# Symphony-Board

Variscite

## CONTENT



## Disclaimer:

Schematics are for reference only.
Variscite LTD provides no warranty for the use of these schematics.
Schematics are subject to change without notice.

## Revision History

| Document | Carrier | |
|---|---|---|
| 1.0 | 1.0 | Initial |
| 1.1 | 1.1 | Released |
| 1.2 | 1.1 | Updated Block Diagrams<br>Added SH1 wire short symbol<br>Updated Compatability value for SOM pins 68,69,176<br>Updated SOM pin 22 net name<br>Fixed U22.B1, C113.1 net name<br>Fixed R1-R2,R35-R38 net name |
| 1.3 | 1.2 | Removed SH1 wire short, J1.68 routed to capacitive touch<br>Changed R29 to C185<br>Changed R123,R127 to N.C.<br>Added resistors R130-132<br>Removed ADC_INxx alternate function from VAR-SOM-MX8 Symbol<br>Updated PCIe resistor assembly note |
| 1.4 | 1.2 | Updated Parallel Camera/HDMI/DP Note<br>Fixed ETH pin names VAR-SOM-MX8X Symbol |
| 1.5 | 1.2A | Disconnected R129 |
| 1.6 | 1.2A | Added VAR-SOM-MX8M-MINI Block Diagram and Symbol<br>PRE-RELEASE VERSION !!!!! Subject to change without notice |
| 1.7 | 1.2B | Fixed VAR-SOM-MX8M-MINI Symbol<br>Changed U29,U30,U31 to P/N: FPF2193<br>Changed R60 to 47K |
| 1.8 | 1.2C | Update VAR-SOM-MX8M-MINI Symbol to V1.1 with side notes for v1.0B(Early access customers)<br>Update VAR-SOM-MX8M-MINI Block Diagram<br>POR circuitry fed by VCC_SOM: see U7 R60 R61 R40 R60 D5 Removed |
| 1.9 | 1.2D | Raise VCC_3V3 to Nominal 3.39V for VAR-SOM-MX8M-MINI/NANO power up threshold voltage requirement of >3.35V |
| 1.10 | 1.2E | Reference for new designs: (changes not implemented in V1.2 BRD)<br>* Added x2 studs for heat plate support<br>* Base_per_3v3 added slew rate limit<br>* U7 (Base POR circuit) added CB_WDOG resistor assmbly options<br>* U29 U30 U31 - Added assembly note<br>* VAR-SOM-MX8M-NANO pages added with symbol pinout<br>* VAR-SOM-MX6 Connector update - added NC on /*/ assembly options<br>* Power switch in OFF position discharge of Custom rails added<br>* Ethernet magnetics - support two Manf: Pulse & UDE;<br>* Base RJ45 LEDs matched to SOM behaviour; |
| 1.11 | 1.3 | * Added VAR-SOM-MX8M-PLUS Preliminary Symbol and Block Diagram<br>Symbol is Pre-Release Version! Subject to change without notice!<br>* All C1210 capacitor footprint updated to C1210_v0<br>* MS1 to MS6 not assembled |
| 1.12 | 1.3A | * ETH1 PHY clock filter U9 replaced with 49.9 Ohm /0603 resistor<br>* Added design note for ETH1 switches U8 and U10. |
| 1.13 | 1.4 | * MS5 and MS6 location adopted to heatplate design - Layout<br>* Update J1 Manufacturer PN, NAME and footprint to epresent the assembled part<br>* Replace PCIe AC caps on RX lines with 0 ohm resistors<br>* Updated VAR-SOM-MX8M-PLUS Symbol pins 1 58 80, swap pins 41 43 and 84 147<br>* J19 Modify Camera connector orientation<br>* Remove U8 U10 analog switches on ETH1<br>* U9 revert to EMI filter on RGMII_RX clock line<br>* Added RN1 RN2 RN3 R151 R136 isolating stubs on ETH1 RGMII signals<br>* U26 footprint updated to DS<br>* Y1 C68 C67 updated<br>* Support for VAR-SOM-6UL boot:<br>- BOOT_MODE1 - R117 assembled<br>- BOOT_MODE0 - Added PD R149<br>- USB#A PWR to HOST J23 always enabled<br>* Remove R39 on pin J1.156 to support SOM-MX8MP 2nd MIPI-CSI Lane2 routing<br>* J3 J30 pinout change |
| 1.14 | 1.4A | * Support for VAR-SOM-MX8MP USB OTG -<br>Changed U5.P4 Pull for board identification, U21.9 connected to GPIO:<br>- Changed R43,R130,R106 to N.C.<br>- Changed R44,R132 to Assembled<br>* Changed Q4 P/N from: TPS27082L (EOL) to -> TPS27081A<br>* Updated VAR-SOM-MX8M-PLUS Block Diagram, Symbol pins 36,38 names<br>* Added notes for SOM pins 29,79,84 |
| 1.15 | 1.4A | Changes in v1.14/1.4A for R43,R44 were not implemented (part of board identification) and only appear in revision history; board identification implemented via EEPROM U3.<br>Board identification required for OS to identifiy method of OTG ID used: PTN5150 or GPIO |
| 1.16 | 1.5 | * Modified VCC_3V3 to 3.35V nominal for all SOMs.<br>For VAR-SOM-MX8M-MINI/NANO, power up threshold voltage requirement of >3.35V is implemented using Q10,R152<br>* Added note for VAR-SOM-MX8M-MINI/NANO pin 91 |
| 1.17 | 1.5 | * Updated note for I2C#B pull up resistors |
| 1.18 | 1.5 | * Updated note for PTN36043BXY chip |
| 1.19 | 1.5A | * Q10 changed to 2N7002P,215<br>Transistor Q10 changed to 2N7002P to stabilize the SOM voltage in the OFF state.<br>Old transisitor leakage current (IDG) changed the feedback current and increased the SOM voltage.<br>2N7002P does not have SG diode that allowed IDSS to flow into the Gate<br>* SOM Pin 84 Note changed |
| 1.20 | 1.6 | Ethernet PHY replaced to ADIN1300<br>R22,R23,R35,R36 assembled with Ferrite Bead<br>C185 assembled with 10K resistor, R30 not assembled<br>U2 changed to CBTL02043B<br>USB3 crossover switch changed to CBTL02043B |
| 1.21 | 1.6A | Due to EOL: U35 changed to NFL18ZT207H1A3D<br>Due to allocation problems: U13 changed to SN65HVD232QDR |
| 1.22 | 1.6B | Due to allocation problems: U22,U29,U30,U31 changed to P/N: FPF2194 |
| 1.23 | 1.6C | Added VAR-SOM-AM62 Block Diagram and Symbol<br>Added VAR-SOM-MX93 Block Diagram and Symbol<br>Temporary removed compatibility notes<br>Added hand wired EXP_MDIO_EN line. |

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File: 00. Cover

| Size | Document Number | Rev |
|---|---|---|
| Custom | Symphony-Board | 1.6C_R1.2 |

| Project | |
|---|---|
| Symphony-Board | |

| Designer: | Relief Int. | Approved By: |
|---|---|---|
| Date: | Monday, January 30, 2023 | Sheet 1 of 24 |

VPC1
PCB
VPC3404-2U

# 03.SOM

For cross probing between SOM symbol and the specific SOM Connector used, set the "Implementation" property value in SOM port symbol to one of the following:

1. VAR-SOM-MX6
2. VAR-SOM-MX8
3. VAR-SOM-MX8X
4. VAR-SOM-MX8M-MINI
5. VAR-SOM-MX8M-NANO
6. VAR-SOM-MX8M-PLUS
7. VAR-SOM-MX93
8. VAR-SOM-AM62

**For complete alternate function per pin and specific SOM: please refer to "VAR-SOMs_Compatibility_and_Pinout.XLS " located at: ftp://ftp.variscite.com/SOM_Compatibility**

OFF PAGE CONNECTOR INDEX:
1. Function# :Interface common to ALL SOMs
2. J1.xxx-Function :Interface common to certains SOMs or Used for carrier board common function
3. J1.xxx :No common interface

Compatability list
Describes the ALT per SOM for compatibility.
Order of names: (MX6/MX8/MX8X/MX8MM/MX8MN/MX8MP)
Note: single name means identical name for all.

Implementation = VAR-SOM-MX8

SOM_3V3
Output from SOM
Used to enable base peripherals power

R57:
SOM-MX8X:
Remove for conneting LICELL

SOM-MX8M-PLUS :
With no "EC" remove & supply power for ENET0 IOs

R55:
SOM-MX6/MX8:
Remove for connecting 1588

R18:
SOM-MX6/MX8I:
Remove for connecting 1588

VAR-SOM-6UL
BOOT

SOM-MX8M-PLUS:
Pin 84 is routed via on SOM buffer with 10K pull up

SOM-MX8M-PLUS:
Pin 79 is routed via on SOM buffer with 10K pull up

TP8:
SOM-MX6/MX8/MX8X:
TAMPER IOs Interface

R8 R10 R12 R13:
MX8X SOM:
without Touch screen controller on SOM,
remove to prevent stubs on High speed lines

