System Controller

File: System_Controller.kicad_sch

RP2040
System Controller

8-Port 10MBit SPE Field Switch

7-Port 10Base-T1L/PoDL CLASS 12 10/100/1000MBit Uplink (RJ45)

STATUS: DESIGN ONLY!
!!! UNTESTED !!!

SJA1105Q Switch

File: SJA1105Q_Switch.kicad_sch

2x 5-Port Switch (SJA1105Q) Daisy Chained

SJA1105Q Power

File: SJA1105Q_Power.kicad_sch

10Base-T1L-PHY0

File: 10Base-T1L-PHY0.kicad_sch

10Base-T1L-PHY1

File: 10Base-T1L-PHY1.kicad_sch

10Base-T1L-PHY2

File: 10Base-T1L-PHY2.kicad_sch

10Base-T1L-PHY3

File: 10Base-T1L-PHY3.kicad_sch

10Base-T1L-PHY4

File: 10Base-T1L-PHY4.kicad_sch

10Base-T1L-PHY5

File: 10Base-T1L-PHY5.kicad_sch

10Base-T1L-PHY6

File: 10Base-T1L-PHY6.kicad_sch

7 PHYs 10Base-T1L ADIN1100 PHY

100Base-TX-PHY7

File: 100Base-TX-PHY7.kicad_sch

1 PHY 100Base-TX Uplink KSZ9131RNX

PoDL PHY 0-1

File: PoDL_PHY0-1.kicad_sch

PoDL PHY 2-3

File: PoDL_PHY2-3.kicad_sch

PoDL PHY 5-6

File: PoDL_PHY5-6.kicad_sch

PoDL PHY4 REG0

File: PoDL_PHY4_REG0.kicad_sch

PoDL REG1

File: PoDL_REG1.kicad_sch

7 Port PoDL CLASS 12 2x LTC4296-1 Controller

Power Supply

File: Power_Supply.kicad_sch

24V supply

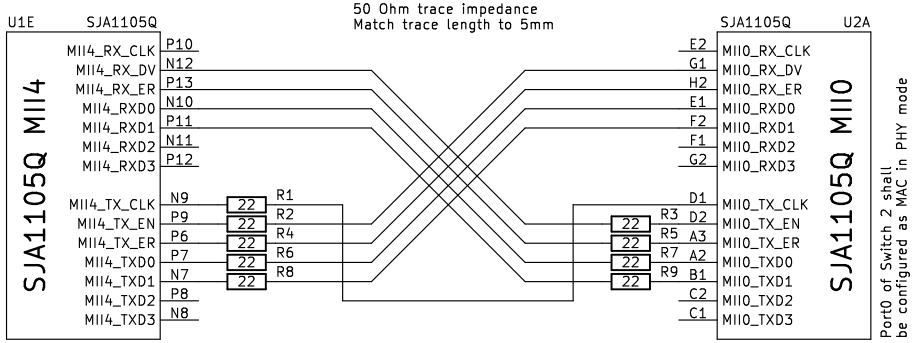
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /
File: Open_10Base-T1L_Switch.kicad_sch

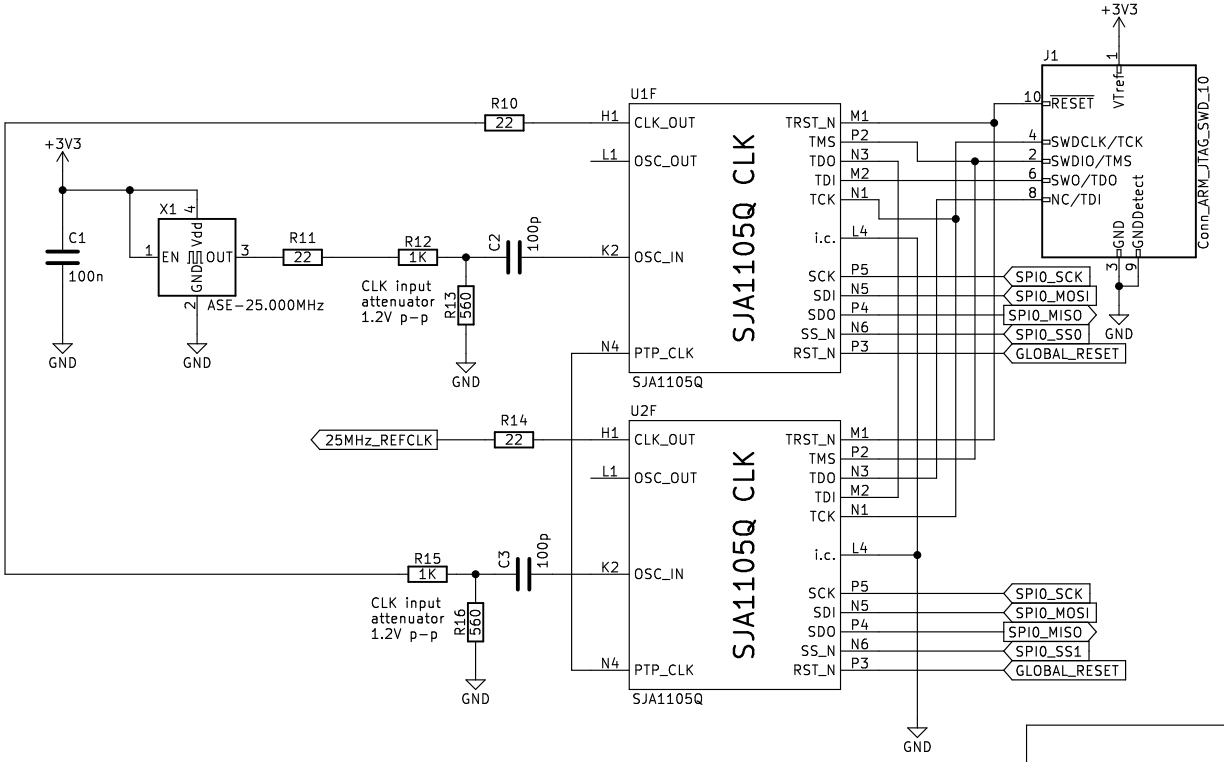
Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 1/18

Inter Switch Connection RMII<->RMII 100MBit



Switch Clock Generation / JTAG Debug



Keep clock lines less than 14 cm, according to
"1/3 rise time" rule.
https://www.altium.com/documentation/altium-designer/interactively-routing-controlled-impedance-pcb

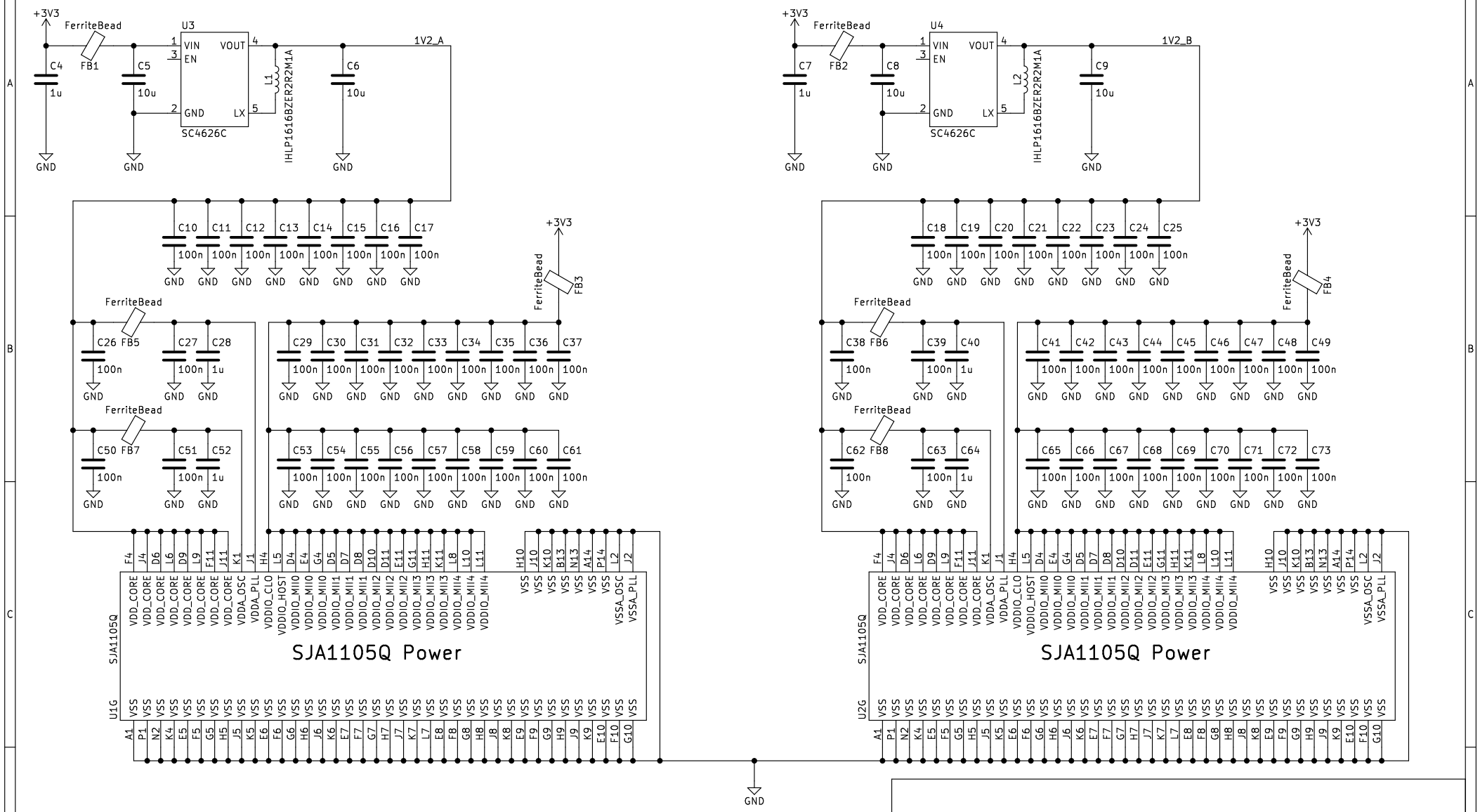
The ASE-25.000MHz has a 2.8ns rise time, hence 0.93ns trace delay, which equals to 14cm trace length on FR4.

