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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
2	0001340220	ENGINEERING RELEASED		2012-01-13

# SCHEM, PCB, LIO, J11

Proto 1B, 2012-01-13

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#### Schematic / PCB #'s

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
051-9282	1	SCHEM, PCB, LIO, J11	SCH	CRITICAL	
820-3213	1	PCBF, LIO, J11	PCB	CRITICAL	

MCO: 056-4710 MCO, LIO, J11

PRODUCT SAFETY REQUIREMENTS:  
 PCB, UL RECOGNIZED, MIN. 130-C TEMP. RATING AND V-0 FLAME RATING PER UL 796 & UL 94.  
 PCB TO BE SILKSCREENED WITH UL/CUL RECOGNITION MARK, MANUFACTURER'S UL FILE  
 NUMBER, UL PCB MATERIAL DESIGNATION, 130-C TEMP. RATING AND V-0 FLAME RATING

DRAWING TITLE		DRAWING NUMBER	SIZE
SCHEM, PCB, LIO, J11		051-9282	D
Apple Inc.		REVISION	2.0.0
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### BOM Variants

BOM NUMBER	BOM NAME	BOM OPTIONS
639-3071	PCBA, LIO, J11	COMMON, ALTERNATE, MIKEY, GLUE, CONN:MG, SOPHIA, CMC:SOLID_STATE

EEEE: DTLR

### Connector variants

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
514-0741	1	CONN, RCPT, AUDIO, K99	J6700	CRITICAL	CONN:MG
514-0807	1	CONN, RCPT, AUDIO, K21_K78	J6700	CRITICAL	CONN:SE

### USB Shield Can

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
806-3084	1	SHLD, USB, LIO, J11/J13	USB_CAN	CRITICAL	

### UV Glue

PART NUMBER	QTY	DESCRIPTION	REFERENCE DES	CRITICAL	BOM OPTION
946-3092	1	LIO LOCTITE UV EB 0.08, K78	UV_GLUE	CRITICAL	GLUE

### Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
155S0694	155S0387		ALL	Murata alt to TDK
155S0661	155S0511		ALL	Murata alt to TDK
155S0660	155S0513		ALL	Murata alt to TDK

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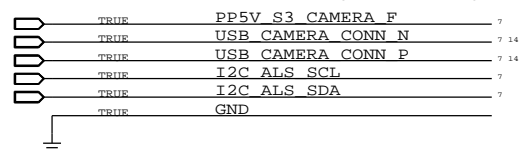
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SYNC MASTER=K78_MLB		SYNC DATE=04/05/2011	
System Block Diagram			
Apple Inc.		DRAWING NUMBER	051-9282
		REVISION	2.0.0
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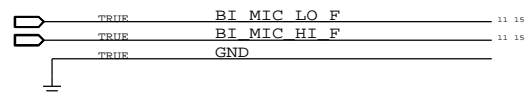
# Functional Test Points

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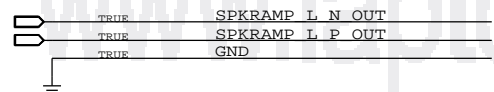
## J4720 (Camera)



## J6701 (Microphone)



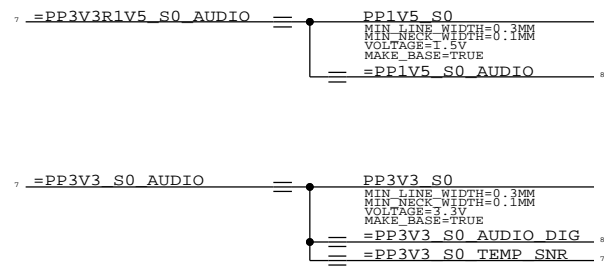
## J6702 (Left speaker)



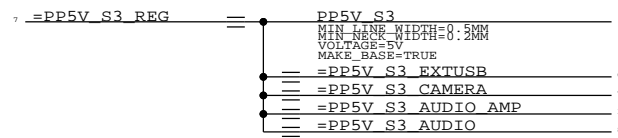
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SYNC_MASTER=(K6_MLB)		SYNC_DATE=(12/11/2009)	
<b>FUNC TEST</b>			
Apple Inc.		DRAWING NUMBER	SIZE
		051-9282	D
		REVISION	
		2.0.0	
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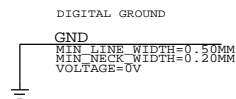
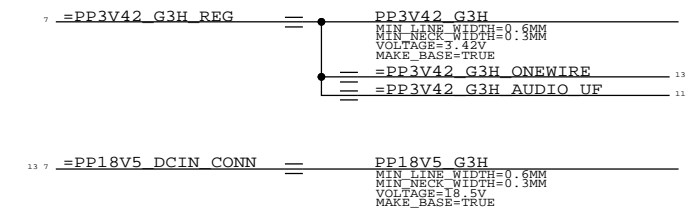
"S0,S0M" RAILS



