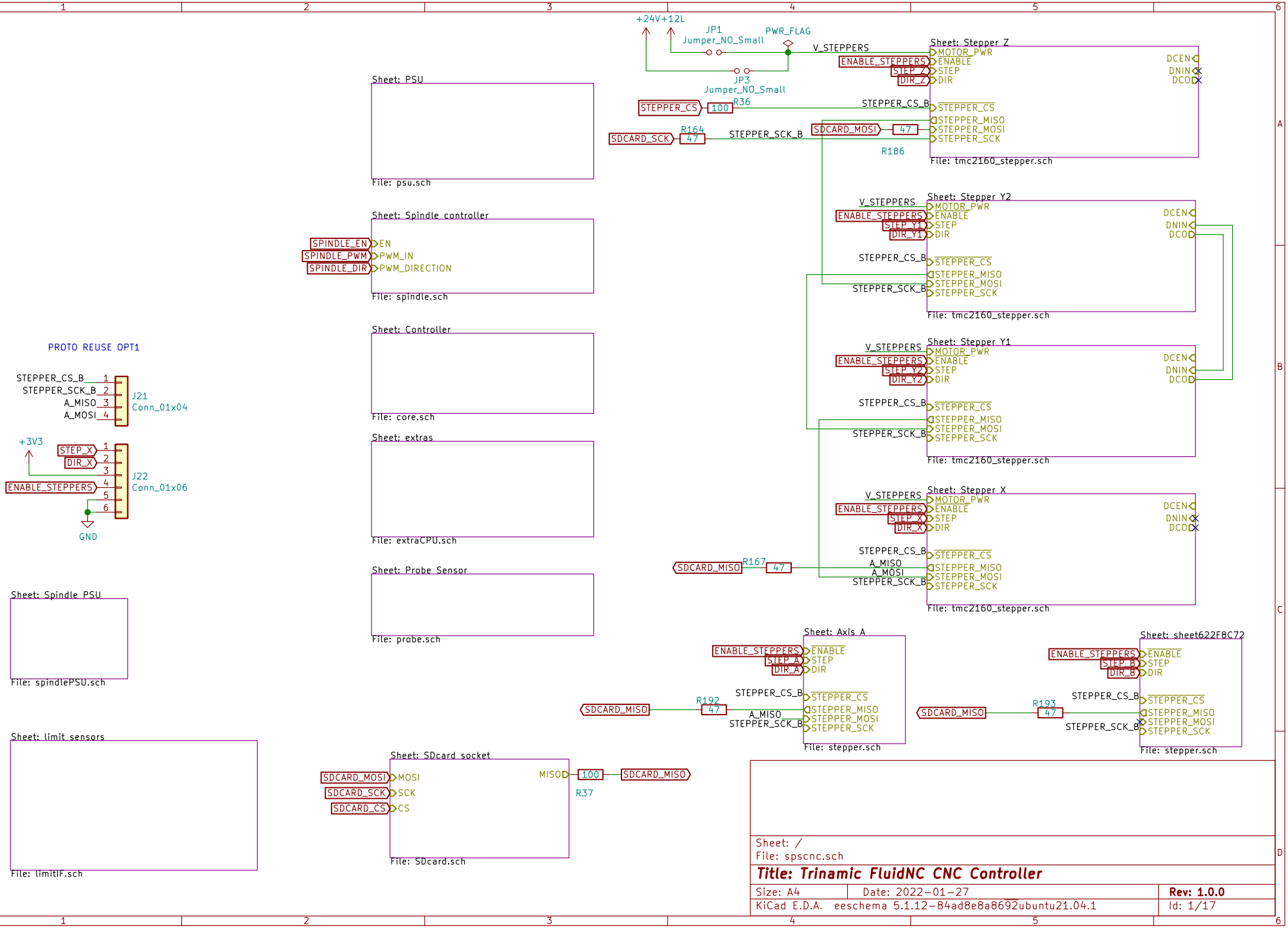
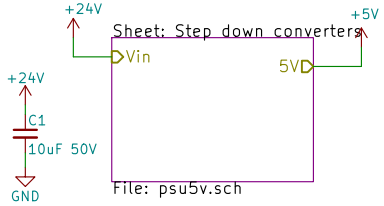
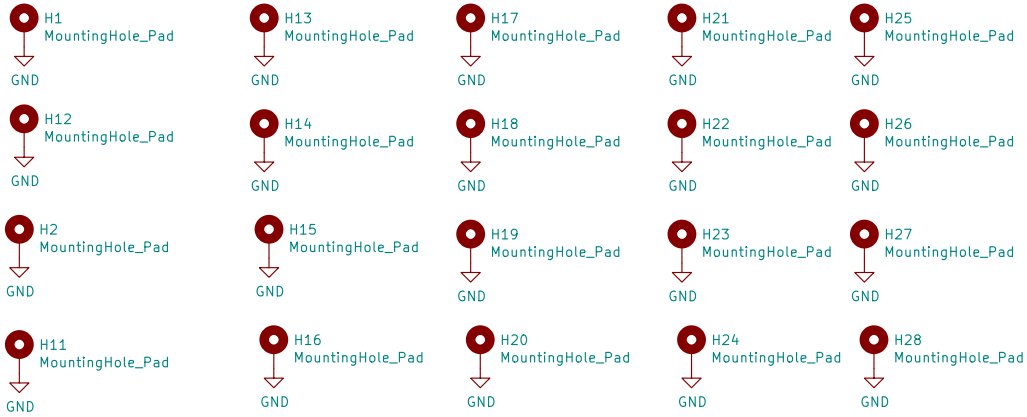
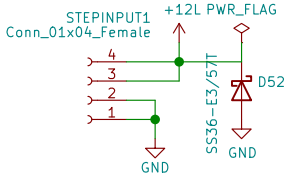

