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26	USB 3.0 NEC UPD720202
27	N/A
28	SATA Port
29	Audio Codec ALC892
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MS-7712

Version : 1.0

CPU :

INTEL Sandy Bridge-E Processor

System Chipset :

INTEL Patsburg Chipset

On Board Chipset :

VRM 12 -- ISL6366 6 Phase

Gigabit LAN -- RTL8111E

USB 3.0 -- UPD720202

HDA Codec -- Realtek ALC892

Super I/O -- F71889AD

SPI Flash 64Mb

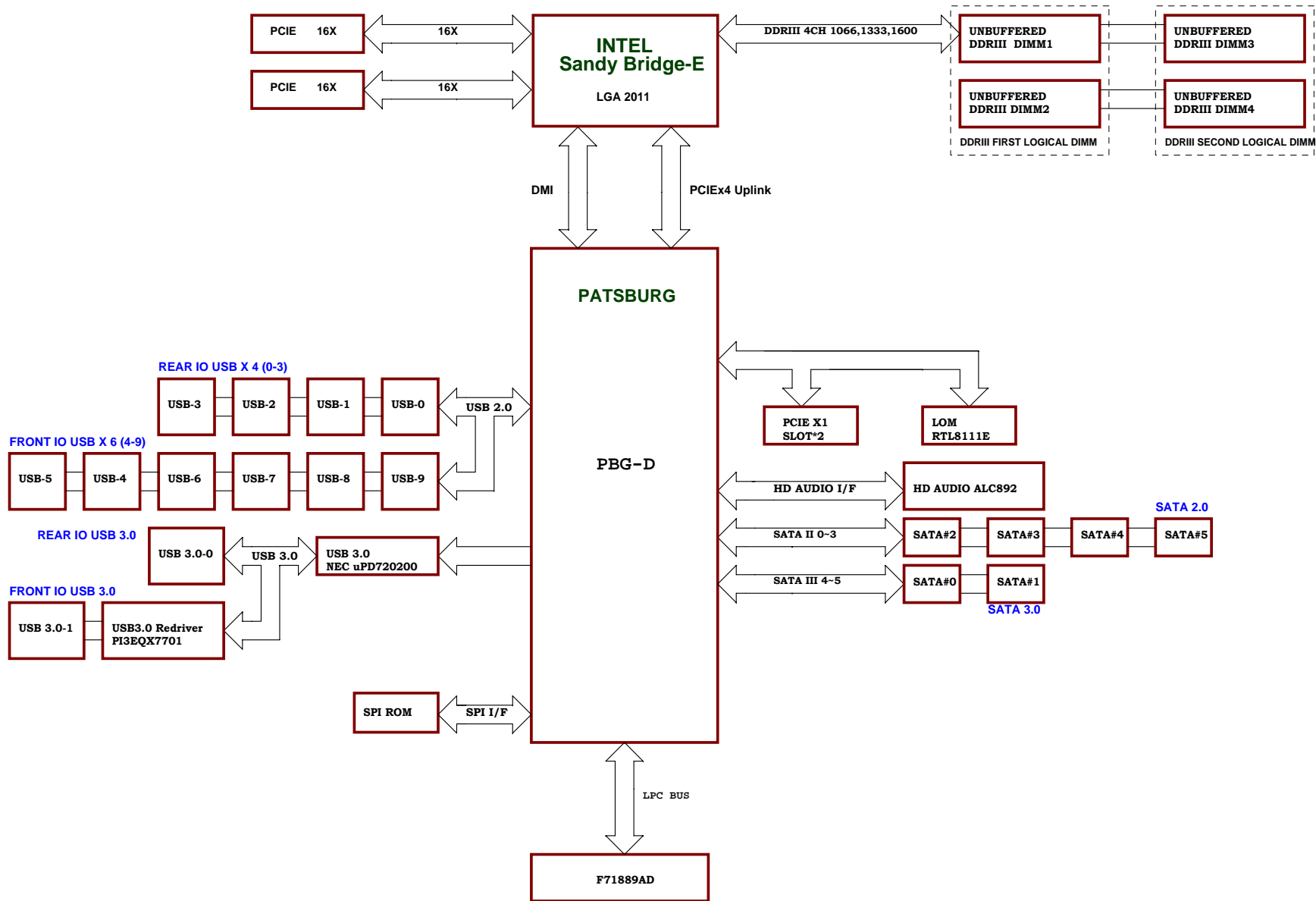
Main Memory :

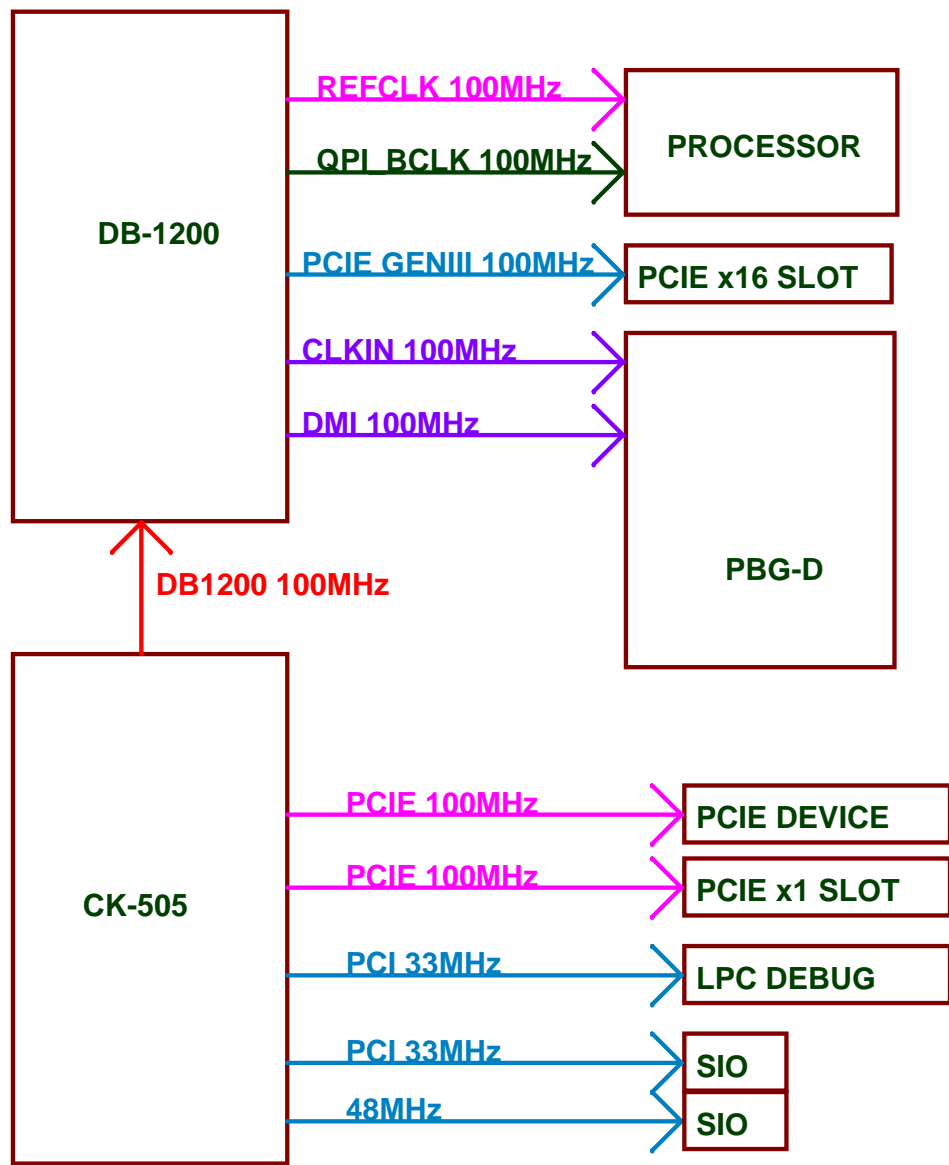
4 Channel DDR III * 4 (Max 16GB)

Expansion Slot :

PCI Express x16 Slot * 2

PCI Express x1 Slot * 2





11 MEM_MA_DATA[63..0] ← MEM_MA_DATA[63..0]

MEM_MA_DATA0	CC7	DDR0_DQ_00	CH8	MEM_MA_DQS_H0	MEM_MA_DQS_H0_11
MEM_MA_DATA1	CD8	DDR0_DQ_01	CG7	MEM_MA_DQS_L0	MEM_MA_DQS_L0_11
MEM_MA_DATA2	CK8	DDR0_DQ_02	CF4	MEM_MA_DQS_H1	MEM_MA_DQS_H1_11
MEM_MA_DATA3	CL9	DDR0_DQ_03	CE3	MEM_MA_DQS_L1	MEM_MA_DQS_L1_11
MEM_MA_DATA4	BY6	DDR0_DQ_04	CK14	MEM_MA_DQS_H2	MEM_MA_DQS_H2_11
MEM_MA_DATA5	CA7	DDR0_DQ_05	CH14	MEM_MA_DQS_L2	MEM_MA_DQS_L2_11
MEM_MA_DATA6	CL7	DDR0_DQ_06	CE11	MEM_MA_DQS_H3	MEM_MA_DQS_H3_11
MEM_MA_DATA7	CB4	DDR0_DQ_07	CD10	MEM_MA_DQS_L3	MEM_MA_DQS_L3_11
MEM_MA_DATA8	CB4	DDR0_DQ_08	CC33	MEM_MA_DQS_H4	MEM_MA_DQS_H4_11
MEM_MA_DATA9	CH4	DDR0_DQ_09	CE33	MEM_MA_DQS_L4	MEM_MA_DQS_L4_11
MEM_MA_DATA10	CH4	DDR0_DQ_10	CJ33	MEM_MA_DQS_H5	MEM_MA_DQS_H5_11
MEM_MA_DATA11	CA1	DDR0_DQ_11	CL33	MEM_MA_DQS_L5	MEM_MA_DQS_L5_11
MEM_MA_DATA12	CA3	DDR0_DQ_12	CD40	MEM_MA_DQS_H6	MEM_MA_DQS_H6_11
MEM_MA_DATA13	CG5	DDR0_DQ_13	CB40	MEM_MA_DQS_L6	MEM_MA_DQS_L6_11
MEM_MA_DATA14	CG5	DDR0_DQ_14	CK40	MEM_MA_DQS_H7	MEM_MA_DQS_H7_11
MEM_MA_DATA15	CK12	DDR0_DQ_15	CH40	MEM_MA_DQS_L7	MEM_MA_DQS_L7_11
MEM_MA_DATA16	CM12	DDR0_DQ_16			
MEM_MA_DATA17	CK16	DDR0_DQ_17			
MEM_MA_DATA18	CM16	DDR0_DQ_18			
MEM_MA_DATA19	CG13	DDR0_DQ_19			
MEM_MA_DATA20	CL11	DDR0_DQ_20			
MEM_MA_DATA21	CL15	DDR0_DQ_21			
MEM_MA_DATA22	BY10	DDR0_DQ_22			
MEM_MA_DATA23	BY10	DDR0_DQ_23			
MEM_MA_DATA24	CB12	DDR0_DQ_24			
MEM_MA_DATA25	CB12	DDR0_DQ_25			
MEM_MA_DATA26	CB12	DDR0_DQ_26			
MEM_MA_DATA27	CB12	DDR0_DQ_27			
MEM_MA_DATA28	CB12	DDR0_DQ_28			
MEM_MA_DATA29	CB12	DDR0_DQ_29			
MEM_MA_DATA30	CB12	DDR0_DQ_30			
MEM_MA_DATA31	CB12	DDR0_DQ_31			
MEM_MA_DATA32	CB12	DDR0_DQ_32			
MEM_MA_DATA33	CB12	DDR0_DQ_33			
MEM_MA_DATA34	CB12	DDR0_DQ_34			
MEM_MA_DATA35	CB12	DDR0_DQ_35			
MEM_MA_DATA36	CB12	DDR0_DQ_36			
MEM_MA_DATA37	CB12	DDR0_DQ_37			
MEM_MA_DATA38	CB12	DDR0_DQ_38			
MEM_MA_DATA39	CB12	DDR0_DQ_39			
MEM_MA_DATA40	CB12	DDR0_DQ_40			
MEM_MA_DATA41	CB12	DDR0_DQ_41			
MEM_MA_DATA42	CB12	DDR0_DQ_42			
MEM_MA_DATA43	CB12	DDR0_DQ_43			
MEM_MA_DATA44	CB12	DDR0_DQ_44			
MEM_MA_DATA45	CB12	DDR0_DQ_45			
MEM_MA_DATA46	CB12	DDR0_DQ_46			
MEM_MA_DATA47	CB12	DDR0_DQ_47			
MEM_MA_DATA48	CB12	DDR0_DQ_48			
MEM_MA_DATA49	CB12	DDR0_DQ_49			
MEM_MA_DATA50	CB12	DDR0_DQ_50			
MEM_MA_DATA51	CB12	DDR0_DQ_51			
MEM_MA_DATA52	CB12	DDR0_DQ_52			
MEM_MA_DATA53	CB12	DDR0_DQ_53			
MEM_MA_DATA54	CB12	DDR0_DQ_54			
MEM_MA_DATA55	CB12	DDR0_DQ_55			
MEM_MA_DATA56	CB12	DDR0_DQ_56			
MEM_MA_DATA57	CB12	DDR0_DQ_57			
MEM_MA_DATA58	CB12	DDR0_DQ_58			
MEM_MA_DATA59	CB12	DDR0_DQ_59			
MEM_MA_DATA60	CB12	DDR0_DQ_60			
MEM_MA_DATA61	CB12	DDR0_DQ_61			
MEM_MA_DATA62	CB12	DDR0_DQ_62			
MEM_MA_DATA63	CB12	DDR0_DQ_63			

