1. ALL RESISTANCE VALUES ARE IN OHMS, 0.1 WATT +/- 5%.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL CRYSTALS & OSCILLATOR VALUES ARE IN HERTZ.

REV	ECN	DESCRIPTION OF REVISION	CK APPD DATE
<REV>	<ECN>	<ECO_DESCRIPTION>	<ECODATE>

J41 MLB SCHEMATIC 6.6.0
DVT
4/09/13

ALIASES RESOLVED

Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-9795	1	SCHEM,MLB,J41	SCH	CRITICAL	
820-3435	1	PCBF,MLB,J41	PCB	CRITICAL	

DRAWING
TITLE=MLB
ABBREV=DRAWING
LAST_MODIFIED=Tue Apr 9 19:41:45 2013

PRODUCT SAFETY REQUIREMENTS:
PCB, UL RECOGNIZED, MIN. 130-C TEMP. RATING AND V-0 FLAME RATING PER UL 796 & UL 94.
PCB TO BE SILK-SCREENED WITH UL/CUL RECOGNITION MARK, MANUFACTURER'S UL FILE NUMBER, UL PCB MATERIAL DESIGNATION, 130-C TEMP. RATING AND V-0 FLAME RATING.

DRAWING TITLE: <PART_DESCRIPTION>

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
BRANCH: <BRANCH>
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BOM Groups

BOM GROUP	BOM OPTIONS
MLB_COMMON	ALTERNATE,COMMON,MLB_MISC,MLB_DEBUG:ENG,MLB_PROGPARTS
MLB_MISC	PP5V5_DCIN:NO,TBTHV:P15V,EDP,CAM_XTAL:NO,CAM_WAKE:NO,APCLKRQ:ISOL,TPAD_INTWAKE:SHARED,USB_PWR:S3,SD_ON_MLB,VCORE_FETS
MLB_DEVEL:ENG	ALTERNATE,BKLT:ENG,XDP_CONN,DDRVREF_DAC,S0PGOOD_ISL,DBGLED,ISNS:ENG
MLB_DEVEL:PVT	XDP_CONN
MLB_DEBUG:ENG	DEVEL_BOM,XDP,LPCPLUS
MLB_DEBUG:PVT	DEVEL_BOM,BKLT:PROD,XDP,LPCPLUS,ISNS:PROD
MLB_DEBUG:PROD	BKLT:PROD,LPCPLUS,XDP,ISNS:PROD

Current Sensor Configuration

BOM GROUP	BOM OPTIONS
ISNS:ENG	CPU_HS_ISNS:YES,CPUVR_ISNS:YES,DRAM_ISNS:YES,P1V05_ISNS:YES,AIRPORT_ISNS:YES,SSD_ISNS:YES,LCDBKLT_ISNS:YES,P3V3SS_ISNS:YES,3V3S0_ISNS:YES,OTHER_HS_ISNS:YES,CAM_ISNS:YES,CPUDDR_ISNS:YES,PANEL_ISNS:YES
ISNS:PROD	CPU_HS_ISNS:YES,CPUVR_ISNS:YES,DRAM_ISNS:YES,P1V05_ISNS:NO,AIRPORT_ISNS:NO,SSD_ISNS:YES,LCDBKLT_ISNS:NO,P3V3SS_ISNS:NO,3V3S0_ISNS:NO,OTHER_HS_ISNS:NO,CAM_ISNS:NO,CPUDDR_ISNS:NO,PANEL_ISNS:NO

CPU DRAM SPD Straps

BOM GROUP	BOM OPTIONS
DDR3:HYNIX_4GB	RAMCFG0:L,RAMCFG1:L,RAMCFG2:L,RAMCFG3:L,DRAM_TYPE:HYNIX_4GB
DDR3:HYNIX_8GB	RAMCFG0:L,RAMCFG1:L,RAMCFG2:H,RAMCFG3:L,DRAM_TYPE:HYNIX_8GB
DDR3:SAMSUNG_4GB	RAMCFG0:L,RAMCFG1:H,RAMCFG2:L,RAMCFG3:L,DRAM_TYPE:SAMSUNG_4GB
DDR3:SAMSUNG_8GB	RAMCFG0:L,RAMCFG1:H,RAMCFG2:H,RAMCFG3:L,DRAM_TYPE:SAMSUNG_8GB
DDR3:ELPIDA_4GB	RAMCFG0:H,RAMCFG1:H,RAMCFG2:L,RAMCFG3:L,DRAM_TYPE:ELPIDA_4GB
DDR3:ELPIDA_8GB	RAMCFG0:H,RAMCFG1:H,RAMCFG2:H,RAMCFG3:L,DRAM_TYPE:ELPIDA_8GB
DDR3:MICRON_4GB	RAMCFG0:H,RAMCFG1:L,RAMCFG2:L,RAMCFG3:L,DRAM_TYPE:MICRON_4GB

Programmable Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
335S0865	1	EEPROM,256KBIT,SPI,5MHZ,1.8V,2X3QFN	U2890	CRITICAL	TBTROM:BLANK
341S3802	1	IC,EEPROM,C/R (V23.4) EVT,J41/J41	U2890	CRITICAL	TBTROM:PROG
338S1159	1	IC,SMC12-A3,40MHZ/50DMIPS MCU,9X9,157BGA	U5000	CRITICAL	SMC:BLANK
335S0809	1	64 MBIT SPI SERIAL DUAL I/O FLASH,8X6X0.8	U6100	CRITICAL	BOOTROM_MAC:BLANK
335S0803	1	64 MBIT SPI SERIAL DUAL I/O FLASH,8X6X0.8	U6100	CRITICAL	BOOTROM_NUM:BLANK
341S3809	1	IC,EFI ROM (V0071) DVT,J41/J43	U6100	CRITICAL	BOOTROM:PROG

Module Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
337S4525	1	HSW,SR16M,PRQ,C0,1.3,15W,2+3,1.0,3M,BGA	U0500	CRITICAL	CPU:1.3GHZ
337S4526	1	HSW,SR16L,PRQ,C0,1.4,15W,2+3,1.1,3M,BGA	U0500	CRITICAL	CPU:1.4GHZ
337S4528	1	HSW,SR16H,PRQ,C0,1.7,15W,2+3,1.1,4M,BGA	U0500	CRITICAL	CPU:1.7GHZ
338S1113	1	IC,TBT,CR-4C,B1,PRQ,CIO,288,12X12 FC-CSP	U2800	CRITICAL	
338S1186	1	IC,BCM15700A2,S2 PCIE CAMERA PROCESSOR	U3900	CRITICAL	
607-6811	1	ASSEMBLY,SUBASSY,PCBA,HALL EFFECT,K99	J6955	CRITICAL	J41_MLB
946-3892	1	J11/J13 MLB DYMAX ADHESIVE 29993-SC 0.4G	GLUE	CRITICAL	
825-7670	1	LABEL,TEXT,MLB,K21/K78	LABEL		
376S0964	2	MOSFET,N-CH,25V,30A,9.6M,8P 3.3X3.3 DFN	Q7310,Q7320	CRITICAL	VCORE_FET:REN
376S1104	2	MOSFET,N-CH,25V,30A,6.1M,8P 3.3X3.3 DFN	Q7311,Q7321	CRITICAL	VCORE_FET:REN
376S1173	2	MOSFET,N-CH,30V,15.3A,12M,8P 3.3X3.3 DFN	Q7310,Q7320	CRITICAL	VCORE_FET:VSHY
376S1174	2	MOSFET,N-CH,30V,22A,6.0M,8P 3.3X3.3 DFN	Q7311,Q7321	CRITICAL	VCORE_FET:VSHY
900-0090	1		SOLDERPASTE	CRITICAL	

DRAM Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
333S0677	4	IC,SDRAM,8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:HYNIX_4GB
333S0681	4	IC,SDRAM,16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:HYNIX_8GB
333S0676	4	IC,SDRAM,8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:SAMSUNG_4GB
333S0680	4	IC,SDRAM,16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:SAMSUNG_8GB
333S0678	4	IC,SDRAM,8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:ELPIDA_4GB
333S0666	4	IC,SDRAM,16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:ELPIDA_8GB
333S0679	4	IC,SDRAM,8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	DRAM_TYPE:MICRON_4GB

CPU DRAM CFG Chart

VENDOR	CFG 1	CFG 0
HYNIX	0	0
SAMSUNG	1	0
MICRON	0	1
ELPIDA	1	1

SIZE	CFG 2
4GB	0
8GB	1

DIE REV	CFG 3
A	0
B	1

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
376S1032	376S0855		ALL	Toshiba alt for Diodes dual
376S1129	376S0855		ALL	NXP alt for Diodes dual
376S1089	376S1128		ALL	NXP alt for Diodes single
138S0684	138S0660		ALL	Murata alt to Taiyo Yuden
138S0703	138S0648		ALL	Murata alt to Taiyo Yuden
152S0586	152S1301		ALL	Dale/Vishay alt to Cyntec
372S0186	372S0185		ALL	NXP alt to Diodes
197S0479	197S0478		ALL	200uW Epson alt to NDK
376S1053	376S0604		ALL	Diodes alt to Fairchild
371S0713	371S0558		ALL	Diodes alt to ST Micro
128S0371	128S0376		ALL	Kemet alt to Sanyo
128S0394	128S0415		ALL	NEC alt to Sanyo
152S1821	152S1757		ALL	Cyntec alt to NEC
197S0480	197S0343		ALL	NDK crystal alt to TXC
197S0481	197S0343		ALL	Epson crystal alt to TXC
107S0254	107S0241		ALL	Cyntec sense R alt to TFT
353S3452	353S1286		ALL	Maxim alt to Microchip
128S0386	128S0284		ALL	Kemet alt to Sanyo
128S0397	128S0325		ALL	Kemet alt to Sanyo
377S0155	377S0104		ALL	OnSemi alt to Infineon
128S0398	128S0220		ALL	Kemet alt to Sanyo
197S0542	197S0544		ALL	NDK alt to TXC
197S0545	197S0544		ALL	Epson alt to TXC
138S0681	138S0638		ALL	Taiyo alt to Samsung
138S0841	138S0638		ALL	Murata alt to Samsung
376S1180	376S0761		ALL	Renesas alt to Vishay
152S1876	152S1804		ALL	TDK alt to Toko
107S0255	107S0240		ALL	Cyntec alt to TFT
107S0250	107S0248		ALL	Cyntec alt to TFT

SYNC_MASTER=J43_MLB SYNC_DATE=01/17/2013

PAGE TITLE: BOM Configuration

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

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BOM Variants

BOM NUMBER	BOM NAME	BOM OPTIONS
639-4118	PCBA,MLB,BEST,HY 4GB,J41:	MLB_CMNPTS,CPU:1.7GHZ,DDR3:HYNIX_4GB
639-4274	PCBA,MLB,BEST,HY 8GB,J41	MLB_CMNPTS,CPU:1.7GHZ,DDR3:HYNIX_8GB
639-4275	PCBA,MLB,BEST,EL 4GB,J41	MLB_CMNPTS,CPU:1.7GHZ,DDR3:ELPIDA_4GB
639-4276	PCBA,MLB,BEST,EL 8GB,J41	MLB_CMNPTS,CPU:1.7GHZ,DDR3:ELPIDA_8GB
639-4702	PCBA,MLB,BEST,MI 4GB,J41	MLB_CMNPTS,CPU:1.7GHZ,DDR3:MICRON_4GB
639-4434	PCBA,MLB,BETTER,HY 4GB,J41	MLB_CMNPTS,CPU:1.3GHZ,DDR3:HYNIX_4GB
639-4435	PCBA,MLB,BETTER,HY 8GB,J41	MLB_CMNPTS,CPU:1.3GHZ,DDR3:HYNIX_8GB
639-4436	PCBA,MLB,BETTER,EL 4GB,J41	MLB_CMNPTS,CPU:1.3GHZ,DDR3:ELPIDA_4GB
639-4437	PCBA,MLB,BETTER,EL 8GB,J41	MLB_CMNPTS,CPU:1.3GHZ,DDR3:ELPIDA_8GB
639-4703	PCBA,MLB,BETTER,MI 4GB,J41	MLB_CMNPTS,CPU:1.3GHZ,DDR3:MICRON_4GB
685-0024	CMN PTS,PCBA,MLB,J41	MLB_COMMON,J41_MLB
985-0017	J41 MLB DEVELOPMENT BOM	MLB_DEVEL:ENG
685-0062	VCORE FET,REN,J41	VCORE_FET:REN
685-0063	VCORE FET,VSHY,J41	VCORE_FET:VSHY

BOM Groups

BOM GROUP	BOM OPTIONS
MLB_PROGPARTS	BOOTROM:PROG,SMC:PROG,TBTROM:PROG

Programmable Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
341S3757	1	IC,SMC-A3 SCPL,EXT,V22.12A18,PROTO 1,J41	U5000	CRITICAL	SMC:PROG

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
685-0062	685-0063		ALL	Renesas alt to Vishay
333S0704	333S0700		ALL	Elpida CAM DRAM alt to Hynix

Sub-BOMs

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
985-0017	1	J41 MLB DEVELOPMENT BOM	DEVEL	CRITICAL	DEVEL_BOM
685-0024	1	CMN PTS,PCBA,MLB,J41	CMNPTS	CRITICAL	MLB_CMNPTS
685-0063	1	VCORE FET,VSHY,J41	VCOREFETS	CRITICAL	VCORE_FETS

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: BOM Variants

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

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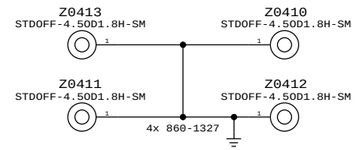
PD Module Parts

806-5107	1	CAN,TOPSIDE,ALT,J41/J43	TBTTOPSIDE_2P_FENCE	CRITICAL	
806-5108	1	CAN,TOPSIDE,COVER,ALT,J41/J43	TBTTOPSIDE_2P_COVER	CRITICAL	
806-3142	1	CAN,TBT,J11/J13	TBTFENCE	CRITICAL	
806-3215	1	CAN,COVER,TBT,J11/J13	TBTCOVER	CRITICAL	
806-3216	1	CAN,MDP,J11/J13	MDPCAN	CRITICAL	
806-3083	1	SHLD,USB,MLB,J11/J13	USBCAN	CRITICAL	
725-1792	1	INSULATOR,CPU,J41/J43	CPU_INSULATOR	CRITICAL	

CPU Heat Sink Mounting Bosses



Fan Boss

Z0405
STDOFF-4.5OD1.8H-SM
860-1327

X21 Boss

Z0414
STDOFF-4.5OD1.9H-SM
860-1327

SSD Boss

Z0415
STDOFF-4.5OD1.9H-SM
860-1327

EMI I/O Pogo Pins

DisplayPort Pogo

CRITICAL
ZS0405
POGO-2.00D-3.6H-K86-K87
SM
870-1938

USB/SD Card Pogo

CRITICAL
ZS0407
POGO-2.00D-2.95H-K86-K87
SM
870-1940

Can Slots

SL0401 TH-NSP, SL-1.1X0.4-1.4x0.7, 998-2691	SL0402 TH-NSP, SL-1.1X0.4-1.4x0.7, 998-2691	2x MDP connector
SL0403 TH-NSP, SL-1.1X0.45-1.4x0.75, 998-3975	SL0404 TH-NSP, SL-1.1X0.45-1.4x0.75, 998-3975	2x USB connector
SL0405 TH-NSP, SL-1.1X0.4-1.4x0.7, 998-2691	SL0406 TH-NSP, SL-1.1X0.4-1.4x0.7, 998-2691	2x TBT pin diodes
SL0407 TH-NSP, SL-1.1X0.45-1.4x0.75, 998-3975	SL0408 TH-NSP, SL-1.1X0.45-1.4x0.75, 998-3975	2x TBT chip

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: PD Parts

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
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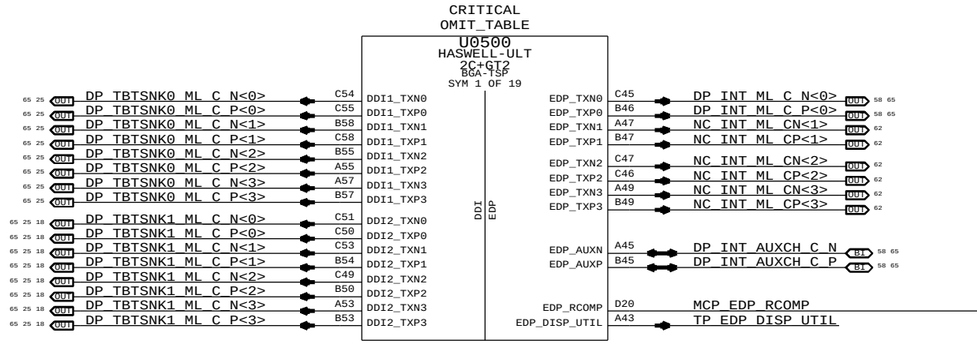
DDI Port Assignments:

TBT Sink 0

TBT Sink 1
(MUXed with HDMI
 if necessary)

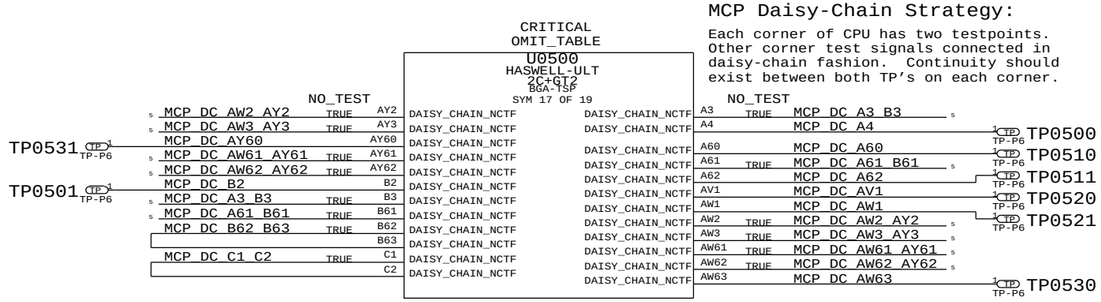


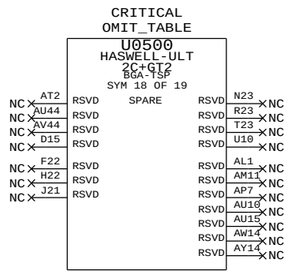
eDP Port Assignment:

Internal panel

MCP Daisy-Chain Strategy:

Each corner of CPU has two testpoints.
Other corner test signals connected in
daisy-chain fashion. Continuity should
exist between both TP's on each corner.





SYNC_MASTER=WILL_J43 SYNC_DATE=09/13/2012

PAGE TITLE: CPU GFX/NCTF/RSVD

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
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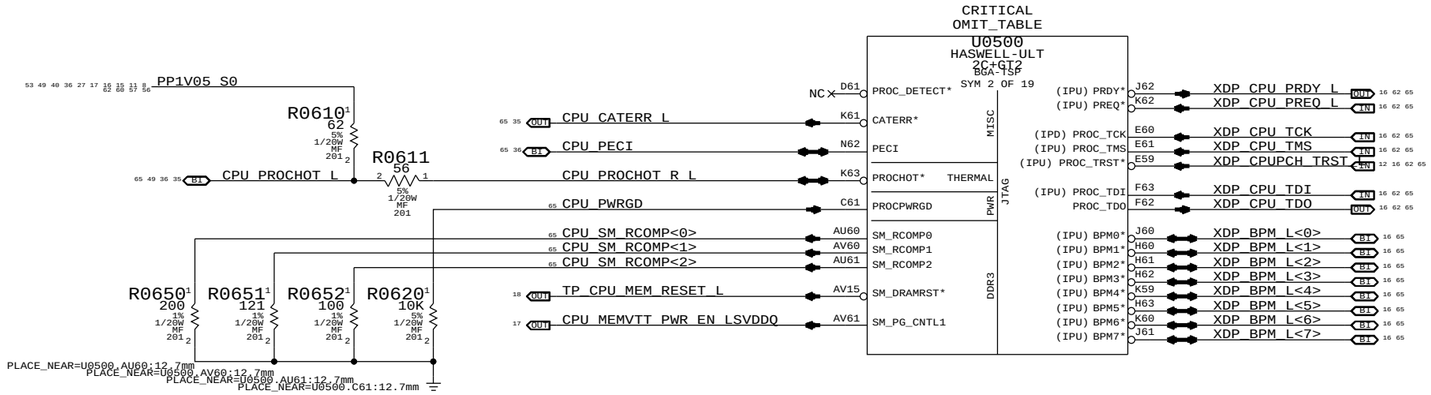
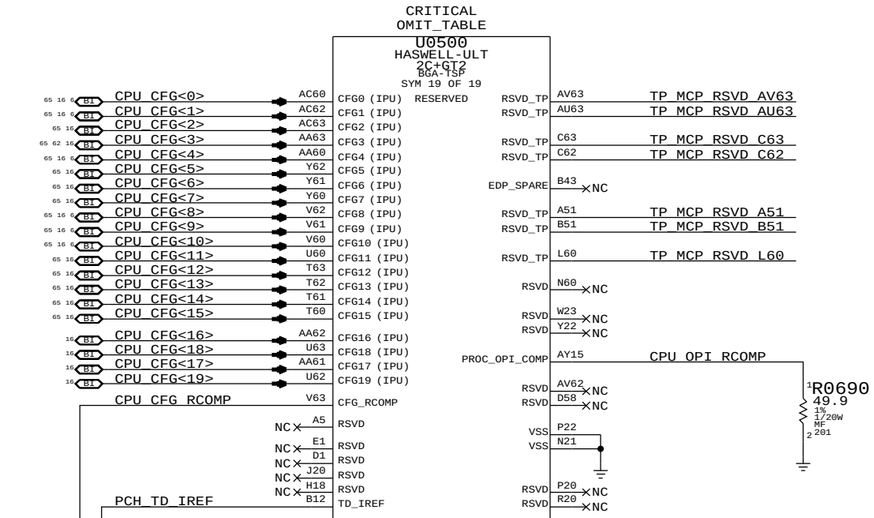
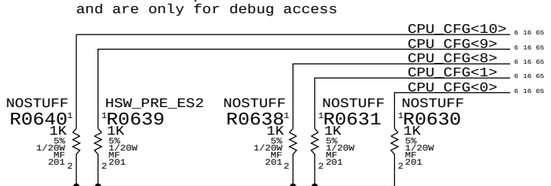


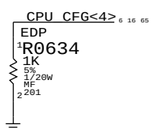


CFG<10>	:SAFE MODE BOOT	1 = NORMAL OPERATION	0 = POWER FEATURES NOT ACTIVE
CFG<9>	:NO SVID-CAPABLE VR	1 = VR SUPPORTS SVID	0 = VR DOES NOT SUPPORT SVID
CFG<8>	:ALLOW NOA ON LOCKED UNITS	1 = NORMAL OPERATION	0 = NOA ALWAYS UNLOCKED
CFG<4>	:eDP ENABLE/DISABLE	1 = DISABLED	0 = ENABLED
CFG<1>	:PCH-LESS MODE	1 = NORMAL OPERATION	0 = PCH-LESS MODE
CFG<0>	:RESET SEQUENCE STALL	1 = NORMAL OPERATION	0 = STALL AFTER PCU PLL LOCK

These can be placed close to J1800
and are only for debug access



NOTE: Pre-ES2 CPUs have issue with Sx cycling, must set CFG<9> low to avoid issue, but this locks CPU VR at 1.7V Vboot (CPU Sighting #4391569).



SYNC_MASTER=WILL_J43 SYNC_DATE=09/13/2012

PAGE TITLE: CPU Misc/JTAG/CFG/RSVD

Apple Inc.

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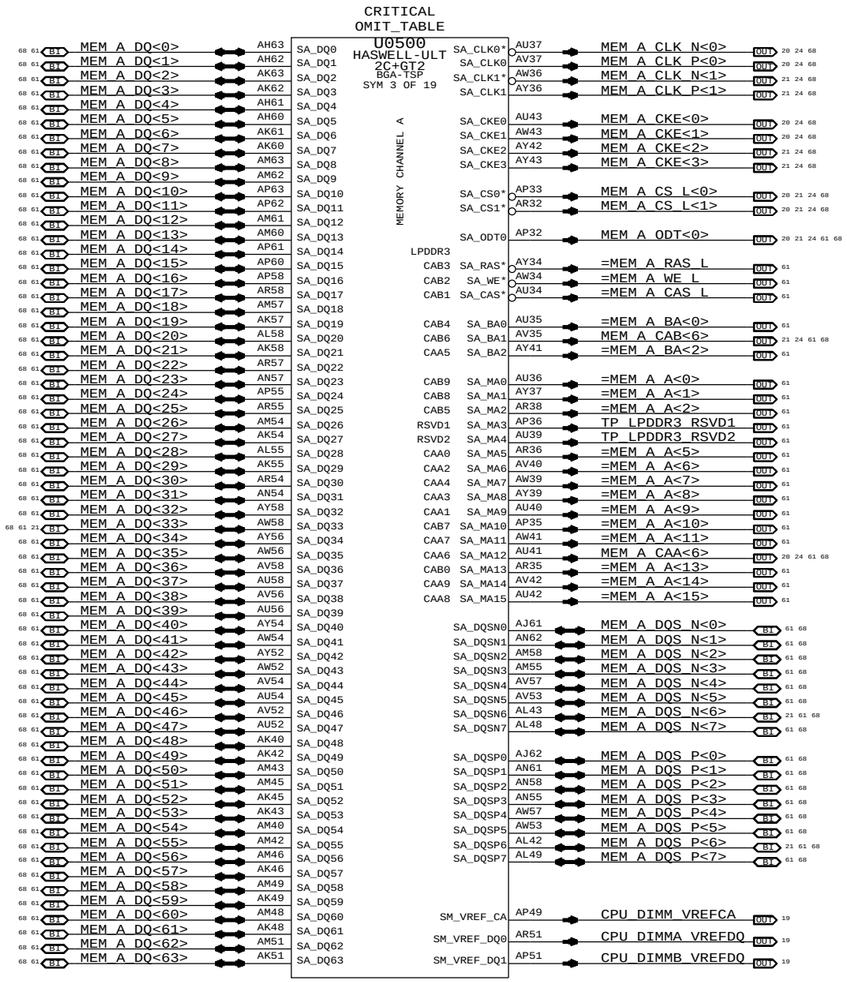

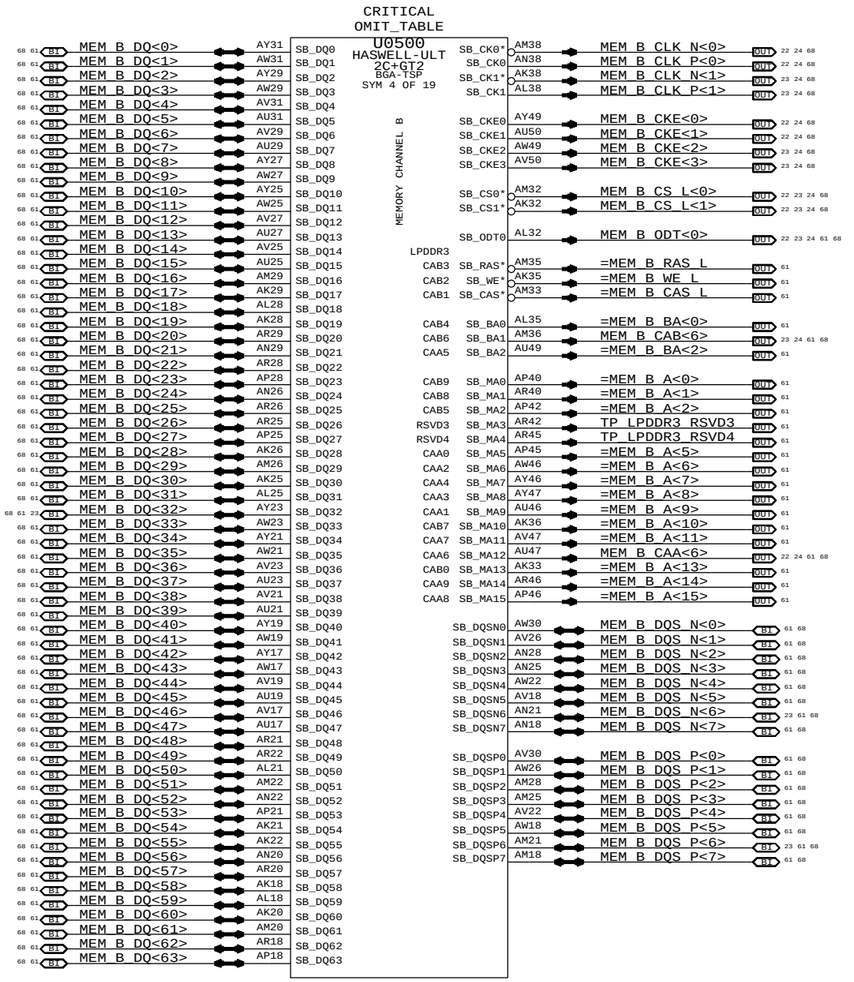

SYNC_MASTER=WILL_J43 SYNC_DATE=09/13/2012

PAGE_TITLE
CPU DDR3/LPDDR3 Interfaces

Apple Inc.

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REVISION <E4LABEL>
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HSW-ULT current estimates from Haswell Mobile ULT Processor EDS vol 1, doc #502406, v0.9.
LPT-LP current estimates from Lynx Point-LP PCH EDS, doc #503118, v1.0.
Note [1] current numbers from clarification email, from Srini, dated 9/10/2012 2:11pm.

CRITICAL
OMIT_TABLE
U0500
HASWELL-ULT
2C+GT2
BGA-TSP
SYM 12 OF 19
HSW ULT POWER

PPVMEMIO_S0_CPU
1.4A Max (DDR3: 1.5-1.35V)
1.1A Max (LPDDR3: 1.2V)

PPVCC_S0_CPU
32A Max

PP1V05_S0
???mA Max

PPVRTC_G3H

PP1V05_S0SW_PCH_HSIO
1838mA Max

PP1V05_S0
29mA Max[1]

PP1V05_S0SW_PCH_VCCUSB3PLL
41mA Max

PP1V05_S0SW_PCH_VCCSATA3PLL
42mA Max

WF: RSVD on Sawtooth Peak rev 1.0

PP1V05_S0_PCH_VCCAPLL_OPI
57mA Max

PP1V5_S0SW_AUDIO_HDA
11mA Max

PP3V3_SUS
59mA Max[1]

PP3V3_S5
114mA Max

PP3V3_S0
40mA Max[1]

PP1V05_S0_PCH_VCC_ICC
VCCCLK: 200mA Max

PP1V05_S0_PCH_VCCACLKPLL
31mA Max

PP1V05_S0
VCCCLK: 200mA Max

WF: RSVD on Sawtooth Peak rev 1.0

PP3V3_SUS
3.3mA Max[1]

PP3V3_SUS
0.3mA Max[1]

PP1V05_S0
1499mA Max[1]

PP1V05_S0
473mA Max[1]

PP1V5_S0
3mA Max

PP3V3_S0
1mA Max[1]

PP3V3_S0
17mA Max

PP1V05_S0
213mA Max[1]

R0800 75 1% 1/20W MF 201
R0802 130 1% 1/20W MF 201
R0810 43 5% 1/20W MF 201
R0811 0 5% 1/20W MF 0201
R0812 0 5% 1/20W MF 0201

Max load: 300mA
Max load: 300mA

R0802.2: PLACE_NEAR=U0500.L63:2.54mm
R0810.2: PLACE_NEAR=U0500.L62:38.1mm
R0800.2: PLACE_NEAR=R0810.1:2.54mm

R0860 100 5% 1/20W MF 201
PLACE_NEAR=U0500.C50:50.8mm

CPU_VCCSENSE_P
TP_PPVCCIO_S0_CPU
PPVCOMP_S0_CPU

NOTE: Aliases not used on CPU supply outputs to avoid any extraneous connections.

CPU_VIDALERT_L
CPU_VIDSCLK
CPU_VIDSOUT
CPU_VIDALERT_R_L
CPU_VIDSCLK_R
CPU_VIDSOUT_R
CPU_VCCST_PWRGD
CPU_VR_EN
CPU_VR_READY
CPU_PWR_DEBUG

TP_CPU_RSVD_P60
TP_CPU_RSVD_P61
TP_CPU_RSVD_N59
TP_CPU_RSVD_N61

C0895 0.1UF 20% 10V CERM 402
C0892 0.1UF 20% 10V CERM 402
C0891 0.1UF 20% 10V CERM 402
C0890 1UF 10% 6.3V CERM 402
BYPASS=U0500.AG10:6.35mm

PLACE_NEAR=U0500.AG19:2.54mm
R0899 5.11 1% 1/20W MF-LF 201
PPVOUT_S5_PCH_DCPSUSBYP
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=1.05V
C0899 1UF 10% 6.3V CERM 402
BYPASS=R0899:U0500:2.54mm

Powered in DeepSx

SYNC_MASTER=J43_MLB	SYNC_DATE=10/02/2012
PAGE TITLE: CPU/PCH POWER	
Apple Inc.	DRAWING NUMBER: <SCH_NUM> SIZE: D
	REVISION: <E4LABEL>
	BRANCH: <BRANCH>
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CRITICAL
OMIT_TABLE

U0500
HASWELL-ULT
2C+GT2
BGA-TSP
SYM 14 OF 19

A11	VSS	VSS	AJ35
A14	VSS	VSS	AJ39
A18	VSS	VSS	AJ41
A24	VSS	VSS	AJ43
A28	VSS	VSS	AJ45
A32	VSS	VSS	AJ47
A36	VSS	VSS	AJ50
A40	VSS	VSS	AJ52
A44	VSS	VSS	AJ54
A48	VSS	VSS	AJ56
A52	VSS	VSS	AJ58
A56	VSS	VSS	AJ60
AA1	VSS	VSS	AJ63
AA58	VSS	VSS	AK23
AB10	VSS	VSS	AK3
AB20	VSS	VSS	AK52
AB22	VSS	VSS	AL10
AB7	VSS	VSS	AL13
AC61	VSS	VSS	AL17
AD21	VSS	VSS	AL20
AD3	VSS	VSS	AL22
AD63	VSS	VSS	AL23
AE10	VSS	VSS	AL26
AE5	VSS	VSS	AL29
AE58	VSS	VSS	AL31
AF11	VSS	VSS	AL33
AF12	VSS	VSS	AL36
AF14	VSS	VSS	AL39
AF15	VSS	VSS	AL40
AF17	VSS	VSS	AL45
AF18	VSS	VSS	AL46
AG1	VSS	VSS	AL51
AG11	VSS	VSS	AL52
AG21	VSS	VSS	AL54
AG23	VSS	VSS	AL57
AG60	VSS	VSS	AL60
AG61	VSS	VSS	AL61
AG62	VSS	VSS	AM1
AG63	VSS	VSS	AM17
AH17	VSS	VSS	AM23
AH19	VSS	VSS	AM31
AH20	VSS	VSS	AM52
AH22	VSS	VSS	AN17
AH24	VSS	VSS	AN23
AH28	VSS	VSS	AN31
AH30	VSS	VSS	AN32
AH32	VSS	VSS	AN35
AH34	VSS	VSS	AN36
AH36	VSS	VSS	AN39
AH38	VSS	VSS	AN40
AH40	VSS	VSS	AN42
AH42	VSS	VSS	AN43
AH44	VSS	VSS	AN45
AH49	VSS	VSS	AN46
AH51	VSS	VSS	AN48
AH53	VSS	VSS	AN49
AH55	VSS	VSS	AN51
AH57	VSS	VSS	AN52
AJ13	VSS	VSS	AN60
AJ14	VSS	VSS	AN63
AJ23	VSS	VSS	AN7
AJ25	VSS	VSS	AP10
AJ27	VSS	VSS	AP17
AJ29	VSS	VSS	AP20

CRITICAL
OMIT_TABLE

U0500
HASWELL-ULT
2C+GT2
BGA-TSP
SYM 15 OF 19

AP22	VSS	VSS	AV59
AP23	VSS	VSS	AV8
AP26	VSS	VSS	AW16
AP29	VSS	VSS	AW24
AP3	VSS	VSS	AW33
AP31	VSS	VSS	AW35
AP38	VSS	VSS	AW37
AP39	VSS	VSS	AW4
AP48	VSS	VSS	AW40
AP52	VSS	VSS	AW42
AP54	VSS	VSS	AW44
AP57	VSS	VSS	AW47
AR11	VSS	VSS	AW50
AR15	VSS	VSS	AW51
AR17	VSS	VSS	AW59
AR23	VSS	VSS	AW60
AR31	VSS	VSS	AY11
AR33	VSS	VSS	AY16
AR39	VSS	VSS	AY18
AR43	VSS	VSS	AY22
AR49	VSS	VSS	AY24
AR5	VSS	VSS	AY26
AR52	VSS	VSS	AY30
AT13	VSS	VSS	AY33
AT35	VSS	VSS	AY4
AT37	VSS	VSS	AY51
AT40	VSS	VSS	AY53
AT42	VSS	VSS	AY57
AT43	VSS	VSS	AY59
AT46	VSS	VSS	AY6
AT49	VSS	VSS	B20
AT61	VSS	VSS	B24
AT62	VSS	VSS	B26
AT63	VSS	VSS	B28
AU1	VSS	VSS	B32
AU16	VSS	VSS	B36
AU18	VSS	VSS	B4
AU20	VSS	VSS	B40
AU22	VSS	VSS	B44
AU24	VSS	VSS	B48
AU26	VSS	VSS	B52
AU28	VSS	VSS	B56
AU30	VSS	VSS	B60
AU33	VSS	VSS	C11
AU51	VSS	VSS	C14
AU53	VSS	VSS	C18
AU55	VSS	VSS	C20
AU57	VSS	VSS	C25
AU59	VSS	VSS	C27
AV14	VSS	VSS	C38
AV16	VSS	VSS	C39
AV20	VSS	VSS	C57
AV24	VSS	VSS	D12
AV28	VSS	VSS	D14
AV33	VSS	VSS	D18
AV34	VSS	VSS	D2
AV36	VSS	VSS	D21
AV39	VSS	VSS	D23
AV41	VSS	VSS	D25
AV43	VSS	VSS	D26
AV46	VSS	VSS	D27
AV49	VSS	VSS	D29
AV51	VSS	VSS	D30
AV55	VSS	VSS	D31

CRITICAL
OMIT_TABLE

U0500
HASWELL-ULT
2C+GT2
BGA-TSP
SYM 16 OF 19

D33	VSS	VSS	H17
D34	VSS	VSS	H57
D35	VSS	VSS	J10
D37	VSS	VSS	J22
D38	VSS	VSS	J59
D39	VSS	VSS	J63
D41	VSS	VSS	K1
D42	VSS	VSS	K12
D43	VSS	VSS	L13
D45	VSS	VSS	L15
D46	VSS	VSS	L17
D47	VSS	VSS	L18
D49	VSS	VSS	L20
D5	VSS	VSS	L58
D50	VSS	VSS	L61
D51	VSS	VSS	L7
D53	VSS	VSS	M22
D54	VSS	VSS	N10
D55	VSS	VSS	N3
D57	VSS	VSS	P59
D59	VSS	VSS	P63
D62	VSS	VSS	R10
D8	VSS	VSS	R22
E11	VSS	VSS	R8
E17	VSS	VSS	T1
F20	VSS	VSS	T58
F26	VSS	VSS	U20
F30	VSS	VSS	U22
F34	VSS	VSS	U61
F38	VSS	VSS	U9
F42	VSS	VSS	V10
F46	VSS	VSS	V3
F50	VSS	VSS	V7
F54	VSS	VSS	W20
F58	VSS	VSS	W22
F61	VSS	VSS	Y10
G18	VSS	VSS	Y59
G22	VSS	VSS	Y63
G3	VSS		
G5	VSS	VSS	V58
G6	VSS	VSS	AH46
G8	VSS	VSS	V23
H13	VSS	VSS_SENSE	E62
		VSS	AH16

CPU_VCCSENSE_N <OUT> 49 65

R0960
100
5%
1/20W
MF
201
2
1
PLACE_NEAR=U0500.E62:50.8mm

SYNC_MASTER=J43_MLB SYNC_DATE=10/02/2012

PAGE TITLE
CPU/PCH GROUNDS

Apple Inc.

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REVISION <E4LABEL>
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All Intel recommendations from Intel doc #503160 Shark Bay Ultrabook Platform Power Delivery Design Guide Rev 1.0 unless stated otherwise

CPU VCC Decoupling

Intel recommendation (Table 5-1): 23x 22uF 0805 stuff, 7x 22uF 0805 nostuff
Apple implementation : 18x 10uF 0402 mirrored stuff, 1x 470uF stuff, 50x 10uF mirrored no stuff, 50x 10uF single sided no stuff

62 60 50 40 8 PPVCC_S0_CPU

NO STUFF C1000 10UF 20% 4V X6S 0402
NO STUFF C1001 10UF 20% 4V X6S 0402
NO STUFF C1002 10UF 20% 4V X6S 0402
NO STUFF C1003 10UF 20% 4V X6S 0402
NO STUFF C1004 10UF 20% 4V X6S 0402
NO STUFF C1005 10UF 20% 4V X6S 0402
NO STUFF C1006 10UF 20% 4V X6S 0402
NO STUFF C1007 10UF 20% 4V X6S 0402
NO STUFF C1008 10UF 20% 4V X6S 0402
NO STUFF C1009 10UF 20% 4V X6S 0402
NO STUFF C1010 10UF 20% 4V X6S 0402
NO STUFF C1011 10UF 20% 4V X6S 0402
NO STUFF C1012 10UF 20% 4V X6S 0402
NO STUFF C1013 10UF 20% 4V X6S 0402
NO STUFF C1014 10UF 20% 4V X6S 0402
NO STUFF C105A 10UF 20% 4V X6S 0402
CRITICAL C105B 10UF 20% 4V X6S 0402
CRITICAL C105C 10UF 20% 4V X6S 0402
NO STUFF C105D 10UF 20% 4V X6S 0402
NO STUFF C105E 10UF 20% 4V X6S 0402
CRITICAL C105F 10UF 20% 4V X6S 0402

NO STUFF C1015 10UF 20% 4V X6S 0402
NO STUFF C1016 10UF 20% 4V X6S 0402
NO STUFF C1017 10UF 20% 4V X6S 0402
NO STUFF C1018 10UF 20% 4V X6S 0402
NO STUFF C1019 10UF 20% 4V X6S 0402
NO STUFF C1020 10UF 20% 4V X6S 0402
NO STUFF C1021 10UF 20% 4V X6S 0402
NO STUFF C1030 10UF 20% 4V X6S 0402
NO STUFF C104A 10UF 20% 4V X6S 0402
NO STUFF C104B 10UF 20% 4V X6S 0402
NO STUFF C104C 10UF 20% 4V X6S 0402
CRITICAL C104D 10UF 20% 4V X6S 0402
NO STUFF C104E 10UF 20% 4V X6S 0402
CRITICAL C104F 10UF 20% 4V X6S 0402
CRITICAL C106A 10UF 20% 4V X6S 0402
NO STUFF C106B 10UF 20% 4V X6S 0402
NO STUFF C106C 10UF 20% 4V X6S 0402
NO STUFF C106D 10UF 20% 4V X6S 0402
NO STUFF C106E 10UF 20% 4V X6S 0402

CRITICAL C1070 10UF 20% 4V X6S 0402
CRITICAL C1071 10UF 20% 4V X6S 0402
NO STUFF C1072 10UF 20% 4V X6S 0402
NO STUFF C1073 10UF 20% 4V X6S 0402
NO STUFF C1074 10UF 20% 4V X6S 0402
NO STUFF C1075 10UF 20% 4V X6S 0402
CRITICAL C1076 10UF 20% 4V X6S 0402
CRITICAL C1077 10UF 20% 4V X6S 0402
NO STUFF C1078 10UF 20% 4V X6S 0402
NO STUFF C1079 10UF 20% 4V X6S 0402
NO STUFF C1080 10UF 20% 4V X6S 0402
NO STUFF C1081 10UF 20% 4V X6S 0402
NO STUFF C1082 10UF 20% 4V X6S 0402
CRITICAL C1083 10UF 20% 4V X6S 0402
CRITICAL C1084 10UF 20% 4V X6S 0402

CRITICAL C1085 10UF 20% 4V X6S 0402
CRITICAL C1086 10UF 20% 4V X6S 0402
CRITICAL C1087 10UF 20% 4V X6S 0402
NO STUFF C1088 10UF 20% 4V X6S 0402
NO STUFF C1089 10UF 20% 4V X6S 0402
NO STUFF C1090 10UF 20% 4V X6S 0402
CRITICAL C1091 10UF 20% 4V X6S 0402
CRITICAL C1092 10UF 20% 4V X6S 0402
NO STUFF C1093 10UF 20% 4V X6S 0402
NO STUFF C1094 10UF 20% 4V X6S 0402
NO STUFF C1095 10UF 20% 4V X6S 0402
NO STUFF C1096 10UF 20% 4V X6S 0402
CRITICAL C1097 10UF 20% 4V X6S 0402

NO STUFF C1022 10UF 20% 4V X6S 0402
NO STUFF C1023 10UF 20% 4V X6S 0402
NO STUFF C1024 10UF 20% 4V X6S 0402
NO STUFF C1025 10UF 20% 4V X6S 0402
NO STUFF C1026 10UF 20% 4V X6S 0402
NO STUFF C1027 10UF 20% 4V X6S 0402
NO STUFF C1028 10UF 20% 4V X6S 0402
NO STUFF C1029 10UF 20% 4V X6S 0402
NO STUFF C1032 10UF 20% 4V X6S 0402
NO STUFF C1033 10UF 20% 4V X6S 0402
NO STUFF C1034 10UF 20% 4V X6S 0402
NO STUFF C1035 10UF 20% 4V X6S 0402
NO STUFF C1036 10UF 20% 4V X6S 0402
NO STUFF C1037 10UF 20% 4V X6S 0402
NO STUFF C1038 10UF 20% 4V X6S 0402

NO STUFF C1039 10UF 20% 4V X6S 0402
NO STUFF C1044 10UF 20% 4V X6S 0402
NO STUFF C1045 10UF 20% 4V X6S 0402
NO STUFF C1046 10UF 20% 4V X6S 0402
NO STUFF C1047 10UF 20% 4V X6S 0402
NO STUFF C1048 10UF 20% 4V X6S 0402
NO STUFF C1049 10UF 20% 4V X6S 0402

NO STUFF C1056 10UF 20% 4V X6S 0402
NO STUFF C1057 10UF 20% 4V X6S 0402
NO STUFF C1058 10UF 20% 4V X6S 0402
NO STUFF C1059 10UF 20% 4V X6S 0402
NO STUFF C1062 10UF 20% 4V X6S 0402
NO STUFF C1063 10UF 20% 4V X6S 0402
NO STUFF C1064 10UF 20% 4V X6S 0402
NO STUFF C1065 10UF 20% 4V X6S 0402
NO STUFF C1066 10UF 20% 4V X6S 0402
NO STUFF C1067 10UF 20% 4V X6S 0402
NO STUFF C1068 10UF 20% 4V X6S 0402
NO STUFF C1069 10UF 20% 4V X6S 0402
NO STUFF C1098 10UF 20% 4V X6S 0402
NO STUFF C1099 10UF 20% 4V X6S 0402
NO STUFF C109A 10UF 20% 4V X6S 0402

NO STUFF C109B 10UF 20% 4V X6S 0402
NO STUFF C109C 10UF 20% 4V X6S 0402
NO STUFF C109D 10UF 20% 4V X6S 0402
NO STUFF C109E 10UF 20% 4V X6S 0402
NO STUFF C109F 10UF 20% 4V X6S 0402
NO STUFF C108A 10UF 20% 4V X6S 0402
NO STUFF C108B 10UF 20% 4V X6S 0402
NO STUFF C108C 10UF 20% 4V X6S 0402
NO STUFF C108D 10UF 20% 4V X6S 0402
NO STUFF C108E 10UF 20% 4V X6S 0402
NO STUFF C108F 10UF 20% 4V X6S 0402
NO STUFF C107A 10UF 20% 4V X6S 0402
NO STUFF C107B 10UF 20% 4V X6S 0402

CRITICAL C1031 470UF-0.0045OHM 20% 2.5V POLY-TANT SM

CPU VDDQ DECOUPLING

Intel recommendation (Table 5-4): 4x 2.2uF 0402, 6x 10uF 0603
Apple implementation : 4x 2.2uF 0402, 6x 10uF 0402, 2x 270uF B2 no stuff

40 8 PPVMEMIO_S0_CPU

C1040 2.2UF 20% 6.3V CERM 402-LF
C1041 2.2UF 20% 6.3V CERM 402-LF
C1042 2.2UF 20% 6.3V CERM 402-LF
C1043 2.2UF 20% 6.3V CERM 402-LF

C1050 10UF 20% 6.3V CERM-X5R 0402-1
C1051 10UF 20% 6.3V CERM-X5R 0402-1
C1052 10UF 20% 6.3V CERM-X5R 0402-1
C1053 10UF 20% 6.3V CERM-X5R 0402-1
C1054 10UF 20% 6.3V CERM-X5R 0402-1
C1055 10UF 20% 6.3V CERM-X5R 0402-1

C1060 270UF 20% 2V TANT CASE-B2-SM
NO STUFF C1061 270UF 20% 2V TANT CASE-B2-SM

2x Bulk nostuff per Harris Beach v1.0 schematic

SYNC_MASTER=LABEL_J41 SYNC_DATE=01/11/2013
PAGE TITLE: CPU Decoupling
Apple Inc.
DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
BRANCH: <BRANCH>
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PCH VCCDSW3_3 BYPASS
(PCH 3.3V DSW PWR)
PP3V3_S5

NO STUFF
C1200 1UF 10% 6.3V CERM 402
BYPASS=U0500.AH10:6.35mm

PCH VCCSPI BYPASS
(PCH 3.3V SPI PWR)
PP3V3_SUS

NO STUFF
C1202 0.1UF 20% 25V CERM 402
BYPASS=U0500.Y8:6.35mm

PCH VCCSUS3_3 BYPASS
(PCH 3.3V SUSPEND PWR)
PP3V3_SUS

C1204 22UF 20% 6.3V X5R-CERM-1 603
BYPASS=U0500.AC9:12.7mm

PCH VCCSUS3_3 BYPASS
(PCH 3.3V SUSPEND RTC PWR)
PP3V3_SUS

C1206 1UF 10% 6.3V CERM 402
BYPASS=U0500.AH11:6.35mm

PCH VCCSDIO BYPASS
(PCH 3.3V/1.8V SDIO PWR)
PP3V3_S0

C1208 1UF 10% 6.3V CERM 402
BYPASS=U0500.U8:6.35mm

PCH VCCSUSHDA BYPASS
(PCH 3.3V/1.5V HDA PWR)
PP1V5_S0SW_AUDIO_HDA

C1210 1UF 10% 6.3V CERM 402
BYPASS=U0500.AH14:6.35mm

PCH VCC3_3 BYPASS
(PCH 3.3V GPIO/LPC PWR)
PP3V3_S0

C1212 22UF 20% 6.3V X5R-CERM-1 603
BYPASS=U0500.V8:12.7mm

PCH VCC3_3 BYPASS
(PCH 3.3V THERMAL PWR)
PP3V3_S0

C1214 0.1UF 20% 25V CERM 402
BYPASS=U0500.K14:6.35mm

PCH VCCASW BYPASS
(PCH 1.05V ME CORE PWR)
PP1V05_S0

NO STUFF
C1250 22UF 20% 6.3V X5R-CERM-1 603
C1251 1UF 10% 6.3V CERM 402
BYPASS=U0500.AE9:12.7mm
BYPASS=U0500.AE9:6.35mm

PCH VCC BYPASS
(PCH 1.05V CORE PWR)
PP1V05_S0

C1255 10UF 20% 6.3V X5R 603
C1256 1UF 10% 6.3V CERM 402
C1257 1UF 10% 6.3V CERM 402
BYPASS=U0500.J11:12.7mm
BYPASS=U0500.J11:6.35mm
BYPASS=U0500.AE8:6.35mm

PCH VCCHSIO BYPASS
(PCH 1.05V PCIe/SATA/USB3 PWR)
PP1V05_S0SW_PCH_HSIO

C1260 1UF 10% 6.3V CERM 402
C1261 1UF 10% 6.3V CERM 402
C1262 10UF 20% 6.3V CERM-X5R 0402-1
BYPASS=U0500.K9:6.35mm
BYPASS=U0500.L10:6.35mm
BYPASS=U0500.M9:6.35mm

PCH VCCIO BYPASS
(PCH 1.05V USB2 PWR)
PP1V05_S0

C1264 1UF 10% 6.3V CERM 402
BYPASS=U0500.AG16:6.35mm

PCH VCCCLK BYPASS
(PCH 1.05V CLK PWR)
PP1V05_S0

C1266 1UF 10% 6.3V CERM 402
C1267 1UF 10% 6.3V CERM 402
BYPASS=U0500.J17:6.35mm
BYPASS=U0500.R21:6.35mm

PP1V05_S0
??mA Max

R1270 0 5% 1/16W MF-LF 402
PP1V05_S0_PCH_VCCACLKPLL_R
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V

CRITICAL
L1270 2.2UH-240MA-0.221OHM 0603

PCH VCCACLKPLL FILTER/BYPASS
(PCH 1.05V ACLK PLL PWR)
PP1V05_S0_PCH_VCCACLKPLL
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.075 MM
VOLTAGE=1.05V
31mA Max

C1270 47UF 20% 4V CERM-X5R 0805-1
C1271 47UF 20% 4V CERM-X5R 0805-1
C1272 1UF 10% 10V X5R 402
BYPASS=U0500.A20:12.7mm
BYPASS=U0500.A20:12.7mm
BYPASS=U0500.A20:6.35mm

R1275 0 5% 1/16W MF-LF 402
PP1V05_S0_PCH_VCC_ICC_R
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V

CRITICAL
L1275 2.2UH-240MA-0.221OHM 0603

PCH VCCCLK FILTER/BYPASS
(PCH 1.05V VCCCLK PWR)
PP1V05_S0_PCH_VCC_ICC
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.075 MM
VOLTAGE=1.05V
??mA Max

C1275 47UF 20% 4V CERM-X5R 0805-1
C1276 47UF 20% 4V CERM-X5R 0805-1
C1277 1UF 10% 10V X5R 402
BYPASS=U0500.J18:12.7mm
BYPASS=U0500.J18:12.7mm
BYPASS=U0500.J18:6.35mm

R1280 0 5% 1/16W MF-LF 402

CRITICAL
NO STUFF
L1280 2.2UH-240MA-0.221OHM 0603

PCH OPI VCCAPLL FILTER/BYPASS
(PCH 1.05V OPI PLL PWR)
PP1V05_S0_PCH_VCCAPLL_OPI
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.075 MM
VOLTAGE=1.05V
57mA Max

NO STUFF C1280 47UF 20% 4V CERM-X5R 0805-1
NO STUFF C1281 47UF 20% 4V CERM-X5R 0805-1
C1282 1UF 10% 10V X5R 402
BYPASS=U0500.AA21:12.7mm
BYPASS=U0500.AA21:12.7mm
BYPASS=U0500.AA21:6.35mm

PP1V05_S0SW_PCH_HSIO
83mA Max

CRITICAL
L1290 2.2UH-240MA-0.221OHM 0603

PCH VCCSATA3PLL FILTER/BYPASS
(PCH 1.05V SATA3 PLL PWR)
PP1V05_S0SW_PCH_VCCSATA3PLL
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.075 MM
VOLTAGE=1.05V
42mA Max

NO STUFF C1290 47UF 20% 4V CERM-X5R 0805-1
NO STUFF C1291 47UF 20% 4V CERM-X5R 0805-1
C1292 1UF 10% 10V X5R 402
BYPASS=U0500.B11:12.7mm
BYPASS=U0500.B11:12.7mm
BYPASS=U0500.B11:6.35mm

CRITICAL
L1295 2.2UH-240MA-0.221OHM 0603

PCH VCCUSB3PLL FILTER/BYPASS
(PCH 1.05V USB3 PLL PWR)
PP1V05_S0SW_PCH_VCCUSB3PLL
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.075 MM
VOLTAGE=1.05V
41mA Max

NO STUFF C1295 47UF 20% 4V CERM-X5R 0805-1
NO STUFF C1296 47UF 20% 4V CERM-X5R 0805-1
C1297 1UF 10% 10V X5R 402
BYPASS=U0500.B18:12.7mm
BYPASS=U0500.B18:12.7mm
BYPASS=U0500.B18:6.35mm

LPT-LP current estimates from Lynx Point-LP PCH EDS, doc #503118, v1.0
as well as from clarification email, from Srini, dated 9/10/2012 2:11pm.