## MECHANICS

HEATPLATE SUPPORT STANDOFF

SOM MOUNTING STANDOFF

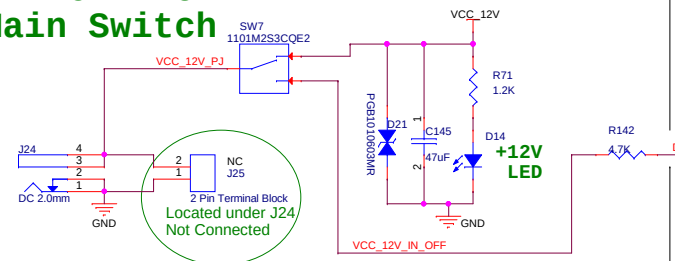
SymphonyBoard STANDOFF

Fiducial

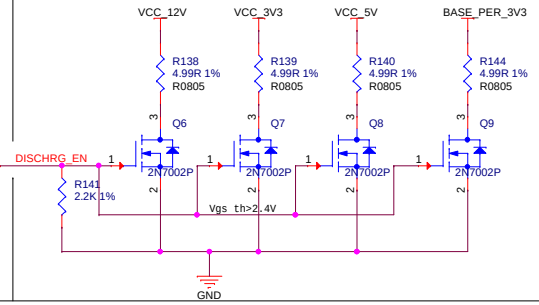
| | |
|---|---|
| Title | 03. SOM |
| Size | A2 |
| Document Number | Symphony-Board |
| Project | Symphony-Board |
| Rev | 1.6C_R1.23 |
| Designer: | Aviad H. |
| Approved By: | |
| Date: | Tuesday, January 31, 2023 |
| Sheet | 2 of 24 |

# 05. Power,Reset,Boot,RTC,EEPROM

## 12VDC INPUT
## Main Switch



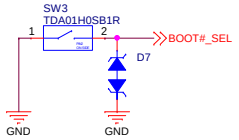

## POWER DISCHARGE



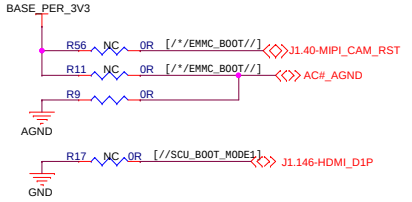

## SOM BOOTSTRP

**Boot Options:**
**OFF : INT**
**ON : SD**

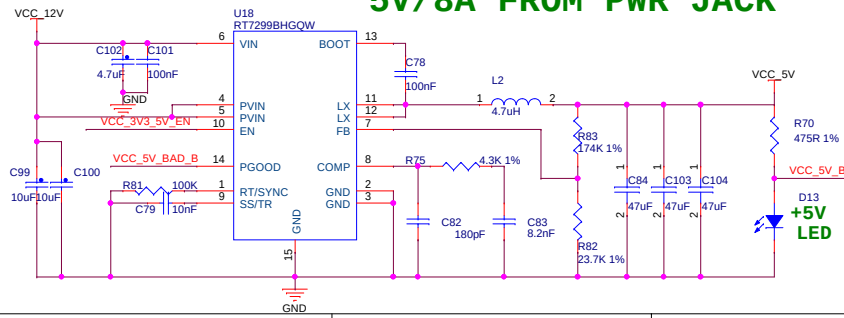
**Internal boot is from eMMC**
**MX6 for eMMC boot see additional changes note**



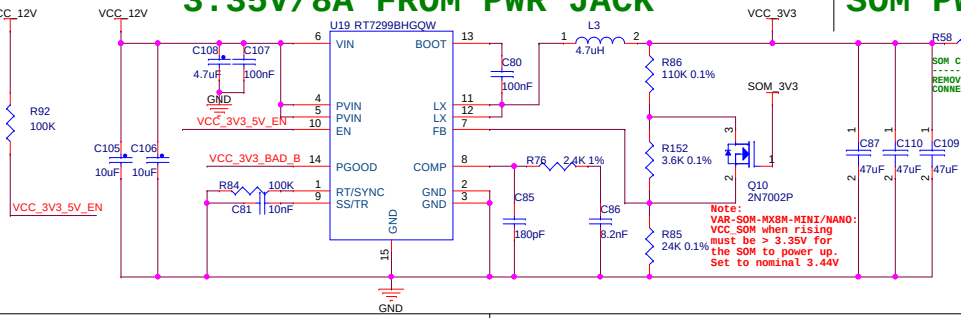

For supporting MX6 eMMC boot option:
Remove R9
Assemble R56,R11
Note: Normal configuration is with NAND



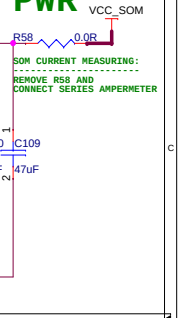

## 5V/8A FROM PWR JACK



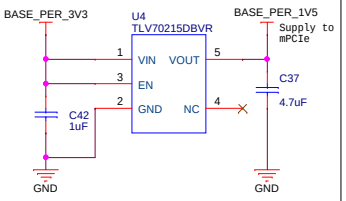

## 3.35V/8A FROM PWR JACK



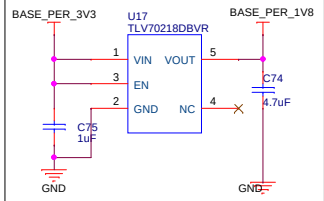

## SOM PWR



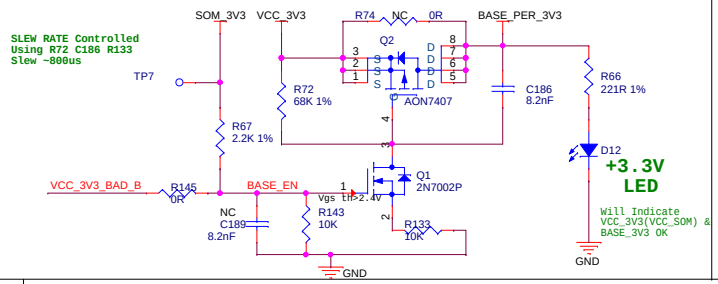

## 1.5V BASE



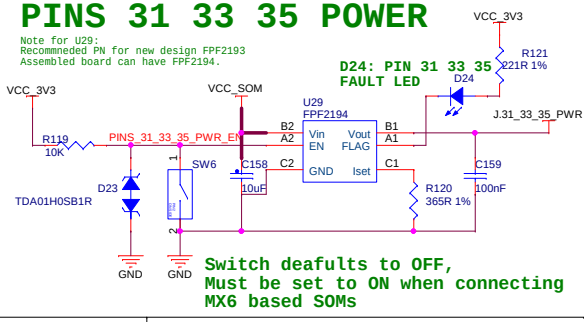

## 1.8V BASE



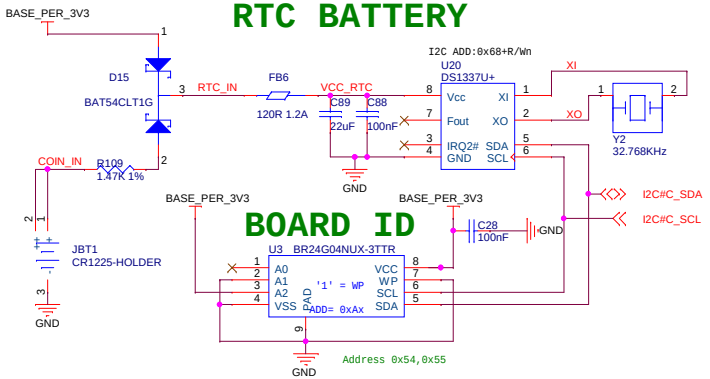

## BASE_3V3



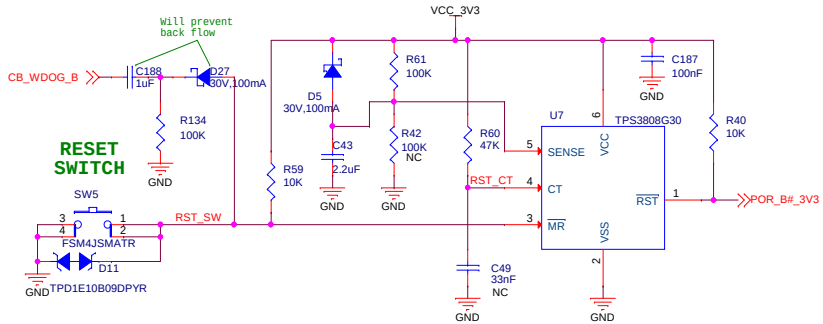

## PINS 31 33 35 POWER



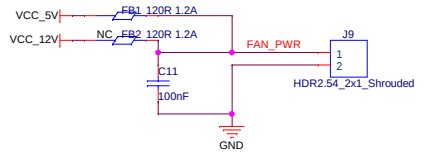

## RTC BATTERY




## RESET CIRCUITRY




## FAN PWR

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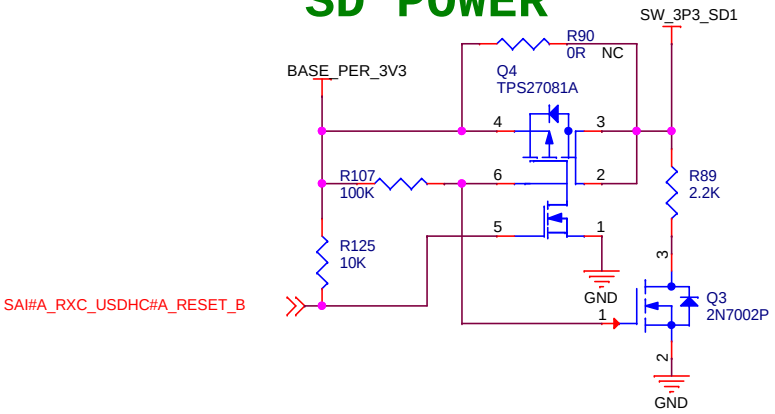
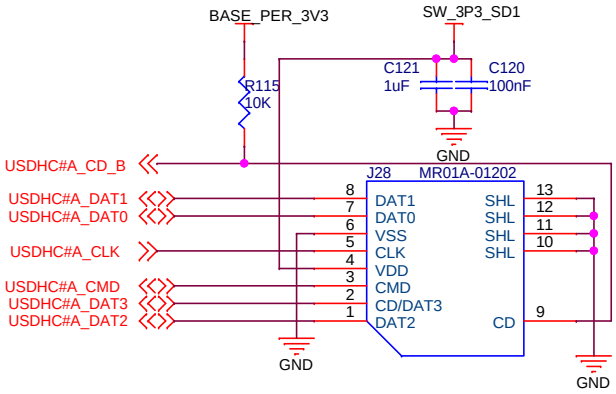
|---|---|---|---|
| Title: 05. Power,Reset,Boot,RTC,EEPROM | | | |
| Size: A3 | Document Number | Project | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 3 of 24 | |