CE15
CE15
CH18
CE18
CB14
CD14
CG17
CK18

SNB-E

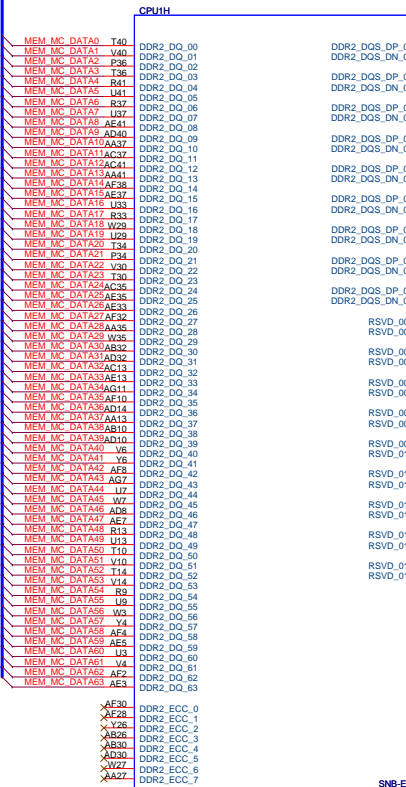
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MEM_MB_DATA0	CP4	DDR1_DQ_00	CR3	MEM_MB_DQS_H0	MEM_MB_DQS_H0_11
MEM_MB_DATA1	CP2	DDR1_DQ_01	CT4	MEM_MB_DQS_L0	MEM_MB_DQS_L0_11
MEM_MB_DATA2	CV4	DDR1_DQ_02	DE9	MEM_MB_DQS_H1	MEM_MB_DQS_H1_11
MEM_MB_DATA3	CV4	DDR1_DQ_03	DC9	MEM_MB_DQS_L1	MEM_MB_DQS_L1_11
MEM_MB_DATA4	CM4	DDR1_DQ_04	CU9	MEM_MB_DQS_H2	MEM_MB_DQS_H2_11
MEM_MB_DATA5	CV2	DDR1_DQ_05	CV8	MEM_MB_DQS_L2	MEM_MB_DQS_L2_11
MEM_MB_DATA6	CV2	DDR1_DQ_06	CU15	MEM_MB_DQS_H3	MEM_MB_DQS_H3_11
MEM_MB_DATA7	DA7	DDR1_DQ_07	CR15	MEM_MB_DQS_L3	MEM_MB_DQS_L3_11
MEM_MB_DATA8	DA7	DDR1_DQ_08	CP32	MEM_MB_DQS_H4	MEM_MB_DQS_H4_11
MEM_MB_DATA9	DC7	DDR1_DQ_09	CT32	MEM_MB_DQS_L4	MEM_MB_DQS_L4_11
MEM_MB_DATA10	DE11	DDR1_DQ_10	DB34	MEM_MB_DQS_H5	MEM_MB_DQS_H5_11
MEM_MB_DATA11	DE11	DDR1_DQ_11	CU34	MEM_MB_DQS_L5	MEM_MB_DQS_L5_11
MEM_MB_DATA12	CV6	DDR1_DQ_12	CU38	MEM_MB_DQS_H6	MEM_MB_DQS_H6_11
MEM_MB_DATA13	DB6	DDR1_DQ_13	CB38	MEM_MB_DQS_L6	MEM_MB_DQS_L6_11
MEM_MB_DATA14	DB10	DDR1_DQ_14	DC38	MEM_MB_DQS_H7	MEM_MB_DQS_H7_11
MEM_MB_DATA15	DE10	DDR1_DQ_15	DE38	MEM_MB_DQS_L7	MEM_MB_DQS_L7_11
MEM_MB_DATA16	CU7	DDR1_DQ_16			
MEM_MB_DATA17	CU7	DDR1_DQ_17			
MEM_MB_DATA18	CU7	DDR1_DQ_18			
MEM_MB_DATA19	CP10	DDR1_DQ_19			
MEM_MB_DATA20	CP6	DDR1_DQ_20			
MEM_MB_DATA21	CP6	DDR1_DQ_21			
MEM_MB_DATA22	CP6	DDR1_DQ_22			
MEM_MB_DATA23	CP6	DDR1_DQ_23			
MEM_MB_DATA24	CP6	DDR1_DQ_24			
MEM_MB_DATA25	CP6	DDR1_DQ_25			
MEM_MB_DATA26	CP6	DDR1_DQ_26			
MEM_MB_DATA27	CP6	DDR1_DQ_27			
MEM_MB_DATA28	CP6	DDR1_DQ_28			
MEM_MB_DATA29	CP6	DDR1_DQ_29			
MEM_MB_DATA30	CP6	DDR1_DQ_30			
MEM_MB_DATA31	CP6	DDR1_DQ_31			
MEM_MB_DATA32	CP6	DDR1_DQ_32			
MEM_MB_DATA33	CP6	DDR1_DQ_33			
MEM_MB_DATA34	CP6	DDR1_DQ_34			
MEM_MB_DATA35	CP6	DDR1_DQ_35			
MEM_MB_DATA36	CP6	DDR1_DQ_36			
MEM_MB_DATA37	CP6	DDR1_DQ_37			
MEM_MB_DATA38	CP6	DDR1_DQ_38			
MEM_MB_DATA39	CP6	DDR1_DQ_39			
MEM_MB_DATA40	CP6	DDR1_DQ_40			
MEM_MB_DATA41	CP6	DDR1_DQ_41			
MEM_MB_DATA42	CP6	DDR1_DQ_42			
MEM_MB_DATA43	CP6	DDR1_DQ_43			
MEM_MB_DATA44	CP6	DDR1_DQ_44			
MEM_MB_DATA45	CP6	DDR1_DQ_45			
MEM_MB_DATA46	CP6	DDR1_DQ_46			
MEM_MB_DATA47	CP6	DDR1_DQ_47			
MEM_MB_DATA48	CP6	DDR1_DQ_48			
MEM_MB_DATA49	CP6	DDR1_DQ_49			
MEM_MB_DATA50	CP6	DDR1_DQ_50			
MEM_MB_DATA51	CP6	DDR1_DQ_51			
MEM_MB_DATA52	CP6	DDR1_DQ_52			
MEM_MB_DATA53	CP6	DDR1_DQ_53			
MEM_MB_DATA54	CP6	DDR1_DQ_54			
MEM_MB_DATA55	CP6	DDR1_DQ_55			
MEM_MB_DATA56	CP6	DDR1_DQ_56			
MEM_MB_DATA57	CP6	DDR1_DQ_57			
MEM_MB_DATA58	CP6	DDR1_DQ_58			
MEM_MB_DATA59	CP6	DDR1_DQ_59			
MEM_MB_DATA60	CP6	DDR1_DQ_60			
MEM_MB_DATA61	CP6	DDR1_DQ_61			
MEM_MB_DATA62	CP6	DDR1_DQ_62			
MEM_MB_DATA63	CP6	DDR1_DQ_63			

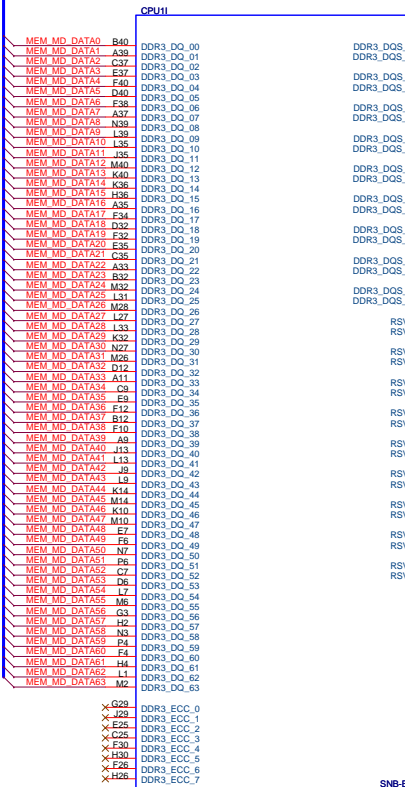
DE13
DE14
DE16
DE16
DA13
DC13
DA15
DE16

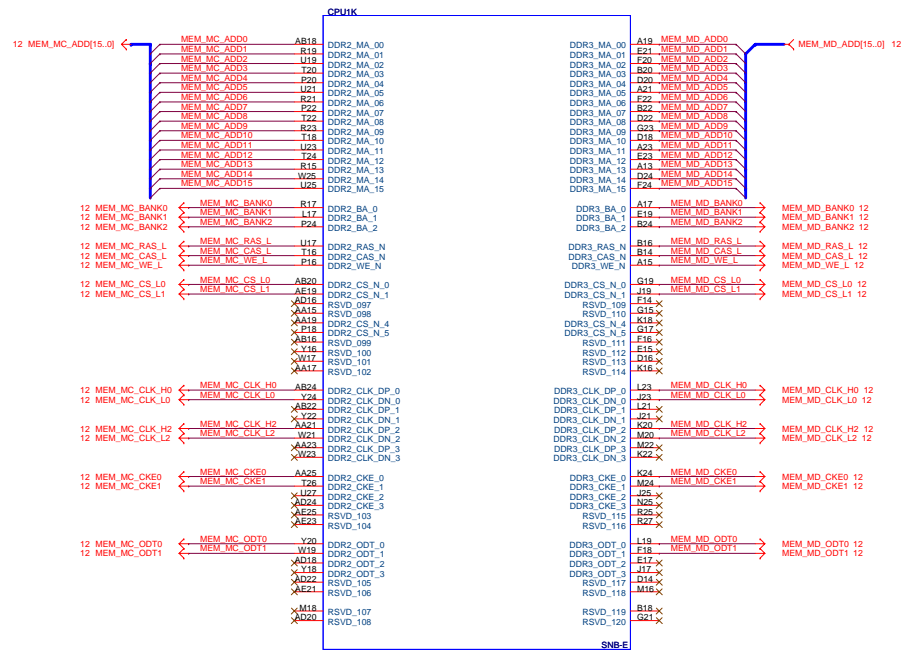
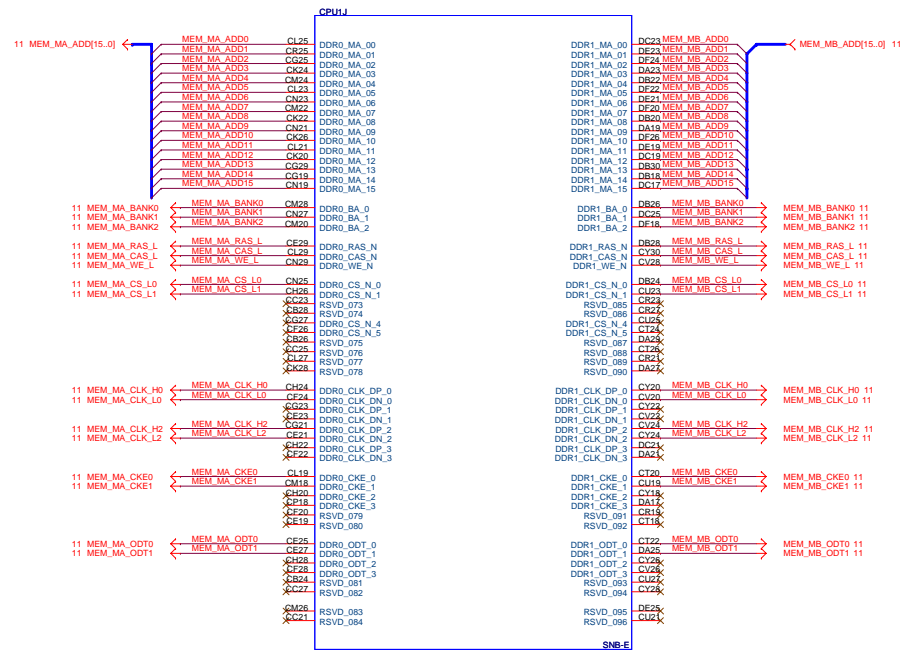
SNB-E

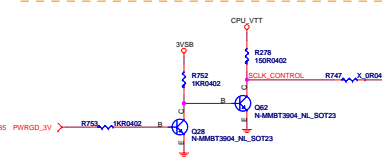
12 MEM_MC_DATA[63..0] <--



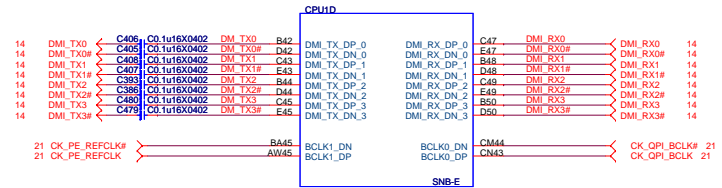
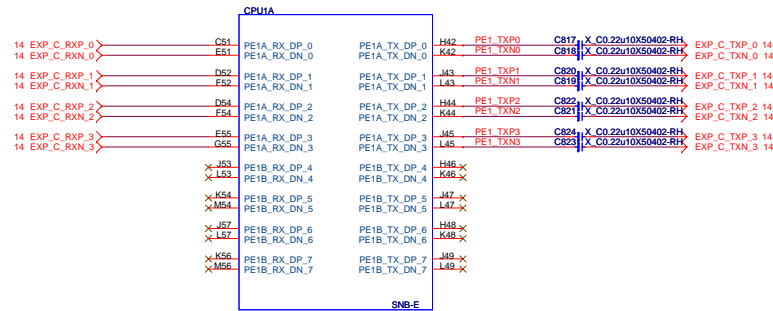
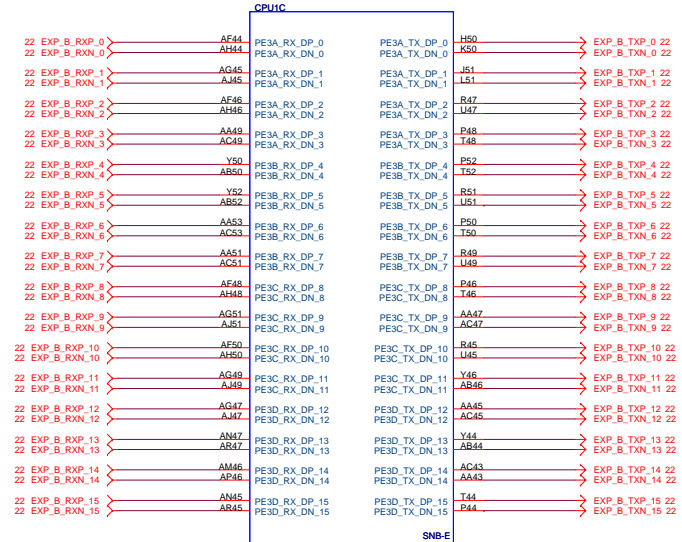
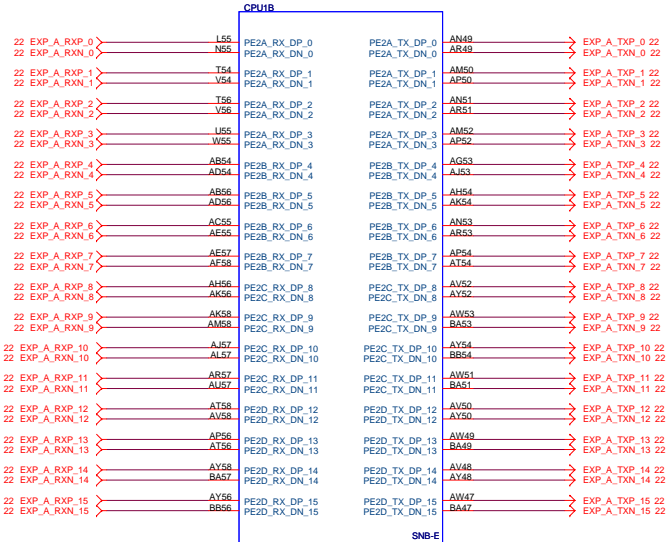
12 MEM_MD_DATA[63..0] <--