https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /SJA1105Q Switch/
File: SJA1105Q_Switch.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 2/18

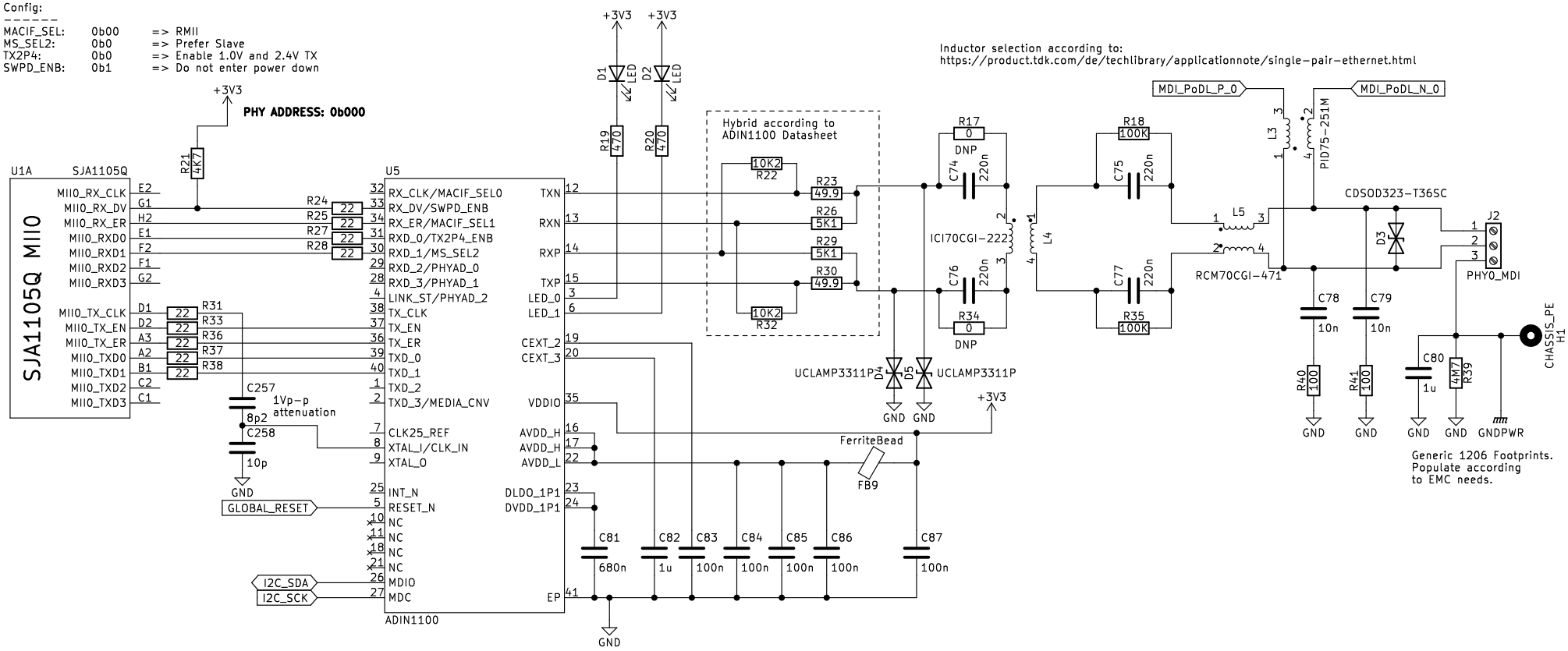


https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /SJA1105Q Power/
File: SJA1105Q_Power.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 3/18



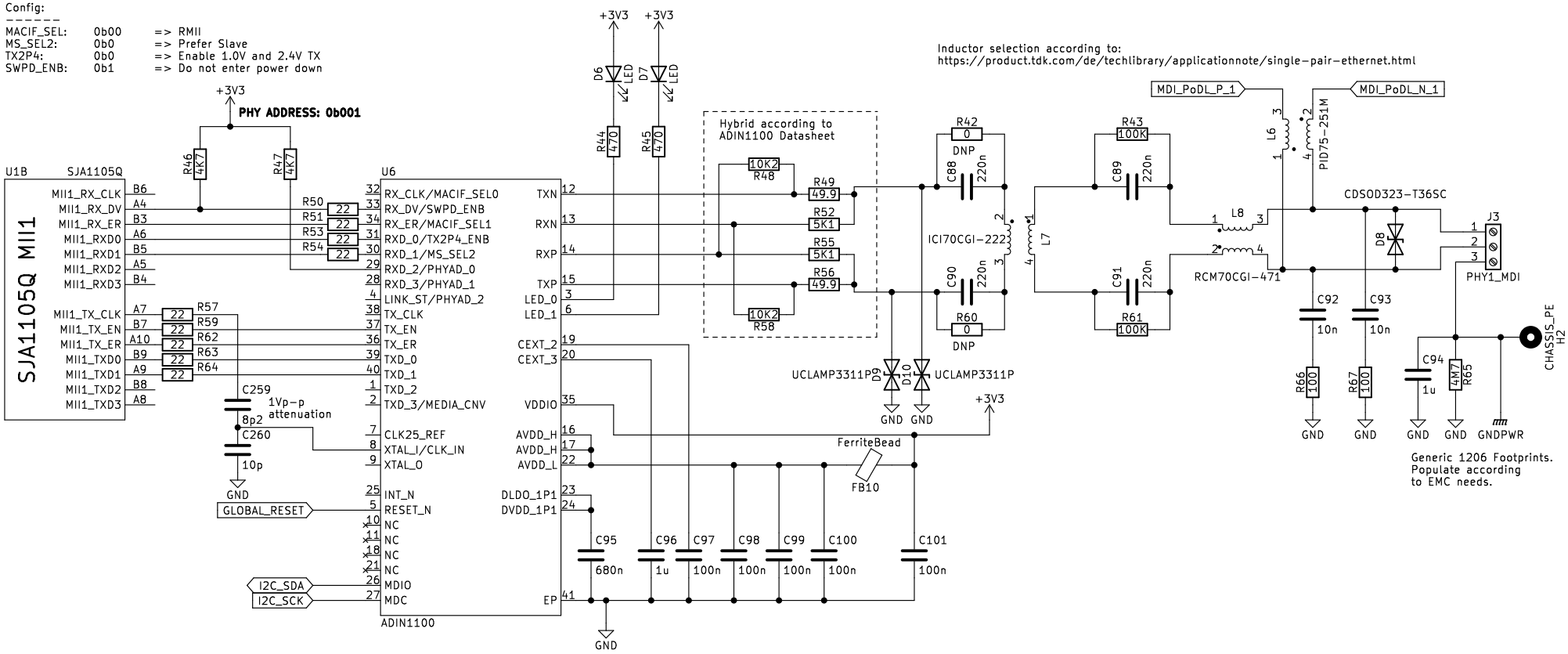
Further documents considered during design
https://www.we-online.com/catalog/media/o341320v410%20ANP085b%20EN.pdf
https://product.tdk.com/de/techlibrary/applicationnote/single-pair-ethernet.html
https://www.ieee802.org/802_tutorials/2015-11/PoDL_tutorial_1115.pdf

https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /10Base-T1L-PHY0/
File: 10Base-T1L-PHY0.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 4/18

