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
6	0000955408	ENGINEERING RELEASED	2010-08-09

SCHEM,PCB,LIO,K16

DVT, 2010-08-09

Schematic / PCB #'s

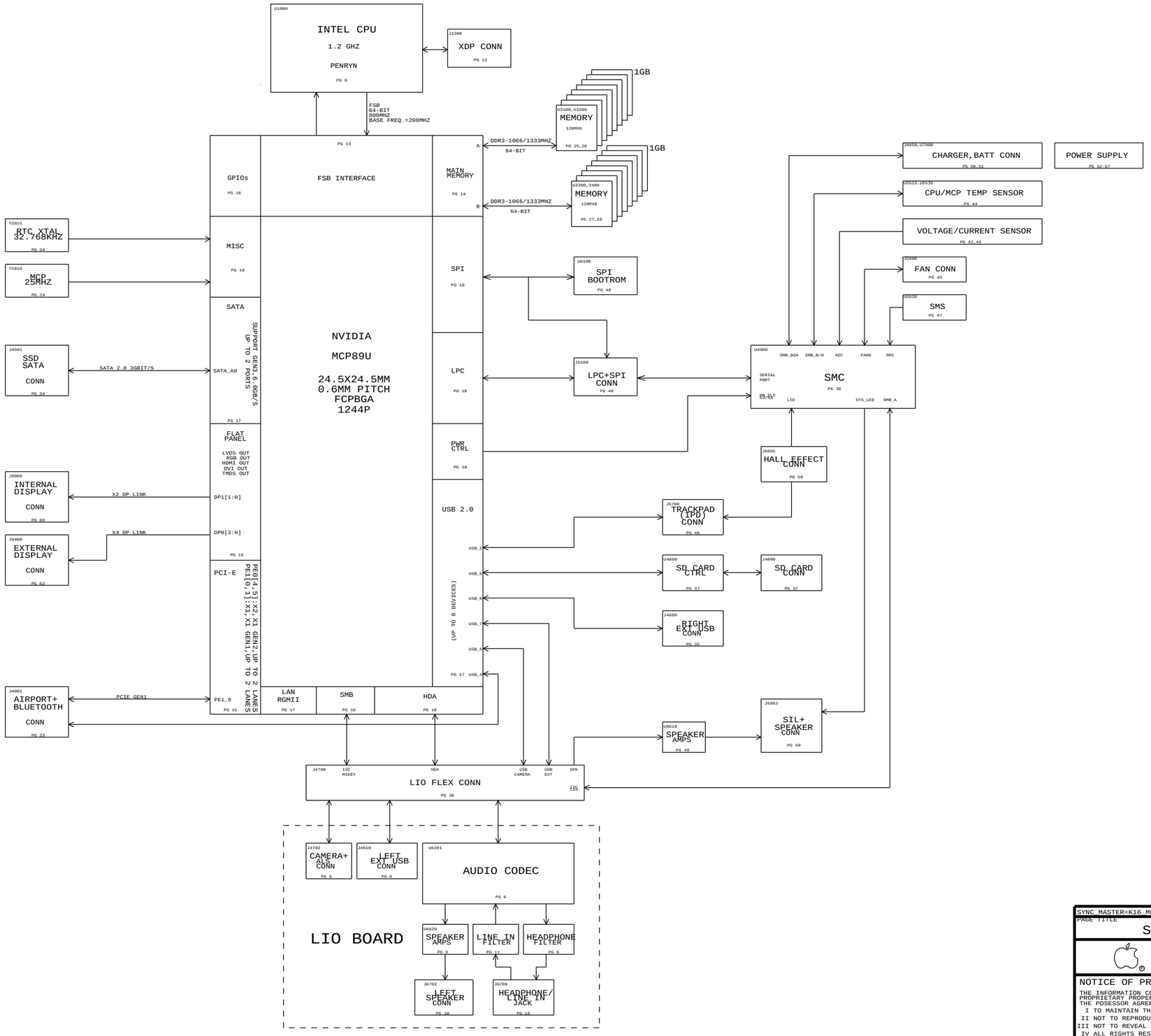
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-8540	1	SCHEM,PCB,LIO,K16	SCH	CRITICAL	
820-2869	1	PCBF,LIO,K16	PCB	CRITICAL	
825-7557	1	LBL,P/N LABEL,PCB,28MM X 6MM	[EEEE_DD1Q]	CRITICAL	

BOM: 639-1057 PCBA,LIO,K16
MCO: 056-3614 MCO,LIO,K16

DRAWING TITLE: SCHEM,PCB,LIO,K16

Apple Inc.