SYNC_MASTER=WILL_J43 SYNC_DATE=09/13/2012

PAGE TITLE: PCH Decoupling

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
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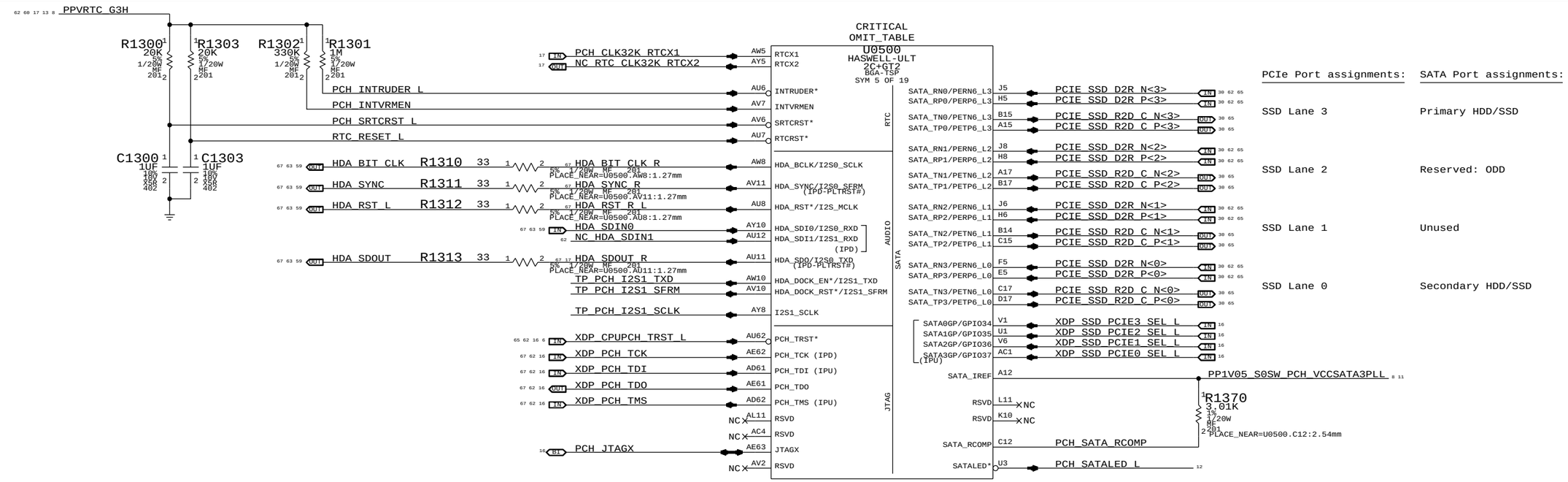

SYNC_MASTER=WILL_J43 SYNC_DATE=12/17/2012

PAGE TITLE: PCH Audio/JTAG/SATA/CLK

Apple Inc.

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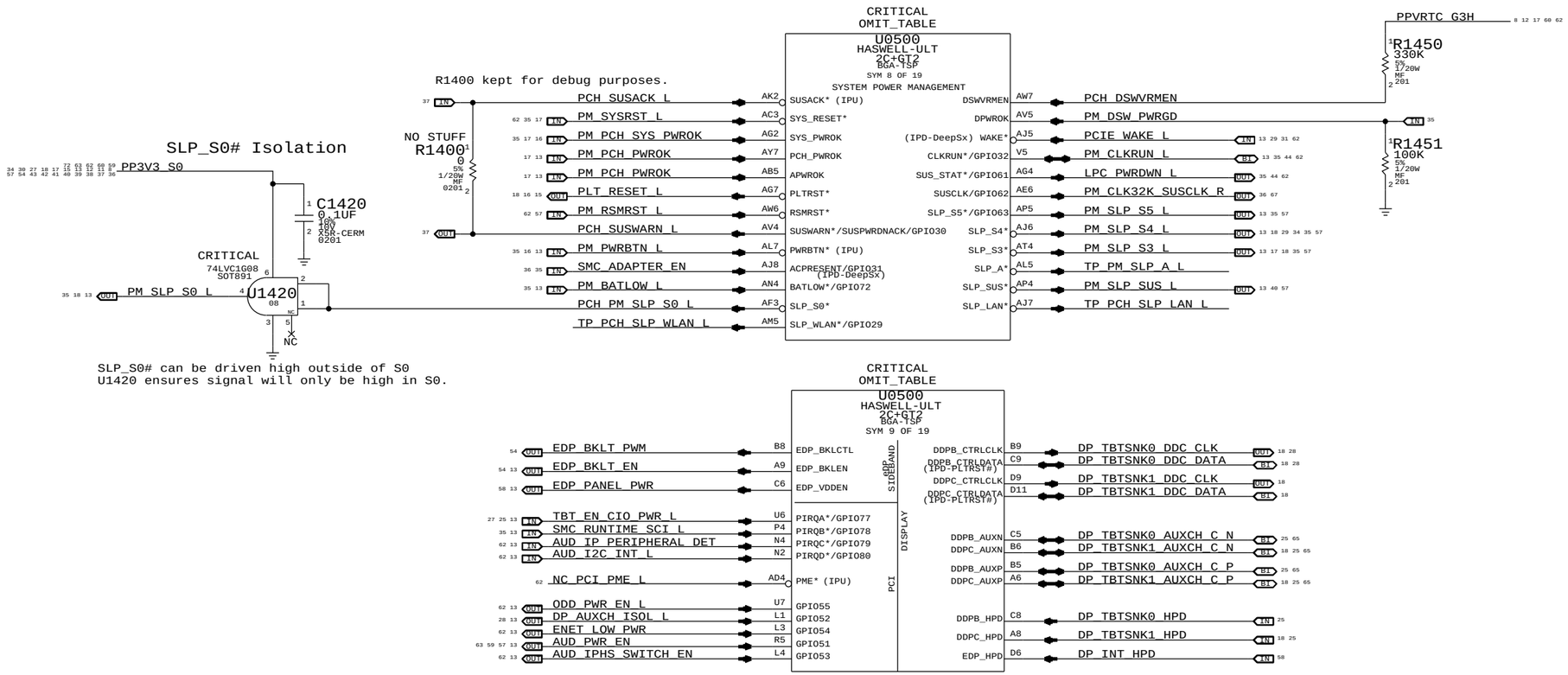

R1405	1K	5%	1/20W	MF	201	PM_PWRBTN_L
R1410	10K	5%	1/20W	MF	201	PM_BATLOW_L
R1452	10K	5%	1/20W	MF	201	PCIE_WAKE_L
R1455	10K	5%	1/20W	MF	201	PM_CLKRUN_L
R1460	100K	5%	1/20W	MF	201	PM_SLP_S5_L
R1461	100K	5%	1/20W	MF	201	PM_SLP_S4_L
R1462	100K	5%	1/20W	MF	201	PM_SLP_S3_L
R1463	100K	5%	1/20W	MF	201	PM_SLP_S0_L
R1464	100K	5%	1/20W	MF	201	PM_SLP_SUS_L
R1430	100K	5%	1/20W	MF	201	EDP_BKLT_EN
R1431	100K	5%	1/20W	MF	201	EDP_PANEL_PWR
R1440	100K	5%	1/20W	MF	201	TBT_EN_CIO_PWR_L
R1441	10K	5%	1/20W	MF	201	SMC_RUNTIME_SCI_L
R1442	100K	5%	1/20W	MF	201	AUD_IP_PERIPHERAL_DET
R1443	100K	5%	1/20W	MF	201	AUD_I2C_INT_L
R1445	100K	5%	1/20W	MF	201	ODD_PWR_EN_L
R1446	100K	5%	1/20W	MF	201	DP_AUXCH_ISOL_L
R1447	100K	5%	1/20W	MF	201	ENET_LOW_PWR
R1448	100K	5%	1/20W	MF	201	AUD_PWR_EN
R1449	100K	5%	1/20W	MF	201	AUD_IPHS_SWITCH_EN

PP3V3_S5
PP3V3_S0

SYNC_MASTER=J43_MLB SYNC_DATE=02/20/2013

PAGE TITLE
PCH PM/PCI/GFX

Apple Inc.

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PCIe Port Assignments:

Thunderbolt lane 0

Thunderbolt lane 1

Thunderbolt lane 2

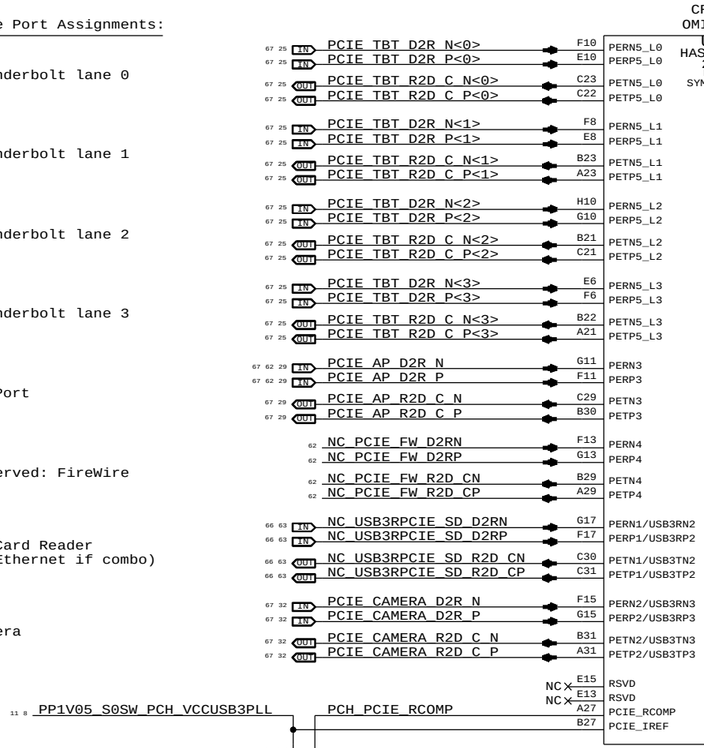
Thunderbolt lane 3

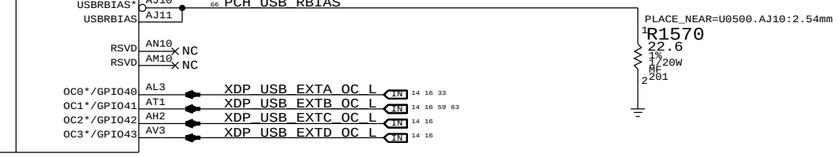
AirPort

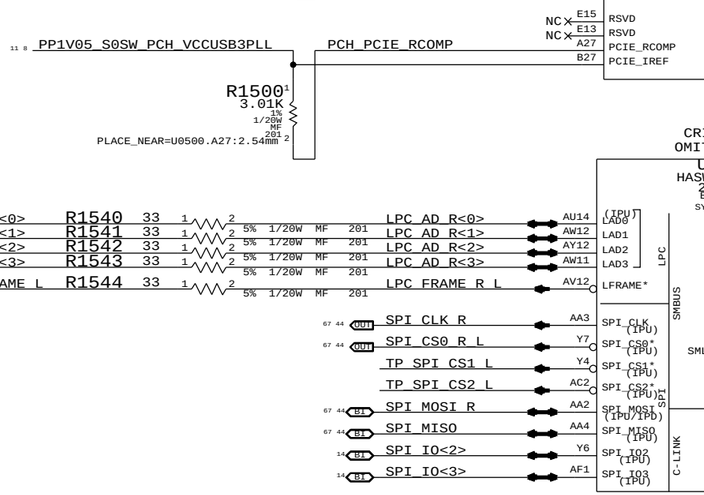
Reserved: FireWire

SD Card Reader
(& Ethernet if combo)

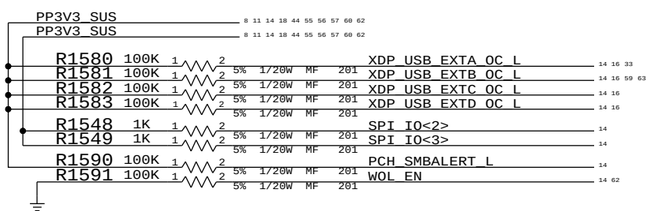
Camera







SML1ALERT# pull-up not provided on this page, may be wire-ORed into other signals. Otherwise, 100k pull-up to 3.3V SUS required.



USB Port Assignments:

Ext A (LS/FS/HS)

Ext B (LS/FS/HS)

BT

IR

Trackpad

Unused

Reserved: Camera

Reserved: SD (HS)

USB3 Port Assignments:

Ext A (SS)

Ext B (SS)

SYNC_MASTER=WILL_J43 SYNC_DATE=09/13/2012

PAGE TITLE
PCH PCIe/USB/LPC/SPI/SMBus

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BOM GROUP	BOM OPTIONS
RAMCFG_SLOT	RAMCFG3:H,RAMCFG2:H,RAMCFG1:H,RAMCFG0:H

PP3V3_S0

RAMCFG3:H R1631 100K 5% 1/20W MF 201
RAMCFG2:H R1636 100K 5% 1/20W MF 201
RAMCFG1:H R1635 100K 5% 1/20W MF 201
RAMCFG0:H R1611 100K 5% 1/20W MF 201

XDP_MLB_RAMCFG0
XDP_MLB_RAMCFG1
XDP_MLB_RAMCFG2
XDP_MLB_RAMCFG3

GPIO12:

CR: TBT_GO2SX_BIDIR, requires 100k pull-up to SUS
RR/FR: DPHDMIMUX_SEL_TBT, requires 100k pull-up to TBTLC

PLT_RESET_L

R1621 100K 5% 1/20W MF 201 → PCH_TBT_PCIE_RESET_L

R1639 100K 5% 1/20W MF 201 → SSD_RESET_L

NO STUFF
R1641 1K 5% 1/20W MF 201 → PCH_TCO_TIMER_DISABLE

CRITICAL
OMIT_TABLE
U0500
HASWELL-ULT
2C+GT2
BGA-1SP
SYM 10 OF 19

XDP_PCH_GPIO76	P1	BMBUSY*/GPIO76
XDP_MLB_RAMCFG0	AU2	GPIO8
TBT_GO2SX_BIDIR	AM7	LAN_PHY_PWR_CTRL/GPIO12
TP_MEM_VDD_SEL_1V5_L	AD6	GPIO15 (IPD-RSMRST#)
XDP_LPCPLUS_GPIO	Y1	GPIO16
XDP_PCH_GPIO17	T3	GPIO17
SD_RESET_L	AD5	GPIO24
SMC_WAKE_SCI_L	AN5	GPIO27 (IPD-DeepSx)
TPAD_SPI_INT_L	AD7	GPIO28
TPAD_USB_IF_EN	AN3	GPIO26
SSD_PWR_EN	AG6	GPIO56
PCH_TBT_PCIE_RESET_L	AP1	GPIO57
HDD_PWR_EN	AL4	GPIO58
XDP_SDCONN_STATE_CHANGE_L	AT5	GPIO59
SD_PWR_EN	AK4	GPIO44
TBT_PWR_EN	AB6	GPIO47
XDP_JTAG_ISP_TCK	U4	GPIO48
XDP_JTAG_ISP_TDI	Y3	GPIO49
JTAG_TBT_TMS	P3	GPIO50
PCH_HSIO_PWR_EN	Y2	HSIOPC/GPIO71
TPAD_SPI_IF_EN	AT3	GPIO13
XDP_MLB_RAMCFG3	AH4	GPIO14
SPIROM_USE_MLB	AM4	GPIO25
CAMERA_PWR_EN_PCH	AG5	GPIO45
FW_PWR_EN	AG3	GPIO46
XDP_MLB_RAMCFG1	AM3	GPIO9
XDP_MLB_RAMCFG2	AM2	GPIO10
SSD_DEVSLP	P2	DEVSLP0*/GPIO33
AP_S0IX_WAKE_SEL	C4	SDIO_POWER_EN/GPIO70
SSD_RESET_L	L2	DEVSLP1*/GPIO38
FW_PME_L	N5	DEVSLP2*/GPIO39
PCH_TCO_TIMER_DISABLE	V2	SPKR/GPIO81 (IPD-PLTRST#)

CPU/MISC

THRMTRIP*	D60	PM_THRMTRIP_L
RCIN*/GPIO82	V4	TBT_CIO_PLUG_EVENT
SERIRQ	T4	LPC_SERIRQ
PCH_OPI_COMP	AW15	PCH_OPI_COMP
RSVD	AF20	NC
RSVD	AB21	NC

GPIO LPIO

GSPI0_CS*/GPIO83	R6	PCH_GSPI0_CS_L
GSPI0_CLK/GPIO84	L6	PCH_GSPI0_CLK
GSPI0_MISO/GPIO85 (IPD)	N6	PCH_GSPI0_MISO
GSPI0_MOSI/GPIO86 (IPD-PLTRST#)	L8	PCH_GSPI0_MOSI
GSPI1_CS*/GPIO87	R7	TPAD_SPI_CS_L
GSPI1_CLK/GPIO88	L5	TPAD_SPI_CLK
GSPI1_MISO/GPIO89 (IPD)	N7	TPAD_SPI_MISO
GSPI_MOSI/GPIO90	K2	TPAD_SPI_MOSI
UART0_RXD/GPIO91	J1	AP_S0IX_WAKE_L
UART0_TXD/GPIO92	K3	HDMITBTMUX_FLAG_L
UART0_RTS*/GPIO93	J2	JTAG_ISP_TDO
UART0_CTS*/GPIO94	G1	AP_RESET_L
UART1_RXD/GPIO0	K4	PCH_UART1_RXD
UART1_TXD/GPIO1	G2	PCH_UART1_TXD
UART1_RST*/GPIO2	J3	PCH_UART1_RTS_L
UART1_CTS*/GPIO3	J4	PCH_UART1_CTS_L
I2C0_SDA/GPIO4	F2	PCH_I2C0_SDA
I2C0_SCL/GPIO5	F3	PCH_I2C0_SCL
I2C1_SDA/GPIO6	G4	PCH_I2C1_SDA
I2C1_SCL/GPIO7	F1	PCH_I2C1_SCL
SDIO_CLK/GPIO64	E3	TBT_POC_RESET_L
SDIO_CMD/GPIO65	F4	BT_PWRRST_L
SDIO_D0/GPIO66 (IPD-PLTRST#)	D3	PCH_STRP_TOPBLK_SWP_L
SDIO_D1/GPIO67	E4	ENET_MEDIA_SENSE
SDIO_D2/GPIO68	C3	LCD_IRQ_L
SDIO_D3/GPIO69	E2	LCD_PSR_EN

PP1V05_S0

R1650 1K 5% 1/20W MF 201 → PM_THRMTRIP_L

Pull-up/down on chipset support page (depends on TBT controller)
Cactus Ridge: Alias to TBT_CIO_PLUG_EVENT, requires pull-down.
Redwood Ridge: Alias to TBT_CIO_PLUG_EVENT_L, requires pull-up (S0).

PLACE_NEAR=U0500.AW15:2.54mm
R1655 49.9 1% 1/20W MF 201

PLT_RESET_L
R1671 100K 5% 1/20W MF 201

Pull-up on TBT page

Requires connection to SMC via 1K series R

PP3V3_S0

R1660 PCH_GSPI0_CS_L 100K 5% 1/20W MF 201
R1661 PCH_GSPI0_CLK 100K 5% 1/20W MF 201
R1662 PCH_GSPI0_MISO 100K 5% 1/20W MF 201
R1663 PCH_GSPI0_MOSI 100K 5% 1/20W MF 201
R1664 TPAD_SPI_CS_L 47K 5% 1/20W MF 201
R1665 TPAD_SPI_CLK 47K 5% 1/20W MF 201
R1666 TPAD_SPI_MISO 47K 5% 1/20W MF 201
R1667 TPAD_SPI_MOSI 47K 5% 1/20W MF 201
R1668 AP_S0IX_WAKE_L 100K 5% 1/20W MF 201
R1669 HDMITBTMUX_FLAG_L 100K 5% 1/20W MF 201
R1672 PCH_UART1_RXD 100K 5% 1/20W MF 201
R1673 PCH_UART1_TXD 100K 5% 1/20W MF 201
R1674 PCH_UART1_RTS_L 100K 5% 1/20W MF 201
R1675 PCH_UART1_CTS_L 100K 5% 1/20W MF 201
R1676 PCH_I2C0_SDA 100K 5% 1/20W MF 201
R1677 PCH_I2C0_SCL 100K 5% 1/20W MF 201
R1678 PCH_I2C1_SDA 100K 5% 1/20W MF 201
R1679 PCH_I2C1_SCL 100K 5% 1/20W MF 201

PP3V3_S5
PP3V3_S3
PP3V3_S3
PP3V3_S3
PP3V3_S3RS0_CAMERA
PP3V3_S0
PP3V3_TBTLC

TBTLC for CR, S0 for RR

R1610 100K XDP_PCH_GPIO76
R1614 100K XDP_LPCPLUS_GPIO
R1615 100K XDP_PCH_GPIO17

SD_ON_MLB

R1616 100K SD_RESET_L
R1617 100K SMC_WAKE_SCI_L
R1618 100K TPAD_SPI_INT_L
R1619 100K TPAD_USB_IF_EN
R1620 100K SSD_PWR_EN
R1622 100K HDD_PWR_EN
R1623 100K XDP_SDCONN_STATE_CHANGE_L
R1624 100K SD_PWR_EN
R1625 100K TBT_PWR_EN
R1626 100K XDP_JTAG_ISP_TCK
R1627 100K XDP_JTAG_ISP_TDI
R1628 100K JTAG_TBT_TMS
R1629 100K PCH_HSIO_PWR_EN
R1630 100K TPAD_SPI_IF_EN

NO STUFF
R1632 100K SPIROM_USE_MLB
R1633 100K CAMERA_PWR_EN_PCH
R1634 100K FW_PWR_EN
R1637 100K SSD_DEVSLP
R1638 100K AP_S0IX_WAKE_SEL
R1640 100K FW_PME_L
R1652 10K LPC_SERIRQ
R1670 100K JTAG_ISP_TDO
R1691 100K BT_PWRRST_L
R1693 100K ENET_MEDIA_SENSE
R1694 100K LCD_IRQ_L
R1695 100K LCD_PSR_EN

R1616 should also be stuffed if platform does not use SD card

SYNC_MASTER=WILL_J43 SYNC_DATE=01/14/2013

PAGE TITLE: PCH GPIO/MISC/LPIO

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Extra BPM Testpoints

XDP_BPM_L<2> → TP1802
XDP_BPM_L<3> → TP1803
XDP_BPM_L<4> → TP1804
XDP_BPM_L<5> → TP1805
XDP_BPM_L<6> → TP1806
XDP_BPM_L<7> → TP1807

(TP-P6)

Merged (CPU/PCH) Micro2-XDP

PP1V05_S0

R1830 150 5% 1/16W MF-LF 402

CRITICAL XDP_CONN J1800 DF40RC-60DP-0.4V M-ST-SM1

518S0847

NOTE: This is not the standard XDP pinout. Use with 921-0133 Adapter Flex to support chipset debug.

XDP_CPU_PREQ_L	OBSEN_A0	OBSEN_C0	CPU_CFG<17>
XDP_CPU_PRDY_L	OBSEN_A1	OBSEN_C1	CPU_CFG<16>
CPU_CFG<0>	OBSDATA_A0	OBSDATA_C0	CPU_CFG<8>
CPU_CFG<1>	OBSDATA_A1	OBSDATA_C1	CPU_CFG<9>
CPU_CFG<2>	OBSDATA_A2	OBSDATA_C2	CPU_CFG<10>
CPU_CFG<3>	OBSDATA_A3	OBSDATA_C3	CPU_CFG<11>
XDP_BPM_L<0>	OBSEN_B0	OBSEN_D0	CPU_CFG<19>
XDP_BPM_L<1>	OBSEN_B1	OBSEN_D1	CPU_CFG<18>
CPU_CFG<4>	OBSDATA_B0	OBSDATA_D0	CPU_CFG<12>
CPU_CFG<5>	OBSDATA_B1	OBSDATA_D1	CPU_CFG<13>
CPU_CFG<6>	OBSDATA_B2	OBSDATA_D2	CPU_CFG<14>
CPU_CFG<7>	OBSDATA_B3	OBSDATA_D3	CPU_CFG<15>
XDP_CPU_VCCST_PWRGD	PWRGD/HOOK0	ITPCLK/HOOK4	NC
XDP_CPU_PWRBTN_L	HOOK1	ITPCLK#/HOOK5	NC
	VCC_OBS_AB	VCC_OBS_CD	
CPU_PWR_DEBUG	HOOK2	RESET#/HOOK6	XDP_CPURST_L
XDP_SYS_PWROK	HOOK3	DBR#/HOOK7	XDP_DBRESET_L
SMBUS_PCH_DATA	SDA	TDO	
SMBUS_PCH_CLK	SCL	TRSTn	XDP_TRST_L
XDP_PCH_TCK	TCK1	TDI	
	TCK0	TMS	
		XDP_PRESENT#	

XDP_CPU_PRESENT_L

NOTE: XDP_DBRESET_L pulled-up to 3.3V on PCH Support Page

XDP_CPU_TDO: R1810 51 1% 1/20W MF 201 — PLACE_NEAR=U0500.F62:28mm
XDP_CPU_TCK: R1813 51 1% 1/20W MF 201 — PLACE_NEAR=U0500.E60:28mm
TDI and TMS are terminated in CPU.

CPU_VCCST_PWRGD: R1800 1K 1% 1/20W MF 201 — PLACE_NEAR=U0500.C61:2.54mm
PM_PWRBTN_L: R1802 0 5% 1/20W MF 0201 — PLACE_NEAR=U5000.J3:2.54mm
PM_PCH_SYS_PWROK: R1804 0 5% 1/16W MF-LF 402
XDP_CPU_TCK
PCH_JTAGX: R1835 0 5% 1/20W MF 0201 — PLACE_NEAR=J1800.58:28mm

C1804 0.1UF 10% 6.3V X5R-CERM 0201
R1831 1K 5% 1/16W MF-LF 402
C1800 0.1UF 10% 6.3V X5R-CERM 0201
C1801 0.1UF 10% 6.3V X5R-CERM 0201
C1806 0.1UF 10% 6.3V X5R-CERM 0201

R1805 1K 5% 1/20W MF 201 — PLACE_NEAR=U0500.AG7:2.54mm
PLT_RESET_L

XDP_PCH_TDO
XDP_PCH_TDI
XDP_PCH_TMS
XDP_CPU_TDO — PLACE_NEAR=J1800.51:28mm
XDP_CPUPCH_TRST_L — PLACE_NEAR=J1800.53:28mm — MAKE_BASE=TRUE
XDP_CPU_TDI — PLACE_NEAR=J1800.55:28mm
XDP_CPU_TMS — PLACE_NEAR=J1800.57:28mm

CRITICAL XDP Q1840 DMN5L06VK-7 SOT-563
CRITICAL XDP Q1840 DMN5L06VK-7 SOT-563
CRITICAL XDP Q1842 DMN5L06VK-7 SOT-563
CRITICAL XDP Q1842 DMN5L06VK-7 SOT-563

PCH XDP Signals

These signals do not connect to XDP connector in this architecture, only accessible via Top-Side Probe. Nets are listed here to show XDP associations and to make clear what restrictions exist on PCH GPIOs when Top-Side Probe is used for PCH debug.

PCH/XDP Signals		Non-XDP Signals
XDP_MLB_RAMCFG0	TP1870	
XDP_USB_EXTA_OC_L	MAKE_BASE=TRUE	XDP_USB_EXTA_OC_L
XDP_USB_EXTB_OC_L	MAKE_BASE=TRUE	XDP_USB_EXTB_OC_L
XDP_USB_EXTC_OC_L	TP1873	
XDP_USB_EXTD_OC_L	TP1874	
XDP_SDCONN_STATE_CHANGE_L	MAKE_BASE=TRUE	XDP_SDCONN_STATE_CHANGE_L
XDP_MLB_RAMCFG1	TP1876	
XDP_MLB_RAMCFG2	TP1877	
XDP_MLB_RAMCFG3	TP1878	
XDP_JTAG_ISP_TCK	MAKE_BASE=TRUE	XDP_JTAG_ISP_TCK
XDP_SSD_PCIE3_SEL_L	R1881 1K 5% 1/20W MF 201	
XDP_SSD_PCIE2_SEL_L	R1882 1K 5% 1/20W MF 201	NOTE: Must not short XDP pins together!
XDP_SSD_PCIE1_SEL_L	R1883 1K 5% 1/20W MF 201	
XDP_SSD_PCIE0_SEL_L	R1884 1K 5% 1/20W MF 201	SSD_PCIE_SEL_L
XDP_LPCPLUS_GPIO	MAKE_BASE=TRUE	XDP_LPCPLUS_GPIO
XDP_PCH_GPIO17	TP1886	
XDP_PCH_GPIO76	TP1887	
XDP_JTAG_ISP_TDI	MAKE_BASE=TRUE	XDP_JTAG_ISP_TDI

Unused & MLB_RAMCFGx GPIOs have TPs.
USB Overcurrents are aliased, do not cause USB OC# events during PCH debug.
SDCONN_STATE_CHANGE_L is aliased, do not plug/unplug SD Cards during PCH debug.
JTAG_ISP (non-TMS) nets are aliased, do not attempt bit-banged JTAG during PCH debug.
NOTE: Should force PCH GPIO47 high to ensure TBT router powered to avoid leakage/clamping of signals.
SSD_PCIEx_SEL_L straps are connected via 1K to common net.
LPCPLUS_GPIO is aliased, do not attempt use during PCH debug.

CPU JTAG Isolation

PP5V_S0
PP3V3_S5
C1845 0.1UF 10% 10V X5R-CERM 0201
U1845 74LVC1G07GF SOT891 (VCC, GND, NC)
R1845 330K 5% 1/20W MF 201
ALL_SYS_PWRGD
XDP_JTAG_CPU_ISOL_L

PP1V05_SUS

PCH_JTAGX	R1899 1K 5% 1/20W MF 201	NO STUFF
XDP_PCH_TDO	R1890 51 5% 1/20W MF 201	XDP
XDP_PCH_TDI	R1891 51 5% 1/20W MF 201	XDP
XDP_PCH_TMS	R1892 51 5% 1/20W MF 201	XDP
XDP_PCH_TCK	R1896 51 5% 1/20W MF 201	NO STUFF
XDP_CPUPCH_TRST_L	R1897 51 5% 1/20W MF 201	NO STUFF

SYNC_MASTER=WILL_J43	SYNC_DATE=12/17/2012
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System RTC Power Source & 32kHz / 25MHz Clock Generator

Chipset uses 24MHz crystal, GreenCLK kept to save 1x 25MHz crystal & 1x 32kHz crystal

PP3V42_G3H
Coin-Cell: VBAT (300-ohm & 10uF RC)
No Coin-Cell: 3.42V G3Hot (no RC)

PP3V3_S5
Coin-Cell & G3Hot: 3.42V G3Hot
Coin-Cell & No G3Hot: 3.3V S5
No Coin-Cell: 3.3V S5

This looks a little ugly to support new and old parts. With GreenCLK Rev C pin 5 must receive S5 power (Stuff R2042)

No bypass necessary

GreenCLK 25MHz Power Must be powered if any VDDIO is powered.

PP3V3_S5RS3RS0_SYSCLKGEN

CAM XTAL Power
TBT XTAL Power

PP1V2_CAM_XTALPCIEVDD
PP3V3_TBTLC

C1924 0.1UF 10% 16V X5R-CERM 0201
C1922 0.1UF 10% 16V X5R-CERM 0201
C1902 1UF 20% 6.3V X5R 0201

U1900
SLG3NB148CV
TQFN
CRITICAL

NC, VDD, VG3HOT

VBAT and +V3.3A are internally ORed to create VDD_RTC_OUT.

+V3.3A should be first available ~3.3V power to reduce VBAT draw.

CKPLUS_WAIVE=PwrTerm2Gnd

C1905 12PF 5% 25V NP0-C0G-CERM 0201
C1906 12PF 5% 25V NP0-C0G-CERM 0201
CRITICAL Y1905 25.000MHZ-12PF-20PPM SM-3.2X2.5MM
R1905 0 5% 1/20W MF 0201
R1906 1M 5% 1/20W MF 201
NO STUFF

SYSCLK_CLK25M_X2
SYSCLK_CLK25M_X2_R
SYSCLK_CLK25M_X1

NOTE: 30 PPM or better required for RTC accuracy

VIOE_25M_A, VIOE_25M_B, VIOE_25M_C
32.768K
25M_A, 25M_B, 25M_C
VOUT
X2, X1
GND, THRM PAD

PCH_CLK32K_RTCX1
SYSCLK_CLK25M_CAMERA
SYSCLK_CLK25M_TBT
PPVRTC_G3H
For SB RTC Power

C1910 1UF 20% 6.3V X5R 0201

NC_RTC_CLK32K_RTCX2 — NC_RTC_CLK32K_RTCX2
MAKE_BASE=TRUE NO_TEST=TRUE

PCH 24MHz Crystal

C1915 6.8PF +/-0.1PF 25V C0G 0201
C1916 6.8PF +/-0.1PF 25V C0G 0201
CRITICAL Y1915 24.000MHZ-20PPM-6PF 3.20X2.50MM-SM1
R1915 0 5% 1/20W MF 0201
R1916 1M 5% 1/20W MF 201

PCH_CLK24M_XTALOUT_R
PCH_CLK24M_XTALOUT
PCH_CLK24M_XTALIN

PCH 24MHz Outputs

R1927 22 5% 1/20W MF 201
R1926 22 5% 1/20W MF 201

LPC_CLK24M_SMC_R — LPC_CLK24M_SMC
PLACE_NEAR=U0500.AN15:5.1mm
MAKE_BASE=TRUE

LPC_CLK24M_LPCPLUS_R — LPC_CLK24M_LPCPLUS
PLACE_NEAR=U0500.AP15:5.1mm

PCH Reset Button

PP3V3_S0
R1995 10K 5% 1/20W MF 201
XDP
R1996 0 1/20W 0201 MF 5%
XDP_DBRESET_L — PM_SYSRST_L
NO STUFF
R1997 0 5% 1/16W MF-LF 402
SILK_PART=SYS RESET

Memory VTT Enable Level-Shifter

CPU output is on VDDQ rail (1.2V), TPS51916 has 1.8V Vih(min).

PP1V2_S3
PP3V3_S0
C1970 0.1UF 10% 16V X5R-CERM 0201
U1970 74AUP1G07GF SOT891
R1970 330K 5% 1/20W MF 201
TPS51916 I(leak) = +/- 1uA, Vih(min) = 1.8V
33uW when driven-low
CPU_MEMVTT_PWR_EN_LSVDDQ
MEMVTT_PWR_EN
MAKE_BASE=TRUE

PCH ME Disable Strap

PP5V_S0
R1920 100K 5% 1/20W MF 201
Q1920 DMN5L06VK-7 SOT-563
PP1V5_S0SW_AUDIO_HDA
SPI_DESCRIPTOR_OVERRIDE_LS5V
SPI_DESCRIPTOR_OVERRIDE
R1921 1K 5% 1/20W MF 201
HDA_SDOUT_R
IPD = 9-50k
SPI_DESCRIPTOR_OVERRIDE_L

PCH uses HDA_SDO as a power-up strap. If low, ME functions normally. If high, ME is disabled. This allows for full re-flashing of SPI ROM. SMC controls strap enable to allow in-field control of strap setting. Q1920 & 5V pull-up allows circuit to work regardless of HDA voltage.

VCCST (1.05V S0) PWRGD

PP3V3_S5
PP1V05_S0
C1930 0.1UF 10% 16V X5R-CERM 0201
CRITICAL U1930 74AUP1G09 SOT891
R1931 10K 5% 1/20W MF 201
ALL_SYS_PWRGD
PM_SLP_S3_L
CPU_VCCST_PWRGD

PCH PWROK Generation

PP3V42_G3H
PP3V3_S0
BYPASS=U1950:5MM
C1950 0.1UF 10% 16V X5R-CERM 0201
R1950 10K 5% 1/20W MF 201
CPU_VR_EN
R1955 10K 5% 1/20W MF 201
NO STUFF
R1951 0 5% 1/20W MF 0201
CPU_VR_READY
MAKE_BASE=TRUE
ALL_SYS_PWRGD
CPUVR_PGOOD_R
U1950 74LVC2G08GT SOT833
PM_S0_PGOOD
NO STUFF
R1961 100K 5% 1/20W MF 201
R1963 0 5% 1/20W MF 0201
NO STUFF WF: Do we need this?
R1960 0 5% 1/20W MF 0201
CKPLUS_WAIVE=UNCONNECTED_PINS
U1950 74LVC2G08GT SOT833
SYS_PWROK_R
R1962 1K 5% 1/20W MF 201
PM_PCH_SYS_PWROK
PM_PCH_PWROK
PM_PCH_PWROK
MAKE_BASE=TRUE
SMC_DELAYED_PWRGD

SYNC_MASTER=J43_MLB1	SYNC_DATE=01/09/2013
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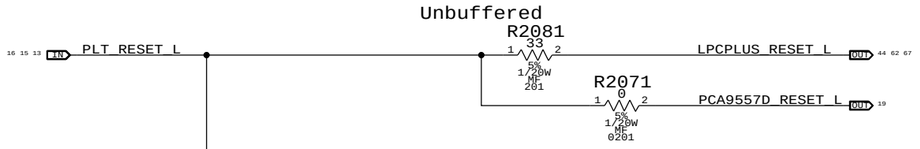
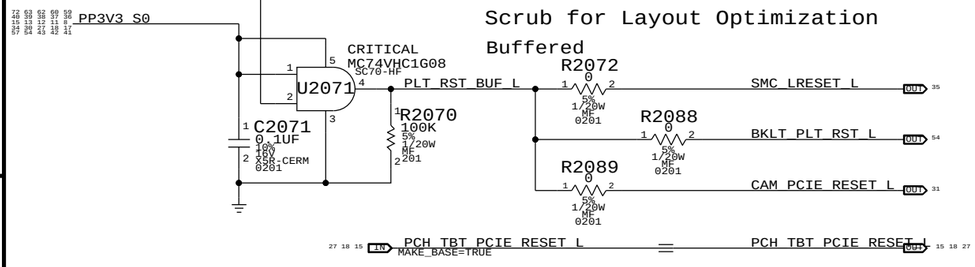
Platform Reset Connections

Unbuffered

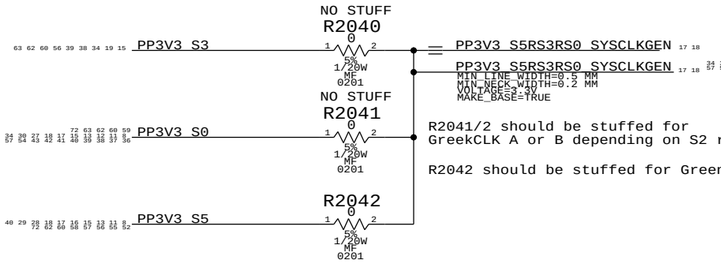


Scrub for Layout Optimization

Buffered



GreenCLK 25MHz Power



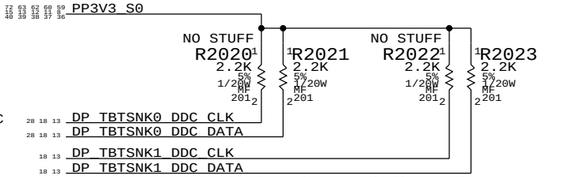
R2041/2 should be stuffed for GreekCLK A or B depending on S2 rail

R2042 should be stuffed for GreenCLK C

DDC Pull-Ups

2.2k pull-ups are required by PCH to indicate active display interface.

DP++ spec violation, should remove!

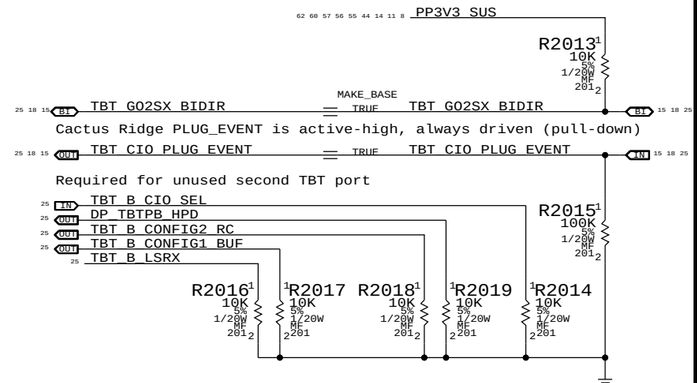


TBTSNK1_DDC is pulled-up just to indicate that DP port is used. No DDC on this port, AUX-only.

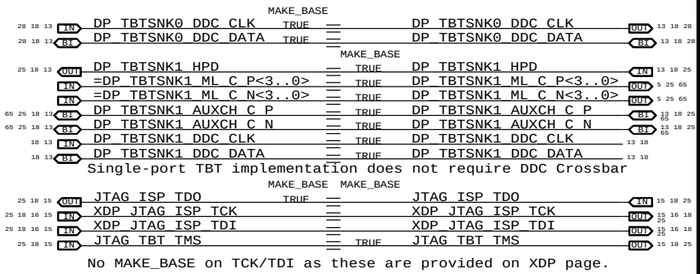
NOTE: Only DDC_DATA is sensed by PCH, so DDC_CLK pull-ups are unstuffed.

Thunderbolt Pull-up/downs

Cactus Ridge GO2SX signal pulled-up to SUS rail



TBT Aliases

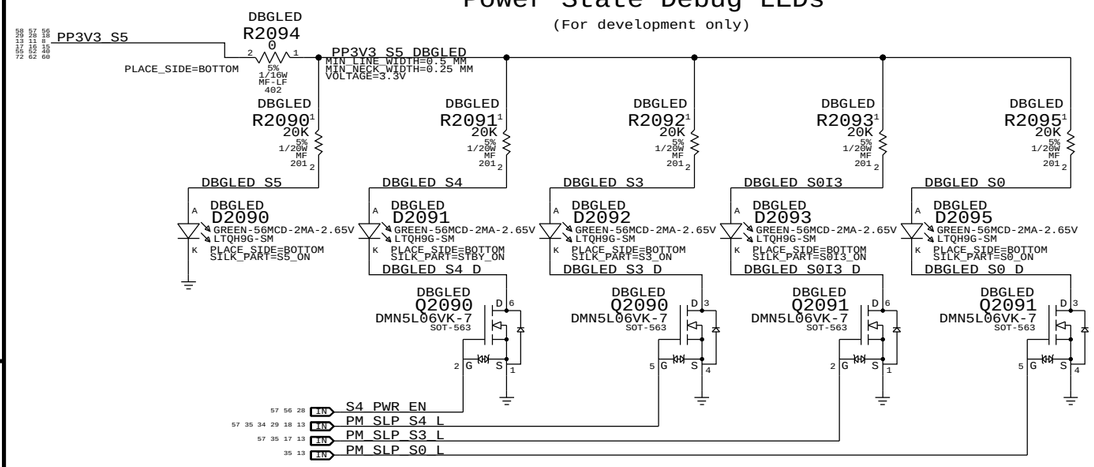


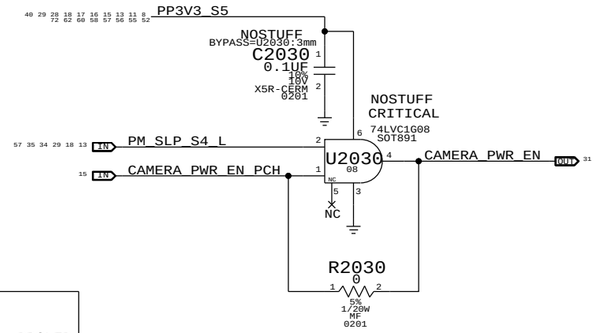
Single-port TBT implementation does not require DDC Crossbar

No MAKE_BASE on TCK/TDI as these are provided on XDP page.

Power State Debug LEDs

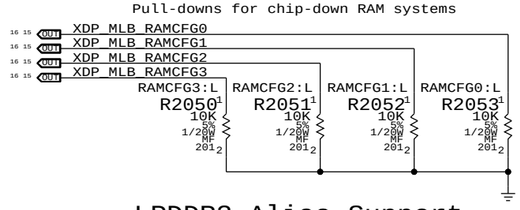
(For development only)



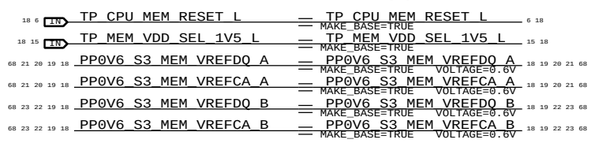


RAM Configuration Straps

Pull-downs for chip-down RAM systems



LPDDR3 Alias Support



SYNC_MASTER=J43_MLB SYNC_DATE=01/17/2013

PAGE TITLE: Project Chipset Support

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DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

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Page Notes

Power aliases required by this page:
- =PP3V3_S3_VREFMRGN
- =PPDDR_S3_MEMVREF

Signal aliases required by this page:
- =I2C_VREFDACS_SCL
- =I2C_VREFDACS_SDA
- =I2C_PCA9557D_SCL
- =I2C_PCA9557D_SDA

BOM options provided by this page:
- DDRVREF_DAC - Stuffs DAC margining circuit.

CPU-Based Margining

FETs for CPU isolation during DAC margining

CPU_DIMMA_VREFDQ
CPU_DIMMB_VREFDQ
CPU_DIMM_VREFCA

CRITICAL Q2220 DMN5L06VK-7 SOT-563
CRITICAL Q2260 DMN5L06VK-7 SOT-563
CRITICAL Q2220 DMN5L06VK-7 SOT-563
CRITICAL Q2260 DMN5L06VK-7 SOT-563

NOTE: CPU DAC output step sizes:
DDR3 (1.5V) 7.70mV per step
DDR3L (1.35V) 6.99mV per step
LPDDR3 (1.2V) ?.??mV per step

NOTE: CPU has single output for VREFCA. Split into two signals for independent DAC margining support. When DAC margining VREFCA ensure VREFMRGN_CPU_EN is low to remove short due to CPU.

CPU MEM VREFDQ A ISOL
CPU MEM VREFDQ B ISOL
CPU MEM VREFCA A ISOL
CPU MEM VREFCA B ISOL

DDRVREF_DAC R2225 100K 5% 1/20W MF 201 — VREFMRGN_DQ_A_EN_RC
DDRVREF_DAC R2201 100K 5% 1/20W MF 201
DDRVREF_DAC C2225 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC Q2225 DMN5L06VK-7 SOT-563
Q2225 pin 6: PLACE_NEAR=Q2220.6:2.54mm

DDRVREF_DAC R2245 100K 5% 1/20W MF 201 — VREFMRGN_DQ_B_EN_RC
DDRVREF_DAC R2202 100K 5% 1/20W MF 201
DDRVREF_DAC C2245 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC Q2265 DMN5L06VK-7 SOT-563
Q2265 pin 6: PLACE_NEAR=Q2260.6:2.54mm

DDRVREF_DAC R2265 100K 5% 1/20W MF 201 — VREFMRGN_CA_A_EN_RC
DDRVREF_DAC R2215 100K 5% 1/20W MF 201
DDRVREF_DAC C2265 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC Q2225 DMN5L06VK-7 SOT-563

DDRVREF_DAC R2285 100K 5% 1/20W MF 201 — VREFMRGN_CA_B_EN_RC
DDRVREF_DAC R2207 100K 5% 1/20W MF 201
DDRVREF_DAC C2285 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC Q2265 DMN5L06VK-7 SOT-563

(All 4 R's) DDRVREF_DAC
R2226 4.02K 1% 1/20W MF 201 — VREFMRGN_DQ_A_RDIV
R2246 4.02K 1% 1/20W MF 201 — VREFMRGN_DQ_B_RDIV
R2266 4.02K 1% 1/20W MF 201 — VREFMRGN_CA_A_RDIV
R2286 4.02K 1% 1/20W MF 201 — VREFMRGN_CA_B_RDIV

R22x6 pin 2:
PLACE_NEAR=Q2225.1:2.54mm
PLACE_NEAR=Q2265.1:2.54mm
PLACE_NEAR=Q2225.4:2.54mm
PLACE_NEAR=Q2265.4:2.54mm

DAC-Based Margining

DAC sets voltage level, PCA9557 & FETs enable outputs and disables margining after platform reset.

PP3V3_S3
OMIT R2218 SHORT NONE NONE NONE NONE 402
PP3V3_S3_VREFMRGN_DAC MIN_LINE_WIDTH=0.3 mm MIN_NECK_WIDTH=0.2 mm VOLTAGE=3.3V
DDRVREF_DAC C2200 2.2UF 20% 6.3V CERM 402-LF
DDRVREF_DAC C2201 0.1UF 10% 6.3V CERM-X5R 0201

CRITICAL DDRVREF_DAC
U2200 DAC5574 MSOP
SMBUS_PCH_CLK — SCL
SMBUS_PCH_DATA — SDA
Addr=0x98(WR)/0x99(RD)
A0, A1
VOUTA — VREFMRGN_DQ_A
VOUTB — VREFMRGN_DQ_B
VOUTC — VREFMRGN_CA_AB
VOUTD — VREFMRGN_MEMVREG

NOTE: MEMVREG and SPARE share a DAC output, cannot enable both at the same time!

DDRVREF_DAC C2202 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC
U2201 PCA9557 QFN (OD)
Addr=0x30(WR)/0x31(RD)
SMBUS_PCH_CLK
SMBUS_PCH_DATA
R2200 100K 5% 1/20W MF 201
P0 — VREFMRGN_CPU_EN
P1 — VREFMRGN_DQ_A_EN
P2 — VREFMRGN_DQ_B_EN
P3 — VREFMRGN_CA_A_EN
P4 — VREFMRGN_CA_B_EN
P5 — VREFMRGN_MEMVREG_EN
P6 — VREFMRGN_SPARE_EN
P7 — NC
RESET* — PCA9557D_RESET_L
THRM PAD, GND

RST* on 'platform reset' so that system watchdog will disable margining.

NOTE: Margining will be disabled across all soft-resets and sleep/wake cycles.

PP3V3_S3
DDRVREF_DAC C2205 0.1UF 10% 6.3V CERM-X5R 0201
CRITICAL DDRVREF_DAC
U2204 MAX4253 UCSP
VREFMRGN_MEMVREG_BUF
DDRVREF_DAC R2214 38.3K 1% 1/20W MF 201
DDRREG_FB (OUT) — PLACE_NEAR=R7415.2:1mm

DDRVREF_DAC R2213 100K 5% 1/20W MF 201
CRITICAL DDRVREF_DAC
U2204 MAX4253 UCSP
VREFMRGN_SPARE_BUF
DDRVREF_DAC R2217 1M 5% 1/20W MF 201
Pins B1 & B4: CKPLUS_WAIVE=unconnected_pins

DDRVREF_DAC R2212 100K 5% 1/20W MF 201

VRef Dividers

Always used, regardless of margining option.

