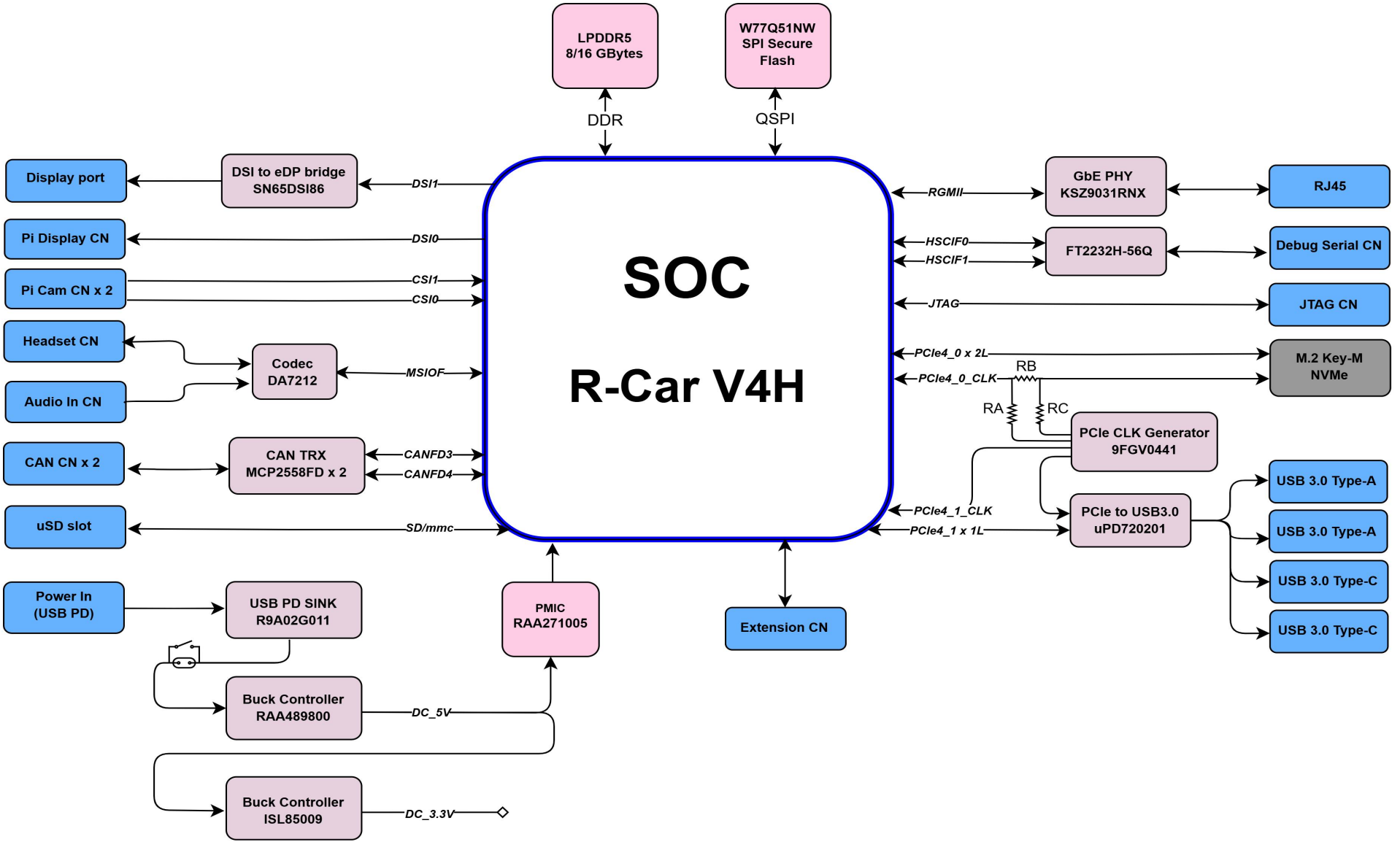
Sparrow Hawk

P01: Title
P02: Block Diagram
P03: POWER/I2C_RAIL
P04: R-Car V4H_EtherAVB
P05: R-Car V4H_INT/I2C
P06: R-Car V4H_MMC/QSPI
P07: R-Car V4H_PCIE/CSI
P08: R-Car V4H_LPDDR5_0_1
P09: R-Car V4H_LPDDR5_2_3
P10: R-Car V4H_POWER1
P11: R-Car V4H_POWER2
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P17: uSD-Slot
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P19: POWER_PMIC
P20: USB_PD Powr Input
P21: POWER_IO
P22: Ether_AVB0
P23: JTAG_DEBUG
P24: MODE SWITCH
P25: PCIe to USB
P26: PCIe_CLK_M.2
P27: DSI_to_DP
P28: CANFD_IF
P29: CSI_IF_CN
P30: Audio_Codec
P31: IO_FAN
P32: Revision History-1
P33_Revision History-2
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RETRONIX

Title: Title		
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Sparrow Hawk Block Diagram



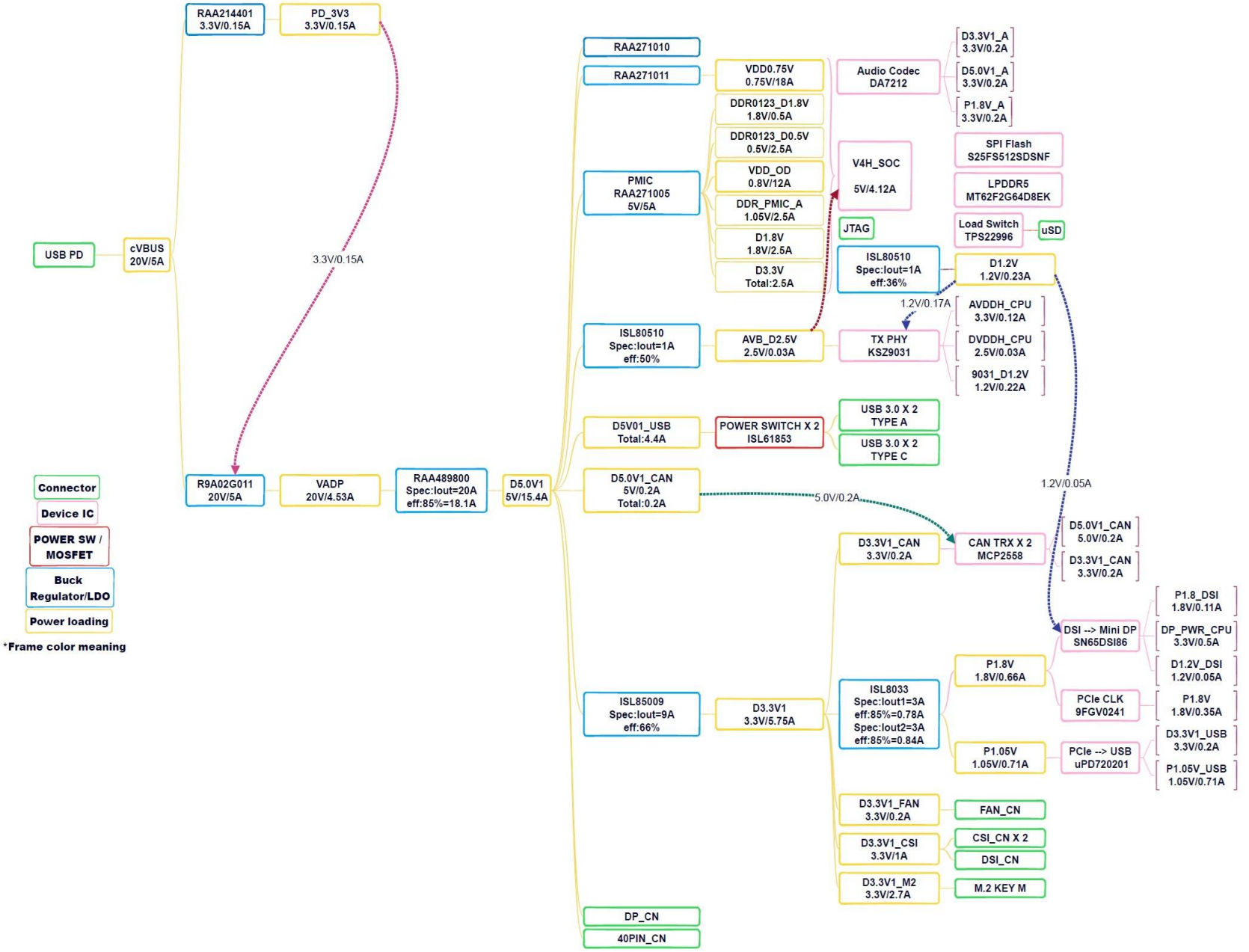
RETRONIX

Block Diagram

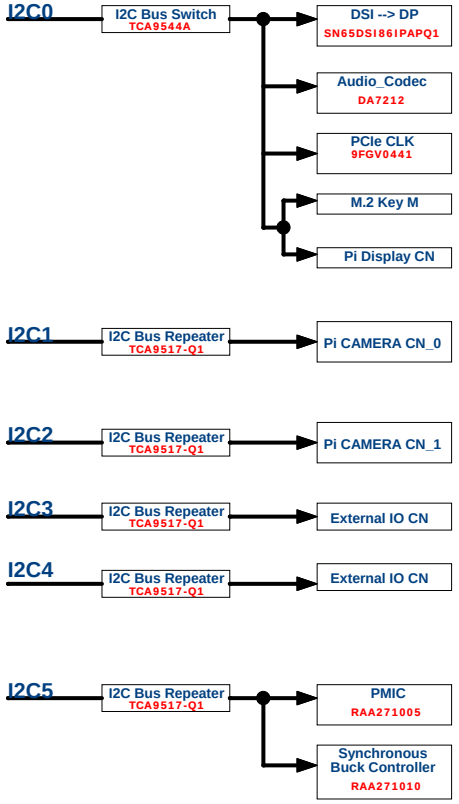
Sparrow Hawk

V1.3

POWER_RAIL



I2C_RAIL



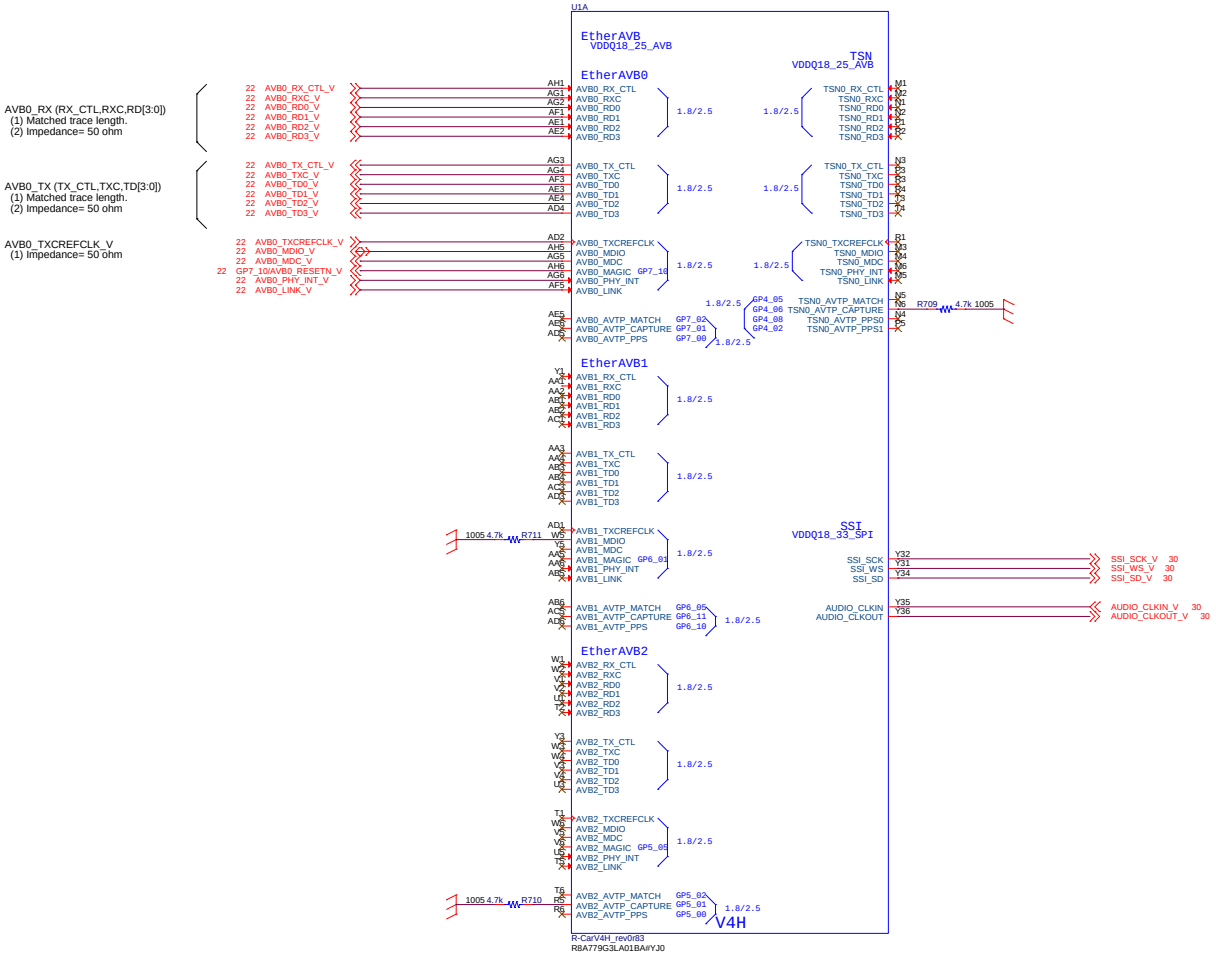
RETRONIX

POWER/ I2C _RAIL

Sparrow Hawk

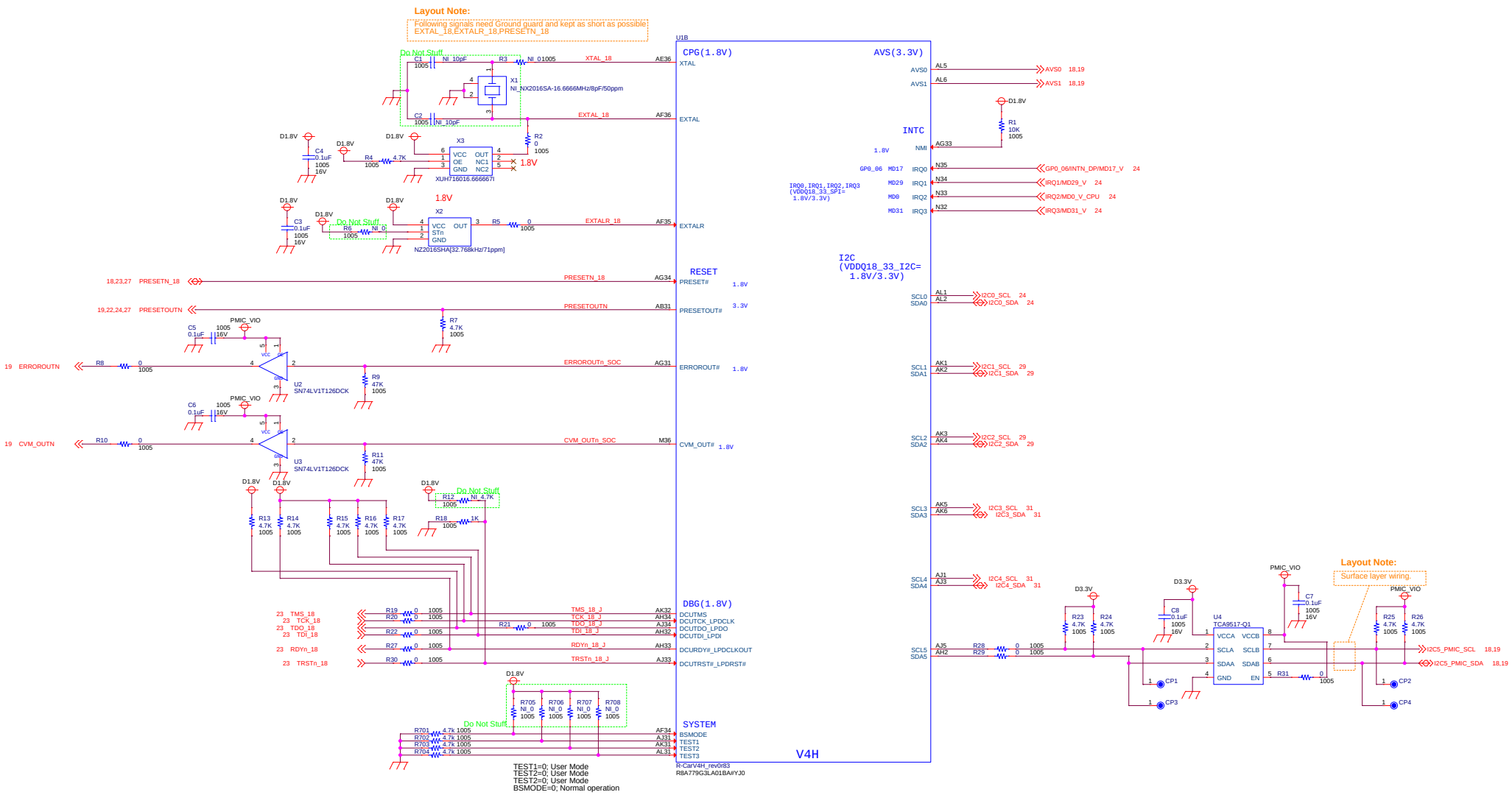
V1.3

R-Car V4H_EtherAVB



RETRONIX			
Title: R-Car V4H_EtherAVB			
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R-Car V4H_INT_I2C



