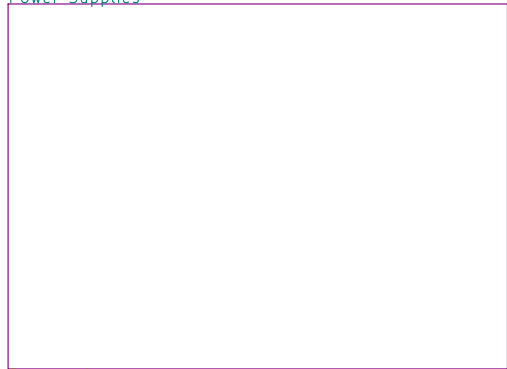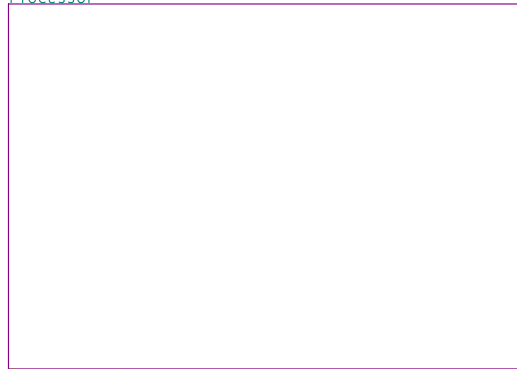Power Supplies

Power.sch

Processor

Processor.sch

Stepper Driver

Stepper_Drv.sch

Heater & Fan Control
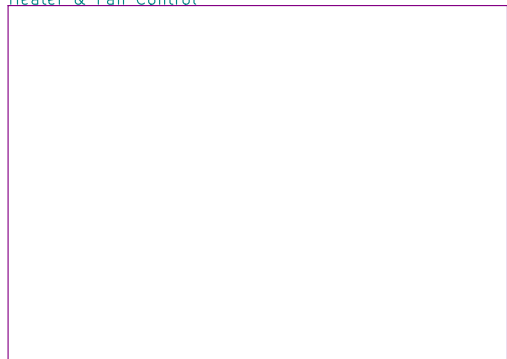
Htr_Fan.sch

Comms
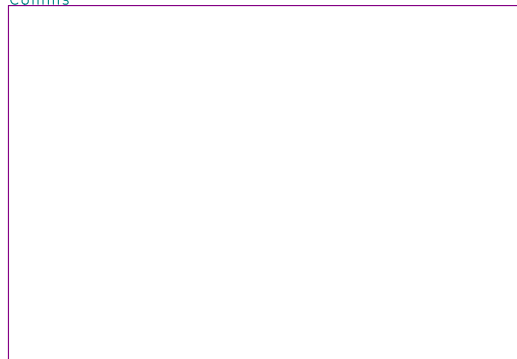
Comms.sch

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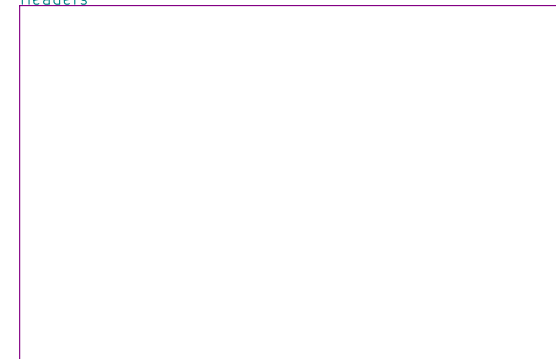
Headers.sch

