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- 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
A	0000865868	PRODUCTION RELEASED		2010-02-26

2/25/2010

SCHEMATIC MLB ITCHY

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21	MCP89 Memory Rail Gating	K87_MLB	02/26/2010	59	MCP VCore Regulator	K87_MLB	02/26/2010
22	MCP89 GFX Core Rail Gating	K87_MLB	02/26/2010	60	CPU VTT(1.05V) SUPPLY	K87_MLB	02/26/2010
23	MCP Standard Decoupling	K87_MLB	02/26/2010	61	Misc Power Supplies	K87_MLB	02/26/2010
24	MCP Graphics Support	K87_MLB	02/26/2010	62	Power Sequencing	K87_MLB	02/26/2010
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26	DDR3 SO-DIMM Connector A	K87_MLB	02/26/2010	64	LVDS CONNECTOR	K87_MLB	02/26/2010
27	DDR3 SO-DIMM Connector B	K87_MLB	02/26/2010	65	DISPLAYPORT SUPPORT	K87_MLB	02/26/2010
28	SO-DIMM Pinswaps	K87_MLB	02/26/2010	66	DisplayPort Connector	K87_MLB	02/26/2010
29	FSB/DDR3 Vref Margining	K87_MLB	02/26/2010	67	LCD Backlight Driver (MC34845)	K87_MLB	02/26/2010
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35	SMC	K87_MLB	02/26/2010	73	Ethernet Constraints	K87_MLB	02/26/2010
36	SMC Support	K87_MLB	02/26/2010	74	SMC Constraints	K87_MLB	02/26/2010
37	LPC+SPI Debug Connector	K87_MLB	02/26/2010	75	K87 SPECIFIC CONSTRAINTS	K87_MLB	02/26/2010
38	K87 SMBus Connections	K87_MLB	02/26/2010	76	K87 RULE DEFINITIONS	K87_MLB	12/03/2009

Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-8407	1	SCHEM_MLB,K86	SCM	CRITICAL	
820-2807	1	PCBP_MLB,K86	PCB	CRITICAL	

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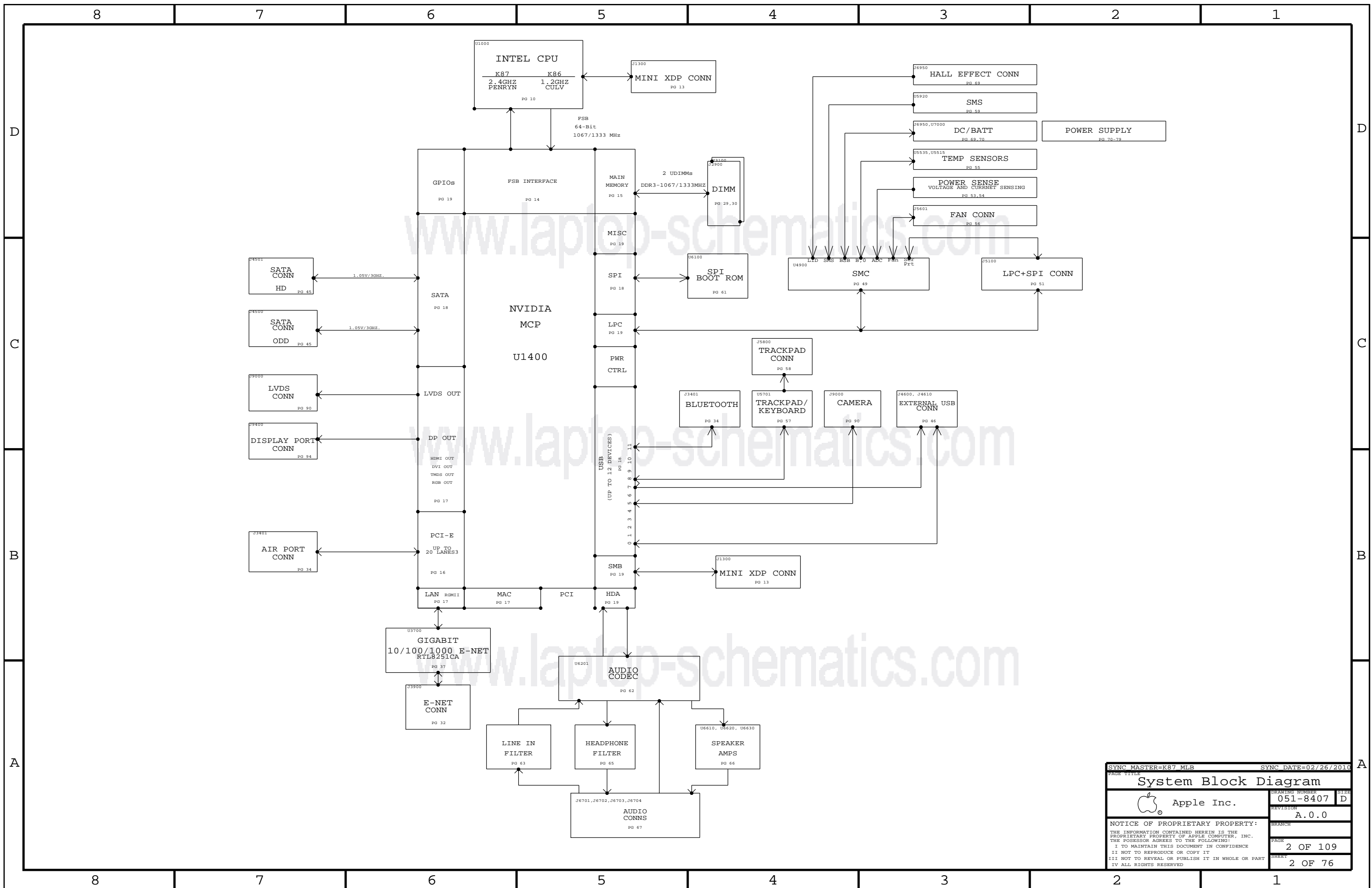
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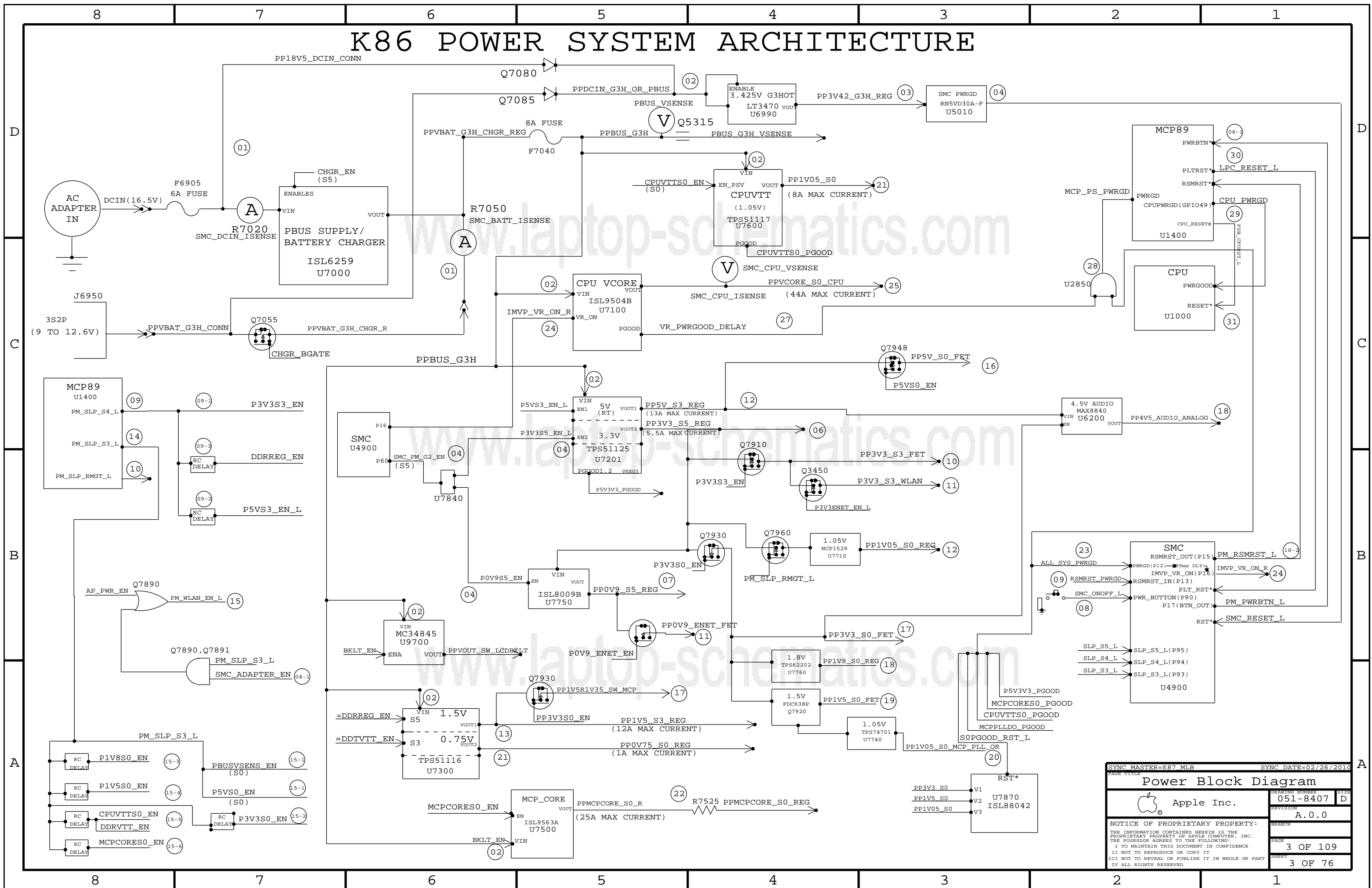
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SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
System Block Diagram			
Apple Inc.		DRAWING NUMBER 051-8407	SIZE D
		REVISION A.0.0	BRANCH
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K86 POWER SYSTEM ARCHITECTURE



SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
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Power Block Diagram		DRAWING NUMBER	SIZE
Apple Inc.		051-8407	D
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BOM Variants

BOM NUMBER	BOM NAME	BOM OPTIONS
639-0708	PCBA,MLB,FOXCONN,K86	K86_K87_COMMON,K86_SPECIFIC,FOX_DDR_CONN,EEE:E3T
639-1059	PCBA,MLB,MOLEX,K86	K86_K87_COMMON,K86_SPECIFIC,MOLEX_DDR_CONN,EEEE:DCV3
085-1154	K86 MLB DEVELOPMENT BOM	K86_K87_DEVELOPMENT_ONLY,K86_K87_DEBUG:DEV

Development BOM

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
085-1154	1	K86 MLB DEVELOPMENT BOM	DEVEL	CRITICAL	DEVELOPMENT_BOM

BOM Groups (always-present)

BOM GROUP	BOM OPTIONS
K86_K87_COMMON	K86_K87_COMMON1,PROJECT_PHASE:PROD,COMMON,ALTERNATE,BOOTROM:PROG,WELLSPRING:PROG,MCP_T_DIODE_SENSOR
K86_K87_COMMON1	DP_ESD,MIKEY,MCPLL,R:REG,ENKTIV05:INT,LED:K86_K87,SOPGOOD_BJT,ENET_ESD,VFRQ:SLP83,SMC_DEBUG:YES,SPI:25MHZ,LPCPLUS_XDP,OLD_AUDIO_SWITCH
K87_SPECIFIC	CPU:2.4GHZ,IMVP6:2PHASE,SMC:PROG_K87,MCP89M:A02
K86_SPECIFIC	CPU:1.2GHZ,IMVP6:1PHASE,SMC:PROG_K86,MCP83M

BOM Groups (project phase-dependent)

BOM GROUP	BOM OPTIONS
PROJECT_PHASE:DEV	DEVELOPMENT_BOM
PROJECT_PHASE:PROD	K86_K87_DEBUG:PROD
K86_K87_DEVELOPMENT_ONLY	DEBUG_ADC,LPCPLUS_CON,SOPGOOD_ISL,EFI_DEBUG,MCPLL_LDO,EXTIV05,XDP_CON
K86_K87_DEBUG:DEV	VREFMRGN:YES,BMON:ENG,BKLT:ENG,SENS_R:ENG
K86_K87_DEBUG:PROD	VREFMRGN:NO,BMON:PROD,BKLT:PROD,SENS_R:PROD

Module Parts

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
337S3680	1	PCD,LDDE,FRQ,2.40,25W,1066,R0,3M,BGA	U1000	CRITICAL	CPU:2.4GHZ
337S3792	1	CDL,SLDYM,FRQ,1.2,1.10W,800,R0,1M,BGA	U1000	CRITICAL	CPU:1.2GHZ
337S3797	1	IC,MCP89M-A01,31X31MM,BGA1168	U1400	CRITICAL	MCP89M:A01
337S3866	1	IC,MCP89M-A02,31X31MM,BGA1168	U1400	CRITICAL	MCP89M:A02
337S3876	1	IC,MCP83M-A02,31X31MM,BGA1168	U1400	CRITICAL	MCP83M
516S0706	1	CONN,204P,SOD128M,SOCKET,DDR3,RAM,BGA	J3100	CRITICAL	FOX_DDR_CONN
516-0201	1	CONN,204P,SOD128M,P=0.6MM	J2900	CRITICAL	FOX_DDR_CONN
516S0790	1	CONN,204P,SOD128M,SOCKET,DDR3,RAM,BGA	J3100	CRITICAL	MOLEX_DDR_CONN
516-0213	1	CONN,204P,SOD128M,P=0.6MM	J2900	CRITICAL	MOLEX_DDR_CONN
452-1708	4	SCR,M1,6X0.35X6.0,D4,HO.3,BLK,M97	SCREEN1,SCREEN2,SCREEN3,SCREEN4	CRITICAL	
870-1940	4	POGO PIN,MED,NOISE-IMPROVED,SILVER,K87	ZS0900,ZS0901,ZS0902,ZS0903	CRITICAL	
870-1940	3	POGO PIN,MED,NOISE-IMPROVED,SILVER,K87	ZS0908,ZS0909,ZS0911	CRITICAL	
870-1939	5	POGO PIN,TALL,NOISE-IMPROVED,SILVER,K87	ZS0904,ZS0905,ZS0906,ZS0907,ZS0910	CRITICAL	
870-1939	5	POGO PIN,TALL,NOISE-IMPROVED,SILVER,K87	ZS0912,ZS0913,ZS0914,ZS0915,ZS0919	CRITICAL	
870-1938	3	POGO PIN,THIN,NOISE-IMPROVED,SILVER,K87	ZS0917,ZS0918,ZS0916	CRITICAL	

353S2718 IS NEW INTERSIL PART FOR FIXING B4 DONGLE ISSUE
 514-0704 IS CLOUD GREY 4/LB3 PLASTIC W/PDNI PLATING VERSION OF 514-0692 PART FOR RJ45 CONNECTOR
 514-0705 IS CLOUD GREY 4/LB3 PLASTIC W/PDNI PLATING VERSION OF 514-0689 PART FOR USB CONNECTORS
 514-0706 IS CLOUD GREY 4/LB3 PLASTIC W/PDNI PLATING VERSION OF 514-0691 PART FOR MINI DP CONNECTOR
 514-0718 IS CLOUD GREY 4/LB3 PLASTIC W/PDNI PLATING VERSION OF 514-0694 PART FOR AUDIO CONNECTOR

Programmable Parts

LOCKED BOOTROM APN IS 341S2488 (QL: old info?)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
338S0563	1	IC,SMC,H8B/2117,9X9MM,TLP,HF	U4900	CRITICAL	SMC:BLANK
341T0252	1	SUBASSY, IC, SMC, K87	U4900	CRITICAL	SMC:PROG_K87
341T0250	1	SUBASSY, IC, SMC, K86	U4900	CRITICAL	SMC:PROG_K86
335S0610	1	IC,FLASH,SPI,32MBIT,3.3V,8MHZ,8-SOP	U6100	CRITICAL	BOOTROM:BLANK
341T0251	1	SUBASSY, IC, BOOT ROM, K86/K87	U6100	CRITICAL	BOOTROM:PROG
337S2983	1	IC,PDCC- W/ USB,56 PIN,MLP,CV8C24794	U5701	CRITICAL	WELLSPRING:BLANK
341S2677	1	IC,WELLSPRING CONTROLLER,K87	U5701	CRITICAL	WELLSPRING:PROG

Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
152S0693	152S0778		ALL	DATE/VERSION, INLAYERS AS ALTERNATE
152S0796	152S0685		ALL	CENTRO AS ALTERNATE
157S0058	157S0055		ALL	DATE AS ALTERNATE
138S0603	138S0602		ALL	DATE AS ALTERNATE
128S0093	128S0218		ALL	DATE AS ALTERNATE
152S0874	152S0516		ALL	INLAYERS AS ALTERNATE
152S0847	152S0586		ALL	INLAYERS AS ALTERNATE
104S0018	104S0023		ALL	DATE/VERSION AS ALTERNATE
353S2811	353S1832		ALL	NEW IMPROVED DETAIL PART AS ALTERNATE

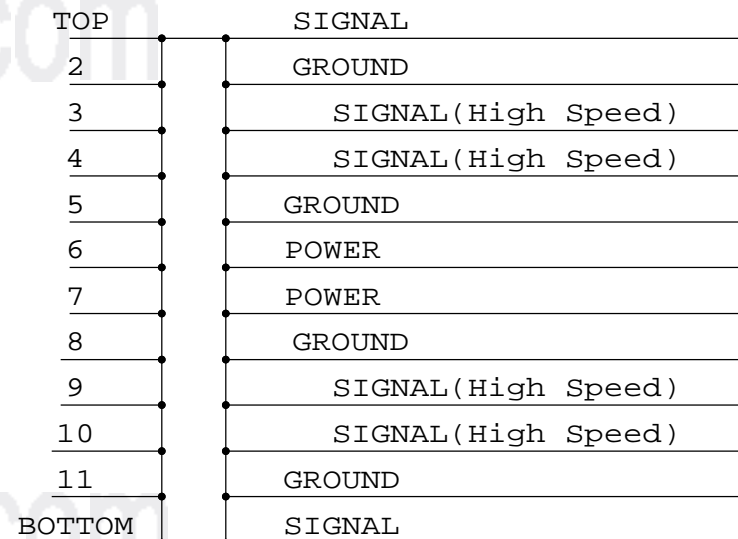
Bar Code Labels / EEE #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
826-4393	1	LBL,P/N LABEL,PCB,28MM X 6 MM	[EEE:E1A]	CRITICAL	EEE:E1A
826-4393	1	LBL,P/N LABEL,PCB,28MM X 6 MM	[EEE:E3T]	CRITICAL	EEE:E3T
826-4393	1	LBL,P/N LABEL,PCB,28MM X 6 MM	[EEEE:DCV2]	CRITICAL	EEEE:DCV2
826-4393	1	LBL,P/N LABEL,PCB,28MM X 6 MM	[EEEE:DCV3]	CRITICAL	EEEE:DCV3

Part Substitutions (differences with K6/K69)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0125	1	RES,MTL,FILM,1/16W,113 OHM,1.0402,SMD,LF	R5714		LED:K86_K87

K86 BOARD STACK-UP



SYNC MASTER=K87 MLB SYNC DATE=01/19/2010

BOM Configuration

Apple Inc.

DRAWING NUMBER: 051-8407
 REVISION: A.0.0

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Revision History NOTE: All page numbers are .csa, not PDF. See page 1 for .csa -> PDF mapping.

10/1/2009: INITIAL RELEASE 0.0.1-
- ALL PAGES SYNC'ED FROM K84
- REPLACED CPU AND PCB PAGES WITH K6 PAGES
- UPDATED SCHEMATIC AND PCB PART NUMBER INFO
2009-12-03: Proto 0 release 1.0.0
2009-12-04: 1.1.0
csa 4: Updated CPU block text to include CPU description for both K86 and K87
csa 3: Added note to include K86 in title
csa 4: Added BOM entry under Module Parts table to include CULV processor (33783779) to minimize delta on this page between K86 and K87 per Diana
2009-12-07: 1.2.0
csa 74: Component value changes per Leo (Interisil):
R7417 from 8.36k => 6.34k 1% (11450296)
C7428 from 100pF => 100pF (11450296)
Implemented different stuffing options for 1-phase vs 2-phase:
Added INV6:2PHASE to the following components:
R7417, C7428, R7409, R7411, C7406, R7414, C7414, C7413
Added BOM table to insert the following APNs for INV6:1PHASE:
R7417 = 7.68k 1% (11450304)
C7428 = 0.22uF 10% (13250102)
R7411 = 255 1% (11450160)
C7406 = 470uF 10% (13250720)
R7414 = 97.5k 1% (11450410)
C7414 = 1000pF 10% (13250045)
C7413 = 100pF 10% (13250277)
Updated table to add new values for lphase (PWM freq., Max current, Load line)
STILL NEED TO UPDATE VALUE OF C7428!
2009-12-08: 1.3.0
csa 45: Added passive deemphasis to SATA HDD D2R lines:
Added R4585, R4586 (51.1 ohm, 1% (11450093) and OMITted
Added R4585, R4586 (10pF) and NOSTUFF
Added BOM table to stuff 0-ohms until we get go-ahead for filter
2009-12-08: 1.4.0
csa 8: Deleted net properties for the following nets:
=PPV3_S0_CPUVTTISS=
=PPV3_S0_HDP=
=PPV3_S0_MCPREG=
=PPV3_S0_MCP_AVDD_UF=
=PPV3_S0_MCP_B=
=PPV3_S0_PMCRTL=
=PPV3_S0_DCCOM=
csa 34: Deleted net properties for =PPV3_S3_WLAN
csa 74: Deleted net properties for =PPV3_S3_WLAN
Changed C7434 from NOSTUFF to INV6:2PHASE per Interisil
Added INV6:2PHASE to R7413 per Interisil
Changed C7428 from 0.47uF to 0.33uF (13250101) per Interisil
Changed component color to green
Cosmetic cleanup
Deleted net properties for =PPV3_S3_CAMERA
csa 98: Deleted net properties for =PPV3_S3_CAMERA
csa 108: Added NET_PHYSICAL property to SATA_HDD_D2R_FILTER_P and _N
2009-12-09: 1.5.0
multiple: Added parentheses for SYNC_DATE property on all pages that have broken sync.
csa 4: Deleted entry in Module Parts table for R6612, R6617, R6630, R6633 since they were removed when we switched from piezo to dynamic speakers
csa 69: Changed 6630 symbol to K87 Hall effect connector
2009-12-10: 1.6.0
csa 69: Added OMIT to J6955, BOM table to stuff K84 Hall effect connector
2009-12-11: 1.7.0
csa 45: Added PLACEMENT NOTE for passive deemphasis circuit.
csa 74: Changed lPHASE BOM table to correctly call out 13250080 (0.22uF) instead of 0.022uF
2009-12-16: 1.8.0
*** Resynced all synced pages and picked up the following (change notes from T27):
T27: Swapped USB_EXTB and USB_EXTP for WVRN-612340 (pg. 18). <radar:7416825> Ensure USB_EXTB is on ports 8-11 (NVRN-612340)
csa 18: T27: Changed USB_RBIAS from 931-ohms to 887-ohms per DG v1.3 (pg. 18). <radar:7459260> Design Guide v1.3 updates
*** Started syncing the following pages:
csa 29,31: Begun syncing from T27 per <radar:7424246> BOM: K87 needs omit on J3100 and J2900 from T27
csa 54: T27: Added BOMPTIONS and APNs for Foxconn and Molex S0-DIMM connectors (pp. 29, 31).
C5490 changed from CAP 402-0.022UF,10%,16V,CEM-XSR to CAP 402-0.022UF,20%,16V,CEM
T27: Added CKPLUS_WAIVE properties to dismiss false errors (pg. 54).
T27: Added gain note for U402 and SMC_BATT_ISNSNS (pg. 54).
T27: Changed RC balance on BATT_ISNSNS, same time constant (pg. 54).
csa 57: Begun syncing from T27 per <radar:740429> T27 schematic bom option for R5714 & R5030 to keep K87 in sync
R5714 has BOMPTION LED:K6_K69, and we need to substitute a different part on csa 4
*** Made the following changes to follow T27 on the following unsynced pages:
csa 25: T27: Removed R2575 & R2580 per DG v1.3 (pg. 25). per <radar:7459260> Design Guide v1.3 updates
*** Other changes:
csa 4: Added BOM table to substitute in parts that have BOMPTION xxx:K6_K69 (to allow sync with T27)
Added R5714 (11450125) to table with BOMPTION LED:K6_K69
2009-12-17: 1.9.0
csa 4: Added BOM table entry for MCP89-A02 per <radar:7416858> Task: Get part numbers for A02 rev.
csa 34: Changed K87_MCP BOM group to call out MCP89-A02
Changed U3440 from AP02 part to AP06 (3430511) per <radar:7459498> BOM: APN updates for PFP1009 and SAK parts
Changed R3454 to 100k, 1% (11450411) to match T27 and K69
Updated DLY text note for U3440 to match T27
Changed R3440 color to green, deleted WF text note about needing PU
csa 72: Changed L720 from 1525079 to 1525078 per <radar:7347216> K69 L720 combo footprint
Alternates table on csa 4 already has 1525078 as alternate to 15250693
2009-12-22: 1.10.0
csa 4: Per <radar://problem/7473229> K86: Move to MCP83
Added BOM table entry for MCP83M (33783876)
This is for K86 ONLY. Adding entry to minimize delta on csa 4 between K87 and K86
BOMPTION is MCP83M
Per <radar://problem/7495072> K87: Call out LED:K86_K87 BOMPTION in the K87_MISC BOM group
Added LED:K86_K87 BOMPTION to the K87_MISC BOM group
Per <radar://problem/7495116> K87: remove ON Semi alternate for Q2300 (37680624)
Removed table entry that says 37680624 is an alternate for 37680624
Per <radar://problem/7495021> K86/K87: Replace "S" APNs with "*" APNs for programmed SMC and BR
Changed BOMPTIONS to call out SUBASSY_IC_SMC_K86/K87
Created SMC:PROG_K87 pointing to 34170252 (SUBASSY_IC_SMC_K87)
Created SMC:PROG_K86 pointing to 34170250 (SUBASSY_IC_SMC_K86)
Changed K87_PRODPARTS BOM group to point to SMC:PROG_K87
csa 69: Per <radar://problem/7494087> K87: remove OMIT from J6955 and delete BOM table
Deleted BOM table for Hall effect assembly
Changed text note to say "HALL EFFECT ASSEMBLY"
Deleted OMIT BOMPTION from J6955
Added text note with part numbers for components of the assembly
Assembly APN: 3390114
- BOM: 639-0680
- PCB: 830-2801
- MCO: 056-3515
- Conn APN: 51850788
csa 74: Cosmetic change, moved R7413, C7406 BOMPTION label so they don't look like wire name
csa 78: Per <radar://problem/7495000> K87: Add NOSTUFF to R7872 to disconnect U7870 from ALL_SYS_PWRGD
Changed BOMPTION for R7872 from S0PGOOD_ISL to NOSTUFF
2010-01-06: 1.11.0
csa 7: Per <radar://problem/7517432> K86/K87 functional net property needed on signals in schematics
Added the following functional test points under the J5100 LPC+SPI_CONN_FUNC_TEST group
LPCPLUS_GPTD
LPC_SPI
SMC_TMS
2010-01-07: 1.12.0
csa 23: *** BROKE SYNC WITH T27
Per <radar://problem/7519025> K86/K87: update all instances of 37680786 schematic symbols
Updated Q2355 and Q2356 with new schematic symbols
Need to resync with T27 once the change has been made there
csa 70: Per <radar://problem/7519048> K86/K87: change U7000 to 35382929
Changed U7000 from 35382392 to 35382929
Updated APN text note
2010-01-08: 2.0.0
csa 45: Per <radar://problem/7524364> K86/K87: change SATA HDD D2R passive EQ values
Removed NOSTUFF from C4585, C4586
Removed OMIT from R4585, R4586
Deleted BOM table that stuffed the bypass option
Changed R4585, R4586 to 11450065 (27.4 ohm, 1%)
Changed C4585, C4586 to 13154713 (47pF, 5%)
2010-01-13: 2.1.0
csa 4: Per <radar://problem/7540383> K86: Update CPU part number to 33783792
Changed U1000 CPU:1.2GHZ BOMPTION from 33783779 to 33783792
2010-01-13: 2.2.0
csa 4: Cosmetic: changed text sizes and alignment
Per <radar://problem/7540522> K86/K87: Production Debug Components
Changed DB-1093 to call out K87_DEVEL_FVT instead of K87_DEVEL_ENG
Changed K87_COMMON to call out K87_DEBUG_FVT instead of K87_DEBUG_ENG
Diff from the two changes above:
Toggled:
VREFMGRM:YES ==> VREFMGRM:NO
BMON:ENG ==> BMON:PRGD
SKLT:ENG ==> SKLT:PRGD
SENS_R:ENG ==> SENS_R:PRGD
Removed:
DEBUC_ADC, S0PGOOD_ISL, EFI_DEBUG, MCPPLL_LDO, EXTV05, MCP_T_DIODE_SENSOR, XDP_CONN
Unchanged:
LPCPLUS_DEVEL_BOM, SMC_DEBUC:YES, XDP
Added LPCPLUS_CON to K87_DEVEL_ENG (does not change BOM for DVT)
Changed all instances of K87_DEBUC_xxxx to K87_DEBUC:xxxx
Changed all instances of K87_DEVEL_xxxx to K87_DEVEL:xxxx
csa 51: (Per <radar://problem/75522> K86/K87: Production Debug Components)
Changed J100 BOMPTION from LPCPLUS to LPCPLUS_CON to unstuff connector at DVT
2010-01-15: 2.3.0
csa 74: Per <radar://7525313> K86 CPU loadline, OCP update
Keeping K86 and K87 pos identical for csa 74, modifying BOM table for INV6 1 phase on K87's schematic to reflect changes for K86.
INV6:1PHASE BOM Table:
R7417 changed to 7.87k (APN 11450305)
R7416 added to BOM Table, 16.9k (APN 11450336)
Added INV6:2PHASE BOM option to R7416 for K87's 13.7k
csa 74, csa 79: Per <radar://7542674> K86/K87 Text note change
Cleaned up text notes for lphase, 2phase, and edp #s per radar request.
2010-01-18: 2.4.0
csa 4: Per <radar://problem/7549122> K86/K87: Switch to new BOM group structure
Reverted back to ENG BOM, no longer PRGD BOM (i.e. reverted much of 2.2.0 changes)
Changed BOM group structure to match that in the radar (see PDF attached to radar)
Net change was to move LPCPLUS to the 639 (from the 065)
Switching from Engineering to Production BOM should only require changing PROJECT_PHASE:DEV to PROJECT_PHASE:PRGD
Per <radar://problem/7544529> K86/K87: Update MCP83 description on csa 4
Changed description for 33783876 to "IC:MCP83M-A02_31X31MM_BGA1168"
Per <radar://problem/7544657> K86/K87: Fix schematic symbol for Q2355, Q2356
*** Started syncing with K6
Syncing with K6 to pick up new symbols for Q2355 and Q2356
Should switch syncing back to T27 once it is updated there
csa 37: Per <radar://problem/7548726> K86/K87 Ethernet series R's need to be 0 ohmed
Changed R3790-R3795 to 11550064 (0-ohm, 0402) from 22-ohm

2010-01-19: 2.5.0
csa 37: Per <radar://problem/7554342> K86/K87: Change L3720 to 15251182
Changed L3720 to 15251182 (IND,PWR,SHD,4.7UH,20V,0.91A,31X31X12MM) for lower ESR
2010-01-22: 2.6.0
csa 4: Per <radar://problem/7571786> K86/K87: Add E3T EEE code for K86 to schematic
Added row to EEE table for E3T
Changed BOMPTIONS to be mutually exclusive (changed "_" to "*")
2010-01-28: 2.7.0
*** Resynced with T27 and K6 (no differences)
*** Resynced Audio pages with the following changes:
pg. 62: changed R6211 to 22 Ohms
pg. 67: no stuffed R6712 and R6713
csa 45: Per <radar://problem/7551001> K87:EMC: Radiated Emissions: Right Audio emissions fail
Added L4530, L4531 (APN 15550137) to SIL connector pins
csa 97: Per <radar://problem/7589365> K86/K87: Compensation settings change to provide more phase margin, reduce ripple
Changed C9705 from 8.2nF to 33nF (13250131)
Changed C9706 from 120pF to 220pF (13152225)
2010-02-02: 2.8.0
*** Resynced with T27 and K6 (no differences)
*** Resynced Audio pages with the following changes:
pg. 67: added BOM options for U6700, R6712, and R6713 to support MAX14560 and MAX14504
csa 97: Changed R9710 from 7.32K 0402 1% to 7.68K (APN 11450304) to support old K84 panel
csa 4: Added OLD_AUDIO_SWITCH BOM OPTION to K86_K87_COMMON
2010-02-15: 2.9.0
2010-02-15: 2.10.0
csa 54: Trace sync with T27. Per <radar://problem/7605797> K69/K86/K87 sensor INIC unreliable
U5400 changed from OPA348 to OPA330. C5434 changed to NOSTUFF
2010-02-16: 2.11.0
Resync with T27 and K6. Clean up and rerelease schematic.
2010-02-18: 2.12.0
Per <radar://7544836> K87 power component update
csa 74: R7417 changed to 5.90K, C7428 changed to 0.47uF, C7434 changed to 0.033uF
csa 75: R7572 changed to 147K
csa 70: R7015 changed to 56.2K, C7015 changed to 1000pF, C7042 changed to 0.068uF
Per <radar://7634730> K86/K87: add an RC on the LVDS IG_BKL_PWM
csa 97: R9725 changed to 200ohm, C9799 of 47pF added. R9726.1 connection moved to LVDS_IG_BKL_PWM
2010-02-18: 2.16.0
Per <radar://7576934> K86/K87: Hall eff documentation change. Substitute 607-6831 for doc purposes
csa 69: J6955 BOMPTION change to OMIT. Added BOM table with 607-6831 for J6955
Per <radar://7488543> K86/K86 Task: Measure each Power supply in MLB
csa 74: For K86 only: C7428 = 0.1uF added, R7417 changed to 8.25kohm
csa 12: For K86 only: C1272 = 330uF added.
Per <radar://7685202> K86/K87 schematic: change U9700 to 35382965 for Freescale backlight issue
csa 97: U9700 changed to APN 514-0718 to 514-0750
2010-02-18: 2.17.0
Per <radar://7686179> K86/K87 schematic: Change audio jack part number for new connector cap
csa 67: J6700 changed from APN 514-0718 to 514-0750
2010-02-25: 2.18.0
Per <radar://7685811> K86/K87 schematic: add additional 639 for differentiation between Foxconn and Molex DIMM connectors
csa 4: MOLEX_DDR_CONN removed from Alternate table. Added second 639 and EEEE # to BOM table
2010-02-25: 2.19.0
Per <radar://7678515> K87:EMC:ESD: System hangs on air/contact discharge to MPM connector
csa 69: C6970, C6971, C6972 of 1000pF (APN 13150222) added

D

D

C

C

B

B

A

A

Revision History table with columns for DATE, REVISION, and SIZE. Includes Apple logo and 'NOTICE OF PROPRIETARY PROPERTY' text.

Revision History NOTE: All page numbers are .csa, not PDF. See page 1 for .csa -> PDF mapping.

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D

D

C


C

B

B

A

A

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
Revision History			
 Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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		PAGE	6 OF 109
		SHEET	6 OF 76

Functional Test Points

FAN CONNECTORS FUNC_TEST

TEST	TRUE	PP5V_S0	7 8 62
TEST	TRUE	FAN_RT_PWM	42
TEST	TRUE	FAN_RT_TACH	42

(NEED TO ADD 1 GND TP)

MIC FUNC_TEST

TEST	TRUE	BI_MIC_N	52 53 75
TEST	TRUE	BI_MIC_P	52 53 75
TEST	TRUE	BI_MIC_SHIELD	52 53

SPEAKER FUNC_TEST

TEST	TRUE	SPKRAMP_L_N_OUT	51 52
TEST	TRUE	SPKRAMP_L_P_OUT	51 52
TEST	TRUE	SPKRAMP_R_N_OUT	51 52
TEST	TRUE	SPKRAMP_R_P_OUT	51 52
TEST	TRUE	SPKRAMP_SUB_N_OUT	51 52
TEST	TRUE	SPKRAMP_SUB_P_OUT	51 52

LVDS FUNC_TEST

TEST	TRUE	PP3V3_S0_LCD_DDC_F	64
TEST	TRUE	PP3V3_SW_LCD_PANEL_F	24 (NEED 2 TP)
TEST	TRUE	PPVOUT_S0_LCDBKLT	7 46 64 67 (NEED 2 TP)
TEST	TRUE	LVDS_IG_DDC_CLK	9 64
TEST	TRUE	LVDS_IG_DDC_DATA	9 64
TEST	TRUE	LVDS_IG_A_DATA_N<0>	9 64 71
TEST	TRUE	LVDS_IG_A_DATA_P<0>	9 64 71
TEST	TRUE	LVDS_IG_A_DATA_N<1>	9 64 71
TEST	TRUE	LVDS_IG_A_DATA_P<1>	9 64 71
TEST	TRUE	LVDS_IG_A_DATA_N<2>	9 64 71
TEST	TRUE	LVDS_IG_A_DATA_P<2>	9 64 71
TEST	TRUE	LVDS_IG_A_CLK_F_N	64 75
TEST	TRUE	LVDS_IG_A_CLK_F_P	64 75
TEST	TRUE	LED_RETURN_1	44 67
TEST	TRUE	LED_RETURN_2	44 67
TEST	TRUE	LED_RETURN_3	44 67
TEST	TRUE	LED_RETURN_4	44 67
TEST	TRUE	LED_RETURN_5	44 67
TEST	TRUE	LED_RETURN_6	44 67
TEST	TRUE	PP5V_S3_CAMERA_F	7 64
TEST	TRUE	USB_CAMERA_CONN_P	64 75
TEST	TRUE	USB_CAMERA_CONN_N	64 75

(NEED TO ADD 5 GND TP)

SATA ODD CONN FUNC_TEST

TEST	TRUE	PP5V_SW_ODD	7 33 46 (NEED 4 TP)
TEST	TRUE	SMC_ODD_DETECT	33 35
TEST	TRUE	SATA_ODD_D2R_C_P	33 71
TEST	TRUE	SATA_ODD_D2R_C_N	33 71
TEST	TRUE	SATA_ODD_R2D_P	33 71
TEST	TRUE	SATA_ODD_R2D_N	33 71

(NEED TO ADD 4 GND TP)

SATA HDD/SIL FUNC_TEST

TEST	TRUE	PP5V_S0_HDD_FLT	7 33 (NEED 4 TP)
TEST	TRUE	SATA_HDD_R2D_P	33 71
TEST	TRUE	SATA_HDD_R2D_N	33 71
TEST	TRUE	SATA_HDD_D2R_C_P	33 71
TEST	TRUE	SATA_HDD_D2R_C_N	33 71
TEST	TRUE	SYS_LED_ANODE_R	33

(NEED TO ADD 4 GND TP)

BATT POWER CONN FUNC_TEST

TEST	TRUE	PPVBAT_G3H_CONN	34 55 (NEED 3 TP)
TEST	TRUE	SMBUS_SMC_BSA_SCL	38 74
TEST	TRUE	SMBUS_SMC_BSA_SDA	38 74
TEST	TRUE	SYS_DETECT_L	54

(NEED TO ADD 3 GND TP)

HALL EFFECT CONNECTOR FUNC_TEST

TEST	TRUE	PP3V42_G3H	7 8 (NEED 2 TP)
TEST	TRUE	SMC_LID_R	54

(NEED TO ADD 3 GND TP)

X16 WIRELESS CONN FUNC_TEST

TEST	TRUE	PP3V3_S3_BT_F	30
TEST	TRUE	CONN_PCIE_MINI_D2R_P	9 30 75
TEST	TRUE	CONN_PCIE_MINI_D2R_N	9 30 75
TEST	TRUE	CONN_PCIE_MINI_R2D_P	9 30 75
TEST	TRUE	CONN_PCIE_MINI_R2D_N	9 30 75
TEST	TRUE	PCIE_CLK100M_MINI_CONN_P	30 75
TEST	TRUE	PCIE_CLK100M_MINI_CONN_N	30 75
TEST	TRUE	PP3V3_WLAN (NEED 4 TP)	7 30
TEST	TRUE	PCIE_WAKE_L	16 30
TEST	TRUE	CONN_USB2_BT_P	30 75
TEST	TRUE	CONN_USB2_BT_N	30 75
TEST	TRUE	AP_CLKREQ_O_L	30
TEST	TRUE	AP_RESET_CONN_L	30

(NEED TO ADD 4 GND TP)

IPD_FLEX_CONN FUNC_TEST

TEST	TRUE	PP3V3_S3	7 8
TEST	TRUE	PP18V5_S3	7 44
TEST	TRUE	Z2_CS_L	43 44
TEST	TRUE	Z2_DEBUG3	43 44
TEST	TRUE	Z2_MOSI	43 44
TEST	TRUE	Z2_MISO	43 44
TEST	TRUE	Z2_SCLK	43 44
TEST	TRUE	Z2_BOOST_EN	44
TEST	TRUE	Z2_HOST_INTN	43 44
TEST	TRUE	Z2_CLKIN	43 44
TEST	TRUE	Z2_KEY_ACT_L	43 44
TEST	TRUE	Z2_RESET	43 44
TEST	TRUE	PSOC_MISO	43 44
TEST	TRUE	PSOC_MOSI	43 44
TEST	TRUE	PSOC_SCLK	43 44
TEST	TRUE	SMBUS_SMC_A_S3_SDA	38 74
TEST	TRUE	SMBUS_SMC_A_S3_SCL	38 74
TEST	TRUE	PSOC_F_CS_L	43 44
TEST	TRUE	PICKB_L	43 44

(NEED TO ADD 2 GND TP)

KEYBOARD CONN FUNC_TEST

TEST	TRUE	PP3V3_S3	7 8
TEST	TRUE	PP3V42_G3H	7 8
TEST	TRUE	WS_KBD1	43
TEST	TRUE	WS_KBD2	43
TEST	TRUE	WS_KBD3	43
TEST	TRUE	WS_KBD4	43
TEST	TRUE	WS_KBD5	43
TEST	TRUE	WS_KBD6	43
TEST	TRUE	WS_KBD7	43
TEST	TRUE	WS_KBD8	43
TEST	TRUE	WS_KBD9	43
TEST	TRUE	WS_KBD10	43
TEST	TRUE	WS_KBD11	43
TEST	TRUE	WS_KBD12	43
TEST	TRUE	WS_KBD13	43
TEST	TRUE	WS_KBD14	43
TEST	TRUE	WS_KBD15_CAP	43
TEST	TRUE	WS_KBD16_NUM	43
TEST	TRUE	WS_KBD17	43
TEST	TRUE	WS_KBD18	43
TEST	TRUE	WS_KBD19	43
TEST	TRUE	WS_KBD20	43
TEST	TRUE	WS_KBD21	43
TEST	TRUE	WS_KBD22	43
TEST	TRUE	WS_KBD23	43
TEST	TRUE	WS_KBD_ONOFF_L	43
TEST	TRUE	WS_LEFT_SHIFT_KBD	43
TEST	TRUE	WS_LEFT_OPTION_KBD	43
TEST	TRUE	WS_CONTROL_KBD	43

(NEED TO ADD 1 GND TP)

DC POWER CONN FUNC_TEST

TEST	TRUE	PP18V5_DCIN_FUSE (NEED 2 TP)	54
TEST	TRUE	ADAPTER_SENSE	54

(NEED TO ADD 2 GND TP)

POWER NETS FUNC_TEST

TEST	TRUE	PPVCORE_S0_CPU	8 39
TEST	TRUE	PPVCORE_S0_MCP	8 39
TEST	TRUE	PP1V05_S0	8 62
TEST	TRUE	PP1V5_S0	8 62 75
TEST	TRUE	PP1V8_S0	8
TEST	TRUE	PP5V_S0	7 8 62
TEST	TRUE	PP5V_S0	7 8 62
TEST	TRUE	PP3V3_S0	8 62 75
TEST	TRUE	PP1V5R1V35_S3	8 75
TEST	TRUE	PP3V3_S3	7 8
TEST	TRUE	PP5V_S3	8
TEST	TRUE	PP3V3_S5	8 62 75
TEST	TRUE	PP3V42_G3H	7 8
TEST	TRUE	PPBUS_G3H	8 39
TEST	TRUE	PP0V9_ENET	8
TEST	TRUE	PP3V3_ENET	8
TEST	TRUE	PP3V3_G3_RTC	8 19 20 23
TEST	TRUE	PP3V3_WLAN	7 30
TEST	TRUE	PP5V_SW_ODD	7 33 46
TEST	TRUE	PP5V_S0_HDD_FLT	7 33
TEST	TRUE	PP3V3_S5_AVREF_SMC	35 36
TEST	TRUE	PP18V5_S3	7 44
TEST	TRUE	PP3V3_SW_LCD_PANEL_F	7 44
TEST	TRUE	PPVOUT_S0_LCDBKLT	7 46 64 67
TEST	TRUE	PP4V5_AUDIO_ANALOG	48
TEST	TRUE	SMC_PM_G2_EN	35 62
TEST	TRUE	PM_SLP_S4_L	19 35 36 62
TEST	TRUE	PM_SLP_S3_L	19 35 62 66
TEST	TRUE	PP5V_S3_CAMERA_F	7 44
TEST	TRUE	PP0V9_S5	8
TEST	TRUE	PPDDRVTT_S0	8
TEST	TRUE	PP1V05_S0_MCP_PLL_UP	8
TEST	TRUE	PPVTT_S3_DDR_BUF	8

(NEED TO ADD 6 GND TP)

FSB SIGNALS WITH NOTEST

TEST	NO TEST	FSB_A_L<35..3>	10 14 69
TEST	NO TEST	FSB_ADS_L	10 14 69
TEST	NO TEST	FSB_ADSTB_L<1..0>	10 14 69
TEST	NO TEST	FSB_D_L<63..0>	10 14 69
TEST	NO TEST	FSB_DINV_L<3..0>	10 14 69
TEST	NO TEST	FSB_DSTB_L_N<3..0>	10 14 69
TEST	NO TEST	FSB_DSTB_L_P<3..0>	10 14 69
TEST	NO TEST	FSB_HIT_L	10 14 69
TEST	NO TEST	FSB_HITM_L	10 14 69
TEST	NO TEST	FSB_LOCK_L	10 14 69
TEST	NO TEST	FSB_REQ_L<4..0>	10 14 69

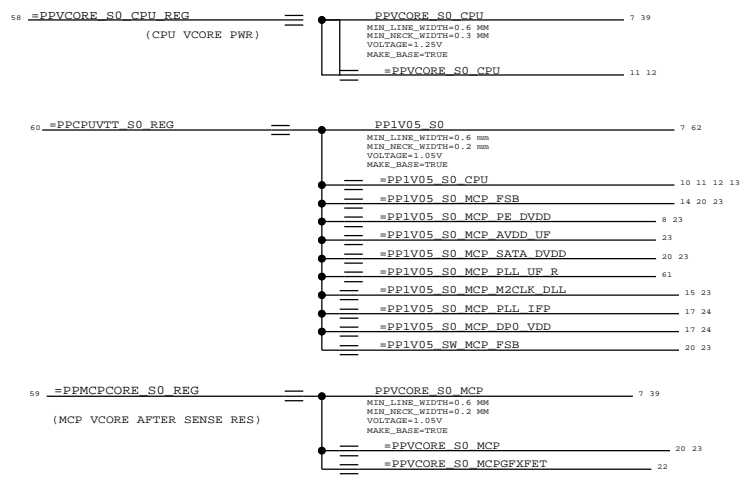
J5100 LPC+SPI CONN FUNC_TEST

TEST	TRUE	PP3V42_G3H	7 8
TEST	TRUE	SPI_CLK	37 72
TEST	TRUE	SPI_CS0_L	37 72
TEST	TRUE	SPI_MISO	19 37 72
TEST	TRUE	SPI_MOSI	37 72
TEST	TRUE	SPIROM_USE_MLB	19 37 47
TEST	TRUE	LPPLUS_GPIO	19 37
TEST	TRUE	LPC_SERIRO	19 35 37
TEST	TRUE	SMC_TMS	35 36 37

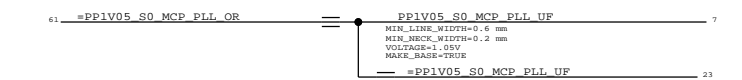
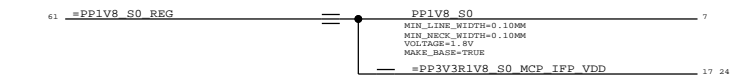
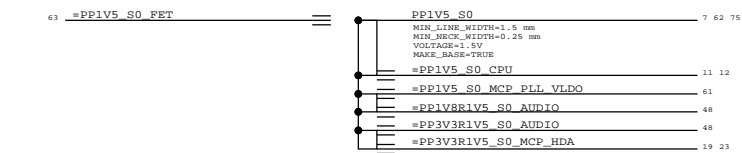
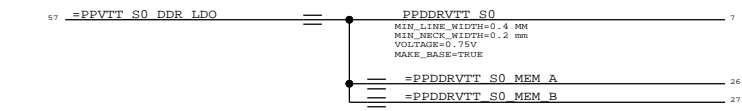
(NEED TO ADD 2 GND TP)

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PAGE TITLE			
FUNC TEST			
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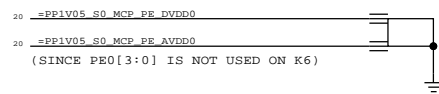
"S0,S0M" RAILS



LVDDR Vref/VTT (0.75V/0.675V) Rails

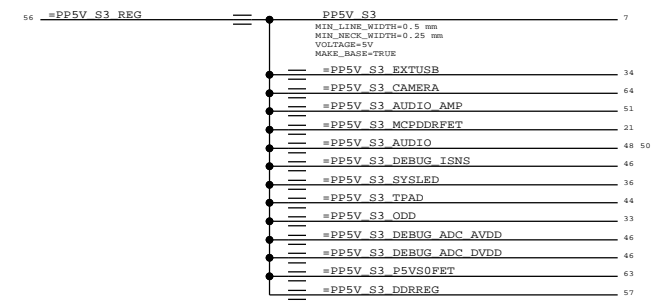
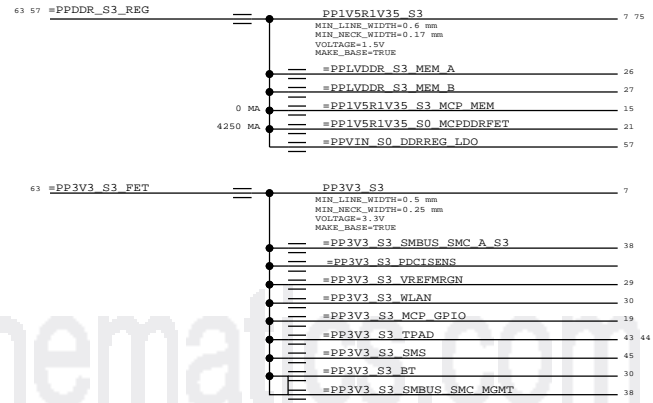