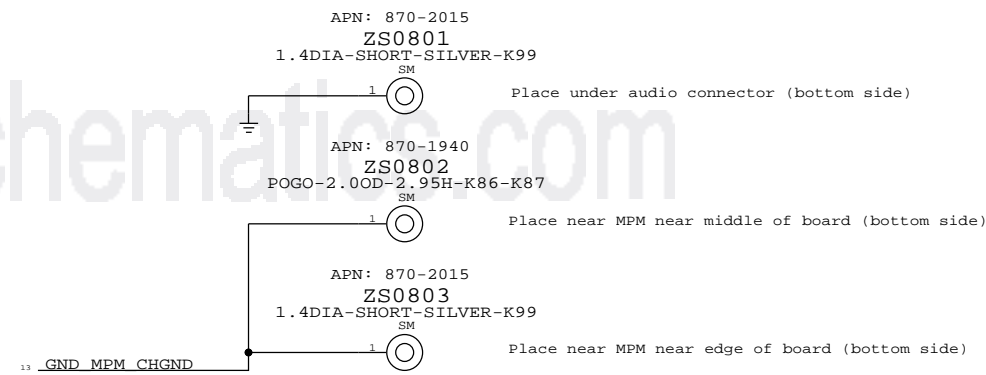
"S3" RAILS



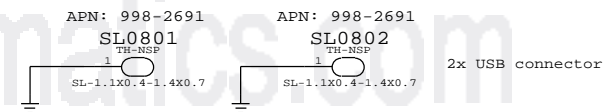
"G3H" RAILS



Pogo Pins

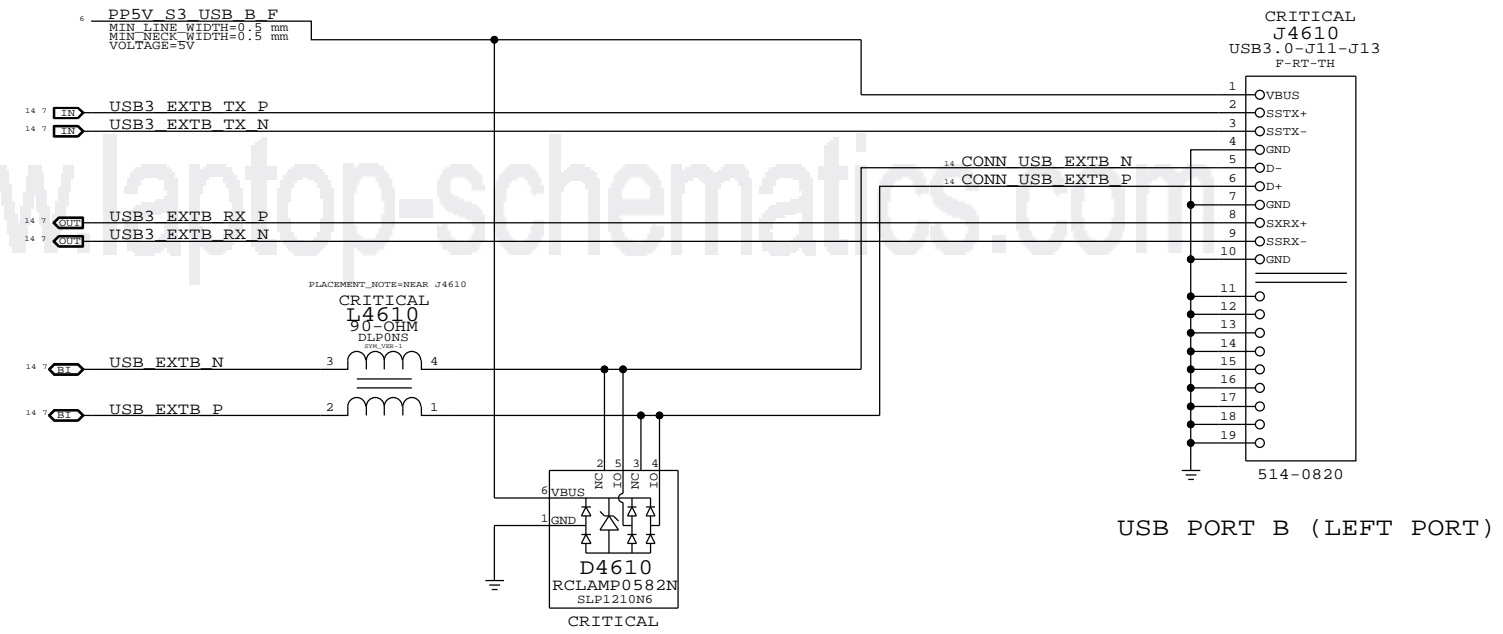
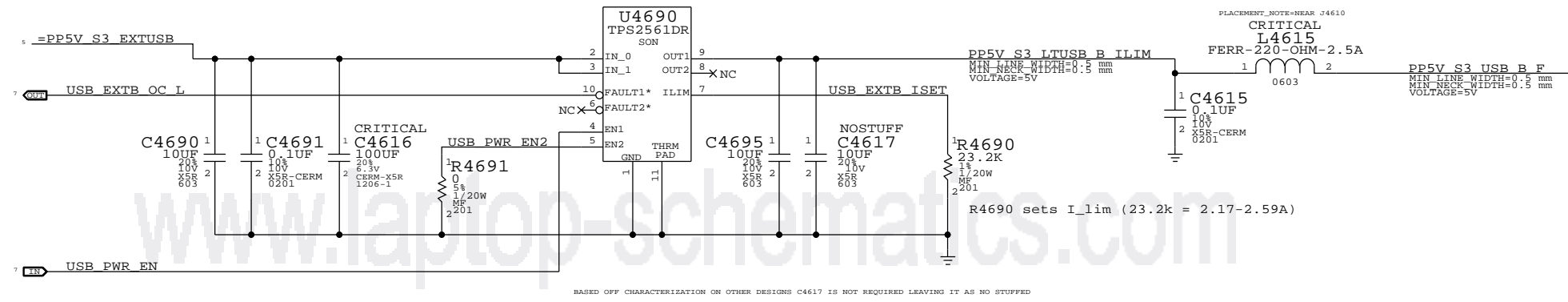


