CRD4630-10

CrystalClear® AC '97 Six Channel Low Cost PCI Audio Reference Design

Features

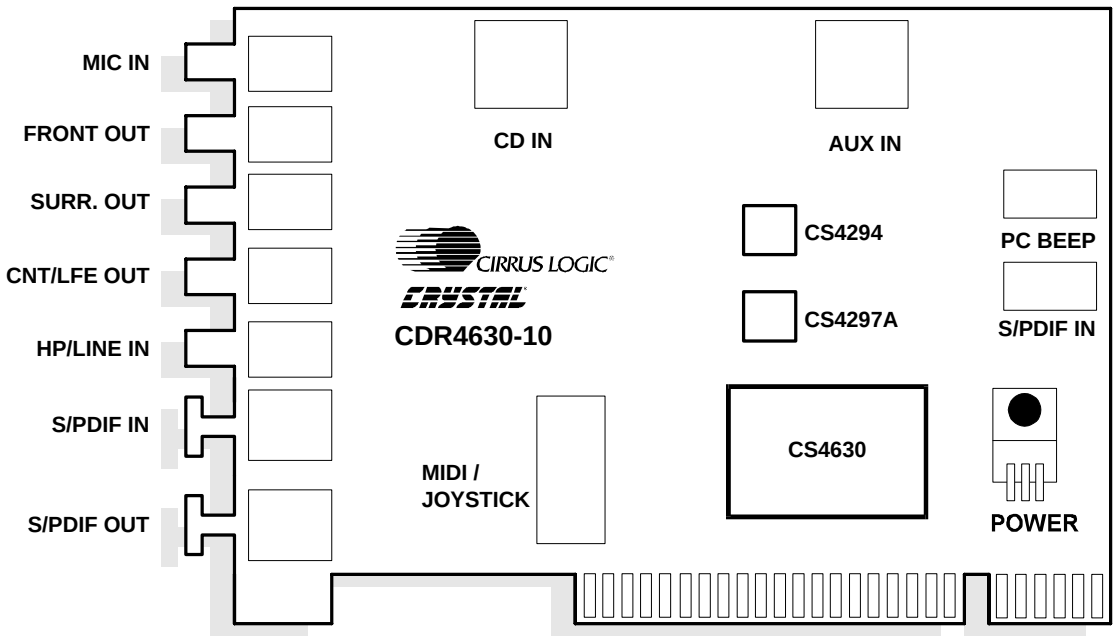
- Six Channel Low Cost High Performance PCI Audio Accelerator Add-in Card
- CS4630 PCI Audio Controller with CS4297A and CS4294 AC '97 Audio Codecs
- Complete Suite of Analog I/O Connections:
  - Line, Mic, CD, and Aux Inputs
  - Front, Surround, and Center/LFE Outputs
  - Headphone Output
- S/PDIF (IEC-958) Digital Output
- Coaxial and Optical S/PDIF Digital Inputs
- PC Beep Input
- Joystick/MIDI Interface
- Two-layer Low Cost Adapter Board
- Exceeds the Microsoft® PC 99 Audio Performance Specifications.
- Complies with the Intel® AC '97 Version 2.1 Specification

Description

The CRD4630-10 is a low cost PCI add-in board reference design that showcases Cirrus Logic's six channel audio capabilities. The board contains three stereo outputs for front L/R, surround L/R, and center/low frequency (LFE) speakers. The card features a CS4630 controller, CS4297A primary audio codec and CS4294 secondary audio codec. The audio codecs include stereo 20-bit DACs and stereo 18-bit ADCs.

The CRD4630-10 reference design is available by ordering the CMK4630-10 manufacturing kit. Use this kit to help you develop high quality PCI add-in cards and PC motherboard audio designs. The CMK4630-10 includes a full set of schematic design files (OrCAD® 7.2 format), PCB job files (PADS® ASCII), PCB artwork files, and bill of materials. This design is production ready and can easily be modified to meet your specific requirements.