UNUSED MCP PE0[3:0] AVDD/DVDD

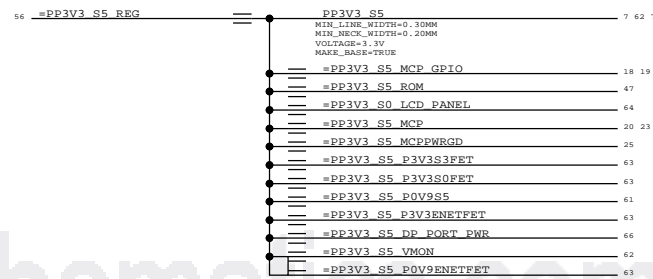
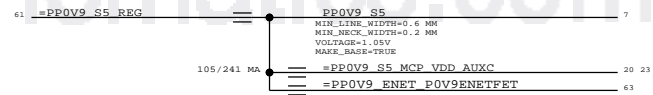


(CONNECTS TO MCP BALLS) 20 =PP1V05_S0_MCP_PE_DVDD1 =PP1V05_S0_MCP_PE_DVDD 31 (CONNECTS TO THE DECAPS)
 (CONNECTS TO MCP BALLS) 20 =PP1V05_S0_MCP_PE_AVDD1 =PP1V05_S0_MCP_PE_AVDD 21 (CONNECTS TO THE DECAPS)

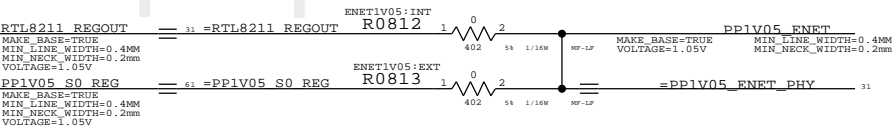
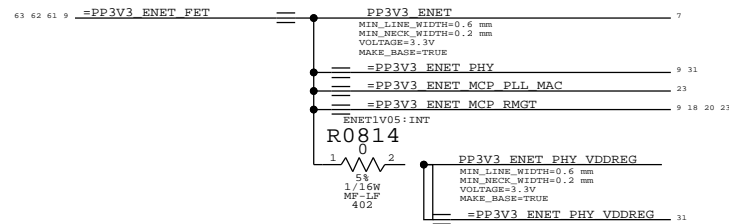
"S3" RAILS



"S5" RAILS

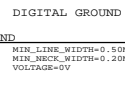
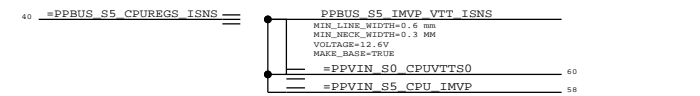
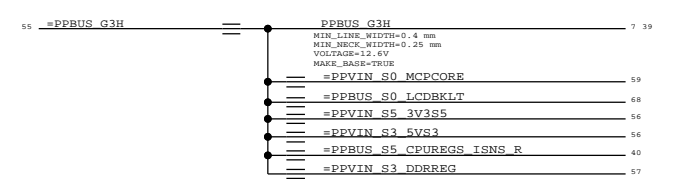
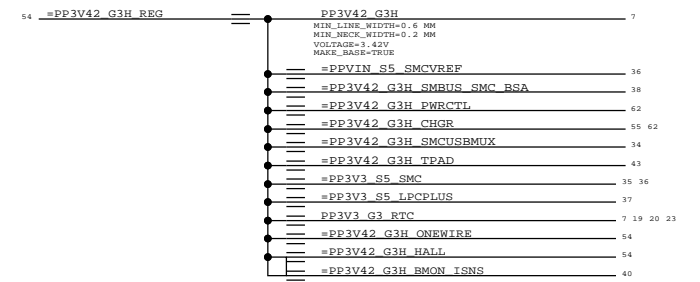


"ENET" RAILS



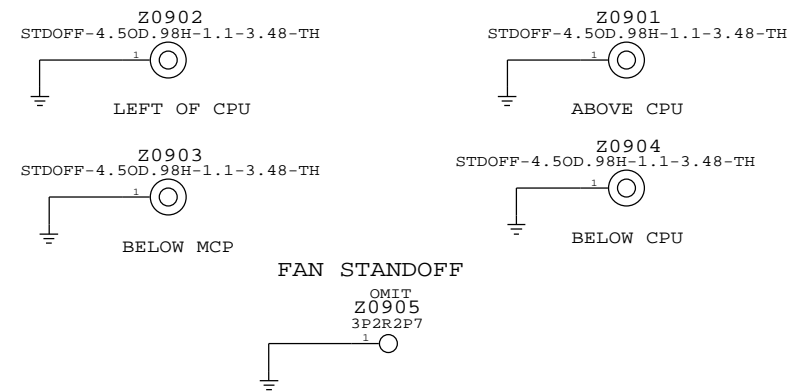
FIX ME!! OUTPUT OF REGULATOR VALUES

"G3H" RAILS



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Power Aliases			
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HEATSINK STANDOFFS



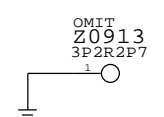
MLB MOUNTING (TO C. BRACKET) SCREW HOLES



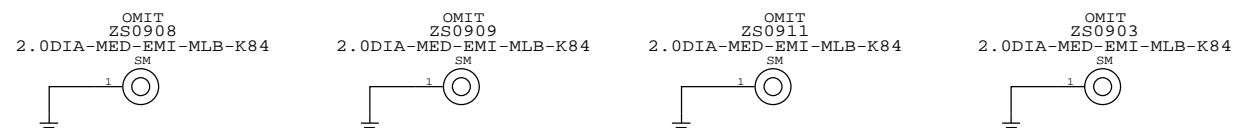
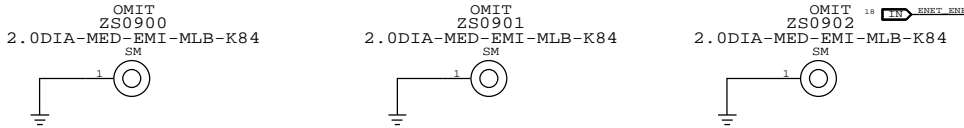
MLB MOUNTING (TO TOPCASE) SCREW HOLES



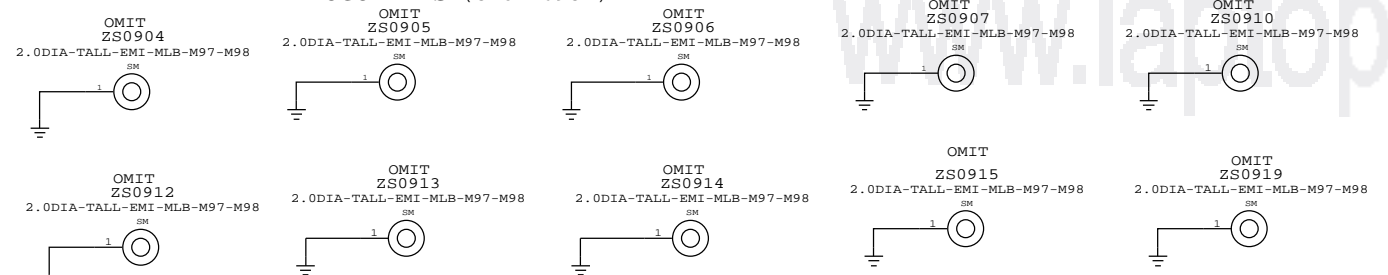
LVDS CONNECTOR HOLE



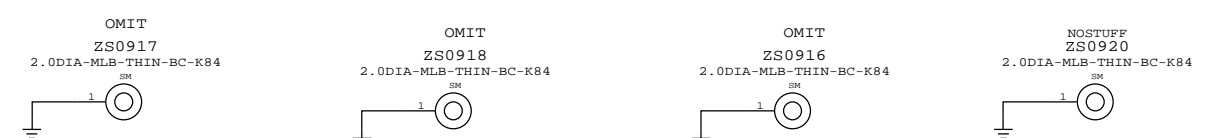
EMI IO MEDIUM POGO PINS (870-1794)



EMI TALL POGO PINS (870-1698)



EMI THINBC POGO PINS (870-1820)



PCI-E ALIASES

Table of PCI-E aliases including PCIE MINI R2D C P, PCIE AP R2D C N, CONN PCIE MINI D2R P, CONN PCIE MINI D2R N, PCIE CLK100M MINI P, PCIE CLK100M AP P, PCIE CLK100M MINI N, PCIE AP R2D P, PCIE AP R2D N, UNUSED GPU LANES, UNUSED FIREWIRE LANE, UNUSED ETHERNET LANE, and ENET ENERGY DET.

USB ALIASES

Table of USB aliases including USB EXTD P, USB EXTD N, USB EXTC P, USB EXTC N, USB MINI P, USB MINI N, USB SDCARD P, USB SDCARD N, USB WM P, USB WM N, USB IR P, USB IR N, USB T57 P, and USB T57 N.

LVDS ALIASES

Table of LVDS aliases including MCP IFPA TXD P<0..2>, MCP IFPA TXD N<0..2>, MCP IFPA TXD P<3>, MCP IFPA TXD N<3>, MCP IFPB TXC P, MCP IFPB TXC N, MCP IFPB TXD P<0..3>, MCP IFPB TXD N<0..3>, LCD IG BKLT PWM, LCD IG BKLT EN, LCD IG PWR EN, MCP IFPA TXC P, MCP IFPA TXC N, DP IG MLO P<0..3>, DP IG MLO N<0..3>, DP IG AUX CH0 P, DP IG AUX CH0 N, DP IG MLI P<0..3>, DP IG MLI N<0..3>, DP IG AUX CH1 P, DP IG AUX CH1 N, DP IG HPDD, DP AUX CH C N, DP AUX CH C P, DP CA DET, DP EXT CA DET, DP EXT MLI P<0..3>, DP EXT MLI N<0..3>, DP EXT HPD, DP EXT AUX CH C N, DP EXT AUX CH C P, and DP EXT CA DET.

DISPLAY PORT ALIASES

Table of display port aliases including DP IG MLO P<0..3>, DP IG MLO N<0..3>, DP IG AUX CH0 P, DP IG AUX CH0 N, DP IG MLI P<0..3>, DP IG MLI N<0..3>, DP IG AUX CH1 P, DP IG AUX CH1 N, DP IG HPDD, DP AUX CH C N, DP AUX CH C P, DP CA DET, DP EXT CA DET, DP EXT MLI P<0..3>, DP EXT MLI N<0..3>, DP EXT HPD, DP EXT AUX CH C N, DP EXT AUX CH C P, and DP EXT CA DET.

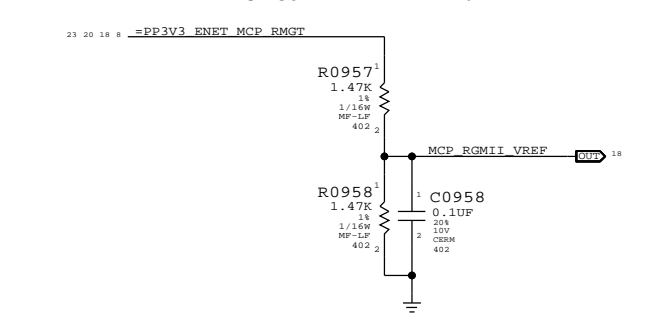
MCP89 MISC ALIASES

Table of MCP89 miscellaneous aliases including MIP MEM VDD SEL LV3 and MIP MEM VDD SEL LV4.

ETHERNET ALIASES

Table of Ethernet aliases including TP ENET RESET L, TP MCP CLK25M BUFO_R, TP ENET MDC, TP ENET TX_CTRL, TP ENET CLK125M TXCLK, TP ENET TXD<0..3>, ENET RESET L, MCP CLK25M BUFO_R, ENET MDC, ENET TX_CTRL, ENET CLK125M TXCLK, and ENET TXD<0..3>.

MCP89 ETHERNET VREF



CPU FSB FREQUENCY STRAPS

Table of CPU FSB frequency straps including CPU_BSEL<0:2>, CPU_PECI-MCP, and BSEL<2..0> with corresponding FSB MHz values.

SMC ALIASES

Table of SMC aliases including SMC_SYS_ENABLED and TP SMC_SYS_ENABLED.

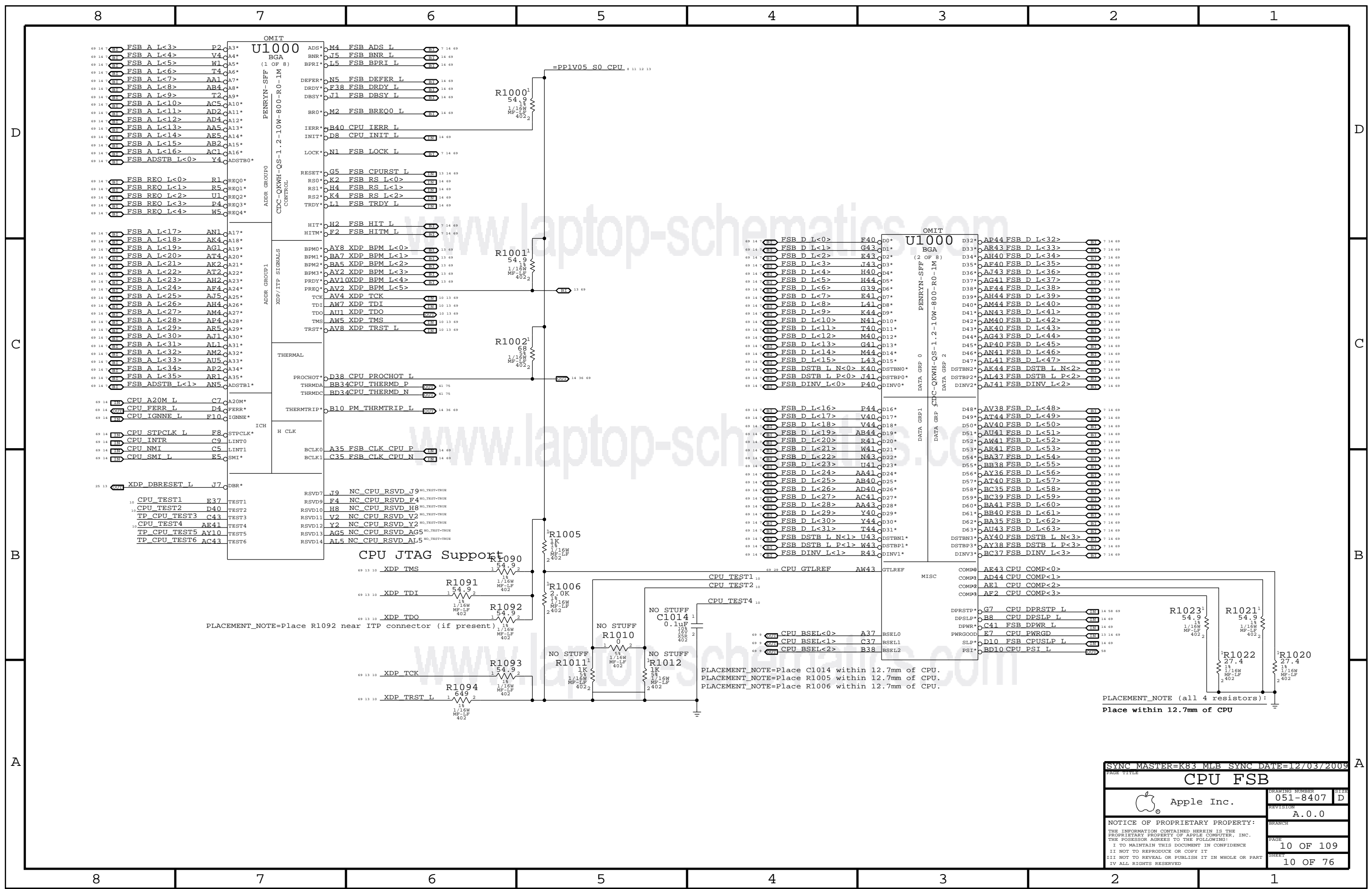
CHARGER SIGNAL

Table of charger signal aliases including CHGR_ACOK and SMC_BC_ACOK.

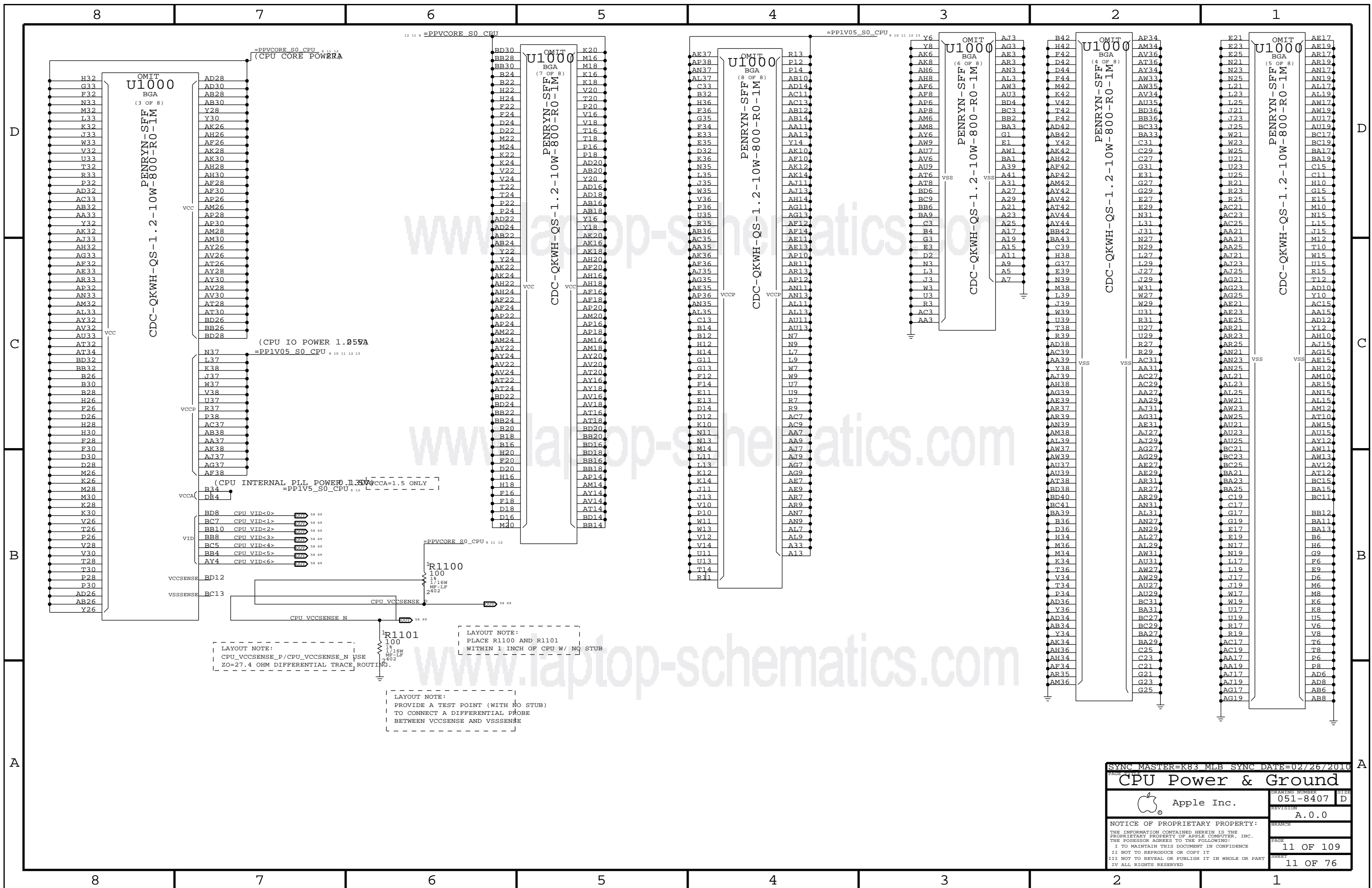
CPU VCORE ALIASES

Table of CPU Vcore aliases including INV6_VR_IT and TP INV6_VR_IT, INV6_NTC, and TP INV6_NTC.

Metadata block containing drawing title 'SIGNAL ALIAS', Apple Inc. logo, drawing number '051-8407', revision 'A.0.0', and page information '9 OF 109' and '9 OF 76'.



SYNC MASTER=K83 MLB SYNC DATE=12/03/2009		
CPU FSB		
Apple Inc.	DRAWING NUMBER 051-8407	SIZE D
REVISION A.0.0		BRANCH
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LAYOUT NOTE:
CPU_VCCSENSE_P/CPU_VCCSENSE_N USE
Z0=27.4 OHM DIFFERENTIAL TRACE ROUTING.

LAYOUT NOTE:
PLACE R1100 AND R1101
WITHIN 1 INCH OF CPU W/ NO STUB

LAYOUT NOTE:
PROVIDE A TEST POINT (WITH NO STUB)
TO CONNECT A DIFFERENTIAL PROBE
BETWEEN VCCSENSE AND VSSSENSE

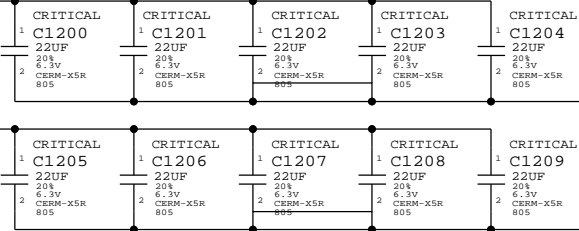
SYNC MASTER=K83 MLB SYNC DATE=02/26/2010		
CPU Power & Ground		
Apple Inc.	DRAWING NUMBER	051-8407
	REVISION	A.0.0
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CPU VCore HF and Bulk Decoupling

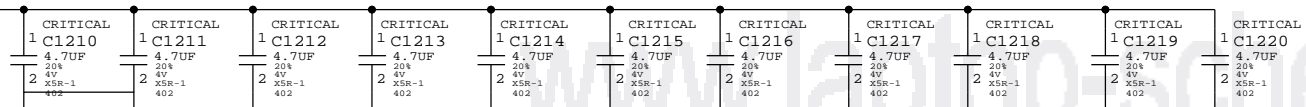
2X 470UF, 10X 22UF 0805, 55X 4.7UF 0402

PLACEMENT_NOTE (C1200-C1209):

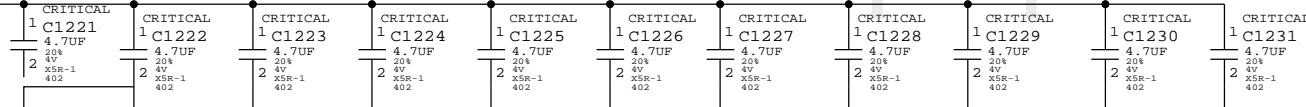
Place inside socket cavity on secondary side.



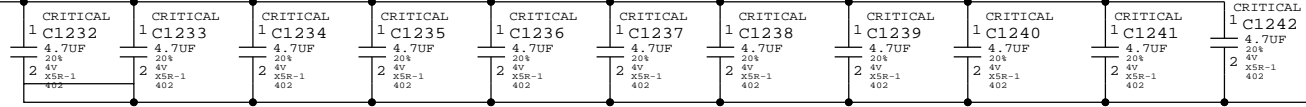
Place inside socket cavity on secondary side.



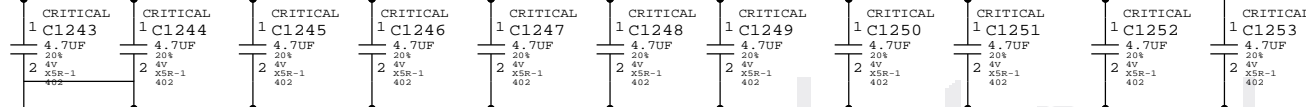
Place inside socket cavity on secondary side.



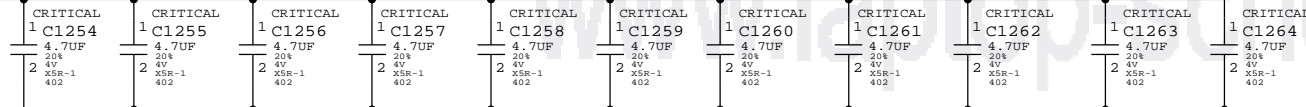
Place inside socket cavity on secondary side.



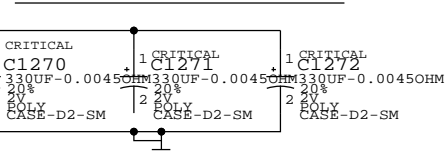
Place inside socket cavity on secondary side.



Place inside socket cavity on secondary side.



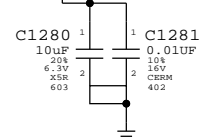
PLACEMENT_NOTE (C1240-C1243):



VCCA (CPU AVdd) DECOUPLING

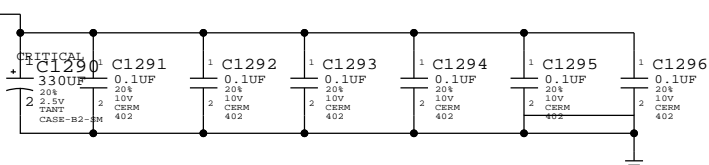
1x 10uF, 1x 0.01uF

BYPASS=U1000.B26::4MM



VCCP (CPU I/O) DECOUPLING

1x 330uF, 6x 0.1uF 0402

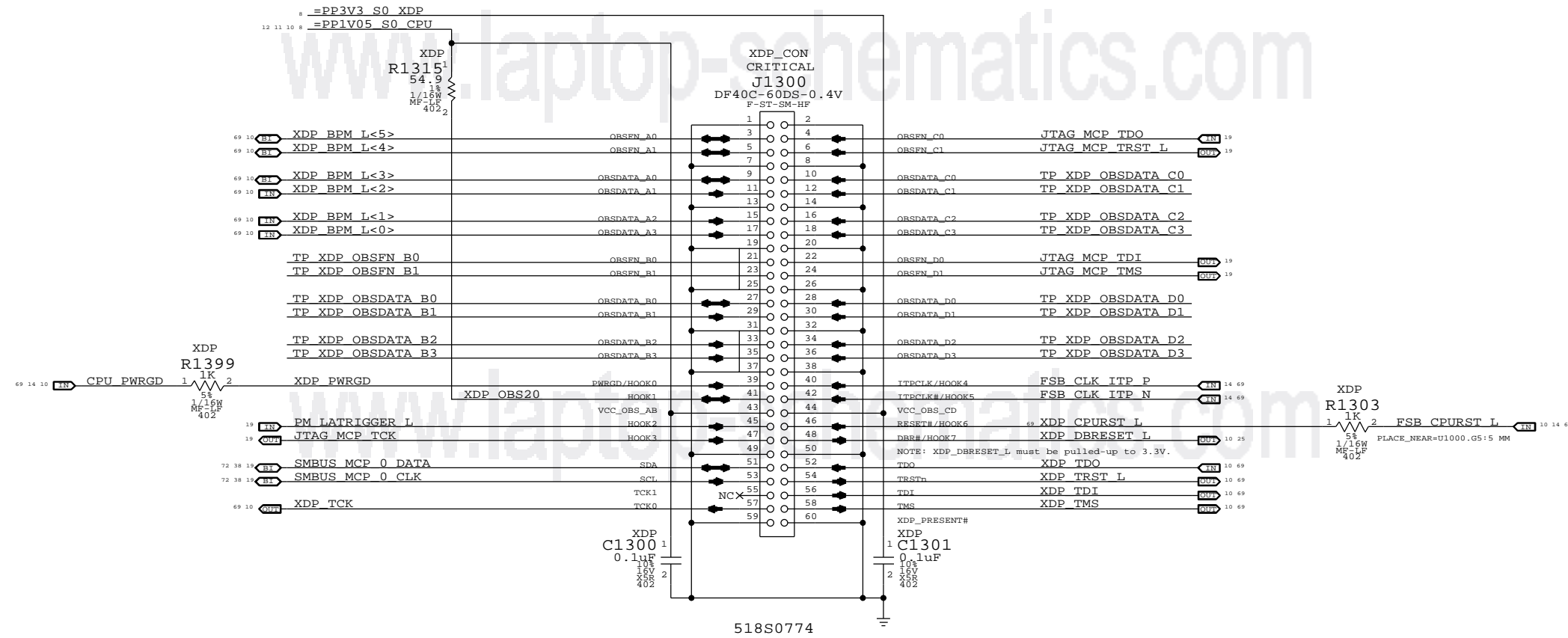


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CPU Decoupling		
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Mini-XDP Connector

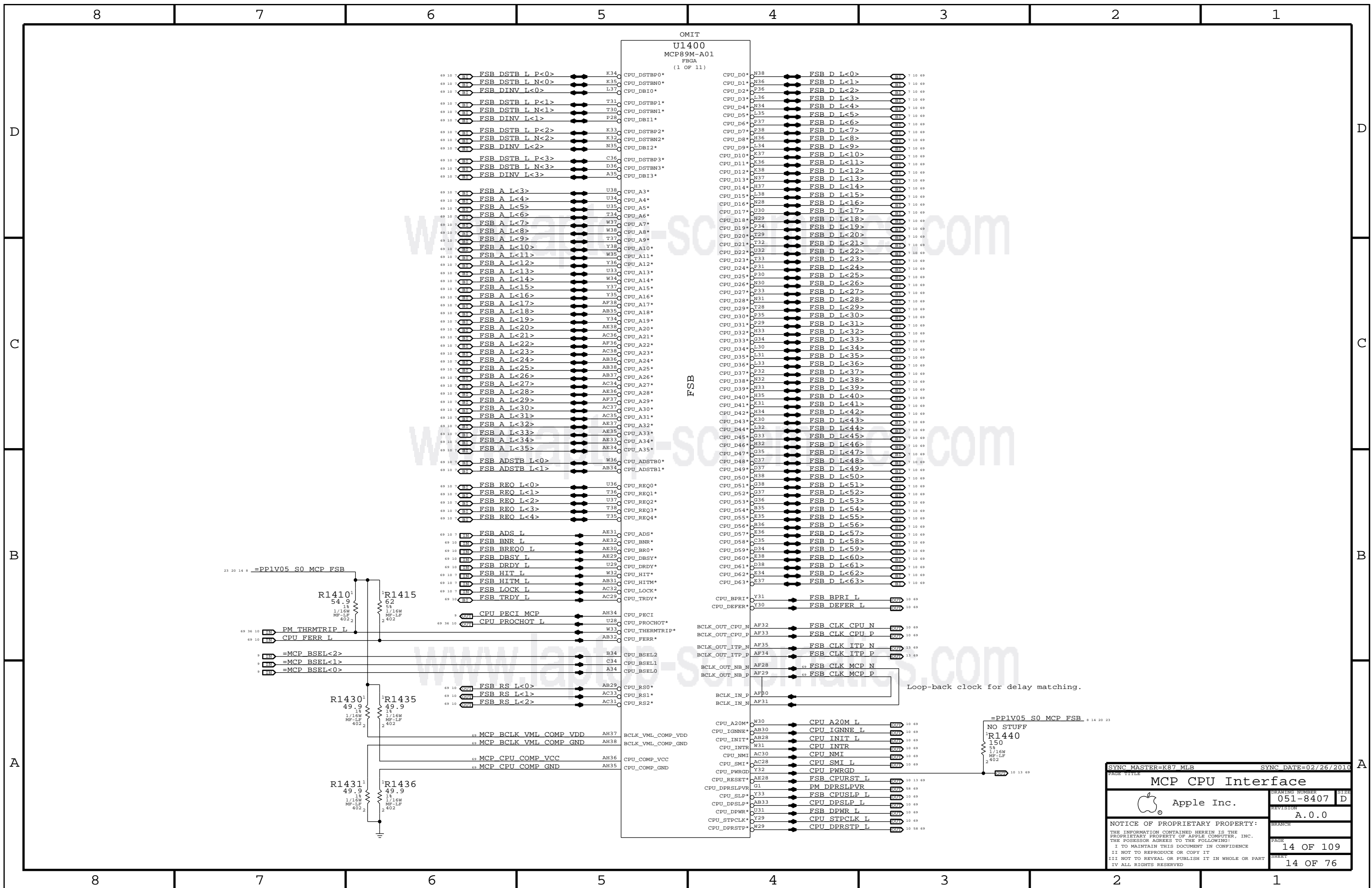
NOTE: This is not the standard XDP pinout.
USE WITH 920-0782 ADAPTER FLEX TO SUPPORT CPU, MCP DEBUGGING.

MCP89-SPECIFIC PINOUT

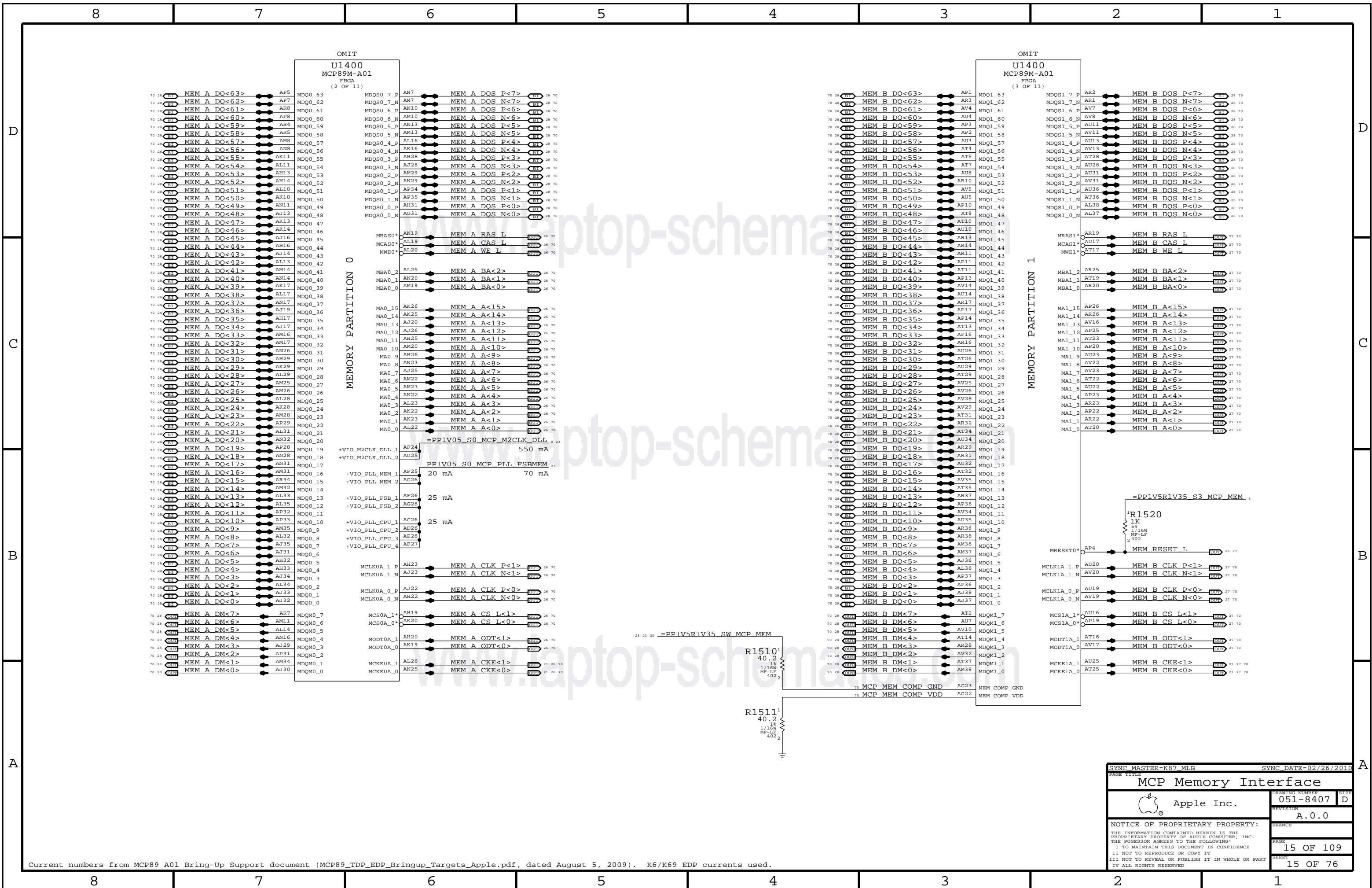


← Direction of XDP module
Please avoid any obstructions
ON ODD-NUMBERED SIDE OF J1300

SYNC MASTER=K87 MLB		SYNC DATE=12/09/2009	
eXtended Debug Port (MiniXDP)			
Apple Inc.		DRAWING NUMBER	051-8407
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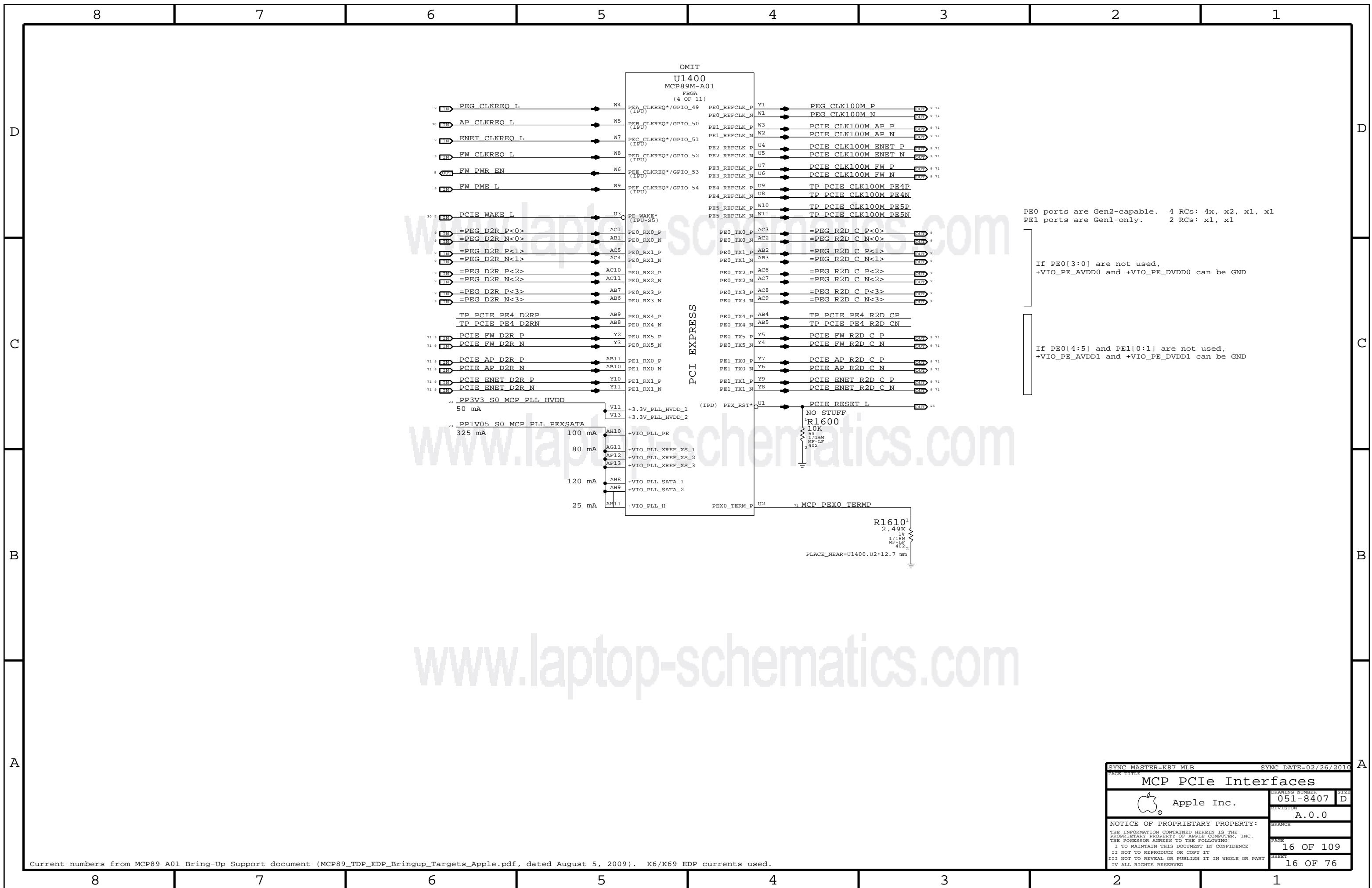


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PAGE TITLE			
MCP CPU Interface		DRAWING NUMBER	SIZE
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Current numbers from MCP89 A01 Bring-Up Support document (MCP89_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE			
MCP Memory Interface		DRAWING NUMBER	SIZE
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MCP PCIe Interfaces			
Apple Inc.		DRAWING NUMBER	051-8407
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RGB DAC Disable:
 Okay to float all RGB_DAC signals.
 DDC_CLK0/DDC_DATA0 pull-ups still required (or use as GPIOs).
 Connect +3.3V_RGBDAC pin to GND.
 NOTE: No Composite/S-Video/Component Video support on MCP89

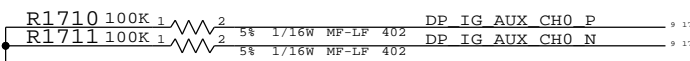
MCP Signal	TMDS/HDMI	LVDS
=MCP_IFPA_TXC_P/N	TMDS_IG_TXC_P/N	LVDS_IG_A_CLK_P/N
=MCP_IFPA_TXD_P/N<0>	TMDS_IG_TXD_P/N<0>	LVDS_IG_A_DATA_P/N<0>
=MCP_IFPA_TXD_P/N<1>	TMDS_IG_TXD_P/N<1>	LVDS_IG_A_DATA_P/N<1>
=MCP_IFPA_TXD_P/N<2>	TMDS_IG_TXD_P/N<2>	LVDS_IG_A_DATA_P/N<2>
(UNUSED)	(UNUSED)	LVDS_IG_A_DATA_P/N<3>
=MCP_IFPB_TXC_P/N	TMDS_IG_TXD_P/N<3>	LVDS_IG_B_CLK_P/N
=MCP_IFPB_TXD_P/N<0>	TMDS_IG_TXD_P/N<4>	LVDS_IG_B_DATA_P/N<0>
=MCP_IFPB_TXD_P/N<1>	TMDS_IG_TXD_P/N<5>	LVDS_IG_B_DATA_P/N<1>
=MCP_IFPB_TXD_P/N<2>	(UNUSED)	LVDS_IG_B_DATA_P/N<2>
=MCP_IFPB_TXD_P/N<3>	TMDS_IG_DDC_CLK	LVDS_IG_B_DATA_P/N<3>
=MCP_IFPAB_DDC_CLK	TMDS_IG_DDC_DATA	LVDS_IG_DDC_CLK
=MCP_IFPAB_DDC_DATA		LVDS_IG_DDC_DATA

LVDS: Power +VDD_IFPx at 1.8V
 TMDS: Power +VDD_IFPx at 3.3V
 NOTE: TMDS/HDMI not supported on IFPA/B for MCP89 A01.

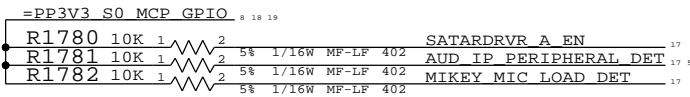
NOTE: 100K pull-downs required if HPLUG_DET0/HPLUG_DET1 are not used.

DDC Mode Pull-downs

NOTE: DP_AUX_CH1 also requires pull-downs if used for dual-mode DisplayPort (DP++). If unused no pulls are necessary, if used for TMDS/HDMI only then only pull-ups are necessary.

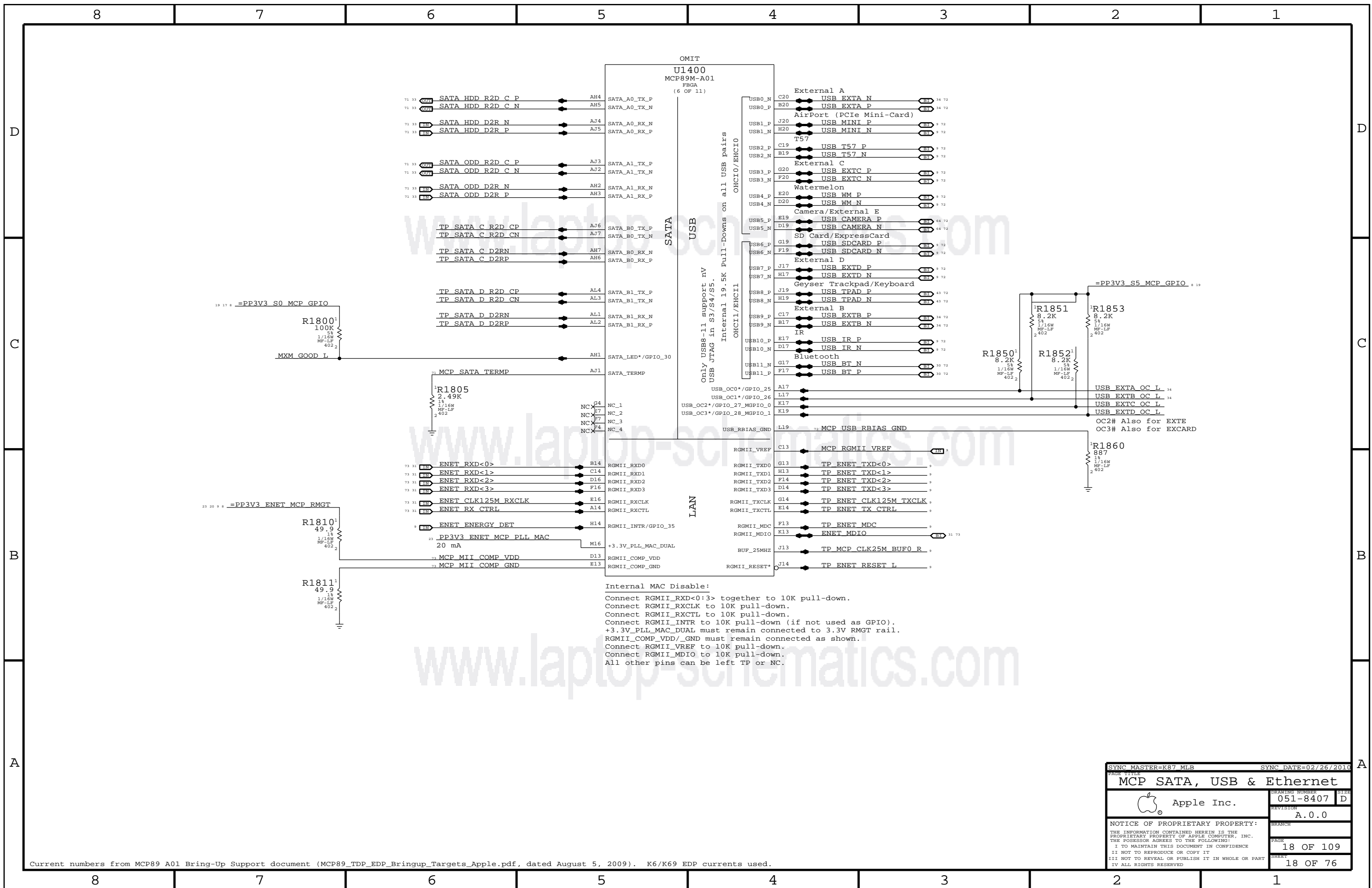


GPIO Pull-Ups



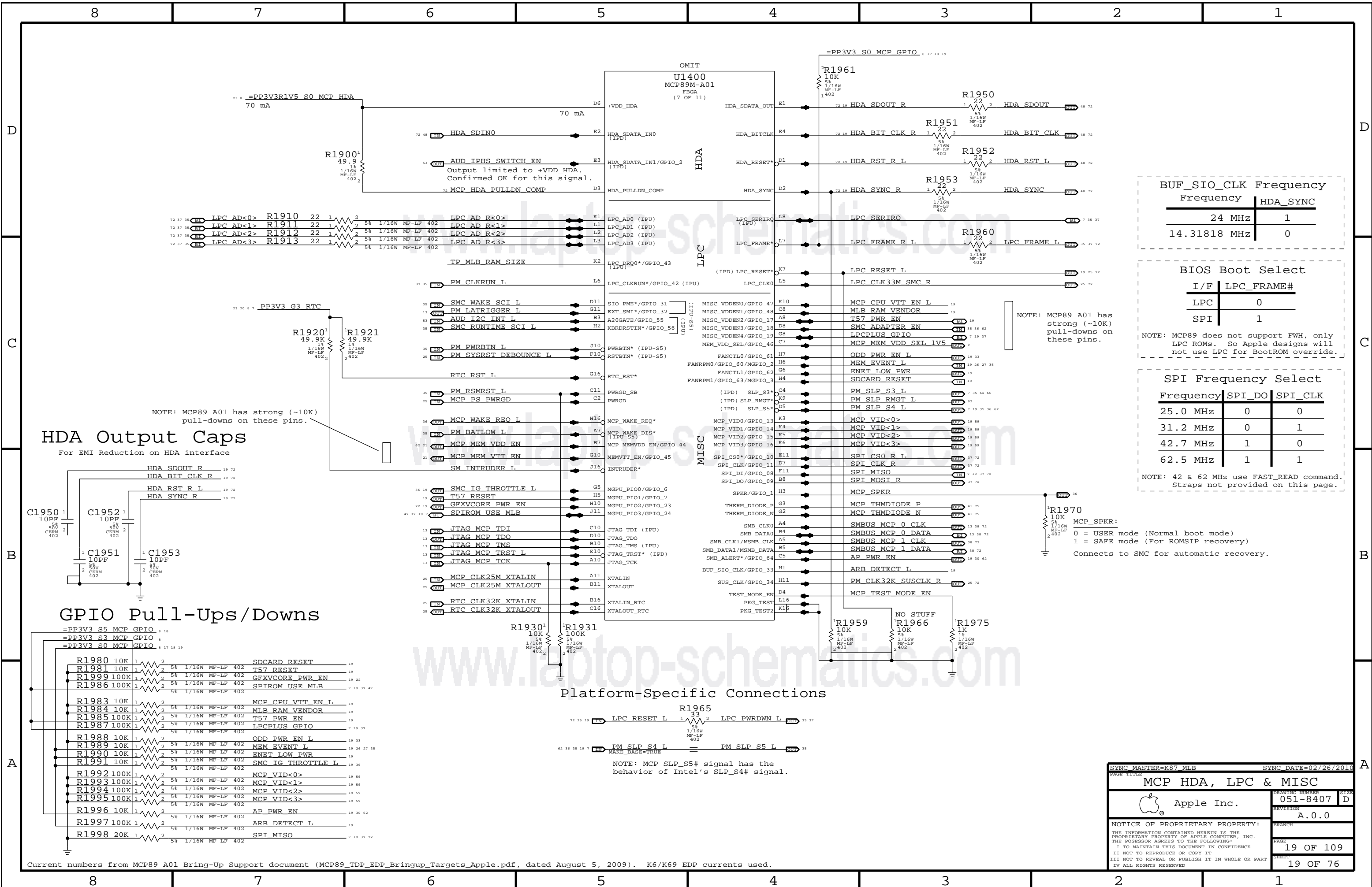
Current numbers from MCP89 A01 Bring-Up Support document (MCP89_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
MCP Graphics			
Apple Inc.		DRAWING NUMBER	SIZE
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Internal MAC Disable:
 Connect RGMII_RXD<0:3> together to 10K pull-down.
 Connect RGMII_RXCLK to 10K pull-down.
 Connect RGMII_RXCTL to 10K pull-down.
 Connect RGMII_INTR to 10K pull-down (if not used as GPIO).
 +3.3V_PLL_MAC_DUAL must remain connected to 3.3V RMTG rail.
 RGMII_COMP_VDD/_GND must remain connected as shown.
 Connect RGMII_VREF to 10K pull-down.
 Connect RGMII_MDIO to 10K pull-down.
 All other pins can be left TP or NC.

