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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
C	0000897412	PRODUCTION RELEASED		2010-04-26

SCHEM MLB_LDO K87

SCRATCHO

04/26/2010

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17	MCP Graphics	T27_MLB	02/16/2010
18	MCP SATA, USB & Ethernet	T27_MLB	02/16/2010
19	MCP HDA, LPC & MISC	T27_MLB	02/16/2010
20	MCP Power & Ground	T27_MLB	02/16/2010
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22	MCP89 GFX Core Rail Gating	T27_MLB	12/15/2009
23	MCP Standard Decoupling	(T27_MLB)	(11/16/2009)
24	MCP Graphics Support	T27_MLB	02/16/2010
25	SB Misc	(T27_MLB)	(10/07/2009)
26	DDR3 SO-DIMM Connector A	T27_MLB	02/16/2010
27	DDR3 SO-DIMM Connector B	T27_MLB	02/16/2010
28	SO-DIMM Pinswaps	MASTER	MASTER
29	FSB/DDR3 Vref Margining	T27_MLB	02/16/2010
30	X16 WIRELESS CONNECTOR	MASTER	MASTER
31	Ethernet PHY (RTL8211CL)	MASTER	MASTER
32	ETHERNET CONNECTOR	MASTER	MASTER
33	SATA Connectors	MASTER	MASTER
34	External USB Connectors	(K84_MLB)	(10/03/2009)
35	SMC	T27_MLB	02/16/2010
36	SMC Support	(T27_MLB)	(10/27/2009)
37	LPC+SPI Debug Connector	(T27_MLB)	(12/15/2009)
38	K87 SMBus Connections	MASTER	MASTER

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39	Voltage Sensing	T27_MLB	02/16/2010
40	Current Sensing	T27_MLB	02/02/2010
41	Thermal Sensors	MASTER	MASTER
42	Fan Connector	T27_MLB	02/16/2010
43	WELLSPRING 1	T27_MLB	02/16/2010
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45	SMS	MASTER	MASTER
46	DEBUG SENSORS AND ADC	MASTER	MASTER
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49	AUDIO: LINE INPUT FILTER	AUDIO	02/16/2010
50	AUDIO: HEADPHONE FILTER	AUDIO	02/16/2010
51	AUDIO: SPEAKER AMP	AUDIO	02/16/2010
52	AUDIO: JACK	AUDIO	02/16/2010
53	AUDIO: JACK TRANSLATORS	AUDIO	02/16/2010
54	DC-In & Battery Connectors	MASTER	MASTER
55	PBus Supply & Battery Charger	(K6_MLB)	(11/06/2009)
56	5V/3.3V SUPPLY	(K6_MLB)	(10/27/2009)
57	1.5V/0.75V DDR3 SUPPLY	(K6_MLB)	(11/06/2009)
58	IMVP6 CPU VCore Regulator	(K84_MLB)	(11/18/2009)
59	MCP VCore Regulator	(K6_MLB)	(10/27/2009)
60	CPU VTT(1.05V) SUPPLY	(K84_MLB)	(02/04/2009)
61	Misc Power Supplies	MASTER	MASTER
62	Power Sequencing	(T27_MLB)	(10/27/2009)
63	POWER FETS	MASTER	MASTER
64	LVDS CONNECTOR	(K84_MLB)	(10/19/2009)
65	DISPLAYPORT SUPPORT	K6_MLB	02/16/2010
66	DisplayPort Connector	MASTER	MASTER
67	LCD Backlight Driver (MC34845)	MASTER	MASTER
68	LCD Backlight Support	(K84_MLB)	(10/19/2009)
69	CPU/FSB Constraints	T27_MLB	02/16/2010
70	Memory Constraints	T27_MLB	02/16/2010
71	MCP Constraints 1	T27_MLB	02/16/2010
72	MCP Constraints 2	T27_MLB	02/16/2010
73	Ethernet Constraints	MASTER	MASTER
74	SMC Constraints	T27_MLB	02/16/2010
75	K87 SPECIFIC CONSTRAINTS	MASTER	MASTER
76	K87 RULE DEFINITIONS	MASTER	MASTER

Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-8561	1	SCHEM_MLB_LDO_K87	SCM	CRITICAL	
820-2877	1	PCBP_MLB_LDO_K87	PCB	CRITICAL	

DRAWING TITLE		SCHEM,MLB_LDO,SCRATCHO,K87	
Apple Inc.	DRAWING NUMBER	051-8561	SIZE
	REVISION	C.0.0	D
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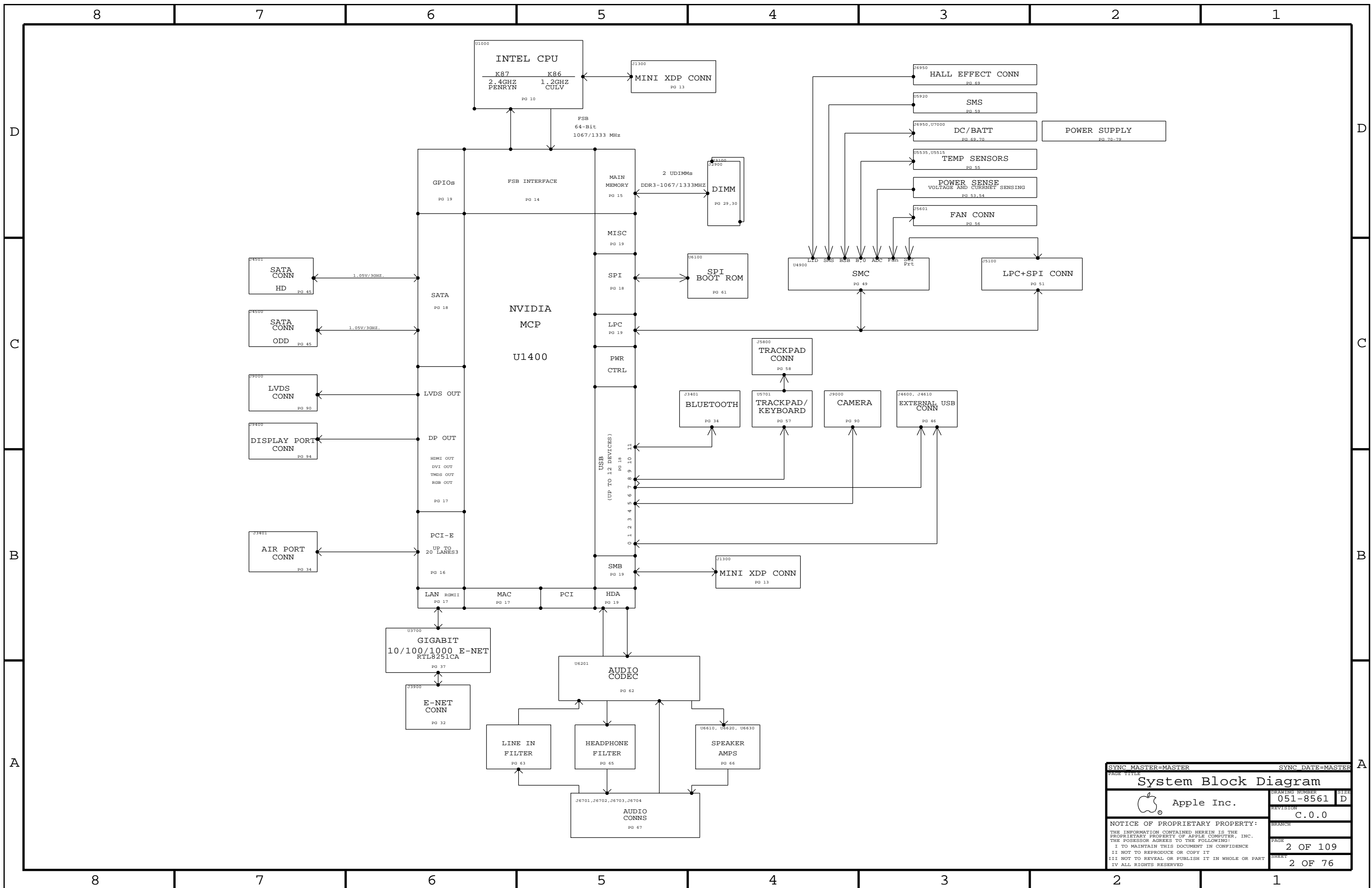
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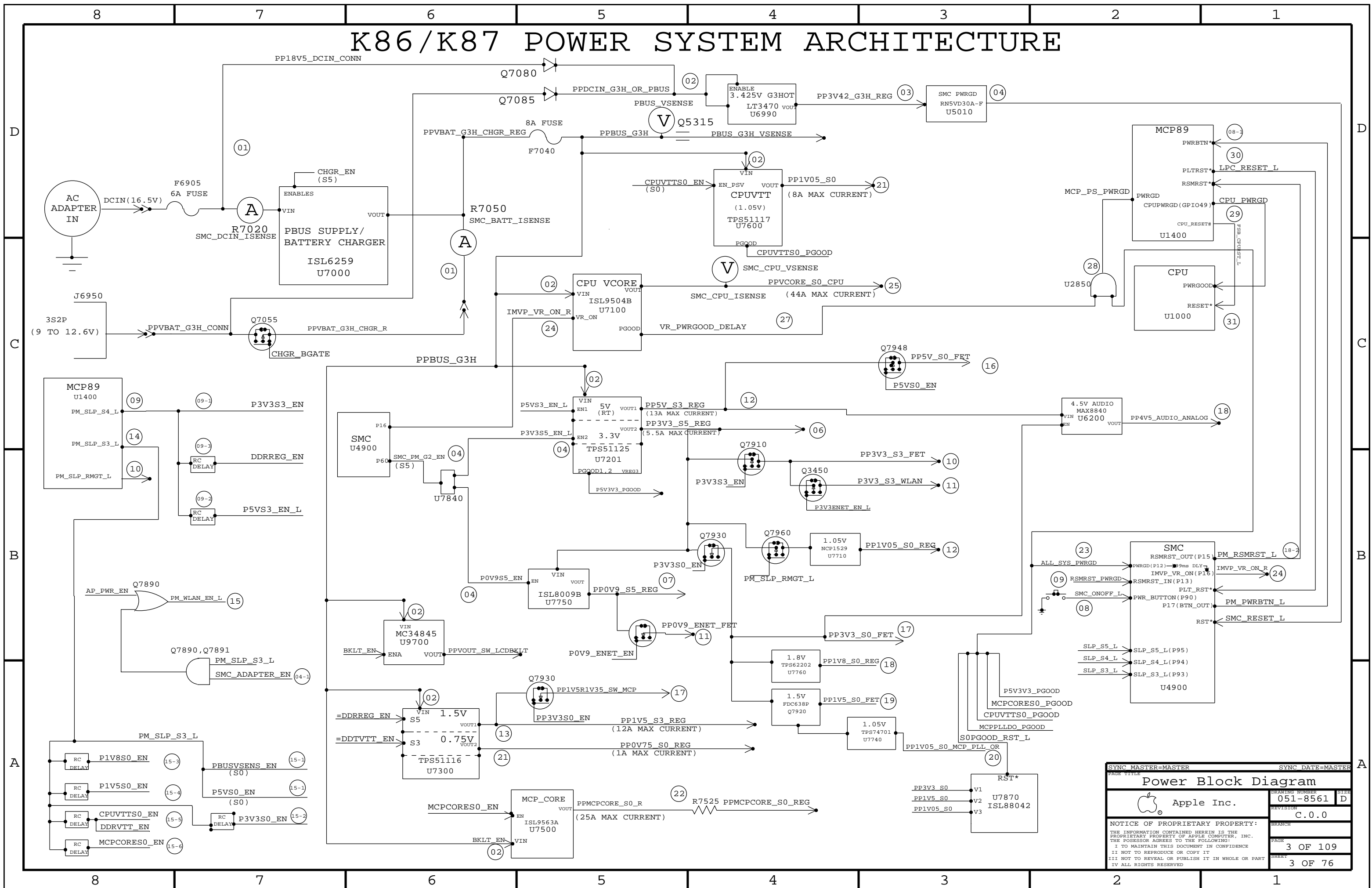
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SYNC MASTER=MASTER		SYNC DATE=MASTER	
System Block Diagram			
 Apple Inc.		DRAWING NUMBER 051-8561	SIZE D
		REVISION C.0.0	BRANCH
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		PAGE 2 OF 109	SHEET 2 OF 76

K86/K87 POWER SYSTEM ARCHITECTURE



SYNC MASTER=MASTER		SYNC DATE=MASTER	
Power Block Diagram			
Apple Inc.		DRAWING NUMBER	051-8561
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		PAGE	3 OF 109
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8		7		6		5		4		3		2		1	
BOM Variants															
BOM NUMBER	BOM NAME					BOM OPTIONS									
639-1115	PCBA,MLB_LDO,FOXCONN,K87					K86_K87_COMMON,K87_SPECIFIC,FOX_DDR_CONN,EEEE:DD16									
639-1116	PCBA,MLB_LDO,MOLEX,K87					K86_K87_COMMON,K87_SPECIFIC,MOLEX_DDR_CONN,EEEE:DD17									
085-1799	K87 MLB_LDO DEVELOPMENT BOM					K86_K87_DEVELOPMENT_PVT									

Development BOM					
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
085-1632	1	K87 MLB_LDO DEVELOPMENT BOM	DEVEL	CRITICAL	DEVELOPMENT_BOM

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,ENET1V05:INT,LED:K86_K87,S0PGOOD_BJT,ENET_ESD,VFRQ:SLP53,SMC_DEBUG:YES,SPI:25MHZ,SDP_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 GROUP		BOM OPTIONS			
PROJECT_PHASE:DEV	DEVELOPMENT_BOM				
PROJECT_PHASE:PROD	K86_K87_DEBUG:PROD				
K86_K87_DEVELOPMENT_ONLY	DEBUG_ADC,LPCPLUS_CON,S0PGOOD_ISL,EFI_DEBUG,MCPLL_LDO,EXT1V05,SDP_CON,LPCPLUS				
K86_K87_DEVELOPMENT_PVT	LPCPLUS_CON,SDP_CON,VREFMRGN:YES,LPCPLUS				
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,MCPHVDD:P2V5,LDO:FIXED,HTOL_SENSE:YES				

Module Parts					
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
33783680	1	PCD,LGDS,FRQ,2.40,25W,1066,R0,3M,BGA	U1000	CRITICAL	CPU:2.4GHZ
33783792	1	CDL,SLOVM,FRQ,1.2,10W,800,R0,1M,BGA	U1000	CRITICAL	CPU:1.2GHZ
33783797	1	IC,MCP89M-A01,31X31MM,BGA1168	U1400	CRITICAL	MCP89M:A01
33783866	1	IC,MCP89M-A02,31X31MM,BGA1168	U1400	CRITICAL	MCP89M:A02
33783876	1	IC,MCP83M-A02,31X31MM,BGA1168	U1400	CRITICAL	MCP83M
51680706	1	CONN,204P,SOD1MM,SOCKET_DCR3,RAM,BGA	J3100	CRITICAL	FOX_DDR_CONN
516-0201	1	CONN,204P,SOD1MM,P=0.6MM	J2900	CRITICAL	FOX_DDR_CONN
51680790	1	CONN,204P,SOD1MM,SOCKET_DCR3,RAM,BGA	J3100	CRITICAL	MOLEX_DDR_CONN
516-0213	1	CONN,204P,SOD1MM,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,ZS0916	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

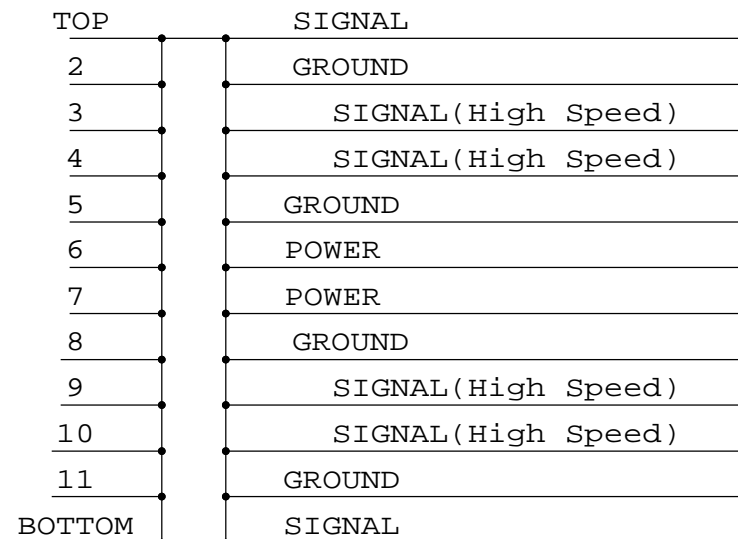
Programmable Parts					
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
338S0563	1	IC,SMC,HSR/2117,9X9MM,TLP,HF	U4900	CRITICAL	SMC:BLANK
341T0252	1	SUBASSY, IC, SMC, K87	U4900	CRITICAL	SMC:PROG_K87
341T0250	1	SUBASSY, IC, SMC, K86	U4900	CRITICAL	SMC:PROG_K86
335S0610	1	IC,FLASH,SPI,32MBIT,3.3V,86MHZ,8-SOP	U6100	CRITICAL	BOOTROM:BLANK
341T0251	1	SUBASSY, IC, BOOT ROM, K86/K87	U6100	CRITICAL	BOOTROM:PROG
337S2983	1	IC,PSOC+ W/ USB,S6 PIN,MFP,CY8C24794	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	DAIJI/YISHAY, MAGLAYERS AS ALTERNATE	
152S0796	152S0685		ALL	CHITAC AS ALTERNATE	
157S0058	157S0055		ALL	DELTA AS ALTERNATE	
138S0603	138S0602		ALL	MURATA AS ALTERNATE	
128S0093	128S0218		ALL	RENAT AS ALTERNATE	
152S0874	152S0516		ALL	MAGLAYERS AS ALTERNATE	
152S0847	152S0586		ALL	MAGLAYERS AS ALTERNATE	
104S0018	104S0023		ALL	DAIJI/YISHAY AS ALTERNATE	
353S2811	353S1832		ALL	NEW INTRODUCED INTERNAL PART AS ALTERNATE	
353S2988	353S2987		ALL	MURATA AS ALTERNATE	
376S0908	376S0634		ALL	CHITAC AS ALTERNATE	
376S0907	376S0634		ALL	CHITAC AS ALTERNATE	
376S0912	376S0868		ALL	CHITAC AS ALTERNATE	

Bar Code Labels / EEE #'s					
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
826-4393	1	LBL,F/N LABEL,PCB,28MM X 6 MM	[EEEE_DD16]	CRITICAL	EEEE:DD16
826-4393	1	LBL,F/N LABEL,PCB,28MM X 6 MM	[EEEE_DD17]	CRITICAL	EEEE:DD17
826-4393	1	LBL,F/N LABEL,PCB,28MM X 6 MM	[EEEE_DD18]	CRITICAL	EEEE:DD18
826-4393	1	LBL,F/N LABEL,PCB,28MM X 6 MM	[EEEE_DD19]	CRITICAL	EEEE:DD19

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/K87 BOARD STACK-UP



SYNC MASTER=(K84 MLB)		SYNC DATE=(01/19/2009)	
PAGE TITLE			
BOM Configuration			
		DRAWING NUMBER	051-8561
		REVISION	C.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
 - REPAIRED K87 CPU 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 (Intersil):
 R7417 from 8.36k => 6.34k 1% (11450296)
 C7418 from 1.2uF => 2.2uF 10% (11450102)
 Implemented different stuffing options for 1-phase vs 2-phase:
 Added IMVP6_2PHASE to the following components:
 R7417, C7428, R7409, R7411, C7406, R7414, C7414, C7413
 Added BOM table to insert the following APNs for IMVP6_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 = 100uF 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, C4586 (10pF) and NOSTUFFED
 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_CPUVTTSSM
 =PPV3_S0_HDP
 =PPV3_S0_MCTREG
 =PPV05_S0_MCP_AVDD_UF
 =PPV3_S0_MCM_B
 =PPV3_S0_PMRCTL
 =PPV3_S0_PDCONN
 Deleted net properties for =PPV3_S3_WLAN
 Changed C7434 from NOSTUFF to IMVP6_2PHASE per Intersil
 Added IMV6_2PHASE to R7413 per Intersil
 Changed C7428 from 0.47uF to 0.33uF (13250101) per Intersil
 Changed component color to green
 Cosmetic cleanup
 Deleted net properties for =PPV5_S3_CAMERA
 Deleted net properties for =PPBUS_S0_LCDKILT
 Added NET_PHYSICAL property to SATA_HDD_D2R_FILT_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 R6620 symbol to K87 Hall effect assembly (33900114)

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 132S0080 (0.22uF) instead of 0.022uF

2009-12-16: 1.8.0
 *** Resynced all changed pages and picked up the following (change notes from T27):
 T27: Swapped USB_EXTB and USB_EXTP for MIP330 (pg. 15) <rdar://7416825> Ensure USB_EXTB is on ports 8-11 (NVRN-612340)
 T27: Changed USB_RBIAS from 931-ohms to 887-ohms per DG v1.3 (pg. 18) <rdar://7459260> Design Guide v1.3 updates
 csa 20: Added C7428 net properties to dismiss false errors (pg. 20). <rdar://7488529> TASK: Waive false CheckPlus errors
 *** Started syncing the following pages:
 csa 29,31: Began syncing from T27 per <rdar://7424246> BOM: K87 needs omit on J3100 and J2900 from T27
 T27: Added BOMOPTIONS and APNs for Foxconn and Molex 50-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_MALVE properties to dismiss false errors (pg. 54).
 T27: Added gain note for U542 and SMC_BATT_ISENSE (pg. 54).
 T27: Changed RC balance on BATT_ISENSE, same time constant (pg. 54).
 csa 57: Began syncing from T27 per <rdar://7432091> BATT_ISENSE filter change to address lower max sink current on ISL6259 BMON pin (K17 auto-shutdown issue)
 R5714 has BOMOPTION 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 <rdar://7459260> Design Guide v1.3 updates
 *** Other changes:
 csa 4: Added BOM table to substitute in parts that have BOMOPTION xxx:K6_K69 (to allow sync with T27)
 Added R5714 (11450125) to table with BOMOPTION LED:K86_K87

2009-12-17: 1.9.0
 csa 4: Added BOM table entry for MCP89-A02 per <rdar://7416858> Task: Get part numbers for A02 rev.
 Changed K87_MCP BOM group to call out MCP89-A02
 csa 34: Changed U340 from AP02 part to AP016 (3430011) per <rdar://7459498> BOM: APN updates for FPP1009 and SAK parts
 Changed R3454 to 100k, 1% (11450411) to match T27 and K69
 Updated DLY text note for U340 to match T27
 Changed R3440 color to green, deleted WF text note about needing PU
 csa 72: Changed L720 from 152S0778 to 152S0778 per <rdar://7472169> K69 L7260 combo footprint
 Alternates table on csa 4 already has 152S0778 as alternate to 152S0693

2009-12-22: 1.10.0
 csa 4: Per <rdar://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 K86 and K86 BOMOPTION in MCP83M
 Per <rdar://problem/7495072> K87: Call out LED:K86_K87 BOMOPTION in the K87_MISC BOM group
 Added LED:K86_K87 BOMOPTION to the K87_MISC BOM group
 Per <rdar://problem/7495116> K87: remove ON Semi alternate for Q2300 (376S0624)
 Removed table entry for an alternate for Q2300 (376S0624)
 Per <rdar://problem/7495021> K86/K87: Replace "S" APNs with "*" APNs for programmed SMC and BR
 Changed BOMOPTION names to call out SUBASSY to the BOM ROM, 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_PRODFACTS BOM group to point to SMC:PROG_K87

csa 69: Per <rdar://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 BOMOPTION 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
 - Conn APN: 51850788

csa 74: Cosmetic change, moved R7413, C7406 BOMOPTION label so they don't look like wire name
 csa 78: Per <rdar://problem/7495000> K87: Add NOSTUFF to R872 to disconnect U780 from ALL_SYS_PWRGD
 Changed BOMOPTION for R872 from S0PGOOD_ISL to NOSTUFF

2010-01-06: 1.11.0
 csa 7: Per <rdar://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_GPI0
 LPCPLUS_GPI1
 SMC_TMS

2010-01-07: 1.12.0
 csa 23: *** BROKE SYNC WITH T27
 Per <rdar://problem/7519025> K86/K87: update all instances of 376S0786 schematic symbols
 Updated Q2355 and Q2356 with new schematic symbols
 The change has been made there
 csa 70: Per <rdar://problem/7519048> K86/K87: change U7000 to 353S2929
 Changed U7000 from 353S2392 to 353S2929
 Updated APN text note

2010-01-08: 2.0.0
 csa 45: Per <rdar://problem/7524364> K86/K87: change SATA HDD D2R passive EQ values
 Removed NOSTUFF from C4585, C4586
 Changed 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 <rdar://problem/7540383> K86: Update CPU part number to 33783792
 Changed U1000 CPU:1.2GHZ BOMOPTION from 33783779 to 33783792

2010-01-13: 2.2.0
 csa 4: Cosmetic: changed text sizes and alignment
 Per <rdar://problem/7540522> K86/K87: Production Debug Components
 Reverted back to SMC BOM, no longer PROD BOM (i.e. reverted much of 2.2.0 changes)
 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:PROD
 SKLT:ENG ==> SKLT:PROD
 SENS_R:ENG ==> SENS_R:PROD
 Removed:
 DEBUG_ADC, S0PGOOD_ISL, EFI_DEBUG, MCPPLL_LDO, EXTV05, MCP_T_DIODE_SENSOR, XDP_CON
 Unchanged:
 LPCPLUS_DEVEL_BOM, SMC_DEBUG:YES, XDP
 Added LPCPLUS_CON to K87_DEVEL_ENG (does not change BOM for DVT)
 Changed all instances of K87_DEVEL_xxxx to K87_DEBUG_xxxx
 Changed all instances of K87_DEVEL_xxxx to K87_DEBUG_xxxx
 csa 51: (Per <rdar://problem/7544529> K86/K87: Update MCP83 description on csa 4
 Changed description for 33783876 to "IC:MCP83M-A02,31X31MM,BGAL168"
 Added IMVP6_2PHASE BOM option to R7416 for K87's 13.7k
 *** 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 <rdar://problem/7548726> K86/K87 Ethernet series R's need to be 0 ohmed
 Changed R3790-R3795 to 115S0004 (0-ohm, 0402) from 22-ohm

2010-01-19: 2.5.0
 csa 37: Per <rdar://problem/7554342> K86/K87: Change L3720 to 152S1182
 Changed L3720 to 152S1182 (IND,PWR,SHD,4.7UH,20V,0.91A,31X31X12MM) for lower ESR

2010-01-22: 2.6.0
 csa 4: Per <rdar://problem/7571786> K86/K87: Add E3T EEE code for K86 to schematic
 Added row to EEE table for E3T
 Changed BOMOPTIONS 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
 Per <rdar://problem/7561001> K87: SMC: Radiated Emissions: Right Audio emissions fail
 Added L4530, L4531 (APN 155S0137) to SIL connector pins
 csa 45: Per <rdar://problem/7589365> K86/K87: Compensation settings change to provide more phase margin, reduce ripple
 Added L4530, L4531 (APN 155S0137) to SIL connector pins
 csa 97: Per <rdar://problem/7589365> K86/K87: Compensation settings change to provide more phase margin, reduce ripple
 Changed C9705 from 8.2nF to 33nF (132S0131)
 Changed C9706 from 120pF to 220pF (131S2225)

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
 Added C97_AUDIO_SWITCH_BOM_OPTION to K86_K87_COMMON

2010-02-15: 2.9.0
 2010-02-15: 2.10.0
 csa 54: broke sync with T27. Per <rdar://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 <rdar://7544836> K87 power component update
 csa 74: R7417 changed to 5.90K, C7428 changed to 0.47uF, C7434 changed to 0.033uF
 csa 75: R7510 changed to 147k to 10k, C7015 changed to 1000pF, C7042 changed to 0.068uF
 csa 70: R7015 changed to 56.2K, C7015 changed to 1000pF, C7042 changed to 0.068uF
 Per <rdar://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_BKLPWM

2010-02-18: 2.13.0
 Per <rdar://765934> K86/K87: Hall eff documentation change. Substitute 607-6831 for doc purposes
 csa 69: J6955 BOMOPTION change to OMIT. Added BOM table with 607-6831 for J6955

Per <rdar://7488543> K86/K87 Task: Measure each power supply in mLB
 csa 74: For K86 only: C1208, C1207, C1209, C1211, C1219, C1204, C1216 NOSTUFFED
 csa 12: Added pads for 0603 caps (APN 138S0635). Components C1230, C1231, C1232, C1233, C1234, C1235, C1236, C1237.
 csa 74: Changed C7434 from 0.033uF to 0.047uF (APN 132S0189) per Liang

Per <rdar://7685202> K86/K87 schematic: change U9700 to 353S2965 for Freescale backlight issue
 csa 97: U9700 changed to APN 514-0718 to 514-0750

2010-02-18: 2.14.0
 Per <rdar://7681979> 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 <rdar://7688111> K86/K87 schematic: add additional 639 for differentiation between Foxconn and Molex DIMM connectors
 csa 4: MOLEX_DDR_CONN added to Module Parts, removed from Alternate table. Added second 639 and EEEE # to BOM table

2010-02-25: 2.19.0, 2.20.0
 Per <rdar://7678515> K87: SMC:ESD: System hangs on air/contact discharge to MPM connector
 csa 69: C6970, C6971, C6972 of 1000pF (APN 131S0222) added

2010-02-26: 2.21.0
 Per <rdar://7488543> K87/K86 Task: Measure each power supply in mLB
 csa 12: Added pads for 0603 caps (APN 138S0635). Components C1230, C1231, C1232, C1233, C1234, C1235, C1236, C1237.
 csa 74: Changed C7434 from 0.033uF to 0.047uF (APN 132S0189) per Liang

2010-03-04: B.0.0
 Per <rdar://7683852> K87 Proto1: 5 of 6 systems failing graphics noise (Underwater) acoustic spec by up to 3.1dB
 csa 12: C1233, C1230, C1237, C1234 changed from NOSTUFF to STUFFED.

** MLB_LDO branch

2010-03-09: 0.8.0
 Summary of changes for MLB_LDO:
 csa 25: U2590 added. APN 353S2971. R2592 of 10K and C2592 of 1uF, C2593 of 1uF added.
 Nets MCP_PLL_LDO_EN and PPV3_S0_LDO_R added.

2010-03-22: A.1.0
 csa 25: Copied from K6
 Added C2599, R2597, R2596, U2593, Q2592, R2599, C2594, U2594, R2598, C2598 with BOMOPTION HTOL_SENSE:YES
 Added R2594 and R2591 with LDO:ADJ_BOMOPTION
 Changed BOMOPTION names from LDO:YES and LDO:NO to MCPHVDD:P2V5 and MCPHVDD:P3V3
 Added BOM TABLE with LDO:FIXED, LDO:ADJ, and HTOL_SENSE:NO stuffing options
 csa 50: Removed SMC alias to TP for SMC_NB_MISC_ISENSE to enable sense circuitry connection to SMC
 Removed SMC_P10 alias to TP SMC_P10
 csa 8: Added =PP3V42_G3H_OPA330 alias to power U2594
 Added =PP3V30_OPA330 alias to power U2593
 csa 4: Added MCPHVDD:P2V5, LDO:FIXED, HTOL_SENSE:YES to BOM Group K86_K87_DEBUG_PROD

2010-03-22: A.2.0
 Per <rdar://7783507> K87: Add cap to DDC line to avoid DDC line glitch issue
 csa 93: Added C9303 3300pF cap on DP_CA_DET.
 csa 25: Changed U2594 power to 3V3_S0 from 3V42_G3H.

2010-03-22: A.3.0
 csa 77: Deleted U7740 1.05V LDO circuit to free space for U2592 and current mirror circuit.

2010-03-22: A.4.0
 Reverted the changes and synced back to A.0.0
 Per <rdar://7783507> K87: Add cap to DDC line to avoid DDC line glitch issue
 csa 93: Added C9303 3300pF cap on DP_CA_DET.

2010-03-22: A.5.0
 csa 25: Added R2591, R2594 for LDO:ADJ option. Changed U2592 to LDO:FIXED option.
 csa 4: Added Alternate part for U2592 LDO. 353S2987(TI), 353S2988(Micrel) to 353S2986(Intersil).
 LDO:FIXED, MCPHVDD:P2V5 added in bom table.

2010-03-30: A.7.0
 Reverted the changes and synced back to A.2.0
 csa 4: Added Alternate part for U2592 LDO. 353S2987(TI), 353S2988(Micrel) to 353S2986(Intersil).
 LDO:FIXED, MCPHVDD:P2V5 added in bom table.

2010-03-31: A.8.0
 csa 25,49,50: Changed Q2592 gate control pin to SMC_P24 from SMC_P10.

2010-04-1: A.9.0
 csa 25: Added R2600 0ohm resistor to help layout change.

2010-04-1: A.10.0
 csa 25: Changed R2600 refdes to R2550 to match with page#.

2010-04-14: B.0.0
 vdar://7822714
 csa 69: R6905 kept same lohm.
 C6900 changed to 2.2uF, 138S0592.
 csa 4: Devel BOM# changed to 085-1799. And BOM OPTIONS to K86_K87_DEVELOPMENT_FVT.
 Removed Intersil LDO(353S2986).

2010-04-14: C.0.0
 csa 4: Added Toshiba(376S0908), Fairchild(376S0907) as an alternate to 376S0634.
 Added Onsemi new spec part(376S0912) as an alternate to Q2300(376S0868).

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Functional Test Points

FAN CONNECTORS FUNC_TEST

7 8 62	TRUE	PP5V_S0
42	TRUE	FAN_RT_PWM
42	TRUE	FAN_RT_TACH

(NEED TO ADD 1 GND TP)

MIC FUNC_TEST

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

SPEAKER FUNC_TEST

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

LVDS FUNC_TEST

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

(NEED TO ADD 5 GND TP)

SATA ODD CONN FUNC_TEST

7 33 46	TRUE	PP5V_SW_ODD
33 35	TRUE	SMC_ODD_DETECT
33 71	TRUE	SATA_ODD_D2R_C_P
33 71	TRUE	SATA_ODD_D2R_C_N
33 71	TRUE	SATA_ODD_R2D_P
33 71	TRUE	SATA_ODD_R2D_N

(NEED TO ADD 4 GND TP)

SATA HDD/SIL FUNC_TEST

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

(NEED TO ADD 4 GND TP)

BATT POWER CONN FUNC_TEST

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

(NEED TO ADD 3 GND TP)

HALL EFFECT CONNECTOR FUNC_TEST

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

(NEED TO ADD 3 GND TP)

X16 WIRELESS CONN FUNC_TEST

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

(NEED TO ADD 4 GND TP)

IPD_FLEX_CONN FUNC_TEST

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

(NEED TO ADD 2 GND TP)

KEYBOARD CONN FUNC_TEST

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

(NEED TO ADD 1 GND TP)

DC POWER CONN FUNC_TEST

54	TRUE	PP18V5_DCIN_FUSE (NEED 2 TP)
54	TRUE	ADAPTER_SENSE

(NEED TO ADD 2 GND TP)

POWER NETS FUNC_TEST

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

(NEED TO ADD 6 GND TP)

FSB SIGNALS WITH NOTEST

10 14 69	NO_TEST	FSB_A_L<35..3>
10 14 69	NO_TEST	FSB_ADS_L
10 14 69	NO_TEST	FSB_ADSTB_L<1..0>
10 14 69	NO_TEST	FSB_D_L<63..0>
10 14 69	NO_TEST	FSB_DINV_L<3..0>
10 14 69	NO_TEST	FSB_DSTB_L_N<3..0>
10 14 69	NO_TEST	FSB_DSTB_L_P<3..0>
10 14 69	NO_TEST	FSB_HIT_L
10 14 69	NO_TEST	FSB_HITM_L
10 14 69	NO_TEST	FSB_LOCK_L
10 14 69	NO_TEST	FSB_LOCK_L
10 14 69	NO_TEST	FSB_REQ_L<4..0>

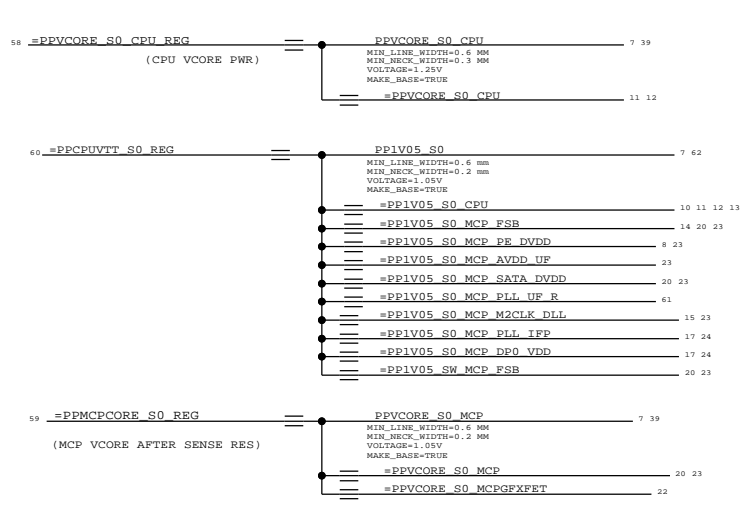
J5100 LPC+SPI CONN FUNC_TEST

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

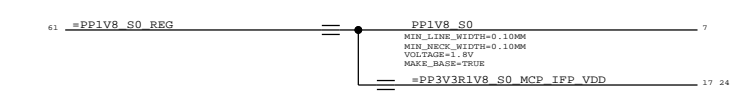
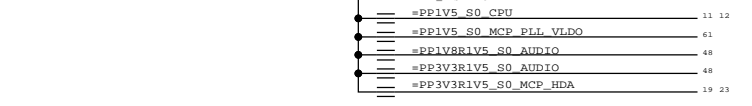
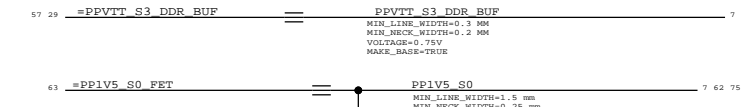
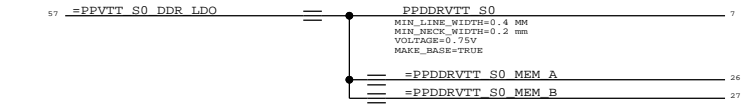
(NEED TO ADD 2 GND TP)

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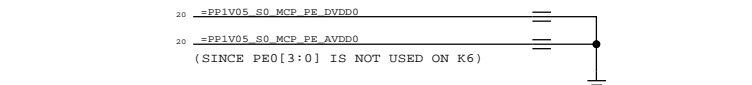
"S0,S0M" RAILS



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

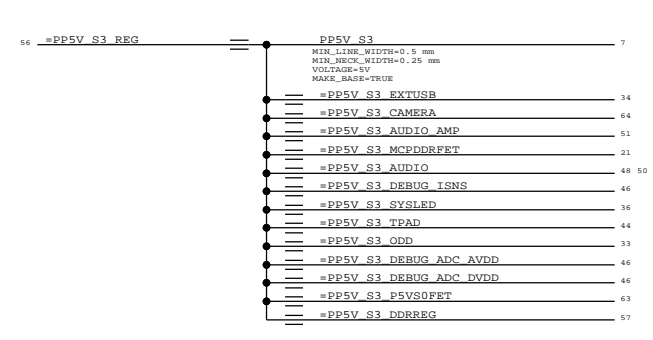
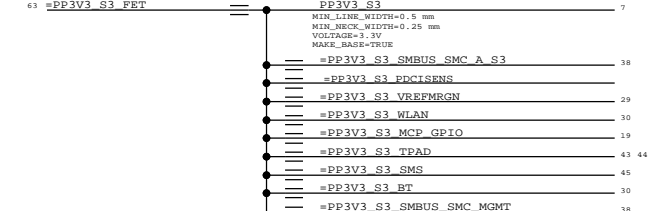
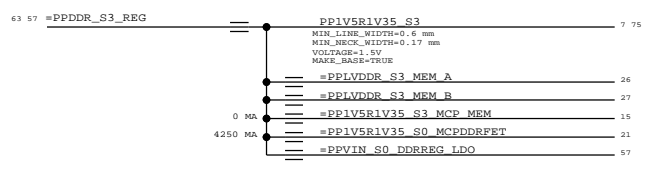


UNUSED MCP PE0[3:0] AVDD/DVDD

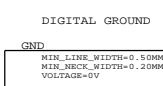
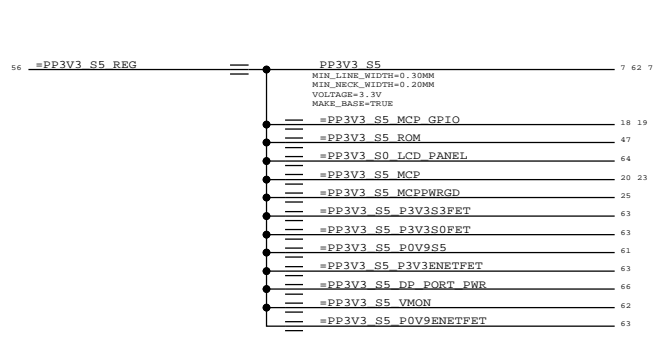
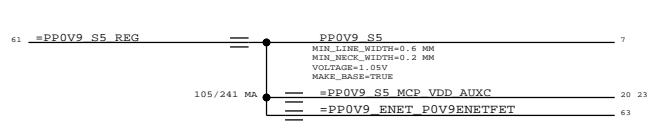


(CONNECTS TO MCP BALLS) 20 =PP1V05_S0_MCP_PE_DVDD1 =PP1V05_S0_MCP_PE_DVDD 31 (CONNECTS TO THE DECAPS)
(CONNECTS TO MCP BALLS) 20 =PP1V05_S0_MCP_PE_AVDD1 =PP1V05_S0_MCP_PE_AVDD 23 (CONNECTS TO THE DECAPS)

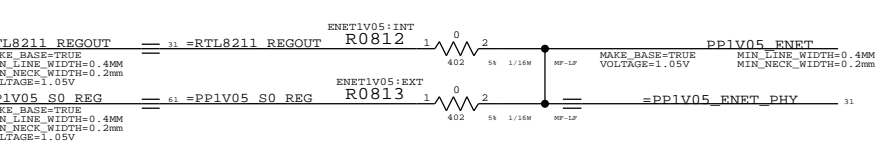
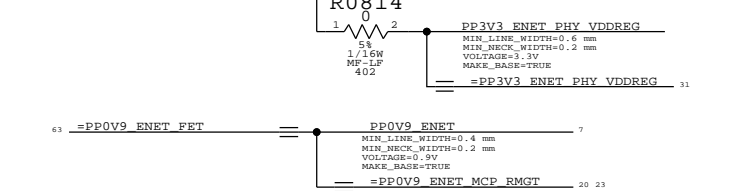
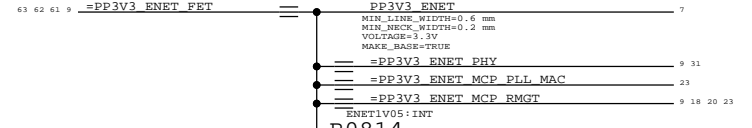
"S3" RAILS



"S5" RAILS

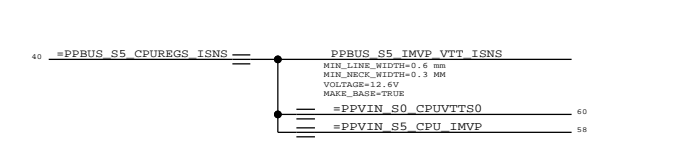
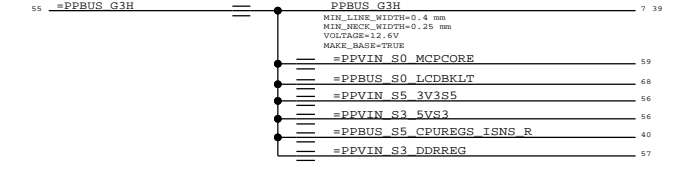
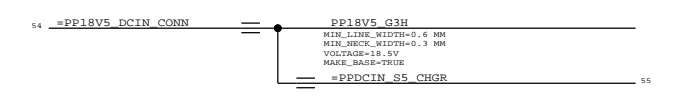
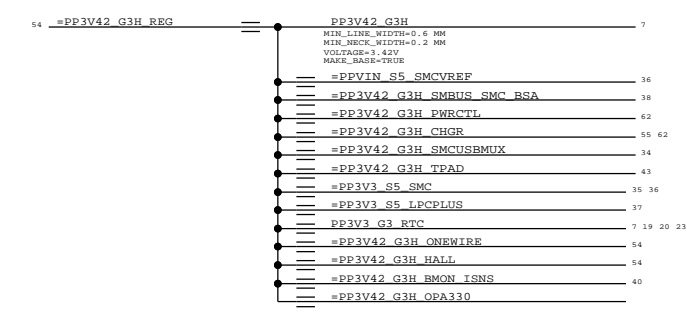


"ENET" RAILS



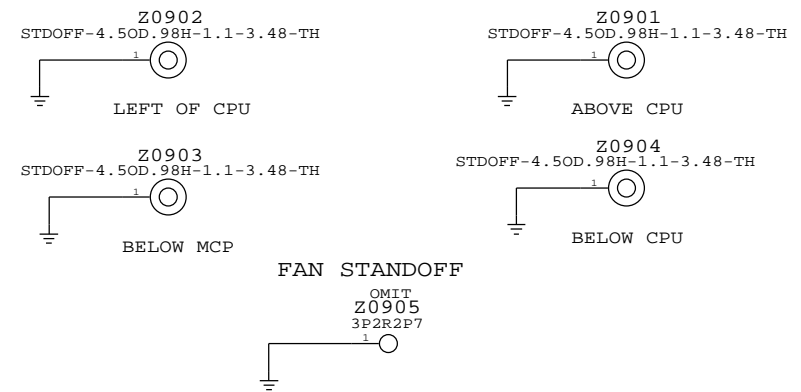
FIX ME!! OUTPUT OF REGULATOR VALUES

"G3H" RAILS



SYNC MASTER=MASTER SYNC DATE=MASTER
Power Aliases
Apple Inc.
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REVISION C.0.0
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PAGE 8 OF 109
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HEATSINK STANDOFFS



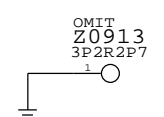
MLB MOUNTING (TO C. BRACKET) SCREW HOLES



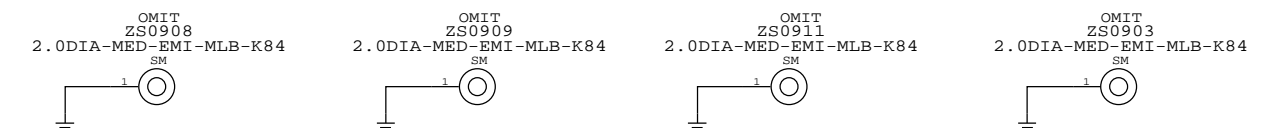
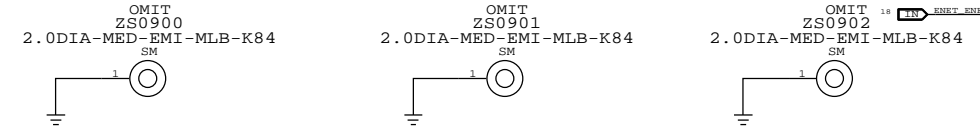
MLB MOUNTING (TO TOPCASE) SCREW HOLES



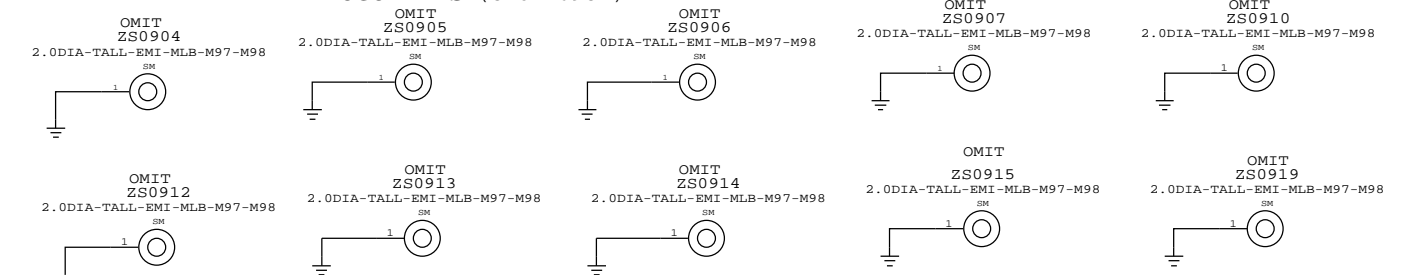
LVDS CONNECTOR HOLE



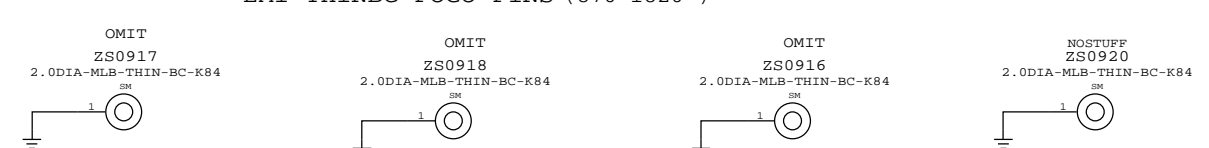
EMI IO MEDIUM POGO PINS (870-1794)



EMI TALL POGO PINS (870-1698)



EMI THINBC POGO PINS (870-1820)



PCI-E ALIASES

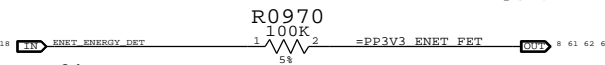
Table of PCI-E aliases including PCIE MINI R2D C P, PCIE AP R2D C N, CONN PCIE MINI D2R P, etc.