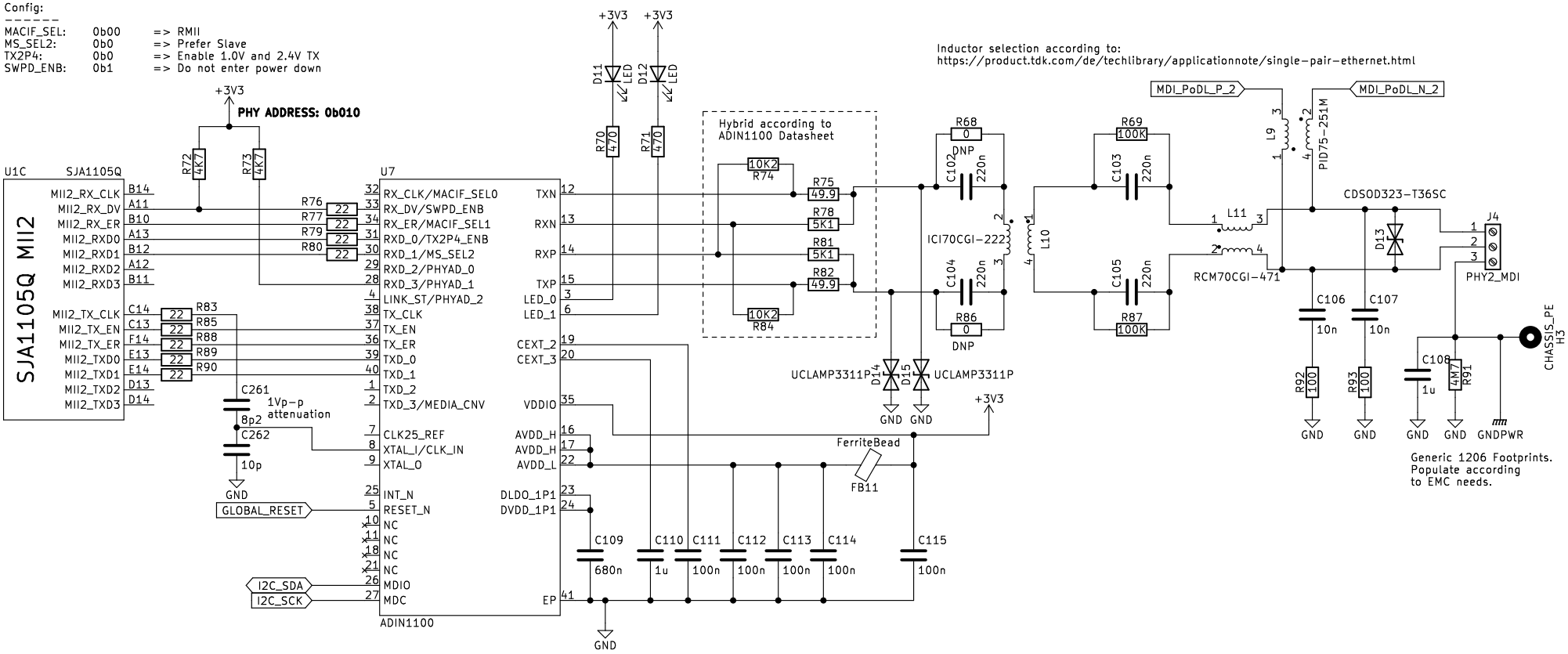


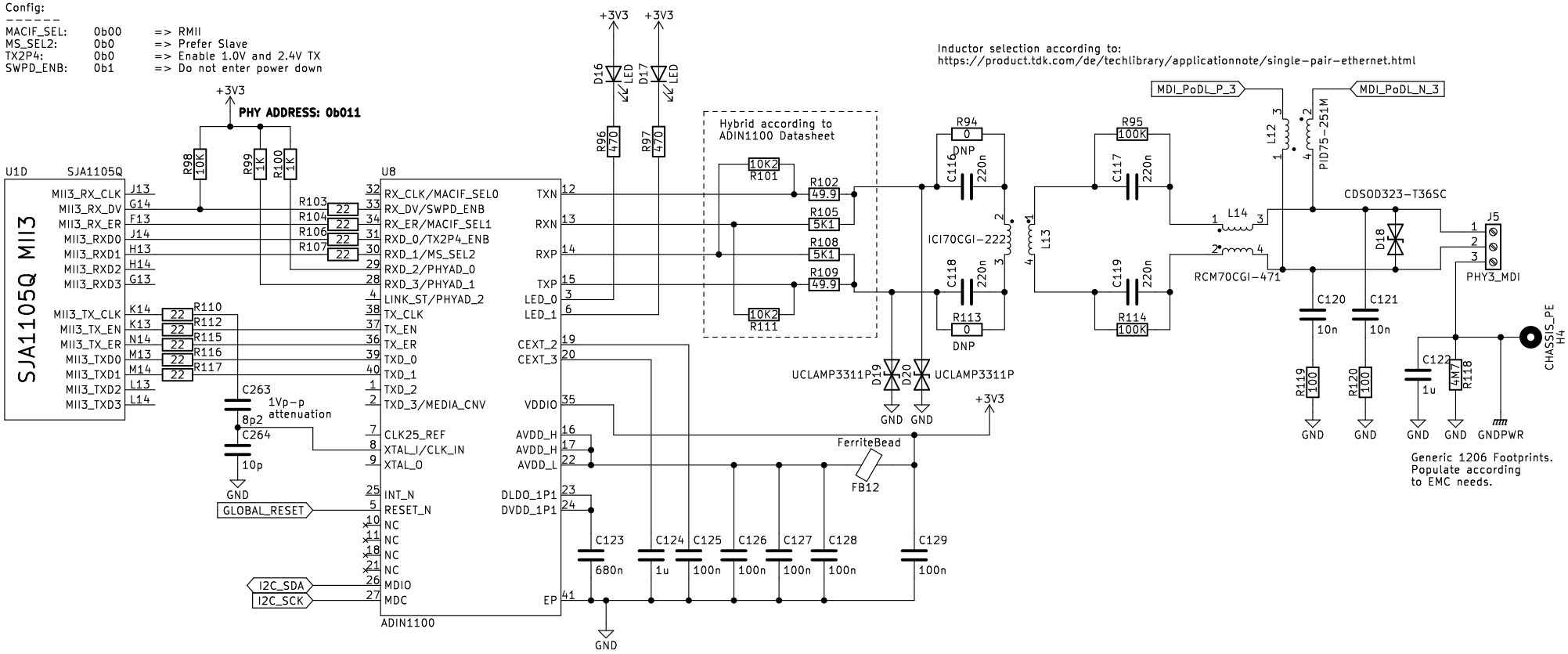
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

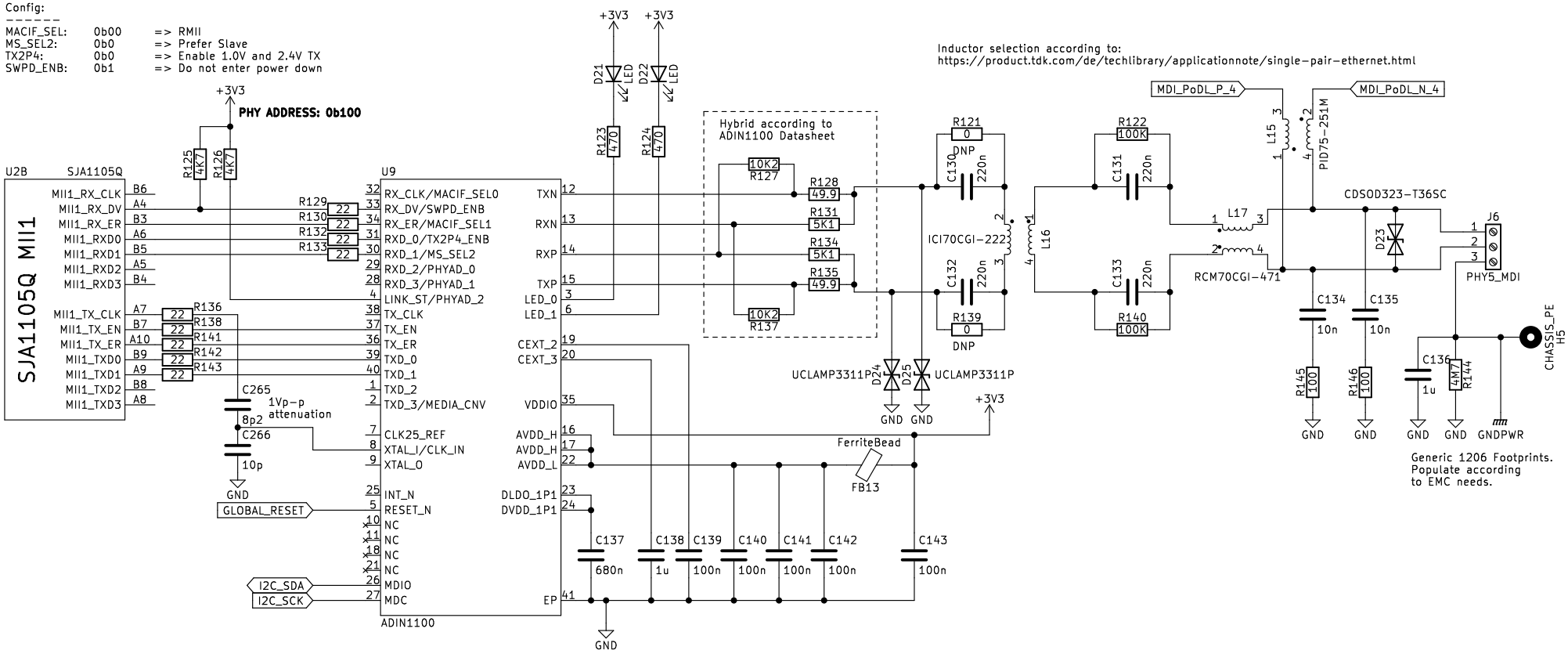
Sheet: /10Base-T1L-PHY1/
File: 10Base-T1L-PHY1.kicad_sch