Sheet: /
File: DuetWifi.sch

Title: Duet Wifi

Size: A4	Date: 2017−02−07	**Rev: 1.02**
KiCad E.D.A. kicad 4.0.2−stable		Id: 1/7

Stepper Driver schematic sheet (X, Y, Z, Extruder 0, Extruder 1 stepper drivers using TMC2660; Endstops; SPI1 Buffer with 74HC125; Stepper circuit EMI protection).
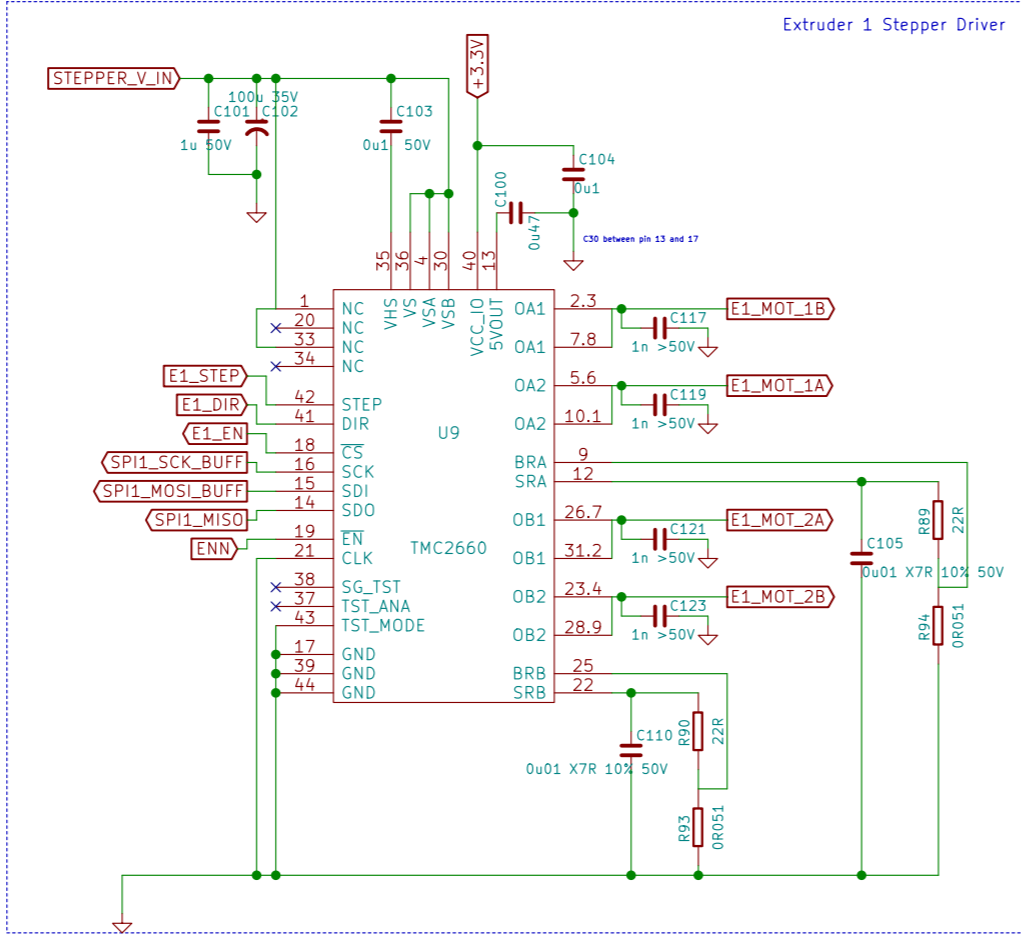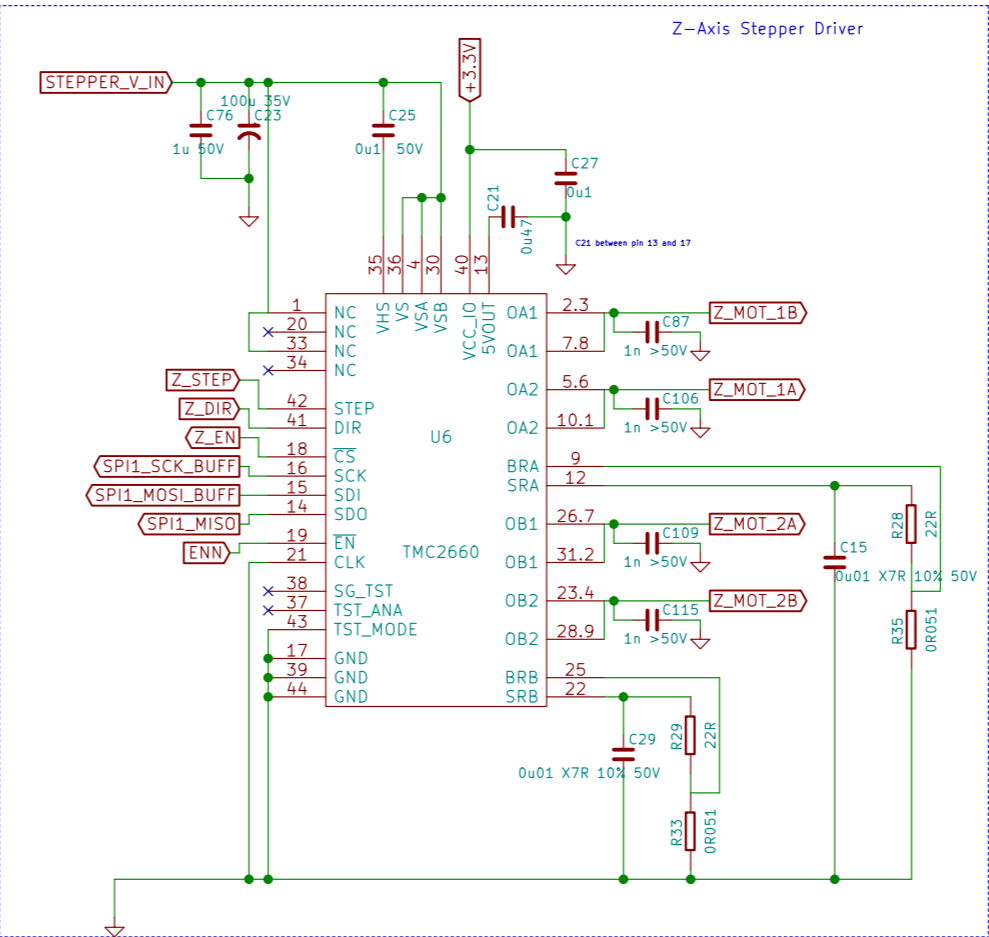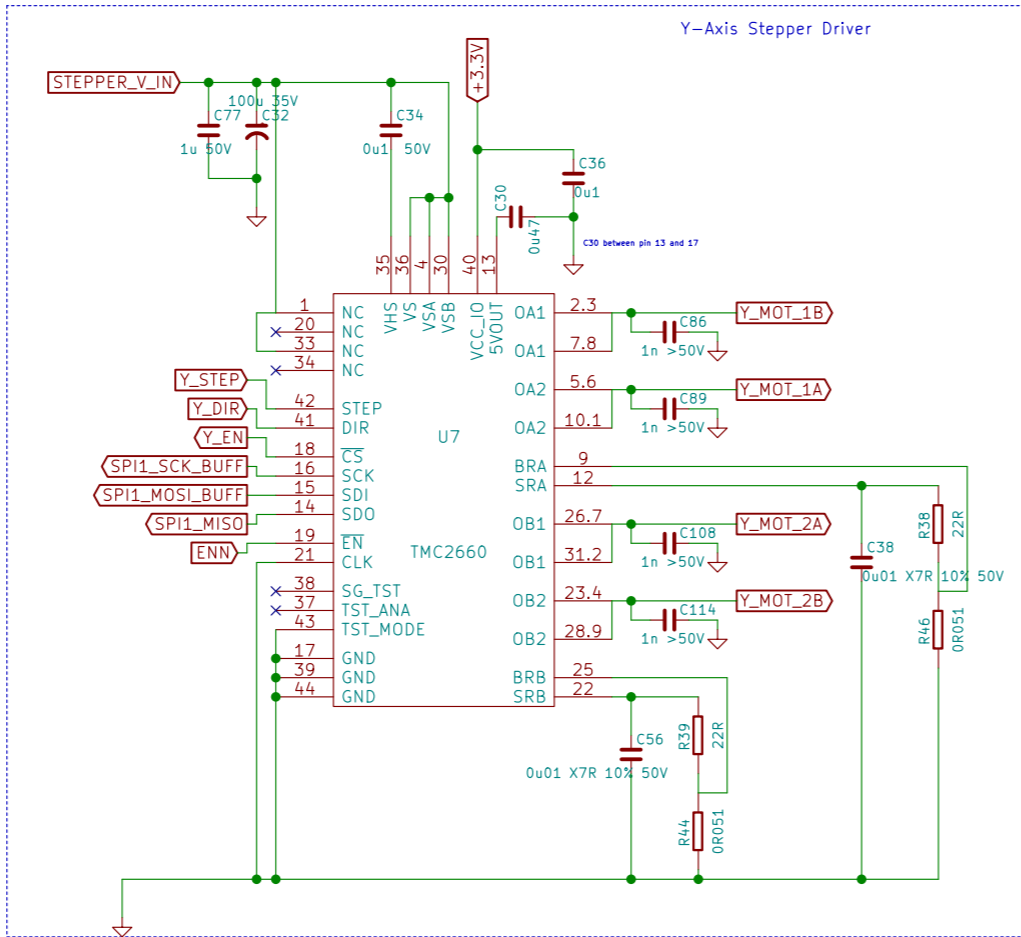
12–24V Input, 5V 2A Output PWM Buck Converter

V_IN

D1 SS3P4

2A L2 1uH

C96 22nF

R80 47K 1%

R81 4K7 1%

C79 0u01

PWR_FAIL_DET2

PWR_FAIL_DET1

R15 47K 1%

R16 4K7 1%

C80 0u01

C1 10u 35V
C3 100u 35V
C12 100u 35V
C6 10u 35V

R84 100K

JP9 1 5V EN

C5

C5 sets the soft start time. Any value between 20nf and 100nf is fine if C97 and C98 total 20uF

U3 A4403

Vin
Ton 3
DIS 10
SS 4
PAD GND 17
GND 6

BOOT 11
LX 12
Isen 8
SGND 9
FB 5

NC NC NC NC NC NC
2 7 13 14 15 16

Resistors R85 and R86 should be surface mount, low inductance type, rated at 250 mW at 70°C
Possibly use 0R2 IOT limit current to 1A

D2 SS3P4

C97 10u
C98 10u

R85 0R1
R86 0R1

R87 3K92

R88 750R

L1 10uH

2A L3 1uH

C81 0u01

C99 100u 10V

C7 10u

D13 SS14M 1A

VBUS

VBUS limited to 500mA ATX Spec advises by the USB specification at least 780mA this design allows up to 1A