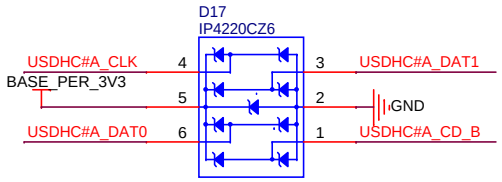
# 06. uSD, Audio,CAN

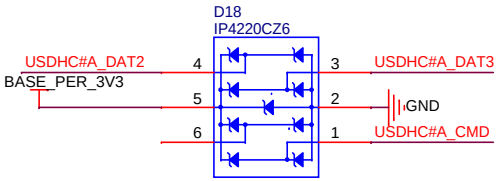
## SD POWER



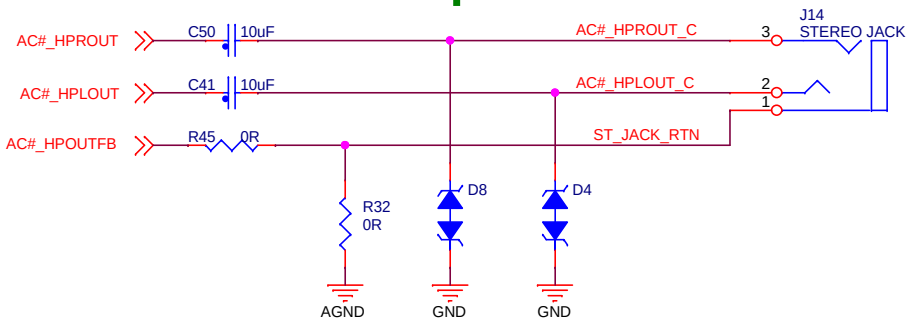

## uSD CARD



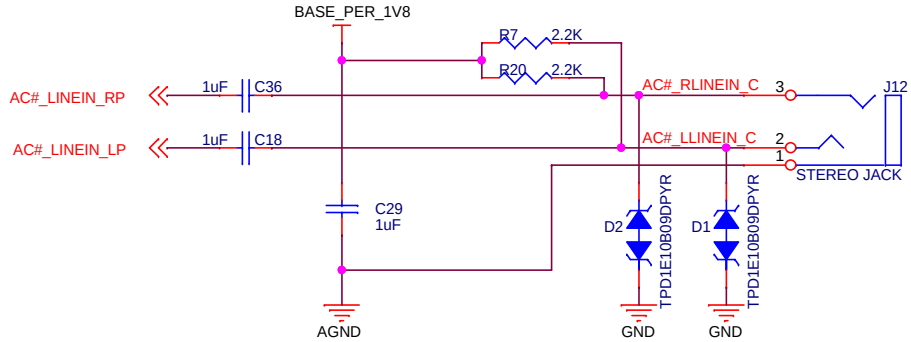



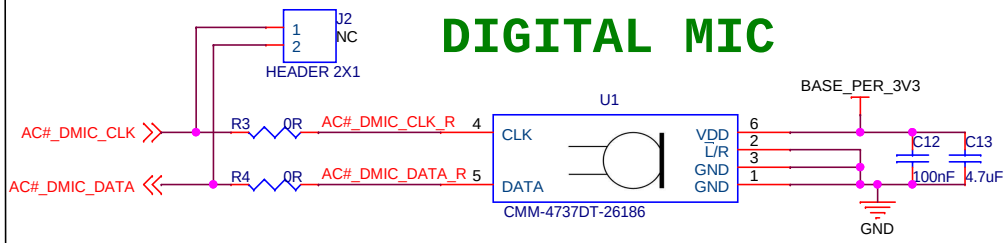

## Headphones



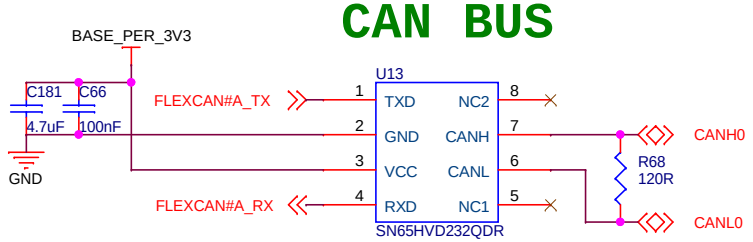

## Line In




## DIGITAL MIC




## CAN BUS

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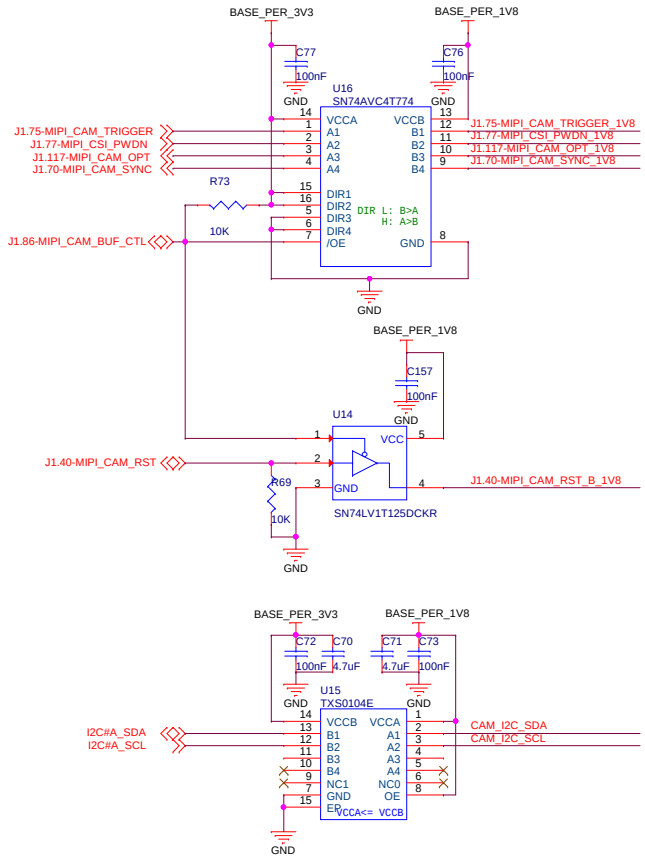
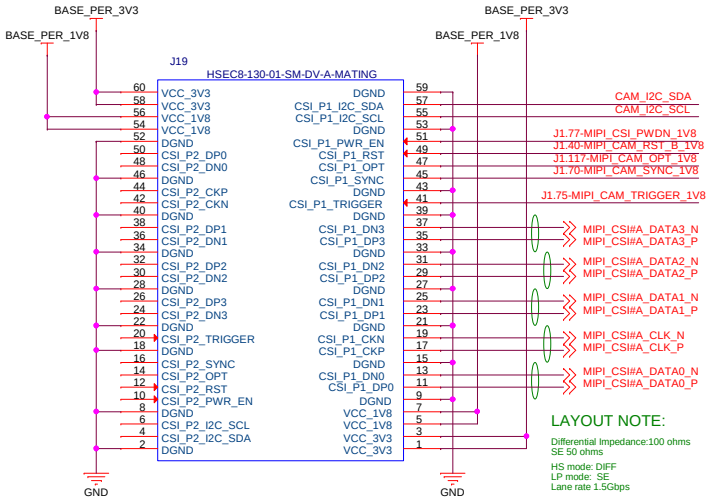
|---|---|---|---|
| Title: 06. uSD, Audio,CAN | | | |
| Size: A4 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.2 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 4 of 24 | |

# 07. Camera, HDMI, DP




## MIPI-CSI



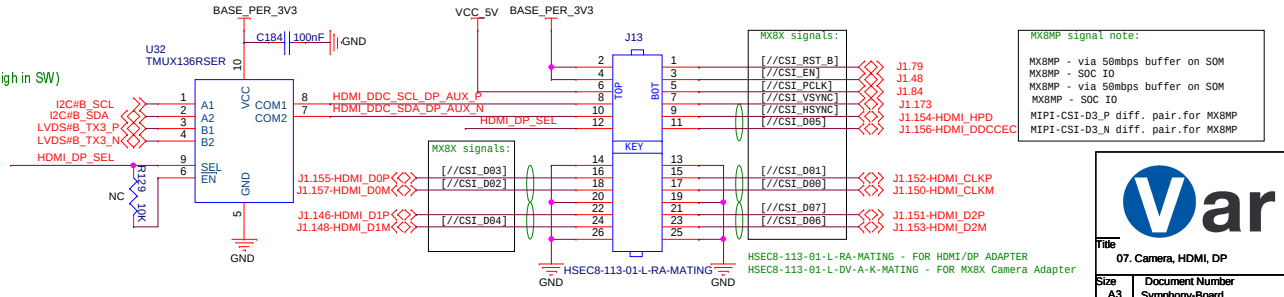

**Note:**
**MIPI_CSI#A signals appears on bottom side of J19 as of SymphonyBoard V1.4.**

## J13: MX6/MX8-HDMI, MX8-DP, MX8X-CSI, MX8MP-2nd MIPI-CSI

Note for U32 (analog switch):
Switch is to enable support for the following adapters:
Parallel camera, HDMI, DisplayPoty and second MIPI-CSI .

Switch select controlled on adaptor will select between:
1) I2C#B which can export
VAR-SOM-MX8X: I2C3 Used by parallel camera
VAR-SOM-MX8: HDMI DDC Used by HDMI (GPIO1_22 in should be set High in SW)
2) LVDS#B_TX3 which can export:
VAR-SOM-MX8(DP assembly option): HDMI AUX used by DP

Switch can be omitted when designing for only one of the the above interfaces.