Can Slots



SYNC MASTER=(K24_MLB)		SYNC DATE=(02/04/2009)	
Power Aliases			
Apple Inc.		DRAWING NUMBER	SIZE
		051-9282	D
		REVISION	
		2.0.0	
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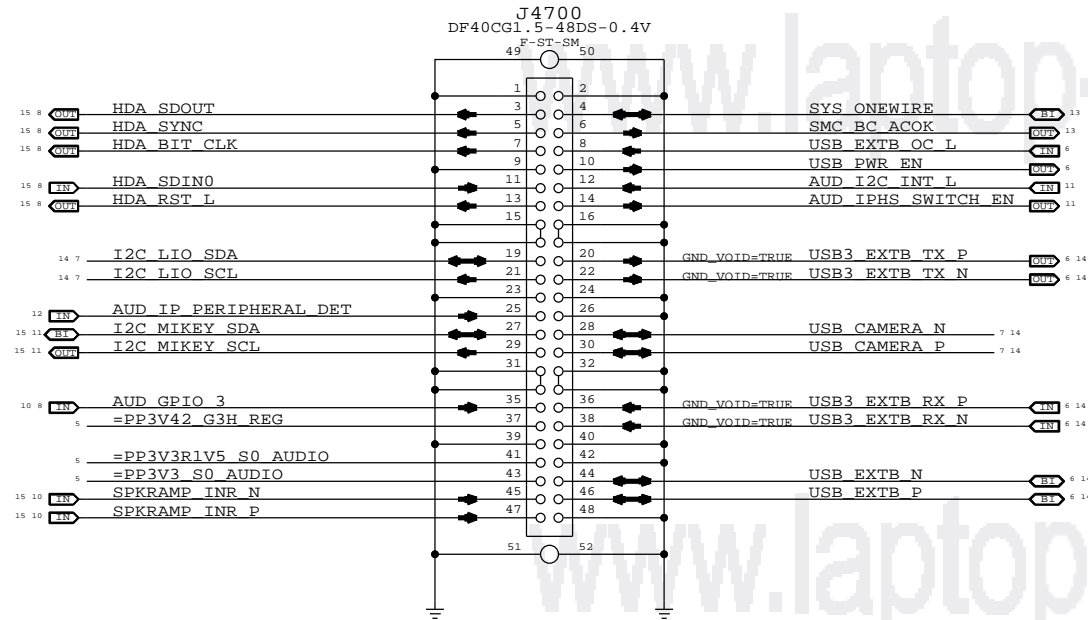
Port Power Switch



USB PORT B (LEFT PORT)

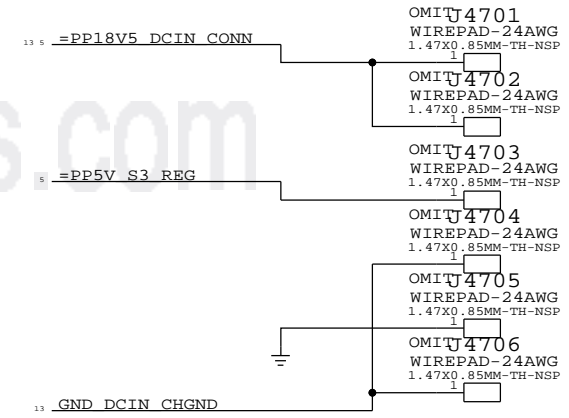
SYNC MASTER=J13 L10		SYNC DATE=09/22/2011	
External USB Connectors			
Apple Inc.		DRAWING NUMBER	051-9282
		REVISION	2.0.0
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40 (48) Pin LIO Flex Connector  
 APN: 998-4616 (1.5mm Hirose Receptacle)



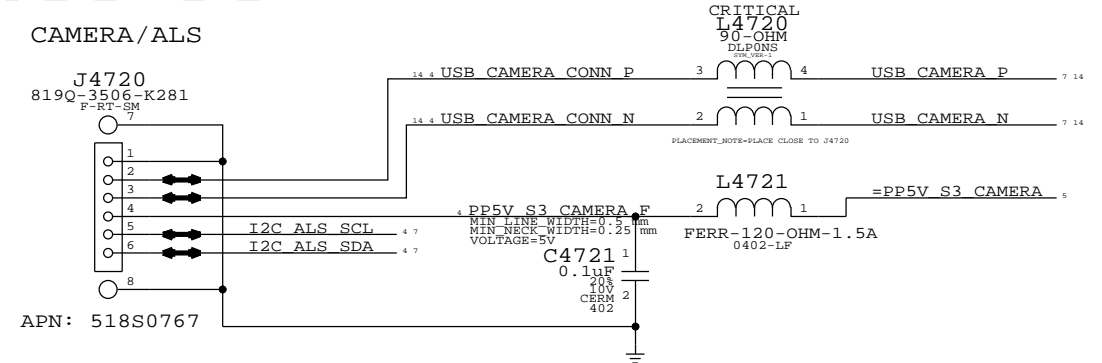
Note: The following pins MUST be GND on J4700 because they connect to the shield:  
 Pins 15-18, 31-34