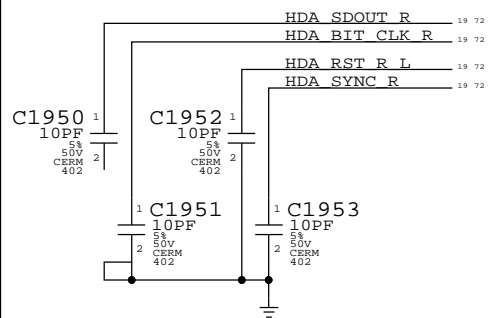
SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE MCP SATA, USB & Ethernet			
Apple Inc.		DRAWING NUMBER 051-8407	SIZE D
		REVISION A.0.0	
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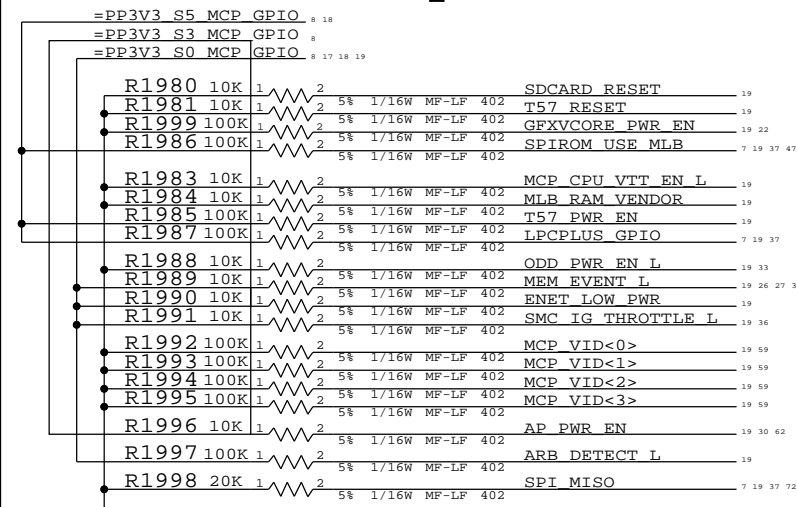
NOTE: MCP89 A01 has strong (~10K) pull-downs on these pins.

HDA Output Caps

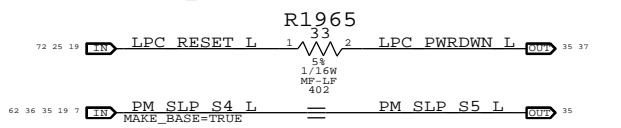
For EMI Reduction on HDA interface



GPIO Pull-Ups/Downs



Platform-Specific Connections



BUF_SIO_CLK Frequency	
Frequency	HDA_SYNC
24 MHz	1
14.31818 MHz	0

BIOS Boot Select	
I/F	LPC_FRAME#
LPC	0
SPI	1

SPI Frequency Select		
Frequency	SPI_DO	SPI_CLK
25.0 MHz	0	0
31.2 MHz	0	1
42.7 MHz	1	0
62.5 MHz	1	1

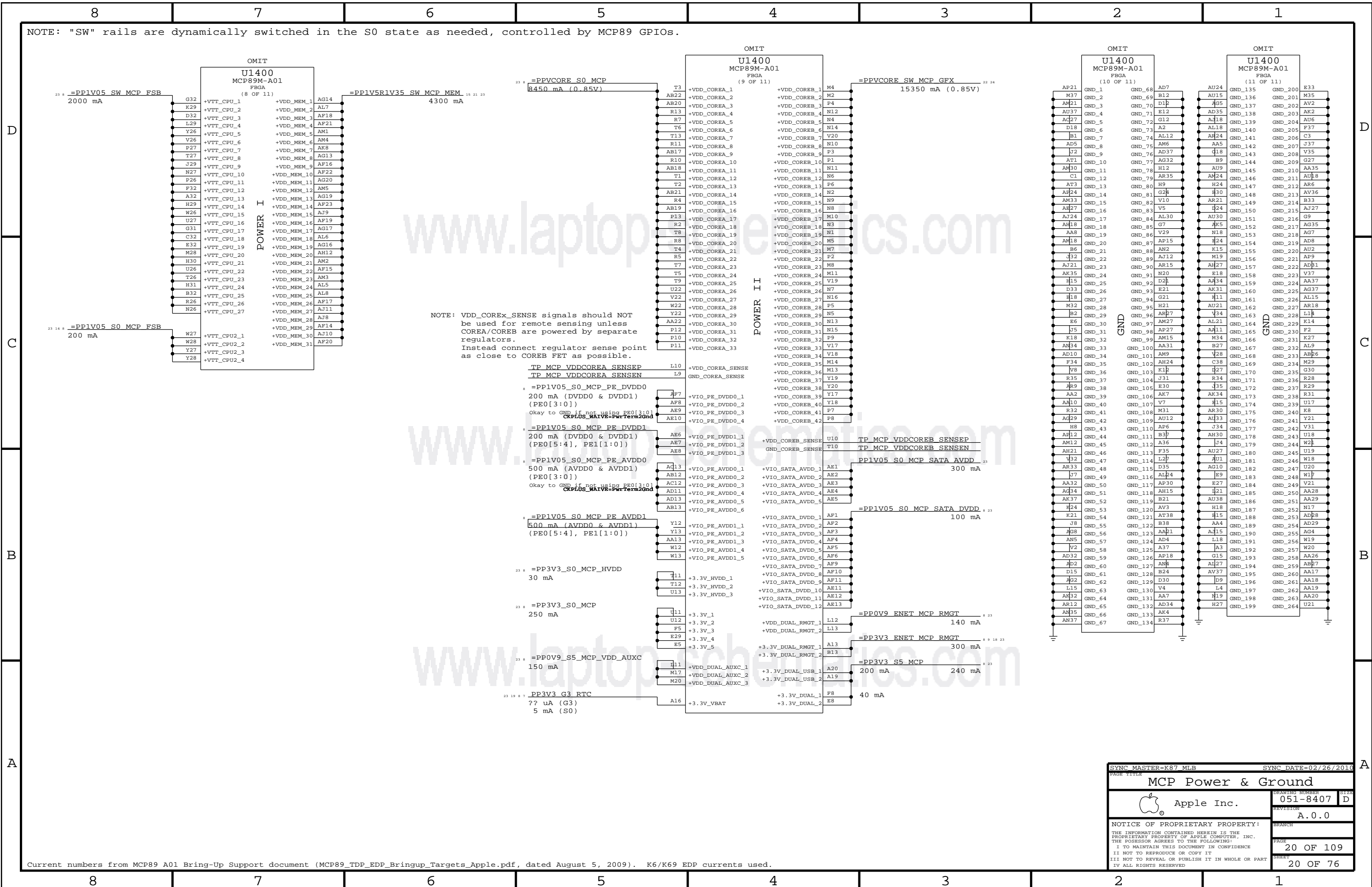
NOTE: 42 & 62 MHz use FAST_READ command. Straps not provided on this page.

NOTE: MCP89 A01 has strong (~10K) pull-downs on these pins.

R1970 MCP_SPKR:
 0 = USER mode (Normal boot mode)
 1 = SAFE mode (For ROMSIP recovery)
 Connects to SMC for automatic recovery.

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MCP HDA, LPC & MISC			
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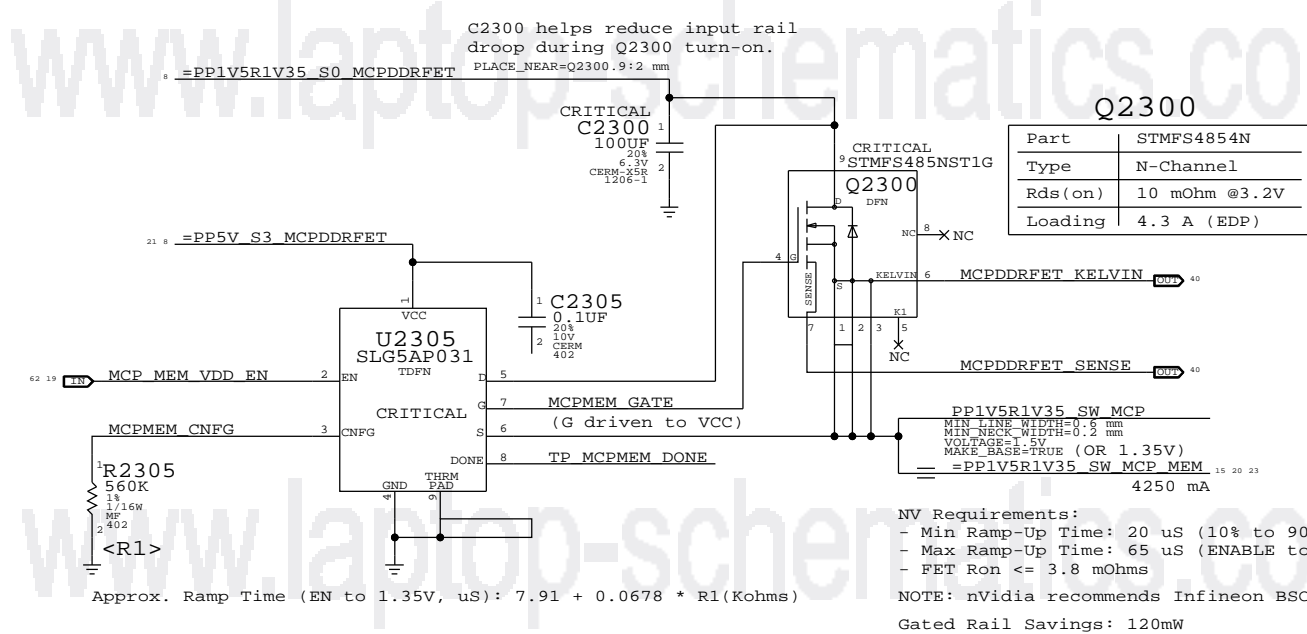
NOTE: "SW" rails are dynamically switched in the S0 state as needed, controlled by MCP89 GPIOs.



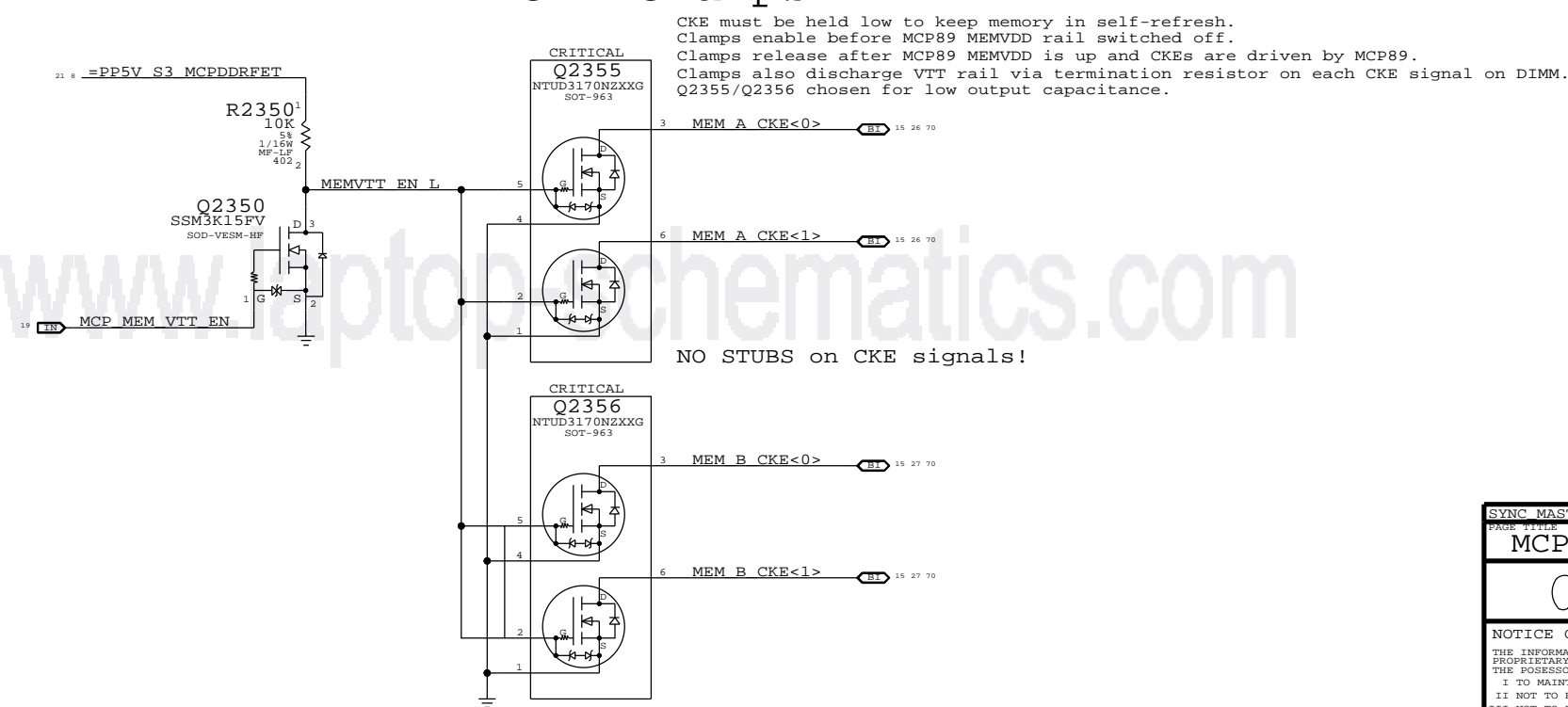
NOTE: VDD_COREx_SENSE signals should NOT be used for remote sensing unless COREA/COREB are powered by separate regulators. Instead connect regulator sense point as close to COREB FET as possible.

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MCP Power & Ground
Apple Inc.
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DIMM CKE Clamps



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MCP89 Memory Rail Gating			
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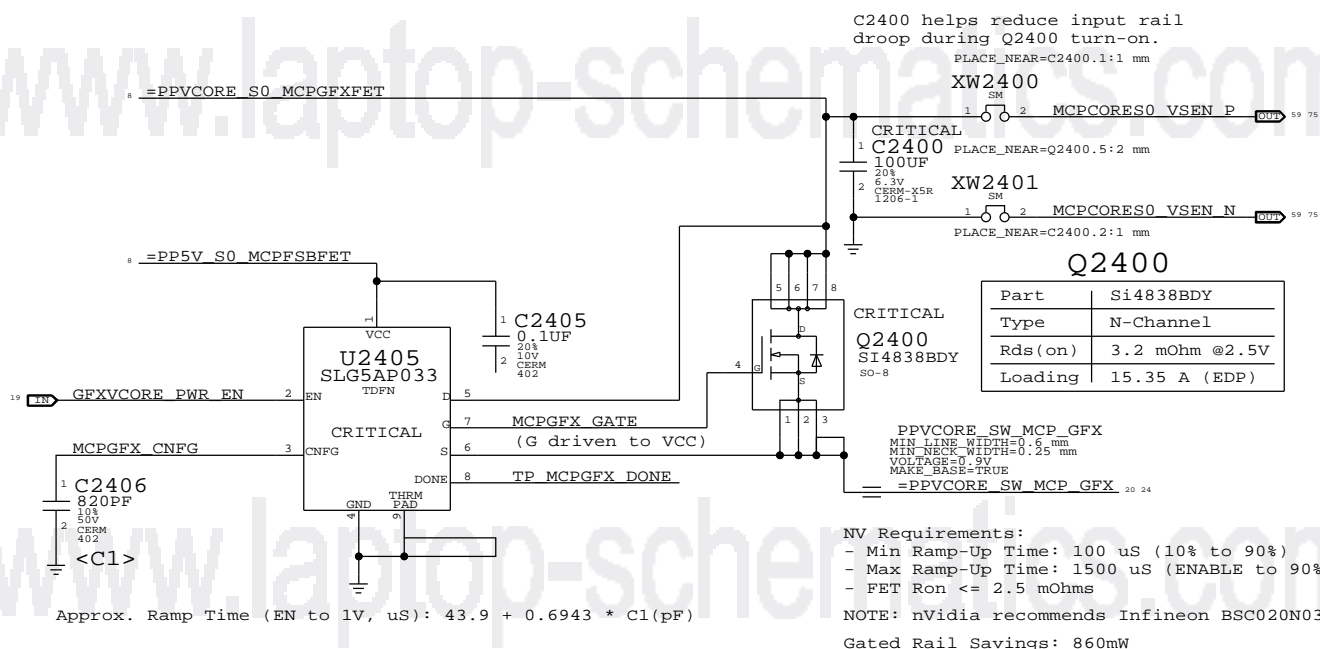
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MCP89 GFX Core Rail Gating			
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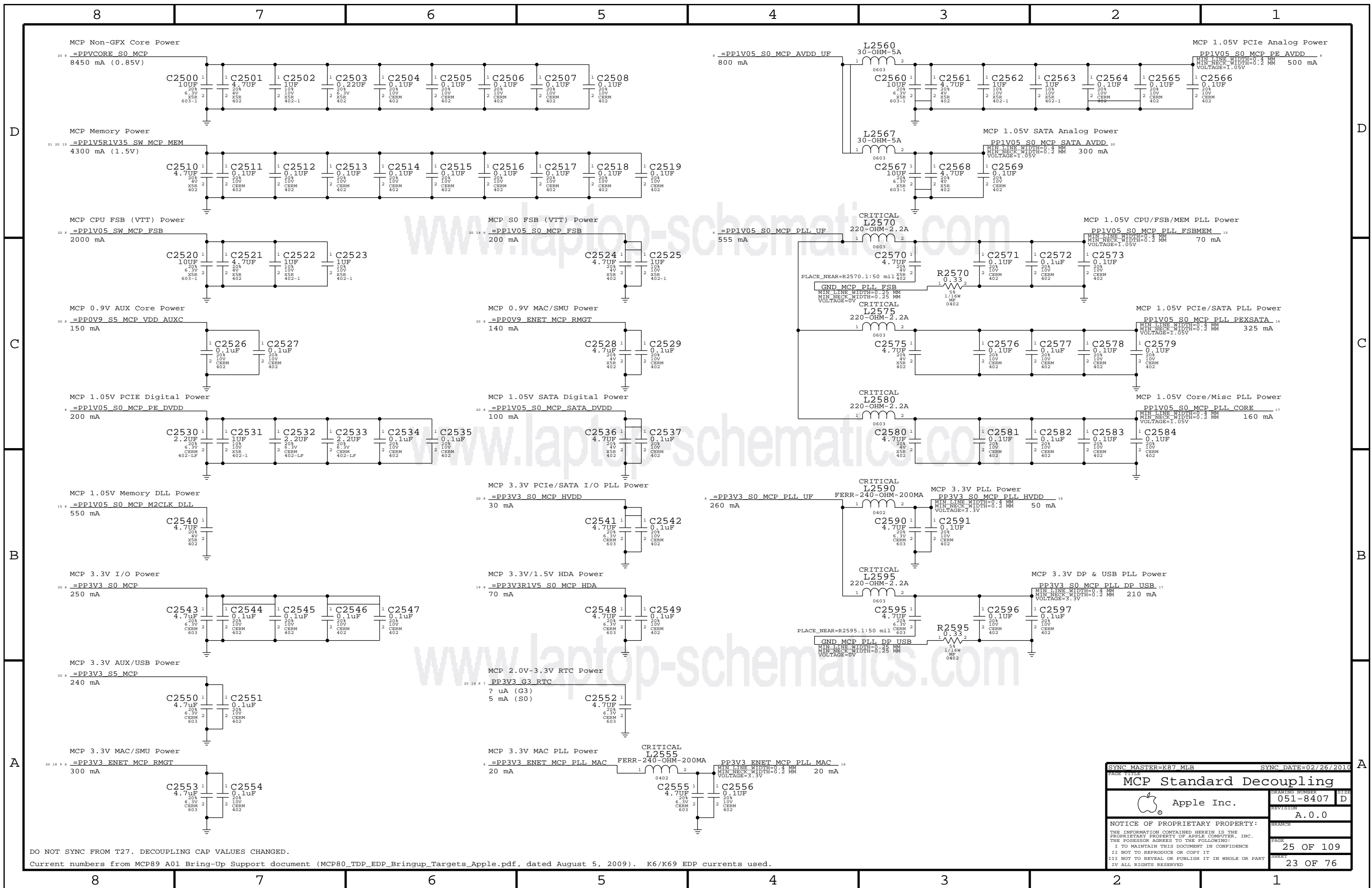
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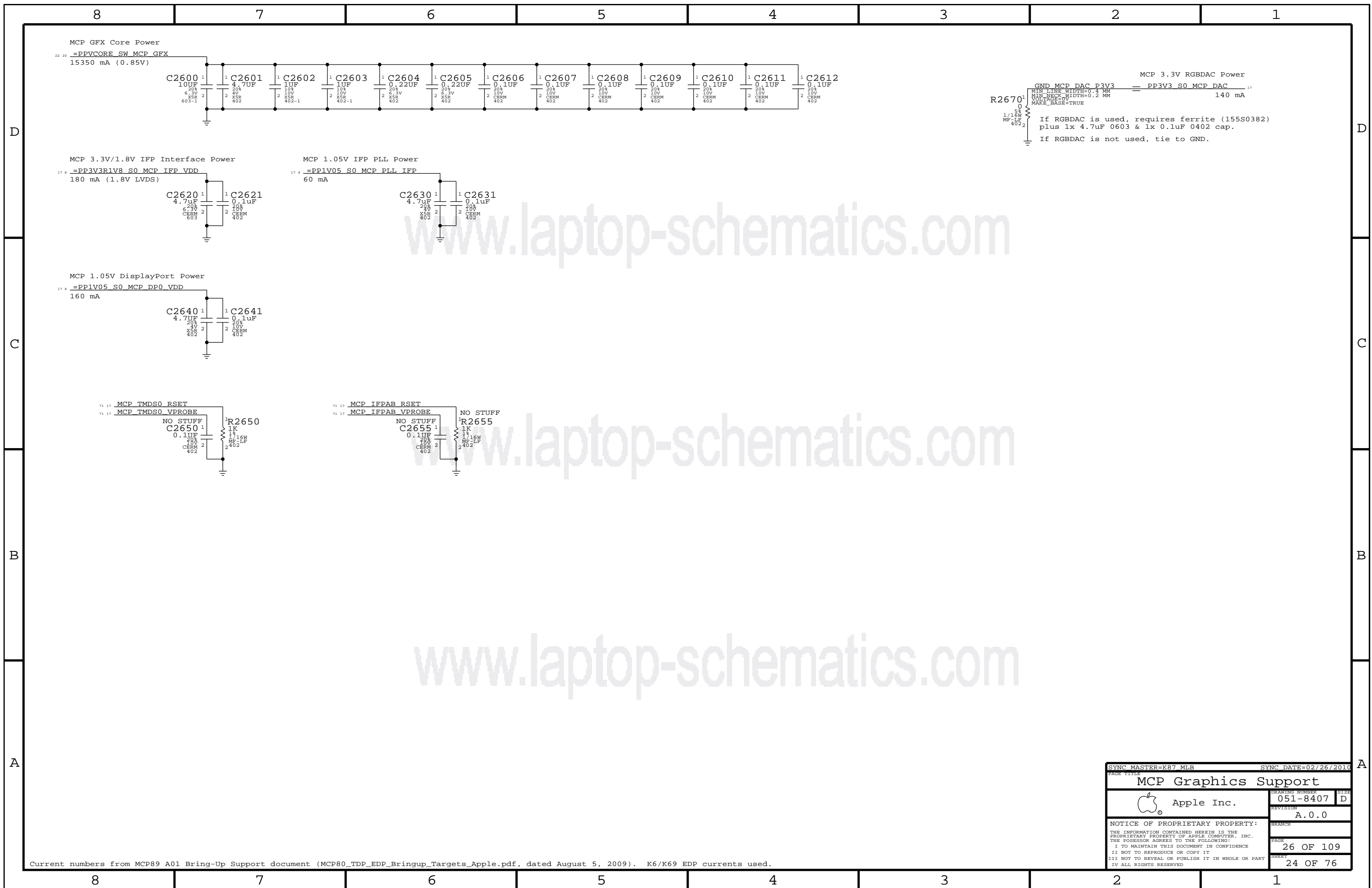
www.laptop-schematics.com



DO NOT SYNC FROM T27. DECOUPLING CAP VALUES CHANGED.

Current numbers from MCP89 A01 Bring-Up Support document (MCP80_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
MCP Standard Decoupling			
Apple Inc.		DRAWING NUMBER	051-8407
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MCP 3.3V RGBDAC Power
 GND MCP_DAC P3V3 = PP3V3 S0 MCP_DAC 17
 140 mA
 MIN_LINE_WIDTH=0.4 MM
 MIN_NECK_WIDTH=0.2 MM
 VOLTAGE=0V
 MAKE_BASE=TRUE
 R2670 1/16W MF-LP 402 2
 If RGBDAC is used, requires ferrite (155S0382) plus 1x 4.7uF 0603 & 1x 0.1uF 0402 cap.
 If RGBDAC is not used, tie to GND.

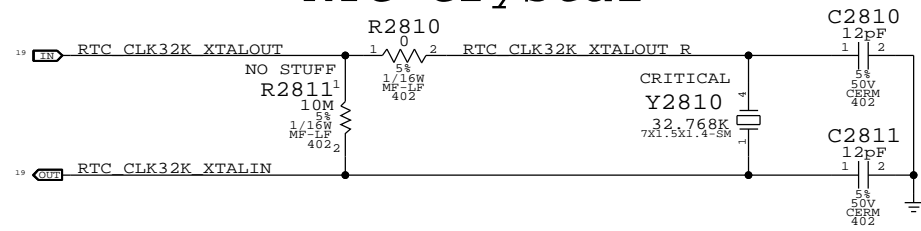
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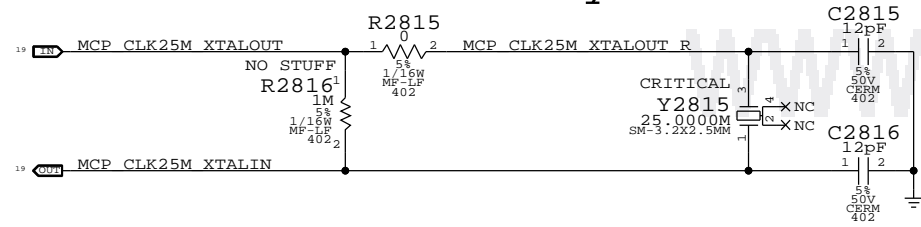
www.laptop-schematics.com

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
MCP Graphics Support			
Apple Inc.	DRAWING NUMBER	051-8407	SIZE
	REVISION	A.0.0	
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RTC Crystal

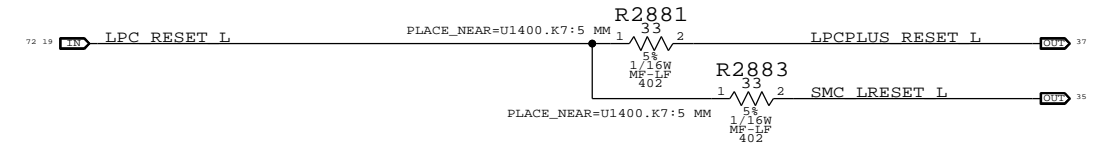


MCP 25MHz Crystal

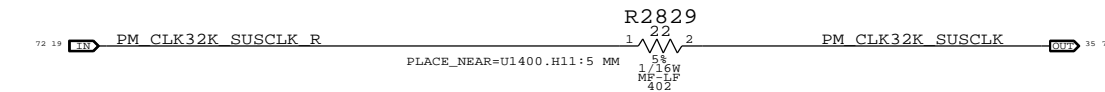
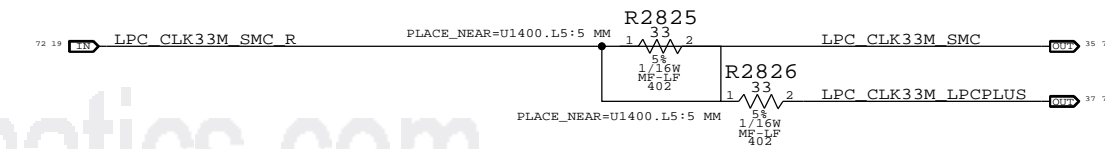
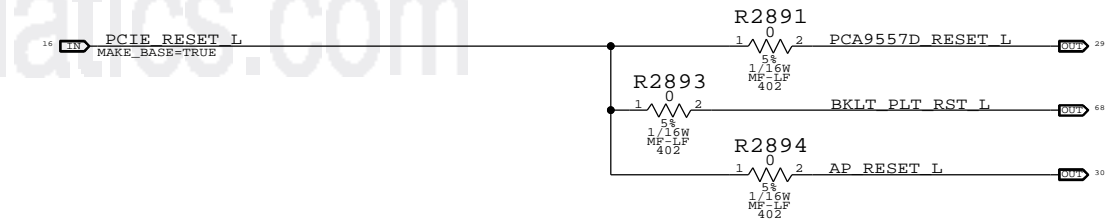


Platform Reset Connections

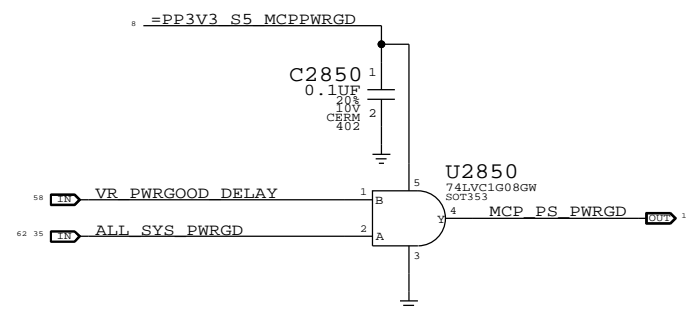
LPC Reset (Unbuffered)



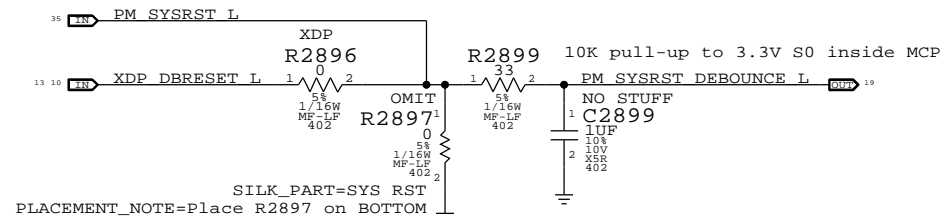
PCIE Reset (Unbuffered)



MCP S0 PWRGD & CPU_VLD



System Reset Circuit



DO NOT SYNC WITH T27. REMOVED PCIE RESET SIGNALS +CAESAR XTAL

PAGE TITLE		SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
SB Misc			DRAWING NUMBER	051-8407	SIZE
Apple Inc.			REVISION	A.0.0	
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Page Notes

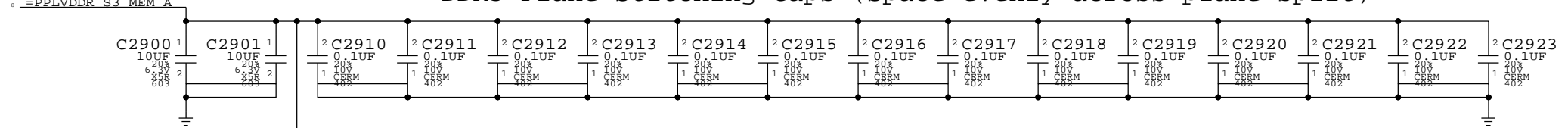
Power aliases required by this page:
 - =PPLVDDR_S3_MEM_A
 - =PPDDRVT S0_MEM_A
 - =PPSPD_S0_MEM_A (2.5 - 3.3V)

Signal aliases required by this page:
 - =I2C_SODIMMA_SCL
 - =I2C_SODIMMA_SDA

BOM options provided by this page:
 (NONE)

NOTE: J3100 is OMITTED on this page.
 Proper APN(s) required elsewhere.

DDR3 Plane Stitching Caps (Space evenly across plane split)

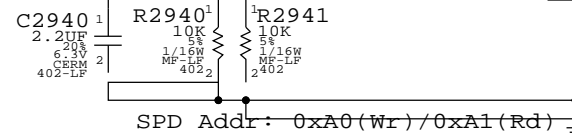


"Factory" (top) slot



Foxconn: 516-0201
 Molex: 516-0213

Foxconn: 516-0201
 Molex: 516-0213



SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
DDR3 SO-DIMM Connector A			
Apple Inc.		DRAWING NUMBER	SIZE
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Page Notes

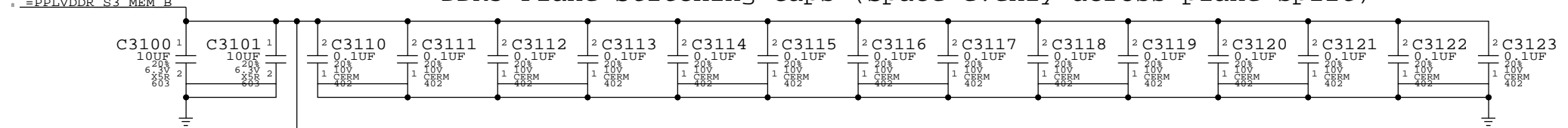
Power aliases required by this page:
- =PPLVDDR_S3_MEM_B
- =PPDDRVT S0_MEM_B
- =PPSPD_S0_MEM_B (2.5 - 3.3V)

Signal aliases required by this page:
- =I2C_SODIMM_SCL
- =I2C_SODIMM_SDA

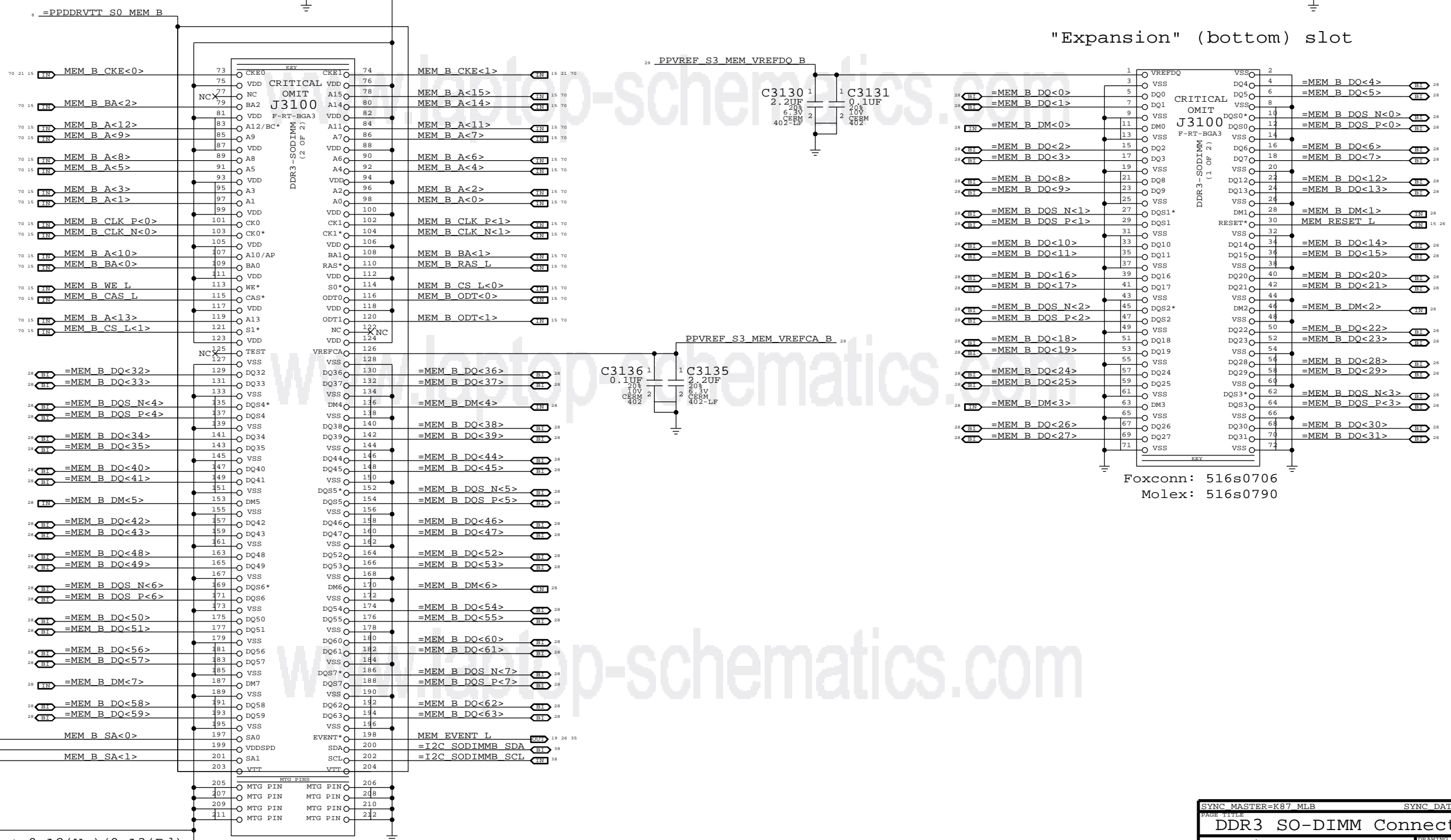
BOM options provided by this page:
(NONE)

NOTE: J3100 is OMITTED on this page.
Proper APN(s) required elsewhere.

DDR3 Plane Stitching Caps (Space evenly across plane split)



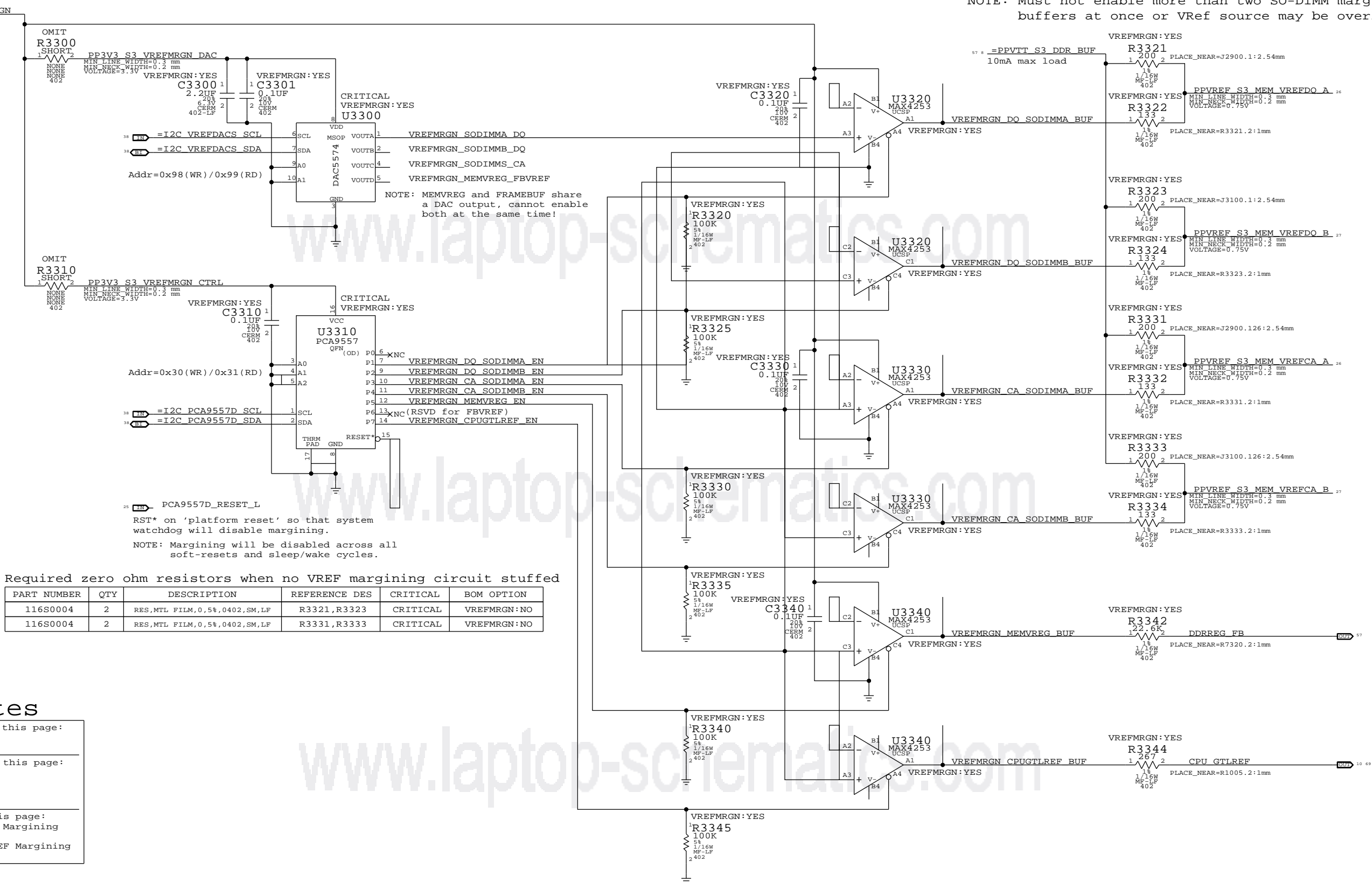
"Expansion" (bottom) slot



Foxconn: 516s0706
Molex: 516s0790

SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
DDR3 SO-DIMM Connector B			
Apple Inc.		DRAWING NUMBER	051-8407
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		SHEET	27 OF 76

NOTE: Must not enable more than two SO-DIMM margining buffers at once or VRef source may be overloaded.



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

PCA9557D_RESET_L
RST* on 'platform reset' so that system watchdog will disable margining.
NOTE: Margining will be disabled across all soft-resets and sleep/wake cycles.

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	R3321, R3323	CRITICAL	VREFMRGN:NO
116S0004	2	RES, MTL FILM, 0, 5%, 0402, SM, LF	R3331, R3333	CRITICAL	VREFMRGN:NO

Page Notes

- Power aliases required by this page:
 - =PP3V3_S3_VREFMRGN
 - =PPVTT_S3_DDR_BUF
- Signal aliases required by this page:
 - =I2C_VREFDACS_SCL
 - =I2C_VREFDACS_SDA
 - =I2C_PCA9557D_SCL
 - =I2C_PCA9557D_SDA
- BOM options provided by this page:
 VREFMRGN:YES - Stuffs VREF Margining Circuitry.
 VREFMRGN:NO - Bypasses VREF Margining Circuitry.

	MEM A VREF DQ	MEM B VREF DQ	MEM A VREF CA	MEM B VREF CA	MEM VREG	CPU GTLREF (FSB)
DAC Channel:	A	B	C	C	D	D
PCA9557D Pin:	1	2	3	4	5	7
Nominal value		0.75V (DAC: 0x3A)			1.5V (DAC: 0x3A)	0.7V (DAC: 0x8B)
Margined target:		0.300V - 1.200V (+/- 450mV)			1.998V - 1.002V (+/- 498mV)	0.200V - 1.050V (+/- 500mV)
DAC range:		0.000V - 1.501V (0x00 - 0x74)			0.000V - 1.501V (0x00 - 0x74)	0.000V - 1.191V (0x00 - 0x5C)
Vref current:		+3.4mA - -3.4mA (- = sourced)			+33uA - -33uA (- = sourced)	+750uA - -528uA (- = sourced)
DAC step size:		7.69mV / step @ output			8.59mV / step @ output	9.24mV / step @ output

SYNC MASTER=K87_MLB SYNC DATE=02/26/2010

FSB/DDR3 Vref Margining

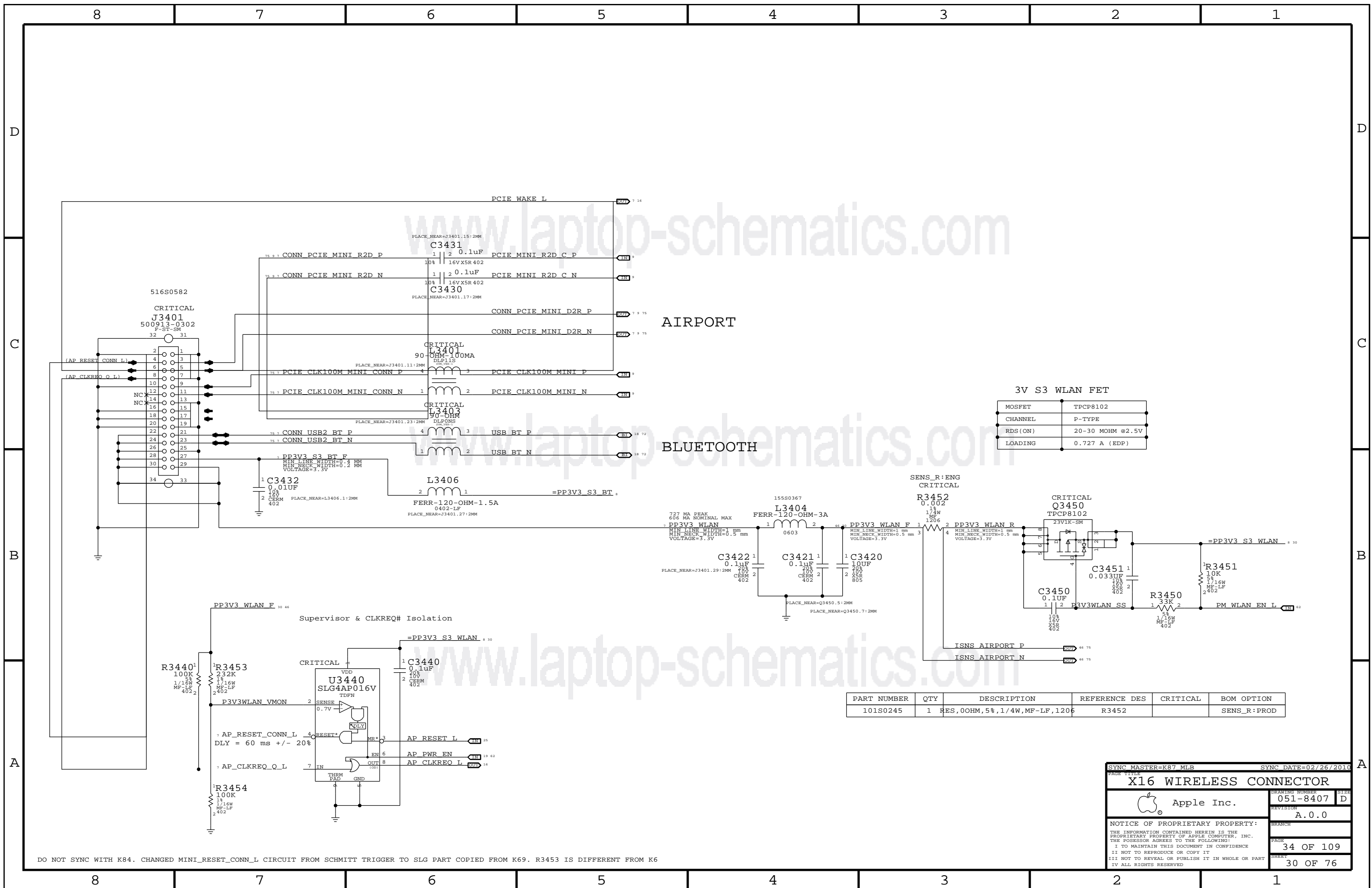
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DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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AIRPORT

BLUETOOTH

3V S3 WLAN FET

MOSFET	TPCP8102
CHANNEL	P-TYPE
RDS(ON)	20-30 MOHM @2.5V
LOADING	0.727 A (EDP)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
101S0245	1	RES,0OHM,5%,1/4W,MF-LF,1206	R3452		SENS_R:PROD

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

X16 WIRELESS CONNECTOR

Apple Inc.

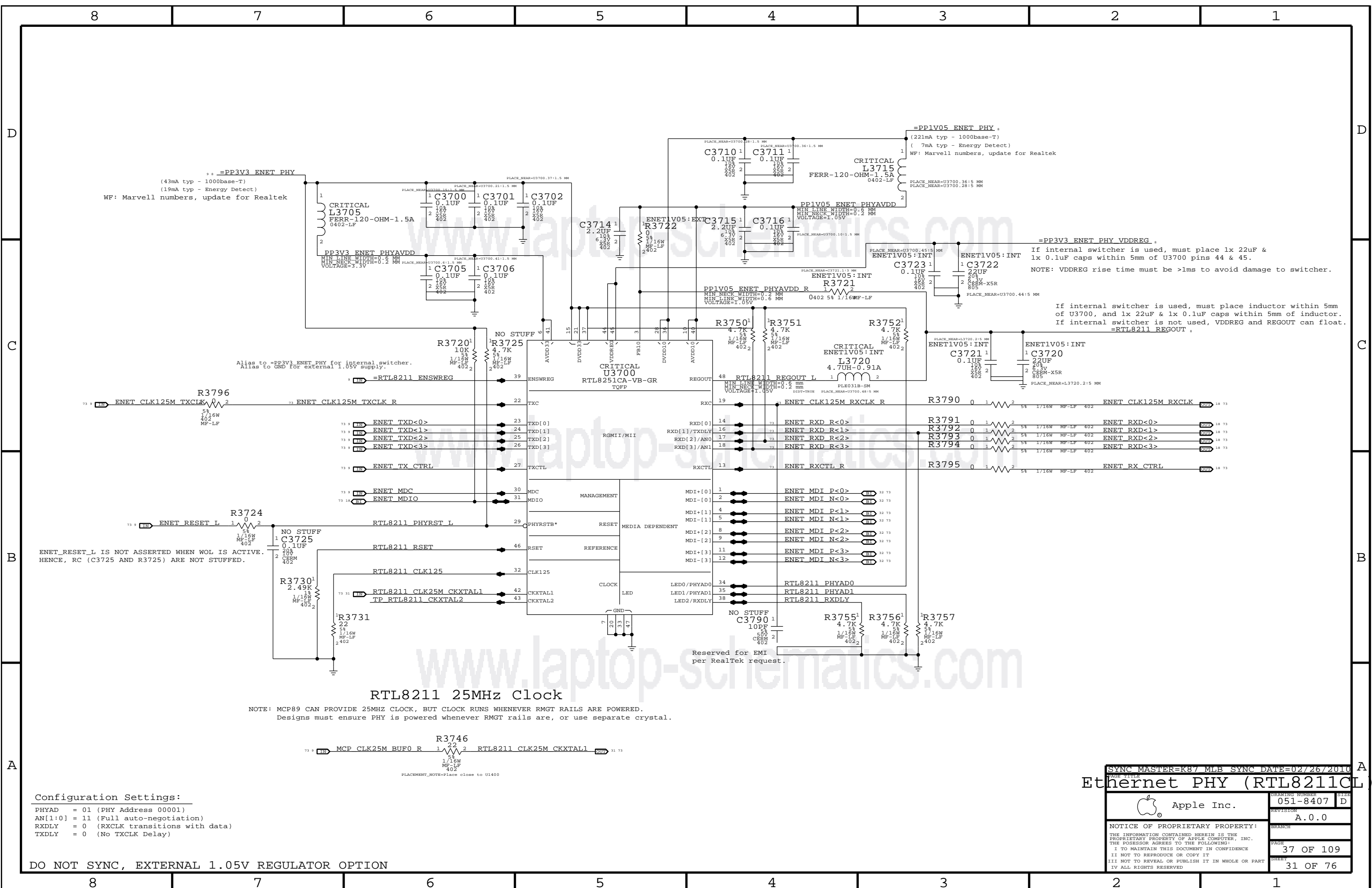
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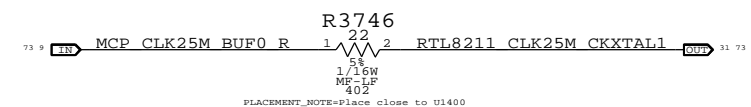
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DO NOT SYNC WITH K84. CHANGED MINI_RESET_CONN_L CIRCUIT FROM SCHMITT TRIGGER TO SLG PART COPIED FROM K69. R3453 IS DIFFERENT FROM K6



RTL8211 25MHz Clock

NOTE: MCP89 CAN PROVIDE 25MHZ CLOCK, BUT CLOCK RUNS WHENEVER RMGT RAILS ARE POWERED.
 Designs must ensure PHY is powered whenever RMGT rails are, or use separate crystal.