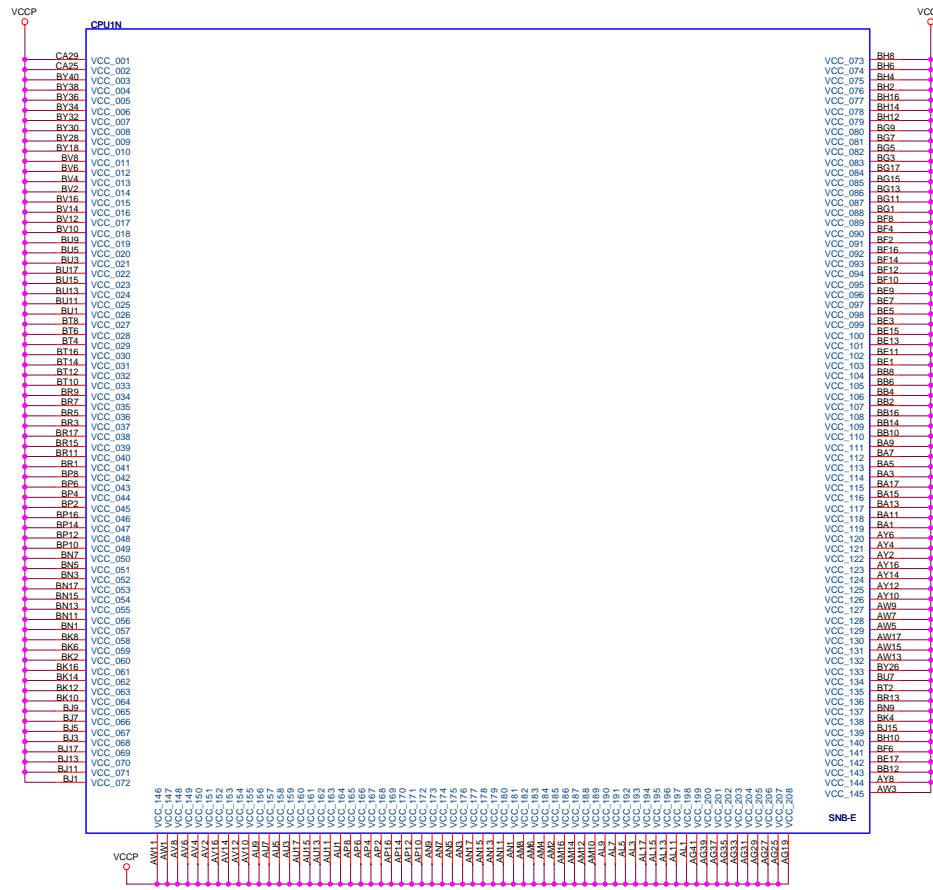




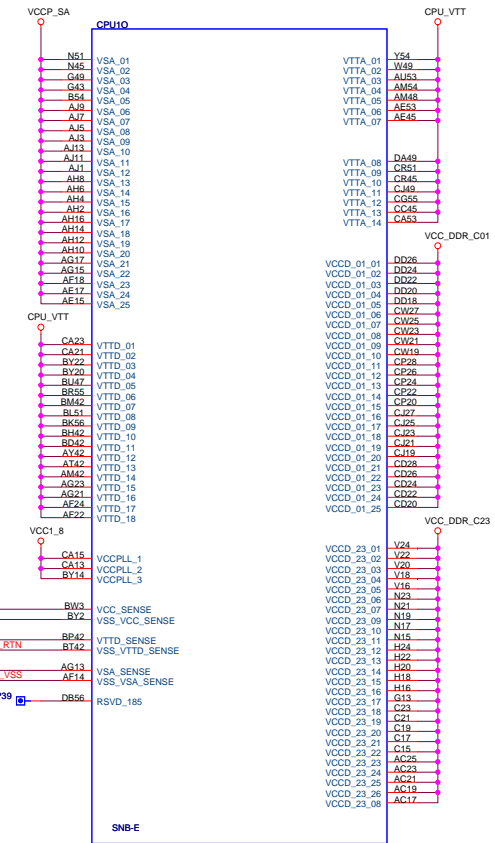


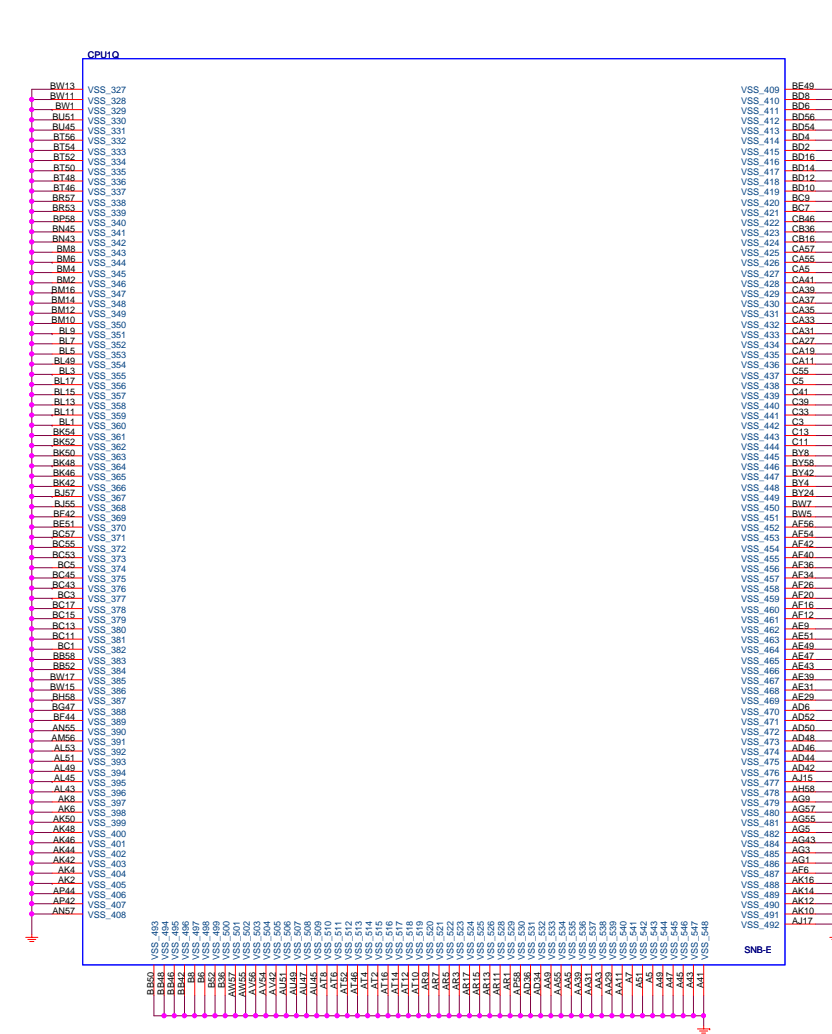
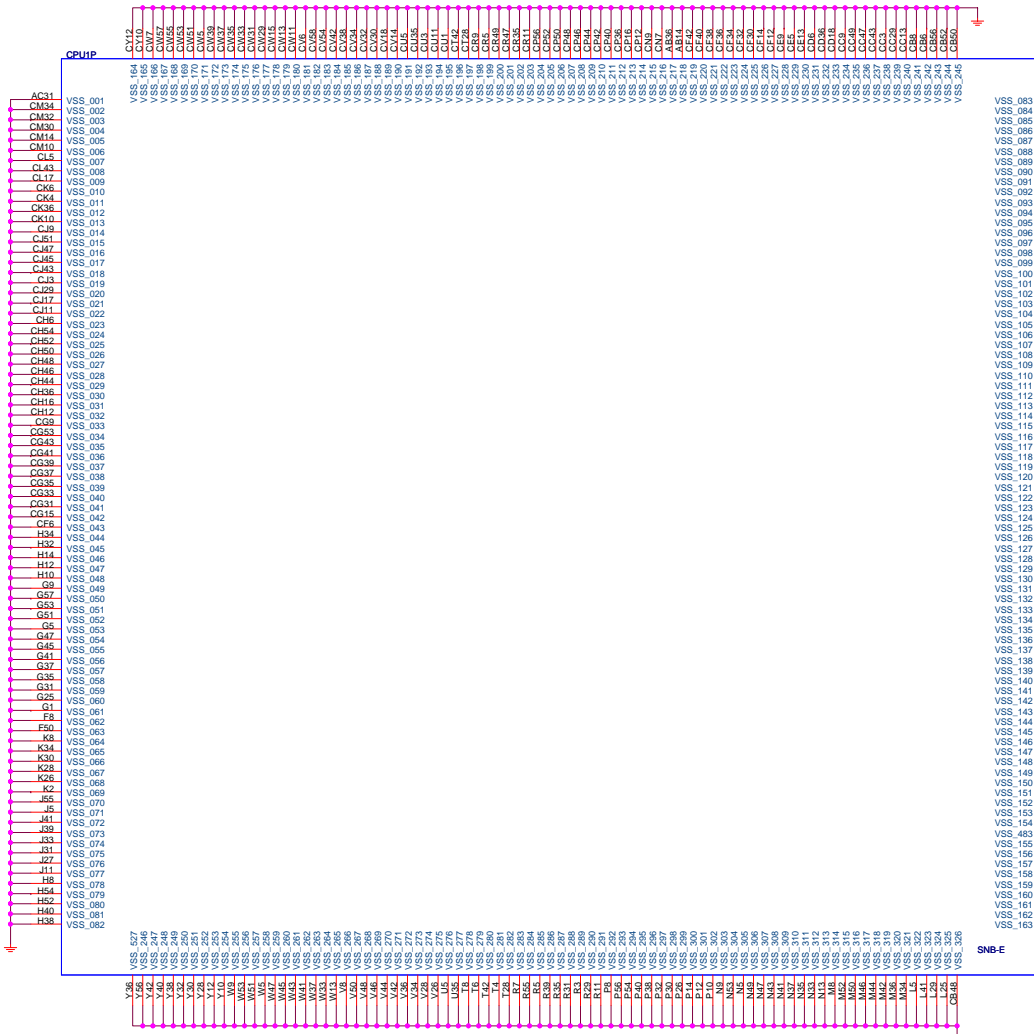
	GPIO 41	GPIO 42	SEL[0]	SEL[1]	BCLK Select
Normal & Turbo	H	H	1	1	100 MHz
BCLK OC	L	H	0	1	125 MHz
BCLK OC	H	L	1	0	167 MHz
BCLK OC	L	L	0	0	Reserve



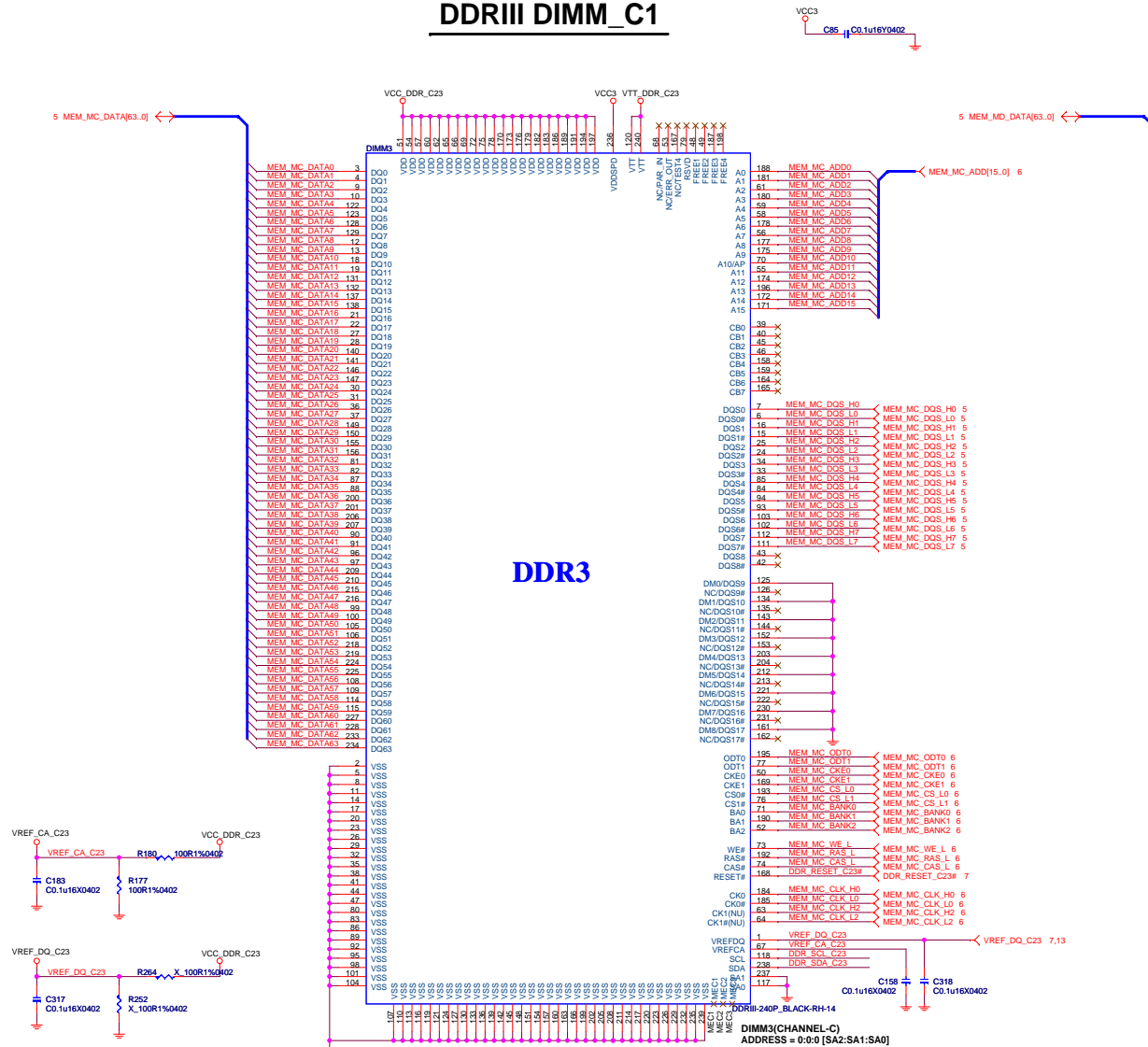


- 35 CPU_VCC_SENSE CPU_VCC_SENSE BW3
- 35 CPU_VSS_SENSE CPU_VSS_SENSE BY2
- 34 CPU_VTT_SENSE CPU_VTT_SENSE BP42
- 34 CPU_VTT_SENSE_RTIN CPU_VTT_SENSE_RTIN BT42
- 35 CPU_VSA_SENSE CPU_VSA_SENSE AG13
- 35 CPU_VSA_SENSE_VSS CPU_VSA_SENSE_VSS AF14

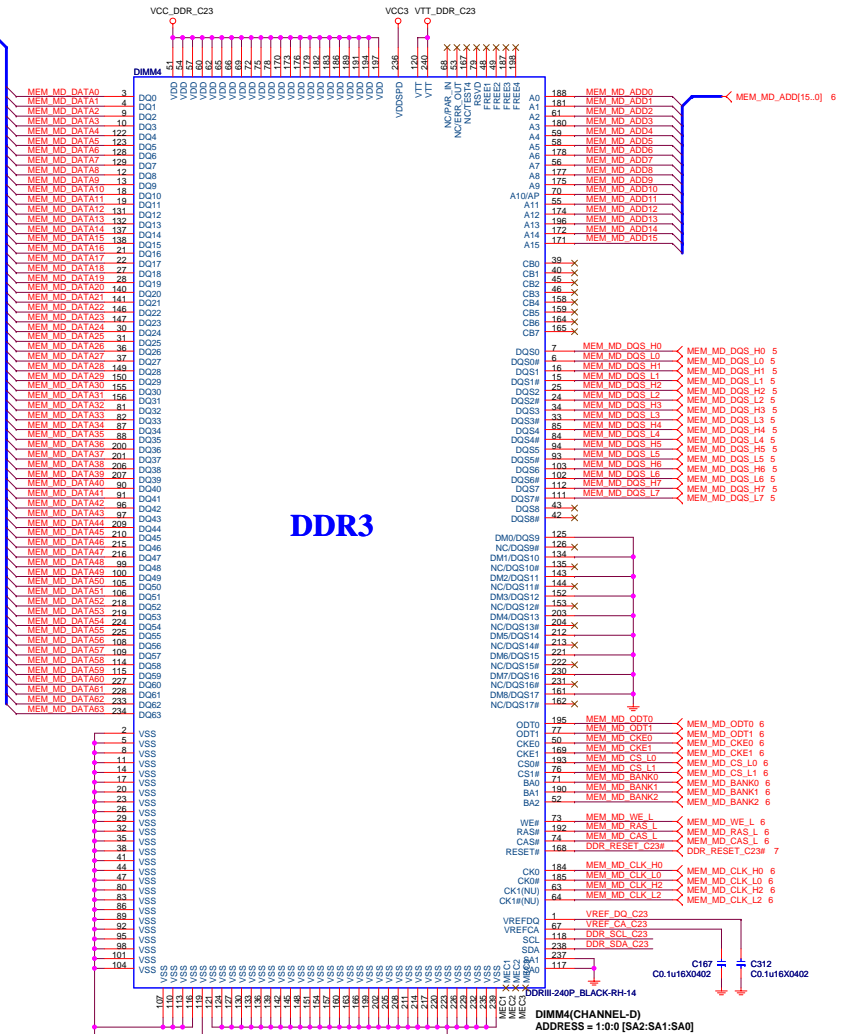




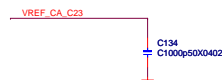
DDR3 DIMM_C1



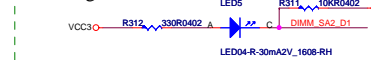
DDR3 DIMM_D1

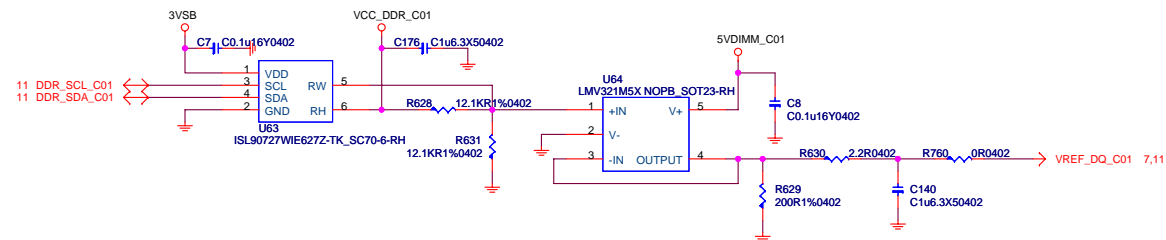
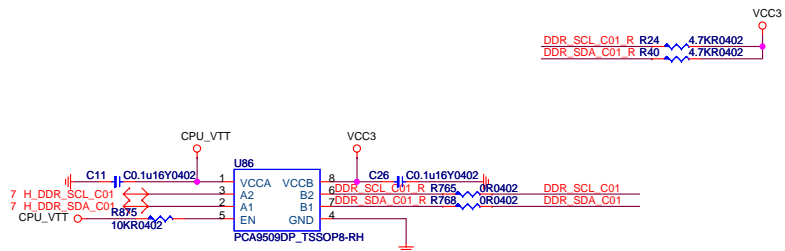


FOR EMI

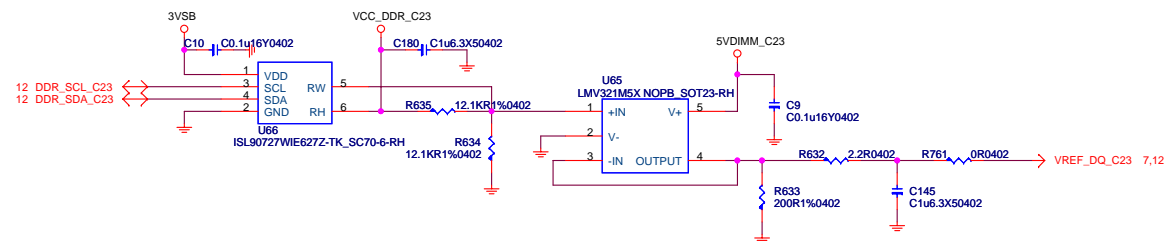
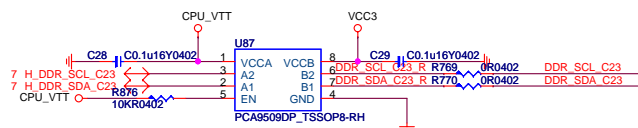


