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
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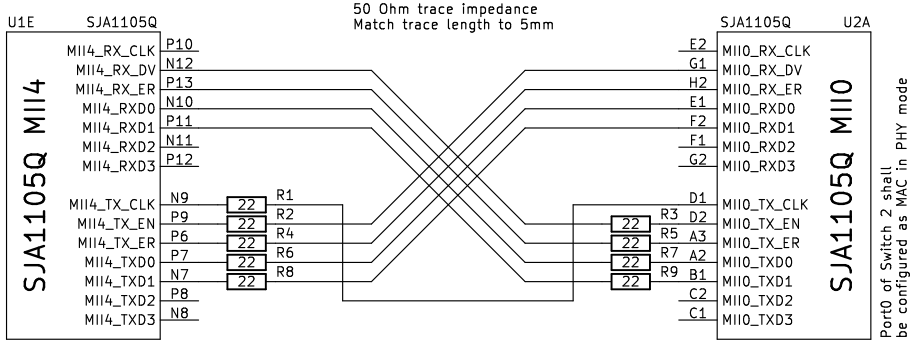
Peter Heinrich

Sheet: /
File: Open_10Base-T1L_Switch.kicad_sch

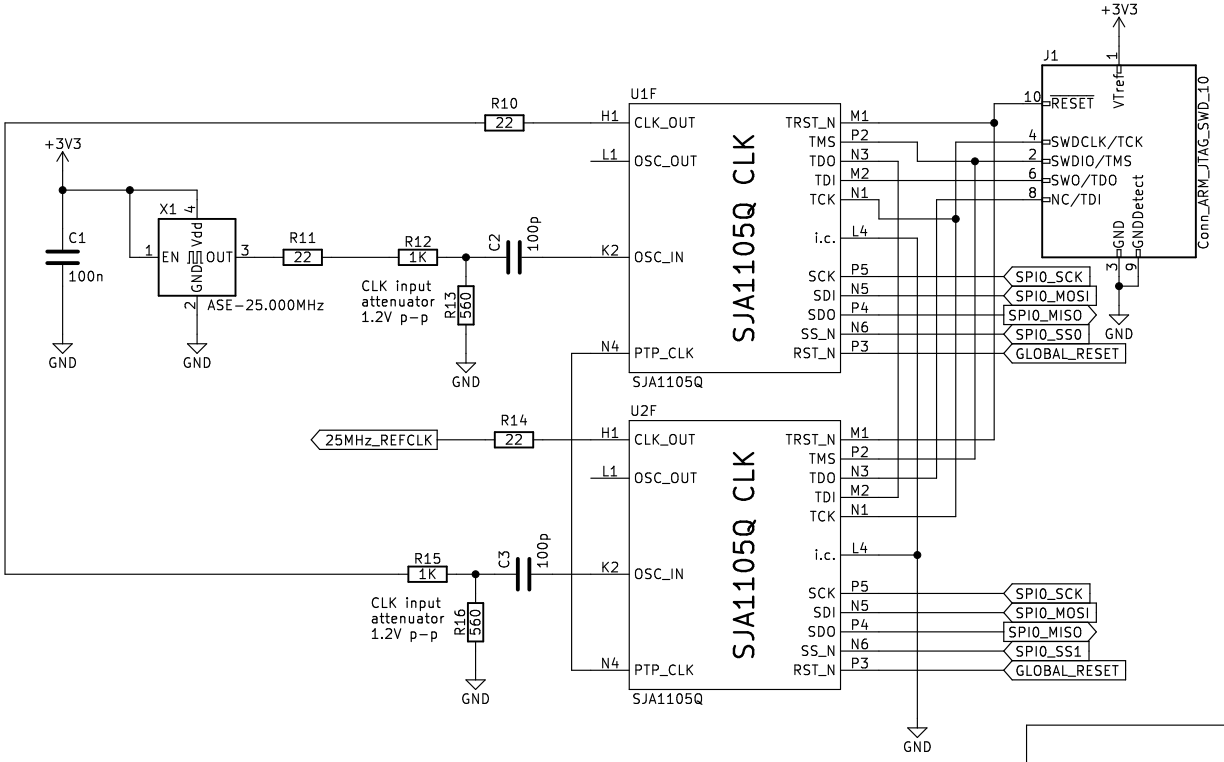
Title: Open Hardware 10Base-T1L Switch

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
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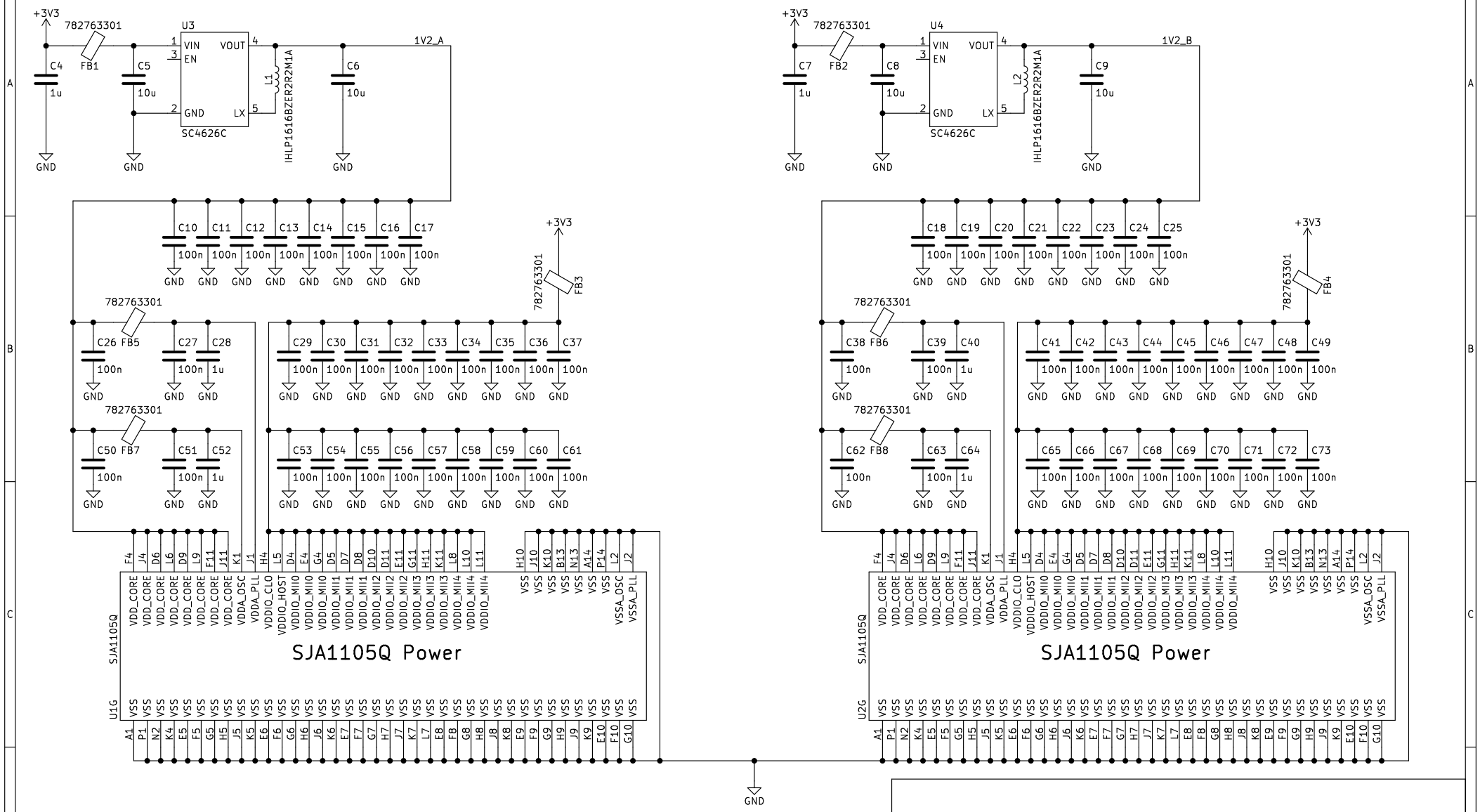
Sheet: /SJA1105Q Switch/
File: SJA1105Q_Switch.kicad_sch

