

## Evaluation Board for the CS8416 and CS8406

### Features

- CS8416 Digital Audio Receiver
- CS8406 Digital Audio Transmitter
- Receives and Transmits AES/EBU, S/PDIF, and EIAJ-340-compatible Digital Audio
- Analog and Digital 3.3 Volt Supply
- 3.3 to 5.0 Volt Logic Interface Supply
- Operates In Stand-alone Hardware Mode or Computer-controlled Software Mode
- Balanced and Unbalanced Inputs Available

### Description

The CDB8416 is designed to allow easy evaluation of the CS8416 and CS8406. The board is designed for easy connection to an Audio Precision or other digital audio test system.

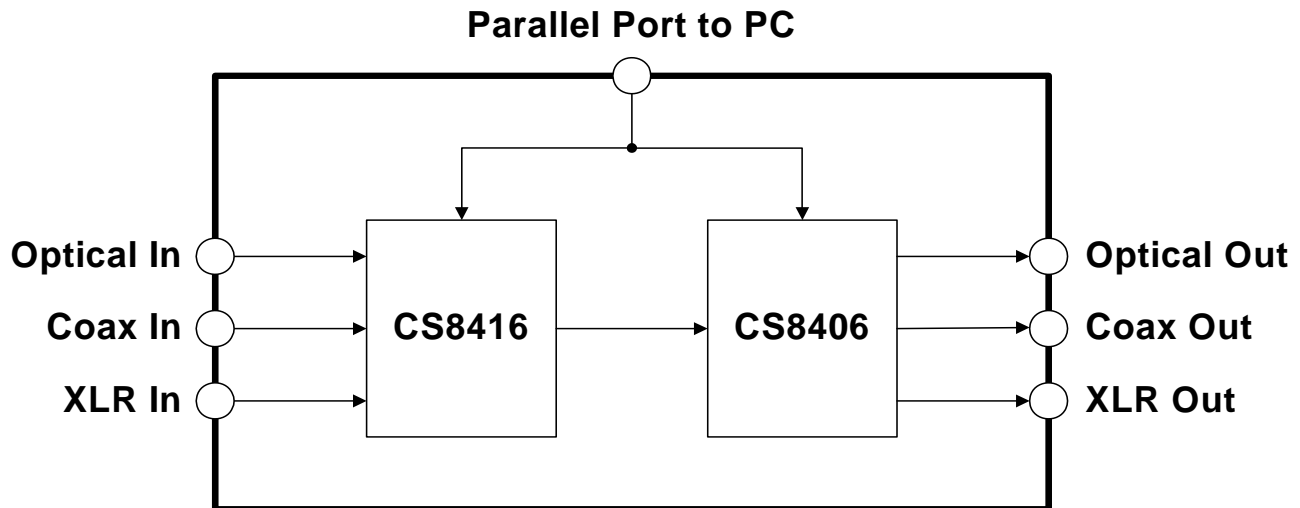
Input and output data may be set for either balanced using the XLR connectors or unbalanced using the coax or optical connectors.

Windows PC software provides a GUI to make configuration easy in Software Mode. The software communicates through the PC's parallel port to control the internal registers so that all the possible software modes of the CS8416 and CS8406 may be tested.

### ORDERING INFORMATION

CDB8416

Evaluation Board



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## 1. OVERVIEW

The CDB84166 evaluation board contains a CS8416 and a CS8406 and the supporting circuitry necessary to operate them. The board provides balanced XLR and unbalanced optical and coaxial inputs and outputs as outlined in the AES3 and IEC60958 standards. In Software Mode, the control registers of the CS8416 and CS8406 are set by a Windows based program through the parallel port of a PC.

### 1.1 CS8416 and CS8406

The features and functions of the CS8416 and the CS8406 are described in their respective data sheets.

### 1.2 Parallel Port

To use the CS8416 and CS8406 on the board in Software Mode, the parallel port on the upper right hand side of the board should be connected to the parallel port of the PC running the CDB8416 control software.

### 1.3 Serial Digital Audio Inputs

The left edge of the board is occupied by a row of serial digital audio input connectors. In either Hardware or Software Mode the user must select which inputs are to be used via the switch setting, INPUT, on switch S3.

Set the switch to the open position to select the XLR balanced input which will use the RXP1 and RXN inputs of the CS8416.

Set the switch to the closed position to select the optical/coaxial unbalanced inputs which will use the RXP0 and RXP2 through RXP7 inputs of the CS8416. This will AC couple the RXN input to GND. Note that in Hardware Mode, only RXP0 through RXP3 on the CS8416 are available for use. To select between the inputs in Hardware Mode, use the RXSEL0 and RXSEL1 switches on S3.

### 1.4 Serial Digital Audio Outputs

The right edge of the board is occupied by the serial digital audio outputs. The optical S/PDIF output is always enabled. The user may also choose to enable either the coaxial S/PDIF output or the XLR AES3 output via jumper J11. These outputs are transformer coupled.

### 1.5 Three-wire (PCM) Serial Audio Input and Output

Header J18 is provided so the user may access the three wire serial audio ports of the receiver and transmitter. The purpose of this port is to allow the user to connect external circuitry such as a DAC, ADC, or DSP to the receiver and transmitter. Signals going into or out of these headers should be operated at VL+.

Setting switch S1-M/ $\bar{S}$  in the open position sets the CS8416 as the master and the CS8406 as slave for LRCK and SCLK. Setting switch S1-M/ $\bar{S}$  in the closed position sets the CS8406 as the master and the CS8416 as slave for LRCK and SCLK.

Setting switch S3-8416\_PCM to the open position will turn off all of the input/output buffers for the CS8416. Setting switch S4-8406\_PCM to the open position will turn off all of the input/output buffers for the CS8406. These switches allow the user to independently set the input and output for the CS8416 and CS8406.

### 1.6 Crystal Oscillators

Oscillator Y1 provides the System Clock (OMCK) for the CS8416. The crystal oscillator on the board is mounted in pin sockets that allow it to be removed or replaced. The board is shipped with a 12.288 MHz crystal oscillator stuffed at Y1, setting the output sampling rate to 48 kHz. Please refer to the CS8416 data sheet for details on OMCK operation.

## 1.7 LED Function Indicators

Several LEDs are provided to indicate board functions. D9 indicates that power is present to the VD+/VA+ section of the CS8416 and CS8406. D11, D12, and D13 indicate the status of the

NV/RERR,  $\overline{\text{AUDIO}}$ , and 96 kHz output of the CS8416 in Hardware Mode. See the CS8416 data sheet for an explanation of the conditions that activate each of these outputs.

## 2. CONFIGURATION SETTINGS

CONNECTOR	INPUT/OUTPUT	SIGNAL PRESENT
J3 (+5V)	Input	+5 Volt Supply for supporting circuitry
J4 (GND)	Input	Ground connection from power supply
J5 (VL+)	Input	+3.3 to 5.0 Volt Digital Logic power for the CS8416 and CS8406
J6 (VD+/VA+)	Input	+3.3 Volt VD+/VA+ when not using the onboard regulator
J9, J16, J21	Input	Digital Audio Interface coaxial input
OPT1-OPT4	Input	Digital Audio Interface optical input
J2	Input	Digital Audio Interface XLR input
J1	Input/Output	Parallel port for connection to parallel port of PC
J20	Output	Digital Audio Interface optical output
J19	Output	Digital Audio Interface coaxial output
J10	Output	Digital Audio Interface XLR output
J18	Input/Output	I/O for CS8416 and CS8406 PCM data and clocks

**Table 1. System Connections**

JUMPER	PURPOSE	POSITION	FUNCTION SELECTED
J7	Selects between using a separate supply for VL+ or using the +5 Supply.	ADJUST +5V	Uses J5 to supply from +3.3V to +5.0V for VL+ Uses J3 to supply +5V for VL+
J8	Selects between using a separate supply for VD+/VA+ or using the onboard +3.3V regulator.	REG ADJUST	Uses the onboard +3.3V regulator for VD+/VA+ Uses J6 to provide the +3.3V supply for VD+/VA+
J12	Current measurement for CS8416 VA+	CLOSED OPEN	Normal operation Use J13 to measure CS8416 VA+ current
J13	Current measurement for CS8416 VD+	CLOSED OPEN	Normal operation Use J12 to measure CS8416 VD+ current
J17	Current measurement for CS8416 VL+	CLOSED OPEN	Normal operation Use J16 to measure CS8416 VL+ current
J14	Current measurement for CS8406 VD+	CLOSED OPEN	Normal operation Use J14 to measure CS8406 VD+ current
J15	Current measurement for CS8406 VL+	CLOSED OPEN	Normal operation Use J15 to measure CS8406 VL+ current
J11	Selects between coaxial or XLR output	XLR COAX	Selects XLR output on J10 Selects coaxial output on J19