PP1V2_S3

R2223 10 1% 1/20W MF 201 — PLACE_NEAR=Q2220.6:2mm
C2220 0.022UF 10% 6.3V X5R-CERM 0201 — MEM_VREFDQ_A_RC
R2221 8.2K 1% 1/20W MF 201 — PLACE_NEAR=Q2220.6:3mm
R2222 8.2K 1% 1/20W MF 201 — PLACE_NEAR=R2221.2:1mm
R2220 24.9 1% 1/20W MF 201 — PLACE_NEAR=Q2220.6:3mm
PP0V6_S3_MEM_VREFDQ_A MIN_LINE_WIDTH=0.3 mm MIN_NECK_WIDTH=0.2 mm

R2243 10 1% 1/20W MF 201 — PLACE_NEAR=Q2260.6:2mm
C2240 0.022UF 10% 6.3V X5R-CERM 0201 — MEM_VREFDQ_B_RC
R2241 8.2K 1% 1/20W MF 201 — PLACE_NEAR=Q2241.2:1mm
R2242 8.2K 1% 1/20W MF 201 — PLACE_NEAR=Q2260.6:3mm
R2240 24.9 1% 1/20W MF 201 — PLACE_NEAR=Q2240.6:3mm
PP0V6_S3_MEM_VREFDQ_B MIN_LINE_WIDTH=0.3 mm MIN_NECK_WIDTH=0.2 mm

R2263 10 1% 1/20W MF 201 — PLACE_NEAR=Q2220.3:2mm
C2260 0.022UF 10% 6.3V X5R-CERM 0201 — MEM_VREFCA_A_RC
R2261 8.2K 1% 1/20W MF 201 — PLACE_NEAR=Q2220.3:3mm
R2262 8.2K 1% 1/20W MF 201 — PLACE_NEAR=R2261.2:1mm
R2260 24.9 1% 1/20W MF 201 — PLACE_NEAR=Q2260.3:3mm
PP0V6_S3_MEM_VREFCA_A MIN_LINE_WIDTH=0.3 mm MIN_NECK_WIDTH=0.2 mm

R2283 10 1% 1/20W MF 201 — PLACE_NEAR=Q2260.3:2mm
C2280 0.022UF 10% 6.3V X5R-CERM 0201 — MEM_VREFCA_B_RC
R2281 8.2K 1% 1/20W MF 201 — PLACE_NEAR=R2281.2:1mm
R2282 8.2K 1% 1/20W MF 201 — PLACE_NEAR=Q2260.3:3mm
R2280 24.9 1% 1/20W MF 201 — PLACE_NEAR=Q2280.6:3mm
PP0V6_S3_MEM_VREFCA_B MIN_LINE_WIDTH=0.3 mm MIN_NECK_WIDTH=0.2 mm

	MEM A VREF DQ	MEM B VREF DQ	MEM A VREF CA	MEM B VREF CA	MEM VREG	
DAC Channel:	A	B	C	C	D	
PCA9557D Pin:	1	2	3	4	5	
	LPDDR3 (1.2V)		DDR3L (1.35V)		LPDDR3 (1.2V)	DDR3L (1.35V)
Nominal value	0.600V (DAC: 0x2E.5)		0.675V (DAC: 0x34)		1.200V (DAC: 0x5D)	1.343V (DAC: 0x68)
Margined target:	0.300V - 0.900V (+/- 300mV)		0.337V - 1.013V (+/- 337.5mV)		0.800V - 1.600V (+/- 400mV)	0.972V - 1.714V (+/- 371mV)
DAC range:	0.000V - 1.199V (0x00 - 0x5D)		0.000V - 1.354V (0x00 - 0x69)		0.000V - 2.397V (0x00 - 0xBA)	0.000V - 2.694V (0x00 - 0xD1)
VRef current:	+73uA - -73uA (- = sourced)		+82uA - -82uA (- = sourced)		+21uA - -21uA (- = sourced)	+25uA - -25uA (- = sourced)
DAC step size:	6.36mV / step @ output		6.36mV / step @ output		4.28mV / step @ output	3.53mV / step @ output

NOTE: LPDDR3 assumes TPS51916 supply with 28.7k/57.6k divider
DDR3L assumes TPS51916 supply with 19.6k/57.6k divider

SYNC_MASTER=WILL_J43 SYNC_DATE=02/04/2013

PAGE TITLE: DDR3 VREF MARGINING

Apple Inc.

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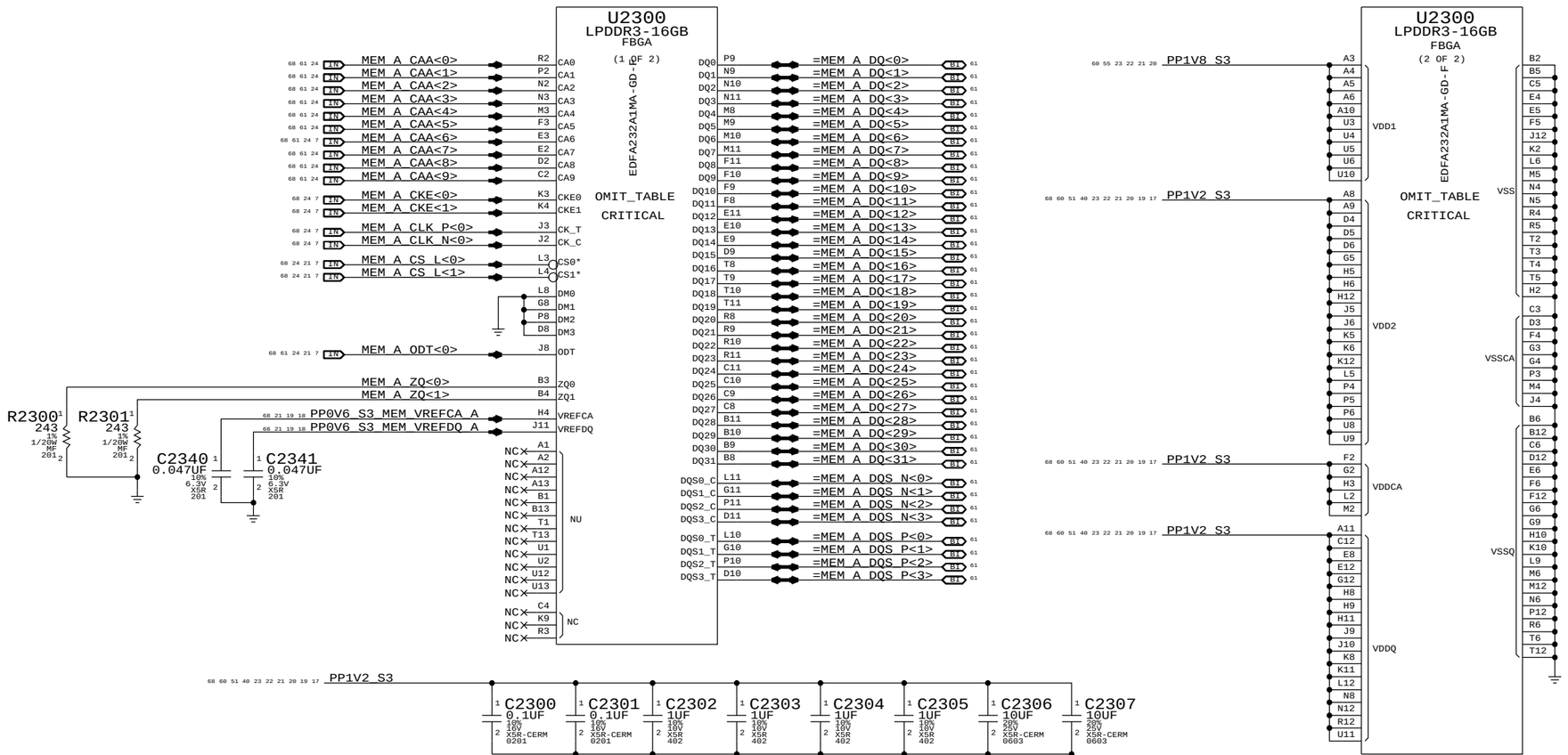
LPDDR3 CHANNEL A (0-31)



PLACEMENT_NOTE:

10uF caps are shared between DRAM.
Distribute evenly.

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE
LPDDR3 DRAM Channel A (0-31)

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
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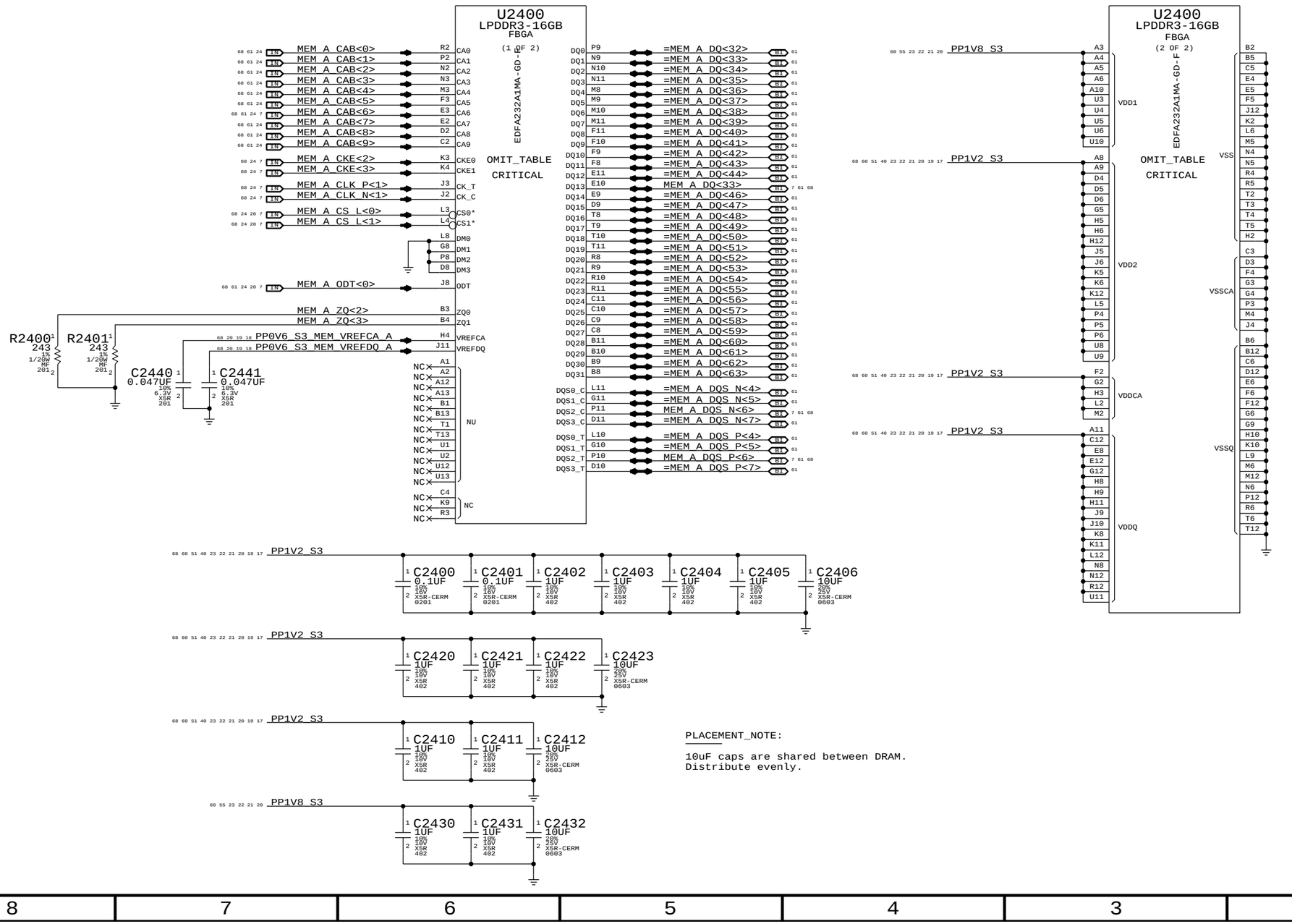
LPDDR3 CHANNEL A (32-63)



PLACEMENT_NOTE:

10uF caps are shared between DRAM.
Distribute evenly.

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LPDDR3 DRAM Channel A (32-63)

Apple Inc.

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REVISION <E4LABEL>
BRANCH <BRANCH>
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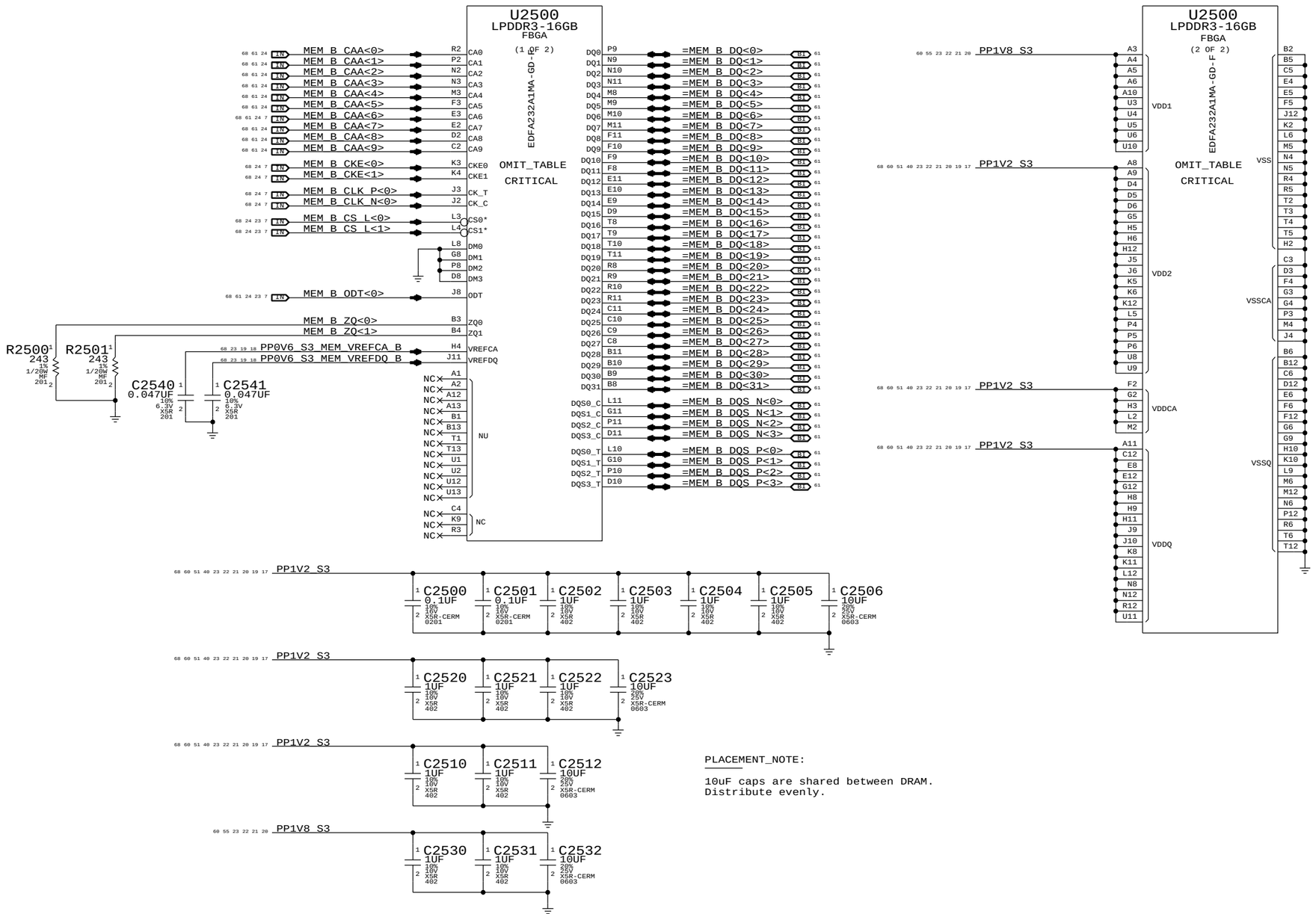
LPDDR3 CHANNEL B (0-31)



PLACEMENT_NOTE:

10uF caps are shared between DRAM.
Distribute evenly.

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LPDDR3 DRAM Channel B (0-31)

Apple Inc.

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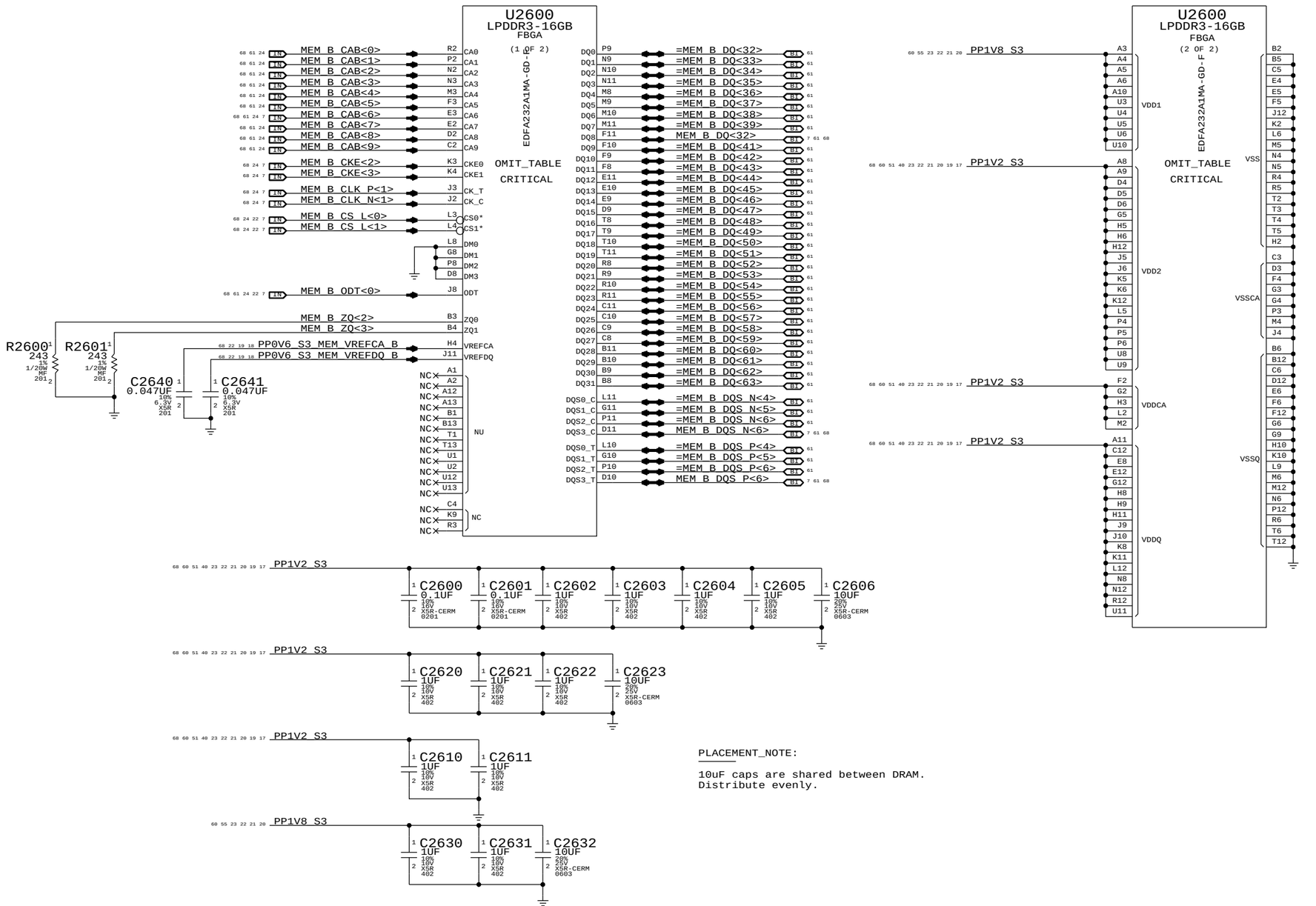
LPDDR3 CHANNEL B (32-63)



PLACEMENT_NOTE:

10uF caps are shared between DRAM.
Distribute evenly.

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PAGE TITLE
LPDDR3 DRAM Channel B (32-63)

Apple Inc.

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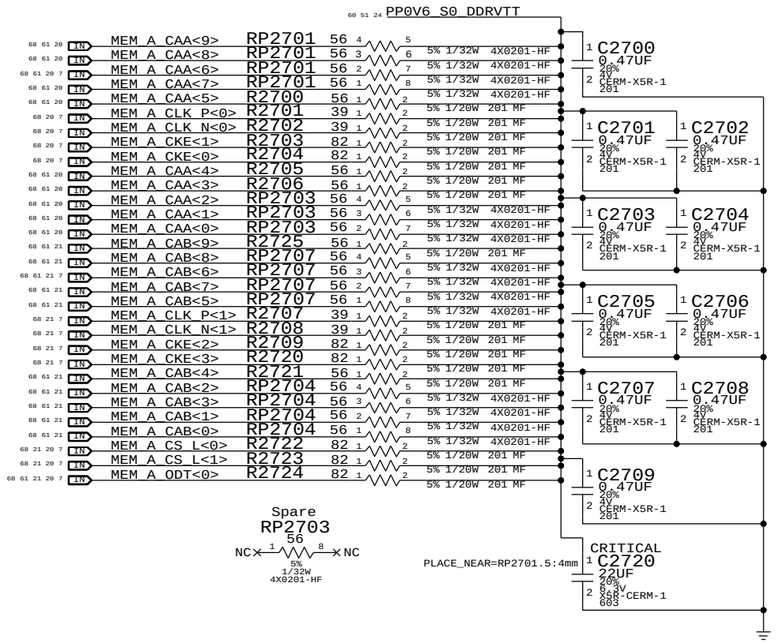
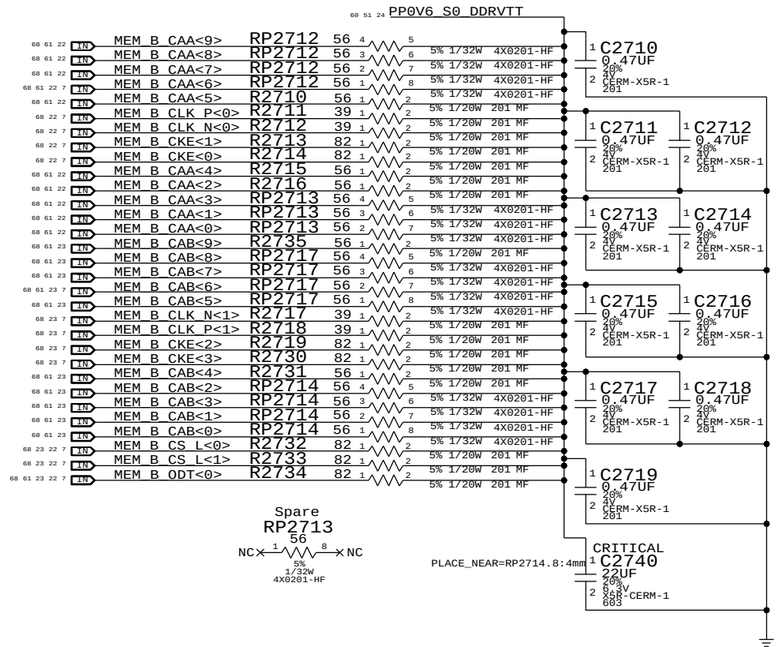
Intel reccomends 55 Ohm for CMD/ADDR, 80 Ohm for CTRL/CKE, 38 Ohm for CLK





SYNC_MASTER=J43_MLB SYNC_DATE=09/21/2012

PAGE TITLE: LPDDR3 DRAM Termination

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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CRITICAL
OMIT_TABLE
U2800
CACTUSRIDGE4C
FCBGA
(SYM 1 OF 2)

PCIE GEN2

RECEIVE

PCIE_TBT_R2D_C_P<0>	C2800 0.1UF	PCIE_TBT_R2D_P<0> AB9
PCIE_TBT_R2D_C_N<0>	C2801 0.1UF	PCIE_TBT_R2D_N<0> AA10
PCIE_TBT_R2D_C_P<1>	C2802 0.1UF	PCIE_TBT_R2D_P<1> AA12
PCIE_TBT_R2D_C_N<1>	C2803 0.1UF	PCIE_TBT_R2D_N<1> AB13
PCIE_TBT_R2D_C_P<2>	C2804 0.1UF	PCIE_TBT_R2D_P<2> AB15
PCIE_TBT_R2D_C_N<2>	C2805 0.1UF	PCIE_TBT_R2D_N<2> AA16
PCIE_TBT_R2D_C_P<3>	C2806 0.1UF	PCIE_TBT_R2D_P<3> AA18
PCIE_TBT_R2D_C_N<3>	C2807 0.1UF	PCIE_TBT_R2D_N<3> AB19

PERP_0, PERN_0, PERP_1, PERN_1, PERP_2, PERN_2, PERP_3, PERN_3

TRANSMIT

PETP_0 AD5	PCIE_TBT_D2R_C_P<0>	C2840 0.1UF PCIE_TBT_D2R_P<0>
PETN_0 AD7	PCIE_TBT_D2R_C_N<0>	C2841 0.1UF PCIE_TBT_D2R_N<0>
PETP_1 AD9	PCIE_TBT_D2R_C_P<1>	C2842 0.1UF PCIE_TBT_D2R_P<1>
PETN_1 AD11	PCIE_TBT_D2R_C_N<1>	C2843 0.1UF PCIE_TBT_D2R_N<1>
PETP_2 AD13	PCIE_TBT_D2R_C_P<2>	C2844 0.1UF PCIE_TBT_D2R_P<2>
PETN_2 AD15	PCIE_TBT_D2R_C_N<2>	C2845 0.1UF PCIE_TBT_D2R_N<2>
PETP_3 AD17	PCIE_TBT_D2R_C_P<3>	C2846 0.1UF PCIE_TBT_D2R_P<3>
PETN_3 AD19	PCIE_TBT_D2R_C_N<3>	C2847 0.1UF PCIE_TBT_D2R_N<3>

MISC

PP3V3_S4_TBTAPWR → R2810 47K 5% 1/20W MF 201

TBT_PCIE_RESET_L	R6	PERST_N
TBT_PWR_ON_POC_RST_L	J2	PWR_ON_POC_RSTN
TP_TBT_MONDC0	AD23	MONDC0
TP_TBT_MONDC1	AC24	MONDC1
TBT_MONOBSP	W18	MONOBS_P
TBT_MONOBSN	W16	MONOBS_N
TP_TBT_THERM_DP	Y7	THERMDA

NO STUFF C2810 0.1UF 10% 16V X5R-CERM 0201

OMIT R2815 NOSTUFF NONE NONE NONE 0201

DEBUG: For monitoring current/voltage

DEBUG: For monitoring clock

Use AA8 GND ball for THERM_DN

EEPROM

TBT_SPI_MOSI	R4	EE_DI
TBT_SPI_MISO	P5	EE_DO
TBT_SPI_CS_L	AD3	EE_CS_N
TBT_SPI_CLK	W4	EE_CLK

JTAG/TEST PORT

XDP_JTAG_ISP_TDI	V1	TDI
JTAG_TBT_TMS	AB3	TMS
XDP_JTAG_ISP_TCK	AA6	TCK
JTAG_ISP_TDO	R2	TDO
TBT_TEST_EN	N4	TEST_EN
TBT_TEST_PWR_GOOD	AB5	TEST_PWR_GOOD

R2825 0 5% 1/20W MF 0201, R2829 0 5% 1/20W MF 0201

RSENSE U20 TBT_RSENSE

RBIAS W20 TBT_RBIAS → R2855 1K 1% 1/20W MF 201

NC U4 NC

Not used in host mode.

PCIE RESET

PCIE_RST_0_N	N6	TP_TBT_PCIE_RESET0_L
PCIE_RST_1_N	T1	TP_TBT_PCIE_RESET1_L
PCIE_RST_2_N	Y5	TP_TBT_PCIE_RESET2_L
PCIE_RST_3_N	U2	TP_TBT_PCIE_RESET3_L

PCIE_CLKREQ_OD_N	W6	TBT_CLKREQ_ISOL_L
EN_LC_PWR	K5	TBT_EN_LC_PWR

CLOCKS

REFCLK_100_IN_P	AB21	PCIE_CLK100M_TBT_P
REFCLK_100_IN_N	AD21	PCIE_CLK100M_TBT_N
XTAL_25_IN	AA24	SYSCLK_CLK25M_TBT_R
XTAL_25_OUT	AB23	TP_TBT_XTAL25OUT
TMU_CLK_OUT	AA4	TBT_TMU_CLK_OUT
TMU_CLK_IN	Y3	TBT_TMU_CLK_IN

PP3V3_TBTLC → R2898 10K 5% 1/20W MF 201

R2895 806 1% 1/20W MF 201 SYSCLK_CLK25M_TBT

Divides 3.3V to 1.8V

NO STUFF R2897 100K 5% 1/20W MF 201, R2899 10K 5% 1/20W MF 201, R2896 1K 5% 1/20W MF 201

PP3V3_TBTLC → R2880 10K 5% 1/20W MF 201

TBT_DDC_XBAR_EN_L

TBT_GO2SX_BIDIR

R2881 for CYA, allows separation of GPIO_2/GPIO_9 if necessary. Stuff one of R2881/2.

R2881 0 5% 1/20W MF 0201

TBT_GPIO_9

TBT_GPIO_14

NO STUFF R2883 10K 5% 1/20W MF 201, R2882 10K 5% 1/20W MF 201

PP3V3_S4_TBTAPWR → R2885 10K 5% 1/20W MF 201, R2886 10K 5% 1/20W MF 201

TBT_A_DP_PWRDN

TBT_B_DP_PWRDN

TBT_A_HV_EN

TBT_B_HV_EN

R2888 10K 5% 1/20W MF 201, R2887 10K 5% 1/20W MF 201

NOTE: The following pins require testpoints:

0 - GPIO_13	8 - GPIO_15
1 - GPIO_1	9 - GPIO_11
2 - GPIO_2	10 - GPIO_14
3 - GPIO_3	11 - GPIO_0
4 - GPIO_5	12 - GPIO_12
5 - PCIE_RST_1_N	13 - GPIO_10
6 - PCIE_RST_2_N	14 - PB_LSTX
7 - PCIE_RST_3_N	15 - PB_LSRX

DISPLAYPORT

SINK PORT 0

DP_TBTSNK0_ML_P<3>	E14	DPSNK0_3_P
DP_TBTSNK0_ML_N<3>	D13	DPSNK0_3_N
DP_TBTSNK0_ML_P<2>	E16	DPSNK0_2_P
DP_TBTSNK0_ML_N<2>	D15	DPSNK0_2_N
DP_TBTSNK0_ML_P<1>	E18	DPSNK0_1_P
DP_TBTSNK0_ML_N<1>	D17	DPSNK0_1_N
DP_TBTSNK0_ML_P<0>	E20	DPSNK0_0_P
DP_TBTSNK0_ML_N<0>	D19	DPSNK0_0_N
DP_TBTSNK0_AUXCH_P	A6	DPSNK0_AUX_P
DP_TBTSNK0_AUXCH_N	B5	DPSNK0_AUX_N
DP_TBTSNK0_HPD	U6	DPSNK0_HPD

R2830 100K 5% 1/20W MF 201

SINK PORT 1

DP_TBTSNK1_ML_P<3>	E6	DPSNK1_3_P
DP_TBTSNK1_ML_N<3>	D5	DPSNK1_3_N
DP_TBTSNK1_ML_P<2>	E8	DPSNK1_2_P
DP_TBTSNK1_ML_N<2>	D7	DPSNK1_2_N
DP_TBTSNK1_ML_P<1>	E10	DPSNK1_1_P
DP_TBTSNK1_ML_N<1>	D9	DPSNK1_1_N
DP_TBTSNK1_ML_P<0>	E12	DPSNK1_0_P
DP_TBTSNK1_ML_N<0>	D11	DPSNK1_0_N
DP_TBTSNK1_AUXCH_P	A4	DPSNK1_AUX_P
DP_TBTSNK1_AUXCH_N	B3	DPSNK1_AUX_N
DP_TBTSNK1_HPD	T5	DPSNK1_HPD

R2831 100K 5% 1/20W MF 201

SOURCE PORT 0

DPSRC_3_P	A14	TP_DP_TBTSRC_ML_CP<3>
DPSRC_3_N	B15	TP_DP_TBTSRC_ML_CN<3>
DPSRC_2_P	A12	TP_DP_TBTSRC_ML_CP<2>
DPSRC_2_N	B13	TP_DP_TBTSRC_ML_CN<2>
DPSRC_1_P	A10	NC_DP_TBTSRC_ML_CP<1>
DPSRC_1_N	B11	NC_DP_TBTSRC_ML_CN<1>
DPSRC_0_P	A8	TP_DP_TBTSRC_ML_CP<0>
DPSRC_0_N	B9	TP_DP_TBTSRC_ML_CN<0>
DPSRC_AUX_P	C2	NC_DP_TBTSRC_AUXCH_CP
DPSRC_AUX_N	D3	NC_DP_TBTSRC_AUXCH_CN
DPSRC_HPD_OD	V3	DP_TBTSRC_HPD

R2832 100K 5% 1/20W MF 201

GPIO_2/GO2SX	Y1	TBT_GO2SX_BIDIR
(FORCE_PWR) GPIO_3	W2	TBT_PWR_EN
GPIO_4/WAKE_N_OD	J4	SMC_PME_S4_DARK_L
GPIO_5/CIO_PLUG_EVENT	AA2	TBT_CIO_PLUG_EVENT
GPIO_6/CIO_SDA_OD	AB1	SMBUS_PCH_DATA
GPIO_7/CIO_SCL_OD	AC2	SMBUS_PCH_CLK
GPIO_8/EN_CIO_PWR_OD*	P3	(TBT_EN_CIO_PWR_L)
GPIO_9/OK2GO2SX_OD*	M5	TBT_GPIO_9
GPIO_14	T3	TBT_GPIO_14
GPIO_15	V5	TBT_DDC_XBAR_EN_L

TBT_EN_CIO_PWR_L → TBT_EN_CIO_PWR_L (MAKE_BASE=TRUE)

PORT0

PA_CIO0_TX_P/DP_SRC_0_P		PB_CIO2_TX_P/DP_SRC_0_P
PA_CIO0_TX_N/DP_SRC_0_N		PB_CIO2_TX_N/DP_SRC_0_N
PA_CIO0_RX_P		PB_CIO2_RX_P
PA_CIO0_RX_N		PB_CIO2_RX_N
PA_CONFIG1/CIO_0_LSEO		PB_CONFIG1/CIO_2_LSEO
PA_CONFIG2/CIO_0_LSOE		PB_CONFIG2/CIO_2_LSOE

PORT2

TBT_A_R2D_C_P<0>	G24	NC_TBT_B_R2D_CP<0>
TBT_A_R2D_C_N<0>	E24	NC_TBT_B_R2D_CN<0>
TBT_A_D2R_P<0>	G22	NC_TBT_B_D2RP<0>
TBT_A_D2R_N<0>	E22	NC_TBT_B_D2RN<0>
TBT_A_CONFIG1_BUF	K1	TBT_B_CONFIG1_BUF
TBT_A_CONFIG2_RC	G4	TBT_B_CONFIG2_RC

PORT1

PA_CIO1_TX_P/DP_SRC_2_P		PB_CIO3_TX_P/DP_SRC_2_P
PA_CIO1_TX_N/DP_SRC_2_N		PB_CIO3_TX_N/DP_SRC_2_N
PA_CIO1_RX_P		PB_CIO3_RX_P
PA_CIO1_RX_N		PB_CIO3_RX_N
PA_LSTX/CIO_1_LSEO		PB_LSTX/CIO_3_LSEO
PA_LSRX/CIO_1_LSOE		PB_LSRX/CIO_3_LSOE

PORT3

TBT_A_R2D_C_P<1>	L24	NC_TBT_B_R2D_CP<1>
TBT_A_R2D_C_N<1>	J24	NC_TBT_B_R2D_CN<1>
TBT_A_D2R_P<1>	L22	NC_TBT_B_D2RP<1>
TBT_A_D2R_N<1>	J22	NC_TBT_B_D2RN<1>
TBT_A_LSTX	N2	NC_TBT_B_LSTX
TBT_A_LSRX	J6	TBT_B_LSRX

PORTS

PA_DPSRC_1_P		PB_DPSRC_1_P
PA_DPSRC_1_N		PB_DPSRC_1_N
PA_DPSRC_3_P		PB_DPSRC_3_P
PA_DPSRC_3_N		PB_DPSRC_3_N
PA_AUX_P		PB_AUX_P
PA_AUX_N		PB_AUX_N
PA_DPSRC_HPD		PB_DPSRC_HPD
GPIO_0/PA_HV_EN/BYP0		GPIO_1/PB_HV_EN/BYP0
GPIO_10/PA_CIO_SEL/BYP1		GPIO_11/PB_CIO_SEL/BYP1
GPIO_12/PA_DP_PWRDN/BYP2		GPIO_13/PB_DP_PWRDN/BYP2

TBT_A_HV_EN	G2	TP_DP_TBTPB_ML_C_P<1> A20
TBT_A_CIO_SEL	M3	TP_DP_TBTPB_ML_C_N<1> B21
TBT_A_DP_PWRDN	H3	TP_DP_TBTPB_ML_C_P<3> A22
		TP_DP_TBTPB_ML_C_N<3> B23
TP_TBTPA_AUXCH_C_P	F3	NC_DP_TBTPB_AUXCH_CP D1
TP_TBTPA_AUXCH_C_N	F1	NC_DP_TBTPB_AUXCH_CN E2
TP_TBTPA_HPD	H1	DP_TBTPB_HPD K3
		TBT_B_HV_EN M1
		TBT_B_CIO_SEL L2
		TBT_B_DP_PWRDN L4

For unused port, pull CONFIG1, CONFIG2, LSRX, HPD and CIO_SEL low (10k). All other port signals can be NC.

SNK0 AC Coupling

DP_TBTSNK0_ML_C_P<0>	C2820 0.1UF	DP_TBTSNK0_ML_P<0>
DP_TBTSNK0_ML_C_N<0>	C2821 0.1UF	DP_TBTSNK0_ML_N<0>
DP_TBTSNK0_ML_C_P<1>	C2822 0.1UF	DP_TBTSNK0_ML_P<1>
DP_TBTSNK0_ML_C_N<1>	C2823 0.1UF	DP_TBTSNK0_ML_N<1>
DP_TBTSNK0_ML_C_P<2>	C2824 0.1UF	DP_TBTSNK0_ML_P<2>
DP_TBTSNK0_ML_C_N<2>	C2825 0.1UF	DP_TBTSNK0_ML_N<2>
DP_TBTSNK0_ML_C_P<3>	C2826 0.1UF	DP_TBTSNK0_ML_P<3>
DP_TBTSNK0_ML_C_N<3>	C2827 0.1UF	DP_TBTSNK0_ML_N<3>
DP_TBTSNK0_AUXCH_C_P	C2828 0.1UF	DP_TBTSNK0_AUXCH_P
DP_TBTSNK0_AUXCH_C_N	C2829 0.1UF	DP_TBTSNK0_AUXCH_N

SNK1 AC Coupling

DP_TBTSNK1_ML_C_P<0>	C2830 0.1UF	DP_TBTSNK1_ML_P<0>
DP_TBTSNK1_ML_C_N<0>	C2831 0.1UF	DP_TBTSNK1_ML_N<0>
DP_TBTSNK1_ML_C_P<1>	C2832 0.1UF	DP_TBTSNK1_ML_P<1>
DP_TBTSNK1_ML_C_N<1>	C2833 0.1UF	DP_TBTSNK1_ML_N<1>
DP_TBTSNK1_ML_C_P<2>	C2834 0.1UF	DP_TBTSNK1_ML_P<2>
DP_TBTSNK1_ML_C_N<2>	C2835 0.1UF	DP_TBTSNK1_ML_N<2>
DP_TBTSNK1_ML_C_P<3>	C2836 0.1UF	DP_TBTSNK1_ML_P<3>
DP_TBTSNK1_ML_C_N<3>	C2837 0.1UF	DP_TBTSNK1_ML_N<3>
DP_TBTSNK1_AUXCH_C_P	C2838 0.1UF	DP_TBTSNK1_AUXCH_P
DP_TBTSNK1_AUXCH_C_N	C2839 0.1UF	DP_TBTSNK1_AUXCH_N

U2890 M95256-RMC6XG MLP

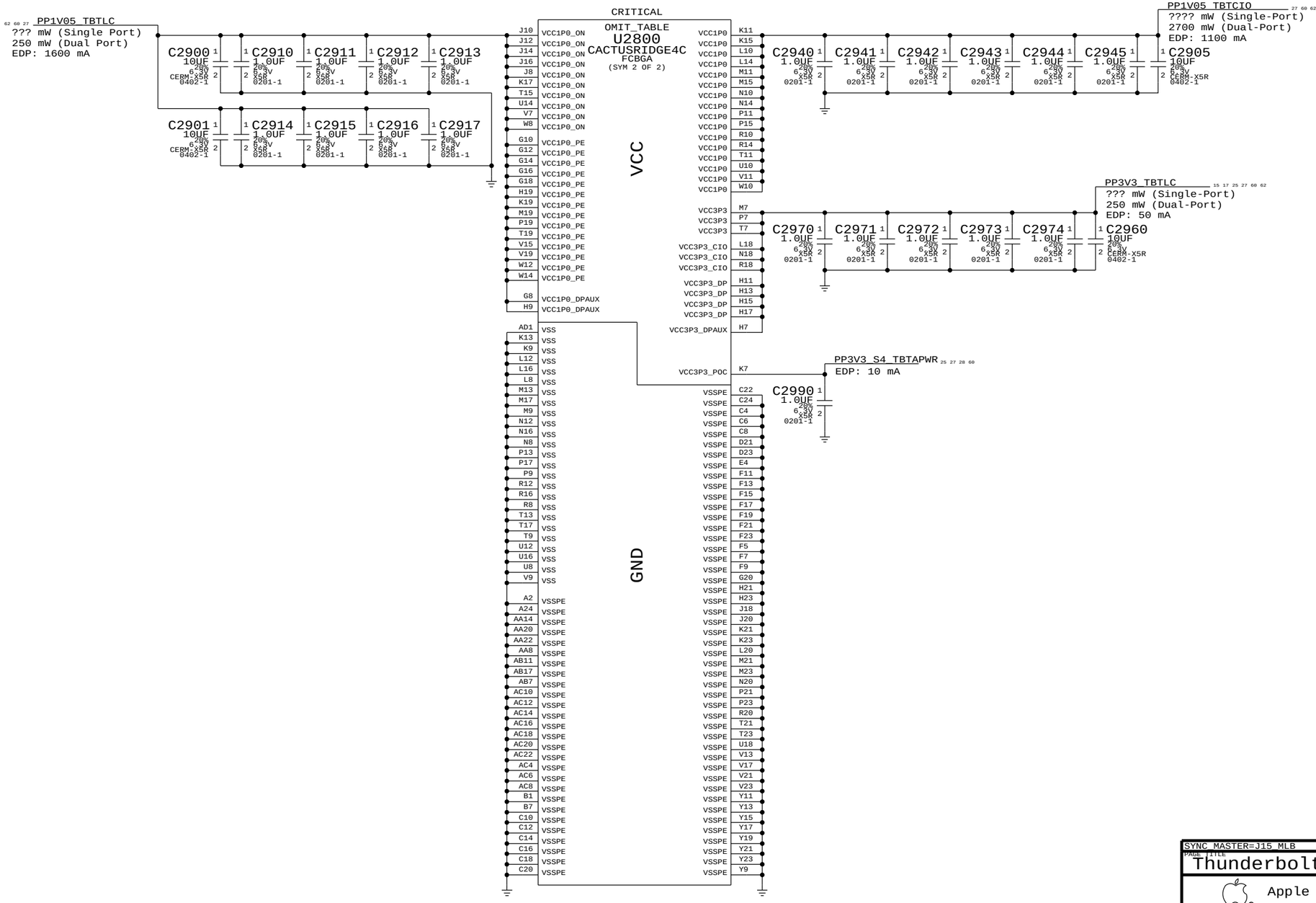
(TBT_SPI_MOSI)	D	
(TBT_SPI_CLK)	C	
(TBT_SPI_CS_L)	S*	
TBTROM_WP_L	W*	
TBTROM_HOLD_L	HOLD*	
	Q	(TBT_SPI_MISO)
	VCC	R2890 3.3K, R2891 3.3K, C2890 1UF, R2892 3.3K, R2893 3.3K
	VSS, THM PAD	

BYPASS=U2890.8:2mm

CRITICAL
OMIT_TABLE

PAGE TITLE: Thunderbolt Host (1 of 2)

Apple Inc.



EDP numbers are from 12/22/2011 email from Haim Lustig (Intel) to Paul Baker (Apple)
Power consumption figures from CR DG v0.57, IBL doc #472455.

SYNC_MASTER=J15_MLB SYNC_DATE=07/16/2012

PAGE TITLE: Thunderbolt Host (2 of 2)

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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Page Notes

Power aliases required by this page:
- =PPVIN_SW_TBTBST (8-13V Boost Input)
- =PP15V_TBT_REG (15V Boost Output)
- =PP3V3_TBT_P3V3TBTFET (3.3V FET Input)
- =PP3V3_TBT_FET (3.3V FET Output)
- =PP3V3_S0_TBTPWRCTL
- =PP1V05_TBT_P1V05TBTFET (1.05V FET Input)
- =PP1V05_TBT_FET (1.05V FET Output)

Signal aliases required by this page:
- =TBT_CLKREQ_L
- =TBT_RESET_L

BOM options provided by this page:
(NONE)

TBT 15V Boost Regulator

SI8409DB:
Vds(max): -30V
Vgs(max): +/-12V
Vgs(th): -1.4V
Rds(on): 46mOhm @ 4.5V Vgs
Id(max): 3.7A @ 70C

PPBUS_G3H
8-13V Input
Changes required for 2S.

CRITICAL Q3080 SI8409DB BGA

PPVIN_S4SW_TBTBST_FET
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
Voltage not specified here, add property on another page.

R3080 470K 5% 1/20W MF 201
C3080 0.1UF 10% 16V X5R 402
TBTBST_PWREN_DIV_L
R3081 150K 5% 1/20W MF 201
TBTBST_PWREN_L
Q3005 DMN32D2LFB4 DFN1006H4-3 SYM_VER_2
TBT_A_HV_EN

CRITICAL L3095 6.8UH-4.0A PIMB062D-SM
C3090 10UF 20% 25V X5R-CERM 0603
C3091 10UF 20% 25V X5R-CERM 0603
R3091 200K 1% 1/20W MF 201 <R1>

CRITICAL U3090 LT3957 QFN
VIN, SW, EN/UVLO, INTVCC, VC, RT, SS, SYNC, SNS1, SNS2, NC, FBX, SGND, GND

TBTBST_EN_UVLO
TBTBST_INTVCC
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
TBTBST_VC
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
TBTBST_RT
TBTBST_SS

C3081 2.2UF 20% 25V X5R-CERM 402
C3092 2.2UF 20% 25V X5R-CERM 402
C3087 47PF 5% 25V NP0-C0G-CERM 0201
R3093 10K 1% 1/20W MF 201
TBTBST_VC_RC
R3092 73.2K 1% 1/20W MF 201 <R2>
C3082 2.2UF 20% 25V X5R-CERM 402
C3093 3300PF 10% 10V X7R-CERM 0201
R3094 41.2K 1% 1/20W MF 201
C3094 0.33UF 10% 6.3V CERM-X5R 402

GND_TBTBST_SGND
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=0V

SGND shorted to GND inside package, no XW necessary.

UVLO(falling) = 1.22 * (R1 + R2) / R2
UVLO(rising) = UVLO(falling) + (2uA * R1)
UVLO = 4.55V (falling), 4.95 (rising)

TBTBST_BOOST
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
SWITCH_NODE=TRUE
DIOT=TRUE
R3089 0 5% 1/20W MF 0201
TBTBST_SNS1
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
TBTBST_SNS2
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
TBTBST_VSNS
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
XW3095 SM PLACE_NEAR=C3095.1:2 mm

CRITICAL D3095 POWERDI-123 DFLS230L
PP15V_TBT
Vout = 15.1V
Max Current = 1.0A
Freq = 300KHz

R3090 49.9K 1% 1/16W MF-LF 402
C3088 22PF 5% 50V CERM 0402
TBTBST_VSNS_RC
R3095 133K 1% 1/16W MF-LF 402 <Ra>
C3095 10UF 20% 25V X5R-CERM 0603
C3097 10UF 20% 25V X5R-CERM 0603
C3096 10UF 20% 25V X5R-CERM 0603
C3098 10UF 20% 25V X5R-CERM 0603
TBTBST_FBX
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
NO STUFF C3089 100PF 5% 50V CERM 402
R3096 15.8K 1% 1/16W MF-LF 402 <Rb>
C3084 10UF 20% 25V X5R-CERM 0603
C3085 10UF 20% 25V X5R-CERM 0603
C309A 10UF 20% 25V X5R-CERM 0603
C309B 10UF 20% 25V X5R-CERM 0603
C3099 0.001UF 10% 50V X7R-CERM 0402

Vout = 1.6V * (1 + Ra / Rb)

Q3088 DMN5L06VK-7 SOT-563
Max Vgs: 10V
R3088 330K 5% 1/20W MF 201
TBTBST_SHDN_DIV
R3087 330K 5% 1/20W MF 201
Q3088 DMN5L06VK-7 SOT-563
SMC_DELAYED_PWRGD

Supervisor & CLKREQ# Isolation

PP3V3_S0
R3040 10K 5% 1/20W MF 201
Q3040 DMN32D2LFB4 DFN1006H4-3 SYM_VER_3
TBT_EN_LC_PWR
C3000 0.1UF 10% 16V X5R-CERM 0201

CRITICAL U3000 SLG4AP016V TDFN
VDD, SENSE 0.7V, DLY, RESET*, MR*, EN, OUT (OD), IN, GND, THRM PAD

PP3V3_TBTLC
R3007 100K 5% 1/20W MF 201
PP1V05_TBTLC
TBT_PCIE_RESET_L
DLY = 60 ms +/- 20%
TBT_CLKREQ_ISOL_L
MAKE_BASE=TRUE

PCH_TBT_PCIE_RESET_L
Platform (PCIe) Reset
TBT_CLKREQ_L
Pull-up provided by SB page.

TBT_EN_LC_ISOL
R3011 36.5K 1% 1/20W MF 201
TBT_EN_LC_RC3V3

3.3V TBT "LC" Switch

U3010 TPS22924 CSP
A2 VIN, B2 VIN, C2 ON, A1 VOUT, B1 VOUT, C1 GND, CRITICAL

PP3V3_S0
PP3V3_TBTLC
Max Current = 2A (85C)

C3010 1.0UF 20% 6.3V X5R 0201-1
C3011 1.0UF 20% 6.3V X5R 0201-1

U3010	
Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max

R3016 0 5% 1/20W MF 0201
TBT_EN_LC_RC1V05

1.05V TBT "LC" Switch

U3015 TPS22920 CSP
A2 VIN, B2 VIN, C2 ON, A1 VOUT, B1 VOUT, C1 GND, CRITICAL

PP1V05_S0
PP1V05_TBTLC
Max Current = 4A (85C)

C3015 1.0UF 20% 6.3V X5R 0201-1
NO STUFF C3016 1.0UF 20% 6.3V X5R 0201-1

U3015	
Part	TPS22920
Type	Load Switch
R(on) @ 1.05V	6.1 mOhm Typ 10.4 mOhm Max

TBT "POC" Power-up Reset

PP3V3_S4_TBTAPWR
CRITICAL U3030 TPS3808 QFN
VDD, SENSE, CT, RESET*, MR*, GND, THRM PAD
Pull-up: R2810
TBT_PWR_ON_POC_RST_L
TBTPOCRST_MR_L
TBTPOCRST_CT
C3031 0.0047UF 10% 25V CERM 0402
C3030 0.1UF 10% 16V X5R-CERM 0201
TPS3808G25
Vt = 2.33V +/- 2%
Delay = 27.3ms
C3025 330PF 10% 16V X7R-CERM 0201
Q3025 DMN5L06VK-7 SOT-563
PP3V3_S0
R3030 100K 5% 1/20W MF 201
TBT_POC_RESET_L

1.05V TBT "CIO" Switch

PP1V05_S0
PP3V3_TBTLC
R3020 100K 5% 1/20W MF 201
TBT_EN_CIO_PWR
Q3025 DMN5L06VK-7 SOT-563
TBT_EN_CIO_PWR_L

U3020 TPS22920 CSP
A2 VIN, B2 VIN, C2 ON, A1 VOUT, B1 VOUT, C1 GND, CRITICAL

PP1V05_TBTCIO
Max Current = 4A (85C)
C3020 1.0UF 20% 6.3V X5R 0201-1

U3020	
Part	TPS22920
Type	Load Switch
R(on) @ 1.05V	6.1 mOhm Typ 10.4 mOhm Max

SYNC_MASTER=WILL_J43 SYNC_DATE=12/17/2012

PAGE TITLE: TBT Power Support

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
BRANCH: <BRANCH>
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3.3V/HV Power MUX

V3P3 must be S4 to support wake from Thunderbolt device attach.

