

### Overview

5916PIA-DK is a high quality stand-alone development and reference board based on SAM5916 (AUDIO & MUSIC MULTI-DSP PROCESSOR) dedicated to digital piano and keyboard instruments.

The SAM5916 can be used in 6 different hardware configurations for different applications. On 5916PIA-DK board the SAM5916 is running in the hardware configuration dedicated to Piano applications with firmware and sound bank stored in NAND Flash, sample cache and extended delay lines in SDRAM.

Beside the SAM5916 the 5916PIA-DK hardware includes:

- 2 x Audio DAC: AKM AK4396 (120dB DR, -100dB THD+N)
- 1 Audio ADC AKM AK5386 (24-bit, DR:110dB, S/(N+D):96dB)
- 2 x 8Gbit NAND Flash MICRON MT29F8G16ABACAWP (2Gbyte)
- 64Mbit SDRAM: MICRON MT48LC4M16A2P-7E
- DataFlash® memory AT45DB081E (8Mbit) for firmware, sequencer and data storage.
- USB High Speed Device Port
- USB High Speed Host Port
- Ethernet PHY and connector

### Dream NAND Flash Solution

DREAM NAND Flash solution allows the storage of large sound banks in cost-effective NAND Flash memory devices. Thanks to its sophisticated sample cache system, the SAM5916 offers high performances, security and reliability:

- Support SLC NAND Flash technology (up to 8GByte)
- High polyphony: up to 256 voices + effects
- Transparent pages transfer from NAND to SDRAM buffers
- Automatic error correction (ECC)
- Bad block management and wear leveling ensuring NAND Flash lifetime
- AES-protected sound banks with on-the-fly decryption
- Sound bank compiler for NAND Flash technology

### Hardware Configuration

5916PIA-DK is designed to be connected to an 88-note velocity sensitive piano keyboard with 3 contact per key (e.g., FATAR TP40M, 3 contacts).

The 5916PIA-C-PDK reference design kit includes the 5916PIFP-DK front panel.

## Operating Modes

5916PIA-DK operates on two modes:

- **Debug/Program mode:**  
The board is connected to a PC through the Dream 5000DBG-IF adaptor. Firmware can be downloaded and debugged into internal or external SDRAM with Dream SamVS-C development software.  
With SamVS or ProgSam software tool it is possible to program the firmware into NAND Flash memory or serial DataFlash memory for stand-alone mode.  
The sound bank can loaded into NAND Flash memory from USB stick.  
With ProgSam tool it is also possible to program the eFuses on SAM5916 for encryption / copy protection of firmware code and sound bank content.
- **Stand-alone mode:**  
In this mode the SAM5916 loads the program from the NAND Flash or serial DataFlash into RAM (internal RAM + external SDRAM) at startup, then executes it in RAM and scans the front panel and the piano keyboard.

## Connectors Configuration

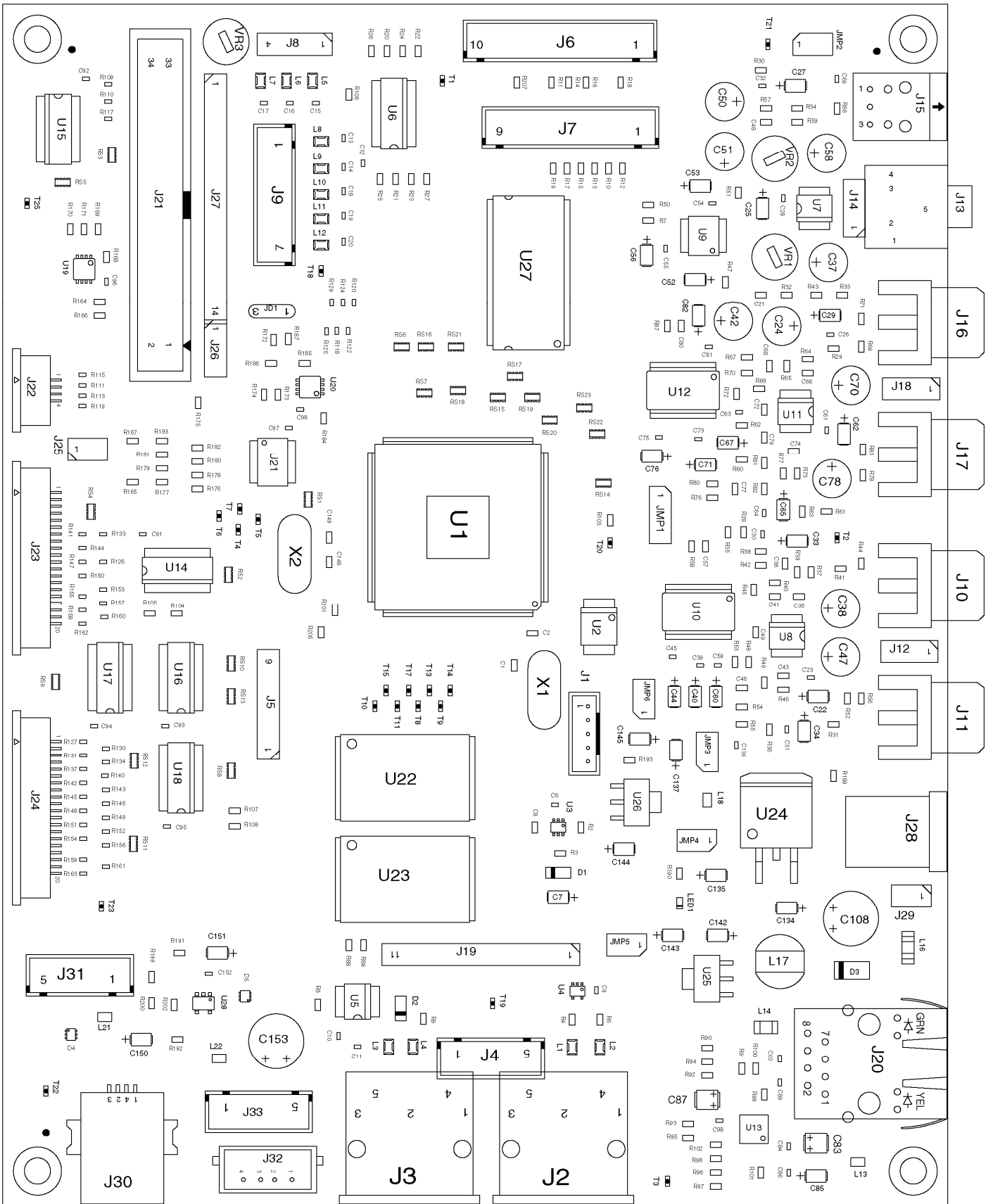
Name	Reference	Type	Description
DEBUG / PROGRAM	J1	JST PH Series, 1*5	Serial connection for debug and program, compatible with Dream 5000DBG-IF
MIDI OUT	J2	5-pin Din	Standard MIDI OUT at 31.25kb/s
MIDI IN	J3	5-pin Din	Standard MIDI IN at 31.25kb/s
	J4 (Optional, n.m.)	1*5	Connection to external MIDI IN an OUT connectors
GPIOs	J5	1*6	General purpose I/Os P5[11:7]
SPI LCD	J6	JST XH Series, 1*10	SPI connection to a Graphic LCD Display
SPI Options	J7	JST XH Series, 1*9	Quad SPI connection to external SPI device
PEDALS INPUT	J8	1*4	Connection of pedals (analog inputs)
SLIDERS INPUT	J9	JST XH Series, 1*7	Connection for analog potentiometers
LINE OUT R	J10	RCA	Right Main audio line output (1.5V RMS)
LINE OUT L	J11	RCA	Left Main audio line output (1.5V RMS)
	J12 (Optional, n.m.)	1*3	Stereo Main audio line output (1.5V RMS)
AUDIO IN STEREO	J13	Mini Jack	Stereo audio input(0.02 to 1V RMS)
	J14 (Optional, n.m.)	1*3	Stereo audio input(0.02 to 1V RMS)
SPDIF OUT	J15	DLT2160A	SPDIF audio optical output
AUX OUT R	J16	RCA	Right Aux audio line output (1.5V RMS)
AUX OUT L	J17	RCA	Left Aux audio line output (1.5V RMS)
	J18 (Optional, n.m.)	1*3	Stereo Aux audio line output (1.5V RMS)
AUDIO Extensions	J19 (Optional)	1*11	Extension for additional digital audio I/Os
ETHERNET	J20	WURTH 7499011121A	ETHERNET 10/100
FRONT PANEL	J21	HE10 - 2*17	Connection of the dedicated front panel
KEYBOARD LOWER PART	J22	FFC, 1mm, 4way	Connection of a Fatar type piano keyboard
KEYBOARD LOWER PART	J23	FFC, 1mm, 20way	Connection of a Fatar type piano keyboard
KEYBOARD HIGHER PART	J24	FFC, 1mm, 20way	Connection of a Fatar type piano keyboard
HEADPHONES DETECT	J25	1*2	Headphones detection
8-BIT //LCD DISPLAY	J26	1*3	Standard 8-bit LCD extension for graphic display
8-BIT //LCD DISPLAY	J27	1*14	Standard 8-bit LCD connection
9 / 12 V DC	J28	DC Plug	Power Supply, +9V...12V/1A, minus on tip
	J29 (Optional, n.m.)	1*2	Power Supply, +9V...12V/1A
USB DEVICE	J30	USB B	USB Device, full or high speed port.
	J31 (Optional, n.m.)	JST XH Series, 1*5	USB Device, full or high speed port.
USB HOST	J32	USB A	USB Host, full or high speed port.
	J33 (Optional, n.m.)	JST XH Series, 1*5	USB Host, full or high speed port.