JP10 1 E 5V EN 2

+5V

D14 SS14M 1A

5V_IN

5V Input, 3.3V 500mA Output Low Drop-Out Linear Regulator
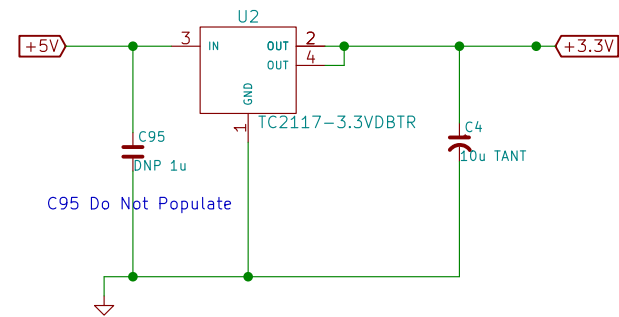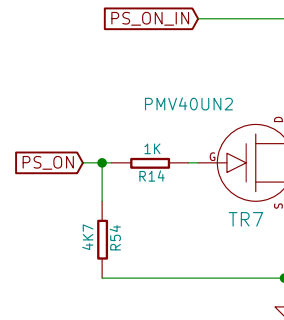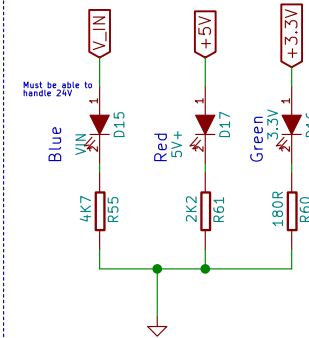
+5V

