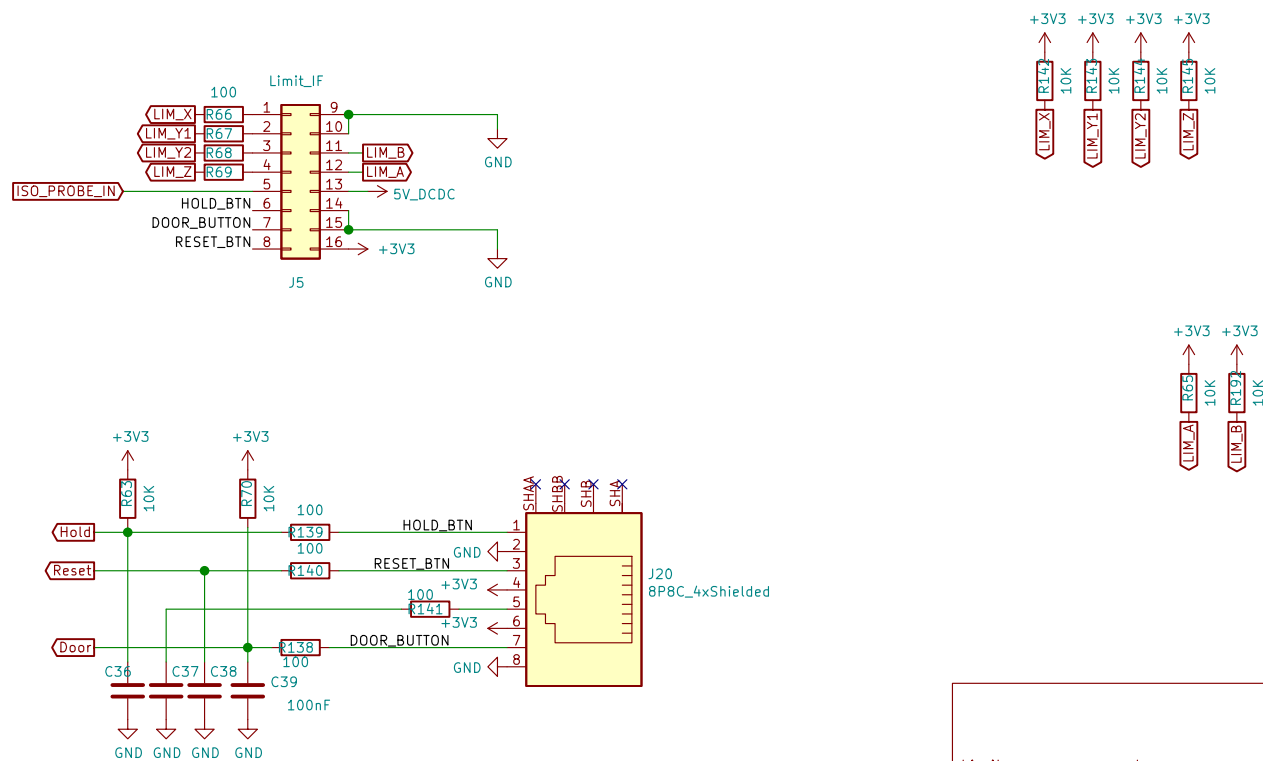
Size: A4 Date: 2022-01-27

KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

Rev: 1.0.0

Id: 11/17





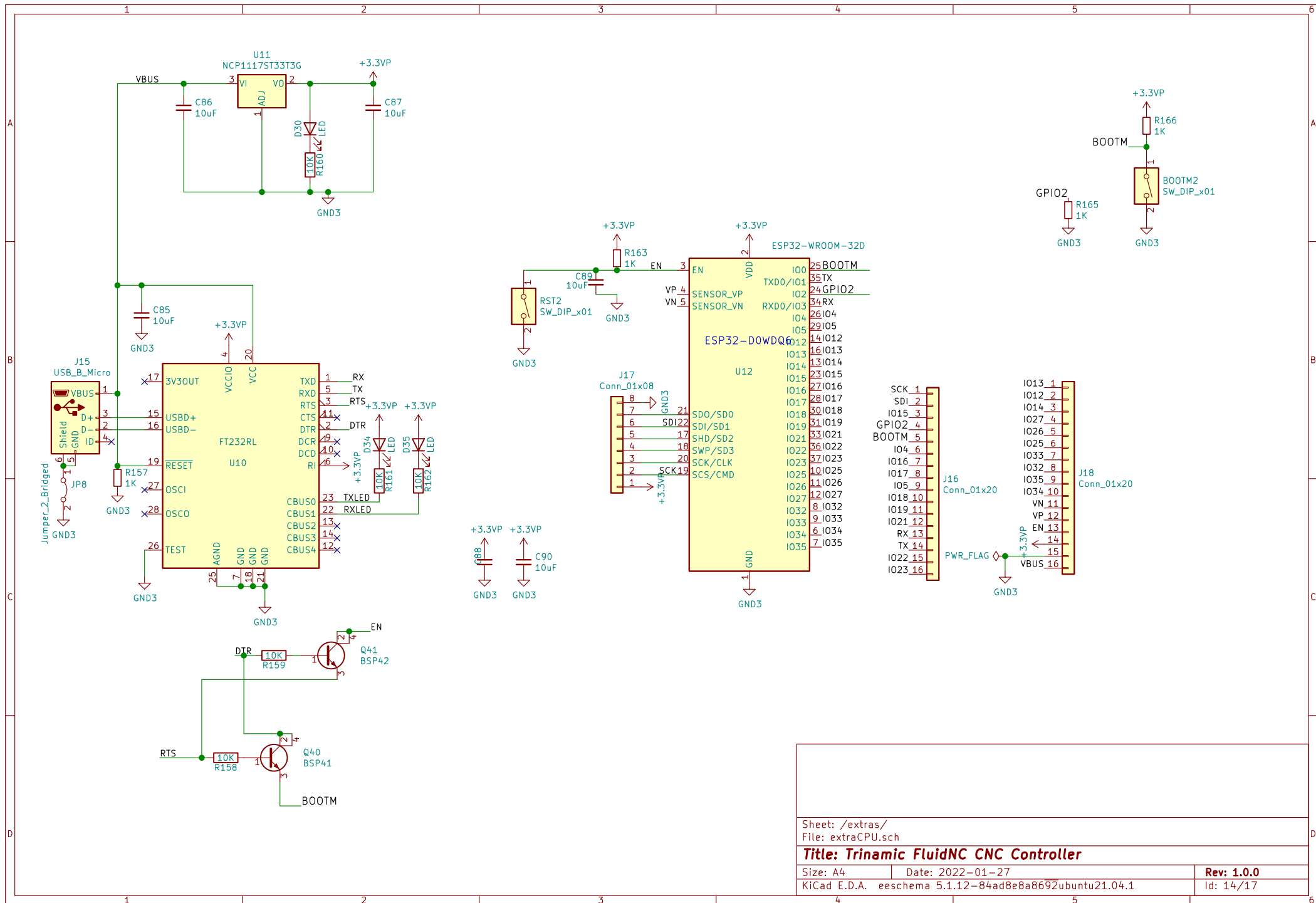
Limit sensor connectors

Sheet: /limit sensors/
File: limitLF.sch

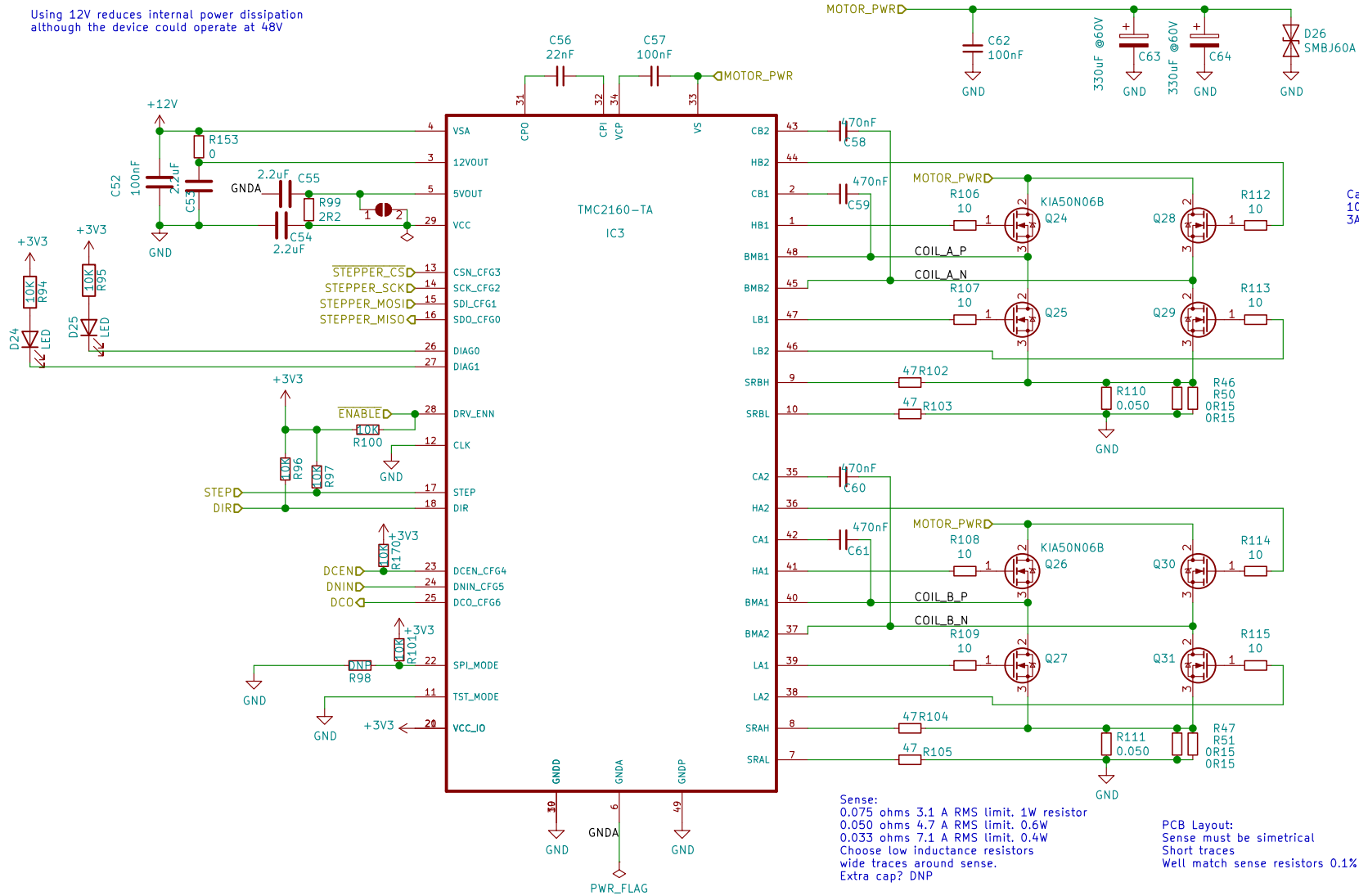
Title: Trinamic FluidNC CNC Controller

Size: A4 Date: 2022-01-27
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

Rev: 1.0.0
Id: 13/17



Using 12V reduces internal power dissipation
although the device could operate at 48V

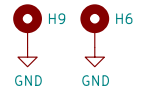


Capacitors need to take ripple
100uF per ampere coil