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|---|---|---|---|
| Title: 07. Camera, HDMI, DP | | | |
| Size: A3 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 5 of 24 | |

# 08. Ethernet

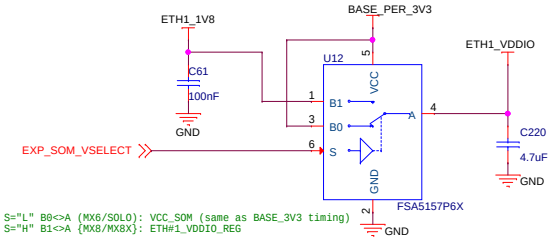
## Header/Stub isolation resistors

| | | | | | | |
|---|---|---|---|---|---|---|
| J1.54-ENET1_RGMII_RXD3 | ENET1_RGMII_RXD3 | NC | R173 | 0R | J1.54_EXT |
| J1.71-ENET1_RGMII_RXD2 | ENET1_RGMII_RXD2 | NC | R174 | 0R | J1.71_EXT |
| J1.122-ENET1_RGMII_RXD0 | ENET1_RGMII_RXD0 | NC | R175 | 0R | J1.122_EXT |
| J1.81-ENET1_RGMII_RXD1 | ENET1_RGMII_RXD1 | NC | R176 | 0R | J1.81_EXT |
| J1.120-ENET1_RGMII_RX_CTL | ENET1_RGMII_RX_CTL | NC | 49.9R 1% | R151 | J1.120_EXT |
| J1.57-ENET1_RGMII_RXC | ENET1_RGMII_RXC | | | | |
| | ENET1_RGMII_RXC_AR | NC | 1.0K 1% | R136 | J1.57_EXT |
| J1.113-ENET1_RGMII_TX_CTL | ENET1_RGMII_TX_CTL | NC | R179 | 0R | J1.113_EXT |
| J1.96-ENET1_RGMII_TXC | ENET1_RGMII_TXC | NC | R180 | 0R | J1.96_EXT |
| J1.73-ENET1_RGMII_TXD0 | ENET1_RGMII_TXD0 | NC | R181 | 0R | J1.73_EXT |
| J1.177-ENET1_RGMII_TXD1 | ENET1_RGMII_TXD1 | NC | R182 | 0R | J1.177_EXT |
| J1.56-ENET1_RGMII_TXD2 | ENET1_RGMII_TXD2 | NC | R177 | 0R | J1.56_EXT |
| J1.55-ENET1_RGMII_TXD3 | ENET1_RGMII_TXD3 | NC | R178 | 0R | J1.55_EXT |

Note:
Customer requiring usage of J30 header (located on bottom side) should assemble these resistors if not assembled by default

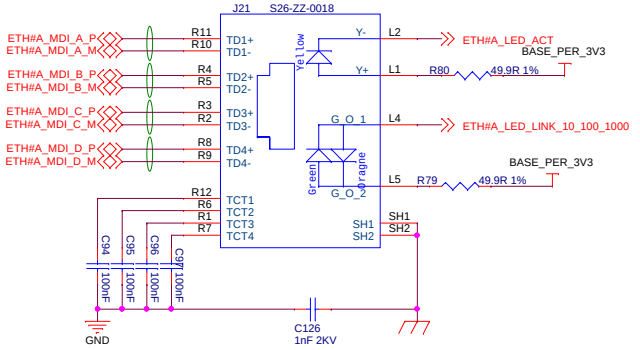
## VDD_ENET for SOM-MX8/MX8X/MX8MP

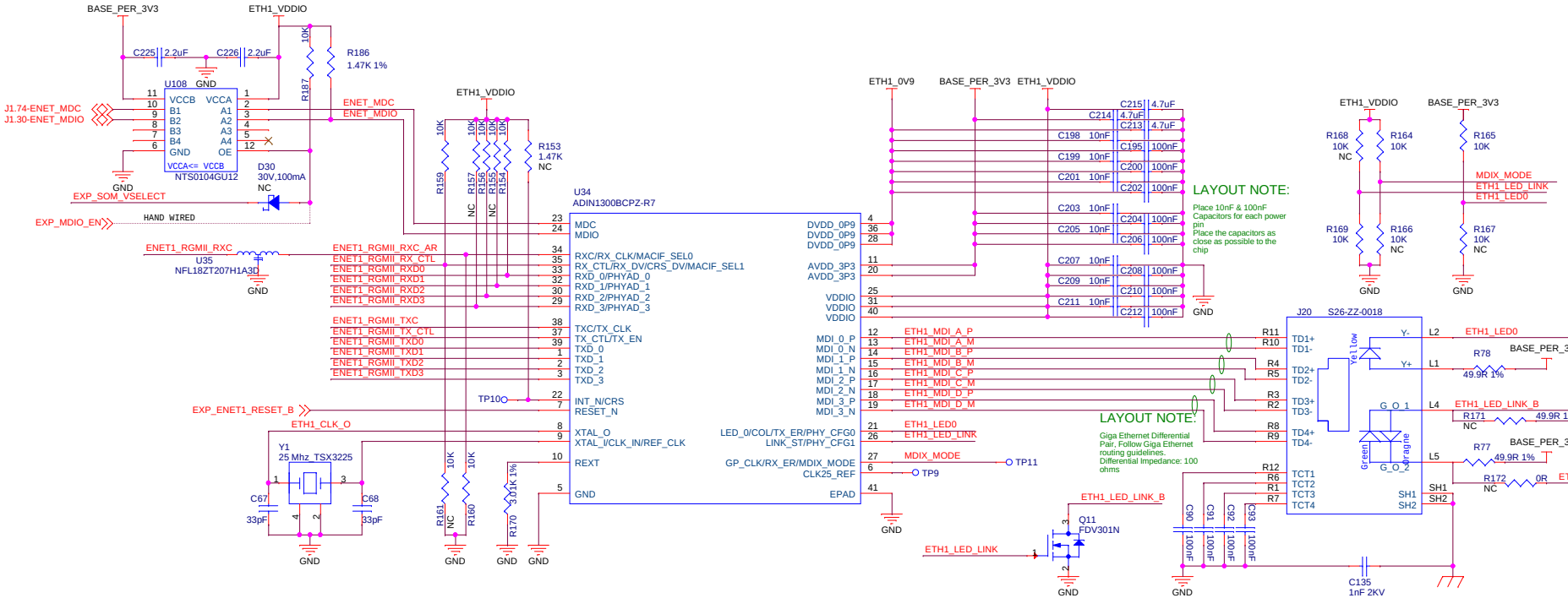
Power for ENET1_RGMII IOs on SOM power fed from pin J1.38
For specific SOM listed above, requiring second ETH port on ENET1 this power should be set to 1.8V source from U11 PHY

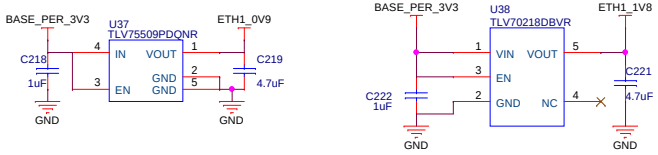



## Gigabit Ethernet (Internal)

LAYOUT NOTE: Giga Ethernet Differential Pair, Follow Giga Ethernet routing guidelines. Differential Impedance: 100 ohms