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


+3V3
782763301
FB1
U3
VIN
VOUT
EN
GND
LX
SC4626C
L1
IHLP1616BZER2R1M1A
C4
1u
C5
10u
C6
10u
1V2_A
C10 C11 C12 C13 C14 C15 C16 C17
100n
FB3
FB5
C26
C27
C28
1u
C29 C30 C31 C32 C33 C34 C35 C36 C37
FB7
C50
C51
C52
C53 C54 C55 C56 C57 C58 C59 C60 C61
U1G
SJA1105Q
SJA1105Q Power
U4
L2
C7
C8
C9
1V2_B
C18 C19 C20 C21 C22 C23 C24 C25
FB4
FB6
C38
C39
C40
C41 C42 C43 C44 C45 C46 C47 C48 C49
FB8
C62
C63
C64
C65 C66 C67 C68 C69 C70 C71 C72 C73
U2G
https://github.com/peterheinrich/Open_10Base-T1L_Switch
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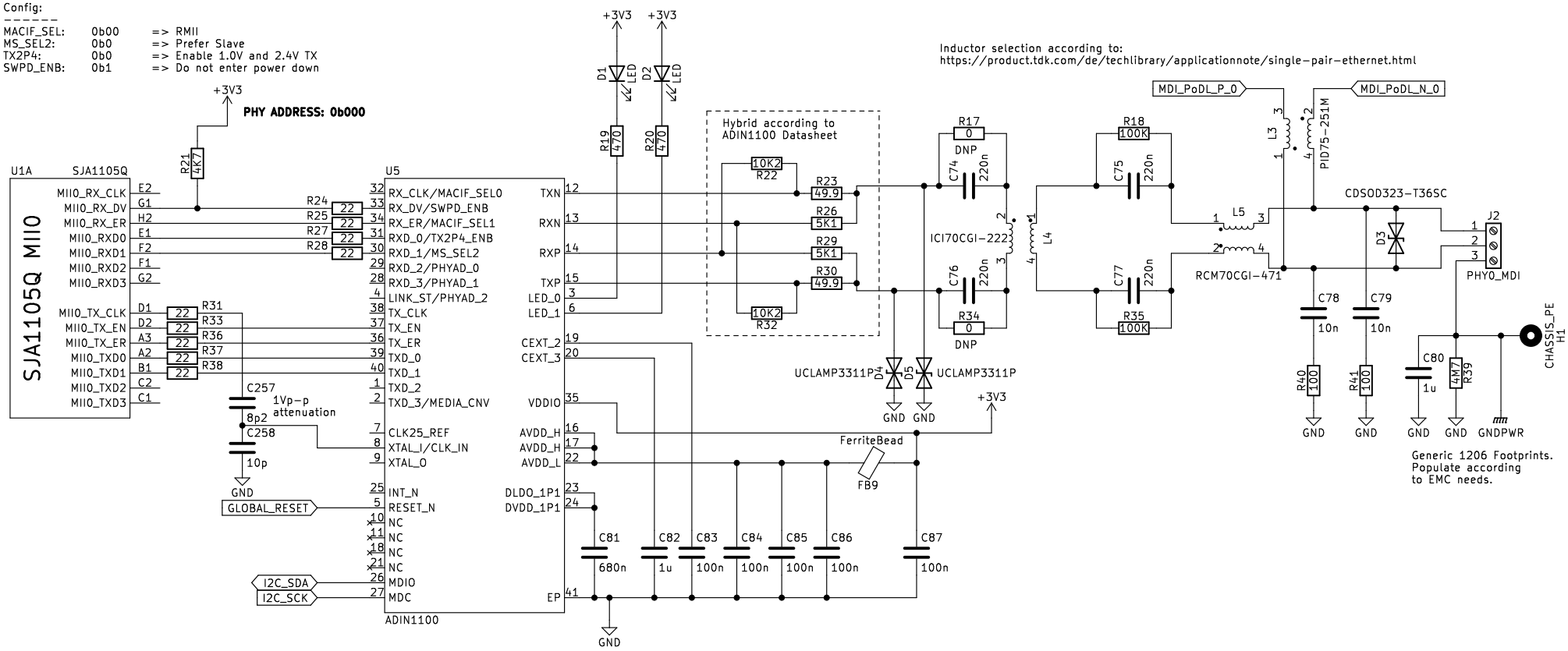
Peter Heinrich
Sheet: /SJA1105Q Power/
File: SJA1105Q_Power.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 3/18



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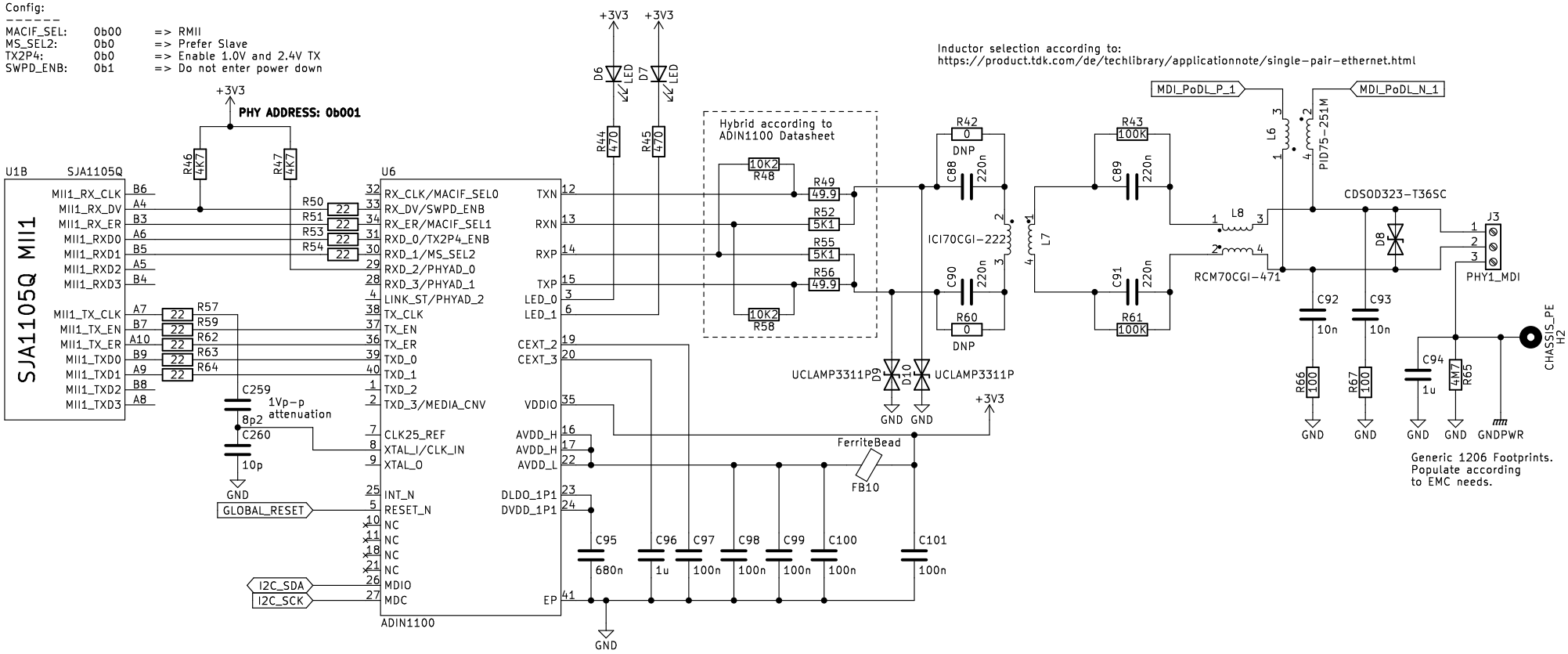
Sheet: /10Base-T1L-PHY0/
File: 10Base-T1L-PHY0.kicad_sch

