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
			2012-05-09

SCHEM,MLB,KEPLER,2PHASE,D2

FSB, 5/9/2012

Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-9589	1	SCHEM,MLB,KEPLER_2PHASE,D2	SCH	CRITICAL	
820-3332	1	PCBF,MLB,KEPLER_2PHASE,D2	PCB	CRITICAL	

DRAWING
TITLE=MLB
ABBREV=ABBREV
LAST_MODIFIED=Wed May 9 13:50:52 2012

DRAWING TITLE: SCHEM,MLB,KEPLER,2PHASE,D2

Apple Inc.

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U8000 GRAPHICS AMD WHISTLER PG 73

INTEL CPU 2.X GHZ IVY BRIDGE PG 9

J2500, J2550 XDP CONN PG 23

2 DIMMS DDR3-1067/1333MHZ

J2900 J3100 DIMM PG 26,28

J6950 DC/BATT PG 63

POWER SUPPLY

GPIO PG 19 | FDI PG 17 | DMI PG 17 | RTC PG 16

U2700 CLOCK CK5G05 PG 24

CLK BUFFER PG 16

J6100 SPI Boot ROM PG 55

U4900 TEMP SENSOR PG 44

POWER SENSE PG 44

J5650,5660 FAN CONN AND CONTROL PG 51

J4501 ODD SATA CONN PG 41

J4500 HDD SATA CONN PG 41

SATA 5 SATA2.0/3(GB/S) 4 SATA2.0/3(GB/S) 3 SATA2.0/3(GB/S) 2 SATA2.0/3(GB/S) PG 16 1 SATA3.0/6(GB/S) 0 SATA3.0/6(GB/S)

INTEL PANTHER-POINT MOBILE U1800

Misc PG 19 | SPI PG 16 | LPC PG 16

J5100 LPC + SPI CONN Port80,serial PG 46

U4900 SMC PG 44 (Ser Prt, 8,0, BSB, ADC, Fan)

U9320 DP MUX XP25-5G PG 83

J9400 MINI DP PORT PG 84

DP OUT RGB OUT HDMI OUT DVI OUT LVDS OUT TMDS OUT PG 18

PWR CTRL PG 17

U3600 USB HUB 2 PG 33

J3402 CAMERA PG 31

J4501 IR PG 41

J4610 EXTERNAL B PG 33

EXTERNAL C (RESERVATION) PG 33

USB (UP TO 14 DEVICES) PG 18 — 0 1 2 3 4 5 6 7 8 9 10 11 12 13

U3700 USB HUB 1 PG 34

J5713 TRACKPAD/KEYBOARD PG 53

J3401 BLUETOOTH PG 31

J4600 EXTERNAL A PG 34

PCI PG 18

JTAG PG 16

SMB PG 16

SMBUS CONNECTION PG 47

PEG PG 16 | PCI-E (UP TO 16 LINES) PG 16 | HDA PG 16

DIMM PG 26,28

U9370 DDC MUX PG 83

LCD PANEL

U9600 GMUX PG 86

U6201 AUDIO CODEC PG 56

LINE TIN FILTER PG 57 | HEADPHONE FILTER PG 58 | U6610,6620,6630 SPEAKTER AMP PG 59

J6700,J6750 AUDIO CONN PG 60

SPEAKTER PG 63

J3401 AirPort PG 31

U4100 FW643 PG 38

J4310 FIREWIRE CONN PG 40

U3900 GB E-NET BCM57765 PG 36

J4000 E-NET CONN PG 37

J3500 SDCARD READER CONN PG 37

苹果笔记本维修交流群群号：325742634

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: System Block Diagram

Apple Inc.

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D2 POWER SYSTEM ARCHITECTURE

J6900 AC ADAPTER IN
DCIN(16.5V)
F6905 6A FUSE
SMC_DCIN_ISENSE
R7020
U7000 ISL6259HRTZ PBUS SUPPLY/ BATTERY CHARGER (PAGE 64)
SMC_RESET_L
PPVBAT_G3H
R7050
SMC_BATT_ISENSE
F7040 8A FUSE
PPBUS_G3H
R6990
PP18V5_DCIN_CONN
D6990
SMC_PBUS_VSENSE
Q5315
ENABLE 3.425V G3HOT PM6640 U6990 (PAGE 62)
PP3V42_G3H
SMC PWRGD NCP303LSN U5000 (PAGE 45)
SMC_RESET_L
SMC AVREF SUPPLY REF3333 (PAGE 45)
PP3V3_S5_AVREF_SMC
PP3V3_S5_SMC
SMC_TPAD_RST_L
SMC_ONOFF_L
U5001
J6950
3S2P (9 TO 12.6V)
PPVBATT_G3H_CONN
Q7055
PPVBAT_G3H_CHGR_R
CHGR_BGATE
PP5V_S3_GFXIMVP6_VDD
GPU VCORE ISL6263C U8900 (PAGE 82)
R5388/U5388
GPUVCORE_EN
GPUVCORE_PGOOD
U5410
SMC_GPU_ISENSE
SMC_GPU_VSENSE
PPVCORE_GPU
PP5V_S0_CPUVTTS0
1.05V ISL95870 U7600 (PAGE 70)
CPUVTTS0_EN
CPUVTTS0_PGOOD
R7640
PPCPUVTT_S0
SMC_CPU_FSB_ISENSE
TPS22924 U4202 (PAGE 39)
PP1V0_FW_FWPHY
FW_PWR_EN
SMC_CPU_HI_ISENSE
CPU VCORE ISL95831 U7400 (PAGE 67)
CPUIMVP7_VR_ON
SMC_CPU_ISENSE
SMC_CPU_VSENSE
PPVCORE_S0_CPU
CPUIMVP7_AXG_PGOOD
PM_PCH_PWRGD
U2850
PANTHER_POINT U1800 (PAGE 16~21)
PM_PWRBTN_L
PLT_RERST_L
CPU_PWRGD
PM_MEM_PWRGD
GMUX U9600 XP25-5 (PAGE 86)
EG_RAIL1_EN
EG_RAIL2_EN
EG_RAIL3_EN
EG_RAIL4_EN
PM_ALL_GPU_PGOOD
P1V1GPU_EN
P3V3GPU_EN
GPUVCORE_EN
SMC U4900 (PAGE 44)
P60
SMC_PM_G2_EN
RC DELAY
P3V3S5_EN
PP5V_S3_DDRREG
P1V0GPU_EN
P1V5FB_EN
EN1 VIN VOUT1 1.003V(L/H)
EN2 VOUT2 1.503V(R/H)
ISL6236 U9500 (PAGE 85)
POK1
POK2
P1V0GPU_PGOOD
P1V5FB_PGOOD
PP1V0_S0GPU_REG
R5413
PP1V5_GPU_REG
SMC_GPU_1V8_ISENSE
DDRREG_EN
DDRVTT_EN
VIN VLDOIN 1.5V S5 0.75V S3 VOUT1 VOUT2 TPS51116 U7300 (PAGE 66) PGOOD
PPDDR_S3_REG
PPVTT_S0_DDR_LDO
DDRREG_PGOOD
R7350
SMC_DDR_ISENSE
U5440
SMC_CPU_DDR_VSENSE
PP1V5_S3
4.5V VIN MAX8840 EN U6200 VOUT
PP4V5_AUDIO_ANALOG
PP3V3_S0
P1V5CPU_EN
VIN ON SLG5AP020 U7801 G
PP1V5_S3
Q7801
PP1V5_S3RS0
P1V5S0FET_GATE
Q7860
PP5V_S0
P5V_S0_EN
P5VS3_EN
P3V3S5_EN
VIN VREG5 EN1 EN2 5V (L/H) 3.3V (R/H) VOUT1 VOUT2 TPS51125 U7201 (PAGE 65) PGOOD
PP5V_S3
PP3V3_S5
Q9806
BKLT_PLT_RST_L && LCD_BKLT_NO
BKLT_EN
VIN ENA LP8550 U9701 VOUT (PAGE 87)
P5V3V3_PGOOD
PPVOUT_S0_LCDBKLT
Q4260
PFWBOOST
SMC_ADAPTER_EN&&PM_SLP_S3_L
Q7870
PP3V3_S0GPU
P3V3GPU_EN
Q7810
PP3V3_S3
P3V3S3_EN
Q7830
PP3V3_S0_FET
P3V3S0_EN
TPS22924 U4201 (PAGE 39)
PP3V3_FW_FWPHY
FW_PWR_EN
Q7922
PP3V3_ENET
PM_SLP_S3_L&&WOL_EN|SMC_ADAPTER_EN
P1V8FB_EN
VIN ON SLG5AP020 U7880 G
PP1V8_S0
Q7880
PP1V8_GPUIFPX
P1V8GPUIFPXFET_GATE
U7980
PM_ALL_GPU_PGOOD
PP3V3_S0_PWRCTL
P1V8S0_PGOOD
P5V3V3_PGOOD
S0PGOOD_PWROK
ALL_SYS_PWRGD
RSMRST_PWRGD
SMC_ONOFF_L
SMC U1800 (PAGE 45)
PWRGD(P12)
RSMRST_IN(P13)
PWR_BUTTON(P90)
RSMRST_OUT(P15)
90ms DLY
IMVP_VR_ON(P16)
SYSRST(PA2)
P17(BTN_OUT)
RES*
SLP_S5_L(P95)
SLP_S4_L(P94)
SLP_S3_L(P93)
H8S2117
SMC_ADAPTER_EN
PM_RSMRST_L
CPUIMVP_VR_ON
PM_SYSRST_L
PM_PWRBTN_L
SMC_RESET_L
PM_SLP_S5_L
PM_SLP_S4_L
PM_SLP_S3_L
CPU U1000 (PAGE 9~14)
SM_DRAMPWROK
VCCCPUPWRGD
RESET*
PANTHER-POINT MOBILE U1800 (PAGE 16~21)
SLP_S5#(E4)
SLP_S4#(H7)
SLP_S3#(P12)
R7978
PM_SLP_S3_L_R
P1V8S0_EN
P1V2S0_EN
CPUVTTS0_EN
P1V5CPU_EN
P5VS0_EN
P3V3S0_EN
PBUSVSENS_EN
ISL8014A U7720 (PAGE 70)
P1V8_S0_EN
PP1V8_S0
P1V8S0_PGOOD
Q7850
PP1V2_S0
P1V2S0_EN
ISL8014A U7760 (PAGE 70)
P1V2ENET_EN
PP1V2_ENET
P1V2ENET_PGOOD
U7971 ISL88042IRTJJZ (PAGE 72)
V2MON
V3MON
V4MON
RST*
TRST = 200mS
PP1V05_S0

SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
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BOM Variants (continued on CSA 6)

BOM NUMBER	BOM NAME	BOM OPTIONS
085-3726	D2,MLB,KEPLER,DEV	D2_DEVEL:ENG
085-4776	D2,MLB,KEPLER,FSB DEV	D2_DEVEL:FSB
607-9546	D2,MLB,KEPLER_2PHASE,COMMON	D2_COMMON,POSCAP_MYLAR_PAIR
685-0016	PBUS PAIR,KEMET POSCAP,TALL MYLAR,D2	PBUS_CAP:KEMET
685-0017	PBUS PAIR,SANYO POSCAP,SHORT MYLAR,D2	PBUS_CAP:SANYO
639-3378	PCBA,2.3G,8G_HYN,VRAM_HYN,MLB_KEPLER,D2,DY3V	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DY3V,DEVEL_BOM,RAM_2G_HYNIX_1600
639-3379	PCBA,2.3G,8G_HYN,VRAM_SAM,MLB_KEPLER,D2,DY3W	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DY3W,DEVEL_BOM,RAM_2G_HYNIX_1600
639-3380	PCBA,2.3G,8G_SAM,VRAM_HYN,MLB_KEPLER,D2,DY3Y	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DY3Y,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-3381	PCBA,2.3G,8G_SAM,VRAM_SAM,MLB_KEPLER,D2,DY40	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DY40,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-3384	PCBA,2.3G,16G_HYN,VRAM_HYN,MLB_KEPLER,D2,DY43	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DY43,DEVEL_BOM,RAM_4G_HYNIX_1600
639-3385	PCBA,2.3G,16G_HYN,VRAM_SAM,MLB_KEPLER,D2,DY44	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DY44,DEVEL_BOM,RAM_4G_HYNIX_1600
639-3386	PCBA,2.3G,16G_SAM,VRAM_HYN,MLB_KEPLER,D2,DY45	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DY45,DEVEL_BOM,RAM_4G_SAMSUNG_1600
639-3387	PCBA,2.3G,16G_SAM,VRAM_SAM,MLB_KEPLER,D2,DY4C	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DY4C,DEVEL_BOM,RAM_4G_SAMSUNG_1600
639-2821	PCBA,2.6G,8G_HYN,VRAM_HYN,MLB_KEPLER,D2,DRF1	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DRF1,DEVEL_BOM,RAM_2G_HYNIX_1600
639-2825	PCBA,2.6G,8G_HYN,VRAM_SAM,MLB_KEPLER,D2,DRF4	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DRF4,DEVEL_BOM,RAM_2G_HYNIX_1600
639-2817	PCBA,2.6G,8G_SAM,VRAM_HYN,MLB_KEPLER,D2,DRDN	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DRDN,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-2815	PCBA,2.6G,8G_SAM,VRAM_SAM,MLB_KEPLER,D2,DRDW	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DRDW,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-2979	PCBA,2.6G,16G_HYN,VRAM_HYN,MLB_KEPLER,D2,DT9H	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DT9H,DEVEL_BOM,RAM_4G_HYNIX_1600
639-2980	PCBA,2.6G,16G_HYN,VRAM_SAM,MLB_KEPLER,D2,DT9D	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DT9D,DEVEL_BOM,RAM_4G_HYNIX_1600
639-2981	PCBA,2.6G,16G_SAM,VRAM_HYN,MLB_KEPLER,D2,DT9F	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DT9F,DEVEL_BOM,RAM_4G_SAMSUNG_1600
639-2982	PCBA,2.6G,16G_SAM,VRAM_SAM,MLB_KEPLER,D2,DT9G	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DT9G,DEVEL_BOM,RAM_4G_SAMSUNG_1600
639-3618	PCBA,2.7G,8G_HYN,VRAM_HYN,MLB_KEPLER,D2,F0HN	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:F0HN,DEVEL_BOM,RAM_2G_HYNIX_1600
639-3619	PCBA,2.7G,8G_HYN,VRAM_SAM,MLB_KEPLER,D2,F0HR	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:F0HR,DEVEL_BOM,RAM_2G_HYNIX_1600
639-3561	PCBA,2.7G,8G_SAM,VRAM_HYN,MLB_KEPLER,D2,DYW4	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:DYW4,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-3620	PCBA,2.7G,8G_SAM,VRAM_SAM,MLB_KEPLER,D2,F0HV	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:F0HV,DEVEL_BOM,RAM_2G_SAMSUNG_1600
639-3627	PCBA,2.7G,16G_HYN,VRAM_HYN,MLB_KEPLER,D2,F0HM	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:F0HM,DEVEL_BOM,RAM_4G_HYNIX_1600
639-3562	PCBA,2.7G,16G_HYN,VRAM_SAM,MLB_KEPLER,D2,DYW5	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:DYW5,DEVEL_BOM,RAM_4G_HYNIX_1600
639-3628	PCBA,2.7G,16G_SAM,VRAM_HYN,MLB_KEPLER,D2,F0HY	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:F0HY,DEVEL_BOM,RAM_4G_SAMSUNG_1600
639-3629	PCBA,2.7G,16G_SAM,VRAM_SAM,MLB_KEPLER,D2,F0HT	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:F0HT,DEVEL_BOM,RAM_4G_SAMSUNG_1600

BOM Groups

BOM GROUP	BOM OPTIONS
D2_COMMON	ALTERNATE,COMMON,D2_COMMON1,D2_COMMON2,D2_PROGPARTS,D2_PVB
D2_COMMON1	CPUMEM_S0,SMC_DEBUG_YES,DPMUX:HOCO,TBTRTR:PRQ,TBTBST:Y,TBTHV:P15V,HUB_2NONREM,USBHUB2512B,SPEAKERID,SMC_PACKAGE:PROD,SKIP_5V3V3:AUDIBLE,CHGR_5V:LDO,P1V5S0:LDO
D2_COMMON2	EDP:YES,MIKEY,PPCPUVCCIO:IVB,PPDDR:1V35,LPCPLUS_CONN:YES,LPCPLUS_R:YES,KBD_BL:SANDWICH,CAPS:INT,BTPWR:S4,XDP,XDP_CPU:BPM,GPU:2P,TPAD_5V:LDO_S5
D2_PVB	VREF:PROD,D_BKL:PROD,SENSOR_NONPROD:N
D2_PROGPARTS	SMC_PROG:FSB,BOOTROM_PROG:FSB,DPMUXMCU:PROG,TPAD_PSOC:PROG,TBTROM:PROG
D2_DEVEL:ENG	ALTERNATE,IVB_PPT_XDP,S0PGOOD_ISL,DPMUX_DEBUG,DDRVREF_DAC,VREF:ENG_M3,SENSOR_NONPROD:Y,D_BKL:DEV
D2_DEVEL:FSB	ALTERNATE,IVB_PPT_XDP
IVB_PPT_XDP	XDP_CONN,XDP_PCH

Module Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
337S4266	1	IVB,S R0MP,PRQ,E1,2.3,45W,4+2,1.2,0M,BGA	U1000	CRITICAL	CPU_IVY:2_3GHZ
337S4267	1	IVB,S R0MP,PRQ,E1,2.6,45W,4+2,1.25,0M,BGA	U1000	CRITICAL	CPU_IVY:2_6GHZ
337S4268	1	IVB,S R0MP,PRQ,E1,2.7,45W,4+2,1.25,0M,BGA	U1000	CRITICAL	CPU_IVY:2_7GHZ
337S4269	1	PANTHER POINT,C1,SLJ8C,PRQ,BD82HM77	U1800	CRITICAL	
337S4256	1	IC,GPU,NV GK107-GTX-PS-A2	U8000	CRITICAL	
338S1113	1	IC,TBT,CR-4C,B1,PRQ,C20,220 12X12 FC:CSP	U3600	CRITICAL	TBTRTR:PRQ
333S0622	32	IC,SDRAM,DDR3-1600,256MX8,78FBGA,HYNIX,C-DIE,38NM		CRITICAL	2G_HYNIX_1600
333S0623	32	IC,SDRAM,DDR3-1600,256MX8,78FBGA,SAMSUNG		CRITICAL	2G_SAMSUNG_1600
333S0628	32	IC,SDRAM,DDR3-1600,256MX8,78FBGA,D-DIE,ELPIDA		CRITICAL	2G_ELPIDA_1600
333S0625	32	IC,SDRAM,DDR3-1600,512MX8,78FBGA,HYNIX		CRITICAL	4G_HYNIX_1600
333S0624	32	IC,SDRAM,DDR3-1600,512MX8,78FBGA,C-DIE,SAMSUNG		CRITICAL	4G_SAMSUNG_1600
333S0629	32	IC,SDRAM,DDR3-1600,512MX8,78FBGA,B-DIE,ELPIDA		CRITICAL	4G_ELPIDA_1600
333S0630	4	IC,SDRAM,GDDR5,64MX32,A-DIE,HYNIX	U8400,U8450,U8500,U8550	CRITICAL	FB_2G_HYNIX_A_DIE
333S0631	4	IC,SDRAM,GDDR5,64MX32,D-DIE,SAMSUNG	U8400,U8450,U8500,U8550	CRITICAL	FB_2G_SAMSUNG
128S0264	30	CAP,TANT,POLY,68UF,20%,16V,50MOHM,D2E		CRITICAL	PBUS_CAP:SANYO
128S0257	30	CAP,TANT,POLY,68UF,20%,16V,50MOHM,D,LF		CRITICAL	PBUS_CAP:KEMET
725-1614	1	INSULATOR,SHORT,REAR,MLB,D2	REAR_INSULATOR	CRITICAL	PBUS_CAP:SANYO
725-1648	1	INSULATOR,TALL,REAR,MLB,D2	REAR_INSULATOR	CRITICAL	PBUS_CAP:KEMET
725-1568	1	INSULATOR,CPU,D2	CPU_INSULATOR	CRITICAL	
725-1569	1	INSULATOR,GPU,D2	GPU_INSULATOR	CRITICAL	
725-1621	1	INSULATOR,PCH,D2	PCH_INSULATOR	CRITICAL	
806-2897	2	CAN,COVER,2,J5	CAN_COVER1,CAN_COVER2	CRITICAL	
825-7697	1	TEXT,LABEL,MLB,D2	TEXT_LABEL	CRITICAL	
946-3819	1	D2 MLB DYMAX ADHESIVE SEE-CURE 29993-SC	EDGE_BOND	CRITICAL	
825-7841	1	LBL,PART CONFIG,BOARDS,D2	CONFIG_LABEL	CRITICAL	

PD Parts

Bar Code Labels / EEEE #'s (continued on CSA 6)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY3V]	CRITICAL	EEEE:DY3V
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY3W]	CRITICAL	EEEE:DY3W
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY3Y]	CRITICAL	EEEE:DY3Y
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY40]	CRITICAL	EEEE:DY40
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY43]	CRITICAL	EEEE:DY43
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY44]	CRITICAL	EEEE:DY44
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY45]	CRITICAL	EEEE:DY45
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY4C]	CRITICAL	EEEE:DY4C
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRF1]	CRITICAL	EEEE:DRF1
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRF4]	CRITICAL	EEEE:DRF4
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRDN]	CRITICAL	EEEE:DRDN
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRDW]	CRITICAL	EEEE:DRDW
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DT9H]	CRITICAL	EEEE:DT9H
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DT9D]	CRITICAL	EEEE:DT9D
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DT9F]	CRITICAL	EEEE:DT9F
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DT9G]	CRITICAL	EEEE:DT9G
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HN]	CRITICAL	EEEE:F0HN
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HR]	CRITICAL	EEEE:F0HR
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DYW4]	CRITICAL	EEEE:DYW4
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HV]	CRITICAL	EEEE:F0HV
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HM]	CRITICAL	EEEE:F0HM
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DYW5]	CRITICAL	EEEE:DYW5
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HY]	CRITICAL	EEEE:F0HY
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0HT]	CRITICAL	EEEE:F0HT

Programmables

341S3584	1	IC,TRKPD/KYBD CNTRLR,DVB,D2	U5701	CRITICAL	TPAD_PSOC:PROG
337S2983	1	IC,TP PSOC,QFN,BLANK	U5701	CRITICAL	TPAD_PSOC:BLANK
341S3597	1	IC,EEPROM,CACTUS RIDGE (0.1) FSB,D2	U3690	CRITICAL	TBTROM:PROG
335S0865	1	EEPROM,256KBIT,SPI,5MHZ,1.8V,2X3QFN	U3690	CRITICAL	TBTROM:BLANK
335S0852	1	IC,GPU ROM,D2,BLANK	U8701	CRITICAL	GPUROM:BLANK
341S3565	1	IC,EDP MUX-9SC, (RENESAS) V3.2.0,DVB,D2	U9100	CRITICAL	DPMUXMCU:PROG
337S4313	1	IC,MCU,H8S/2113,8X8MM,TLP-145V	U9100	CRITICAL	DPMUXMCU:BLANK

DRAM VREF Configs

BOM GROUP	BOM OPTIONS
VREF:PROD	VREFDQ:M1_M3,VREFCA:LDO
VREF:ENG_M3	VREFDQ:M1_M3,VREFCA:LDO_DAC
VREF:ENG_LDO	VREFDQ:M1_DAC,VREFCA:LDO_DAC

DRAM SPD Straps

BOM GROUP	BOM OPTIONS
RAM_4G_HYNIX_1600_S	RAMCFG3:L,RAMCFG2:L,RAMCFG1:L,RAMCFG0:L
RAM_1G_SAMSUNG_1600	RAMCFG3:L,RAMCFG2:L,RAMCFG1:L,RAMCFG0:H
RAM_4G_SAMSUNG_1600_S	RAMCFG3:L,RAMCFG2:L,RAMCFG1:H,RAMCFG0:L
RAM_1G_HYNIX_1600	RAMCFG3:L,RAMCFG2:L,RAMCFG1:H,RAMCFG0:H
RAM_4G_ELPIDA_1600_S	RAMCFG3:L,RAMCFG2:H,RAMCFG1:L,RAMCFG0:L
RAM_2G_SAMSUNG_1600	2G_SAMSUNG_1600,RAMCFG3:L,RAMCFG2:H,RAMCFG1:L,RAMCFG0:H
RAM_2G_SAMSUNG_1333	RAMCFG3:L,RAMCFG2:H,RAMCFG1:H,RAMCFG0:L
RAM_2G_HYNIX_1600	2G_HYNIX_1600,RAMCFG3:L,RAMCFG2:H,RAMCFG1:H,RAMCFG0:H
RAM_4G_SAMSUNG_1600	4G_SAMSUNG_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:L,RAMCFG0:L
RAM_4G_HYNIX_1600	4G_HYNIX_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:L,RAMCFG0:H
RAM_2G_ELPIDA_1600_S	RAMCFG3:H,RAMCFG2:L,RAMCFG1:H,RAMCFG0:L
RAM_2G_ELPIDA_1600	2G_ELPIDA_1600,RAMCFG3:H,RAMCFG2:L,RAMCFG1:H,RAMCFG0:H
RAM_4G_ELPIDA_1600	4G_ELPIDA_1600,RAMCFG3:H,RAMCFG2:H,RAMCFG1:L,RAMCFG0:L
RAM_2G_SAMSUNG_1600_S	RAMCFG3:H,RAMCFG2:H,RAMCFG1:L,RAMCFG0:H
RAM_2G_HYNIX_1600_S	RAMCFG3:H,RAMCFG2:H,RAMCFG1:H,RAMCFG0:L

DEVELOPMENT/BASE BOM

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
085-3726	1	D2 MLB KEPLER DEVEL BOM	DEVEL	CRITICAL	DEVEL_BOM
085-4776	1	D2 MLB KEPLER FSB DEVEL BOM	DEVEL_FSB	CRITICAL	DEVEL_FSB_BOM
607-9546	1	D2 MLB KEPLER 2PHASE BASE BOM	BASE	CRITICAL	BASE_BOM
685-0016	1	PBUS PAIR,KEMET POSCAP,TALL MYLAR,D2	POSCAP_MYLAR	CRITICAL	POSCAP_MYLAR_PAIR

SMC

34153308	1	IC,SMC,DEVELOPMENT-FSB,A3,D2	U4900	CRITICAL	SMC_PROG:FSB
34153309	1	IC,SMC,PVB,A3,2.2F36,D2	U4900	CRITICAL	SMC_PROG:PVB

EFI ROM

34153595	1	IC,EFI,ROM,FSB, D2	U6100	CRITICAL	BOOTROM_PROG:FSB

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
128S0257	128S0264		ALL	Kemet alt to Sanyo
353S3527	353S3528		ALL	Pericom eDP MUX
353S3526	353S3528		ALL	TI eDP MUX
376S0855	376S0613		ALL	Diodes alt to Toshiba
376S0855	376S0613	VREFDQ:M1_M3	ALL	Diodes alt to Toshiba
376S1076	376S0634		ALL	Diodes alt to On Semi
376S0903	376S0796		ALL	Fairchild alt to Siliconix
376S0977	376S0859		ALL	Diodes alt to Toshiba
376S1053	376S0604		ALL	Diodes alt to Fairchild
128S0311	128S0329		ALL	NEC alt to Sanyo
138S0739	138S0706		ALL	Samsung alt to Murata
197S0434	197S0343		ALL	Epson Alt to TXC
197S0435	197S0343		ALL	NDK Alt to TXC
197S0432	197S0431		ALL	NDK Alt to Epson
197S0452	197S0181		ALL	Epson Alt to TXC
197S0453	197S0181		ALL	NDK Alt to TXC
685-0017	685-0016		ALL	Sanyo POSCAP/Mylar alt to Kemet
376S0975	376S1081		ALL	Toshiba alt to diodes
371S0709	371S0652		ALL	NXP alt to infineon
371S0713	371S0558		ALL	DDS alt to ST
377S0126	377S0066		ALL	New Semtech package
377S0147	377S0066		ALL	On Semi alt to Semtech
152S0461	152S1645		ALL	Cyntec alt to Vishay
376S1080	376S0820		ALL	Diodes alt to On Semi
155S0667	155S0583		ALL	Panasonic alt to TDK
107S0232	107S0129		ALL	Cyntec alt to TFT
197S0466	197S0464		ALL	Epson alt to NDK
341S3564	341S3565		ALL	Avnet eDP MUX alt to Renesas

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BOM Variants (continued from CSA 5)

BOM NUMBER	BOM NAME	BOM OPTIONS
639-3382	PCBA,2.3G,8G_ELP,VRAM_HYN,MLB_KEPLER,D2,DY41	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DY41,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-3383	PCBA,2.3G,8G_ELP,VRAM_SAM,MLB_KEPLER,D2,DY42	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DY42,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-3445	PCBA,2.3G,16G_ELP,VRAM_HYN,MLB_KEPLER,D2,DYJ5	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_HYNIX_A_DIE,EEEE:DYJ5,DEVEL_BOM,RAM_4G_ELPIDA_1600
639-3446	PCBA,2.3G,16G_ELP,VRAM_SAM,MLB_KEPLER,D2,DYJ6	BASE_BOM,CPU_IVY:2_3GHZ,FB_2G_SAMSUNG,EEEE:DYJ6,DEVEL_BOM,RAM_4G_ELPIDA_1600
639-2818	PCBA,2.6G,8G_ELP,VRAM_HYN,MLB_KEPLER,D2,DRF0	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DRF0,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-2820	PCBA,2.6G,8G_ELP,VRAM_SAM,MLB_KEPLER,D2,DRDP	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DRDP,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-2823	PCBA,2.6G,16G_ELP,VRAM_HYN,MLB_KEPLER,D2,DRDT	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_HYNIX_A_DIE,EEEE:DRDT,DEVEL_BOM,RAM_4G_ELPIDA_1600
639-2819	PCBA,2.6G,16G_ELP,VRAM_SAM,MLB_KEPLER,D2,DRDQ	BASE_BOM,CPU_IVY:2_6GHZ,FB_2G_SAMSUNG,EEEE:DRDQ,DEVEL_BOM,RAM_4G_ELPIDA_1600
639-3632	PCBA,2.7G,8G_ELP,VRAM_HYN,MLB_KEPLER,D2,F0JD	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:F0JD,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-3633	PCBA,2.7G,8G_ELP,VRAM_SAM,MLB_KEPLER,D2,F0J3	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:F0J3,DEVEL_BOM,RAM_2G_ELPIDA_1600
639-3630	PCBA,2.7G,16G_ELP,VRAM_HYN,MLB_KEPLER,D2,F0J4	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_HYNIX_A_DIE,EEEE:F0J4,DEVEL_BOM,RAM_4G_ELPIDA_1600
639-3631	PCBA,2.7G,16G_ELP,VRAM_SAM,MLB_KEPLER,D2,F0JC	BASE_BOM,CPU_IVY:2_7GHZ,FB_2G_SAMSUNG,EEEE:F0JC,DEVEL_BOM,RAM_4G_ELPIDA_1600

Bar Code Labels / EEEE #’s (continued from CSA 5)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY41]	CRITICAL	EEEE:DY41
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DY42]	CRITICAL	EEEE:DY42
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DYJ5]	CRITICAL	EEEE:DYJ5
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DYJ6]	CRITICAL	EEEE:DYJ6
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRF0]	CRITICAL	EEEE:DRF0
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRDP]	CRITICAL	EEEE:DRDP
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRDT]	CRITICAL	EEEE:DRDT
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:DRDQ]	CRITICAL	EEEE:DRDQ
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0JD]	CRITICAL	EEEE:F0JD
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0J3]	CRITICAL	EEEE:F0J3
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0J4]	CRITICAL	EEEE:F0J4
825-7563	1	LABEL,MLB/LIO,MBA	[EEEE:F0JC]	CRITICAL	EEEE:F0JC

Elipda DQ’d
Keeping for PRQ

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Functional Test Points

FUNC_TEST

J3501 - airport

AP_CLKREQ_Q_L
AP_RESET_CONN_L
PCIE_AP_D2R_PI_N
PCIE_AP_D2R_PI_P
PCIE_AP_R2D_N
PCIE_AP_R2D_P
PCIE_CLK100M_AP_CONN_N
PCIE_CLK100M_AP_CONN_P
PCIE_WAKE_L
PP3V3_S3RS4_BT_F
PP3V3_WLAN
USB_BT_CONN_N
USB_BT_CONN_P
WIFI_EVENT_L
GND 4X GND

J3502 - ALS camera

PP5V_S3_ALSCAMERA_F
SMBUS_SMC_2_S3_SCL
SMBUS_SMC_2_S3_SDA
USB_CAMERA_CONN_N
USB_CAMERA_CONN_P
GND

J4400 - rio coax

HDMI_EG_CLK_C_N
HDMI_EG_CLK_C_P
HDMI_EG_DATA_C_N<0>
HDMI_EG_DATA_C_N<1>
HDMI_EG_DATA_C_N<2>
HDMI_EG_DATA_C_P<0>
HDMI_EG_DATA_C_P<1>
HDMI_EG_DATA_C_P<2>
PCIE_CLK100M_ENET_N
PCIE_CLK100M_ENET_P
PCIE_ENET_D2R_N
PCIE_ENET_D2R_P
PCIE_ENET_R2D_C_N
PCIE_ENET_R2D_C_P
USB3_EXTB_RX_N
USB3_EXTB_RX_P
USB3_EXTB_TX_C_N
USB3_EXTB_TX_C_P
USB_EXTB_N
USB_EXTB_P
GND 19X GND

J4410 - rio flex

ENET_CLKREQ_L
ENET_RESET_L
HDMI_EG_DDC_CLK
HDMI_EG_DDC_DATA
HDMI_HPD_L
I2C_DPMUX_A_SCL
I2C_DPMUX_A_SDA
PM_SLP_S3_L
PM_SLP_S4_L
PP1V5_S0_RIO
PP3V3_S3 3X P3V3_S3
PP3V3_S4
PP5V_S4 5X P5V_S4
SDCONN_STATE_CHANGE_RIO
SD_PWR_EN
USB_EXTB_OC_L
GND 10X GND

J5050 - hall effect

PP3V42_G3H
SMC_LID_R
GND

J5650 - left fan

FAN_LT_PWM
FAN_LT_TACH
PP5V_S0 3X P5V_S0
GND 5X GND

J5660 - right fan

FAN_RT_PWM
FAN_RT_TACH
PP5V_S0 3X P5V_S0
GND 5X GND

J5815 - kbd backlight

KBDLED_ANODE1 2X
KBDLED_ANODE2 2X
SMC_KBDLED_PRESENT_L
GND 4X GND

PLACEABLE BEAD-PROBES FOR TBT

Net		Probe	Model
TBT_B_R2D_C_P<1>	SM BEAD-PROBE	BP0733	SIGNAL_MODEL=EMPTY
TBT_B_R2D_C_P<0>	SM BEAD-PROBE	BP0734	SIGNAL_MODEL=EMPTY
TBT_A_R2D_C_P<1>	SM BEAD-PROBE	BP0735	SIGNAL_MODEL=EMPTY
TBT_A_D2R_P<1>	SM BEAD-PROBE	BP0731	SIGNAL_MODEL=EMPTY
TBT_A_D2R_N<1>	SM BEAD-PROBE	BP0732	SIGNAL_MODEL=EMPTY

J5100 - lpc + spi

FUNC_TEST

LPCPLUS_GPIO
LPCPLUS_RESET_L
LPC_AD<0>
LPC_AD<1>
LPC_AD<2>
LPC_AD<3>
LPC_CLK33M_LPCPLUS
LPC_FRAME_L
LPC_PWRDWN_L
LPC_SERIRQ
PM_CLKRUN_L
PP5V_S0
SMC_RESET_L
SMC_ROMBOOT
SMC_RX_L
SMC_TCK
SMC_TDI
SMC_TDO
SMC_TMS
SMC_TX_L
SPIROM_USE_MLB
SPI_ALT_CLK
SPI_ALT_CS_L
SPI_ALT_MISO
SPI_ALT_MOSI
TP_SMC_MD1
TP_SMC_TRST_L
GND 2X GND

J5700 - ipd flex

Z2_CS_L
Z2_DEBUG3
Z2_MOSI
Z2_MISO
Z2_SCLK
Z2_HOST_INTN
Z2_CLKIN
Z2_KEY_ACT_L
Z2_RESET
PSOC_F_CS_L
PICKB_L
PP3V3_S4
PP5V_S5
PSOC_MISO
PSOC_MOSI
PSOC_SCLK
SMBUS_SMC_2_S3_SCL
SMBUS_SMC_2_S3_SDA
GND 2X GND

J5713 - keyboard

PP3V3_S4
PP3V42_G3H
WS_CONTROL_KBD
WS_KBD1
WS_KBD10
WS_KBD11
WS_KBD12
WS_KBD13
WS_KBD14
WS_KBD15_CAP
WS_KBD16_NUM
WS_KBD17
WS_KBD18
WS_KBD19
WS_KBD2
WS_KBD20
WS_KBD21
WS_KBD22
WS_KBD23
WS_KBD3
WS_KBD4
WS_KBD5
WS_KBD6
WS_KBD7
WS_KBD8
WS_KBD9
WS_KBD_ONOFF_L
WS_LEFT_OPTION_KBD
WS_LEFT_SHIFT_KBD
GND 2X GND

J6701 - audio flex

FUNC_TEST

AUD_HP_PORT_L
AUD_HP_PORT_R
AUD_SPDIF_OUT_JACK
AUD_TIPDET_INV
AUD_TYPEDET
CH_HS_GND 4X
CH_HS_MIC
PP3V3_S0
US_HS_GND 4X
US_HS_MIC
GND 2X GND

J6801 - 3-mic

CON_DMIC_CLK
CON_DMIC_PWR
CON_DMIC_SDA1
CON_DMIC_SDA2
GND

J6802 - L speaker

SPKRCONN_L_ID
SPKRCONN_L_OUT_N
SPKRCONN_L_OUT_P
SPKRCONN_SL_OUT_N
SPKRCONN_SL_OUT_P
GND

J6803 - R speaker

SPKRCONN_R_ID
SPKRCONN_R_OUT_N
SPKRCONN_R_OUT_P
SPKRCONN_SR_OUT_N
SPKRCONN_SR_OUT_P
GND

J6900 - DC PWR

ADAPTER_SENSE
PP18V5_DCIN_FUSE 2X
TDM_ONEWIRE_MPM
GND 2X GND

POWER RAILS

FUNC_TEST

PM_SLP_S3_L
PP0V75_S0_DDRVTT
PP1V05_S0
PP1V8_S0
PP3V3_S0
PP3V3_S0GPU
PP3V3_S3
PP3V3_S5
PP3V3_S5_AVREF_SMC
PP3V42_G3H
PP5V_S0
PP5V_S3
PP5V_S5
PPBUS_G3H
PPDCIN_G3H
PPVCORE_GPU
PPVCORE_S0_CPU
PPVTTDDR_S3

J6950 - battery

FUNC_TEST

PPVBAT_G3H_CONN 8X
SMBUS_SMC_5_G3_SCL
SMBUS_SMC_5_G3_SDA
SYS_DETECT_L
GND 8X GND

J9000 - eDP

DP_INT_AUX_N
DP_INT_AUX_P
DP_INT_ML_N<0>
DP_INT_ML_N<1>
DP_INT_ML_N<2>
DP_INT_ML_N<3>
DP_INT_ML_P<0>
DP_INT_ML_P<1>
DP_INT_ML_P<2>
DP_INT_ML_P<3>
LCD_FSS
LCD_HPD_CONN
LED_RETURN_1
LED_RETURN_2
LED_RETURN_3
LED_RETURN_4
LED_RETURN_5
LED_RETURN_6
PP5VR3V3_SW_LCD 3X
PPVOUT_S0_LCDBKLT
GND 16X GND

NO_TEST=TRUE

TBT_A_D2R_C_P<1..0>
TBT_A_D2R_C_N<1..0>
TBT_A_D2R_P<1..0>
TBT_A_D2R_N<1..0>
TBT_A_R2D_C_P<1..0>
TBT_A_R2D_C_N<1..0>
TBT_A_R2D_P<1..0>
TBT_A_R2D_N<1..0>
TBT_B_D2R_C_P<1..0>
TBT_B_D2R_C_N<1..0>
TBT_B_D2R_P<1..0>
TBT_B_D2R_N<1..0>
TBT_B_R2D_C_P<1..0>
TBT_B_R2D_C_N<1..0>
TBT_B_R2D_P<1..0>
TBT_B_R2D_N<1..0>
DP_TBTSNK0_ML_C_P<3..0>
DP_TBTSNK0_ML_C_N<3..0>
DP_TBTSNK0_ML_P<3..0>
DP_TBTSNK0_ML_N<3..0>
DP_TBTSNK0_AUXCH_C_P
DP_TBTSNK0_AUXCH_C_N
DP_TBTSNK0_AUXCH_P
DP_TBTSNK0_AUXCH_N
DP_TBTSNK1_ML_C_P<3..0>
DP_TBTSNK1_ML_C_N<3..0>
DP_TBTSNK1_ML_P<3..0>
DP_TBTSNK1_ML_N<3..0>
DP_TBTSNK1_AUXCH_C_P
DP_TBTSNK1_AUXCH_C_N
DP_TBTSNK1_AUXCH_P
DP_TBTSNK1_AUXCH_N

NC NO_TESTs

NO_TEST / MAKE_BASE=TRUE

TP net	NC net
TP_PCIE_5_D2RN	NC_PCIE_5_D2RN
TP_PCIE_5_D2RP	NC_PCIE_5_D2RP
TP_PCIE_5_R2D_CN	NC_PCIE_5_R2D_CN
TP_PCIE_5_R2D_CP	NC_PCIE_5_R2D_CP
TP_PCIE_6_D2RN	NC_PCIE_6_D2RN
TP_PCIE_6_D2RP	NC_PCIE_6_D2RP
TP_PCIE_6_R2D_CN	NC_PCIE_6_R2D_CN
TP_PCIE_6_R2D_CP	NC_PCIE_6_R2D_CP
TP_PCIE_7_D2RN	NC_PCIE_7_D2RN
TP_PCIE_7_D2RP	NC_PCIE_7_D2RP
TP_PCIE_7_R2D_CN	NC_PCIE_7_R2D_CN
TP_PCIE_7_R2D_CP	NC_PCIE_7_R2D_CP
TP_PCIE_8_D2RN	NC_PCIE_8_D2RN
TP_PCIE_8_D2RP	NC_PCIE_8_D2RP
TP_PCIE_8_R2D_CN	NC_PCIE_8_R2D_CN
TP_PCIE_8_R2D_CP	NC_PCIE_8_R2D_CP
TP_PCIE_PE5_D2RN	NC_PCIE_PE5_D2RN
TP_PCIE_PE5_D2RP	NC_PCIE_PE5_D2RP
TP_PCIE_PE5_R2D_CN	NC_PCIE_PE5_R2D_CN
TP_PCIE_PE5_R2D_CP	NC_PCIE_PE5_R2D_CP
TP_PCIE_PE6_D2RN	NC_PCIE_PE6_D2RN
TP_PCIE_PE6_D2RP	NC_PCIE_PE6_D2RP
TP_PCIE_PE6_R2D_CN	NC_PCIE_PE6_R2D_CN
TP_PCIE_PE6_R2D_CP	NC_PCIE_PE6_R2D_CP
TP_PCIE_PE7_D2RN	NC_PCIE_PE7_D2RN
TP_PCIE_PE7_D2RP	NC_PCIE_PE7_D2RP
TP_PCIE_PE7_R2D_CN	NC_PCIE_PE7_R2D_CN
TP_PCIE_PE7_R2D_CP	NC_PCIE_PE7_R2D_CP
TP_PCIE_PE8_D2RN	NC_PCIE_PE8_D2RN
TP_PCIE_PE8_D2RP	NC_PCIE_PE8_D2RP
TP_PCIE_PE8_R2D_CN	NC_PCIE_PE8_R2D_CN
TP_PCIE_PE8_R2D_CP	NC_PCIE_PE8_R2D_CP

ICT Test Points

CPU NO_TESTs

TP net	NC net
TP_CPU_RSVD<65..62>	NC_TP_CPU_RSVD<65..62>
TP_CPU_RSVD<58..45>	NC_TP_CPU_RSVD<58..45>
TP_CPU_RSVD<43..32>	NC_TP_CPU_RSVD<43..32>
TP_CPU_RSVD<27..26>	NC_TP_CPU_RSVD<27..26>
TP_CPU_RSVD<24..15>	NC_TP_CPU_RSVD<24..15>
TP_CPU_RSVD<2..1>	NC_TP_CPU_RSVD<2..1>
TP_CPU_RSVD_NCTF<8..5>	NC_TP_CPU_RSVD_NCTF<8..5>

NC NO_TESTs

TP net	NC net
TP_CRT_IG_BLUE	NC_CRT_IG_BLUE
TP_CRT_IG_GREEN	NC_CRT_IG_GREEN
TP_CRT_IG_RED	NC_CRT_IG_RED
TP_CRT_IG_DDC_CLK	NC_CRT_IG_DDC_CLK
TP_CRT_IG_DDC_DATA	NC_CRT_IG_DDC_DATA
TP_CRT_IG_HSYNC	NC_CRT_IG_HSYNC
TP_CRT_IG_VSYNC	NC_CRT_IG_VSYNC
TP_LVDS_IG_CTRL_CLK	NC_LVDS_IG_CTRL_CLK
TP_LVDS_IG_CTRL_DATA	NC_LVDS_IG_CTRL_DATA
TP_PCH_LVDS_VBG	NC_PCH_LVDS_VBG
TP_HDA_SDIN1	NC_HDA_SDIN1
TP_HDA_SDIN2	NC_HDA_SDIN2
TP_HDA_SDIN3	NC_HDA_SDIN3
TP_PCI_AD<31..0>	NC_PCI_AD<31..0>
TP_PCI_C_BE_L<3..0>	NC_PCI_C_BE_L<3..0>
TP_PCI_GNT3_L	NC_PCI_GNT3_L
TP_PCI_GNT2_L	NC_PCI_GNT2_L
TP_PCI_GNT1_L	NC_PCI_GNT1_L
TP_PCI_GNT0_L	NC_PCI_GNT0_L
TP_PCI_PAR	NC_PCI_PAR
TP_PCI_RESET_L	NC_PCI_RESET_L
TP_PCI_PME_L	NC_PCI_PME_L
TP_PCI_CLK33M_OUT3	NC_PCI_CLK33M_OUT3
TP_PCH_NV_RCOMP	NC_PCH_NV_RCOMP
TP_NV_DQ<15..0>	NC_NV_DQ<15..0>
TP_NV_DQS<1..0>	NC_NV_DQS<1..0>
TP_NV_CE_L<3..0>	NC_NV_CE_L<3..0>
TP_NV_ALE	NC_NV_ALE
TP_NV_CLE	NC_NV_CLE
TP_NV_RB_L	NC_NV_RB_L
TP_NV_WR_RE_L<1..0>	NC_NV_WR_RE_L<1..0>
TP_NV_WE_CK_L<1..0>	NC_NV_WE_CK_L<1..0>
TP_PCIE_CLK100M_PE4N	NC_PCIE_CLK100M_PE4N
TP_PCIE_CLK100M_PE4P	NC_PCIE_CLK100M_PE4P
TP_PCIE_CLK100M_PE5N	NC_PCIE_CLK100M_PE5N
TP_PCIE_CLK100M_PE5P	NC_PCIE_CLK100M_PE5P
TP_PCIE_CLK100M_PE6N	NC_PCIE_CLK100M_PE6N
TP_PCIE_CLK100M_PE6P	NC_PCIE_CLK100M_PE6P
TP_PCIE_CLK100M_PE7N	NC_PCIE_CLK100M_PE7N
TP_PCIE_CLK100M_PE7P	NC_PCIE_CLK100M_PE7P
TP_PSOC_P1_3	NC_PSOC_P1_3
TP_SATA_B_D2RN	NC_SATA_B_D2RN
TP_SATA_B_D2RP	NC_SATA_B_D2RP
TP_SATA_B_R2D_CN	NC_SATA_B_R2D_CN
TP_SATA_B_R2D_CP	NC_SATA_B_R2D_CP
TP_SATA_D_D2RN	NC_SATA_D_D2RN
TP_SATA_D_D2RP	NC_SATA_D_D2RP
TP_SATA_D_R2D_CN	NC_SATA_D_R2D_CN
TP_SATA_D_R2D_CP	NC_SATA_D_R2D_CP
TP_SATA_E_D2RN	NC_SATA_E_D2RN
TP_SATA_E_D2RP	NC_SATA_E_D2RP
TP_SATA_E_R2D_CN	NC_SATA_E_R2D_CN
TP_SATA_E_R2D_CP	NC_SATA_E_R2D_CP
TP_SATA_F_D2RN	NC_SATA_F_D2RN
TP_SATA_F_D2RP	NC_SATA_F_D2RP
TP_SATA_F_R2D_CN	NC_SATA_F_R2D_CN
TP_SATA_F_R2D_CP	NC_SATA_F_R2D_CP
TP_SMC_P41	NC_SMC_P41

GPU NO_TESTs

TP net	NC net
TP_DVPDATA<21..4>	NC_DVPDATA<21..4>
TP_DVPCNTL_M<1..0>	NC_DVPCNTL_M<1..0>
TP_DVPCNTL<2..0>	NC_DVPDATA<2..0>
TP_DVPDATA<2..0>	NC_DVPDATA<2..0>

Thunderbolt NO_TESTs

TP net	NC net
TP_TBT_XTAL25OUT	NC_TBT_XTAL25OUT
TP_TBT_PCIE_RESET0_L	NC_TBT_PCIE_RESET0_L
TP_TBT_PCIE_RESET1_L	NC_TBT_PCIE_RESET1_L
TP_TBT_PCIE_RESET2_L	NC_TBT_PCIE_RESET2_L
TP_TBT_PCIE_RESET3_L	NC_TBT_PCIE_RESET3_L
TP_DP_TBTSRC_ML_CP<3..0>	NC_DP_TBTSRC_ML_CP<3..0>
TP_DP_TBTSRC_ML_CN<3..0>	NC_DP_TBTSRC_ML_CN<3..0>
TP_DP_TBTSRC_AUXCH_CP	NC_DP_TBTSRC_AUXCH_CP
TP_DP_TBTSRC_AUXCH_CN	NC_DP_TBTSRC_AUXCH_CN

PCH ALIASES

NC_LPC_DREQ0_L — TP_LPC_DREQ0_L (MAKE_BASE=TRUE)

TP net	NC net
TP_CLINK_CLK	NC_CLINK_CLK
TP_CLINK_DATA	NC_CLINK_DATA
TP_CLINK_RESET_L	NC_CLINK_RESET_L
TP_PCIE_CLK100M_PEBN	NC_PCIE_CLK100M_PEBN
TP_PCIE_CLK100M_PEBP	NC_PCIE_CLK100M_PEBP

NC NO_TESTs

NO_TEST

NC_SMC_FAN_3_TACH
NC_SMC_FAN_3_CTL
NC_SMC_FAN_2_TACH
NC_SMC_FAN_2_CTL
NC_FW2_TPBP
NC_FW2_TPBN
NC_FW2_TPBIAS
NC_FW2_TPAP
NC_FW2_TPAN
NC_FW0_TPBP
NC_FW0_TPBN
NC_FW0_TPAP
NC_ESTARLDO_EN
NC_ALS_GAIN
NC_USB_HUB_PRTPWR2
NC_USB_HUB_PRTPWR3
NC_USB_HUB_PRTPWR4
NC_USB_HUB_OCS2
NC_USB_HUB_OCS3
NC_USB_HUB_OCS4
NC_SMC_XOSC1
NC_SMC_ODD_DETECT
NC_SMC_SYS_LED
NC_SMC_HIB_L
NC_SMBUS_SMC_4_ASF_SDA
NC_SMBUS_SMC_4_ASF_SCL
NC_SMC_T25_EN_L
NC_SMC_T25_ISENSE
NC_ISNS_P1V5R1V35_CPUDDRP
NC_ISNS_P1V5R1V35_CPUDDRN
NC_ISNS_LCDBKLTP
NC_ISNS_LCDBKLTN
NC_ISNS_LCD_PANELP
NC_ISNS_LCD_PANELN
NC_ISNS_AIRPORTP
NC_ISNS_AIRPORTN

TP net	NC net
TP_HDMI_CEC	NC_HDMI_CEC
TP_DP_IG_C_HPD	NC_DP_IG_C_HPD
TP_DP_IG_C_CTRL_CLK	NC_DP_IG_C_CTRL_CLK
TP_DP_IG_C_CTRL_DATA	NC_DP_IG_C_CTRL_DATA
TP_DP_IG_C_MLP<3..0>	NC_DP_IG_C_MLP<3..0>
TP_DP_IG_C_MLN<3..0>	NC_DP_IG_C_MLN<3..0>
TP_DP_IG_C_AUXP	NC_DP_IG_C_AUXP
TP_DP_IG_C_AUXN	NC_DP_IG_C_AUXN
TP_DP_IG_D_HPD	NC_DP_IG_D_HPD
TP_DP_IG_D_CTRL_CLK	NC_DP_IG_D_CTRL_CLK
TP_DP_IG_D_CTRL_DATA	NC_DP_IG_D_CTRL_DATA
TP_DP_IG_D_MLP<3..0>	NC_DP_IG_D_MLP<3..0>
TP_DP_IG_D_MLN<3..0>	NC_DP_IG_D_MLN<3..0>
TP_DP_IG_D_AUXP	NC_DP_IG_D_AUXP
TP_DP_IG_D_AUXN	NC_DP_IG_D_AUXN
TP_SDVO_TVCLKINN	NC_SDVO_TVCLKINN
TP_SDVO_TVCLKINP	NC_SDVO_TVCLKINP
TP_SDVO_STALLN	NC_SDVO_STALLN
TP_SDVO_STALLP	NC_SDVO_STALLP
TP_SDVO_INTN	NC_SDVO_INTN
TP_SDVO_INTP	NC_SDVO_INTP
TP_GPU_BUFRST_L	NC_GPU_BUFRST_L
TP_GPU_GSTATE<0>	NC_GPU_GSTATE<0>
TP_GPU_GSTATE<1>	NC_GPU_GSTATE<1>
TP_GPU_MIOA_D<9..0>	NC_GPU_MIOA_D<9..0>
TP_GPU_MIOA_DE	NC_GPU_MIOA_DE
TP_LVDS_EG_BKL_PWM	NC_LVDS_EG_BKL_PWM
LVDS_IG_B_CLK_N	NC_LVDS_IG_B_CLKN
LVDS_IG_B_CLK_P	NC_LVDS_IG_B_CLKP
LVDS_IG_BKL_PWM	NC_LVDS_IG_BKL_PWM
SMC_BS_ALRT_L	NC_SMC_BS_ALRT_L

PCH_VSS_NCTF<1>
PCH_VSS_NCTF<2>
PCH_VSS_NCTF<5>
PCH_VSS_NCTF<7>
PCH_VSS_NCTF<9>
PCH_VSS_NCTF<11>
PCH_VSS_NCTF<12>
PCH_VSS_NCTF<15>
PCH_VSS_NCTF<17>
PCH_VSS_NCTF<19>
PCH_VSS_NCTF<19>
PCH_VSS_NCTF<21>
PCH_VSS_NCTF<25>
PCH_VSS_NCTF<27>
PCH_VSS_NCTF<29>

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

Functional / ICT Test

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D

REVISION 4.18.0

BRANCH

G3H Rails

=PPBUS_G3H
PPBUS_G3H
MIN_LINE_WIDTH=0.6 mm VOLTAGE=12.8V
MIN_NECK_WIDTH=0.25 mm MAKE_BASE=TRUE
=PPBUS_S0_LCDBKLT
=PPVIN_S5_HS_OTHER_ISNS_R
=PPVIN_S5_HS_COMPUTING_ISNS_R
=PPVIN_S5_HS_GPU_ISNS_R
=PPVIN_SW_TBTBST
=PPBUS_S0_VSENSE
=PPBUS_G3H_T25_R

=PPVIN_S5_HS_COMPUTING_ISNS
PPVIN_S5_HS_COMPUTING_ISNS
MIN_LINE_WIDTH=0.6 mm VOLTAGE=12.8V
MIN_NECK_WIDTH=0.25 mm MAKE_BASE=TRUE
=PPVIN_S0_CPUIMVP
=PPVIN_S3_DDRREG
=PPVIN_S0_CPUVCCIOS0
=PPVIN_S0_CPUAXG
=PPVIN_S0_VCCSAS0
=PPVIN_S0_PCHVCCIOS0

=PPVIN_S5_HS_GPU_ISNS
PPVIN_S5_HS_GPU_ISNS
MIN_LINE_WIDTH=0.6 mm VOLTAGE=12.8V
MIN_NECK_WIDTH=0.25 mm MAKE_BASE=TRUE
=PPVIN_S0_GFXIMVP
=PPVIN_S0GPU_P1V5P1V0

=PPVIN_S5_HS_OTHER_ISNS
PPVIN_S5_HS_OTHER_ISNS
MIN_LINE_WIDTH=0.6 mm VOLTAGE=12.8V
MIN_NECK_WIDTH=0.25 mm MAKE_BASE=TRUE
=PPVIN_S5_P5VP3V3

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

=PP18V5_DCIN_ISOL
PPDCIN_G3H_ISOL
MIN_LINE_WIDTH=0.6 MM VOLTAGE=18.5V
MIN_NECK_WIDTH=0.25 MM MAKE_BASE=TRUE
=PPDCIN_S5_CHGR_ISOL
=PPDCIN_S5_VSENSE

=PP3V42_G3H_REG
PP3V42_G3H
MIN_LINE_WIDTH=0.3 MM VOLTAGE=3.42V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP3V3_S5_LPCPLUS
=PP3V3_S5_SMC
=PP3V42_G3H_CHGR
=PP3V42_G3H_ONEWIREPROT
=PP3V42_G3H_PWRCTL
=PP3V42_G3H_SMBUS_SMC_5
=PP3V42_G3H_SMCUSBMUX
=PP3V42_G3H_TPAD
=PPVIN_S5_SMCVREF
=PPVBAT_G3_SYSCLK

=PP3V42_G3H_AUDIO
=PP3V42_G3H_TDM
=PP3V42_S3_HALL
For PCH RTC Power

=PPVRTC_G3_OUT
PPVRTC_G3H
MIN_LINE_WIDTH=0.3 MM VOLTAGE=3.42V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PPVRTC_G3_PCH

5V Rails

=PP5V_S5_LDO
PP5V_S5
MIN_LINE_WIDTH=0.5 MM VOLTAGE=5V
MIN_NECK_WIDTH=0.1 MM MAKE_BASE=TRUE
=PP5V_S5_P1V5S3RS0FET
=PP5V_S5_P5VSUSFET
=PP5V_S5_TPAD

=PP5V_SUS_FET
PP5V_SUS
MIN_LINE_WIDTH=0.8 MM VOLTAGE=5V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP5V_SUS_PCH

=PP5V_S4_REG
PP5V_S4
MIN_LINE_WIDTH=0.5 mm VOLTAGE=5V
MIN_NECK_WIDTH=0.2 mm MAKE_BASE=TRUE
=PP5V_S4_RIO
=PP5V_S4_P5VS0FET
=PP5V_S4_P5VS3FET
=PP5V_S0_LCD
=PP5V_S3_LTUSB
=PP5V_S4_ISNS
=PP5V_S4_TPAD
=PP5V_S4_AUDIO

=PP5V_S3_FET
PP5V_S3
MIN_LINE_WIDTH=0.5 mm VOLTAGE=5V
MIN_NECK_WIDTH=0.2 mm MAKE_BASE=TRUE
=PP5V_S3_ISNS
=PP5V_S3_ALSCAMERA
=PP5V_S3_DDRREG
=PP5V_S3_DEBUG_ADC_AVDD
=PP5V_S3_DEBUG_ADC_DVDD
=PP5V_S3_DEBUG_ISNS
=PP5V_S3_MEMRESET

=PP5V_S0_FET
PP5V_S0
MIN_LINE_WIDTH=0.4 MM VOLTAGE=5V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP5V_S0GPU_P1V0P1V35_GPU

=PP5V_S0_P1V5_LDO
=PP5V_S0_AUDIO_XW
=PP5V_S0_BKL
=PP5V_S0_CPUIMVP
=PP5V_S0_CPUVCCIOS0
=PP5V_S0_FAN_LT
=PP5V_S0_FAN_RT
=PP5V_S0_GFXIMVP
=PP5V_S0_KBDLED
=PP5V_S0_LPCPLUS
=PP5V_S0_PCH
=PP5V_S0_PCHVCCIOS0
=PP5V_S0_RMC
=PP5V_S0_VCCSAS0
=PP5V_S0_VMON

3.3V Rails

=PP3V3_S4_FET
PP3V3_S4
MIN_LINE_WIDTH=0.6 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.1 MM MAKE_BASE=TRUE
=PP3V3_S4_TBT_R
=PP3V3_S4_TPAD
=PP3V3_S4_SMC
=PP3V3_S4_RIO
=PP3V3_S4_BT

=PP3V3_SUS_FET
PP3V3_SUS
MIN_LINE_WIDTH=0.8 MM MAKE_BASE=TRUE
=PP3V3_SUS_P1V05SUSLDO
=PP3V3_SUS_PCH_VCCSUS
=PP3V3_SUS_PCH_VCCSUS_GPIO
=PP3V3_SUS_PCH_GPIO
=PP3V3_SUS_PCH_VCCSUS_USB
=PP3V3_SUS_CNTRL
=PP3V3_SUS_SMC

=PP3V3_SUS_ROM
=PP3V3_SUS_PCH_VCC_SPI

=PP3V3_S5_REG
PP3V3_S5
MIN_LINE_WIDTH=0.6 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP3V3_GPU_P3V3GPUFET
=PP3V3_GPU_MISC_P3V3GPUMISCFET
=PP3V3_S0_P3V3S0FET
=PP3V3_S3_P3V3S3FET
=PP3V3_S4_DPAPWRSW
=PP3V3_S4_DPBPWRSW
=PP3V3_S4_P3V3S4FET
=PP3V3_S5_CPU_VCCDDR
=PP3V3_S5_P1V2P1V8
=PP3V3_S5_P1V5S0
=PP3V3_S5_P3V3SUSFET
=PP3V3_S5_PCH
=PP3V3_S5_PCHPWRGD
=PP3V3_S5_PCH_GPIO
=PP3V3_S5_PCH_VCCDSW
=PP3V3_S5_PWRCTL
=PP3V3_S5_SMCBATLOW
=PP3V3_S5_SYSCLK
=PP3V3_S5_VMON
=PP3V3_S5_XDP
=PP3V3_S4_TBTAPWRSW
=PP3V3_S4_TBTBPWRSW

=PP3V3_S3_FET
PP3V3_S3
MIN_LINE_WIDTH=0.50MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.20MM MAKE_BASE=TRUE
=PP3V3_S3_BT
=PP3V3_S3_DPMUX_UC
=PP3V3_S3_ISNS
=PP3V3_S3_MEMRESET
=PP3V3_S3_PCH_GPIO
=PP3V3_S3_RIO
=PP3V3_S3_SMBUS_SMC_2_S3
=PP3V3_S3_SMBUS_SMC_3
=PP3V3_S3_TPAD
=PP3V3_S3_USBMUX
=PP3V3_S3_USB_HUB
=PP3V3_S3_USB_RESET
=PP3V3_S3_VREFMRGN
=PP3V3_S3_WLAN
=PP3V3_S3_GYRO
=PP3V3_S3_SMS
=PP3V3_S3_SDBUF

=PP3V3_S0_FET
PP3V3_S0
MIN_LINE_WIDTH=0.5 MM VOLTAGE=3.3V
MIN_NECK_WIDTH=0.075 mm MAKE_BASE=TRUE
=PP3V3_S0_AUDIO
=PP3V3_S0_AUDIO_DIG
=PP3V3_S0_BKL_VDDIO
=PP3V3_S0_CPUTHMSNS
=PP3V3_S0_CPU_VCCIO_SEL
=PP3V3_S0_DPMUX
=PP3V3_S0_DPMUXI2C
=PP3V3_S0_DPMUX_UC
=PP3V3_S0_FAN_LT
=PP3V3_S0_FAN_RT
=PP3V3_S0_GPUTHMSNS
=PP3V3_S0_HS_ISNS
=PP3V3_S0_IMVPISNS
=PP3V3_S0_ISNS
=PP3V3_S0_LCD
=PP3V3_S0_P1V8GPUFET
=PP3V3_S0_P3V3TBTFET
=PP3V3_S0_PCH
=PP3V3_S0_PCH_GPIO
=PP3V3_S0_PCH_VCC3_3_CLK
=PP3V3_S0_PCH_VCC3_3_GPIO
=PP3V3_S0_PCH_VCC3_3_HVCMOS
=PP3V3_S0_PCH_VCC3_3_PCI
=PP3V3_S0_PCH_VCC3_3_SATA
=PP3V3_S0_PCH_VCCADAC
=PP3V3_S0_PWRCTL
=PP3V3_S0_RSTBUF
=PP3V3_S0_SATAMUX
=PP3V3_S0_SB_PM
=PP3V3_S0_SMBUS_PCH
=PP3V3_S0_SMBUS_SMC_0_S0
=PP3V3_S0_SMBUS_SMC_1_S0
=PP3V3_S0_SSD
=PP3V3_S0_SYSCLK
=PP3V3_S0_TBTI2C
=PP3V3_S0_TBTPWRCTL
=PP3V3_S0_TPAD
=PP3V3_S0_VMON
=PP3V3_S0_X29THMSNS
=PP3V3_S0_XDP
=PP3V3_S0_DDR3THMSNS
=PP3V3_S0_SPKRTHMSNS

TBT RAILS

=PP3V3_TBTLC_FET
PP3V3_TBTLC
MIN_LINE_WIDTH=0.4 MM VOLTAGE=3.3V MIN_NECK_WIDTH=0.15 MM
MAKE_BASE=TRUE
=PP3V3_TBT_PCH_GPIO
=PPVDDIO_TBT_CLK
=PP3V3_TBTLC_RTR

=PP1V05_TBTLC_FET
PP1V05_TBTLC
MIN_LINE_WIDTH=0.4 MM VOLTAGE=1.05V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP1V05_TBTLC_RTR

=PP1V05_TBTCIO_FET
PP1V05_TBTCIO
MIN_LINE_WIDTH=0.4 MM VOLTAGE=1.05V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP1V05_TBTCIO_RTR

=PP15V_TBT_REG
PP15V_TBT
MIN_LINE_WIDTH=0.4 MM VOLTAGE=15V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PPHV_SW_TBTAPWRSW
=PPHV_SW_TBTBPWRSW

1.8V/1.5V/1.2V/1.05V Rails

=PP1V8_S0_REG
4A max supply
PP1V8_S0
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V8R1V5_S0_PCH_VCCVRM
=PP1V8_S0_AUDIO
=PP1V8_S0_CPU_VCCPLL
=PP1V8_S0_GPUFET
=PP1V8_S0_PCH_VCCTX_LVDS
=PP1V8_S0_PCH_VCC_DFTERM
=PPVDDIO_S0_SBCLK
=PP1V8_S0_P1V5_LDO

=PP1V8_S0_CPU_VCCPLL_R
PP1V8_S0_CPU_VCCPLL_R
MIN_LINE_WIDTH=0.5 MM VOLTAGE=1.8V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE

=PPDDR_S3_REG
PP1V5R1V35_S3
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V5_S3_MEMRESET
=PPDDR_S3_MEMVREF
=PPVIN_S3_P1V5S3RS0_FET
=PPVIN_S0_DDRREG_LDO
=PPVIN_S3_MEM_ISNS_R

=PPVIN_S3_MEM_ISNS
PP1V5R1V35_MEM
MIN_LINE_WIDTH=0.2 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V5R1V35_S3_MEM_A
=PP1V5R1V35_S3_MEM_B

=PP1V5_S3RS0_FET_ISNS
PP1V5_S3RS0_CPUDDR
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V5_S3RS0_VMON
=PP1V5_S3_CPU_VCCDDR

=PP1V5_S0_REG
PP1V5_S0
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V5_S0_AUDIO
=PP3V3R1V5_S0_PCH_VCCSUSHDA

=PP1V5_S0_RIO_LDO
PP1V5_S0_RIO
MIN_LINE_WIDTH=0.6 MM VOLTAGE=1.5V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP1V5_S0_RIO

=PPVTT_S3_DDR_BUF
PPVTTDDR_S3
MIN_LINE_WIDTH=0.3 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=0.75V
MAKE_BASE=TRUE

=PPVTT_S0_DDR_LDO
PP0V75_S0_DDRVTT
MIN_LINE_WIDTH=2 mm
MIN_NECK_WIDTH=0.17 mm
VOLTAGE=0.75V
MAKE_BASE=TRUE
=PP0V75_S0_MEM_VTT_A
=PP0V75_S0_MEM_VTT_B
=PPVTT_S0_VTTCLAMP

=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

=PPCPUVCCIO_S0_REG
PP1V05_S0
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
MAKE_BASE=TRUE
=PP1V05_S0_CPU_VCCIO
=PPVCCIO_S0_XDP
=PPVCCIO_S0_CPUIMVP
=PPVCCIO_S0_SMC
=PP1V05_S0_VMON
=PP1V05_S0_RMC

=PPPCHVCCIO_S0_REG
PP1V05_PCHVCCIO_S0
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
MAKE_BASE=TRUE
=PP1V05_S0_PCH_VCCIO_PLLPCIE
=PP1V05_S0_PCH_VCCADPLL
=PP1V05_S0_PCH_VCCIO
=PP1V05_S0_PCH_VCCIO_PCIE
=PP1V05_S0_PCH_VCCIO_SATA
=PP1V05_S0_PCH_VCCIO_CLK
=PP1V05_S0_PCH_VCCIO_USB
=PP1V05_S0_PCH_VCC_CORE
=PP1V05_S0_PCH_VCCASW
=PP1V05_S0_PCH_VCCIO_CLK
=PP1V05_S0_PCH_VCCDIFFCLK
=PP1V05_S0_PCH
=PP1V05_S0_PCH_VCCSSC
=PP1V05_S0_PCH_V_PROC_IO
=PP1V05_S0_PCH_VCCIO_PLLUSB
=PP1V05_S0_PCH_VCC_DMI
=PP1V05_S0_PCH_VCCIO_PLLFDI
=PP1V05_S0_PCH_VCCDMI_FDI
=PP1V05_S0_P1V05TBTFET_R

Defined here since TBT page does not know PBUS voltage
IGNORE PPVIN_SW_TBTBST
VOLTAGE=12.6V

Backlight Rails

=PPBUS_SW_BKL
PPBUS_SW_BKL
MIN_LINE_WIDTH=0.5 MM MAKE_BASE=TRUE
MIN_NECK_WIDTH=0.25 MM VOLTAGE=12.6V
PPBUS_S0_LCDBKLT_PWR

SMC_T25_EN_L
NC_SMC_T25_EN_L
MAKE_BASE=TRUE

=PP1V05_S0_P1V05TBTFET
PP1V05_S0_P1V05TBTFET
MIN_LINE_WIDTH=0.4 MM VOLTAGE=1.05V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE

"GPU" Rails

=PP3V3_S0GPU_FET
PP3V3_S0GPU
MIN_LINE_WIDTH=0.3 MM
MIN_NECK_WIDTH=0.10MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
=PP3V3_GPU_IFPX_PLLVDD
=PP3V3_S0_GFX3V3BIAS
=PP3V3_GPU_VDD33

=PP3V3_S0GPU_MISC_FET
PP3V3_S0GPU_MISC
MIN_LINE_WIDTH=0.3 MM
MIN_NECK_WIDTH=0.10MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
=PP3V3_GPU_MISC

TP_P1V8GPU_EN =P1V8GPU_EN

=PP1V5R1V35_GPU_REG
PP1V5R1V35_S0GPU
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.5V
MAKE_BASE=TRUE
=PP1V35_GPU_FBVDDQ
=PP1V35_GPU_S0_FB

=PP1V8_GPU_FET
TP_GPU_PGOOD2
MAKE_BASE=TRUE

=PP1V05_S0GPU_REG
PP1V0_S0GPU_ISNS
MIN_LINE_WIDTH=0.6 MM VOLTAGE=1.05V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PP1V0_GPU_DPLL
=PP1V0_GPU_DP_AB
=PP1V0_GPU_DP_CD
=PP1V05_GPU_IFPCD_IOVDD
=PP1V05_GPU_IFPEF_IOVDD
=PP1V05_GPU_PEX_IOVDD
=PP1V05_GPU_PEX_PLLVDD

=PPVCORE_GPU_REG
PPVCORE_GPU
MIN_LINE_WIDTH=0.6 MM VOLTAGE=1.0V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PPVCORE_GPU
=PPVCORE_S0_GFX_REG

GND =LVDS_VCCA
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.08SMM
VOLTAGE=0V
MAKE_BASE=TRUE

Chipset "VCore" Rails

=PPVCORE_S0_CPU_REG
PPVCORE_S0_CPU
MIN_LINE_WIDTH=0.6 MM MAKE_BASE=TRUE
MIN_NECK_WIDTH=0.25 MM VOLTAGE=1.25V
=PPVCORE_S0_CPU

=PPVCORE_S0_AXG_REG
PPVCORE_S0_AXG
MIN_LINE_WIDTH=0.6 MM MAKE_BASE=TRUE
MIN_NECK_WIDTH=0.2 MM VOLTAGE=1.05V
=PPVCORE_S0_CPU_VCCAXG

=PP1V5_S3_CPU_VCCDQ
PP1V5_S3_CPU_VCCDQ
MIN_LINE_WIDTH=0.6 MM MAKE_BASE=TRUE
MIN_NECK_WIDTH=0.2 MM VOLTAGE=1.5V

=PP1V05_S0_CPU_VCCPQE
PP1V05_S0_CPU_VCCPQE
MIN_LINE_WIDTH=0.6 MM VOLTAGE=1.05V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE

=PPVCCSA_S0_REG
PPVCCSA_S0_REG
MIN_LINE_WIDTH=0.6 MM VOLTAGE=0.9V
MIN_NECK_WIDTH=0.2 MM MAKE_BASE=TRUE
=PPVCCSA_S0_CPU

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Frame Holes

ZT0915 2.8R2.3 — GND_BATT_CHGND
ZT0950 TH-NSP SL-2.3X3.9-2.9X4.5 — GND_CHASSIS_FAN
ZT0974 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN5
ZT0975 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN6
GND (MAKE_BASE=TRUE)
ZT0970 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN1
ZT0971 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN2
ZT0972 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN3
ZT0973 TH-NSP SL-1.1X0.45-1.4x0.75 — GND_CHASSIS_MLBCAN4

THERMAL MODULE STANDOFFS

SH0920 STDOFF-4.5OD2.15H-SM
SH0927 STDOFF-4.5OD2.15H-SM
SH0926 STDOFF-4.5OD2.15H-SM
SH0925 STDOFF-4.5OD1.8H-SM
SH0928 STDOFF-4.5OD2.15H-SM
SH0923 STDOFF-4.5OD1.8H-SM
SH0921 STDOFF-4.5OD2.15H-SM-1
SH0929 STDOFF-4.5OD2.15H-SM
SH0924 STDOFF-4.5OD1.9H-SM
SH0922 STDOFF-4.5OD2.15H-SM
SH0930 STDOFF-4.5OD2.15H-SM
SH0946 STDOFF-4.9OD2.38H-SM-2
SH0945 STDOFF-4.9OD2.38H-SM-SL-2.6X2NP-2

APN 806-2247

SH0950 SM — SHLD-J5-USB
SH0952 SM — SHLD-J5-CAN-FENCE-MDP-2
SH0951 SM — SHLD-J5-CAN-FENCE-MDP-1
BR0901 MLB-MTG-BRKT-J5

POGO PINS

SH0931 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0932 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0933 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0934 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0935 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0936 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
SH0940 2.8OD1.2ID-1.35H-SM
SH0941 2.8OD1.2ID-1.35H-SM
SH0944 2.8OD1.2ID-1.35H-SM
SH0942 2.8OD1.2ID-1.35H-SM
SH0943 2.8OD1.2ID-1.35H-SM

T29 / GMUX JTAG Signals

TBT_LSOE<3> — TBT_LSEO_LSOE3 (MAKE_BASE=TRUE, NO_TEST=TRUE) — TBT_LSEO<3>
TBT_LSOE<2> — TBT_LSEO_LSOE2 (MAKE_BASE=TRUE, NO_TEST=TRUE) — TBT_LSEO<2>

GMUX ALIASES

82 EG_RESET_L — GPU_RESET_L 71 78
LVDS_IG_BKL_ON (18) — IG_BKLT_EN 82
LVDS_IG_PANEL_PWR (18) — IG_LCD_PWR_EN 82
PEX_CLKREQ_L — EG_CLKREQ_IN_L 78 82
17 PEG_CLKREQ_L — EG_CLKREQ_OUT_L 82
82 DP_TBTSNK0_HPD_IG — DPA_IG_HPD 18 82
82 DP_TBTSNK1_HPD_IG — DPB_IG_HPD 18 82

17 PCIE_EXCARD_D2R_N — TRUE — NC_PCIE_EXCARD_D2R_N
17 PCIE_EXCARD_D2R_P — TRUE — NC_PCIE_EXCARD_D2R_P
17 PCIE_EXCARD_R2D_C_N — TRUE — NC_PCIE_EXCARD_R2D_C_N
17 PCIE_EXCARD_R2D_C_P — TRUE — NC_PCIE_EXCARD_R2D_C_P
(MAKE_BASE=TRUE)

92 17 PCIE_CLK100M_EXCARD_N — TRUE — NC_PCIE_CLK100M_EXCARD_N
92 17 PCIE_CLK100M_EXCARD_P — TRUE — NC_PCIE_CLK100M_EXCARD_P
(MAKE_BASE=TRUE)

17 TP_PCH_CLKOUT_DPN — TRUE — DPLL_REF_CLKN 11 89
17 TP_PCH_CLKOUT_DPP — TRUE — DPLL_REF_CLKP 11 89
(MAKE_BASE=TRUE)

17 TP_PCH_GPIO64_CLKOUTFLEX0 — TRUE — NC_PCH_GPIO64_CLKOUTFLEX0
17 TP_PCH_GPIO65_CLKOUTFLEX1 — TRUE — NC_PCH_GPIO65_CLKOUTFLEX1
17 TP_PCH_GPIO66_CLKOUTFLEX2 — TRUE — NC_PCH_GPIO66_CLKOUTFLEX2
17 TP_PCH_GPIO67_CLKOUTFLEX3 — TRUE — NC_PCH_GPIO67_CLKOUTFLEX3
(MAKE_BASE=TRUE)

SD_PWR_EN_PCH — ENET_LOW_PWR_PCH 20 24 25
38 7 SD_PWR_EN — ENET_LOW_PWR 25
TP_FW_PWR_EN — FW_PWR_EN 25
(MAKE_BASE=TRUE)

SMT GND TEST PONTS

ZT0990 2.1SM2.0MM-CIR SMT-PAD-NSP
ZT0991 2.1SM2.0MM-CIR SMT-PAD-NSP
ZT0992 2.1SM2.0MM-CIR SMT-PAD-NSP
SH0937 POGO-2.3OD-5.5H-SM-LOW-FORCE SM
ZT0993 2.1SM2.0MM-CIR SMT-PAD-NSP
SH0960 2.8OD1.2ID-1.35H-SM
SH0961 2.8OD1.2ID-1.35H-SM

Digital Ground

20 MLB_RAMCFG3 — RAMCFG3:L R0913 1K 5% 1/20W MF 201
20 MLB_RAMCFG2 — RAMCFG2:L R0912 1K 5% 1/20W MF 201
20 MLB_RAMCFG1 — RAMCFG1:L R0911 1K 5% 1/20W MF 201
20 MLB_RAMCFG0 — RAMCFG0:L R0910 1K 5% 1/20W MF 201

CPU signals

CPU_VID<0..6> (MAKE_BASE=TRUE) — CPUIMVP_VID<0..6>
27 MEMVTT_EN (MAKE_BASE=TRUE) — =DDRVTT_EN 27 64
TP_CPU_VTT_SELECT (MAKE_BASE=TRUE) — CPU_VTTSELECT

Unused PEG signals

NC_PEG_D2R_P<15..14> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =PEG_D2R_P<15..14> 10
NC_PEG_D2R_N<15..14> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =PEG_D2R_N<15..14> 10
NC_PEG_R2D_C_P<15..14> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =PEG_R2D_C_P<15..14> 10
NC_PEG_R2D_C_N<15..14> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =PEG_R2D_C_N<15..14> 10

T29 Signals Through PEG

92 35 PCIE_TBT_D2R_P<3..0> (MAKE_BASE=TRUE) — =PEG_D2R_P<11..8> 10
92 35 PCIE_TBT_D2R_N<3..0> (MAKE_BASE=TRUE) — =PEG_D2R_N<11..8> 10
92 35 PCIE_TBT_R2D_C_P<3..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_P<11..8> 10
92 35 PCIE_TBT_R2D_C_N<3..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_N<11..8> 10

GPU signals

89 88 71 PEG_D2R_P<7..0> (MAKE_BASE=TRUE) — =PEG_D2R_P<7..0> 10
89 88 71 PEG_D2R_N<7..0> (MAKE_BASE=TRUE) — =PEG_D2R_N<7..0> 10
89 71 PEG_R2D_C_P<7..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_P<7..0> 10
89 71 PEG_R2D_C_N<7..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_N<7..0> 10

UNUSED TBT PORTS

TBT_D2R_P<3..2> (MAKE_BASE=TRUE) — NC_TBT_D2RP<3..2> (NO_TEST=TRUE)
TBT_D2R_N<3..2> (MAKE_BASE=TRUE) — NC_TBT_D2RN<3..2> (NO_TEST=TRUE)
TBT_R2D_C_P<3..2> (MAKE_BASE=TRUE) — NC_TBT_R2D_CP<3..2> (NO_TEST=TRUE)
TBT_R2D_C_N<3..2> (MAKE_BASE=TRUE) — NC_TBT_R2D_CN<3..2> (NO_TEST=TRUE)

DPMUX TX & RX

82 DPMUX_UC_BOOT_TX — DPMUX_UC_TX (MAKE_BASE=TRUE) 82
82 DPMUX_UC_BOOT_RX — DPMUX_UC_RX (MAKE_BASE=TRUE) 82

SSD PCIE SIGNALS

92 39 PCIE_SSD_D2R_P<1..0> (MAKE_BASE=TRUE) — =PEG_D2R_P<13..12> 10
92 39 PCIE_SSD_D2R_N<1..0> (MAKE_BASE=TRUE) — =PEG_D2R_N<13..12> 10
92 39 PCIE_SSD_R2D_C_P<1..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_P<13..12> 10
92 39 PCIE_SSD_R2D_C_N<1..0> (MAKE_BASE=TRUE) — =PEG_R2D_C_N<13..12> 10

TP_PCIE_CLK100M_FW_P (MAKE_BASE=TRUE) — PCIE_CLK100M_FW_P 17 92
TP_PCIE_CLK100M_FW_N (MAKE_BASE=TRUE) — PCIE_CLK100M_FW_N 17 92

UNUSED FDI SIGNALS

NC_PCH_FDI_DATA_N<7..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =FDI_DATA_N<7..0> 18
NC_PCH_FDI_DATA_P<7..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =FDI_DATA_P<7..0> 18
NC_PCH_FDI_FSYNC<1..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =FDI_FSYNC<1..0> 18
NC_PCH_FDI_LSYNC<1..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — =FDI_LSYNC<1..0> 18

NC_CPU_FDI_DATA_N<7..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — FDI_DATA_N<7..0> 10 89
NC_CPU_FDI_DATA_P<7..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — FDI_DATA_P<7..0> 10 89
NC_CPU_FDI_FSYNC<1..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — FDI_FSYNC<1..0> 10 89
NC_CPU_FDI_LSYNC<1..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — FDI_LSYNC<1..0> 10 89

USB SIGNALS

91 34 USB_BT_P (MAKE_BASE=TRUE) — USBHUB_DN1_P 26
91 34 USB_BT_N (MAKE_BASE=TRUE) — USBHUB_DN1_N 26
91 49 USB_TPAD_P (MAKE_BASE=TRUE) — USBHUB_DN2_P 26
91 49 USB_TPAD_N (MAKE_BASE=TRUE) — USBHUB_DN2_N 26
91 41 USB_SMC_P (MAKE_BASE=TRUE) — USBHUB_DN3_P 26
91 41 USB_SMC_N (MAKE_BASE=TRUE) — USBHUB_DN3_N 26
PU_USBHUB_DN4P (MAKE_BASE=TRUE) — USBHUB_DN4_P 26
PU_USBHUB_DN4N (MAKE_BASE=TRUE) — USBHUB_DN4_N 26

8 =PP5V_S0_AUDIO_XW

XW0902 SM — PP5V_S0_AUDIO_AMP_L 57
XW0903 SM — PP5V_S0_AUDIO_AMP_R 57
(MIN_LINE_WIDTH=0.4MM, MIN_NECK_WIDTH=0.2MM, VOLTAGE=5V)

NC_LVDS_IG_A_DATAP<3> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_DATA_P<3> 18 91
NC_LVDS_IG_A_DATAN<3> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_DATA_N<3> 18 91
NC_LVDS_IG_B_DATAP<3> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_B_DATA_P<3> 18
NC_LVDS_IG_B_DATAN<3> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_B_DATA_N<3> 18

NC_LVDS_IG_A_CLK_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_CLK_N 18 91
NC_LVDS_IG_A_CLK_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_CLK_P 18 91

NC_LVDS_IG_A_DATA_N<2..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_DATA_N<2..0> 18 91
NC_LVDS_IG_A_DATA_P<2..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_A_DATA_P<2..0> 18 91
NC_LVDS_IG_B_DATA_N<2..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_B_DATA_N<2..0> 18 91
NC_LVDS_IG_B_DATA_P<2..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_B_DATA_P<2..0> 18 91
NC_LVDS_IG_DDC_CLK (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_DDC_CLK 18
NC_LVDS_IG_DDC_DATA (MAKE_BASE=TRUE, NO_TEST=TRUE) — LVDS_IG_DDC_DATA 18

NC_PCIE_FW_D2RN (MAKE_BASE=TRUE, NO_TEST=TRUE) — PCIE_FW_D2R_N 17
NC_PCIE_FW_D2RP (MAKE_BASE=TRUE, NO_TEST=TRUE) — PCIE_FW_D2R_P 17
NC_PCIE_FW_R2D_CN (MAKE_BASE=TRUE, NO_TEST=TRUE) — PCIE_FW_R2D_C_N 17
NC_PCIE_FW_R2D_CP (MAKE_BASE=TRUE, NO_TEST=TRUE) — PCIE_FW_R2D_C_P 17

NC_SATA_ODD_R2D_N (MAKE_BASE=TRUE) — SATA_ODD_R2D_N 17 91
NC_SATA_ODD_R2D_P (MAKE_BASE=TRUE) — SATA_ODD_R2D_P 17 91
NC_SATA_ODD_R2D_C_N (MAKE_BASE=TRUE) — SATA_ODD_R2D_C_N 17 91
NC_SATA_ODD_R2D_C_P (MAKE_BASE=TRUE) — SATA_ODD_R2D_C_P 17 91

NC_DP_IG_MLP<3..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — TP_DP_IG_B_MLP<3..0> 18
NC_DP_IG_MLN<3..0> (MAKE_BASE=TRUE, NO_TEST=TRUE) — TP_DP_IG_B_MLN<3..0> 18

TBTBST:N
37 8 =PPVIN_SW_TBTBST — R0950 0 5% 1/8W MF-LF 805 — =PP15V_TBT_REG 8 37

UNUSED USB SIGNALS

NC_USB3_EXTD_TX_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTD_TX_P 19
NC_USB3_EXTD_TX_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTD_TX_N 19
NC_USB3_EXTD_RX_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTD_RX_P 19
NC_USB3_EXTD_RX_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTD_RX_N 19
NC_USB_EXTD_EHCI_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB_EXTD_EHCI_P 19
NC_USB_EXTD_EHCI_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB_EXTD_EHCI_N 19
NC_USB3_EXTC_TX_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTC_TX_P 19 91
NC_USB3_EXTC_TX_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTC_TX_N 19 91
NC_USB3_EXTC_RX_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTC_RX_P 19 91
NC_USB3_EXTC_RX_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB3_EXTC_RX_N 19 91
NC_USB_EXTC_P (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB_EXTC_P 19 91
NC_USB_EXTC_N (MAKE_BASE=TRUE, NO_TEST=TRUE) — USB_EXTC_N 19 91

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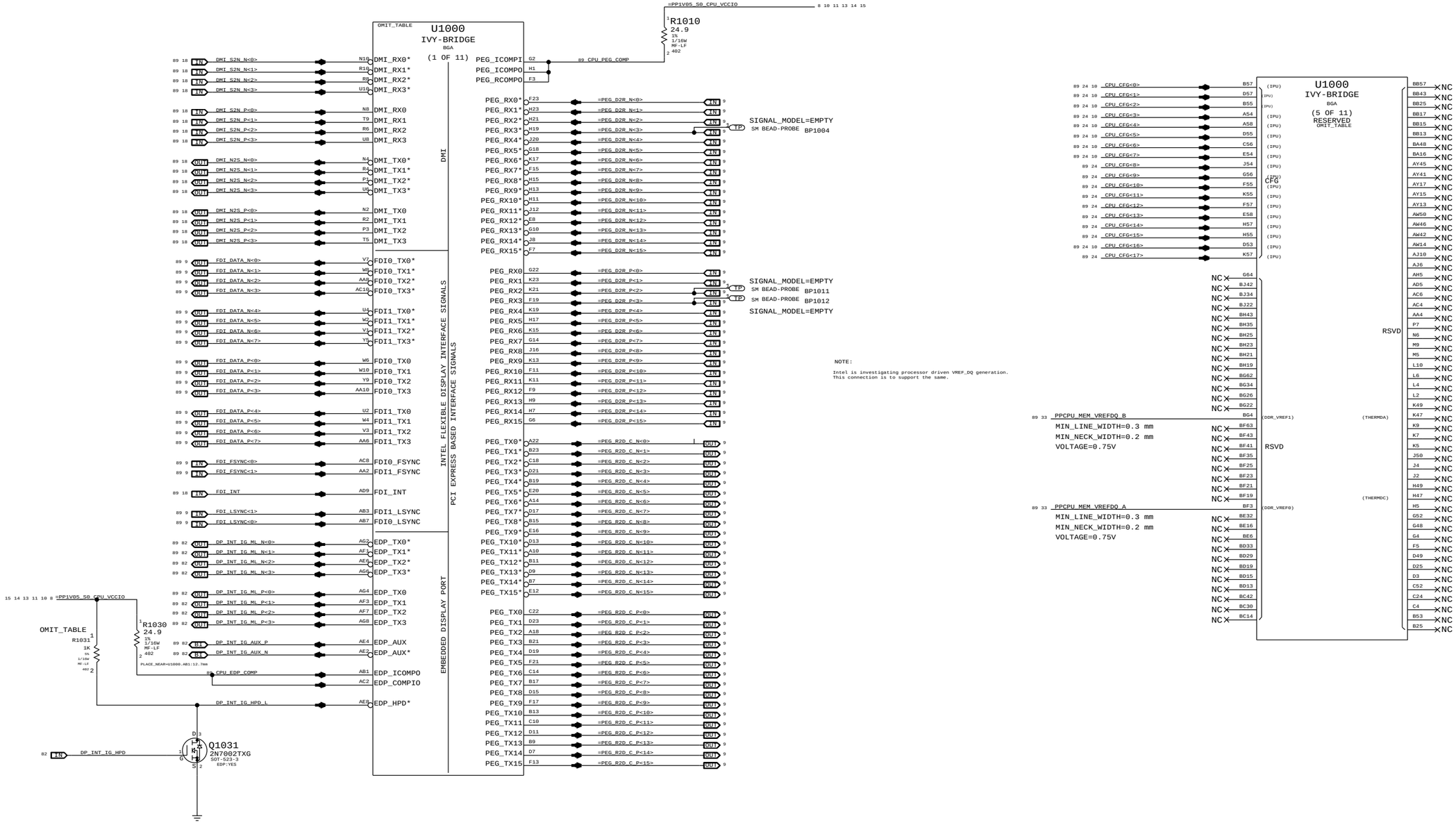

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0066	1	RES,MTL FILM,1/16W,1K,0402,SMD,LF	R1031		EDP:YES
116S0090	1	RES,MTL FILM,1/16W,10K,0402,SMD,LF	R1031		EDP:NO

```
CFG [7] :PEG DEFER TRAINING          1 = (DEFAULT) IMMEDIATELY AFTER xxRESETB   0 = WAIT FOR BIOS
CFG [6:5] :PCIE BIFURCATION          11 = 1 X16 (DEFAULT)   10 = 2 X8    01 = RSVD    00 = X8, X4, X4
CFG [4] :eDP ENABLE/DISABLE          1 = DISABLED   0 = ENABLED
CFG [3] :PCIE x4 LANE REVERSAL       1 = NORMAL OPERATION   0 = LANES REVERSED
CFG [2] :PCIE x16 LANE REVERSAL      1 = NORMAL OPERATION   0 = LANES REVERSED
```

PAGE TITLE
CPU DMI/PEG/FDI/RSVD

Apple Inc.

