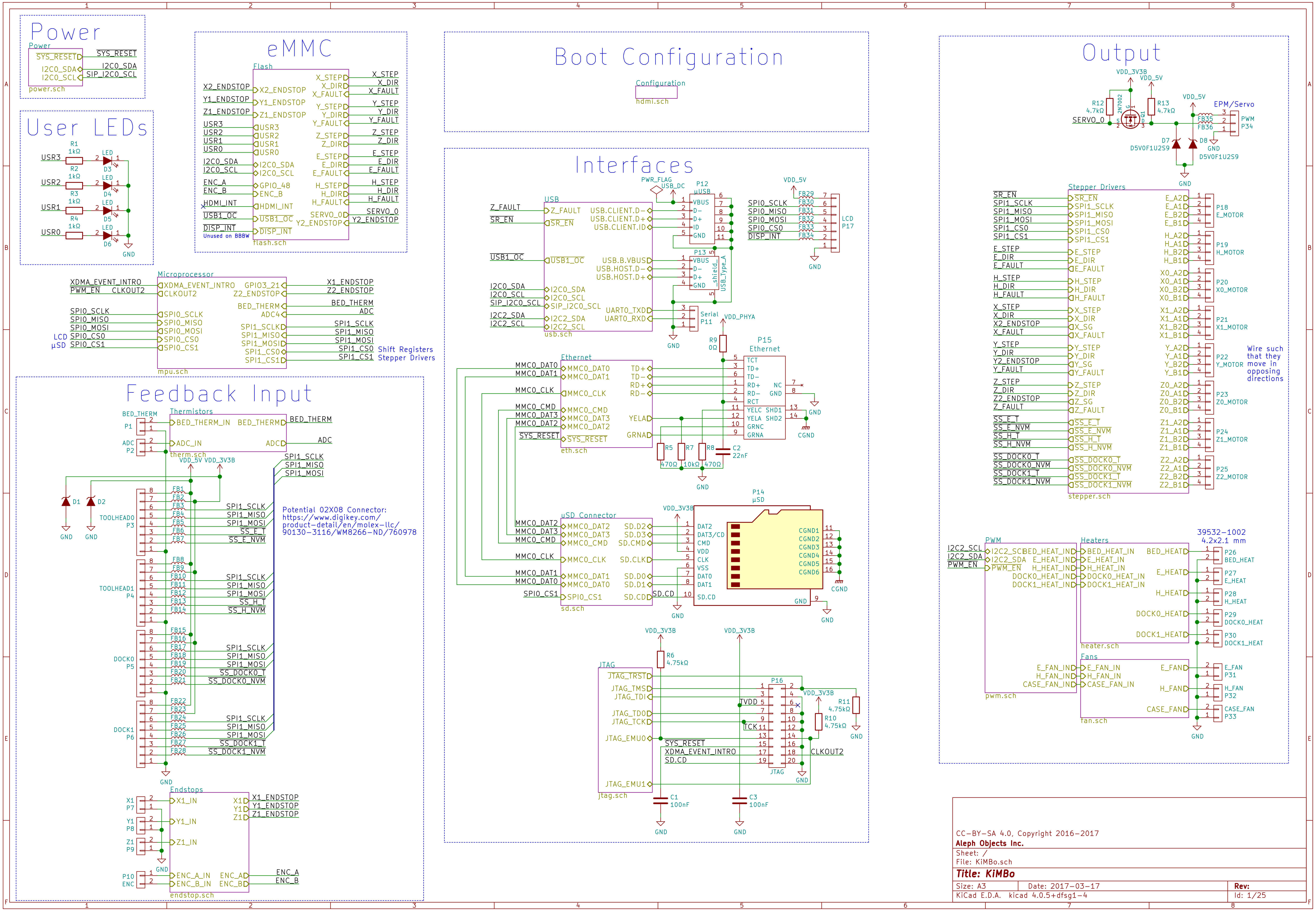
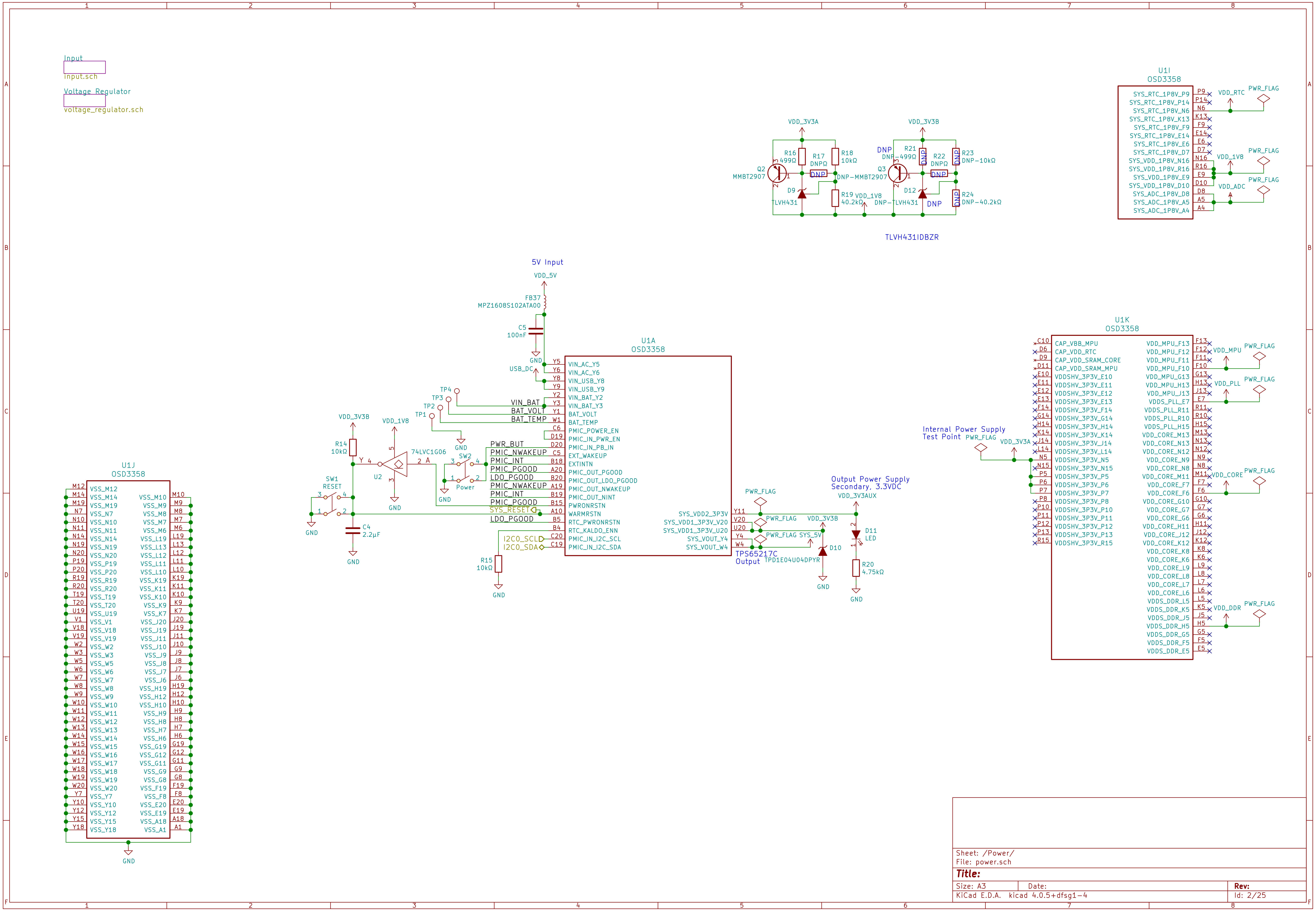
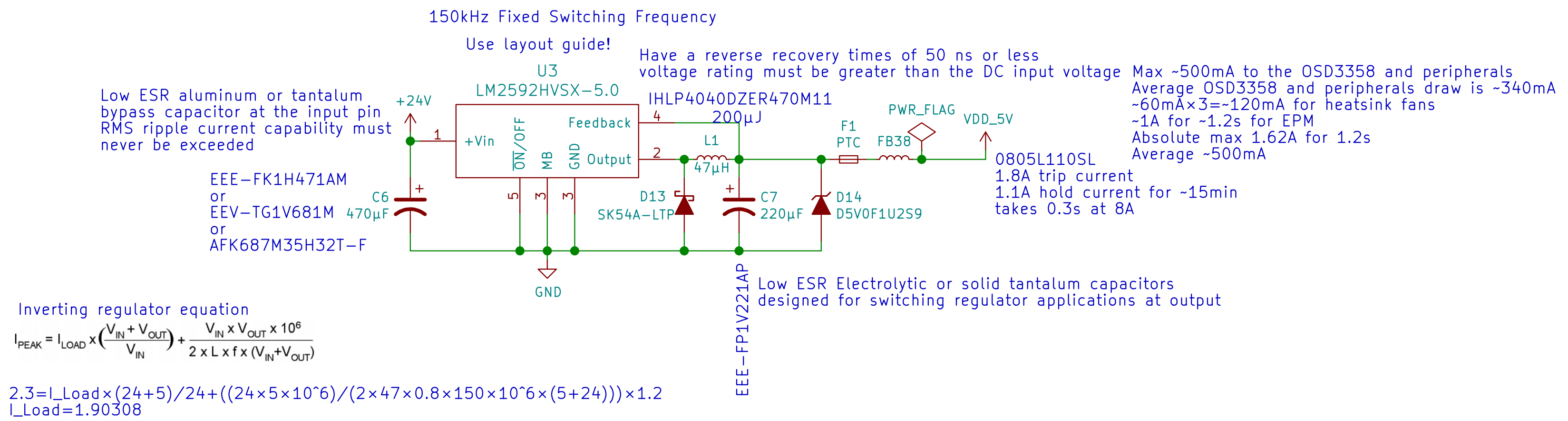


Power
power.sch
SYS_RESET
I2C0_SDA
I2C0_SCL
SIP_I2C0_SCL
User LEDs
USR3
USR2
USR1
USR0
eMMC
Flash
flash.sch
Unused on BBBW
Boot Configuration
Configuration
hdmi.sch
Interfaces
USB
usb.sch
Serial P11
Ethernet
eth.sch
P15 Ethernet
uSD Connector
sd.sch
P14 µSD
JTAG
jtag.sch
Output
EPM/Servo
Stepper Drivers
stepper.sch
Wire such that they move in opposing directions
PWM
pwm.sch
Heaters
heater.sch
39532-1002 4.2x2.1 mm
Fans
fan.sch
Microprocessor
mpu.sch
Shift Registers
Stepper Drivers
Feedback Input
Thermistors
therm.sch
Potential 02X08 Connector:
https://www.digikey.com/product-detail/en/molex-llc/90130-3116/WM8266-ND/760978
TOOLHEAD0 P3
TOOLHEAD1 P4
DOCK0 P5
DOCK1 P6
Endstops
endstop.sch
CC-BY-SA 4.0, Copyright 2016-2017
Aleph Objects Inc.
Sheet: /
File: KiMBo.sch
Title: KiMBo
Size: A3
Date: 2017-03-17
Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4
Id: 1/25