U2

IN 3
OUT 2
OUT 4
GND 1

TC2117-3.3VDBTR

C95 DNP 1u

C4 10u TANT

+3.3V

C95 Do Not Populate

PS_ON Control

PS_ON_IN

PMV40UN2

PS_ON

R14 1K

R54 4K7

TR7
D
G
S

Power LEDs

V_IN

+5V

+3.3V

Must be able to handle 24V

Blue
VIN
D15

Red
5V+
D17

Green
3.3V
D16

R55 4K7

R61 2K2

R60 180R

http://www.ohwr.org/attachments/2388/cern_ohl_v_1_2.txt
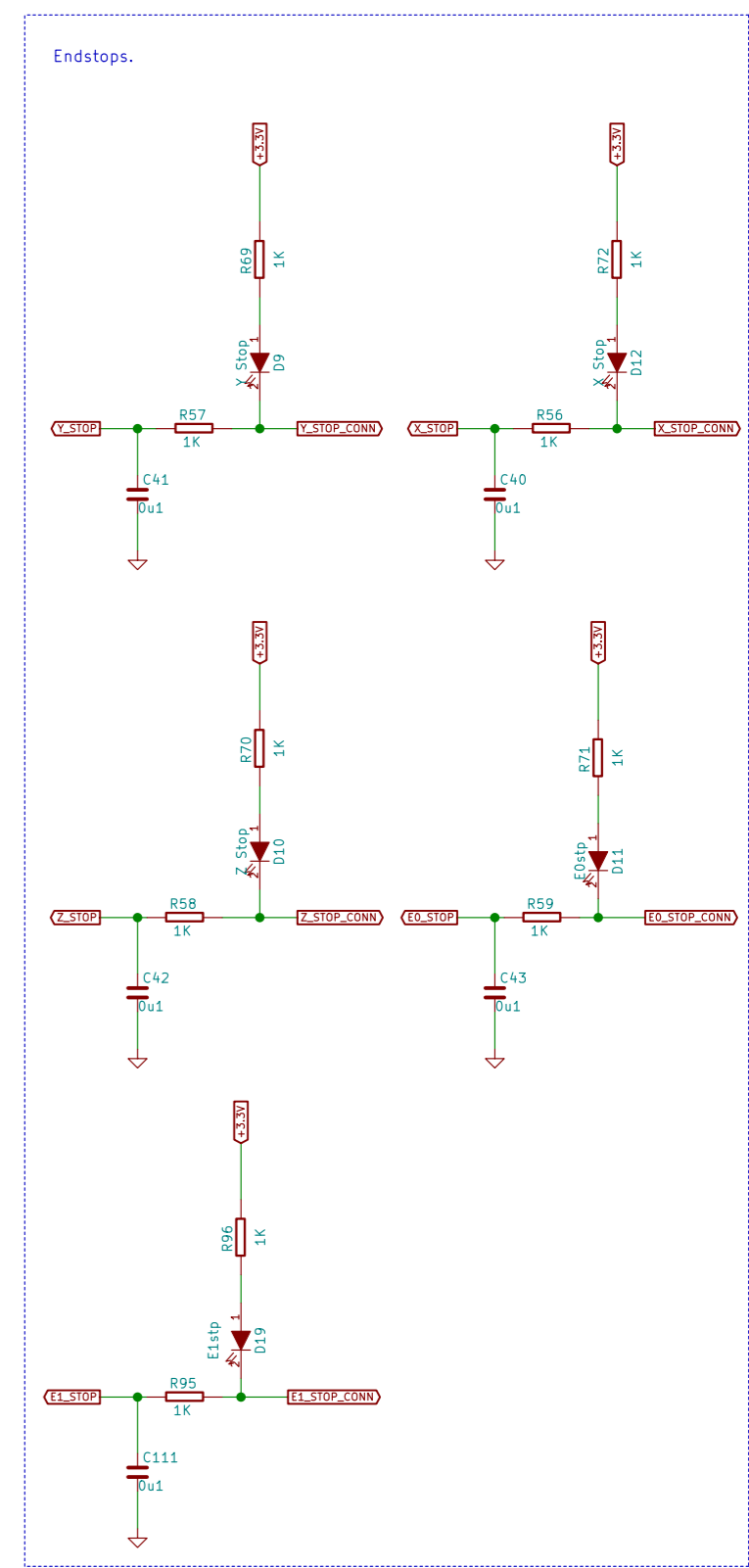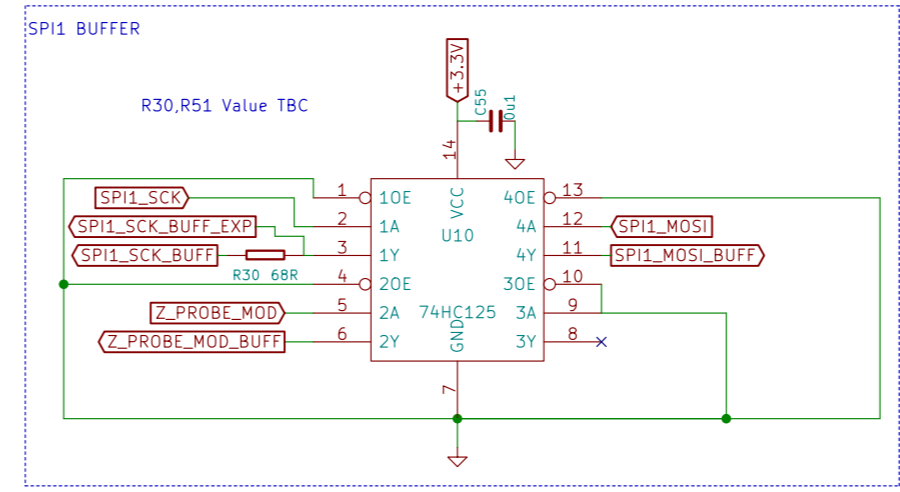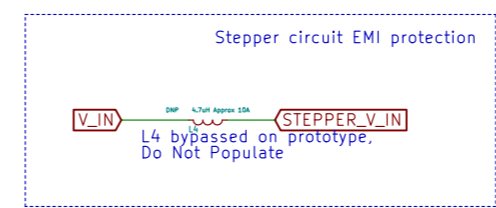CERN OSH License 1.2
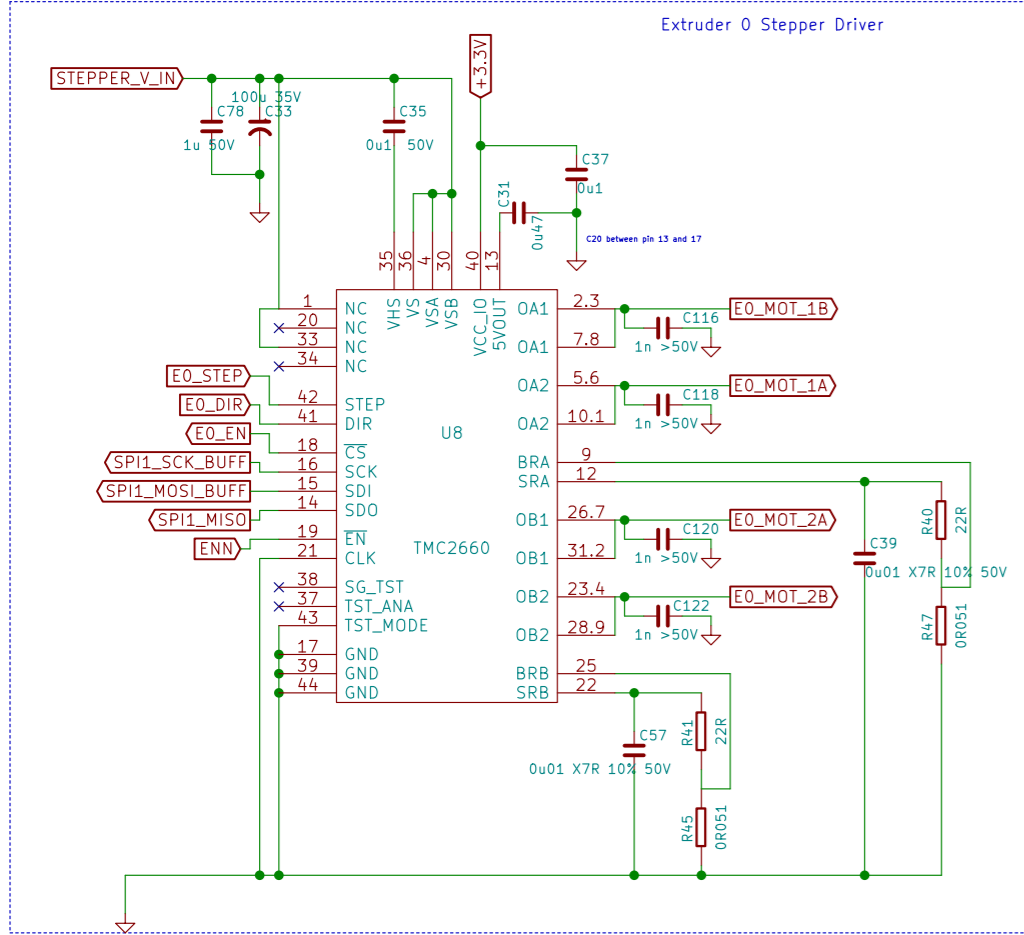**Think3DPrint3D, Escher 3D**
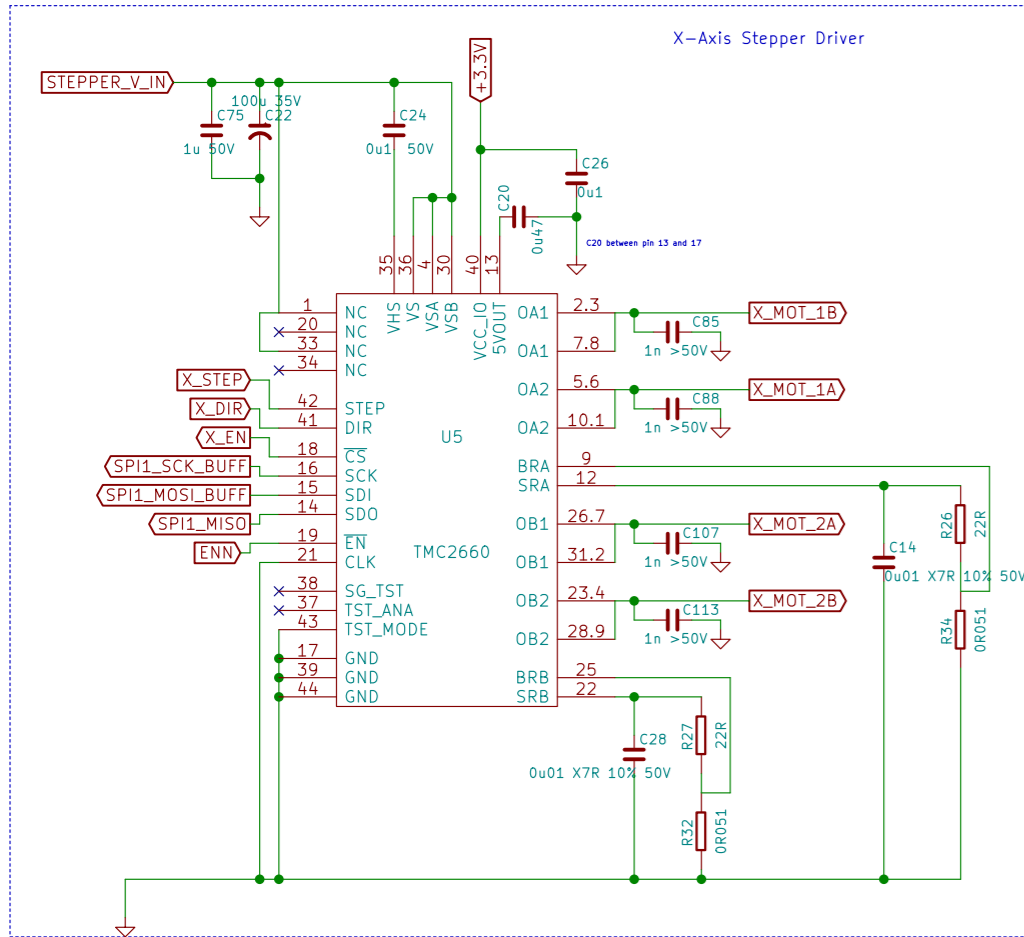Sheet: /Power Supplies/
File: Power.sch
Title: Duet Wifi
Size: A4   Date: 2017-02-07   **Rev: 1.02**
KiCad E.D.A. kicad 4.0.2-stable   Id: 3/7

POWER

High Current Screw Term

V_IN — 1, 2 — J23 VIN

5V_IN — 1
PS_ON_IN — 2, 3 — J20 5V_PS

Heater and Fans

High Current Screw Term

V_IN — 2, BED HEAT
BED− — 1 — J4 BED HEAT

E0− — 2 — J11 E0 HEAT
V_IN — 1

E1− — 2 — J13 E1 HEAT
V_IN — 1

FAN0− — 2 — J25 FAN0
V_FAN — 1

FAN1− — 2 — J29 FAN1
V_FAN — 1

FAN2− — 2 — J2 FAN2
V_FAN — 1

V_FAN — 2 — J24 V_FAN GND V_IN Always on FAN 0
V_FAN — 2 — J31 GND V_IN GND V_IN Always on FAN1