DRAWING NUMBER: 051-8540 SIZE: D
REVISION: 6.0.0
BRANCH:
PAGE: 1 OF 103
SHEET: 1 OF 13



SYNC_MASTER=K16_MLB SYNC_DATE=05/19/2010

PAGE TITLE

System Block Diagram

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D

REVISION 6.0.0

BRANCH

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Functional Test Points

AUDIO

TRUE	I2C_MIKEY_SCL	6 11 13	
TRUE	I2C_MIKEY_SDA	6 11 13	
TRUE	AUD_GPIO_3	6 7 9	
TRUE	AUD_IPHS_SWITCH_EN	6 11	
TRUE	AUD_I2C_INT_L	6 11	
TRUE	AUD_IP_PERIPHERAL_DET	6 11	
TRUE	HDA_BIT_CLK	6 7 13	
TRUE	HDA_RST_L	6 7 13	
TRUE	HDA_SDIN0	6 7 13	
TRUE	HDA_SDOUT	6 7 13	
TRUE	HDA_SYNC	6 7 13	
TRUE	SPKRAMP_INL_N	9	
TRUE	SPKRAMP_INL_P	9	
TRUE	BI_MIC_HI_F	11	
TRUE	BI_MIC_LO_F	11	
TRUE	BI_MIC_SHIELD	10 11	
TRUE	SPKRAMP_L_P_OUT	9 10	(PLACE BOTH NEAR J4720)
TRUE	SPKRAMP_L_N_OUT	9 10	

SMC

TRUE	SMC_BC_ACOK	6 12	
TRUE	SYS_ONEWIRE	6 12	
TRUE	ADAPTER_SENSE_UF_L	12	
TRUE	SMC_LID	6	

I2C

TRUE	I2C_LIO_SCL	6 13	
TRUE	I2C_LIO_SDA	6 13	

POWER

TRUE	PP18V5_DCIN_UF	12	(NEED 4 TP NEAR J6910)
TRUE	PP18V5_G3H	4	(NEED 1 EACH TP NEAR J4701 AND J4702)
TRUE	PP5V_S3	4	
TRUE	PP3V3_S0	4	
TRUE	PP1V5_S0	4	
TRUE	PP3V42_G3H	4	

USB

TRUE	USB_EXTB_N	5 6 13	(PLACE BOTH NEAR J4720)
TRUE	USB_EXTB_P	5 6 13	
TRUE	USB_CAMERA_N	6 13	(PLACE BOTH NEAR J4700)
TRUE	USB_CAMERA_P	6 13	
TRUE	USB_CAMERA_CONN_N	6 13	(PLACE BOTH NEAR J4720)
TRUE	USB_CAMERA_CONN_P	6 13	
TRUE	USB_EXTB_OC_L	5 6	
TRUE	USB_PWR_EN	5 6	

GROUNDS

TRUE	GND_ADAPTER_UF	12	(NEED 4 TP NEAR J6910)
TRUE	GND_DCIN_CHGND	4 12	(NEED 2 TP NEAR J6910)
TRUE	GND		

(NEED 2 TP NEAR J4720)
(NEED 8 TP NEAR J4700)
(NEED 4 TP NEAR J4701-J4706)
(NEED 2 TP NEAR J6701)
(NEED 2 TP NEAR J6702)

SYNC_MASTER=(K6_MLB) SYNC_DATE=(12/11/2009)

PAGE TITLE: FUNC TEST

Apple Inc.

DRAWING NUMBER: 051-8540 SIZE: D

REVISION: 6.0.0

BRANCH:

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SHEET: 3 OF 13

"S0,S0M" RAILS

6 =PP1V8R1V5_S0_AUDIO → PP1V5_S0
MIN_LINE_WIDTH=0.3MM
MIN_NECK_WIDTH=0.1MM
VOLTAGE=1.5V
MAKE_BASE=TRUE
→ =PP1V5_S0_AUDIO 7

6 =PP3V3_S0_AUDIO → PP3V3_S0
MIN_LINE_WIDTH=0.3MM
MIN_NECK_WIDTH=0.1MM
VOLTAGE=3.3V
MAKE_BASE=TRUE
→ =PP3V3_S0_AUDIO_DIG 7 11
→ =PP3V3_S0_TEMP_SNR 6

"S3" RAILS

6 =PP5V_S3_REG → PP5V_S3
MIN_LINE_WIDTH=0.5MM
MIN_NECK_WIDTH=0.2MM
VOLTAGE=5V
MAKE_BASE=TRUE
→ =PP5V_S3_EXTUSB 5
→ =PP5V_S3_CAMERA 6
→ =PP5V_S3_AUDIO_AMP 9
→ =PP5V_S3_AUDIO 7

"G3H" RAILS

6 =PP3V42_G3H_REG → PP3V42_G3H
MIN_LINE_WIDTH=0.6
MIN_NECK_WIDTH=0.3
VOLTAGE=3.42V
MAKE_BASE=TRUE
→ =PP3V42_G3H_ONEWIRE 12
→ =PP3V42_S3_HALL 6

12 6 =PP18V5_DCIN_CONN → PP18V5_G3H
MIN_LINE_WIDTH=0.6MM
MIN_NECK_WIDTH=0.3MM
VOLTAGE=18.5V
MAKE_BASE=TRUE

DIGITAL GROUND
GND
MIN_LINE_WIDTH=0.58MM
MIN_NECK_WIDTH=0.20MM
VOLTAGE=0V

Pogo pins

APN: 870-1938
ZS8001
POGO-2.00D-3.6H-K86-K87
SM
1 — Place near USB connector (top side)

APN: 870-1938
ZS8002
POGO-2.00D-3.6H-K86-K87
SM
1 — Place near MPM connector (top side)

12 3 GND_DCIN_CHGND

APN: 870-1939
ZS8005
POGO-2.00D-3.5H-K86-K87
SM
1 — Place near audio connector (bottom side)

APN: 870-1939
ZS8003
POGO-2.00D-3.5H-K86-K87
SM
1 — Place near MPM near middle of board (bottom side)

APN: 870-1940
ZS8004
POGO-2.00D-2.95H-K86-K87
SM
1 — Place near MPM near edge of board (bottom side)