ORDERING INFO
CMK4630-10 (Manufacturing Kit)



Preliminary Product Information | This document contains information for a new product. Cirrus Logic reserves the right to modify this product without notice.

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1. GENERAL INFORMATION

The CRD4630-10 is a PCI add-in card that features the CS4630 PCI audio controller coupled with the CS4297A and CS4294 AC '97 audio codecs. The CRD4630-10 is a low cost board with a rich feature set and industry-leading audio performance. In order to maintain a high level of audio quality, careful consideration has been given to component selection and PCB layout. For detailed information on audio quality measurements in a PC environment refer to *Personal Computer Audio Quality Measurements* [6].

The CS4297A and CS4294 are mixed-signal serial audio codecs compliant with the Intel® *Audio Codec '97 Specification* [1] (referred to as AC '97). The CS4297A is compliant with revision 2.1 of the AC '97 specification, while the CS4294 is AC '97 revision 2.0 compliant. These audio codecs feature 20-bit stereo DACs, 18-bit stereo ADCs, and analog audio mixers. The CS4297A line-level analog outputs include: Line Out, Alt Line Out, and Mono Out. The CS4297A line-level analog inputs include: Line In, CD, Video, Aux, Mic1, Mic2, PC Beep, and Phone. The CS4294 line-level analog outputs include: Line Out and Alt Line Out. The CS4294 line-level analog inputs include: Line In, CD, Aux, and Mic1. The input signals can be routed to the ADC for recording, or mixed together for recording and direct playback. The CS4297A and CS4294 have register sets used to control various features such as volume levels, mutes and signal routing. A high level of audio quality is maintained throughout the signal chain, exceeding the specifications presented in Chapter 17 of Microsoft's® *PC 99 System Design Guide* [7] (referred to as PC 99). For detailed CS4297A information refer to *CS4297A CrystalClear® SoundFusion® Audio Codec '97* [4]. For detailed CS4294 information refer to *CS4294 SoundFusion® Audio/Docking Codec '97* [5].

The CS4630 audio controller streams digital audio data and MIDI over the PCI bus. It also performs hardware-controlled signal processing and sample rate conversion. The CS4630 features several peripheral interfaces including MIDI I/O, joystick and game controller input, hardware volume control, and several general purpose I/Os. For detailed CS4630 information refer to *CS4630 CrystalClear® SoundFusion® PCI Audio Accelerator* [3].

The CS4297A, CS4294, and CS4630 communicate through a 5-wire serial digital interface known as the AC-Link, see Figure 1. The AC-Link is used to transfer digital audio between the devices. It is also used to send commands from the CS4630 to the audio codec registers. For more information on the AC-Link, see the AC '97 specification.

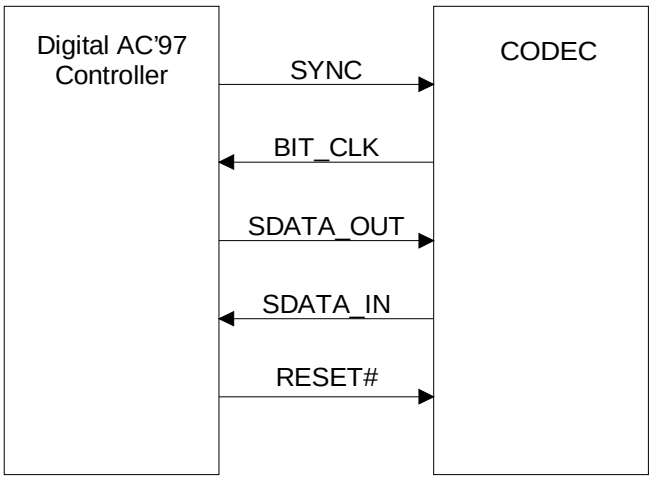

Figure 1. AC-Link Connections

2. SCHEMATIC DESCRIPTIONS

This section describes the CRD4630-10 schematic designs shown in figures 1 through 12. These schematics are also available in the CMK4630-10 manufacturing kit as OrCAD 7.2 files to be used or modified for individual designs.