Motors

Z_MOT_1B
Z_MOT_1A — 1, 2, 3, 4 — J7 Z B
Z_MOT_2A
Z_MOT_2B

J36 Z A

Y_MOT_1B
Y_MOT_1A — 1, 2, 3, 4 — J8 Y MOT
Y_MOT_2A
Y_MOT_2B

X_MOT_1B
X_MOT_1A — 1, 2, 3, 4 — J9 X MOT
X_MOT_2A
X_MOT_2B

E0_MOT_1B
E0_MOT_1A — 1, 2, 3, 4 — J10 E0 MOT
E0_MOT_2A
E0_MOT_2B

E1_MOT_1B
E1_MOT_1A — 1, 2, 3, 4 — J6 E1 MOT
E1_MOT_2A
E1_MOT_2B

Endstops

+3.3V

Z_STOP_CONN — 1, 2, 3 — J19 Z_STOP
Y_STOP_CONN — 1, 2, 3 — J32 Y_STOP
X_STOP_CONN — 1, 2, 3 — J33 X_STOP
E0_STOP_CONN — 1, 2, 3 — J34 E0_STOP
E1_STOP_CONN — 1, 2, 3 — J35 E1_STOP

Temperature

THERMISTOR0 — 2 — J5 BED TEMP
VSSA — 1

THERMISTOR1 — 2 — J12 E0 TEMP
VSSA — 1

THERMISTOR2 — 2 — J14 E1 TEMP
VSSA — 1

Expansion & Miscellaneous

+5V — EXPANSION
2
+3.3V — 3
E2_STOP — 4
E2_STEP — 5
E2_DIR — 6
E2_EN — 7
HEATER3 — 8
E3_STOP — 9
E3_STEP — 10
E3_DIR — 11
E3_EN — 12
HEATER4 — 13
E4_STOP — 14
E4_STEP — 15
E4_DIR — 16
E4_EN — 17
HEATER5 — 18
E5_STOP — 19
E5_STEP — 20
E5_DIR — 21
E5_EN — 22
HEATER6 — 23
E6_STOP — 24
E6_STEP — 25
E6_DIR — 26
E6_EN — 27
ENN — 28
PB6/TMS — 29
30
HEATER7 — 31
SPI1_SCK_BUFF_EXP — 32
SPI1_MOSI_BUFF — 33
SPI1_MISO — 34
THERMISTOR3 — 35
THERMISTOR4 — 36
THERMISTOR5 — 37
THERMISTOR6 — 38
THERMISTOR7 — 39
VSSA — 40
ADVREF — 41
42
+3.3V — 43
RESET — 44
TWD0 — 45
TWCK0 — 46
SPI0_SCK — 47
SPI0_MOSI — 48
SPI0_MISO — 49
CS5 — 50

J1

CONN_SD (P1)
+5V — 1, 2
SPI0_CS0 — 3, 4 — SPI0_SCK
SPI0_MOSI — 5, 6 — SPI0_MISO
ENC_SW — 7, 8
URXD0 — 9, 10 — +3.3V / UTXD0

CONN_LCD (P2)
+3.3V — 1, 2
ENC_B — 3, 4 — ENC_A
LCD_DB7 — 5, 6 — LCD_RS
LCD_DB6 — 7, 8 — LCD_E
LCD_DB5 — 9, 10 — LCD_DB4

SPI0 (J37)
SPI0_CS2 — 1, 2
SPI0_CS1 — 3, 4 — SPI0_SCK
SPI0_MOSI — 5, 6 — SPI0_MISO
CS3 — 7, 8 — +3.3V
CS4 — 9, 10

Probe (J28)
Z_PROBE_IN — 1
+3.3V
Z_PROBE_MOD — 2, 3, 4

PanelDUE (J30)
+5V — 1, 2
URXD0 — 3
UTXD0 — 4

ESP_COMMS (J39)
URXD1_CONN — 1, 2 — GPIO5
UTXD1_CONN — 3, 4 — ADC
5, 6 — GPIO16
GPIO2 — 7, 8 — +5V

J39 Not populated in production boards

Test Points

Z_STEP — 1 — TP1 Z_Stp_Tp
Z_DIR — 2
Z_EN — 3

Y_STEP — 1 — TP2 Y_Stp_Tp
Y_DIR — 2
Y_EN — 3

X_STEP — 1 — TP3 X_Stp_Tp
X_DIR — 2
X_EN — 3

E0_STEP — 1 — TP4 E0_Stp_Tp
E0_DIR — 2
E0_EN — 3

E1_STEP — 1 — TP5 E1_Stp_Tp
E1_DIR — 2
E1_EN — 3

HEATER0 — 1 — TP6
HEATER1 — 1 — TP7
HEATER2 — 1 — TP8
BED_PWM — 1 — TP9
E0_PWM — 1 — TP10
E1_PWM — 1 — TP11
FAN0 — 1 — TP12
FAN1 — 1 — TP13
FAN2 — 1 — TP14

SPI1_SCK_BUFF — 1 — TP15
D6_TestPoint — 1 — TP16

All test points are DNP

Comms Alternate Headers

CONN_ALT_HEADER J16
ESP_RST — 1, 15 — URXD1_CONN
ESP_EN — 2, 14 — UTXD1_CONN
SPCK — 3, 13 — GPIO5
4, 12
MISO — 5, 11 — EDR_CONN
MOSI — 6, 10 — NPCS0_CONN
+3.3V
7, 8, 9 — ADC, GPIO16, GPIO2

USB

VBUS D3 USB R1 2K2

DDP R2 27R 1% DP 3
DDM R3 27R 1% DN 2
VBUS 1
ID 4
GND 5
USB

USB_PWR_MON R37 27K
R31 47K C82 0u1
J22
CE C13 0u01

uSD

+3.3V

R73 DNP 47K
R71 DNP 47K
R75 DNP 47K
R76 DNP 47K
R63 10K
R66 10K

uSDHC
MCDA2 R22 220R DAT2 1
MCDA3 R25 220R DAT3 2
MCCDA R48 220R CMD 3
VDD 4
CLK 5
MCCK R68 100R DAT0/DO 7
MCDA0 R77 220R DAT1 8
MCDA1 R78 220R Card_Detect 9
SD_CD R79 220R GND 6
GND G
J15
C58 2u2

WIFI

Do not populate C17 unless
the layout changes moving
the 74HC74 away from the ESP

+3.3V

C17 0u1

NPCS0 1CLR 1
1D 2
SAM_TFR_RDY 1CLK 3
1PRE 4
1Q 5
R82 1Q 6
OR DNP
74HC74 U12
VCC 14
2CLR 13
2D 12
2CLK 11
2PRE 10
2Q 9
2Q 8
GND 7

DNP (R82 Is populated Instead of the 74HC74
As a bypass. Either populate R82 or U12 not Both)

ESP_EN

R18 4K7

+3.3V

C74 10u C73 10u

ESP_RST R5 470R
R4 2K2

ADC

GPIO16

SPCK
MISO
MOSI

REST 1
ADC 2
CH_PD/EN 3
GPIO16 4
GPIO14 5
GPIO12 6
GPIO13 7
VCC 8
ESP-07/12 U4
TXD0 22
RXD0 21
GPIO5 20
GPIO4 19
GPIO0 18
GPIO2 17
GPIO15 16
GND 15