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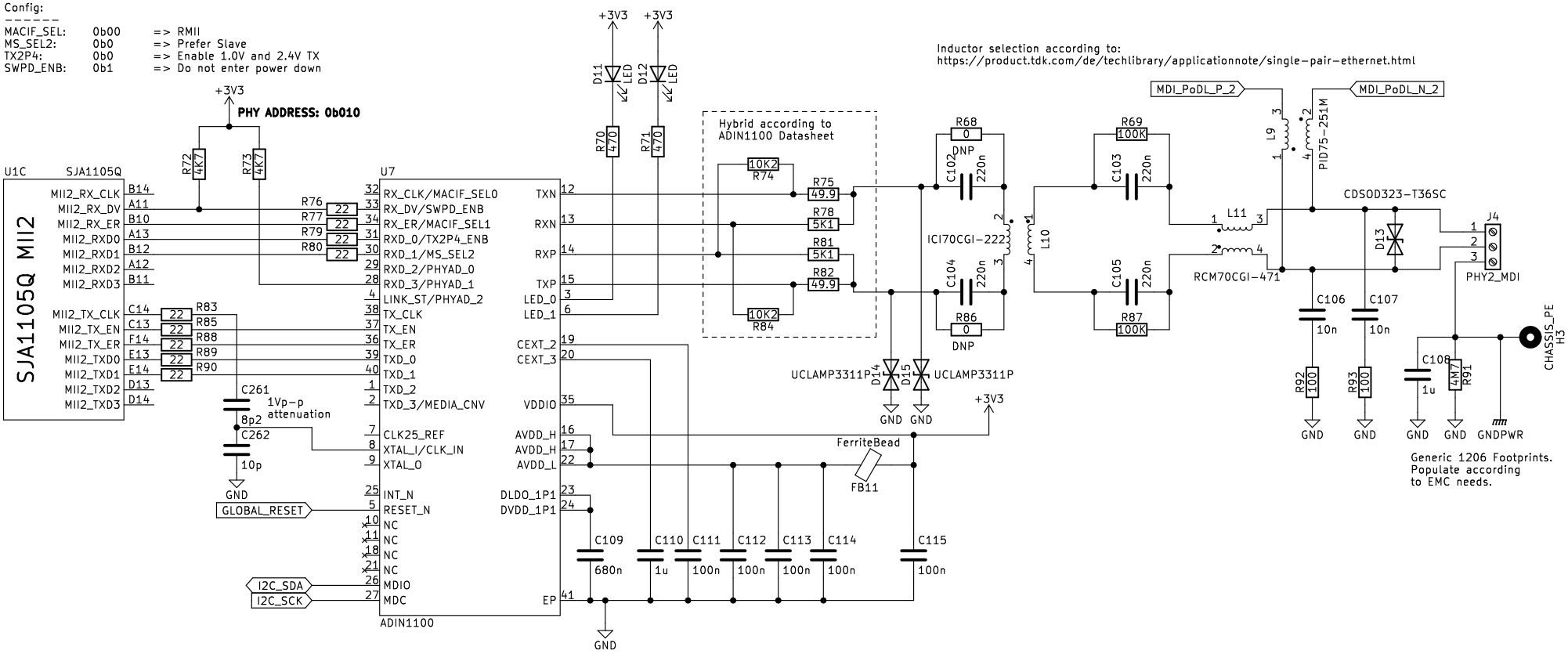
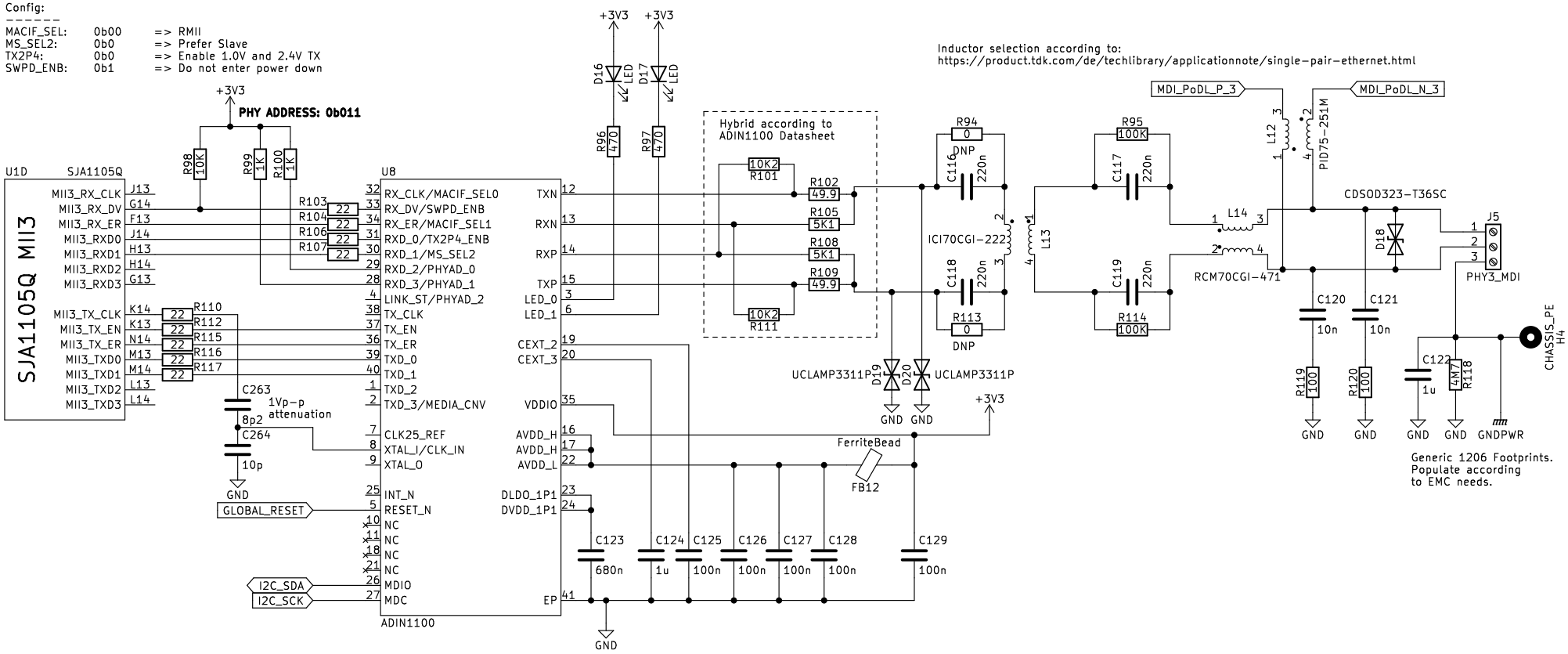
Sheet: /10Base-T1L-PHY1/
File: 10Base-T1L-PHY1.kicad_sch

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
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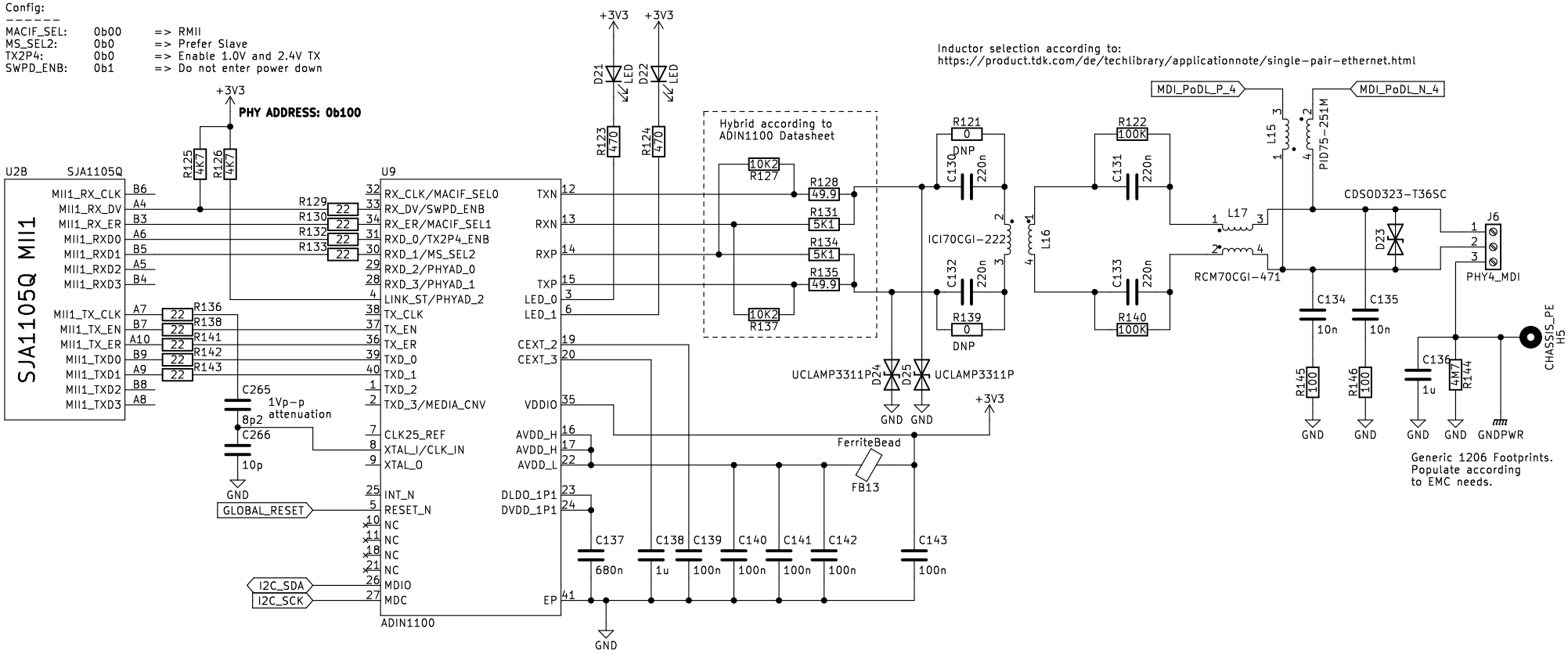
Peter Heinrich
Sheet: /10Base-T1L-PHY3/
File: 10Base-T1L-PHY3.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 7/18