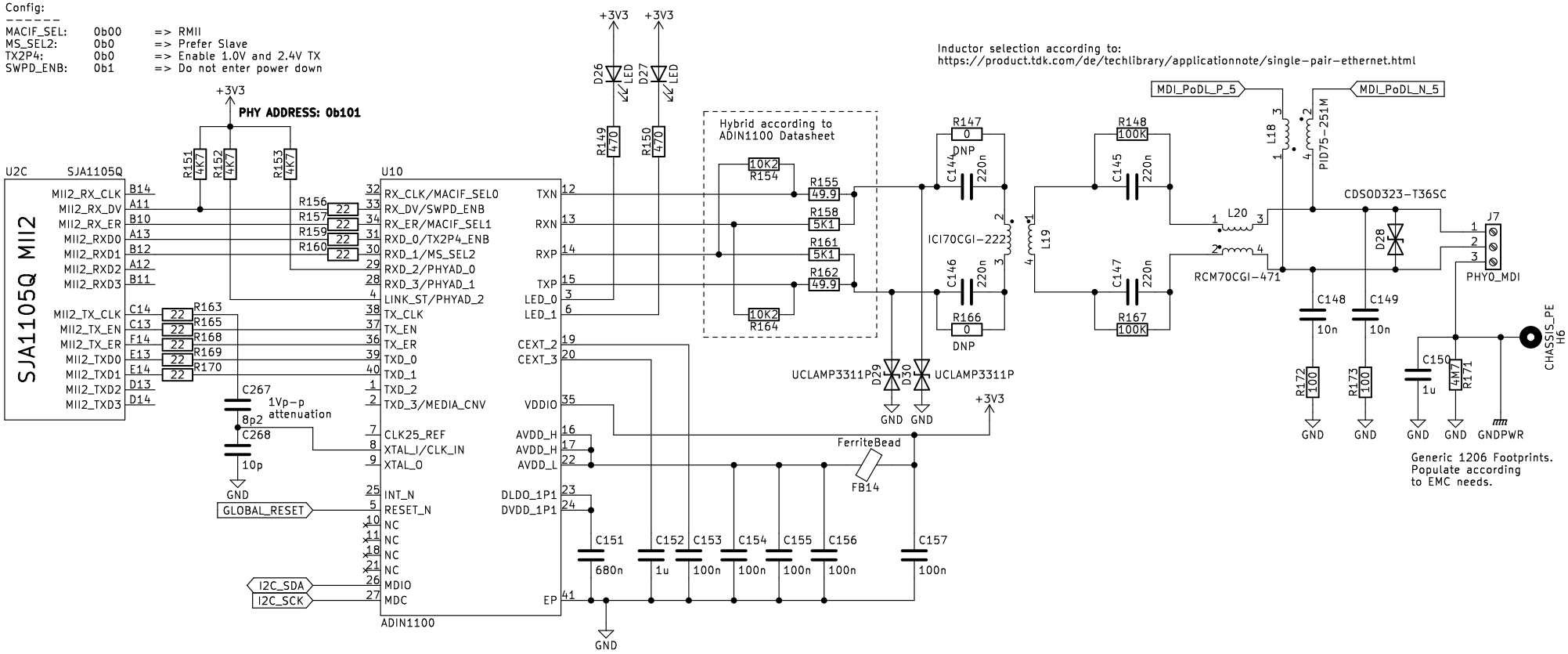
Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 5/18


Config:
MACIF_SEL: 0b00 => RMII
MS_SEL2: 0b0 => Prefer Slave
TX2P4: 0b0 => Enable 1.0V and 2.4V TX
SWPD_ENB: 0b1 => Do not enter power down
PHY ADDRESS: 0b010
U1C SJA1105Q
SJA1105Q MII2
MII2_RX_CLK
MII2_RX_DV
MII2_RX_ER
MII2_RXD0
MII2_RXD1
MII2_RXD2
MII2_RXD3
MII2_TX_CLK
MII2_TX_EN
MII2_TX_ER
MII2_TXD0
MII2_TXD1
MII2_TXD2
MII2_TXD3
U7
RX_CLK/MACIF_SEL0
RX_DV/SWPD_ENB
RX_ER/MACIF_SEL1
RXD_0/TX2P4_ENB
RXD_1/MS_SEL2
RXD_2/PHYAD_0
RXD_3/PHYAD_1
LINK_ST/PHYAD_2
TX_CLK
TX_EN
TX_ER
TXD_0
TXD_1
TXD_2
TXD_3/MEDIA_CNV
CLK25_REF
XTAL_I/CLK_IN
XTAL_O
INT_N
RESET_N
NC
MDIO
MDC
TXN
RXN
RXP
TXP
LED_0
LED_1
CEXT_2
CEXT_3
VDDIO
AVDD_H
AVDD_L
DLDO_1P1
DVDD_1P1
EP
ADIN1100
GLOBAL_RESET
I2C_SDA
I2C_SCK
C261 8p2
C262 10p
1Vp-p attenuation
Hybrid according to ADIN1100 Datasheet
Inductor selection according to:
https://product.tdk.com/de/techlibrary/applicationnote/single-pair-ethernet.html
ICI70CGI-222
RCM70CGI-471
PID75-251M
CDSOD323-T36SC
UCLAMP3311P
FerriteBead
FB11
PHY2_MDI
CHASSIS_PE
Generic 1206 Footprints.
Populate according
to EMC needs.
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich
Sheet: /10Base-T1L-PHY2/
File: 10Base-T1L-PHY2.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 6/18


Config:
MACIF_SEL: 0b00 => RMII
MS_SEL2: 0b0 => Prefer Slave
TX2P4: 0b0 => Enable 1.0V and 2.4V TX
SWPD_ENB: 0b1 => Do not enter power down
PHY ADDRESS: 0b011
U1D SJA1105Q
SJA1105Q MII3
MII3_RX_CLK
MII3_RX_DV
MII3_RX_ER
MII3_RXD0
MII3_RXD1
MII3_RXD2
MII3_RXD3
MII3_TX_CLK
MII3_TX_EN
MII3_TX_ER
MII3_TXD0
MII3_TXD1
MII3_TXD2
MII3_TXD3
U8
ADIN1100
RX_CLK/MACIF_SEL0
RX_DV/SWPD_ENB
RX_ER/MACIF_SEL1
RXD_0/TX2P4_ENB
RXD_1/MS_SEL2
RXD_2/PHYAD_0
RXD_3/PHYAD_1
LINK_ST/PHYAD_2
TX_CLK
TX_EN
TX_ER
TXD_0
TXD_1
TXD_2
TXD_3/MEDIA_CNV
CLK25_REF
XTAL_I/CLK_IN
XTAL_O
INT_N
RESET_N
NC
MDIO
MDC
TXN
TXP
RXN
RXP
LED_0
LED_1
CEXT_2
CEXT_3
VDDIO
AVDD_H
AVDD_L
DLDO_1P1
DVDD_1P1
EP
GLOBAL_RESET
I2C_SDA
I2C_SCK
C263
1Vp-p attenuation
8p2
C264
10p
Hybrid according to ADIN1100 Datasheet
Inductor selection according to:
https://product.tdk.com/de/techlibrary/applicationnote/single-pair-ethernet.html
ICI70CGI-222
RCM70CGI-471
PID75-251M
CDSOD323-T36SC
UCLAMP3311P
FerriteBead
FB12
MDI_PoDL_P_3
MDI_PoDL_N_3
PHY3_MDI
CHASSIS_PE
GNDPWR
DNP
Generic 1206 Footprints.
Populate according
to EMC needs.
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich
Sheet: /10Base-T1L-PHY3/
File: 10Base-T1L-PHY3.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 7/18


Config:
MACIF_SEL: 0b00 => RMII
MS_SEL2: 0b0 => Prefer Slave
TX2P4: 0b0 => Enable 1.0V and 2.4V TX
SWPD_ENB: 0b1 => Do not enter power down
PHY ADDRESS: 0b100
U2B SJA1105Q
SJA1105Q MII1
MII1_RX_CLK
MII1_RX_DV
MII1_RX_ER
MII1_RXD0
MII1_RXD1
MII1_RXD2
MII1_RXD3
MII1_TX_CLK
MII1_TX_EN
MII1_TX_ER
MII1_TXD0
MII1_TXD1
MII1_TXD2
MII1_TXD3
U9
RX_CLK/MACIF_SEL0
RX_DV/SWPD_ENB
RX_ER/MACIF_SEL1
RXD_0/TX2P4_ENB
RXD_1/MS_SEL2
RXD_2/PHYAD_0
RXD_3/PHYAD_1
LINK_ST/PHYAD_2
TX_CLK
TX_EN
TX_ER
TXD_0
TXD_1
TXD_2
TXD_3/MEDIA_CNV
CLK25_REF
XTAL_I/CLK_IN
XTAL_O
INT_N
RESET_N
NC
MDIO
MDC
TXN
RXN
RXP
TXP
LED_0
LED_1
CEXT_2
CEXT_3
VDDIO
AVDD_H
AVDD_L
DLDO_1P1
DVDD_1P1
EP
ADIN1100
GLOBAL_RESET
I2C_SDA
I2C_SCK
Hybrid according to ADIN1100 Datasheet
Inductor selection according to:
https://product.tdk.com/de/techlibrary/applicationnote/single-pair-ethernet.html
ICI70CGI-222
RCM70CGI-471
PID75-251M
CDSOD323-T36SC
UCLAMP3311P
FerriteBead
FB13
PHY5_MDI
CHASSIS_PE
MDI_PoDL_P_4
MDI_PoDL_N_4
Generic 1206 Footprints.
Populate according
to EMC needs.
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich
Sheet: /10Base-T1L-PHY4/
File: 10Base-T1L-PHY4.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 8/18