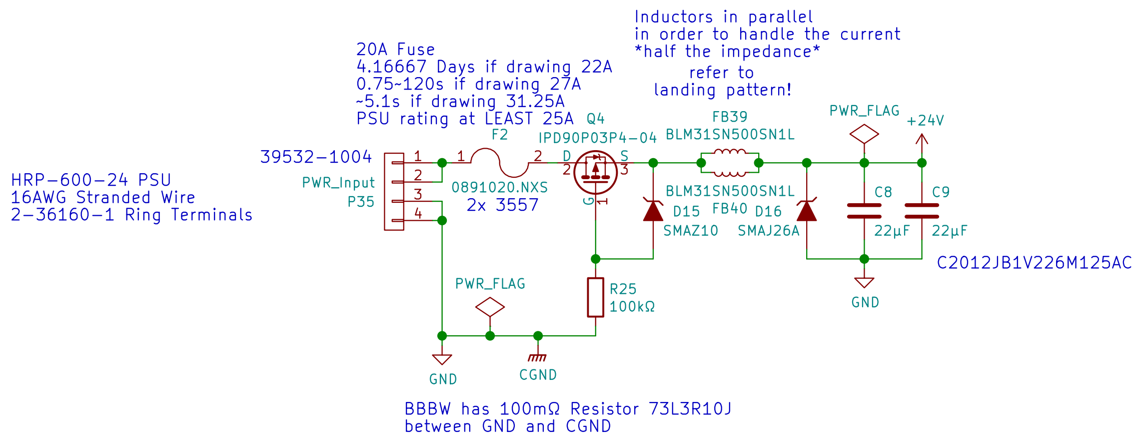
Input
input.sch
Voltage Regulator
voltage_regulator.sch
U1I
OSD3358
SYS_RTC_1P8V_P9
SYS_RTC_1P8V_P14
SYS_RTC_1P8V_N6
SYS_RTC_1P8V_K13
SYS_RTC_1P8V_F9
SYS_RTC_1P8V_E14
SYS_RTC_1P8V_E6
SYS_RTC_1P8V_D7
SYS_VDD_1P8V_N16
SYS_VDD_1P8V_R16
SYS_VDD_1P8V_E9
SYS_VDD_1P8V_D10
SYS_ADC_1P8V_D8
SYS_ADC_1P8V_A5
SYS_ADC_1P8V_A4
VDD_RTC
VDD_1V8
VDD_ADC
PWR_FLAG
VDD_3V3A
VDD_3V3B
R16 499Ω
R17 DNPΩ
R18 10kΩ
R19 40.2kΩ
Q2 MMBT2907
D9 TLVH431
R21 DNP-499Ω
R22 DNPΩ
R23 DNP-10kΩ
R24 DNP-40.2kΩ
Q3 DNP-MMBT2907
D12 DNP-TLVH431
DNP
TLVH431IDBZR
5V Input
VDD_5V
FB37
MPZ1608S102ATA00
C5 100nF
GND
USB_DC
U1A
OSD3358
VIN_AC_Y5
VIN_AC_Y6
VIN_USB_Y8
VIN_USB_Y9
VIN_BAT_Y2
VIN_BAT_Y3
BAT_VOLT
BAT_TEMP
PMIC_POWER_EN
PMIC_IN_PWR_EN
PMIC_IN_PB_IN
EXT_WAKEUP
EXTINTN
PMIC_OUT_PGOOD
PMIC_OUT_LDO_PGOOD
PMIC_OUT_NWAKEUP
PMIC_OUT_NINT
PWRONRSTN
WARMRSTN
RTC_PWRONRSTN
RTC_KALDO_ENN
PMIC_IN_I2C_SCL
PMIC_IN_I2C_SDA
SYS_VDD2_3P3V
SYS_VDD1_3P3V_V20
SYS_VDD1_3P3V_U20
SYS_VOUT_Y4
SYS_VOUT_W4
TP1
TP2
TP3
TP4
VIN_BAT
BAT_VOLT
BAT_TEMP
PWR_BUT
PMIC_NWAKEUP
PMIC_INT
PMIC_PGOOD
LDO_PGOOD
SYS_RESET
I2C0_SCL
I2C0_SDA
R14 10kΩ
R15 10kΩ
U2
74LVC1G06
SW1 RESET
SW2 Power
C4 2.2µF
TPS65217C Output
Output Power Supply Secondary, 3.3VDC
VDD_3V3AUX
SYS_5V
D10 TPD1E04U04DPYR
D11 LED
R20 4.75kΩ
Internal Power Supply Test Point
U1K
OSD3358
CAP_VBB_MPU
CAP_VDD_RTC
CAP_VDD_SRAM_CORE
CAP_VDD_SRAM_MPU
VDDSHV_3P3V_E10
VDDSHV_3P3V_E11
VDDSHV_3P3V_E12
VDDSHV_3P3V_E13
VDDSHV_3P3V_F14
VDDSHV_3P3V_G14
VDDSHV_3P3V_H14
VDDSHV_3P3V_K14
VDDSHV_3P3V_J14
VDDSHV_3P3V_L14
VDDSHV_3P3V_N5
VDDSHV_3P3V_N15
VDDSHV_3P3V_P5
VDDSHV_3P3V_P6
VDDSHV_3P3V_P7
VDDSHV_3P3V_P8
VDDSHV_3P3V_P10
VDDSHV_3P3V_P11
VDDSHV_3P3V_P12
VDDSHV_3P3V_P13
VDDSHV_3P3V_R15
VDD_MPU_F13
VDD_MPU_F12
VDD_MPU_F11
VDD_MPU_F10
VDD_MPU_G13
VDD_MPU_H13
VDD_MPU_J13
VDDS_PLL_E7
VDDS_PLL_R11
VDDS_PLL_R10
VDDS_PLL_H15
VDD_CORE_M13
VDD_CORE_N13
VDD_CORE_N12
VDD_CORE_N9
VDD_CORE_N8
VDD_CORE_M11
VDD_CORE_F7
VDD_CORE_F6
VDD_CORE_G10
VDD_CORE_G7
VDD_CORE_G6
VDD_CORE_H11
VDD_CORE_J12
VDD_CORE_K12
VDD_CORE_K8
VDD_CORE_K6
VDD_CORE_L9
VDD_CORE_L8
VDD_CORE_L7
VDD_CORE_L6
VDDS_DDR_L5
VDDS_DDR_K5
VDDS_DDR_J5
VDDS_DDR_H5
VDDS_DDR_G5
VDDS_DDR_F5
VDDS_DDR_E5
VDD_MPU
VDD_PLL
VDD_CORE
VDD_DDR
U1J
OSD3358
VSS_M12
VSS_M14
VSS_M19
VSS_N7
VSS_N10
VSS_N11
VSS_N14
VSS_N19
VSS_N20
VSS_P19
VSS_P20
VSS_R19
VSS_R20
VSS_T19
VSS_T20
VSS_U19
VSS_V1
VSS_V18
VSS_V19
VSS_W2
VSS_W3
VSS_W5
VSS_W6
VSS_W7
VSS_W8
VSS_W9
VSS_W10
VSS_W11
VSS_W12
VSS_W13
VSS_W14
VSS_W15
VSS_W16
VSS_W17
VSS_W18
VSS_W19
VSS_W20
VSS_Y7
VSS_Y10
VSS_Y12
VSS_Y15
VSS_Y18
VSS_M10
VSS_M9
VSS_M8
VSS_M7
VSS_M6
VSS_L19
VSS_L13
VSS_L12
VSS_L11
VSS_L10
VSS_K19
VSS_K11
VSS_K10
VSS_K9
VSS_K7
VSS_J20
VSS_J19
VSS_J11
VSS_J10
VSS_J9
VSS_J8
VSS_J7
VSS_J6
VSS_H19
VSS_H12
VSS_H10
VSS_H9
VSS_H8
VSS_H7
VSS_H6
VSS_G19
VSS_G12
VSS_G11
VSS_G9
VSS_G8
VSS_F19
VSS_F8
VSS_E20
VSS_E19
VSS_A18
VSS_A1
Sheet: /Power/
File: power.sch
Title:
Size: A3
Date:
Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4
Id: 2/25



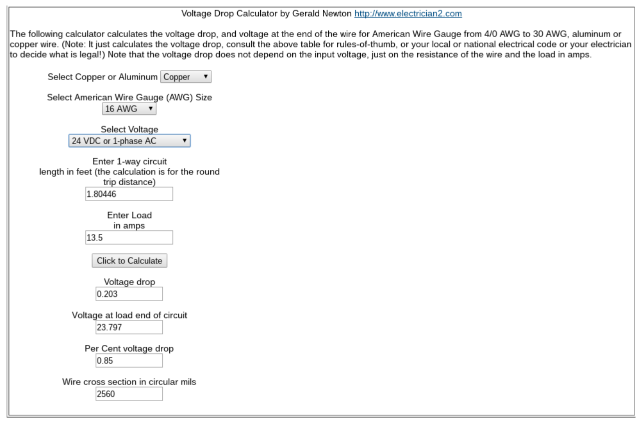
Sheet: /Power/Voltage Regulator/
File: voltage_regulator.sch

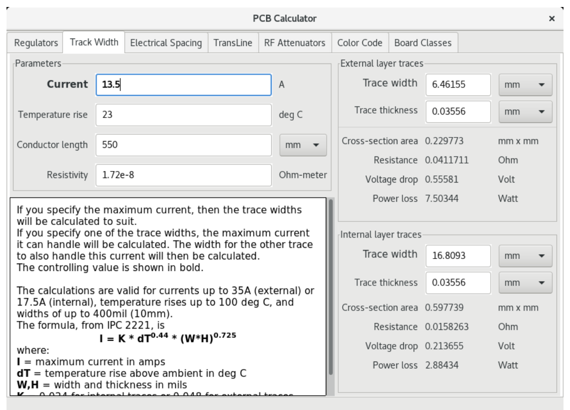
Title:

Size: A3	Date:	Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 3/25



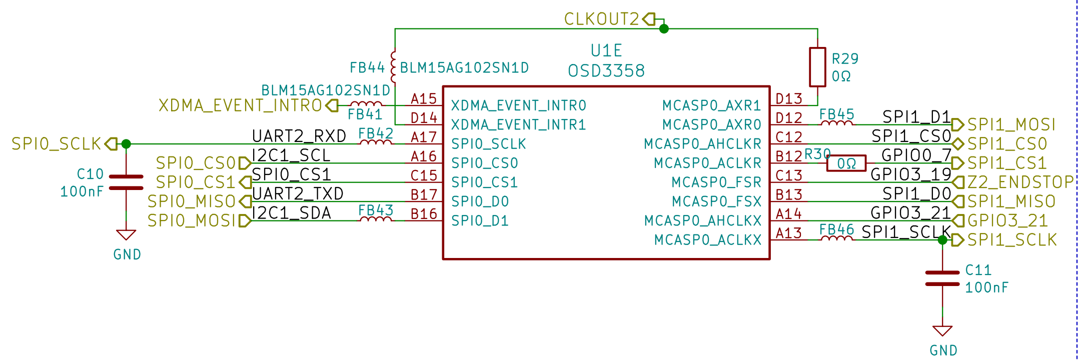
AWG	Diameter		Turns of wire, without insulation		Area		Copper wire							
							Resistance/length[6]		Ampacity,[7] at 20 °C insulation material temperature rating, or 16 AWG and smaller for single unbundled wires in equipment:[8]			Fusing current[9][10]		
									60 °C	75 °C	90 °C	Preece[11][12][13][14]	Onderdonk[15][14]	
	(in)	(mm)	(per in)	(per cm)	(kcmil)	(mm²)	(mΩ/m[a])	(mΩ/ft[b])	(A)			~10 s	1 s	32 ms
16	0.0508	1.291	19.7	7.75	2.58	1.31	13.17	4.016	22*free air	13*enclosed	18	117 A	398 A	2.2 kA



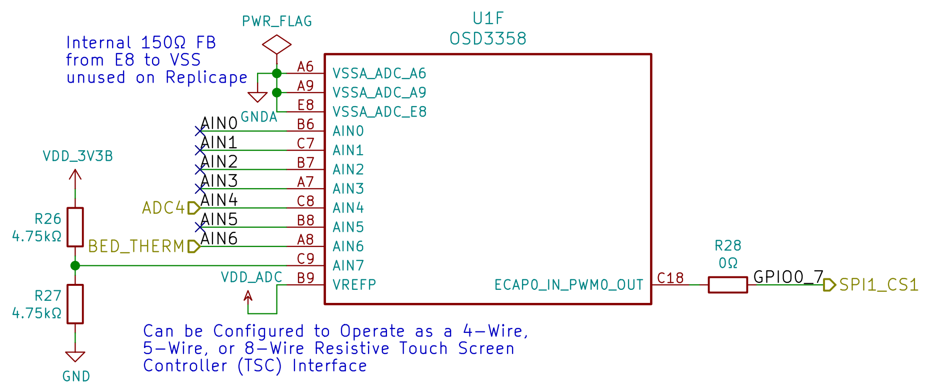


Sheet: /Power/Input/
File: input.sch
Title:
Size: A3 Date:
Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4
Id: 4/25