“n.m.” = not mounted

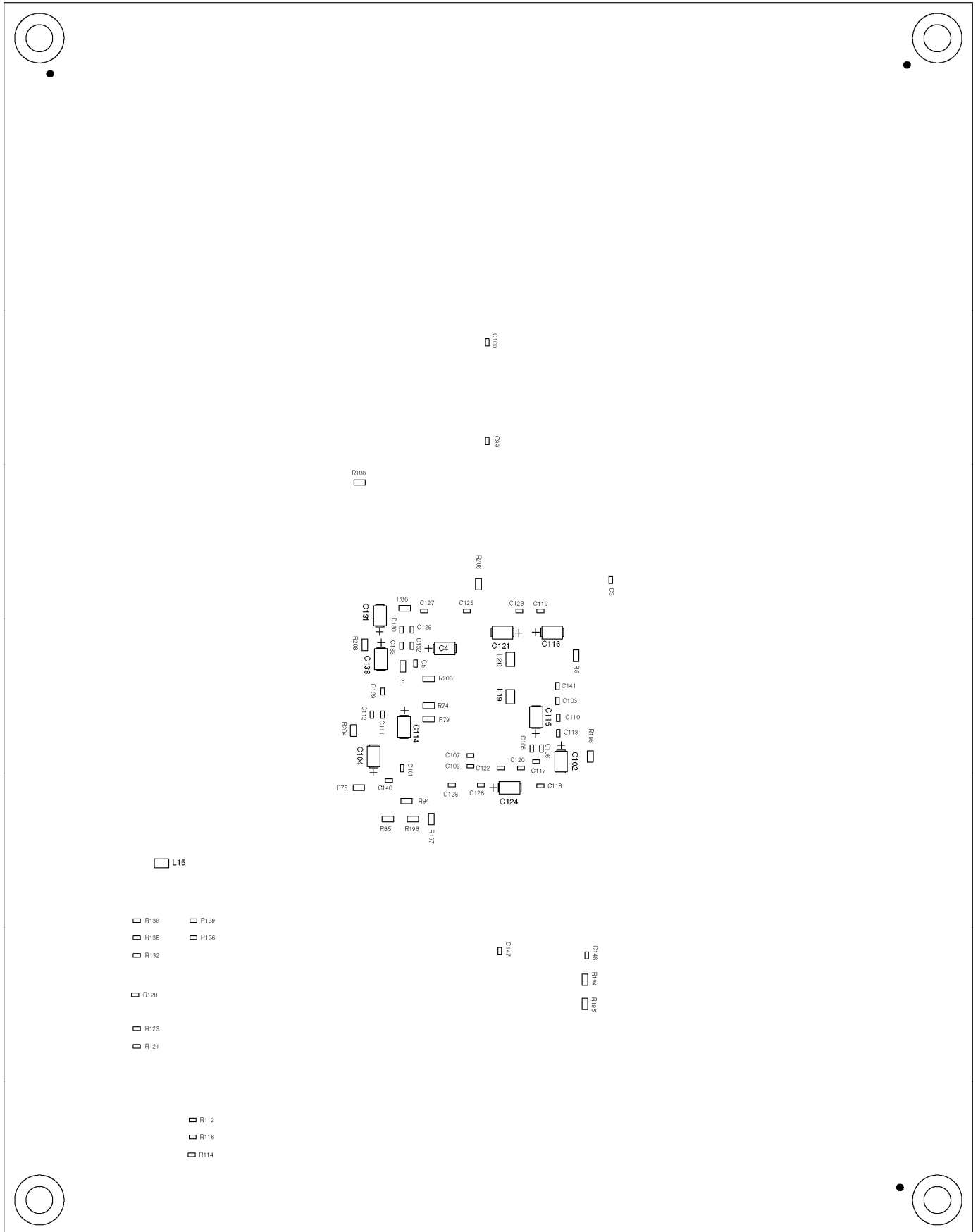
## Jumper Configuration

Reference	Default Setting	Description
JMP1	1-2	Select Digital audio source for Main audio out. <ul style="list-style-type: none"><li>• 1-2: DABD2</li><li>• 2-3: DABD0 (cannot be used while SPDIF OUT is needed)</li></ul>
JMP2	Closed	Should be open if DABD0 is used for Main audio out <ul style="list-style-type: none"><li>• Closed: SPDIF OUT is used. DABD0 cannot be used.</li><li>• Closed: SPDIF OUT is not used. DABD0 can be used.</li></ul>
JMP3	Closed	For test and measurements on VA33
JMP4	Closed	For test and measurements on VD33
JMP5	Closed	For test and measurements on VD50
JMP6	Closed	For test and measurements on VA50
JD1	VD50	Power supply for LCD (VLCD on pin 2 of J27): <ul style="list-style-type: none"><li>• VD50: VLCD =+5V</li><li>• VD33: VLCD =+3.3V</li></ul>

Layout - Top side



Layout – Bottom side



## Bill of Material

SAM5916 - PIANO BOARD - Revised: October 20, 2015

5916PIA-DK.DSN Revision: 2.1

Page 1

Item	Quantity	Reference	Part	Manufacturer	Designation
1	4	C1, C2, C148, C149	22pF		
2	70	C3, C5, C6, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C23, C26, C28, C30, C31, C32, C39, C45, C54, C55, C59, C61, C63, C64, C69, C73, C75, C81, C84, C86, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100, C101, C103, C105, C107, C111, C113, C118, C119, C122, C123, C125, C127, C128, C129, C132, C136, C139, C140, C141, C146, C147, C152	100nF		
3	27	C4, C22, C25, C27, C29, C40, C44, C53, C56, C60, C62, C71, C76, C82, C102, C104, C114, C115, C121, C124, C131, C135, C137, C138, C143, C145, C151	10 $\mu$ F-T-10V		
4	2	C7, C116	4.7 $\mu$ F-T-10V		
5	11	C8, C35, C41, C43, C49, C57, C66, C72, C74, C79, C80	470pF		
6	2	C21, C48	100pF		
7	6	C24, C38, C47, C50, C70, C78	10 $\mu$ F-Low Dist	PANASONIC	ECA1HAM100X
8	4	C33, C34, C65, C67	47 $\mu$ F-T-6V		
9	4	C36, C46, C68, C77	1nF		
10	2	C37, C58	2.2 $\mu$ F-Low dist	PANASONIC	ECA1HAK2R2X
11	2	C42, C51	4.7 $\mu$ F-Low dist	PANASONIC	ECA1HAM4R7X
12	1	C52	2.2 $\mu$ F-T-10V		
13	2	C83, C87	22 $\mu$ F-T-6V		
14	1	C85	2.2 $\mu$ F-T-6V		
15	9	C106, C109, C110, C112, C117, C120, C126, C130, C133	10nF		
16	1	C108	470 $\mu$ F-25V		
17	3	C134, C142, C144	10 $\mu$ F-T-16V		
18	1	C150	1 $\mu$ F-T		
19	1	C153	150 $\mu$ F		
20	2	D1, D2	LL4148	VISHAY	LL4148
21	1	D3	1N4002		

Item	Quantity	Reference	Part	Manufacturer	Designation
22	2	D4, D5	TPD2E1B06	TI	TPD2E1B06
23	1	JD1	Jumper Disk2P		
24	1	JMP1	Jumper2P	Generic	BA25-Male-7mm-Gold
25	5	JMP2, JMP3, JMP4, JMP5, JMP6	Jumper1P	Generic	BA25-Male-7mm-Gold
26	1	J1	B5B-PH-K-S	JST	B5B-PH-K-S
27	2	J2, J3	MIDI_DIN		
28	3	J4, J31, J33	N.M.	JST	B5B-XH-A
29	1	J5	HEAD_6	Generic	BA25-Male-7mm-Gold
30	1	J6	B10B-XH-A	JST	B10B-XH-A
31	1	J7	B9B-XH-A	JST	B9B-XH-A
32	1	J8	HEAD_4	Generic	BA25-Male-7mm-Gold
33	1	J9	B7B-XH-A	JST	B7B-XH-A
34	4	J10, J11, J16, J17	RCA_JACK	3E	10.575N
35	3	J12, J14, J18	N.M.		
36	1	J13	JACK 3.5 STEREO	3E	15.427
37	1	J15	DLT2160A	AIXIN OPTO-ELECTRICAL	DLT2160A
38	1	J19	HEAD_11	Generic	BA25-Male-7mm-Gold
39	1	J20	7499011121A	WURTH	7499011121A
40	1	J21	HEAD_17X2_Splitte d		
41	1	J22	AMP-84952-4	TYCO ELECTRONICS	AMP-84952-4
42	2	J23, J24	AMP- 2-84952-0	TYCO ELECTRONICS	AMP- 2-84952-0
43	1	J25	HEAD_2	Generic	BA25-Male-7mm-Gold
44	1	J26	HEAD_3	Generic	BA25-Male-7mm-Gold
45	1	J27	HEAD_14	Generic	BA25-Male-7mm-Gold
46	1	J28	DC PLUG	3E	LD02.02
47	1	J29	N.M.		



Item	Quantity	Reference	Part	Manufacturer	Designation
48	1	J30	WERI 62910416121	WERI	WERI 62910416121
49	1	J32	WERI 614004135023	WERI	WERI 614004135023
50	1	LED1	TLMS1000-Vishay	VISHAY	TLMS1000-GS08
51	12	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	NFM21CC102R1H3	MURATA	NFM21CC102R1H
52	5	L13, L18, L19, L21, L22	742792093	WURTH	742792093
53	1	L20	7427920415	WURTH	7427920415
54	1	L14	742792113	WURTH	742792113
55	1	L15	742792093	WURTH	742792093
56	1	L16	NFM41PC204F1H3	MURATA	NFM41PC204F1H3
57	1	L17	74477510	WURTH	74477510
58	9	RS1, RS6, RS7, RS8, RS9, RS10, RS11, RS12, RS13	4x2.2k		
59	2	RS3, RS5	4x100		
60	12	RS2, RS4, RS14, RS15, RS16, RS17, RS18, RS19, RS20, RS21, RS22, RS23	4x10		
61	20	R1, R2, R3, R5, R7, R29, R30, R33, R34, R43, R44, R56, R59, R71, R83, R165, R194, R197, R198, R202	10k		
62	7	R4, R6, R9, R41, R52, R69, R78	220		
63	13	R8, R25, R26, R27, R28, R31, R35, R36, R60, R61, R62, R63, R188	4.7k		
64	12	R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R206, R207	100		
65	5	R20, R21, R22, R23, R24	1M		
66	16	R32, R57, R91, R102, R103, R104, R105, R106, R107, R108, R164, R166, R168, R173, R174, R175	1k		
67	8	R37, R45, R46, R55, R64, R72, R73, R82	3k		
68	8	R38, R42, R48, R53, R67, R70, R76, R80	3.9k		
69	8	R39, R40, R49, R54, R65, R68, R77, R81	3.6k		
70	6	R47, R51, R189, R191, R192, R193	0		