Configuration Settings:
 PHYAD = 01 (PHY Address 00001)
 AN[1:0] = 11 (Full auto-negotiation)
 RXDLY = 0 (RXCLK transitions with data)
 TXDLY = 0 (No TXCLK Delay)

DO NOT SYNC, EXTERNAL 1.05V REGULATOR OPTION

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

Ethernet PHY (RTL8211CL)

Apple Inc.	DRAWING NUMBER 051-8407	SIZE D
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8 7 6 5 4 3 2 1

D

D

C

C

B

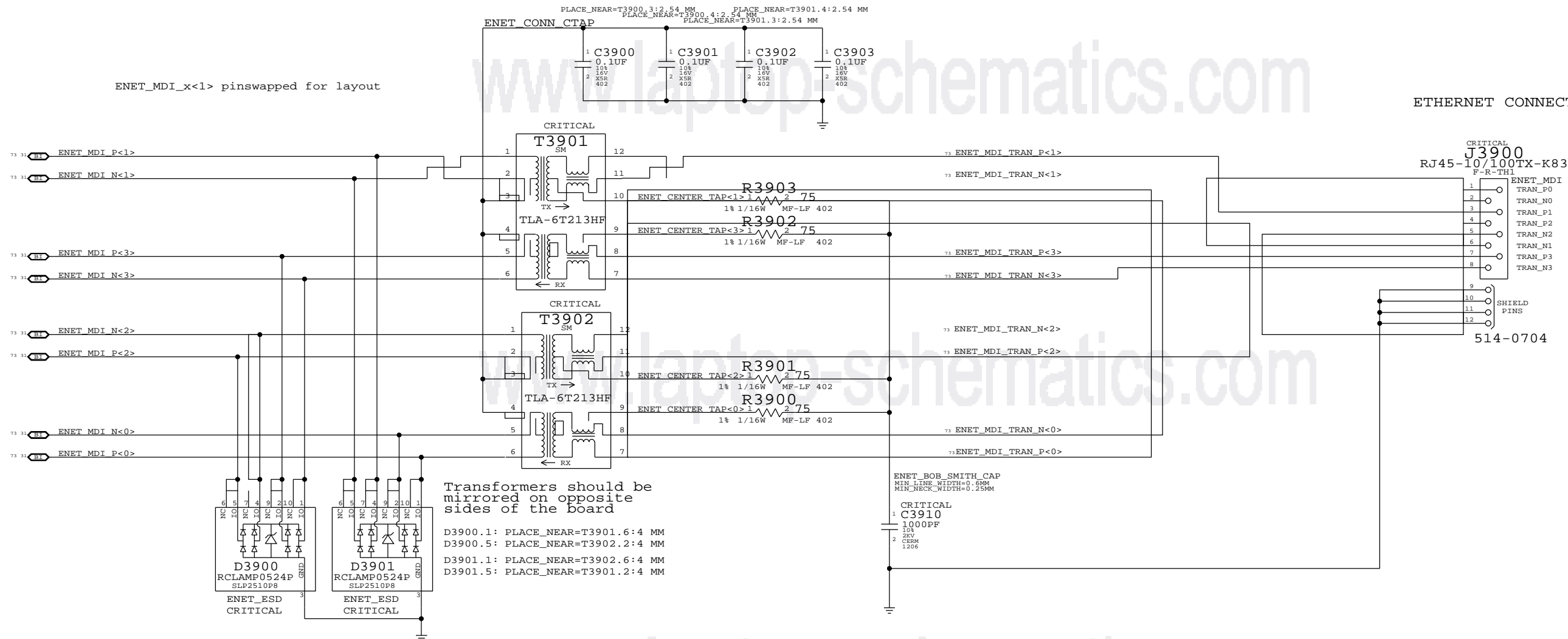
B

A

A

ENET_MDI_x<1> pinswapped for layout

ETHERNET CONNECTOR

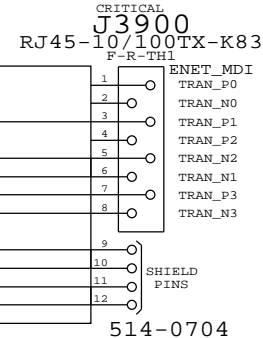


Transformers should be mirrored on opposite sides of the board

- D3900.1: PLACE_NEAR=T3901.6:4 MM
- D3900.5: PLACE_NEAR=T3902.2:4 MM
- D3901.1: PLACE_NEAR=T3902.6:4 MM
- D3901.5: PLACE_NEAR=T3901.2:4 MM

ENET_BOB_SMITH_CAP
 MIN_LINE_WIDTH=0.6MM
 MIN_NECK_WIDTH=0.25MM

CRITICAL
 C3910
 1000PF
 10V
 0603
 1206



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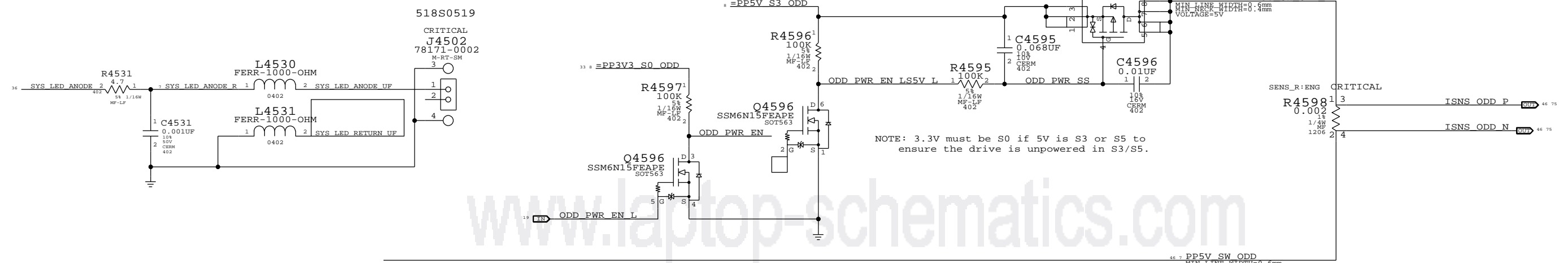
DO NOT SYNC FROM K6, WITH K84'S CONNECTOR

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010		
ETHERNET CONNECTOR		
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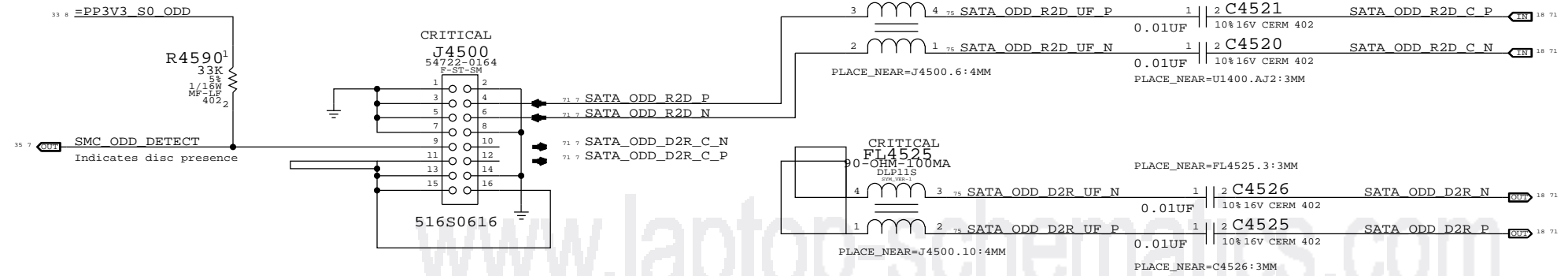
8 7 6 5 4 3 2 1

SIL

ODD Power Control

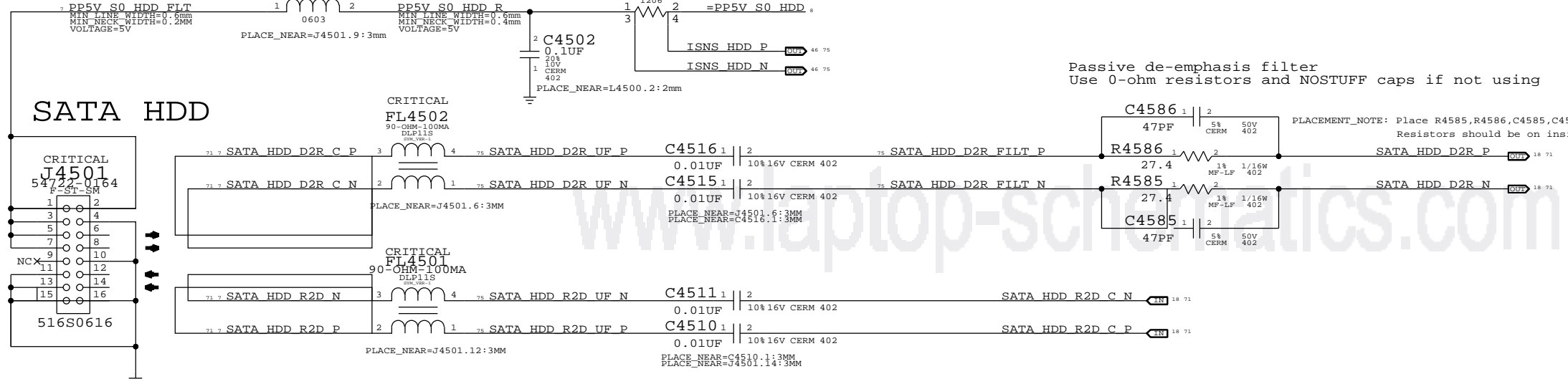


SATA ODD



PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
101S0245	2	RES, 0OHM, 5%, 1/4W, MF-LP, 1206	R4599, R4598		SENS_R:PROD

SATA HDD



SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

SATA Connectors

Apple Inc.

DRAWING NUMBER: 051-8407 SIZE: D

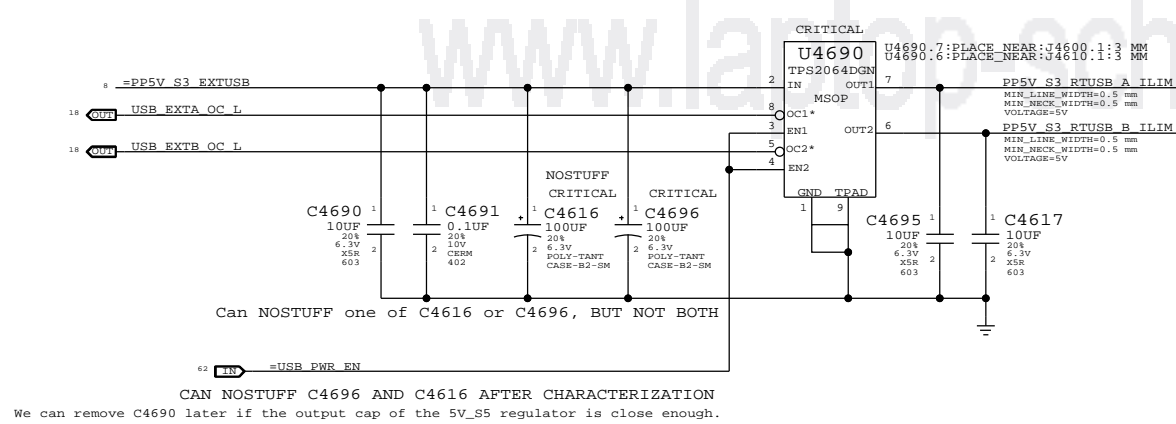
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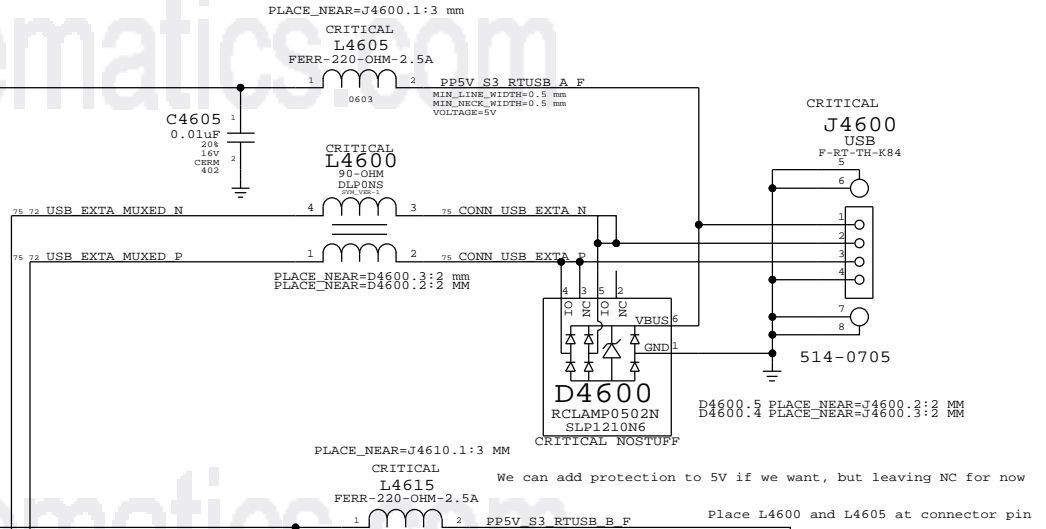
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POR IS METAL USB CONNECTOR PARTS

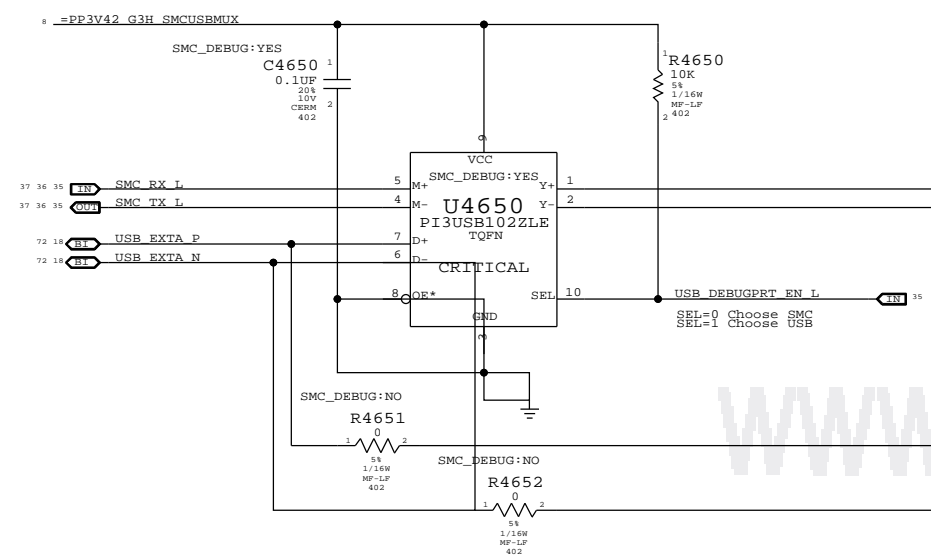
Port Power Switch



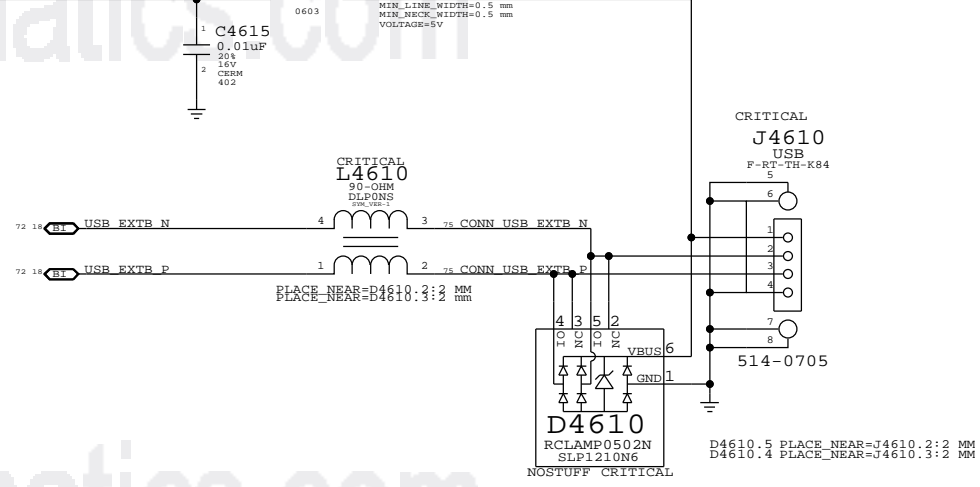
USB PORT A (FRONT PORT)



USB/SMC Debug Mux



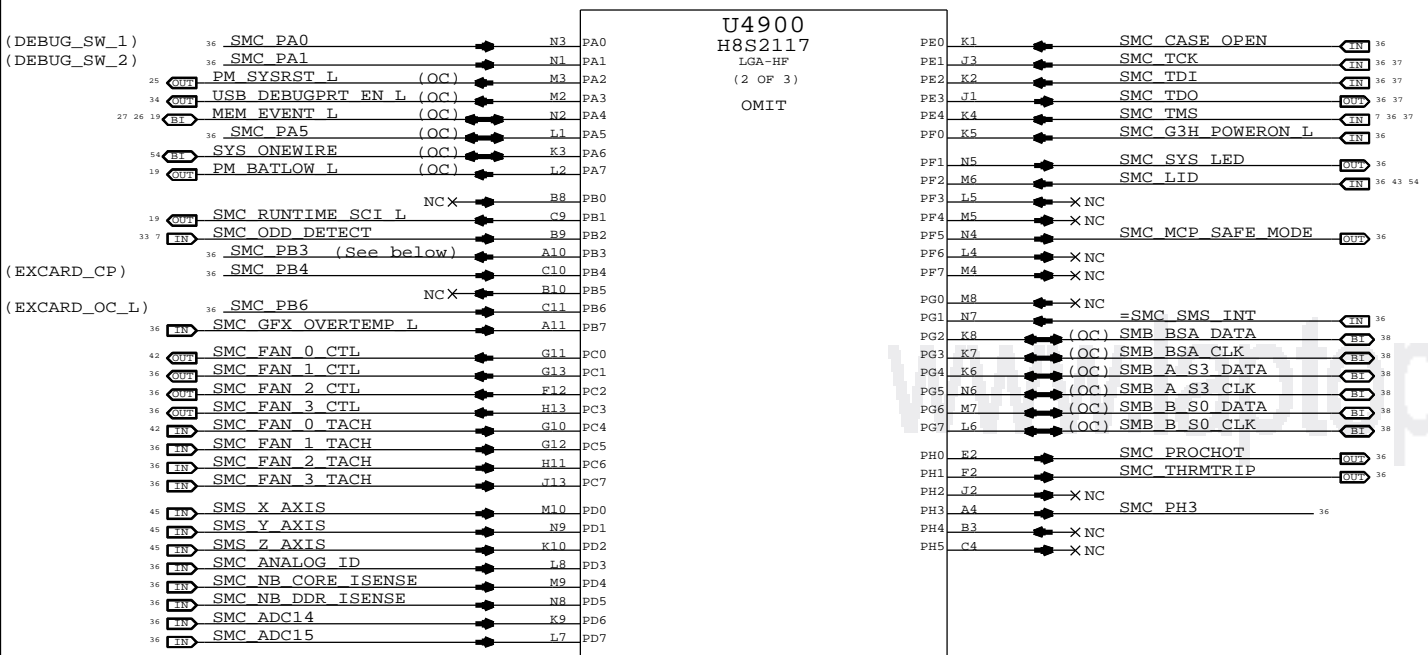
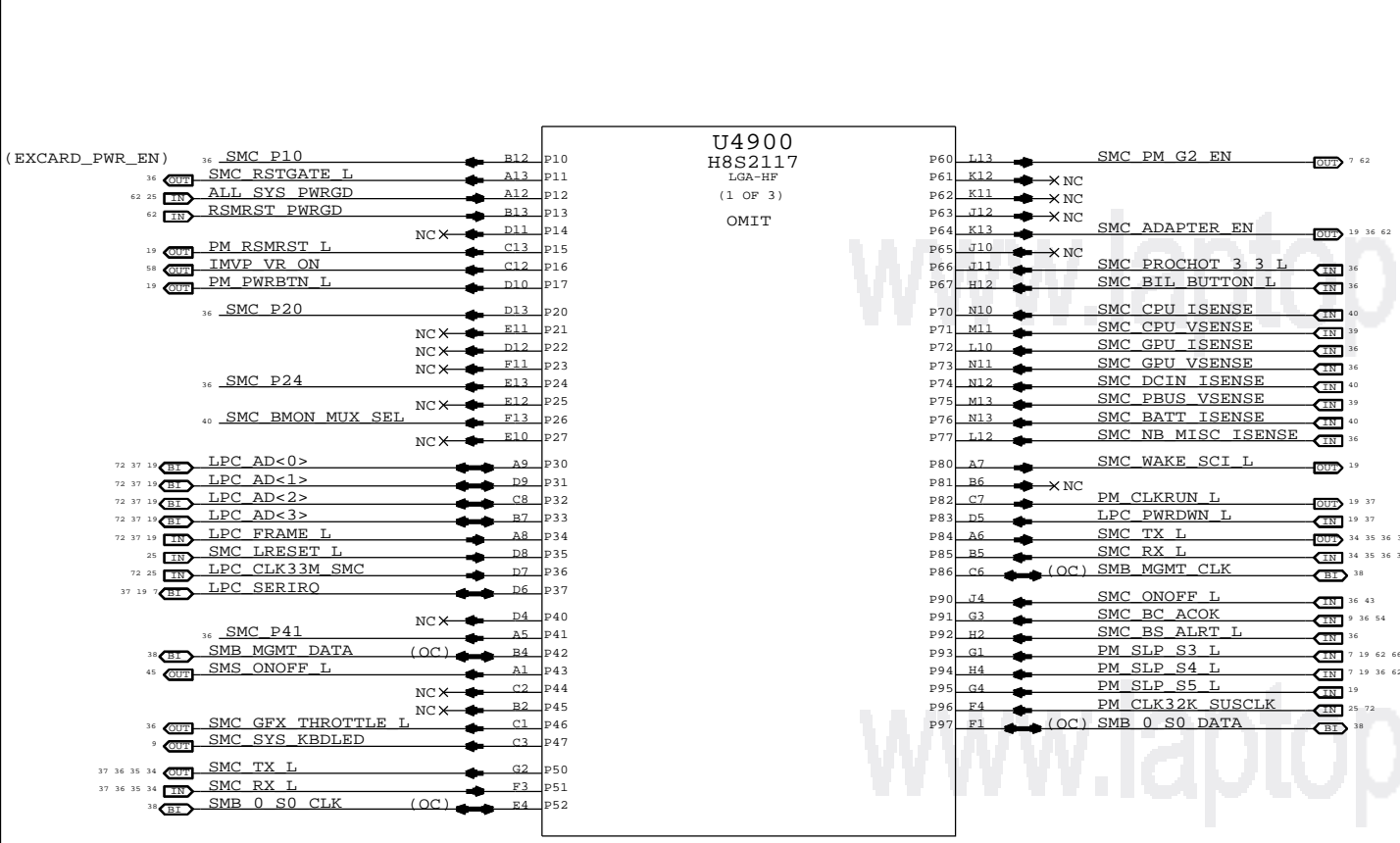
USB PORT B (BACK PORT)



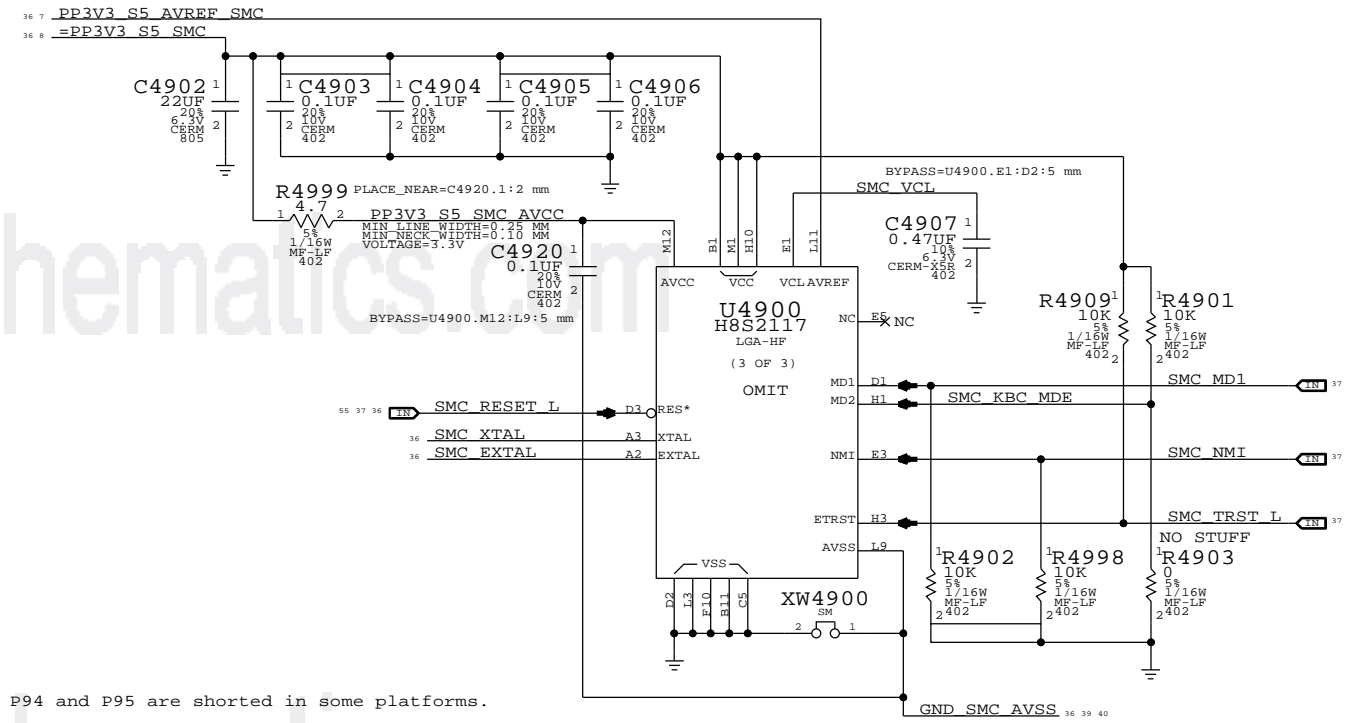
DO NOT SYNC WITH K84. UPDATED PLACE NEAR NOTES
UPDATED SMC_DEBUG BOMOPTION, STUFFED C4690

SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
External USB Connectors			
Apple Inc.		DRAWING NUMBER	051-8407
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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.



SMC_PB3:
SMC_IG_THROTTLE_L for MG systems.
Otherwise, TP/NC okay.



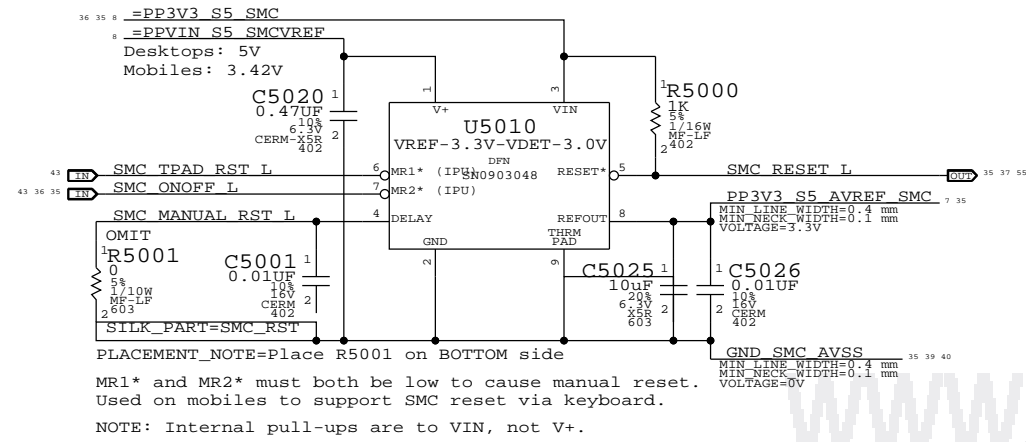
NOTE: P94 and P95 are shorted in some platforms.

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

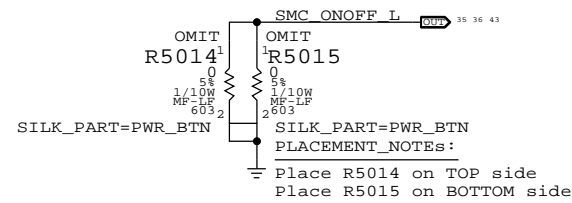
H8S2117-R:
(SMC_PECI)
(SMC_PECI_VREF)
(SMC_PECI_VSTP)

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
SMC			
Apple Inc.		DRAWING NUMBER	SIZE
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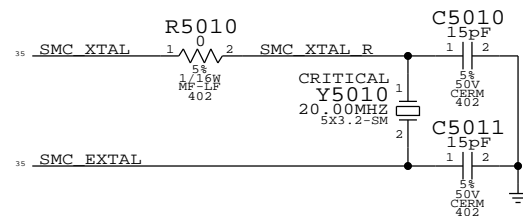
SMC Reset "Button", Supervisor & AVREF Supply



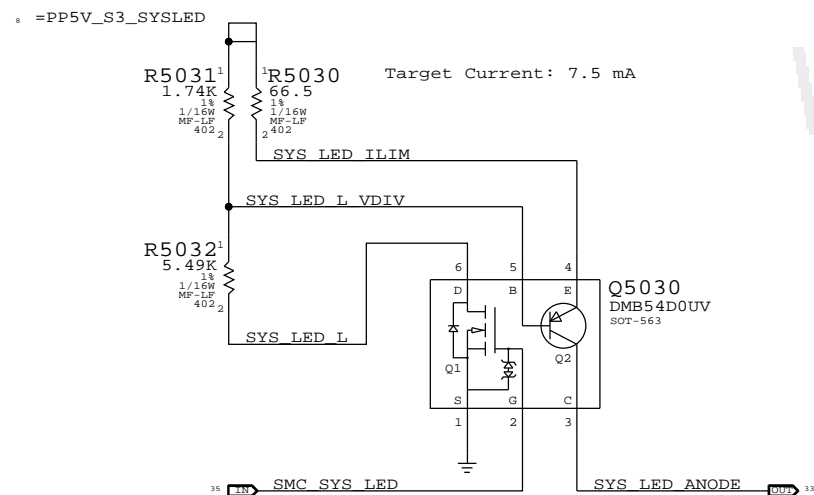
Debug Power "Buttons"



SMC Crystal Circuit

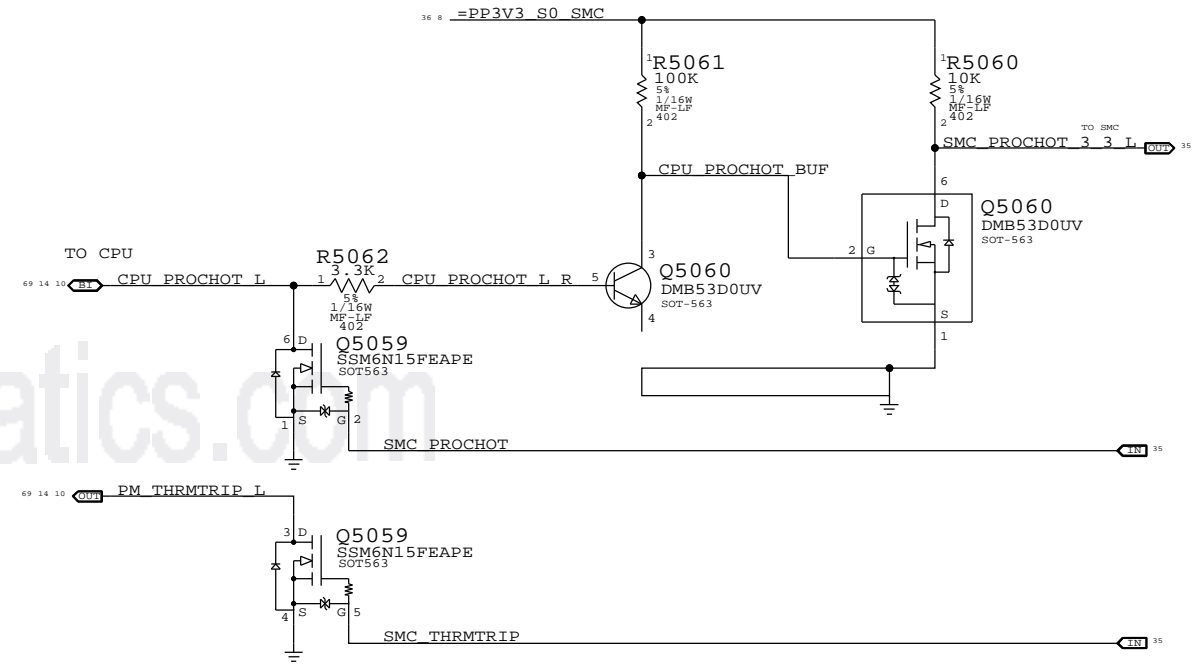


System (Sleep) LED Circuit

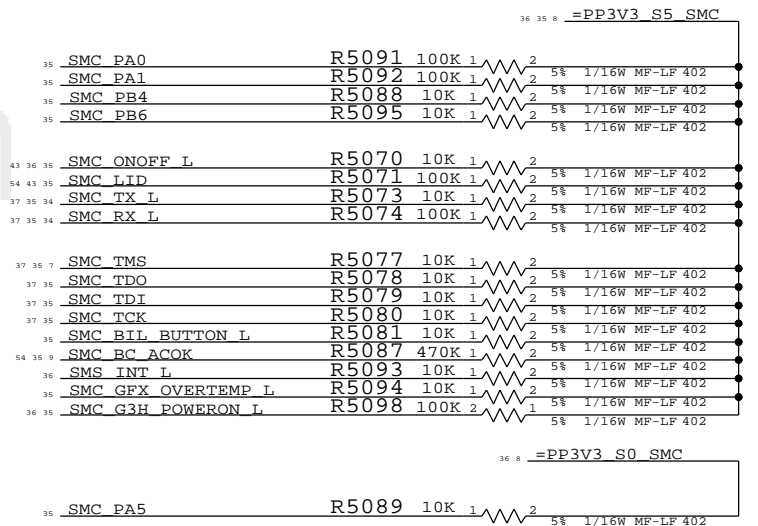


R5030, R5031, R5032 CHANGED FOR DIMMER LED

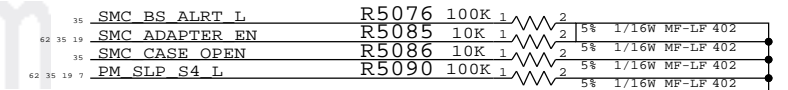
SMC FSB to 3.3V Level Shifting



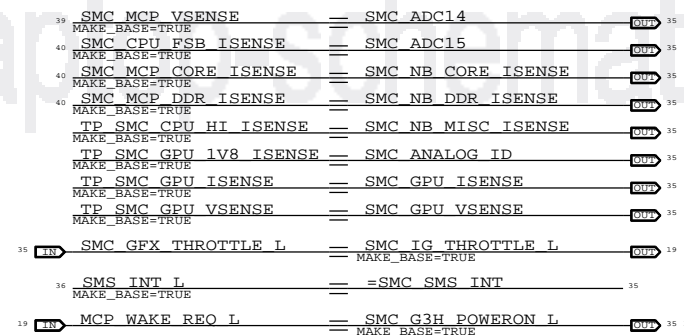
SMC Pull-ups



SMC Pull-downs



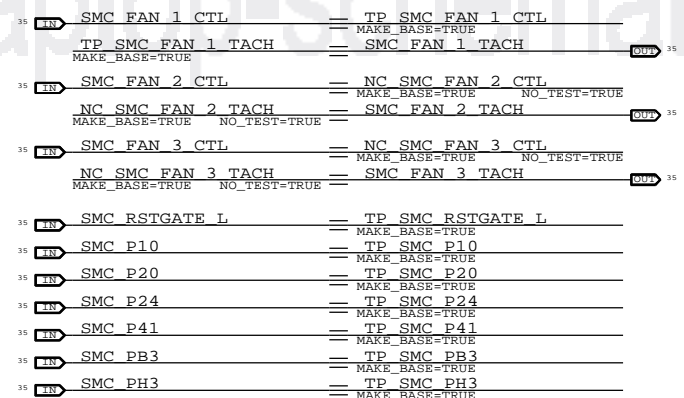
SMC Aliases



R5096



Unused Pins



SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

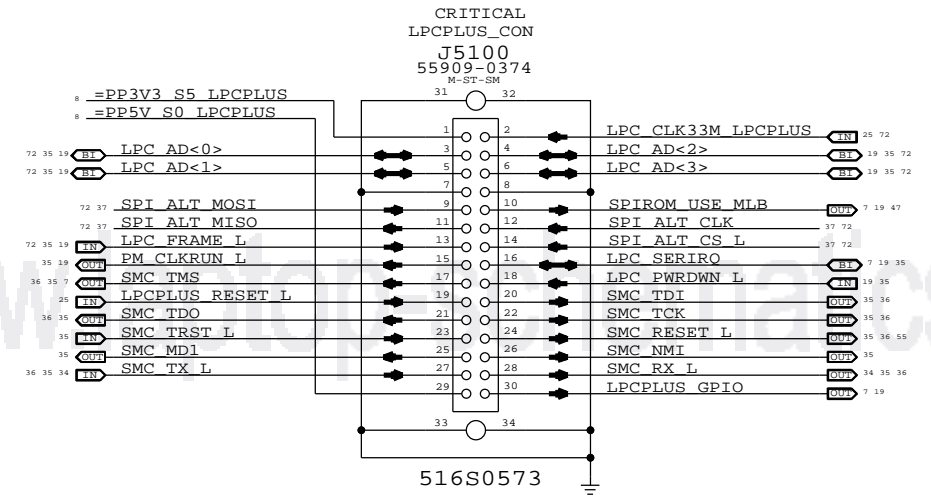
Apple Inc. SMC Support

Drawing Number: 051-8407 D
Revision: A.0.0

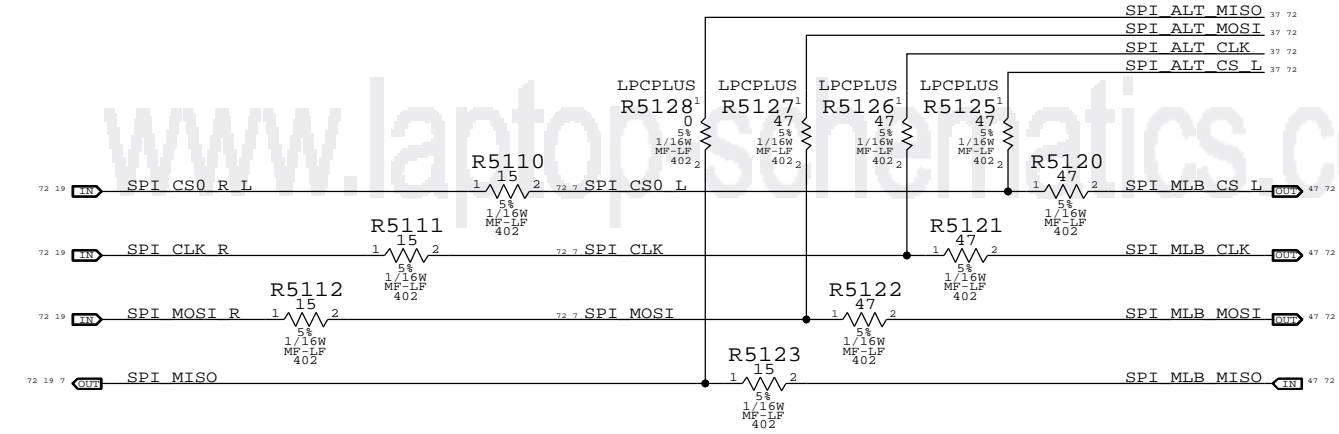
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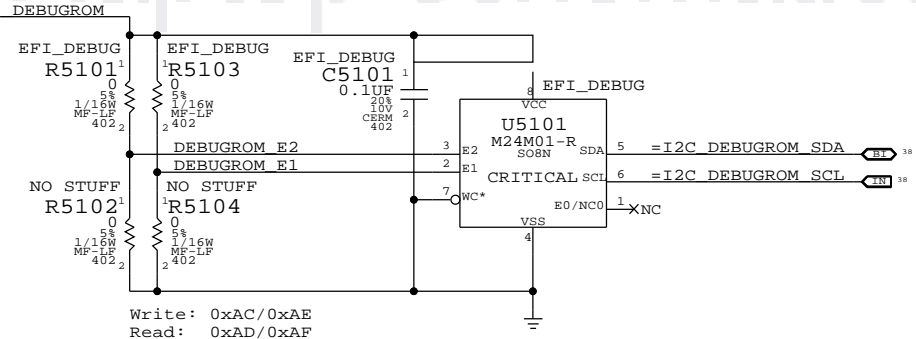
LPC+SPI Connector



SPI Bus Series Termination



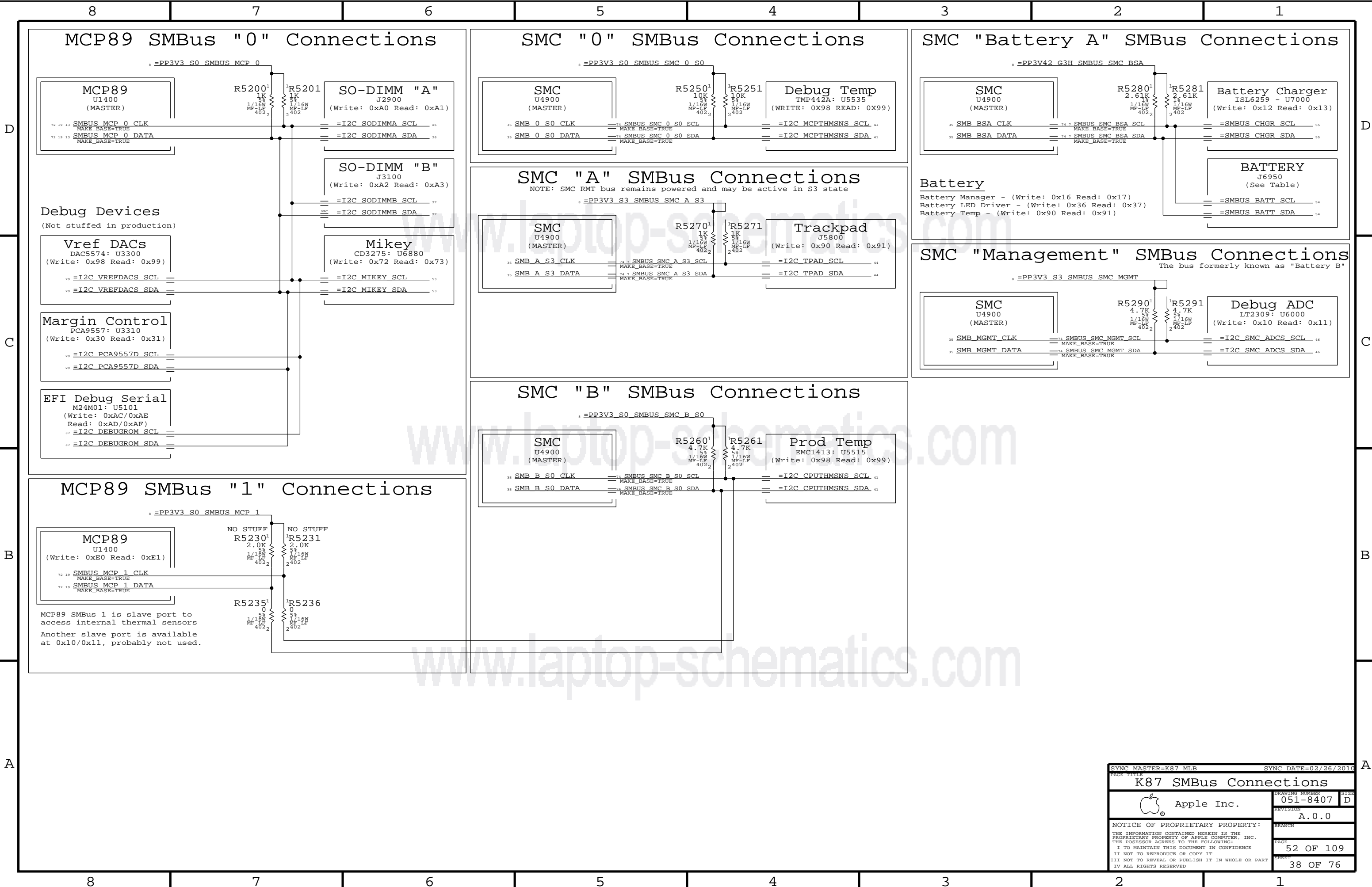
EFI Debug ROM



PAGE TITLE		SYNC DATE=02/26/2010	
LPC+SPI Debug Connector			
DRAWING NUMBER		051-8407	
REVISION		A.0.0	
BRANCH			
PAGE		51 OF 109	
SHEET		37 OF 76	

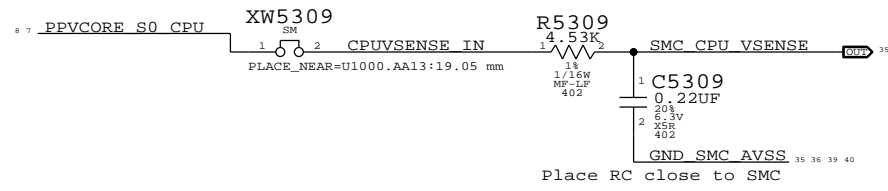
Apple Inc.