2.1 Block Diagram

The block diagram, shown in Figure 2, illustrates schematic section interconnection. The schematic is divided into nine blocks: Analog In, Analog Out, Line In + Headphone Out, CS4294, CS4297A, CS4630, Digital I/O, PCI Bus, and Power.

2.2 Analog In

The CRD4630-10 has three stereo (LINE IN, CD IN, and AUX IN) and two mono (MIC IN and PC SPEAKER IN) analog inputs. See section 2.4.1 for LINE IN details.

The 220 pF capacitors located on the MIC input, and the ferrite beads located on the AUX, CD, and PC_BEEP inputs are provided for EMI suppression. These components may be removed if EMC testing determines they are not required.

All analog inputs except PC_BEEP are AC-coupled through a 2.2 µF electrolytic capacitor, minimizing the low frequency roll-off. PC_BEEP is AC- coupled through a 0.1 µF capacitor.

2.2.1 CD Input

The CD input, shown in Figure 3, is passed through a divider circuit that does not reduce the voltage. This allows for connection of line-level sources up to 1 Vrms. The divider circuit can be reconfigured to allow for sources up to 2 Vrms.

The internal CD audio connection, shown in Figure 3, utilizes a pseudo-differential interface with CD_COM as the common return path for both left and right channels. This arrangement reduces common mode noise picked up along the CD signal path.

2.2.2 AUX Input

The AUX input, shown in Figure 3, is passed through a divider circuit that does not reduce the voltage. This allows for connection of line-level sources up to 1 Vrms. The divider circuit can be reconfigured to allow for sources up to 2 Vrms.

2.2.3 Microphone Input

The MIC input pre-amp circuit, shown in Figure 4, uses a Motorola MC33078D low noise dual op-amp. One op-amp provides an 18 dB gain stage for the MIC signal. The other op-amp buffers the phantom power supply. Phantom power is derived from the +5 V analog supply and buffered by U1A to provide a maximum of +4.2 V with no load and a minimum of +2.0 V under a 0.8 mA load, as required by PC 99. Also included are 3 dB rolloffs at 60 Hz and 15 kHz, as recommended by PC 99.

An alternate, low-cost MIC circuit is also offered. This circuit maintains the PC 99 requirements for both MIC phantom power and frequency response, without providing any boost. The optional primary audio codec, CS4201, contains up to 30 dB of internal microphone boost. If replacing the CS4297A with a CS4201, external boost is not needed.

Both the CS4297A and CS4294 receive the MIC signal. This allows for several capture options.

2.2.4 PC_BEEP Input

The PC_BEEP input, shown in Figure 3, routes the PC's beep tones through the CS4297A. A PC Beep Bypass feature is used that allows system beep tones to be heard during a system reset or boot-up.

2.3 Analog Out

The CRD4630-10 has three stereo output signals providing six channels of audio output (FRONT OUT, SURROUND OUT, and CENTER/LFE OUT).

The FRONT, SURROUND, and CENTER/LFE outputs, shown in Figure 5, provide 1 Vrms line-level outputs. The 220 pF capacitors provided are for EMI suppression and may be removed if EMC testing determines they are not required. Each output is AC-coupled through a 10 µF electrolytic capacitor, minimizing the low frequency roll-off. Also provided are 220 kΩ bleed-off resistors, maintaining the audio jacks at 0 V DC.

2.4 Line In + Headphone Out

Audio jack J20, shown in Figure 6, receives either the LINE input or the HEADPHONE output. Set jumpers JP2 and JP3 according to the positions listed in Table 1 to determine the functionality of J20.

The 220 pF capacitors provided are for EMI suppression. These components may be removed if EMC testing determines they are not required.