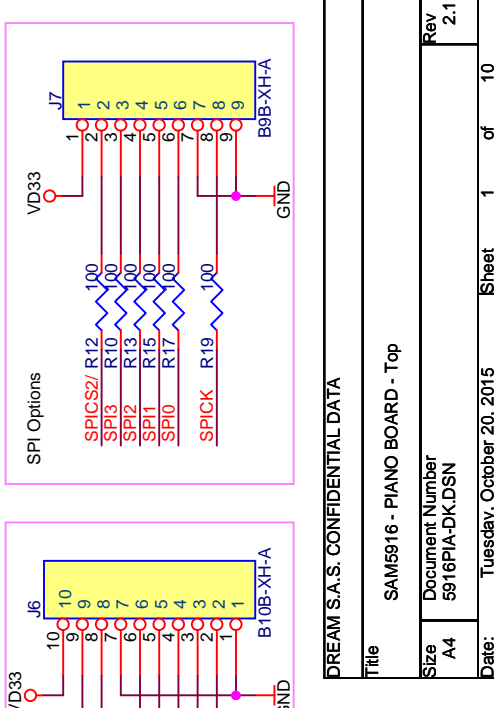
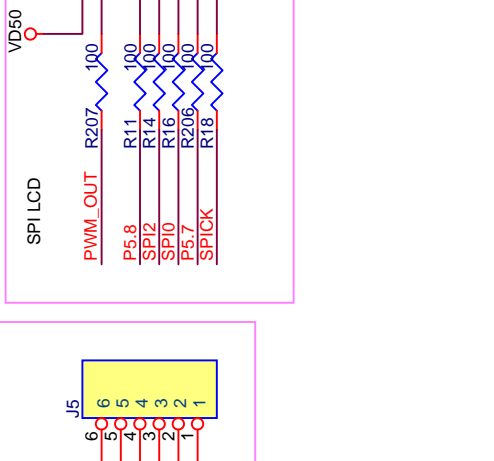
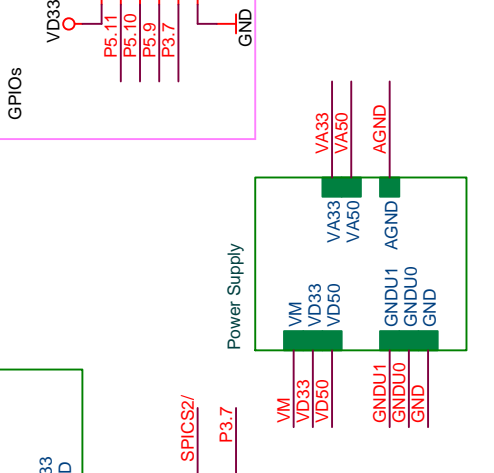
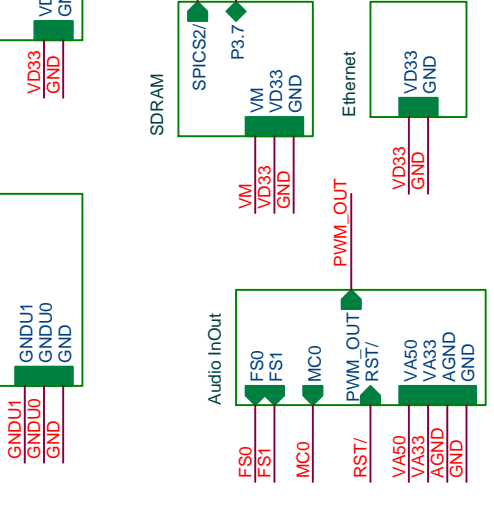
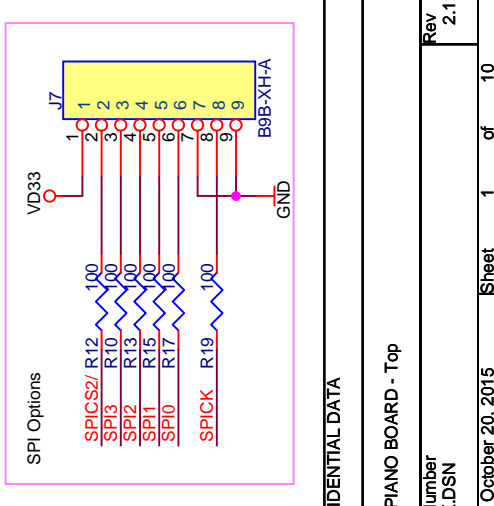
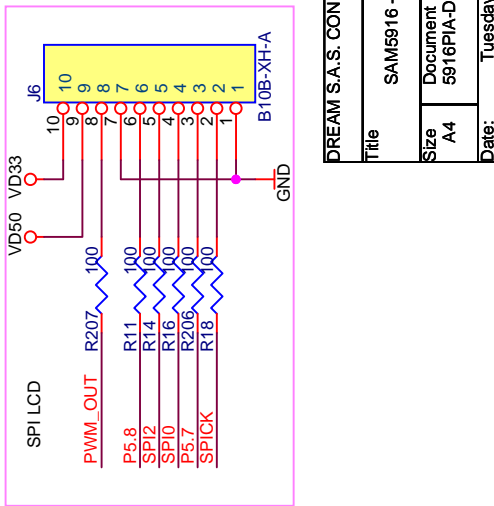
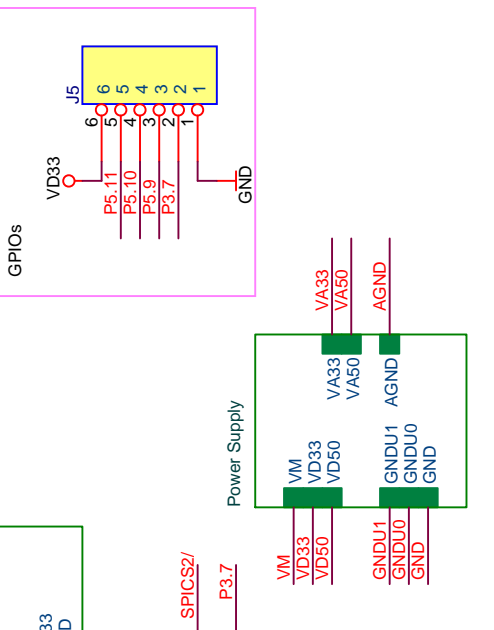
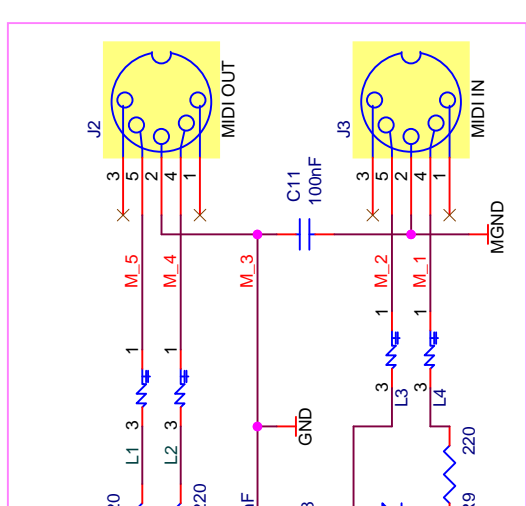
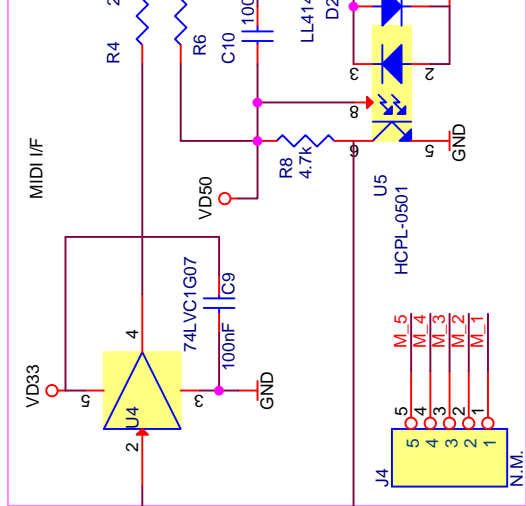
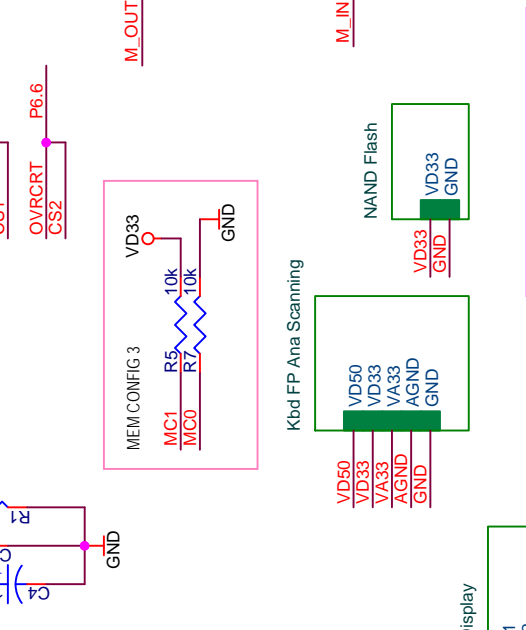
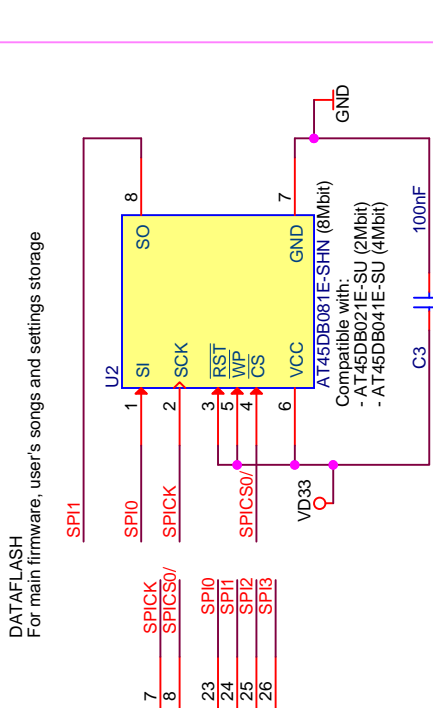
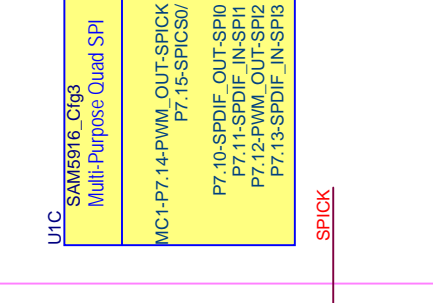
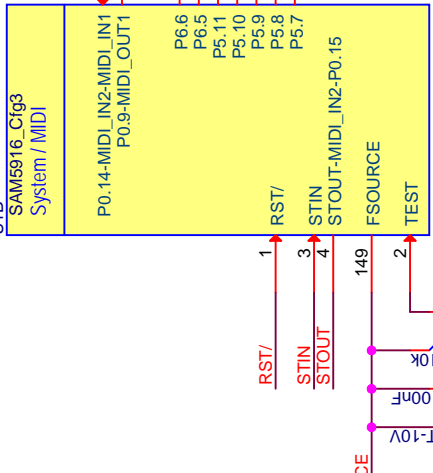
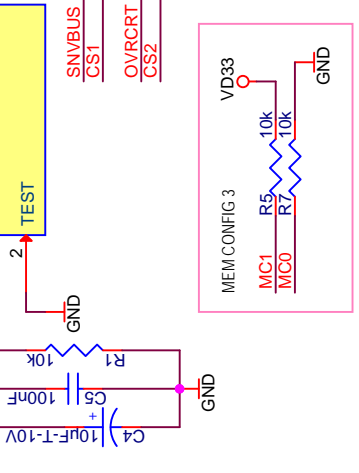
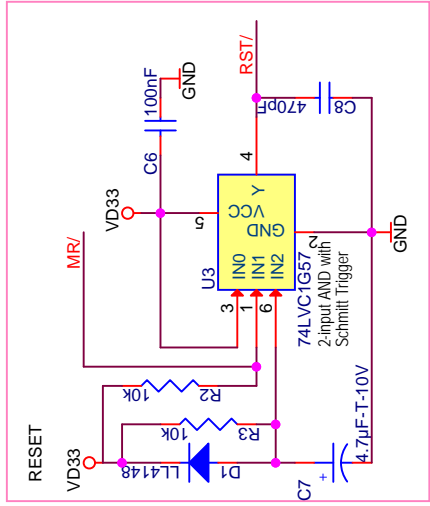
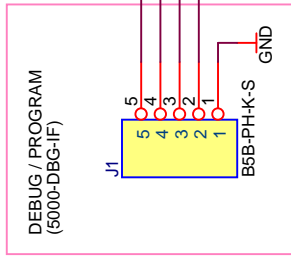
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72	2	R58, R87	22		
73	2	R66, R90	100k		
74	5	R92, R93, R94, R95, R99	47		
75	1	R100	6.49k, 1%		
76	2	R101, R190	750		
77	11	R109, R110, R117, R121, R123, R125, R128, R129, R132, R135, R138	33		
78	44	R111, R112, R113, R114, R115, R116, R118, R119, R120, R122, R124, R126, R127, R130, R131, R133, R134, R136, R137, R139, R140, R141, R142, R143, R144, R145, R146, R147, R148, R149, R150, R151, R152, R153, R154, R155, R156, R157, R158, R159, R160, R161, R162, R163	100		
79	3	R167, R199, R204	22k		
80	14	R169, R170, R171, R176, R177, R178, R179, R180, R181, R182, R183, R184, R185, R186	N.M.		
81	4	R172, R187, R200, R203	47k		
82	2	R195, R196	10		
83	2	R201, R205	12k, 1%		
84	23	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T13, T14, T15, T17, T18, T19, T20, T21, T22, T23, T25	TestPoint	Vogt	N.M. (985.62 or 1000C.22)
85	1	U1	SAM5916_Cfg3		
86	1	U2	AT45DB081E-SHN	ATMEL	AT45DB081E-SHN
87	1	U3	74LVC1G57	TI	74LVC1G57DCK
88	1	U4	74LVC1G07	TI	74LVC1G07DCK
89	1	U5	HCPL-0501		
90	1	U6	74HC4051	TI	CD74HC4051
91	1	U7	OPA2353	BURR-BROWN	OPA2353
92	2	U8, U11	OPA2353	TI	OPA2353
93	1	U9	AK5386	AKM	AK5386VT
94	2	U10, U12	AK4396	AKM	AK4396VF
95	1	U13	KSZ8081RNDCA	MICREL	KSZ8081RNDCA