UNUSED FIREWIRE LANE

Table of unused firewire lane aliases including PCIE FW D2R P, PCIE FW D2R N, PCIE FW R2D C P, etc.

UNUSED ETHERNET LANE

Table of unused ethernet lane aliases including ENET CLKREQ L, PCIE CLKREQ ENET P, PCIE CLKREQ ENET N, etc.



USB ALIASES

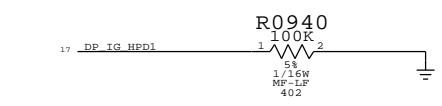
Table of USB aliases including USB EXTD P, USB EXTD N, USB EXTC P, etc.

LVDS ALIASES

Table of LVDS aliases including MCP IFPA TXD P<0..2>, MCP IFPA TXD N<0..2>, MCP IFPA TXD P<3>, etc.

DISPLAY PORT ALIASES

Table of display port aliases including DP IG ML0 P<0..3>, DP IG ML0 N<0..3>, DP IG AUX CH0 P, etc.



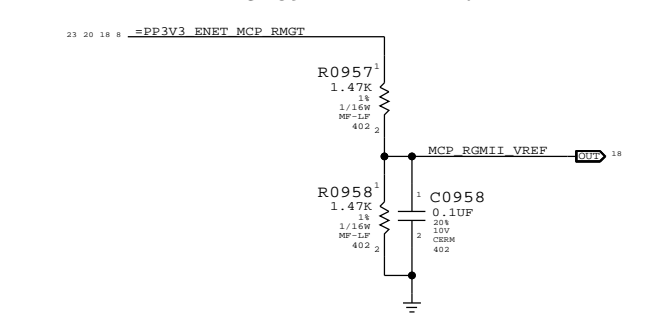
MCP89 MISC ALIASES

Table of MCP89 misc aliases including MCP MEM VDD SEEL LV5, TP MCP MEM VDD SEEL LV5.

ETHERNET ALIASES

Table of ethernet aliases including TP ENET RESET L, TP MCP CLK25M BUFO R, TP ENET MDC, etc.

MCP89 ETHERNET VREF



CPU FSB FREQUENCY STRAPS

Table of CPU FSB frequency straps including CPU BSSEL<0:2>, MCP BSSEL<0:2>, BSSEL<2..0>, and FSB MHZ values.

SMC ALIASES

Table of SMC aliases including SMC SYS ENBLED, TP SMC SYS ENBLED.

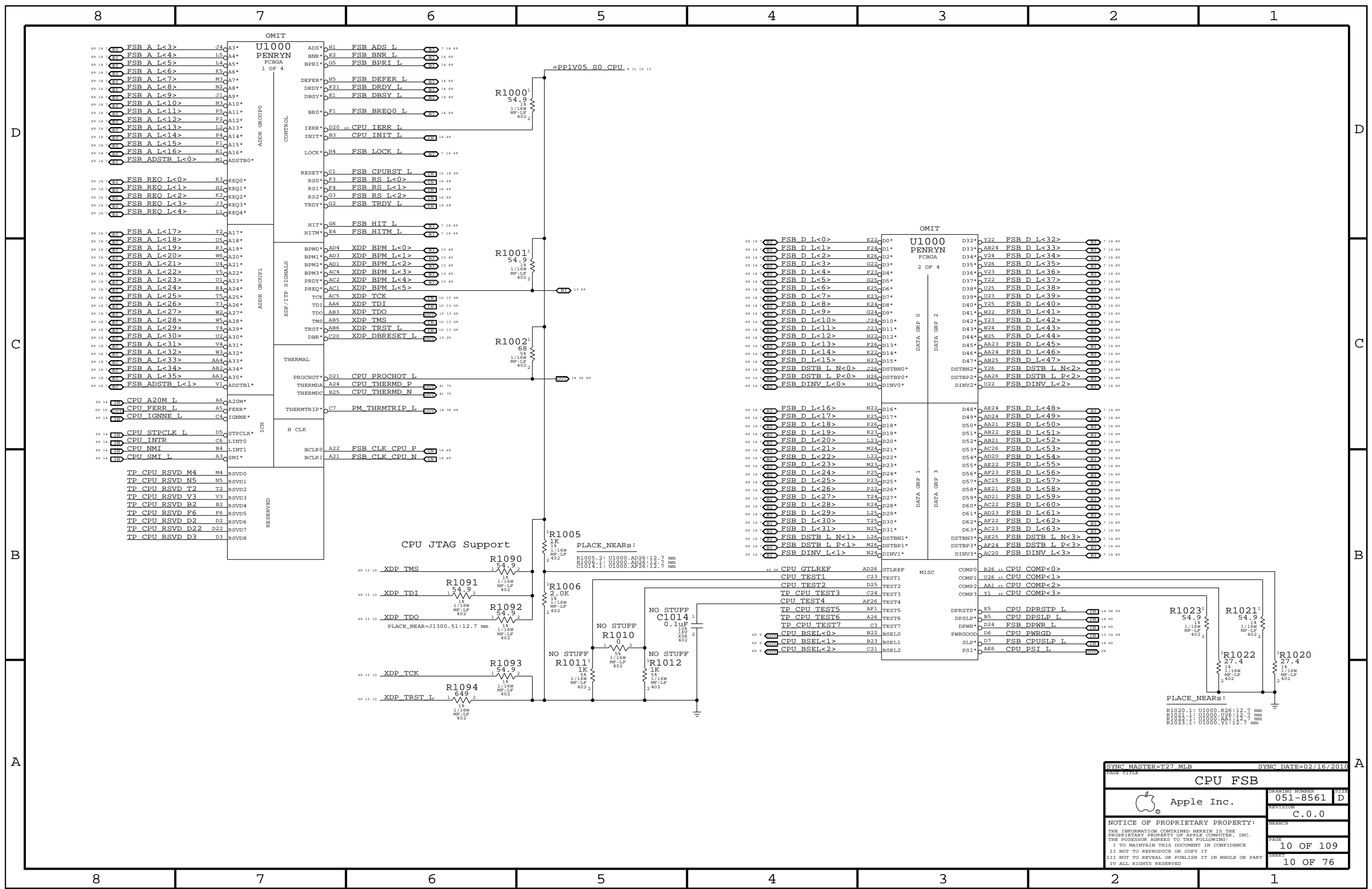
CHARGER SIGNAL

Table of charger signal aliases including CHGR ACOK, SMC BC ACOK.

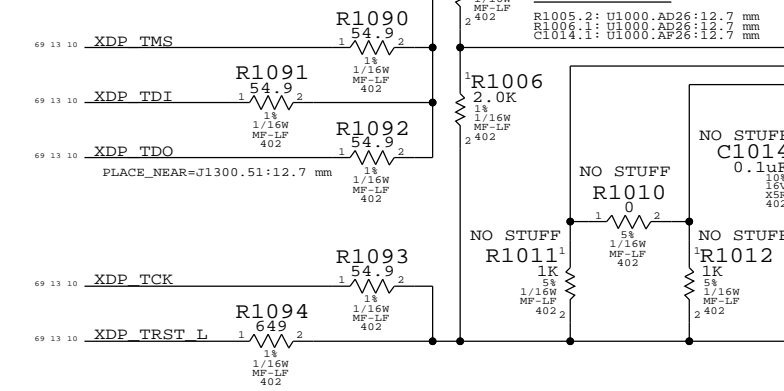
CPU VCORE ALIASES

Table of CPU vcore aliases including INV26 VR TT, TP INV26 VR TT, INV26 NTC, TP INV26 NTC.

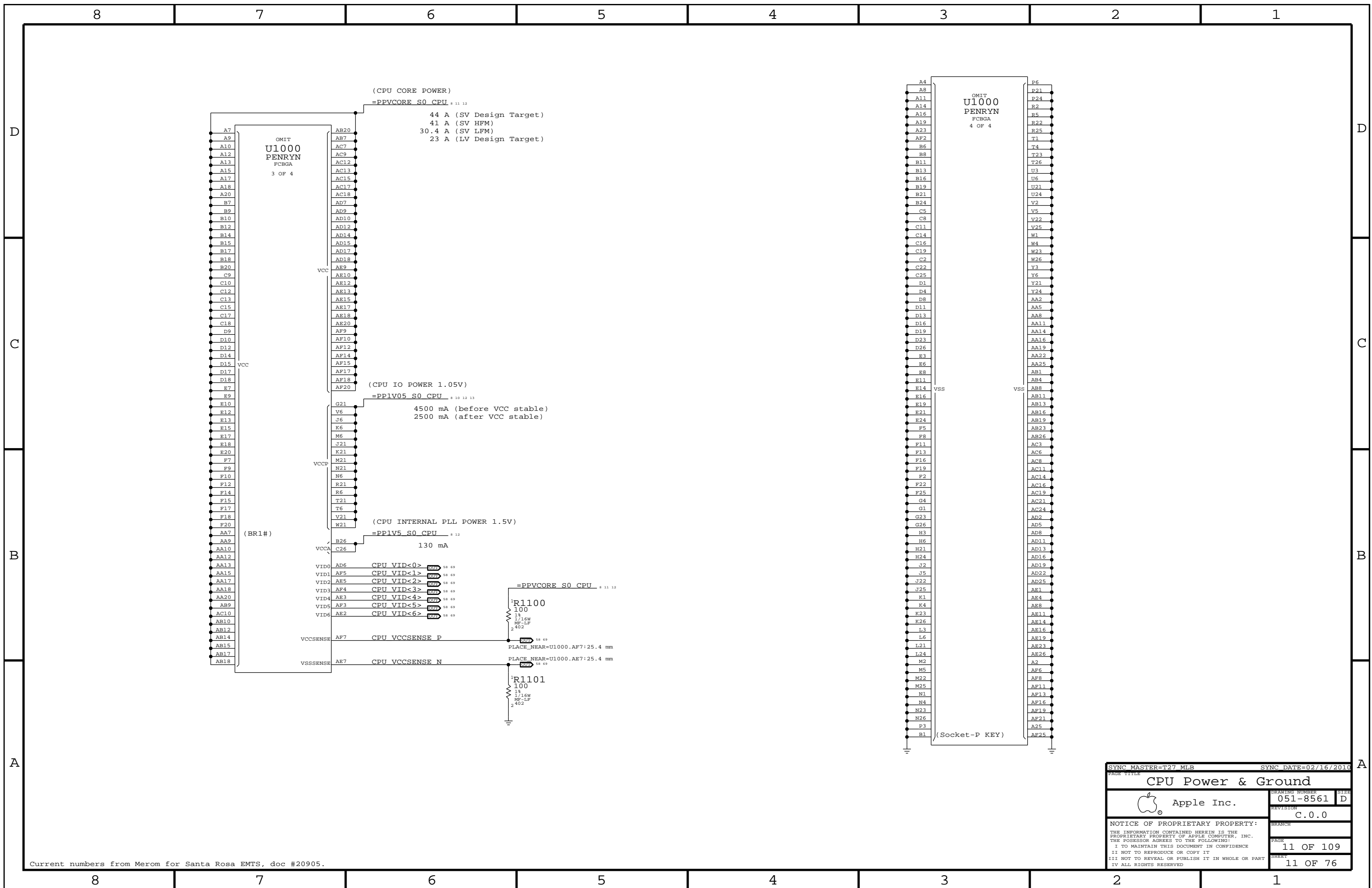
Metadata box containing SYNC MASTER, SYNC DATE, SIGNAL ALIAS title, Apple Inc. logo, drawing number 051-8561, revision C.0.0, and page 9 of 109.



CPU JTAG Support



SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
CPU FSB			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8561	D
		REVISION	
		C.0.0	
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10 OF 109		10 OF 76	

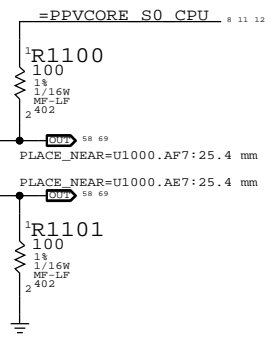


(CPU CORE POWER)
 =PPV CORE S0 CPU # 11 12
 44 A (SV Design Target)
 41 A (SV HFM)
 30.4 A (SV LFM)
 23 A (LV Design Target)

(CPU IO POWER 1.05V)
 =PP1V05 S0 CPU # 10 12 13
 4500 mA (before VCC stable)
 2500 mA (after VCC stable)

(CPU INTERNAL PLL POWER 1.5V)
 =PP1V5 S0 CPU # 12
 130 mA

- VID0 AD6 CPU VID<0> 58 69
- VID1 AF5 CPU VID<1> 58 69
- VID2 AE5 CPU VID<2> 58 69
- VID3 AF4 CPU VID<3> 58 69
- VID4 AE3 CPU VID<4> 58 69
- VID5 AF3 CPU VID<5> 58 69
- VID6 AE2 CPU VID<6> 58 69

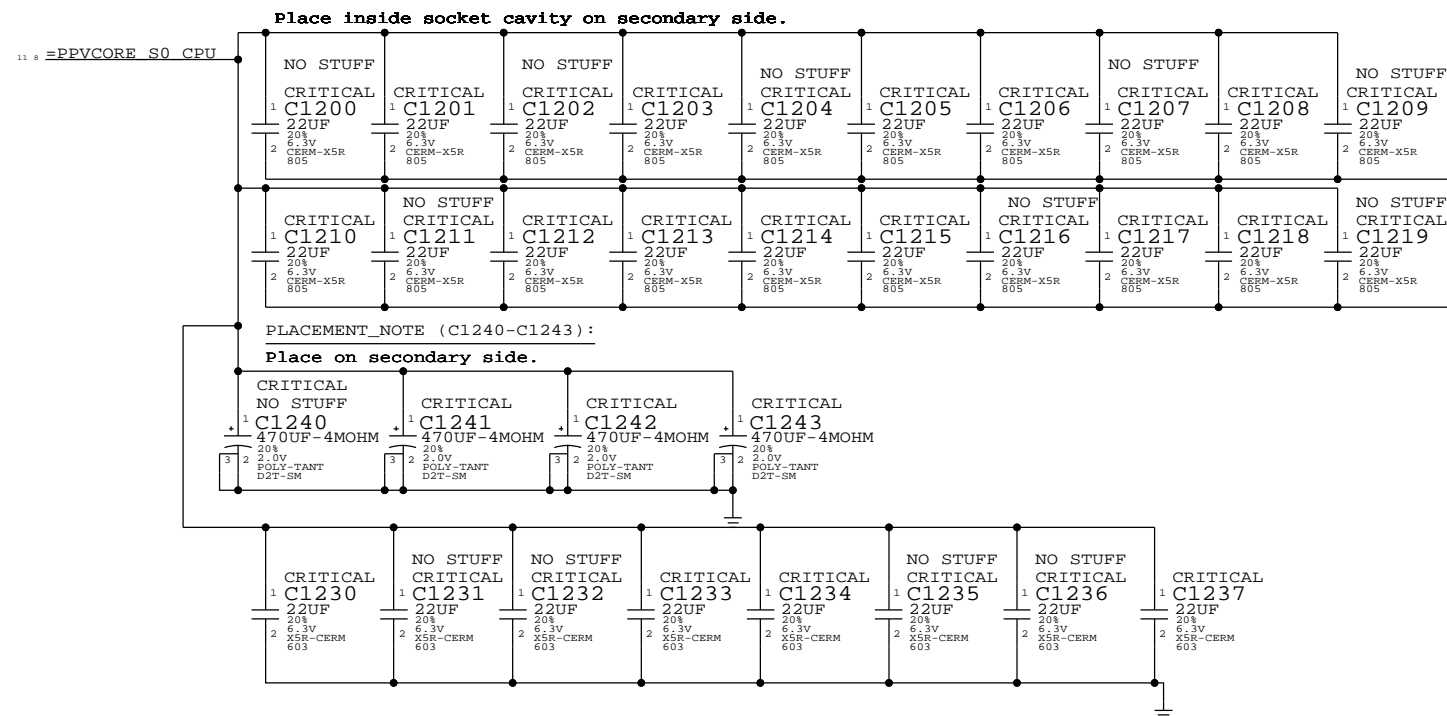


SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
CPU Power & Ground			
Apple Inc.		DRAWING NUMBER	051-8561
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CPU VCore HF and Bulk Decoupling

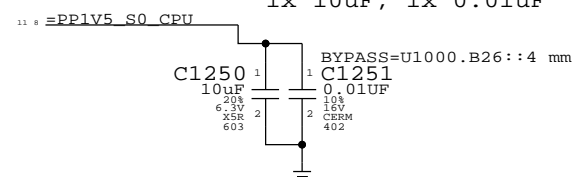
4X 330UF, 20X 22UF 0805

PLACEMENT_NOTE (C1200-C1219):



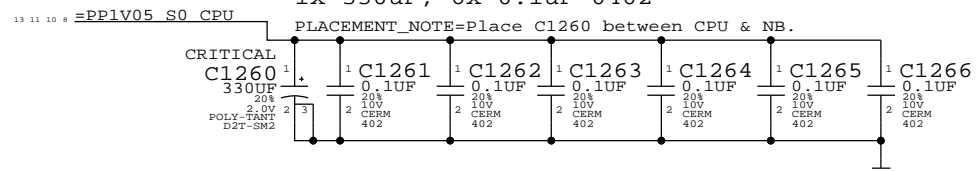
VCCA (CPU AVdd) DECOUPLING

1x 10uF, 1x 0.01uF



VCCP (CPU I/O) DECOUPLING

1x 330uF, 6x 0.1uF 0402

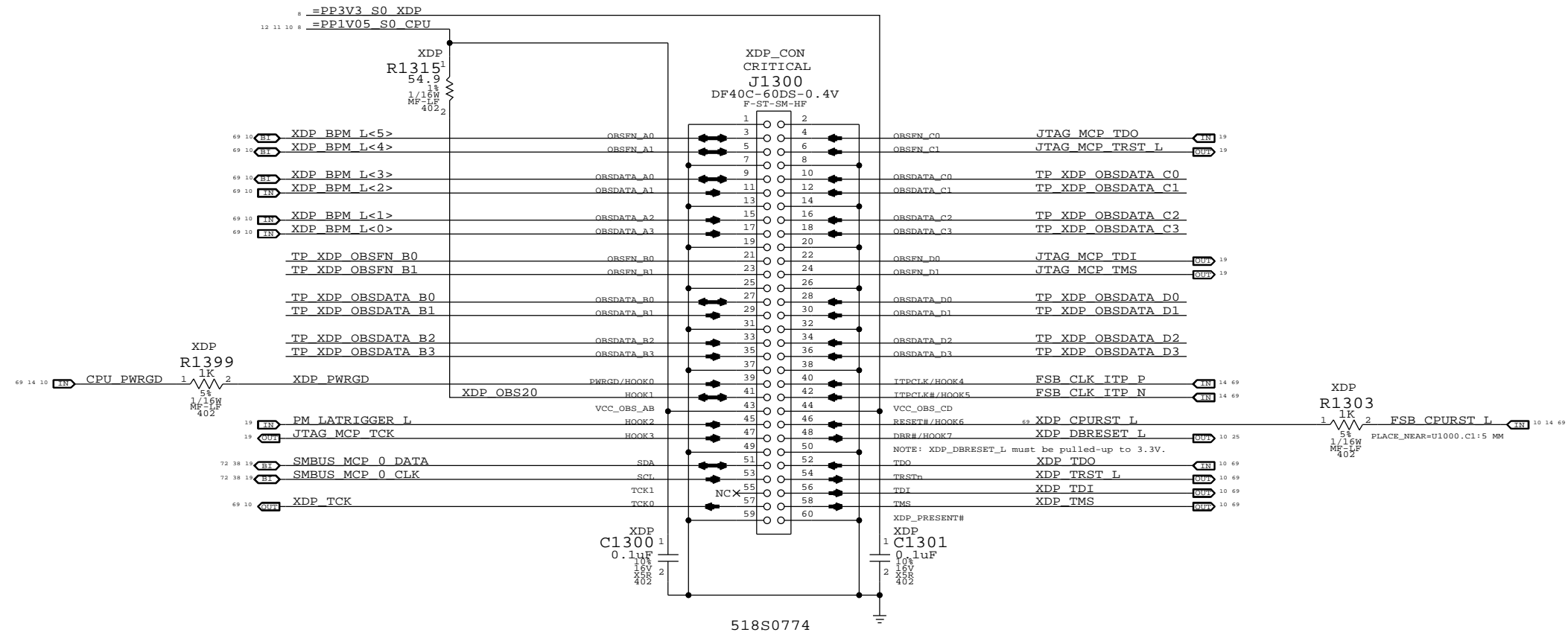


SYNC_MASTER=T27_MLB		SYNC_DATE=02/16/2010	
PAGE TITLE CPU Decoupling			
DRAWING NUMBER 051-8561		SIZE D	
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Mini-XDP Connector

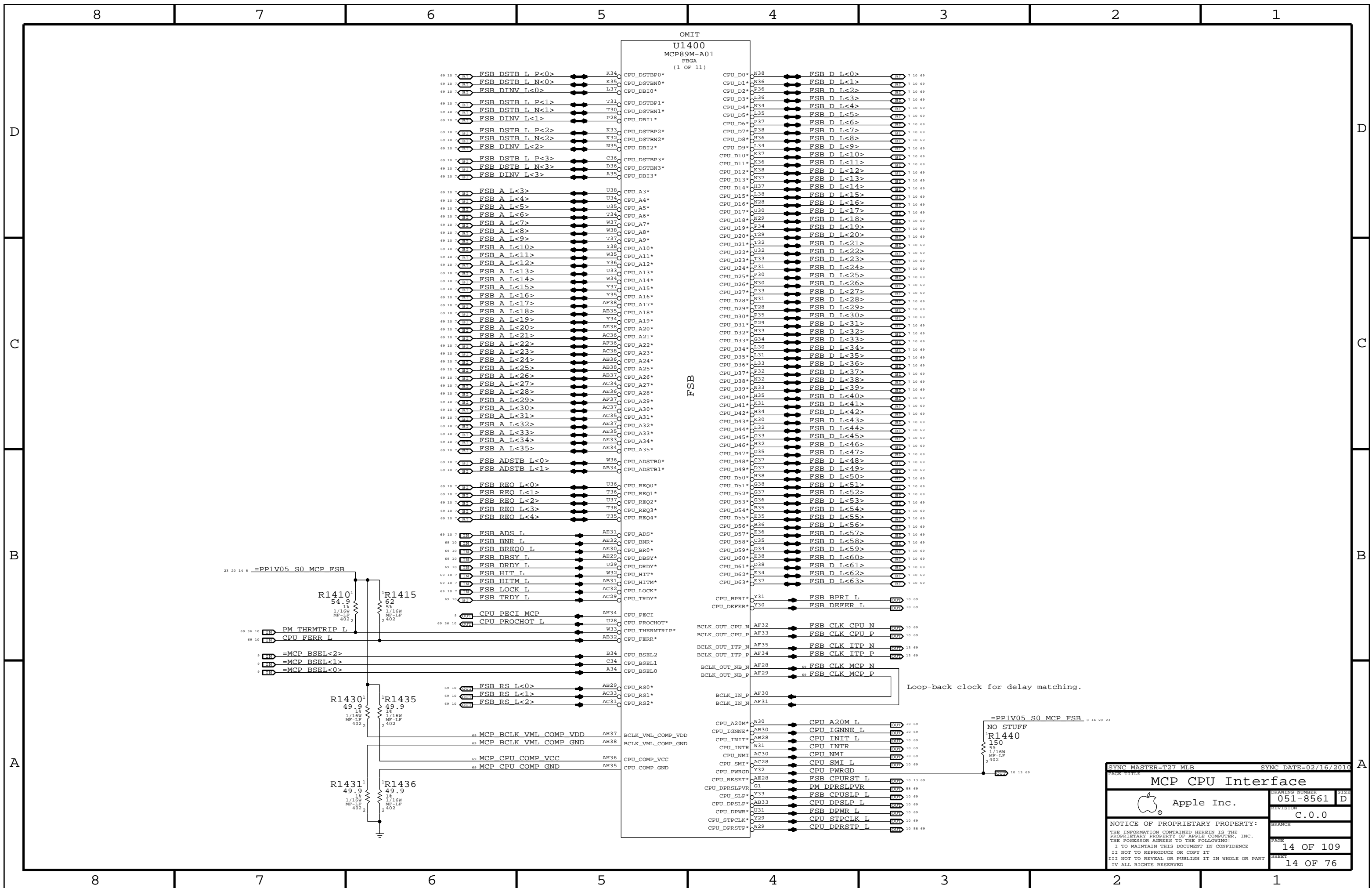
NOTE: This is not the standard XDP pinout.
USE WITH 920-0782 ADAPTER FLEX TO SUPPORT CPU, MCP DEBUGGING.

MCP89-SPECIFIC PINOUT

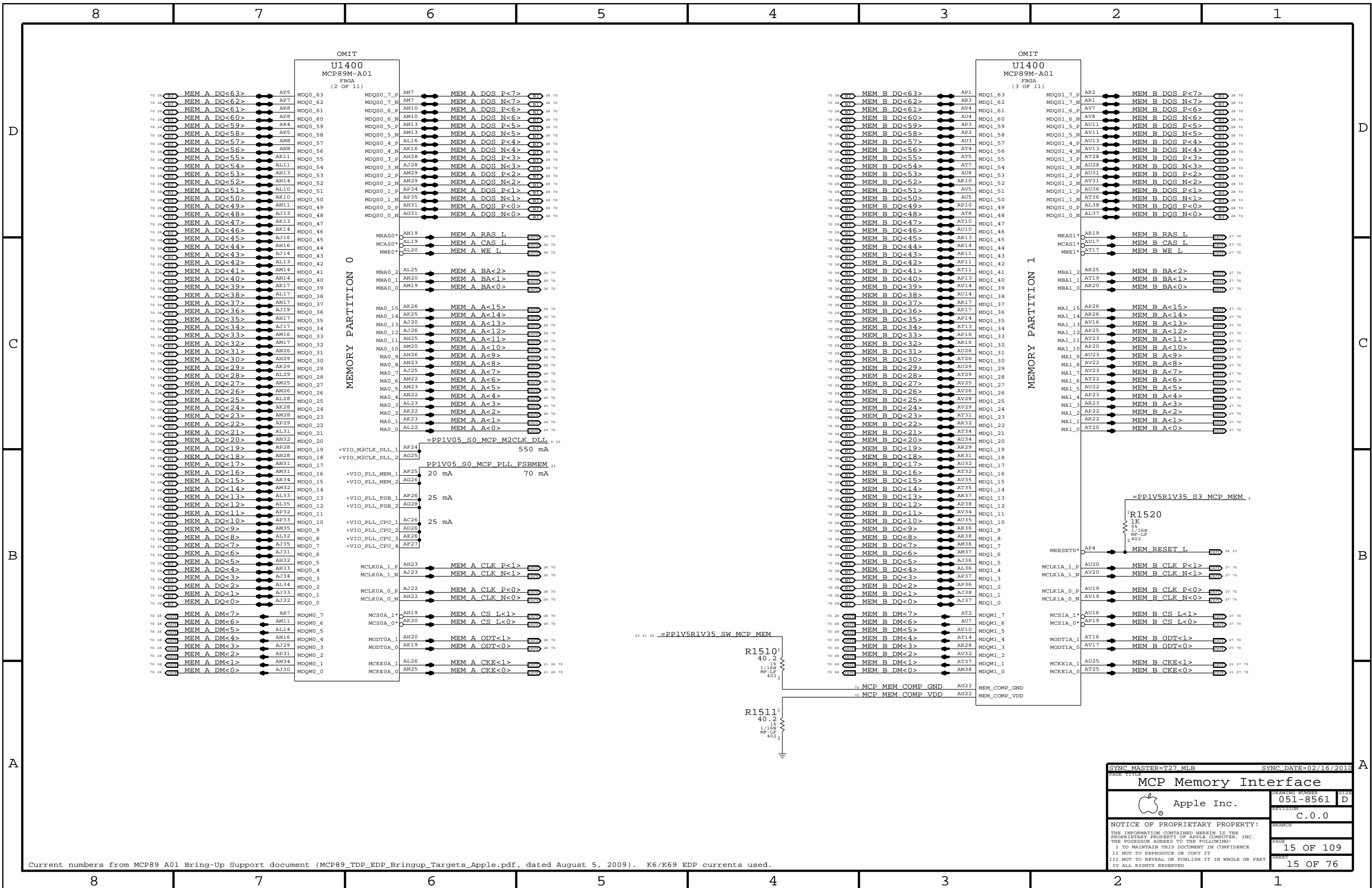


← Direction of XDP module
Please avoid any obstructions
ON ODD-NUMBERED SIDE OF J1300

SYNC MASTER=(K84 MLB)		SYNC DATE=(02/25/2009)	
eXtended Debug Port (MiniXDP)			
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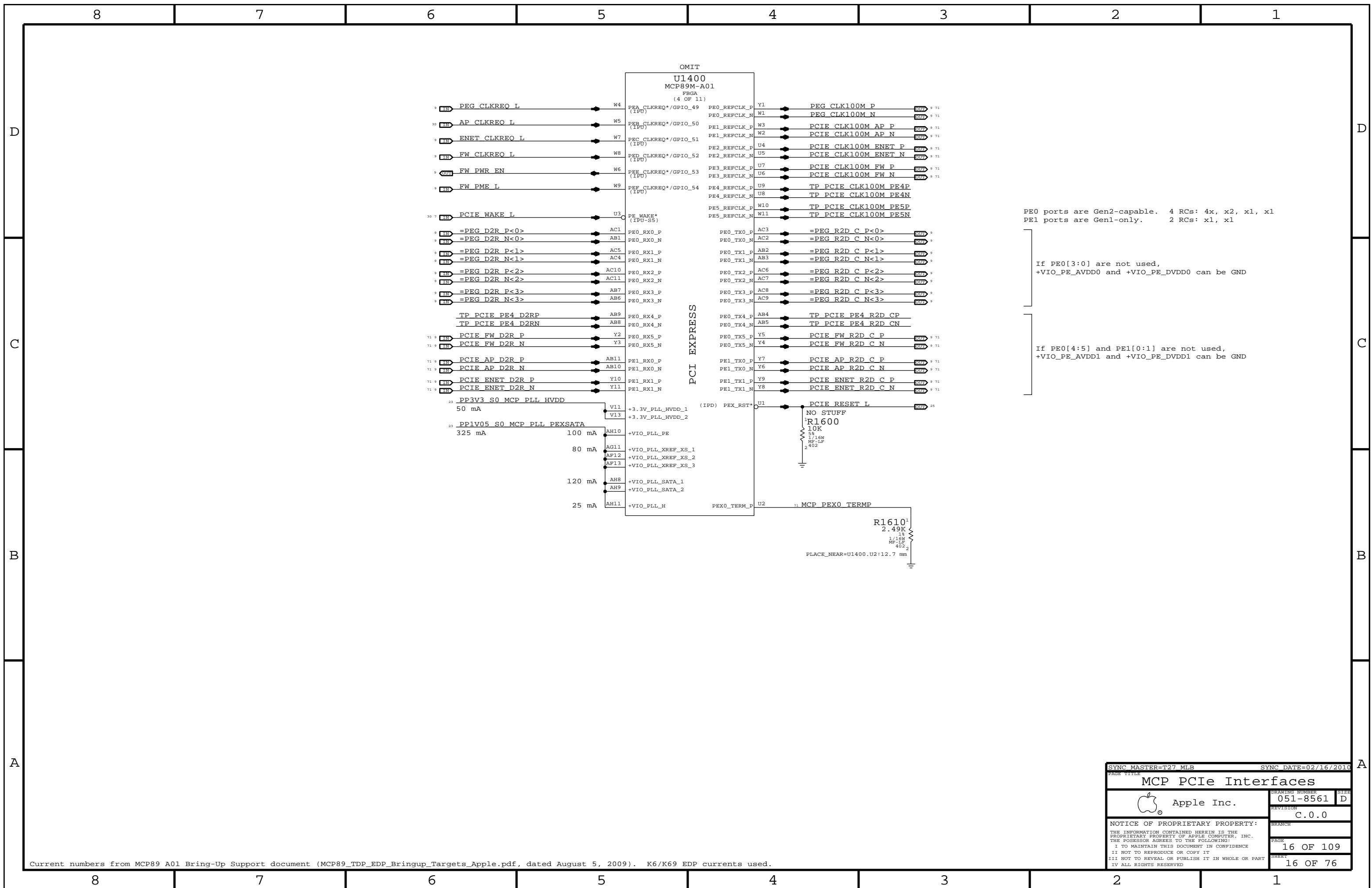


PAGE TITLE		SYNC DATE=02/16/2010	
MCP CPU Interface		DRAWING NUMBER	051-8561
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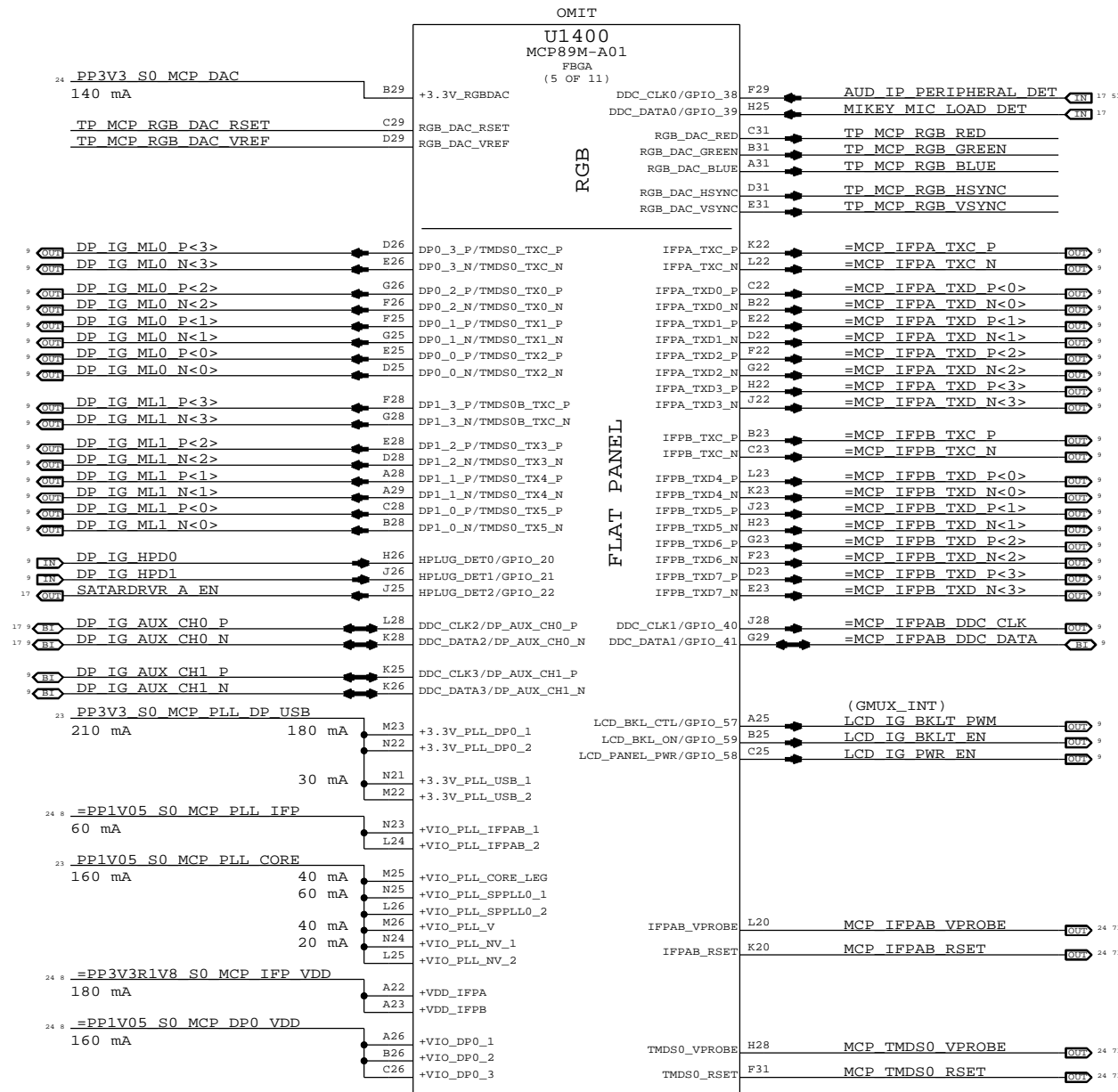
Current numbers from MCP89 A01 Bring-Up Support document (MCP89_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
PAGE TITLE			
MCP Memory Interface			
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		SHEET	15 OF 76



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SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
MCP PCIe Interfaces			
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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

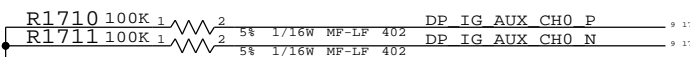
MCP Signal	TMDS/HDMI	LVDS
=MCP_IFPA_TXC_P/N	TMDS_IG_TXC_P/N	LVDS_IG_A_CLK_P/N
=MCP_IFPA_TXD_P/N<0>	TMDS_IG_TXD_P/N<0>	LVDS_IG_A_DATA_P/N<0>
=MCP_IFPA_TXD_P/N<1>	TMDS_IG_TXD_P/N<1>	LVDS_IG_A_DATA_P/N<1>
=MCP_IFPA_TXD_P/N<2>	TMDS_IG_TXD_P/N<2>	LVDS_IG_A_DATA_P/N<2>
=MCP_IFPA_TXD_P/N<3>	(UNUSED)	LVDS_IG_A_DATA_P/N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

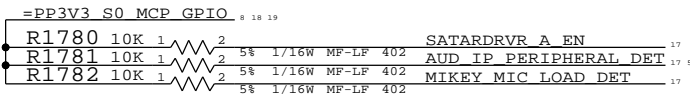
NOTE: 100K pull-downs required if HPLUG_DET0/HPLUG_DET1 are not used.

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.