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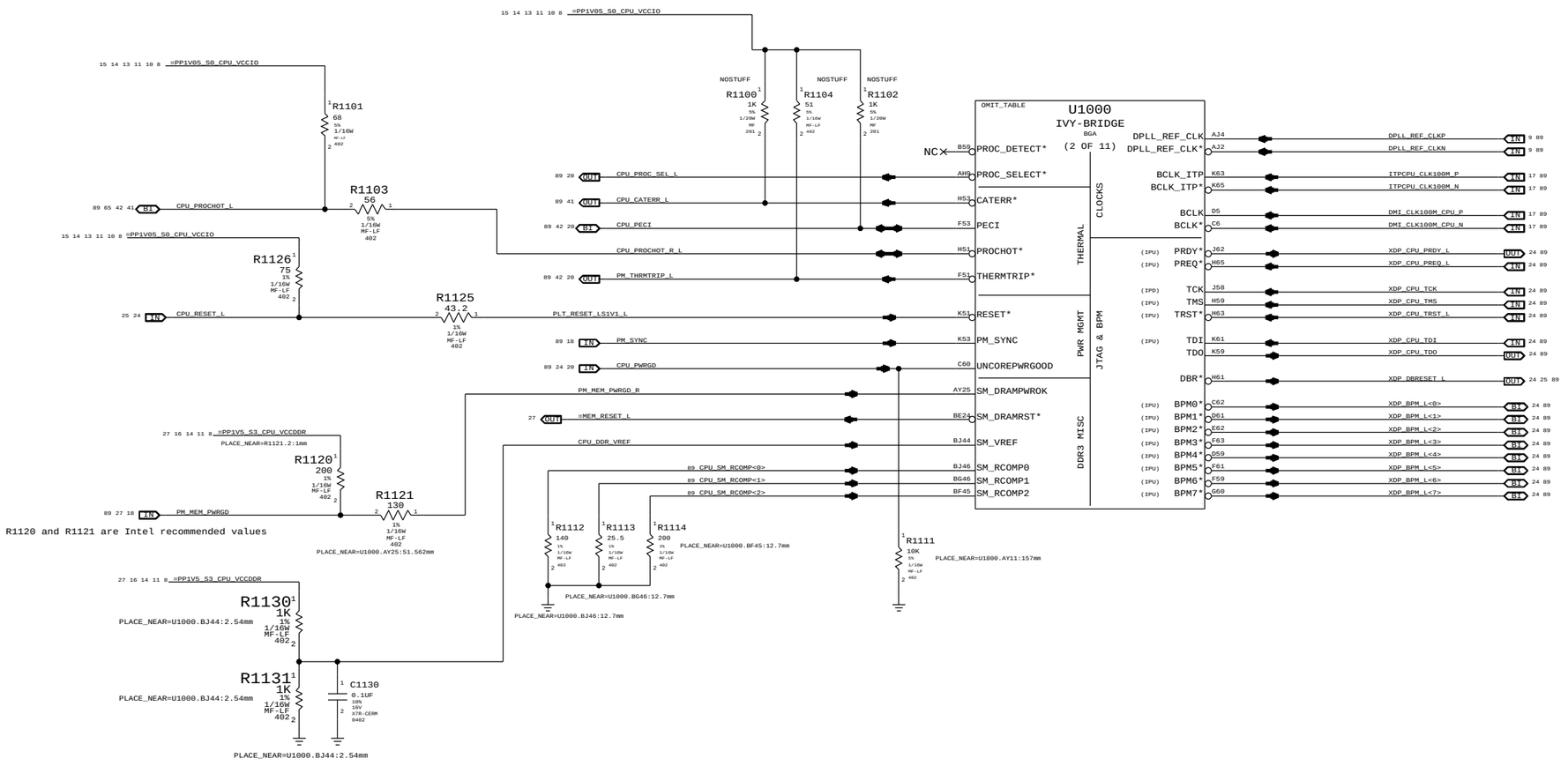

PAGE TITLE

CPU CLOCK/MISC/JTAG

Apple Inc.

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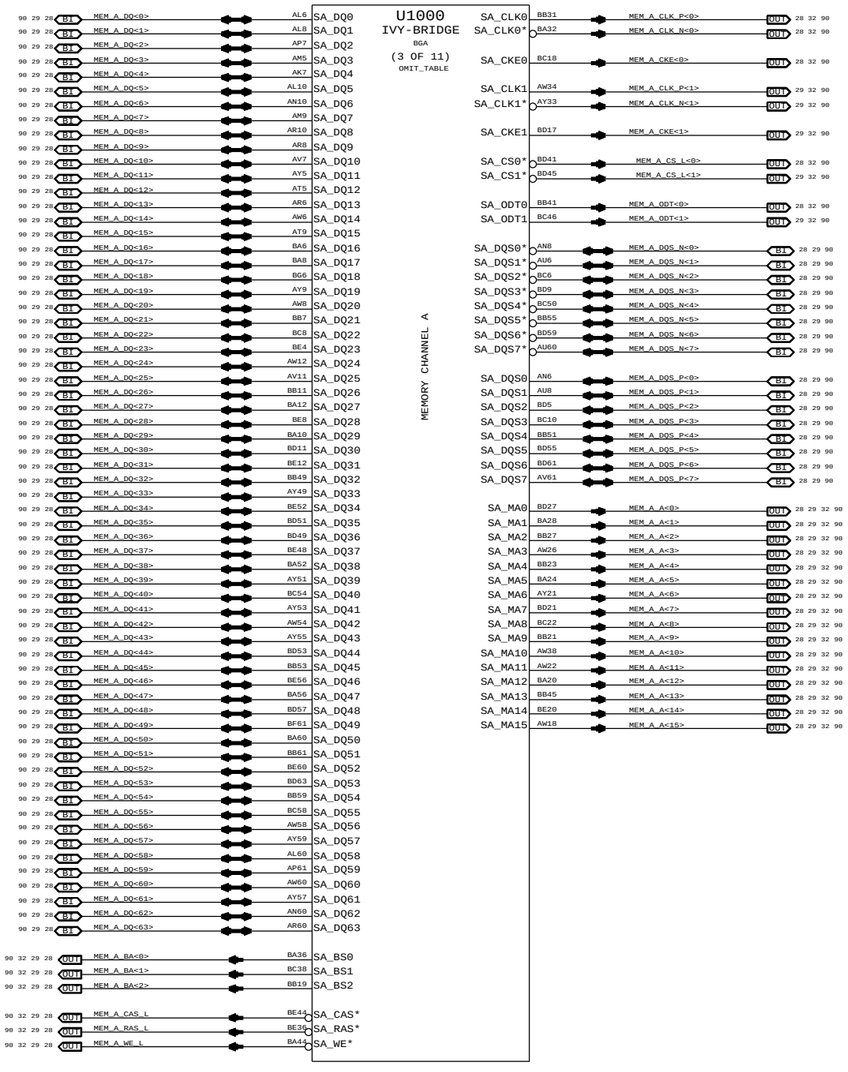

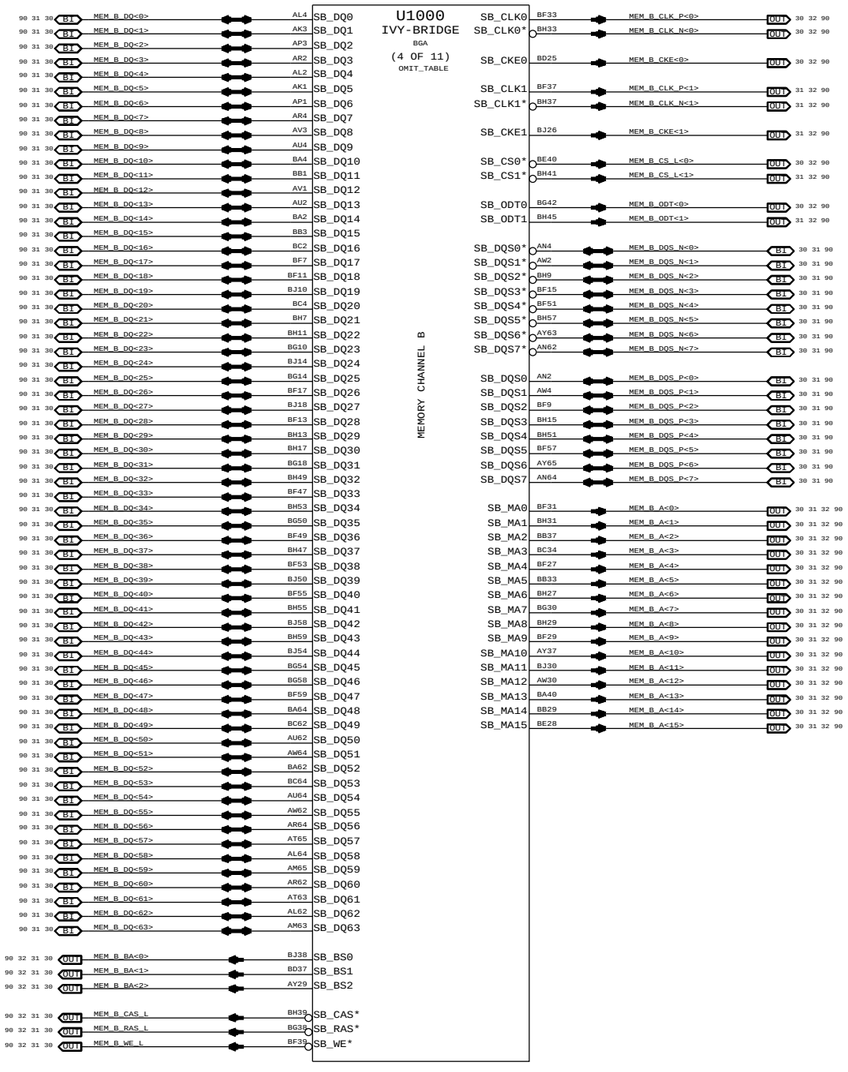

SYNC DATE=01/13/2012

PAGE TITLE

CPU DDR3 INTERFACES

Apple Inc.

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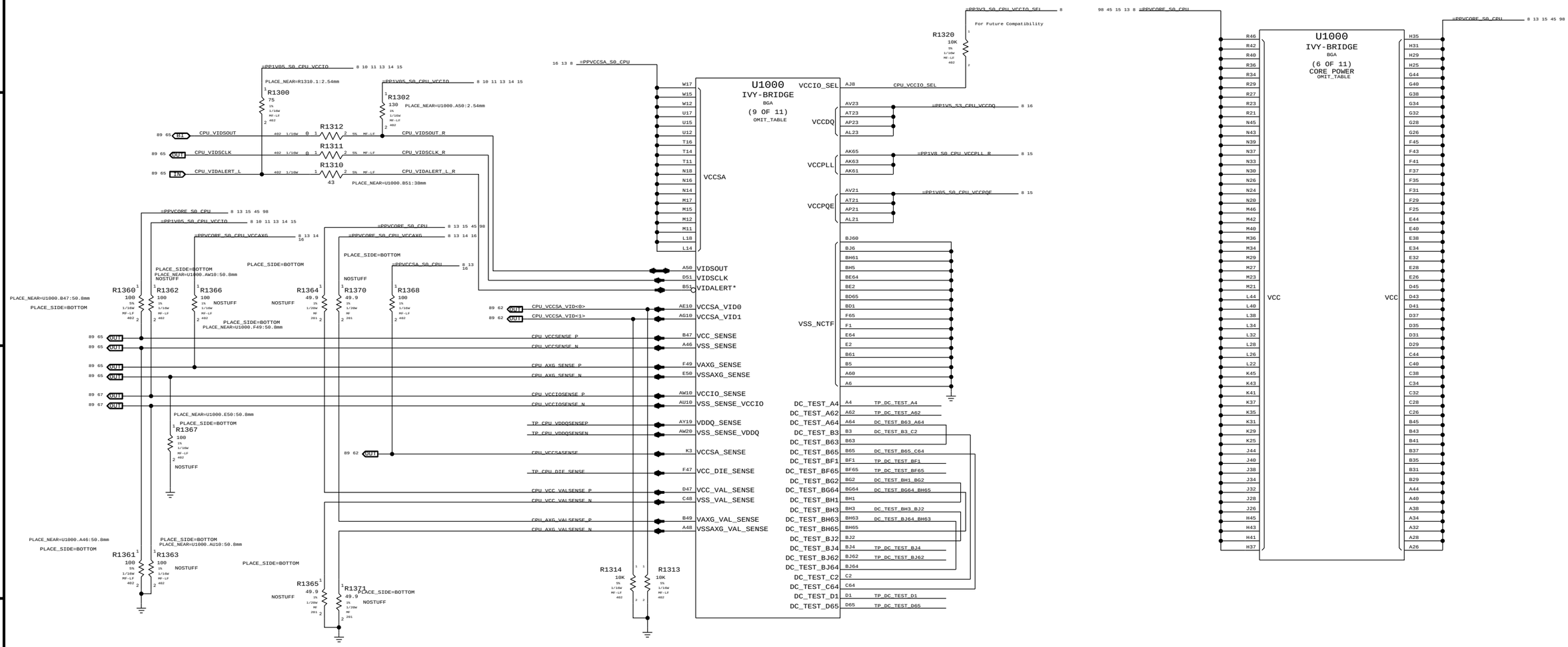

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: CPU POWER

Apple Inc.

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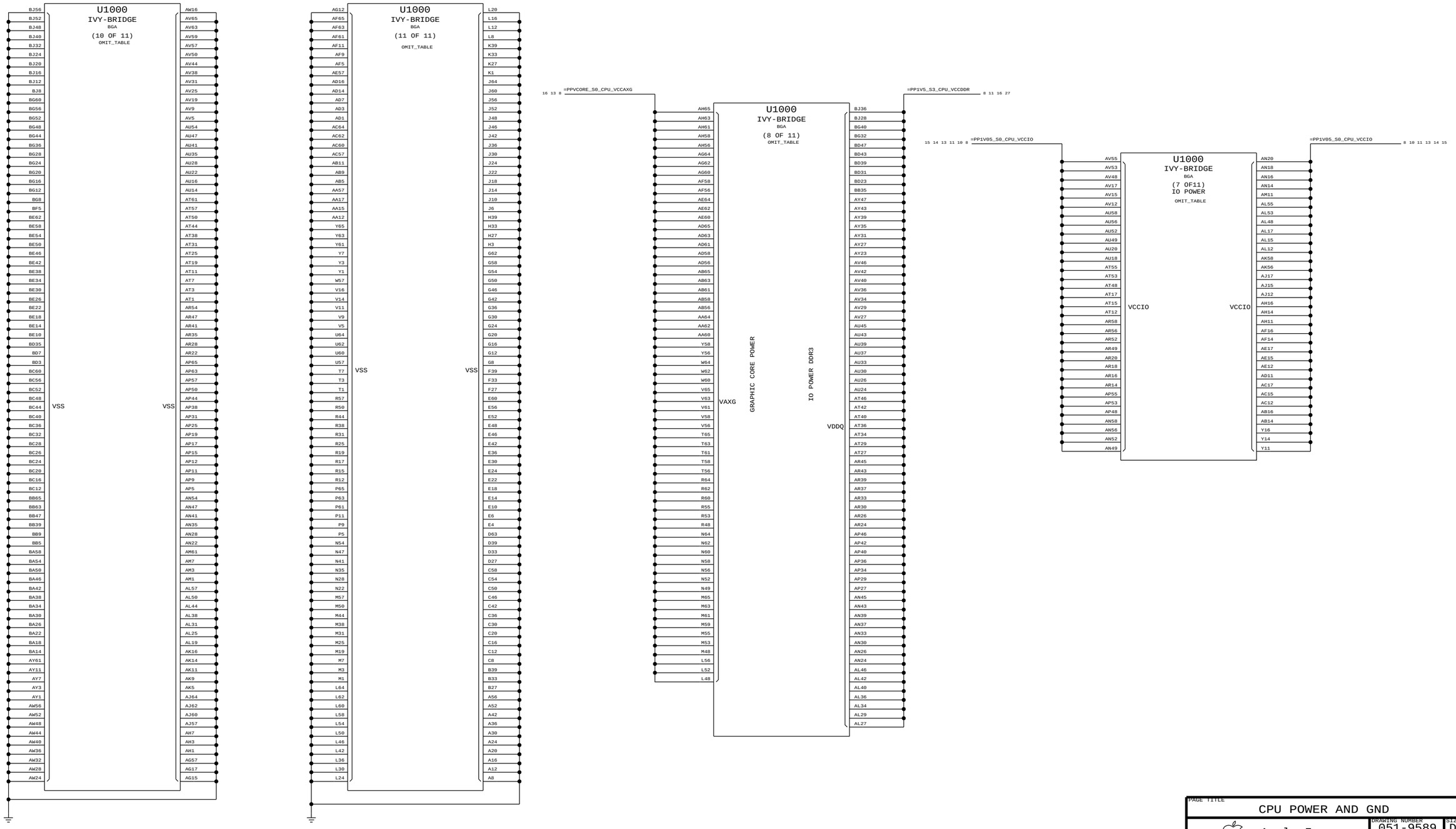

PAGE TITLE	CPU POWER AND GND
	Apple Inc.
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CPU VCORE DECOUPLING

Intel recommendation: 4x 470uF 4mOhm, 2x 470uF 4mOhm (NOSTUFF), 16x 22uF 0805, 4x 10uF 0603, 20x 1uF 0402, 28x 1uF 0402 (NOSTUFF)
Apple Implementation: 8x 270uF 6mOhm, 0x 470uF 4mOhm , 16x 22uF 0402, 4x 10uF 0402, 20x 1uF 0402, 28x 1uF 0201 (NOSTUFF), 4x 22uF 0402 (NOSTUFF)

98 45 13 8 =PPVCORE_S0_CPU

PLACEMENT_NOTE (C1600-C16C7):
Place on bottom side of U1000

C1600 C1601 C1602 C1603 C1604 C1605 C1606 C1607 C1608 C1609 C1610 C1611 C1612 C1613 C1614 C1615 C1616 C1617 C1618 C1619
1UF 10% 10V X6S-CERM 0402

NOSTUFF C16A0 C16A1 C16A2 C16A3 C16A4 C16A5 C16A6 C16A7 C16A8 C16A9 C16B0 C16B1 C16B2 C16B3 C16B4 C16B5 C16B6 C16B7 C16B8 C16B9
1UF 20% 4V CERM-X6S 0201

NOSTUFF C16C0 C16C1 C16C2 C16C3 C16C4 C16C5 C16C6 C16C7
1UF 20% 4V CERM-X6S 0201

PLACEMENT_NOTE (C1620-C1623):
Place near inductors on bottom side.
Place near U1000 on bottom side

C1620 C1621 C1622 C1623
10UF 20% 4V X6S 0402

NOSTUFF CRITICAL C1690 C1691 C1698 C1693 C1694 C1695 C1696 NOSTUFF CRITICAL C1699
20UF 20% 2V X6T-CERM 0402

PLACEMENT_NOTE (C1624-C16D5):
Place near inductors on bottom side.

CRITICAL C1624 C1625 C1626 C1627 NOSTUFF C1628 CRITICAL C1629 C1630 C1631 NOSTUFF C1632 NOSTUFF C1633 C1634 C1635 C1636 C1637 NOSTUFF C1638 C1639 NOSTUFF C16D0 NOSTUFF C16D1 NOSTUFF C16D2 NOSTUFF C16D3 NOSTUFF C16D4 NOSTUFF C16D5
20UF 20% 2V X6T-CERM 0402

PLACEMENT_NOTE (C1640-C1645):

CRITICAL C1640 C1641 C1642 C1643 C1644 C1645 C1688 C1689
270UF 20% 2V TANT CASE-B2-SM

CPU VCCIO/VCCPQ DECOUPLING

Intel recommendation: 2x 330uF, 10x 10uF 0603, 26x 1uF 0402
Apple Implementation: 2x 330uF, 10x 10uF 0603, 26x 1uF 0402

PLACEMENT_NOTE (C1646-C1671):
Place on bottom side of U1000

13 11 10 8 14 =PP1V05_S0_CPU_VCCIO

C1646 C1647 C1648 C1649 C1650 C1651 C1652 C1653 C1654 C1655 C1656 C1657 C1658
1UF 10% 10V X6S-CERM 0402

C1659 C1660 C1661 C1662 C1663 C1664 C1665 C1666 C1667 C1668 C1669 C1670 C1671
1UF 10% 10V X6S-CERM 0402

PLACEMENT_NOTE (C1672-C1681):
Place near U1000 on bottom side

C1672 C1673 C1674 C1675 C1676 C1677 C1678 C1679 C1680 C1681
10UF 20% 4V X6S-CERM 0603

CRITICAL C1682 330UF-6MOHM 20% 2.0V POLY-TANT D15T-ECGLT-COMBO
CRITICAL C1683 330UF-6MOHM 20% 2.0V POLY-TANT D15T-ECGLT-COMBO
(Z = 1.5mm, place on tall side next to CPU & under heat pipe)

Intel recommendation: 1x 10mOhn resistor, 1x 1uF 0402

R1601 0.010 2% 1/4W MF 0603
=PP1V05_S0_CPU_VCCPQE 8 13
C1684 1UF 10% 10V X6S-CERM 0402

CPU VCCPLL DECOUPLING

8 =PP1V8_S0_CPU_VCCPLL
R1600 0 5% 1/10W MF-LF 402
=PP1V8_S0_CPU_VCCPLL_R 8 13
PLACE_NEAR=U1000.AK61:5MM
C1685 1UF 10% 10V X6S-CERM 0402
C1686 1UF 10% 10V X6S-CERM 0402
CRITICAL C1687 220UF 20% 2.5V TANT B16 (Z = 1.2mm, place on short side behind CPU)
PLACE_NEAR=U1000.AK63:2.54 mm:NO_VIA
PLACE_NEAR=U1000.AK65:2.54 mm:NO_VIA

CPU VCCPLL Low pass filter

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: CPU DECOUPLING-I

Apple Inc.

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VAXG DECOUPLING

INTEL RECOMMENDATION: 2X 470UF 4MOHM, 2X 470UF 4MOHM (NOSTUFF), 6X 22UF 0805, 2X 22UF 0805 (NOSTUFF), 6X 10UF 0603, 2X 10UF 0603 (NOSTUFF), 9X 1UF 0402, 9X 1UF 0402 (NOSTUFF)
APPLE IMPLEMENTATION: 0X 470UF 4MOHM, 3X 330UF 9MOHM , 6X 22UF 0603, 2X 22UF 0603 (NOSTUFF), 6X 10UF 0402, 2X 10UF 0402 (NOSTUFF), 9X 1UF 0402, 9X 1UF 0402 (NOSTUFF)

14 13 8 =PPVCORE_S0_CPU_VCCAXG

PLACEMENT_NOTE (C1700-C1708):
Place on bottom side of U1000

C1700 C1701 C1702 C1703 C1704 C1705 C1706 C1707 C1708 NOSTUFF: C1709 C1710 C1711 C1712 C1713 C1714 C1715 C1716 C1717
1UF 10% 10V X6S-CERM 0402

PLACEMENT_NOTE (C1718-C1723):
Place close to U1000 on bottom side

C1718 C1719 C1720 C1721 C1722 C1723 NOSTUFF: C1724 C1725
10UF 20% 4V X6S 0402

PLACEMENT_NOTE (C1726-C1731):
Place near inductors on bottom side.

C1726 C1727 C1728 C1729 C1730 C1731 NOSTUFF: C1732 C1733
22UF 20% 4V X6S 0603

PLACEMENT_NOTE (C1734-C1735):

CRITICAL C1734 330UF-6MOHM 20% 2.0V POLY-TANT D15T
CRITICAL C1735 330UF-6MOHM 20% 2.0V POLY-TANT D15T
CRITICAL C1737 330UF-6MOHM 20% 2.0V POLY-TANT D15T
(Z = 1.5mm, place on tall side next to CPU & under heat pipe)

CPU VDDQ/VCCDQ DECOUPLING

Intel recommendation: 1x 330uF, 8x 10uF 0603, 10x 1uF 0402
Apple Implementation: 1x 330uF, 8x 10uF 0603, 10x 1uF 0402

27 14 11 8 =PP1V5_S3_CPU_VCCDDR

PLACEMENT_NOTE (C1738-C1747):
Place on bottom side of U1000

C1738 C1739 C1740 C1741 C1742 C1743 C1744 C1745 C1746 C1747
1UF 10% 10V X6S-CERM 0402

Place close to U1000 on bottom side

C1748 C1749 C1750 C1751 C1752 C1753 C1754 C1755
10UF 20% 4V X6S-CERM 0603

Place near inductors on bottom side

C1756 330UF-0.006OHM 20% 2V POLY CASE-D2-SM

Intel recommendation: 1x 10mOhn resistor, 1x 1uF 0402

R1700 0.010 1% 1/4W MF 0603
=PP1V5_S3_CPU_VCCDQ 8 13
C1757 1UF 10% 10V X6S-CERM 0402

CPU VCCSA DECOUPLING

Intel recommendation: 1x 330uF, 5x 10uF 0603, 5x 1uF 0402
Apple Implementation: 1x 330uF, 5x 10uF 0603, 5x 1uF 0402

13 8 =PPVCCSA_S0_CPU

PLACEMENT_NOTE (C1758-C1762):
Place on bottom side of U1000

C1758 C1759 C1760 C1761 C1762
1UF 10% 10V X6S-CERM 0402

C1763 C1764 C1765 C1766 C1767
10UF 20% 4V X6S-CERM 0603

CRITICAL C1768 330UF-6MOHM 20% 2.0V POLY-TANT DIST-ECGLT-COMBO
(Z = 1.5mm, place on tall side next to CPU & under heat pipe)

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: CPU DECOUPLING-II

Apple Inc.

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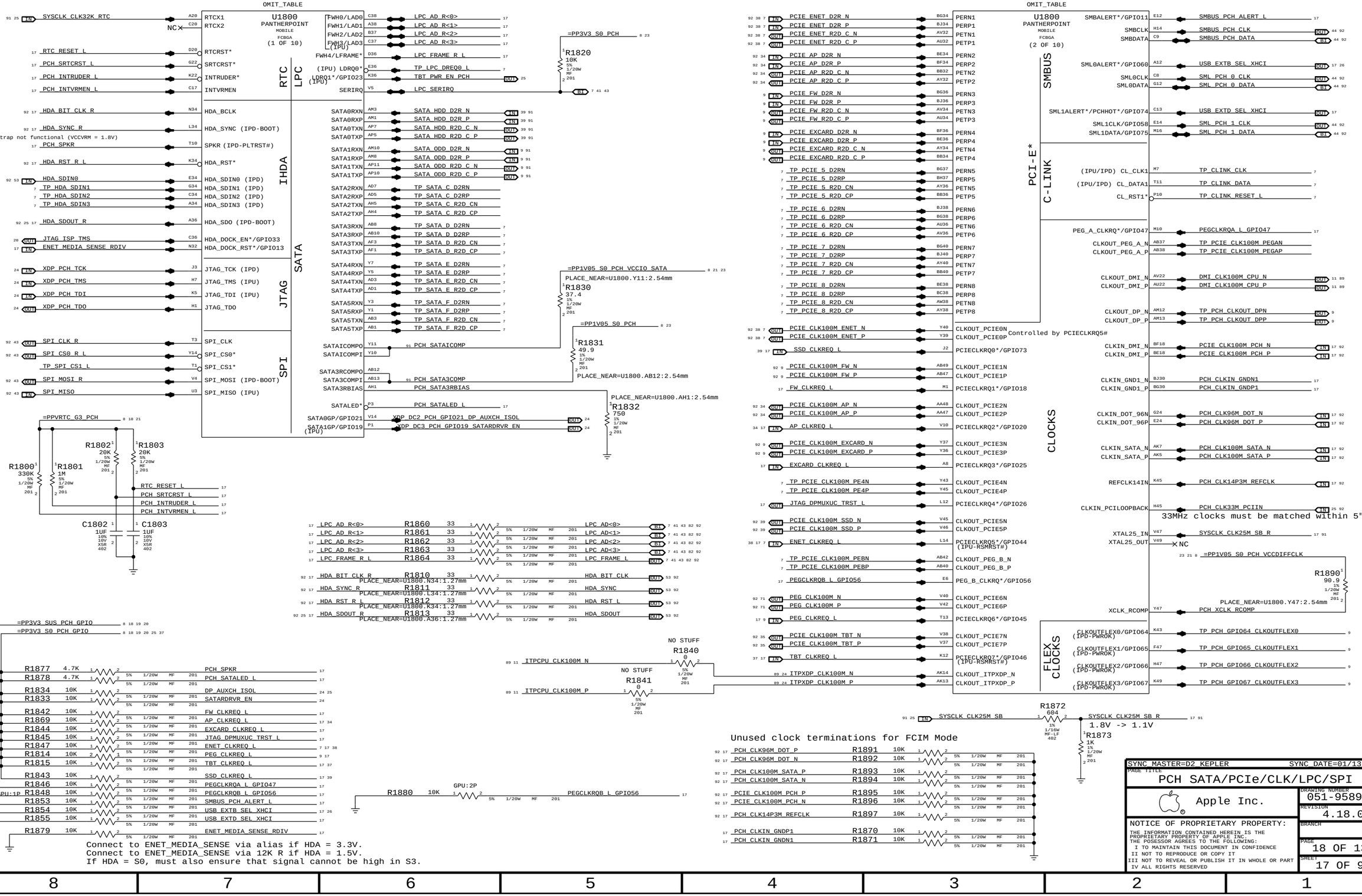
OMIT_TABLE
U1800
PANTHERPOINT
MOBILE
FCBGA
(1 OF 10)
RTCX1
RTCX2
RTCRST*
SRTCRST*
INTRUDER*
INTVRMEN
HDA_BCLK
HDA_SYNC (IPD-BOOT)
SPKR (IPD-PLTRST#)
HDA_RST*
HDA_SDIN0 (IPD)
HDA_SDIN1 (IPD)
HDA_SDIN2 (IPD)
HDA_SDIN3 (IPD)
HDA_SDO (IPD-BOOT)
HDA_DOCK_EN*/GPIO33
HDA_DOCK_RST*/GPIO13
JTAG_TCK (IPD)
JTAG_TMS (IPD)
JTAG_TDI (IPU)
JTAG_TDO
SPI_CLK
SPI_CS0*
SPI_CS1*
SPI_MOSI (IPD-BOOT)
SPI_MISO (IPU)
RTC
LPC
IHDA
SATA
JTAG
SPI
SYSCLK_CLK32K_RTC
RTC_RESET_L
PCH_SRTCRST_L
PCH_INTRUDER_L
PCH_INTVRMEN_L
HDA_BIT_CLK_R
HDA_SYNC_R
VSel strap not functional (VCCVRM = 1.8V)
PCH_SPKR
HDA_RST_R_L
HDA_SDIN0
TP_HDA_SDIN1
TP_HDA_SDIN2
TP_HDA_SDIN3
HDA_SDOUT_R
JTAG_ISP_TMS
ENET_MEDIA_SENSE_RDIV
XDP_PCH_TCK
XDP_PCH_TMS
XDP_PCH_TDI
XDP_PCH_TDO
SPI_CLK_R
SPI_CS0_R_L
TP_SPI_CS1_L
SPI_MOSI_R
SPI_MISO
FWH0/LAD0
FWH1/LAD1
FWH2/LAD2
FWH3/LAD3
(IPU)
FWH4/LFRAME*
(IPU) LDRQ0*
LDRQ1*/GPIO23
(IPU)
SERIRQ
LPC_AD_R<0>
LPC_AD_R<1>
LPC_AD_R<2>
LPC_AD_R<3>
LPC_FRAME_R_L
TP_LPC_DREQ0_L
TBT_PWR_EN_PCH
LPC_SERIRQ
=PP3V3_S0_PCH
R1820
10K
SATA0RXN
SATA0RXP
SATA0TXN
SATA0TXP
SATA_HDD_D2R_N
SATA_HDD_D2R_P
SATA_HDD_R2D_C_N
SATA_HDD_R2D_C_P
SATA1RXN
SATA1RXP
SATA1TXN
SATA1TXP
SATA_ODD_D2R_N
SATA_ODD_D2R_P
SATA_ODD_R2D_C_N
SATA_ODD_R2D_C_P
SATA2RXN
SATA2RXP
SATA2TXN
SATA2TXP
TP_SATA_C_D2RN
TP_SATA_C_D2RP
TP_SATA_C_R2D_CN
TP_SATA_C_R2D_CP
SATA3RXN
SATA3RXP
SATA3TXN
SATA3TXP
TP_SATA_D_D2RN
TP_SATA_D_D2RP
TP_SATA_D_R2D_CN
TP_SATA_D_R2D_CP
SATA4RXN
SATA4RXP
SATA4TXN
SATA4TXP
TP_SATA_E_D2RN
TP_SATA_E_D2RP
TP_SATA_E_R2D_CN
TP_SATA_E_R2D_CP
SATA5RXN
SATA5RXP
SATA5TXN
SATA5TXP
TP_SATA_F_D2RN
TP_SATA_F_D2RP
TP_SATA_F_R2D_CN
TP_SATA_F_R2D_CP
SATAICOMPO
SATAICOMPI
PCH_SATAICOMP
=PP1V05_S0_PCH_VCCIO_SATA
PLACE_NEAR=U1800.Y11:2.54mm
R1830
37.4
=PP1V05_S0_PCH
R1831
49.9
PLACE_NEAR=U1800.AB12:2.54mm
SATA3RCOMPO
SATA3COMPI
SATA3RBIAS
PCH_SATA3COMP
PCH_SATA3RBIAS
PLACE_NEAR=U1800.AH1:2.54mm
R1832
750
SATALED*
PCH_SATALED_L
SATA0GP/GPIO21
SATA1GP/GPIO19
(IPU)
XDP_DC2_PCH_GPIO21_DP_AUXCH_ISOL
XDP_DC3_PCH_GPIO19_SATARDRVR_EN
=PPVRTC_G3_PCH
R1800
330K
R1801
1M
R1802
20K
R1803
20K
RTC_RESET_L
PCH_SRTCRST_L
PCH_INTRUDER_L
PCH_INTVRMEN_L
C1802
1UF
C1803
1UF
R1860
R1861
R1862
R1863
R1864
R1810
R1811
R1812
R1813
HDA_BIT_CLK
HDA_SYNC
HDA_RST_L
HDA_SDOUT
PLACE_NEAR=U1800.N34:1.27mm
PLACE_NEAR=U1800.L34:1.27mm
PLACE_NEAR=U1800.K34:1.27mm
PLACE_NEAR=U1800.A36:1.27mm
R1877
4.7K
R1878
4.7K
R1834
10K
R1833
10K
R1842
10K
R1869
10K
R1844
10K
R1845
10K
R1847
10K
R1814
10K
R1815
10K
R1843
10K
R1846
10K
R1848
10K
R1853
10K
R1854
10K
R1855
10K
R1879
10K
PCH_SPKR
PCH_SATALED_L
DP_AUXCH_ISOL
SATARDRVR_EN
FW_CLKREQ_L
AP_CLKREQ_L
EXCARD_CLKREQ_L
JTAG_DPMUXUC_TRST_L
ENET_CLKREQ_L
PEG_CLKREQ_L
TBT_CLKREQ_L
SSD_CLKREQ_L
PEGCLKRQA_L_GPIO47
PEGCLKRQB_L_GPIO56
SMBUS_PCH_ALERT_L
USB_EXTB_SEL_XHCI
USB_EXTD_SEL_XHCI
ENET_MEDIA_SENSE_RDIV
=PP3V3_SUS_PCH_GPIO
=PP3V3_S0_PCH_GPIO
GPU:1P
GPU:2P
R1880
10K
PEGCLKRQB_L_GPIO56
Connect to ENET_MEDIA_SENSE via alias if HDA = 3.3V.
Connect to ENET_MEDIA_SENSE via 12K R if HDA = 1.5V.
If HDA = S0, must also ensure that signal cannot be high in S3.
OMIT_TABLE
U1800
PANTHERPOINT
MOBILE
FCBGA
(2 OF 10)
PERN1
PERP1
PETN1
PETP1
PERN2
PERP2
PETN2
PETP2
PERN3
PERP3
PETN3
PETP3
PERN4
PERP4
PETN4
PETP4
PERN5
PERP5
PETN5
PETP5
PERN6
PERP6
PETN6
PETP6
PERN7
PERP7
PETN7
PETP7
PERN8
PERP8
PETN8
PETP8
PCIE_ENET_D2R_N
PCIE_ENET_D2R_P
PCIE_ENET_R2D_C_N
PCIE_ENET_R2D_C_P
PCIE_AP_D2R_N
PCIE_AP_D2R_P
PCIE_AP_R2D_C_N
PCIE_AP_R2D_C_P
PCIE_FW_D2R_N
PCIE_FW_D2R_P
PCIE_FW_R2D_C_N
PCIE_FW_R2D_C_P
PCIE_EXCARD_D2R_N
PCIE_EXCARD_D2R_P
PCIE_EXCARD_R2D_C_N
PCIE_EXCARD_R2D_C_P
TP_PCIE_5_D2RN
TP_PCIE_5_D2RP
TP_PCIE_5_R2D_CN
TP_PCIE_5_R2D_CP
TP_PCIE_6_D2RN
TP_PCIE_6_D2RP
TP_PCIE_6_R2D_CN
TP_PCIE_6_R2D_CP
TP_PCIE_7_D2RN
TP_PCIE_7_D2RP
TP_PCIE_7_R2D_CN
TP_PCIE_7_R2D_CP
TP_PCIE_8_D2RN
TP_PCIE_8_D2RP
TP_PCIE_8_R2D_CN
TP_PCIE_8_R2D_CP
CLKOUT_PCIE0N
CLKOUT_PCIE0P
Controlled by PCIECLKRQ5#
PCIECLKRQ0*/GPIO73
CLKOUT_PCIE1N
CLKOUT_PCIE1P
PCIECLKRQ1*/GPIO18
CLKOUT_PCIE2N
CLKOUT_PCIE2P
PCIECLKRQ2*/GPIO20
CLKOUT_PCIE3N
CLKOUT_PCIE3P
PCIECLKRQ3*/GPIO25
CLKOUT_PCIE4N
CLKOUT_PCIE4P
PCIECLKRQ4*/GPIO26
CLKOUT_PCIE5N
CLKOUT_PCIE5P
PCIECLKRQ5*/GPIO44
(IPU-RSMRST#)
CLKOUT_PEG_B_N
CLKOUT_PEG_B_P
PEG_B_CLKRQ*/GPIO56
CLKOUT_PCIE6N
CLKOUT_PCIE6P
PCIECLKRQ6*/GPIO45
CLKOUT_PCIE7N
CLKOUT_PCIE7P
PCIECLKRQ7*/GPIO46
(IPU-RSMRST#)
CLKOUT_ITPXDP_N
CLKOUT_ITPXDP_P
PCIE_ENET_D2R_N
PCIE_ENET_D2R_P
PCIE_ENET_R2D_C_N
PCIE_ENET_R2D_C_P
PCIE_AP_D2R_N
PCIE_AP_D2R_P
PCIE_AP_R2D_C_N
PCIE_AP_R2D_C_P
PCIE_FW_D2R_N
PCIE_FW_D2R_P
PCIE_FW_R2D_C_N
PCIE_FW_R2D_C_P
PCIE_EXCARD_D2R_N
PCIE_EXCARD_D2R_P
PCIE_EXCARD_R2D_C_N
PCIE_EXCARD_R2D_C_P
TP_PCIE_5_D2RN
TP_PCIE_5_D2RP
TP_PCIE_5_R2D_CN
TP_PCIE_5_R2D_CP
TP_PCIE_6_D2RN
TP_PCIE_6_D2RP
TP_PCIE_6_R2D_CN
TP_PCIE_6_R2D_CP
TP_PCIE_7_D2RN
TP_PCIE_7_D2RP
TP_PCIE_7_R2D_CN
TP_PCIE_7_R2D_CP
TP_PCIE_8_D2RN
TP_PCIE_8_D2RP
TP_PCIE_8_R2D_CN
TP_PCIE_8_R2D_CP
PCIE_CLK100M_ENET_N
PCIE_CLK100M_ENET_P
SSD_CLKREQ_L
PCIE_CLK100M_FW_N
PCIE_CLK100M_FW_P
FW_CLKREQ_L
PCIE_CLK100M_AP_N
PCIE_CLK100M_AP_P
AP_CLKREQ_L
PCIE_CLK100M_EXCARD_N
PCIE_CLK100M_EXCARD_P
EXCARD_CLKREQ_L
TP_PCIE_CLK100M_PE4N
TP_PCIE_CLK100M_PE4P
JTAG_DPMUXUC_TRST_L
PCIE_CLK100M_SSD_N
PCIE_CLK100M_SSD_P
ENET_CLKREQ_L
TP_PCIE_CLK100M_PEBN
TP_PCIE_CLK100M_PEBP
PEGCLKRQB_L_GPIO56
PEG_CLK100M_N
PEG_CLK100M_P
PEG_CLKREQ_L
PCIE_CLK100M_TBT_N
PCIE_CLK100M_TBT_P
TBT_CLKREQ_L
ITPXDP_CLK100M_N
ITPXDP_CLK100M_P
ITPCPU_CLK100M_N
ITPCPU_CLK100M_P
NO STUFF
R1840
0
NO STUFF
R1841
0
SMBUS
C-LINK
PCI-E*
CLOCKS
FLEX CLOCKS
SMBALERT*/GPIO11
SMBCLK
SMBDATA
SML0ALERT*/GPIO60
SML0CLK
SML0DATA
SML1ALERT*/PCHHOT*/GPIO74
SML1CLK/GPIO58
SML1DATA/GPIO75
(IPU/IPD) CL_CLK1
(IPU/IPD) CL_DATA1
CL_RST1*
PEG_A_CLKRQ*/GPIO47
CLKOUT_PEG_A_N
CLKOUT_PEG_A_P
CLKOUT_DMI_N
CLKOUT_DMI_P
CLKOUT_DP_N
CLKOUT_DP_P
CLKIN_DMI_N
CLKIN_DMI_P
CLKIN_GND1_N
CLKIN_GND1_P
CLKIN_DOT_96N
CLKIN_DOT_96P
CLKIN_SATA_N
CLKIN_SATA_P
REFCLK14IN
CLKIN_PCILOOPBACK
XTAL25_IN
XTAL25_OUT
XCLK_RCOMP
CLKOUTFLEX0/GPIO64
(IPD-PWROK)
CLKOUTFLEX1/GPIO65
(IPD-PWROK)
CLKOUTFLEX2/GPIO66
(IPD-PWROK)
CLKOUTFLEX3/GPIO67
(IPD-PWROK)
SMBUS_PCH_ALERT_L
SMBUS_PCH_CLK
SMBUS_PCH_DATA
USB_EXTB_SEL_XHCI
SML_PCH_0_CLK
SML_PCH_0_DATA
USB_EXTD_SEL_XHCI
SML_PCH_1_CLK
SML_PCH_1_DATA
TP_CLINK_CLK
TP_CLINK_DATA
TP_CLINK_RESET_L
PEGCLKRQA_L_GPIO47
TP_PCIE_CLK100M_PEGAN
TP_PCIE_CLK100M_PEGAP
DMI_CLK100M_CPU_N
DMI_CLK100M_CPU_P
TP_PCH_CLKOUT_DPN
TP_PCH_CLKOUT_DPP
PCIE_CLK100M_PCH_N
PCIE_CLK100M_PCH_P
PCH_CLKIN_GNDN1
PCH_CLKIN_GNDP1
PCH_CLK96M_DOT_N
PCH_CLK96M_DOT_P
PCH_CLK100M_SATA_N
PCH_CLK100M_SATA_P
PCH_CLK14P3M_REFCLK
PCH_CLK33M_PCIIN
33MHz clocks must be matched within 5"
SYSCLK_CLK25M_SB_R
NC
=PP1V05_S0_PCH_VCCDIFFCLK
R1890
90.9
PLACE_NEAR=U1800.Y47:2.54mm
PCH_XCLK_RCOMP
TP_PCH_GPIO64_CLKOUTFLEX0
TP_PCH_GPIO65_CLKOUTFLEX1
TP_PCH_GPIO66_CLKOUTFLEX2
TP_PCH_GPIO67_CLKOUTFLEX3
SYSCLK_CLK25M_SB
R1872
604
SYSCLK_CLK25M_SB_R
1.8V -> 1.1V
R1873
1K
Unused clock terminations for FCIM Mode
PCH_CLK96M_DOT_P
PCH_CLK96M_DOT_N
PCH_CLK100M_SATA_P
PCH_CLK100M_SATA_N
PCIE_CLK100M_PCH_P
PCIE_CLK100M_PCH_N
PCH_CLK14P3M_REFCLK
PCH_CLKIN_GNDP1
PCH_CLKIN_GNDN1
R1891
R1892
R1893
R1894
R1895
R1896
R1897
R1870
R1871
10K
SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
PAGE TITLE
PCH SATA/PCIe/CLK/LPC/SPI
Apple Inc.
DRAWING NUMBER
051-9589
SIZE
D
REVISION
4.18.0
BRANCH
PAGE
18 OF 132
SHEET
17 OF 99
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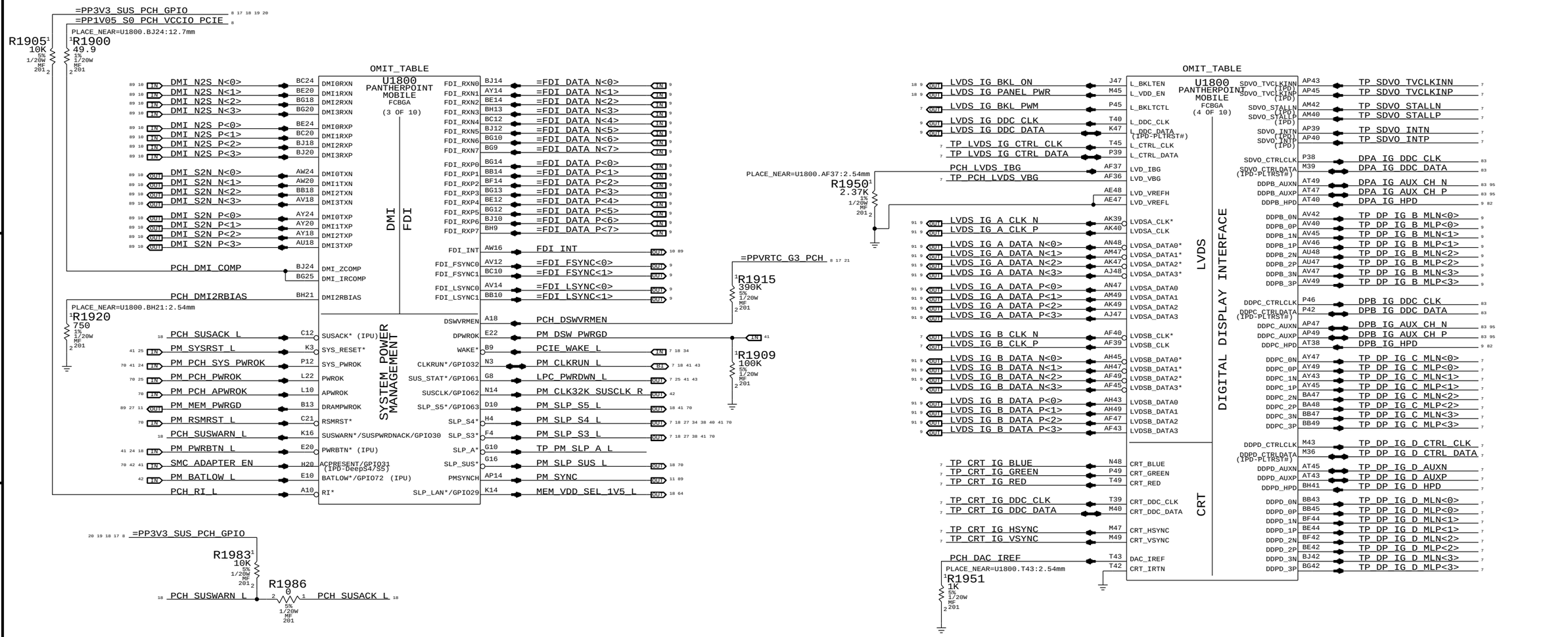

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: PCH DMI/FDI/PM/Graphics

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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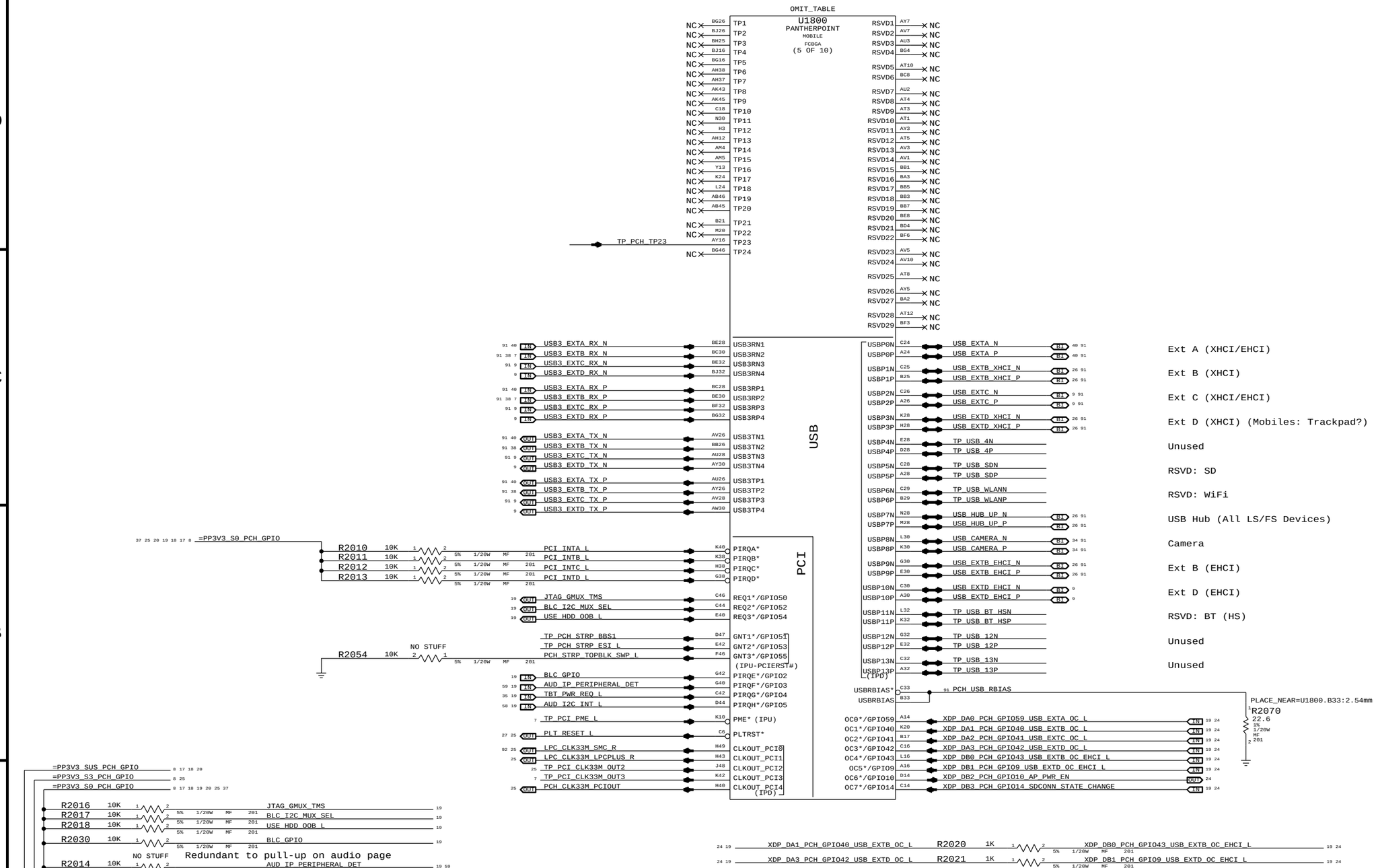

Ext A (XHCI/EHCI)

Ext B (XHCI)

Ext C (XHCI/EHCI)

Ext D (XHCI) (Mobiles: Trackpad?)

Unused

RSVD: SD

RSVD: WiFi

USB Hub (All LS/FS Devices)

Camera

Ext B (EHCI)

Ext D (EHCI)

RSVD: BT (HS)

Unused

Unused

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

PCH PCI/USB/TP/RSVD

Apple Inc.

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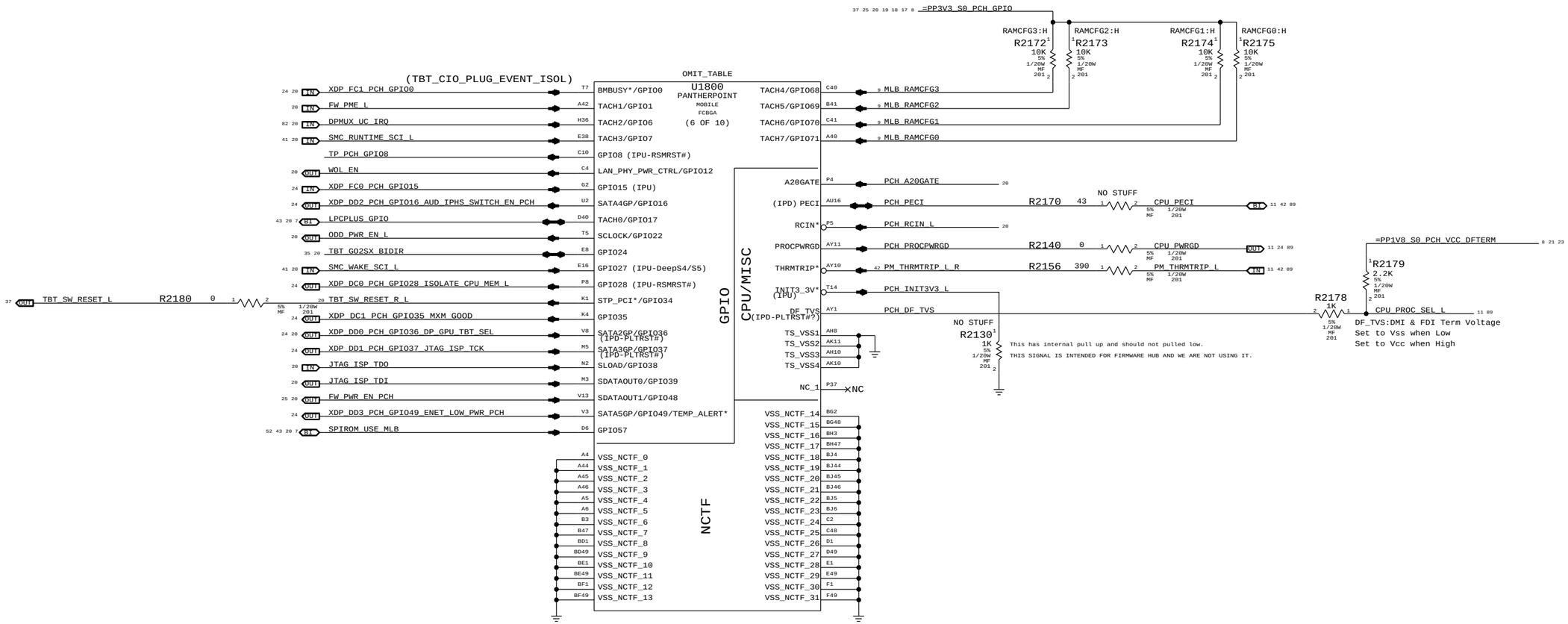
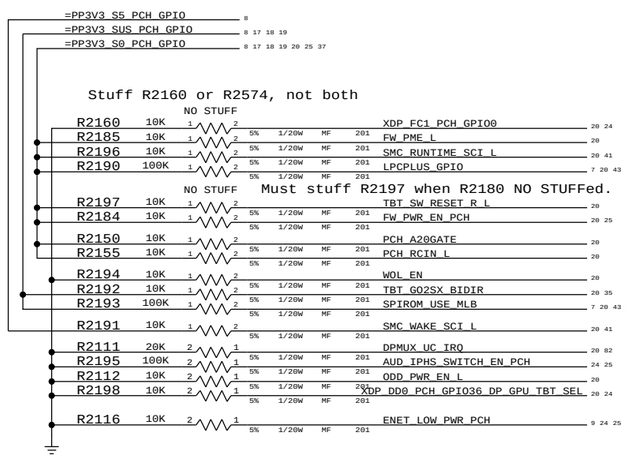
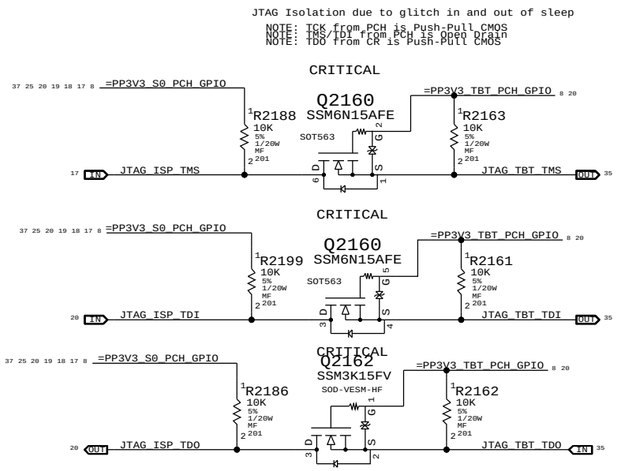
BOM GROUP	BOM OPTIONS
RAMCFG_SLOT	RAMCFG3:H,RAMCFG2:H,RAMCFG1:H,RAMCFG0:H

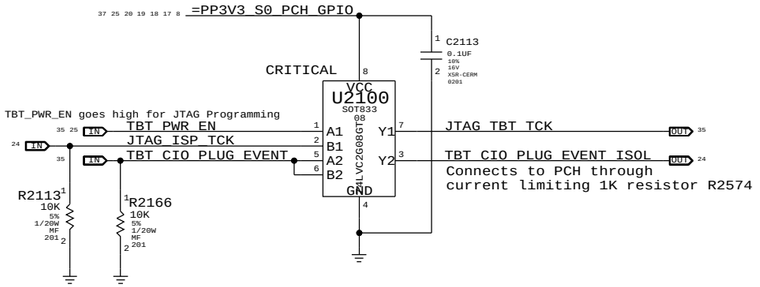
Systems with no chip-down memory should pull all 4 RAMCFG GPIOs high.

Systems with chip-down memory should add pull-downs on another page and set straps per software.









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DRAWING NUMBER: 051-9589 SIZE: D

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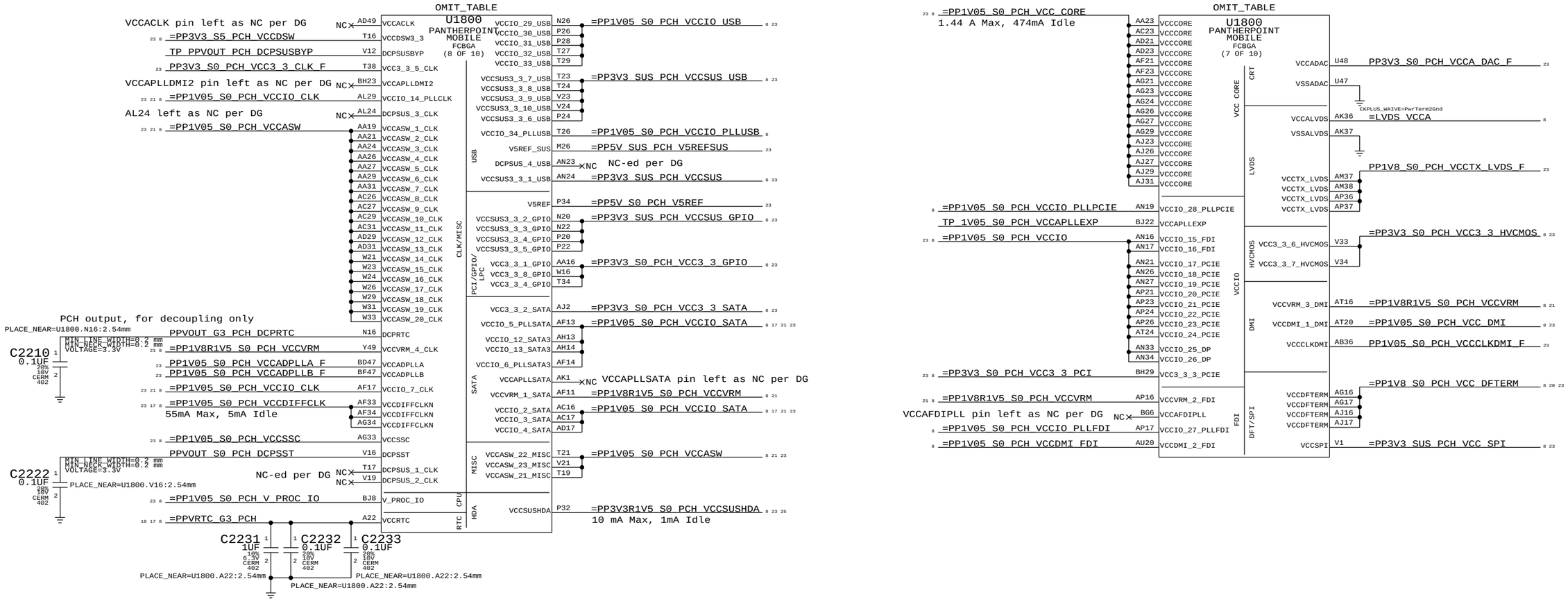

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Apple Inc.	DRAWING NUMBER 051-9589 · SIZE D
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OMIT_TABLE

U1800
PANTHERPOINT
MOBILE
FCBGA
(9 OF 10)
VSS

H5	VSS	VSS	AK38
AA17	VSS	VSS	AK4
AA2	VSS	VSS	AK42
AA3	VSS	VSS	AK46
AA33	VSS	VSS	AK8
AA34	VSS	VSS	AL16
AB11	VSS	VSS	AL17
AB14	VSS	VSS	AL19
AB39	VSS	VSS	AL2
AB4	VSS	VSS	AL21
AB43	VSS	VSS	AL23
AB5	VSS	VSS	AL26
AB7	VSS	VSS	AL27
AC19	VSS	VSS	AL31
AC2	VSS	VSS	AL33
AC21	VSS	VSS	AL34
AC24	VSS	VSS	AL48
AC33	VSS	VSS	AM11
AC34	VSS	VSS	AM14
AC48	VSS	VSS	AM36
AD10	VSS	VSS	AM39
AD11	VSS	VSS	AM43
AD12	VSS	VSS	AM45
AD13	VSS	VSS	AM46
AD19	VSS	VSS	AM7
AD24	VSS	VSS	AN2
AD26	VSS	VSS	AN29
AD27	VSS	VSS	AN3
AD33	VSS	VSS	AN31
AD34	VSS	VSS	AP12
AD36	VSS	VSS	AP19
AD37	VSS	VSS	AP28
AD38	VSS	VSS	AP30
AD39	VSS	VSS	AP32
AD4	VSS	VSS	AP38
AD40	VSS	VSS	AP4
AD42	VSS	VSS	AP42
AD43	VSS	VSS	AP46
AD45	VSS	VSS	AP8
AD46	VSS	VSS	AR2
AD8	VSS	VSS	AR48
AE2	VSS	VSS	AT11
AE3	VSS	VSS	AT13
AF10	VSS	VSS	AT18
AF12	VSS	VSS	AT22
AD14	VSS	VSS	AT26
AD16	VSS	VSS	AT28
AF16	VSS	VSS	AT30
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AF31	VSS	VSS	AT7
AF38	VSS	VSS	AU24
AF4	VSS	VSS	AU30
AF42	VSS	VSS	AV11
AF46	VSS	VSS	AV16
AF5	VSS	VSS	AV20
AF7	VSS	VSS	AV24
AF8	VSS	VSS	AV30
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AG2	VSS	VSS	AV4
AG31	VSS	VSS	AV43
AG48	VSS	VSS	AV8
AH11	VSS	VSS	AW14
AH3	VSS	VSS	AW18
AH36	VSS	VSS	AW2
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AJ21	VSS	VSS	AW40
AJ24	VSS	VSS	AW48
AJ33	VSS	VSS	AY12
AJ34	VSS	VSS	AY22
AK12	VSS	VSS	AY28
AK3	VSS		

OMIT_TABLE

U1800
PANTHERPOINT
MOBILE
FCBGA
(10 OF 10)
VSS

AY4	VSS	VSS	H46
AY42	VSS	VSS	K18
AY46	VSS	VSS	K26
AY8	VSS	VSS	K39
B11	VSS	VSS	K46
B15	VSS	VSS	K7
B19	VSS	VSS	L18
B23	VSS	VSS	L2
B27	VSS	VSS	L20
B31	VSS	VSS	L26
B35	VSS	VSS	L28
B39	VSS	VSS	L36
B7	VSS	VSS	L48
F45	VSS	VSS	M12
BB12	VSS	VSS	P16
BB16	VSS	VSS	M18
BB20	VSS	VSS	M22
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BC32	VSS	VSS	P11
BC34	VSS	VSS	P18
BC36	VSS	VSS	T33
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BC48	VSS	VSS	P47
BD46	VSS	VSS	P7
BD5	VSS	VSS	R2
BE22	VSS	VSS	R48
BE26	VSS	VSS	T12
BE40	VSS	VSS	T31
BF10	VSS	VSS	T37
BF12	VSS	VSS	T4
BF16	VSS	VSS	W34
BF20	VSS	VSS	T46
BF22	VSS	VSS	T47
BF24	VSS	VSS	T8
BF26	VSS	VSS	V11
BF28	VSS	VSS	V17
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BG33	VSS	VSS	V7
BG44	VSS	VSS	W17
BG8	VSS	VSS	W19
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BH15	VSS	VSS	W27
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BH19	VSS	VSS	Y12
H10	VSS	VSS	Y38
BH27	VSS	VSS	Y4
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BH35	VSS	VSS	Y8
BH39	VSS		
BH43	VSS	VSS	BG29
BH7	VSS	VSS	N24
D3	VSS	VSS	AJ3
D12	VSS	VSS	AD47
D16	VSS		
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D24	VSS	VSS	BG41
D26	VSS		
D30	VSS	VSS	G14
D32	VSS	VSS	H16
D34	VSS		
D38	VSS	VSS	T36
D42	VSS		
D8	VSS	VSS	BG22
E18	VSS	VSS	BG24
E26	VSS	VSS	C22
G18	VSS	VSS	AP13
G20	VSS	VSS	M14
G26	VSS	VSS	AP3
G28	VSS	VSS	AP1
G36	VSS	VSS	BE16
G48	VSS	VSS	BC16
H12	VSS	VSS	BG28
H18	VSS	VSS	BJ28
H22	VSS		
H24	VSS		
H26	VSS		
H30	VSS		
H32	VSS		
H34	VSS		
F3	VSS		

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

PCH GROUNDS

Apple Inc.