CS0 9
MISO 10
GPIO9 11
GPIO10 12
MOSI 13
SCLK 14

URXD1_CONN
UTXD1_CONN
C83 DNP 47p

R102 2K2 URXD1
R103 2K2 UTXD1
470R GPIO5

EDR_CONN
R17 2K2 ESP_DATA_RDY
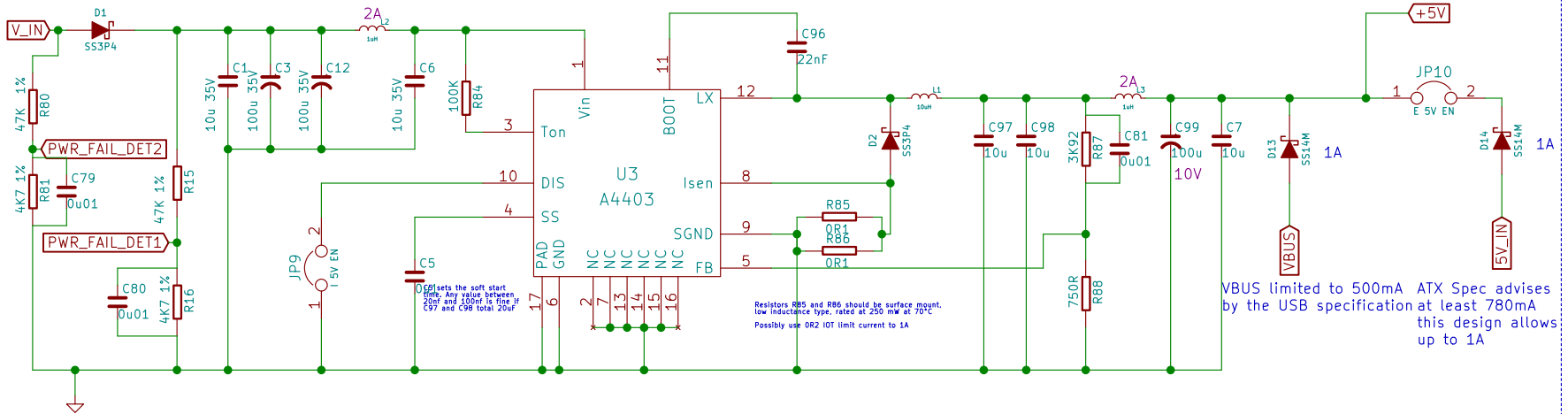GPIO2
R99 2K2 NPCS0
NPCS0_CONN

Title: Duet Wifi

Size: A4 | Date: 2017-02-07 | Rev: 1.02
KiCad E.D.A. kicad 4.0.2-stable | Id: 5/7

BED MOSFET CONTROL

V_IN

D5 Anti-parallel diode to protect Bed LED
If the heated bed uses a different voltage from
the rest of the board

D6_TestPoint

R65 4K7
BED−

D5 SOD-523F
Bed Heat D6
C91 10u C92 100u

BED_PWM
180R R20

TR2
IPD036N04L

E0 MOSFET CONTROL

V_IN

R67 4K7
E0−

E0 Heat D7
C93 10u C94 100u

E0_PWM
180R R23

TR4
IPD036N04L

E1 MOSFET CONTROL

V_IN

R98 4K7
E1−

E1 Heat D20
C112 10u

E1_PWM
180R R97

TR8
IPD036N04L

FAN 0 MOSFET CONTROL

V_FAN

D18 DO-219AB

FAN0−

FAN0
1K R42

TR5
PMV40UN2

R24 10K

FAN 1 MOSFET CONTROL

V_FAN

D8 DO-219AB

FAN1−

FAN1
1K R43

TR9
PMV40UN2

FAN 2 MOSFET CONTROL

V_FAN

D21 DO-219AB

FAN2−

FAN2
1K R66

TR1
PMV40UN2

R91 10K

POWER MOSFET DRIVER

+3.3V

+5V
C54 10u1

This is a safety feature: If 3.3V gets shorted to ground,
the mosfets don't turn on.

U11
74HCT02
VCC 14

2 1A   1Y 1
3 1B

HEATER0 5 2A   2Y 4   BED_PWM
6 2B

HEATER1 8 3A   3Y 10 E0_PWM
9 3B

HEATER2 11 4A   4Y 13 E1_PWM
12 4B

GND 7

FAN Voltage Select

+5V   1
V_FAN 2
V_IN   3
J3
5V V_FAN VIN

Title: Duet Wifi

Size: A3 | Date: 2017-02-07 | Rev: 1.02
KiCad E.D.A. kicad 4.0.2-stable | Id: 6/7

ADVREF requires a filter

To ensure stability, an external 2.2 µF output capacitor, CDOUT must be
connected between the VDDOUT and the closest GND pin of the device.
The ESR (Equivalent Series Resistance) of the capacitor must be in the range
0.1Ω to 10Ω. Solid tantalum and multilayer ceramic capacitors are all
suitable as output capacitor. A 100 nF bypass capacitor between VDDOUT
and the closest GND pin of the device helps decrease output noise and
improves the load transient response.

A 4.7 µF or higher ceramic capacitor must be
connected between VDDIN and the closest
GND pin of the device.
This large decoupling capacitor is mandatory
to reduce startup current, improving transient
response and noise rejection.

The ESR of C68 must be in the range 0.1Ω to 10Ω.

+3.3V
ADVREF ADVREF
VDDPLL
C64 0u1
C67 0u1
C66 0u7
R13 1R
VDDIN
C47 10u   C51 0u1

VDDIO
C8 10u C9 0u1 C11 0u1 C16 0u1 C46 0u1 C48 0u1 C50 0u1 C49 0u1

VDDCORE
C68 2u2 C61 0u1 C69 0u1 C52 0u1 C62 0u1 C70 0u1 C71 0u1 C72 0u1 C10 10u

VDDIO   VDDCORE

U1
ATSAM4EBE

VDDIO VDDIO VDDIO VDDIO VDDIO VDDIO VDDIN ADVREF VDDOUT VDDPLL VDDCORE VDDCORE VDDCORE VDDCORE VDDCORE VDDCORE
30 43 72 80 96 143 5 9 139 3 29 33 50 81 107 123

Left pins:
1   PD0   E4_STEP
2   PD31   ESP_DATA_RDY
4   PE0   E2_STOP
6   PE1   E3_STOP
7   PE2   E4_STOP
10 PE3   E5_STOP
11 AFE0_AD14   E6_DIR
12 AFE0_AD13
13 TIOA4   FAN1
14 AFE0_AD11
15 AFE0_AD10
16 AFE0_AD9
17 AFE0_AD8
18 AFE0_AD7
19 AFE0_AD6
20 TXD0   SPI0_MOSI
21 RXD0   SPI0_MISO
22 PWML1   HEATER1
23 PWML0   HEATER0
24 AFE0_AD1
25 PA17/AFE0_AD0   E6_STOP
26 CTS0   SPI0_CS1
27 PE4   ESP_RST
28 PE5   ESP_EN
31 PB3/AFE1_AD1   PWR_FAIL_DET1
32 RXD1   SPI1_MISO
34 PD30   SAM_TFR_RDY
37 TXD1   SPI1_MOSI
38 AFE1_AD4
39 PC2   Z_PROBE_MOD
40 PWML3   HEATER3
41 PC4/AFE1_AD7   PWR_FAIL_DET2
42 MOSI
45 PWML2   HEATER2
46 SCK1   SPI1_SCK
47 PD27   E6_STEP
48 PC7   ENC_B
49 TIOA1   HEATER7
51 SPCK   SPCK
52 PD25   E4_EN
53 PD26   E5_EN
54 PC6   ENN
55 PD24   E3_EN
56 RTS1   C5%
57 PD23   E2_EN
58 TIOA6   HEATER4
59 PA25   LCD_E
60 PD22   E3_DIR
62 MCDA2   MCDA2
63 PD21   LCD_DB4
64 NPCS0   NPCS0
65 PD20   LCD_DB5
66 UTXD0   UTXD0
67 PD19   LCD_DB6
68 MISO   MISO
69 PD18   LCD_DB7
70 MCDA3   MCDA3
71 PD28   E2_DIR
73 URXD1   URXD1
74 PD17   E5_DIR
75 URXD0   URXD0