3A x 2 => 600uF min

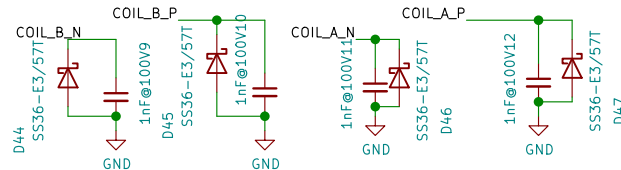
MOTOR_CONN3
MOTOR_CONN
COIL_B_P 4
COIL_B_N 3
COIL_A_N 2
COIL_A_P 1

Sense:
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0.050 ohms 4.7 A RMS limit. 0.6W
0.033 ohms 7.1 A RMS limit. 0.4W
Choose low inductance resistors
wide traces around sense.
Extra cap? DNP

PCB Layout:
Sense must be simetrical
Short traces
Well match sense resistors 0.1%



1nF caps added to reduce ringing



Sheet: /Stepper Y2/
File: tmc2160-stepper.sch

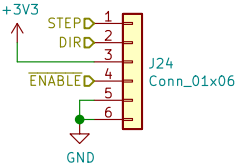
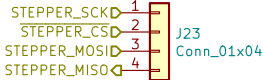
Title: Trinamic FluidNC CNC Controller

Size: A4 Date: 2022-01-27

KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1

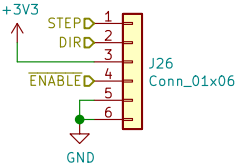
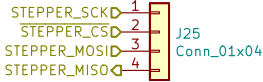
Rev: 1.0.0

Id: 15/17



Optional module.
When getting prototypes from JLC, the second module can be reused from another prototype.

Sheet: /Axis A/ File: stepper.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 16/17



Optional module.
When getting prototypes from JLC, the second module can be reused from another prototype.

Sheet: /sheet622F8C72/ File: stepper.sch		
Title:		
Size: A4	Date:	Rev:
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 17/17