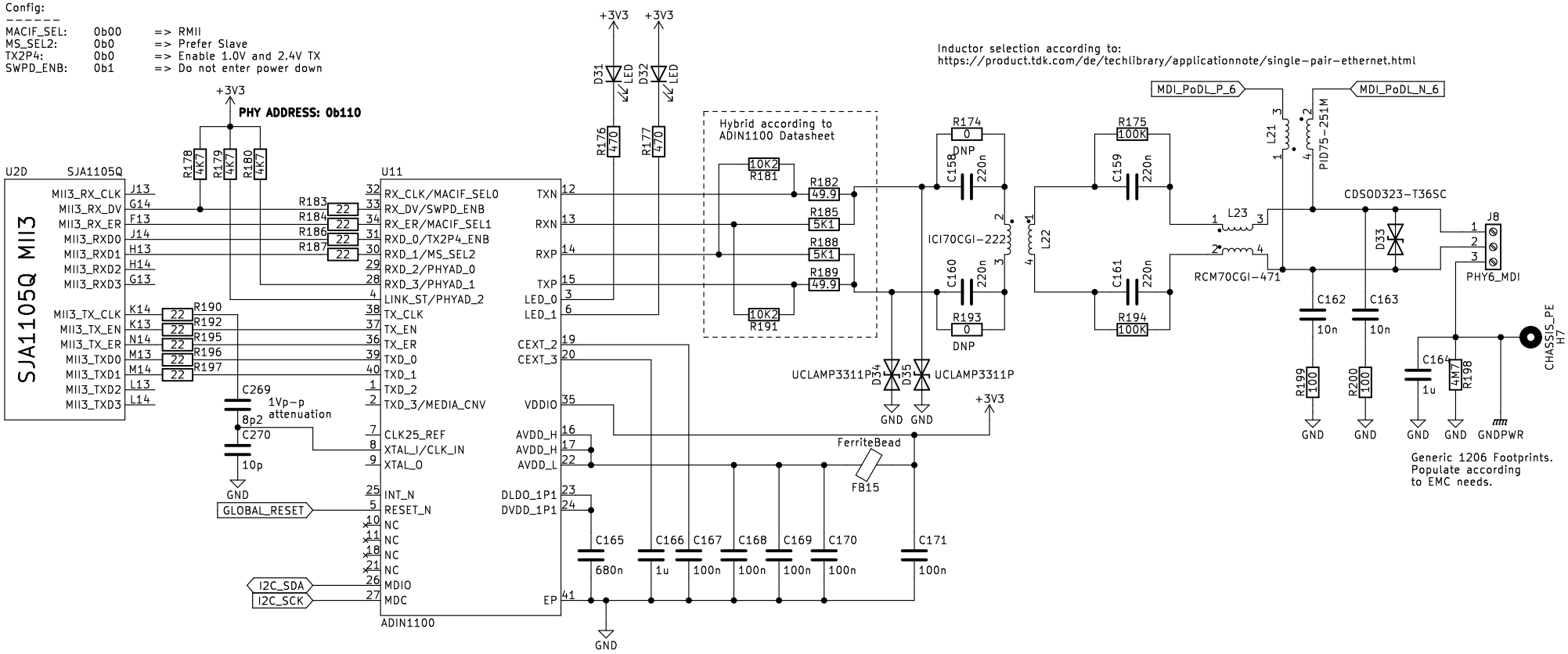


https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /10Base-T1L-PHY5/
File: 10Base-T1L-PHY5.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 9/18

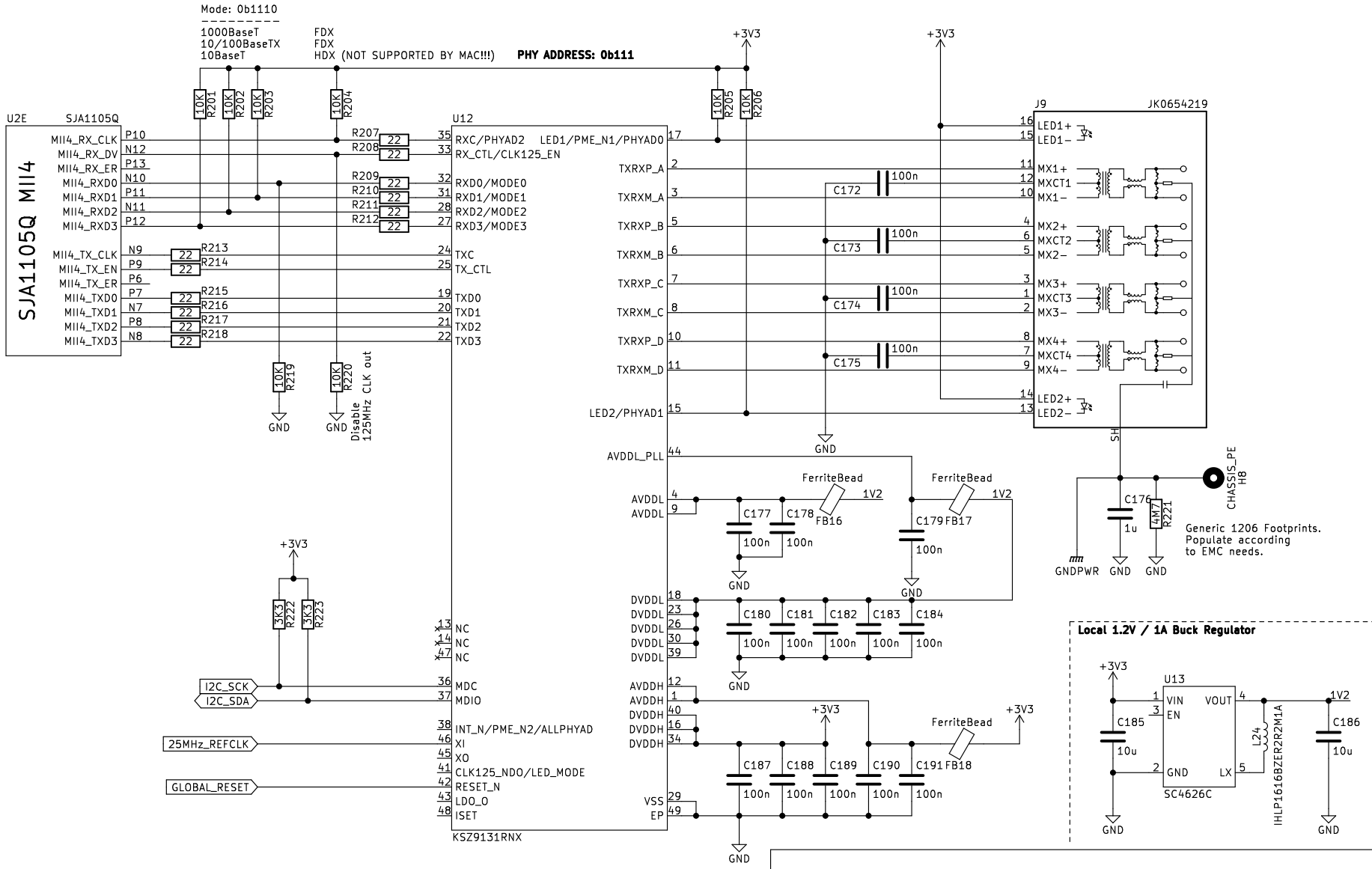


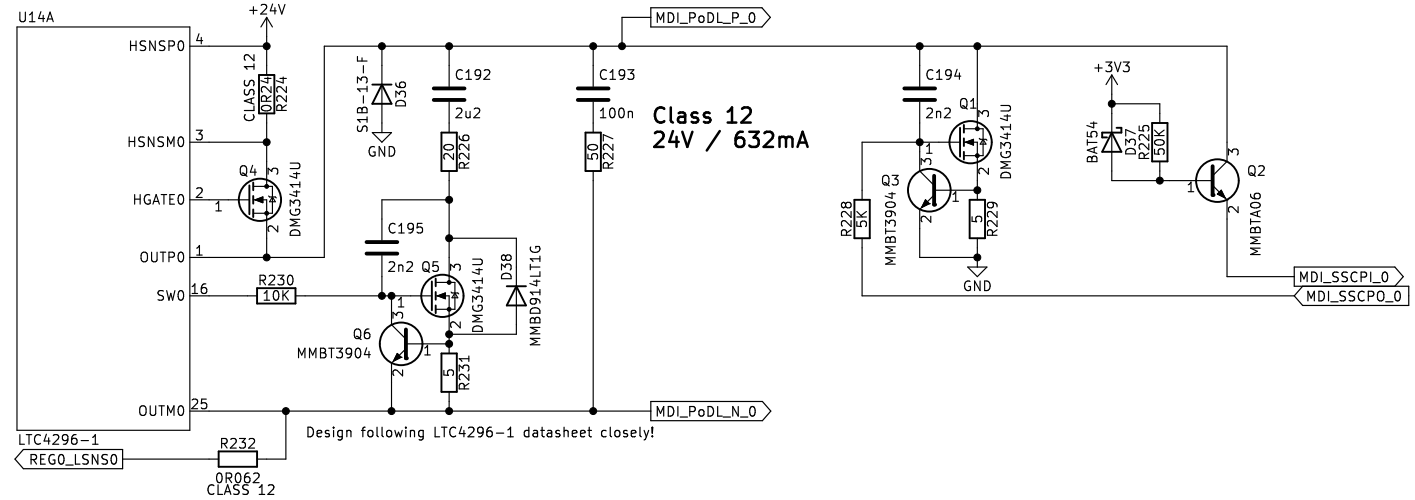
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