Speaker clip

APN: 806-1178

SPKR-LIO-CLIP-K16
1 ZT0801
SM

Power cable clip

APN: 806-1171

LIO-CLIP-K16
1 ZT0802
SM

SYNC_MASTER=(K24 MLB) SYNC_DATE=(02/04/2009)

PAGE TITLE
Power Aliases

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D
REVISION 6.0.0
BRANCH
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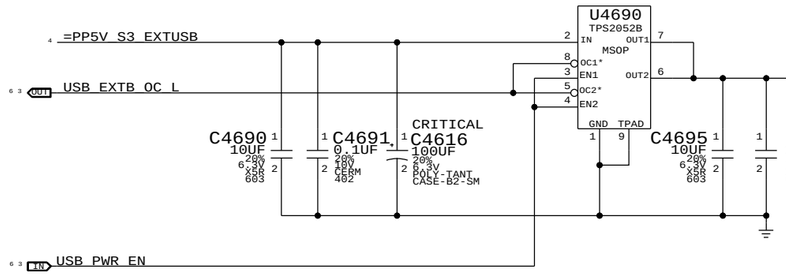
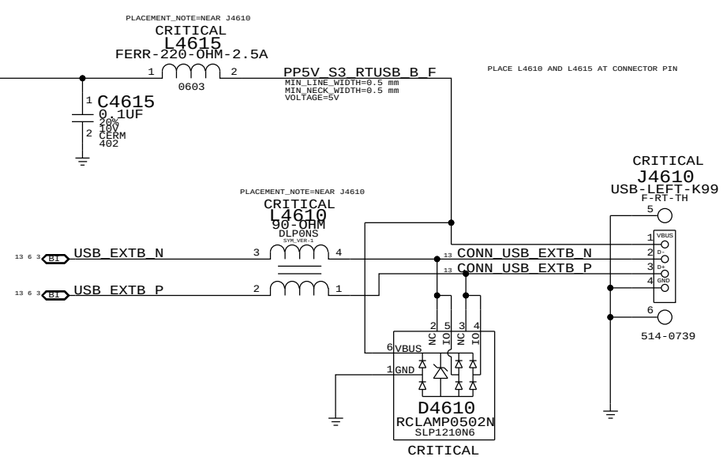
Port Power Switch



BASED OFF CHARACTERIZATION ON OTHER DESIGNS C4690 IS NOT REQUIRED LEAVING IT AS NO STUFFED



USB PORT B (LEFT PORT)

SYNC_MASTER=(K84 MLB) SYNC_DATE=(11/09/2009)

PAGE TITLE
External USB Connectors

Apple Inc.

DRAWING NUMBER 051-8540 | SIZE D
REVISION 6.0.0
BRANCH
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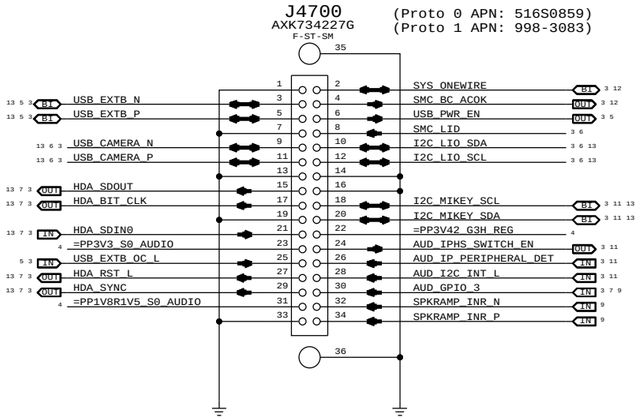
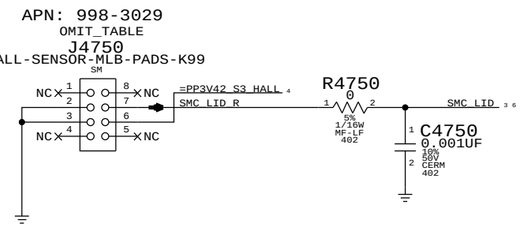
34 Pin LIO Flex Connector

APN: 516S0870



Hall Effect pads

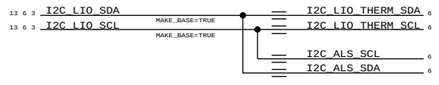
APN: 998-3029
OMIT_TABLE
J4750
HALL-SENSOR-MLB-PADS-K99



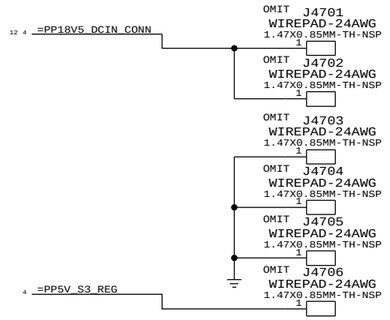
PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
607-6812	1	SUBASSY,PCBA HALL EFFECT,K16	J4750	CRITICAL	