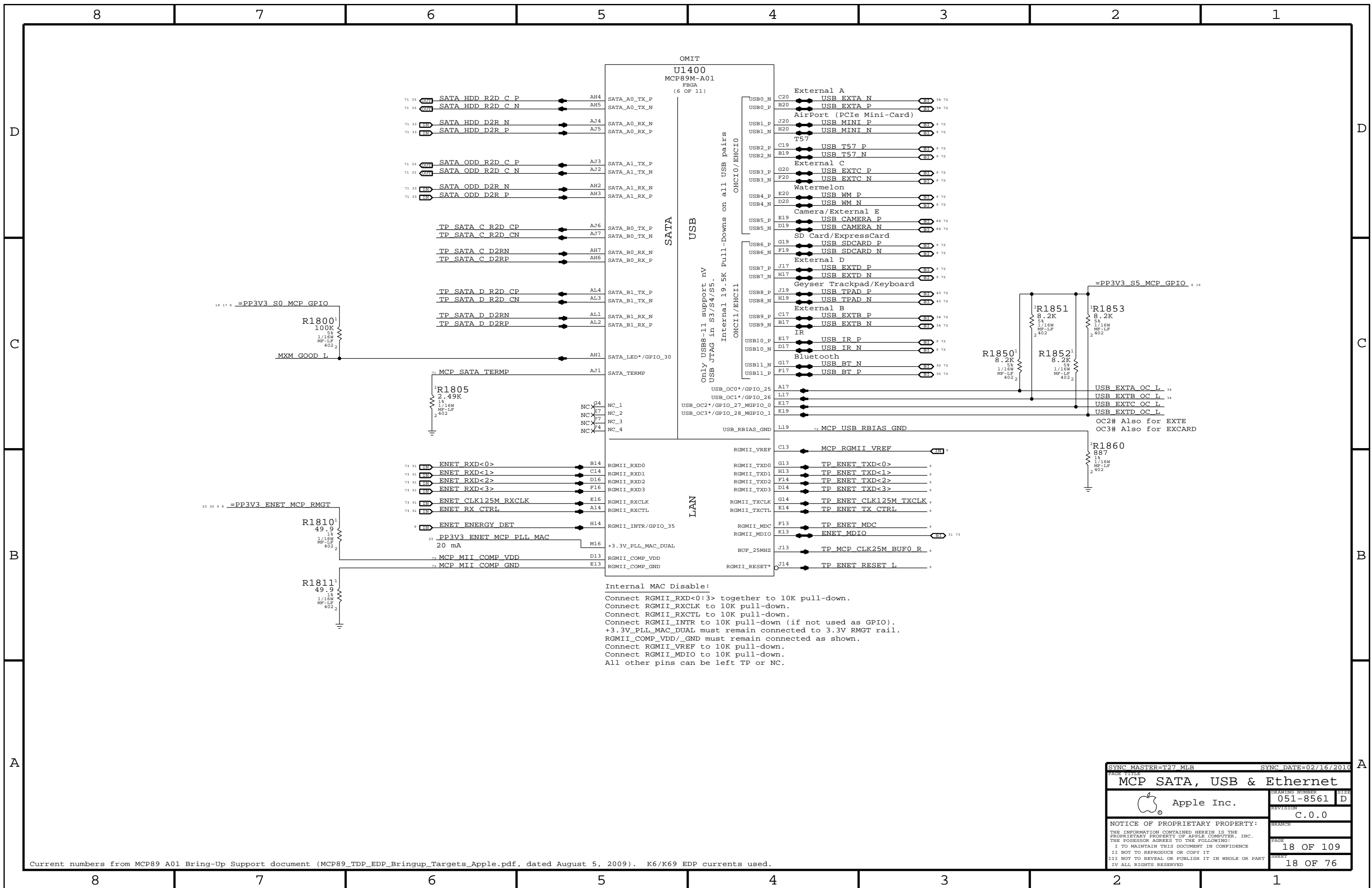


GPIO Pull-Ups

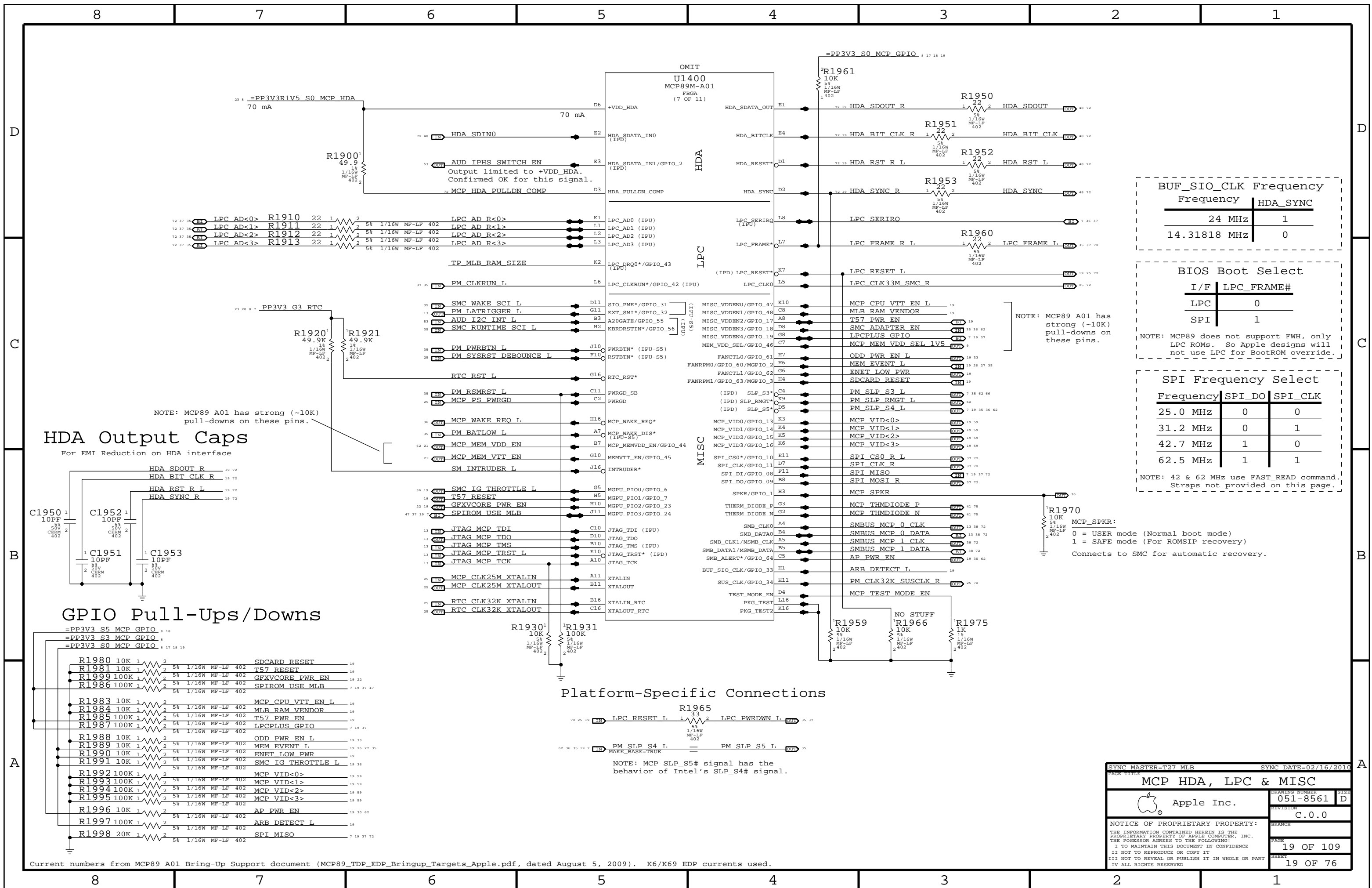


Current numbers from MCP89 A01 Bring-Up Support document (MCP89_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

PAGE TITLE		SYNC DATE=02/16/2010	
MCP Graphics			
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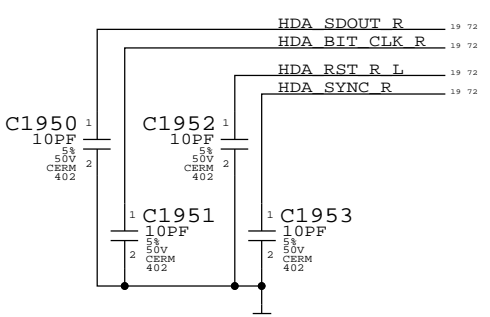
SYNC MASTER=T27_MLB		SYNC DATE=02/16/2010	
PAGE TITLE MCP SATA, USB & Ethernet			
Apple Inc.		DRAWING NUMBER 051-8561	SIZE D
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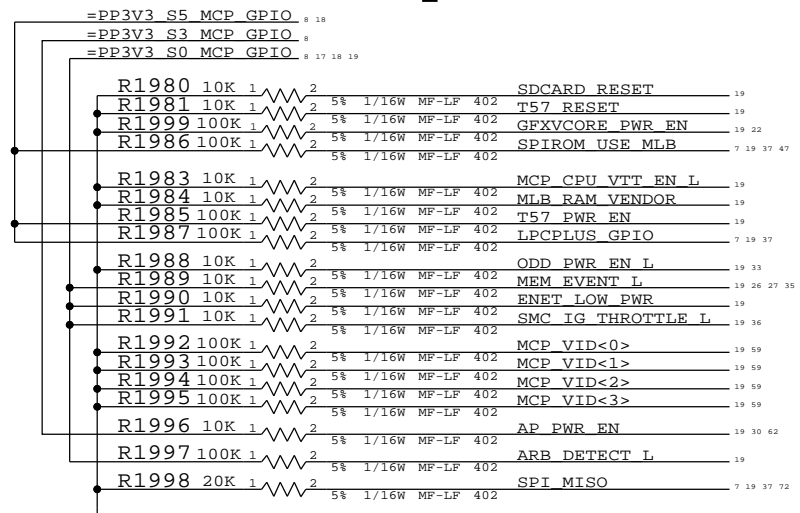
NOTE: MCP89 A01 has strong (~10K) pull-downs on these pins.

HDA Output Caps

For EMI Reduction on HDA interface

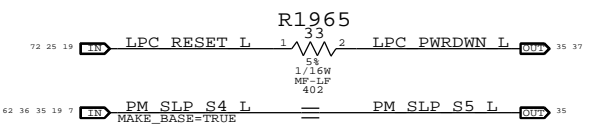


GPIO Pull-Ups/Downs



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.

Platform-Specific Connections



NOTE: MCP SLP_S5# signal has the behavior of Intel's SLP_S4# signal.

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

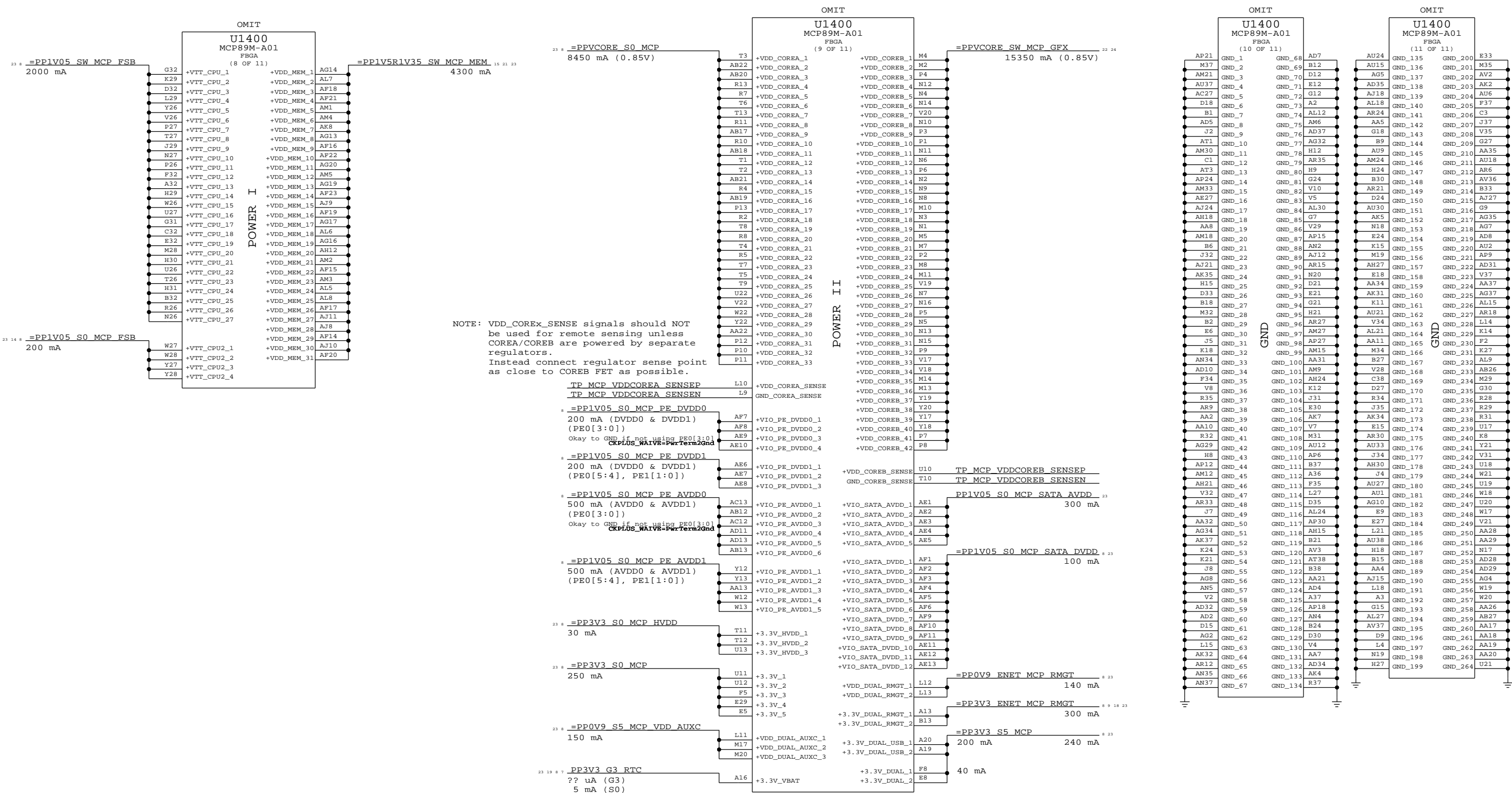
NOTE: 42 & 62 MHz use FAST_READ command. Straps not provided on this page.

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

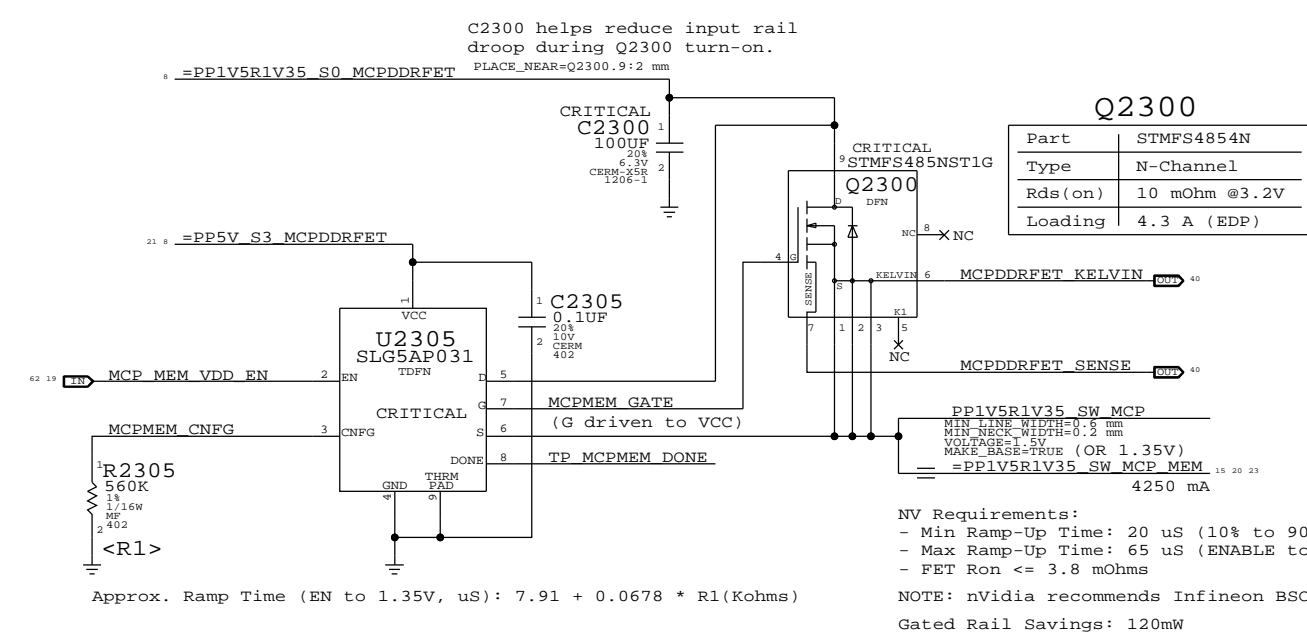
MCP_SPKR:
 0 = USER mode (Normal boot mode)
 1 = SAFE mode (For ROMSIP recovery)
 Connects to SMC for automatic recovery.

PAGE TITLE		SYNC_DATE=02/16/2010	
MCP HDA, LPC & MISC			
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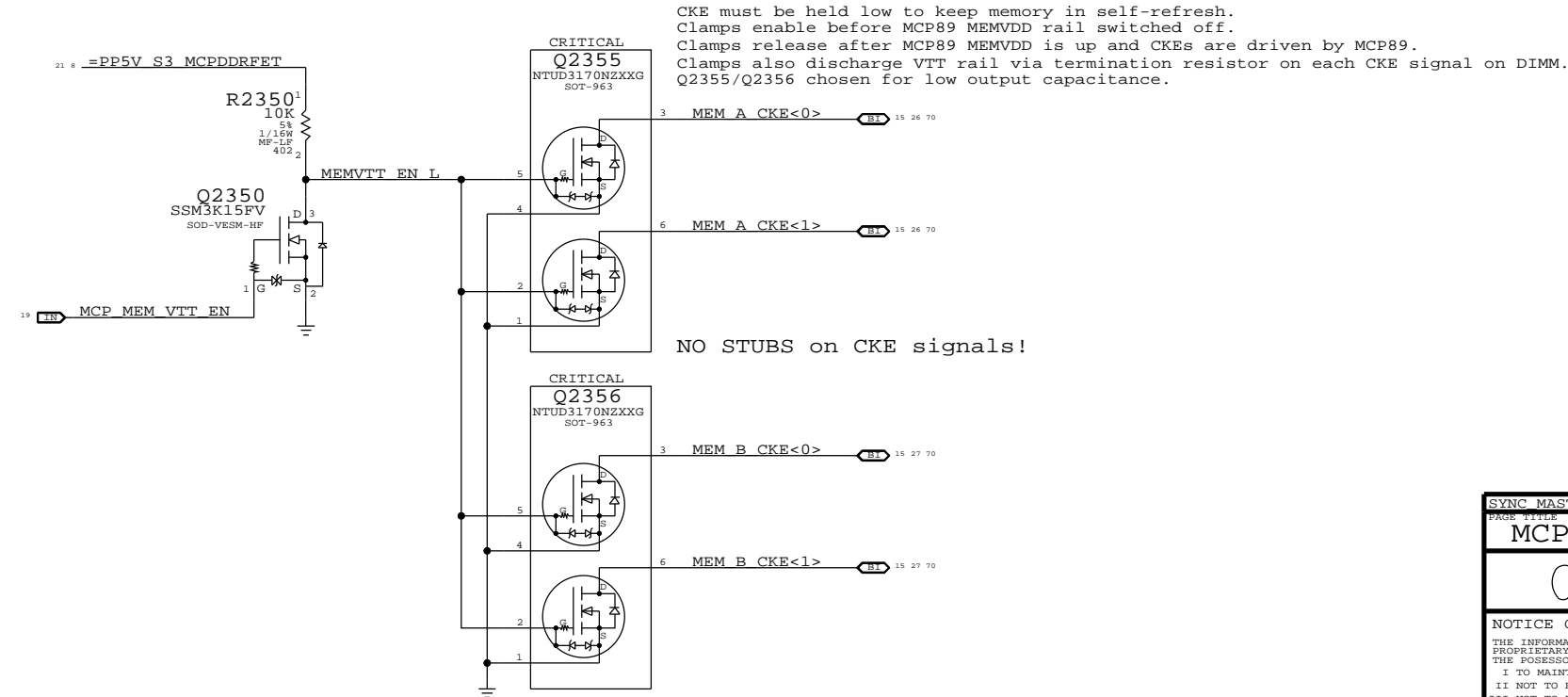
NOTE: "SW" rails are dynamically switched in the S0 state as needed, controlled by MCP89 GPIOs.



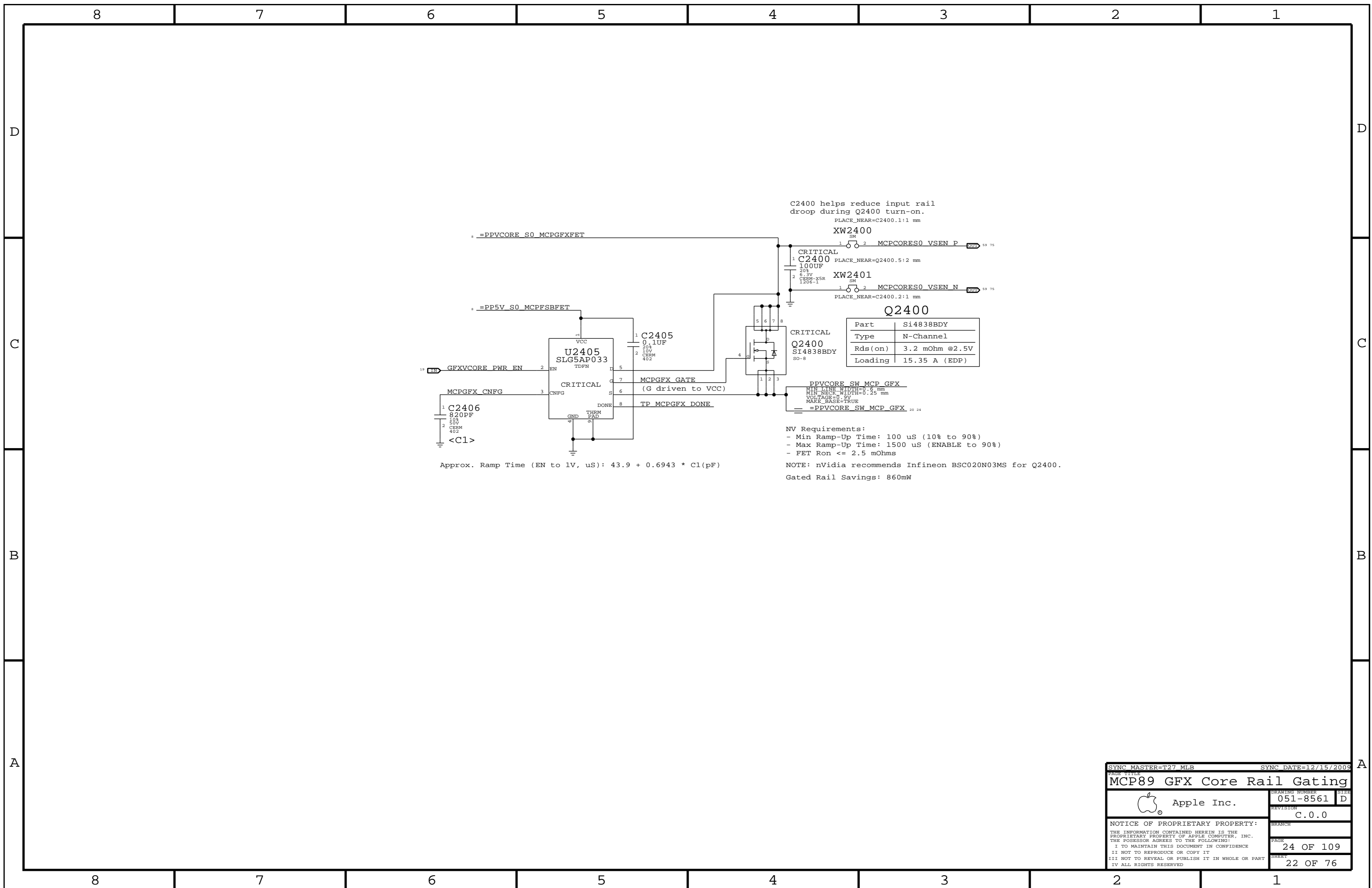
SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
MCP Power & Ground			
Apple Inc.		DRAWING NUMBER	051-8561
		REVISION	C.0.0
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		PAGE	20 OF 109
		SHEET	20 OF 76



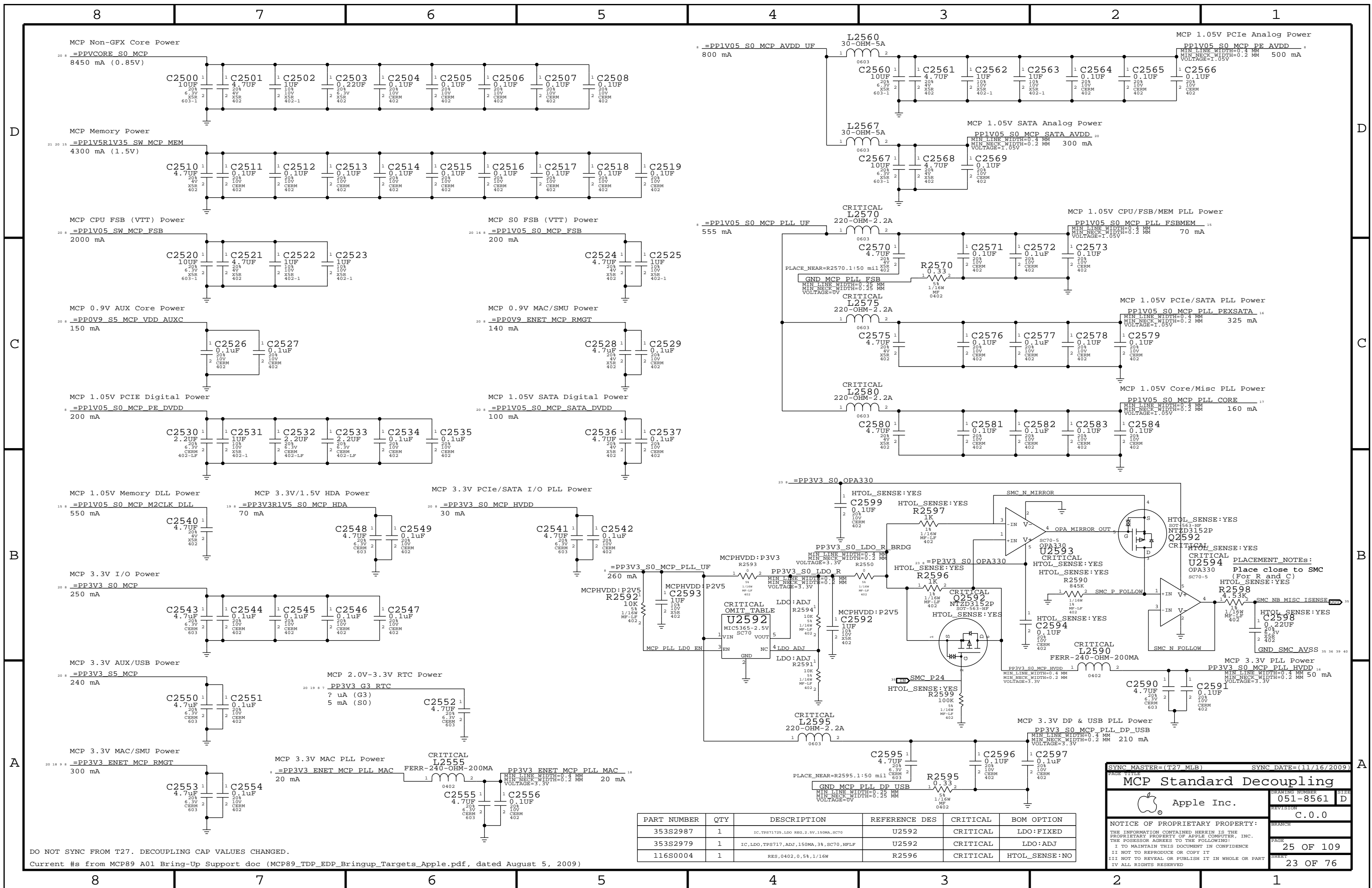
DIMM CKE Clamps



SYNC MASTER=K6 MLB		SYNC DATE=02/16/2010	
MCP89 Memory Rail Gating			
Apple Inc.		DRAWING NUMBER	051-8561
		REVISION	C.0.0
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SYNC MASTER=T27 MLB		SYNC DATE=12/15/2009	
PAGE TITLE MCP89 GFX Core Rail Gating			
DRAWING NUMBER 051-8561		SIZE D	
REVISION C.0.0		BRANCH	
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PAGE 24 OF 109		SHEET 22 OF 76	



DO NOT SYNC FROM T27. DECOUPLING CAP VALUES CHANGED.
 Current #s from MCP89 A01 Bring-Up Support doc (MCP89_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009)

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
353S2987	1	IC,TP971725,LDO REG,2.5V,150MA,SC70	U2592	CRITICAL	LDO:FIXED
353S2979	1	IC,LDO,TP9717,ADJ,150MA,3%,SC70,HFLF	U2592	CRITICAL	LDO:ADJ
116S0004	1	RES,0402,0.5%,1/16W	R2596	CRITICAL	HTOL_SENSE:NO

SYNC MASTER=(T27_MLB) SYNC DATE=(11/16/2009)

MCP Standard Decoupling

Apple Inc.

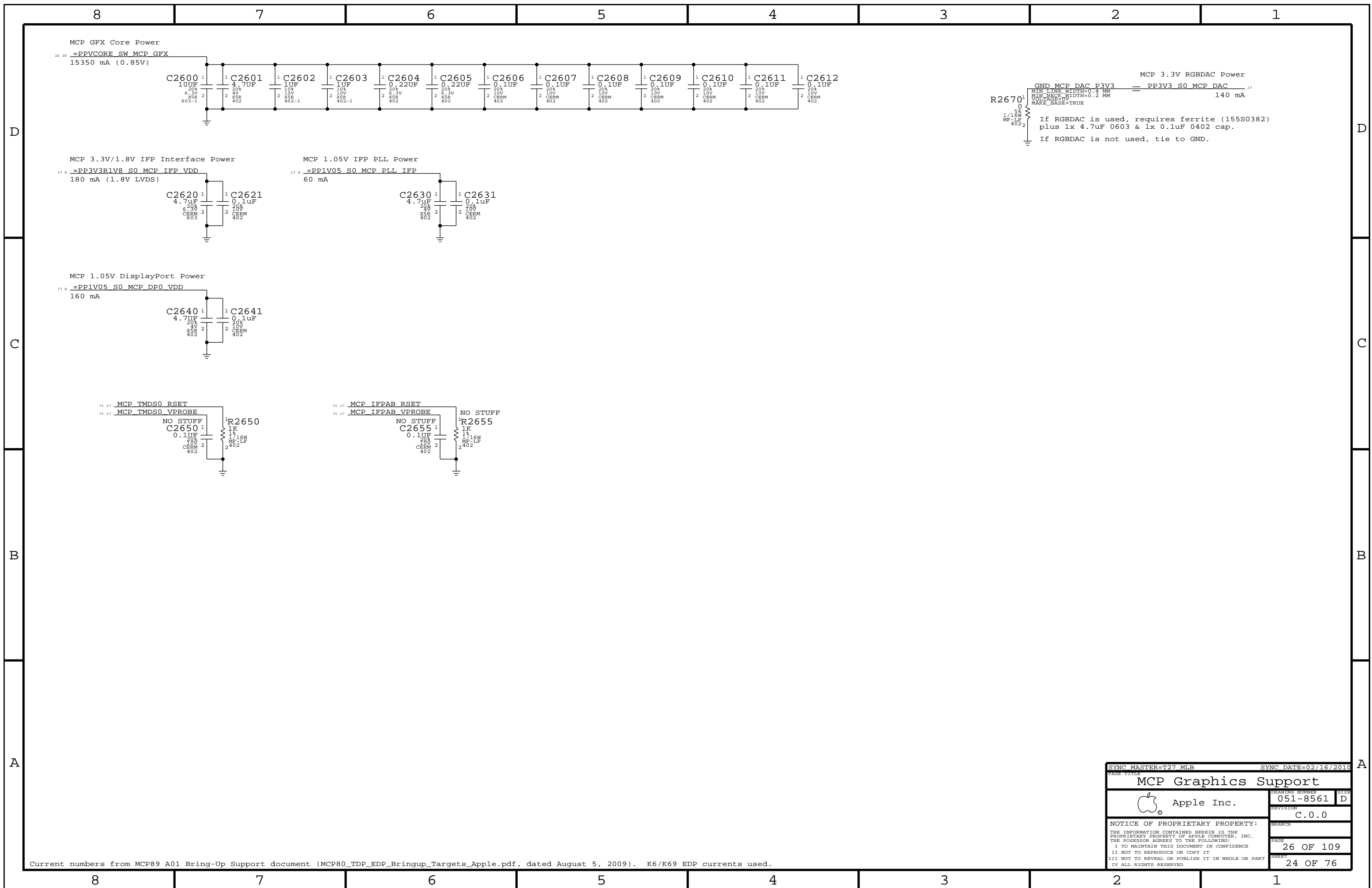
DRAWING NUMBER: 051-8561 SIZE: D

REVISION: C.0.0

BRANCH:

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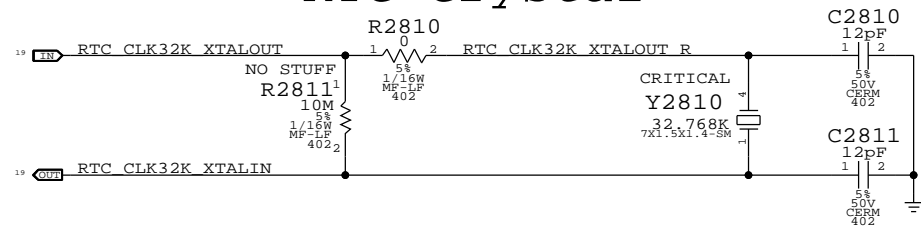
PAGE: 25 OF 109
 SHEET: 23 OF 76



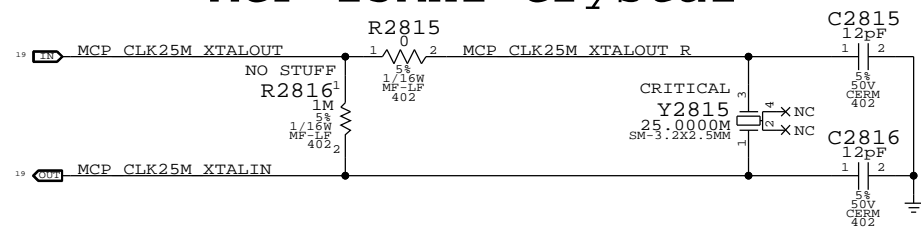
Current numbers from MCP89 A01 Bring-Up Support document (MCP80_TDP_EDP_Bringup_Targets_Apple.pdf, dated August 5, 2009). K6/K69 EDP currents used.

SYNC MASTER=T27_MLB		SYNC DATE=02/16/2010	
MCP Graphics Support			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8561	D
		REVISION	
		C.0.0	
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RTC Crystal

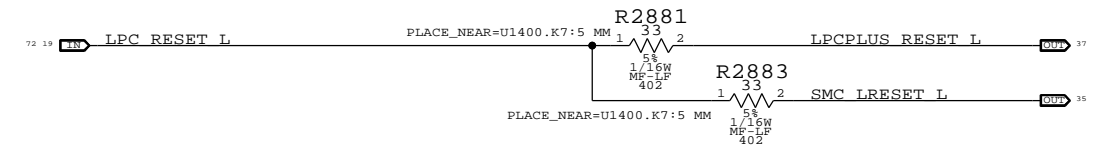


MCP 25MHz Crystal

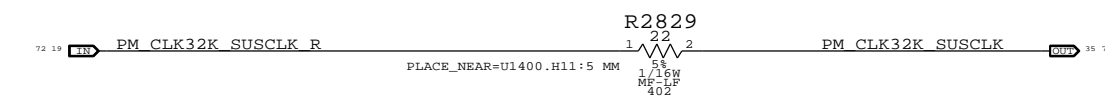
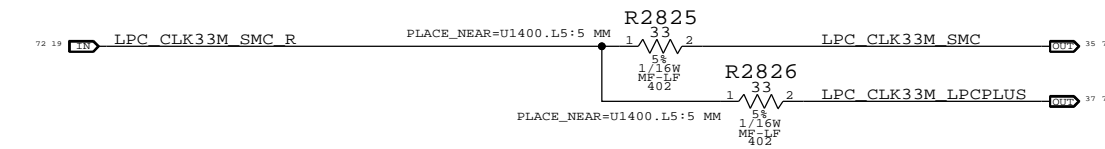
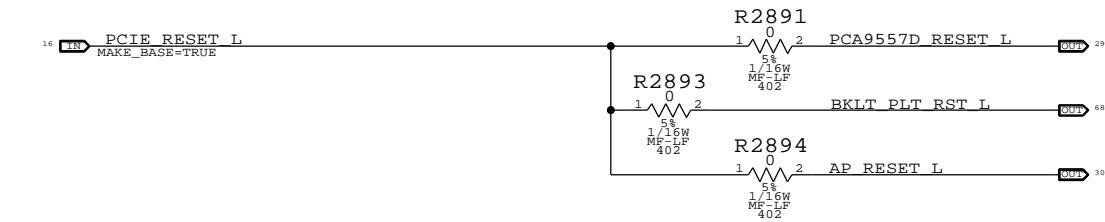


Platform Reset Connections

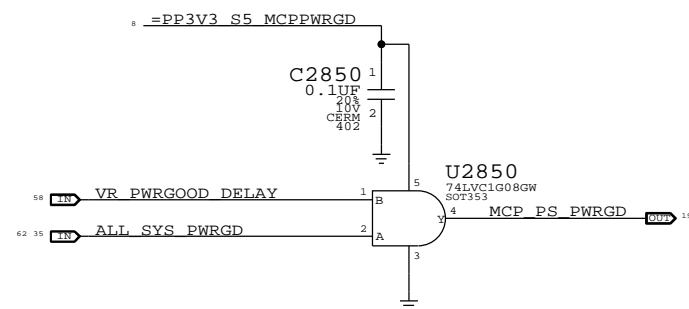
LPC Reset (Unbuffered)



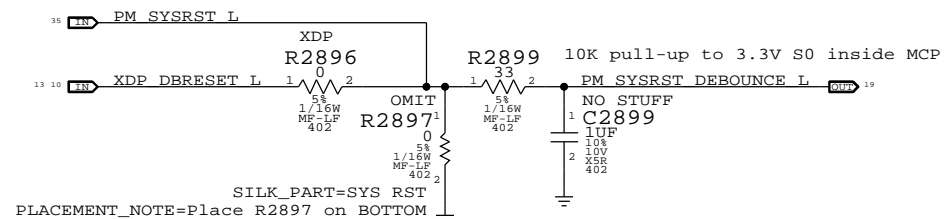
PCIE Reset (Unbuffered)



MCP S0 PWRGD & CPU_VLD



System Reset Circuit



PAGE TITLE		SYNC MASTER=(T27_MLB)		SYNC DATE=(10/07/2009)	
SB Misc					
Apple Inc.		DRAWING NUMBER	051-8561	SIZE	D
		REVISION	C.0.0		
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		SHEET	25 OF 76		

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

Page Notes

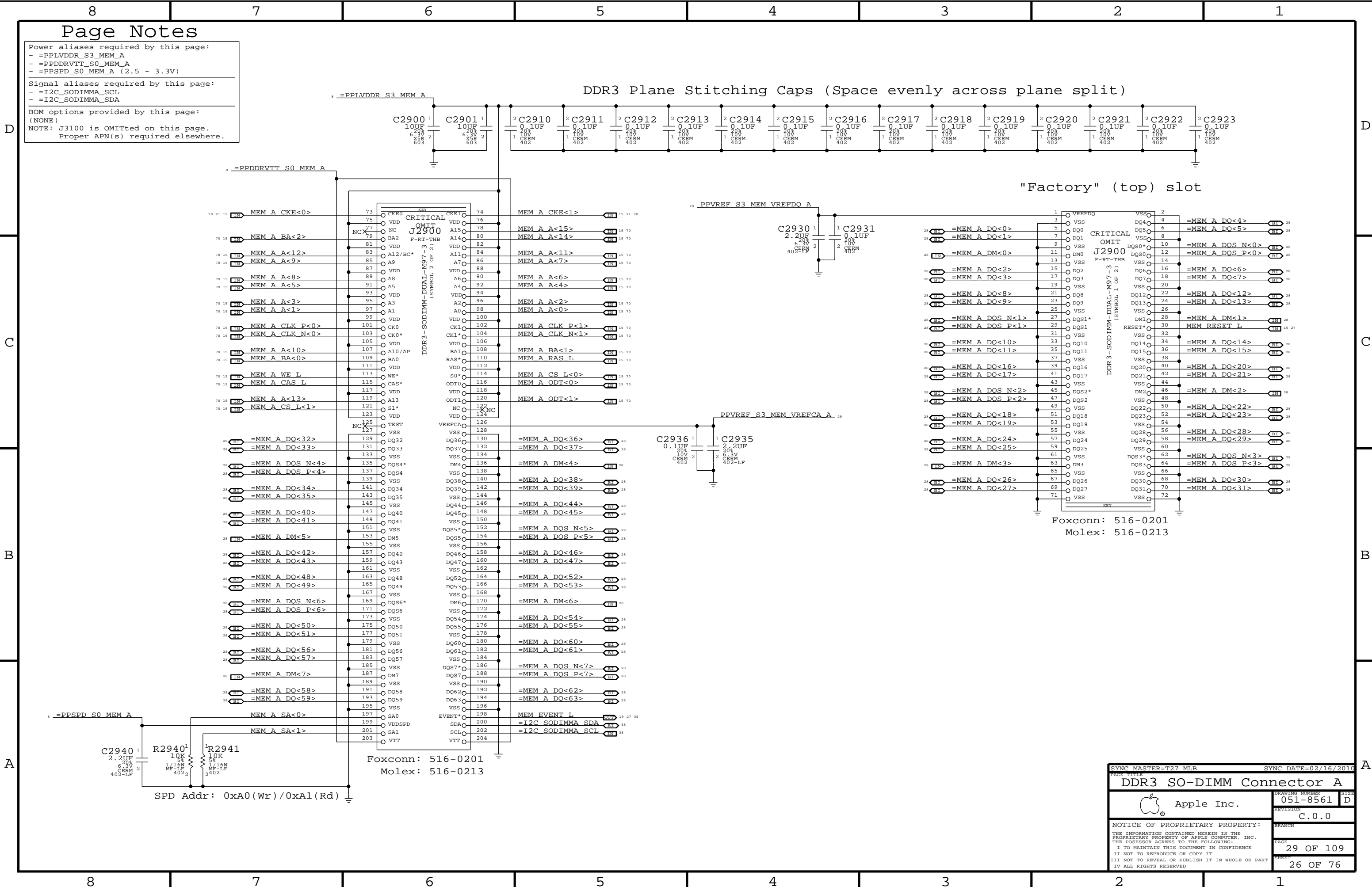
Power aliases required by this page:
 - =PPLVDDR_S3_MEM_A
 - =PPDDRVT S0_MEM_A
 - =PPSPD_S0_MEM_A (2.5 - 3.3V)

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)



SYNC MASTER=T27_MLB		SYNC DATE=02/16/2010	
DDR3 SO-DIMM Connector A			
Apple Inc.		DRAWING NUMBER	051-8561
		REVISION	C.0.0
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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)

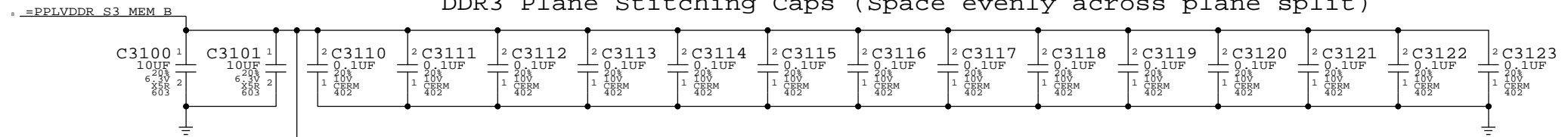
Signal aliases required by this page:

- =I2C_SODIMM_SCL
- =I2C_SODIMM_SDA

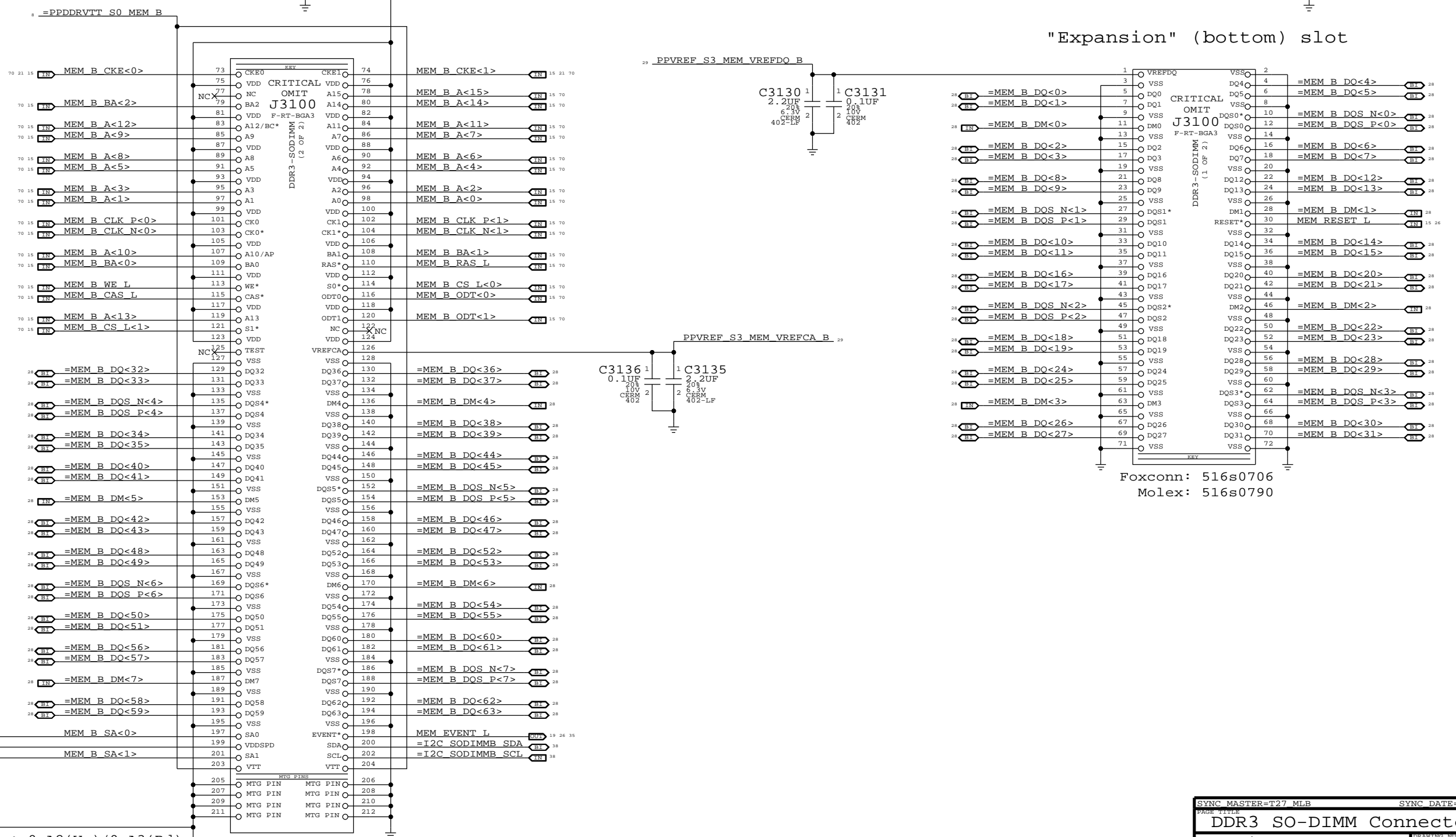
BOM options provided by this page:

(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

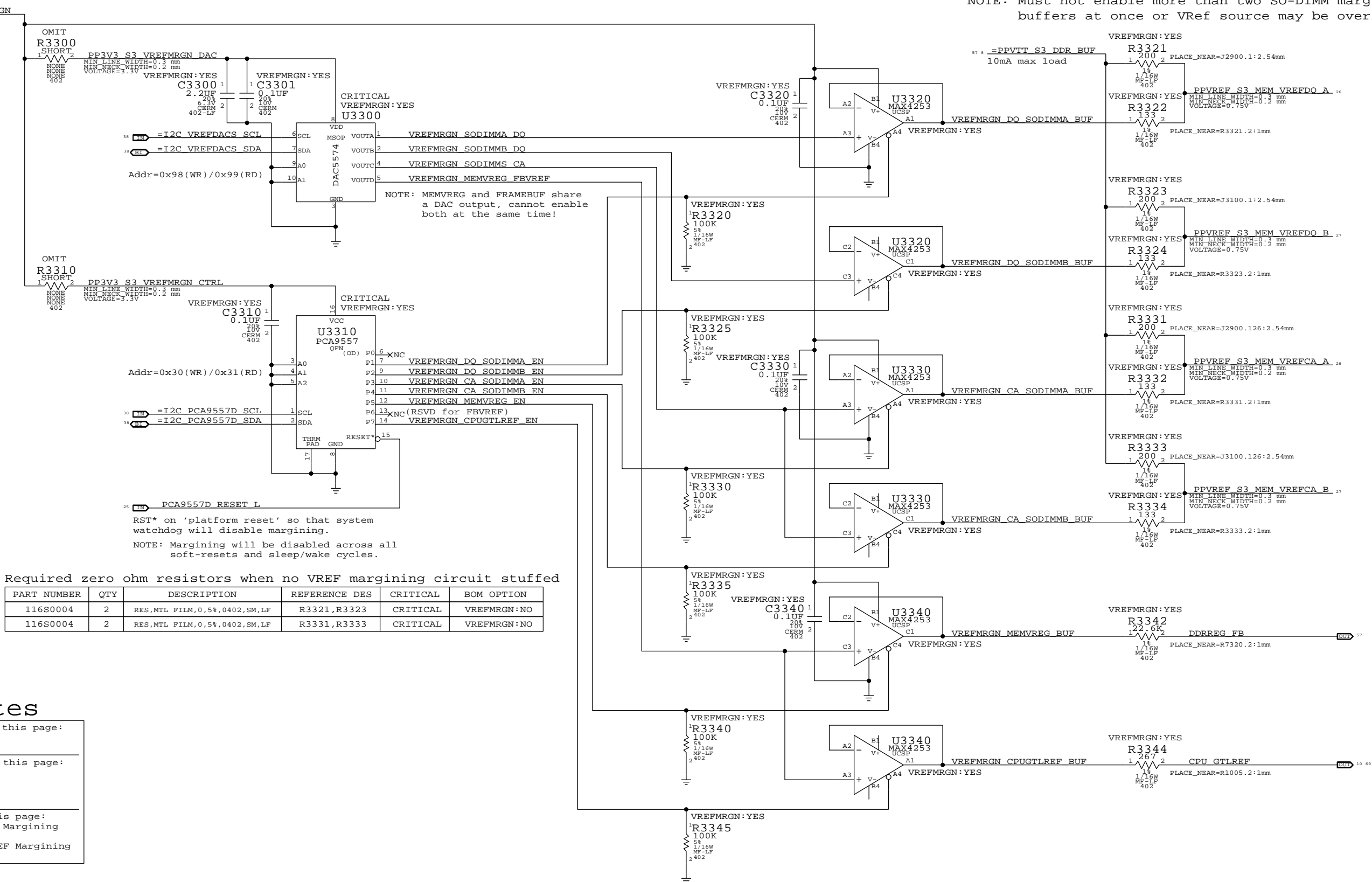


SPD Addr: 0xA2(Wr)/0xA3(Rd)
Foxconn: 516s0706
Molex: 516s0790

Foxconn: 516s0706
Molex: 516s0790

SYNC MASTER=T27_MLB		SYNC DATE=02/16/2010	
PAGE TITLE DDR3 SO-DIMM Connector B			
Apple Inc.		DRAWING NUMBER 051-8561	SIZE D
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		BRANCH	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!