SAM5916 - PIANO BOARD - Revised: October 20, 2015

5916PIA-DK.DSN Revision: 2.1

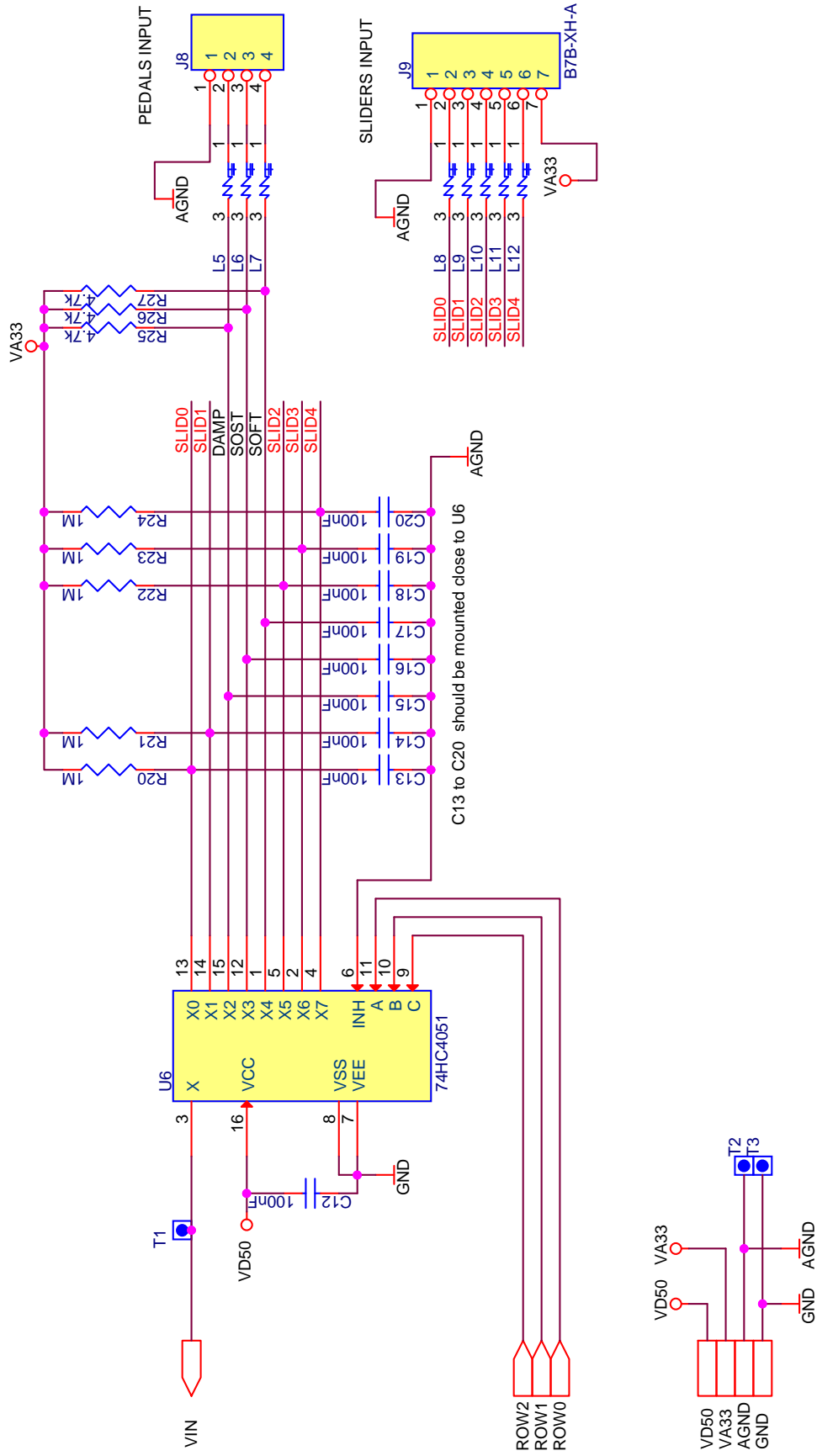
Page 5

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99	1	U21	74AHCT245	TI	74AHCT245PW
100	2	U22, U23	MT29F8G16ABACA WP	MICRON	MT29F8G16ABACA WP
101	1	U24	LD1086D2T33	ST	LD1086D2T33
102	2	U25, U26	LM1117MPX-5.0	NS	LM1117MPX-5.0
103	1	U27	MT48LC4M16A2P- 7E	MICRON	MT48LC4M16A2P- 7E
104	1	U28	MIC2005A-1YM5	MICREL	MIC2005A-1YM5
105	2	VR1, VR2	50k	BOURNS	POT-3329H
106	1	VR3	20k	BOURNS	POT-3329H-203
107	1	X1	12.288 MHz + socket	FISCHER	PQ18
108	1	X2	12 MHz		



**DREAM S.A.S. CONFIDENTIAL DATA**

Title	SAM5916 - PIANO BOARD - Top
Size	A4
Document Number	5916PIA-DKDSN
Date:	Tuesday, October 20, 2015
Sheet	1 of 10
Rev	2.1