639-1017 (K16 Hall effect board) reports to 607-6812

I2C aliases



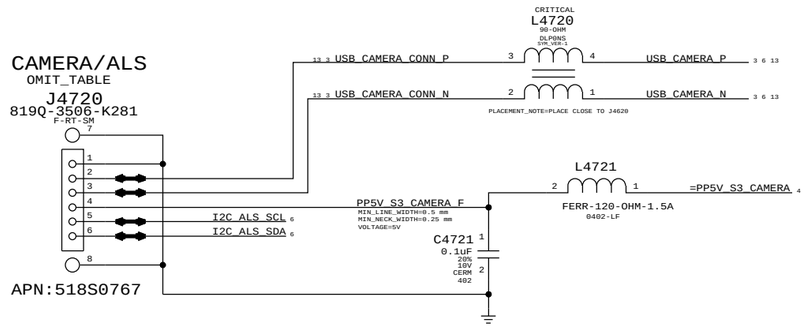
LIO POWER



SPACE THE HOLES 2MM APART CENTER TO CENTER

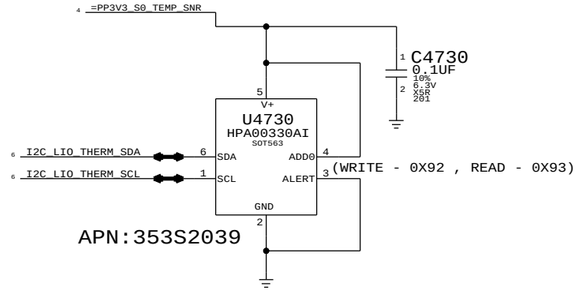
CAMERA/ALS

OMIT_TABLE
J4720
819Q-3506-K281
F-RT-SM



APN:518S0767

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
518S0815	1	CONN,HDR,TWIN-AX,P=0.4,6P,HF	J4720	CRITICAL	



APN:353S2039

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: LIO CONNECTORS

Apple Inc.

DRAWING NUMBER: 051-8540 SIZE: D
REVISION: 6.0.0
BRANCH:
PAGE: 47 OF 103
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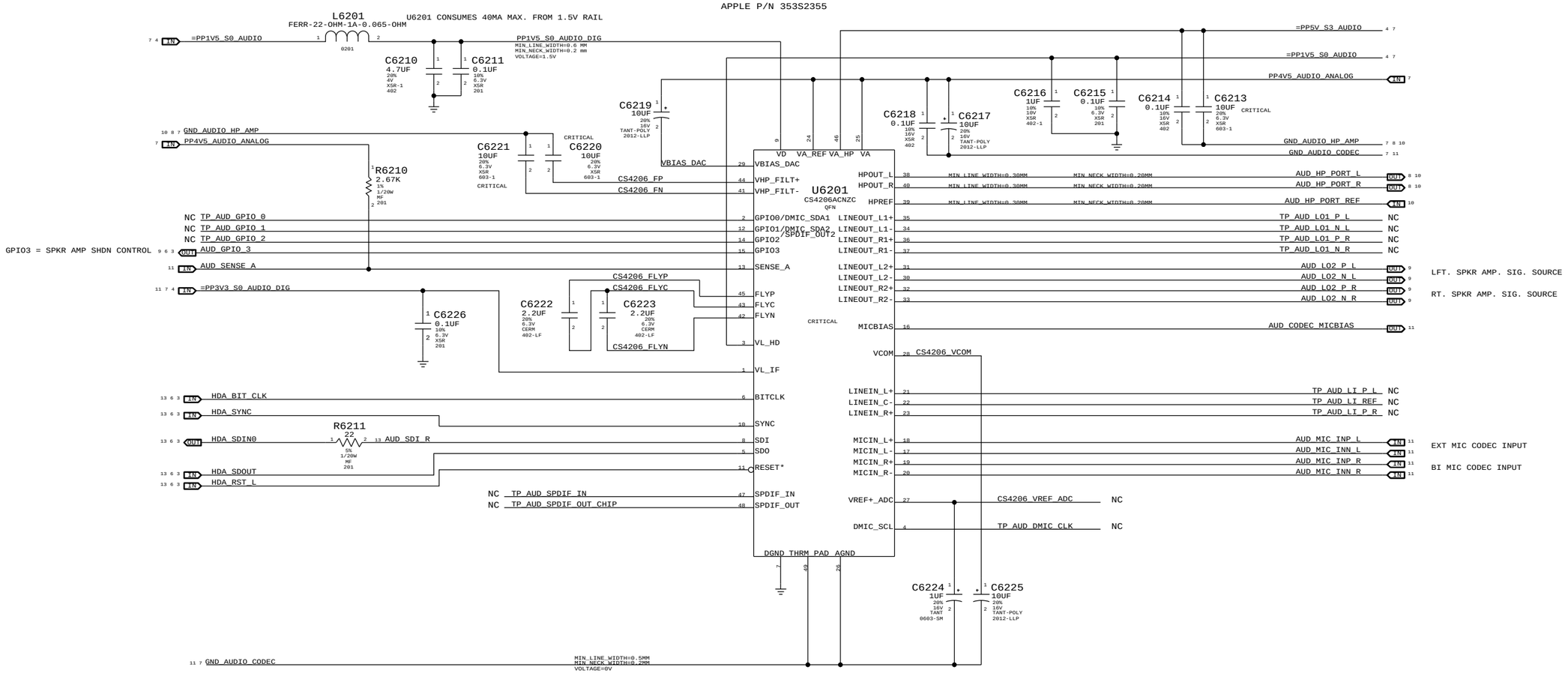
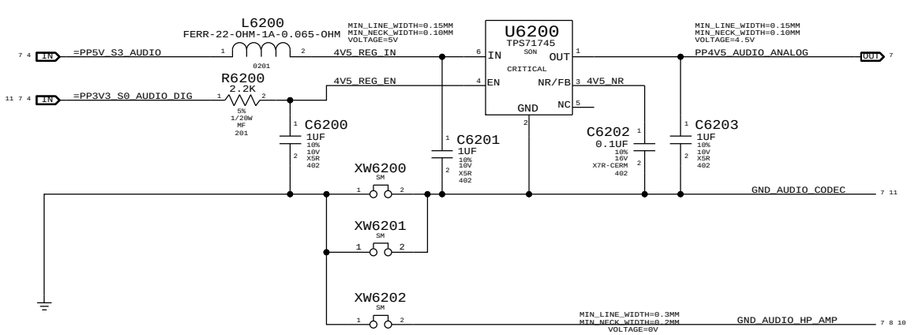
AUDIO CODEC