LIO POWER

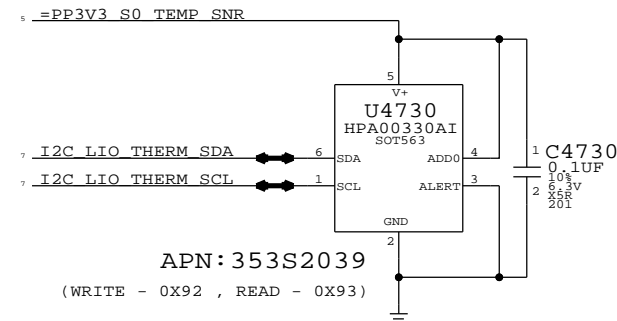


SPACE THE HOLES 2MM APART CENTER TO CENTER

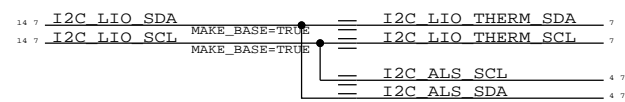
CAMERA/ALS



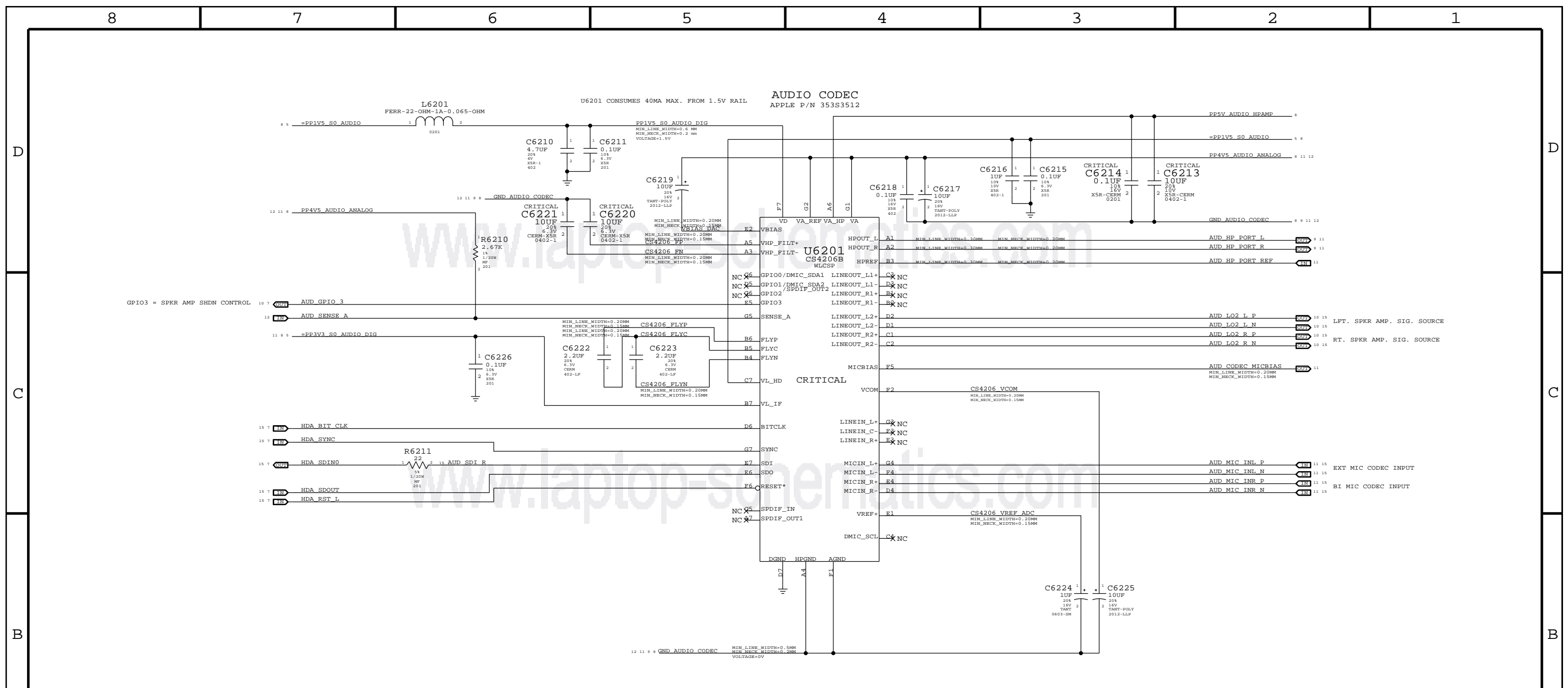
Temp Sensor



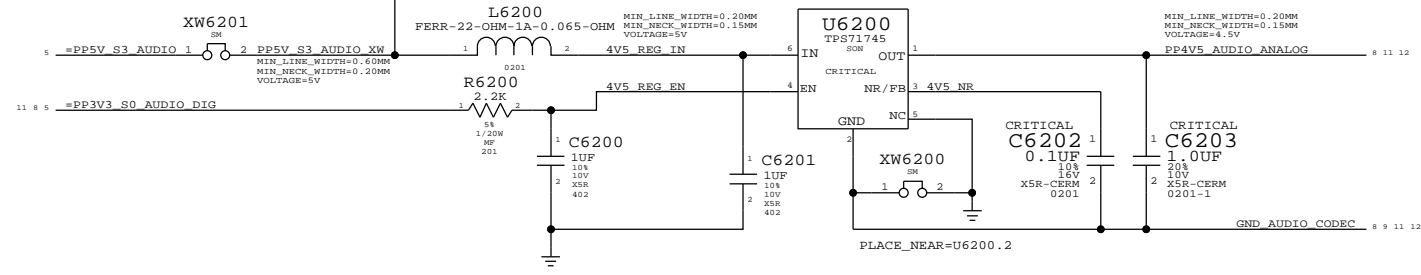
I2C aliases



PAGE TITLE		SYNC DATE=MASTER	
<b>LIO CONNECTORS</b>			
Apple Inc.	DRAWING NUMBER	051-9282	SIZE
	REVISION	2.0.0	D
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J13: PLACE XW6201 NEAR J4702  
J11: PLACE XW6201 NEAR C4616

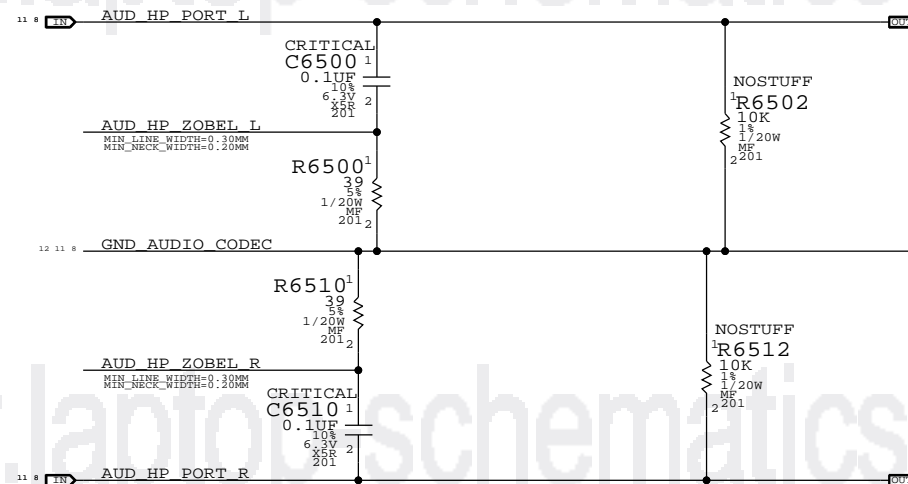


SYNC MASTER=AUDIO		SYNC DATE=01/05/2012	
<b>AUDIO: CODEC/REGULATOR</b>			
Apple Inc.		DRAWING NUMBER	051-9282
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ZOBEL NETWORK & 1ST ORDER DAC FILTER PLACEHOLDER