+24V+12L
JP1
Jumper_NO_Small
PWR_FLAG
V_STEPPERS
JP3
Jumper_NO_Small
Sheet: Stepper Z
MOTOR_PWR
ENABLE
STEP
DIR
ENABLE_STEPPERS
STEP_Z
DIR_Z
DCEN
DNIN
DCOD
STEPPER_CS
100
R36
STEPPER_CS_B
STEPPER_MISO
STEPPER_MOSI
STEPPER_SCK
SDCARD_MOSI
47
SDCARD_SCK
R164
47
STEPPER_SCK_B
R186
File: tmc2160_stepper.sch
Sheet: PSU
File: psu.sch
Sheet: Spindle controller
SPINDLE_EN
SPINDLE_PWM
SPINDLE_DIR
EN
PWM_IN
PWM_DIRECTION
File: spindle.sch
Sheet: Stepper Y2
V_STEPPERS
ENABLE_STEPPERS
STEP_Y1
DIR_Y1
STEPPER_CS_B
STEPPER_SCK_B
File: tmc2160_stepper.sch
Sheet: Controller
File: core.sch
Sheet: Stepper Y1
V_STEPPERS
ENABLE_STEPPERS
STEP_Y2
DIR_Y2
STEPPER_CS_B
STEPPER_SCK_B
File: tmc2160_stepper.sch
PROTO REUSE OPT1
STEPPER_CS_B
STEPPER_SCK_B
A_MISO
A_MOSI
J21
Conn_01x04
+3V3
STEP_X
DIR_X
ENABLE_STEPPERS
J22
Conn_01x06
GND
Sheet: extras
File: extraCPU.sch
Sheet: Stepper X
V_STEPPERS
ENABLE_STEPPERS
STEP_X
DIR_X
STEPPER_CS_B
A_MISO
A_MOSI
STEPPER_SCK_B
SDCARD_MISO
R167
47
File: tmc2160_stepper.sch
Sheet: Probe Sensor
File: probe.sch
Sheet: Spindle PSU
File: spindlePSU.sch
Sheet: Axis A
ENABLE_STEPPERS
STEP_A
DIR_A
STEPPER_CS_B
A_MISO
STEPPER_SCK_B
SDCARD_MISO
R192
47
File: stepper.sch
Sheet: sheet622F8C72
ENABLE_STEPPERS
STEP_B
DIR_B
STEPPER_CS_B
STEPPER_SCK_B
SDCARD_MISO
R193
47
File: stepper.sch
Sheet: limit sensors
File: limitIF.sch
Sheet: SDcard socket
SDCARD_MOSI
SDCARD_SCK
SDCARD_CS
MOSI
SCK
CS
MISO
100
R37
SDCARD_MISO
File: SDcard.sch
Sheet: /
File: spscnc.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: 1/17

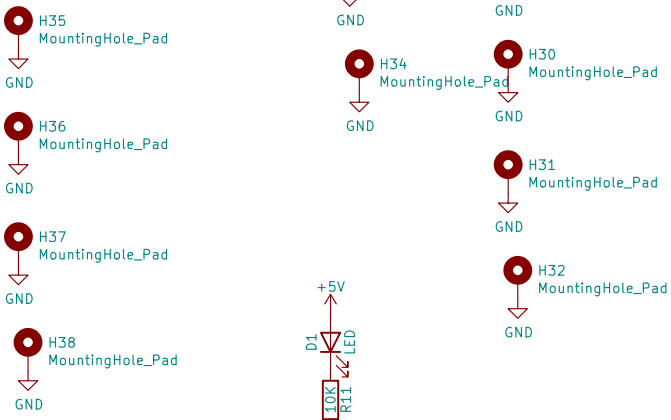






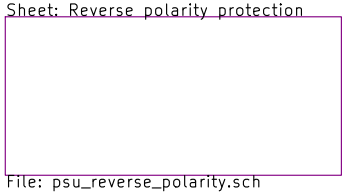
Voltage Rails:
24V General supply.
12V Supply for stepper controllers only
12L (External supply for steppers)
5V uC and some circuits
3v3 uC and support

48V only spindle, accepts 24V as well.

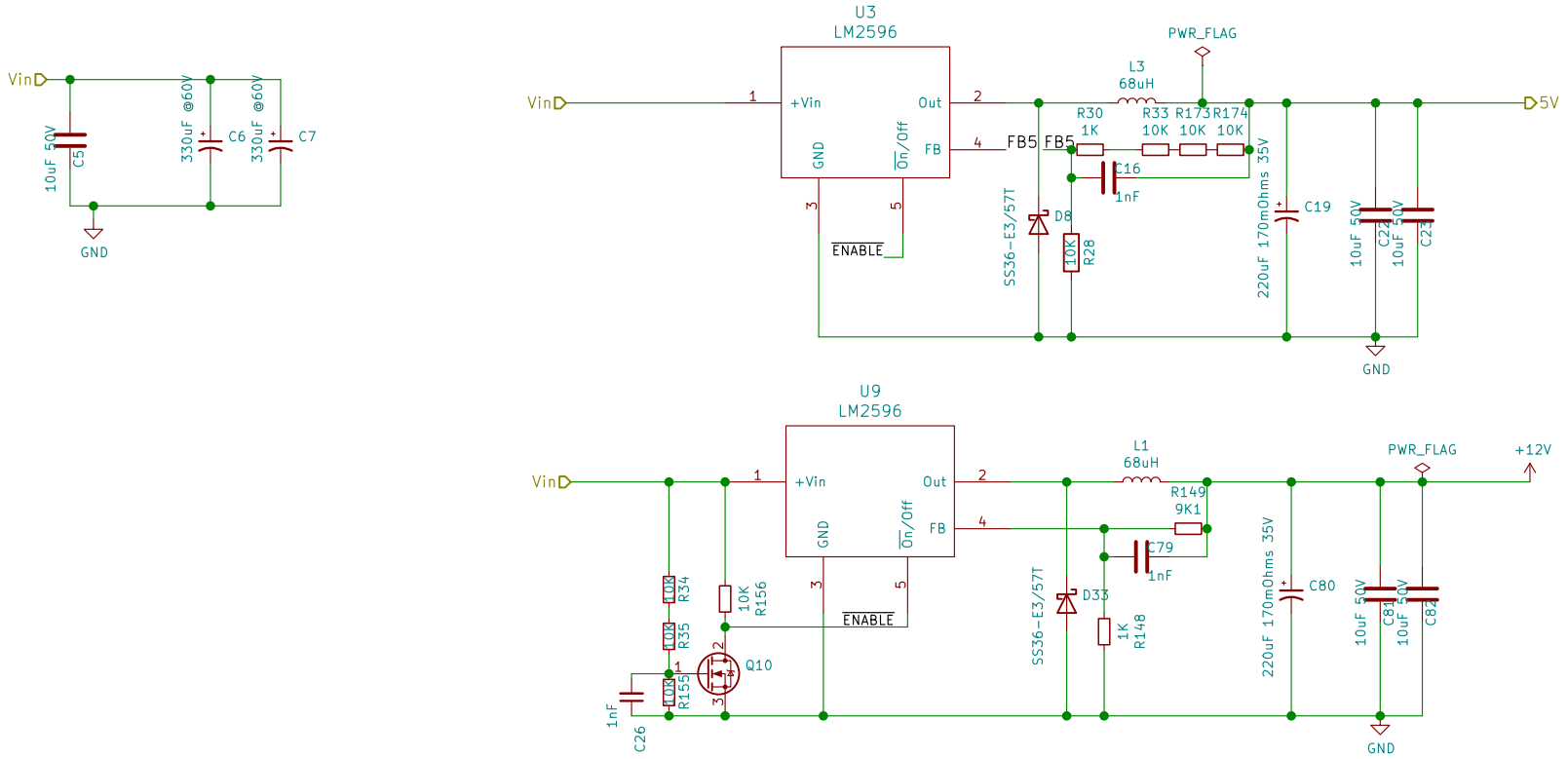


Power budget:
24V => TODO
12V steppers < 500mA
5V uC < 1A
3v3 < 0.5 A
12V steppers 3Ax2x4 => 24A (trace widths!!)
24V stepper alt: 12A width
24V 8A (trace widths)
PWM Spindle IO 10A traces!