APPLE P/N 353S2355



4.5V POWER SUPPLY FOR CODEC

APPLE P/N 353S2456



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=05/19/2010

PAGE TITLE
AUDIO: CODEC/REGULATOR

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D
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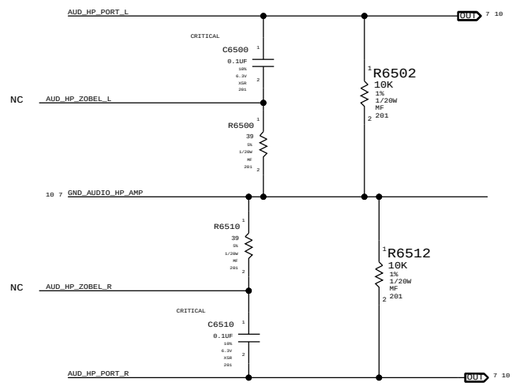
ZOBEL NETWORK & IO PULL-DOWNS



SYNC_MASTER=AUDIO SYNC_DATE=05/19/2010

PAGE TITLE

AUDIO: HEADPHONE FILTER

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D

REVISION 6.0.0

BRANCH

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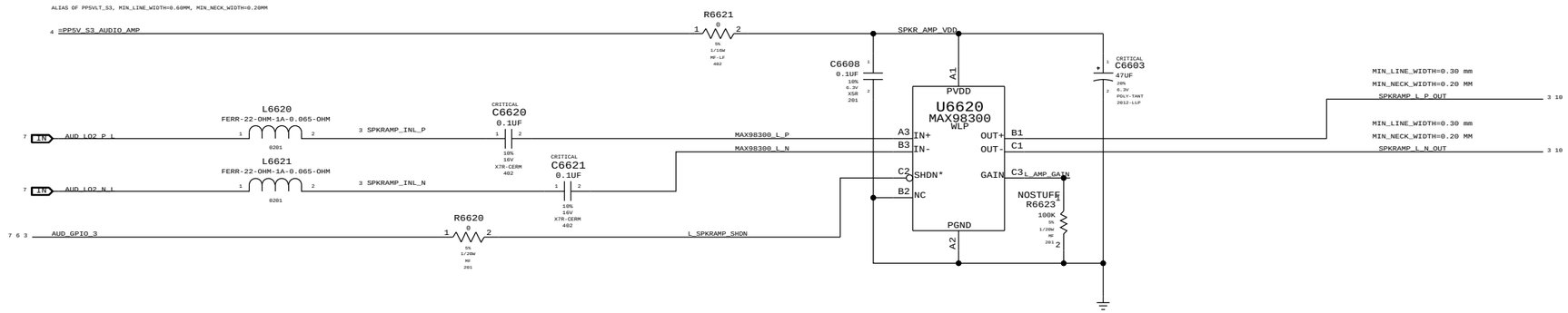
SHEET 8 OF 13