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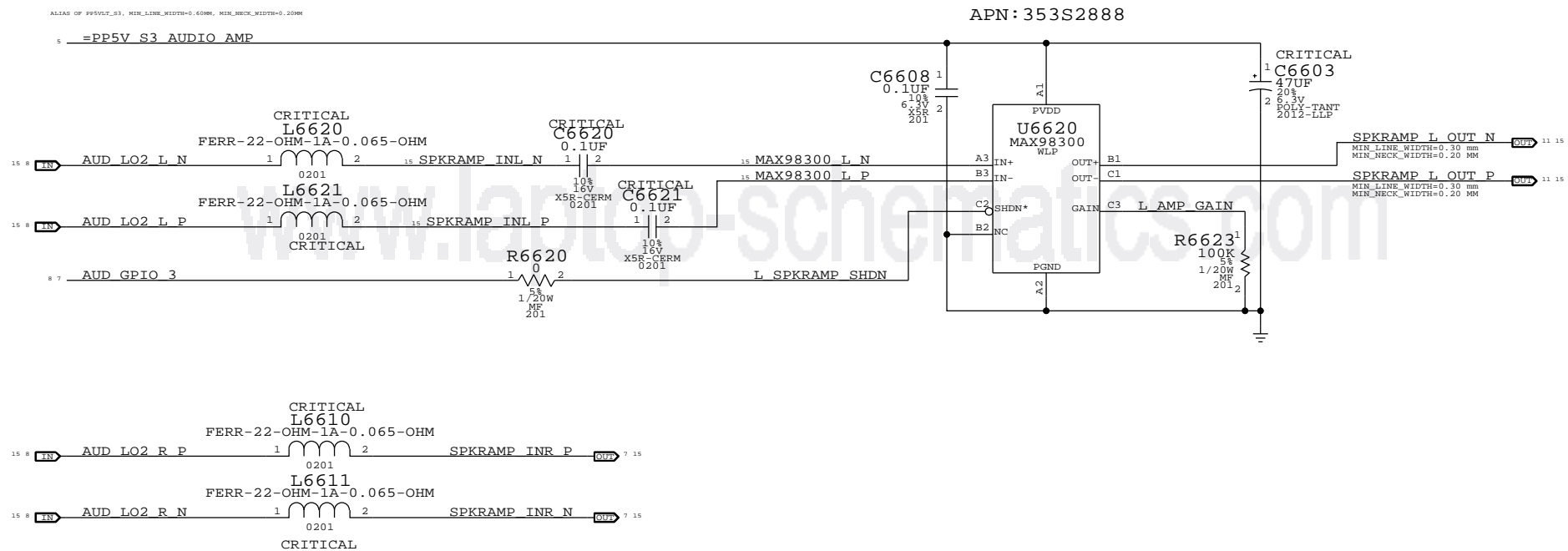
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SYNC MASTER=AUDIO		SYNC DATE=01/05/2012	
PAGE TITLE			
AUDIO: HEADPHONE FILTER			
DRAWING NUMBER		SIZE	
051-9282		D	
REVISION		BRANCH	
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# SPEAKER AMPLIFIERS

SPEAKER HIGHPASS FC NOM = 57 HZ  
 GAIN 3DB

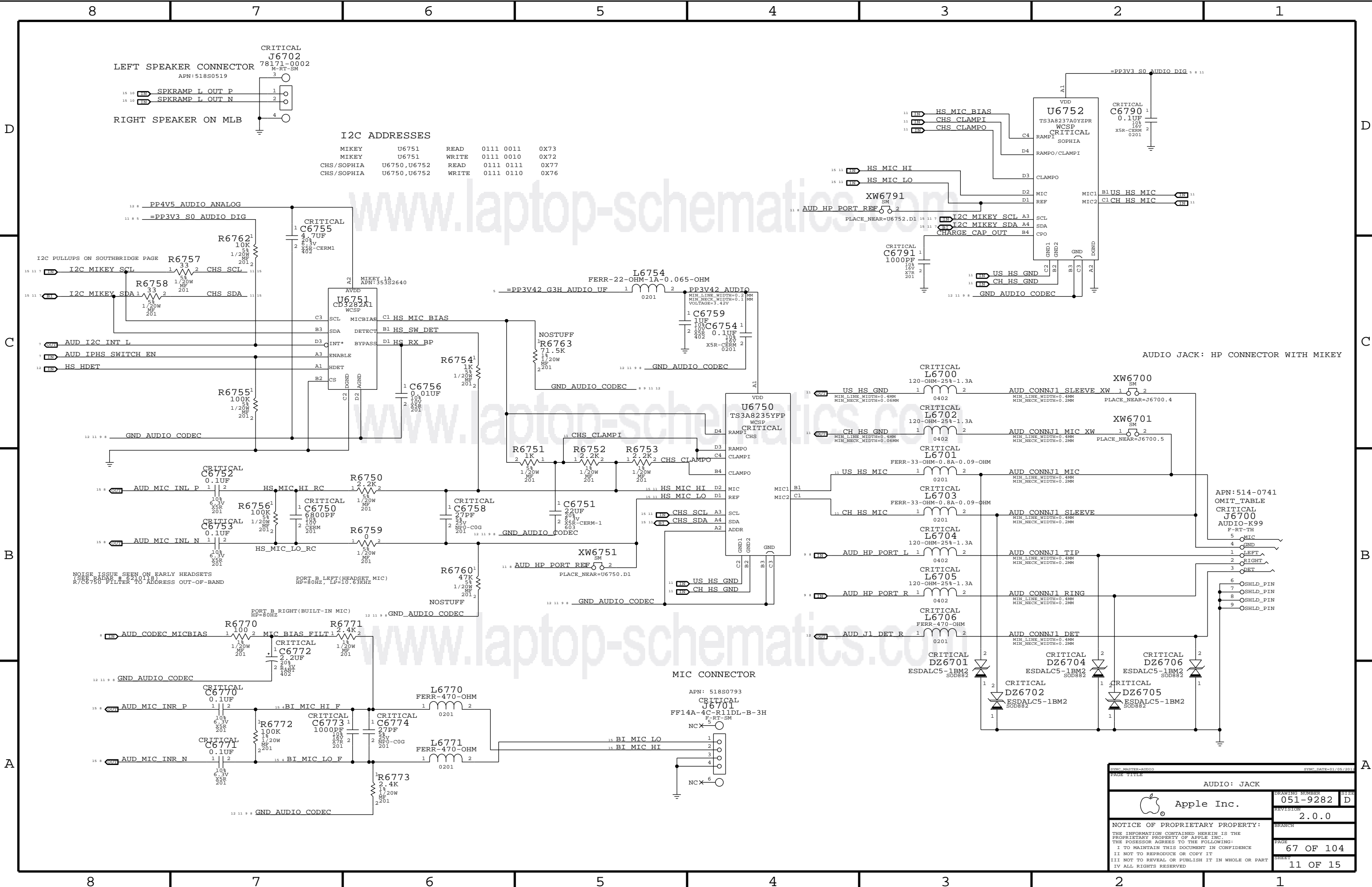
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SPEAKER OUT P/N LINES SWAPPED FOR ROUTING EASE ON LIO-SIDE

