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
8	0003549590	ENGINEERING RELEASED	2014-12-19

X304 MLB SCHEMATIC - DVT

Fri Dec 19 12:14:48 2014

Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-1573	1	SCHEM,MLB,X304	SCH	CRITICAL	
820-4924	1	PCBF,MLB,X304	PCB	CRITICAL	

DRAWING TITLE: SCHEM,MLB,X304

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 1 OF 120

SHEET: 1 OF 82

BOM Groups

BOM GROUP	BOM OPTIONS
X304_COMMON	ALTERNATE,COMMON,X304_COMMON1,X304_COMMON2,X304_COMMON3,X304_COMMON4,X304_PROGPARTS
X304_COMMON1	TBTHV:P15V,SKIP_5V3V3:AUDIBLE,PANEL:NEW,SSD_CLKREQ:BI
X304_COMMON2	EDP,EDP_LS_CAP,CAMERA_3V3:S0,CAM_WAKE:NO,CAM_XTAL:NO,VCORE_FETS
X304_COMMON3	XDP,SAMCONN,BKLT:PROD,CPUTHRM:ALRT,LOADRC:NO,OTHERRC:NO,DDRRC:NO,TBTRC:NO,BMONRC:NO,TPADRC:NO
X304_PROGPARTS	SMC_PROG:PROTO0,BOOTROM_PROG,TBTROM_PROG
X304_DEVEL:ENG	ALTERNATE,ENGISNS,XDP_CONN,DBGLED
X304_DEVEL:DVT	ALTERNATE,ENGISNS,XDP_CONN,S0PGOOD_ISL
X304_DEVEL:PVT	ALTERNATE
ENGISNS	LOADISNS,OTHERISNS,DDRISNS,TBTISNS,BMONISNS,TPADISNS

Module Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
337S00107	1	CPU,BW,SR26K,PRQ,F0-B2,2.7,28W,1.05,1168	U0500	CRITICAL	CPU_BDW23:2.7G
337S00108	1	CPU,BW,SR26H,PRQ,F0-B2,2.9,28W,1.1,1168	U0500	CRITICAL	CPU_BDW23:2.9G
337S00109	1	CPU,BW,SR26E,PRQ,F0-B2,3.1,28W,1.1,1168	U0500	CRITICAL	CPU_BDW23:3.1G

DVT

998-7866	1	INTERPOSER,BGA1168P, SINGLE SIDE	U0500	CRITICAL	CPU_SOCKET
338S1247	1	IC,TBT,FR-4C,A0,PRQ,CIO,SR1JC,FCBGA288	U2800	CRITICAL	
338S1264	1	IC,BCM15700A2KFEB4G,S2 CMRA,8X8,208FCBGA	U3900	CRITICAL	
376S1194	2	MOSFET,N-CH,30V,15.3A,12M,8P 3.3X3.3 DFN	Q7310,Q7320	CRITICAL	VCORE_FET:VSHY
376S1193	2	MOSFET,N-CH,30V,22A,6.0M,8P 3.3X3.3 DFN	Q7311,Q7321	CRITICAL	VCORE_FET:VSHY
376S00036	2	MOSFET,N-CH,30V,52A,5.9MO,3.3X3.3 DFN8	Q7310,Q7320	CRITICAL	VCORE_FET:ONSMI
376S00037	2	MOSFET,N-CH,30V,64A,3.5MO,3.3X3.3 DFN8	Q7311,Q7321	CRITICAL	VCORE_FET:ONSMI

Programmables (All Builds)

TBT

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
341S00192	1	T29,EPROM,FALCON RIDGE (V27.1) EVT2,X304	U2890	CRITICAL	TBTROM_PROG

SMC

341S3982	1	IC,SMC-B1,EXT(V2.21A5) PROTO 0,X304	U5000	CRITICAL	SMC_PROG:PROTO0

EFI ROM

341S00235	1	EFI ROM,MLB (V0145) DVT,X304	U6100	CRITICAL	BOOTROM_PROG

Variable BOM Groups

BOM GROUP	BOM OPTIONS
X304_COMMON4	SMCBOARDID:16

Development/Base BOMs

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
685-1314	1	X304 MLB COMMON BOM	BASE	CRITICAL	BASE_BOM
985-1319	1	X304 MLB DEVEL BOM	DEVEL	CRITICAL	DEVEL_BOM

Sub-BOMs

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
685-1318	1	VCORE FET,VSHY,X304	VCOREFETS	CRITICAL	VCORE_FETS

Main DRAM SPD Straps

BOM GROUP	BOM OPTIONS
RAM_16G_HYNIX_1600	16G_HYNIX_1600,RAMCFG3:L,RAMCFG2:L,RAMCFG1:H,RAMCFG0:L
RAM_16G_HYNIX_1866	16G_HYNIX_1866,RAMCFG3:L,RAMCFG2:H,RAMCFG1:H,RAMCFG0:L
RAM_8G_HYNIX_1600	8G_HYNIX_1600,RAMCFG3:L,RAMCFG2:L,RAMCFG1:L,RAMCFG0:H
RAM_8G_HYNIX_1866	8G_HYNIX_1866,RAMCFG3:L,RAMCFG2:H,RAMCFG1:L,RAMCFG0:H
RAM_4G_HYNIX_1600	4G_HYNIX_1600,RAMCFG3:L,RAMCFG2:L,RAMCFG1:L,RAMCFG0:L
RAM_4G_HYNIX_1866	4G_HYNIX_1866,RAMCFG3:L,RAMCFG2:H,RAMCFG1:L,RAMCFG0:L
RAM_16G_ELPIDA_1600	16G_ELPIDA_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:H,RAMCFG0:L
RAM_16G_ELPIDA_1866	16G_ELPIDA_1866,RAMCFG3:H,RAMCFG2:H,RAMCFG1:H,RAMCFG0:L
RAM_8G_ELPIDA_1600	8G_ELPIDA_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:L,RAMCFG0:H
RAM_8G_ELPIDA_1866	8G_ELPIDA_1866,RAMCFG3:H,RAMCFG2:H,RAMCFG1:L,RAMCFG0:H
RAM_4G_ELPIDA_1600	4G_ELPIDA_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:L,RAMCFG0:L
RAM_4G_ELPIDA_1866	4G_ELPIDA_1866,RAMCFG3:H,RAMCFG2:H,RAMCFG1:L,RAMCFG0:L
RAM_8G_SAMSUNG_1600	8G_SAMSUNG_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:H,RAMCFG0:H
RAM_8G_SAMSUNG_1866	8G_SAMSUNG_1866,RAMCFG3:H,RAMCFG2:H,RAMCFG1:H,RAMCFG0:H
RAM_4G_SAMSUNG_1600	4G_SAMSUNG_1600,RAMCFG3:L,RAMCFG2:L,RAMCFG1:H,RAMCFG0:H
RAM_4G_SAMSUNG_1866	4G_SAMSUNG_1866,RAMCFG3:L,RAMCFG2:H,RAMCFG1:H,RAMCFG0:H

Strategic Silicon

PART#	STRATEGIC VALUE	COMMENT
337S00068	08	CPU
337S00069	08	CPU
337S00070	08	CPU
337S00071	08	CPU
353S00200	07	TPAD ELEC FUSE
333S0786	07	SYS MEMORY HYNIX
333S0784	07	SYS MEMORY HYNIX
333S0792	07	SYS MEMORY MICRON
333S0790	07	SYS MEMORY MICRON
333S00004	07	SYS MEMORY SAMSUNG
311S0597	02	KEYBOARD I2C EXPANDER
359S0197	01	GREEN CLOCK
338S1247	01	FALCON RIDGE
353S3931	01	TBT PWR MUX
353S3812	01	TBT MUX
353S3814	01	TBT MUX
353S00095	01	DDC CROSSBAR
353S3328	01	DDC CROSSBAR
343S0511	01	PCIE DELAY IC
338S1264	01	S2
333S0700	01	S2 MEMORY
333S0704	01	S2 MEMORY
353S3054	01	USB POWER/SAFETY
343S0649	01	SMC RESET CHIP
353S4080	01	AUDIO
353S2888	01	AUDIO AMPS
353S2958	01	AUDIO AMPS
353S2929	01	BAT CHARGER
353S00036	01	VR12.6 CONTROLLER
353S4160	01	BEN
343S0666	01	SAK, HDMI SELECT
341S3982	01	SMC
341S00192	01	T29 ROM
341S00235	01	EFI ROM

Main DRAM Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
333S0783	4	IC,SDRAM,25nm 32Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	16G_HYNIX_1600
333S0784	4	IC,SDRAM,25nm 32Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	16G_HYNIX_1866
333S0785	4	IC,SDRAM,29nm 16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_HYNIX_1600
333S0786	4	IC,SDRAM,29nm 16Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_HYNIX_1866
333S0787	4	IC,SDRAM,29nm 8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_HYNIX_1600
333S0788	4	IC,SDRAM,29nm 8Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_HYNIX_1866
333S0789	4	IC,SDRAM,25nm 32Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	16G_ELPIDA_1600
333S0790	4	IC,SDRAM,25nm 32Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	16G_ELPIDA_1866
333S0791	4	IC,SDRAM,25nm 16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_ELPIDA_1600
333S0792	4	IC,SDRAM,25nm 16Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_ELPIDA_1866
333S0793	4	IC,SDRAM,25nm 8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_ELPIDA_1600
333S0794	4	IC,SDRAM,25nm 8Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_ELPIDA_1866
333S00003	4	IC,SDRAM,23nm 16Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_SAMSUNG_1600
333S00004	4	IC,SDRAM,23nm 16Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	8G_SAMSUNG_1866
333S00001	4	IC,SDRAM,23nm 8Gb,LPDDR3-1600,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_SAMSUNG_1600
333S00002	4	IC,SDRAM,23nm 8Gb,LPDDR3-1866,178P FBGA	U2300,U2400,U2500,U2600	CRITICAL	4G_SAMSUNG_1866

S2 DRAM Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
333S0700	1	IC,SDRAM,4GBIT.DDR3L-1600,HUMA,96B BGA	U4000		

SYNC_MASTER=SHART_J44 SYNC_DATE=11/27/2013

PAGE TITLE

BOM Configuration

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 2 OF 120

SHEET 2 OF 82

BOM Variants

BOM NUMBER	BOM NAME	BOM OPTIONS
685-1314	COMMON,MLB,X304	X304_COMMON
985-1319	DEV,MLB,X304	X304_DEVEL:ENG
639-00772	MLB,BDW2+3,2.7GHz,8GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.7G,RAM_8G_HYNIX_1866
639-00773	MLB,BDW2+3,2.7GHz,16GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.7G,RAM_16G_HYNIX_1866
639-00774	MLB,BDW2+3,2.7GHz,8GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.7G,RAM_8G_ELPIDA_1866
639-00775	MLB,BDW2+3,2.7GHz,16GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.7G,RAM_16G_ELPIDA_1866
639-00776	MLB,BDW2+3,2.7GHz,8GB-SM-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.7G,RAM_8G_SAMSUNG_1866
639-00777	MLB,BDW2+3,2.9GHz,8GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.9G,RAM_8G_HYNIX_1866
639-00778	MLB,BDW2+3,2.9GHz,16GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.9G,RAM_16G_HYNIX_1866
639-00779	MLB,BDW2+3,2.9GHz,8GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.9G,RAM_8G_ELPIDA_1866
639-00780	MLB,BDW2+3,2.9GHz,16GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.9G,RAM_16G_ELPIDA_1866
639-00781	MLB,BDW2+3,2.9GHz,8GB-SM-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:2.9G,RAM_8G_SAMSUNG_1866
639-00782	MLB,BDW2+3,3.1GHz,8GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:3.1G,RAM_8G_HYNIX_1866
639-00783	MLB,BDW2+3,3.1GHz,16GB-HY-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:3.1G,RAM_16G_HYNIX_1866
639-00784	MLB,BDW2+3,3.1GHz,8GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:3.1G,RAM_8G_ELPIDA_1866
639-00785	MLB,BDW2+3,3.1GHz,16GB-EP-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:3.1G,RAM_16G_ELPIDA_1866
639-00786	MLB,BDW2+3,3.1GHz,8GB-SM-1866,X304	BASE_BOM,DEVEL_BOM,CPU_BDW23:3.1G,RAM_8G_SAMSUNG_1866

BOM NUMBER	BOM NAME	BOM OPTIONS
639-00035	PCBA,MLB,NO CPU,X304	BASE_BOM,DEVEL_BOM,RAM_8G_HYNIX_1866
639-00036	PCBA,MLB,CPU SOCKET,X304	BASE_BOM,DEVEL_BOM,CPU_SOCKET,RAM_8G_HYNIX_1866
685-1318	VCORE FET,VSHY,X304	VCORE_FET:VSHY
685-00022	VCORE FET,ONSMI,X304	VCORE_FET:ONSMI

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:	
685-00022	685-1318		ALL		Onsemi alt to Vishay for CPU Core Mosfets
333S0704	333S0700		ALL		Elpida alt to Hynix for S2 Camera DDR3 Memory

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:	
376S1053	376S0604		ALL		Diodes alt to Fairchild
128S0311	128S0329		ALL		NEC alt to Sanyo
138S0739	138S0706		ALL		Samsung alt to Murata
197S0481	197S0480		ALL		Epson alt to NDK
152S0461	152S1645		ALL		Cyntec alt to Vishay
376S1080	376S0820		ALL		Diodes alt to On Semi
138S0725	138S0724		ALL		Samsung alt to Murata
376S00074	376S0855		ALL		Toshiba alt for Diodes Dual
376S1129	376S0855		ALL		NXP Alt for Diodes Dual
376S1089	376S1128		ALL		NXP Alt for Diodes Single
353S3452	353S1286		ALL		Maxim alt to Microchip
128S0364	128S0264		ALL		Sanyo 2nd Factory alt
107S0254	107S0241		ALL		Cyntec alt to TFT
138S0843	138S0674		ALL		Samsung alt to Murata (BKLT)
138S0846	138S0811		ALL		Samsung alt to Murata (BKLT)
197S0542	197S0544		ALL		NDK alt to TXC
197S0545	197S0544		ALL		Epson alt to TXC
107S0248	107S0250		ALL		TFT alt to Cyntec
127S0164	127S0162		ALL		Rohm alt to Vishay
353S4070	353S4069		ALL		Pericom alt to TI DP Mux U9750
353S4068	353S4069		ALL		NXP alt to TI DP Mux U9750
353S3814	353S3812		ALL		TI alt to NXP
311S0649	311S0541		ALL		ONsemi alt to Toshiba
138S0614	138S0578		ALL		Murata, TDK, Samsung, Taiyo Yuden alt to Murata, TDK
155S0694	155S0387		ALL		Murata alt to TDK
155S0660	155S0513		ALL		Murata alt to TDK
740S00003	740S0135		ALL		AEM alt to Tyco
138S0738	138S1101		ALL		Samsung alt to Murata for LCD BKL caps
353S00095	353S3328		ALL		Pericom alt to TI
311S00007	311S0426		ALL		Diodes alt to NXP
128S0398	128S0220		ALL		Kemet alt to Sanyo
128S0386	128S0284		ALL		Kemet alt to Sanyo
128S0397	128S0325		ALL		Kemet alt to Sanyo
377S00011	377S0184		ALL		Infineon alt to Infineon
377S0155	377S0184		ALL		On Semi alt to Infineon
155S0914	155S0897		ALL		Panasonic alt to TDK
371S0558	371S0713		ALL		ST Micro alt to Diodes
128S0436	128S0392		ALL		Kemet alt to Sanyo
128S0445	128S0392		ALL		Panasonic alt to Sanyo
353S00034	353S2220		ALL		Pericom alt to Fairchild
311S00014	311S0515		ALL		Diodes alt to NXP
311S00008	311S0271		ALL		Diodes alt to NXP
197S0479	197S0478		ALL		Epson alt to NDK
311S00013	311S0508		ALL		Diodes alt to NXP
376S00014	376S0761		ALL		Toshiba alt to Vishay
371S00019	371S0463		ALL		Rohm alt to Rohm
371S00018	371S0619		ALL		Rohm alt to Rohm
311S00015	311S0450		ALL		Diodes alt to NXP
371S00017	371S0749		ALL		Diodes alt to Onsemi
353S00107	353S3239	ANY	ALL		Onsemi alt to Intersil
107S00024	107S0226		ALL		Yageo alt to Cyntec
372S0186	372S0185		ALL		NXP alt to Diodes
353S00231	353S3987		ALL		NXP alt to TI
353S00135	353S2220		ALL		Onsemi alt to Fairchild
353S00133	353S2741		ALL		Onsemi alt to TI
131S00040	131S00041		ALL		Murata alt to Taiyo Yuden
107S00015	107S00011		ALL		TFT alt to Cyntec
107S00031	107S00032		ALL		TFT alt to Cyntec
107S00029	107S00030		ALL		TFT alt to Cyntec

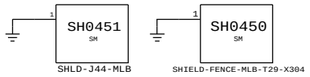
SYNC_MASTER=J14 SYNC_DATE=09/04/2013

PAGE TITLE: BOM Configuration

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 3 OF 120
SHEET: 3 OF 82

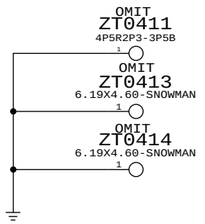
Shield Cans



USB Cage

TBT Cage

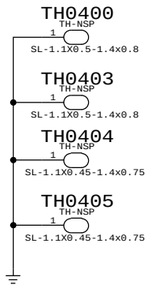
Mounting Holes & Slots



ABOVE GUMSTICK CARD IN MIDDLE OF BOARD
(998-1195)

SNOWMAN-SHAPED SLOT AT LEFT OF MEMORY BANK
(998-5879)

SNOWMAN-SHAPED SLOT AT RIGHT OF MEMORY BANK
(998-5879)



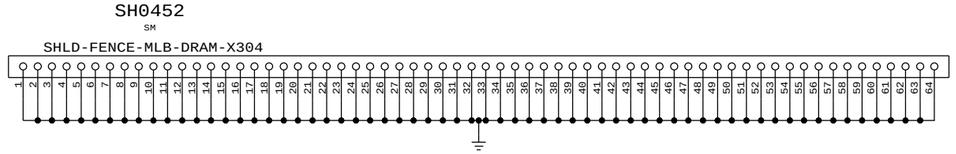
Upper TBT can Ground slot
(862-0118)

Lower TBT can Ground slot
(862-0118)

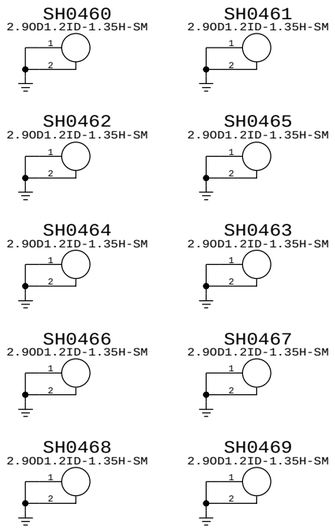
USB can Ground slot
(998-3975)

USB can Ground slot
(998-3975)

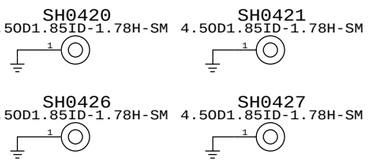
Memory Shield CAN (806-00037)



Rubber Mount Standoffs (860-1448)

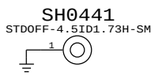


THERMAL MODULE STANDOFF (860-00165)



SSD STANDOFF (860-00164)

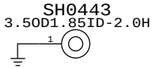
FAN STANDOFF (860-00183)



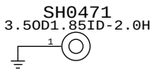
POGO PINS (870-00607)

SH0435 & SH0436 removed.

RIO FLEX BRACKET BOSSES (860-00166)



IPD FLEX BRACKET BOSSES (860-00166)



BOM_COST_GROUP=PD PARTS

SYNC_MASTER=LDUNN_J44 SYNC_DATE=01/13/2012

PAGE TITLE: PD Parts

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 4 OF 120

SHEET: 4 OF 82

DDI Port Assignments:

TBT Sink 0

TBT Sink 1
(MUXed with HDMI
if necessary)

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 1 OF 19

DP_TBTSNK0_ML_C_N<0>	C54	DDI1_TXN0		EDP_TXN0	C45	DP_INT_ML_C_N<0>	
DP_TBTSNK0_ML_C_P<0>	C55	DDI1_TXP0		EDP_TXP0	B46	DP_INT_ML_C_P<0>	
DP_TBTSNK0_ML_C_N<1>	B58	DDI1_TXN1		EDP_TXN1	A47	DP_INT_ML_C_N<1>	
DP_TBTSNK0_ML_C_P<1>	C58	DDI1_TXP1		EDP_TXP1	B47	DP_INT_ML_C_P<1>	
DP_TBTSNK0_ML_C_N<2>	B55	DDI1_TXN2		EDP_TXN2	C47	DP_INT_ML_C_N<2>	
DP_TBTSNK0_ML_C_P<2>	A55	DDI1_TXP2		EDP_TXP2	C46	DP_INT_ML_C_P<2>	
DP_TBTSNK0_ML_C_N<3>	A57	DDI1_TXN3		EDP_TXN3	A49	DP_INT_ML_C_N<3>	
DP_TBTSNK0_ML_C_P<3>	B57	DDI1_TXP3		EDP_TXP3	B49	DP_INT_ML_C_P<3>	
=DP_TBTSNK1_ML_C_N<0>	C51	DDI2_TXN0					
=DP_TBTSNK1_ML_C_P<0>	C50	DDI2_TXP0					
=DP_TBTSNK1_ML_C_N<1>	C53	DDI2_TXN1					
=DP_TBTSNK1_ML_C_P<1>	B54	DDI2_TXP1		EDP_AUXN	A45	DP_INT_AUXCH_C_N	
=DP_TBTSNK1_ML_C_N<2>	C49	DDI2_TXN2		EDP_AUXP	B45	DP_INT_AUXCH_C_P	
=DP_TBTSNK1_ML_C_P<2>	B50	DDI2_TXP2					
=DP_TBTSNK1_ML_C_N<3>	A53	DDI2_TXN3		EDP_RCOMP	D20	MCP_EDP_RCOMP	
=DP_TBTSNK1_ML_C_P<3>	B53	DDI2_TXP3		EDP_DISP_UTIL	A43	TP_EDP_DISP_UTIL	

eDP Port Assignment:

Internal panel

PPVCOMP_S0_CPU

R0530
24.9
1%
1/20W
MF
201

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 17 OF 19

		NO_TEST					
MCP_DC_AW2_AY2	AY2	TRUE		DAISY_CHAIN_NCTF	A3	TRUE	MCP_DC_A3_B3
MCP_DC_AW3_AY3	AY3	TRUE		DAISY_CHAIN_NCTF	A4		MCP_DC_A4
MCP_DC_AY60	AY60			DAISY_CHAIN_NCTF	A60		MCP_DC_A60
MCP_DC_AW61_AY61	AY61	TRUE		DAISY_CHAIN_NCTF	A61	TRUE	MCP_DC_A61_B61
MCP_DC_AW62_AY62	AY62	TRUE		DAISY_CHAIN_NCTF	A62		MCP_DC_A62
MCP_DC_B2	B2			DAISY_CHAIN_NCTF	AV1		MCP_DC_AV1
MCP_DC_A3_B3	B3	TRUE		DAISY_CHAIN_NCTF	AW1		MCP_DC_AW1
MCP_DC_A61_B61	B61	TRUE		DAISY_CHAIN_NCTF	AW2	TRUE	MCP_DC_AW2_AY2
MCP_DC_B62_B63	B62	TRUE		DAISY_CHAIN_NCTF	AW3	TRUE	MCP_DC_AW3_AY3
	B63			DAISY_CHAIN_NCTF	AW61	TRUE	MCP_DC_AW61_AY61
MCP_DC_C1_C2	C1	TRUE		DAISY_CHAIN_NCTF	AW62	TRUE	MCP_DC_AW62_AY62
	C2			DAISY_CHAIN_NCTF	AW63		MCP_DC_AW63

TP0531 TP-P6
TP0501 TP-P6

TP0500 TP-P6
TP0510 TP-P6
TP0511 TP-P6
TP0520 TP-P6
TP0521 TP-P6
TP0530 TP-P6

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.

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 18 OF 19
SPARE

NC	AT2	RSVD	RSVD	N23	NC
NC	AU44	RSVD	RSVD	R23	NC
NC	AV44	RSVD	RSVD	T23	NC
NC	D15	RSVD	RSVD	U10	NC
NC	F22	RSVD	RSVD	AL1	NC
NC	H22	RSVD	RSVD	AM11	NC
NC	J21	RSVD	RSVD	AP7	NC
			RSVD	AU10	NC
			RSVD	AU15	NC
			RSVD	AW14	NC
			RSVD	AY14	NC

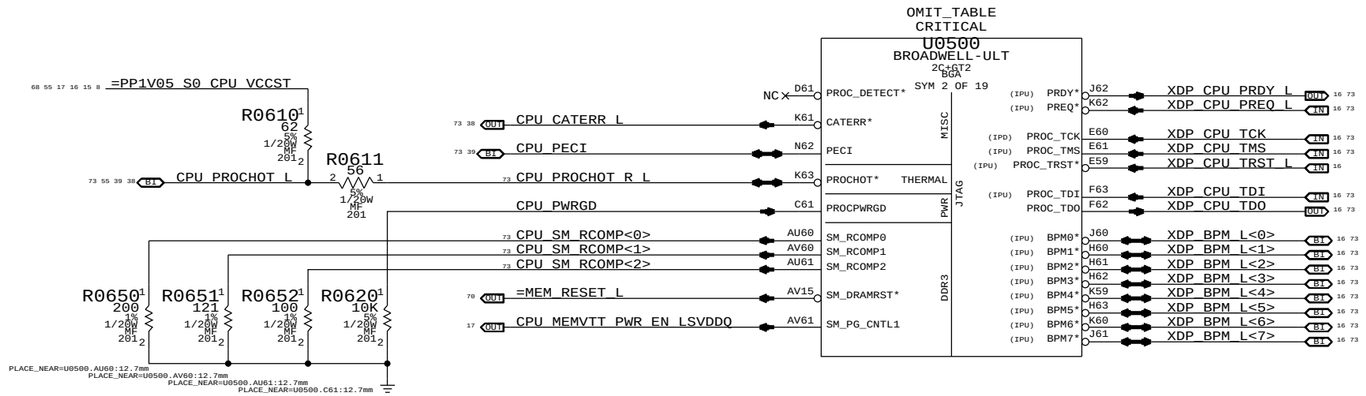
BOM_COST_GROUP=CPU

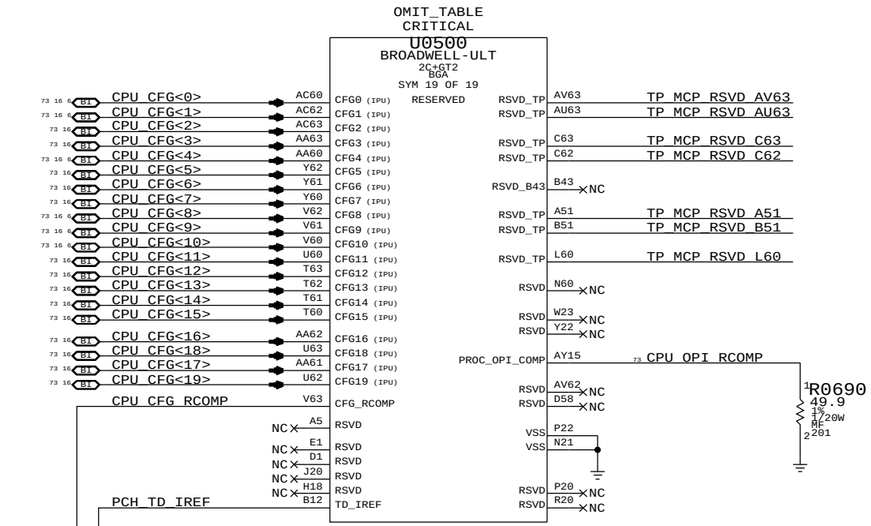
SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE
CPU GFX,NCTF,RSVD

Apple Inc.

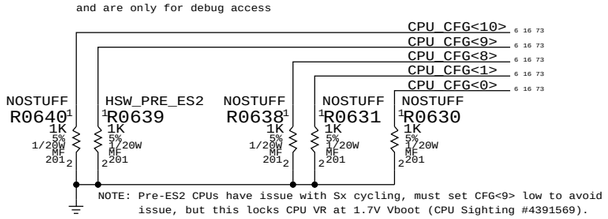
DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 5 OF 120
SHEET 5 OF 82



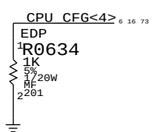


CFG<10>:SAFE MODE BOOT	1 = NORMAL OPERATION	0 = POWER FEATURES NOT ACTIVE
CFG<9> :NO SVID-CAPABLE VR	1 = VR SUPPORTS SVID	0 = VR DOES NOT SUPPORT SVID
CFG<8> :ALLOW NOA ON LOCKED UNITS	1 = NORMAL OPERATION	0 = NOA ALWAYS UNLOCKED
CFG<4> :eDP ENABLE/DISABLE	1 = DISABLED	0 = ENABLED
CFG<1> :PCH-LESS MODE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



BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE: CPU Misc,JTAG,CFG,RSVD

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 6 OF 120
SHEET: 6 OF 82

OMIT_TABLE
CRITICAL

U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 3 OF 19

MEMORY CHANNEL A

MEM_A_DQ<0>	AH63	SA_DQ0		SA_CLK0*	AU37	MEM_A_CLK_N<0>
MEM_A_DQ<1>	AH62	SA_DQ1		SA_CLK0	AV37	MEM_A_CLK_P<0>
MEM_A_DQ<2>	AK63	SA_DQ2		SA_CLK1*	AW36	MEM_A_CLK_N<1>
MEM_A_DQ<3>	AK62	SA_DQ3		SA_CLK1	AY36	MEM_A_CLK_P<1>
MEM_A_DQ<4>	AH61	SA_DQ4				
MEM_A_DQ<5>	AH60	SA_DQ5		SA_CKE0	AU43	MEM_A_CKE<0>
MEM_A_DQ<6>	AK61	SA_DQ6		SA_CKE1	AW43	MEM_A_CKE<1>
MEM_A_DQ<7>	AK60	SA_DQ7		SA_CKE2	AY42	MEM_A_CKE<2>
MEM_A_DQ<8>	AM63	SA_DQ8		SA_CKE3	AY43	MEM_A_CKE<3>
MEM_A_DQ<9>	AM62	SA_DQ9				
MEM_A_DQ<10>	AP63	SA_DQ10		SA_CS0*	AP33	MEM_A_CS_L<0>
MEM_A_DQ<11>	AP62	SA_DQ11		SA_CS1*	AR32	MEM_A_CS_L<1>
MEM_A_DQ<12>	AM61	SA_DQ12				
MEM_A_DQ<13>	AM60	SA_DQ13		SA_ODT0	AP32	=MEM_A_ODT<0>
MEM_A_DQ<14>	AP61	SA_DQ14	LPDDR3			
MEM_A_DQ<15>	AP60	SA_DQ15	CAB3	SA_RAS*	AY34	=MEM_A_RAS_L
MEM_A_DQ<16>	AP58	SA_DQ16	CAB2	SA_WE*	AW34	=MEM_A_WE_L
MEM_A_DQ<17>	AR58	SA_DQ17	CAB1	SA_CAS*	AU34	=MEM_A_CAS_L
MEM_A_DQ<18>	AM57	SA_DQ18				
MEM_A_DQ<19>	AK57	SA_DQ19	CAB4	SA_BA0	AU35	=MEM_A_BA<0>
MEM_A_DQ<20>	AL58	SA_DQ20	CAB6	SA_BA1	AV35	=MEM_A_BA<1>
MEM_A_DQ<21>	AK58	SA_DQ21	CAA5	SA_BA2	AY41	=MEM_A_BA<2>
MEM_A_DQ<22>	AR57	SA_DQ22				
MEM_A_DQ<23>	AN57	SA_DQ23	CAB9	SA_MA0	AU36	=MEM_A_A<0>
MEM_A_DQ<24>	AP55	SA_DQ24	CAB8	SA_MA1	AY37	=MEM_A_A<1>
MEM_A_DQ<25>	AR55	SA_DQ25	CAB5	SA_MA2	AR38	=MEM_A_A<2>
MEM_A_DQ<26>	AM54	SA_DQ26	RSVD1	SA_MA3	AP36	=MEM_A_A<3>
MEM_A_DQ<27>	AK54	SA_DQ27	RSVD2	SA_MA4	AU39	=MEM_A_A<4>
MEM_A_DQ<28>	AL55	SA_DQ28	CAA0	SA_MA5	AR36	=MEM_A_A<5>
MEM_A_DQ<29>	AK55	SA_DQ29	CAA2	SA_MA6	AV40	=MEM_A_A<6>
MEM_A_DQ<30>	AR54	SA_DQ30	CAA4	SA_MA7	AW39	=MEM_A_A<7>
MEM_A_DQ<31>	AN54	SA_DQ31	CAA3	SA_MA8	AY39	=MEM_A_A<8>
MEM_A_DQ<32>	AY58	SA_DQ32	CAA1	SA_MA9	AU40	=MEM_A_A<9>
MEM_A_DQ<33>	AW58	SA_DQ33	CAB7	SA_MA10	AP35	=MEM_A_A<10>
MEM_A_DQ<34>	AY56	SA_DQ34	CAA7	SA_MA11	AW41	=MEM_A_A<11>
MEM_A_DQ<35>	AW56	SA_DQ35	CAA6	SA_MA12	AU41	=MEM_A_A<12>
MEM_A_DQ<36>	AV58	SA_DQ36	CAB0	SA_MA13	AR35	=MEM_A_A<13>
MEM_A_DQ<37>	AU58	SA_DQ37	CAA9	SA_MA14	AV42	=MEM_A_A<14>
MEM_A_DQ<38>	AV56	SA_DQ38	CAA8	SA_MA15	AU42	=MEM_A_A<15>
MEM_A_DQ<39>	AU56	SA_DQ39				
MEM_A_DQ<40>	AY54	SA_DQ40		SA_DQSN0	AJ61	MEM_A_DQS_N<0>
MEM_A_DQ<41>	AW54	SA_DQ41		SA_DQSN1	AN62	MEM_A_DQS_N<1>
MEM_A_DQ<42>	AY52	SA_DQ42		SA_DQSN2	AM58	MEM_A_DQS_N<2>
MEM_A_DQ<43>	AW52	SA_DQ43		SA_DQSN3	AM55	MEM_A_DQS_N<3>
MEM_A_DQ<44>	AV54	SA_DQ44		SA_DQSN4	AV57	MEM_A_DQS_N<4>
MEM_A_DQ<45>	AU54	SA_DQ45		SA_DQSN5	AV53	MEM_A_DQS_N<5>
MEM_A_DQ<46>	AV52	SA_DQ46		SA_DQSN6	AL43	MEM_A_DQS_N<6>
MEM_A_DQ<47>	AU52	SA_DQ47		SA_DQSN7	AL48	MEM_A_DQS_N<7>
MEM_A_DQ<48>	AK40	SA_DQ48				
MEM_A_DQ<49>	AK42	SA_DQ49		SA_DQSP0	AJ62	MEM_A_DQS_P<0>
MEM_A_DQ<50>	AM43	SA_DQ50		SA_DQSP1	AN61	MEM_A_DQS_P<1>
MEM_A_DQ<51>	AM45	SA_DQ51		SA_DQSP2	AN58	MEM_A_DQS_P<2>
MEM_A_DQ<52>	AK45	SA_DQ52		SA_DQSP3	AN55	MEM_A_DQS_P<3>
MEM_A_DQ<53>	AK43	SA_DQ53		SA_DQSP4	AW57	MEM_A_DQS_P<4>
MEM_A_DQ<54>	AM40	SA_DQ54		SA_DQSP5	AW53	MEM_A_DQS_P<5>
MEM_A_DQ<55>	AM42	SA_DQ55		SA_DQSP6	AL42	MEM_A_DQS_P<6>
MEM_A_DQ<56>	AM46	SA_DQ56		SA_DQSP7	AL49	MEM_A_DQS_P<7>
MEM_A_DQ<57>	AK46	SA_DQ57				
MEM_A_DQ<58>	AM49	SA_DQ58				
MEM_A_DQ<59>	AK49	SA_DQ59				
MEM_A_DQ<60>	AM48	SA_DQ60		SM_VREF_CA	AP49	CPU_DIMM_VREFCA
MEM_A_DQ<61>	AK48	SA_DQ61		SM_VREF_DQ0	AR51	CPU_DIMMA_VREFDQ
MEM_A_DQ<62>	AM51	SA_DQ62		SM_VREF_DQ1	AP51	CPU_DIMMB_VREFDQ
MEM_A_DQ<63>	AK51	SA_DQ63				

OMIT_TABLE
CRITICAL

U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 4 OF 19

MEMORY CHANNEL B

MEM_B_DQ<0>	AY31	SB_DQ0		SB_CK0*	AM38	MEM_B_CLK_N<0>
MEM_B_DQ<1>	AW31	SB_DQ1		SB_CK0	AN38	MEM_B_CLK_P<0>
MEM_B_DQ<2>	AY29	SB_DQ2		SB_CK1*	AK38	MEM_B_CLK_N<1>
MEM_B_DQ<3>	AW29	SB_DQ3		SB_CK1	AL38	MEM_B_CLK_P<1>
MEM_B_DQ<4>	AV31	SB_DQ4				
MEM_B_DQ<5>	AU31	SB_DQ5		SB_CKE0	AY49	MEM_B_CKE<0>
MEM_B_DQ<6>	AV29	SB_DQ6		SB_CKE1	AU50	MEM_B_CKE<1>
MEM_B_DQ<7>	AU29	SB_DQ7		SB_CKE2	AW49	MEM_B_CKE<2>
MEM_B_DQ<8>	AY27	SB_DQ8		SB_CKE3	AV50	MEM_B_CKE<3>
MEM_B_DQ<9>	AW27	SB_DQ9				
MEM_B_DQ<10>	AY25	SB_DQ10		SB_CS0*	AM32	MEM_B_CS_L<0>
MEM_B_DQ<11>	AW25	SB_DQ11		SB_CS1*	AK32	MEM_B_CS_L<1>
MEM_B_DQ<12>	AV27	SB_DQ12				
MEM_B_DQ<13>	AU27	SB_DQ13		SB_ODT0	AL32	=MEM_B_ODT<0>
MEM_B_DQ<14>	AV25	SB_DQ14	LPDDR3			
MEM_B_DQ<15>	AU25	SB_DQ15	CAB3	SB_RAS*	AM35	=MEM_B_RAS_L
MEM_B_DQ<16>	AM29	SB_DQ16	CAB2	SB_WE*	AK35	=MEM_B_WE_L
MEM_B_DQ<17>	AK29	SB_DQ17	CAB1	SB_CAS*	AM33	=MEM_B_CAS_L
MEM_B_DQ<18>	AL28	SB_DQ18				
MEM_B_DQ<19>	AK28	SB_DQ19	CAB4	SB_BA0	AL35	=MEM_B_BA<0>
MEM_B_DQ<20>	AR29	SB_DQ20	CAB6	SB_BA1	AM36	=MEM_B_BA<1>
MEM_B_DQ<21>	AN29	SB_DQ21	CAA5	SB_BA2	AU49	=MEM_B_BA<2>
MEM_B_DQ<22>	AR28	SB_DQ22				
MEM_B_DQ<23>	AP28	SB_DQ23	CAB9	SB_MA0	AP40	=MEM_B_A<0>
MEM_B_DQ<24>	AN26	SB_DQ24	CAB8	SB_MA1	AR40	=MEM_B_A<1>
MEM_B_DQ<25>	AR26	SB_DQ25	CAB5	SB_MA2	AP42	=MEM_B_A<2>
MEM_B_DQ<26>	AR25	SB_DQ26	RSVD3	SB_MA3	AR42	=MEM_B_A<3>
MEM_B_DQ<27>	AP25	SB_DQ27	RSVD4	SB_MA4	AR45	=MEM_B_A<4>
MEM_B_DQ<28>	AK26	SB_DQ28	CAA0	SB_MA5	AP45	=MEM_B_A<5>
MEM_B_DQ<29>	AM26	SB_DQ29	CAA2	SB_MA6	AW46	=MEM_B_A<6>
MEM_B_DQ<30>	AK25	SB_DQ30	CAA4	SB_MA7	AY46	=MEM_B_A<7>
MEM_B_DQ<31>	AL25	SB_DQ31	CAA3	SB_MA8	AY47	=MEM_B_A<8>
MEM_B_DQ<32>	AY23	SB_DQ32	CAA1	SB_MA9	AU46	=MEM_B_A<9>
MEM_B_DQ<33>	AW23	SB_DQ33	CAB7	SB_MA10	AK36	=MEM_B_A<10>
MEM_B_DQ<34>	AY21	SB_DQ34	CAA7	SB_MA11	AV47	=MEM_B_A<11>
MEM_B_DQ<35>	AW21	SB_DQ35	CAA6	SB_MA12	AU47	=MEM_B_A<12>
MEM_B_DQ<36>	AV23	SB_DQ36	CAB0	SB_MA13	AK33	=MEM_B_A<13>
MEM_B_DQ<37>	AU23	SB_DQ37	CAA9	SB_MA14	AR46	=MEM_B_A<14>
MEM_B_DQ<38>	AV21	SB_DQ38	CAA8	SB_MA15	AP46	=MEM_B_A<15>
MEM_B_DQ<39>	AU21	SB_DQ39				
MEM_B_DQ<40>	AY19	SB_DQ40		SB_DQSN0	AW30	MEM_B_DQS_N<0>
MEM_B_DQ<41>	AW19	SB_DQ41		SB_DQSN1	AV26	MEM_B_DQS_N<1>
MEM_B_DQ<42>	AY17	SB_DQ42		SB_DQSN2	AN28	MEM_B_DQS_N<2>
MEM_B_DQ<43>	AW17	SB_DQ43		SB_DQSN3	AN25	MEM_B_DQS_N<3>
MEM_B_DQ<44>	AV19	SB_DQ44		SB_DQSN4	AW22	MEM_B_DQS_N<4>
MEM_B_DQ<45>	AU19	SB_DQ45		SB_DQSN5	AV18	MEM_B_DQS_N<5>
MEM_B_DQ<46>	AV17	SB_DQ46		SB_DQSN6	AN21	MEM_B_DQS_N<6>
MEM_B_DQ<47>	AU17	SB_DQ47		SB_DQSN7	AN18	MEM_B_DQS_N<7>
MEM_B_DQ<48>	AR21	SB_DQ48				
MEM_B_DQ<49>	AR22	SB_DQ49		SB_DQSP0	AV30	MEM_B_DQS_P<0>
MEM_B_DQ<50>	AL21	SB_DQ50		SB_DQSP1	AW26	MEM_B_DQS_P<1>
MEM_B_DQ<51>	AM22	SB_DQ51		SB_DQSP2	AM28	MEM_B_DQS_P<2>
MEM_B_DQ<52>	AN22	SB_DQ52		SB_DQSP3	AM25	MEM_B_DQS_P<3>
MEM_B_DQ<53>	AP21	SB_DQ53		SB_DQSP4	AV22	MEM_B_DQS_P<4>
MEM_B_DQ<54>	AK21	SB_DQ54		SB_DQSP5	AW18	MEM_B_DQS_P<5>
MEM_B_DQ<55>	AK22	SB_DQ55		SB_DQSP6	AM21	MEM_B_DQS_P<6>
MEM_B_DQ<56>	AN20	SB_DQ56		SB_DQSP7	AM18	MEM_B_DQS_P<7>
MEM_B_DQ<57>	AR20	SB_DQ57				
MEM_B_DQ<58>	AK18	SB_DQ58				
MEM_B_DQ<59>	AL18	SB_DQ59				
MEM_B_DQ<60>	AK20	SB_DQ60				
MEM_B_DQ<61>	AM20	SB_DQ61				
MEM_B_DQ<62>	AR18	SB_DQ62				
MEM_B_DQ<63>	AP18	SB_DQ63				

BOM_COST_GROUP=CPU

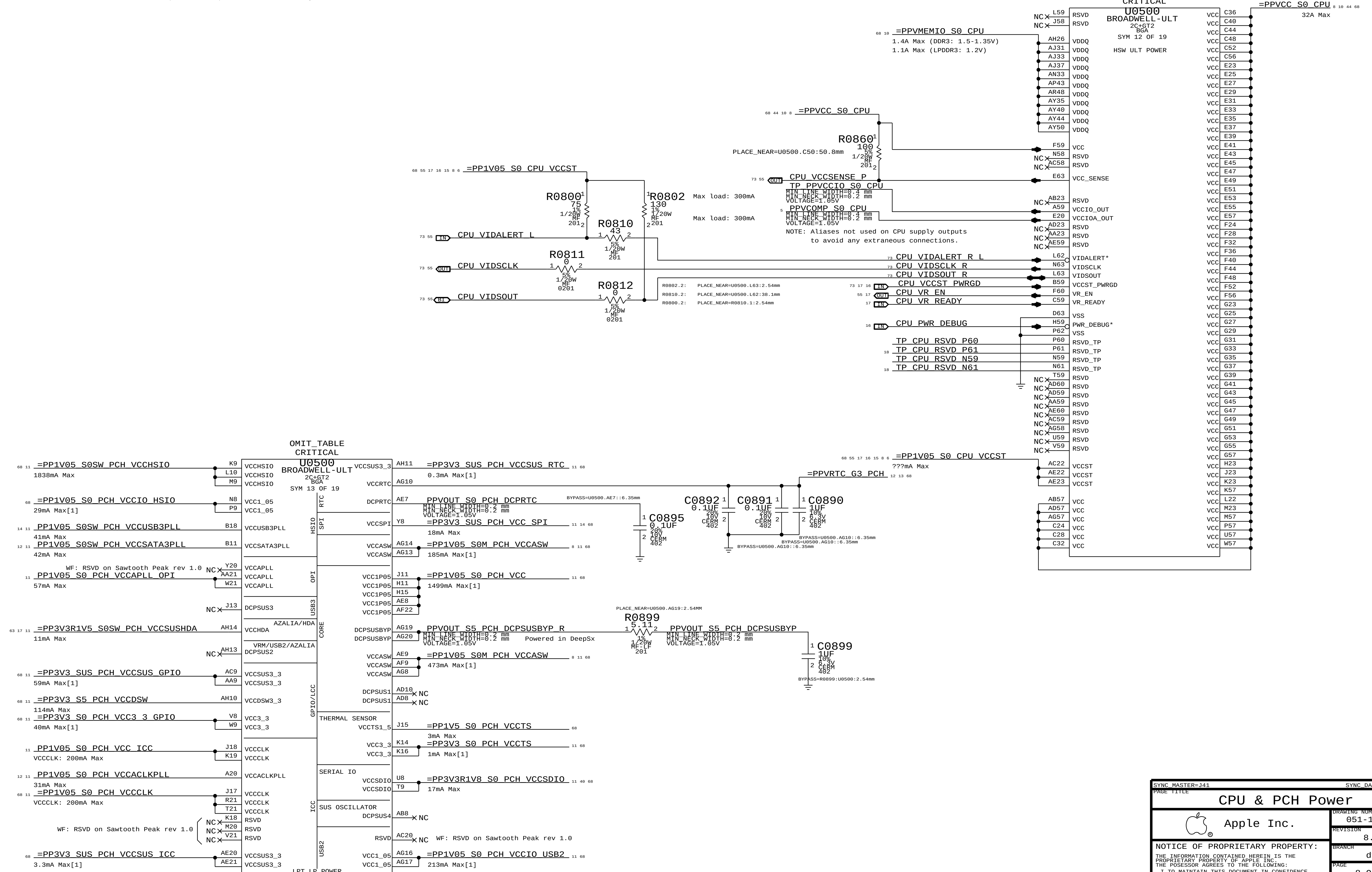
SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE
CPU LPDDR3 Interfaces

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 7 OF 120
SHEET 7 OF 82

BDW-ULT current estimates from Broadwell Mobile ULT Processor EDS vol.1 Doc# 514405, Rev.: 0.9v1
Wildcat Point-LP current estimates from Wildcat Point-LP PCH EDS, Doc# 515621, Rev. 0.9
Note [1] current numbers from clarification email, from Srini, dated 9/10/2012 2:11pm.



OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 12 OF 19
HSW ULT POWER
=PPVCC_S0_CPU
32A Max
=PPVMEMIO_S0_CPU
1.4A Max (DDR3: 1.5-1.35V)
1.1A Max (LPDDR3: 1.2V)
VDDQ
VCC
RSVD
VCC_SENSE
VCCIO_OUT
VCCIOA_OUT
VIDALERT*
VIDSCLK
VIDSOUT
VCCST_PWRGD
VR_EN
VR_READY
VSS
PWR_DEBUG*
RSVD_TP
VCCST
=PP1V05_S0_CPU_VCCST
R0860
100
PLACE_NEAR=U0500.C50:50.8mm
CPU_VCCSENSE_P
TP_PPVCCIO_S0_CPU
MIN_LINE_WIDTH=0.4 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=1.05V
PPVCOMP_S0_CPU
NOTE: Aliases not used on CPU supply outputs
to avoid any extraneous connections.
R0800
75
R0802
130
Max load: 300mA
Max load: 300mA
R0810
43
R0811
0
R0812
0
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
R0802.2: PLACE_NEAR=U0500.L63:2.54mm
R0810.2: PLACE_NEAR=U0500.L62:38.1mm
R0800.2: PLACE_NEAR=R0810.1:2.54mm
???mA Max
=PPVRTC_G3_PCH
C0892
0.1UF
C0891
0.1UF
C0890
1UF
C0895
0.1UF
BYPASS=U0500.AE7::6.35mm
BYPASS=U0500.AG10::6.35mm
OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 13 OF 19
LPT LP POWER
=PP1V05_S0SW_PCH_VCCHSIO
1838mA Max
=PP1V05_S0_PCH_VCCIO_HSIO
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
=PP3V3R1V5_S0SW_PCH_VCCSUSHDA
11mA Max
=PP3V3_SUS_PCH_VCCSUS_GPIO
59mA Max[1]
=PP3V3_S5_PCH_VCCDSW
114mA Max
=PP3V3_S0_PCH_VCC3_3_GPIO
40mA Max[1]
PP1V05_S0_PCH_VCC_ICC
VCCCLK: 200mA Max
PP1V05_S0_PCH_VCCACLKPLL
31mA Max
=PP1V05_S0_PCH_VCCCLK
VCCCLK: 200mA Max
=PP3V3_SUS_PCH_VCCSUS_ICC
3.3mA Max[1]
=PP3V3_SUS_PCH_VCCSUS_RTC
0.3mA Max[1]
PPVOUT_S0_PCH_DCPRTC
=PP3V3_SUS_PCH_VCC_SPI
18mA Max
=PP1V05_S0M_PCH_VCCASW
185mA Max[1]
=PP1V05_S0_PCH_VCC
1499mA Max[1]
PPVOUT_S5_PCH_DCPSUSBYP_R
Powered in DeepSx
PLACE_NEAR=U0500.AG19:2.54MM
R0899
5.11
PPVOUT_S5_PCH_DCPSUSBYP
C0899
1UF
BYPASS=R0899:U0500:2.54mm
=PP1V05_S0M_PCH_VCCASW
473mA Max[1]
=PP1V5_S0_PCH_VCCTS
3mA Max
=PP3V3_S0_PCH_VCCTS
1mA Max[1]
=PP3V3R1V8_S0_PCH_VCCSDIO
17mA Max
WF: RSVD on Sawtooth Peak rev 1.0
=PP1V05_S0_PCH_VCCIO_USB2
213mA Max[1]

BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE: CPU & PCH Power

Apple Inc.

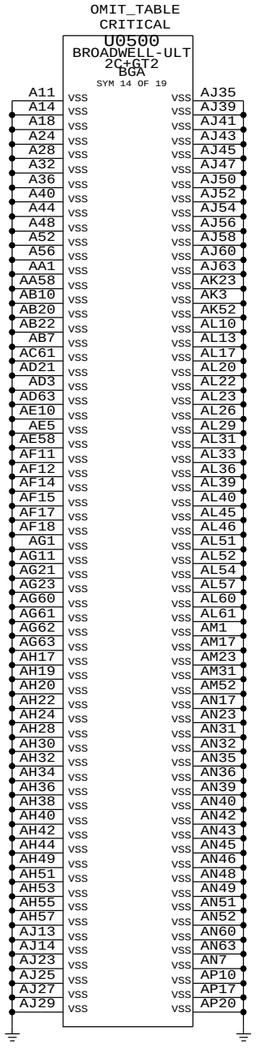
DRAWING NUMBER: 051-1573 SIZE: D

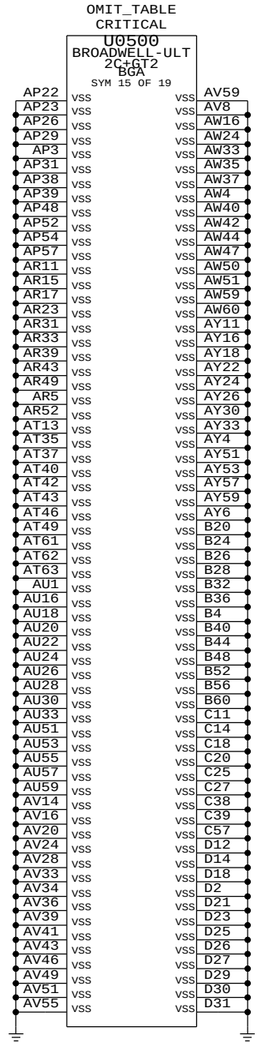
REVISION: 8.0.0

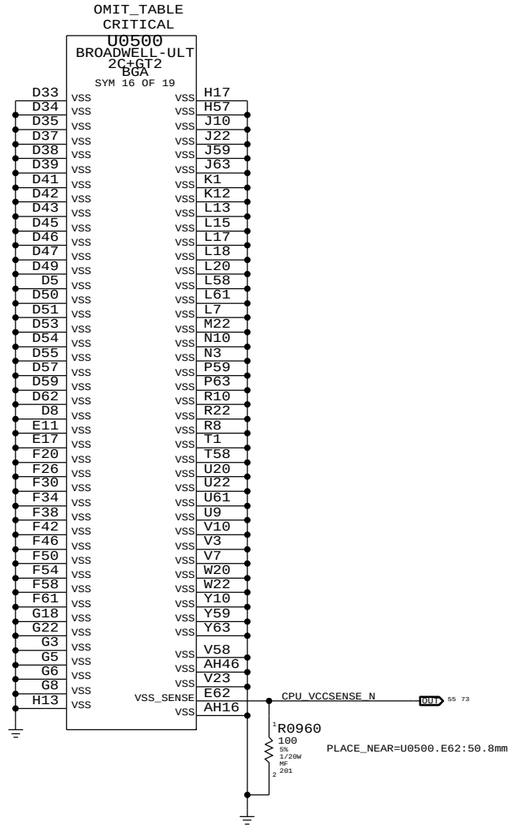
BRANCH: dvt1

PAGE: 8 OF 120

SHEET: 8 OF 82







BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE

CPU & PCH Grounds

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 9 OF 120

SHEET 9 OF 82

All Intel recommendations from Intel doc #503160 Shark Bay Ultrabook Platform Power Delivery Design Guide Rev 0.9 unless stated otherwise

CPU VCC Decoupling

Intel recommendation (Table 5-1): 23x 22uF 0805 stuff, 7x 22uF 0805 nostuff
Apple implementation : 18x 22uF 0603 stuff, 80x 22uF 0603 nostuff

68 44 8 =PPVCC_S0_CPU

CRITICAL C1000 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1001 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1002 12PF 2% 50V C0G-CERM 0402
CRITICAL C1003 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1004 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1008 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1009 12PF 2% 50V C0G-CERM 0402
CRITICAL C1010 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1011 12PF 2% 50V C0G-CERM 0402
CRITICAL C1012 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1014 12PF 2% 50V C0G-CERM 0402
CRITICAL C105A 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C105B 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C105C 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C105D 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C105E 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C105F 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1018 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1019 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1020 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1021 12PF 2% 50V C0G-CERM 0402
CRITICAL C1030 12PF 2% 50V C0G-CERM 0402
CRITICAL C104E 12PF 2% 50V C0G-CERM 0402
CRITICAL C104F 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C106D 12PF 2% 50V C0G-CERM 0402
CRITICAL C106E 12PF 2% 50V C0G-CERM 0402
CRITICAL C1070 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1072 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1073 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1074 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1075 12PF 2% 50V C0G-CERM 0402
CRITICAL C1077 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1081 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1082 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1083 12PF 2% 50V C0G-CERM 0402
CRITICAL C1084 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1085 12PF 2% 50V C0G-CERM 0402
CRITICAL C1086 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1087 12PF 2% 50V C0G-CERM 0402
CRITICAL C1088 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1089 12PF 2% 50V C0G-CERM 0402
CRITICAL C1090 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1091 12PF 2% 50V C0G-CERM 0402
CRITICAL C1092 12PF 2% 50V C0G-CERM 0402
CRITICAL C1093 12PF 2% 50V C0G-CERM 0402
CRITICAL C1094 12PF 2% 50V C0G-CERM 0402
CRITICAL C1095 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1096 10UF 20% 4V X6S 0402 NO STUFF
CRITICAL C1097 12PF 2% 50V C0G-CERM 0402
CRITICAL C1022 10UF 20% 4V X6S 0402 OMIT_TABLE
CRITICAL C1023 12PF 2% 50V C0G-CERM 0402
CRITICAL C1024 12PF 2% 50V C0G-CERM 0402
NO STUFF C1025 10UF 20% 4V X6S 0402
CRITICAL C1026 10UF 20% 4V X6S 0402 OMIT_TABLE
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
C1033 12PF 2% 50V C0G-CERM 0402
CRITICAL C1034 10UF 20% 4V X6S 0402 OMIT_TABLE
C1035 12PF 2% 50V C0G-CERM 0402
C1036 12PF 2% 50V C0G-CERM 0402
C1037 12PF 2% 50V C0G-CERM 0402
C1038 12PF 2% 50V C0G-CERM 0402
NO STUFF C1039 10UF 20% 4V X6S 0402
C1044 12PF 2% 50V C0G-CERM 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
C1049 12PF 2% 50V C0G-CERM 0402
NO STUFF C1056 10UF 20% 4V X6S 0402
NO STUFF C1057 10UF 20% 4V X6S 0402
C1058 12PF 2% 50V C0G-CERM 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
C1064 12PF 2% 50V C0G-CERM 0402
CRITICAL C1065 10UF 20% 4V X6S 0402 OMIT_TABLE
NO STUFF C1066 10UF 20% 4V X6S 0402
NO STUFF C1067 10UF 20% 4V X6S 0402
C1068 12PF 2% 50V C0G-CERM 0402
C1069 12PF 2% 50V C0G-CERM 0402
NO STUFF C1098 10UF 20% 4V X6S 0402
C1099 12PF 2% 50V C0G-CERM 0402
NO STUFF C109A 10UF 20% 4V X6S 0402
NO STUFF C109B 10UF 20% 4V X6S 0402
C109C 12PF 2% 50V C0G-CERM 0402
NO STUFF C109D 10UF 20% 4V X6S 0402
C109E 12PF 2% 50V C0G-CERM 0402
NO STUFF C109F 10UF 20% 4V X6S 0402
C108A 12PF 2% 50V C0G-CERM 0402
C108B 12PF 2% 50V C0G-CERM 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
C108F 12PF 2% 50V C0G-CERM 0402
NO STUFF C107A 10UF 20% 4V X6S 0402
C107B 12PF 2% 50V C0G-CERM 0402
CRITICAL C1031 470UF-0.0045OHM 20% 2.5V POLY-TANT SM

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0942	18	CAP,CER,10UF,20%,4V,X6S,HRZTL,0402		CRITICAL	

C1000,C1004,C1008,C1012,C1018,C1019,C1020,C1022,C1026,C1034,C1065,C1070,C1074,C105A,C105C,C105D,C104F,C105F

CPU VDDQ DECOUPLING

Intel recommendation (Table 5-4): 2x 2.2uF 0402, 6x 10uF 0603
Apple implementation : 2x 2.2uF 0402, 6x 10uF 0402

68 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
Added 2 extra 2.2uF per Harris Beach v0.9 schematic

C1050 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1051 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1052 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1053 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1054 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1055 10UF 20% 6.3V CERM-X5R 0402-1 OMIT_TABLE
C1079 12PF 5% 25V NP0-C0G 0201
C1080 12PF 5% 25V NP0-C0G 0201
C1060 270UF 20% 2V TANT CASE-B2-SM
NO STUFF C1061 270UF 20% 2V TANT CASE-B2-SM
1x Bulk nostuff, Harris Beach has 2x nostuff

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0801	6	CAP,CER,10UF,20%,6.3V,HRZTL,0402		CRITICAL	

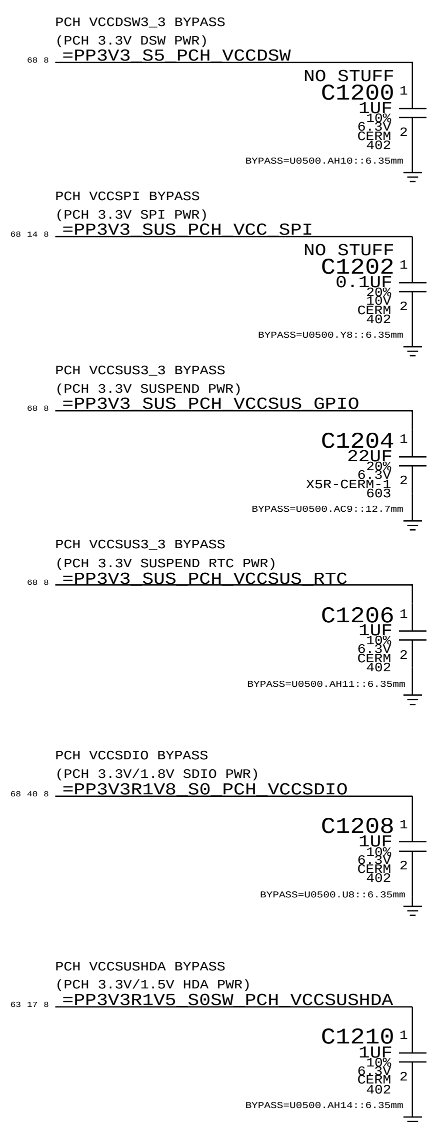
C1050,C1051,C1052,C1053,C1054,C1055

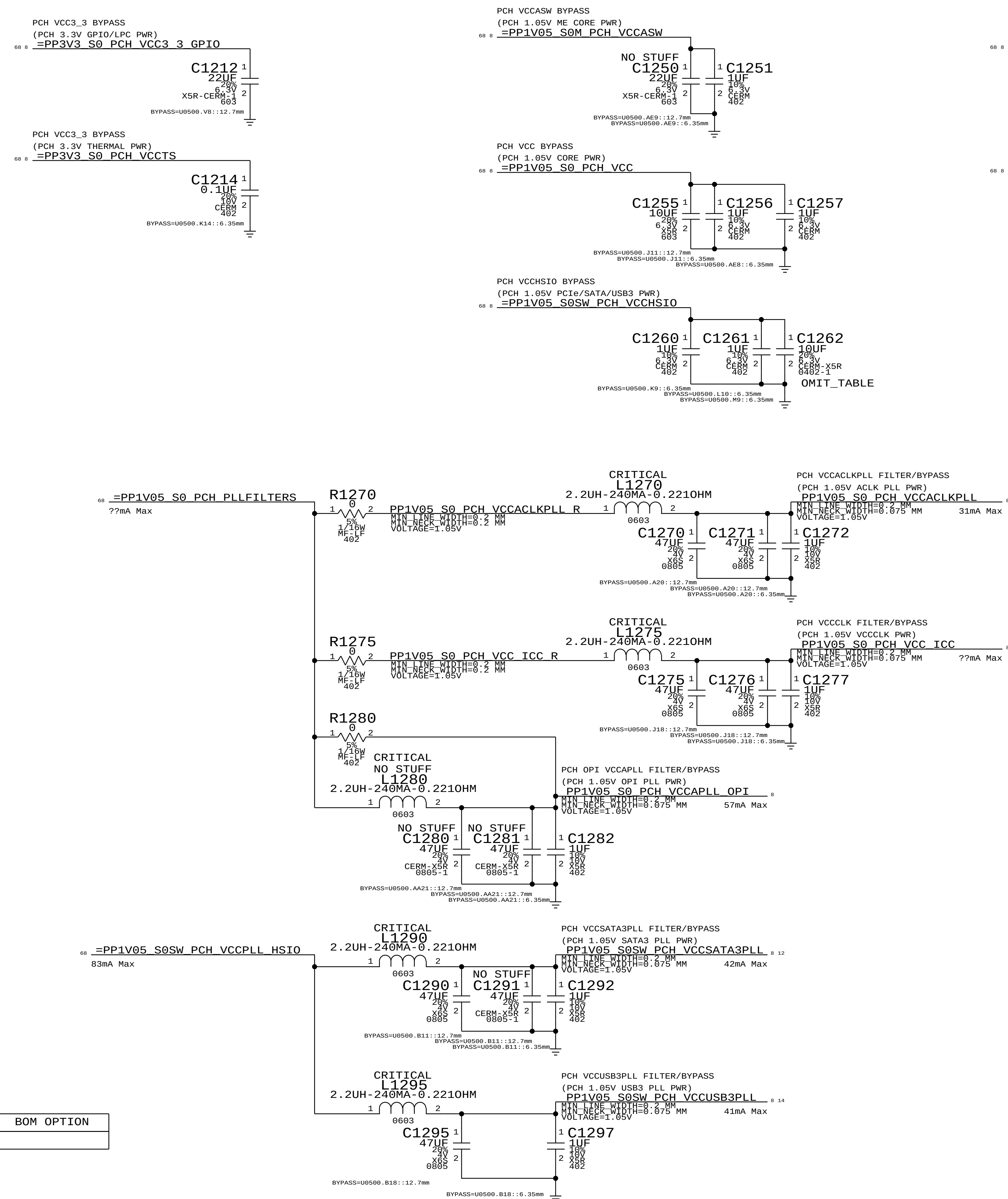
CPU VCC Decoupling

NOTE: 38X capacitors are STUFFED and have been changed to 12pF for Noise Floor Reasons (Radar # 17754026).

BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012
PAGE TITLE: CPU Decoupling
Apple Inc.
DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 10 OF 120
SHEET 10 OF 82


PCH VCCDSW3_3 BYPASS
(PCH 3.3V DSW PWR)
=PP3V3_S5_PCH_VCCDSW
NO STUFF
C1200
1UF
10%
6.3V
CERM
402
BYPASS=U0500.AH10::6.35mm
PCH VCCSPI BYPASS
(PCH 3.3V SPI PWR)
=PP3V3_SUS_PCH_VCC_SPI
NO STUFF
C1202
0.1UF
20%
10V
CERM
402
BYPASS=U0500.Y8::6.35mm
PCH VCCSUS3_3 BYPASS
(PCH 3.3V SUSPEND PWR)
=PP3V3_SUS_PCH_VCCSUS_GPIO
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_PCH_VCCSUS_RTC
C1206
1UF
10%
6.3V
CERM
402
BYPASS=U0500.AH11::6.35mm
PCH VCCSDIO BYPASS
(PCH 3.3V/1.8V SDIO PWR)
=PP3V3R1V8_S0_PCH_VCCSDIO
C1208
1UF
10%
6.3V
CERM
402
BYPASS=U0500.U8::6.35mm
PCH VCCSUSHDA BYPASS
(PCH 3.3V/1.5V HDA PWR)
=PP3V3R1V5_S0SW_PCH_VCCSUSHDA
C1210
1UF
10%
6.3V
CERM
402
BYPASS=U0500.AH14::6.35mm


PCH VCC3_3 BYPASS
(PCH 3.3V GPIO/LPC PWR)
=PP3V3_S0_PCH_VCC3_3_GPIO
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_PCH_VCCTS
C1214
0.1UF
20%
10V
CERM
402
BYPASS=U0500.K14::6.35mm
PCH VCCASW BYPASS
(PCH 1.05V ME CORE PWR)
=PP1V05_S0M_PCH_VCCASW
NO STUFF
C1250
22UF
C1251
1UF
PCH VCC BYPASS
(PCH 1.05V CORE PWR)
=PP1V05_S0_PCH_VCC
C1255
10UF
C1256
1UF
C1257
1UF
PCH VCCHSIO BYPASS
(PCH 1.05V PCIe/SATA/USB3 PWR)
=PP1V05_S0SW_PCH_VCCHSIO
C1260
1UF
C1261
1UF
C1262
10UF
OMIT_TABLE
PCH VCCIO BYPASS
(PCH 1.05V USB2 PWR)
=PP1V05_S0_PCH_VCCIO_USB2
C1264
1UF
PCH VCCCLK BYPASS
(PCH 1.05V CLK PWR)
=PP1V05_S0_PCH_VCCCLK
C1266
1UF
C1267
1UF
=PP1V05_S0_PCH_PLLFILTERS
??mA Max
R1270
0
PP1V05_S0_PCH_VCCACLKPLL_R
CRITICAL
L1270
2.2UH-240MA-0.221OHM
0603
C1270
47UF
C1271
47UF
C1272
1UF
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
R1275
0
PP1V05_S0_PCH_VCC_ICC_R
CRITICAL
L1275
2.2UH-240MA-0.221OHM
C1275
47UF
C1276
47UF
C1277
1UF
PCH VCCCLK FILTER/BYPASS
(PCH 1.05V VCCCLK PWR)
PP1V05_S0_PCH_VCC_ICC
??mA Max
R1280
CRITICAL
NO STUFF
L1280
2.2UH-240MA-0.221OHM
NO STUFF
C1280
47UF
NO STUFF
C1281
47UF
C1282
1UF
PCH OPI VCCAPLL FILTER/BYPASS
(PCH 1.05V OPI PLL PWR)
PP1V05_S0_PCH_VCCAPLL_OPI
57mA Max
=PP1V05_S0SW_PCH_VCCPLL_HSIO
83mA Max
CRITICAL
L1290
2.2UH-240MA-0.221OHM
C1290
47UF
NO STUFF
C1291
47UF
C1292
1UF
PCH VCCSATA3PLL FILTER/BYPASS
(PCH 1.05V SATA3 PLL PWR)
PP1V05_S0SW_PCH_VCCSATA3PLL
42mA Max
CRITICAL
L1295
2.2UH-240MA-0.221OHM
C1295
47UF
C1297
1UF
PCH VCCUSB3PLL FILTER/BYPASS
(PCH 1.05V USB3 PLL PWR)
PP1V05_S0SW_PCH_VCCUSB3PLL
41mA Max

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0801	1	CAP,CER,10UF,20%,6.3V,HRZTL,0402	C1262	CRITICAL	

Wildcat Point-LP current estimates from Wildcat Point-LP PCH EDS, Doc# 515621, Rev. 0.9
as well as from clarification email, from Srini, dated 9/10/2012 2:11pm.

BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE

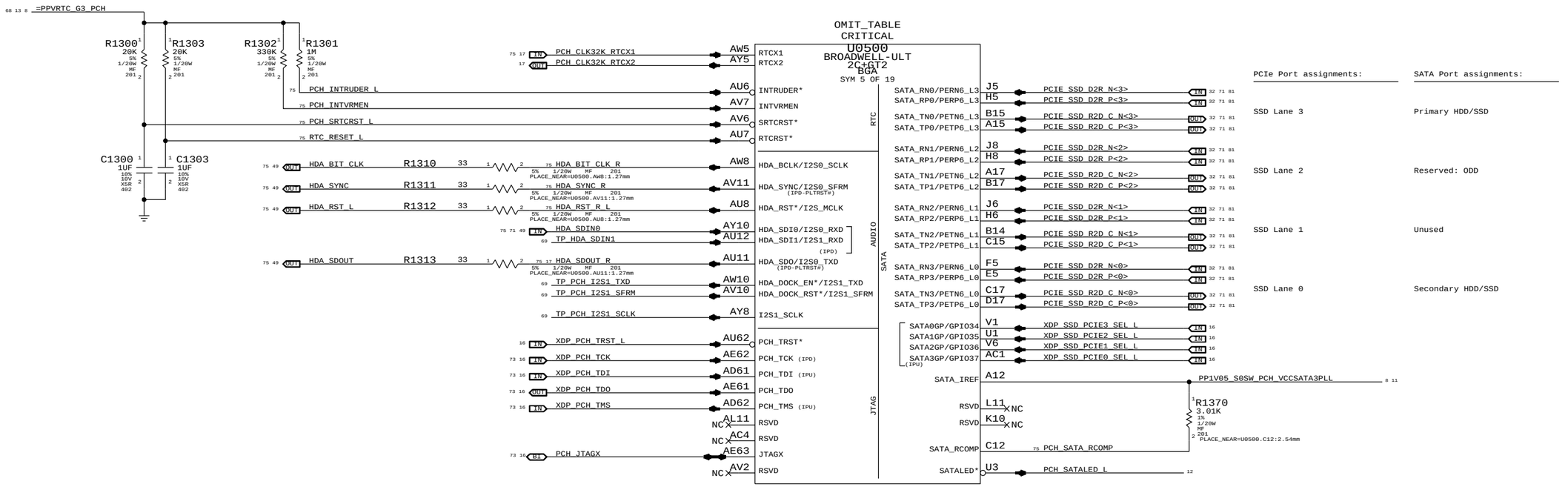
PCH Decoupling

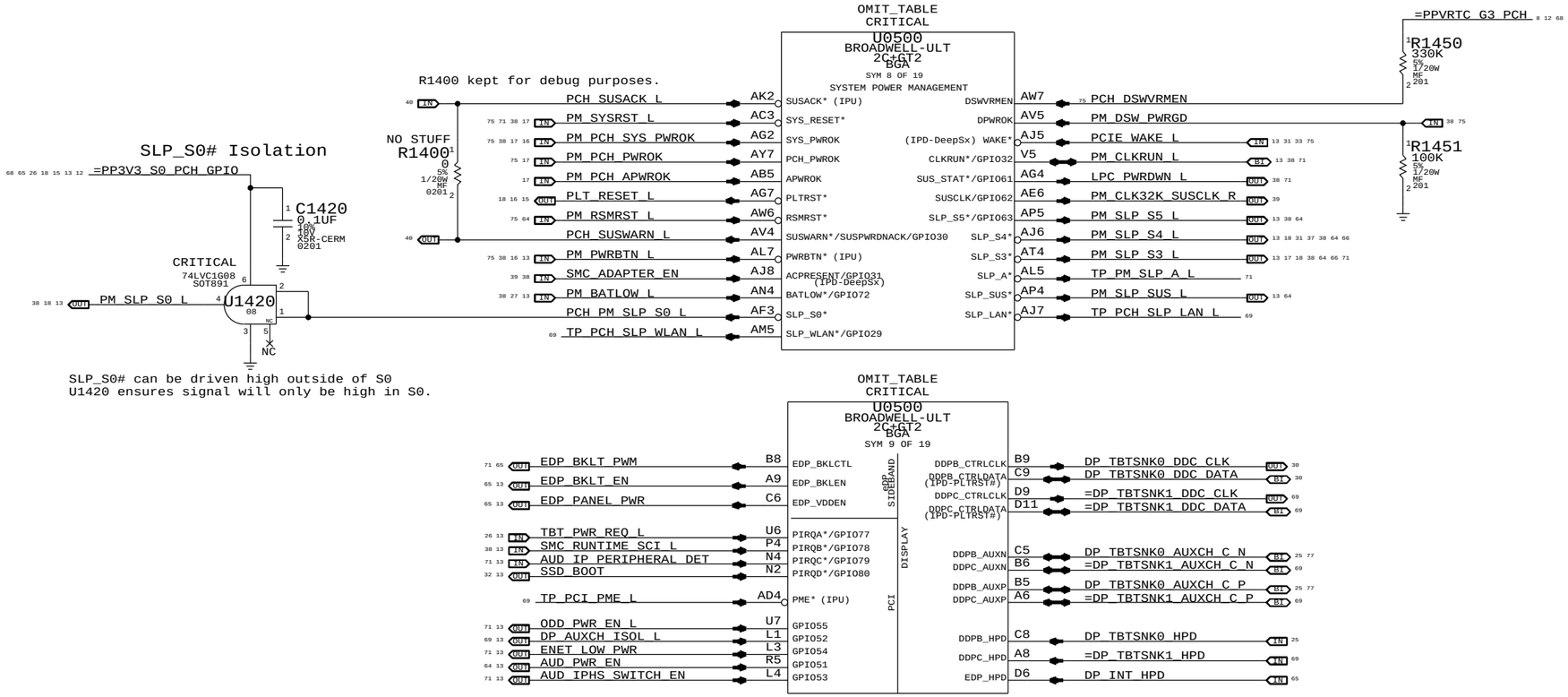
Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1


=PPVRTC_G3_PCH
R1300 20K 5% 1/20W MF 201
R1303 20K 5% 1/20W MF 201
R1302 330K 5% 1/20W MF 201
R1301 1M 5% 1/20W MF 201
C1300 1UF 10% 10V X5R 402
C1303 1UF 10% 10V X5R 402
PCH_INTRUDER_L
PCH_INTVRMEN
PCH_SRTCRST_L
RTC_RESET_L
HDA_BIT_CLK
HDA_SYNC
HDA_RST_L
HDA_SDOUT
R1310 33
R1311 33
R1312 33
R1313 33
HDA_BIT_CLK_R
HDA_SYNC_R
HDA_RST_R_L
HDA_SDOUT_R
PLACE_NEAR=U0500.AW8:1.27mm
PLACE_NEAR=U0500.AV11:1.27mm
PLACE_NEAR=U0500.AU8:1.27mm
PLACE_NEAR=U0500.AU11:1.27mm
HDA_SDIN0
TP_HDA_SDIN1
TP_PCH_I2S1_TXD
TP_PCH_I2S1_SFRM
TP_PCH_I2S1_SCLK
XDP_PCH_TRST_L
XDP_PCH_TCK
XDP_PCH_TDI
XDP_PCH_TDO
XDP_PCH_TMS
PCH_JTAGX
OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 5 OF 19
RTC
AUDIO
SATA
JTAG
PCH_CLK32K_RTCX1
PCH_CLK32K_RTCX2
RTCX1
RTCX2
INTRUDER*
INTVRMEN
SRTCRST*
RTCRST*
HDA_BCLK/I2S0_SCLK
HDA_SYNC/I2S0_SFRM
HDA_RST*/I2S_MCLK
HDA_SDI0/I2S0_RXD
HDA_SDI1/I2S1_RXD
HDA_SDO/I2S0_TXD
HDA_DOCK_EN*/I2S1_TXD
HDA_DOCK_RST*/I2S1_SFRM
I2S1_SCLK
PCH_TRST*
PCH_TCK
PCH_TDI
PCH_TDO
PCH_TMS
JTAGX
RSVD
SATA_RN0/PERN6_L3
SATA_RP0/PERP6_L3
SATA_TN0/PETN6_L3
SATA_TP0/PETP6_L3
SATA_RN1/PERN6_L2
SATA_RP1/PERP6_L2
SATA_TN1/PETN6_L2
SATA_TP1/PETP6_L2
SATA_RN2/PERN6_L1
SATA_RP2/PERP6_L1
SATA_TN2/PETN6_L1
SATA_TP2/PETP6_L1
SATA_RN3/PERN6_L0
SATA_RP3/PERP6_L0
SATA_TN3/PETN6_L0
SATA_TP3/PETP6_L0
SATA0GP/GPIO34
SATA1GP/GPIO35
SATA2GP/GPIO36
SATA3GP/GPIO37
SATA_IREF
SATA_RCOMP
SATALED*
PCIE_SSD_D2R_N<3>
PCIE_SSD_D2R_P<3>
PCIE_SSD_R2D_C_N<3>
PCIE_SSD_R2D_C_P<3>
PCIE_SSD_D2R_N<2>
PCIE_SSD_D2R_P<2>
PCIE_SSD_R2D_C_N<2>
PCIE_SSD_R2D_C_P<2>
PCIE_SSD_D2R_N<1>
PCIE_SSD_D2R_P<1>
PCIE_SSD_R2D_C_N<1>
PCIE_SSD_R2D_C_P<1>
PCIE_SSD_D2R_N<0>
PCIE_SSD_D2R_P<0>
PCIE_SSD_R2D_C_N<0>
PCIE_SSD_R2D_C_P<0>
XDP_SSD_PCIE3_SEL_L
XDP_SSD_PCIE2_SEL_L
XDP_SSD_PCIE1_SEL_L
XDP_SSD_PCIE0_SEL_L
PP1V05_S0SW_PCH_VCCSATA3PLL
R1370 3.01K 1% 1/20W MF 201
PLACE_NEAR=U0500.C12:2.54mm
PCH_SATA_RCOMP
PCH_SATALED_L
PCIe Port assignments:
SSD Lane 3
SSD Lane 2
SSD Lane 1
SSD Lane 0
SATA Port assignments:
Primary HDD/SSD
Reserved: ODD
Unused
Secondary HDD/SSD
OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 6 OF 19
CLOCK SIGNALS
TP_PCIE_CLK100M_ENETSDN
TP_PCIE_CLK100M_ENETSDP
ENETSD_CLKREQ_L
PCIE_CLK100M_CAMERA_N
PCIE_CLK100M_CAMERA_P
CAMERA_CLKREQ_L
PCIE_CLK100M_AP_N
PCIE_CLK100M_AP_P
AP_CLKREQ_L
TP_PCIE_CLK100M_FWN
TP_PCIE_CLK100M_FWP
FW_CLKREQ_L
PCIE_CLK100M_TBT_N
PCIE_CLK100M_TBT_P
TBT_CLKREQ_L
PCIE_CLK100M_SSD_N
PCIE_CLK100M_SSD_P
SSD_CLKREQ_L
CLKOUT_PCIE_N0
CLKOUT_PCIE_P0
PCIECLKRQ0*/GPIO18
CLKOUT_PCIE_N1
CLKOUT_PCIE_P1
PCIECLKRQ1*/GPIO19
CLKOUT_PCIE_N2
CLKOUT_PCIE_P2
PCIECLKRQ2*/GPIO20
CLKOUT_PCIE_N3
CLKOUT_PCIE_P3
PCIECLKRQ3*/GPIO21
CLKOUT_PCIE_N4
CLKOUT_PCIE_P4
PCIECLKRQ4*/GPIO22
CLKOUT_PCIE_N5
CLKOUT_PCIE_P5
PCIECLKRQ5*/GPIO23
XTAL24_IN
XTAL24_OUT
DIFFCLK_BIASREF
CLKOUT_LPC_0
CLKOUT_LPC_1
CLKOUT_ITPXDP_N
CLKOUT_ITPXDP_P
PCH_CLK24M_XTALIN
PCH_CLK24M_XTALOUT
PP1V05_S0_PCH_VCCACLKPLL
R1380 3.01K 1% 1/20W MF 201
PLACE_NEAR=U0500.C26:2.54mm
PCH_DIFFCLK_BIASREF
TESTLOW_C35
TESTLOW_C34
TESTLOW_AK8
TESTLOW_AL8
R1390 10K
R1391 10K
R1392 10K
R1393 10K
LPC_CLK24M_SMC_R
TP_LPC_CLK24M_LPCPLUS
TP_ITPXDP_CLK100MN
TP_ITPXDP_CLK100MP
=PP3V3_S0_PCH_GPIO
R1375 100K
R1340 100K
R1341 100K
R1342 20K
R1343 100K
R1344 100K
R1345 10K
PCH_SATALED_L
ENETSD_CLKREQ_L
CAMERA_CLKREQ_L
AP_CLKREQ_L
FW_CLKREQ_L
TBT_CLKREQ_L
SSD_CLKREQ_L
BOM_COST_GROUP=CPU
SYNC_MASTER=J41
SYNC_DATE=12/17/2012
PAGE TITLE
PCH Audio/JTAG/SATA/CLK
Apple Inc.
DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 13 OF 120
SHEET 12 OF 82
NOTICE OF PROPRIETARY PROPERTY:
THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC.
THE POSESSOR AGREES TO THE FOLLOWING:
I TO MAINTAIN THIS DOCUMENT IN CONFIDENCE
II NOT TO REPRODUCE OR COPY IT
III NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART
IV ALL RIGHTS RESERVED


SLP_S0# Isolation
=PP3V3_S0_PCH_GPIO
C1420
0.1UF
10V
X5R-CERM
0201
CRITICAL
74LVC1G08
SOT891
U1420
PM_SLP_S0_L
NC
SLP_S0# can be driven high outside of S0
U1420 ensures signal will only be high in S0.
R1400 kept for debug purposes.
NO STUFF
R1400
0
OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 8 OF 19
SYSTEM POWER MANAGEMENT
PCH_SUSACK_L
PM_SYSRST_L
PM_PCH_SYS_PWROK
PM_PCH_PWROK
PM_PCH_APWROK
PLT_RESET_L
PM_RSMRST_L
PCH_SUSWARN_L
PM_PWRBTN_L
SMC_ADAPTER_EN
PM_BATLOW_L
PCH_PM_SLP_S0_L
TP_PCH_SLP_WLAN_L
SUSACK* (IPU)
SYS_RESET*
SYS_PWROK
PCH_PWROK
APWROK
PLTRST*
RSMRST*
SUSWARN*/SUSPWRDNACK/GPIO30
PWRBTN* (IPU)
ACPRESENT/GPIO31
(IPD-DeepSx)
BATLOW*/GPIO72
SLP_S0*
SLP_WLAN*/GPIO029
DSWVRMEN
DPWROK
(IPD-DeepSx) WAKE*
CLKRUN*/GPIO32
SUS_STAT*/GPIO61
SUSCLK/GPIO62
SLP_S5*/GPIO63
SLP_S4*
SLP_S3*
SLP_A*
SLP_SUS*
SLP_LAN*
=PPVRTC_G3_PCH
R1450
330K
R1451
100K
PCH_DSWVRMEN
PM_DSW_PWRGD
PCIE_WAKE_L
PM_CLKRUN_L
LPC_PWRDWN_L
PM_CLK32K_SUSCLK_R
PM_SLP_S5_L
PM_SLP_S4_L
PM_SLP_S3_L
TP_PM_SLP_A_L
PM_SLP_SUS_L
TP_PCH_SLP_LAN_L
OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 9 OF 19
EDP_BKLT_PWM
EDP_BKLT_EN
EDP_PANEL_PWR
TBT_PWR_REQ_L
SMC_RUNTIME_SCI_L
AUD_IP_PERIPHERAL_DET
SSD_BOOT
TP_PCI_PME_L
ODD_PWR_EN_L
DP_AUXCH_ISOL_L
ENET_LOW_PWR
AUD_PWR_EN
AUD_IPHS_SWITCH_EN
EDP_BKLTCTL
EDP_BKLEN
EDP_VDDEN
PIRQA*/GPIO77
PIRQB*/GPIO78
PIRQC*/GPIO79
PIRQD*/GPIO80
PME* (IPU)
GPIO55
GPIO52
GPIO54
GPIO51
GPIO53
DDP SIDEBAND
DISPLAY
PCI
DDPB_CTRLCLK
DDPB_CTRLDATA
(IPD-PLTRST#)
DDPC_CTRLCLK
DDPC_CTRLDATA
(IPD-PLTRST#)
DDPB_AUXN
DDPC_AUXN
DDPB_AUXP
DDPC_AUXP
DDPB_HPD
DDPC_HPD
EDP_HPD
DP_TBTSNK0_DDC_CLK
DP_TBTSNK0_DDC_DATA
=DP_TBTSNK1_DDC_CLK
=DP_TBTSNK1_DDC_DATA
DP_TBTSNK0_AUXCH_C_N
=DP_TBTSNK1_AUXCH_C_N
DP_TBTSNK0_AUXCH_C_P
=DP_TBTSNK1_AUXCH_C_P
DP_TBTSNK0_HPD
=DP_TBTSNK1_HPD
DP_INT_HPD
=PP3V3_S5_PCH_GPIO
=PP3V3_S0_PCH_GPIO
R1405 1K
R1410 10K
R1452 10K
R1455 10K
R1460 100K
R1461 100K
R1462 100K
R1463 100K
R1464 100K
R1430 100K
R1431 100K
R1440 100K
R1441 10K
R1442 100K
R1443 100K
R1445 100K
R1446 100K
R1447 100K
R1448 100K
R1449 100K
5% 1/20W MF 201
PM_PWRBTN_L
PM_BATLOW_L
PCIE_WAKE_L
PM_CLKRUN_L
PM_SLP_S5_L
PM_SLP_S4_L
PM_SLP_S3_L
PM_SLP_S0_L
PM_SLP_SUS_L
EDP_BKLT_EN
EDP_PANEL_PWR
TBT_PWR_REQ_L
SMC_RUNTIME_SCI_L
AUD_IP_PERIPHERAL_DET
SSD_BOOT
ODD_PWR_EN_L
DP_AUXCH_ISOL_L
ENET_LOW_PWR
AUD_PWR_EN
AUD_IPHS_SWITCH_EN
BOM_COST_GROUP=CPU
SYNC_MASTER=J41
SYNC_DATE=02/21/2013
PAGE TITLE
PCH PM/PCI/GFX
Apple Inc.
DRAWING NUMBER
051-1573
SIZE
D
REVISION
8.0.0
BRANCH
dvt1
PAGE
14 OF 120
SHEET
13 OF 82
NOTICE OF PROPRIETARY PROPERTY:
THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC.
THE POSESSOR AGREES TO THE FOLLOWING:
I TO MAINTAIN THIS DOCUMENT IN CONFIDENCE
II NOT TO REPRODUCE OR COPY IT
III NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART
IV ALL RIGHTS RESERVED

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

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 11 OF 19

PCIE_TBT_D2R_N<0>	F10	PERN5_L0	
PCIE_TBT_D2R_P<0>	E10	PERP5_L0	
PCIE_TBT_R2D_C_N<0>	C23	PETN5_L0	
PCIE_TBT_R2D_C_P<0>	C22	PETP5_L0	
PCIE_TBT_D2R_N<1>	F8	PERN5_L1	
PCIE_TBT_D2R_P<1>	E8	PERP5_L1	
PCIE_TBT_R2D_C_N<1>	B23	PETN5_L1	
PCIE_TBT_R2D_C_P<1>	A23	PETP5_L1	
PCIE_TBT_D2R_N<2>	H10	PERN5_L2	
PCIE_TBT_D2R_P<2>	G10	PERP5_L2	
PCIE_TBT_R2D_C_N<2>	B21	PETN5_L2	
PCIE_TBT_R2D_C_P<2>	C21	PETP5_L2	
PCIE_TBT_D2R_N<3>	E6	PERN5_L3	
PCIE_TBT_D2R_P<3>	F6	PERP5_L3	
PCIE_TBT_R2D_C_N<3>	B22	PETN5_L3	
PCIE_TBT_R2D_C_P<3>	A21	PETP5_L3	
PCIE_AP_D2R_N	G11	PERN3	
PCIE_AP_D2R_P	F11	PERP3	
PCIE_AP_R2D_C_N	C29	PETN3	
PCIE_AP_R2D_C_P	B30	PETP3	
TP_PCIE_FW_D2RN	F13	PERN4	
TP_PCIE_FW_D2RP	G13	PERP4	
TP_PCIE_FW_R2D_CN	B29	PETN4	
TP_PCIE_FW_R2D_CP	A29	PETP4	
USB3RPCIE_SD_D2R_N	G17	PERN1/USB3RN3	
USB3RPCIE_SD_D2R_P	F17	PERP1/USB3RP3	
USB3RPCIE_SD_R2D_C_N	C30	PETN1/USB3TN3	
USB3RPCIE_SD_R2D_C_P	C31	PETP1/USB3TP3	
PCIE_CAMERA_D2R_N	F15	PERN2/USB3RN4	
PCIE_CAMERA_D2R_P	G15	PERP2/USB3RP4	
PCIE_CAMERA_R2D_C_N	B31	PETN2/USB3TN4	
PCIE_CAMERA_R2D_C_P	A31	PETP2/USB3TP4	
NC	E15	RSVD	
NC	E13	RSVD	
PCH_PCIE_RCOMP	A27	PCIE_RCOMP	
	B27	PCIE_IREF	

PCI-E / USB

USB Port Assignments:

USB2N0 / USB2P0	AN8 / AM8	USB_EXTA_N / USB_EXTA_P
USB2N1 / USB2P1	AR7 / AT7	USB_EXTB_N / USB_EXTB_P
USB2N2 / USB2P2	AR8 / AP8	USB_BT_N / USB_BT_P
USB2N3 / USB2P3	AR10 / AT10	USB_IR_N / USB_IR_P
USB2N4 / USB2P4	AM15 / AL15	USB_TPAD_N / USB_TPAD_P
USB2N5 / USB2P5	AM13 / AN13	TP_USB_5N / TP_USB_5P
USB2N6 / USB2P6	AP11 / AN11	TP_USB_CAMERAN / TP_USB_CAMERAP
USB2N7 / USB2P7 (IPD)	AR13 / AP13	TP_USB_SDN / TP_USB_SDP

Ext A (LS/FS/HS)

Ext B (LS/FS/HS)

BT

IR

Trackpad

Unused

Reserved: Camera

Reserved: SD (HS)

USB3 Port Assignments:

USB3RN1 / USB3RP1	G20 / H20	USB3_EXTA_D2R_N / USB3_EXTA_D2R_P
USB3TN1 / USB3TP1	C33 / B34	USB3_EXTA_R2D_C_N / USB3_EXTA_R2D_C_P
USB3RN2 / USB3RP2	E18 / F18	USB3_EXTB_D2R_N / USB3_EXTB_D2R_P
USB3TN2 / USB3TP2	B33 / A33	USB3_EXTB_R2D_C_N / USB3_EXTB_R2D_C_P

Ext A (SS)

Ext B (SS)

USBRBIAS* / USBRBIAS	AJ10 / AJ11	PCH_USB_RBIAS
RSVD / RSVD	AN10 / AM10	NC / NC
OC0*/GPIO40	AL3	XDP_USB_EXTA_OC_L
OC1*/GPIO41	AT1	XDP_USB_EXTB_OC_L
OC2*/GPIO42	AH2	XDP_USB_EXTC_OC_L
OC3*/GPIO43	AV3	XDP_USB_EXTD_OC_L

PP1V05_S0SW_PCH_VCCUSB3PLL

R1500 3.01K 1% 1/20W MF 201 — PLACE_NEAR=U0500.A27:2.54mm

R1570 22.6 1% 1/20W MF 201 — PLACE_NEAR=U0500.AJ10:2.54mm

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT
2C+GT2
BGA
SYM 7 OF 19

LPC_AD<0>	AU14	LAD0	LPC
LPC_AD<1>	AW12	LAD1	LPC
LPC_AD<2>	AY12	LAD2	LPC
LPC_AD<3>	AW11	LAD3	LPC
LPC_FRAME_L	AV12	LFRAME*	LPC
SPI_CLK_R	AA3	SPI_CLK	SPI
SPI_CS0_R_L	Y7	SPI_CS0*	SPI
TP_SPI_CS1_L	Y4	SPI_CS1*	SPI
TP_SPI_CS2_L	AC2	SPI_CS2*	SPI
SPI_MOSI_R	AA2	SPI_MOSI	SPI
SPI_MISO	AA4	SPI_MISO	SPI
SPI_IO<2>	Y6	SPI_IO2	SPI
SPI_IO<3>	AF1	SPI_IO3	SPI
SMBALERT*/GPIO11	AN2	PCH_SMBALERT_L	SMBUS
SMBCLK	AP2	SMBUS_PCH_CLK	SMBUS
SMBDATA	AH1	SMBUS_PCH_DATA	SMBUS
SML0ALERT*/GPIO60	AL2	WOL_EN	SMBUS
SML0CLK	AN1	SML_PCH_0_CLK	SMBUS
SML0DATA	AK1	SML_PCH_0_DATA	SMBUS
SML1ALERT*/PCHHOT*/GPIO73	AU4	PCH_SML1ALERT_L	SMBUS
SML1CLK_GPIO75	AU3	SML_PCH_1_CLK	SMBUS
SML1DATA/GPIO74	AH3	SML_PCH_1_DATA	SMBUS
CL_CLK	AF2	TP_CLINK_CLK	C-LINK
CL_DATA	AD2	TP_CLINK_DATA	C-LINK
CL_RST*	AF4	TP_CLINK_RESET_L	C-LINK

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

=PP3V3_SUS_PCH_GPIO
=PP3V3_SUS_PCH_VCC_SPI

R1580 100K	XDP_USB_EXTA_OC_L	
R1581 100K	XDP_USB_EXTB_OC_L	
R1582 100K	XDP_USB_EXTC_OC_L	
R1583 100K	XDP_USB_EXTD_OC_L	
R1548 1K	SPI_IO<2>	
R1549 1K	SPI_IO<3>	
R1590 100K	PCH_SMBALERT_L	
R1591 100K	WOL_EN	

5% 1/20W MF 201

BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

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

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 15 OF 120
SHEET 14 OF 82

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

=PP3V3_S0_PCH_GPIO 12 13 15 18 26 65 68

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 15 16 18
XDP_MLB_RAMCFG1 15 16 18
XDP_MLB_RAMCFG2 15 16 18
XDP_MLB_RAMCFG3 15 16 18

GPIO12:
CR: TBT_GO2SX_BIDIR, requires 100k pull-up to SUS
RR/FR: DPHDMIMUX_SEL_TBT, requires 100k pull-up to TBTLC

D1600 BAT54XV2T1 SOD-523
69 BI =TBT_GO2SX_BIDIR

R1600 1M 5% 1/20W MF 201

18 16 15 13 IN PLT_RESET_L

R1621 100K 5% 1/20W MF 201
18 OUT

TPAD_SPI_INT_GPIO28_L 15
R1681 0 5% 1/20W MF 0201
71 36 18 IN TPAD_SPI_INT_L
R1682 0 5% 1/20W MF 0201
TPAD_SPI_INT_GPIO46_L 15

R1639 100K 5% 1/20W MF 201
R1680 100K 5% 1/20W MF 201
32 OUT
33 18 OUT

68 65 26 18 15 13 12 =PP3V3_S0_PCH_GPIO
R1641 1K 5% 1/20W MF 201

OMIT_TABLE
CRITICAL
U0500
BROADWELL-ULT 2C+GT2 BGA
SYM 10 OF 19

16 15 BI	XDP_PCH_GPIO76	P1	BMBUSY*/GPIO76
18 16 15 BI	XDP_MLB_RAMCFG0	AU2	GPIO8
	HDMI_TBT_MUX_SEL_GPIO12	AM7	LAN_PHY_PWR_CTRL/GPIO12
	TP_MEM_VDD_SEL_1V5_L	AD6	GPIO15 (IPD-RSMRST#)
16 15 BI	XDP_LPCPLUS_GPIO	Y1	GPIO16
16 15 BI	XDP_PCH_GPIO17	T3	GPIO17
66 15 OUT	SD_RESET_L	AD5	GPIO24
38 15 IN	SMC_WAKE_SCI_L	AN5	GPIO27 (IPD-DeepSx)
15	TPAD_SPI_INT_GPIO28_L	AD7	GPIO28
37 15	TPAD_USB_IF_EN	AN3	GPIO26
64 32 15 OUT	SSD_PWR_EN	AG6	GPIO56
	PCH_TBT_PCIE_RESET_L	AP1	GPIO57
71 15 OUT	HDD_PWR_EN	AL4	GPIO58
16 15 BI	XDP_SDCONN_STATE_CHANGE_L	AT5	GPIO59
66 15 OUT	SD_PWR_EN	AK4	GPIO44
25 15 OUT	TBT_PWR_EN	AB6	GPIO47
16 15 OUT	XDP_JTAG_ISP_TCK	U4	GPIO48
16 15 OUT	XDP_JTAG_ISP_TDI	Y3	GPIO49
18 15 OUT	JTAG_TBT_TMS_PCH	P3	GPIO50
63 15 OUT	PCH_HSIO_PWR_EN	Y2	HSIOPC/GPIO71
37 15 OUT	TPAD_SPI_IF_EN	AT3	GPIO13
18 16 15 BI	XDP_MLB_RAMCFG3	AH4	GPIO14
71 47 15 BI	SPIROM_USE_MLB	AM4	GPIO25
18 15 OUT	CAMERA_PWR_EN_PCH	AG5	GPIO45
15	TPAD_SPI_INT_GPIO46_L	AG3	GPIO46
18 16 15 BI	XDP_MLB_RAMCFG1	AM3	GPIO9
18 16 15 BI	XDP_MLB_RAMCFG2	AM2	GPIO10
32 15 OUT	SSD_SR_EN_L	P2	DEVSLP0/GPIO33
31 15 OUT	AP_S0IX_WAKE_SEL	C4	SDIO_POWER_EN/GPIO70
32 OUT	SSD_RESET_L	L2	DEVSLP1/GPIO38
33 18 OUT	CAM_PCIE_RESET_L	N5	DEVSLP2/GPIO39
	PCH_TCO_TIMER_DISABLE	V2	SPKR/GPIO81 (IPD-PLTRST#)

CPU/MISC

THERMTRIP*	D60	PM_THRMTRIP_L	39 75 OUT
RCIN*/GPIO82	V4	=TBT_CIO_PLUG_EVENT	18 IN
SERIRQ	T4	LPC_SERIRQ	15 38 71 BI
PCH_OPI_COMP	AW15	PCH_OPI_COMP	75
RSVD	AF20	NC	
RSVD	AB21	NC	

GPIO LPIO

GSPI0_CS*/GPIO83	R6	PCH_GSPI0_CS_L	15
GSPI0_CLK/GPIO84	L6	PCH_GSPI0_CLK	15
GSPI0_MISO/GPIO85 (IPD)	N6	PCH_GSPI0_MISO	15
GSPI0_MOSI/GPIO86 (IPD-PLTRST#)	L8	PCH_GSPI0_MOSI	15
GSPI1_CS*/GPIO87	R7	TPAD_SPI_CS_L	15 37 75 OUT
GSPI1_CLK/GPIO88	L5	TPAD_SPI_CLK	15 37 75 OUT
GSPI1_MISO/GPIO89 (IPD)	N7	TPAD_SPI_MISO	15 37 75 IN
GSPI_MOSI/GPIO90	K2	TPAD_SPI_MOSI	15 37 75 OUT
UART0_RXD/GPIO91	J1	AP_S0IX_WAKE_L	15 31 IN
UART0_TXD/GPIO92	K3	HDMITBTMUX_FLAG_L	15 67 IN
UART0_RTS*/GPIO93	J2	JTAG_ISP_TDO	15 18 IN
UART0_CTS*/GPIO94	G1	AP_RESET_L	OUT 66
UART1_RXD/GPIO0	K4	PCH_UART1_RXD	15
UART1_TXD/GPIO1	G2	PCH_UART1_TXD	15
UART1_RST*/GPIO2	J3	PCH_UART1_RTS_L	15
UART1_CTS*/GPIO3	J4	PCH_UART1_CTS_L	15
I2C0_SDA/GPIO4	F2	PCH_I2C0_SDA	15
I2C0_SCL/GPIO5	F3	PCH_I2C0_SCL	15
I2C1_SDA/GPIO6	G4	PCH_I2C1_SDA	15
I2C1_SCL/GPIO7	F1	PCH_I2C1_SCL	15
SDIO_CLK/GPIO64	E3	TBT_POC_RESET_L	OUT 26
SDIO_CMD/GPIO65	F4	BT_PWRRST_L	OUT 15 71
SDIO_D0/GPIO66 (IPD-PLTRST#)	D3	PCH_STRP_TOPBLK_SWP_L	IN 40
SDIO_D1/GPIO67	E4	ENET_MEDIA_SENSE	IN 15 71
SDIO_D2/GPIO68	C3	LCD_IRQ_L	IN 65 71
SDIO_D3/GPIO69	E2	LCD_PSR_EN	OUT 15 65

68 55 17 16 8 6 =PP1V05_S0_CPU_VCCST
R1650 1K 1/20W MF 201
75 PCH_OPI_COMP

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 IN 13 15 16 18
R1671 100K 5% 1/20W MF 201

Pull-up on TBT page

Requires connection to SMC via 1K series R

R1694 10K 5% 1/20W MF 201
65 41 PP3V3_S0_EDP_SW

=PP3V3_S5_PCH_GPIO 13 68
=PP3V3_S3RS4_PCH_GPIO 68
=PP3V3_S3SW_SD_RESET 68
=PP3V3_S3_PCH_GPIO 68
=PP3V3_S3RS0_CAMPWREN 18 44
=PP3V3_S0_PCH_GPIO 12 13 15 18 26 65 68
=PP3V3_S0RTBTLC_PCH_GPIO 68

TBTLC for CR, S0 for RR

R1610 100K	XDP_PCH_GPIO76	15 16
R1614 100K	XDP_LPCPLUS_GPIO	15 16
R1615 100K	XDP_PCH_GPIO17	15 16
SD_ON_MLB		
R1616 100K	SD_RESET_L	15 66
R1617 100K	SMC_WAKE_SCI_L	15 38
R1618 100K	TPAD_SPI_INT_L	15 36 71
R1619 100K	TPAD_USB_IF_EN	15 37
R1620 100K	SSD_PWR_EN	15 32 64
R1622 100K	HDD_PWR_EN	15 71
R1623 100K	XDP_SDCONN_STATE_CHANGE_L	15 16
R1624 100K	SD_PWR_EN	15 66
R1625 100K	TBT_PWR_EN	15 25
R1626 100K	XDP_JTAG_ISP_TCK	15 16
R1627 100K	XDP_JTAG_ISP_TDI	15 16
R1628 100K	JTAG_TBT_TMS_PCH	15 18
R1629 100K	PCH_HSIO_PWR_EN	15 63
R1630 100K	TPAD_SPI_IF_EN	15 37
R1632 100K	SPIROM_USE_MLB	15 47 71
R1633 100K	CAMERA_PWR_EN_PCH	15 18
R1637 100K	SSD_SR_EN_L	15 32
R1638 100K	AP_S0IX_WAKE_SEL	15 31
R1652 10K	LPC_SERIRQ	15 38 71
R1670 100K	JTAG_ISP_TDO	15 18
R1691 100K	BT_PWRRST_L	15 71
R1693 100K	ENET_MEDIA_SENSE	15 71
R1695 100K	LCD_PSR_EN	15 65

All 5% 1/20W MF 201

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

STUFFED R1632

68 65 26 18 15 13 12 =PP3V3_S0_PCH_GPIO

PCH_GSPI0_CS_L	R1660 100K	15
PCH_GSPI0_CLK	R1661 100K	15
PCH_GSPI0_MISO	R1662 100K	15
PCH_GSPI0_MOSI	R1663 100K	15
TPAD_SPI_CS_L	R1664 47K	75 37 15
TPAD_SPI_CLK	R1665 47K	75 37 15
TPAD_SPI_MISO	R1666 47K	75 37 15
TPAD_SPI_MOSI	R1667 47K	75 37 15
AP_S0IX_WAKE_L	R1668 100K	31 15
HDMITBTMUX_FLAG_L	R1669 100K	67 15
PCH_UART1_RXD	R1672 100K	15
PCH_UART1_TXD	R1673 100K	15
PCH_UART1_RTS_L	R1674 100K	15
PCH_UART1_CTS_L	R1675 100K	15
PCH_I2C0_SDA	R1676 100K	15
PCH_I2C0_SCL	R1677 100K	15
PCH_I2C1_SDA	R1678 100K	15
PCH_I2C1_SCL	R1679 100K	15

All 5% 1/20W MF 201

BOM_COST_GROUP=CPU

SYNC_MASTER=J41 SYNC_DATE=01/19/2013

PAGE TITLE
PCH GPIO/MISC/LPIO

Apple Inc.

DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 16 OF 120
SHEET 15 OF 82

Merged (CPU/PCH) Micro2-XDP

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

=PP1V05_S0_XDP

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_XDP_SDA	SDA	TDO	XDP_TRST_L
=SMBUS_XDP_SCL	SCL	TRSTn	
XDP_PCH_TCK	TCK1	TDI	
	TCK0	TMS	
		XDP_PRESENT#	

XDP_CPU_PRESENT_L

CPU_VCCST_PWRGD → R1800 1K → XDP
PLACE_NEAR=U0500.C61:2.54mm
5% 1/20W MF 201

PM_PWRBTN_L → R1802 0 → XDP
PLACE_NEAR=U5000.J3:2.54mm
5% 1/20W MF 0201

PM_PCH_SYS_PWROK → R1804 0 → XDP
5% 1/16W MF-LF 402

XDP_CPU_TCK

PCH_JTAGX → R1835 0 → XDP
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

XDP_CPU_TDO → R1810 51 → XDP
PLACE_NEAR=U0500.F62:28mm
XDP_CPU_TCK → R1813 51 → XDP
PLACE_NEAR=U0500.E60:28mm
5% 1/20W MF 201

TDI and TMS are terminated in CPU.

R1805 1K → XDP → PLT_RESET_L
PLACE_NEAR=U0500.AG7:2.54mm
NOTE: XDP_DBRESET_L pulled-up to 3.3V on PCH Support Page

XDP_PCH_TDO
XDP_PCH_TDI
XDP_PCH_TMS

CRITICAL
Q1840 DMN5L06VK-7 SOT563
SIGNAL_MODEL=DMN5L06VK_7
PLACE_NEAR=J1800.51:28mm
XDP_CPU_TDO

CRITICAL
Q1840 DMN5L06VK-7 SOT563
SIGNAL_MODEL=DMN5L06VK_7
PLACE_NEAR=J1800.53:28mm
XDP_CPUPCH_TRST_L
MAKE_BASE=TRUE
XDP_CPU_TRST_L
XDP_PCH_TRST_L

CRITICAL
Q1842 DMN5L06VK-7 SOT563
SIGNAL_MODEL=DMN5L06VK_7
PLACE_NEAR=J1800.55:28mm
XDP_CPU_TDI

CRITICAL
Q1842 DMN5L06VK-7 SOT563
SIGNAL_MODEL=DMN5L06VK_7
PLACE_NEAR=J1800.57:28mm
XDP_CPU_TMS

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	USB_EXTA_OC_L
XDP_USB_EXTB_OC_L	MAKE_BASE=TRUE	USB_EXTB_OC_L
XDP_USB_EXTC_OC_L	TP1873	
XDP_USB_EXTD_OC_L	TP1874	
XDP_SDCONN_STATE_CHANGE_L	MAKE_BASE=TRUE	SDCONN_STATE_CHANGE_L
XDP_MLB_RAMCFG1	TP1876	
XDP_MLB_RAMCFG2	TP1877	
XDP_MLB_RAMCFG3	TP1878	
XDP_JTAG_ISP_TCK	MAKE_BASE=TRUE	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	LPCPLUS_GPIO
XDP_PCH_GPIO17	TP1886	
XDP_PCH_GPIO76	TP1887	
XDP_JTAG_ISP_TDI	MAKE_BASE=TRUE	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_XDPJTAGISOL
=PP3V3_S5_XDPJTAGISOL
C1845 0.1UF 10% 10V X5R-CERM 0201
U1845 74LVC1G07GF SOT891 (VCC, GND, NC, NC, A, Y)
R1845 330K 5% 1/20W MF 201
ALL_SYS_PWRGD
XDP_JTAG_CPU_ISOL_L

=PP1V05_SUS_PCH_JTAG

PCH_JTAGX	R1899 1K	NO STUFF
XDP_PCH_TDO	R1890 51	XDP
XDP_PCH_TDI	R1891 51	XDP
XDP_PCH_TMS	R1892 51	XDP
XDP_PCH_TCK	R1896 51	NO STUFF
XDP_PCH_TRST_L	R1897 51	NO STUFF

All: 5% 1/20W MF 201

BOM_COST_GROUP=CPU SUPPORT

SYNC_MASTER=WFERRY_J43 SYNC_DATE=12/21/2012

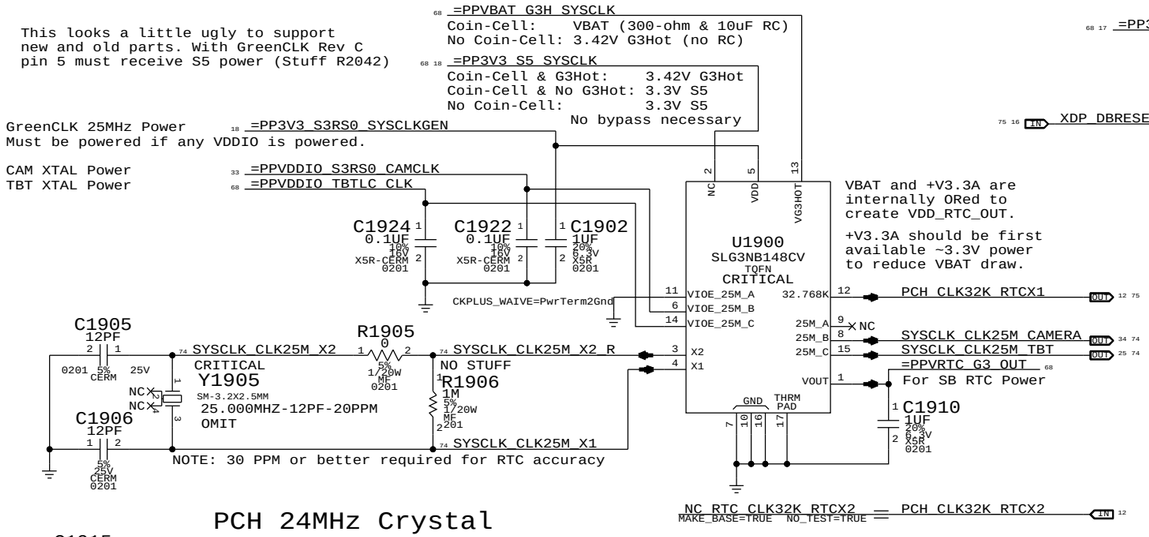
PAGE TITLE: CPU/PCH Merged XDP

Apple Inc.

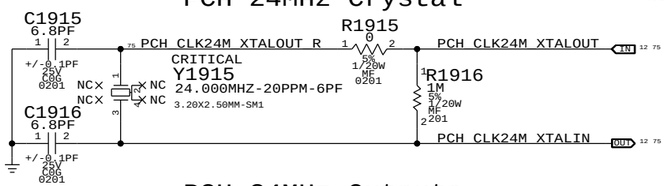
DRAWING NUMBER: 051-1573
SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 18 OF 120
SHEET: 16 OF 82

System RTC Power Source & 32kHz / 25MHz Clock Generator

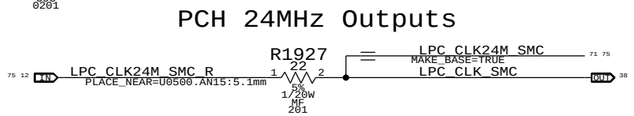
Chipset uses 24MHz crystal, GreenCLK kept to save 1x 25MHz crystal & 1x 32kHz crystal



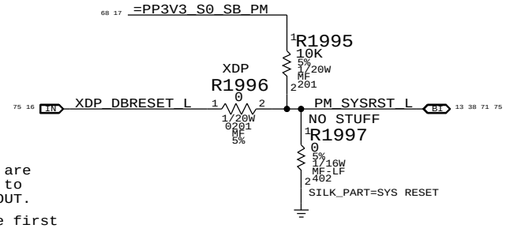
PCH 24MHz Crystal



PCH 24MHz Outputs

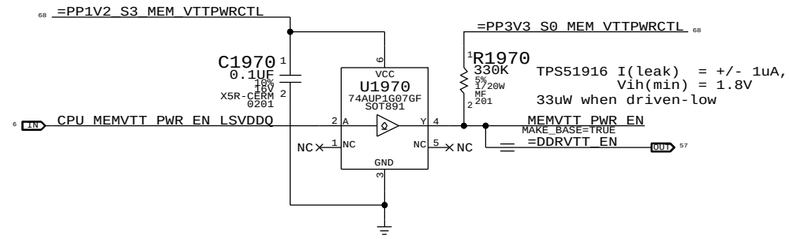


PCH Reset Button

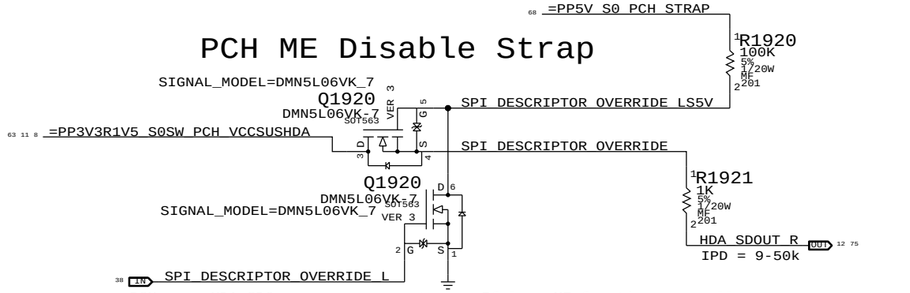


Memory VTT Enable Level-Shifter

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

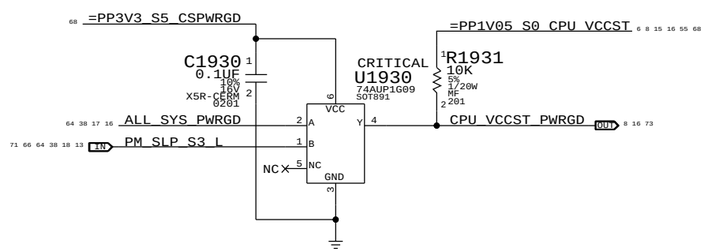


PCH ME Disable Strap

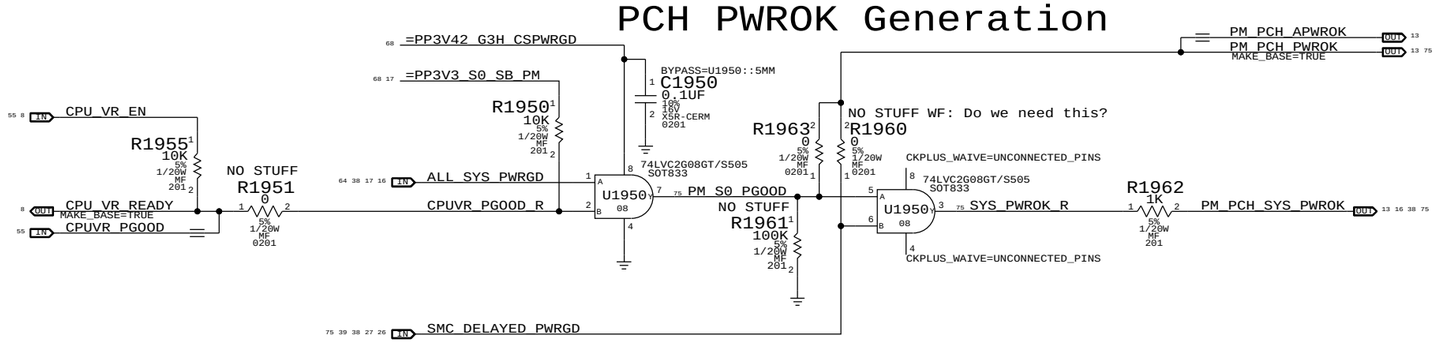


PCH uses HDA_SDO as a power-up strap. If low, ME functions normally. If high, ME is disabled. This allows for full re-flashing of SPI ROM. SMC controls strap enable to allow in-field control of strap setting. Q1920 & 5V pull-up allows circuit to work regardless of HDA voltage.

VCCST (1.05V S0) PWRGD



PCH PWROK Generation



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
197S0480	1	XTAL,25MHZ,20PPM,12PF,3.2X2.5X.6MM,85C	Y1905		

BOM_COST_GROUP=CPU SUPPORT

SYNC_MASTER=J41 SYNC_DATE=01/30/2013

PAGE TITLE: Chipset Support

Apple Inc.

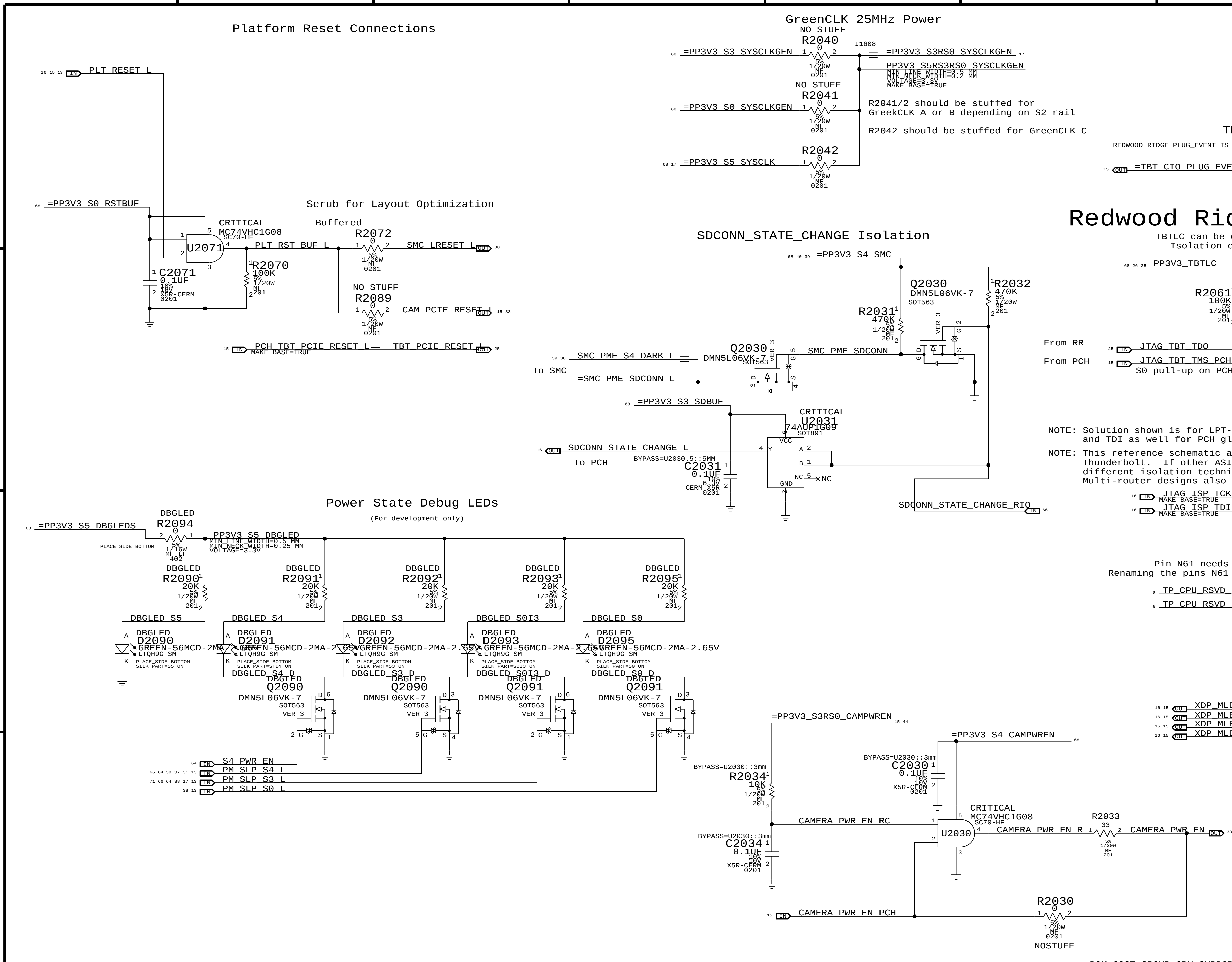
DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 19 OF 120

SHEET: 17 OF 82



Platform Reset Connections
PLT_RESET_L
=PP3V3_S0_RSTBUF
CRITICAL
MC74VHC1G08
SC70-HF
U2071
C2071
0.1UF
10%
16V
X5R-CERM
0201
R2070
100K
5%
1/20W
MF
201
Scrub for Layout Optimization
Buffered
R2072
0
PLT_RST_BUF_L
SMC_LRESET_L
NO STUFF
R2089
0
CAM_PCIE_RESET_L
PCH_TBT_PCIE_RESET_L
MAKE_BASE=TRUE
TBT_PCIE_RESET_L
GreenCLK 25MHz Power
NO STUFF
R2040
0
=PP3V3_S3_SYSCLKGEN
I1608
=PP3V3_S3RS0_SYSCLKGEN
PP3V3_S5RS3RS0_SYSCLKGEN
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
NO STUFF
R2041
0
=PP3V3_S0_SYSCLKGEN
R2041/2 should be stuffed for
GreekCLK A or B depending on S2 rail
R2042 should be stuffed for GreenCLK C
R2042
0
=PP3V3_S5_SYSCLK
SDCONN_STATE_CHANGE Isolation
=PP3V3_S4_SMC
Q2030
DMN5L06VK-7
SOT563
R2032
470K
R2031
470K
SMC_PME_S4_DARK_L
To SMC
=SMC_PME_SDCONN_L
SMC_PME_SDCONN
=PP3V3_S3_SDBUF
CRITICAL
U2031
74AUP1G09
SOT891
SDCONN_STATE_CHANGE_L
To PCH
BYPASS=U2030.5::5MM
C2031
0.1UF
10%
6.3V
CERM-X5R
0201
NC
SDCONN_STATE_CHANGE_RIO
=PP3V3_S0_PCH_GPIO
R2015
100K
THUNDERBOLT PULL-UP
REDWOOD RIDGE PLUG_EVENT IS ACTIVE-LOW, ALWAYS DRIVEN (PULL-UP)
=TBT_CIO_PLUG_EVENT
MAKE_BASE
TRUE
TBT_CIO_PLUG_EVENT_L
Redwood Ridge JTAG Isolation
TBTLC can be on when S0 is off, and vice-versa
Isolation ensures no leakage to RR or PCH
PP3V3_TBTLC
R2061
100K
C2060
0.1UF
10%
10V
CERM
402
U2060
74LVC2G07
SOT891
R2062
100K
S0 pull-up on PCH page
From RR
JTAG_TBT_TDO
JTAG_ISP_TDO
To PCH
From PCH
JTAG_TBT_TMS_PCH
JTAG_TBT_TMS
To RR
S0 pull-up on PCH page
NOTE: Solution shown is for LPT-LP. Other PCH’s may require isolation on TCK and TDI as well for PCH glitch-prevention.
NOTE: This reference schematic assumes PCH JTAG GPIOs are only used for Thunderbolt. If other ASIC JTAG signals are wired into these GPIOs different isolation techniques will likely be necessary. Multi-router designs also require different circuitry.
JTAG_ISP_TCK
MAKE_BASE=TRUE
JTAG_TBT_TCK
JTAG_ISP_TDI
MAKE_BASE=TRUE
JTAG_TBT_TDI
Pin N61 needs a TP for Power to perform iFDIM test
Renaming the pins N61 and P61 to remove automatic diffpari property
TP_CPU_RSVD_N61
TP_CPU_RSVDN61
MAKE_BASE=TRUE
TP_CPU_RSVD_P61
TP_CPU_RSVDP61
MAKE_BASE=TRUE
Power State Debug LEDs
(For development only)
=PP3V3_S5_DBGLEDS
DBGLED
R2094
0
PLACE_SIDE=BOTTOM
PP3V3_S5_DBGLED
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.25 MM
VOLTAGE=3.3V
DBGLED R2090 20K
DBGLED R2091 20K
DBGLED R2092 20K
DBGLED R2093 20K
DBGLED R2095 20K
DBGLED_S5
DBGLED_S4
DBGLED_S3
DBGLED_S0I3
DBGLED_S0
DBGLED D2090 GREEN-56MCD-2MA-2.65V LTQH9G-SM
PLACE_SIDE=BOTTOM
SILK_PART=S5_ON
DBGLED D2091
SILK_PART=STBY_ON
DBGLED D2092
SILK_PART=S3_ON
DBGLED D2093
SILK_PART=S0I3_ON
DBGLED D2095
SILK_PART=S0_ON
DBGLED_S4_D
DBGLED_S3_D
DBGLED_S0I3_D
DBGLED_S0_D
DBGLED Q2090 DMN5L06VK-7 SOT563 VER 3
DBGLED Q2091 DMN5L06VK-7 SOT563 VER 3
S4_PWR_EN
PM_SLP_S4_L
PM_SLP_S3_L
PM_SLP_S0_L
=PP3V3_S3RS0_CAMPWREN
=PP3V3_S4_CAMPWREN
BYPASS=U2030::3mm
C2030
0.1UF
10%
16V
X5R-CERM
0201
BYPASS=U2030::3mm
R2034
10K
CAMERA_PWR_EN_RC
CRITICAL
MC74VHC1G08
SC70-HF
U2030
CAMERA_PWR_EN_R
R2033
33
CAMERA_PWR_EN
BYPASS=U2030::3mm
C2034
0.1UF
10%
16V
X5R-CERM
0201
CAMERA_PWR_EN_PCH
R2030
0
NOSTUFF
RAM Configuration Straps
Pull-downs for chip-down RAM systems
XDP_MLB_RAMCFG0
XDP_MLB_RAMCFG1
XDP_MLB_RAMCFG2
XDP_MLB_RAMCFG3
RAMCFG3:L R2050 10K
RAMCFG2:L R2051 10K
RAMCFG1:L R2052 10K
RAMCFG0:L R2053 10K
BOM_COST_GROUP=CPU SUPPORT

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE

Project Chipset Support

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 20 OF 120

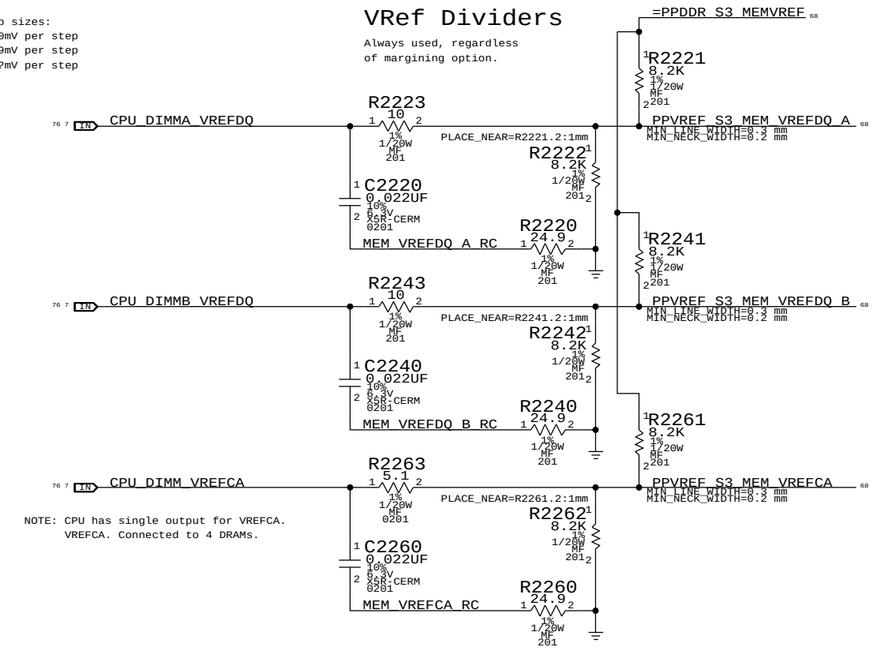
SHEET 18 OF 82

CPU-Based Margining

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

VRef Dividers

Always used, regardless of margining option.