Right pins:
144 SCK0/DAC0   SPI0_SCK
140 DAC1   E6_EN
137 DDP   DDP
136 DDM   DDM
133 PC25   E1_EN
132 PD1   E3_STEP
131 PD2   E2_STEP
130 PC24/TIOB3 SPI0_CS0
129 MCCK   MCCK
128 PD3   E5_STEP
127 TIOA4   FAN0
126 PD4   E1_STEP
125 PD5   E0_STEP
124 PC22   USB_PWR_MON
122 PC21   S0_CD
121 PD6   X_STEP
120 PC20   C5%
119 PD7   Y_STEP
118 MCDA1   MCDA1
117 PC19   C5%
116 MCDA0   MCDA0
114 UTXD1   UTXD1
113 PD8   Z_STEP
112 MCCDA   MCCDA
111 PC18   SPI0_CS2
110 PD9   E1_DIR
108 PD29   Z_STOP
106 PD15   PS_ON
103 PC17   E0_EN
102 TIOA0   FAN2
101 PD10   E0_STOP
100 PC16   E1_STOP
99   PA1   E0_DIR
98   PD11   X_DIR
97   PC14   X_STOP
94   TIOA8   HEATER6
93   PA2   Y_STOP
92   PD12   Y_DIR
91   TWD0   TWD0
90   PC10   Z_EN
88   PD13   Z_DIR
86   PC9   Y_EN
84   PD14   X_EN
82   TIOA7   HEATER5
78   PD16   E4_DIR
77   TWCK0   TWCK0
76   PC28   LCD_RS
83   NRST   RESET
87   ERASE   ERASE
79   PB6/TMS   PB6/TMS
89   PB7/TCK   PB7/TCK
105 PB4/TDI   PB4/TDI
109 PB5/TDO   PB5/TDO
104 JTAGSEL
85   TEST
35   PA7/XIN32   ENC_SW
36   PA8/XOUT32 ENC_A
141 XOUT
142 XIN

(approx)100 kΩ pullup internally
(approx)100 kΩ pulldown internally

GND
8 44 61 95 115 135 138

All thermistors should be pulled up to ADVREF

ADVREF
R2 4k7 1% R11 4k7 1% R5 4k7 1%
THERMISTOR6   R6 10K
THERMISTOR5   R7 10K
THERMISTOR4   R8 10K
THERMISTOR3   R9 10K
THERMISTOR2   R10 10K
THERMISTOR1   R11 10K
THERMISTOR0   R12 10K
THERMISTOR7   R50 10K

C84 2u2 C19 2u2 C18 2u2 C53 2u2 C59 2u2 C60 2u2 C63 2u2 C65 2u2

Z_PROBE_MOD_BUFF   D4 Diag   R10 2K2
Z_PROBE_IN   R62 10K   C90 0u01

+3.3V
R51 10K
ENN

+3.3V
C2 0u01

+3.3V   ERASE
S2   RESET   S1

VSSA
VSSA sensing
+3.3V
JTAG
J21
DNP 100K R36 DNP 100K R49 DNP 100K R52
R83 10K
PB6/TMS PB7/TCK PB5/TDO PB4/TDI
RESET
Do Not Populate the JTAG header or resistors R36,R49,R52

VSSA   F1   PPTC Resettable Fuse
Fuse to protect the SAM from
VIN applied to VSSA in error.
Multicomp MC36207, Bel Fuse 0ZCJ0020FF2E