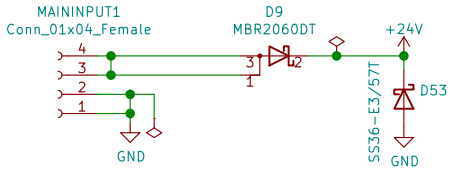
Stepper paths may allow for 20 A per coil.
Total supply 20A x 2 x 4 => 160A (1KW!!) Does not consider actual stepper motor being below 12V Nominally.



Sheet: /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



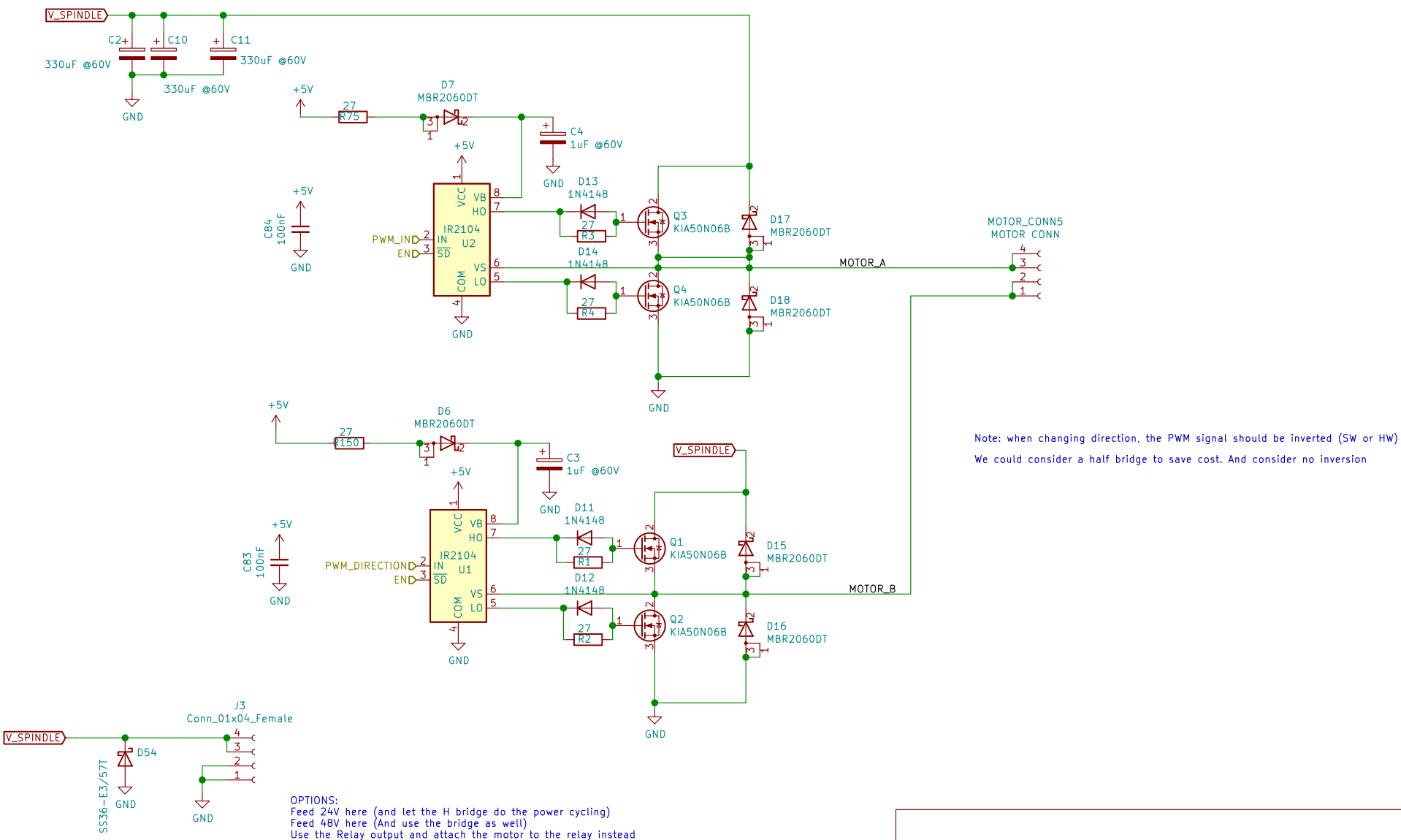
Sheet: /PSU/Step down converters/		
File: psu5v.sch		
Title: Trinamic FluidNC CNC Controller		
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 3/17