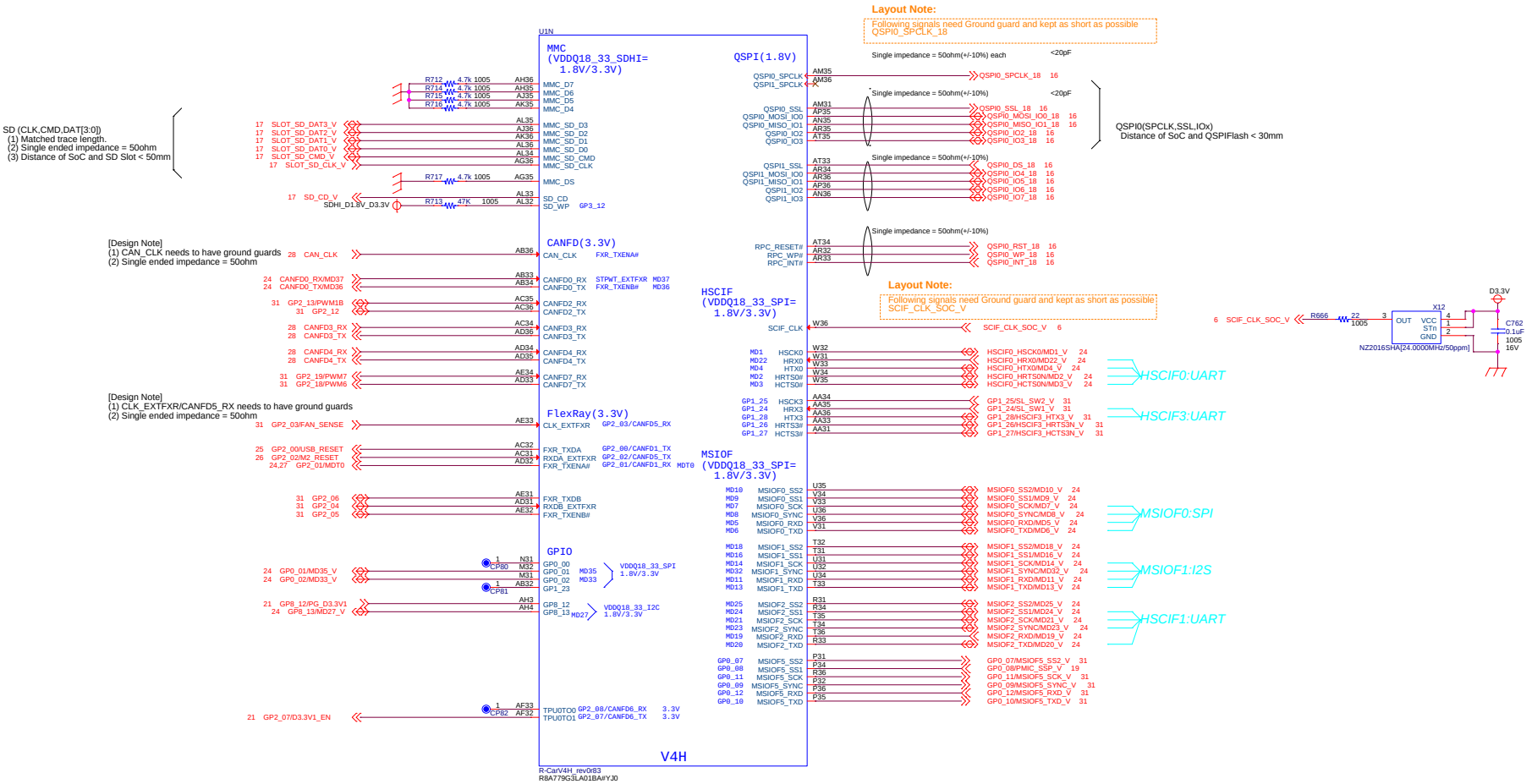
RETRONIX

Title: R-Car V4H_INT_I2C

Size	Document Number	Rev
A2	Sparrow Hawk	V1.3

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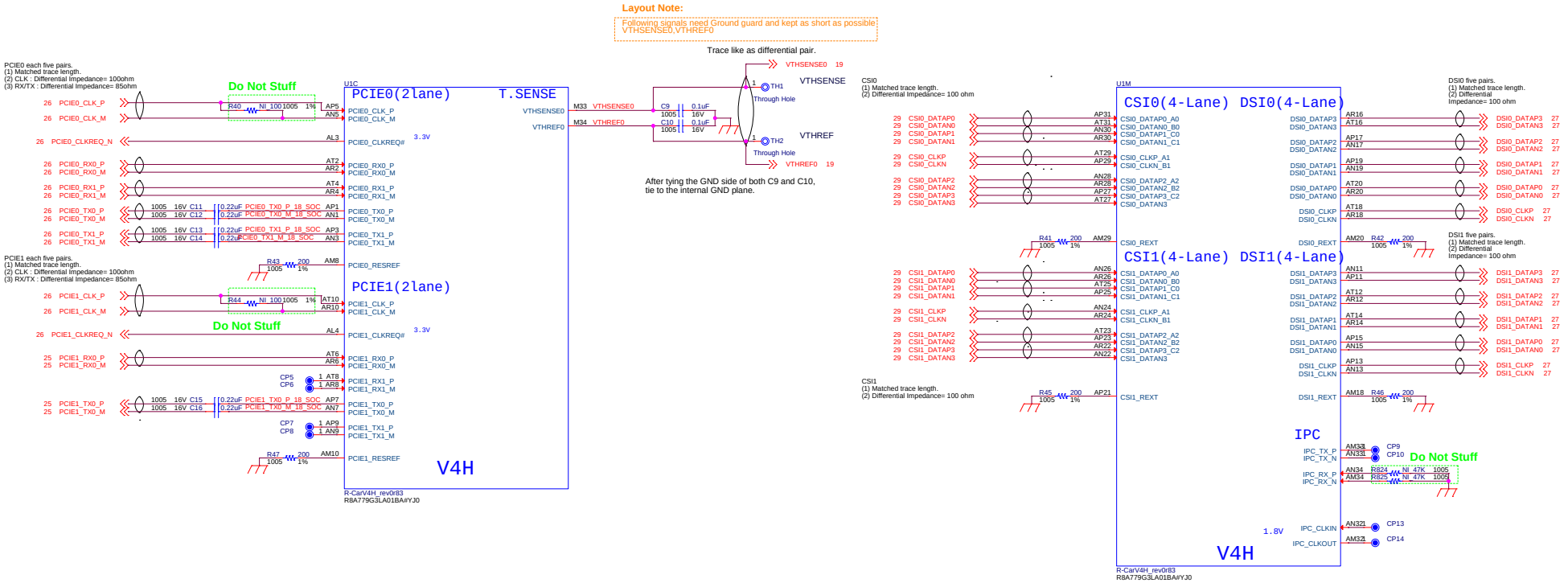
R-Car V4H_MMC_QSPI



RETRONIX

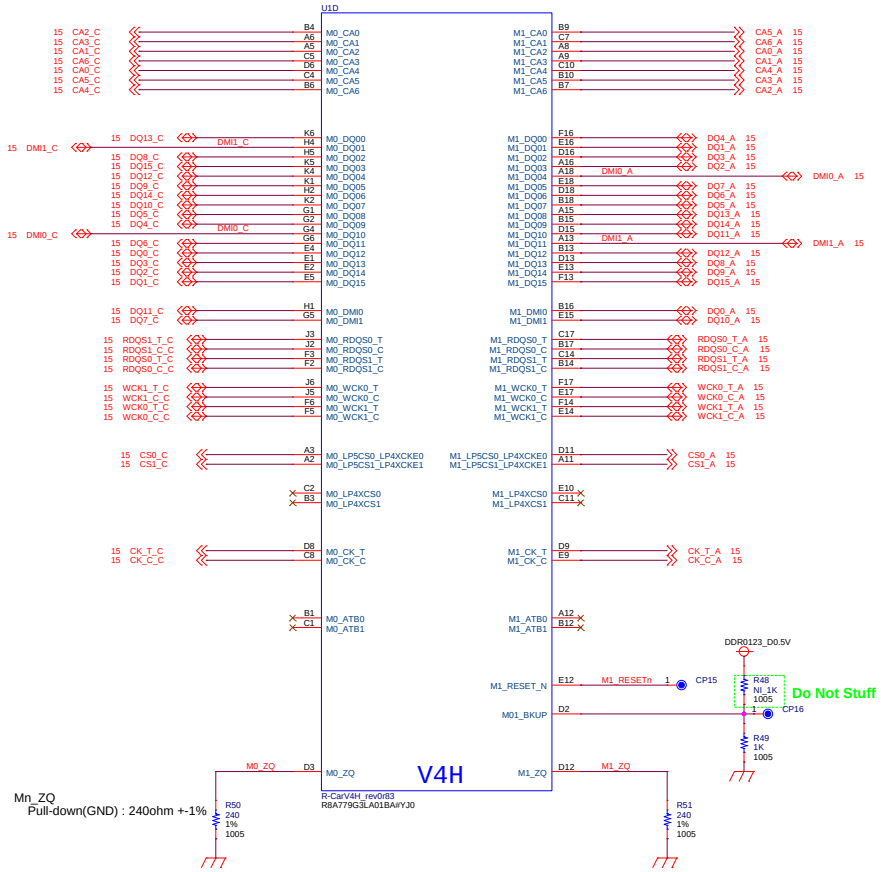
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Size A2	Document Number Sparrow Hawk		Rev V1.3
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R-Car V4H_PCIE_CSI



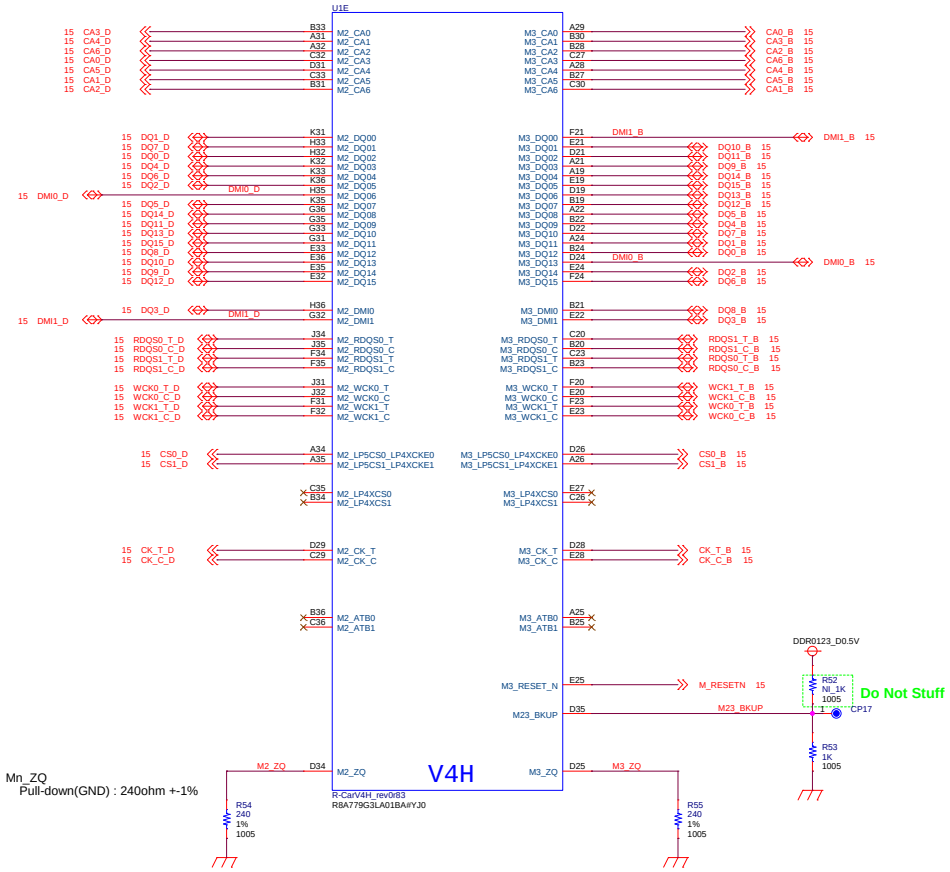
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Title: R-Car V4H_PCIE_CSI			
Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
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R-Car V4H_LPDDR5_0_1



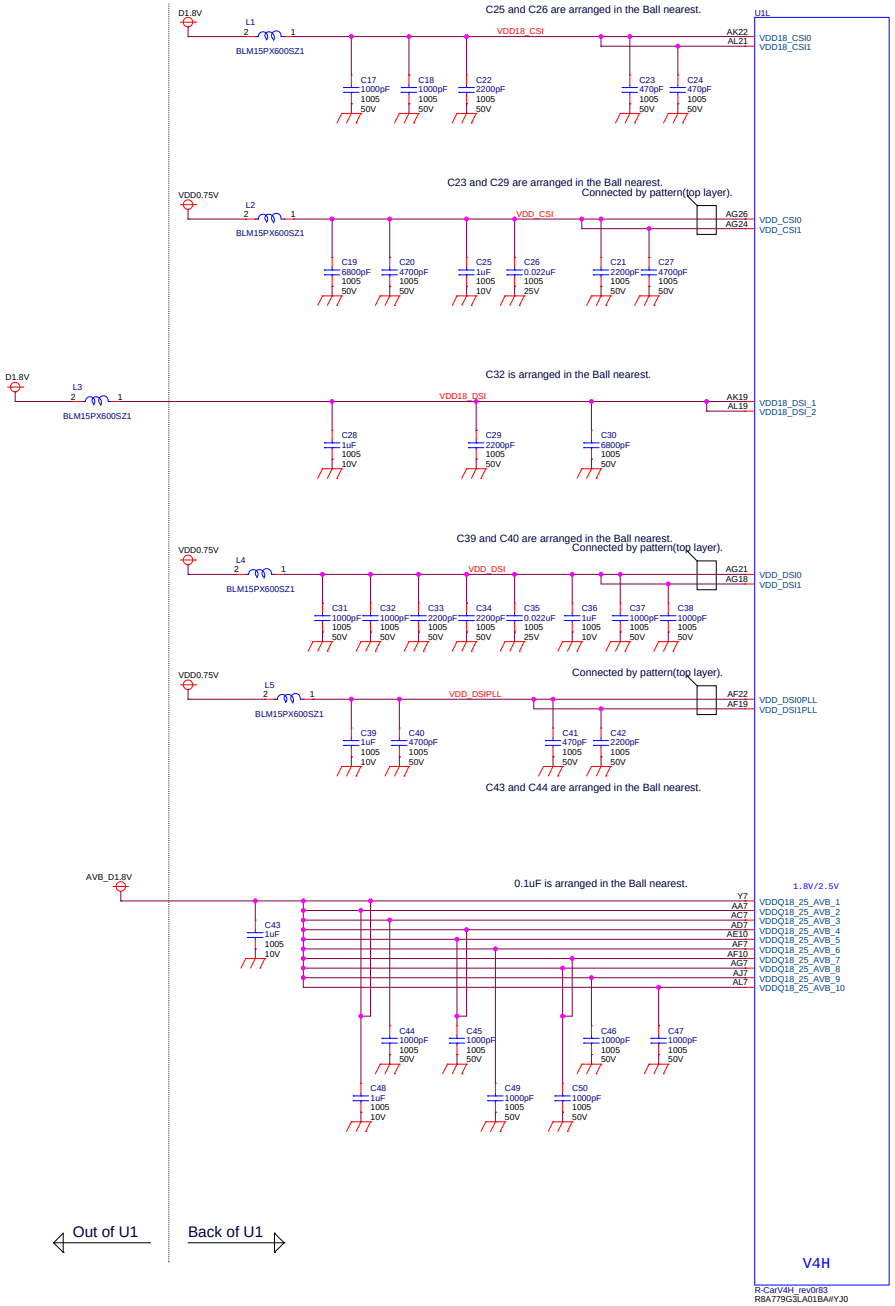
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Title: R-Car V4H_LPDDR5_0_1			
Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
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R-Car V4H_LPDDR5_2_3