SPEAKER AMPLIFIERS

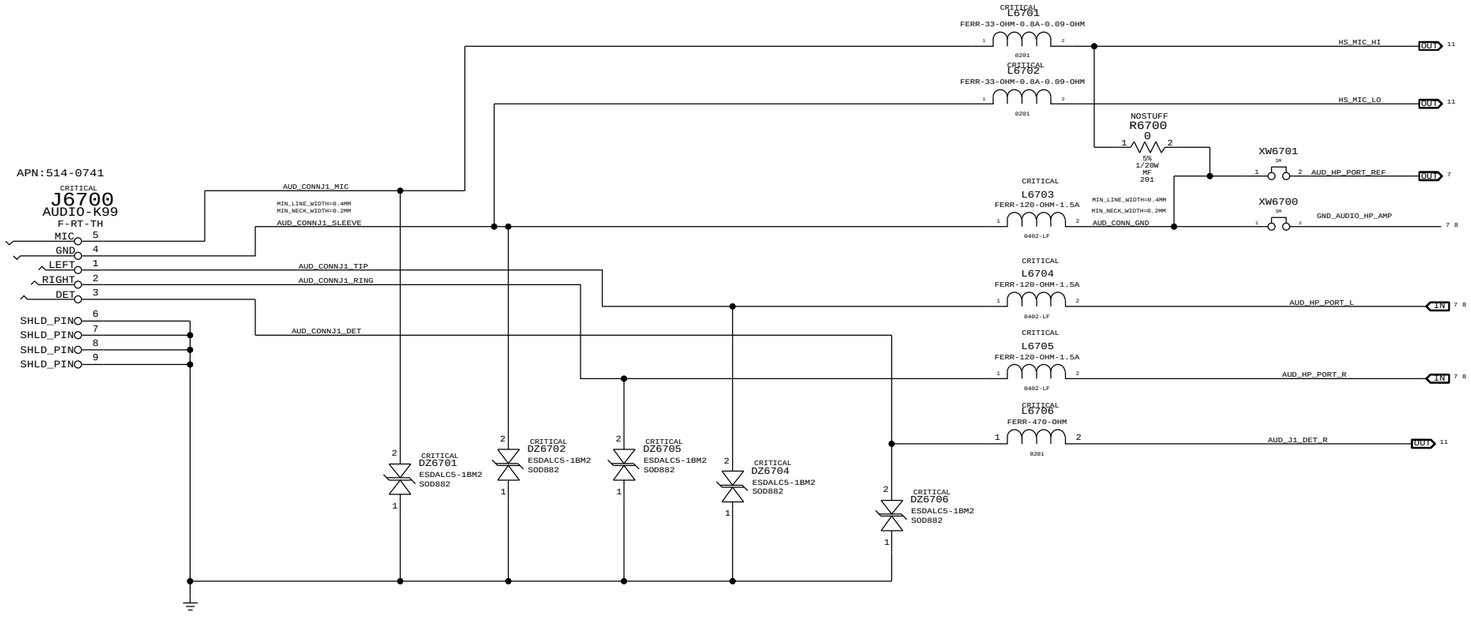
APN:353S2888

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



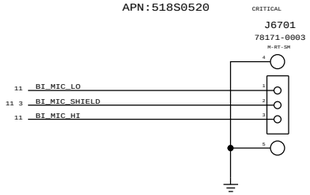
SYNC_MASTER=AUDIO	SYNC_DATE=05/19/2010
PAGE TITLE	AUDIO: SPEAKER AMP
Apple Inc.	DRAWING NUMBER 051-8540 SIZE D
	REVISION 6.0.0
	BRANCH
	PAGE 66 OF 103
	SHEET 9 OF 13

AUDIO JACK: HP CONNECTOR WITH MIKEY



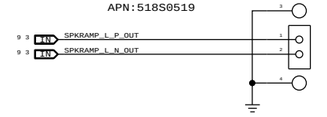
MIC CONNECTOR

APN:518S0520



LEFT SPEAKER CONNECTOR

APN:518S0519



RIGHT SPEAKER ON MLB

SYNC_MASTER=AUDIO SYNC_DATE=05/19/2010

PAGE TITLE

AUDIO: JACK

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D

REVISION 6.0.0

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CODEC OUTPUT SIGNAL PATHS

FUNCTION	VOLUME	CONVERTER	PIN COMPLEX	MUTE CONTROL	DET ASSIGNMENT
HP/LINE OUT	0X02 (2)	0X02 (2)	0X09 (9,A)	GPIO_0 AND GPIO_1	0X09 (A)
SPEAKERS	0X04 (4)	0X04 (4)	0X0B (11)	GPIO_3	N/A

CODEC INPUT SIGNAL PATHS

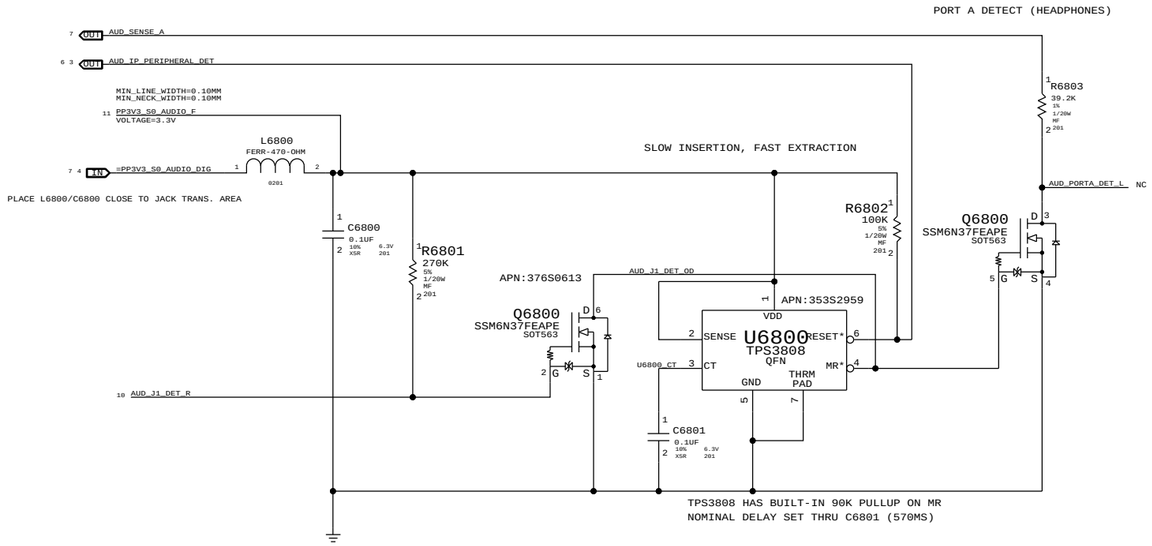
FUNCTION	CONVERTER	PIN COMPLEX	VREF	DET ASSIGNMENT
BUILT-IN MIC	0X06 (6)	0X0D (13,B,RIGHT)	MIC_BIAS (80%)	N/A
HEADSET MIC	0X06 (6)	0X0D (13,V22,B,LEFT)	MIKEY	MIKEY