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=T27_MLB SYNC DATE=02/16/2010

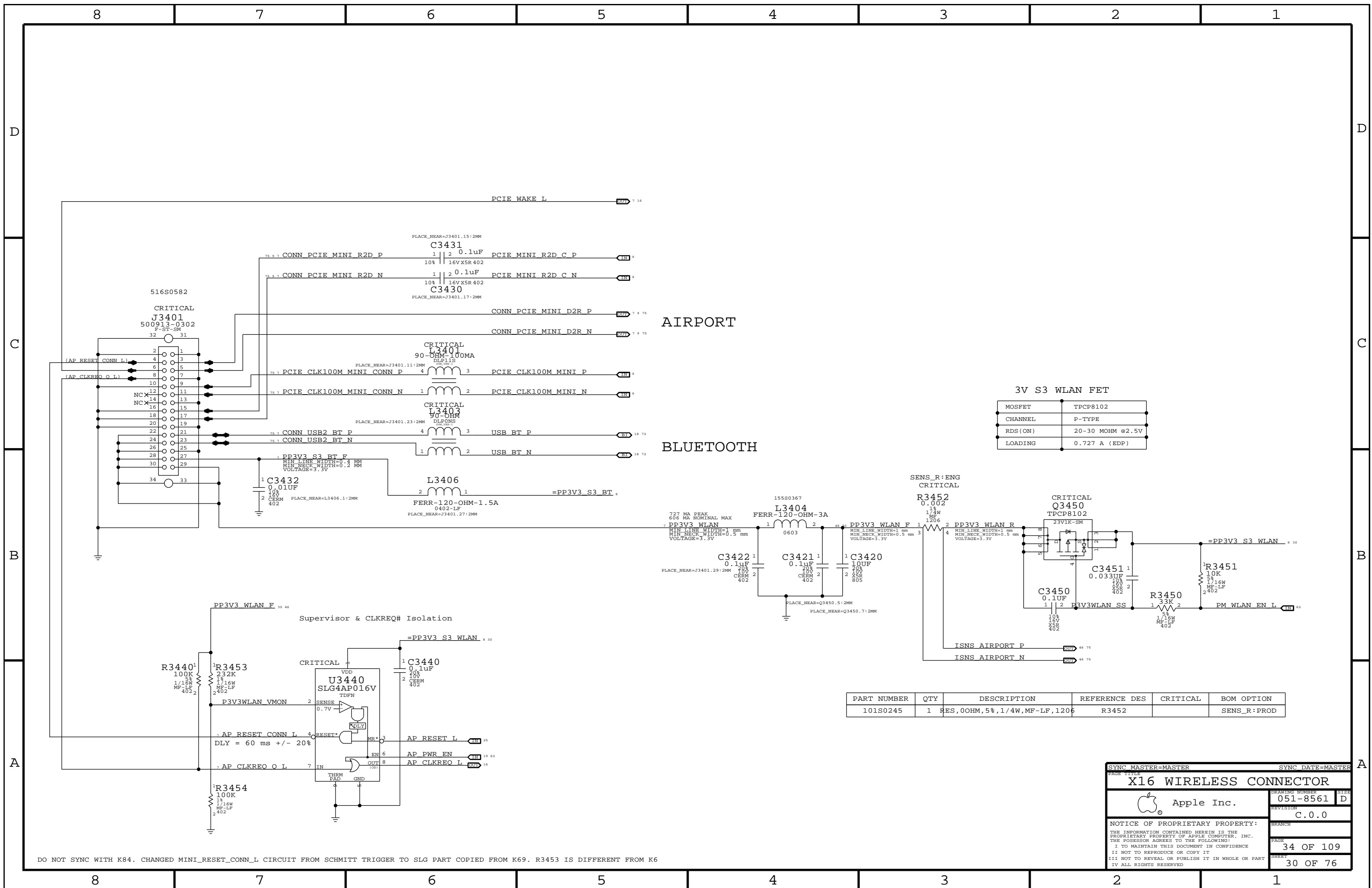
FSB/DDR3 Vref Margining

Apple Inc.

DRAWING NUMBER: 051-8561
REVISION: C.0.0

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AIRPORT

BLUETOOTH

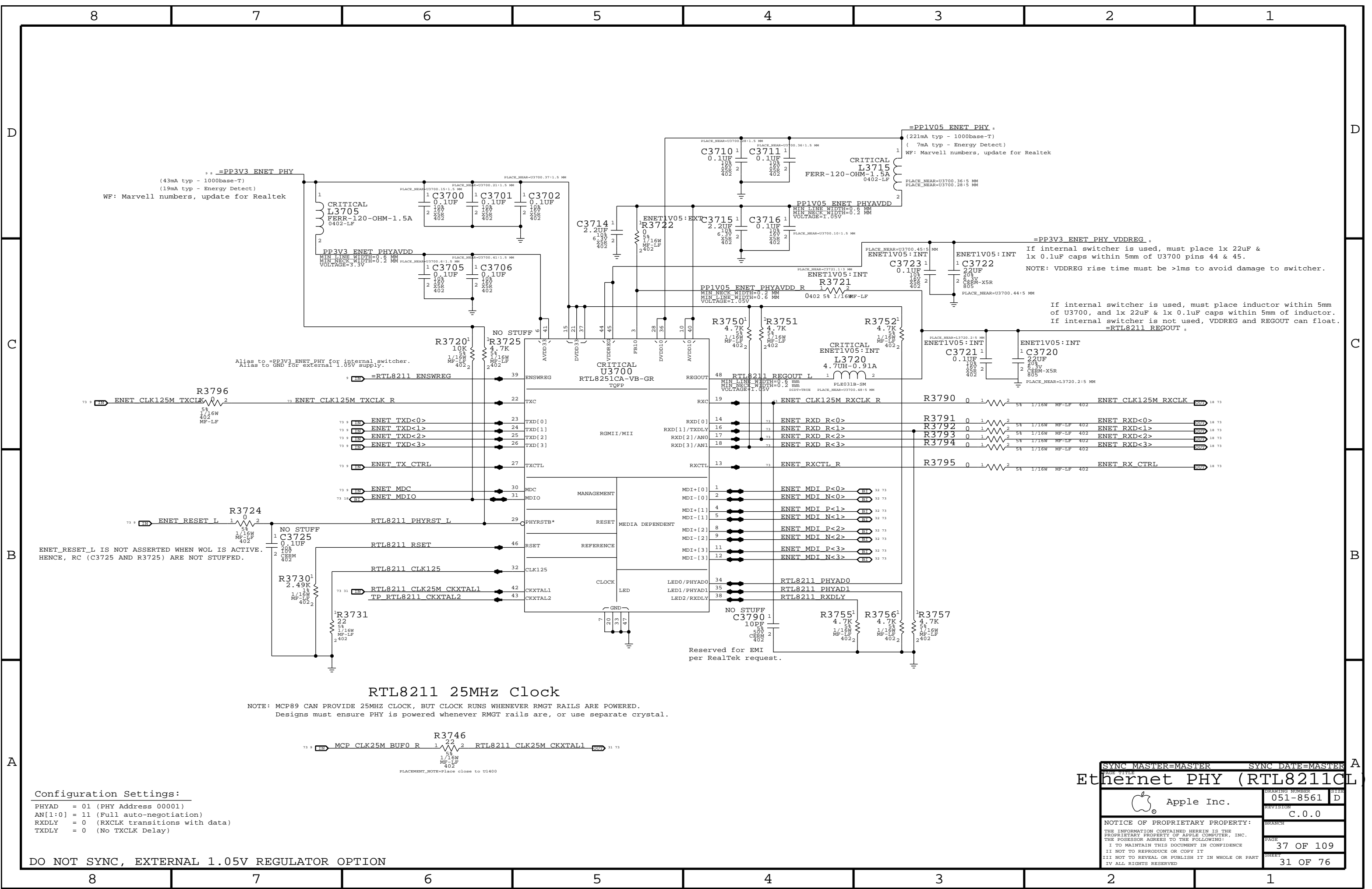
3V S3 WLAN FET

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=MASTER		SYNC DATE=MASTER	
X16 WIRELESS CONNECTOR			
Apple Inc.		DRAWING NUMBER	051-8561
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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



PP3V3 ENET PHY
 (43mA typ - 1000base-T)
 (19mA typ - Energy Detect)
 WF: Marvell numbers, update for Realtek

PP1V05 ENET PHY
 (221mA typ - 1000base-T)
 (7mA typ - Energy Detect)
 WF: Marvell numbers, update for Realtek

PP3V3 ENET PHY VDDREG
 If internal switcher is used, must place 1x 22uF & 1x 0.1uF caps within 5mm of U3700 pins 44 & 45.
 NOTE: VDDREG rise time must be >1ms to avoid damage to switcher.

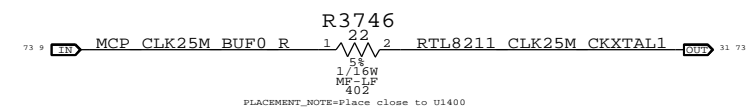
If internal switcher is used, must place inductor within 5mm of U3700, and 1x 22uF & 1x 0.1uF caps within 5mm of inductor.
 If internal switcher is not used, VDDREG and REGOUT can float.
 =RTL8211 REGOUT

Alias to =PP3V3 ENET_PHY for internal switcher.
 Alias to GND for external 1.05V supply.

ENET_RESET_L IS NOT ASSERTED WHEN WOL IS ACTIVE.
 HENCE, RC (C3725 AND R3725) ARE NOT STUFFED.

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=MASTER		SYNC DATE=MASTER	
Ethernet PHY (RTL8211CL)			
Apple Inc.		DRAWING NUMBER	051-8561
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		BRANCH	
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8 7 6 5 4 3 2 1

D

D

C

C

B

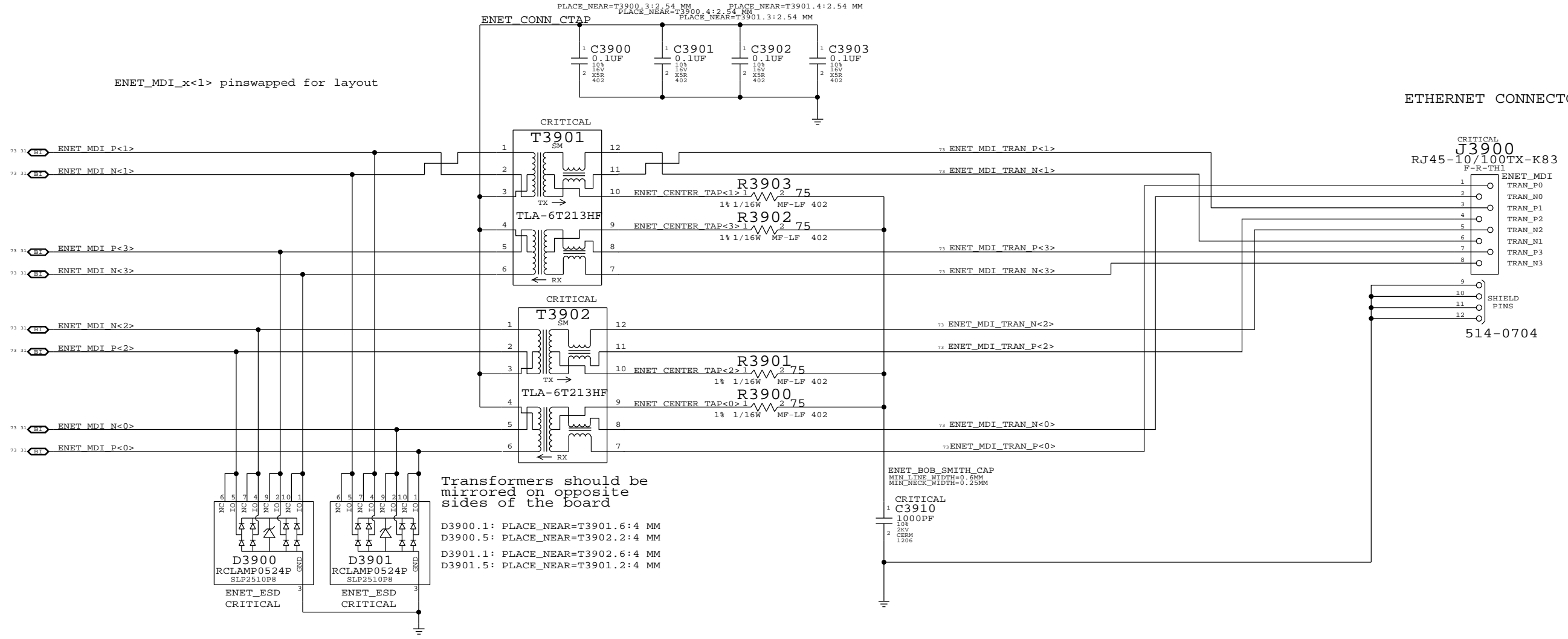
B

A

A

ENET_MDI_x<1> pinswapped for layout

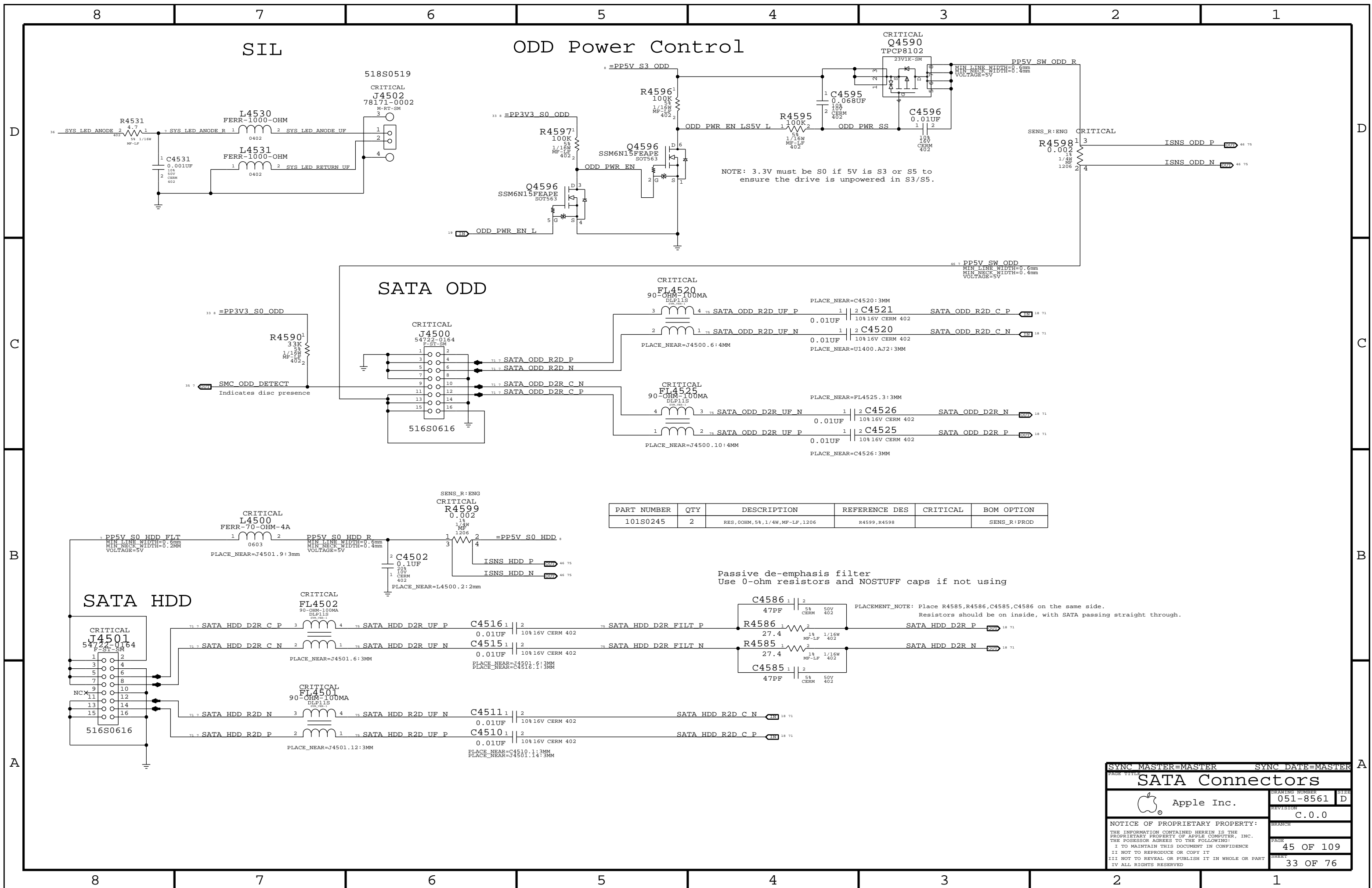
ETHERNET CONNECTOR



DO NOT SYNC FROM K6, WITH K84'S CONNECTOR

SYNC MASTER=MASTER		SYNC DATE=MASTER	
ETHERNET CONNECTOR			
Apple Inc.		DRAWING NUMBER	SIZE
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8 7 6 5 4 3 2 1



NOTE: 3.3V must be S0 if 5V is S3 or S5 to ensure the drive is unpowered in S3/S5.

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

Passive de-emphasis filter
Use 0-ohm resistors and NOSTUFF caps if not using

PLACEMENT_NOTE: Place R4585, R4586, C4585, C4586 on the same side.
Resistors should be on inside, with SATA passing straight through.

SYNC MASTER=MASTER SYNC DATE=MASTER

SATA Connectors

Apple Inc.

DRAWING NUMBER: 051-8561 SIZE: D

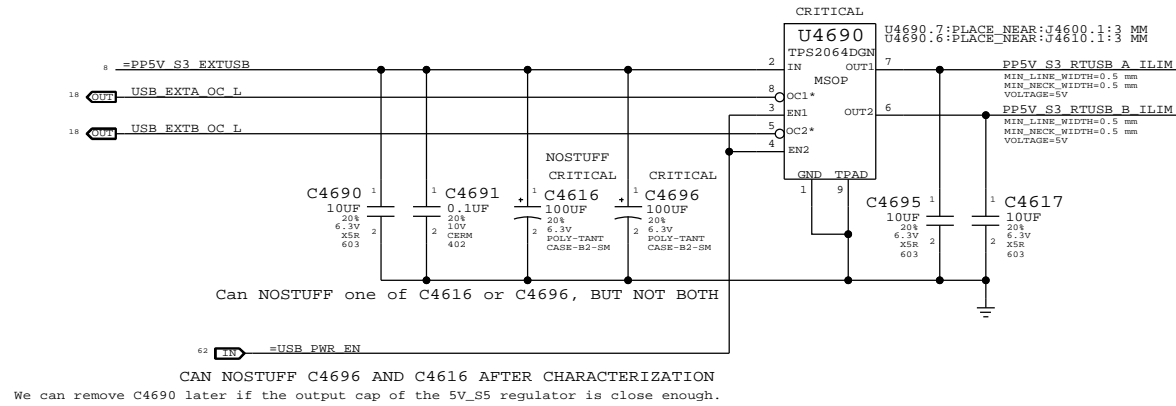
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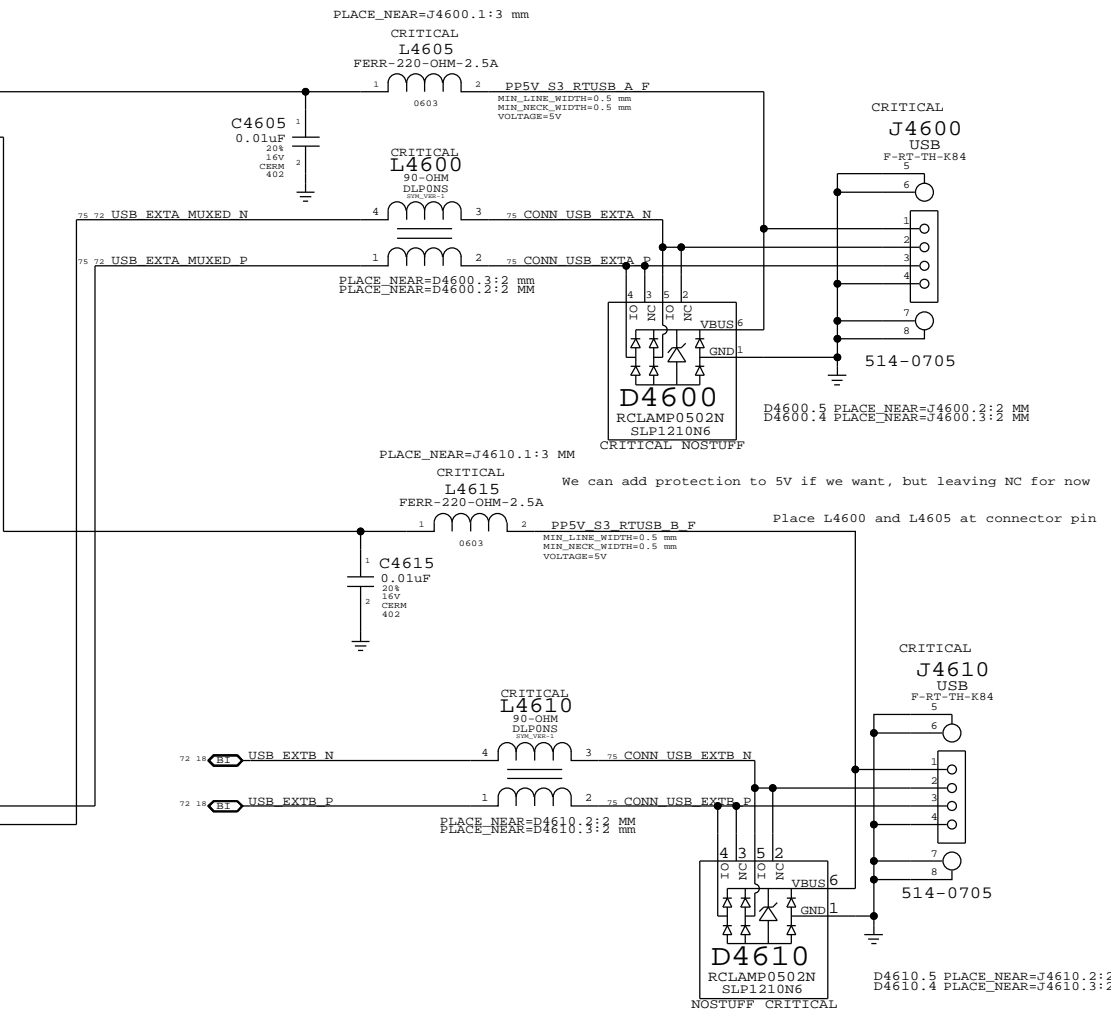
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POR IS METAL USB CONNECTOR PARTS

Port Power Switch

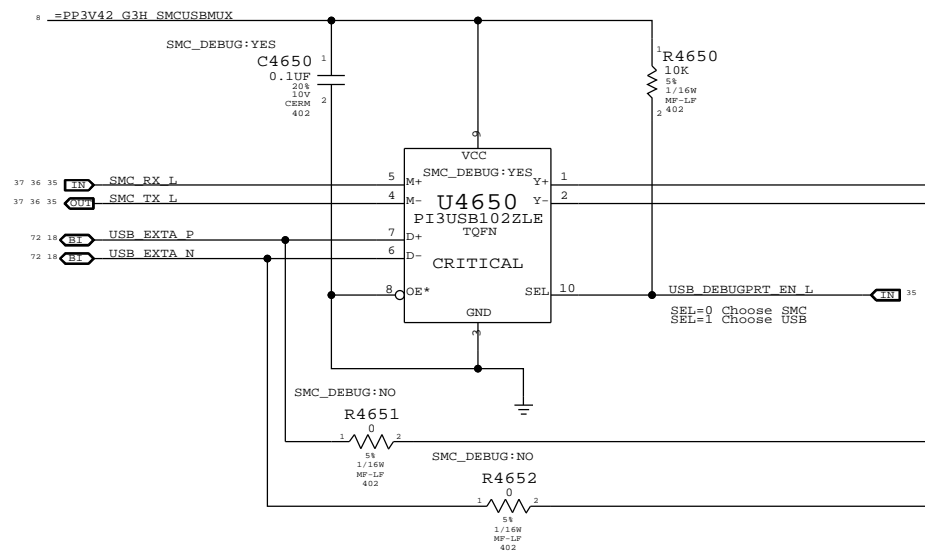


USB PORT A (FRONT PORT)



USB PORT B (BACK PORT)

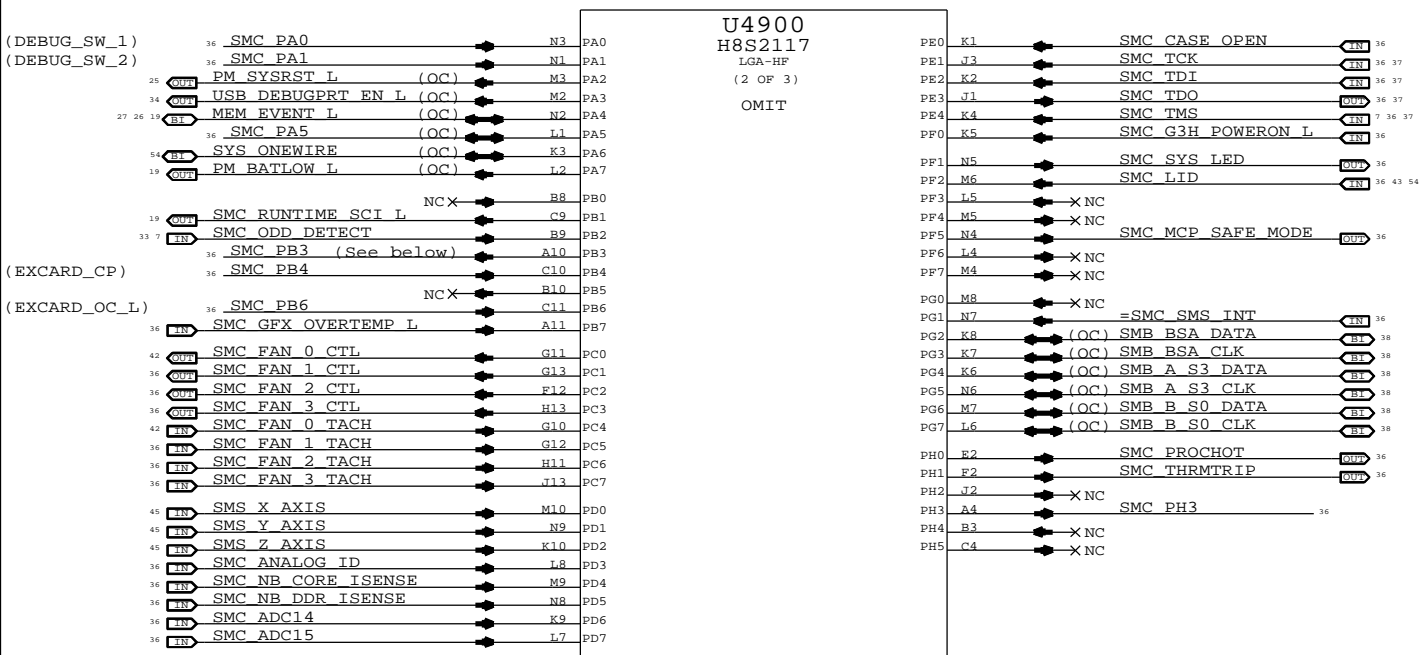
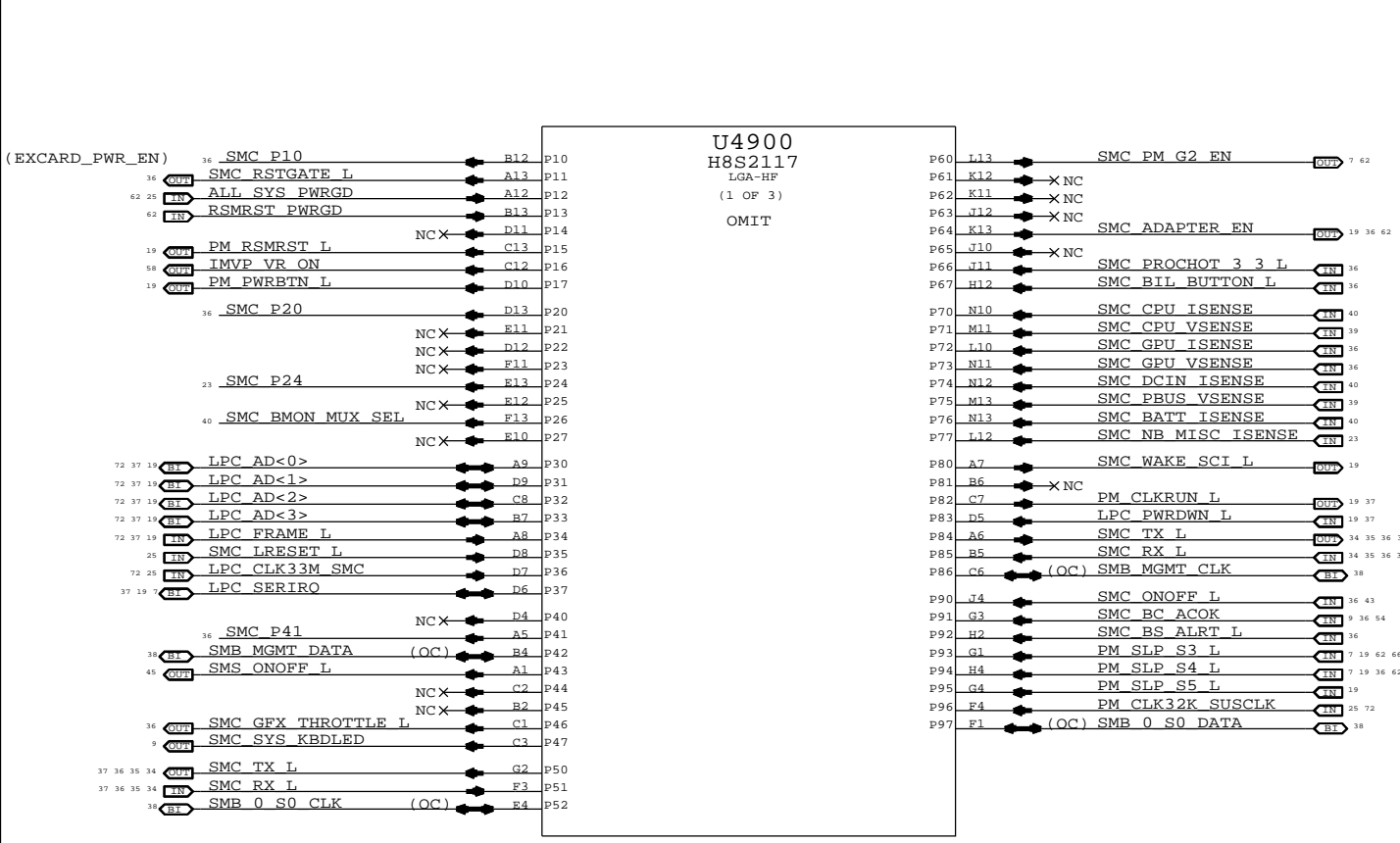
USB/SMC Debug Mux



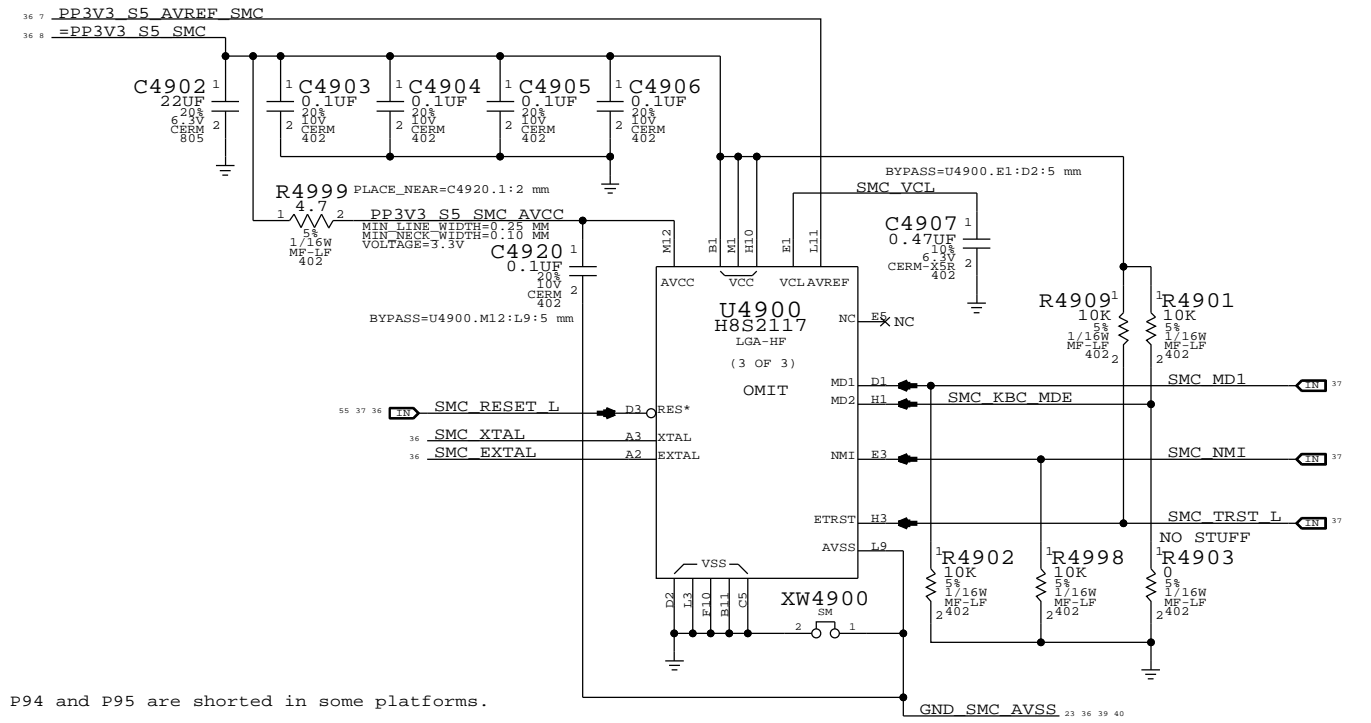
DO NOT SYNC WITH K84. UPDATED PLACE NEAR NOTES
 UPDATED SMC_DEBUG BOMOPTION, STUFFED C4690

SYNC MASTER=(K84_MLB)		SYNC DATE=(10/03/2009)	
External USB Connectors			
Apple Inc.		DRAWING NUMBER	051-8561
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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.



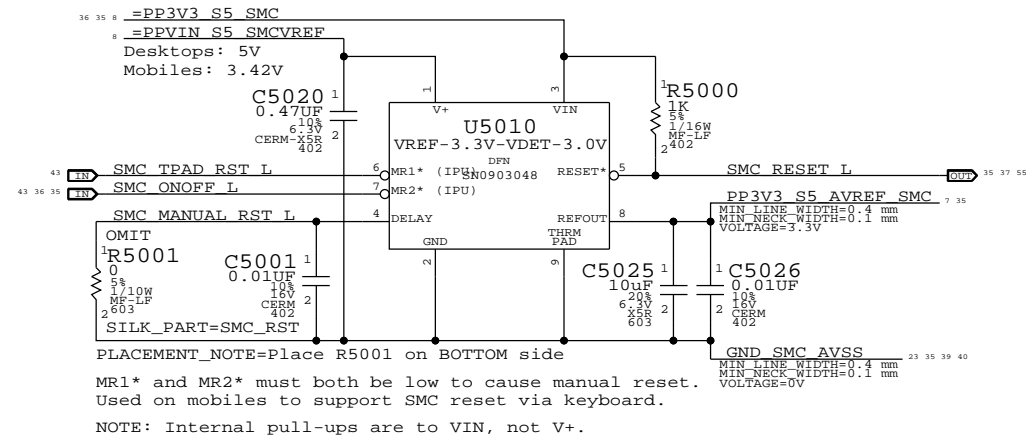
NOTE: P94 and P95 are shorted in some platforms.