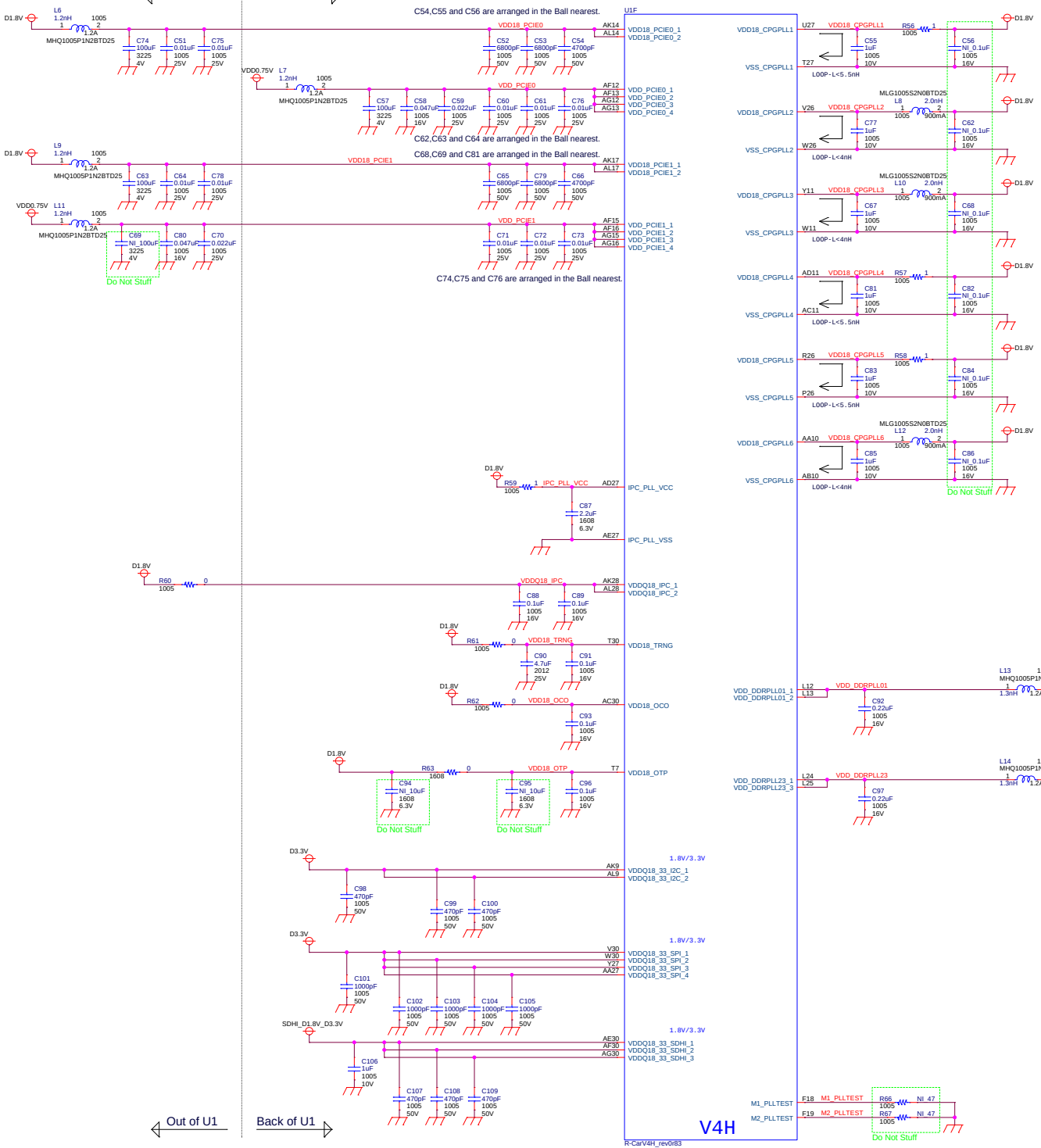
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Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
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R-Car V4H_POWER1

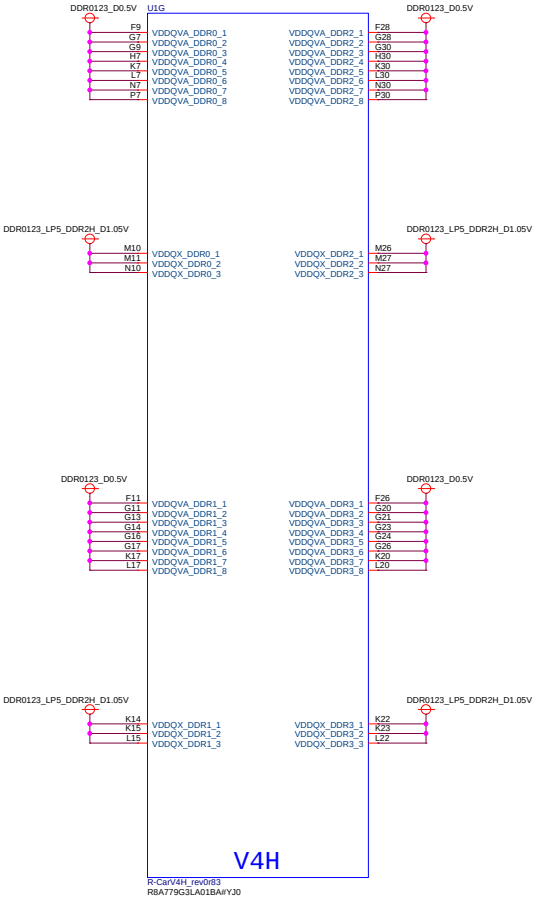


RETRONIX		
Title	R-Car V4H_POWER1	
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R-Car V4H_POWER2



R-Car V4H_POWER3



DDR0123_D0.5V

19 VOUT_DDR_D0.5V — R68 0 1005

Layout Note:
VOUT_DDR_D0.5V should be branched from the Inner layer plane.

Following signals need Ground guard.

VOUT_DDR_D0.5V

DDR0123_LP5_DDR2H_D1.05V

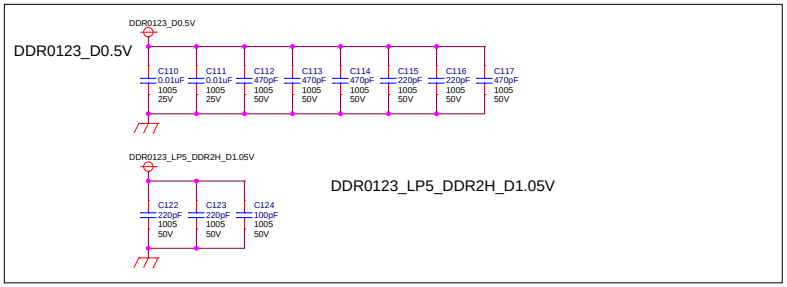
19 VOUT_DDR_PMIC — R69 0 1005

Layout Note:
VOUT_DDR_PMIC should be branched from the Inner layer plane.

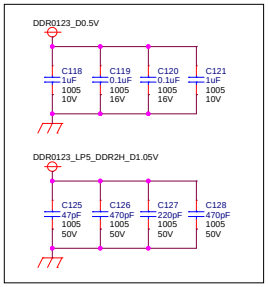
Following signals need Ground guard.

VOUT_DDR_PMIC

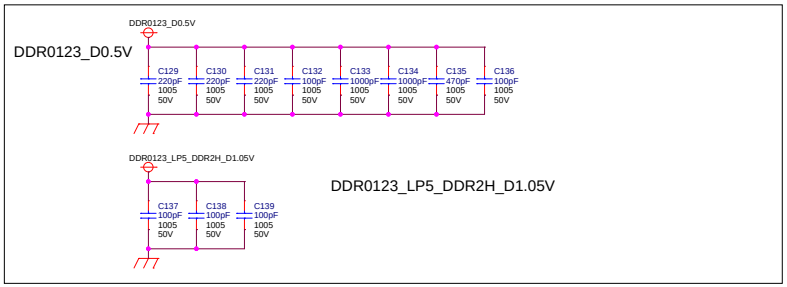
Back of U1



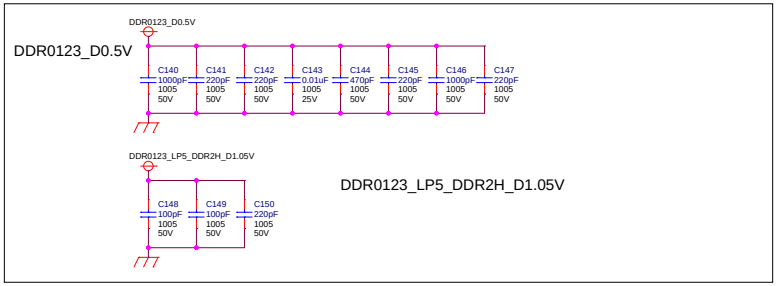
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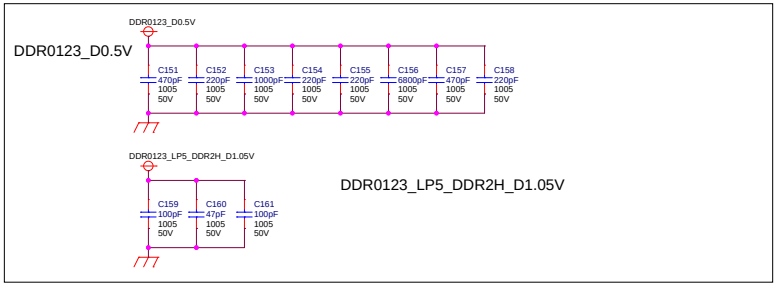
Back of U1



Back of U1



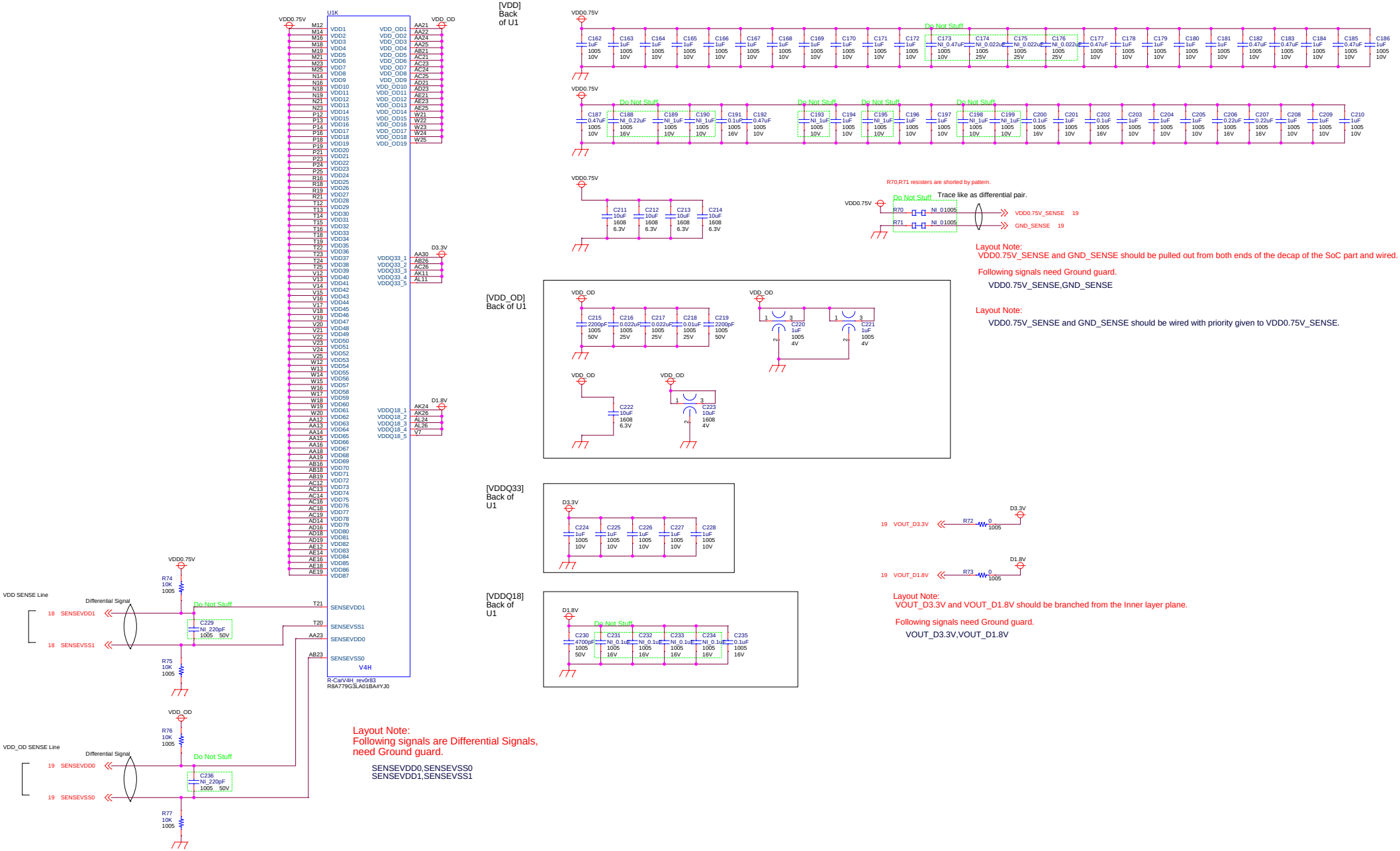
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RETRONIX

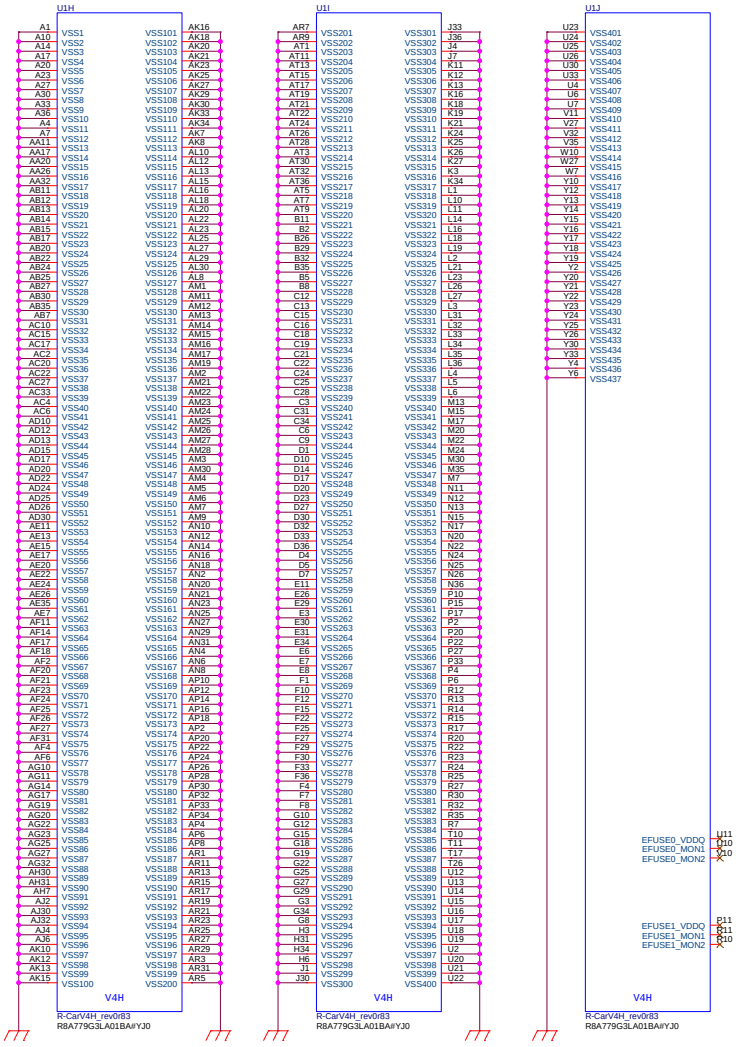
Title	R-Car V4H_POWER3	
Size A2	Document Number Sparrow Hawk	Rev V1.3
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R-Car V4H_POWER4