Variscite

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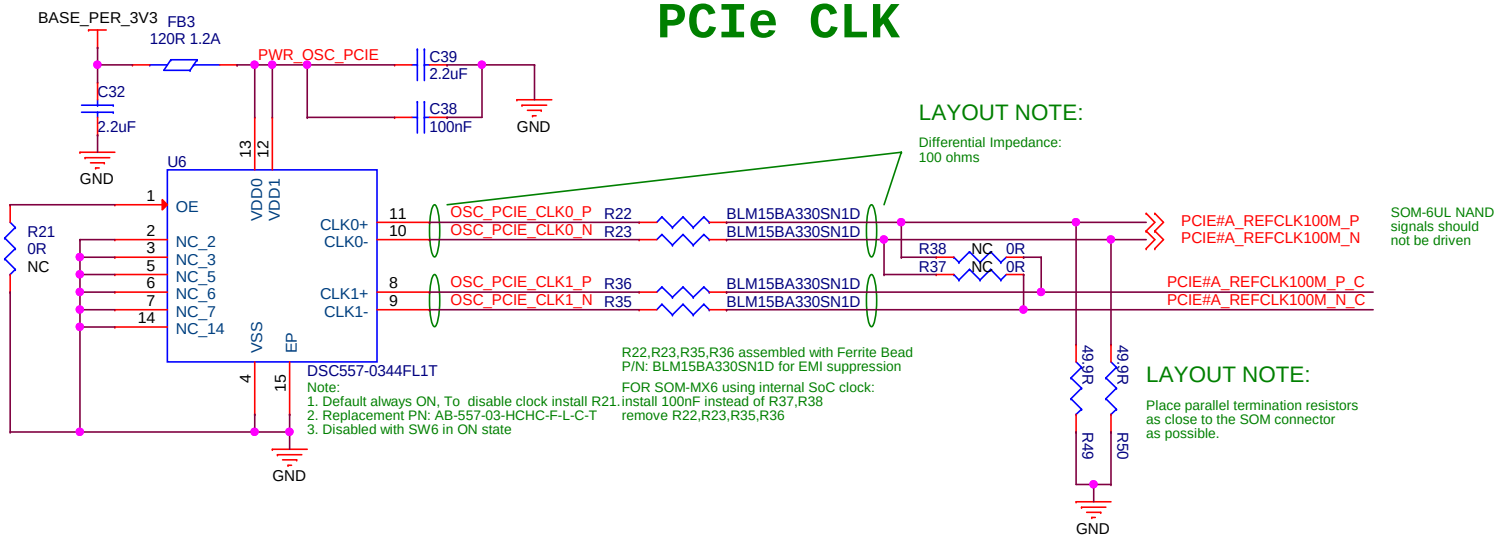
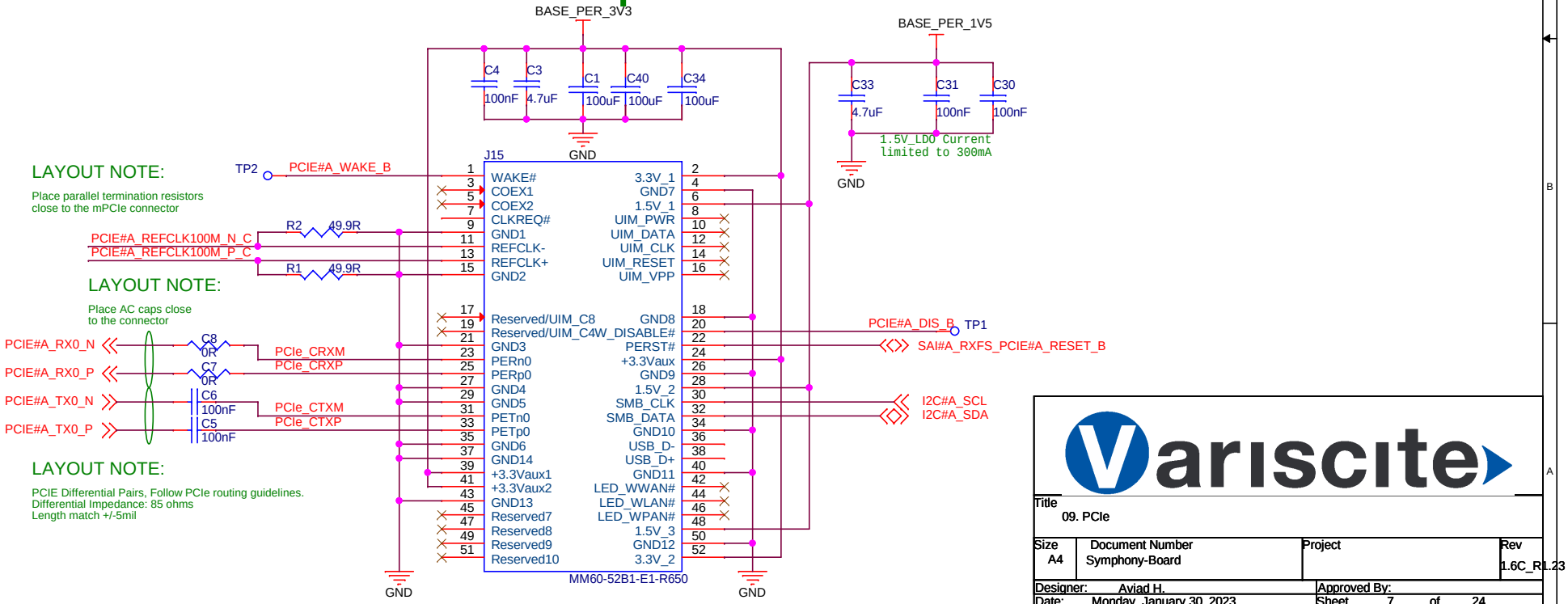
|---|---|---|---|
| Title: 08. Ethernet | | | |
| Size: A3 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 6 of 24 | |

# 09. PCIe

## PCIe CLK




## mPCIexp

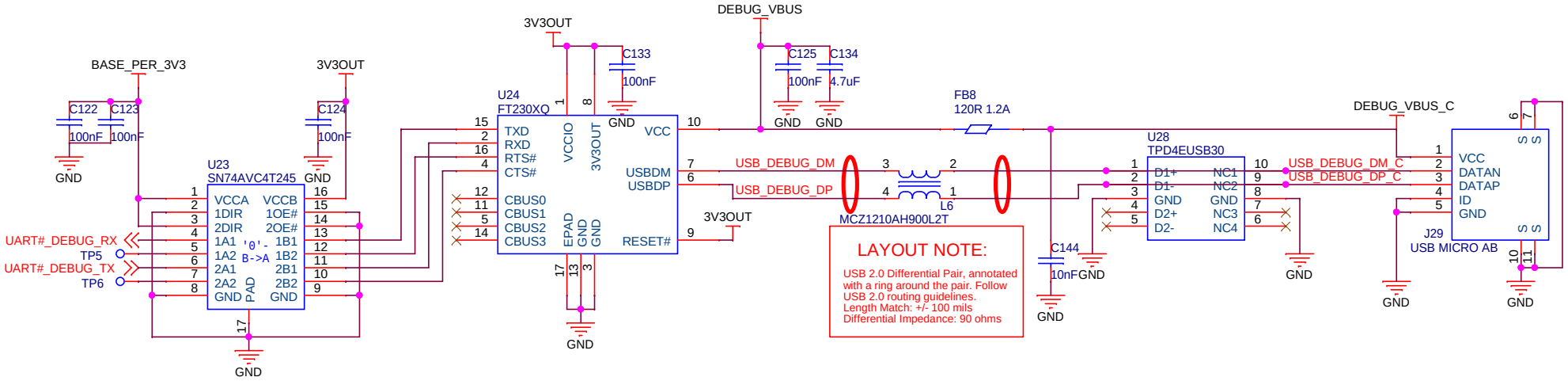



Variscite

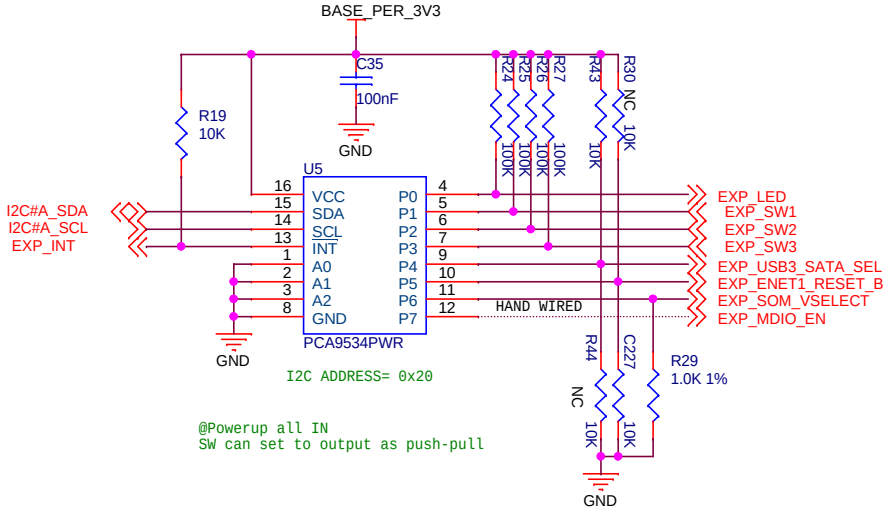
| | | | |
|---|---|---|---|
| Title: 09. PCIe | | | |
| Size: A4 | Document Number: Symphony-Board | Project: | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 7 of 24 | |

# 10. Debug, GPIO Exp, Buttons, LED

## USB UART DEBUG

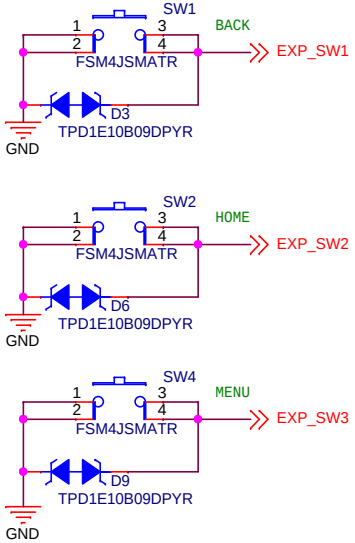



## GPIO EXPANDER

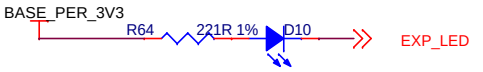



In VAR-SOM-MX8 SOM pin 29 EXP_INT is referenced to 1.8V.
When using pin 29 as an input pin driven by higher input voltage,
use an external voltage divider or limit the current using a series resistor to a maximum of 1mA.

## GP BUTTON




## GP LED

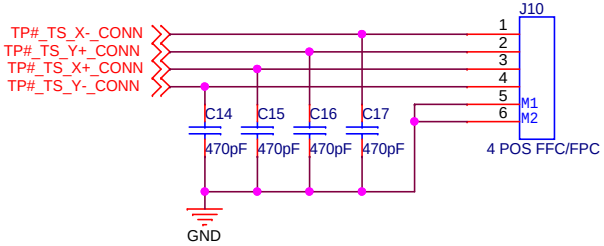



Variscite

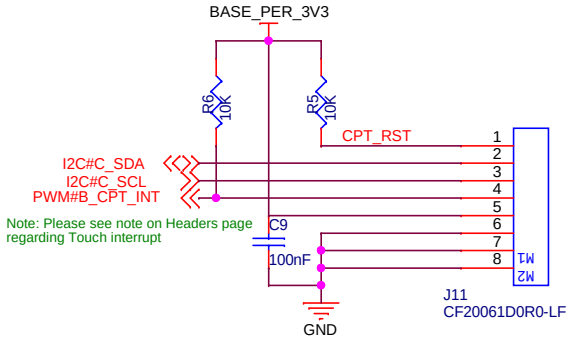
| | | | |
|---|---|---|---|
| Title: 10. Debug, GPIO Exp, Buttons, LED | | | |
| Size: A4 | Document Number: Symphony-Board | Project: | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 8 of 24 | |