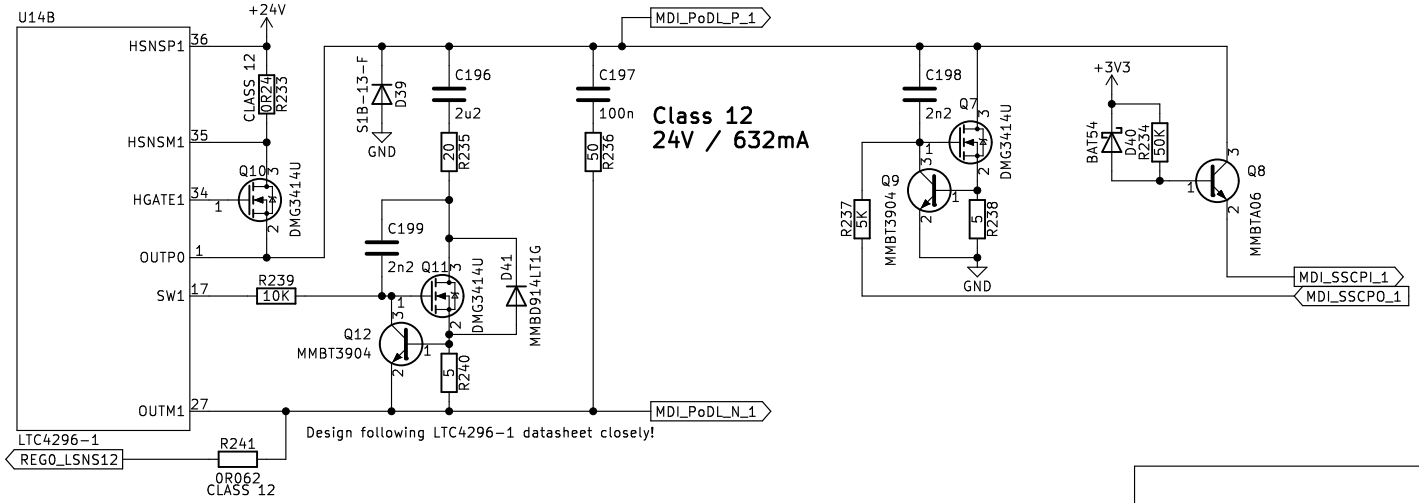
Sheet: /10Base-T1L-PHY6/
File: 10Base-T1L-PHY6.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 10/18


Mode: 0b1110
1000BaseT
10/100BaseTX
10BaseT
FDX
FDX
HDX (NOT SUPPORTED BY MAC!!!)
PHY ADDRESS: 0b111
U2E SJA1105Q
SJA1105Q MII4
MII4_RX_CLK P10
MII4_RX_DV N12
MII4_RX_ER P13
MII4_RXD0 N10
MII4_RXD1 P11
MII4_RXD2 N11
MII4_RXD3 P12
MII4_TX_CLK N9
MII4_TX_EN P9
MII4_TX_ER P6
MII4_TXD0 P7
MII4_TXD1 N7
MII4_TXD2 P8
MII4_TXD3 N8
U12
KSZ9131RNX
RXC/PHYAD2 LED1/PME_N1/PHYAD0
RX_CTL/CLK125_EN
RXD0/MODE0
RXD1/MODE1
RXD2/MODE2
RXD3/MODE3
TXC
TX_CTL
TXD0
TXD1
TXD2
TXD3
TXRXP_A
TXRXM_A
TXRXP_B
TXRXM_B
TXRXP_C
TXRXM_C
TXRXP_D
TXRXM_D
LED2/PHYAD1
AVDDL_PLL
AVDDL
DVDDL
AVDDH
DVDDH
VSS
EP
NC
MDC
MDIO
INT_N/PME_N2/ALLPHYAD
XI
XO
CLK125_NDO/LED_MODE
RESET_N
LDO_O
ISET
Disable 125MHz CLK out
J9 JK0654219
LED1+
LED1−
MX1+
MXCT1
MX1−
MX2+
MXCT2
MX2−
MX3+
MXCT3
MX3−
MX4+
MXCT4
MX4−
LED2+
LED2−
SH
CHASSIS_PE
H8
GNDPWR
Generic 1206 Footprints.
Populate according
to EMC needs.
Local 1.2V / 1A Buck Regulator
U13
VIN
EN
GND
VOUT
LX
SC4626C
IHLP1616BZER2R2M1A
I2C_SCK
I2C_SDA
25MHz_REFCLK
GLOBAL_RESET
+3V3
GND
1V2
FerriteBead
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich
Sheet: /100Base-TX-PHY7/
File: 100Base-TX-PHY7.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 11/18



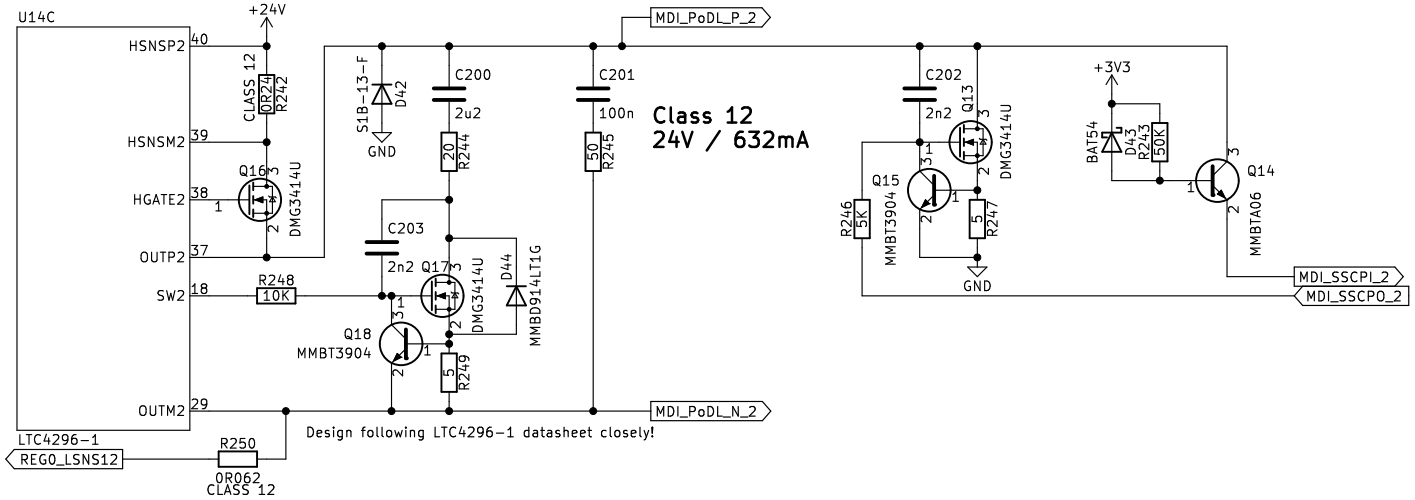


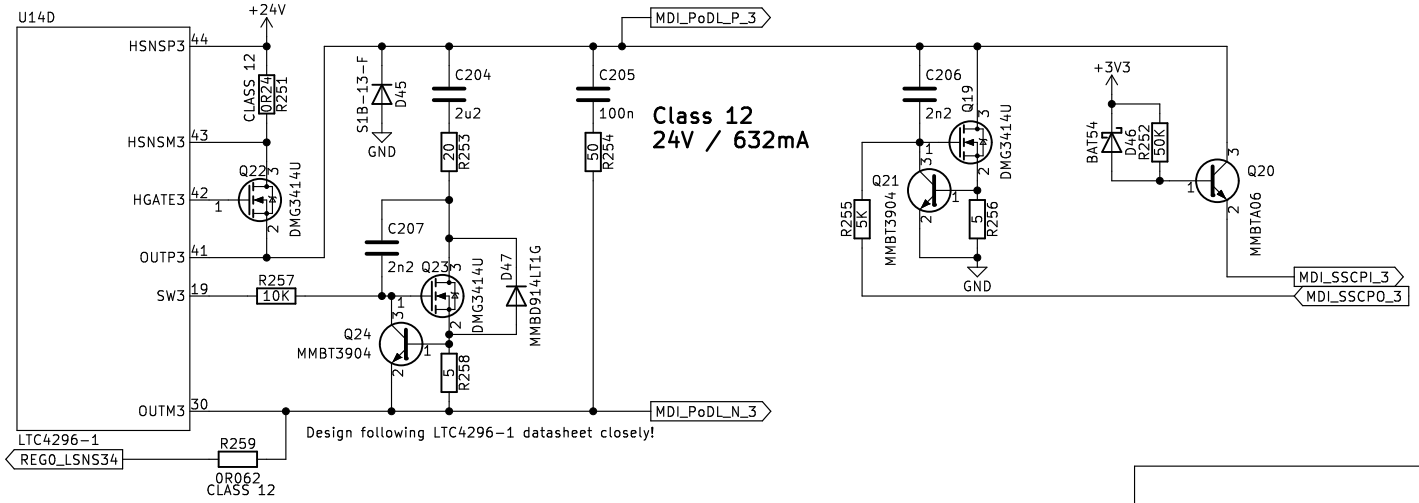
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /PoDL PHY 0-1/
File: PoDL_PHY0-1.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 12/18