NOTE: CPU has single output for VREFCA. VREFCA. Connected to 4 DRAMs.

	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

BOM_COST_GROUP=CPU SUPPORT

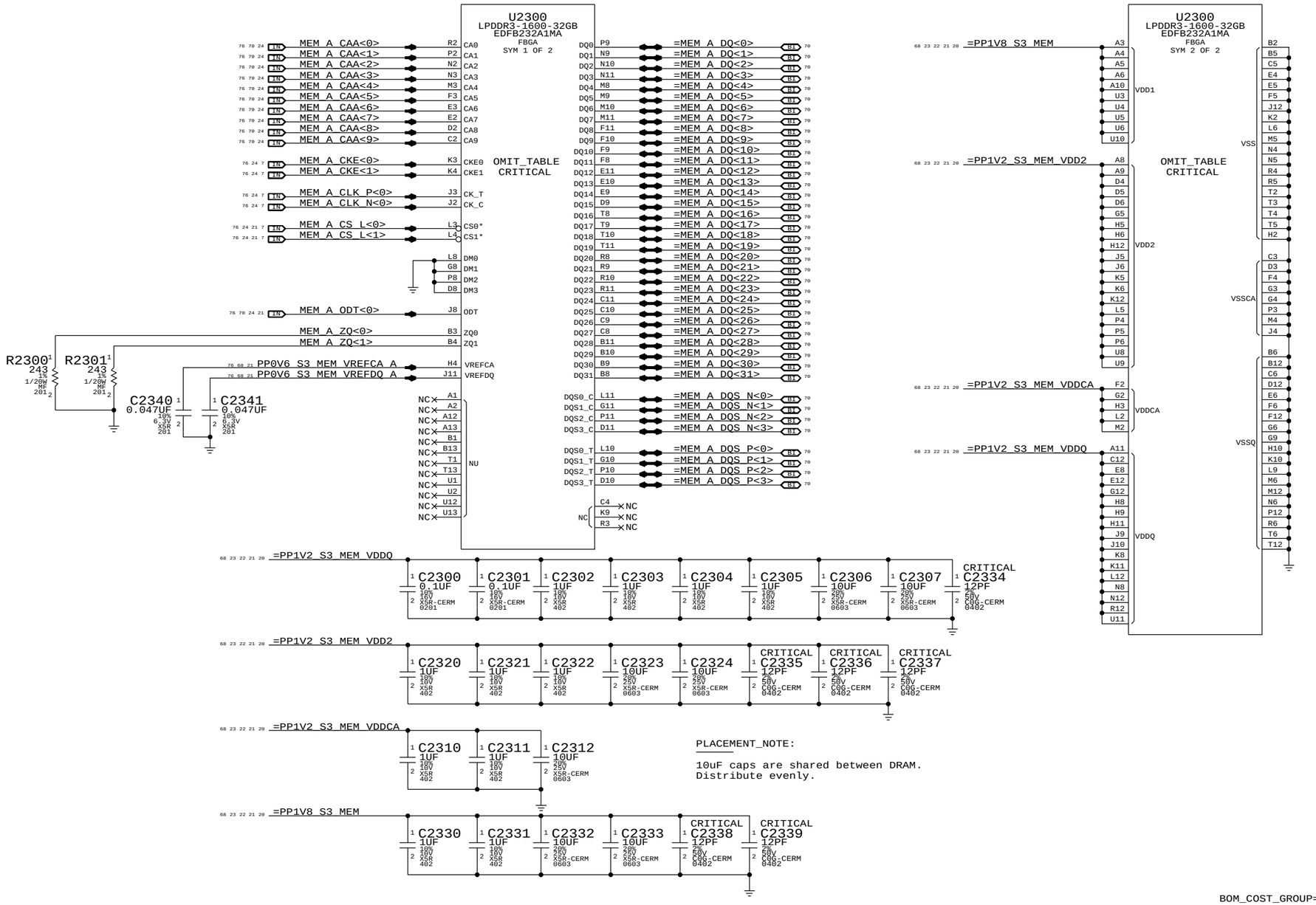
SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/02/2013

PAGE TITLE: LPDDR3 VREF Margining

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 22 OF 120
SHEET: 19 OF 82

LPDDR3 CHANNEL A (0-31)



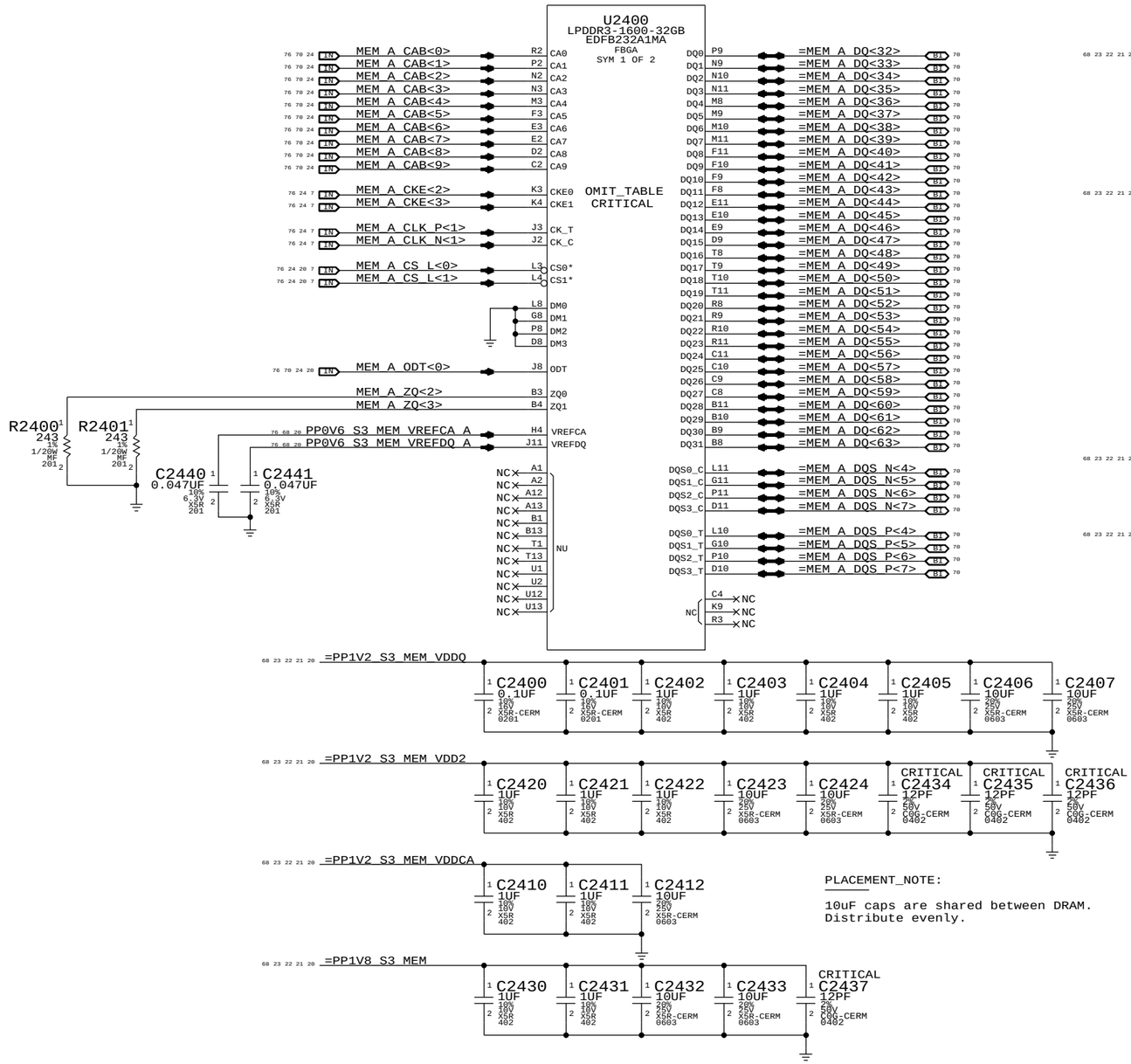
SYNC_MASTER=J41_MLB SYNC_DATE=02/06/2013

PAGE TITLE
LPDDR3 DRAM Channel A (00-31)

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 23 OF 120
SHEET 20 OF 82

LPDDR3 CHANNEL A (32-63)



BOM_COST_GROUP=DRAM

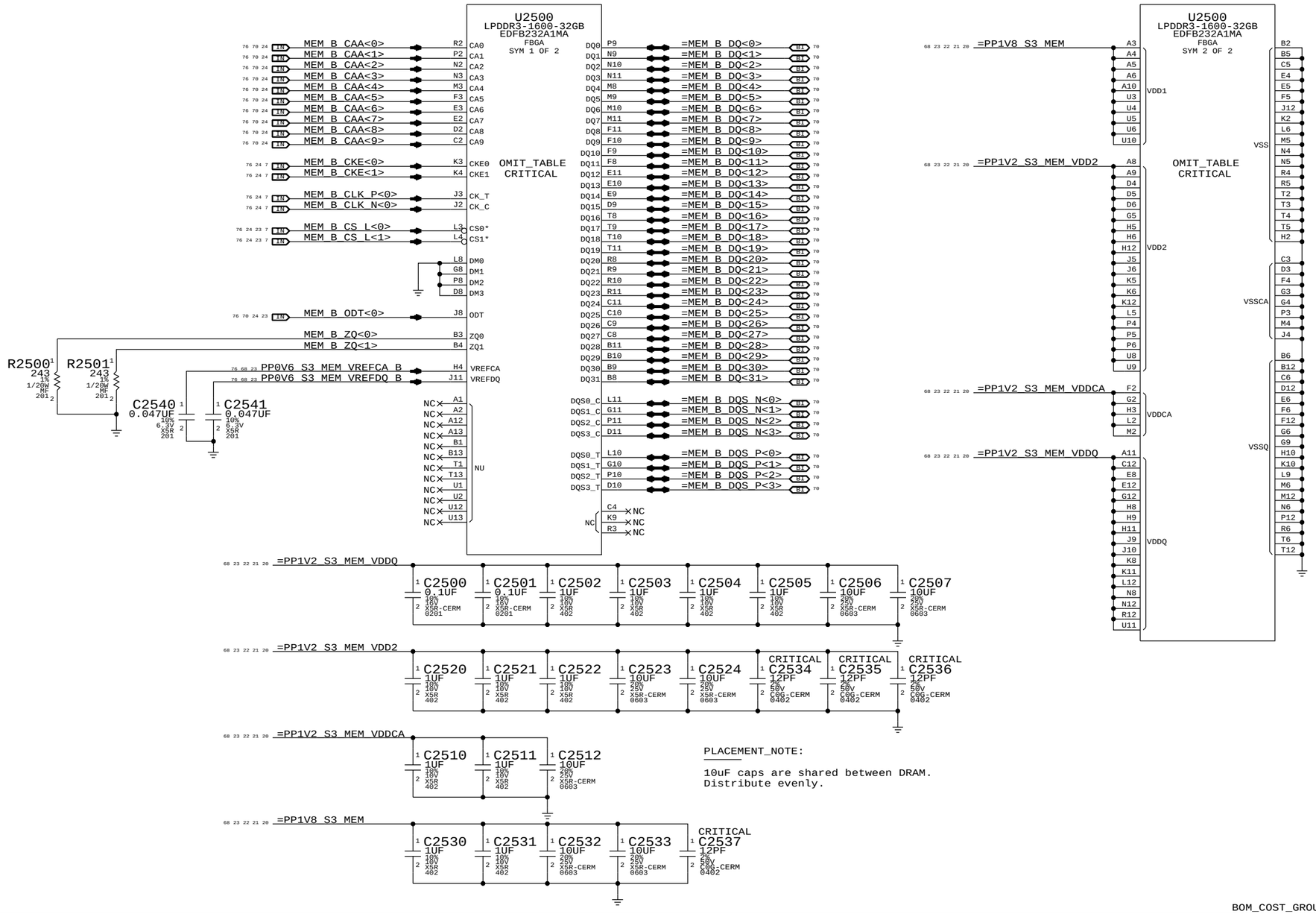
SYNC_MASTER=J41_MLB SYNC_DATE=02/06/2013

PAGE TITLE
LPDDR3 DRAM Channel A (32-63)

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 24 OF 120
SHEET 21 OF 82

LPDDR3 CHANNEL B (0-31)



BOM_COST_GROUP=DRAM

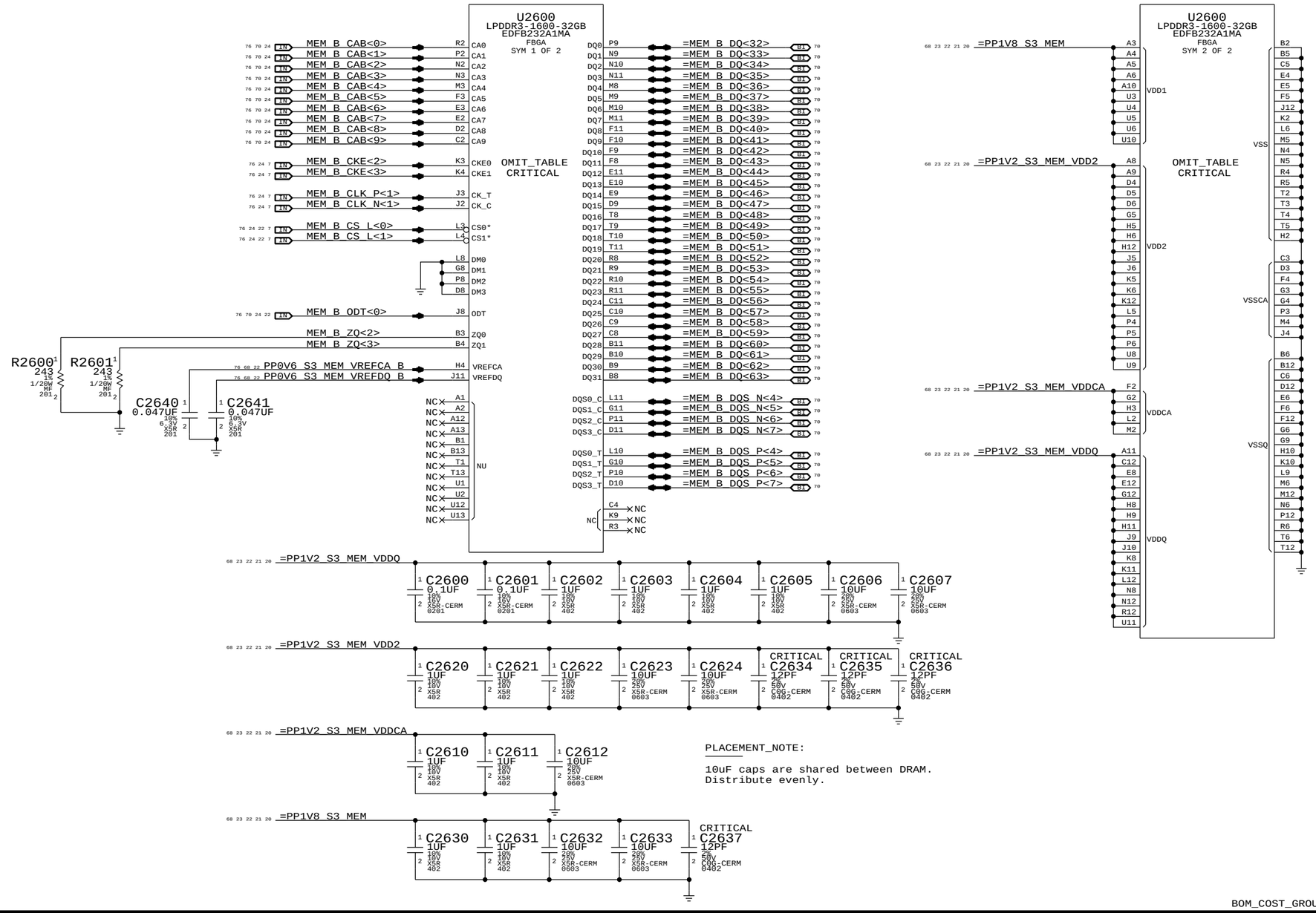
SYNC_MASTER=J41_MLB SYNC_DATE=02/06/2013

PAGE TITLE
LPDDR3 DRAM Channel B (00-31)

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 25 OF 120
SHEET 22 OF 82

LPDDR3 CHANNEL B (32-63)



BOM_COST_GROUP=DRAM

SYNC_MASTER=J41_MLB SYNC_DATE=02/06/2013

PAGE TITLE
LPDDR3 DRAM Channel B (32-63)

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 26 OF 120
SHEET 23 OF 82

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

68 =PP0V6_S0_MEM_VTT_A

MEM_A_CAA<9>	R2700	56	1% 1/20W 201 MF	C2700 0.47UF 20% 4V CERM-X5R-1 201	C2730 12PF 5% 25V NP0-C0G 0201
MEM_A_CAA<8>	R2701	56	1% 1/20W 201 MF		
MEM_A_CAA<6>	R2702	56	1% 1/20W 201 MF		
MEM_A_CAA<7>	R2703	56	1% 1/20W 201 MF		
MEM_A_CAA<5>	R2704	56	1% 1/20W 201 MF		
MEM_A_CLK_P<0>	R2705	39	1% 1/20W 201 MF	C2701 0.47UF 20% 4V CERM-X5R-1 201	C2702 0.47UF 20% 4V CERM-X5R-1 201
MEM_A_CLK_N<0>	R2706	39	1% 1/20W 201 MF		
MEM_A_CKE<1>	R2707	82	1% 1/20W 201 MF		
MEM_A_CKE<0>	R2708	82	1% 1/20W 201 MF		
MEM_A_CAA<4>	R2709	56	1% 1/20W 201 MF	C2703 0.47UF 20% 4V CERM-X5R-1 201	C2704 0.47UF 20% 4V CERM-X5R-1 201
MEM_A_CAA<3>	R2710	56	1% 1/20W 201 MF		
MEM_A_CAA<2>	R2711	56	1% 1/20W 201 MF		
MEM_A_CAA<1>	R2712	56	1% 1/20W 201 MF		
MEM_A_CAA<0>	R2713	56	1% 1/20W 201 MF		
MEM_A_CAB<9>	R2714	56	1% 1/20W 201 MF	C2705 0.47UF 20% 4V CERM-X5R-1 201	C2706 0.47UF 20% 4V CERM-X5R-1 201
MEM_A_CAB<8>	R2715	56	1% 1/20W 201 MF		
MEM_A_CAB<6>	R2716	56	1% 1/20W 201 MF		
MEM_A_CAB<7>	R2717	56	1% 1/20W 201 MF		
MEM_A_CAB<5>	R2718	56	1% 1/20W 201 MF		
MEM_A_CLK_P<1>	R2719	39	1% 1/20W 201 MF	C2707 0.47UF 20% 4V CERM-X5R-1 201	C2708 0.47UF 20% 4V CERM-X5R-1 201
MEM_A_CLK_N<1>	R2720	39	1% 1/20W 201 MF		
MEM_A_CKE<2>	R2721	82	1% 1/20W 201 MF		
MEM_A_CKE<3>	R2722	82	1% 1/20W 201 MF		
MEM_A_CAB<4>	R2723	56	1% 1/20W 201 MF	C2709 0.47UF 20% 4V CERM-X5R-1 201	
MEM_A_CAB<2>	R2724	56	1% 1/20W 201 MF		
MEM_A_CAB<3>	R2725	56	1% 1/20W 201 MF		
MEM_A_CAB<1>	R2726	56	1% 1/20W 201 MF		
MEM_A_CAB<0>	R2727	56	1% 1/20W 201 MF		
MEM_A_CS_L<0>	R2728	82	1% 1/20W 201 MF	CRITICAL C2720 22UF 20% 6.3V X6S-CERM-1 603	
MEM_A_CS_L<1>	R2729	82	1% 1/20W 201 MF		
MEM_A_ODT<0>	R2730	82	1% 1/20W 201 MF		

68 =PP0V6_S0_MEM_VTT_B

MEM_B_CAA<9>	R2740	56	1% 1/20W 201 MF	C2710 0.47UF 20% 4V CERM-X5R-1 201	C2731 12PF 5% 25V NP0-C0G 0201
MEM_B_CAA<8>	R2741	56	1% 1/20W 201 MF		
MEM_B_CAA<7>	R2742	56	1% 1/20W 201 MF		
MEM_B_CAA<6>	R2743	56	1% 1/20W 201 MF		
MEM_B_CAA<5>	R2744	56	1% 1/20W 201 MF		
MEM_B_CLK_P<0>	R2745	39	1% 1/20W 201 MF	C2711 0.47UF 20% 4V CERM-X5R-1 201	C2712 0.47UF 20% 4V CERM-X5R-1 201
MEM_B_CLK_N<0>	R2746	39	1% 1/20W 201 MF		
MEM_B_CKE<1>	R2747	82	1% 1/20W 201 MF		
MEM_B_CKE<0>	R2748	82	1% 1/20W 201 MF		
MEM_B_CAA<4>	R2749	56	1% 1/20W 201 MF	C2713 0.47UF 20% 4V CERM-X5R-1 201	C2714 0.47UF 20% 4V CERM-X5R-1 201
MEM_B_CAA<2>	R2750	56	1% 1/20W 201 MF		
MEM_B_CAA<3>	R2751	56	1% 1/20W 201 MF		
MEM_B_CAA<1>	R2752	56	1% 1/20W 201 MF		
MEM_B_CAA<0>	R2753	56	1% 1/20W 201 MF		
MEM_B_CAB<9>	R2754	56	1% 1/20W 201 MF	C2715 0.47UF 20% 4V CERM-X5R-1 201	C2716 0.47UF 20% 4V CERM-X5R-1 201
MEM_B_CAB<8>	R2755	56	1% 1/20W 201 MF		
MEM_B_CAB<7>	R2756	56	1% 1/20W 201 MF		
MEM_B_CAB<6>	R2757	56	1% 1/20W 201 MF		
MEM_B_CAB<5>	R2758	56	1% 1/20W 201 MF		
MEM_B_CLK_N<1>	R2759	39	1% 1/20W 201 MF	C2717 0.47UF 20% 4V CERM-X5R-1 201	C2718 0.47UF 20% 4V CERM-X5R-1 201
MEM_B_CLK_P<1>	R2760	39	1% 1/20W 201 MF		
MEM_B_CKE<2>	R2761	82	1% 1/20W 201 MF		
MEM_B_CKE<3>	R2762	82	1% 1/20W 201 MF		
MEM_B_CAB<4>	R2763	56	1% 1/20W 201 MF	C2719 0.47UF 20% 4V CERM-X5R-1 201	
MEM_B_CAB<2>	R2764	56	1% 1/20W 201 MF		
MEM_B_CAB<3>	R2765	56	1% 1/20W 201 MF		
MEM_B_CAB<1>	R2766	56	1% 1/20W 201 MF		
MEM_B_CAB<0>	R2767	56	1% 1/20W 201 MF		
MEM_B_CS_L<0>	R2768	82	1% 1/20W 201 MF	CRITICAL C2740 22UF 20% 6.3V X6S-CERM-1 603	
MEM_B_CS_L<1>	R2769	82	1% 1/20W 201 MF		
MEM_B_ODT<0>	R2770	82	1% 1/20W 201 MF		

BOM_COST_GROUP=DRAM

SYNC_MASTER=J41_MLB SYNC_DATE=02/06/2013

PAGE TITLE: LPDDR3 DRAM Termination

Apple Inc.

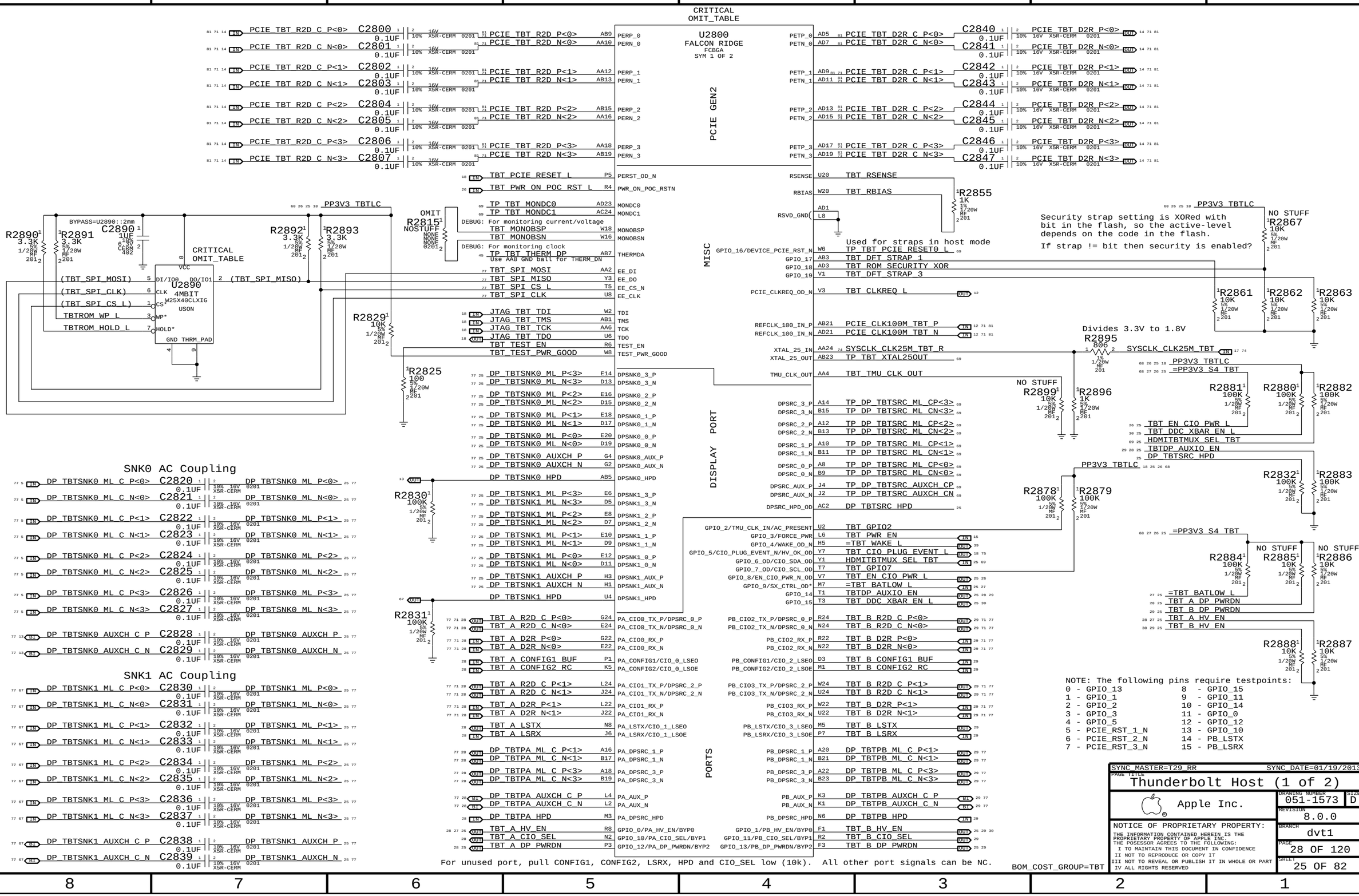
DRAWING NUMBER: 051-1573 SIZE: D

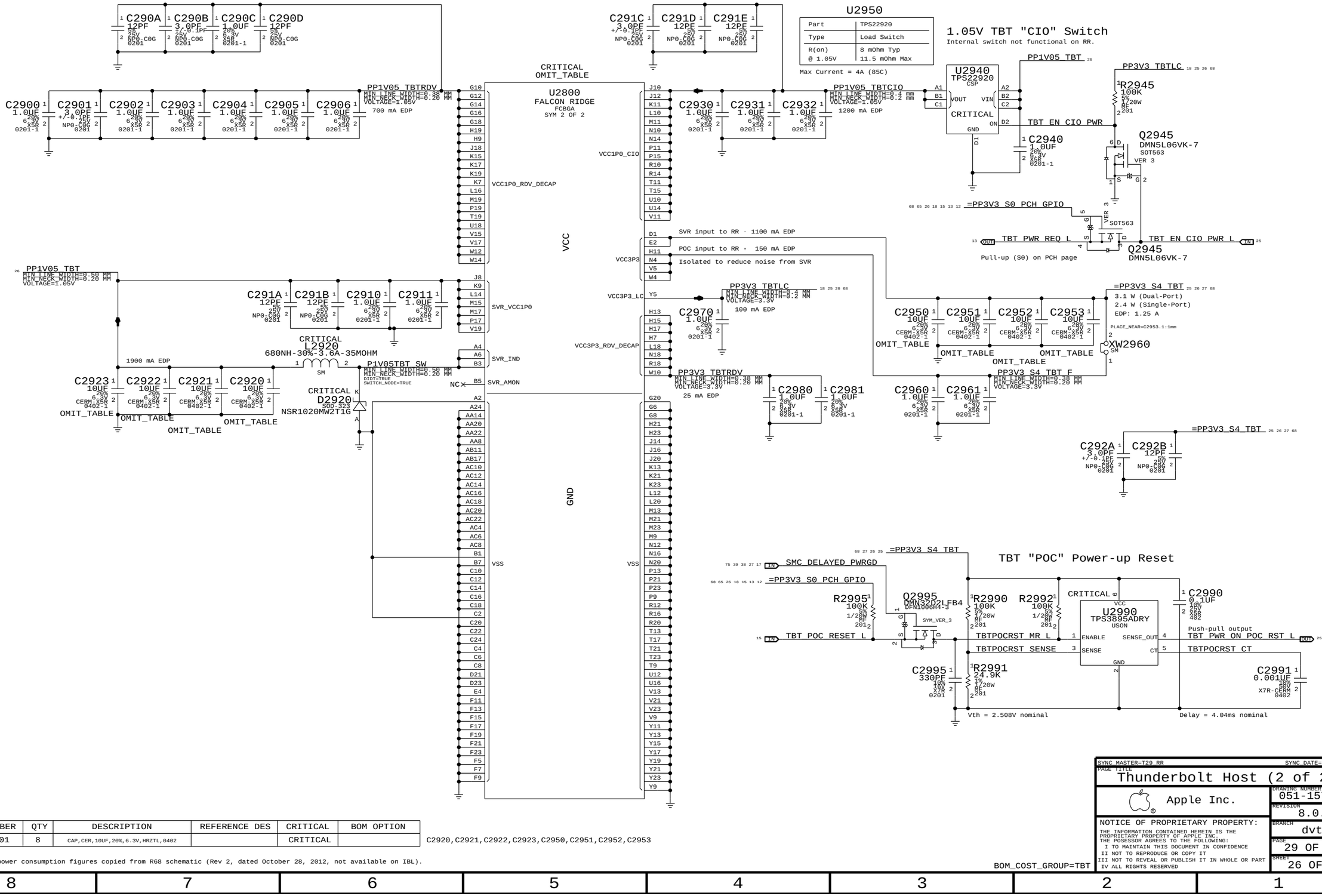
REVISION: 8.0.0

BRANCH: dvt1

PAGE: 27 OF 120

SHEET: 24 OF 82


CRITICAL
OMIT_TABLE
U2800
FALCON RIDGE
FCBGA
SYM 1 OF 2
PCIE GEN2
MISC
DISPLAY PORT
PORTS
PCIE_TBT_R2D_C_P<0>
PCIE_TBT_R2D_C_N<0>
PCIE_TBT_R2D_C_P<1>
PCIE_TBT_R2D_C_N<1>
PCIE_TBT_R2D_C_P<2>
PCIE_TBT_R2D_C_N<2>
PCIE_TBT_R2D_C_P<3>
PCIE_TBT_R2D_C_N<3>
PCIE_TBT_R2D_P<0>
PCIE_TBT_R2D_N<0>
PCIE_TBT_R2D_P<1>
PCIE_TBT_R2D_N<1>
PCIE_TBT_R2D_P<2>
PCIE_TBT_R2D_N<2>
PCIE_TBT_R2D_P<3>
PCIE_TBT_R2D_N<3>
PCIE_TBT_D2R_P<0>
PCIE_TBT_D2R_N<0>
PCIE_TBT_D2R_P<1>
PCIE_TBT_D2R_N<1>
PCIE_TBT_D2R_P<2>
PCIE_TBT_D2R_N<2>
PCIE_TBT_D2R_P<3>
PCIE_TBT_D2R_N<3>
TBT_PCIE_RESET_L
TBT_PWR_ON_POC_RST_L
PP3V3_TBTLC
TP_TBT_MONDC0
TP_TBT_MONDC1
DEBUG: For monitoring current/voltage
TBT_MONOBSP
TBT_MONOBSN
DEBUG: For monitoring clock
TP_TBT_THERM_DP
Use AA8 GND ball for THERM_DN
TBT_SPI_MOSI
TBT_SPI_MISO
TBT_SPI_CS_L
TBT_SPI_CLK
JTAG_TBT_TDI
JTAG_TBT_TMS
JTAG_TBT_TCK
JTAG_TBT_TDO
TBT_TEST_EN
TBT_TEST_PWR_GOOD
DP_TBTSNK0_ML_P<3>
DP_TBTSNK0_ML_N<3>
DP_TBTSNK0_ML_P<2>
DP_TBTSNK0_ML_N<2>
DP_TBTSNK0_ML_P<1>
DP_TBTSNK0_ML_N<1>
DP_TBTSNK0_ML_P<0>
DP_TBTSNK0_ML_N<0>
DP_TBTSNK0_AUXCH_P
DP_TBTSNK0_AUXCH_N
DP_TBTSNK0_HPD
DP_TBTSNK1_ML_P<3>
DP_TBTSNK1_ML_N<3>
DP_TBTSNK1_ML_P<2>
DP_TBTSNK1_ML_N<2>
DP_TBTSNK1_ML_P<1>
DP_TBTSNK1_ML_N<1>
DP_TBTSNK1_ML_P<0>
DP_TBTSNK1_ML_N<0>
DP_TBTSNK1_AUXCH_P
DP_TBTSNK1_AUXCH_N
DP_TBTSNK1_HPD
TBT_A_R2D_C_P<0>
TBT_A_R2D_C_N<0>
TBT_A_D2R_P<0>
TBT_A_D2R_N<0>
TBT_A_CONFIG1_BUF
TBT_A_CONFIG2_RC
TBT_A_R2D_C_P<1>
TBT_A_R2D_C_N<1>
TBT_A_D2R_P<1>
TBT_A_D2R_N<1>
TBT_A_LSTX
TBT_A_LSRX
TBT_A_HV_EN
TBT_A_CIO_SEL
TBT_A_DP_PWRDN
TBT_RSENSE
TBT_RBIAS
TBT_DFT_STRAP_1
TBT_ROM_SECURITY_XOR
TBT_DFT_STRAP_3
TBT_CLKREQ_L
PCIE_CLK100M_TBT_P
PCIE_CLK100M_TBT_N
SYSCLK_CLK25M_TBT_R
TP_TBT_XTAL25OUT
TBT_TMU_CLK_OUT
TP_DP_TBTSRC_ML_CP<3>
TP_DP_TBTSRC_ML_CN<3>
TP_DP_TBTSRC_ML_CP<2>
TP_DP_TBTSRC_ML_CN<2>
TP_DP_TBTSRC_ML_CP<1>
TP_DP_TBTSRC_ML_CN<1>
TP_DP_TBTSRC_ML_CP<0>
TP_DP_TBTSRC_ML_CN<0>
TP_DP_TBTSRC_AUXCH_CP
TP_DP_TBTSRC_AUXCH_CN
DP_TBTSRC_HPD
TBT_GPIO2
TBT_PWR_EN
=TBT_WAKE_L
TBT_CIO_PLUG_EVENT_L
HDMITBTMUX_SEL_TBT
TBT_GPIO7
TBT_EN_CIO_PWR_L
=TBT_BATLOW_L
TBTDP_AUXIO_EN
TBT_DDC_XBAR_EN_L
TBT_B_R2D_C_P<0>
TBT_B_R2D_C_N<0>
TBT_B_D2R_P<0>
TBT_B_D2R_N<0>
TBT_B_CONFIG1_BUF
TBT_B_CONFIG2_RC
TBT_B_R2D_C_P<1>
TBT_B_R2D_C_N<1>
TBT_B_D2R_P<1>
TBT_B_D2R_N<1>
TBT_B_LSTX
TBT_B_LSRX
TBT_B_HV_EN
TBT_B_CIO_SEL
TBT_B_DP_PWRDN
R2855 1K
R2867 10K NO STUFF
R2861 10K
R2862 10K
R2863 10K
R2895 806
R2896 1K
R2899 10K NO STUFF
R2881 100K
R2880 100K
R2882 100K
R2878 100K
R2879 100K
R2832 100K
R2883 100K
R2884 100K
R2885 10K NO STUFF
R2886 10K NO STUFF
R2888 10K
R2887 10K
R2890 3.3K
R2891 3.3K
C2890 1UF
R2892 3.3K
R2893 3.3K
R2815 NOSTUFF
R2829 10K
R2825 100
R2830 100K
R2831 100K
C2800 0.1UF
C2801 0.1UF
C2802 0.1UF
C2803 0.1UF
C2804 0.1UF
C2805 0.1UF
C2806 0.1UF
C2807 0.1UF
C2840 0.1UF
C2841 0.1UF
C2842 0.1UF
C2843 0.1UF
C2844 0.1UF
C2845 0.1UF
C2846 0.1UF
C2847 0.1UF
U2890 4MBIT W25X40CLXIG USON
BYPASS=U2890::2mm
CRITICAL OMIT_TABLE
OMIT
Used for straps in host mode
Security strap setting is XORed with bit in the flash, so the active-level depends on the code in the flash.
If strap != bit then security is enabled?
Divides 3.3V to 1.8V
SNK0 AC Coupling
SNK1 AC Coupling
For unused port, pull CONFIG1, CONFIG2, LSRX, HPD and CIO_SEL low (10k). All other port signals can be NC.
NOTE: The following pins require testpoints:
0 - GPIO_13
1 - GPIO_1
2 - GPIO_2
3 - GPIO_3
4 - GPIO_5
5 - PCIE_RST_1_N
6 - PCIE_RST_2_N
7 - PCIE_RST_3_N
8 - GPIO_15
9 - GPIO_11
10 - GPIO_14
11 - GPIO_0
12 - GPIO_12
13 - GPIO_10
14 - PB_LSTX
15 - PB_LSRX
BOM_COST_GROUP=TBT
SYNC_MASTER=T29_RR
SYNC_DATE=01/19/2013
PAGE TITLE
Thunderbolt Host (1 of 2)
Apple Inc.
DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 28 OF 120
SHEET 25 OF 82
NOTICE OF PROPRIETARY PROPERTY:
THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC.
THE POSESSOR AGREES TO THE FOLLOWING:
I TO MAINTAIN THIS DOCUMENT IN CONFIDENCE
II NOT TO REPRODUCE OR COPY IT
III NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART
IV ALL RIGHTS RESERVED



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0801	8	CAP,CER,10UF,20%,6.3V,HRZTL,0402		CRITICAL	

C2920,C2921,C2922,C2923,C2950,C2951,C2952,C2953

EDP current / power consumption figures copied from R68 schematic (Rev 2, dated October 28, 2012, not available on IBL).

BOM_COST_GROUP=TBT

SYNC MASTER=T29_RR SYNC DATE=12/17/2012

PAGE TITLE: Thunderbolt Host (2 of 2)

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 29 OF 120

SHEET: 26 OF 82

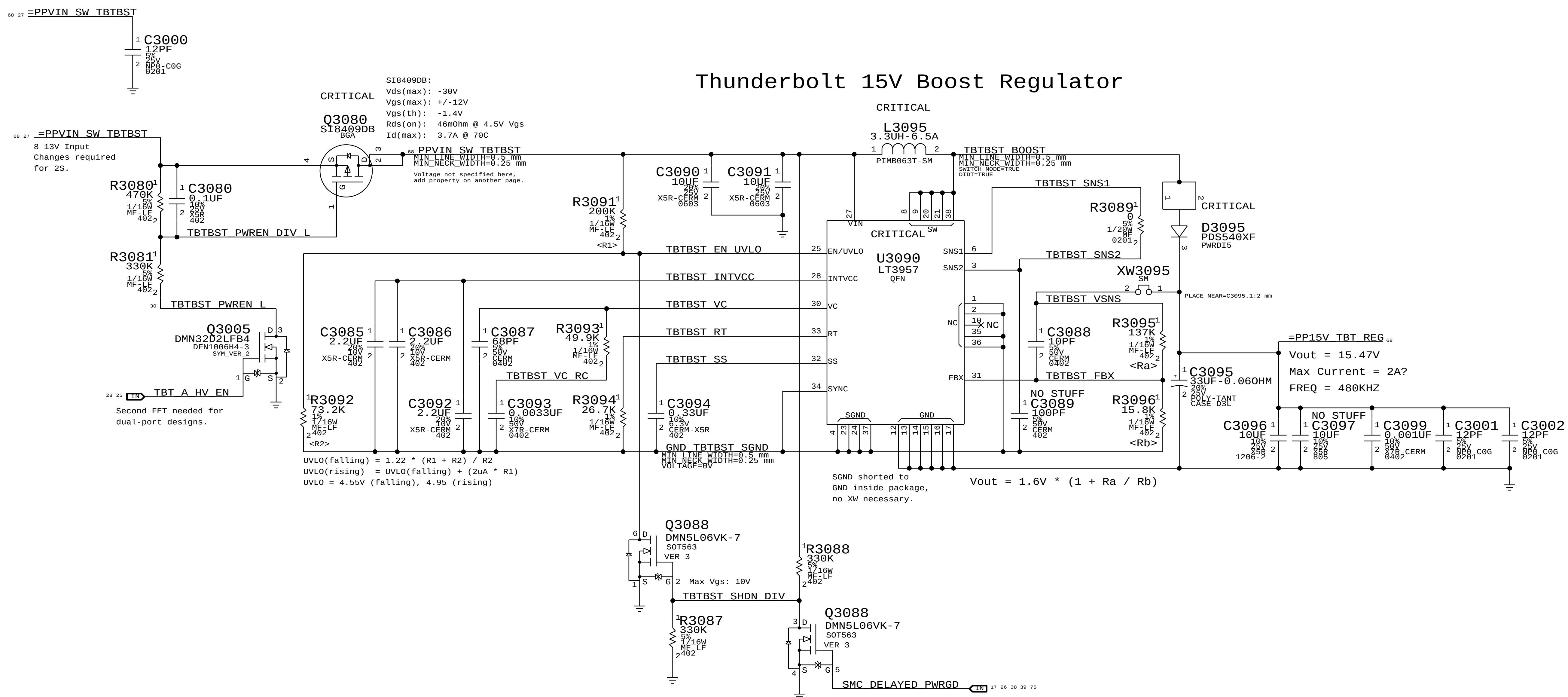
Page Notes

Power aliases required by this page:
- =PPVIN_SW_TBTBST (8-13V Boost Input)
- =PP15V_TBT_REG (15V Boost Output)

Signal aliases required by this page:
(NONE)

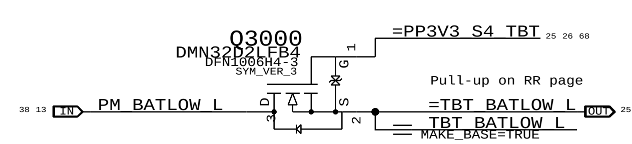
BOM options provided by this page:
(NONE)

Thunderbolt 15V Boost Regulator



=PPVIN_SW_TBTBST
C3000 12PF 5% 25V NP0-C0G 0201
CRITICAL
Q3080 SI8409DB BGA
SI8409DB:
Vds(max): -30V
Vgs(max): +/-12V
Vgs(th): -1.4V
Rds(on): 46mOhm @ 4.5V Vgs
Id(max): 3.7A @ 70C
8-13V Input
Changes required
for 2S.
PPVIN_SW_TBTBST
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
Voltage not specified here,
add property on another page.
R3080 470K 5% 1/16W MF-LF 402
C3080 0.1UF 10% 25V X5R 402
TBTBST_PWREN_DIV_L
R3081 330K 5% 1/16W MF-LF 402
TBTBST_PWREN_L
Q3005 DMN32D2LFB4 DFN1006H4-3 SYM_VER_2
TBT_A_HV_EN
Second FET needed for
dual-port designs.
CRITICAL
L3095 3.3UH-6.5A PIMB063T-SM
TBTBST_BOOST
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
SWITCH_NODE=TRUE
DIDT=TRUE
C3090 10UF 20% 25V X5R-CERM 0603
C3091 10UF 20% 25V X5R-CERM 0603
R3091 200K 1% 1/16W MF-LF 402 <R1>
TBTBST_EN_UVLO
TBTBST_INTVCC
TBTBST_VC
TBTBST_RT
TBTBST_SS
TBTBST_VC_RC
CRITICAL
U3090 LT3957 QFN
VIN SW EN/UVLO INTVCC VC RT SS SYNC SNS1 SNS2 FBX NC SGND GND
TBTBST_SNS1
TBTBST_SNS2
TBTBST_VSNS
TBTBST_FBX
R3089 0 5% 1/20W MF 0201
CRITICAL
D3095 PDS540XF PWRDI5
XW3095 SM
PLACE_NEAR=C3095.1:2 mm
C3085 2.2UF 20% 10V X5R-CERM 402
C3086 2.2UF 20% 10V X5R-CERM 402
C3087 68PF 5% 50V CERM 0402
R3093 49.9K 1% 1/16W MF-LF 402
R3092 73.2K 1% 1/16W MF-LF 402 <R2>
C3092 2.2UF 20% 10V X5R-CERM 402
C3093 0.0033UF 10% 50V X7R-CERM 0402
R3094 26.7K 1% 1/16W MF-LF 402
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
UVLO(falling) = 1.22 * (R1 + R2) / R2
UVLO(rising) = UVLO(falling) + (2uA * R1)
UVLO = 4.55V (falling), 4.95 (rising)
SGND shorted to
GND inside package,
no XW necessary.
C3088 10PF 5% 50V CERM 0402
NO STUFF
C3089 100PF 5% 50V CERM 402
R3095 137K 1% 1/16W MF-LF 402 <Ra>
R3096 15.8K 1% 1/16W MF-LF 402 <Rb>
C3095 33UF-0.060OHM 20% 25V POLY-TANT CASE-D3L
Vout = 1.6V * (1 + Ra / Rb)
=PP15V_TBT_REG
Vout = 15.47V
Max Current = 2A?
FREQ = 480KHZ
C3096 10UF 10% 25V X5R 1206-2
NO STUFF
C3097 10UF 10% 25V X5R 805
C3099 0.001UF 10% 50V X7R-CERM 0402
C3001 12PF 5% 25V NP0-C0G 0201
C3002 12PF 5% 25V NP0-C0G 0201
Q3088 DMN5L06VK-7 SOT563 VER 3
Max Vgs: 10V
R3088 330K 5% 1/16W MF-LF 402
TBTBST_SHDN_DIV
R3087 330K 5% 1/16W MF-LF 402
Q3088 DMN5L06VK-7 SOT563 VER 3
SMC_DELAYED_PWRGD

BATLOW# Isolation



BOM_COST_GROUP=TBT

SYNC_MASTER=T29_RR SYNC_DATE=11/19/2012

PAGE TITLE: Thunderbolt Mobile Support

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

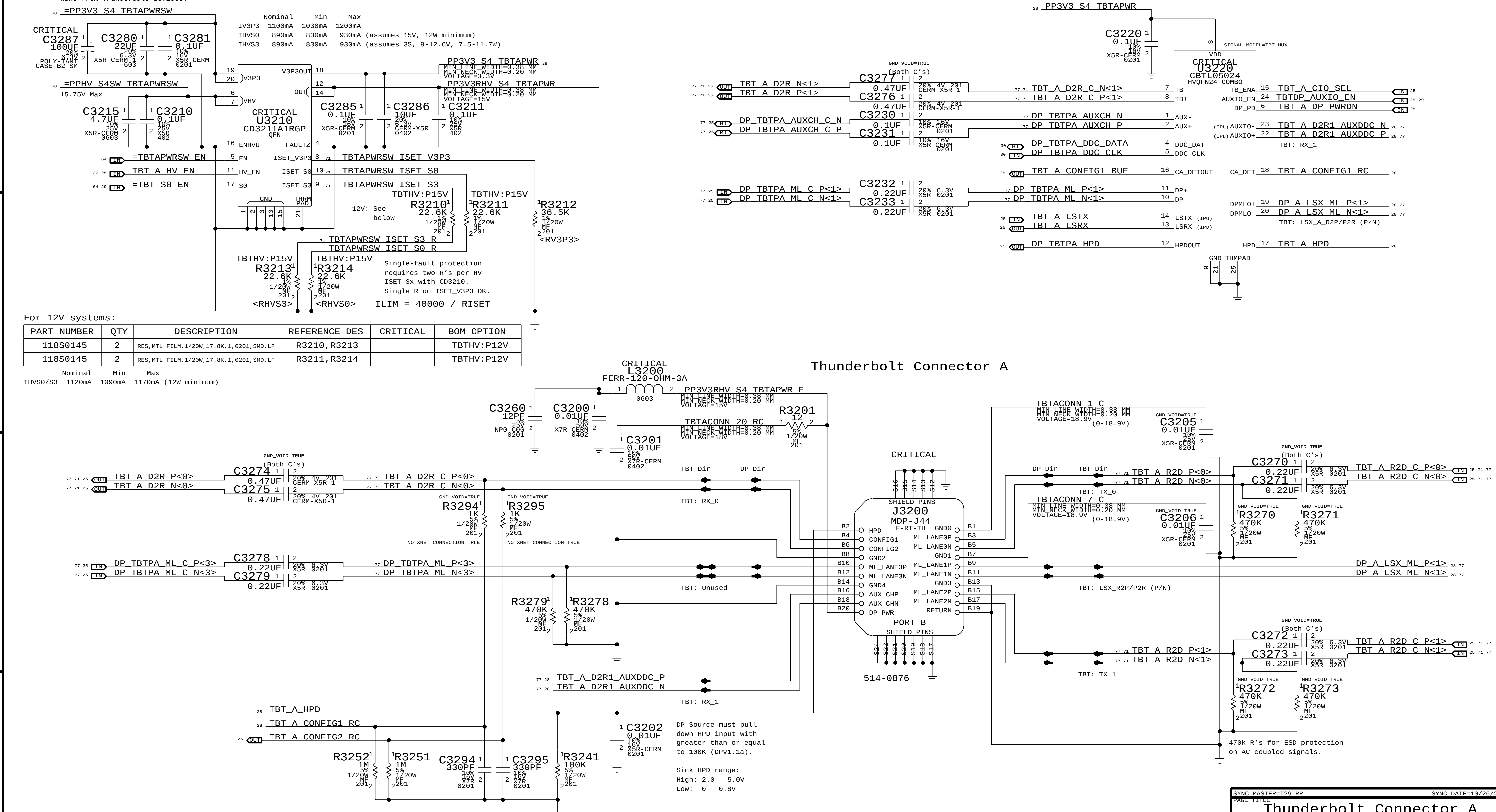
PAGE: 30 OF 120

SHEET: 27 OF 82

3.3V/HV Power MUX

V3P3 must be S4 to support
wake from Thunderbolt devices.

	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)



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)

SYNC_MASTER=T29_RR SYNC_DATE=10/26/2012

PAGE TITLE: Thunderbolt Connector A

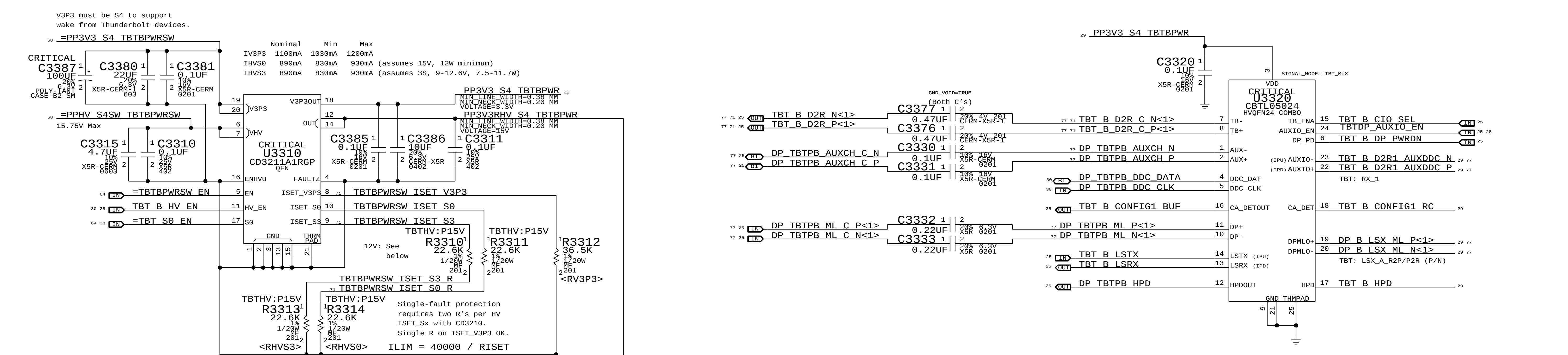
Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

3.3V/HV Power MUX

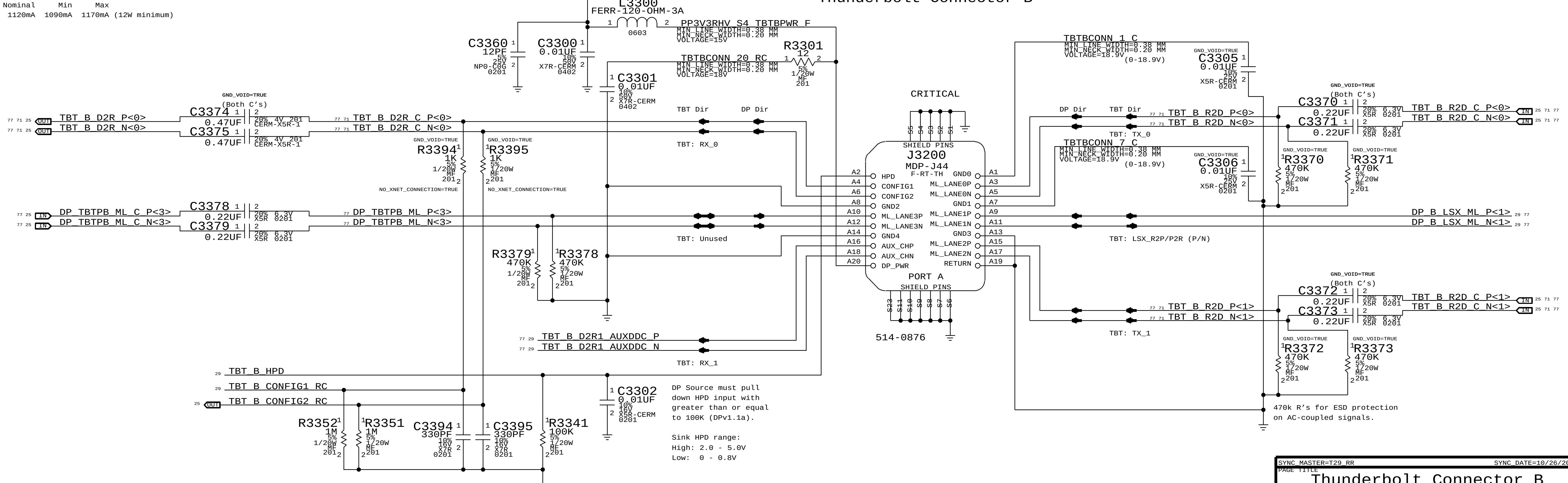


For 12V systems:

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R3310,R3313		TBTHV:P12V
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R3311,R3314		TBTHV:P12V

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

Thunderbolt Connector B



SYNC_MASTER=T29_RR SYNC_DATE=10/26/2012

PAGE TITLE: Thunderbolt Connector B

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

BOM_COST_GROUP=TBT

DDC Pull-Ups

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

DP++ spec violation, should remove!

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

DDC Crossbar

Only necessary on dual-port hosts.
On single-port hosts alias TBTPA_DDC to TBTSNK0_DDC.
NEVER SEND AUXCH THROUGH CROSSBAR!

68 =PP3V3_S0_DDCMUX

R3451 2.2K 1% 1/20W MF 201
R3452 2.2K 1% 1/20W MF 201
R3453 2.2K 1% 1/20W MF 201
R3454 2.2K 1% 1/20W MF 201

R3485 100K 5% 1/20W MF 201

C3480 0.1UF 20% 10V CERM 402

U3400
TS3DS10224
QFN
CRITICAL

		VCC	13
		ENA	16
28 OUT	DP_TBTPA_DDC_CLK	INA+	1
28 BI	DP_TBTPA_DDC_DATA	INA-	2
		SAI	14
		ENB	10
29 OUT	DP_TBTPB_DDC_CLK	INB+	3
29 BI	DP_TBTPB_DDC_DATA	INB-	4
	TBT_DDC_XBAR_EN	SBI	12
		GND	5
		THRM PAD	21
		OUTA1+	20
		OUTA1-	19
		OUTA0+	18
		OUTA0-	17
		SAO	15
		OUTB1+	6
		OUTB1-	7
		OUTB0+	8
		OUTB0-	9
		SBO	11

DP_TBTSNK1_DDC_CLK IN 67
DP_TBTSNK1_DDC_DATA BI 67

DP_TBTSNK0_DDC_CLK IN 13
DP_TBTSNK0_DDC_DATA BI 13

Q3485
DMN5L06VK-7
SOT563
VER 3

D	3	
G	5	
S	4	

25 IN TBT_DDC_XBAR_EN_L

SAI/SBI = 1: INA == OUTA0, INB == OUTB0
SAI/SBI = 0: INA == OUTB0, INB == OUTA0

Second FET needed for
dual-port designs.
CONNECTS TO TBTBTS_PWREN_L ON PAGE 30.

Q3485
DMN5L06VK-7
SOT563
VER 3

D	6	
G	2	
S	1	

TBTBST_PWREN_L OUT 27

29 25 IN TBT_B_HV_EN

BOM_COST_GROUP=TBT

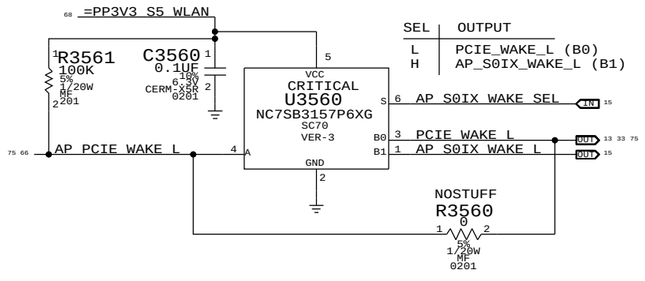
SYNC_MASTER=J14 SYNC_DATE=10/23/2012

PAGE TITLE: DDC Crossbar

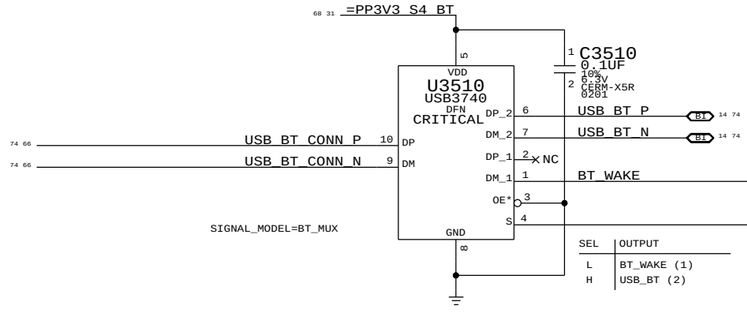
Apple Inc.

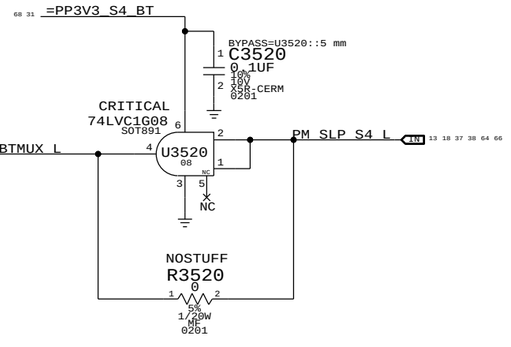
DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 34 OF 120
SHEET: 30 OF 82

PCIe Wake Muxing



BLUETOOTH





SYNC_MASTER=J41 SYNC_DATE=11/01/2012

PAGE TITLE: Wireless Support

Apple Inc.