**Table 2. CDB8416 Jumper Settings**

<b>SWITCH</b>	<b>PURPOSE</b>	<b>POSITION</b>	<b>FUNCTION SELECTED</b>
S1-H/S	Selects Hardware or Software Mode for CS8416 and CS8406.	OPEN CLOSED	CS8416 and CS8406 are in Hardware Mode. CS8416 and CS8406 are in Software Mode.
S1-M/S	Selects Master or Slave Mode for LRCK and SCLK.	OPEN CLOSED	CS8416 Master. CS8406 Slave. CS8416 Master. CS8406 Slave.
S1-SFMT1 S1-SFMT0	Selects serial audio output format for the CS8416 and input format for the CS8406.	00 01 10 11	Left Justified 24 bit I2S 24 bit Right Justified 24 bit Direct AES3 (CS8416) Right Justified 16 bit (CS8406)
S3-INPUT	Selects CS8416 receiver input topology.	OPEN CLOSED	XLR balanced input. Optical/Coaxial unbalanced input.
S3-8416_PCM	Controls the input/output buffers for the CS8416 serial audio port.	OPEN CLOSED	CS8416 I/O buffers off. CS8416 I/O buffers on.
S3-NVSEL	Selects between NVERR and RERR.	OPEN CLOSED	NVERR output selected. RERR output selected.
S3-RXSEL1 S3-RXSEL0	Hardware mode RXP input channel select for the CS8416.	00 01 10 11	RXP0 Selected RXP1 Selected RXP2 Selected RXP3 Selected
S3-TXSEL1 S3-TXSEL0	Hardware mode TX pass through channel select for the CS8416	00 01 10 11	RXP0 pass through to TX RXP1 pass through to TX RXP2 pass through to TX RXP3 pass through to TX
S4-8406_PCM	Controls the input/output buffers for the CS8406 serial audio port.	OPEN CLOSED	CS8406 I/O buffers off. CS8406 I/O buffers on.
S4-TCBLD	Selects the direction of TCBL for the CS8406.	OPEN CLOSED	TCBL set to output. TCBL set to input.
S4-CEN	Selects input method for channel status, user, and validity data.	OPEN CLOSED	Mode B is selected. Mode A is selected.

**Table 3. CDB8416 Switch Settings**

### 3. BOARD SETUP

#### 3.1 Power Supplies:

- 1) Verify that all power supplies are off before making connections.
- 2) Connect a +3.3 V DC power supply to the VD+/VA+ (J6) binding post and place jumper J8 in the ADJUST position. This connection may be omitted by setting J8 to the REG position. VD+/VA+ will be derived from the on-board +3.3V regulator.
- 3) Connect a +3.3 V to +5.0 V DC power supply to the VL+ (J5) binding post and place jumper J7 in the ADJUST position. This connection may be omitted by setting J7 to the +5 V position. VL+ will be derived from the +5 V binding post.
- 4) Connect a +5.0 V DC power supply to the +5 V (J3) binding post.
- 5) Connect the common ground of the power supplies to the GND (J4) binding post.
- 6) Apply power to the board. D9 should illuminate indicating power is applied to VD+/VA+.

#### 3.2 Hardware Mode Settings:

- 1) Place switch S1-H/ $\bar{S}$  in the OPEN position.
- 2) Place switches S3-INPUT, S3-8416\_PCM, S3-NVSEL, S3-RXSEL1, S3-RXSEL0, S3-TXSEL1, S3-TXSEL0, S1-M/ $\bar{S}$ , S1-SFMT1, S1-SFMT0, S4-8406\_PCM, S4-TCBLD, S4-CEN to the appropriate positions.
- 3) Press and release the RESET switch S3. The board should now be setup for use in Hardware Mode.

#### 3.3 Software Mode Settings:

- 1) Place switch S1-H/ $\bar{S}$  in the CLOSED position.
- 2) Place switches S1-M/ $\bar{S}$ , S3-INPUT, S3-8416\_PCM, and S4-8406\_PCM to the appropriate positions. All other switch setting do not

effect Software Mode operation.

- 3) Press and release the RESET switch S2. The board should now be setup for use in Software mode.
- 4) Connect a DB-25 parallel port cable from the PC's parallel port to J1 on the CDB8416.

##### 3.3.1 Installing the Software:

- 1) Create a directory called CDB8416 anywhere on your system.
- 2) Copy CDB8416.exe from the included CD into this directory.
- 3) Run port95nt.exe from the CD. After running the program the system will need to be restarted.
- 4) If desired, create a shortcut to CDB8416.exe on your desktop. You should now be able to run CDB8416.exe.
- 5) Double-click on CDB8416.exe or its shortcut.
- 6) Click on the button on the lower right labeled "Advanced".
- 7) Select the LPT port you are using to connect to the CDB8416.
- 8) Shut down the application, reset the board, and then restart the application.

##### 3.3.2 Verifying Board Operation:

- 1) In the "CS8416 AES Receiver Controls" window, select the check box "Enable Internal Clocks" (enables the RUN bit in the Clock Control register).
- 2) In the "CS8406 AES Transmitter Controls" window, select the check box "Enable Clocks" (enables the RUN bit in the Clock Control register).
- 3) In the "CS8416 AES Receiver Controls" window, select the check box "Generate SCLK/LRCK". Make sure that switch S1-M/ $\bar{S}$  is in the OPEN position.

- 4) Check the performance of the board by doing an FFT with a -1 dBFS 1 kHz sine wave for input at a 48 kHz sample rate using the optical input and optical output.

## 4. CDB8416.EXE USER'S GUIDE

### 4.1 Main Window

The main window of the CDB8416 Control Application allows the user to view the configuration of the CS8416. Clicking the left mouse button on the

CS8406 Controls button will bring up a control panel containing all the register bits relevant to that part.

Clicking on the Advanced button at the lower right brings up the Advanced Options control panel. Within the Advanced Options you may read and write hex values into specified registers in either part. Changes made on the CS8406 or CS8416 control panels will also be immediately reflected in the Main Window, so you may wish to arrange them so that they do not obscure each other.