SOUTHBRIDGE RESOURCE/PIN ALLOCATIONS

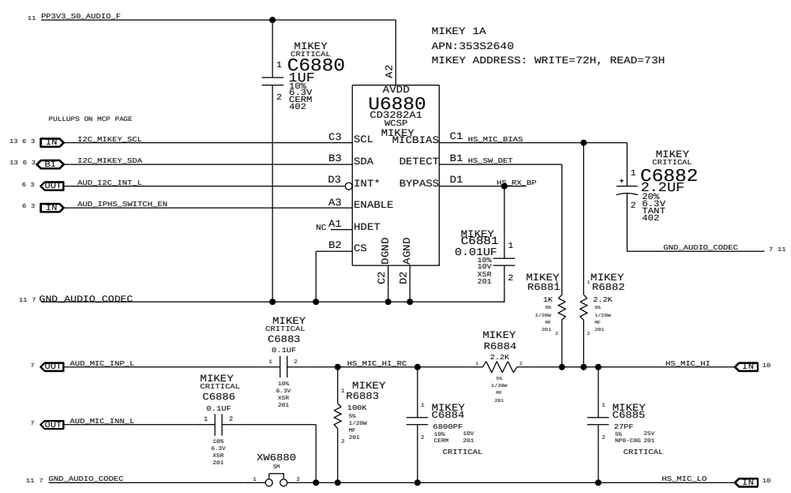
FUNCTION	NET NAME	SB GPIO/INT
PERIPHERAL/EXTRACTION DETECT	AUD_IP_PERIPHERAL_DET	GPIO 38
MIKEY INTERRUPT	AUD_I2C_INT_L	GPIO 55
MIKEY ENABLE	AUD_IPHS_SWITCH_EN	GPIO 2

PORT A DETECT (HEADPHONES)

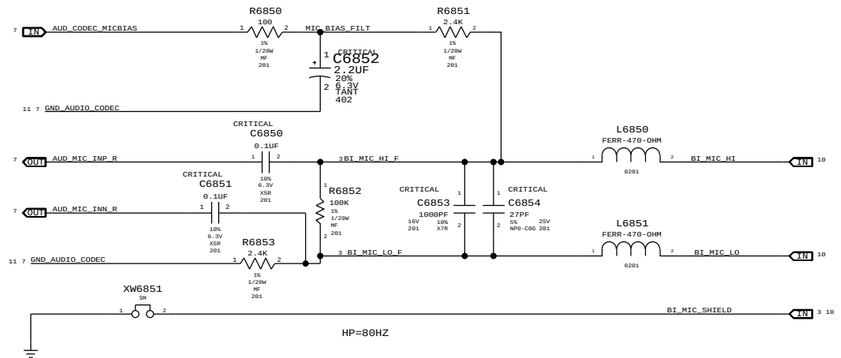
SLOW INSERTION, FAST EXTRACTION



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



PORT B RIGHT(BUILT-IN MIC)



SYNC_MASTER=AUDIO SYNC_DATE=08/05/2010

PAGE TITLE
AUDIO: JACK TRANSLATORS

Apple Inc.

DRAWING NUMBER 051-8540 SIZE D
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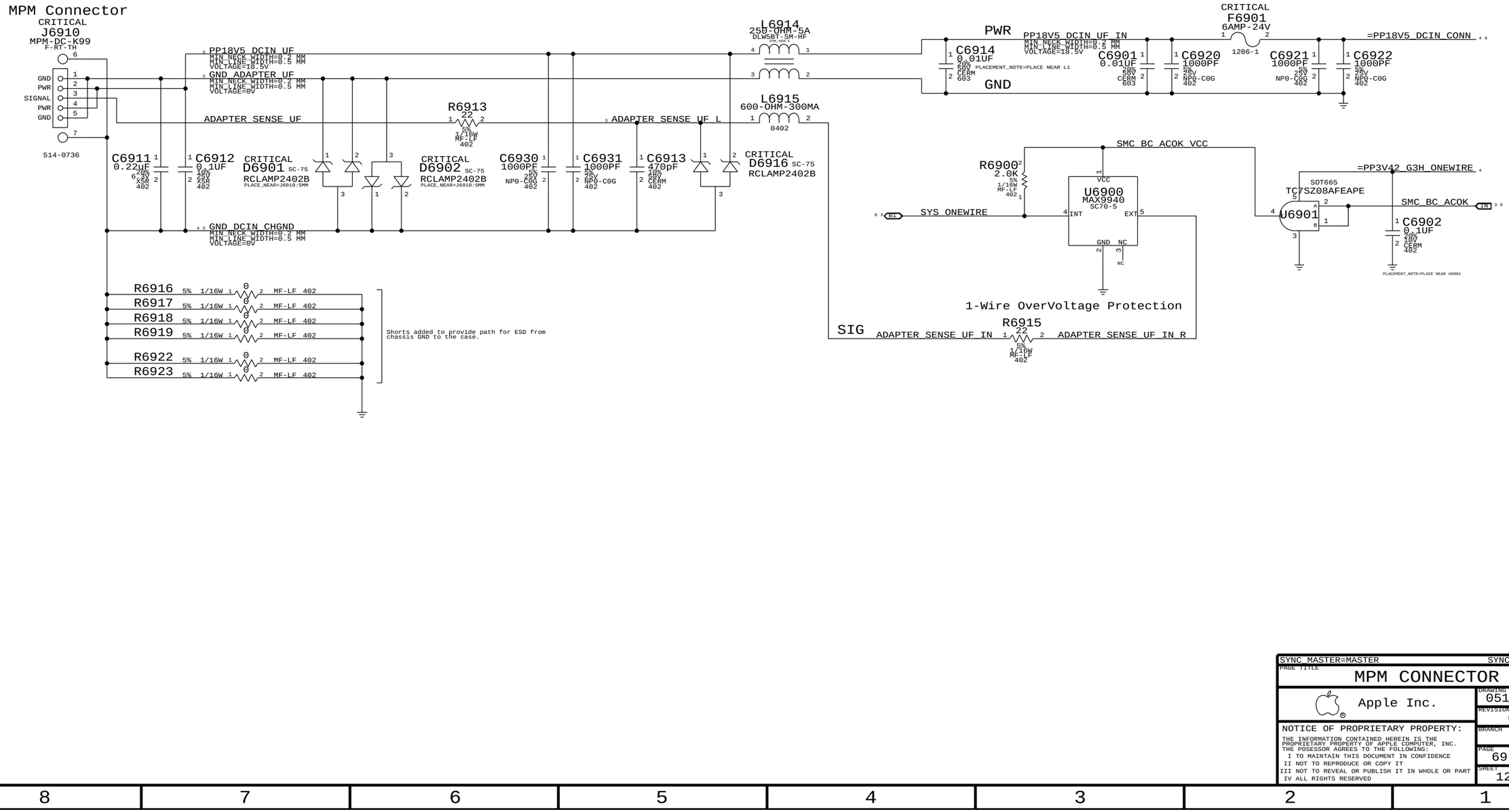