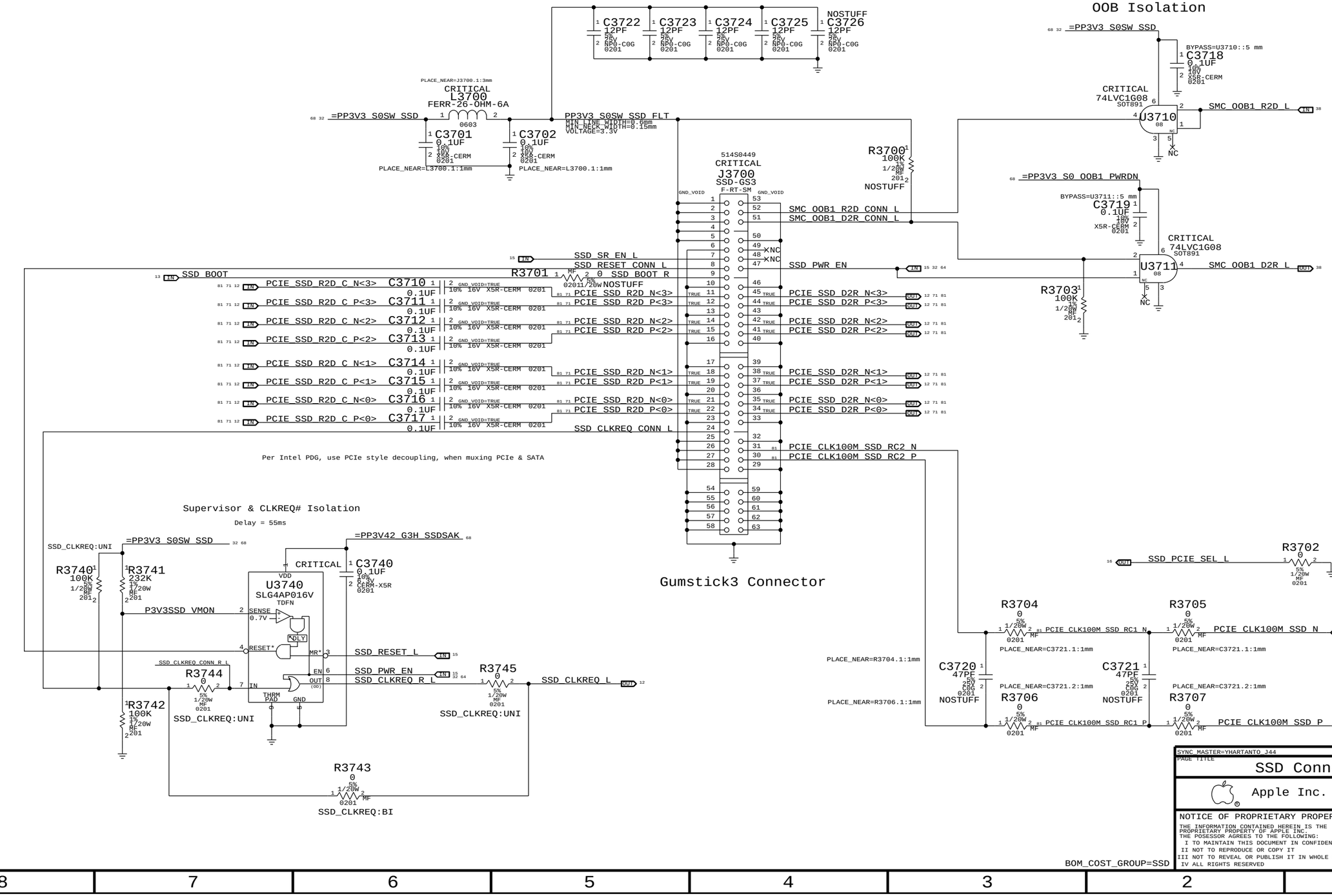
DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

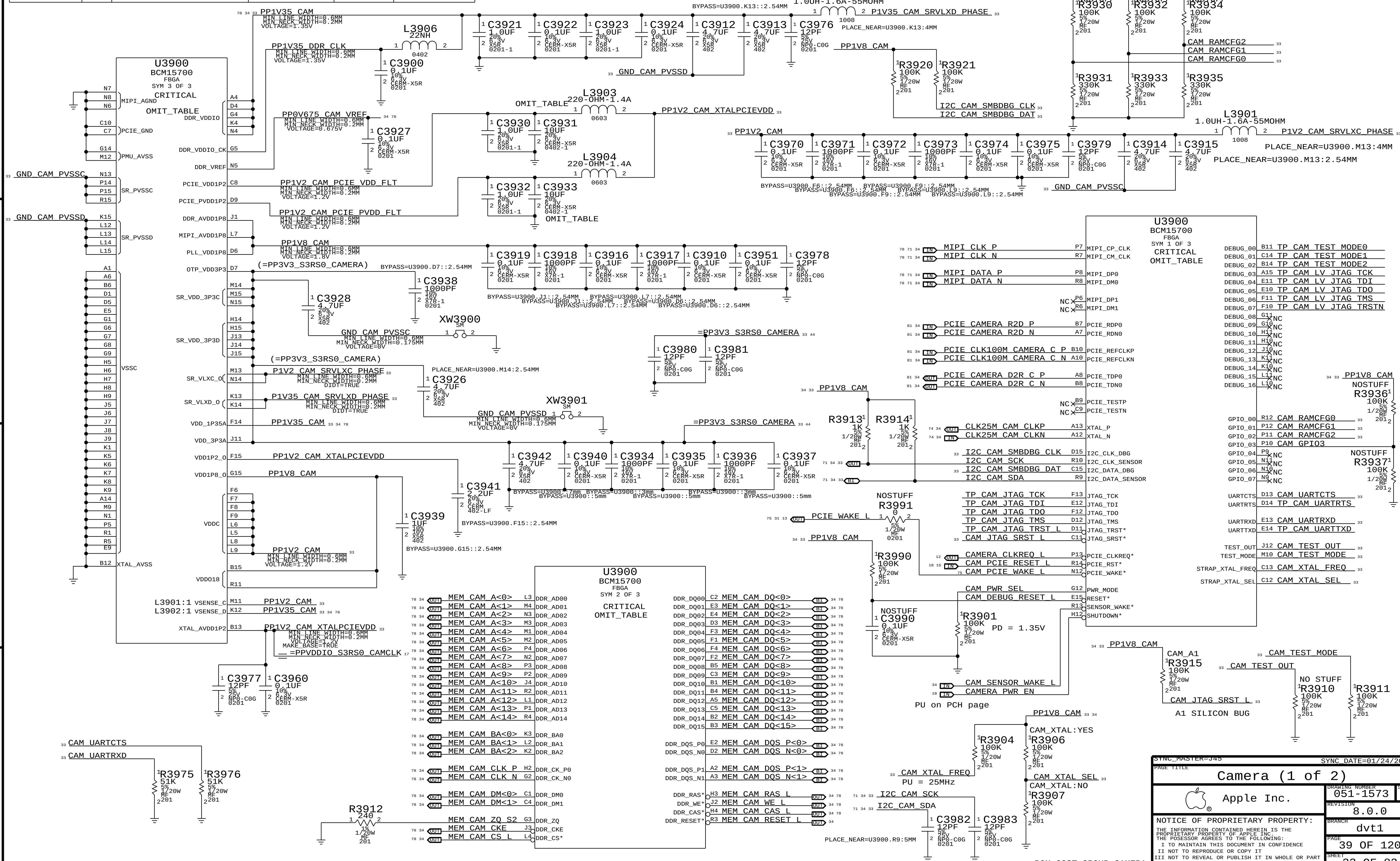
BRANCH: dvt1

PAGE: 35 OF 120

SHEET: 31 OF 82


C3722 12PF 5% 50V NPO-C0G 0201
C3723 12PF 5% 50V NPO-C0G 0201
C3724 12PF 5% 50V NPO-C0G 0201
C3725 12PF 5% 50V NPO-C0G 0201
NOSTUFF C3726 12PF 5% 50V NPO-C0G 0201
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
GND_VOID
R3700 100K 1% 1/20W MF 0201
NOSTUFF
SSD_SR_EN_L
SSD_RESET_CONN_L
SSD_BOOT
R3701 0 5% 1/20W MF 0201 NOSTUFF
SSD_BOOT_R
PCIE_SSD_R2D_C_N<3> C3710 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_P<3> C3711 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_N<2> C3712 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_P<2> C3713 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_N<1> C3714 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_P<1> C3715 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_N<0> C3716 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_C_P<0> C3717 0.1UF 10% 16V X5R-CERM 0201
PCIE_SSD_R2D_N<3>
PCIE_SSD_R2D_P<3>
PCIE_SSD_R2D_N<2>
PCIE_SSD_R2D_P<2>
PCIE_SSD_R2D_N<1>
PCIE_SSD_R2D_P<1>
PCIE_SSD_R2D_N<0>
PCIE_SSD_R2D_P<0>
SSD_CLKREQ_CONN_L
Per Intel PDG, use PCIe style decoupling, when muxing PCIe & SATA
SMC_OOB1_R2D_CONN_L
SMC_OOB1_D2R_CONN_L
NC
SSD_PWR_EN
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_RC2_N
PCIE_CLK100M_SSD_RC2_P
Gumstick3 Connector
OOB Isolation
=PP3V3_S0SW_SSD
BYPASS=U3710::5 mm
C3718 0.1UF 10% 10V X5R-CERM 0201
CRITICAL
74LVC1G08
SOT891
U3710
SMC_OOB1_R2D_L
=PP3V3_S0_OOB1_PWRDN
BYPASS=U3711::5 mm
C3719 0.1UF 10% 10V X5R-CERM 0201
U3711
SMC_OOB1_D2R_L
R3703 100K 1% 1/20W MF 0201
Supervisor & CLKREQ# Isolation
Delay = 55ms
SSD_CLKREQ:UNI
=PP3V3_S0SW_SSD
=PP3V42_G3H_SSDSAK
R3740 100K 5% 1/20W MF 0201
R3741 232K 1% 1/20W MF 0201
R3742 100K 1% 1/20W MF 0201
CRITICAL
C3740 0.1UF 10% 6.3V CERM-X5R 0201
U3740
SLG4AP016V
TDFN
VDD
SENSE
0.7V
DLY
RESET*
MR*
EN
OUT
(OD)
IN
THRM PAD
GND
P3V3SSD_VMON
SSD_CLKREQ_CONN_R_L
R3744 0 5% 1/20W MF 0201
SSD_RESET_L
SSD_PWR_EN
SSD_CLKREQ_R_L
R3745 0 5% 1/20W MF 0201
SSD_CLKREQ_L
SSD_CLKREQ:UNI
R3743 0 5% 1/20W MF 0201
SSD_CLKREQ:BI
SSD_PCIE_SEL_L
R3702 0 5% 1/20W MF 0201
R3704 0 5% 1/20W MF 0201
R3705 0 5% 1/20W MF 0201
PCIE_CLK100M_SSD_RC1_N
PCIE_CLK100M_SSD_N
PLACE_NEAR=R3704.1:1mm
PLACE_NEAR=R3706.1:1mm
C3720 47PF 5% 25V C0G 0201 NOSTUFF
C3721 47PF 5% 25V C0G 0201 NOSTUFF
PLACE_NEAR=C3721.1:1mm
PLACE_NEAR=C3721.2:1mm
R3706 0 5% 1/20W MF 0201
R3707 0 5% 1/20W MF 0201
PCIE_CLK100M_SSD_RC1_P
PCIE_CLK100M_SSD_P
SYNC_MASTER=YHARTANTO_J44
SYNC_DATE=12/18/2012
PAGE TITLE
SSD Connector
Apple Inc.
DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 37 OF 120
SHEET 32 OF 82
NOTICE OF PROPRIETARY PROPERTY:
THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC.
THE POSESSOR AGREES TO THE FOLLOWING:
I TO MAINTAIN THIS DOCUMENT IN CONFIDENCE
II NOT TO REPRODUCE OR COPY IT
III NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART
IV ALL RIGHTS RESERVED
BOM_COST_GROUP=SSD

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0801	2	CAP,CER,10UF,20%,6.3V,HRZTL,0402	C3931,C3933	CRITICAL	



SYNC_MASTER=J45 SYNC_DATE=01/24/2013

PAGE TITLE

Camera (1 of 2)

Apple Inc.

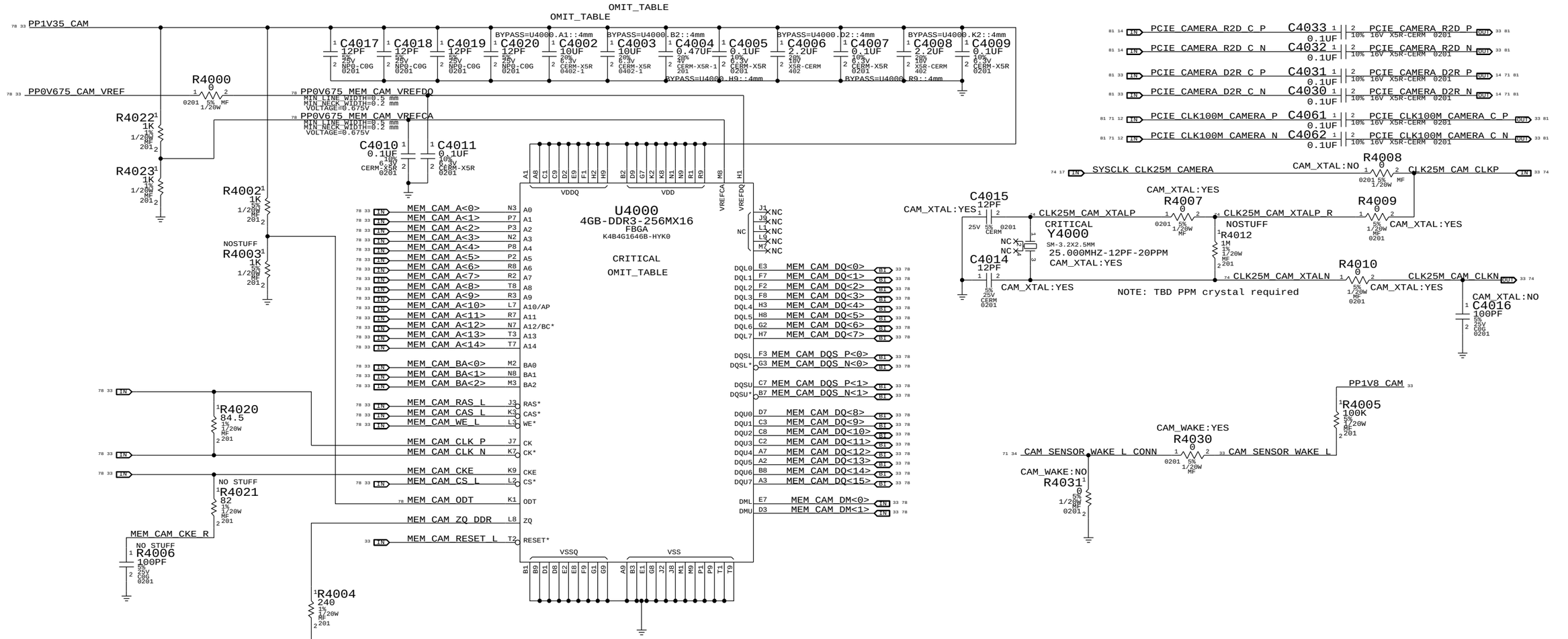
DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 39 OF 120

SHEET 33 OF 82



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
138S0801	2	CAP,CER,10UF,20%,6.3V,HRZTL,0402	C4002,C4003	CRITICAL	

BOM_COST_GROUP=CAMERA

SYNC_MASTER=J41 SYNC_DATE=12/21/2012

PAGE TITLE: Camera (2 of 2)

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

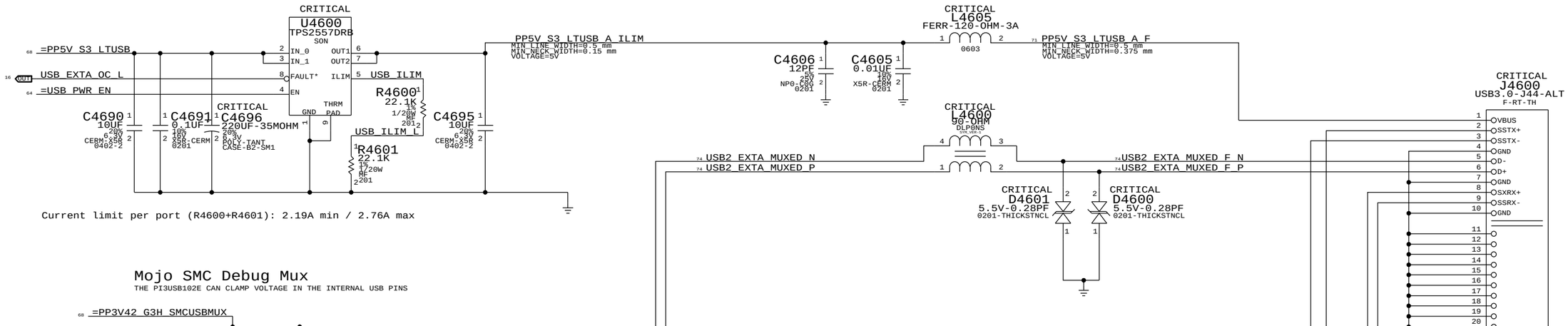
BRANCH: dvt1

PAGE: 40 OF 120

SHEET: 34 OF 82

RIGHT USB PORT A

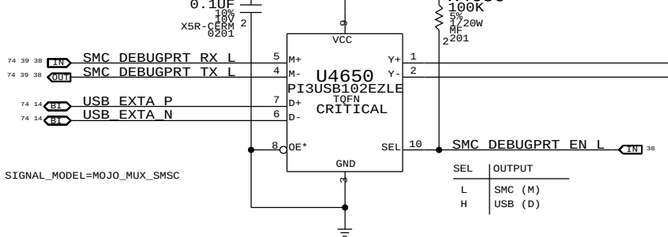
USB Port Power Switch



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

Mojo SMC Debug Mux

THE PI3USB102E CAN CLAMP VOLTAGE IN THE INTERNAL USB PINS



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

BOM_COST_GROUP=IO PORTS

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE: External A USB3 Connector

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 46 OF 120

SHEET: 35 OF 82

IPD Interface

L4803
FERR-120-OHM-1.5A
0402-LF
PLACE_NEAR=J4802:3MM

PP5V_S4_TPAD_F
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=5V

=PP5V_S4_TPAD

C4803 0.1UF 10% 20V CERM 402
PLACE_NEAR=J4802:3MM

CRITICAL
F4800
2.5A-16V-0.1OHM
1812

=PPVIN_S4_TPAD
PPVIN_S4_TPAD_FUSE
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=8.6V

PLACE_NEAR=J4802.1:8MM

C4862 0.1UF 10% 20V CERM 402

GND_ACTUATOR

J4802
DF40BG-48DP-0.4V
M-ST-SM

		GND_ACTUATOR	
TPAD_ACTUATOR_EN_L (OUT)		TPAD_VBUS_EN (IN)	
=I2C_TPAD_SDA (IN)		TPAD_ACTUATOR_THRMTRIP_L (OUT)	
=I2C_TPAD_SCL (IN)		=TPAD_WAKE_L (OUT)	
PP5V_S4_TPAD_F		SMC_LID (IN)	
=PP3V3_S4_TPAD			
USB_TPAD_P (BI)		TPAD_SPI_INT_L (OUT)	
USB_TPAD_N (BI)		=TPAD_SPI_BUS_EN (IN)	
I2C_IOXP_SCL (OUT)		=TPAD_SPI_SCLK (IN)	
IOXP2_INT_L (OUT)		=TPAD_SPI_MISO (OUT)	
I2C_IOXP_SDA (BI)		=TPAD_SPI_CS_L (IN)	
		=TPAD_SPI_MOSI (IN)	

MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=0V

XW4801
SM
PLACE_NEAR=J4802:3MM

CRITICAL
516S1037

=PP3V3_S4_TPAD
PP5V_S4_TPAD_F

C4864 12PF 5% 25V C0G-CSG 0201
C4863 12PF 5% 25V C0G-CSG 0201

NOTE: Mates with 516S1035 on IPD Flex

Keyboard Connector

518S0752
CRITICAL
J4813

=PP3V3_S4_TPAD
=PP3V42_G3H_TPAD

WS_KBD1	WS_KBD15_CAP
WS_KBD2	WS_KBD16_NUM
WS_KBD3	WS_KBD17
WS_KBD4	WS_KBD18
WS_KBD5	WS_KBD19
WS_KBD6	WS_KBD20
WS_KBD7	WS_KBD21
WS_KBD8	WS_KBD22
WS_KBD9	WS_KBD23
WS_KBD10	WS_KBD_ONOFF_L
WS_KBD11	
WS_KBD12	WS_LEFT_SHIFT_KBD
WS_KBD13	WS_LEFT_OPTION_KBD
WS_KBD14	WS_CONTROL_KBD

TBT
R4814 113 1% 1/16W MF-LF 402
WS_KBD15_C

R4815 0 5% 1/16W MF-LF 402
WS_KBD16N

R4810 1K 5% 1/16W MF-LF 402
SMC_ONOFF_L (OUT)

C4810 0.1UF 10% 10V CERM 402
PLACE_NEAR=J4813.5:5MM

F-RT-SM
FF14A-30C-R11DL-B-3H

SMC Manual Reset & Isolation

Left shift, option & control keys combined with power button cause SMC RESET# assertion.
Keys ANDed with PSoC power to isolate when PSoC is not powered.
No IPD on OE input pin PP3V3_S4 (symbol error).

=PP3V42_G3H_TPAD

C4850 0.1UF 10% 10V X7R-CERM 0402
BYPASS=U4850.10:5:5 mm

10
VDD

U4850
SLG4AP4103
TQFN

=PP3V3_S4_TPAD	4 OE (IPD)		
WS_LEFT_SHIFT_KBD	1 IN_1 (IPD)	OUT_1 9	WS_LEFT_SHIFT_KEY
WS_LEFT_OPTION_KBD	2 IN_2 (IPD)	OUT_2 8	WS_LEFT_OPTION_KEY
WS_CONTROL_KBD	3 IN_3 (IPD)	OUT_3 7	WS_CONTROL_KEY
		OUT_ALL# 6	SMC_TPAD_RST_L (OUT)

Pull-up in U5110.
GND 5
THRM PAD 11

IO Expander / Keyboard Interface

=PP3V3_S4_TPAD
BYPASS=U4830.B4:E2:5MM
BYPASS=U4830.B3:E2:2MM
BYPASS=U4830.B4:E2:2MM
=PP3V3_S4_TPAD

R4831 10K 5% 1/20W MF 201
R4830 100K 5% 1/20W MF 201
C4830 1UF 10% 6.3V CERM 402
C4831 0.1UF 10% 6.3V CERM-X5R 0201
C4832 0.1UF 10% 6.3V CERM-X5R 0201

U4830
PCAL6416A
VFBGA

IOXP2_INT_L	A3 INT*	P0_0 A1	WS_KBD5
	B5 ADDR	P0_1 C3	WS_KBD6
I2C_IOXP_SCL	A5 SCL	P0_2 B1	WS_KBD7
I2C_IOXP_SDA	A4 SDA	P0_3 C1	WS_KBD9
IOXP2_RESET_L	A2 RESET*	P0_4 C2	WS_KBD12
		P0_5 D1	WS_KBD8
		P0_6 E1	WS_KBD17
		P0_7 D2	WS_KBD18
		P1_0 E3	WS_KBD19
		P1_1 E4	WS_KBD10
		P1_2 D3	WS_KBD14
		P1_3 E5	WS_KBD13
		P1_4 D4	WS_KBD11
		P1_5 D5	WS_CONTROL_KEY
		P1_6 C5	WS_LEFT_OPTION_KEY
		P1_7 C4	WS_LEFT_SHIFT_KEY

R4850 10K 5% 1/20W MF 201
R4851 10K 5% 1/20W MF 201
R4852 10K 5% 1/20W MF 201
R4853 10K 5% 1/20W MF 201
R4854 10K 5% 1/20W MF 201
R4855 10K 5% 1/20W MF 201
R4856 10K 5% 1/20W MF 201
R4857 10K 5% 1/20W MF 201

=PP3V3_S4_TPAD
R4858 10K 5% 1/20W MF 201
R4859 10K 5% 1/20W MF 201
R4860 10K 5% 1/20W MF 201
R4861 10K 5% 1/20W MF 201
R4862 10K 5% 1/20W MF 201

NOSTUFF
C4834 0.01UF 10% 10V X5R-CERM 0201

GND
E2
311S0597
(Write: 0x42 Read: 0x43)

=PP3V3_S4_TPAD
BYPASS=U4820.B4:E2:5MM
BYPASS=U4820.B3:E2:2MM
BYPASS=U4820.B4:E2:2MM

R4821 2.0K 5% 1/20W MF 201
R4822 2.0K 5% 1/20W MF 201
R4823 2.0K 5% 1/20W MF 201
R4820 100K 5% 1/20W MF 201
C4820 1UF 10% 6.3V CERM 402
C4821 0.1UF 10% 6.3V X5R 0201
C4822 0.1UF 10% 6.3V X5R 0201

U4820
PCAL6416A
VFBGA

IOXP1_INT_L	A3 INT*	P0_0 A1	WS_KBD23
	B5 ADDR	P0_1 C3	WS_KBD2
I2C_IOXP_SCL	A5 SCL	P0_2 B1	WS_KBD1
I2C_IOXP_SDA	A4 SDA	P0_3 C1	WS_KBD3
IOXP1_RESET_L	A2 RESET*	P0_4 C2	WS_KBD4
		P0_5 D1	WS_KBD20
		P0_6 E1	WS_KBD22
		P0_7 D2	WS_KBD21
		P1_0 E3	TP_IOXP1_0
		P1_1 E4	TP_IOXP1_1
		P1_2 D3	TP_IOXP1_2
		P1_3 E5	TP_IOXP1_3
		P1_4 D4	TP_IOXP1_4
		P1_5 D5	TP_IOXP1_DEBUG
		P1_6 C5	WS_KBD16N
		P1_7 C4	IOXP1_LED_DRV

NOSTUFF
C4824 0.01UF 10% 10V X5R-CERM 0201

GND
E2
311S0597
(Write: 0x40 Read: 0x41)

WS_KBD15_C

Q4840
DMN32D2LFB4
DFN1006H4-3
SYM_VER_2

R4840 100K 1% 1/10W MF-LF 402

BOM_COST_GROUP=TRACKPAD

SYNC_MASTER=JACK_J52 SYNC_DATE=01/28/2014

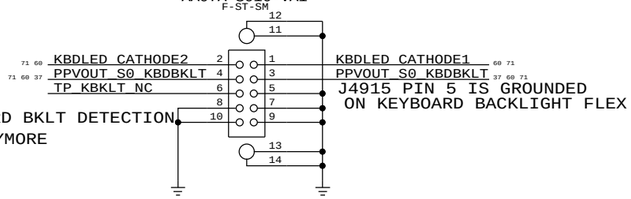
PAGE TITLE
Keyboard & Trackpad (1 of 2)

Apple Inc.

DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 48 OF 120
SHEET 36 OF 82

Keyboard Backlight Connector

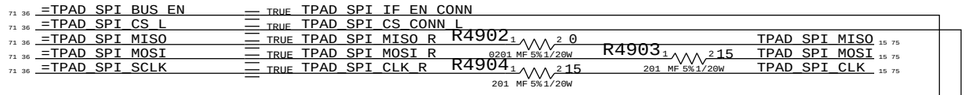
516S0899
CRITICAL
J4915
AA07A-S010-VA1
F-ST-SM

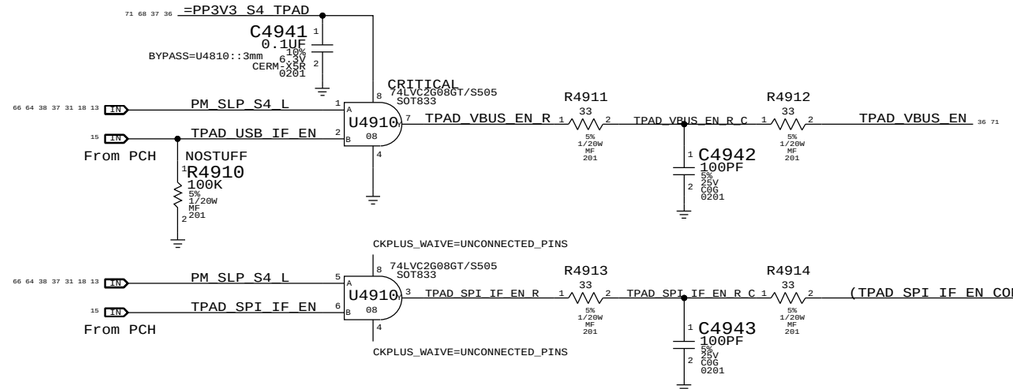


PIN 6 WAS USED KEYBOARD BKLT DETECTION
NOT USED ANYMORE

J4915 PIN 5 IS GROUNDED
ON KEYBOARD BACKLIGHT FLEX

TPAD SPI WITH SRC TERMINATION





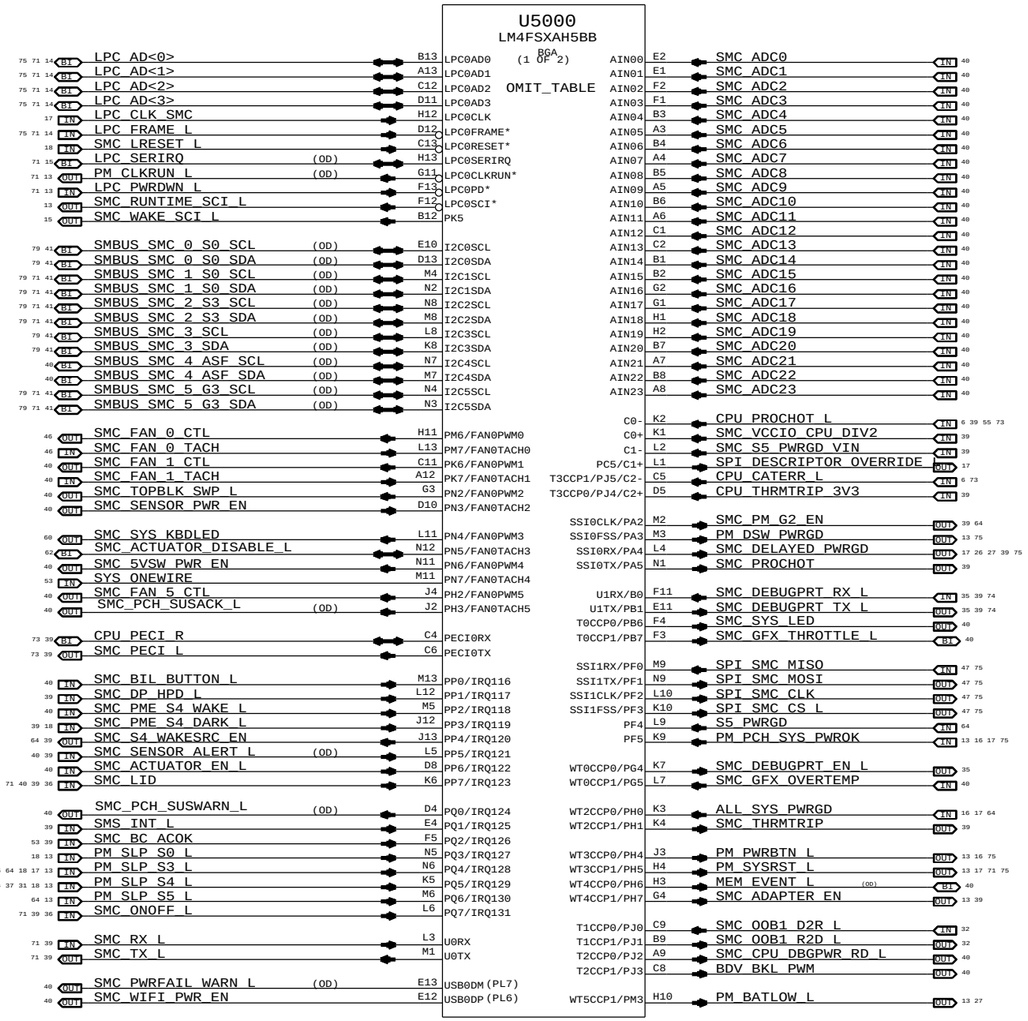
BOM_COST_GROUP=TRACKPAD

SYNC MASTER=JACK J58 SYNC DATE=01/31/2014

PAGE TITLE
Keyboard & Trackpad (2 of 2)

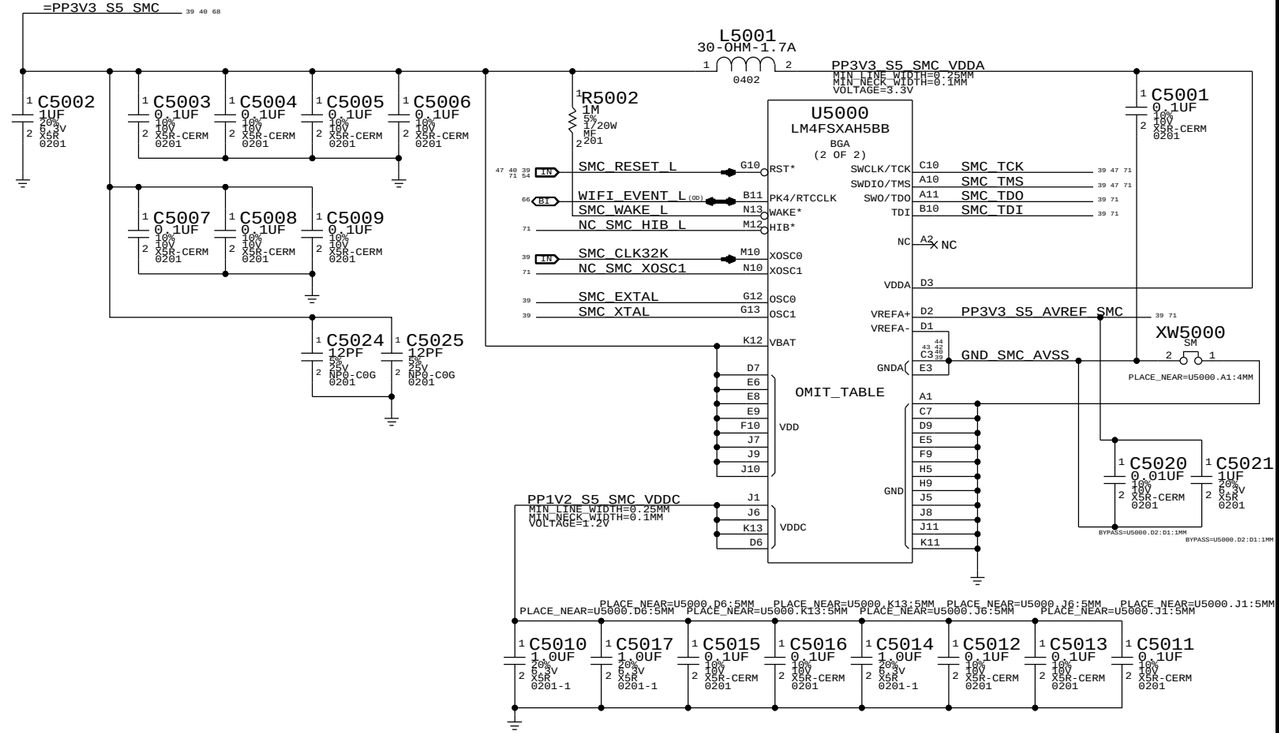
Apple Inc.

DRAWING NUMBER 051-1573
SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 49 OF 120
SHEET 37 OF 82



NOTE:
SMS INTERRUPT IS NOT USED, PULL UP TO SMC RAIL.

NOTE:
Unused pins have "SMC_Pxx" names. Unused pins designed as outputs can be left floating, those designated as inputs require pull-ups.



BOM_COST_GROUP=SMC

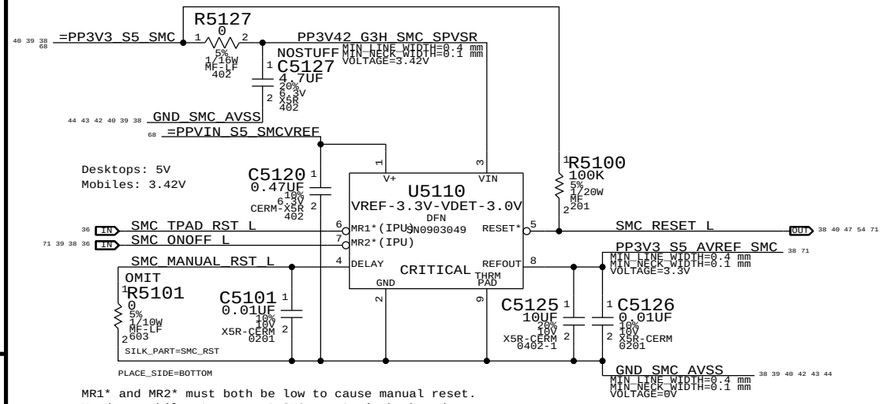
SYNC_MASTER=JACK_J52 SYNC_DATE=11/07/2013

PAGE TITLE: SMC

Apple Inc.

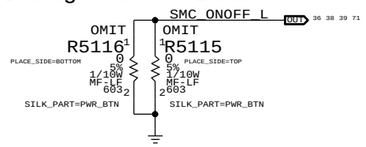
DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 50 OF 120
SHEET: 38 OF 82

SMC Reset "Button", Supervisor & AVREF Supply



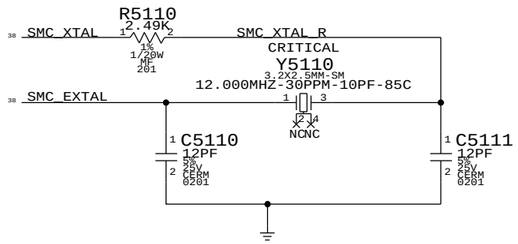
MR1* and MR2* must both be low to cause manual reset.
Used on mobiles to support SMC reset via keyboard.
NOTE: Internal pull-ups are to VIN, not V+.

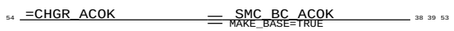
Debug Power "Buttons"

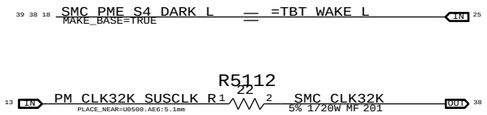


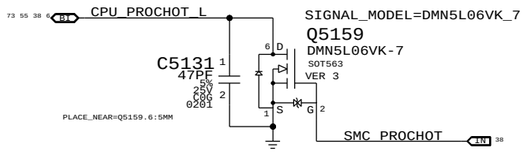
SMC Crystal Circuit

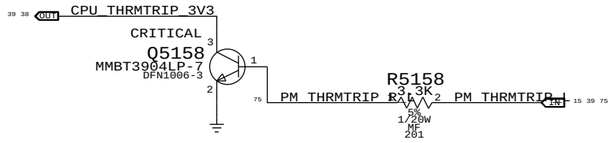
SMC USB Clock require these crystal
values:5,6,8,10,12,16,18,20,24,25 MHz



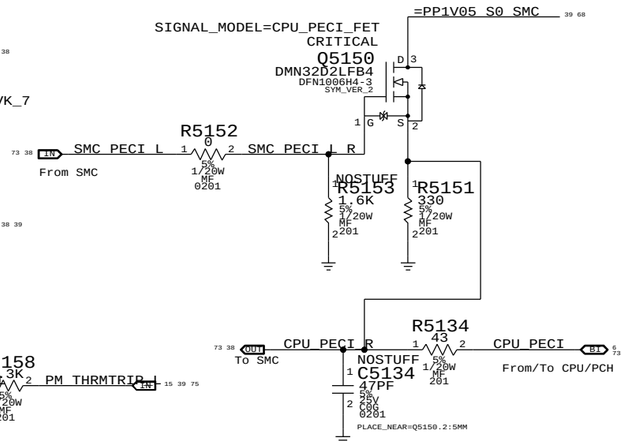


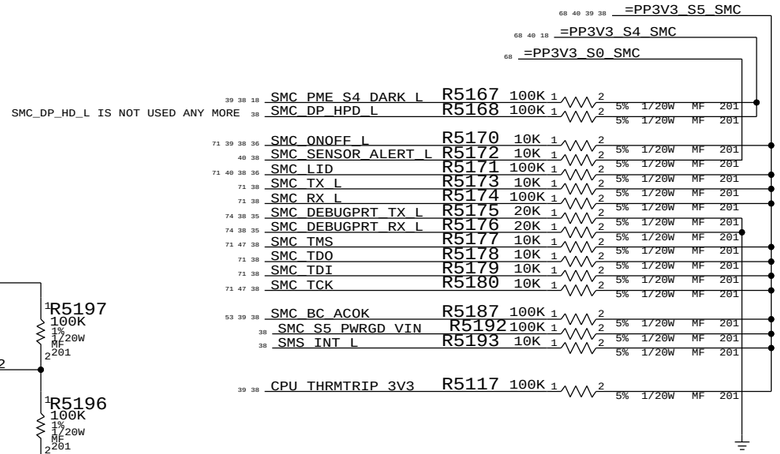






SMC12 PECI Support





BOM_COST_GROUP=SMC

SYNC MASTER=JACK J52 SYNC DATE=10/24/2013

PAGE TITLE: SMC Shared Support

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 51 OF 120
SHEET: 39 OF 82

SMC12 ADC Assignments

SMC_ADC0	SMC_CPU_HI_ISENSE	MAKE_BASE=TRUE
SMC_ADC1	SMC_PBUS_VSENSE	MAKE_BASE=TRUE
SMC_ADC2	SMC_BMON_ISENSE	MAKE_BASE=TRUE
SMC_ADC3	SMC_DCIN_ISENSE	MAKE_BASE=TRUE
SMC_ADC4	SMC_DCIN_VSENSE	MAKE_BASE=TRUE
SMC_ADC5	SMC_BMON_DISCRETE_ISENSE	MAKE_BASE=TRUE
SMC_ADC6	SMC_CPU_ISENSE	MAKE_BASE=TRUE
SMC_ADC7	SMC_OTHER5V_HI_ISENSE	MAKE_BASE=TRUE
SMC_ADC8	SMC_OTHER3V3_HI_ISENSE	MAKE_BASE=TRUE
SMC_ADC9	SMC_DDR_ISENSE	MAKE_BASE=TRUE
SMC_ADC10	SMC_LCDBKLT_ISENSE	MAKE_BASE=TRUE
SMC_ADC11	SMC_TPAD_ISENSE	MAKE_BASE=TRUE
SMC_ADC12	SMC_DDR1V8_ISENSE	MAKE_BASE=TRUE
SMC_ADC13	SMC_SSD_ISENSE	MAKE_BASE=TRUE
SMC_ADC14	SMC_PP3V3S0_ISENSE	MAKE_BASE=TRUE
SMC_ADC15	SMC_CAMERA_ISENSE	MAKE_BASE=TRUE
SMC_ADC16	SMC_TPAD_VSENSE	MAKE_BASE=TRUE
SMC_ADC17	SMC_PP5VS0_ISENSE	MAKE_BASE=TRUE
SMC_ADC18	SMC_CPUDDR_ISENSE	MAKE_BASE=TRUE
SMC_ADC19	SMC_PCH_ISENSE	MAKE_BASE=TRUE
SMC_ADC20	SMC_CPU_VSENSE	MAKE_BASE=TRUE
SMC_ADC21	SMC_LCDPANEL_ISENSE	MAKE_BASE=TRUE
SMC_ADC22	SMC_CPU_IMON_ISENSE	MAKE_BASE=TRUE
SMC_ADC23	SMC_TBT_ISENSE	MAKE_BASE=TRUE

SMC12 Pin Assignments

SMBUS_SMC_4_ASF_SCL	NC_SMBUS_SMC_4_ASF_SCL	MAKE_BASE=TRUE, NO_TEST=TRUE
SMBUS_SMC_4_ASF_SDA	NC_SMBUS_SMC_4_ASF_SDA	MAKE_BASE=TRUE, NO_TEST=TRUE
BDV_BKL_PWM	NC_SMC_TPAD_BOOST_DISABLE_L	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_SYS_LED	NC_SMC_SYS_LED	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_GFX_THROTTLE_L	NC_SMC_GFX_THROTTLE_L	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_GFX_OVERTEMP	NC_SMC_GFX_OVERTEMP	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_FAN_1_CTL	NC_SMC_FAN_1_CTL	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_FAN_1_TACH	NC_SMC_FAN_1_TACH	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_5VSW_PWR_EN	NC_SMC_5VSW_PWR_EN	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_FAN_5_CTL	NC_SMC_FAN_5_CTL	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_BIL_BUTTON_L	NC_SMC_BIL_BUTTON_L	MAKE_BASE=TRUE, NO_TEST=TRUE
MEM_EVENT_L	NC_MEM_EVENT_L	MAKE_BASE=TRUE, NO_TEST=TRUE
SMC_PWRFAIL_WARN_L	NC_SMC_PWRFAIL_WARN_L	MAKE_BASE=TRUE, NO_TEST=TRUE

Thermal Alerts

PCH_SML1ALERT_L — R5215 NOSTUFF 100 5% 1/20W MF 201

SMC_CPUHI_COMP_ALERT_L — R5217 CPUHYS 100 5% 1/20W MF 201

SMC_BMON_COMP_ALERT_L — R5213 BMONHYS 100 5% 1/20W MF 201

CPUTHMSNS_THM_L — R5216 100 5% 1/20W MF 201 — CPUTHRM_THRM:SMC

CPUTHMSNS_ALERT_L — R5214 100 5% 1/20W MF 201 — CPUTHRM_ALRT:SMC

TBTTHMSNS_THM_L — R5220 100 5% 1/20W MF 201 — TBTTHRM_THRM:SMC

TBTTHMSNS_ALERT_L — R5210 100 5% 1/20W MF 201 — TBTTHRM_ALRT:SMC

SMC_SENSOR_ALERT_L

=PP3V3_S5_SMC — R5232 10K 5% 1/20W MF 201 — SMC_CPU_DBGPWR_RD_L — SMC_BOARDID — SMCBOARDID:16

R5233 10K 5% 1/20W MF 201 — SMCBOARDID:8

Hall Effect Pads

APN: 998-00296

OMIT_TABLE

J5250 HALL-EFFECT-MLB-J44 SM

=PP3V42_G3H_HALL — NC — NC — NC — NC — SMC_LID_R — R5250 0 5% 1/10W MF-LF 402 — SMC_LID

C5250 0.001UF 10% 50V X7R-CERM 0402

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
677-01216	1	SUBASSY,PCBA,HALL EFFECT,X304	J5250	CRITICAL	

639-00525 (PCBA,HALL EFFECT,X304) REPORTS TO 677-01216

Specify one of these BOM GROUPs.

BOM GROUP	BOM OPTIONS
CPUTHRM:BOTH	CPUTHRM_THRM:SMC,CPUTHRM_ALRT:SMC
CPUTHRM:THRM	CPUTHRM_THRM:SMC,CPUTHRM_ALRT:PU
CPUTHRM:ALRT	CPUTHRM_THRM:PU,CPUTHRM_ALRT:SMC
CPUTHRM:NONE	CPUTHRM_THRM:PU,CPUTHRM_ALRT:PU

Specify one of these BOM GROUPs.

BOM GROUP	BOM OPTIONS
TBTTHRM:BOTH	TBTTHRM_THRM:SMC,TBTTHRM_ALRT:SMC
TBTTHRM:THRM	TBTTHRM_THRM:SMC,TBTTHRM_ALRT:PU
TBTTHRM:ALRT	TBTTHRM_THRM:PU,TBTTHRM_ALRT:SMC
TBTTHRM:NONE	TBTTHRM_THRM:PU,TBTTHRM_ALRT:PU

Requires EMC1412-1 or EMC1412-2 instead of EMC1412-A, new APN needs to be created.

S4 SMC Wake Sources

=PP3V3_S4_SMC — R5282 100K 5% 1/20W MF 201

=TPAD_WAKE_L

BT_WAKE_L

SMC_PME_S4_WAKE_L

R5230 0 5% 1/20W MF 0201 — SMC_PCH_SUSWARN_L — PCH_SUSWARN_L

R5231 0 5% 1/20W MF 0201 — SMC_PCH_SUSACK_L — PCH_SUSACK_L

P3V3S4SW_SNS_EN

SMC_SENSOR_PWR_EN — PBUSVSENSE_EN

SMC_WIFI_PWR_EN — PM_WLAN_EN

=PP3V3_S4_SMC

SMC_WIFI_PWR_EN — R5295 10K 5% 1/20W MF 201 NOSTUFF

SMC_SENSOR_PWR_EN — R5294 10K 5% 1/20W MF 201 NOSTUFF

Top Block Swap

=PP3V3R1V8_S0_PCH_VCCSDIO

R5296 1K 5% 1/20W MF 201

SMC_TOPBLK_SWP_L — R5283 1K 5% 1/20W MF 201 — PCH_STRP_TOPBLK_SWP_L

TPAD_ACTUATOR_EN_L — R5297 100 1% 1/20W MF 201 — TPAD_ACTUATOR_EN_RC_L — SMC_ACTUATOR_EN_L

RC Placeholder to filter noise on this signal towards SMC IO.

C5271 220PF 10% 25V X7R-CERM 201

SMC_RESET_L

NOSTUFF C5270 1000PF 10% 16V X7R-1 0201

GND_SMC_AVSS

BOM_COST_GROUP=SMC

PAGE TITLE: SMC Project Support

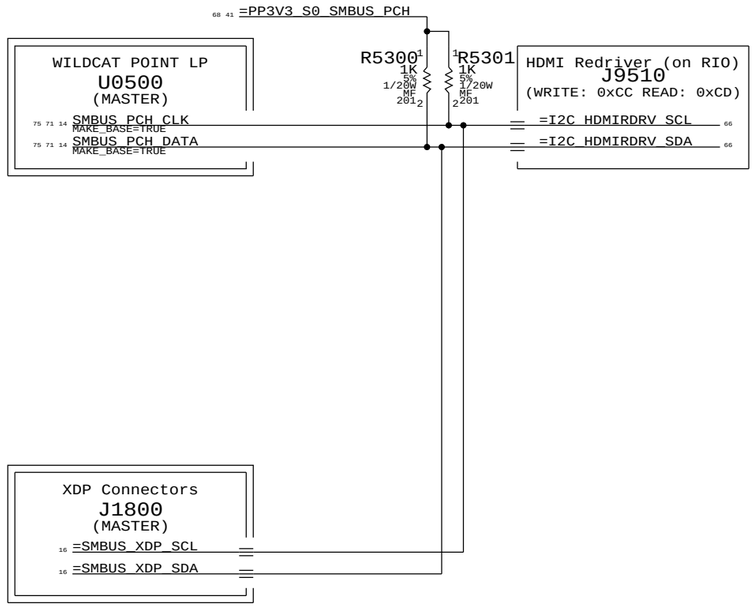
Apple Inc.

NOTICE OF PROPRIETARY PROPERTY:

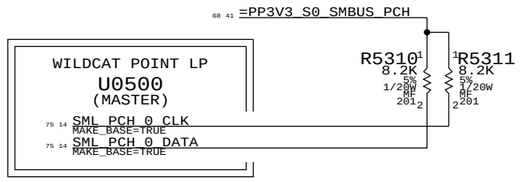
THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY PROPERTY OF APPLE INC.
THE POSESSOR AGREES TO THE FOLLOWING:
I TO MAINTAIN THIS DOCUMENT IN CONFIDENCE
II NOT TO REPRODUCE OR COPY IT
III NOT TO REVEAL OR PUBLISH IT IN WHOLE OR PART
IV ALL RIGHTS RESERVED

DRAWING NUMBER	051-1573
SIZE	D
REVISION	8.0.0
BRANCH	dvt1
PAGE	52 OF 120
SHEET	40 OF 82

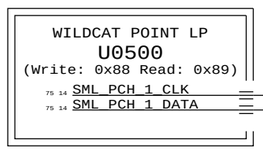
WILDCAT POINT LP S0 "SMBus 0" Connections



WILDCAT POINT LP S0 "SMLink 0" Connections

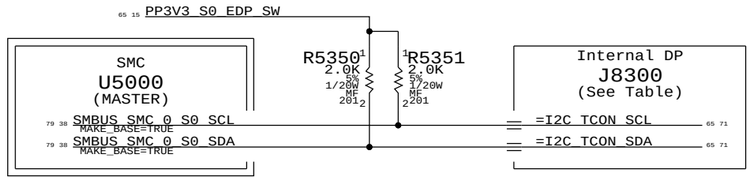


WILDCAT POINT LP S0 "SMLink 1" Connections



SMLink 1 is slave port to access PCH.

SMC SMBus "0" S0 Connections

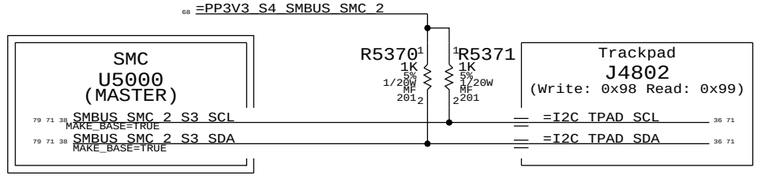


Internal DP

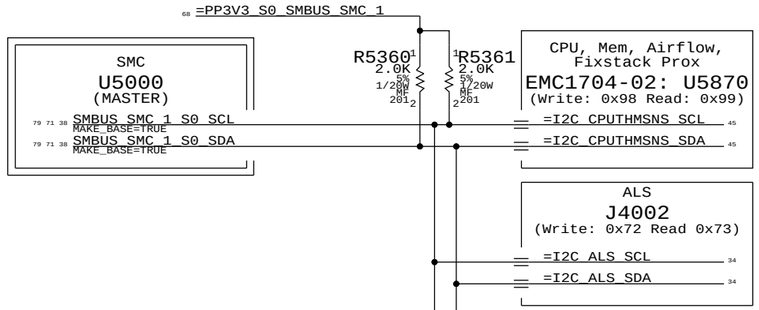
Parade T-con - (0x10-0x2F or 0x30-0x4F)

	J44 Samsung	J44 LGD
	Y	Y

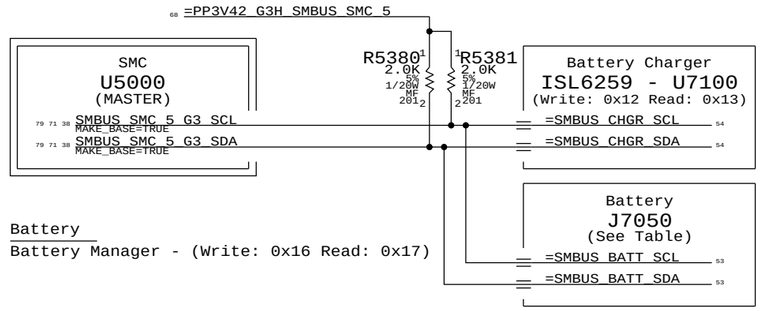
SMC SMBus "2" S3 Connections



SMC SMBus "1" S0 Connections



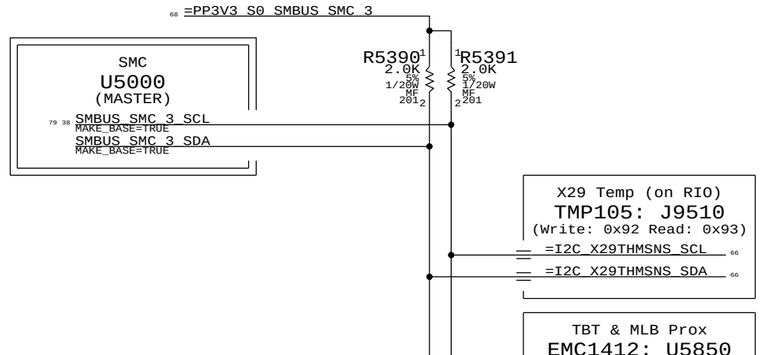
SMC SMBus "5" G3H Connections



Battery

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

SMC SMBus "3" S0 Connections



BOM_COST_GROUP=SMC

SYNC_MASTER=GKOO_J52 SYNC_DATE=12/06/2013

PAGE TITLE: SMBus Connections

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

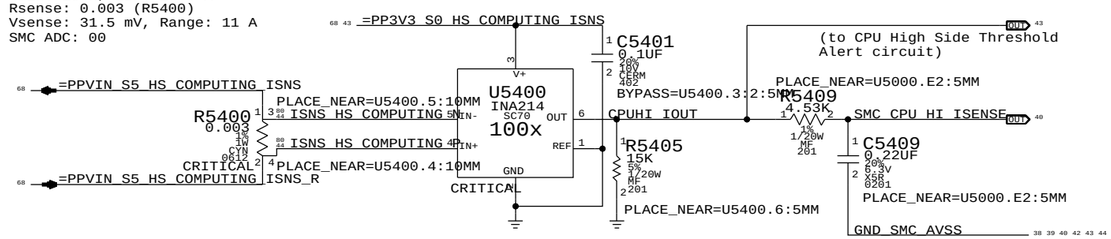
BRANCH: dvt1

PAGE: 53 OF 120

SHEET: 41 OF 82

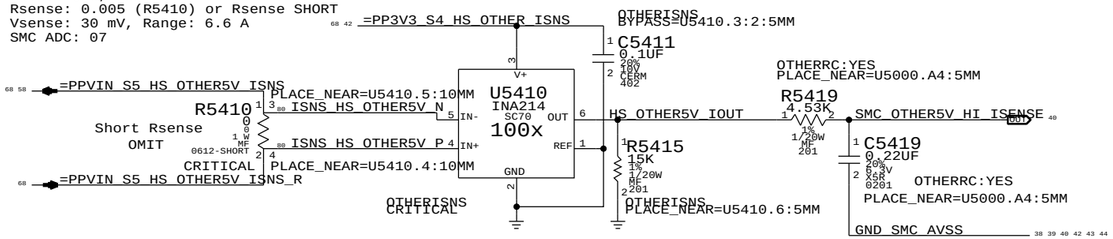
CPU High Side Current Sense (IC0R)

Gain: 100x, EDP: 10.5 A
Rsense: 0.003 (R5400)
Vsense: 31.5 mV, Range: 11 A
SMC ADC: 00



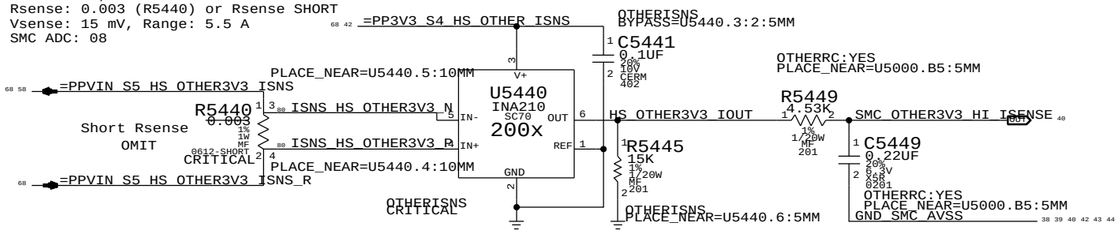
OTHER 5V High Side Current Sense (IO5R)

Gain: 100x, EDP: 6 A
Rsense: 0.005 (R5410) or Rsense SHORT
Vsense: 30 mV, Range: 6.6 A
SMC ADC: 07



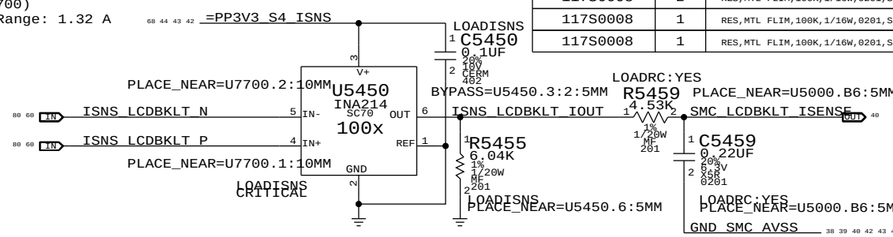
OTHER 3.3V High Side Current Sense (IO3R)

Gain: 200x, EDP: 5 A
Rsense: 0.003 (R5440) or Rsense SHORT
Vsense: 15 mV, Range: 5.5 A
SMC ADC: 08



LCD Backlight Current Sense (IBLC)

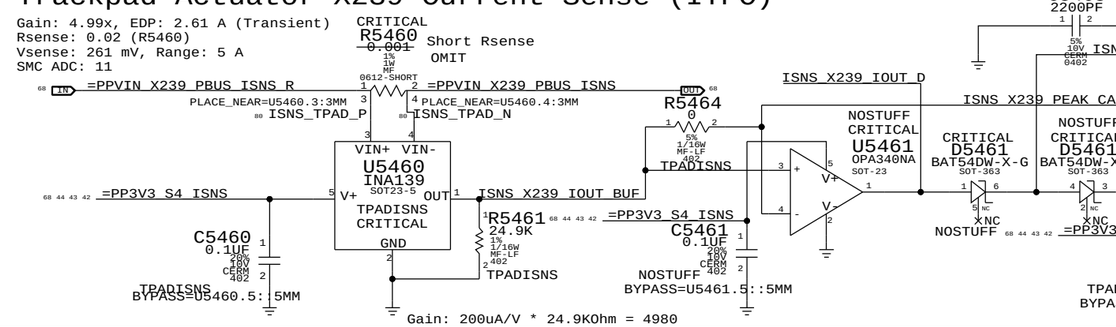
Gain: 100x. EDP: 0.9 A
Rsense: 0.025 (R7700)
Vsense: 22.5 mV, Range: 1.32 A
SMC AD: 10



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	2	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5419,C5449		OTHERRC:NO
117S0008	1	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5459		LOADRC:NO
117S0008	1	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5469		TPADRC:NO

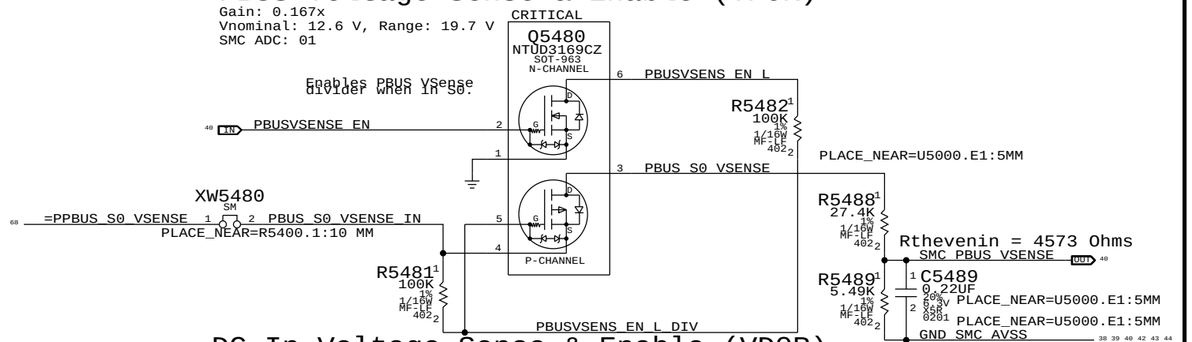
Trackpad Actuator X239 Current Sense (ITPC)

Gain: 4.99x, EDP: 2.61 A (Transient)
Rsense: 0.02 (R5460)
Vsense: 261 mV, Range: 5 A
SMC ADC: 11



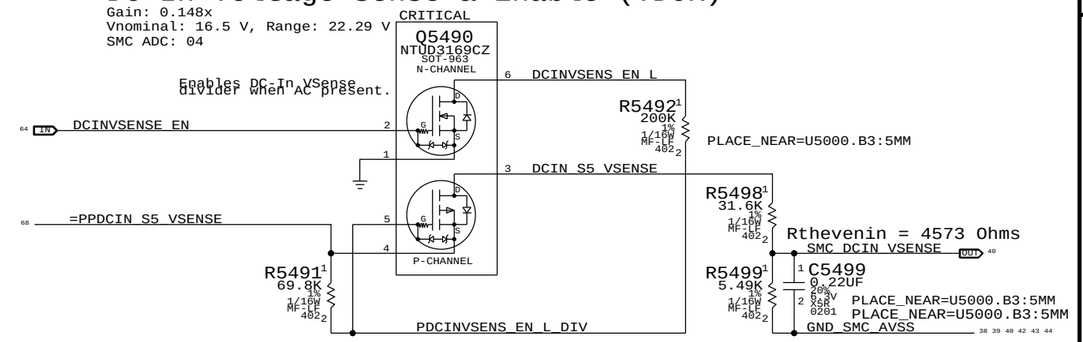
PBUS Voltage Sense & Enable (VP0R)

Gain: 0.167x
Vnominal: 12.6 V, Range: 19.7 V
SMC ADC: 01



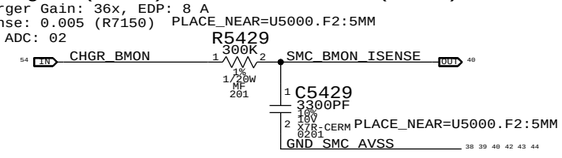
DC In Voltage Sense & Enable (VD0R)

Gain: 0.148x
Vnominal: 16.5 V, Range: 22.29 V
SMC ADC: 04



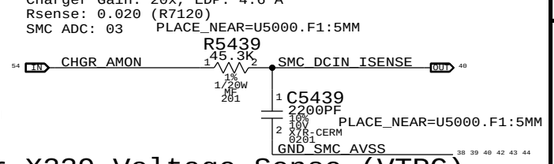
Charger (BMON) Current Sense (IPBR)

Charger Gain: 36x, EDP: 8 A
Rsense: 0.005 (R7150)
SMC ADC: 02



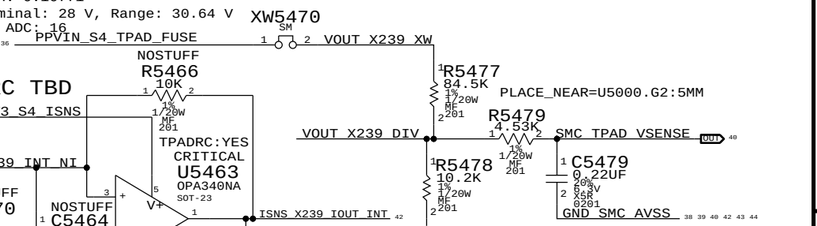
DC-IN (AMON) Current Sense (ID0R)

Charger Gain: 20x, EDP: 4.6 A
Rsense: 0.020 (R7120)
SMC ADC: 03



Trackpad Actuator X239 Voltage Sense (VTPC)

Gain: 0.10771
Vnominal: 28 V, Range: 30.64 V
SMC ADC: 16



SYNC MASTER=JACK J52 SYNC DATE=12/15/2013

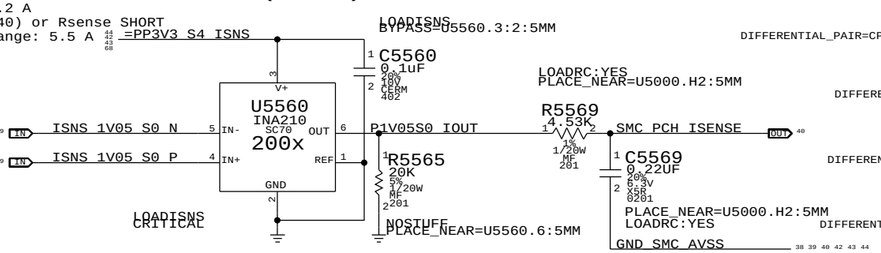
PAGE TITLE
Power Sensors: High Side

Apple Inc.