PP3V3_S5

	Nominal	Min	Max
IV3P3	1100mA	1030mA	1200mA
IHVS0	890mA	830mA	930mA (assumes 15V, 12W minimum)
IHVS3	890mA	830mA	930mA (assumes 3S, 9-12.6V, 7.5-11.7W)

CRITICAL C3287 100UF 20% 6.3V POLY-TANT CASE-B2-SM; C3280 22UF 20% 6.3V X5R-CERM 603; C3281 0.1UF 10% 16V X5R-CERM 0201

PP15V_TBT 18.9V Max

C3215 4.7UF 10% 25V X5R-CERM 0603; C3210 0.1UF 10% 25V X5R 402

CRITICAL U3210 CD3211A0RGPR QFN

Pin	Name
19, 20	V3P3
18	V3P3OUT
6, 7	VHV
12, 14	OUT
16	ENHVU
4	FAULTZ
5	EN
11	HV_EN
17	S0
8	ISET_V3P3
10	ISET_S0
9	ISET_S3
GND, THRM PAD	

C3285 0.1UF 10% 16V X5R-CERM 0201; C3286 10UF 20% 6.3V CERM-X5R 0402-1; C3211 0.1UF 10% 25V X5R 402

PP3V3_S4_TBTAPWR — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=3.3V

PP3V3RHV_S4_TBTAPWR — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=15V

S4_PWR_EN

TBT_A_HV_EN

PM_SLP_S3_BUF_L

TBTAPWRSW_ISET_V3P3

TBTAPWRSW_ISET_S0

TBTAPWRSW_ISET_S3

TBTHV:P15V R3210 22.6K 1% 1/20W MF 2012 — 12V: See below

TBTHV:P15V R3211 22.6K 1% 1/20W MF 2012

R3212 36.5K 1% 1/20W MF 2012 <RV3P3>

TBTAPWRSW_ISET_S3_R

TBTAPWRSW_ISET_S0_R

TBTHV:P15V R3213 22.6K 1% 1/20W MF 2012 <RHVS3>

TBTHV:P15V R3214 22.6K 1% 1/20W MF 2012 <RHVS0>

Single-fault protection requires two R's per HV ISET_Sx with CD3210. Single R on ISET_V3P3 OK.

ILIM = 40000 / RISET

For 12V systems:

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R3210,R3213		TBTHV:P12V
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R3211,R3214		TBTHV:P12V

	Nominal	Min	Max
IHVS0/S3	1120mA	1090mA	1170mA (12W minimum)

PP3V3_S4_TBTAPWR

C3220 0.1UF 10% 16V X5R-CERM 0201

CRITICAL U3220 CBTL05024 HVQFN24-COMBO — SIGNAL_MODEL=TBT_MUX

TB-	7	TB_ENA	15 TBT_A_CIO_SEL
TB+	8	AUXIO_EN	24 DP_AUXCH_ISOL_L
		DP_PD	6 TBT_A_DP_PWRDN
AUX-	1	(IPU) AUXIO-	23 TBT_A_D2R1_AUXDDC_N
AUX+	2	(IPD) AUXIO+	22 TBT_A_D2R1_AUXDDC_P
DDC_DAT	4		TBT: RX_1
DDC_CLK	5		
CA_DETOUT	16	CA_DET	18 TBT_A_CONFIG1_RC
DP+	11	DPML0+	19 DP_A_LSX_ML_P<1>
DP-	10	DPML0-	20 DP_A_LSX_ML_N<1>
			TBT: LSX_A_R2P/P2R (P/N)
LSTX (IPU)	14		
LSRX (IPD)	13		
HPDOUT	12	HPD	17 TBT_A_HPD
GND_THMPAD	9, 21, 25		

GND_VOID=TRUE (Both C's)

TBT_A_D2R_N<1> — C3277 0.47UF 20% 4V_201 CERM-X5R-1 — TBT_A_D2R_C_N<1>

TBT_A_D2R_P<1> — C3276 0.47UF 20% 4V_201 CERM-X5R-1 — TBT_A_D2R_C_P<1>

DP_TBTPA_AUXCH_C_N — C3230 0.1UF 10% 16V X5R-CERM 0201 — DP_TBTPA_AUXCH_N

DP_TBTPA_AUXCH_C_P — C3231 0.1UF 10% 16V X5R-CERM 0201 — DP_TBTPA_AUXCH_P

DP_TBTPA_ML_C_P<1> — C3232 0.22UF 20% 6.3V X5R 0201 — DP_TBTPA_ML_P<1>

DP_TBTPA_ML_C_N<1> — C3233 0.22UF 20% 6.3V X5R 0201 — DP_TBTPA_ML_N<1>

TBT_A_LSTX

TBT_A_LSRX

DP_TBTPA_HPD

TBT_A_CONFIG1_BUF

TBTSNK0_DDC_DATA

TBTSNK0_DDC_CLK

Thunderbolt Connector A

CRITICAL L3200 FERR-120-OHM-3A 0603 — PP3V3RHV_S4_TBTAPWR_F — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=15V

C3200 0.01UF 10% 50V X7R-CERM 0402

R3201 12 5% 1/20W MF 201

C3201 0.01UF 10% 50V X7R-CERM 0402

TBTACONN_20_RC — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=18V

TBTACONN_1_C — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=18.9V

TBTACONN_7_C — MIN_LINE_WIDTH=0.38 MM, MIN_NECK_WIDTH=0.20 MM, VOLTAGE=18.9V

GND_VOID=TRUE C3205 0.01UF 10% 25V X5R-CERM 0201 (0-18.9V)

GND_VOID=TRUE C3206 0.01UF 10% 25V X5R-CERM 0201 (0-18.9V)

J3200 MDP-J11 F-RT-TH

CRITICAL 514-0818

HOT_PLUG_DETECT	2	GND	1
CONFIG1	4	ML_LANE0P	3
CONFIG2	6	ML_LANE0N	5
GND	13	GND	7
ML_LANE3P	10	ML_LANE1P	9
ML_LANE3N	12	ML_LANE1N	11
GND	14	GND	8
AUX_CHP	16	ML_LANE2P	15
AUX_CHN	18	ML_LANE2N	17
DP_PWR	20	RETURN	19
SHIELD PINS	28, 27, 26, 25, 24, 23, 22, 21		

DP_Dir TBT_Dir — TBT_A_R2D_P<0> / TBT_A_R2D_N<0> — TBT: TX_0

TBT_Dir DP_Dir — TBT_A_D2R_C_P<0> / TBT_A_D2R_C_N<0> — TBT: RX_0

TBT_A_R2D_P<1> / TBT_A_R2D_N<1> — TBT: TX_1

DP_A_LSX_ML_P<1> / DP_A_LSX_ML_N<1> — TBT: LSX_R2P/P2R (P/N)

TBT_A_D2R1_AUXDDC_P / TBT_A_D2R1_AUXDDC_N — TBT: RX_1

TBT_A_HPD

TBT_A_CONFIG1_RC

TBT_A_CONFIG2_RC

GND_VOID=TRUE (Both C's)

C3270 0.22UF 20% 6.3V X5R 0201 — TBT_A_R2D_C_P<0>

C3271 0.22UF 20% 6.3V X5R 0201 — TBT_A_R2D_C_N<0>

C3272 0.22UF 20% 6.3V X5R 0201 — TBT_A_R2D_C_P<1>

C3273 0.22UF 20% 6.3V X5R 0201 — TBT_A_R2D_C_N<1>

R3270 470K 5% 1/20W MF 201; R3271 470K 5% 1/20W MF 201

R3272 470K 5% 1/20W MF 201; R3273 470K 5% 1/20W MF 201

470K R's for ESD protection on AC-coupled signals.

GND_VOID=TRUE — R3294 1K 5% 1/20W MF 201 — NO_XNET_CONNECTION=TRUE

R3295 1K 5% 1/20W MF 201 — NO_XNET_CONNECTION=TRUE

C3274 0.47UF 20% 4V_201 CERM-X5R-1 — TBT_A_D2R_P<0> / TBT_A_D2R_N<0>

C3275 0.47UF 20% 4V_201 CERM-X5R-1 — TBT_A_D2R_C_P<0> / TBT_A_D2R_C_N<0>

C3278 0.22UF 20% 6.3V X5R 0201 — DP_TBTPA_ML_C_P<3> / DP_TBTPA_ML_P<3>

C3279 0.22UF 20% 6.3V X5R 0201 — DP_TBTPA_ML_C_N<3> / DP_TBTPA_ML_N<3>

R3279 470K 5% 1/20W MF 201; R3278 470K 5% 1/20W MF 201

TBT: Unused

C3202 0.01UF 10% 16V X5R-CERM 0201

DP Source must pull down HPD input with greater than or equal to 100K (DPv1.1a).

Sink HPD range:
High: 2.0 - 5.0V
Low: 0 - 0.8V

R3252 1M 5% 1/20W MF 201; R3251 1M 5% 1/20W MF 201

C3294 330PF 10% 16V X7R-CERM 0201; C3295 330PF 10% 16V X7R-CERM 0201

R3241 100K 5% 1/20W MF 201

SYNC_MASTER=J43_MLB SYNC_DATE=09/04/2012

PAGE TITLE: Thunderbolt Connector A

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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3.3V WLAN Switch

Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max

Sense resistor on sensor page

PP3V3_WLAN
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=3.3V

PP3V3_WLAN_R
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=3.3V

Max Current = 2A (85C)

U3550
TPS22924
CSP
CRITICAL
A1 VOUT
B1
A2 VIN
B2 PP3V3_S5
C2 ON SMC_WIFI_PWR_EN
C1 GND

C3550
1.0UF
20%
6.3V
X6S
0201-1

C3521
0.1UF
10%
6.3V
CERM-X5R
0201
BYPASS=J3501:5mm

514S0335
CRITICAL
J3501
SSD-K99
F-RT-SM1

AIRPORT

PCIE_AP_R2D_N → C3531 0.1UF → PCIE_AP_R2D_C_N
PCIE_AP_R2D_P → C3530 0.1UF → PCIE_AP_R2D_C_P
PCIE_CLK100M_AP_N
PCIE_CLK100M_AP_P
PCIE_AP_D2R_P
PCIE_AP_D2R_N
WIFI_EVENT_L

C3531, C3530: 0.1UF 10% 16V X5R-CERM 0201

C3532
0.1UF
10%
6.3V
CERM-X5R
0201
BYPASS=J3501:1.5mm

Supervisor & CLKREQ# Isolation

Delay = 130 ms +/- 20%

U3540
SLG4AP041V
TDFN
CRITICAL
VDD
SENSE
VREF
DLY
RESET*
MR*
EN
OUT (OD)
IN
THRM PAD
GND

C3540
0.1UF
10%
6.3V
CERM-X5R
0201

APCLKRQ:ISOL
R3553
100K
5%
1/20W
MF
201

R3554
232K
1%
1/20W
MF
201

P3V3WLAN_VMON

R3558
0
5%
1/20W
MF
0201

AP_RESET_CONN_L → AP_RESET_CONN_R_L → AP_RESET_L
AP_CLKREQ_Q_L → AP_CLKREQ_R_L
SMC_WIFI_PWR_EN

R3555
100K
5%
1/20W
MF
201

APCLKRQ:ISOL
R3556
0
5%
1/20W
MF
0201

APCLKRQ:BIDIR
R3557
0
5%
1/20W
MF
0201

AP_CLKREQ_L

NOSTUFF
R3559
0
5%
1/20W
MF
0201

PCIe Wake Muxing

PP3V3_S5
R3561 100K 5% 1/20W MF 201
C3560 0.1UF 10% 6.3V CERM-X5R 0201
AP_PCIE_WAKE_L

U3560
NC7SB3157P6XG
SC70
VER-3
VCC
GND
S
B0
B1
A

SEL	OUTPUT
L	PCIE_WAKE_L (B0)
H	AP_S0IX_WAKE_L (B1)

AP_S0IX_WAKE_SEL
PCIE_WAKE_L
AP_S0IX_WAKE_L

NOSTUFF
R3560
0
5%
1/20W
MF
0201

BLUETOOTH

PP3V3_S4

U3510
USB3740
DFN
CRITICAL
VDD
DP_2
DM_2
DP_1
DM_1
OE*
S
GND
NC

C3510
0.1UF
10%
6.3V
CERM-X5R
0201

USB_BT_CONN_P
USB_BT_CONN_N
USB_BT_P
USB_BT_N
BT_WAKE
PM_SLP_S4_L

SIGNAL_MODEL=BT_MUX

SEL	OUTPUT
L	BT_WAKE (1)
H	USB_BT (2)

NO_XNET_CONNECTION=TRUE

Q3510
DMN32D2LFB4
DFN1006H4-3
SYM_VER_2

SMC_PME_S4_WAKE_L

R3512
15K
1%
1/20W
MF
201

SYNC_MASTER=J43_MLB SYNC_DATE=10/02/2012

PAGE TITLE
Wireless Connector

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
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PLACE_NEAR=J3700.1:3mm
CRITICAL
L3700
FERR-26-OHM-6A
0603
PP3V3_S0SW_SSD
PP3V3_S0SW_SSD_FLT
MIN_LINE_WIDTH=0.6mm
MIN_NECK_WIDTH=0.15mm
VOLTAGE=3.3V
C3701 0.1UF 10% 10V X5R-CERM 0201
C3702 0.1UF 10% 10V X5R-CERM 0201
PLACE_NEAR=L3700.1:1mm
PLACE_NEAR=L3700.1:1mm

514S0449
CRITICAL
J3700
SSD-GS3
F-RT-SM

PP3V3_S0
R3710 100K 5% 1/20W MF 201
R3700 100K 5% 1/20W MF 201

GND_VOID
SMC_OOB1_R2D_CONN_L
SMC_OOB1_D2R_CONN_L
SSD_PCIE_SEL_L
SSD_DEVSLP
SMC_PWRFAIL_WARN_L
SSD_PWR_EN
SMC_PWRFAIL_WARN_L Signal has PU on SSD module
PCIE_SSD_D2R_N<3>
PCIE_SSD_D2R_P<3>
PCIE_SSD_D2R_N<2>
PCIE_SSD_D2R_P<2>
PCIE_SSD_D2R_N<1>
PCIE_SSD_D2R_P<1>
PCIE_SSD_D2R_N<0>
PCIE_SSD_D2R_P<0>
PCIE_CLK100M_SSD_N
PCIE_CLK100M_SSD_P

PCIe polarity inversion and lane reversal
are only permitted on the device side,
provided the device PHY supports it.

Gumstick3 Connector

PP3V3_S0
SSD_RESET_CONN_L
NC_SSD_MFG_RSVD

PCIE_SSD_R2D_C_N<3> C3710 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_P<3> C3711 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_N<2> C3712 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_P<2> C3713 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_N<1> C3714 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_P<1> C3715 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_N<0> C3716 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
PCIE_SSD_R2D_C_P<0> C3717 0.1UF 10% 16V X5R-CERM 0201 2 GND_VOID=TRUE
SSD_CLKREQ_CONN_L

Per Intel PDG, use PCIe style decoupling, when muxing PCIe & SATA

OOB Isolation

PP3V3_S0SW_SSD
BYPASS=U3710:5 mm
C3718 0.1UF 10% 10V X5R-CERM 0201
CRITICAL
74LVC1G08 SOT891
U3710 08
SMC_OOB1_R2D_L
NC

PP3V3_S0
BYPASS=U3711:5 mm
C3719 0.1UF 10% 10V X5R-CERM 0201
CRITICAL
74LVC1G08 SOT891
U3711 08
SMC_OOB1_D2R_L
NC

Supervisor & CLKREQ# Isolation

Delay = ~55ms

PP3V3_S0SW_SSD
PP3V42_G3H
R3740 100K 5% 1/20W MF 201
R3741 232K 1% 1/20W MF 201
R3742 100K 1% 1/20W MF 201
CRITICAL
U3740
SLG4AP016V
TDFN
VDD
SENSE 0.7V
DLY
RESET*
MR*
EN
OUT (OD)
IN
THRM PAD
GND
C3740 0.1UF 10% 6.3V CERM-X5R 0201
P3V3SSD_VMON
SSD_RESET_L
SSD_PWR_EN
SSD_CLKREQ_L

SYNC_MASTER=J43_MLB SYNC_DATE=02/20/2013

PAGE TITLE
SSD Connector

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
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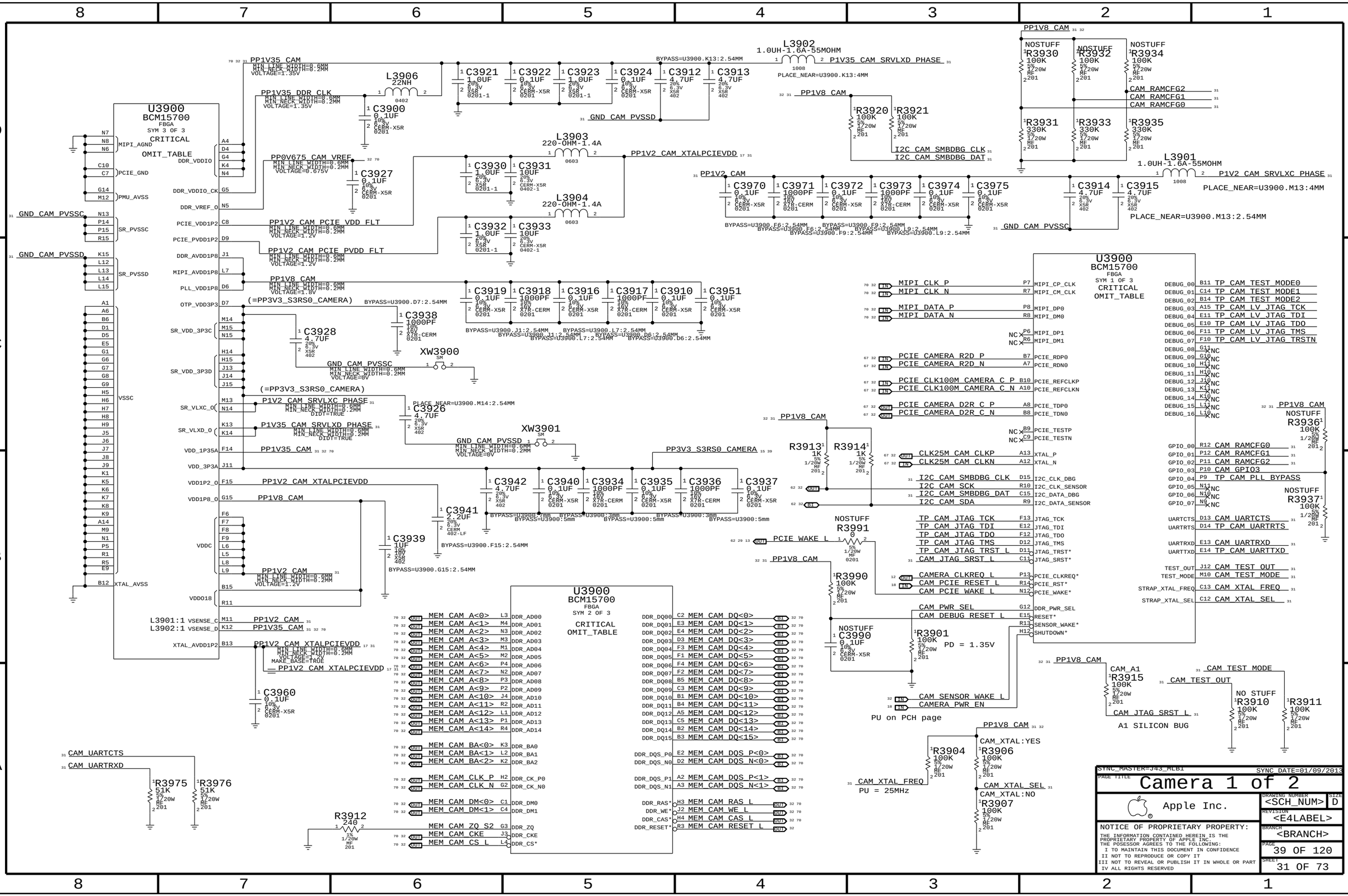
U3900
BCM15700
FBGA
SYM 3 OF 3
CRITICAL
OMIT_TABLE
PP1V35 CAM
PP1V35 DDR CLK
L3906
22NH
L3902
1.0UH-1.6A-55MOHM
P1V35 CAM SRVLXD PHASE
PP1V8 CAM
R3930 100K
R3932 100K
R3934 100K
R3931 330K
R3933 330K
R3935 330K
CAM RAMCFG2
CAM RAMCFG1
CAM RAMCFG0
R3920 100K
R3921 100K
I2C CAM SMBDBG CLK
I2C CAM SMBDBG DAT
GND CAM PVSSD
L3903
220-OHM-1.4A
L3904
220-OHM-1.4A
PP1V2 CAM XTALPCIEVDD
PP0V675 CAM VREF
L3901
1.0UH-1.6A-55MOHM
P1V2 CAM SRVLXC PHASE
PLACE_NEAR=U3900.M13:4MM
PLACE_NEAR=U3900.M13:2.54MM
PP1V2 CAM
GND CAM PVSSC
PP1V2 CAM PCIE VDD FLT
PP1V2 CAM PVDD FLT
PP1V8 CAM
(=PP3V3_S3RS0_CAMERA)
XW3900
XW3901
GND CAM PVSSD
PP3V3_S3RS0_CAMERA
P1V2 CAM SRVLXC PHASE
P1V35 CAM SRVLXD PHASE
PP1V35 CAM
PP1V2 CAM XTALPCIEVDD
PP1V8 CAM
PP1V2 CAM
PP1V35 CAM
L3901:1 VSENSE_C
L3902:1 VSENSE_D
XTAL_AVDD1P2
R3912 240
MEM CAM A<0>
MEM CAM A<1>
MEM CAM A<2>
MEM CAM A<3>
MEM CAM A<4>
MEM CAM A<5>
MEM CAM A<6>
MEM CAM A<7>
MEM CAM A<8>
MEM CAM A<9>
MEM CAM A<10>
MEM CAM A<11>
MEM CAM A<12>
MEM CAM A<13>
MEM CAM A<14>
MEM CAM BA<0>
MEM CAM BA<1>
MEM CAM BA<2>
MEM CAM CLK P
MEM CAM CLK N
MEM CAM DM<0>
MEM CAM DM<1>
MEM CAM ZQ S2
MEM CAM CKE
MEM CAM CS L
MEM CAM DQ<0>
MEM CAM DQ<1>
MEM CAM DQ<2>
MEM CAM DQ<3>
MEM CAM DQ<4>
MEM CAM DQ<5>
MEM CAM DQ<6>
MEM CAM DQ<7>
MEM CAM DQ<8>
MEM CAM DQ<9>
MEM CAM DQ<10>
MEM CAM DQ<11>
MEM CAM DQ<12>
MEM CAM DQ<13>
MEM CAM DQ<14>
MEM CAM DQ<15>
MEM CAM DQS P<0>
MEM CAM DQS N<0>
MEM CAM DQS P<1>
MEM CAM DQS N<1>
MEM CAM RAS L
MEM CAM WE L
MEM CAM CAS L
MEM CAM RESET L
MIPI CLK P
MIPI CLK N
MIPI DATA P
MIPI DATA N
PCIE CAMERA R2D P
PCIE CAMERA R2D N
PCIE CLK100M CAMERA C P
PCIE CLK100M CAMERA C N
PCIE CAMERA D2R C P
PCIE CAMERA D2R C N
CLK25M CAM CLKP
CLK25M CAM CLKN
I2C CAM SMBDBG CLK
I2C CAM SCK
I2C CAM SMBDBG DAT
I2C CAM SDA
TP CAM JTAG TCK
TP CAM JTAG TDI
TP CAM JTAG TDO
TP CAM JTAG TMS
TP CAM JTAG TRST L
CAM JTAG SRST L
CAMERA CLKREQ L
CAM PCIE RESET L
CAM PCIE WAKE L
CAM PWR SEL
CAM DEBUG RESET L
CAM SENSOR WAKE L
CAMERA PWR EN
PCIE WAKE L
R3913 1K
R3914 1K
R3990 100K
R3991 0
R3901 100K
PD = 1.35V
PU on PCH page
R3904 100K
R3906 100K
R3907 100K
CAM_XTAL:YES
CAM_XTAL:NO
CAM_XTAL_FREQ
PU = 25MHz
R3915 100K
CAM_A1
CAM_JTAG_SRST_L
A1 SILICON BUG
CAM TEST MODE
CAM TEST OUT
NO STUFF
R3910 100K
R3911 100K
R3936 100K
R3937 100K
TP CAM TEST MODE0
TP CAM TEST MODE1
TP CAM TEST MODE2
TP CAM LV JTAG TCK
TP CAM LV JTAG TDI
TP CAM LV JTAG TDO
TP CAM LV JTAG TMS
TP CAM LV JTAG TRSTN
CAM RAMCFG0
CAM RAMCFG1
CAM RAMCFG2
CAM GPIO3
TP CAM PLL BYPASS
CAM UARTCTS
CAM UARTRTS
CAM UARTRXD
CAM UARTTXD
CAM TEST OUT
CAM TEST MODE
CAM XTAL FREQ
CAM XTAL SEL
R3975 51K
R3976 51K
SYNC_MASTER=J43_MLB1
SYNC_DATE=01/09/2013
PAGE TITLE
Camera 1 of 2
Apple Inc.
DRAWING NUMBER
<SCH_NUM>
SIZE
D
REVISION
<E4LABEL>
BRANCH
<BRANCH>
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39 OF 120
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31 OF 73
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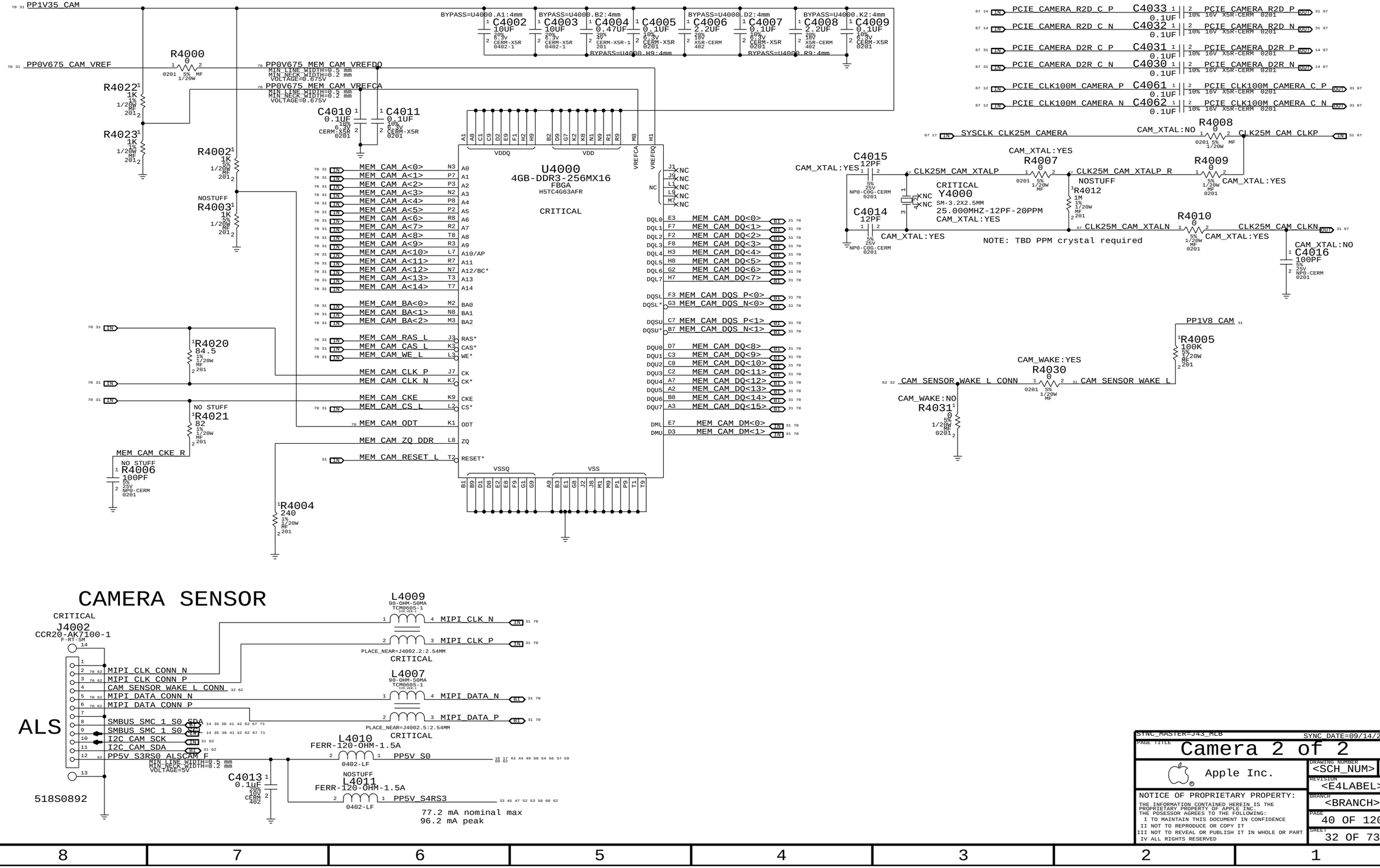

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PAGE TITLE: Camera 2 of 2

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

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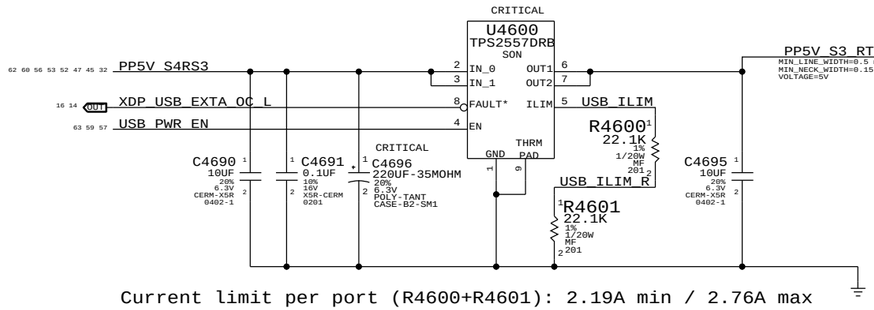
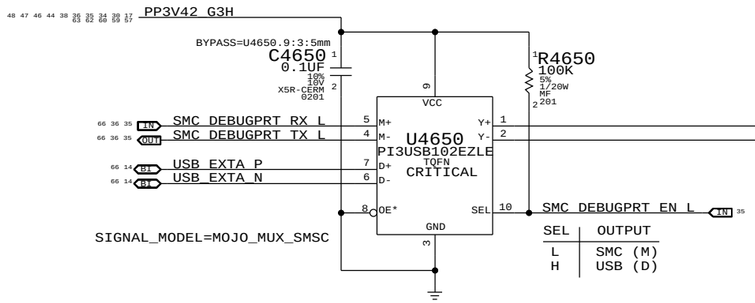
Right USB Port A

USB Port Power Switch

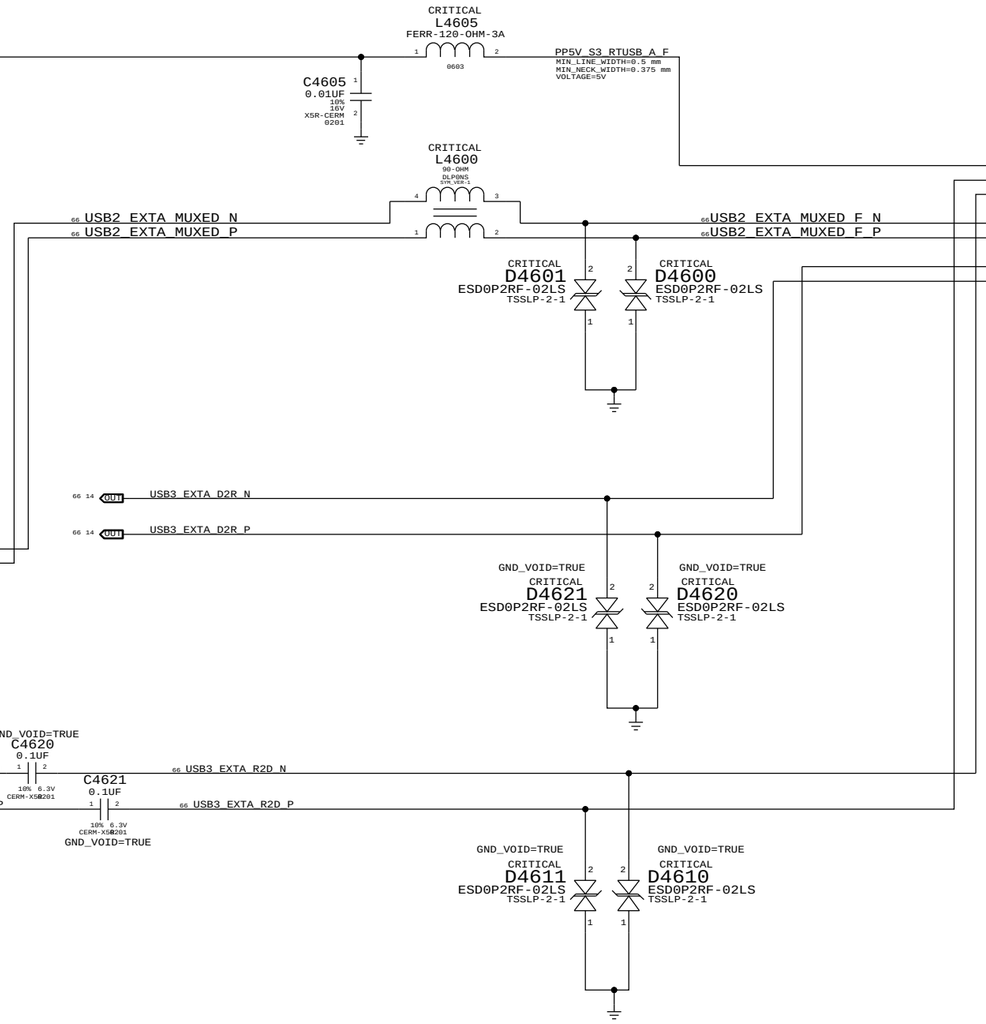


Current limit per port (R4600+R4601): 2.19A min / 2.76A max

Mojo SMC Debug Mux



SEL	OUTPUT
L	SMC (M)
H	USB (D)



APN: 514-0819

SYNC_MASTER=J43_MLB SYNC_DATE=02/20/2013

PAGE TITLE
External A USB3 Connector

Apple Inc.

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REVISION <E4LABEL>
BRANCH <BRANCH>
PAGE 46 OF 120
SHEET 33 OF 73

IPD Flex Connector

PLACE_NEAR=J4800.10:1.5MM
R4830
0
62 60 56 37 36 34 29 PP3V3_S4
5% 1/20W MF 0201
C4800 0.1UF 10% 6.3V CERM-X5R 0201
VOLTAGE=3.3V
MIN_NECK_WIDTH=0.2 mm
MIN_LINE_WIDTH=0.5 mm
BYPASS=J4800.10:1.5MM
PLACE_NEAR=J4800.14:1.5MM
L4820
FERR-120-OHM-1.5A
60 52 51 PP5V_S5
0402-LF
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=5V
C4810 0.1UF 10% 16V X5R-CERM 0201
PLACE_NEAR=J4800.14:1.5MM
47 46 44 38 35 35 33 30 17 63 62 60 59 57 48 PP3V42_G3H
BYPASS=J4800.10:1.5MM
C4820 0.1UF 10% 6.3V CERM-X5R 0201

TPAD_INTWAKE:SPLIT
PLACE_NEAR=R4844.1:1.5MM
R4841
0
5% 1/20W MF 0201
(TPAD_WAKE_L)

TPAD_INTWAKE:SHARED
R4843
0
37 35 29 OUT SMC_PME_S4_WAKE_L
To SMC
5% 1/20W MF 0201
PLACE_NEAR=R4841.1:1.5MM
(TPAD_SPI_INT_S4_WAKE_L_CONN)

TPAD_INTWAKE:SHARED
R4844
0
5% 1/20W MF 0201
PLACE_NEAR=J4800.8:1.5MM

TPAD_INTWAKE:SHARED
Q4800
DMN32D2LFB4
DFN1006H4-3
SYM_VER_3
63 62 60 56 39 38 34 19 18 15 PP3V3_S3
15 OUT TPAD_SPI_INT_L
To PCH
PLACE_NEAR=R4842.2:5MM

TPAD_INTWAKE:SPLIT
R4842
0
5% 1/20W MF 0201
PLACE_NEAR=R4843.2:1.5MM

62 60 56 37 36 34 29 PP3V3_S4
C4841 0.1UF 10% 16V CERM-X5R 0201
BYPASS=U4810:3mm

CRITICAL
74LVC2G08GT
SOT833
U4810
57 35 34 29 18 13 IN PM_SLP_S4_L
15 IN TPAD_USB_IF_EN
From PCH
(TPAD_USB_IF_EN_CONN)

NOSTUFF
R4810
100K
5% 1/20W MF 201

CKPLUS_WAIVE=UNCONNECTED_PINS
74LVC2G08GT
SOT833
U4810
57 35 34 29 18 13 IN PM_SLP_S4_L
15 IN TPAD_SPI_IF_EN
From PCH
(TPAD_SPI_IF_EN_CONN)
CKPLUS_WAIVE=UNCONNECTED_PINS

63 62 60 56 39 38 34 19 18 15 PP3V3_S3
R4860
100K
5% 1/20W MF 201
Q4860
DMN32D2LFB4
DFN1006H4-3
SYM_VER_3
36 30 27 18 17 15 13 12 11 8 59 57 54 43 42 41 40 39 38 37 PP3V3_S0
15 IN TPAD_SPI_CS_L
TPAD_SPI_CS_CONN_L

R4850
33
62 46 36 35 34 IN SMC_LID
15 66 OUT TPAD_SPI_MISO_L
5% 1/20W MF 201
PLACE_NEAR=J4800.2:2.54mm
62 TPAD_SPI_MISO_R
66 62 14 BI USB_TPAD_P
66 62 14 BI USB_TPAD_N
R4851
15 66 IN TPAD_SPI_CLK_L
5% 1/20W MF 201
PLACE_NEAR=J4800.7:2.54mm
62 TPAD_SPI_CLK_R
62 TPAD_WAKE_L
R4852
15 66 IN TPAD_SPI_MOSI_L
5% 1/20W MF 201
PLACE_NEAR=J4800.9:2.54mm
62 TPAD_SPI_MOSI_R
62 PP3V3_S4_IPD
R4853
5% 1/20W MF 201
PLACE_NEAR=J4800.12:2.54mm
62 TPAD_SPI_CS_R_L
62 TPAD_SPI_IF_EN_CONN
62 TPAD_SPI_INT_S4_WAKE_L_CONN
62 PP5V_S4_IPD
62 TPAD_USB_IF_EN_CONN
71 62 42 38 35 34 BI SMBUS_SMC_3_SDA
71 62 42 38 35 34 BI SMBUS_SMC_3_SCL
62 36 34 OUT SMC_LSOC_RST_L
(=PP3V42_G3H_IPD)
62 36 35 34 OUT SMC_ONOFF_L

CRITICAL
518S0884
J4800
TF13BS-20S-0.4SH
F-RT-SM-1
22
1 SMC_LID
2 TPAD_SPI_MISO_R
3
4 USB_TPAD_P
5 USB_TPAD_N
6
7 TPAD_SPI_CLK_R
8 TPAD_WAKE_L
9 TPAD_SPI_MOSI_R
10 PP3V3_S4_IPD
11 TPAD_SPI_CS_R_L
12 TPAD_SPI_IF_EN_CONN
13 TPAD_SPI_INT_S4_WAKE_L_CONN
14 PP5V_S4_IPD
15 TPAD_USB_IF_EN_CONN
16 SMBUS_SMC_3_SDA
17 SMBUS_SMC_3_SCL
18 SMC_LSOC_RST_L
19 (=PP3V42_G3H_IPD)
20 SMC_ONOFF_L
21

SMBUS_SMC_3_SDA 34 35 38 42 62 71
SMBUS_SMC_3_SCL 34 35 38 42 62 71
SMC_ONOFF_L 34 35 36 62
SMC_LID 34 35 36 46 62
SMC_LSOC_RST_L 34 36 62

NOSTUFF C4832 100PF 5% 25V NP0-CERM 0201 BYPASS=J4800.6:1.5MM
NOSTUFF C4833 100PF 5% 25V NP0-CERM 0201 BYPASS=J4800.5:1.5MM
C4834 100PF 5% 25V NP0-CERM 0201 BYPASS=J4800.4:1.5MM
C4835 100PF 5% 25V NP0-CERM 0201 BYPASS=J4800.3:1.5MM
C4836 100PF 5% 25V NP0-CERM 0201 BYPASS=J4800.1:1.5MM

SYNC_MASTER=J43_MLB SYNC_DATE=01/17/2013
PAGE TITLE
IPD Connector
Apple Inc.
DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
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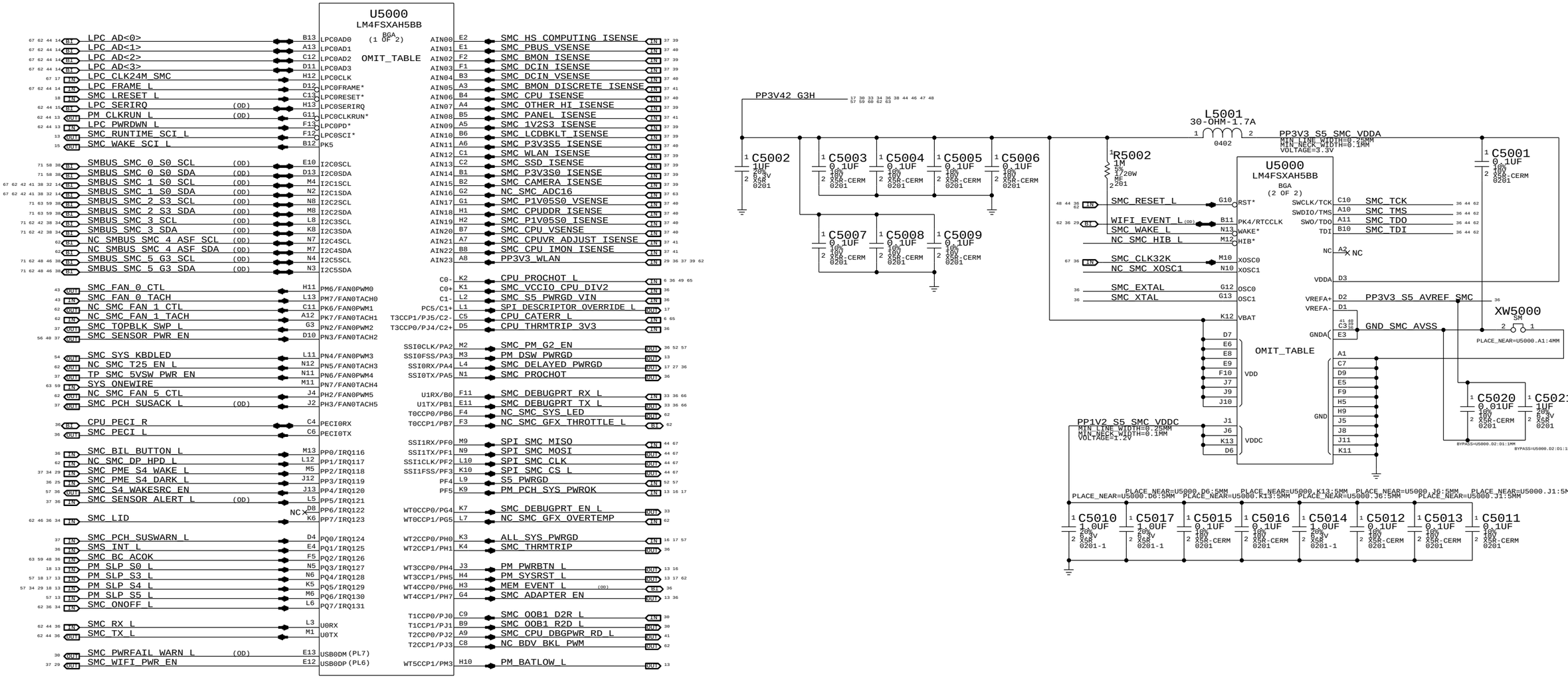

SYNC_MASTER=WILL_J43 SYNC_DATE=12/17/2012

PAGE TITLE: SMC

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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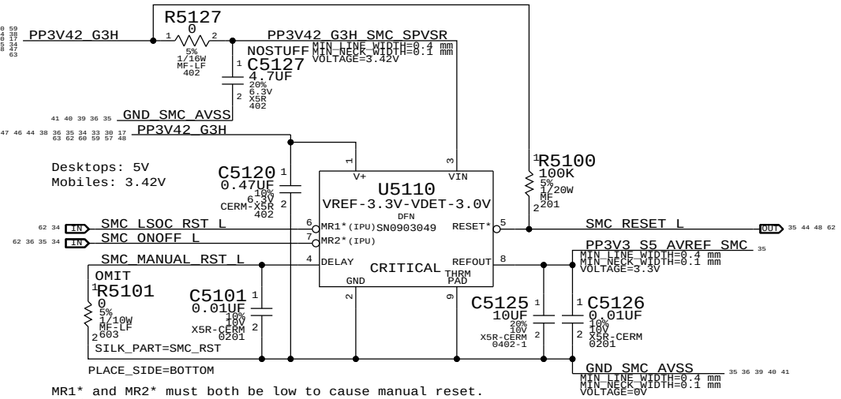
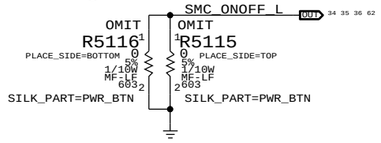
SMC Reset "Button", Supervisor & AVREF Supply



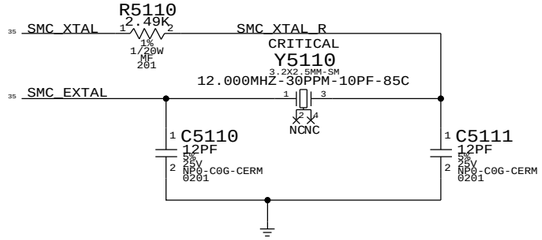
MR1* and MR2* must both be low to cause manual reset.
Used on mobiles to support SMC reset via keyboard.
NOTE: Internal pull-ups are to VIN, not V+.

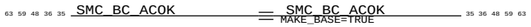
Debug Power "Buttons"

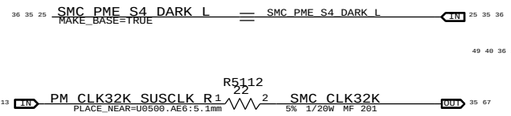


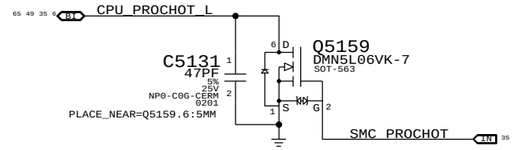
SMC Crystal Circuit

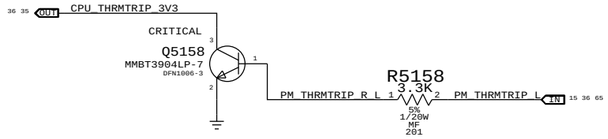
SMC USB Clock require these crystal
values:5,6,8,10,12,16,18,20,24,25 MHz



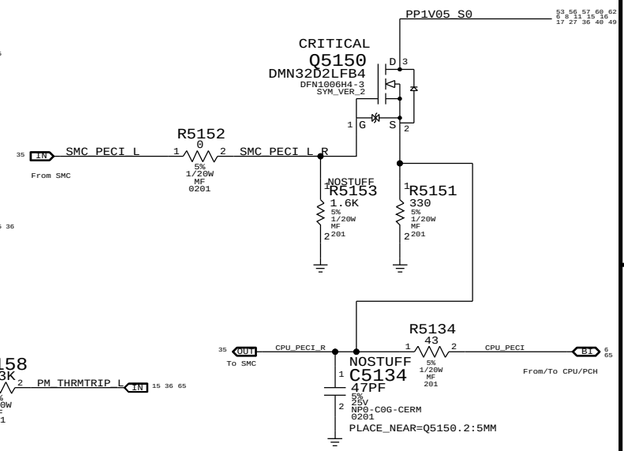


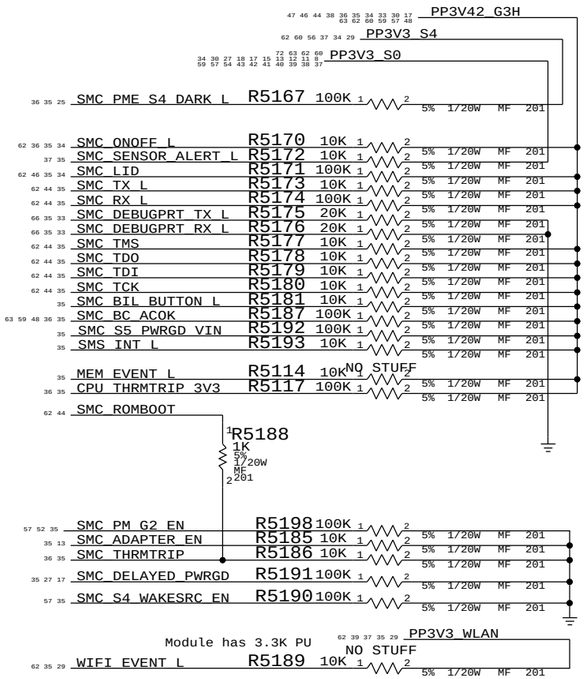






SMC12 PECI Support





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PAGE TITLE: SMC Shared Support

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
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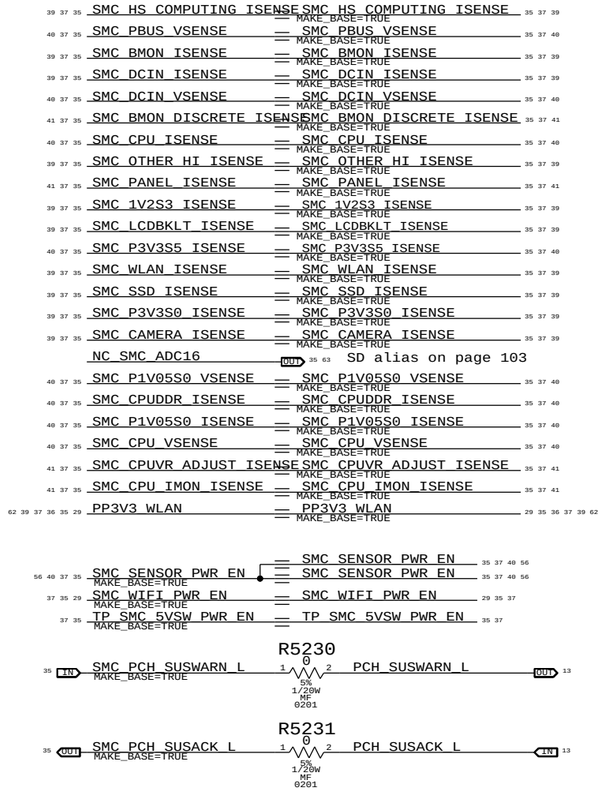
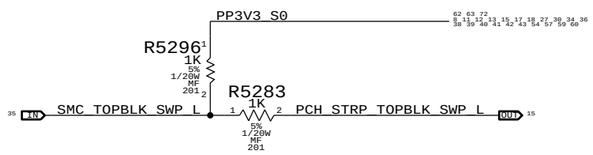
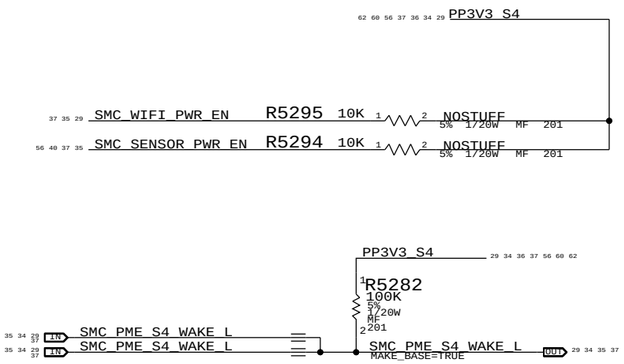
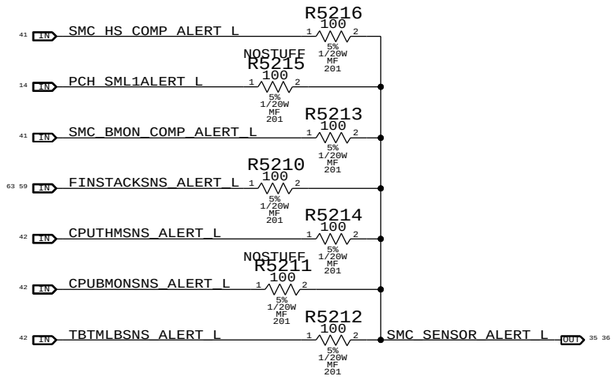


Top-Block Swap







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PAGE TITLE: SMC Project Support

Apple Inc.