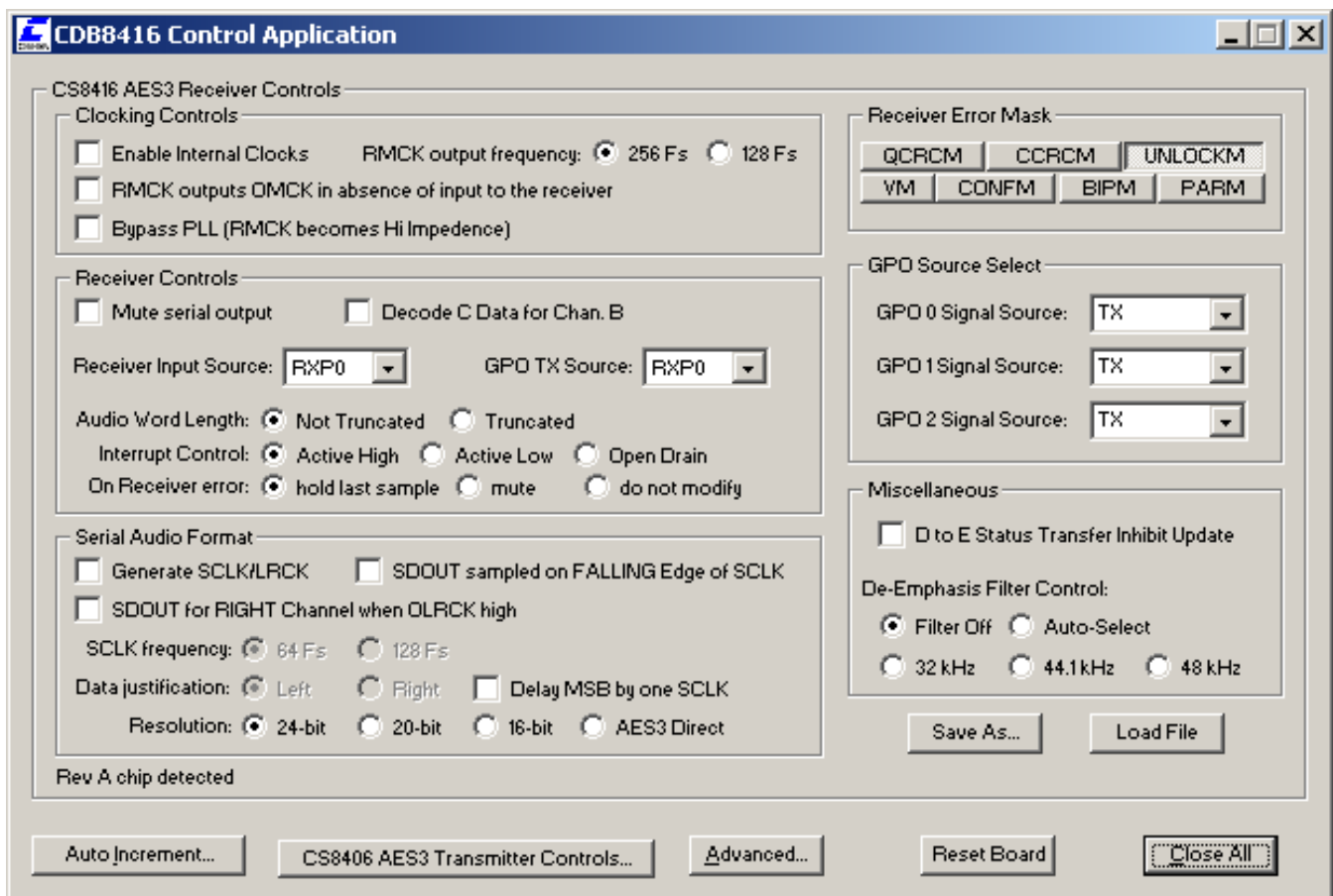
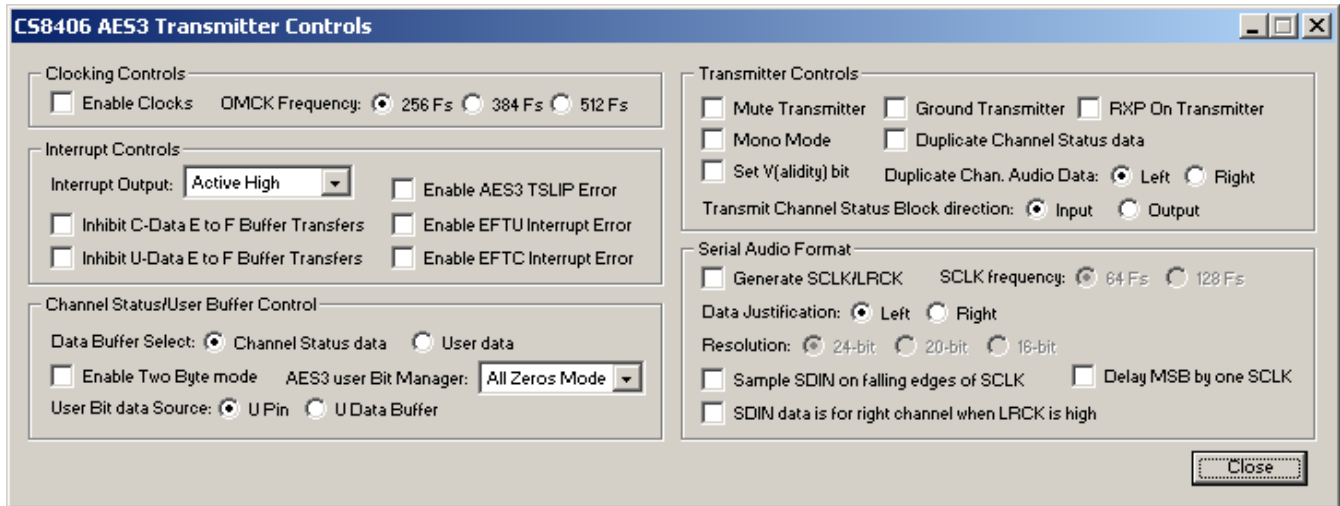
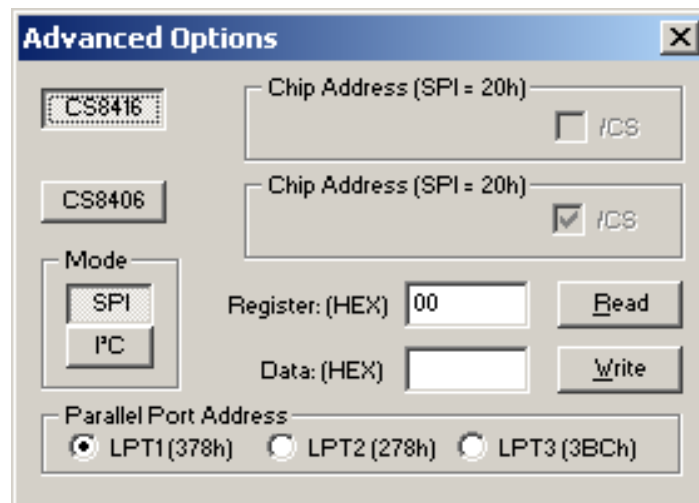