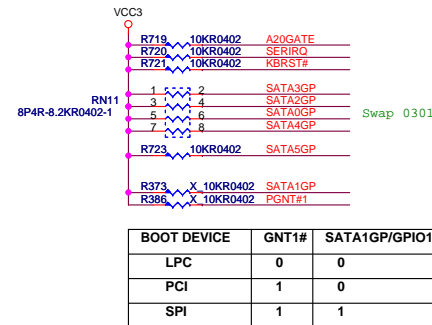
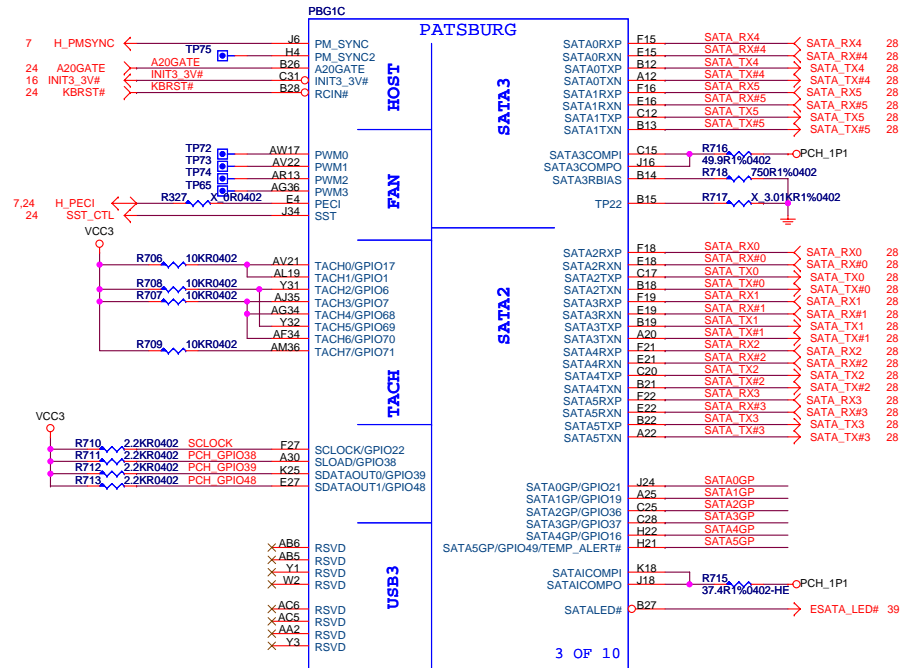
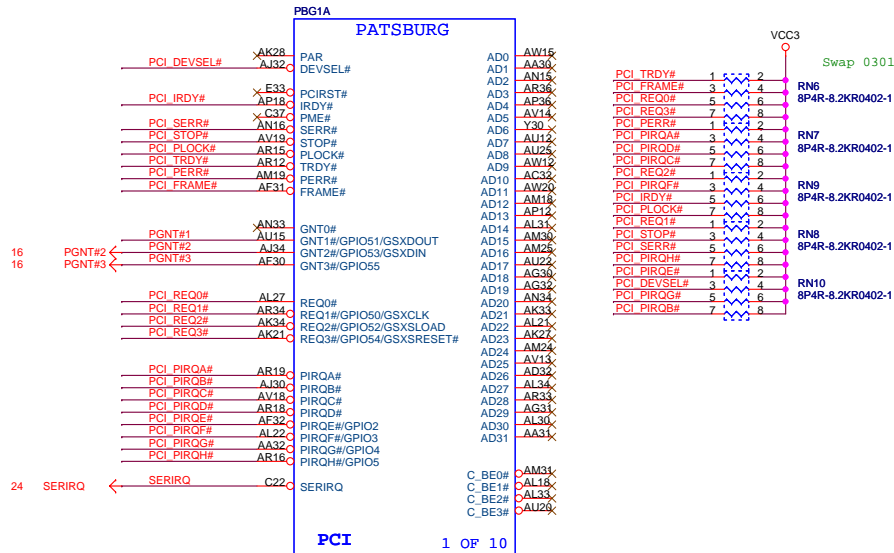
Warning LED



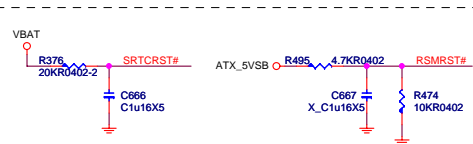
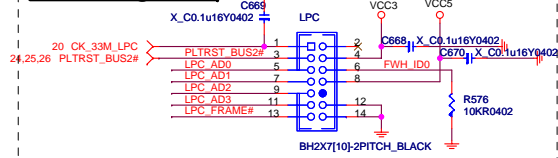
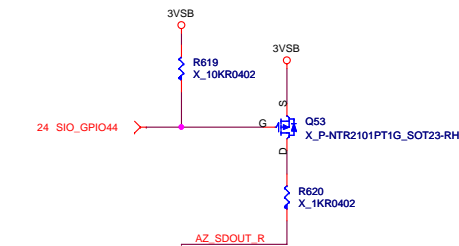
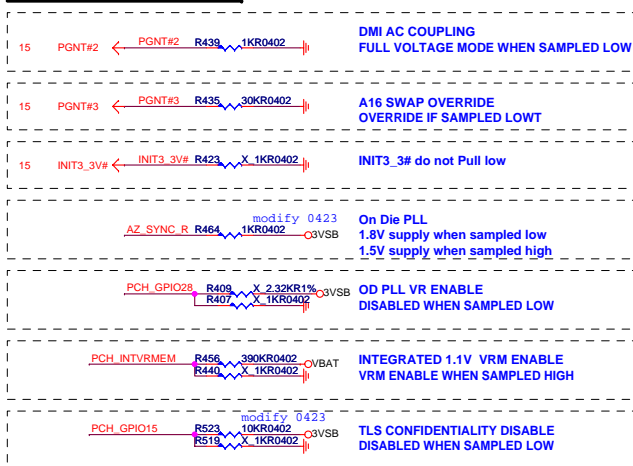
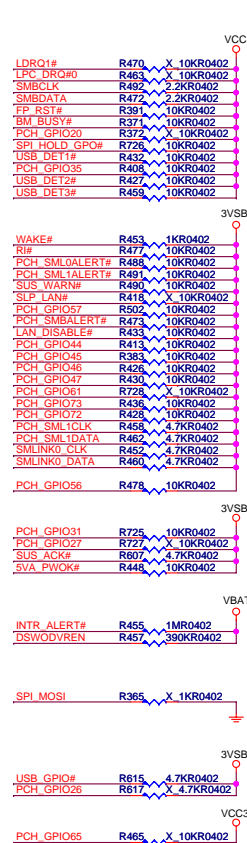


DDR SCL C23 R R46 4.7KR0402
DDR SDA C23 R R56 4.7KR0402





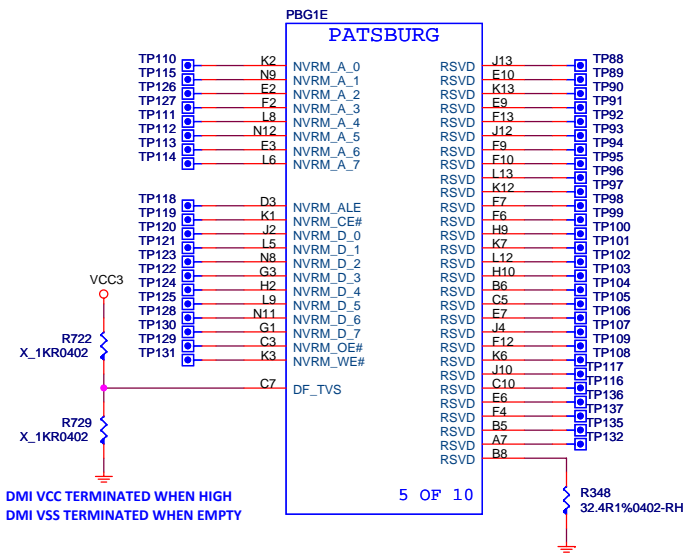
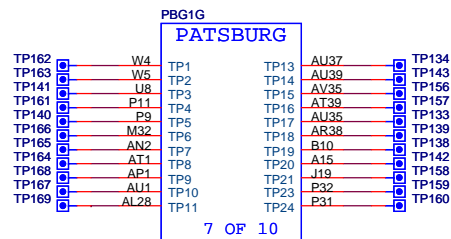
BOOT DEVICE	GNT1#	SATA1GP/GPIO19
LPC	0	0
PCI	1	0
SPI	1	1

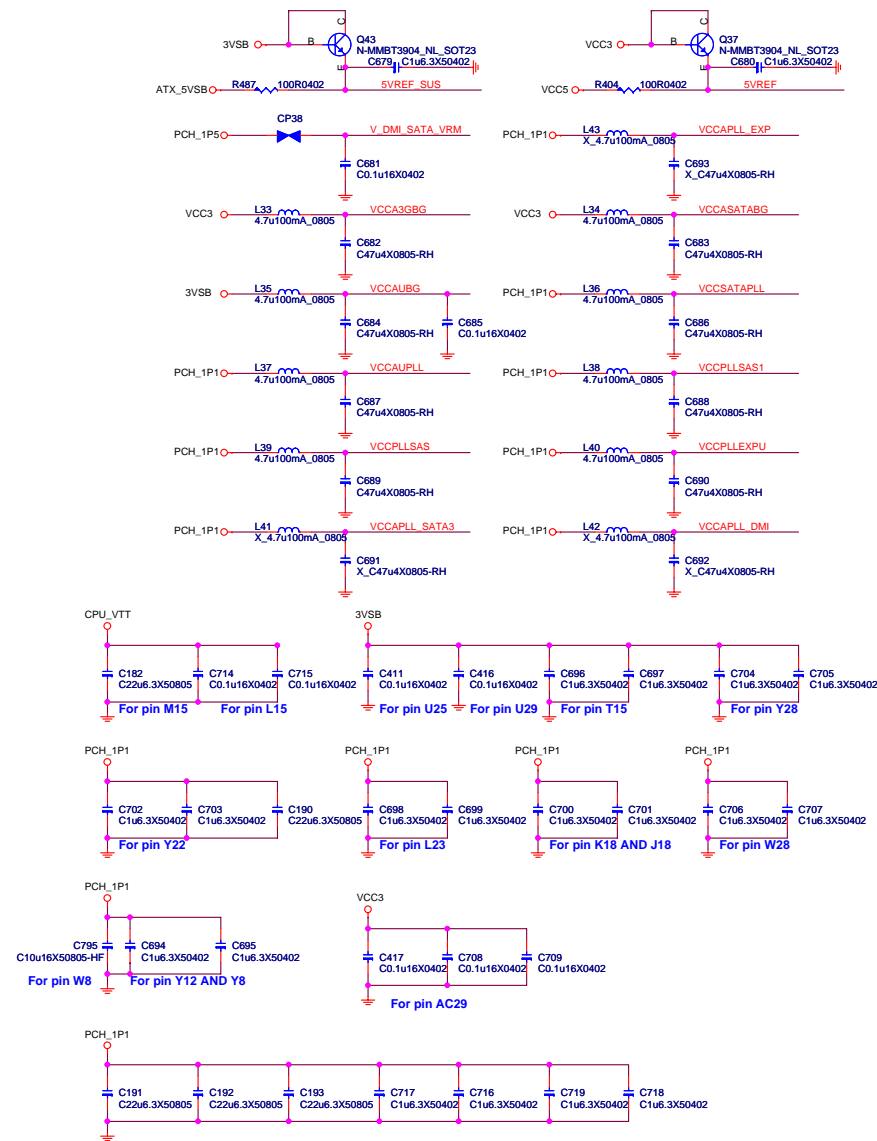


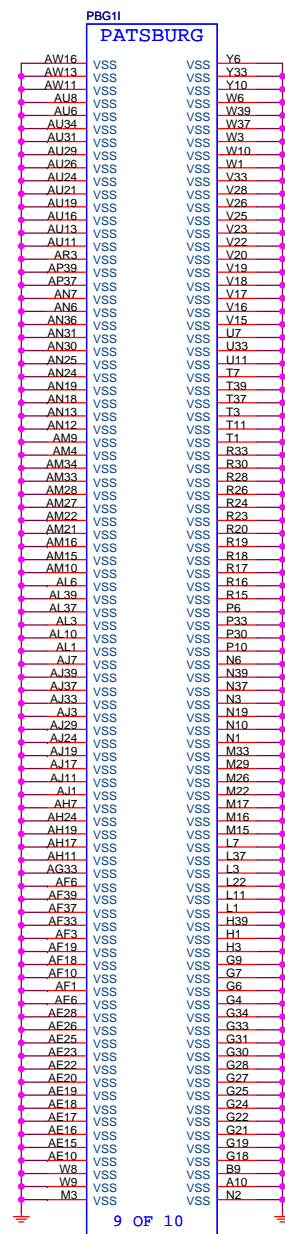
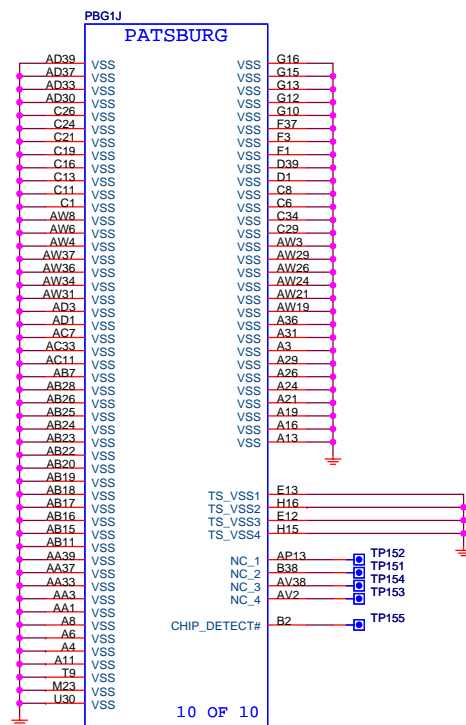
H1X2_BLACK-RH-1

HDA_SDO need to be pulled high to disable flash security and ME

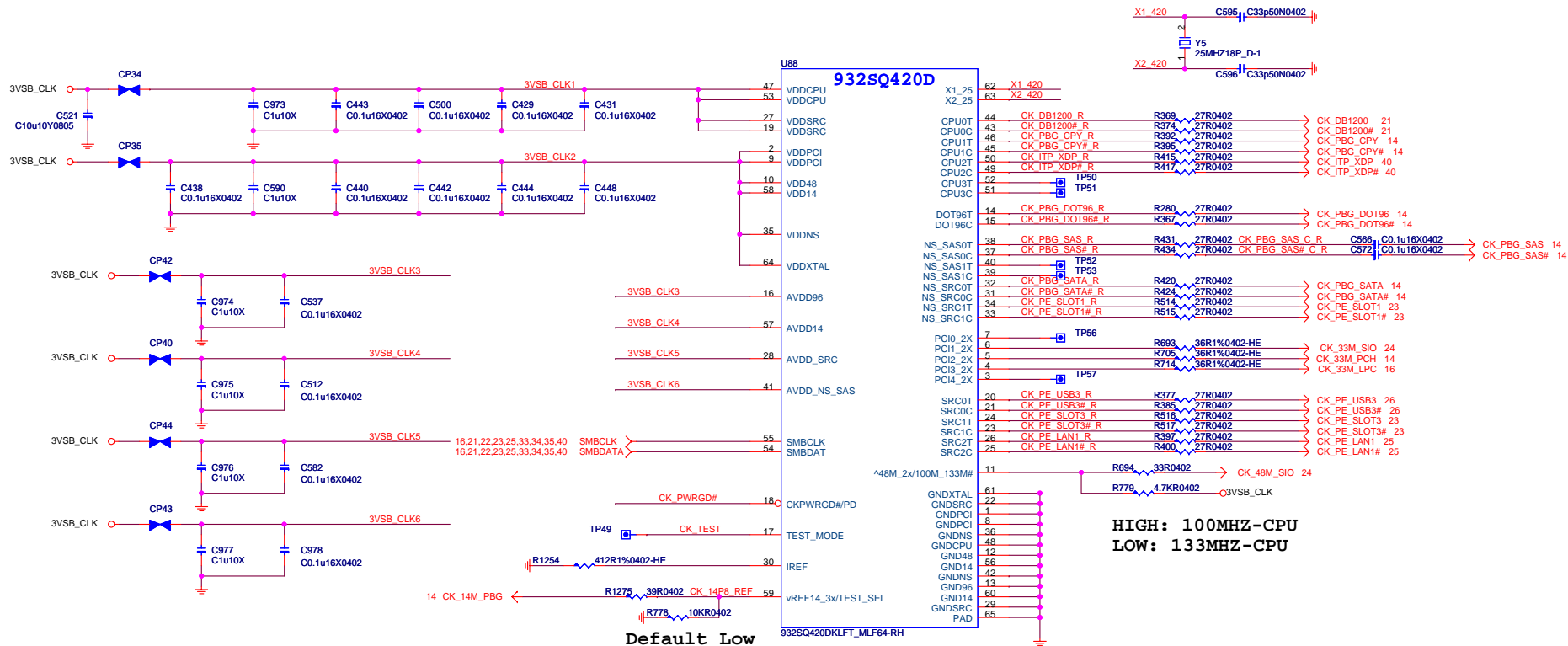
	GPIO 44	AZ_SDOUT_R
Normal	H	Floating
Flash ME	L	Pull High