SYNC_MASTER=MASTER SYNC_DATE=MASTER

PAGE TITLE: MPM CONNECTOR

Apple Inc.

DRAWING NUMBER: 051-8540 SIZE: D

REVISION: 6.0.0

BRANCH:

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SHEET: 12 OF 13

K16 LIO BOARD-SPECIFIC SPACING & PHYSICAL CONSTRAINTS

BOARD LAYERS	BOARD AREAS	BOARD UNITS (MIL or MM)	ALLEGRO VERSION
TOP,ISL2,ISL3,ISL4,ISL5,BOTTOM	NO_TYPE,BGA_P1MM	MM	15.5.1

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_OHM_SE	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	0.115 MM	0.115 MM			
55_OHM_SE	*	Y	0.110 MM	0.110 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
90_OHM_DIFF	*	N	=STANDARD	=STANDARD	=STANDARD	=STANDARD	=STANDARD
90_OHM_DIFF	ISL3,ISL4	Y	0.115 MM	0.115 MM		0.130 MM	0.130 MM
90_OHM_DIFF	TOP,BOTTOM	Y	0.110 MM	0.110 MM		0.125 MM	0.125 MM

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

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
2X_DIELECTRIC	TOP,BOTTOM	0.180 MM	?
4X_DIELECTRIC	TOP,BOTTOM	0.360 MM	?
2X_DIELECTRIC	-	0.254 MM	?
4X_DIELECTRIC	-	0.508 MM	?

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
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
USB	*	=2x_DIELECTRIC	?

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

SOURCE: MCP79 Interface DG (DG-03328-001_v0D), Section 2.10.1.

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: MCP79 Interface DG (DG-03328-001_v0D), Section 2.11.1.

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	?

SOURCE: MCP79 Interface DG (DG-03328-001_v0D), Section 2.12.1.

ELECTRICAL_CONSTRAINT_SET	NET_TYPE PHYSICAL	NET_TYPE SPACING		
USB_EXTA	USB_90D	USB	CONN_USB_EXTB_N	5
USB_EXTA	USB_90D	USB	CONN_USB_EXTB_P	5
USB_EXTA	USB_90D	USB	USB_EXTB_N	3 5 6
USB_EXTA	USB_90D	USB	USB_EXTB_P	3 5 6
USB_CAMERA	USB_90D	USB	USB_CAMERA_P	3 6
USB_CAMERA	USB_90D	USB	USB_CAMERA_N	3 6
USB_CAMERA	USB_90D	USB	USB_CAMERA_CONN_P	3 6
USB_CAMERA	USB_90D	USB	USB_CAMERA_CONN_N	3 6
	SMB_55S	SMB	I2C_LIO_SDA	3 6
	SMB_55S	SMB	I2C_LIO_SCL	3 6
	SMB_55S	SMB	I2C_MIKEY_SCL	3 6 11
	SMB_55S	SMB	I2C_MIKEY_SDA	3 6 11
HDA_BIT_CLK	HDA_55S	HDA	HDA_BIT_CLK	3 6 7
HDA_SYNC	HDA_55S	HDA	HDA_SYNC	3 6 7
	HDA_55S	HDA	HDA_RST_L	3 6 7
HDA_SDIN0	HDA_55S	HDA	HDA_SDIN0	3 6 7
	HDA_55S	HDA	AUD_SDI_R	7
HDA_SDOUT	HDA_55S	HDA	HDA_SDOUT	3 6 7

SYNC_MASTER=(K24 MLB) SYNC_DATE=(04/06/2009)

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DRAWING NUMBER: 051-8540 SIZE: D

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