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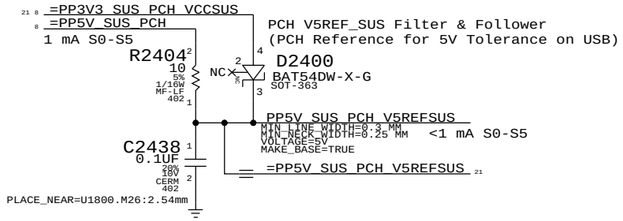

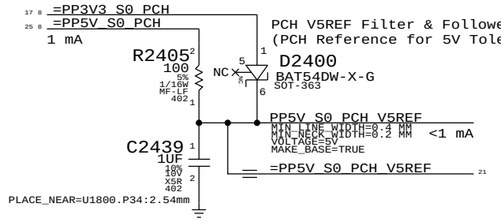

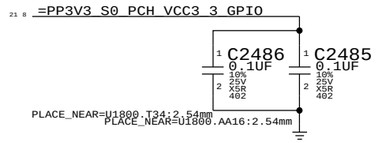

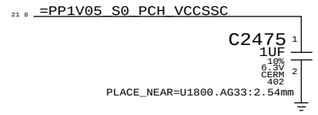

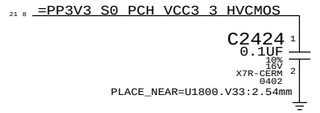

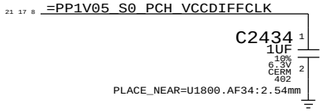

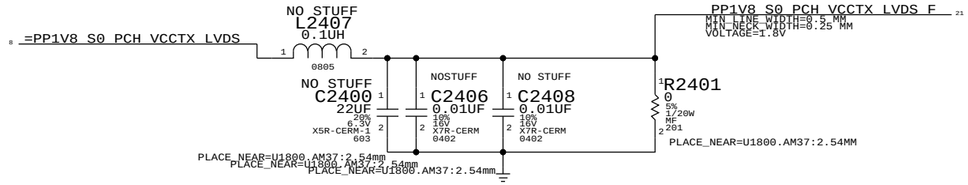

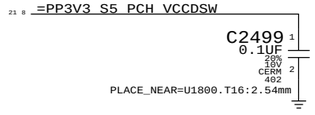

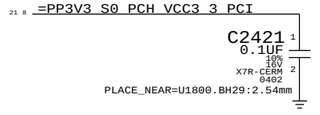

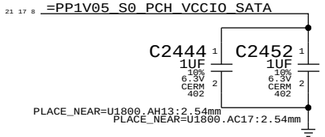

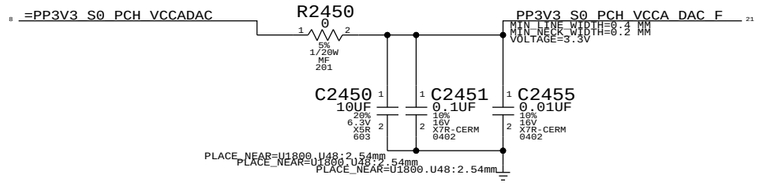

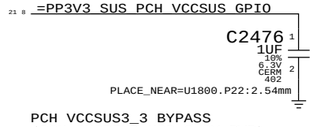

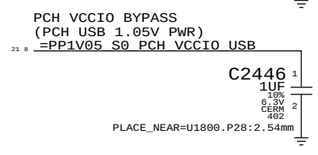

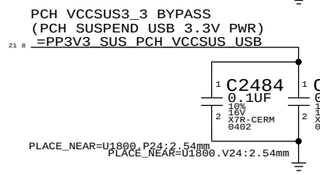

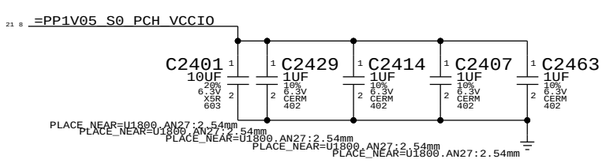

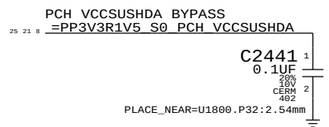

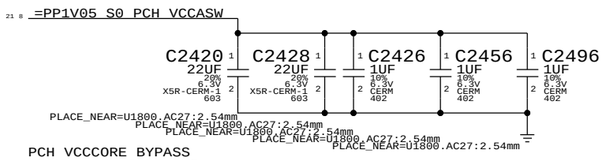

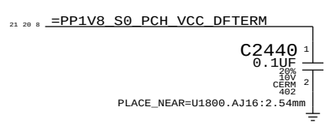

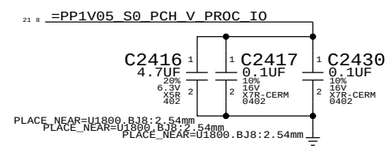

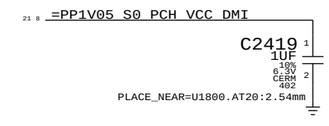

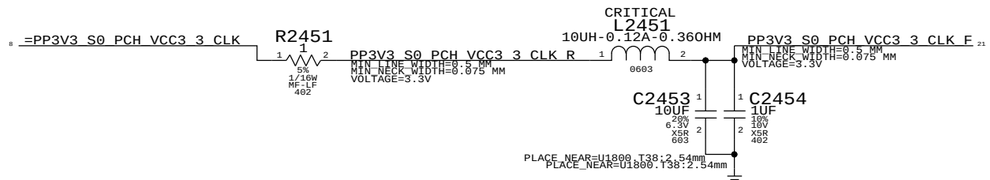

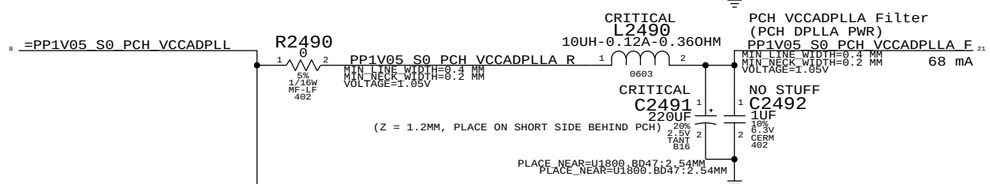

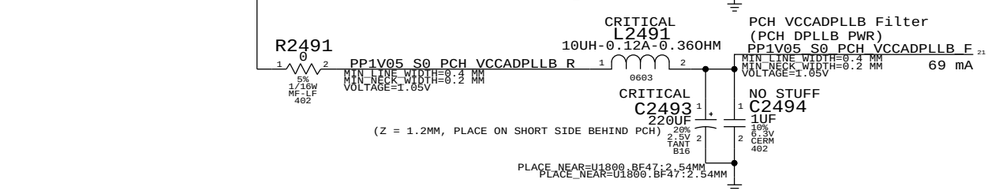

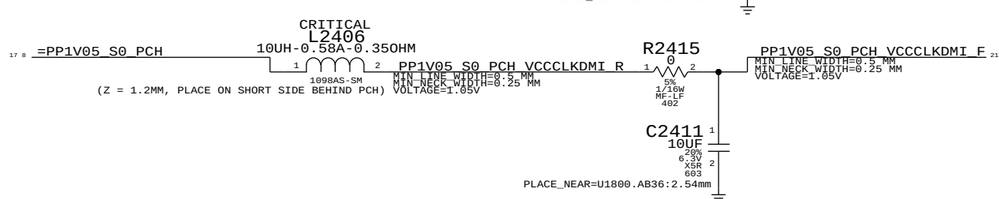

PCH VCCIO BYPASS

PCH VCC3_3 BYPASS
(PCH PCI 3.3V PWR)

SYNC_MASTER=D2_CLEAN	SYNC_DATE=03/19/2012
PAGE TITLE	PCH DECOUPLING
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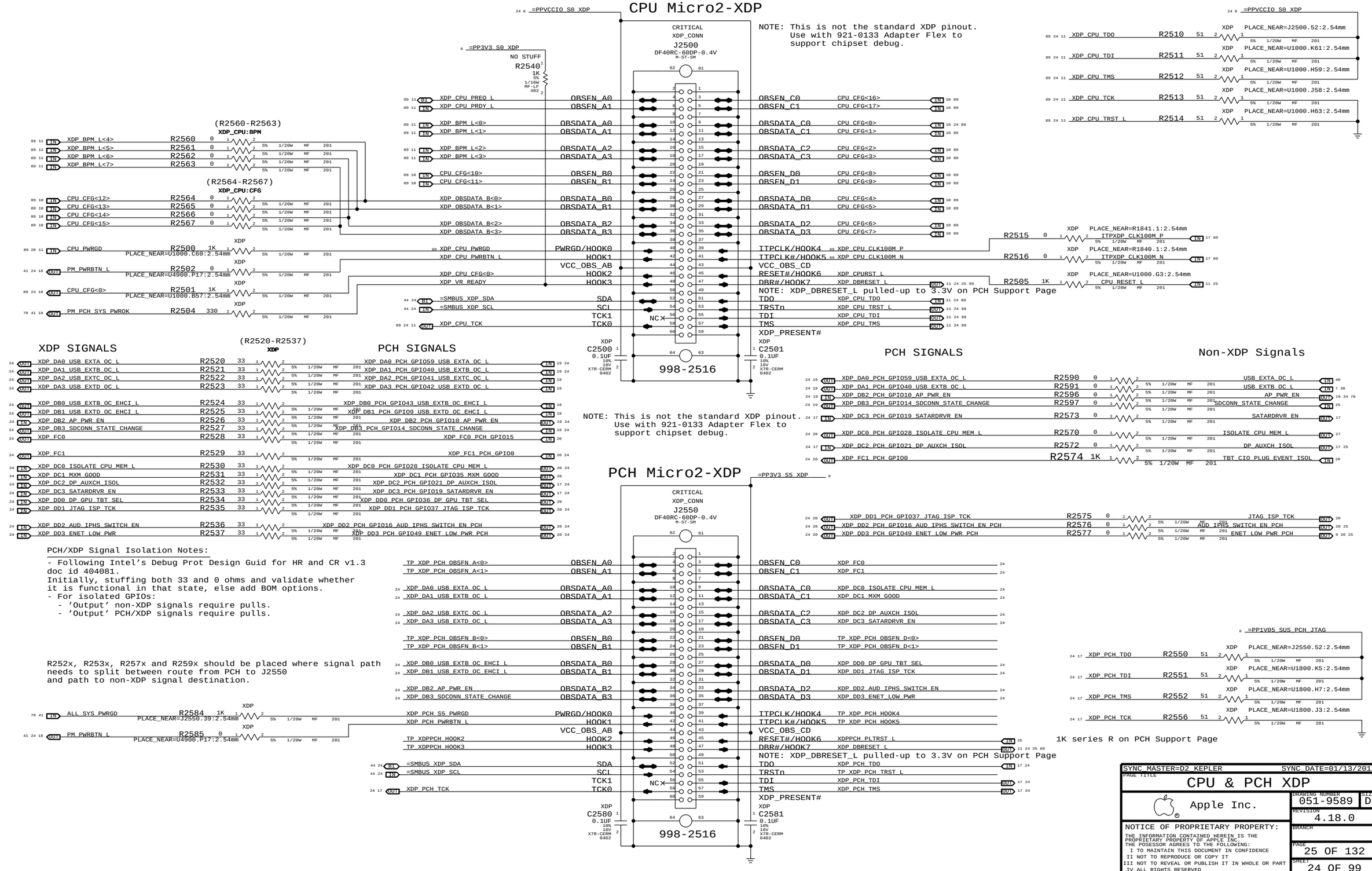
CPU Micro2-XDP



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

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

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

(R2560-R2563) XDP_CPU:BPM

XDP_BPM_L<4>	R2560	0	5% 1/20W MF 201
XDP_BPM_L<5>	R2561	0	5% 1/20W MF 201
XDP_BPM_L<6>	R2562	0	5% 1/20W MF 201
XDP_BPM_L<7>	R2563	0	5% 1/20W MF 201

(R2564-R2567) XDP_CPU:CFG

CPU_CFG<12>	R2564	0	5% 1/20W MF 201
CPU_CFG<13>	R2565	0	5% 1/20W MF 201
CPU_CFG<14>	R2566	0	5% 1/20W MF 201
CPU_CFG<15>	R2567	0	5% 1/20W MF 201

CPU_PWRGD	R2500	1K	XDP PLACE_NEAR=U1000.C60:2.54mm 5% 1/20W MF 201
PM_PWRBTN_L	R2502	0	XDP PLACE_NEAR=U4900.P17:2.54mm 5% 1/20W MF 201
CPU_CFG<0>	R2501	1K	XDP PLACE_NEAR=U1000.B57:2.54mm 5% 1/20W MF 201
PM_PCH_SYS_PWROK	R2504	330	XDP 5% 1/20W MF 201

XDP_CPU_TDO	R2510	51	XDP PLACE_NEAR=J2500.52:2.54mm 5% 1/20W MF 201
XDP_CPU_TDI	R2511	51	XDP PLACE_NEAR=U1000.K61:2.54mm 5% 1/20W MF 201
XDP_CPU_TMS	R2512	51	XDP PLACE_NEAR=U1000.H59:2.54mm 5% 1/20W MF 201
XDP_CPU_TCK	R2513	51	XDP PLACE_NEAR=U1000.J58:2.54mm 5% 1/20W MF 201
XDP_CPU_TRST_L	R2514	51	XDP PLACE_NEAR=U1000.H63:2.54mm 5% 1/20W MF 201

R2515	0	XDP PLACE_NEAR=R1841.1:2.54mm	ITPXDP_CLK100M_P
R2516	0	XDP PLACE_NEAR=R1840.1:2.54mm	ITPXDP_CLK100M_N
R2505	1K	XDP PLACE_NEAR=U1000.G3:2.54mm	CPU_RESET_L

XDP SIGNALS

(R2520-R2537) XDP

XDP_DA0_USB_EXTA_OC_L	R2520	33	XDP_DA0_PCH_GPIO59_USB_EXTA_OC_L
XDP_DA1_USB_EXTB_OC_L	R2521	33	XDP_DA1_PCH_GPIO40_USB_EXTB_OC_L
XDP_DA2_USB_EXTC_OC_L	R2522	33	XDP_DA2_PCH_GPIO41_USB_EXTC_OC_L
XDP_DA3_USB_EXTD_OC_L	R2523	33	XDP_DA3_PCH_GPIO42_USB_EXTD_OC_L
XDP_DB0_USB_EXTB_OC_EHCI_L	R2524	33	XDP_DB0_PCH_GPIO43_USB_EXTB_OC_EHCI_L
XDP_DB1_USB_EXTD_OC_EHCI_L	R2525	33	XDP_DB1_PCH_GPIO9_USB_EXTD_OC_EHCI_L
XDP_DB2_AP_PWR_EN	R2526	33	XDP_DB2_PCH_GPIO10_AP_PWR_EN
XDP_DB3_SDCONN_STATE_CHANGE	R2527	33	XDP_DB3_PCH_GPIO14_SDCONN_STATE_CHANGE
XDP_FC0	R2528	33	XDP_FC0_PCH_GPIO15
XDP_FC1	R2529	33	XDP_FC1_PCH_GPIO0
XDP_DC0_ISOLATE_CPU_MEM_L	R2530	33	XDP_DC0_PCH_GPIO28_ISOLATE_CPU_MEM_L
XDP_DC1_MXM_GOOD	R2531	33	XDP_DC1_PCH_GPIO35_MXM_GOOD
XDP_DC2_DP_AUXCH_ISOL	R2532	33	XDP_DC2_PCH_GPIO21_DP_AUXCH_ISOL
XDP_DC3_SATARDRVR_EN	R2533	33	XDP_DC3_PCH_GPIO19_SATARDRVR_EN
XDP_DD0_DP_GPU_TBT_SEL	R2534	33	XDP_DD0_PCH_GPIO36_DP_GPU_TBT_SEL
XDP_DD1_JTAG_ISP_TCK	R2535	33	XDP_DD1_PCH_GPIO37_JTAG_ISP_TCK
XDP_DD2_AUD_IPHS_SWITCH_EN	R2536	33	XDP_DD2_PCH_GPIO16_AUD_IPHS_SWITCH_EN_PCH
XDP_DD3_ENET_LOW_PWR	R2537	33	XDP_DD3_PCH_GPIO49_ENET_LOW_PWR_PCH

PCH SIGNALS

XDP_DA0_PCH_GPIO59_USB_EXTA_OC_L	R2590	0	USB_EXTA_OC_L
XDP_DA1_PCH_GPIO40_USB_EXTB_OC_L	R2591	0	USB_EXTB_OC_L
XDP_DB2_PCH_GPIO10_AP_PWR_EN	R2596	0	AP_PWR_EN
XDP_DB3_PCH_GPIO14_SDCONN_STATE_CHANGE	R2597	0	SDCONN_STATE_CHANGE
XDP_DC3_PCH_GPIO19_SATARDRVR_EN	R2573	0	SATARDRVR_EN
XDP_DC0_PCH_GPIO28_ISOLATE_CPU_MEM_L	R2570	0	ISOLATE_CPU_MEM_L
XDP_DC2_PCH_GPIO21_DP_AUXCH_ISOL	R2572	0	DP_AUXCH_ISOL
XDP_FC1_PCH_GPIO0	R2574	1K	TBT_CIO_PLUG_EVENT_ISOL
XDP_DD1_PCH_GPIO37_JTAG_ISP_TCK	R2575	0	JTAG_ISP_TCK
XDP_DD2_PCH_GPIO16_AUD_IPHS_SWITCH_EN_PCH	R2576	0	AUD_IPHS_SWITCH_EN_PCH
XDP_DD3_PCH_GPIO49_ENET_LOW_PWR_PCH	R2577	0	ENET_LOW_PWR_PCH

Non-XDP Signals

PCH Micro2-XDP

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

1K series R on PCH Support Page

ALL_SYS_PWRGD	R2584	1K	XDP PLACE_NEAR=J2550.39:2.54mm 5% 1/20W MF 201
PM_PWRBTN_L	R2585	0	XDP PLACE_NEAR=U4900.P17:2.54mm 5% 1/20W MF 201

XDP_PCH_TDO	R2550	51	XDP PLACE_NEAR=J2550.52:2.54mm 5% 1/20W MF 201
XDP_PCH_TDI	R2551	51	XDP PLACE_NEAR=U1800.K5:2.54mm 5% 1/20W MF 201
XDP_PCH_TMS	R2552	51	XDP PLACE_NEAR=U1800.H7:2.54mm 5% 1/20W MF 201
XDP_PCH_TCK	R2556	51	XDP PLACE_NEAR=U1800.J3:2.54mm 5% 1/20W MF 201

PCH/XDP Signal Isolation Notes:

- Following Intel's Debug Prot Design Guid for HR and CR v1.3 doc id 404081.
Initially, stuffing both 33 and 0 ohms and validate whether it is functional in that state, else add BOM options.
- For isolated GPIOs:
  - 'Output' non-XDP signals require pulls.
  - 'Output' PCH/XDP signals require pulls.

R252x, R253x, R257x and R259x should be placed where signal path needs to split between route from PCH to J2550 and path to non-XDP signal destination.

SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
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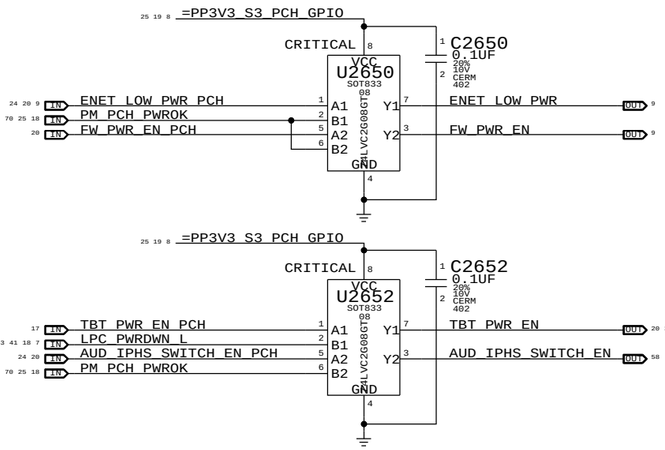
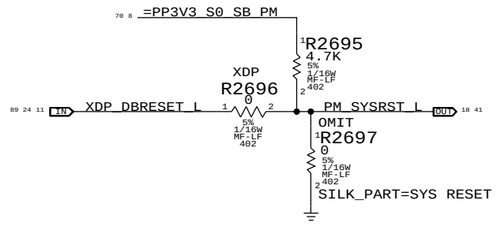
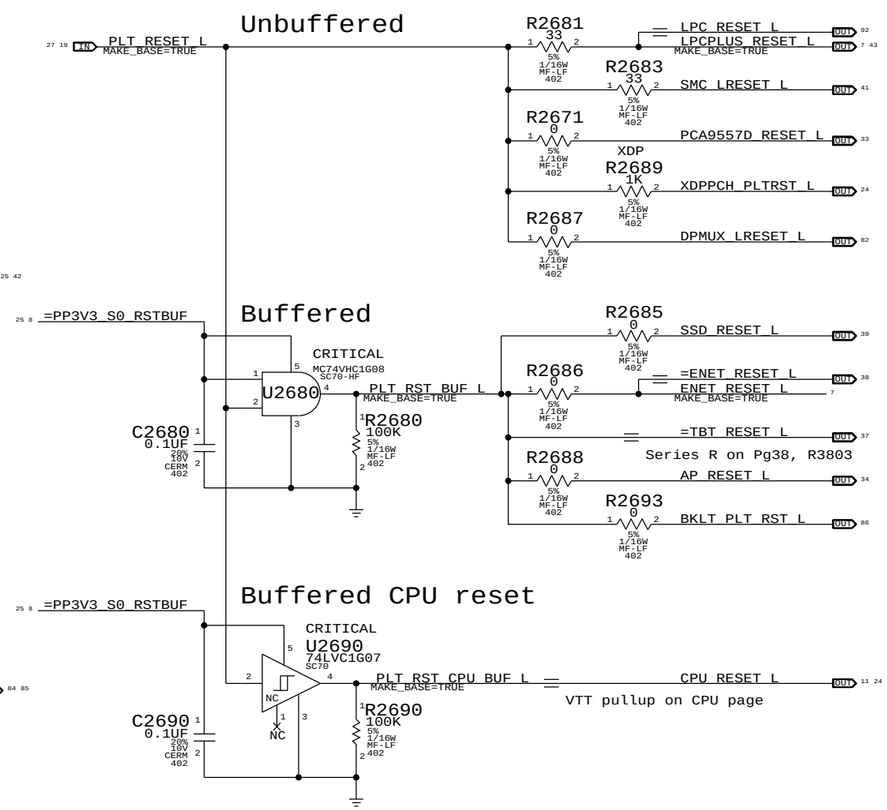
GPIO Glitch Prevention



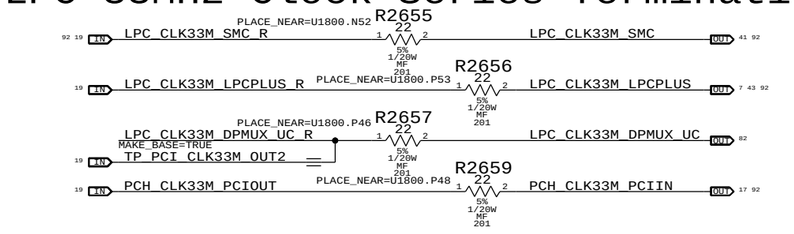
PCH Reset Button

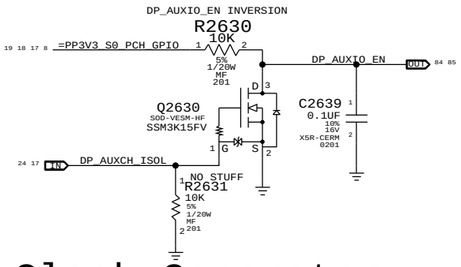


Platform Reset Connections

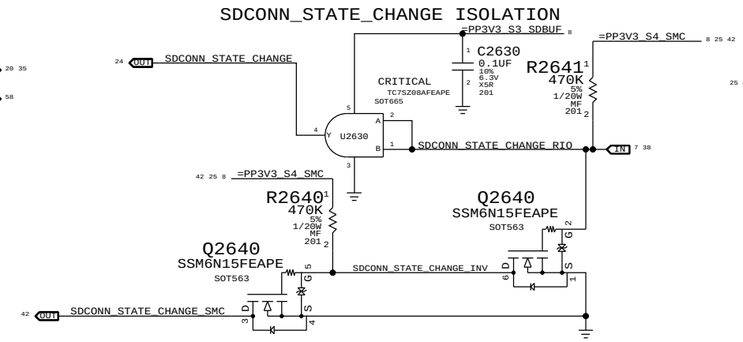


LPC 33MHz Clock Series Termination





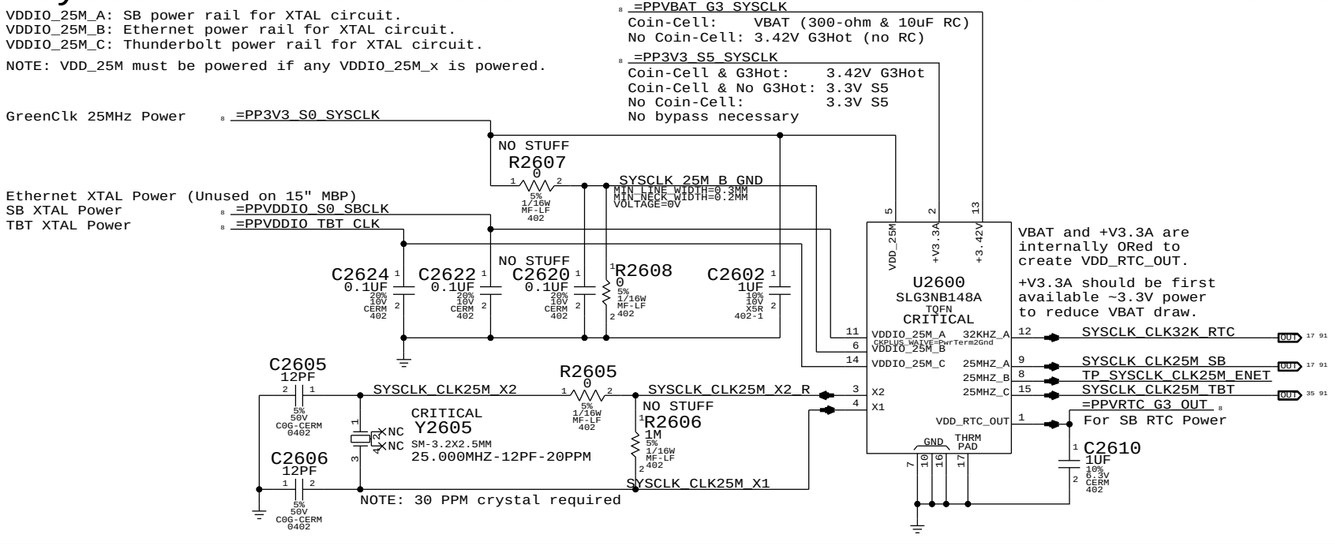
SDCONN_STATE_CHANGE ISOLATION



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

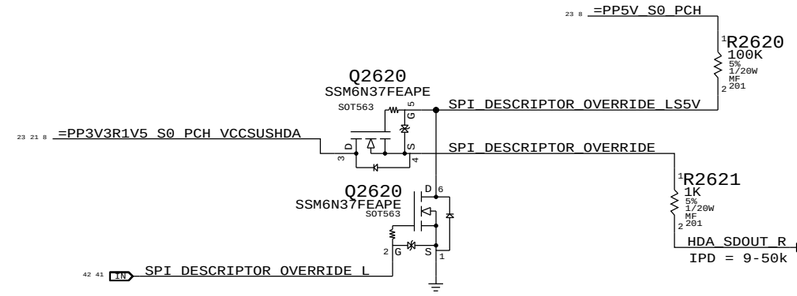
VDDIO_25M_A: SB power rail for XTAL circuit.
VDDIO_25M_B: Ethernet power rail for XTAL circuit.
VDDIO_25M_C: Thunderbolt power rail for XTAL circuit.

NOTE: VDD_25M must be powered if any VDDIO_25M_x is powered.



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.
Q2620 & 5V pull-up allows circuit to work regardless of HDA voltage.



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: Chipset Support

Apple Inc.

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BOM GROUP	BOM OPTIONS
HUB_ALLREM	HUB_NONREM1_0,HUB_NONREM0_0
HUB_1NONREM	HUB_NONREM1_0,HUB_NONREM0_1
HUB_2NONREM	HUB_NONREM1_1,HUB_NONREM0_0
HUB_3NONREM	HUB_NONREM1_1,HUB_NONREM0_1

USB MUX FOR LS/FS INTERNAL DEVICES

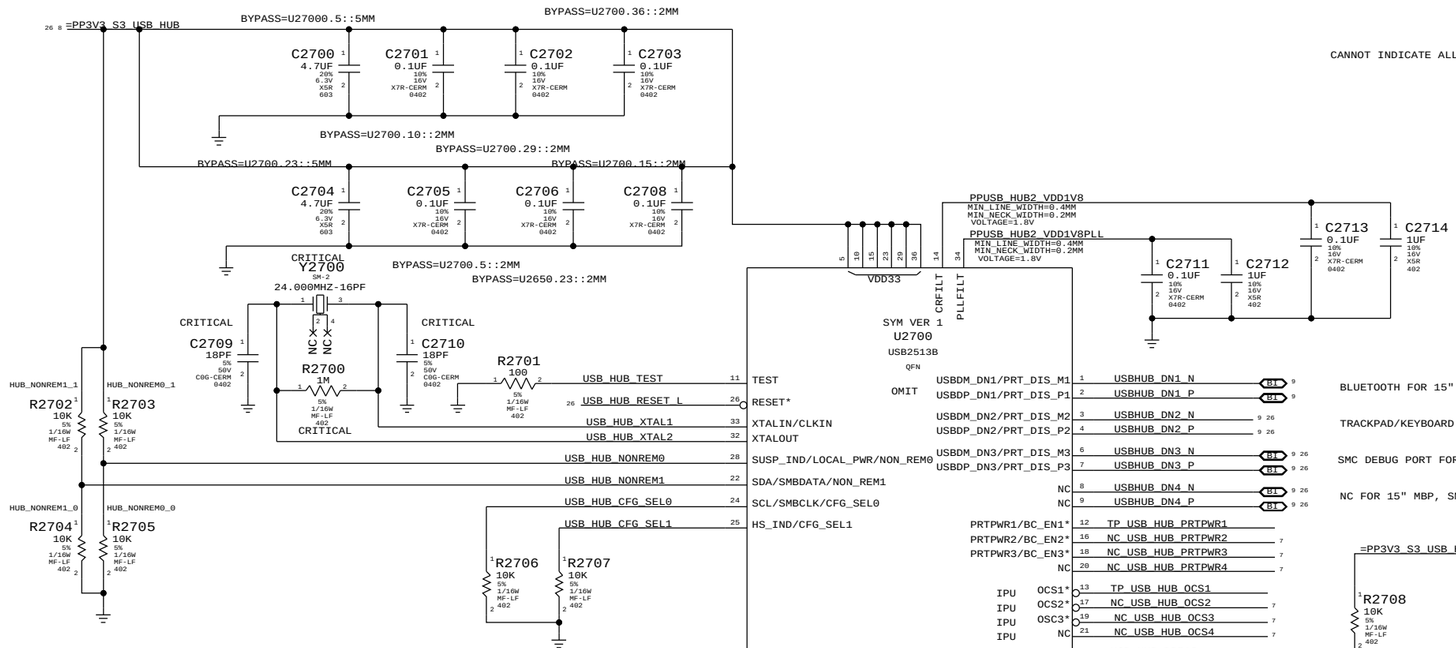
NON_REM 1	NON_REM 0	STRAP PIN CFG
0	0	ALL PORTS ARE REMOVABLE
0	1	PORT 1 IS NON REMOVABLE
1	0	PORT 1&2 ARE NON REMOVABLE
1	1	PORT 1&2&3 ARE NON REMOVABLE

CANNOT INDICATE ALL 4 PORTS ARE NON REMOVABLE ON USB2514B VIA STARPPING, PROGRAM NON_REMOVABLE DEVICE REGISTER 09H

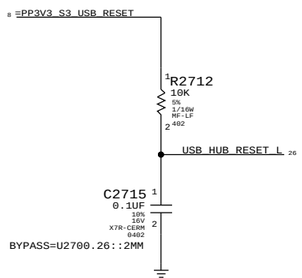
BOM TABLE

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
338S0824	1	USB HUB 2514B	U2700	CRITICAL	USBHUB2514B
338S0923	1	USB HUB 2513B	U2700	CRITICAL	USBHUB2513B
338S0983	1	USB HUB 2512B	U2700	CRITICAL	USBHUB2512B

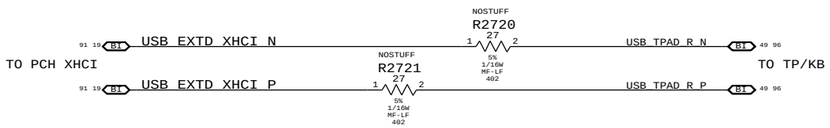
15" MBP ENGINEERING: USE USB2513B PRODUCTION: USE USB2512B
MBP OG ENGINEERING: USE USB2514B PRODUCTION: USE USB2513B



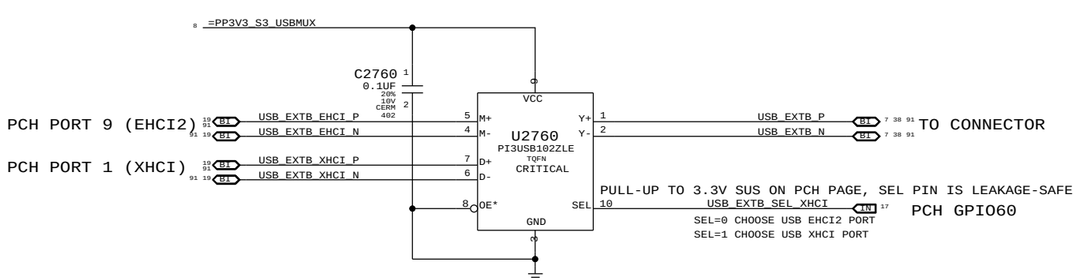
15" MBP USES 197S0181 FOR Y2700 DUE TO HEIGHT LIMITATION
MBP OG USES 197S0284 FOR Y2700 TO SAVE COST



TO CONNECT TP/KB TO PCH XHCI
NOSTUFF R5701 & R5702, STUFF R2720 & R2721



USB XHCI/EHCI2 PORT MUX FOR EXT B



SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
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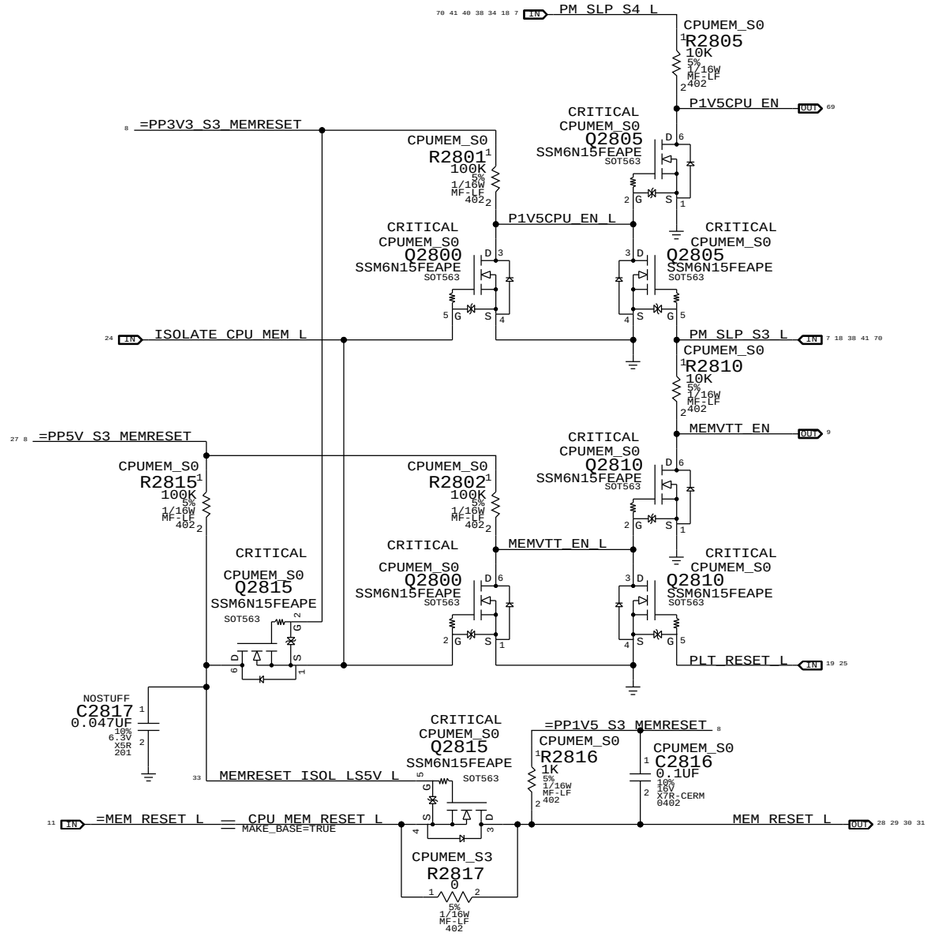
The circuit below handles CPU and VTT power during S0->S3->S0 transitions, as well as isolating the CPU's SM_DRAMRST# output from the SO-DIMMs when necessary.

ISOLATE_CPU_MEM_L GPIO state during S3<->S0 transitions determines behavior of signals.
WHEN HIGH: CPU 1.5V remains powered in S3, VTT follows S0 rails, MEM_RESET_L not isolated.
WHEN LOW: CPU 1.5V follows S0 rails, VTT ensures clean CKE transition, MEM_RESET_L isolated.

P1V5CPU_EN = (ISOLATE_CPU_MEM_L + PM_SLP_S3_L) * PM_SLP_S4_L
MEMVTT_EN = (ISOLATE_CPU_MEM_L + PLT_RST_L) * PM_SLP_S3_L
MEM_RESET_L = !ISOLATE_CPU_MEM_L + CPU_MEM_RESET_L



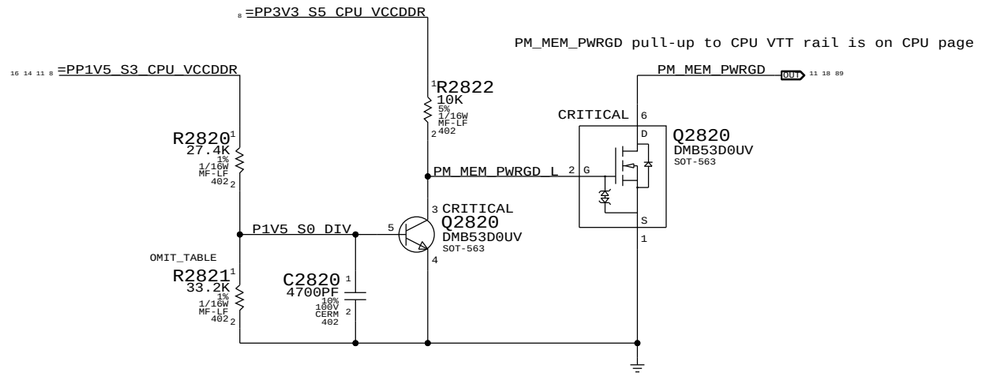
Step	ISOLATE_CPU_MEM_L	PLT_RESET_L	PM_SLP_S3_L	PM_SLP_S4_L	CPU_MEM_RESET_L	MEM_RESET_L	MEMVTT_EN	P1V5CPU_EN
S0 0	1	1	1	1	1	CPU_MEM_RESET_L	1	1
to 1	0	1	1	1	1	1	1	1
2	0	0	1	1	1	1	0	1
S3 3	0	0	0	1	X	1	0	0
4	0	0	1	1	X	1	0	1
to 5	0	1	1	1	0 (*)	1	1	1
6	0	1	1	1	1	1	1	1
S0 7	1	1	1	1	1	CPU_MEM_RESET_L	1	1

(*) CPU_MEM_RESET_L asserts due to loss of PM_MEM_PWRGD, must wait for software to clear before deasserting ISOLATE_CPU_MEM_L GPIO.

NOTE: In the event of a S3->S5 transition ISOLATE_CPU_MEM_L will still be asserted on next S5->S0 transition. Rails will power-up as if from S3, but MEM_RESET_L will not properly assert. Software must deassert ISOLATE_CPU_MEM_L and then generate a valid reset cycle on CPU_MEM_RESET_L.

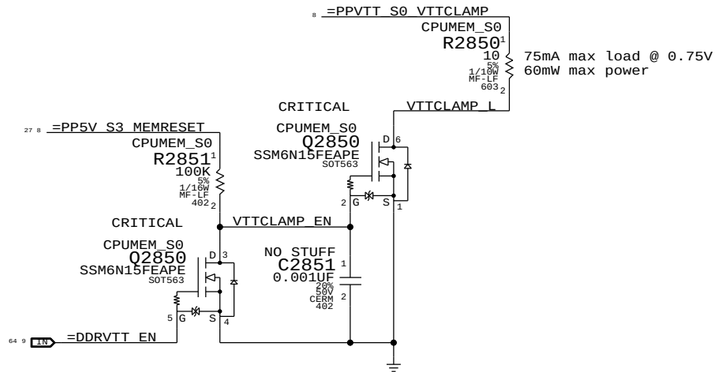
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0365	1	RES,MTL FILM,1/16W,33.2K,1,0402,SMD,LF	R2821		PPDDR:1V5
114S0376	1	RES,MTL FILM,1/16W,43.2K,1,0402,SMD,LF	R2821		PPDDR:1V35

1V5 S0 "PGOOD" for CPU



MEMVTT Clamp

Ensures CKE signals are held low in S3



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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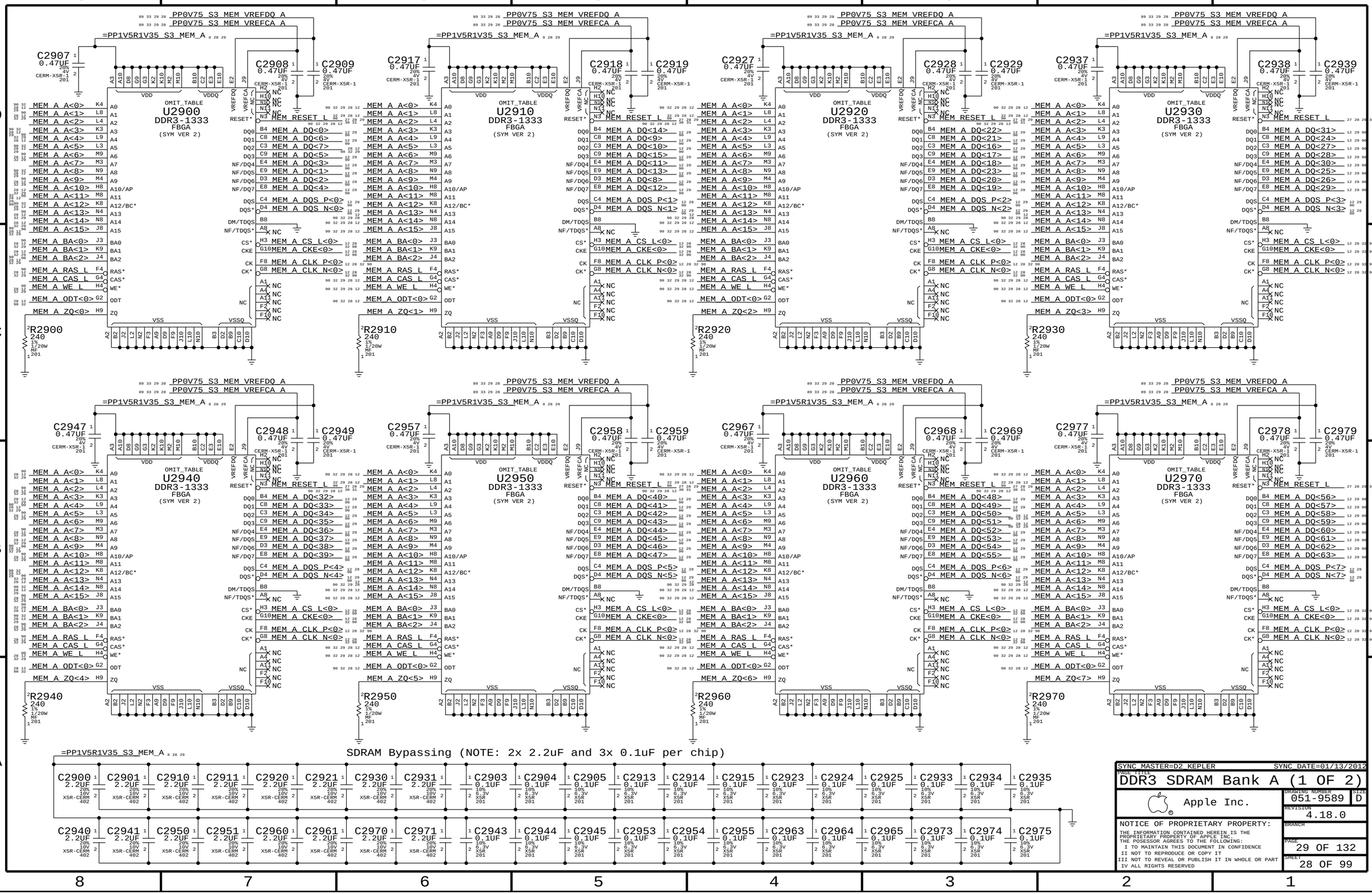

SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
PAGE TITLE	DDR3 SDRAM Bank A (1 OF 2)
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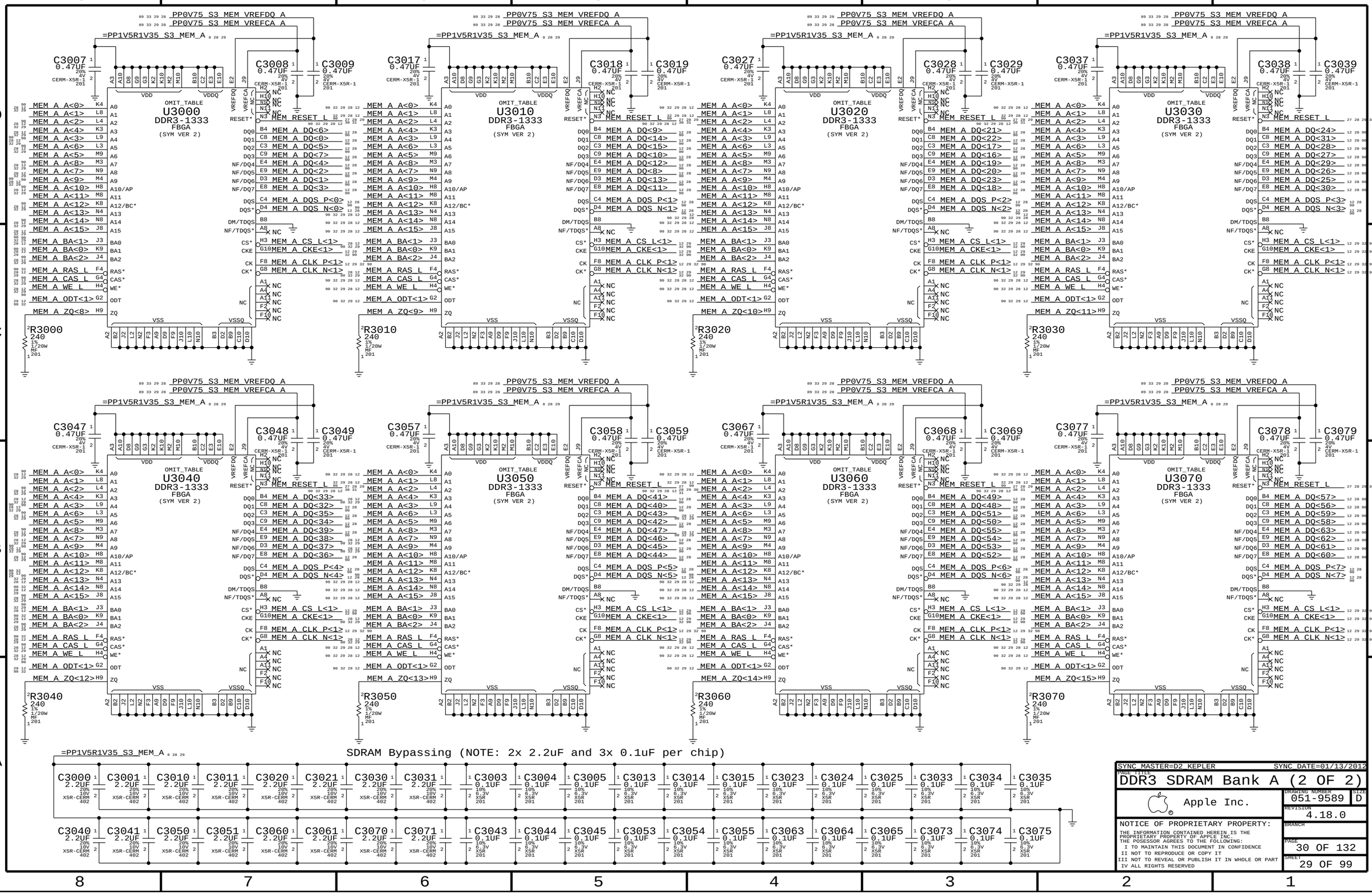
U3000 DDR3-1333 FBGA (SYM VER 2)
U3010 DDR3-1333 FBGA (SYM VER 2)
U3020 DDR3-1333 FBGA (SYM VER 2)
U3030 DDR3-1333 FBGA (SYM VER 2)
U3040 DDR3-1333 FBGA (SYM VER 2)
U3050 DDR3-1333 FBGA (SYM VER 2)
U3060 DDR3-1333 FBGA (SYM VER 2)
U3070 DDR3-1333 FBGA (SYM VER 2)
OMIT_TABLE
PP0V75_S3_MEM_VREFDQ_A
PP0V75_S3_MEM_VREFCA_A
=PP1V5R1V35_S3_MEM_A
MEM_A_RESET_L
MEM_A_ZQ
MEM_A_ODT
MEM_A_CS_L
MEM_A_CKE
MEM_A_CLK_P
MEM_A_CLK_N
MEM_A_RAS_L
MEM_A_CAS_L
MEM_A_WE_L
MEM_A_BA
MEM_A_DQS_P
MEM_A_DQS_N
MEM_A_DQ
SDRAM Bypassing (NOTE: 2x 2.2uF and 3x 0.1uF per chip)
SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
PAGE TITLE
DDR3 SDRAM Bank A (2 OF 2)
Apple Inc.
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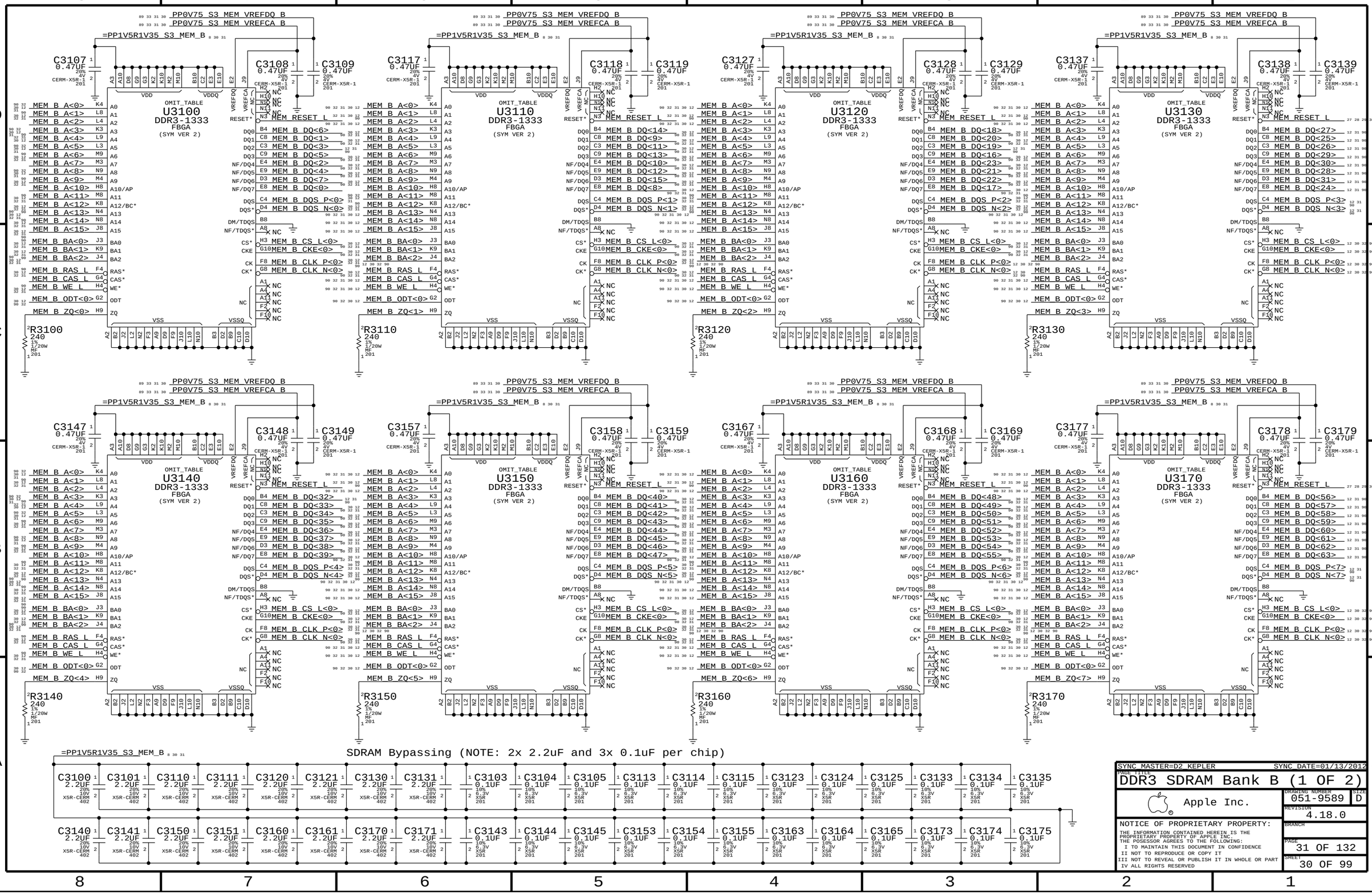
PP0V75_S3_MEM_VREFDQ_B
PP0V75_S3_MEM_VREFCA_B
=PP1V5R1V35_S3_MEM_B
C3107 0.47UF
C3108 0.47UF
C3109 0.47UF
U3100 DDR3-1333 FBGA (SYM VER 2)
OMIT_TABLE
MEM_RESET_L
MEM_B_DQ<6>
MEM_B_DQ<1>
MEM_B_DQ<3>
MEM_B_DQ<5>
MEM_B_DQ<2>
MEM_B_DQ<4>
MEM_B_DQ<7>
MEM_B_DQ<0>
MEM_B_DQS_P<0>
MEM_B_DQS_N<0>
MEM_B_CS_L<0>
MEM_B_CKE<0>
MEM_B_CLK_P<0>
MEM_B_CLK_N<0>
MEM_B_A<0>
MEM_B_A<1>
MEM_B_A<2>
MEM_B_A<3>
MEM_B_A<4>
MEM_B_A<5>
MEM_B_A<6>
MEM_B_A<7>
MEM_B_A<8>
MEM_B_A<9>
MEM_B_A<10>
MEM_B_A<11>
MEM_B_A<12>
MEM_B_A<13>
MEM_B_A<14>
MEM_B_A<15>
MEM_B_BA<0>
MEM_B_BA<1>
MEM_B_BA<2>
MEM_B_RAS_L
MEM_B_CAS_L
MEM_B_WE_L
MEM_B_ODT<0>
MEM_B_ZQ<0>
R3100 240 1% 1/20W MF 201
C3147 0.47UF
C3148 0.47UF
C3149 0.47UF
U3140 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<4>
R3140 240 1% 1/20W MF 201
C3117 0.47UF
C3118 0.47UF
C3119 0.47UF
U3110 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<1>
R3110 240 1% 1/20W MF 201
C3157 0.47UF
C3158 0.47UF
C3159 0.47UF
U3150 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<5>
R3150 240 1% 1/20W MF 201
C3127 0.47UF
C3128 0.47UF
C3129 0.47UF
U3120 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<2>
R3120 240 1% 1/20W MF 201
C3167 0.47UF
C3168 0.47UF
C3169 0.47UF
U3160 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<6>
R3160 240 1% 1/20W MF 201
C3137 0.47UF
C3138 0.47UF
C3139 0.47UF
U3130 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<3>
R3130 240 1% 1/20W MF 201
C3177 0.47UF
C3178 0.47UF
C3179 0.47UF
U3170 DDR3-1333 FBGA (SYM VER 2)
MEM_B_ZQ<7>
R3170 240 1% 1/20W MF 201
SDRAM Bypassing (NOTE: 2x 2.2uF and 3x 0.1uF per chip)
C3100 2.2UF
C3101 2.2UF
C3110 2.2UF
C3111 2.2UF
C3120 2.2UF
C3121 2.2UF
C3130 2.2UF
C3131 2.2UF
C3140 2.2UF
C3141 2.2UF
C3150 2.2UF
C3151 2.2UF
C3160 2.2UF
C3161 2.2UF
C3170 2.2UF
C3171 2.2UF
C3103 0.1UF
C3104 0.1UF
C3105 0.1UF
C3113 0.1UF
C3114 0.1UF
C3115 0.1UF
C3123 0.1UF
C3124 0.1UF
C3125 0.1UF
C3133 0.1UF
C3134 0.1UF
C3135 0.1UF
C3143 0.1UF
C3144 0.1UF
C3145 0.1UF
C3153 0.1UF
C3154 0.1UF
C3155 0.1UF
C3163 0.1UF
C3164 0.1UF
C3165 0.1UF
C3173 0.1UF
C3174 0.1UF
C3175 0.1UF
SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
PAGE TITLE
DDR3 SDRAM Bank B (1 OF 2)
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
BRANCH
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SHEET 30 OF 99
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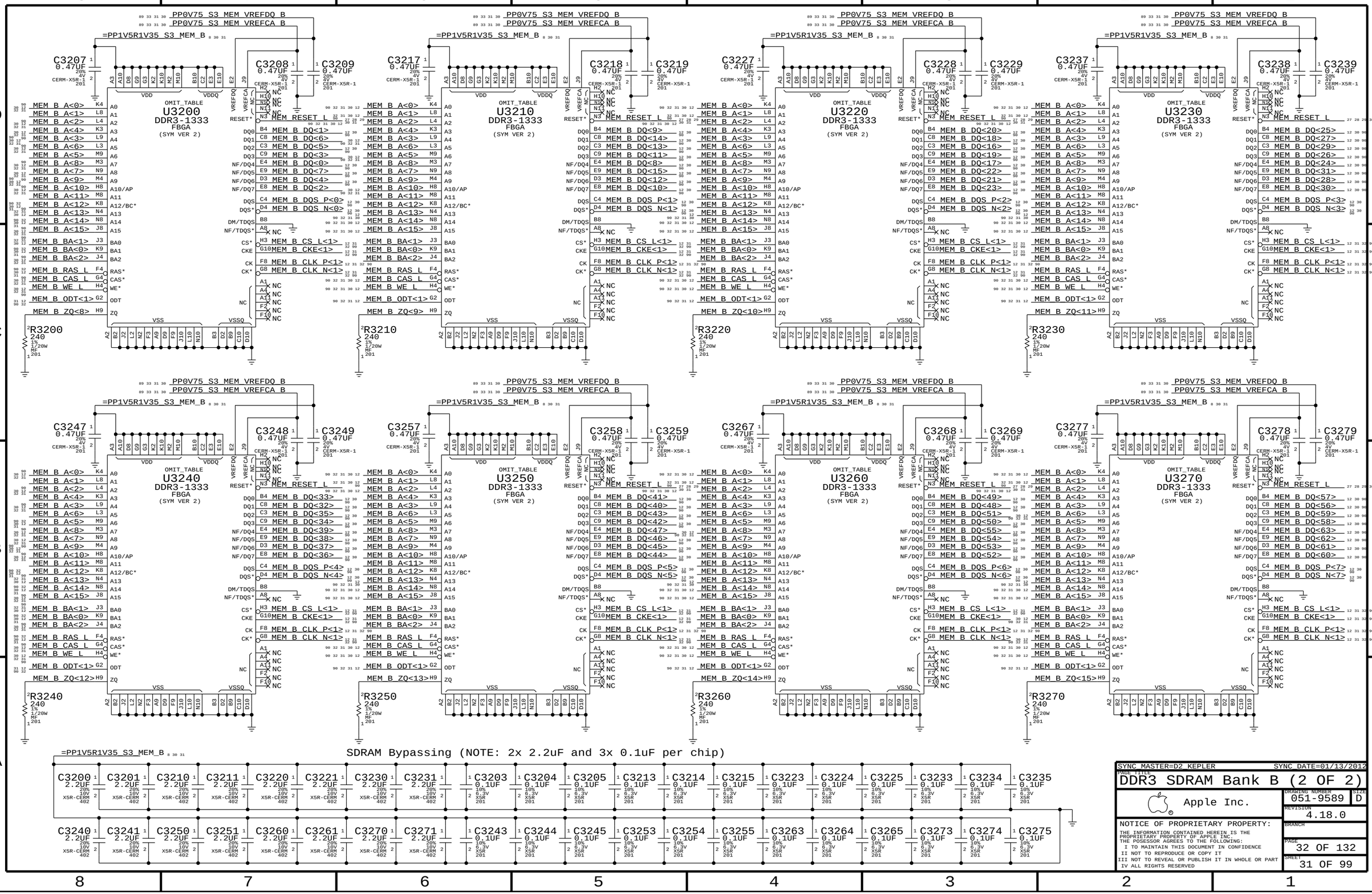
PP0V75_S3_MEM_VREFDQ_B
PP0V75_S3_MEM_VREFCA_B
=PP1V5R1V35_S3_MEM_B
C3207 0.47UF
C3208 0.47UF
C3209 0.47UF
U3200 DDR3-1333 FBGA (SYM VER 2)
OMIT_TABLE
MEM_B_A<0>
MEM_B_A<1>
MEM_B_A<2>
MEM_B_A<3>
MEM_B_A<4>
MEM_B_A<5>
MEM_B_A<6>
MEM_B_A<7>
MEM_B_A<8>
MEM_B_A<9>
MEM_B_A<10>
MEM_B_A<11>
MEM_B_A<12>
MEM_B_A<13>
MEM_B_A<14>
MEM_B_A<15>
MEM_B_BA<1>
MEM_B_BA<0>
MEM_B_BA<2>
MEM_B_RAS_L
MEM_B_CAS_L
MEM_B_WE_L
MEM_B_ODT<1>
MEM_B_ZQ<8>
MEM_RESET_L
MEM_B_DQ<1>
MEM_B_DQ<6>
MEM_B_DQ<5>
MEM_B_DQ<3>
MEM_B_DQ<0>
MEM_B_DQ<7>
MEM_B_DQ<4>
MEM_B_DQ<2>
MEM_B_DQS_P<0>
MEM_B_DQS_N<0>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
R3200 240 1% 1/20W MF 201
C3217 0.47UF
C3218 0.47UF
C3219 0.47UF
U3210 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<9>
MEM_B_DQ<14>
MEM_B_DQ<13>
MEM_B_DQ<11>
MEM_B_DQ<8>
MEM_B_DQ<15>
MEM_B_DQ<12>
MEM_B_DQ<10>
MEM_B_DQS_P<1>
MEM_B_DQS_N<1>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<9>
R3210 240 1% 1/20W MF 201
C3227 0.47UF
C3228 0.47UF
C3229 0.47UF
U3220 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<20>
MEM_B_DQ<18>
MEM_B_DQ<16>
MEM_B_DQ<19>
MEM_B_DQ<17>
MEM_B_DQ<22>
MEM_B_DQ<21>
MEM_B_DQ<23>
MEM_B_DQS_P<2>
MEM_B_DQS_N<2>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<10>
R3220 240 1% 1/20W MF 201
C3237 0.47UF
C3238 0.47UF
C3239 0.47UF
U3230 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<25>
MEM_B_DQ<27>
MEM_B_DQ<29>
MEM_B_DQ<26>
MEM_B_DQ<24>
MEM_B_DQ<31>
MEM_B_DQ<28>
MEM_B_DQ<30>
MEM_B_DQS_P<3>
MEM_B_DQS_N<3>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<11>
R3230 240 1% 1/20W MF 201
C3247 0.47UF
C3248 0.47UF
C3249 0.47UF
U3240 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<33>
MEM_B_DQ<32>
MEM_B_DQ<35>
MEM_B_DQ<34>
MEM_B_DQ<39>
MEM_B_DQ<38>
MEM_B_DQ<37>
MEM_B_DQ<36>
MEM_B_DQS_P<4>
MEM_B_DQS_N<4>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<12>
R3240 240 1% 1/20W MF 201
C3257 0.47UF
C3258 0.47UF
C3259 0.47UF
U3250 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<41>
MEM_B_DQ<40>
MEM_B_DQ<43>
MEM_B_DQ<42>
MEM_B_DQ<47>
MEM_B_DQ<46>
MEM_B_DQ<45>
MEM_B_DQ<44>
MEM_B_DQS_P<5>
MEM_B_DQS_N<5>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<13>
R3250 240 1% 1/20W MF 201
C3267 0.47UF
C3268 0.47UF
C3269 0.47UF
U3260 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<49>
MEM_B_DQ<48>
MEM_B_DQ<51>
MEM_B_DQ<50>
MEM_B_DQ<55>
MEM_B_DQ<54>
MEM_B_DQ<53>
MEM_B_DQ<52>
MEM_B_DQS_P<6>
MEM_B_DQS_N<6>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<14>
R3260 240 1% 1/20W MF 201
C3277 0.47UF
C3278 0.47UF
C3279 0.47UF
U3270 DDR3-1333 FBGA (SYM VER 2)
MEM_B_DQ<57>
MEM_B_DQ<56>
MEM_B_DQ<59>
MEM_B_DQ<58>
MEM_B_DQ<63>
MEM_B_DQ<62>
MEM_B_DQ<61>
MEM_B_DQ<60>
MEM_B_DQS_P<7>
MEM_B_DQS_N<7>
MEM_B_CS_L<1>
MEM_B_CKE<1>
MEM_B_CLK_P<1>
MEM_B_CLK_N<1>
MEM_B_ODT<1>
MEM_B_ZQ<15>
R3270 240 1% 1/20W MF 201
SDRAM Bypassing (NOTE: 2x 2.2uF and 3x 0.1uF per chip)
C3200 2.2UF
C3201 2.2UF
C3210 2.2UF
C3211 2.2UF
C3220 2.2UF
C3221 2.2UF
C3230 2.2UF
C3231 2.2UF
C3203 0.1UF
C3204 0.1UF
C3205 0.1UF
C3213 0.1UF
C3214 0.1UF
C3215 0.1UF
C3223 0.1UF
C3224 0.1UF
C3225 0.1UF
C3233 0.1UF
C3234 0.1UF
C3235 0.1UF
C3240 2.2UF
C3241 2.2UF
C3250 2.2UF
C3251 2.2UF
C3260 2.2UF
C3261 2.2UF
C3270 2.2UF
C3271 2.2UF
C3243 0.1UF
C3244 0.1UF
C3245 0.1UF
C3253 0.1UF
C3254 0.1UF
C3255 0.1UF
C3263 0.1UF
C3264 0.1UF
C3265 0.1UF
C3273 0.1UF
C3274 0.1UF
C3275 0.1UF
SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
PAGE TITLE
DDR3 SDRAM Bank B (2 OF 2)
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
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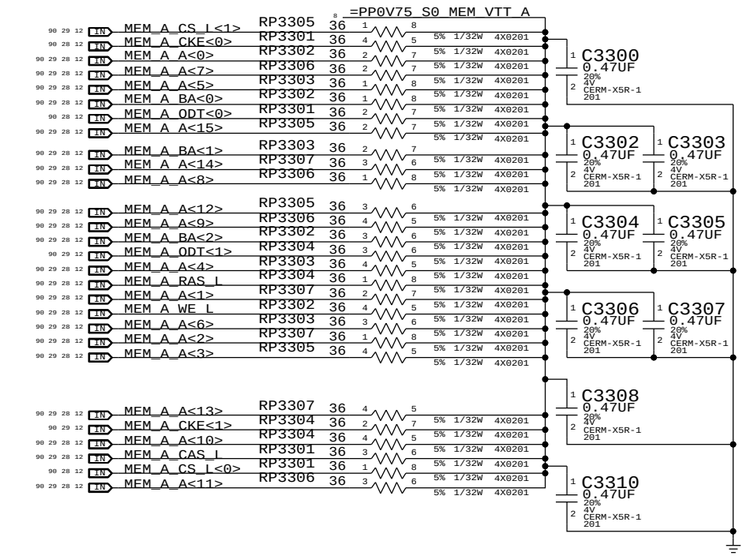
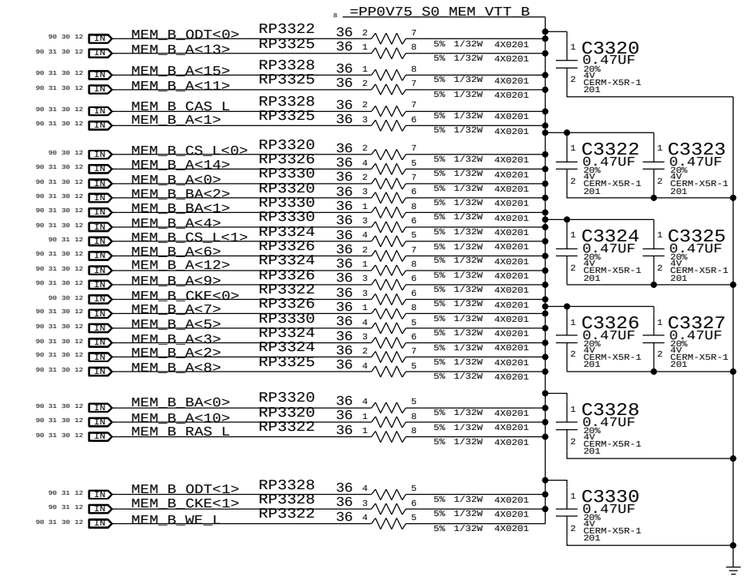
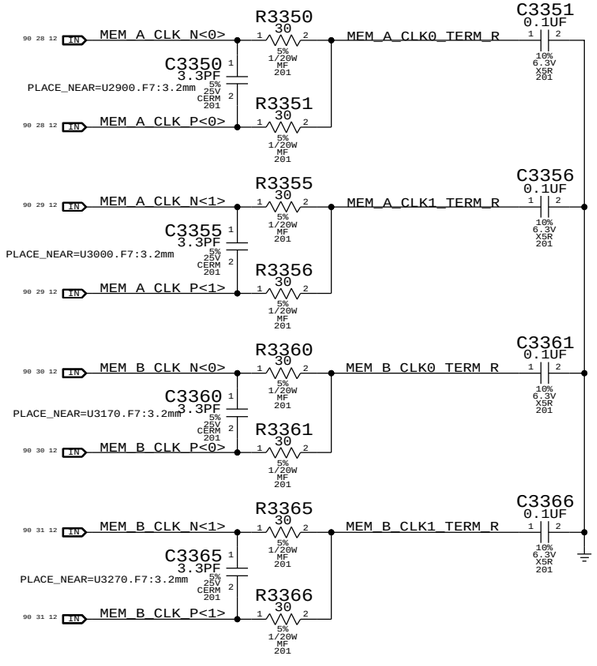
JEDEC 4.20.18 Unbuffered SODIMM Raw Card F spec recommends 36 Ohm term to VTT for CS,CKE,ODT and 36 Ohm for BA,A,RAS,CAS,WE





MEM Clock Termination

Place RC end termination after last DRAM
Place Source Cterm at neckdown at first DRAM



SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
PAGE TITLE: DDR3 Termination	
Apple Inc.	DRAWING NUMBER: 051-9589 SIZE: D
	REVISION: 4.18.0
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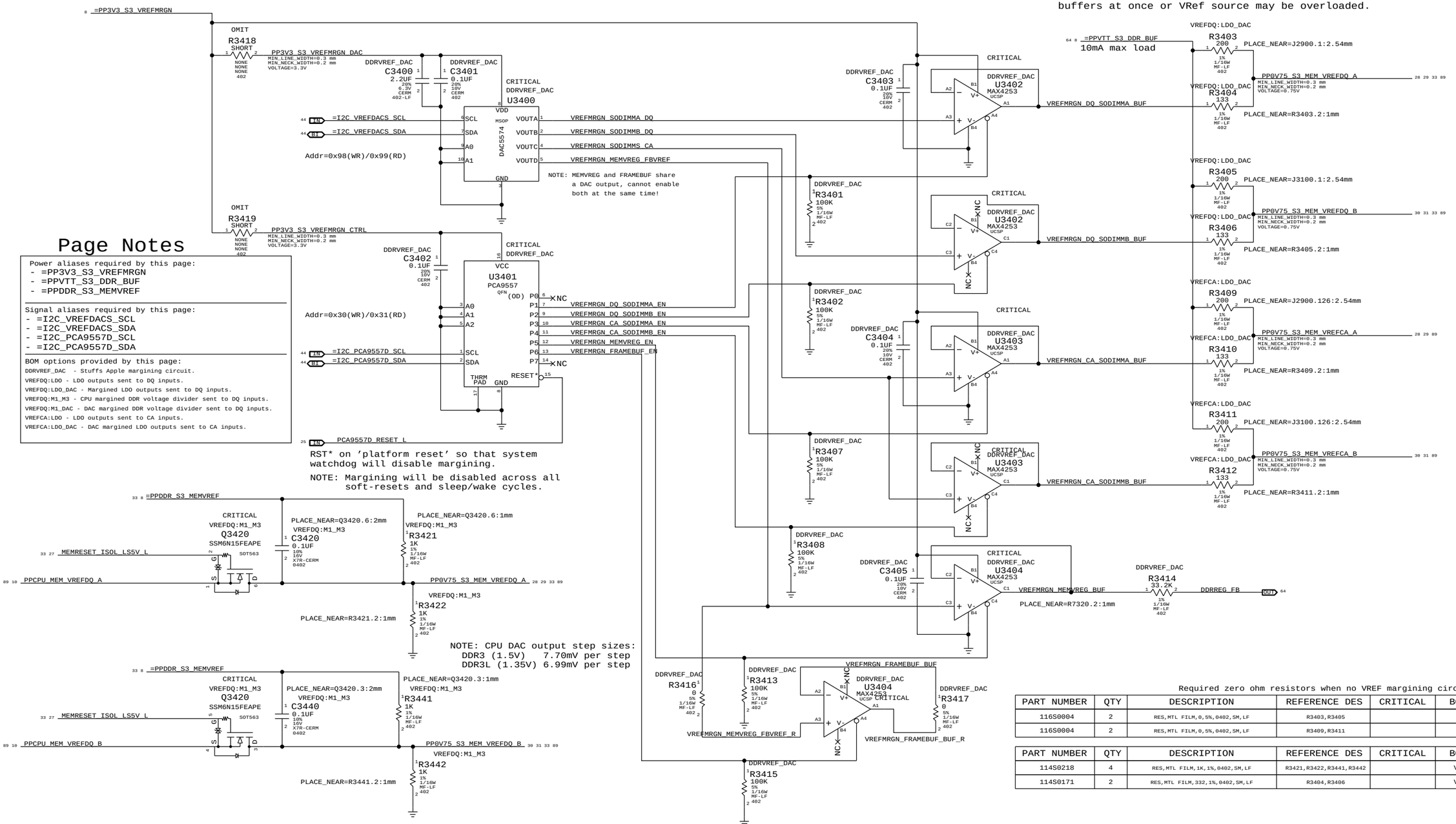
NOTE: Must not enable more than two SO-DIMM margining buffers at once or VRef source may be overloaded.



Page Notes

Power aliases required by this page:
- =PP3V3_S3_VREFMRGN
- =PPVTT_S3_DDR_BUF
- =PPDDR_S3_MEMVREF

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

BOM options provided by this page:

DDRVREF_DAC - Stuffs Apple margining circuit.
VREFDQ:LDO - LDO outputs sent to DQ inputs.
VREFDQ:LDO_DAC - Margined LDO outputs sent to DQ inputs.
VREFDQ:M1_M3 - CPU margined DDR voltage divider sent to DQ inputs.
VREFDQ:M1_DAC - DAC margined DDR voltage divider sent to DQ inputs.
VREFCA:LDO - LDO outputs sent to CA inputs.
VREFCA:LDO_DAC - DAC margined LDO outputs sent to CA inputs.

Required zero ohm resistors when no VREF margining circuit stuffed

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0004	2	RES,MTL FILM,0,5%,0402,SM,LF	R3403,R3405		VREFDQ:LDO
116S0004	2	RES,MTL FILM,0,5%,0402,SM,LF	R3409,R3411		VREFCA:LDO

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0218	4	RES,MTL FILM,1K,1%,0402,SM,LF	R3421,R3422,R3441,R3442		VREFDQ:M1_DAC
114S0171	2	RES,MTL FILM,332,1%,0402,SM,LF	R3404,R3406		VREFDQ:M1_DAC

	MEM A VREF DQ	MEM B VREF DQ	MEM A VREF CA	MEM B VREF CA	MEM VREG	GPU Frame Buffer (1.8V, 70% VRef)
DAC Channel:	A	B	C	C	D	D
PCA9557D Pin:	1	2	3	4	5	6
Nominal value	0.75V (DAC: 0x3A)				1.5V (DAC: 0x3A)	1.267V (DAC: 0x8B)
Margined target:	0.300V - 1.200V (+/- 450mV)				1.000V - 2.000V (+/- 500mV)	1.056V - 1.442V (+/- 180mV)
DAC range:	0.000V - 1.501V (0x00 - 0x74)				0.000V - 3.000V (0x00 - 0x74)	0.000V - 3.300V (0x00 - 0xFF)
VRef current:	+3.4mA - -3.4mA (- = sourced)				+61uA - -61uA (- = sourced)	+6.0mA - -5.0mA (- = sourced)
DAC step size:	7.69mV / step @ output				8.59mV / step @ output	1.51mV / step @ output

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: DDR3/FRAMEBUF VREF MARGINING

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D
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PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
117S0002	4	RES, 000HM, 0201	L3570,L3571,L3573,L3574		

AIRPORT

OMIT_TABLE
L3570
0.6NH+/-0.1NH-0.85A
0201
PLACE_NEAR=J3501.15:2.54MM
C3531 0.1UF 10% 16V X7R-CERM0402
92 PCIE_AP_R2D_PI_P
PCIE_AP_R2D_C_P IN 17 92
NOSTUFF C3570 0.1UF 10% 16V XSR-CERM 0201
NOSTUFF C3571 0.1UF 10% 16V XSR-CERM 0201
L3571
0.6NH+/-0.1NH-0.85A
0201
92 PCIE_AP_R2D_PI_N
PCIE_AP_R2D_C_N IN 17 92
C3530 0.1UF 10% 16V X7R-CERM0402
PLACE_NEAR=J3501.17:2.54MM
WIFI_EVENT_L IN 7 41 42
OMIT_TABLE
NOSTUFF C3572 0.1UF 10% 16V XSR-CERM 0201
NOSTUFF C3573 0.1UF 10% 16V XSR-CERM 0201
OMIT_TABLE
L3573
0.6NH+/-0.1NH-0.85A
0201
PCIE_AP_D2R_P OUT 17 92
92 7 PCIE_AP_R2D_P
92 7 PCIE_AP_R2D_N
NOSTUFF C3574 0.1UF 10% 16V XSR-CERM 0201
NOSTUFF C3575 0.1UF 10% 16V XSR-CERM 0201
L3574
0.6NH+/-0.1NH-0.85A
0201
PCIE_AP_D2R_N OUT 17 92
OMIT_TABLE
NOSTUFF C3576 0.1UF 10% 16V XSR-CERM 0201
NOSTUFF C3577 0.1UF 10% 16V XSR-CERM 0201
92 7 PCIE_AP_D2R_PI_P
92 7 PCIE_AP_D2R_PI_N

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

CRITICAL
L3501
90-OHM-100MA
DLP11S
SYM_VER-1
96 7 PCIE_CLK100M_AP_CONN_P
PCIE_CLK100M_AP_P IN 17 92
96 7 PCIE_CLK100M_AP_CONN_N
PCIE_CLK100M_AP_N IN 17 92
PLACE_NEAR=J3501.11:2.54MM

PCIE_WAKE_L OUT 7 18

BLUETOOTH

91 7 USB_BT_CONN_N
91 7 USB_BT_CONN_P
PP3V3_S3RS4_BT_F
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=3.3V
C3532 0.01UF 10% 16V X7R-CERM 0402
BTPWR:S4 L3505 =PP3V3_S4_BT 8
FERR-120-OHM-1.5A 0402-LF
PLACE_NEAR=J3501.27:2.54MM
BTPWR:S3 L3506 =PP3V3_S3_BT 8
FERR-120-OHM-1.5A 0402-LF
PLACE_NEAR=J3501.27:2.54MM

NOSTUFF R3517 15K 1% 1/20W MF 201
BTPWR:S3 R3518 0 5% 1/20W MF 201
PP3V3_S3RS4_BT_F 7 34
C3510 0.1UF 10% 6.3V X5R 201
NOSTUFF R3514 15K 1% 1/20W MF 201
SIGNAL_MODEL=EMPTY
BTPWR:S4 Q3510 SSM3K15FV SOD-VESM-HF
=BT_WAKE_L OUT 42
NOSTUFF R3515 15K 1% 1/20W MF 201
NOSTUFF R3516 15K 1% 1/20W MF 201
U3510 PI3USB102ZLE TQFN CRITICAL
USB_BT_WAKE_P
USB_BT_WAKE_N
USB_BT_P BI 9 91
USB_BT_N BI 9 91
BTPWR:S4 R3512 15K 1% 1/20W MF 201
NOSTUFF R3513 15K 1% 1/20W MF 201
BTPWR:S4 R3511 0 5% 1/20W MF 201
PM_SLP_S4_L IN
BTMUX_SEL
NOSTUFF C3511 0.01UF 10% 16V X7R-CERM 0402

SEL	OUTPUT
L	USB_BT_WAKE
H	USB_BT

7 AP_RESET_CONN_L
7 AP_CLKREQ_Q_L

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
518S0767	1	CONN,HDR,TWIN:AX,P=0.4MM,GP,HF	J3502	CRITICAL	

OMIT
CRITICAL
J3502
CCR20-6K710S
F-RT-SM
=I2C_ALS_SDA BI 44
=I2C_ALS_SCL IN 44
7 PP5V_S3_ALSCAMERA_F
91 7 USB_CAMERA_CONN_N
91 7 USB_CAMERA_CONN_P

ALS CAMERA

MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=5V
CRITICAL
L3507
90-OHM
DLP0NS
SYM_VER-1
USB_CAMERA_N BI 19 91
USB_CAMERA_P BI 19 91
PLACE_NEAR=J3502.3:2.54MM

275 mA peak
206 mA nominal max
PLACE_NEAR=J3502.6:2.54MM
L3508
FERR-120-OHM-1.5A
0402-LF
=PP5V_S3_ALSCAMERA 8
C3552 0.1uF 20% 10V CERM 402

3V S3 WLAN FET

MOSFET	DMP2018LFK
CHANNEL	P-TYPE
RDS(ON) @ 2.5V	14 mOhm Typ 20 mOhm Max
LOADING	1 A (EDP)

CRITICAL
Q3550
DMP2018LFK
DFN2563-6

155S0367
L3504
FERR-120-0HM-3A
1A PEAK
0603
42 7 PP3V3_WLAN
PP3V3_WLAN_F IN 34 99
MIN_LINE_WIDTH=1 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=3.3V
MIN_LINE_WIDTH=1 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=3.3V
C3522 0.1uF 20% 10V CERM 402
C3521 0.1uF 20% 10V CERM 402
PLACE_NEAR=J3501.29:2.54MM
PLACE_NEAR=J3501.29:2.54MM

CURRENT SENSE

PP3V3_WLAN_R OUT
MIN_LINE_WIDTH=1 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=3.3V
=PP3V3_S3_WLAN 8 34
C3551 0.033UF 10% 16V X5R 402
R3551 10K 5% 1/16W MF-LF 402
C3550 0.1UF 10% 16V X7R-CERM 0402
R3550 33K 5% 1/16W MF-LF 402
P3V3WLAN_SS
PM_WLAN_EN_L IN 70

SIGNAL_MODEL=EMPTY
BTPWR:S4
Q3510
SSM3K15FV
SOD-VESM-HF
=BT_WAKE_L OUT 42

Supervisor & CLKFREG # Isolation

Delay = 130 ms +/- 20%

PP3V3_WLAN_F 34 99
=PP3V3_S3_WLAN 8 34
R3553 100K 1% 1/16W MF-LF 402
R3554 232K 1% 1/16W MF-LF 402
P3V3WLAN_VMON
CRITICAL
U3540
SLG4AP041V
TDFN
VDD
SENSE
VREF
DLY
RESET* MR*
EN
OUT (OD)
IN
THRM PAD
GND
C3540 0.1uF 20% 10V CERM 402
AP_RESET_L IN 25
AP_PWR_EN IN 19 24 70
AP_CLKREQ_L OUT 17
R3555 100K 1% 1/16W MF-LF 402

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012
PAGE TITLE
X29/ALS/CAMERA CONNECTOR
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
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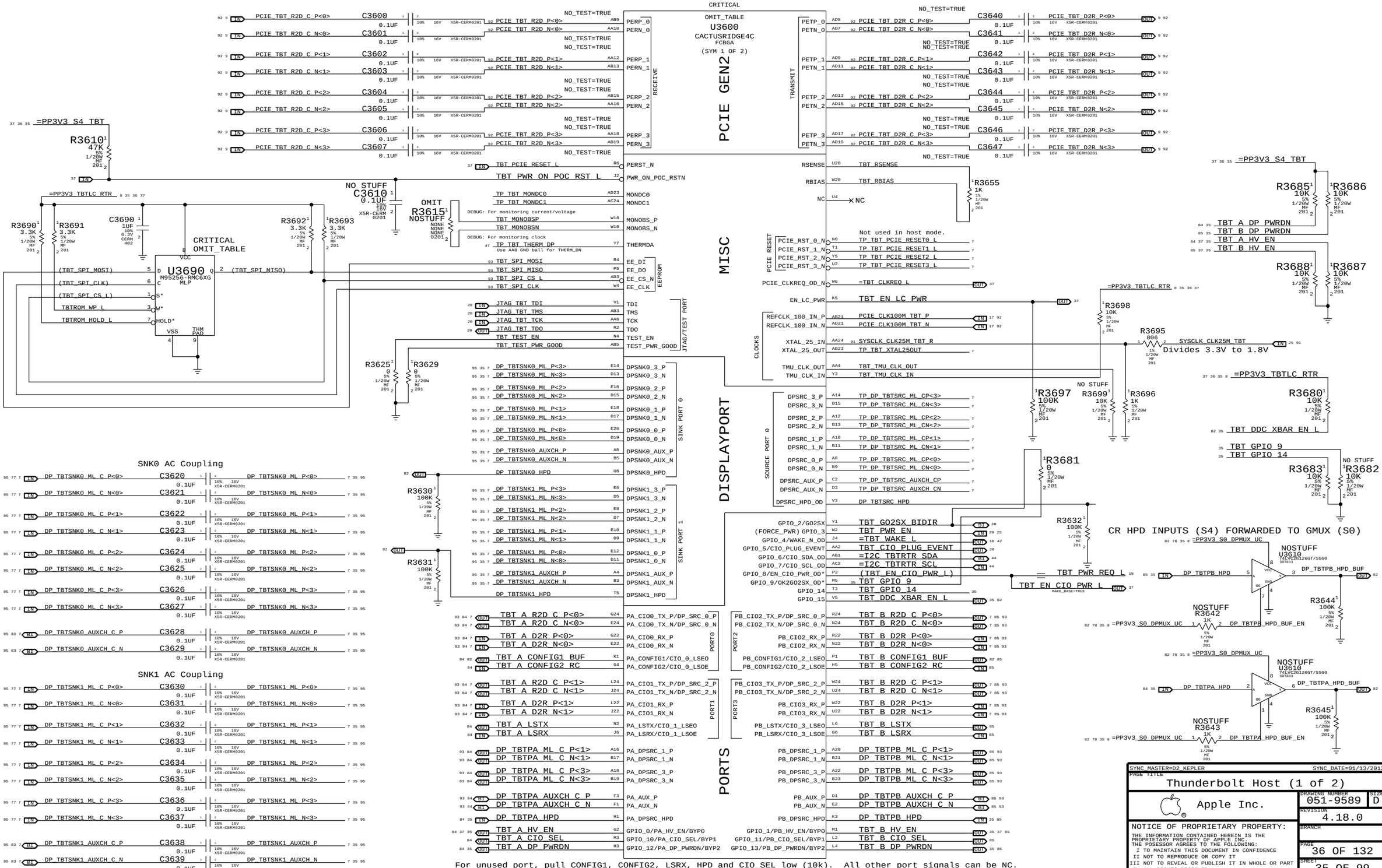
PAGE 35 OF 132
SHEET 34 OF 99



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: Thunderbolt Host (1 of 2)

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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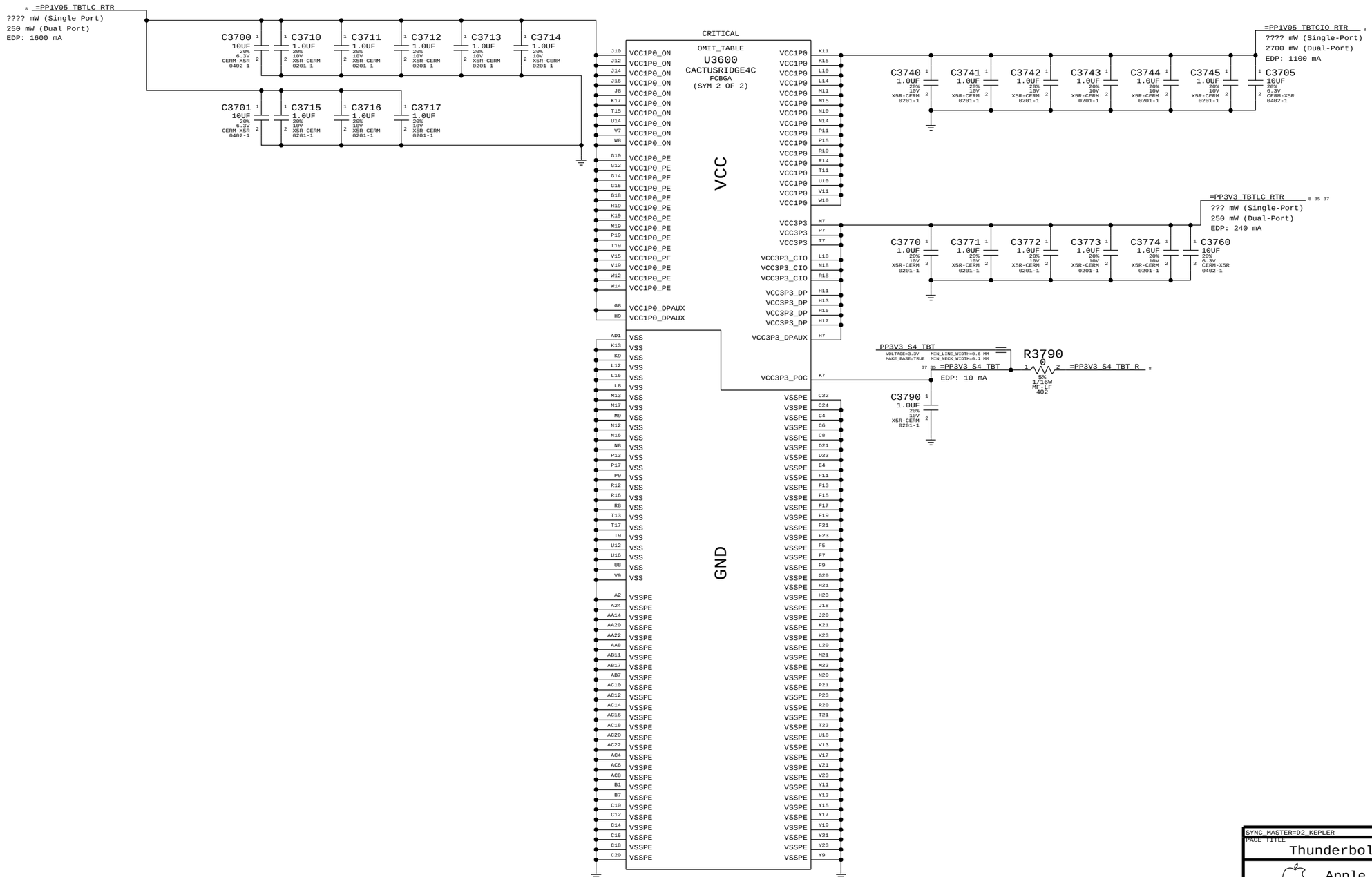

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

Thunderbolt Host (2 of 2)

Apple Inc.