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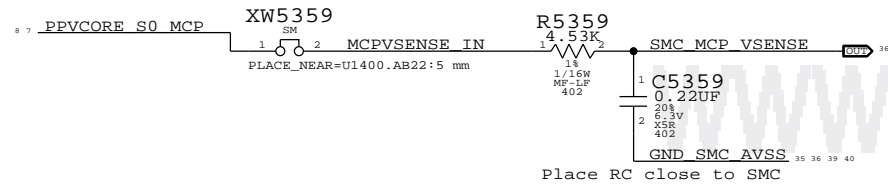


SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
PAGE TITLE K87 SMBus Connections			
Apple Inc.		DRAWING NUMBER 051-8407	SIZE D
		REVISION A.0.0	BRANCH
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		PAGE 52 OF 109	SHEET 38 OF 76

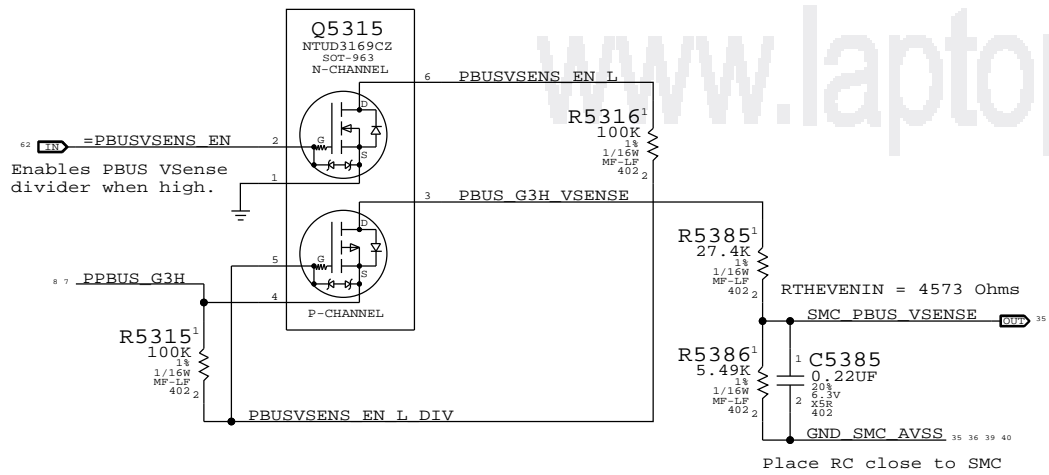
CPU Voltage Sense / Filter



MCP Voltage Sense / Filter



PBUS Voltage Sense Enable & Filter



SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
Voltage Sensing			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8407	D
		REVISION	
		A.0.0	
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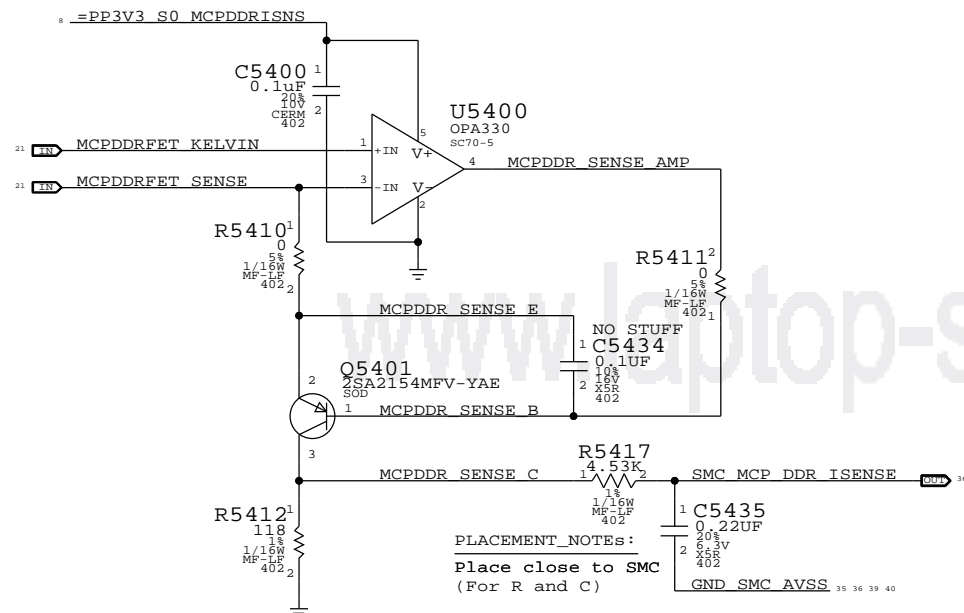
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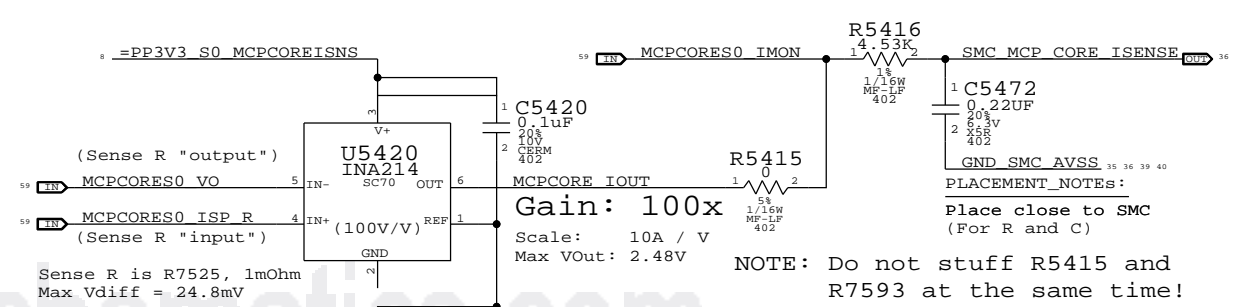
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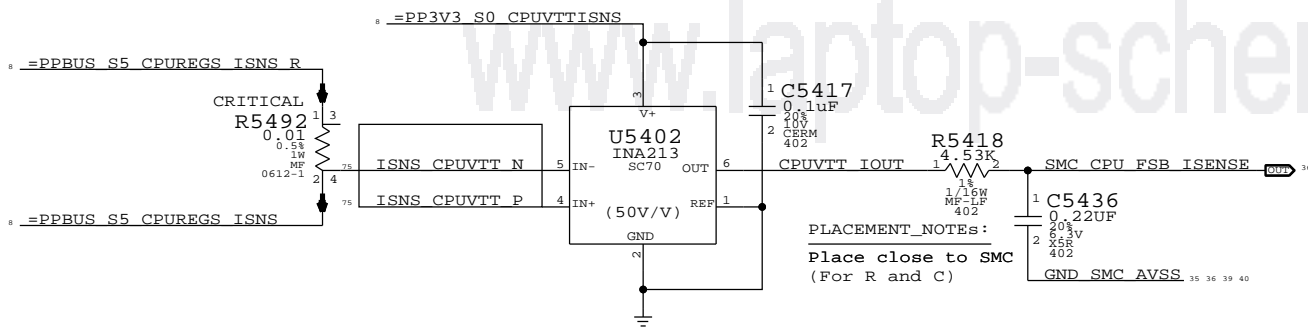
MCP MEM VDD Current Sense / Filter



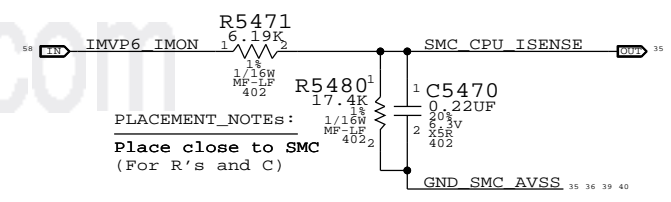
MCP VCore Current Sense Filter



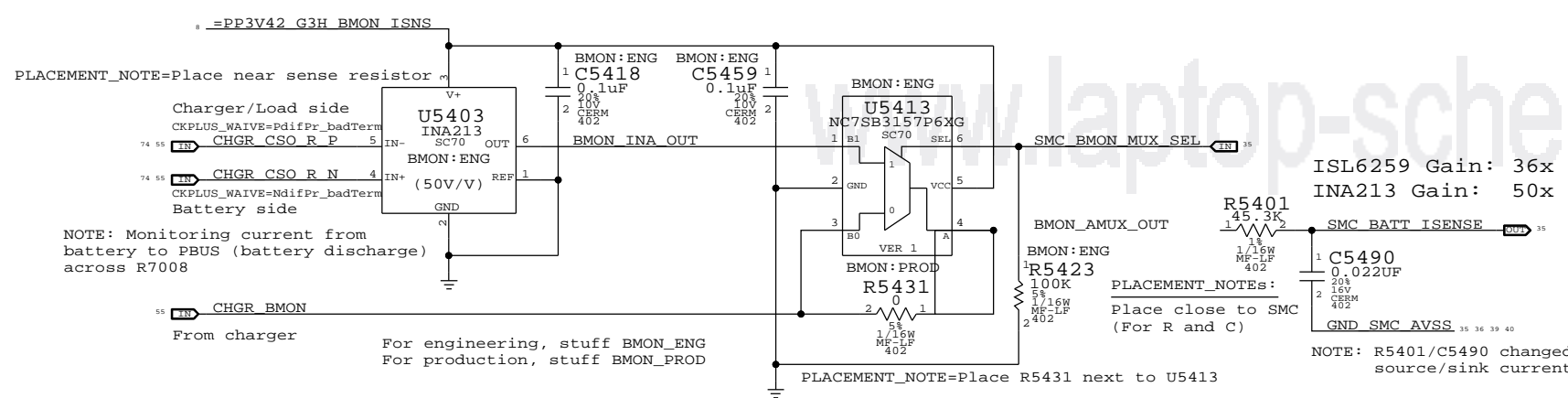
MCP/CPU 1.05V AND CPU VCore High-Side Current Sense / Filter



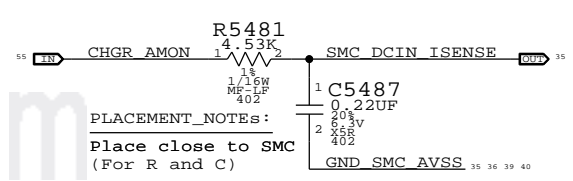
CPU VCore Load Side Current Sense / Filter



Battery (BMON) Current Sense, MUX & Filter

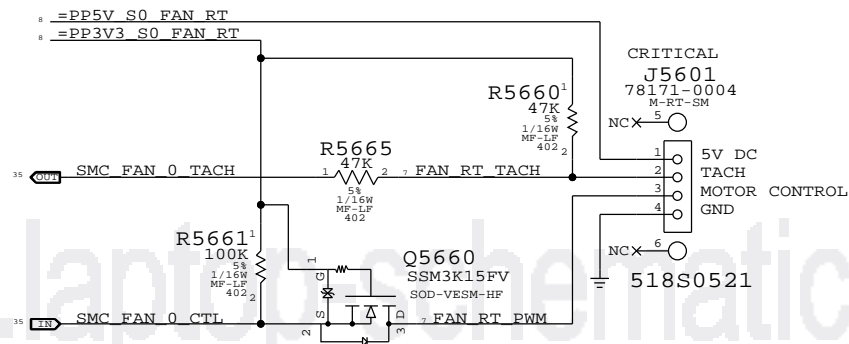


DC-IN (AMON) Current Sense Filter



SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE: Current Sensing			
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		REVISION: A.0.0	BRANCH:
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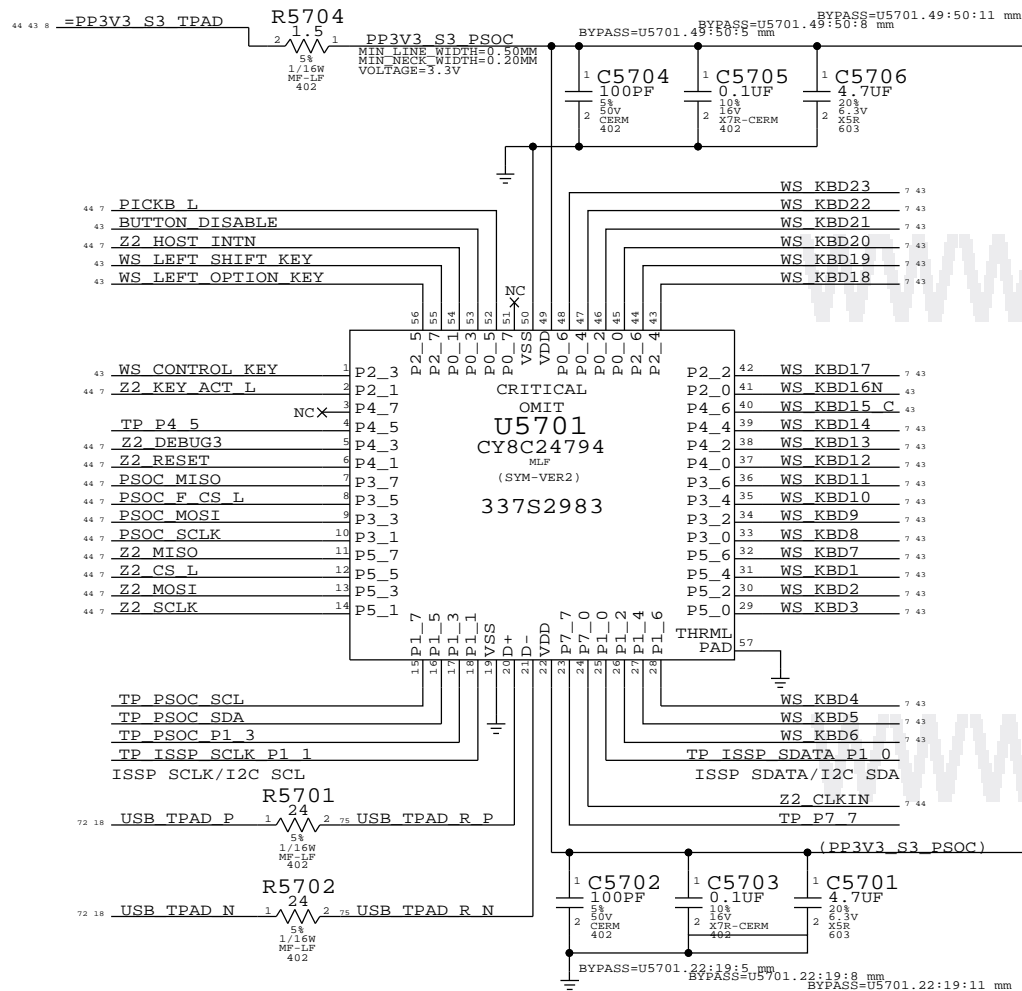
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SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE Fan Connector			
DRAWING NUMBER 051-8407		SIZE D	
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PAGE 56 OF 109		SHEET 42 OF 76	

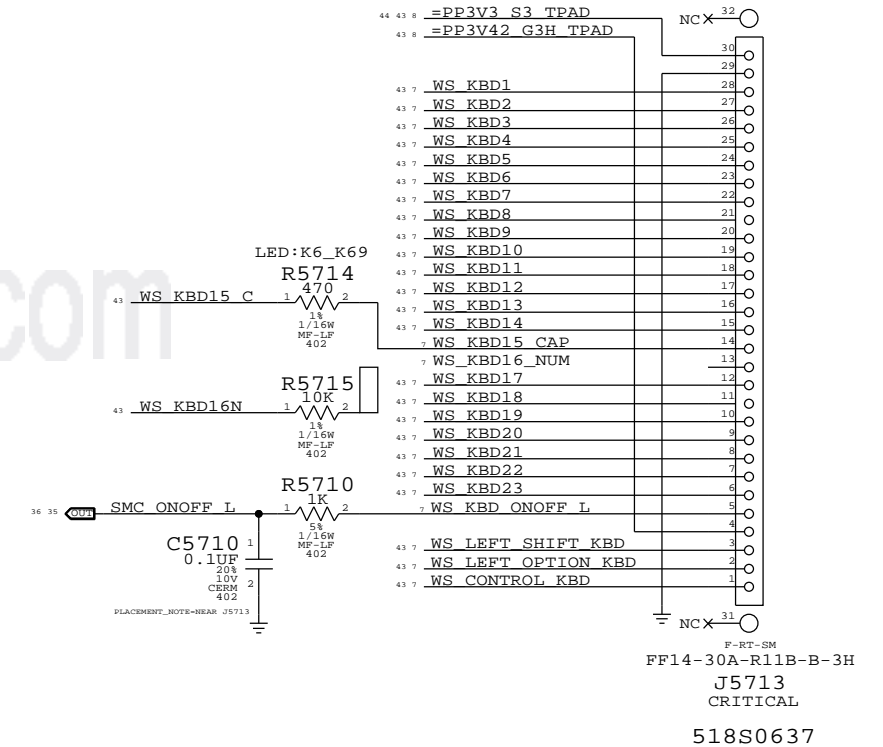
PSOC USB CONTROLLER

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

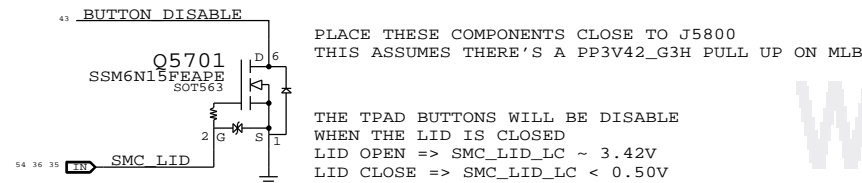


IC	PIN NAME	CURRENT	R_SNS	V_SNS	POWER
TMP102	V+	10UA	2.55 KOHM	0.0255 V	0.255E-6 W
	80UA			0.204 V	16.32E-6 W
3V3 LDO	VDD	60MA (MAX)	10 OHM	0.6 V	36E-3 W
	VOUT	60MA (MAX)	0.2 OHM	0.012 V	0.72E-3 W
PSOC	VDD	8MA (TYP)	1.5 OHM	0.012 V	96E-6 W
	14MA (MAX)			0.021 V	294E-6 W
18V BOOSTER	VIN	4MA (MAX)	4.7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

Keyboard Connector

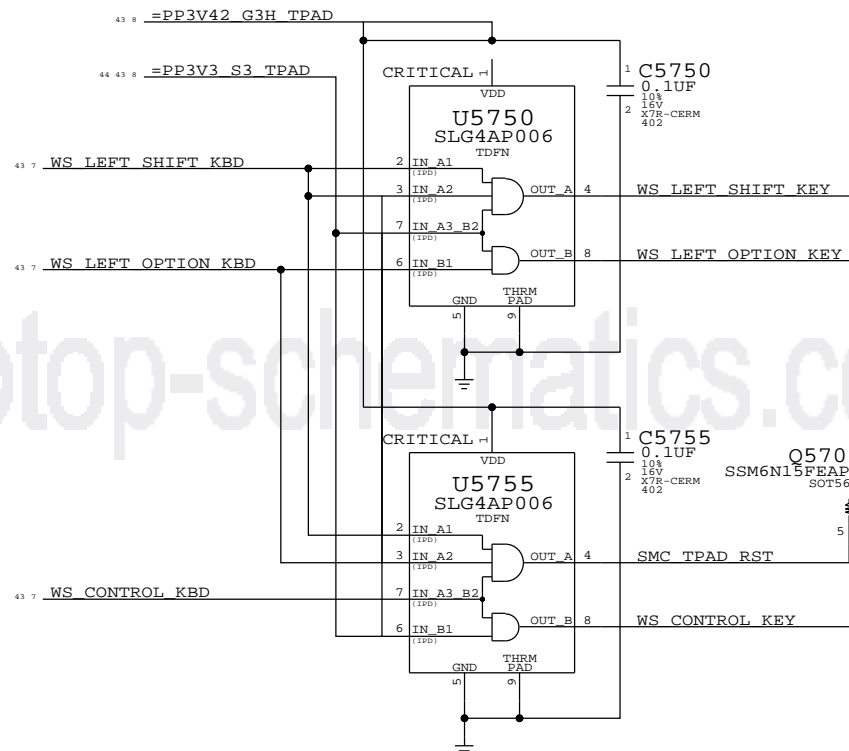


TPAD Buttons Disable



SMC Manual Reset & Isolation

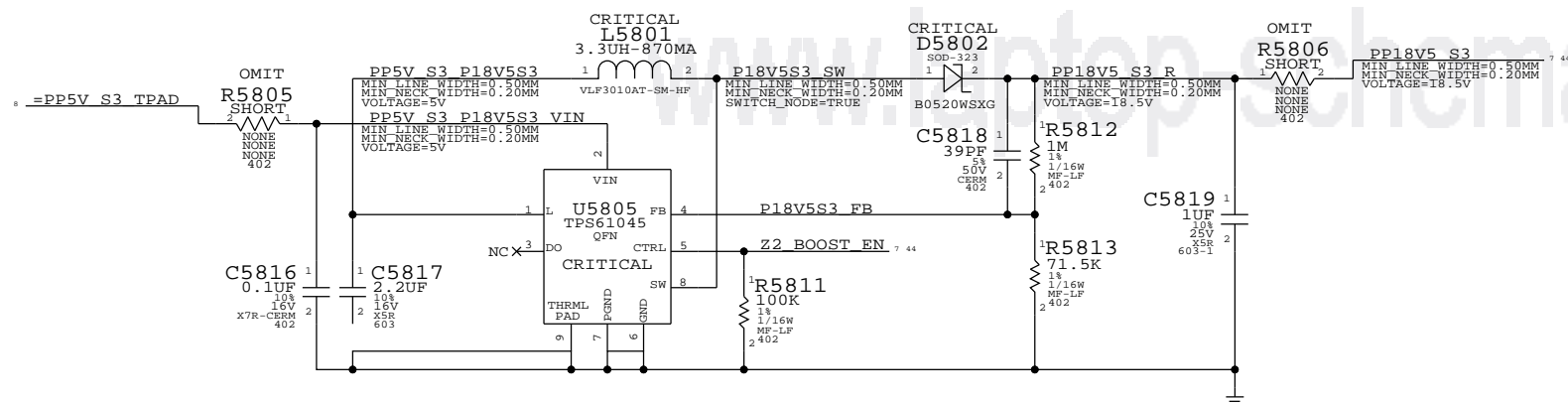
Left shift, option & control keys combined with power button cause SMC RESET# assertion.
Keys ANDed with PSOC power to isolate when PSOC is not powered.



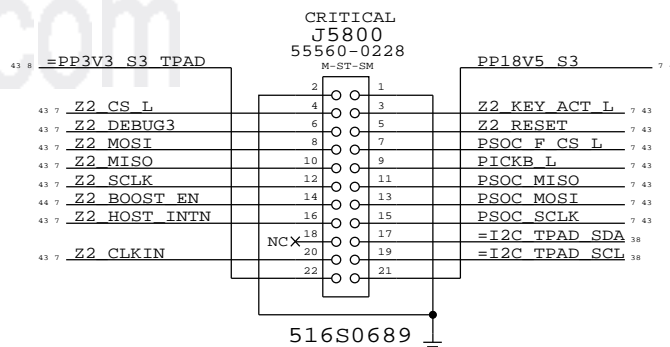
SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
WELLSPRING 1			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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BOOSTER +18.5VDC FOR SENSORS

- BOOSTER DESIGN CONSIDERATION:
- POWER CONSUMPTION
 - DROOP LINE REGULATION
 - RIPPLE TO MEET ERS
 - 100-300 KHZ CLEAN SPECTRUM
 - STARTUP TIME LESS THAN 2MS
 - R5812,R5813,C5818 MODIFIED



IPD Flex Connector



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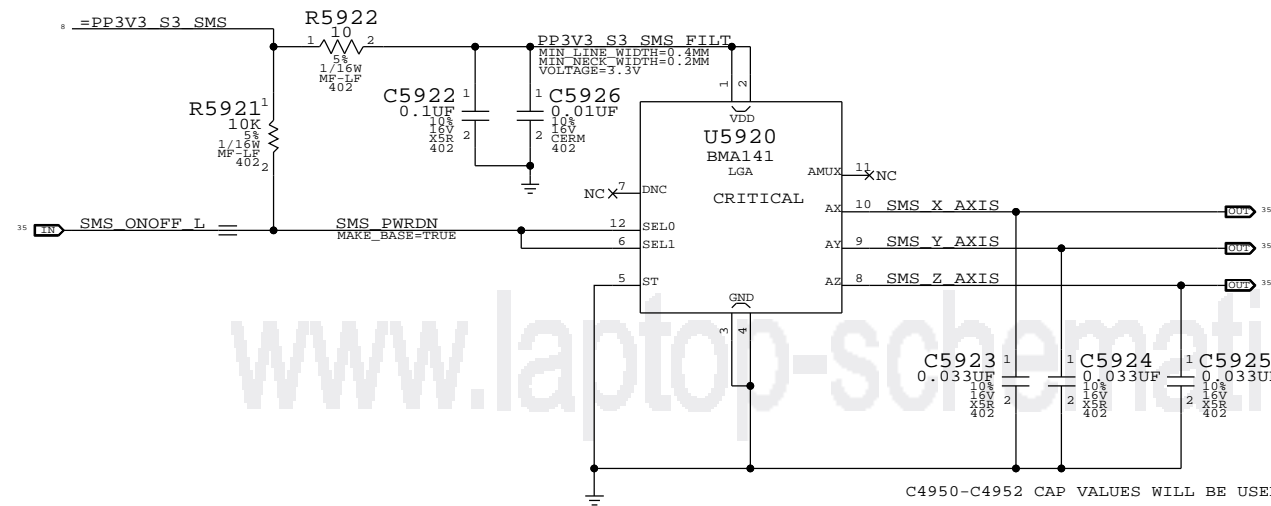
DO NOT SYNC FROM T27. REMOVED KEYBOARD BKLIGHT CIRCUIT

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
WELLSPRING 2			
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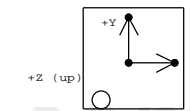
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R5921 PULLS UP SEL PINS TO ENTER STANDBY MODE WHEN PIN IS NOT BEING DRIVEN BY SMC

Analog SMS



Desired orientation when placed on board top-side:



Front of system

Circle indicates pin 1 location when placed in correct orientation


C4950-C4952 CAP VALUES WILL BE USED TO GET CUT-OFF FREQUENCY OF ~146HZ

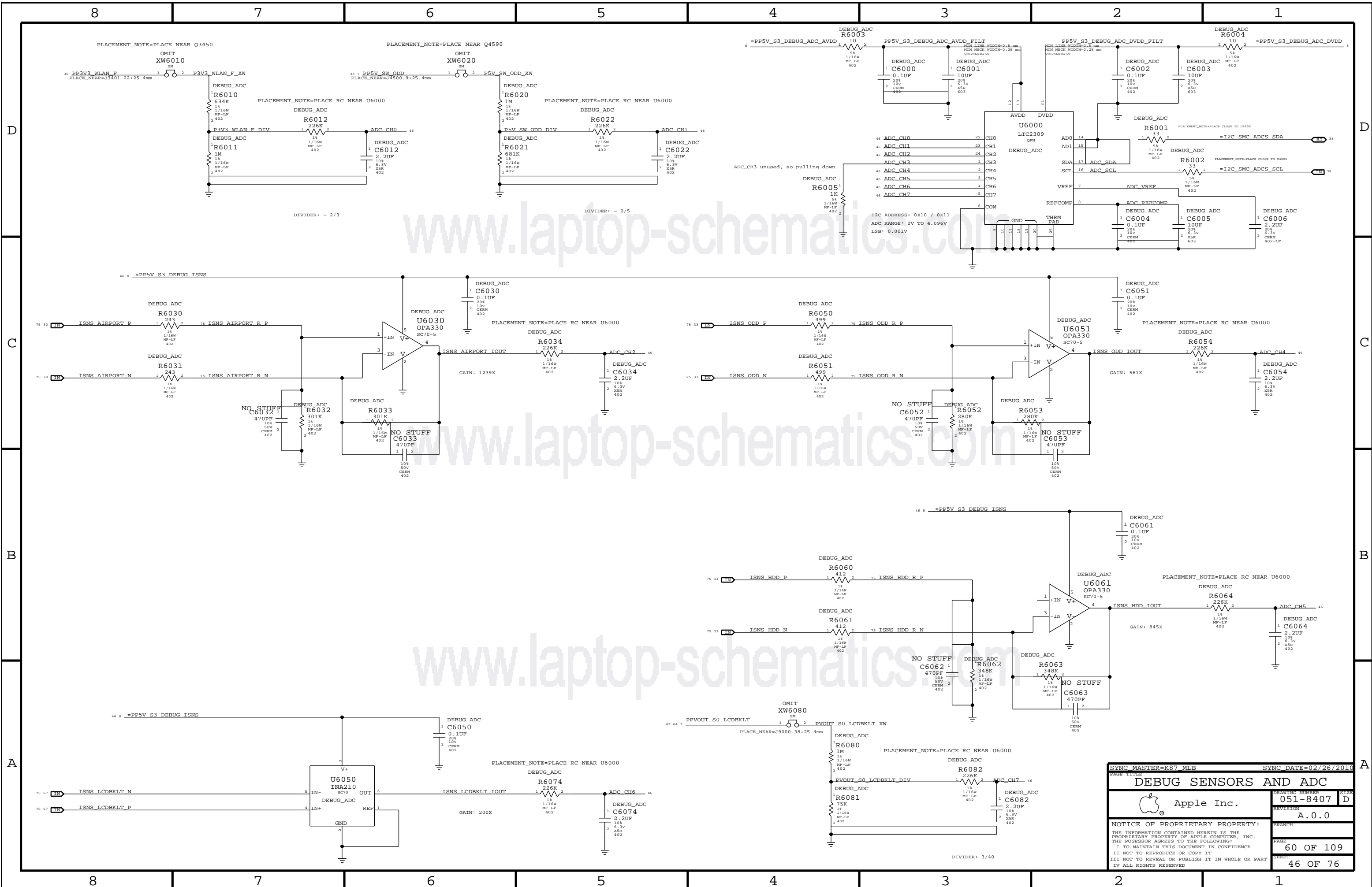
PLACE_NEARs:

C5923:1:PLACE_NEAR=U4900.M10:2.54MM
C5924:1:PLACE_NEAR=U4900.N9:2.54MM
C5925:1:PLACE_NEAR=U4900.K10:2.54MM

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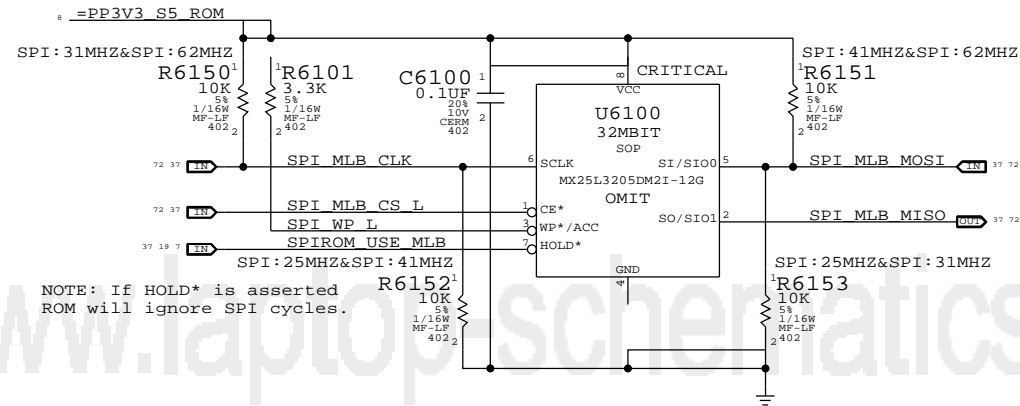
DO NOT SYNC WITH K84. REMOVED NO STUFF ON C5923,C5924,C5925. ADDED PLACE NEARS

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE			
SMS			
 Apple Inc.	DRAWING NUMBER	051-8407	SIZE
	REVISION	A.0.0	
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SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
DEBUG SENSORS AND ADC			
Apple Inc.		DRAWING NUMBER	SIZE
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		60 OF 109	
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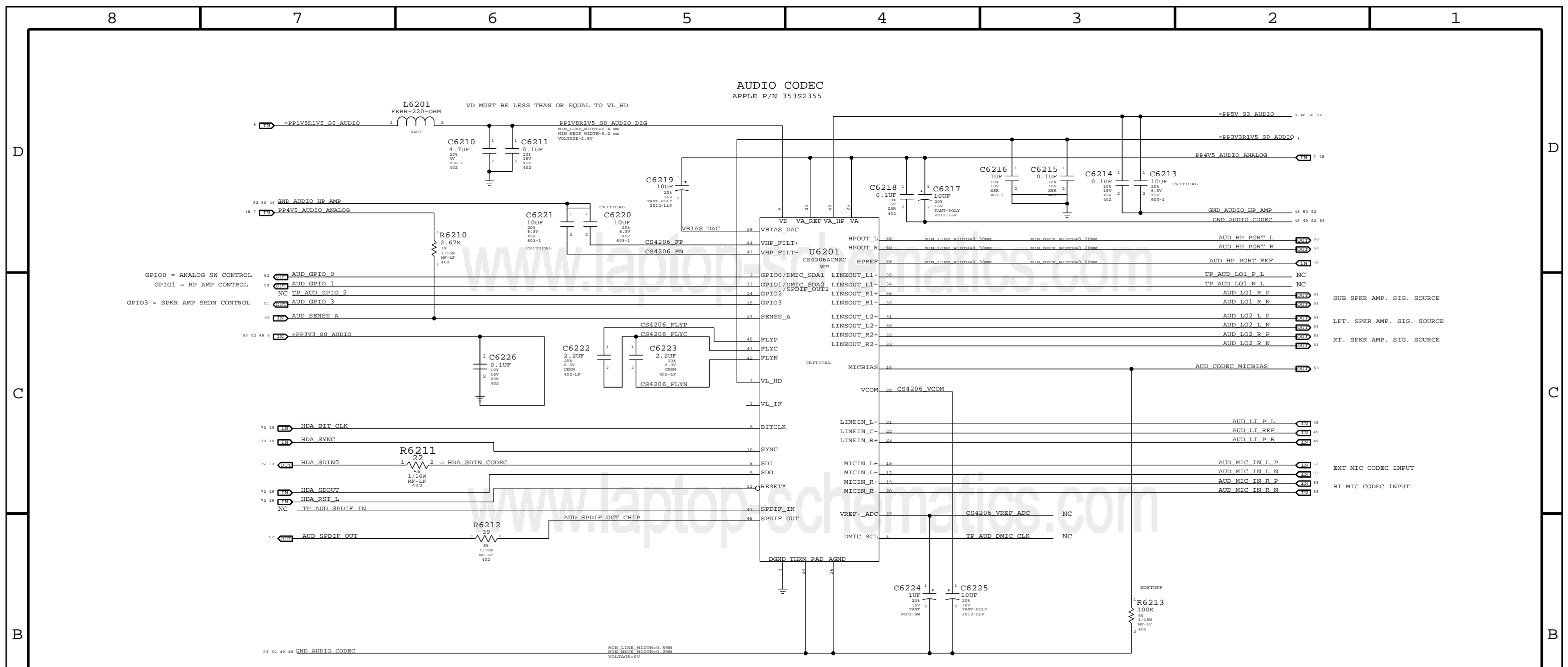
MCP89 SPI Frequency Select

Frequency	SPI_MOSI	SPI_CLK
25.0 MHz	0	0
31.2 MHz	0	1
41.7 MHz	1	0
62.5 MHz	1	1

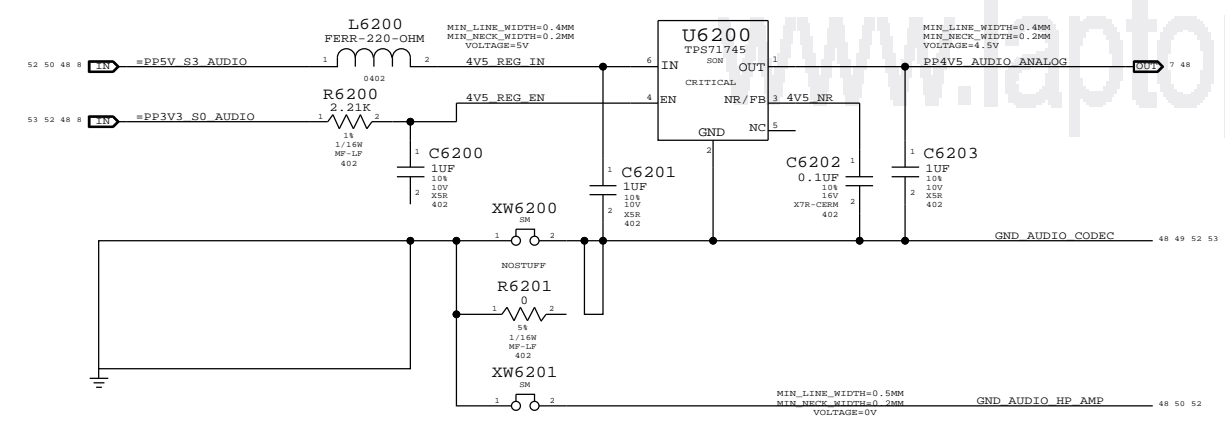
NOTE: 42 & 62 MHz use FAST_READ command.

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SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE SPI ROM			
Apple Inc.	DRAWING NUMBER	051-8407	SIZE D
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4.5V POWER SUPPLY FOR CODEC
APPLE P/N 353S2281



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=K87.MLB		SYNC DATE=02/26/2011	
PAGE TITLE			
AUDIO: CODEC/REGULATOR			
Apple Inc.		DRAWING NUMBER	051-8407
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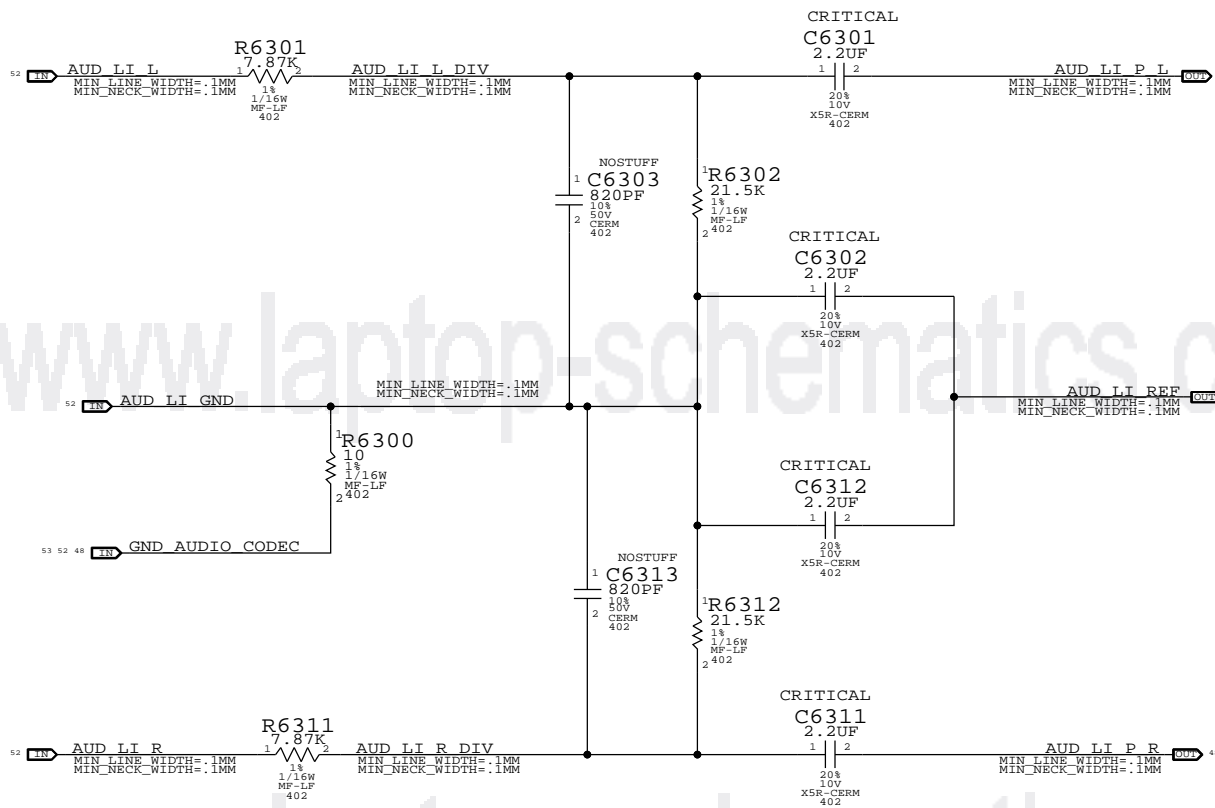
B


A

A

LINE INPUT VOLTAGE DIVIDER

CODEC RIN = 20K OHMS
 NET RIN = 10.36K OHMS (INCLUDING PULL-DOWNS AT ANALOG SWITCH COM PINS)
 FC_HP = 3.6 HZ
 FC_LP = 43KHZ
 VIN = 2VRMS, CODEC VIN = 1.14 VRMS



PAGE TITLE AUDIO: LINE INPUT FILTER		
 Apple Inc.	DRAWING NUMBER 051-8407	SIZE D
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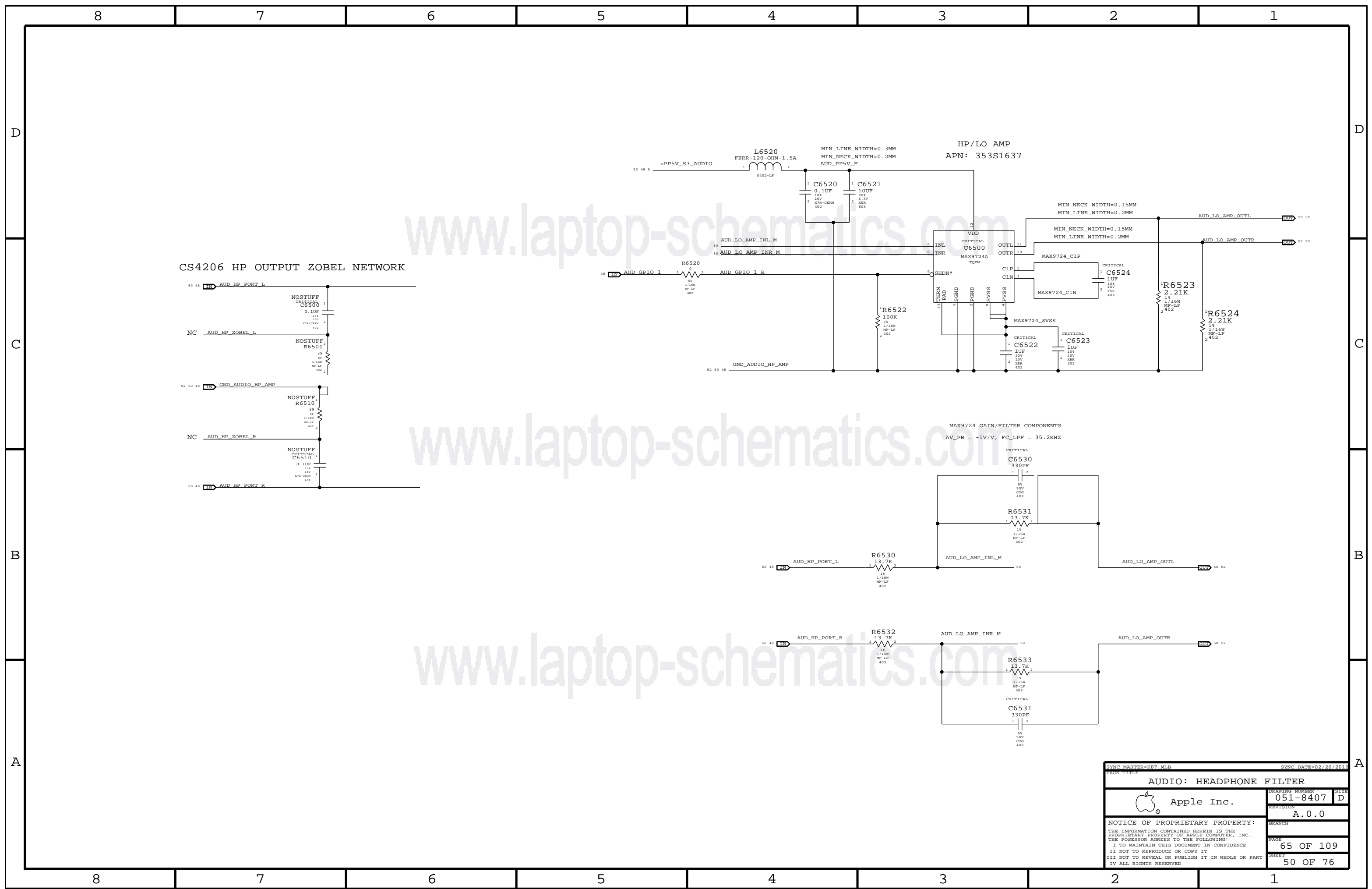
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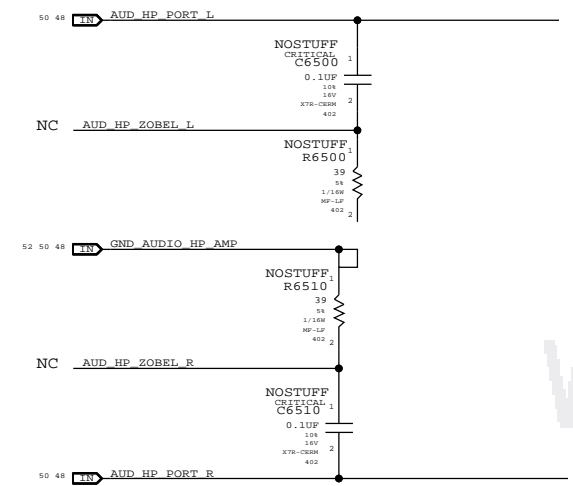
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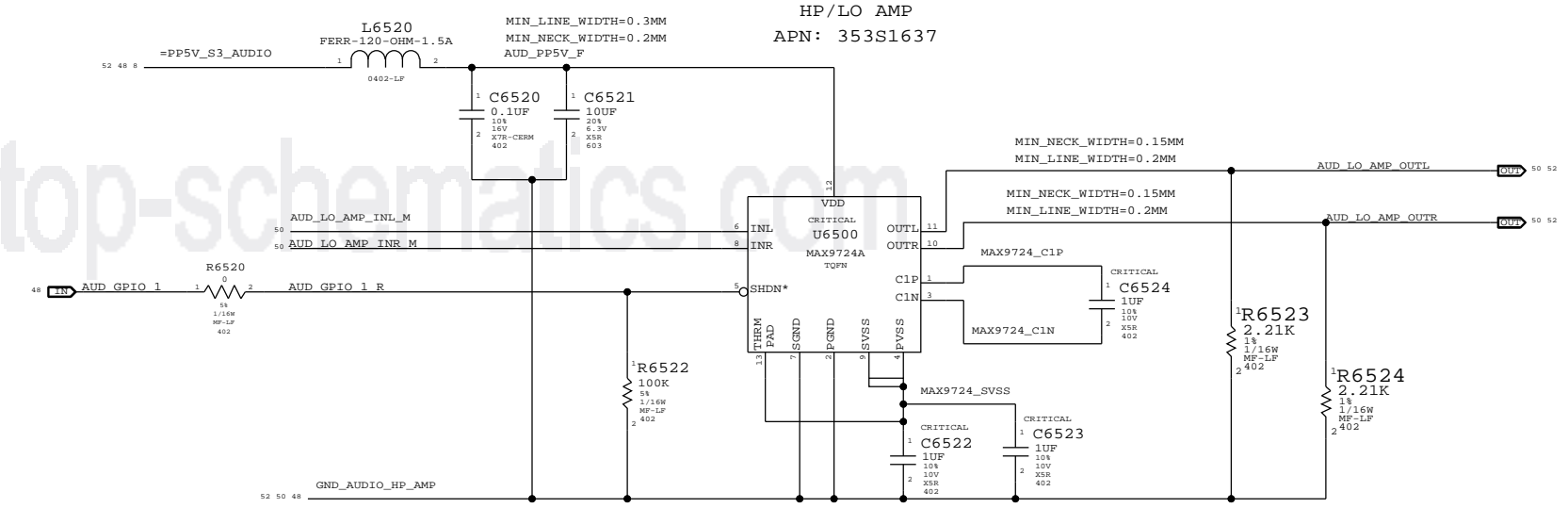
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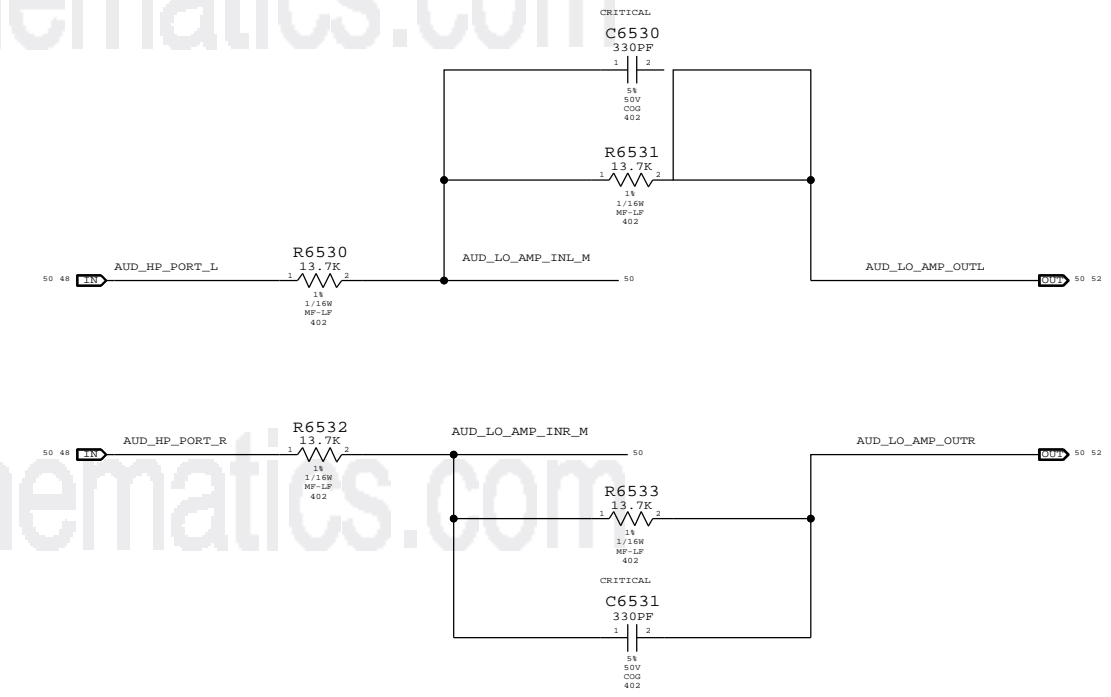
CS4206 HP OUTPUT ZOBEL NETWORK



HP/LO AMP
APN: 353S1637



MAX9724 GAIN/FILTER COMPONENTS
AV_PB = -1V/V, FC_LPF = 35.2KHZ

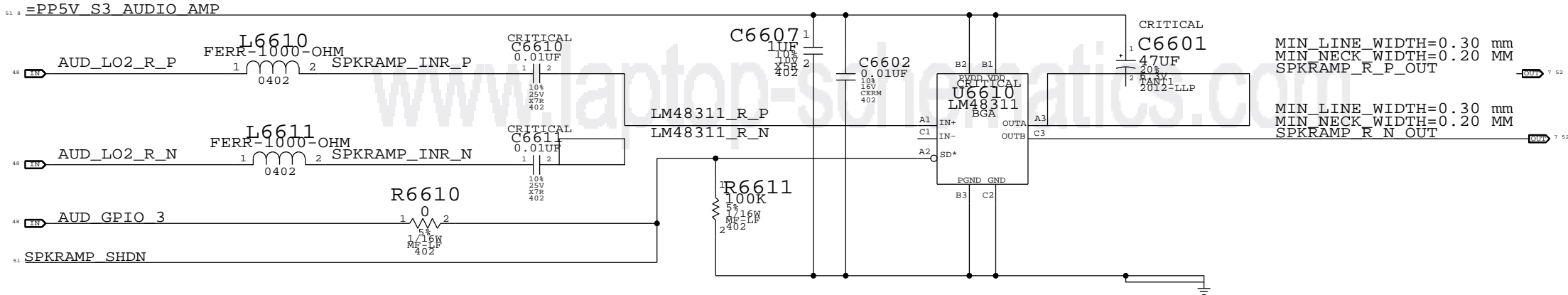


SYNC MASTER=k87_MLB		SYNC DATE=02/26/2011	
AUDIO: HEADPHONE FILTER			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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		PAGE	65 OF 109
		SHEET	50 OF 76

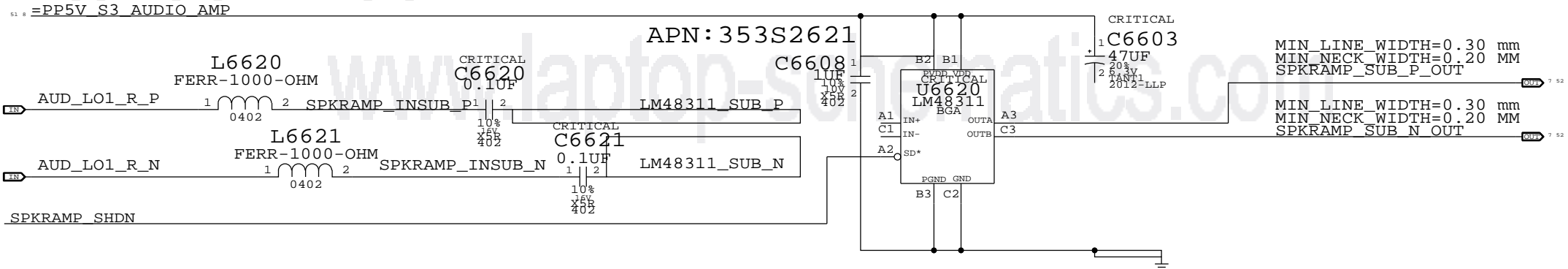
SATELLITE 796Hz < HPF FC < 936Hz
 SUB 80 Hz < HPF FC < 94 Hz
 GAIN 6DB (2V/V)
 SPRK AMP. INPUT REFERRED CLIP POINT = ~-6dBFS

ALIAS OF PP5V_S3_REG, MIN_LINE_WIDTH=0.60MM, MIN_NECK_WIDTH=0.20MM

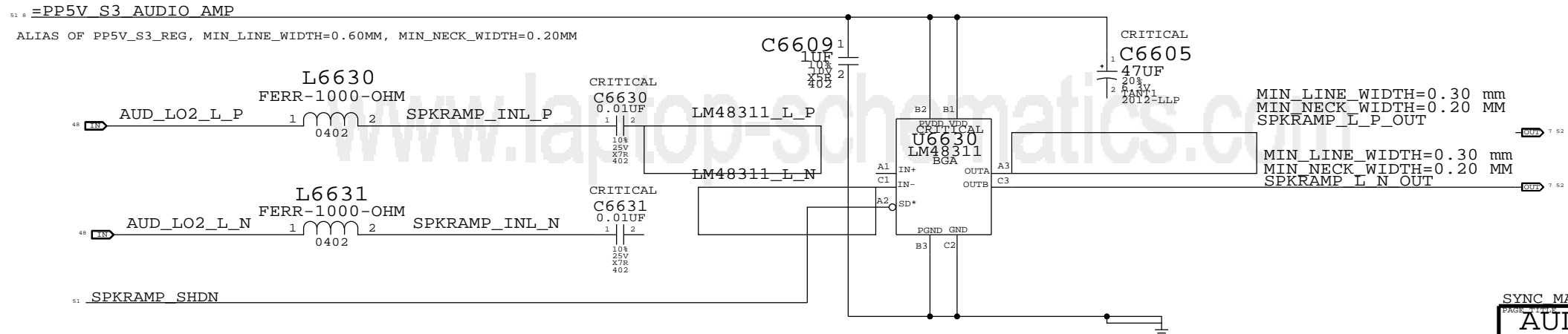
APN: 353S2621



ALIAS OF PP5V_S3_REG, MIN_LINE_WIDTH=0.60MM, MIN_NECK_WIDTH=0.20MM



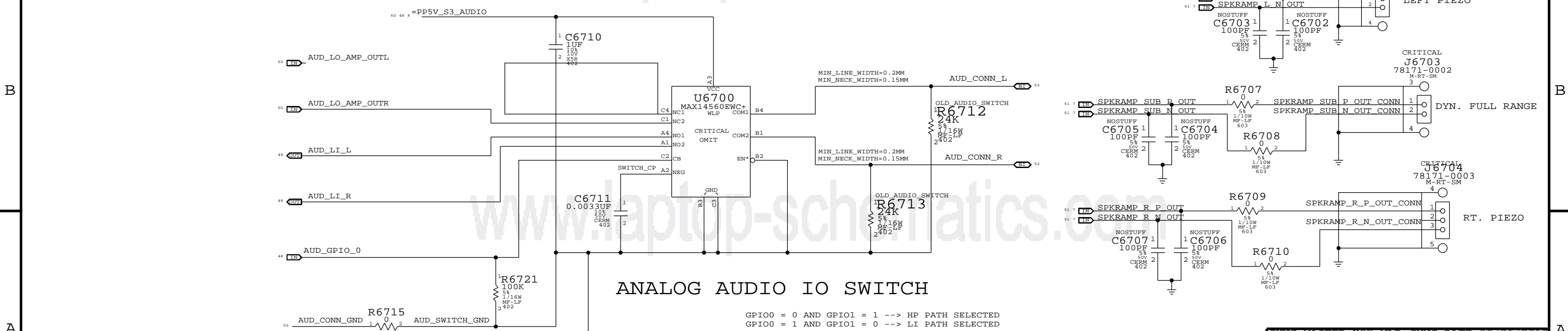
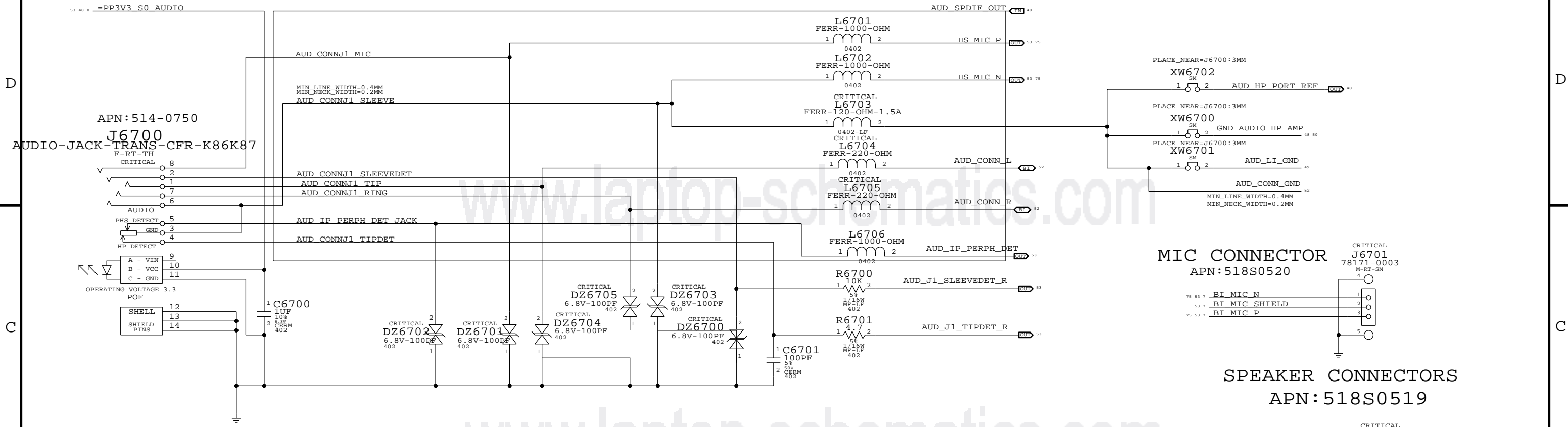
APN: 353S2621



SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

AUDIO0: SPEAKER AMP		
Apple Inc.	DRAWING NUMBER 051-8407	SIZE D
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AUDIO JACK: LI/LO/HP CONNECTOR, SPDIF TX



PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
353S2803	1	IC, MAX14560, Dual SPDT	U6700	CRITICAL	NEW_AUDIO_SWITCH
353S2536	1	IC, MAX14504, Dual SPDT	U6700	CRITICAL	OLD_AUDIO_SWITCH

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

AUDIO: JACK

Apple Inc.