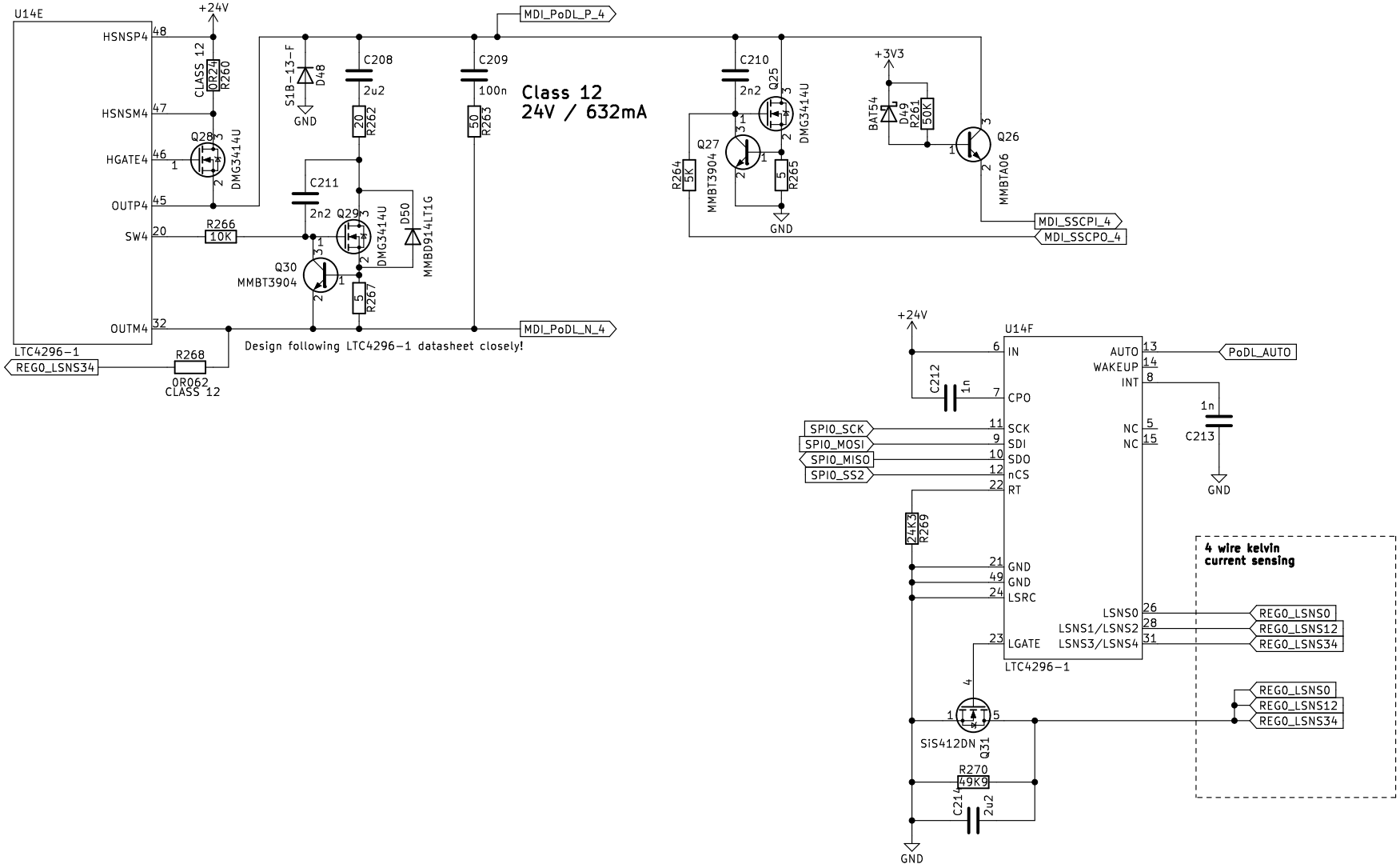


https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /PoDL PHY 2-3/
File: PoDL_PHY2-3.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 13/18

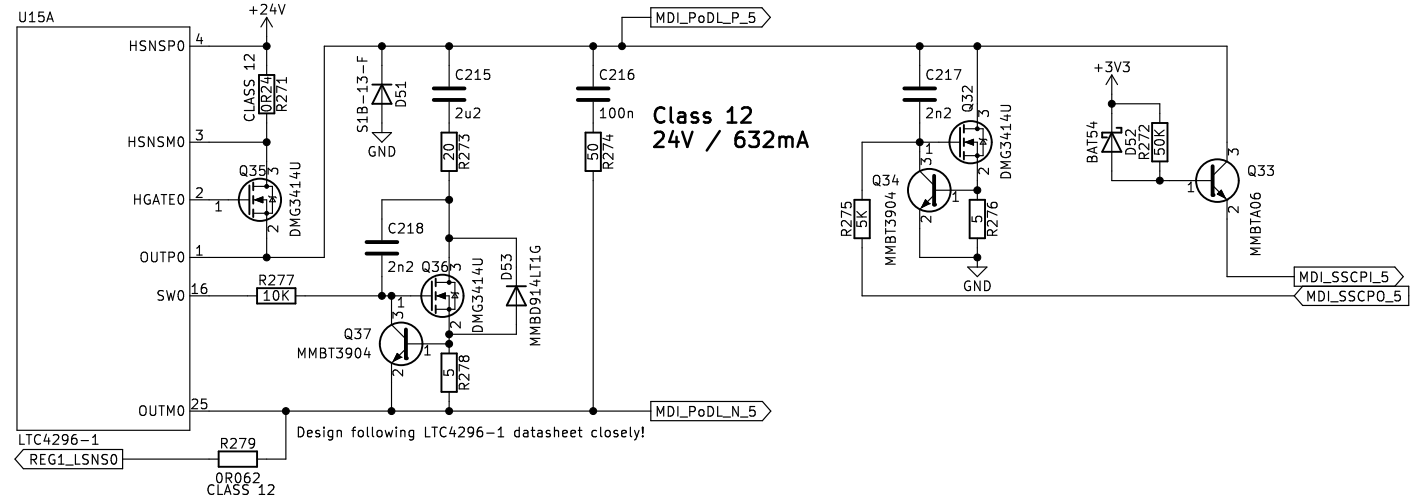


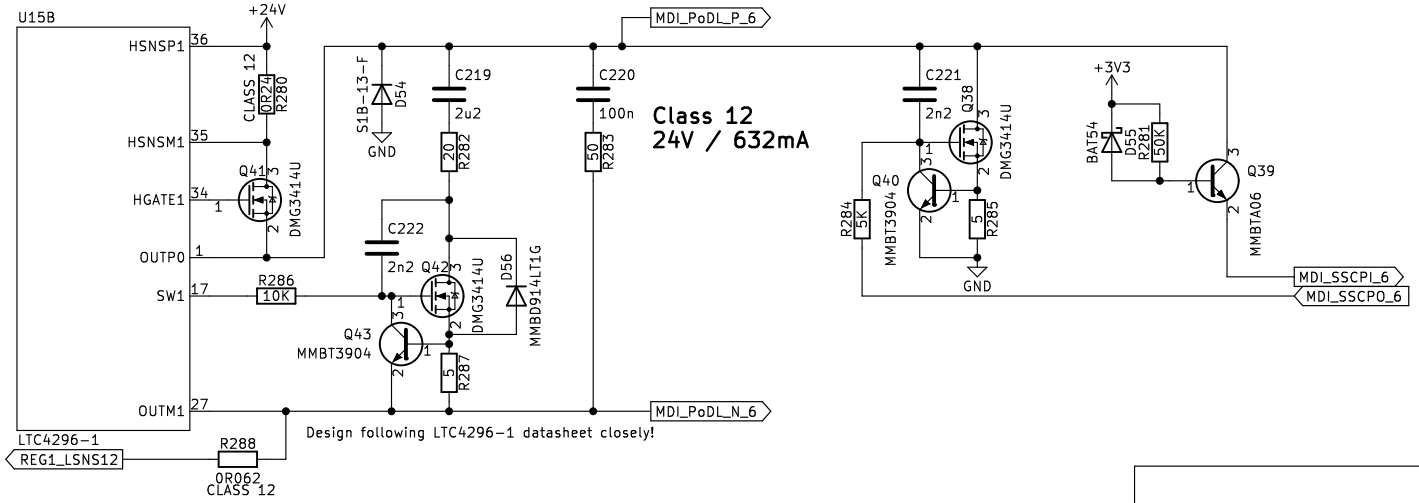
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /PoDL PHY4 REG0/
File: PoDL_PHY4_REG0.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 14/18