DRAWING NUMBER	051-1573
SIZE	D
REVISION	8.0.0
BRANCH	dvt1
PAGE	54 OF 120
SHEET	42 OF 82

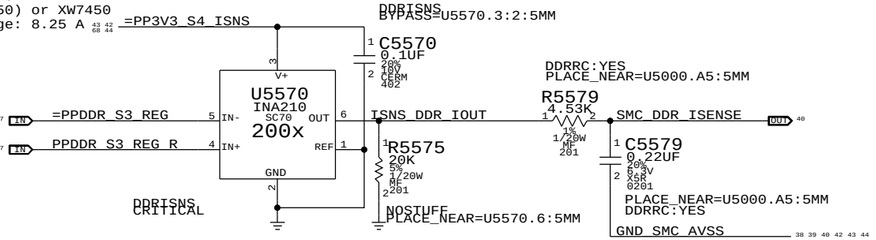
PCH 1.05V Current Sense (IC1C)

Gain: 200x, EDP: 5.2 A
Rsense: 0.003 (R7640) or Rsense SHORT
Vsense: 15.6 mV, Range: 5.5 A
SMC ADC: 19



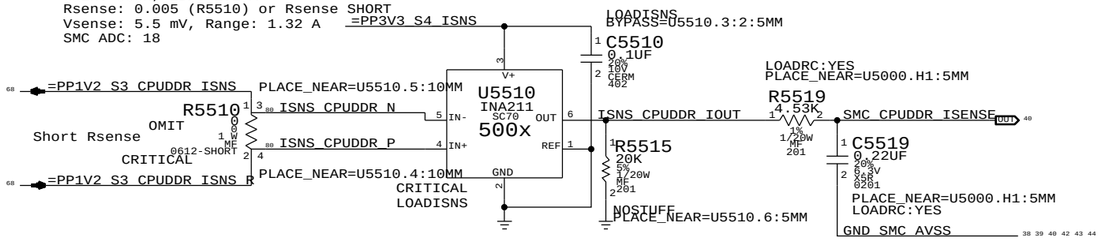
DDR 1.2V S3 (CPU & Memory) Current Sense (IM0C)

Gain: 200x, EDP: 9.5 A
Rsense: 0.002 (R7450) or XW7450
Vsense: 19 mV, Range: 8.25 A
SMC ADC: 09



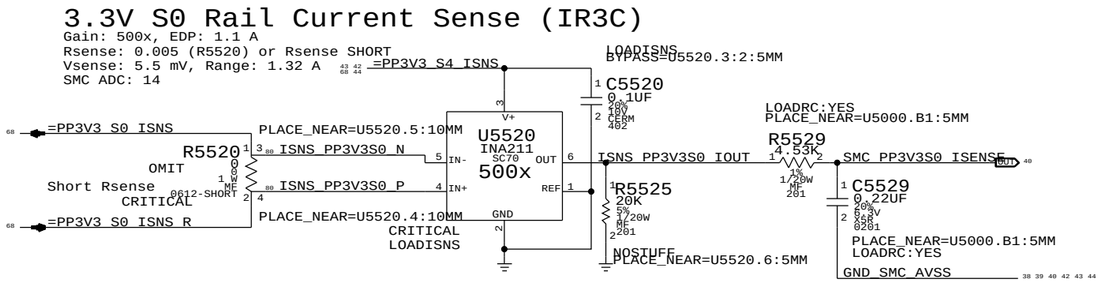
CPU DDR 1.2V S3 (CPU Only) Current Sense (IM1C)

Gain: 500x, EDP: 1.1 A
Rsense: 0.005 (R5510) or Rsense SHORT
Vsense: 5.5 mV, Range: 1.32 A
SMC ADC: 18



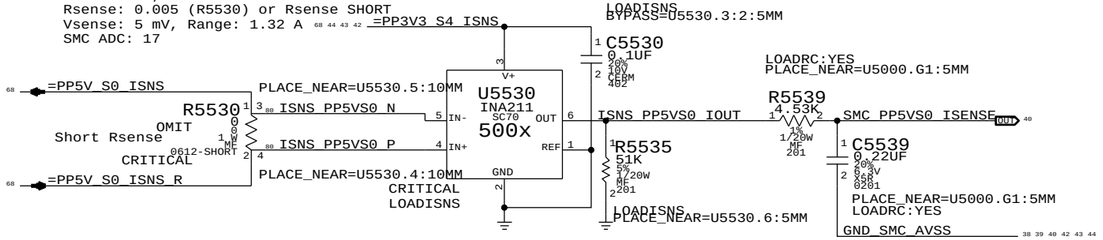
3.3V S0 Rail Current Sense (IR3C)

Gain: 500x, EDP: 1.1 A
Rsense: 0.005 (R5520) or Rsense SHORT
Vsense: 5.5 mV, Range: 1.32 A
SMC ADC: 14



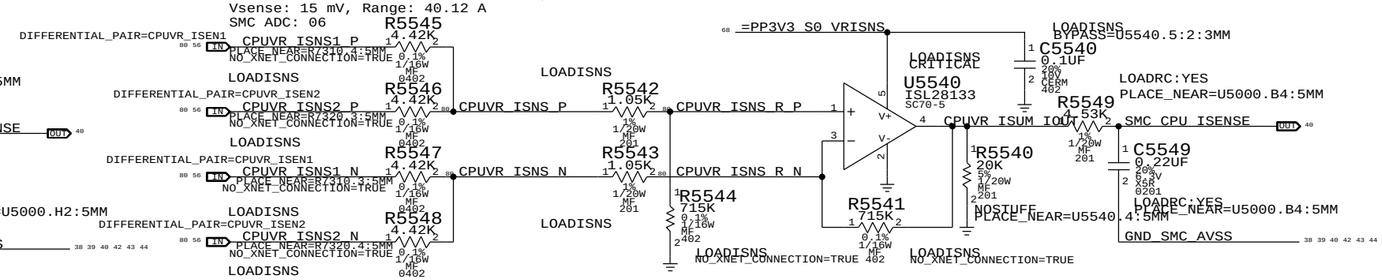
5V S0 Rail Current Sense (IR5C)

Gain: 500x, EDP: 1.0 A
Rsense: 0.005 (R5530) or Rsense SHORT
Vsense: 5 mV, Range: 1.32 A
SMC ADC: 17



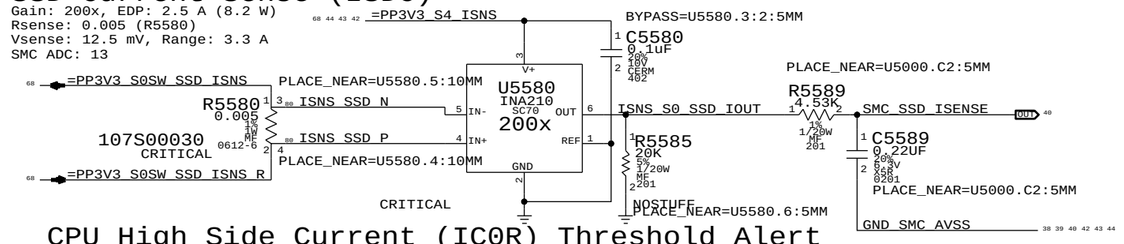
CPU Fixed Current Sense (IC0C)

Gain: 219.33x, EDP: 40 A
Rsense: 2x of 0.00075 (R7310, R7320), Rsum: 0.000375
Vsense: 15 mV, Range: 40.12 A
SMC ADC: 06



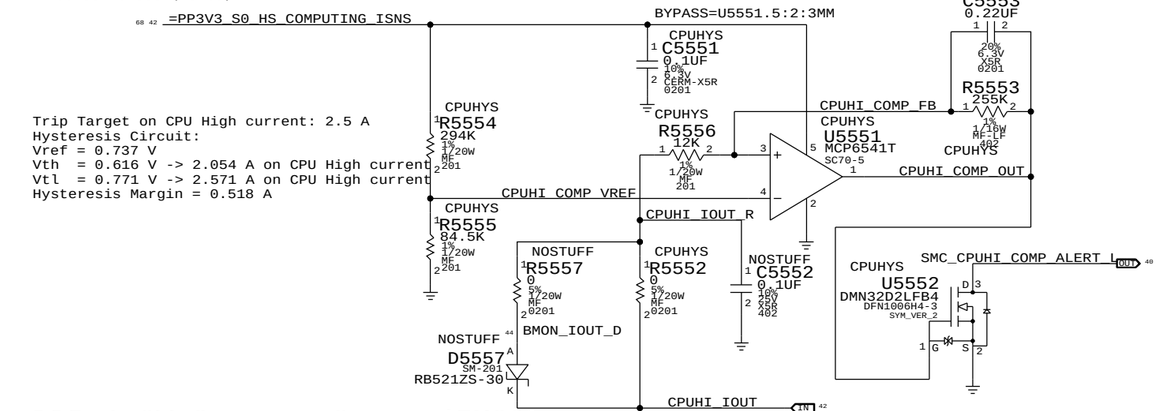
SSD Current Sense (ISDC)

Gain: 200x, EDP: 2.5 A (8.2 W)
Rsense: 0.005 (R5580)
Vsense: 12.5 mV, Range: 3.3 A
SMC ADC: 13



CPU High Side Current (IC0R) Threshold Alert

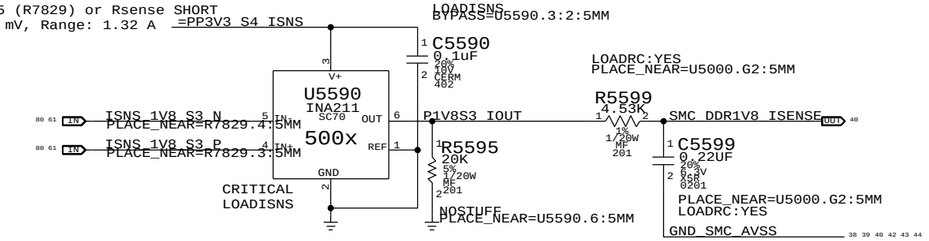
Gain: 100x
Rsense: 0.003 (R5400)



Trip Target on CPU High current: 2.5 A
Hysteresis Circuit:
Vref = 0.737 V
Vth = 0.616 V -> 2.054 A on CPU High current
Vtl = 0.771 V -> 2.571 A on CPU High current
Hysteresis Margin = 0.518 A

DDR 1.8V Current Sense (IM2C)

Gain: 500x, EDP: 0.45 A
Rsense: 0.005 (R7829) or Rsense SHORT
Vsense: 2.25 mV, Range: 1.32 A
SMC ADC: 12



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	3	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5569,C5519,C5599		LOADRC:NO
117S0008	3	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5529,C5539,C5549		LOADRC:NO
117S0008	1	RES,MTL FLIM,100K,1/16W,0201,SMD,LF	C5579		DDRRC:NO

BOM_COST_GROUP=SENSORS

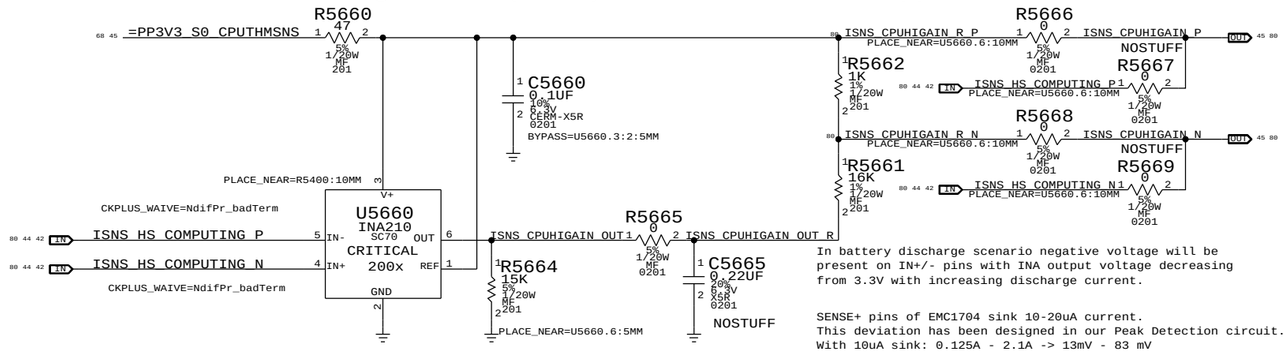
SYNC_MASTER=JACK_J52 SYNC_DATE=12/06/2013

PAGE TITLE: Power Sensors: Load Side

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 55 OF 120
SHEET: 43 OF 82

CPU High Side (IC0R) Peak Detection Support

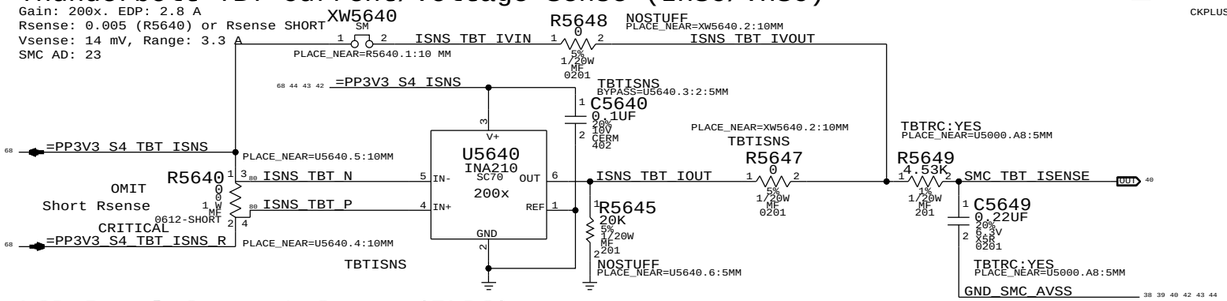


In battery discharge scenario negative voltage will be present on IN+/- pins with INA output voltage decreasing from 3.3V with increasing discharge current.

SENSE+ pins of EMC1704 sink 10-20uA current.
This deviation has been designed in our Peak Detection circuit.
With 10uA sink: 0.125A - 2.1A -> 13mV - 83 mV
With 20uA sink: 0.125A - 2.1A -> 23mV - 92 mV

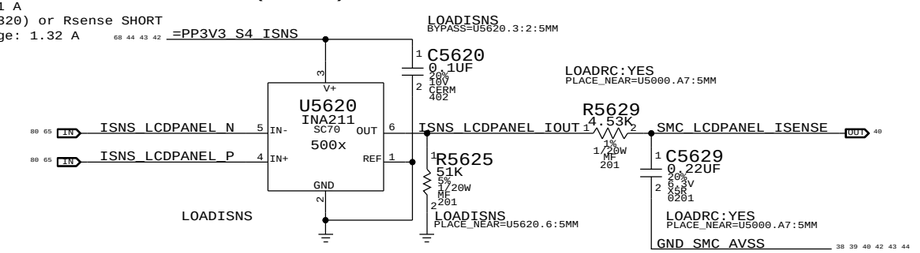
Thunderbolt TBT Current/Voltage Sense (IHSC/VHSC)

Gain: 200x. EDP: 2.8 A
Rsense: 0.005 (R5640) or Rsense SHORT
Vsense: 14 mV, Range: 3.3 A
SMC AD: 23



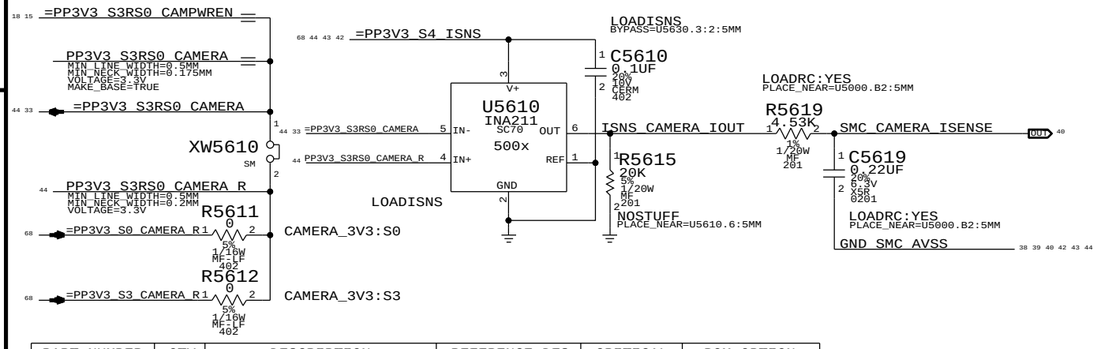
LCD Panel Current Sense (ILDC)

Gain: 500x. EDP: 1 A
RSENSE: 0.005 (R8320) or Rsense SHORT
Vsense: 5 mV, Range: 1.32 A
SMC AD: 21



Camera (S2 Controller) Current Sense (ICMC)

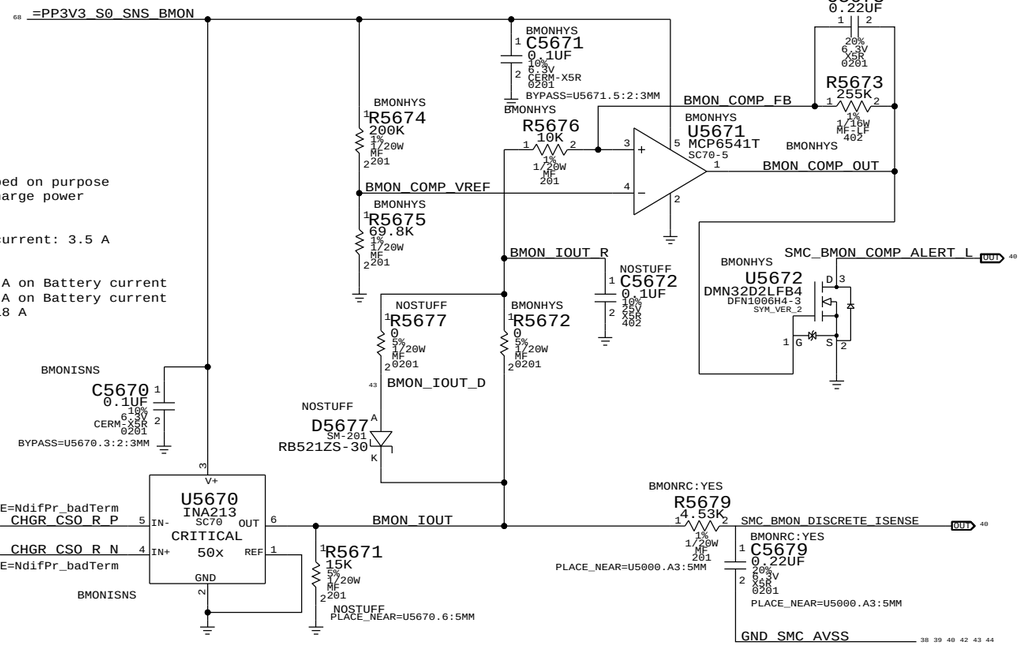
Gain: 500x. EDP: 0.82 A
Rsense: 0.005 (R5610) or XW5610
Vsense: 4.1 mV, Range: 1.32 A
SMC AD: 15



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0008	2	RES,MTL FILM,100K,1/16W,0201,SMD,LF	C5619,C5629		LOADRC:NO
117S0008	1	RES,MTL FILM,100K,1/16W,0201,SMD,LF	C5679		BMONRC:NO
117S0008	1	RES,MTL FILM,100K,1/16W,0201,SMD,LF	C5649		TBTRC:NO

Battery BMON Discrete Current Sense (IP0R) & Threshold Alert

Gain: 50x. EDP: 8 A
Rsense: 0.005 (R7150)
Vsense: 50 mV, Range: 13.2 A
SMC AD: 05

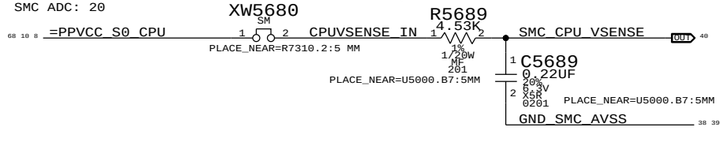


CHGR_CSO_R_P/N are swapped on purpose to measure Battery discharge power into system.

Trip Target on Battery current: 3.5 A
Hysteresis Circuit:
Vref = 0.854 V
Vth = 0.758 V -> 3.031 A on Battery current
Vtl = 0.887 V -> 3.549 A on Battery current
Hysteresis Margin = 0.518 A

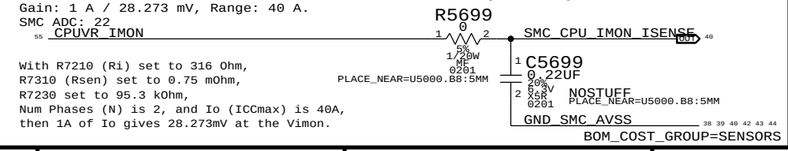
CPU Core Voltage Sense (VC0C)

SMC ADC: 20



CPU Core IMON Current Sense (IC2C)

Gain: 1 A / 28.273 mV, Range: 40 A.
SMC ADC: 22



With R7210 (Ri) set to 316 Ohm,
R7310 (Rsen) set to 0.75 mOhm,
R7230 set to 95.3 kOhm,
Num Phases (N) is 2, and Io (ICCmax) is 40A,
then 1A of Io gives 28.273mV at the Vimon.

BOM_COST_GROUP=SENSORS

SYNC_MASTER=JACK J52 SYNC_DATE=10/26/2013

PAGE TITLE: Power Sensors: Extended

Apple Inc.

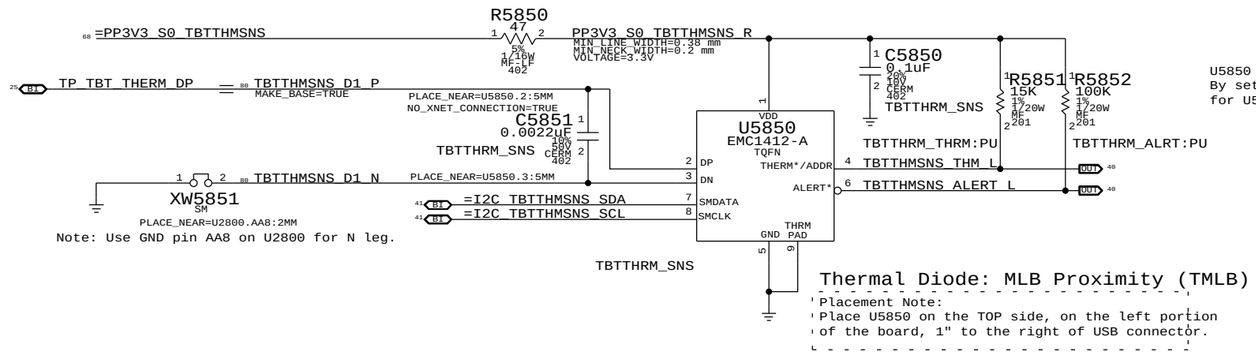
DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 56 OF 120
SHEET: 44 OF 82

Thermal Sensor A:
Thunderbolt Die, MLB Proximity

I2C Write: 0xD8, I2C Read: 0xD9

Thermal Diode: TBT Die (THSP)

Placement Note:
The P leg connects to THERMDA pin of the TBT chip, the N leg connect to pin AA8.



Note: Use GND pin AA8 on U2800 for N leg.

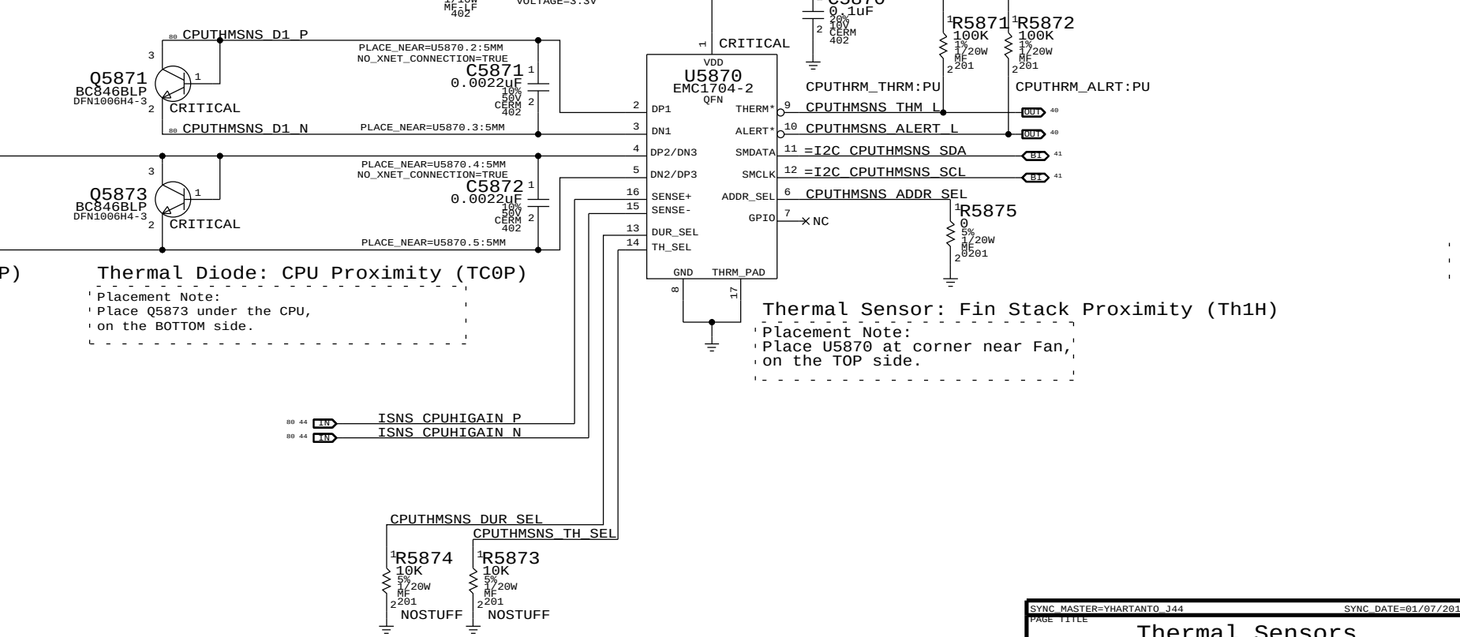
U5850 I2C Address:
By setting R5851 to 15k, I2C address for U5850 is 0xD8/0xD9.

Thermal Diode: MLB Proximity (TMLB)

Placement Note:
Place U5850 on the TOP side, on the left portion of the board, 1" to the right of USB connector.

Thermal Sensor B & CPU High Peak Detection:
CPU Proximity, Memory Proximity, Airflow, Fin Stack Proximity

I2C Write: 0x98, I2C Read: 0x99



Thermal Diode: Airflow (TA0P)

Placement Note:
Place Q5871, Airflow thermal indicator, above the SSD, on the BOTTOM side.

Thermal Diode: Memory Proximity (TM0P)

Placement Note:
Place Q5872 between two rows of Memory devices, between channel A and B, on the BOTTOM side.

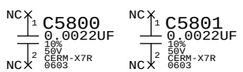
Thermal Diode: CPU Proximity (TC0P)

Placement Note:
Place Q5873 under the CPU, on the BOTTOM side.

Thermal Sensor: Fin Stack Proximity (Th1H)

Placement Note:
Place U5870 at corner near Fan, on the TOP side.

Placement Note: Place C5800 and C5801 near Q5871.



BOM_COST_GROUP=SENSORS

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/07/2013

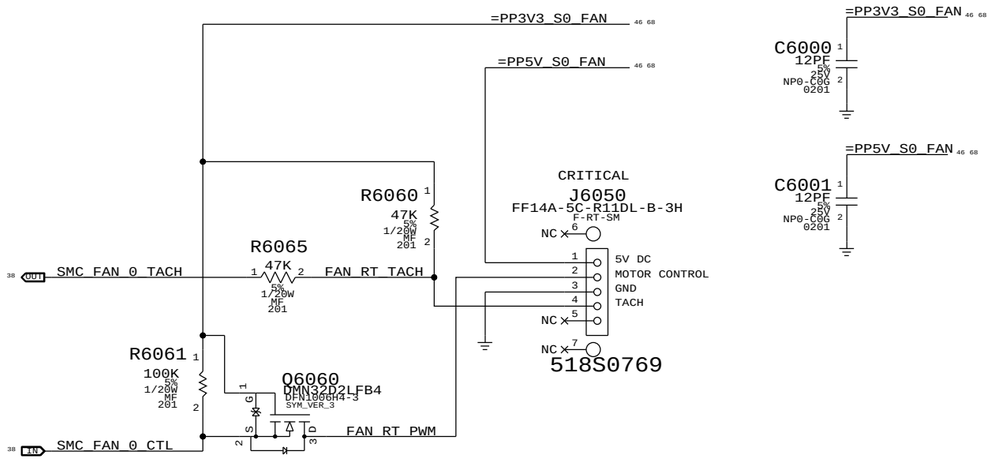
PAGE TITLE: Thermal Sensors

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 58 OF 120
SHEET: 45 OF 82

FAN CONNECTOR

KEEP THE 5 PIN CONNECTOR FROM D1



Placement Note: Place C6002 and C6003 near Q6060

BOM_COST_GROUP=FAN

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE: Fan

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

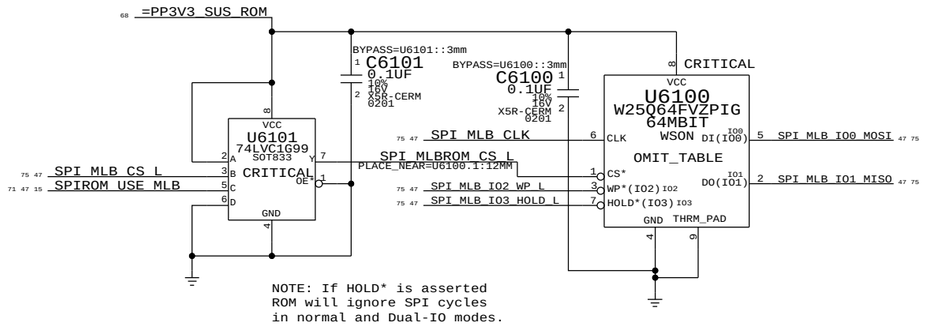
BRANCH: dvt1

PAGE: 60 OF 120

SHEET: 46 OF 82

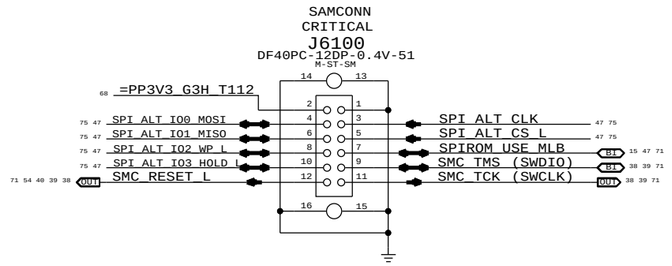
SPI ROM

Quad-IO Mode (Mode 0 & 3) supported.
SPI Frequency: 50MHz for CPU, 20MHz for SMC.



Quad SPI and QPI instructions require the non-volatile Quad Enable bit (QE)
in Status Register-2 to be set. When QE=1, the /WP pin becomes IO2 and /HOLD pin becomes IO3.

SPI+SWD SAM Connector



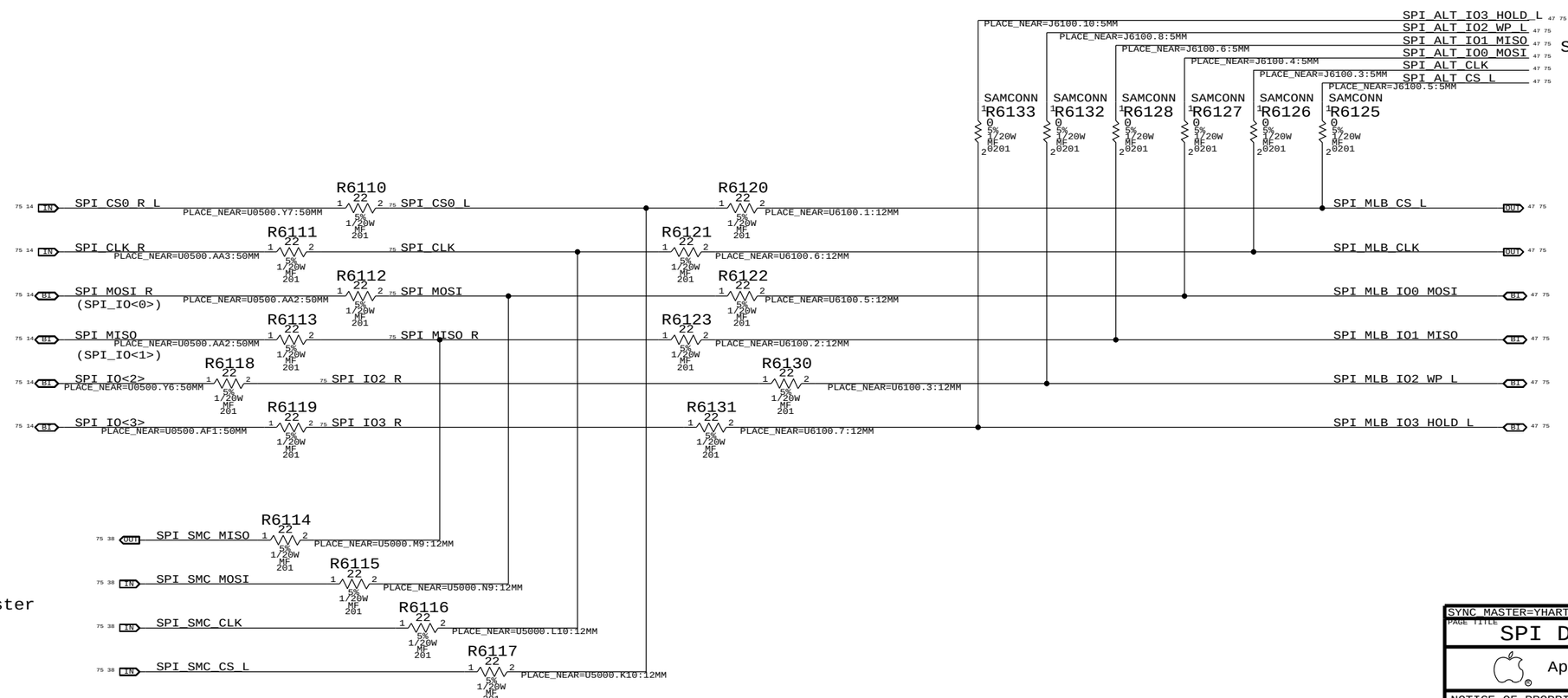
SPI Bus Series Termination

CPU Master

SMC12 Master

Sam Card ROM Slave

SPI ROM Slave



BOM_COST_GROUP=CPU SUPPORT

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/09/2013

PAGE TITLE: SPI Debug Connector

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

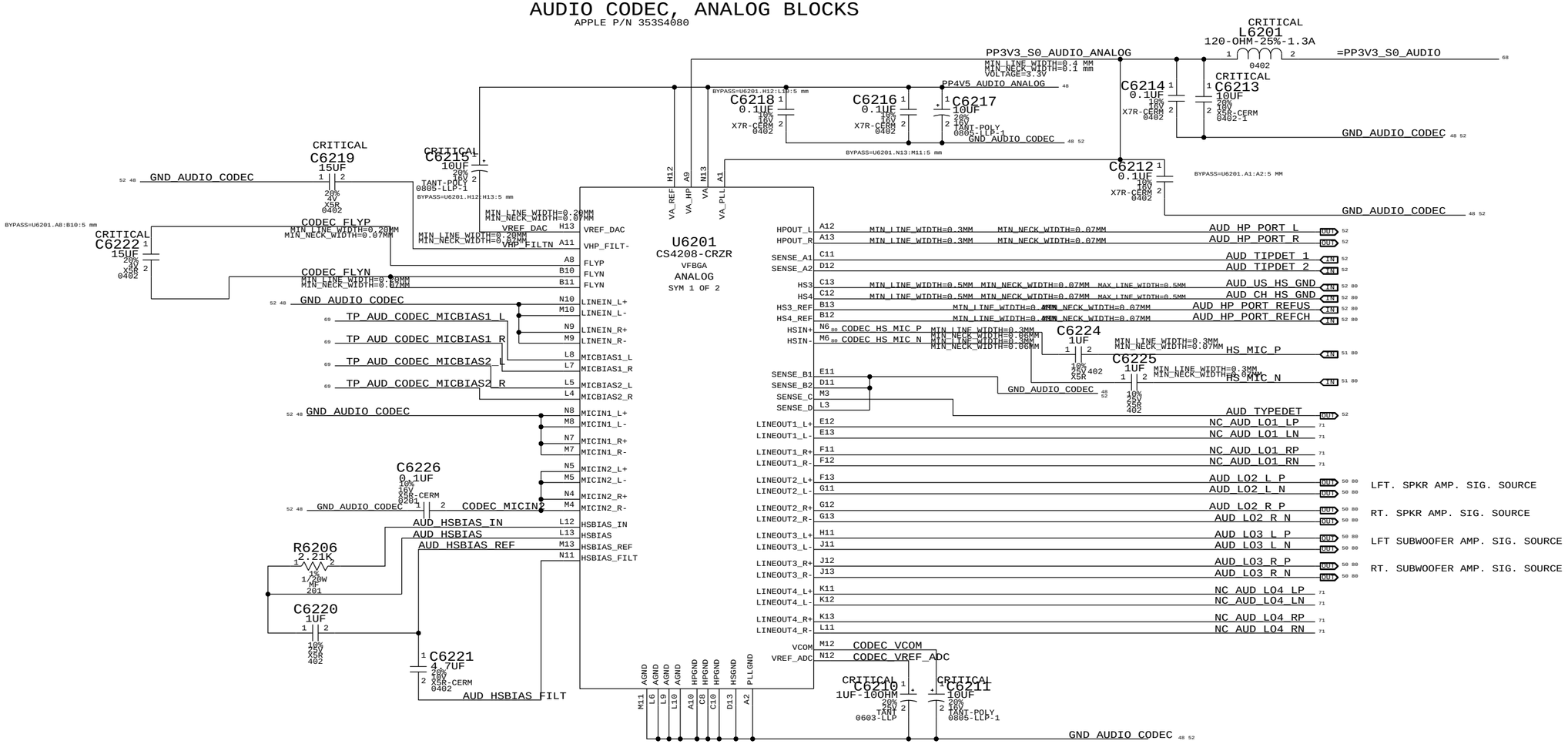
BRANCH: dvt1

PAGE: 61 OF 120

SHEET: 47 OF 82

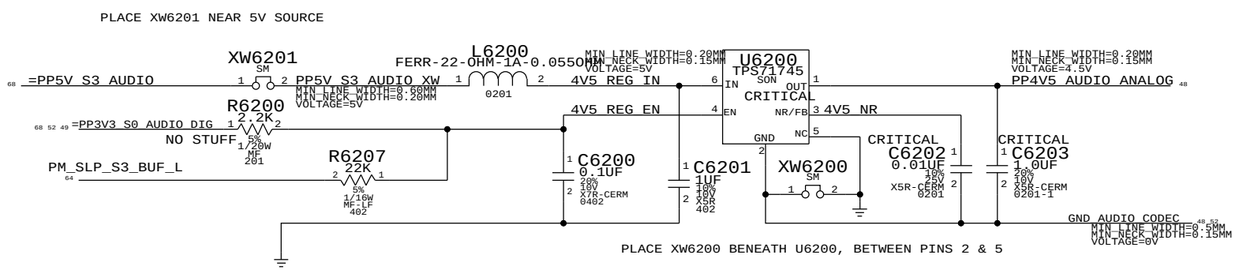
AUDIO CODEC, ANALOG BLOCKS

APPLE P/N 353S4080



4.5V POWER SUPPLY FOR CODEC

APPLE P/N 353S2456



BOM_COST_GROUP=AUDIO

SYNC_MASTER=JCURCIO_J44 SYNC_DATE=05/13/2013

PAGE TITLE: Audio: Codec,Analog

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 62 OF 120

SHEET: 48 OF 82

AUDIO CODEC, DIGITAL BLOCKS

APPLE P/N 353S4080

L6300
FERR-22-OHM-1A-0.055OHM
0201

=PP1V5_S0_AUDIO → PP1V5_S0_AUDIO_DIG
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.07MM
VOLTAGE=1.5V

C6300 4.7UF 20% 10V X5R-1 402
C6301 0.1UF 10% 16V X7R-CERM 0402
BYPASS=U6201.J2:J1:5 mm
C6302 0.1UF 10% 16V X7R-CERM 0402
BYPASS=U6201.E1:F1:5 mm

=PP3V3_S0_AUDIO_DIG
BYPASS=U6201.G1:F1:5 mm
C6303 0.1UF 10% 6.3V CERM-X5R 0201
BYPASS=U6201.K1:K3:5 mm
C6304 0.1UF 10% 6.3V CERM-X5R 0201
C6305 10UF 20% 6.3V X5R-CERM 0402-1
C6306 10UF 20% 6.3V X5R-CERM 0402-1
BYPASS=U6201.A7:E3:5 mm
C6307 0.1UF 10% 6.3V CERM-X5R 0201

=PP3V3_S0_AUDIO_DIG
R6324 100K 5% 1/20W MF 201
R6325 100K 5% 1/20W MF 201

OMIT
R6302 SHORT 402

R6323 100K 5% 1/20W MF 201
NOSTUFF
R6322 100K 5% 1/20W MF 201

GPIO0_SPKR_SHUTDOWN → PD_CS4208_GPIO1
SPKRCONN_L_ID
SPKRCONN_R_ID
DFET_OPENUS
DFET_OPENCH

NC_CS4208_GPO0
NC_CS4208_GPO1

HDA_BIT_CLK
HDA_SYNC
HDA_SDIN0
HDA_SDOUT
HDA_RST_L

R6331 22 5% 1/20W MF 201
CS4208_HDA_SDOUT0_R → TP_CS4208_HDA_SDOUT1

NC_CS4208_MCLKA
NC_CS4208_SCLKA
NC_CS4208_LRCLKA
NC_CS4208_SDOUTA

NC_CS4208_MCLKB
NC_CS4208_SCLKB
NC_CS4208_LRCLKB
NC_CS4208_SDOUTB

U6201
CS4208-CRZR
VFBGA
DIGITAL
SYM 2 OF 2

H3	GPIO0	
H2	GPIO1	
H1	GPIO2	
C4	GPIO3	
C5	GPIO4	
C7	GPIO5	
C9	GPO0	
B9	GPO1	
F2	BCLK	
E2	SYNC	
D1	SDI0	
C1	SDI1	
D2	SDO0	
C2	SDO1	
C3	SDO2	
B1	SDO3	
D3	RST*	
A5	MCLK_A	
B2	SCLK_A	
B4	LRCK_A	
A3	SDOUT_A	
B3	SDIN_A	
A6	MCLK_B	
B6	SCLK_B	
B5	LRCK_B	
B8	SDOUT_B	
A4	SDIN_B	
C6	SDA	
B7	SCL	
J1	DGND	
F1	LGND	
E3	LGND	
F3	LGND	
J3	LGND	
K3	LGND	
J2	VD	
E1	VL_HD	
A7	VL_SP	
G1	VL_IF	
K1	VL_DM	
G3	SPDIF_IN	CS4208_SPDIF_IN
G2	SPDIF_OUT	CS4208_SPDIF_OUT
N3	DMIC_SDA0	
N2	DMIC_SCL0	
N1	DMIC_SDA1	
M1	DMIC_SCL1	
M2	DMIC_SDA2	
L1	DMIC_SCL2	
K2	DMIC_SDA3	
L2	DMIC_SCL3	DMIC_CLK3_R
F6	NC	
F7	NC	
F8	NC	
G6	NC	
G7	NC	
G8	NC	
H6	NC	
H7	NC	
H8	NC	

R6330 33 5% 1/10W MF-LF 402
SPDIF_OUT_JACK

NC_DMIC_CLK0
NC_DMIC_CLK1
NC_DMIC_CLK2

R6332 75 1% 1/10W MF-LF 402
DMIC_SDA3
DMIC_CLK3

PP6301
P3MM SM
DMIC_SDA3 → PLACE_NEAR=U6201.N3:5 mm

PP6304
P3MM SM
HDA_SDOUT → PLACE_NEAR=U6201.D2:5 mm

BOM_COST_GROUP=AUDIO

SYNC_MASTER=JCURCIO_J44 SYNC_DATE=07/25/2013

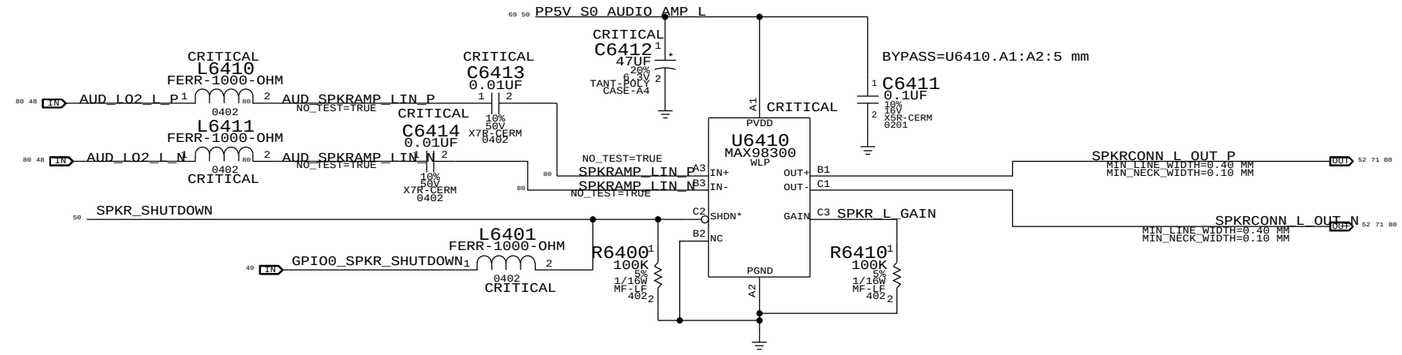
PAGE TITLE: Audio: Codec,Digital

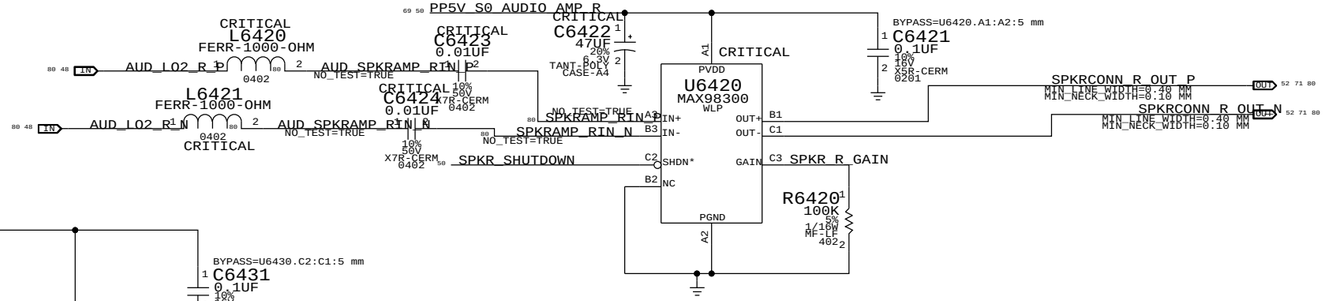
Apple Inc.

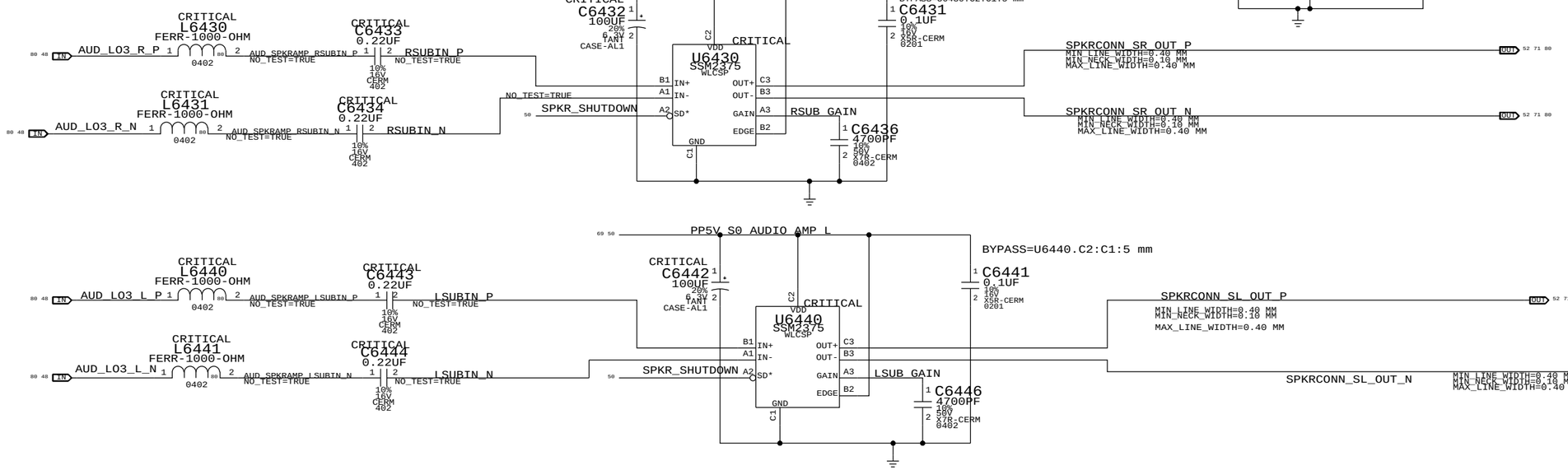
DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 63 OF 120
SHEET: 49 OF 82

4X MONO SPEAKER AMPLIFIERS (MAX98300 & SSM2375)

APN: 353S2888 & 353S2958
GAIN = +3 DB
1ST ORDER FC (L&R) = NOM 569 HZ
1ST ORDER FC (SUB) = NOM 9 HZ







Placement Note: Place C6447 and C6452 near U6420

NC C6447 0.0022UF 10% 50V CERM-X7R 0603 NC
NC C6452 0.0022UF 10% 50V CERM-X7R 0603 NC

Placement Note: Place C6448 and C6449 near U6430

NC C6448 0.0022UF 10% 50V CERM-X7R 0603 NC
NC C6449 0.0022UF 10% 50V CERM-X7R 0603 NC

Placement Note: Place C6450 near U6410

NC C6450 0.0022UF 10% 50V CERM-X7R 0603 NC

Placement Note: Place C6451 near U6440

NC C6451 0.0022UF 10% 50V CERM-X7R 0603 NC

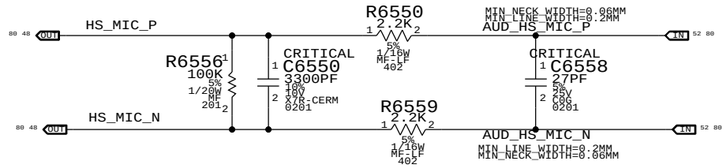
BOM_COST_GROUP=AUDIO

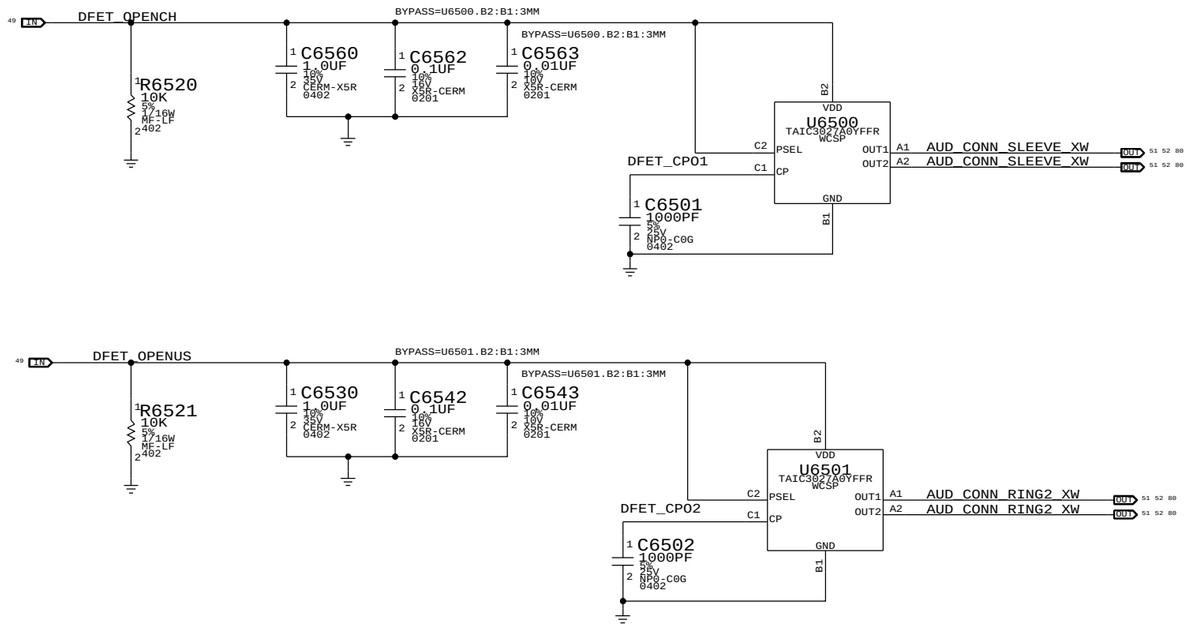
SYNC_MASTER=DIRK_J44 SYNC_DATE=01/09/2013

PAGE TITLE: Audio: Speaker Amps

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 64 OF 120
SHEET: 50 OF 82





BOM_COST_GROUP=AUDIO

SYNC_MASTER=JCURCIO_J44 SYNC_DATE=07/25/2013

PAGE TITLE: Audio: Jack Support

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 65 OF 120

SHEET: 51 OF 82

CODEC OUTPUT SIGNAL PATHS

FUNCTION	VOLUME	CONVERTER	PIN COMPLEX	MUTE CONTROL
HP/HS OUT	0X02 (2)	0X02 (2)	0X10 (16)	N/A
TWEETERS	0X03 (3)	0X03 (3)	0X12 (18)	CODEC GPIO0
SUB	0X04 (4)	0X04 (4)	0X13 (19)	CODEC GPIO0
SPDIF OUT	N/A	0X0E (14)	0X21 (33)	N/A

CODEC INPUT SIGNAL PATHS

FUNCTION	CONVERTER	PIN COMPLEX	VREF
DMIC 1	0X09 (9)	0X1C (28)	3.3V
DMIC 2	0X09 (9)	0X1C (28)	3.3V
HEADSET MIC	0X07 (7)	0X18 (24)	2.7V

OTHER CODEC GPIO LINES

LEFT SPEAKER ID	GPIO2 INPUT	HIGH = FG, LOW = MERRY
RIGHT SPEAKER ID	GPIO3 INPUT	HIGH = FG, LOW = MERRY
DFET CONTROL	GPIO4 OUTPUT	HIGH = DFETS OPEN

2-MIC CONNECTOR

APN: 518S0818

68 52 49 48 =PP3V3_S0_AUDIO_DIG

71 49 OUT DMIC_SDA3

OMIT
R6680
SHORT
402
71 DMIC_SDA2

71 49 OUT DMIC_CLK3

CRITICAL
J6601
FF14A-6C-R11DL-B-3H
F-RT-SM
7
1 2 3 4 5 6
8

SPEAKER CONNECTOR

HP=80HZ

APN: 518S0672

CRITICAL
J6602
78171-6006
M-RT-SM

80 71 58 IN SPKRCONN_L_OUT_P
80 71 58 IN SPKRCONN_L_OUT_N
71 49 IN SPKRCONN_L_ID
80 71 58 IN SPKRCONN_SL_OUT_P
80 71 58 IN SPKRCONN_SL_OUT_N

CRITICAL
J6603
78171-6006
M-RT-SM

80 71 58 IN SPKRCONN_R_OUT_P
80 71 58 IN SPKRCONN_R_OUT_N
71 49 IN SPKRCONN_R_ID
80 71 58 IN SPKRCONN_SR_OUT_P
80 71 58 IN SPKRCONN_SR_OUT_N

80 48 OUT AUD_HP_PORT_REFCH — CRITICAL L6611 120-OHM-25%-1.3A 0402 — 80 AUD_CONN_SLEEVE
MIN_LINE_WIDTH=0.4MM MIN_NECK_WIDTH=0.06MM
PLACE_NEAR=J6600.5:5mm XW6600 SM

80 48 OUT AUD_CH_HS_GND — CRITICAL L6612 120-OHM-25%-1.3A 0402 — 80 51 AUD_CONN_SLEEVE_XW
MIN_LINE_WIDTH=0.5MM MIN_NECK_WIDTH=0.1MM
XW6601 SM
80 51 OUT AUD_HS_MIC_P

80 48 OUT AUD_HP_PORT_REFUS — CRITICAL L6613 120-OHM-25%-1.3A 0402 — 80 AUD_CONN_RING2
MIN_LINE_WIDTH=0.4MM MIN_NECK_WIDTH=0.06MM
PLACE_NEAR=J6600.6:5mm XW6602 SM

80 48 OUT AUD_US_HS_GND — CRITICAL L6614 120-OHM-25%-1.3A 0402 — 80 51 AUD_CONN_RING2_XW
MIN_LINE_WIDTH=0.5MM MIN_NECK_WIDTH=0.1MM
XW6603 SM
80 51 OUT AUD_HS_MIC_N

48 IN AUD_HP_PORT_L — CRITICAL L6604 120-OHM-25%-1.3A 0402 — AUD_CONN_HP_LEFT
MIN_LINE_WIDTH=0.3MM MIN_NECK_WIDTH=0.06MM

R6602 2.2K 5% 1/16W MF-LF 402

48 OUT AUD_TIPDET_2 — CRITICAL L6608 FERR-470-OHM 0201 — AUD_CONN_TIPDET_2

GND_AUDIO_CODEC

R6603 2.2K 5% 1/16W MF-LF 402

48 OUT AUD_TIPDET_1 — CRITICAL L6607 FERR-470-OHM 0201 — AUD_CONN_TIPDET_1

48 IN AUD_HP_PORT_R — CRITICAL L6605 120-OHM-25%-1.3A 0402 — AUD_CONN_HP_RIGHT
MIN_LINE_WIDTH=0.3MM MIN_NECK_WIDTH=0.06MM

48 OUT AUD_TYPEDET — CRITICAL L6606 FERR-470-OHM 0201 — AUD_CONN_TYPEDET

49 IN SPDIF_OUT_JACK

68 52 49 48 =PP3V3_S0_AUDIO_DIG

APN: 514-0875

J6600
AUDIO-SPDIF-J44
F-RT-TH

5 MIC
6 AUDIO GND
2 2RTN
1 DET2
8 DET1
NC
7 1RTN
3 R.AUDIO
4 AUDIO GND
AUDIO

9 VIN
10 VDD
11 GND
OPERATING VOLTAGE 3.3
POF

C6600 1UF 10% 10V X5R 402
C6601 0.1UF 10% 6.3V CERM-X5R 0201

12 13 14 15 SHELL PINS

R6601 10K 5% 1/16W MF-LF 402

C6602 100PF 5% 25V C0G 0201
CRITICAL DZ6607 ESDALC5-1BM2 SOD882
C6603 100PF 5% 25V C0G 0201
CRITICAL DZ6601 ESDALC5-1BM2 SOD882
C6604 100PF 5% 25V C0G 0201
CRITICAL DZ6602 ESDALC5-1BM2 SOD882
C6605 100PF 5% 25V C0G 0201
CRITICAL DZ6603 ESDALC5-1BM2 SOD882
C6606 100PF 5% 25V C0G 0201
CRITICAL DZ6606 ESDALC5-1BM2 SOD882
CRITICAL DZ6605 ESDALC5-1BM2 SOD882
C6607 100PF 5% 25V C0G 0201
C6608 100PF 5% 25V C0G 0201
CRITICAL DZ6604 ESDALC5-1BM2 SOD882

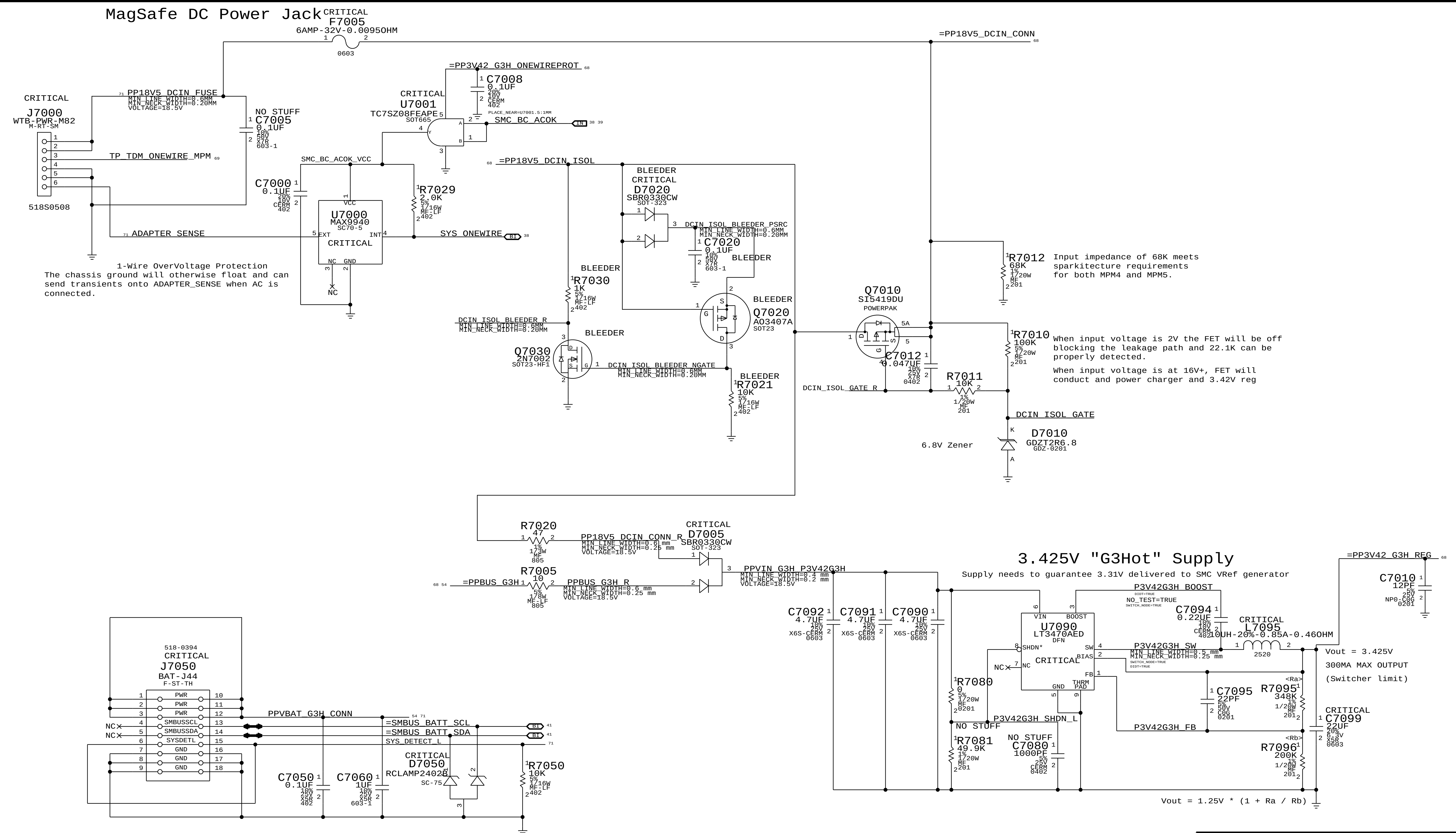
BOM_COST_GROUP=AUDIO

SYNC_MASTER=JCURCIO_J44 SYNC_DATE=05/13/2013

PAGE TITLE
Audio: Jack Translators

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 66 OF 120
SHEET 52 OF 82


MagSafe DC Power Jack
CRITICAL
F7005
6AMP-32V-0.0095OHM
0603
=PP18V5_DCIN_CONN
=PP3V42_G3H_ONEWIREPROT
CRITICAL
J7000
WTB-PWR-M82
M-RT-SM
518S0508
PP18V5_DCIN_FUSE
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.20MM
VOLTAGE=18.5V
NO STUFF
C7005
0.1UF
TP_TDM_ONEWIRE_MPM
C7008
0.1UF
CRITICAL
U7001
TC7SZ08FEAPE
SOT665
SMC_BC_ACOK
PLACE_NEAR=U7001.5:1MM
SMC_BC_ACOK_VCC
C7000
0.1UF
U7000
MAX9940
SC70-5
CRITICAL
R7029
2.0K
ADAPTER_SENSE
SYS_ONEWIRE
1-Wire OverVoltage Protection
The chassis ground will otherwise float and can send transients onto ADAPTER_SENSE when AC is connected.
=PP18V5_DCIN_ISOL
BLEEDER
CRITICAL
D7020
SBR0330CW
SOT-323
DCIN_ISOL_BLEEDER_PSRC
C7020
0.1UF
BLEEDER
R7030
1K
BLEEDER
Q7020
AO3407A
SOT23
DCIN_ISOL_BLEEDER_R
BLEEDER
Q7030
2N7002
SOT23-HF1
DCIN_ISOL_BLEEDER_NGATE
BLEEDER
R7021
10K
Q7010
SI5419DU
POWERPAK
C7012
0.047UF
R7011
10K
DCIN_ISOL_GATE_R
DCIN_ISOL_GATE
R7012
68K
Input impedance of 68K meets sparkitecture requirements for both MPM4 and MPM5.
R7010
100K
When input voltage is 2V the FET will be off blocking the leakage path and 22.1K can be properly detected.
When input voltage is at 16V+, FET will conduct and power charger and 3.42V reg
D7010
GDZT2R6.8
GDZ-0201
6.8V Zener
R7020
47
PP18V5_DCIN_CONN_R
CRITICAL
D7005
SBR0330CW
SOT-323
R7005
10
=PPBUS_G3H
PPBUS_G3H_R
PPVIN_G3H_P3V42G3H
3.425V "G3Hot" Supply
Supply needs to guarantee 3.31V delivered to SMC VRef generator
=PP3V42_G3H_REG
C7010
12PF
C7092
4.7UF
C7091
4.7UF
C7090
4.7UF
P3V42G3H_BOOST
C7094
0.22UF
U7090
LT3470AED
DFN
CRITICAL
CRITICAL
L7095
10UH-20%-0.85A-0.460HM
2520
P3V42G3H_SW
Vout = 3.425V
300MA MAX OUTPUT
(Switcher limit)
R7080
0
C7095
22PF
R7095
348K
CRITICAL
C7099
22UF
P3V42G3H_FB
P3V42G3H_SHDN_L
NO STUFF
R7081
49.9K
NO STUFF
C7080
1000PF
R7096
200K
Vout = 1.25V * (1 + Ra / Rb)
518-0394
CRITICAL
J7050
BAT-J44
F-ST-TH
PPVBAT_G3H_CONN
=SMBUS_BATT_SCL
=SMBUS_BATT_SDA
SYS_DETECT_L
CRITICAL
D7050
RCLAMP2402B
SC-75
C7050
0.1UF
C7060
1UF
R7050
10K

BOM_COST_GROUP=POWER

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/09/2013

PAGE TITLE

DC-In & Battery Connectors

Apple Inc.