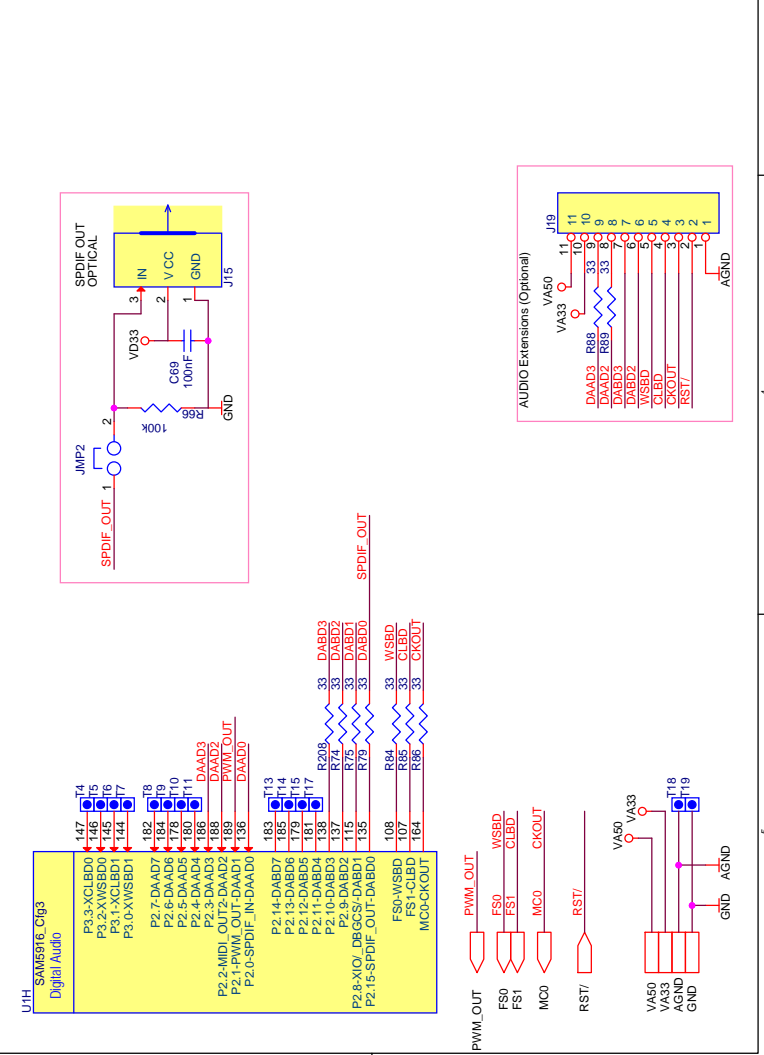
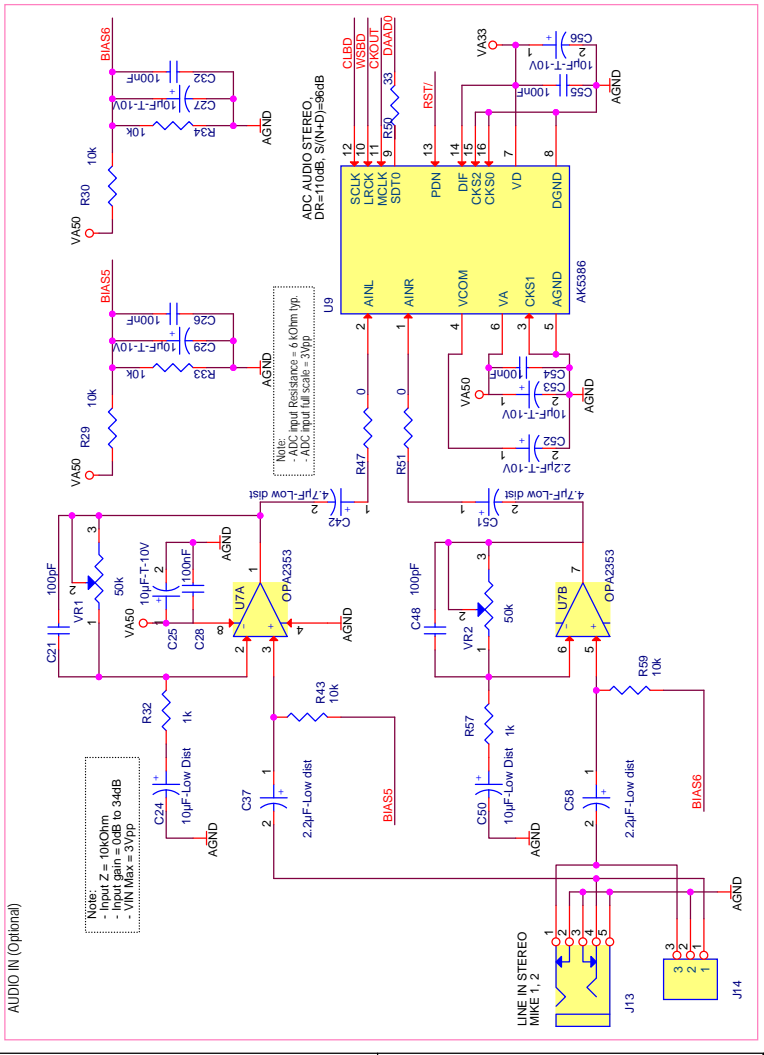
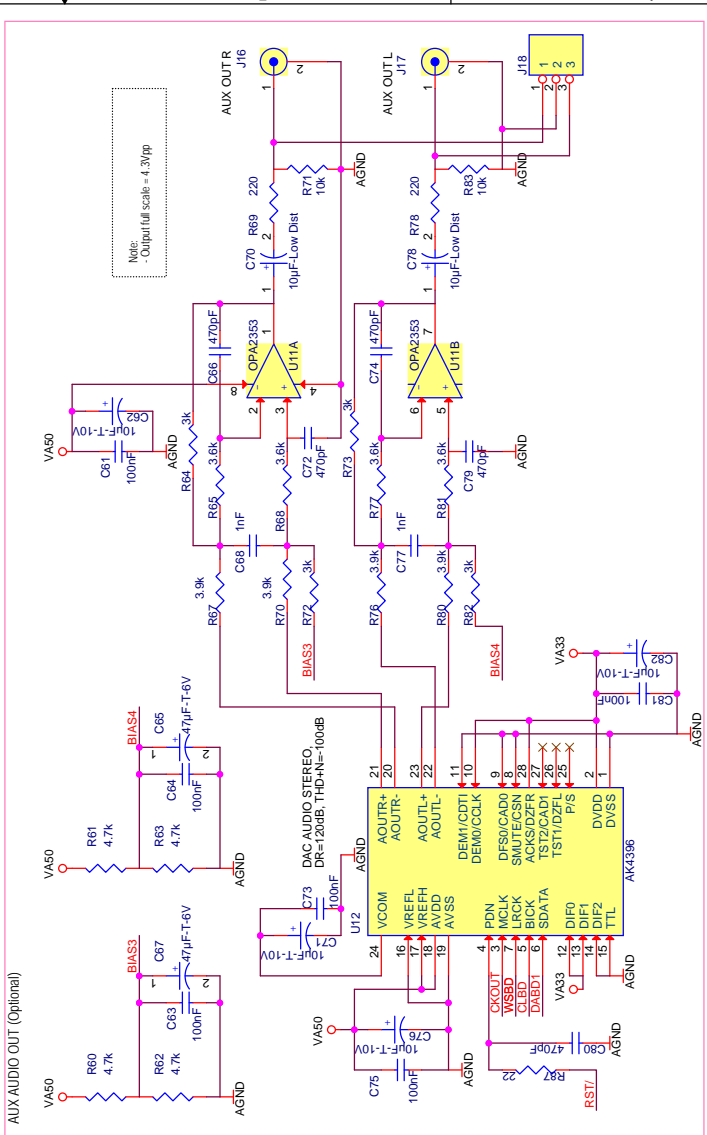
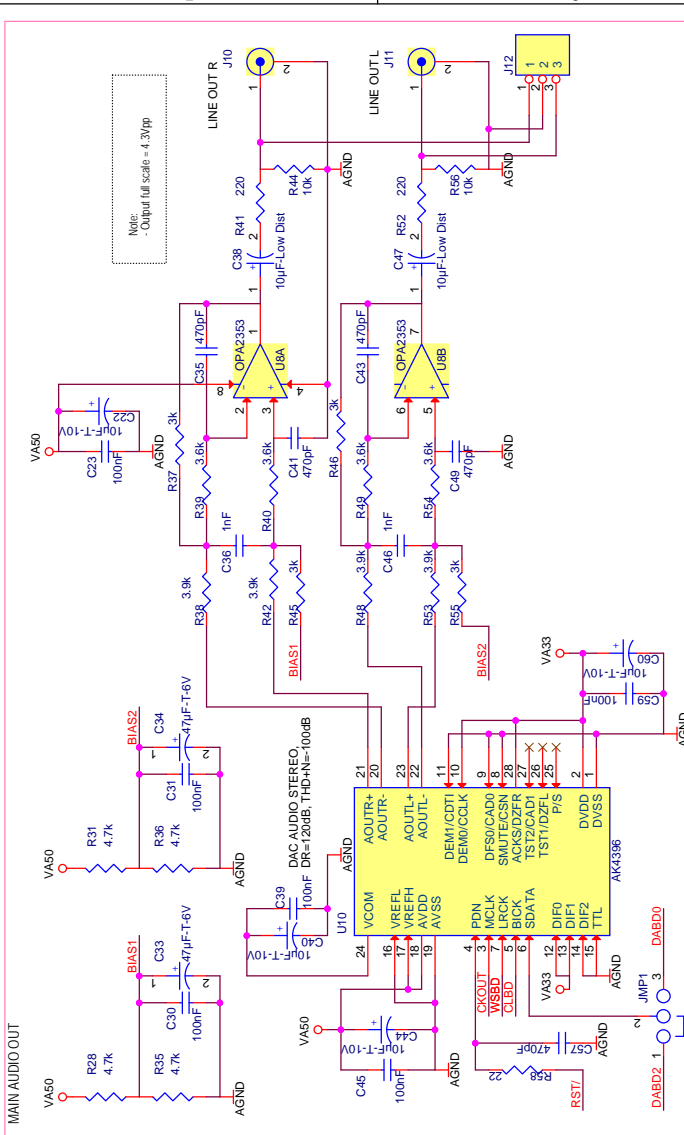