RETRONIX			
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R-Car V4H_GND



RETRONIX

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LPDDR5

DDR_1.8V & DDR_1.05V&DDR_0.5V

U5A

U5B

MT62F2G64D8EK-023 WT:C

ZQ
Pull-up(DDRIO) : 240ohm +-1%

Back of U2

DDR0123_1.8V(VDD1)

DDR0123_1.05V(VDD2H)

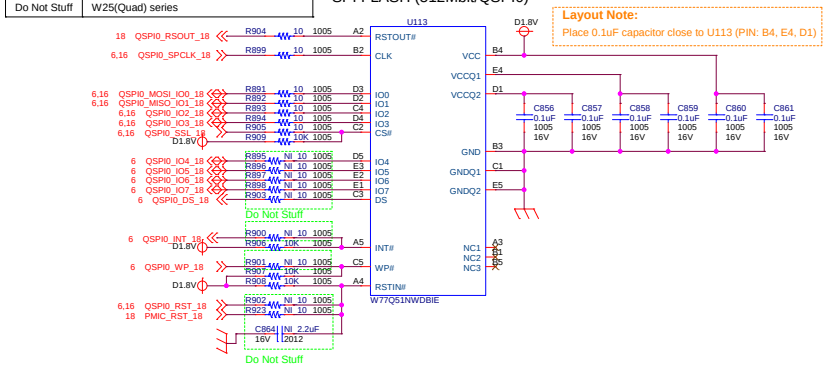
DDR0123_1.05V(VDD2L)

DDR0123_D0.5V(VDDQ)

Title	LPDDR5
Size	A2
Document Number	Sparrow Hawk
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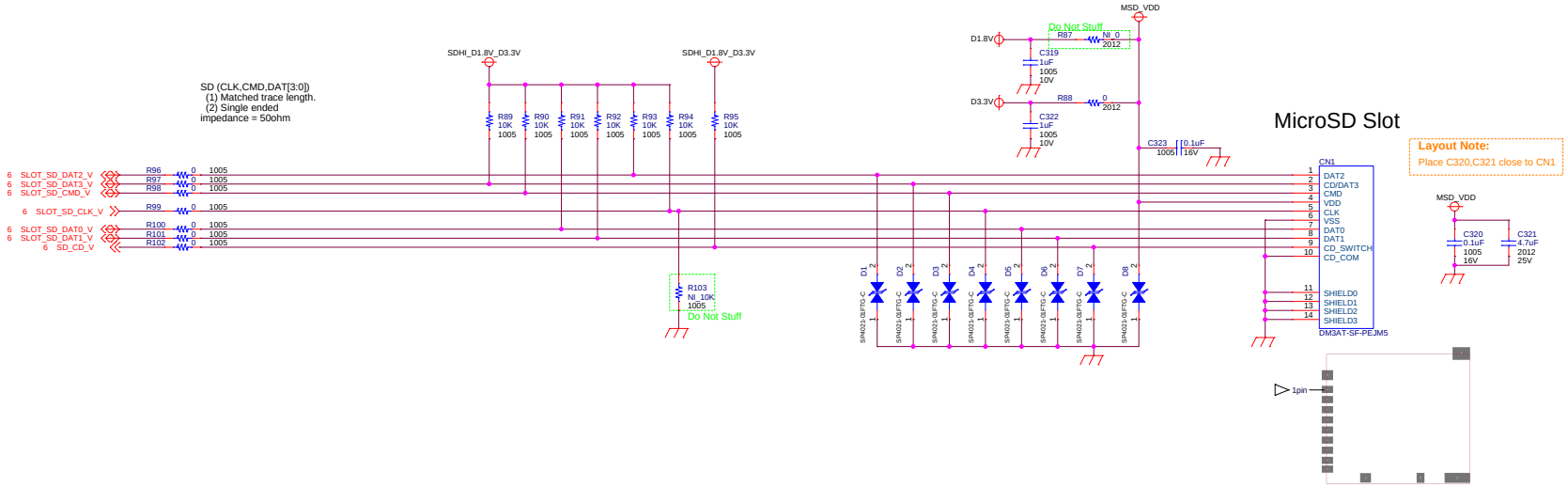
QSPI_FLASH

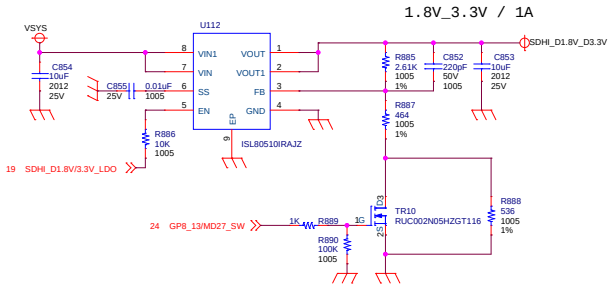
R904	Description
Stuff	W77Q(Quad),W77T(Octal),W35(Octal) series
Do Not Stuff	W25(Quad) series



RETRONIX			
Title: QSPI_FLASH			
Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
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uSD-Slot



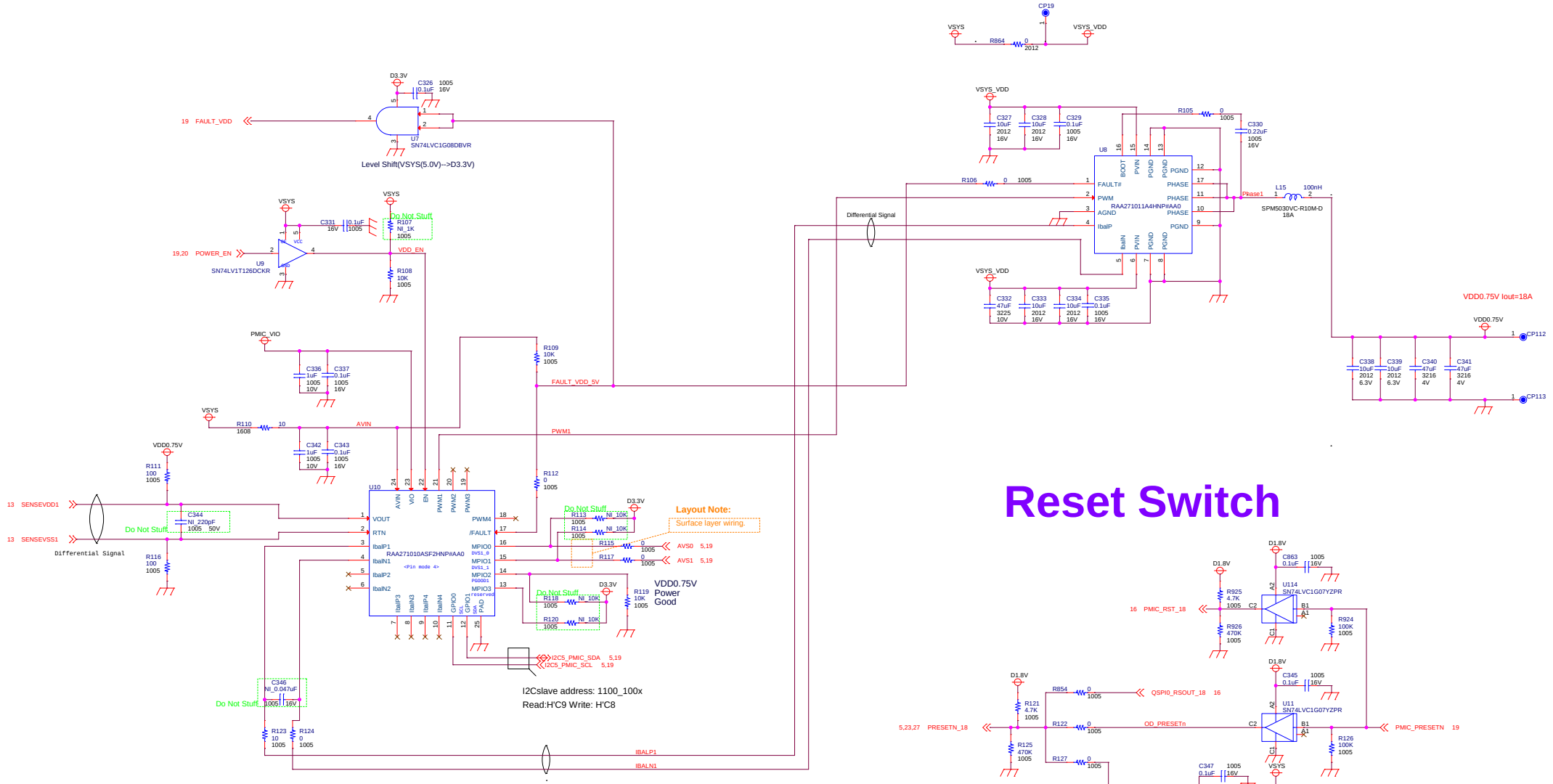


GP8_13/MD27_SW	Description
LOW	SDHI_D1.8V_D3.3V = D1.8V
HI	SDHI_D1.8V_D3.3V = D3.3V

RETRONIX

Title: uSD-Slot		
Size: A2	Document Number: Sparrow Hawk	Rev: V1.3
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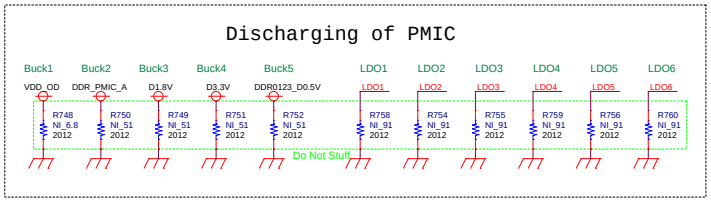
POWER_CORE

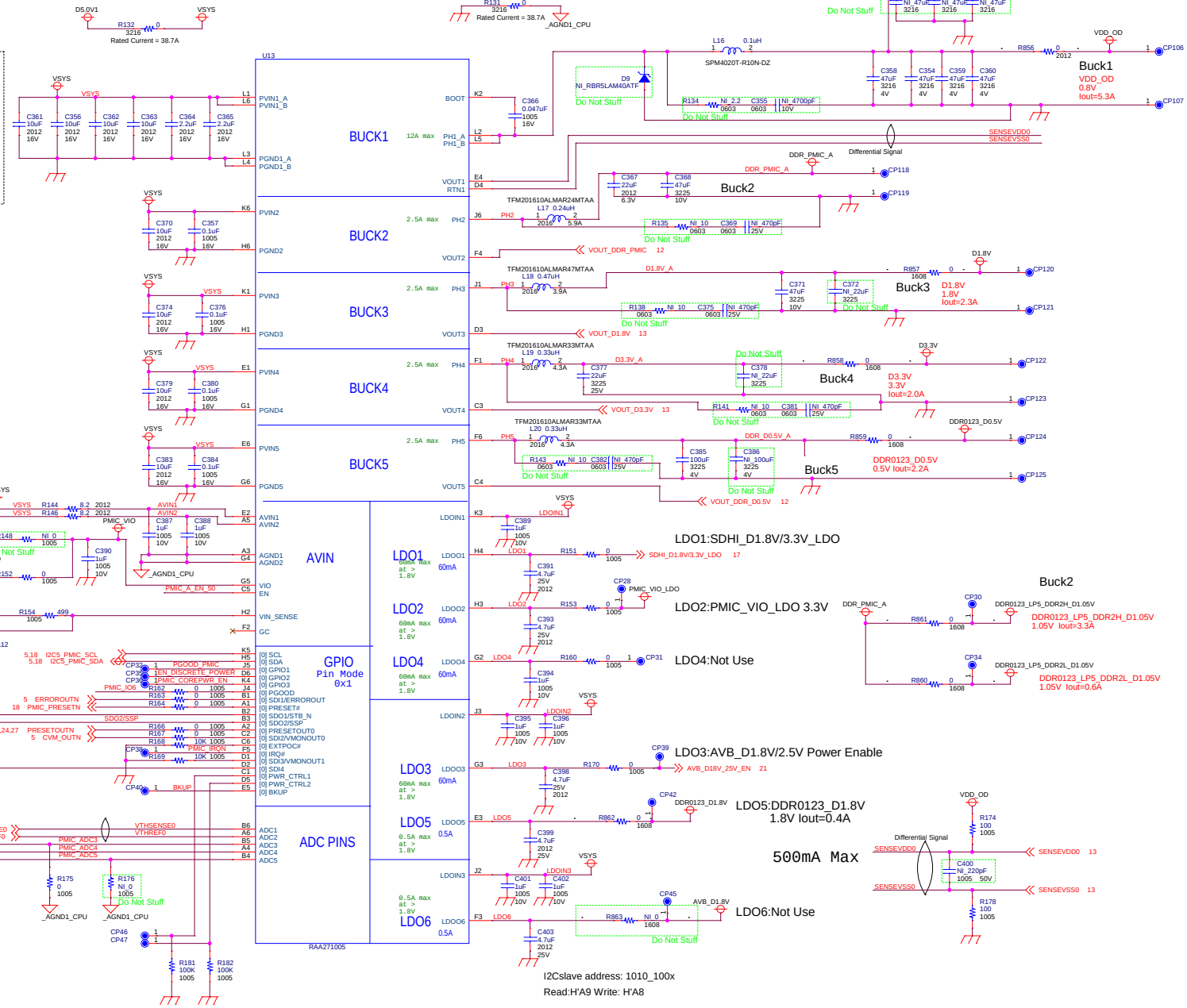


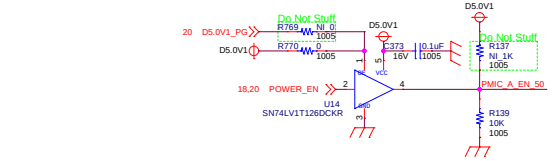
Reset Switch

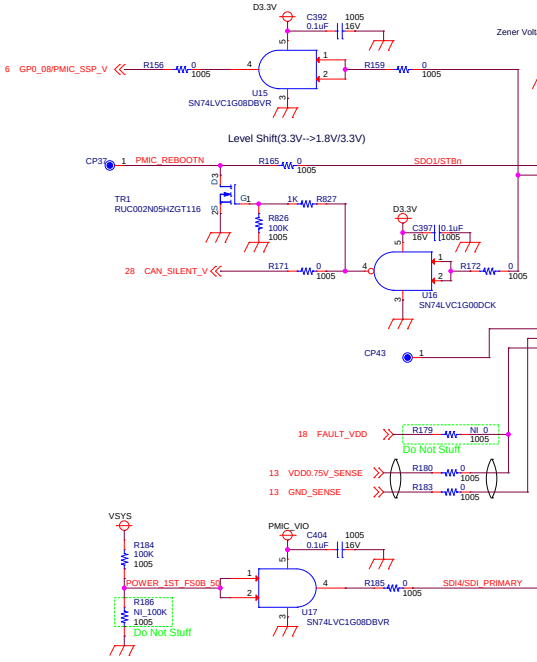
RETRONIX			
Title: V4H_POWER_CORE			
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POWER_PMIC


Discharging of PMIC
Buck1
Buck2
Buck3
Buck4
Buck5
LDO1
LDO2
LDO3
LDO4
LDO5
LDO6
VDD_OD
DDR_PMIC_A
D1.8V
D3.3V
DDR0123_D0.5V
R748 NI_6.8 2012
R750 NI_51 2012
R749 NI_51 2012
R751 NI_51 2012
R752 NI_51 2012
R758 NI_91 2012
R754 NI_91 2012
R755 NI_91 2012
R759 NI_91 2012
R756 NI_91 2012
R760 NI_91 2012
Do Not Stuff