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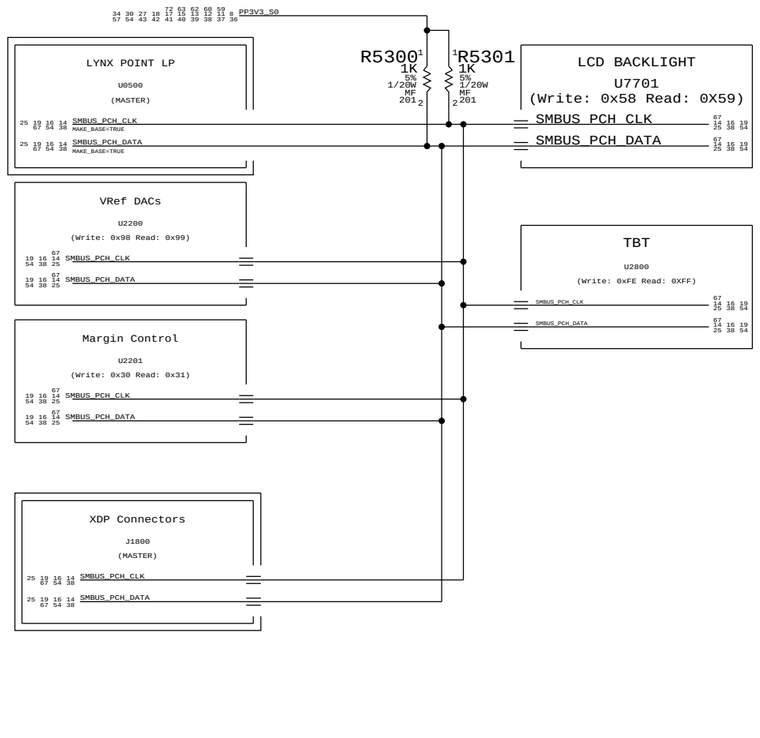
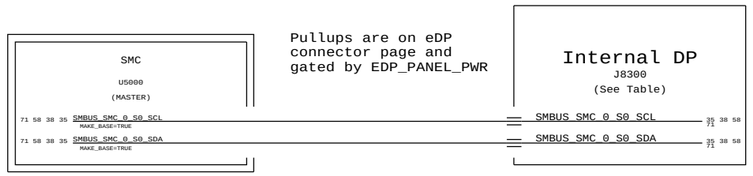
LYNX POINT LP S0 SMBus "0" Connections



SMC "0" SMBus S0 Connections

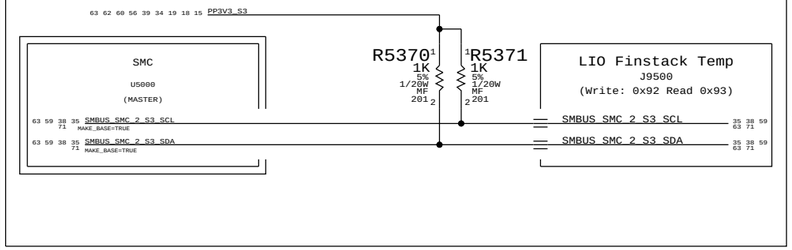


(* = Multiple options)

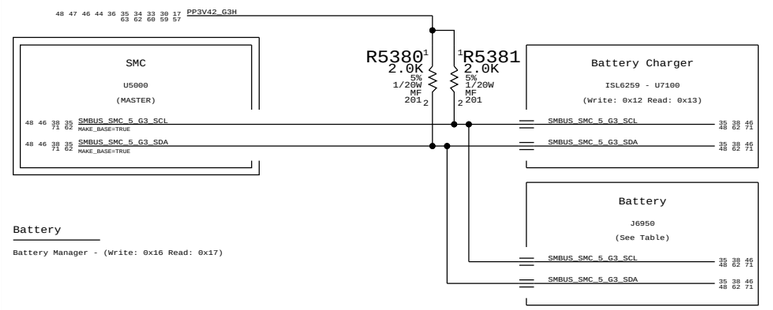
Internal DP

	J43		J41		
	Samsung	LGD	Samsung	LGD	AUO
Analogix T-con - (Write: 0x7B/0x87 Read: 0x7C/0x88)	N	Y	*	Y	*
Parade T-con - (0x10-0x1F or 0x30-0x3F)	Y	N	*	N	*
DVR - (Write: 0x4E Read: 0x4F)	Y	Y	Y	Y	N

SMC "2" SMBus S3 Connections



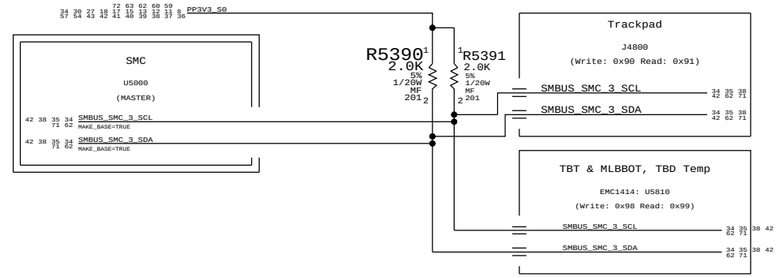
SMC "5" SMBus G3H Connections



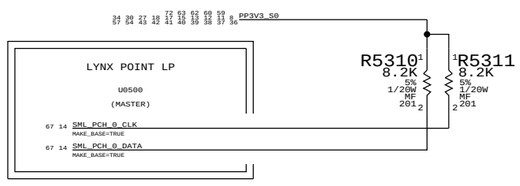
Battery

Battery Manager - (Write: 0x16 Read: 0x17)

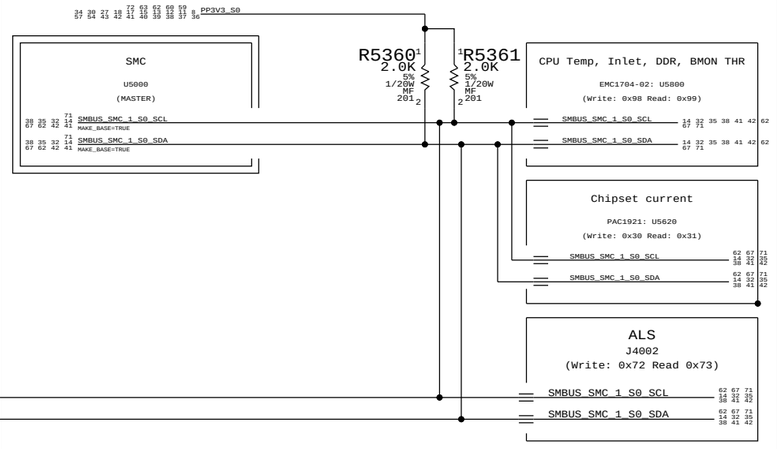
SMC "3" SMBus S0 Connections



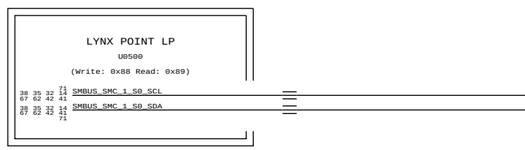
LYNX POINT LP S0 "SMLink 0" Connections



SMC S0 "1" SMBus Connections



LYNX POINT LP S0 "SMLink 1" Connections



SMLink 1 is slave port to
access PCH

SYNC_MASTER=J43_MLB SYNC_DATE=09/28/2012

PAGE TITLE

SMBus Connections

Apple Inc.

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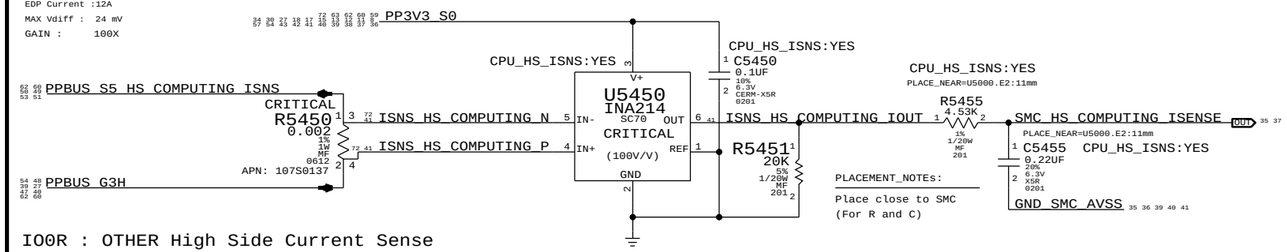
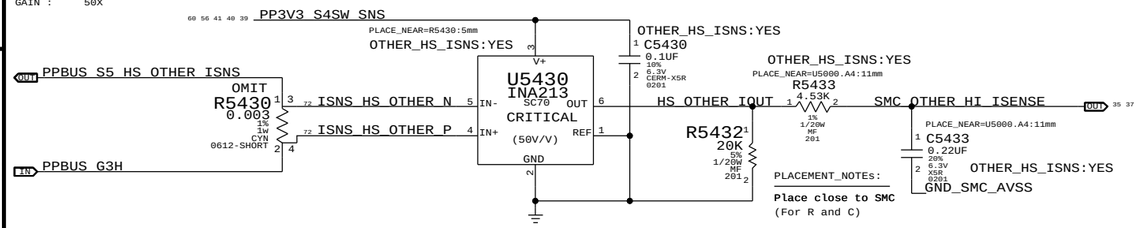
IC0R : COMPUTING High Side Current Sense

EDP Current :12A
MAX Vdiff : 24 mV
GAIN : 100X



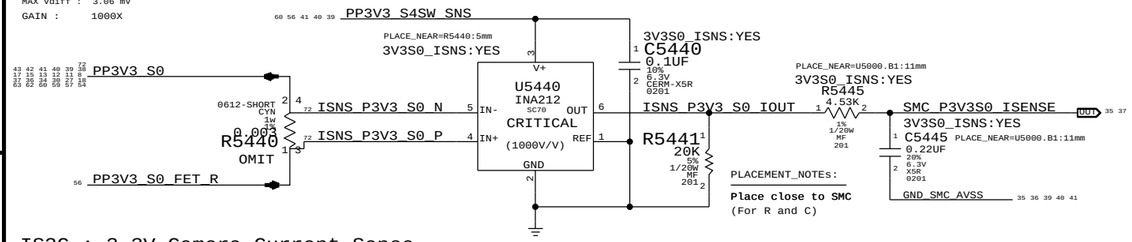
IO0R : OTHER High Side Current Sense

EDP Current :10.75A
MAX Vdiff : 53.75 mV
GAIN : 50X



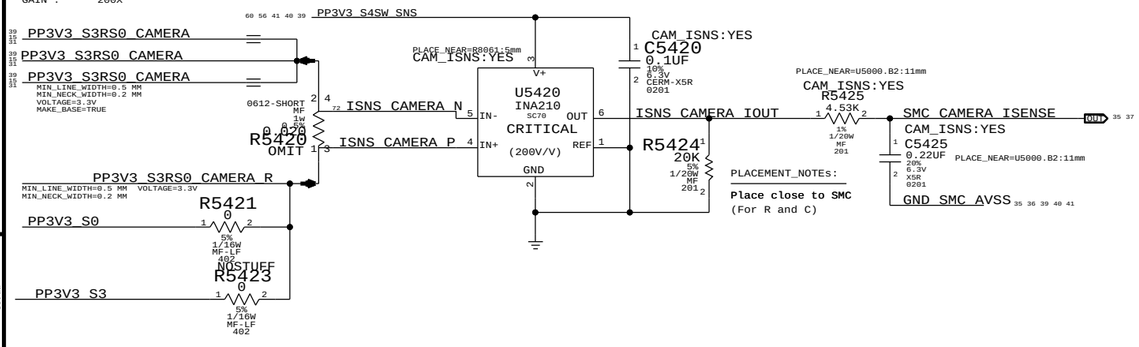
IR0C : 3.3V S0 FET Current Sense

EDP Current :1.02A
MAX Vdiff : 3.06 mV
GAIN : 1000X

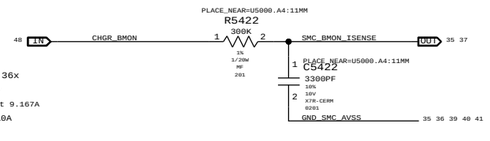


IS2C : 3.3V Camera Current Sense

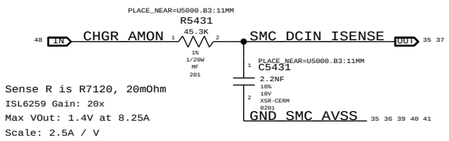
EDP Current : 0.82A
MAX Vdiff : 16.36 mV
GAIN : 200X



CHARGER BMON High Side Current Sense



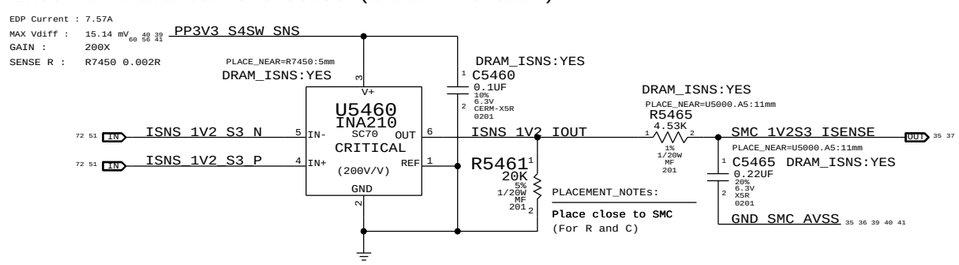
DC-IN (AMON) Current Sense



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
107S0248	1	RES,SENSE,0.003OHM,1W,4-TERM,1%,0612,TFT	R5480	CRITICAL	

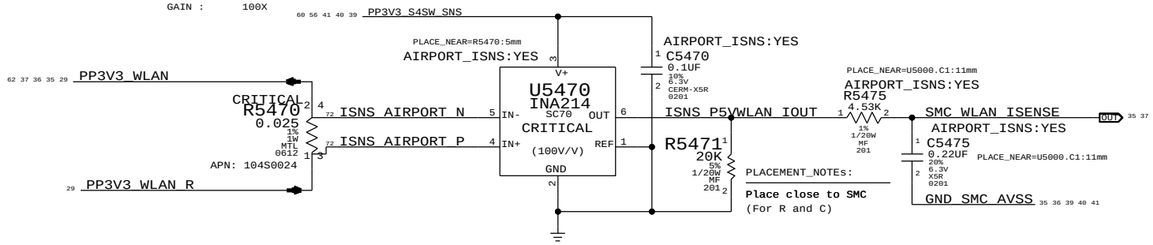
IM3C :DDR 1V2 Current Sense (LPDDR + CPUDDR)

EDP Current : 7.57A
MAX Vdiff : 15.14 mV
GAIN : 200X
SENSE R : R7450 0.002R



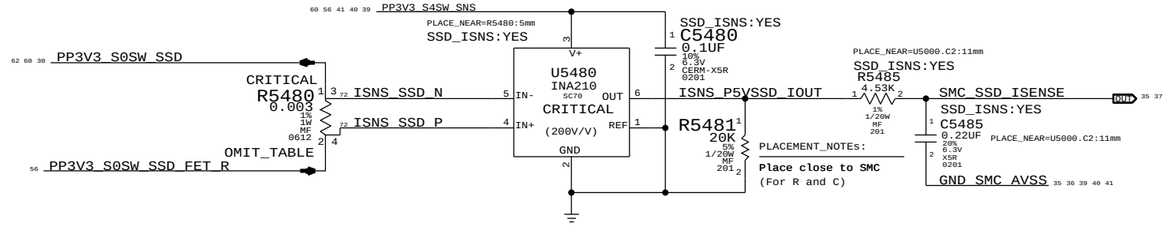
IAPC :AirPort Current Sense

EDP Current : 1.00A
MAX Vdiff : 25 mV
GAIN : 100X



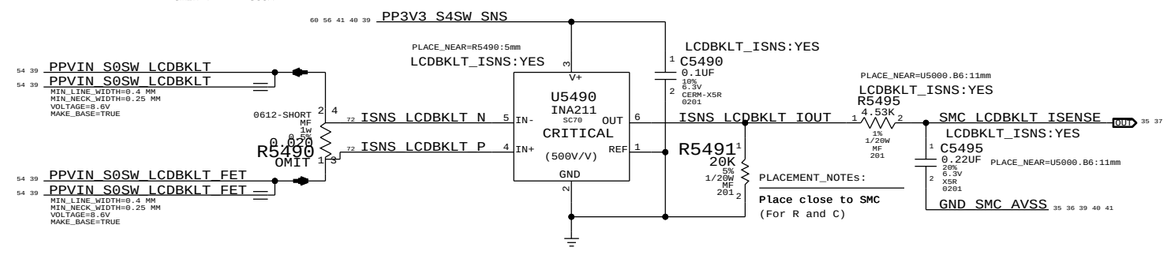
ISDC : SSD Current Sense

EDP Current : 3.00A
MAX Vdiff : 15 mV
GAIN : 200X



IBLC : LCD Backlight Driver Input Current Sense

EDP Current : 0.67A
MAX Vdiff : 0.06 mV
GAIN : 500X

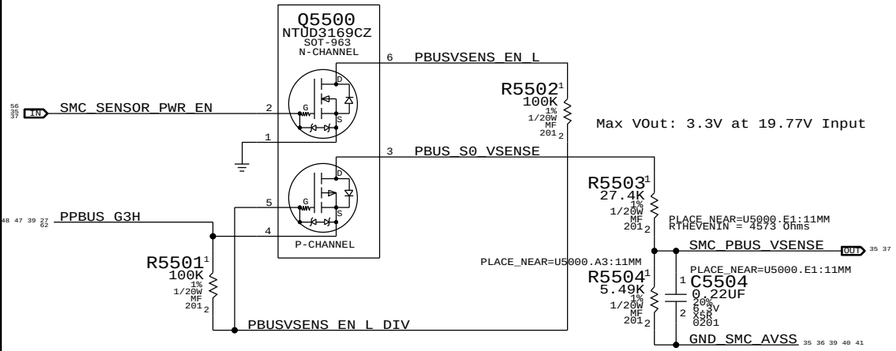


Replacing caps with 100K PD on ISENSE SMC inputs

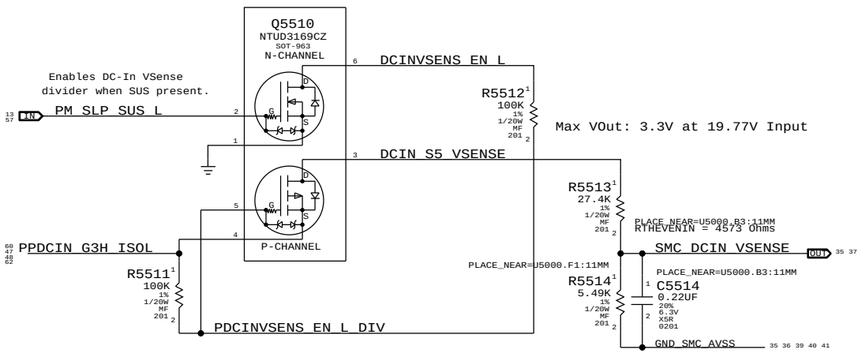
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5455		CPU_HS_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5465		DRAM_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5475		AIRPORT_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5485		SSD_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5495		LCDBKLT_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5433		OTHER_HS_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5425		CAM_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5445		3V3S0_ISNS:NO

SYNC_MASTER=SID J41 SYNC_DATE=02/26/2013
PAGE TITLE: High Side Current Sensing
Apple Inc.
DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
BRANCH: <BRANCH>
PAGE: 54 OF 120
SHEET: 39 OF 73

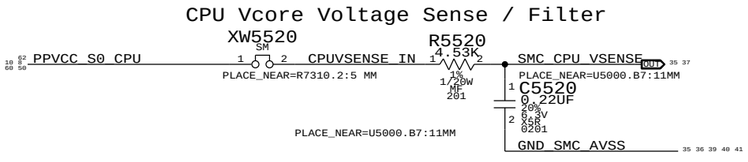
VP0R: PBUS Voltage Sense Enable & Filter



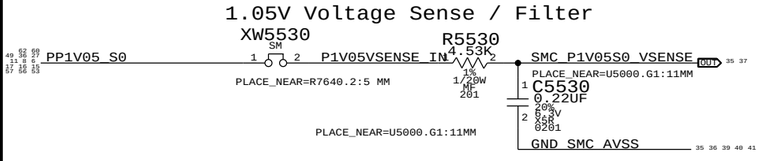
VD0R: DC-In Voltage Sense Enable & Filter



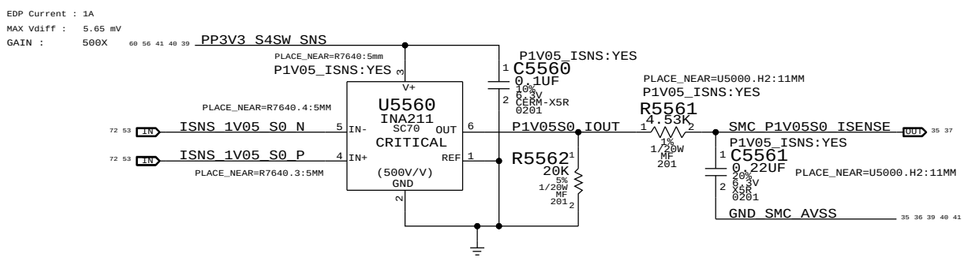
CPU Vcore Voltage Sense / Filter



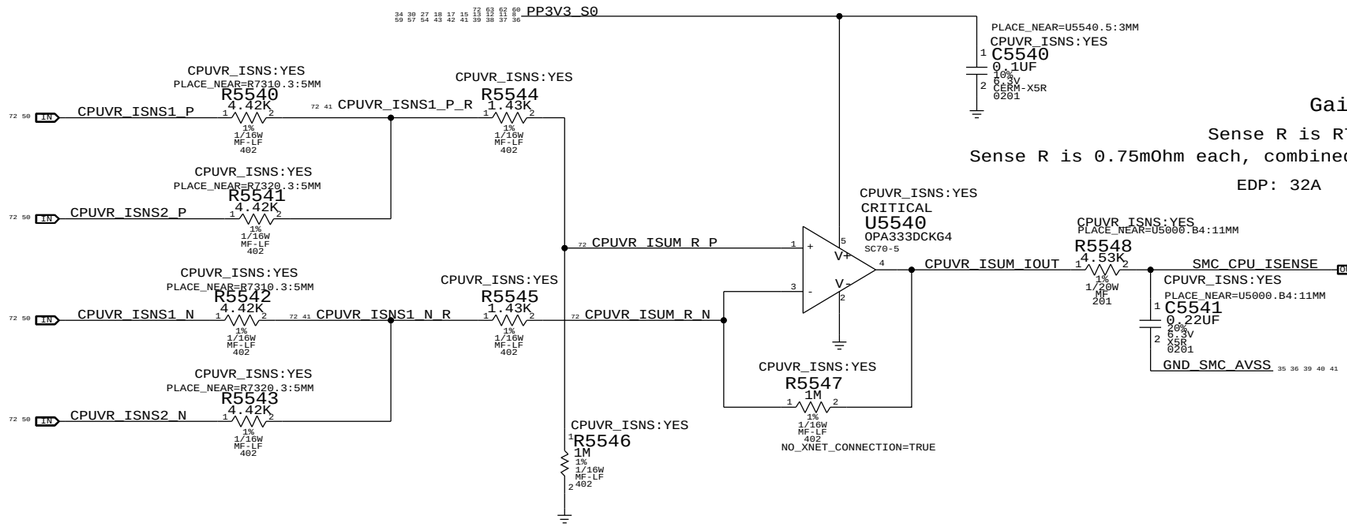
1.05V Voltage Sense / Filter



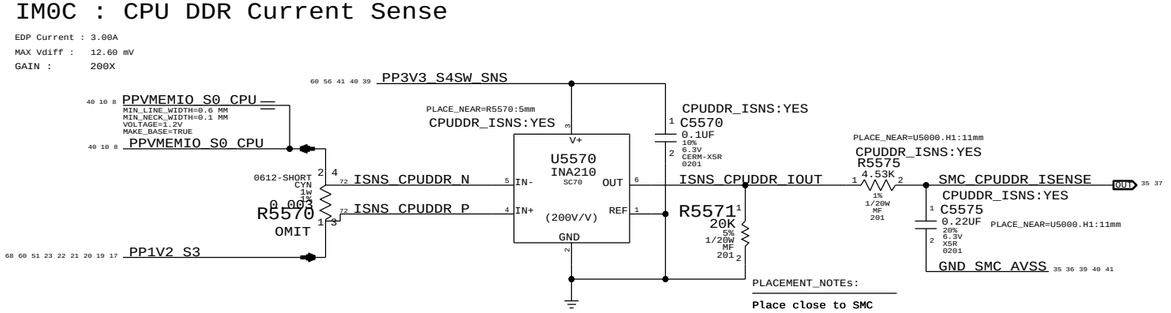
IC1C: 1.05V S0 CURRENT SENSE / FILTER



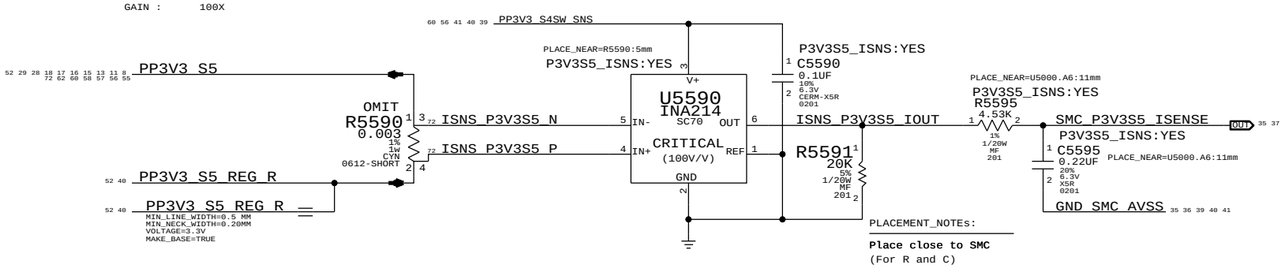
ICS0 : CPU VCore Load Side Current Sense



IM0C : CPU DDR Current Sense



IR5C :3.3 S5 REG Current Sense



Replacing caps with 100K PD on ISENSE SMC inputs

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5541		CPUVR_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5561		P1V05_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5595		P3V3S5_ISNS:NO
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5575		CPUDDR_ISNS:NO

SYNC_MASTER=SID_J41 SYNC_DATE=02/26/2013

PAGE TITLE

Voltage & Load Side Current Sensing

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D

REVISION <E4LABEL>

BRANCH <BRANCH>

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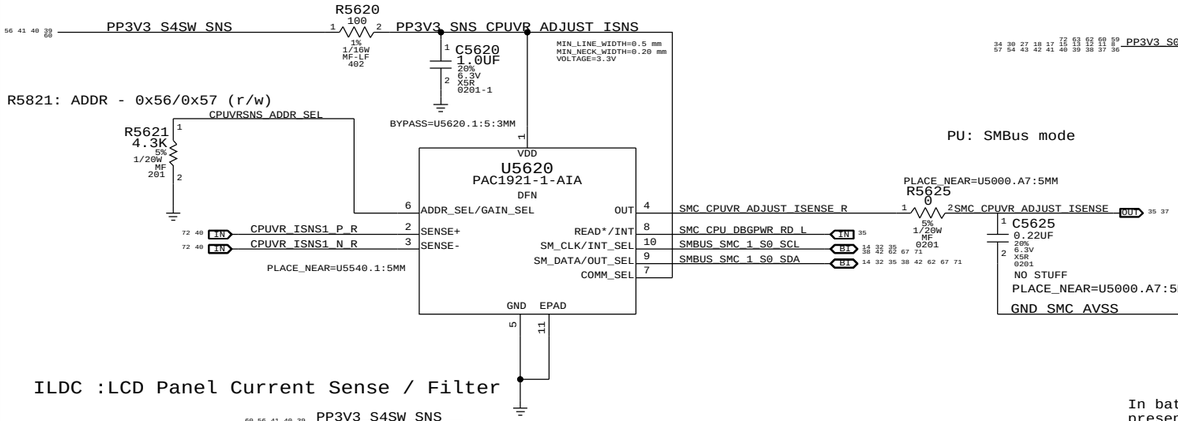
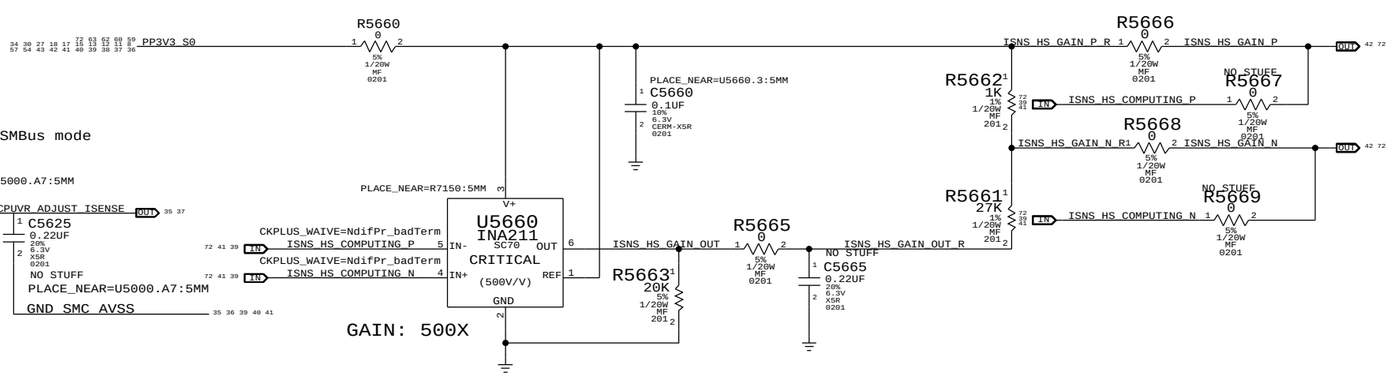
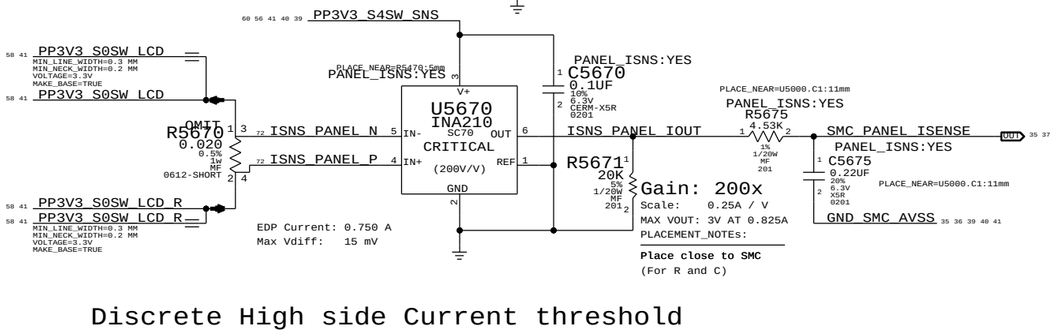
ICS3 : Adjustable Gain CPU VR Current



Sense Pins gain stage for U5800 (EMC1704)



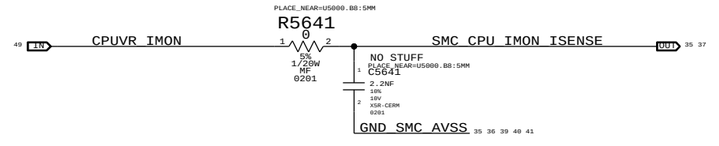
ILDC :LCD Panel Current Sense / Filter



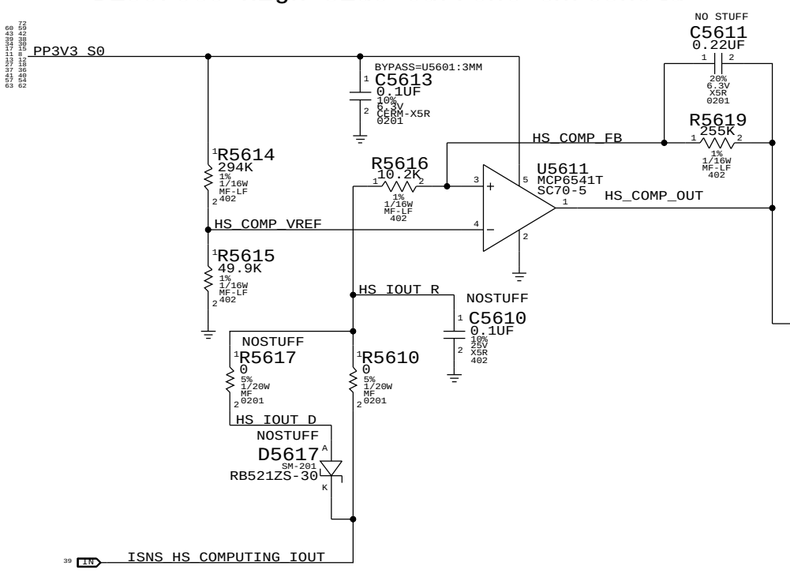
In battery discharge scenario negative voltage will be present on IN+/- pins with INA output voltage decreasing from 3.3V with increasing discharge current.

With 100mA battery current, Will have 10.2mV difference going into sense pins of U5800.
This will set the minumum current threshold at 0.100mA

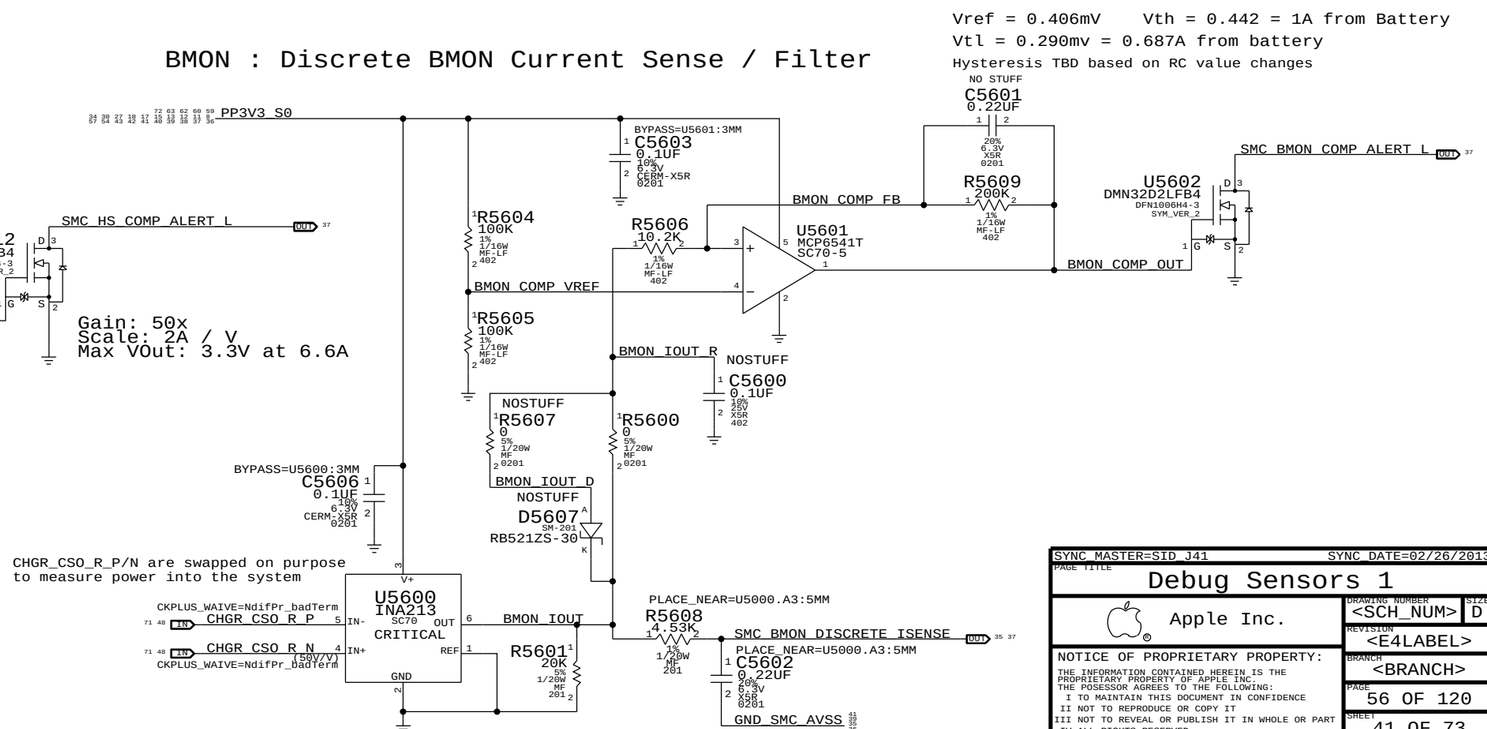
VR IMON Current Sense Filter



Discrete High side Current threshold



BMON : Discrete BMON Current Sense / Filter



Vref = 0.406mV Vth = 0.442 = 1A from Battery
Vtl = 0.290mv = 0.687A from battery
Hysteresis TBD based on RC value changes

Replacing caps with 100K PD on ISENSE SMC inputs

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5675		PANEL_ISNS:NO

SYNC_MASTER=SID_J41 SYNC_DATE=02/26/2013

PAGE TITLE: Debug Sensors 1

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D
REVISION: <E4LABEL>
BRANCH: <BRANCH>
PAGE: 56 OF 120
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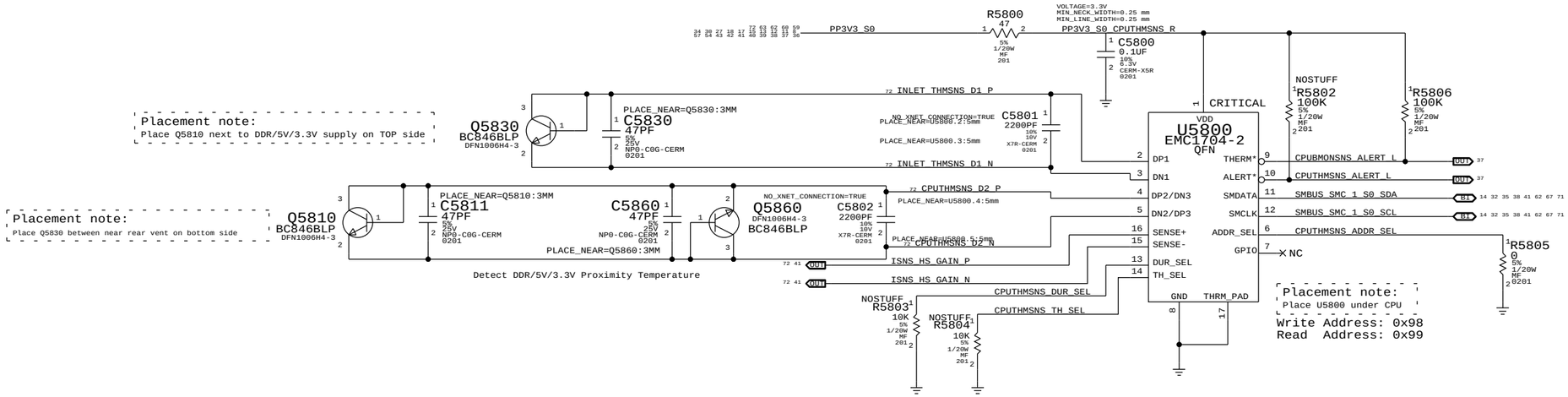
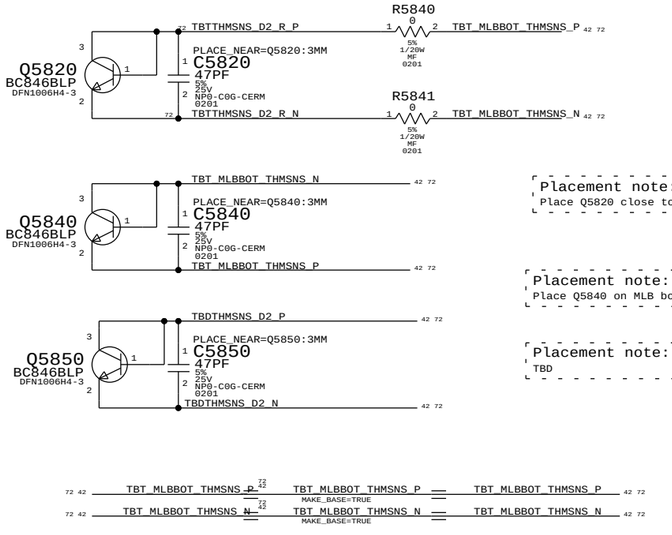
CPU Proximity, Inlet ,DDR and BMON THR Sensor



TBT,MLB Bottom Proximity Sensors



Placement note:
Place Q5820 close to TBT on TOP side

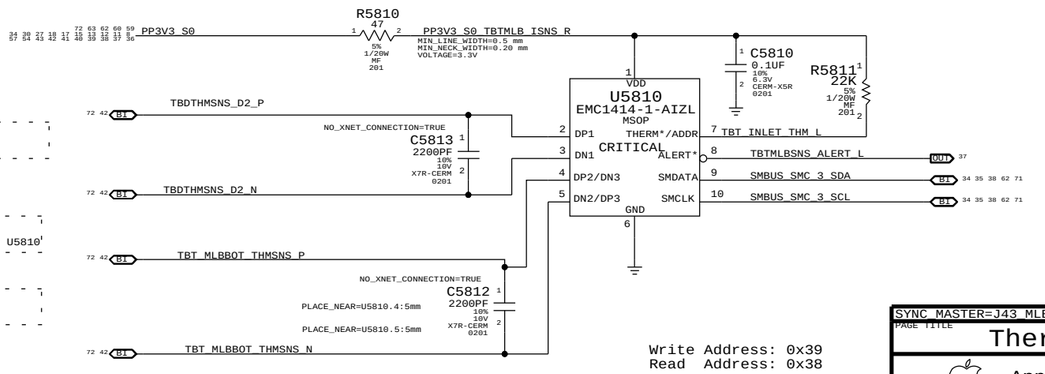
Placement note:
Place Q5840 on MLB bottom side opposite U5810

Placement note:
TBD

TBT_MLBBOT_THMSNS_P — MAKE_BASE=TRUE — TBT_MLBBOT_THMSNS_P

TBT_MLBBOT_THMSNS_N — MAKE_BASE=TRUE — TBT_MLBBOT_THMSNS_N

TBT, MLBBOT and TBD Temp Sensor



Write Address: 0x39
Read Address: 0x38

SYNC_MASTER=J43_MLB SYNC_DATE=02/20/2013

PAGE TITLE

Thermal Sensors

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D

REVISION <E4LABEL>

BRANCH <BRANCH>

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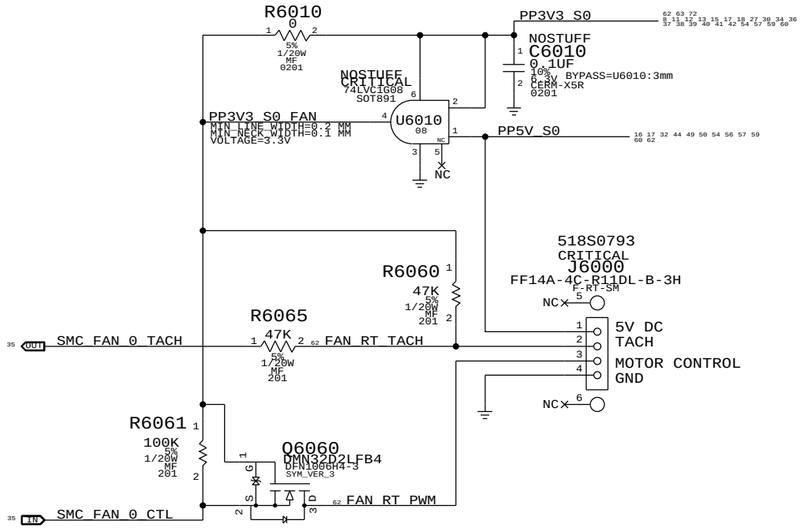
FAN CONNECTOR



SYNC_MASTER=J43_MLB SYNC_DATE=09/13/2012

PAGE TITLE

Fan

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D

REVISION <E4LABEL>

BRANCH <BRANCH>

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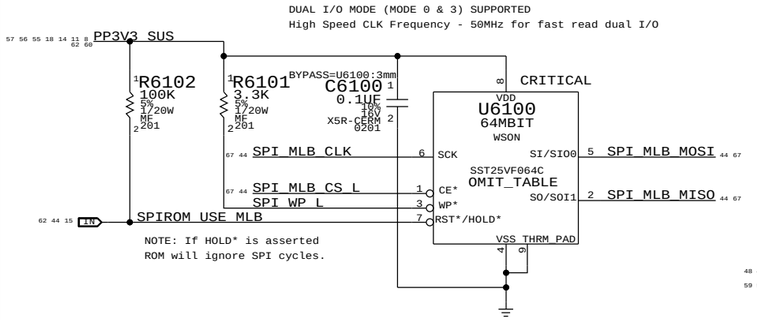
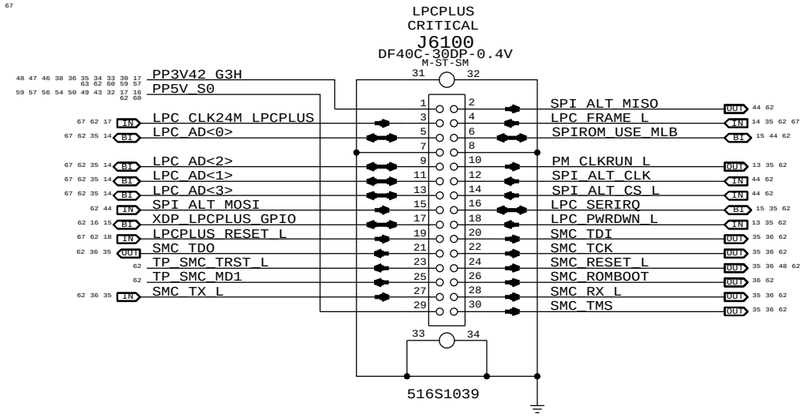
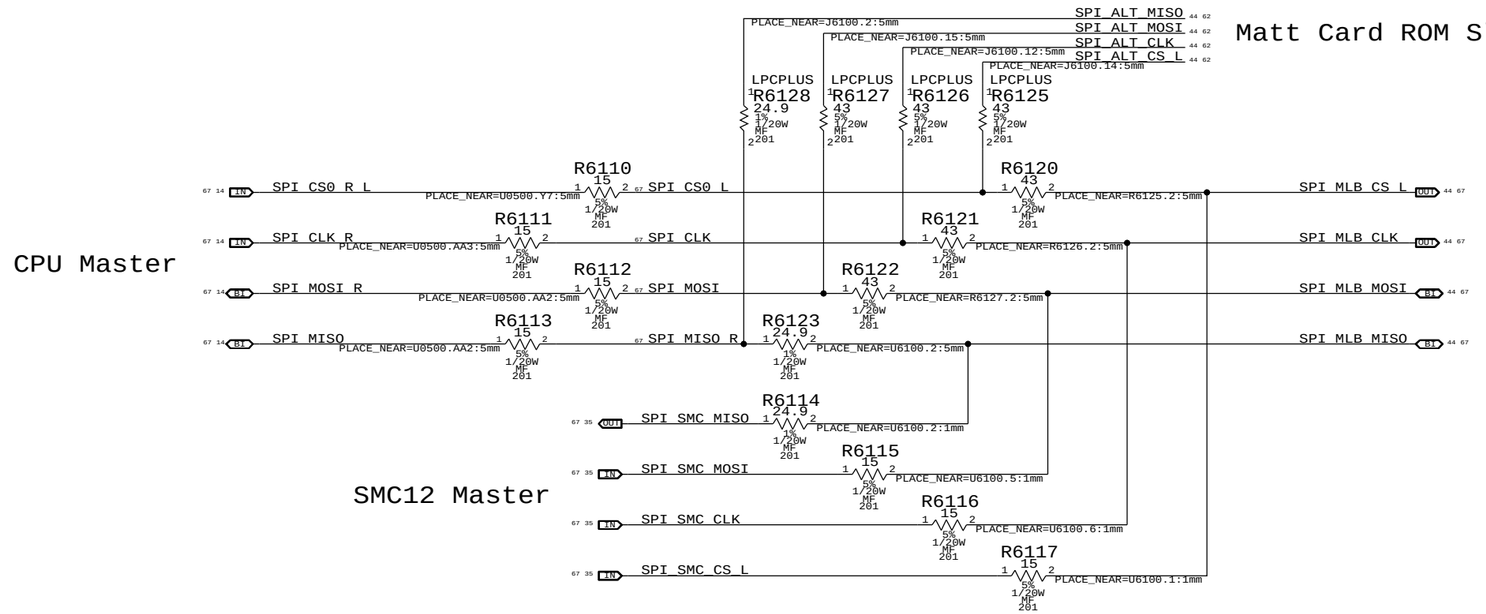


LPC+SPI Connector



SPI Bus Series Termination



SYNC_MASTER=K21_MLB	SYNC_DATE=12/13/2010
PAGE TITLE: LPC+SPI Debug Connector	
Apple Inc.	DRAWING NUMBER: <SCH_NUM> SIZE: D
	REVISION: <E4LABEL>
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	PAGE: 61 OF 120
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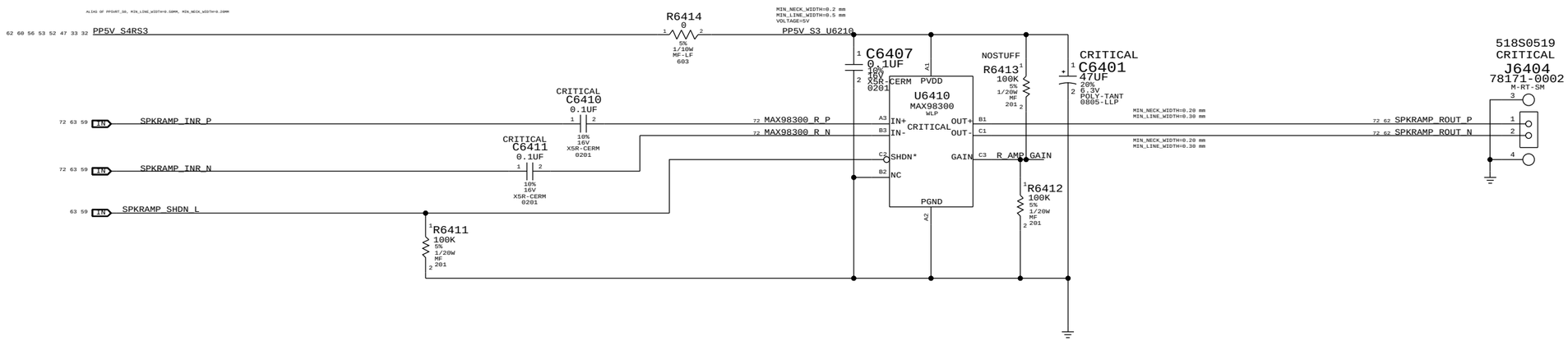
SPEAKER AMPLIFIERS

APN:353S2888

SPEAKER LOWPASS	80 HZ < FC < 132 HZ
GAIN	6DB

Right Speaker Connector



SYNC_MASTER=J43_MLB SYNC_DATE=09/04/2012

PAGE TITLE: Audio: Speaker Amp

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

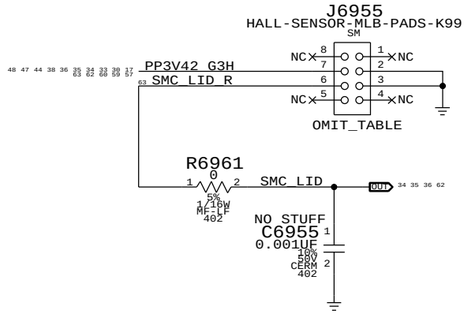
REVISION: <E4LABEL>

BRANCH: <BRANCH>

PAGE: 64 OF 120

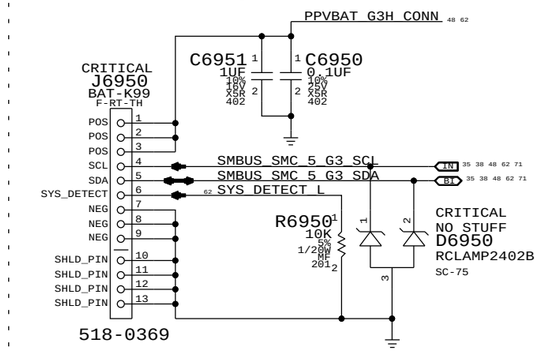
SHEET: 45 OF 73

Hall Effect Sensor



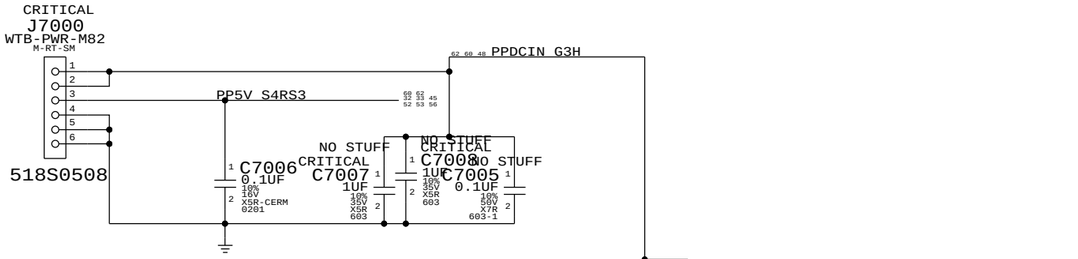
11"-Specific

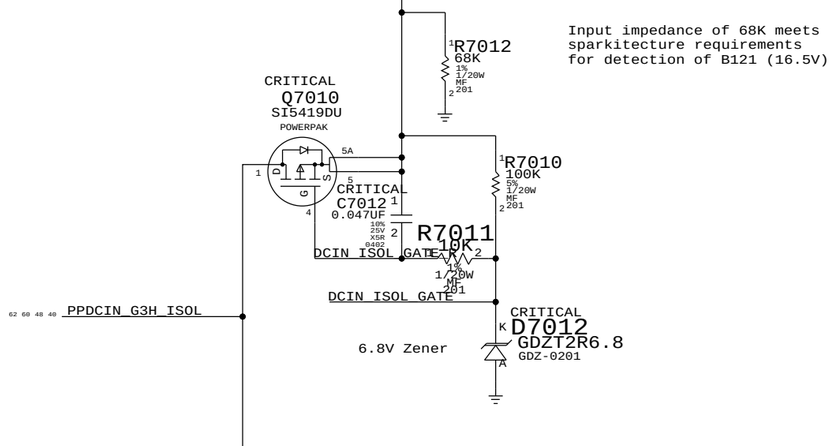
Battery Connector



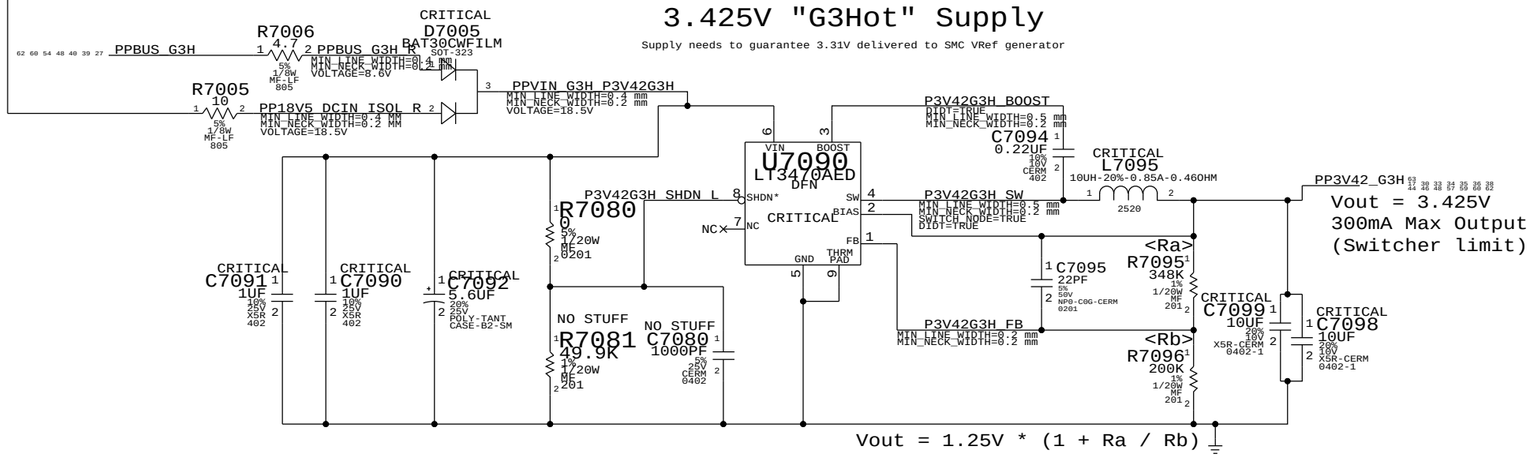
SYNC_MASTER=MASTER	SYNC_DATE=MASTER
PAGE TITLE	Battery Connector & Hall Effect
Apple Inc.	DRAWING NUMBER <SCH_NUM> SIZE D
	REVISION <E4LABEL>
	BRANCH <BRANCH>
	PAGE 69 OF 120
	SHEET 46 OF 73

MLB to LIO Power Cable Connector





Input impedance of 68K meets sparkitecture requirements for detection of B121 (16.5V)



SYNC_MASTER=J43_MLB	SYNC_DATE=09/13/2012
PAGE TITLE: DC-In & G3H Supply	
Apple Inc.	DRAWING NUMBER: <SCH_NUM> SIZE: D
	REVISION: <E4LABEL>
	BRANCH: <BRANCH>
	PAGE: 70 OF 120
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Reverse-Current Protection

Need to stuff R7192 if either PP5V5_DCIN:YES or PP5V5_VDDP are used!