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
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
C265 1Vp-p attenuation 8p2
C266 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
FB13
MDI_PoDL_P_4
MDI_PoDL_N_4
PHY4_MDI
CHASSIS_PE
Generic 1206 Footprints.
Populate according
to EMC needs.
https://github.com/peterheinrich/Open_10Base-T1L_Switch
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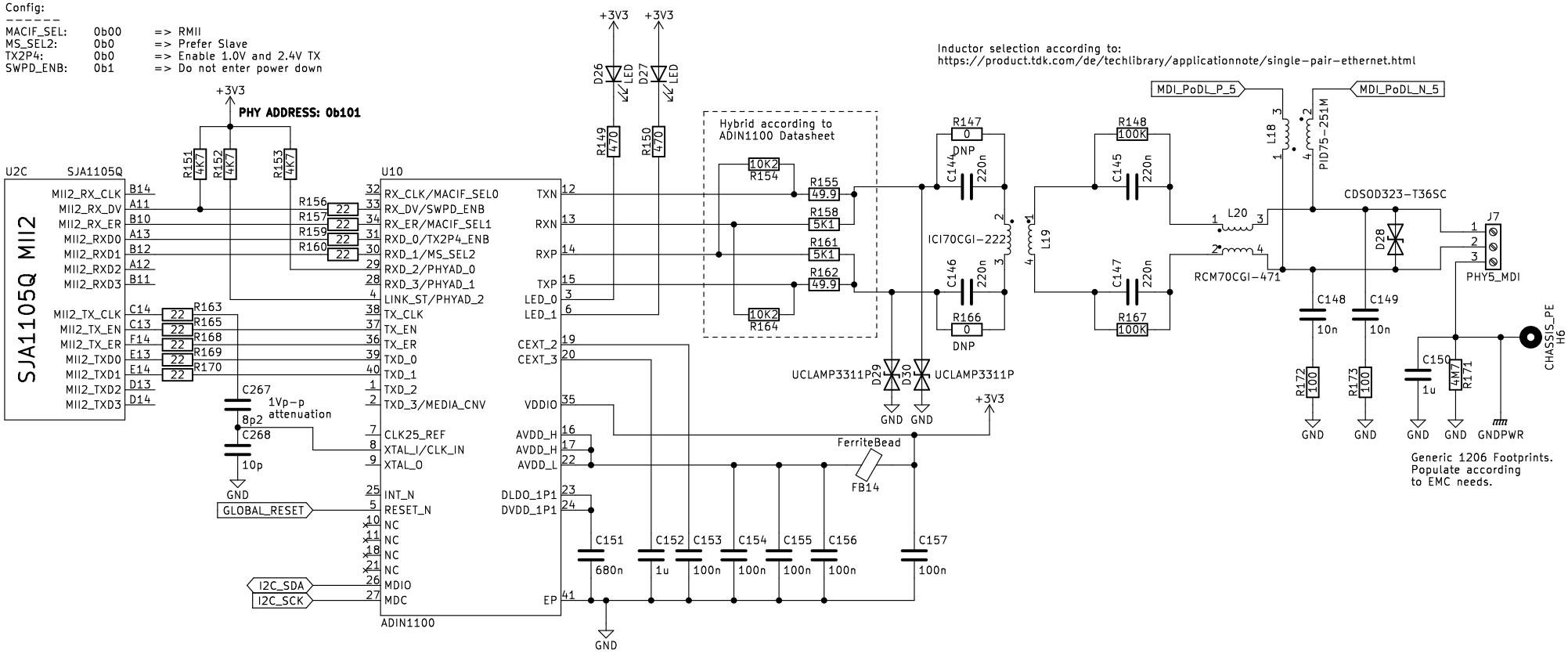
Peter Heinrich
Sheet: /10Base-T1L-PHY4/
File: 10Base-T1L-PHY4.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 8/18



https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
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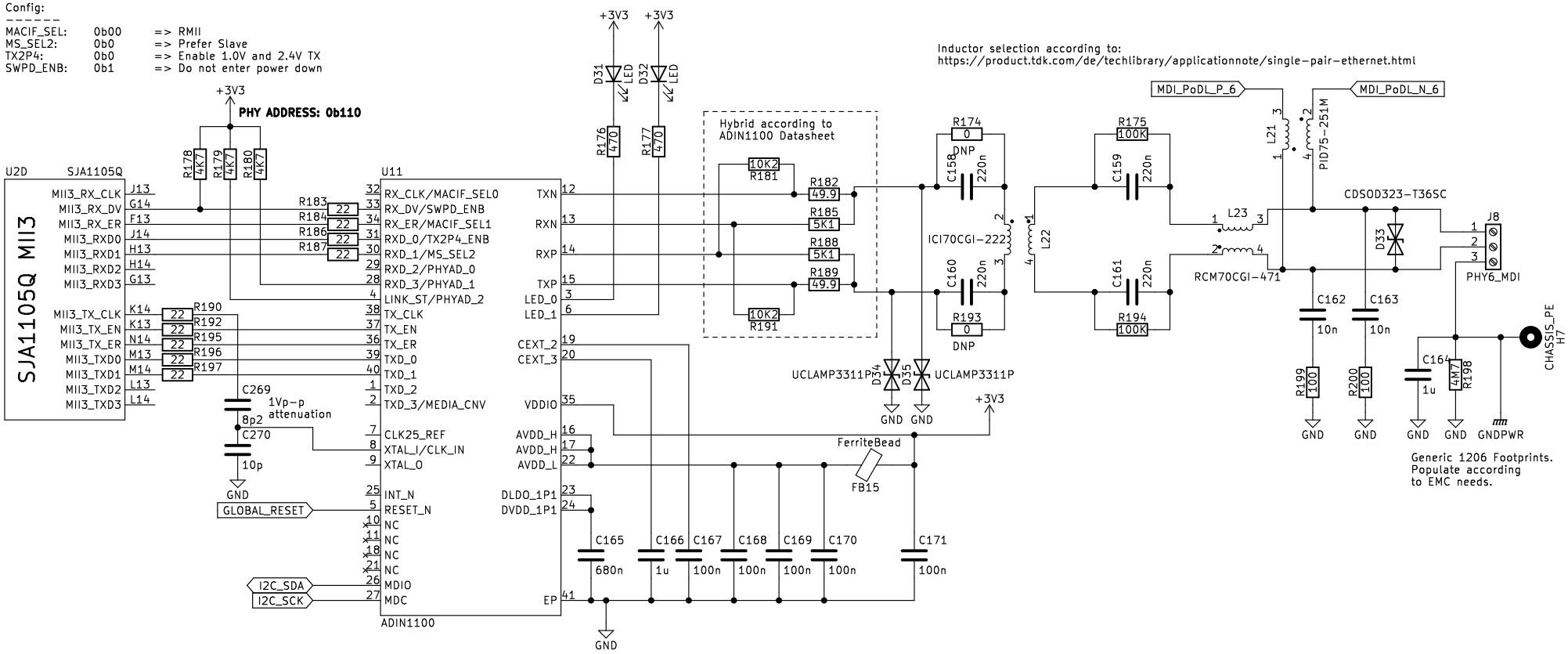
Sheet: /10Base-T1L-PHY5/
File: 10Base-T1L-PHY5.kicad_sch