Figure 1. CS8416 Control Panel





**Figure 2. CS8406 Control Panel**



**Figure 3. Advanced Control Panel**

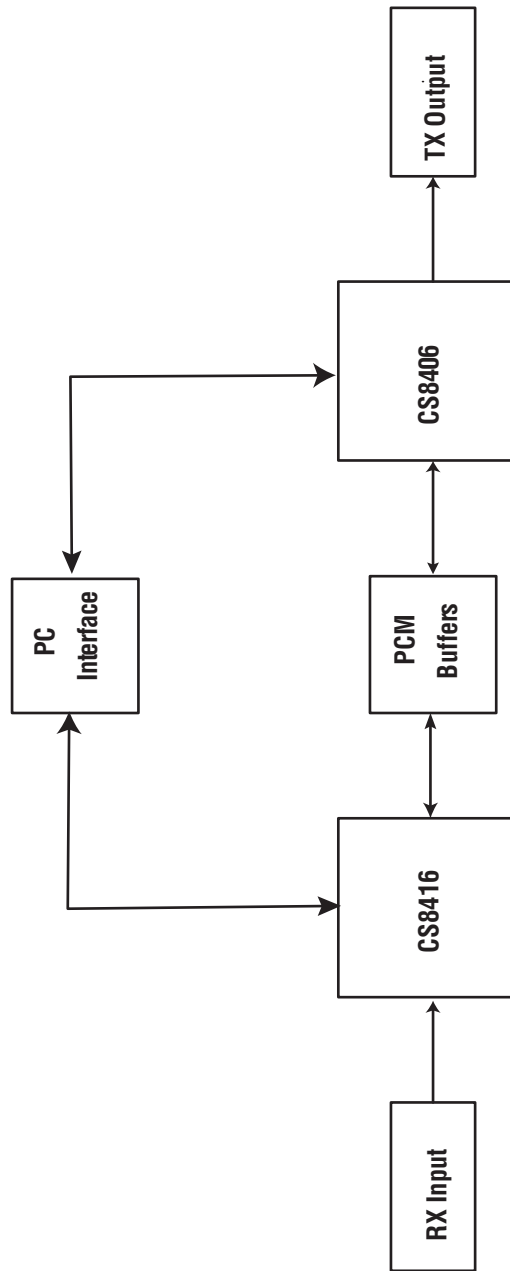
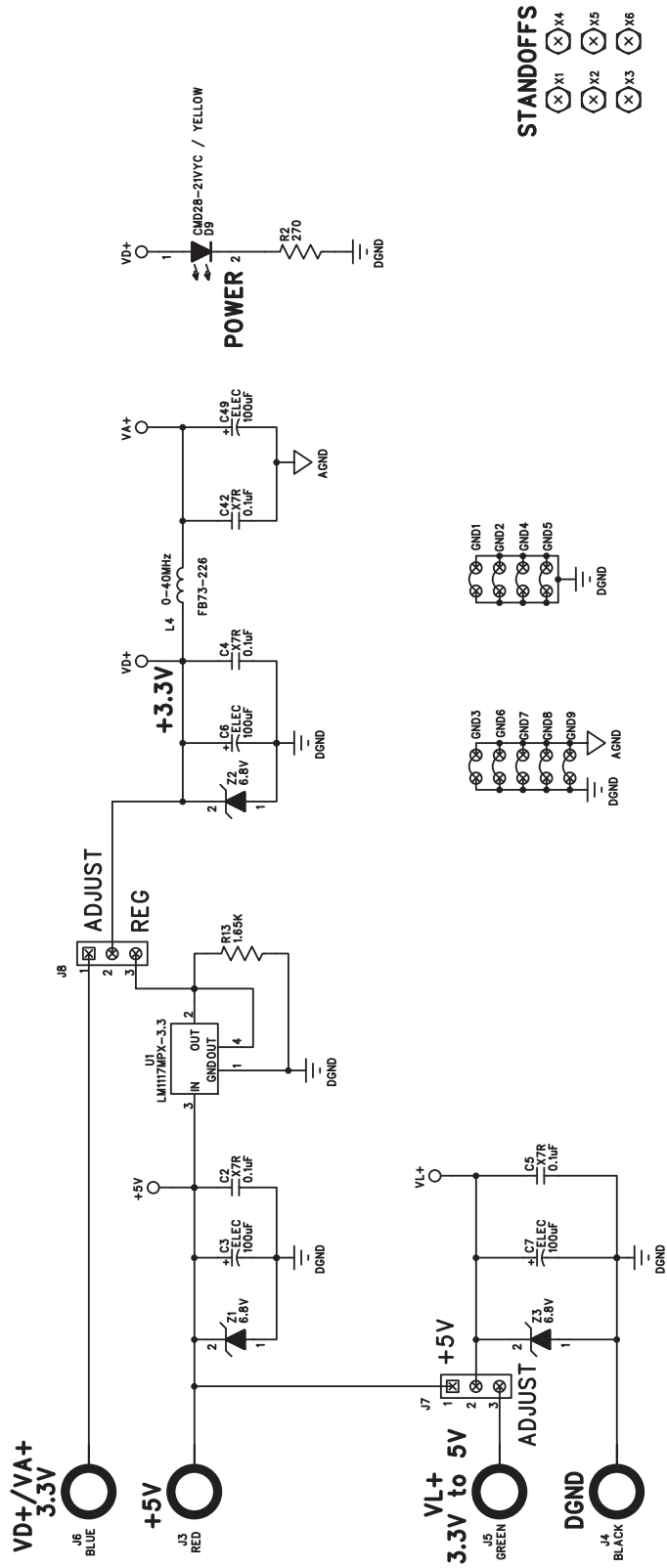
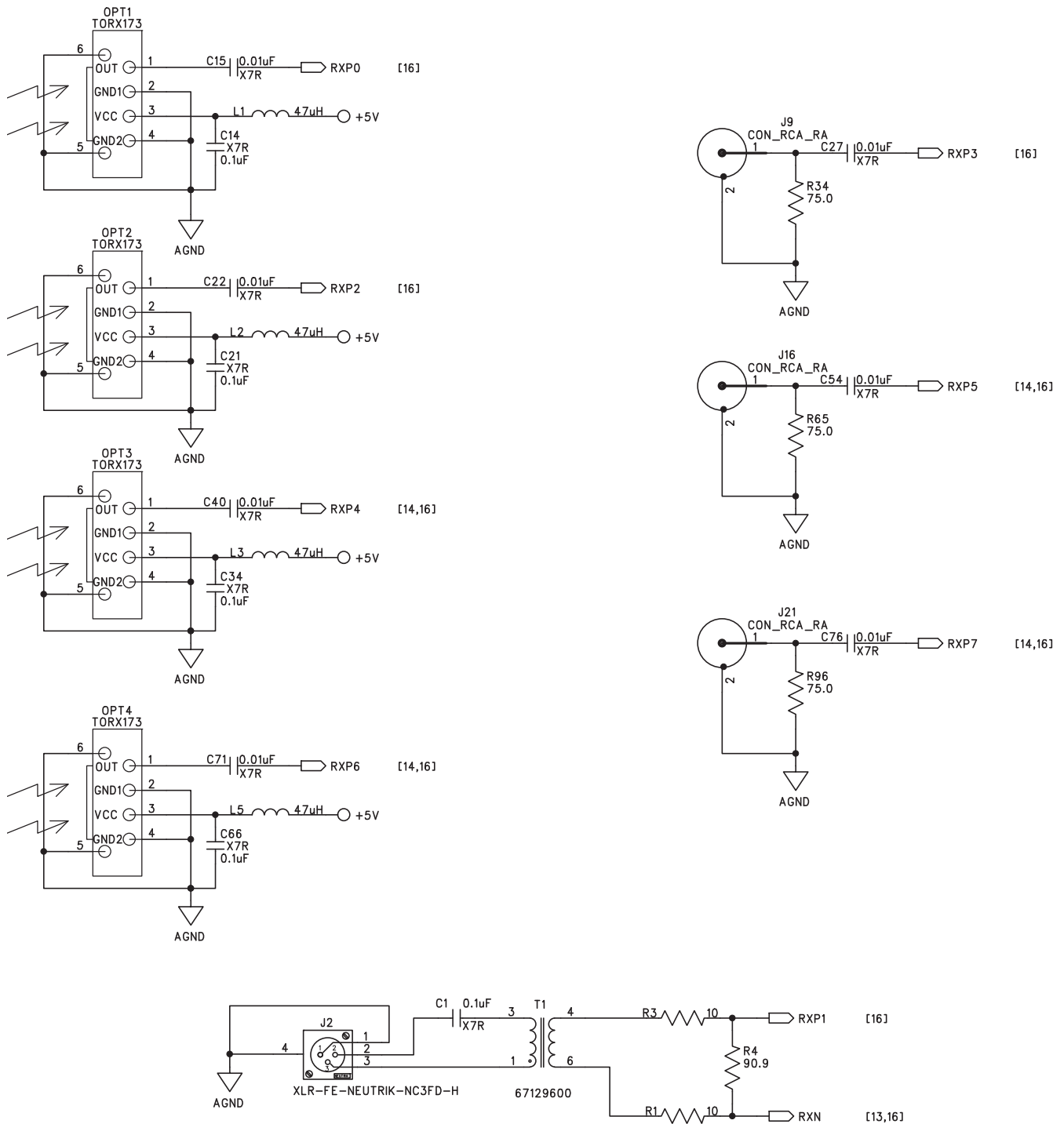
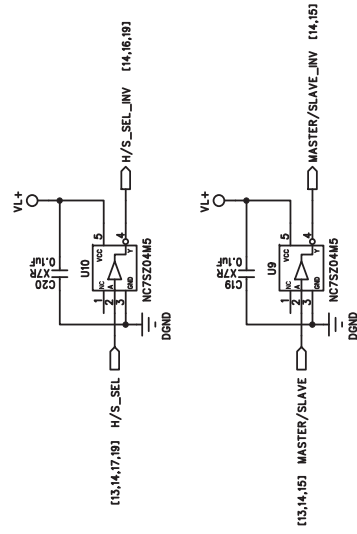


Figure 4. CDB8416 Block Diagram


**Figure 5. Power**


**Figure 6. Digital Audio Inputs**



**CS8416 SETUP**

	OPEN	CLOSED
INPUT	XLR BALANCED	OPT/COAX UNBAL
8446_PCM	PCM OFF	PCM IN/OUT
INSEL	INVERR	RERR
RXSEL1	HI	LOW
RXSEL0	HI	LOW
TXSEL1	HI	LOW
TXSEL0	HI	LOW