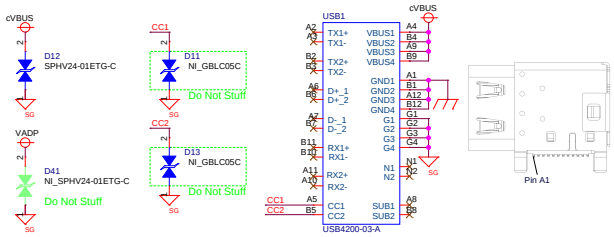

U13
BUCK1
BUCK2
BUCK3
BUCK4
BUCK5
AVIN
GPIO
Pin Mode
0x1
ADC PINS
LDO1
LDO2
LDO3
LDO4
LDO5
LDO6
RAA271005
Buck1
VDD_OD
0.8V
Iout=5.3A
Buck2
DDR_PMIC_A
Buck3
D1.8V
1.8V
Iout=2.3A
Buck4
D3.3V
3.3V
Iout=2.0A
Buck5
DDR0123_D0.5V
0.5V Iout=2.2A
LDO1:SDHI_D1.8V/3.3V_LDO
LDO2:PMIC_VIO_LDO 3.3V
LDO4:Not Use
LDO3:AVB_D1.8V/2.5V Power Enable
LDO5:DDR0123_D1.8V
1.8V Iout=0.4A
500mA Max
LDO6:Not Use
I2Cslave address: 1010_100x
Read:H'A9 Write: H'A8
Differential Signal
SENSEVDD0
SENSEVSS0

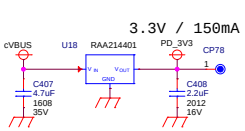

U14
SN74LV1T126DCKR
PMIC_A_EN_50
POWER_EN

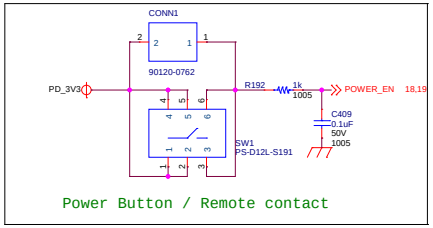

PMIC_VIO_LDO
PMIC_IO6
Level Shift(3.3V-->1.8V/3.3V)
U15
SN74LVC1G08DBVR
U16
SN74LVC1G00DCK
U17
SN74LVC1G08DBVR
TR1
RUC002N05HZGT116
Zener Voltage 12.12V(max)
BZX84-A12
SDO1/STBn
SDO2/SSP
PMIC_REBOOTN
CAN_SILENT_V
FAULT_VDD
VDD0.75V_SENSE
GND_SENSE
SDI4/SDI_PRIMARY

USB_PD Power Input

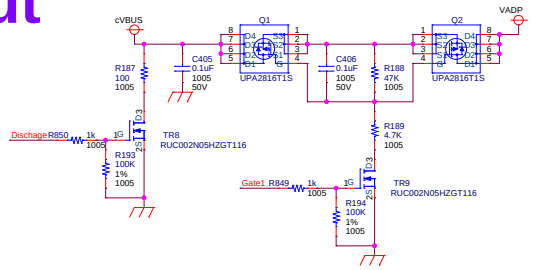
USB TYPE C

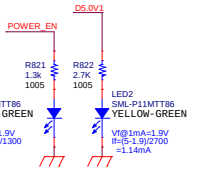


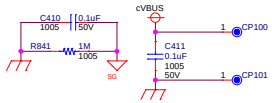


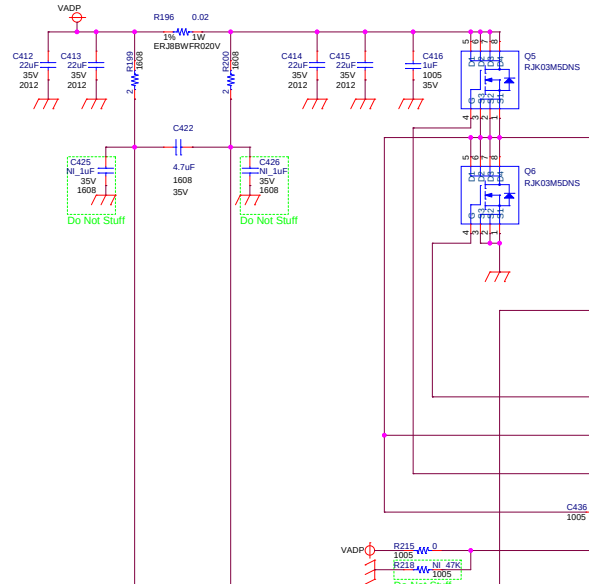


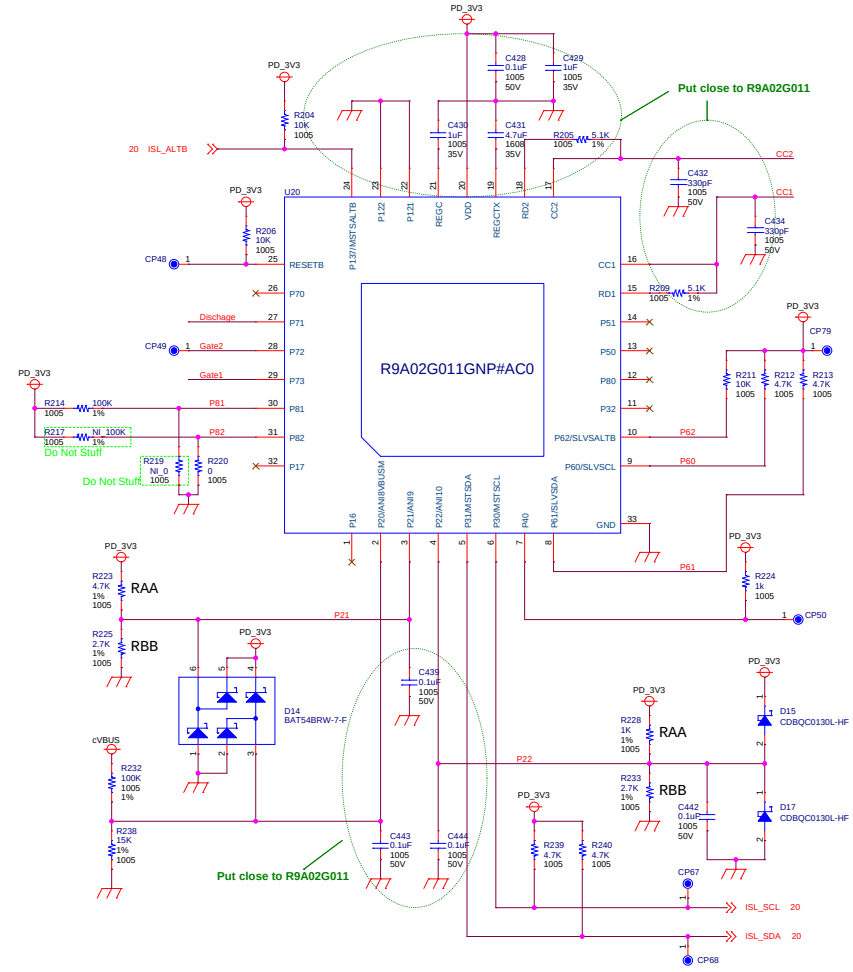
USB Type-C receptacle to Vadp

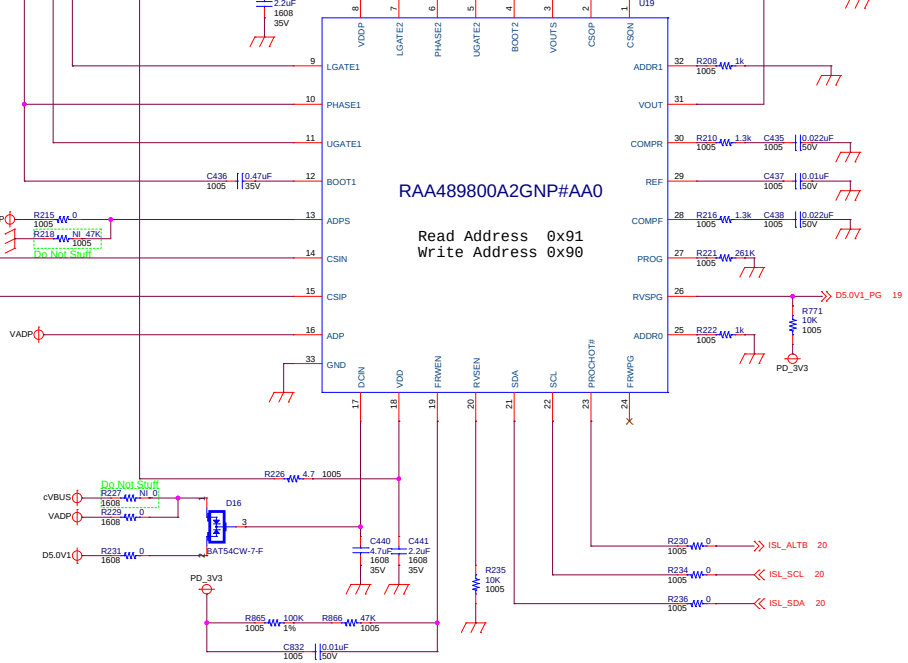










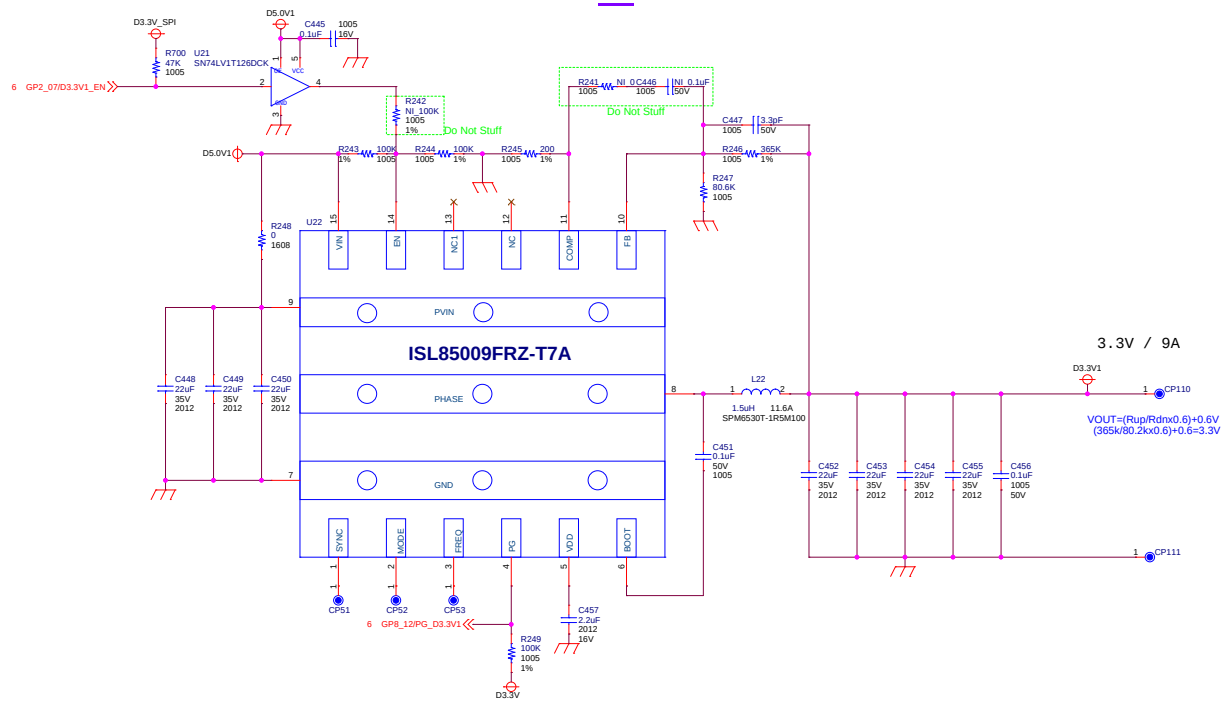


RAA	RBB	Current	VOUT
4.7K	2.7K	0A	5V
3.3K	2.7K	1A	9V
2.2K	2.7K	2A	12V
1.5K	2.7K	3A	15V
1.2K	2.7K	4A	18V
1K	2.7K	5A	20V

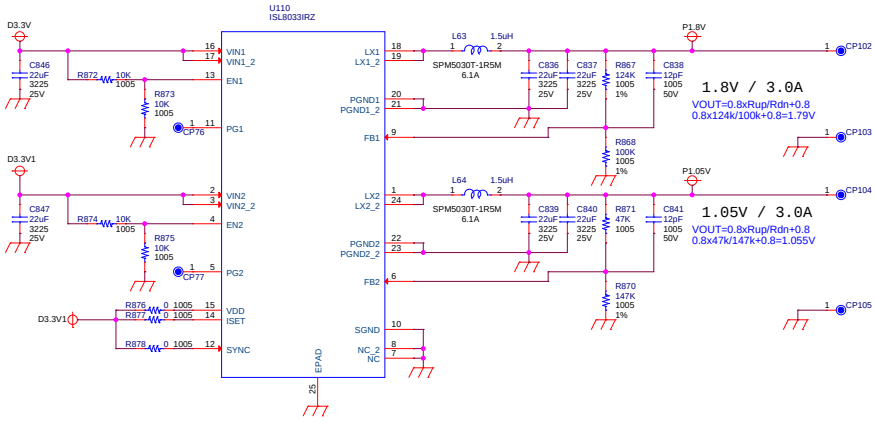
RETRONIX

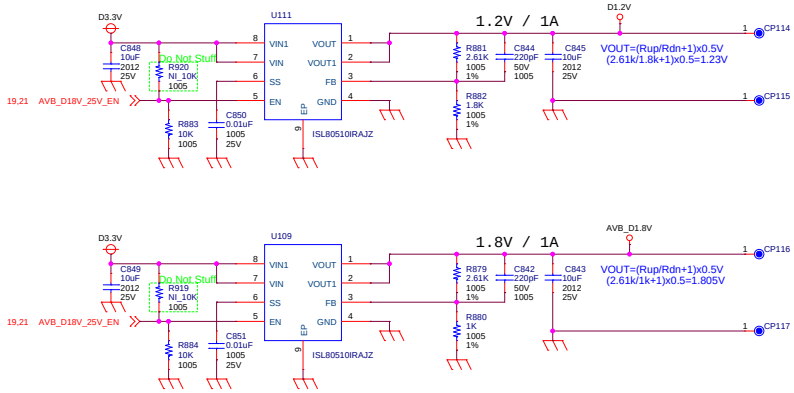
Title	USB_PD Powr Input	
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POWER_IO