DRAWING NUMBER: 051-8407
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DO NOT SYNC K84. UPDATED PLACE NEARS

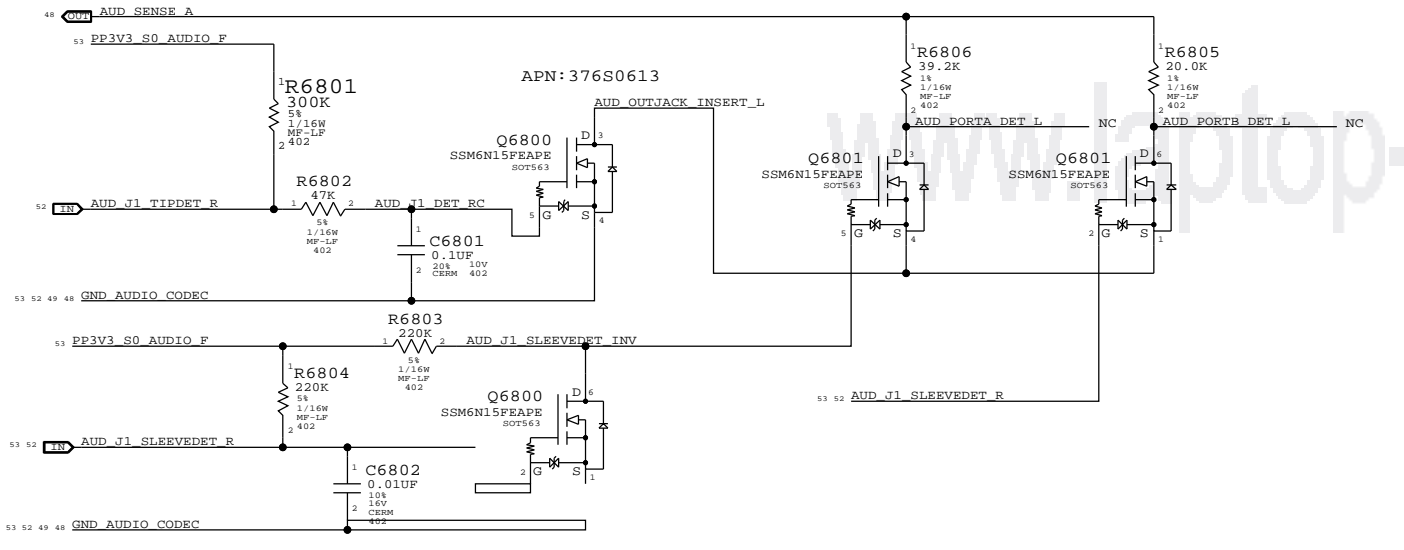
CODEC OUTPUT SIGNAL PATHS

FUNCTION	VOLUME	CONVERTER	PIN COMPLEX	MUTE CONTROL	DET ASSIGNMENT
HP/LINE OUT	0X02 (2)	0X02 (2)	0X09 (9,A)	GPIO_0 AND GPIO_1	0X09 (A)
LINE IN	0X05 (5)	0X05 (5)	0X0C (12)	GPIO_0 AND GPIO_1	0X09 (A) AND UI ELEMENT
SATELLITES	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	0X0D (B)

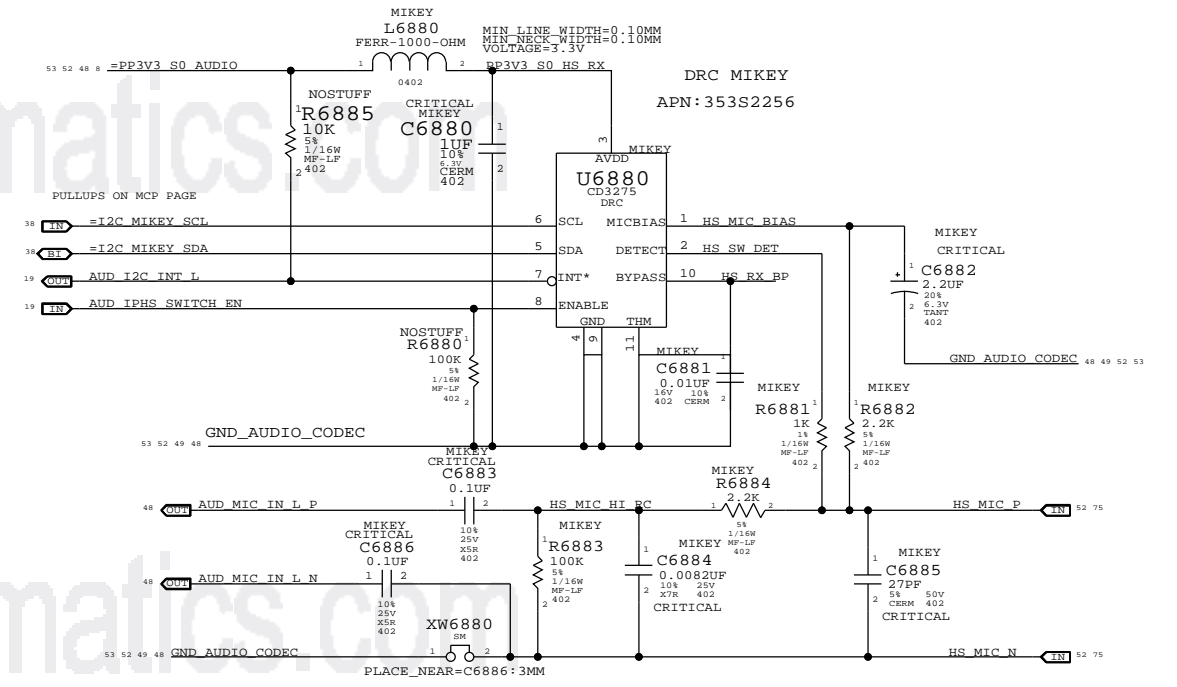
CODEC INPUT SIGNAL PATHS

FUNCTION	CONVERTER	PIN COMPLEX	VREF/ENABLE	DET ASSIGNMENT
BUILT-IN MIC	0X06 (6)	0X0D (13,B,RIGHT)	MIC_BIAS (80%)	N/A
HEADSET MIC	0X06 (6)	0X0D (13,V22,B,LEFT)	MCP79 GPIO_38	MCP79 GPIO_17 (PERIPH_DETECT) MCP79 GPIO_4 (LOAD_DETECT)

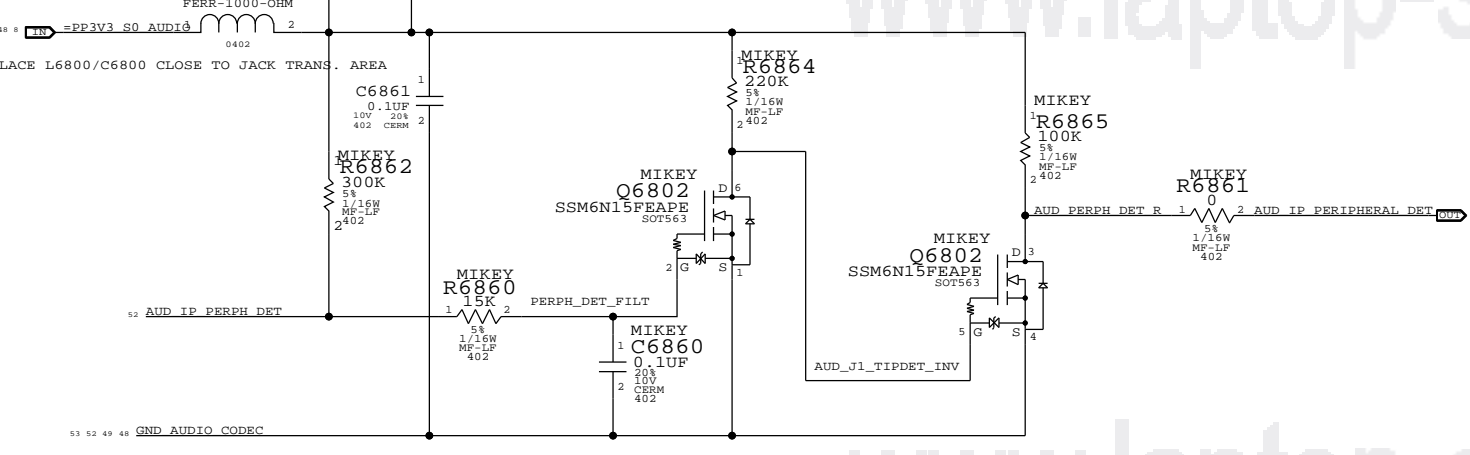
PORT A DETECT (HEADPHONES) PORT B DETECT (SPDIF DELEGATE)



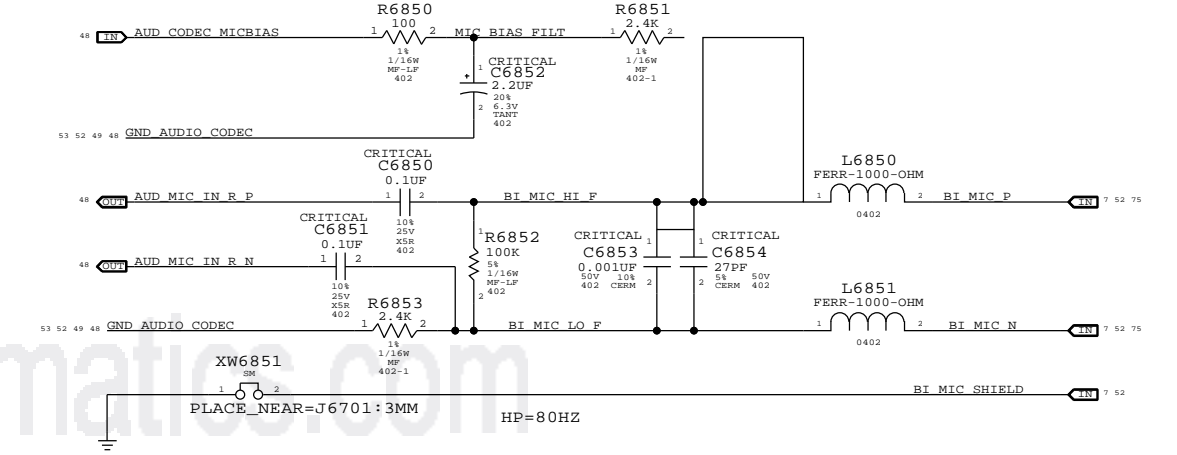
PORT B LEFT (HEADSET MIC) HP=80HZ, LP=8.82KHZ



EXTRACTION NOTIFICATION CKT



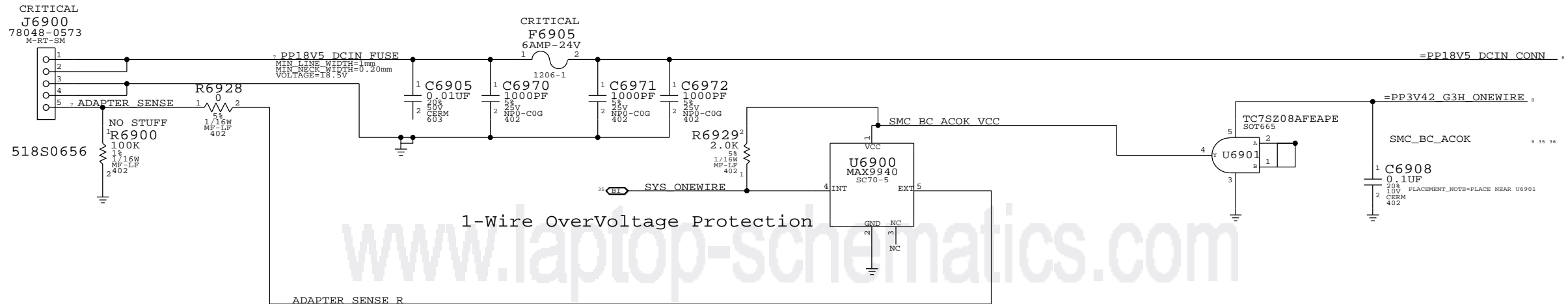
PORT B RIGHT (BUILT-IN MIC)



SYNC MASTER=K87 MLB SYNC DATE=02/26/2010
AUDIO: JACK TRANSLATORS

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			SHEET	53 OF 76

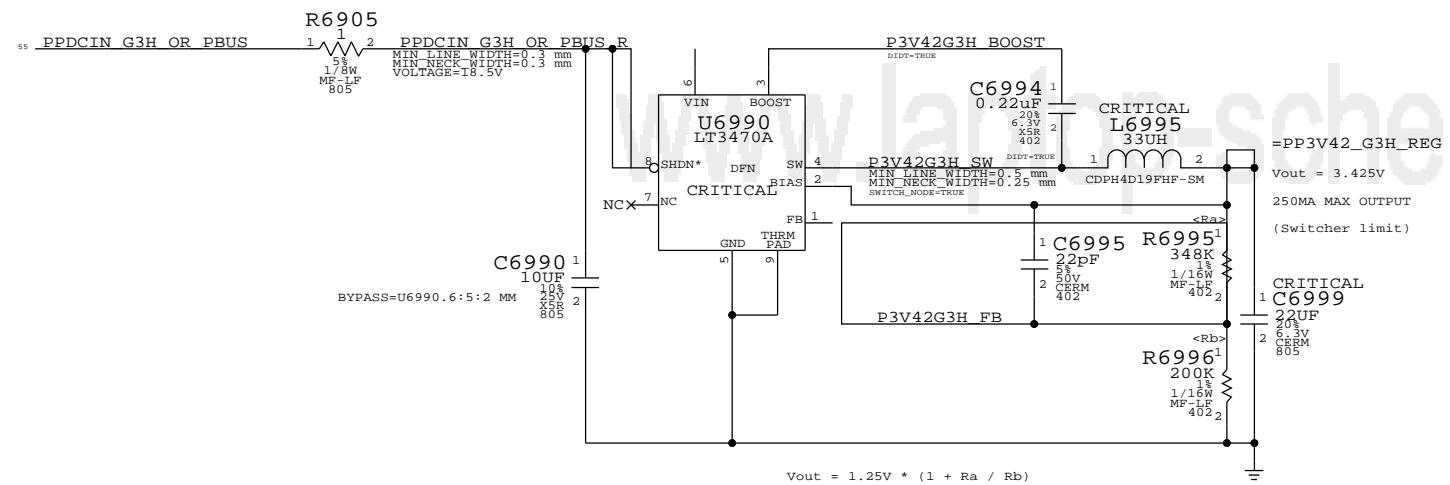
MagSafe DC Power Jack



www.laptop-schematics.com

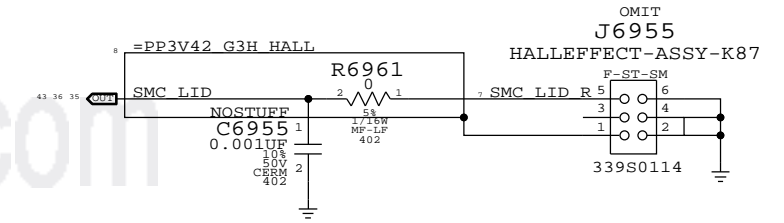
3.425V "G3Hot" Supply

Supply needs to guarantee 3.31V delivered to SMC Vref generator



HALL EFFECT ASSEMBLY

- Assembly APN: 339S0114
- BOM: 639-0680
- PCBF: 820-2801
- MCO: 056-3515
- Conn APN: 518S0788

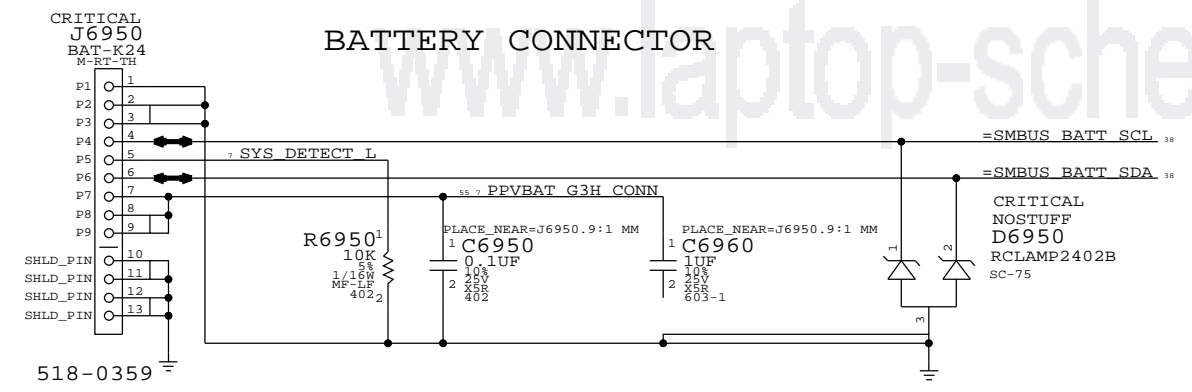


PROTO 0: STUFFING K84 CONNECTOR ONTO MODIFIED K84 PADS
 PROTO 1: STUFFING K87 HALL EFFECT ASSEMBLY ONTO K87 PADS

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
607-6831	1	SUB ASSY - HALL EFFECT, K86 K87	J6955	CRITICAL	

PN: 607-6831 for WCPM. PN: 339S0114 for schematic/board layout

BATTERY CONNECTOR



www.laptop-schematics.com

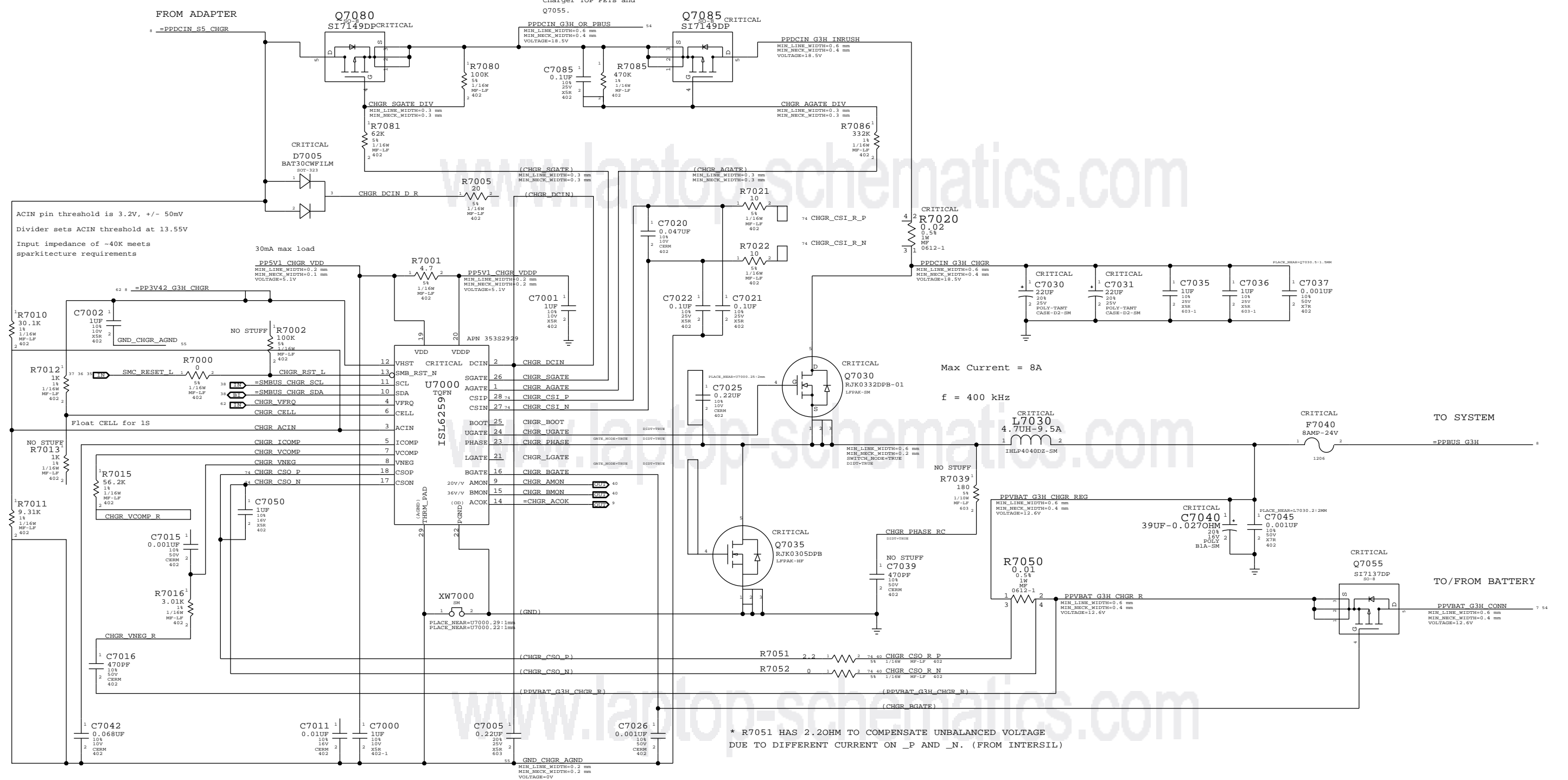
PAGE TITLE		SYNC DATE=02/26/2010	
DC-In & Battery Connectors			
DRAWING NUMBER		051-8407	
REVISION		A.0.0	
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SHEET		54 OF 76	

DO NOT SYNC WITH K84. R6900,C6960,SIGNAL NAMES CHANGED. HALL EFFECT CONNECTOR CHANGED.

Reverse-Current Protection

Inrush Limiter

This node is powered through body diodes:
 * DCIN through Q7080.
 * PBUS through Q7085, Charger TOP FETs and Q7055.



Max Current = 8A

f = 400 kHz

* R7051 HAS 2.20HM TO COMPENSATE UNBALANCED VOLTAGE DUE TO DIFFERENT CURRENT ON _P AND _N. (FROM INTERSIL)

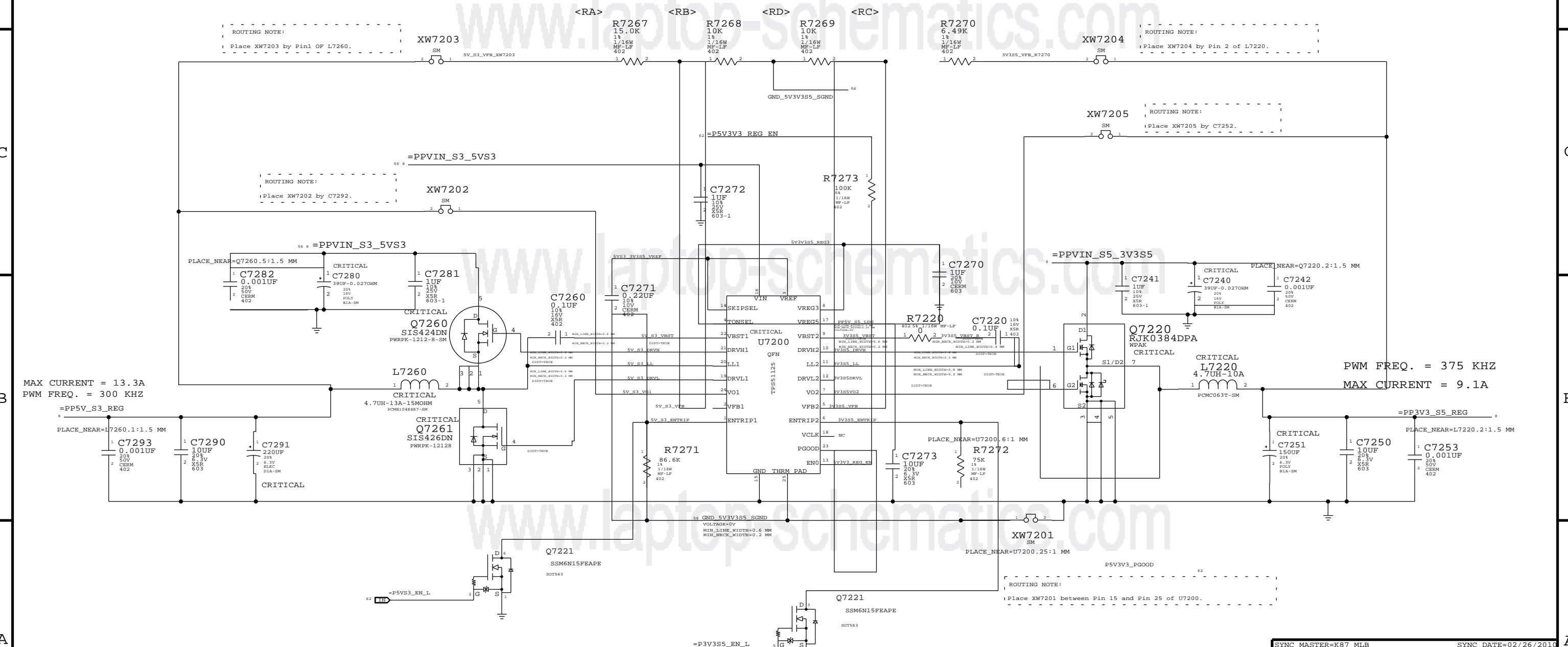
K6 NOTES : L7030 CHANGED BACK TO K24 IND DUE TO LAYOUT
 K67 NOTES : R7050 APN 10750075

SYNC MASTER=K87_MLB		SYNC DATE=02/26/2011	
PAGE TITLE			
PBus Supply & Battery Charger			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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5V_S3 / 3.3V_S5 POWER SUPPLY

$$V_{OUT} = (2 * R_A / R_B) + 2$$

$$V_{OUT} = (2 * R_C / R_D) + 2$$



MAX CURRENT = 13.3A
PWM FREQ. = 300 KHZ

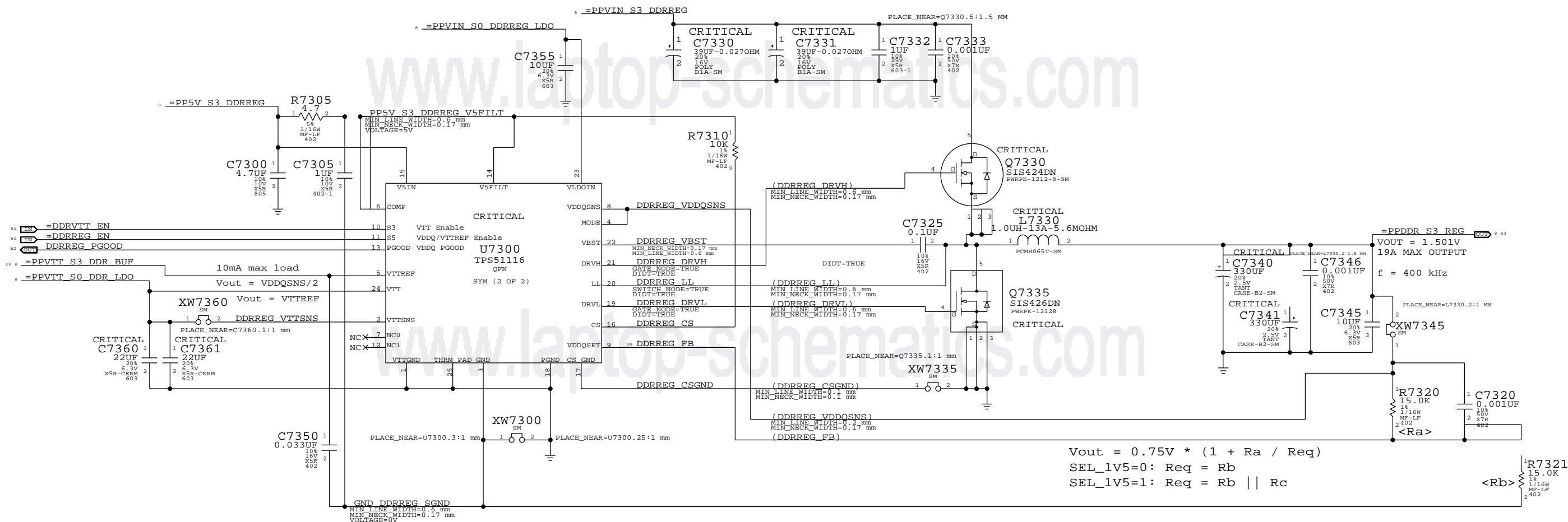
PWM FREQ. = 375 KHZ
MAX CURRENT = 9.1A

NOTE: DONT SYNC THIS PAGE FROM T27

SEPARATED MASTER PGOOD FOR BOTH 5V AND 3V3.

SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
5V/3.3V SUPPLY			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8407	D
		REVISION	
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		PAGE	
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1.5V/0.75 DDR3 POWER SUPPLY

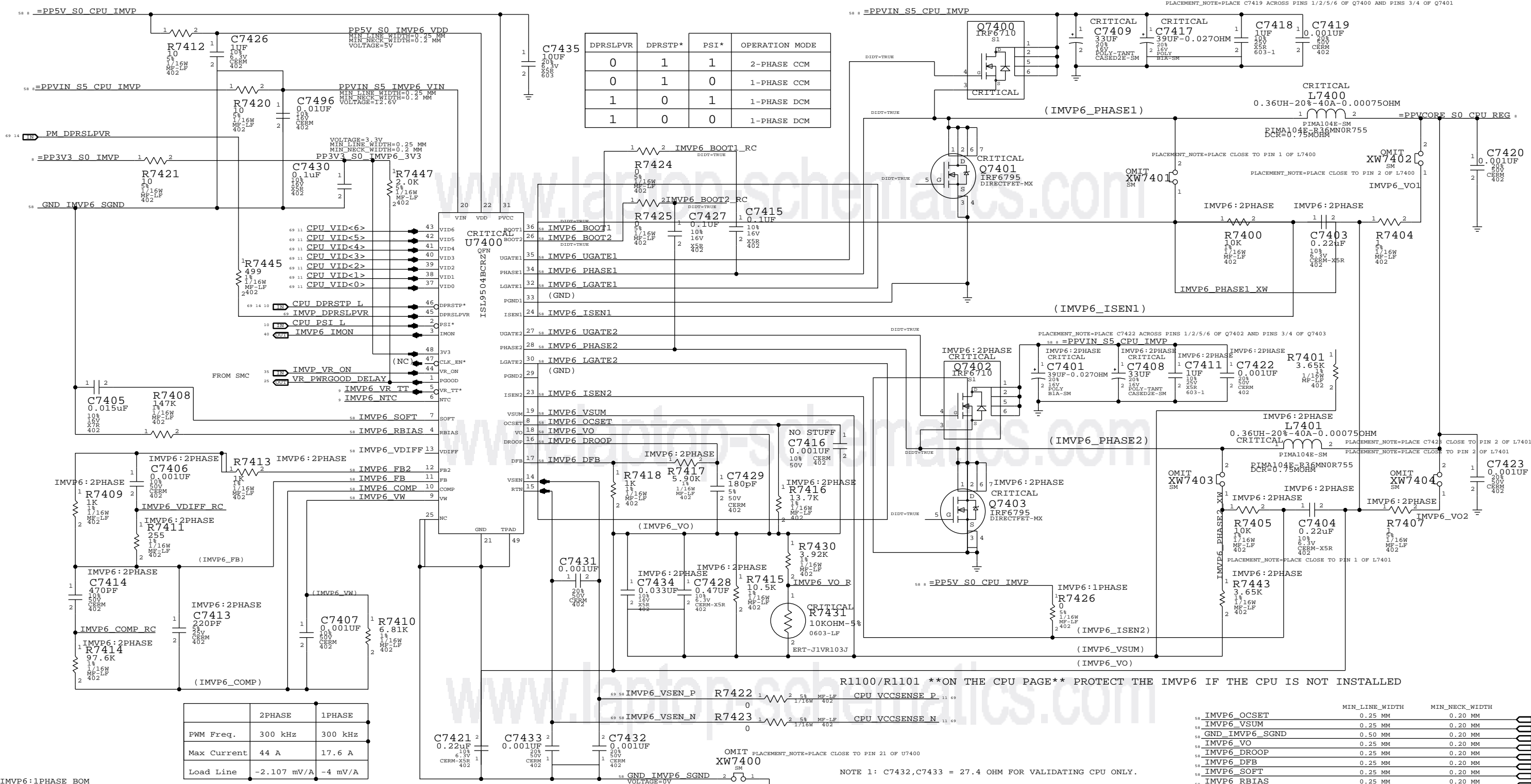


$V_{out} = 0.75V * (1 + R_a / R_{eq})$
 SEL_1V5=0: $R_{eq} = R_b$
 SEL_1V5=1: $R_{eq} = R_b || R_c$

NOTE: DONT SYNC THIS PAGE FROM T27. C7330 AND C7331 IS CHANGED TO OSCON CAPS
 NOTE: DONT SYNC THIS PAGE FROM K6 REMOVED R7380

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
1.5V/0.75V DDR3 SUPPLY			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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IMVP6 CPU VCORE REGULATOR



	2PHASE	1PHASE
PWM Freq.	300 kHz	300 kHz
Max Current	44 A	17.6 A
Load Line	-2.107 mV/A	-4 mV/A

IMVP6:1PHASE BOM

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
114S0307	1	RES.MTL.FILM,1/16W,8.25K,1.0402,SMD,LF	R7417		IMVP6:1PHASE
114S0336	1	RES.MTL.FILM,1/16W,16.9K,1.0402,SMD,LF	R7416		IMVP6:1PHASE
132S0080	1	CAP,CER.,.220P,20.6.3V,XSR,0402	C7428		IMVP6:1PHASE
114S0236	1	RES.MTL.FILM,1/16W,1.58K,1.0402,SMD,LF	R7409		IMVP6:1PHASE
114S0160	1	RES.MTL.FILM,1/16W,255 OHM,1.0402,SMD,LF	R7411		IMVP6:1PHASE
132S4720	1	CAP CER 470PF,+-10%,50V,0402,SMD	C7406		IMVP6:1PHASE
114S0410	1	RES.MTL.FILM,1/16W,97.6K,1.0402,SMD,LF	R7414		IMVP6:1PHASE
132S0045	1	CAP,CER,1000PF,50V,10%,XTR,0402,SMD	C7414		IMVP6:1PHASE
131S1027	1	CAP,CER,100PF,50V,50V,CC0402	C7413		IMVP6:1PHASE

	MIN_LINE_WIDTH	MIN_NECK_WIDTH
IMVP6_VDIFF	0.25 MM	0.20 MM
IMVP6_FB2	0.25 MM	0.20 MM
IMVP6_FB	0.25 MM	0.20 MM
IMVP6_COMP	0.25 MM	0.20 MM
IMVP6_VW	0.25 MM	0.25 MM
IMVP6_VSEN_P	0.25 MM	0.25 MM
IMVP6_VSEN_N	0.25 MM	0.25 MM

	MIN_LINE_WIDTH	MIN_NECK_WIDTH
IMVP6_PHASE1	1.5 MM	0.25 MM
IMVP6_BOOT1	0.25 MM	0.25 MM
IMVP6_UGATE1	1.5 MM	0.25 MM
IMVP6_LGATE1	1.5 MM	0.25 MM
IMVP6_ISEN1	0.25 MM	0.25 MM
IMVP6_PHASE2	1.5 MM	0.25 MM
IMVP6_BOOT2	0.25 MM	0.25 MM
IMVP6_UGATE2	0.25 MM	0.25 MM
IMVP6_LGATE2	0.25 MM	0.25 MM
IMVP6_ISEN2	0.25 MM	0.25 MM

	MIN_LINE_WIDTH	MIN_NECK_WIDTH
IMVP6_OCSET	0.25 MM	0.20 MM
IMVP6_VSUM	0.25 MM	0.20 MM
GND_IMVP6_SGND	0.50 MM	0.20 MM
IMVP6_VO	0.25 MM	0.20 MM
IMVP6_DROOP	0.25 MM	0.20 MM
IMVP6_DFB	0.25 MM	0.20 MM
IMVP6_SOFT	0.25 MM	0.20 MM
IMVP6_RBIAIS	0.25 MM	0.20 MM

SYNC MASTER=K87_MLB SYNC DATE=02/26/2010

IMVP6 CPU VCore Regulator

Apple Inc.

Drawing Number: 051-8407

Revision: A.0.0

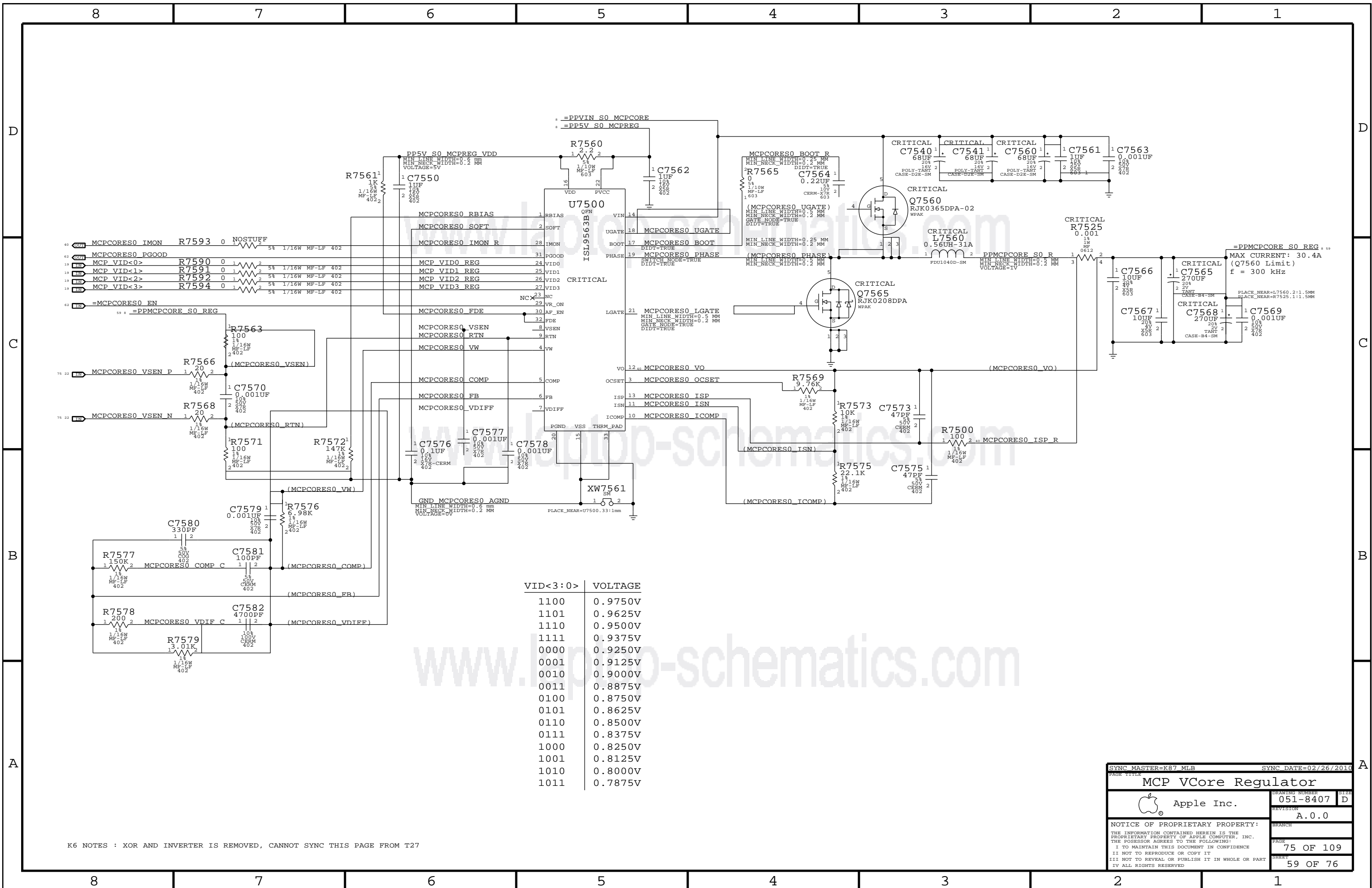
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Sheet: 58 OF 76

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R1100/R1101 **ON THE CPU PAGE** PROTECT THE IMVP6 IF THE CPU IS NOT INSTALLED

NOTE 1: C7432,C7433 = 27.4 OHM FOR VALIDATING CPU ONLY.