Inrush Limiter

5.5v "G3Hot" Supply
For Erp Lot6 spec

FROM ADAPTER

PPDCIN_G3H

R7185 470K 1/20W MF 201

C7185 0.1UF 10% 25V X5R 402

CRITICAL Q7180 IRF9395TRPBF DIRECTFET-MC

CHGR_AGATE_DIV

R7186 332K 1% 1/20W MF 201

PPDCIN_G3H_ISOL

CRITICAL D7105 BAT30CWFILM SOT-323

PPCHGR_DCIN_D_R

PP5V5_DCIN:NO R7105 20 5% 1/10W MF-LF 603

(CHGR_DCIN)

PPDCIN_G3H_INRUSH

R7180 100K 5% 1/20W MF 201

C7184 4.7UF 10% 25V X5R-CERM 0603

CHGR_SGATE_DIV

R7181 62K 5% 1/20W MF 201

(CHGR_AGATE)

(CHGR_SGATE)

NO STUFF R7192 0 5% 1/10W MF-LF 402

PPCHGR_DCIN_D_R

CHGR_DCIN_D

NO STUFF C7190 4.7UF 10% 25V X5R-CERM 0603

U7190 LT3470A DFN

VIN BOOST SW BIAS FB THRM GND PAD SHDN* NC

P5V1_BOOST DIDT=TRUE

NO STUFF C7194 0.22UF 10% 10V CERM 402

CRITICAL NO STUFF L7195 10UH-20%-0.85A-0.46OHM 2520

P5V1_SW

P5V1_FB

NO STUFF C7195 22PF 5% 50V NPO-C0G-CERM 0201

NO STUFF <Ra> R7195 681K 1% 1/20W MF 201

NO STUFF <Rb> R7196 200K 1% 1/20W MF 201

Vout = 1.25V * (1 + Ra / Rb)

PP5V5_DCIN:YES

R7190 0 5% 1/16W MF-LF 402

CHGR_DCIN

PP5V5_VDDP

R7191 0 5% 1/16W MF-LF 402

P5V1_CHGR_VDDP

NO STUFF CRITICAL C7198 10UF 20% 10V X5R 603

NO STUFF CRITICAL C7199 10UF 20% 10V X5R 603

PP5V5_CHGR_VDDP

Vout = 5.50V
200MA MAX OUTPUT
(Switcher limit)

ACIN pin threshold is 3.2V, +/- 50mV

DIVIDER SETS ACIN THRESHOLD AT 13.55V

30mA max load

PP5V1_CHGR_VDD

R7101 4.7 5% 1/16W MF-LF 402

PP5V1_CHGR_VDDP

C7101 1UF 10% 10V X5R 402

PP3V42_G3H

R7110 130K 1% 1/20W MF 201

NO STUFF R7102 100K 5% 1/20W MF 201

R7100 0 5% 1/20W MF 0201

SMC_RESET_L

CHGR_RST_L

SMBUS_SMC_5_G3_SCL

SMBUS_SMC_5_G3_SDA

CHGR_VFRQ

CHGR_CELL

Float CELL for 1S

CHGR_ACIN

R7113 100 5% 1/20W MF 201

R7115 255K 1% 1/20W MF 201

CHGR_VCOMP

CHGR_VNEG

CHGR_CSO_P

CHGR_CSO_N

R7111 46.4K 1% 1/20W MF 201

CHGR_VCOMP_R

C7115 470PF 10% 16V X5R-X7R-CERM 0201

R7142 1K 5% 1/20W MF 201

R7116 10K 1% 1/20W MF 201

CHGR_ICOMP_R

CHGR_VNEG_R

C7116 470PF 10% 16V X5R-X7R-CERM 0201

C7142 0.1UF 10% 6.3V CERM-X5R 0201

C7150 0.47UF 10% 10V X5R 0402

C7102 1UF 10% 10V X5R 402

C7111 0.01UF 10% 10V X5R-CERM 0201

C7100 1UF 10% 10V X5R 402-1

C7105 0.22UF 10% 50V X5R-CERM 0603-1

C7126 1000PF 10% 16V X7R-CERM 0201

XW7100 SM PLACE_NEAR=U7100.22:1mm

GND_CHGR_AGND

ISL6259 U7100 TQFN

VDD	19	
VDDP	20	
VHST	12	
SMB_RST_N	13	
SCL	11	CHGR_RST_L
SDA	10	SMBUS_SMC_5_G3_SCL
VFRQ	4	SMBUS_SMC_5_G3_SDA
CELL	6	CHGR_VFRQ
ACIN	3	CHGR_CELL
ICOMP	5	CHGR_ACIN
VCOMP	7	CHGR_ICOMP
VNEG	8	CHGR_VCOMP
CSOP	18	CHGR_VNEG
CSON	17	CHGR_CSO_P
		CHGR_CSO_N
DCIN	2	CHGR_DCIN
SGATE	26	CHGR_SGATE
AGATE	1	CHGR_AGATE
CSIP	28	CHGR_CSI_P
CSIN	27	CHGR_CSI_N
BOOT	25	CHGR_BOOT
UGATE	24	CHGR_UGATE
PHASE	23	CHGR_PHASE
LGATE	21	CHGR_LGATE
BGATE	16	CHGR_BGATE
20V/V AMON	9	CHGR_AMON
36V/V BMON	15	CHGR_BMON
(0.8) ACOK	14	SMC_BC_ACOK
(AGND) THRM_PAD	29	
PGND	22	

R7121 10 1% 1/20W MF 201

R7122 10 1% 1/20W MF 201

C7120 0.047UF 10% 16V X7R-CERM 0402

C7122 0.1UF 10% 25V X5R 402

C7121 0.1UF 10% 25V X5R 402

CHGR_CSI_R_P

CHGR_CSI_R_N

CRITICAL R7120 0.020 0.5% 1W MF-LF 0612

PPDCIN_G3H_CHGR

CRITICAL C7130 33UF-0.060HM 20% 25V POLY-TANT CASE-D3L

CRITICAL C7131 33UF-0.060HM 20% 25V POLY-TANT CASE-D3L

C7135 1UF 10% 25V X5R 603-1

C7136 1UF 10% 25V X5R 603-1

BYPASS=Q7130:1.5mm

C7137 0.001UF 10% 50V X7R-CERM 0402

Max Current = 8A

f = 400 kHz

C7125 0.22UF 10% 10V CERM 402

CRITICAL Q7130 RJK03P0DPA WPAK

CRITICAL L7130 4.7UH-17A PIMC104T4R7MN-SM

SWITCH_NODE=TRUE DIDT=TRUE

CRITICAL F7140 8AMP-24V 1206

TO SYSTEM

PPBUS_G3H

PPVBAT_G3H_CHGR_REG

C7140 62UF-0.023OHM 20% 11V TANT-POLY CASE-B2S-1

C7141 62UF-0.023OHM 20% 11V TANT-POLY CASE-B2S-1

C7143 62UF-0.023OHM 20% 11V TANT-POLY CASE-B2S-1

BYPASS=L7130:Q7130:1.5mm

C7145 1000PF 10% 16V X7R-CERM 0201

CRITICAL Q7155 SI7137DP SO-8

R7150 0.01 0.5% 1W MF 0612-4

TO/FROM BATTERY

PPVBAT_G3H_CHGR_R

PPVBAT_G3H_CONN

R7151 2.2 5% 1/20W MF 201

R7152 0 5% 1/20W MF 0201

CHGR_CSO_R_P

CHGR_CSO_R_N

(CHGR_CSO_P)

(CHGR_CSO_N)

(PPVBAT_G3H_CHGR_R)

(CHGR_BGATE)

C7117 10UF 10% 25V X5R 805

C7114 1UF 10% 25V X5R 603-1

C7113 0.1UF 10% 25V X5R 402

C7112 0.01UF 10% 25V X7R 402

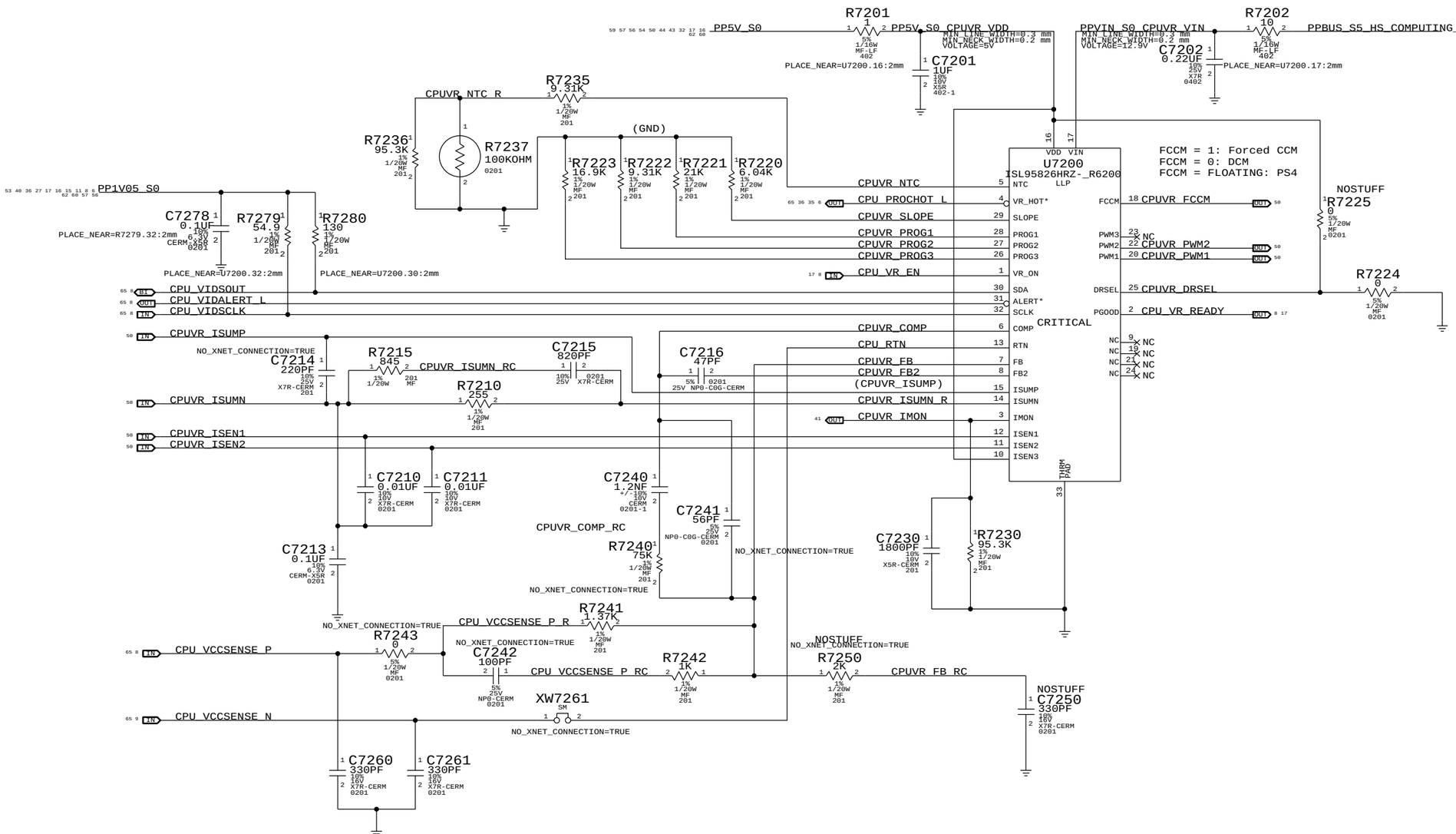
* R7151 HAS 2.2OHM TO COMPENSATE UNBALANCED VOLTAGE
DUE TO DIFFERENT CURRENT ON _P AND _N. (FROM INTERSIL)

SYNC_MASTER=J43_MLB SYNC_DATE=09/14/2012

PAGE TITLE
PBus Supply & Battery Charger

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
PAGE 71 OF 120
SHEET 48 OF 73



SYNC_MASTER=J43_MLB SYNC_DATE=10/09/2012

PAGE TITLE
CPU VR12.6 VCC Regulator IC

Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
PAGE 72 OF 120
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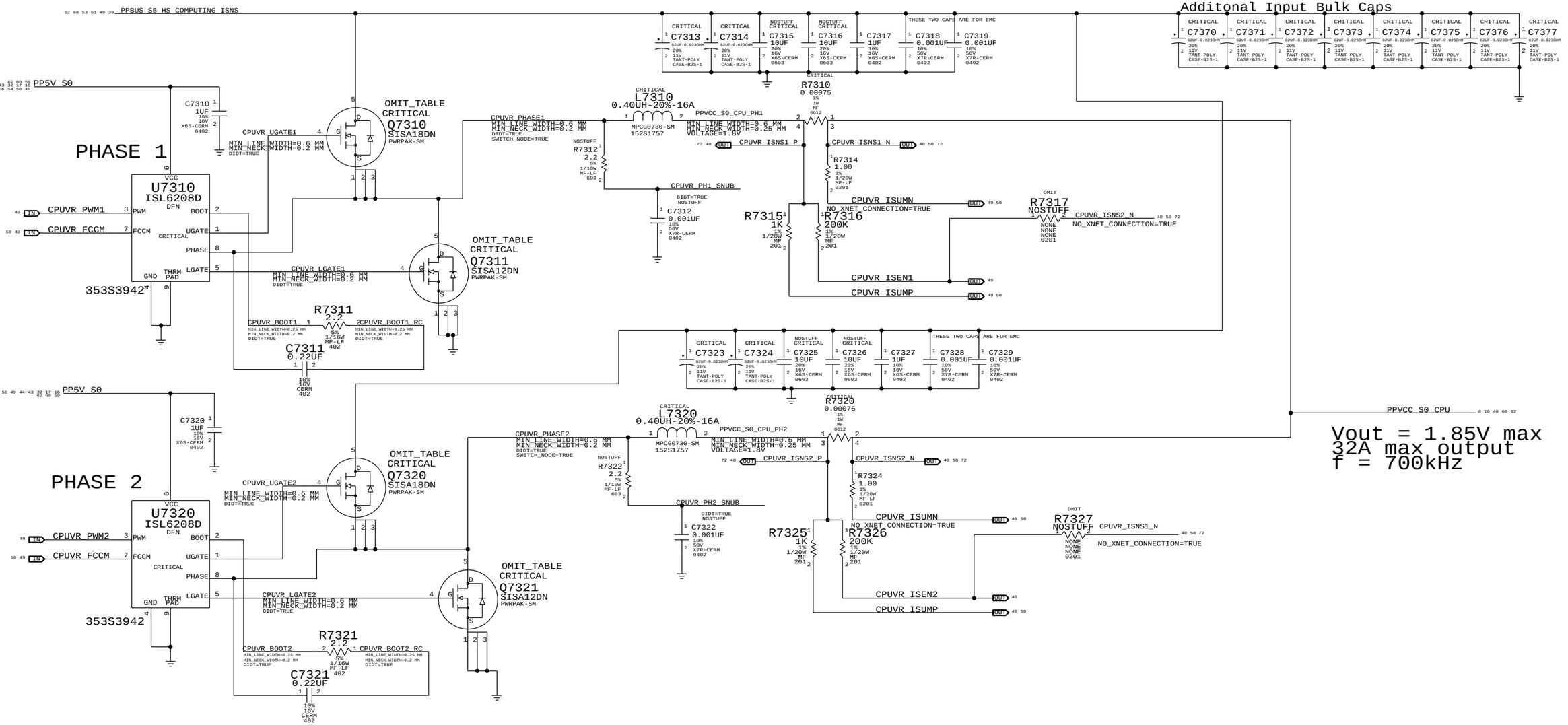

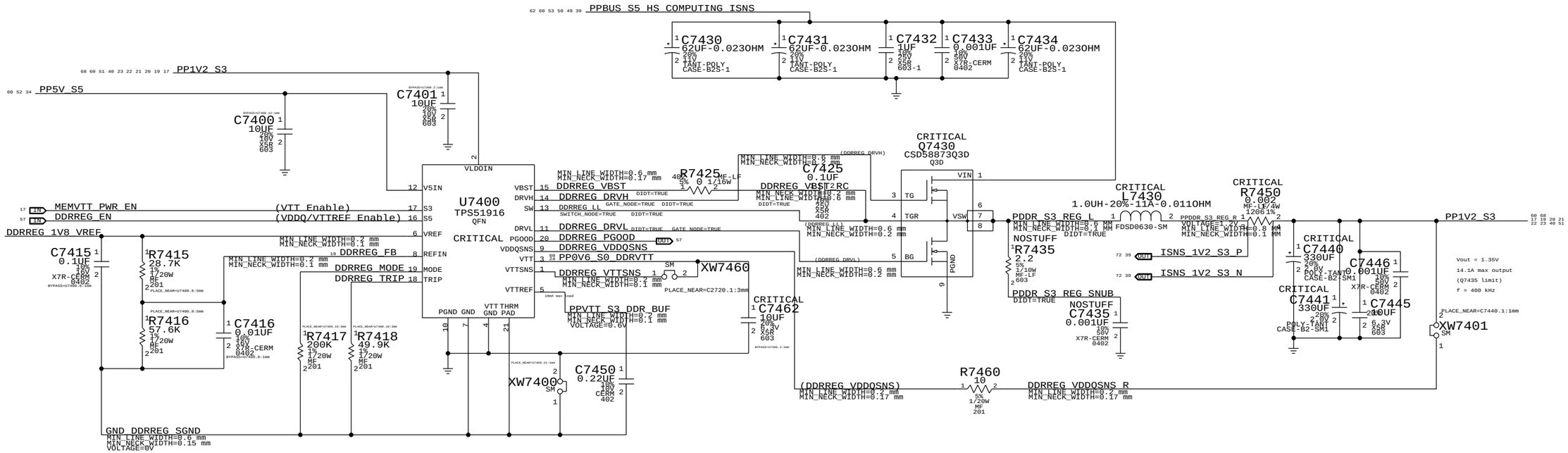

SYNC_MASTER=J43_MLB	SYNC_DATE=09/17/2012
PAGE TITLE	LPDDR3 Supply
Apple Inc.	DRAWING NUMBER: <SCH_NUM> SIZE: D
	REVISION: <E4LABEL>
	BRANCH: <BRANCH>
	PAGE: 74 OF 120
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SKIPSEL Strap		
VREF2	Auto Skip	(Higher Efficiency)
VREG3	OOA Auto Skip	(Lower Efficiency)

F=400KHZ
Vout = 5.0V
7.2A MAX OUTPUT

F=400KHZ
Vout = 3.3V
6.5A MAX OUTPUT

SYNC_MASTER=J43_MLB	SYNC_DATE=10/02/2012
PAGE TITLE	5V S4RS3 / 3.3V S5 Power Supply
Apple Inc.	DRAWING NUMBER <SCH_NUM> SIZE D
	REVISION <E4LABEL>
	BRANCH <BRANCH>
	PAGE 75 OF 120
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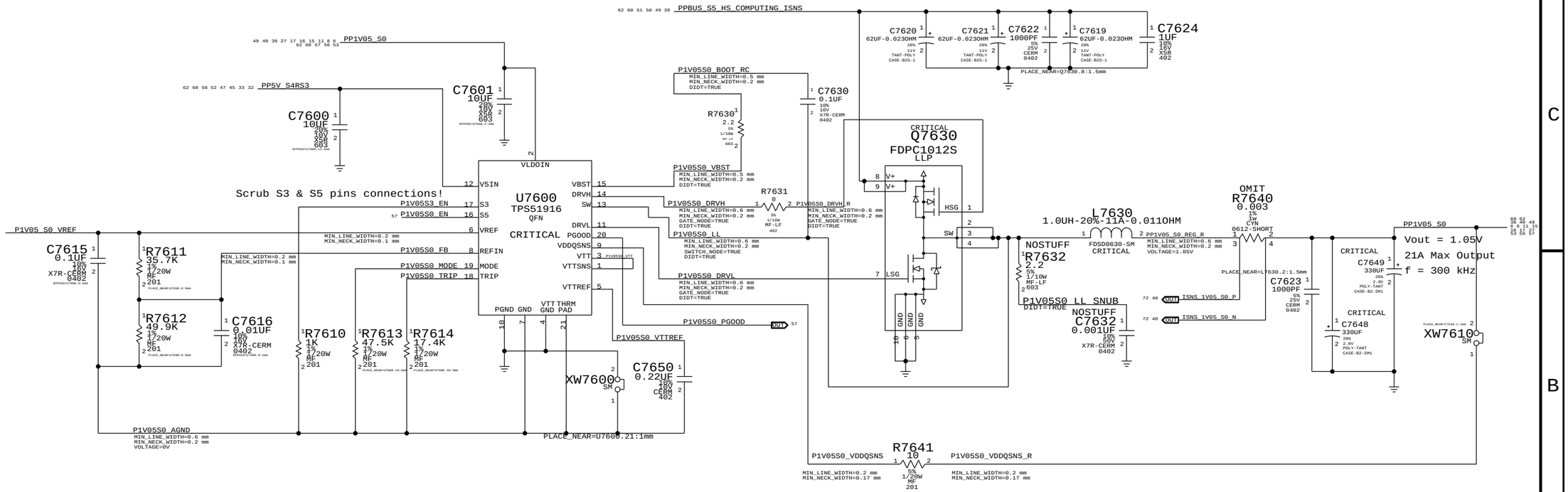
1.05V S0 Regulator



SYNC_MASTER=J43_MLB	SYNC_DATE=09/10/2012
PAGE TITLE	1.05V S0 Power Supply
Apple Inc.	DRAWING NUMBER <SCH_NUM> SIZE D
	REVISION <E4LABEL>
	BRANCH <BRANCH>
	PAGE 76 OF 120
	SHEET 53 OF 73

PPBUS S0 LCDBkLT FET

MOSFET	FDC638APZ
CHANNEL	P-TYPE
RDS(ON)	43 mOhm @4.5V
LOADING	0.65 A (EDP)

*C7797 AND C7799 SHOULD BE PLACED IN T-BONE FOR ACOUSTICS
*PPBUS_SW_LCDBKLT_PWR_SW SHOULD BE KEPT AS SHORT AS POSSIBLE.
*LCD_BKLT_PWM SHOULD BE AWAY FROM BOOST CIRCUIT

CRITICAL
Q7706
FDC638APZ_SBMS001
SSOT6-HF

F7700
3AMP-32V-467
603-HF
PLACE_SIDE=BOTTOM

PPBUS_G3H
PPVIN_S0SW_LCDBKLTFET
MIN_LINE_WIDTH=0.4mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=12.6V

R7788 301K 1% 1/20W MF 201
C7782 0.1UF 10% 10V X7R-CERM 0402
LCDBKLT_EN_DIV_L
R7789 147K 1% 1/20W MF 201
LCDBKLT_EN_L

Q7707
DMN5L06VK-7
SOT-563

EDP_BKLT_EN
LCDBKLT_DISABLE
BKLT_PLT_RST_L

PPVIN_S0SW_LCDBKLT_FET
THERE IS A SENSE RESISTOR BETWEEN PPBUS_SW_LCDBKLT_PWR AND PPBUS_SW_BKL ON THE SENSOR PAGE

CRITICAL
L7701
15UH-2.8A
PIMB053T-SM

PPVIN_S0SW_LCDBKLT
CRITICAL C7712 10UF 10% 10V 25V X5R 805
C7713 0.1UF 10% 10V 25V X5R 402
PLACE_NEAR=L7701.1:3mm

LCDBKLT_BOOST
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.150 MM
VOLTAGE=58V
SWITCH_NODE=TRUE
DIDT=TRUE

PLACE_NEAR=L7701.2:3mm
CRITICAL
D7701
SOD-123
RB160M-60G

PPHV_S0SW_LCDBKLT
C7796 220PF 10% 50V X7R-CERM 0402
CRITICAL C7797 10UF 10% 10V X5R 1210-1
CRITICAL C7799 10UF 10% 10V X5R 1210-1
PLACE_NEAR=U7701.A5:3mm
PLACE_NEAR=D7701.2:5mm
PLACE_NEAR=D7701.2:3mm

XW7720
SM
PPVOUT_SW_LCDBKLT_FB
VOLTAGE=50V
MIN_LINE_WIDTH=0.1 MM
MIN_NECK_WIDTH=0.1 MM
PLACE_NEAR=C7797.1:5mm

PP5V_S0
C7710 1UF 10% 25V X5R 603-1
C7714 0.01UF 10% 16V X5R-CERM 0201
BYPASS=U7701.D1:5mm
BYPASS=U7701.D1:3mm

PP3V3_S0
BYPASS=U7701.C4:4mm
C7711 0.1UF 10% 6.3V CERM-X5R 0201

(GND_BKL_SGND)

U7701
25-BUMP-MICRO
LP8550
VDDIO VLDO VIN
VSYNC FILTER ISET FSET SCLK SDA PWM EN FAULT
SW_0 SW_1 FB
OUT1 OUT2 OUT3 OUT4 OUT5 OUT6
GND_S GND_L GND_SW GND_SW

BKL_VSYNC_R
BKL_FLTR
BKL_ISET
BKL_FSET
BKL_SCL
BKL_SDA
BKL_PWM
BKL_EN
BKL_FAULT
BKL_ISEN1
BKL_ISEN2
BKL_ISEN3
BKL_ISEN4
BKL_ISEN5
BKL_ISEN6

R7741 10K 5% 1/20W MF 201

SMBUS_PCH_CLK
R7753 0 5% 1/20W MF 0201
SMBUS_PCH_DATA
R7757 0 5% 1/20W MF 0201
Addr: 0x58(Wr)/0x59(Rd)

PPVIN_S0SW_LCDBKLT
R7731 200K 1/20W MF 201
R7715 100K 1% 1/20W MF 201
TP7701 TP-P6
PLACE_SIDE=BOTTOM
I_LED=17.1mA

R7704 33 5% 1/20W MF 201
EDP_BKLT_PWM
C7704 33PF 5% 50V C0G 0201

R7755 10K 5% 1/20W MF 201
R7714 21.5K 1% 1/20W MF 201
R7716 90.9K 1% 1/20W MF 201
Fpwm=9.62kHz
see spec for others
I_LED=369/Riset
(EEPROM should set EN_I_RES=1)

XW7710
SM
GND_BKL_SGND
MIN_LINE_WIDTH=0.4 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=0V

PLACEMENT_NOTE=Keep away from noise nodes(E4, A1, A2, B1, B2 pins)

10.2 ohm resistors for current measurement on LED strings.

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
103S0198	3	RES,THIN FLIM,1/16W,10.2 OHM,0.1,0402,SM	R7717,R7718,R7719		BKLT:ENG
103S0198	3	RES,THIN FLIM,1/16W,10.2 OHM,0.1,0402,SM	R7720,R7721,R7722		BKLT:ENG

R7717 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_1
R7718 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_2
R7719 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_3
R7720 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_4
R7721 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_5
R7722 0 5% 1/16W MF-LF 402 — BKLT:PROD — LED_RETURN_6
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.20 mm
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2mm

Keyboard Backlight Driver & Detection

CRITICAL
L7750
10UH-0.58A-0.35OHM
1098AS-SM

PP5V_S0
BYPASS=U7750.1:2:2 MM
C7750 1UF 10% 10V X5R 402-1

KBDLED_SW
MIN_LINE_WIDTH=0.3 MM
MIN_NECK_WIDTH=0.225 MM
SWITCH_NODE=TRUE
DIDT=TRUE

U7750
SPN035007G
MLF
VIN EN FB NC SW OUT GND THRM PAD

SMC_SYS_KBDLED
KBDLED_FB
MIN_LINE_WIDTH=0.25 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=40V
KBDLED_ANODE
MIN_LINE_WIDTH=0.25 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=40V

R7700 4.7 5% 1/16W MF-LF 402
C7755 0.22UF 10% 50V X5R-CERM 0603-1
C7756 0.22UF 10% 50V X5R-CERM 0603-1

Keyboard Backlight Connector

CRITICAL
J7715
FF14A-4C-R11DL-B-3H
F-RT-SM
NC NC
518S0793

SYNC_MASTER=J43 MLB
SYNC_DATE=09/13/2012
PAGE TITLE
LCD/KBD Backlight Driver
Apple Inc.
DRAWING NUMBER <SCH_NUM> SIZE D
REVISION <E4LABEL>
BRANCH <BRANCH>
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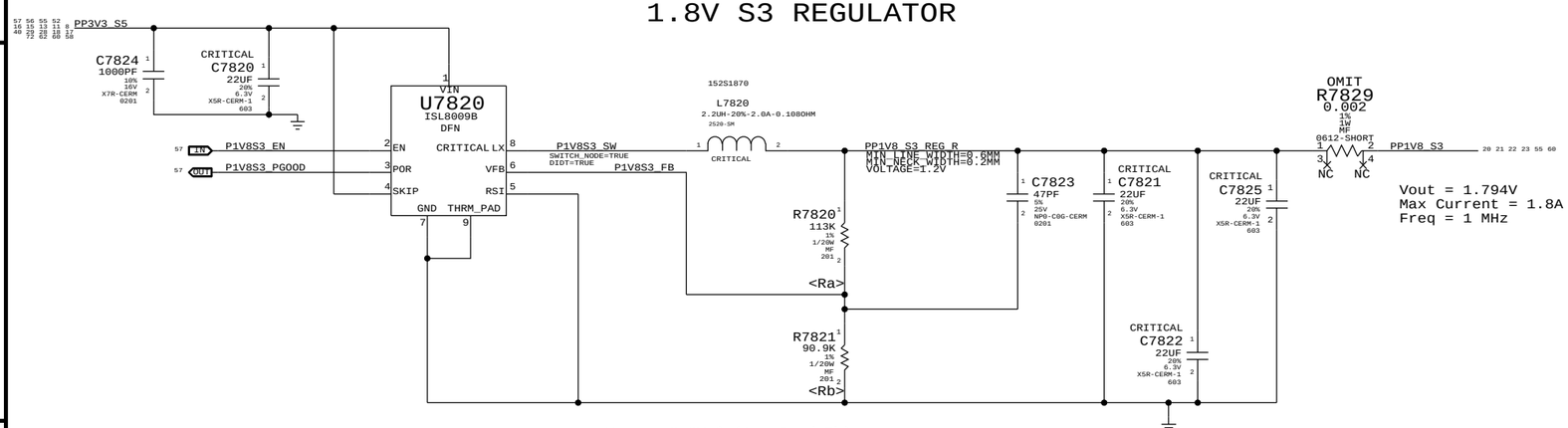
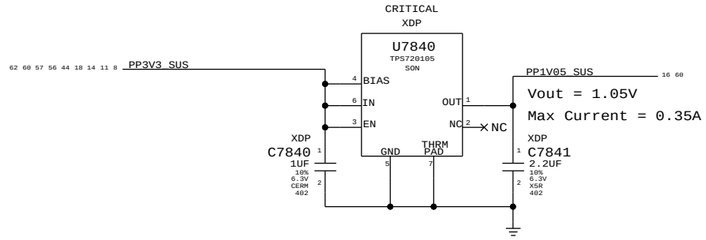
1.8V S3 REGULATOR

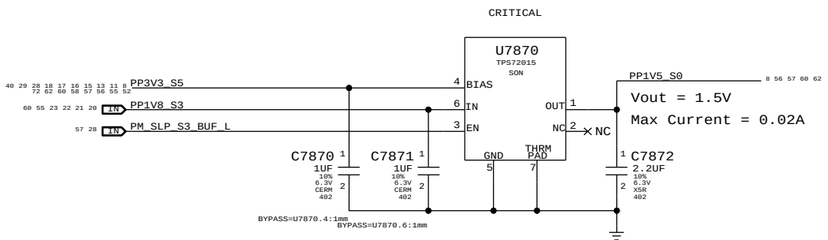


1.05V SUS LDO

Cougar Point requires JTAG pull-ups to be powered at 1.05V when SUS suspend well is active.
Pull-ups (3) must be 51 ohms to support XDP (not required in production).
70mA is required to support pull-ups. Alternative is strong voltage
dividers (200/100) to 3.3V S5, which burns 100mW in all S-states.



1.5V S0 LDO



SYNC_MASTER=J43_MLB SYNC_DATE=10/04/2012

PAGE TITLE: Misc Power Supplies

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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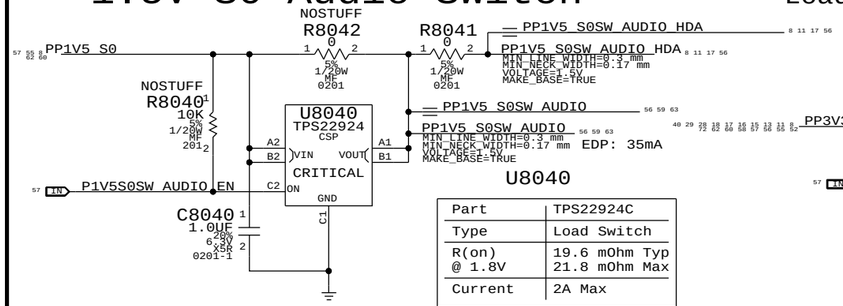
1.5V S0 Audio Switch

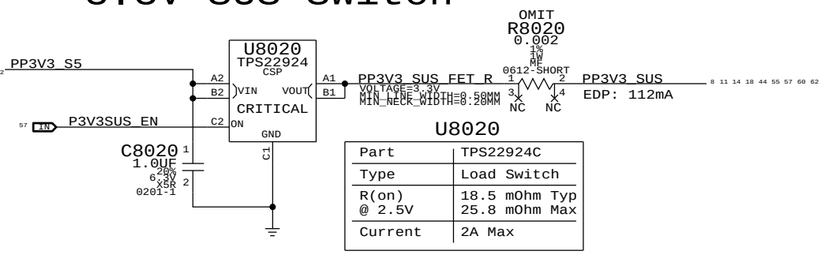
Loading specs per J41/43_PowerBudget_Riviera_rev0.99e



U8040

Part	TPS22924C
Type	Load Switch
R(on) @ 1.8V	19.6 mOhm Typ 21.8 mOhm Max
Current	2A Max

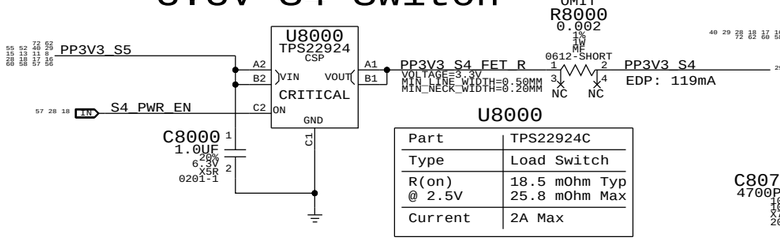
3.3V SUS Switch



U8020

Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max
Current	2A Max

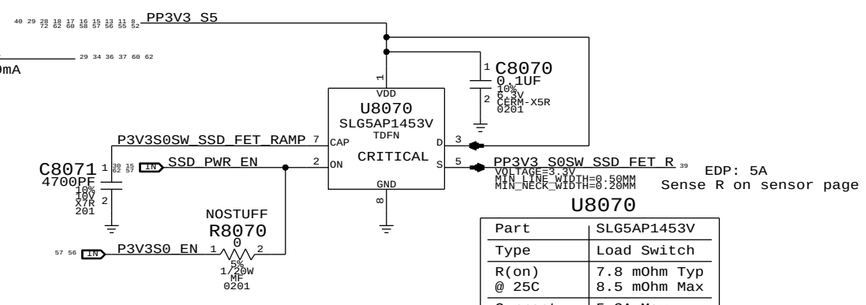
3.3V S4 Switch



U8000

Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max
Current	2A Max

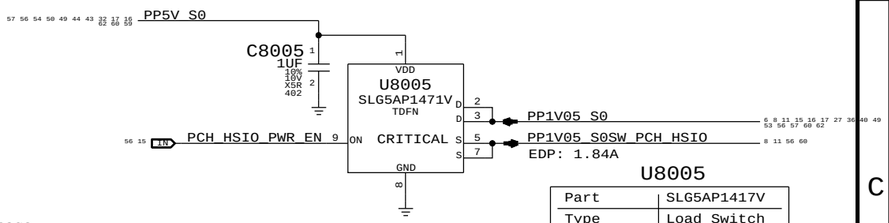
3.3V SSD Switch



U8070

Part	SLG5AP1453V
Type	Load Switch
R(on) @ 25C	7.8 mOhm Typ 8.5 mOhm Max
Current	5.3A Max

1.05V PCH HSIO Switch

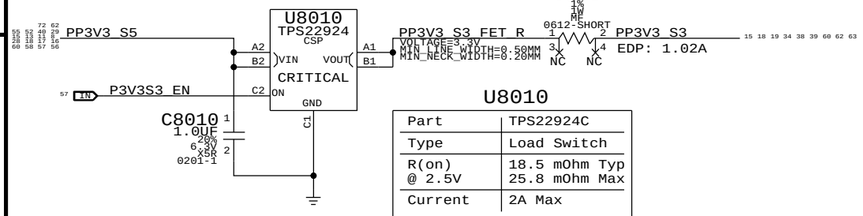


U8005

Part	SLG5AP1417V
Type	Load Switch
R(on) @ 4V Vgs	9.8 mOhm Typ TBD mOhm Max
Current	6A Max

HSIO has turn-on requirement of
<0.1V/uS ramp rate and
<65uS from EN to 95% (1.05V)

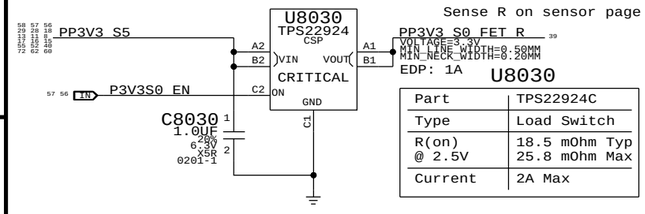
3.3V S3 Switch



U8010

Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max
Current	2A Max

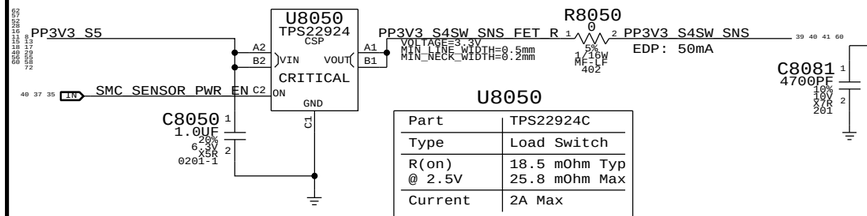
3.3V S0 Switch



U8030

Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max
Current	2A Max

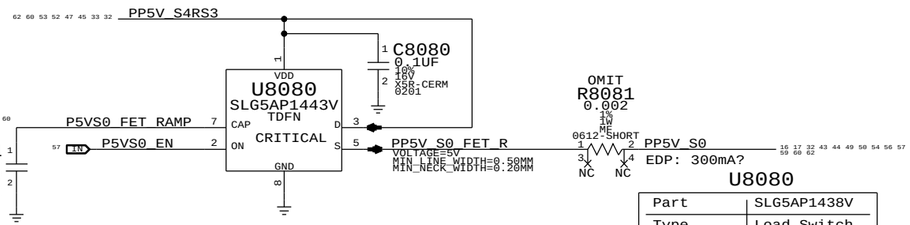
3.3V Sensor Switch



U8050

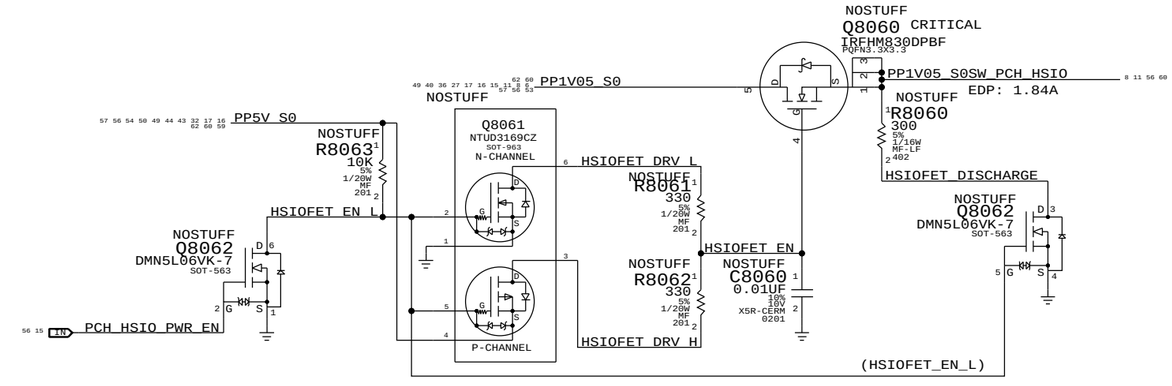
Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.5 mOhm Typ 25.8 mOhm Max
Current	2A Max

5V S0 Switch



U8080

Part	SLG5AP1438V
Type	Load Switch
R(on)	15 mOhm Typ 17 mOhm Max
Current	2.5A



SYNC_MASTER=J43_MLB	SYNC_DATE=10/04/2012
PAGE TITLE	Power FETs
	Apple Inc.
DRAWING NUMBER	<SCH_NUM>
SIZE	D
REVISION	<E4LABEL>
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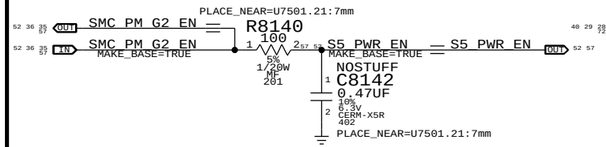
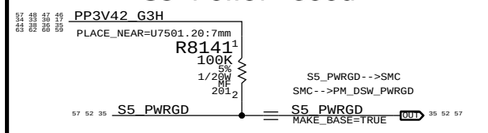
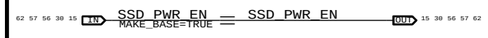
S5 Enables



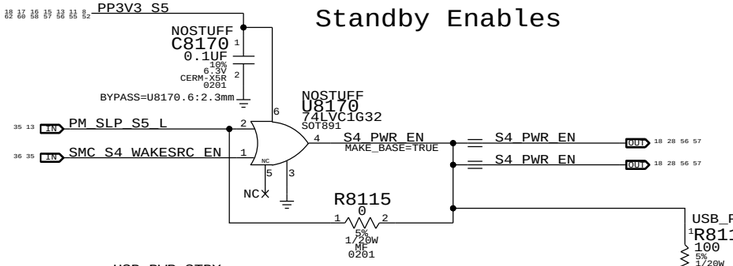
S5 Power Good

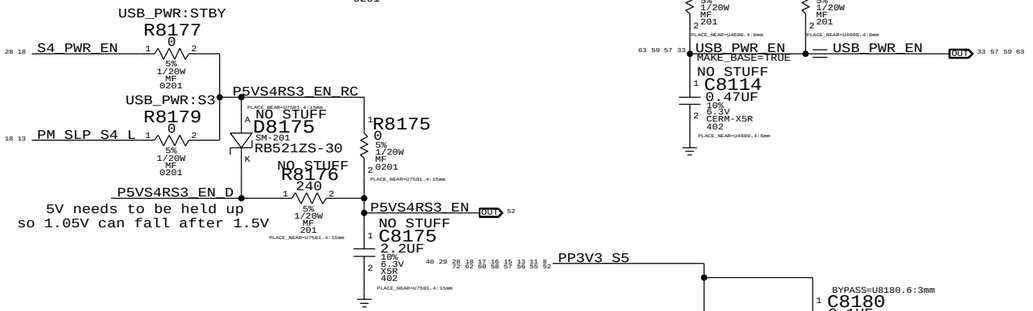


SSD Enable

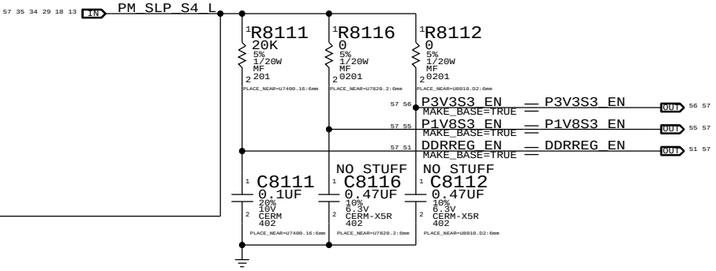


Standby Enables





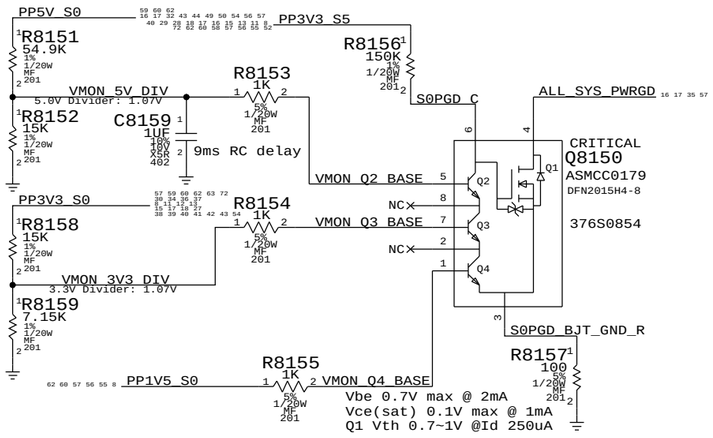
S3 Enables



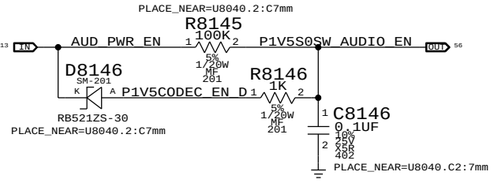
Mobile System Power State Table

State	SMC_ADAPTER_EN	SMC_PM_G2_ENABLE	SMC_S4_WAKESRC_EN	PM_SUS_EN	PM_SLP_S5_L	PM_SLP_S4_L	PM_SLP_S3_L
Run (S0)	X	1	1	1	1	1	1
Sleep (S3AC)	1	1	1	1	1	1	0
Sleep (S3)	0	1	1	1	1	1	0
Deep Sleep (S4AC)	1	1	1	0	0	0	0
Deep Sleep (S4)	0	1	1	0	0	0	0
Deep Sleep (S5AC)	1	1	0	0	0	0	0
Deep Sleep (S5)	0	1	0	0	0	0	0
Battery Off (G3HotAC)	toggle 3Hz	0	0	0	0	0	0
Battery Off (G3Hot)	1	0	0	0	0	0	0

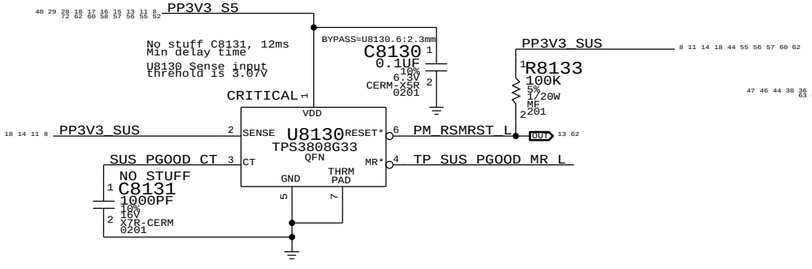
S0 Rail PGOOD (BJT Version)



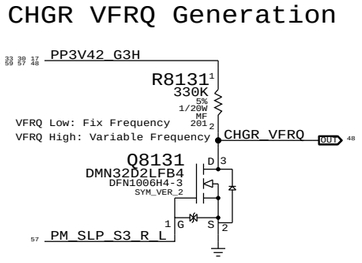
1.5V Codec Enable



3.3V SUS Detect



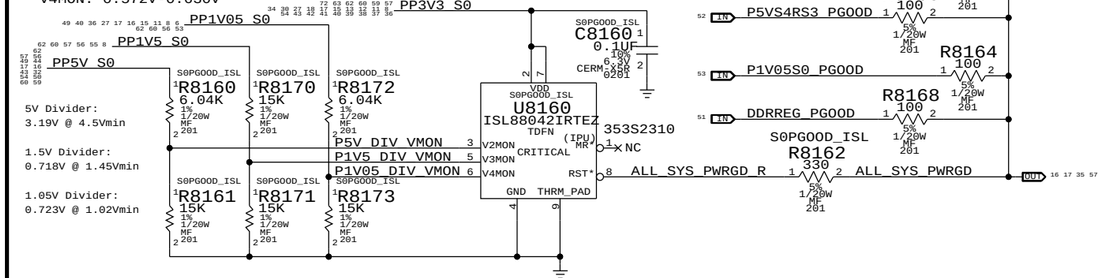
CHGR VFRQ Generation



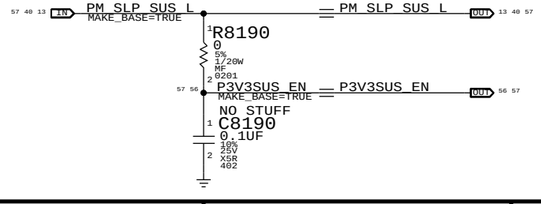
S0 Rail PGOOD Circuitry

(ISL version used for development)

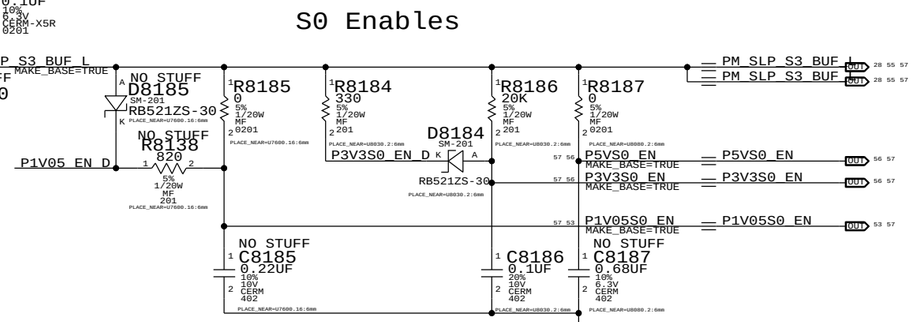
Thresholds:
VDD: 2.734V-3.010V
V2MON: 2.815V-3.099V
V3MON: 0.572V-0.630V
V4MON: 0.572V-0.630V



SUS Enables



S0 Enables



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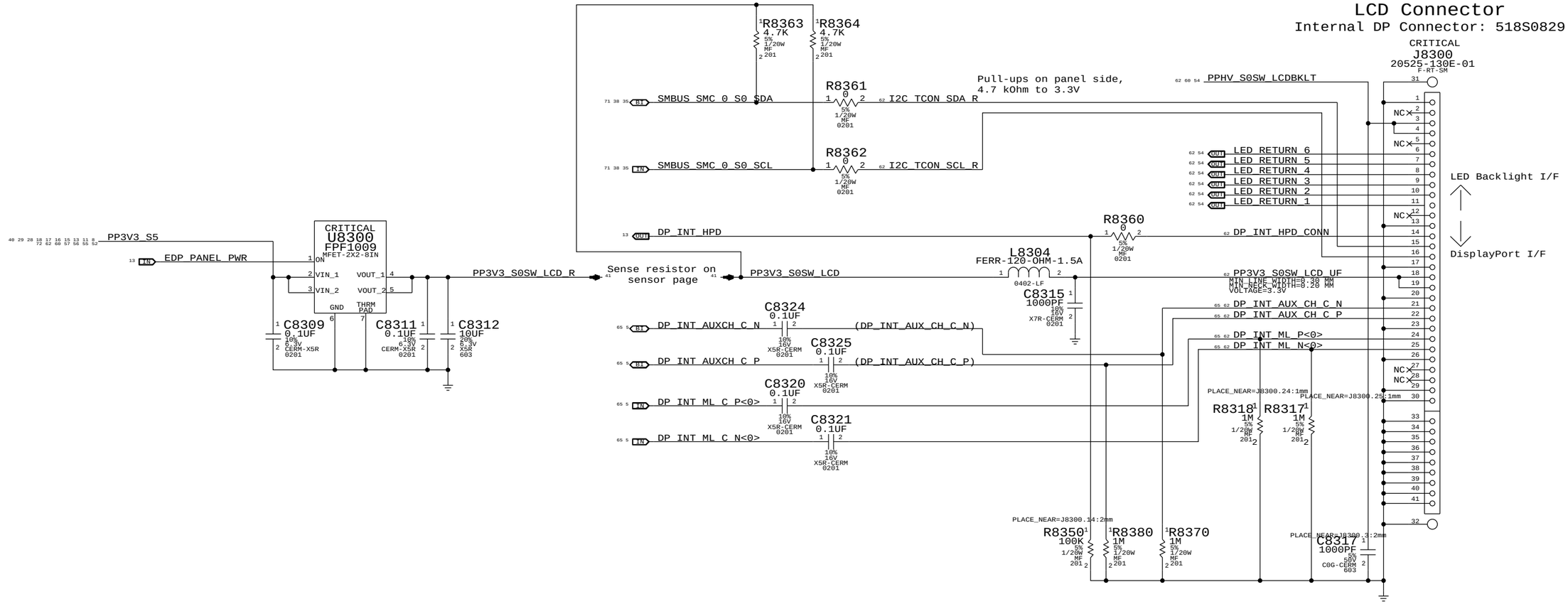
	SHEET 57 OF 73



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Apple Inc.