Unused



Analog I/O

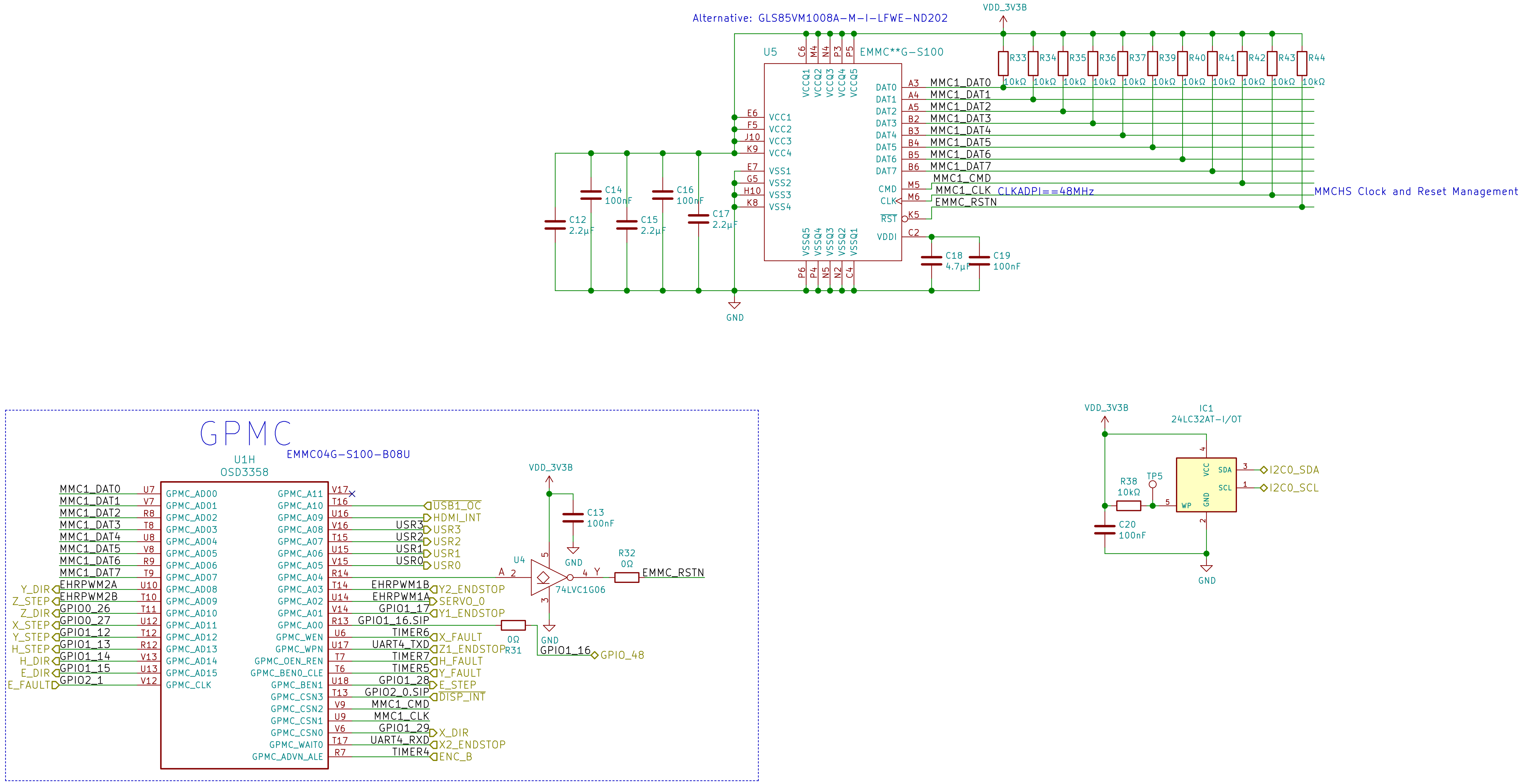


Sheet: /Microprocessor/
File: mpu.sch

Title:

Size: A3 | Date: | **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 5/25



Removed OSC1, description for BBB (it is not applicable to Cimarron):

GPIO3_21 has a 24.576 MHZ clock on it.

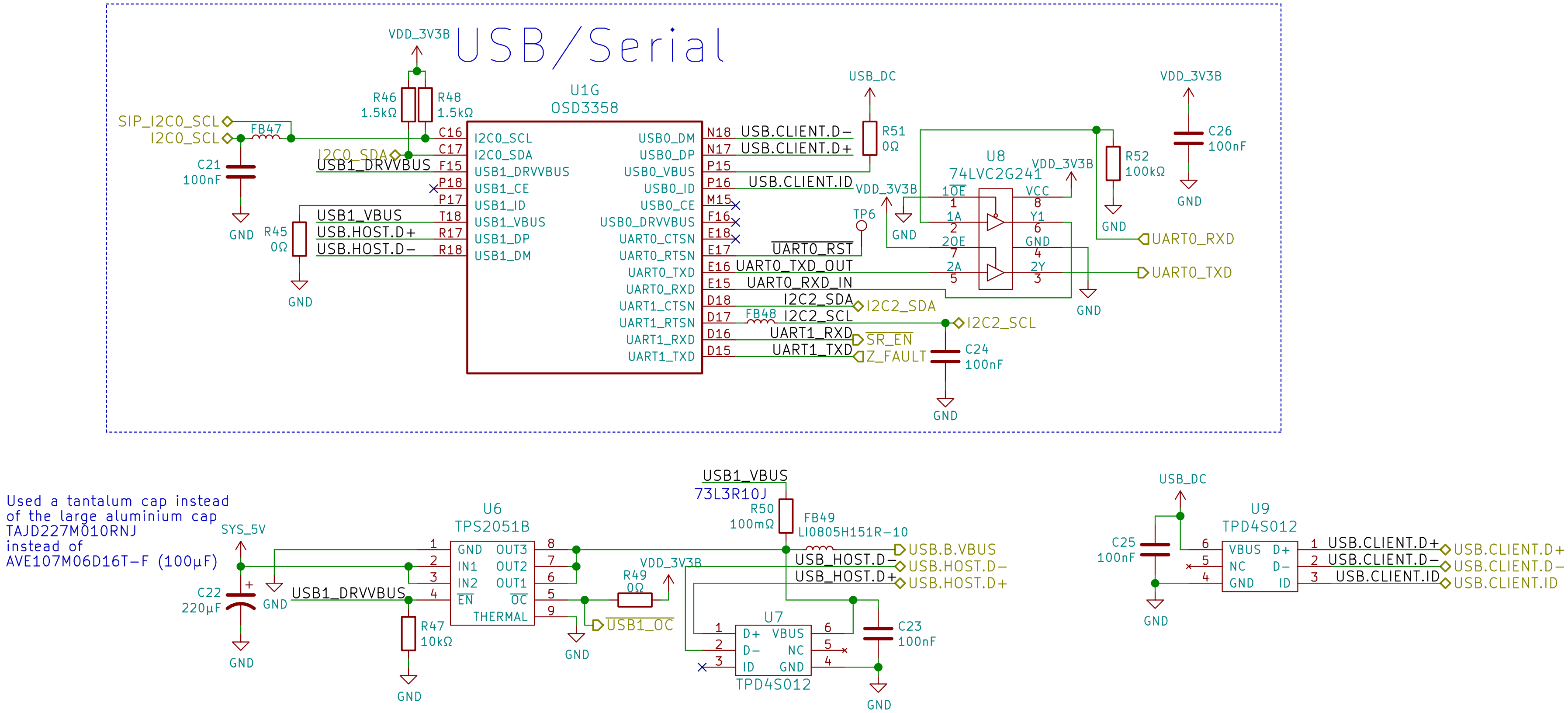
o This is required by the HDMI Framer for Audio purposes.
We needed to run a clock into the processor to generate the correct clock frequency. The pin on the processor was already routed to the expansion header. In order not to remove this feature on the expansion header, it was left connected. In order to use the pin as a GPIO pin, you need to disable the clock. While this disables audio to the HDMI, the fact that you want to use this pin for something else, does the same thing.

Sheet: /Flash/
File: flash.sch

Title:

Size: A3 | Date: | **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 6/25

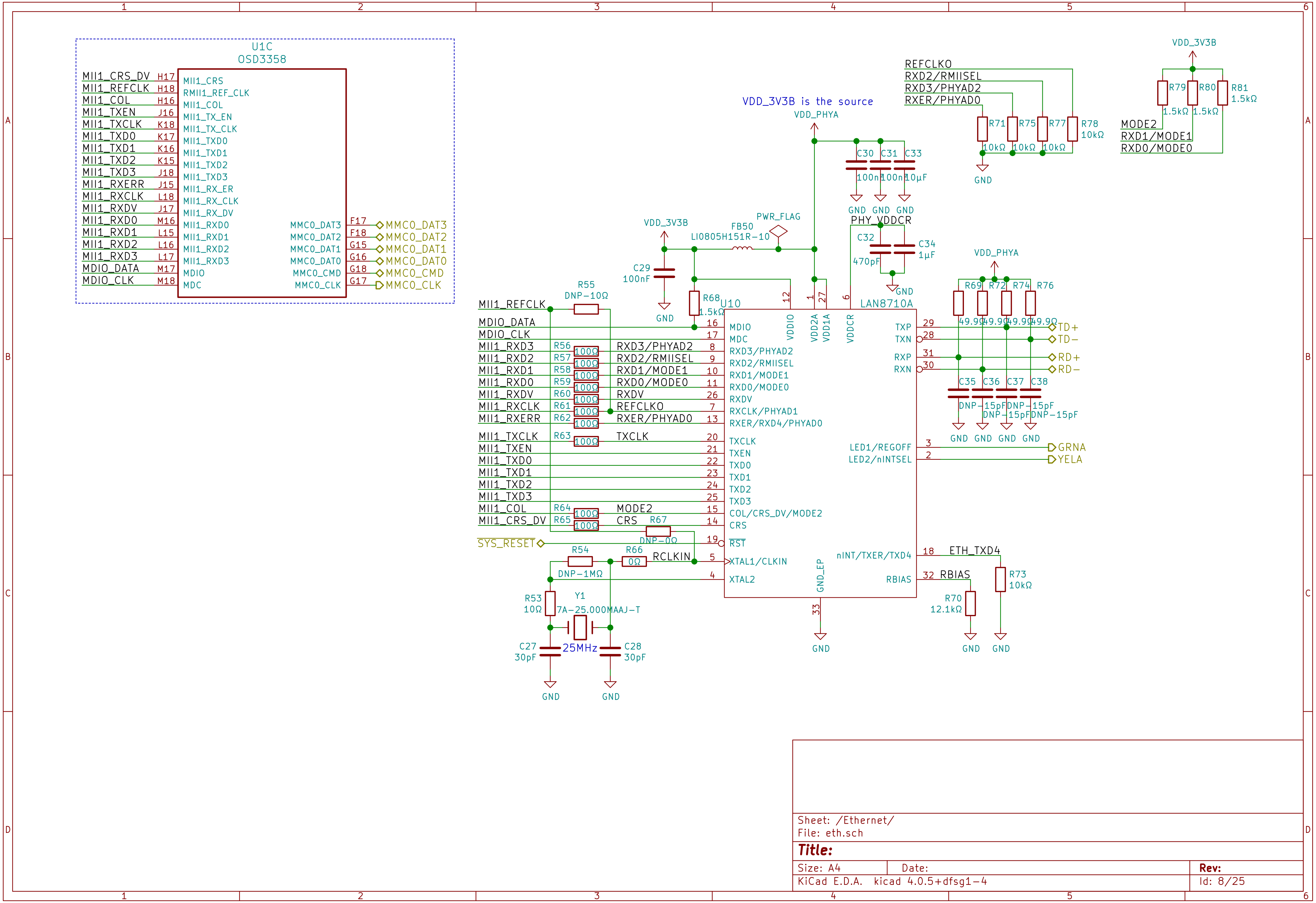


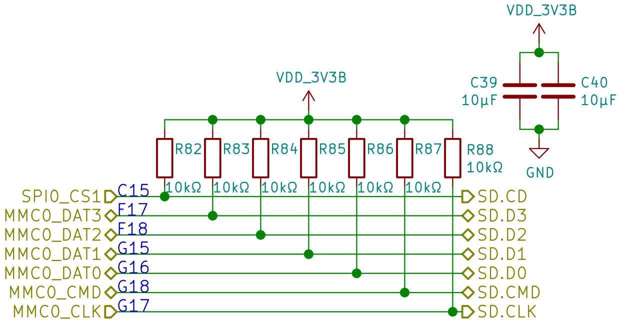
Sheet: /USB/
File: usb.sch

Title:

Size: A4 | Date: | Rev:

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 7/25


U1C
OSD3358
MII1_CRS_DV H17 MII1_CRS
MII1_REFCLK H18 RMII1_REF_CLK
MII1_COL H16 MII1_COL
MII1_TXEN J16 MII1_TX_EN
MII1_TXCLK K18 MII1_TX_CLK
MII1_TXD0 K17 MII1_TXD0
MII1_TXD1 K16 MII1_TXD1
MII1_TXD2 K15 MII1_TXD2
MII1_TXD3 J18 MII1_TXD3
MII1_RXERR J15 MII1_RX_ER
MII1_RXCLK L18 MII1_RX_CLK
MII1_RXDV J17 MII1_RX_DV
MII1_RXD0 M16 MII1_RXD0
MII1_RXD1 L15 MII1_RXD1
MII1_RXD2 L16 MII1_RXD2
MII1_RXD3 L17 MII1_RXD3
MDIO_DATA M17 MDIO
MDIO_CLK M18 MDC
MMC0_DAT3 F17 MMC0_DAT3
MMC0_DAT2 F18 MMC0_DAT2
MMC0_DAT1 G15 MMC0_DAT1
MMC0_DAT0 G16 MMC0_DAT0
MMC0_CMD G18 MMC0_CMD
MMC0_CLK G17 MMC0_CLK
VDD_3V3B is the source
VDD_PHYA
C30 C31 C33
100nF 100nF 10µF
GND GND GND
REFCLKO
RXD2/RMIISEL
RXD3/PHYAD2
RXER/PHYAD0
R71 R75 R77 R78
10kΩ 10kΩ 10kΩ 10kΩ
GND
VDD_3V3B
R79 R80 R81
1.5kΩ 1.5kΩ 1.5kΩ
MODE2
RXD1/MODE1
RXD0/MODE0
VDD_3V3B
FB50
LI0805H151R-10
PWR_FLAG
PHY_VDDCR
C32 470pF
C34 1µF
GND
C29 100nF
GND
R68 1.5kΩ
R55 DNP-10Ω
U10
LAN8710A
MII1_REFCLK
MDIO_DATA 16 MDIO
MDIO_CLK 17 MDC
MII1_RXD3 R56 100Ω RXD3/PHYAD2 8 RXD3/PHYAD2
MII1_RXD2 R57 100Ω RXD2/RMIISEL 9 RXD2/RMIISEL
MII1_RXD1 R58 100Ω RXD1/MODE1 10 RXD1/MODE1
MII1_RXD0 R59 100Ω RXD0/MODE0 11 RXD0/MODE0
MII1_RXDV R60 100Ω RXDV 26 RXDV
MII1_RXCLK R61 100Ω REFCLKO 7 RXCLK/PHYAD1
MII1_RXERR R62 100Ω RXER/PHYAD0 13 RXER/RXD4/PHYAD0
MII1_TXCLK R63 100Ω TXCLK 20 TXCLK
MII1_TXEN 21 TXEN
MII1_TXD0 22 TXD0
MII1_TXD1 23 TXD1
MII1_TXD2 24 TXD2
MII1_TXD3 25 TXD3
MII1_COL R64 100Ω MODE2 15 COL/CRS_DV/MODE2
MII1_CRS_DV R65 100Ω CRS 14 CRS
R67 DNP-0Ω
SYS_RESET 19 RST
R54 DNP-1MΩ
R66 0Ω
RCLKIN 5 XTAL1/CLKIN
4 XTAL2
R53 10Ω
Y1
7A-25.000MAAJ-T
25MHz
C27 30pF
C28 30pF
GND GND
12 VDDIO
1 VDD2A
27 VDD1A
6 VDDCR
GND_EP 33
GND
VDD_PHYA
R69 R72 R74 R76
49.9Ω 49.9Ω 49.9Ω 49.9Ω
TXP 29 TD+
TXN 28 TD−
RXP 31 RD+
RXN 30 RD−
C35 C36 C37 C38
DNP-15pF DNP-15pF DNP-15pF DNP-15pF
GND GND GND GND
LED1/REGOFF 3 GRNA
LED2/nINTSEL 2 YELA
nINT/TXER/TXD4 18 ETH_TXD4
R73 10kΩ
RBIAS 32 RBIAS
R70 12.1kΩ
GND GND
Sheet: /Ethernet/
File: eth.sch
Title:
Size: A4
Date:
Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4
Id: 8/25



Sheet: /uSD Connector/
File: sd.sch

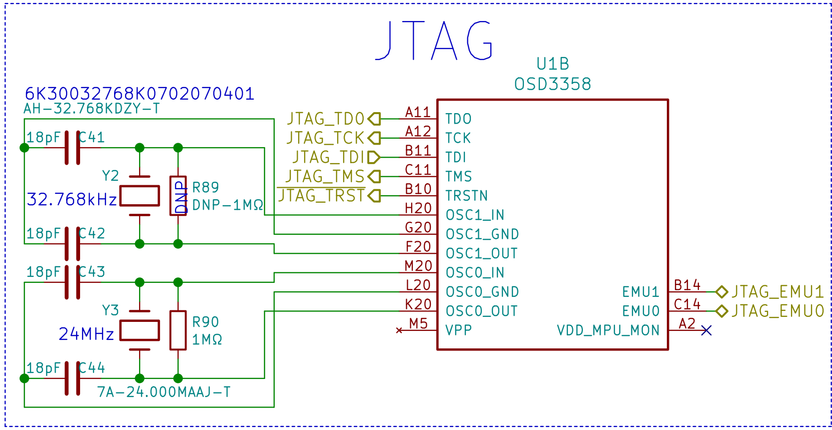
Title:

Size: A4 Date: **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 Id: 9/25

https://www.digikey.com/products/en/crystals-oscillators-resonators/
crystals/171?k=&pkeyword=&pv46=14783&FV=8c0011%
2C22c0060%2C8640003%2C1f140000%2Cffe000ab%
2C402f3e&mnonly=0&newproducts=0&ColumnSort=0&page=1&quan
tity=0&ptm=0&fid=0&pageSize=25

8.1.6.6 Spread Spectrum Clocking (SSC)

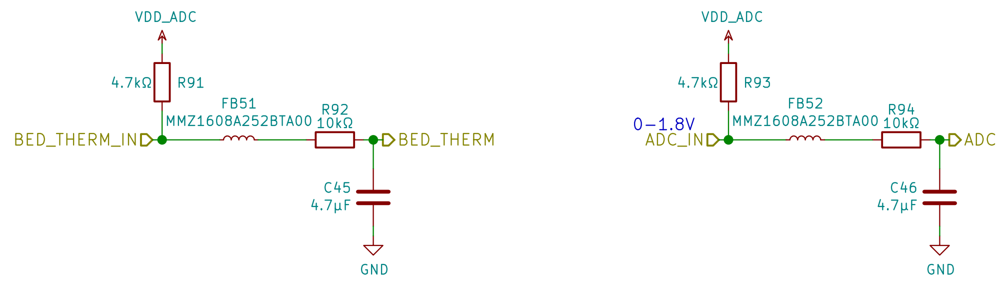


Sheet: /JTAG/
File: jtag.sch

Title:

Size: A4 | Date: | **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 10/25



Sheet: /Thermistors/
File: therm.sch

Title:

Size: A3 Date: Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4 Id: 11/25

TAZ 6 X&Y homing feedrate:
100µsteps/mm * 30mm/sec = 3000µsteps/sec
1/(3kHz) = 333.33µs

V_IH = 0.65*VDDS_DDR

RC_rise=183.3µs T_rise(20% to 80%) ≅ 1.4τ ≅ 256.62µs

256.62µs < 333.33µs

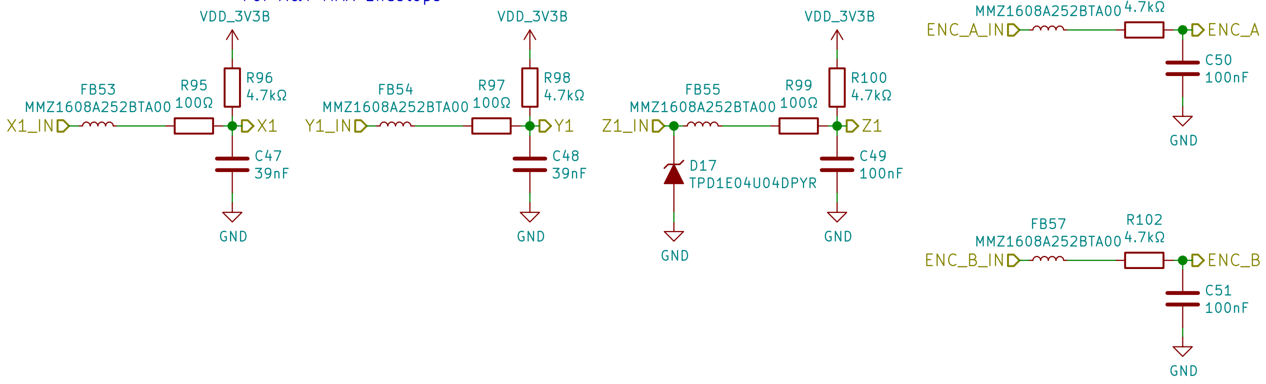
TAZ 6 Z homing feedrate:
1600µsteps/mm * 12mm/sec = 19200µsteps/sec
1/(19.2kHz) = 52.0833µs

V_IL=0.35*VDDS_DDR

RC_fall=10µs T_rise(80% to 20%) ≅ 1.4τ ≅ 14µs

14µs < 52.0833µs

Use TMC2130
Back-EMF Detection
DRV_STATUS Register
For X&Y MAX Endstops

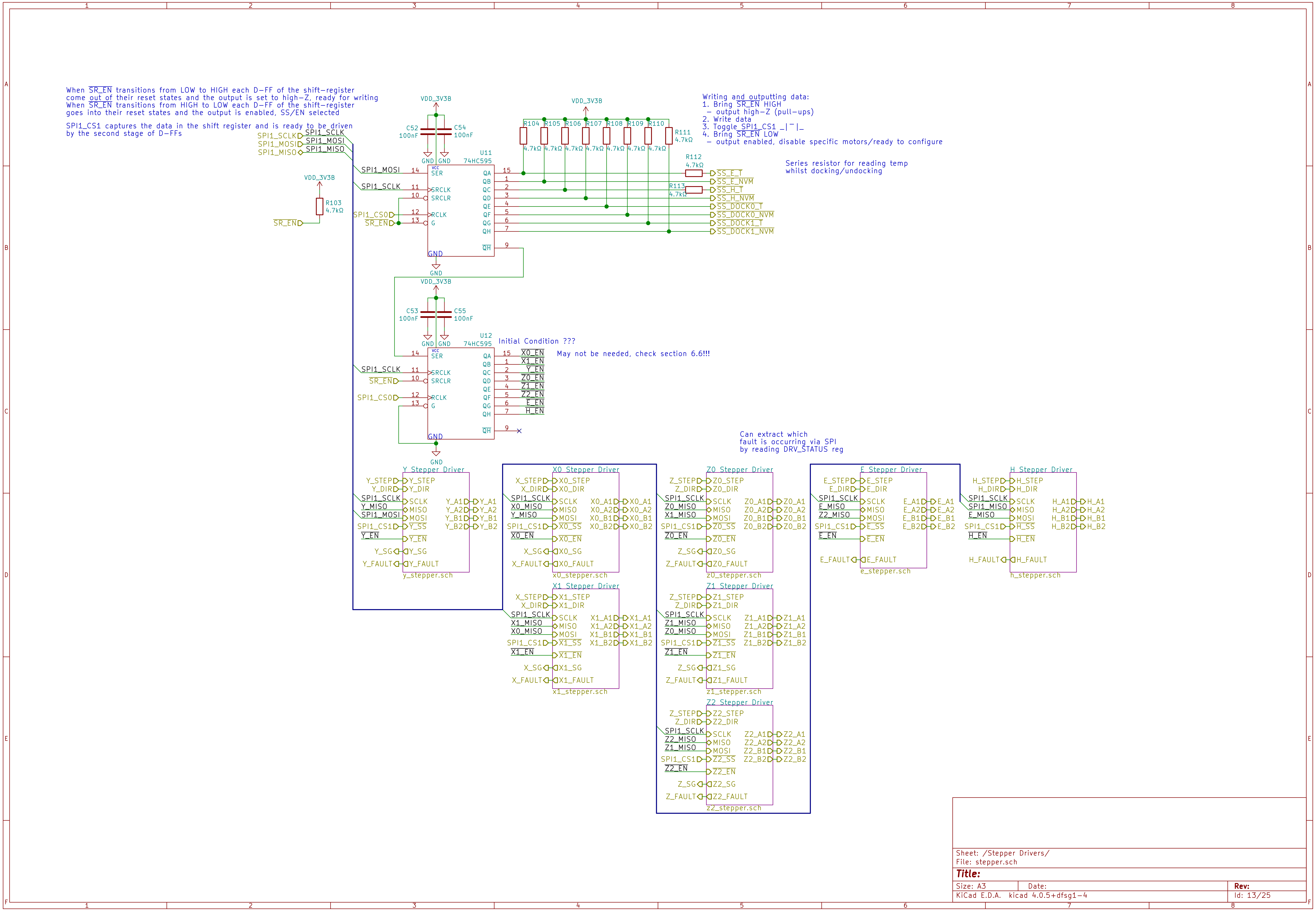


Sheet: /Endstops/
File: endstop.sch

Title:

Size: A3 | Date: | Rev:

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 12/25


When SR_EN transitions from LOW to HIGH each D-FF of the shift-register come out of their reset states and the output is set to high-Z, ready for writing
When SR_EN transitions from HIGH to LOW each D-FF of the shift-register goes into their reset states and the output is enabled, SS/EN selected
SPI1_CS1 captures the data in the shift register and is ready to be driven by the second stage of D-FFs
Writing and outputting data:
1. Bring SR_EN HIGH
- output high-Z (pull-ups)
2. Write data
3. Toggle SPI1_CS1 _|¯|_
4. Bring SR_EN LOW
- output enabled, disable specific motors/ready to configure
Series resistor for reading temp whilst docking/undocking
Initial Condition ???
May not be needed, check section 6.6!!!
Can extract which fault is occurring via SPI by reading DRV_STATUS reg
VDD_3V3B
C52 100nF
C54 100nF
C53 100nF
C55 100nF
U11 74HC595
U12 74HC595
R103 4.7kΩ
R104 R105 R106 R107 R108 R109 R110 R111
4.7kΩ
R112 4.7kΩ
R113 4.7kΩ
SPI1_SCLK
SPI1_MOSI
SPI1_MISO
SPI1_CS0
SPI1_CS1
SR_EN
GND
SER SRCLK SRCLR RCLK G QA QB QC QD QE QF QG QH QH
SS_E_T
SS_E_NVM
SS_H_T
SS_H_NVM
SS_DOCK0_T
SS_DOCK0_NVM
SS_DOCK1_T
SS_DOCK1_NVM
X0_EN X1_EN Y_EN Z0_EN Z1_EN Z2_EN E_EN H_EN
Y Stepper Driver
y_stepper.sch
X0 Stepper Driver
x0_stepper.sch
X1 Stepper Driver
x1_stepper.sch
Z0 Stepper Driver
z0_stepper.sch
Z1 Stepper Driver
z1_stepper.sch
Z2 Stepper Driver
z2_stepper.sch
E Stepper Driver
e_stepper.sch
H Stepper Driver
h_stepper.sch
Y_STEP Y_DIR Y_MISO Y_SS Y_EN Y_SG Y_FAULT Y_A1 Y_A2 Y_B1 Y_B2
X_STEP X_DIR X0_STEP X0_DIR X0_MISO X0_SS X0_EN X0_SG X0_FAULT X0_A1 X0_A2 X0_B1 X0_B2
X1_STEP X1_DIR X1_MISO X1_SS X1_EN X1_SG X1_FAULT X1_A1 X1_A2 X1_B1 X1_B2
Z_STEP Z_DIR Z0_STEP Z0_DIR Z0_MISO Z0_SS Z0_EN Z0_SG Z0_FAULT Z0_A1 Z0_A2 Z0_B1 Z0_B2
Z1_STEP Z1_DIR Z1_MISO Z1_SS Z1_EN Z1_SG Z1_FAULT Z1_A1 Z1_A2 Z1_B1 Z1_B2
Z2_STEP Z2_DIR Z2_MISO Z2_SS Z2_EN Z2_SG Z2_FAULT Z2_A1 Z2_A2 Z2_B1 Z2_B2
Z_SG Z_FAULT X_SG X_FAULT
E_STEP E_DIR E_MISO E_SS E_EN E_FAULT E_A1 E_A2 E_B1 E_B2
H_STEP H_DIR H_SS H_EN H_FAULT H_A1 H_A2 H_B1 H_B2
SCLK MISO MOSI
Sheet: /Stepper Drivers/
File: stepper.sch
Title:
Size: A3
Date:
Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4
Id: 13/25

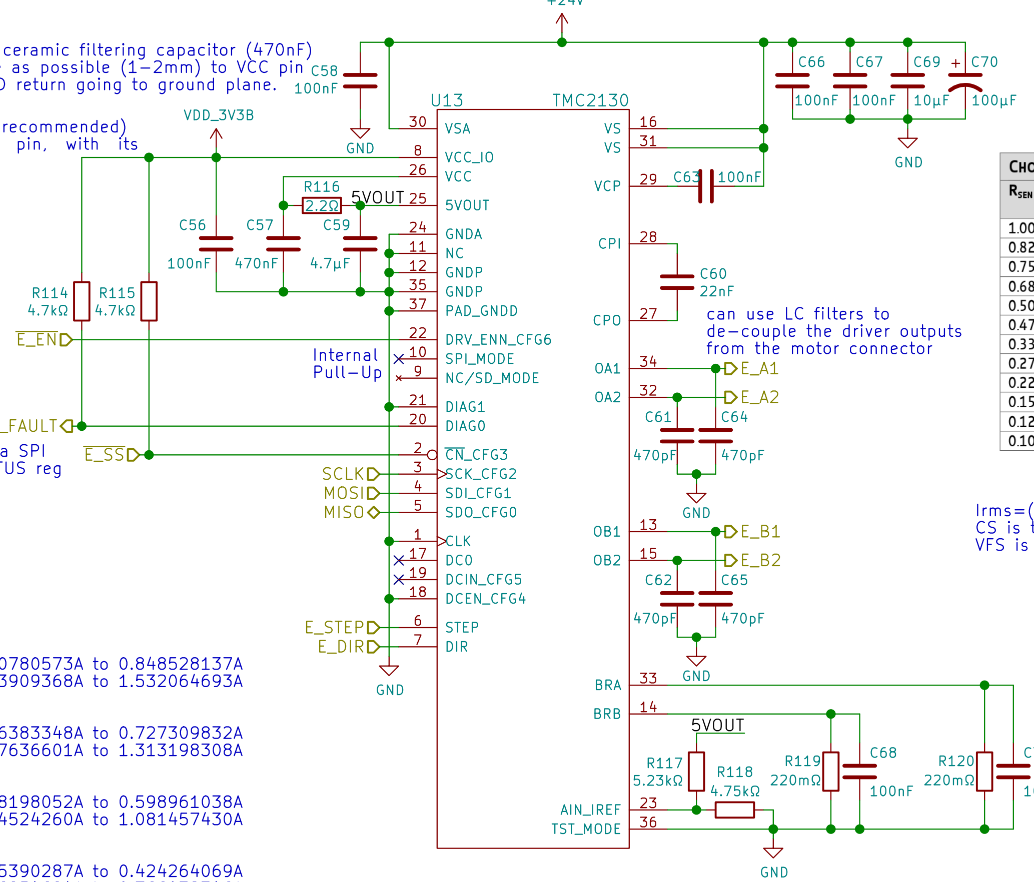
See Chapter 29 of the datasheet for layout

Place sense resistors and all filter capacitors as close as possible to the related IC pins. Use a solid common GND for all GND connections, also for sense resistor GND. Connect 5VOUT filtering capacitor directly to 5VOUT and GNDA pin. See layout hints for more details. Low ESR electrolytic capacitors are recommended for VS filtering.

A 100nF filtering capacitor should be placed as close as possible to the VSA pin to ground plane. The motor supply pins VS should be decoupled with an electrolytic capacitor (47µF or larger is recommended) and a ceramic capacitor, placed close to the device.

place a ceramic filtering capacitor (470nF) as close as possible (1−2mm) to VCC pin with GND return going to ground plane.

5VOUT output voltage ceramic filtering capacitor (4.7µF recommended) should be placed as close as possible to the 5VOUT pin, with its GND return going directly to the GNDA pin



Can extract which fault is occurring via SPI by reading DRV_STATUS reg

AIN_IREF=1−2.4V

Choice of R_{SENSE} and resulting max. motor current		
R_{SENSE} [Ω]	*RMS current [A] (CS=31, vsense=0)*	*RMS current [A] (CS=31, vsense=1)*
1.00	0.23	0.12
0.82	0.27	0.15
0.75	0.30	0.17
0.68	0.33	0.18
0.50	0.44	0.24
0.47	0.47	0.26
0.33	0.66	0.36
0.27	0.79	0.44
0.22	0.96	0.53
0.15	1.35	0.75
0.12	1.64	0.91
0.10	1.92*)	1.06

Irms=(CS+1)/32 × Vfs/(Rsense+20mΩ) × 1/√2
CS is the current scale setting as set by IHOLD IRUN and coolStep
VFS is the full scale voltage as determined by vsense control bit

Bit 0 of GCONF:
I_scale_analog
0: Normal operation, use internal reference voltage
1: Use voltage supplied to AIN as current reference

When *I_scale_analog* is enabled for analog scaling of V_{FS}, the resulting voltage V_{FS}' is calculated by:

$$V_{FS}' = V_{FS} * \frac{V_{AIN}}{2.5V}$$

Vain = 2.0V

Rsense = 100mOhm:
Vsense = 1 : 26.516504mA res : 397.747564mA range : 0.450780573A to 0.848528137A
Vsense = 0 : 47.877022mA res : 718.155325mA range : 0.813909368A to 1.532064693A

Rsense = 120mOhm:
Vsense = 1 : 22.728432mA res : 340.926484mA range : 0.386383348A to 0.727309832A
Vsense = 0 : 41.037447mA res : 615.561707mA range : 0.697636601A to 1.313198308A

Rsense = 150mOhm:
Vsense = 1 : 18.717532mA res : 280.762986mA range : 0.318198052A to 0.598961038A
Vsense = 0 : 33.795545mA res : 506.933170mA range : 0.574524260A to 1.081457430A

Rsense = 220mOhm:
Vsense = 1 : 13.258252mA res : 198.873782mA range : 0.225390287A to 0.424264069A
Vsense = 0 : 23.938511mA res : 359.077662mA range : 0.406954684A to 0.766032346A

Vain = 2.4V

Rsense = 220mOhm:
Vsense = 1 : 15.909903mA res : 238.648538mA range : 0.270468344A to 0.509116882A
Vsense = 0 : 28.726213mA res : 430.893195mA range : 0.488345621A to 0.919238816A

Vain = 2.379759519V

Rsense = 220mOhm:
Vsense = 1 : 15.775726mA res : 236.635888mA range : 0.26818734A to 0.504823228A
Vsense = 0 : 28.483949mA res : 427.259243mA range : 0.484227141A to 0.911486384A

Choose sense resistors in a way, that normal IRUN is 16 to 31 for best microstep performance.