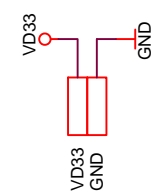
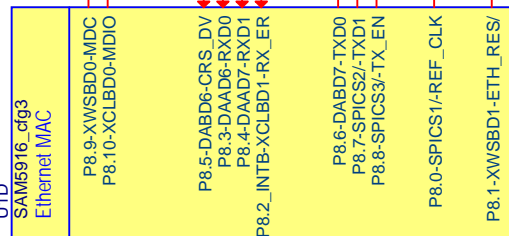
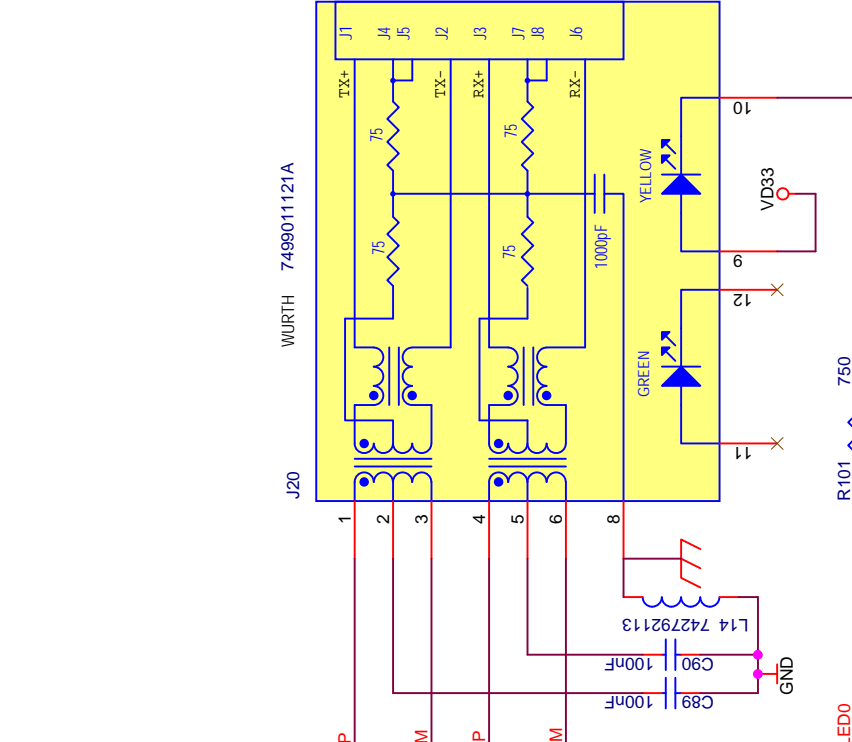
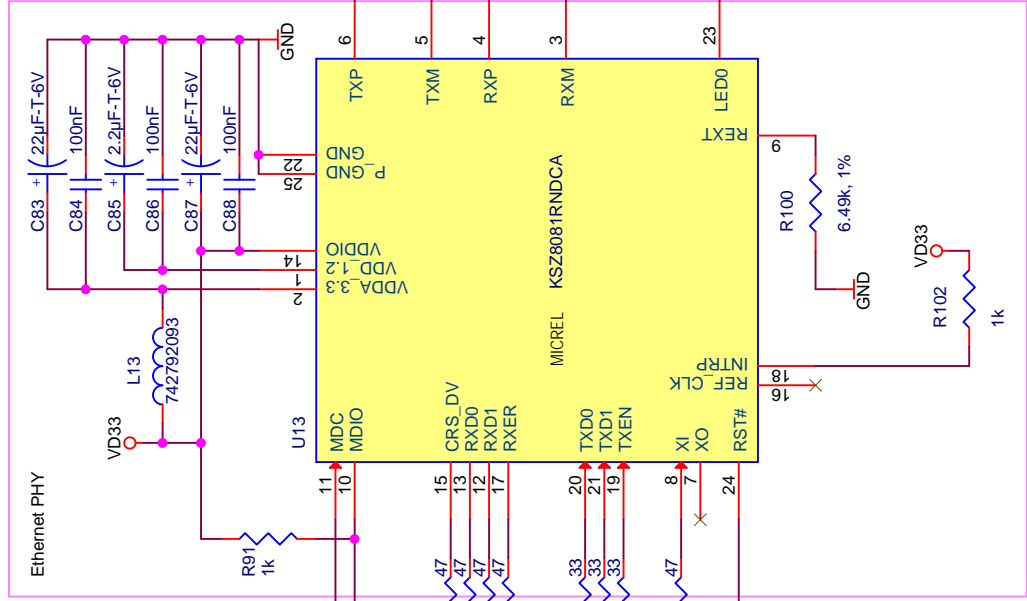
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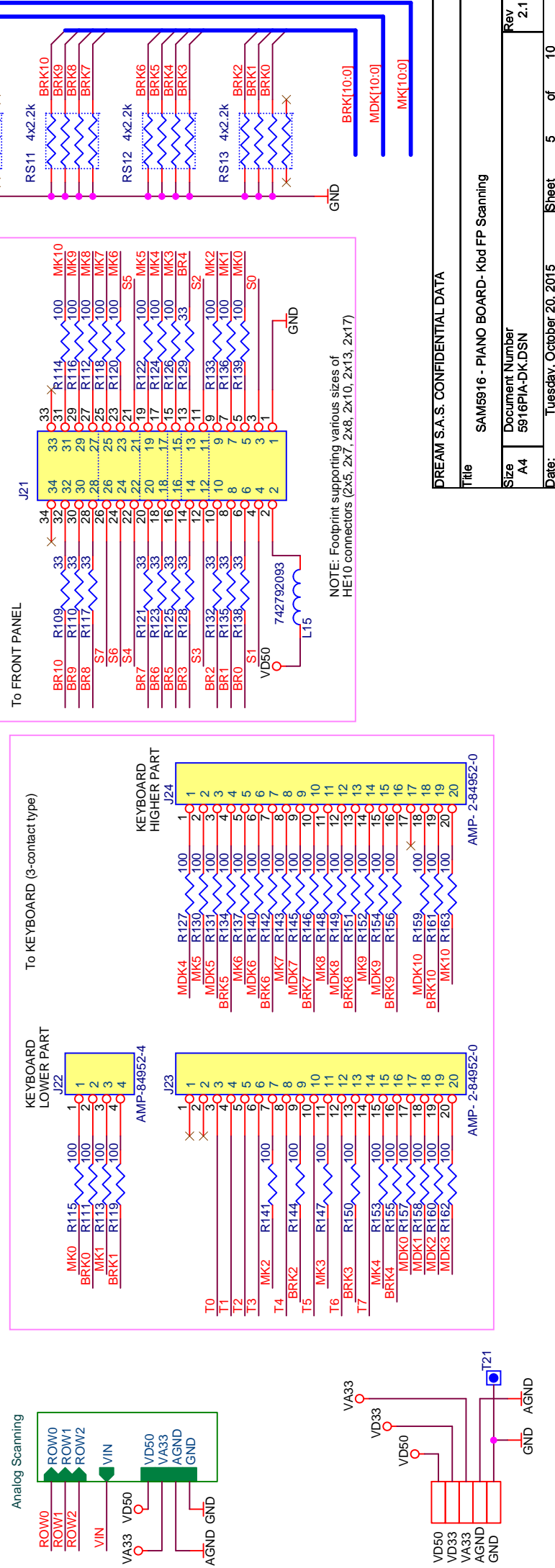
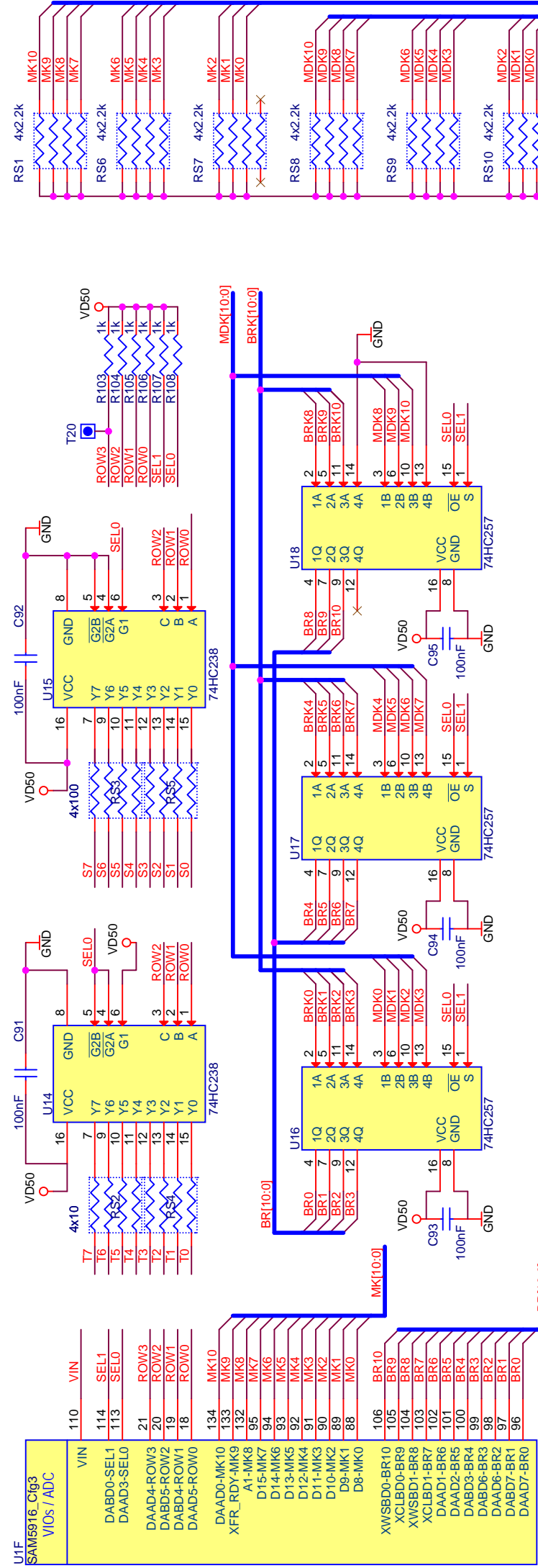
Date: Tuesday, October 20, 2015 Sheet 2 of 10





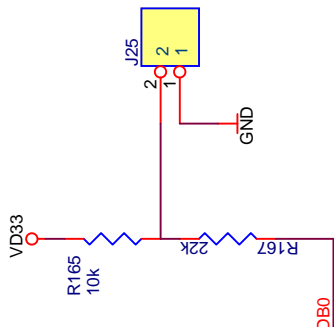
DREAM S.A.S. CONFIDENTIAL DATA

Title	SAM5916 - PIANO BOARD - Ethernet
Size	Document Number
A4	5916PIA-DKDSN
Date:	Tuesday, October 20, 2015
Sheet	4 of 10
Rev	2.1



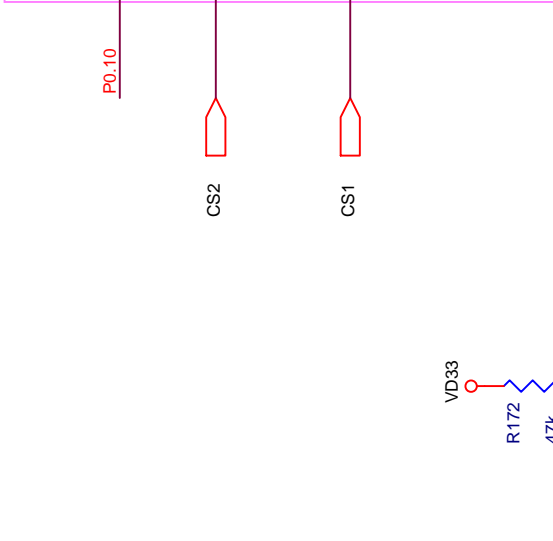
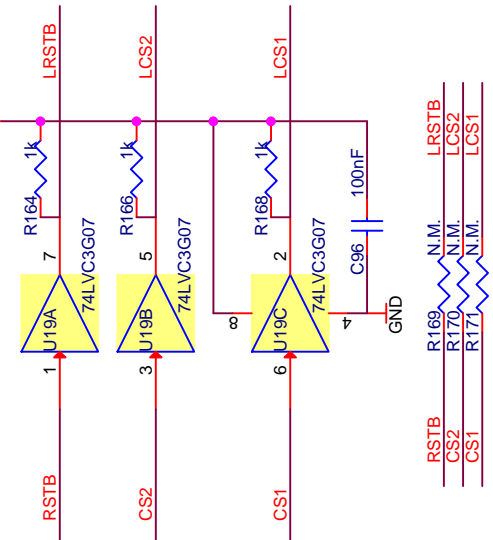