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

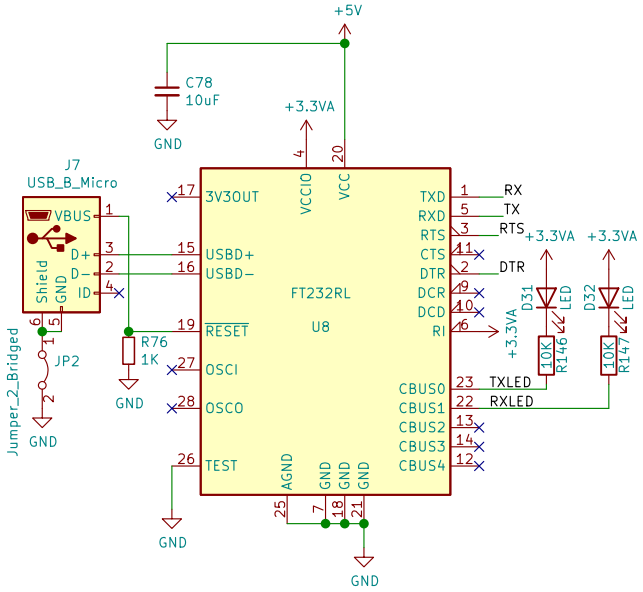
Title: Trinamic FluidNC CNC Controller

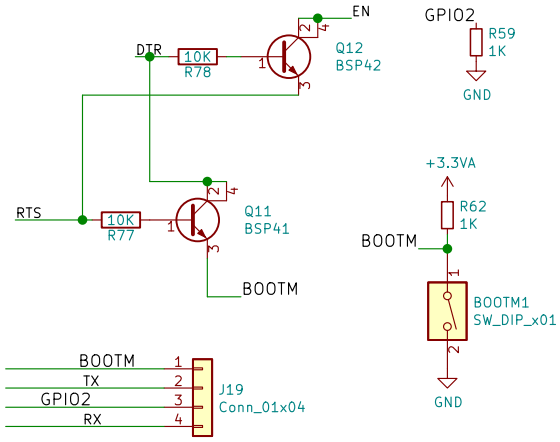
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A.	eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1	Id: 4/17

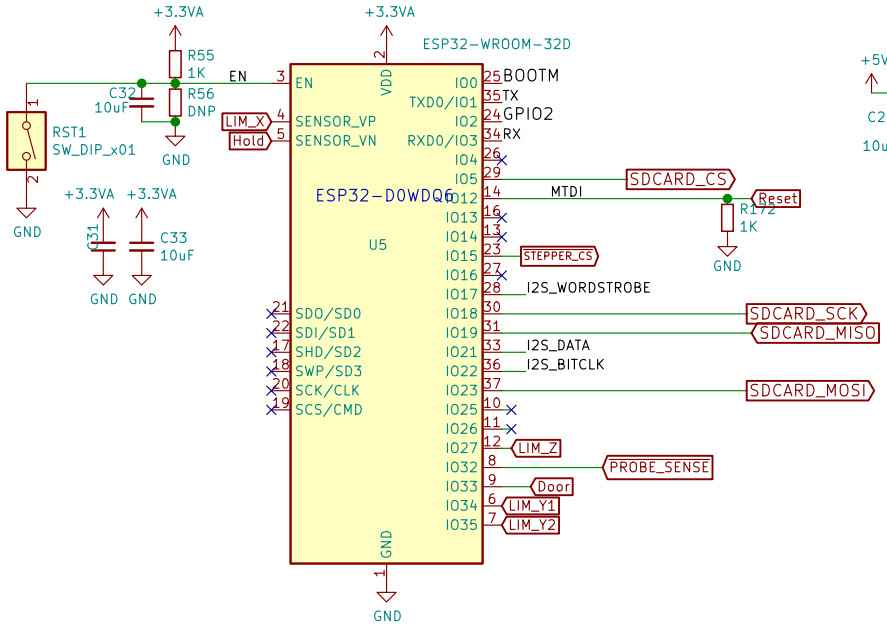


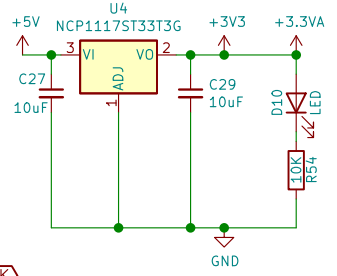
Sheet: /Spindle controller/		
File: spindle.sch		
Title: Trinamic FluidNC CNC Controller		
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 5/17