# 11. LVDS, DSI, Touch

## RESISTIVE TOUCH

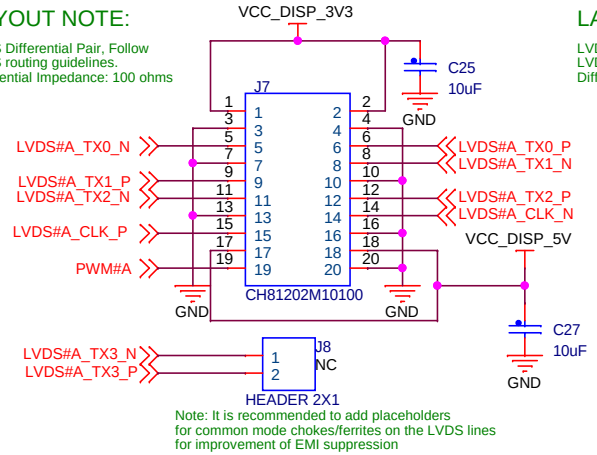



## CAPACITIVE TOUCH




## LVDS DISPLAY A

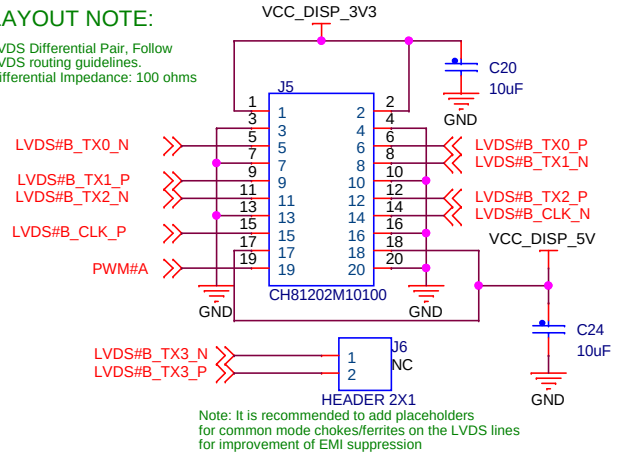
LAYOUT NOTE:
LVDS Differential Pair, Follow LVDS routing guidelines.
Differential Impedance: 100 ohms




Note: It is recommended to add placeholders for common mode chokes/ferrites on the LVDS lines for improvement of EMI suppression

## LVDS DISPLAY B

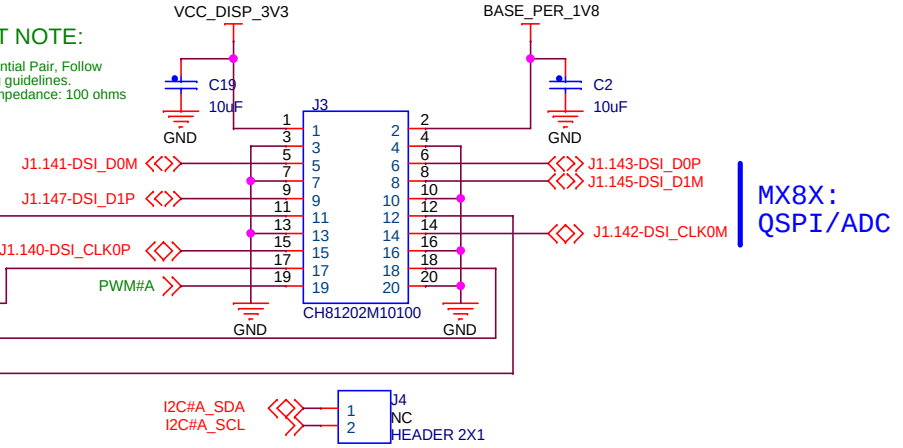
LAYOUT NOTE:
LVDS Differential Pair, Follow LVDS routing guidelines.
Differential Impedance: 100 ohms




Note: It is recommended to add placeholders for common mode chokes/ferrites on the LVDS lines for improvement of EMI suppression

## MIPI DSI DISPLAY

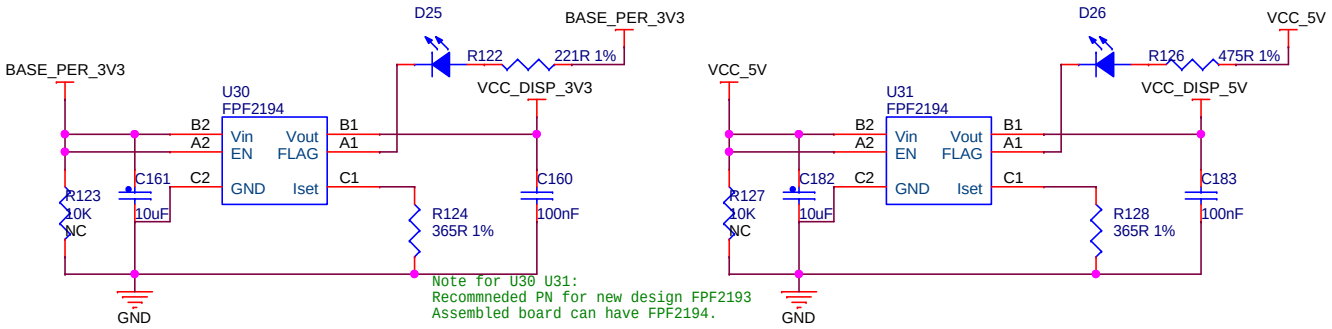
LAYOUT NOTE:
LVDS Differential Pair, Follow LVDS routing guidelines.
Differential Impedance: 100 ohms




See note in : "Headers" Page 14

J1.57_EXT
CB_WDOG_B
J1.82-USB#A_HOST_PWR
CB-USB#A_HOST_PWR

## Short circuit protection



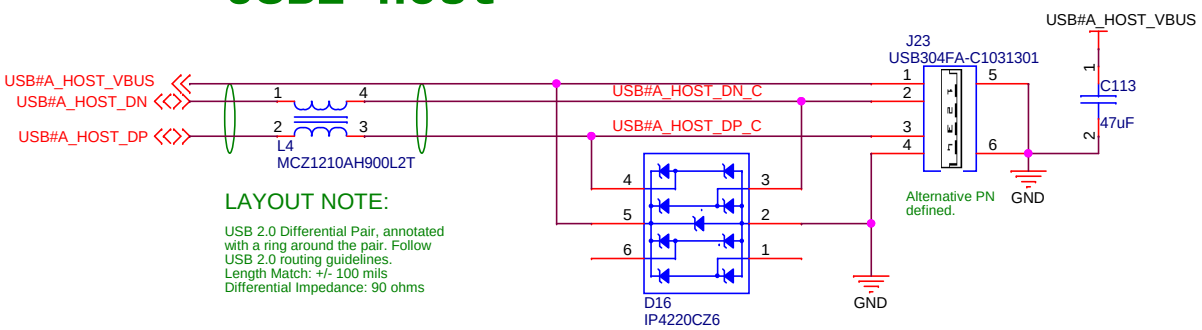

Note for U30 U31:
Recommneded PN for new design FPF2193
Assembled board can have FPF2194.

Variscite

| | | | |
|---|---|---|---|
| Title: 11. LVDS, DSI, Touch | | | |
| Size: A4 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.2 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 9 of 24 | |

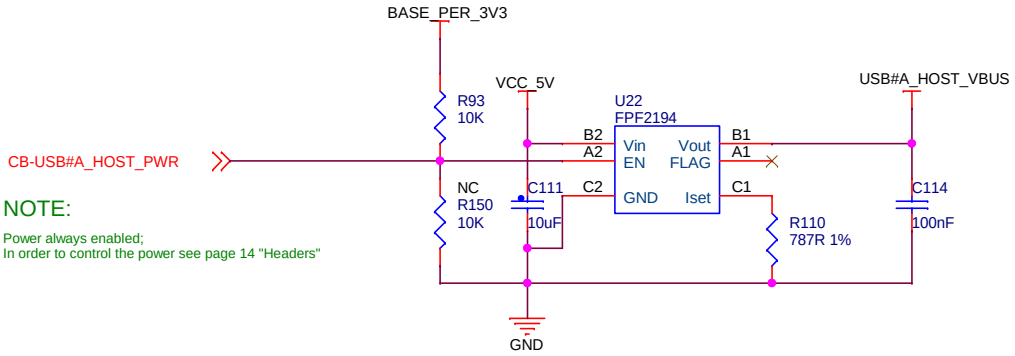
# 12. USB2 Host

## USB2 Host




LAYOUT NOTE:

USB 2.0 Differential Pair, annotated with a ring around the pair. Follow USB 2.0 routing guidelines.
Length Match: +/- 100 mils
Differential Impedance: 90 ohms




NOTE:

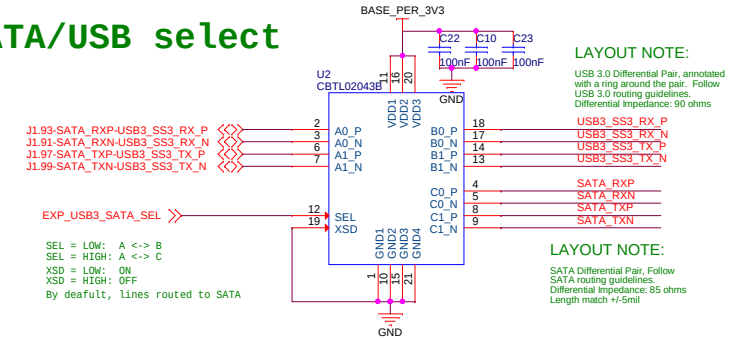
Power always enabled;
In order to control the power see page 14 "Headers"