**BOARD SETUP**

	OPEN	CLOSED
H/S	HARDWARE	SOFTWARE
M/S	CS8416 MASTER	CS8406 MASTER
	CS8406 SLAVE	CS8416 SLAVE
SFMT1	HI	LOW
SFMT0	HI	LOW

**CS8406 SETUP**

	OPEN	CLOSED
8406_PCM	OFF	PCM IN/OUT
TCBLD	OUTPUT	INPUT
GEN	MODE B	MODE A

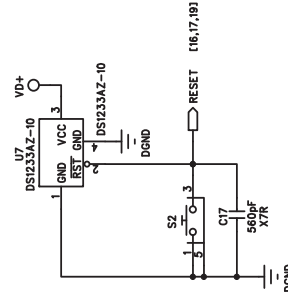
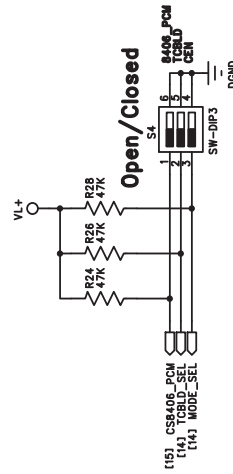
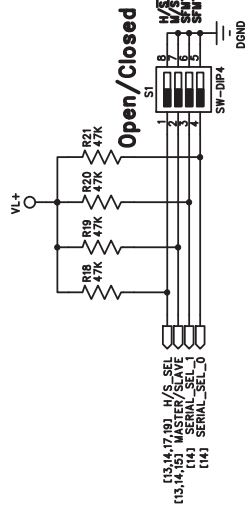
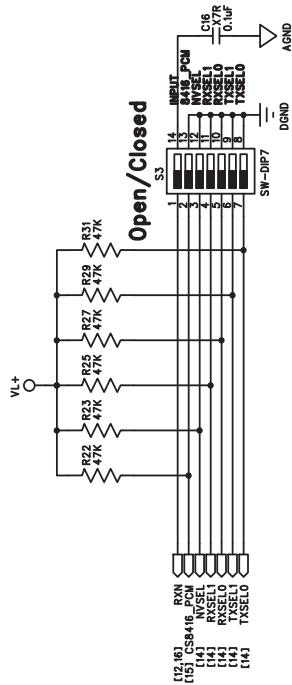


Figure 7. Hardware Switches

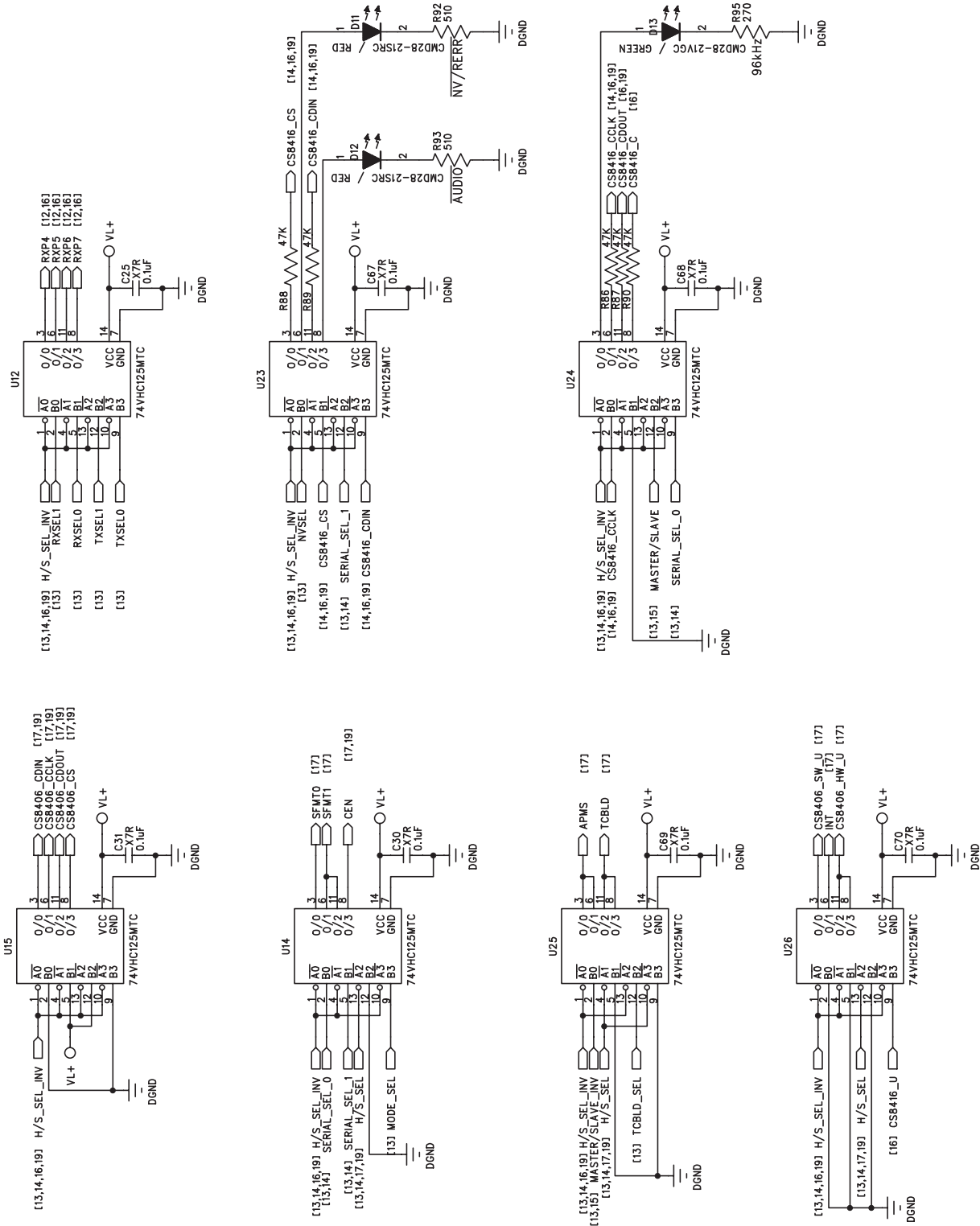


Figure 8. Buffers



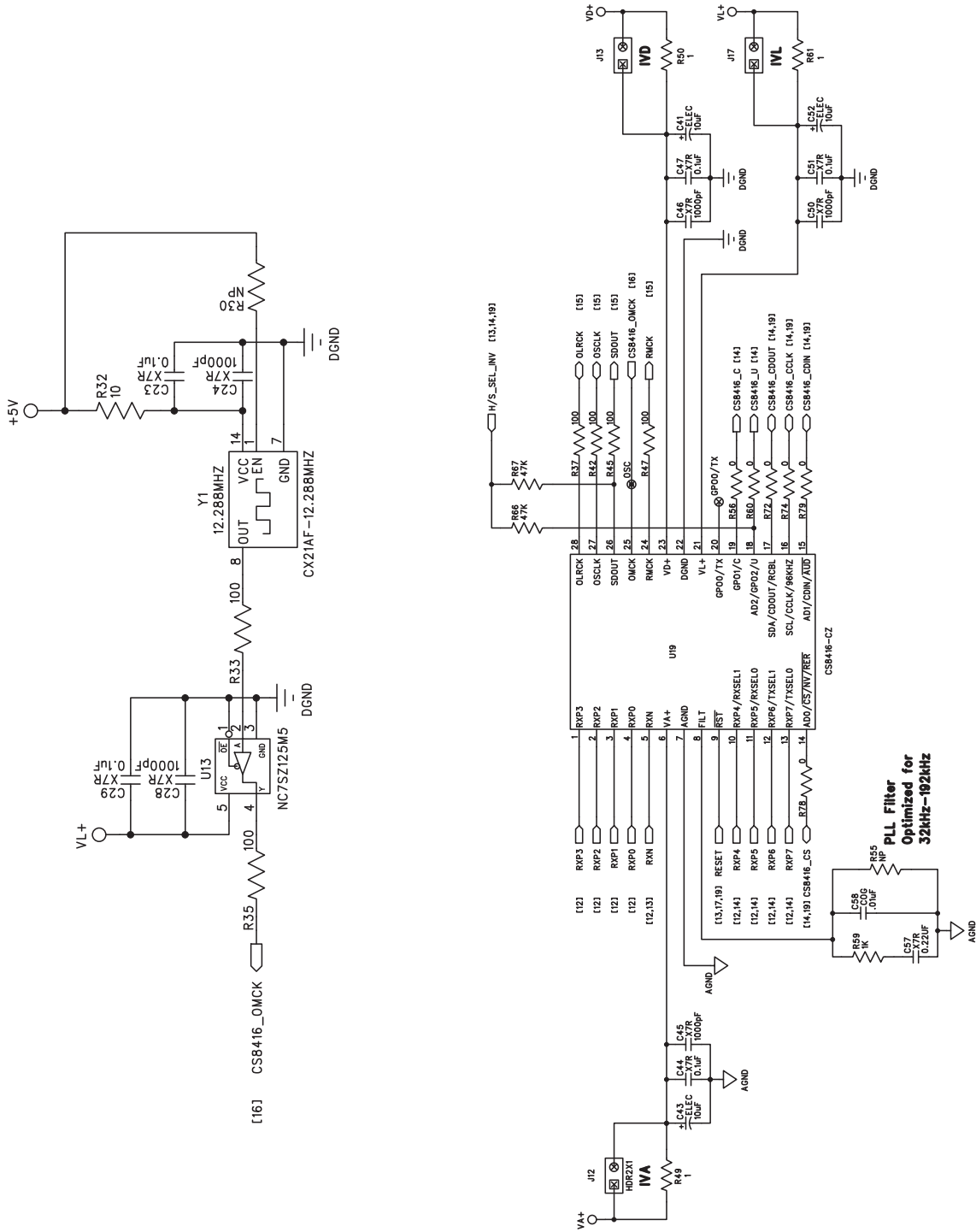
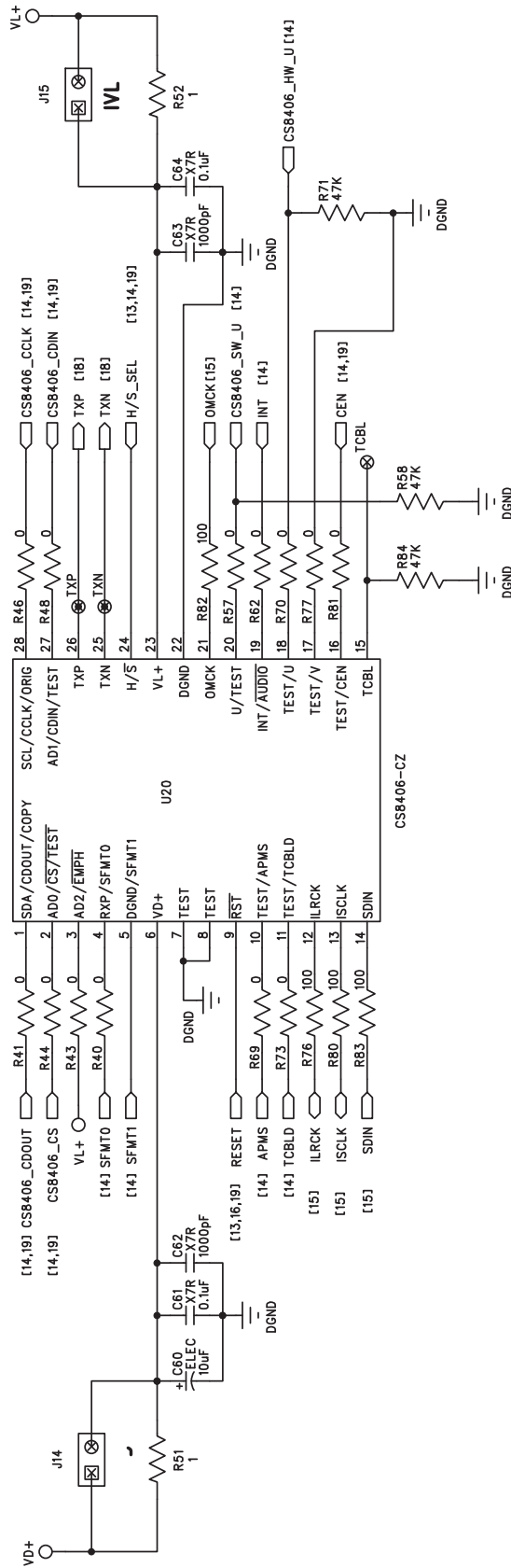