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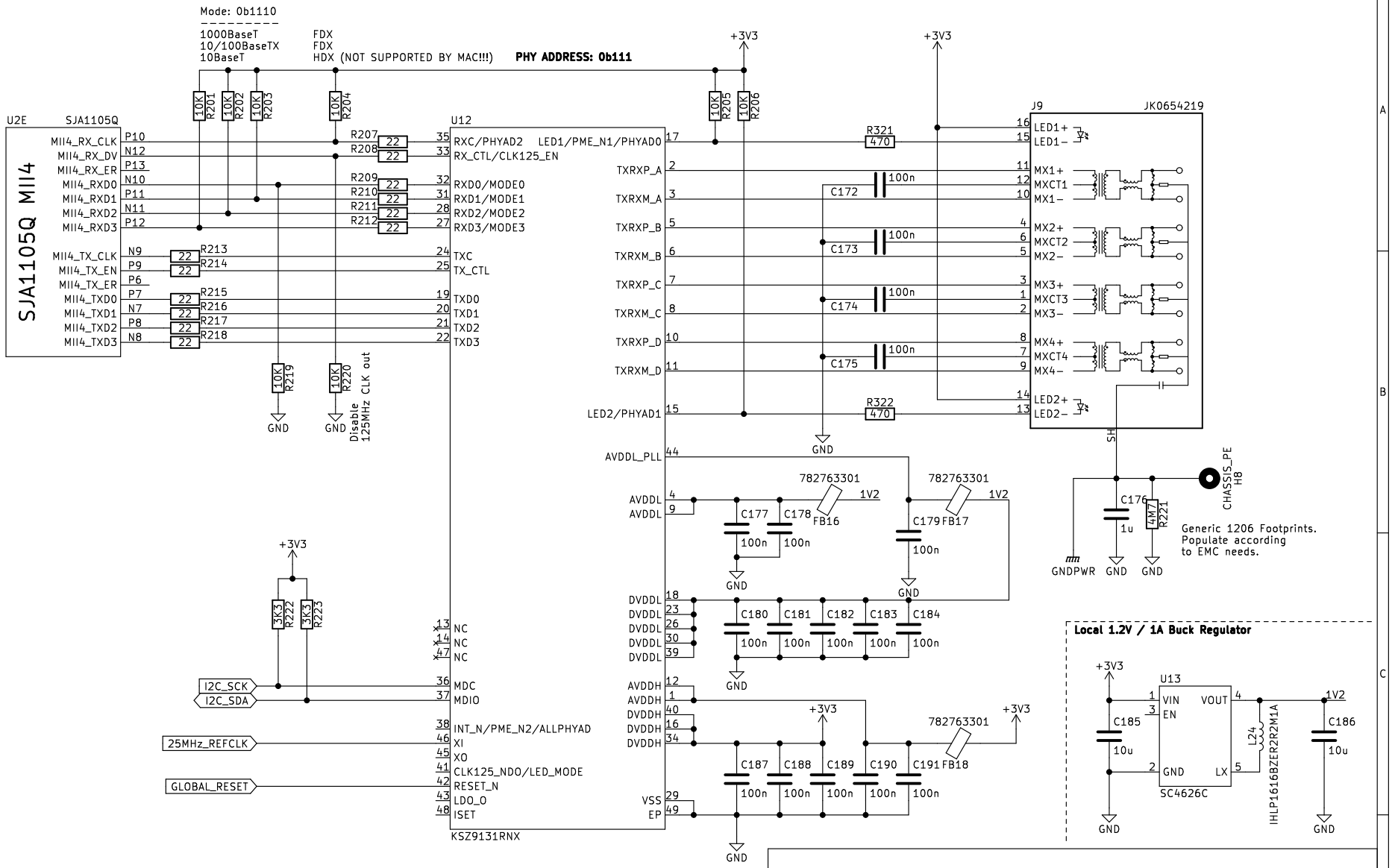
Sheet: /10Base-T1L-PHY6/
File: 10Base-T1L-PHY6.kicad_sch

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 FDX
10/100BaseTX FDX
10BaseT 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
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
KSZ9131RNX
Disable 125MHz CLK out
I2C_SCK
I2C_SDA
25MHz_REFCLK
GLOBAL_RESET
J9 JK0654219
LED1+
LED1−
MX1+
MXCT1
MX1−
MX2+
MXCT2
MX2−
MX3+
MXCT3
MX3−
MX4+
MXCT4
MX4−
LED2+
LED2−
SH
782763301
FB16
FB17
FB18
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
https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
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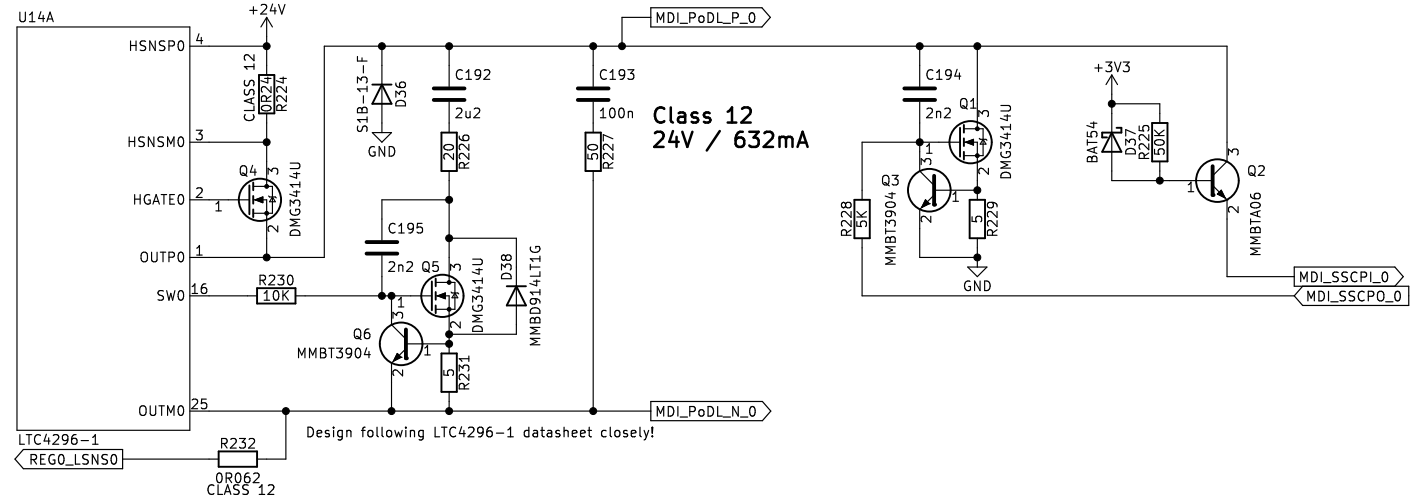
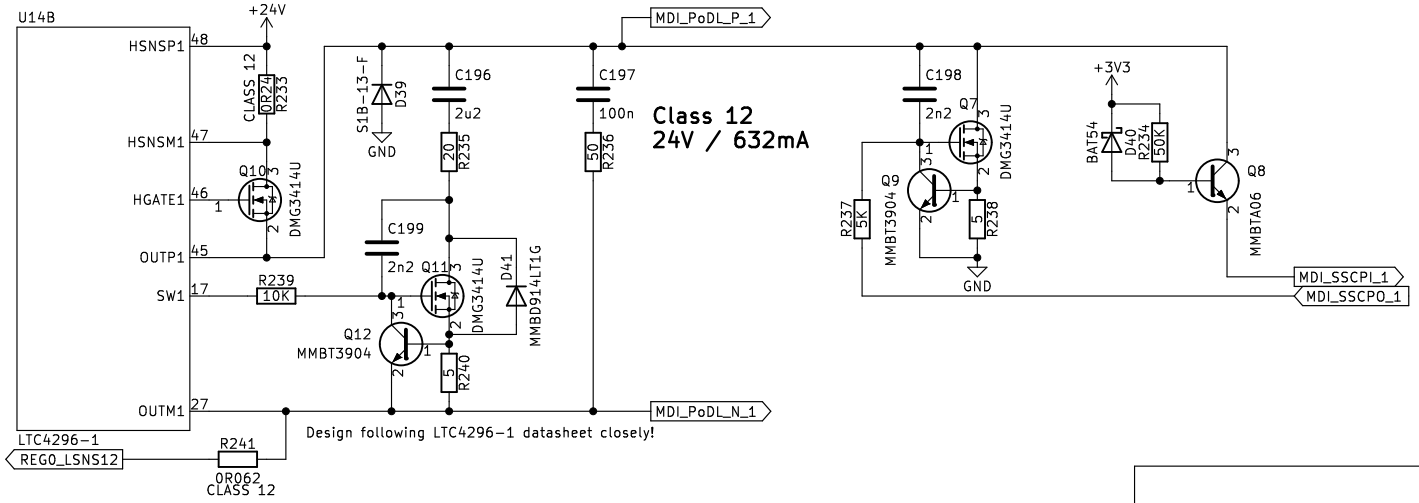
Sheet: /100Base-TX-PHY7/
File: 100Base-TX-PHY7.kicad_sch
Title: Open Hardware 10Base-T1L Switch
Size: A4
Date: 2023-04-07
Rev: REV A
KiCad E.D.A. kicad (6.0.9-0)
Id: 11/18