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Thunderbolt 15V Boost Regulator

Page Notes

Power aliases required by this page:
- =PPVIN_SW_TBTBST (8-13V Boost Input)
- =PP15V_TBT_REG (15V Boost Output)
- =PP3V3_TBT_P3V3TBTFET (3.3V FET Input)
- =PP3V3_TBTLC_FET (3.3V FET Output)
- =PP3V3_S0_TBTPWRCTL
- =PP1V05_TBT_P1V05TBTFET (1.05V FET Input)
- =PP1V05_TBTLC_FET (1.05V FET Output)

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

BOM options provided by this page:
TBTBST:Y - Stuffs 15V boost circuitry.

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

CRITICAL TBTBST:Y Q3880 SI8409DB 8GA

=PPVIN_SW_TBTBST
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.

CRITICAL TBTBST:Y L3895 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

CRITICAL TBTBST:Y U3890 LT3957 QFN

TBTBST_EN_UVLO
TBTBST_INTVCC
TBTBST_VC
TBTBST_RT
TBTBST_SS
TBTBST_VC_RC
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)

TBTBST_SNS1
TBTBST_SNS2
TBTBST_VSNS
TBTBST_FBX
SGND
GND

SGND shorted to GND inside package, no XW necessary.

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

=PP15V_TBT_REG
Vout = 15.47V
Max Current = 2A?
Freq = 300KHz

33UF-0.060HM

TBT_A_HV_EN
TBT_B_HV_EN

Supervisor & CLKREQ# Isolation

=PP3V3_S0_TBTPWRCTL
TBT_EN_LC_PWR
Platform (PCIe) Reset
=TBT_RESET_L
TBT_CLKREQ_L
Pull-ups provided by SB page.

CRITICAL U3800 SLG4AP016V TDFN
VDD, SENSE 0.7V, DLY, RESET*, MR*, EN, OUT (OD), IN, GND, THRM PAD

=PP3V3_TBTLC_RTR
PP1V05_TBTLC
TBT_PCIE_RESET_L
DLY = 60 ms +/- 20%
=TBT_CLKREQ_L
TBT_CLKREQ_ISOL_L
MAKE_BASE=TRUE

TBT "POC" Power-up Reset

Intel investigating whether RC is sufficient.

=PP3V3_S4_TBT
CRITICAL U3830 TPS3808 QFN
VDD, SENSE, CT, RESET*, MR*, GND, THRM PAD
Pull-up: R3610
TBTPOCRST_CT
TBTPOCRST_MR_L
TBT_PWR_ON_POC_RST_L
TPS3808G25
Vt = 2.33V +/- 2%
Delay = 27.3ms

=PP3V3_S0_PCH_GPIO
TBT_SW_RESET_L

3.3V TBT "LC" Switch

=PP3V3_S0_P3V3TBTFET
TBT_EN_LC_3V3
TBT_EN_LC_ISOL
CRITICAL U3810 TPS22924 CSP
VIN, VOUT, ON, GND
=PP3V3_TBTLC_FET
Max Current = 2A (85C)

U3810	
Part	TPS22924C
Type	Load Switch
R(on) @ 2.5V	18.3 mOhm Typ 24 mOhm Max

1.05V TBT "LC" Switch

=PP1V05_S0_P1V05TBTFET
TBT_EN_LC_1V05
CRITICAL U3815 TPS22924 CSP
VIN, VOUT, ON, GND
=PP1V05_TBTLC_FET
Max Current = 2A (85C)

U3815	
Part	TPS22924C
Type	Load Switch
R(on) @ 1.0V	20.3 mOhm Typ 28.6 mOhm Max

C3816 must be 10%
RC guarantees minimum 5ms to reach 0.5V

1.05V TBT "CIO" Switch

=PP1V05_S0_P1V05TBTFET
=PP3V3_TBTLC_RTR
TBT_EN_CIO_PWR
TBT_EN_CIO_PWR_L
CRITICAL U3820 TPS22920 CSP
VIN, VOUT, ON, GND
=PP1V05_TBTCIO_FET
Max Current = 4A (85C)

U3820	
Part	TPS22920
Type	Load Switch
R(on) @ 1.05V	8 mOhm Typ 11.5 mOhm Max

TBTBST_SHDN_DIV
Max Vgs: 10V
SMC_DELAYED_PWRGD

SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
PAGE TITLE	Thunderbolt Power Support
	Apple Inc.
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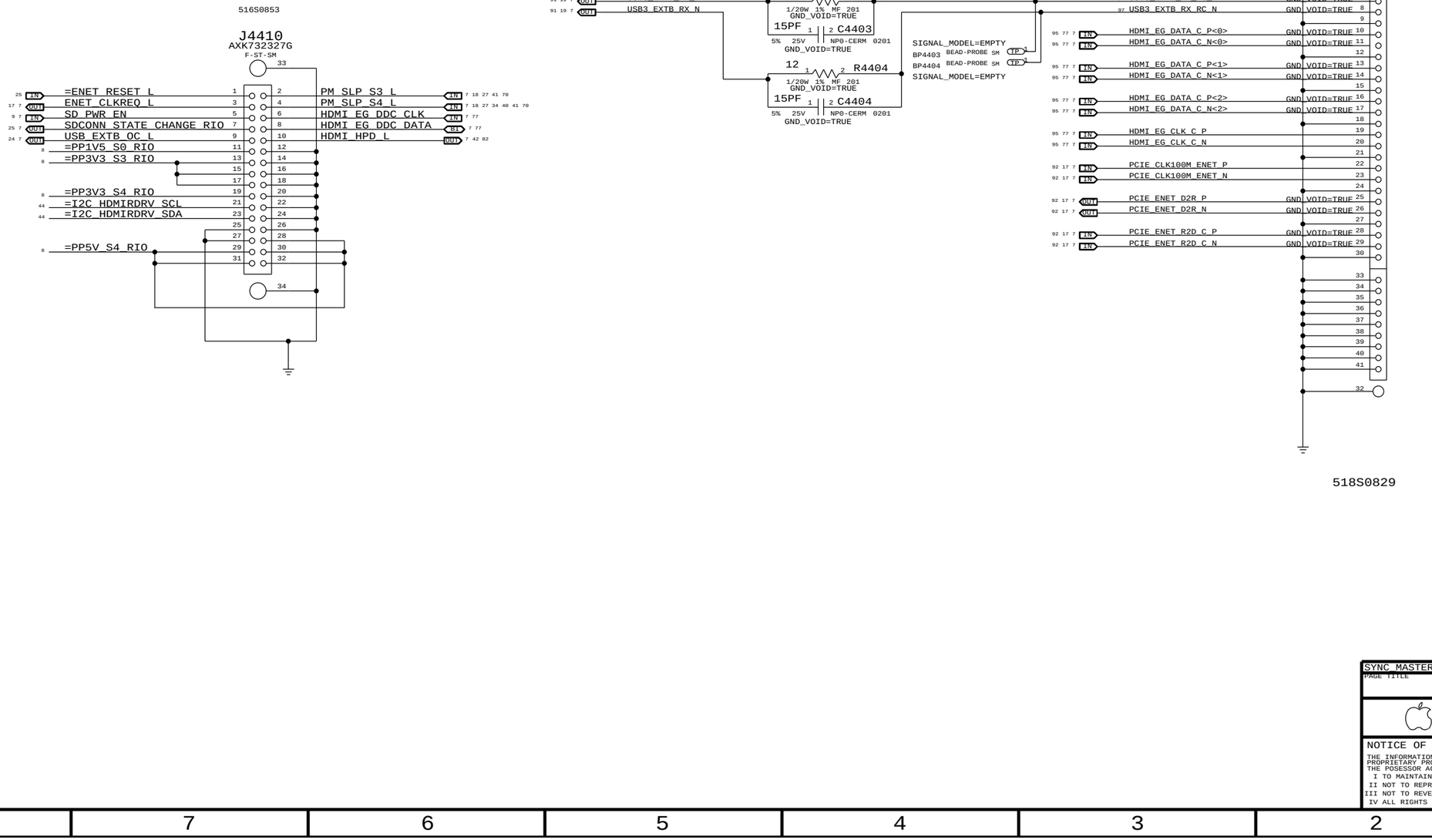

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PAGE TITLE

RIO CONNECTOR

Apple Inc.

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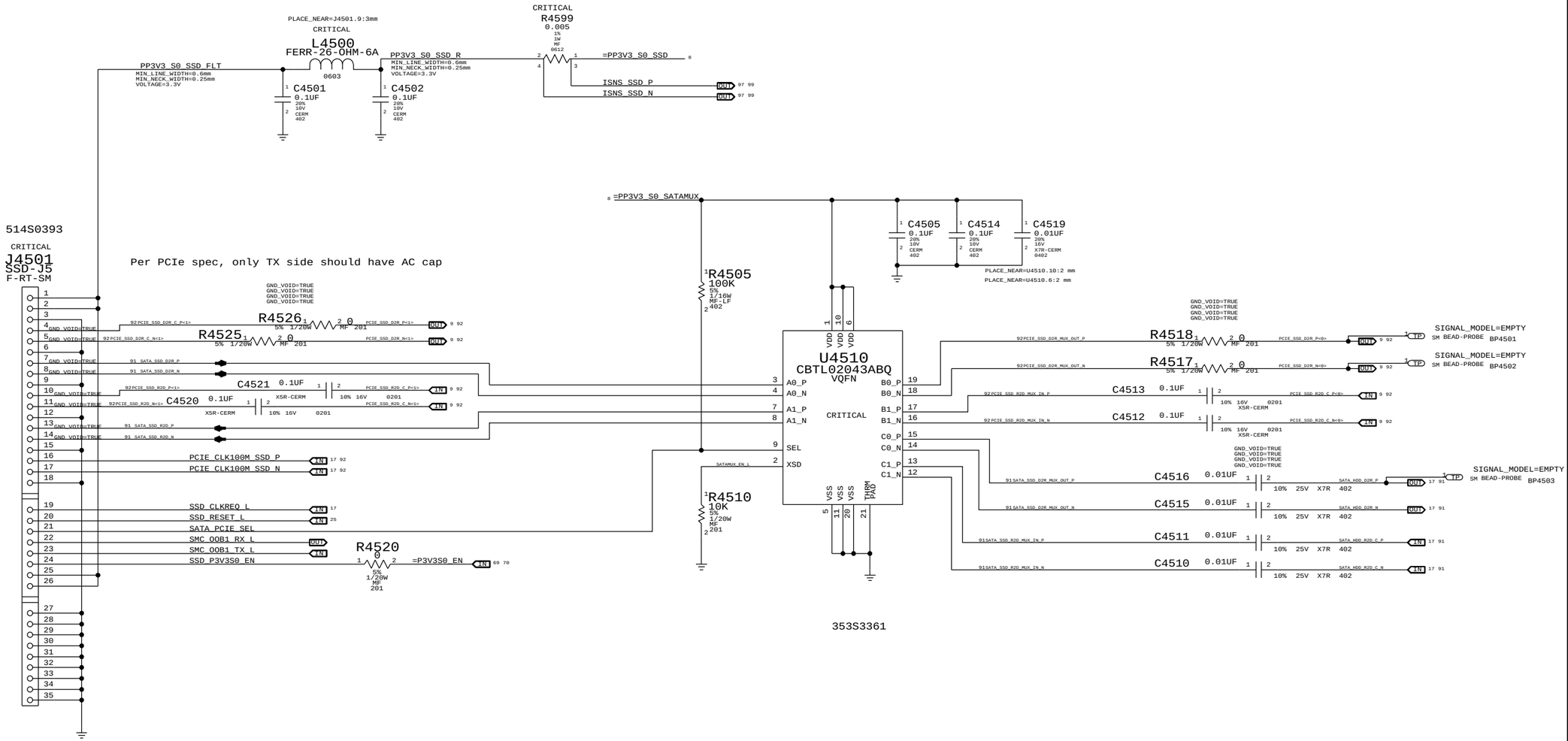

PCIE/SATA GUMSTICK2 CONNECTOR

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: SSD CONNECTOR

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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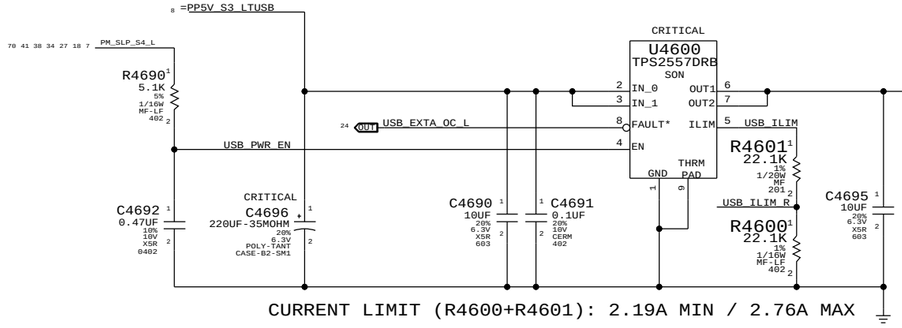
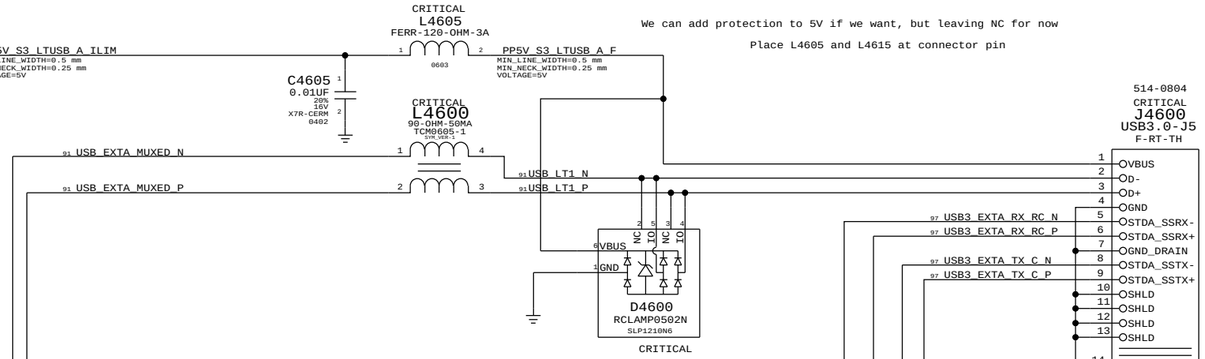
USB Port Power Switch

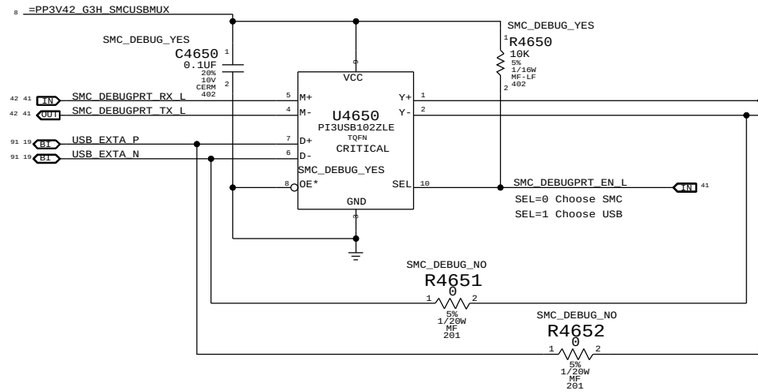


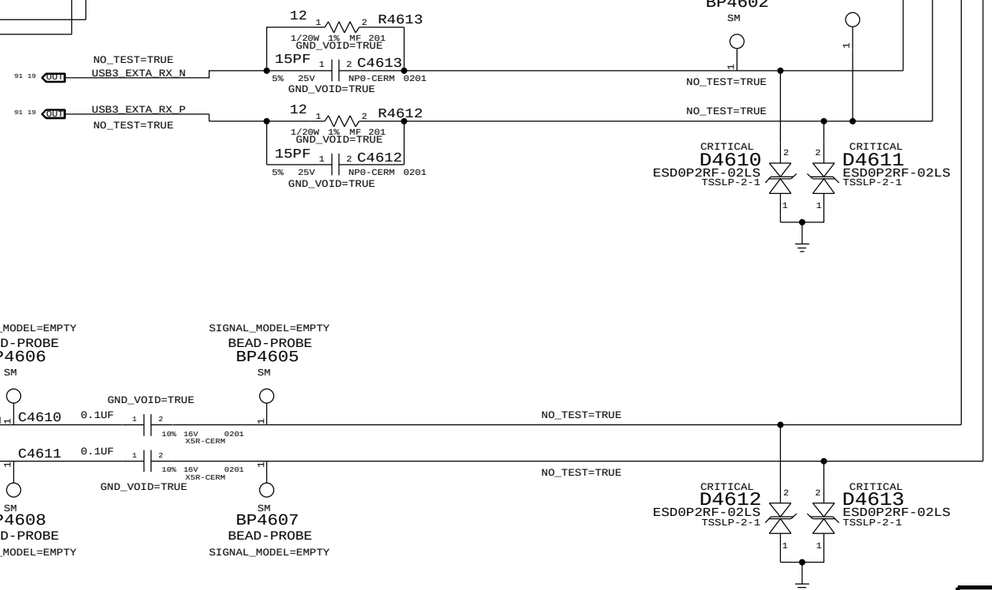
CURRENT LIMIT (R4600+R4601): 2.19A MIN / 2.76A MAX

Left USB Port A



USB/SMC Debug Mux





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PAGE TITLE

USB 3.0 CONNECTORS

Apple Inc.

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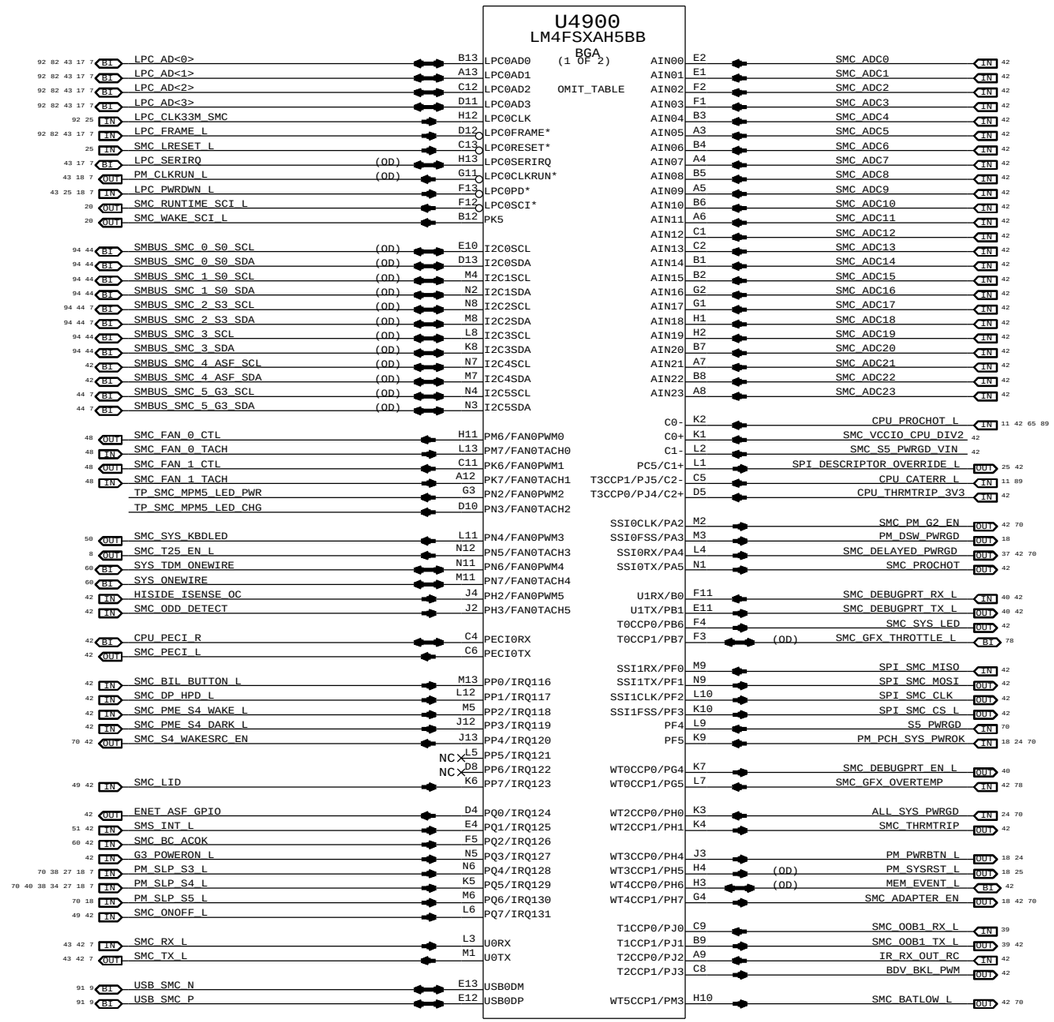
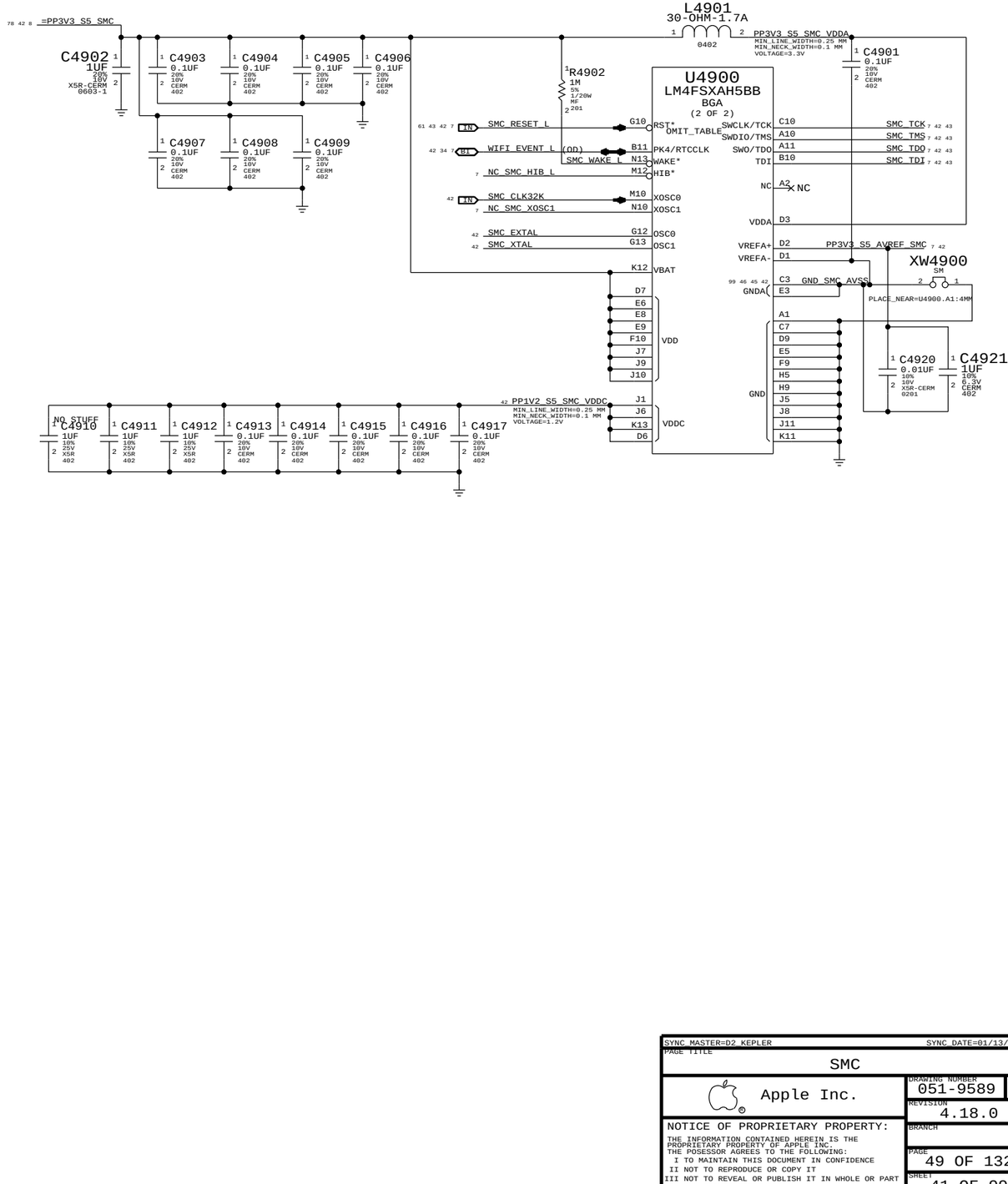
NOTE: Unused pins have "SMC_Pxx" names. Unused pins designed as outputs can be left floating, those designated as inputs require pull-ups.



NOTE: SMS Interrupt can be active high or low, rename net accordingly.
If SMS interrupt is not used, pull up to SMC rail.



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PAGE TITLE: SMC	
Apple Inc.	DRAWING NUMBER: 051-9589 SIZE: D
	REVISION: 4.18.0
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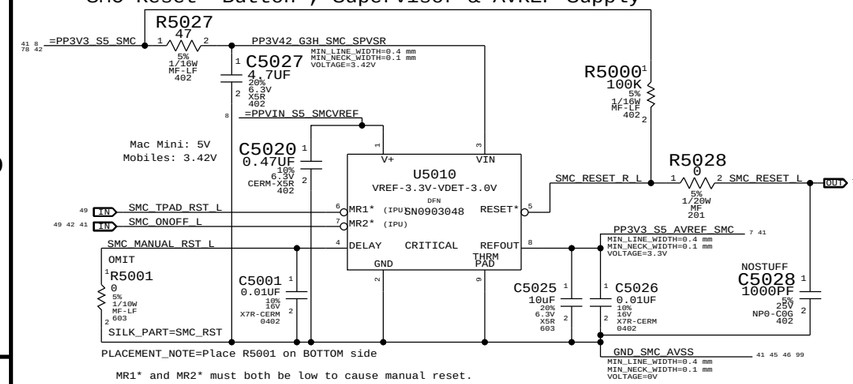
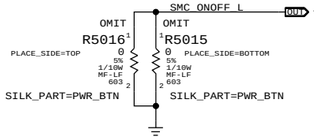
SMC Reset "Button", Supervisor & AVREF Supply



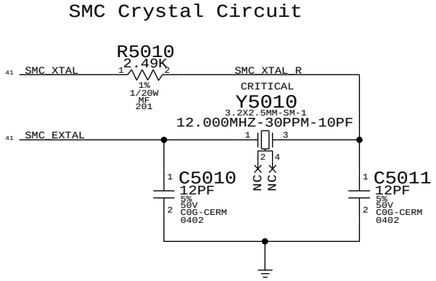
MR1* and MR2* must both be low to cause manual reset.
Used on mobiles to support SMC reset via keyboard.

NOTE: Internal pull-ups are to VIN, not V+.

Debug Power "Buttons"



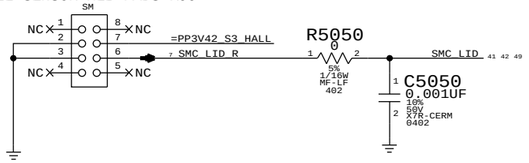
SMC Crystal Circuit



SMC USB CLOCK REQUIRE THESE CRYSTAL VALUES:5,6,8,10,12,16,18,20,24,25 MHZ

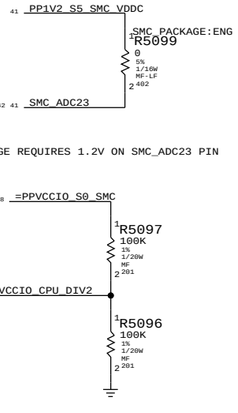
Hall Effect pads

APN: 998-3029
OMIT_TABLE
J5050
HALL-SENSOR-MLB-PADS-K99



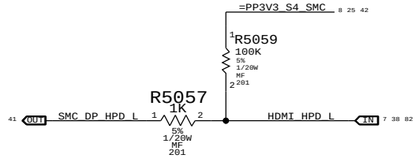
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
607-6811	1	SUBASSY,PCBA HALL EFFECT,K99	J5050	CRITICAL	

Power Rail Connections



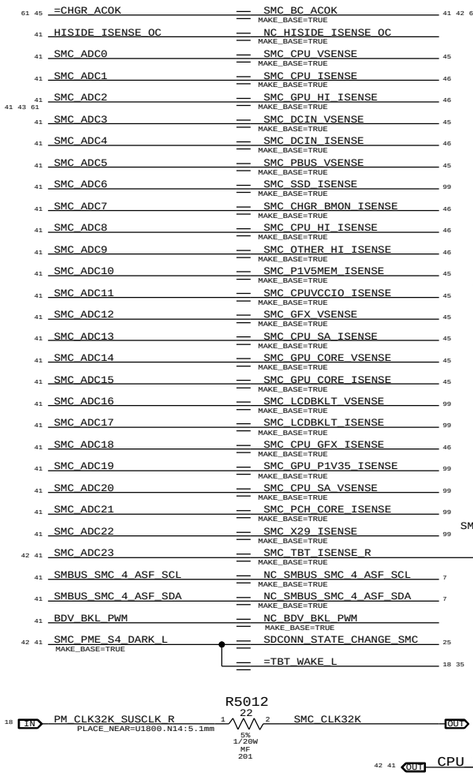
HDMI HPD ESD PROTECTION

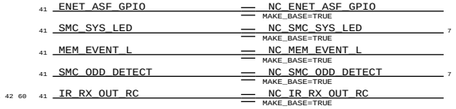
Inversion now taking place on RIO

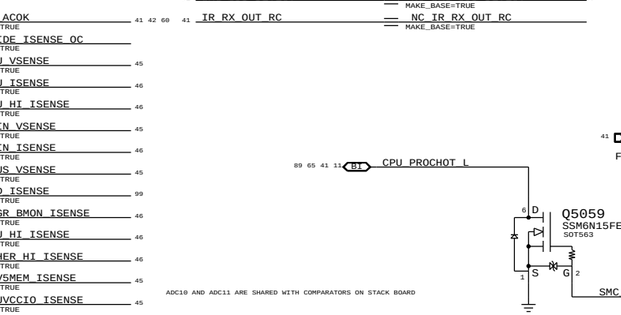


1K for ESD protection

Signal Connections

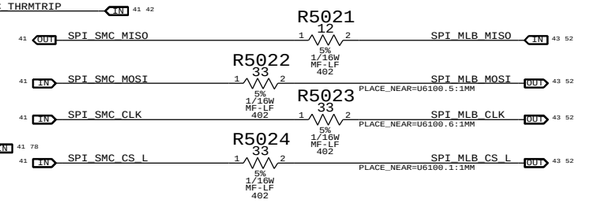




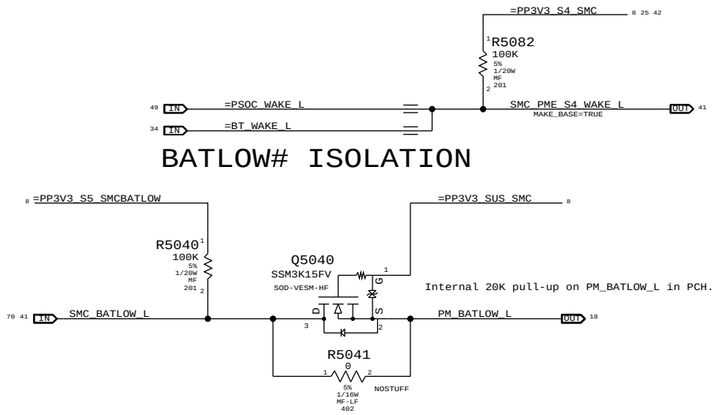


SMC12 PECI SUPPORT

SMC12 SPI SUPPORT



BATLOW# ISOLATION



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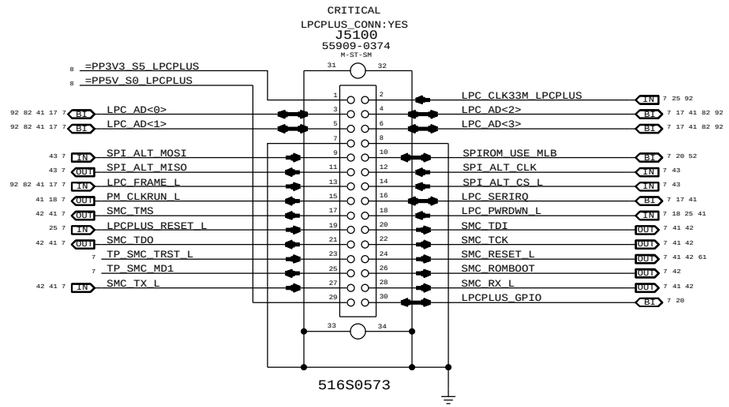
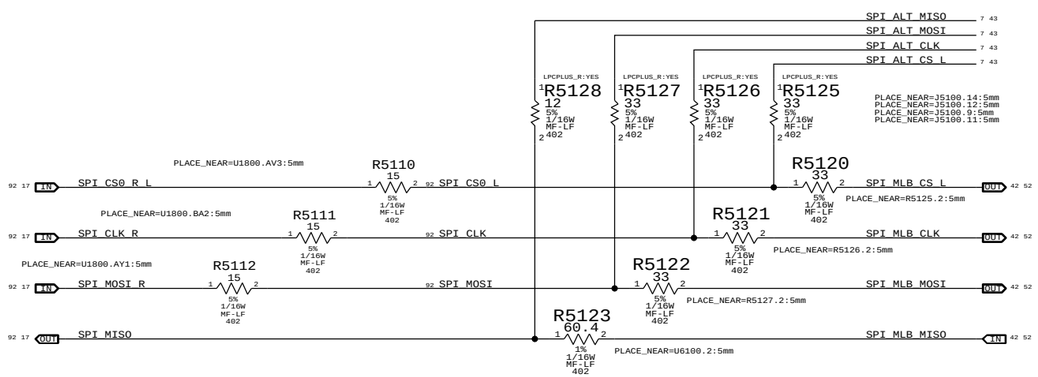
LPC+SPI Connector



SPI Bus Series Termination



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: LPC+SPI Debug Connector

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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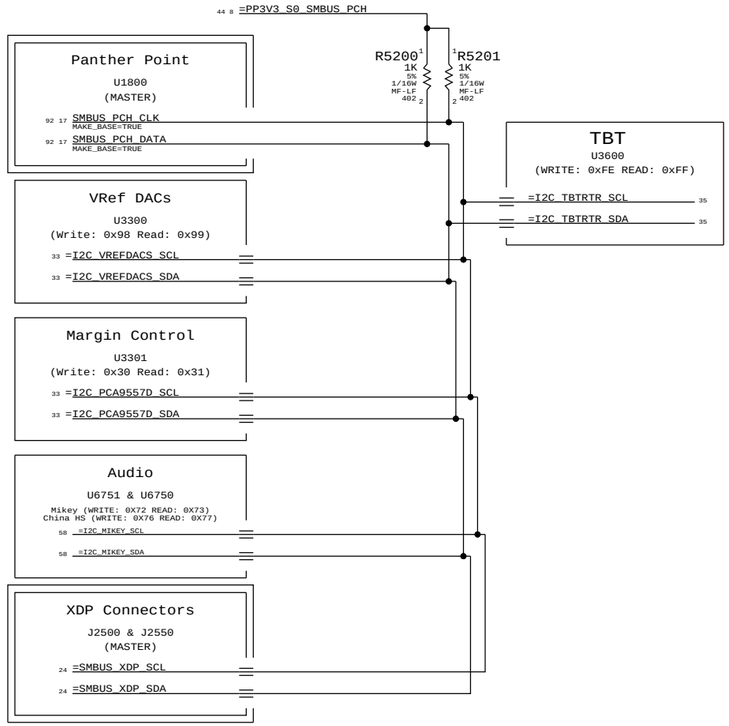
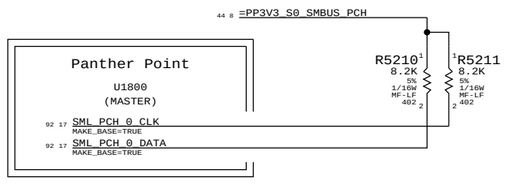
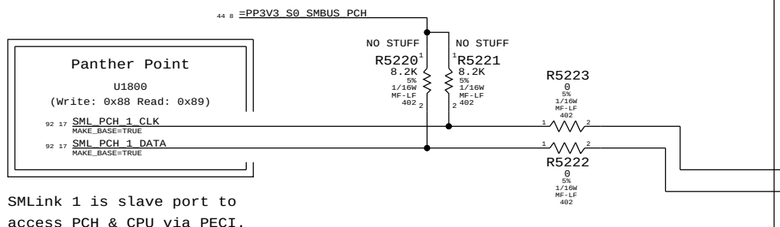
PCH SMBus "0" Connections



PCH "SMLink 0" Connections

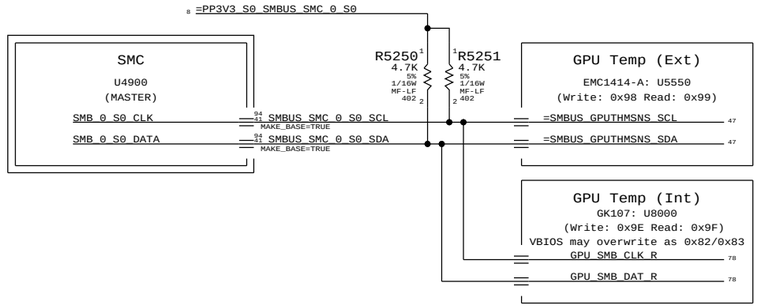


PCH "SMLink 1" Connections



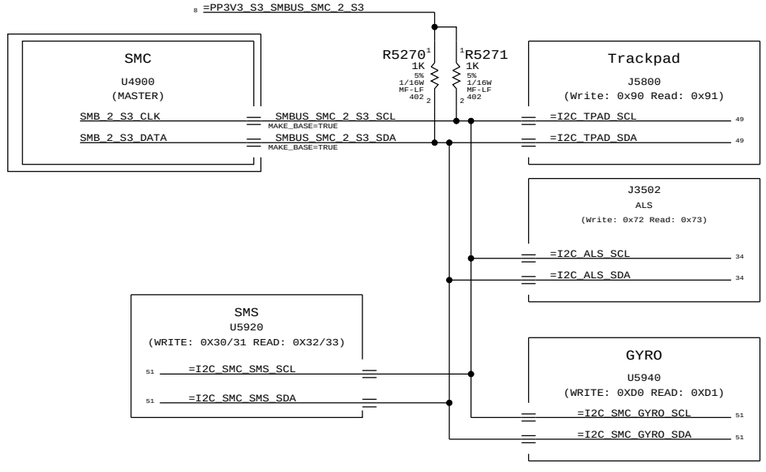
SMLink 1 is slave port to access PCH & CPU via PECI.

SMC "0" SMBus Connections

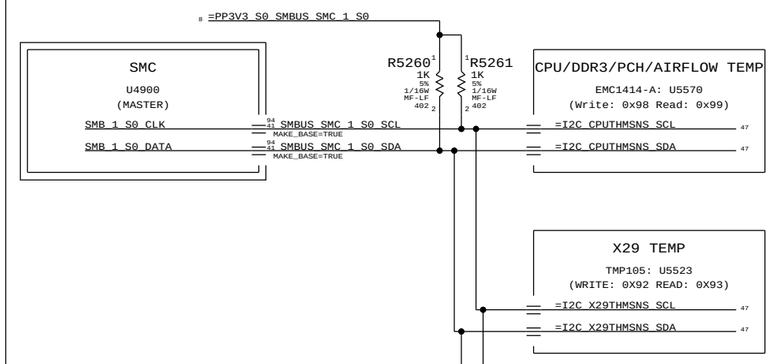


SMC "2" SMBUS CONNECTIONS

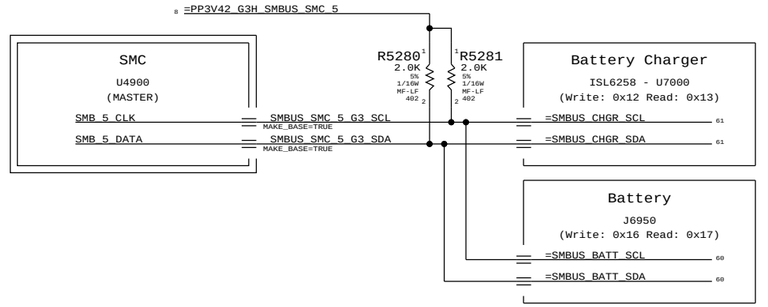
NOTE: SMC RMT bus remains powered and may be active in S3 state



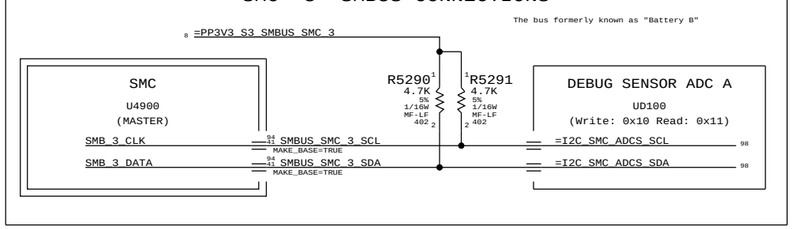
SMC "1" SMBUS CONNECTIONS



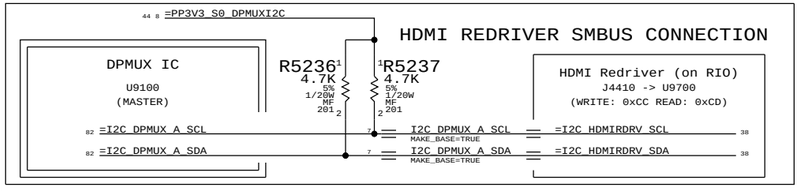
SMC "5" SMBUS CONNECTIONS



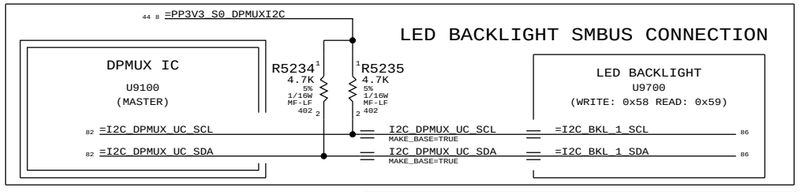
SMC "3" SMBUS CONNECTIONS



HDMI REDRIVER SMBUS CONNECTION



LED BACKLIGHT SMBUS CONNECTION



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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SMBus Connections

Apple Inc.

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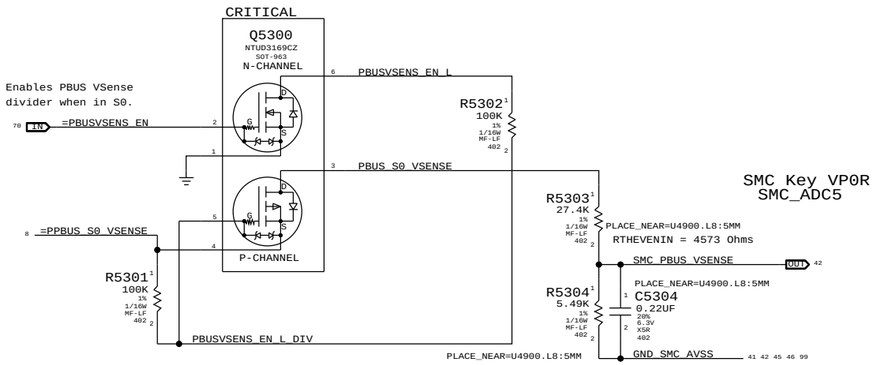
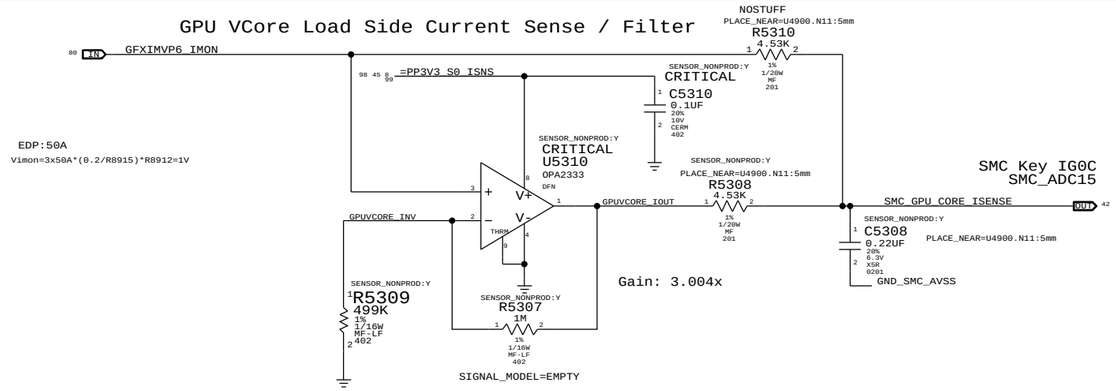
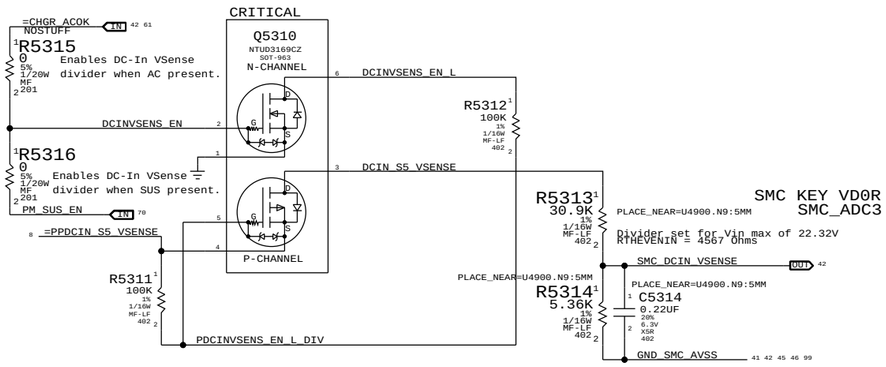
PBUS Voltage Sense Enable & Filter



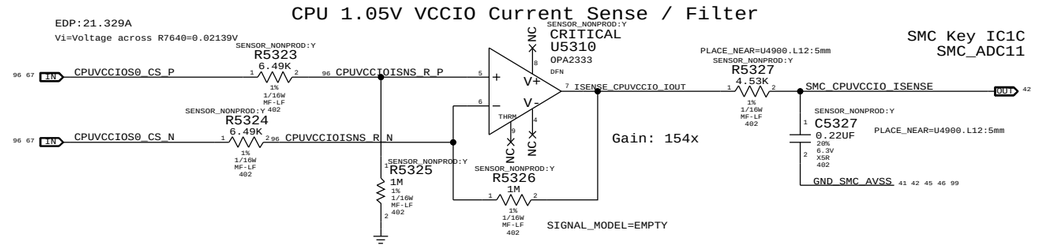
GPU VCore Load Side Current Sense / Filter



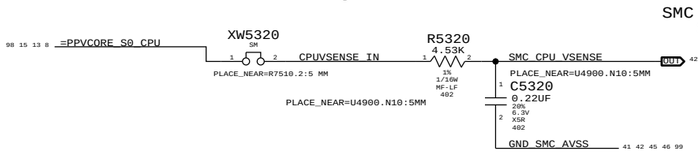
DC-In Voltage Sense Enable & Filter



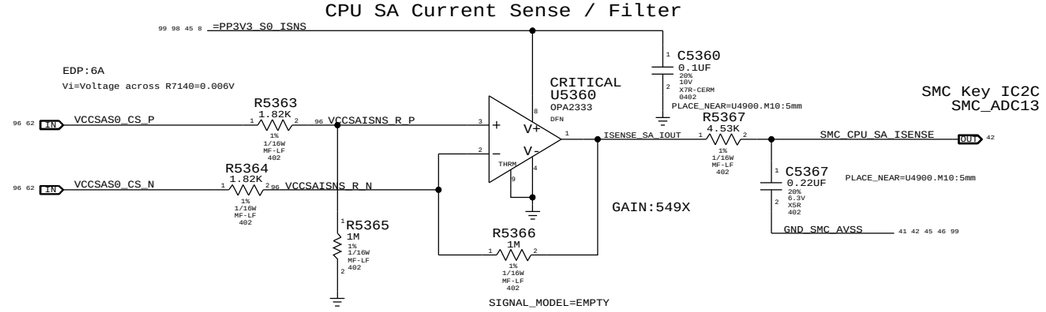
CPU 1.05V VCCIO Current Sense / Filter



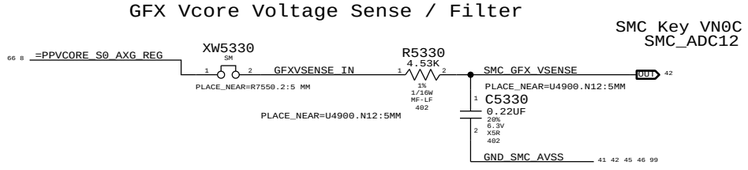
CPU Vcore Voltage Sense / Filter



CPU SA Current Sense / Filter

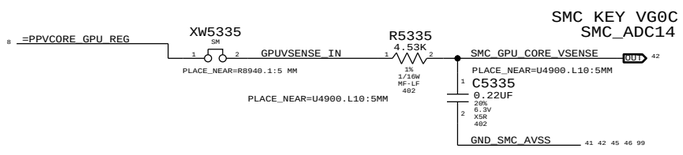


GFX Vcore Voltage Sense / Filter

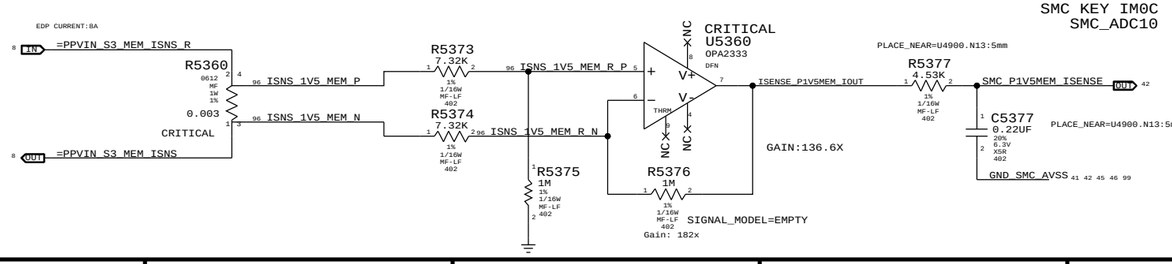


PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0114	1	RES,MTL FILM,100K,5,1/16W,0402,SMD,LF	C5327		SENSOR_NONPROD:N
1175O008	1	RES,MF,1/20W,100K OHM,5,0201,SMD	C5308		SENSOR_NONPROD:N

GPU Vcore Voltage Sense / Filter



DDR3 1.5V DRAM ONLY CURRENT SENSE / FILTER



SYNC_MASTER=D2_SEAN
SYNC_DATE=03/05/2012

PAGE TITLE

Voltage & Load Side Current Sensing

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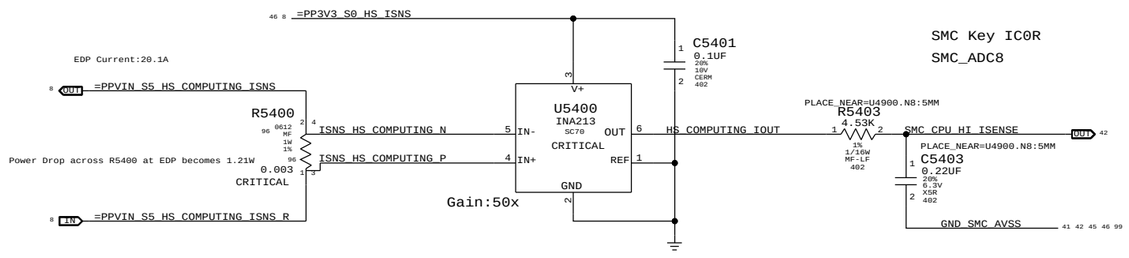
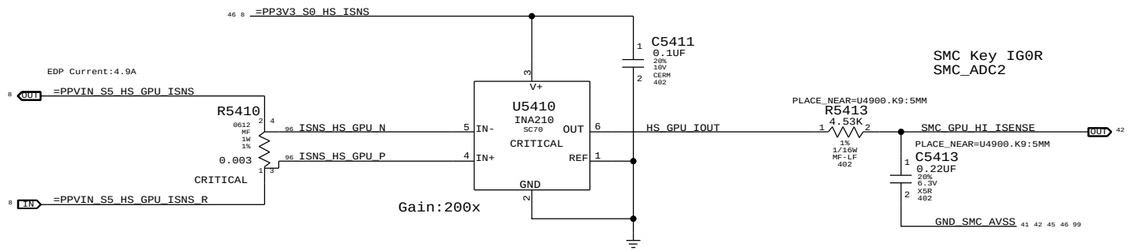
COMPUTING High Side Current Sense / Filter

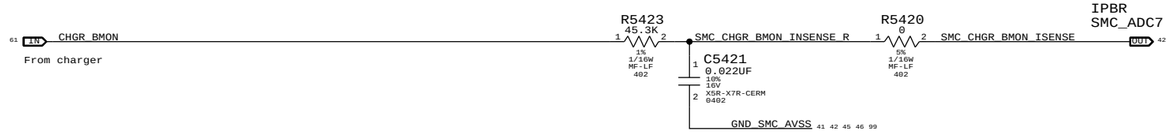


GRAPHICS High Side Current Sense / Filter

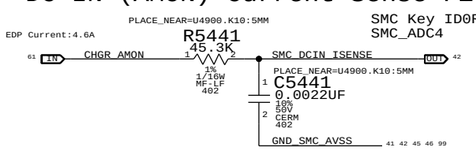


OTHER High Side Current Sense / Filter

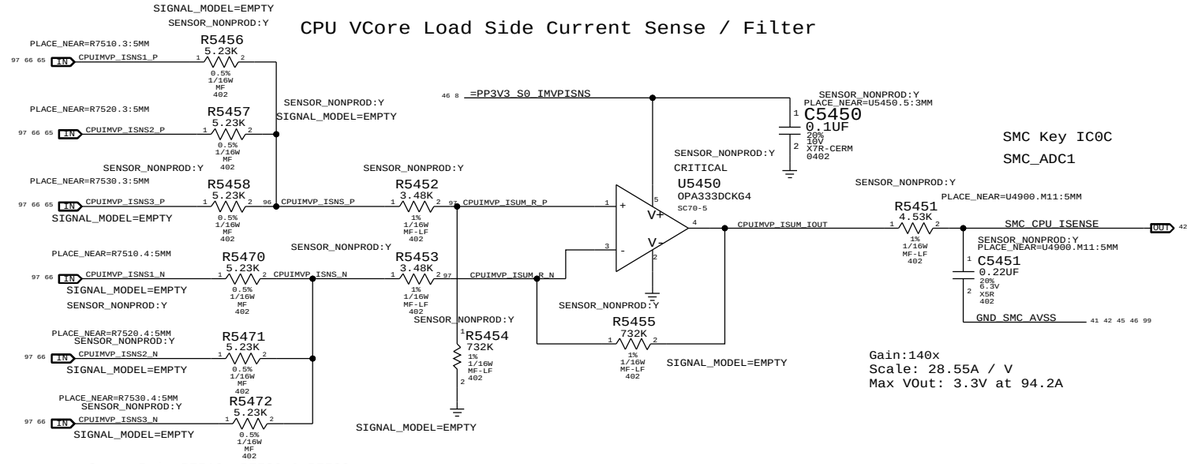
CHARGER BMON HIGH SIDE (BATTERY DISCHARGE) CURRENT SENSE & FILTER



DC-IN (AMON) Current Sense Filter



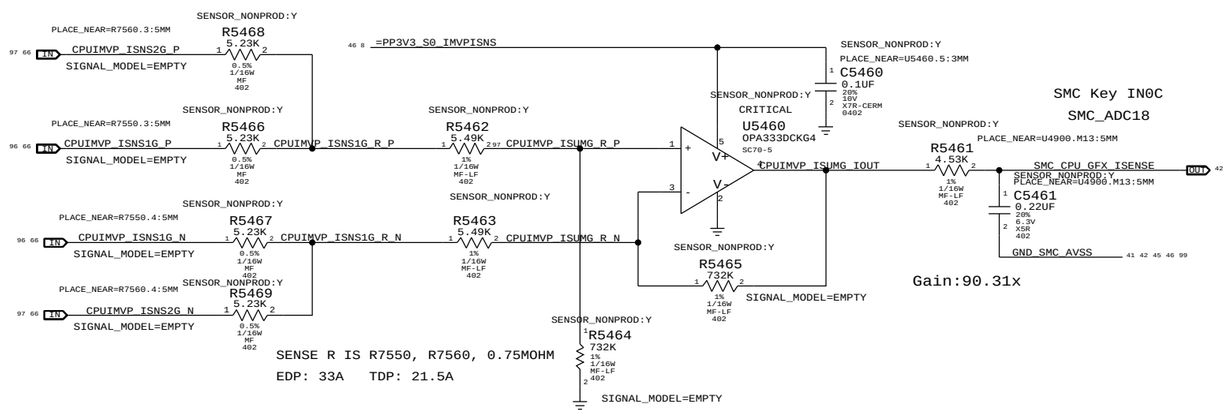
CPU VCore Load Side Current Sense / Filter



Sense R is R7510, R7520 & R7530
Individual Sense R is 0.75mOhm
EDP: 94A TDP :45A

(Effective Sense R is 0.25mOhm due to summing of the 3 phases)

GFX/IG VCore Load Side Current Sense / Filter



SENSE R IS R7550, R7560, 0.75MOHM
EDP: 33A TDP: 21.5A

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0114	2	RES,MTL FILM,100K,1,1/16W,0402,SMD,LF	C5451,C5461		SENSOR_NONPROD:N

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High Side and CPU/AXG Current Sensing

Apple Inc.

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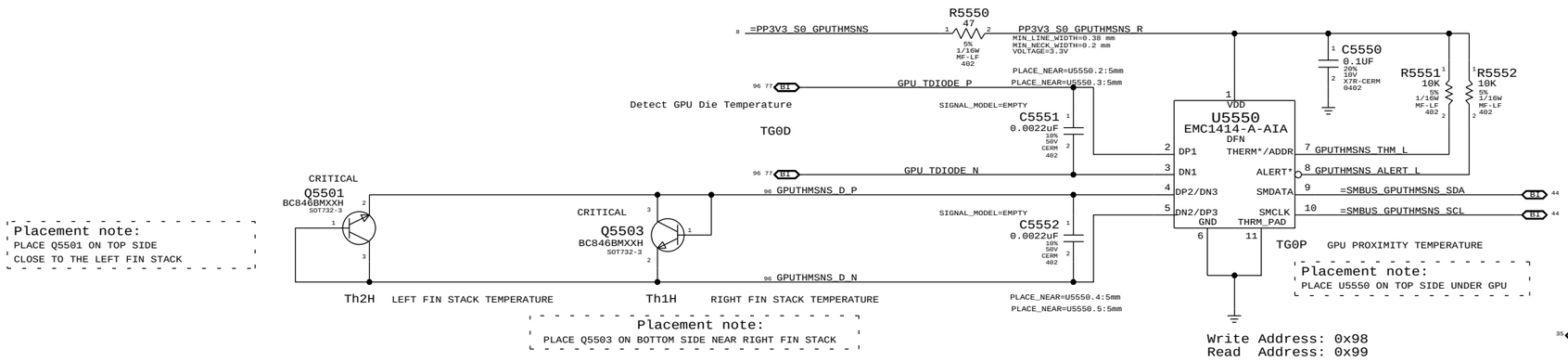
GPU PROXIMITY/GPU DIE/LEFT FIN STACK/RIGHT FIN STACK

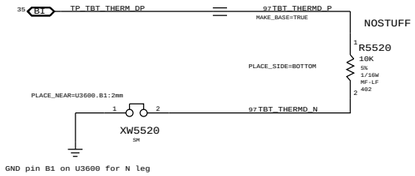


Placement note:
PLACE Q5501 ON TOP SIDE
CLOSE TO THE LEFT FIN STACK

Placement note:
PLACE Q5503 ON BOTTOM SIDE NEAR RIGHT FIN STACK

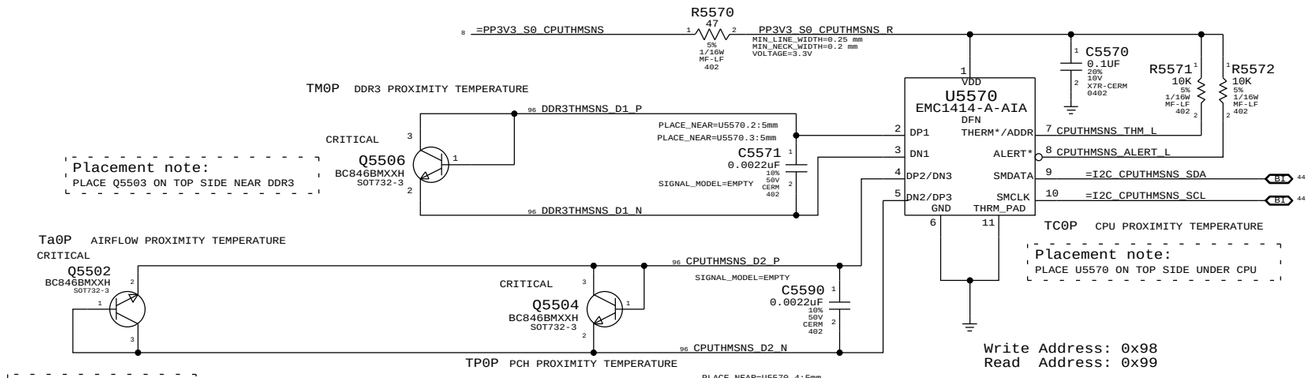
Placement note:
PLACE U5550 ON TOP SIDE UNDER GPU

TBT DIE



Use GND pin B1 on U3600 for N leg

DDR3 PROXIMITY/CPU PROXIMITY/PCH PROXIMITY/AIRFLOW PROXIMITY



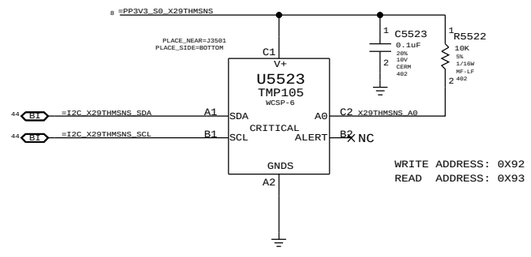
Placement note:
PLACE Q5503 ON TOP SIDE NEAR DDR3

Placement note:
PLACE Q5502 ON TOP SIDE
CLOSE TO BOARD EDGE

Placement note:
PLACE Q5504 ON TOP SIDE UNDER PCH

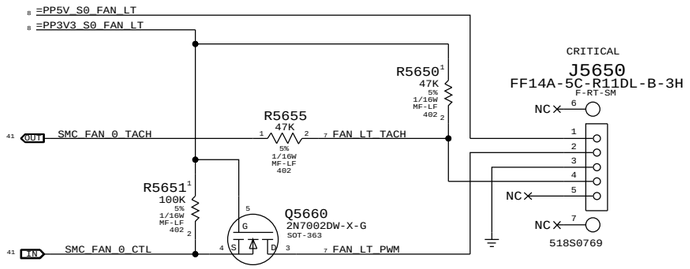
Placement note:
PLACE U5570 ON TOP SIDE UNDER CPU

TW0P X29 PROXIMITY

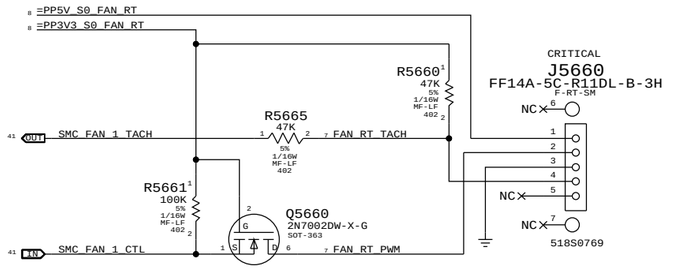


Placement note:
PLACE U5523 ON BOTTOM NEAR X29 CONN

Left Fan



Right Fan



SYNC MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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Fan Connectors

Apple Inc.

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PSOC USB CONTROLLER

- USB INTERFACES TO MLB
- SPI HOST TO Z2
- TRACKPAD PICK BUTTONS
- KEYBOARD SCANNER

PLACE_SIDE=BOTTOM

=PP3V3_S4_TPAD → R5704 5% 1/16W MF-LF 402 → PP3V3_S3_PSOC (MIN_LINE_WIDTH=0.50MM, MIN_NECK_WIDTH=0.20MM, VOLTAGE=3.3V)

BYPASS=U5701.49:50:5 mm

C5704 100PF 5% 50V C0G-CERM 0201
C5705 0.1UF 10% 6.3V X5R 201
C5706 4.7UF 20% 6.3V X5R 402

R5703 220K 5% 1/20W MF 201

=PSOC_WAKE_L (OUT)
PICKB_L
BUTTON_DISABLE
Z2_HOST_INTN
WS_LEFT_SHIFT_KEY
WS_LEFT_OPTION_KEY

WS_CONTROL_KEY
Z2_KEY_ACT_L
TPAD_VBUS_EN (IN)
PSOC_MISO
PSOC_F_CS_L
PSOC_MOSI
PSOC_SCLK
Z2_MISO
Z2_CS_L
Z2_MOSI
Z2_SCLK

CRITICAL
OMIT
U5701
CY8C24794
MLF
(SYM-VER2)
337S2983

P2_3 P2_5 P2_7 P0_1 P0_3 P0_5 P0_7 VSS VDD P0_6 P0_4 P0_2 P0_0 P2_6 P2_4
P2_2 P2_0 P4_6 P4_4 P4_2 P4_0 P3_6 P3_4 P3_2 P3_0 P5_6 P5_4 P5_2 P5_0 THRML PAD
P1_7 P1_5 P1_3 P1_1 VSS D+ D- VDD P7_7 P7_0 P1_0 P1_2 P1_4 P1_6

WS_KBD23 WS_KBD22 WS_KBD21 WS_KBD20 WS_KBD19 WS_KBD18
WS_KBD17 WS_KBD16N WS_KBD15_C WS_KBD14 WS_KBD13 WS_KBD12 WS_KBD11 WS_KBD10 WS_KBD9 WS_KBD8 WS_KBD7 WS_KBD1 WS_KBD2 WS_KBD3
WS_KBD4 WS_KBD5 WS_KBD6

TP_PSOC_SCL
TP_PSOC_SDA
TP_PSOC_P1_3
TP_ISSP_SCLK_P1_1
ISSP SCLK/I2C SCL
TP_ISSP_SDATA_P1_0
ISSP SDATA/I2C SDA

R5701 24 5% 1/20W MF 201 → USB_TPAD_P → USB_TPAD_R_P
R5702 24 5% 1/20W MF 201 → USB_TPAD_N → USB_TPAD_R_N

Z2_CLKIN
TP_P7_7

(PP3V3_S3_PSOC)

C5702 100PF 5% 50V C0G-CERM 0201
C5703 0.1UF 10% 6.3V X5R 201
C5701 4.7UF 20% 6.3V X5R 402

BYPASS=U5701.22:19:5 mm
BYPASS=U5701.22:19:8 mm
BYPASS=U5701.22:19:11 mm

IC	PIN NAME	CURRENT	R_SNS	V_SNS	POWER
TMP102	V+	10UA	2.55 KOHM	0.0255 V	0.255E-6 W
		80UA		0.204 V	16.32E-6 W
3V3 LDO	VDD	60MA (MAX)	10 OHM	0.6 V	36E-3 W
	VOUT	60MA (MAX)	0.2 OHM	0.012 V	0.72E-3 W
PSOC	VDD	8MA (TYP)	1.5 OHM	0.012 V	96E-6 W
		14MA (MAX)		0.021 V	294E-6 W
18V BOOSTER	VIN	4MA (MAX)	4.7 OHM	0.0188 V	75.2E-6 W

IPD Flex Connector

CRITICAL
J5700 516S0689
55560-0228
M-ST-SM

R5708 0 5% 1/20W MF 201 → C5708 0.1UF 10% 6.3V X5R 201

PP3V3_TPAD_CONN (VOLTAGE=3.3V, MIN_NECK_WIDTH=0.20MM, MIN_LINE_WIDTH=0.50MM)

Z2_CS_L → Z2_KEY_ACT_L
Z2_MOSI → PSOC_F_CS_L
Z2_MISO → PICKB_L
Z2_SCLK → PSOC_MISO
Z2_HOST_INTN → PSOC_MOSI
Z2_CLKIN → PSOC_SCLK
=I2C_TPAD_SDA
=I2C_TPAD_SCL
NC

TPAD_5V_SW_S4 L5700 FERR-120-OHM-1.5A 0402-LF
=PP5V_S4_TPAD → PP5V_S4_CUMULUS (VOLTAGE=5V, MIN_NECK_WIDTH=0.20MM, MIN_LINE_WIDTH=0.50MM)
C5700 0.1UF 10% 10V X5R-CERM 0201 (PLACE_NEAR=J5800.18:3MM)
R5700 220K 5% 1/20W MF 201

TPAD_5V_LDO L5707 FERR-120-OHM-1.5A 0402-LF
=PP5V_S5RS4_CUMULUS
C5707 0.1UF 10% 10V X5R-CERM 0201 (PLACE_NEAR=J5800.18:3MM)

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 → C5750 0.1UF 10% 16V X7R-CERM 0402

U5750
SLG4AP021
TQFN

=PP3V3_S4_TPAD → OE (IPD)
WS_LEFT_SHIFT_KBD → IN_1 (IPD) → OUT_1 → WS_LEFT_SHIFT_KEY
WS_LEFT_OPTION_KBD → IN_2 (IPD) → OUT_2 → WS_LEFT_OPTION_KEY
WS_CONTROL_KBD → IN_3 (IPD) → OUT_3 → WS_CONTROL_KEY
OUT_ALL# → SMC_TPAD_RST_L (OUT)
Pull-up in U5010.
GND, THRM PAD

Keyboard Connector

=PP3V3_S4_TPAD
=PP3V42_G3H_TPAD
WS_KBD1 WS_KBD2 WS_KBD3 WS_KBD4 WS_KBD5 WS_KBD6 WS_KBD7 WS_KBD8 WS_KBD9 WS_KBD10 WS_KBD11 WS_KBD12 WS_KBD13 WS_KBD14 WS_KBD15_CAP WS_KBD16_NUM WS_KBD17 WS_KBD18 WS_KBD19 WS_KBD20 WS_KBD21 WS_KBD22 WS_KBD23 WS_KBD_ONOFF_L
WS_LEFT_SHIFT_KBD WS_LEFT_OPTION_KBD WS_CONTROL_KBD

CAPS:INT
R5714 56.2 1% 1/16W MF-LF 402 → WS_KBD15_C
R5715 10K 1% 1/16W MF-LF 402 → WS_KBD16N
R5710 1K 5% 1/16W MF-LF 402 → SMC_ONOFF_L (OUT)
C5710 0.1UF 20% 10V CERM 402 (PLACEMENT_NOTE=NEAR J5713)

F-RT-SM
FF14A-30C-R11DL-B-3H
J5713
CRITICAL
518S0752

WS_KBD15_C	CAP_COMP_H	CAP_COMP_L	Q5736	Q5738	LED Current
Z	1	1	off	off	none
1	0	1	on	off	source
0	1	0	off	on	sink

All RC values are TBD

5V TRACKPAD S4 FET

TPAD_5V_NO_FET R5720 0 5% 1/16W MF-LF 402
TPAD_5V_FET CRITICAL Q5720 SIA413DJ SC70-6L

5V TPAD FET	
MOSFET	SiA413
CHANNEL	P-TYPE 12V
RDS(ON)	29 mOhm @4.5V
LOADING	16 mA (EDP)

=PP5V_S5_TPAD
TPAD_5V_FET Q5721 SSM3K15FV SOD-VESM-HF
=P5VS4_TPAD_EN (IN)
TPAD_5V_FET R5721 220K 5% 1/20W MF 201
TPAD_5V_FET C5722 0.033UF 10% 16V X5R 402
TPAD_5V_FET R5722 3.3K 5% 1/20W MF 201
TPAD_5V_FET C5723 0.01UF 10% 16V X5R 201
P5VCUMULUS_EN_L
P5VCUMULUS_SS
PP5V_S5RS4_CUMULUS (VOLTAGE=5V, MIN_NECK_WIDTH=0.20MM, MIN_LINE_WIDTH=0.50MM)

Caps Lock LED Drive

=PP3V3_S4_TPAD
WS_KBD15_C

CAPS:EXT R5730 10K, R5732 10K, R5734 20K
CAP_VREF_L
CAPS:EXT R5731 10K, R5733 20K, R5735 10K
CAP_VREF_H
CAPS:EXT U5730 LM393ADGKR MSOP (V+, GND)
CAP_COMP_H
CAP_COMP_L

CAPS:EXT R5740 10K
CAPS:EXT R5738 10K
CAPS:EXT R5736 10K

CAPS:EXT Q5736 NTZD3152P SOT-563-HF

CAP_SOURCE
CAPS:EXT R5737 113 1% 1/20W MF 201 (MIN_LINE_WIDTH=0.2MM, MIN_NECK_WIDTH=0.1MM)
WS_KBD15_CAP
CAPS:EXT R5739 113 1% 1/20W MF 201 (MIN_LINE_WIDTH=0.2MM, MIN_NECK_WIDTH=0.1MM)
CAP_SINK

CAPS:EXT Q5738 DMN3730UFB4 DFN1006H4-3
CAP_COMP_L_INV

CAPS:EXT CRITICAL Q5734 SSM3K15AMFVAPE VESM
CAP_COMP_L

TPAD Buttons Disable

BUTTON_DISABLE
Q5701 SSM6N15FEAPE SOT563
SMC_LID (IN)

PLACE THESE COMPONENTS CLOSE TO J5800
THIS ASSUMES THERE'S A PP3V42_G3H PULL UP ON MLB

THE TPAD BUTTONS WILL BE DISABLE
WHEN THE LID IS CLOSED
LID OPEN => SMC_LID_LC ~ 3.42V
LID CLOSE => SMC_LID_LC < 0.50V

BOM Options available to CSA 5

TPAD_5V:SW_S4	Original implementation off PP5V_S4
TPAD_5V:LDO_S4	PP5V_S5 LDO power in S4 only
TPAD_5V:LDO_S5	PP5V_S5 LDO power

BOM GROUP	BOM OPTIONS
TPAD_5V:SW_S4	TPAD_5V_SW_S4
TPAD_5V:LDO_S4	TPAD_5V_FET,TPAD_5V_LDO
TPAD_5V:LDO_S5	TPAD_5V_NO_FET,TPAD_5V_LDO

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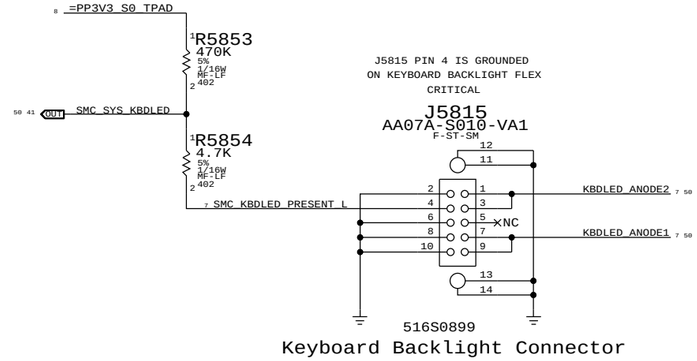
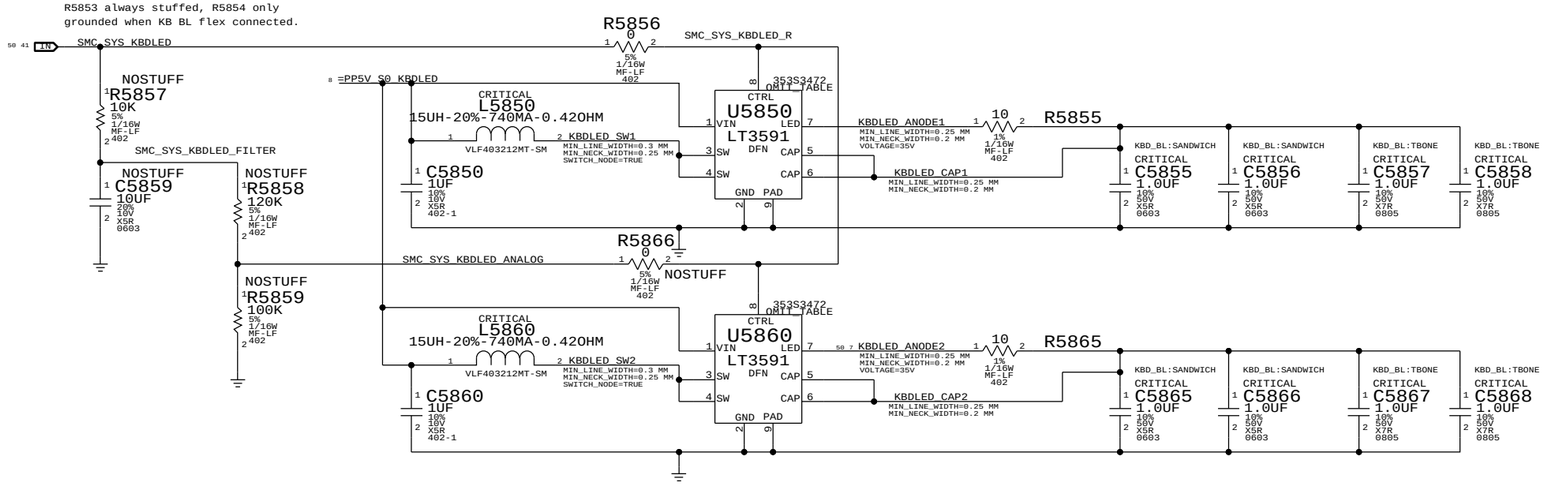


Keyboard Backlight Driver & Detection

To detect Keyboard backlight, SMC will
tristate and read SMC_SYS_KBDLED:

If LOW, keyboard backlight present
If HIGH, keyboard backlight not present

R5853 always stuffed, R5854 only
grounded when KB BL flex connected.