HEADPHONES DETECT



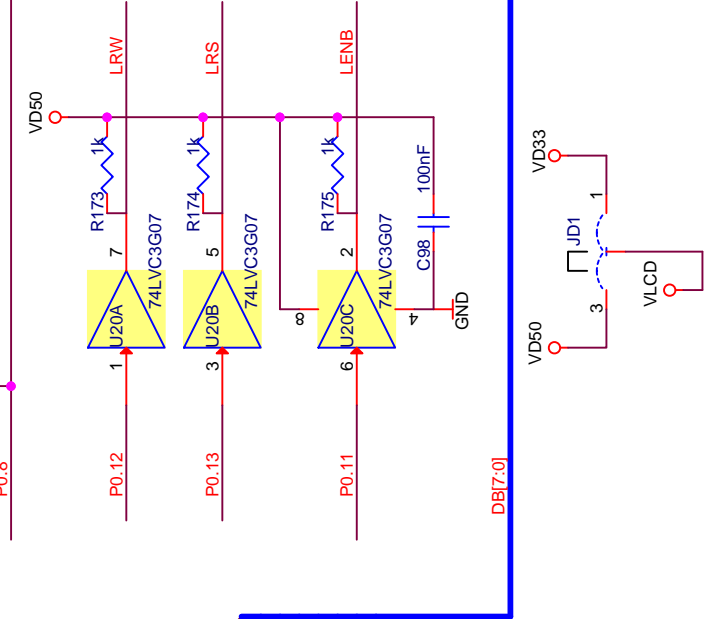
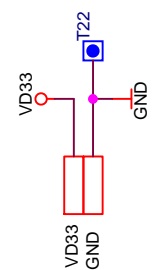
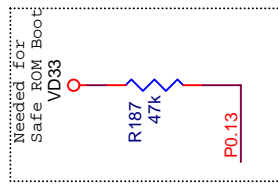
NOTE:  
 - If no headphones are plugged, Pin 2 of J24 should be not connected.  
 - If headphones are plugged, Pin 2 of J24 should be grounded.

GRAPHIC DISPLAY EXTENSION



U1E SAM5916\_Cfg3 Slave 8-bit I/F

RD/-MIDI_OUT2-P0.13	118	P0.13
WR/-SSDIN-P0.12	119	P0.12
CS/-SSYNC-P0.11	117	P0.11
A0-SSCLK-P0.10	121	P0.10
IRQ-SSINT/-P0.8_INITA	120	P0.8
D7-XCLBD0-P0.7	130	DB7
D6-XWSBD0-P0.6	129	DB6
D5-XCLBD1-P0.5	128	DB5
D4-XWSBD1-P0.4	127	DB4
D3-DABD2-P0.3	126	DB3
D2-DABD3-P0.2	125	DB2
D1-DABD4-P0.1	124	DB1
D0-DAAD2-P0.0	122	DB0



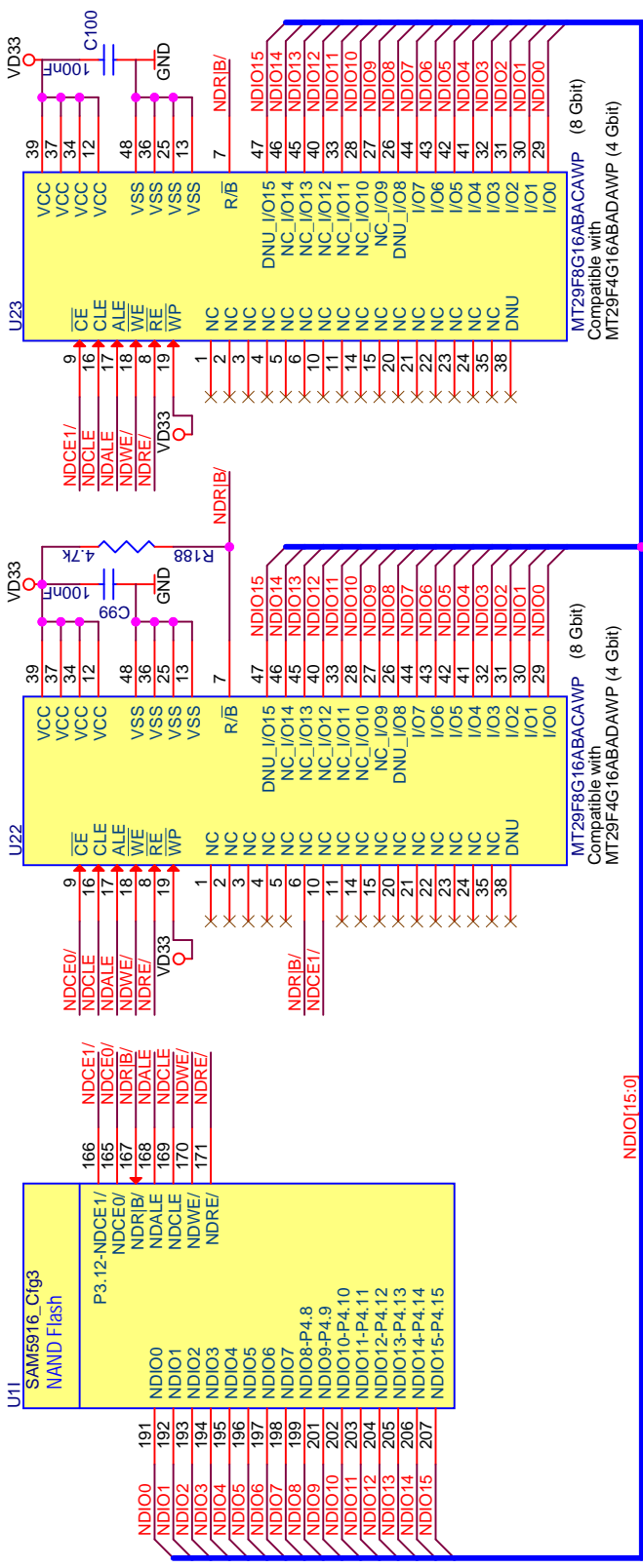
NOTE:

If +5V LCD DISPLAY:  
 -R169-R171, R176-R186 are Not Mounted  
 -U19 and U20 are Mounted, VLCD = VD50  
 -R173-R175, R164, R166, R168 are Mounted

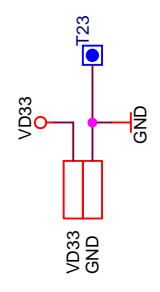
If +3.3V LCD DISPLAY:  
 - R169-R171, R176-R186 (10 Ohm) are Mounted,  
 - U19 and U20 are Not Mounted, VLCD = VD33.  
 - R173-R175, R164, R166, R168 are Not Mounted

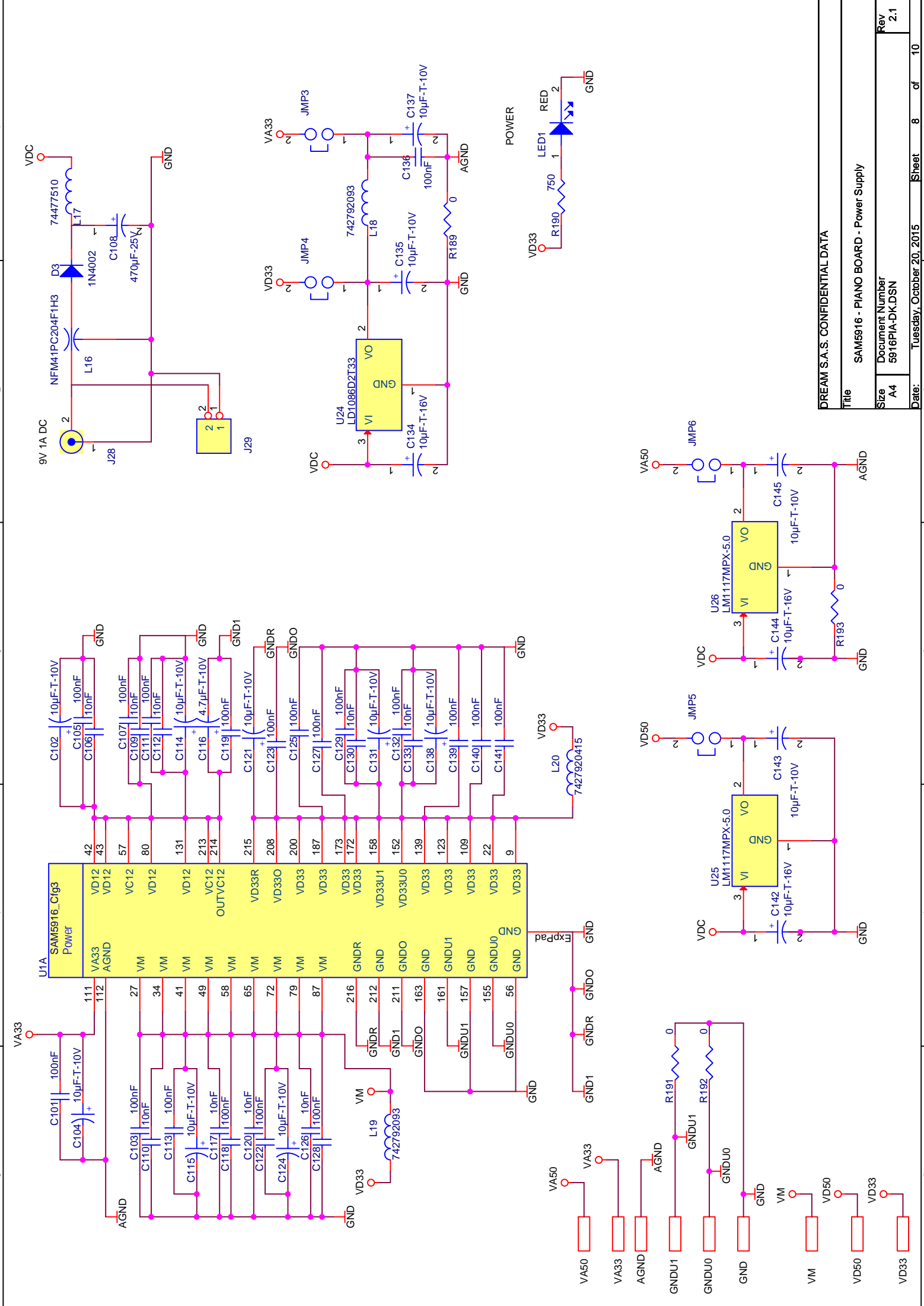
DREAM S.A.S. CONFIDENTIAL DATA

Title		SAM5916 - PIANO BOARD - LCD Display	
Size	Document Number	Sheet	6 of 10
A4	5916PIA-DKDSN	Date	Tuesday, October 20, 2015
Rev	2.1		