Dual Buck

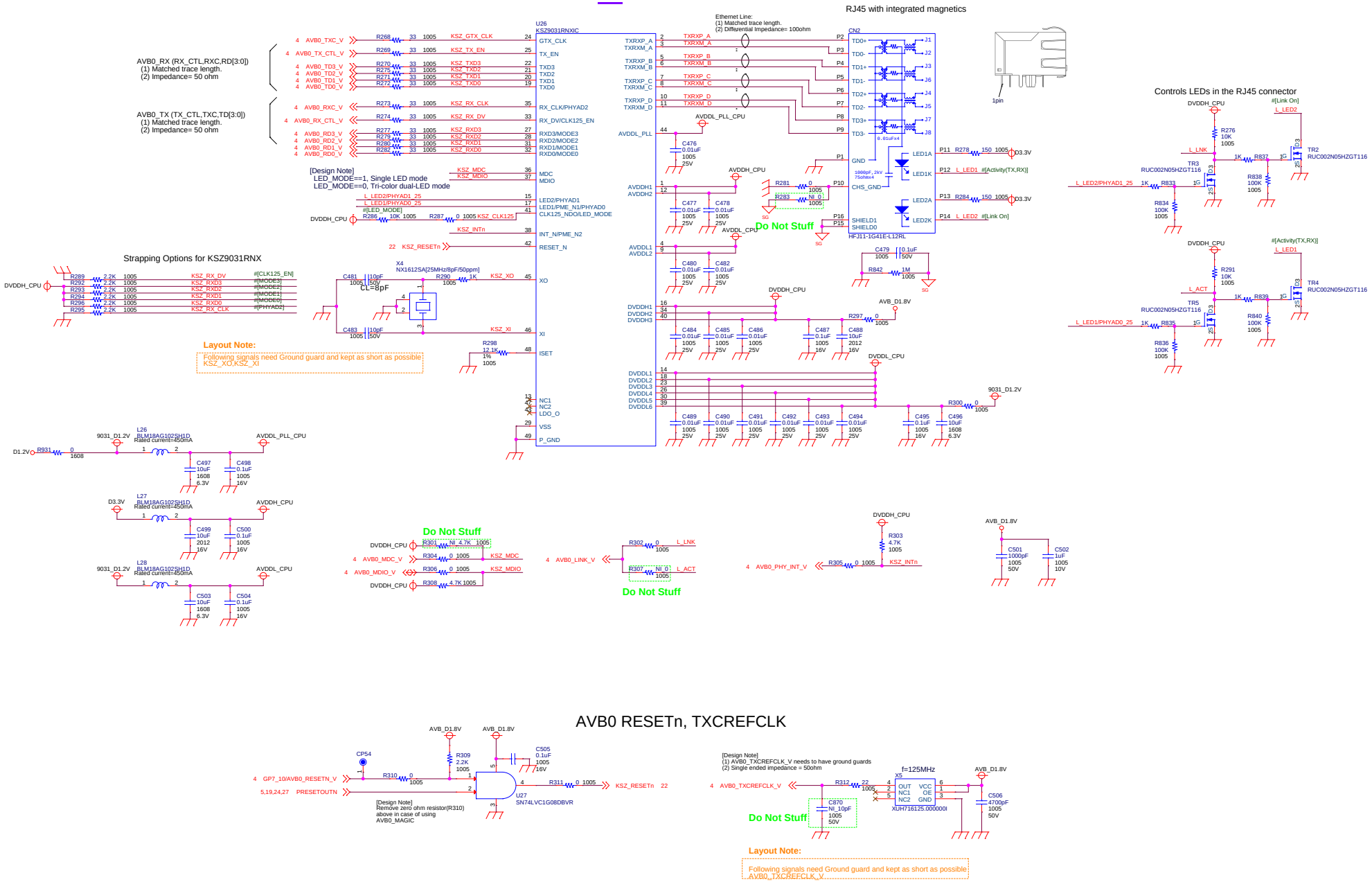




RETRONIX

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Size A2	Document Number Sparrow Hawk	Rev V1.3
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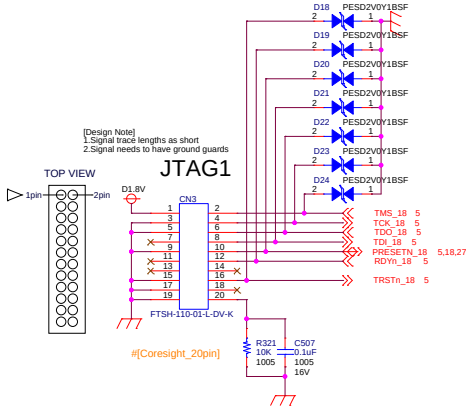
Ether_AVB0



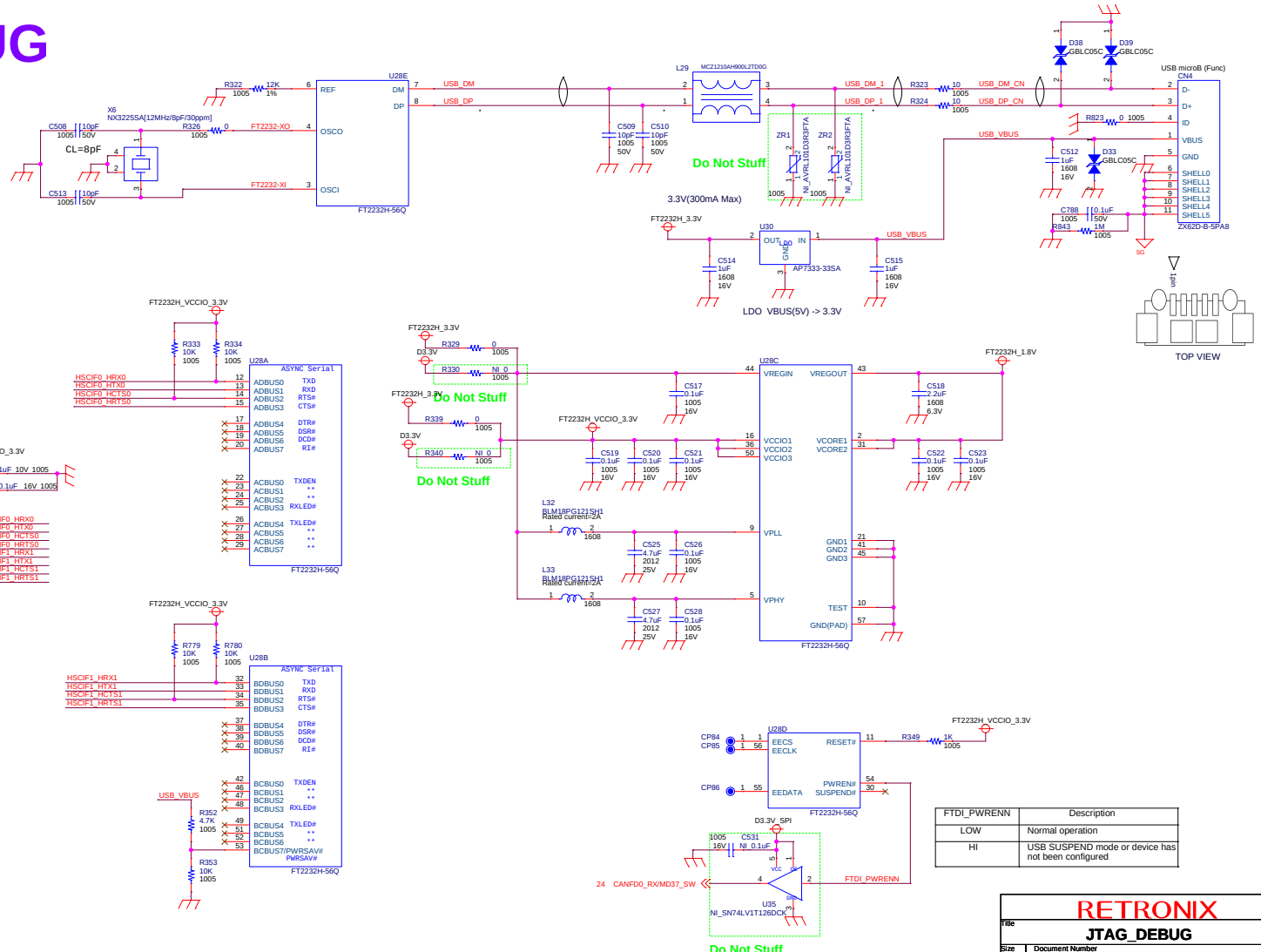
Title	Ether_AVB0
Size	A2
Document Number	Sparrow Hawk
Rev	V1.3
Date:	Tuesday, January 13, 2026
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RETRONIX

JTAG1



DEBUG

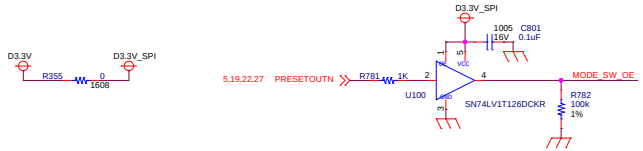


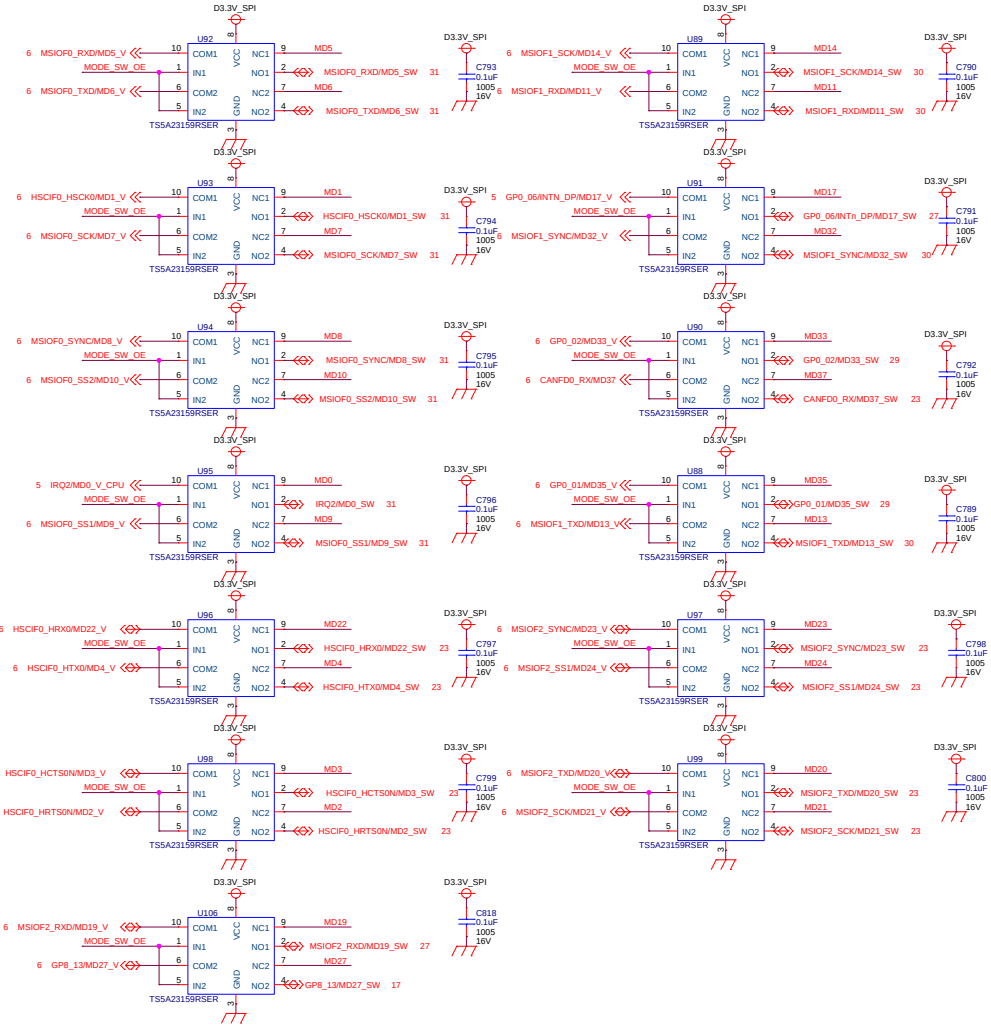
FTDI_PWRENN	Description
LOW	Normal operation
HI	USB SUSPEND mode or device has not been configured

RETRONIX

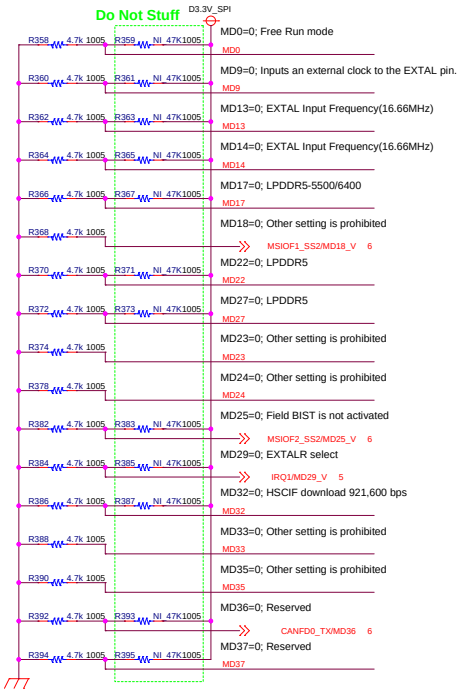
Title	JTAG_DEBUG	
Size A2	Document Number Sparrow Hawk	Rev V1.3
Date: Tuesday, January 13, 2026	Sheet 23 of 34	

MODE SWITCH

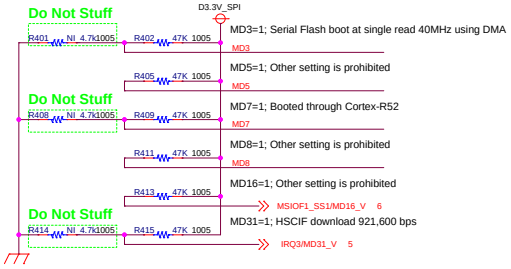


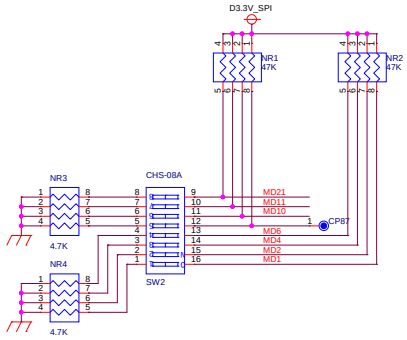


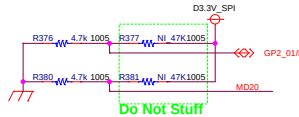
Pull Low

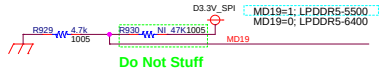


Pull High









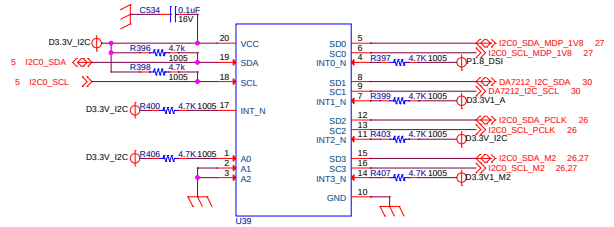
Initial setting

MD1	MD2	MD3	MD4	Description
0	0	1	0	Serial Flash boot at single read 40MHz using DMA
1	1	1	1	SCIF/HSCIF download mode

MD6	MD7	Description
0	1	Booted through ICUMX
1	1	Booted through Cortex-R52

MDT0	MD20	MD21	MD11	MD10	Description
0	0	0	0	0	Initial setting
0	0	0	1	0	ICUMX JTAG
0	0	0	1	1	ICUMX LPD
0	0	1	0	0	CoreSight

I2C SWITCH



I2Cslave address: 1110_001x
Read:H'E3 Write: H'E2

RETRONIX

Title	MODE SWITCH	
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PCIe to USB

USB ESD Protection

USB TYPE A

USB 3.0
VBUS MAX Current = 0.9A

USB TYPE C

USB 3.0
VBUS MAX Current = 0.9A

USB TYPE C

USB 3.0
VBUS MAX Current = 0.9A

uPD720201

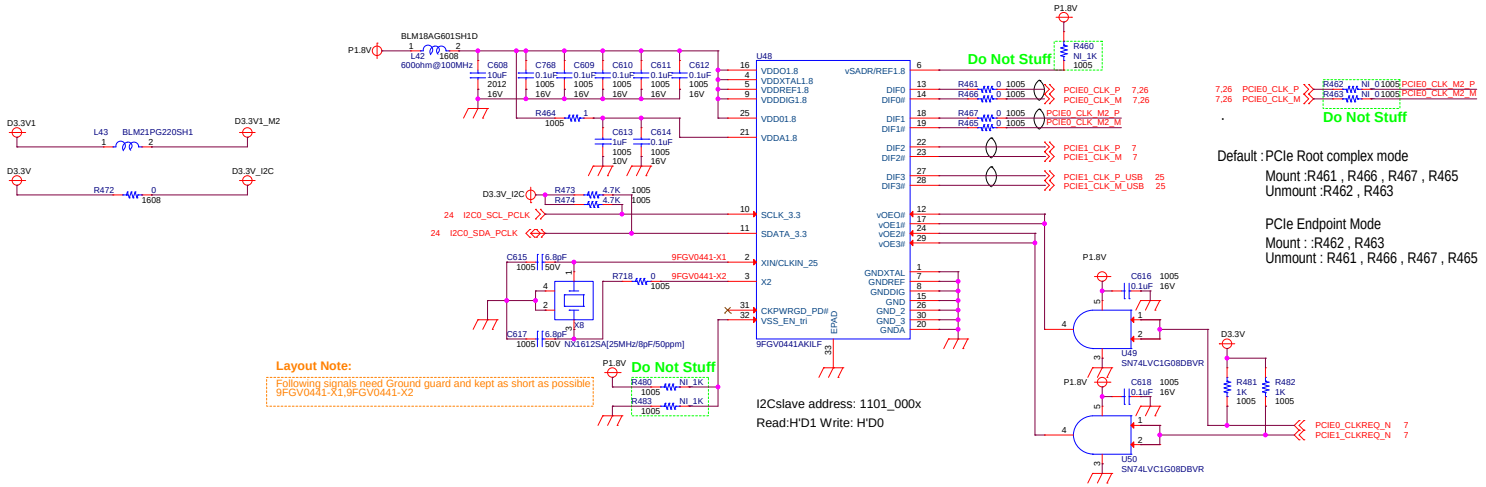
Do Not Stuff

Layout Note:
Following signals need Ground guard and kept as short as possible
uPD720201_X1,uPD720201_X2