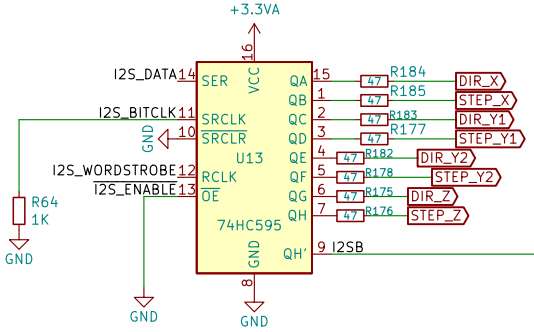
Programming and bootmode

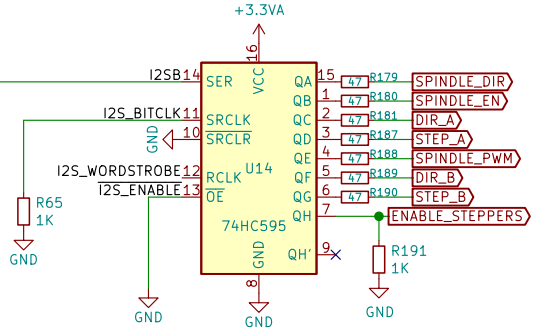








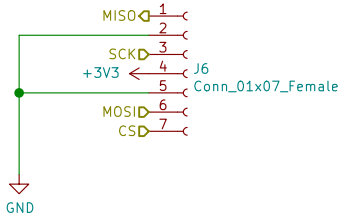




Sheet: /Controller/
File: core.sch

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: 6/17



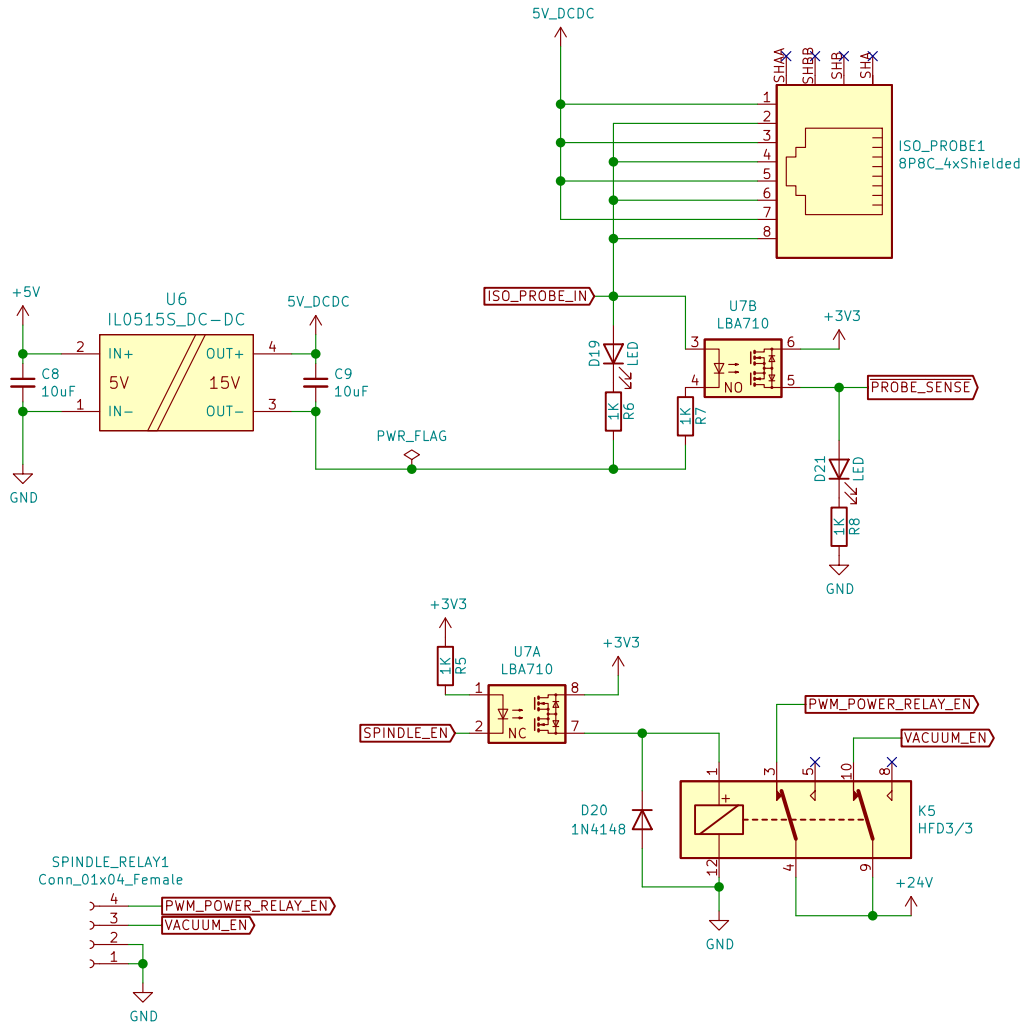
Sheet: /SDcard socket/ File: SDcard.sch		
Title: Trinamic FluidNC CNC Controller		
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 7/17

A power step up circuit
can be assembled here.

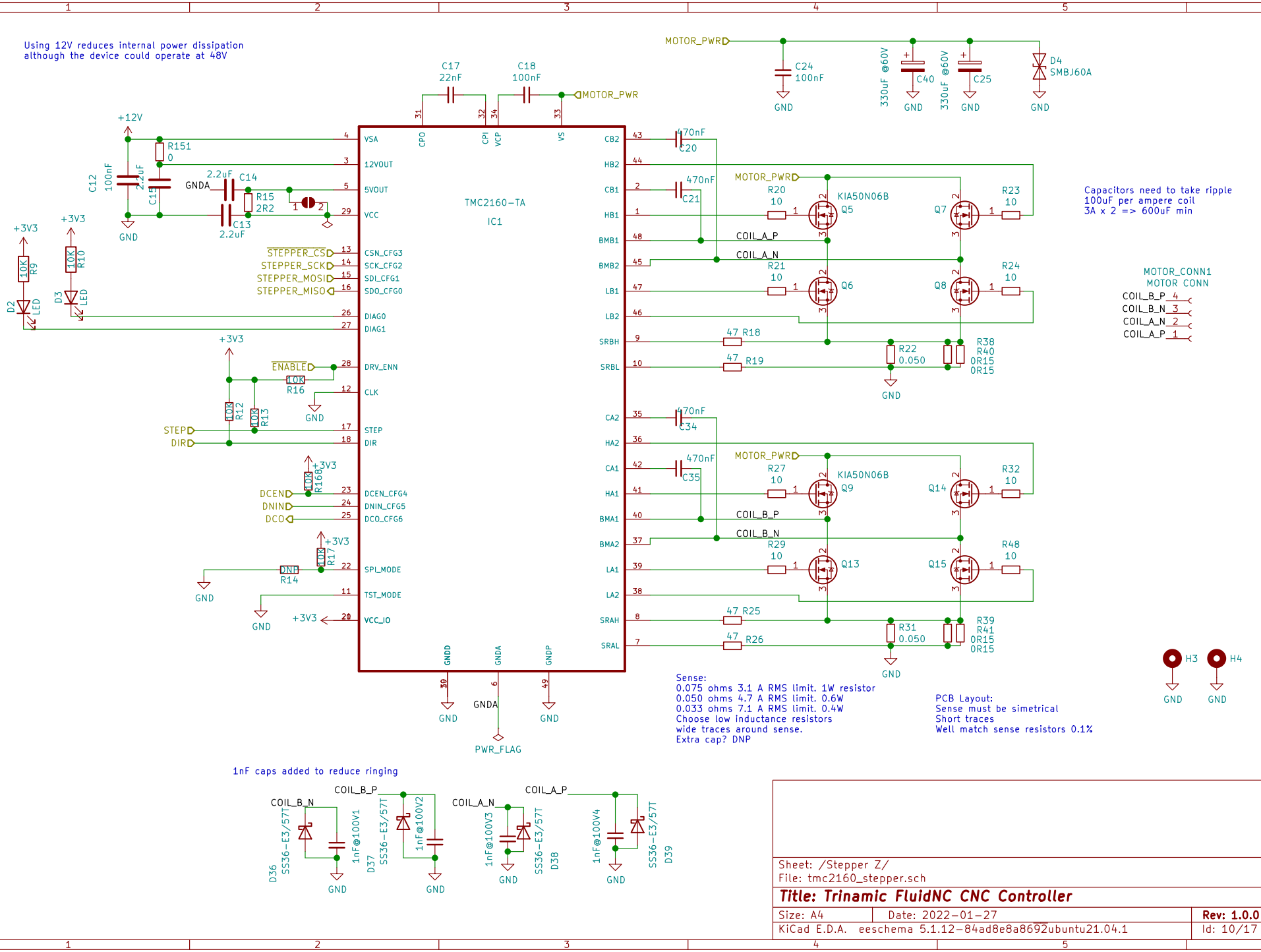
Sheet: /Spindle PSU/
File: spindlePSU.sch