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

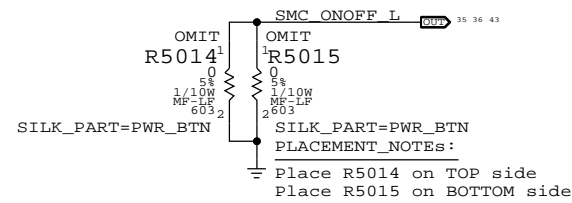
H8S2117-R:
(SMC_PECI)
(SMC_PECI_VREF)
(SMC_PECI_VSTP)

SYNC MASTER=T27 MLB		SYNC DATE=02/16/2010	
SMC			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8561	D
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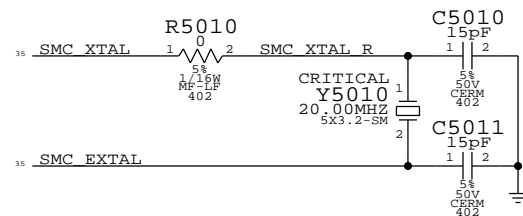
SMC Reset "Button", Supervisor & AVREF Supply



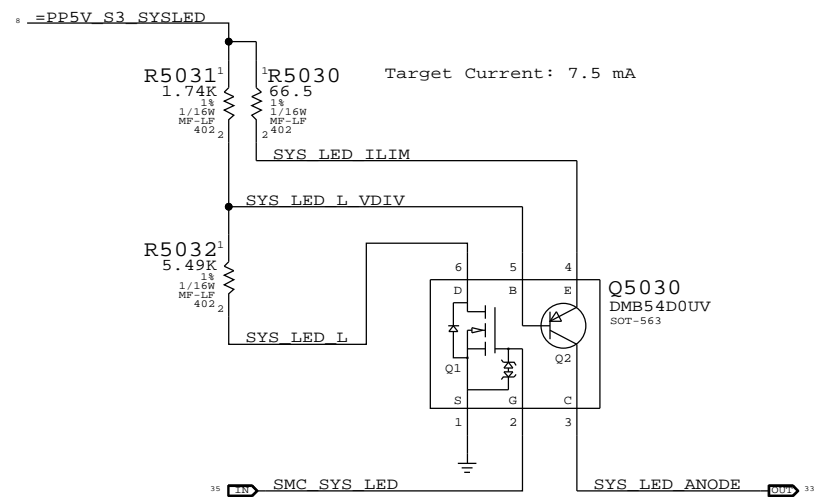
Debug Power "Buttons"



SMC Crystal Circuit

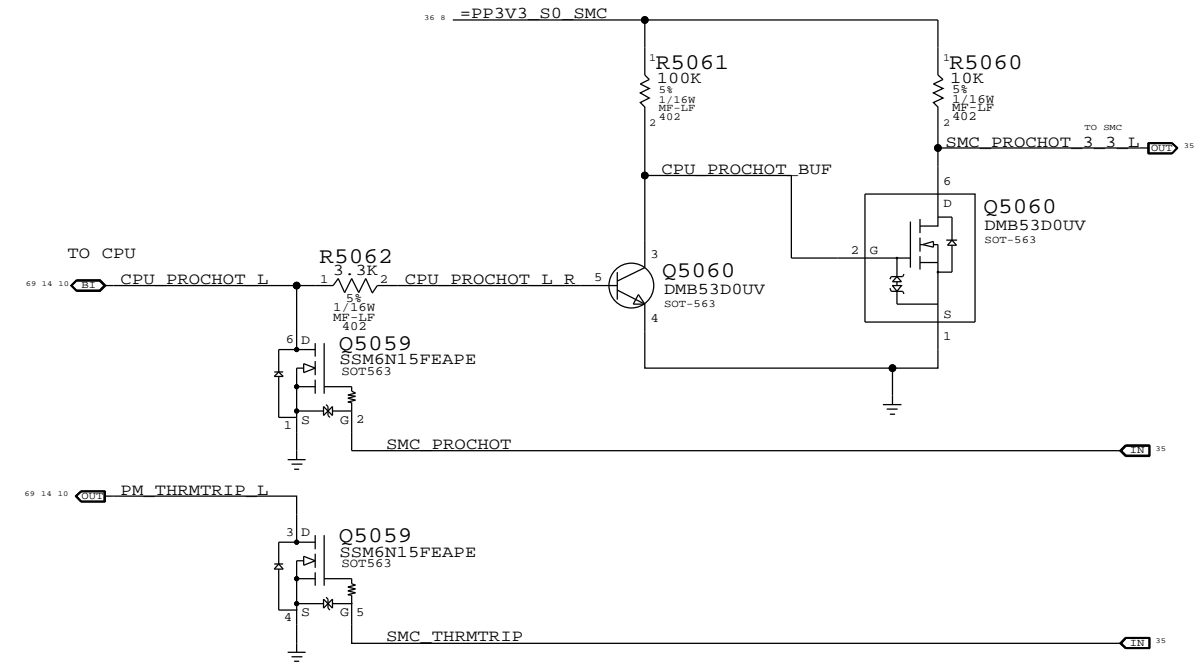


System (Sleep) LED Circuit

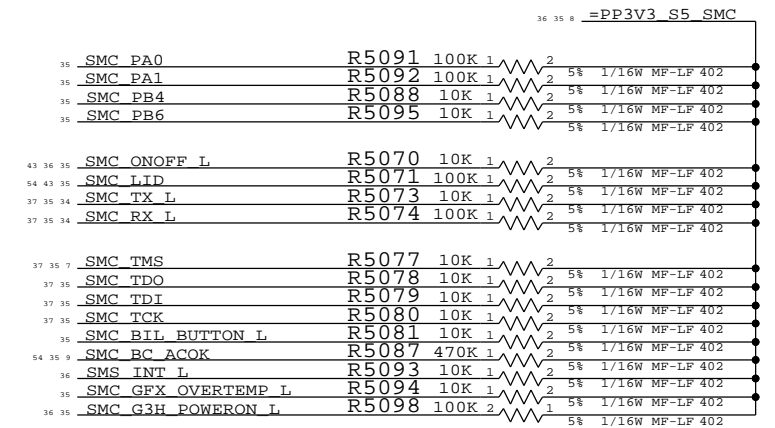


R5030,R5031,R5032 CHANGED FOR DIMMER LED

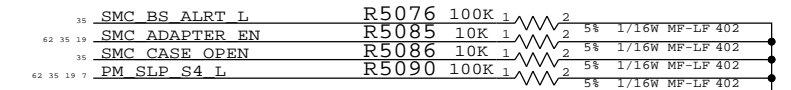
SMC FSB to 3.3V Level Shifting



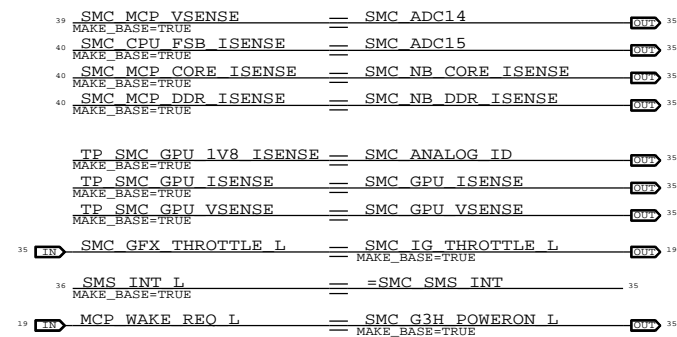
SMC Pull-ups



SMC Pull-downs



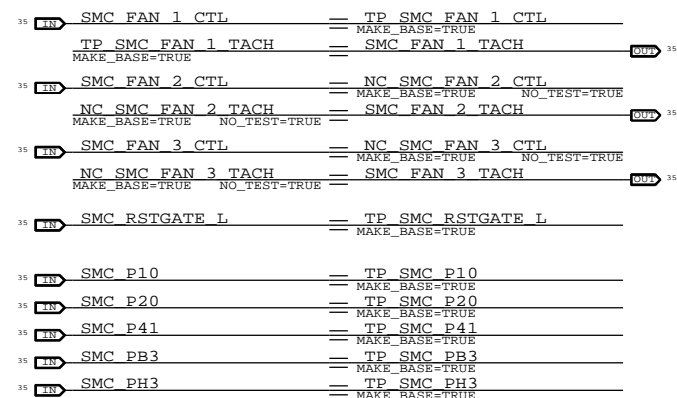
SMC Aliases



R5096

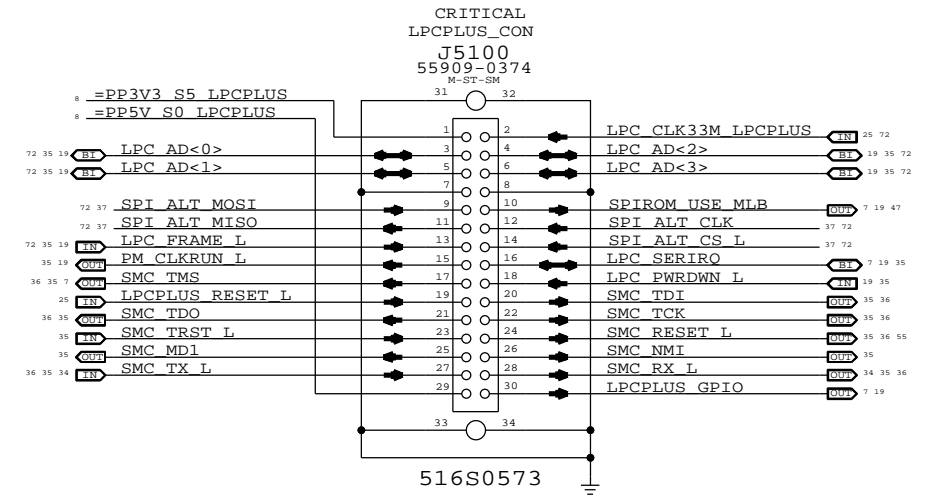


Unused Pins

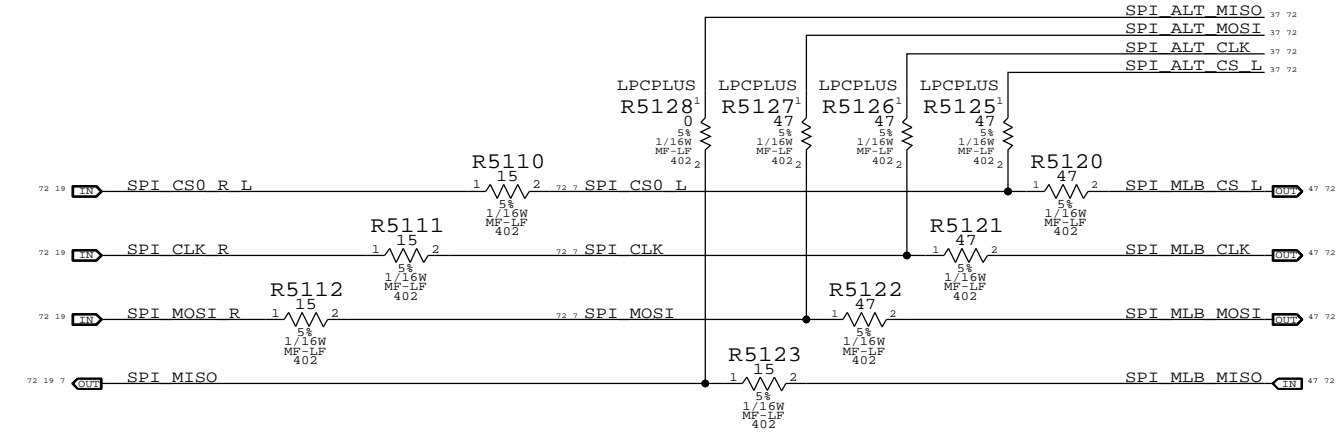


SYNC MASTER=(T27_MLB)		SYNC DATE=(10/27/2009)	
SMC Support			
Apple Inc.		DRAWING NUMBER	SIZE
Apple logo		051-8561	D
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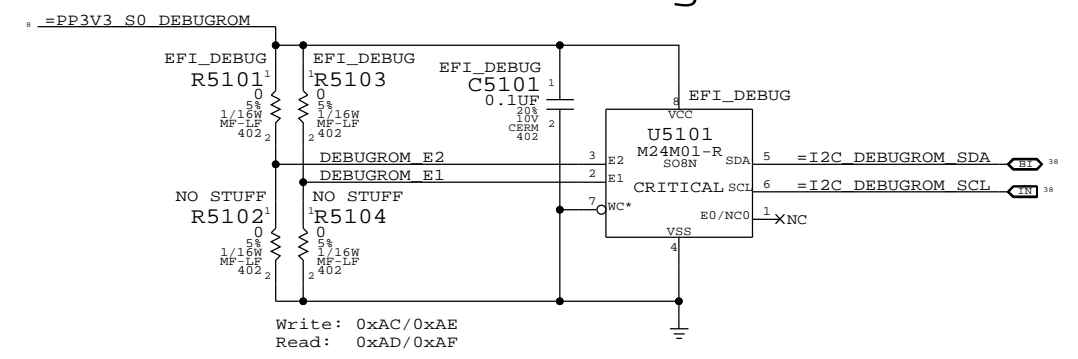
LPC+SPI Connector



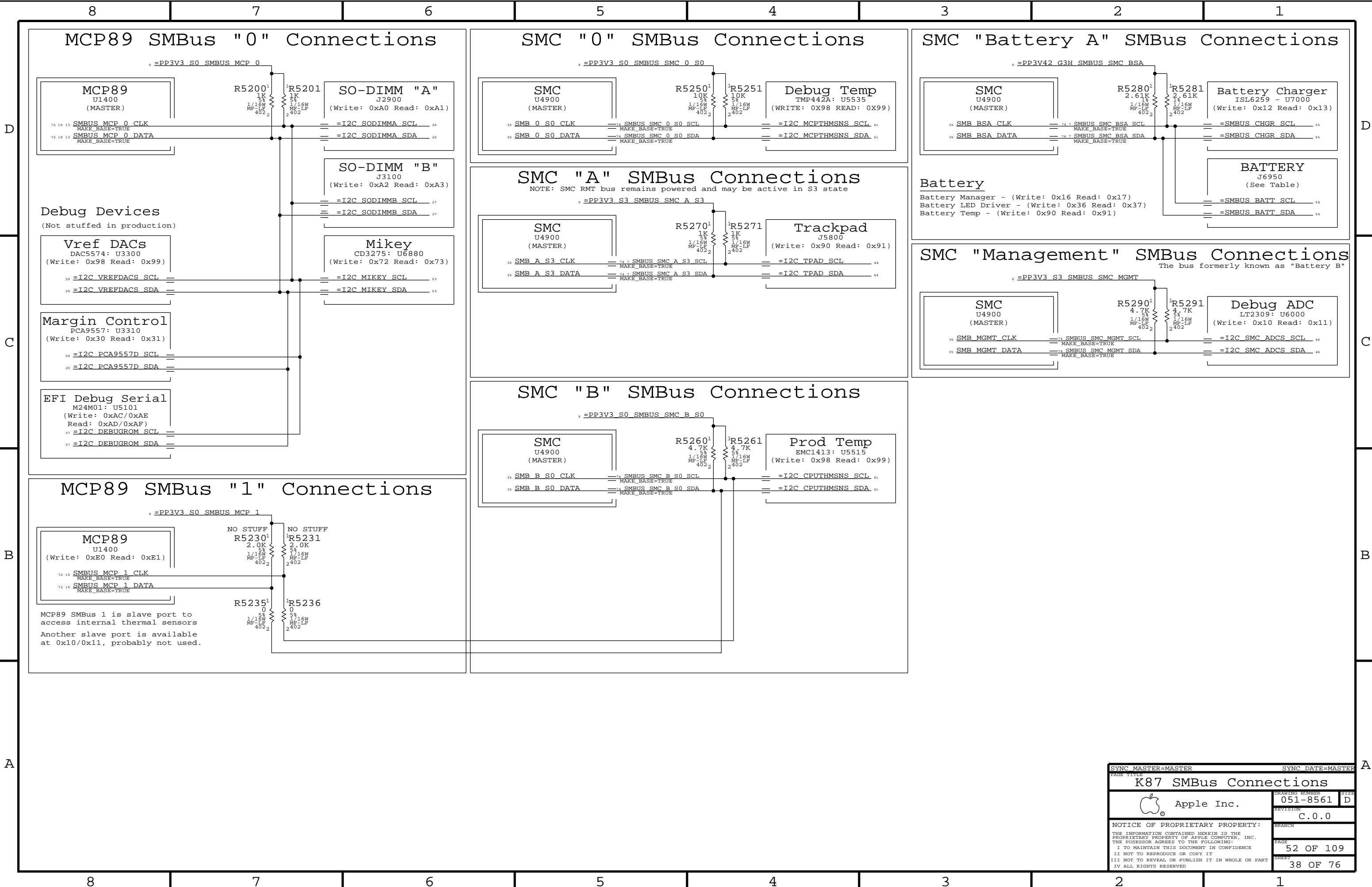
SPI Bus Series Termination



EFI Debug ROM

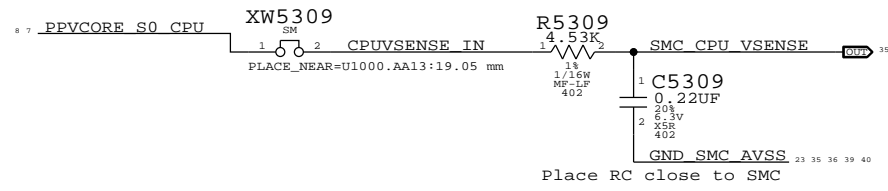


PAGE TITLE		SYNC DATE=(12/15/2009)	
LPC+SPI Debug Connector			
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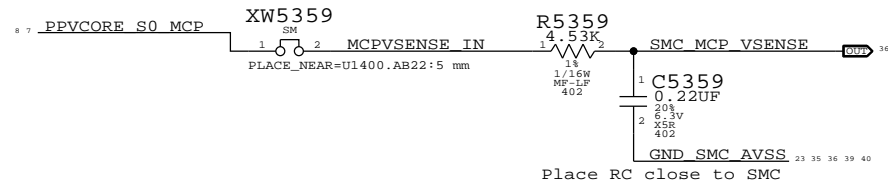


SYNC MASTER=MASTER		SYNC DATE=MASTER	
PAGE TITLE K87 SMBus Connections			
Apple Inc.	DRAWING NUMBER	051-8561	SIZE D
	REVISION	C.0.0	
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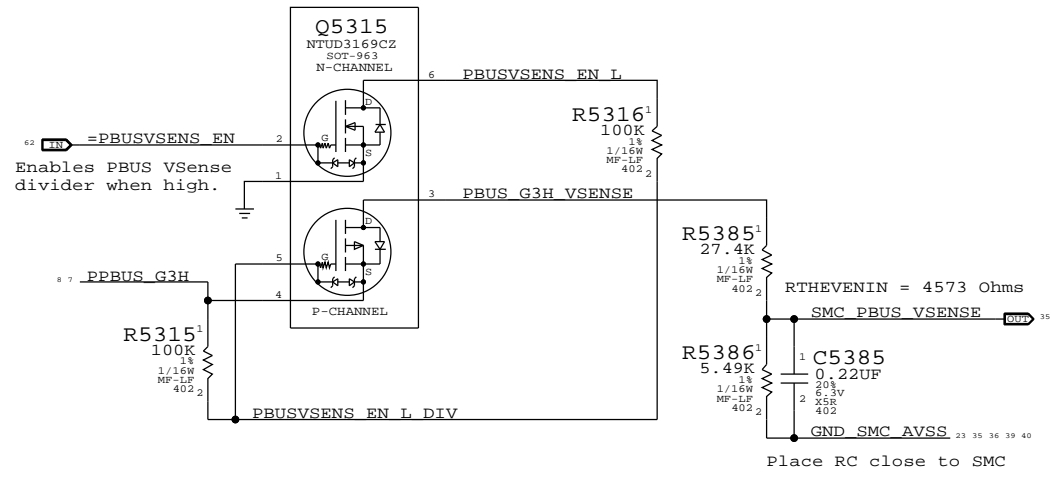
CPU Voltage Sense / Filter



MCP Voltage Sense / Filter

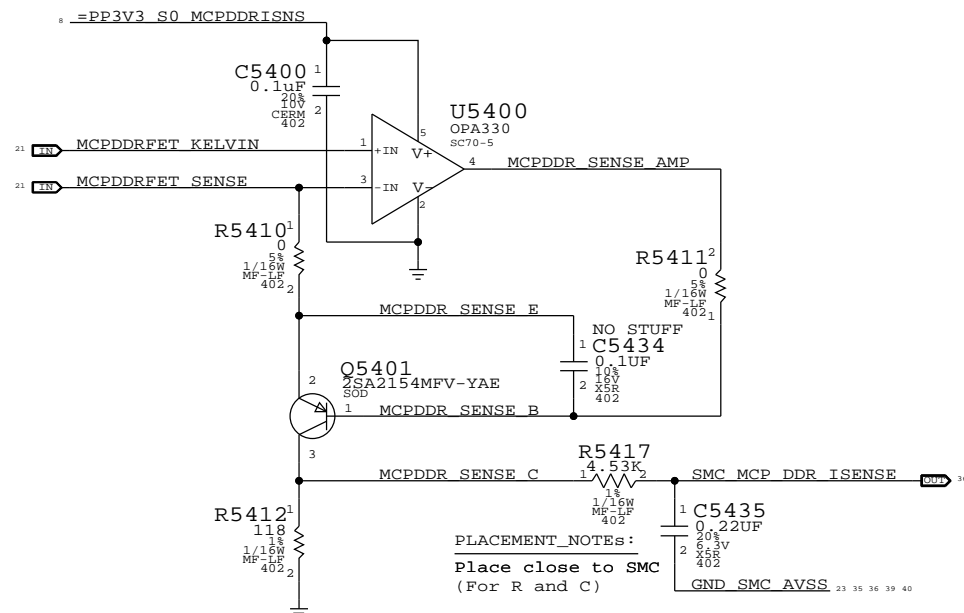


PBUS Voltage Sense Enable & Filter

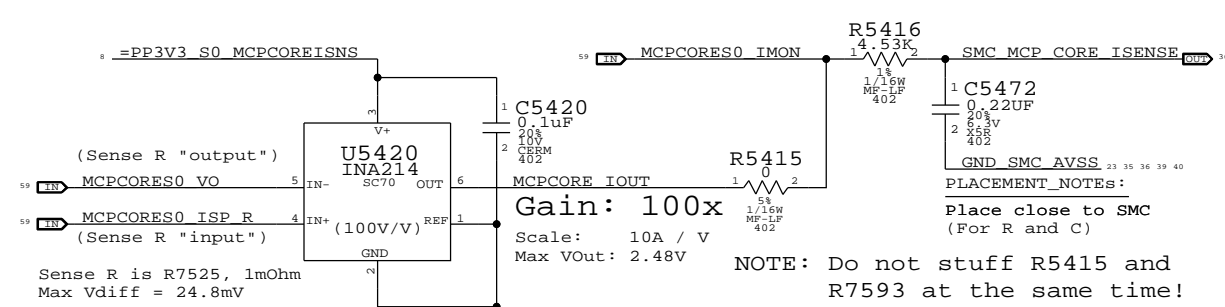


PAGE TITLE		DRAWING NUMBER		SIZE	
Voltage Sensing		051-8561		D	
Apple Inc.		REVISION		C.0.0	
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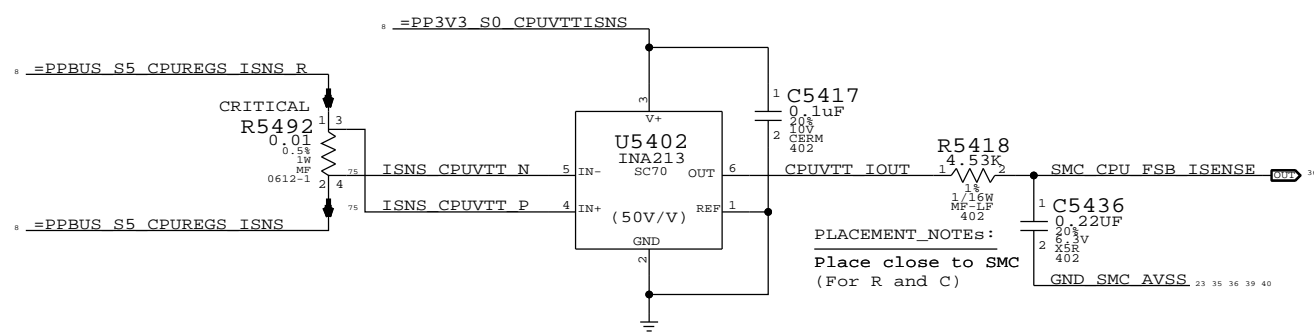
MCP MEM VDD Current Sense / Filter



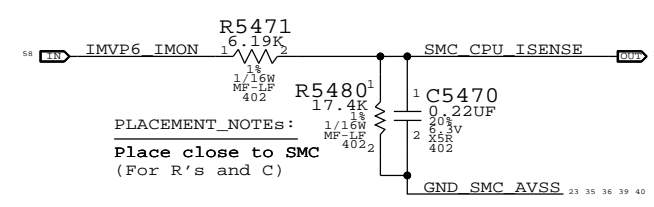
MCP VCore Current Sense Filter



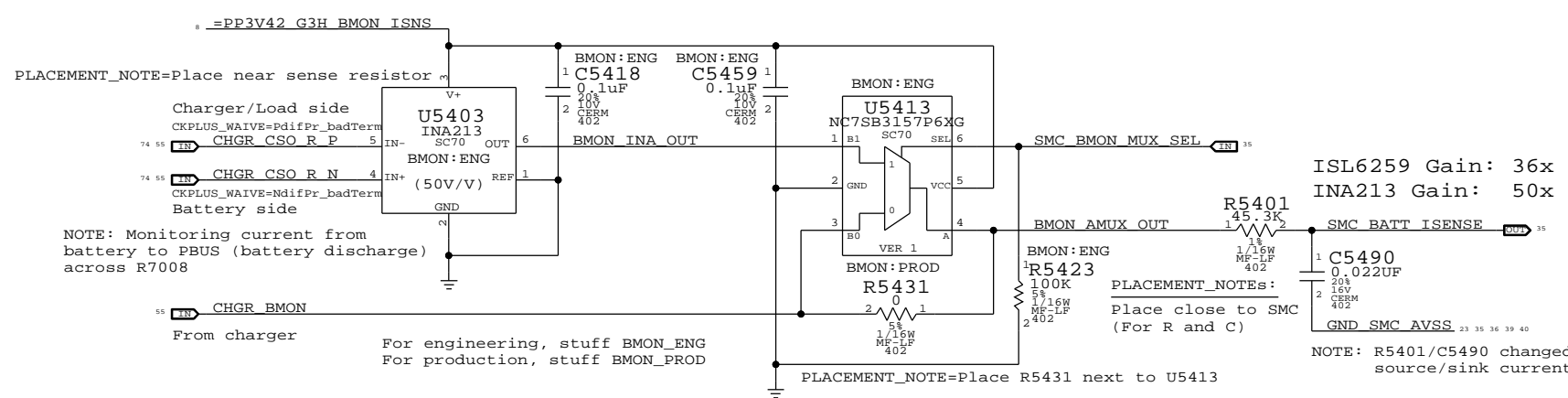
MCP/CPU 1.05V AND CPU VCore High-Side Current Sense / Filter



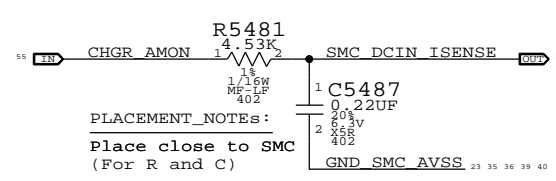
CPU VCore Load Side Current Sense / Filter



Battery (BMON) Current Sense, MUX & Filter

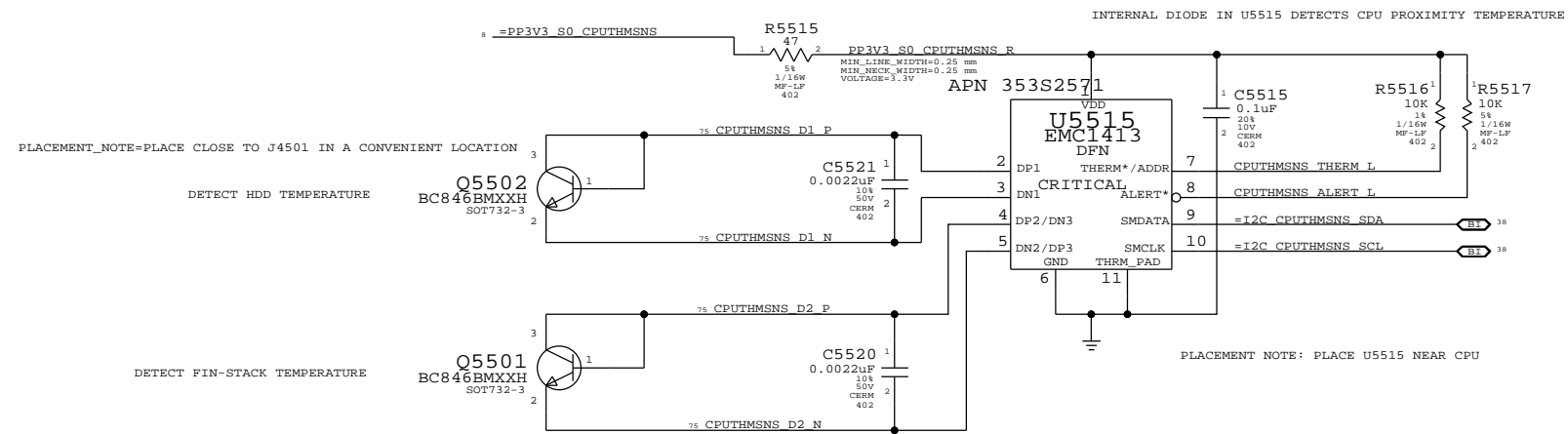


DC-IN (AMON) Current Sense Filter

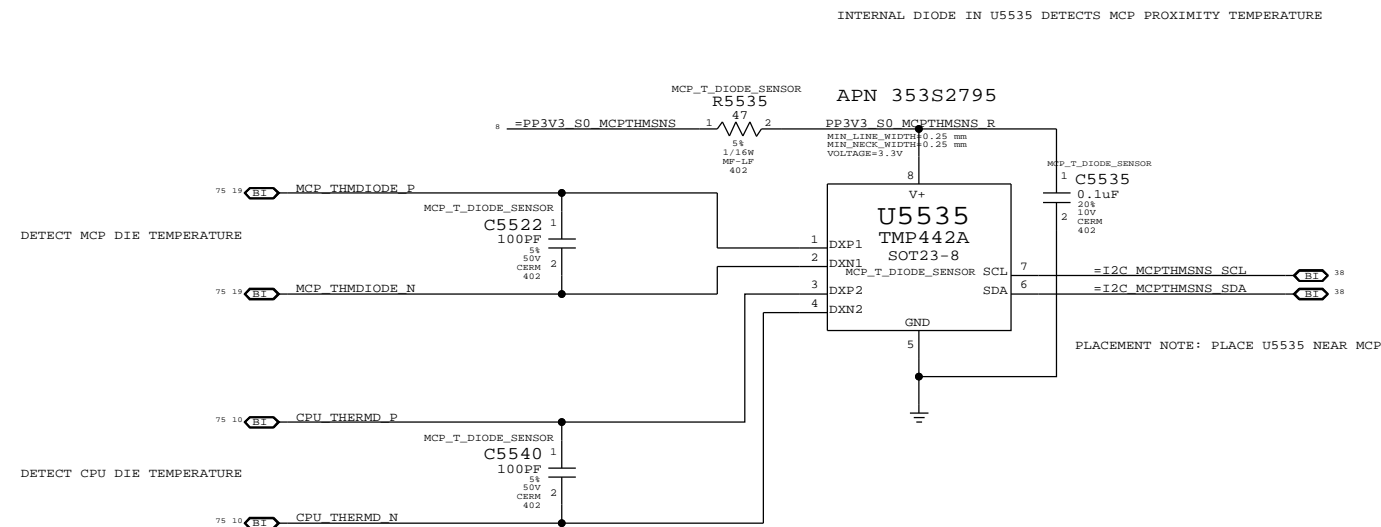


PAGE TITLE		SYNC MASTER=T27 MLB		SYNC DATE=02/02/2010	
Current Sensing					
Apple Inc.		DRAWING NUMBER	051-8561	SIZE	D
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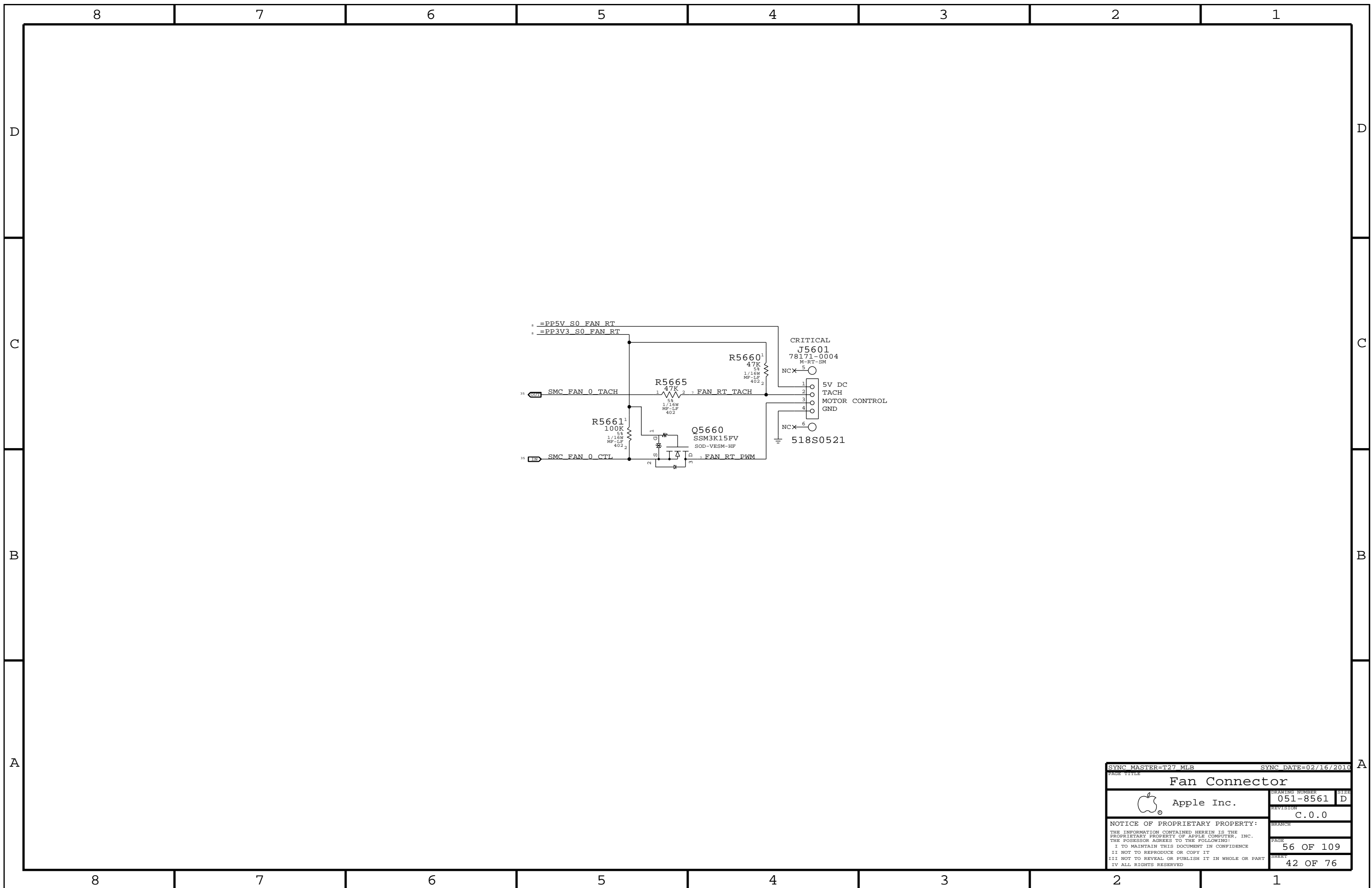
CPU PROXIMITY/HDD FLEX AREA/FINSTACK THERMAL SENSOR



MCP DIE/CPU DIE/MCP PROXIMITY THERMAL SENSOR



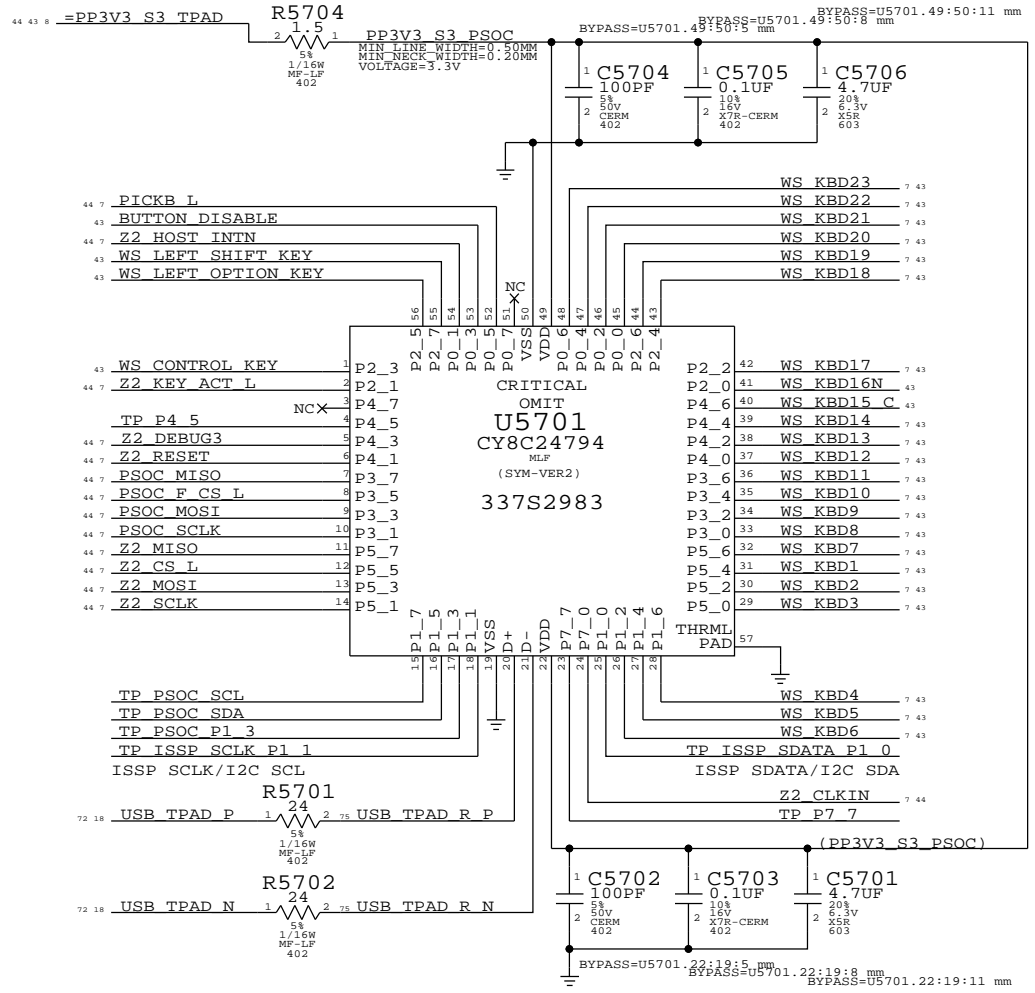
SYNC MASTER=MASTER		SYNC DATE=MASTER	
Thermal Sensors			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8561	D
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SYNC_MASTER=T27_MLB		SYNC_DATE=02/16/2010	
PAGE TITLE Fan Connector			
DRAWING NUMBER 051-8561		SIZE D	
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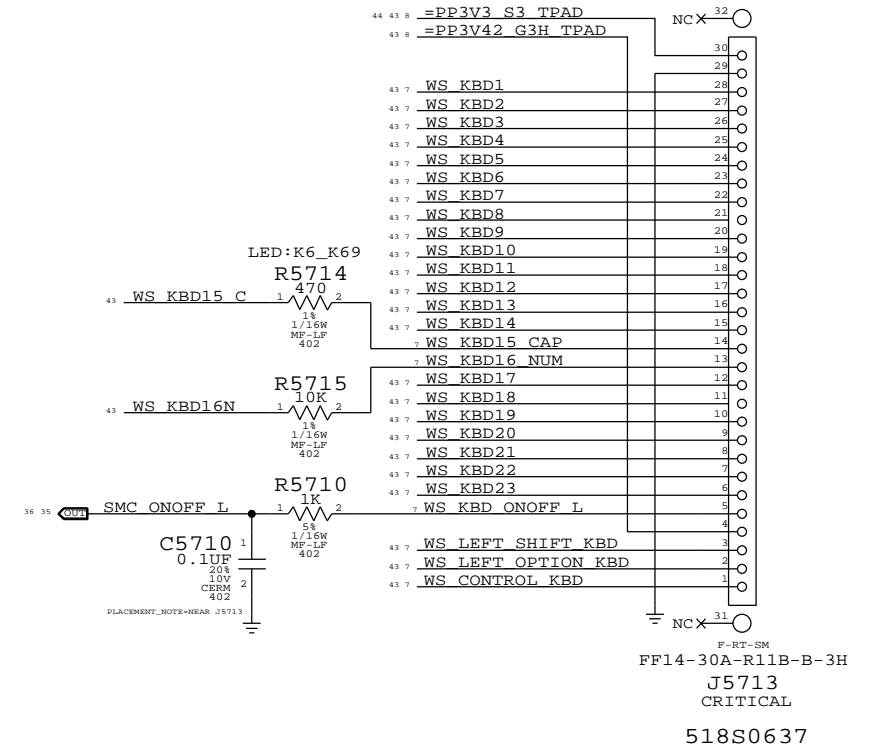
PSOC USB CONTROLLER

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

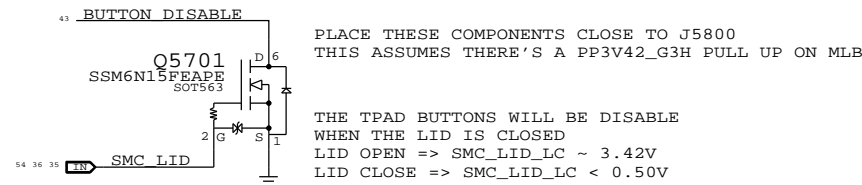


IC	PIN NAME	CURRENT	R_SNS	V_SNS	POWER
TMP102	V+	10UA	2.55 KOHM	0.0255 V	0.255E-6 W
	80UA			0.204 V	16.32E-6 W
3V3 LDO	VDD	60MA (MAX)	10 OHM	0.6 V	36E-3 W
	VOUT	60MA (MAX)	0.2 OHM	0.012 V	0.72E-3 W
PSOC	VDD	8MA (TYP)	1.5 OHM	0.012 V	96E-6 W
	14MA (MAX)			0.021 V	294E-6 W
18V BOOSTER	VIN	4MA (MAX)	4.7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

Keyboard Connector

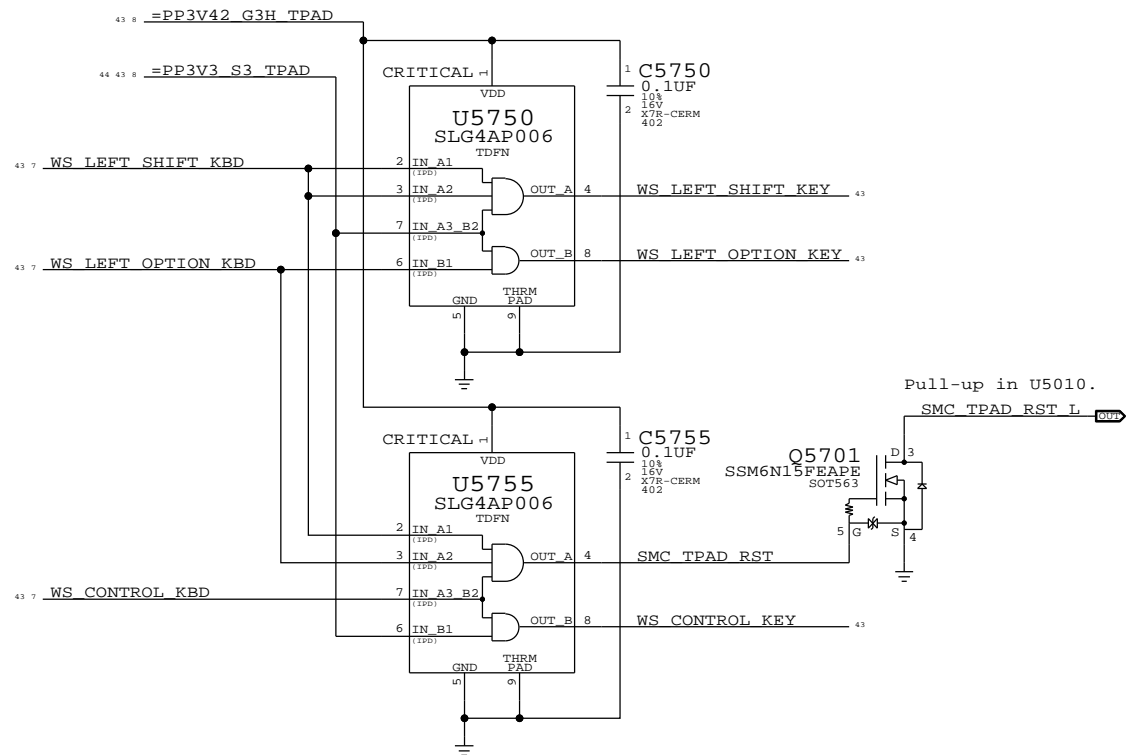


TPAD Buttons Disable



SMC Manual Reset & Isolation

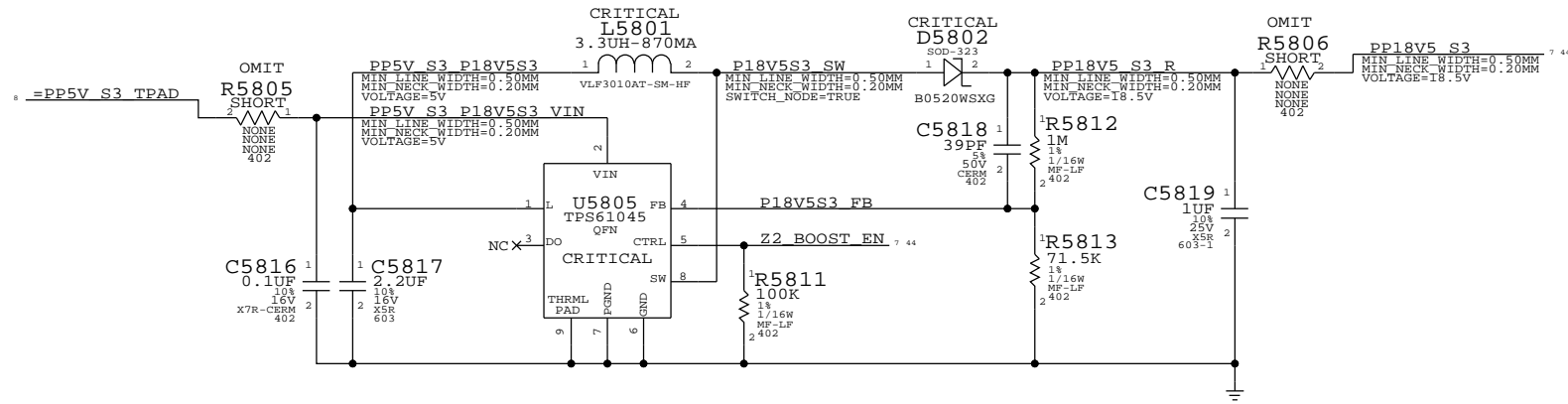
Left shift, option & control keys combined with power button cause SMC RESET# assertion.
Keys ANDed with PSOC power to isolate when PSOC is not powered.