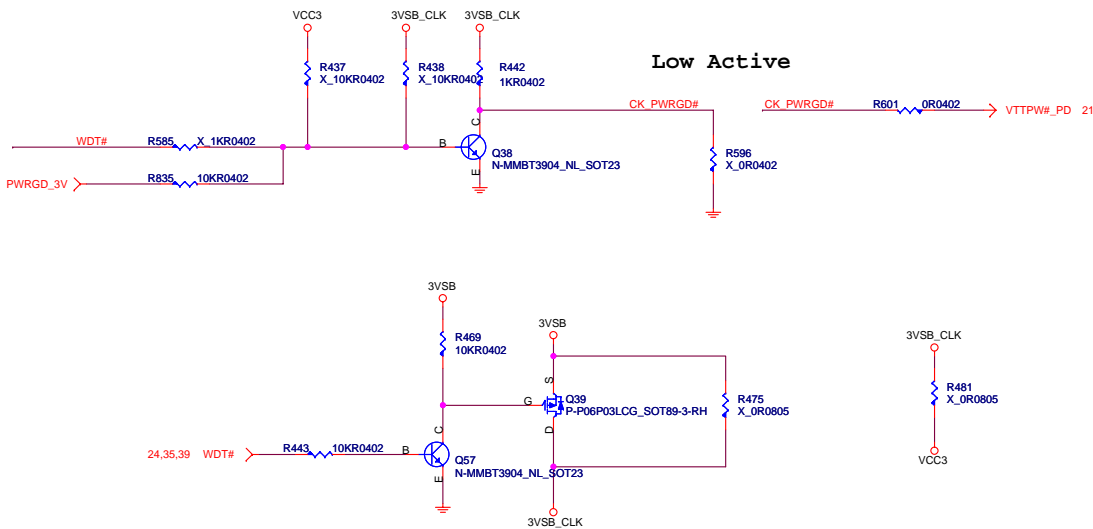


Clock Gen 932SQ420D

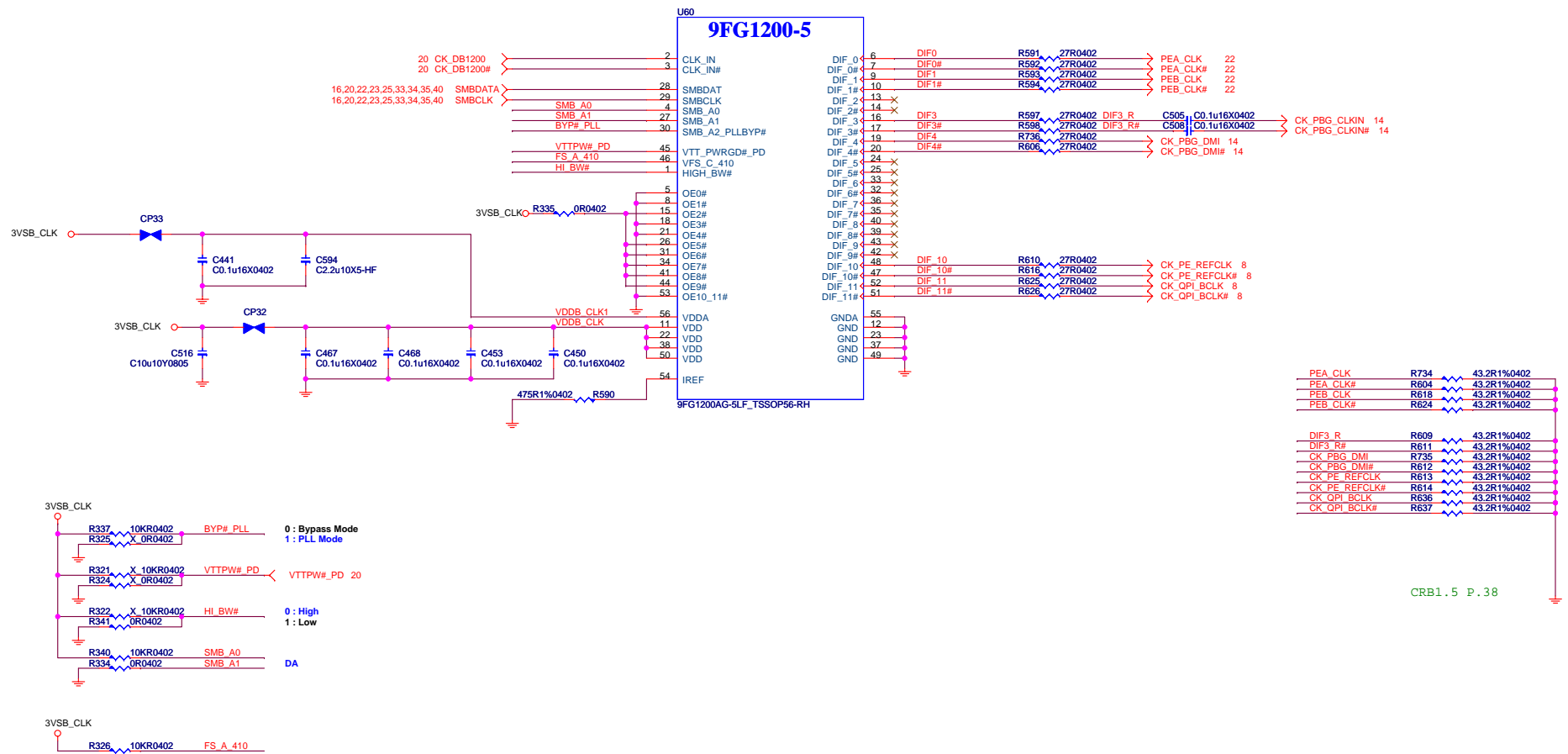


HIGH: 100MHZ-CPU
LOW: 133MHZ-CPU

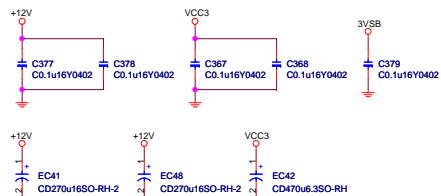
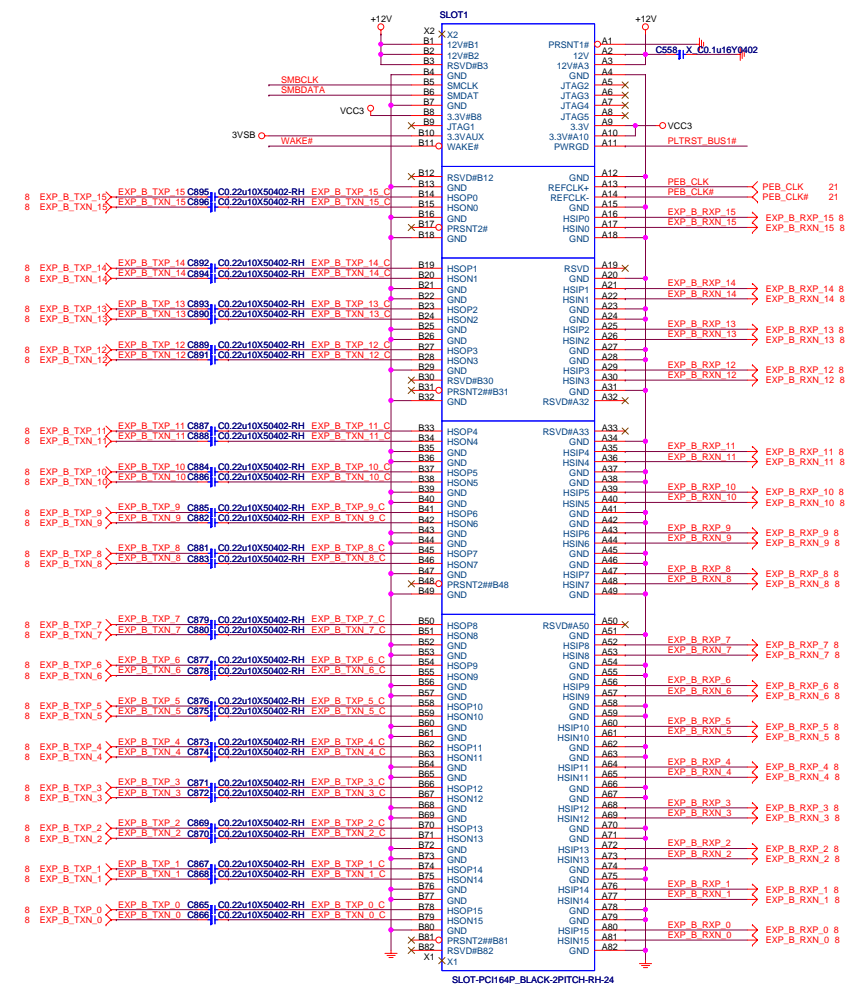
Low Active



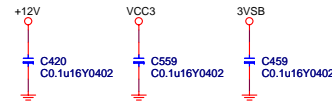
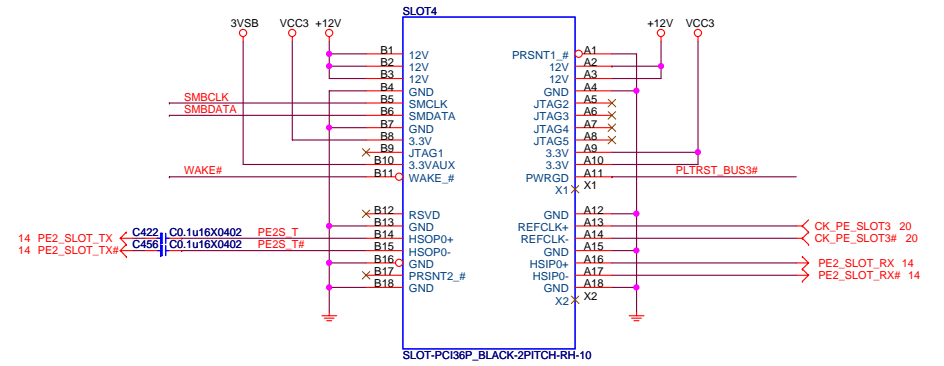
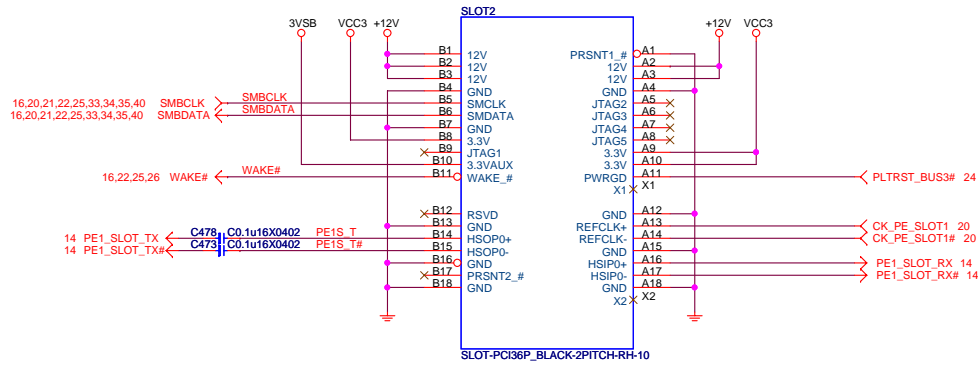
Clock Buffer 9FG1200D

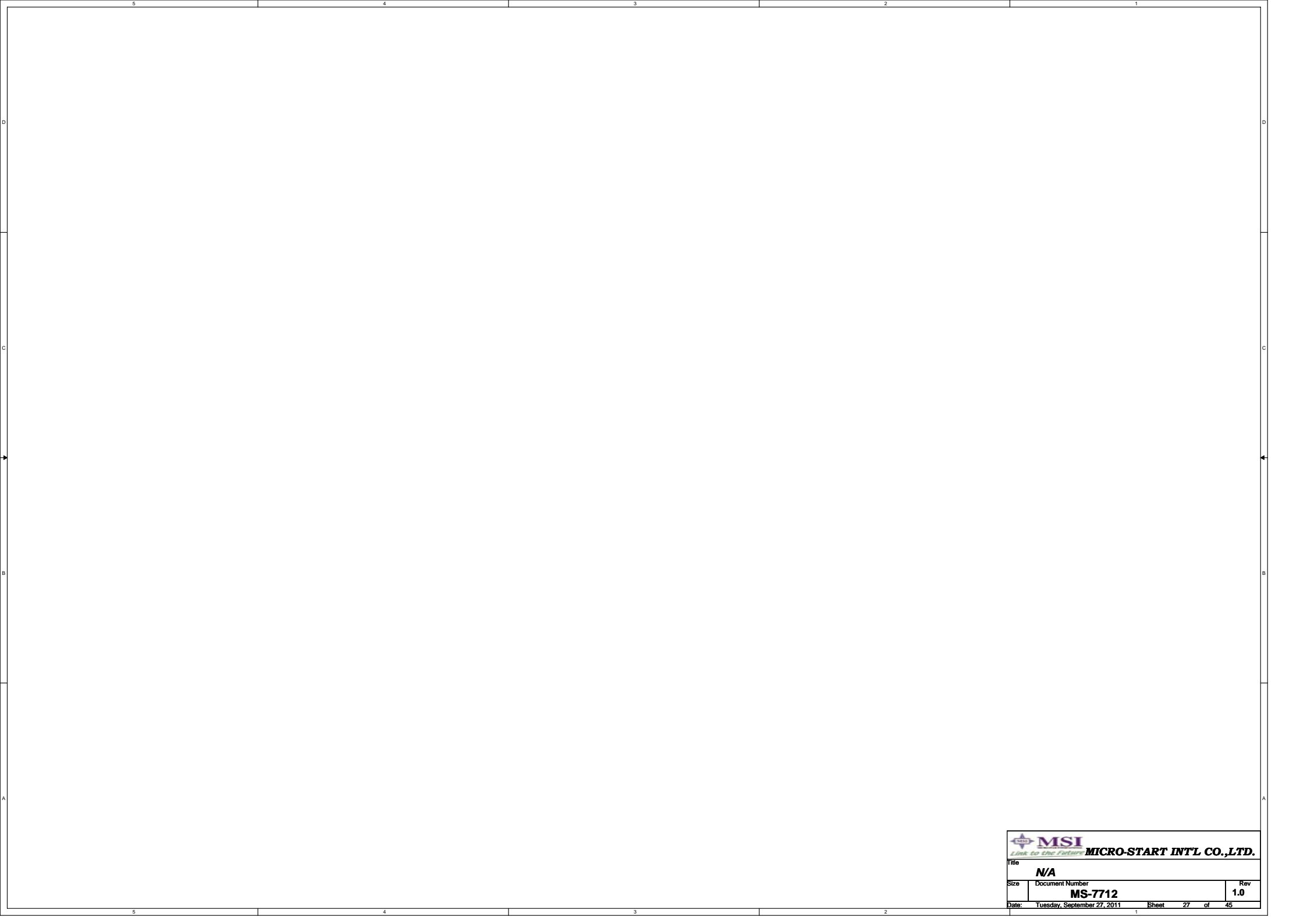



PCI EXPRESS X16 SLOT



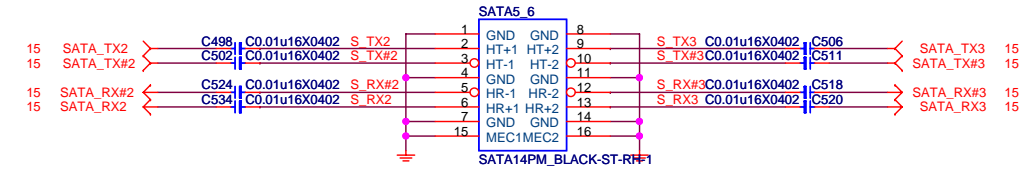
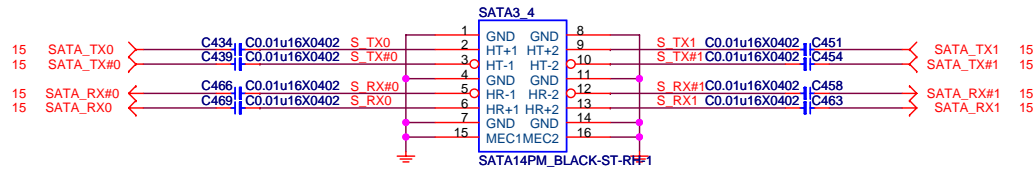
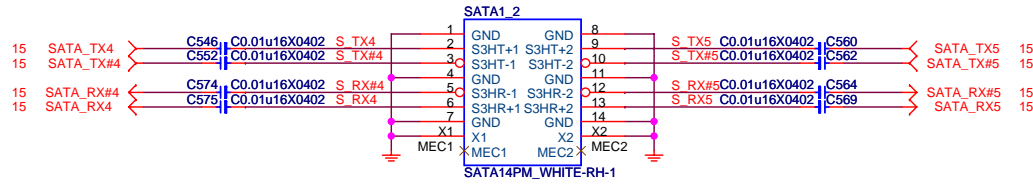
PCI EXPRESS X1 SLOT