Variscite

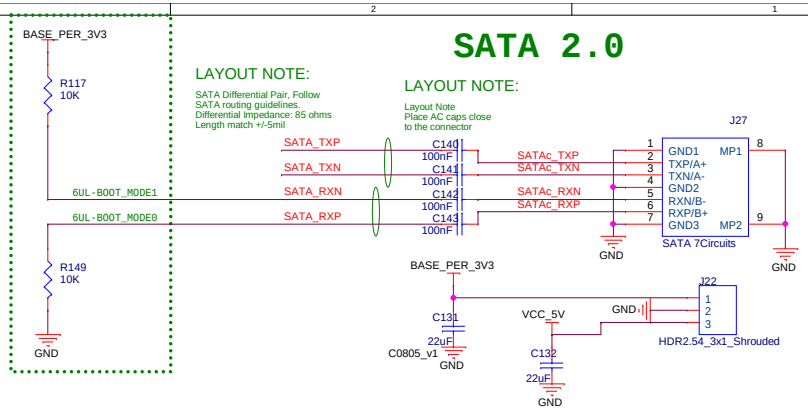
| | | | |
|---|---|---|---|
| Title: 12. USB2 Host | | | |
| Size: A4 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.2 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 10 of 24 | |

# 13. USB3, uSATA

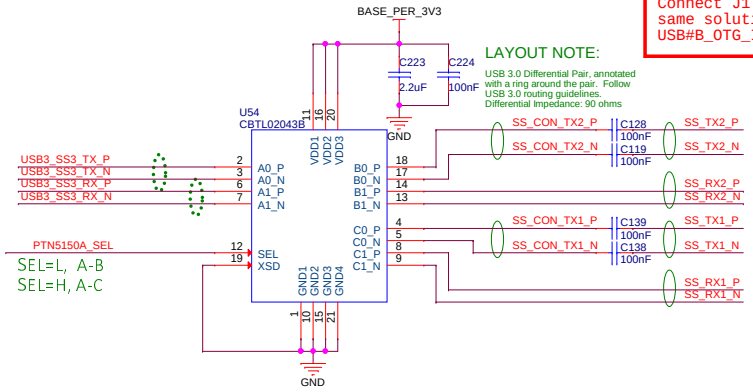
## SATA/USB select




## SATA 2.0

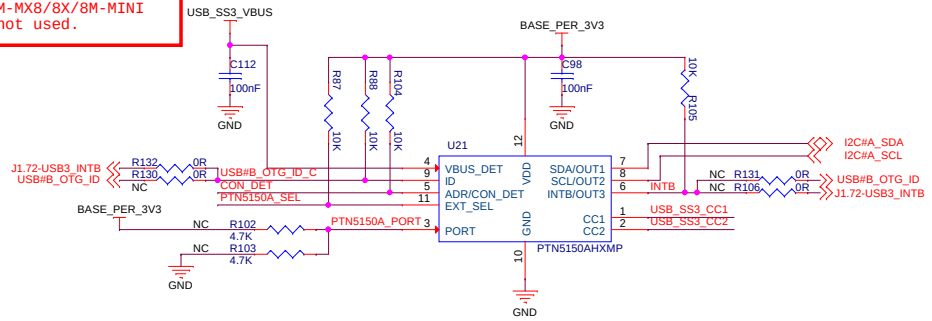



## USB TYPE C Circuitry

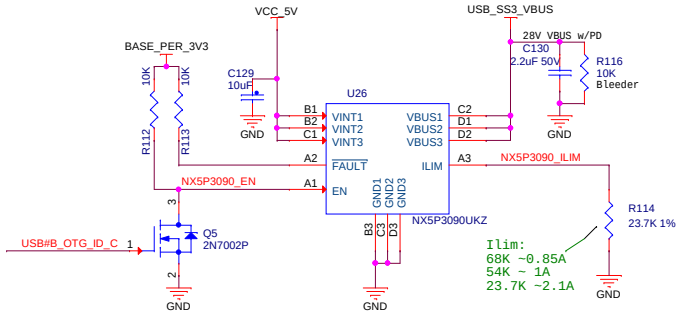



Usage of native USB_ID for iMX8MP requires patches not included in the formal release, pull up should be to 1.8V.
For simple OTG function for VAR-SOM-MX8M-PLUS Connect J1.72 GPIO to U22 PTN ID output - same solution appIies also for VAR-SOM-MX8/8X/8M-MINI USB#B_OTG_ID can be left floating if not used.

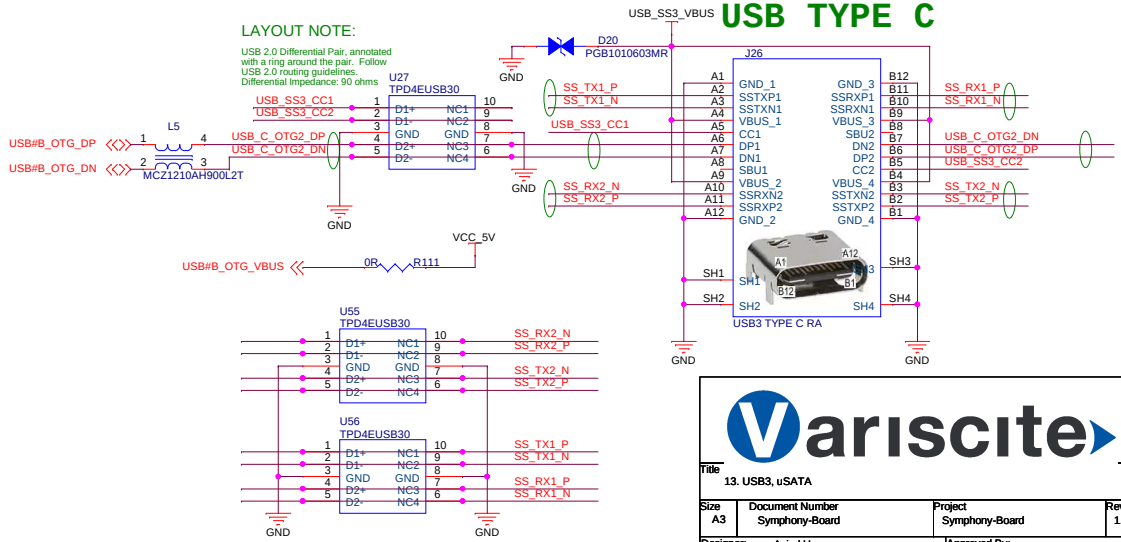
## Config Channel Logic Detection & Indication of Plug Orientation




## 5V Source Load Switch




## USB TYPE C

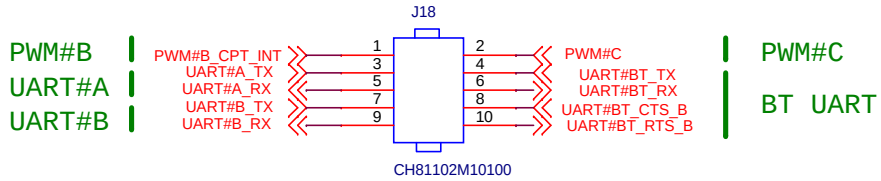


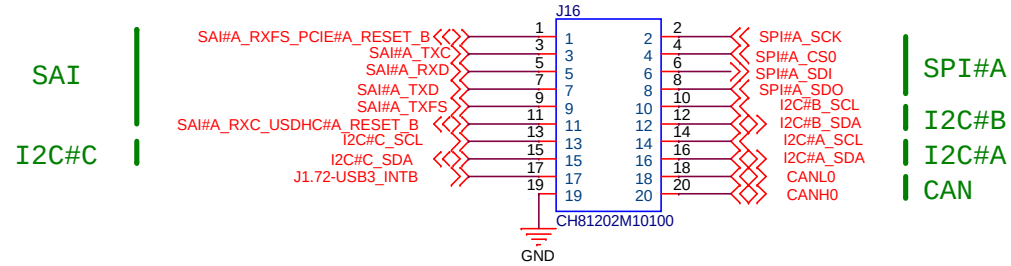

Variscite

| | | | |
|---|---|---|---|
| Title: 13. USB3, uSATA | | | |
| Size: A3 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 11 of 24 | |

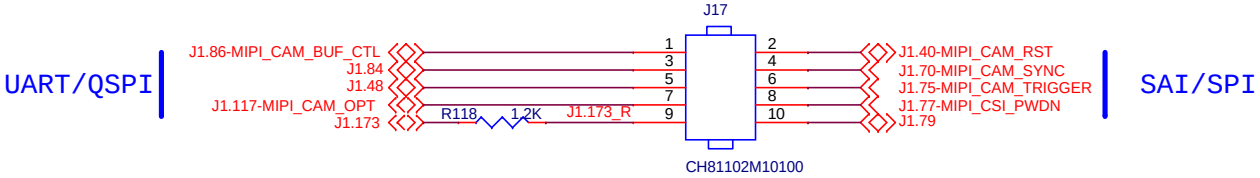
# 14. Headers

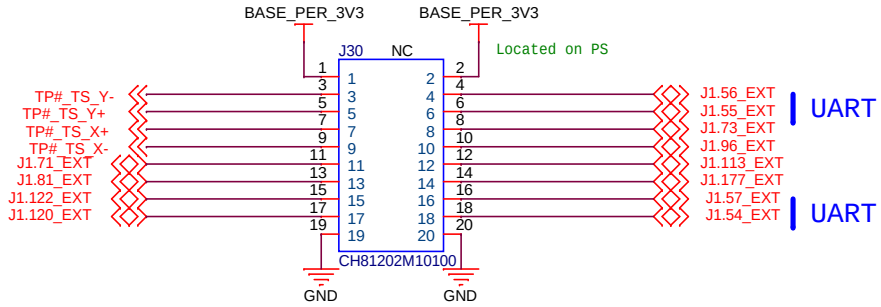
## Headers arranged for compatible alternate function



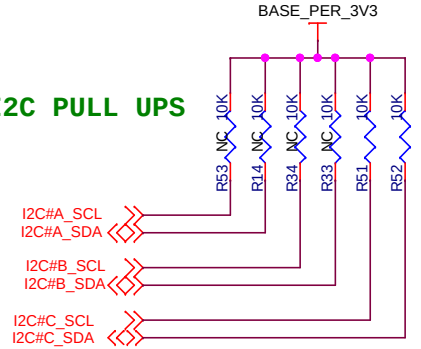

## Headers arranged for partial compatible alternate function




**For complete header alternate function refer to "VAR-SOMs_Compatibility_and_Pinout.XLS " located at: ftp://ftp.variscite.com/SOM_Compatibility**

## I2C PULL UPS




I2C_A has internal pulls in Camera buffer

I2C_B has internal pulls in MX6/MX8/MX8X/MX8MP SOMs.
For MX8MM/MX8MN/6UL SOMs - external pull ups should be added.