Figure 10. CS8416




**Figure 11. CS8406**



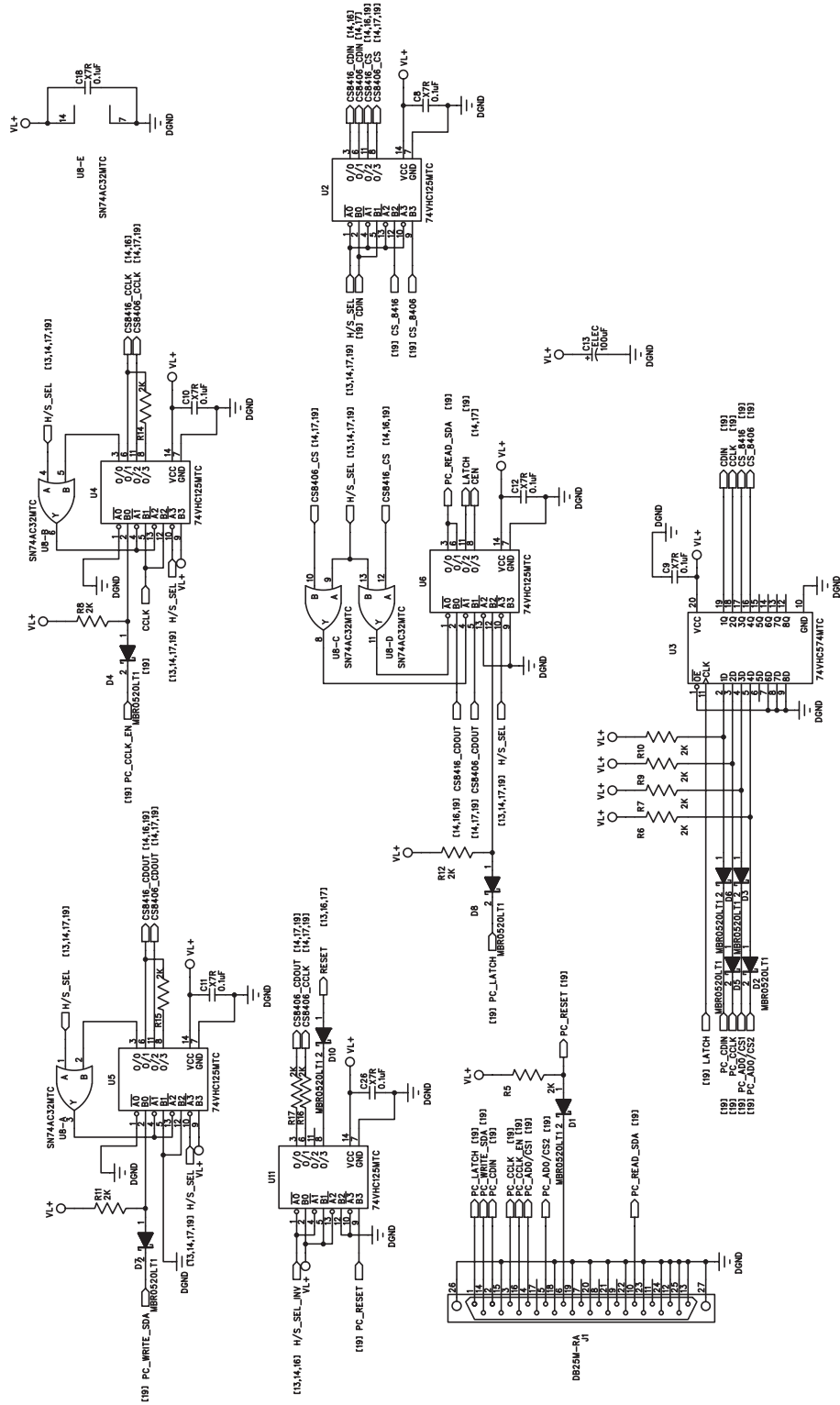


Figure 13. PC Control Interface



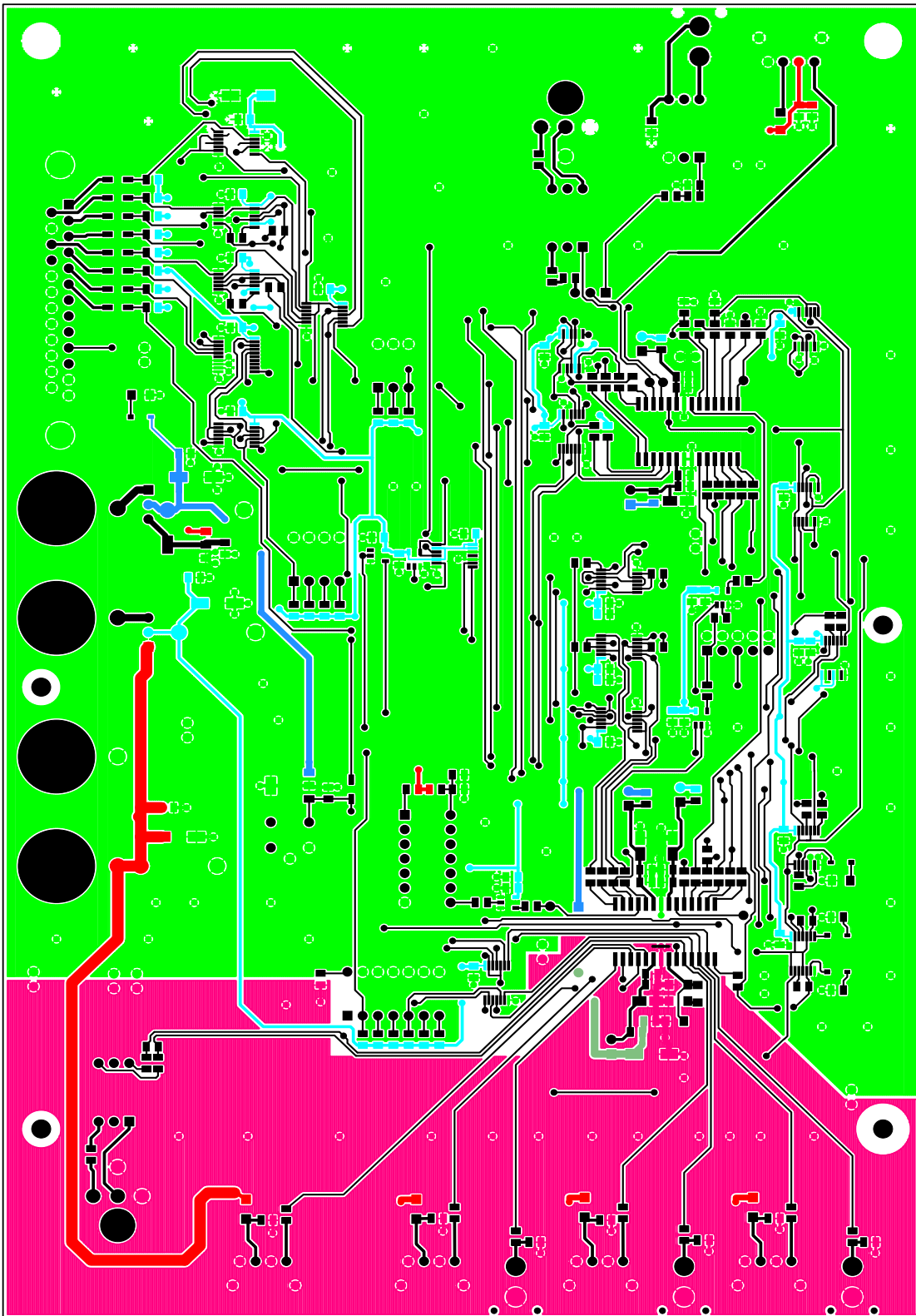


Figure 15. Top

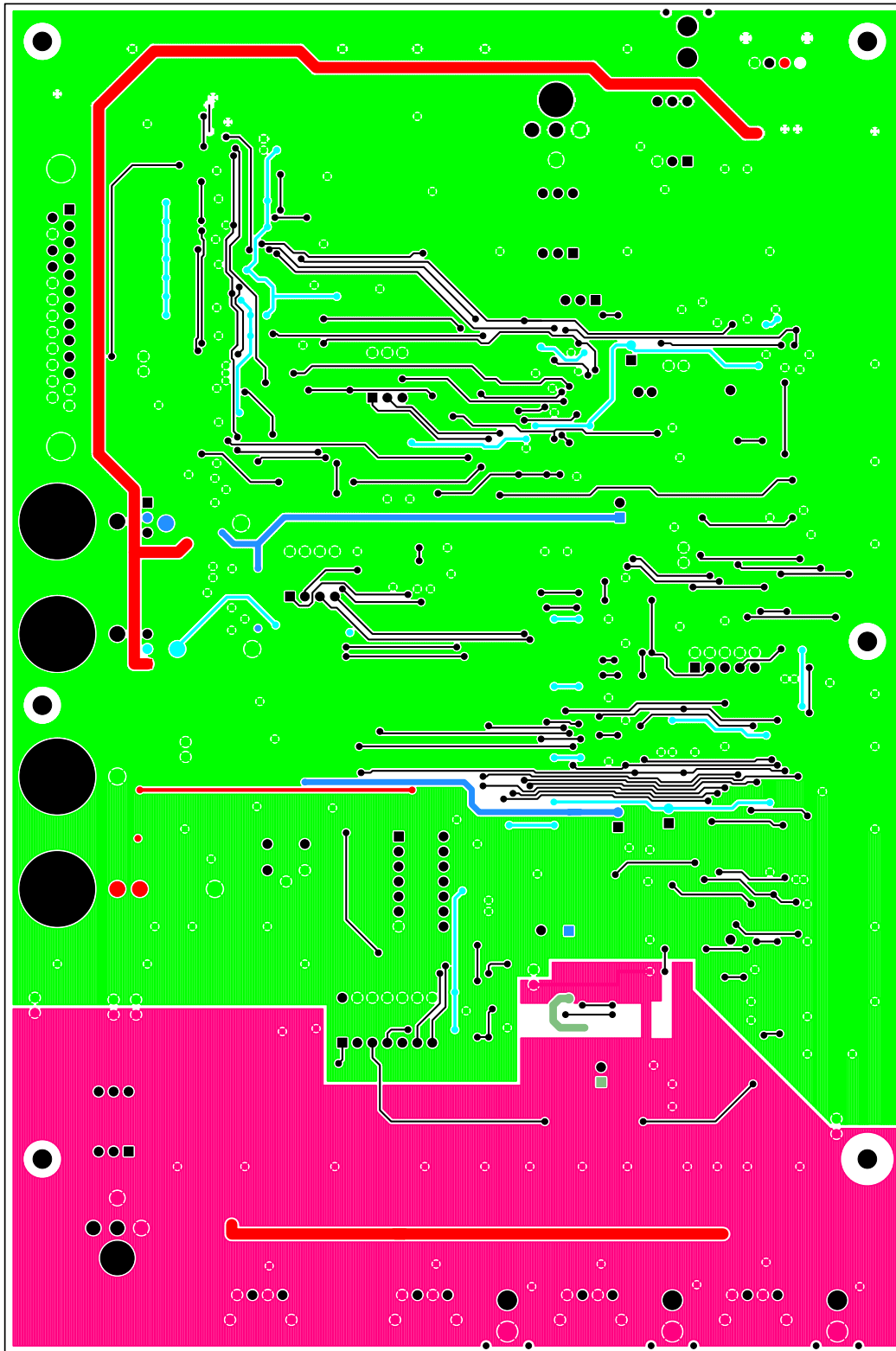


Figure 16. Bottom

**5. BILL OF MATERIAL**

Item	Qty	Reference	Part Number	Manufacturer	Description
1	41	C1 C2 C4 C5 C8 C9 C10 C11 C12 C14 C16 C18 C19 C20 C21 C23 C25 C26 C29 C30 C31 C32 C34 C35 C36 C38 C42 C44 C47 C51 C53 C59 C61 C64 C66 C67 C68 C69 C70 C72 C75	C0805C104J5RAC	KEMET	CAP, 0.1UF, X7R, 0805, 50V, 5%
2	5	C3 C6 C7 C13 C49	ECE-V1AA101WR	PANASONIC	
3	7	C15 C22 C27 C40 C54 C71 C76	C0805C103K5RAC	KEMET	CAP, 0.01UF, X7R, 0805, 50V, 10%
4	1	C17	C0805C561J5RAC	KEMET	CAP, 560PF, X7R, 0805, 50V, 5%
5	13	C24 C28 C37 C39 C45 C46 C50 C55 C62 C63 C65 C73 C74	C0805C102J5RAC	KEMET	CAP, 1000pF, X7R, 0805, 50V, 5%
6	2	C33 C56	C0805C103J5RAC	KEMET	CAP, 0.01UF, X7R, 0805, 50V, 5%
7	4	C41 C43 C52 C60	ECE-V1CS100SR	PANASONIC	CAP, 10uF, ELEC, VS SERIES, SMT CASE-A, 16V, 20%