JP2	JP3	Signal Enabled
1-2	1-2	Line Input
2-3	2-3	Headphone Output

Table 1. JP2 and JP3 Position Definitions

2.4.1 Line Input

The LINE input, shown in Figure 6, is passed through a divider circuit reducing the voltage by 6 dB allowing connection of line-level sources up to 2 Vrms. This input is AC-coupled through 2.2 µF electrolytic capacitors to minimize the low frequency roll-off.

2.4.2 Headphone Output

The HEADPHONE output circuit, shown in Figure 6, consists of a Philips TDA1308 low noise headphone amplifier connected to the ALT_LINE_OUT signal of the CS4297A. The circuit has a gain of 3 dB and is capable of driving stereo headphones with impedances of 32 Ω or greater. The TDA1308 uses a single ended supply and is biased with Vref from the CS4297A. R119 and R120 are included for short-circuit protection.

An option is provided to bypass the amplifier when replacing the CS4297A with a CS4201 audio codec. Since the CS4201 contains an integrated headphone amplifier, an external headphone amplifier circuit is not needed.

2.5 CS4294

The CS4294, shown in Figure 7, acts as the secondary audio codec for the CRD4630-10. This audio codec receives the CRD4630-10 AUX, CD, MIC, and LINE analog inputs. The CS4294 LINE_OUT and ALT_LINE_OUT signals connect respectively to the CRD4630-10 SURROUND OUT and CENTER/LFE OUT speaker jacks. All the signals are AC-coupled.

The primary audio codec, CS4297A, generates the BIT_CLK AC-Link signal for the CS4294. The SDATA_IN/ASDIN2 AC-Link signal, created by the CS4294, is used to communicate with the CS4630. ASDIN2 has a 47 Ω series termination resistor to prevent reflections on the AC-Link.

2.6 CS4297A

The CS4297A, shown in Figure 8, acts as the primary audio codec for the CRD4630-10. This audio codec receives the CRD4630-10 PC_BEEP and MIC analog inputs. The CS4297A LINE_OUT and ALT_LINE_OUT signals connect respectively to the CRD4630-10 FRONT OUT and HEADPHONE OUT speaker jacks. All the signals are AC-coupled. Unused analog inputs should be tied to Vrefout (CS4297A pin 28) or AC-coupled to ground through a capacitor to prevent noise.

The BIT_CLK and SDATA_IN/ASDIN AC-Link signals, created by the CS4297A, are used to communicate with the CS4630. Both outputs have a

47 Ω series termination resistor to prevent reflections on the AC-Link.

An option is provided to replace the CS4297A with a CS4201 audio codec. In this case, C131 will need to be changed to a 2.2 µF ceramic capacitor.

2.7 CS4630

The CS4630 audio controller, shown in Figure 9, acts as a bridge between the PCI bus and the audio codecs. Communication between the CS4297A, CS4294, and CS4630 is achieved through the AC-Link signals. The CS4630 generates three AC-Link signals, SYNC, SDOUT, and RESET#. The SYNC and SDOUT outputs have a 47 Ω series termination resistor to prevent reflections on the AC-Link.

An external EEPROM, U7, is used to provide a Vendor ID and Subsystem ID to the CS4630 at power-up. The EEPROM is connected to the CS4630 through a data and clock signal, EEDAT and EECLK. The EEPROM interface is enabled by connecting the EEPDIS pin to digital ground.

The CS4630 requires three power supply voltages: +3.3 V, +5 V, and +2.5 V. The PCIVDD pins supply +3.3 V to the CS4630 PCI bus drivers. The CRYVDD pin supplies +3.3 V to the internal phase lock loop and crystal oscillator. The VDD5REF pin is a +5 V pseudo supply for the PCI bus drivers. This supply enables the PCI interface to support +5 V signals. The CVDD pins supply +2.5 V to the core stream processor inside the CS4630. All power supply pins have a 0.1 µF decoupling capacitor connected to digital ground.