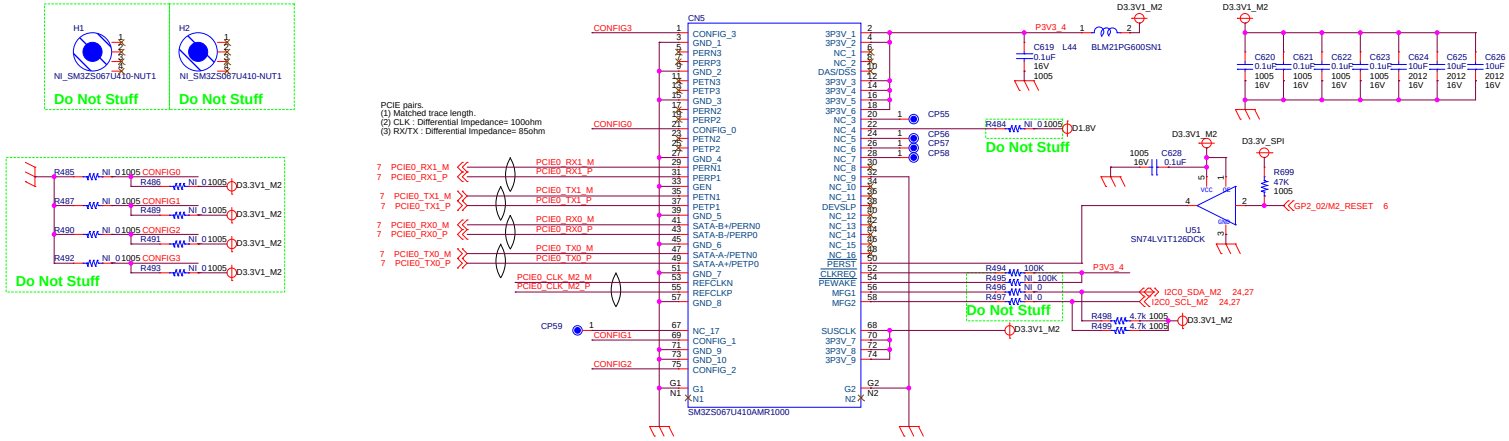
Title	PCIe to USB
Size	A2
Document Number	Sparrow Hawk
Rev	V1.3
Date:	Tuesday, January 13, 2026
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RETRONIX

PCIe.0/1 CLK

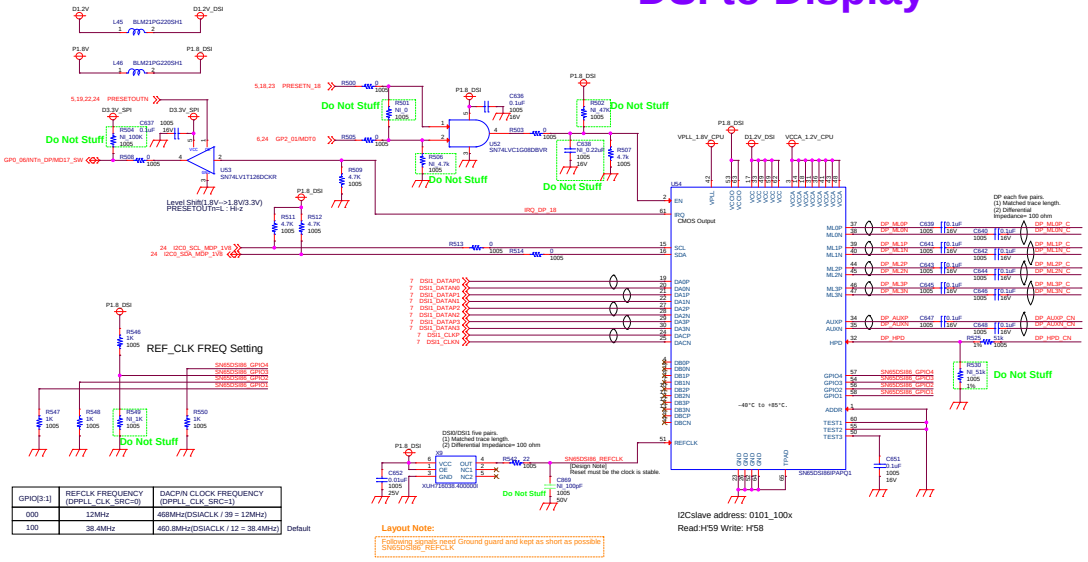


PCIe (2 lane) M.2 Key M 2230 / 2243

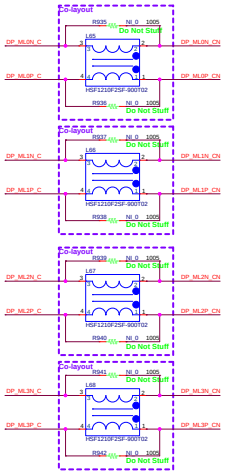


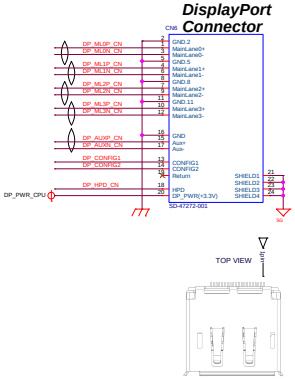
Title	PCIe_CLK_M.2
Size	A2
Document Number	Sparrow Hawk
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Date:	Tuesday, January 13, 2026
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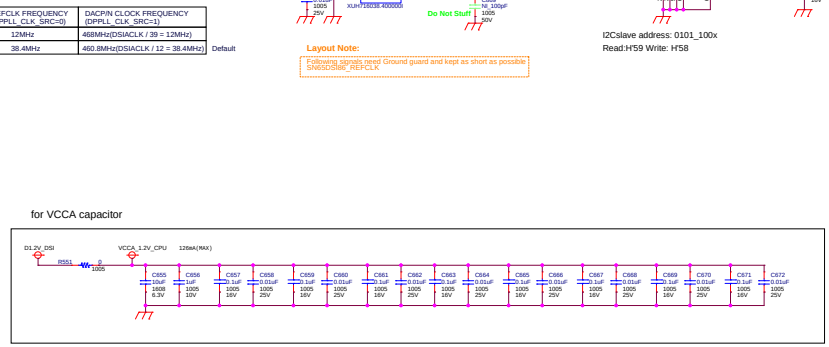
DSI to Display

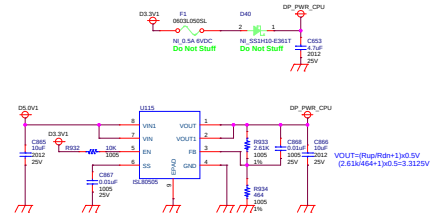


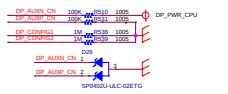
GPIO[3:1]	REFCLK FREQUENCY (DPPLL_CLK_SRC=0)	DACPN CLOCK FREQUENCY (DPPLL_CLK_SRC=1)
000	12MHz	468MHz(DSIACLK / 39 = 12MHz)
100	38.4MHz	460.8MHz(DSIACLK / 12 = 38.4MHz) Default



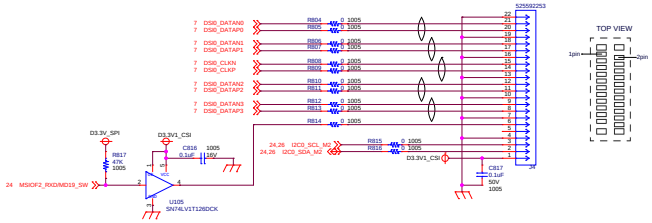








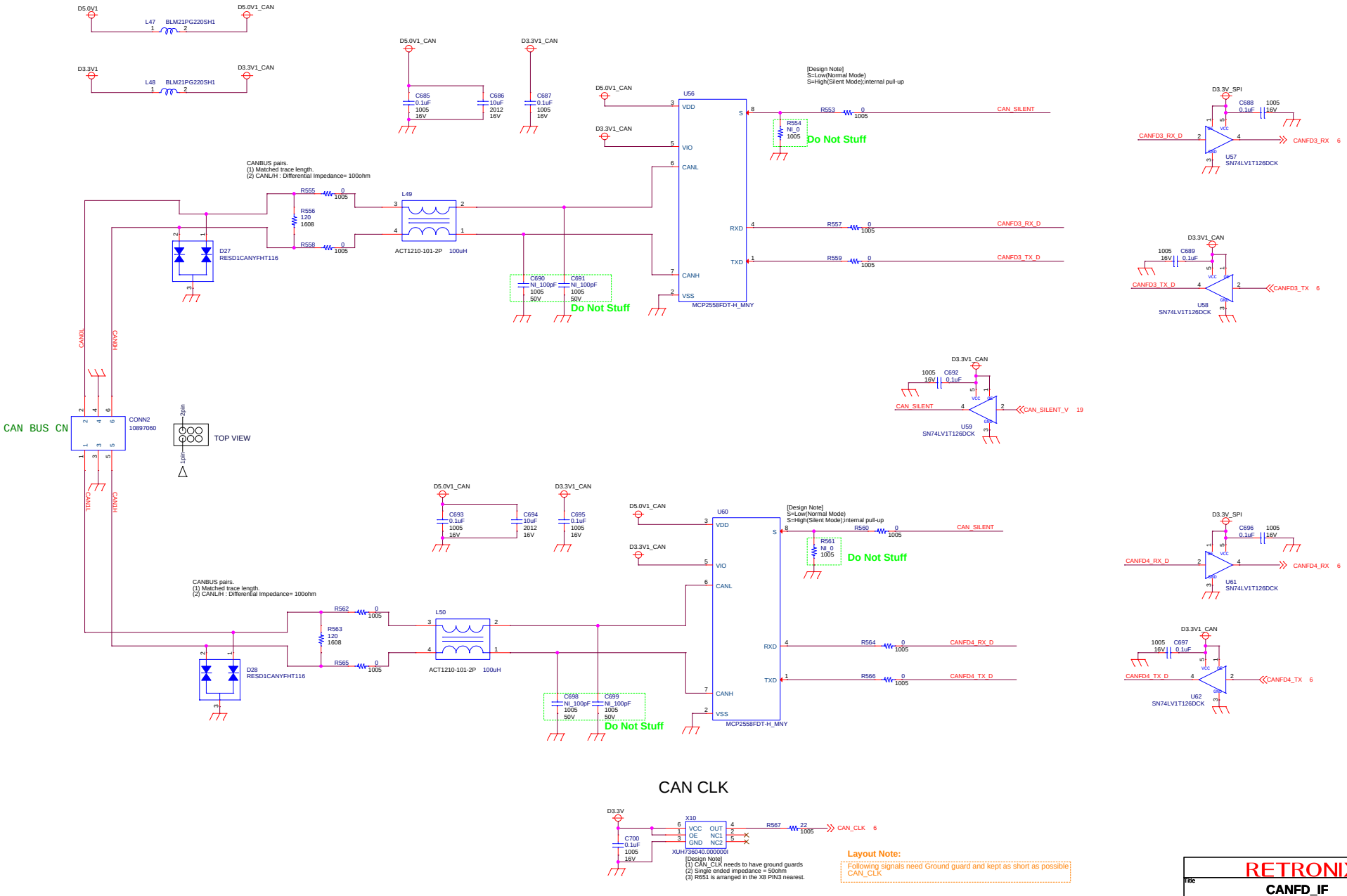
DSI_IF_CN



RETRONIX

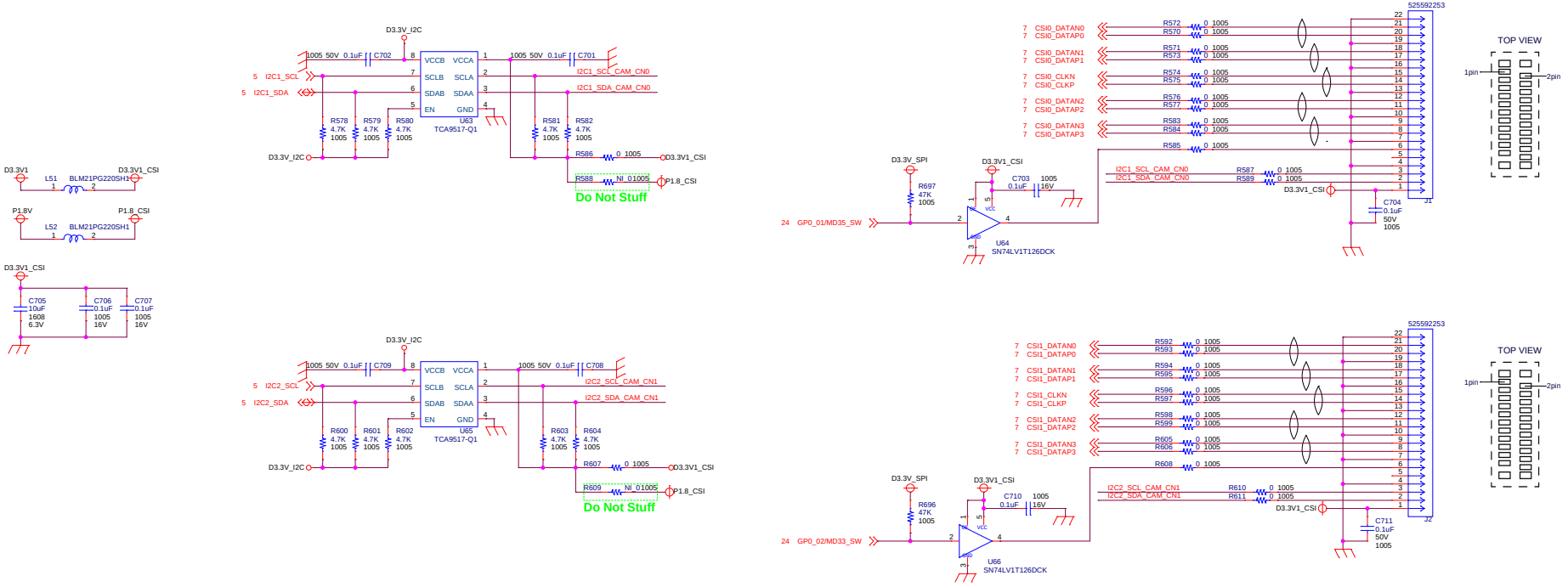
Title	DSI_to_DP	
Size: A1	Document Number: Sparrow Hawk	Rev: V1.3
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CANFD_IF



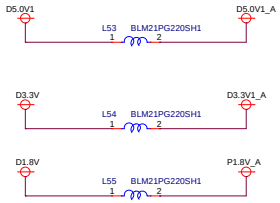
RETRONIX			
Title: CANFD_IF			
Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
Date: Tuesday, January 13, 2026	Sheet 28 of 34		

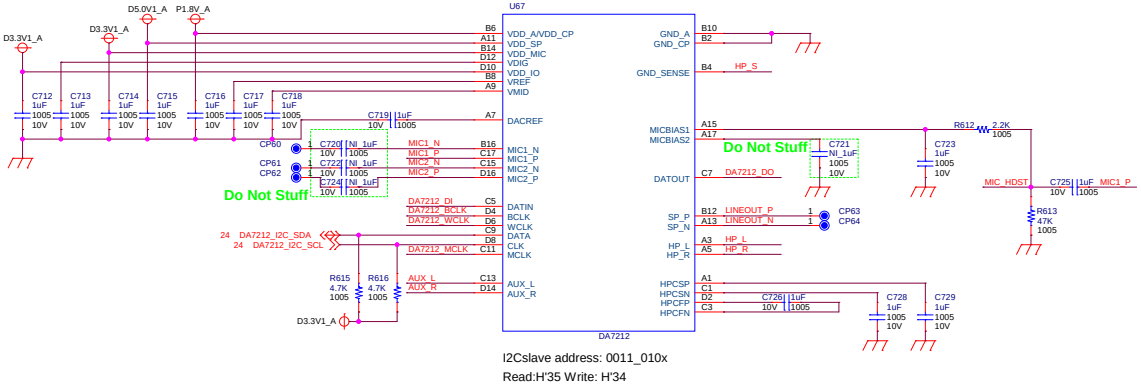
CSI_IF_CN



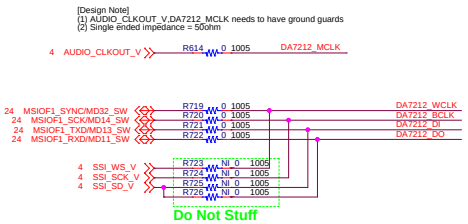
RETRONIX			
Title: CSI_IF_CN			
Size: A2	Document Number: Sparrow Hawk		Rev: V1.3
Date: Tuesday, January 13, 2026	Sheet 29 of 34		