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SYMC MASTER-AUDIO		SYMC_DATE=01/05/2015	
PAGE TITLE			
AUDIO: SPEAKER AMP			
	DRAWING NUMBER	051-9282	SIZE
	REVISION	2.0.0	D
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I2C ADDRESSES

MIKEY	U6751	READ	0111 0011	0X73
MIKEY	U6751	WRITE	0111 0010	0X72
CHS/SOPHIA	U6750,U6752	READ	0111 0111	0X77
CHS/SOPHIA	U6750,U6752	WRITE	0111 0110	0X76

AUDIO: JACK		
Apple Inc.	DRAWING NUMBER	051-9282
	REVISION	2.0.0
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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)		0X09 (A)
SPEAKERS	0X04 (4)	0X04 (4)	0X0B (11)	GPIO_3	N/A

CODEC INPUT SIGNAL PATHS

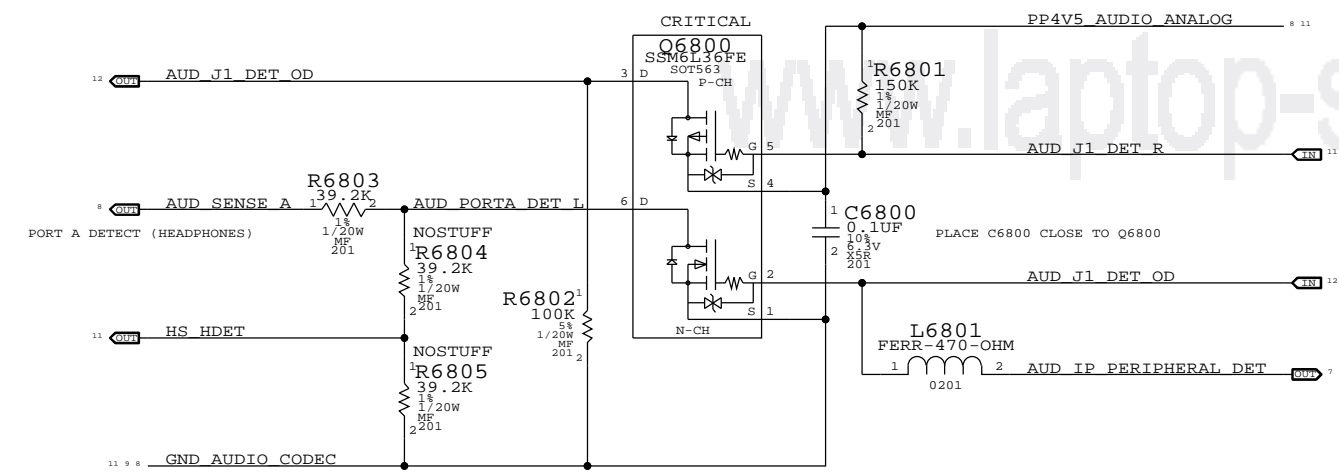
FUNCTION	CONVERTER	PIN COMPLEX	VREF	DET ASSIGNMENT
BUILT-IN MIC	0X06 (6)	0X0D (13,B,RIGHT)	MIC_BIAS (80%)	N/A
HEADSET MIC	0X06 (6)	0X0D (13,V22,B,LEFT)	MIKEY	MIKEY

SOUTHBRIDGE RESOURCE/PIN ALLOCATIONS

FUNCTION	NET NAME	SB GPIO/INT
PERIPHERAL/EXTRACTION DETECT	AUD_IP_PERIPHERAL_DET	GPIO 3
MIKEY INTERRUPT	AUD_I2C_INT_L	GPIO 5
MIKEY ENABLE	AUD_IPHS_SWITCH_EN	GPIO 16
MIKEY I2C BUS	I2C_MIKEY_SDA/SCL	PCH SMBUS 0

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Alternate Parts

PART NUMBER	ALTERNATE FOR PART NUMBER	BOM OPTION	REF DES	COMMENTS:
376S1081	376S0975		Q6800	Please build with only 376S1081

SYNC MASTER=AUDIO SYNC DATE=01/05/2012

**AUDIO: JACK TRANSLATORS**

Apple Inc.