https://github.com/peterheinrich/Open_10Base-T1L_Switch
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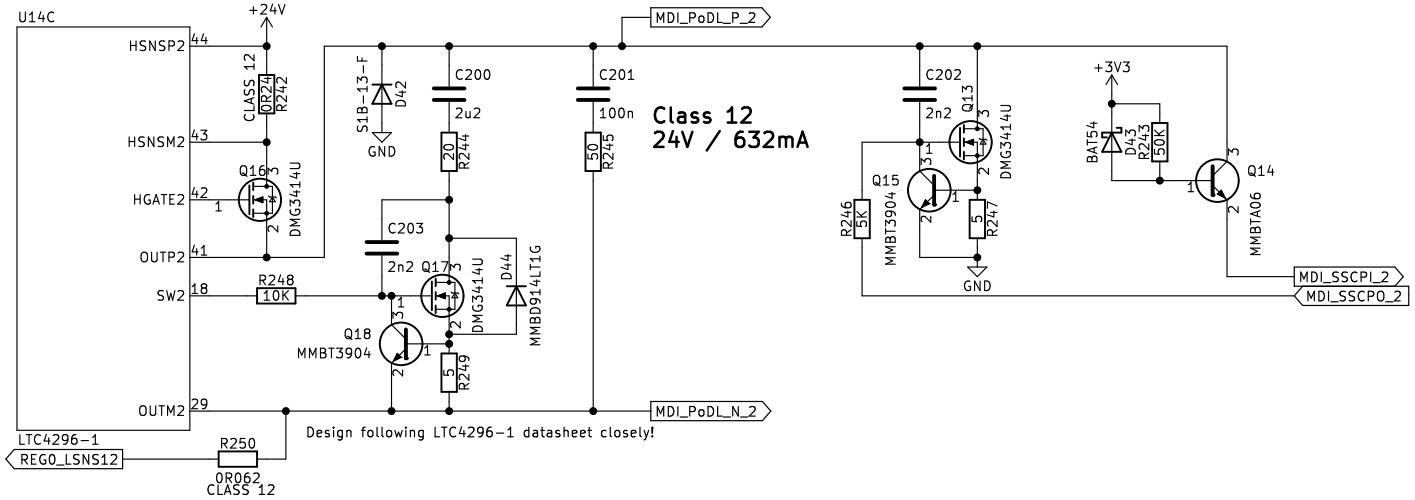
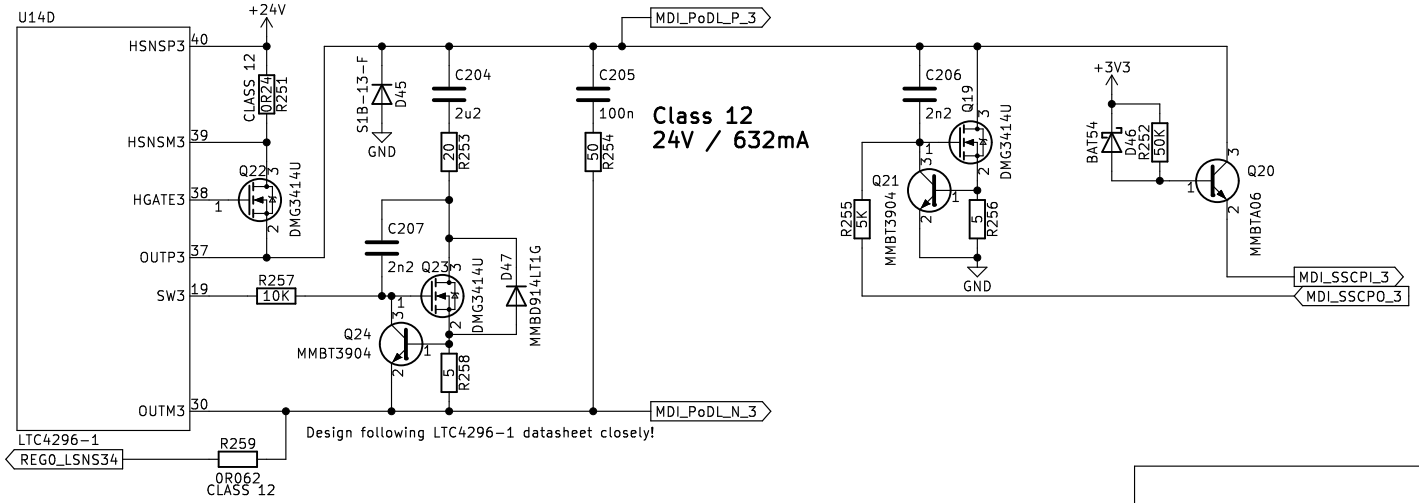
Sheet: /PoDL PHY 0-1/
File: PoDL_PHY0-1.kicad_sch