DRAWING NUMBER <SCH_NUM> SIZE D

REVISION <E4LABEL>

BRANCH <BRANCH>

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LIO Connector

516S1036 (HIROSE 3.0mm RCPT)

CRITICAL

J9500

DF40CG3.0-48DS-0.4V

F-ST-SM

PP5V_S0

NOSTUFF R9500 0 1/20W 5% MF 0201 — VOLTAGE=5V, MIN_LINE_WIDTH=0.1MM, MIN_NECK_WIDTH=0.1MM

AUD_PWR_EN

PP5V_S0_ALT_AUD_LDO_EN

SPKRAMP_SHDN_L

PP1V5_S0SW_AUDIO

PP3V3_S0

C9520 0.1UF 10% 16V X5R-CERM 0201 — BYPASS=J9500:1.5mm

C9500 0.1UF 10% 16V X5R-CERM 0201 — BYPASS=J9500:1.5mm

SPKRAMP_INR_N

SPKRAMP_INR_P

PP3V42_G3H

SMBUS_SMC_2_S3_SCL

SMBUS_SMC_2_S3_SDA

C9510 0.1UF 10% 16V X5R-CERM 0201 — BYPASS=J9500:1.5mm

SYS_ONEWIRE

SMC_BC_ACOK

XDP_USB_EXTB_OC_L

USB_PWR_EN

FINSTACKSNS_ALERT_L

GND_VOID=TRUE

R9510 0 1/20W 5% MF 0201 — NOSTUFF C9531 15PF 5% 25V NP0-CERM 0201

USB3_EXTB_D2R_N

USB3_EXTB_D2R_P

R9520 0 1/20W 5% MF 0201 — NOSTUFF C9532 15PF 5% 25V NP0-CERM 0201

USB3_EXTB_D2R_C_N — C9521 0.1UF 10% 16V X5R-CERM 0201

USB3_EXTB_D2R_C_P — C9522 0.1UF 10% 16V X5R-CERM 0201

USB3_EXTB_D2R_RC_N

USB3_EXTB_D2R_RC_P

HDA_SYNC

HDA_RST_L

USB_EXTB_N

USB_EXTB_P

HDA_SDOUT

HDA_SDIN0

HDA_BIT_CLK

USB3_EXTB_R2D_N

USB3_EXTB_R2D_P

NOSTUFF C9550 10PF 5% 50V C0G-CERM 0402

CRITICAL D9511 ESD0P2RF-02LS TSSLP-2-1

CRITICAL D9510 ESD0P2RF-02LS TSSLP-2-1

CRITICAL D9520 ESD0P2RF-02LS TSSLP-2-1

CRITICAL D9521 ESD0P2RF-02LS TSSLP-2-1

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Apple Inc.

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REVISION: <E4LABEL>

BRANCH: <BRANCH>

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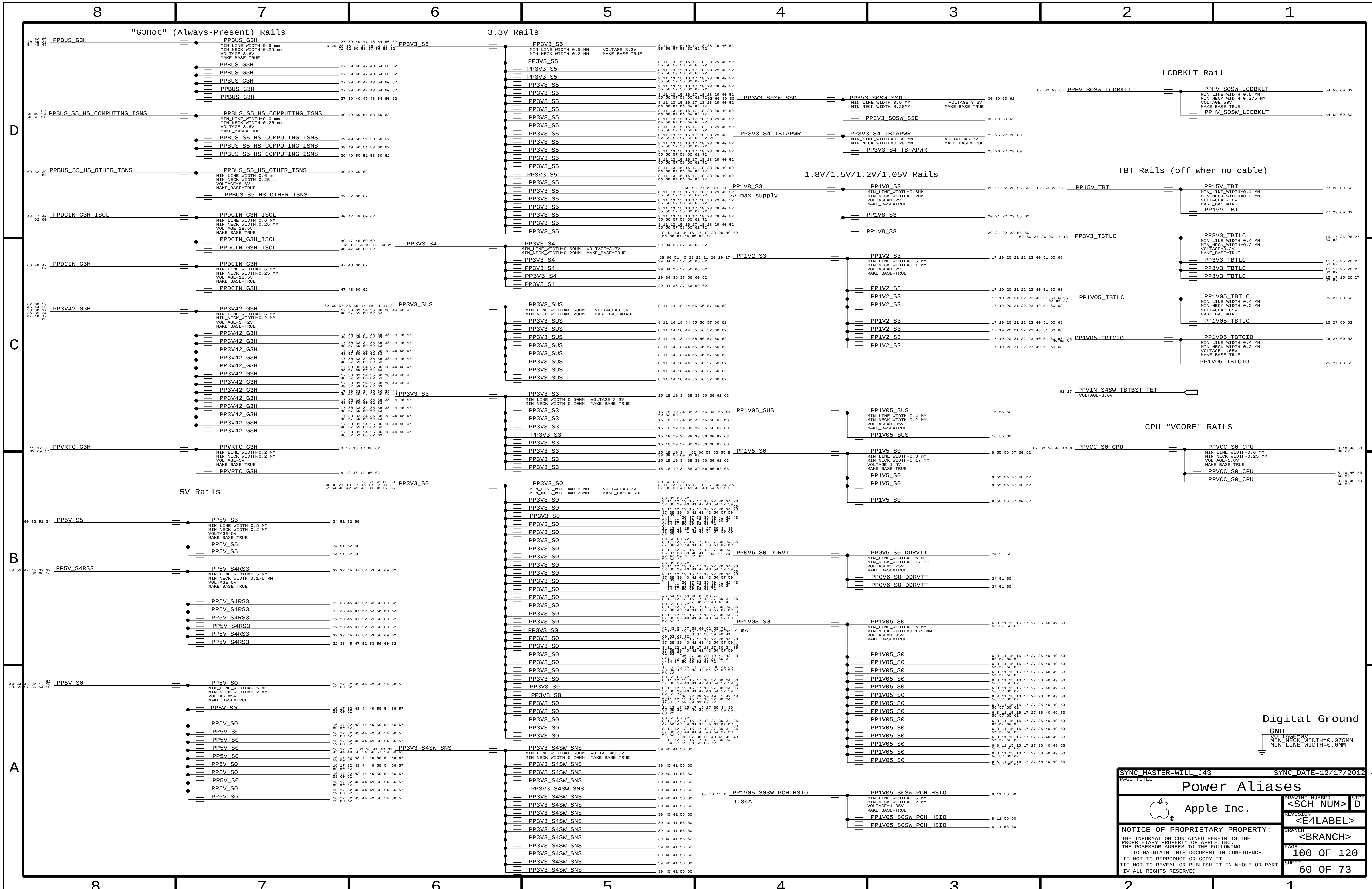

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Power Aliases

Apple Inc.

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REVISION <E4LABEL>

BRANCH <BRANCH>

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68 61 24 20	MEM_A_CAA<6>		TRUE	MEM_A_CAA<6>	7 20 24 61 68
	=MEM_A_A<11>		TRUE	MEM_A_CAA<7>	20 24 68
	=MEM_A_A<15>		TRUE	MEM_A_CAA<8>	20 24 68
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23	=MEM_B_DQ<45>		TRUE	MEM_B_DQ<37>	7 68
23	=MEM_B_DQ<46>		TRUE	MEM_B_DQ<38>	7 68
23	=MEM_B_DQ<47>		TRUE	MEM_B_DQ<35>	7 68
23	=MEM_B_DQ<48>		TRUE	MEM_B_DQ<57>	7 68
23	=MEM_B_DQ<49>		TRUE	MEM_B_DQ<56>	7 68
23	=MEM_B_DQ<50>		TRUE	MEM_B_DQ<60>	7 68
23	=MEM_B_DQ<51>		TRUE	MEM_B_DQ<59>	7 68
23	=MEM_B_DQ<52>		TRUE	MEM_B_DQ<63>	7 68
23	=MEM_B_DQ<53>		TRUE	MEM_B_DQ<62>	7 68
23	=MEM_B_DQ<54>		TRUE	MEM_B_DQ<58>	7 68
23	=MEM_B_DQ<55>		TRUE	MEM_B_DQ<61>	7 68
23	=MEM_B_DQ<56>		TRUE	MEM_B_DQ<49>	7 68
23	=MEM_B_DQ<57>		TRUE	MEM_B_DQ<51>	7 68
23	=MEM_B_DQ<58>		TRUE	MEM_B_DQ<48>	7 68
23	=MEM_B_DQ<59>		TRUE	MEM_B_DQ<53>	7 68
23	=MEM_B_DQ<60>		TRUE	MEM_B_DQ<52>	7 68
23	=MEM_B_DQ<61>		TRUE	MEM_B_DQ<55>	7 68
23	=MEM_B_DQ<62>		TRUE	MEM_B_DQ<50>	7 68
23	=MEM_B_DQ<63>		TRUE	MEM_B_DQ<54>	7 68
22	=MEM_B_DQS_P<0>		TRUE	MEM_B_DQS_P<1>	7 68
22	=MEM_B_DQS_N<0>		TRUE	MEM_B_DQS_N<1>	7 68
22	=MEM_B_DQS_P<1>		TRUE	MEM_B_DQS_P<0>	7 68
22	=MEM_B_DQS_N<1>		TRUE	MEM_B_DQS_N<0>	7 68
22	=MEM_B_DQS_P<2>		TRUE	MEM_B_DQS_P<3>	7 68
22	=MEM_B_DQS_N<2>		TRUE	MEM_B_DQS_N<3>	7 68
22	=MEM_B_DQS_P<3>		TRUE	MEM_B_DQS_P<2>	7 68
22	=MEM_B_DQS_N<3>		TRUE	MEM_B_DQS_N<2>	7 68
23	=MEM_B_DQS_P<4>		TRUE	MEM_B_DQS_P<5>	7 68
23	=MEM_B_DQS_N<4>		TRUE	MEM_B_DQS_N<5>	7 68
23	=MEM_B_DQS_P<5>		TRUE	MEM_B_DQS_P<4>	7 68
23	=MEM_B_DQS_N<5>		TRUE	MEM_B_DQS_N<4>	7 68
23	=MEM_B_DQS_P<6>		TRUE	MEM_B_DQS_P<7>	7 68
23	=MEM_B_DQS_N<6>		TRUE	MEM_B_DQS_N<7>	7 68
68 61 23 7	MEM_B_DQS_P<6>		TRUE	MEM_B_DQS_P<6>	7 23 61 68
68 61 23 7	MEM_B_DQS_N<6>		TRUE	MEM_B_DQS_N<6>	7 23 61 68

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: Signal Aliases

Apple Inc.

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REVISION: <E4LABEL>

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Functional Test Points

J3501: AirPort / BT Connector

FUNC_TEST

TRUE	PP3V3_WLAN (Need 6 TPs)	29 35 36 37 39
TRUE	WIFI_EVENT_L	29 35 36
TRUE	PCIE_AP_R2D_N	29 67
TRUE	PCIE_AP_R2D_P	29 67
TRUE	PCIE_CLK100M_AP_N	12 29 67
TRUE	PCIE_CLK100M_AP_P	12 29 67
TRUE	PCIE_AP_D2R_P	14 29 67
TRUE	PCIE_AP_D2R_N	14 29 67
TRUE	PCIE_WAKE_L	13 29 31
TRUE	AP_RESET_CONN_L	29
TRUE	AP_CLKREQ_O_L	29
TRUE	USB_BT_CONN_P	29 66
TRUE	USB_BT_CONN_N	29 66
TRUE	PP3V3_S4	29 34 36 37 56 60 62

(Need to add 8 GND TPs)

J3700: SSD Connector

FUNC_TEST

TRUE	PP3V3_S0SW_SSD_FLT (Need 5 TPs)	30
TRUE	PCIE_SSD_R2D_N<3..0>	30 65
TRUE	PCIE_SSD_R2D_P<3..0>	30 65
TRUE	PP3V3_S0	8 11 12 13 15 16 17 18 27 30 34 36 37 38 39 56 60 62 63 72
TRUE	SSD_RESET_CONN_L	30
TRUE	SSD_CLKREQ_CONN_L	30
TRUE	SMC_OOB1_R2D_CONN_L	30
TRUE	SMC_OOB1_D2R_CONN_L	30
TRUE	SSD_PCIE_SEL_L	16 30
TRUE	SSD_DEVSLP	15 30
TRUE	SSD_PWRFAIL_WARN_L	
TRUE	SSD_PWR_EN	15 30 56 57
TRUE	PCIE_SSD_D2R_N<3..0>	12 30 65
TRUE	PCIE_SSD_D2R_P<3..0>	12 30 65
TRUE	PCIE_CLK100M_SSD_N	12 30 65
TRUE	PCIE_CLK100M_SSD_P	12 30 65

(Need to add 6 GND TPs)

J4002: Camera Connector

FUNC_TEST

TRUE	MIPI_CLK_CONN_N	32 70
TRUE	MIPI_CLK_CONN_P	32 70
TRUE	CAM_SENSOR_WAKE_L_CONN	32
TRUE	MIPI_DATA_CONN_N	32 70
TRUE	MIPI_DATA_CONN_P	32 70
TRUE	SMBUS_SMC_1_S0_SDA	14 32 35 38 41 42 67 71
TRUE	SMBUS_SMC_1_S0_SCL	14 32 35 38 41 42 67 71
TRUE	I2C_CAM_SCK	31 32
TRUE	I2C_CAM_SDA	31 32
TRUE	PP5V_S3RS0_ALSCAM_F (Need TBD TPs)	32

(Need to add TBD GND TPs)

J6000: Fan Connector

FUNC_TEST

TRUE	PP5V_S0	16 17 32 43 44 49 50 54 56 57 59 60 62
TRUE	FAN_RT_TACH	43
TRUE	FAN_RT_PWM	43

(Need to add 1 GND TP)

J4800: IPD Flex Connector

FUNC_TEST

TRUE	SMC_LID	34 35 36 46
TRUE	TPAD_SPI_MISO_R	34
TRUE	USB_TPAD_P	14 34 66
TRUE	USB_TPAD_N	14 34 66
TRUE	TPAD_SPI_CLK_R	34
TRUE	TPAD_WAKE_L	34
TRUE	TPAD_SPI_MOSI_R	34
TRUE	PP3V3_S4_IPD	34
TRUE	TPAD_SPI_CS_R_L	34
TRUE	TPAD_SPI_IF_EN_CONN	34
TRUE	TPAD_SPI_INT_S4_WAKE_L_CONN	34
TRUE	PP5V_S4_IPD	34
TRUE	TPAD_USB_IF_EN_CONN	34
TRUE	SMBUS_SMC_3_SDA	34 35 38 42 71
TRUE	SMBUS_SMC_3_SCL	34 35 38 42 71
TRUE	SMC_LSOC_RST_L	34 36
TRUE	PP3V42_G3H	17 30 33 34 35 36 38 44 46 47 48 57 59 60 62 63
TRUE	SMC_ONOFF_L	34 35 36

(Need to add 5 GND TPs)

J7000: DC-In Connector

FUNC_TEST

TRUE	PPDCIN_G3H (Need 4 TPs)	2 48 60 62
TRUE	PP5V_S4RS3 (Need 3 TPs)	32 33 45 47 52 53 56 60

(Need to add 5 GND TPs)

J6404: Speaker Connector

FUNC_TEST

TRUE	SPKRAMP_ROUT_P	45 72
TRUE	SPKRAMP_ROUT_N	45 72

(Need to add 3 GND TPs)

J6950: Battery Connector

FUNC_TEST

TRUE	PPVBAT_G3H_CONN (Need 4 TPs)	46 48
TRUE	SMBUS_SMC_5_G3_SCL	35 38 46 48 71
TRUE	SMBUS_SMC_5_G3_SDA	35 38 46 48 71
TRUE	SYS_DETECT_L	46

(Need to add 4 GND TPs near J7050 and 1 for shield)

J8300: Internal DP Connector

FUNC_TEST

TRUE	PPHV_S0SW_LCDBKLT (Need 2 TPs)	54 58 60
TRUE	LED_RETURN_6	54 58
TRUE	LED_RETURN_5	54 58
TRUE	LED_RETURN_4	54 58
TRUE	LED_RETURN_3	54 58
TRUE	LED_RETURN_2	54 58
TRUE	LED_RETURN_1	54 58
TRUE	DP_INT_HPD_CONN	58
TRUE	I2C_TCON_SDA_R	58
TRUE	I2C_TCON_SCL_R	58
TRUE	PP3V3_S0SW_LCD_UF (Need 2 TPs)	58
TRUE	DP_INT_AUX_CH_C_N	58 65
TRUE	DP_INT_AUX_CH_C_P	58 65
TRUE	DP_INT_ML_P<0>	58 65
TRUE	DP_INT_ML_N<0>	58 65

(Need to add 5 GND TPs)

J7715: KB BKLT Connector

FUNC_TEST

TRUE	KBDLED_ANODE	54
TRUE	KBDLED_FB	54

(Need to add 2 GND TPs)

J1800: XDP Connector

(Only a subset are needed for FCT HVM test fixture)

FUNC_TEST

TRUE	XDP_CPU_TCK	6 16 65
TRUE	XDP_PCH_TCK	12 16 67
TRUE	XDP_CPU_TDI	6 16 65
TRUE	XDP_CPU_TDO	6 16 65
TRUE	XDP_CPUPCH_TRST_L	6 12 16 65
TRUE	XDP_CPU_TMS	6 16 65
TRUE	XDP_PCH_TMS	12 16 67
TRUE	XDP_PCH_TDI	12 16 67
TRUE	XDP_PCH_TDO	12 16 67
TRUE	XDP_CPU_PREQ_L	6 16 65
TRUE	XDP_CPU_PRDY_L	6 16 65
TRUE	XDP_CPU_VCCST_PWRGD	16
TRUE	PM_RSMRST_L	13 57
TRUE	XDP_SYS_PWROK	16
TRUE	PM_SYSRST_L	13 17 35
TRUE	CPU_CFG<3>	6 16 65
TRUE	PP1V05_S0	6 8 11 15 16 17 27 36 40 49 53 56 57 60 62

(Need to add 2 GND TPs)

J6100: LPC+SPI Connector

FUNC_TEST

TRUE	PP3V42_G3H	62 63
TRUE	PP5V_S0	17 30 33 34 35 36 38 44 46 47 48 49 50 54 56 57 59 60 62 63
TRUE	LPC_CLK24M_LPCPLUS	17 44 67
TRUE	LPC_AD<3..0>	14 35 44 67
TRUE	SPI_ALT_MOSI	44
TRUE	XDP_LPCPLUS_GPIO	15 16 44
TRUE	LPCPLUS_RESET_L	18 44 67
TRUE	SMC_TDO	35 36 44
TRUE	TP_SMC_TRST_L	44
TRUE	TP_SMC_MD1	44
TRUE	SMC_TX_L	35 36 44
TRUE	SPI_ALT_MISO	44
TRUE	LPC_FRAME_L	14 35 44 67
TRUE	SPIROM_USE_MLB	15 44
TRUE	PM_CLKRUN_L	13 35 44
TRUE	SPI_ALT_CLK	44
TRUE	SPI_ALT_CS_L	44
TRUE	LPC_SERIRQ	15 35 44
TRUE	LPC_PWRDWN_L	13 35 44
TRUE	SMC_TDI	35 36 44
TRUE	SMC_TCK	35 36 44
TRUE	SMC_RESET_L	35 36 44 48
TRUE	SMC_ROMBOOT	36 44
TRUE	SMC_RX_L	35 36 44
TRUE	SMC_TMS	35 36 44

(Need to add 6 GND TPs)

TRUE	GND	

Misc Voltages & Control Signals

FUNC_TEST

TRUE	PPBUS_G3H	27 39 40 47 48 54 60
TRUE	PPVIN_S4SW_TBTBST_FET	27 60
TRUE	PPBUS_S5_HS_COMPUTING_ISNS	39 49 50 51 53 60
TRUE	PPDCIN_G3H	47 48 60 62
TRUE	PP3V42_G3H	17 30 33 34 35 36 38 44 46 47 48 57 59 60 62 63
TRUE	PPVRTC_G3H	8 12 13 17 60
TRUE	PP3V3_S5	8 11 13 15 16 17 18 28 29 40 52 56 59 67 68 69 72
TRUE	PP3V3_SUS	8 11 14 18 44 55 56 57 60
TRUE	PP3V3_S3	15 18 19 34 38 39 56 60 63
TRUE	PP3V3_S0	60 62 63 72
TRUE	PP3V3_S0SW_SSD	8 11 12 13 15 16 17 18 27 30 34 36 37 38 39 40 41 42 43 54 57 59
TRUE	PP1V5_S0	30 39 60
TRUE	PP1V05_S0	8 55 56 57 60
TRUE	PP1V05_S0	6 8 11 15 16 17 27 36 40 49 53 56 57 60 62
TRUE	PP15V_TBT	27 28 60
TRUE	PP3V3_TBTLC	15 17 25 26 27 60
TRUE	PP1V05_TBTLC	26 27 60
TRUE	PPVCC_S0_CPU	8 10 40 50 60
TRUE	PP1V05_TBTCIO	26 27 60
TRUE	PPBUS_S5_HS_OTHER_ISNS	39 52 60
TRUE	PPDCIN_G3H_ISOL	40 47 48 60
TRUE	PP3V3_S4	29 34 36 37 56 60 62

(Need to add 27 GND TPs)

NO_TEST Nets

NO_TEST

MAKE_BASE					
62	NC_PCIE_CLK100M_SDP	TRUE	TRUE	NC_PCIE_CLK100M_SDP	62
62	NC_PCIE_CLK100M_SDN	TRUE	TRUE	NC_PCIE_CLK100M_SDN	62
62 12	NC_PCIE_CLK100M_FWP	TRUE	TRUE	NC_PCIE_CLK100M_FWP	12 62
62 12	NC_PCIE_CLK100M_FWN	TRUE	TRUE	NC_PCIE_CLK100M_FWN	12 62
62 14	NC_PCIE_FW_D2RP	TRUE	TRUE	NC_PCIE_FW_D2RP	14 62
62 14	NC_PCIE_FW_D2RN	TRUE	TRUE	NC_PCIE_FW_D2RN	14 62
62 14	NC_PCIE_FW_R2D_CP	TRUE	TRUE	NC_PCIE_FW_R2D_CP	14 62
62 14	NC_PCIE_FW_R2D_CN	TRUE	TRUE	NC_PCIE_FW_R2D_CN	14 62
62 14	NC_USB_IRP	TRUE	TRUE	NC_USB_IRP	14 62
62 14	NC_USB_IRN	TRUE	TRUE	NC_USB_IRN	14 62
62 14	NC_USB_CAMERAP	TRUE	TRUE	NC_USB_CAMERAP	14 62
62 14	NC_USB_CAMERAN	TRUE	TRUE	NC_USB_CAMERAN	14 62
62 14	NC_USB_SDP	TRUE	TRUE	NC_USB_SDP	14 62
62 14	NC_USB_SDN	TRUE	TRUE	NC_USB_SDN	14 62
65	DP_INT_ML_C_P<3..1>	TRUE	TRUE	NC_INT_ML_CP<3..1>	5
65	DP_INT_ML_C_N<3..1>	TRUE	TRUE	NC_INT_ML_CN<3..1>	5
62 12	NC_HDA_SDIN1	TRUE	TRUE	NC_HDA_SDIN1	12 62
62 13	NC_PCI_PME_L	TRUE	TRUE	NC_PCI_PME_L	13 62
62 14	NC_CLINK_CLK	TRUE	TRUE	NC_CLINK_CLK	14 62
62 14	NC_CLINK_DATA	TRUE	TRUE	NC_CLINK_DATA	14 62
62 14	NC_CLINK_RESET_L	TRUE	TRUE	NC_CLINK_RESET_L	14 62

CPU/PCH

62 35	NC_SMC_SYS_LED	TRUE	TRUE	NC_SMC_SYS_LED	35 62
62	NC_IR_RX_OUT_RC	TRUE	TRUE	NC_IR_RX_OUT_RC	62
62	NC_USB_SMCP	TRUE	TRUE	NC_USB_SMCP	62
62	NC_USB_SMCN	TRUE	TRUE	NC_USB_SMCN	62
62 35	NC_SMC_GFX_OVERTEMP	TRUE	TRUE	NC_SMC_GFX_OVERTEMP	35 62
62 35	NC_SMC_GFX_THROTTLE_L	TRUE	TRUE	NC_SMC_GFX_THROTTLE_L	35 62
62 35	NC_SMC_FAN_1_CTL	TRUE	TRUE	NC_SMC_FAN_1_CTL	35 62
62 35	NC_SMC_FAN_1_TACH	TRUE	TRUE	NC_SMC_FAN_1_TACH	35 62
62 35	NC_SMC_FAN_5_CTL	TRUE	TRUE	NC_SMC_FAN_5_CTL	35 62
62	NC_ENET_ASF_GPIO	TRUE	TRUE	NC_ENET_ASF_GPIO	62
62	NC_SMC_MPM5_LED_PWR	TRUE	TRUE	NC_SMC_MPM5_LED_PWR	62
62	NC_SMC_MPM5_LED_CHG	TRUE	TRUE	NC_SMC_MPM5_LED_CHG	62
62 35	NC_SMC_T25_EN_L	TRUE	TRUE	NC_SMC_T25_EN_L	35 62
62 35	NC_SMC_DP_HPD_L	TRUE	TRUE	NC_SMC_DP_HPD_L	35 62
62 35	NC_SMBUS_SMC_4_ASF_SCL	TRUE	TRUE	NC_SMBUS_SMC_4_ASF_SCL	35 62
62 35	NC_SMBUS_SMC_4_ASF_SDA	TRUE	TRUE	NC_SMBUS_SMC_4_ASF_SDA	35 62
62 35	NC_BDV_BKL_PWM	TRUE	TRUE	NC_BDV_BKL_PWM	35 62

SMC

69	TBT_B_R2D_C_P<1..0>	TRUE	TRUE	NC_TBT_B_R2D_CP<1..0>	25
69	TBT_B_R2D_C_N<1..0>	TRUE	TRUE	NC_TBT_B_R2D_CN<1..0>	25
69	TBT_B_D2R_P<1..0>	TRUE	TRUE	NC_TBT_B_D2RP<1..0>	25
69	TBT_B_D2R_N<1..0>	TRUE	TRUE	NC_TBT_B_D2RN<1..0>	25
62 25	NC_TBT_B_LSTX	TRUE	TRUE	NC_TBT_B_LSTX	25 62
69 62	NC_DP_TBTPB_ML_CP<3..1:2>	TRUE	TRUE	NC_DP_TBTPB_ML_CP<3..1:2>	62 69
69 62	NC_DP_TBTPB_ML_CN<3..1:2>	TRUE	TRUE	NC_DP_TBTPB_ML_CN<3..1:2>	62 69
69 62 25	NC_DP_TBTPB_AUXCH_CP	TRUE	TRUE	NC_DP_TBTPB_AUXCH_CP	25 62 69
69 62 25	NC_DP_TBTPB_AUXCH_CN	TRUE	TRUE	NC_DP_TBTPB_AUXCH_CN	25 62 69
25	TP_DP_TBTSRC_ML_CP<3>	TRUE	TRUE	NC_DP_TBTSRC_ML_CP<3>	
25	TP_DP_TBTSRC_ML_CN<3>	TRUE	TRUE	NC_DP_TBTSRC_ML_CN<3>	
25	TP_DP_TBTSRC_ML_CP<2>	TRUE	TRUE	NC_DP_TBTSRC_ML_CP<2>	
25	TP_DP_TBTSRC_ML_CN<2>	TRUE	TRUE	NC_DP_TBTSRC_ML_CN<2>	
62 25	NC_DP_TBTSRC_ML_CP<1>	TRUE	TRUE	NC_DP_TBTSRC_ML_CP<1>	25 62
62 25	NC_DP_TBTSRC_ML_CN<1>	TRUE	TRUE	NC_DP_TBTSRC_ML_CN<1>	25 62
25	TP_DP_TBTSRC_ML_CP<0>	TRUE	TRUE	NC_DP_TBTSRC_ML_CP<0>	
25	TP_DP_TBTSRC_ML_CN<0>	TRUE	TRUE	NC_DP_TBTSRC_ML_CN<0>	
62 25	NC_DP_TBTSRC_AUXCH_CP	TRUE	TRUE	NC_DP_TBTSRC_AUXCH_CP	25 62
62 25	NC_DP_TBTSRC_AUXCH_CN	TRUE	TRUE	NC_DP_TBTSRC_AUXCH_CN	25 62

TBT

Unused nets with offpage

(Nets with offpages not used on this project)

HDD_PWR_EN	15
WOL_EN	14
BT_PWRRST_L	15
HDMITBTMUX_FLAG_L	15
FW_PWR_EN	15
FW_PME_L	15
ENET_MEDIA_SENSE	15
LCD_PSR_EN	15
LCD_IRQ_L	15
ODD_PWR_EN_L	13
ENET_LOW_PWR	13
AUD_IP_PERIPHERAL_DET	13
AUD_I2C_INT_L	13
AUD_IPHS_SWITCH_EN	13

SYNC_MASTER=WILL_J43 SYNC_DATE=12/17/2012

PAGE TITLE: Func Test / No Test

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Functional Test Points

J9500: LIO Connector

FUNC_TEST

TRUE	AUD_PWR_EN	13 57 59
TRUE	PP5V_S0_ALT_AUD_LDO_EN	59
TRUE	SPKRAMP_SHDN_L	45 59
TRUE	PP1V5_S0SW_AUDIO	56 59
TRUE	PP3V3_S0	60 62 72
TRUE	SPKRAMP_INR_N	5 11 12 13 15 17 18 27 30 34 36 37 38 39 40 41 42 43 54 57 59
TRUE	SPKRAMP_INR_P	45 59 72
TRUE	USB3_EXTB_D2R_RC_N	59 63 66
TRUE	USB3_EXTB_D2R_RC_P	59 63 66
TRUE	USB_EXTB_N	14 59 66
TRUE	USB_EXTB_P	14 59 66
TRUE	USB3_EXTB_R2D_N	59 63 66
TRUE	USB3_EXTB_R2D_P	59 63 66
TRUE	PP3V42_G3H	17 30 33 34 35 36 38 44 46 47 48 57 59 60 62 63
TRUE	SMBUS_SMC_2_S3_SCL	35 38 59 71
TRUE	SMBUS_SMC_2_S3_SDA	35 38 59 71
TRUE	SYS_ONEWIRE	35 59
TRUE	SMC_BC_ACOK	35 36 48 59
TRUE	XDP_USB_EXTB_OC_L	14 16 59
TRUE	USB_PWR_EN	33 57 59
TRUE	FINSTACKSNS_ALERT_L	37 59

TRUE	HDA_SYNC	12 59 67
TRUE	HDA_RST_L	12 59 67
TRUE	HDA_SDOUT	12 59 67
TRUE	HDA_SDIN0	12 59 67
TRUE	HDA_BIT_CLK	12 59 67

(Need to add 5 GND TPs)

J6955: HALL EFFECT Connector

FUNC_TEST

TRUE	SMC_LID_R	46
TRUE	PP3V42_G3H	17 30 33 34 35 36 38 44 46 47 48 57 59 60 62 63

Power Aliases

63 62 60 56 39 38 34 19 18 15 PP3V3_S3 = PP3V3_S3 15 18 19 34 38 39 56 60 62 63

NO_TEST Nets

NO_TEST MAKE_BASE

66 63 14	NC_USB3RPCIE_SD_D2RP	TRUE	TRUE	NC_USB3RPCIE_SD_D2RP	14 63 66	
66 63 14	NC_USB3RPCIE_SD_D2RN	TRUE	TRUE	NC_USB3RPCIE_SD_D2RN	14 63 66	
66 63 14	NC_USB3RPCIE_SD_R2D_CP	TRUE	TRUE	NC_USB3RPCIE_SD_R2D_CP	14 63 66	CPU/PCH
66 63 14	NC_USB3RPCIE_SD_R2D_CN	TRUE	TRUE	NC_USB3RPCIE_SD_R2D_CN	14 63 66	
63 37 35	NC_SMC_ADC16	TRUE	TRUE	NC_SMC_ADC16	35 63 37	SMC

Bead Probes

66 59 14	USB3_EXTB_D2R_N	1	SM BEAD-PROBE	BPA511
66 59 14	USB3_EXTB_D2R_P	1	SM BEAD-PROBE	BPA510
66 63 59	USB3_EXTB_D2R_RC_N	1	SM BEAD-PROBE	BPA520
66 63 59	USB3_EXTB_D2R_RC_P	1	SM BEAD-PROBE	BPA521
66 59 14	USB3_EXTB_R2D_C_N	1	SM BEAD-PROBE	BPA513
66 59 14	USB3_EXTB_R2D_C_P	1	SM BEAD-PROBE	BPA512
66 63 59	USB3_EXTB_R2D_N	1	SM BEAD-PROBE	BPA523
66 63 59	USB3_EXTB_R2D_P	1	SM BEAD-PROBE	BPA522

Unused nets with offpage

(Nets with offpages not used on this project)

SD_RESET_L	15
XDP_SDCONN_STATE_CHANGE_L	15 16
SD_PWR_EN	15

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: Project FCT/NC/Aliases

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J41/J43 Board-Specific Spacing & Physical Constraints

BOARD LAYERS	BOARD AREAS	BOARD UNITS (MIL or MM)	ALLEGRO VERSION
TOP,ISL2,ISL3,ISL4,ISL5,ISL6,ISL7,ISL8,ISL9,ISL10,ISL11,BOTTOM	NO_TYPE,BGA,MEM_TERM	MM	16.2

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DEFAULT	TOP,BOTTOM	Y	=50_OHM_SE	=50_OHM_SE			
DEFAULT	ISL2,ISL11	Y	=45_OHM_SE	=45_OHM_SE			
DEFAULT	ISL3,ISL10	Y	=45_OHM_SE	=45_OHM_SE			
DEFAULT	ISL4,ISL9	Y	=45_OHM_SE	=45_OHM_SE			
DEFAULT	*	N	100 MM	100 MM	10 MM	0 MM	0 MM
STANDARD	*	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT

Single-ended Physical Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
27P4_OHM_SE	TOP,BOTTOM	Y	0.310 MM	0.310 MM			
27P4_OHM_SE	ISL2,ISL11	Y	0.182 MM	0.182 MM			
27P4_OHM_SE	ISL3,ISL10	Y	0.182 MM	0.182 MM			
27P4_OHM_SE	ISL4,ISL9	Y	0.182 MM	0.182 MM			
27P4_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
35_OHM_SE	TOP,BOTTOM	Y	0.195 MM	0.195 MM			
35_OHM_SE	ISL2,ISL11	Y	0.125 MM	0.125 MM			
35_OHM_SE	ISL3,ISL10	Y	0.125 MM	0.125 MM			
35_OHM_SE	ISL4,ISL9	Y	0.125 MM	0.125 MM			
35_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
40_OHM_SE	TOP,BOTTOM	Y	0.170 MM	0.170 MM			
40_OHM_SE	ISL2,ISL11	Y	0.096 MM	0.096 MM			
40_OHM_SE	ISL3,ISL10	Y	0.096 MM	0.096 MM			
40_OHM_SE	ISL4,ISL9	Y	0.099 MM	0.099 MM			
40_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
45_OHM_SE	TOP,BOTTOM	Y	0.135 MM	0.135 MM			
45_OHM_SE	ISL2,ISL11	Y	0.075 MM	0.075 MM			
45_OHM_SE	ISL3,ISL10	Y	0.075 MM	0.075 MM			
45_OHM_SE	ISL4,ISL9	Y	0.080 MM	0.080 MM			
45_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
50_OHM_SE	TOP,BOTTOM	Y	0.110 MM	0.110 MM			
50_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
55_OHM_SE	TOP,BOTTOM	Y	0.090 MM	0.090 MM			
55_OHM_SE	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

Differential Pair Physical Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
70_OHM_DIFF	TOP,BOTTOM	Y	0.165 MM	0.165 MM		0.110 MM	0.110 MM
70_OHM_DIFF	ISL2,ISL11	Y	0.105 MM	0.105 MM		0.100 MM	0.100 MM
70_OHM_DIFF	ISL3,ISL10	Y	0.105 MM	0.105 MM		0.100 MM	0.100 MM
70_OHM_DIFF	ISL4,ISL9	Y	0.110 MM	0.110MM		0.095 MM	0.095 MM
70_OHM_DIFF	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
80_OHM_DIFF	TOP,BOTTOM	Y	0.132 MM	0.132 MM		0.130 MM	0.130 MM
80_OHM_DIFF	ISL2,ISL11	Y	0.081 MM	0.081 MM		0.115 MM	0.115 MM
80_OHM_DIFF	ISL3,ISL10	Y	0.081 MM	0.081 MM		0.115 MM	0.115 MM
80_OHM_DIFF	ISL4,ISL9	Y	0.088 MM	0.088 MM		0.110 MM	0.110 MM
80_OHM_DIFF	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
90_OHM_DIFF	TOP,BOTTOM	Y	0.115 MM	0.115 MM		0.200 MM	0.200 MM
90_OHM_DIFF	ISL2,ISL11	Y	0.070 MM	0.070 MM		0.180 MM	0.180 MM
90_OHM_DIFF	ISL3,ISL10	Y	0.070 MM	0.070 MM		0.180 MM	0.180 MM
90_OHM_DIFF	ISL4,ISL9	Y	0.076 MM	0.076 MM		0.180 MM	0.180 MM
90_OHM_DIFF	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

Spacing Constraints

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1:1_SPACING	*	0.100 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1x_DIELECTRIC	TOP,BOTTOM	0.071 MM	?
1x_DIELECTRIC	ISL3,ISL10	0.053 MM	?
1x_DIELECTRIC	ISL4,ISL9	0.050 MM	?
1x_DIELECTRIC	*	0.090 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DEFAULT	*	0.1 MM	?
STANDARD	*	=DEFAULT	?
BGA_P075MM	*	0.075 MM	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
*	*	BGA	BGA_P075MM

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
*	BGA	P070MM_BGA

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
P070MM_BGA	*			0.070 MM	5 MM		0.075 MM

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
73_OHM_DIFF	TOP,BOTTOM	Y	0.165 MM	0.165 MM		0.150 MM	0.150 MM
73_OHM_DIFF	ISL2,ISL11	Y	0.106 MM	0.106 MM		0.150 MM	0.150 MM
73_OHM_DIFF	ISL3,ISL10	Y	0.106 MM	0.106 MM		0.150 MM	0.150 MM
73_OHM_DIFF	ISL4,ISL9	Y	0.110 MM	0.110 MM		0.150 MM	0.150 MM
73_OHM_DIFF	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
85_OHM_DIFF	TOP,BOTTOM	Y	0.120 MM	0.120 MM		0.150 MM	0.150 MM
85_OHM_DIFF	ISL2,ISL11	Y	0.078 MM	0.078 MM		0.160 MM	0.160 MM
85_OHM_DIFF	ISL3,ISL10	Y	0.078 MM	0.078 MM		0.160 MM	0.160 MM
85_OHM_DIFF	ISL4,ISL9	Y	0.082 MM	0.082 MM		0.140 MM	0.140 MM
85_OHM_DIFF	*	N	100 MM	100 MM	=STANDARD	=STANDARD	=STANDARD

SYNC_MASTER=J43 MLB SYNC_DATE=10/24/2012

PAGE TITLE: PCB Rule Definitions

Apple Inc.

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CPU Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CPU_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD
CPU_27P4S	*	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	0.100 MM	0.100 MM

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_AGTL	TOP,BOTTOM	=2x_DIELECTRIC	?
CPU_AGTL	*	=STANDARD	?

Note: CPU_8MIL and CPU_ITP can be converted back to TABLE_SPACING_RULE once rdar://10308147 is resolved

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_8MIL	*	*	CPU_8MIL_2ANY

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_8MIL_2ANY	*	8 MIL	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_ITP	*	*	CPU_ITP_2ANY

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_ITP_2ANY	*	=4x_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_COMP	CPU_COMP	*	CPU_COMP_2SELF
CPU_COMP	*	*	CPU_COMP_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_COMP_2SELF	TOP,BOTTOM	=6x_DIELECTRIC	?
CPU_COMP_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_COMP_2SELF	*	=4x_DIELECTRIC	?
CPU_COMP_2OTHER	*	=6x_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_VCCSENSE	CPU_VCCSENSE	*	CPU_VCCSENSE_2SELF
CPU_VCCSENSE	*	*	CPU_VCCSENSE_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_VCCSENSE_2SELF	TOP,BOTTOM	=6x_DIELECTRIC	?
CPU_VCCSENSE_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_VCCSENSE_2SELF	*	=4x_DIELECTRIC	?
CPU_VCCSENSE_2OTHER	*	=6x_DIELECTRIC	?

PCI-Express Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
PCIE_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF
CLK_PCIE_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

PCIE Clock Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CLK_PCIE	CLK_PCIE	*	CLK_PCIE_2SELF
CLK_PCIE	*	*	CLK_PCIE_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CLK_PCIE_2SELF	TOP,BOTTOM	=6x_DIELECTRIC	?
CLK_PCIE_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CLK_PCIE_2SELF	*	=4x_DIELECTRIC	?
CLK_PCIE_2OTHER	*	=6x_DIELECTRIC	?

CPU PCIE Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
PCIE_CPU_TX	PCIE_CPU_TX	*	PCIE_TX2TX
PCIE_CPU_RX	PCIE_CPU_RX	*	PCIE_RX2RX
PCIE_CPU_TX	*_CPU_TX	*	PCIE_TX2OTHERTX
PCIE_CPU_RX	*_CPU_RX	*	PCIE_RX2OTHERRX
PCIE_CPU_TX	*_CPU_RX	*	PCIE_TX2RX
PCIE_CPU_RX	*_CPU_TX	*	PCIE_RX2TX
PCIE_CPU_TX	*_TX	*	PCIE_2OTHERHS
PCIE_CPU_RX	*_TX	*	PCIE_2OTHERHS
PCIE_CPU_TX	*_RX	*	PCIE_2OTHERHS
PCIE_CPU_RX	*_RX	*	PCIE_2OTHERHS
PCIE_CPU_TX	*	*	PCIE_2OTHER
PCIE_CPU_RX	*	*	PCIE_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE_TX2TX	TOP,BOTTOM	=5x_DIELECTRIC	?
PCIE_RX2RX	TOP,BOTTOM	=5x_DIELECTRIC	?
PCIE_TX2OTHERTX	TOP,BOTTOM	=5x_DIELECTRIC	?
PCIE_RX2OTHERRX	TOP,BOTTOM	=5x_DIELECTRIC	?
PCIE_TX2RX	TOP,BOTTOM	=7x_DIELECTRIC	?
PCIE_RX2TX	TOP,BOTTOM	=7x_DIELECTRIC	?
PCIE_2OTHERHS	TOP,BOTTOM	=6x_DIELECTRIC	?
PCIE_2OTHER	TOP,BOTTOM	=5x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE_TX2TX	*	=2.5x_DIELECTRIC	?
PCIE_RX2RX	*	=2.5x_DIELECTRIC	?
PCIE_TX2OTHERTX	*	=4x_DIELECTRIC	?
PCIE_RX2OTHERRX	*	=4x_DIELECTRIC	?
PCIE_TX2RX	*	=6x_DIELECTRIC	?
PCIE_RX2TX	*	=6x_DIELECTRIC	?
PCIE_2OTHERHS	*	=4x_DIELECTRIC	?
PCIE_2OTHER	*	=3x_DIELECTRIC	?

PCH PCIE Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
PCIE_PCH_TX	PCIE_PCH_TX	*	PCIE_TX2TX
PCIE_PCH_RX	PCIE_PCH_RX	*	PCIE_RX2RX
PCIE_PCH_TX	*_PCH_TX	*	PCIE_TX2OTHERTX
PCIE_PCH_RX	*_PCH_RX	*	PCIE_RX2OTHERRX
PCIE_PCH_TX	*_PCH_RX	*	PCIE_TX2RX
PCIE_PCH_RX	*_PCH_TX	*	PCIE_RX2TX
PCIE_PCH_TX	*_TX	*	PCIE_2OTHERHS
PCIE_PCH_RX	*_TX	*	PCIE_2OTHERHS
PCIE_PCH_TX	*_RX	*	PCIE_2OTHERHS
PCIE_PCH_RX	*_RX	*	PCIE_2OTHERHS
PCIE_PCH_TX	*	*	PCIE_2OTHER
PCIE_PCH_RX	*	*	PCIE_2OTHER

SOURCE: 471984_Chief_River_MS_PDG_1.0 and the spacing rule is adjusted per SI team feedback.

Note: DisplayPort tables are on Page 113

CPU Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
CPU_PECI	CPU_45S	CPU_COMP	CPU_PECI	6 36
PM_SYNC	CPU_45S	CPU_AGTL	PM_SYNC	
PM_MEM_PWRGD	CPU_45S	CPU_AGTL	PM_MEM_PWRGD	
	CPU_45S	CPU_TTP	XDP_DBRESET_L	16 17
	CPU_45S	CPU_TTP	XDP_CPU_PRDY_L	6 16 62
	CPU_45S	CPU_TTP	XDP_CPU_PREQ_L	6 16 62
	CPU_27P4S	CPU_COMP	EDP_COMP	
	CPU_27P4S	CPU_COMP	CPU_PEG_COMP	
CPU_SM_RCOMP	CPU_27P4S	CPU_COMP	CPU_SM_RCOMP<0>	6
CPU_SM_RCOMP	CPU_27P4S	CPU_COMP	CPU_SM_RCOMP<1>	6
CPU_SM_RCOMP	CPU_27P4S	CPU_COMP	CPU_SM_RCOMP<2>	6
	CPU_45S	CPU_TTP	CPU_CFG<11..0>	6 16 62
CPU_CATERR_L	CPU_45S	CPU_AGTL	CPU_CATERR_L	6 35
	CPU_45S	CPU_AGTL	CPU_VCCIO_SEL	
CPU_PROCHOT_L	CPU_45S	CPU_AGTL	CPU_PROCHOT_L	6 35 36 49
CPU_PWRGD	CPU_45S	CPU_AGTL	CPU_PWRGD	6
PM_THRMTRIP_L	CPU_45S	CPU_8MIL	PM_THRMTRIP_L	15 36
DMI_CLK100M	CLK_PCIE_80D	CLK_PCIE	DMI_CLK100M_CPU_P	
DMI_CLK100M	CLK_PCIE_80D	CLK_PCIE	DMI_CLK100M_CPU_N	
DPLL_REF_CLK120M	CLK_PCIE_80D	CLK_PCIE	DPLL_REF_CLKP	
DPLL_REF_CLK120M	CLK_PCIE_80D	CLK_PCIE	DPLL_REF_CLKN	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	ITPCPU_CLK100M_P	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	ITPCPU_CLK100M_N	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	ITPXDP_CLK100M_P	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	ITPXDP_CLK100M_N	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	XDP_CPU_CLK100M_P	
ITPCPU_CLK100M	CLK_PCIE_80D	CLK_PCIE	XDP_CPU_CLK100M_N	
XDP_TDI	CPU_45S	CPU_TTP	XDP_CPU_TDI	6 16 62
XDP_TDO	CPU_45S	CPU_TTP	XDP_CPU_TDO	6 16 62
XDP_TMS	CPU_45S	CPU_TTP	XDP_CPU_TMS	6 16 62
XDP_TCK	CPU_45S	CPU_TTP	XDP_CPU_TCK	6 16 62
XDP_TRST_L	CPU_45S	CPU_TTP	XDP_CPUPCH_TRST_L	6 12 16 62
XDP_BPM_L	CPU_45S	CPU_TTP	XDP_BPM_L<1..0>	6 16
	CPU_45S	CPU_TTP	XDP_BPM_L<7..2>	6 16
	CPU_45S	CPU_TTP	XDP_OBSDATA_B<3..0>	
	CPU_45S	CPU_TTP	CPU_CFG<15..12>	6 16
(FSB_CPURST_L)	CPU_45S	CPU_TTP	XDP_CPURST_L	16
CPU_VCCSENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_VCCSENSE_P	8 49
CPU_VCCSENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_VCCSENSE_N	9 49
CPU_VCCIOSENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_VCCIOSENSE_P	
CPU_VCCIOSENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_VCCIOSENSE_N	
CPU_AXG_SENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_AXG_SENSE_P	
CPU_AXG_SENSE	SENSE_1TO1_P2MM	CPU_VCCSENSE	CPU_AXG_SENSE_N	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VDDQ_SENSE_P	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VDDQ_SENSE_N	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_VALSENSE_P	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_VALSENSE_N	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCC_VALSENSE_P	
CPU_VALSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCC_VALSENSE_N	
CPU_SVIDALERT_L	CPU_45S	CPU_COMP	CPU_VIDALERT_L	8 49
CPU_SVIDSCLK	CPU_45S	CPU_COMP	CPU_VIDSCLK	8 49
CPU_SVIDSOUT	CPU_45S	CPU_COMP	CPU_VIDSOUT	8 49
PCIE_CPU_SSD_R2D	PCIE_80D	PCIE_CPU_TX	PCIE_SSD_R2D_C_P<3..0>	12 30
PCIE_CPU_SSD_R2D	PCIE_80D	PCIE_CPU_TX	PCIE_SSD_R2D_C_N<3..0>	12 30
	PCIE_80D	PCIE_CPU_TX	PCIE_SSD_R2D_P<3..0>	30 62
	PCIE_80D	PCIE_CPU_TX	PCIE_SSD_R2D_N<3..0>	30 62
	PCIE_80D	PCIE_CPU_RX	PCIE_SSD_D2R_C_P<3..0>	
	PCIE_80D	PCIE_CPU_RX	PCIE_SSD_D2R_C_N<3..0>	
PCIE_CPU_SSD_D2R	PCIE_80D	PCIE_CPU_RX	PCIE_SSD_D2R_P<3..0>	12 30 62
PCIE_CPU_SSD_D2R	PCIE_80D	PCIE_CPU_RX	PCIE_SSD_D2R_N<3..0>	12 30 62
PCIE_CLK100M_SSD	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_SSD_P	12 30 62
PCIE_CLK100M_SSD	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_SSD_N	12 30 62
DP_TBT_ML	DP_80D	DP_TX	DP_TBTSNK0_ML_P<3..0>	25
DP_TBT_ML	DP_80D	DP_TX	DP_TBTSNK0_ML_N<3..0>	25
	DP_80D	DP_TX	DP_TBTSNK0_ML_C_P<3..0>	5 25
	DP_80D	DP_TX	DP_TBTSNK0_ML_C_N<3..0>	5 25
DP_TBT_AUXCH	DP_80D	DP_AUX	DP_TBTSNK0_AUXCH_P	25
DP_TBT_AUXCH	DP_80D	DP_AUX	DP_TBTSNK0_AUXCH_N	25
	DP_80D	DP_AUX	DP_TBTSNK0_AUXCH_C_P	13 25
	DP_80D	DP_AUX	DP_TBTSNK0_AUXCH_C_N	13 25
DP_TBT_ML	DP_80D	DP_TX	DP_TBTSNK1_ML_P<3..0>	25
DP_TBT_ML	DP_80D	DP_TX	DP_TBTSNK1_ML_N<3..0>	25
	DP_80D	DP_TX	DP_TBTSNK1_ML_C_P<3..0>	5 18 25
	DP_80D	DP_TX	DP_TBTSNK1_ML_C_N<3..0>	5 18 25
DP_TBT_AUXCH	DP_80D	DP_AUX	DP_TBTSNK1_AUXCH_P	25
DP_TBT_AUXCH	DP_80D	DP_AUX	DP_TBTSNK1_AUXCH_N	25
	DP_80D	DP_AUX	DP_TBTSNK1_AUXCH_C_P	13 18 25
	DP_80D	DP_AUX	DP_TBTSNK1_AUXCH_C_N	13 18 25
DP_INT_ML	DP_80D	DP_TX	DP_INT_ML_P<3..0>	58 62
DP_INT_ML	DP_80D	DP_TX	DP_INT_ML_N<3..0>	58 62
	DP_80D	DP_TX	DP_INT_ML_C_P<3..0>	5 58 62
	DP_80D	DP_TX	DP_INT_ML_C_N<3..0>	5 58 62
DP_INT_AUXCH	DP_80D	DP_AUX	DP_INT_AUX_CH_C_P	58 62
DP_INT_AUXCH	DP_80D	DP_AUX	DP_INT_AUX_CH_C_N	58 62
DP_INT_AUXCH	DP_80D	DP_AUX	DP_INT_AUXCH_C_P	5 58
DP_INT_AUXCH	DP_80D	DP_AUX	DP_INT_AUXCH_C_N	5 58
	DP_80D	DP_AUX	DP_INT_AUXCH_P	
	DP_80D	DP_AUX	DP_INT_AUXCH_N	

PCIe SSD

DP

SYNC_MASTER=J43_MLB SYNC_DATE=09/21/2012

PAGE TITLE

CPU Constraints

Apple Inc.