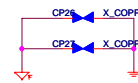
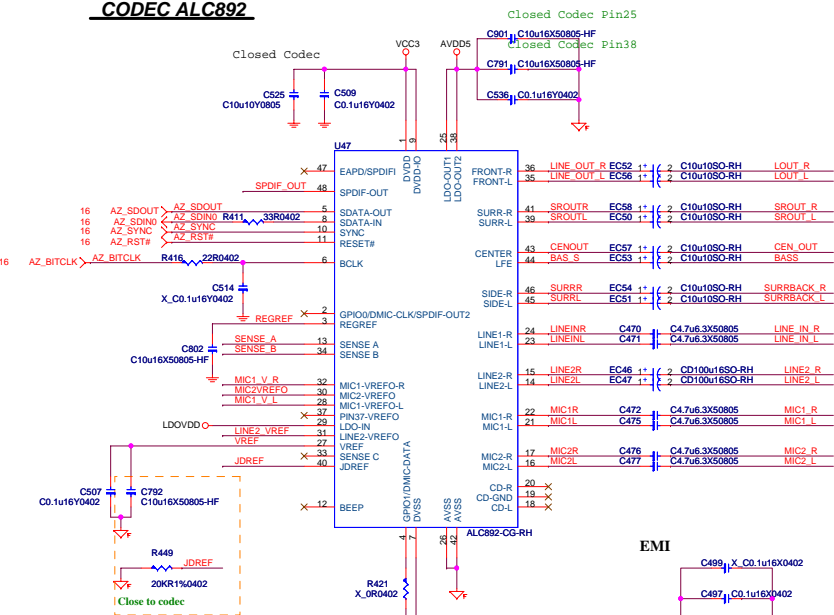
 MSI <i>Link to the Future</i>			MICRO-START INT'L CO.,LTD.		
Title					
N/A					
Size	Document Number				Rev
	MS-7712				1.0
Date:	Tuesday, September 27, 2011		Sheet	27	of 45

SATA Connector

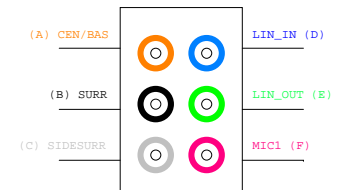
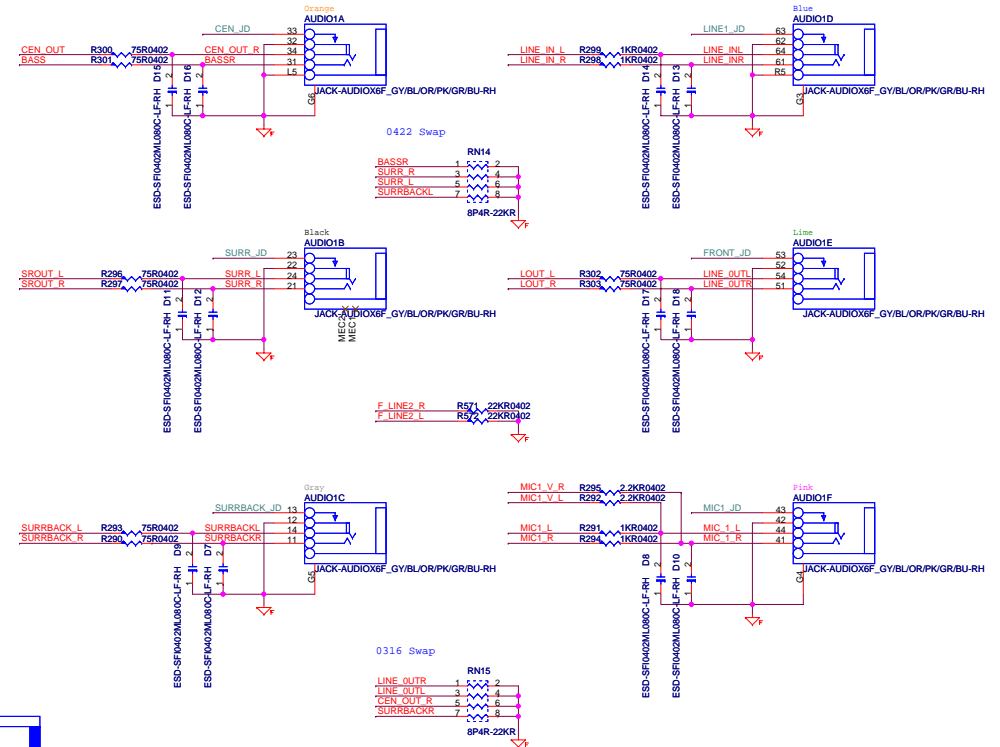
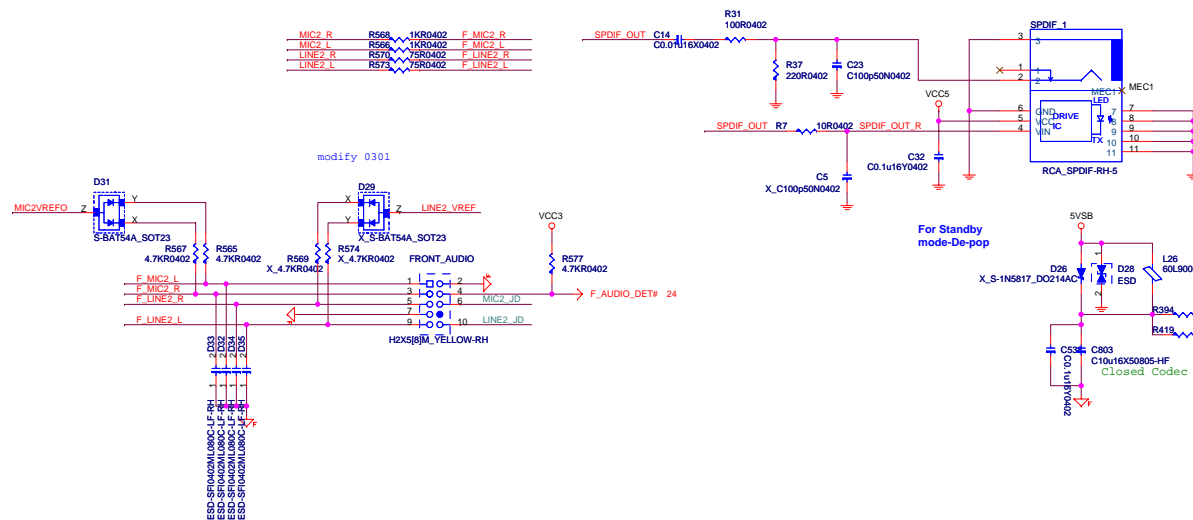


 MICRO-START INT'L CO.,LTD.		
Title		
SATA Port		
Size	Document Number	Rev
	MS-7712	1.0
Date:	Tuesday, September 27, 2011	Sheet 28 of 45

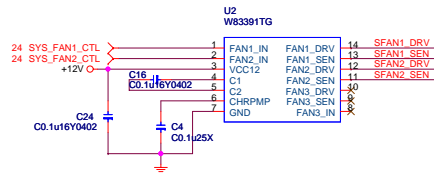
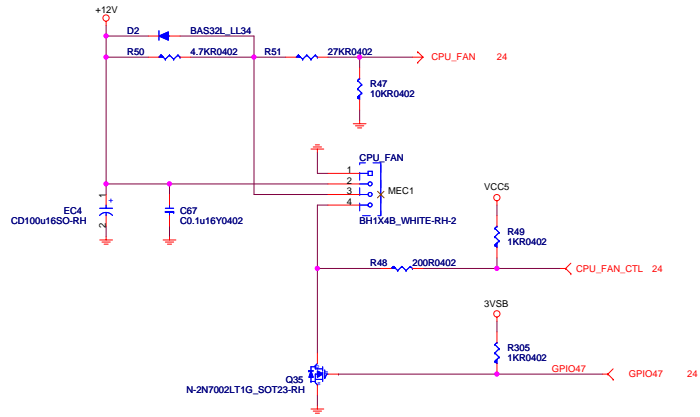
CODEC ALC892



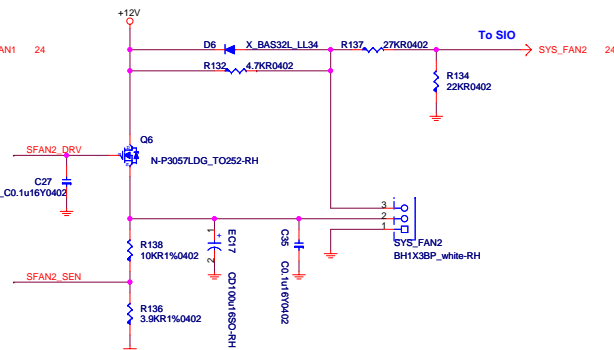
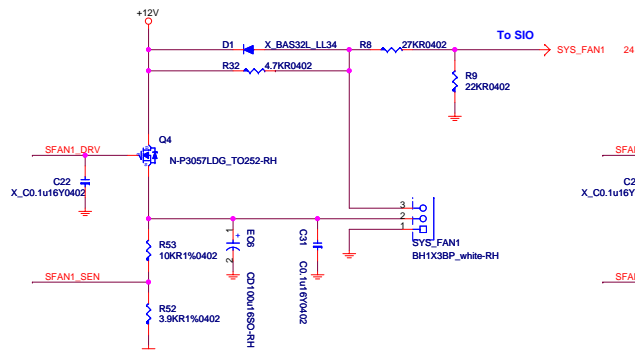
SPDIF OUT OPT+RCA



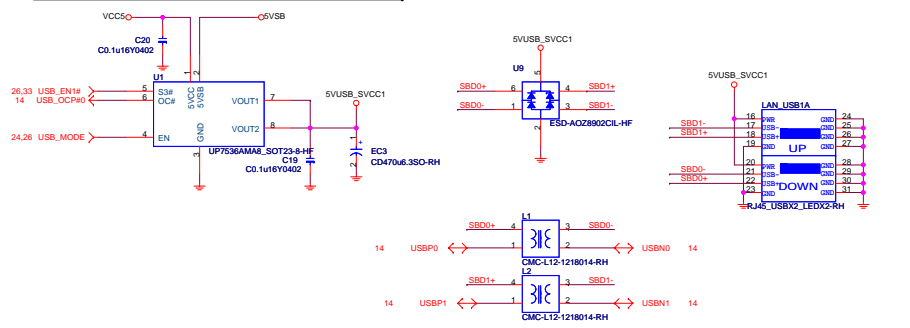
CPU Fan



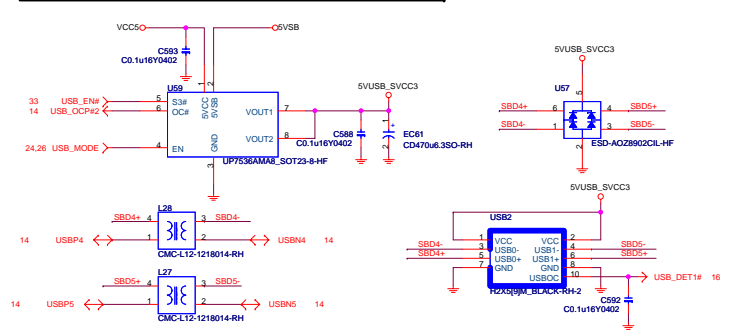
System Fan



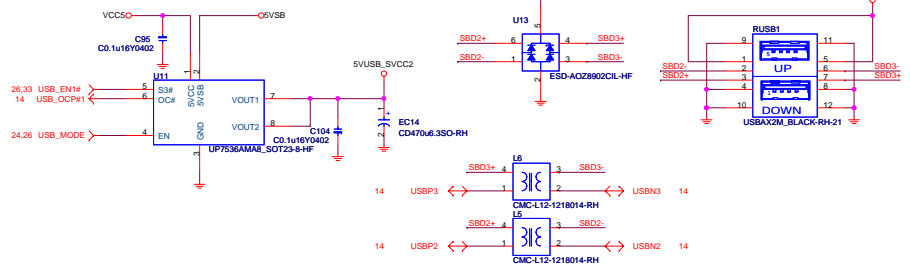
Rear USB Connector For USB Port 0 / 1



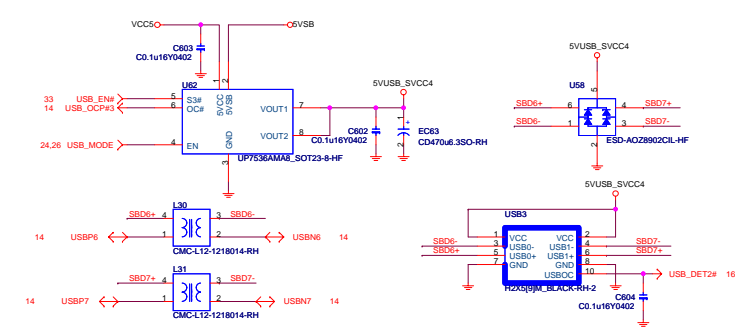
Front Panel USB Connector For USB Port 4 / 5



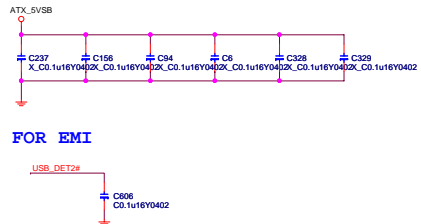
Rear USB Connector For USB Port 2 / 3



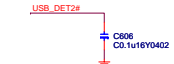
Front Panel USB Connector For USB Port 6 / 7



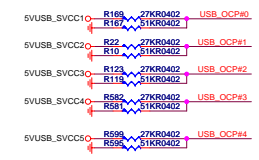
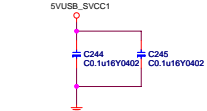
FOR EMI