8	1	C48	C0805C220J5GAC	KEMET	CAP, 22PF, COG, 0805, 50V, 5%
9	1	C57	C1206C224J5RAC	KEMET	CAP, 0.22UF, X7R, 1206, 50V, 5%
10	1	C58	C1206C103J3GAC	KEMET	CAP, 0.01UF, COG, 1206, 25V, 5%
11	9	D1 D2 D3 D4 D5 D6 D7 D8 D10	MBR0520LT1	MOTOROLA	SCHOTTKY POWER RECTIFIER, SMT SOD123 CASE
12	1	D9	CMD28-21VYC/TR8/T1	CHICAGO MINIA- TURE	LED, SMT, YELLOW
13	2	D11 D12	CMD28-21SRC/TR8/T1	CHICAGO MINIA- TURE	LED, SMT, RED
14	1	D13	CMD28-21VGC/TR8/T1	CHICAGO MINIA- TURE	LED, SMT, GREEN
15	5	GND1 GND2 GND3 GND4 GND5			JUMPER WIRE
16	4	GND6 GND7 GND8 GND9			DO NOT POPULATE
17	1	J1	747842-6	AMP	CONNECTOR, DB25, MALE, RT. ANGLE, 0.318 MNT
18	1	J2	NC3FD-H	NEUTRIK	CONNECTOR, XLR, FEMALE
19	1	J3	111-0102-001	E.F. JOHNSON	BINDING POST, RED
20	1	J4	111-0103-001	E.F. JOHNSON	BINDING POST, BLACK
21	1	J5	111-0104-001	E.F. JOHNSON	BINDING POST, GREEN
22	1	J6	111-0110-001	E.F. JOHNSON	BINDING POST, BLUE
23	3	J7 J8 J11	TSW-103-07-G-S	SAMTEC	STAKE HEADER, 3X1, 0.1" CTR, GOLD