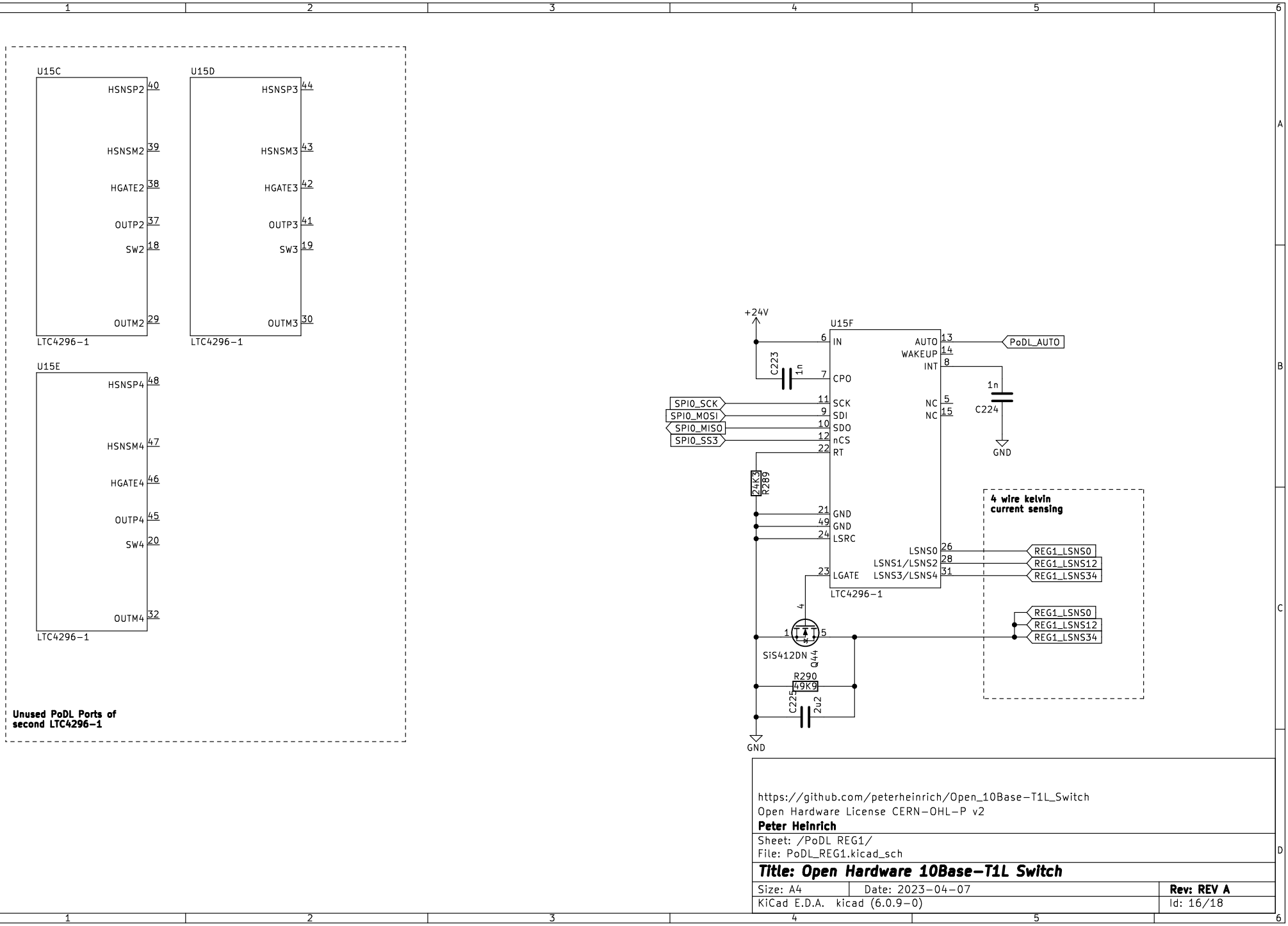


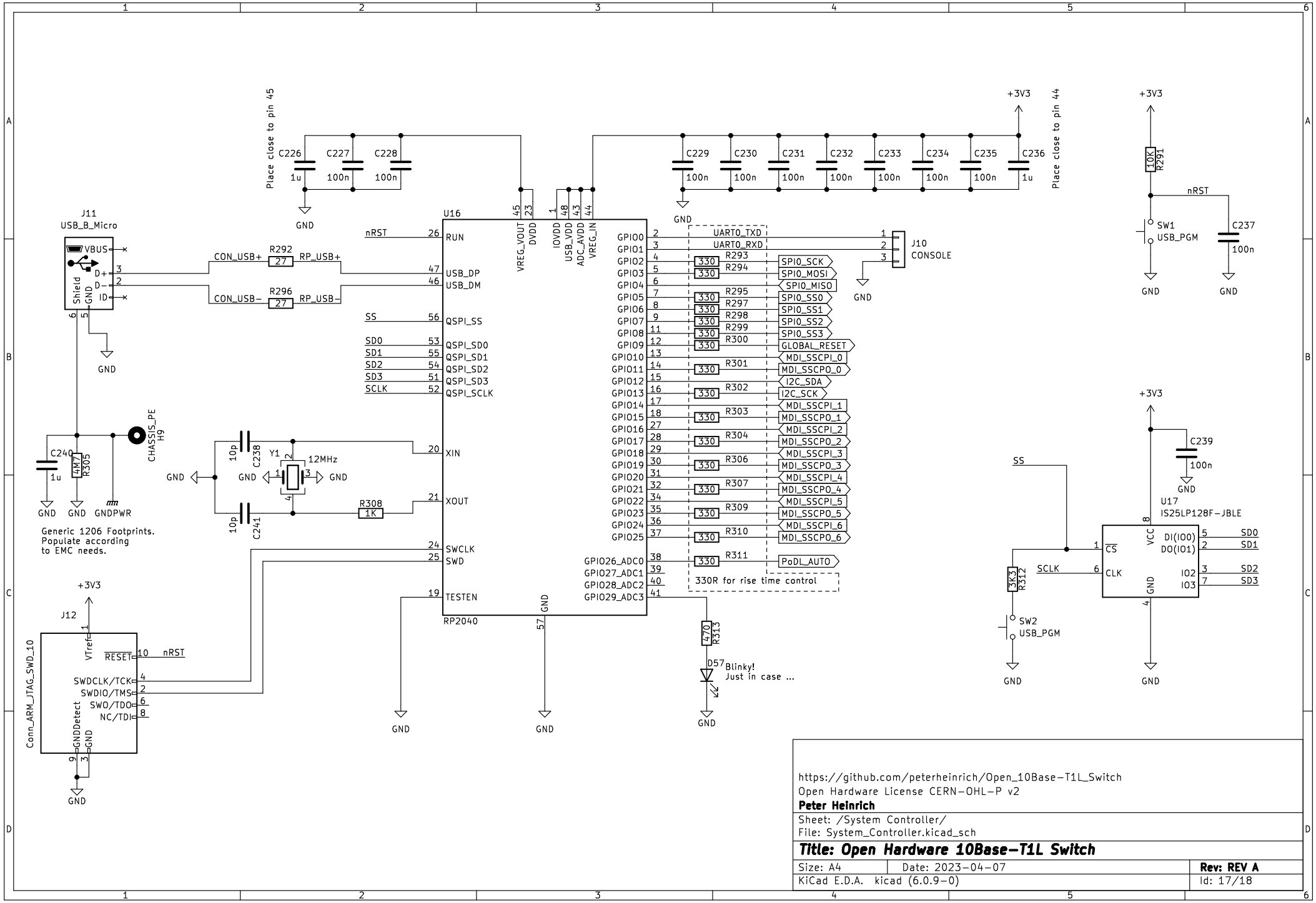
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /PoDL PHY 5-6/
File: PoDL_PHY5-6.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 15/18


U15C
HSNSP2 40
HSNSM2 39
HGATE2 38
OUTP2 37
SW2 18
OUTM2 29
LTC4296-1
U15D
HSNSP3 44
HSNSM3 43
HGATE3 42
OUTP3 41
SW3 19
OUTM3 30
LTC4296-1
U15E
HSNSP4 48
HSNSM4 47
HGATE4 46
OUTP4 45
SW4 20
OUTM4 32
LTC4296-1
Unused PoDL Ports of
second LTC4296-1
+24V
U15F
6 IN
C223 1n
7 CPO
SPI0_SCK 11 SCK
SPI0_MOSI 9 SDI
SPI0_MISO 10 SDO
SPI0_SS3 12 nCS
22 RT
24K3 R289
21 GND
49 GND
24 LSRC
23 LGATE
LTC4296-1
AUTO 13 PoDL_AUTO
WAKEUP 14
INT 8
1n C224
NC 5
NC 15
GND
LSNS0 26 REG1_LSNS0
LSNS1/LSNS2 28 REG1_LSNS12
LSNS3/LSNS4 31 REG1_LSNS34
4 wire kelvin
current sensing
REG1_LSNS0
REG1_LSNS12
REG1_LSNS34
4
1
5
SiS412DN Q44
R290 49K9
C225 2u2
GND
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich
Sheet: /PoDL REG1/
File: PoDL_REG1.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 16/18

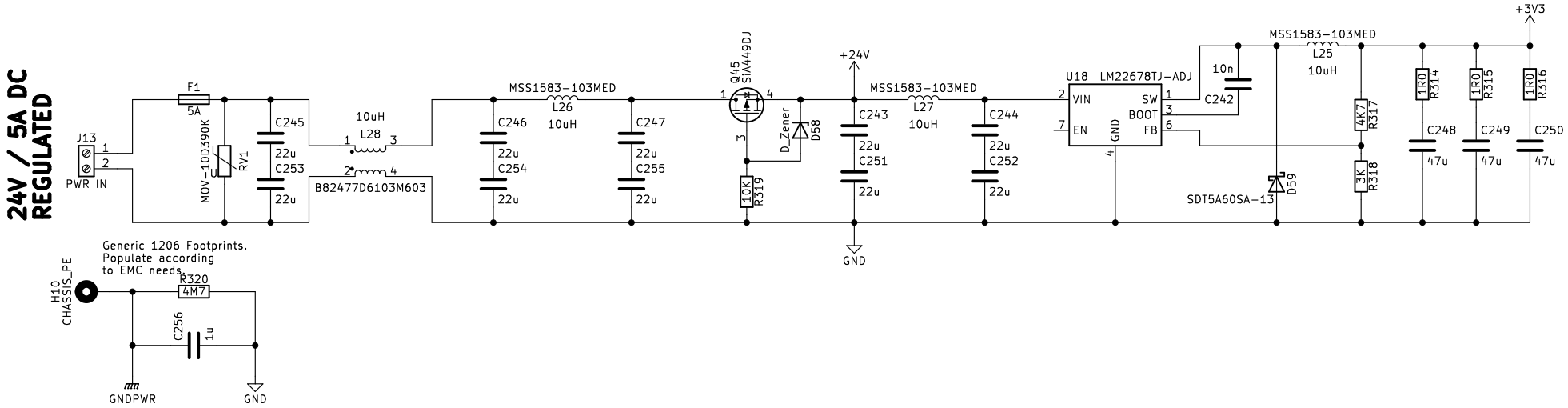


https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /System Controller/
File: System_Controller.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 17/18



https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

Sheet: /Power Supply/
File: Power_Supply.kicad_sch

Title: Open Hardware 10Base-T1L Switch

Size: A4	Date: 2023-04-07	**Rev: REV A**
KiCad E.D.A. kicad (6.0.9-0)		Id: 18/18