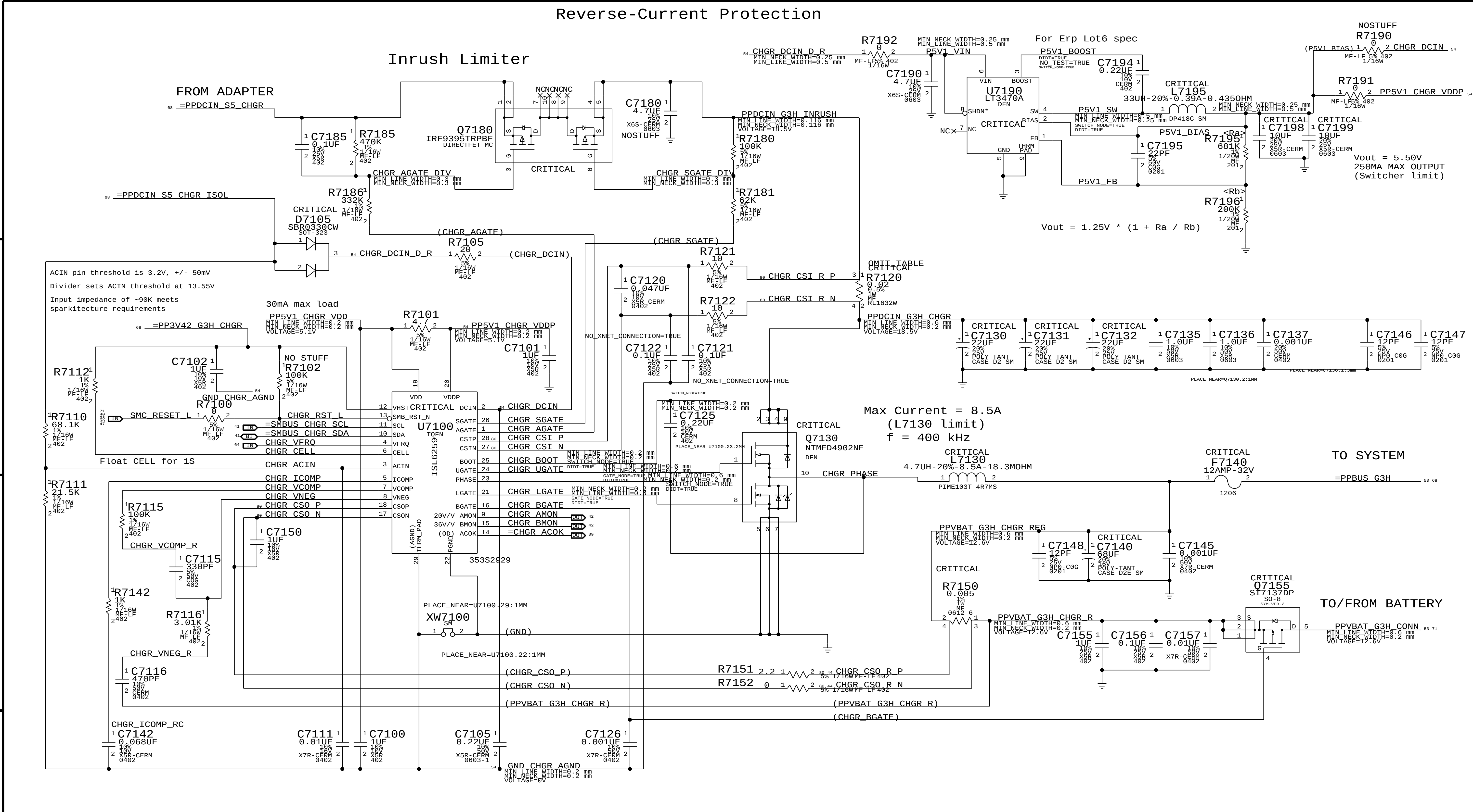
DRAWING NUMBER	SIZE
051-1573	D

REVISION 8.0.0

BRANCH dvt1

PAGE 70 OF 120

SHEET 53 OF 82



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
107S0387	1	RES,MTL FILM,1W,20MOHM,0.5%,0612,LF,BLK	R7120	CRITICAL	

BOM_COST_GROUP=POWER

SYNC_MASTER=AHARTMAN_J52 SYNC_DATE=11/06/2013

PAGE TITLE
PBus Supply & Battery Charger

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

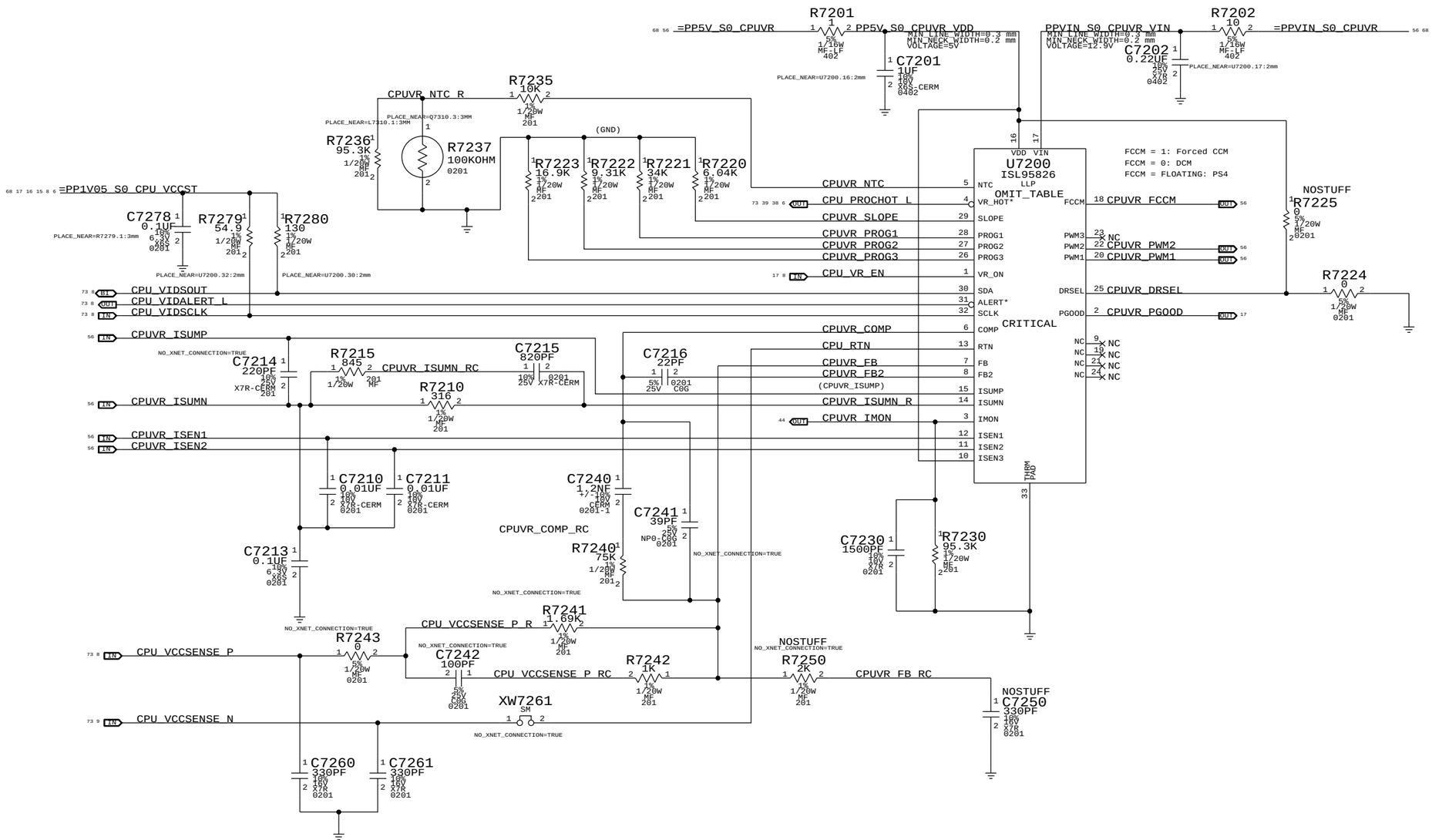
REVISION 8.0.0

BRANCH dvt1

PAGE 71 OF 120

SHEET 54 OF 82

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
353S00036	1	IC,ISL95826AS2378,PWM,PG,VR12.5/6,QFN-32	U7200	CRITICAL	



BOM_COST_GROUP=POWER

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE

CPU VR12.6 VCC Regulator IC

Apple Inc.

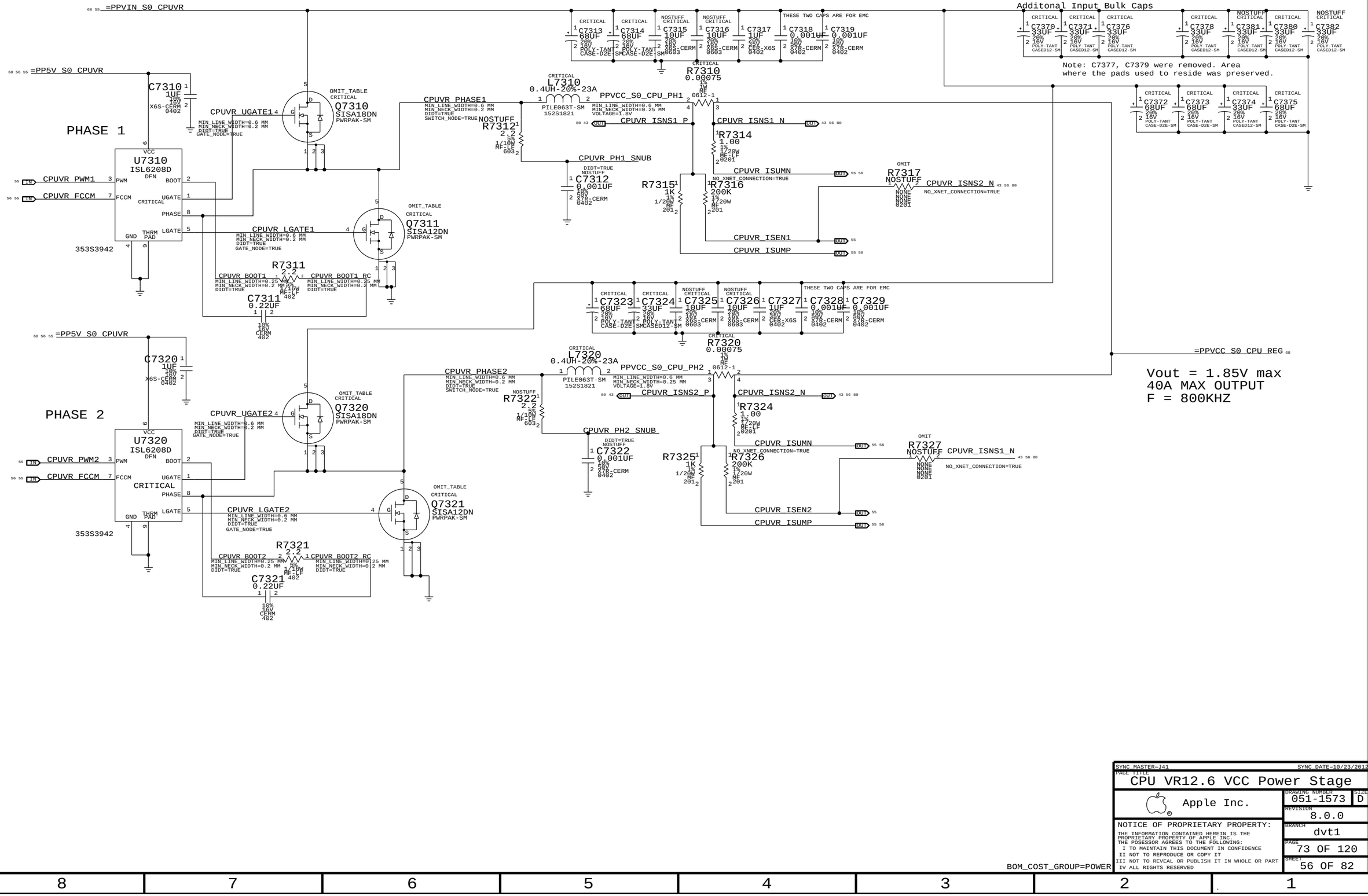
DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 72 OF 120

SHEET 55 OF 82



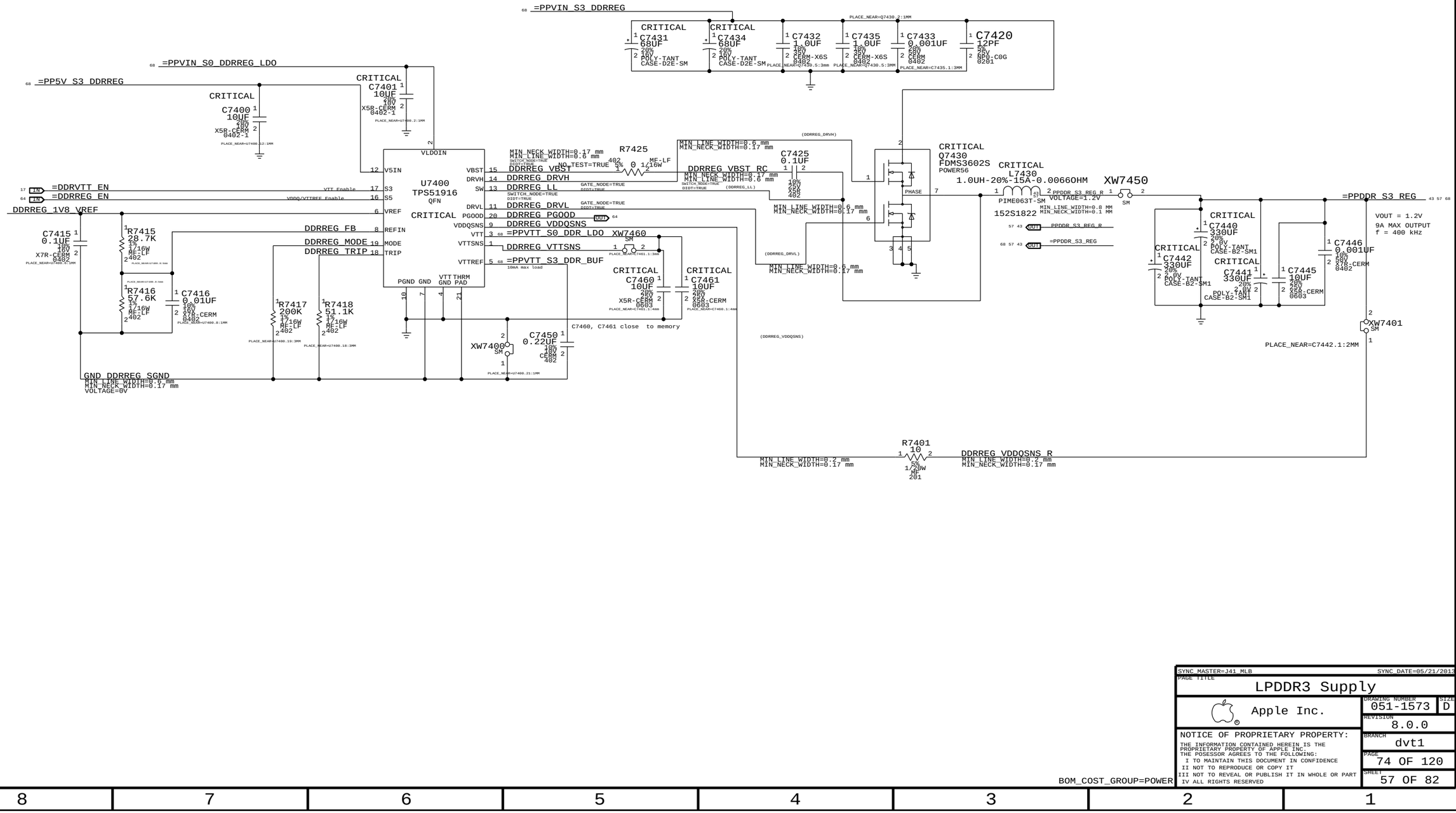
SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE
CPU VR12.6 VCC Power Stage

Apple Inc.

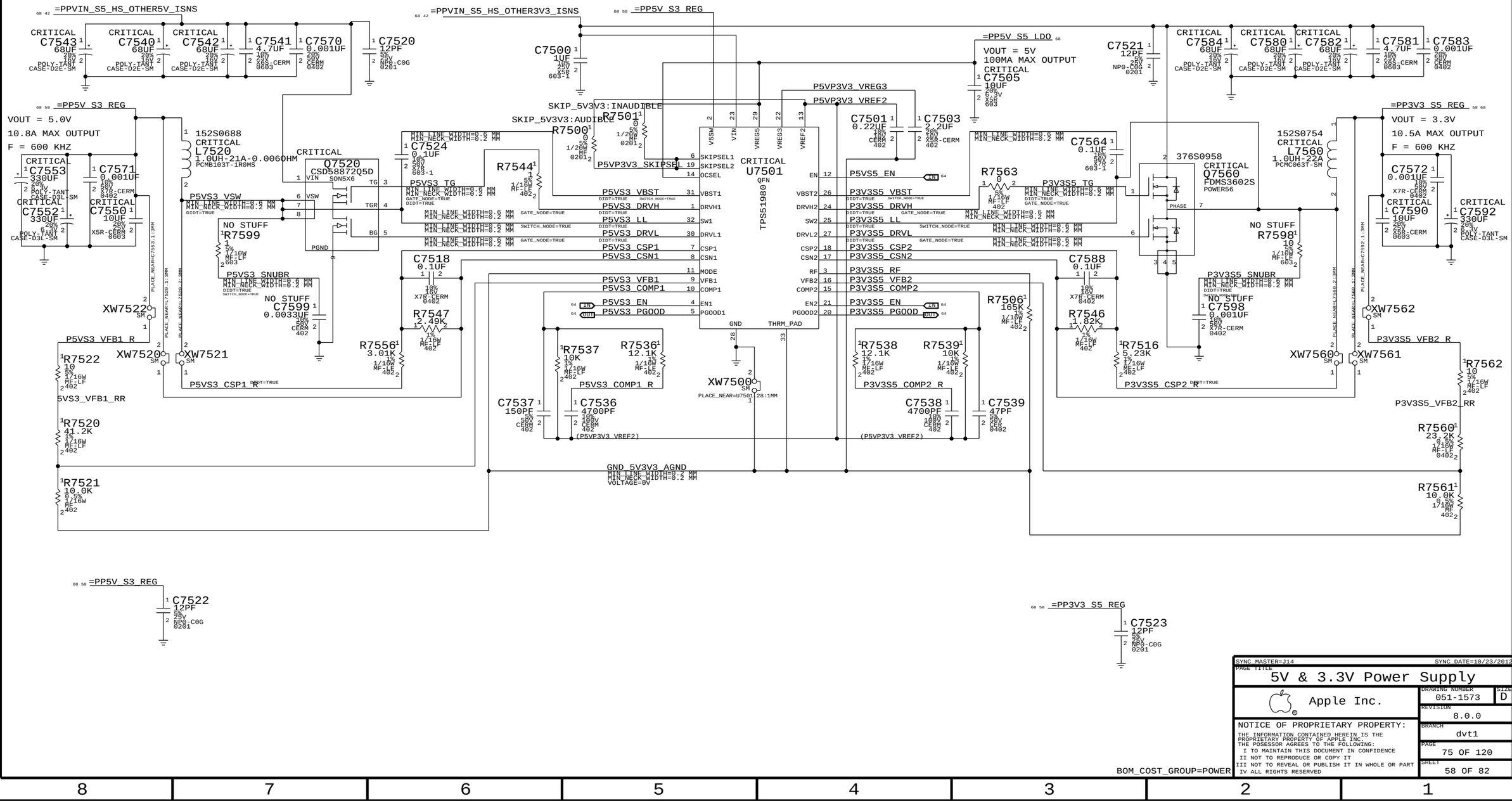
DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 73 OF 120
SHEET 56 OF 82

1.2V S3 Regulator



SYNC_MASTER=J41_MLB	SYNC_DATE=05/21/2013
PAGE TITLE	LPDDR3 Supply
Apple Inc.	DRAWING NUMBER 051-1573 · SIZE D
	REVISION 8.0.0
	BRANCH dvt1
	PAGE 74 OF 120
	SHEET 57 OF 82

BOM_COST_GROUP=POWER



SYNC_MASTER=J14 SYNC_DATE=10/23/2012

PAGE TITLE: 5V & 3.3V Power Supply

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

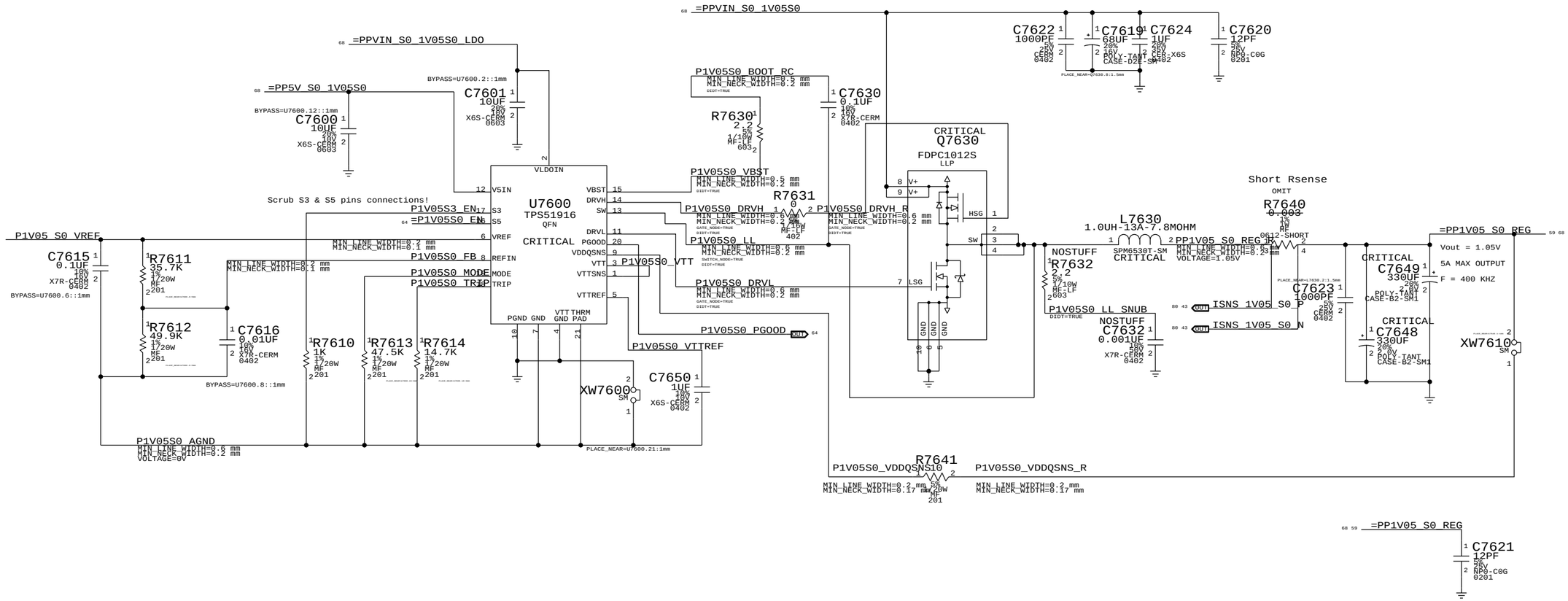
REVISION: 8.0.0

BRANCH: dvt1

PAGE: 75 OF 120

SHEET: 58 OF 82

1.05V S0 Regulator



SYNC_MASTER=AHARTMAN_J52	SYNC_DATE=10/29/2013
PAGE TITLE	1.05V Power Supply
Apple Inc.	DRAWING NUMBER 051-1573 · SIZE D
	REVISION 8.0.0
	BRANCH dvt1
	PAGE 76 OF 120
	SHEET 59 OF 82

BOM_COST_GROUP=POWER

Page Notes

Power aliases required by this page:

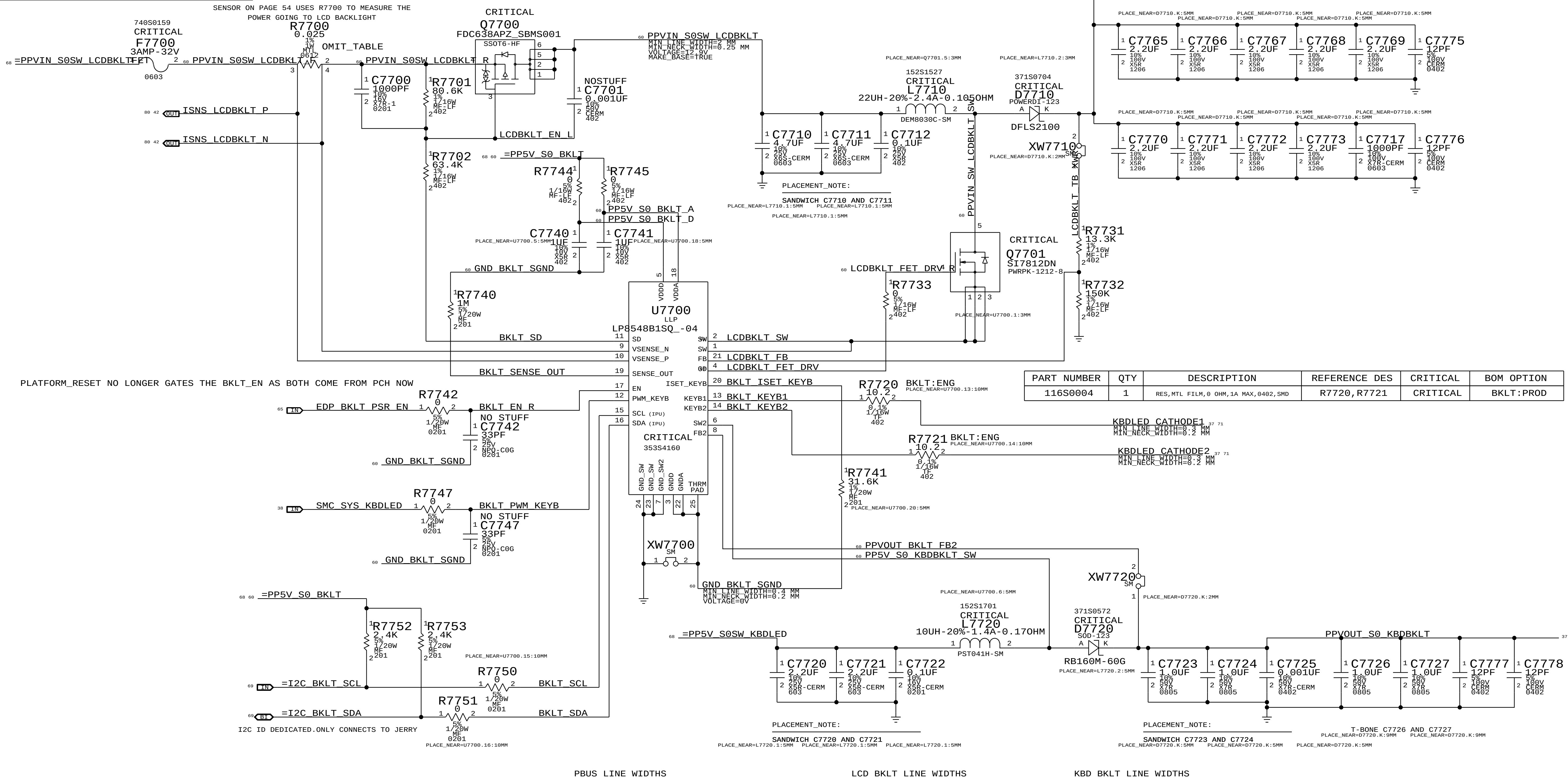
- =PPVIN_S0SW_LCDBKLTFET (9-12.6V LCD BACKLIGHT INPUT)
- =PP5V_S0_BKLT (5V BACKLIGHT DRIVER INPUT)
- =PP5V_S0SW_KBDLED (5V KEYBOARD BACKLIGHT INPUT)

BOM options provided by this page:

BKLT:ENG - Stuffs 10.2 ohm series R for engineering builds

BKLT:PROD - Stuffs 0 ohm series R for production

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
107S0386	1	RES,MTL FILM,1W,25MOHM,1%,4TERM,0612,BLK	R7700	CRITICAL	



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0004	1	RES,MTL FILM,0 OHM,1A MAX,0402,SMD	R7720,R7721	CRITICAL	BKLT:PROD

SYNC_MASTER=SHART_J44 SYNC_DATE=11/20/2012

PAGE TITLE

LCD & KBD Backlight Driver

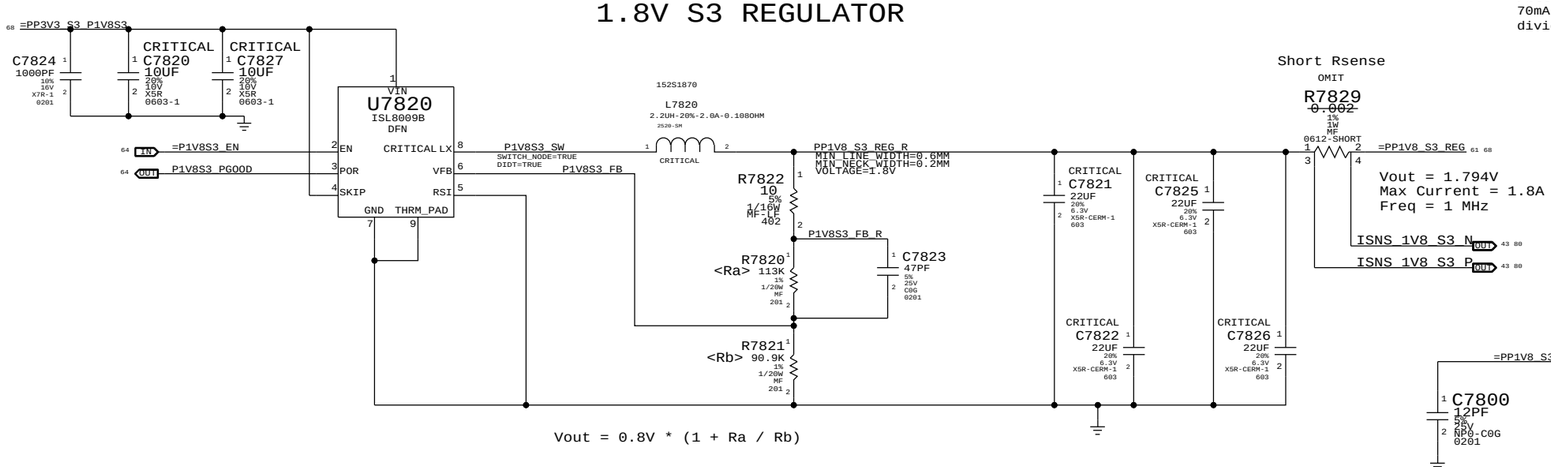
Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

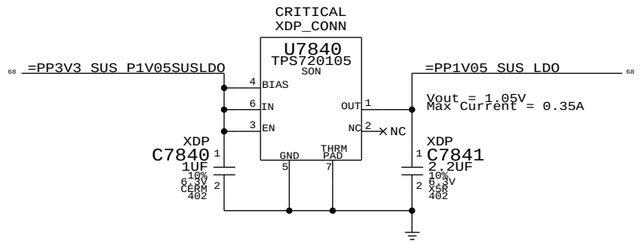
BRANCH dvt1

1.8V S3 REGULATOR

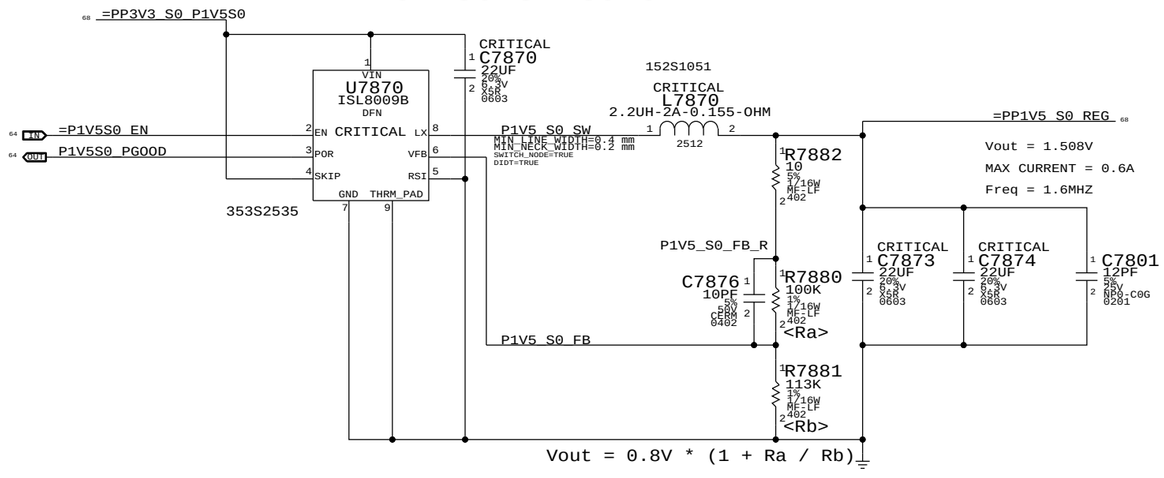


1.05V SUS LDO

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 Switcher



BOM_COST_GROUP=POWER

SYNC_MASTER=AHARTMAN_J52 SYNC_DATE=11/06/2013

PAGE TITLE: Misc Power Supplies

Apple Inc.

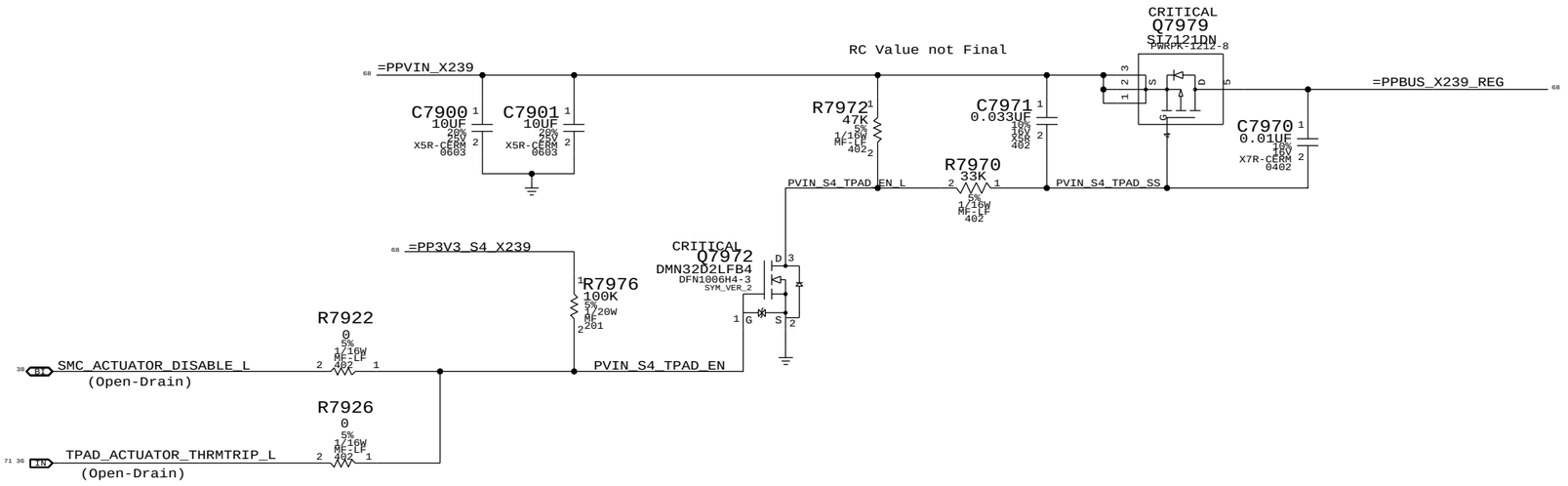
DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 78 OF 120

SHEET: 61 OF 82



SYNC_MASTER=AHARTMAN_J52 SYNC_DATE=11/06/2013

PAGE TITLE: X239 Power Supply

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

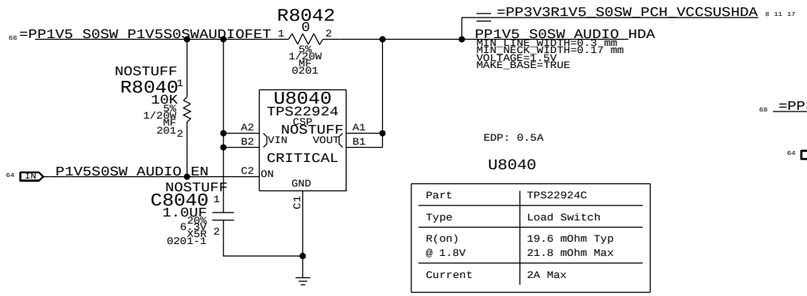
PAGE: 79 OF 120

SHEET: 62 OF 82

BOM_COST_GROUP=TRACKPAD

1.5V S0 Audio Switch (BYPASSED)

Loading specs per J41/43_PowerBudget_Riviera_rev0.99e

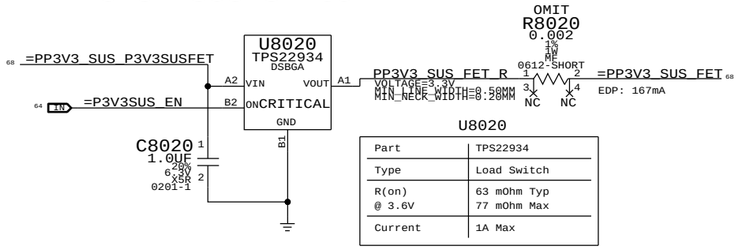


EDP: 0.5A

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

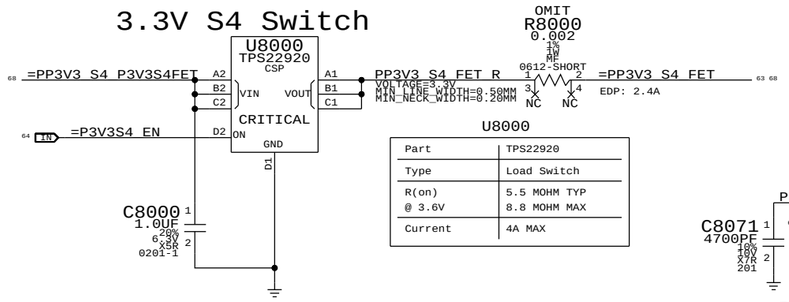


EDP: 167mA

U8020

Part	TPS22934
Type	Load Switch
R(on) @ 3.6V	63 mOhm Typ 77 mOhm Max
Current	1A Max

3.3V S4 Switch

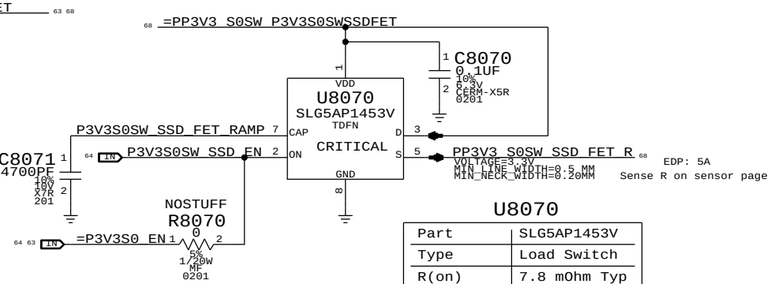


EDP: 2.4A

U8000

Part	TPS22920
Type	Load Switch
R(on) @ 3.6V	5.5 MOHM TYP 8.8 MOHM MAX
Current	4A MAX

3.3V SSD Switch



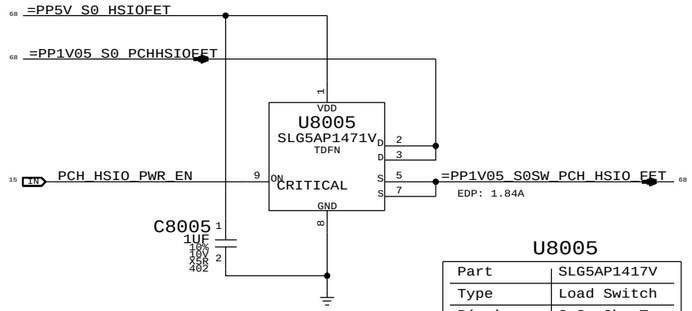
EDP: 5A

Sense R on sensor page

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

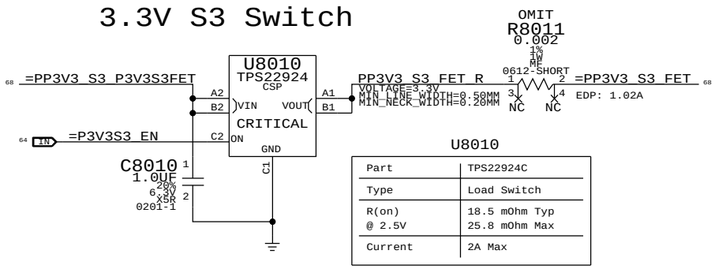


EDP: 1.84A

U8005

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

3.3V S3 Switch

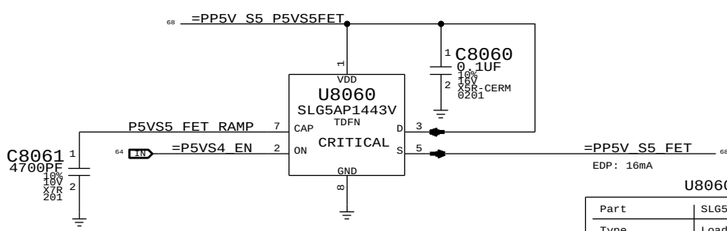


EDP: 1.02A

U8010

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

5V S4 Switch



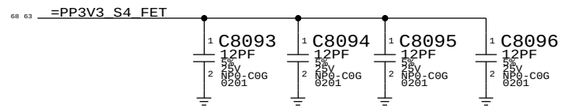
EDP: 16mA

U8060

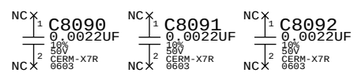
Part	SLG5AP1443V
Type	Load Switch
R(on)	17 mOhm Typ 19 mOhm Max
Current	2.5A

REMOVED THE ANALOG POWER GATE AS SLG5AP1471 SHOULD BE AVAILABLE BY THEN

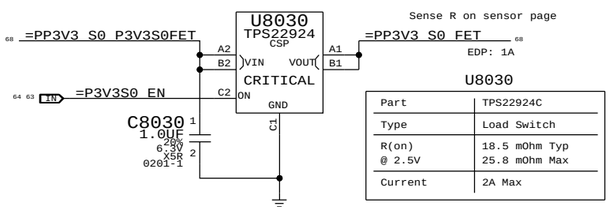
CAPACITORS ADDED FOR NOISE FLOOR REASONS:



Placement Note: Place C8090, C8091 and C8092 near U8000



3.3V S0 Switch

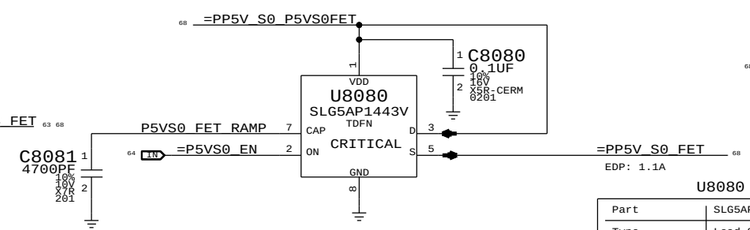


EDP: 1A

U8030

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

5V S0 Switch

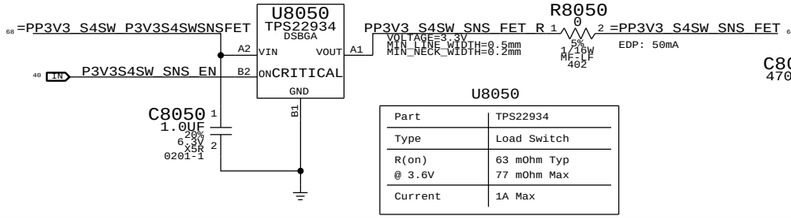


EDP: 1.1A

U8080

Part	SLG5AP1443V
Type	Load Switch
R(on)	17 mOhm Typ 19 mOhm Max
Current	2.5A

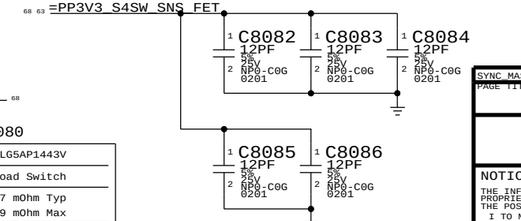
3.3V Sensor Switch



EDP: 50mA

U8050

Part	TPS22934
Type	Load Switch
R(on) @ 3.6V	63 mOhm Typ 77 mOhm Max
Current	1A Max



BOM_COST_GROUP=POWER

SYNC_MASTER=J41 SYNC_DATE=10/23/2012

PAGE TITLE

Power FETs

Apple Inc.

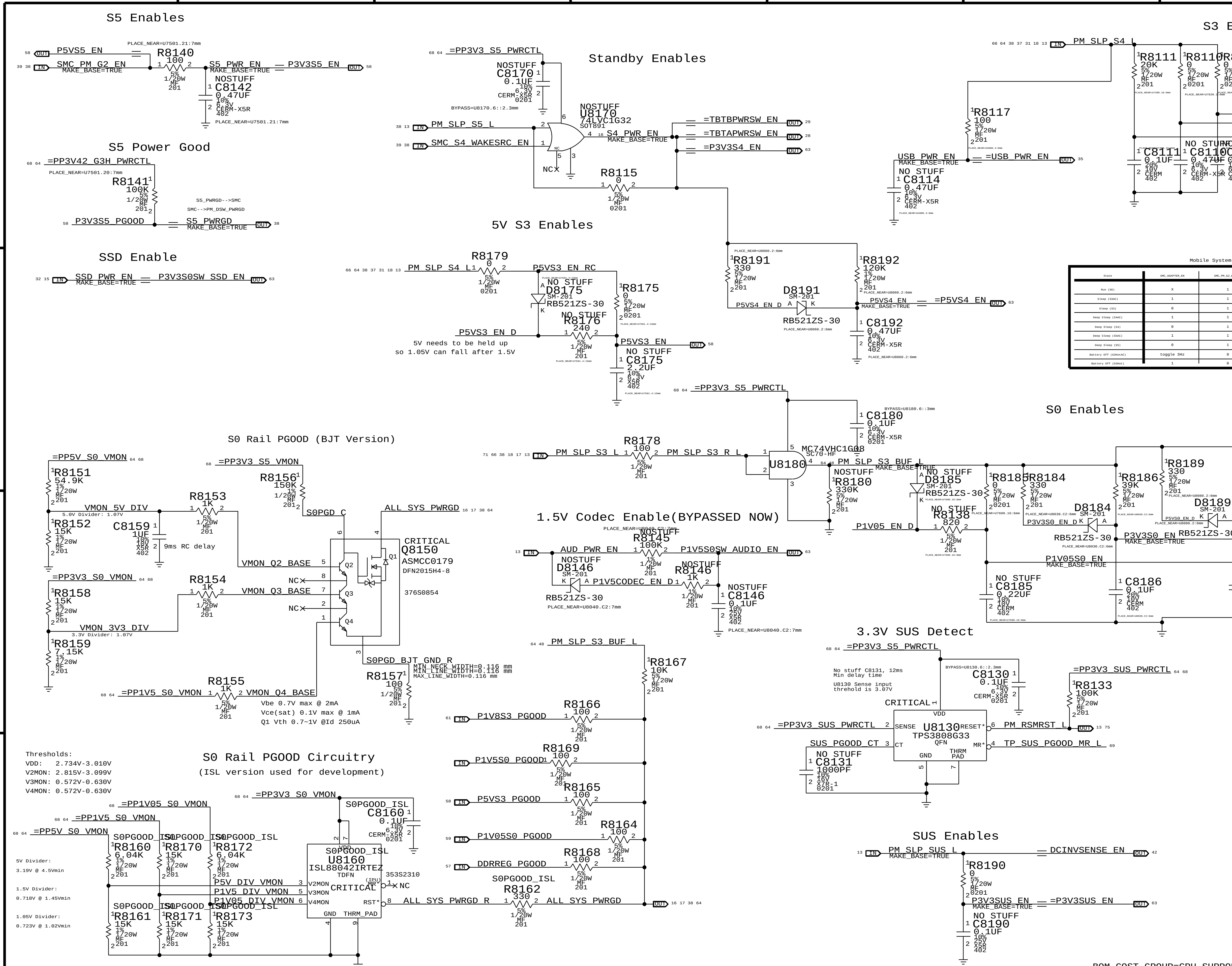
DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 80 OF 120

SHEET 63 OF 82



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

SYNC_MASTER=AHARTMAN_J52 SYNC_DATE=11/06/2013

PAGE TITLE

Power Control

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

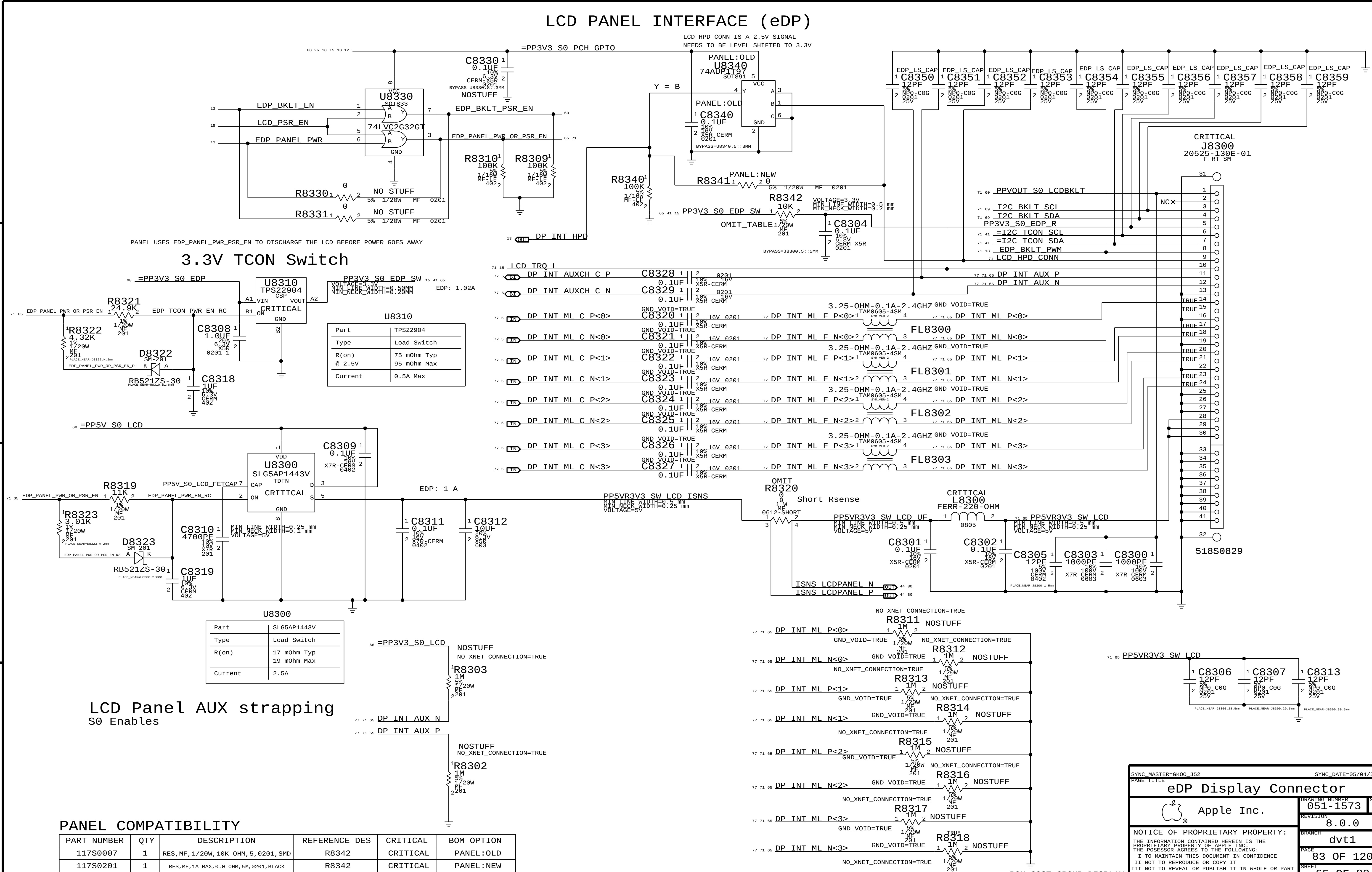
REVISION 8.0.0

BRANCH dvt1

PAGE 81 OF 120

SHEET 64 OF 82

LCD PANEL INTERFACE (eDP)



Part	TPS22904
Type	Load Switch
R(on) @ 2.5V	75 mOhm Typ 95 mOhm Max
Current	0.5A Max

U8310

Part	SLG5AP1443V
Type	Load Switch
R(on)	17 mOhm Typ 19 mOhm Max
Current	2.5A

U8300

PANEL COMPATIBILITY

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0007	1	RES,MF,1/20W,10K OHM,5,0201,SMD	R8342	CRITICAL	PANEL:OLD
117S0201	1	RES,MF,1A MAX,0.0 OHM,5%,0201,BLACK	R8342	CRITICAL	PANEL:NEW

SYNC_MASTER=GKOO_J52 SYNC_DATE=05/04/2014

PAGE TITLE: eDP Display Connector

Apple Inc.

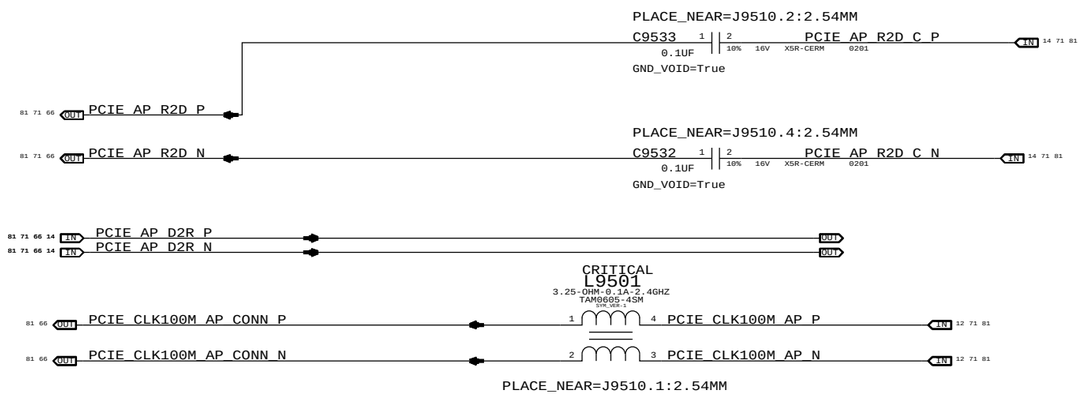
DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

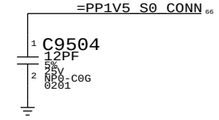
BRANCH: dvt1

PAGE: 83 OF 120

SHEET: 65 OF 82

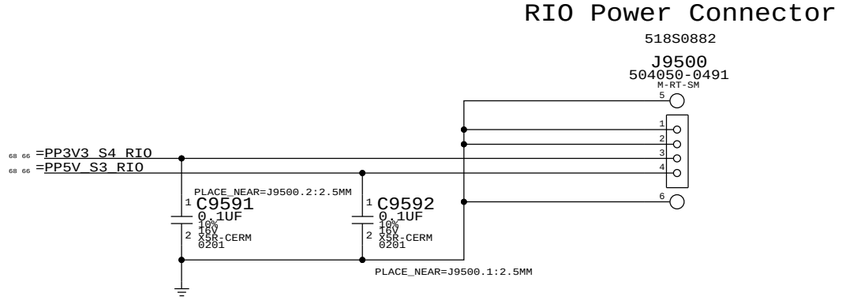


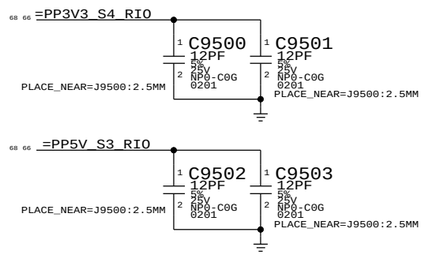
RIO FLEX CONNECTOR

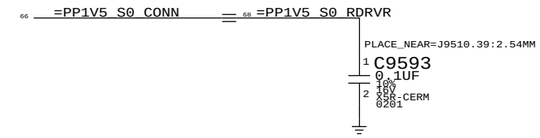


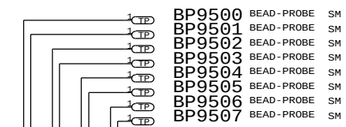
NOTE: This connector is shielded 70P Hirose Plug APN 516S1059, mates with APN 516S1058.