Unused inputs and bidirectional pins on the CS4630 are tied to their respective inactive levels through 220 kΩ resistors.

2.8 Digital I/O

The CRD4630-10 digital I/O capabilities include the Joystick/MIDI interface as well as several S/PDIF I/O options: S/PDIF optical output, S/PDIF optical input, and S/PDIF coaxial input.

2.8.1 Joystick/MIDI

The MIDIOUT buffer driver circuit, shown in Figure 10, provides the +5 V TTL compatible output on J12. If a +3.3 V compatible output is sufficient, remove this circuit and populate R65 to bypass the buffer circuit. Capacitors C71, C78, C81, C84, C86, and C89 are provided for EMI suppression and can be removed if EMC testing shows they are not required. Capacitors C72, C75, C79, C82, C87, C90, C91 and C95 are functional to the joystick circuitry, as well as provide for EMI suppression, and must not be removed.

The Joystick/MIDI output on the CRD4630-10 is not located on the primary bracket, shown in Figure 18. A short cable is provided to bring the Joystick/MIDI signal to a secondary bracket, shown in Figure 19, when using an analog joystick. If using a USB joystick, the secondary bracket is not needed.

2.8.2 S/PDIF

The S/PDIF (IEC-958) input and output designs, shown in Figure 11, are compatible with digital inputs and outputs on consumer devices such as consumer stereo receivers and MiniDisc recorders. The CRD4630-10 includes an optical S/PDIF output and two S/PDIF input choices, optical and coaxial. As shown in Table 2, jumper JP1 controls which input is enabled.

JP1	Signal Enabled
1-2	S/PDIF In Coaxial
2-3	S/PDIF In Optical

Table 2. JP1 Position Definitions

The S/PDIF output operates at a fixed sampling frequency of 48 kHz. The S/PDIF inputs are capable of accepting S/PDIF signals with a sample frequency from 22 kHz up to 48 kHz.

The optical S/PDIF input and output use industry standard TOSLINK, a digital optical transmitter and receiver. The input uses a Toshiba TORX-173 digital optical receiver. The output uses a Toshiba TOTX-173 transmitter.

2.9 PCI Bus

The *PCI Local Bus Specification*, Revision 2.2 [2] requires each unused +3.3 V power pin be connected with an average of 0.01 µF capacitance. Three 0.047 µF capacitors in parallel, shown in Figure 12, provide the required capacitance. An option to omit the +3.3 V regulator is offered if this voltage is known to be provided on the PCI bus. This is done by populating several 0 Ω resistors: R84, R85, and R86.

2.10 Power

The CRD4630-10 has three linear voltage regulators, shown in Figure 13, supplying the three required power supply voltages: +5 V, +3.3 V, and +2.5 V. The +5 V supply is used exclusively for the analog audio circuitry surrounding the CS4297A and CS4294. The +3.3 V supply is used for the audio codecs and controller. The +2.5 V supply, labeled +CVDD, is used exclusively for the CS4630.

The +3.3 VD and +CVDD digital power signals are supplied from the +5 V_PCI signal located on the PCI bus. A LM1117CST-3.3 regulator supplies +3.3 VD while a LM2937IMP-2.5 regulator supplies +CVDD. A separate regulator is recommended for the analog voltage supply to provide good audio signal quality. A Motorola MC78M05 regulates the +12 VD supply from the PCI bus down to a clean +5 VA analog supply. For the best audio performance, the analog voltage regulator should be located near the audio codecs.

2.11 Component Selection

Great attention was given to the particular components used on the CRD4630-10 board with cost, performance, and package selection as the most important factors. Listed are some of the guidelines used in the selection of components:

- No components smaller than 0805 package.
- Single package components; no resistor packs.
- 8-pin devices are in surface mount packages.