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
353S1612	2	IC,DC/DC CVTR,BOOST,WHITE LED,1MHZ,DFN8	U5850,U5860	CRITICAL	

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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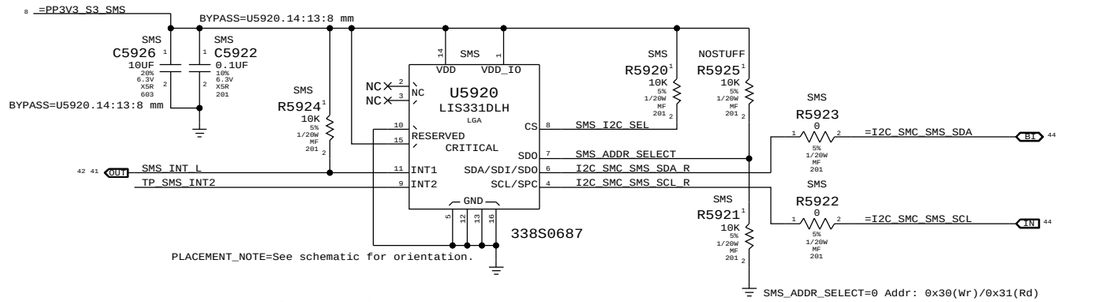

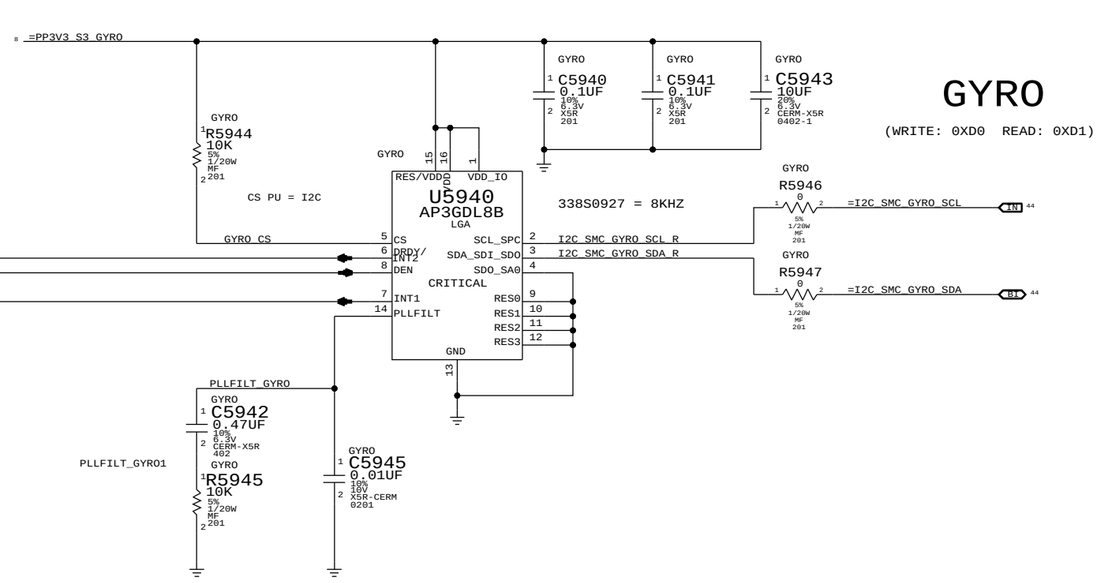

GYRO

(WRITE: 0XD0 READ: 0XD1)

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: DIGITAL ACCELEROMETER & GYRO

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

REVISION: 4.18.0

BRANCH:

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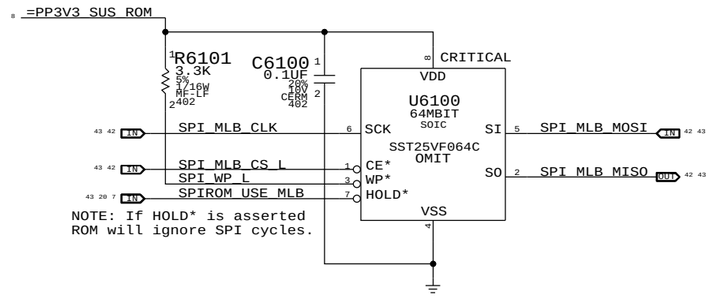

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

SPI ROM

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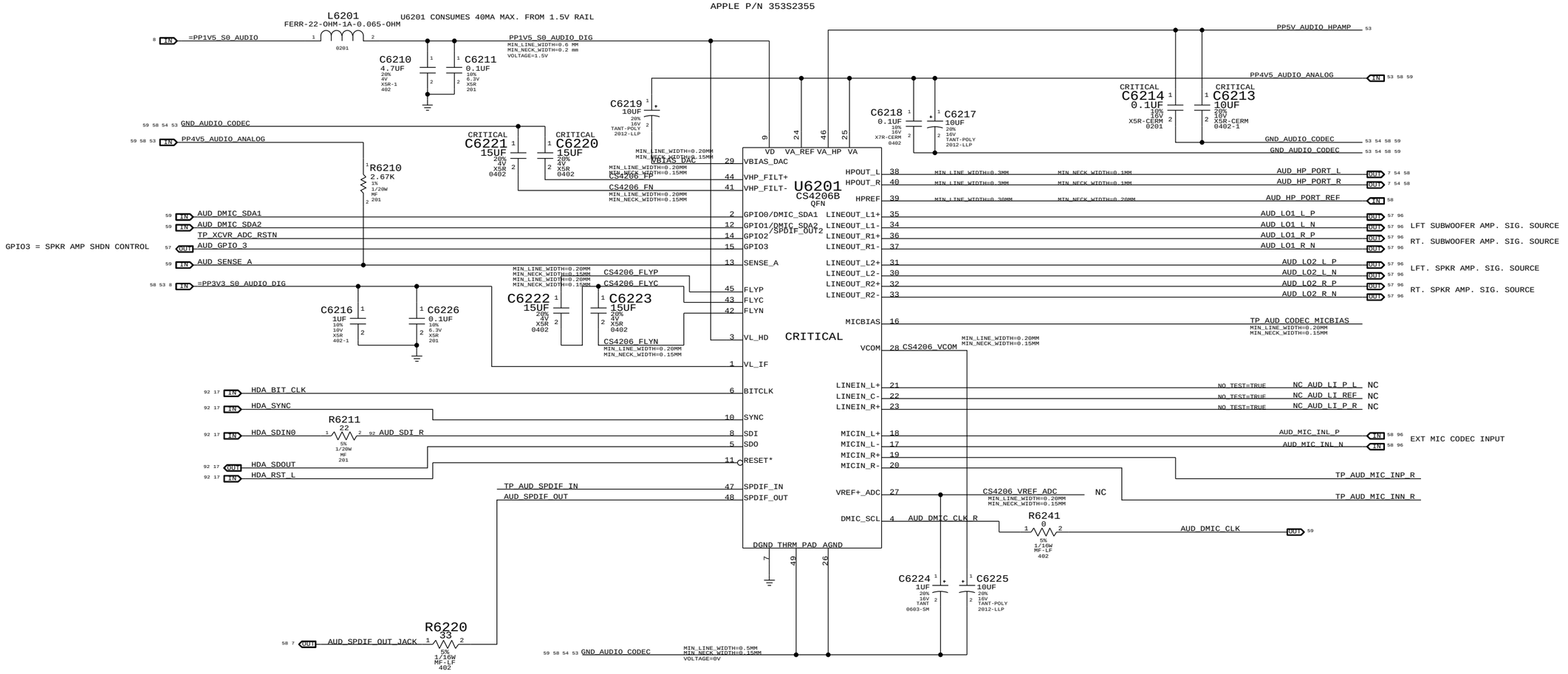
AUDIO CODEC

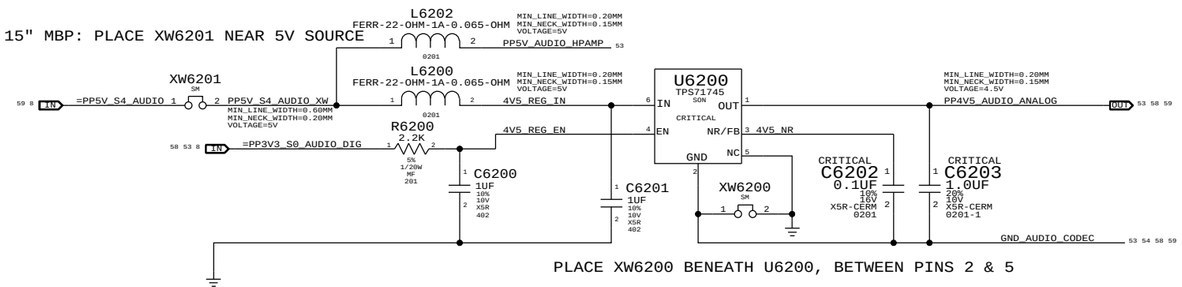
APPLE P/N 353S2355



4.5V POWER SUPPLY FOR CODEC

APPLE P/N 353S2456

15" MBP: PLACE XW6201 NEAR 5V SOURCE



PLACE XW6200 BENEATH U6200, BETWEEN PINS 2 & 5

NOTES ON CODEC I/O

DIFF FSINPUT= 2.45VRMS
SE FSINPUT= 1.22VRMS
DAC1 FSOUTPUT= 1.34VRMS
DAC2/3 FSOUTPUTDIFF= 2.67VRMS
DAC2/3 FSOUTPUTSE= 1.34VRMS

SYNC_MASTER=D2_CARA SYNC_DATE=03/16/2012
PAGE TITLE
AUDIO: CODEC/REGULATOR

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D
REVISION 4.18.0
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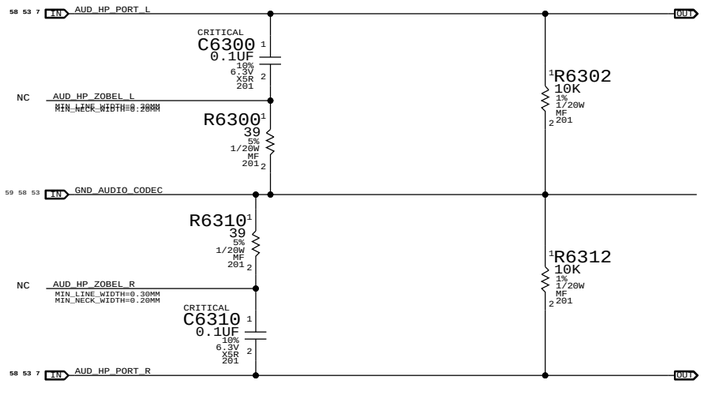
ZOBEL NETWORK & 1ST ORDER DAC FILTER PLACEHOLDER



SYNC_MASTER=D2_CARA SYNC_DATE=03/16/2012

PAGE TITLE

AUDIO: HEADPHONE FILTER

Apple Inc.

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SYNC_MASTER=D2_CARA SYNC_DATE=03/16/2012

PAGE TITLE

AUDIO: IV SENSE

Apple Inc.

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SYNC_MASTER=D2_CARA SYNC_DATE=03/16/2012

PAGE TITLE

AUDIO: IV SENSE FILTER

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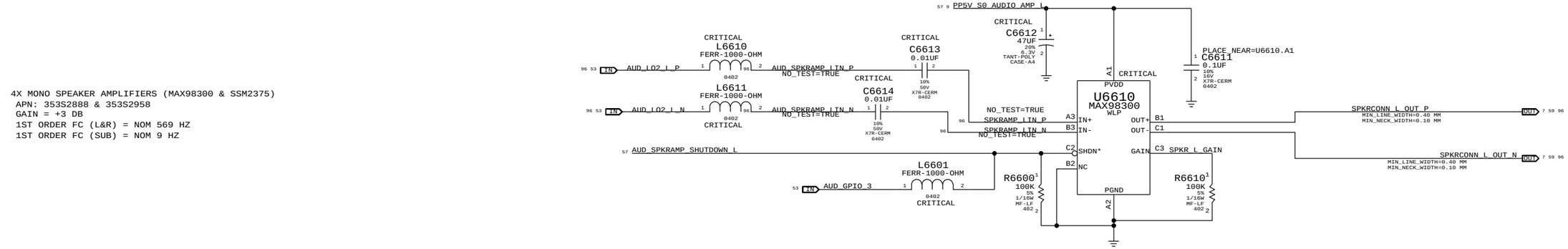
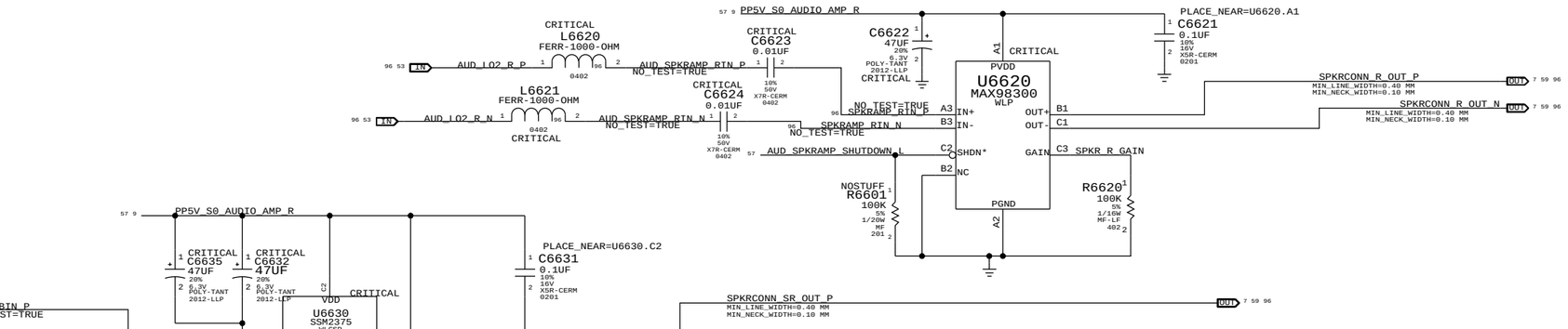
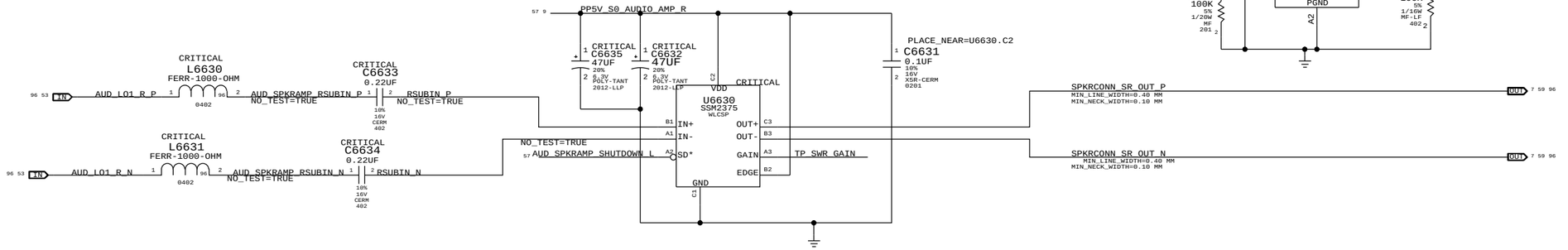
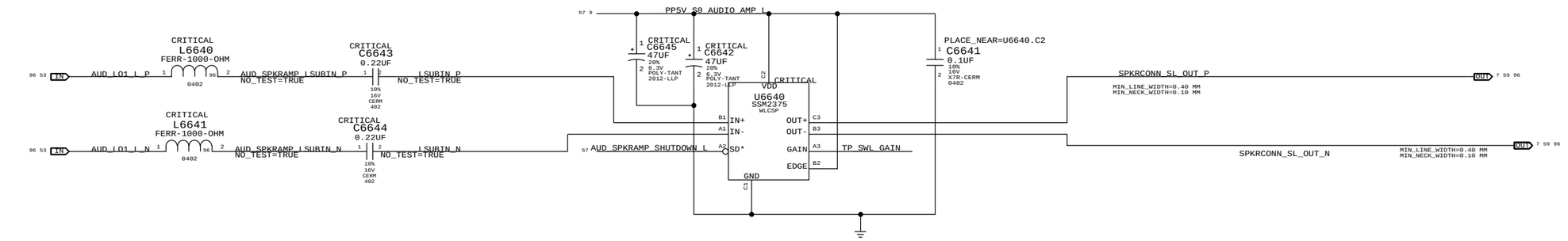
4X MONO SPEAKER AMPLIFIERS (MAX98300 & SSM2375)
APN: 353S2888 & 353S2958
GAIN = +3 DB
1ST ORDER FC (L&R) = NOM 569 HZ
1ST ORDER FC (SUB) = NOM 9 HZ









SYNC MASTER=D2_CARA
SYNC DATE=03/16/2012

PAGE TITLE
AUDIO: SPEAKER AMP

Apple Inc.

DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
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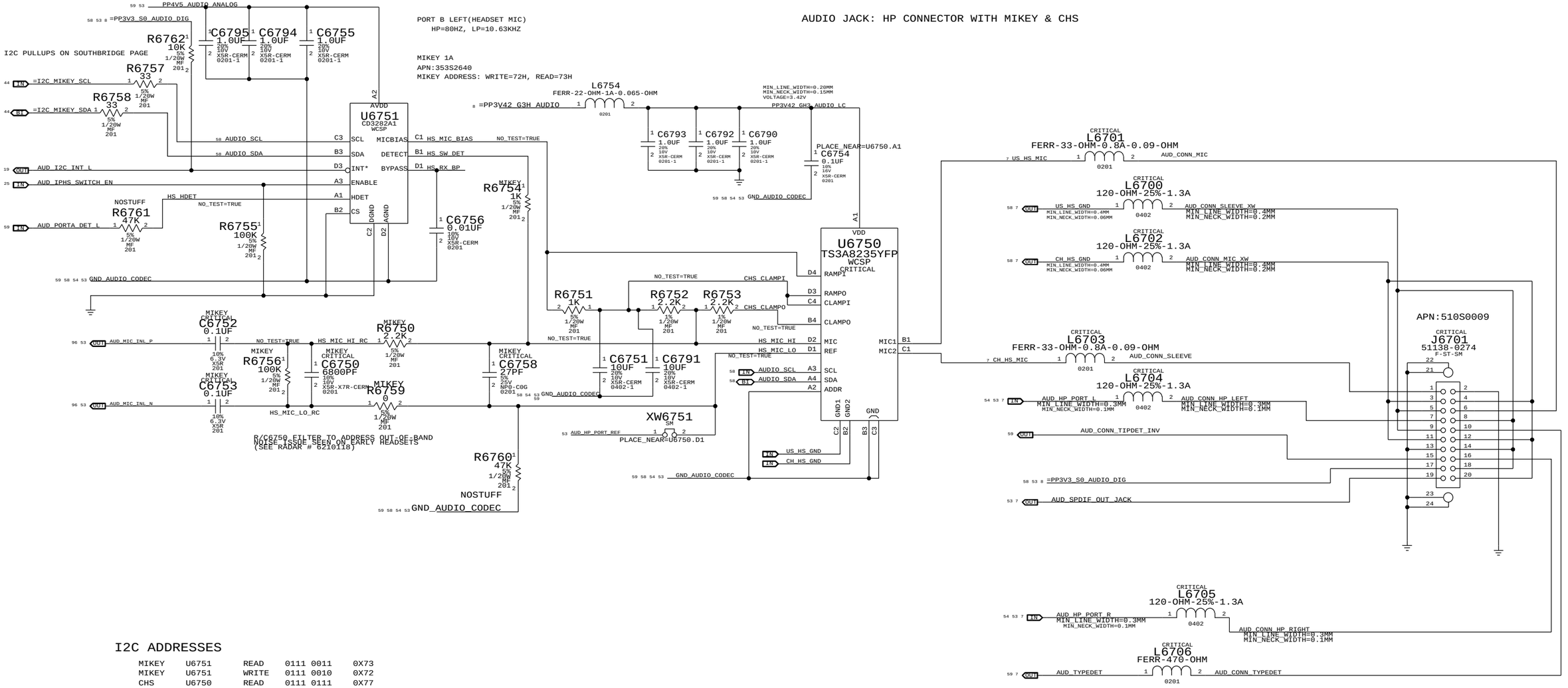
AUDIO JACK: HP CONNECTOR WITH MIKEY & CHS

PORT B LEFT(HEADSET MIC)
HP=80HZ, LP=10.63KHZ

MIKEY 1A
APN:353S2640
MIKEY ADDRESS: WRITE=72H, READ=73H

I2C PULLUPS ON SOUTHBRIDGE PAGE



I2C ADDRESSES

MIKEY	U6751	READ	0111 0011	0X73
MIKEY	U6751	WRITE	0111 0010	0X72
CHS	U6750	READ	0111 0111	0X77
CHS	U6750	WRITE	0111 0110	0X76

SYNC_MASTER=D2_CARA SYNC_DATE=03/16/2017

PAGE TITLE: AUDIO: JACK

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D
REVISION: 4.18.0
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CODEC OUTPUT SIGNAL PATHS

FUNCTION	VOLUME	CONVERTER	PIN COMPLEX	MUTE CONTROL	DET ASSIGNMENT
HP/LINE OUT	0X02 (2)	0X02 (2)	0X09 (9,A)	N/A	0X09 (B)
TWEETERS	0X04 (4)	0X04 (4)	0X0B (11)	GPIO_3	N/A
SUB	0X03 (3)	0X03 (03)	0X0A (10)	GPIO_3	N/A
SPDIF OUT	N/A	0X08 (8)	0X10 (16)	N/A	0X0C (A)

CODEC INPUT SIGNAL PATHS

FUNCTION	CONVERTER	PIN COMPLEX	VREF	DET ASSIGNMENT
DMIC 1	0X06 (6)	0X0E (D,E)	3V3	N/A
DMIC2	0X05 (5)	0X12 (12,C)	3V3	0X0C (12,C)
SPDIF IN	0X07 (7)	0X0F (15)	N/A	N/A
HEADSET MIC	0X06 (6)	0X0D (13,V22,B,LEFT)	MIKEY	MIKEY

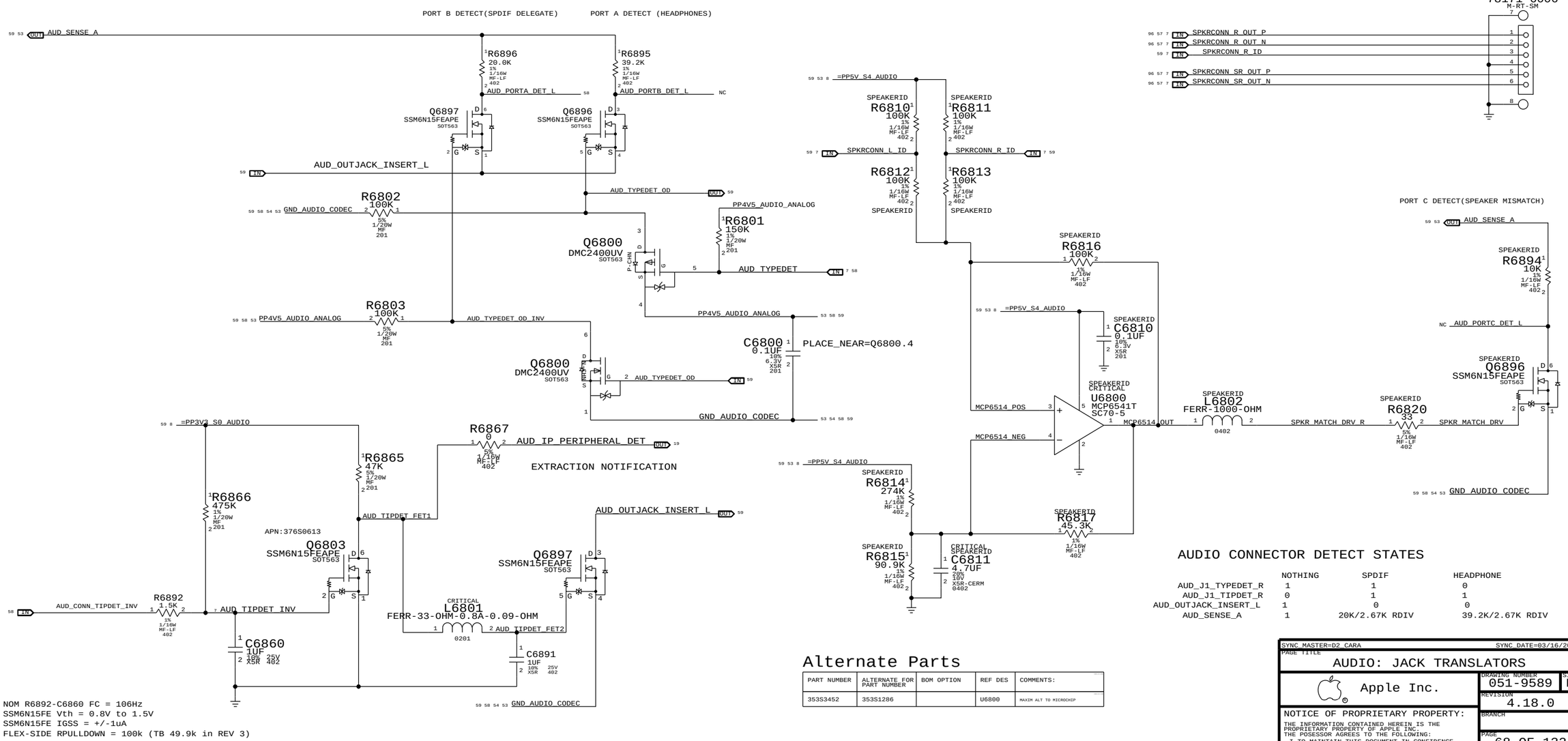
SYSTEM INT AND GPIO LINES

FUNCTION	INT	GPIO
MIKEY ENABLE		SATA4GP/GPIO 16
MIKEY INTERRUPT	PIRQ H	GPIO 5
PERIPHERAL DETECT	PIRQ F	GPIO 3

3-MIC CONNECTOR

SPEAKER CONNECTOR HP=80HZ

APN: 518S0627



AUDIO CONNECTOR DETECT STATES

	NOTHING	SPDIF	HEADPHONE
AUD_J1_TYPEDET_R	1	1	0
AUD_J1_TIPDET_R	0	1	1
AUD_OUTJACK_INSERT_L	1	0	0
AUD_SENSE_A	1	20K/2.67K RDIV	39.2K/2.67K RDIV

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
353S3452	353S1286		U6800	MAXIM ALT TO MICROCHIP

SYNC MASTER=D2_CARA SYNC_DATE=03/16/2012

PAGE TITLE: AUDIO: JACK TRANSLATORS

Apple Inc.

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MagSafe DC Power Jack

CRITICAL
F6905
6AMP-32V-0.00950HM
0603

=PP18V5_DCIN_CONN

CRITICAL
J6900
WTB-PWR-M82
M-RT-SM
518S0508

PP18V5_DCIN_FUSE
MIN_LINE_WIDTH=1MM
MIN_NECK_WIDTH=0.20MM
VOLTAGE=18.5V

C6905 0.01UF 20% 50V CERM 0603

TDM_ONEWIRE_MPM

=PP3V42_G3H_ONEWIREPROT

C6908 0.1UF 20% 10V CERM 402
PLACEMENT_NOTE=PLACE NEAR U6900 and U6901

CRITICAL
U6901
TC7SZ08FEAPE
SOT665

SMC_BC_ACOK_VCC

C6900 0.1UF 20% 10V CERM 402

R6929 2.0K 5% 1/16W MF-LF 402

SMC_BC_ACOK
IN 41 42

ADAPTER_SENSE

U6900
MAX9940
SC70-5
CRITICAL
EXT
INT
VCC
NC GND
NC

SYS_ONEWIRE
BI 41

1-Wire OverVoltage Protection

The chassis ground will otherwise float and can send transients onto ADAPTER_SENSE when AC is connected.

=PP3V42_G3H_TDM

TDM:MPM R6977 22 5% 1/20W MF 201

TDM:MLB R6975 2.21K 1% 1/20W MF 201

TDM:MLB R6976 22 5% 1/20W MF 201

SYS_TDM_ONEWIRE
BI 41

TDM_ONEWIRE_MLB

R6912 22.1K 1% 1/20W MF 201

Input impedance of 22.1K meets sparkitecture requirements for 15" MBP design only

TDM:MLB
U6970
SLG4AP030
TDFN
IN_A
IN_B1
IN_B2
OUT_C
OUT_D1
OUT_D2
CRITICAL
GND PAD
THRM PAD
VDD

TDM:MLB CRITICAL D6970 DDZ9694T SOD523

TDM_RX_D

TDM:MLB R6973 24.9K 1% 1/20W MF 201

TDM_RX

TDM:MLB R6974 6.34K 1% 1/20W MF 201

TDM_PD_BASE_R

TDM_PD_BASE

TDM:MLB R6972 54.9 1% 1/20W MF 201

TDM:MLB CRITICAL Q6970 ZXTN619MA DFN

TDM:MLB CRITICAL Q6971 MMBT2222AM3T5G SOT723

TDM_PD_DS

TDM:MLB R6971 12.1 1% 1/8W MF-LF 805

TDM:MLB R6970 12.1 1% 1/8W MF-LF 805

LAYOUT NOTE:
Q0220 NEEDS 10 SQ CM
OF 1 OZ CU FOR THERMAL

TDM LEVEL SHIFT

Q6910
SI5419DU
POWERPAK

R6910 100K 5% 1/20W MF 201

C6912 0.047UF 10% 25V X5R 0402

R6911 10K 5% 1/20W MF 201

DCIN_ISOL_GATE_R

DCIN_ISOL_GATE

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

=PP18V5_DCIN_ISOL

D6910
GDZT2R6.8
GDZ-0201
6.8V Zener

R6920 47 1% 1/3W MF 805

PP18V5_DCIN_CONN_R
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=18.5V

CRITICAL
D6905
BAT30CWFILM
SOT-323

R6905 10 5% 1/8W MF-LF 805

=PPBUS_G3H

PPBUS_G3H_R
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=18.5V

PPVIN_G3H_P3V42G3H
MIN_LINE_WIDTH=0.4 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=18.5V

BATTERY CONNECTOR

518-0376
CRITICAL
J6950
BAT-J5
F-ST-TH

POS 1
POS 2
POS 3
POS 4
SCL 5
SDA 6
SYS_DETECT 7
NEG 8
NEG 9
NEG 10
NEG 11

NC
NC

PPVBAT_G3H_CONN

=SMBUS_BATT_SCL
=SMBUS_BATT_SDA
SYS_DETECT_L

C6950 0.1UF 10% 25V X5R 402

C6960 1UF 10% 25V X5R 603-1

CRITICAL
D6950
RCLAMP2402B
SC-75

R6950 10K 5% 1/16W MF-LF 402

3.425V "G3Hot" Supply

Supply needs to guarantee 3.31V delivered to SMC VRef generator

C6990 4.7UF 10% 16V X5R-CERM 0603

C6991 4.7UF 10% 16V X5R-CERM 0603

NOSTUFF C6992 4.7UF 10% 16V X5R-CERM 0603

C6993 4.7UF 10% 16V X5R-CERM 0603

NOSTUFF C6996 4.7UF 10% 16V X5R-CERM 0603

NOSTUFF C6997 4.7UF 10% 16V X5R-CERM 0603

U6990
LT3470AED
DFN
VIN
BOOST
SHDN*
NC
SW
BIAS
FB
GND PAD
THRM PAD
CRITICAL

P3V42G3H_BOOST
DIDT=TRUE

C6994 0.22UF 10% 10V CERM 402

CRITICAL
L6995
33UH-20%-0.39A-0.435OHM
DP418C-SM

P3V42G3H_SW
MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm
SWITCH_NODE=TRUE
DIDT=TRUE

P3V42G3H_FB

C6995 22PF 5% 50V NP0-C0G-CERM 0201

<Ra>
R6995 348K 1% 1/20W MF 201

<Rb>
R6996 200K 1% 1/20W MF 201

C6999 22UF 20% 6.3V X5R-CERM-1 603

=PP3V42_G3H_REG

Vout = 3.425V
100MA MAX OUTPUT
(Switcher limit)

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

苹果笔记本维修交流群群号：325742634

SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012

PAGE TITLE
DC-In & Battery Connectors

Apple Inc.

DRAWING NUMBER 051-9589
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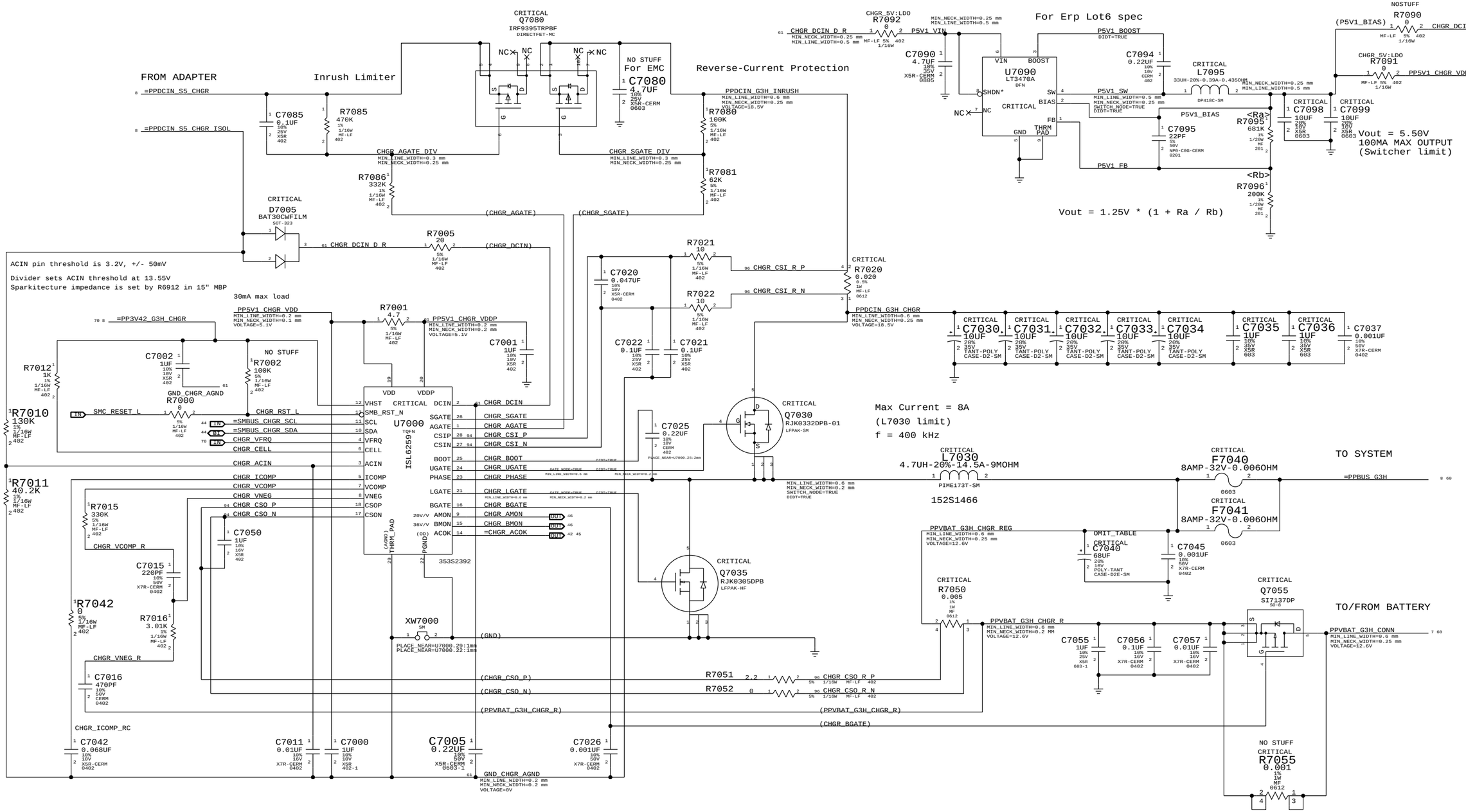

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

PBus Supply & Battery Charger

Apple Inc.

DRAWING NUMBER	051-9589
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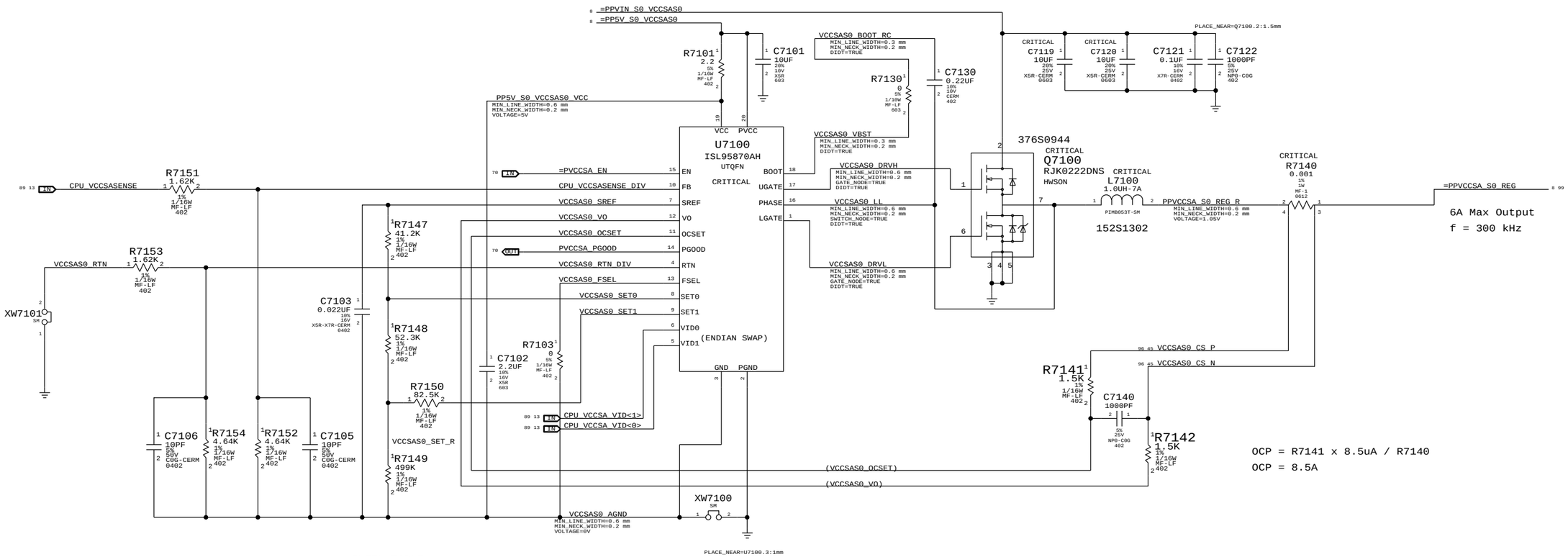

INTEL TABLE:

VID1	VID0	Voltage
0	0	0.9V
1	0	0.8V
0	1	0.725V
1	1	0.675V

fb = (R7151+R7152)/R7152 = 1.349 and Vref = 0.5;

VID1=1, VIC0=1:
Vout<1,1> = Vref x fb;

VID1=0, VID0=1:
Vout<0,1> = Vref x (1+R7147 / (R7148 + R7149)) x fb

VID1=1, VID0=0
Vout<1,0> = Vref x (1+ (R7147 + R7148) / R7149)) x fb

VID1=0, VID0=0
Vout<0,0> = Vref x (1+ (R7147 / (R7148 + R7149 // R7150)) x fb

SYNC MASTER=D2_KEPLER SYNC DATE=01/13/2012

PAGE TITLE

System Agent Supply

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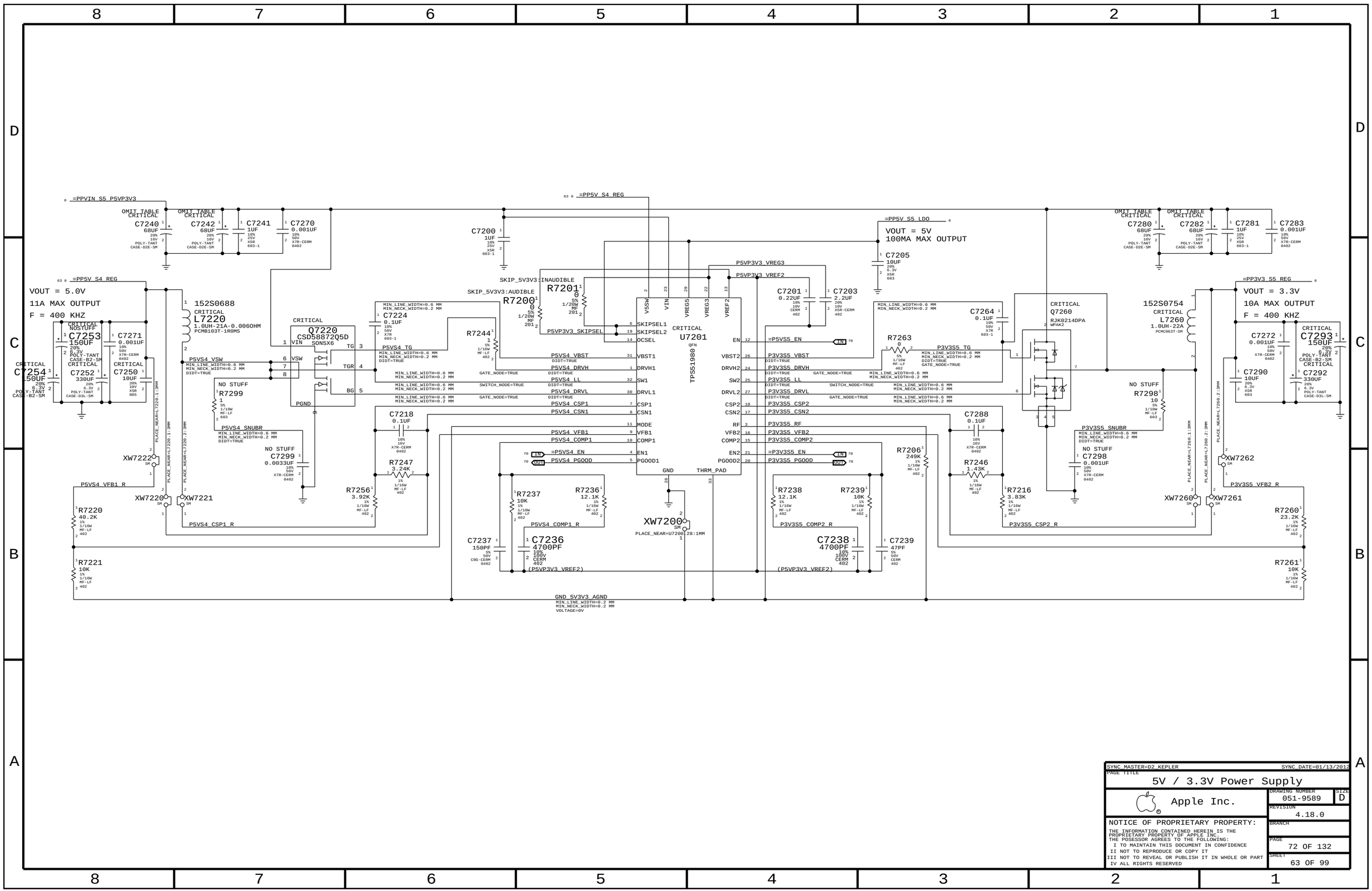

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: 5V / 3.3V Power Supply

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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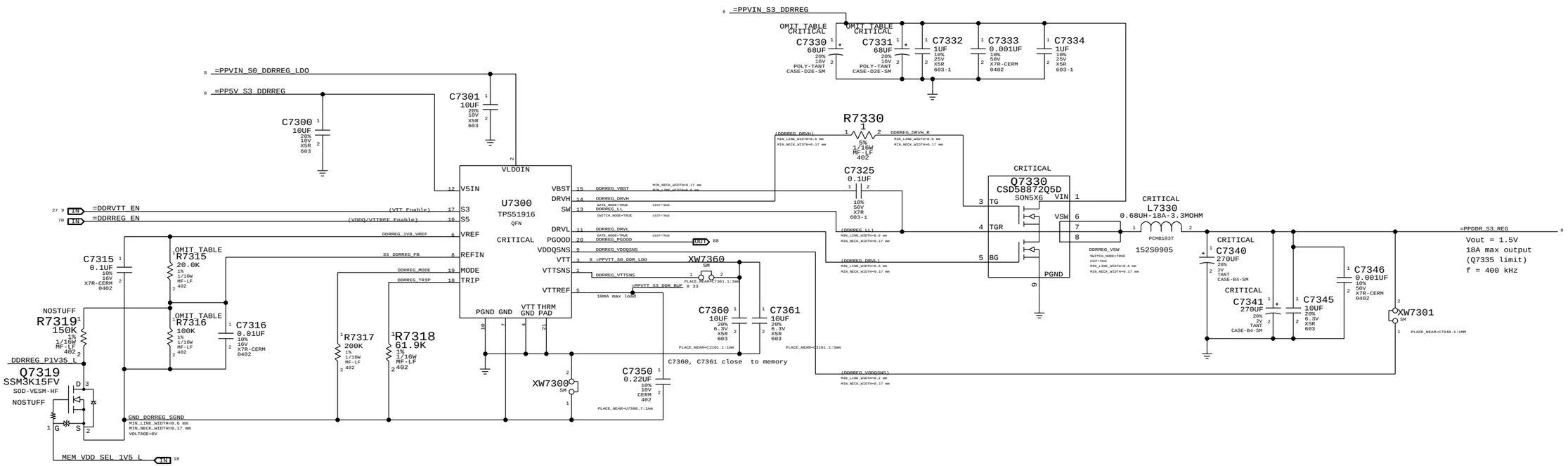
DDR3 (1V5R1V35 S3) REGULATOR



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0343	1	RES,MTL FILM,1/16W,20.0K,1,0402,SMD,LF	R7315		PPDDR:1V5
114S0342	1	RES,MTL FILM,1/16W,19.6K,1,0402,SMD,LF	R7315		PPDDR:1V35
114S0411	1	RES,MTL FILM,1/16W,100K,1,0402,SMD,LF	R7316		PPDDR:1V5
114S0389	1	RES,MTL FILM,1/16W,57.6K,1,0402,SMD,LF	R7316		PPDDR:1V35

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

1V5R1V35V DDR3 SUPPLY

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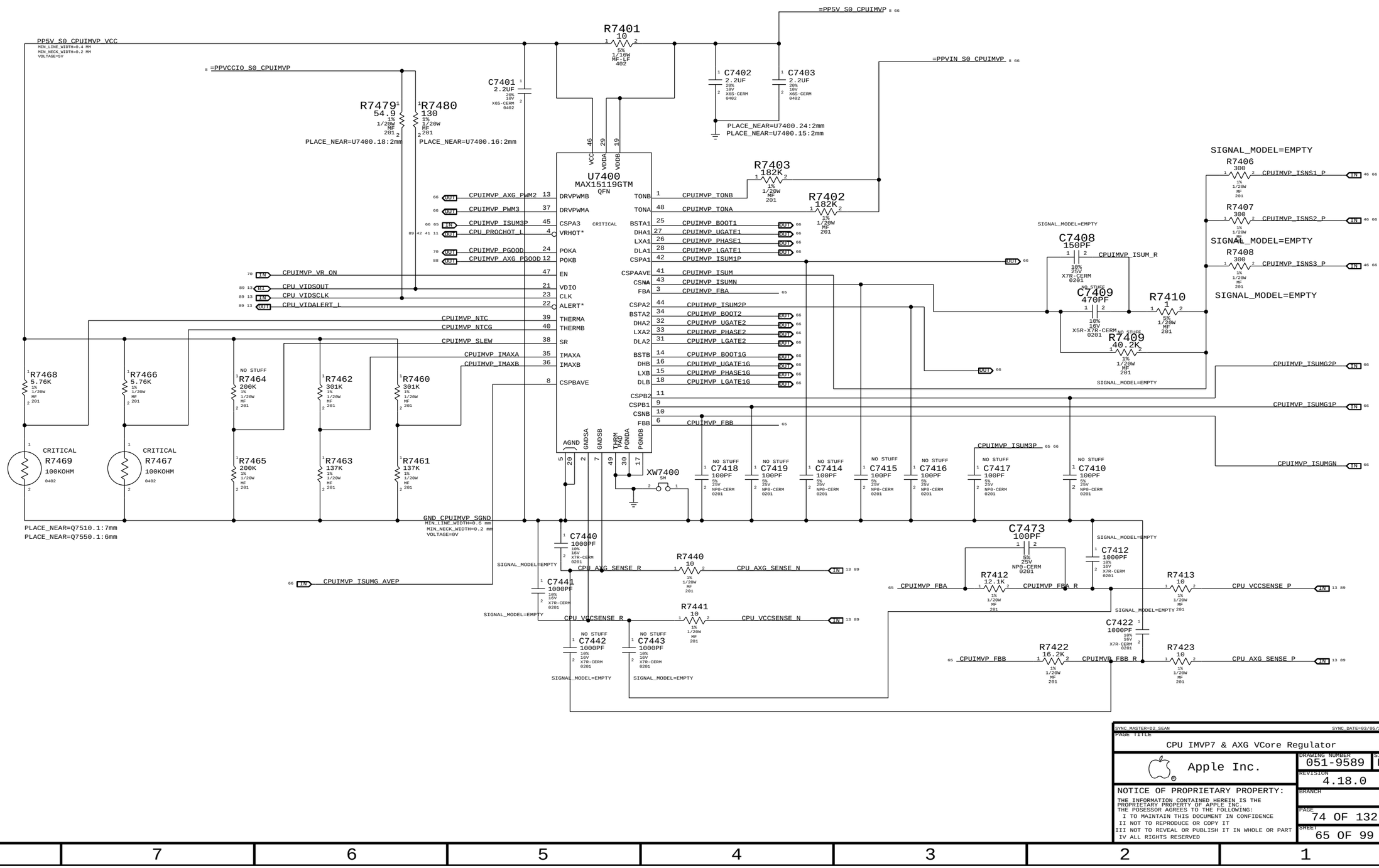
PP5V_S0_CPUIMVP_VCC
MIN_LINE_WIDTH=0.4 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=5V
=PPVCCIO_S0_CPUIMVP
=PP5V_S0_CPUIMVP
=PPVIN_S0_CPUIMVP
R7401 10 5% 1/16W MF-LF 402
C7401 2.2UF 20% 10V X6S-CERM 0402
C7402 2.2UF 20% 10V X6S-CERM 0402
C7403 2.2UF 20% 10V X6S-CERM 0402
PLACE_NEAR=U7400.24:2mm
PLACE_NEAR=U7400.15:2mm
R7479 54.9 1% 1/20W MF 201
R7480 130 1% 1/20W MF 201
PLACE_NEAR=U7400.18:2mm
PLACE_NEAR=U7400.16:2mm
U7400
MAX15119GTM
QFN
VCC
VDDA
VDDB
R7403 182K 1% 1/20W MF 201
R7402 182K 1% 1/20W MF 201
DRVPWMB
DRVPWMA
CSPA3
VRHOT*
POKA
POKB
EN
VDIO
CLK
ALERT*
THERMA
THERMB
SR
IMAXA
IMAXB
CSPBAVE
TONB
TONA
BSTA1
DHA1
LXA1
DLA1
CSPA1
CSPAAVE
CSNA
FBA
CSPA2
BSTA2
DHA2
LXA2
DLA2
BSTB
DHB
LXB
DLB
CSPB2
CSPB1
CSNB
FBB
CPUIMVP_AXG_PWM2
CPUIMVP_PWM3
CPUIMVP_ISUM3P
CPU_PROCHOT_L
CPUIMVP_PGOOD
CPUIMVP_AXG_PGOOD
CPUIMVP_VR_ON
CPU_VIDSOUT
CPU_VIDSCLK
CPU_VIDALERT_L
CPUIMVP_NTC
CPUIMVP_NTCG
CPUIMVP_SLEW
CPUIMVP_IMAXA
CPUIMVP_IMAXB
CPUIMVP_TONB
CPUIMVP_TONA
CPUIMVP_BOOT1
CPUIMVP_UGATE1
CPUIMVP_PHASE1
CPUIMVP_LGATE1
CPUIMVP_ISUM1P
CPUIMVP_ISUM
CPUIMVP_ISUMN
CPUIMVP_FBA
CPUIMVP_ISUM2P
CPUIMVP_BOOT2
CPUIMVP_UGATE2
CPUIMVP_PHASE2
CPUIMVP_LGATE2
CPUIMVP_BOOT1G
CPUIMVP_UGATE1G
CPUIMVP_PHASE1G
CPUIMVP_LGATE1G
CPUIMVP_FBB
AGND
GNDSA
GNDSB
PGND
PGNDA
PGNDB
XW7400
SM
R7468 5.76K 1% 1/20W MF 201
R7466 5.76K 1% 1/20W MF 201
R7464 200K 1% 1/20W MF 201
R7462 301K 1% 1/20W MF 201
R7460 301K 1% 1/20W MF 201
R7465 200K 1% 1/20W MF 201
R7463 137K 1% 1/20W MF 201
R7461 137K 1% 1/20W MF 201
CRITICAL
R7469 100KOHM 0402
CRITICAL
R7467 100KOHM 0402
NO STUFF
PLACE_NEAR=Q7510.1:7mm
PLACE_NEAR=Q7550.1:6mm
GND_CPUIMVP_SGND
MIN_LINE_WIDTH=0.6 mm
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=0V
C7440 1000PF 10% 16V X7R-CERM 0201
C7441 1000PF 10% 16V X7R-CERM 0201
C7442 1000PF 10% 16V X7R-CERM 0201
C7443 1000PF 10% 16V X7R-CERM 0201
R7440 10 1% 1/20W MF 201
R7441 10 1% 1/20W MF 201
CPU_AXG_SENSE_R
CPU_AXG_SENSE_N
CPU_VCCSENSE_R
CPU_VCCSENSE_N
CPUIMVP_ISUMG_AVEP
SIGNAL_MODEL=EMPTY
C7418 100PF 5% 25V NP0-CERM 0201
C7419 100PF 5% 25V NP0-CERM 0201
C7414 100PF 5% 25V NP0-CERM 0201
C7415 100PF 5% 25V NP0-CERM 0201
C7416 100PF 5% 25V NP0-CERM 0201
C7417 100PF 5% 25V NP0-CERM 0201
C7410 100PF 5% 25V NP0-CERM 0201
C7473 100PF 5% 25V NP0-CERM 0201
C7408 150PF 10% 25V X7R-CERM 0201
C7409 470PF 10% 16V X5R-X7R-CERM 0201
R7410 1 5% 1/20W MF 201
R7409 40.2K 1% 1/20W MF 201
R7412 12.1K 1% 1/20W MF 201
R7413 10 1% 1/20W MF 201
C7412 1000PF 10% 16V X7R-CERM 0201
C7422 1000PF 10% 16V X7R-CERM 0201
R7422 16.2K 1% 1/20W MF 201
R7423 10 1% 1/20W MF 201
CPUIMVP_ISUM_R
CPUIMVP_FBA_R
CPUIMVP_FBB_R
CPU_VCCSENSE_P
CPU_AXG_SENSE_P
CPUIMVP_ISUM3P
R7406 300 1% 1/20W MF 201
R7407 300 1% 1/20W MF 201
R7408 300 1% 1/20W MF 201
CPUIMVP_ISNS1_P
CPUIMVP_ISNS2_P
CPUIMVP_ISNS3_P
CPUIMVP_ISUMG2P
CPUIMVP_ISUMG1P
CPUIMVP_ISUMGN
SYNC_MASTER=D2_SEAN
SYNC_DATE=03/05/2013
PAGE TITLE
CPU IMVP7 & AXG VCore Regulator
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
BRANCH
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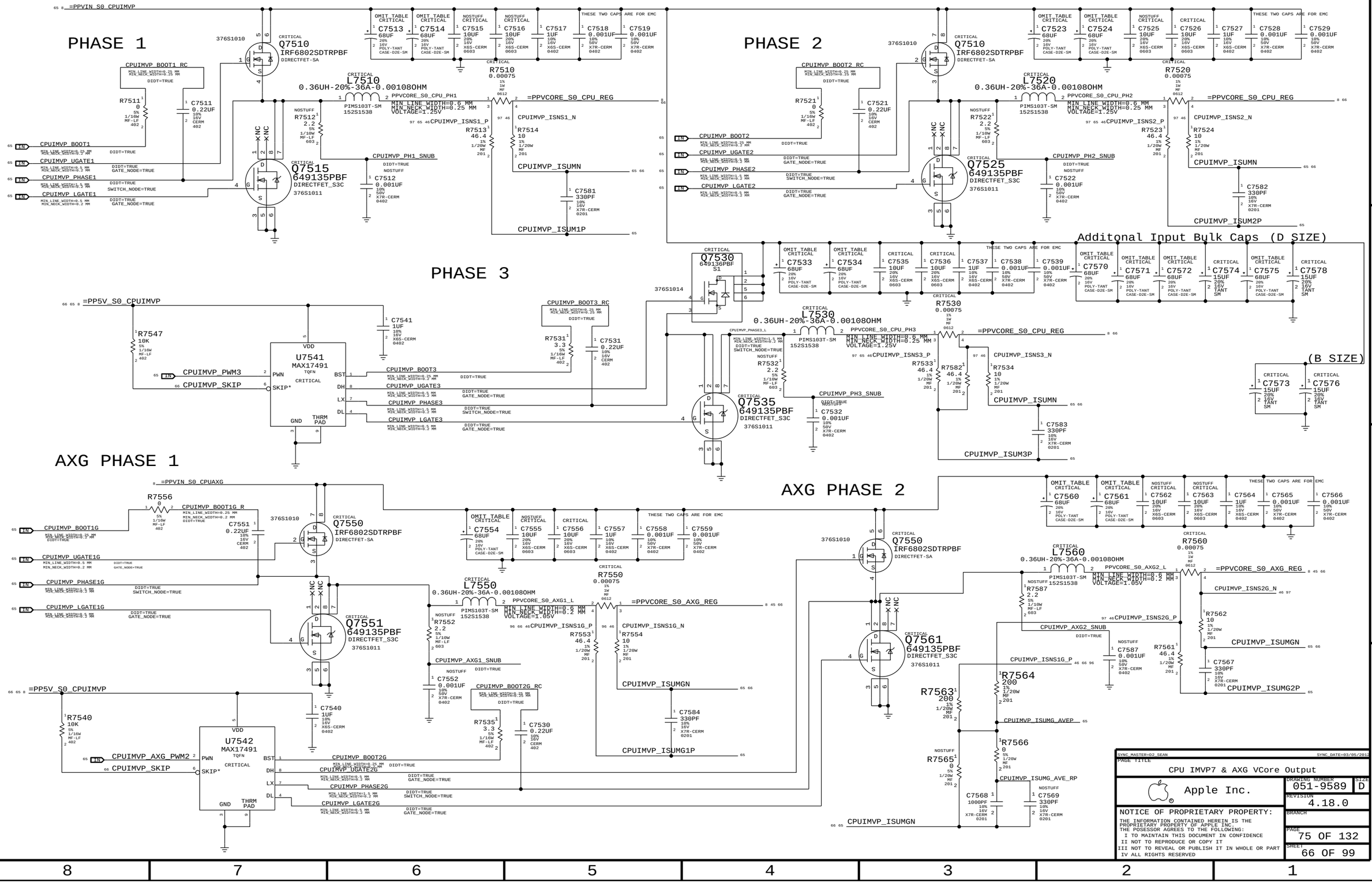
PHASE 1
PHASE 2
PHASE 3
AXG PHASE 1
AXG PHASE 2
Additonal Input Bulk Caps (D SIZE)
(B SIZE)
=PPVIN_S0_CPUIMVP
=PPV5V_S0_CPUIMVP
=PPVIN_S0_CPUAXG
=PPVCORE_S0_CPU_REG
=PPVCORE_S0_AXG_REG
376S1010
376S1011
376S1014
Q7510 IRF6802SDTRPBF DIRECTFET-SA
Q7515 649135PBF DIRECTFET_S3C
Q7525 649135PBF DIRECTFET_S3C
Q7530 649136PBF S1
Q7535 649135PBF DIRECTFET_S3C
Q7550 IRF6802SDTRPBF DIRECTFET-SA
Q7551 649135PBF DIRECTFET_S3C
Q7561 649135PBF DIRECTFET_S3C
U7541 MAX17491 TQFN
U7542 MAX17491 TQFN
L7510 0.36UH-20%-36A-0.001080HM PIMS103T-SM 152S1538
L7520 0.36UH-20%-36A-0.001080HM PIMS103T-SM 152S1538
L7530 0.36UH-20%-36A-0.001080HM PIMS103T-SM 152S1538
L7550 0.36UH-20%-36A-0.001080HM PIMS103T-SM 152S1538
L7560 0.36UH-20%-36A-0.001080HM PIMS103T-SM 152S1538
CPUIMVP_BOOT1
CPUIMVP_UGATE1
CPUIMVP_PHASE1
CPUIMVP_LGATE1
CPUIMVP_BOOT2
CPUIMVP_UGATE2
CPUIMVP_PHASE2
CPUIMVP_LGATE2
CPUIMVP_BOOT1_R
CPUIMVP_BOOT1G
CPUIMVP_UGATE1G
CPUIMVP_PHASE1G
CPUIMVP_LGATE1G
CPUIMVP_BOOT2_RC
CPUIMVP_BOOT3_RC
CPUIMVP_BOOT2G_RC
CPUIMVP_PWM3
CPUIMVP_SKIP
CPUIMVP_AXG_PWM2
CPUIMVP_BOOT3
CPUIMVP_UGATE3
CPUIMVP_PHASE3
CPUIMVP_LGATE3
CPUIMVP_BOOT2G
CPUIMVP_UGATE2G
CPUIMVP_PHASE2G
CPUIMVP_LGATE2G
CPUIMVP_PH1_SNUB
CPUIMVP_PH2_SNUB
CPUIMVP_PH3_SNUB
CPUIMVP_AXG1_SNUB
CPUIMVP_AXG2_SNUB
CPUIMVP_ISNS1_N
CPUIMVP_ISNS1_P
CPUIMVP_ISNS2_N
CPUIMVP_ISNS2_P
CPUIMVP_ISNS3_N
CPUIMVP_ISNS3_P
CPUIMVP_ISNS1G_N
CPUIMVP_ISNS1G_P
CPUIMVP_ISNS2G_N
CPUIMVP_ISNS2G_P
CPUIMVP_ISUMN
CPUIMVP_ISUM1P
CPUIMVP_ISUM2P
CPUIMVP_ISUM3P
CPUIMVP_ISUMGN
CPUIMVP_ISUMG1P
CPUIMVP_ISUMG2P
CPUIMVP_ISUMG_AVEP
CPUIMVP_ISUMG_AVE_RP
CPUIMVP_PHASE3_L
SYNC_MASTER=D2_SEAN
SYNC_DATE=03/05/2012
PAGE TITLE
CPU IMVP7 & AXG VCore Output
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
BRANCH
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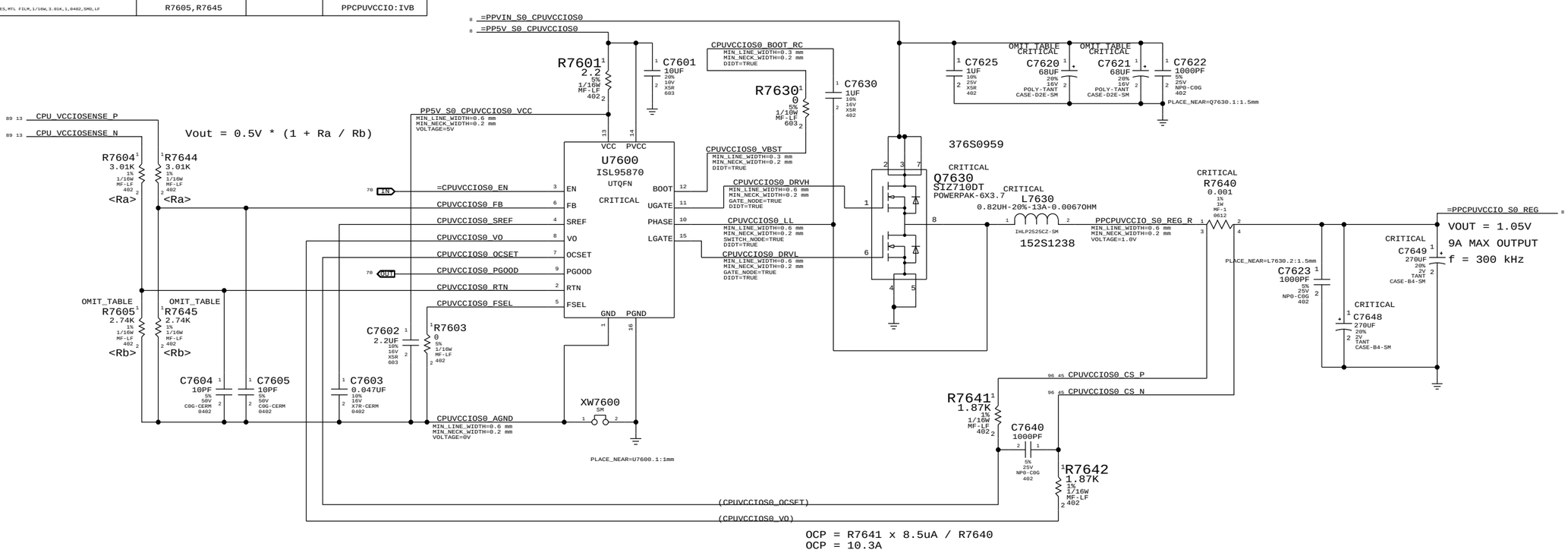
CPU VCCIO (1V0R1V05 S0) REGULATOR

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0260	2	RES,MTL FILM,1/16W,2.74K,1,0402,SMD,LF	R7605,R7645		PPCPUVCCIO:SNB
114S0264	2	RES,MTL FILM,1/16W,3.01K,1,0402,SMD,LF	R7605,R7645		PPCPUVCCIO:IVB



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

CPU VCCIO (1V0R1V05 S0) POWER SUPPLY

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D

REVISION 4.18.0

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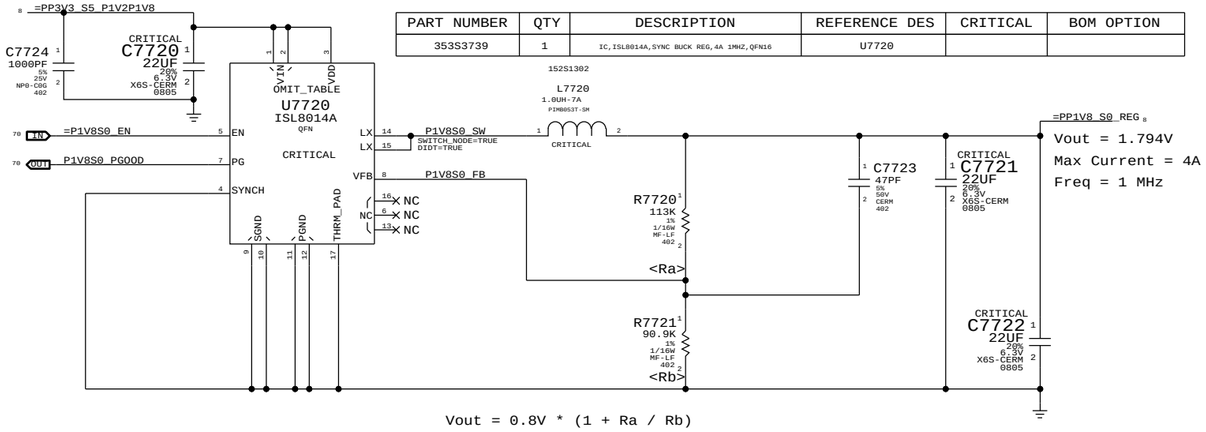
1.8V S0 Regulator

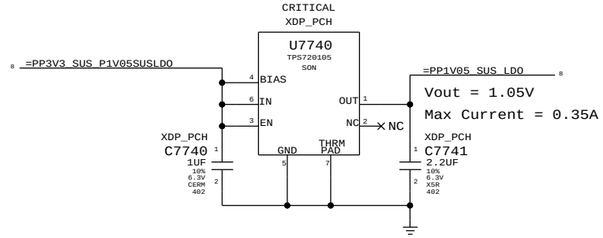


PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
353S3739	1	IC,ISL8014A,SYNC BUCK REG,4A 1MHZ,QFN16	U7720		

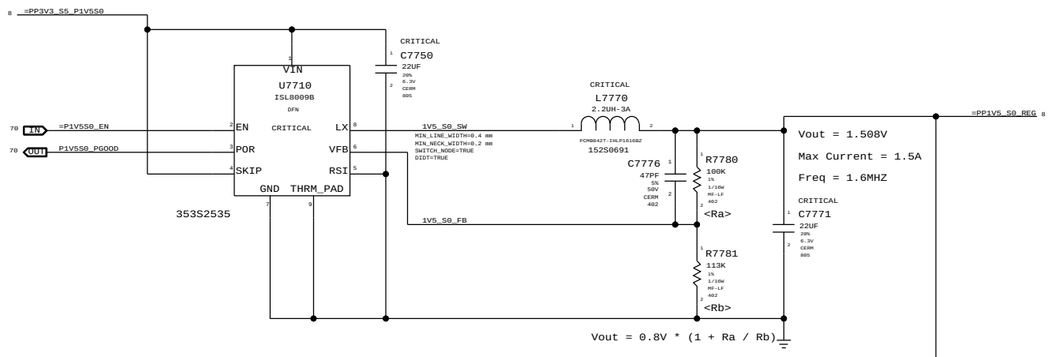
Vout = 0.8V * (1 + Ra / Rb)

1.05V SUS LDO

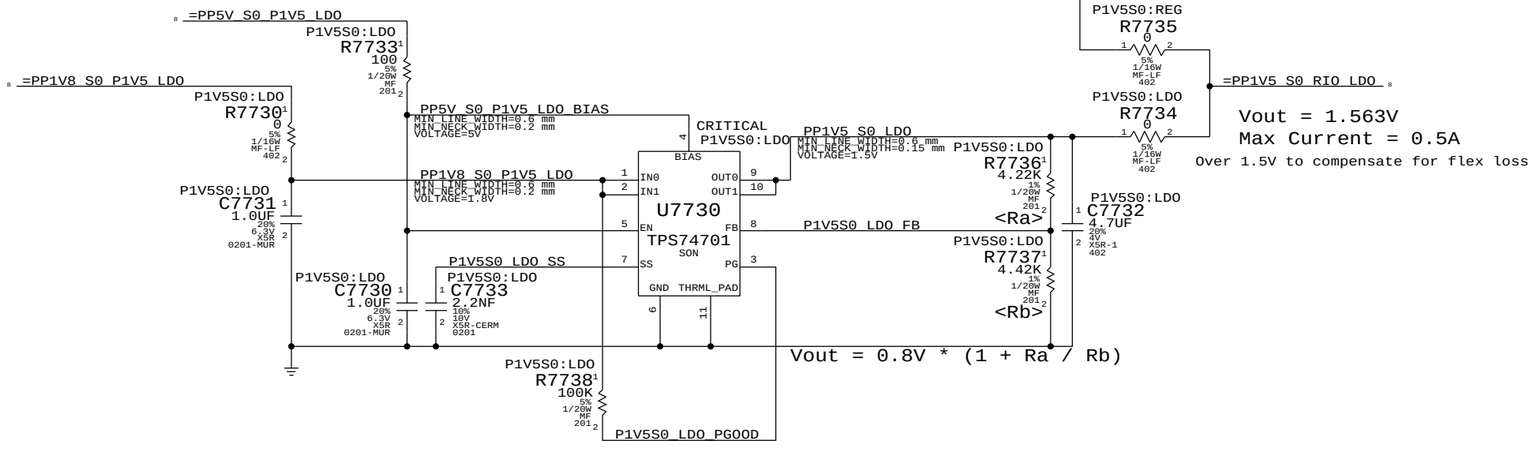
Panther Point-M requires JTAG pull-ups to be powered at 1.05V in Sus.
Pull-ups (3) must be 51 ohms to support XDP (not required in production).
70mA is required to support pull-ups. Alternative is strong voltage
dividers (200/100) to 3.3V Sus, which burns 100mW in all S-states.