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



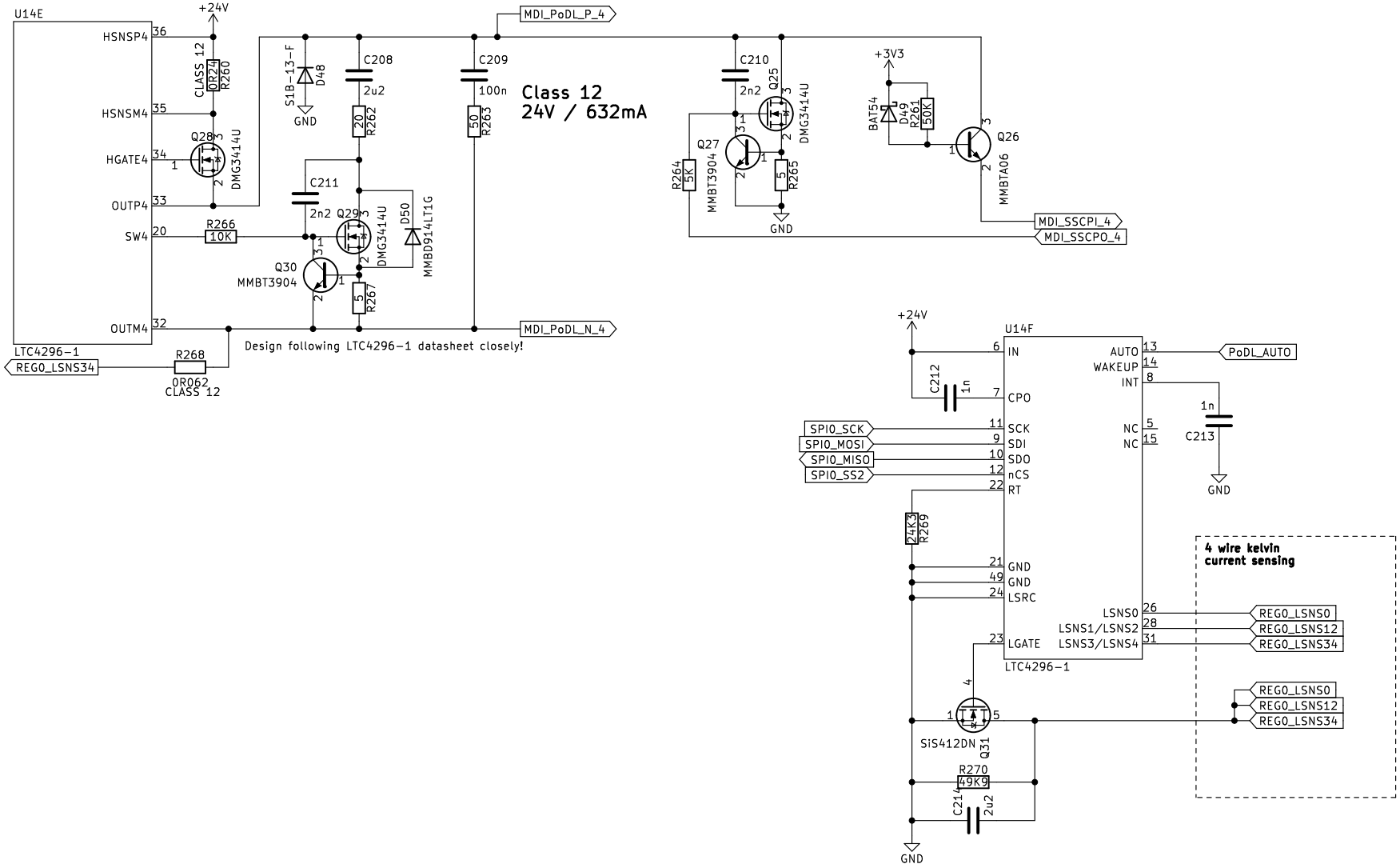


https://github.com/peterheinrich/Open_10Base-T1L_Switch
Open Hardware License CERN-OHL-P v2
Peter Heinrich

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



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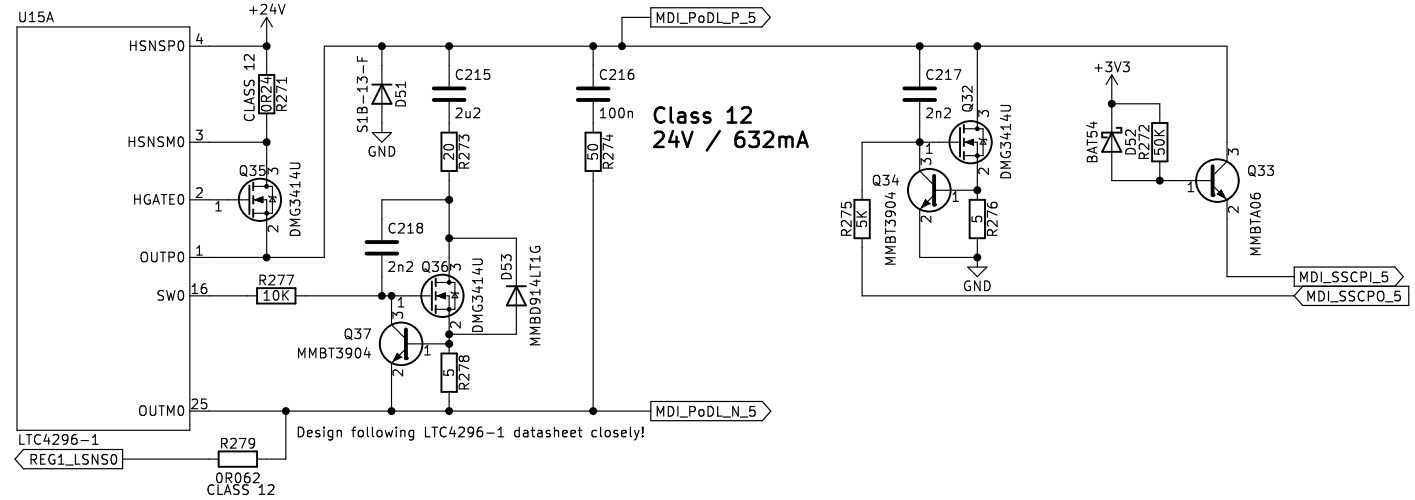
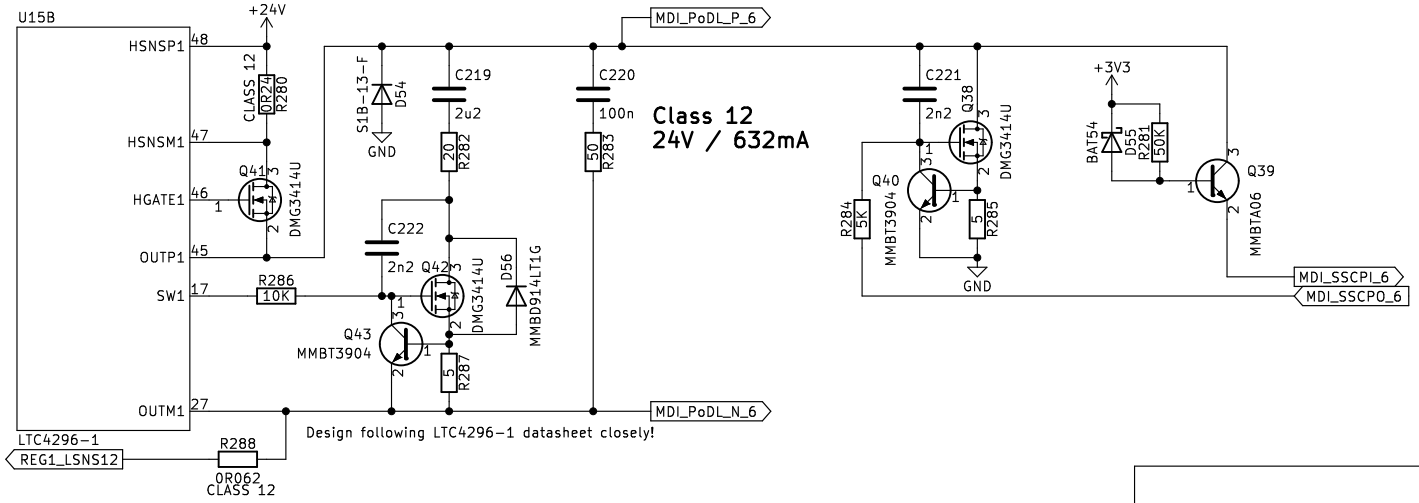
Sheet: /PoDL PHY4 REG0/
File: PoDL_PHY4_REG0.kicad_sch