Audio_Codec

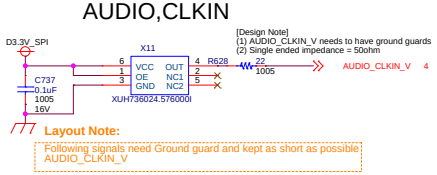


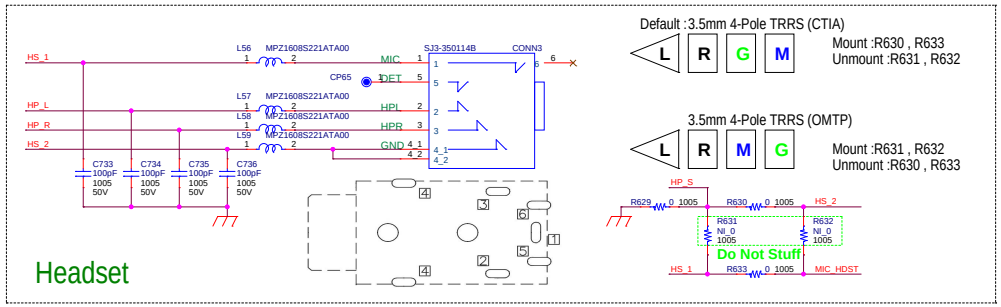


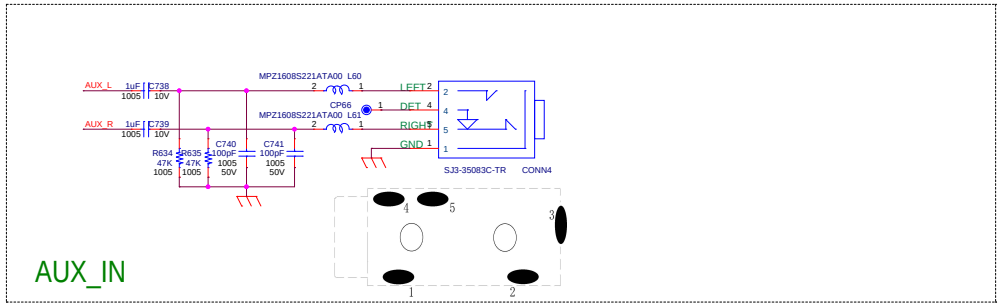
I2Cslave address: 0011_010x
Read:H'35 Write: H'34



AUDIO,CLKIN

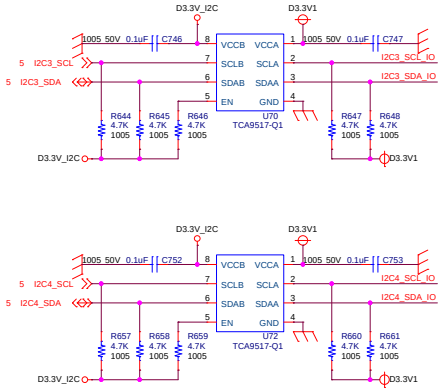


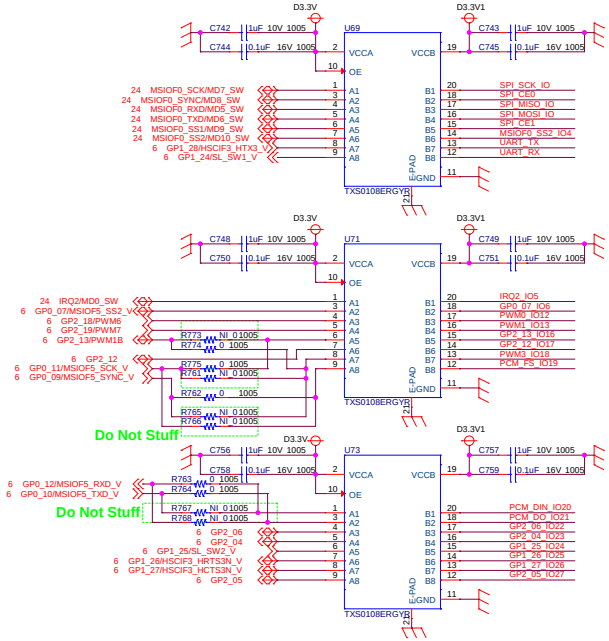


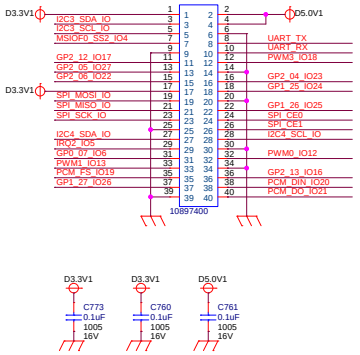


RETRONIX		
Title: Audio_Codec		
Size: A2	Document Number: Sparrow Hawk	Rev: V1.3
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IO_CN

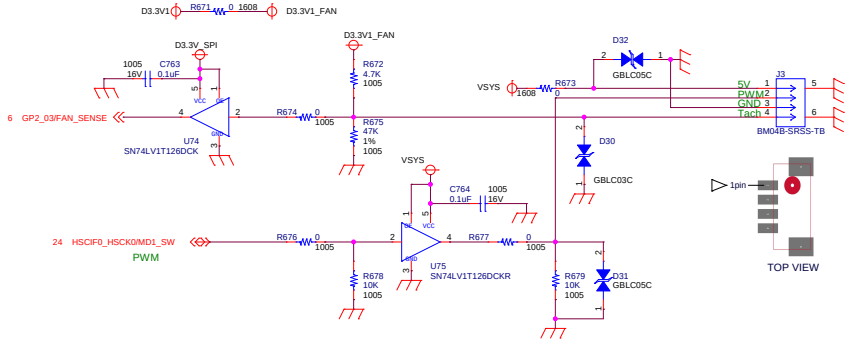




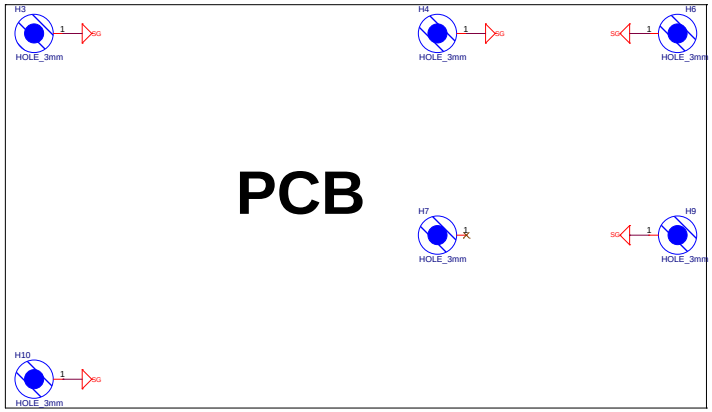


3v3 Power	1	2	5v Power
GPIO 2 (I2C1 SDA)	3	4	5v Power
GPIO 3 (I2C1 SCL)	5	6	Ground
GPIO 4 (GPCLK0)	7	8	GPIO 14 (UART TX)
Ground	9	10	GPIO 15 (UART RX)
GPIO 17	11	12	GPIO 18 (PWM0)
GPIO 27	13	14	Ground
GPIO 22	15	16	GPIO 23
3v3 Power	17	18	GPIO 24
GPIO 10 (SPI0 MOSI)	19	20	Ground
GPIO 9 (SPI0 MISO)	21	22	GPIO 25
GPIO 11 (SPI0 SCLK)	23	24	GPIO 8 (SPI0 CE0)
Ground	25	26	GPIO 7 (SPI0 CE1)
GPIO 0 (EEPROM SDA)	27	28	GPIO 1 (EEPROM SCL)
GPIO 5	29	30	Ground
GPIO 6	31	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	34	Ground
GPIO 19 (PCM FS)	35	36	GPIO 16
GPIO 26	37	38	GPIO 20 (PCM DIN)
Ground	39	40	GPIO 21 (PCM DOUT)

FAN



Fixing Hole



RETRONIX			
Title: IO_FAN			
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Sparrow Hawk

Revision History

Rev. Code	Date	By	Description
V1.0	2024-10-04	Bill	Initial version
	2024-10-15	Bill	1.J1,J2 Change to RPi5 22-Pin FPC Connector and Individual I2C for Each Camera 2.I2C group change, refer to page 3
	2024-11-01	Bill	1.Modified based on "Retronix_Low_cost_Sch_V4H_2024_1014_RTX_Reply1028.xlsx" file 2.Modified based on "V4H LCB schematic review_RTX_Reply1028.pptx" file 3.Added Reset button "SW3" 4.Fan control is changed to V4H PWM pin "HSCIF0_HSCK0/MD1_SW" 5.Debug connection modified to HSCIF0 and HSCIF1
	2024-11-11	Bill	1.Modified based on "V4H LCB schematic review_NOV1_UPDATE_RTX_Reply1108.pptx" file 2.Remove : U37,U40,C533,C536,C754,C755,R688,R689,R692,R757 3.Added : C773,R761~R771 4.Modify CN7 pin definition 5.Change part number: A.U69,U70,U71(TXS0108EPWR --> TXS0108ERGYR) B.U56,U60(MCP2558FD-H/SN --> MCP2558FDT-H_MNY) C.U41~U44(AP2191SG-13 --> AP2191WG-13) D.D12(SM8S24A-AU --> SPHV24-01ETG-C)
	2024-11-15	Bill	1.Modified Block Diagram (Page2) 2.Added : U81~U85,SW8,C774~C783,R772~R775 3.Remove : U41~U44
	2024-11-22	Bill	1.Modified based on "V4H SBC Nov 11 Schematic Review_2024_1114_B_RTX_Reply1122.pptx" file 2.Modified based on "Retronix_Low_cost_Sch_V4H_Ren_Reply_2024_1114_RTX_Reply_1122.xlsx" file 3.Modified Block Diagram "DSI1 independent output connector"(Page2) 4.DSI1/CSI1 switch via MUX-->DSI1 independent connector(Page27)
	2024-12-17	Bill	1.Modify DSI connection device:DSI0-->DSI_IF_CN ; DSI1-->DP 2.CN6 Change to DP-F20S-S297 3.Modified based on "V4H LCB Nov 27 schematic review_2024_1205_A_RTX_Reply1213.pptx" file 4.Modified based on "Retronix_Low_cost_Sch_Review_V4H_2024_1203 - Copy_RTX_Reply1213.xlsx" file
	2024-12-25	Bill	1.Modify USB1 (Pin-A1, B1, A12, B12) to connect to GND 2.Modify "CONN4-Pin1" ; "U84,U85-Pin11" ; "CONN2-PIN3,Pin4" ; "C411" ; "U69,U71,U73,U101-Pin21" to connect to GND 3.Added : C819~C830 4.H7,USB1-PIN G1:Floating 5.U84,U85 Change to ISL61852DIRZ
	2024-12-25	Bill	1.Modified based on "V4H LCB 2nd schematic review Dec 24th revision_2025_0108_A_RTX_0122.pptx" file 2.Modified based on "V4H LCB schematic review Dec 24th revision_2025_0103_A_RTX_0122.pptx" file

RETRONIX

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Sparrow Hawk

Revision History

Rev. Code	Date	By	Description
V1.1	2025-02-25	Bill	01. Change QSPI flash to Winbond W77Q51NWDEIE. 02. Modify the SDIO power rail switching circuit(U111), to avoid reverse current occurs when power rails are switched. 03. Change shunt to 0 ohm resistor: R133, R136, R140, R142, R158, R161, R173, R177, R104. 04. Modify automotive parts to industrial parts: ISL78322ARZ=>ISL8033IRZ; ISL78310ARAJZ=>ISL80510IRAJZ; KSZ9031RNXVB=>KSZ9031RNXIC;. 05. Change oscillators to RENESAS parts: X3,X5,X9,X10,X11. 06. Change power input N-MOSFET Q1 & Q2 : RJK0651DPB --> RUC002N05HZGT116. 07. Modify indicator light circuit: LED1 & LED2. 08. Change parts for SD card protection circuit: SP4021-01FTG -> SP4021-01FTG-C. 09. Modify the RAA489800(U19) for soft start consideration. 10. Modify USB TYPE C circuit: Unable to reach USB 3.0 speeds & Unable to plug in both orientations. 11. Modify PCIe to USB reset circuit. 12. Change Headset Connector 4-pole (PJ-S3112A1-S124 => SJ3-350114B). 13. Change PCIe to USB IC part number (uPD720201K8-711-BAC-A => uPD720201K8-701-BAC-A). 14. Add ground reference for U20 R9A peripheral C442 and D17. 15. Change L25 by resistor R931 0 Ohms to keep AVDDL_PLL_CPU power rail at 1.2V.
V1.1.1	2025-07-07	Mick	01. Modify D15 D17 (CDBQC0130L-HF) diode pin definition. 02. Add ground reference for U110. 03. Add R4 4.7K Ohms to enable X3. 04. Unmount display fuse F1 to avoid reverse current. 05. Adjust R880 to 1K Ohm to set AVB0 I/O at 1.8V. 06. Update block diagram (CANFD). 07. Modify Pin 1 definition of M.2 connector drawing.
V1.1.2	2025-08-12	Mick	01. Due to AVB_D2.5V change to AVB_D1.8V, Change X5 to XUH716125.000000I. 02. Mount Fuse F1 for external display converter. 03. Modify CN4 description.
V1.2	2025-08-29	Mick	01. Modify CN6 connector pin definition. 02. Modify Audio codec (U67) pin definition. 03. Update block diagram (W77Q51NW SPI Secure Flash). 04. Change Power net name : AVB_D1.8V 05. Modify MD pin setting for prevent system enter Sub-jtag mode. 06. Remove M.2 picture. 07. Add protection circuit for DP connector power. 08. Change U45 PN to MX25V5126FM1I-TR for material shortage. 09. Modify the redundant capacitor to a 0 ohm resistor on the M.2 PCIe signal trace.
V1.2.1	2025-12-10	Mick	01. Change C862 to 2.2 µF, R429 to 4.7 kΩ, and R434 to 33 kΩ in order to improve the USB sequence performance.

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Title: Revision History

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Sparrow Hawk

Revision History

Rev. Code	Date	By	Description
V1.3	2026-01-14	Mick	01. C870 added for EMI suppression on Ethernet clock, not populated on board. 02. Changed Ethernet TX signal series resistors (R268, R269, R270, R271, R272, R275) to 33 Ohms to improve EMI performance. 03. Removed capacitors on M.2 connector TX/RX lines due to duplicate. 04. Removed reserved resistor R855 on AUDIO_CLKIN_V to resolve radiation issues. 05. Replaced R545 with capacitor C869 (100 pF) to address EMI issues 06. Added a common mode choke(L65 ~ L68) on the DisplayPort output to improve EMI issues. 07. Additional test points (CP100 ~ CP125) were implemented to support automated testing in the manufacturing process. 08. Reserved TVS D41 for VADP protection. 09. Change U110 Vin from D3.3V1 to D3.3V to meet DP IC power sequence requirement. 10. Replace Fuse (F1) and Schottky Diode (D40) with LDO (U115) for DP power protection. 11. Change R434 to 110 kΩ in order to improve the USB sequence performance. 12. Replace the USB Type-C connectors (USB1, USB4, USB5) with GCT USB4200-03-A to avoid incoming material defects. 13. RAA489800: Modify DCIN pin reference voltage setting from original reference to VADP to prevent device damage.

RETRONIX

Title: Revision History

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