1.5V S0 Regulator



1.5V S0 LDO (RIO)



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: Misc Power Supplies

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

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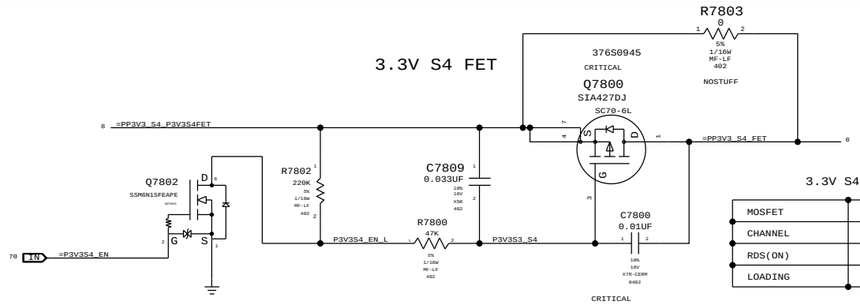
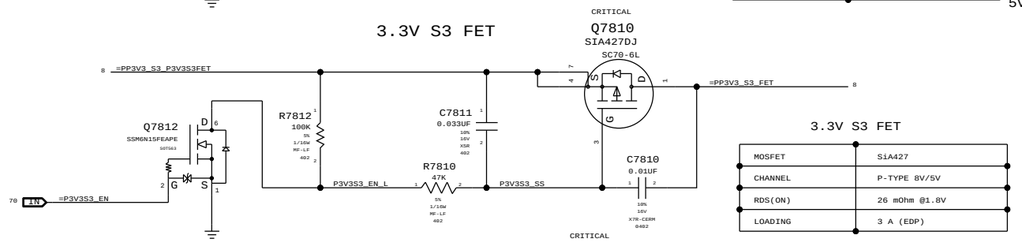
3.3V S4 FET



3.3V S4 FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	0.7? A (EDP)

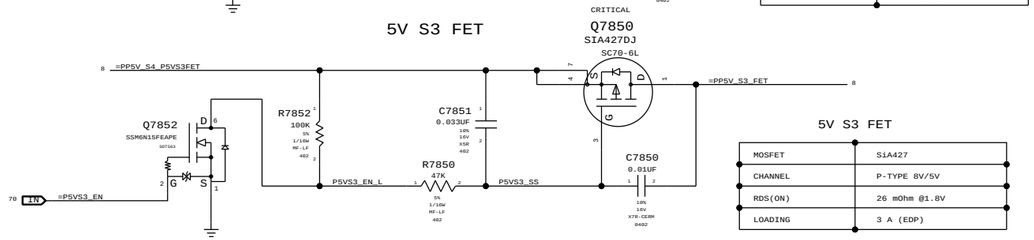
3.3V S3 FET



3.3V S3 FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	3 A (EDP)

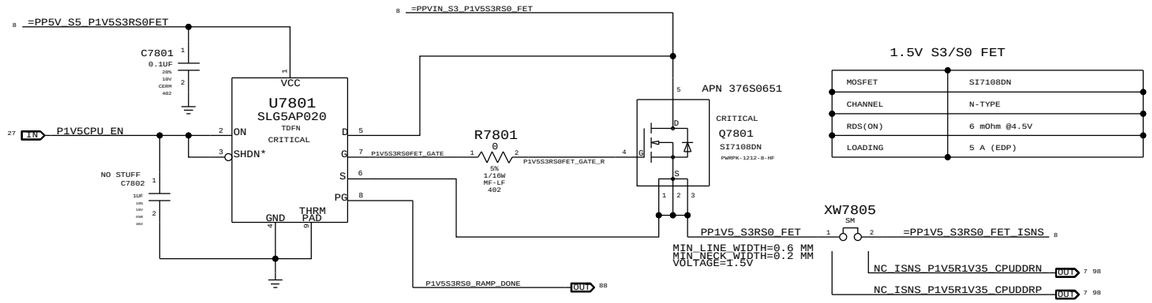
5V S3 FET



5V S3 FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	3 A (EDP)

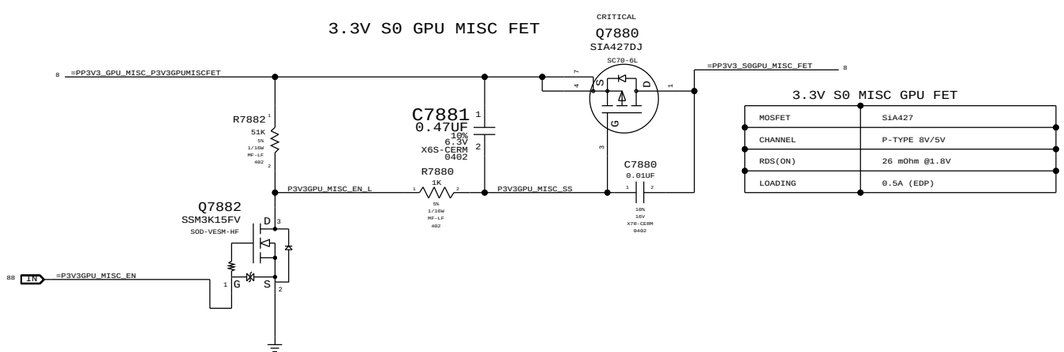
1.5V S3/S0 FET



1.5V S3/S0 FET

MOSFET	SI7108DN
CHANNEL	N-TYPE
RDS(ON)	6 mOhm @4.5V
LOADING	5 A (EDP)

3.3V S0 GPU MISC FET

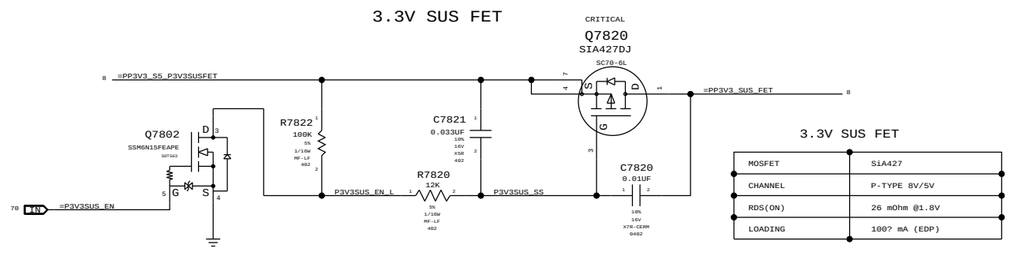


3.3V S0 MISC GPU FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	0.5A (EDP)

5V_SUS FET INPUT FILTER

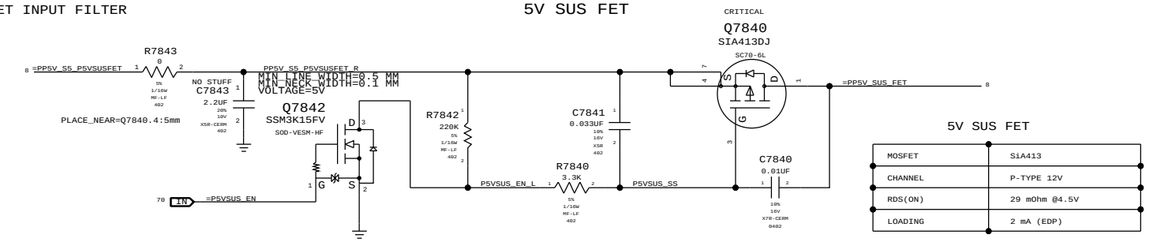
3.3V SUS FET



3.3V SUS FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	100? mA (EDP)

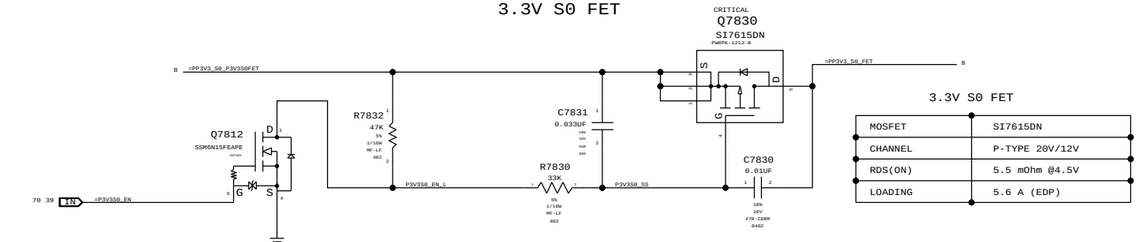
5V SUS FET



5V SUS FET

MOSFET	SiA413
CHANNEL	P-TYPE 12V
RDS(ON)	29 mOhm @4.5V
LOADING	2 mA (EDP)

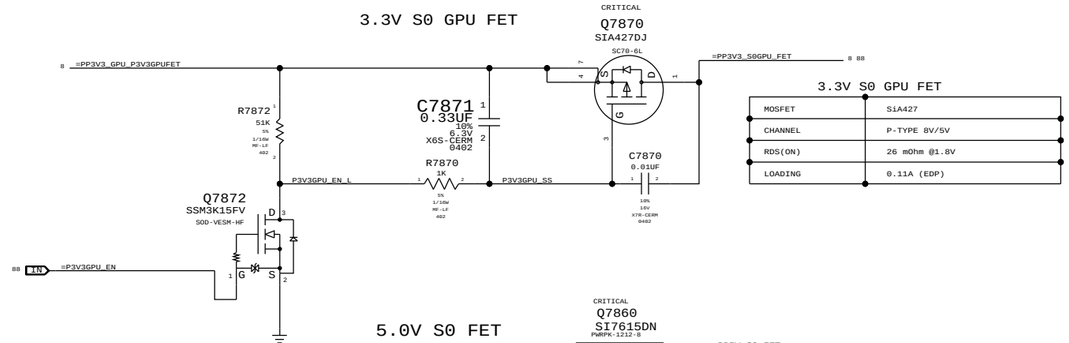
3.3V S0 FET



3.3V S0 FET

MOSFET	SI7615DN
CHANNEL	P-TYPE 20V/12V
RDS(ON)	5.5 mOhm @4.5V
LOADING	5.6 A (EDP)

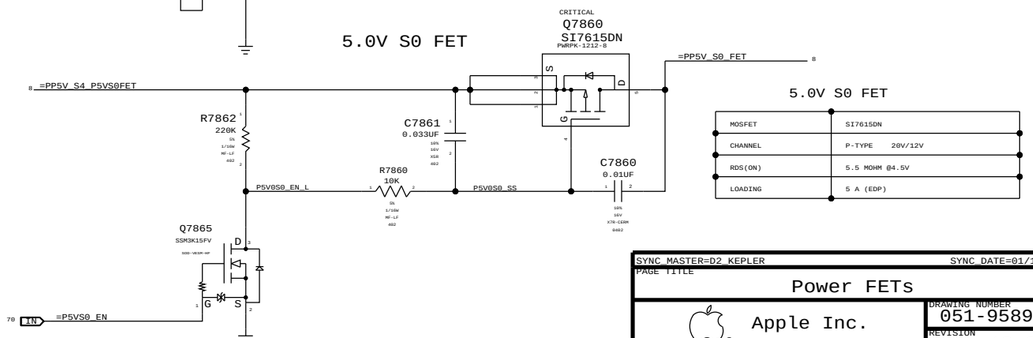
3.3V S0 GPU FET



3.3V S0 GPU FET

MOSFET	SiA427
CHANNEL	P-TYPE 8V/5V
RDS(ON)	26 mOhm @1.8V
LOADING	0.11A (EDP)

5.0V S0 FET



5.0V S0 FET

MOSFET	SI7615DN
CHANNEL	P-TYPE 20V/12V
RDS(ON)	5.5 MOHM @4.5V
LOADING	5 A (EDP)

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

Power FETs

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D

REVISION 4.18.0

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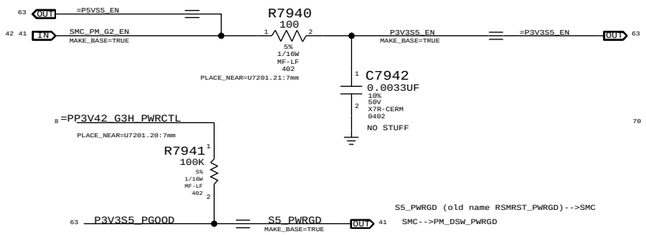
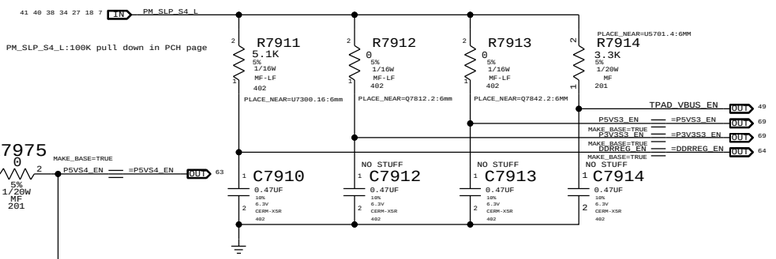
S5 Rail Enables & PGOOD



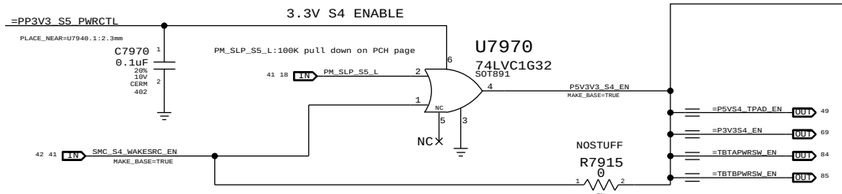
Mobile System Power State Table

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 (dS4AC)	1	1	1	0	0	0	0
Deep Sleep (dS4)	0	1	1	0	0	0	0
Deep Sleep (dS5AC)	1	1	0	0	0	0	0
Deep Sleep (dS5)	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

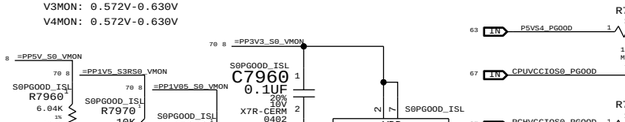
5V, 3.3V, DDR S3 ENABLE



3.3V S4 ENABLE

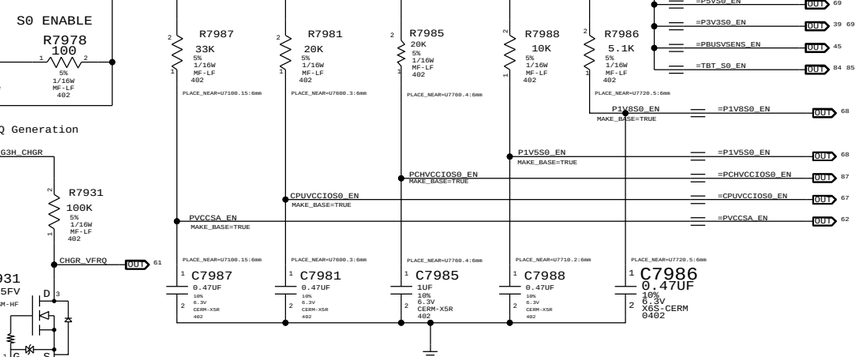


CPUVCORE ENABLE



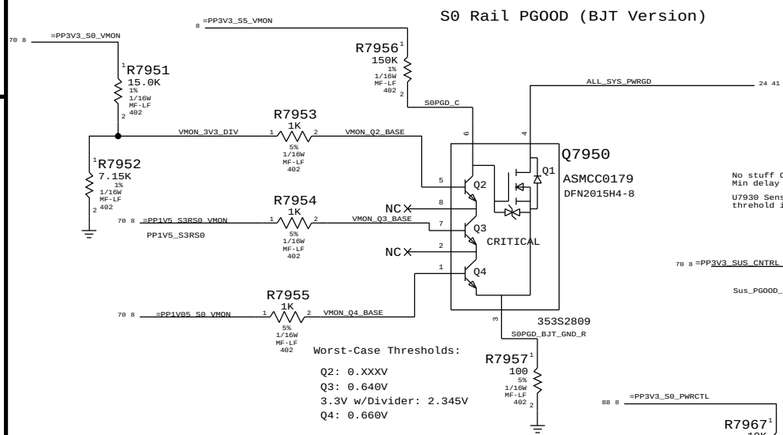
3.3V/5.0V Sus ENABLE

S0 ENABLE



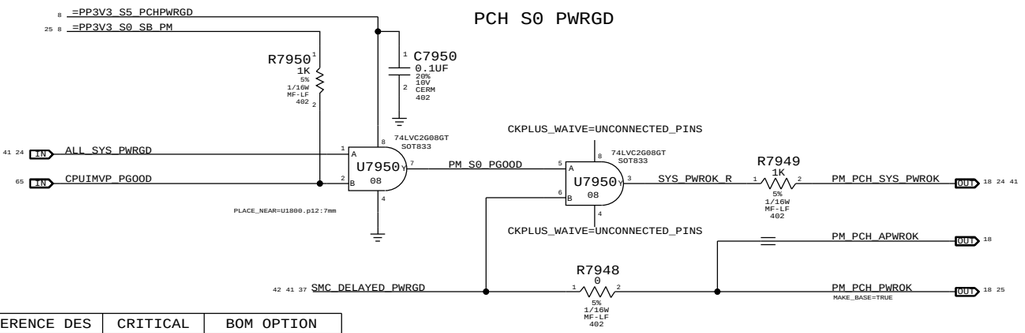
CHGR VFRQ Generation

S0 Rail PGOOD (BJT Version)



3.3V SUS Detect

PCH S0 PWRGD

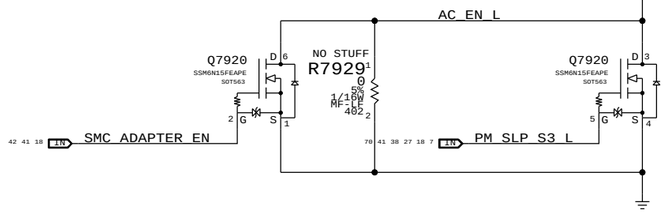


S0 Rail PGOOD Circuitry
(ISL Version in development)

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

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0315	1	RES,MTL FILM,1/16W,10K,1,0402,SMD,LF	R7971		PPDDR:1V5
114S0323	1	RES,MTL FILM,1/16W,12.4K,1,0402,SMD,LF	R7971		PPDDR:1V35

"WLAN" = ("S3" && "AP_PWR_EN" && ("AC" || "S0"))
NOTE: S3 term is guaranteed by S3 pull-up
on open-drain AP_PWR_EN signal.



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE
Power Control 1/ENABLE

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D
REVISION 4.18.0
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Page Notes

Power aliases required by this page:

- +PP3V3_GPU_VDD33

Signal aliases required by this page:

(NONE)

BOM options provided by this page:

(NONE)

C8020 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<0> (89 9 IN) → PEG_R2D_P<0> (71 88 89)

C8021 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<0> (89 9 IN) → PEG_R2D_N<0> (71 88 89)

C8022 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<1> (89 9 IN) → PEG_R2D_P<1> (71 89)

C8023 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<1> (89 9 IN) → PEG_R2D_N<1> (71 89)

C8024 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<2> (89 9 IN) → PEG_R2D_P<2> (71 89)

C8025 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<2> (89 9 IN) → PEG_R2D_N<2> (71 89)

C8026 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<3> (89 9 IN) → PEG_R2D_P<3> (71 88 89)

C8027 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<3> (89 9 IN) → PEG_R2D_N<3> (71 88 89)

C8028 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<4> (89 9 IN) → PEG_R2D_P<4> (71 89)

C8029 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<4> (89 9 IN) → PEG_R2D_N<4> (71 89)

C8030 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<5> (89 9 IN) → PEG_R2D_P<5> (71 88 89)

C8031 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<5> (89 9 IN) → PEG_R2D_N<5> (71 88 89)

C8032 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<6> (89 9 IN) → PEG_R2D_P<6> (71 89)

C8033 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<6> (89 9 IN) → PEG_R2D_N<6> (71 89)

C8034 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_P<7> (89 9 IN) → PEG_R2D_P<7> (71 88 89)

C8035 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_R2D_C_N<7> (89 9 IN) → PEG_R2D_N<7> (71 88 89)

C8055 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<0> (89 71) → PEG_D2R_P<0> (OUT 9 88 89)

C8056 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<0> (89 71) → PEG_D2R_N<0> (OUT 9 88 89)

C8057 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<1> (89 71) → PEG_D2R_P<1> (OUT 9 89)

C8058 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<1> (89 71) → PEG_D2R_N<1> (OUT 9 89)

C8059 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<2> (89 71) → PEG_D2R_P<2> (OUT 9 89)

C8060 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<2> (89 71) → PEG_D2R_N<2> (OUT 9 89)

C8061 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<3> (89 71) → PEG_D2R_P<3> (OUT 9 89)

C8062 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<3> (89 71) → PEG_D2R_N<3> (OUT 9 89)

C8063 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<4> (89 71) → PEG_D2R_P<4> (OUT 9 88 89)

C8064 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<4> (89 71) → PEG_D2R_N<4> (OUT 9 88 89)

C8065 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<5> (89 71) → PEG_D2R_P<5> (OUT 9 89)

C8066 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<5> (89 71) → PEG_D2R_N<5> (OUT 9 89)

C8067 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<6> (89 71) → PEG_D2R_P<6> (OUT 9 89)

C8068 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<6> (89 71) → PEG_D2R_N<6> (OUT 9 89)

C8069 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_P<7> (89 71) → PEG_D2R_P<7> (OUT 9 88 89)

C8070 0.22UF 1 2 20% 6.3V X6S-CERM 0201 GND_VOID=TRUE
PEG_D2R_C_N<7> (89 71) → PEG_D2R_N<7> (OUT 9 88 89)

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PEG_R2D_P<0> (89 88 71)	AN12	PEX_RX0	PEX_TX0	AK14	PEG_D2R_C_P<0> (71 89)
PEG_R2D_N<0> (89 88 71)	AM12	PEX_RX0*	PEX_TX0*	AJ14	PEG_D2R_C_N<0> (71 89)
PEG_R2D_P<1> (89 71)	AN14	PEX_RX1	PEX_TX1	AH14	PEG_D2R_C_P<1> (71 89)
PEG_R2D_N<1> (89 71)	AM14	PEX_RX1*	PEX_TX1*	AG14	PEG_D2R_C_N<1> (71 89)
PEG_R2D_P<2> (89 71)	AP14	PEX_RX2	PEX_TX2	AK15	PEG_D2R_C_P<2> (71 89)
PEG_R2D_N<2> (89 71)	AP15	PEX_RX2*	PEX_TX2*	AJ15	PEG_D2R_C_N<2> (71 89)
PEG_R2D_P<3> (89 88 71)	AN15	PEX_RX3	PEX_TX3	AL16	PEG_D2R_C_P<3> (71 89)
PEG_R2D_N<3> (89 88 71)	AM15	PEX_RX3*	PEX_TX3*	AK16	PEG_D2R_C_N<3> (71 89)
PEG_R2D_P<4> (89 71)	AN17	PEX_RX4	PEX_TX4	AK17	PEG_D2R_C_P<4> (71 89)
PEG_R2D_N<4> (89 71)	AM17	PEX_RX4*	PEX_TX4*	AJ17	PEG_D2R_C_N<4> (71 89)
PEG_R2D_P<5> (89 88 71)	AP17	PEX_RX5	PEX_TX5	AH17	PEG_D2R_C_P<5> (71 89)
PEG_R2D_N<5> (89 88 71)	AP18	PEX_RX5*	PEX_TX5*	AG17	PEG_D2R_C_N<5> (71 89)
PEG_R2D_P<6> (89 71)	AN18	PEX_RX6	PEX_TX6	AK18	PEG_D2R_C_P<6> (71 89)
PEG_R2D_N<6> (89 71)	AM18	PEX_RX6*	PEX_TX6*	AJ18	PEG_D2R_C_N<6> (71 89)
PEG_R2D_P<7> (89 88 71)	AN20	PEX_RX7	PEX_TX7	AL19	PEG_D2R_C_P<7> (71 89)
PEG_R2D_N<7> (89 88 71)	AM20	PEX_RX7*	PEX_TX7*	AK19	PEG_D2R_C_N<7> (71 89)
NC	AP20	PEX_RX8	PEX_TX8	AK20	NC
NC	AP21	PEX_RX8*	PEX_TX8*	AJ20	NC
NC	AN21	PEX_RX9	PEX_TX9	AH20	NC
NC	AM21	PEX_RX9*	PEX_TX9*	AG20	NC
NC	AN23	PEX_RX10	PEX_TX10	AK21	NC
NC	AM23	PEX_RX10*	PEX_TX10*	AJ21	NC
NC	AP23	PEX_RX11	PEX_TX11	AL22	NC
NC	AP24	PEX_RX11*	PEX_TX11*	AK22	NC
NC	AN24	PEX_RX12	PEX_TX12	AK23	NC
NC	AM24	PEX_RX12*	PEX_TX12*	AJ23	NC
NC	AN26	PEX_RX13	PEX_TX13	AH23	NC
NC	AM26	PEX_RX13*	PEX_TX13*	AG23	NC
NC	AP26	PEX_RX14	PEX_TX14	AK24	NC
NC	AP27	PEX_RX14*	PEX_TX14*	AJ24	NC
NC	AN27	PEX_RX15	PEX_TX15	AL25	NC
NC	AM27	PEX_RX15*	PEX_TX15*	AK25	NC
PEG_CLK100M_P (92 17 IN)	AL13	PEX_REFCLK	PEX_TSTCLK_OUT	AJ26	PEX_TSTCLK_O_P (95 92)
PEG_CLK100M_N (92 17 IN)	AK13	PEX_REFCLK*	PEX_TSTCLK_OUT*	AK26	PEX_TSTCLK_O_N (95 92)
GPU_RESET_L (78 9 IN) → R8000 0 MF 5% 1/20W 201 → GPU_RESET_R_L	AJ12	PEX_RST*	PEX_TERMP	AJ29	GPU_PEX_TERMP → R8005 2.49K 1% 1/20W MF 201
PEX_CLKREQ_L_R (78 71 OUT)	AK12	PEX_CLKREQ*			
NC	AJ11	PEX_WAKE*	PEX_SVDD_3V3	AG12	PP3V3_GPU_PEX_PLL_HVDD (79)

=PP3V3_GPU_VDD33 (79 78 77 8) → R8001 10K 1% 1/20W MF 201 → PEX_CLKREQ_L_R (78 71)

NOSTUFF R8002 200 1% 1/20W MF 201

SYNC_MASTER=D2_KEPLER		SYNC_DATE=01/13/2012	
PAGE TITLE	KEPLER PCI-E		
Apple Inc.		DRAWING NUMBER	051-9589
		SIZE	D
		REVISION	4.18.0
		BRANCH	
		PAGE	80 OF 132
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Page Notes

Power aliases required by this page:

- =PPVCORE_GPU
- =PP1V35_GPU_FBVDDQ

Signal aliases required by this page:

(NONE)

BOM options provided by this page:

(NONE)

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=PP1V35_GPU_FBVDDQ
76 75 72 8

AA27			H18
AA30			H19
AB27			H20
AB33			H21
AC27			H22
AD27			H23
AE27			H24
AF27			H8
AG27			H9
B13			L27
B16	FBVDDQ	FBVDDQ	M27
B19			N27
E13			P27
E16			R27
E19			T27
H10			T30
H11			T33
H12			V27
H13			W27
H14			W30
H15			W33
H16			Y27

=PP1V35_GPU_FBVDDQ
8 72 75 76

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=PPVCORE_GPU
79 72 8

AA12			V17
AA14			V18
AA16			V20
AA19			V22
AA21			W12
AA23			W14
AB13			W16
AB15		VDD	W19
AB17			W21
AB18			W23
AB20			Y13
AB22			Y15
AC12			Y17
AC14			Y18
AC16			Y20
AC19			Y22
AC21			U1 NC
AC23			U2 NC
M12			U3 NC
M14			U4 NC
M16			U5 NC
M19			U6 NC
M21			U7 NC
M23			U8 NC
N13			V1 NC
N15			V2 NC
N17		VDD	V3 NC
N18			V4 NC
N20			V5 NC
N22			V6 NC
P12			V7 NC
P14			V8 NC
P16			W2 NC
P19			W3 NC
P21			W4 NC
P23			W5 NC
R13			W7 NC
R15		XVDD	W8 NC
R17			Y1 NC
R18			Y2 NC
R20			Y3 NC
R22			Y4 NC
T12			Y5 NC
T14			Y6 NC
T16			Y7 NC
T19			Y8 NC
T21			AA1 NC
T23			AA2 NC
U13			AA3 NC
U15			AA4 NC
U17			AA5 NC
U18			AA6 NC
U20			AA7 NC
U22			AA8 NC
V13			
V15			

=PP1V35_GPU_FBVDDQ
76 75 72 8

GPU FB DE-COUPLING

EDP = 6500 MA

C8125 20UF 20% 4V X6T-CERM 0402	C8126 20UF 20% 4V X6T-CERM 0402	C8127 20UF 20% 4V X6T-CERM 0402	C8128 20UF 20% 4V X6T-CERM 0402	C8101 10UF 20% 4V X6S-CERM 0402-1	C8102 10UF 20% 4V X6S-CERM 0402-1	C8103 10UF 20% 4V X6S-CERM 0402-1	C8104 10UF 20% 4V X6S-CERM 0402-1
C8105 4.7UF 20% 6.3V X6S 0402	C8106 4.7UF 20% 6.3V X6S 0402	C8107 4.7UF 20% 6.3V X6S 0402	C8108 4.7UF 20% 6.3V X6S 0402	C8109 4.7UF 20% 6.3V X6S 0402	C8110 4.7UF 20% 6.3V X6S 0402	C8111 1UF 20% 4V CERM-X6S 0201	C8112 1UF 20% 4V CERM-X6S 0201	C8113 1UF 20% 4V CERM-X6S 0201	C8114 1UF 20% 4V CERM-X6S 0201
C8115 0.1UF 10% 6.3V X6S 0201	C8118 0.1UF 10% 6.3V X6S 0201	C8119 0.1UF 10% 6.3V X6S 0201	C8120 0.1UF 10% 6.3V X6S 0201	C8121 0.1UF 10% 6.3V X6S 0201	C8122 0.1UF 10% 6.3V X6S 0201	C8123 0.1UF 10% 6.3V X6S 0201	C8124 0.1UF 10% 6.3V X6S 0201

=PPVCORE_GPU
79 72 8

EDP = 30 A

NOSTUFF C8161 47UF 20% 4V X6S 0805	NOSTUFF CRITICAL C8198 22UF 20% 4V X6S-CERM 0603	NOSTUFF CRITICAL C8199 22UF 20% 4V X6S-CERM 0603	CRITICAL C8162 20UF 20% 4V X6T-CERM 0402	CRITICAL C8163 20UF 20% 4V X6T-CERM 0402	CRITICAL C8164 20UF 20% 4V X6T-CERM 0402	CRITICAL C8165 20UF 20% 4V X6T-CERM 0402	NOSTUFF CRITICAL C8182 20UF 20% 4V X6T-CERM 0402	NOSTUFF CRITICAL C8183 20UF 20% 4V X6T-CERM 0402	C8166 10UF 20% 4V X6S-CERM 0402-1	C8167 10UF 20% 4V X6S-CERM 0402-1
CRITICAL C8145 20UF 20% 4V X6T-CERM 0402	CRITICAL C8146 20UF 20% 4V X6T-CERM 0402	CRITICAL C8147 20UF 20% 4V X6T-CERM 0402	CRITICAL C8148 20UF 20% 4V X6T-CERM 0402	NOSTUFF CRITICAL C8149 20UF 20% 4V X6T-CERM 0402	NOSTUFF CRITICAL C8150 20UF 20% 4V X6T-CERM 0402	NOSTUFF CRITICAL C8151 20UF 20% 4V X6T-CERM 0402				
C8168 10UF 20% 4V X6S-CERM 0402-1	C8169 10UF 20% 4V X6S-CERM 0402-1	C8170 10UF 20% 4V X6S-CERM 0402-1	C8171 10UF 20% 4V X6S-CERM 0402-1	C8172 10UF 20% 4V X6S-CERM 0402-1	C8173 10UF 20% 4V X6S-CERM 0402-1	C8174 10UF 20% 4V X6S-CERM 0402-1	C8175 10UF 20% 4V X6S-CERM 0402-1	C8176 10UF 20% 4V X6S-CERM 0402-1	C8177 10UF 20% 4V X6S-CERM 0402-1	
C8178 10UF 20% 4V X6S-CERM 0402-1	C8179 10UF 20% 4V X6S-CERM 0402-1	C8180 10UF 20% 4V X6S-CERM 0402-1	C8181 10UF 20% 4V X6S-CERM 0402-1	C8184 10UF 20% 4V X6S-CERM 0402-1	C8185 10UF 20% 4V X6S-CERM 0402-1	CRITICAL C8186 1UF 20% 4V CERM-X6S 0201	CRITICAL C8187 1UF 20% 4V CERM-X6S 0201	CRITICAL C8188 1UF 20% 4V CERM-X6S 0201	CRITICAL C8189 1UF 20% 4V CERM-X6S 0201	
CRITICAL C8190 1UF 20% 4V CERM-X6S 0201	C8191 0.1UF 10% 6.3V X6S 0201	C8192 0.1UF 10% 6.3V X6S 0201	C8193 0.1UF 10% 6.3V X6S 0201	C8194 0.1UF 10% 6.3V X6S 0201	C8195 0.1UF 10% 6.3V X6S 0201	C8196 1000PF 10% 16V X7R-CERM 0201	C8197 1000PF 10% 16V X7R-CERM 0201			

GPU VCORE DE-COUPLING

NOTE: ATLEAST 2 GND VIAS & 2 POWER VIAS PER CAP

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

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KEPLER CORE/FB POWER

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D

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NOTE:GDDR5 MODE H MAPPING

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MEM INTERFACE A

FB_A0_DQ<0>	L28	FBA_D0	U30	FBA_CMD0	FB_A0_CS_L	
FB_A0_DQ<1>	M29	FBA_D1	T31	FBA_CMD1	FB_A0_A<3>	
FB_A0_DQ<2>	L29	FBA_D2	U29	FBA_CMD2	FB_A0_A<2>	
FB_A0_DQ<3>	M28	FBA_D3	R34	FBA_CMD3	FB_A0_A<4>	
FB_A0_DQ<4>	N31	FBA_D4	R33	FBA_CMD4	FB_A0_A<5>	
FB_A0_DQ<5>	P29	FBA_D5	U32	FBA_CMD5	FB_A0_WE_L	
FB_A0_DQ<6>	R29	FBA_D6	U33	FBA_CMD6	FB_A0_A<7>	
FB_A0_DQ<7>	P28	FBA_D7	U28	FBA_CMD7	FB_A0_A<6>	
FB_A0_DQ<8>	J28	FBA_D8	V28	FBA_CMD8	FB_A0_ABI_L	
FB_A0_DQ<9>	H29	FBA_D9	V29	FBA_CMD9	FB_A0_A<8>	
FB_A0_DQ<10>	J29	FBA_D10	V30	FBA_CMD10	FB_A0_A<0>	
FB_A0_DQ<11>	H28	FBA_D11	U34	FBA_CMD11	FB_A0_A<1>	
FB_A0_DQ<12>	G29	FBA_D12	U31	FBA_CMD12	FB_A0_RAS_L	
FB_A0_DQ<13>	E31	FBA_D13	V34	FBA_CMD13	FB_A0_RESET_L	
FB_A0_DQ<14>	E32	FBA_D14	V33	FBA_CMD14	FB_A0_CKE_L	
FB_A0_DQ<15>	F30	FBA_D15	Y32	FBA_CMD15	FB_A0_CAS_L	
FB_A0_DQ<16>	C34	FBA_D16	AA31	FBA_CMD16	FB_A1_CS_L	
FB_A0_DQ<17>	D32	FBA_D17	AA29	FBA_CMD17	FB_A1_A<3>	
FB_A0_DQ<18>	B33	FBA_D18	AA28	FBA_CMD18	FB_A1_A<2>	
FB_A0_DQ<19>	C33	FBA_D19	AC34	FBA_CMD19	FB_A1_A<4>	
FB_A0_DQ<20>	F33	FBA_D20	AC33	FBA_CMD20	FB_A1_A<5>	
FB_A0_DQ<21>	F32	FBA_D21	AA32	FBA_CMD21	FB_A1_WE_L	
FB_A0_DQ<22>	H33	FBA_D22	AA33	FBA_CMD22	FB_A1_A<7>	
FB_A0_DQ<23>	H32	FBA_D23	Y28	FBA_CMD23	FB_A1_A<6>	
FB_A0_DQ<24>	P34	FBA_D24	Y29	FBA_CMD24	FB_A1_ABI_L	
FB_A0_DQ<25>	P32	FBA_D25	W31	FBA_CMD25	FB_A1_A<8>	
FB_A0_DQ<26>	P31	FBA_D26	Y30	FBA_CMD26	FB_A1_A<0>	
FB_A0_DQ<27>	P33	FBA_D27	AA34	FBA_CMD27	FB_A1_A<1>	
FB_A0_DQ<28>	L31	FBA_D28	Y31	FBA_CMD28	FB_A1_RAS_L	
FB_A0_DQ<29>	L34	FBA_D29	Y34	FBA_CMD29	FB_A1_RESET_L	
FB_A0_DQ<30>	L32	FBA_D30	Y33	FBA_CMD30	FB_A1_CKE_L	
FB_A0_DQ<31>	L33	FBA_D31	V31	FBA_CMD31	FB_A1_CAS_L	
FB_A1_DQ<0>	AG28	FBA_D32				
FB_A1_DQ<1>	AF29	FBA_D33	R30	FBA_CLK0	FB_A0_CLK_P	
FB_A1_DQ<2>	AG29	FBA_D34	R31	FBA_CLK0*	FB_A0_CLK_N	
FB_A1_DQ<3>	AF28	FBA_D35	AB31	FBA_CLK1	FB_A1_CLK_P	
FB_A1_DQ<4>	AD30	FBA_D36	AC31	FBA_CLK1*	FB_A1_CLK_N	
FB_A1_DQ<5>	AD29	FBA_D37				
FB_A1_DQ<6>	AC29	FBA_D38	P30	FBA_DQM0	FB_A0_DBI_L<0>	
FB_A1_DQ<7>	AD28	FBA_D39	F31	FBA_DQM1	FB_A0_DBI_L<1>	
FB_A1_DQ<8>	AJ29	FBA_D40	F34	FBA_DQM2	FB_A0_DBI_L<2>	
FB_A1_DQ<9>	AK29	FBA_D41	M32	FBA_DQM3	FB_A0_DBI_L<3>	
FB_A1_DQ<10>	AJ30	FBA_D42	AD31	FBA_DQM4	FB_A1_DBI_L<0>	
FB_A1_DQ<11>	AK28	FBA_D43	AL29	FBA_DQM5	FB_A1_DBI_L<1>	
FB_A1_DQ<12>	AM29	FBA_D44	AM32	FBA_DQM6	FB_A1_DBI_L<2>	
FB_A1_DQ<13>	AM31	FBA_D45	AF34	FBA_DQM7	FB_A1_DBI_L<3>	
FB_A1_DQ<14>	AN29	FBA_D46				
FB_A1_DQ<15>	AM30	FBA_D47	M30	FBA_DQS_RN0	NC	
FB_A1_DQ<16>	AN31	FBA_D48	H30	FBA_DQS_RN1	NC	
FB_A1_DQ<17>	AN32	FBA_D49	E34	FBA_DQS_RN2	NC	
FB_A1_DQ<18>	AP30	FBA_D50	M34	FBA_DQS_RN3	NC	
FB_A1_DQ<19>	AP32	FBA_D51	AF30	FBA_DQS_RN4	NC	
FB_A1_DQ<20>	AM33	FBA_D52	AK31	FBA_DQS_RN5	NC	
FB_A1_DQ<21>	AL31	FBA_D53	AM34	FBA_DQS_RN6	NC	
FB_A1_DQ<22>	AK33	FBA_D54	AF32	FBA_DQS_RN7	NC	
FB_A1_DQ<23>	AK32	FBA_D55				
FB_A1_DQ<24>	AD34	FBA_D56	M31	FBA_DQS_WP0	FB_A0_EDC<0>	
FB_A1_DQ<25>	AD32	FBA_D57	G31	FBA_DQS_WP1	FB_A0_EDC<1>	
FB_A1_DQ<26>	AC30	FBA_D58	E33	FBA_DQS_WP2	FB_A0_EDC<2>	
FB_A1_DQ<27>	AD33	FBA_D59	M33	FBA_DQS_WP3	FB_A0_EDC<3>	
FB_A1_DQ<28>	AF31	FBA_D60	AE31	FBA_DQS_WP4	FB_A1_EDC<0>	
FB_A1_DQ<29>	AG34	FBA_D61	AK30	FBA_DQS_WP5	FB_A1_EDC<1>	
FB_A1_DQ<30>	AG32	FBA_D62	AN33	FBA_DQS_WP6	FB_A1_EDC<2>	
FB_A1_DQ<31>	AG33	FBA_D63	AF33	FBA_DQS_WP7	FB_A1_EDC<3>	
FB_A0_WCLK_P<0>	K31	FBA_WCK01	K27	FBA_DLL_AVDD	PP1V05_GPU_FB_DLL_AVDD	
FB_A0_WCLK_N<0>	L30	FBA_WCK01*	U27	FBA_PLL_AVDD	PP1V05_GPU_FB_PLL_AVDD	
FB_A0_WCLK_P<1>	H34	FBA_WCK23	R28	FBA_DEBUG	GPU_FBA_DEBUG0	
FB_A0_WCLK_N<1>	J34	FBA_WCK23*	AC28	FBA_DEBUG	GPU_FBA_DEBUG1	
FB_A1_WCLK_P<0>	AG30	FBA_WCK45	J27	FBA_CAL_PD_VDDQ	FB_CAL_PD_VDDQ	
FB_A1_WCLK_N<0>	AG31	FBA_WCK45*	H27	FBA_CAL_PU_GND	FB_CAL_PU_GND	
FB_A1_WCLK_P<1>	AJ34	FBA_WCK67	H25	FBA_CAL_TERM_GND	FB_CAL_TERM_GND	
FB_A1_WCLK_N<1>	AK34	FBA_WCK67*	E1	FB_CLAMP	FB_CLAMP	
	J30	FBA_WCKB01	R32	FBA_CMD_RFU	NC	
	J31	FBA_WCKB01*	AC32	FBA_CMD_RFU	NC	
	J32	FBA_WCKB23	F1	FB_VDDQ_SENSE	GPU_FBVDDQ_SENSE	
	J33	FBA_WCKB23*	F2	FB_GND_SENSE	GPU_FBGND_SENSE	
	AH31	FBA_WCKB45				
	AJ31	FBA_WCKB45*				
	AJ32	FBA_WCKB67				
	AJ33	FBA_WCKB67*				

FB_A0_RESET_L — R8250 10K 1% 1/20W MF 201

FB_A1_RESET_L — R8251 10K 1% 1/20W MF 201

FB_A0_CKE_L — R8252 10K 1% 1/20W MF 201

FB_A1_CKE_L — R8253 10K 1% 1/20W MF 201

FB VREF GEN (TEST ONLY)

=PP1V35_GPU_S0_FB — NOSTUFF R8258 1.33K 1% 1/20W MF 201 — PLACE_NEAR=U8000.H26:8.4MM

FB_VREF — NOSTUFF R8259 1.33K 1% 1/20W MF 201 — PLACE_NEAR=U8000.H26:8.4MM

NOSTUFF C8260 0.1UF 10% 6.3V X6S 0201 — PLACE_NEAR=U8000.H26:8.4MM

=PP1V35_GPU_S0_FB — R8203 60.4 1% 1/20W MF 201; R8202 60.4 1% 1/20W MF 201; R8270 100 5% 1/20W MF 201

FB_CAL_TERM_GND — R8201 60.4 1% 1/20W MF 201 — PLACE_NEAR=U8000.H25:8.4MM

FB_CLAMP — R8261 10K MF 1% 1/20W 201

PLACE CLOSE TO BGA

FB_CAL_PU_GND — R8204 40.2 1% 1/20W MF 201 — PLACE_NEAR=U8000.H27:8.4MM

=PP1V35_GPU_S0_FB — R8205 40.2 1% 1/20W MF 201 — PLACE_NEAR=U8000.J27:8.4MM

FB_CAL_PD_VDDQ

R8271 100 5% 1/20W MF 201

OMIT_TABLE

U8000
NV-GK107
BGA
(4 OF 10)
MEM INTRERFACE B

FB_B0_DQ<0>	G9	FBB_D0	D13	FBB_CMD0	FB_B0_CS_L	
FB_B0_DQ<1>	E9	FBB_D1	E14	FBB_CMD1	FB_B0_A<3>	
FB_B0_DQ<2>	G8	FBB_D2	F14	FBB_CMD2	FB_B0_A<2>	
FB_B0_DQ<3>	F9	FBB_D3	A12	FBB_CMD3	FB_B0_A<4>	
FB_B0_DQ<4>	F11	FBB_D4	B12	FBB_CMD4	FB_B0_A<5>	
FB_B0_DQ<5>	G11	FBB_D5	C14	FBB_CMD5	FB_B0_WE_L	
FB_B0_DQ<6>	F12	FBB_D6	B14	FBB_CMD6	FB_B0_A<7>	
FB_B0_DQ<7>	G12	FBB_D7	G15	FBB_CMD7	FB_B0_A<6>	
FB_B0_DQ<8>	G6	FBB_D8	F15	FBB_CMD8	FB_B0_ABI_L	
FB_B0_DQ<9>	F5	FBB_D9	E15	FBB_CMD9	FB_B0_A<8>	
FB_B0_DQ<10>	E6	FBB_D10	D15	FBB_CMD10	FB_B0_A<0>	
FB_B0_DQ<11>	F6	FBB_D11	A14	FBB_CMD11	FB_B0_A<1>	
FB_B0_DQ<12>	F4	FBB_D12	D14	FBB_CMD12	FB_B0_RAS_L	
FB_B0_DQ<13>	G4	FBB_D13	A15	FBB_CMD13	FB_B0_RESET_L	
FB_B0_DQ<14>	E2	FBB_D14	B15	FBB_CMD14	FB_B0_CKE_L	
FB_B0_DQ<15>	F3	FBB_D15	C17	FBB_CMD15	FB_B0_CAS_L	
FB_B0_DQ<16>	C2	FBB_D16	D18	FBB_CMD16	FB_B1_CS_L	
FB_B0_DQ<17>	D4	FBB_D17	E18	FBB_CMD17	FB_B1_A<3>	
FB_B0_DQ<18>	D3	FBB_D18	F18	FBB_CMD18	FB_B1_A<2>	
FB_B0_DQ<19>	C1	FBB_D19	A20	FBB_CMD19	FB_B1_A<4>	
FB_B0_DQ<20>	B3	FBB_D20	B20	FBB_CMD20	FB_B1_A<5>	
FB_B0_DQ<21>	C4	FBB_D21	C18	FBB_CMD21	FB_B1_WE_L	
FB_B0_DQ<22>	B5	FBB_D22	B18	FBB_CMD22	FB_B1_A<7>	
FB_B0_DQ<23>	C5	FBB_D23	G18	FBB_CMD23	FB_B1_A<6>	
FB_B0_DQ<24>	A11	FBB_D24	G17	FBB_CMD24	FB_B1_ABI_L	
FB_B0_DQ<25>	C11	FBB_D25	F17	FBB_CMD25	FB_B1_A<8>	
FB_B0_DQ<26>	D11	FBB_D26	D16	FBB_CMD26	FB_B1_A<0>	
FB_B0_DQ<27>	B11	FBB_D27	A18	FBB_CMD27	FB_B1_A<1>	
FB_B0_DQ<28>	D8	FBB_D28	D17	FBB_CMD28	FB_B1_RAS_L	
FB_B0_DQ<29>	A8	FBB_D29	A17	FBB_CMD29	FB_B1_RESET_L	
FB_B0_DQ<30>	C8	FBB_D30	B17	FBB_CMD30	FB_B1_CKE_L	
FB_B0_DQ<31>	B8	FBB_D31	E17	FBB_CMD31	FB_B1_CAS_L	
FB_B1_DQ<0>	F24	FBB_D32				
FB_B1_DQ<1>	G23	FBB_D33	D12	FBB_CLK0	FB_B0_CLK_P	
FB_B1_DQ<2>	E24	FBB_D34	E12	FBB_CLK0*	FB_B0_CLK_N	
FB_B1_DQ<3>	G24	FBB_D35	E20	FBB_CLK1	FB_B1_CLK_P	
FB_B1_DQ<4>	D21	FBB_D36	F20	FBB_CLK1*	FB_B1_CLK_N	
FB_B1_DQ<5>	E21	FBB_D37				
FB_B1_DQ<6>	G21	FBB_D38	E11	FBB_DQM0	FB_B0_DBI_L<0>	
FB_B1_DQ<7>	F21	FBB_D39	E3	FBB_DQM1	FB_B0_DBI_L<1>	
FB_B1_DQ<8>	G27	FBB_D40	A3	FBB_DQM2	FB_B0_DBI_L<2>	
FB_B1_DQ<9>	D27	FBB_D41	C9	FBB_DQM3	FB_B0_DBI_L<3>	
FB_B1_DQ<10>	G26	FBB_D42	F23	FBB_DQM4	FB_B1_DBI_L<0>	
FB_B1_DQ<11>	E27	FBB_D43	F27	FBB_DQM5	FB_B1_DBI_L<1>	
FB_B1_DQ<12>	E29	FBB_D44	C30	FBB_DQM6	FB_B1_DBI_L<2>	
FB_B1_DQ<13>	F29	FBB_D45	A24	FBB_DQM7	FB_B1_DBI_L<3>	
FB_B1_DQ<14>	E30	FBB_D46				
FB_B1_DQ<15>	D30	FBB_D47	D9	FBB_DQS_RN0	NC	
FB_B1_DQ<16>	A32	FBB_D48	E4	FBB_DQS_RN1	NC	
FB_B1_DQ<17>	C31	FBB_D49	B2	FBB_DQS_RN2	NC	
FB_B1_DQ<18>	C32	FBB_D50	A9	FBB_DQS_RN3	NC	
FB_B1_DQ<19>	B32	FBB_D51	D22	FBB_DQS_RN4	NC	
FB_B1_DQ<20>	D29	FBB_D52	D28	FBB_DQS_RN5	NC	
FB_B1_DQ<21>	A29	FBB_D53	A30	FBB_DQS_RN6	NC	
FB_B1_DQ<22>	C29	FBB_D54	B23	FBB_DQS_RN7	NC	
FB_B1_DQ<23>	B29	FBB_D55				
FB_B1_DQ<24>	B21	FBB_D56	D10	FBB_DQS_WP0	FB_B0_EDC<0>	
FB_B1_DQ<25>	C23	FBB_D57	D5	FBB_DQS_WP1	FB_B0_EDC<1>	
FB_B1_DQ<26>	A21	FBB_D58	C3	FBB_DQS_WP2	FB_B0_EDC<2>	
FB_B1_DQ<27>	C21	FBB_D59	B9	FBB_DQS_WP3	FB_B0_EDC<3>	
FB_B1_DQ<28>	B24	FBB_D60	E23	FBB_DQS_WP4	FB_B1_EDC<0>	
FB_B1_DQ<29>	C24	FBB_D61	E28	FBB_DQS_WP5	FB_B1_EDC<1>	
FB_B1_DQ<30>	B26	FBB_D62	B30	FBB_DQS_WP6	FB_B1_EDC<2>	
FB_B1_DQ<31>	C26	FBB_D63	A23	FBB_DQS_WP7	FB_B1_EDC<3>	
FB_B0_WCLK_P<0>	F8	FBB_WCK01	H17	FBB_PLL_AVDD	PP1V05_GPU_FB_PLL_AVDD	
FB_B0_WCLK_N<0>	E8	FBB_WCK01*	G14	FBB_DEBUG0	GPU_FBB_DEBUG0	
FB_B0_WCLK_P<1>	A5	FBB_WCK23	G20	FBB_DEBUG1	GPU_FBB_DEBUG1	
FB_B0_WCLK_N<1>	A6	FBB_WCK23*	H26	FB_VREF	FB_VREF	
FB_B1_WCLK_P<0>	D24	FBB_WCK45	C12	FBB_CMD_RFU0	NC	
FB_B1_WCLK_N<0>	D25	FBB_WCK45*	C20	FBB_CMD_RFU1	NC	
FB_B1_WCLK_P<1>	B27	FBB_WCK67				
FB_B1_WCLK_N<1>	C27	FBB_WCK67*				
	D6	FBB_WCKB01				
	D7	FBB_WCKB01*				
	C6	FBB_WCKB23				
	B6	FBB_WCKB23*				
	F26	FBB_WCKB45				
	E26	FBB_WCKB45*				
	A26	FBB_WCKB67				
	A27	FBB_WCKB67*				

L8201 FERR-220-OHM-2A 0603 CRITICAL ESR = 0.050OHM — MIN_LINE_WIDTH=0.6 MM, MIN_NECK_WIDTH=0.2 MM, VOLTAGE=1.05V — =PP1V05_GPU_PEX_IOVDD — PP1V05_GPU_FB_PLL_AVDD

FB PLL & DLL VDD

C8201 20UF 20% 2V X6T-CERM 0402; C8202 1UF 20% 6V CERM-X6S 0201; C8203 0.1UF 10% 6.3V X6S 0201

L8202 FERR-220-OHM-2A 0603 CRITICAL ESR = 0.050OHM — MIN_LINE_WIDTH=0.6 MM, MIN_NECK_WIDTH=0.2 MM, VOLTAGE=1.05V — =PP1V05_GPU_PEX_IOVDD — PP1V05_GPU_FB_DLL_AVDD

C8208 20UF 20% 2V X6T-CERM 0402; C8204 1UF 20% 6V CERM-X6S 0201; C8205 0.1UF 10% 6.3V X6S 0201

FB_B0_RESET_L — R8254 10K 1% 1/20W MF 201

FB_B1_RESET_L — R8255 10K 1% 1/20W MF 201

FB_B0_CKE_L — R8256 10K 1% 1/20W MF 201

FB_B1_CKE_L — R8257 10K 1% 1/20W MF 201

MEM VREFC & VREFD SWITCH

FB_SW_LEG — Q8265 SSM3K15FV SOD-VESM-HF — GPU_ALT_VREF

C8206 1UF 20% 4V CERM-X6S 0201; C8207 0.1UF 10% 6.3V X6S 0201

=PP1V35_GPU_S0_FB — R8206 60.4 1% 1/20W MF 201; R8207 60.4 1% 1/20W MF 201

GPU_FBB_DEBUG0

GPU_FBB_DEBUG1

Page Notes

Power aliases required by this page:
- =PP1V35_GPU_S0_FB
- =PP1V05_GPU_PEX_IOVDD

Signal aliases required by this page:
(NONE)

BOM options provided by this page:
(NONE)

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE
KEPLER FRAME BUFFER I/F

Apple Inc.

DRAWING NUMBER 051-9589 SIZE D
REVISION 4.18.0
BRANCH
PAGE 82 OF 132
SHEET 73 OF 99

GPU FB SUPPLY

VOUT = 1.5V / 1.35V
13A MAX OUTPUT
F = 500 KHZ

GPIO(16)	VID1	VID0	FBVDD
	0	0	1.5V
	1	0	1.35V

GPU 1V05 SUPPLY

VOUT = 1.05V
5.3A MAX OUTPUT
F = 500 KHZ

Vout = 0.5V * (1 + Ra / Rb)

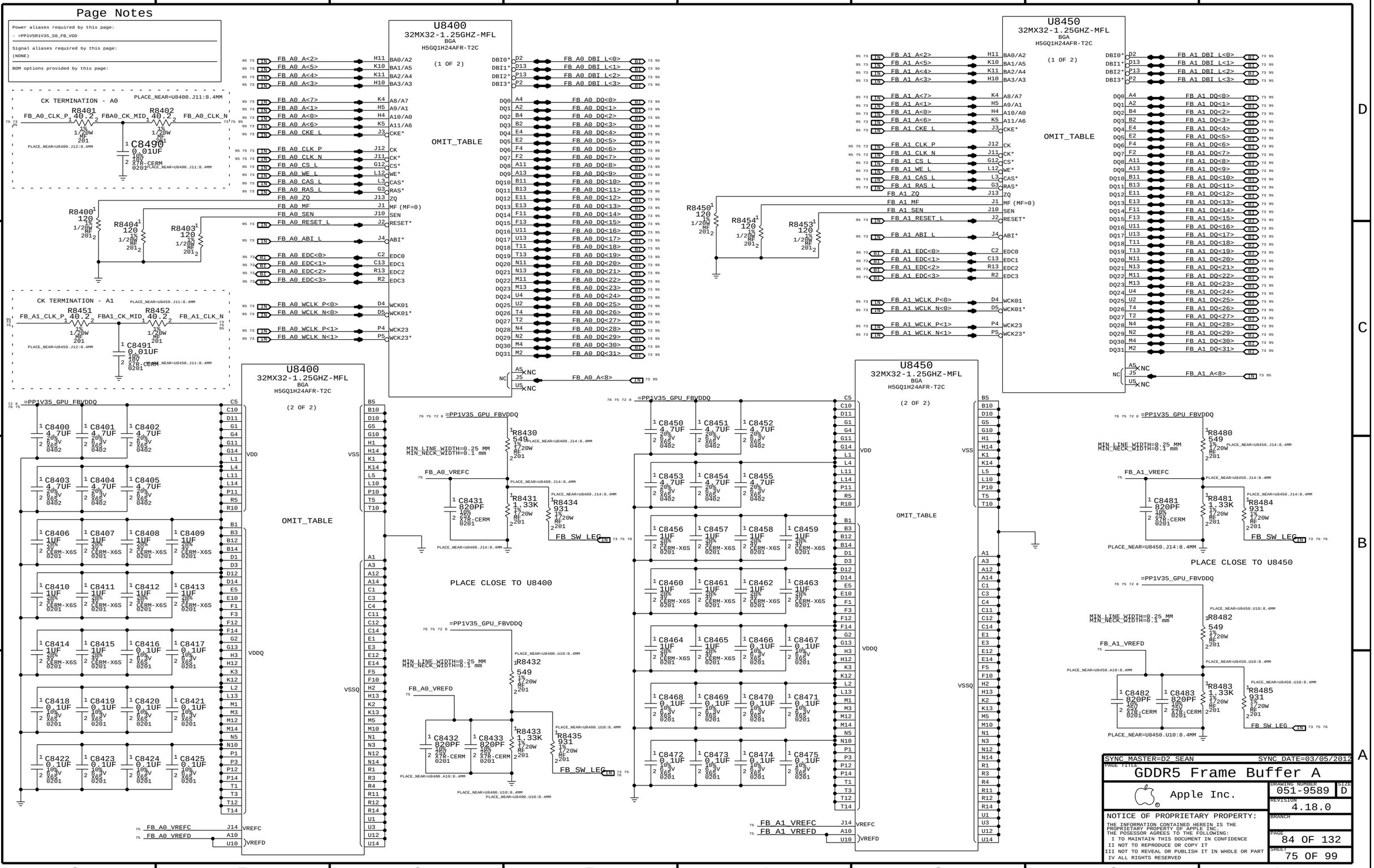
SYNC_MASTER=D2_SEAN	SYNC_DATE=03/05/2012
PAGE TITLE	1V05 GPU / 1V35 FB POWER SUPPLY
Apple Inc.	DRAWING NUMBER 051-9589 SIZE D
	REVISION 4.18.0
	BRANCH
	PAGE 83 OF 132
	SHEET 74 OF 99

Page Notes

Power aliases required by this page:
- =PP1V5R1V35_S0_FB_VDD

Signal aliases required by this page:
(NONE)

BOM options provided by this page:



SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: GDDR5 Frame Buffer A

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D
REVISION: 4.18.0
BRANCH:
PAGE: 84 OF 132
SHEET: 75 OF 99

Page Notes

Power aliases required by this page:
- =PP1V5R1V35_S0_FB_VDD

Signal aliases required by this page:
(NONE)

BOM options provided by this page:
(NONE)

CK TERMINATION - B0

R8501 40.2 1% 1/20W MF 201 — FB_B0_CLK_P — FBB0_CK_MID
R8502 40.2 1% 1/20W MF 201 — FB_B0_CLK_N — FBB0_CK_MID
C8590 0.01UF 10% 10V X7R-CERM 0201
PLACE_NEAR=U8500.J12:8.4MM
PLACE_NEAR=U8500.J11:8.4MM

CK TERMINATION - B1

R8551 40.2 1% 1/20W MF 201 — FB_B1_CLK_P — FBB1_CK_MID
R8552 40.2 1% 1/20W MF 201 — FB_B1_CLK_N — FBB1_CK_MID
C8591 0.01UF 10% 10V X7R-CERM 0201
PLACE_NEAR=U8550.J12:8.4MM
PLACE_NEAR=U8550.J11:8.4MM

R8500 120 1% 1/20W MF 201
R8504 120 1% 1/20W MF 201
R8503 120 1% 1/20W MF 201

U8500
32MX32-1.25GHZ-MFL
BGA
H5GQ1H24AFR-T2C
(1 OF 2)
OMIT_TABLE

FB_B0_A<2>	H11	BA0/A2
FB_B0_A<5>	K10	BA1/A5
FB_B0_A<4>	K11	BA2/A4
FB_B0_A<3>	H10	BA3/A3
FB_B0_A<7>	K4	A8/A7
FB_B0_A<1>	H5	A9/A1
FB_B0_A<0>	H4	A10/A0
FB_B0_A<6>	K5	A11/A6
FB_B0_CKE_L	J3	CKE*
FB_B0_CLK_P	J12	CK
FB_B0_CLK_N	J11	CK*
FB_B0_CS_L	G12	CS*
FB_B0_WE_L	L12	WE*
FB_B0_CAS_L	L3	CAS*
FB_B0_RAS_L	G3	RAS*
FB_B0_ZQ	J13	ZQ
FB_B0_MF	J1	MF (MF=0)
FB_B0_SEN	J10	SEN
FB_B0_RESET_L	J2	RESET*
FB_B0_ABI_L	J4	ABI*
FB_B0_EDC<0>	C2	EDC0
FB_B0_EDC<1>	C13	EDC1
FB_B0_EDC<2>	R13	EDC2
FB_B0_EDC<3>	R2	EDC3
FB_B0_WCLK_P<0>	D4	WCK01
FB_B0_WCLK_N<0>	D5	WCK01*
FB_B0_WCLK_P<1>	P4	WCK23
FB_B0_WCLK_N<1>	P5	WCK23*

DBI0*	D2	FB_B0_DBI_L<0>
DBI1*	D13	FB_B0_DBI_L<1>
DBI2*	P13	FB_B0_DBI_L<2>
DBI3*	P2	FB_B0_DBI_L<3>
DQ0	A4	FB_B0_DQ<0>
DQ1	A2	FB_B0_DQ<1>
DQ2	B4	FB_B0_DQ<2>
DQ3	B2	FB_B0_DQ<3>
DQ4	E4	FB_B0_DQ<4>
DQ5	E2	FB_B0_DQ<5>
DQ6	F4	FB_B0_DQ<6>
DQ7	F2	FB_B0_DQ<7>
DQ8	A11	FB_B0_DQ<8>
DQ9	A13	FB_B0_DQ<9>
DQ10	B11	FB_B0_DQ<10>
DQ11	B13	FB_B0_DQ<11>
DQ12	E11	FB_B0_DQ<12>
DQ13	E13	FB_B0_DQ<13>
DQ14	F11	FB_B0_DQ<14>
DQ15	F13	FB_B0_DQ<15>
DQ16	U11	FB_B0_DQ<16>
DQ17	U13	FB_B0_DQ<17>
DQ18	T11	FB_B0_DQ<18>
DQ19	T13	FB_B0_DQ<19>
DQ20	N11	FB_B0_DQ<20>
DQ21	N13	FB_B0_DQ<21>
DQ22	M11	FB_B0_DQ<22>
DQ23	M13	FB_B0_DQ<23>
DQ24	U4	FB_B0_DQ<24>
DQ25	U2	FB_B0_DQ<25>
DQ26	T4	FB_B0_DQ<26>
DQ27	T2	FB_B0_DQ<27>
DQ28	N4	FB_B0_DQ<28>
DQ29	N2	FB_B0_DQ<29>
DQ30	M4	FB_B0_DQ<30>
DQ31	M2	FB_B0_DQ<31>
NC	A5, J5, U5	NC
		FB_B0_A<8>

U8500
32MX32-1.25GHZ-MFL
BGA
H5GQ1H24AFR-T2C
(2 OF 2)
OMIT_TABLE

=PP1V35_GPU_FBVDDQ	C5, C10, D11, G1, G4, G11, G14, L1	VDD
VSS	B5, B10, D10, G5, G10, H1, H14, K1, K14, L5, L10, P10, T5, T10	
	L4, L11, L14, P11, R5, R10	VDD
	B1, B3, B12, B14, D1, D3, D12, D14, E5, E10, F1, F3, F12, F14, G2, G13, H3, H12, K3, K12, L2, L13, M1, M3, M12, M14, N5, N10, P1, P3, P12, P14, T1, T3, T12, T14	VDDQ
VSSQ	A1, A3, A12, A14, C1, C3, C4, C11, C12, C14, E1, E3, E12, E14, F5, F10, H2, H13, K2, K13, M5, M10, N1, N3, N12, N14, R1, R3, R4, R11, R12, R14, U1, U3, U12, U14	
FB_B0_VREFC	J14	VREFC
FB_B0_VREFD	A10, U10	VREFD

PLACE CLOSE TO U8500

=PP1V35_GPU_FBVDDQ — MIN_LINE_WIDTH=0.25 MM — MIN_NECK_WIDTH=0.1 mm
R8530 549 1% 1/20W MF 201 — PLACE_NEAR=U8500.J14:8.4MM
FB_B0_VREFC
C8531 820PF 10% 25V X7R-CERM 0201
R8531 1.33K 1% 1/20W MF 201
R8534 931 1% 1/20W MF 201 — FB_SW_LEG
PLACE_NEAR=U8500.J14:8.4MM

=PP1V35_GPU_FBVDDQ — MIN_LINE_WIDTH=0.25 MM — MIN_NECK_WIDTH=0.1 mm
R8532 549 1% 1/20W MF 201 — PLACE_NEAR=U8500.U10:8.4MM
FB_B0_VREFD
C8532 820PF 10% 25V X7R-CERM 0201
C8533 820PF 10% 25V X7R-CERM 0201
R8533 1.33K 1% 1/20W MF 201
R8535 931 1% 1/20W MF 201 — FB_SW_LEG
PLACE_NEAR=U8500.U10:8.4MM
PLACE_NEAR=U8500.A10:8.4MM

U8550
32MX32-1.25GHZ-MFL
BGA
H5GQ1H24AFR-T2C
(1 OF 2)
OMIT_TABLE

FB_B1_A<2>	H11	BA0/A2
FB_B1_A<5>	K10	BA1/A5
FB_B1_A<4>	K11	BA2/A4
FB_B1_A<3>	H10	BA3/A3
FB_B1_A<7>	K4	A8/A7
FB_B1_A<1>	H5	A9/A1
FB_B1_A<0>	H4	A10/A0
FB_B1_A<6>	K5	A11/A6
FB_B1_CKE_L	J3	CKE*
FB_B1_CLK_P	J12	CK
FB_B1_CLK_N	J11	CK*
FB_B1_CS_L	G12	CS*
FB_B1_WE_L	L12	WE*
FB_B1_CAS_L	L3	CAS*
FB_B1_RAS_L	G3	RAS*
FB_B1_ZQ	J13	ZQ
FB_B1_MF	J1	MF (MF=0)
FB_B1_SEN	J10	SEN
FB_B1_RESET_L	J2	RESET*
FB_B1_ABI_L	J4	ABI*
FB_B1_EDC<0>	C2	EDC0
FB_B1_EDC<1>	C13	EDC1
FB_B1_EDC<2>	R13	EDC2
FB_B1_EDC<3>	R2	EDC3
FB_B1_WCLK_P<0>	D4	WCK01
FB_B1_WCLK_N<0>	D5	WCK01*
FB_B1_WCLK_P<1>	P4	WCK23
FB_B1_WCLK_N<1>	P5	WCK23*

DBI0*	D2	FB_B1_DBI_L<0>
DBI1*	D13	FB_B1_DBI_L<1>
DBI2*	P13	FB_B1_DBI_L<2>
DBI3*	P2	FB_B1_DBI_L<3>
DQ0	A4	FB_B1_DQ<0>
DQ1	A2	FB_B1_DQ<1>
DQ2	B4	FB_B1_DQ<2>
DQ3	B2	FB_B1_DQ<3>
DQ4	E4	FB_B1_DQ<4>
DQ5	E2	FB_B1_DQ<5>
DQ6	F4	FB_B1_DQ<6>
DQ7	F2	FB_B1_DQ<7>
DQ8	A11	FB_B1_DQ<8>
DQ9	A13	FB_B1_DQ<9>
DQ10	B11	FB_B1_DQ<10>
DQ11	B13	FB_B1_DQ<11>
DQ12	E11	FB_B1_DQ<12>
DQ13	E13	FB_B1_DQ<13>
DQ14	F11	FB_B1_DQ<14>
DQ15	F13	FB_B1_DQ<15>
DQ16	U11	FB_B1_DQ<16>
DQ17	U13	FB_B1_DQ<17>
DQ18	T11	FB_B1_DQ<18>
DQ19	T13	FB_B1_DQ<19>
DQ20	N11	FB_B1_DQ<20>
DQ21	N13	FB_B1_DQ<21>
DQ22	M11	FB_B1_DQ<22>
DQ23	M13	FB_B1_DQ<23>
DQ24	U4	FB_B1_DQ<24>
DQ25	U2	FB_B1_DQ<25>
DQ26	T4	FB_B1_DQ<26>
DQ27	T2	FB_B1_DQ<27>
DQ28	N4	FB_B1_DQ<28>
DQ29	N2	FB_B1_DQ<29>
DQ30	M4	FB_B1_DQ<30>
DQ31	M2	FB_B1_DQ<31>
NC	A5, J5, U5	NC
		FB_B1_A<8>

U8550
32MX32-1.25GHZ-MFL
BGA
H5GQ1H24AFR-T2C
(2 OF 2)
OMIT_TABLE

=PP1V35_GPU_FBVDDQ	C5, C10, D11, G1, G4, G11, G14, L1	VDD
VSS	B5, B10, D10, G5, G10, H1, H14, K1, K14, L5, L10, P10, T5, T10	
	L4, L11, L14, P11, R5, R10	VDD
	B1, B3, B12, B14, D1, D3, D12, D14, E5, E10, F1, F3, F12, F14, G2, G13, H3, H12, K3, K12, L2, L13, M1, M3, M12, M14, N5, N10, P1, P3, P12, P14, T1, T3, T12, T14	VDDQ
VSSQ	A1, A3, A12, A14, C1, C3, C4, C11, C12, C14, E1, E3, E12, E14, F5, F10, H2, H13, K2, K13, M5, M10, N1, N3, N12, N14, R1, R3, R4, R11, R12, R14, U1, U3, U12, U14	
FB_B1_VREFC	J14	VREFC
FB_B1_VREFD	A10, U10	VREFD

PLACE CLOSE TO U8550

=PP1V35_GPU_FBVDDQ — MIN_LINE_WIDTH=0.25 MM — MIN_NECK_WIDTH=0.1 mm
R8580 549 1% 1/20W MF 201 — PLACE_NEAR=U8550.J14:8.4MM
FB_B1_VREFC
C8581 820PF 10% 25V X7R-CERM 0201
R8581 1.33K 1% 1/20W MF 201
R8584 931 1% 1/20W MF 201 — FB_SW_LEG
PLACE_NEAR=U8550.J14:8.4MM
PLACE_NEAR=U8550.J14:8.4MM

=PP1V35_GPU_FBVDDQ — MIN_LINE_WIDTH=0.25 MM — MIN_NECK_WIDTH=0.1 mm
R8582 549 1% 1/20W MF 201 — PLACE_NEAR=U8550.U10:8.4MM
FB_B1_VREFD
C8582 820PF 10% 25V X7R-CERM 0201
C8583 820PF 10% 25V X7R-CERM 0201
R8583 1.33K 1% 1/20W MF 201
R8585 931 1% 1/20W MF 201 — FB_SW_LEG
PLACE_NEAR=U8550.U10:8.4MM
PLACE_NEAR=U8550.A10:8.4MM

SYNC_MASTER=D2_SEAN — SYNC_DATE=03/05/2012

PAGE TITLE: GDDR5 Frame Buffer B

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DRAWING NUMBER: 051-9589 — SIZE: D
REVISION: 4.18.0
BRANCH:
PAGE: 85 OF 132
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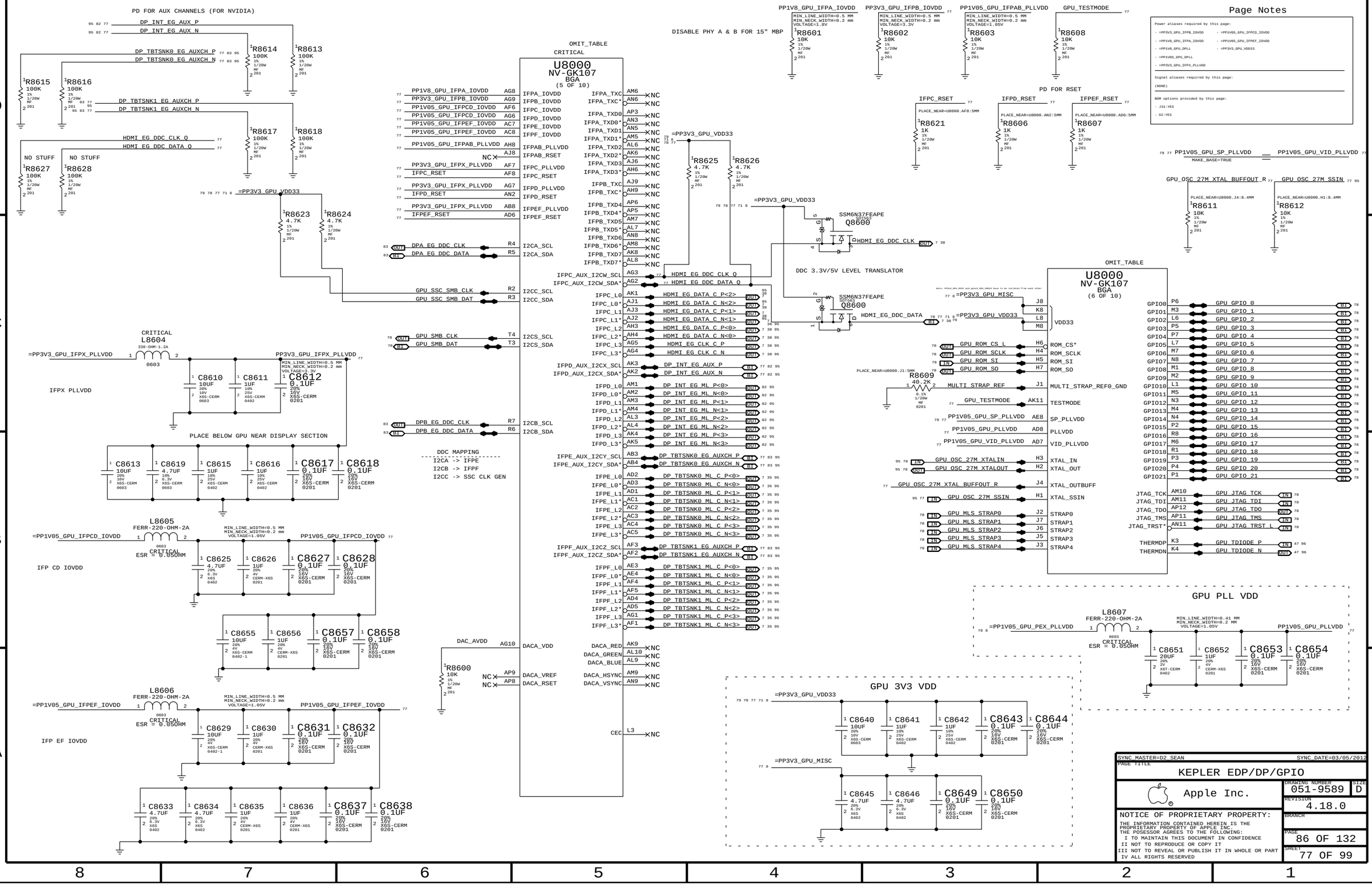
PD FOR AUX CHANNELS (FOR NVIDIA)
DP_INT_EG_AUX_P
DP_INT_EG_AUX_N
DP_TBTSNK0_EG_AUXCH_P
DP_TBTSNK0_EG_AUXCH_N
DP_TBTSNK1_EG_AUXCH_P
DP_TBTSNK1_EG_AUXCH_N
HDMI_EG_DDC_CLK_Q
HDMI_EG_DDC_DATA_Q
NO STUFF
NO STUFF
R8614 100K
R8613 100K
R8615 100K
R8616 100K
R8617 100K
R8618 100K
R8627 100K
R8628 100K
=PP3V3_GPU_VDD33
R8623 4.7K
R8624 4.7K
DISABLE PHY A & B FOR 15" MBP
PP1V8_GPU_IFPA_IOVDD
PP3V3_GPU_IFPB_IOVDD
PP1V05_GPU_IFPAB_PLLVDD
GPU_TESTMODE
R8601 10K
R8602 10K
R8603 10K
R8608 10K
OMIT_TABLE
CRITICAL
U8000
NV-GK107
BGA
(5 OF 10)
PP1V8_GPU_IFPA_IOVDD
PP3V3_GPU_IFPB_IOVDD
PP1V05_GPU_IFPCD_IOVDD
PP1V05_GPU_IFPEF_IOVDD
PP1V05_GPU_IFPAF_PLLVDD
NC
PP3V3_GPU_IFPX_PLLVDD
IFPC_RSET
IFPD_RSET
IFPEF_RSET
IFPA_IOVDD
IFPB_IOVDD
IFPC_IOVDD
IFPD_IOVDD
IFPE_IOVDD
IFPF_IOVDD
IFPAB_PLLVDD
IFPAB_RSET
IFPC_PLLVDD
IFPC_RSET
IFPD_PLLVDD
IFPD_RSET
IFPEF_PLLVDD
IFPEF_RSET
IFPA_TXC
IFPA_TXC*
IFPA_TXD0
IFPA_TXD0*
IFPA_TXD1
IFPA_TXD1*
IFPA_TXD2
IFPA_TXD2*
IFPA_TXD3
IFPA_TXD3*
IFPB_TXC
IFPB_TXC*
IFPB_TXD4
IFPB_TXD4*
IFPB_TXD5
IFPB_TXD5*
IFPB_TXD6
IFPB_TXD6*
IFPB_TXD7
IFPB_TXD7*
DPA_EG_DDC_CLK
DPA_EG_DDC_DATA
I2CA_SCL
I2CA_SDA
GPU_SSC_SMB_CLK
GPU_SSC_SMB_DAT
I2CC_SCL
I2CC_SDA
GPU_SMB_CLK
GPU_SMB_DAT
I2CS_SCL
I2CS_SDA
DPB_EG_DDC_CLK
DPB_EG_DDC_DATA
I2CB_SCL
I2CB_SDA
DDC MAPPING
I2CA -> IFPE
I2CB -> IFPF
I2CC -> SSC CLK GEN
IFPC_AUX_I2CW_SCL
IFPC_AUX_I2CW_SDA*
IFPC_L0
IFPC_L0*
IFPC_L1
IFPC_L1*
IFPC_L2
IFPC_L2*
IFPC_L3
IFPC_L3*
HDMI_EG_DDC_CLK_Q
HDMI_EG_DDC_DATA_Q
HDMI_EG_DATA_C_P<2>
HDMI_EG_DATA_C_N<2>
HDMI_EG_DATA_C_P<1>
HDMI_EG_DATA_C_N<1>
HDMI_EG_DATA_C_P<0>
HDMI_EG_DATA_C_N<0>
HDMI_EG_CLK_C_P
HDMI_EG_CLK_C_N
IFPD_AUX_I2CX_SCL
IFPD_AUX_I2CX_SDA*
IFPD_L0
IFPD_L0*
IFPD_L1
IFPD_L1*
IFPD_L2
IFPD_L2*
IFPD_L3
IFPD_L3*
DP_INT_EG_AUX_P
DP_INT_EG_AUX_N
DP_INT_EG_ML_P<0>
DP_INT_EG_ML_N<0>
DP_INT_EG_ML_P<1>
DP_INT_EG_ML_N<1>
DP_INT_EG_ML_P<2>
DP_INT_EG_ML_N<2>
DP_INT_EG_ML_P<3>
DP_INT_EG_ML_N<3>
IFPE_AUX_I2CY_SCL
IFPE_AUX_I2CY_SDA*
IFPE_L0
IFPE_L0*
IFPE_L1
IFPE_L1*
IFPE_L2
IFPE_L2*
IFPE_L3
IFPE_L3*
DP_TBTSNK0_EG_AUXCH_P
DP_TBTSNK0_EG_AUXCH_N
DP_TBTSNK0_ML_C_P<0>
DP_TBTSNK0_ML_C_N<0>
DP_TBTSNK0_ML_C_P<1>
DP_TBTSNK0_ML_C_N<1>
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DP_TBTSNK0_ML_C_N<2>
DP_TBTSNK0_ML_C_P<3>
DP_TBTSNK0_ML_C_N<3>
IFPF_AUX_I2CZ_SCL
IFPF_AUX_I2CZ_SDA*
IFPF_L0
IFPF_L0*
IFPF_L1
IFPF_L1*
IFPF_L2
IFPF_L2*
IFPF_L3
IFPF_L3*
DP_TBTSNK1_EG_AUXCH_P
DP_TBTSNK1_EG_AUXCH_N
DP_TBTSNK1_ML_C_P<0>
DP_TBTSNK1_ML_C_N<0>
DP_TBTSNK1_ML_C_P<1>
DP_TBTSNK1_ML_C_N<1>
DP_TBTSNK1_ML_C_P<2>
DP_TBTSNK1_ML_C_N<2>
DP_TBTSNK1_ML_C_P<3>
DP_TBTSNK1_ML_C_N<3>
DAC_AVDD
DACA_VDD
DACA_RED
DACA_GREEN
DACA_BLUE
DACA_HSYNC
DACA_VSYNC
DACA_VREF
DACA_RSET
CEC
R8600 10K
=PP3V3_GPU_VDD33
R8625 4.7K
R8626 4.7K
SSM6N37FEAPE
Q8600
HDMI_EG_DDC_CLK
HDMI_EG_DDC_DATA
DDC 3.3V/5V LEVEL TRANSLATOR
IFPC_RSET
IFPD_RSET
IFPEF_RSET
R8621 1K
R8606 1K
R8607 1K
PD FOR RSET
PLACE_NEAR=U8000.AF8:5MM
PLACE_NEAR=U8000.AN2:5MM
PLACE_NEAR=U8000.AD6:5MM
Page Notes
Power aliases required by this page:
- =PP3V3_GPU_IFPB_IOVDD
- =PP1V8_GPU_IFPA_IOVDD
- =PP1V8_GPU_DPLL
- =PP1V05_GPU_DPLL
- =PP3V3_GPU_IFPX_PLLVDD
- =PP1V05_GPU_IFPFCD_IOVDD
- =PP1V05_GPU_IFPEF_IOVDD
- =PP3V3_GPU_VDD33
Signal aliases required by this page:
(NONE)
BOM options provided by this page:
- J31:YES
- D2:YES
PP1V05_GPU_SP_PLLVDD
PP1V05_GPU_VID_PLLVDD
MAKE_BASE=TRUE
GPU_OSC_27M_XTAL_BUFFOUT_R
GPU_OSC_27M_SSIN
R8611 10K
R8612 10K
OMIT_TABLE
U8000
NV-GK107
BGA
(6 OF 10)
=PP3V3_GPU_MISC
=PP3V3_GPU_VDD33
VDD33
GPU_ROM_CS_L
GPU_ROM_SCLK
GPU_ROM_SI
GPU_ROM_SO
ROM_CS*
ROM_SCLK
ROM_SI
ROM_SO
R8609 40.2K
MULTI_STRAP_REF
MULTI_STRAP_REF0_GND
GPU_TESTMODE
TESTMODE
PP1V05_GPU_SP_PLLVDD
SP_PLLVDD
PP1V05_GPU_PLLVDD
PLLVDD
PP1V05_GPU_VID_PLLVDD
VID_PLLVDD
GPU_OSC_27M_XTALIN
GPU_OSC_27M_XTALOUT
XTAL_IN
XTAL_OUT
GPU_OSC_27M_XTAL_BUFFOUT_R
XTAL_OUTBUFF
GPU_OSC_27M_SSIN
XTAL_SSIN
GPU_MLS_STRAP0
GPU_MLS_STRAP1
GPU_MLS_STRAP2
GPU_MLS_STRAP3
GPU_MLS_STRAP4
STRAP0
STRAP1
STRAP2
STRAP3
STRAP4
GPIO0 GPU_GPIO_0
GPIO1 GPU_GPIO_1
GPIO2 GPU_GPIO_2
GPIO3 GPU_GPIO_3
GPIO4 GPU_GPIO_4
GPIO5 GPU_GPIO_5
GPIO6 GPU_GPIO_6
GPIO7 GPU_GPIO_7
GPIO8 GPU_GPIO_8
GPIO9 GPU_GPIO_9
GPIO10 GPU_GPIO_10
GPIO11 GPU_GPIO_11
GPIO12 GPU_GPIO_12
GPIO13 GPU_GPIO_13
GPIO14 GPU_GPIO_14
GPIO15 GPU_GPIO_15
GPIO16 GPU_GPIO_16
GPIO17 GPU_GPIO_17
GPIO18 GPU_GPIO_18
GPIO19 GPU_GPIO_19
GPIO20 GPU_GPIO_20
GPIO21 GPU_GPIO_21
JTAG_TCK GPU_JTAG_TCK
JTAG_TDI GPU_JTAG_TDI
JTAG_TDO GPU_JTAG_TDO
JTAG_TMS GPU_JTAG_TMS
JTAG_TRST* GPU_JTAG_TRST_L
THERMDP GPU_TDIODE_P
THERMDN GPU_TDIODE_N
PP1V05_GPU_IFPX_PLLVDD
CRITICAL
L8604
330-OHM-1.2A
0603
IFPX PLLVDD
C8610 10UF
C8611 1UF
C8612 0.1UF
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=3.3V
PLACE BELOW GPU NEAR DISPLAY SECTION
C8613 10UF
C8619 4.7UF
C8615 1UF
C8616 1UF
C8617 0.1UF
C8618 0.1UF
L8605
FERR-220-OHM-2A
=PP1V05_GPU_IFPCD_IOVDD
PP1V05_GPU_IFPCD_IOVDD
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=1.05V
CRITICAL
ESR = 0.050HM
IFP CD IOVDD
C8625 4.7UF
C8626 1UF
C8627 0.1UF
C8628 0.1UF
C8655 10UF
C8656 1UF
C8657 0.1UF
C8658 0.1UF
L8606
FERR-220-OHM-2A
=PP1V05_GPU_IFPEF_IOVDD
PP1V05_GPU_IFPEF_IOVDD
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.2 mm
VOLTAGE=1.05V
CRITICAL
ESR = 0.050HM
IFP EF IOVDD
C8629 10UF
C8630 1UF
C8631 0.1UF
C8632 0.1UF
C8633 4.7UF
C8634 4.7UF
C8635 1UF
C8636 1UF
C8637 0.1UF
C8638 0.1UF
GPU PLL VDD
L8607
FERR-220-OHM-2A
=PP1V05_GPU_PEX_PLLVDD
PP1V05_GPU_PLLVDD
MIN_LINE_WIDTH=0.41 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=1.05V
CRITICAL
ESR = 0.050HM
C8651 20UF
C8652 1UF
C8653 0.1UF
C8654 0.1UF
GPU 3V3 VDD
=PP3V3_GPU_VDD33
=PP3V3_GPU_MISC
C8640 10UF
C8641 1UF
C8642 1UF
C8643 0.1UF
C8644 0.1UF
C8645 4.7UF
C8646 4.7UF
C8649 0.1UF
C8650 0.1UF
SYNC_MASTER=D2_SEAN
SYNC_DATE=03/05/2012
PAGE TITLE
KEPLER EDP/DP/GPIO
Apple Inc.
DRAWING NUMBER 051-9589
SIZE D
REVISION 4.18.0
BRANCH
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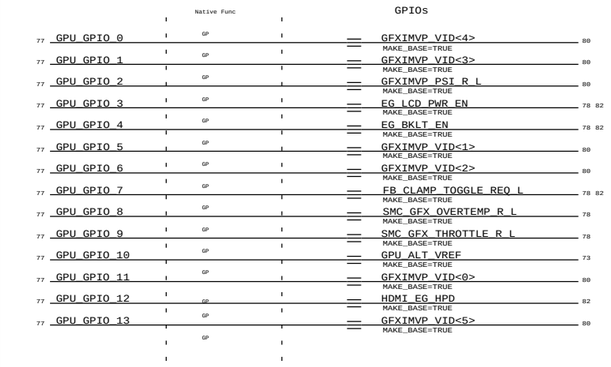
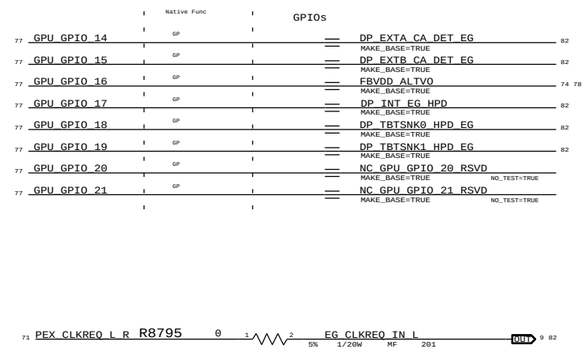
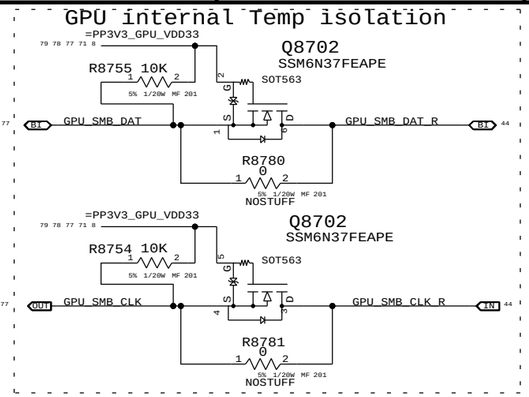
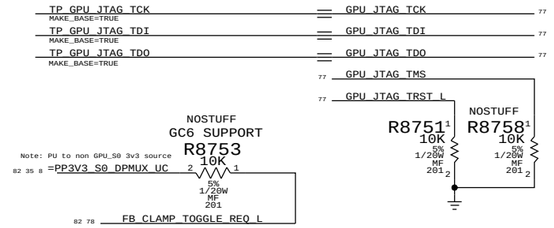




GPU internal Temp isolation



Unused signals

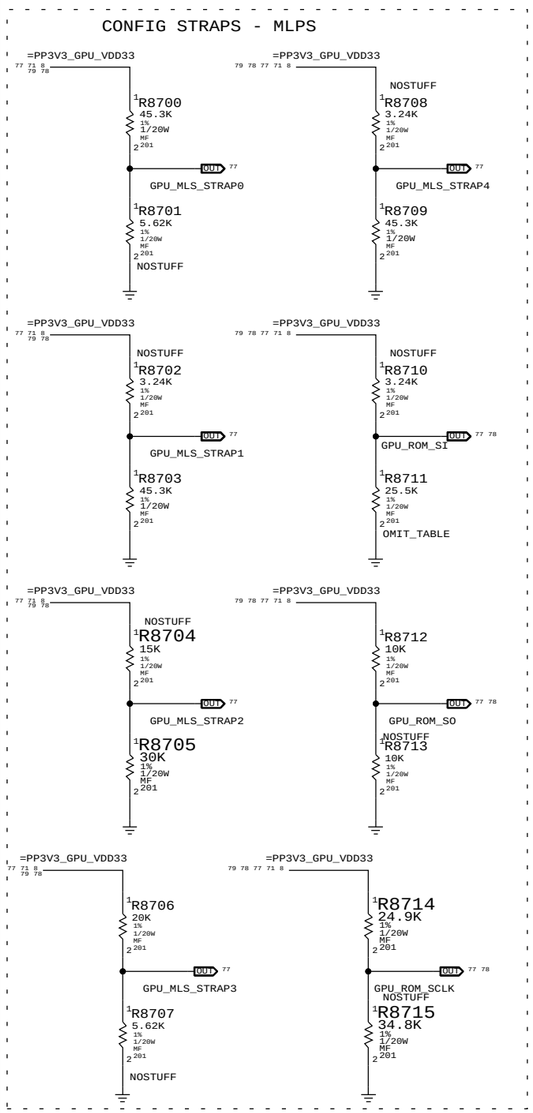


PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
118S0013	1	RES, 10KOHM, 0201	R8711		FB_2G_SAMSUNG
118S0414	1	RES,5.1KOHM, 0201	R8711		FB_2G_HYNIX_M_DIE
118S0230	1	RES,MF,24.9KOHM,1,1/20W,0201	R8711		FB_2G_HYNIX_A_DIE

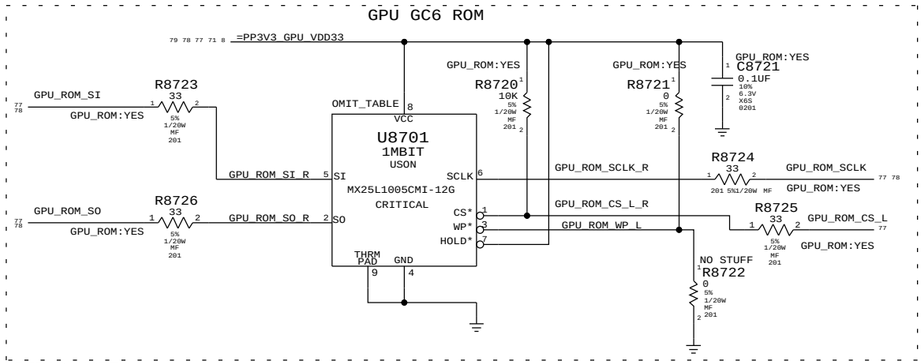
Die Rev	Strap
D-DIE	0x1
M-DIE	0x0
A-DIE	0x4

Straps for GK107. GF108 support has been removed.