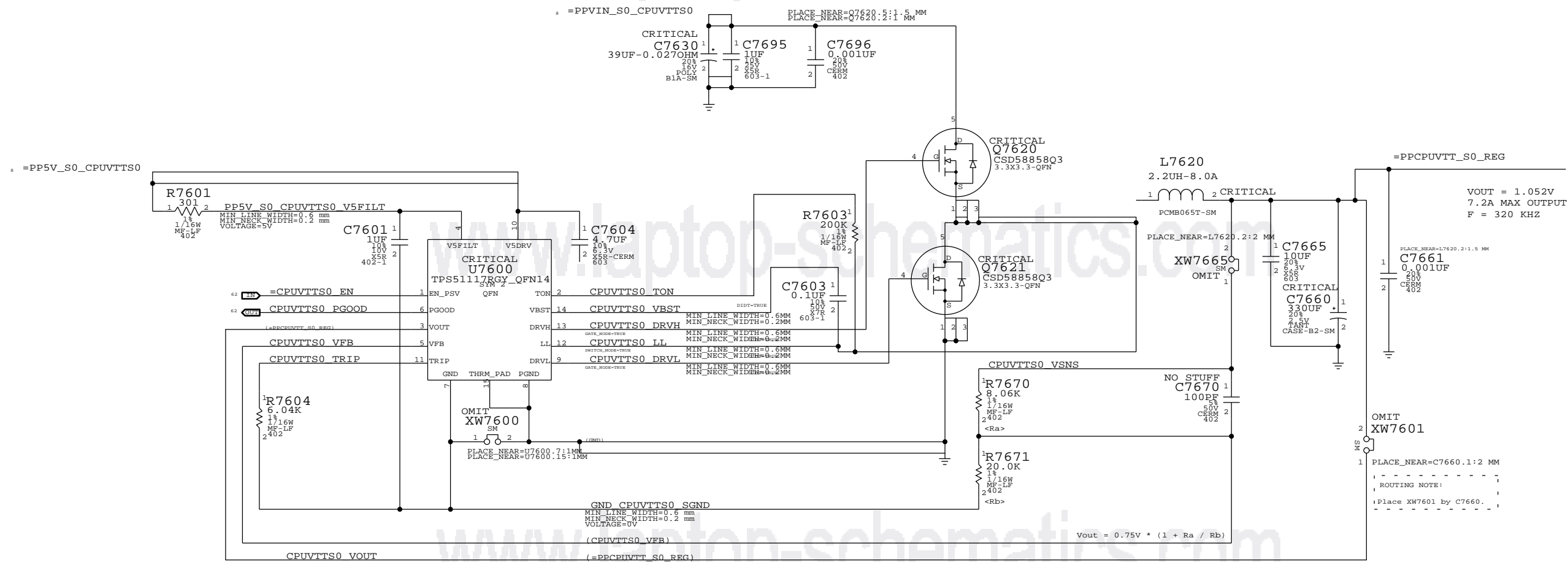
VID<3:0>	VOLTAGE
1100	0.9750V
1101	0.9625V
1110	0.9500V
1111	0.9375V
0000	0.9250V
0001	0.9125V
0010	0.9000V
0011	0.8875V
0100	0.8750V
0101	0.8625V
0110	0.8500V
0111	0.8375V
1000	0.8250V
1001	0.8125V
1010	0.8000V
1011	0.7875V

K6 NOTES : XOR AND INVERTER IS REMOVED, CANNOT SYNC THIS PAGE FROM T27

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
MCP VCore Regulator			
Apple Inc.		DRAWING NUMBER 051-8407	SIZE D
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		PAGE 75 OF 109	SHEET
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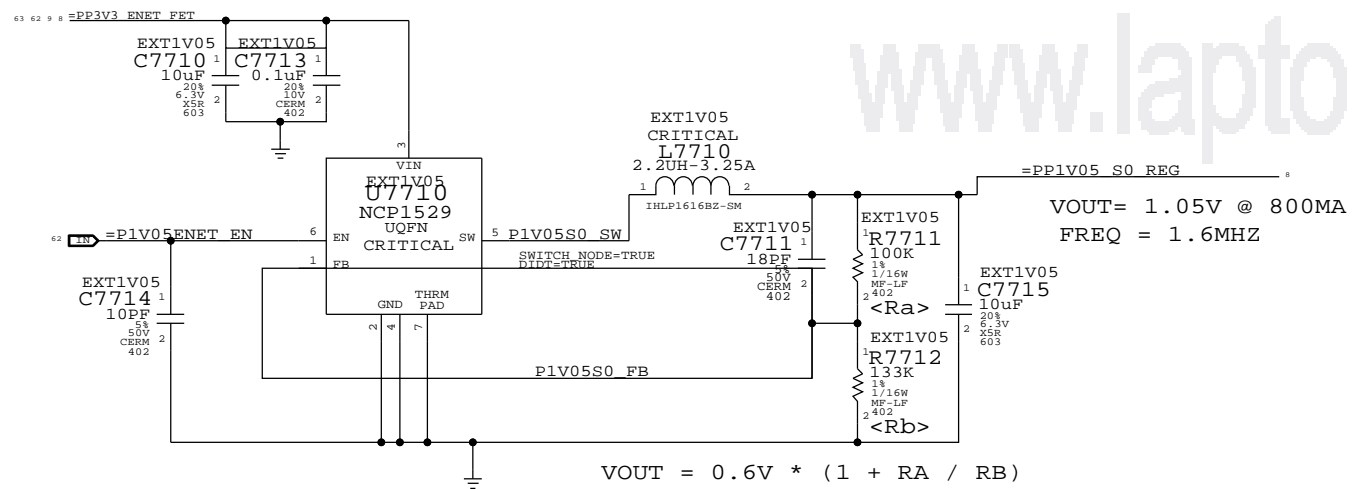
CPUVTT POWER SUPPLY

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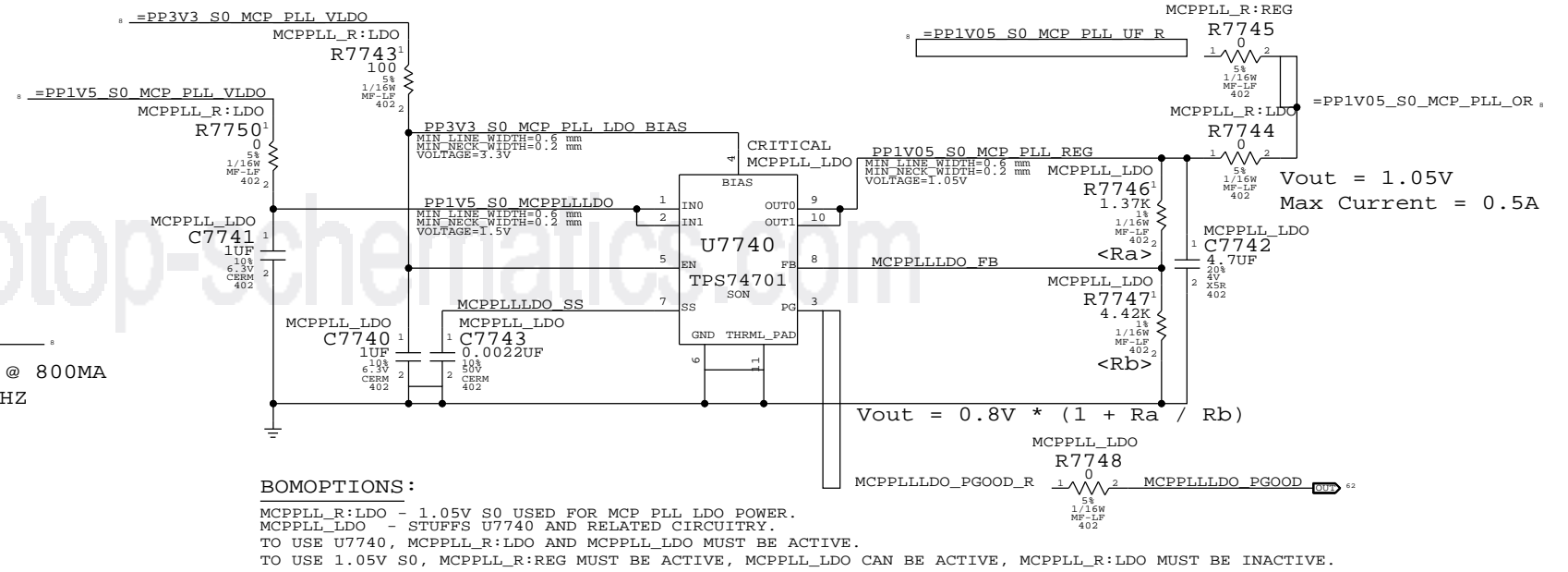


SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
CPU VTT(1.05V) SUPPLY			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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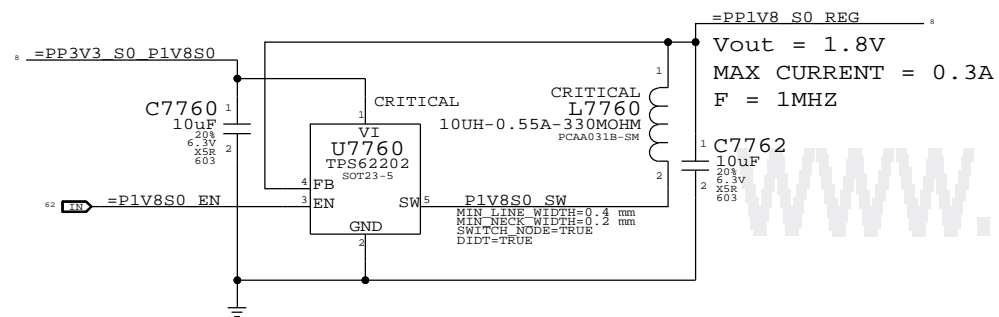
1.05V ENET Switcher



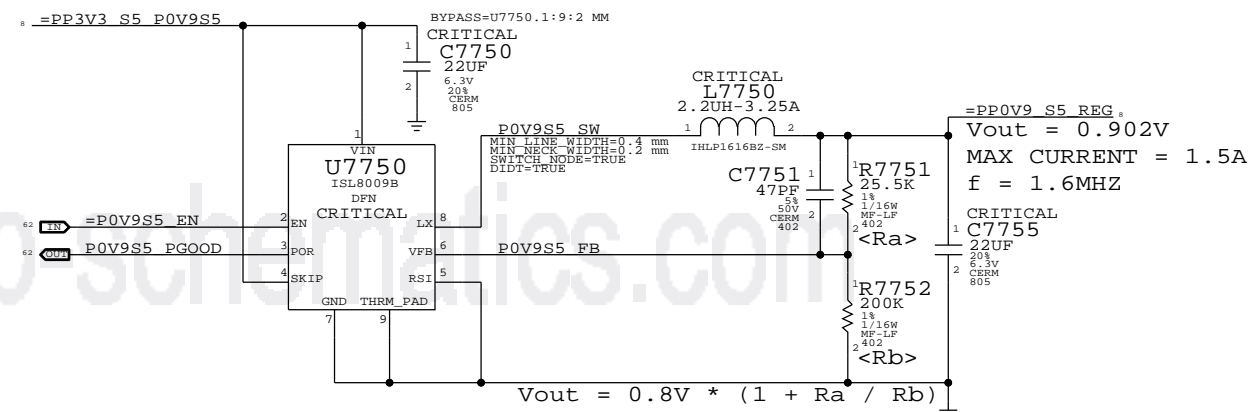
1.05V S0 MCP PLL LDO



1.8V S0 Switcher



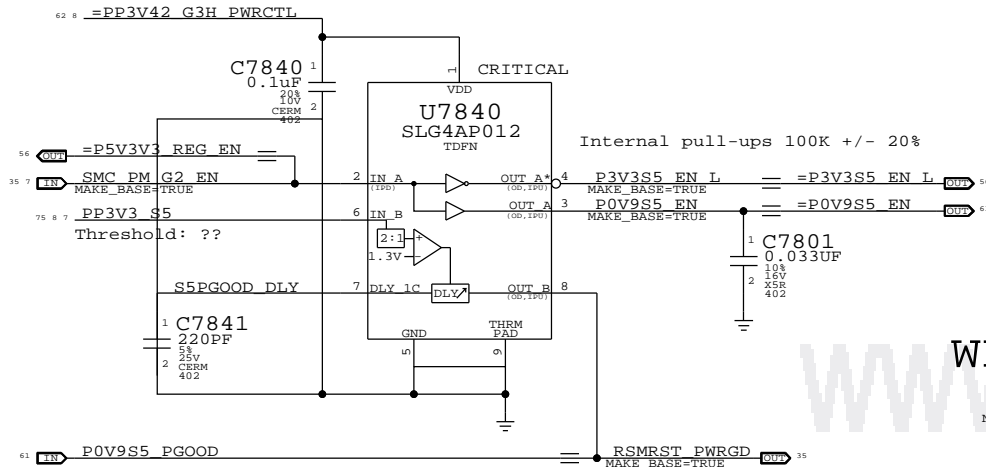
MCP 0.9V S5 (AUXC) Switcher



K6 NOTES : C7710 AND C7750 HAS BYPASS PROPERTY, SHOULD BE ADDED INCASE THIS PAGE IS SYNC'ED FROM T27

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
Misc Power Supplies			
Apple Inc.		DRAWING NUMBER 051-8407	SIZE D
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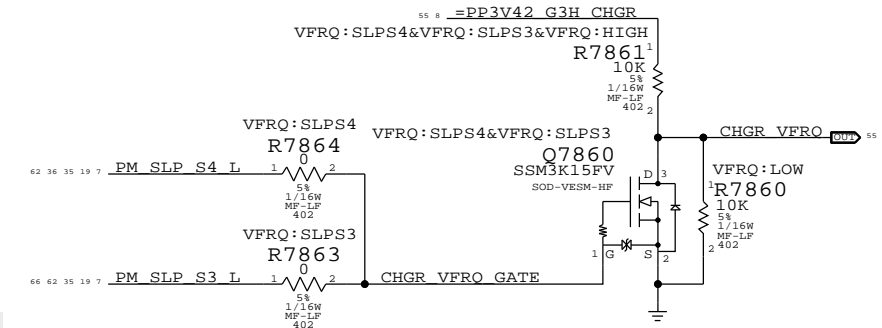
S5 Rail Enables & PGOOD



Power Control Signals

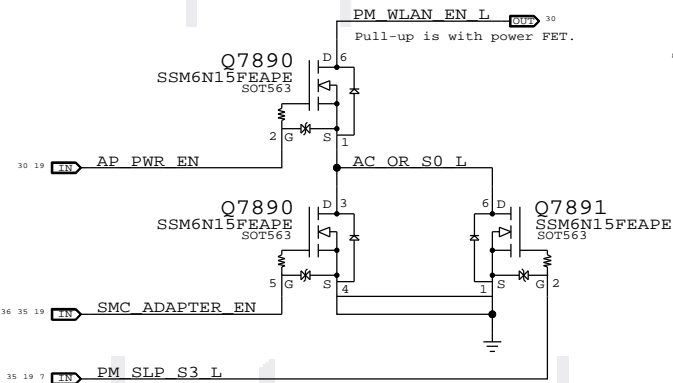
State	SMC_PM_G2_ENABLE	PM_SLP_S4_L	PM_SLP_S3_L
Run (S0)	1	1	1
Sleep (S3)	1	1	0
Soft-Off (S5)	1	0	0
Battery Off (G3Hot)	0	0	0

ISL6259 Frequency Select



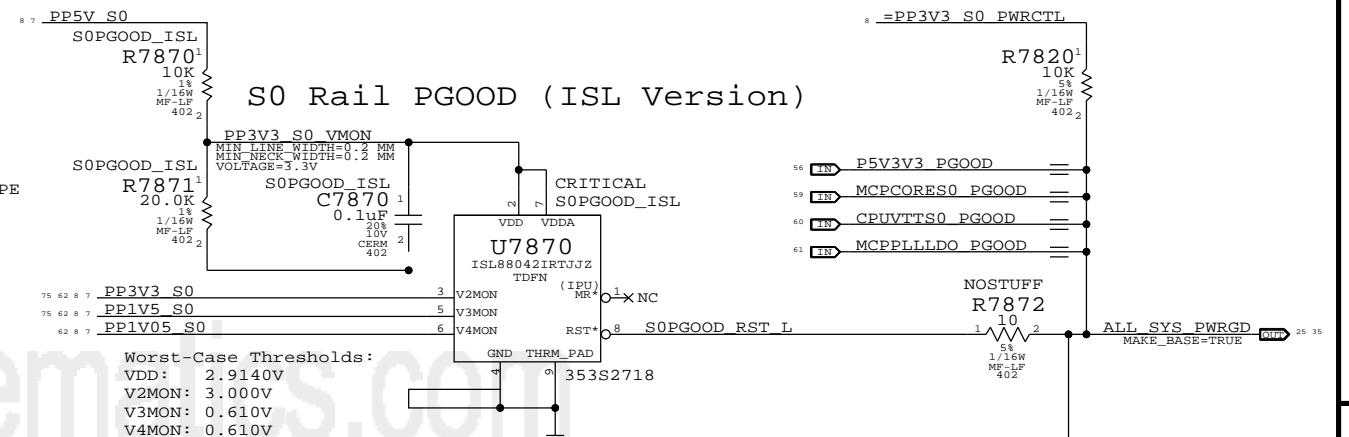
WLAN Enable Generation

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

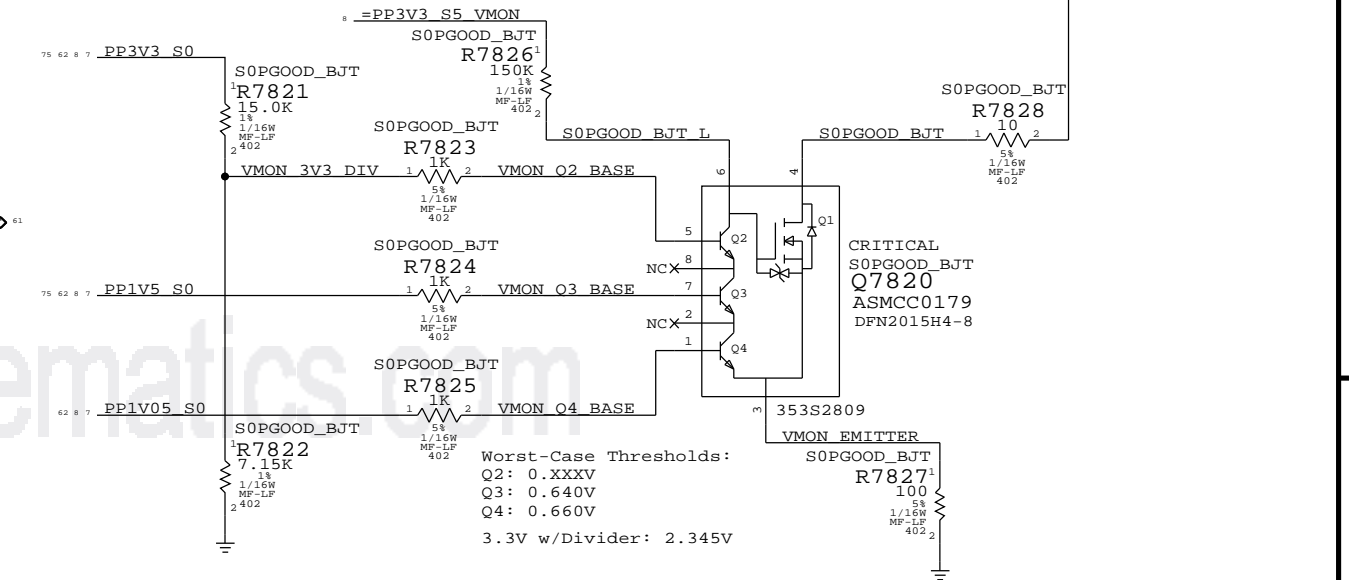


S0 Rail PGOOD Circuitry

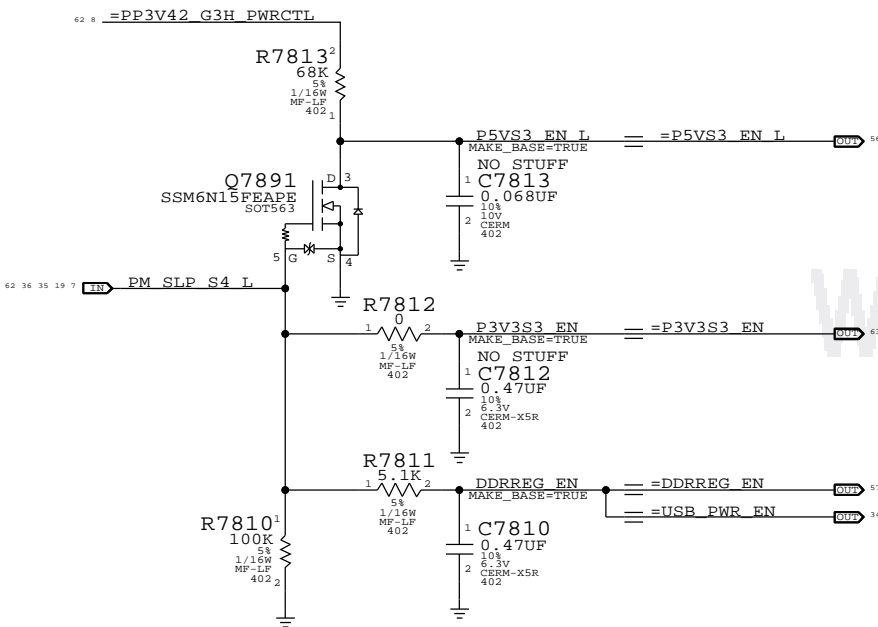
S0 Rail PGOOD (ISL Version)



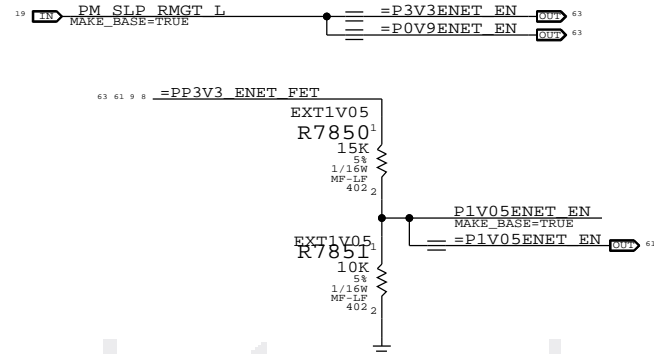
S0 Rail PGOOD (BJT Version)



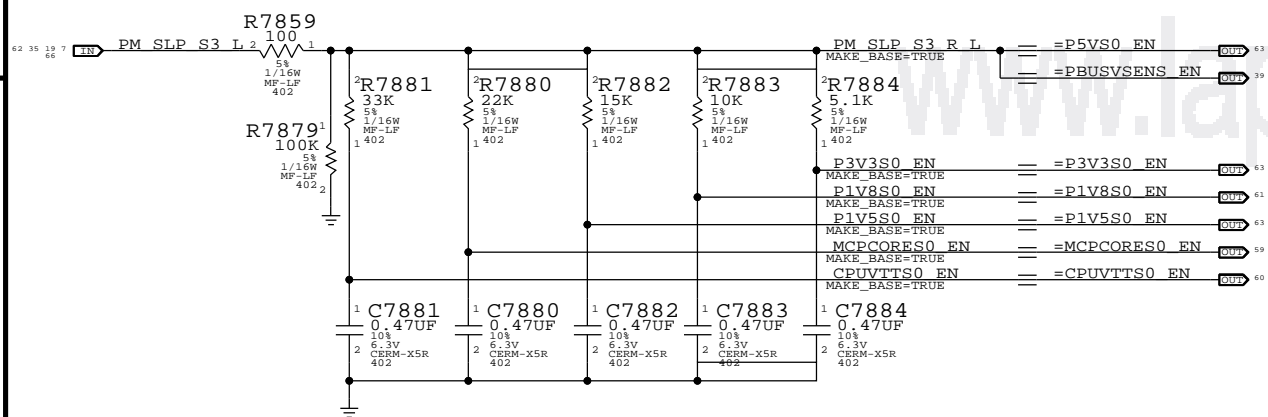
S3 Rail Enables



ENET Rail Enables



S0 Rail Enables



VTT Rail Enable

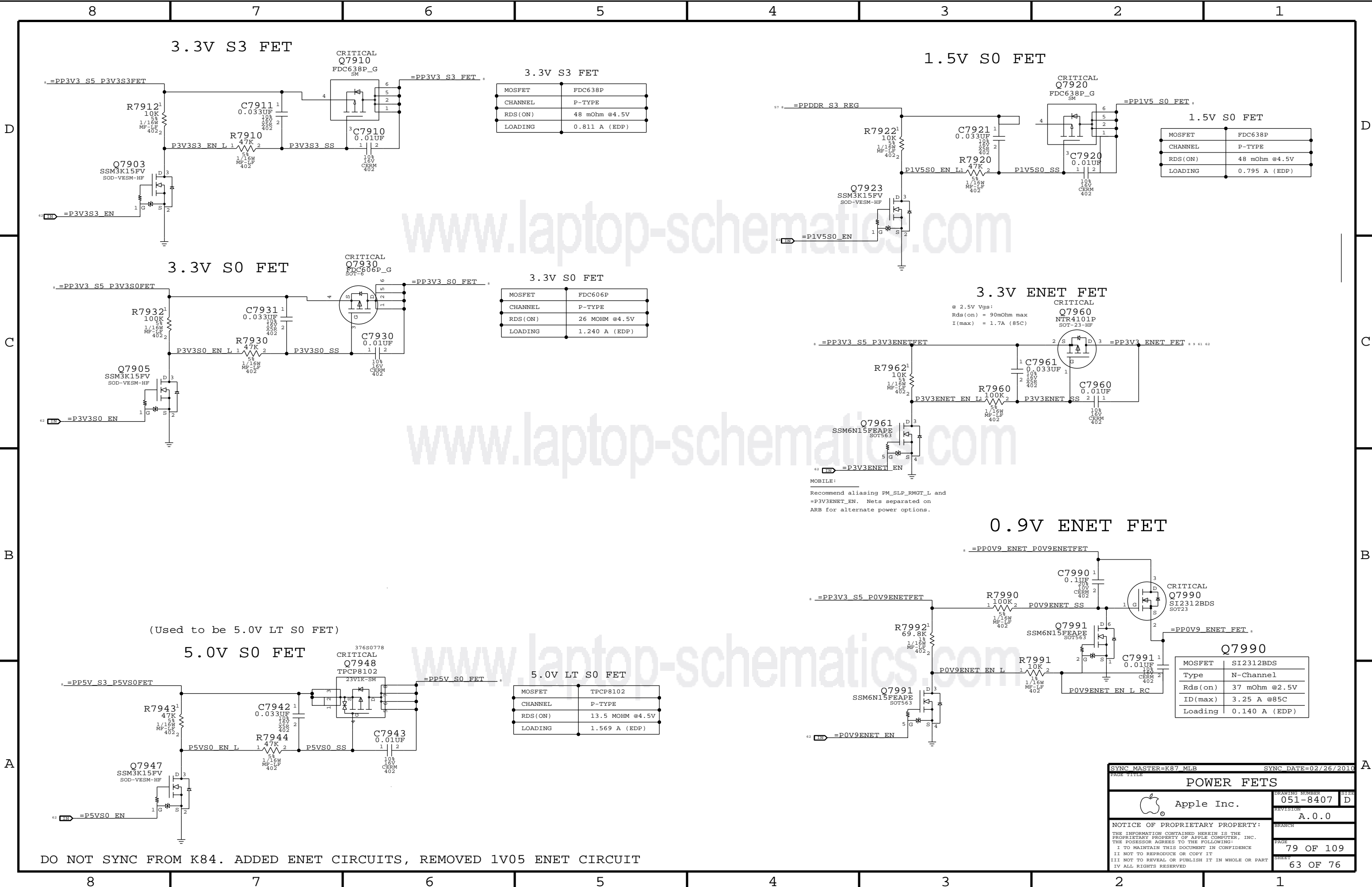
VTT rail must ramp up in about the same time as MEMVDD rail (Q2300).

Unused PGOOD signal



PAGE TITLE		SYNC_DATE=02/26/2010	
Power Sequencing			
Apple Inc.		DRAWING NUMBER	SIZE
Apple Logo		051-8407	D
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DO NOT SYNC T27, ENET RAILS CHANGED



3.3V S3 FET

MOSFET	FDC638P
CHANNEL	P-TYPE
RDS(ON)	48 mOhm @4.5V
LOADING	0.811 A (EDP)

1.5V S0 FET

MOSFET	FDC638P
CHANNEL	P-TYPE
RDS(ON)	48 mOhm @4.5V
LOADING	0.795 A (EDP)

3.3V S0 FET

MOSFET	FDC606P
CHANNEL	P-TYPE
RDS(ON)	26 MOHM @4.5V
LOADING	1.240 A (EDP)

3.3V ENET FET

@ 2.5V Vgs:
Rds(on) = 90mOhm max
I(max) = 1.7A (85C)

0.9V ENET FET

MOSFET	SI2312BDS
Type	N-Channel
Rds(on)	37 mOhm @2.5V
ID(max)	3.25 A @85C
Loading	0.140 A (EDP)

5.0V S0 FET

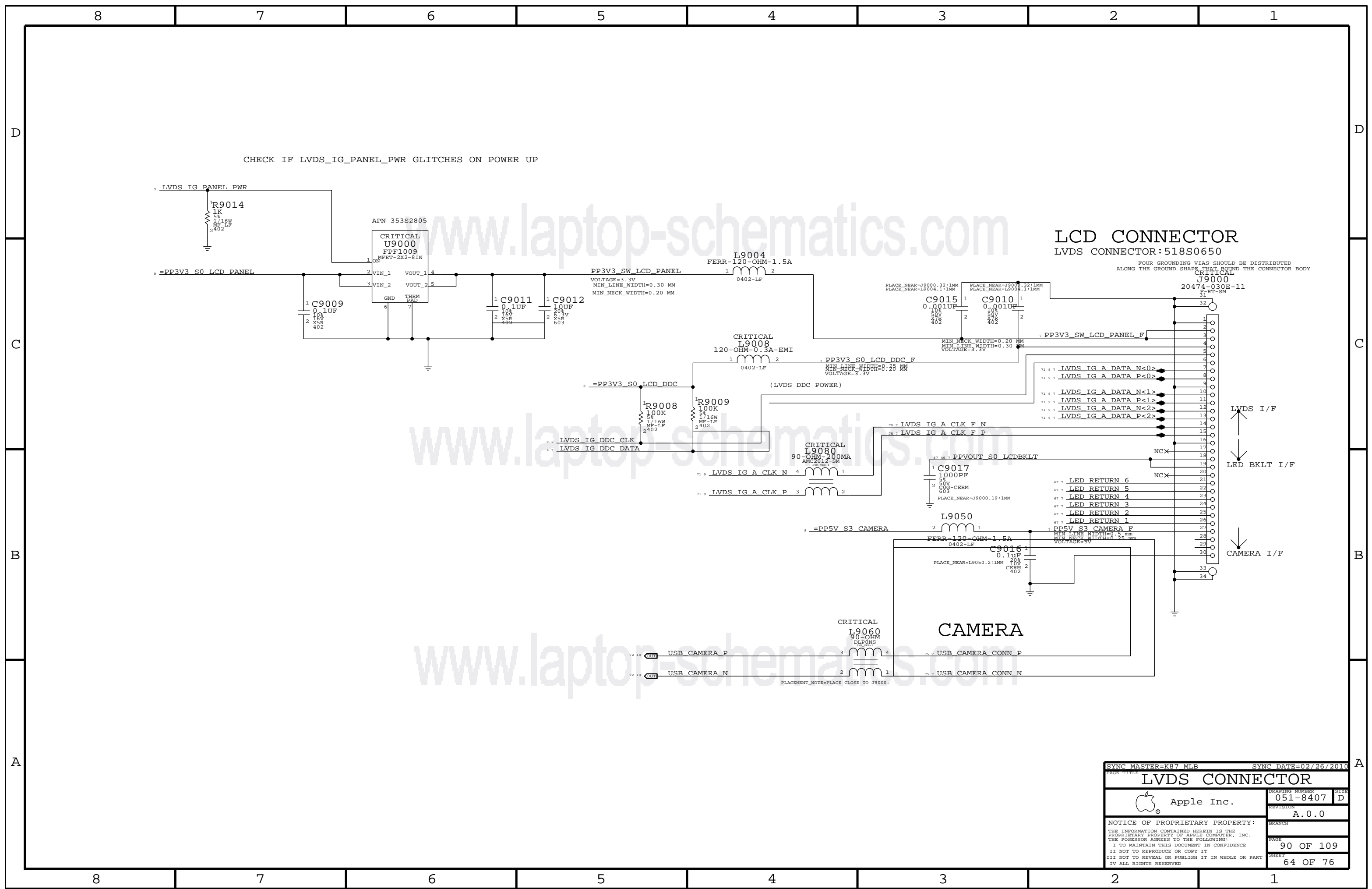
(Used to be 5.0V LT S0 FET)

MOSFET	TPCP8102
CHANNEL	P-TYPE
RDS(ON)	13.5 MOHM @4.5V
LOADING	1.569 A (EDP)

MOBILE:
Recommend aliasing PM_SLP_RMGT_L and =P3V3ENET_EN. Nets separated on ARB for alternate power options.

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
PAGE TITLE			
POWER FETS			
Apple Inc.		DRAWING NUMBER	051-8407
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		SHEET	63 OF 76

DO NOT SYNC FROM K84. ADDED ENET CIRCUITS, REMOVED 1V05 ENET CIRCUIT



LCD CONNECTOR
LVDS CONNECTOR: 518S0650

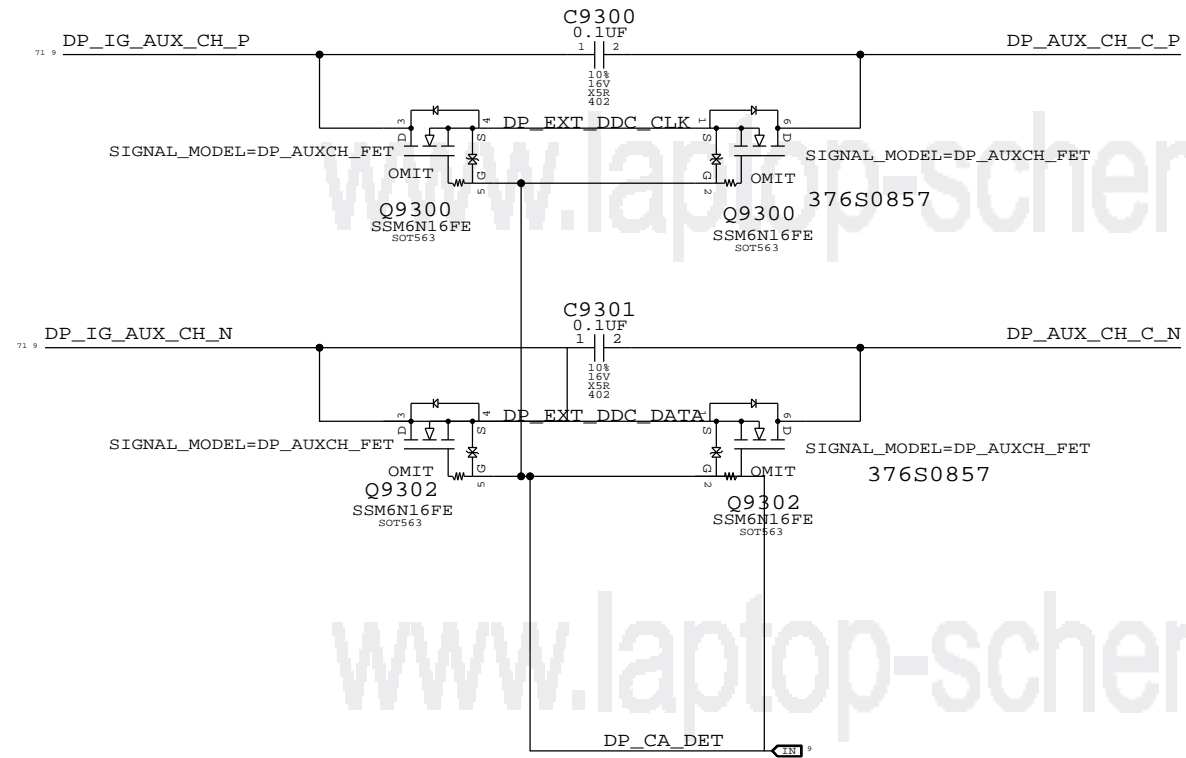
FOUR GROUNDING VIAS SHOULD BE DISTRIBUTED ALONG THE GROUND SHAPE THAT BOUND THE CONNECTOR BODY

CRITICAL
J9000
20474-030E-11
RT-SM

LVDS I/F
LED BKLT I/F
CAMERA I/F

CAMERA

SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
LVDS CONNECTOR			
Apple Inc.		DRAWING NUMBER	SIZE
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		PAGE	
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PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
376S0859	2	XSTR, FT, N-CH, DUAL, SOT-563	Q9300, Q9302	CRITICAL	

SYNC MASTER=K87_MLB SYNC DATE=02/26/2010

DISPLAYPORT SUPPORT

Apple Inc.

DRAWING NUMBER: 051-8407 SIZE: D

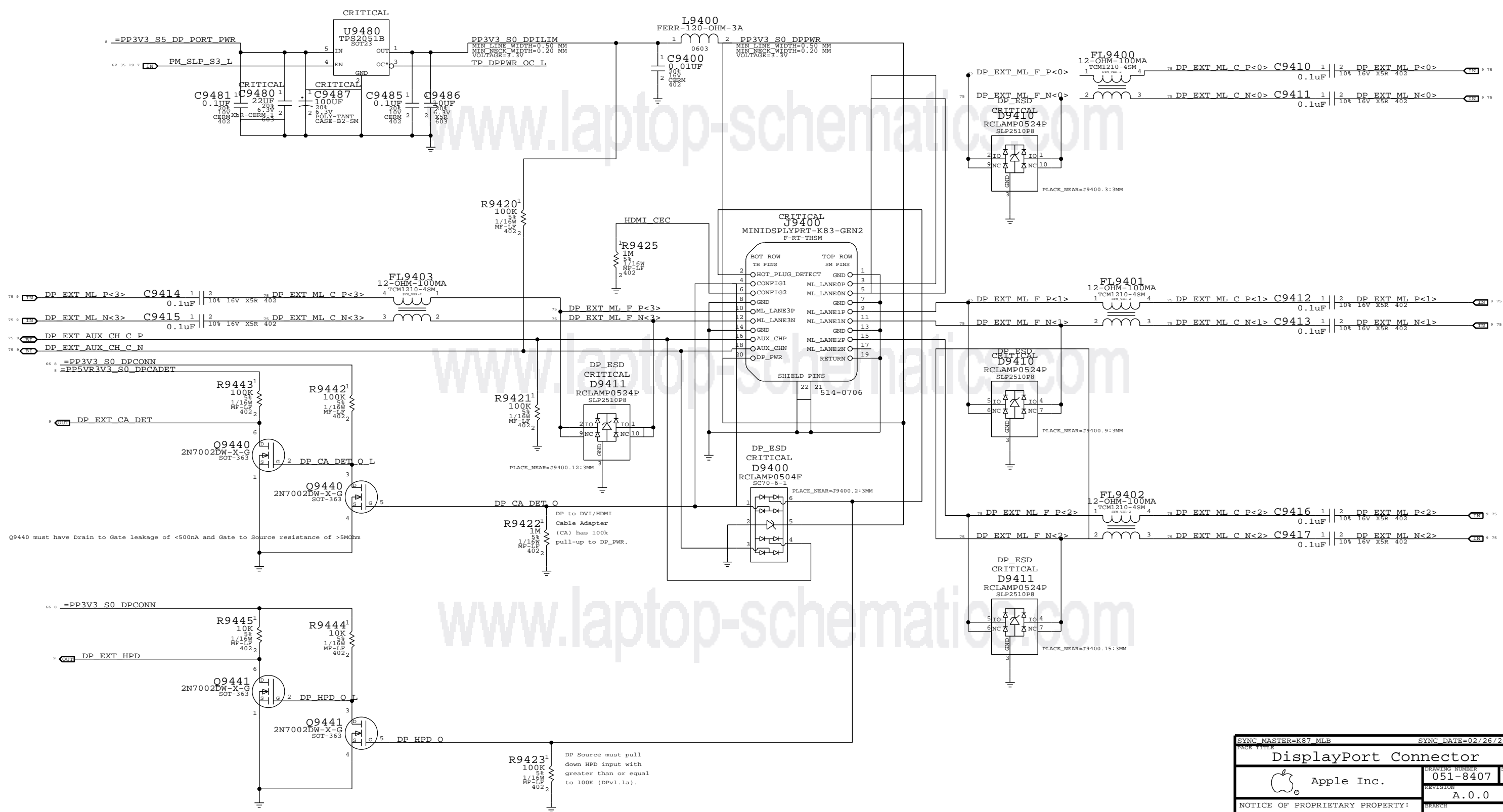
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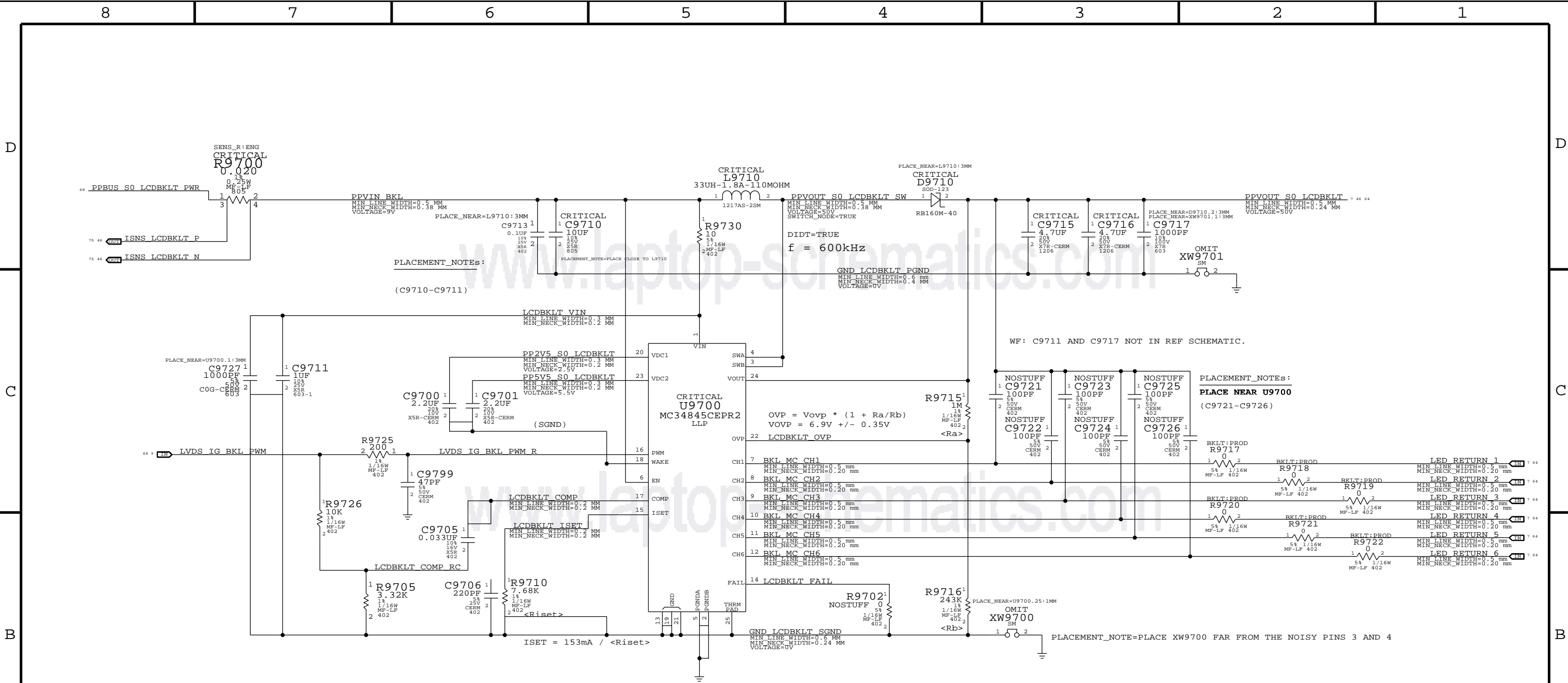
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Port Power Switch



DO NOT SYNC. K6 PAGE WITH K84 CONNECTOR

SYNC MASTER=K87.MLB		SYNC DATE=02/26/2010	
DisplayPort Connector			
Apple Inc.		DRAWING NUMBER	051-8407
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		PAGE	94 OF 109
		SHEET	66 OF 76



13.3 Inch, K84 Panel (9 LEDs per string)
 TARGET: ISET = 20mA, OVP = 35V
 ACTUAL: ISET = 19.9mA, OVP = 35.2V

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PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
103S0198	3	RES, THIN FLIM, 1/16W, 10.2 OHM, 0.1, 0.402, SM	R9717, R9718, R9719		BKLT: ENG
103S0198	3	RES, THIN FLIM, 1/16W, 10.2 OHM, 0.1, 0.402, SM	R9720, R9721, R9722		BKLT: ENG
101S0075	1	RES, MF, 0 OHM, 5%, 1/8W, SMD, LF, 0805	R9700		SENS_R: PROD

10.2 ohm resistors for current measurement on LED strings.

DO NOT SYNC FROM K84. L9710 CHANGED TO K6/K69

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

LCD Backlight Driver (MC34845)

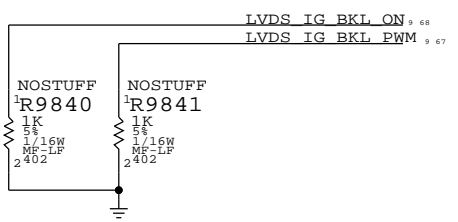
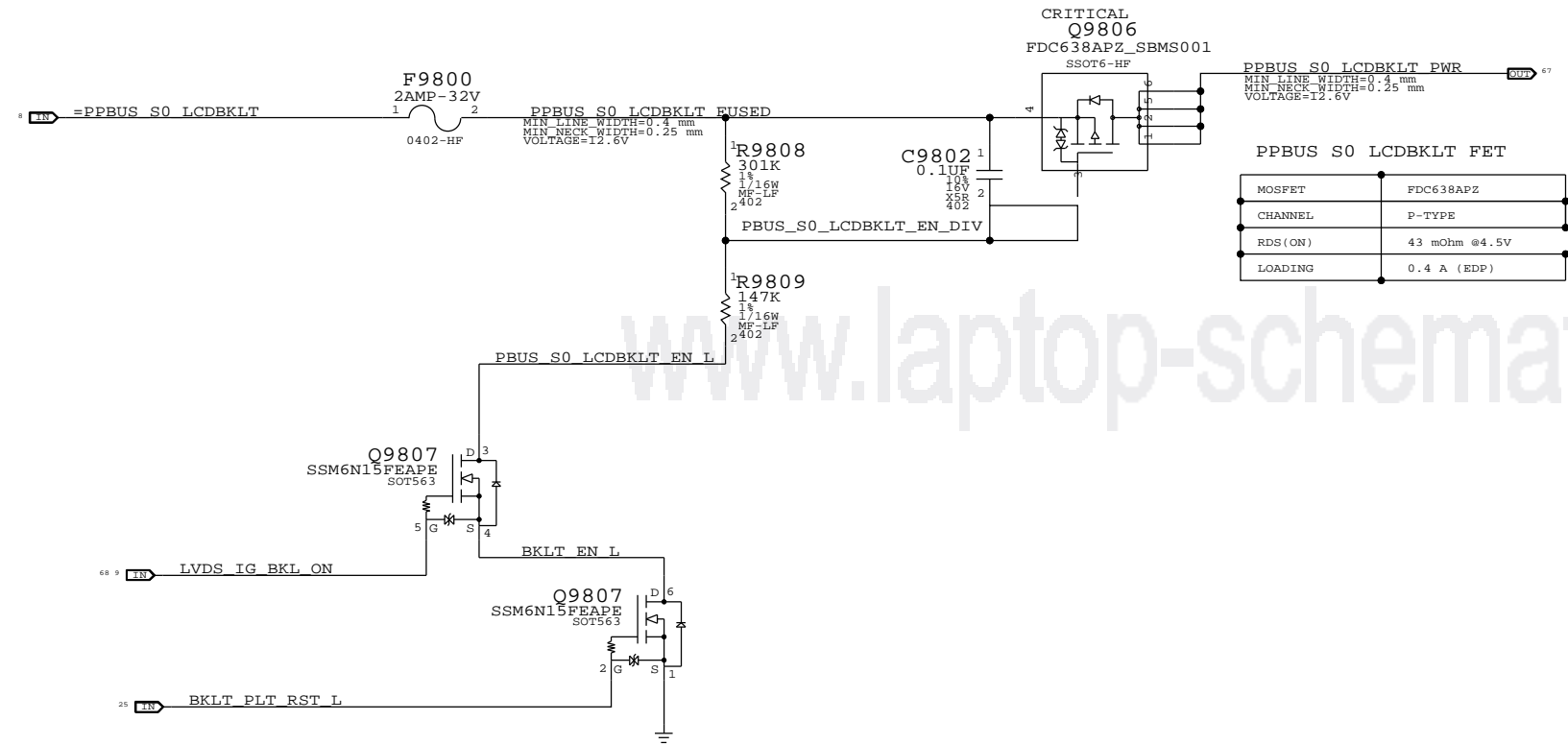
Apple Inc.

DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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MCP79 HAD INTERNAL 10K PULL-UP FOR THESE SIGNALS
MCP89 DRIVES THEM LOW

PAGE TITLE		SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
LCD Backlight Support					
Apple Inc.		DRAWING NUMBER	051-8407	SIZE	D
		REVISION	A.0.0	BRANCH	
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FSB (Front-Side 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
FSB_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD
FSB_DSTB_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=1:1_DIFFPAIR	=1:1_DIFFPAIR

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
FSB_DATA	*	=2x_DIELECTRIC	?	FSB_DATA	TOP,BOTTOM	=4x_DIELECTRIC	?
FSB_DSTB	*	=3x_DIELECTRIC	?	FSB_DSTB	TOP,BOTTOM	=5x_DIELECTRIC	?
FSB_ADDR	*	=STANDARD	?	FSB_ADDR	TOP,BOTTOM	=3x_DIELECTRIC	?
FSB_ADSTB	*	=2x_DIELECTRIC	?	FSB_ADSTB	TOP,BOTTOM	=4x_DIELECTRIC	?
FSB_1X	*	=STANDARD	?	FSB_1X	TOP,BOTTOM	=3x_DIELECTRIC	?

All 4x/2x/1x FSB signals with impedance requirements are 50-ohm single-ended.

FSB 4X signals / groups shown in signal table on right.

Signals within each 4x group should be matched within 5 ps of strobe.

DSTB# complementary pairs should be matched within 1 ps of each other, all DSTB#s matched to +/- 135 ps.

Spacing is 2x dielectric between DATA#, DINV# signals, with 3x dielectric spacing to the DSTB#s.

FSB 2X signals / groups shown in signal table on right.

Signals within each 2x group should be matched within 20 ps. ADTSB#s should be matched +/- 270 ps.

Spacing is 1x dielectric between ADDR#, REQ# signals, with 2x dielectric spacing to ADTSB#.

FSB 1X signals shown in signal table on right.

Intel Design Guide recommends FSB signals be routed only on internal layers.

NOTE: Intel Design Guide allows closer spacing if signal lengths can be shortened.

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.1

SOURCE: Santa Rosa Platform DG, Rev 1.5 (#22294), Sections 4.2 & 4.3

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_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	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CPU_AGTL	*	=STANDARD	?	CPU_AGTL	TOP,BOTTOM	=2x_DIELECTRIC	?
CPU_8MIL	*	8 MIL	?				
CPU_COMP	*	25 MIL	?				
CPU_GTLREF	*	25 MIL	?				
CPU_ITP	*	=2:1_SPACING	?				
CPU_VCCSENSE	*	25 MIL	?				

SR DG recommends at least 25 mils, >50 mils preferred

Most CPU signals with impedance requirements are 55-ohm single-ended.

Some signals require 27.4-ohm single-ended impedance.

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.1

SOURCE: Santa Rosa Platform DG, Rev 0.9 (#20517), Sections 4.4 & 5.8.2.4

MCP FSB COMP 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
MCP_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD

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

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.1.4

FSB Clock 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_FSB_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	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
CLK_FSB	*	=3x_DIELECTRIC	?	CLK_FSB	TOP,BOTTOM	=4x_DIELECTRIC	?