**Table 4. CDB8416 Bill of Materials**

Item	Qty	Reference	Part Number	Manufacturer	Description
24	4	J9 J16 J19 J21	ARJ-2018-1	A/D ELECTRONICS	RCA JACK - RIGHT ANGLE, GOLD PLATED
25	1	J10	NC3MD-H	NEUTRIK	CONNECTOR, XLR, MALE
26	5	J12 J13 J14 J15 J17	TSW-102-07-G-S	SAMTEC	STAKE HEADER, 2X1, 0.1"CTR, GOLD
27	1	J18	TSW-105-07-G-D	SAMTEC	STAKE HEADER, 5X2, 0.1"CTR, GOLD
28	1	J20	TOTX173	TOSHIBA	OPTICAL TOSLINK TRANSMITTER
29	4	L1 L2 L3 L5	ELJ-FA470KF	PANASONIC	INDUCTOR, 47uH, 1210, TYPE FA, 10%
30	1	L4	FB73-226	J.W.MILLER	FERRITE BEAD, 0-40MHz
31	4	OPT1 OPT2 OPT3 OPT4	TORX173	TOSHIBA	OPTICAL TOSLINK RECEIVER
32	3	R1 R3 R32	CRCW0805100FT	DALE	RES, 10-OHM, 0805, 1/10W, 1%. 100ppm
33	2	R2 R95	CRCW1206271J	DALE	RES, 270, 1206, 1/8W, 5%, 200ppm
34	2	R4 R64	CRCW080590R9F	DALE	RES, 90.9 OHMS, 0805, 1/10W, 1%. 100ppm
35	12	R5 R6 R7 R8 R9 R10 R11 R12 R14 R15 R16 R17	CRCW08052001F	DALE	RES, 2K, 0805, 1/10W, 1%. 100ppm
36	1	R13	CRCW08051651F	DALE	RES, 1.65K, 0805, 1/10W, 1%. 100ppm
37	23	R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R31 R58 R66 R67 R71 R84 R86 R87 R88 R89 R90	CRCW0805473J	DALE	RES, 47K, 0805, 1/10W, 5%, 200ppm
38	1	R30	NP-RES-0805	N/A	DO NOT POPULATE
39	10	R33 R35 R37 R42 R45 R47 R76 R80 R82 R83	CRCW08051000F	DALE	RES, 100-OHM, 0805, 1/10W, 1%. 100ppm. 100ppm
40	3	R34 R65 R96	CRCW080575R0F	DALE	RES, 75.0 OHMS, 0805, 1/10W, 1%. 100ppm
41	1	R36	CRCW080556R2FKEA	DALE	RES, 56.2 OHMS, 0805, 1/8W, 1%. 100ppm
42	8	R38 R39 R53 R54 R68 R75 R91 R94	ERJ-6GEYJ330V	PANASONIC	RES, 33 OHMS, 1/10W,0805, 5%
43	19	R40 R41 R43 R44 R46 R48 R56 R57 R60 R62 R69 R70 R72 R73 R74 R77 R78 R79 R81	CRCW0805000FT	DALE	RES, 0-OHM, 0805
44	5	R49 R50 R51 R52 R61	CRCW08051R0J	DALE	RES, 1 OHM, 0805, 1/8W, 5%, 300ppm
45	1	R55	NP-RES-1206	N/A	DO NOT POPULATE
46	1	R59	CRCW12061001F	DALE	RES, 1K, 1206, 1/8W, 1%, 100ppm
47	1	R63	CRCW0805348RFKEA	DALE	RES, 348 OHMS, 0805, 1/8W, 1%. 100ppm

**Table 4. CDB8416 Bill of Materials (Continued)**



Item	Qty	Reference	Part Number	Manufacturer	Description
48	1	R85	CRCW1206622J	DALE	RES, 6.2K, 1206, 1/8W, 5%, 200ppm
49	2	R92 R93	CRCW0805511J	DALE	RES, 510, 0805, 1/8W, 5%, 200ppm
50	1	S1	76SB04	GRAYHILL	4 POSITION DIP SWITCH
51	1	S2	PTS645TL50	C&K	SWITCH, MOMENTARY, PUSHBUTTON
52	1	S3	76SB07	GRAYHILL	7 POSITION DIP SWITCH
53	1	S4	76SB03	GRAYHILL	3 POSITION DIP SWITCH
54	3	T1 T2 T3	67129600	SCHOTT	SCHOTT XFMR, ISOLATION FOR DIG AUDIO, SHIELDED
55	1	U1	LM1117MPX-3.3	NATIONAL SEMICONDUCTOR	REGULATOR, VOLTAGE, FIXED, 3.3V, SOT-223
56	15	U2 U4 U5 U6 U11 U12 U14 U15 U17 U18 U23 U24 U25 U26 U27	74VHC125MTC	FAIRCHILD SEMICONDUCTOR	IC, QUAD BUFFER WITH HIGH-Z--STATE OUTPUTS, TSSOP14-173
57	1	U3	SN74HC574DW	FAIRCHILD	IC, OCTAL D-TYPE FLIP-FLOPS, TSSOP20-173
58	1	U7	DS1233AZ-10	DALLAS SEMICONDUCTOR	IC, 3.3-VOLT ECONO RESET, SOT223
59	2	U8 U16	SN74AC32MTC	FAIRCHILD SEMICONDUCTOR	QUAD 2-INPUT POS-OR GATE, TSSOP14-4.4mm
60	2	U9 U10	NC7SZ04M5	FAIRCHILD	TINYLOGIC UHS INVERTER, SOT23-5
61	3	U13 U21 U22	NC7SZ125M5	FAIRCHILD	TINYLOGIC UHS BUFFER W/ HIGH-Z-STATE OUTPUT, SOT23-5
62	1	U19	CS8416-CS	CRYSTAL SEMICONDUCTOR	IC, 192kHz DIGITAL AUDIO RECEIVER, SO28-300
63	1	U20	CS8406-CS	CRYSTAL SEMICONDUCTOR	IC, 192kHz DIGITAL AUDIO TRANSMITTER, SO28-300
64	1	X4	313-6477-032	E.F.JOHNSON	STANDOFF, #4-40,.25 HEX x .875 LG
65	1	Y1	CX21AF-12.288MHZ	CAL CRYSTAL	OSCILLATOR, 12.288MHZ, FULLSIZE CASE
66	3	Z1 Z2 Z3	P6KE6.8	MOTOROLA	TRANSIENT SUPPRESSOR, 6.8V
67	4	J1,J4,J6,J7	L-1.5x.25" TIN x .25" TIN, TYP E E	SQUIRES ELECTRONICS	BINDING POST WIRE
68	6	X1 X2 X3 X4 X5 X6	H343-ND	DIGI-KEY	SCREW, 4-40, 5/16", MACHINE
69	4	YX2	8134-HC-5P2	AUGAT	SOCKET, PIN, POP-IN, SMALL, GOLD

**Table 4. CDB8416 Bill of Materials (Continued)**

## 6. REVISION HISTORY

Release	Changes
DB3	-Updated Figure 12. -Updated Item 41 and 47 in Section 5 Bill of Material.

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### Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.  
To find one nearest you go to [www.cirrus.com](http://www.cirrus.com)

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