DRAWING NUMBER: 051-9282 SIZE: D

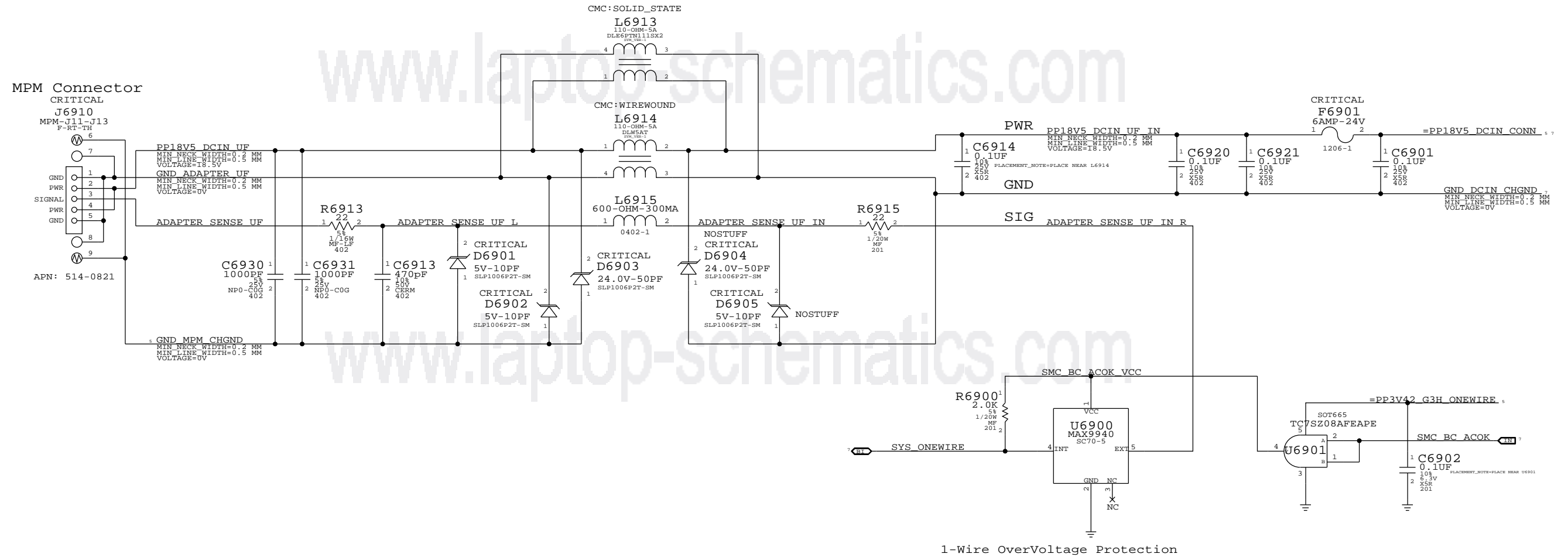
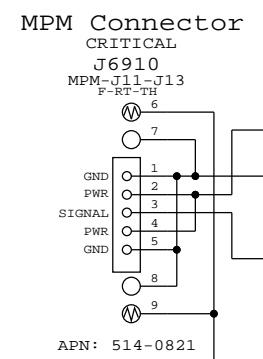
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SYNC MASTER=MASTER		SYNC DATE=MASTER	
<b>MPM CONNECTOR</b>			
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K21 LIO BOARD SPECIFIC SPACING & PHYSICAL CONSTRAINTS

BOARD LAYERS		BOARD AREAS		BOARD UNITS (MIL OR MM)	ALLEGRO VERSION
TOP, ISL2, ISL3, ISL4, ISL5, BOTTOM		NO_TYPE		MM	16.2

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
50_OHM_SE	TOP,BOTTOM	Y	0.110 MM	0.090 MM			
50_OHM_SE	ISL3,ISL4	Y	0.100 MM	0.090 MM			
50_OHM_SE	*	Y	0.100 MM	0.090 MM	=STANDARD	=STANDARD	=STANDARD

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
80_OHM_DIFF	TOP,BOTTOM	Y	0.140 MM	0.125 MM		0.150 MM	0.150 MM
80_OHM_DIFF	ISL3,ISL4	Y	0.135 MM	0.115 MM		0.200 MM	0.200 MM
80_OHM_DIFF	*	Y	0.135 MM	0.115 MM	=STANDARD	=STANDARD	=STANDARD

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1X_DIELECTRIC	TOP,BOTTOM	0.071 MM	?
1X_DIELECTRIC	ISL3,ISL4	0.080 MM	?
1X_DIELECTRIC	*	0.080 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
1:1_SPACING	*	0.100 MM	?

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
DEFAULT	*	0.100 MM	?
STANDARD	*	=DEFAULT	?

ELECTRICAL_CONSTRAINT_SET	NET_TYPE		DIFFERENTIAL_PAIR
	PHYSICAL	SPACING	
USB_EXTR	USB_80D	USB	USB_EXTB_P DP_USB_EXTR 6 7
USB_EXTR	USB_80D	USB	USB_EXTB_N DP_USB_EXTR 6 7
CONN_USB_EXTB_P	USB_80D	USB	CONN_USB_EXTB_P DP_USB_EXTR 6
CONN_USB_EXTB_N	USB_80D	USB	CONN_USB_EXTB_N DP_USB_EXTR 6
USB_CAMERA	USB_80D	USB	USB_CAMERA_P DP_USB_CAMERA 7
USB_CAMERA	USB_80D	USB	USB_CAMERA_N DP_USB_CAMERA 7
USB_CAMERA_CONN_P	USB_80D	USB	USB_CAMERA_CONN_P DP_USB_CAMERA 4 7
USB_CAMERA_CONN_N	USB_80D	USB	USB_CAMERA_CONN_N DP_USB_CAMERA 4 7
USB3_EXTR_RX	USB3_80D	USB3_TX	USB3_EXTB_RX_P DP_USB3_EXTR_RX 6 7
USB3_EXTR_RX	USB3_80D	USB3_TX	USB3_EXTB_RX_N DP_USB3_EXTR_RX 6 7
USB3_EXTR_TX	USB3_80D	USB3_RX	USB3_EXTB_TX_P DP_USB3_EXTR_TX 6 7
USB3_EXTR_TX	USB3_80D	USB3_RX	USB3_EXTB_TX_N DP_USB3_EXTR_TX 6 7
SMB	SMB_50S	SMB	I2C LIO SDA 7
SMB	SMB_50S	SMB	I2C LIO SCL 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
USB_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

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

USB 3.0 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
USB3_80D	*	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF	=80_OHM_DIFF

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
USB3_TX2RX	*	=6X_DIELECTRIC	?
USB3_RX2TX	*	=6X_DIELECTRIC	?
USB3_2OTHER	*	=3X_DIELECTRIC	?