RIO Power Connector









MAKE BASE

=HDMI_DATA_C_P<2>	TRUE	HDMI_IG_DATA_C_P<2>	67 71 77
=HDMI_DATA_C_N<2>	TRUE	HDMI_IG_DATA_C_N<2>	67 71 77
=HDMI_DATA_C_P<1>	TRUE	HDMI_IG_DATA_C_P<1>	67 71 77
=HDMI_DATA_C_N<1>	TRUE	HDMI_IG_DATA_C_N<1>	67 71 77
=HDMI_DATA_C_P<0>	TRUE	HDMI_IG_DATA_C_P<0>	67 71 77
=HDMI_DATA_C_N<0>	TRUE	HDMI_IG_DATA_C_N<0>	67 71 77
=HDMI_CLK_C_LS_P	TRUE	HDMI_IG_CLK_C_P	67 71 77
=HDMI_CLK_C_LS_N	TRUE	HDMI_IG_CLK_C_N	67 71 77
=USB_BT_P	TRUE	USB_BT_CONN_P	31 74
=USB_BT_N	TRUE	USB_BT_CONN_N	31 74
=PCIE_CLK100M_AP_P	TRUE	PCIE_CLK100M_AP_CONN_P	66 81
=PCIE_CLK100M_AP_N	TRUE	PCIE_CLK100M_AP_CONN_N	66 81
I2C_HDMIRDRV_SCL_CONN		=I2C_HDMIRDRV_SCL	41
I2C_HDMIRDRV_SDA_CONN		=I2C_HDMIRDRV_SDA	41
HDMI_DDC_LS_CLK	TRUE	HDMI_IG_DDC_CLK	67
HDMI_DDC_LS_DATA	TRUE	HDMI_IG_DDC_DATA	67
I2C_X29THMSNS_SCL_CONN		=I2C_X29THMSNS_SCL	41
I2C_X29THMSNS_SDA_CONN		=I2C_X29THMSNS_SDA	41
SDCONN_STATE_CHANGE_SAK_L	TRUE	SDCONN_STATE_CHANGE_RIO	18
USB3_SD_D2R_N	TRUE	USB3RPCIE_SD_D2R_P	14 71 74
USB3_SD_D2R_P	TRUE	USB3RPCIE_SD_D2R_N	14 71 74
USB3_SD_R2D_C_N	TRUE	USB3RPCIE_SD_R2D_C_P	14 74
USB3_SD_R2D_C_P	TRUE	USB3RPCIE_SD_R2D_C_N	14 74
=PCIE_WAKE_L	TRUE	AP_PCIE_WAKE_L	31 75

MAKE BASE FOR I2C IS ON I2C PAGE

MAKE BASE FOR I2C IS ON I2C PAGE

BOM_COST_GROUP=IO PORTS

SYNC_MASTER=GKOO_J52 SYNC_DATE=05/01/2014

PAGE TITLE: RIO Connector

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

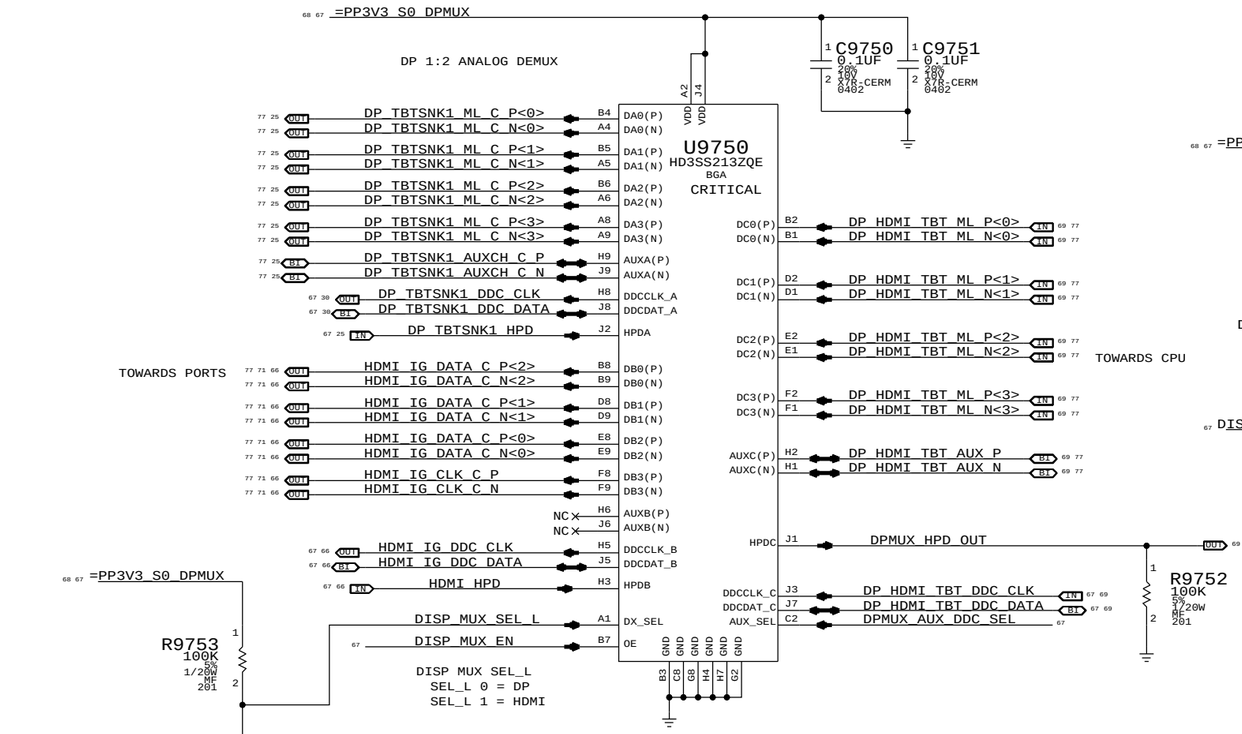
REVISION: 8.0.0

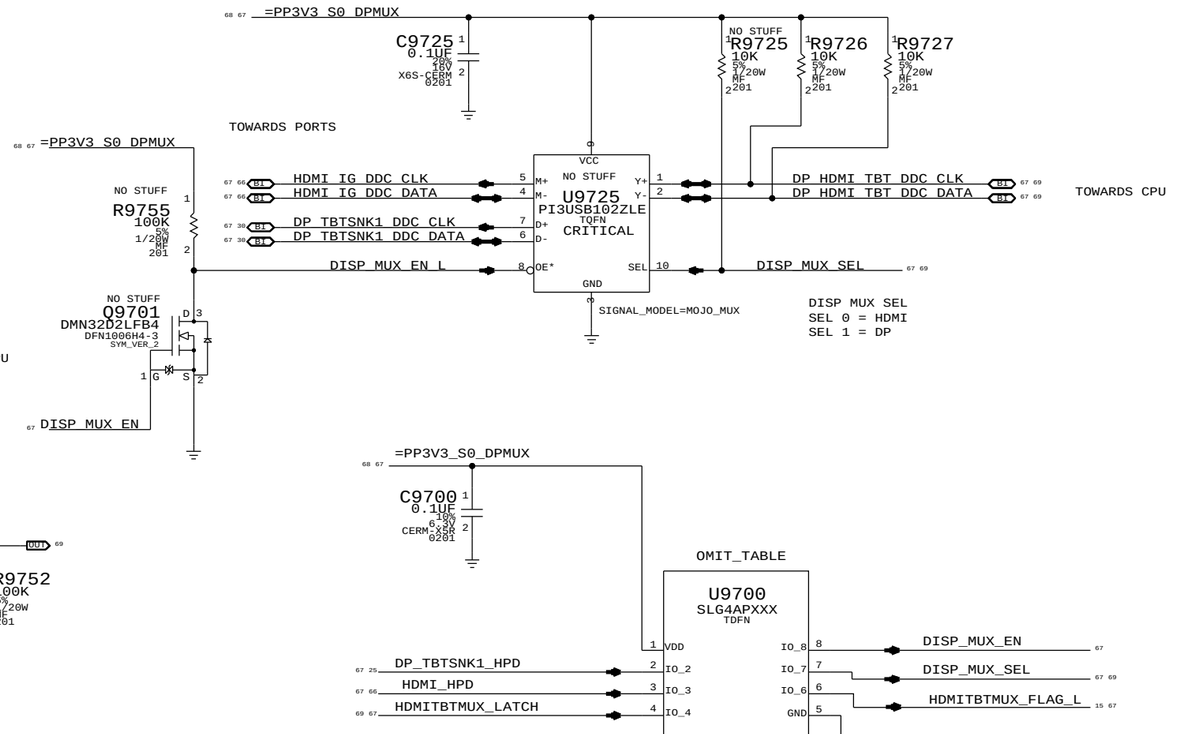
BRANCH: dvt1

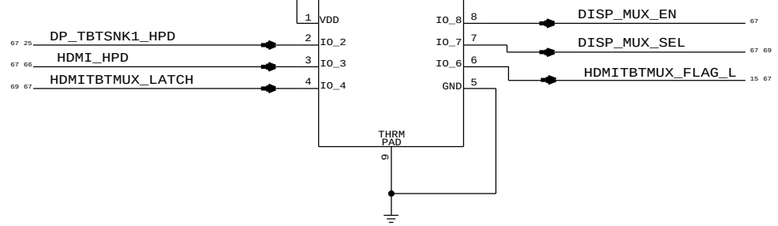
PAGE: 95 OF 120

SHEET: 66 OF 82

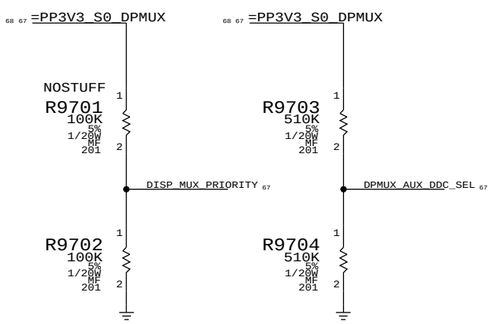
DISPLAY MUX: DP OR HDMI

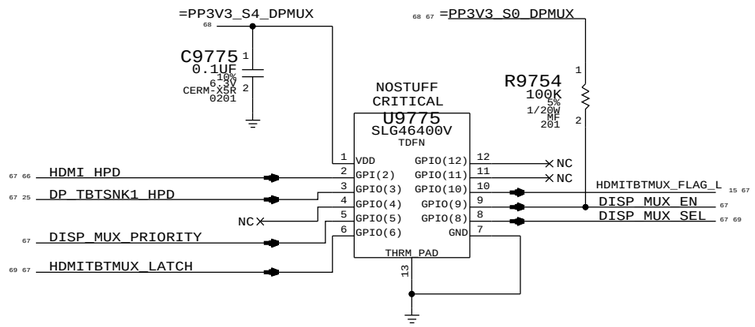






PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
343S0666	1	IC, SAK,AP4179,DP MUX CTRLR,TDFN-8	U9700	CRITICAL	





BOM_COST_GROUP=TBT

SYNC_MASTER=SRAMAN_J44 SYNC_DATE=01/29/2013

PAGE TITLE: Display Mux: HDMI vs DP

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 97 OF 120

SHEET: 67 OF 82

"G3Hot" (Always-Present) Rails

=PPBUS_G3H
PPBUS_G3H
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=8.6V
MAKE_BASE=TRUE
=PPVIN_S0SW_LCDBKLTFET
=PPBUS_S0_VSENSE
=PPVIN_SW_TBTBST
=PPVIN_S5_HS_COMPUTING_ISNS_R
=PPVIN_S5_HS_OTHER5V_ISNS_R
=PPVIN_S5_HS_OTHER3V3_ISNS_R
=PPVIN_X239

=PPVIN_S5_HS_COMPUTING_ISNS
PPBUS_S5_HS_COMPUTING
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=8.6V
MAKE_BASE=TRUE
=PPVIN_S0_CPUVR
=PPVIN_S3_DDRREG
=PPVIN_S0_1V05S0

=PPVIN_S5_HS_OTHER5V_ISNS
PPBUS_S5_HS_OTHER5V
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=8.6V MAKE_BASE=TRUE

=PPVIN_S5_HS_OTHER3V3_ISNS
PPBUS_S5_HS_OTHER3V3
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=8.6V MAKE_BASE=TRUE

=PPBUS_X239_REG
PPBUS_S4_X239
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=12.6V MAKE_BASE=TRUE
=PPVIN_X239_PBUS_ISNS_R

=PPVIN_X239_PBUS_ISNS
PPVIN_S4_TPAD
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=8.6V MAKE_BASE=TRUE
=PPVIN_S4_TPAD

=PP18V5_DCIN_ISOL
PPDCIN_G3H_ISOL
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.5 MM
VOLTAGE=18.5V MAKE_BASE=TRUE
=PPDCIN_S5_CHGR_ISOL
=PPDCIN_S5_VSENSE

=PP18V5_DCIN_CONN
PPDCIN_G3H
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.25 MM
VOLTAGE=18.5V
MAKE_BASE=TRUE
=PPDCIN_S5_CHGR

=PP3V42_G3H_REG
PP3V42_G3H
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=3.42V
MAKE_BASE=TRUE
=PP3V3_G3H_T112
=PP3V3_S5_SMC
=PP3V42_G3H_HALL
=PP3V42_G3H_CHGR
=PP3V42_G3H_PWRCTL
=PP3V42_G3H_SMBUS_SMC_5
=PP3V42_G3H_SMCUSBMUX
=PP3V42_G3H_TPAD
=PPVIN_S5_SMCVREF
=PPVBAT_G3H_SYSCLK
=PP3V42_G3H_ONEWIREPROT
=PP3V42_G3H_SSDSAK
=PP3V42_G3H_CSPWRGD
=PP3V42_G3H_X239_COFET_EN

=PPVRTC_G3_OUT
PPVRTC_G3H
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=3V
MAKE_BASE=TRUE
=PPVRTC_G3_PCH

5V Rails

=PP5V_S5_LDO
PP5V_S5
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=5V
MAKE_BASE=TRUE
=PP5V_S5_P5VS5FET

=PP5V_S5_FET
PP5V_S4
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=5V
MAKE_BASE=TRUE
=PP5V_S4_TPAD

=PP5V_S3_REG
PP5V_S3
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.175 MM
VOLTAGE=5V
MAKE_BASE=TRUE
=PP5V_S3_ALSCAM
=PP5V_S3_LTUSB
=PP5V_S3_RIO
=PP5V_S0_P5VS0FET
=PP5V_S0_1V05S0
=PP5V_S0_AUDIO_AMP
=PP5V_S0_LCD
=PP5V_S3_DDRREG

=PP5V_S0_ISNS
PP5V_S0
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=5V
MAKE_BASE=TRUE
=PP5V_S0_LPCPLUS
=PP5V_S0_CPUVR
=PP5V_S0_VMON
=PP5V_S0_PCH_STRAP
=PP5V_S0_XDPJTAGISOL
=PP5V_S0_FAN
=PP5V_S0_BKLT
=PP5V_S0SW_KBDLED
=PP5V_S0_ALSCAM
=PP5V_S0_HSIOFET

3.3V Rails

=PP3V3_S5_REG
PP3V3_S5
MIN_LINE_WIDTH=0.2 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S0SW_P3V3S0SWSSDFET
=PP3V3_S4_TBTBPWRSW
=PP3V3_S0_P3V3S0FET
=PP3V3_S3_P3V3S3FET
=PP3V3_S4_P3V3S4FET
=PP3V3_S5_DBGLEDS
=PP3V3_SUS_P3V3SUSFET
=PP3V3_S5_CSPWRGD
=PP3V3_S5_PCH_VCCDSW
=PP3V3_S5_PWRCTL
=PP3V3_S5_SYSCLK
=PP3V3_S5_VMON
=PP3V3_S5_PCH_GPIO
=PP3V3_S4_TBTAPWRSW
=PP3V3_S4SW_P3V3S4SWSNSFET
=PP3V3_S5_XDPJTAGISOL
=PP3V3_S0_P1V5S0
=PP3V3_S5_WLAN
=PP3V3_S5_CAMPWREN
=PP3V3_S3_P1V8S3

=PP3V3_S4_FET
PP3V3_S4
MIN_LINE_WIDTH=0.20MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S4_SMC
=PP3V3_S4_TPAD
=PP3V3_S4_BT
=PP3V3_S4_TBT_ISNS_R
=PP3V3_S4_DPMUX
=PP3V3_S4_RIO
=PP3V3_S4_X239
=PP3V3_S4_SMBUS_SMC_2
=PP3V3_S4_CAMPWREN

=PP3V3_SUS_FET
PP3V3_SUS
MIN_LINE_WIDTH=0.20MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_SUS_ROM
=PP3V3_SUS_PCH_VCCSUS_GPIO
=PP3V3_SUS_PCH_VCCSUS_ICC
=PP3V3_SUS_PCH_VCC_SPI
=PP3V3_SUS_PWRCTL
=PP3V3_SUS_P1V05SUSLDO
=PP3V3_SUS_PCH_GPIO
=PP3V3_SUS_PCH_VCCSUS_RTC

=PP3V3_S3_FET
PP3V3_S3
MIN_LINE_WIDTH=0.20MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S3SW_SD_RESET
=PP3V3_S3_PCH_GPIO
=PP3V3_S3_SDBUF
=PP3V3_S3RS4_PCH_GPIO
=PP3V3_S3_SYSCLKGEN
=PP3V3_S3_CAMERA_R
=PP3V3_S3_TPAD

=PP3V3_S0_ISNS
PP3V3_S0
MIN_LINE_WIDTH=0.2 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S0_FAN
=PP3V3_S0_SMBUS_SMC_0
=PP3V3_S0_PCH_VCC3_3_GPIO
=PP3V3_S0_PCH_GPIO

=PP3V3_S0_AUDIO
=PP3V3_S0_AUDIO_DIG
=PP3V3_S0_PCH_VCCTS
=PP3V3_S0_DDCMUX
=PP3V3_S0_RSTBUF
=PP3V3_S0_DPMUX
=PP3V3_S0_SB_PM
=PP3V3_S0_EDP
=PP3V3_S0_SMBUS_PCH
=PP3V3_S0_LCD
=PP3V3_S0_SMBUS_SMC_1
=PP3V3_S0_SMC
=PP3V3R1V8_S0_PCH_VCCSDIO
=PP3V3_S0_VMON
=PP3V3_S0RTBTLC_PCH_GPIO
=PP3V3_S0_SYSCLKGEN
=PP3V3_S0_OOB1_PWRDN
=PP3V3_S0_MEM_VTTPWRCTL
=PP3V3_S0_SNS_BMON
=PP3V3_S0_HS_COMPUTING_ISNS
=PP3V3_S0_VRISNS
=PP3V3_S0_CAMERA_R
=PP3V3_S0_SMBUS_SMC_3
=PP3V3_S0_TPAD

=PP5V_S0_FET
PP5V_S0_FET
MIN_LINE_WIDTH=0.5MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=5V
MAKE_BASE=TRUE
=PP5V_S0_ISNS_R

=PP3V3_S0_FET
PP3V3_S0_FET
MIN_LINE_WIDTH=0.50MM
MIN_NECK_WIDTH=0.20MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
=PP3V3_S0_ISNS_R

PPVREF_S3_MEM_VREFDQ_A
PP0V6_S3_MEM_VREFDQ_A
MAKE_BASE=TRUE VOLTAGE=0.6V
PPVREF_S3_MEM_VREFCA
PP0V6_S3_MEM_VREFCA_A
MAKE_BASE=TRUE VOLTAGE=0.6V
PPVREF_S3_MEM_VREFDQ_B
PP0V6_S3_MEM_VREFDQ_B
MAKE_BASE=TRUE VOLTAGE=0.6V
PPVREF_S3_MEM_VREFCA
PP0V6_S3_MEM_VREFCA_B
MAKE_BASE=TRUE VOLTAGE=0.6V

=PP3V3_S4SW_SNS_FET
PP3V3_S4SW_SNS
MIN_LINE_WIDTH=0.20MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S4_HS_OTHER_ISNS
=PP3V3_S4_ISNS

PP3V3_S0SW_SSD_FET_R
PP3V3_S0SW_SSD_FET
MIN_LINE_WIDTH=0.5 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S0SW_SSD_ISNS_R

=PP3V3_S0SW_SSD_ISNS
PP3V3_S0SW_SSD
MIN_LINE_WIDTH=0.5 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S0SW_SSD

=PP3V3_S4_TBT_ISNS
PP3V3_S4_TBT
MIN_LINE_WIDTH=0.5 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S4_TBT

1.5V/1.2V/1.8V/1.05V RAILS

=PP1V2_S3_CPUDDR_ISNS
PP1V2_S3_CPUDDR
MIN_LINE_WIDTH=0.5MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=1.2V
MAKE_BASE=TRUE
=PPVMEMIO_S0_CPU

=PPDDR_S3_REG
PP1V2_S3
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=1.2V
MAKE_BASE=TRUE
=PP1V2_S3_MEM_VDDQ
=PPVIN_S0_DDRREG_LDO
=PP1V2_S3_CPUDDR_ISNS_R
=PP1V2_S3_MEM_VTTPWRCTL
=PPDDR_S3_MEMVREF
=PP1V2_S3_MEM_VDDCA
=PP1V2_S3_MEM_VDD2

=PP1V8_S3_REG
PP1V8_S3
MIN_LINE_WIDTH=0.5MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=1.8V
MAKE_BASE=TRUE
=PP1V8_S3_MEM

=PPVTT_S0_DDR_LDO
PP0V6_S0_DDRVTT
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=0.6V
MAKE_BASE=TRUE
=PP0V6_S0_MEM_VTT_A
=PP0V6_S0_MEM_VTT_B

=PPVTT_S3_DDR_BUF
PPVTTDDR_S3
MIN_LINE_WIDTH=0.3 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=0.6V
MAKE_BASE=TRUE

=PP1V05_SUS_LDO
PP1V05_SUS
MIN_LINE_WIDTH=0.4 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
MAKE_BASE=TRUE
=PP1V05_SUS_PCH_JTAG

=PP1V5_S0_REG
PP1V5_S0
MIN_LINE_WIDTH=0.3 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V5_S0SW_P1V5S0SWAUDIOFET
=PP1V5_S0_PCH_VCCTS
=PP1V5_S0_AUDIO
=PP1V5_S0_VMON
=PP1V5_S0_RDRVR

=PP1V05_S0_REG
? mA
PP1V05_S0
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
MAKE_BASE=TRUE
=PP1V05_S0M_PCH_VCCASW
=PP1V05_S0_PCH_VCC
=PP1V05_S0_PCHHSIOFET
=PP1V05_S0_PCH_PLLFILTERS
=PP1V05_S0_VMON
=PP1V05_S0_PCH_VCCIO_USB2
=PP1V05_S0_PCH_VCCCLK
=PP1V05_S0_CPU_VCCST
=PP1V05_S0_PCH_VCCIO_HSIO
=PPVIN_S0_1V05S0_LDO
=PP1V05_S0_SMC
=PP1V05_S0_XDP

=PP1V05_S0SW_PCH_HSIO_FET
1.84A
PP1V05_S0SW_PCH_HSIO
MIN_LINE_WIDTH=0.2 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
MAKE_BASE=TRUE
=PP1V05_S0SW_PCH_VCCHSIO
=PP1V05_S0SW_PCH_VCCPLL_HSIO

TBT RAILS (OFF WHEN NO CABLE)

PPVIN_SW_TBTBST
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=12.6V

=PP15V_TBT_REG
PP15V_TBT
MIN_LINE_WIDTH=0.4 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=15V
MAKE_BASE=TRUE
=PPHV_S4SW_TBTAPWRSW
=PPHV_S4SW_TBTBPWRSW

PP3V3_TBTLC
MIN_LINE_WIDTH=0.4 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
=PPVDDIO_TBTLC_CLK

CPU "VCORE" RAILS

=PPVCC_S0_CPU_REG
PPVCC_S0_CPU
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.25 MM
VOLTAGE=1.8V
MAKE_BASE=TRUE
=PPVCC_S0_CPU

Digital Ground

GND
VOLTAGE=0V
MIN_NECK_WIDTH=0.2MM
MIN_LINE_WIDTH=0.6MM

SYNC_MASTER=SHART_J44 SYNC_DATE=01/14/2013
PAGE TITLE
Power Aliases
Apple Inc.
DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 100 OF 120
SHEET 68 OF 82

HDMI VS TBT

MAKE_BASE

5	=DP_TBTSNK1_ML_C_P<0>	TRUE	DP_HDMI_TBT_ML_P<0>	67	77
5	=DP_TBTSNK1_ML_C_N<0>	TRUE	DP_HDMI_TBT_ML_N<0>	67	77
5	=DP_TBTSNK1_ML_C_P<1>	TRUE	DP_HDMI_TBT_ML_P<1>	67	77
5	=DP_TBTSNK1_ML_C_N<1>	TRUE	DP_HDMI_TBT_ML_N<1>	67	77
5	=DP_TBTSNK1_ML_C_P<2>	TRUE	DP_HDMI_TBT_ML_P<2>	67	77
5	=DP_TBTSNK1_ML_C_N<2>	TRUE	DP_HDMI_TBT_ML_N<2>	67	77
5	=DP_TBTSNK1_ML_C_P<3>	TRUE	DP_HDMI_TBT_ML_P<3>	67	77
5	=DP_TBTSNK1_ML_C_N<3>	TRUE	DP_HDMI_TBT_ML_N<3>	67	77
13	=DP_TBTSNK1_AUXCH_C_P	TRUE	DP_HDMI_TBT_AUX_P	67	77
13	=DP_TBTSNK1_AUXCH_C_N	TRUE	DP_HDMI_TBT_AUX_N	67	77
13	=DP_TBTSNK1_DDC_CLK	TRUE	DP_HDMI_TBT_DDC_CLK	67	
13	=DP_TBTSNK1_DDC_DATA	TRUE	DP_HDMI_TBT_DDC_DATA	67	
13	=DP_TBTSNK1_HPD	TRUE	DPMUX_HPD_OUT	67	

25	HDMITBTMUX_SEL_TBT MAKE_BASE=TRUE	=TBT_GO2SX_BIDIR		15
		DISP_MUX_SEL		67
13	DP_AUXCH_ISOL_L	HDMITBTMUX_LATCH MAKE_BASE=TRUE		67

EPD PANEL

MAKE_BASE

60	=I2C_BKLT_SCL	TRUE	I2C_BKLT_SCL	65	71
60	=I2C_BKLT_SDA	TRUE	I2C_BKLT_SDA	65	71

UNUSED SIGNALS

MAKE_BASE

12	TP_PCIE_CLK100M_FWP	TRUE	NO_TEST=TRUE	NC_PCIE_CLK100M_FWP	
12	TP_PCIE_CLK100M_FWN	TRUE	NO_TEST=TRUE	NC_PCIE_CLK100M_FWN	
14	TP_PCIE_FW_D2RP	TRUE	NO_TEST=TRUE	NC_PCIE_FW_D2RP	
14	TP_PCIE_FW_D2RN	TRUE	NO_TEST=TRUE	NC_PCIE_FW_D2RN	
14	TP_PCIE_FW_R2D_CP	TRUE	NO_TEST=TRUE	NC_PCIE_FW_R2D_CP	
14	TP_PCIE_FW_R2D_CN	TRUE	NO_TEST=TRUE	NC_PCIE_FW_R2D_CN	
12	TP_PCIE_CLK100M_ENETSDP	TRUE	NO_TEST=TRUE	NC_PCIE_CLK100M_ENETSDP	
12	TP_PCIE_CLK100M_ENETSDN	TRUE	NO_TEST=TRUE	NC_PCIE_CLK100M_ENETSDN	
14	TP_USB_IR_P	TRUE	NO_TEST=TRUE	NC_USB_IRP	74
14	TP_USB_IR_N	TRUE	NO_TEST=TRUE	NC_USB_IRN	74
14	TP_USB_CAMERAP	TRUE	NO_TEST=TRUE	NC_USB_CAMERAP	74
14	TP_USB_CAMERAN	TRUE	NO_TEST=TRUE	NC_USB_CAMERAN	74
14	TP_USB_SDP	TRUE	NO_TEST=TRUE	NC_USB_SDP	74
14	TP_USB_SDN	TRUE	NO_TEST=TRUE	NC_USB_SDN	74
12	TP_HDA_SDIN1	TRUE	NO_TEST=TRUE	NC_HDA_SDIN1	
13	TP_PCI_PME_L	TRUE	NO_TEST=TRUE	NC_PCI_PME_L	
14	TP_CLINK_CLK	TRUE	NO_TEST=TRUE	NC_CLINK_CLK	
14	TP_CLINK_DATA	TRUE	NO_TEST=TRUE	NC_CLINK_DATA	
14	TP_CLINK_RESET_L	TRUE	NO_TEST=TRUE	NC_CLINK_RESET_L	
12	TP_ITPXDP_CLK100MN	TRUE	NO_TEST=TRUE	NC_ITPXDP_CLK100MN	
12	TP_ITPXDP_CLK100MP	TRUE	NO_TEST=TRUE	NC_ITPXDP_CLK100MP	
12	TP_PCH_I2S1_TXD	TRUE	NO_TEST=TRUE	NC_PCH_I2S1_TXD	
12	TP_PCH_I2S1_SFRM	TRUE	NO_TEST=TRUE	NC_PCH_I2S1_SFRM	
12	TP_PCH_I2S1_SCLK	TRUE	NO_TEST=TRUE	NC_PCH_I2S1_SCLK	
13	TP_PCH_SLP_WLAN_L	TRUE	NO_TEST=TRUE	NC_PCH_SLP_WLAN_L	
13	TP_PCH_SLP_LAN_L	TRUE	NO_TEST=TRUE	NC_PCH_SLP_LAN_L	
14	TP_SPI_CS1_L	TRUE	NO_TEST=TRUE	NC_SPI_CS1_L	
14	TP_SPI_CS2_L	TRUE	NO_TEST=TRUE	NC_SPI_CS2_L	
14	TP_USB_5N	TRUE	NO_TEST=TRUE	NC_USB_5N	74
14	TP_USB_5P	TRUE	NO_TEST=TRUE	NC_USB_5P	74
48	TP_AUD_CODEC_MICBIAS1_L	TRUE	NO_TEST=TRUE	NC_AUD_CODEC_MICBIAS1_L	
48	TP_AUD_CODEC_MICBIAS1_R	TRUE	NO_TEST=TRUE	NC_AUD_CODEC_MICBIAS1_R	
48	TP_AUD_CODEC_MICBIAS2_L	TRUE	NO_TEST=TRUE	NC_AUD_CODEC_MICBIAS2_L	
48	TP_AUD_CODEC_MICBIAS2_R	TRUE	NO_TEST=TRUE	NC_AUD_CODEC_MICBIAS2_R	
64	TP_SUS_PGOOD_MR_L	TRUE	NO_TEST=TRUE	NC_SUS_PGOOD_MR_L	
	TP_SMC_TRST_L	TRUE	NO_TEST=TRUE	NC_SMC_TRST_L	
	TP_SMC_MD1	TRUE	NO_TEST=TRUE	NC_SMC_MD1	
53	TP_TDM_ONEWIRE_MPM	TRUE	NO_TEST=TRUE	NC_TDM_ONEWIRE_MPM	

GND
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=0V

Digital Ground

68 =PP5V_S0_AUDIO_AMP

XWA202
SM
1 2
PP5V_S0_AUDIO_AMP_L 50
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=5V

XWA203
SM
1 2
PP5V_S0_AUDIO_AMP_R 50
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=5V

TBT UNUSED NETS

25	TP_TBT_MONDC0	TRUE	NC_TBT_MONDC0
25	TP_TBT_MONDC1 MAKE_BASE=TRUE	TRUE	NC_TBT_MONDC1 MAKE_BASE=TRUE
25	TP_TBT_PCIE_RESET0_L MAKE_BASE=TRUE	TRUE	NC_TBT_PCIE_RESET0_L MAKE_BASE=TRUE
25	TP_TBT_XTAL25OUT MAKE_BASE=TRUE	TRUE	NC_TBT_XTAL25OUT MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CP<3>	TRUE	NC_DP_TBTSRC_ML_CP<3> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CN<3>	TRUE	NC_DP_TBTSRC_ML_CN<3> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CP<2>	TRUE	NC_DP_TBTSRC_ML_CP<2> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CN<2>	TRUE	NC_DP_TBTSRC_ML_CN<2> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CP<1>	TRUE	NC_DP_TBTSRC_ML_CP<1> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CN<1>	TRUE	NC_DP_TBTSRC_ML_CN<1> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CP<0>	TRUE	NC_DP_TBTSRC_ML_CP<0> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_ML_CN<0>	TRUE	NC_DP_TBTSRC_ML_CN<0> MAKE_BASE=TRUE
25	TP_DP_TBTSRC_AUXCH_CP	TRUE	NC_DP_TBTSRC_AUXCH_CP MAKE_BASE=TRUE
25	TP_DP_TBTSRC_AUXCH_CN	TRUE	NC_DP_TBTSRC_AUXCH_CN MAKE_BASE=TRUE

SYNC_MASTER=SHART_J44 SYNC_DATE=11/19/2012

PAGE TITLE
Signal Aliases

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D
REVISION 8.0.0
BRANCH dvt1
PAGE 102 OF 120
SHEET 69 OF 82

LPDDR3 COMMAND/ADDRESS

		MAKE_BASE		
=MEM_A_A<5>		TRUE	MEM_A_CAA<0>	20 24 76
=MEM_A_A<9>		TRUE	MEM_A_CAA<1>	20 24 76
=MEM_A_A<6>		TRUE	MEM_A_CAA<2>	20 24 76
=MEM_A_A<8>		TRUE	MEM_A_CAA<3>	20 24 76
=MEM_A_A<7>		TRUE	MEM_A_CAA<4>	20 24 76
=MEM_A_BA<2>		TRUE	MEM_A_CAA<5>	20 24 76
=MEM_A_A<12>		TRUE	MEM_A_CAA<6>	20 24 76
=MEM_A_A<11>		TRUE	MEM_A_CAA<7>	20 24 76
=MEM_A_A<15>		TRUE	MEM_A_CAA<8>	20 24 76
=MEM_A_A<14>		TRUE	MEM_A_CAA<9>	20 24 76
=MEM_A_A<13>		TRUE	MEM_A_CAB<0>	21 24 76
=MEM_A_CAS_L		TRUE	MEM_A_CAB<1>	21 24 76
=MEM_A_WE_L		TRUE	MEM_A_CAB<2>	21 24 76
=MEM_A_RAS_L		TRUE	MEM_A_CAB<3>	21 24 76
=MEM_A_BA<0>		TRUE	MEM_A_CAB<4>	21 24 76
=MEM_A_A<2>		TRUE	MEM_A_CAB<5>	21 24 76
=MEM_A_BA<1>		TRUE	MEM_A_CAB<6>	21 24 76
=MEM_A_A<10>		TRUE	MEM_A_CAB<7>	21 24 76
=MEM_A_A<1>		TRUE	MEM_A_CAB<8>	21 24 76
=MEM_A_A<0>		TRUE	MEM_A_CAB<9>	21 24 76
=MEM_A_ODT<0>		TRUE	MEM_A_ODT<0>	20 21 24 76
=MEM_A_A<3>		TRUE	TP_LPDDR3_RSVD1	
=MEM_A_A<4>		TRUE	TP_LPDDR3_RSVD2	
=MEM_B_A<5>		TRUE	MEM_B_CAA<0>	22 24 76
=MEM_B_A<9>		TRUE	MEM_B_CAA<1>	22 24 76
=MEM_B_A<6>		TRUE	MEM_B_CAA<2>	22 24 76
=MEM_B_A<8>		TRUE	MEM_B_CAA<3>	22 24 76
=MEM_B_A<7>		TRUE	MEM_B_CAA<4>	22 24 76
=MEM_B_BA<2>		TRUE	MEM_B_CAA<5>	22 24 76
=MEM_B_A<12>		TRUE	MEM_B_CAA<6>	22 24 76
=MEM_B_A<11>		TRUE	MEM_B_CAA<7>	22 24 76
=MEM_B_A<15>		TRUE	MEM_B_CAA<8>	22 24 76
=MEM_B_A<14>		TRUE	MEM_B_CAA<9>	22 24 76
=MEM_B_A<13>		TRUE	MEM_B_CAB<0>	23 24 76
=MEM_B_CAS_L		TRUE	MEM_B_CAB<1>	23 24 76
=MEM_B_WE_L		TRUE	MEM_B_CAB<2>	23 24 76
=MEM_B_RAS_L		TRUE	MEM_B_CAB<3>	23 24 76
=MEM_B_BA<0>		TRUE	MEM_B_CAB<4>	23 24 76
=MEM_B_A<2>		TRUE	MEM_B_CAB<5>	23 24 76
=MEM_B_BA<1>		TRUE	MEM_B_CAB<6>	23 24 76
=MEM_B_A<10>		TRUE	MEM_B_CAB<7>	23 24 76
=MEM_B_A<1>		TRUE	MEM_B_CAB<8>	23 24 76
=MEM_B_A<0>		TRUE	MEM_B_CAB<9>	23 24 76
=MEM_B_ODT<0>		TRUE	MEM_B_ODT<0>	22 23 24 76
=MEM_B_A<3>		TRUE	TP_LPDDR3_RSVD3	
=MEM_B_A<4>		TRUE	TP_LPDDR3_RSVD4	

UNUSED MEMORY SIGNALS

		MAKE_BASE		
=MEM_RESET_L		TRUE	TP_CPU_MEM_RESET_L	6

Memory Bit/Byte Swizzle

TRUE			TRUE		
MEM_A_DQ<0>		=MEM_A_DQ<7>	MEM_B_DQ<0>		=MEM_B_DQ<7>
MEM_A_DQ<1>		=MEM_A_DQ<6>	MEM_B_DQ<1>		=MEM_B_DQ<6>
MEM_A_DQ<2>		=MEM_A_DQ<5>	MEM_B_DQ<2>		=MEM_B_DQ<5>
MEM_A_DQ<3>		=MEM_A_DQ<1>	MEM_B_DQ<3>		=MEM_B_DQ<1>
MEM_A_DQ<4>		=MEM_A_DQ<3>	MEM_B_DQ<4>		=MEM_B_DQ<3>
MEM_A_DQ<5>		=MEM_A_DQ<2>	MEM_B_DQ<5>		=MEM_B_DQ<2>
MEM_A_DQ<6>		=MEM_A_DQ<0>	MEM_B_DQ<6>		=MEM_B_DQ<0>
MEM_A_DQ<7>		=MEM_A_DQ<4>	MEM_B_DQ<7>		=MEM_B_DQ<4>
MEM_A_DQ<8>		=MEM_A_DQ<10>	MEM_B_DQ<8>		=MEM_B_DQ<10>
MEM_A_DQ<9>		=MEM_A_DQ<14>	MEM_B_DQ<9>		=MEM_B_DQ<14>
MEM_A_DQ<10>		=MEM_A_DQ<8>	MEM_B_DQ<10>		=MEM_B_DQ<8>
MEM_A_DQ<11>		=MEM_A_DQ<9>	MEM_B_DQ<11>		=MEM_B_DQ<9>
MEM_A_DQ<12>		=MEM_A_DQ<15>	MEM_B_DQ<12>		=MEM_B_DQ<15>
MEM_A_DQ<13>		=MEM_A_DQ<11>	MEM_B_DQ<13>		=MEM_B_DQ<11>
MEM_A_DQ<14>		=MEM_A_DQ<12>	MEM_B_DQ<14>		=MEM_B_DQ<12>
MEM_A_DQ<15>		=MEM_A_DQ<13>	MEM_B_DQ<15>		=MEM_B_DQ<13>
MEM_A_DQ<16>		=MEM_A_DQ<21>	MEM_B_DQ<16>		=MEM_B_DQ<22>
MEM_A_DQ<17>		=MEM_A_DQ<16>	MEM_B_DQ<17>		=MEM_B_DQ<18>
MEM_A_DQ<18>		=MEM_A_DQ<23>	MEM_B_DQ<18>		=MEM_B_DQ<17>
MEM_A_DQ<19>		=MEM_A_DQ<18>	MEM_B_DQ<19>		=MEM_B_DQ<16>
MEM_A_DQ<20>		=MEM_A_DQ<19>	MEM_B_DQ<20>		=MEM_B_DQ<23>
MEM_A_DQ<21>		=MEM_A_DQ<22>	MEM_B_DQ<21>		=MEM_B_DQ<19>
MEM_A_DQ<22>		=MEM_A_DQ<17>	MEM_B_DQ<22>		=MEM_B_DQ<20>
MEM_A_DQ<23>		=MEM_A_DQ<20>	MEM_B_DQ<23>		=MEM_B_DQ<21>
MEM_A_DQ<24>		=MEM_A_DQ<27>	MEM_B_DQ<24>		=MEM_B_DQ<27>
MEM_A_DQ<25>		=MEM_A_DQ<26>	MEM_B_DQ<25>		=MEM_B_DQ<26>
MEM_A_DQ<26>		=MEM_A_DQ<25>	MEM_B_DQ<26>		=MEM_B_DQ<24>
MEM_A_DQ<27>		=MEM_A_DQ<29>	MEM_B_DQ<27>		=MEM_B_DQ<28>
MEM_A_DQ<28>		=MEM_A_DQ<30>	MEM_B_DQ<28>		=MEM_B_DQ<31>
MEM_A_DQ<29>		=MEM_A_DQ<31>	MEM_B_DQ<29>		=MEM_B_DQ<30>
MEM_A_DQ<30>		=MEM_A_DQ<24>	MEM_B_DQ<30>		=MEM_B_DQ<29>
MEM_A_DQ<31>		=MEM_A_DQ<28>	MEM_B_DQ<31>		=MEM_B_DQ<25>
MEM_A_DQ<32>		=MEM_A_DQ<38>	MEM_B_DQ<32>		=MEM_B_DQ<39>
MEM_A_DQ<33>		=MEM_A_DQ<39>	MEM_B_DQ<33>		=MEM_B_DQ<38>
MEM_A_DQ<34>		=MEM_A_DQ<37>	MEM_B_DQ<34>		=MEM_B_DQ<37>
MEM_A_DQ<35>		=MEM_A_DQ<33>	MEM_B_DQ<35>		=MEM_B_DQ<33>
MEM_A_DQ<36>		=MEM_A_DQ<35>	MEM_B_DQ<36>		=MEM_B_DQ<35>
MEM_A_DQ<37>		=MEM_A_DQ<34>	MEM_B_DQ<37>		=MEM_B_DQ<34>
MEM_A_DQ<38>		=MEM_A_DQ<32>	MEM_B_DQ<38>		=MEM_B_DQ<32>
MEM_A_DQ<39>		=MEM_A_DQ<36>	MEM_B_DQ<39>		=MEM_B_DQ<36>
MEM_A_DQ<40>		=MEM_A_DQ<42>	MEM_B_DQ<40>		=MEM_B_DQ<42>
MEM_A_DQ<41>		=MEM_A_DQ<46>	MEM_B_DQ<41>		=MEM_B_DQ<46>
MEM_A_DQ<42>		=MEM_A_DQ<40>	MEM_B_DQ<42>		=MEM_B_DQ<40>
MEM_A_DQ<43>		=MEM_A_DQ<41>	MEM_B_DQ<43>		=MEM_B_DQ<41>
MEM_A_DQ<44>		=MEM_A_DQ<47>	MEM_B_DQ<44>		=MEM_B_DQ<47>
MEM_A_DQ<45>		=MEM_A_DQ<43>	MEM_B_DQ<45>		=MEM_B_DQ<43>
MEM_A_DQ<46>		=MEM_A_DQ<44>	MEM_B_DQ<46>		=MEM_B_DQ<44>
MEM_A_DQ<47>		=MEM_A_DQ<45>	MEM_B_DQ<47>		=MEM_B_DQ<45>
MEM_A_DQ<48>		=MEM_A_DQ<61>	MEM_B_DQ<48>		=MEM_B_DQ<53>
MEM_A_DQ<49>		=MEM_A_DQ<60>	MEM_B_DQ<49>		=MEM_B_DQ<55>
MEM_A_DQ<50>		=MEM_A_DQ<58>	MEM_B_DQ<50>		=MEM_B_DQ<49>
MEM_A_DQ<51>		=MEM_A_DQ<62>	MEM_B_DQ<51>		=MEM_B_DQ<54>
MEM_A_DQ<52>		=MEM_A_DQ<63>	MEM_B_DQ<52>		=MEM_B_DQ<51>
MEM_A_DQ<53>		=MEM_A_DQ<59>	MEM_B_DQ<53>		=MEM_B_DQ<52>
MEM_A_DQ<54>		=MEM_A_DQ<57>	MEM_B_DQ<54>		=MEM_B_DQ<48>
MEM_A_DQ<55>		=MEM_A_DQ<56>	MEM_B_DQ<55>		=MEM_B_DQ<50>
MEM_A_DQ<56>		=MEM_A_DQ<48>	MEM_B_DQ<56>		=MEM_B_DQ<62>
MEM_A_DQ<57>		=MEM_A_DQ<49>	MEM_B_DQ<57>		=MEM_B_DQ<63>
MEM_A_DQ<58>		=MEM_A_DQ<55>	MEM_B_DQ<58>		=MEM_B_DQ<57>
MEM_A_DQ<59>		=MEM_A_DQ<51>	MEM_B_DQ<59>		=MEM_B_DQ<60>
MEM_A_DQ<60>		=MEM_A_DQ<53>	MEM_B_DQ<60>		=MEM_B_DQ<61>
MEM_A_DQ<61>		=MEM_A_DQ<52>	MEM_B_DQ<61>		=MEM_B_DQ<56>
MEM_A_DQ<62>		=MEM_A_DQ<54>	MEM_B_DQ<62>		=MEM_B_DQ<58>
MEM_A_DQ<63>		=MEM_A_DQ<50>	MEM_B_DQ<63>		=MEM_B_DQ<59>

=MEM_A_DQS_P<0>		TRUE	MEM_A_DQS_P<0>	20 7 76
=MEM_A_DQS_N<0>		TRUE	MEM_A_DQS_N<0>	20 7 76
=MEM_A_DQS_P<1>		TRUE	MEM_A_DQS_P<1>	20 7 76
=MEM_A_DQS_N<1>		TRUE	MEM_A_DQS_N<1>	20 7 76
=MEM_A_DQS_P<2>		TRUE	MEM_A_DQS_P<2>	20 7 76
=MEM_A_DQS_N<2>		TRUE	MEM_A_DQS_N<2>	20 7 76
=MEM_A_DQS_P<3>		TRUE	MEM_A_DQS_P<3>	20 7 76
=MEM_A_DQS_N<3>		TRUE	MEM_A_DQS_N<3>	20 7 76
=MEM_A_DQS_P<4>		TRUE	MEM_A_DQS_P<4>	21 7 76
=MEM_A_DQS_N<4>		TRUE	MEM_A_DQS_N<4>	21 7 76
=MEM_A_DQS_P<5>		TRUE	MEM_A_DQS_P<5>	21 7 76
=MEM_A_DQS_N<5>		TRUE	MEM_A_DQS_N<5>	21 7 76
=MEM_A_DQS_P<6>		TRUE	MEM_A_DQS_P<7>	21 7 76
=MEM_A_DQS_N<6>		TRUE	MEM_A_DQS_N<7>	21 7 76
=MEM_A_DQS_P<7>		TRUE	MEM_A_DQS_P<6>	21 7 76
=MEM_A_DQS_N<7>		TRUE	MEM_A_DQS_N<6>	21 7 76

=MEM_B_DQS_P<0>		TRUE	MEM_B_DQS_P<0>	22 7 76
=MEM_B_DQS_N<0>		TRUE	MEM_B_DQS_N<0>	22 7 76
=MEM_B_DQS_P<1>		TRUE	MEM_B_DQS_P<1>	22 7 76
=MEM_B_DQS_N<1>		TRUE	MEM_B_DQS_N<1>	22 7 76
=MEM_B_DQS_P<2>		TRUE	MEM_B_DQS_P<2>	22 7 76
=MEM_B_DQS_N<2>		TRUE	MEM_B_DQS_N<2>	22 7 76
=MEM_B_DQS_P<3>		TRUE	MEM_B_DQS_P<3>	22 7 76
=MEM_B_DQS_N<3>		TRUE	MEM_B_DQS_N<3>	22 7 76
=MEM_B_DQS_P<4>		TRUE	MEM_B_DQS_P<4>	23 7 76
=MEM_B_DQS_N<4>		TRUE	MEM_B_DQS_N<4>	23 7 76
=MEM_B_DQS_P<5>		TRUE	MEM_B_DQS_P<5>	23 7 76
=MEM_B_DQS_N<5>		TRUE	MEM_B_DQS_N<5>	23 7 76
=MEM_B_DQS_P<6>		TRUE	MEM_B_DQS_P<6>	23 7 76
=MEM_B_DQS_N<6>		TRUE	MEM_B_DQS_N<6>	23 7 76
=MEM_B_DQS_P<7>		TRUE	MEM_B_DQS_N<7>	23 7 76
=MEM_B_DQS_N<7>		TRUE	MEM_B_DQS_N<7>	23 7 76

SYNC_MASTER=AHARTMAN_J52 SYNC_DATE=10/29/2013

PAGE TITLE: Memory Bit & Byte Swizzle

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 103 OF 120

SHEET: 70 OF 82

Functional Test Points

J6050 (LEFT FAN CONN)

FUNC_TEST

PP5V_S0 (68 71) — 3 TPs per Fan

FAN_LT_PWM

FAN_LT_TACH

J4002 (ALS/CAMERA CONN)

SMBUS_SMC_1_S0_SCL (38 41 79)

SMBUS_SMC_1_S0_SDA (38 41 79)

PP5V_S3RS0_ALSCAM_F (34)

MIPI_CLK_CONN_N (34 78)

MIPI_CLK_CONN_P (34 78)

CAM_SENSOR_WAKE_L_CONN (34)

MIPI_DATA_CONN_N (34 78)

MIPI_DATA_CONN_P (34 78)

I2C_CAM_SCK (33 34)

I2C_CAM_SDA (33 34)

J9500 (RIO POWER PINS)

PP3V3_S4 (68 71)

PP5V_S3 (68 71)

PP1V5_S0 (68)

GND

SMBUS_PCH_CLK (14 41 75)

SMBUS_PCH_DATA (14 41 75)

J7715 (KBD BACKLIGHT CONN)

PPVOUT_S0_KBDBKLT (37 60)

KBDLED_CATHODE1 (37 60)

KBDLED_CATHODE2 (37 60)

J7050 (MAIN BATT CONN)

PPVBAT_G3H_CONN (53 54)

SMBUS_SMC_5_G3_SCL (38 41 79)

SMBUS_SMC_5_G3_SDA (38 41 79)

SYS_DETECT_L (53)

J6601 (2 MIC CONN)

CON_DMIC_PWR

CON_DMIC_SDA1

CON_DMIC_CLK

PCH_VSS_NCTF<19> (71)

PCH_VSS_NCTF<19> (71)

J4600 (LEFT USB CONN)

PP5V_S3_LTUSB_A_F (35)

USB_LT1_N (74)

USB_LT1_P (74)

FUNC_TEST

GND

GND

GND — 6 TPs

U0500 CHARZ TPS

PCIE_TBT_D2R_P<0> (81 25 14) — P2MM SM 1 PP — PPA400

PCIE_TBT_D2R_N<0> (81 25 14) — P2MM SM 1 PP — PPA401

PCIE_CLK100M_TBT_P (81 71 25 32) — P2MM SM 1 PP — PPA423

PCIE_CLK100M_TBT_N — P2MM SM 1 PP — PPA424

PCIE_CAMERA_D2R_P (81 34 14) — P2MM SM 1 PP — PPA402

PCIE_CAMERA_D2R_N (81 34 14) — P2MM SM 1 PP — PPA403

PCIE_SSD_D2R_P<0> (81 71 32 12) — P2MM SM 1 PP — PPA404

PCIE_SSD_D2R_N<0> (81 71 32 12) — P2MM SM 1 PP — PPA405

PCIE_AP_D2R_P (81 71 66 14) — P2MM SM 1 PP — PPA410

PCIE_AP_D2R_N (81 71 66 14) — P2MM SM 1 PP — PPA411

USB3RPCIE_SD_D2R_P (74 66 14) — P2MM SM 1 PP — PPA420

USB3RPCIE_SD_D2R_N (74 66 14) — P2MM SM 1 PP — PPA421

HDA_SDIN0 (75 49 12) — P2MM SM 1 PP — PPA408

PLACE_NEAR=U0500.AY10:6MM

MIPI_CLK_N (78 34 33) — P2MM SM 1 PP — PPA441

MIPI_CLK_P — P2MM SM 1 PP — PPA442

MIPI_DATA_N (78 34 33) — P2MM SM 1 PP — PPA443

MIPI_DATA_P — P2MM SM 1 PP — PPA444

U5000 CHARZ TPS

LPC_CLK24M_SMC (79 37) — P2MM SM 1 PP — PPA419

J6601 (AUDIO 2-MIKE CONN)

DMIC_SDA3 (49 52)

DMIC_SDA2 (52)

DMIC_CLK3 (49 52)

J6602 (AUDIO LEFT SPEAKER CONN)

SPKRCONN_L_OUT_P (50 52 80)

SPKRCONN_L_OUT_N (50 52 80)

SPKRCONN_L_ID (49 52)

SPKRCONN_SL_OUT_P (50 52 80)

SPKRCONN_SL_OUT_N (50 52 80)

J6603 (AUDIO RIGHT SPEAKER CONN)

SPKRCONN_R_OUT_P (50 52 80)

SPKRCONN_R_OUT_N (50 52 80)

SPKRCONN_R_ID (49 52)

SPKRCONN_SR_OUT_P (50 52 80)

SPKRCONN_SR_OUT_N (50 52 80)

GND

J8300 (EDP CONN)

PP5VR3V3_SW_LCD (65)

PPVOUT_S0_LCDBKLT (60 65) — 2 TP needed

I2C_BKLT_SCL (65 69)

I2C_BKLT_SDA (65 69)

LCD_HPD_CONN (65)

LCD_IRQ_L (15 65)

EDP_BKLT_PWM (13 65)

=I2C_TCON_SCL (41 65)

=I2C_TCON_SDA (41 65)

EDP_PANEL_PWR_OR_PSR_EN (65)

DP_INT_AUX_P (65 77)

DP_INT_AUX_N (65 77)

DP_INT_ML_P<0> (65 77)

DP_INT_ML_N<0> (65 77)

DP_INT_ML_P<1> (65 77)

DP_INT_ML_N<1> (65 77)

DP_INT_ML_P<2> (65 77)

DP_INT_ML_N<2> (65 77)

DP_INT_ML_P<3> (65 77)

DP_INT_ML_N<3> (65 77)

J4813 (KEY BOARD CONN)

PP3V3_S4 (68 71)

PP3V42_G3H (68 71)

WS_KBD1 (36)

WS_KBD2 (36)

WS_KBD3 (36)

WS_KBD4 (36)

WS_KBD5 (36)

WS_KBD6 (36)

WS_KBD7 (36)

WS_KBD8 (36)

WS_KBD9 (36)

WS_KBD10 (36)

WS_KBD11 (36)

WS_KBD12 (36)

WS_KBD13 (36)

WS_KBD14 (36)

WS_KBD15_CAP (36)

WS_KBD16_NUM (36)

WS_KBD17 (36)

WS_KBD18 (36)

WS_KBD19 (36)

WS_KBD20 (36)

WS_KBD21 (36)

WS_KBD22 (36)

WS_KBD23 (36)

WS_KBD_ONOFF_L (36)

WS_LEFT_SHIFT_KBD (36)

WS_LEFT_OPTION_KBD (36)

WS_CONTROL_KBD (36)

J4802 (TPAD CONN)

SMBUS_SMC_2_S3_SDA (38 41 79)

SMBUS_SMC_2_S3_SCL (38 41 79)

=PPVIN_S4_TPAD (36 68)

TPAD_ACTUATOR_EN_L (36 40 42)

TPAD_ACTUATOR_THRMTRIP_L (36 62)

=TPAD_WAKE_L (36 40)

SMC_LID (36 38 39 40)

=PP3V3_S4_TPAD (36 37 68)

I2C_IOXP_SDA (36)

I2C_IOXP_SCL (36)

TPAD_SPI_INT_L (15 36)

=TPAD_SPI_SCLK (36 37)

=TPAD_SPI_MISO (36 37)

=TPAD_SPI_MOSI (36 37)

TPAD_VBUS_EN (36 37)

PP5V_S4_TPAD_F (36)

IOXP2_INT_L (36)

=TPAD_SPI_BUS_EN (36 37)

=TPAD_SPI_CS_L (36 37)

GND_ACTUATOR (36)

USB_TPAD_P (14 36 74)

USB_TPAD_N (14 36 74)

=I2C_TPAD_SCL (36 41)

=I2C_TPAD_SDA (36 41)

J7000 (DC POWER CONN)

TDM_ONEWIRE_MPM

ADAPTER_SENSE (53)

PP18V5_DCIN_FUSE (53)

GND

PM_CLKRUN_L (13 38 71)

PM_SYSRST_L (13 17 38 75)

SMC_ONOFF_L (36 38 39)

J6100 (LPC + SPI CONN)

PP3V42_G3H (68 71)

PP5V_S0 (68 71)

LPC_AD<0> (14 38 75)

LPC_AD<2> (14 38 75)

LPC_AD<1> (14 38 75)

LPC_AD<3> (14 38 75)

LPCPLUS_GPIO (16)

LPCPLUS_RESET_L

SMC_TDO (38 39)

SMC_TX_L (38 39)

LPC_FRAME_L (14 38 75)

SPIROM_USE_MLB (15 47)

PM_CLKRUN_L (13 38 71)

LPC_SERIRQ (15 38)

LPC_PWRDWN_L (13 38)

SMC_TDI (38 39)

SMC_TCK (38 39 47)

SMC_RESET_L (38 39 40 47 54)

SMC_ROMBOOT

SMC_RX_L (38 39)

SMC_TMS (38 39 47)

POWER RAILS

FUNC_TEST

PM_SLP_S3_L (13 17 18 38 64 66)

PP0V6_S0_DDRVTT (68 76)

PP1V05_S0 (68)

GND — 4 TPs

PP3V3_S0 (68 80)

PP3V3_S3 (68)

PP3V3_S5 (68 80)

PP3V3_S5_AVREF_SMC (38 39)

PP3V42_G3H (68 71)

PP5V_S0 (68 71)

PP5V_S3 (68 71)

PP5V_S5 (68)

PPBUS_G3H (68)

PPDCIN_G3H (68)

PPVCC_S0_CPU (68)

PPVTTDDR_S3 (68 71 76 13) — TP_PM_SLP_A_L — TRUE = MAKE_BASE=TRUE — NC_PM_SLP_A_L

TBTBPWRSW_ISET_V3P3 (29)

TBTBPWRSW_ISET_S0_R (29)

TBTBPWRSW_ISET_S3 (29)

TBTAPWRSW_ISET_V3P3 (28)

TBTAPWRSW_ISET_S0 (28)

TBTAPWRSW_ISET_S3 (28)

TBTAPWRSW_ISET_S3_R (28)

TBT_A_R2D_C_P<1..0> (25 28 77)

TBT_A_R2D_C_N<1..0> (25 28 77)

TBT_A_R2D_P<1..0> (28 77)

TBT_A_R2D_N<1..0> (28 77)

TBT_A_D2R_C_P<1> (28 77)

TBT_A_D2R_C_N<1> (28 77)

TBT_A_D2R_C_P<0> (28 77)

TBT_A_D2R_C_N<0> (28 77)

TBT_A_D2R_P<1> (25 28 77)

TBT_A_D2R_N<1> (25 28 77)

TBT_A_D2R_P<0> (25 28 77)

TBT_A_D2R_N<0> (25 28 77)

TBT_B_R2D_C_P<1..0> (25 29 77)

TBT_B_R2D_C_N<1..0> (25 29 77)

TBT_B_R2D_P<1..0> (29 77)

TBT_B_R2D_N<1..0> (29 77)

TBT_B_D2R_C_P<0> (29 77)

TBT_B_D2R_C_N<0> (29 77)

TBT_B_D2R_C_P<1> (29 77)

TBT_B_D2R_C_N<1> (29 77)

TBT_B_D2R_P<0> (25 29 77)

TBT_B_D2R_N<0> (25 29 77)

TBT_B_D2R_P<1> (25 29 77)

TBT_B_D2R_N<1> (25 29 77)

PCIE_AP_D2R_P (14 66 71 81)

PCIE_AP_D2R_N (14 66 71 81)

PCIE_AP_R2D_P (66 81)

PCIE_AP_R2D_N (66 81)

NO_TESTs

MEM_A_DQ<63..0> (7 70 76)

PPVTTDDR_S3 (68 71 76)

MEM_B_DQ<63..0> (7 70 76)

HDMI_IG_CLK_C_P (66 67 77)

HDMI_IG_CLK_C_N (66 67 77)

HDMI_IG_DATA_C_P<2..0> (66 67 77)

HDMI_IG_DATA_C_N<2..0> (66 67 77)

TP_XDP_PCH_HOOK4 — TRUE = MAKE_BASE=TRUE — NC_XDP_PCH_HOOK4

TP_XDP_PCH_HOOK5 — NC_XDP_PCH_HOOK5

TP_XDP_PCH_OBSFN_B<0> — NC_XDP_PCH_OBSFN_B<0>

TP_XDP_PCH_OBSFN_B<1> — NC_XDP_PCH_OBSFN_B<1>

TP_XDP_PCH_OBSFN_A<0> — NC_XDP_PCH_OBSFN_A<0>

TP_XDP_PCH_OBSFN_A<1> — NC_XDP_PCH_OBSFN_A<1>

TP_XDP_PCH_OBSFN_D<0> — NC_XDP_PCH_OBSFN_D<0>

TP_XDP_PCH_OBSFN_D<1> — NC_XDP_PCH_OBSFN_D<1>

TP_XDP_PCH_TRST_L — NC_XDP_PCH_TRST_L

TP_1V05_S0_PCH_VCCAPLLEXP — NC_1V05_S0_PCH_VCCAPLLEXP

TP_AUD_CODEC_MICBIAS — NC_AUD_CODEC_MICBIAS

TP_AUD_MIC_INRP — NC_AUD_MIC_INRP

TP_AUD_MIC_INRN — NC_AUD_MIC_INRN

ICT Test Points

NC_AUD_LO1_LN (48)

NC_AUD_LO1_LP (48)

NC_AUD_LO1_RN (48)

NC_AUD_LO1_RP (48)

NC_AUD_LO4_LN (48)

NC_AUD_LO4_LP (48)

NC_AUD_LO4_RN (48)

NC_AUD_LO4_RP (48)

NC_CS4208_GPO0 (49)

NC_CS4208_GPO1 (49)

NC_CS4208_LRCLKA (49)

NC_CS4208_LRCLKB (49)

NC_CS4208_MCLKA (49)

NC_CS4208_MCLKB (49)

NC_CS4208_SCLKA (49)

NC_CS4208_SCLKB (49)

NC_CS4208_SDOUTA (49)

NC_CS4208_SDOUTB (49)

NC_DMIC_CLK0 (49)

NC_DMIC_CLK1 (49)

NC_DMIC_CLK2 (49)

NC_SMC_HIB_L (38)

NC_SMC_XOSC1 (38)

NC NO_TEST

High Speed NO_TEST

PCIE_AP_R2D_C_P (14 66 81)

PCIE_AP_R2D_C_N (14 66 81)

PCIE_AP_D2R_P (14 66 71 81)

PCIE_AP_D2R_N (14 66 71 81)

PCIE_SSD_R2D_C_P<3..0> (12 32 81)

PCIE_SSD_R2D_C_N<3..0> (12 32 81)

PCIE_SSD_R2D_P<3..0> (32 81)

PCIE_SSD_R2D_N<3..0> (32 81)

PCIE_SSD_D2R_P<3..0> (12 32 71 81)

PCIE_SSD_D2R_N<3..0> (12 32 71 81)

PCIE_TBT_R2D_C_P<3..0> (14 25 81)

PCIE_TBT_R2D_C_N<3..0> (14 25 81)

PCIE_TBT_R2D_P<3..0> (25 81)

PCIE_TBT_R2D_N<3..0> (25 81)

PCIE_TBT_D2R_P<3..1> (14 25 81)

PCIE_TBT_D2R_N<3..1> (14 25 81)

PCIE_TBT_D2R_C_P<3..1> (25 81)

PCIE_TBT_D2R_C_N<3..1> (25 81)

USB3_EXTA_D2R_P (14 35 74)

USB3_EXTA_D2R_N (14 35 74)

USB3_EXTA_R2D_C_P (14 35 74)

USB3_EXTA_R2D_C_N (14 35 74)

USB3_EXTA_R2D_N (35 71 74)

USB3_EXTA_R2D_N (35 71 74)

USB3_EXTB_D2R_P (14 66 74)

USB3_EXTB_D2R_N (14 66 74)

USB3_EXTB_R2D_C_P (14 66 74)

USB3_EXTB_R2D_C_N (14 66 74)

PCIE_CLK100M_SSD_P (12 32 81)

PCIE_CLK100M_SSD_N (12 32 81)

PCIE_CLK100M_TBT_P (12 25 71 81)

PCIE_CLK100M_TBT_N (12 25 71 81)

PCIE_CLK100M_AP_P (12 66 81)

PCIE_CLK100M_AP_N (12 66 81)

PCIE_CLK100M_CAMERA_P (12 34 81)

PCIE_CLK100M_CAMERA_N (12 34 81)

Unused nets with offpage

(Nets with offpages not used on this project)

HDD_PWR_EN (15)

WOL_EN (14)

BT_PWRRST_L (15)

ENET_MEDIA_SENSE (15)

ODD_PWR_EN_L (13)

ENET_LOW_PWR (13)

AUD_IP_PERIPHERAL_DET (13)

AUD_IPHS_SWITCH_EN (13)

ENETSD_CLKREQ_L (12)

SYNC_MASTER=GKOO_J52 SYNC_DATE=12/06/2013

PAGE TITLE: Functional & ICT Test

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 104 OF 120

SHEET: 71 OF 82

X304 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,P65BGA,BGA_MEM	MM	16.5

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DEFAULT	*	Y	=45_OHM_SE	=45_OHM_SE	10 MM	0 MM	0 MM
STANDARD	*	Y	=DEFAULT	=DEFAULT	10 MM	=DEFAULT	=DEFAULT

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	0.095 MM	0.095 MM			
50_OHM_SE	*	Y	0.066 MM	0.066 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	0.116 MM	0.116 MM			
45_OHM_SE	*	Y	0.083 MM	0.083 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	0.145 MM	0.095 MM			
40_OHM_SE	*	Y	0.102 MM	0.090 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
37_OHM_SE	TOP,BOTTOM	Y	0.165 MM	0.095 MM			
37_OHM_SE	*	Y	0.118 MM	0.090 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
27P4_OHM_SE	TOP,BOTTOM	Y	0.265 MM	0.095 MM			
27P4_OHM_SE	*	Y	0.190 MM	0.090 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
72_OHM_DIFF	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
72_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.105 MM	0.105 MM		0.120 MM	0.120 MM
72_OHM_DIFF	ISL2,ISL11	Y	0.105 MM	0.105 MM		0.120 MM	0.120 MM
72_OHM_DIFF	TOP,BOTTOM	Y	0.146 MM	0.146 MM		0.120 MM	0.120 MM

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	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
80_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.092 MM	0.092 MM		0.120 MM	0.120 MM
80_OHM_DIFF	ISL2,ISL11	Y	0.092 MM	0.092 MM		0.120 MM	0.120 MM
80_OHM_DIFF	TOP,BOTTOM	Y	0.125 MM	0.125 MM		0.155 MM	0.155 MM

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	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
85_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.080 MM	0.080 MM		0.120 MM	0.120 MM
85_OHM_DIFF	ISL2,ISL11	Y	0.080 MM	0.080 MM		0.120 MM	0.120 MM
85_OHM_DIFF	TOP,BOTTOM	Y	0.105 MM	0.105 MM		0.125 MM	0.125 MM

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	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
90_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.078 MM	0.078 MM		0.200 MM	0.200 MM
90_OHM_DIFF	ISL2,ISL11	Y	0.078 MM	0.078 MM		0.200 MM	0.200 MM
90_OHM_DIFF	TOP,BOTTOM	Y	0.101 MM	0.101 MM		0.180 MM	0.180 MM

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	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
70_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.120 MM	0.120 MM		0.125 MM	0.125 MM
70_OHM_DIFF	ISL2,ISL11	Y	0.120 MM	0.120 MM		0.125 MM	0.125 MM
70_OHM_DIFF	TOP,BOTTOM	Y	0.155 MM	0.155 MM		0.125 MM	0.125 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	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
73_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.110 MM	0.110 MM		0.120 MM	0.120 MM
73_OHM_DIFF	ISL2,ISL11	Y	0.110 MM	0.110 MM		0.120 MM	0.120 MM
73_OHM_DIFF	TOP,BOTTOM	Y	0.141 MM	0.141 MM		0.120 MM	0.120 MM

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
P65_BGA	*	Y	0.071MM	0.071MM		0.075MM	0.126MM

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	*	Y	=STANDARD	=STANDARD	=STANDARD	0.1 MM	0.1 MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
*	*	BGA	P072_SPACE
*	*	P65BGA	P075_SPACE

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DEFAULT	*	0.1 MM	?
STANDARD	*	=DEFAULT	?
P072_SPACE	*	0.071 MM	?
P075_SPACE	*	0.075 MM	?

Stackup-Defined Spacing Rules

Note: Outer dielectric is 0.058 mm nominal,
Inner dielectric is 0.053 mm nominal.

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1:1_SPACING	·	0.1 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1x_DIELECTRIC	TOP,BOTTOM	0.058 MM	?
1x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.053 MM	?
1X_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.101 MM	?

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
*	P65BGA	P65_BGA

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=12/14/2012

PAGE TITLE: PCB Rule Definitions

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 110 OF 120
SHEET: 72 OF 82

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	7 MIL	7 MIL

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_VCCSENSE	*	25 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_08MIL	*	0.203 MM	?
CPU_12MIL	*	0.305 MM	?
CPU_18MIL	*	0.457 MM	?
CPU_25MIL	*	0.635 MM	?