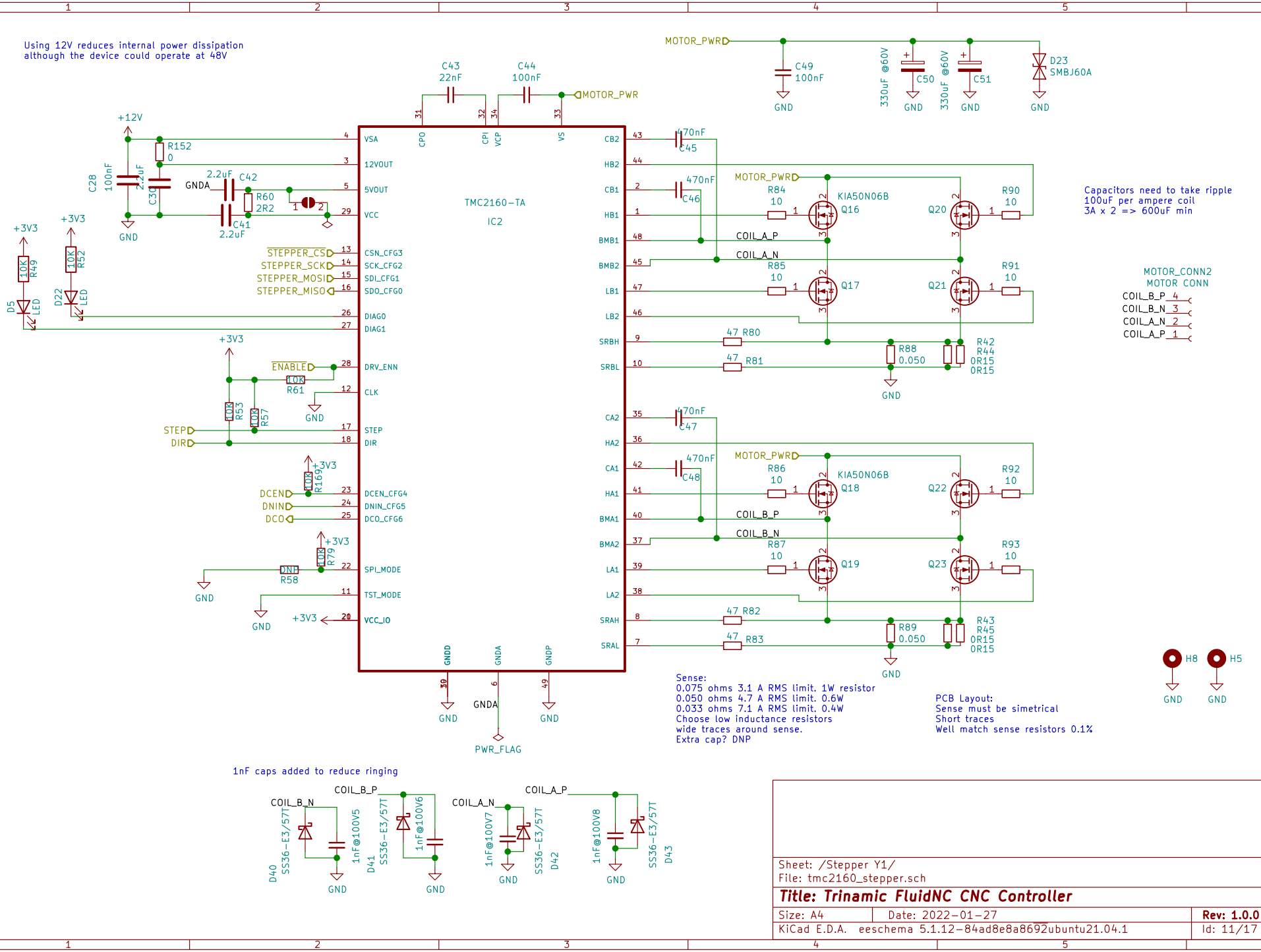
Title: Trinamic FluidNC CNC Controller

Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A. eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1		Id: 8/17



Sheet: /Probe Sensor/		
File: probe.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: 9/17