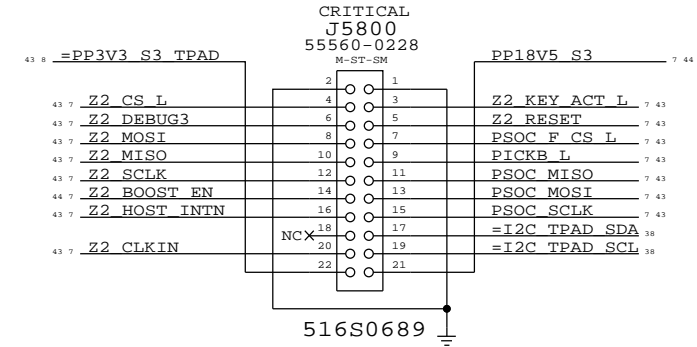
PAGE TITLE		SYNC DATE=02/16/2010	
WELLSPRING 1			
Apple Inc.	DRAWING NUMBER	051-8561	SIZE D
	REVISION	C.0.0	
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BOOSTER +18.5VDC FOR SENSORS

- 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



DO NOT SYNC FROM T27. REMOVED KEYBOARD BKLIGHT CIRCUIT

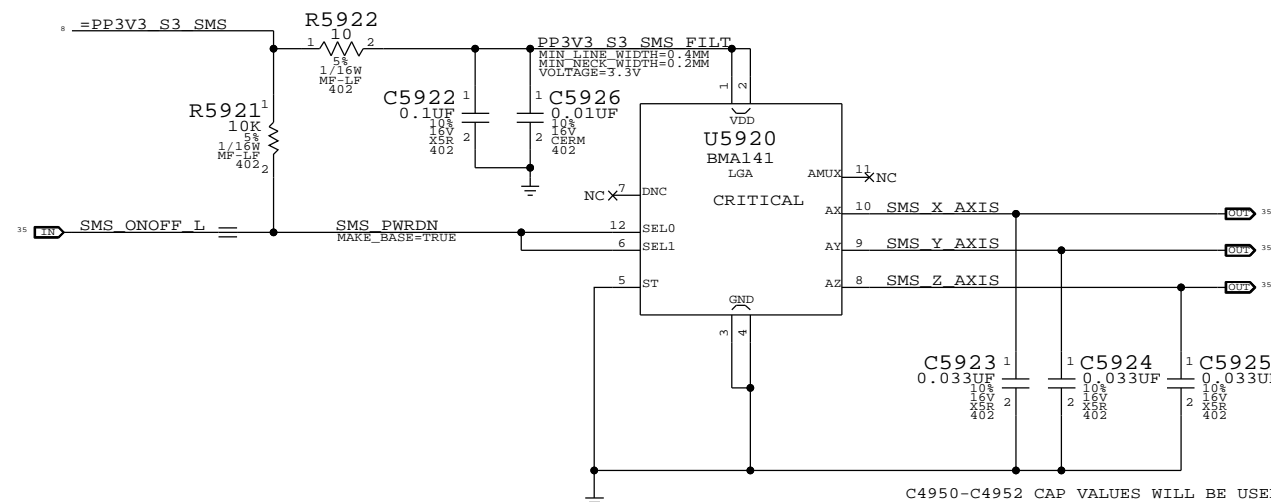
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WELLSPRING 2			
		DRAWING NUMBER	SIZE
		051-8561	D
		REVISION	
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D
C
B
A

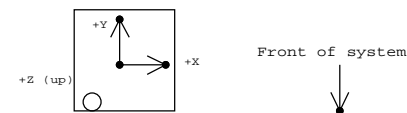
D
C
B
A

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:



Circle indicates pin 1 location when placed in correct orientation

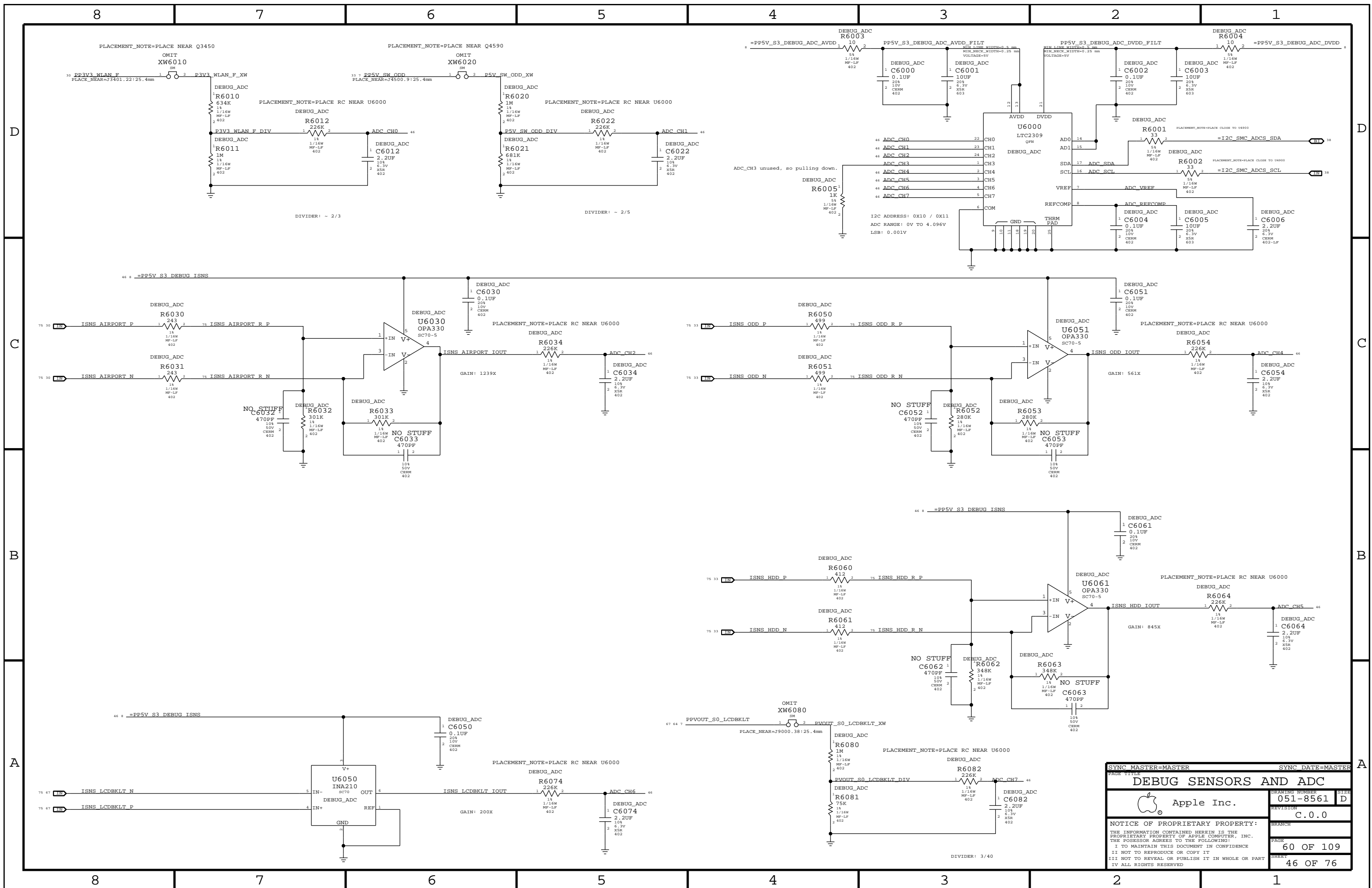
C4950-C4952 CAP VALUES WILL BE USED TO GET CUT-OFF FREQUENCY OF ~146HZ

PLACE_NEARs:

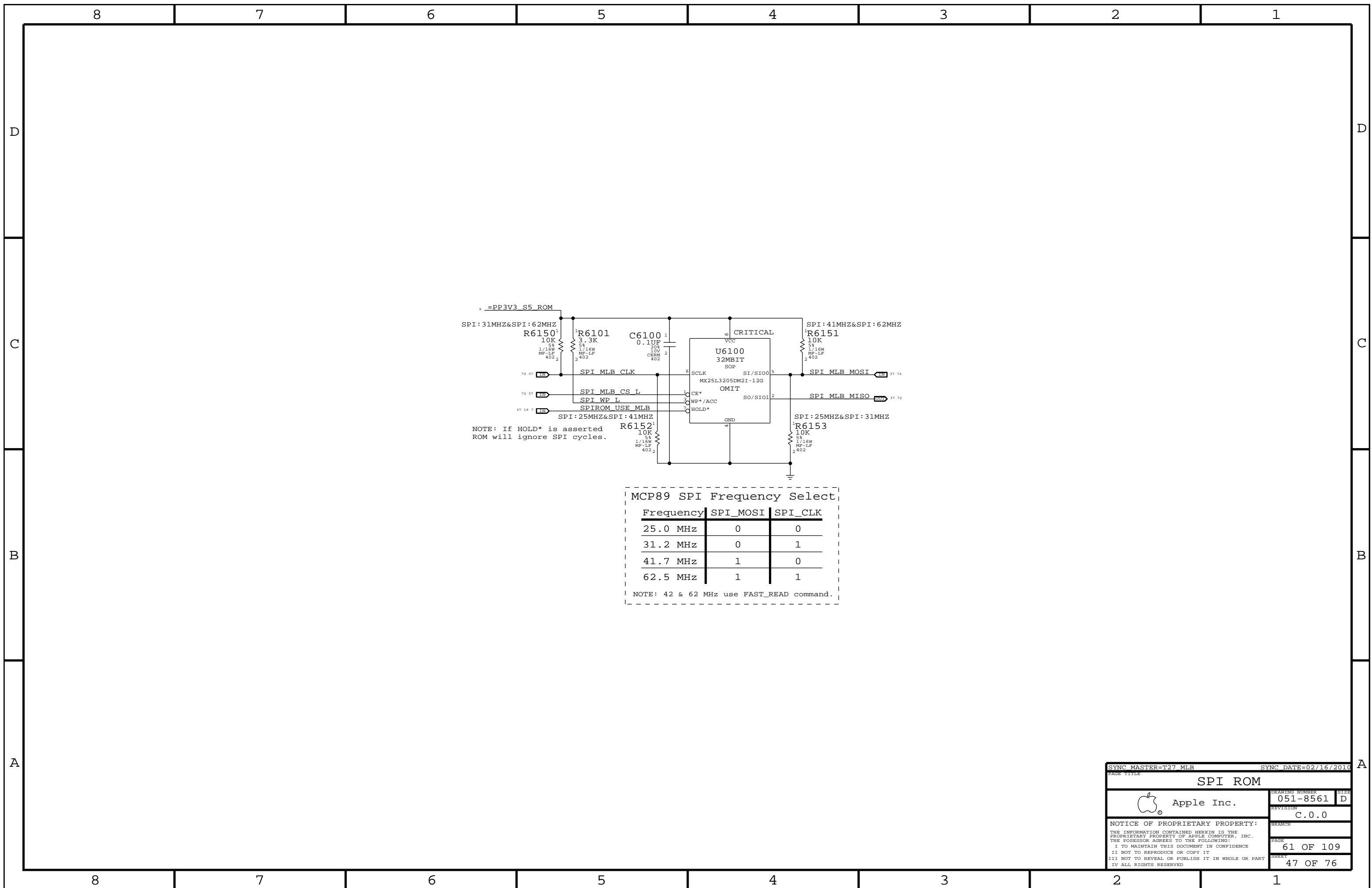
C5923.1:PLACE_NEAR=U4900.M10:2.54MM
 C5924.1:PLACE_NEAR=U4900.N9:2.54MM
 C5925.1:PLACE_NEAR=U4900.K10:2.54MM

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

SYNC MASTER=MASTER		SYNC DATE=MASTER	
PAGE TITLE SMS			
DRAWING NUMBER 051-8561		SIZE D	
REVISION C.0.0		BRANCH	
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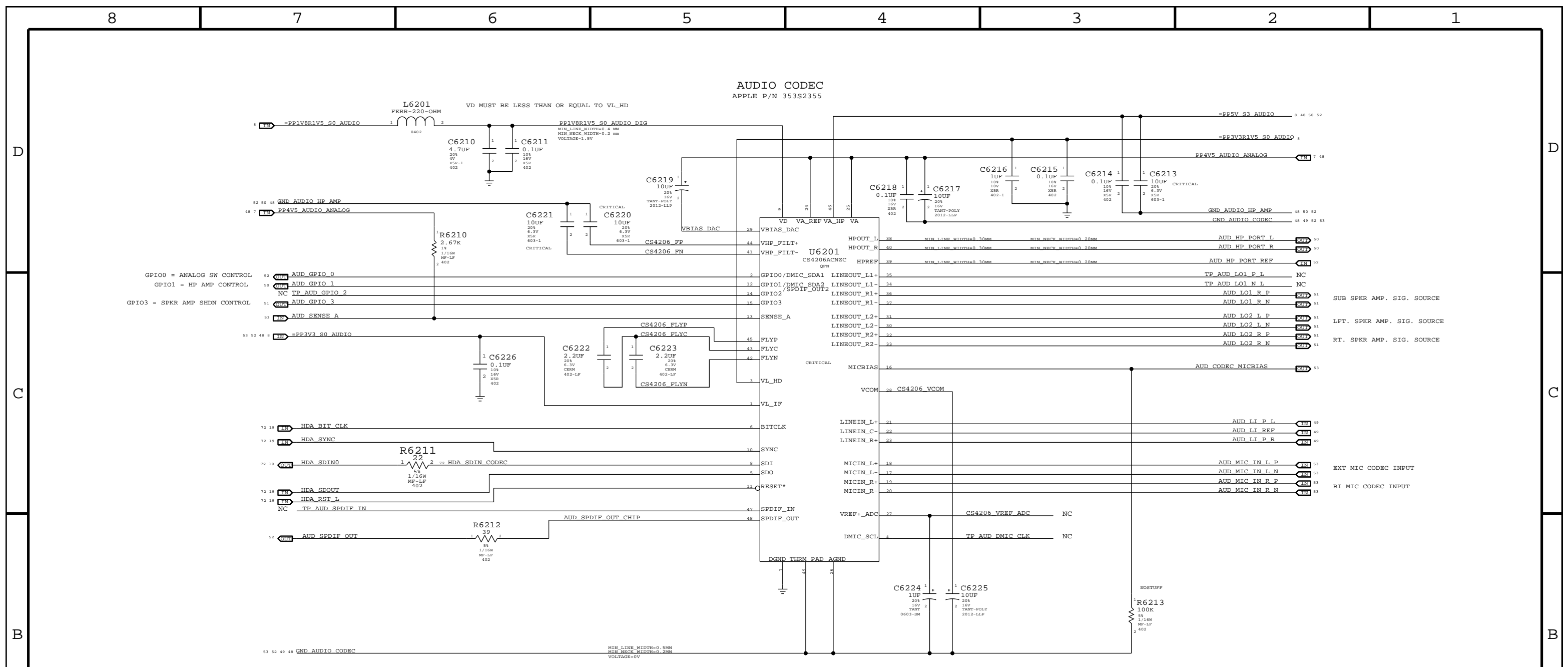
SYNC MASTER=MASTER		SYNC DATE=MASTER	
DEBUG SENSORS AND ADC			
Apple Inc.		DRAWING NUMBER	051-8561
		SIZE	D
		REVISION	C.0.0
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MCP89 SPI Frequency Select

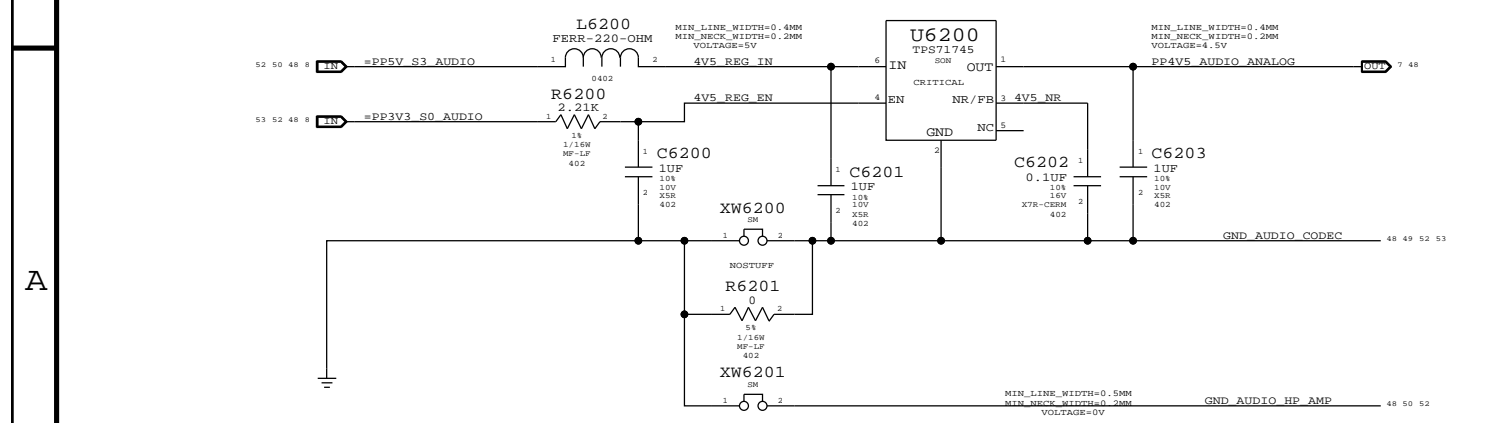
Frequency	SPI_MOSI	SPI_CLK
25.0 MHz	0	0
31.2 MHz	0	1
41.7 MHz	1	0
62.5 MHz	1	1

NOTE: 42 & 62 MHz use FAST_READ command.



4.5V POWER SUPPLY FOR CODEC
APPLE P/N 353S2281

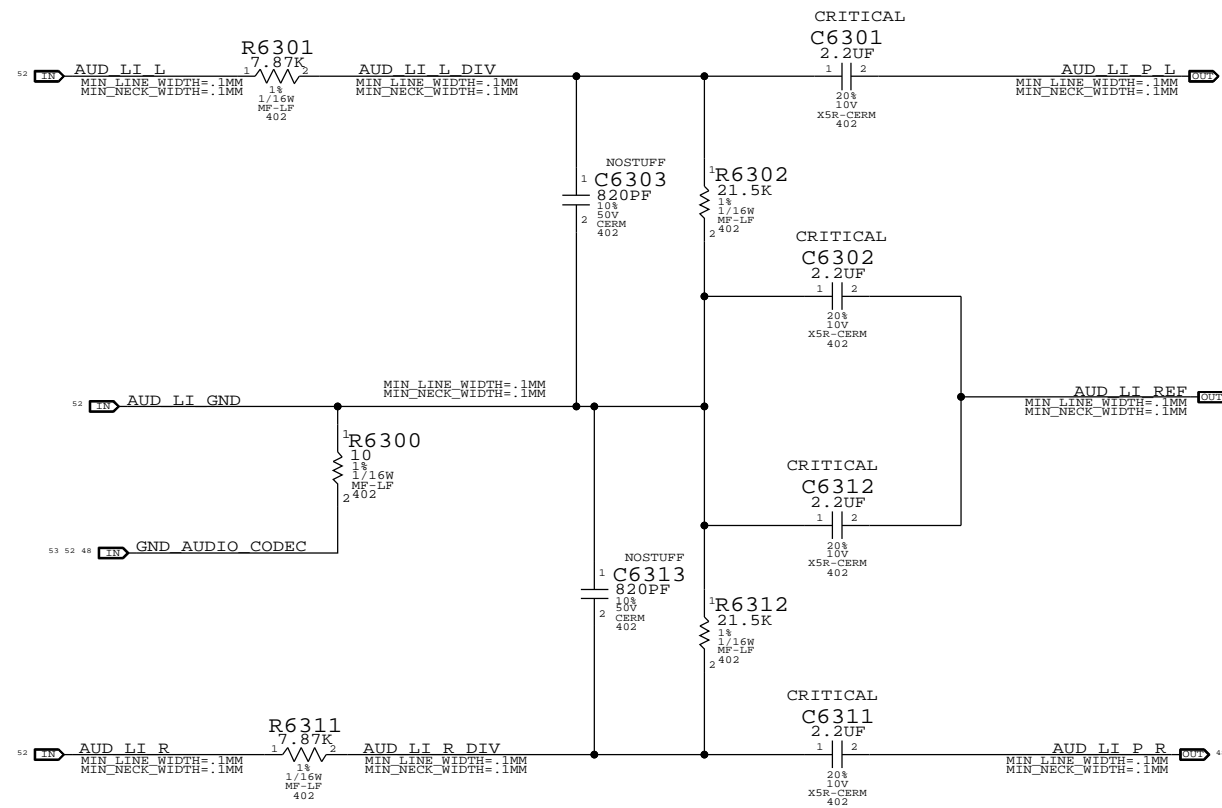
NOTES ON CODEC I/O
DIFF FSINPUT= 2.45VRMS
SE FSINPUT= 1.22VRMS
DAC1 FSOUTPUT= 1.34VRMS
DAC2/3 FSOUTPUTDIFF= 2.67VRMS
DAC2/3 FSOUTPUTSE= 1.34VRMS



SYNC MASTER=AUDIO		SYNC DATE=02/16/2011	
PAGE TITLE			
AUDIO: CODEC/REGULATOR			
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		REVISION	C.0.0
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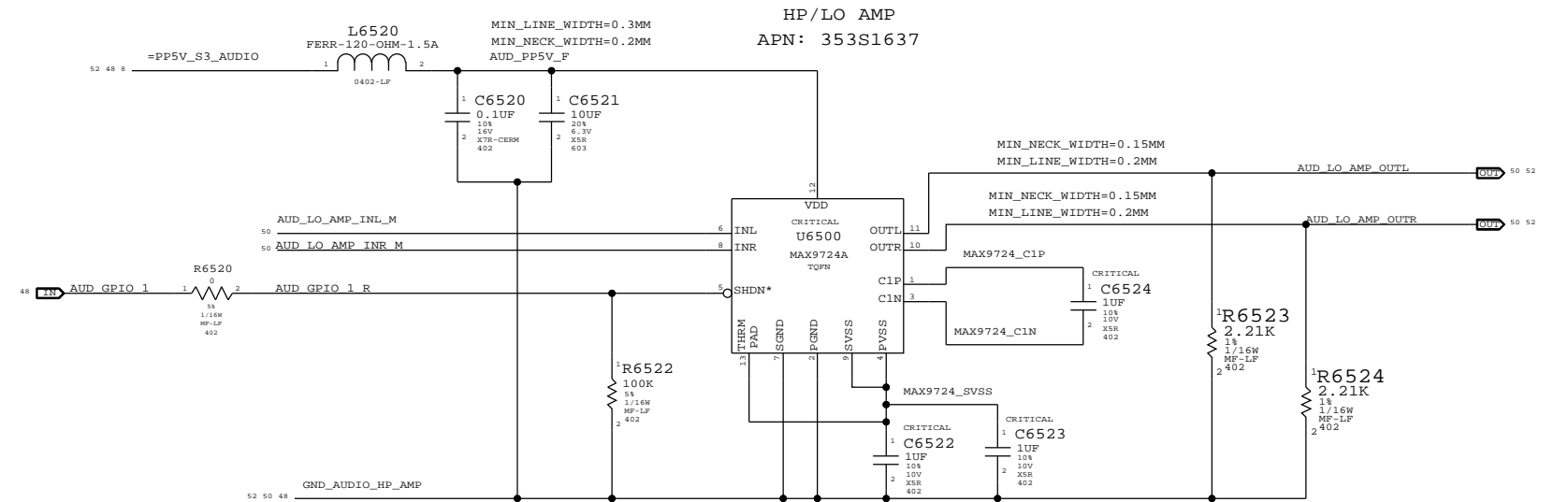
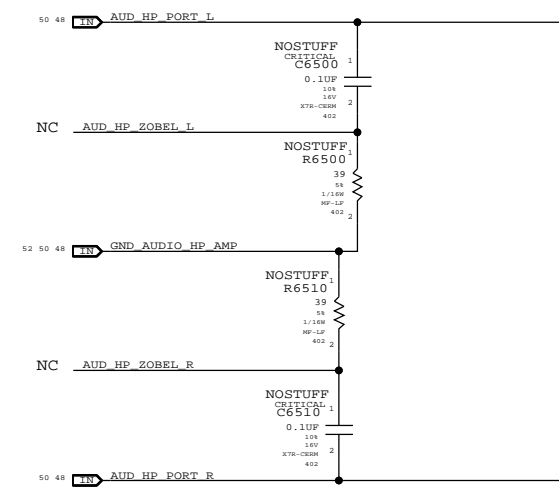
LINE INPUT VOLTAGE DIVIDER

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



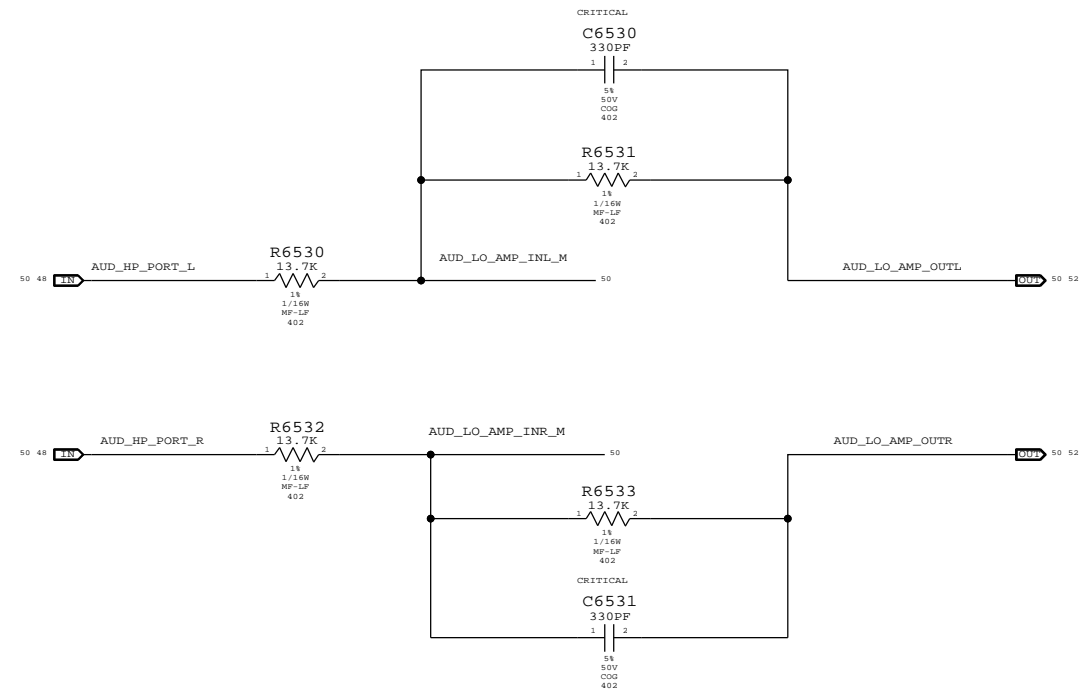
PAGE TITLE AUDIO: LINE INPUT FILTER		
	DRAWING NUMBER 051-8561	SIZE D
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CS4206 HP OUTPUT Zobel Network



MAX9724 GAIN/FILTER COMPONENTS

AV_PB = -1V/V, FC_LPF = 35.2KHZ

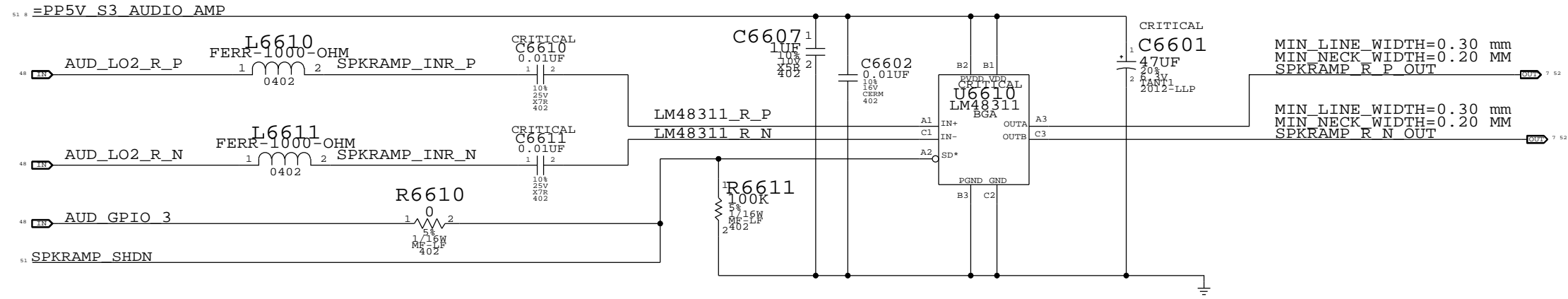


SYNC MASTER=AUDIO		SYNC DATE=02/16/2011	
AUDIO: HEADPHONE FILTER			
		DRAWING NUMBER	051-8561
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SATELLITE 796Hz < HPF FC < 936Hz
 SUB 80 Hz < HPF FC < 94 Hz
 GAIN 6DB (2V/V)
 SPRK AMP. INPUT REFERRED CLIP POINT = ~-6dBFS

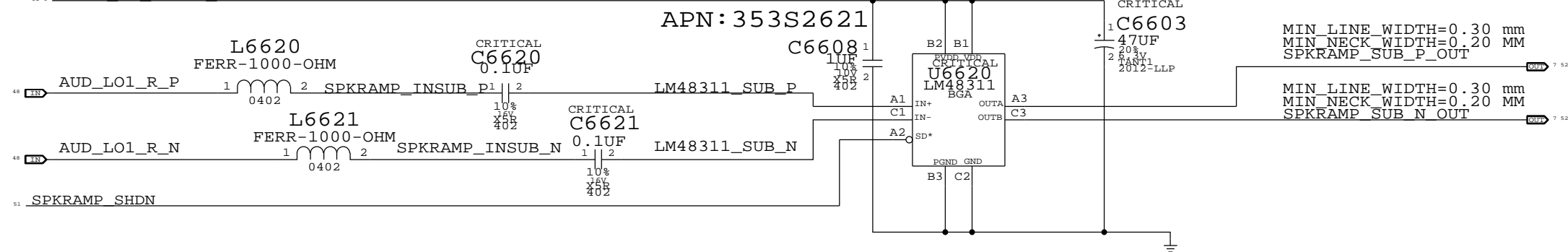
ALIAS OF PP5V_S3_REG, MIN_LINE_WIDTH=0.60MM, MIN_NECK_WIDTH=0.20MM

APN: 353S2621



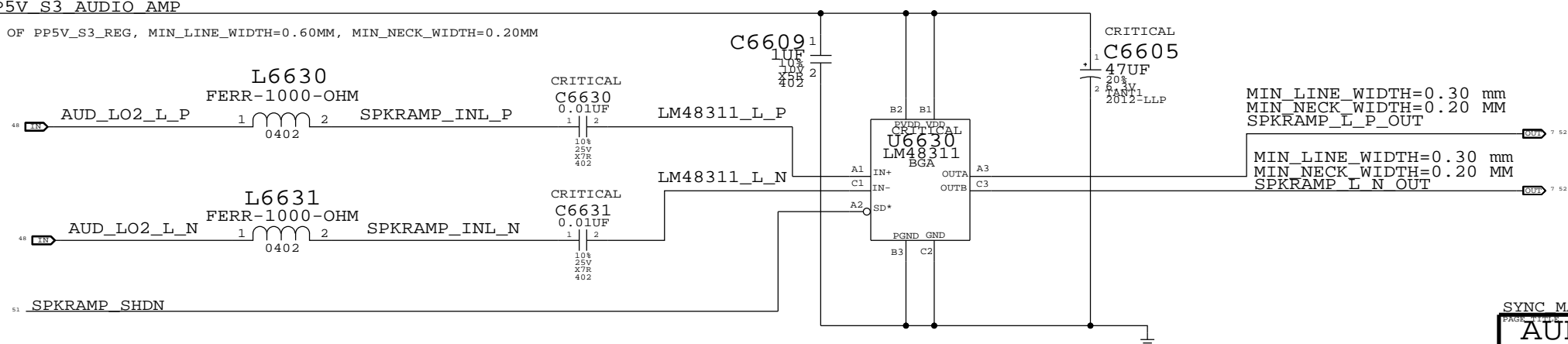
ALIAS OF PP5V_S3_REG, MIN_LINE_WIDTH=0.60MM, MIN_NECK_WIDTH=0.20MM

APN: 353S2621




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

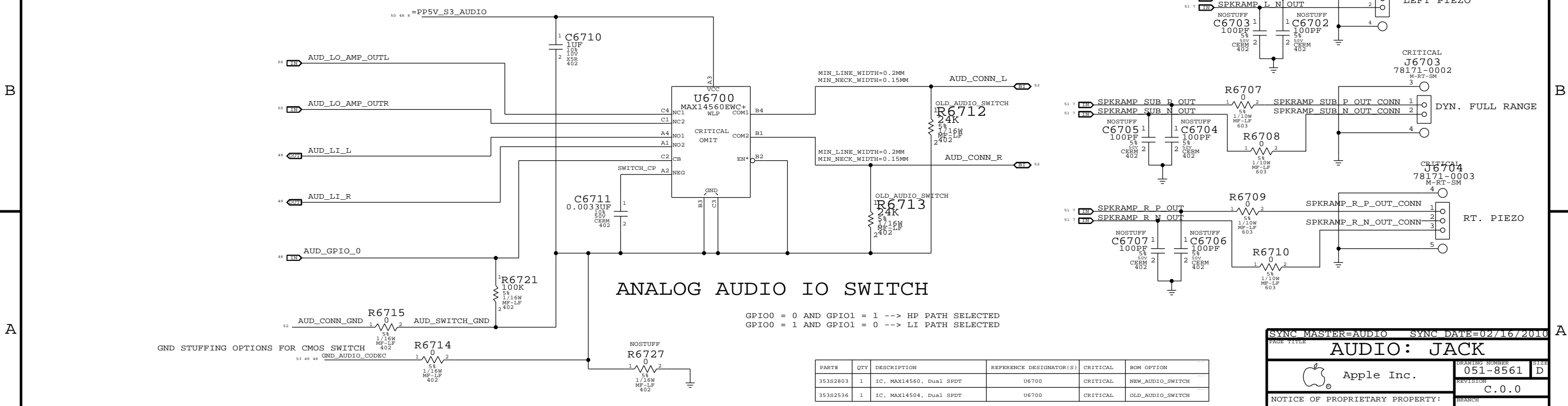
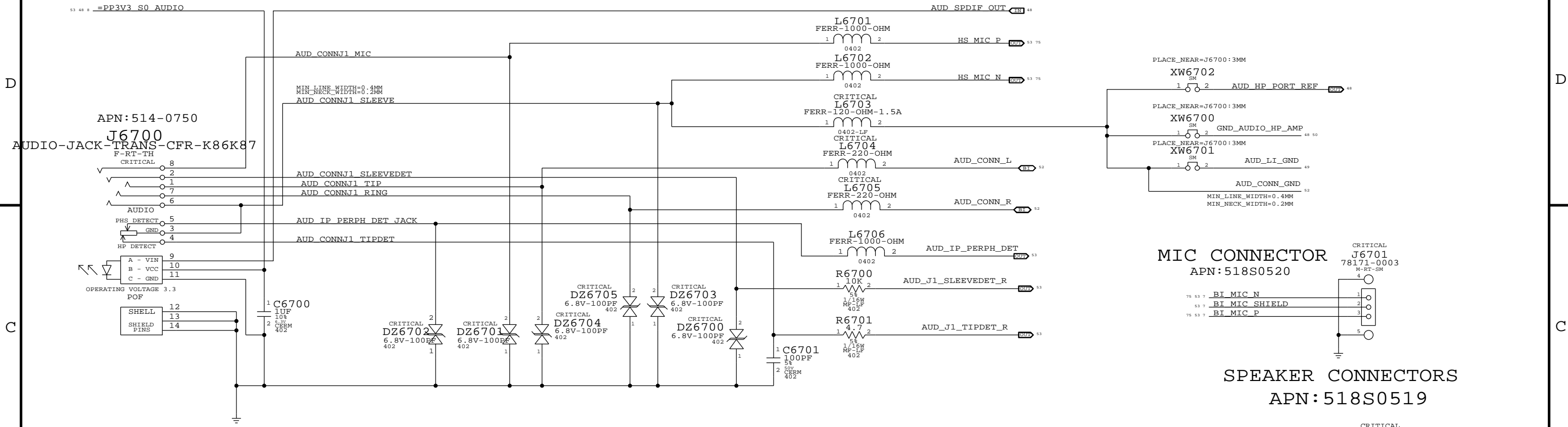
APN: 353S2621



SYNC MASTER=AUDIO SYNC DATE=02/16/2010

AUDIO: SPEAKER AMP		
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AUDIO JACK: LI/LO/HP CONNECTOR, SPDIF TX



SYNC MASTER=AUDIO SYNC DATE=02/16/2010

AUDIO: JACK

Apple Inc.

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DO NOT SYNC K84. UPDATED PLACE NEARS

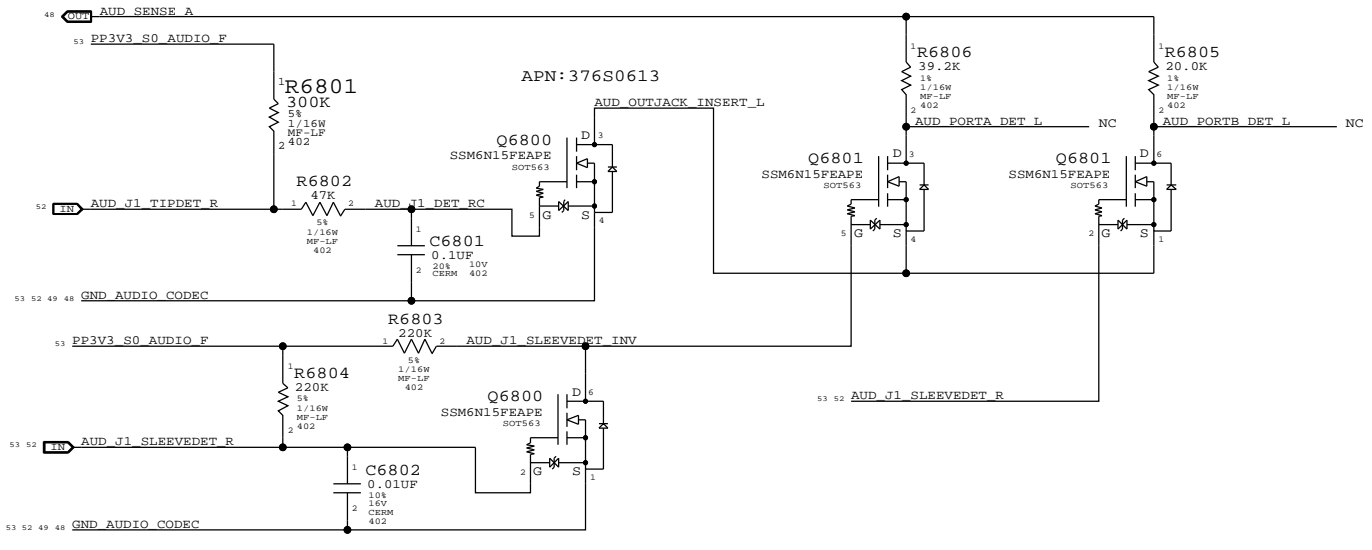
CODEC OUTPUT SIGNAL PATHS

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)

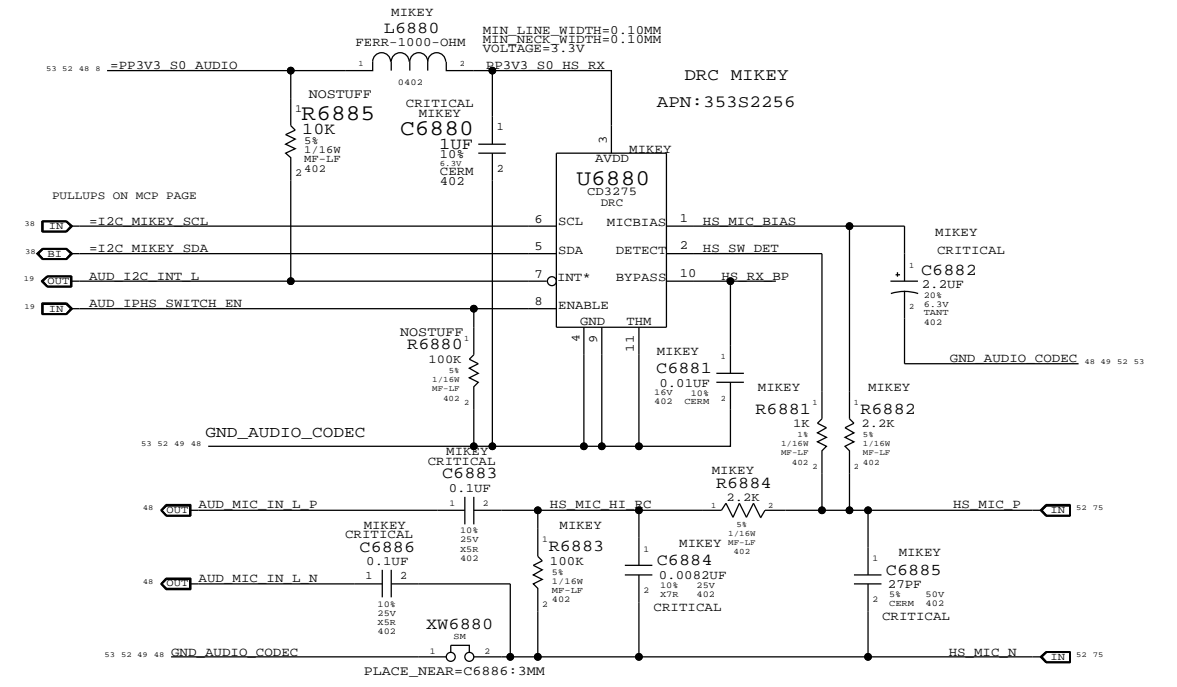
CODEC INPUT SIGNAL PATHS

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)

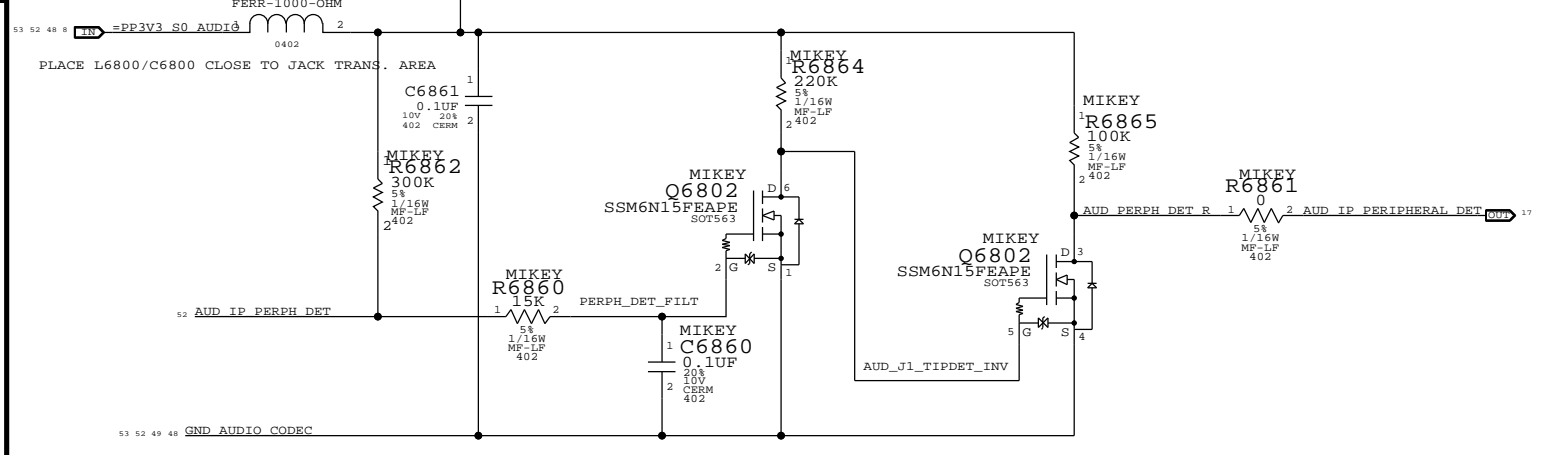
PORT A DETECT (HEADPHONES) PORT B DETECT (SPDIF DELEGATE)



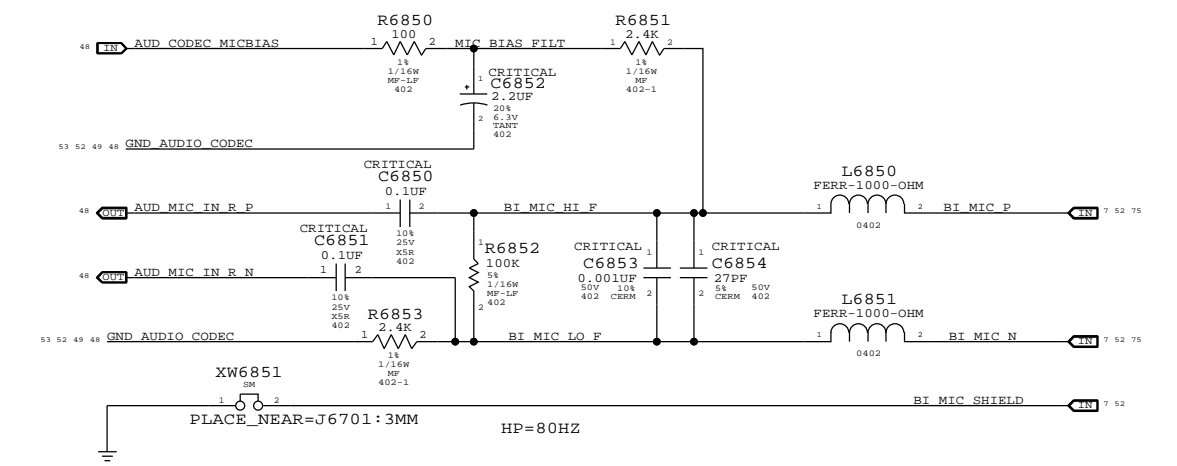
PORT B LEFT (HEADSET MIC) HP=80HZ, LP=8.82KHZ



EXTRACTION NOTIFICATION CKT



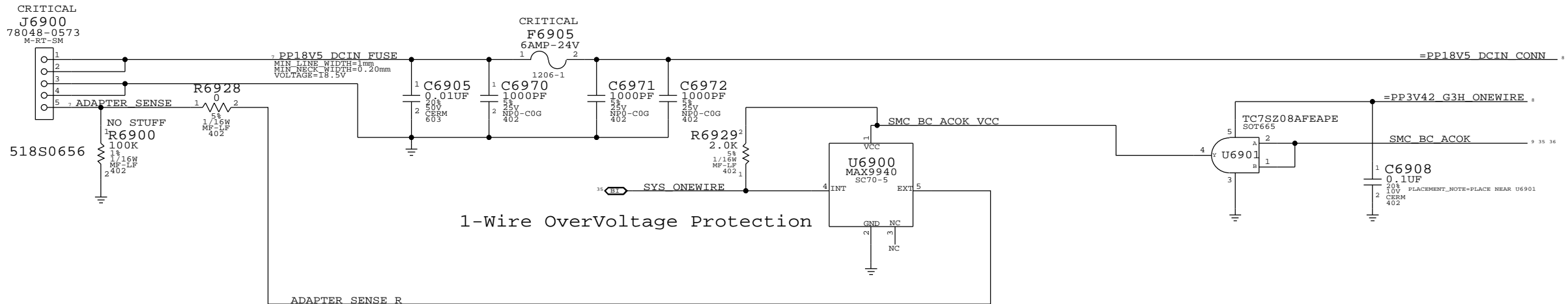
PORT B RIGHT (BUILT-IN MIC)



SYNC MASTER=AUDIO SYNC DATE=02/16/2010
AUDIO: JACK TRANSLATORS

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	PAGE 68 OF 109	SHEET 53 OF 76