For best precision, choose the sense resistors in a way that the desired maximum current is reached with AIN in the range 2V to 2.4V

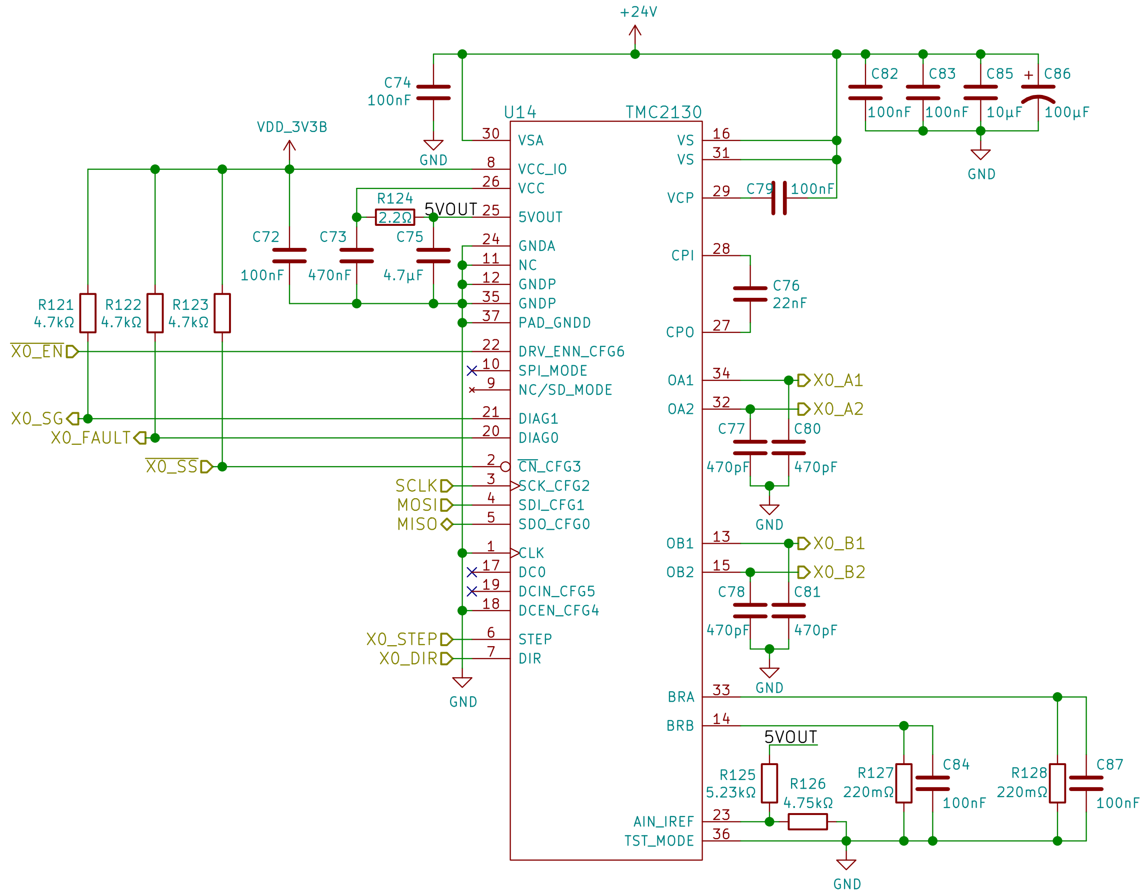
Sense input tolerance / motor current full scale tolerance -using internal reference	I_{COIL}	*I_scale_analog*=0, *vsense*=0	-5		+5	%
Sense input tolerance / motor current full scale tolerance -using external reference voltage	I_{COIL}	*I_scale_analog*=1, V_{AIN}=2V, *vsense*=0	-2		+2	%

Vain = 2.379759519V

The sense resistor voltage range can be selected by the vsense bit in CHOPCONF. The low sensitivity setting (high sense resistor voltage, vsense=0) brings *best and most robust current regulation*, while high sensitivity (low sense resistor voltage, vsense=1) reduces power dissipation in the sense resistor. The high sensitivity setting reduces the power dissipation in the sense resistor by nearly half.

vsense	Allows control of the sense resistor *voltage range* for full scale current.	0	V_{FS} = 0.32 V
		1	V_{FS} = 0.18 V

Vsrtl=325mV

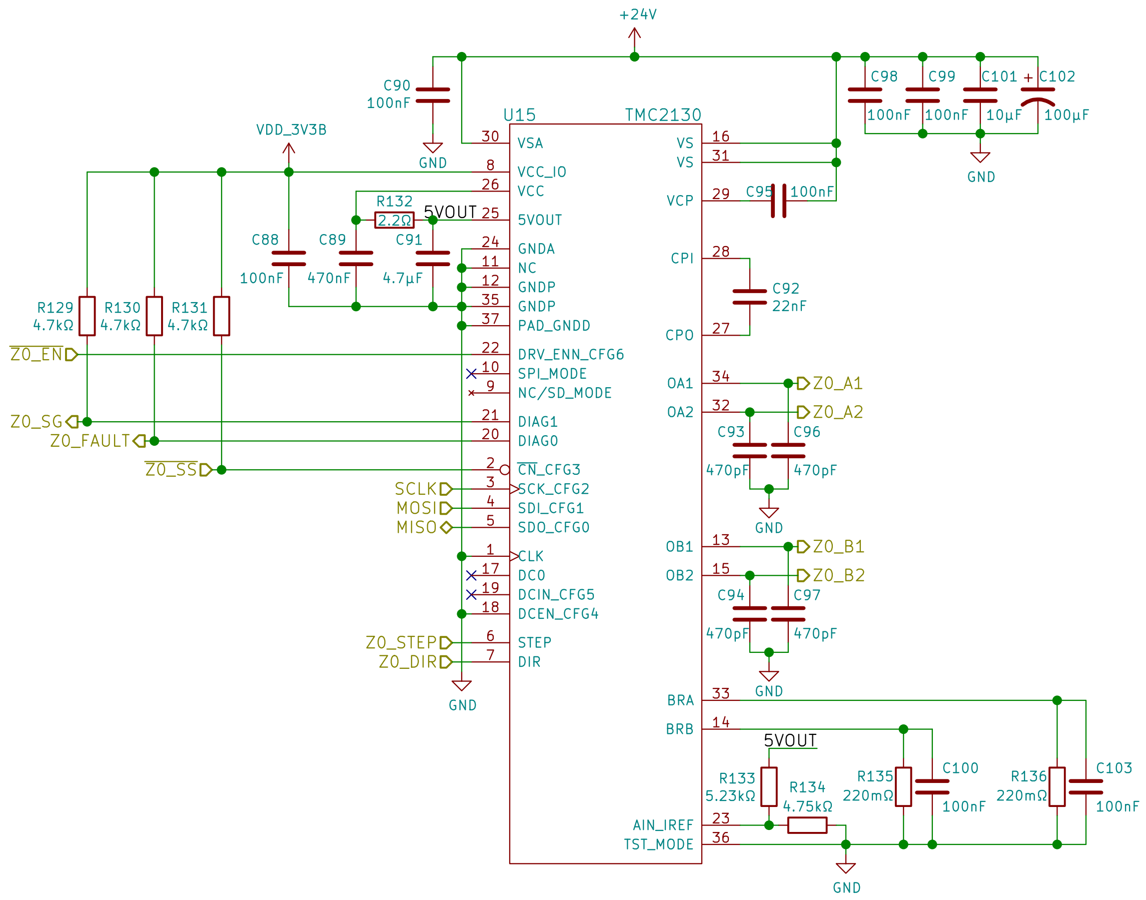


Sheet: /Stepper Drivers/X0 Stepper Driver/
File: x0_stepper.sch

Title:

Size: A3 Date: **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 Id: 15/25

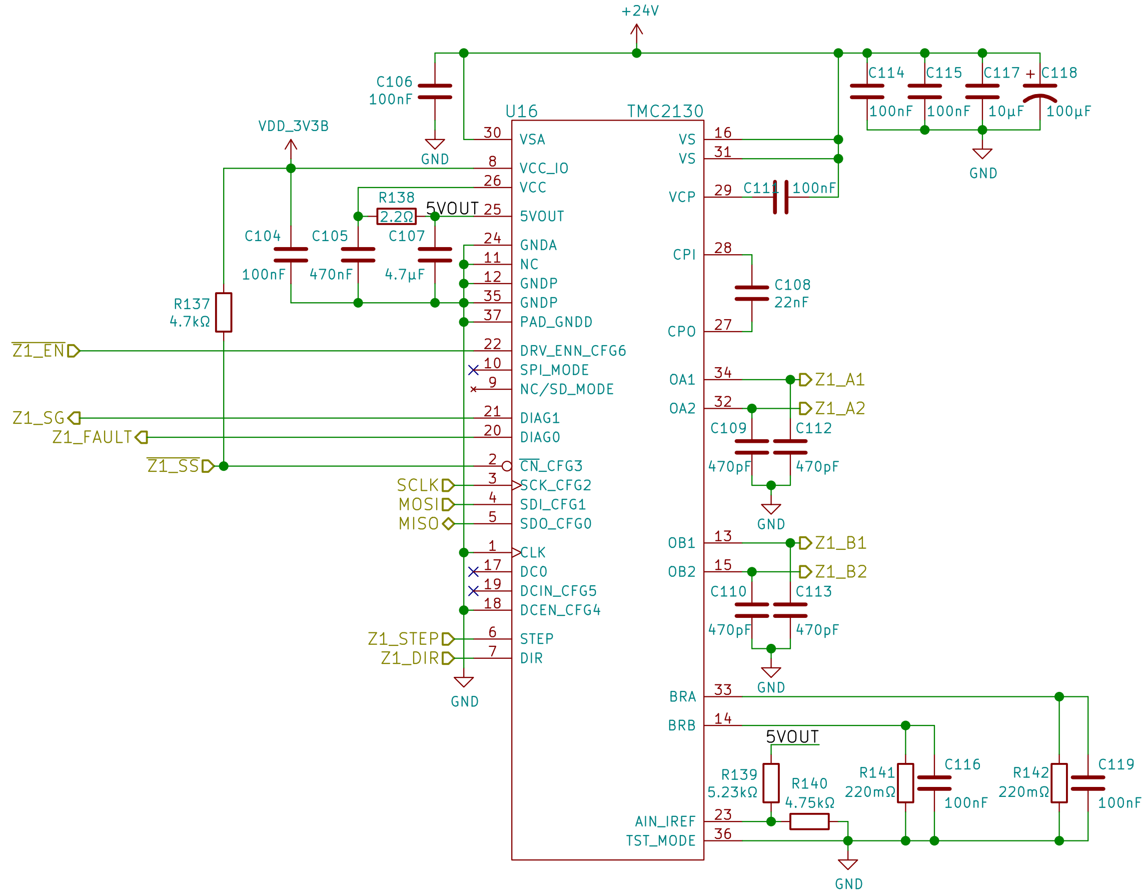


Sheet: /Stepper Drivers/Z0 Stepper Driver/
File: z0_stepper.sch

Title:

Size: A3 | Date: | Rev:

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 16/25

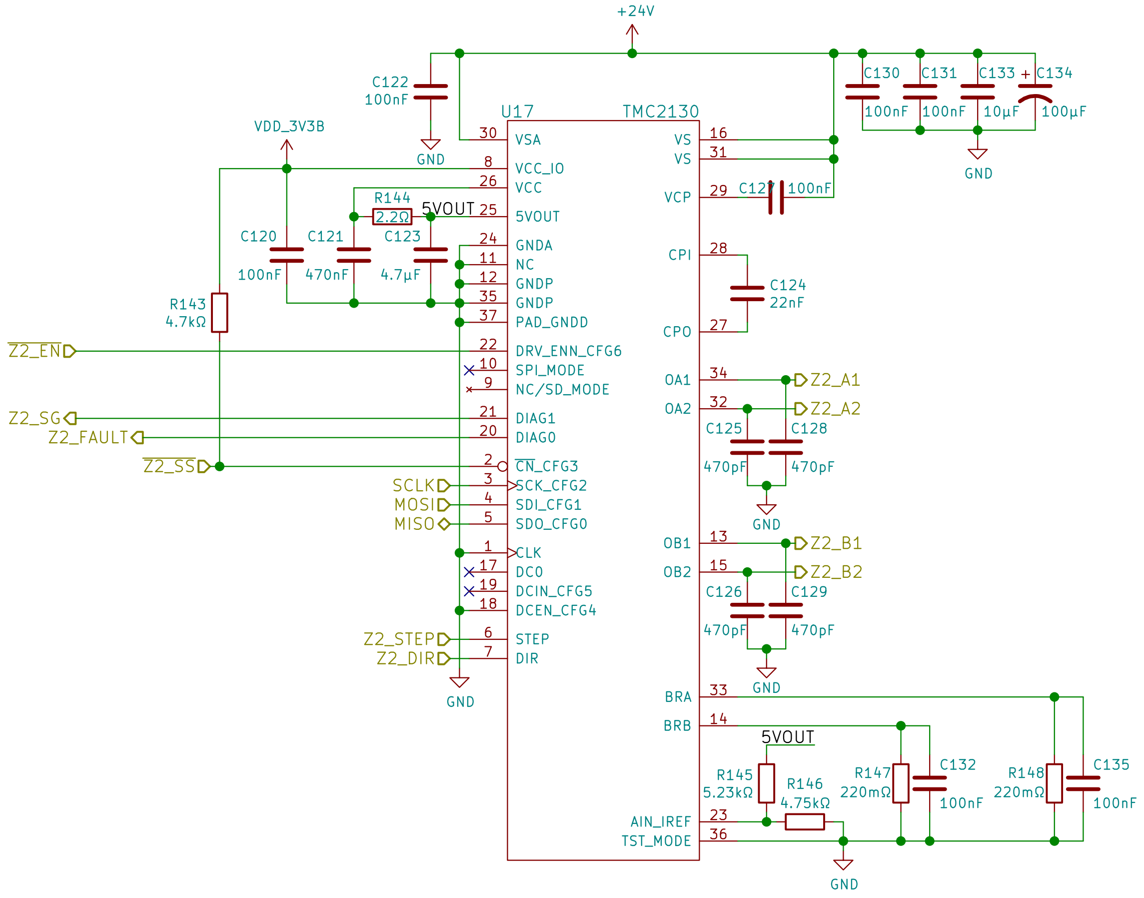


Sheet: /Stepper Drivers/Z1 Stepper Driver/
File: z1_stepper.sch

Title:

Size: A3 | Date: | Rev:

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 17/25

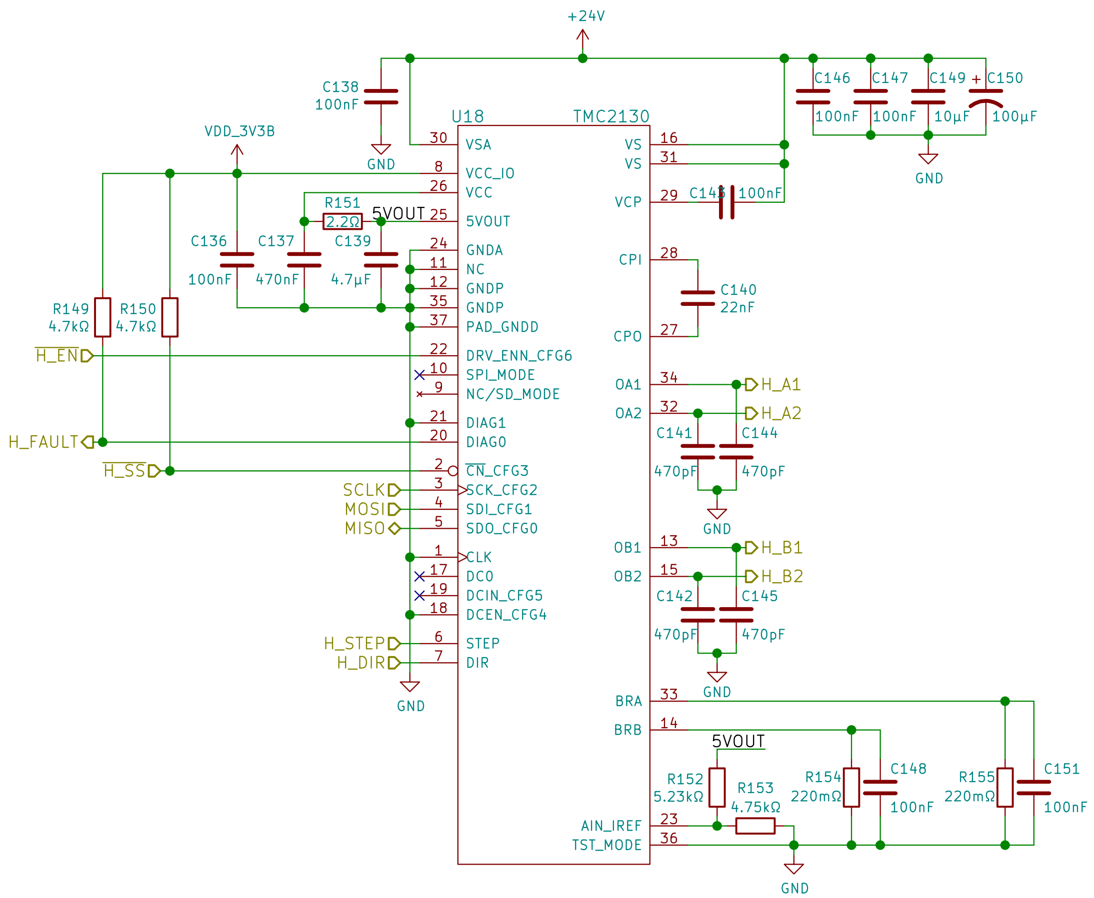


Sheet: /Stepper Drivers/Z2 Stepper Driver/
File: z2_stepper.sch

Title:

Size: A3 | Date: | Rev:

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 18/25

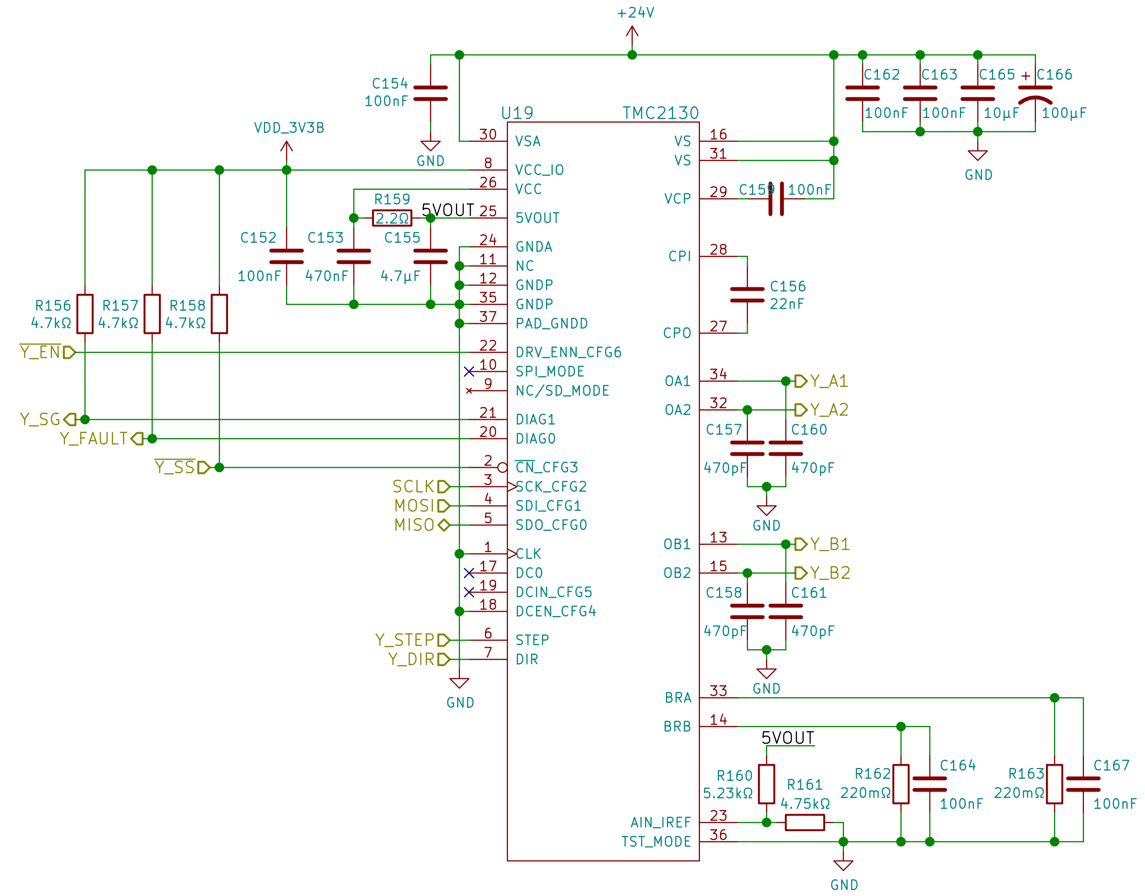


Sheet: /Stepper Drivers/H Stepper Driver/
File: h_stepper.sch

Title:

Size: A3 Date: **Rev:**

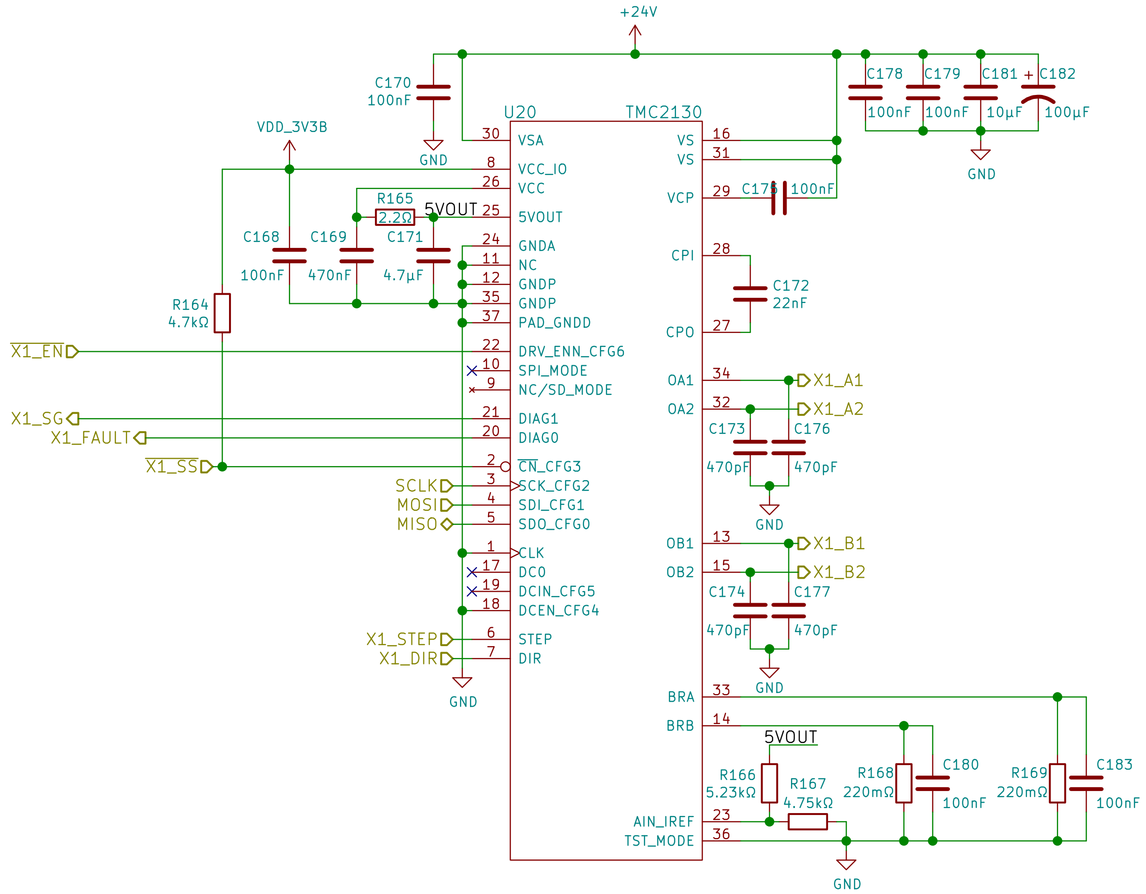
KiCad E.D.A. kicad 4.0.5+dfsg1-4 Id: 19/25



Sheet: /Stepper Drivers/Y Stepper Driver/
File: y_stepper.sch

Title:

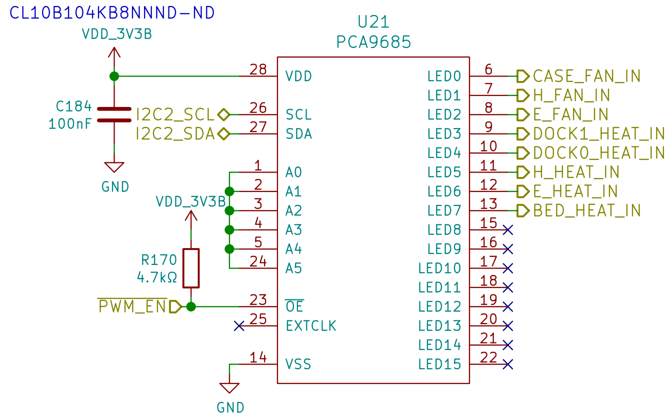
Size: A3	Date:	Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 20/25



Sheet: /Stepper Drivers/X1 Stepper Driver/
File: x1_stepper.sch

Title:

Size: A3 Date: **Rev:**
KiCad E.D.A. kicad 4.0.5+dfsg1-4 Id: 21/25

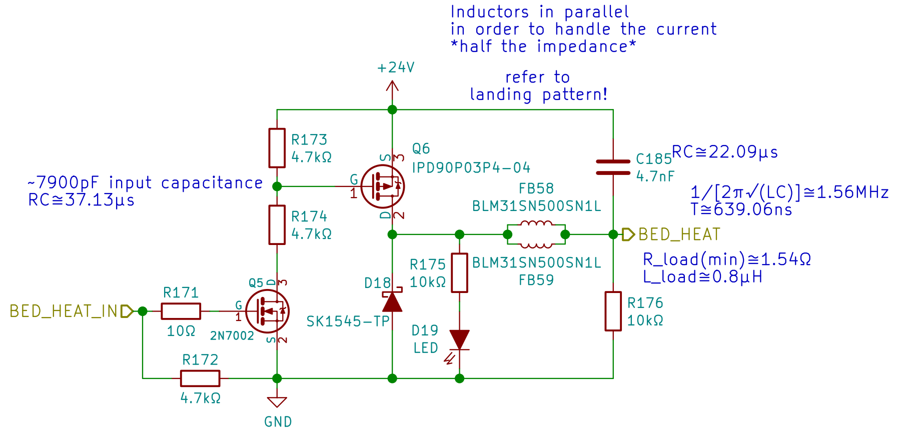


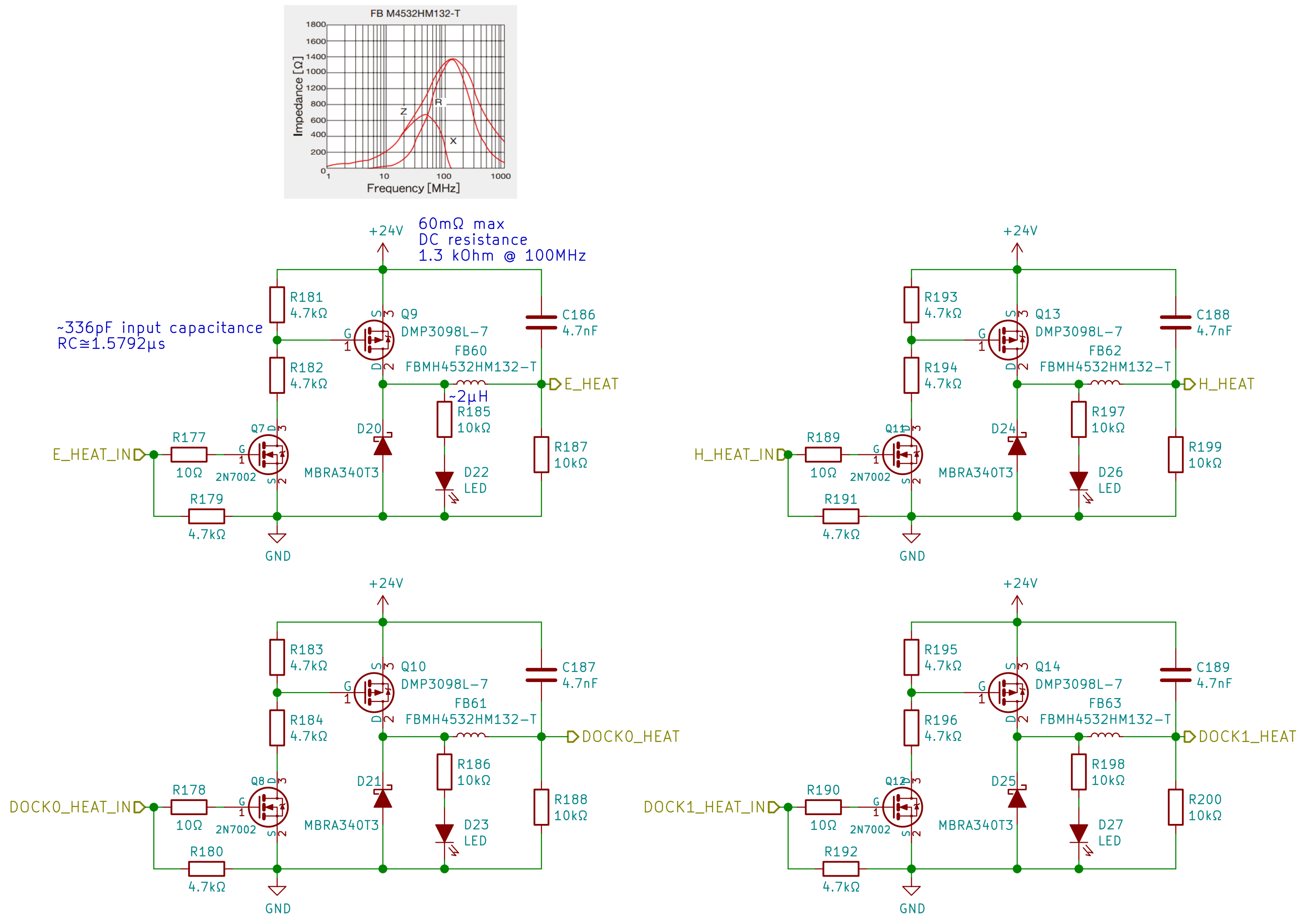
Sheet: /PWM/
File: pwm.sch

Title:

Size: A4 | Date: | **Rev:**

KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 22/25

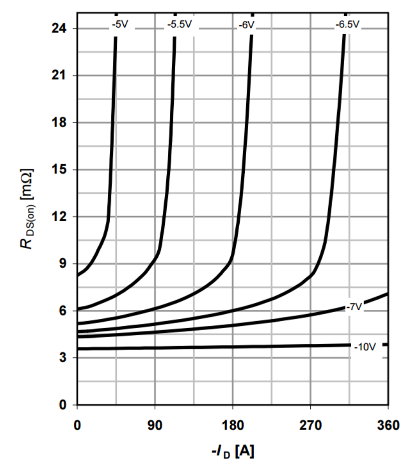




6 Typ. drain-source on-state resistance

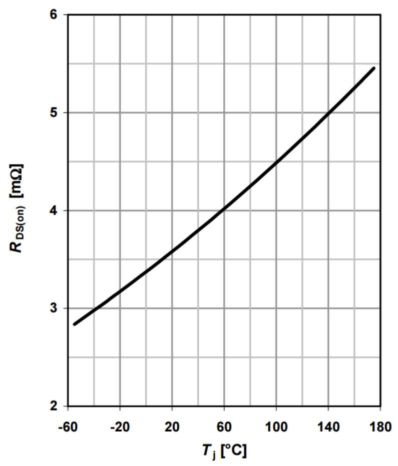
$R_{DS(on)} = (I_D)$; $T_j = 25$ °C

parameter: V_{GS}



8 Typ. drain-source on-state resistance

$R_{DS(on)} = f(T_j)$; $I_D = -90$ A; $V_{GS} = -10$ V

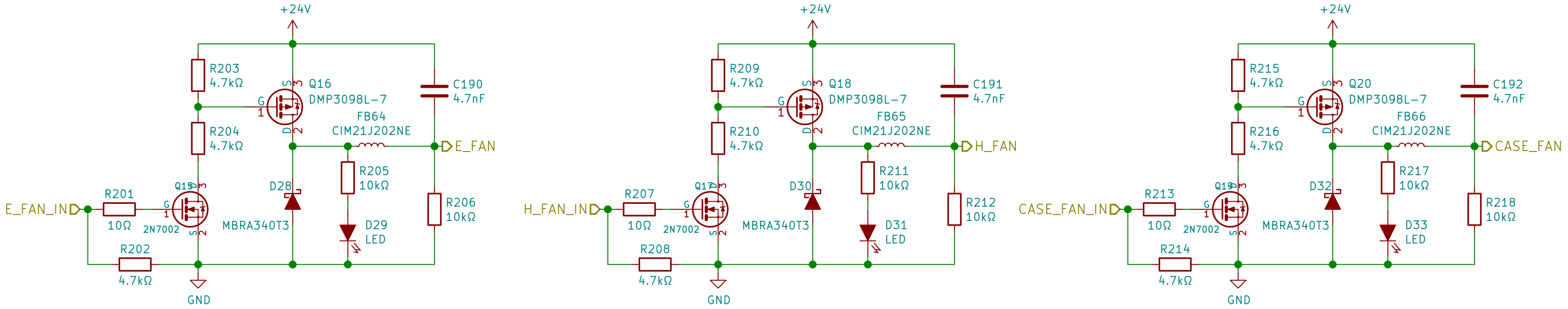


Sheet: /Heaters/
File: heater.sch

Title:

Size: A3 | Date: | Rev:

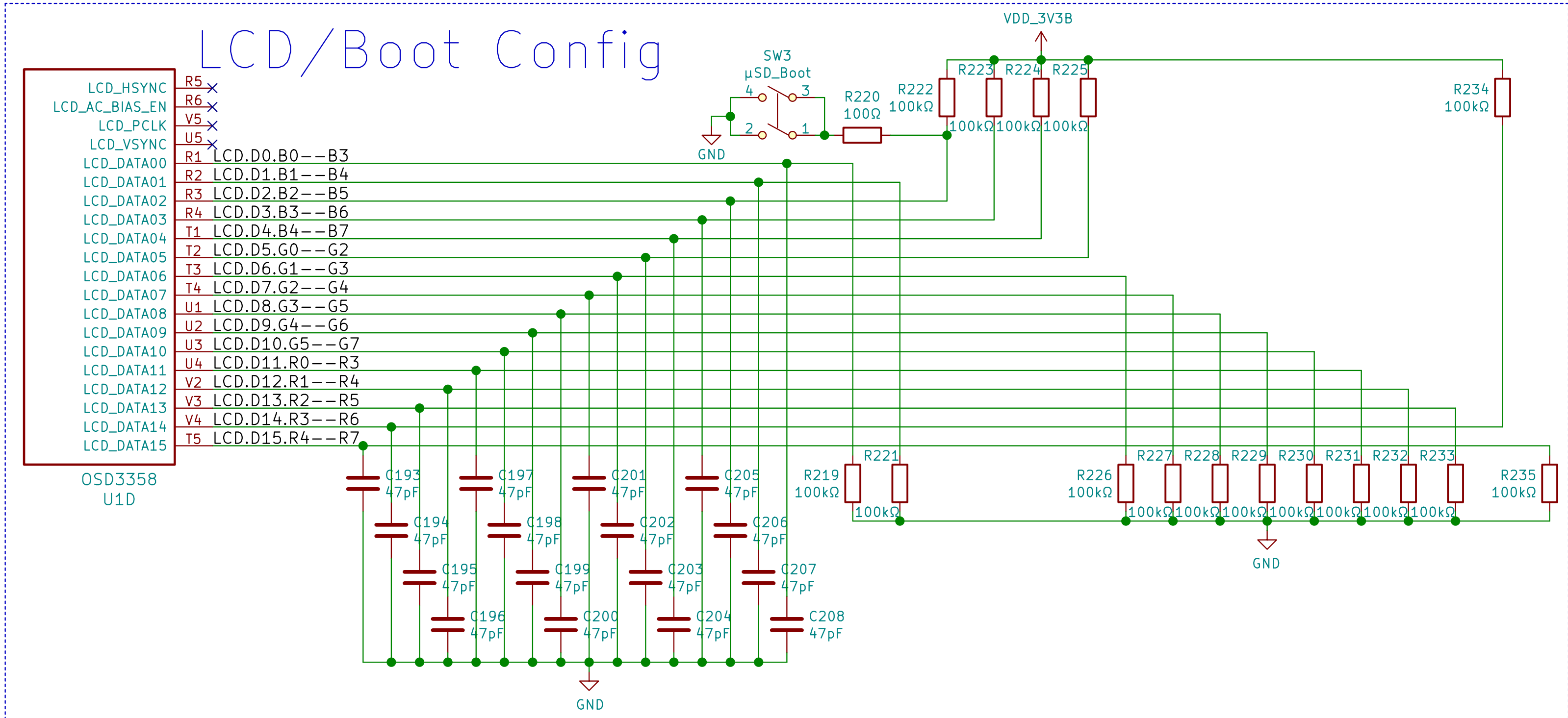
KiCad E.D.A. kicad 4.0.5+dfsg1-4 | Id: 23/25



Sheet: /Fans/
File: fan.sch

Title:

Size: A3	Date:	**Rev:**
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 24/25



Sheet: /Configuration/
File: hdmi.sch

Title:

Size: A4	Date:	Rev:
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 25/25