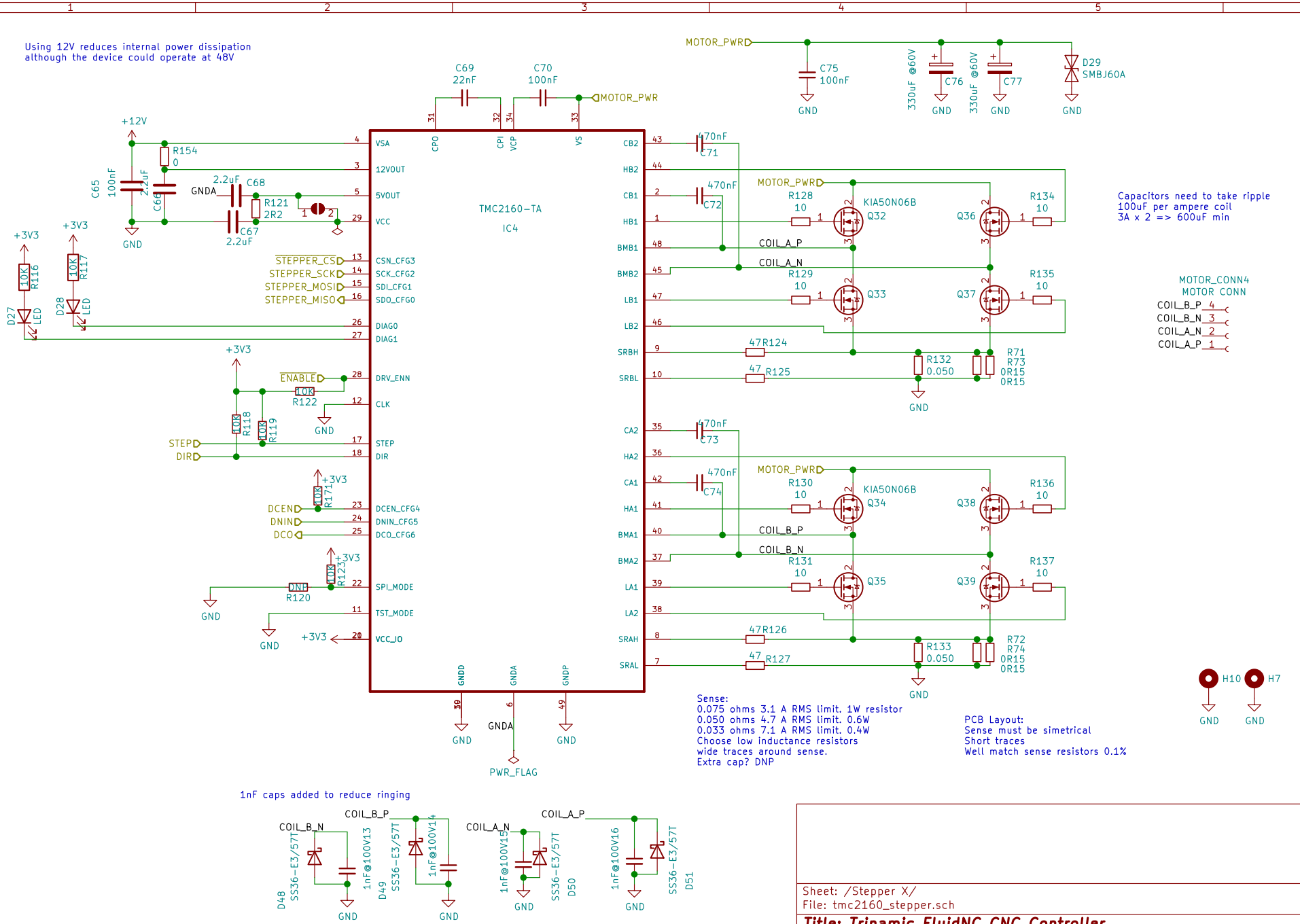

Using 12V reduces internal power dissipation
although the device could operate at 48V
TMC2160-TA
IC1
MOTOR_PWR
C24 100nF
C40 330uF @60V
C25 330uF @60V
D4 SMBJ60A
C17 22nF
C18 100nF
+12V
R151 0
C12 100nF
C15 2.2uF
C14 2.2uF
C13 2.2uF
R15 2R2
+3V3
R9 10K
R10 10K
D2 LED
D3 LED
STEPPER_CS
STEPPER_SCK
STEPPER_MOSI
STEPPER_MISO
ENABLE
R16 10K
R12 10K
R13 10K
STEP
DIR
DCEN
DNIN
DCO
R168 10K
R17 10K
R14 DNP
C20 470nF
C21 470nF
C34 470nF
C35 470nF
KIA50N06B
Q5
Q6
Q7
Q8
Q9
Q13
Q14
Q15
R20 10
R21 10
R23 10
R24 10
R27 10
R29 10
R32 10
R48 10
COIL_A_P
COIL_A_N
COIL_B_P
COIL_B_N
47 R18
47 R19
47 R25
47 R26
R22 0.050
R31 0.050
R38 R40 0R15 0R15
R39 R41 0R15 0R15
Capacitors need to take ripple
100uF per ampere coil
3A x 2 => 600uF min
MOTOR_CONN1
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 simetrical
Short traces
Well match sense resistors 0.1%
H3
H4
PWR_FLAG
1nF caps added to reduce ringing
D36 SS36-E3/57T 1nF@100V1
D37 SS36-E3/57T 1nF@100V2
D38 SS36-E3/57T 1nF@100V3
D39 SS36-E3/57T 1nF@100V4
Sheet: /Stepper Z/
File: tmc2160_stepper.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: 10/17



Sheet: /Stepper Y1/
File: tmc2160_stepper.sch

Title: Trinamic FluidNC CNC Controller

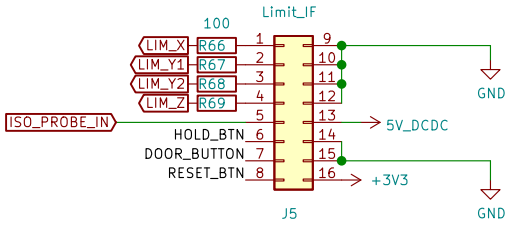
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A.	eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1	Id: 11/17

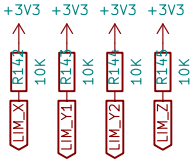


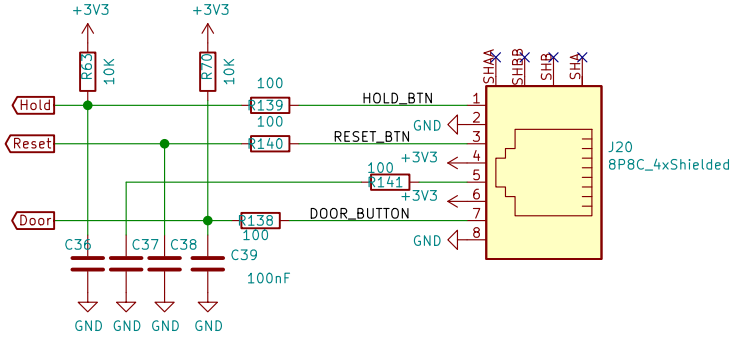
Sheet: /Stepper X/
File: tmc2160_stepper.sch