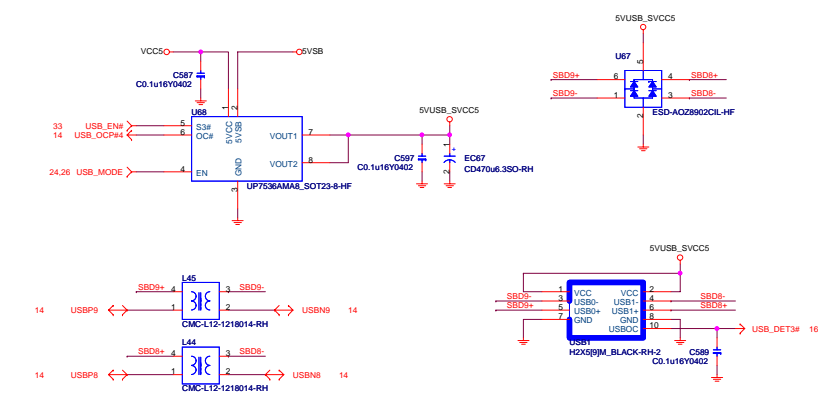
FOR EMI



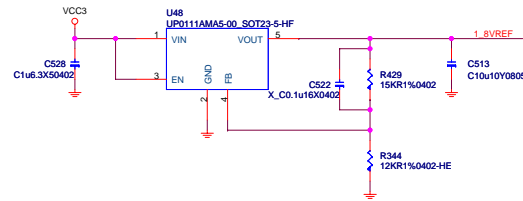
FOR EMI



Front Panel USB Connector For USB Port 8 / 9

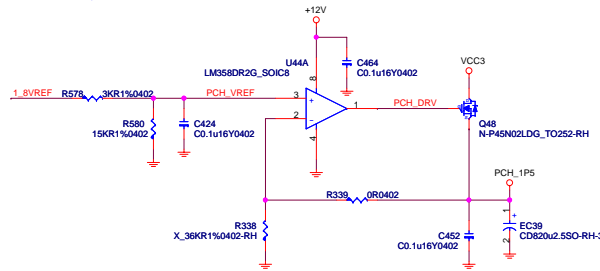


1.8V Reference Power



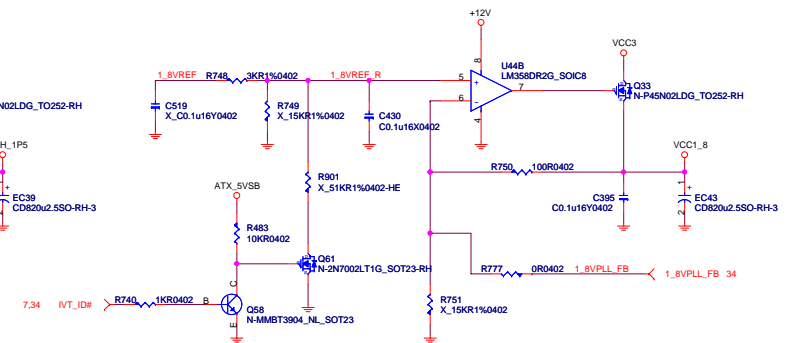
PBG 1.5V Power Rail

Linear 1.5V, 0.512A Imax



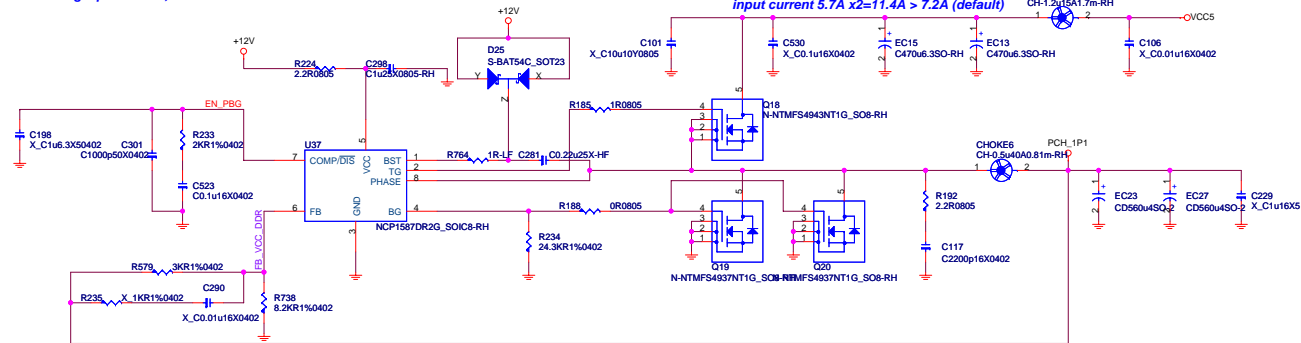
VCCPLL Power Rail

Linear 1.8V, 2A Imax



PBG Core Power Rail

Switching 1 phase 1.1V, 16.4A Imax



$$V_{out} = 0.8 \left[\frac{R738(GND) + R759}{R738} \right]$$

$$= 0.8 \left[\frac{(8.2 + 3)}{8.2} \right]$$

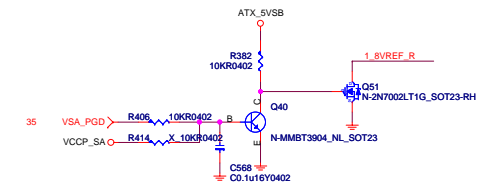
$$= 1.09268(V)$$

$$I_{octr} = (I_{ocet} * R_{ocet}) / R_{dson}$$

$$= (10uA * 24.3K) / 7.2m$$

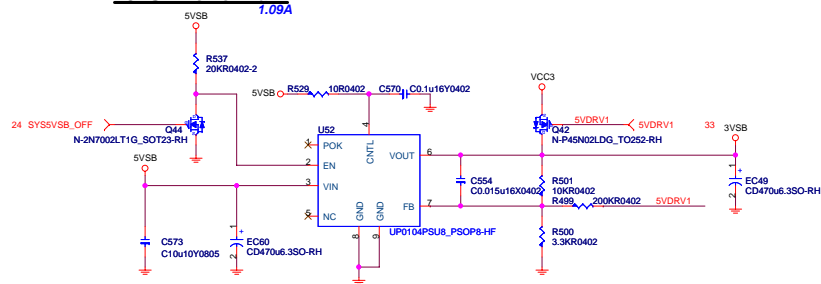
$$= 33.75A (> 1.5 * 16.64A)$$

IVT_ID#		VOLTAGE
H	SNB-E	1.8V(normal)
L	IVB-E	1.7V



3VSB Power Rail

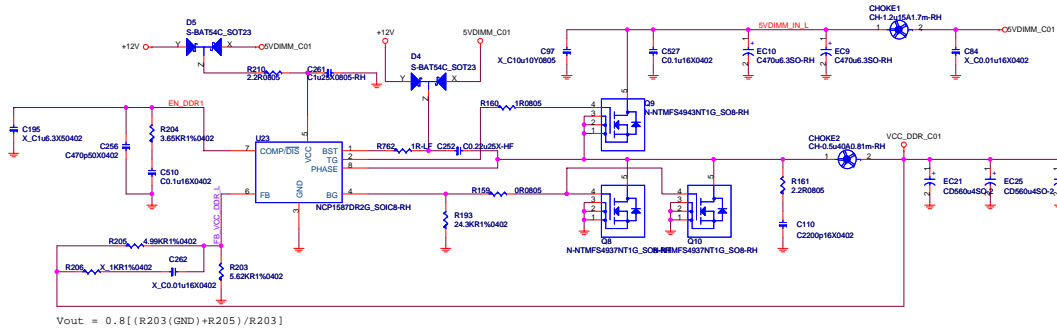
1.09A



DDR III 1.5V POWER

Switch 1 Phase 1.5V 17A

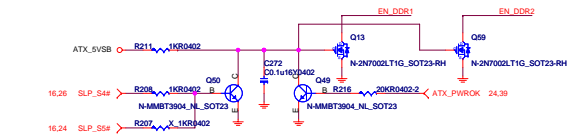
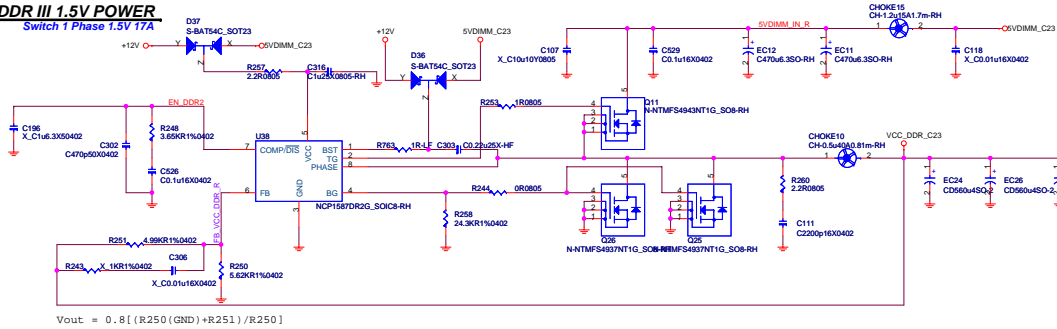
input current 5.7A x2=11.4A > 7.8A (default)



DDR III 1.5V POWER

Switch 1 Phase 1.5V 17A

input current 5.7A x2=11.4A > 7.8A (default)



UPI VOLTAGE CONSOLE

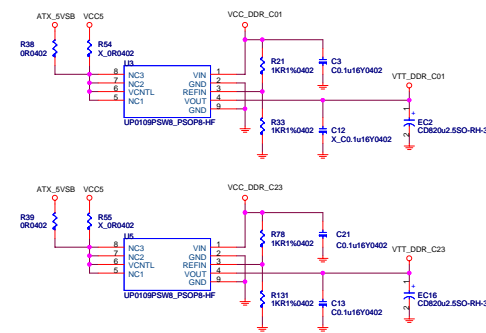
ADDRESS	0x2A	0X28	0x26	0x24	0x22	0x20
RH (KOhm)	OPEN	3.9	3	2.2	1.3	10
RL (KOhm)	10	1.3	2.3	3	3.9	OPEN
BUS_SEL	0%	25%	40%	60%	75%	100%

UPI VOLTAGE CONSOLE

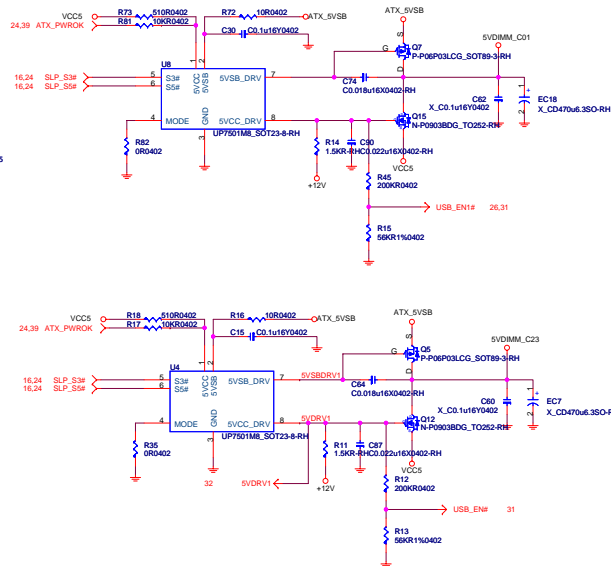
ADDRESS	0x2A	0X28	0x26	0x24	0x22	0x20
RH (KOhm)	OPEN	3.9	3	2.2	1.3	10
RL (KOhm)	10	1.3	2.3	3	3.9	OPEN
BUS_SEL	0%	25%	40%	60%	75%	100%

DDRIII Termination Power

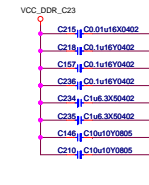
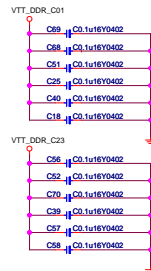
Linear, 0.75V - 1A



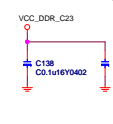
DDRIII Regulator Power Source



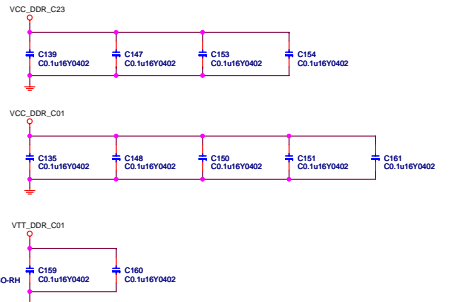
DDRIII I/O Power Decoupling Caps.



EMI CAPs

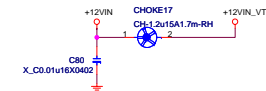
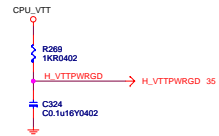


FOR EMI

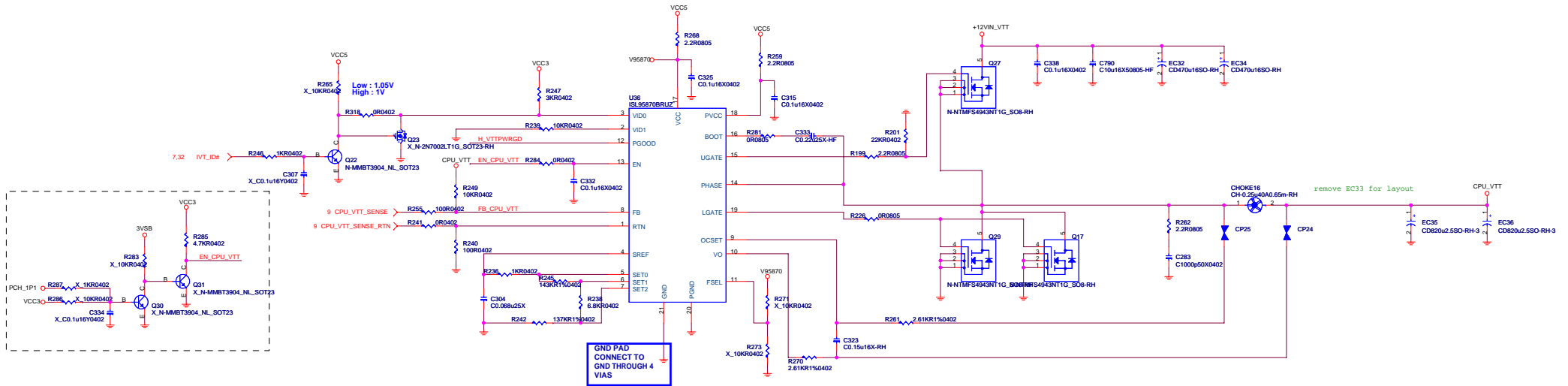
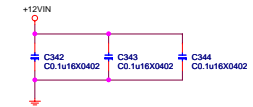


CPU VTT Power Rail

Switch 1 Phase 1.05V 22A



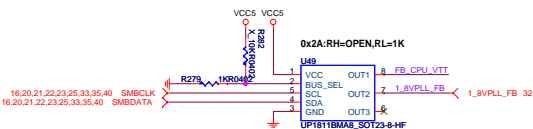
FOR EMI

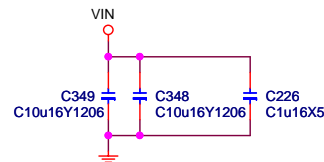
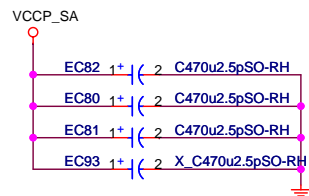
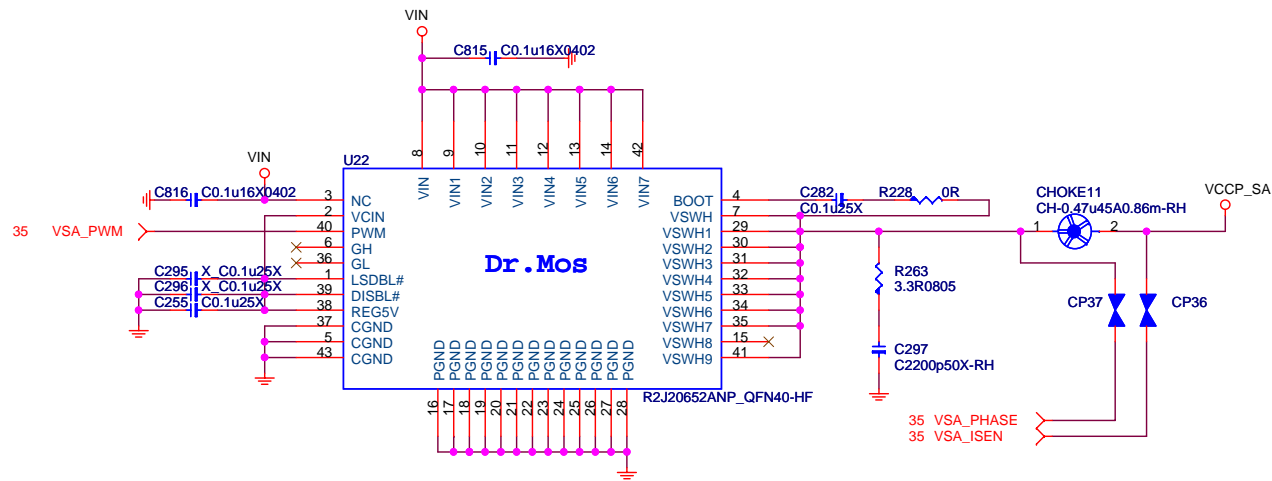


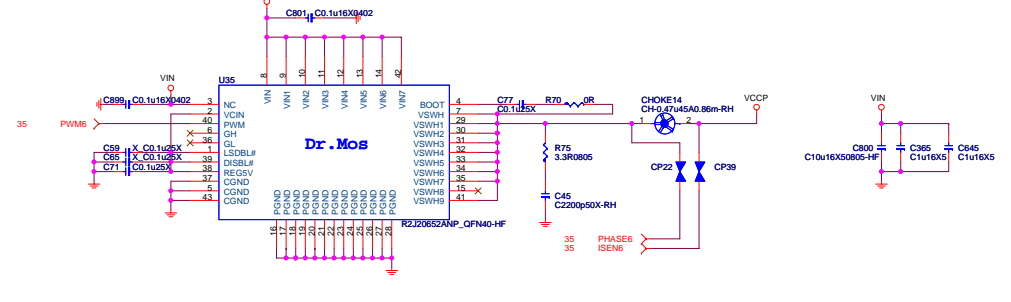
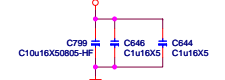
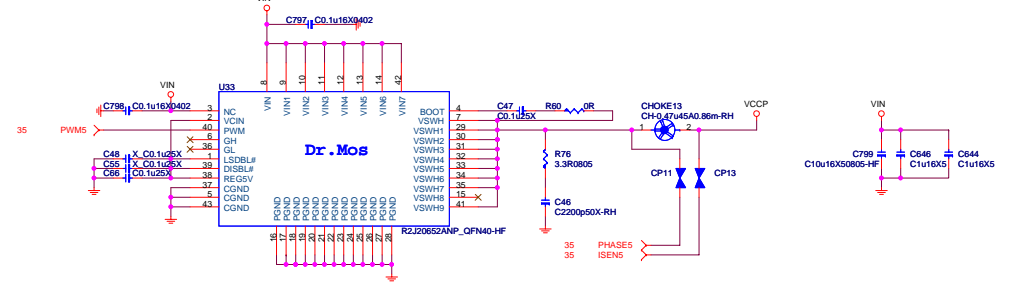
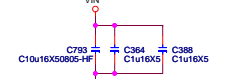
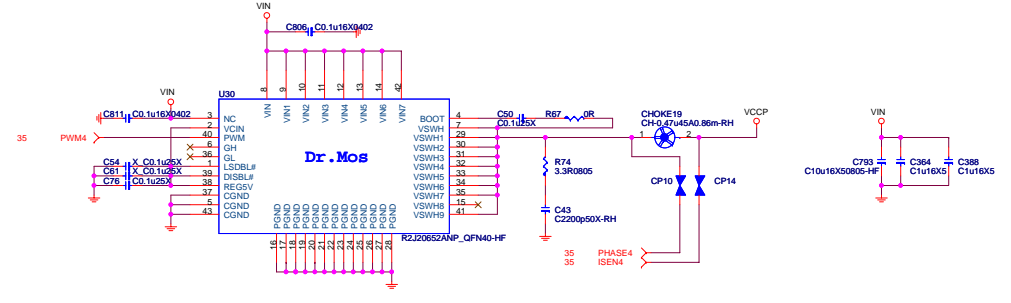
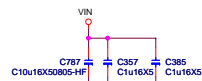
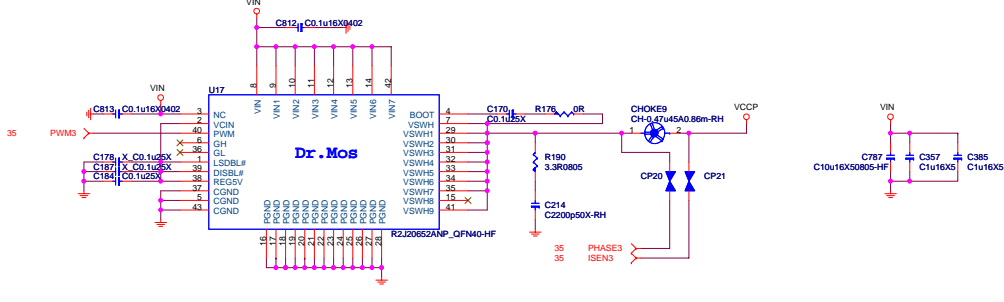
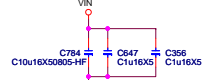
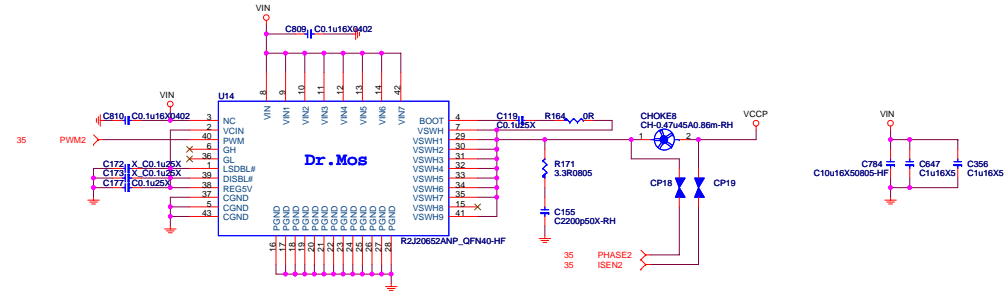
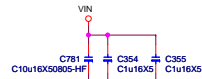
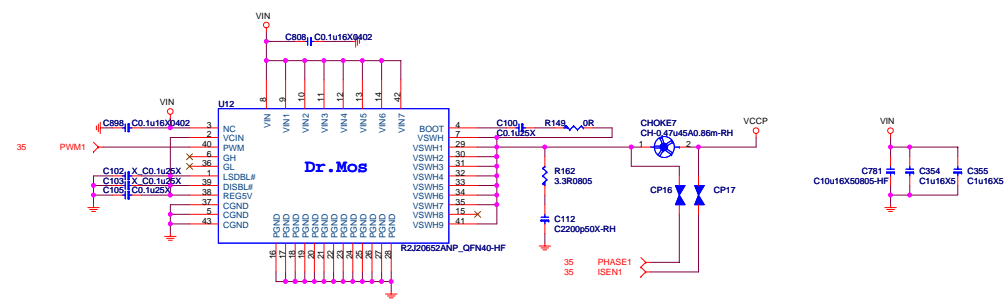
1. $R_{ocset} = I_{out} \cdot DCR / I_{ocset}$; $I_{ocset} = 10\mu A$
If $DCR = 1m$; $I_{out} = 20A$, $R_{ocset} = 20A \cdot 1m / 10\mu A \rightarrow R_{ocset} = 2K$
2. $C_{sen} = L / R_{ocset} \cdot DCR$
If $DCR = 1m$; $L = 1\mu$, $C_{sen} = 1\mu / 2K \cdot 1m \rightarrow C_{sen} = 0.5\mu$