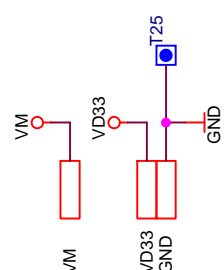
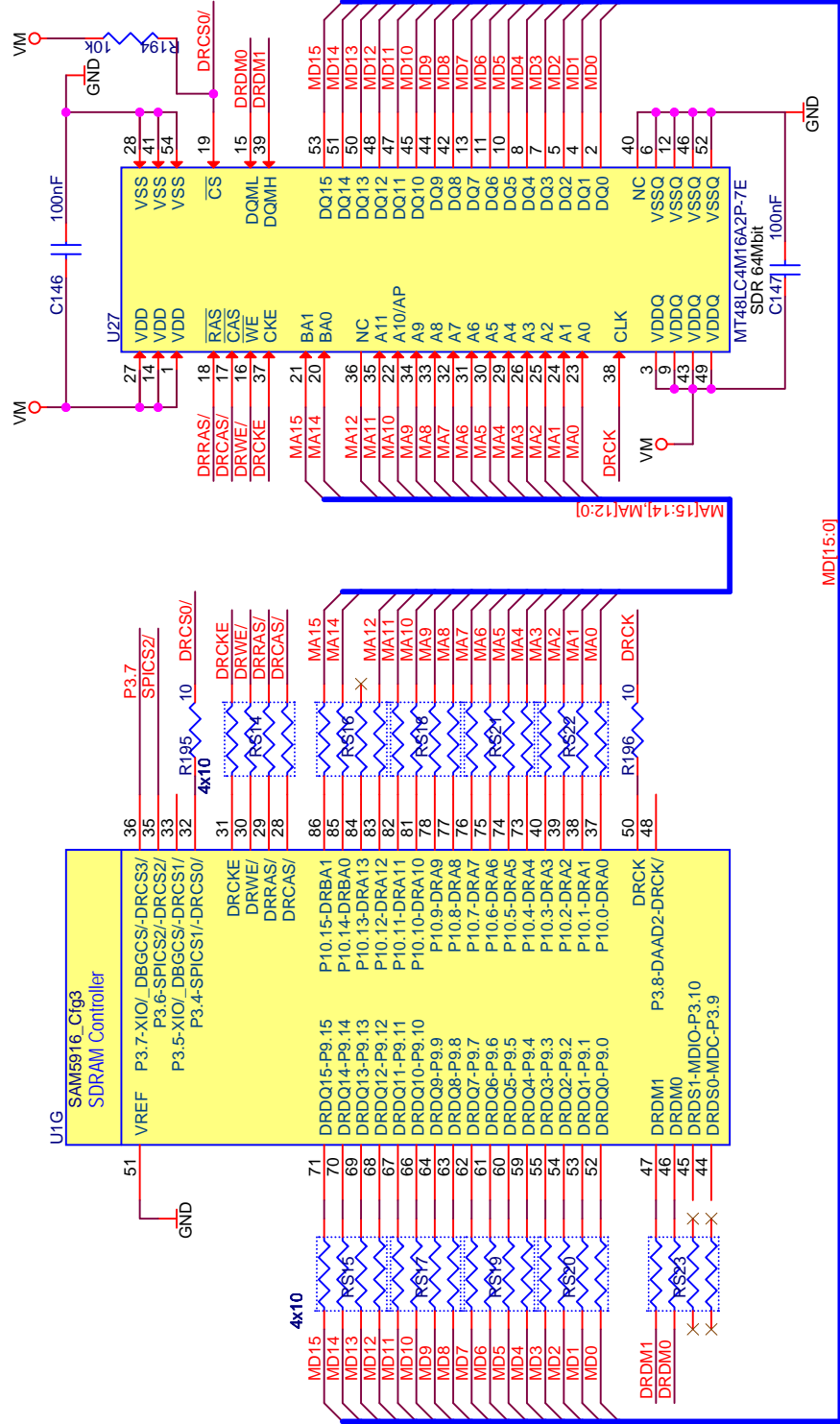
NDIO15:0J





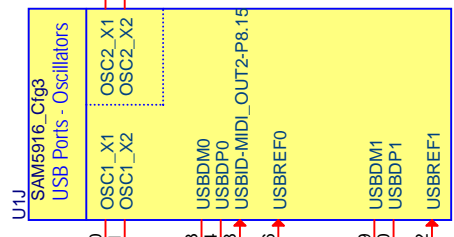
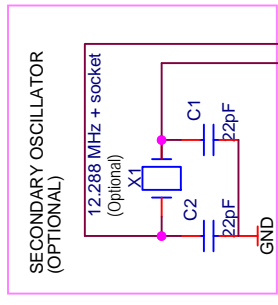
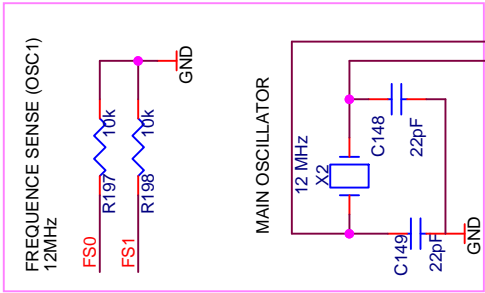
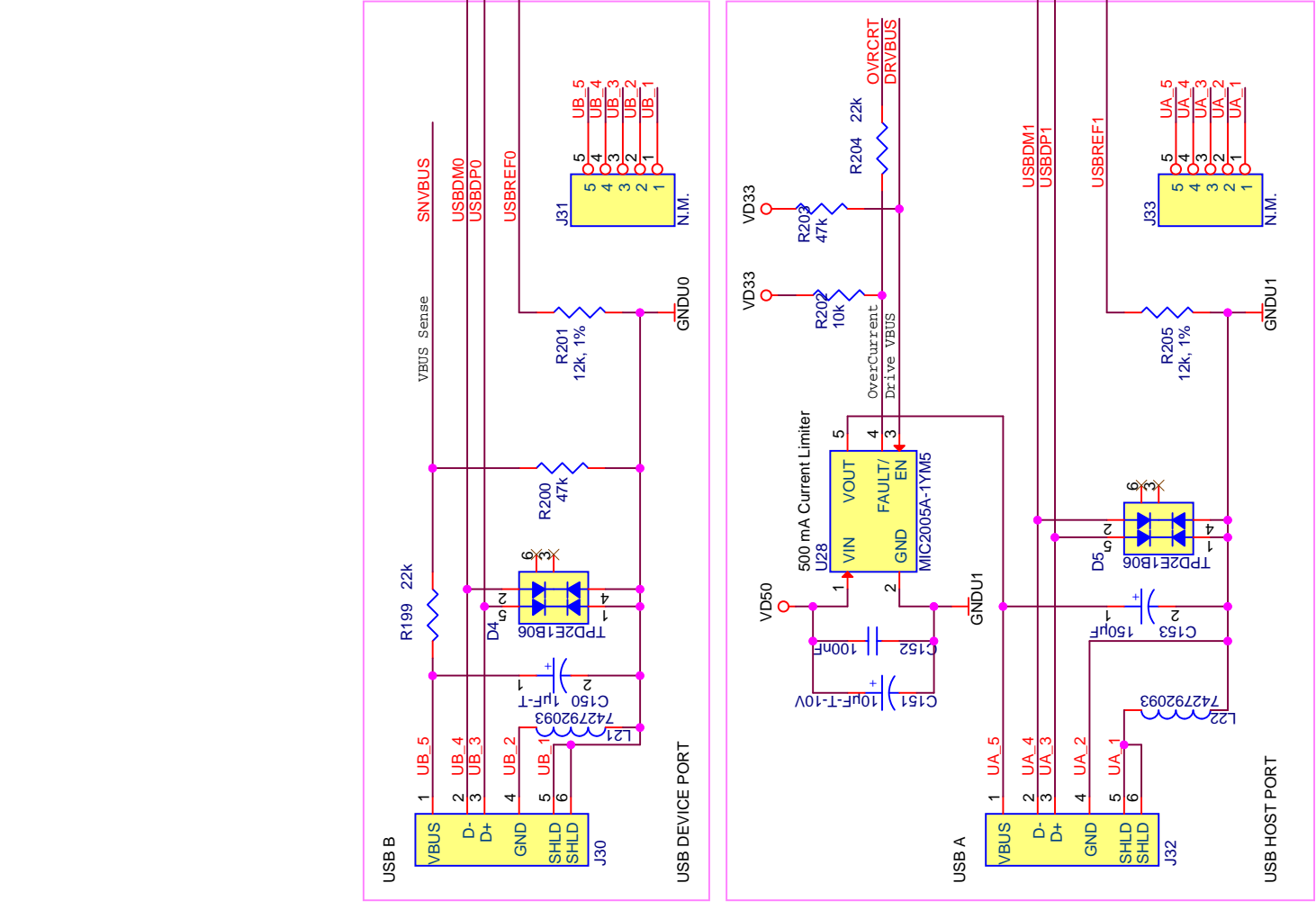
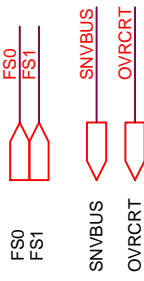
DREAM S.A.S. CONFIDENTIAL DATA

File	SAMS916 - PIANO BOARD - Power Supply
Size	Document Number
A4	5916PIA-DK.DSN
Date:	Tuesday, October 20, 2015
Sheet	8 of 10
Rev	2.1



DREAM S.A.S. CONFIDENTIAL DATA

Title		SAM5916 - PIANO BOARD - SDR SDRAM	
Size	A4	Document Number	5916PIA-DKDSN
Rev	2.1	Date:	Tuesday, October 20, 2015
Sheet	9	of	10



DREAM S.A.S. CONFIDENTIAL DATA

File	SAM5916 - PIANO BOARD - USB Ports
Size	Document Number
A4	5916PIA-DK.DSN
Date:	Tuesday, October 20, 2015
Sheet	10 of 10

## **Dream Contact**

info@dream.fr

## **Website**

<http://www.dream.fr>

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