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: 12/17





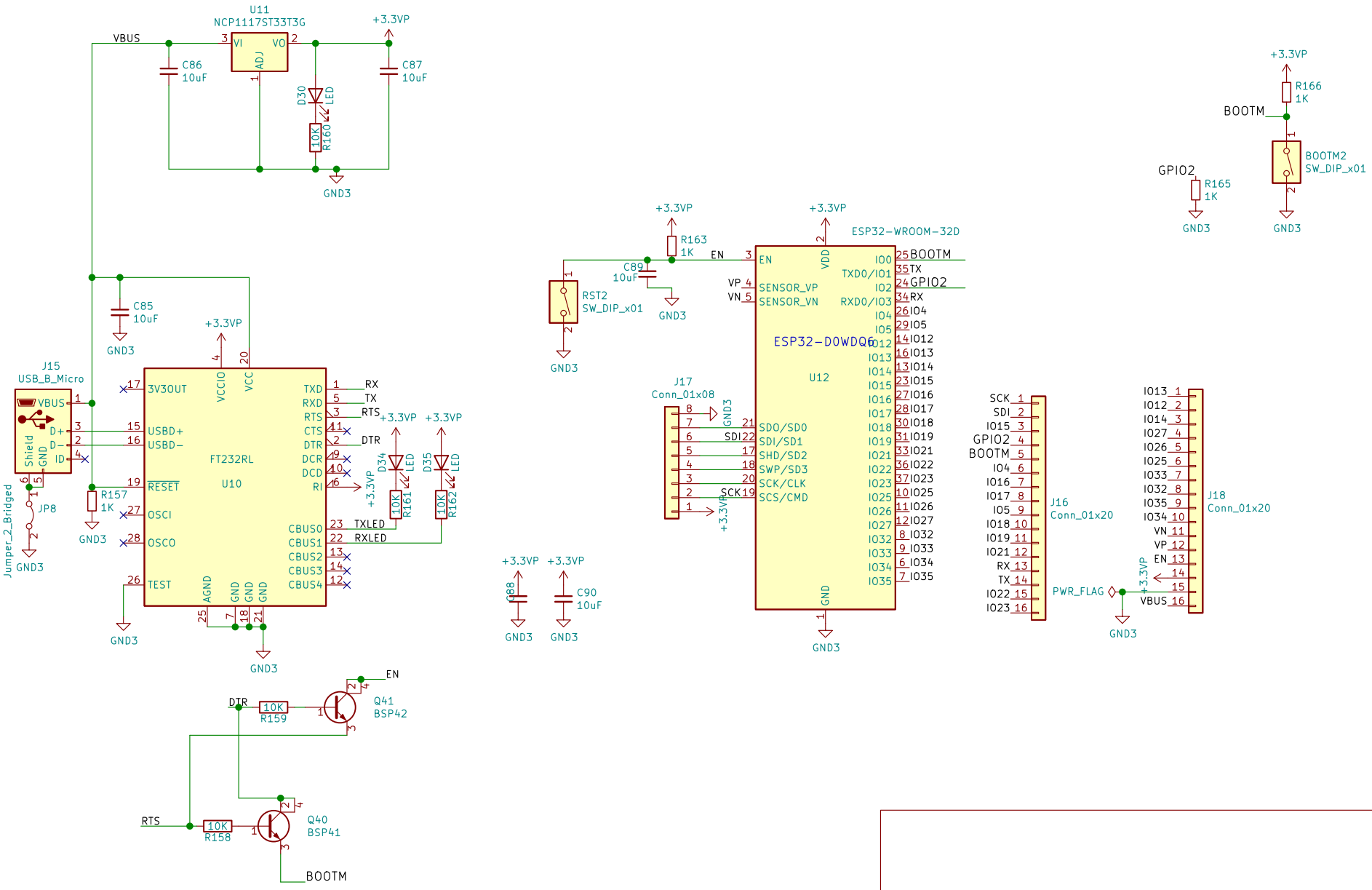


Limit sensor connectors

Sheet: /limit sensors/
File: limitIF.sch

Title: Trinamic FluidNC CNC Controller

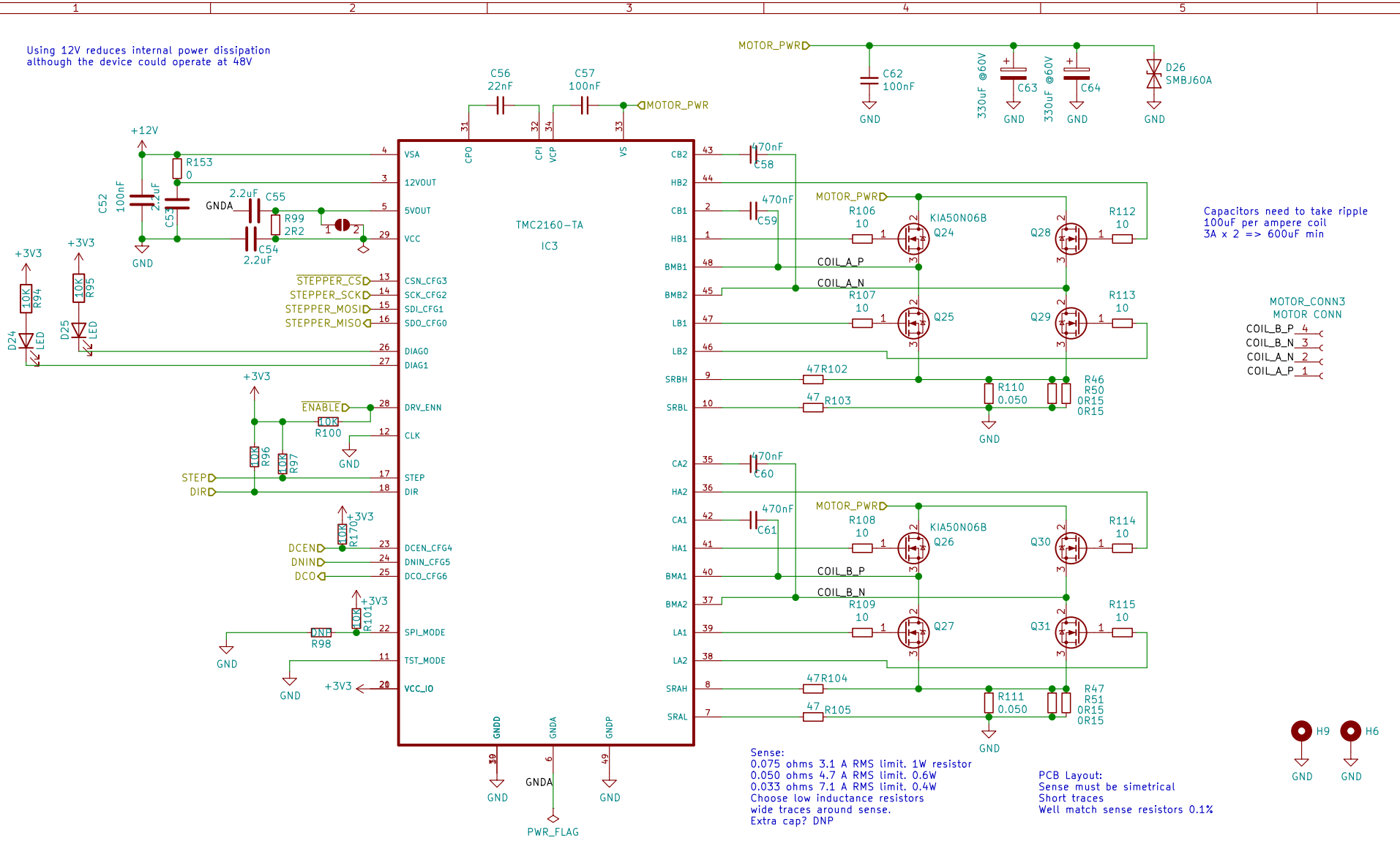
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A.	eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1	Id: 13/17



Sheet: /extras/
File: extraCPU.sch

Title: Trinamic FluidNC CNC Controller

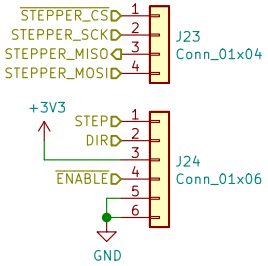
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A.	eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1	Id: 14/17



Sheet: /Stepper Y2/
File: tmc2160_stepper.sch

Title: Trinamic FluidNC CNC Controller

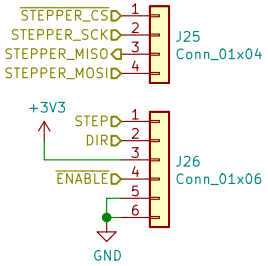
Size: A4	Date: 2022-01-27	**Rev: 1.0.0**
KiCad E.D.A.	eeschema 5.1.12-84ad8e8a8692ubuntu21.04.1	Id: 15/17



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