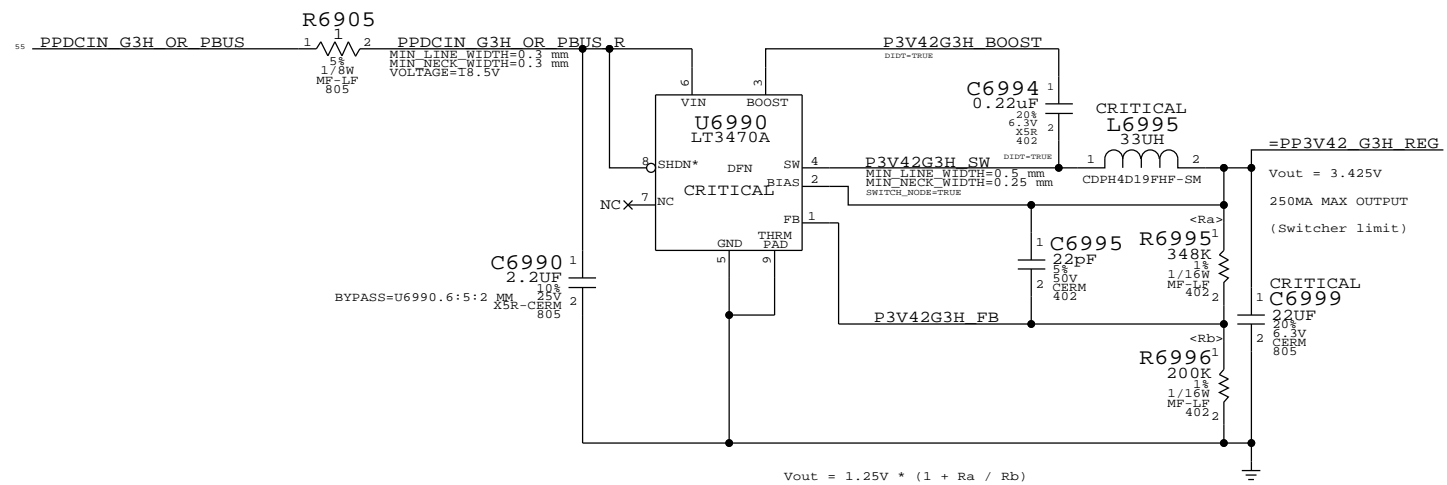
MagSafe DC Power Jack



1-Wire OverVoltage Protection

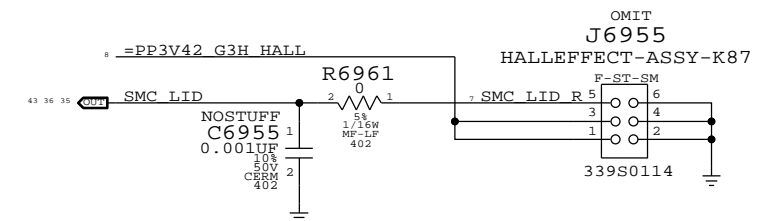
3.425V "G3Hot" Supply

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

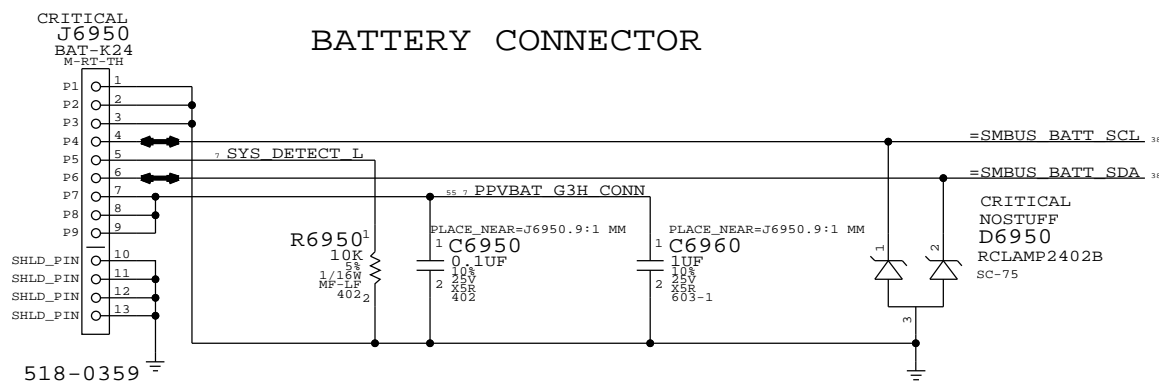


PROTO 0: STUFFING K84 CONNECTOR ONTO MODIFIED K84 PADS
 PROTO 1: STUFFING K87 HALL EFFECT ASSEMBLY ONTO K87 PADS

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

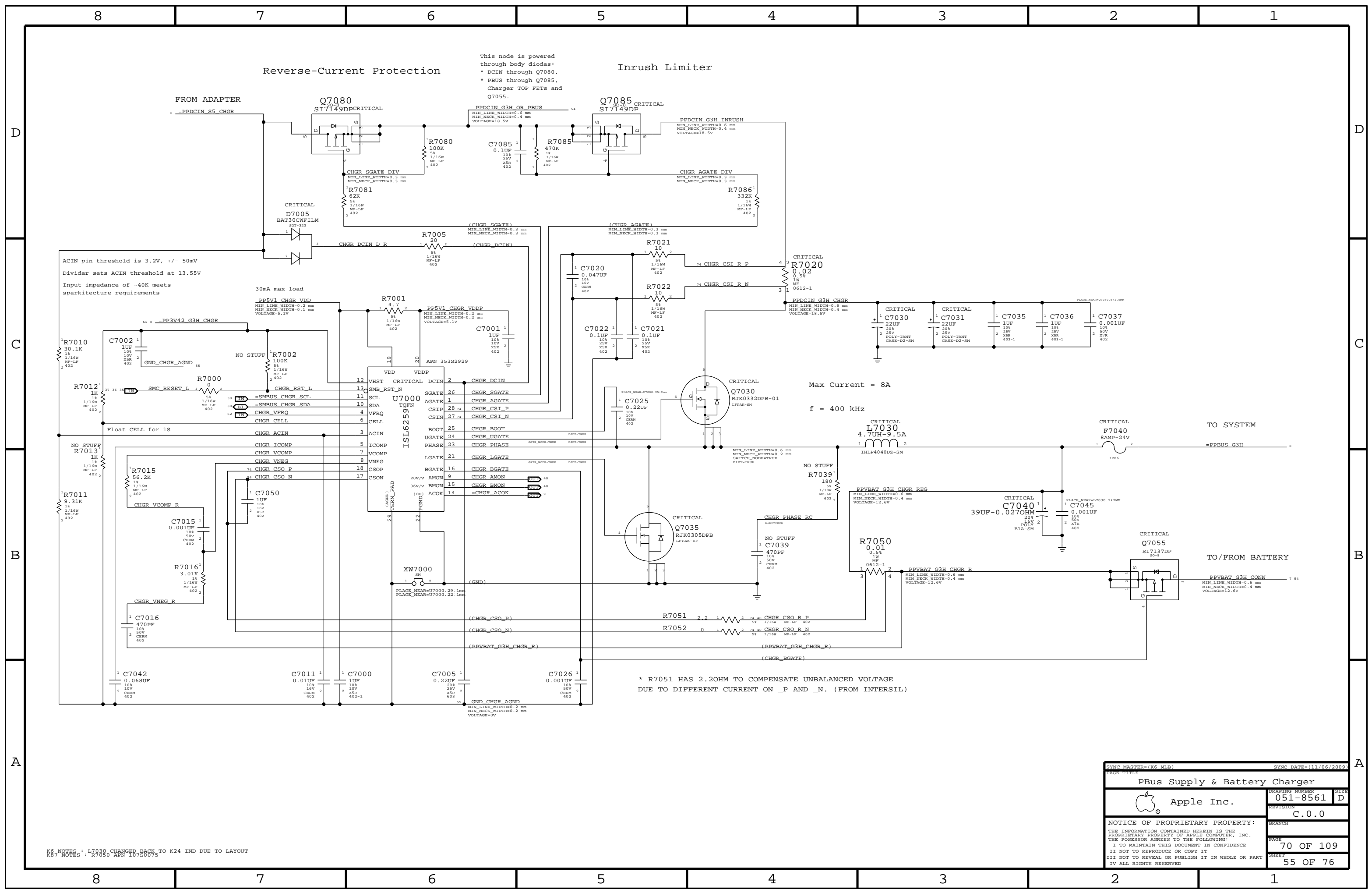
PN: 607-6831 for WCPM. PN: 339S0114 for schematic/board layout

BATTERY CONNECTOR



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

PAGE TITLE		SYNC DATE=MASTER	
DC-In & Battery Connectors		DRAWING NUMBER	051-8561
Apple Inc.		REVISION	C.0.0
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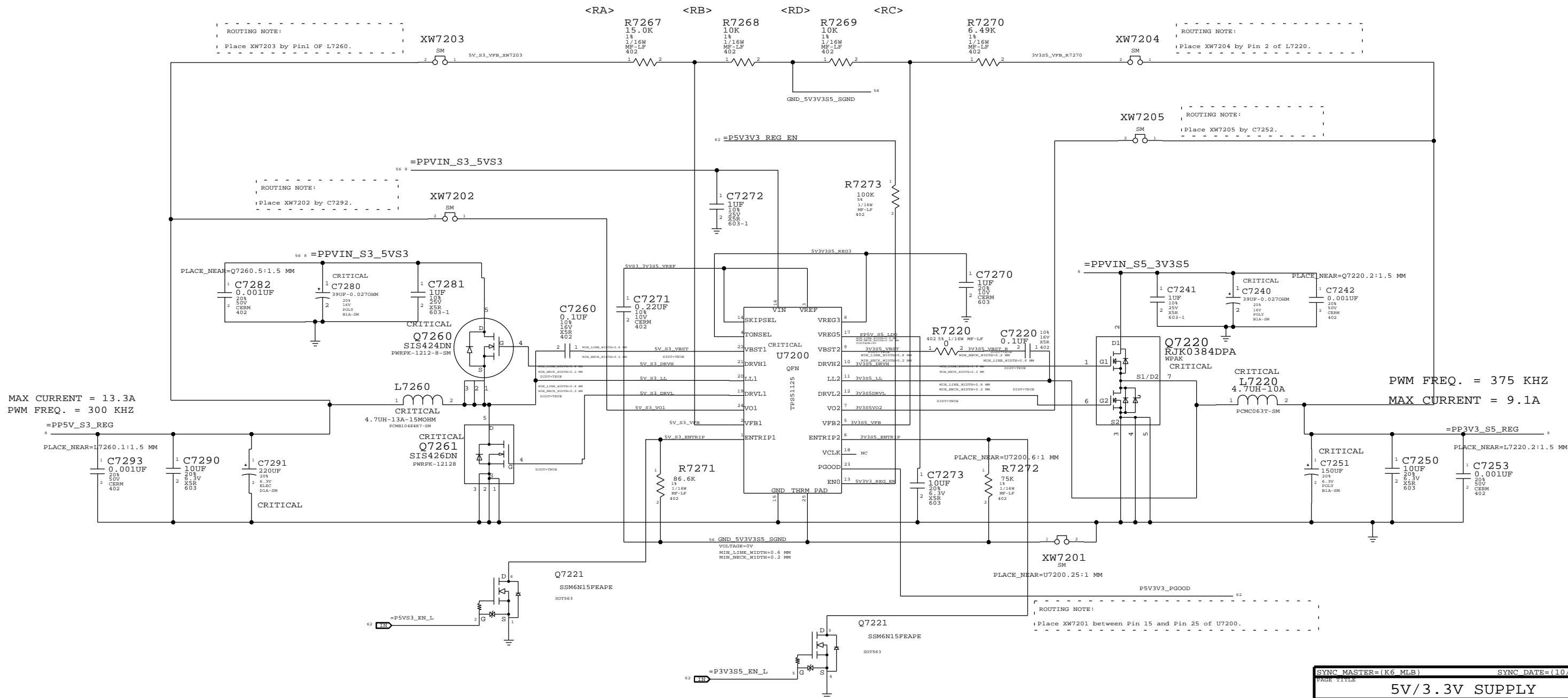
K6 NOTES : L7030 CHANGED BACK TO K24 IND DUE TO LAYOUT
 K67 NOTES : R7050 APN 10750075

SYNC MASTER=(K6_MLB)		SYNC DATE=(11/06/2009)	
PAGE TITLE			
PBus Supply & Battery Charger			
Apple Inc.	DRAWING NUMBER	051-8561	SIZE D
	REVISION	C.0.0	
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PAGE	70 OF 109		SHEET
		55 OF 76	

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

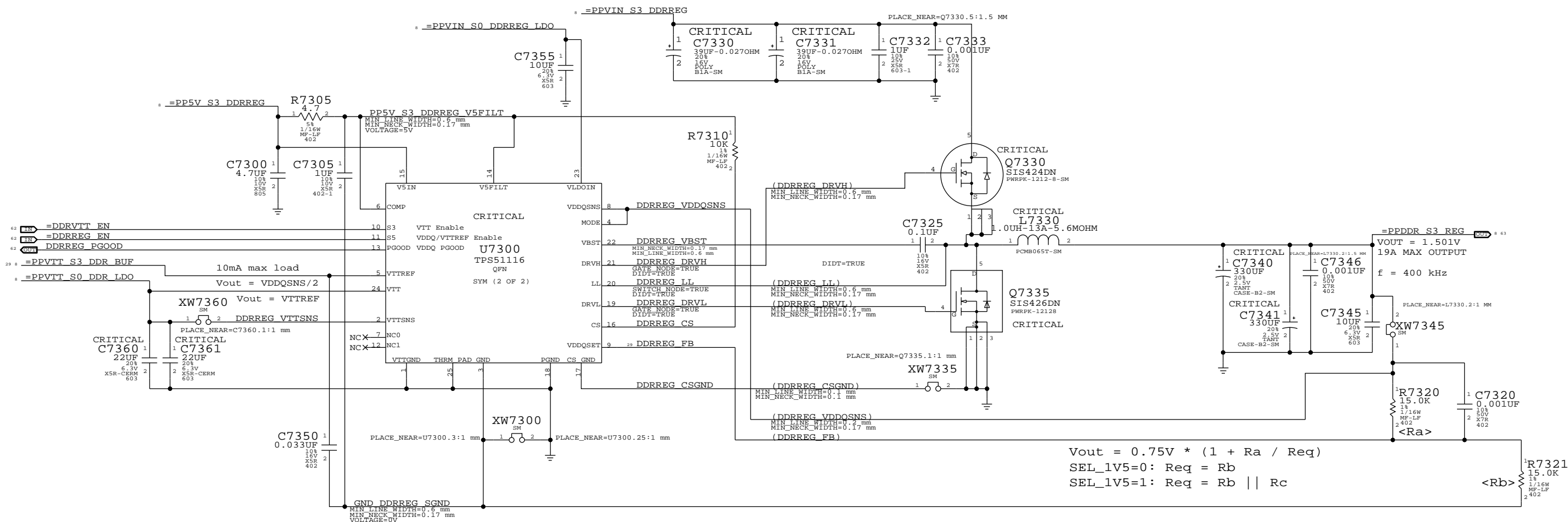
PWM FREQ. = 375 KHZ
MAX CURRENT = 9.1A

NOTE: DONT SYNC THIS PAGE FROM T27

SEPARATED MASTER PGOOD FOR BOTH 5V AND 3V3.

PAGE TITLE		SYNC MASTER=(K6 MLB)		SYNC DATE=(10/27/2009)	
5V/3.3V SUPPLY					
Apple Inc.		DRAWING NUMBER	051-8561	SIZE	D
		REVISION	C.0.0		
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PAGE		72 OF 109		SHEET	
				56 OF 76	

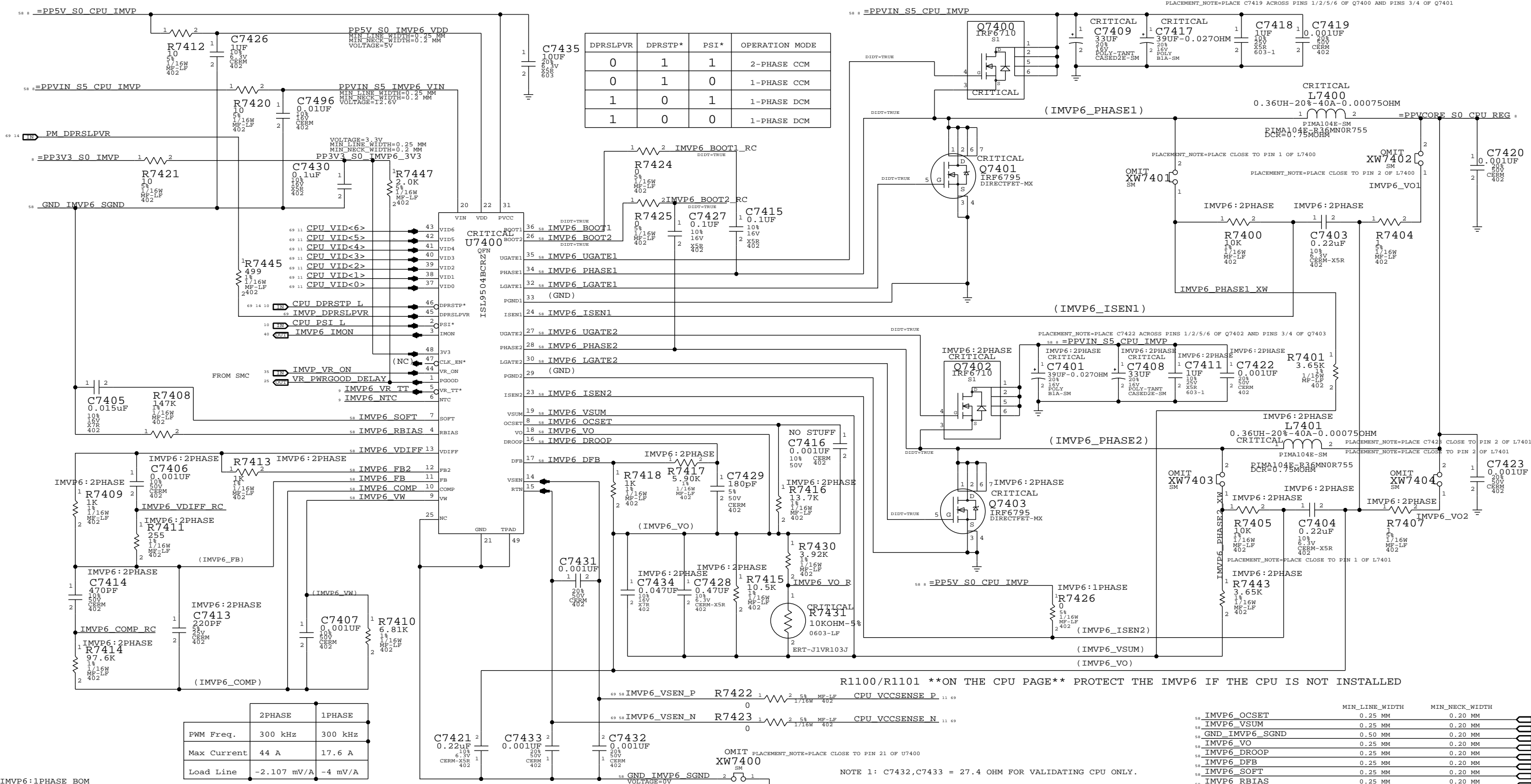
1.5V/0.75V DDR3 POWER SUPPLY



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=(K6 MLB)		SYNC DATE=(11/06/2009)	
1.5V/0.75V DDR3 SUPPLY			
Apple Inc.		DRAWING NUMBER	051-8561
		REVISION	C.0.0
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IMVP6 CPU VCore REGULATOR



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%,X7R,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_RBIA5	0.25 MM	0.20 MM

SYNC MASTER=(K84 MLB) SYNC DATE=(11/18/2009)

IMVP6 CPU VCore Regulator

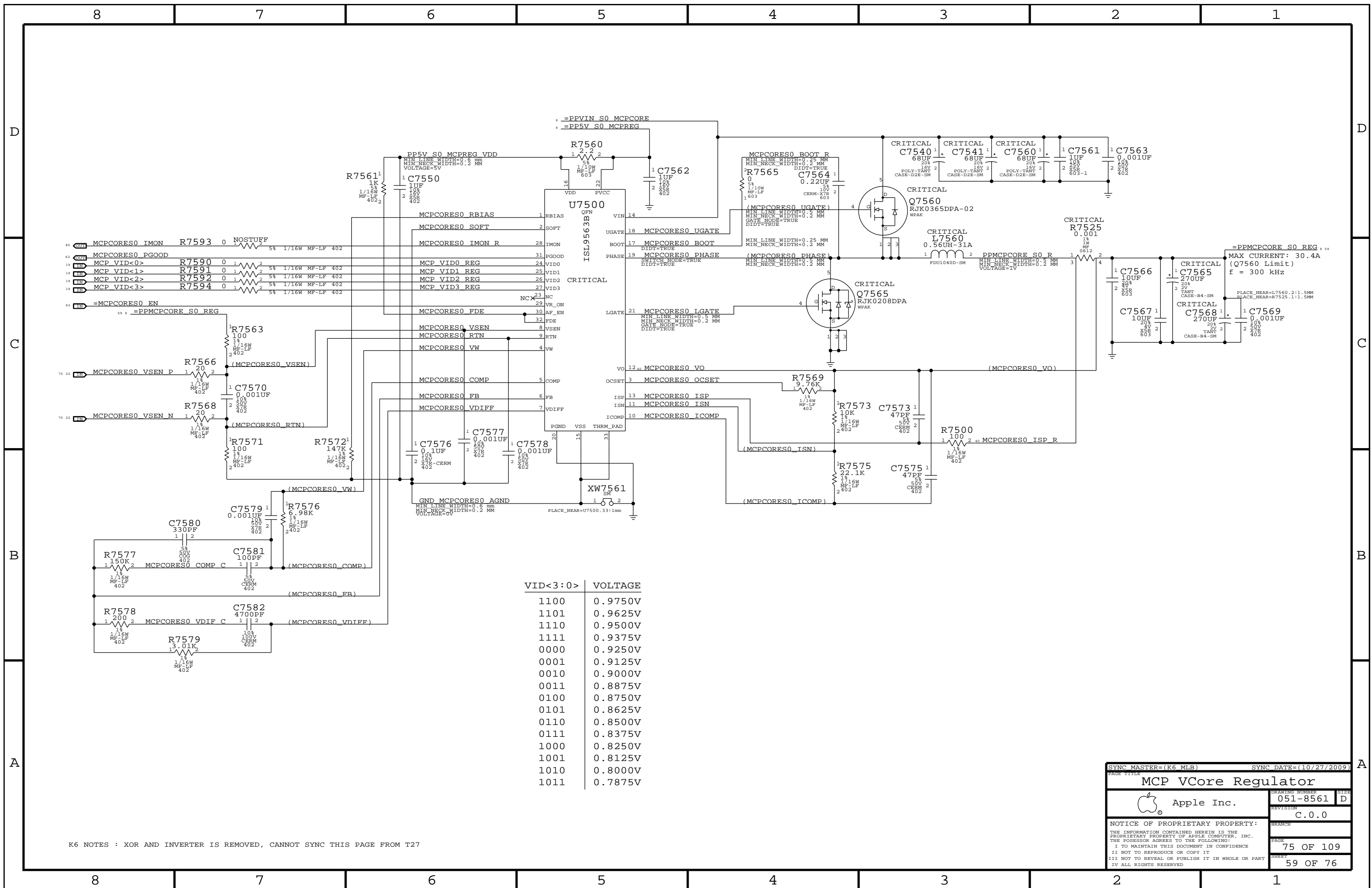
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VID<3:0>	VOLTAGE
1100	0.9750V
1101	0.9625V
1110	0.9500V
1111	0.9375V
0000	0.9250V
0001	0.9125V
0010	0.9000V
0011	0.8875V
0100	0.8750V
0101	0.8625V
0110	0.8500V
0111	0.8375V
1000	0.8250V
1001	0.8125V
1010	0.8000V
1011	0.7875V

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

SYNC MASTER=(K6 MLB) SYNC DATE=(10/27/2009)

MCP VCore Regulator

Apple Inc.

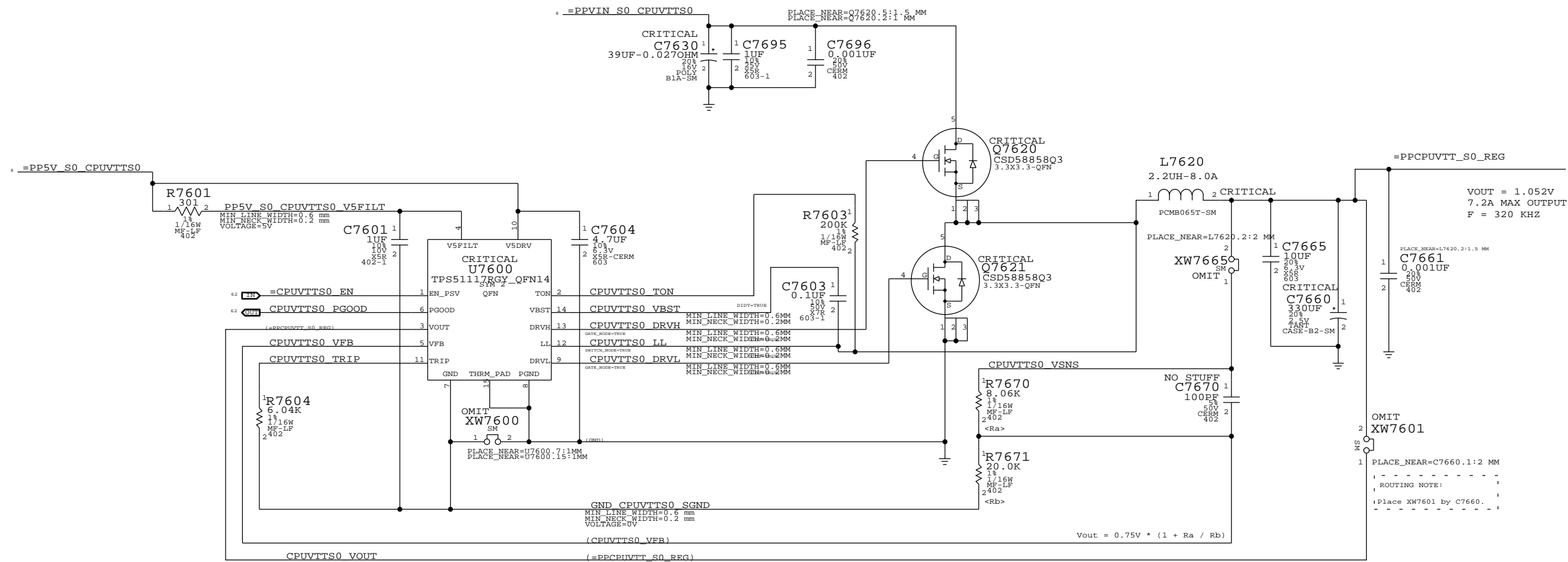
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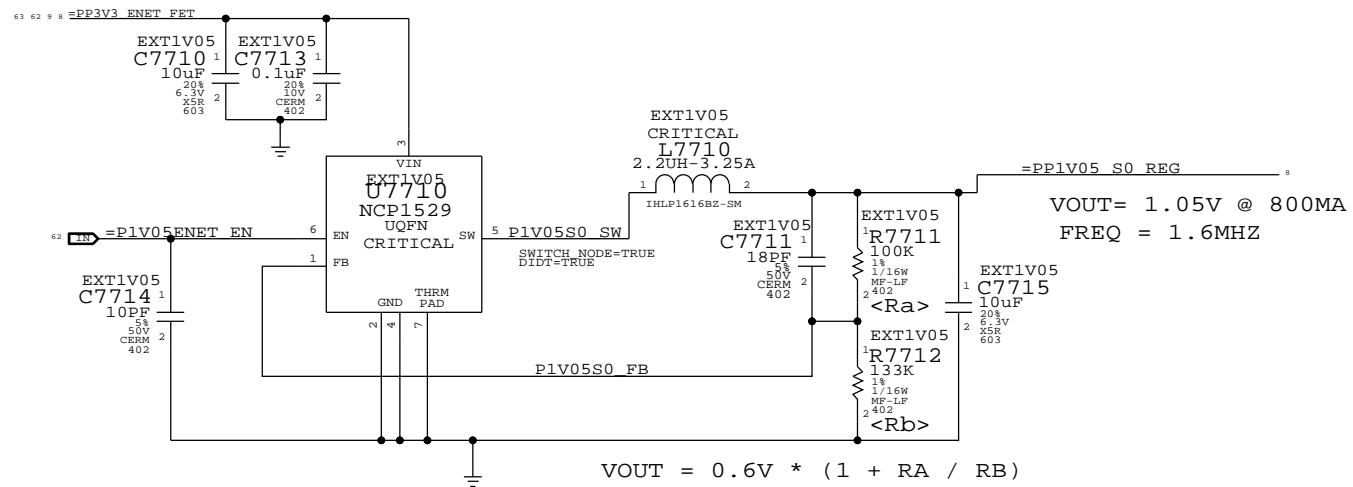
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CPUVTT POWER SUPPLY

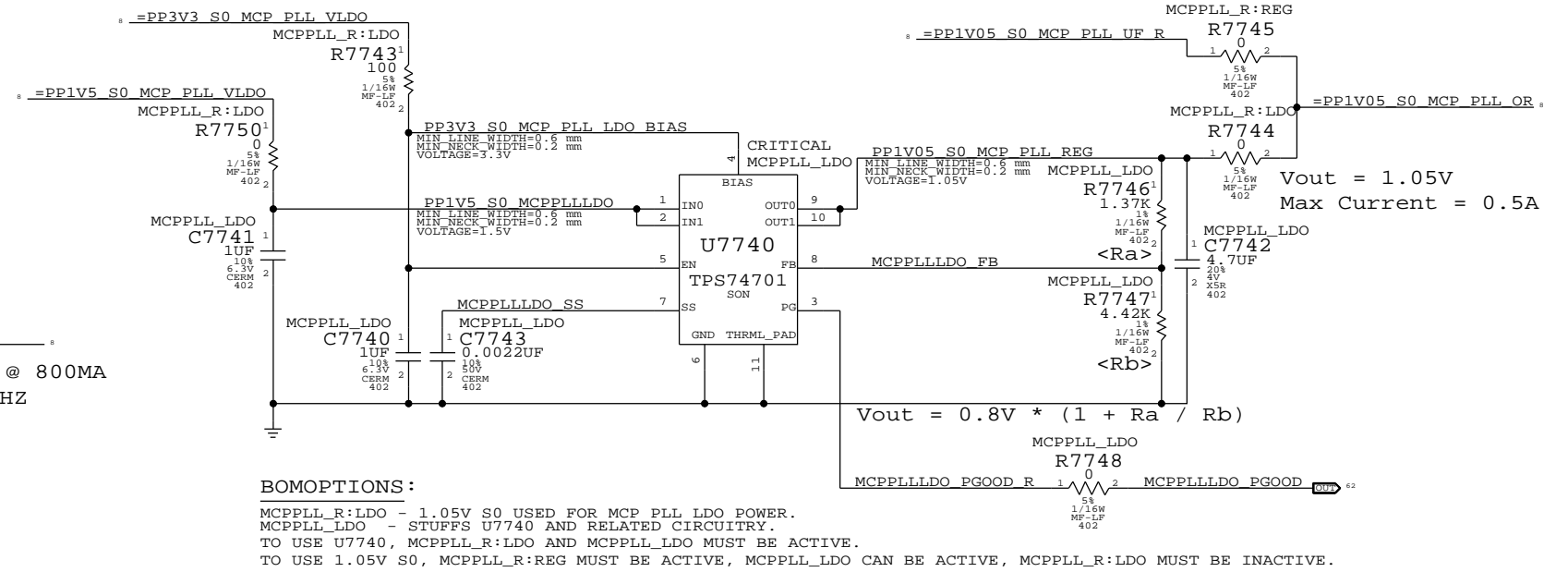


SYNC MASTER=(K84_MLB)		SYNC DATE=(02/04/2009)	
CPU VTT(1.05V) SUPPLY			
Apple Inc.		DRAWING NUMBER	051-8561
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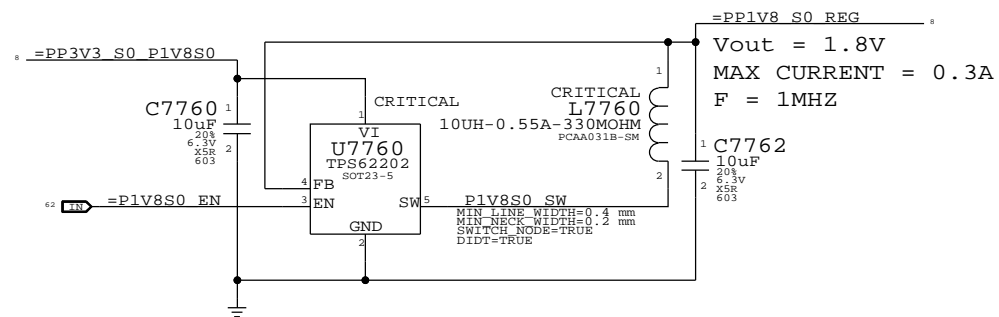
1.05V ENET Switcher



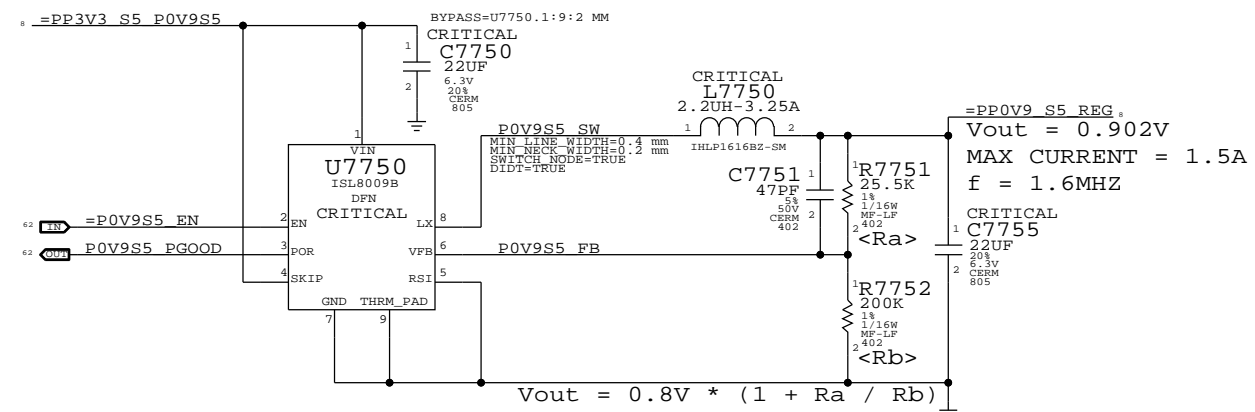
1.05V S0 MCP PLL LDO



1.8V S0 Switcher



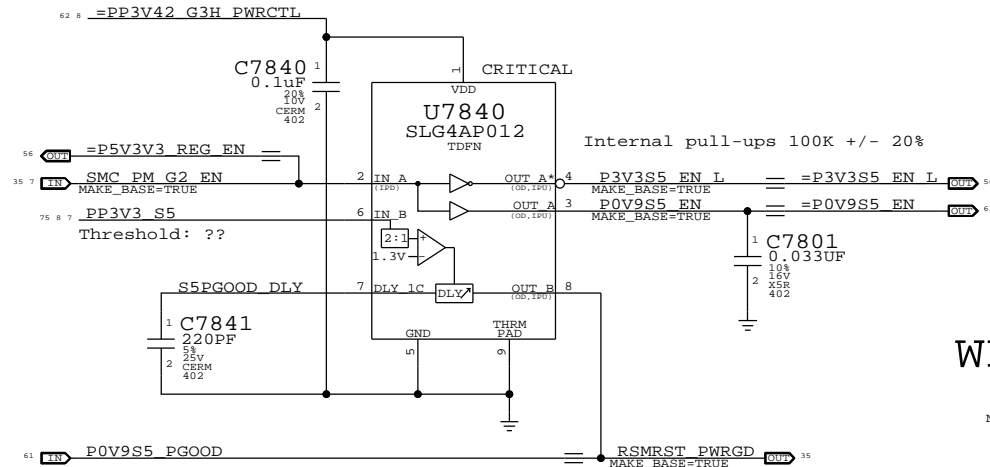
MCP 0.9V S5 (AUXC) Switcher



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

SYNC MASTER=MASTER		SYNC DATE=MASTER	
PAGE TITLE Misc Power Supplies			
Apple Inc.		DRAWING NUMBER 051-8561	SIZE D
		REVISION C.0.0	
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		PAGE 77 OF 109	SHEET 61 OF 76

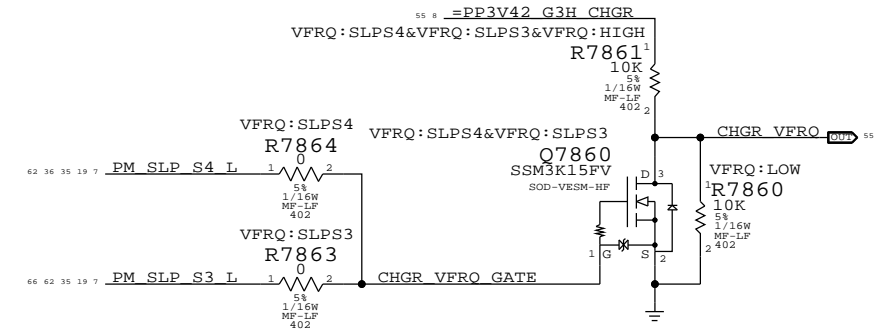
S5 Rail Enables & PGOOD



Power Control Signals

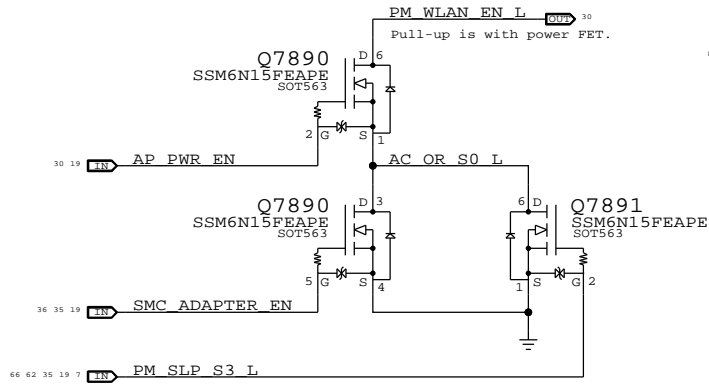
State	SMC_PM_G2_ENABLE	PM_SLP_S4_L	PM_SLP_S3_L
Run (S0)	1	1	1
Sleep (S3)	1	1	0
Soft-Off (S5)	1	0	0
Battery Off (G3Hot)	0	0	0

ISL6259 Frequency Select



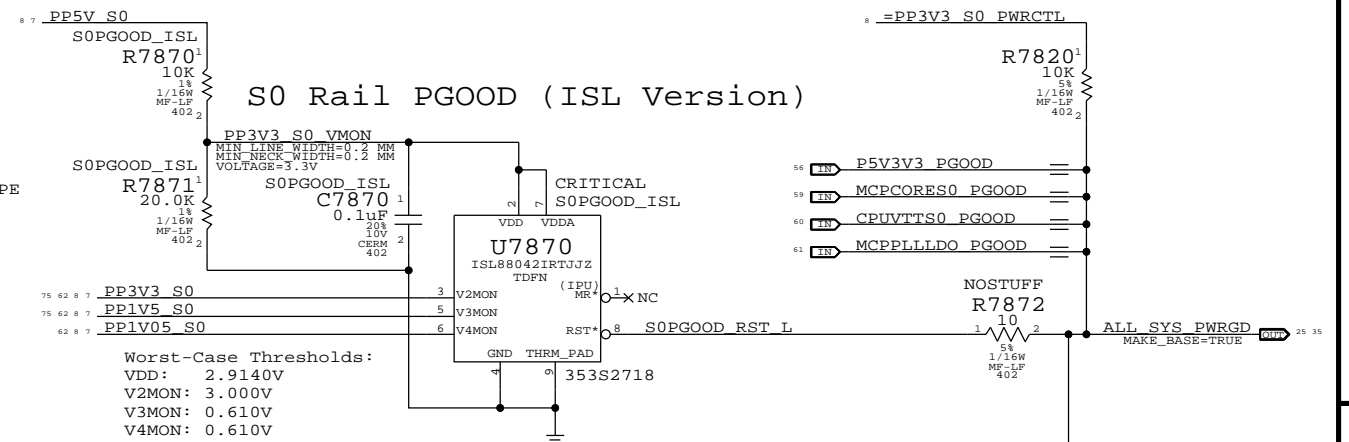
WLAN Enable Generation

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.

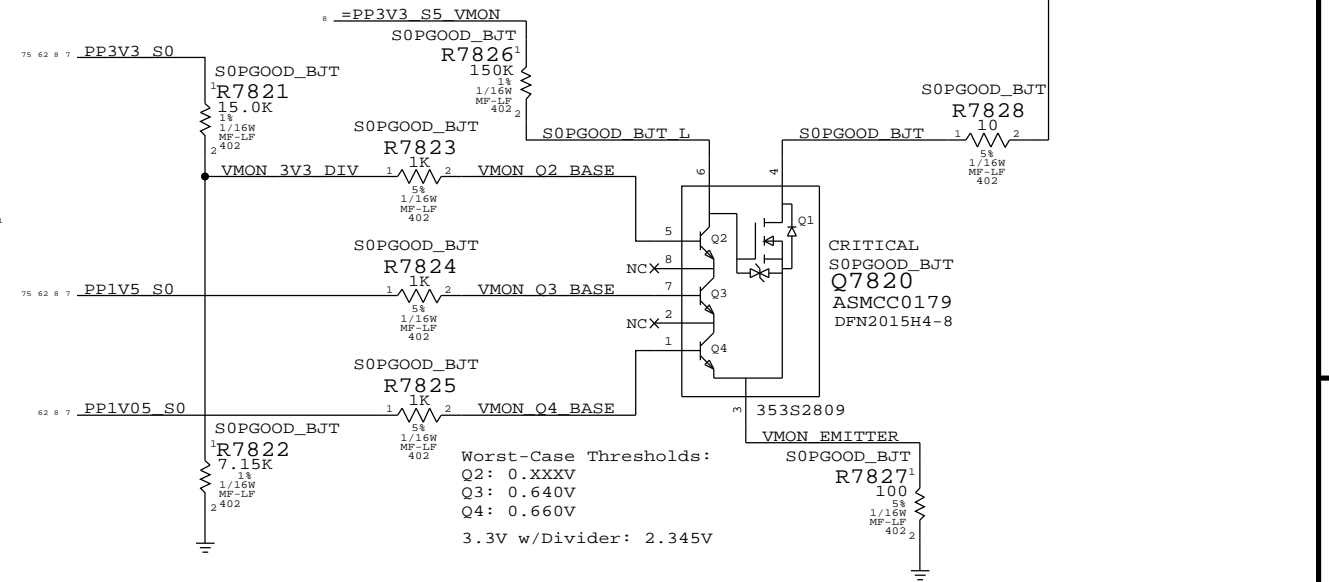


S0 Rail PGOOD Circuitry

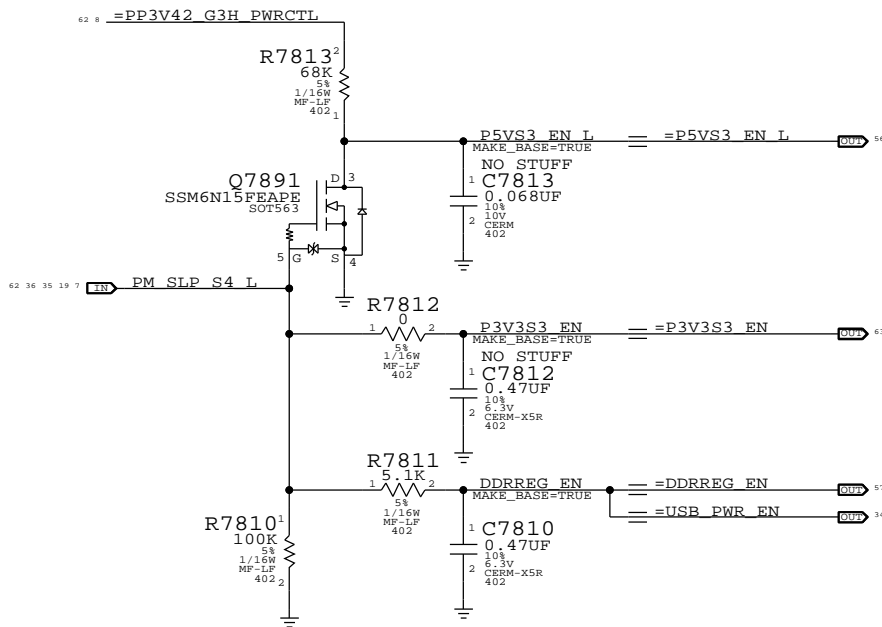
S0 Rail PGOOD (ISL Version)



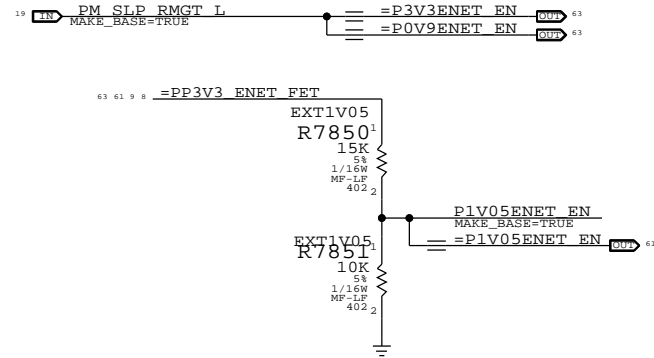
S0 Rail PGOOD (BJT Version)



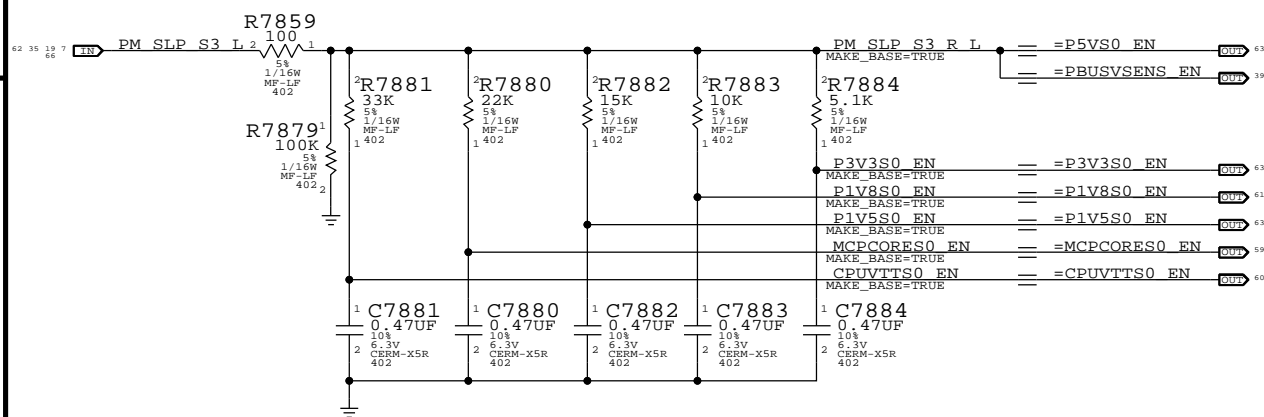
S3 Rail Enables



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



SYNC_MASTER=(T27_MLB) SYNC_DATE=(10/27/2009)

Power Sequencing

Apple Inc.