CRYSTAL 4PIN
12MHz   X2
C45 10p   C44 10p

FID FID FID   MOUNTING MOUNTINGMOUNTINGMOUNTING   LOGO
M1 M2 M3   M4   M5   M6   M7   M8

http://www.ohwr.org/attachments/2388/cern_ohl_v_1_2.txt
CERN OSH License 1.2
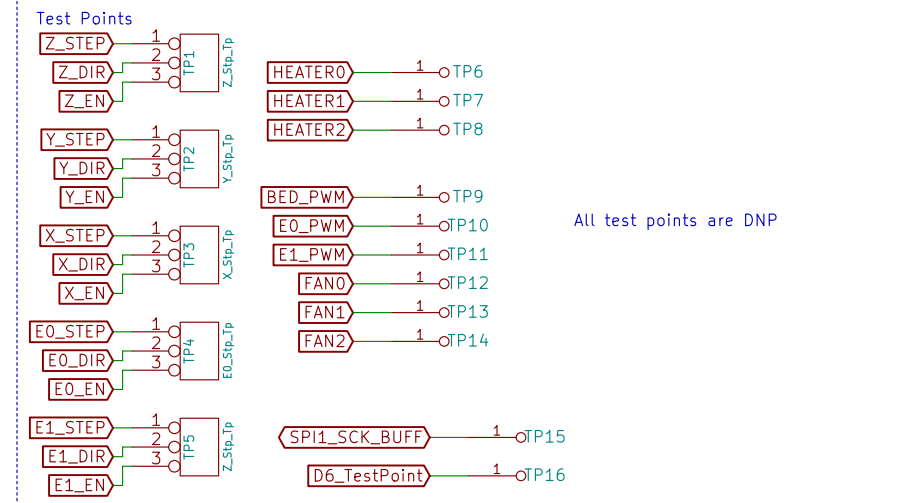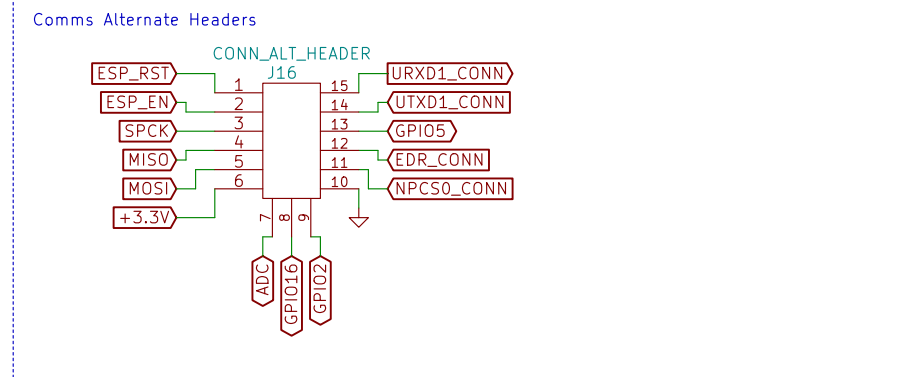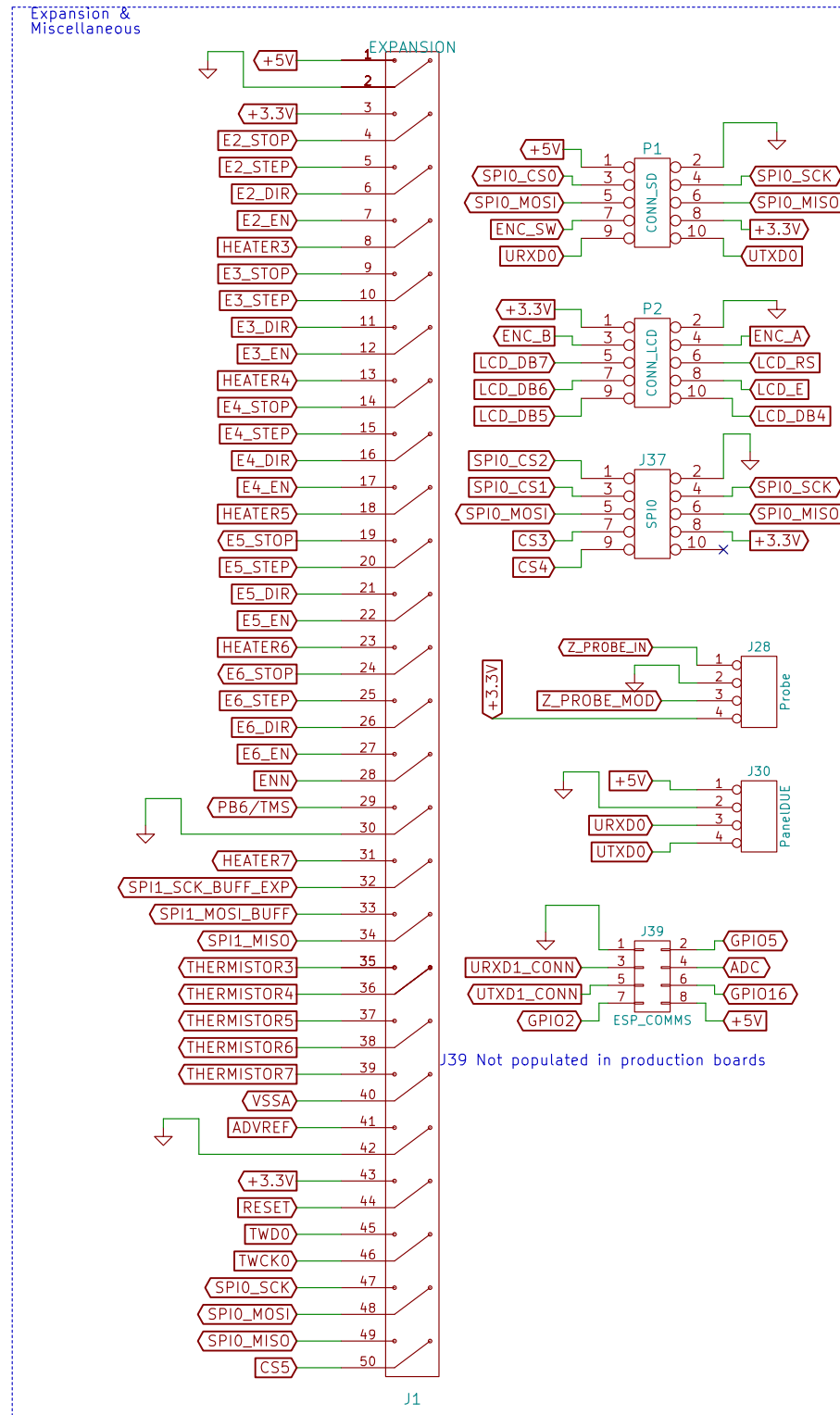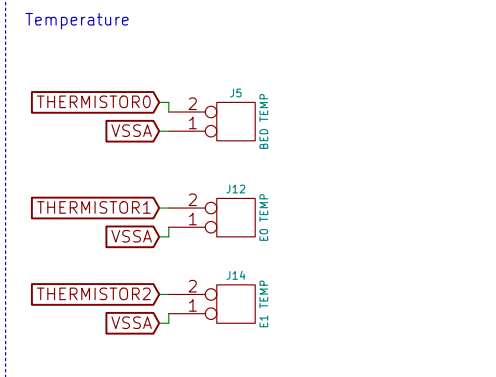Think3DPrint3D, Escher 3D
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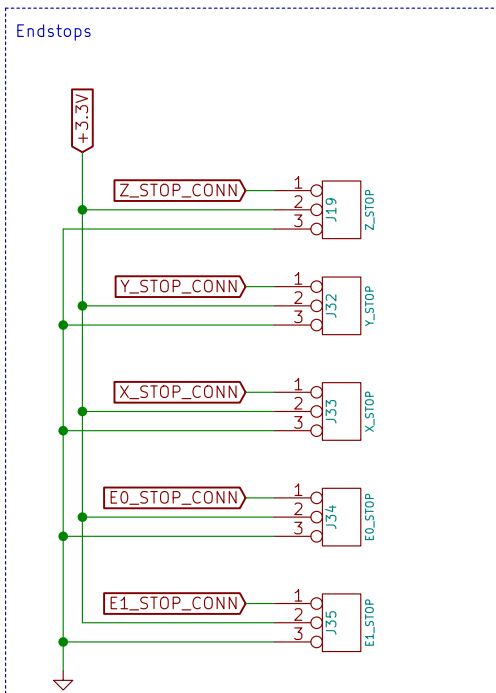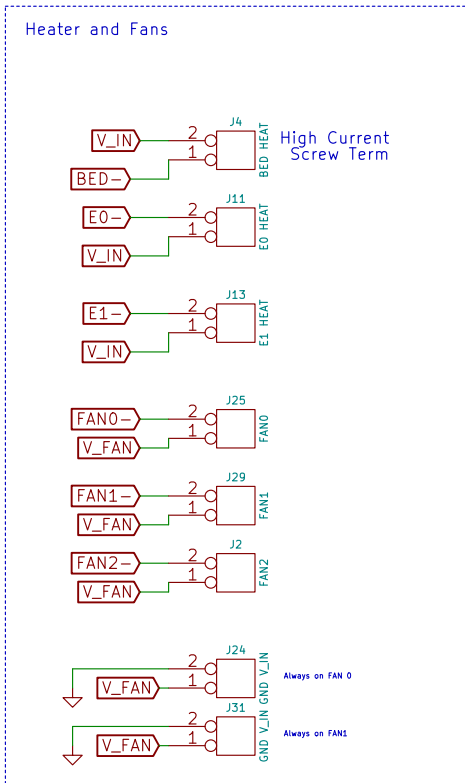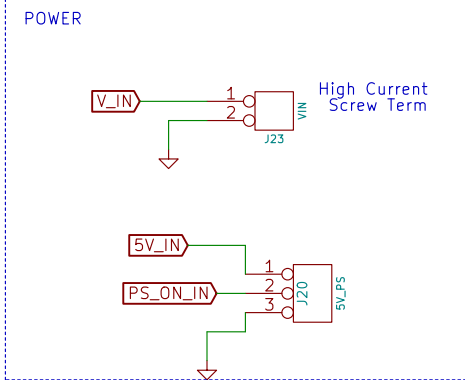Title: Duet Wifi
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