CONFIG STRAPS - MLPS



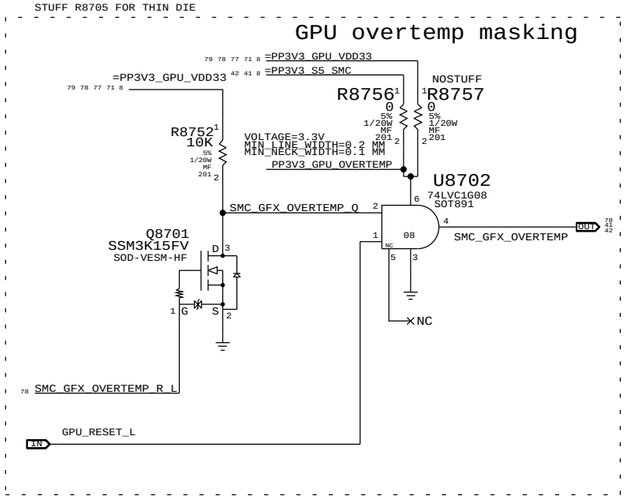
GPU GC6 ROM



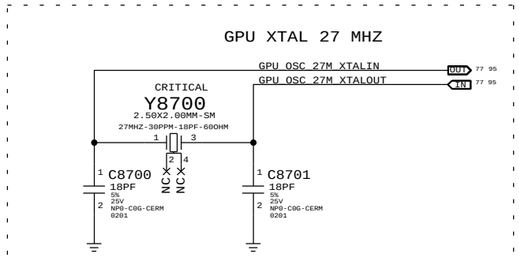
STRAP NOTES:

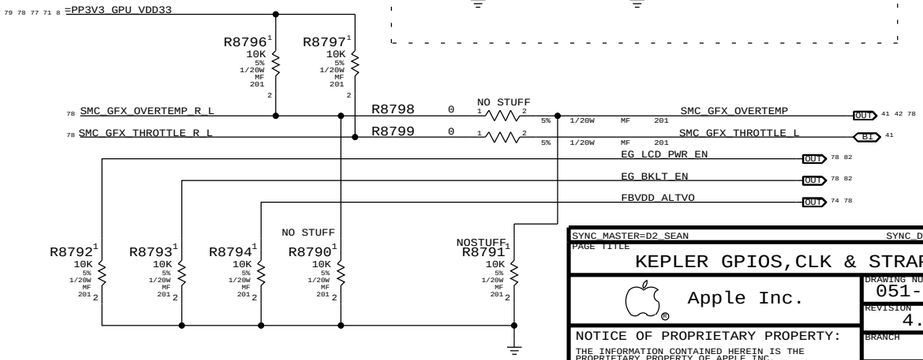
CURRENTLY STUFFED FOR GF108a/GK107-GTX
STUFF R8704 FOR THICK DIE
STUFF R8705 FOR THIN DIE

GPU overtemp masking



GPU XTAL 27 MHZ





SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE

KEPLER GPIOS,CLK & STRAPS

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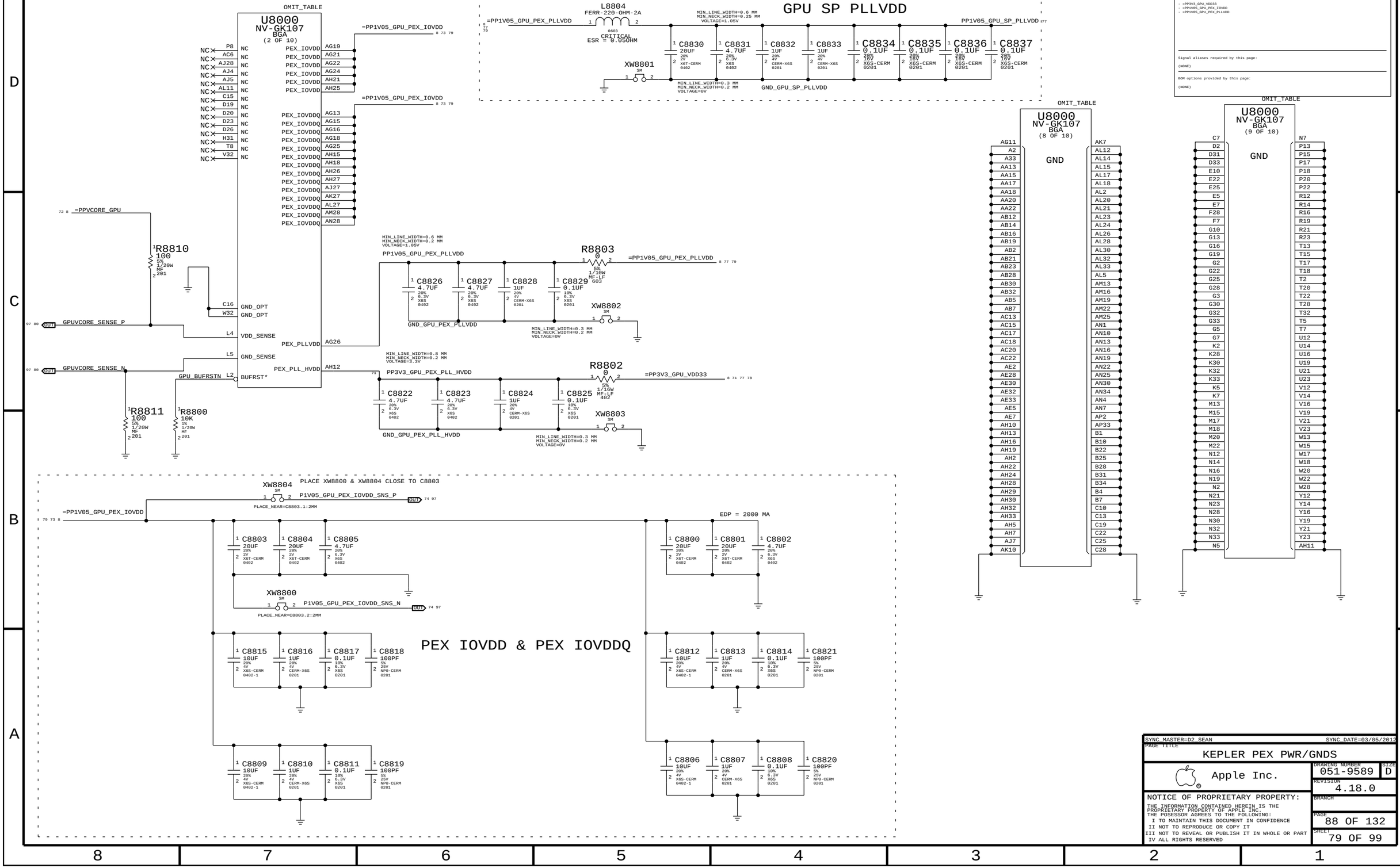

Page Notes

Power aliases required by this page:

- =PP3V3_GPU_VDD33
- =PP1V05_GPU_PEX_IOVDD
- =PP1V05_GPU_PEX_PLLVDD

Signal aliases required by this page:

(NONE)

BOM options provided by this page:

(NONE)

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: KEPLER PEX PWR/GNDS

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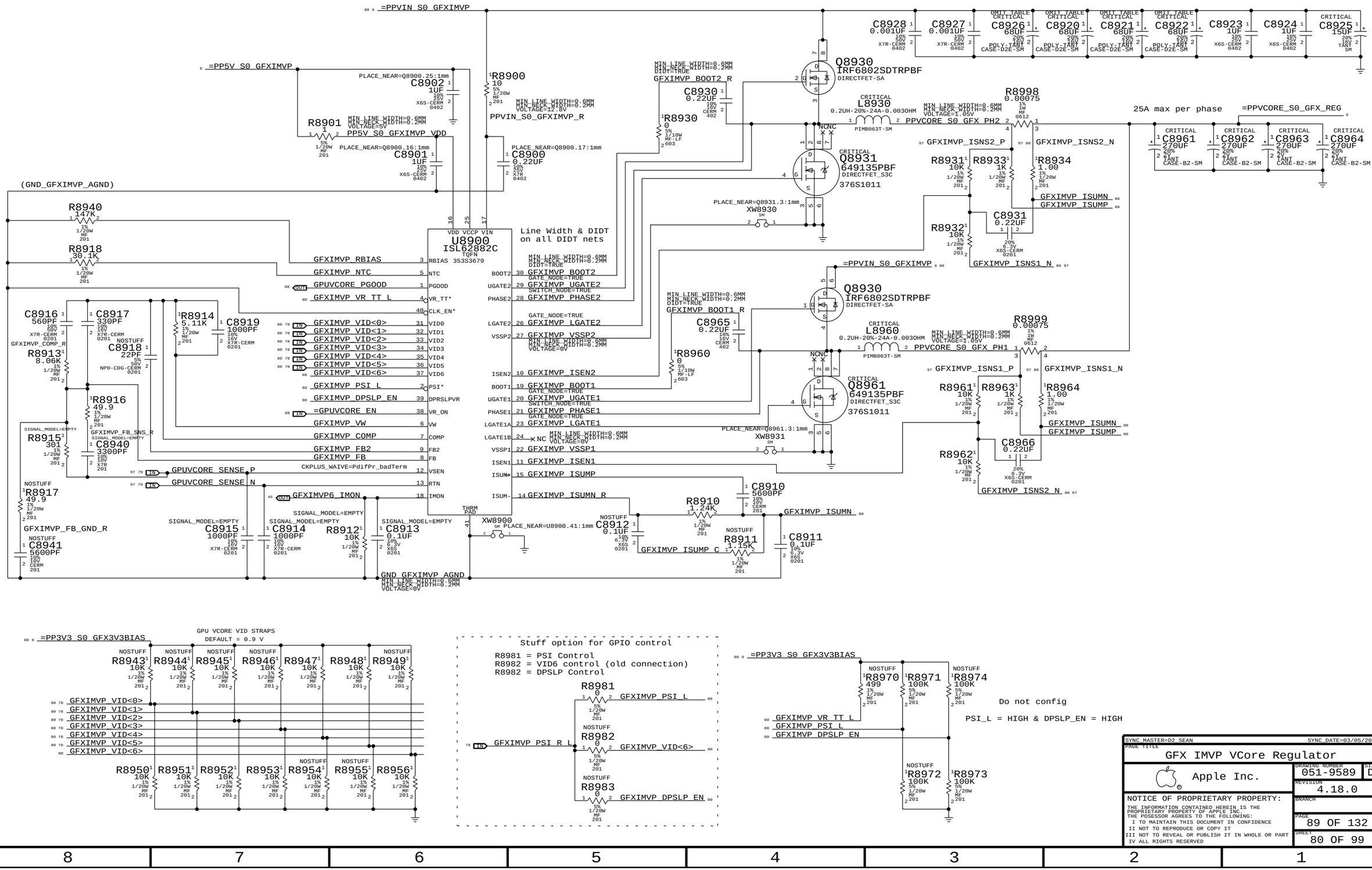
=PPVIN_S0_GFXIMVP
=PP5V_S0_GFXIMVP
PP5V_S0_GFXIMVP_VDD
PPVIN_S0_GFXIMVP_R
(GND_GFXIMVP_AGND)
U8900
ISL62882C
TQFN
Line Width & DIDT on all DIDT nets
GFXIMVP_RBIAS
GFXIMVP_NTC
GPUVCORE_PGOOD
GFXIMVP_VR_TT_L
GFXIMVP_VID<0>
GFXIMVP_VID<1>
GFXIMVP_VID<2>
GFXIMVP_VID<3>
GFXIMVP_VID<4>
GFXIMVP_VID<5>
GFXIMVP_VID<6>
GFXIMVP_PSI_L
GFXIMVP_DPSLP_EN
=GPUVCORE_EN
GFXIMVP_VW
GFXIMVP_COMP
GFXIMVP_FB2
GFXIMVP_FB
GPUVCORE_SENSE_P
GPUVCORE_SENSE_N
GFXIMVP6_IMON
GFXIMVP_BOOT2
GFXIMVP_UGATE2
GFXIMVP_PHASE2
GFXIMVP_LGATE2
GFXIMVP_VSSP2
GFXIMVP_ISEN2
GFXIMVP_BOOT1
GFXIMVP_UGATE1
GFXIMVP_PHASE1
GFXIMVP_LGATE1
GFXIMVP_VSSP1
GFXIMVP_ISEN1
GFXIMVP_ISUMP
GFXIMVP_ISUMN_R
GFXIMVP_ISUMP_C
GFXIMVP_FB_SNS_R
GFXIMVP_FB_GND_R
GND_GFXIMVP_AGND
Q8930
IRF6802SDTRPBF
DIRECTFET-SA
Q8931
649135PBF
DIRECTFET_S3C
376S1011
Q8961
L8930
L8960
PPVCORE_S0_GFX_PH2
PPVCORE_S0_GFX_PH1
25A max per phase
=PPVCORE_S0_GFX_REG
GFXIMVP_ISNS2_P
GFXIMVP_ISNS2_N
GFXIMVP_ISNS1_P
GFXIMVP_ISNS1_N
GFXIMVP_ISUMN
GFXIMVP_ISUMP
GFXIMVP_ISNS2_N
GFXIMVP_ISNS1_N
GPU VCORE VID STRAPS
DEFAULT = 0.9 V
=PP3V3_S0_GFX3V3BIAS
Stuff option for GPIO control
R8981 = PSI Control
R8982 = VID6 control (old connection)
R8982 = DPSLP Control
GFXIMVP_PSI_R_L
Do not config
PSI_L = HIGH & DPSLP_EN = HIGH
SYNC_MASTER=D2_SEAN
SYNC_DATE=03/05/2012
PAGE TITLE
GFX IMVP VCore Regulator
Apple Inc.
DRAWING NUMBER
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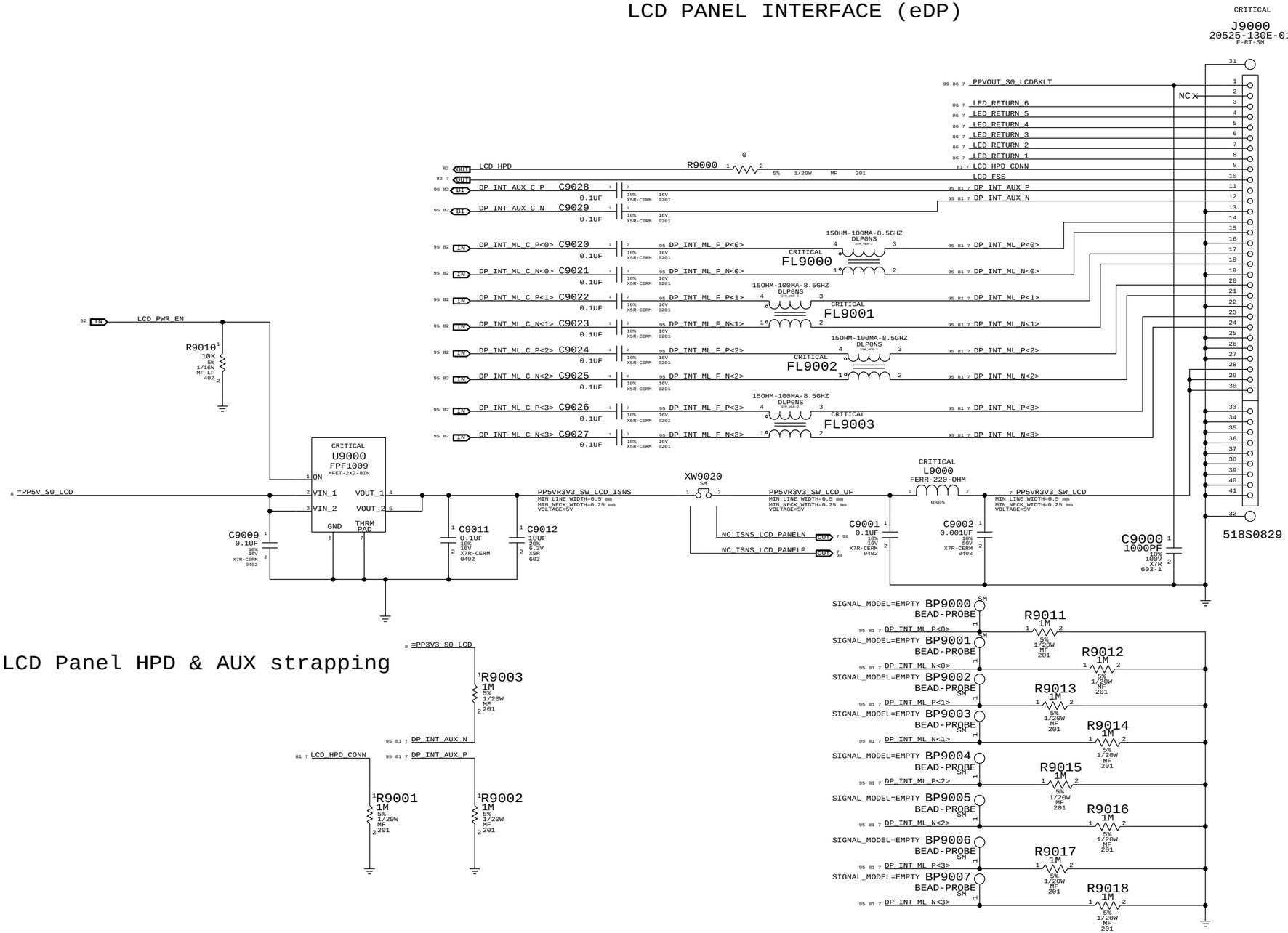
LCD PANEL INTERFACE (eDP)



LCD Panel HPD & AUX strapping

SYNC_MASTER=D2_KEPLER	SYNC_DATE=01/13/2012
PAGE TITLE	eDP Display Connector
Apple Inc.	DRAWING NUMBER 051-9589 SIZE D
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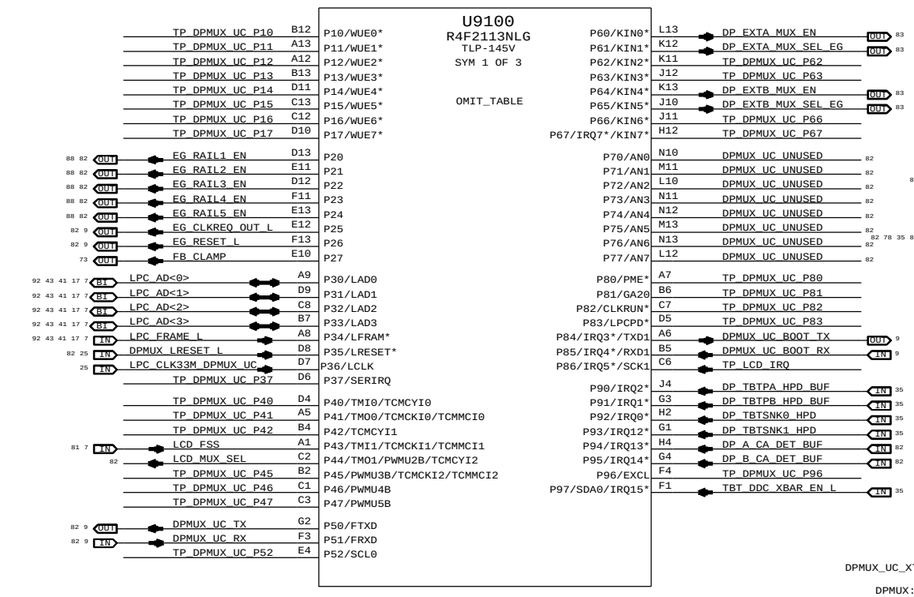

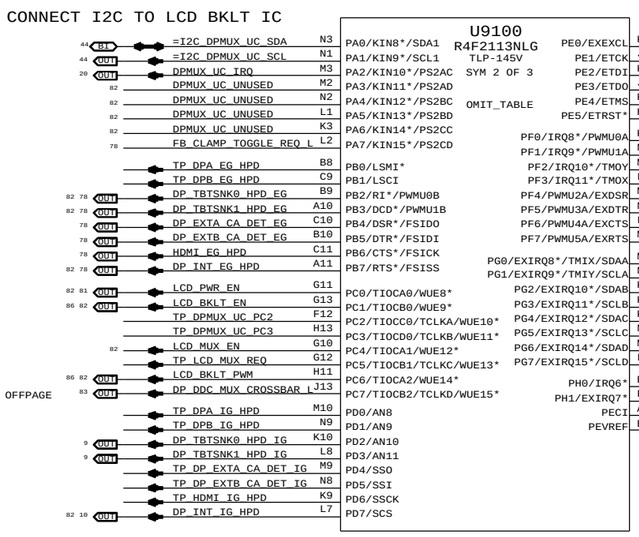

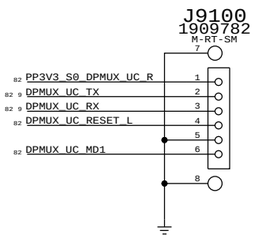

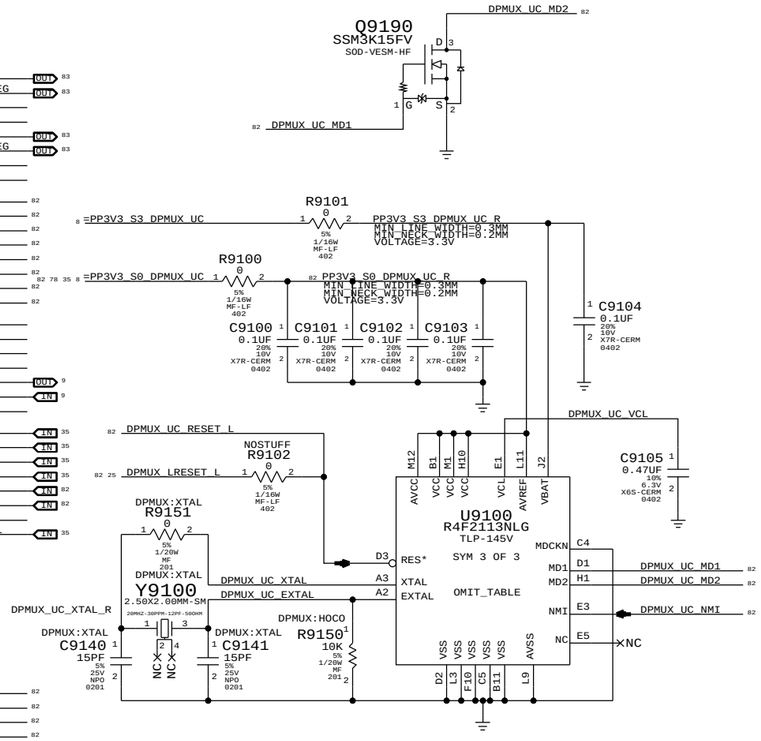

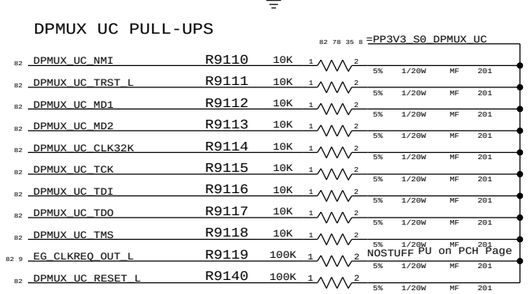

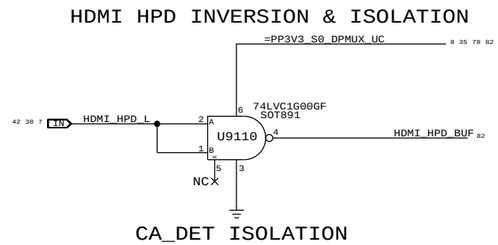

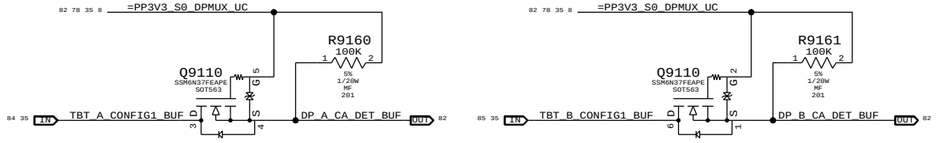

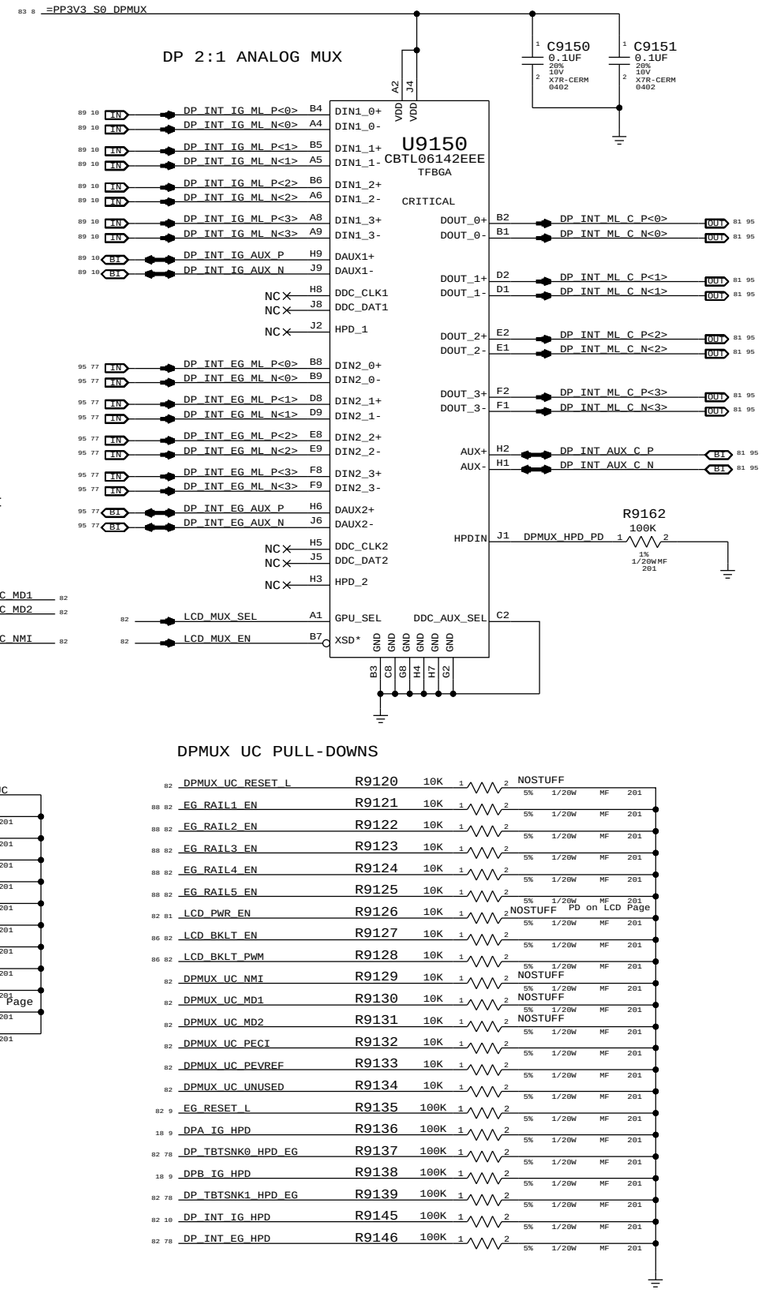

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: eDP Mux

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

REVISION: 4.18.0

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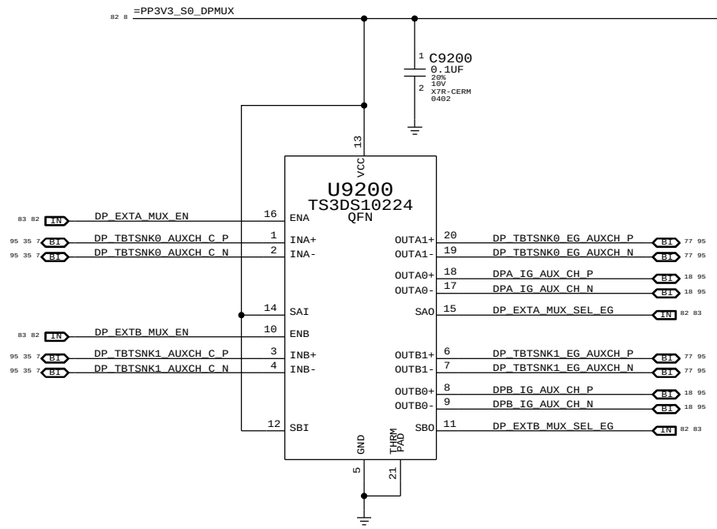
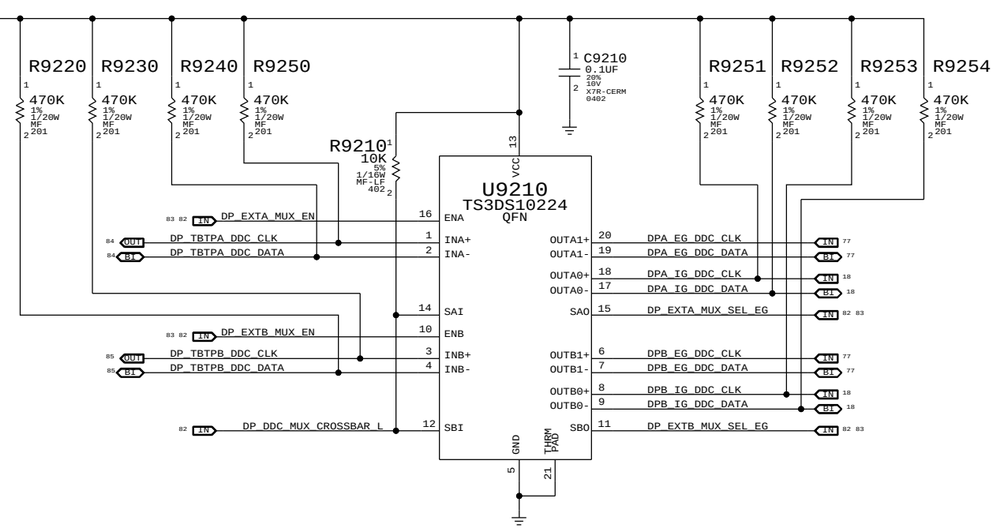
DP A & DP B AUX MUX



DP A & DP B DDC MUX



MUX TRUTH TABLE

SAI/SBI	SAO	SBO	INA	INB
0	0	0	OUTB0	OUTA0
0	0	1	OUTB1	OUTA0
0	1	0	OUTB0	OUTA1
0	1	1	OUTB1	OUTA1
1	0	0	OUTA0	OUTB0
1	0	1	OUTA0	OUTB1
1	1	0	OUTA1	OUTB0
1	1	1	OUTA1	OUTB1

SYNC_MASTER=D2_SEAN SYNC_DATE=03/05/2012

PAGE TITLE: eDP Muxed Graphics Support

Apple Inc.

DRAWING NUMBER: 051-9589 SIZE: D

REVISION: 4.18.0

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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)

=PP3V3_S4_TBTAPWRSW
CRITICAL
C9487 100UF 20% 6.3V POLY-TANT CASE-B2-SM
C9480 22UF 20% 6.3V X5R-CERM-1 603
C9481 0.1UF 10% 16V X5R-CERM 0201
=PPHV_SW_TBTAPWRSW
18.9V Max
C9415 4.7UF 10% 25V X5R-CERM 0603
C9410 0.1UF 10% 25V X5R 402
U9410 CD3210A0RGP QFN
V3P3
VHV
RSVD
EN
HV_EN
S0
V3P3OUT
OUT
ISET_V3P3
ISET_S0
ISET_S3
GND
THRM PAD
PP3V3_SW_TBTAPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=3.3V
PPHV_SW_TBTAPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=15V
C9485 0.1UF 10% 16V X5R-CERM 0201
C9486 10UF 20% 6.3V CERM-X5R 0402
C9411 0.1UF 10% 25V X5R 402
=TBTAPWRSW_EN
TBT_A_HV_EN
=TBT_S0_EN
TBTAPWRSW_ISET_V3P3
TBTAPWRSW_ISET_S0
TBTAPWRSW_ISET_S3
12V: See below
TBTHV:P15V
R9410 22.6K 1% 1/20W MF 201
R9411 22.6K 1% 1/20W MF 201
R9412 36.5K 1% 1/20W MF 201 <RV3P3>
TBTAPWRSW_ISET_S3_R
TBTAPWRSW_ISET_S0_R
R9413 22.6K 1% 1/20W MF 201 <RHVS3>
R9414 22.6K 1% 1/20W MF 201 <RHVS0>
Single-fault protection requires two R_S_per HV ISET_SX with CD3210. Single R on ISET_V3P3 OK.
ILIM = 40000 / RISET

For 12V systems:

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R9410,R9413		TBTHV:P12V
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R9411,R9414		TBTHV:P12V

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

Thunderbolt Connector A

PP3V3_SW_TBTAPWR
C9420 0.1UF 10% 16V X5R-CERM 0201
C9421 0.1UF 10% 16V X5R-CERM 0201
R9427 10K 5% 1/20W MF 201
R9429 100K 5% 1/20W MF 201
VDD
CRITICAL
U9420 CBTL05023 HVQFN
SIGNAL_MODEL=TBT_MUX
TBT_A_BIAS VOLTAGE=3.3V
C9425 0.1UF 10% 16V X5R-CERM 0201
TBT_A_CIO_SEL
DP_AUXIO_EN
BIASIN
AUXIO_EN
BIASOUT
DP_TBTPA_AUXCH_C_N
DP_TBTPA_AUXCH_C_P
C9430 0.1UF 10% 16V X5R-CERM 0201
C9431 0.1UF 10% 16V X5R-CERM 0201
AUX-
AUX+
AUXIO-
AUXIO+
DP_A_AUXCH_DDC_N
DP_A_AUXCH_DDC_P
TBT: RX_1 Bias Sink
DP_TBTPA_DDC_DATA
DP_TBTPA_DDC_CLK
DDC_DAT
DDC_CLK
TBT_A_CONFIG1_BUF
CA_DETOUT
CA_DET
TBT_A_CONFIG1_RC
DP_TBTPA_ML_C_P<1>
DP_TBTPA_ML_C_N<1>
C9432 0.22UF 20% 6.3V X5R 0201
C9433 0.22UF 20% 6.3V X5R 0201
DP+
DP-
DPML0+
DPML0-
DP_A_LSX_ML_P<1>
DP_A_LSX_ML_N<1>
TBT: LSX_A_R2P/P2R (P/N)
TBT_A_LSTX
TBT_A_LSRX_UNBUF
LSTX
LSRX
TBT_A_DP_PWRDN
DP_PD
TBT_A_HPD
HPDOUT
HPD
GND_THMPAD
R9426 1M 5% 1/20W MF 201
R9428 100K 5% 1/20W MF 201
PP3V3_SW_TBTAPWR
CRITICAL
U9460 74AUP1T97 SOT891
VCC
GND
TBT_A_LSRX
Y = B
C9460 0.1UF 10% 16V X5R-CERM 0201

CRITICAL
L9400 FERR-120-OHM-3A 0603
PP3V3RHV_SW_TBTAPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=15V
C9400 0.01UF 10% 50V X7R-CERM 0402
TBTACONN_20_RC
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18V
R9401 12 5% 1/20W MF 201
C9401 0.01UF 10% 50V X7R-CERM 0402

For J9400 TBT SMT pads (3, 5, 17 & 19):

TBTACONN_1_C
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18.9V
GND_VOID=TRUE
C9405 0.01UF 10% 25V X5R-CERM 0201
(0-18.9V)
DP Dir
TBT Dir
TBT_A_R2D_P<0>
TBT_A_R2D_N<0>
TBT: TX_0
TBTACONN_7_C
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18.9V
C9406 0.01UF 10% 25V X5R-CERM 0201
GND_VOID=TRUE (Both C's)
C9470 0.22UF 20% 6.3V X5R 0201
C9471 0.22UF 20% 6.3V X5R 0201
R9470 470K 5% 1/20W MF 201
R9471 470K 5% 1/20W MF 201
TBT_A_R2D_C_P<0>
TBT_A_R2D_C_N<0>
(0-18.9V)
DP_A_LSX_ML_P<1>
DP_A_LSX_ML_N<1>
TBT: LSX_R2P/P2R (P/N)
TBT_A_R2D_P<1>
TBT_A_R2D_N<1>
TBT: TX_1
C9472 0.22UF 20% 6.3V X5R 0201
C9473 0.22UF 20% 6.3V X5R 0201
R9472 470K 5% 1/20W MF 201
R9473 470K 5% 1/20W MF 201
TBT_A_R2D_C_P<1>
TBT_A_R2D_C_N<1>
470k R's for ESD protection on AC-coupled signals.

J9400 MDP-D2 F-RT-TH
SHIELD PINS
PORT B
514-0803
HPD
CONFIG1
CONFIG2
GND2
ML_LANE3P
ML_LANE3N
GND4
AUX_CHP
AUX_CHN
DP_PWR
ML_LANE0P
ML_LANE0N
GND1
ML_LANE1P
ML_LANE1N
GND3
ML_LANE2P
ML_LANE2N
RETURN
TBT Dir
DP Dir

TBT_A_D2R_P<0>
TBT_A_D2R_N<0>
C9474 0.47UF 20% 4V CERM-X5R-1 201
C9475 0.47UF 20% 4V CERM-X5R-1 201
R9494 1K 5% 1/20W MF 201 SIGNAL_MODEL=EMPTY
R9495 1K 5% 1/20W MF 201 SIGNAL_MODEL=EMPTY
R9478 470K 5% 1/20W MF 201
R9479 470K 5% 1/20W MF 201
DP_TBTPA_ML_C_P<3>
DP_TBTPA_ML_C_N<3>
C9478 0.22UF 20% 6.3V X5R 0201
C9479 0.22UF 20% 6.3V X5R 0201
TBT: Unused
TBT_A_BIAS
R9498 2.2K 5% 1/20W MF 201
R9499 2.2K 5% 1/20W MF 201
TBT_A_D2R_P<1>
TBT_A_D2R_N<1>
C9476 0.47UF 20% 4V CERM-X5R-1 201
C9477 0.47UF 20% 4V CERM-X5R-1 201
CRITICAL
SIGNAL_MODEL=TBTPIN
GND_VOID=TRUE
(Both D's)
D9498 BAR90-02LRH SOD-523
D9499 BAR90-02LRH SOD-523
TBT_A_D2R1_AUXDDC_P
TBT_A_D2R1_AUXDDC_N
CRITICAL
L9498 650NH-5%-0.430MA-0.52OHM 0603
L9499 650NH-5%-0.430MA-0.52OHM 0603
SIGNAL_MODEL=EMPTY
DP_A_AUXCH_DDC_P
DP_A_AUXCH_DDC_N
C9498 30PF 5% 50V C0G-NP0 0402
C9499 30PF 5% 50V C0G-NP0 0402
TBT_A_HPD
TBT_A_CONFIG1_RC
TBT_A_CONFIG2_RC
R9452 1M 5% 1/20W MF 201
R9451 1M 5% 1/20W MF 201
C9494 330PF 10% 16V X7R-CERM 0201
C9495 330PF 10% 16V X7R-CERM 0201
R9441 100K 5% 1/20W MF 201
C9402 0.01UF 10% 16V X5R-CERM 0201

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

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

SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012
PAGE TITLE: Thunderbolt Connector A
Apple Inc.
DRAWING NUMBER: 051-9589
SIZE: D
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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)

=PP3V3_S4_TBTBPWRSW
CRITICAL
C9687 100UF 20% 6.3V POLY-TANT CASE-B2-SM
C9680 22UF 20% 6.3V X5R-CERM-1 603
C9681 0.1UF 10% 16V X5R-CERM 0201
=PPHV_SW_TBTBPWRSW
18V Max
C9615 4.7UF 10% 25V X5R-CERM 0603
C9610 0.1UF 10% 25V X5R 402
V3P3
VHV
CRITICAL
U9610
CD3210A0RGP
QFN
V3P3OUT
OUT
RSVD
RSVD
EN
HV_EN
S0
ISET_V3P3
ISET_S0
ISET_S3
GND
THRM PAD
PP3V3_SW_TBTBPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=3.3V
PPHV_SW_TBTBPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=15V
C9685 0.1UF 10% 16V X5R-CERM 0201
C9686 10UF 20% 6.3V CERM-X5R 0402
C9611 0.1UF 10% 25V X5R 402
=TBTBPWRSW_EN
TBT_B_HV_EN
=TBT_S0_EN
TBTBPWRSW_ISET_V3P3
TBTBPWRSW_ISET_S0
TBTBPWRSW_ISET_S3
12V: See below
TBTHV:P15V
R9610 22.6K 1% 1/20W MF 201
R9611 22.6K 1% 1/20W MF 201
R9612 36.5K 1% 1/20W MF 201
<RV3P3>
TBTBPWRSW_ISET_S3_R
TBTBPWRSW_ISET_S0_R
R9613 22.6K 1% 1/20W MF 201
R9614 22.6K 1% 1/20W MF 201
<RHVS3>
<RHVS0>
Single-fault protection requires two R's per HV ISET_SX with CD3210. Single R on ISET_V3P3 OK.
ILIM = 40000 / RISET

For 12V systems:

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R9610,R9613		TBTHV:P12V
118S0145	2	RES,MTL FILM,1/20W,17.8K,1,0201,SMD,LF	R9611,R9614		TBTHV:P12V

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

Thunderbolt Connector B

PP3V3_SW_TBTBPWR
C9620 0.1UF 10% 16V X5R-CERM 0201
C9621 0.1UF 10% 16V X5R-CERM 0201
R9627 10K 5% 1/20W MF 201
R9629 100K 5% 1/20W MF 201
VDD
CRITICAL
U9620
CBTL05023
HVQFN
SIGNAL_MODEL=TBT_MUX
TBT_B_BIAS
VOLTAGE=3.3V
C9625 0.1UF 10% 16V X5R-CERM 0201
TBT_B_CIO_SEL
DP_AUXIO_EN
DP_TBTPB_AUXCH_C_N
DP_TBTPB_AUXCH_C_P
C9630 0.1UF 10% 16V X5R-CERM 0201
C9631 0.1UF 10% 16V X5R-CERM 0201
DP_TBTPB_DDC_DATA
DP_TBTPB_DDC_CLK
TBT_B_CONFIG1_BUF
DP_TBTPB_ML_C_P<1>
DP_TBTPB_ML_C_N<1>
C9632 0.22UF 20% 6.3V X5R 0201
C9633 0.22UF 20% 6.3V X5R 0201
TBT_B_LSTX
TBT_B_LSRX_UNBUF
TBT_B_DP_PWRDN
DP_TBTPB_HPD
BIASIN
AUXIO_EN
AUX-
AUX+
DDC_DAT
DDC_CLK
CA_DETOUT
DP+
DP-
LSTX
LSRX
DP_PD
HPDOUT
BIASOUT
AUXIO-
AUXIO+
CA_DET
DPMLO+
DPMLO-
HPD
GND_THMPAD
DP_B_AUXCH_DDC_N
DP_B_AUXCH_DDC_P
TBT: RX_1 Bias Sink
TBT_B_CONFIG1_RC
DP_B_LSX_ML_P<1>
DP_B_LSX_ML_N<1>
TBT: LSX_A_R2P/P2R (P/N)
TBT_B_HPD
R9626 1M 5% 1/20W MF 201
R9628 100K 5% 1/20W MF 201
PP3V3_SW_TBTBPWR
CRITICAL
U9660
74AUP1T97
SOT891
VCC
GND
TBT_B_LSRX
Y = B
C9660 0.1UF 10% 16V X5R-CERM 0201

CRITICAL
L9600
FERR-120-OHM-3A
0603
PP3V3RHV_SW_TBTBPWR
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=15V
C9600 0.01UF 10% 50V X7R-CERM 0402
TBTBCONN_20_RC
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18V
R9601 12 5% 1/20W MF 201
C9601 0.01UF 10% 50V X7R-CERM 0402

TBTBCONN_1_C
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18.9V
GND_VOID=TRUE
C9605 0.01UF 10% 25V X5R-CERM 0201
(0-18.9V)
DP Dir
TBT Dir
TBT: TX_0
TBTBCONN_7_C
MIN_LINE_WIDTH=0.38 MM
MIN_NECK_WIDTH=0.20 MM
VOLTAGE=18.9V
C9606 0.01UF 10% 16V X5R-CERM 0201
(0-18.9V)
TBT: LSX_R2P/P2R (P/N)
TBT: TX_1

For J9600 TBT SMT pads (3, 5, 17 & 19):

TBT Dir
DP Dir
SHIELD PINS
J9400
MDP-D2
F-RT-TH
PORT A
SHIELD PINS
HPD
CONFIG1
CONFIG2
GND2
ML_LANE3P
ML_LANE3N
GND4
AUX_CHP
AUX_CHN
DP_PWR
GND0
ML_LANE0P
ML_LANE0N
GND1
ML_LANE1P
ML_LANE1N
GND3
ML_LANE2P
ML_LANE2N
RETURN
514-0803

GND_VOID=TRUE (Both C's)
C9670 0.22UF 20% 6.3V X5R 0201
C9671 0.22UF 20% 6.3V X5R 0201
R9670 470K 5% 1/20W MF 201
R9671 470K 5% 1/20W MF 201
C9672 0.22UF 20% 6.3V X5R 0201
C9673 0.22UF 20% 6.3V X5R 0201
R9672 470K 5% 1/20W MF 201
R9673 470K 5% 1/20W MF 201
470k R's for ESD protection on AC-coupled signals.

C9674 0.47UF 20% 4V CERM-X5R-1 201
C9675 0.47UF 20% 4V CERM-X5R-1 201
TBT_B_D2R_P<0>
TBT_B_D2R_N<0>
TBT_B_D2R_C_P<0>
TBT_B_D2R_C_N<0>
R9694 1K 5% 1/20W MF 201
R9695 1K 5% 1/20W MF 201
SIGNAL_MODEL=EMPTY
R9678 470K 5% 1/20W MF 201
R9679 470K 5% 1/20W MF 201
C9678 0.22UF 20% 6.3V X5R 0201
C9679 0.22UF 20% 6.3V X5R 0201
DP_TBTPB_ML_C_P<3>
DP_TBTPB_ML_C_N<3>
TBT: Unused
R9698 2.2K 5% 1/20W MF 201
R9699 2.2K 5% 1/20W MF 201
C9676 0.47UF 20% 4V CERM-X5R-1 201
C9677 0.47UF 20% 4V CERM-X5R-1 201
TBT_B_D2R_P<1>
TBT_B_D2R_N<1>
TBT_B_D2R_C_P<1>
TBT_B_D2R_C_N<1>
CRITICAL
SIGNAL_MODEL=TBTPIN
GND_VOID=TRUE
(Both D's)
D9698 BAR90-02LRH TSLP-2-7
D9699 BAR90-02LRH TSLP-2-7
TBT_B_D2R1_AUXDDC_P
TBT_B_D2R1_AUXDDC_N
CRITICAL
L9698
650NH-5%-0.430MA-0.52OHM
0603
SIGNAL_MODEL=EMPTY
CRITICAL
L9699
650NH-5%-0.430MA-0.52OHM
0603
SIGNAL_MODEL=EMPTY
DP_B_AUXCH_DDC_P
DP_B_AUXCH_DDC_N
C9698 30PF 5% 50V C0G-NP0 0402
C9699 30PF 5% 50V C0G-NP0 0402
TBT_B_HPD
TBT_B_CONFIG1_RC
TBT_B_CONFIG2_RC
R9652 1M 5% 1/20W MF 201
R9651 1M 5% 1/20W MF 201
C9694 330PF 10% 16V X7R-CERM 0201
C9695 330PF 10% 16V X7R-CERM 0201
R9641 100K 5% 1/20W MF 201
C9602 0.01UF 10% 16V X5R-CERM 0201

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

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

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PPBUS S0 LCDBkLT FET

MOSFET	FDC638APZ
CHANNEL	P-TYPE
RDS(ON)	43 mOhm @4.5V
LOADING	0.715 A (EDP)

CRITICAL
Q9706
FDC638APZ_SBMS001
SSOT6-HF

F9700
3AMP-32V-467
603-HF
BOTTOM

=PPBUS_S0_LCDBKLT → PPBUS_S0_LCDBKLT_FUSED
MIN_LINE_WIDTH=0.4 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=12.6V

PPBUS_SW_LCDBKLT_PWR
MIN_LINE_WIDTH=0.4 mm
MIN_NECK_WIDTH=0.25 mm
VOLTAGE=12.6V

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

NEED VALUE CHANGES FOR 55V AND 96 LEDS !!!

R9788 301K 1% 1/16W MF-LF 402
C9782 0.1UF 10% 16V X7R-CERM 0402

LCDBKLT_EN_DIV

R9789 147K 1% 1/16W MF-LF 402

LCDBKLT_EN_L

Q9707 SSM6N15FEAPE SOT563

LCD_BKLT_EN
LCDBKLT_DISABLE

Q9707 SSM6N15FEAPE SOT563

BKLT_PLT_RST_L

=PP5V_S0_BKL

*L9710, Q9701, D9701, C9715-C9719 SHOULD ALL BE PLACED NEAR EACH OTHER.

PPBUS_S0_LCDBKLT_PWR
PLACE_NEAR=L9710.1:5MM
PLACE_NEAR=L9710.1:3MM

CRITICAL
C9712 10UF 10% 25V X5R 805
C9713 0.1UF 10% 25V X5R 402

CRITICAL
L9710
22UH-20%-2.4A-0.105OHM
DEM8030C-SM
152S1527

PPBUS_S0_LCDBKLT_PWR_SW
PLACE_NEAR=L9710.2:3MM

CRITICAL
D9701
POWERDI-123
DFLS2100

PPBUS_S0_LCDBKLT_PWR_SW SHOULD BE KEPT AS SHORT AS POSSIBLE

C9715, C9716 SHOULD BE PLACED IN T-BONE. SAME FOR C9718,C9719
C9715, C9716 SHOULD BE PLACED ON TOP SIDE. PLACE C9718,C9719 ON BOTTOM SIDE

PLACE_NEAR=D9701.2:5MM
PLACE_NEAR=D9701.2:5MM

CRITICAL C9715 2.2UF 10% 100V X7R-CERM 1210
CRITICAL C9716 2.2UF 10% 100V X7R-CERM 1210
CRITICAL C9718 2.2UF 10% 100V X7R-CERM 1210
CRITICAL C9719 2.2UF 10% 100V X7R-CERM 1210
C9717 1000PF 10% 100V X7R-CERM 0603

PLACE_NEAR=R9708.1:5MM
PLACE_NEAR=D9701.2:3MM
PLACE_NEAR=D9701.2:3MM

PPVOUT_S0_LCDBKLT
MIN_LINE_WIDTH=0.5 MM
MIN_NECK_WIDTH=0.25 MM
VOLTAGE=55V

=PP3V3_S0_BKL_VDDIO

PLACE_NEAR=U9701.22:3MM
PLACE_NEAR=U9701.22:5MM
PLACE_NEAR=U9701.8:3MM

C9714 0.01UF 10% 16V X7R-CERM 0402
C9710 1UF 10% 25V X5R 603-1
C9711 0.1UF 10% 16V X7R-CERM 0402

PLACE_NEAR=L9710.2:3MM

CRITICAL
Q9701
SI7812DN
PWRPK-1212-8

BKL_FET_CNTL
MIN_LINE_WIDTH=0.6 MM
MIN_NECK_WIDTH=0.25 MM

R9708 63.4K 1% 1/16W MF-LF 402
R9709 59.0K 1% 1/16W MF-LF 402

U9701
LP8545SQX-EXTJ
LLP

VDDIO	8	SW	24
VLDO	22	FB	21
VIN	23	OUT1	12
GD	6	OUT2	13
FSET	5	OUT3	14
FILTER	20	OUT4	16
ISET	3	OUT5	17
SCLK	10	OUT6	18
SDA	11	VSYNC	19
PWM	2		
FAULT	7		
EN	4		
GND_SW	1		
GND_S	9		
GND_L	15		
THRM PAD	25		

BKL_SW
BKL_FB
BKL_ISEN1
BKL_ISEN2
BKL_ISEN3
BKL_ISEN4
BKL_ISEN5
BKL_ISEN6
BKL_VSYNC_R

MIN_LINE_WIDTH=0.5 mm
MIN_NECK_WIDTH=0.25 mm

D_BKL:DEV
R9717 10.2 0.1% 1/16W TF 402
R9718 10.2 0.1% 1/16W TF 402
R9719 10.2 0.1% 1/16W TF 402
R9720 10.2 0.1% 1/16W TF 402
R9721 10.2 0.1% 1/16W TF 402
R9722 10.2 0.1% 1/16W TF 402

PLACE_NEAR=U9701.12:10MM
PLACE_NEAR=U9701.13:10MM
PLACE_NEAR=U9701.14:10MM
PLACE_NEAR=U9701.16:10MM
PLACE_NEAR=U9701.17:10MM
PLACE_NEAR=U9701.18:10MM

LED_RETURN_1
LED_RETURN_2
LED_RETURN_3
LED_RETURN_4
LED_RETURN_5
LED_RETURN_6

R9753 AND R9757 NEED TO BE 402 PACK FOR LAB ACCESS

=I2C_BKL_1_SCL R9753 0 5% 1/16W MF-LF 402
=I2C_BKL_1_SDA R9757 0 5% 1/16W MF-LF 402

BKL_SCL
BKL_SDA
BKL_ISET
LVDS_BKL_PWM_RC
TP_BKL_FAULT
BKLT_EN

PPBUS_S0_LCDBKLT_PWR
R9731 301K 1% 1/16W MF-LF 402
R9715 100K 1% 1/16W MF-LF 402

R9765 10K 5% 1/16W MF-LF 402
R9755 10K 5% 1/16W MF-LF 402

CRITICAL

(EEPROM should set EN_I_RES=1)
R9714 15.4K 1% 1/16W MF-LF 402
I_LED=23.96MA
I_LED=369/Riset

(APN: 353S3376)
PWM RES = 9+3

R9716 12.7K 1% 1/16W MF-LF 402
FPWM=19.2KHZ
details in spec

LCD_BKLT_PWM
R9704 0 5% 1/16W MF-LF 402
LCD_BKLT_PWM SHOULD BE KEPT AWAY FROM BOOST CIRCUIT

NO STUFF
C9704 33PF 5% 50V C0G-CERM 0402

BKL_SGND
XW9710 SM
MIN_LINE_WIDTH=0.4 MM
MIN_NECK_WIDTH=0.2 MM
VOLTAGE=0V
PLACE_NEAR=U9701.9:10MM

PLACE XW9710 AWAY FROM U9701.1 AND U9701.15
ADD VIAS IN TPAD OF U9701

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0004	6	RES, 0OHM, 0402	R9717,R9718,R9719,R9720,R9721,R9722		D_BKL:PROD

SYNC_MASTER=D2_KEPLER
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LCD Backlight Driver (LP8545)

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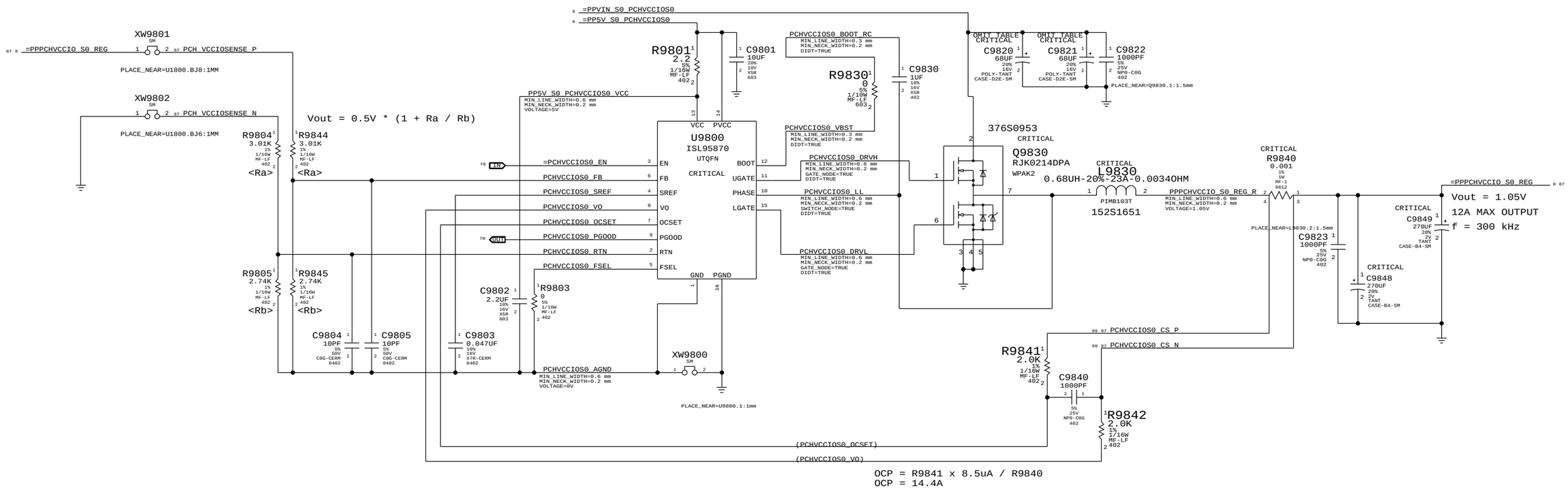
PCH VCCIO (1.05V S0) REGULATOR



SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE

PCH VCCIO (1.05V) POWER SUPPLY

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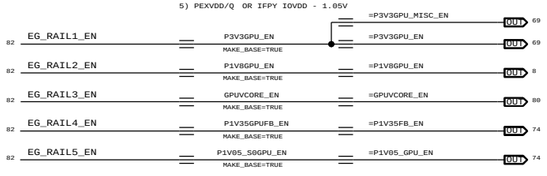
GPU Rail Sequencing

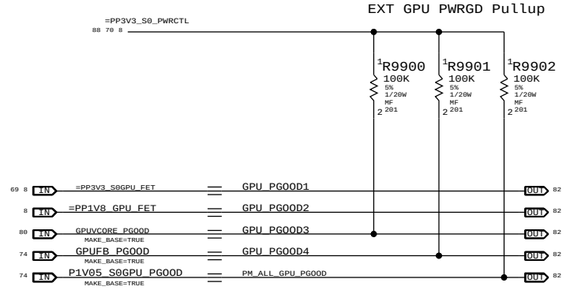
KEPLER GPU REQUIRES RAILS TO COME
up in the following order:

1) GPU_3.3V
2) IFPX IOVDD - 1.8V
3) GPUVCORE
4) FBVDDQ/GDDR5 1.35V
5) PEXVDD/Q OR IFPY IOVDD - 1.05V



NOTE: 1V8 MAY NOT BE REQUIRED FOR KEPLER IF THERE IS NO LVDS

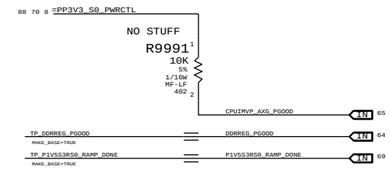
EXT GPU PWRGD Pullup

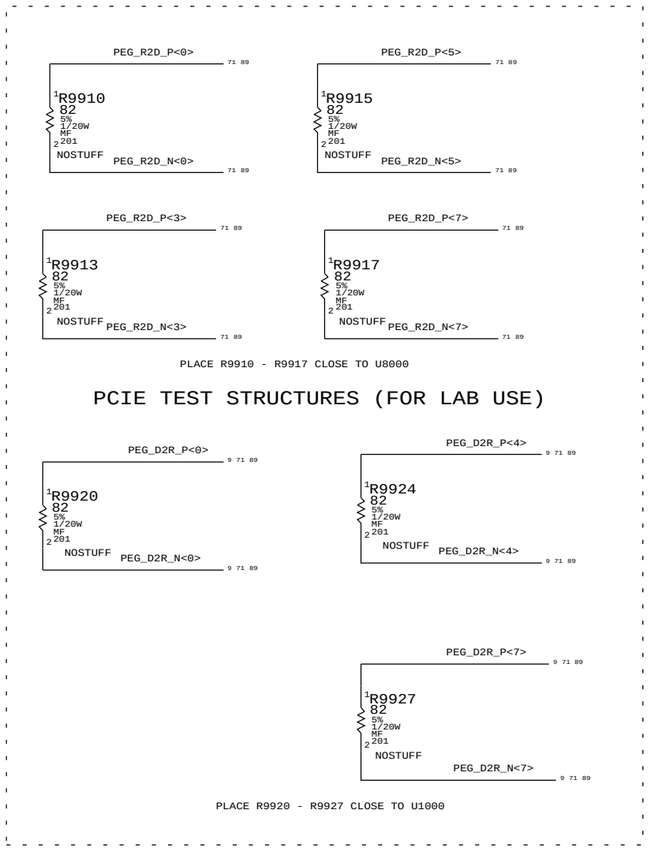


NOTE: NO PU ON 3V3 AND 1V8 PGOODS SINCE THEY ARE SYNTHETIC.

NOTE 2: CHECK IF 1V8 IS READ AS LOGIC HIGH BY GMUX

Unused PGOOD signal





PLACE R9910 - R9917 CLOSE TO U8000

PCIE TEST STRUCTURES (FOR LAB USE)

PLACE R9920 - R9927 CLOSE TO U1000

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE
Power Sequencing EG/PCH S0

Apple Inc.

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CPU Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CPU_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD
CPU_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD
CPU_27P4S	*	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	=27P4_OHM_SE	7 MIL	7 MIL

NOTE: 7 mil gap is for VCCSense pair, which Intel says to route with 7 mil spacing without specifying a target impedance.

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_AGTL	*	=STANDARD	?
CPU_8MIL	*	8 MIL	?
CPU_COMP	*	20 MIL	?
CPU_ITP	*	=2:1_SPACING	?
CPU_VCCSENSE	*	25 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_AGTL	TOP,BOTTOM	=2x_DIELECTRIC	?
CPU_VID	*	0.457 MM	?
CPU_VREF	*	12 MIL	?

Most CPU signals with impedance requirements are 50-ohm single-ended.
Some signals require 27.4-ohm single-ended impedance.

SOURCE: IVB PLATFORM DG , Tables 205-207

PCI-Express

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_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE	*	15 MIL	?
CLK_PCIE	*	20 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE	TOP,BOTTOM	15 MIL	?

PEG

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
PEG_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PEG_RXRX	*	=4X_DIELECTRIC	?
PEG_TXTX	*	=4X_DIELECTRIC	?
PEG_TXRX	*	=10X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
PEG_D2R	PEG_D2R	*	PEG_RXRX
PEG_R2D	PEG_R2D	*	PEG_TXTX
PEG_D2R	PEG_R2D	*	PEG_TXRX

CPU Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
DMI_S2N	PCIE_85D	PCIE	DMI_S2N_P<3:0>	10 18
DMI_S2N	PCIE_85D	PCIE	DMI_S2N_N<3:0>	10 18
DMI_N2S	PCIE_85D	PCIE	DMI_N2S_P<3:0>	10 18
DMI_N2S	PCIE_85D	PCIE	DMI_N2S_N<3:0>	10 18
FDI_DATA	PCIE_85D	PCIE	FDI_DATA_P<7:0>	9 10
FDI_DATA	PCIE_85D	PCIE	FDI_DATA_N<7:0>	9 10
FDI_FSYNC	CPU_50S	CPU_AGTL	FDI_FSYNC<1..0>	9 10
FDI_LSYNC	CPU_50S	CPU_AGTL	FDI_LSYNC<1..0>	9 10
FDI_INT	CPU_50S	CPU_AGTL	FDI_INT	10 18
DMI_CLK100M	CLK_PCIE_90D	CLK_PCIE	DMI_CLK100M_CPU_P	11 17
DMI_CLK100M	CLK_PCIE_90D	CLK_PCIE	DMI_CLK100M_CPU_N	11 17
DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_IG_ML_P<3:0>	10 82
DP_INT_ML	DP_85D	DISPLAYPORT	DP_INT_IG_ML_N<3:0>	10 82
DP_INT_AUX	DP_85D	DISPLAYPORT	DP_INT_IG_AUX_P	10 82
DP_INT_AUX	DP_85D	DISPLAYPORT	DP_INT_IG_AUX_N	10 82
CPU_EDP_COMP	CPU_27P4S	CPU_COMP	CPU_EDP_COMP	10
CPU_PEG_COMP	CPU_27P4S	CPU_COMP	CPU_PEG_COMP	10
CPU_CFG	CPU_50S	CPU_ITP	CPU_CFG<17..0>	10 24
XDP_CLK_CPU	CLK_PCIE_90D	CLK_PCIE	ITPCPU_CLK100M_P	11 17
XDP_CLK_CPU	CLK_PCIE_90D	CLK_PCIE	ITPCPU_CLK100M_N	11 17
XDP_CLK_PCH	CLK_PCIE_90D	CLK_PCIE	ITPXDP_CLK100M_P	17 24
XDP_CLK_PCH	CLK_PCIE_90D	CLK_PCIE	ITPXDP_CLK100M_N	17 24
DPLL_REF_CLK120M	CLK_PCIE_90D	CLK_PCIE	DPLL_REF_CLKP	9 11
DPLL_REF_CLK120M	CLK_PCIE_90D	CLK_PCIE	DPLL_REF_CLKN	9 11
XDP_TDI	CPU_50S	CPU_ITP	XDP_CPU_TDI	11 24
XDP_TDO	CPU_50S	CPU_ITP	XDP_CPU_TDO	11 24
XDP_TMS	CPU_50S	CPU_ITP	XDP_CPU_TMS	11 24
XDP_TCK	CPU_50S	CPU_ITP	XDP_CPU_TCK	11 24
XDP_TRST_L	CPU_50S	CPU_ITP	XDP_CPU_TRST_L	11 24
XDP_BPM	CPU_50S	CPU_ITP	XDP_BPM_L<3..0>	11 24
XDP_BPM_L	CPU_50S	CPU_ITP	XDP_BPM_L<7..4>	11 24
XDP_RESET_L	CPU_50S	CPU_ITP	XDP_DBRESET_L	11 24 25
XDP_PRDY_L	CPU_50S	CPU_ITP	XDP_CPU_PRDY_L	11 24
XDP_PREQ_L	CPU_50S	CPU_ITP	XDP_CPU_PREQ_L	11 24
CPU_CATERR_L	CPU_50S	CPU_AGTL	CPU_CATERR_L	11 41
CPU_PROC_SEL_L	CPU_50S	CPU_AGTL	CPU_PROC_SEL_L	11 20
CPU_PECI	CPU_50S	CPU_VID	CPU_PECI	11 20 42
CPU_PROCHOT_L	CPU_50S	CPU_AGTL	CPU_PROCHOT_L	11 41 42 65
XDP_CPU_PWRGD	CPU_50S	CPU_ITP	XDP_CPU_PWRGD	24
PM_THRMTRIP_L	CPU_50S	CPU_BMIL	PM_THRMTRIP_L	11 20 42
PM_SYNC	CPU_50S	CPU_AGTL	PM_SYNC	11 18
PM_MEM_PWRGD	CPU_50S	CPU_AGTL	PM_MEM_PWRGD	11 18 27
CPU_PWRGD	CPU_50S	CPU_AGTL	CPU_PWRGD	11 20 24
CPU_SM_RCOMP	CPU_27P4S	CPU_COMP	CPU_SM_RCOMP<2..0>	11
	CPU_50S	CPU_VID	CPU_VIDSOUT	13 65
	CPU_50S	CPU_VID	CPU_VIDSCLK	13 65
	CPU_50S	CPU_VID	CPU_VIDALERT_L	13 65
	CPU_55S	CPU_VID	CPU_VCCSA_VID<1..0>	13 62
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCSENSE_P	13 65
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCSENSE_N	13 65
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCIOSENSE_P	13 67
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCCIOSENSE_N	13 67
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_SENSE_P	13 65
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_SENSE_N	13 65
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCC_VALSENSE_P	13
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_VCC_VALSENSE_N	13
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_VALSENSE_P	13
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU_AXG_VALSENSE_N	13
CPU_VCCSASENSE	CPU_50S	CPU_AGTL	CPU_VCCSASENSE	13 62
CPU_MEM_VREF		CPU_VREF	PPCPU_MEM_VREFDQ_A	10 33
CPU_MEM_VREF		CPU_VREF	PPCPU_MEM_VREFDQ_B	10 33
CPU_MEM_VREF		CPU_VREF	PP0V75_S3_MEM_VREFDQ_A	28 29 33
CPU_MEM_VREF		CPU_VREF	PP0V75_S3_MEM_VREFDQ_B	30 31 33
CPU_MEM_VREF		CPU_VREF	PP0V75_S3_MEM_VREFCA_A	28 29 33
CPU_MEM_VREF		CPU_VREF	PP0V75_S3_MEM_VREFCA_B	30 31 33
XDP_CLK_ITP	CLK_PCIE_90D	CLK_PCIE	XDP_CPU_CLK100M_P	24
XDP_CLK_ITP	CLK_PCIE_90D	CLK_PCIE	XDP_CPU_CLK100M_N	24
	PEG_80D	PEG_R2D	PEG_R2D_P<7..0>	71 88
	PEG_80D	PEG_R2D	PEG_R2D_N<7..0>	71 88
PEG_R2D	PEG_80D	PEG_R2D	PEG_R2D_C_P<7..0>	9 71
	PEG_80D	PEG_R2D	PEG_R2D_C_N<7..0>	9 71
PEG_D2R	PEG_80D	PEG_D2R	PEG_D2R_P<7..0>	9 71 88
	PEG_80D	PEG_D2R	PEG_D2R_N<7..0>	9 71 88
	PEG_80D	PEG_D2R	PEG_D2R_C_P<7..0>	71
	PEG_80D	PEG_D2R	PEG_D2R_C_N<7..0>	71

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

PAGE TITLE: CPU Constraints

Apple Inc.

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Memory Bus Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MEM_37S	*	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE	=STANDARD	=STANDARD
MEM_40S	*	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=STANDARD	=STANDARD
MEM_72D	*	=72_OHM_DIFF	=72_OHM_DIFF	=72_OHM_DIFF	=72_OHM_DIFF	=72_OHM_DIFF	=72_OHM_DIFF
MEM_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD
MEM_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
MEM_CLK2MEM	*	=4:1_SPACING	?
MEM_CTRL2CTRL	*	=3:1_SPACING	?
MEM_CTRL2MEM	*	=2.5:1_SPACING	?
MEM_CMD2CMD	*	=1.5:1_SPACING	?
MEM_CMD2MEM	*	=3:1_SPACING	?
MEM_DATA2DATA	*	=1.5:1_SPACING	?
MEM_DATA2MEM	*	=3:1_SPACING	?
MEM_DQS2MEM	*	=3:1_SPACING	?
MEM_2OTHER	*	25 MILS	?
MEM_DQBL2BL	*	16 MILS	?
MEM_DQCH2CH	*	25 MILS	?

Memory Bus Spacing Group Assignments

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CLK	MEM_*	*	MEM_CLK2MEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CMD	MEM_*	*	MEM_CMD2MEM
MEM_CMD	MEM_CMD	*	MEM_CMD2CMD

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CTRL	MEM_*	*	MEM_CTRL2MEM
MEM_CTRL	MEM_CTRL	*	MEM_CTRL2CTRL

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_DQS	MEM_*	*	MEM_DQS2MEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*	*	*	MEM_2OTHER

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_*_DQ_BYTE*	MEM_*	*	MEM_DATA2MEM
MEM_*_DQ_BYTE*	=SAME	*	MEM_DATA2DATA
MEM_A_DQ_BYTE*	MEM_A_DQ_BYTE*	*	MEM_DQBL2BL
MEM_B_DQ_BYTE*	MEM_B_DQ_BYTE*	*	MEM_DQBL2BL
MEM_A_DQ_BYTE*	MEM_B_DQ_BYTE*	*	MEM_DQCH2CH

DDR3 (Memory Down):
DQ signals should be matched within 0.508mm of associated DQS pair
DQS intra-pair matching should be within 0.127mm, no inter-pair matching requirement.
DQS to clock matching should be within [CLK-139.73mm] and [CLK-30.48mm].
CLK intra-pair matching should be within 0.127mm, inter-pair matching should be within 0.508mm.
CONTROL signals should be matched within [CLK-2.54mm] to [CLK+0mm] of CLK pairs.
A/BA/CMD signals should be matched within [CLK-2.54mm] to [CLK+2.54mm] of CLK pairs.
DQ/DQS/A/BA/cmd signal spacing is 4x dielectric, CLK is 5x dielectric.
Maximum length of any signal from die pad to first DRAM device is 139.7mm max, to last DRAM device is 194.31mm max.