SOURCE: MCP79 Interface DG (DG-03328-001_v01), Section 2.2.5

CPU / FSB Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE		PROPERTY	VALUE	UNIT
	PHYSICAL	SPACING			
FSB_DATA_GROUP0	FSB_50S	FSB_DATA	FSB D L<15..0>	7	10 14
FSB_DATA_GROUP0	FSB_50S	FSB_DATA	FSB DINV L<0>	7	10 14
FSB_DSTB0	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L P<0>	7	10 14
FSB_DSTB0	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L N<0>	7	10 14
FSB_DATA_GROUP1	FSB_50S	FSB_DATA	FSB D L<31..16>	7	10 14
FSB_DATA_GROUP1	FSB_50S	FSB_DATA	FSB DINV L<1>	7	10 14
FSB_DSTB1	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L P<1>	7	10 14
FSB_DSTB1	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L N<1>	7	10 14
FSB_DATA_GROUP2	FSB_50S	FSB_DATA	FSB D L<47..32>	7	10 14
FSB_DATA_GROUP2	FSB_50S	FSB_DATA	FSB DINV L<2>	7	10 14
FSB_DSTB2	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L P<2>	7	10 14
FSB_DSTB2	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L N<2>	7	10 14
FSB_DATA_GROUP3	FSB_50S	FSB_DATA	FSB D L<63..48>	7	10 14
FSB_DATA_GROUP3	FSB_50S	FSB_DATA	FSB DINV L<3>	7	10 14
FSB_DSTB3	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L P<3>	7	10 14
FSB_DSTB3	FSB_DSTB_50S	FSB_DSTB	FSB DSTB L N<3>	7	10 14
FSB_ADDR_GROUP0	FSB_50S	FSB_ADDR	FSB A L<16..3>	7	10 14
FSB_ADDR_GROUP0	FSB_50S	FSB_ADDR	FSB REQ L<4..0>	7	10 14
FSB_ADSTB0	FSB_50S	FSB_ADSTB	FSB ADSTB L<0>	7	10 14
FSB_ADDR_GROUP1	FSB_50S	FSB_ADDR	FSB A L<35..17>	7	10 14
FSB_ADSTB1	FSB_50S	FSB_ADSTB	FSB ADSTB L<1>	7	10 14
FSB_1X	FSB_50S	FSB_1X	FSB ADS L	7	10 14
FSB_BREQ0_L	FSB_50S	FSB_1X	FSB BREQ0 L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB BNR L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB BPRI L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB DBSY L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB DEFER L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB DRDY L	10	14
FSB_1X	FSB_50S	FSB_1X	FSB HIT L	7	10 14
FSB_1X	FSB_50S	FSB_1X	FSB HITM L	7	10 14
FSB_1X	FSB_50S	FSB_1X	FSB LOCK L	7	10 14
FSB_CPURST_L	FSB_50S	FSB_1X	FSB CPURST L	10	13 14
FSB_1X	FSB_50S	FSB_1X	FSB RS L<2..0>	10	14
FSB_1X	FSB_50S	FSB_1X	FSB TRDY L	10	14
CPU_ASYNC	CPU_50S	CPU_AGTL	CPU A20M L	10	14
CPU_BSEL	CPU_50S	CPU_AGTL	CPU BSEL<2..0>	9	10
CPU_FERR_L	CPU_50S	CPU_8MIL	CPU FERR L	10	14
CPU_ASYNC	CPU_50S	CPU_AGTL	CPU IGNE L	10	14
CPU_INIT_L	CPU_50S	CPU_AGTL	CPU INIT L	10	14
CPU_ASYNC_R	CPU_50S	CPU_AGTL	CPU INTR	10	14
CPU_ASYNC_R	CPU_50S	CPU_AGTL	CPU NMI	10	14
CPU_PROCHOT_L	CPU_50S	CPU_AGTL	CPU PROCHOT L	10	13 14
CPU_PWRGD	CPU_50S	CPU_AGTL	CPU PWRGD	10	13 14
CPU_ASYNC	CPU_50S	CPU_AGTL	CPU SMI L	10	14
CPU_ASYNC	CPU_50S	CPU_AGTL	CPU STPCLK L	10	14
PM_THERMTRIP_L	CPU_50S	CPU_8MIL	PM THERMTRIP L	10	13 14
FSB_CPUSLP_L	CPU_50S	CPU_AGTL	FSB CPUSLP L	10	14
CPU_PROM_SB	CPU_50S	CPU_AGTL	CPU DPRSLP L	10	14
CPU_DPRSTP_L	CPU_50S	CPU_AGTL	CPU DPRSTP L	10	14 58
CPU_ASYNC	CPU_50S	CPU_AGTL	FSB DPWR L	10	14
FSB_CLK_CPUH	CLK_FSB_100D	CLK_FSB	FSB CLK CPU P	10	14
FSB_CLK_CPUN	CLK_FSB_100D	CLK_FSB	FSB CLK CPU N	10	14
FSB_CLK_ITP_P	CLK_FSB_100D	CLK_FSB	FSB CLK ITP P	13	14
FSB_CLK_ITP_N	CLK_FSB_100D	CLK_FSB	FSB CLK ITP N	13	14
FSB_CLK_MCP_P	CLK_FSB_100D	CLK_FSB	FSB CLK MCP P	14	
FSB_CLK_MCP_N	CLK_FSB_100D	CLK_FSB	FSB CLK MCP N	14	
CPU_IERR_L	CPU_50S		CPU IERR L	10	
PM_DPRSLPVR	CPU_50S	CPU_AGTL	PM DPRSLPVR	14	58
(See above)	CPU_50S	CPU_AGTL	IMVP DPRSLPVR	58	
MCP_CPU_COMP	MCP_50S	MCP_FSB_COMP	MCP BCLK VML COMP VDD	14	
MCP_CPU_COMP	MCP_50S	MCP_FSB_COMP	MCP BCLK VML COMP GND	14	
MCP_CPU_COMP	MCP_50S	MCP_FSB_COMP	MCP CPU COMP VCC	14	
MCP_CPU_COMP	MCP_50S	MCP_FSB_COMP	MCP CPU COMP GND	14	
CPU_GTLREF	CPU_50S	CPU_GTLREF	CPU GTLREF	10	29
CPU_COMP<3>	CPU_50S	CPU_COMP	CPU COMP<3>	10	
CPU_COMP<2>	CPU_27P4S	CPU_COMP	CPU COMP<2>	10	
CPU_COMP<1>	CPU_50S	CPU_COMP	CPU COMP<1>	10	
CPU_COMP<0>	CPU_27P4S	CPU_COMP	CPU COMP<0>	10	
XDP_TDI	CPU_50S	CPU_ITP	XDP TDI	10	13
XDP_TDO	CPU_50S	CPU_ITP	XDP TDO	10	13
XDP_TMS	CPU_50S	CPU_ITP	XDP TMS	10	13
XDP_TCK	CPU_50S	CPU_ITP	XDP TCK	10	13
XDP_TRST_L	CPU_50S	CPU_ITP	XDP TRST L	10	13
XDP_BPM_L	CPU_50S	CPU_ITP	XDP BPM L<4..0>	10	13
XDP_BPM_L5	CPU_50S	CPU_ITP	XDP BPM L<5>	10	13
(FSB_CPURST_L)	CPU_50S	CPU_ITP	XDP CPURST L	13	
	CPU_50S	CPU_8MIL	CPU VID<6..0>	11	58
	CPU_50S	CPU_8MIL	IMVP6 VID<6..0>	11	58
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU VCCSENSE P	11	58
CPU_VCCSENSE	CPU_27P4S	CPU_VCCSENSE	CPU VCCSENSE N	11	58
(CPU_VCCSENSE)	CPU_27P4S	CPU_VCCSENSE	IMVP6 VSEN P	58	
(CPU_VCCSENSE)	CPU_27P4S	CPU_VCCSENSE	IMVP6 VSEN N	58	

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

CPU/FSB Constraints

Apple Inc.

DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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Memory Bus Constraints

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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MEM_CLK2MEM	*	=4:1_SPACING	?
MEM_CTRL2CTRL	*	=2:1_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 MIL	?

NV DG says 3x inner, 4x outer
 NV DG says 2x inner, 4x outer
 NV DG says 2x inner, 4x outer
 NV DG says 2x inner, 4x outer
 NV DG says 2x inner, 4x outer
 NV DG says 2x inner, 4x outer
 NV DG says 4x inner, 5x outer

Memory Bus Spacing Group Assignments

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CLK	MEM_CLK	*	MEM_CLK2MEM
MEM_CLK	MEM_CTRL	*	MEM_CLK2MEM
MEM_CLK	MEM_CMD	*	MEM_CLK2MEM
MEM_CLK	MEM_DATA	*	MEM_CLK2MEM
MEM_CLK	MEM_DQS	*	MEM_CLK2MEM
MEM_CMD	MEM_CLK	*	MEM_CMD2MEM
MEM_CMD	MEM_CTRL	*	MEM_CMD2MEM
MEM_CMD	MEM_CMD	*	MEM_CMD2MEM
MEM_CMD	MEM_DATA	*	MEM_CMD2MEM
MEM_CMD	MEM_DQS	*	MEM_CMD2MEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CTRL	MEM_CLK	*	MEM_CTRL2MEM
MEM_CTRL	MEM_CTRL	*	MEM_CTRL2CTRL
MEM_CTRL	MEM_CMD	*	MEM_CTRL2MEM
MEM_CTRL	MEM_DATA	*	MEM_CTRL2MEM
MEM_CTRL	MEM_DQS	*	MEM_CTRL2MEM
MEM_DATA	MEM_CLK	*	MEM_DATA2MEM
MEM_DATA	MEM_CTRL	*	MEM_DATA2MEM
MEM_DATA	MEM_CMD	*	MEM_DATA2MEM
MEM_DATA	MEM_DATA	*	MEM_DATA2DATA
MEM_DATA	MEM_DQS	*	MEM_DATA2MEM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_DQS	MEM_CLK	*	MEM_DQS2MEM
MEM_DQS	MEM_CTRL	*	MEM_DQS2MEM
MEM_DQS	MEM_CMD	*	MEM_DQS2MEM
MEM_DQS	MEM_DATA	*	MEM_DQS2MEM
MEM_DQS	MEM_DQS	*	MEM_DQS2MEM
MEM_CLK	*	*	MEM_2OTHER
MEM_CTRL	*	*	MEM_2OTHER
MEM_CMD	*	*	MEM_2OTHER
MEM_DATA	*	*	MEM_2OTHER
MEM_DQS	*	*	MEM_2OTHER

Need to support MEM*-style wildcards!
DDR3:
 DQ signals should be matched within 5 ps of associated DQS pair.
 DQS intra-pair matching should be within 1 ps, inter-pair matching should be within 360 ps
 No DQS to clock matching requirement.
 CLK intra-pair matching should be within 1 ps, inter-pair matching should be within 2 ps.
 CMD/CTRL signals should be matched within 150 ps.
 All memory signals maximum length is 1.030 ps.

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.2.3
 SOURCE: Santa Rosa Platform DG, Rev 1.0 (#21112), Section 6.2

MCP MEM COMP 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
MCP_MEM_COMP	*	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=40_OHM_SE	=STANDARD	=STANDARD

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

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.2.2

Memory Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	NET_TYPE	SPACING
MEM_A_CLK	MEM_70D	MEM_CLK	MEM A CLK P<5..0>
MEM_A_CLK	MEM_70D	MEM_CLK	MEM A CLK N<5..0>
MEM_A_CKE	MEM_40S	MEM_CTRL	MEM A CKE<3..0>
MEM_A_CNVL	MEM_40S	MEM_CTRL	MEM A CS L<3..0>
MEM_A_CNVL	MEM_40S	MEM_CTRL	MEM A ODT<3..0>
MEM_A_CMD	MEM_40S	MEM_CMD	MEM A A<15..0>
MEM_A_CMD	MEM_40S	MEM_CMD	MEM A BA<2..0>
MEM_A_CMD	MEM_40S	MEM_CMD	MEM A RAS L
MEM_A_CMD	MEM_40S	MEM_CMD	MEM A CAS L
MEM_A_CMD	MEM_40S	MEM_CMD	MEM A WE L
MEM_A_DQ_BYTE0	MEM_40S	MEM_DATA	MEM A DQ<7..0>
MEM_A_DQ_BYTE1	MEM_40S	MEM_DATA	MEM A DQ<15..8>
MEM_A_DQ_BYTE2	MEM_40S	MEM_DATA	MEM A DQ<23..16>
MEM_A_DQ_BYTE3	MEM_40S	MEM_DATA	MEM A DQ<31..24>
MEM_A_DQ_BYTE4	MEM_40S	MEM_DATA	MEM A DQ<39..32>
MEM_A_DQ_BYTE5	MEM_40S	MEM_DATA	MEM A DQ<47..40>
MEM_A_DQ_BYTE6	MEM_40S	MEM_DATA	MEM A DQ<55..48>
MEM_A_DQ_BYTE7	MEM_40S	MEM_DATA	MEM A DQ<63..56>
MEM_A_DQ_BYTE0	MEM_40S	MEM_DATA	MEM A DM<0>
MEM_A_DQ_BYTE1	MEM_40S	MEM_DATA	MEM A DM<1>
MEM_A_DQ_BYTE2	MEM_40S	MEM_DATA	MEM A DM<2>
MEM_A_DQ_BYTE3	MEM_40S	MEM_DATA	MEM A DM<3>
MEM_A_DQ_BYTE4	MEM_40S	MEM_DATA	MEM A DM<4>
MEM_A_DQ_BYTE5	MEM_40S	MEM_DATA	MEM A DM<5>
MEM_A_DQ_BYTE6	MEM_40S	MEM_DATA	MEM A DM<6>
MEM_A_DQ_BYTE7	MEM_40S	MEM_DATA	MEM A DM<7>
MEM_A_DQS0	MEM_70D	MEM_DQS	MEM A DOS P<0>
MEM_A_DQS0	MEM_70D	MEM_DQS	MEM A DOS N<0>
MEM_A_DQS1	MEM_70D	MEM_DQS	MEM A DOS P<1>
MEM_A_DQS1	MEM_70D	MEM_DQS	MEM A DOS N<1>
MEM_A_DQS2	MEM_70D	MEM_DQS	MEM A DOS P<2>
MEM_A_DQS2	MEM_70D	MEM_DQS	MEM A DOS N<2>
MEM_A_DQS3	MEM_70D	MEM_DQS	MEM A DOS P<3>
MEM_A_DQS3	MEM_70D	MEM_DQS	MEM A DOS N<3>
MEM_A_DQS4	MEM_70D	MEM_DQS	MEM A DOS P<4>
MEM_A_DQS4	MEM_70D	MEM_DQS	MEM A DOS N<4>
MEM_A_DQS5	MEM_70D	MEM_DQS	MEM A DOS P<5>
MEM_A_DQS5	MEM_70D	MEM_DQS	MEM A DOS N<5>
MEM_A_DQS6	MEM_70D	MEM_DQS	MEM A DOS P<6>
MEM_A_DQS6	MEM_70D	MEM_DQS	MEM A DOS N<6>
MEM_A_DQS7	MEM_70D	MEM_DQS	MEM A DOS P<7>
MEM_A_DQS7	MEM_70D	MEM_DQS	MEM A DOS N<7>
MEM_B_CLK	MEM_70D	MEM_CLK	MEM B CLK P<5..0>
MEM_B_CLK	MEM_70D	MEM_CLK	MEM B CLK N<5..0>
MEM_B_CKE	MEM_40S	MEM_CTRL	MEM B CKE<3..0>
MEM_B_CNVL	MEM_40S	MEM_CTRL	MEM B CS L<3..0>
MEM_B_CNVL	MEM_40S	MEM_CTRL	MEM B ODT<3..0>
MEM_B_CMD	MEM_40S	MEM_CMD	MEM B A<15..0>
MEM_B_CMD	MEM_40S	MEM_CMD	MEM B BA<2..0>
MEM_B_CMD	MEM_40S	MEM_CMD	MEM B RAS L
MEM_B_CMD	MEM_40S	MEM_CMD	MEM B CAS L
MEM_B_CMD	MEM_40S	MEM_CMD	MEM B WE L
MEM_B_DQ_BYTE0	MEM_40S	MEM_DATA	MEM B DQ<7..0>
MEM_B_DQ_BYTE1	MEM_40S	MEM_DATA	MEM B DQ<15..8>
MEM_B_DQ_BYTE2	MEM_40S	MEM_DATA	MEM B DQ<23..16>
MEM_B_DQ_BYTE3	MEM_40S	MEM_DATA	MEM B DQ<31..24>
MEM_B_DQ_BYTE4	MEM_40S	MEM_DATA	MEM B DQ<39..32>
MEM_B_DQ_BYTE5	MEM_40S	MEM_DATA	MEM B DQ<47..40>
MEM_B_DQ_BYTE6	MEM_40S	MEM_DATA	MEM B DQ<55..48>
MEM_B_DQ_BYTE7	MEM_40S	MEM_DATA	MEM B DQ<63..56>
MEM_B_DQ_BYTE0	MEM_40S	MEM_DATA	MEM B DM<0>
MEM_B_DQ_BYTE1	MEM_40S	MEM_DATA	MEM B DM<1>
MEM_B_DQ_BYTE2	MEM_40S	MEM_DATA	MEM B DM<2>
MEM_B_DQ_BYTE3	MEM_40S	MEM_DATA	MEM B DM<3>
MEM_B_DQ_BYTE4	MEM_40S	MEM_DATA	MEM B DM<4>
MEM_B_DQ_BYTE5	MEM_40S	MEM_DATA	MEM B DM<5>
MEM_B_DQ_BYTE6	MEM_40S	MEM_DATA	MEM B DM<6>
MEM_B_DQ_BYTE7	MEM_40S	MEM_DATA	MEM B DM<7>
MEM_B_DQS0	MEM_70D	MEM_DQS	MEM B DOS P<0>
MEM_B_DQS0	MEM_70D	MEM_DQS	MEM B DOS N<0>
MEM_B_DQS1	MEM_70D	MEM_DQS	MEM B DOS P<1>
MEM_B_DQS1	MEM_70D	MEM_DQS	MEM B DOS N<1>
MEM_B_DQS2	MEM_70D	MEM_DQS	MEM B DOS P<2>
MEM_B_DQS2	MEM_70D	MEM_DQS	MEM B DOS N<2>
MEM_B_DQS3	MEM_70D	MEM_DQS	MEM B DOS P<3>
MEM_B_DQS3	MEM_70D	MEM_DQS	MEM B DOS N<3>
MEM_B_DQS4	MEM_70D	MEM_DQS	MEM B DOS P<4>
MEM_B_DQS4	MEM_70D	MEM_DQS	MEM B DOS N<4>
MEM_B_DQS5	MEM_70D	MEM_DQS	MEM B DOS P<5>
MEM_B_DQS5	MEM_70D	MEM_DQS	MEM B DOS N<5>
MEM_B_DQS6	MEM_70D	MEM_DQS	MEM B DOS P<6>
MEM_B_DQS6	MEM_70D	MEM_DQS	MEM B DOS N<6>
MEM_B_DQS7	MEM_70D	MEM_DQS	MEM B DOS P<7>
MEM_B_DQS7	MEM_70D	MEM_DQS	MEM B DOS N<7>
MCP_MEM_COMP	MCP_MEM_COMP	MCP_MEM_COMP	MCP MEM COMP VDD
MCP_MEM_COMP	MCP_MEM_COMP	MCP_MEM_COMP	MCP MEM COMP GND

SYNC_MASTER=K87_MLB SYNC_DATE=02/26/2010

Memory Constraints

Apple Inc.

DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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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_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF
CLK_PCIE_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	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE	*	=3X_DIELECTRIC	?	PCIE	TOP,BOTTOM	=4X_DIELECTRIC	?
CLK_PCIE	*	20 MIL	?				
MCP_PEX_COMP	*	8 MIL	?				

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.3

NEED PCIe Gen1/Gen2 notes!

Analog 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
CRT_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT	NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CRT	*	20 MIL	?	CRT	CRT	*	CRT_2CRT
CRT_2CRT	*	15 MIL	?				
CRT_2CLK	*	50 MIL	?				
CRT_2SWITCHER	*	250 MIL	?				
CRT_SYNC	*	=4x_DIELECTRIC	?				
MCP_DAC_COMP	*	=2x_DIELECTRIC	?				

CRT signal single-ended impedance varies by location:
 - 37.5-ohm from MCP to first termination resistor.
 - 50-ohm from first to second termination resistor.
 - 75-ohm from output of three-pole filter to connector (if possible).
 R/G/B signals should be matched as close as possible and < 10 inches.
 SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.4.1.

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_90D	*	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF	=90_OHM_DIFF
LVDS_100D	*	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF	=100_OHM_DIFF
MCP_DV_COMP	*	Y	20 MIL	20 MIL	=STANDARD	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DISPLAYPORT	*	=3x_DIELECTRIC	?	DISPLAYPORT	TOP,BOTTOM	=4x_DIELECTRIC	?
LVDS	*	=3x_DIELECTRIC	?	LVDS	TOP,BOTTOM	=4x_DIELECTRIC	?

LVDS intra-pair matching should be 5 mils. Pairs should be matched within 100 mils.
 NOTE: NV DG recommends 90 ohm differential for LVDS, but cable/display assume 100 ohm.
 DisplayPort/TMDS intra-pair matching should be 5 ps. Inter-pair matching should be within 100 ps.
 DisplayPort AUX CH intra-pair matching should be 5 ps. No relationship to other signals.
 Max trace length: LVDS 10 inches, DP 8.5 inches.
 SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.4.2

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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SATA	*	=3x_DIELECTRIC	?	SATA	TOP,BOTTOM	=4x_DIELECTRIC	?
SATA_TERMP	*	8 MIL	?				

SATA intra-pair matching should be 1 ps.
 Max trace length: 12 inches for SATA Gen1/Gen2, TBD for SATA Gen3.
 SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.6

MCP89 Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
PEG_R2D	PCIE_90D	PCIE	PEG R2D P<15..0>
PEG_R2D	PCIE_90D	PCIE	PEG R2D N<15..0>
PEG_R2D	PCIE_90D	PCIE	PEG R2D C P<15..0>
PEG_R2D	PCIE_90D	PCIE	PEG R2D C N<15..0>
PEG_D2R	PCIE_90D	PCIE	PEG D2R P<15..0>
PEG_D2R	PCIE_90D	PCIE	PEG D2R N<15..0>
PEG_D2R	PCIE_90D	PCIE	PEG D2R C P<15..0>
PEG_D2R	PCIE_90D	PCIE	PEG D2R C N<15..0>
PCIE_AP_R2D	PCIE_90D	PCIE	PCIE AP R2D P
PCIE_AP_R2D	PCIE_90D	PCIE	PCIE AP R2D N
PCIE_AP_R2D	PCIE_90D	PCIE	PCIE AP R2D C P
PCIE_AP_R2D	PCIE_90D	PCIE	PCIE AP R2D C N
PCIE_AP_D2R	PCIE_90D	PCIE	PCIE AP D2R P
PCIE_AP_D2R	PCIE_90D	PCIE	PCIE AP D2R N
PCIE_ENET_R2D	PCIE_90D	PCIE	PCIE ENET R2D P
PCIE_ENET_R2D	PCIE_90D	PCIE	PCIE ENET R2D N
PCIE_ENET_R2D	PCIE_90D	PCIE	PCIE ENET R2D C P
PCIE_ENET_R2D	PCIE_90D	PCIE	PCIE ENET R2D C N
PCIE_ENET_D2R	PCIE_90D	PCIE	PCIE ENET D2R P
PCIE_ENET_D2R	PCIE_90D	PCIE	PCIE ENET D2R N
PCIE_ENET_D2R	PCIE_90D	PCIE	PCIE ENET D2R C P
PCIE_ENET_D2R	PCIE_90D	PCIE	PCIE ENET D2R C N
PCIE_FW_R2D	PCIE_90D	PCIE	PCIE FW R2D P
PCIE_FW_R2D	PCIE_90D	PCIE	PCIE FW R2D N
PCIE_FW_R2D	PCIE_90D	PCIE	PCIE FW R2D C P
PCIE_FW_R2D	PCIE_90D	PCIE	PCIE FW R2D C N
PCIE_FW_D2R	PCIE_90D	PCIE	PCIE FW D2R P
PCIE_FW_D2R	PCIE_90D	PCIE	PCIE FW D2R N
PCIE_FW_D2R	PCIE_90D	PCIE	PCIE FW D2R C P
PCIE_FW_D2R	PCIE_90D	PCIE	PCIE FW D2R C N
MCP_PEG0_BEECLK	CLK_PCIE_100D	CLK_PCIE	PEG CLK100M P
MCP_PEG0_BEECLK	CLK_PCIE_100D	CLK_PCIE	PEG CLK100M N
MCP_PEG1_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M AP P
MCP_PEG1_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M AP N
MCP_PEG2_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M ENET P
MCP_PEG2_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M ENET N
MCP_PEG3_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M FW P
MCP_PEG3_BEECLK	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M FW N
MCP_PEX_CLK_COMP		MCP_PEX_COMP	MCP PEX0 TERMP
CRT_RED	CRT_50S	CRT	CRT IG R C PR
CRT_GREEN	CRT_50S	CRT	CRT IG G Y Y
CRT_BLUE	CRT_50S	CRT	CRT IG B COMP PB
CRT_SYNC	CRT_50S	CRT_SYNC	CRT IG HSYNC
CRT_SYNC	CRT_50S	CRT_SYNC	CRT IG VSYNC
MCP_DAC_RSET		MCP_DAC_COMP	MCP TV DAC RSET
MCP_DAC_VREF		MCP_DAC_COMP	MCP TV DAC VREF
TMDS_IG_TXC	DP_90D	DISPLAYPORT	TMDS IG TXC P
TMDS_IG_TXC	DP_90D	DISPLAYPORT	TMDS IG TXC N
TMDS_IG_TXD	DP_90D	DISPLAYPORT	TMDS IG TXD P<5..0>
TMDS_IG_TXD	DP_90D	DISPLAYPORT	TMDS IG TXD N<5..0>
DP_EXT_ML	DP_90D	DISPLAYPORT	DP IG ML P<3..0>
DP_EXT_ML	DP_90D	DISPLAYPORT	DP IG ML N<3..0>
DP_EXT_AUX_CH	DP_90D	DISPLAYPORT	DP IG AUX CH P
DP_EXT_AUX_CH	DP_90D	DISPLAYPORT	DP IG AUX CH N
MCP_TMDS0_RSET	MCP_DV_COMP		MCP TMDS0 RSET
MCP_TMDS0_VPROBE			MCP TMDS0 VPROBE
LVDS_IG_A_CLK	LVDS_100D	LVDS	LVDS IG A CLK P
LVDS_IG_A_CLK	LVDS_100D	LVDS	LVDS IG A CLK N
LVDS_IG_A_DATA	LVDS_100D	LVDS	LVDS IG A DATA P<2..0>
LVDS_IG_A_DATA	LVDS_100D	LVDS	LVDS IG A DATA N<2..0>
LVDS_IG_A_DATA3	LVDS_100D	LVDS	LVDS IG A DATA P<3>
LVDS_IG_A_DATA3	LVDS_100D	LVDS	LVDS IG A DATA N<3>
LVDS_IG_B_CLK	LVDS_100D	LVDS	LVDS IG B CLK P
LVDS_IG_B_CLK	LVDS_100D	LVDS	LVDS IG B CLK N
LVDS_IG_B_DATA	LVDS_100D	LVDS	LVDS IG B DATA P<2..0>
LVDS_IG_B_DATA	LVDS_100D	LVDS	LVDS IG B DATA N<2..0>
LVDS_IG_B_DATA3	LVDS_100D	LVDS	LVDS IG B DATA P<3>
LVDS_IG_B_DATA3	LVDS_100D	LVDS	LVDS IG B DATA N<3>
MCP_IFPAB_RSET	MCP_DV_COMP		MCP IFPAB RSET
MCP_IFPAB_VPROBE			MCP IFPAB VPROBE
SATA_HDD_R2D	SATA_90D	SATA	SATA HDD R2D C P
SATA_HDD_R2D	SATA_90D	SATA	SATA HDD R2D C N
SATA_HDD_R2D	SATA_90D	SATA	SATA HDD R2D P
SATA_HDD_R2D	SATA_90D	SATA	SATA HDD R2D N
SATA_HDD_D2R	SATA_90D	SATA	SATA HDD D2R P
SATA_HDD_D2R	SATA_90D	SATA	SATA HDD D2R N
SATA_HDD_D2R	SATA_90D	SATA	SATA HDD D2R C P
SATA_HDD_D2R	SATA_90D	SATA	SATA HDD D2R C N
SATA_ODD_R2D	SATA_90D	SATA	SATA ODD R2D C P
SATA_ODD_R2D	SATA_90D	SATA	SATA ODD R2D C N
SATA_ODD_R2D	SATA_90D	SATA	SATA ODD R2D P
SATA_ODD_R2D	SATA_90D	SATA	SATA ODD R2D N
SATA_ODD_D2R	SATA_90D	SATA	SATA ODD D2R P
SATA_ODD_D2R	SATA_90D	SATA	SATA ODD D2R N
SATA_ODD_D2R	SATA_90D	SATA	SATA ODD D2R C P
SATA_ODD_D2R	SATA_90D	SATA	SATA ODD D2R C N
MCP_SATA_TERMP		SATA_TERMP	MCP SATA TERMP

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

MCP Constraints 1

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DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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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_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD
CLK_LPC_55S	*	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
LPC	*	=1.5x_DIELECTRIC	?
CLK_LPC	*	=2x_DIELECTRIC	?

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.7

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
MCP_USB_RBIA5	*	=STANDARD	8 MIL	8 MIL	=STANDARD	=STANDARD	=STANDARD
USB_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	SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB	*	=2x_DIELECTRIC	?	USB	TOP,BOTTOM	=4x_DIELECTRIC	?

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.8

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

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

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.9

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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
HDA	*	=2x_DIELECTRIC	?
MCP_HDA_COMP	*	8 MIL	?

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.10

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	*	=1.5x_DIELECTRIC	?

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.11

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	*	=1.5x_DIELECTRIC	?

SOURCE: MCP89 Interface DG (DG-04625-001_v0.9), Section 2.12

MCP89 Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE		PROPERTY	VALUE
	PHYSICAL	SPACING		
LPC_AD	LPC_55S	LPC	LPC AD<3..0>	19 35 37
LPC_FRAME_L	LPC_55S	LPC	LPC FRAME L	19 35 37
LPC_RESET_L	LPC_55S	LPC	LPC RESET L	19 25
MCP_LPC_CLK0	CLK_LPC_55S	CLK_LPC	LPC CLK33M SMC R	19 25
	CLK_LPC_55S	CLK_LPC	LPC CLK33M SMC	25 35
	CLK_LPC_55S	CLK_LPC	LPC CLK33M LPCPLUS	25 37
USB_EXT_A	USB_90D	USB	USB EXT_A P	18 34
	USB_90D	USB	USB EXT_A N	18 34
	USB_90D	USB	USB EXT_A MUXED P	34 75
	USB_90D	USB	USB EXT_A MUXED N	34 75
USB_MINI	USB_90D	USB	USB MINI P	9 18
	USB_90D	USB	USB MINI N	9 18
USB_EXTD	USB_90D	USB	USB EXT_D P	9 18
	USB_90D	USB	USB EXT_D N	9 18
USB_CAMERA	USB_90D	USB	USB CAMERA P	18 64
	USB_90D	USB	USB CAMERA N	18 64
USB_BT	USB_90D	USB	USB BT P	18 30
	USB_90D	USB	USB BT N	18 30
USB_TP_A	USB_90D	USB	USB TP_A P	18 43
	USB_90D	USB	USB TP_A N	18 43
USB_IR	USB_90D	USB	USB IR P	9 18
	USB_90D	USB	USB IR N	9 18
USB_EXTR	USB_90D	USB	USB EXTB P	18 34
	USB_90D	USB	USB EXTB N	18 34
USB_T57	USB_90D	USB	USB T57 P	9 18
	USB_90D	USB	USB T57 N	9 18
USB_EXTC	USB_90D	USB	USB EXTC P	9 18
	USB_90D	USB	USB EXTC N	9 18
USB_SDCARD	USB_90D	USB	USB SDCARD P	9 18
	USB_90D	USB	USB SDCARD N	9 18
USB_WM	USB_90D	USB	USB WM P	9 18
	USB_90D	USB	USB WM N	9 18
MCP_USB_RBIA5	MCP_USB_RBIA5		MCP USB RBIA5 GND	18
SMBUS_MCP_0_CLK	SMB_55S	SMB	SMBUS MCP 0 CLK	13 19 38
SMBUS_MCP_0_DATA	SMB_55S	SMB	SMBUS MCP 0 DATA	13 19 38
(SMBUS_SMC_MGMT_SCL)	SMB_55S	SMB	SMBUS MCP 1 CLK	19 38
(SMBUS_SMC_MGMT_SDA)	SMB_55S	SMB	SMBUS MCP 1 DATA	19 38
HDA_BIT_CLK	HDA_55S	HDA	HDA BIT_CLK	19 48
	HDA_55S	HDA	HDA BIT_CLK R	19
HDA_SYNC	HDA_55S	HDA	HDA SYNC	19 48
	HDA_55S	HDA	HDA SYNC R	19
HDA_RST_L	HDA_55S	HDA	HDA RST L	19 48
	HDA_55S	HDA	HDA RST L	19 48
HDA_SDIN0	HDA_55S	HDA	HDA SDIN0	48
	HDA_55S	HDA	HDA SDIN CODEC	48
HDA_SDOUT	HDA_55S	HDA	HDA SDOUT	19 48
	HDA_55S	HDA	HDA SDOUT R	19
MCP_HDA_PULLDN_COMP	MCP_HDA_COMP		MCP HDA PULLDN COMP	19
MCP_SUS_CLK	CLK_SLOW_55S	CLK_SLOW	PM CLK32K SUSCLK R	19 25
	CLK_SLOW_55S	CLK_SLOW	PM CLK32K SUSCLK	25 35
SPI_CLK	SPI_55S	SPI	SPI CLK R	19 37
	SPI_55S	SPI	SPI CLK	7 37
SPI_MOST	SPI_55S	SPI	SPI MOST R	19 37
	SPI_55S	SPI	SPI MOST	7 37
SPI_MISO	SPI_55S	SPI	SPI MISO	7 19 37
SPI_CS0	SPI_55S	SPI	SPI CS0 R L	19 37
	SPI_55S	SPI	SPI CS0 L	7 37
	SPI_55S	SPI	SPI MLB CLK	37 47
	SPI_55S	SPI	SPI MLB MOSI	37 47
	SPI_55S	SPI	SPI MLB MISO	37 47
	SPI_55S	SPI	SPI MLB CS L	37 47
	SPI_55S	SPI	SPI ALT CLK	37
	SPI_55S	SPI	SPI ALT MOSI	37
	SPI_55S	SPI	SPI ALT MISO	37
	SPI_55S	SPI	SPI ALT CS L	37

SYNC MASTER=K87 MLB SYNC DATE=02/26/2010

MCP Constraints 2

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DRAWING NUMBER: 051-8407 SIZE: D

REVISION: A.0.0

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MCP RGMII (Ethernet) Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
MCP_MII_COMP	*	-STANDARD	7.5 MIL	7.5 MIL	-STANDARD	-STANDARD	-STANDARD
ENET_MII_55S	*	-55_OHM_SE	-55_OHM_SE	-55_OHM_SE	-55_OHM_SE	-STANDARD	-STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
MCP_WFP_CLK	*	-3:1_SPACING	?
ENET_MII	*	12 MIL	?

SOURCE: MCP73 Interface DG (DG-02974-001_v01), Sections 2.7.2 & 2.7.4

88E1116R (Ethernet PHY) Constraints


PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
ENET_MDI_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
ENET_MDI	*	25 MIL	?

SOURCE: MCP73 Interface DG (DG-02974-001_v01), Section 2.7.4

ELECTRICAL_CONSTRAINT_SET	NET_TYPE			
	PHYSICAL	SPACING		
MCP_MII_COMP	MCP_MII_COMP		MCP MII COMP VDD	18
MCP_MII_COMP	MCP_MII_COMP		MCP MII COMP GND	18
MCP_CLK25M_BUF0	ENET_MII_55S	MCP_BUF0_CLK	MCP CLK25M BUF0 R	9 31
	ENET_MII_55S	MCP_BUF0_CLK	RTL8211 CLK25M CKXTAL1	31
ENET_INTR_L	ENET_MII_55S	ENET_MII	ENET INTR L	
ENET_MDIO	ENET_MII_55S	ENET_MII	ENET MDIO	18 31
ENET_MDC	ENET_MII_55S	ENET_MII	ENET MDC	9 31
ENET_PWRDWN_L	ENET_MII_55S	ENET_MII	ENET PWRDWN L	
	ENET_MII_55S	ENET_MII	ENET CLK125M RXCLK R	31
ENET_RXCLK	ENET_MII_55S	ENET_MII	ENET CLK125M RXCLK	18 31
	ENET_MII_55S	ENET_MII	ENET RXD R<3..0>	31
ENET_RXD	ENET_MII_55S	ENET_MII	ENET RXD<0>	18 31
ENET_RXD_STRAP	ENET_MII_55S	ENET_MII	ENET RXD<3..1>	18 31
ENET_RXD	ENET_MII_55S	ENET_MII	ENET RX CTRL	18 31
	ENET_MII_55S	ENET_MII	ENET RXCTL R	31
	ENET_MII_55S	ENET_MII	ENET CLK125M TXCLK R	31
ENET_TXCLK	ENET_MII_55S	ENET_MII	ENET CLK125M TXCLK	9 31
ENET_TXD0	ENET_MII_55S	ENET_MII	ENET TXD<0>	9 31
ENET_TXD	ENET_MII_55S	ENET_MII	ENET TXD<3..1>	9 31
ENET_TXD	ENET_MII_55S	ENET_MII	ENET TX CTRL	9 31
	ENET_MII_55S	ENET_MII	ENET RESET L	9 31
ENET_MDI	ENET_MDI_100D	ENET_MDI	ENET MDI P<3..0>	31 32
	ENET_MDI_100D	ENET_MDI	ENET MDI N<3..0>	31 32
	ENET_MDI_100D	ENET_MDI	ENET MDI TRAN P<3..0>	32
	ENET_MDI_100D	ENET_MDI	ENET MDI TRAN N<3..0>	32

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SYNC MASTER=K87 MLB		SYNC DATE=02/26/2010	
Ethernet Constraints			
 Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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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
IT01_DIFFPAIR	*	=STANDARD	=STANDARD	=STANDARD	=STANDARD	0.1 MM	0.1 MM

SMC SMBus Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE			
	PHYSICAL	SPACING		
SMBUS_SMC_A_S3_SCL	SMB_55S	SMB	SMBUS_SMC_A_S3_SCL	7 38
SMBUS_SMC_A_S3_SDA	SMB_55S	SMB	SMBUS_SMC_A_S3_SDA	7 38
SMBUS_SMC_B_S0_SCL	SMB_55S	SMB	SMBUS_SMC_B_S0_SCL	38
SMBUS_SMC_B_S0_SDA	SMB_55S	SMB	SMBUS_SMC_B_S0_SDA	38
SMBUS_SMC_0_S0_SCL	SMB_55S	SMB	SMBUS_SMC_0_S0_SCL	38
SMBUS_SMC_0_S0_SDA	SMB_55S	SMB	SMBUS_SMC_0_S0_SDA	38
SMBUS_SMC_BSA_SCL	SMB_55S	SMB	SMBUS_SMC_BSA_SCL	7 38
SMBUS_SMC_BSA_SDA	SMB_55S	SMB	SMBUS_SMC_BSA_SDA	7 38
SMBUS_SMC_MGMT_SCL	SMB_55S	SMB	SMBUS_SMC_MGMT_SCL	38
SMBUS_SMC_MGMT_SDA	SMB_55S	SMB	SMBUS_SMC_MGMT_SDA	38

SMBus Charger Net Properties

ELECTRICAL_CONSTRAINT_SET	NET_TYPE			
	PHYSICAL	SPACING		
CHGR_CSI	1T01_DIEFPAIR		CHGR_CSI_P	55
	1T01_DIEFPAIR		CHGR_CSI_N	55
	1T01_DIEFPAIR		CHGR_CSI_R_P	55
	1T01_DIEFPAIR		CHGR_CSI_R_N	55
CHGR_CSO	1T01_DIEFPAIR		CHGR_CSO_P	55
	1T01_DIEFPAIR		CHGR_CSO_N	55
	1T01_DIEFPAIR		CHGR_CSO_R_P	40 55
	1T01_DIEFPAIR		CHGR_CSO_R_N	40 55

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SYNC_MASTER=K87_MLB		SYNC_DATE=02/26/2010	
PAGE TITLE SMC Constraints			
DRAWING NUMBER 051-8407		SIZE D	
REVISION A.0.0		BRANCH	
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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_1T01_55S	*	=1:1_DIFFPAIR	=55_OHM_SE	=55_OHM_SE	=55_OHM_SE	=1:1_DIFFPAIR	=1:1_DIFFPAIR
THERM_1T01_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

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
ENETCONN	*	25 MILS	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
GND	*	=STANDARD	?
MEM_POWER	*	=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
MEM_CLK	GND	*	GND_P2MM
MEM_CMD	GND	*	GND_P2MM
MEM_CTRL	GND	*	GND_P2MM
MEM_DATA	GND	*	GND_P2MM
MEM_DQS	GND	*	GND_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
MEM_CLK	MEM_POWER	*	PWR_P2MM
MEM_CMD	MEM_POWER	*	PWR_P2MM
MEM_CTRL	MEM_POWER	*	PWR_P2MM
MEM_DATA	MEM_POWER	*	PWR_P2MM
MEM_DQS	MEM_POWER	*	PWR_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
CLK_FSB	GND	*	GND_P2MM
CPU_COMP	GND	*	GND_P2MM
CPU_GTLREF	GND	*	GND_P2MM
CPU_VCCSENSE	GND	*	GND_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
LVDS	GND	*	GND_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
ENET_MDI	GND	*	GND_P2MM

MCP Fanout Constraint Relaxations

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	*	VERRIDE	VERRIDE	0.09 MM_OVERRIDE	5.8 MM_OVERRIDE	VERRIDE	VERRIDE
MCP_DV_COMP_OVERRIDE	TOP_OVERRIDE	VERRIDE	VERRIDE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	VERRIDE	VERRIDE
MCP_MEM_COMP_OVERRIDE	TOP_OVERRIDE	VERRIDE	VERRIDE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	VERRIDE	VERRIDE
MCP_MII_COMP_OVERRIDE	TOP_OVERRIDE	VERRIDE	VERRIDE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	VERRIDE	VERRIDE
MCP_USB_RBIA_OVERRIDE	TOP_OVERRIDE	VERRIDE	VERRIDE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	VERRIDE	VERRIDE
MCP_DV_COMP_OVERRIDE	*	VERRIDE	VERRIDE	0.25 MM_OVERRIDE	250 MIL_OVERRIDE	VERRIDE	VERRIDE

Misc Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
(PCIE_AP)	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M AP CONN P
	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M AP CONN N
(USB_EXT_A)	USR_90D	USR	USB EXT_A MUXED P
(USB_EXT_A)	USR_90D	USR	USB EXT_A MUXED N
(USB_EXT_A)	USR_90D	USR	USB LT1 P
(USB_EXT_A)	USR_90D	USR	USB LT1 N
(USB_TPAD)	USR_90D	USR	USB TPAD R P
(USB_TPAD)	USR_90D	USR	USB TPAD R N
(USB_CAMERA)	USR_90D	USR	USB CAMERA CONN P
(USB_CAMERA)	USR_90D	USR	USB CAMERA CONN N
	USR_90D	USR	USB LT2 P
	USR_90D	USR	USB LT2 N
	ENET_MDI_100D	ENETCONN	ENETCONN P<3..0>
	ENET_MDI_100D	ENETCONN	ENETCONN N<3..0>
	SATA_90D	SATA	SATA ODD R2D UF P
	SATA_90D	SATA	SATA ODD R2D UF N
	SATA_90D	SATA	SATA ODD D2R UF P
	SATA_90D	SATA	SATA ODD D2R UF N
	SATA_90D	SATA	SATA HDD D2R FILT P
	SATA_90D	SATA	SATA HDD D2R FILT N
	SATA_90D	SATA	SATA HDD D2R UF P
	SATA_90D	SATA	SATA HDD D2R UF N
	SATA_90D	SATA	SATA HDD R2D UF P
	SATA_90D	SATA	SATA HDD R2D UF N
	SATA_90D	SATA	SATA HDD D2R RDRV IN P
	SATA_90D	SATA	SATA HDD D2R RDRV IN N
	SATA_90D	SATA	SATA HDD R2D RDRV IN P
	SATA_90D	SATA	SATA HDD R2D RDRV IN N
	SATA_90D	SATA	SATA HDD D2R RDRV OUT P
	SATA_90D	SATA	SATA HDD D2R RDRV OUT N
	SATA_90D	SATA	SATA HDD R2D RDRV OUT P
	SATA_90D	SATA	SATA HDD R2D RDRV OUT N
	SATA_90D	SATA	SATA HDD D2R NORDRV P
	SATA_90D	SATA	SATA HDD R2D NORDRV P
	SATA_90D	SATA	SATA HDD R2D NORDRV N
	SATA_90D	SATA	SATA HDD R2D NORDRV N
	PCIE_AP_D2R	PCIE	CONN PCIE MINI D2R P
	PCIE_90D	PCIE	CONN PCIE MINI D2R P
	PCIE_AP_R2D	PCIE	CONN PCIE MINI R2D P
	PCIE_90D	PCIE	CONN PCIE MINI R2D P
	PCIE_90D	PCIE	CONN PCIE MINI R2D N
	USB_BT	USR	CONN USB2 BT P
	USB_90D	USR	CONN USB2 BT N
	LVDS_IG_A_CLK	LVDS	LVDS IG A CLK F P
	LVDS_100D	LVDS	LVDS IG A CLK F N
	MCP_PEL_REFCLK	CLK_PCIE_100D	PCIE CLK100M MINI CONN P
	CLK_PCIE_100D	CLK_PCIE	PCIE CLK100M MINI CONN N
	USB_EXT_A	USR	CONN USB EXT_A P
	USR_90D	USR	CONN USB EXT_A N
	USR_90D	USR	CONN USB EXT_B P
	USR_90D	USR	CONN USB EXT_B N

Power Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D1 P
	THERM_1T01_55S	THERM	CPUTHMSNS D1 N
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D2 P
	THERM_1T01_55S	THERM	CPUTHMSNS D2 N
CPU_THERMD	THERM_1T01_55S	THERM	CPU THERMD P
	THERM_1T01_55S	THERM	CPU THERMD N
MCPTHMSNS_D2	THERM_1T01_55S	THERM	MCPTHMSNS D2 P
	THERM_1T01_55S	THERM	MCPTHMSNS D2 N
MCP_THMDIODE	THERM_1T01_55S	THERM	MCP THMDIODE P
	THERM_1T01_55S	THERM	MCP THMDIODE N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LV5 S3 P
	SENSE_1T01_55S	SENSE	ISNS LV5 S3 N
	SENSE_1T01_55S	SENSE	ISNS LV5 S3 R P
	SENSE_1T01_55S	SENSE	ISNS LV5 S3 R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS AIRPORT P
	SENSE_1T01_55S	SENSE	ISNS AIRPORT N
	SENSE_1T01_55S	SENSE	ISNS AIRPORT R P
	SENSE_1T01_55S	SENSE	ISNS AIRPORT R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS HDD P
	SENSE_1T01_55S	SENSE	ISNS HDD N
	SENSE_1T01_55S	SENSE	ISNS HDD R P
	SENSE_1T01_55S	SENSE	ISNS HDD R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LCDBKLT P
	SENSE_1T01_55S	SENSE	ISNS LCDBKLT N
	SENSE_1T01_55S	SENSE	ISNS LCDBKLT R P
	SENSE_1T01_55S	SENSE	ISNS LCDBKLT R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS ODD P
	SENSE_1T01_55S	SENSE	ISNS ODD N
	SENSE_1T01_55S	SENSE	ISNS ODD R P
	SENSE_1T01_55S	SENSE	ISNS ODD R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS CPUVTT P
	SENSE_1T01_55S	SENSE	ISNS CPUVTT N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	MCPCORES0 VSEN P
	SENSE_1T01_55S	SENSE	MCPCORES0 VSEN N
	MEM_POWER		PP1V5R1V35 S3
	SR_POWER		PP3V3 S5
	SR_POWER		PP3V3 S0
	SR_POWER		PP1V5 S0
	GND		GND

Audio Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
	DIFFPATR	AUDIO	AUD SPKRAMP LIN P
	DIFFPATR	AUDIO	AUD SPKRAMP LIN N
	DIFFPATR	AUDIO	AUD SPKRAMP SUBIN P
	DIFFPATR	AUDIO	AUD SPKRAMP SUBIN N
	DIFFPATR	AUDIO	AUD SPKRAMP RIN P
	DIFFPATR	AUDIO	AUD SPKRAMP RIN N
	DIFFPATR	AUDIO	SSM2315L P
	DIFFPATR	AUDIO	SSM2315L N
	DIFFPATR	AUDIO	SSM2315S P
	DIFFPATR	AUDIO	SSM2315S N
	DIFFPATR	AUDIO	SSM2315R P
	DIFFPATR	AUDIO	SSM2315R N
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN L OUT P
	DIFFPATR	AUDIO	SPKRCONN L OUT N
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN S OUT P
	DIFFPATR	AUDIO	SPKRCONN S OUT N
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN R OUT P
	DIFFPATR	AUDIO	SPKRCONN R OUT N
	DIFFPATR	AUDIO	BI MIC P
	DIFFPATR	AUDIO	BI MIC N
	DIFFPATR	AUDIO	HS MIC P
	DIFFPATR	AUDIO	HS MIC N

GRAPHICS NET PROPERTIES

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
(DP_EXT_ML)	DP_90D	DISPLAYPORT	DP EXT ML P<3..0>
	DP_90D	DISPLAYPORT	DP EXT ML N<3..0>
	DP_90D	DISPLAYPORT	DP EXT ML C P<3..0>
	DP_90D	DISPLAYPORT	DP EXT ML C N<3..0>
	DP_90D	DISPLAYPORT	DP EXT ML F P<3..0>
	DP_90D	DISPLAYPORT	DP EXT ML F N<3..0>
(DP_EXT_AUX_CH)	DP_90D	DISPLAYPORT	DP EXT AUX CH C P
	DP_90D	DISPLAYPORT	DP EXT AUX CH C N
	DP_90D	DISPLAYPORT	DP EXT DDC DATA
	DP_90D	DISPLAYPORT	DP EXT DDC CLK

SYNC MASTER=K87_MLB		SYNC DATE=02/26/2010	
K87 SPECIFIC CONSTRAINTS			
Apple Inc.		DRAWING NUMBER	051-8407
		REVISION	A.0.0
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K87 BOARD-SPECIFIC SPACING & PHYSICAL CONSTRAINTS

BOARD LAYERS				BOARD AREAS				BOARD UNITS (MIL OR MM)	ALLEGRO VERSION
TOP, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, BOTTOM				NO_TYPE, NOA_P10M				MM	16.5.1
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	$+50_{OHMS}$	0.100MM	30 MM	0 MM	0 MM		
STANDARD	*	Y	-DEFAULT	-DEFAULT	12.7 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	0.590 MM	0.090 MM					
55_OHM_SE	*	Y	0.576 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	0.115 MM	0.115 MM					
50_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		
40_OHM_SE	TOP, BOTTOM	Y	0.165 MM	0.100 MM					
40_OHM_SE	*	Y	0.126 MM	0.100 MM	-STANDARD	-STANDARD	-STANDARD		
PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP		
2704_OHM_SE	TOP, BOTTOM	Y	0.310 MM	0.310 MM					
2704_OHM_SE	*	Y	0.222 MM	0.222 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		
70_OHM_DIFF	*	N	-STANDARD	-STANDARD	-STANDARD	-STANDARD	-STANDARD		
70_OHM_DIFF	103, 104, 109, 110, 111	Y	0.151 MM	0.100 MM	-STANDARD	0.234 MM	0.234 MM		
70_OHM_DIFF	TOP, BOTTOM	Y	0.185 MM	0.100 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		
90_OHM_DIFF	*	N	-STANDARD	-STANDARD	-STANDARD	-STANDARD	-STANDARD		
90_OHM_DIFF	103, 104, 109, 110, 111	Y	0.595 MM	0.095 MM		0.234 MM	0.234 MM		
90_OHM_DIFF	TOP, BOTTOM	Y	0.112 MM	0.112 MM		0.220 MM	0.220 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	103, 104, 109, 110, 111	Y	0.975 MM	0.075 MM		0.244 MM	0.244 MM		
100_OHM_DIFF	TOP, BOTTOM	Y	0.091 MM	0.091 MM		0.230 MM	0.230 MM		
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		


SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DEFAULT	*	0.08 MM	?
STANDARD	*	-DEFAULT	?
NOA_P10M	*	-DEFAULT	?
NOA_P20M	*	-DEFAULT	?
NOA_P30M	*	-DEFAULT	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1.5:1_SPACING	*	0.15 MM	?
2:1_SPACING	*	0.2 MM	?
2.5:1_SPACING	*	0.25 MM	?
3:1_SPACING	*	0.3 MM	?
4:1_SPACING	*	0.4 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1_5X_DIELECTRIC	TOP, BOTTOM	0.105 MM	?
2X_DIELECTRIC	TOP, BOTTOM	0.140 MM	?
3X_DIELECTRIC	TOP, BOTTOM	0.210 MM	?
4X_DIELECTRIC	TOP, BOTTOM	0.280 MM	?
5X_DIELECTRIC	TOP, BOTTOM	0.350 MM	?
1_5X_DIELECTRIC	*	0.095 MM	?
2X_DIELECTRIC	*	0.126 MM	?
3X_DIELECTRIC	*	0.189 MM	?
4X_DIELECTRIC	*	0.252 MM	?
5X_DIELECTRIC	*	0.315 MM	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
*	*	NOA_P10M	NOA_P10M
MEM_CLK	*	NOA_P10M	NOA_P20M
CLK_PSB	*	NOA_P10M	NOA_P20M
CLK_LPC	*	NOA_P10M	NOA_P20M
CLK_PCIE	*	NOA_P10M	NOA_P20M
CLK_SLOW	*	NOA_P10M	NOA_P20M
PSB_DSTR	PSB_DSTR	NOA_P10M	NOA_P30M

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
MEM_405	NOA_P10M	STANDARD

SYNC MASTER=K87_MLB		SYNC DATE=12/03/2009	
PAGE TITLE K87 RULE DEFINITIONS			
 Apple Inc.	DRAWING NUMBER	051-8407	SIZE D
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