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





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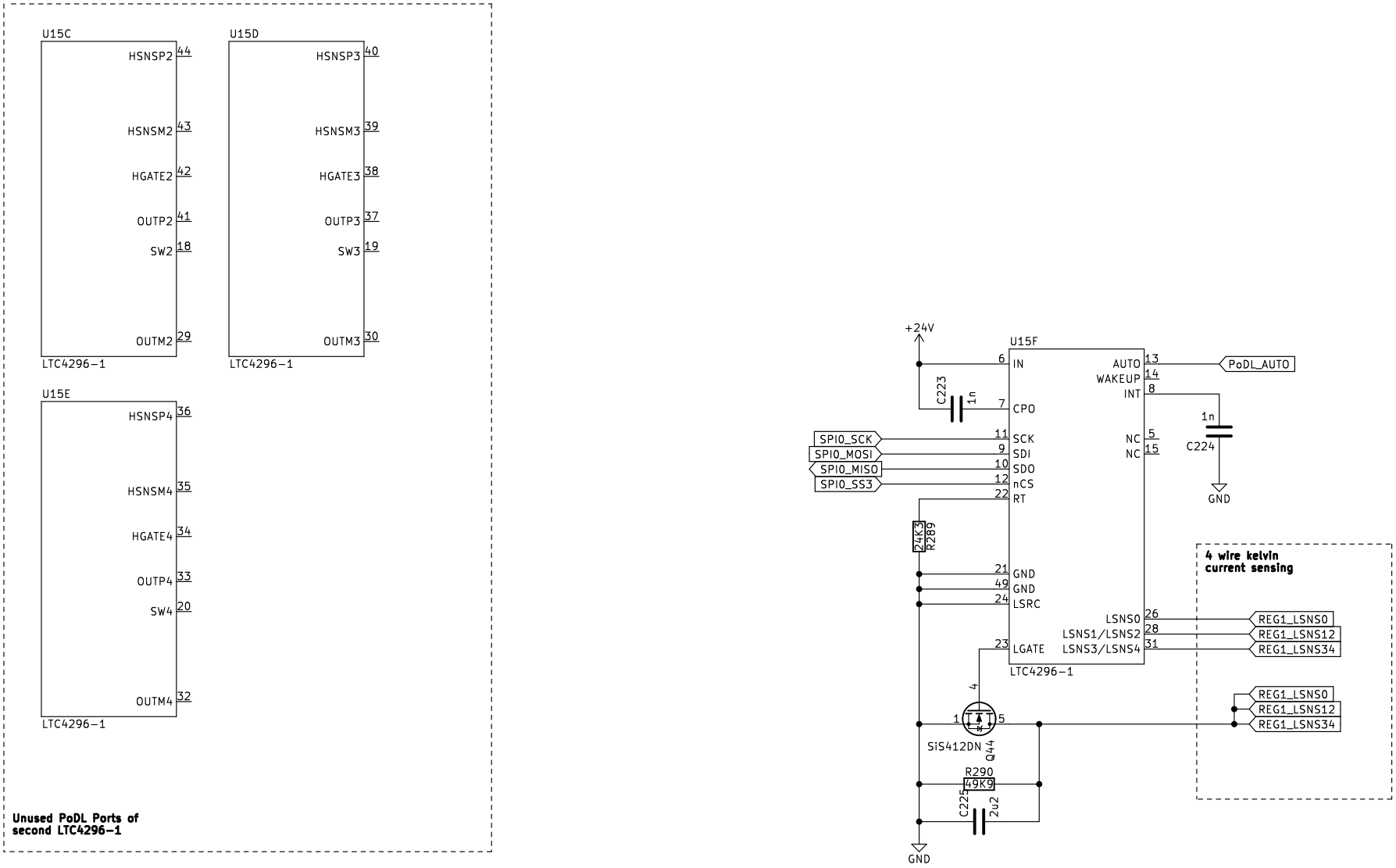
Sheet: /PoDL PHY 5-6/
File: PoDL_PHY5-6.kicad_sch

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



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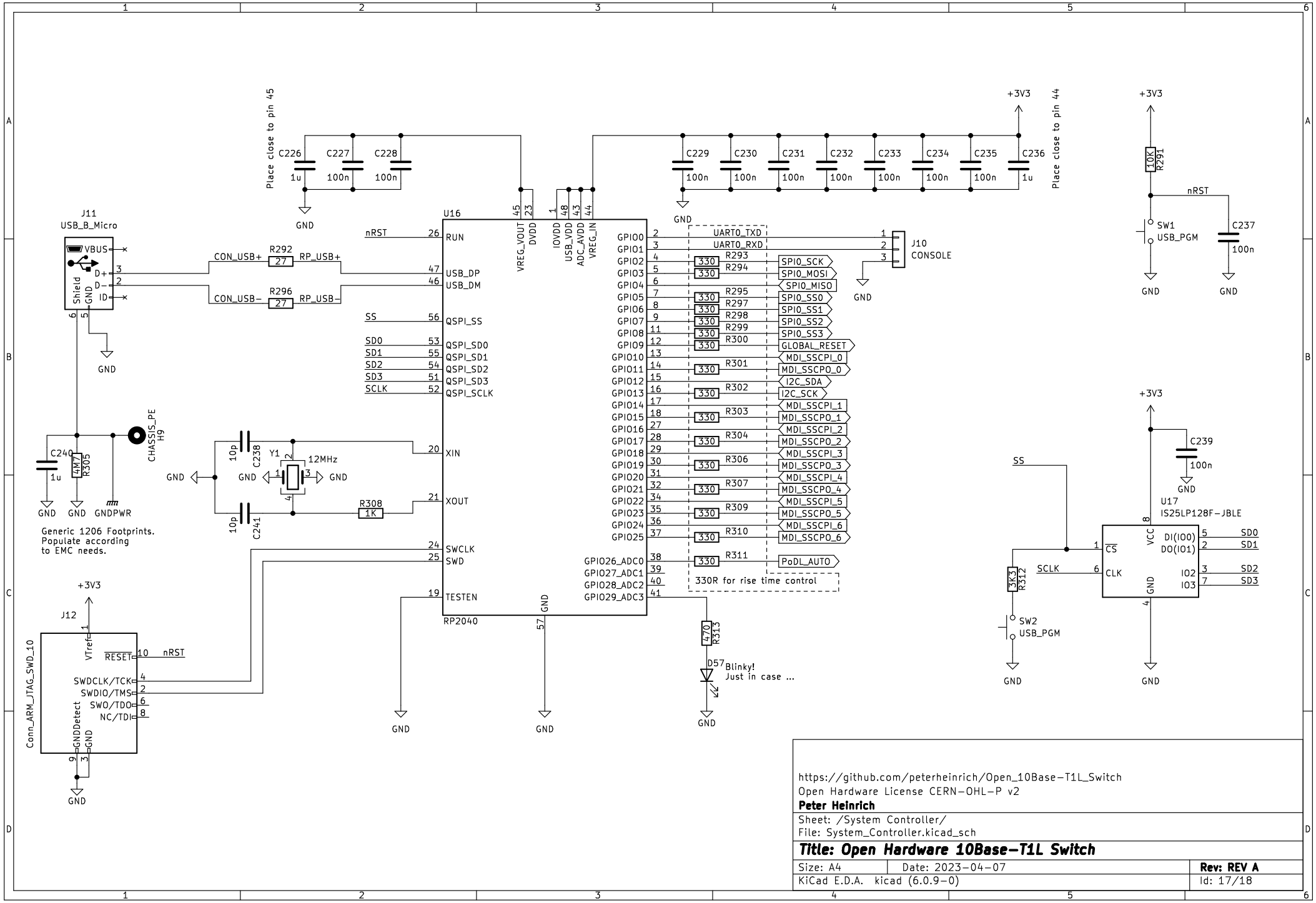
Sheet: /PoDL REG1/
File: PoDL_REG1.kicad_sch

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



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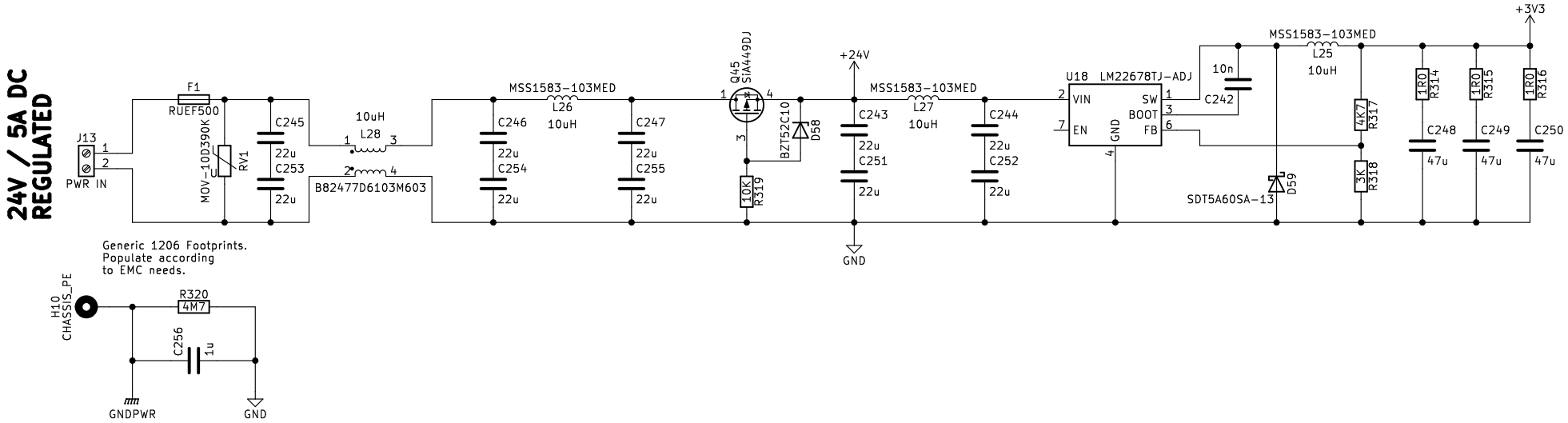
Sheet: /System Controller/
File: System_Controller.kicad_sch

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



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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