SOURCE: Chief River SFF Platform DG, Rev 0.7 (#460452), Section 2.6.3

Memory Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
MEM_A_CLK	MEM_72D	MEM_CLK	MEM_A_CLK_P<5..0> 12 28 29 32
MEM_A_CLK	MEM_72D	MEM_CLK	MEM_A_CLK_N<5..0> 12 28 29 32
MEM_A_CNTL	MEM_37S	MEM_CTRL	MEM_A_CKE<3..0> 12 28 29 32
MEM_A_CNTL	MEM_37S	MEM_CTRL	MEM_A_CS_L<3..2>
T103 MEM_A_CNTL1	MEM_37S	MEM_CTRL	MEM_A_CS_L<1> 12 29 32
T102 MEM_A_CNTL	MEM_37S	MEM_CTRL	MEM_A_CS_L<0> 12 28 32
MEM_A_CNTL	MEM_37S	MEM_CTRL	MEM_A_ODT<3..2>
T104 MEM_A_CNTL1	MEM_37S	MEM_CTRL	MEM_A_ODT<1> 12 29 32
T101 MEM_A_CNTL	MEM_37S	MEM_CTRL	MEM_A_ODT<0> 12 28 32
MEM_A_CMD	MEM_40S	MEM_CMD	MEM_A_A<15..0> 12 28 29 32
MEM_A_CMD	MEM_40S	MEM_CMD	MEM_A_BA<2..0> 12 28 29 32
MEM_A_CMD	MEM_40S	MEM_CMD	MEM_A_RAS_L 12 28 29 32
MEM_A_CMD	MEM_40S	MEM_CMD	MEM_A_CAS_L 12 28 29 32
MEM_A_CMD	MEM_40S	MEM_CMD	MEM_A_WE_L 12 28 29 32
MEM_A_DQ_BYTE0	MEM_50S	MEM_A_DQ_BYTE0	MEM_A_DQ<7..0> 12 28 29
MEM_A_DQ_BYTE1	MEM_50S	MEM_A_DQ_BYTE1	MEM_A_DQ<15..8> 12 28 29
MEM_A_DQ_BYTE2	MEM_50S	MEM_A_DQ_BYTE2	MEM_A_DQ<23..16> 12 28 29
MEM_A_DQ_BYTE3	MEM_50S	MEM_A_DQ_BYTE3	MEM_A_DQ<31..24> 12 28 29
MEM_A_DQ_BYTE4	MEM_50S	MEM_A_DQ_BYTE4	MEM_A_DQ<39..32> 12 28 29
MEM_A_DQ_BYTE5	MEM_50S	MEM_A_DQ_BYTE5	MEM_A_DQ<47..40> 12 28 29
MEM_A_DQ_BYTE6	MEM_50S	MEM_A_DQ_BYTE6	MEM_A_DQ<55..48> 12 28 29
T105 MEM_A_DQ_BYTE7	MEM_50S	MEM_A_DQ_BYTE7	MEM_A_DQ<63..56> 12 28 29
T106 MEM_A_DQS0	MEM_85D	MEM_DQS	MEM_A_DQS_P<0> 12 28 29
MEM_A_DQS0	MEM_85D	MEM_DQS	MEM_A_DQS_N<0> 12 28 29
MEM_A_DQS1	MEM_85D	MEM_DQS	MEM_A_DQS_P<1> 12 28 29
MEM_A_DQS1	MEM_85D	MEM_DQS	MEM_A_DQS_N<1> 12 28 29
MEM_A_DQS2	MEM_85D	MEM_DQS	MEM_A_DQS_P<2> 12 28 29
MEM_A_DQS2	MEM_85D	MEM_DQS	MEM_A_DQS_N<2> 12 28 29
MEM_A_DQS3	MEM_85D	MEM_DQS	MEM_A_DQS_P<3> 12 28 29
MEM_A_DQS3	MEM_85D	MEM_DQS	MEM_A_DQS_N<3> 12 28 29
MEM_A_DQS4	MEM_85D	MEM_DQS	MEM_A_DQS_P<4> 12 28 29
MEM_A_DQS4	MEM_85D	MEM_DQS	MEM_A_DQS_N<4> 12 28 29
MEM_A_DQS5	MEM_85D	MEM_DQS	MEM_A_DQS_P<5> 12 28 29
MEM_A_DQS5	MEM_85D	MEM_DQS	MEM_A_DQS_N<5> 12 28 29
MEM_A_DQS6	MEM_85D	MEM_DQS	MEM_A_DQS_P<6> 12 28 29
MEM_A_DQS6	MEM_85D	MEM_DQS	MEM_A_DQS_N<6> 12 28 29
MEM_A_DQS7	MEM_85D	MEM_DQS	MEM_A_DQS_P<7> 12 28 29
MEM_A_DQS7	MEM_85D	MEM_DQS	MEM_A_DQS_N<7> 12 28 29
MEM_B_CLK	MEM_72D	MEM_CLK	MEM_B_CLK_P<5..0> 12 30 31 32
MEM_B_CLK	MEM_72D	MEM_CLK	MEM_B_CLK_N<5..0> 12 30 31 32
MEM_B_CNTL	MEM_37S	MEM_CTRL	MEM_B_CKE<3..2>
T110 MEM_B_CNTL1	MEM_37S	MEM_CTRL	MEM_B_CKE<1> 12 31 32
T111 MEM_B_CNTL0	MEM_37S	MEM_CTRL	MEM_B_CKE<0> 12 30 32
MEM_B_CNTL	MEM_37S	MEM_CTRL	MEM_B_CS_L<3..0> 12 30 31 32
MEM_B_CNTL	MEM_37S	MEM_CTRL	MEM_B_ODT<3..1> 12 31 32
T109 MEM_B_CNTL0	MEM_37S	MEM_CTRL	MEM_B_ODT<0> 12 30 32
T108 MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_A<15..7> 12 30 31 32
T107 MEM_B_CMD6	MEM_40S	MEM_CMD	MEM_B_A<6> 12 30 31 32
MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_A<5..0> 12 30 31 32
MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_BA<2..0> 12 30 31 32
MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_RAS_L 12 30 31 32
MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_CAS_L 12 30 31 32
MEM_B_CMD	MEM_40S	MEM_CMD	MEM_B_WE_L 12 30 31 32
MEM_B_DQ_BYTE0	MEM_50S	MEM_B_DQ_BYTE0	MEM_B_DQ<7..0> 12 30 31
MEM_B_DQ_BYTE1	MEM_50S	MEM_B_DQ_BYTE1	MEM_B_DQ<15..8> 12 30 31
MEM_B_DQ_BYTE2	MEM_50S	MEM_B_DQ_BYTE2	MEM_B_DQ<23..16> 12 30 31
MEM_B_DQ_BYTE3	MEM_50S	MEM_B_DQ_BYTE3	MEM_B_DQ<31..24> 12 30 31
MEM_B_DQ_BYTE4	MEM_50S	MEM_B_DQ_BYTE4	MEM_B_DQ<39..32> 12 30 31
MEM_B_DQ_BYTE5	MEM_50S	MEM_B_DQ_BYTE5	MEM_B_DQ<47..40> 12 30 31
MEM_B_DQ_BYTE6	MEM_50S	MEM_B_DQ_BYTE6	MEM_B_DQ<55..48> 12 30 31
MEM_B_DQ_BYTE7	MEM_50S	MEM_B_DQ_BYTE7	MEM_B_DQ<63..56> 12 30 31
MEM_B_DQS0	MEM_85D	MEM_DQS	MEM_B_DQS_P<0> 12 30 31
MEM_B_DQS0	MEM_85D	MEM_DQS	MEM_B_DQS_N<0> 12 30 31
MEM_B_DQS1	MEM_85D	MEM_DQS	MEM_B_DQS_P<1> 12 30 31
MEM_B_DQS1	MEM_85D	MEM_DQS	MEM_B_DQS_N<1> 12 30 31
MEM_B_DQS2	MEM_85D	MEM_DQS	MEM_B_DQS_P<2> 12 30 31
MEM_B_DQS2	MEM_85D	MEM_DQS	MEM_B_DQS_N<2> 12 30 31
MEM_B_DQS3	MEM_85D	MEM_DQS	MEM_B_DQS_P<3> 12 30 31
MEM_B_DQS3	MEM_85D	MEM_DQS	MEM_B_DQS_N<3> 12 30 31
MEM_B_DQS4	MEM_85D	MEM_DQS	MEM_B_DQS_P<4> 12 30 31
MEM_B_DQS4	MEM_85D	MEM_DQS	MEM_B_DQS_N<4> 12 30 31
MEM_B_DQS5	MEM_85D	MEM_DQS	MEM_B_DQS_P<5> 12 30 31
MEM_B_DQS5	MEM_85D	MEM_DQS	MEM_B_DQS_N<5> 12 30 31
MEM_B_DQS6	MEM_85D	MEM_DQS	MEM_B_DQS_P<6> 12 30 31
MEM_B_DQS6	MEM_85D	MEM_DQS	MEM_B_DQS_N<6> 12 30 31
MEM_B_DQS7	MEM_85D	MEM_DQS	MEM_B_DQS_P<7> 12 30 31
MEM_B_DQS7	MEM_85D	MEM_DQS	MEM_B_DQS_N<7> 12 30 31

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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Apple Inc.

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Digital Video 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
PCH_DP_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF
LVDS_85D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCH_DISPLAYPORT	TS3,TS4,TS5,TS6,TS10	=4:1_SPACING	?
LVDS	TS3,TS4,TS5,TS6,TS10	=4:1_SPACING	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCH_DISPLAYPORT	TOP,BOTTOM	=4:1_SPACING	?
LVDS	TOP,BOTTOM	=4:1_SPACING	?

SOURCE: HR PLATFORM DESIGN GUIDE, TABLES 191,193

SATA Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SATA_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF
SATA_37SE	*	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE	=37_OHM_SE
SATA_50SE	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SATA	TS3,TS4,TS5,TS6,TS10	=5:1_SPACING	?
SATA_ICOMP	*	15 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SATA	TOP,BOTTOM	=5:1_SPACING	?

SOURCE: HR PLATFORM DESIGN GUIDE, TABLES 191,193

USB 2.0 Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
PCH_USB_RBIAS	*	=STANDARD	=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	TS3,TS4,TS5,TS6,TS10	=4:1_SPACING	?
USB_RBIAS	*	15 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB	TOP,BOTTOM	=4:1_SPACING	?

SOURCE: HR PLATFORM DESIGN GUIDE, TABLES 191,193

USB 3.0 INTERFACE CONSTRAINTS

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3	TS3,TS4,TS5,TS6,TS10	=5:1_SPACING	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3	TOP,BOTTOM	=5:1_SPACING	?

SOURCE: CR SFF PLATFORM DESIGN GUIDE V0.7, TABLE 4-211, 1X1+

System Clock Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CLK_SLOW_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD
CLK_25M_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD

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

NOTE: 25MHz system clocks very sensitive to noise.

PCH Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
LVDS_IG_A_CLK	LVDS_85D	LVDS	LVDS_IG_A_CLK_P	9 18
LVDS_IG_A_CLK	LVDS_85D	LVDS	LVDS_IG_A_CLK_N	9 18
LVDS_IG_A_DATA	LVDS_85D	LVDS	LVDS_IG_A_DATA_P<2..0>	9 18
LVDS_IG_A_DATA	LVDS_85D	LVDS	LVDS_IG_A_DATA_N<2..0>	9 18
LVDS_IG_A_DATA3	LVDS_85D	LVDS	LVDS_IG_A_DATA_P<3>	9 18
LVDS_IG_A_DATA3	LVDS_85D	LVDS	LVDS_IG_A_DATA_N<3>	9 18
LVDS_IG_B_DATA	LVDS_85D	LVDS	LVDS_IG_B_DATA_P<2..0>	9 18
LVDS_IG_B_DATA	LVDS_85D	LVDS	LVDS_IG_B_DATA_N<2..0>	9 18
SATA_HDD_R2D	SATA_90D	SATA	SATA_HDD_R2D_C_P	17 39
	SATA_90D	SATA	SATA_HDD_R2D_C_N	17 39
SATA_HDD_D2R	SATA_90D	SATA	SATA_HDD_D2R_P	17 39
	SATA_90D	SATA	SATA_HDD_D2R_N	17 39
SATA_HDD_D2R	SATA_90D	SATA	SATA_SSD_D2R_MUX_OUT_P	39
	SATA_90D	SATA	SATA_SSD_D2R_MUX_OUT_N	39
SATA_HDD_R2D	SATA_90D	SATA	SATA_SSD_R2D_MUX_IN_P	39
	SATA_90D	SATA	SATA_SSD_R2D_MUX_IN_N	39
T237 SATA_HDD_D2R	SATA_90D	SATA	SATA_SSD_D2R_P	39
T238	SATA_90D	SATA	SATA_SSD_D2R_N	39
T239 SATA_HDD_R2D	SATA_90D	SATA	SATA_SSD_R2D_P	39
T240	SATA_90D	SATA	SATA_SSD_R2D_N	39
T218 SATA_HDD_R2D	SATA_90D	SATA	SATA_HDD_R2D_UF_P	
T219	SATA_90D	SATA	SATA_HDD_R2D_UF_N	
SATA_ODD_R2D	SATA_90D	SATA	SATA_ODD_R2D_C_P	9 17
	SATA_90D	SATA	SATA_ODD_R2D_C_N	9 17
SATA_ODD_R2D	SATA_90D	SATA	SATA_ODD_R2D_P	
	SATA_90D	SATA	SATA_ODD_R2D_N	
SATA_ODD_D2R	SATA_90D	SATA	SATA_ODD_D2R_P	9 17
	SATA_90D	SATA	SATA_ODD_D2R_N	9 17
SATA_ODD_D2R	SATA_90D	SATA	SATA_ODD_D2R_UF_P	
	SATA_90D	SATA	SATA_ODD_D2R_UF_N	
T213 PCH_SATA3_TCOMP	SATA_50SE	SATA_TCOMP	PCH_SATA3COMP	17
PCH_SATA_TCOMP	SATA_37SE	SATA_TCOMP	PCH_SATAICOMP	17
T235 USB_HUB1_UP	USB_85D	USB	USB_EXTB_XHCI_P	19 26
T236	USB_85D	USB	USB_EXTB_XHCI_N	19 26
USB_HUB1_UP	USB_85D	USB	USB_EXTB_EHCI_P	19 26
	USB_85D	USB	USB_EXTB_EHCI_N	19 26
USB_HUB2_UP	USB_85D	USB	USB_HUB_UP_P	19 26
	USB_85D	USB	USB_HUB_UP_N	19 26
USB_EXTA	USB_85D	USB	USB_EXTA_P	19 40
	USB_85D	USB	USB_EXTA_N	19 40
USB_EXTB	USB_85D	USB	USB_EXTB_P	7 26 38
	USB_85D	USB	USB_EXTB_N	7 26 38
USB_EXTC	USB_85D	USB	USB_EXTC_P	9 19
	USB_85D	USB	USB_EXTC_N	9 19
USB_CAMERA	USB_85D	USB	USB_CAMERA_CONN_P	7 34
	USB_85D	USB	USB_CAMERA_CONN_N	7 34
USB_BT	USB_85D	USB	USB_BT_P	9 34
	USB_85D	USB	USB_BT_N	9 34
USB_BT	USB_85D	USB	USB_BT_CONN_P	7 34
	USB_85D	USB	USB_BT_CONN_N	7 34
T249 USB_BT	USB_85D	USB	USB_BT_WAKE_P	34
T250	USB_85D	USB	USB_BT_WAKE_N	34
USB_TPAD	USB_85D	USB	USB_TPAD_P	9 49
	USB_85D	USB	USB_TPAD_N	9 49
USB_IR	USB_85D	USB	USB_SMC_P	9 41
	USB_85D	USB	USB_SMC_N	9 41
PCH_USB_RBIAS	PCH_USB_RBIAS	USB_RBIAS	PCH_USB_RBIAS	19
T231 USB_T29A	USB_85D	USB	USB_EXTD_XHCI_P	19 26
T232	USB_85D	USB	USB_EXTD_XHCI_N	19 26
T241 USB_EXTA	USB_85D	USB	USB_EXTA_MUXED_P	40
T242	USB_85D	USB	USB_EXTA_MUXED_N	40
T247 USB_CAMERA	USB_85D	USB	USB_CAMERA_P	19 34
T248	USB_85D	USB	USB_CAMERA_N	19 34
T243 USB_EXTA	USB_85D	USB	USB_LT1_P	40
T244	USB_85D	USB	USB_LT1_N	40
T229 USB3_EXTB_TX	USB_85D	USB3	USB3_EXTB_TX_P	19 38
T224	USB_85D	USB3	USB3_EXTB_TX_N	19 38
T227 USB3_EXTB_RX	USB_85D	USB3	USB3_EXTB_RX_P	7 19 38
T228	USB_85D	USB3	USB3_EXTB_RX_N	7 19 38
T223 USB3_EXTC_TX	USB_85D	USB3	USB3_EXTC_TX_P	9 19
T225	USB_85D	USB3	USB3_EXTC_TX_N	9 19
T226 USB3_EXTC_RX	USB_85D	USB3	USB3_EXTC_RX_P	9 19
T222	USB_85D	USB3	USB3_EXTC_RX_N	9 19
T233 USB3_EXTA_TX	USB_85D	USB3	USB3_EXTA_TX_P	19 40
T234	USB_85D	USB3	USB3_EXTA_TX_N	19 40
T220 USB3_EXTA_RX	USB_85D	USB3	USB3_EXTA_RX_P	19 40
T221	USB_85D	USB3	USB3_EXTA_RX_N	19 40

Clock Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
T255 SYSCLK_CLK32K_RTC	CLK_SLOW_55S	CLK_SLOW	SYSCLK_CLK32K_RTC	17 25
T253 SYSCLK_CLK25M_SB	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_SB	17 25
T254	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_SB_R	17
T252 SYSCLK_CLK25M_ENET	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_ENET	
T257	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_ENET_R	
T251 SYSCLK_CLK25M_TBT	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_TBT	25 35
T256	CLK_25M_55S	CLK_25M	SYSCLK_CLK25M_TBT_R	35

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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LPC Bus Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
LPC_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD
CLK_LPC_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_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_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_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_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD

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

SIO Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
CLK_SLOW_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD

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

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_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD

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

PCH Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	SPACING		
LPC_AD	LPC_50S	LPC	LPC_AD<3..0>	7 17 41 43 82
LPC_FRAME_L	LPC_50S	LPC	LPC_FRAME_L	7 17 41 43 82
LPC_RESET_L	LPC_50S	LPC	LPC_RESET_L	25
PCH_LPC_CLK0	CLK_LPC_50S	CLK_LPC	LPC_CLK33M_SMC_R	19 25
	CLK_LPC_50S	CLK_LPC	LPC_CLK33M_SMC	25 41
	CLK_LPC_50S	CLK_LPC	LPC_CLK33M_LPCPLUS	7 25 43
SMBUS_PCH_CLK	SMB_50S	SMB	SMBUS_PCH_CLK	17 44
SMBUS_PCH_DATA	SMB_50S	SMB	SMBUS_PCH_DATA	17 44
SMBUS_PCH_0_CLK	SMB_50S	SMB	SML_PCH_0_CLK	17 44
SMBUS_PCH_0_DATA	SMB_50S	SMB	SML_PCH_0_DATA	17 44
SMBUS_PCH_1_CLK	SMB_50S	SMB	SML_PCH_1_CLK	17 44
SMBUS_PCH_1_DATA	SMB_50S	SMB	SML_PCH_1_DATA	17 44
HDA_BIT_CLK	HDA_50S	HDA	HDA_BIT_CLK	17 53
	HDA_50S	HDA	HDA_BIT_CLK_R	17
HDA_SYNC	HDA_50S	HDA	HDA_SYNC	17 53
	HDA_50S	HDA	HDA_SYNC_R	17
HDA_RST_L	HDA_50S	HDA	HDA_RST_R_L	17
	HDA_50S	HDA	HDA_RST_L	17 53
HDA_SDIN0	HDA_50S	HDA	HDA_SDIN0	17 53
	HDA_50S	HDA	AUD_SDI_R	53
HDA_SDOUT	HDA_50S	HDA	HDA_SDOUT	17 53
	HDA_50S	HDA	HDA_SDOUT_R	17 25
SPI_CLK	SPI_55S	SPI	SPI_CLK_R	17 43
	SPI_55S	SPI	SPI_CLK	43
SPI_MOSI	SPI_55S	SPI	SPI_MOSI_R	17 43
	SPI_55S	SPI	SPI_MOSI	43
SPI_MISO	SPI_55S	SPI	SPI_MISO	17 43
SPI_CS0	SPI_55S	SPI	SPI_CS0_R_L	17 43
	SPI_55S	SPI	SPI_CS0_L	43
	PCIE_85D	PCIE	PCIE_ENET_R2D_P	
	PCIE_85D	PCIE	PCIE_ENET_R2D_N	
PCIE_ENET_R2D	PCIE_85D	PCIE	PCIE_ENET_R2D_C_P	7 17 38
	PCIE_85D	PCIE	PCIE_ENET_R2D_C_N	7 17 38
PCIE_ENET_D2R	PCIE_85D	PCIE	PCIE_ENET_D2R_P	7 17 38
	PCIE_85D	PCIE	PCIE_ENET_D2R_N	7 17 38
	PCIE_85D	PCIE	PCIE_ENET_D2R_C_P	
	PCIE_85D	PCIE	PCIE_ENET_D2R_C_N	
	PCIE_85D	PCIE	PCIE_AP_R2D_P	7 34
	PCIE_85D	PCIE	PCIE_AP_R2D_N	7 34
PCIE_AP_R2D	PCIE_85D	PCIE	PCIE_AP_R2D_C_P	17 34
	PCIE_85D	PCIE	PCIE_AP_R2D_C_N	17 34
PCIE_AP_D2R	PCIE_85D	PCIE	PCIE_AP_D2R_P	17 34
	PCIE_85D	PCIE	PCIE_AP_D2R_N	17 34
1275 PCIE_AP_D2R	PCIE_85D	PCIE	PCIE_AP_D2R_PI_P	7 34
1276	PCIE_85D	PCIE	PCIE_AP_D2R_PI_N	7 34
1275 PCIE_AP_D2R	PCIE_85D	PCIE	PCIE_AP_R2D_PI_P	34
1277	PCIE_85D	PCIE	PCIE_AP_R2D_PI_N	34
PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_SSD_D2R_MUX_OUT_P	39
	PCIE_85D	PCIE	PCIE_SSD_D2R_MUX_OUT_N	39
PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_SSD_R2D_C_P<1..0>	9 39
	PCIE_85D	PCIE	PCIE_SSD_R2D_C_N<1..0>	9 39
PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_SSD_D2R_P<1..0>	9 39
	PCIE_85D	PCIE	PCIE_SSD_D2R_N<1..0>	9 39
PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_SSD_R2D_MUX_IN_P	39
	PCIE_85D	PCIE	PCIE_SSD_R2D_MUX_IN_N	39
1274 PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_SSD_D2R_C_P<1>	39
1275	PCIE_85D	PCIE	PCIE_SSD_D2R_C_N<1>	39
1274 PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_SSD_R2D_P<1>	39
1277	PCIE_85D	PCIE	PCIE_SSD_R2D_N<1>	39
PCIE_CLK100M	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_PCH_P	17
254	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_PCH_N	17
262 PCIE_CLK100M_TBT_	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_TBT_P	17 35
261	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_TBT_N	17 35
255	CLK_PCIE_90D	CLK_PCIE	PCH_CLK96M_DOT_P	17
257	CLK_PCIE_90D	CLK_PCIE	PCH_CLK96M_DOT_N	17
256 PCIE_CLK100M_TBT_	CLK_PCIE_90D	CLK_PCIE	PCH_CLK100M_SATA_P	17
259	CLK_PCIE_90D	CLK_PCIE	PCH_CLK100M_SATA_N	17
258	CPU_50S	CLK_PCIE	PCH_CLK14P3M_REFCLK	17
266	CPU_50S	CLK_PCIE	PCH_CLK33M_PCIIN	17 25
270 PCIE_CLK100M	1:1_DIFFPAIR	CLK_PCIE	PEX_TSTCLK_O_P	71 95
280	1:1_DIFFPAIR	CLK_PCIE	PEX_TSTCLK_O_N	71 95
PCIE_CLK100M	CLK_PCIE_90D	CLK_PCIE	PEG_CLK100M_P	17 71
	CLK_PCIE_90D	CLK_PCIE	PEG_CLK100M_N	17 71
PCIE_CLK100M_ENET	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_ENET_P	7 17 38
	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_ENET_N	7 17 38
PCIE_CLK100M_AP	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_AP_P	17 34
	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_AP_N	17 34
PCIE_CLK100M_FW	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_FW_P	9 17
	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_FW_N	9 17
281 PCIE_CLK100M_FW	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_SSD_P	17 39
282	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_SSD_N	17 39
PCIE_CLK100M_EXCARD	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_EXCARD_P	9 17
	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_EXCARD_N	9 17
263 PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_TBT_R2D_C_P<3..0>	9 35
264 PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_TBT_R2D_C_N<3..0>	9 35
265 PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_TBT_R2D_P<3..0>	35
267 PCIE_TBT_R2D	PCIE_85D	PCIE	PCIE_TBT_R2D_N<3..0>	35
268 PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_TBT_D2R_P<3..0>	9 35
269 PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_TBT_D2R_N<3..0>	9 35
270 PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_TBT_D2R_C_P<3..0>	35
269 PCIE_TBT_D2R	PCIE_85D	PCIE	PCIE_TBT_D2R_C_N<3..0>	35

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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DisplayPort Signal Constraints

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

Thunderbolt SPI Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
TBT_SPI_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD

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

Thunderbolt/DP Connector Signal Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
TBTDP_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF
TBTDP_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF
TBTDP_100D	*	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBTDP	*	=5x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
TBTDP	TOP,BOTTOM	=7x_DIELECTRIC	?

NOTE: Thunderbolt high-speed nets are NOT directly assigned to TBTDP_*D physical rules.
TABLE_PHYSICAL_ASSIGNMENT symbols must be used to create the assignments.
Proper differential impedance depends on mDP connector used.
For 514-0637: R2D nets (SMT pins) = 80D, D2R nets (TH pins) = 100D

SOURCE: Bill Cornelius’s Thunderbolt Routing Notes

Thunderbolt/DP Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE: PHYSICAL	NET_TYPE: SPACING		
TBT_A_R2D	TBTDP_85D	TBTDP	TBT_A_R2D_C_P<1..0>	7 35 84
TBT_A_R2D	TBTDP_85D	TBTDP	TBT_A_R2D_C_N<1..0>	7 35 84
	TBTDP_85D	TBTDP	TBT_A_R2D_P<1..0>	7 84
	TBTDP_85D	TBTDP	TBT_A_R2D_N<1..0>	7 84
DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_P<3..1:2>	35 84
DP_TBTPA_ML	DP_85D	DISPLAYPORT	DP_TBTPA_ML_C_N<3..1:2>	35 84
	DP_85D	DISPLAYPORT	DP_TBTPA_ML_P<3..1:2>	84
	DP_85D	DISPLAYPORT	DP_TBTPA_ML_N<3..1:2>	84
	DP_85D	DISPLAYPORT	DP_A_LSX_ML_P<1>	84
	DP_85D	DISPLAYPORT	DP_A_LSX_ML_N<1>	84
	TBTDP_85D	TBTDP	TBT_A_D2R_C_P<1..0>	7 84
	TBTDP_85D	TBTDP	TBT_A_D2R_C_N<1..0>	7 84
TBT_A_D2R	TBTDP_85D	TBTDP	TBT_A_D2R_P<1..0>	7 35 84
TBT_A_D2R	TBTDP_85D	TBTDP	TBT_A_D2R_N<1..0>	7 35 84
TBT_A_AUXCH	DP_85D	DISPLAYPORT	DP_TBTPA_AUXCH_C_P	35 84
TBT_A_AUXCH	DP_85D	DISPLAYPORT	DP_TBTPA_AUXCH_C_N	35 84
	DP_85D	DISPLAYPORT	DP_TBTPA_AUXCH_P	84
	DP_85D	DISPLAYPORT	DP_TBTPA_AUXCH_N	84
	DP_85D	DISPLAYPORT	DP_A_AUXCH_DDC_P	84
	DP_85D	DISPLAYPORT	DP_A_AUXCH_DDC_N	84
	TBTDP_85D	TBTDP	TBT_A_D2R1_AUXDDC_P	84
	TBTDP_85D	TBTDP	TBT_A_D2R1_AUXDDC_N	84
TBT_B_R2D	TBTDP_85D	TBTDP	TBT_B_R2D_C_P<1..0>	7 35 85
TBT_B_R2D	TBTDP_85D	TBTDP	TBT_B_R2D_C_N<1..0>	7 35 85
	TBTDP_85D	TBTDP	TBT_B_R2D_P<1..0>	7 85
	TBTDP_85D	TBTDP	TBT_B_R2D_N<1..0>	7 85
DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_P<3..1:2>	35 85
DP_TBTPB_ML	DP_85D	DISPLAYPORT	DP_TBTPB_ML_C_N<3..1:2>	35 85
	DP_85D	DISPLAYPORT	DP_TBTPB_ML_P<3..1:2>	85
	DP_85D	DISPLAYPORT	DP_TBTPB_ML_N<3..1:2>	85
	DP_85D	DISPLAYPORT	DP_B_LSX_ML_P<1>	85
	DP_85D	DISPLAYPORT	DP_B_LSX_ML_N<1>	85
	TBTDP_85D	TBTDP	TBT_B_D2R_C_P<1..0>	7 85
	TBTDP_85D	TBTDP	TBT_B_D2R_C_N<1..0>	7 85
TBT_B_D2R	TBTDP_85D	TBTDP	TBT_B_D2R_P<1..0>	7 35 85
TBT_B_D2R	TBTDP_85D	TBTDP	TBT_B_D2R_N<1..0>	7 35 85
TBT_B_AUXCH	DP_85D	DISPLAYPORT	DP_TBTPB_AUXCH_C_P	35 85
TBT_B_AUXCH	DP_85D	DISPLAYPORT	DP_TBTPB_AUXCH_C_N	35 85
	DP_85D	DISPLAYPORT	DP_TBTPB_AUXCH_P	85
	DP_85D	DISPLAYPORT	DP_TBTPB_AUXCH_N	85
	DP_85D	DISPLAYPORT	DP_B_AUXCH_DDC_P	85
	DP_85D	DISPLAYPORT	DP_B_AUXCH_DDC_N	85
TBT_B_D2R	TBTDP_85D	TBTDP	TBT_B_D2R1_AUXDDC_P	85
	TBTDP_85D	TBTDP	TBT_B_D2R1_AUXDDC_N	85

Only used on dual-port hosts.

Thunderbolt IC Net Properties

ELECTRICAL_CONSTRAINT_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	
TBT_SPI_CLK	TBT_SPI_55S	TBT_SPI	TBT_SPI_CLK	35
TBT_SPI_MOSI	TBT_SPI_55S	TBT_SPI	TBT_SPI_MOSI	35
TBT_SPI_MISO	TBT_SPI_55S	TBT_SPI	TBT_SPI_MISO	35
TBT_SPI_CS_L	TBT_SPI_55S	TBT_SPI	TBT_SPI_CS_L	35

Only used on hosts supporting Thunderbolt video-in

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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

SMC SMBus Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
SMBUS_SMC_2_S3_SCL	SMB_50S	SMB	SMBUS_SMC_2_S3_SCL	7 41 44
SMBUS_SMC_2_S3_SDA	SMB_50S	SMB	SMBUS_SMC_2_S3_SDA	7 41 44
SMBUS_SMC_1_S0_SCL	SMB_50S	SMB	SMBUS_SMC_1_S0_SCL	41 44
SMBUS_SMC_1_S0_SDA	SMB_50S	SMB	SMBUS_SMC_1_S0_SDA	41 44
SMBUS_SMC_0_S0_SCL	SMB_50S	SMB	SMBUS_SMC_0_S0_SCL	41 44
SMBUS_SMC_0_S0_SDA	SMB_50S	SMB	SMBUS_SMC_0_S0_SDA	41 44
SMBUS_SMC_5_SCL	SMB_50S	SMB	SMBUS_SMC_5_SCL	
SMBUS_SMC_5_SDA	SMB_50S	SMB	SMBUS_SMC_5_SDA	
SMBUS_SMC_3_SCL	SMB_50S	SMB	SMBUS_SMC_3_SCL	41 44
SMBUS_SMC_3_SDA	SMB_50S	SMB	SMBUS_SMC_3_SDA	41 44

SMBus Charger Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
CHGR_CSI	1TO1_DIFFPAIR		CHGR_CSI_P	61
	1TO1_DIFFPAIR		CHGR_CSI_N	61
CHGR_CSO	1TO1_DIFFPAIR		CHGR_CSO_P	61
	1TO1_DIFFPAIR		CHGR_CSO_N	61

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GDDR5 Frame Buffer 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
GDDR5_45R50SE	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	12.7 MM	=STANDARD	=STANDARD
GDDR5_45SE	*	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=45_OHM_SE	=STANDARD	=STANDARD
GDDR5_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GDDR5_CLK	*	=5x_DIELECTRIC	?
GDDR5_CMD	*	=3x_DIELECTRIC	?
GDDR5_DATA	*	=3x_DIELECTRIC	?
GDDR5_EDC	*	=5x_DIELECTRIC	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GDDR5_CLK	TOP,BOTTOM	=5x_DIELECTRIC	?
GDDR5_CMD	TOP,BOTTOM	=4x_DIELECTRIC	?
GDDR5_DATA	TOP,BOTTOM	=5x_DIELECTRIC	?
GDDR5_EDC	TOP,BOTTOM	=5x_DIELECTRIC	?

Digital Video 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
DP_85D	*	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF	=85_OHM_DIFF
HDMI_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DISPLAYPORT	*	=3x_DIELECTRIC	?
HDMI	*	=3x_DIELECTRIC	?

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

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.
MAX LENGTH OF DISPLAYPORT/TMDS TRACES: 13 INCHES.
SOURCE: Calpella SFF DG Rev 1.5 (407364) and Family GPU DG-04202-001-v04.

GDDR5 FB A Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
FB_A0_CLK	GDDR5_80D	GDDR5_CLK	FB A0 CLK P
FB_A0_CLK	GDDR5_80D	GDDR5_CLK	FB A0 CLK N
FB_A1_CLK	GDDR5_80D	GDDR5_CLK	FB A1 CLK P
FB_A1_CLK	GDDR5_80D	GDDR5_CLK	FB A1 CLK N
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 A<8..0>
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 A<8..0>
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 ABI L
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 ABI L
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 RAS L
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 RAS L
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 CAS L
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 CAS L
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 WE L
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 WE L
FB_A0_CMD_R	GDDR5_45SE	GDDR5_CMD	FB A0 CKE L
FB_A1_CMD_R	GDDR5_45SE	GDDR5_CMD	FB A1 CKE L
FB_A0_CMD	GDDR5_45SE	GDDR5_CMD	FB A0 CS L
FB_A1_CMD	GDDR5_45SE	GDDR5_CMD	FB A1 CS L
FB_A0_EDC0	GDDR5_45SE	GDDR5_EDC	FB A0 EDC<0>
FB_A0_EDC1	GDDR5_45SE	GDDR5_EDC	FB A0 EDC<1>
FB_A0_EDC2	GDDR5_45SE	GDDR5_EDC	FB A0 EDC<2>
FB_A0_EDC3	GDDR5_45SE	GDDR5_EDC	FB A0 EDC<3>
FB_A1_EDC0	GDDR5_45SE	GDDR5_EDC	FB A1 EDC<0>
FB_A1_EDC1	GDDR5_45SE	GDDR5_EDC	FB A1 EDC<1>
FB_A1_EDC2	GDDR5_45SE	GDDR5_EDC	FB A1 EDC<2>
FB_A1_EDC3	GDDR5_45SE	GDDR5_EDC	FB A1 EDC<3>
FB_A0_DBI_L0	GDDR5_45SE	GDDR5_DATA	FB A0 DBI L<0>
FB_A0_DBI_L1	GDDR5_45SE	GDDR5_DATA	FB A0 DBI L<1>
FB_A0_DBI_L2	GDDR5_45SE	GDDR5_DATA	FB A0 DBI L<2>
FB_A0_DBI_L3	GDDR5_45SE	GDDR5_DATA	FB A0 DBI L<3>
FB_A1_DBI_L0	GDDR5_45SE	GDDR5_DATA	FB A1 DBI L<0>
FB_A1_DBI_L1	GDDR5_45SE	GDDR5_DATA	FB A1 DBI L<1>
FB_A1_DBI_L2	GDDR5_45SE	GDDR5_DATA	FB A1 DBI L<2>
FB_A1_DBI_L3	GDDR5_45SE	GDDR5_DATA	FB A1 DBI L<3>
FB_A0_WCLK0	GDDR5_80D	GDDR5_CMD	FB A0 WCLK P<0>
FB_A0_WCLK0	GDDR5_80D	GDDR5_CMD	FB A0 WCLK N<0>
FB_A0_WCLK1	GDDR5_80D	GDDR5_CMD	FB A0 WCLK P<1>
FB_A0_WCLK1	GDDR5_80D	GDDR5_CMD	FB A0 WCLK N<1>
FB_A1_WCLK0	GDDR5_80D	GDDR5_CMD	FB A1 WCLK P<0>
FB_A1_WCLK0	GDDR5_80D	GDDR5_CMD	FB A1 WCLK N<0>
FB_A1_WCLK1	GDDR5_80D	GDDR5_CMD	FB A1 WCLK P<1>
FB_A1_WCLK1	GDDR5_80D	GDDR5_CMD	FB A1 WCLK N<1>
FB_A0_DQ_BYTE0	GDDR5_45SE	GDDR5_DATA	FB A0 DQ<7..0>
FB_A0_DQ_BYTE1	GDDR5_45SE	GDDR5_DATA	FB A0 DQ<15..8>
FB_A0_DQ_BYTE2	GDDR5_45SE	GDDR5_DATA	FB A0 DQ<23..16>
FB_A0_DQ_BYTE3	GDDR5_45SE	GDDR5_DATA	FB A0 DQ<31..24>
FB_A1_DQ_BYTE0	GDDR5_45SE	GDDR5_DATA	FB A1 DQ<7..0>
FB_A1_DQ_BYTE1	GDDR5_45SE	GDDR5_DATA	FB A1 DQ<15..8>
FB_A1_DQ_BYTE2	GDDR5_45SE	GDDR5_DATA	FB A1 DQ<23..16>
FB_A1_DQ_BYTE3	GDDR5_45SE	GDDR5_DATA	FB A1 DQ<31..24>
FB_A0_CMD_R	GDDR5_45SE	GDDR5_CMD	FB A0 RESET L
FB_A1_CMD_R	GDDR5_45SE	GDDR5_CMD	FB A1 RESET L

GDDR5 FB B Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
FB_B0_CLK	GDDR5_80D	GDDR5_CLK	FB B0 CLK P
FB_B0_CLK	GDDR5_80D	GDDR5_CLK	FB B0 CLK N
FB_B1_CLK	GDDR5_80D	GDDR5_CLK	FB B1 CLK P
FB_B1_CLK	GDDR5_80D	GDDR5_CLK	FB B1 CLK N
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 A<8..0>
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 A<8..0>
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 ABI L
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 ABI L
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 RAS L
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 RAS L
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 CAS L
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 CAS L
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 WE L
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 WE L
FB_B0_CMD_R	GDDR5_45SE	GDDR5_CMD	FB B0 CKE L
FB_B1_CMD_R	GDDR5_45SE	GDDR5_CMD	FB B1 CKE L
FB_B0_CMD	GDDR5_45SE	GDDR5_CMD	FB B0 CS L
FB_B1_CMD	GDDR5_45SE	GDDR5_CMD	FB B1 CS L
FB_B0_EDC0	GDDR5_45SE	GDDR5_EDC	FB B0 EDC<0>
FB_B0_EDC1	GDDR5_45SE	GDDR5_EDC	FB B0 EDC<1>
FB_B0_EDC2	GDDR5_45SE	GDDR5_EDC	FB B0 EDC<2>
FB_B0_EDC3	GDDR5_45SE	GDDR5_EDC	FB B0 EDC<3>
FB_B1_EDC0	GDDR5_45SE	GDDR5_EDC	FB B1 EDC<0>
FB_B1_EDC1	GDDR5_45SE	GDDR5_EDC	FB B1 EDC<1>
FB_B1_EDC2	GDDR5_45SE	GDDR5_EDC	FB B1 EDC<2>
FB_B1_EDC3	GDDR5_45SE	GDDR5_EDC	FB B1 EDC<3>
FB_B0_DBI_L0	GDDR5_45SE	GDDR5_DATA	FB B0 DBI L<0>
FB_B0_DBI_L1	GDDR5_45SE	GDDR5_DATA	FB B0 DBI L<1>
FB_B0_DBI_L2	GDDR5_45SE	GDDR5_DATA	FB B0 DBI L<2>
FB_B0_DBI_L3	GDDR5_45SE	GDDR5_DATA	FB B0 DBI L<3>
FB_B1_DBI_L0	GDDR5_45SE	GDDR5_DATA	FB B1 DBI L<0>
FB_B1_DBI_L1	GDDR5_45SE	GDDR5_DATA	FB B1 DBI L<1>
FB_B1_DBI_L2	GDDR5_45SE	GDDR5_DATA	FB B1 DBI L<2>
FB_B1_DBI_L3	GDDR5_45SE	GDDR5_DATA	FB B1 DBI L<3>
FB_B0_WCLK0	GDDR5_80D	GDDR5_CMD	FB B0 WCLK P<0>
FB_B0_WCLK0	GDDR5_80D	GDDR5_CMD	FB B0 WCLK N<0>
FB_B0_WCLK1	GDDR5_80D	GDDR5_CMD	FB B0 WCLK P<1>
FB_B0_WCLK1	GDDR5_80D	GDDR5_CMD	FB B0 WCLK N<1>
FB_B1_WCLK0	GDDR5_80D	GDDR5_CMD	FB B1 WCLK P<0>
FB_B1_WCLK0	GDDR5_80D	GDDR5_CMD	FB B1 WCLK N<0>
FB_B1_WCLK1	GDDR5_80D	GDDR5_CMD	FB B1 WCLK P<1>
FB_B1_WCLK1	GDDR5_80D	GDDR5_CMD	FB B1 WCLK N<1>
FB_B0_DQ_BYTE0	GDDR5_45SE	GDDR5_DATA	FB B0 DQ<7..0>
FB_B0_DQ_BYTE1	GDDR5_45SE	GDDR5_DATA	FB B0 DQ<15..8>
FB_B0_DQ_BYTE2	GDDR5_45SE	GDDR5_DATA	FB B0 DQ<23..16>
FB_B0_DQ_BYTE3	GDDR5_45SE	GDDR5_DATA	FB B0 DQ<31..24>
FB_B1_DQ_BYTE0	GDDR5_45SE	GDDR5_DATA	FB B1 DQ<7..0>
FB_B1_DQ_BYTE1	GDDR5_45SE	GDDR5_DATA	FB B1 DQ<15..8>
FB_B1_DQ_BYTE2	GDDR5_45SE	GDDR5_DATA	FB B1 DQ<23..16>
FB_B1_DQ_BYTE3	GDDR5_45SE	GDDR5_DATA	FB B1 DQ<31..24>
FB_B0_CMD_R	GDDR5_45SE	GDDR5_CMD	FB B0 RESET L
FB_B1_CMD_R	GDDR5_45SE	GDDR5_CMD	FB B1 RESET L

MUXGFX & DP AUX MUX NET PROPERTIES

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
DP_INT_ML	DP_85D	DISPLAYPORT	DP INT ML C P<3..0>
	DP_85D	DISPLAYPORT	DP INT ML C N<3..0>
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DP INT AUX C P
	DP_85D	DISPLAYPORT	DP INT AUX C N
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DP INT AUX P
	DP_85D	DISPLAYPORT	DP INT AUX N
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DP INT EG AUX P
	DP_85D	DISPLAYPORT	DP INT EG AUX N
DP_INT_ML	DP_85D	DISPLAYPORT	DP INT ML P<3..0>
	DP_85D	DISPLAYPORT	DP INT ML N<3..0>
DP_INT_ML	DP_85D	DISPLAYPORT	DP INT ML F P<3..0>
	DP_85D	DISPLAYPORT	DP INT ML F N<3..0>
DP_INT_ML	DP_85D	DISPLAYPORT	DP INT EG ML P<3..0>
	DP_85D	DISPLAYPORT	DP INT EG ML N<3..0>
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DPA IG AUX CH P
	DP_85D	DISPLAYPORT	DPA IG AUX CH N
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DPB IG AUX CH P
	DP_85D	DISPLAYPORT	DPB IG AUX CH N
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK0 EG AUXCH P
	DP_85D	DISPLAYPORT	DP TBTSNK0 EG AUXCH N
DP_INT_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK1 EG AUXCH P
	DP_85D	DISPLAYPORT	DP TBTSNK1 EG AUXCH N
TBT_A_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK0 AUXCH C P
	DP_85D	DISPLAYPORT	DP TBTSNK0 AUXCH C N
TBT_B_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK1 AUXCH C P
	DP_85D	DISPLAYPORT	DP TBTSNK1 AUXCH C N
DP_INT_ML	DP_85D	DISPLAYPORT	DP TBTSNK0 ML C P<3..0>
	DP_85D	DISPLAYPORT	DP TBTSNK0 ML C N<3..0>
DP_INT_ML	DP_85D	DISPLAYPORT	DP TBTSNK1 ML C P<3..0>
	DP_85D	DISPLAYPORT	DP TBTSNK1 ML C N<3..0>
TBT_A_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK0 AUXCH P
	DP_85D	DISPLAYPORT	DP TBTSNK0 AUXCH N
TBT_B_AUXCH	DP_85D	DISPLAYPORT	DP TBTSNK1 AUXCH P
	DP_85D	DISPLAYPORT	DP TBTSNK1 AUXCH N
DP_INT_ML	DP_85D	DISPLAYPORT	DP TBTSNK0 ML P<3..0>
	DP_85D	DISPLAYPORT	DP TBTSNK0 ML N<3..0>
DP_INT_ML	DP_85D	DISPLAYPORT	DP TBTSNK1 ML P<3..0>
	DP_85D	DISPLAYPORT	DP TBTSNK1 ML N<3..0>

Kepler Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING	
GPU_CLK27M	CLK_SLOW_555	CLK_SLOW	GPU OSC 27M XTALIN
GPU_CLK27M	CLK_SLOW_555	CLK_SLOW	GPU OSC 27M XTALOUT
GPU_CLK27M	CLK_SLOW_555	CLK_SLOW	GPU OSC 27M XTAL BUFFOUT
GPU_CLK27M	CLK_SLOW_555	CLK_SLOW	GPU OSC 27M SSIN
	1:1_DIFFPAIR		PEX TSTCLK O P
	1:1_DIFFPAIR		PEX TSTCLK O N
HDMI_DATA	HDMI_90D	HDMI	HDMI EG DATA C P<2..0>
	HDMI_90D	HDMI	HDMI EG DATA C N<2..0>
HDMI_CLK	HDMI_90D	HDMI	HDMI EG CLK C P
	HDMI_90D	HDMI	HDMI EG CLK C N

SYNC_MASTER=D2_KEPLER
SYNC_DATE=01/13/2012

PAGE TITLE
GPU (Kepler) CONSTRAINTS

Apple Inc.

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PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SENSE_1TO1_55S	*	=1:1_DIFFPAIR	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=1:1_DIFFPAIR	=1:1_DIFFPAIR
THERM_1TO1_55S	*	=1:1_DIFFPAIR	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=1:1_DIFFPAIR	=1:1_DIFFPAIR
DIFFPAIR	*	=1:1_DIFFPAIR			=1:1_DIFFPAIR	=1:1_DIFFPAIR	=1:1_DIFFPAIR
AUDIODIFF	*	=1:1_DIFFPAIR	0.1 MM	0.1 MM	10 MM	0.1 MM	0.1 MM
THERM_55S_CPUIMVPISNS1	*	=1:1_DIFFPAIR	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	0.2 MM	0.2 MM

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

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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GND_P2MM	*	0.20 MM	1000
PWR_P2MM	*	0.20 MM	1000

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
GND	MEM_CLK	*	GND_P2MM
GND	MEM_CMD	*	GND_P2MM
GND	MEM_CTRL	*	GND_P2MM
GND	MEM_*_DQ_BYTE*	*	GND_P2MM
GND	MEM_DQS	*	GND_P2MM

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

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

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
LVDS	GND	*	GND_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_40S OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.09 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_72D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.09 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_37S OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.09 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
MEM_85D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.09 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE
PCIE_85D OVERRIDE	* OVERRIDE	OVERRIDE	OVERRIDE	0.09 MM OVERRIDE	10 mm OVERRIDE	OVERRIDE	OVERRIDE
USB_85D OVERRIDE	TOP OVERRIDE	OVERRIDE	OVERRIDE	0.1 MM OVERRIDE	500 MIL OVERRIDE	OVERRIDE	OVERRIDE
CPU_27P4S OVERRIDE	BOTTOM OVERRIDE	OVERRIDE	OVERRIDE	0.23 MM OVERRIDE	100 MIL OVERRIDE	OVERRIDE	OVERRIDE

Graphics ,SATA Constraint Relaxations

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

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
LVDS_85D	BGA	LVDS_85D
DP_85D	BGA	100_DIFF_BGA
SATA_90D	BGA	100_DIFF_BGA
CLK_PCIE_90D	BGA	100_DIFF_BGA

Memory Constraint Relaxations

Allow 0.127 mm necks for >0.127 mm lines for ARD fanout.

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MEM_72D	BOTTOM			0.127 MM	6.35 MM		
MEM_85D	TOP			0.1 MM	6.35 MM		

D2 Specific Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	CPUTHMSNS_D2_P	47
	THERM_1TO1_55S	THERM	CPUTHMSNS_D2_N	47
SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	DDR3THMSNS_D1_P	47
	THERM_1TO1_55S	THERM	DDR3THMSNS_D1_N	47
SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GPUTHMSNS_D_P	47
	THERM_1TO1_55S	THERM	GPUTHMSNS_D_N	47
SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GPU_TDIODE_P	47 77
	THERM_1TO1_55S	THERM	GPU_TDIODE_N	47 77
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	VCCSAS0_CS_P	45 62
	SENSE_1TO1_55S	SENSE	VCCSAS0_CS_N	45 62
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	VCCSAISNS_R_P	45
	SENSE_1TO1_55S	SENSE	VCCSAISNS_R_N	45
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_1V5_MEM_R_P	45
	SENSE_1TO1_55S	SENSE	ISNS_1V5_MEM_R_N	45
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	CPUVCCIOS0_CS_P	45 67
	SENSE_1TO1_55S	SENSE	CPUVCCIOS0_CS_N	45 67
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	CPUVCCIOISNS_R_P	45
	SENSE_1TO1_55S	SENSE	CPUVCCIOISNS_R_N	45
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	GPUISENS_N	
	SENSE_1TO1_55S	SENSE	GPUISENS_P	
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_1V5_MEM_N	45
	SENSE_1TO1_55S	SENSE	ISNS_1V5_MEM_P	45
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_N	96
	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_N	96
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_P	96
	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_P	96
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_R_N	99
	SENSE_1TO1_55S	SENSE	ISNS_AIRPORT_R_P	99
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_LCDBKLT_N	
	SENSE_1TO1_55S	SENSE	ISNS_LCDBKLT_P	
	SENSE_1TO1_55S	SENSE	GPUFB_CS_P	74 99
	SENSE_1TO1_55S	SENSE	GPUFB_CS_N	74 99
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_PP1V0_S0GPU_R_P	98
	SENSE_1TO1_55S	SENSE	ISNS_PP1V0_S0GPU_R_N	98
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_PP1V8_S0GPU_P	
	SENSE_1TO1_55S	SENSE	ISNS_PP1V8_S0GPU_N	
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_PP1V8_S0GPU_R_P	
	SENSE_1TO1_55S	SENSE	ISNS_PP1V8_S0GPU_R_N	
	SENSE_1TO1_55S	SENSE	P1V05_GPU_CS_P	74 98
	SENSE_1TO1_55S	SENSE	P1V05_GPU_CS_N	74 98
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_PP1V5_S0GPU_R_P	99
	SENSE_1TO1_55S	SENSE	ISNS_PP1V5_S0GPU_R_N	99
SENSE_DIFFPAIR_42	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS1G_P	46 66
SENSE_DIFFPAIR_42	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS1G_N	46 66
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS1G_R_P	46
	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS1G_R_N	46
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_HS_OTHER_P	46
	SENSE_1TO1_55S	SENSE	ISNS_HS_OTHER_N	46
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_HS_GPU_P	46
	SENSE_1TO1_55S	SENSE	ISNS_HS_GPU_N	46
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	ISNS_HS_COMPUTING_P	46
	SENSE_1TO1_55S	SENSE	ISNS_HS_COMPUTING_N	46
SENSE_DIFFPAIR	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS_P	46
	SENSE_1TO1_55S	SENSE	CPUIMVP_ISNS_N	46
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ADC1_VSENSE_P	
	AUDIODIFF	AUDIO	ADC1_VSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ADC2_VSENSE_P	
	AUDIODIFF	AUDIO	ADC2_VSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ADC2_ISENSE_P	96
	AUDIODIFF	AUDIO	ADC2_ISENSE_N	96
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ADC2_ISENSE_P	96
	AUDIODIFF	AUDIO	ADC2_ISENSE_N	96
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SPKR_R_RSENSE_P	
	AUDIODIFF	AUDIO	SPKR_R_RSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SPKR_L_RSENSE_P	
	AUDIODIFF	AUDIO	SPKR_L_RSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_LO1_L_P	53 57
	AUDIODIFF	AUDIO	AUD_LO1_L_N	53 57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_LO1_R_P	53 57
	AUDIODIFF	AUDIO	AUD_LO1_R_N	53 57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_LO2_L_P	53 57
	AUDIODIFF	AUDIO	AUD_LO2_L_N	53 57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_LO2_R_P	53 57
	AUDIODIFF	AUDIO	AUD_LO2_R_N	53 57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_MIC_INL_P	53 58
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_MIC_INL_N	53 58
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_SPKRAMP_LIN_P	57
	AUDIODIFF	AUDIO	AUD_SPKRAMP_LIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_SPKRAMP_RIN_P	57
	AUDIODIFF	AUDIO	AUD_SPKRAMP_RIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_SPKRAMP_LSUBIN_P	57
	AUDIODIFF	AUDIO	AUD_SPKRAMP_LSUBIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	AUD_SPKRAMP_RSUBIN_P	57
	AUDIODIFF	AUDIO	AUD_SPKRAMP_RSUBIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_INTIV_RSENSE_P	
	AUDIODIFF	AUDIO	LSPKR_INTIV_RSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_INTIV_RSENSE_P	
	AUDIODIFF	AUDIO	RSPKR_INTIV_RSENSE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_INTIV_P	
	AUDIODIFF	AUDIO	LSPKR_INTIV_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_INTIV_P	
	AUDIODIFF	AUDIO	RSPKR_INTIV_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ISNS_TBT_N	99
	AUDIODIFF	AUDIO	ISNS_TBT_P	99
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ISNS_TBT_R_N	99
	AUDIODIFF	AUDIO	ISNS_TBT_R_P	99

D2 Specific Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
PCIE_CLK100M_AP	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_AP_CONN_P	7 34
	CLK_PCIE_90D	CLK_PCIE	PCIE_CLK100M_AP_CONN_N	7 34
	1TO1_DIFFPAIR		CHGR_CSI_R_P	61
	1TO1_DIFFPAIR		CHGR_CSI_R_N	61
	1TO1_DIFFPAIR		CHGR_CSO_R_P	61
	1TO1_DIFFPAIR		CHGR_CSO_R_N	61
(USB_EXTA)	USB_85D	USB	USB2_EXTA_MUXED_P	
(USB_EXTA)	USB_85D	USB	USB2_EXTA_MUXED_N	
(USB_EXTA)	USB_85D	USB	USB2_LT1_P	
(USB_EXTA)	USB_85D	USB	USB2_LT1_N	
	USB_85D	USB	CONN_USB2_BT_P	
	USB_85D	USB	CONN_USB2_BT_N	
	USB_85D	USB	USB_LT2_P	
	USB_85D	USB	USB_LT2_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SPKRAMP_LIN_P	57
	AUDIODIFF	AUDIO	SPKRAMP_LIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SPKRAMP_RIN_P	57
	AUDIODIFF	AUDIO	SPKRAMP_RIN_N	57
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SSM2375SL_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SSM2375SL_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	SSM2375SR_P	
	AUDIODIFF	AUDIO	SSM2375SR_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_SL_OUT_P_R	
	DIFFPAIR	AUDIO	SPKRCONN_SL_OUT_N_R	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_SL_OUT_P	7 57 59
	DIFFPAIR	AUDIO	SPKRCONN_SL_OUT_N	7 57 59
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	LSPKR_VSENSE_FILT_P	
	DIFFPAIR	AUDIO	LSPKR_VSENSE_FILT_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	RSPKR_VSENSE_FILT_P	
	DIFFPAIR	AUDIO	RSPKR_VSENSE_FILT_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_SR_OUT_P_R	
	DIFFPAIR	AUDIO	SPKRCONN_SR_OUT_N_R	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_SR_OUT_P	7 57 59
	DIFFPAIR	AUDIO	SPKRCONN_SR_OUT_N	7 57 59
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_L_OUT_P	7 57 59
	DIFFPAIR	AUDIO	SPKRCONN_L_OUT_N	7 57 59
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_R_OUT_P	7 57 59
	DIFFPAIR	AUDIO	SPKRCONN_R_OUT_N	7 57 59
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SPKRCONN_S_OUT_P	
	DIFFPAIR	AUDIO	SPKRCONN_S_OUT_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	LSPKR_ISENSE_FILT_P	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	LSPKR_ISENSE_FILT_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	RSPKR_ISENSE_FILT_P	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	RSPKR_ISENSE_FILT_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	RSUBIN_P	57
	DIFFPAIR	AUDIO	RSUBIN_N	57
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	LSUBIN_P	57
	DIFFPAIR	AUDIO	LSUBIN_N	57
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SSM4321SR_P	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SSM4321SR_N	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SSM4321SL_P	
AUDIO_DIFFPAIR	DIFFPAIR	AUDIO	SSM4321SL_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_VSENSE_IN_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_VSENSE_IN_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_VSENSE_IN_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_VSENSE_IN_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_ISENSE_RDIVIDE_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_ISENSE_RDIVIDE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_ISENSE_RDIVIDE_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_ISENSE_RDIVIDE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_VSENSE_RDIVIDE_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	LSPKR_VSENSE_RDIVIDE_N	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_VSENSE_RDIVIDE_P	
AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	RSPKR_VSENSE_RDIVIDE_N	
	USB_85D	USB	USB_TPAD_R_P	26 49
	USB_85D	USB	USB_TPAD_R_N	26 49
	SB_POWER		PP3V3_S5	7 8
	SB_POWER		PP3V3_S0	7 8
	SB_POWER		PP1V5_S3RS0_CPUDDR	8
	GND		GND	

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PAGE TITLE
Project Specific Constraints

Apple Inc.

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15" MBP 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	MM	16.2

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DEFAULT	*	Y	=50_OHM_SE	=50_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
55_OHM_SE	TOP,BOTTOM	Y	0.090 MM	0.090 MM			
55_OHM_SE	*	Y	0.076 MM	0.076 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
50_OHM_SE	TOP,BOTTOM	Y	0.090 MM	0.090 MM			
50_OHM_SE	*	Y	0.070 MM	0.070 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	0.085 MM	0.085 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	0.105 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	0.120 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	0.1 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	0.124 MM	0.124 MM		0.200 MM	0.200 MM
72_OHM_DIFF	ISL2,ISL11	Y	0.124 MM	0.124 MM		0.200 MM	0.200 MM
72_OHM_DIFF	TOP,BOTTOM	Y	0.140 MM	0.140 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	0.096 MM	0.096 MM		0.126 MM	0.126 MM
80_OHM_DIFF	ISL2,ISL11	Y	0.096 MM	0.096 MM		0.126 MM	0.126 MM
80_OHM_DIFF	TOP,BOTTOM	Y	0.120 MM	0.120 MM		0.160 MM	0.160 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	0.089 MM	0.089 MM		0.180 MM	0.180 MM
85_OHM_DIFF	ISL2,ISL11	Y	0.089 MM	0.089 MM		0.180 MM	0.180 MM
85_OHM_DIFF	TOP,BOTTOM	Y	0.110 MM	0.110 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
90_OHM_DIFF	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
90_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.081 MM	0.081 MM		0.200 MM	0.200 MM
90_OHM_DIFF	ISL2,ISL11	Y	0.081 MM	0.081 MM		0.200 MM	0.200 MM
90_OHM_DIFF	TOP,BOTTOM	Y	0.099 MM	0.090 MM		0.200 MM	0.200 MM

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
100_OHM_DIFF	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
100_OHM_DIFF	ISL3,ISL4,ISL9,ISL10	Y	0.065 MM	0.065 MM		0.200 MM	0.200 MM
100_OHM_DIFF	ISL2,ISL11	Y	0.065 MM	0.065 MM		0.200 MM	0.200 MM
100_OHM_DIFF	TOP,BOTTOM	Y	0.079 MM	0.079 MM		0.200 MM	0.200 MM

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
100_DIFF_BGA	*	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF
100_DIFF_BGA	ISL3,ISL4	Y	0.075 MM	0.075 MM		0.125 MM	0.125 MM
100_DIFF_BGA	ISL9,ISL10	Y	0.075 MM	0.075 MM		0.125 MM	0.125 MM

NOTE: 100_DIFF_BGA is 100-ohms differential impedance on outer layers and 95-ohms on inner layers.

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
1:1_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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DEFAULT	*	0.1 MM	?
STANDARD	*	=DEFAULT	?
BGA_P1MM	*	0.1 MM	?
BGA_P2MM	*	0.2 MM	?
P072_SPACE	*	0.071 MM	?

15" MBP Specific Net Properties

	ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE	
I1	AUDIO_DIFFPAIR	AUDIODIFF	AUDIO	ADC1_ISENSE_P	
I2		AUDIODIFF	AUDIO	ADC1_ISENSE_N	
I3	SENSE_DIFFPAIR_42	THERM_55S_CPUIMVP_DIFFSNS	THERM	CPUIMVP_ISNS1_P	46 65 66
I4		THERM_55S_CPUIMVP_DIFFSNS	THERM	CPUIMVP_ISNS1_N	46 66
I5	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	CPUIMVP_ISNS2G_P	46 66
I6		THERM_1TO1_55S	THERM	CPUIMVP_ISNS2G_N	46 66
I7	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	CPUIMVP_ISNS2_P	46 65 66
I8		THERM_1TO1_55S	THERM	CPUIMVP_ISNS2_N	46 66
I9	SENSE_DIFFPAIR	THERM_55S_CPUIMVP_DIFFSNS	THERM	CPUIMVP_ISNS3_P	46 65 66
I10		THERM_55S_CPUIMVP_DIFFSNS	THERM	CPUIMVP_ISNS3_N	46 66
I11	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	CPUIMVP_ISUM_R_P	46
I12		THERM_1TO1_55S	THERM	CPUIMVP_ISUM_R_N	46
I13	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	CPUIMVP_ISUMG_R_P	46
I14		THERM_1TO1_55S	THERM	CPUIMVP_ISUMG_R_N	46
I15	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GFXIMVP_ISNS1_P	80
I16		THERM_1TO1_55S	THERM	GFXIMVP_ISNS1_N	80
I17	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GFXIMVP_ISNS2_P	80
I18		THERM_1TO1_55S	THERM	GFXIMVP_ISNS2_N	80
I19	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	ISNS_CPU_DDR_R_P	98
I20		THERM_1TO1_55S	THERM	ISNS_CPU_DDR_R_N	98
I21	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	ISNS_LCD_PANEL_P	
I22		THERM_1TO1_55S	THERM	ISNS_LCD_PANEL_N	
I23	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	ISNS_P1V5R1V35_CPUDDR_P	
I24		THERM_1TO1_55S	THERM	ISNS_P1V5R1V35_CPUDDR_N	
I26	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	ISNS_SSD_P	39 99
I25		THERM_1TO1_55S	THERM	ISNS_SSD_N	39 99
I28	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	ISNS_SSD_R_P	99
I27		THERM_1TO1_55S	THERM	ISNS_SSD_R_N	99
I30	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	PCHVCCIOS0_CS_P	87 99
I29		THERM_1TO1_55S	THERM	PCHVCCIOS0_CS_N	87 99
I32	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	PCH_VCCIOSENSE_P	87
I31		THERM_1TO1_55S	THERM	PCH_VCCIOSENSE_N	87
I67	SENSE_DIFFPAIR	40_OHM_SE	THERM	GPUVCORE_SENSE_P	79 80
I68	SENSE_DIFFPAIR	40_OHM_SE	THERM	GPUVCORE_SENSE_N	79 80
I64		THERM_1TO1_55S	THERM	GPU_FBVDDQ_SENSE	73 74
I63		THERM_1TO1_55S	THERM	GPU_FBGND_SENSE	73 74
I55		THERM_1TO1_55S	THERM	P1V05_GPU_PEX_IOVDD_SNS_P	74 79
I56		THERM_1TO1_55S	THERM	P1V05_GPU_PEX_IOVDD_SNS_N	74 79
I33	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	SPKRL_THMSNS_D2_P	
I34		THERM_1TO1_55S	THERM	SPKRL_THMSNS_D2_N	
I35	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	SPKR_THMSNS_D2_P	
I36		THERM_1TO1_55S	THERM	SPKR_THMSNS_D2_N	
I37	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	TBT_THERMD_P	47
I38		THERM_1TO1_55S	THERM	TBT_THERMD_N	47
I39	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	X29THMSNS_D2_P	
I40		THERM_1TO1_55S	THERM	X29THMSNS_D2_N	
I57	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	VDDCIS0_CS_P	
I58	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	VDDCIS0_CS_N	
I59	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GFXIMVP6_VSEN_P	
I60	SENSE_DIFFPAIR	THERM_1TO1_55S	THERM	GFXIMVP6_VSEN_N	
I41		USB_85D	USB3	USB3_EXTA_TX_F_P	
I42		USB_85D	USB3	USB3_EXTA_TX_F_N	
I43		USB_85D	USB3	USB3_EXTA_RX_F_P	
I44		USB_85D	USB3	USB3_EXTA_RX_F_N	
I45		USB_85D	USB3	USB3_EXTA_TX_C_P	40
I46		USB_85D	USB3	USB3_EXTA_TX_C_N	40
I47		USB_85D	USB3	USB3_EXTB_TX_C_P	7 38
I48		USB_85D	USB3	USB3_EXTB_TX_C_N	7 38
I49		USB_85D	USB3	USB3_EXTB_RX_RC_P	38
I50		USB_85D	USB3	USB3_EXTB_RX_RC_N	38
I70		USB_85D	USB3	USB3_EXTA_RX_RC_P	40
I69		USB_85D	USB3	USB3_EXTA_RX_RC_N	40
I61			CLK_25M	P1V5_GPU_VSNS	
I62			CLK_25M	P1V0S0_VSNS	

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	TOP,BOTTOM	0.058 MM	?
2:1_SPACING	TOP,BOTTOM	0.116 MM	?
3:1_SPACING	TOP,BOTTOM	0.174 MM	?
4:1_SPACING	TOP,BOTTOM	0.232 MM	?
5:1_SPACING	TOP,BOTTOM	0.290 MM	?
1:1_SPACING	ISL3,ISL4,ISL9,ISL10	0.053 MM	?
2:1_SPACING	ISL3,ISL4,ISL9,ISL10	0.106 MM	?
3:1_SPACING	ISL3,ISL4,ISL9,ISL10	0.159 MM	?
4:1_SPACING	ISL3,ISL4,ISL9,ISL10	0.212 MM	?
5:1_SPACING	ISL3,ISL4,ISL9,ISL10	0.265 MM	?
1:1_SPACING	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.101 MM	?
2:1_SPACING	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.202 MM	?
3:1_SPACING	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.303 MM	?
4:1_SPACING	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.404 MM	?
5:1_SPACING	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.505 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1x_DIELECTRIC	TOP,BOTTOM	0.058 MM	?
2x_DIELECTRIC	TOP,BOTTOM	0.116 MM	?
3x_DIELECTRIC	TOP,BOTTOM	0.174 MM	?
4x_DIELECTRIC	TOP,BOTTOM	0.232 MM	?
5x_DIELECTRIC	TOP,BOTTOM	0.290 MM	?
1x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.053 MM	?
2x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.106 MM	?
3x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.159 MM	?
4x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.212 MM	?
5x_DIELECTRIC	ISL3,ISL4,ISL9,ISL10	0.265 MM	?
1X_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.101 MM	?
2x_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.202 MM	?
3x_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.303 MM	?
4x_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.404 MM	?
5x_DIELECTRIC	ISL2,ISL5,ISL6,ISL7,ISL8,ISL11	0.505 MM	?

SYNC_MASTER=D2_KEPLER SYNC_DATE=01/13/2012

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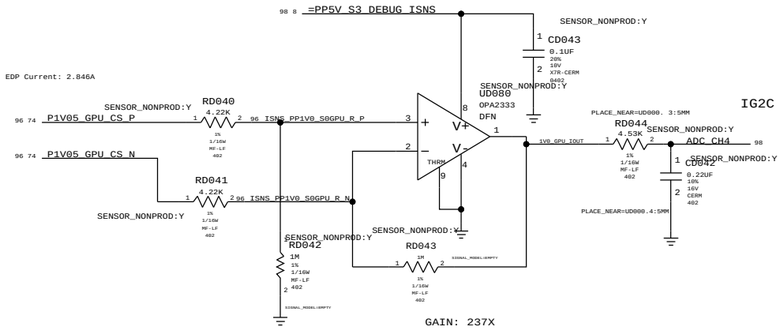
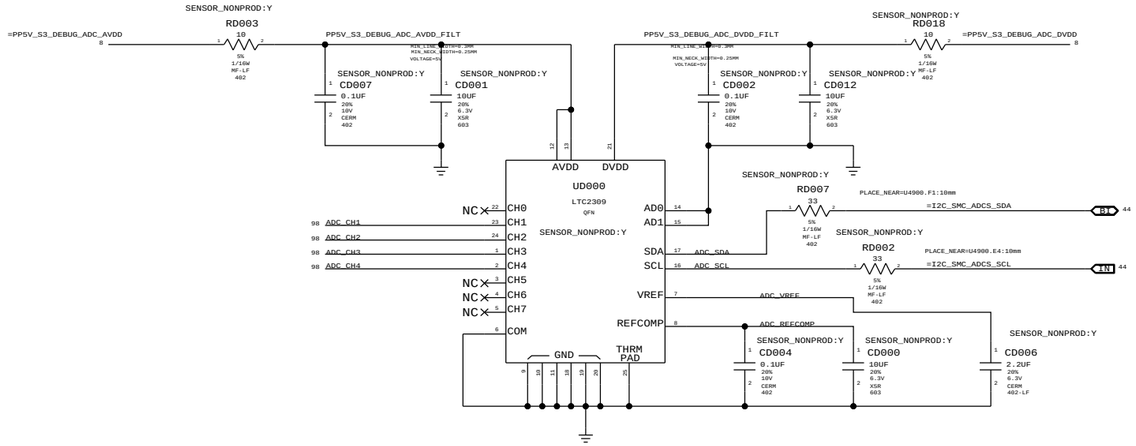
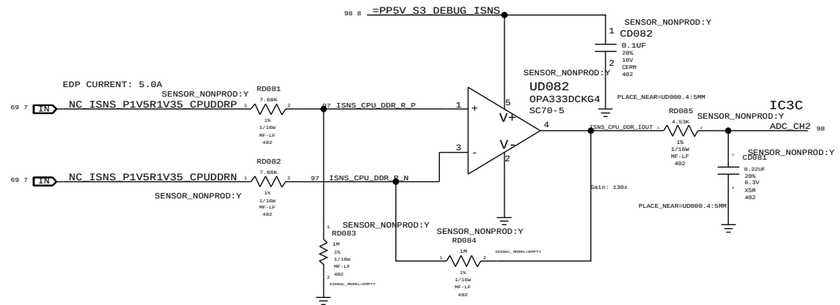
GPU 1.0V CURRENT SENSE

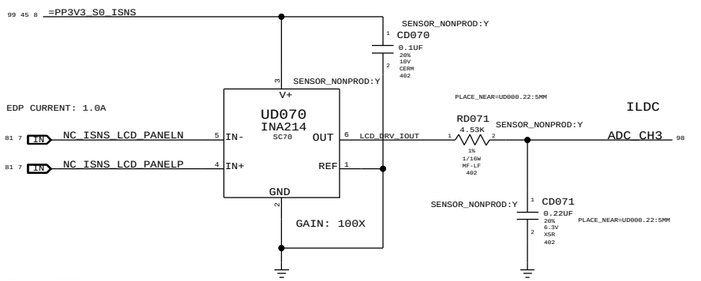


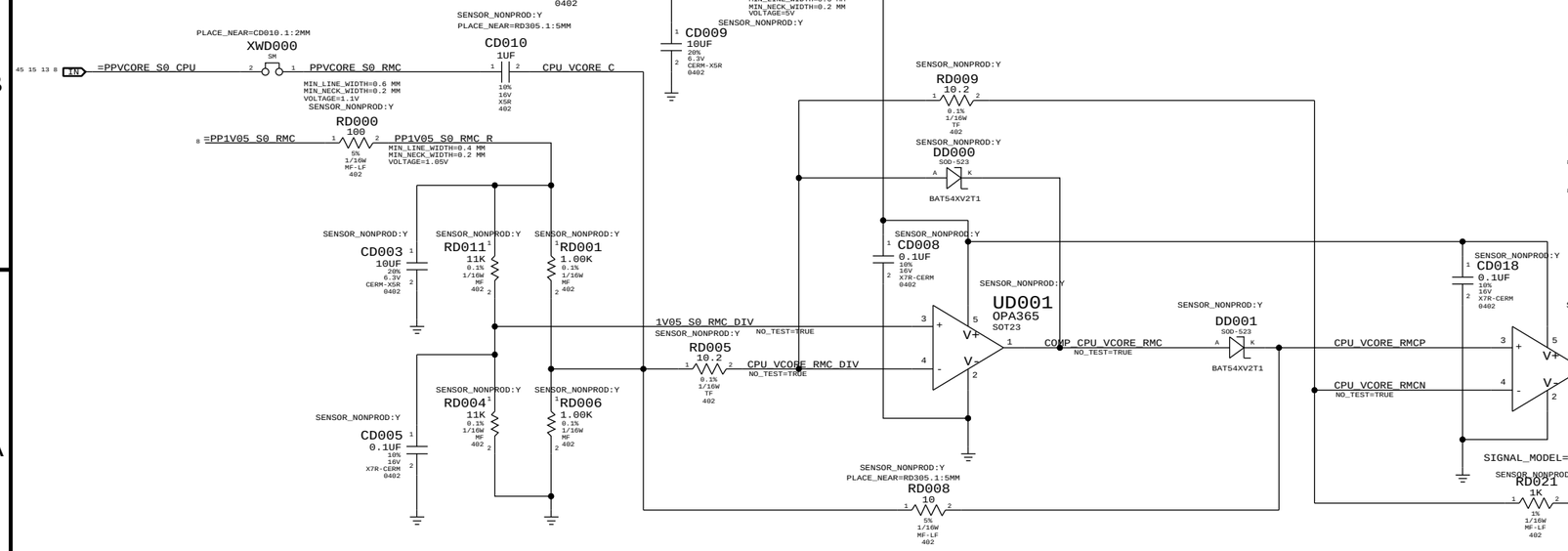


CPU DDR CURRENT SENSE



LCD PANEL CURRENT SENSE





SYNC_MASTER=D2_SEAN	SYNC_DATE=03/05/2013
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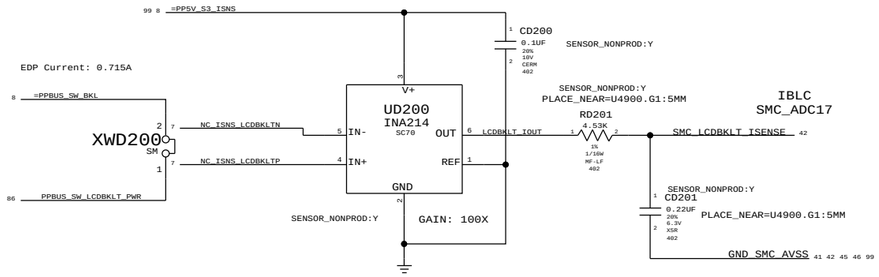
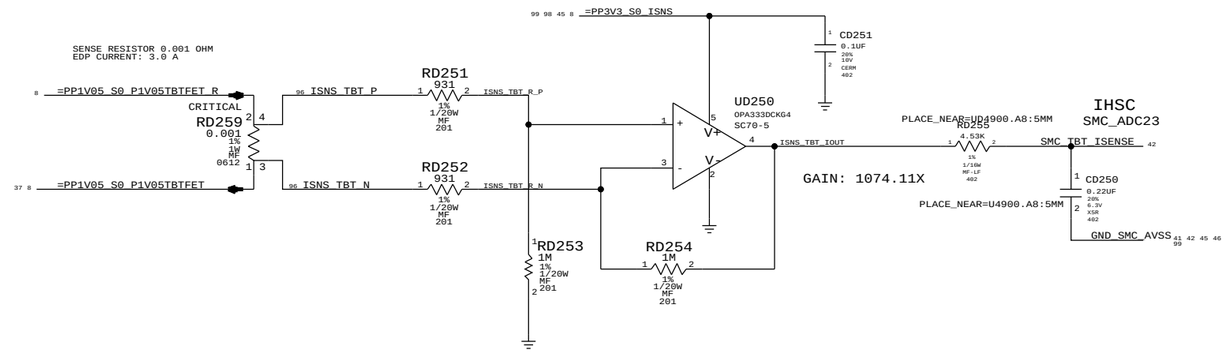
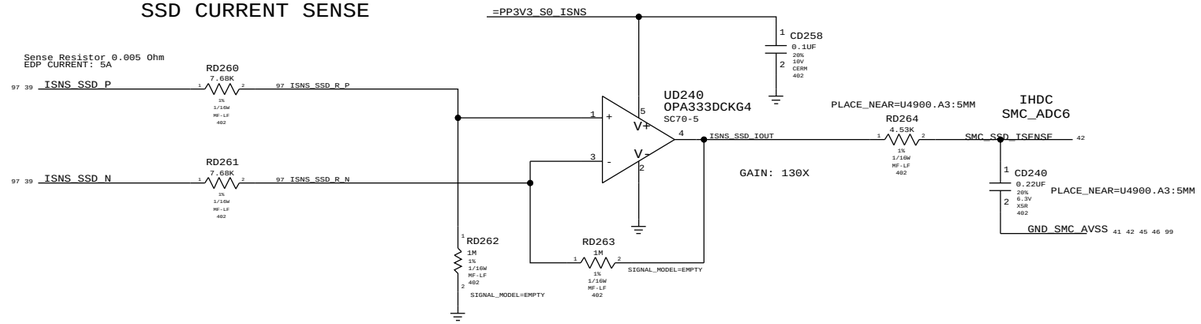
LCD BKLT Current Sense



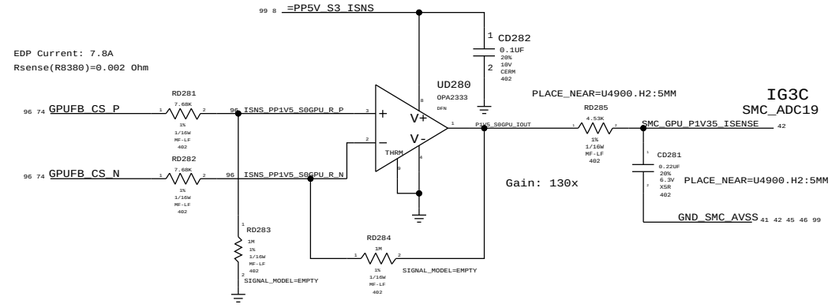
TBT (T29) CURRENT SENSE



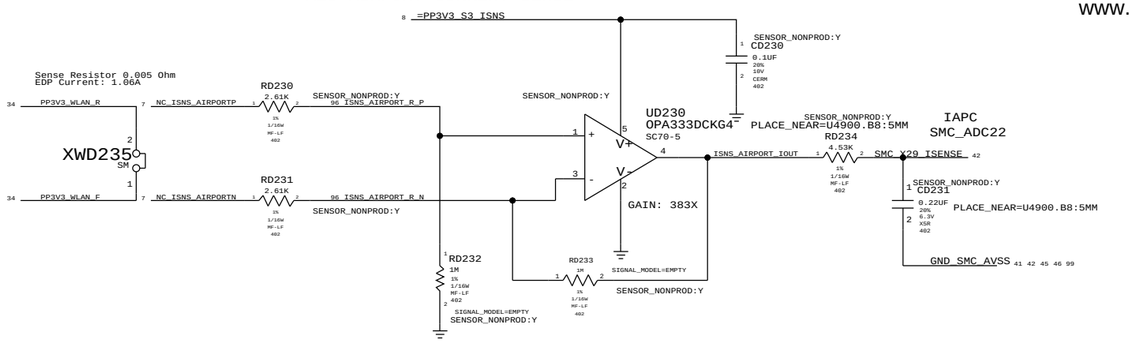
SSD CURRENT SENSE



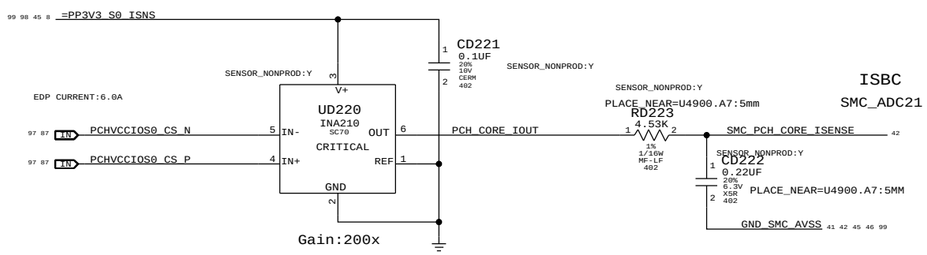
GPU FB (1.35V/1.5V) CURRENT SENSE



X29 AIRPORT CURRENT SENSE

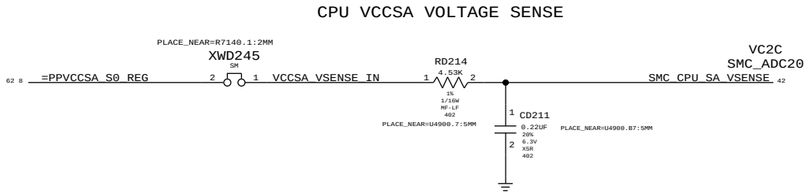


PCH VCORE CURRENT SENSE

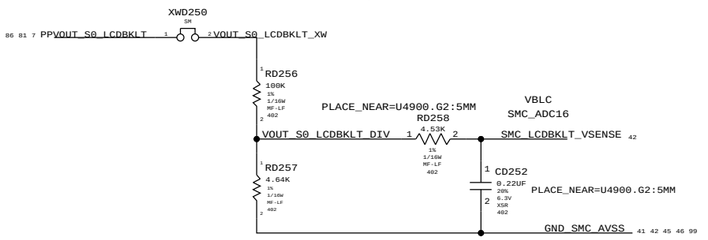


PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
116S0114	4	RES,MTL FILM,100K,5,1/16W,0402,SMD,LF	CD201,CD222,CD231		SENSOR_NONPROD:N

CPU VCCSA VOLTAGE SENSE



LCD BKLT Voltage Sense



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SMC12 SENSORS EXTENDED

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