NET_SPACING_TYPE1	NET_SPACING_TYPE2	AREA_TYPE	SPACING_RULE_SET
USB3_TX	*_RX	*	USB3_TX2RX
USB3_RX	*_TX	*	USB3_RX2TX
USB3_TX	*	*	USB3_2OTHER
USB3_RX	*	*	USB3_2OTHER

SMBus Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
SMB_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD

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

Chief River SMB 5mil spacing. 50 ohm trace +/- 10.

SYNC MASTER=CONSTRAINTS		SYNC DATE=01/09/2012	
PAGE TITLE <b>COUGAR POINT CONSTRAINTS 2</b>			
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K21 LIO BOARD AUDIO SPECIFIC SPACING & PHYSICAL CONSTRAINTS

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
DEFAULT	*	Y	=50_OHM_SE	=50_OHM_SE	10 MM	0 MM	0 MM
STANDARD	*	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT	=DEFAULT
1:1_DIFFPAIR	*	=STANDARD	=STANDARD	=STANDARD	=STANDARD	0.100 MM	0.100 MM

HD Audio Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
HDA_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD

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

Other Audio Interface Constraints

PHYSICAL_RULE_SET	LAYER	ALLOW ROUTE ON LAYER?	MINIMUM LINE WIDTH	MINIMUM NECK WIDTH	MAXIMUM NECK LENGTH	DIFFPAIR PRIMARY GAP	DIFFPAIR NECK GAP
HDA_50S	*	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=50_OHM_SE	=STANDARD	=STANDARD
SPK_CONN_DIFF	*	TOP,BOTTOM	0.300 MM	0.200 MM	=1:1_DIFFPAIR	=1:1_DIFFPAIR	=1:1_DIFFPAIR

SPACING_RULE_SET	LAYER	LINE-TO-LINE SPACING	WEIGHT
SPEAKER	*	=2:1_SPACING	?
MIC	*	=2.5:1_SPACING	?


ELECTRICAL_CONSTRAINT_SET	NET_TYPE		DIFFERENTIAL_PAIR
	PHYSICAL	SPACING	
HDA_BIT_CLK	HDA_50S	HDA	HDA BIT CLK 7 8
HDA_SYNC	HDA_50S	HDA	HDA SYNC 7 8
HDA_RST_L	HDA_50S	HDA	HDA RST L 7 8
HDA_SDIN0	HDA_50S	HDA	HDA SDIN0 7 8
HDA_SDI_R	HDA_50S	HDA	AUD SDI R 8
HDA_SDOUT	HDA_50S	HDA	HDA SDOUT 7 8
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	AUD LO2 R P DP_RIGHT_SPEAKER 8 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	AUD LO2 R N DP_RIGHT_SPEAKER 8 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	SPKRAMP INR P DP_RIGHT_SPEAKER 7 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	SPKRAMP INR N DP_RIGHT_SPEAKER 7 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	AUD LO2 L P DP_LEFT_SPEAKER 8 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	AUD LO2 L N DP_LEFT_SPEAKER 8 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	SPKRAMP INL P DP_LEFT_SPEAKER 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	SPKRAMP INL N DP_LEFT_SPEAKER 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	MAX98300 L P DP_LEFT_SPEAKER 10
DIFFPAIR	1:1 DIFFPAIR	SPEAKER	MAX98300 L N DP_LEFT_SPEAKER 10
DIFFPAIR	SPK_CONN_DIFF	SPEAKER	SPKRAMP L OUT P DP_SPK_CONN 10 11
DIFFPAIR	SPK_CONN_DIFF	SPEAKER	SPKRAMP L OUT N DP_SPK_CONN 10 11
DIFFPAIR	1:1 DIFFPAIR	MIC	AUD MIC INR P DP_MIC_INTERNAL 8 11
DIFFPAIR	1:1 DIFFPAIR	MIC	AUD MIC INR N DP_MIC_INTERNAL 8 11
DIFFPAIR	1:1 DIFFPAIR	MIC	BI MIC HI F DP_MIC_INTERNAL 4 11
DIFFPAIR	1:1 DIFFPAIR	MIC	BI MIC LO F DP_MIC_INTERNAL 4 11
DIFFPAIR	1:1 DIFFPAIR	MIC	BI MIC HI DP_MIC_INTERNAL 11
DIFFPAIR	1:1 DIFFPAIR	MIC	BI MIC LO DP_MIC_INTERNAL 11
DIFFPAIR	1:1 DIFFPAIR	MIC	AUD MIC INL P DP_MIC_JACK 8 11
DIFFPAIR	1:1 DIFFPAIR	MIC	AUD MIC INL N DP_MIC_JACK 8 11
DIFFPAIR	1:1 DIFFPAIR	MIC	HS MIC HI DP_MIC_JACK 11
DIFFPAIR	1:1 DIFFPAIR	MIC	HS MIC LO DP_MIC_JACK 11
SMB_AUDIO	SMB_50S	SMB	CHS SDA 11
SMB_AUDIO	SMB_50S	SMB	CHS SCL 11
SMB_AUDIO	SMB_50S	SMB	I2C MIKEY SDA 7 11
SMB_AUDIO	SMB_50S	SMB	I2C MIKEY SCL 7 11

TO LIO CONNECTOR

TO LEFT SPEAKER

TO INTERNAL MIC

TO JACK MIC

SYNC_MASTER=CONSTRAINTS		SYNC_DATE=01/09/2012	
<b>AUDIO CONSTRAINTS</b>			
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