UPI VOLTAGE CONSOLE

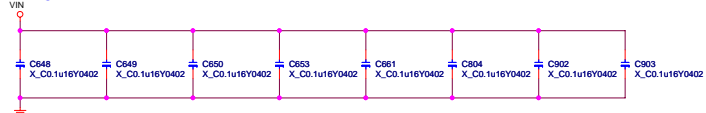
ADDRESS	0x2A	0x28	0x26	0x24	0x22	0x20
RH (Kohm)	OPEN	3.9	3	2.2	1.3	10
RL (Kohm)	10	1.3	2.3	3	3.9	OPEN
BUS_SEL	0%	25%	40%	60%	75%	100%



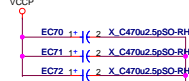
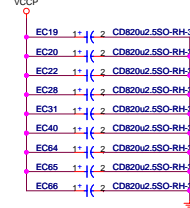
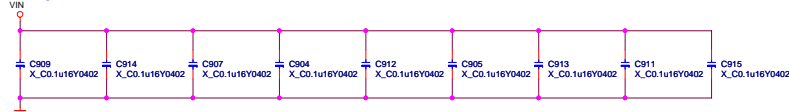




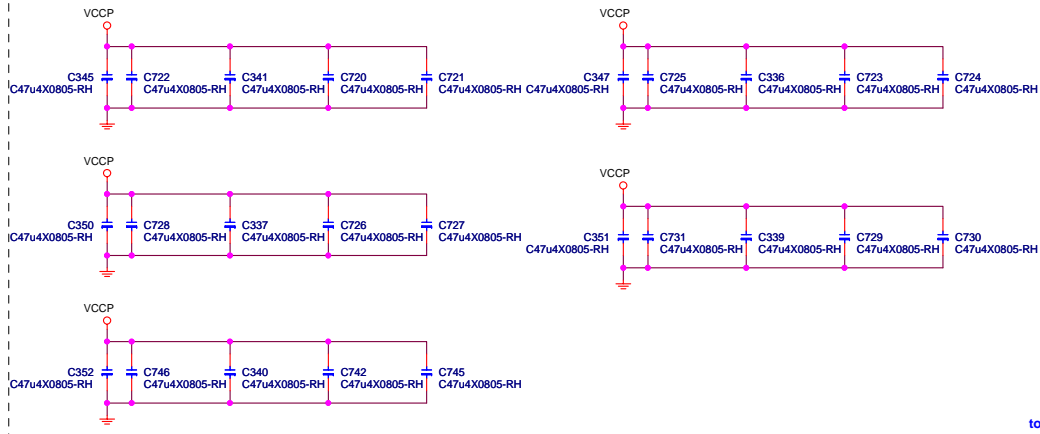
FOR EMI



FOR EMI

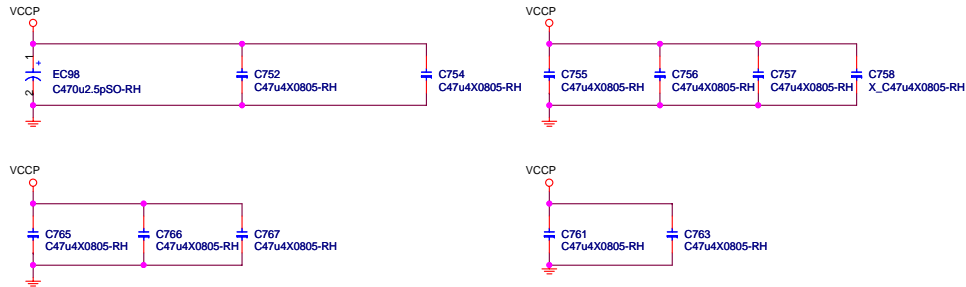


VCCP Decoupling



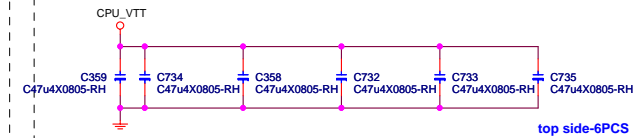
top side-25PCS

VCCP Decoupling Bottom Side

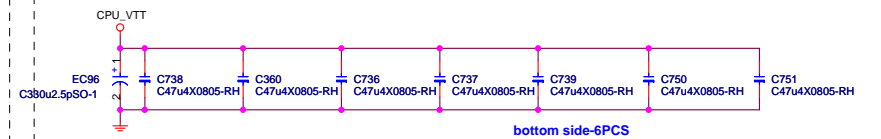


bottom side-4+1PCS

CPU VTT Decoupling

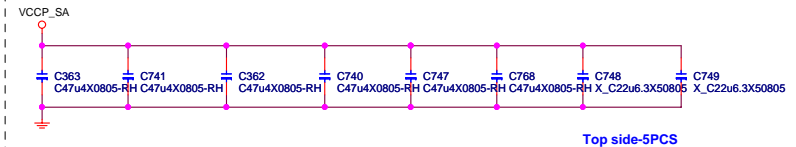


top side-6PCS

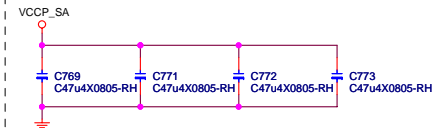


bottom side-6PCS

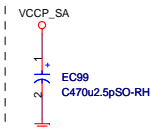
CPU VSA Decoupling



Top side-5PCS



bottom side-4+1PCS



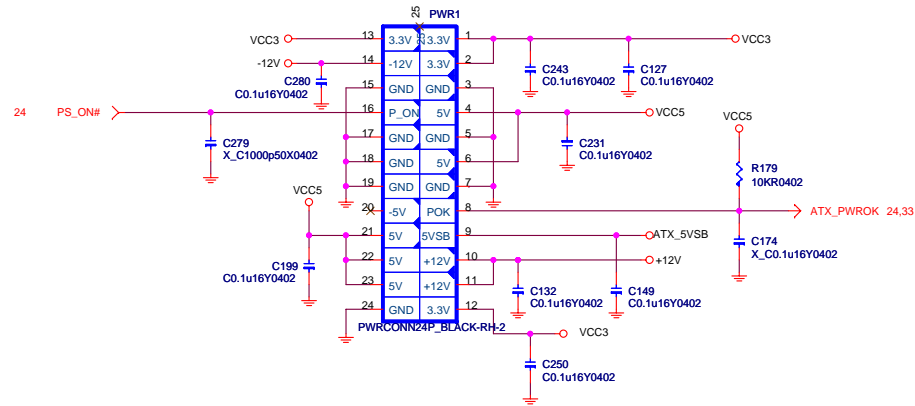
CPU VCC_DDR Decoupling



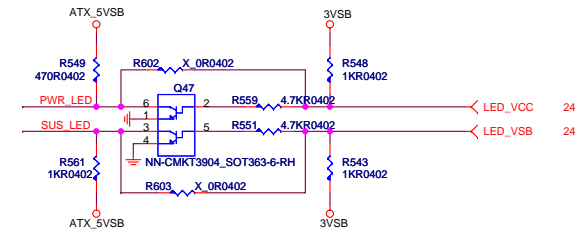
bottom side-4PCS

ATX Power Connector / Front Panel / LED

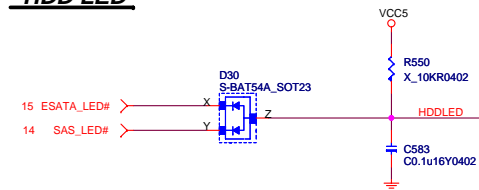
24 Pin ATX Power Connector



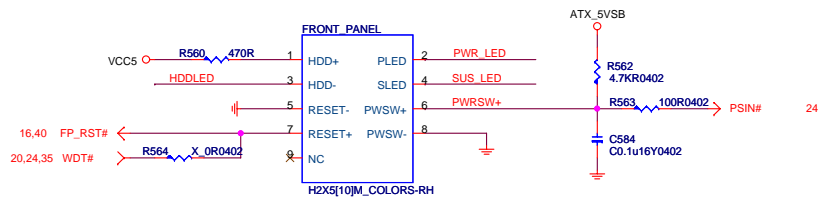
Power LED



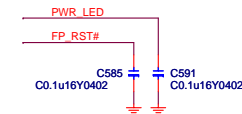
HDD LED



Front Panel



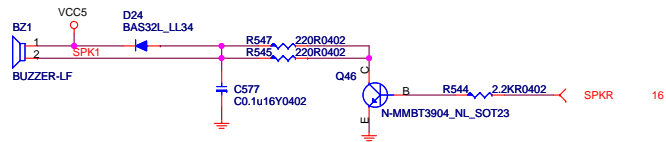
For EMI
(close pin header)



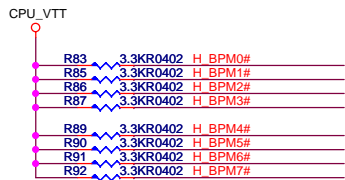
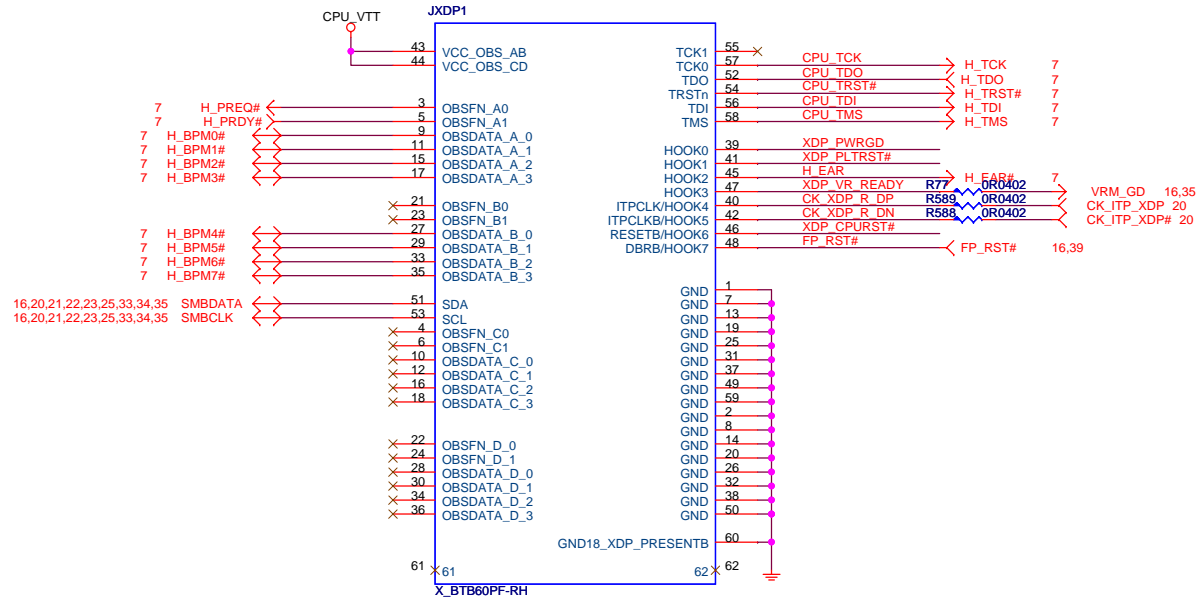
FOR EMI



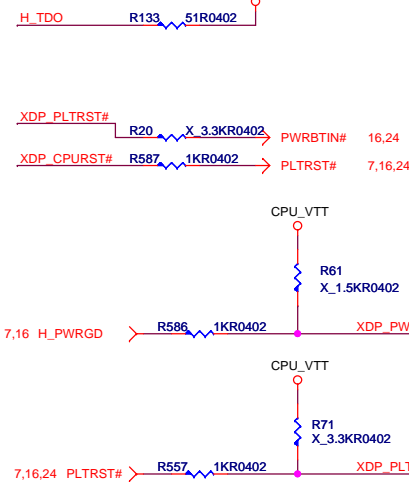
Buzzer Circuit



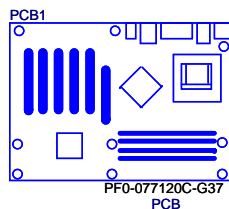
CPU XDP PORT



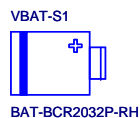
PLACE NEAR XDP CONNECTOR CPU_VTT



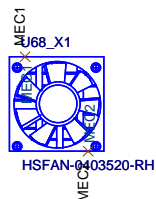
Manual Parts



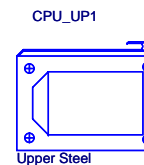
精成PF0-077120C-G37



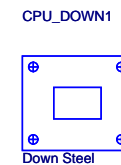
BAT-BCR2032P-RH



HSFAN-0403520-RH

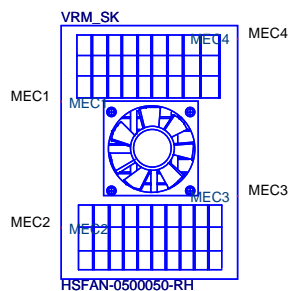
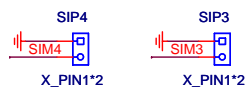


Upper Steel



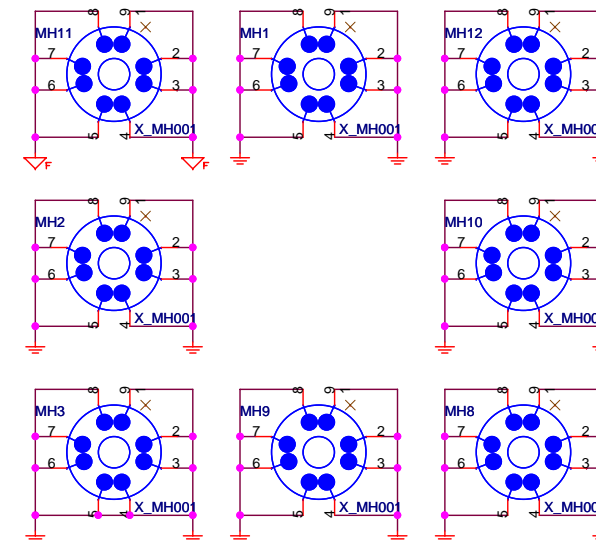
Down Steel

Simulation



PCB Mounting Holes

Mounting Holes



Optics Orientation Holes

Optical Fiducial Marks-120