## COLD RESET ON WDOG_B EVENT for MX6/SOLO and 6UL SOMs

Listed above SOMs require short on headers to get "reboot" to function.
For all other watch dog looped on SOM

| | | |
|---|---|---|
| CB_WDOG_B | Symphony Board reset circuitry watch dog input | See J3.17 |
| J1.57_EXT | SOM_6UL: PIN57 WDOG1_B | See J3.11 |
| PWM#B_CPT_INT | MX6/SOLO: PIN68 WDOG1_B | See J18.1 |

## USB#A Host VBUS power control

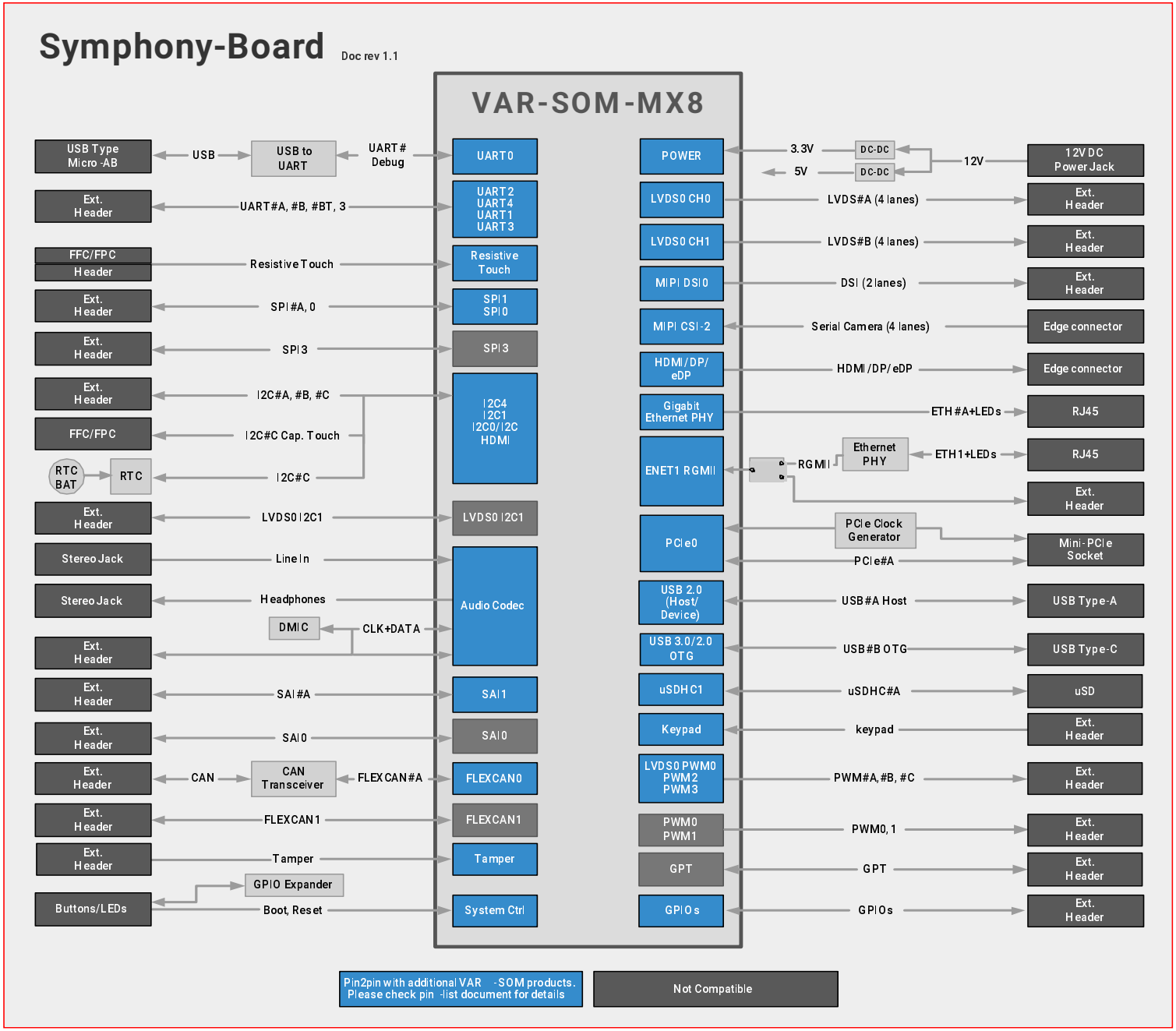
In order to control the USB#A HOST VBUS power a short is required:

| | | |
|---|---|---|
| CB-USB#A_HOST_PWR | Symphony Board U22 control input | See J3.12 |
| J1.82-USB#A_HOST_PWR | | See J3.18 |

Variscite

| | | | |
|---|---|---|---|
| Title: 14. Headers | | | |
| Size: A4 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.2 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 12 of 24 | |

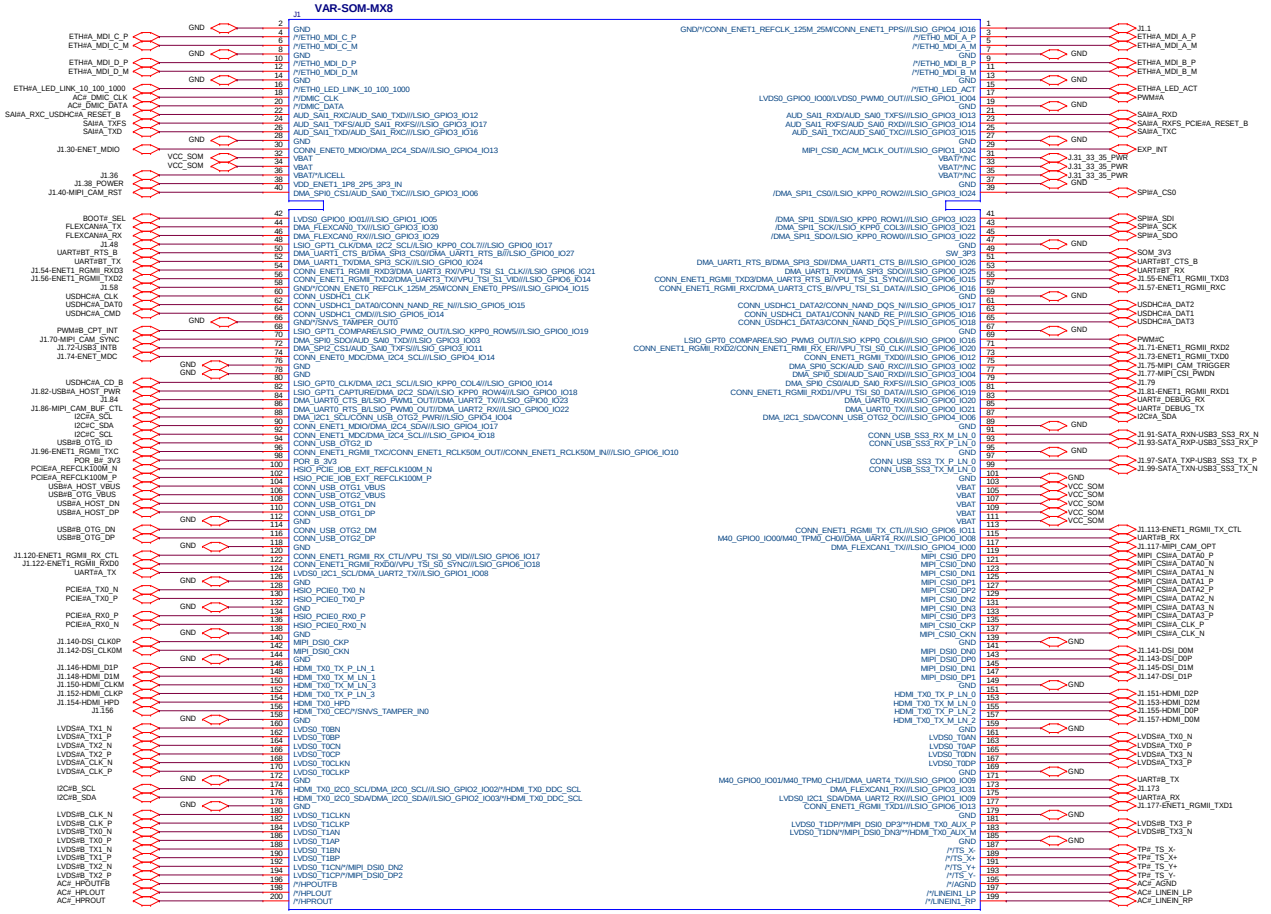
# 02. Block Diagram VAR-SOM-MX8




Variscite

| | | | |
|---|---|---|---|
| Title: 02. Block Diagram VAR-SOM-MX8 | | | |
| Size: A3 | Document Number: Symphony-Board | Project: Symphony-Board | Rev: 1.6C_R1.23 |
| Designer: Aviad H. | | Approved By: | |
| Date: Monday, January 30, 2023 | | Sheet 15 of 24 | |

# 04. VAR-SOM-MX8 Connector




| Title | |
|---|---|
| | 04. VAR-SOM-MX8 Connector |

| Size | Document Number | Project | Rev |
|---|---|---|---|
| A2 | Symphony-Board | Symphony-Board | 1.6C_R1.23 |

| Designer: | Awad H. | Approved By: | |
|---|---|---|---|
| Date: | Monday, January 30, 2023 | Sheet 16 of 24 | |