CPU Signal Properties

ELECTRICAL CONST SET	NET TYPE: PHYSICAL	NET TYPE: SPACING		
XDP_TCK0	CPU_45S	CPU_18MIL	XDP_CPU_TCK	6 16
XDP_TCK0	CPU_45S	CPU_18MIL	PCH_JTAGX	12 16
XDP_TCK1	CPU_45S	CPU_18MIL	XDP_PCH_TCK	12 16
XDP_TDO	CPU_45S		XDP_CPU_TDO	6 16
XDP_TDO	CPU_45S		XDP_PCH_TDO	12 16
XDP_TDI	CPU_45S		XDP_CPU_TDI	6 16
XDP_TDI	CPU_45S		XDP_PCH_TDI	12 16
XDP_TMS	CPU_45S		XDP_CPU_TMS	6 16
XDP_TMS	CPU_45S		XDP_PCH_TMS	12 16
XDP_TRST_L	CPU_45S		XDP_TRST_L	16
XDP_TRST_L	CPU_45S		XDP_CPUPCH_TRST_L	16
XDP_PRDY_L	CPU_45S		XDP_CPU_PRDY_L	6 16
XDP_PREQ_L	CPU_45S		XDP_CPU_PREQ_L	6 16
CPU_VCCST_PWRGD	CPU_45S	CPU_08MIL	CPU_VCCST_PWRGD	8 16 17
CPU_VCCST_PWRGD	CPU_45S	CPU_08MIL	XDP_CPU_VCCST_PWRGD	16
CPU_BPM	CPU_45S	CPU_08MIL	XDP_BPM_L<1..0>	6 16
CPU_BPM_TP	CPU_45S		XDP_BPM_L<7..2>	6 16
CPU_RCOMP_SM	CPU_27P4S	CPU_25MIL	CPU_SM_RCOMP<2..0>	6
CPU_RCOMP_EDP	CPU_27P4S	CPU_25MIL	MCP_EDP_RCOMP	5
CPU_RCOMP_OPI	CPU_27P4S	CPU_12MIL	CPU_OPI_RCOMP	6
CPU_PROCHOT	CPU_45S	CPU_08MIL	CPU_PROCHOT_L	6 38 39 55
CPU_PROCHOT	CPU_45S	CPU_08MIL	CPU_PROCHOT_R_L	6
CPU_CATERR	CPU_45S	CPU_08MIL	CPU_CATERR_L	6 38
CPU_VIDALERT	CPU_45S	CPU_18MIL	CPU_VIDALERT_L	8 55
CPU_VIDALERT	CPU_45S	CPU_18MIL	CPU_VIDALERT_R_L	8
CPU_VIDSCLK	CPU_45S	CPU_18MIL	CPU_VIDSCLK	8 55
CPU_VIDSCLK	CPU_45S	CPU_18MIL	CPU_VIDSCLK_R	8
CPU_VIDSOUT	CPU_45S	CPU_18MIL	CPU_VIDSOUT	8 55
CPU_VIDSOUT	CPU_45S	CPU_18MIL	CPU_VIDSOUT_R	8
CPU_PECI	CPU_45S	CPU_18MIL	CPU_PECI	6 39
CPU_PECI	CPU_45S	CPU_18MIL	CPU_PECI_R	38 39
CPU_PECI	CPU_45S	CPU_18MIL	SMC_PECI_L	38 39
CPU_PECI	CPU_45S	CPU_18MIL	SMC_PECI_L_R	39
CPU_CFG	CPU_45S		CPU_CFG<19..11>	6 16
CPU_CFG_PD	CPU_45S		CPU_CFG<10..8>	6 16
CPU_CFG	CPU_45S		CPU_CFG<7..5>	6 16
CPU_CFG_PD	CPU_45S		CPU_CFG<4>	6 16
CPU_CFG_3	CPU_45S		CPU_CFG<3>	6 16
CPU_CFG	CPU_45S		CPU_CFG<2>	6 16
CPU_CFG_PD	CPU_45S		CPU_CFG<1..0>	6 16
CPU_MEM_RESET	CPU_45S	CPU_08MIL	MEM_RESET_L	
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCSENSE_P	8 55
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCSENSE_N	9 55

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/13/2013

PAGE TITLE: CPU Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 111 OF 120

SHEET: 73 OF 82

USB 2 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	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
USB_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
USB	*	=4X_DIELECTRIC	?
USB_RBIAS	*	=6X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB	TOP,BOTTOM	=6X_DIELECTRIC	?
USB_RBIAS	TOP,BOTTOM	=10X_DIELECTRIC	?

USB 3 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
USB3_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
USB3_2SAME	*	=3X_DIELECTRIC	?
USB3_TXRX	*	=6X_DIELECTRIC	?
USB3_2OTHER	*	=4X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3_2SAME	TOP,BOTTOM	=4x_DIELECTRIC	?
USB3_TXRX	TOP,BOTTOM	=10X_DIELECTRIC	?
USB3_2OTHER	TOP,BOTTOM	=6X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
USB3_*	*	*	USB3_2OTHER
USB3_*	=SAME	*	USB3_2SAME
USB3_TX	*_RX	*	USB3_TXRX
USB3_RX	*_TX	*	USB3_TXRX

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_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_25M	*	=5x_DIELECTRIC	?

SATA Interface Constraints (Not Used)

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SATA_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF
SATA_45SE	*	=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
SATA_2SAME	*	=3X_DIELECTRIC	?
SATA_TXRX	*	=6X_DIELECTRIC	?
SATA_2OTHER	*	=4X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SATA_2SAME	TOP,BOTTOM	=4x_DIELECTRIC	?
SATA_TXRX	TOP,BOTTOM	=10X_DIELECTRIC	?
SATA_2OTHER	TOP,BOTTOM	=6X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
SATA_*	*	*	SATA_2OTHER
SATA_*	=SAME	*	SATA_2SAME
SATA_TX	*_RX	*	SATA_TXRX
SATA_RX	*_TX	*	SATA_TXRX

USB Constraints

ELECTRICAL CONST SET	NET TYPE: PHYSICAL	NET TYPE: SPACING	
USB_BT	USB_85D	USB	USB_BT_P 14 31
USB_BT	USB_85D	USB	USB_BT_N 14 31
USB_BT	USB_85D	USB	USB_BT_CONN_P 31 66
USB_BT	USB_85D	USB	USB_BT_CONN_N 31 66
USB_EXTA	USB_85D	USB	USB_EXTA_P 14 35
USB_EXTA	USB_85D	USB	USB_EXTA_N 14 35
	DEFAULT	DEFAULT	SMC_DEBUGPRT_RX_L 35 38 39
	DEFAULT	DEFAULT	SMC_DEBUGPRT_TX_L 35 38 39
USB_EXTA	USB_85D	USB	USB2_EXTA_MUXED_P 35
USB_EXTA	USB_85D	USB	USB2_EXTA_MUXED_N 35
USB_EXTA	USB_85D	USB	USB2_EXTA_MUXED_F_P 35
USB_EXTA	USB_85D	USB	USB2_EXTA_MUXED_F_N 35
USB_EXTA	USB_85D	USB	USB_LT1_P 71
USB_EXTA	USB_85D	USB	USB_LT1_N 71
USB_EXTB	USB_85D	USB	USB_EXTB_P 14 66
USB_EXTB	USB_85D	USB	USB_EXTB_N 14 66
USB_TPAD	USB_85D	USB	USB_TPAD_P 14 36 71
USB_TPAD	USB_85D	USB	USB_TPAD_N 14 36 71
USB3_EXTA_D2R	USB_85D	USB3_RX	USB3_EXTA_D2R_P 14 35 71
USB3_EXTA_D2R	USB_85D	USB3_RX	USB3_EXTA_D2R_N 14 35 71
USB3_EXTA_R2D	USB_85D	USB3_TX	USB3_EXTA_R2D_P 35
USB3_EXTA_R2D	USB_85D	USB3_TX	USB3_EXTA_R2D_N 35 71
USB3_EXTA_R2D	USB_85D	USB3_TX	USB3_EXTA_R2D_C_P 14 35 71
USB3_EXTA_R2D	USB_85D	USB3_TX	USB3_EXTA_R2D_C_N 14 35 71
USB3_EXTB_D2R	USB_85D	USB3_RX	USB3_EXTB_D2R_P 14 66 71
USB3_EXTB_D2R	USB_85D	USB3_RX	USB3_EXTB_D2R_N 14 66 71
USB3_EXTB_R2D	USB_85D	USB3_TX	USB3_EXTB_R2D_C_P 14 66 71
USB3_EXTB_R2D	USB_85D	USB3_TX	USB3_EXTB_R2D_C_N 14 66 71
USB3_SD_D2R	USB3_85D	USB3_RX	USB3RPCIE_SD_D2R_P 14 66 71
USB3_SD_D2R	USB3_85D	USB3_RX	USB3RPCIE_SD_D2R_N 14 66 71
USB3_SD_R2D	USB3_85D	USB3_TX	USB3RPCIE_SD_R2D_C_P 14 66
USB3_SD_R2D	USB3_85D	USB3_TX	USB3RPCIE_SD_R2D_C_N 14 66
USB_NC	USB_85D	USB	NC_USB_IRP 69
USB_NC	USB_85D	USB	NC_USB_IRN 69
USB_NC	USB_85D	USB	NC_USB_5P 69
USB_NC	USB_85D	USB	NC_USB_5N 69
USB_NC	USB_85D	USB	NC_USB_SDP 69
USB_NC	USB_85D	USB	NC_USB_SDN 69
USB_NC	USB_85D	USB	NC_USB_CAMERAP 69
USB_NC	USB_85D	USB	NC_USB_CAMERAN 69
PCH_USB_RBIAS	PCH_USB_RBIAS	USB_RBIAS	PCH_USB_RBIAS 14
	SATA_85D	SATA_RX	DUMMY_SATA_D2R_P
	SATA_85D	SATA_RX	DUMMY_SATA_D2R_N
	SATA_85D	SATA_TX	DUMMY_SATA_R2D_P
	SATA_85D	SATA_TX	DUMMY_SATA_R2D_N
SYSCLK_CLK25M	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X1 17
SYSCLK_CLK25M	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X2 17
SYSCLK_CLK25M	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_X2_R 17
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_CAMERA 17 34
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	CLK25M_CAM_CLKP 33 34
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALP_R 34
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALP 34
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	CLK25M_CAM_XTALN 34
SYSCLK_CLK25M_CAM	CLK_25M_45S	CLK_25M	CLK25M_CAM_CLKN 33 34
SYSCLK_CLK25M_TBT	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_TBT 17 25
SYSCLK_CLK25M_TBT	CLK_25M_45S	CLK_25M	SYSCLK_CLK25M_TBT_R 25

Notes:
This is here to keep the SATA rules.

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/07/2013

PAGE TITLE: USB Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 112 OF 120
SHEET: 74 OF 82

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	*	6 MIL	?
CLK_LPC	*	8 MIL	?

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	*	=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	?

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	*	8 MIL	?

PCH Single Net 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
PCH_27P4S	*	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	7 MIL	7 MIL

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCH_12MIL	*	0.305 MM	?
PCH_15MIL	*	0.381 MM	?
PCH_18MIL	*	0.457 MM	?
PCH_20MIL	*	0.508 MM	?

PCH Net Properties

ELECTRICAL CONST SET	NET TYPE: PHYSICAL	NET TYPE: SPACING		
LPC_AD	LPC_45S	LPC	LPC_AD<3..0>	14 38 71
LPC_AD	LPC_45S	LPC	LPC_FRAME_L	14 38 71
LPC_CLK24M_SMC	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_SMC_R	12 17
LPC_CLK24M_SMC	CLK_LPC_45S	CLK_LPC	LPC_CLK24M_SMC	17 71
SMBUS_PCH	SMB_45S	SMB	SMBUS_PCH_CLK	14 41 71
SMBUS_PCH	SMB_45S	SMB	SMBUS_PCH_DATA	14 41 71
SML_PCH_0	SMB_45S	SMB	SML_PCH_0_CLK	14 41
SML_PCH_0	SMB_45S	SMB	SML_PCH_0_DATA	14 41
	SMB_45S	SMB	SML_PCH_1_CLK	14 41
	SMB_45S	SMB	SML_PCH_1_DATA	14 41
HDA_BIT_CLK	HDA_45S	HDA	HDA_BIT_CLK	12 49
HDA_BIT_CLK	HDA_45S	HDA	HDA_BIT_CLK_R	12
HDA_SYNC	HDA_45S	HDA	HDA_SYNC	12 49
HDA_SYNC	HDA_45S	HDA	HDA_SYNC_R	12
HDA_RST	HDA_45S	HDA	HDA_RST_R_L	12
HDA_RST	HDA_45S	HDA	HDA_RST_L	12 49
HDA_SDIN	HDA_45S	HDA	HDA_SDIN0	12 49 71
HDA_SDIN	HDA_45S	HDA	CS4208_HDA_SDOUT0_R	49
HDA_SDOUT	HDA_45S	HDA	HDA_SDOUT	12 49
HDA_SDOUT	HDA_45S	HDA	HDA_SDOUT_R	12 17
SPI_MLB	SPI_45S	SPI	SPI_ALT_CLK	47
SPI_MLB	SPI_45S	SPI	SPI_CLK	47
SPI_MLB	SPI_45S	SPI	SPI_CLK_R	14 47
SPI_MLB	SPI_45S	SPI	SPI_MLB_CLK	47
SPI_MLB	SPI_45S	SPI	SPI_SMC_CLK	38 47
SPI_MLB	SPI_45S	SPI	SPI_ALT_CS_L	47
SPI_MLB	SPI_45S	SPI	SPI_CS0_L	47
SPI_MLB	SPI_45S	SPI	SPI_CS0_R_L	14 47
SPI_MLB	SPI_45S	SPI	SPI_MLB_CS_L	47
SPI_MLB	SPI_45S	SPI	SPI_SMC_CS_L	38 47
SPI_MLB	SPI_45S	SPI	SPI_ALT_IO1_MISO	47
SPI_MLB	SPI_45S	SPI	SPI_MISO	14 47
SPI_MLB	SPI_45S	SPI	SPI_MISO_R	47
SPI_MLB	SPI_45S	SPI	SPI_MLB_IO1_MISO	47
SPI_MLB	SPI_45S	SPI	SPI_SMC_MISO	38 47
SPI_MLB	SPI_45S	SPI	SPI_ALT_IO0_MOSI	47
SPI_MLB	SPI_45S	SPI	SPI_MOSI	47
SPI_MLB	SPI_45S	SPI	SPI_MOSI_R	14 47
SPI_MLB	SPI_45S	SPI	SPI_MLB_IO0_MOSI	47
SPI_MLB	SPI_45S	SPI	SPI_SMC_MOSI	38 47
SPI_MLB_IO2	SPI_45S	SPI	SPI_IO<2>	14 47
SPI_MLB_IO2	SPI_45S	SPI	SPI_IO2_R	47
SPI_MLB_IO2	SPI_45S	SPI	SPI_MLB_IO2_WP_L	47
SPI_MLB_IO2	SPI_45S	SPI	SPI_ALT_IO2_WP_L	47
SPI_MLB_IO3	SPI_45S	SPI	SPI_IO<3>	14 47
SPI_MLB_IO3	SPI_45S	SPI	SPI_IO3_R	47
SPI_MLB_IO3	SPI_45S	SPI	SPI_MLB_IO3_HOLD_L	47
SPI_MLB_IO3	SPI_45S	SPI	SPI_ALT_IO3_HOLD_L	47
SPI_TPAD	SPI_45S	SPI	TPAD_SPI_CLK	15 37
SPI_TPAD_CS	SPI_45S	SPI	TPAD_SPI_CS_L	15 37
SPI_TPAD	SPI_45S	SPI	TPAD_SPI_MISO	15 37
SPI_TPAD	SPI_45S	SPI	TPAD_SPI_MOSI	15 37
PCH_RTCX	PCH_45S	PCH_15MIL	PCH_CLK32K_RTCX1	12 17
PCH_SRTCRST	PCH_45S	PCH_15MIL	PCH_SRTCRST_L	12
PCH_RTCRST	PCH_45S	PCH_15MIL	RTC_RESET_L	12
PCH_THRMTRIP	PCH_45S	PCH_18MIL	PM_THRMTRIP_L	15 39
PCH_THRMTRIP	PCH_45S	PCH_18MIL	PM_THRMTRIP_R_L	39
	PCH_45S	PCH_15MIL	PCH_INTRUDER_L	12
	PCH_45S	PCH_15MIL	PCH_INTVRMEN	12
	PCH_45S	PCH_15MIL	PCH_DSWVRMEN	13
	PCH_45S	PCH_15MIL	PM_RSMRST_L	13 64
	PCH_45S	PCH_15MIL	PM_SYSRST_L	13 17 38 71
	PCH_45S	PCH_15MIL	XDP_DBRESET_L	16 17
	PCH_45S	PCH_15MIL	PM_PCH_SYS_PWROK	13 16 17 38
	PCH_45S	PCH_15MIL	XDP_SYS_PWROK	16
	PCH_45S	PCH_15MIL	SYS_PWROK_R	17
	PCH_45S	PCH_15MIL	PM_PCH_PWROK	13 17
	PCH_45S	PCH_15MIL	PM_S0_PGOOD	17
	PCH_45S	PCH_15MIL	SMC_DELAYED_PWRGD	17 26 27 38 39
	PCH_45S	PCH_15MIL	PM_DSW_PWRGD	13 38
	PCH_45S	PCH_15MIL	PM_PWRBTN_L	13 16 38
	PCH_45S	PCH_15MIL	XDP_CPU_PWRBTN_L	16
	PCH_45S	PCH_15MIL	PCIE_WAKE_L	13 31 33
	PCH_45S	PCH_15MIL	AP_PCIE_WAKE_L	31 66
	PCH_45S	PCH_15MIL	CAM_PCIE_WAKE_L	33
	PCH_45S	PCH_15MIL	TBT_CIO_PLUG_EVENT_L	18 25
PCH_CLK24M_XTAL	PCH_45S	PCH_20MIL	PCH_CLK24M_XTALIN	12 17
PCH_CLK24M_XTAL	PCH_45S	PCH_20MIL	PCH_CLK24M_XTALOUT	12 17
PCH_CLK24M_XTAL	PCH_45S	PCH_20MIL	PCH_CLK24M_XTALOUT_R	17
PCH_RCOMP_PCIE	PCH_27P4S	PCH_12MIL	PCH_PCIE_RCOMP	14
PCH_RCOMP_OPI	PCH_27P4S	PCH_12MIL	PCH_OPI_COMP	15
PCH_RCOMP_SATA	PCH_27P4S	PCH_12MIL	PCH_SATA_RCOMP	12

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/08/2013

PAGE TITLE: PCH Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 113 OF 120

SHEET: 75 OF 82

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	0.066 MM	=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_DQS2OWNDATA	*	=3x_DIELECTRIC	?
MEM_CMD2CMD	*	=3x_DIELECTRIC	?
MEM_CMD2CTL	*	=3x_DIELECTRIC	?
MEM_CTL2CTL	*	=3x_DIELECTRIC	?
MEM_CLK2CLK	*	=6x_DIELECTRIC	?
MEM_DATA2OTHERMEM	*	=8x_DIELECTRIC	?
MEM_2OTHERMEM	*	=4x_DIELECTRIC	?
MEM_2PWR	*	=2x_DIELECTRIC	?
MEM_2GND	*	=2x_DIELECTRIC	?
MEM_2OTHER	*	=6x_DIELECTRIC	?
MEM_CMD2CMD_BM	*	=3x_DIELECTRIC	?
MEM_CMD2CTL_BM	*	=3x_DIELECTRIC	?
MEM_CTL2CTL_BM	*	=3x_DIELECTRIC	?
MEM_12MIL	*	0.305 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MEM_DATA2SELF	TOP,BOTTOM	=5x_DIELECTRIC	?
MEM_DQS2OWNDATA	TOP,BOTTOM	=5x_DIELECTRIC	?
MEM_CMD2CMD	TOP,BOTTOM	=5x_DIELECTRIC	?
MEM_CMD2CTL	TOP,BOTTOM	=5x_DIELECTRIC	?
MEM_CTL2CTL	TOP,BOTTOM	=5x_DIELECTRIC	?
MEM_CLK2CLK	TOP,BOTTOM	=8x_DIELECTRIC	?
MEM_2OTHERMEM	TOP,BOTTOM	=8x_DIELECTRIC	?
MEM_2PWR	TOP,BOTTOM	=4x_DIELECTRIC	?
MEM_2GND	TOP,BOTTOM	=4x_DIELECTRIC	?
MEM_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?
MEM_CMD2CMD_BM	TOP,BOTTOM	=3x_DIELECTRIC	?
MEM_CMD2CTL_BM	TOP,BOTTOM	=3x_DIELECTRIC	?
MEM_CTL2CTL_BM	TOP,BOTTOM	=3x_DIELECTRIC	?

Memory Bus Spacing Group Assignments

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*_DQBYTE_*	*	*	MEM_2OTHER
MEM_*_DQS_*	*	*	MEM_2OTHER
MEM_CMD	*	*	MEM_2OTHER
MEM_CTL	*	*	MEM_2OTHER
MEM_CLK	*	*	MEM_2OTHER
MEM_*	MEM_*	*	MEM_2OTHERMEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_A_DQS_0	MEM_A_DQBYTE_0	*	MEM_DQS2OWNDATA
MEM_A_DQS_1	MEM_A_DQBYTE_1	*	MEM_DQS2OWNDATA
MEM_A_DQS_2	MEM_A_DQBYTE_2	*	MEM_DQS2OWNDATA
MEM_A_DQS_3	MEM_A_DQBYTE_3	*	MEM_DQS2OWNDATA
MEM_A_DQS_4	MEM_A_DQBYTE_4	*	MEM_DQS2OWNDATA
MEM_A_DQS_5	MEM_A_DQBYTE_5	*	MEM_DQS2OWNDATA
MEM_A_DQS_6	MEM_A_DQBYTE_6	*	MEM_DQS2OWNDATA
MEM_A_DQS_7	MEM_A_DQBYTE_7	*	MEM_DQS2OWNDATA
MEM_B_DQS_0	MEM_B_DQBYTE_0	*	MEM_DQS2OWNDATA
MEM_B_DQS_1	MEM_B_DQBYTE_1	*	MEM_DQS2OWNDATA
MEM_B_DQS_2	MEM_B_DQBYTE_2	*	MEM_DQS2OWNDATA
MEM_B_DQS_3	MEM_B_DQBYTE_3	*	MEM_DQS2OWNDATA
MEM_B_DQS_4	MEM_B_DQBYTE_4	*	MEM_DQS2OWNDATA
MEM_B_DQS_5	MEM_B_DQBYTE_5	*	MEM_DQS2OWNDATA
MEM_B_DQS_6	MEM_B_DQBYTE_6	*	MEM_DQS2OWNDATA
MEM_B_DQS_7	MEM_B_DQBYTE_7	*	MEM_DQS2OWNDATA

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

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*_DQBYTE_*	MEM_*	*	MEM_DATA2OTHERMEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CMD	MEM_CMD	*	MEM_CMD2CMD
MEM_CMD	MEM_CTL	*	MEM_CMD2CTL
MEM_CTL	MEM_CTL	*	MEM_CTL2CTL
MEM_CLK	MEM_CLK	*	MEM_CLK2CLK
MEM_CMD	MEM_CMD	BGA_MEM	MEM_CMD2CMD_BM
MEM_CMD	MEM_CTL	BGA_MEM	MEM_CMD2CTL_BM
MEM_CTL	MEM_CTL	BGA_MEM	MEM_CTL2CTL_BM

Broadwell ULT Memory Down LPDDR3 1x4 Length Matching

LPDDR3 Signal Group	Unit	Min Length	Max Length
CTL/CKEmax - CTL/CKEmin	mils	0	50
CTL/CKE to CLK	mils	CLK - 100	0
(CMDmax - CMDmin)	mils	0	50
CMD to CLK	mils	CLK - 250	CLK + 250
DQmax - DQmin per byte	mils	0	125
DQmax to DQs per byte	mils	DQS - 200	DQS + 50
DQS to DQS#	mils	-2.5	2.5
DQS to CLK (Rule 1)	mils	CLK - 750	CLK + 1250
CLK to CLK#	mils	-2.5	2.5

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	BGA_MEM	MEM_73D
MEM_40S	BGA_MEM	MEM_50S

Memory to GND Spacing

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
GND	MEM_*	*	MEM_2GND

Memory Net Properties

ELECTRICAL CONST SET	NET TYPE: PHYSICAL	NET TYPE: SPACING	
MEM_A_CLK0	MEM_70D	MEM_CLK	MEM_A_CLK_P<0> 7 20 24
MEM_A_CLK0	MEM_70D	MEM_CLK	MEM_A_CLK_N<0> 7 20 24
MEM_A_CLK1	MEM_70D	MEM_CLK	MEM_A_CLK_P<1> 7 21 24
MEM_A_CLK1	MEM_70D	MEM_CLK	MEM_A_CLK_N<1> 7 21 24
MEM_A_CTL	MEM_40S	MEM_CTL	MEM_A_CS_L<1..0> 7 20 21 24
MEM_A_CTL	MEM_40S	MEM_CTL	MEM_A_ODT<0> 20 21 24 70
MEM_A_CKE0	MEM_40S	MEM_CMD	MEM_A_CKE<1..0> 7 20 24
MEM_A_CKE1	MEM_40S	MEM_CMD	MEM_A_CKE<3..2> 7 21 24
MEM_A_CMD0	MEM_40S	MEM_CMD	MEM_A_CAA<9..0> 20 24 70
MEM_A_CMD1	MEM_40S	MEM_CMD	MEM_A_CAB<9..0> 21 24 70
MEM_A_DQBYTE0	MEM_40S	MEM_A_DQBYTE_0	MEM_A_DQ<7..0> 7 70 71
MEM_A_DQBYTE1	MEM_40S	MEM_A_DQBYTE_1	MEM_A_DQ<15..8> 7 70 71
MEM_A_DQBYTE2	MEM_40S	MEM_A_DQBYTE_2	MEM_A_DQ<23..16> 7 70 71
MEM_A_DQBYTE3	MEM_40S	MEM_A_DQBYTE_3	MEM_A_DQ<31..24> 7 70 71
MEM_A_DQBYTE4	MEM_40S	MEM_A_DQBYTE_4	MEM_A_DQ<39..32> 7 70 71
MEM_A_DQBYTE5	MEM_40S	MEM_A_DQBYTE_5	MEM_A_DQ<47..40> 7 70 71
MEM_A_DQBYTE6	MEM_40S	MEM_A_DQBYTE_6	MEM_A_DQ<55..48> 7 70 71
MEM_A_DQBYTE7	MEM_40S	MEM_A_DQBYTE_7	MEM_A_DQ<63..56> 7 70 71
MEM_A_DQS0	MEM_70D	MEM_A_DQS_0	MEM_A_DQS_P<0> 7 70
MEM_A_DQS0	MEM_70D	MEM_A_DQS_0	MEM_A_DQS_N<0> 7 70
MEM_A_DQS1	MEM_70D	MEM_A_DQS_1	MEM_A_DQS_P<1> 7 70
MEM_A_DQS1	MEM_70D	MEM_A_DQS_1	MEM_A_DQS_N<1> 7 70
MEM_A_DQS2	MEM_70D	MEM_A_DQS_2	MEM_A_DQS_P<2> 7 70
MEM_A_DQS2	MEM_70D	MEM_A_DQS_2	MEM_A_DQS_N<2> 7 70
MEM_A_DQS3	MEM_70D	MEM_A_DQS_3	MEM_A_DQS_P<3> 7 70
MEM_A_DQS3	MEM_70D	MEM_A_DQS_3	MEM_A_DQS_N<3> 7 70
MEM_A_DQS4	MEM_70D	MEM_A_DQS_4	MEM_A_DQS_P<4> 7 70
MEM_A_DQS4	MEM_70D	MEM_A_DQS_4	MEM_A_DQS_N<4> 7 70
MEM_A_DQS5	MEM_70D	MEM_A_DQS_5	MEM_A_DQS_P<5> 7 70
MEM_A_DQS5	MEM_70D	MEM_A_DQS_5	MEM_A_DQS_N<5> 7 70
MEM_A_DQS6	MEM_70D	MEM_A_DQS_6	MEM_A_DQS_P<6> 7 70
MEM_A_DQS6	MEM_70D	MEM_A_DQS_6	MEM_A_DQS_N<6> 7 70
MEM_A_DQS7	MEM_70D	MEM_A_DQS_7	MEM_A_DQS_P<7> 7 70
MEM_A_DQS7	MEM_70D	MEM_A_DQS_7	MEM_A_DQS_N<7> 7 70
MEM_B_CLK0	MEM_70D	MEM_CLK	MEM_B_CLK_P<0> 7 22 24
MEM_B_CLK0	MEM_70D	MEM_CLK	MEM_B_CLK_N<0> 7 22 24
MEM_B_CLK1	MEM_70D	MEM_CLK	MEM_B_CLK_P<1> 7 23 24
MEM_B_CLK1	MEM_70D	MEM_CLK	MEM_B_CLK_N<1> 7 23 24
MEM_B_CTL	MEM_40S	MEM_CTL	MEM_B_CS_L<1..0> 7 22 23 24
MEM_B_CTL	MEM_40S	MEM_CTL	MEM_B_ODT<0> 22 23 24 70
MEM_B_CKE0	MEM_40S	MEM_CMD	MEM_B_CKE<1..0> 7 22 24
MEM_B_CKE1	MEM_40S	MEM_CMD	MEM_B_CKE<3..2> 7 23 24
MEM_B_CMD0	MEM_40S	MEM_CMD	MEM_B_CAA<9..0> 22 24 70
MEM_B_CMD1	MEM_40S	MEM_CMD	MEM_B_CAB<9..0> 23 24 70
MEM_B_DQBYTE0	MEM_40S	MEM_B_DQBYTE_0	MEM_B_DQ<7..0> 7 70 71
MEM_B_DQBYTE1	MEM_40S	MEM_B_DQBYTE_1	MEM_B_DQ<15..8> 7 70 71
MEM_B_DQBYTE2	MEM_40S	MEM_B_DQBYTE_2	MEM_B_DQ<23..16> 7 70 71
MEM_B_DQBYTE3	MEM_40S	MEM_B_DQBYTE_3	MEM_B_DQ<31..24> 7 70 71
MEM_B_DQBYTE4	MEM_40S	MEM_B_DQBYTE_4	MEM_B_DQ<39..32> 7 70 71
MEM_B_DQBYTE5	MEM_40S	MEM_B_DQBYTE_5	MEM_B_DQ<47..40> 7 70 71
MEM_B_DQBYTE6	MEM_40S	MEM_B_DQBYTE_6	MEM_B_DQ<55..48> 7 70 71
MEM_B_DQBYTE7	MEM_40S	MEM_B_DQBYTE_7	MEM_B_DQ<63..56> 7 70 71
MEM_B_DQS0	MEM_70D	MEM_B_DQS_0	MEM_B_DQS_P<0> 7 70
MEM_B_DQS0	MEM_70D	MEM_B_DQS_0	MEM_B_DQS_N<0> 7 70
MEM_B_DQS1	MEM_70D	MEM_B_DQS_1	MEM_B_DQS_P<1> 7 70
MEM_B_DQS1	MEM_70D	MEM_B_DQS_1	MEM_B_DQS_N<1> 7 70
MEM_B_DQS2	MEM_70D	MEM_B_DQS_2	MEM_B_DQS_P<2> 7 70
MEM_B_DQS2	MEM_70D	MEM_B_DQS_2	MEM_B_DQS_N<2> 7 70
MEM_B_DQS3	MEM_70D	MEM_B_DQS_3	MEM_B_DQS_P<3> 7 70
MEM_B_DQS3	MEM_70D	MEM_B_DQS_3	MEM_B_DQS_N<3> 7 70
MEM_B_DQS4	MEM_70D	MEM_B_DQS_4	MEM_B_DQS_P<4> 7 70
MEM_B_DQS4	MEM_70D	MEM_B_DQS_4	MEM_B_DQS_N<4> 7 70
MEM_B_DQS5	MEM_70D	MEM_B_DQS_5	MEM_B_DQS_P<5> 7 70
MEM_B_DQS5	MEM_70D	MEM_B_DQS_5	MEM_B_DQS_N<5> 7 70
MEM_B_DQS6	MEM_70D	MEM_B_DQS_6	MEM_B_DQS_P<6> 7 70
MEM_B_DQS6	MEM_70D	MEM_B_DQS_6	MEM_B_DQS_N<6> 7 70
MEM_B_DQS7	MEM_70D	MEM_B_DQS_7	MEM_B_DQS_P<7> 7 70
MEM_B_DQS7	MEM_70D	MEM_B_DQS_7	MEM_B_DQS_N<7> 7 70
		MEM_PWR	PP1V2_S3 68
		MEM_PWR	PP1V2_S3_CPUDDR 68
		MEM_PWR	PP0V6_S0_DDRVTT 68 71
		MEM_PWR	PPVTTDDR_S3 68 71
		MEM_12MIL	CPU_DIMMA_VREFDQ 7 19
		MEM_12MIL	CPU_DIMMB_VREFDQ 7 19
		MEM_12MIL	CPU_DIMM_VREFCA 7 19
		MEM_12MIL	PP0V6_S3_MEM_VREFDQ_A 20 21 68
		MEM_12MIL	PP0V6_S3_MEM_VREFDQ_B 22 23 68
		MEM_12MIL	PP0V6_S3_MEM_VREFCA_A 20 21 68
		MEM_12MIL	PP0V6_S3_MEM_VREFCA_B 22 23 68

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/02/2013

PAGE TITLE: Memory Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 114 OF 120

SHEET: 76 OF 82

Thunderbolt, DP, HDMI Constraints

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 & DisplayPort 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_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
TBTDP_2SAME	*	=3X_DIELECTRIC	?
TBTDP_TXRX	*	=6X_DIELECTRIC	?
TBTDP_2OTHER	*	=4X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBTDP_2SAME	TOP,BOTTOM	=4x_DIELECTRIC	?
TBTDP_TXRX	TOP,BOTTOM	=10X_DIELECTRIC	?
TBTDP_2OTHER	TOP,BOTTOM	=6X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
TBTDP_*	*	*	TBTDP_2OTHER
TBTDP_*	=SAME	*	TBTDP_2SAME
TBTDP_TX	*_RX	*	TBTDP_TXRX
TBTDP_RX	*_TX	*	TBTDP_TXRX

DisplayPort & HDMI Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DP_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF
HDMI_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
DP_2SAME	*	=3x_DIELECTRIC	?
DP_2OTHER	*	=4x_DIELECTRIC	?
HDMICLK_2OTHER	*	=7x_DIELECTRIC	?
HDMICLK_2DPHDMI	*	=4x_DIELECTRIC	?
HDMIDATA_2SAME	*	=3x_DIELECTRIC	?
HDMIDATA_2OTHER	*	=4x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DP_2SAME	TOP,BOTTOM	=4x_DIELECTRIC	?
DP_2OTHER	TOP,BOTTOM	=6x_DIELECTRIC	?
HDMICLK_2OTHER	TOP,BOTTOM	=10x_DIELECTRIC	?
HDMICLK_2DPHDMI	TOP,BOTTOM	=6x_DIELECTRIC	?
HDMIDATA_2SAME	TOP,BOTTOM	=4x_DIELECTRIC	?
HDMIDATA_2OTHER	TOP,BOTTOM	=6x_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
HDMI_DATA	*	*	HDMIDATA_2OTHER
HDMI_DATA	=SAME	*	HDMIDATA_2SAME
HDMI_DATA	TBTDP_TX	*	HDMIDATA_2SAME
HDMI_DATA	TBTDP_RX	*	TBTDP_TXRX
HDMI_CLK	*	*	HDMICLK_2OTHER
HDMI_CLK	HDMI_DATA	*	HDMICLK_2DPHDMI
HDMI_CLK	DISPLAYPORT	*	HDMICLK_2DPHDMI
HDMI_CLK	TBTDP_TX	*	HDMICLK_2DPHDMI

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
DISPLAYPORT	*	*	DP_2OTHER
DISPLAYPORT	=SAME	*	DP_2SAME
DISPLAYPORT	HDMI_DATA	*	DP_2SAME
DISPLAYPORT	TBTDP_TX	*	DP_2SAME
DISPLAYPORT	TBTDP_RX	*	TBTDP_TXRX

DisplayPort/TMDS intra-pair matching should be 0.127mm. Inter-pair matching should be within 2.54cm. Max Length 241.3mm.
DisplayPort AUX CH intra-pair matching should be 0.127mm. Max length 330.2mm.
SOURCE: Calpella SFF DG Rev 1.5 (407364) and Family GPU DG-04202-001-v04.
MAX LENGTH OF DISPLAYPORT/TMDS TRACES: 13 INCHES.

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING		
	DP_85D	DISPLAYPORT	DP_TBTSRC_ML_C_P<3..0>	
	DP_85D	DISPLAYPORT	DP_TBTSRC_ML_C_N<3..0>	
	DP_85D	DISPLAYPORT	DP_TBTSRC_AUXCH_C_P	
	DP_85D	DISPLAYPORT	DP_TBTSRC_AUXCH_C_N	
SPI_TBT_CLK	TBT_SPI_45S	TBT_SPI	TBT_SPI_CLK	25
SPI_TBT_MOSI	TBT_SPI_45S	TBT_SPI	TBT_SPI_MOSI	25
SPI_TBT_MISO	TBT_SPI_45S	TBT_SPI	TBT_SPI_MISO	25
SPI_TBT_CS_L	TBT_SPI_45S	TBT_SPI	TBT_SPI_CS_L	25
DP_HDMI_TBT_ML	DP_85D	DISPLAYPORT	DP_HDMI_TBT_ML_P<3..0>	67 69
DP_HDMI_TBT_ML	DP_85D	DISPLAYPORT	DP_HDMI_TBT_ML_N<3..0>	67 69
DP_HDMI_TBT_AUX	DP_85D		DP_HDMI_TBT_AUX_P	67 69
DP_HDMI_TBT_AUX	DP_85D		DP_HDMI_TBT_AUX_N	67 69
HDMI_CLOCK	HDMI_85D	HDMI_CLK	HDMI_IG_CLK_C_P	66 67 71
HDMI_CLOCK	HDMI_85D	HDMI_CLK	HDMI_IG_CLK_C_N	66 67 71
HDMI_DATA	HDMI_85D	HDMI_DATA	HDMI_IG_DATA_C_P<2..0>	66 67 71
HDMI_DATA	HDMI_85D	HDMI_DATA	HDMI_IG_DATA_C_N<2..0>	66 67 71

Only used on hosts supporting Thunderbolt video-in

Thunderbolt, DP, HDMI Net Properties

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING		
TBT_A_R2D	TBTDP_85D	TBTDP_TX	TBT_A_R2D_C_P<1..0>	25 28 71
TBT_A_R2D	TBTDP_85D	TBTDP_TX	TBT_A_R2D_C_N<1..0>	25 28 71
TBT_A_R2D	TBTDP_85D	TBTDP_TX	TBT_A_R2D_P<1..0>	28 71
TBT_A_R2D	TBTDP_85D	TBTDP_TX	TBT_A_R2D_N<1..0>	28 71
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_P<1>	25 28
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_N<1>	25 28
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_P<1>	28
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_N<1>	28
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_A_LSX_ML_P<1>	28
DP_A_LSX_ML	DP_85D	DISPLAYPORT	DP_A_LSX_ML_N<1>	28
DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_P<3>	25 28
1355 DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_N<3>	25 28
1354 DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_P<3>	28
1353 DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_N<3>	28
1352 DP_TBTPA_ML	DP_85D	DISPLAYPORT		
TBT_A_D2R_0	TBTDP_85D	TBTDP_RX	TBT_A_D2R_C_P<0>	28 71
TBT_A_D2R_0	TBTDP_85D	TBTDP_RX	TBT_A_D2R_C_N<0>	28 71
TBT_A_D2R_0	TBTDP_85D	TBTDP_RX	TBT_A_D2R_P<0>	25 28 71
TBT_A_D2R_0	TBTDP_85D	TBTDP_RX	TBT_A_D2R_N<0>	25 28 71
1343 TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R_C_P<1>	28 71
1342 TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R_C_N<1>	28 71
1341 TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R_P<1>	25 28 71
1340 TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R_N<1>	25 28 71
TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R1_AUXDDC_P	28
TBT_A_D2R_1	TBTDP_85D	TBTDP_RX	TBT_A_D2R1_AUXDDC_N	28
DP_TBTPA_AUXCH	DP_85D		DP_TBTPA_AUXCH_C_P	25 28
DP_TBTPA_AUXCH	DP_85D		DP_TBTPA_AUXCH_C_N	25 28
DP_TBTPA_AUXCH	DP_85D		DP_TBTPA_AUXCH_P	28
DP_TBTPA_AUXCH	DP_85D		DP_TBTPA_AUXCH_N	28
TBT_B_R2D	TBTDP_85D	TBTDP_TX	TBT_B_R2D_C_P<1..0>	25 29 71
TBT_B_R2D	TBTDP_85D	TBTDP_TX	TBT_B_R2D_C_N<1..0>	25 29 71
TBT_B_R2D	TBTDP_85D	TBTDP_TX	TBT_B_R2D_P<1..0>	29 71
TBT_B_R2D	TBTDP_85D	TBTDP_TX	TBT_B_R2D_N<1..0>	29 71
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_P<1>	25 29
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_N<1>	25 29
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_P<1>	29
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_N<1>	29
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_B_LSX_ML_P<1>	29
DP_B_LSX_ML	DP_85D	DISPLAYPORT	DP_B_LSX_ML_N<1>	29
1361 DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_P<3>	25 29
1360 DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_N<3>	25 29
1348 DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_P<3>	29
1349 DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_N<3>	29
TBT_B_D2R_0	TBTDP_85D	TBTDP_RX	TBT_B_D2R_C_P<0>	29 71
TBT_B_D2R_0	TBTDP_85D	TBTDP_RX	TBT_B_D2R_C_N<0>	29 71
TBT_B_D2R_0	TBTDP_85D	TBTDP_RX	TBT_B_D2R_P<0>	25 29 71
TBT_B_D2R_0	TBTDP_85D	TBTDP_RX	TBT_B_D2R_N<0>	25 29 71
1347 TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R_C_P<1>	29 71
1346 TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R_C_N<1>	29 71
1344 TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R_P<1>	25 29 71
1345 TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R_N<1>	25 29 71
TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R1_AUXDDC_P	29
TBT_B_D2R_1	TBTDP_85D	TBTDP_RX	TBT_B_D2R1_AUXDDC_N	29
DP_TBTPB_AUXCH	DP_85D		DP_TBTPB_AUXCH_C_P	25 29
DP_TBTPB_AUXCH	DP_85D		DP_TBTPB_AUXCH_C_N	25 29
DP_TBTPB_AUXCH	DP_85D		DP_TBTPB_AUXCH_P	29
DP_TBTPB_AUXCH	DP_85D		DP_TBTPB_AUXCH_N	29
1338 DP_TBTSNK0_ML	DP_85D	DISPLAYPORT	DP_TBTSNK0_ML_C_P<3..0>	5 25
1339 DP_TBTSNK0_ML	DP_85D	DISPLAYPORT	DP_TBTSNK0_ML_C_N<3..0>	5 25
1336 DP_TBTSNK0_ML	DP_85D	DISPLAYPORT	DP_TBTSNK0_ML_P<3..0>	25
1337 DP_TBTSNK0_ML	DP_85D	DISPLAYPORT	DP_TBTSNK0_ML_N<3..0>	25
1335 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK0_AUXCH_C_P	13 25
1334 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK0_AUXCH_C_N	13 25
1324 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK0_AUXCH_P	25
1333 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK0_AUXCH_N	25
1332 DP_TBTSNK1_ML	DP_85D	DISPLAYPORT	DP_TBTSNK1_ML_C_P<3..0>	25 67
1330 DP_TBTSNK1_ML	DP_85D	DISPLAYPORT	DP_TBTSNK1_ML_C_N<3..0>	25 67
1331 DP_TBTSNK1_ML	DP_85D	DISPLAYPORT	DP_TBTSNK1_ML_P<3..0>	25
1328 DP_TBTSNK1_ML	DP_85D	DISPLAYPORT	DP_TBTSNK1_ML_N<3..0>	25
1329 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK1_AUXCH_C_P	25 67
1327 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK1_AUXCH_C_N	25 67
1325 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK1_AUXCH_P	25
1326 DP_TBTSNK_AUXCH	DP_85D		DP_TBTSNK1_AUXCH_N	25
1357 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_F_P<3..0>	65
1356 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_F_N<3..0>	65
1316 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_C_P<3..0>	5 65
1315 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_C_N<3..0>	5 65
1317 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_P<3..0>	65 71
1318 DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_ML_N<3..0>	65 71
1320 DP_INT_AUXCH	DP_85D		DP_INT_AUXCH_C_P	5 65
1321 DP_INT_AUXCH	DP_85D		DP_INT_AUXCH_C_N	5 65
1322 DP_INT_AUXCH	DP_85D		DP_INT_AUX_P	65 71
1323 DP_INT_AUXCH	DP_85D		DP_INT_AUX_N	65 71

Notes:
AUX and DDC was removed from DISPLAYPORT or TBTDP_RX/TX because it's not high speed, and to save routing space.

Only used on dual-port hosts.

SYNC_MASTER=GKOO_J52 SYNC_DATE=12/06/2013

PAGE TITLE: TBT,DP,HDMI Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 115 OF 120
SHEET: 77 OF 82

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 CONST SET	NET TYPE: PHYSICAL	NET TYPE: SPACING		
S2_MEM_CLK	S2_MEM_85D	S2_MEM_CLK	MEM_CAM_CLK_P	33 34
S2_MEM_CLK	S2_MEM_85D	S2_MEM_CLK	MEM_CAM_CLK_N	33 34
S2_MEM_CKE	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CKE	33 34
S2_MEM_CS	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CS_L	33 34
	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_ODT	34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_CAS_L	33 34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CTRL	MEM_CAM_RAS_L	33 34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_WE_L	33 34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<0>	33 34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<1>	33 34
S2_MEM_CMD	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_BA<2>	33 34
S2_MEM_DQS0	S2_MEM_85D	S2_MEM_DQS0	MEM_CAM_DQS_P<0>	33 34
S2_MEM_DQS0	S2_MEM_85D	S2_MEM_DQS0	MEM_CAM_DQS_N<0>	33 34
S2_MEM_DQS1	S2_MEM_85D	S2_MEM_DQS1	MEM_CAM_DQS_P<1>	33 34
S2_MEM_DQS1	S2_MEM_85D	S2_MEM_DQS1	MEM_CAM_DQS_N<1>	33 34
S2_MEM_DATA_0	S2_MEM_45S	S2_MEM_DATA0	MEM_CAM_DM<0>	33 34
S2_MEM_DATA_1	S2_MEM_45S	S2_MEM_DATA1	MEM_CAM_DM<1>	33 34
S2_MEM_A	S2_MEM_45S	S2_MEM_CMD	MEM_CAM_A<14..0>	33 34
S2_MEM_DATA_0	S2_MEM_45S	S2_MEM_DATA0	MEM_CAM_DQ<7..0>	33 34
S2_MEM_DATA_1	S2_MEM_45S	S2_MEM_DATA1	MEM_CAM_DQ<15..8>	33 34
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_P	33 34 71
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_N	33 34 71
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_CONN_P	34 71
MIPI_DATA_S2	MIPI_85D	MIPI_DATA	MIPI_DATA_CONN_N	34 71
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_P	33 34 71
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_N	33 34 71
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_CONN_P	34 71
MIPI_CLK_S2	MIPI_85D	CLK_MIPI	MIPI_CLK_CONN_N	34 71
		S2_MEM_PWR	PP1V35_CAM	33 34
		S2_MEM_PWR	PP0V675_CAM_VREF	33 34
		S2_MEM_PWR	PP0V675_MEM_CAM_VREFCA	34
		S2_MEM_PWR	PP0V675_MEM_CAM_VREFDQ	34

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/09/2013

PAGE TITLE: Camera Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 116 OF 120

SHEET: 78 OF 82

SMC SMBus & Charger Net Properties

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING		
SMBUS_SMC_2	SMB_45S	SMB	SMBUS_SMC_2_S3_SCL	38 41 71
SMBUS_SMC_2	SMB_45S	SMB	SMBUS_SMC_2_S3_SDA	38 41 71
SMBUS_SMC_1	SMB_45S	SMB	SMBUS_SMC_1_S0_SCL	38 41 71
SMBUS_SMC_1	SMB_45S	SMB	SMBUS_SMC_1_S0_SDA	38 41 71
SMBUS_SMC_0	SMB_45S	SMB	SMBUS_SMC_0_S0_SCL	38 41
SMBUS_SMC_0	SMB_45S	SMB	SMBUS_SMC_0_S0_SDA	38 41
SMBUS_SMC_5	SMB_45S	SMB	SMBUS_SMC_5_G3_SCL	38 41 71
SMBUS_SMC_5	SMB_45S	SMB	SMBUS_SMC_5_G3_SDA	38 41 71
SMBUS_SMC_3	SMB_45S	SMB	SMBUS_SMC_3_SCL	38 41
SMBUS_SMC_3	SMB_45S	SMB	SMBUS_SMC_3_SDA	38 41

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/02/2013

PAGE TITLE: SMC Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 117 OF 120

SHEET: 79 OF 82

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SENSE_45S	*	=1TO1_DIFFPAIR	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	0.1 MM	0.1 MM
THERM_45S	*	=1TO1_DIFFPAIR	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	0.1 MM	0.1 MM
DIG_AUDIO	*	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR	=1TO1_DIFFPAIR	0.1 MM	0.1 MM
ANL_AUDIO	*	=1TO1_DIFFPAIR	0.1 MM	0.1 MM	10 MM	0.1 MM	0.1 MM
ANL_AUDIO_WIDE	*	=1TO1_DIFFPAIR	0.3 MM	0.3 MM	10 MM	0.1 MM	0.1 MM

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SENSE	*	=2X_DIELECTRIC	?
THERM	*	=2X_DIELECTRIC	?
AUDIO	*	=2X_DIELECTRIC	?

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	1000
PWR_P2MM	*	0.20 MM	1000

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CPU_VCCSENSE	GND	*	GND_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CLK_PCIE	GND	*	GND_P2MM
GND	PCIE_*	*	GND_P2MM
GND	SATA_*	*	GND_P2MM
USB	GND	*	GND_P2MM
CLK_PCIE	SB_POWER	*	PWR_P2MM
SB_POWER	SATA_*	*	PWR_P2MM
USB	SB_POWER	*	PWR_P2MM

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MEM_45S OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.070 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_40S OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.090 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_72D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.090 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_85D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.090 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
PCIE_85D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.090 MM OVERRIDE	10 MM OVERRIDE	OVERRIDE	OVERRIDE
USB_85D	TOP			0.100 MM	500 MIL		
CPU_27P4S	BOTTOM			0.230 MM	100 MIL		
USB3_85D	TOP			0.100 MM	500 MIL		
USB3_85D	ISL10			0.075 MM			0.090 MM
DP_85D	ISL9			0.075 MM			0.090 MM
PCIE_85D	ISL10			0.075 MM			0.090 MM

DP, SATA, HDMI, PCIE CONSTRAINT RELAXATIONS

Alternate diffpair width/gap through BGA fanout areas (95-ohm diff)

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
DP_85D	BGA	P65_BGA
PCIE_85D	BGA	P65_BGA
CLK_PCIE_85D	BGA	P65_BGA
HDMI_85D	BGA	P65_BGA

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
SENSE_45S	*	SENSE_45S
THERM_45S	*	THERM_45S
DIG_AUDIO	*	DIG_AUDIO
ANL_AUDIO	*	ANL_AUDIO

X304 Specific Net Properties

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING		
THERM_DP_TBT_D1	THERM_45S	THERM	TBTTHMSNS_D1_P	45
THERM_DP_TBT_D1	THERM_45S	THERM	TBTTHMSNS_D1_N	45
THERM_DP_CPU_D1	THERM_45S	THERM	CPUTHMSNS_D1_P	45
THERM_DP_CPU_D1	THERM_45S	THERM	CPUTHMSNS_D1_N	45
THERM_DP_CPU_D2	THERM_45S	THERM	CPUTHMSNS_D2_P	45
THERM_DP_CPU_D2	THERM_45S	THERM	CPUTHMSNS_D2_N	45
SENSE_DP	SENSE_45S	SENSE	ISNS_CPUDDR_P	43
SENSE_DP	SENSE_45S	SENSE	ISNS_CPUDDR_N	43
SENSE_DP_LCDBKLT	SENSE_45S	SENSE	ISNS_LCDBKLT_P	42 60
SENSE_DP_LCDBKLT	SENSE_45S	SENSE	ISNS_LCDBKLT_N	42 60
SENSE_DP_TBT	SENSE_45S	SENSE	ISNS_TBT_P	44
SENSE_DP_TBT	SENSE_45S	SENSE	ISNS_TBT_N	44
SENSE_DP	SENSE_45S	SENSE	ISNS_LCDPANEL_P	44 65
SENSE_DP	SENSE_45S	SENSE	ISNS_LCDPANEL_N	44 65
	SENSE_45S	SENSE	ISNS_HS_COMPUTING_P	42 44
	SENSE_45S	SENSE	ISNS_HS_COMPUTING_N	42 44
SENSE_DP	SENSE_45S	SENSE	ISNS_HS_OTHER5V_P	42
SENSE_DP	SENSE_45S	SENSE	ISNS_HS_OTHER5V_N	42
SENSE_DP	SENSE_45S	SENSE	ISNS_HS_OTHER3V3_P	42
SENSE_DP	SENSE_45S	SENSE	ISNS_HS_OTHER3V3_N	42
SENSE_DP_CPUVR	SENSE_45S	SENSE	CPUVR_ISNS_P	43
SENSE_DP_CPUVR	SENSE_45S	SENSE	CPUVR_ISNS_N	43
SENSE_DP_CPUVR	SENSE_45S	SENSE	CPUVR_ISNS_R_P	43
SENSE_DP_CPUVR	SENSE_45S	SENSE	CPUVR_ISNS_R_N	43
SENSE_DP	SENSE_45S	SENSE	ISNS_1V05_S0_P	43 59
SENSE_DP	SENSE_45S	SENSE	ISNS_1V05_S0_N	43 59
SENSE_DP	SENSE_45S	SENSE	ISNS_SSD_P	43
SENSE_DP	SENSE_45S	SENSE	ISNS_SSD_N	43
SENSE_DP	SENSE_45S	SENSE	ISNS_TPAD_P	42
SENSE_DP	SENSE_45S	SENSE	ISNS_TPAD_N	42
SENSE_DP	SENSE_45S	SENSE	ISNS_1V8_S3_P	43 61
SENSE_DP	SENSE_45S	SENSE	ISNS_1V8_S3_N	43 61
SENSE_DP	SENSE_45S	SENSE	ISNS_PP3V3S0_P	43
SENSE_DP	SENSE_45S	SENSE	ISNS_PP3V3S0_N	43
SENSE_DP	SENSE_45S	SENSE	ISNS_PP5VS0_P	43
SENSE_DP	SENSE_45S	SENSE	ISNS_PP5VS0_N	43
SENSE_DP_CPUHIGN	SENSE_45S	SENSE	ISNS_CPUHIGAIN_P	44 45
SENSE_DP_CPUHIGN	SENSE_45S	SENSE	ISNS_CPUHIGAIN_N	44 45
SENSE_DP_CPUHIGN	SENSE_45S	SENSE	ISNS_CPUHIGAIN_R_P	44
SENSE_DP_CPUHIGN	SENSE_45S	SENSE	ISNS_CPUHIGAIN_R_N	44
SENSE_DP_CHGR_CSI	SENSE_45S	SENSE	CHGR_CSI_P	54
SENSE_DP_CHGR_CSI	SENSE_45S	SENSE	CHGR_CSI_N	54
SENSE_DP_CHGR_CSI	SENSE_45S	SENSE	CHGR_CSI_R_P	54
SENSE_DP_CHGR_CSI	SENSE_45S	SENSE	CHGR_CSI_R_N	54
SENSE_DP_CHGR_CSO	SENSE_45S	SENSE	CHGR_CSO_P	54
SENSE_DP_CHGR_CSO	SENSE_45S	SENSE	CHGR_CSO_N	54
SENSE_DP_CHGR_CSO	SENSE_45S	SENSE	CHGR_CSO_R_P	44 54
SENSE_DP_CHGR_CSO	SENSE_45S	SENSE	CHGR_CSO_R_N	44 54

The signals below have no topologies assigned.

DP_NO_TOPOLOGY	SENSE_45S	SENSE	CPUVR_ISNS1_P	43 56
DP_NO_TOPOLOGY	SENSE_45S	SENSE	CPUVR_ISNS1_N	43 56
DP_NO_TOPOLOGY	SENSE_45S	SENSE	CPUVR_ISNS2_P	43 56
DP_NO_TOPOLOGY	SENSE_45S	SENSE	CPUVR_ISNS2_N	43 56

X304 Specific Net Properties

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING		
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_LO2_L_P	48 50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_LO2_L_N	48 50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_SPKRAMP_LIN_P	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_SPKRAMP_LIN_N	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	SPKRAMP_LIN_P	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	SPKRAMP_LIN_N	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_LO2_R_P	48 50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_LO2_R_N	48 50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_SPKRAMP_RIN_P	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	AUD_SPKRAMP_RIN_N	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	SPKRAMP_RIN_P	50
AUDIO_DP_AMPTWT	ANL_AUDIO	AUDIO	SPKRAMP_RIN_N	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_LO3_L_P	48 50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_LO3_L_N	48 50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_SPKRAMP_LSUBIN_P	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_SPKRAMP_LSUBIN_N	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	LSUBIN_P	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	LSUBIN_N	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_LO3_R_P	48 50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_LO3_R_N	48 50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_SPKRAMP_RSUBIN_P	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	AUD_SPKRAMP_RSUBIN_N	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	RSUBIN_P	50
AUDIO_DP_AMPSUB	ANL_AUDIO	AUDIO	RSUBIN_N	50
AUDIO_DP_SPKSUB	DIG_AUDIO	AUDIO	SPKRCONN_SL_OUT_P	50 52 71
AUDIO_DP_SPKSUB	DIG_AUDIO	AUDIO	SPKRCONN_SL_OUT_N	50 52 71
AUDIO_DP_SPKSUB	DIG_AUDIO	AUDIO	SPKRCONN_SR_OUT_P	50 52 71
AUDIO_DP_SPKSUB	DIG_AUDIO	AUDIO	SPKRCONN_SR_OUT_N	50 52 71
AUDIO_DP_SPKTWT	DIG_AUDIO	AUDIO	SPKRCONN_L_OUT_P	50 52 71
AUDIO_DP_SPKTWT	DIG_AUDIO	AUDIO	SPKRCONN_L_OUT_N	50 52 71
AUDIO_DP_SPKTWT	DIG_AUDIO	AUDIO	SPKRCONN_R_OUT_P	50 52 71
AUDIO_DP_SPKTWT	DIG_AUDIO	AUDIO	SPKRCONN_R_OUT_N	50 52 71
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CH_HS_GND	48 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_HS_MIC_P	
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_SLEEVE	52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_SLEEVE_XW	51 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_HP_PORT_REFCH	48 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_HS_MIC_P	51 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	CODEC_HS_MIC_P	48
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	HS_MIC_P	48 51
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_HS_MIC_N	
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_RING2	52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_CONN_RING2_XW	51 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_HP_PORT_REFUS	48 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_HS_MIC_N	51 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	AUD_US_HS_GND	48 52
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	HS_MIC_N	48 51
AUDIO_DP_MIC	ANL_AUDIO_WIDE	AUDIO	CODEC_HS_MIC_N	48
		SB_POWER	PP3V3_S5	68 71
		SB_POWER	PP3V3_S0	68 71
		GND	GND	

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/04/2013

PAGE TITLE

Project Specific Constraints

Apple Inc.

DRAWING NUMBER 051-1573 SIZE D

REVISION 8.0.0

BRANCH dvt1

PAGE 118 OF 120

SHEET 80 OF 82

PCI Express 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_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF
CLK_PCIE_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
PCIE_2SAME	*	=3X_DIELECTRIC	?
PCIE_TXRX	*	=6X_DIELECTRIC	?
PCIE_2OTHER	*	=4X_DIELECTRIC	?
PCIE_2CLK	*	=7X_DIELECTRIC	?
PCIECLK_2OTHER	*	=7X_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE_2SAME	TOP,BOTTOM	=4X_DIELECTRIC	?
PCIE_TXRX	TOP,BOTTOM	=10X_DIELECTRIC	?
PCIE_2OTHER	TOP,BOTTOM	=6X_DIELECTRIC	?
PCIE_2CLK	TOP,BOTTOM	=10X_DIELECTRIC	?
PCIECLK_2OTHER	TOP,BOTTOM	=10X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
PCIE_*	*	*	PCIE_2OTHER
PCIE_*	=SAME	*	PCIE_2SAME
PCIE_*	CLK_*	*	PCIE_2CLK
CLK_PCIE	*	*	PCIECLK_2OTHER
PCIE_TX	*_RX	*	PCIE_TXRX
PCIE_RX	*_TX	*	PCIE_TXRX

PCI Express Properties

ELECTRICAL CONST SET	NET TYPE PHYSICAL	NET TYPE SPACING	
PCIE_SSD_D2R	PCIE_85D	PCIE_RX	PCIE_SSD_D2R_P<3..1> 12 32 71
PCIE_SSD_D2R	PCIE_85D	PCIE_RX	PCIE_SSD_D2R_N<3..1> 12 32 71
PCIE_SSD_D2R_PP	PCIE_85D	PCIE_RX	PCIE_SSD_D2R_P<0> 12 32 71
PCIE_SSD_D2R_PP	PCIE_85D	PCIE_RX	PCIE_SSD_D2R_N<0> 12 32 71
PCIE_SSD_R2D	PCIE_85D	PCIE_TX	PCIE_SSD_R2D_C_P<3..0> 12 32 71
PCIE_SSD_R2D	PCIE_85D	PCIE_TX	PCIE_SSD_R2D_C_N<3..0> 12 32 71
PCIE_SSD_R2D	PCIE_85D	PCIE_TX	PCIE_SSD_R2D_P<3..0> 32 71
PCIE_SSD_R2D	PCIE_85D	PCIE_TX	PCIE_SSD_R2D_N<3..0> 32 71
PCIE_TBT_D2R_0	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_P<0> 14 25 71
PCIE_TBT_D2R_0	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_N<0> 14 25 71
PCIE_TBT_D2R_0	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_C_P<0> 25
PCIE_TBT_D2R_0	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_C_N<0> 25
PCIE_TBT_D2R	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_P<3..1> 14 25 71
PCIE_TBT_D2R	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_N<3..1> 14 25 71
PCIE_TBT_D2R	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_C_P<3..1> 25 71
PCIE_TBT_D2R	PCIE_85D	PCIE_RX	PCIE_TBT_D2R_C_N<3..1> 25 71
PCIE_TBT_R2D	PCIE_85D	PCIE_TX	PCIE_TBT_R2D_P<3..0> 25 71
PCIE_TBT_R2D	PCIE_85D	PCIE_TX	PCIE_TBT_R2D_N<3..0> 25 71
PCIE_TBT_R2D	PCIE_85D	PCIE_TX	PCIE_TBT_R2D_C_P<3..0> 14 25 71
PCIE_TBT_R2D	PCIE_85D	PCIE_TX	PCIE_TBT_R2D_C_N<3..0> 14 25 71
PCIE_AP_R2D	PCIE_85D	PCIE_TX	PCIE_AP_R2D_P 66 71
PCIE_AP_R2D	PCIE_85D	PCIE_TX	PCIE_AP_R2D_N 66 71
PCIE_AP_R2D	PCIE_85D	PCIE_TX	PCIE_AP_R2D_C_P 14 66 71
PCIE_AP_R2D	PCIE_85D	PCIE_TX	PCIE_AP_R2D_C_N 14 66 71
PCIE_AP_D2R	PCIE_85D	PCIE_RX	PCIE_AP_D2R_P 14 66 71
PCIE_AP_D2R	PCIE_85D	PCIE_RX	PCIE_AP_D2R_N 14 66 71
PCIE_CLK100M_AP	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_AP_CONN_P 66
PCIE_CLK100M_AP	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_AP_CONN_N 66
PCIE_CLK100M_AP	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_AP_P 12 66 71
PCIE_CLK100M_AP	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_AP_N 12 66 71
PCIE_CLK100M_CAM	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_CAMERA_P 12 34 71
PCIE_CLK100M_CAM	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_CAMERA_N 12 34 71
PCIE_CLK100M_CAM	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_CAMERA_C_P 33 34
PCIE_CLK100M_CAM	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_CAMERA_C_N 33 34
PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_P 12 32 71
PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_N 12 32 71
I301 PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_RC1_P 32
I302 PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_RC1_N 32
I303 PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_RC2_P 32
I304 PCIE_CLK100M_SSD	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_SSD_RC2_N 32
PCIE_CLK100M_TBT	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_TBT_P 12 25 71
PCIE_CLK100M_TBT	CLK_PCIE_85D	CLK_PCIE	PCIE_CLK100M_TBT_N 12 25 71
PCIE_CAMERA_D2R	PCIE_85D	PCIE_RX	PCIE_CAMERA_D2R_P 14 34 71
PCIE_CAMERA_D2R	PCIE_85D	PCIE_RX	PCIE_CAMERA_D2R_N 14 34 71
PCIE_CAMERA_D2R	PCIE_85D	PCIE_RX	PCIE_CAMERA_D2R_C_P 33 34
PCIE_CAMERA_D2R	PCIE_85D	PCIE_RX	PCIE_CAMERA_D2R_C_N 33 34
PCIE_CAMERA_R2D	PCIE_85D	PCIE_TX	PCIE_CAMERA_R2D_P 33 34
PCIE_CAMERA_R2D	PCIE_85D	PCIE_TX	PCIE_CAMERA_R2D_N 33 34
PCIE_CAMERA_R2D	PCIE_85D	PCIE_TX	PCIE_CAMERA_R2D_C_P 14 34
PCIE_CAMERA_R2D	PCIE_85D	PCIE_TX	PCIE_CAMERA_R2D_C_N 14 34

SYNC_MASTER=YHARTANTO_J44 SYNC_DATE=01/13/2013

PAGE TITLE: PCIe Constraints

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D

REVISION: 8.0.0

BRANCH: dvt1

PAGE: 119 OF 120

SHEET: 81 OF 82

Change List:
<RDAR://COMPONENT/XXXXXX> X304 HW EE SCHEMATIC | PROTO 0

Kismet:
AFP://KISMET.APPLE.COM/KISMET-PROJECTS/X304

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

Other Info:
Page Allocations - <rdar://problem/11791318> 2012 Schematic Page Allocations

SYNC_MASTER=J14 SYNC_DATE=10/23/2012

PAGE TITLE: Reference

Apple Inc.

DRAWING NUMBER: 051-1573 SIZE: D
REVISION: 8.0.0
BRANCH: dvt1
PAGE: 120 OF 120
SHEET: 82 OF 82