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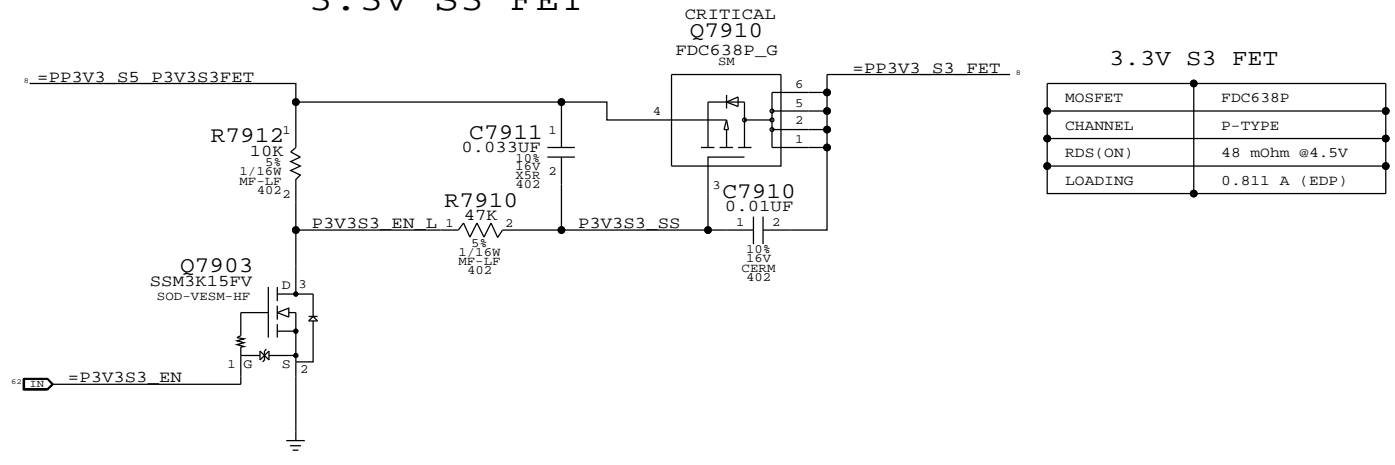
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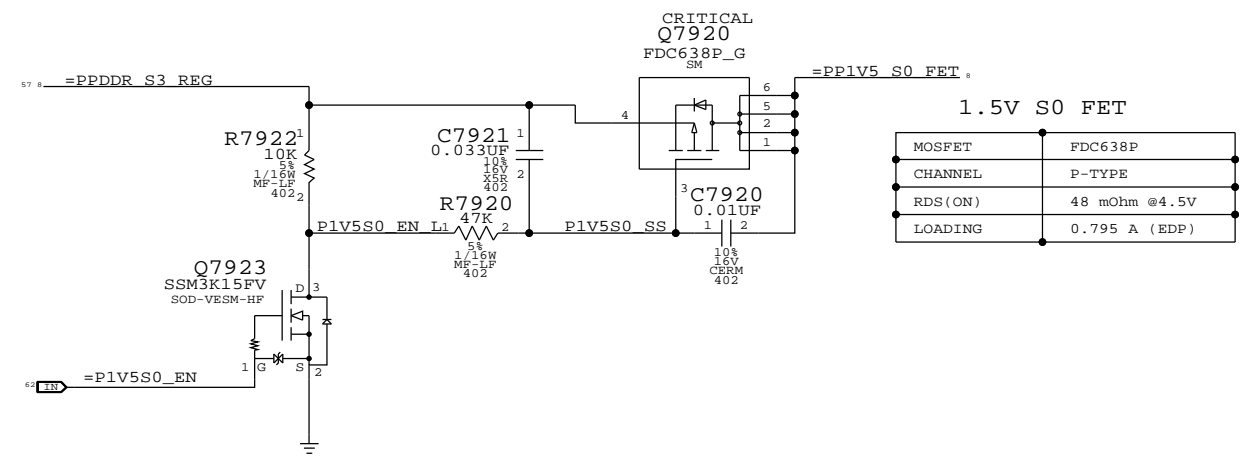
DO NOT SYNC T27, ENET RAILS CHANGED

3.3V S3 FET



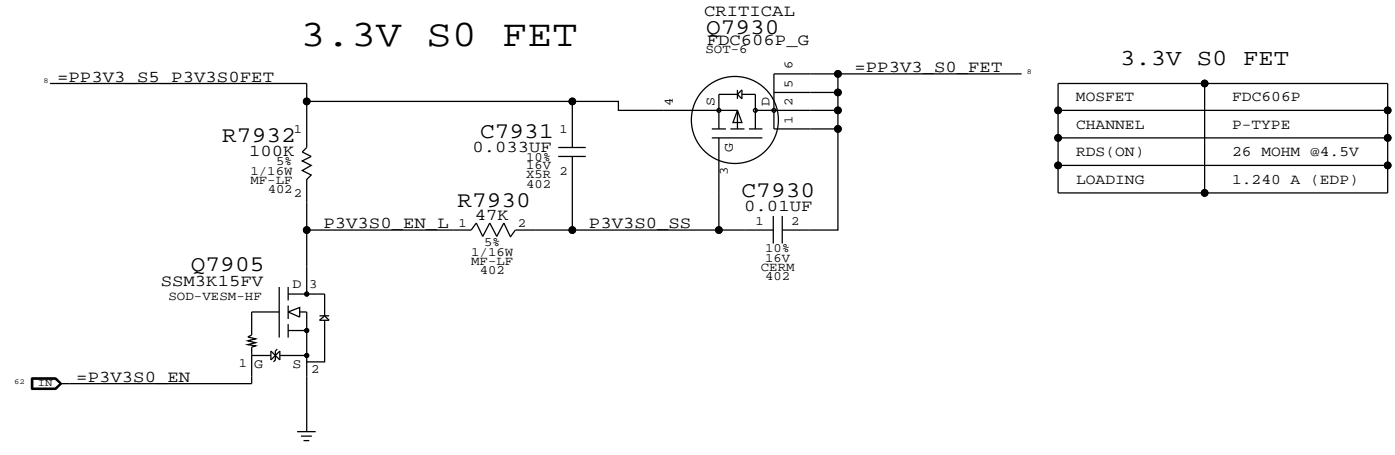
MOSFET	FDC638P
CHANNEL	P-TYPE
RDS(ON)	48 mOhm @4.5V
LOADING	0.811 A (EDP)

1.5V S0 FET



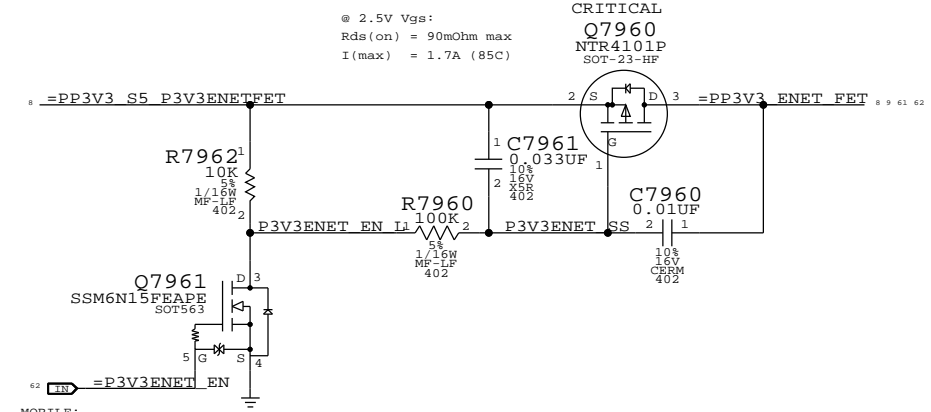
MOSFET	FDC638P
CHANNEL	P-TYPE
RDS(ON)	48 mOhm @4.5V
LOADING	0.795 A (EDP)

3.3V S0 FET



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

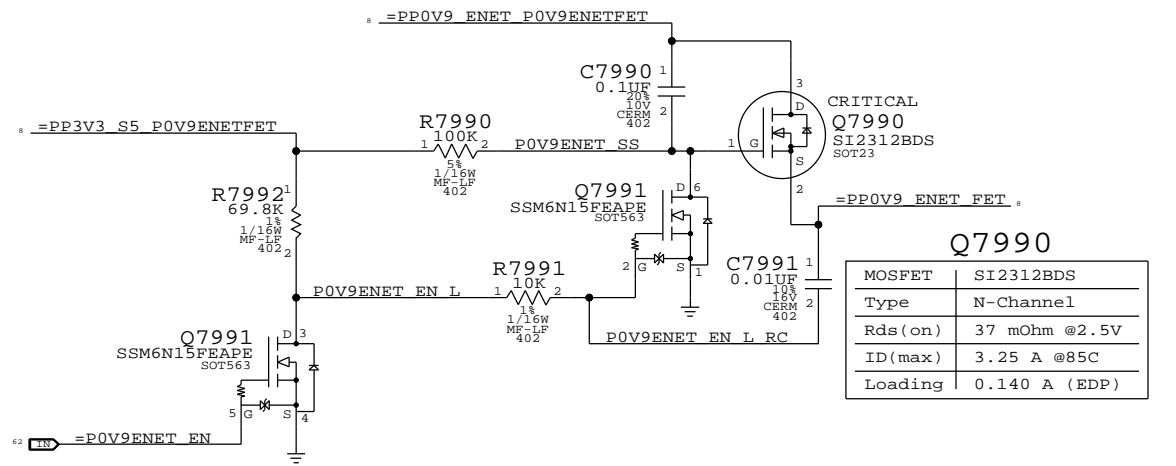
3.3V ENET FET



MOSFET	NTR4101P
CHANNEL	P-TYPE
Rds(on)	90mOhm max
I(max)	1.7A (85C)

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

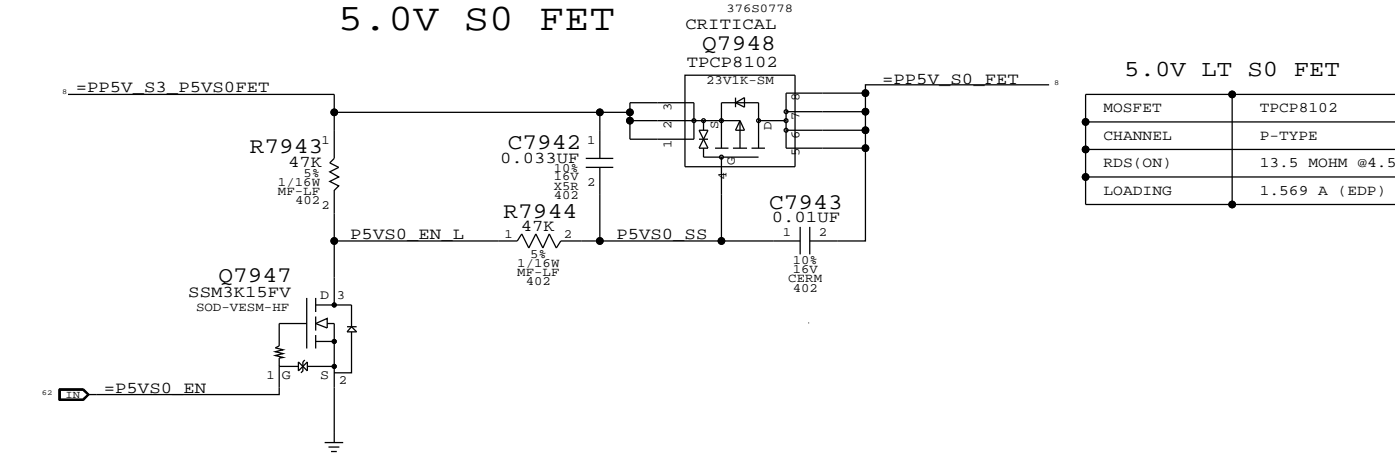
0.9V ENET FET



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

(Used to be 5.0V LT S0 FET)

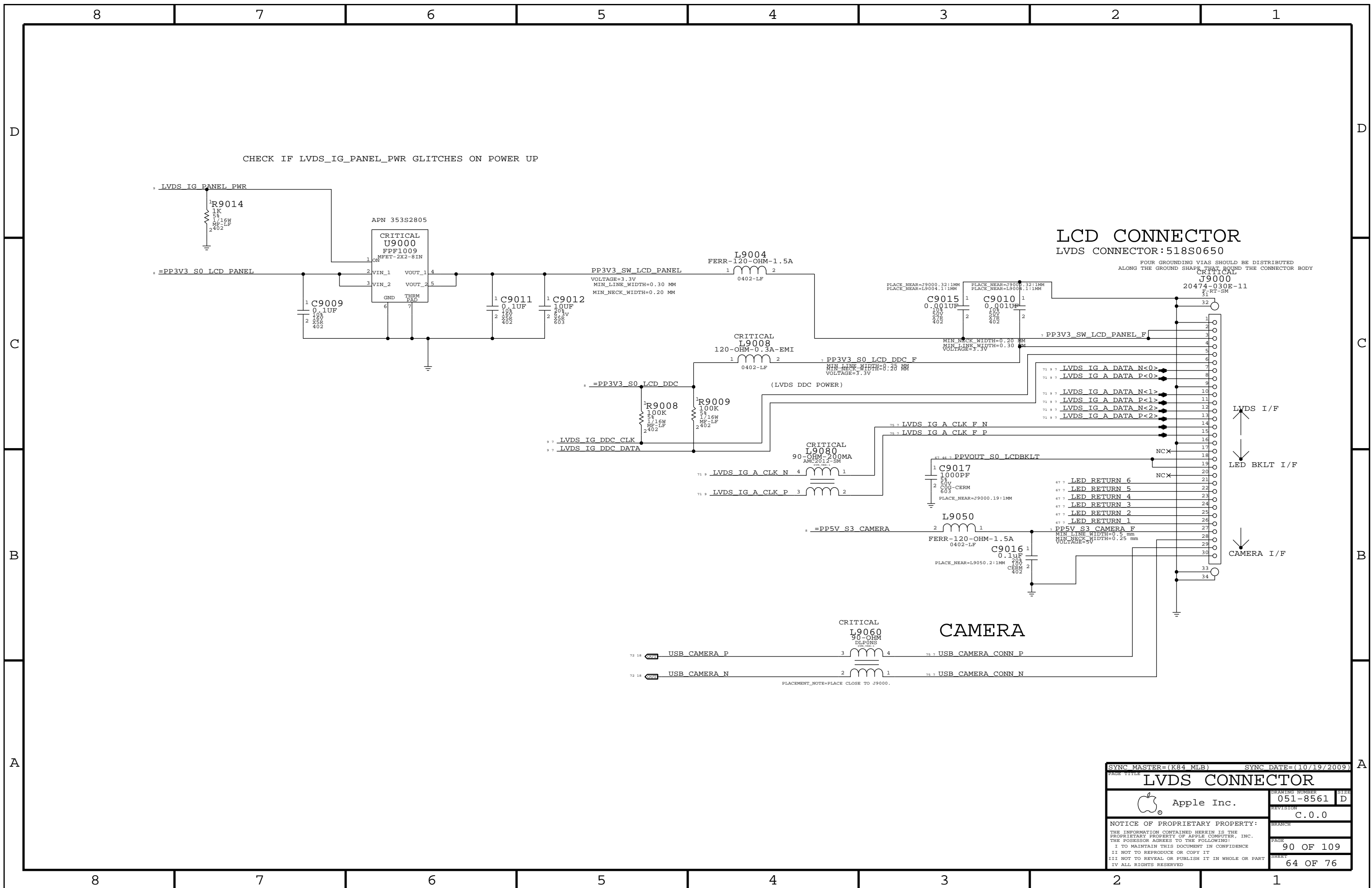
5.0V S0 FET



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

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

PAGE TITLE		SYNC DATE=MASTER	
POWER FETS			
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BRANCH		PAGE	79 OF 109
SHEET		63 OF 76	



CHECK IF LVDS_IG_PANEL_PWR GLITCHES ON POWER UP

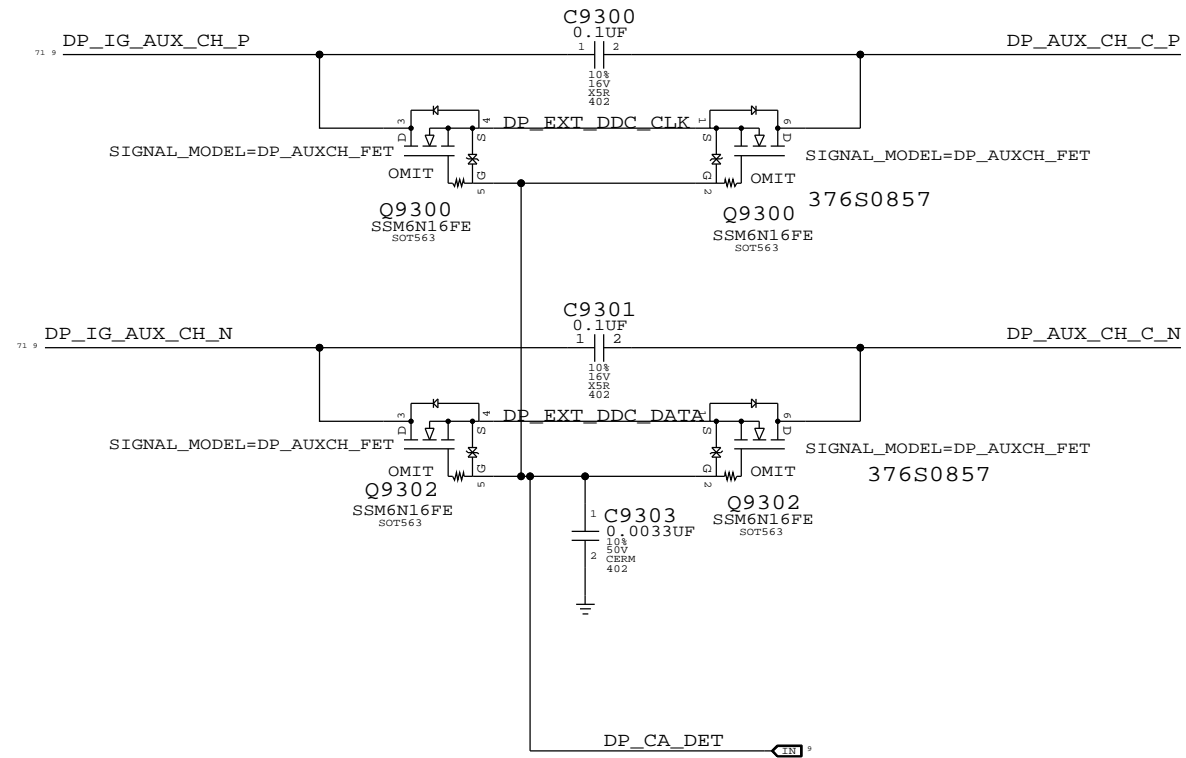
LCD CONNECTOR

LVDS CONNECTOR: 518S0650

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

CAMERA

SYNC MASTER=(K84 MLB)		SYNC DATE=(10/19/2009)	
LVDS CONNECTOR			
Apple Inc.		DRAWING NUMBER	SIZE
		051-8561	D
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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=K6_MLB SYNC DATE=02/16/2010

DISPLAYPORT SUPPORT

Apple Inc.

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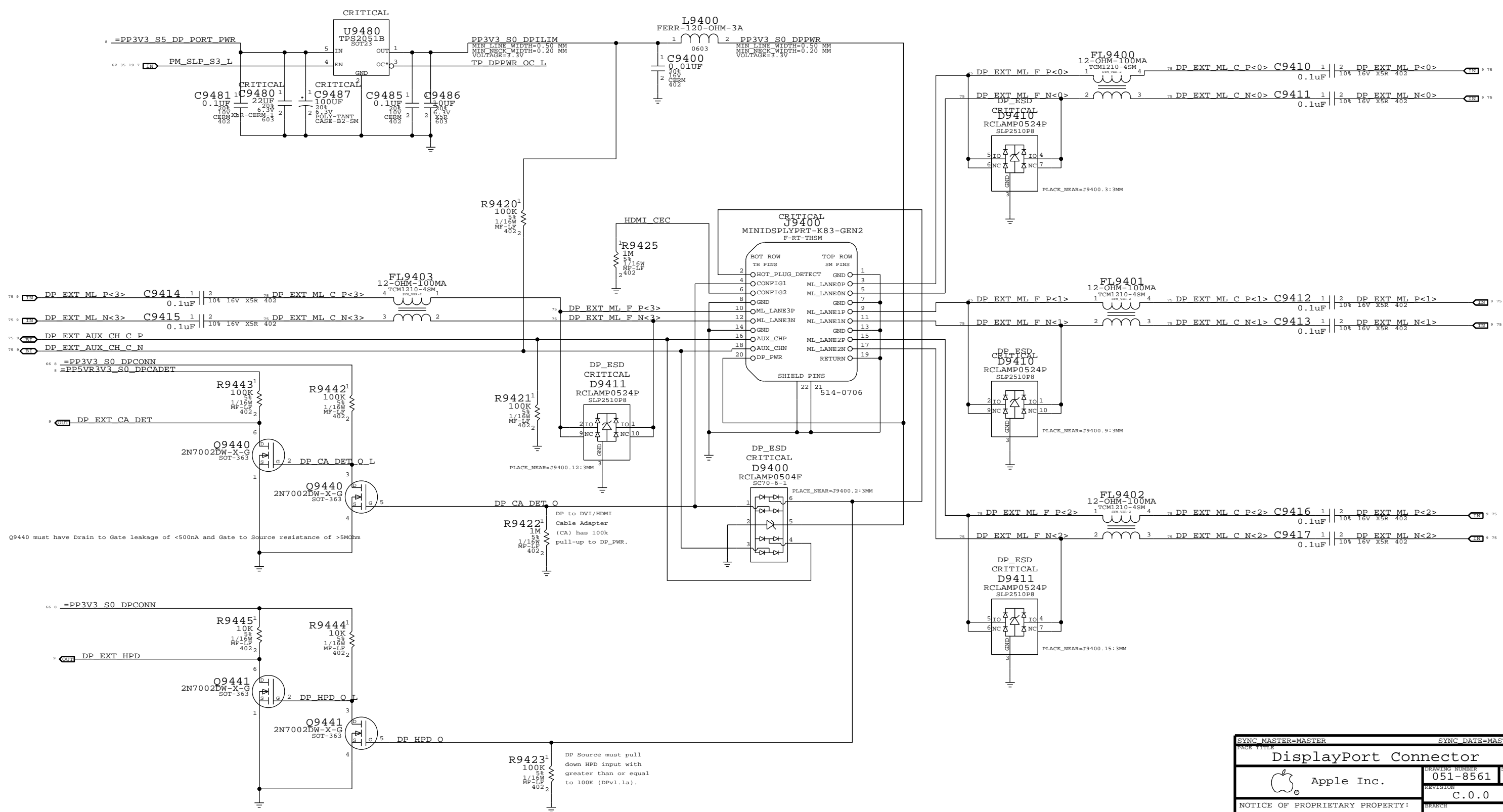
REVISION: C.0.0

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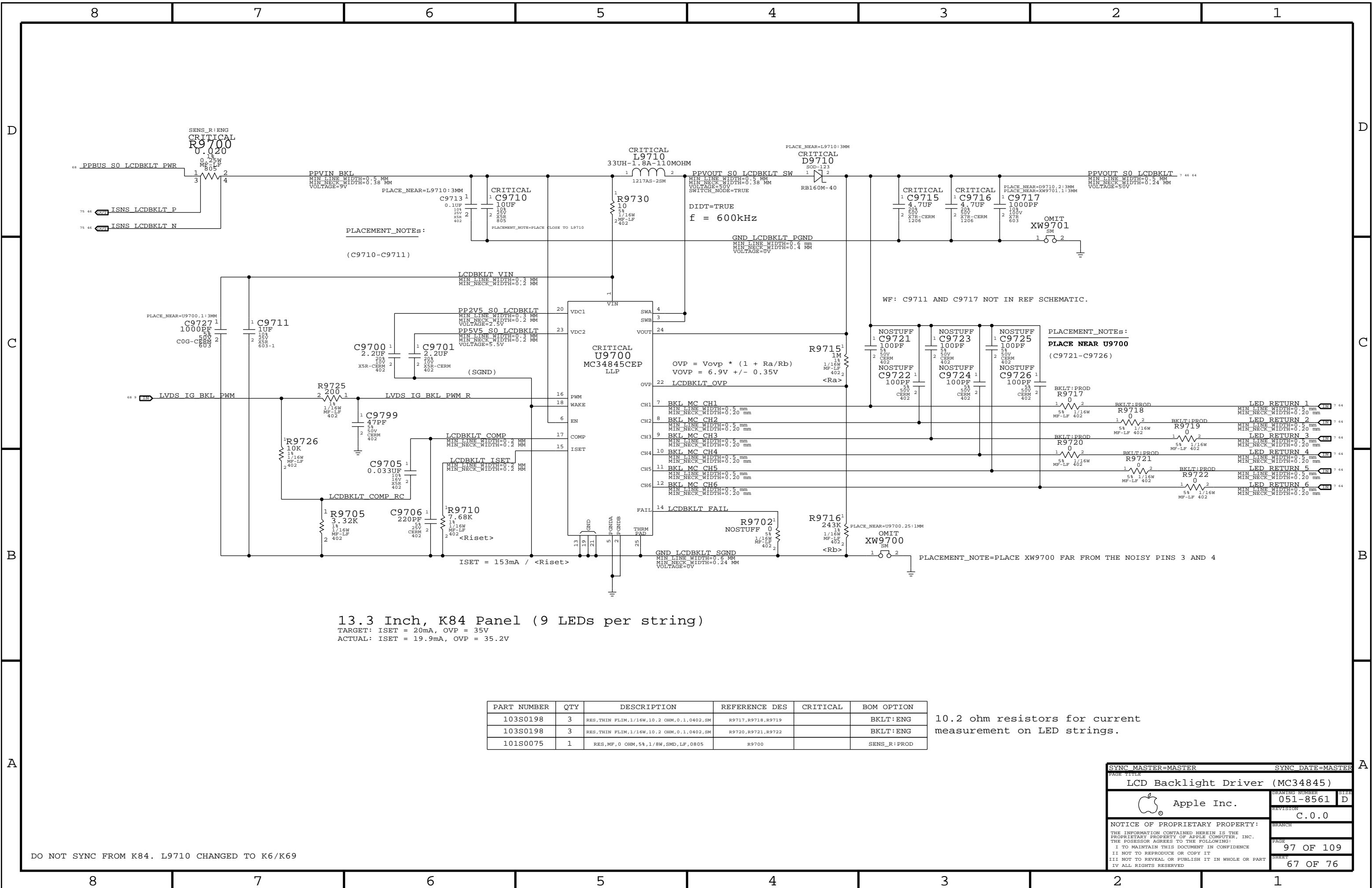
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Port Power Switch



SYNC MASTER=MASTER		SYNC DATE=MASTER	
PAGE TITLE DisplayPort Connector			
DRAWING NUMBER 051-8561		SIZE D	
REVISION C.0.0		BRANCH	
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DO NOT SYNC. K6 PAGE WITH K84 CONNECTOR



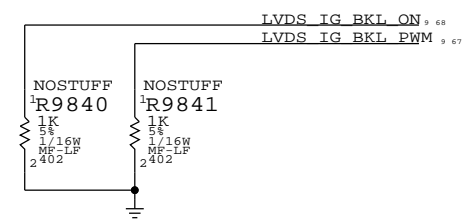
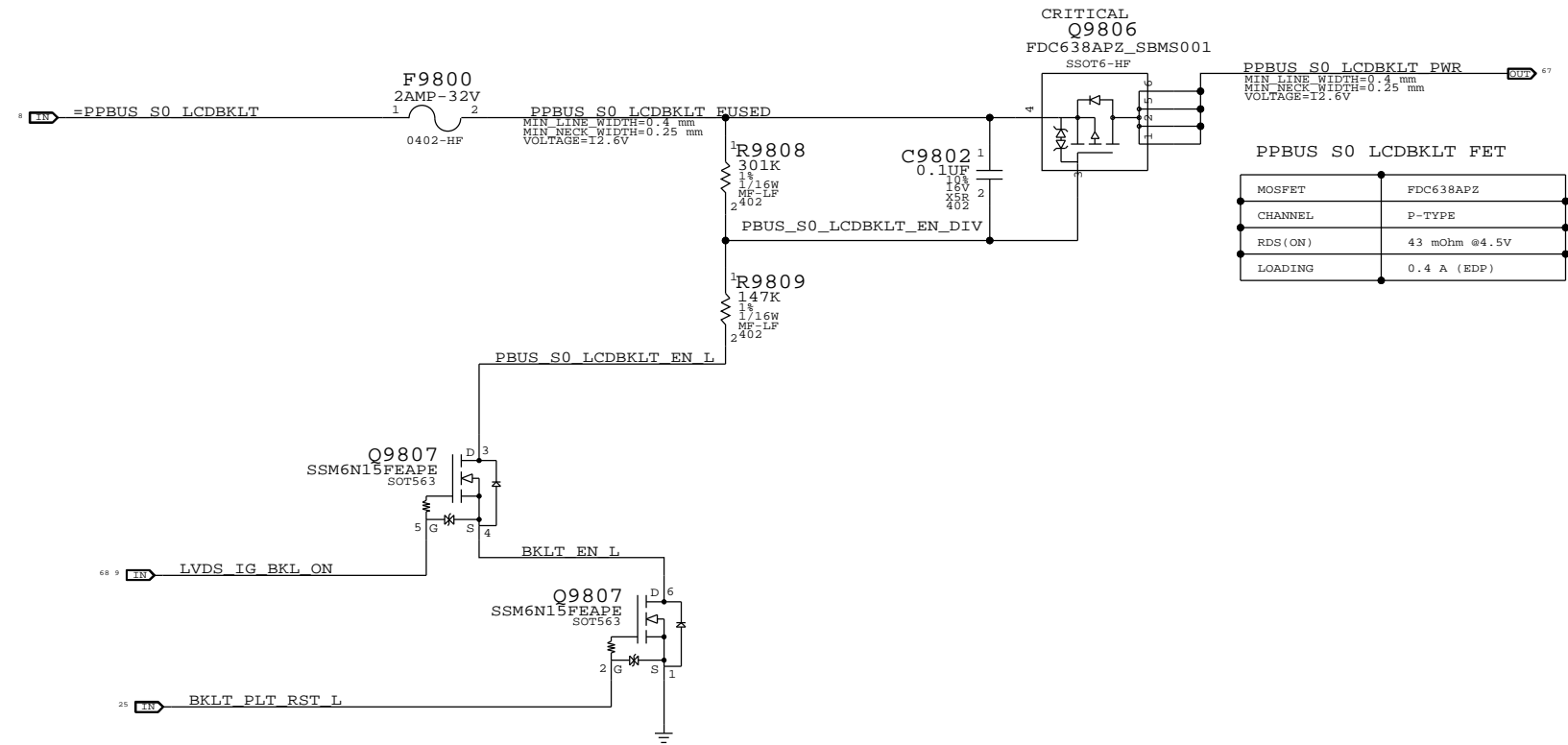
13.3 Inch, K84 Panel (9 LEDs per string)
 TARGET: ISET = 20mA, OVP = 35V
 ACTUAL: ISET = 19.9mA, OVP = 35.2V

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
103S0198	3	RES, THIN FLIM, 1/16W, 10.2 OHM, 0.1, 0402, SM	R9717, R9718, R9719		BKLT: PROD
103S0198	3	RES, THIN FLIM, 1/16W, 10.2 OHM, 0.1, 0402, 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=MASTER		SYNC DATE=MASTER	
PAGE TITLE LCD Backlight Driver (MC34845)			
DRAWING NUMBER 051-8561		SIZE D	
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MCP79 HAD INTERNAL 10K PULL-UP FOR THESE SIGNALS
MCP89 DRIVES THEM LOW

SYNC MASTER=(K84_MLB)		SYNC DATE=(10/19/2009)	
PAGE TITLE LCD Backlight Support			
DRAWING NUMBER 051-8561		SIZE D	
REVISION C.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
	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 REO L<4..0>	7 10 14
FSB_ADSTR0	FSB_50S	FSB_ADSTR	FSB ADSTR L<0>	7 10 14
FSB_ADDR_GROUP1	FSB_50S	FSB_ADDR	FSB A L<35..17>	7 10 14
FSB_ADSTR1	FSB_50S	FSB_ADSTR	FSB ADSTR 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_BMTL	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 14 36
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_BMTL	PM THERMTRIP L	10 14 36
FSB_CPUSLP_L	CPU_50S	CPU_AGTL	FSB CPUSLP L	10 14
CPU_PROM_SB	CPU_50S	CPU_AGTL	CPU DPSLP 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_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_I)	CPU_50S	CPU_ITP	XDP CPURST L	13
CPU_50S	CPU_50S	CPU_BMTL	CPU VID<6..0>	11 58
CPU_50S	CPU_50S	CPU_BMTL	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=T27_MLB SYNC_DATE=02/16/2010

CPU/FSB Constraints

Apple Inc.

DRAWING NUMBER: 051-8561 SIZE: D

REVISION: C.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_CTRL	MEM_CTRL	*	MEM_CTRL2MEM
MEM_CMD	MEM_CMD	*	MEM_CMD2MEM
MEM_DATA	MEM_DATA	*	MEM_DATA2MEM
MEM_DQS	MEM_DQS	*	MEM_DQS2MEM

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

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

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	SPACING	NET_TYPE
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_CNTRL	MEM_40S	MEM_CTRL	MEM A CS L<3..0>
MEM_A_CNTRL	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_CNTRL	MEM_40S	MEM_CTRL	MEM B CS L<3..0>
MEM_B_CNTRL	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=T27 MLB SYNC DATE=02/16/2010

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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
PCIE	*	=3X_DIELECTRIC	?
CLK_PCIE	*	20 MIL	?
MCP_PEX_COMP	*	8 MIL	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
PCIE	TOP,BOTTOM	=4X_DIELECTRIC	?

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
CRT	*	20 MIL	?
CRT_2CRT	*	15 MIL	?
CRT_2CLK	*	50 MIL	?
CRT_2SWITCHER	*	250 MIL	?
CRT_SYNC	*	=4x_DIELECTRIC	?
MCP_DAC_COMP	*	=2x_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
CRT	CRT	*	CRT_2CRT

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
DISPLAYPORT	*	=3x_DIELECTRIC	?
LVDS	*	=3x_DIELECTRIC	?

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

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

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	NET_TYPE		
	PHYSICAL	SPACING	
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=T27_MLB SYNC DATE=02/16/2010

MCP Constraints 1

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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_EXTN	USB_90D	USB	USB EXTN P	18 34
	USB_90D	USB	USB EXTN N	18 34
	USB_90D	USB	USB EXTN MUXED P	34 75
	USB_90D	USB	USB EXTN 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 EXTD P	9 18
	USB_90D	USB	USB EXTD 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_TPAD	USB_90D	USB	USB TPAD P	18 43
	USB_90D	USB	USB TPAD 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 R L	19 48
	HDA_55S	HDA	HDA RST L	19 48
HDA_SDIN0	HDA_55S	HDA	HDA SDIN0	19 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	SPT_55S	SPT	SPI CLK R	19 37
	SPT_55S	SPT	SPI CLK	7 37
SPI_MOST	SPT_55S	SPT	SPI MOST R	19 37
	SPT_55S	SPT	SPI MOST	7 37
SPI_MISO	SPT_55S	SPT	SPI MISO	7 19 37
SPI_CS0	SPT_55S	SPT	SPI CS0 R L	19 37
	SPT_55S	SPT	SPI CS0 L	7 37
	SPT_55S	SPT	SPI MLB CLK	37 47
	SPT_55S	SPT	SPI MLB MOSI	37 47
	SPT_55S	SPT	SPI MLB MISO	37 47
	SPT_55S	SPT	SPI MLB CS L	37 47
	SPT_55S	SPT	SPI ALT CLK	37
	SPT_55S	SPT	SPI ALT MOSI	37
	SPT_55S	SPT	SPI ALT MISO	37
	SPT_55S	SPT	SPI ALT CS L	37

SYNC MASTER=T27 MLB SYNC DATE=02/16/2010

MCP Constraints 2

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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_BUF0_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	PHYSICAL	SPACING	NET_TYPE
MCP_MII_COMP	MCP_MII_COMP		MCP_MII_COMP_VDD
MCP_MII_COMP	MCP_MII_COMP		MCP_MII_COMP_GND
MCP_CLK25M_BUF0	ENET_MII_55S	MCP_BUF0_CLK	MCP_CLK25M_BUF0_R
	ENET_MII_55S	MCP_BUF0_CLK	RTL8211_CLK25M_CKXTAL1
ENET_INTR_L	ENET_MII_55S	ENET_MII	ENET_INTR_L
ENET_MDIO	ENET_MII_55S	ENET_MII	ENET_MDIO
ENET_MDC	ENET_MII_55S	ENET_MII	ENET_MDC
ENET_PWRDWN_L	ENET_MII_55S	ENET_MII	ENET_PWRDWN_L
	ENET_MII_55S	ENET_MII	ENET_CLK125M_RXCLK_R
ENET_RXCLK	ENET_MII_55S	ENET_MII	ENET_CLK125M_RXCLK
	ENET_MII_55S	ENET_MII	ENET_RXD_R<3..0>
ENET_RXD_STRAP	ENET_MII_55S	ENET_MII	ENET_RXD<0>
ENET_RXD_STRAP	ENET_MII_55S	ENET_MII	ENET_RXD<3..1>
ENET_RXD	ENET_MII_55S	ENET_MII	ENET_RX_CTRL
	ENET_MII_55S	ENET_MII	ENET_RXCTL_R
	ENET_MII_55S	ENET_MII	ENET_CLK125M_TXCLK_R
ENET_TXCLK	ENET_MII_55S	ENET_MII	ENET_CLK125M_TXCLK
ENET_TXD0	ENET_MII_55S	ENET_MII	ENET_TXD<0>
ENET_TXD	ENET_MII_55S	ENET_MII	ENET_TXD<3..1>
ENET_TXD	ENET_MII_55S	ENET_MII	ENET_TX_CTRL
	ENET_MII_55S	ENET_MII	ENET_RESET_L
ENET_MDI	ENET_MDI_100D	ENET_MDI	ENET_MDI_P<3..0>
	ENET_MDI_100D	ENET_MDI	ENET_MDI_N<3..0>
	ENET_MDI_100D	ENET_MDI	ENET_MDI_TRAN_P<3..0>
	ENET_MDI_100D	ENET_MDI	ENET_MDI_TRAN_N<3..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_DIFFPAIR		CHGR_CSI_P	55
	1T01_DIFFPAIR		CHGR_CSI_N	55
	1T01_DIFFPAIR		CHGR_CSI_R_P	55
	1T01_DIFFPAIR		CHGR_CSI_R_N	55
CHGR_CSO	1T01_DIFFPAIR		CHGR_CSO_P	55
	1T01_DIFFPAIR		CHGR_CSO_N	55
	1T01_DIFFPAIR		CHGR_CSO_R_P	40 55
	1T01_DIFFPAIR		CHGR_CSO_R_N	40 55

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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
CLK_PCIE	GND	*	GND_P2MM
PCIE	GND	*	GND_P2MM
SATA	GND	*	GND_P2MM
USB	GND	*	GND_P2MM
CLK_PCIE	SB_POWER	*	PWR_P2MM
SATA	SB_POWER	*	PWR_P2MM
USB	SB_POWER	*	PWR_P2MM

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
LVDS	GND	*	GND_P2MM

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

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	*	OVERWRITE	OVERWRITE	0.09 MM_OVERRIDE	5.8 MM_OVERRIDE	OVERWRITE	OVERWRITE
MCP_DV_COMP_OVERRIDE	TOP	OVERWRITE	OVERWRITE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	OVERWRITE	OVERWRITE
MCP_MEM_COMP_OVERRIDE	TOP	OVERWRITE	OVERWRITE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	OVERWRITE	OVERWRITE
MCP_MII_COMP_OVERRIDE	TOP	OVERWRITE	OVERWRITE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	OVERWRITE	OVERWRITE
MCP_USB_RBIA_OVERRIDE	TOP	OVERWRITE	OVERWRITE	0.1 MM_OVERRIDE	500 MIL_OVERRIDE	OVERWRITE	OVERWRITE
MCP_DV_COMP_OVERRIDE	*	OVERWRITE	OVERWRITE	0.25 MM_OVERRIDE	250 MIL_OVERRIDE	OVERWRITE	OVERWRITE

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
(USB_CAMERA)	USR_90D	USR	USB LT2 P
(USB_CAMERA)	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 D2R NORDRV N
	PCIE_AP_D2R	PCIE	CONN PCIE MINI D2R P
	PCIE_AP_D2R	PCIE	CONN PCIE MINI D2R N
	PCIE_AP_R2D	PCIE	CONN PCIE MINI R2D P
	PCIE_AP_R2D	PCIE	CONN PCIE MINI R2D N
	USB_BT	USR	CONN USB2 BT P
	USB_BT	USR	CONN USB2 BT N
	LVDS_IG_A_CLK	LVDS	LVDS IG A CLK F P
	LVDS_IG_A_CLK	LVDS	LVDS IG A CLK F N
	MCP_PEL_REFCLK	CLK_PCIE_100D	CLK_PCIE
	MCP_PEL_REFCLK	CLK_PCIE_100D	CLK_PCIE
	(USB_EXT_A)	USR_90D	USR
	(USB_EXT_A)	USR_90D	USR
	(USB_EXT_B)	USR_90D	USR
	(USB_EXT_B)	USR_90D	USR

Power Net Properties

ELECTRICAL_CONSTRAINT_SET	PHYSICAL	SPACING	NET_TYPE
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D1 P
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D1 N
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D2 P
CPUTHMSNS_D2	THERM_1T01_55S	THERM	CPUTHMSNS D2 N
CPU_THERMD	THERM_1T01_55S	THERM	CPU_THERMD P
CPU_THERMD	THERM_1T01_55S	THERM	CPU_THERMD N
MCPTHMSNS_D2	THERM_1T01_55S	THERM	MCPTHMSNS D2 P
MCPTHMSNS_D2	THERM_1T01_55S	THERM	MCPTHMSNS D2 N
MCP_THMDIODE	THERM_1T01_55S	THERM	MCP_THMDIODE P
MCP_THMDIODE	THERM_1T01_55S	THERM	MCP_THMDIODE N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LV5 S3 P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LV5 S3 R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LV5 S3 R P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LV5 S3 R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS AIRPORT P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS AIRPORT N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS AIRPORT R P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS AIRPORT R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS HDD P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS HDD N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS HDD R P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS HDD R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LCDBKLT P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LCDBKLT N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LCDBKLT R P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS LCDBKLT R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS ODD P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS ODD N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS ODD R P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS ODD R N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS CPUVTT P
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	ISNS CPUVTT N
SENSE_DIFFPATR	SENSE_1T01_55S	SENSE	MCPCORES0 VSEN P
SENSE_DIFFPATR	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
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN L OUT N
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN S OUT P
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN S OUT N
SPK_OUT	DIFFPATR	AUDIO	SPKRCONN R OUT P
SPK_OUT	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

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K87 SPECIFIC CONSTRAINTS			
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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, NO_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	0.095 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	0.075 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	*	0.1 MM	?
STANDARD	*	-DEFAULT	?
BGA_P10M	*	-DEFAULT	?
BGA_P20M	*	-DEFAULT	?
BGA_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
*	*	BGA_P10M	BGA_P10M
MEM_CLK	*	BGA_P10M	BGA_P20M
CLK_PSB	*	BGA_P10M	BGA_P20M
CLK_LPC	*	BGA_P10M	BGA_P20M
CLK_PCIE	*	BGA_P10M	BGA_P20M
CLK_SLOW	*	BGA_P10M	BGA_P20M
FSB_D5TB	FSB_D5TB	BGA_P10M	BGA_P30M

NET_PHYSICAL_TYPE	AREA_TYPE	PHYSICAL_RULE_SET
MEM_40S	BGA_P10M	STANDARD

SYNC MASTER=MASTER		SYNC DATE=MASTER	
PAGE TITLE K87 RULE DEFINITIONS			
DRAWING NUMBER 051-8561		SIZE D	
REVISION C.0.0		BRANCH	
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