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BRANCH <BRANCH>

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SATA Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SATA_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SATA_ICOMP	*	=4x_DIELECTRIC	?

SOURCE: 471984_Chief_River_MS_PDG_1.0 and the spacing rule is adjusted per SI team feedback.

UART Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
UART_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
UART	*	=2x_DIELECTRIC	?

USB 2.0 Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
PCH_USB_RBIAS	*	=STANDARD	8 MIL	8 MIL	=STANDARD	=STANDARD	=STANDARD
USB_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB	*	=2x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB	TOP,BOTTOM	=4x_DIELECTRIC	?

SOURCE: Calpella Platform Design Guide for Ibex Peak M (DG-398905-398905_v1.5), Section 3.8

USB 3.0 Interface Constraints

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
USB3_PCH_TX	USB3_PCH_TX	*	USB3_TX2TX
USB3_PCH_RX	USB3_PCH_RX	*	USB3_RX2RX
USB3_PCH_TX	*_PCH_TX	*	USB3_TX2OTHERTX
USB3_PCH_RX	*_PCH_RX	*	USB3_RX2OTHERRX
USB3_PCH_TX	*_PCH_RX	*	USB3_TX2RX
USB3_PCH_RX	*_PCH_TX	*	USB3_RX2TX
USB3_PCH_TX	*_TX	*	USB3_2OTHERHS
USB3_PCH_RX	*_TX	*	USB3_2OTHERHS
USB3_PCH_TX	*_RX	*	USB3_2OTHERHS
USB3_PCH_RX	*_RX	*	USB3_2OTHERHS
USB3_PCH_TX	*	*	USB3_2OTHER
USB3_PCH_RX	*	*	USB3_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3_TX2TX	TOP,BOTTOM	=5x_DIELECTRIC	?
USB3_RX2RX	TOP,BOTTOM	=5x_DIELECTRIC	?
USB3_TX2OTHERTX	TOP,BOTTOM	=5x_DIELECTRIC	?
USB3_RX2OTHERRX	TOP,BOTTOM	=5x_DIELECTRIC	?
USB3_TX2RX	TOP,BOTTOM	=7x_DIELECTRIC	?
USB3_RX2TX	TOP,BOTTOM	=7x_DIELECTRIC	?
USB3_2OTHERHS	TOP,BOTTOM	=6x_DIELECTRIC	?
USB3_2OTHER	TOP,BOTTOM	=5x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3_TX2TX	*	=2.5x_DIELECTRIC	?
USB3_RX2RX	*	=2.5x_DIELECTRIC	?
USB3_TX2OTHERTX	*	=4x_DIELECTRIC	?
USB3_RX2OTHERRX	*	=4x_DIELECTRIC	?
USB3_TX2RX	*	=6x_DIELECTRIC	?
USB3_RX2TX	*	=6x_DIELECTRIC	?
USB3_2OTHERHS	*	=4x_DIELECTRIC	?
USB3_2OTHER	*	=3x_DIELECTRIC	?

SOURCE: 471984_Cheif_River_MS_PDG_1.0 and the spacing rule is adjusted per SI team feedback.

PCH Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
PCH_SATA_ICOMP		SATA_ICOMP	PCH_SATAICOMP	
USB_HUB1_UP	USB_80D	USB	USB_HUB_UP_P	
USB_HUB1_UP	USB_80D	USB	USB_HUB_UP_N	
USB_BT	USB_80D	USB	USB_BT_P	14 29
USB_BT	USB_80D	USB	USB_BT_N	14 29
	USB_80D	USB	USB_BT_CONN_P	29 62
	USB_80D	USB	USB_BT_CONN_N	29 62
	USB_80D	USB	USB_BT_WAKE_P	
	USB_80D	USB	USB_BT_WAKE_N	
USB_TPAD	USB_80D	USB	USB_TPAD_P	14 34 62
USB_TPAD	USB_80D	USB	USB_TPAD_N	14 34 62
	USB_80D	USB	USB_TPAD_CONN_P	
	USB_80D	USB	USB_TPAD_CONN_N	
	USB_80D	USB	TPAD_SPI_MOSI_USB_P	
	USB_80D	USB	TPAD_SPI_MISO_USB_N	
USB_TPAD_M	USB_80D	USB	USB_TPAD_M_P	
USB_TPAD_M	USB_80D	USB	USB_TPAD_M_N	
USB_SDCARD	USB_80D	USB	USB_SDCARD_P	
USB_SDCARD	USB_80D	USB	USB_SDCARD_N	
	SPI_45S	SPI	TPAD_SPI_MOSI	15 34
	SPI_45S	SPI	TPAD_SPI_MISO	15 34
	SPI_45S	SPI	TPAD_SPI_CLK	15 34
USB_EXTA	USB_80D	USB	USB_EXTA_P	14 33
USB_EXTA	USB_80D	USB	USB_EXTA_N	14 33
	UART_45S	UART	SMC_DEBUGPRT_TX_L	33 35 36
	UART_45S	UART	SMC_DEBUGPRT_RX_L	33 35 36
USB2_EXTA	USB_80D	USB	USB2_EXTA_MUXED_P	33
USB2_EXTA	USB_80D	USB	USB2_EXTA_MUXED_N	33
USB2_EXTA	USB_80D	USB	USB2_EXTA_MUXED_F_P	33
USB2_EXTA	USB_80D	USB	USB2_EXTA_MUXED_F_N	33
USB3_EXTA_RX	USB_80D	USB3_PCH_RX	USB3_EXTA_D2R_P	14 33
USB3_EXTA_RX	USB_80D	USB3_PCH_RX	USB3_EXTA_D2R_N	14 33
USB3_EXTA_TX	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_P	33
USB3_EXTA_TX	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_N	33
	USB_80D	USB3_PCH_RX	USB3_EXTA_D2R_F_P	
	USB_80D	USB3_PCH_RX	USB3_EXTA_D2R_F_N	
	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_F_P	
	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_F_N	
	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_C_P	14 33
	USB_80D	USB3_PCH_TX	USB3_EXTA_R2D_C_N	14 33
USB_EXTB	USB_80D	USB	USB_EXTB_P	14 59 63
USB_EXTB	USB_80D	USB	USB_EXTB_N	14 59 63
USB3_EXTB_RX	USB_80D	USB3_PCH_RX	USB3_EXTB_D2R_P	14 59 63
USB3_EXTB_RX	USB_80D	USB3_PCH_RX	USB3_EXTB_D2R_N	14 59 63
	USB_80D	USB3_PCH_RX	USB3_EXTB_D2R_RC_P	59 63
	USB_80D	USB3_PCH_RX	USB3_EXTB_D2R_RC_N	59 63
USB3_EXTB_TX	USB_80D	USB3_PCH_TX	USB3_EXTB_R2D_P	59 63
USB3_EXTB_TX	USB_80D	USB3_PCH_TX	USB3_EXTB_R2D_N	59 63
	USB_80D	USB3_PCH_TX	USB3_EXTB_R2D_C_P	14 59 63
	USB_80D	USB3_PCH_TX	USB3_EXTB_R2D_C_N	14 59 63
USB3_SD_RX	USB_80D	USB3_PCH_RX	NC_USB3RPCIE_SD_D2RP	14 63
USB3_SD_RX	USB_80D	USB3_PCH_RX	NC_USB3RPCIE_SD_D2RN	14 63
USB3_SD_TX	USB_80D	USB3_PCH_TX	NC_USB3RPCIE_SD_R2D_CP	14 63
USB3_SD_TX	USB_80D	USB3_PCH_TX	NC_USB3RPCIE_SD_R2D_CN	14 63
	USB_80D	USB3_PCH_RX	USB3_SD_D2R_C_P	
	USB_80D	USB3_PCH_RX	USB3_SD_D2R_C_N	
	USB_80D	USB3_PCH_TX	USB3_SD_R2D_P	
	USB_80D	USB3_PCH_TX	USB3_SD_R2D_N	
PCH_USB_RBIAS	PCH_USB_RBIAS		PCH_USB_RBIAS	14
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_PCH_P	
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_PCH_N	
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCH_CLK96M_DOT_P	
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCH_CLK96M_DOT_N	
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCH_CLK100M_SATA_P	
PCH_DIFFCLK_UNUSED_	CLK_PCIE_80D	CLK_PCIE	PCH_CLK100M_SATA_N	
	CPU_45S	CLK_PCIE	PCH_CLK14P3M_REFCLK	

USB Hucopyb nets

TP SPI nets

USB EXTA nets (Right USB port)

USB EXTB nets (Left USB port)

SYNC_MASTER=CLEAN_J41 SYNC_DATE=11/13/2012

PAGE TITLE: PCH Constraints 1

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

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LPC Bus Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
LPC_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD
CLK_LPC_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
LPC	*	=3x_DIELECTRIC	?
CLK_LPC	*	=4x_DIELECTRIC	?

SOURCE: Calpella Platform Design Guide for Ibex Peak M (DG-398905-398905_v1.5), Section 3.15

SMBus Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SMB_45S_R_50S	TOP,BOTTOM	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE		
SMB_45S_R_50S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SMB	*	=2x_DIELECTRIC	?

HD Audio Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
HDA_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
HDA	*	=2x_DIELECTRIC	?

SOURCE: Calpella Platform Design Guide for Ibex Peak M (DG-398905-398905_v1.5), Section 3.15

SIO Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CLK_SLOW_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CLK_SLOW	*	=4x_DIELECTRIC	?

SPI Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SPI_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SPI	*	=4x_DIELECTRIC	?

XDP Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
PCH_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCH_ITP	*	=2:1_SPACING	?

DisplayPort

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DP_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DP_2DP	*	=3x_DIELECTRIC	?
DP_2OTHERHS	*	=4x_DIELECTRIC	?
DP_2OTHER	*	=3x_DIELECTRIC	?
DP_AUX	*	=3x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DP_2DP	TOP,BOTTOM	=4x_DIELECTRIC	?
DP_2OTHERHS	TOP,BOTTOM	=6x_DIELECTRIC	?
DP_2OTHER	TOP,BOTTOM	=4x_DIELECTRIC	?
DP_AUX	TOP,BOTTOM	=4x_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
DP_TX	DP_TX	*	DP_2DP
DP_TX	*_TX	*	DP_2OTHERHS
DP_TX	*_RX	*	DP_2OTHERHS
DP_TX	*	*	DP_2OTHER

System Clock Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CLK_SLOW_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD
CLK_25M_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CLK_SLOW	*	=2x_DIELECTRIC	?
CLK_25M	*	=5x_DIELECTRIC	?

NOTE: 25MHz system clocks very sensitive to noise.

PCH Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
LPC_AD	LPC_45S	LPC	LPC_AD<3..0> 14 35 44 62
LPC_FRAME_L	LPC_45S	LPC	LPC_FRAME_L 14 35 44 62
	LPC_45S	LPC	LPCPLUS_RESET_L 18 44 62
LPC_CLK33M	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_SMC 17 35
	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_SMC_R 12 17
LPC_CLK33M	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_LPCPLUS 17 44 62
	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_LPCPLUS_R 12 17
SMBUS_PCH_CLK	SMB_45S_R_50S	SMB	SMBUS_PCH_CLK 14 16 19 25 38 54
SMBUS_PCH_DATA	SMB_45S_R_50S	SMB	SMBUS_PCH_DATA 14 16 19 25 38 54
SMBUS_PCH_0_CLK	SMB_45S_R_50S	SMB	SML_PCH_0_CLK 14 38
SMBUS_PCH_0_DATA	SMB_45S_R_50S	SMB	SML_PCH_0_DATA 14 38
SMBUS_SMC_1_S0_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_1_S0_SCL 14 32 35 38 41 42 62
SMBUS_SMC_1_S0_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_1_S0_SDA 14 32 35 38 41 42 62
HDA_BIT_CLK	HDA_45S	HDA	HDA_BIT_CLK 12 59 63
	HDA_45S	HDA	HDA_BIT_CLK_R 12
HDA_SYNC	HDA_45S	HDA	HDA_SYNC 12 59 63
	HDA_45S	HDA	HDA_SYNC_R 12
HDA_RST_L	HDA_45S	HDA	HDA_RST_R_L 12
	HDA_45S	HDA	HDA_RST_L 12 59 63
HDA_SDIN0	HDA_45S	HDA	HDA_SDIN0 12 59 63
HDA_SDOUT	HDA_45S	HDA	HDA_SDOUT 12 59 63
	HDA_45S	HDA	HDA_SDOUT_R 12 17
PM_SUS_CLK	CLK_SLOW_45S	CLK_SLOW	PM_CLK32K_SUSCLK_R 13 36
	CLK_SLOW_45S	CLK_SLOW	SMC_CLK32K 35 36
SPI_CLK	SPI_45S	SPI	SPI_CLK_R 14 44
	SPI_45S	SPI	SPI_CLK 44
SPI_MOSI	SPI_45S	SPI	SPI_MOSI_R 14 44
	SPI_45S	SPI	SPI_MOSI 44
SPI_MISO	SPI_45S	SPI	SPI_MISO 14 44
	SPI_45S	SPI	SPI_MISO_R 44
SPI_CS0	SPI_45S	SPI	SPI_CS0_R_L 14 44
	SPI_45S	SPI	SPI_CS0_L 44
	SPI_45S	SPI	SPI_SMC_CLK 35 44
	SPI_45S	SPI	SPI_SMC_MOSI 35 44
	SPI_45S	SPI	SPI_SMC_MISO 35 44
	SPI_45S	SPI	SPI_SMC_CS_L 35 44
	SPI_45S	SPI	SPI_MLB_CLK 44
	SPI_45S	SPI	SPI_MLB_MOSI 44
	SPI_45S	SPI	SPI_MLB_MISO 44
	SPI_45S	SPI	SPI_MLB_CS_L 44
PCIE_AP_R2D	PCIE_80D	PCIE_PCH_TX	PCIE_AP_R2D_P 29 62
PCIE_AP_R2D	PCIE_80D	PCIE_PCH_TX	PCIE_AP_R2D_N 29 62
	PCIE_80D	PCIE_PCH_TX	PCIE_AP_R2D_C_P 14 29
	PCIE_80D	PCIE_PCH_TX	PCIE_AP_R2D_C_N 14 29
PCIE_AP_D2R	PCIE_80D	PCIE_PCH_RX	PCIE_AP_D2R_P 14 29 62
PCIE_AP_D2R	PCIE_80D	PCIE_PCH_RX	PCIE_AP_D2R_N 14 29 62
PCIE_CLK100M_AP	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_AP_P 12 29 62
PCIE_CLK100M_AP	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_AP_N 12 29 62
PCIE_TBT_R2D	PCIE_80D	PCIE_PCH_TX	PCIE_TBT_R2D_P<3..0> 25
PCIE_TBT_R2D	PCIE_80D	PCIE_PCH_TX	PCIE_TBT_R2D_N<3..0> 25
	PCIE_80D	PCIE_PCH_TX	PCIE_TBT_R2D_C_P<3..0> 14 25
	PCIE_80D	PCIE_PCH_TX	PCIE_TBT_R2D_C_N<3..0> 14 25
PCIE_TBT_D2R	PCIE_80D	PCIE_PCH_RX	PCIE_TBT_D2R_P<3..0> 14 25
PCIE_TBT_D2R	PCIE_80D	PCIE_PCH_RX	PCIE_TBT_D2R_N<3..0> 14 25
	PCIE_80D	PCIE_PCH_RX	PCIE_TBT_D2R_C_P<3..0> 25
	PCIE_80D	PCIE_PCH_RX	PCIE_TBT_D2R_C_N<3..0> 25
PCIE_CLK100M_TBT	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_TBT_P 12 25
PCIE_CLK100M_TBT	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_TBT_N 12 25
	CLK_PCIE_80D	CLK_PCIE	PEG_CLK100M_P
	CLK_PCIE_80D	CLK_PCIE	PEG_CLK100M_N
XDP_TDI	PCH_45S	PCH_TTP	XDP_PCH_TDI 12 16 62
XDP_TDO	PCH_45S	PCH_TTP	XDP_PCH_TDO 12 16 62
XDP_TMS	PCH_45S	PCH_TTP	XDP_PCH_TMS 12 16 62
XDP_TCK	PCH_45S	PCH_TTP	XDP_PCH_TCK 12 16 62
PCIE_CAM	PCIE_80D	PCIE_PCH_TX	PCIE_CAMERA_R2D_P 31 32
PCIE_CAM	PCIE_80D	PCIE_PCH_TX	PCIE_CAMERA_R2D_N 31 32
	PCIE_80D	PCIE_PCH_TX	PCIE_CAMERA_R2D_C_P 14 32
	PCIE_80D	PCIE_PCH_TX	PCIE_CAMERA_R2D_C_N 14 32
PCIE_CAM	PCIE_80D	PCIE_PCH_RX	PCIE_CAMERA_D2R_P 14 32
PCIE_CAM	PCIE_80D	PCIE_PCH_RX	PCIE_CAMERA_D2R_N 14 32
	PCIE_80D	PCIE_PCH_RX	PCIE_CAMERA_D2R_C_P 31 32
	PCIE_80D	PCIE_PCH_RX	PCIE_CAMERA_D2R_C_N 31 32
PCIE_CLK100M_CAM	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_CAMERA_P 12 32
PCIE_CLK100M_CAM	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_CAMERA_N 12 32
	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_CAMERA_C_P 31 32
	CLK_PCIE_80D	CLK_PCIE	PCIE_CLK100M_CAMERA_C_N 31 32

Clock Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
SYSCLK_CLK32K_RTC	CLK_SLOW_45S	CLK_SLOW	SYSCLK_CLK32K_RTCX1
SYSCLK_CLK25M_SB	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_CAMERA 17 32
	CLK_25M_45S	CLK_25M	CLK25M_CAM_CLKP 31 32
	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALP_R 32
	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALP 32
	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALN 32
	CLK_25M_45S	CLK_25M	CLK25M_CAM_CLKN 31 32
SYSCLK_CLK25M_TBT	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_TBT 17 25
	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_TBT_R 25
SYSCLK_CLK25M_XTAL	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X1 17
	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X2 17
	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X2_R 17
	CLK_25M_45S	CLK_25M	SDCLK_CLK25M_X2
	CLK_25M_45S	CLK_25M	SDCLK_CLK25M_X2_R
	CLK_25M_45S	CLK_25M	SDSCLK_CLK25M_X1

SYNC_MASTER=J43_MLB SYNC_DATE=09/14/2012

PAGE TITLE: PCH Constraints 2

Apple Inc.

DRAWING NUMBER: <SCH_NUM> SIZE: D

REVISION: <E4LABEL>

BRANCH: <BRANCH>

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Memory Bus Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MEM_40S	*	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE
MEM_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE
MEM_70D	*	=70_OHM_DIFF	=70_OHM_DIFF	=70_OHM_DIFF	=70_OHM_DIFF	=70_OHM_DIFF	=70_OHM_DIFF
MEM_73D	*	=73_OHM_DIFF	=73_OHM_DIFF	=73_OHM_DIFF	=73_OHM_DIFF	=73_OHM_DIFF	=73_OHM_DIFF

Spacing Rule Sets

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MEM_DATA2SELF	*	=2x_DIELECTRIC	?
MEM_DATA2OTHERMEM	*	=8x_DIELECTRIC	?
MEM_DQS2OWNDATA	*	=3x_DIELECTRIC	?
MEM_CMD2CMD	*	=3x_DIELECTRIC	?
MEM_CMD2CTRL	*	=3x_DIELECTRIC	?
MEM_CTRL2CTRL	*	=3x_DIELECTRIC	?
MEM_CLK2CLK	*	=6x_DIELECTRIC	?
MEM_2OTHERMEM	*	=4x_DIELECTRIC	?
MEM_2PWR	*	=2x_DIELECTRIC	10000
MEM_2GND	*	=2x_DIELECTRIC	10000
MEM_2OTHER	*	=6x_DIELECTRIC	?

Memory to Power Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_PWR	MEM_*	*	MEM_2PWR
MEM_PWR	*	*	DEFAULT

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
MEM_70D	MEM_TERM	MEM_73D
MEM_40S	MEM_TERM	MEM_50S

Memory to GND Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
GND	MEM_*	*	MEM_2GND

Memory Bus Spacing Group Assignments

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_A_DQS_0	MEM_A_DATA_0	*	MEM_DQS2OWNDATA
MEM_A_DQS_1	MEM_A_DATA_1	*	MEM_DQS2OWNDATA
MEM_A_DQS_2	MEM_A_DATA_2	*	MEM_DQS2OWNDATA
MEM_A_DQS_3	MEM_A_DATA_3	*	MEM_DQS2OWNDATA
MEM_A_DQS_4	MEM_A_DATA_4	*	MEM_DQS2OWNDATA
MEM_A_DQS_5	MEM_A_DATA_5	*	MEM_DQS2OWNDATA
MEM_A_DQS_6	MEM_A_DATA_6	*	MEM_DQS2OWNDATA
MEM_A_DQS_7	MEM_A_DATA_7	*	MEM_DQS2OWNDATA
MEM_B_DQS_0	MEM_B_DATA_0	*	MEM_DQS2OWNDATA
MEM_B_DQS_1	MEM_B_DATA_1	*	MEM_DQS2OWNDATA
MEM_B_DQS_2	MEM_B_DATA_2	*	MEM_DQS2OWNDATA
MEM_B_DQS_3	MEM_B_DATA_3	*	MEM_DQS2OWNDATA
MEM_B_DQS_4	MEM_B_DATA_4	*	MEM_DQS2OWNDATA
MEM_B_DQS_5	MEM_B_DATA_5	*	MEM_DQS2OWNDATA
MEM_B_DQS_6	MEM_B_DATA_6	*	MEM_DQS2OWNDATA
MEM_B_DQS_7	MEM_B_DATA_7	*	MEM_DQS2OWNDATA

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*_DATA_*	=SAME	*	MEM_DATA2SELF

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*_DATA_*	MEM_*	*	MEM_DATA2OTHERMEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CMD	MEM_CMD	*	MEM_CMD2CMD
MEM_CMD	MEM_CTRL	*	MEM_CMD2CTRL
MEM_CTRL	MEM_CTRL	*	MEM_CTRL2CTRL

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CLK	MEM_CLK	*	MEM_CLK2CLK

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*	MEM_*	*	MEM_2OTHERMEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_A_DQS_0	*	*	MEM_2OTHER
MEM_A_DQS_1	*	*	MEM_2OTHER
MEM_A_DQS_2	*	*	MEM_2OTHER
MEM_A_DQS_3	*	*	MEM_2OTHER
MEM_A_DQS_4	*	*	MEM_2OTHER
MEM_A_DQS_5	*	*	MEM_2OTHER
MEM_A_DQS_6	*	*	MEM_2OTHER
MEM_A_DQS_7	*	*	MEM_2OTHER
MEM_B_DQS_0	*	*	MEM_2OTHER
MEM_B_DQS_1	*	*	MEM_2OTHER
MEM_B_DQS_2	*	*	MEM_2OTHER
MEM_B_DQS_3	*	*	MEM_2OTHER
MEM_B_DQS_4	*	*	MEM_2OTHER
MEM_B_DQS_5	*	*	MEM_2OTHER
MEM_B_DQS_6	*	*	MEM_2OTHER
MEM_B_DQS_7	*	*	MEM_2OTHER
MEM_A_DATA_0	*	*	MEM_2OTHER
MEM_A_DATA_1	*	*	MEM_2OTHER
MEM_A_DATA_2	*	*	MEM_2OTHER
MEM_A_DATA_3	*	*	MEM_2OTHER
MEM_A_DATA_4	*	*	MEM_2OTHER
MEM_A_DATA_5	*	*	MEM_2OTHER
MEM_A_DATA_6	*	*	MEM_2OTHER
MEM_A_DATA_7	*	*	MEM_2OTHER
MEM_B_DATA_0	*	*	MEM_2OTHER
MEM_B_DATA_1	*	*	MEM_2OTHER
MEM_B_DATA_2	*	*	MEM_2OTHER
MEM_B_DATA_3	*	*	MEM_2OTHER
MEM_B_DATA_4	*	*	MEM_2OTHER
MEM_B_DATA_5	*	*	MEM_2OTHER
MEM_B_DATA_6	*	*	MEM_2OTHER
MEM_B_DATA_7	*	*	MEM_2OTHER
MEM_CMD	*	*	MEM_2OTHER
MEM_CTRL	*	*	MEM_2OTHER
MEM_CLK	*	*	MEM_2OTHER

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_A_DATA_0	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_1	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_2	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_3	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_4	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_5	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_6	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_A_DATA_7	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_0	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_1	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_2	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_3	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_4	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_5	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_6	MEM_*_DATA_*	*	MEM_2OTHERMEM
MEM_B_DATA_7	MEM_*_DATA_*	*	MEM_2OTHERMEM

Memory Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE: PHYSICAL	NET_TYPE: SPACING	
MEM_A_CLK0	MEM_70D	MEM_CLK	MEM_A_CLK_P<0>
MEM_A_CLK0	MEM_70D	MEM_CLK	MEM_A_CLK_N<0>
MEM_A_CLK1	MEM_70D	MEM_CLK	MEM_A_CLK_P<1>
MEM_A_CLK1	MEM_70D	MEM_CLK	MEM_A_CLK_N<1>
MEM_A_CTRL	MEM_40S	MEM_CTRL	MEM_A_CS_L<1..0>
MEM_A_CTRL	MEM_40S	MEM_CTRL	MEM_A_ODT<0>
MEM_A_CKE0	MEM_40S	MEM_CMD	MEM_A_CKE<1..0>
MEM_A_CKE1	MEM_40S	MEM_CMD	MEM_A_CKE<3..2>
MEM_A_CMD0	MEM_40S	MEM_CMD	MEM_A_CAA<9..0>
MEM_A_CMD1	MEM_40S	MEM_CMD	MEM_A_CAB<9..0>
MEM_A_DQ_BYTE0	MEM_40S	MEM_A_DATA_0	MEM_A_DQ<7..0>
MEM_A_DQ_BYTE1	MEM_40S	MEM_A_DATA_1	MEM_A_DQ<15..8>
MEM_A_DQ_BYTE2	MEM_40S	MEM_A_DATA_2	MEM_A_DQ<23..16>
MEM_A_DQ_BYTE3	MEM_40S	MEM_A_DATA_3	MEM_A_DQ<31..24>
MEM_A_DQ_BYTE4	MEM_40S	MEM_A_DATA_4	MEM_A_DQ<39..32>
MEM_A_DQ_BYTE5	MEM_40S	MEM_A_DATA_5	MEM_A_DQ<47..40>
MEM_A_DQ_BYTE6	MEM_40S	MEM_A_DATA_6	MEM_A_DQ<55..48>
MEM_A_DQ_BYTE7	MEM_40S	MEM_A_DATA_7	MEM_A_DQ<63..56>
MEM_A_DQS0	MEM_70D	MEM_A_DQS_0	MEM_A_DQS_P<0>
MEM_A_DQS0	MEM_70D	MEM_A_DQS_0	MEM_A_DQS_N<0>
MEM_A_DQS1	MEM_70D	MEM_A_DQS_1	MEM_A_DQS_P<1>
MEM_A_DQS1	MEM_70D	MEM_A_DQS_1	MEM_A_DQS_N<1>
MEM_A_DQS2	MEM_70D	MEM_A_DQS_2	MEM_A_DQS_P<2>
MEM_A_DQS2	MEM_70D	MEM_A_DQS_2	MEM_A_DQS_N<2>
MEM_A_DQS3	MEM_70D	MEM_A_DQS_3	MEM_A_DQS_P<3>
MEM_A_DQS3	MEM_70D	MEM_A_DQS_3	MEM_A_DQS_N<3>
MEM_A_DQS4	MEM_70D	MEM_A_DQS_4	MEM_A_DQS_P<4>
MEM_A_DQS4	MEM_70D	MEM_A_DQS_4	MEM_A_DQS_N<4>
MEM_A_DQS5	MEM_70D	MEM_A_DQS_5	MEM_A_DQS_P<5>
MEM_A_DQS5	MEM_70D	MEM_A_DQS_5	MEM_A_DQS_N<5>
MEM_A_DQS6	MEM_70D	MEM_A_DQS_6	MEM_A_DQS_P<6>
MEM_A_DQS6	MEM_70D	MEM_A_DQS_6	MEM_A_DQS_N<6>
MEM_A_DQS7	MEM_70D	MEM_A_DQS_7	MEM_A_DQS_P<7>
MEM_A_DQS7	MEM_70D	MEM_A_DQS_7	MEM_A_DQS_N<7>
MEM_B_CLK0	MEM_70D	MEM_CLK	MEM_B_CLK_P<0>
MEM_B_CLK0	MEM_70D	MEM_CLK	MEM_B_CLK_N<0>
MEM_B_CLK1	MEM_70D	MEM_CLK	MEM_B_CLK_P<1>
MEM_B_CLK1	MEM_70D	MEM_CLK	MEM_B_CLK_N<1>
MEM_B_CTRL	MEM_40S	MEM_CTRL	MEM_B_CS_L<1..0>
MEM_B_CTRL	MEM_40S	MEM_CTRL	MEM_B_ODT<0>
MEM_B_CKE0	MEM_40S	MEM_CMD	MEM_B_CKE<1..0>
MEM_B_CKE1	MEM_40S	MEM_CMD	MEM_B_CKE<3..2>
MEM_B_CMD0	MEM_40S	MEM_CMD	MEM_B_CAA<9..0>
MEM_B_CMD1	MEM_40S	MEM_CMD	MEM_B_CAB<9..0>
MEM_B_DQ_BYTE0	MEM_40S	MEM_B_DATA_0	MEM_B_DQ<7..0>
MEM_B_DQ_BYTE1	MEM_40S	MEM_B_DATA_1	MEM_B_DQ<15..8>
MEM_B_DQ_BYTE2	MEM_40S	MEM_B_DATA_2	MEM_B_DQ<23..16>
MEM_B_DQ_BYTE3	MEM_40S	MEM_B_DATA_3	MEM_B_DQ<31..24>
MEM_B_DQ_BYTE4	MEM_40S	MEM_B_DATA_4	MEM_B_DQ<39..32>
MEM_B_DQ_BYTE5	MEM_40S	MEM_B_DATA_5	MEM_B_DQ<47..40>
MEM_B_DQ_BYTE6	MEM_40S	MEM_B_DATA_6	MEM_B_DQ<55..48>
MEM_B_DQ_BYTE7	MEM_40S	MEM_B_DATA_7	MEM_B_DQ<63..56>
MEM_B_DQS0	MEM_70D	MEM_B_DQS_0	MEM_B_DQS_P<0>
MEM_B_DQS0	MEM_70D	MEM_B_DQS_0	MEM_B_DQS_N<0>
MEM_B_DQS1	MEM_70D	MEM_B_DQS_1	MEM_B_DQS_P<1>
MEM_B_DQS1	MEM_70D	MEM_B_DQS_1	MEM_B_DQS_N<1>
MEM_B_DQS2	MEM_70D	MEM_B_DQS_2	MEM_B_DQS_P<2>
MEM_B_DQS2	MEM_70D	MEM_B_DQS_2	MEM_B_DQS_N<2>
MEM_B_DQS3	MEM_70D	MEM_B_DQS_3	MEM_B_DQS_P<3>
MEM_B_DQS3	MEM_70D	MEM_B_DQS_3	MEM_B_DQS_N<3>
MEM_B_DQS4	MEM_70D	MEM_B_DQS_4	MEM_B_DQS_P<4>
MEM_B_DQS4	MEM_70D	MEM_B_DQS_4	MEM_B_DQS_N<4>
MEM_B_DQS5	MEM_70D	MEM_B_DQS_5	MEM_B_DQS_P<5>
MEM_B_DQS5	MEM_70D	MEM_B_DQS_5	MEM_B_DQS_N<5>
MEM_B_DQS6	MEM_70D	MEM_B_DQS_6	MEM_B_DQS_P<6>
MEM_B_DQS6	MEM_70D	MEM_B_DQS_6	MEM_B_DQS_N<6>
MEM_B_DQS7	MEM_70D	MEM_B_DQS_7	MEM_B_DQS_P<7>
MEM_B_DQS7	MEM_70D	MEM_B_DQS_7	MEM_B_DQS_N<7>
		MEM_PWR	PP1V2_S3
		MEM_PWR	PP0V6_S3_MEM_VREFCA_A
		MEM_PWR	PP0V6_S3_MEM_VREFDQ_A
		MEM_PWR	PP0V6_S3_MEM_VREFCA_B
		MEM_PWR	PP0V6_S3_MEM_VREFDQ_B

SYNC_MASTER=CHINMAY_J41 SYNC_DATE=09/07/2012

PAGE TITLE: Memory Constraints

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DRAWING NUMBER: <SCH_NUM> SIZE: D

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DisplayPort Signal Constraints

NOTE: DisplayPort Physical/Spacing Constraints provided by Chipset or GPU page.

Thunderbolt SPI Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
TBT_SPI_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBT_SPI	*	=2x_DIELECTRIC	?

Thunderbolt/DP Connector Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
TBTDP_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
TBTDP_TX	TBTDP_TX	*	TBTDP_TX2TX
TBTDP_RX	TBTDP_RX	*	TBTDP_RX2RX
TBTDP_TX	TBTDP_RX	*	TBTDP_TX2RX
TBTDP_RX	TBTDP_TX	*	TBTDP_TX2RX
TBTDP_TX	*_TX	*	TBTDP_2OTHERHS
TBTDP_RX	*_TX	*	TBTDP_2OTHERHS
TBTDP_TX	*_RX	*	TBTDP_2OTHERHS
TBTDP_RX	*_RX	*	TBTDP_2OTHERHS
TBTDP_TX	*	*	TBTDP_2OTHER
TBTDP_RX	*	*	TBTDP_2OTHER

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBTDP_TX2TX	TOP,BOTTOM	=6x_DIELECTRIC	?
TBTDP_RX2RX	TOP,BOTTOM	=6x_DIELECTRIC	?
TBTDP_TX2RX	TOP,BOTTOM	=10x_DIELECTRIC	?
TBTDP_2OTHERHS	TOP,BOTTOM	=10x_DIELECTRIC	?
TBTDP_2OTHER	TOP,BOTTOM	=6x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBTDP_TX2TX	*	=4x_DIELECTRIC	?
TBTDP_RX2RX	*	=4x_DIELECTRIC	?
TBTDP_TX2RX	*	=6x_DIELECTRIC	?
TBTDP_2OTHERHS	*	=6x_DIELECTRIC	?
TBTDP_2OTHER	*	=4x_DIELECTRIC	?

Thunderbolt/DP Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	SPACING	
TBT_A_R2D	TBTDP_80D	TBTDP_TX	TBT_A_R2D_C_P<1..0> 25 28
TBT_A_R2D	TBTDP_80D	TBTDP_TX	TBT_A_R2D_C_N<1..0> 25 28
	TBTDP_80D	TBTDP_TX	TBT_A_R2D_P<1..0> 28
	TBTDP_80D	TBTDP_TX	TBT_A_R2D_N<1..0> 28
DP_TBTPA_ML1	DP_80D	DP_TX	DP_TBTPA_ML_C_P<1> 25 28
DP_TBTPA_ML1	DP_80D	DP_TX	DP_TBTPA_ML_C_N<1> 25 28
DP_TBTPA_ML3	DP_80D	DP_TX	DP_TBTPA_ML_C_P<3> 25 28
DP_TBTPA_ML3	DP_80D	DP_TX	DP_TBTPA_ML_C_N<3> 25 28
	DP_80D	DP_TX	DP_TBTPA_ML_P<3..1:2> 28
	DP_80D	DP_TX	DP_TBTPA_ML_N<3..1:2> 28
	DP_80D	DP_TX	DP_A_LSX_ML_P<1> 28
	DP_80D	DP_TX	DP_A_LSX_ML_N<1> 28
	TBTDP_80D	TBTDP_RX	TBT_A_D2R_C_P<1..0> 28
	TBTDP_80D	TBTDP_RX	TBT_A_D2R_C_N<1..0> 28
TBT_A_D2R1	TBTDP_80D	TBTDP_RX	TBT_A_D2R_P<1> 25 28
TBT_A_D2R1	TBTDP_80D	TBTDP_RX	TBT_A_D2R_N<1> 25 28
TBT_A_D2R0	TBTDP_80D	TBTDP_RX	TBT_A_D2R_P<0> 25 28
TBT_A_D2R0	TBTDP_80D	TBTDP_RX	TBT_A_D2R_N<0> 25 28
TBT_A_AUXCH	DP_80D	DP_AUX	DP_TBTPA_AUXCH_C_P 25 28
TBT_A_AUXCH	DP_80D	DP_AUX	DP_TBTPA_AUXCH_C_N 25 28
	DP_80D	DP_AUX	DP_TBTPA_AUXCH_P 28
	DP_80D	DP_AUX	DP_TBTPA_AUXCH_N 28
	DP_80D	DP_AUX	DP_A_AUXCH_DDC_P
	DP_80D	DP_AUX	DP_A_AUXCH_DDC_N
	TBTDP_80D	TBTDP_RX	TBT_A_D2R1_AUXDDC_P 28
	TBTDP_80D	TBTDP_RX	TBT_A_D2R1_AUXDDC_N 28
TBT_B_R2D	TBTDP_80D	TBTDP_TX	TBT_B_R2D_C_P<1..0> 62
TBT_B_R2D	TBTDP_80D	TBTDP_TX	TBT_B_R2D_C_N<1..0> 62
	TBTDP_80D	TBTDP_TX	TBT_B_R2D_P<1..0>
	TBTDP_80D	TBTDP_TX	TBT_B_R2D_N<1..0>
DP_TBTPB_ML	DP_80D	DP_TX	NC_DP_TBTPB_ML_CP<3..1:2> 62
DP_TBTPB_ML	DP_80D	DP_TX	NC_DP_TBTPB_ML_CN<3..1:2> 62
	DP_80D	DP_TX	DP_TBTPB_ML_P<3..1:2>
	DP_80D	DP_TX	DP_TBTPB_ML_N<3..1:2>
	DP_80D	DP_TX	DP_B_LSX_ML_P<1>
	DP_80D	DP_TX	DP_B_LSX_ML_N<1>
	TBTDP_80D	TBTDP_RX	TBT_B_D2R_C_P<1..0>
	TBTDP_80D	TBTDP_RX	TBT_B_D2R_C_N<1..0>
TBT_B_D2R	TBTDP_80D	TBTDP_RX	TBT_B_D2R_P<1..0> 62
TBT_B_D2R	TBTDP_80D	TBTDP_RX	TBT_B_D2R_N<1..0> 62
TBT_B_AUXCH	DP_80D	DP_AUX	NC_DP_TBTPB_AUXCH_CP 25 62
TBT_B_AUXCH	DP_80D	DP_AUX	NC_DP_TBTPB_AUXCH_CN 25 62
	DP_80D	DP_AUX	DP_TBTPB_AUXCH_P
	DP_80D	DP_AUX	DP_TBTPB_AUXCH_N
	DP_80D	DP_AUX	DP_B_AUXCH_DDC_P
	DP_80D	DP_AUX	DP_B_AUXCH_DDC_N
	TBTDP_80D	TBTDP_RX	TBT_B_D2R1_AUXDDC_P
	TBTDP_80D	TBTDP_RX	TBT_B_D2R1_AUXDDC_N

Only used on dual-port hosts.

Thunderbolt IC Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	SPACING	
	DP_80D	DP_TX	DP_TBTSRC_ML_C_P<3..0>
	DP_80D	DP_TX	DP_TBTSRC_ML_C_N<3..0>
	DP_80D	DP_AUX	DP_TBTSRC_AUXCH_C_P
	DP_80D	DP_AUX	DP_TBTSRC_AUXCH_C_N
TBT_SPI_CLK	TBT_SPI_45S	TBT_SPI	TBT_SPI_CLK 25
TBT_SPI_MOSI	TBT_SPI_45S	TBT_SPI	TBT_SPI_MOSI 25
TBT_SPI_MISO	TBT_SPI_45S	TBT_SPI	TBT_SPI_MISO 25
TBT_SPI_CS_L	TBT_SPI_45S	TBT_SPI	TBT_SPI_CS_L 25

Only used on hosts supporting Thunderbolt video-in

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MIPI Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MIPI_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MIPI_2OTHER	*	=4X_DIELECTRIC	?
MIPI_2CLK	*	=6X_DIELECTRIC	?
MIPICLK_2OTHER	*	=7X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MIPI_2OTHER	TOP,BOTTOM	=6X_DIELECTRIC	?
MIPI_2CLK	TOP,BOTTOM	=8X_DIELECTRIC	?
MIPICLK_2OTHER	TOP,BOTTOM	=10X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MIPI_DATA	*	*	MIPI_2OTHER
MIPI_DATA	CLK_MIPI	*	MIPI_2CLK
CLK_MIPI	*	*	MIPICLK_2OTHER

Memory Bus Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
S2_MEM_45S	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD
S2_MEM_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF

Spacing Rule Sets

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
S2_DATA2SELF	*	=2x_DIELECTRIC	?
S2_DQS2OWNDATA	*	=2x_DIELECTRIC	?
S2_CMD2CMD	*	=2x_DIELECTRIC	?
S2_CMD2CTRL	*	=2x_DIELECTRIC	?
S2_CTRL2CTRL	*	=2x_DIELECTRIC	?
S2_2OTHERMEM	*	=4x_DIELECTRIC	?
S2MEM_2PWR	*	=2x_DIELECTRIC	?
S2MEM_2GND	*	=2x_DIELECTRIC	?
S2MEM_2OTHER	*	=6x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
S2_DATA2SELF	TOP,BOTTOM	=4x_DIELECTRIC	?
S2_DQS2OWNDATA	TOP,BOTTOM	=4x_DIELECTRIC	?
S2_CMD2CMD	TOP,BOTTOM	=4x_DIELECTRIC	?
S2_CMD2CTRL	TOP,BOTTOM	=4x_DIELECTRIC	?
S2_CTRL2CTRL	TOP,BOTTOM	=4x_DIELECTRIC	?
S2_2OTHERMEM	TOP,BOTTOM	=6x_DIELECTRIC	?
S2MEM_2PWR	TOP,BOTTOM	=4x_DIELECTRIC	?
S2MEM_2GND	TOP,BOTTOM	=4x_DIELECTRIC	?
S2MEM_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?

Memory Bus Spacing Group Assignments

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
S2_MEM_DATA*	*	*	S2MEM_2OTHER
S2_MEM_DQS*	*	*	S2MEM_2OTHER
S2_MEM_CMD	*	*	S2MEM_2OTHER
S2_MEM_CTRL	*	*	S2MEM_2OTHER
S2_MEM_CLK	*	*	S2MEM_2OTHER
S2_MEM_DATA*	=SAME	*	S2_DATA2SELF
S2_MEM_CMD	S2_MEM_CMD	*	S2_CMD2CMD
S2_MEM_CMD	S2_MEM_CTRL	*	S2_CMD2CTRL
S2_MEM_CTRL	S2_MEM_CTRL	*	S2_CTRL2CTRL
S2_MEM_*	S2_MEM_*	*	S2_2OTHERMEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
S2_MEM_DQS1	S2_MEM_DATA1	*	S2_DQS2OWNDATA
S2_MEM_DQS0	S2_MEM_DATA0	*	S2_DQS2OWNDATA

Memory to Power Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
S2_MEM_PWR	S2_MEM_*	*	S2MEM_2PWR
S2_MEM_PWR	*	*	DEFAULT

Memory to GND Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
GND	S2_MEM_*	*	S2MEM_2GND

Camera Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE: PHYSICAL	NET_TYPE: SPACING	
S2_MEM_CLK	S2_MEM_85D	S2_MEM_CLK	MEM_CAM_CLK_P 31 32
S2_MEM_CLK	S2_MEM_85D	S2_MEM_CLK	MEM_CAM_CLK_N 31 32
S2_MEM_CNTL	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CKE 31 32
S2_MEM_CNTL	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CS_L 31 32
	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_ODT 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CAS_L 31 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_RAS_L 31 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_WE_L 31 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<0> 31 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<1> 31 32
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<2> 31 32
S2_MEM_DQS0	S2_MEM_85D	S2_MEM_DQS0	MEM_CAM_DQS_P<0> 31 32
S2_MEM_DQS0	S2_MEM_85D	S2_MEM_DQS0	MEM_CAM_DQS_N<0> 31 32
S2_MEM_DQS1	S2_MEM_85D	S2_MEM_DQS1	MEM_CAM_DQS_P<1> 31 32
S2_MEM_DQS1	S2_MEM_85D	S2_MEM_DQS1	MEM_CAM_DQS_N<1> 31 32
S2_MEM_DATA_0	S2_MEM_45S	S2_MEM_DATA0	MEM_CAM_DM<0> 31 32
S2_MEM_DATA_1	S2_MEM_45S	S2_MEM_DATA1	MEM_CAM_DM<1> 31 32
S2_MEM_A	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_A<14..0> 31 32
S2_MEM_DATA_0	S2_MEM_45S	S2_MEM_DATA0	MEM_CAM_DQ<7..0> 31 32
S2_MEM_DATA_1	S2_MEM_45S	S2_MEM_DATA1	MEM_CAM_DQ<15..8> 31 32
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_P 31 32
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_N 31 32
	MIPI_85D	MIPI_DATA	MIPI_DATA_CONN_P 32 62
	MIPI_85D	MIPI_DATA	MIPI_DATA_CONN_N 32 62
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_P 31 32
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_N 31 32
	MIPI_85D	CLK_MIPI	MIPI_CLK_CONN_P 32 62
	MIPI_85D	CLK_MIPI	MIPI_CLK_CONN_N 32 62
		S2_MEM_PWR	PP1V35_CAM 31 32
		S2_MEM_PWR	PP0V675_CAM_VREF 31 32
		S2_MEM_PWR	PP0V675_MEM_CAM_VREFCA 32
		S2_MEM_PWR	PP0V675_MEM_CAM_VREFDQ 32

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PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
1TO1_DIFFPAIR	*	=STANDARD	=STANDARD	=STANDARD	=STANDARD	0.1 MM	0.1 MM
2TO1_DIFFPAIR	*	=STANDARD	0.2 MM	0.1 MM	=STANDARD	0.1 MM	0.1 MM

SMC SMBus Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	SPACING	
SMBUS_SMC_0_S0_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_0_S0_SCL 35 38 58
SMBUS_SMC_0_S0_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_0_S0_SDA 35 38 58
SMBUS_SMC_1_S0_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_1_S0_SCL 14 32 35 38 41 42 62 67
SMBUS_SMC_1_S0_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_1_S0_SDA 14 32 35 38 41 42 62 67
SMBUS_SMC_2_S3_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_2_S3_SCL 35 38 59 63
SMBUS_SMC_2_S3_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_2_S3_SDA 35 38 59 63
SMBUS_SMC_3_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_3_SCL 34 35 38 42 62
SMBUS_SMC_3_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_3_SDA 34 35 38 42 62
SMBUS_SMC_5_G3_SCL	SMB_45S_R_50S	SMB	SMBUS_SMC_5_G3_SCL 35 38 46 48 62
SMBUS_SMC_5_G3_SDA	SMB_45S_R_50S	SMB	SMBUS_SMC_5_G3_SDA 35 38 46 48 62

SMBus Charger Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	SPACING	
SENSE_DIFFPAIR			CHGR_CSI_P 48
SENSE_DIFFPAIR	2TO1_DIFFPAIR		CHGR_CSI_N 48
	2TO1_DIFFPAIR		CHGR_CSI_R_P 48
	2TO1_DIFFPAIR		CHGR_CSI_R_N 48
SENSE_DIFFPAIR	2TO1_DIFFPAIR		CHGR_CSO_P 48
SENSE_DIFFPAIR	2TO1_DIFFPAIR		CHGR_CSO_N 48
	2TO1_DIFFPAIR		CHGR_CSO_R_P 41 48
	2TO1_DIFFPAIR		CHGR_CSO_R_N 41 48

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PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SENSE_1TO1_45S	*	=1TO1_DIFFPAIR	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR
SENSE_1TO1_P2MM	*	=1TO1_DIFFPAIR	0.200 MM	0.100 MM	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR
THERM_1TO1_45S	*	=1TO1_DIFFPAIR	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR
SPKR_DIFFPAIR	*	=1TO1_DIFFPAIR	0.300 MM	0.100 MM	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SENSE	*	=2:1_SPACING	?
THERM	*	=2:1_SPACING	?
AUDIO	*	=2:1_SPACING	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GND	*	=STANDARD	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GND_P2MM	*	0.20 MM	10000
PWR_P2MM	*	0.20 MM	10000

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_COMP	GND	*	GND_P2MM
CPU_VCCSENSE	GND	*	GND_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
GND	CLK_PCIE	*	GND_P2MM
GND	PCIE*	*	GND_P2MM
GND	SATA*	*	GND_P2MM
GND	USB*	*	GND_P2MM
GND	LVDS*	*	GND_P2MM
SB_POWER	CLK_PCIE	*	PWR_P2MM
SB_POWER	SATA*	*	PWR_P2MM
SB_POWER	SATA*	*	PWR_P2MM

J11/J13 Specific Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	INLET_THMSNS_D1_P	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	INLET_THMSNS_D1_N	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBTTHMSNS_D2_R_P	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBTTHMSNS_D2_R_N	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBTTHMSNS_D2_P	
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBTTHMSNS_D2_N	
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBT_MLBBOT_THMSNS_P	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	TBT_MLBBOT_THMSNS_N	42
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	MLBBOT_THMSNS_D3_P	
SENSE_DIFFPAIR	THERM_1TO1_45S	THERM	MLBBOT_THMSNS_D3_N	
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	TBDTHMSNS_D2_P	42
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	TBDTHMSNS_D2_N	42
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	CPUTHMSNS_D2_P	42
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	CPUTHMSNS_D2_N	42
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	CPUVCCIOS0_CS_N	
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	CPUVCCIOS0_CS_P	
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	CPUVR_ISNS1_P	40 50
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	CPUVR_ISNS1_N	40 50
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	CPUVR_ISNS2_P	40 50
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	CPUVR_ISNS2_N	40 50
	SENSE_1TO1_P2MM	SENSE	CPUVR_ISNS1_P_R	40 41
	SENSE_1TO1_P2MM	SENSE	CPUVR_ISNS1_N_R	40 41
	SENSE_1TO1_45S	SENSE	CPUVR_ISUM_R_P	40
	SENSE_1TO1_45S	SENSE	CPUVR_ISUM_R_N	40
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	ISNS_CPUDDR_P	40
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	ISNS_CPUDDR_N	40
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_P3V3S5_N	40
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_P3V3S5_P	40
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_3V3_S0_P	
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_3V3_S0_N	
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_CAMERA_P	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_CAMERA_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_P3V3_S0_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_P3V3_S0_P	39
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	ISNS_1V05_S0_P	40 53
SENSE_DIFFPAIR	SENSE_1TO1_P2MM	SENSE	ISNS_1V05_S0_N	40 53
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_BMON_GAIN_P	
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_BMON_GAIN_N	
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_COMPUTING_N	39 41
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_COMPUTING_P	39 41
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_OTHER_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_OTHER_P	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_1V2_S3_N	39 51
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_1V2_S3_P	39 51
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_AIRPORT_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_AIRPORT_P	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_SSD_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_SSD_P	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_LCDBKLT_N	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_LCDBKLT_P	39
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_PANEL_N	41
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_PANEL_P	41
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_GAIN_N	41 42
SENSE_DIFFPAIR	SENSE_1TO1_45S	SENSE	ISNS_HS_GAIN_P	41 42
AUD_DIFF	1TO1_DIFFPAIR	AUDIO	SPKRAMP_INR_P	45 59 63
AUD_DIFF	1TO1_DIFFPAIR	AUDIO	SPKRAMP_INR_N	45 59 63
	1TO1_DIFFPAIR	AUDIO	MAX98300_R_P	45
	1TO1_DIFFPAIR	AUDIO	MAX98300_R_N	45
SPKR_OUT	SPKR_DIFFPAIR	AUDIO	SPKRAMP_ROUT_P	45 62
SPKR_OUT	SPKR_DIFFPAIR	AUDIO	SPKRAMP_ROUT_N	45 62
		SB_POWER	PP3V3_S5	8 11 13 15 16 17 18 28 29 40 52 55 56 57 58 60 62 63
		SB_POWER	PP3V3_S0	8 11 12 13 15 17 18 27 30 34 36 37 38 39 40 41 42 43 54 57 59
	GND		GND	

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<rdar://component/512995> J41 HW EE Schematic | Pre Proto 1
<rdar://component/508412> J41 HW EE Schematic | Proto 1
<rdar://component/508413> J41 HW EE Schematic | EVT
<rdar://component/508414> J41 HW EE Schematic | DVT

Kismet:

afp://kismet.apple.com/Kismet-Projects/J41-J43

Useful Wiki Links:

Schematic Conventions - https://hmts.ecs.apple.com/wiki/index.php/User:Wferry/SchConventions
Schematic Design Wiki - https://hmts.ecs.apple.com/wiki/index.php/Schematic_Design

MobileMac HW Radar:

<rdar://component/497591> MobileMac HW | Task
<rdar://component/497587> MobileMac HW | Schematic
<rdar://component/497585> MobileMac HW | New Bugs
<rdar://component/497588> MobileMac HW | Layout
<rdar://component/497590> MobileMac HW | Investigation
<rdar://component/497589> MobileMac HW | Architecture

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