2.12 EMI Components

A number of capacitors and inductors are included to meet EMI compliance tests. These component values are suggestions only. Actual component values will depend on your PC board layout and other design factors. Modify these values as needed in order to achieve an acceptable EMI profile. Please refer to *Printed Circuit Board Design Techniques for EMC Compliance* [8] for further information on EMI compliance techniques.

3. GROUNDING AND LAYOUT

The component layout and signal routing of the CRD4630-10 provides a good model for laying out your own PCI add-in card. PCI bus based add-in cards have explicit requirements on trace lengths that are not imposed on motherboard designs. These trace length limits for add-in cards are as follows:

- Maximum trace length for 32-bit signals on 32-bit and 64-bit cards is 1.5 inches.
- Maximum trace lengths for signals on the 64-bit extension are 2 inches.
- Trace length for the PCI CLK signal is 2.5 inches ± 0.1 inch.
- The PCI CLK signal must drive only one load.

Please refer to the *PCI Local Bus Specification*, Revision 2.2 [2] for information on routing PCI bus signals on a motherboard.

3.1 Partitioned Voltage and Ground Planes

The CRD4630-10 is partitioned into separate digital and analog sections to prevent digital noise from affecting the performance of the analog circuits. The analog section is completely isolated from the digital section, with each section having their own separate ground plane. All analog components, power traces and signal traces are routed over the analog ground plane. Digital components, power traces and signal traces are not allowed to crossover into the analog section.

The audio codecs, CS4297A and CS4294, are located over the transition point between the analog and digital ground planes. The pins are arranged on the audio codecs so that the analog and digital signals are separated from each other. The analog and digital ground planes must be tied together for the codec to maintain proper voltage references. For best results, the two ground planes are tied together with a single wide trace between the CS4297A and the CS4294, near their digital ground pins.

Data converters are generally susceptible to noise on the crystal pins. In order to reduce coupling noise on these pins, the area around the crystal and its signal traces is filled with copper on the top and bottom of the PCB and attached to digital ground.

A separate chassis ground provides a reference plane for all the EMI suppression components. The chassis ground plane is connected to the analog ground plane at the external jacks.

3.2 CS4297A/CS4294 Layout Notes

Refer to the *CS4297A CrystalClear® SoundFusion® Audio Codec '97* [4] and the *CS4294 SoundFusion® Audio/Docking Codec '97* [5] data sheets for partitioning and bypass capacitor placement. Pay close attention to bypass capacitors on the REFFLT, AFLT1, AFLT2 pins, and power supply capacitors.

4. REFERENCES

1) Intel®, Audio Codec ’97 Component Specification, Revision 2.1, May 22, 1998.
http://developer.intel.com/ial/scalableplatforms/audio/

2) PCI Special Interest Group, PCI Local Bus Specification, Revision 2.2, December 18, 1998.
http://www.pcisig.com/developers/specification/

3) Cirrus Logic, CS4630 CrystalClear® SoundFusion® PCI Audio Accelerator Data Sheet
http://www.cirrus.com/pubs/cs4630.pdf

4) Cirrus Logic, CS4297A CrystalClear® SoundFusion® Audio Codec ’97 Data Sheet
http://www.cirrus.com/pubs/cs4297A.pdf

5) Cirrus Logic, CS4294 SoundFusion® Audio/Docking Codec ’97 (AMC’97) Data Sheet
http://www.cirrus.com/pubs/cs4294.pdf

6) Steve Harris, Clif Sanchez, Personal Computer Audio Quality Measurements, Ver 1.0
http://www.cirrus.com/pubs/meas100.pdf

7) Microsoft®, PC 99 System Design Guide, Version 1.0, July 1999,
http://www.microsoft.com/hwdev/desguid/

8) M. Montrose. Printed Circuit Board Design Techniques for EMC Compliance, IEEE Press, New York: 1996.

5. DRAWINGS

- Schematic drawings
- Layout drawings
- Bracket drawings

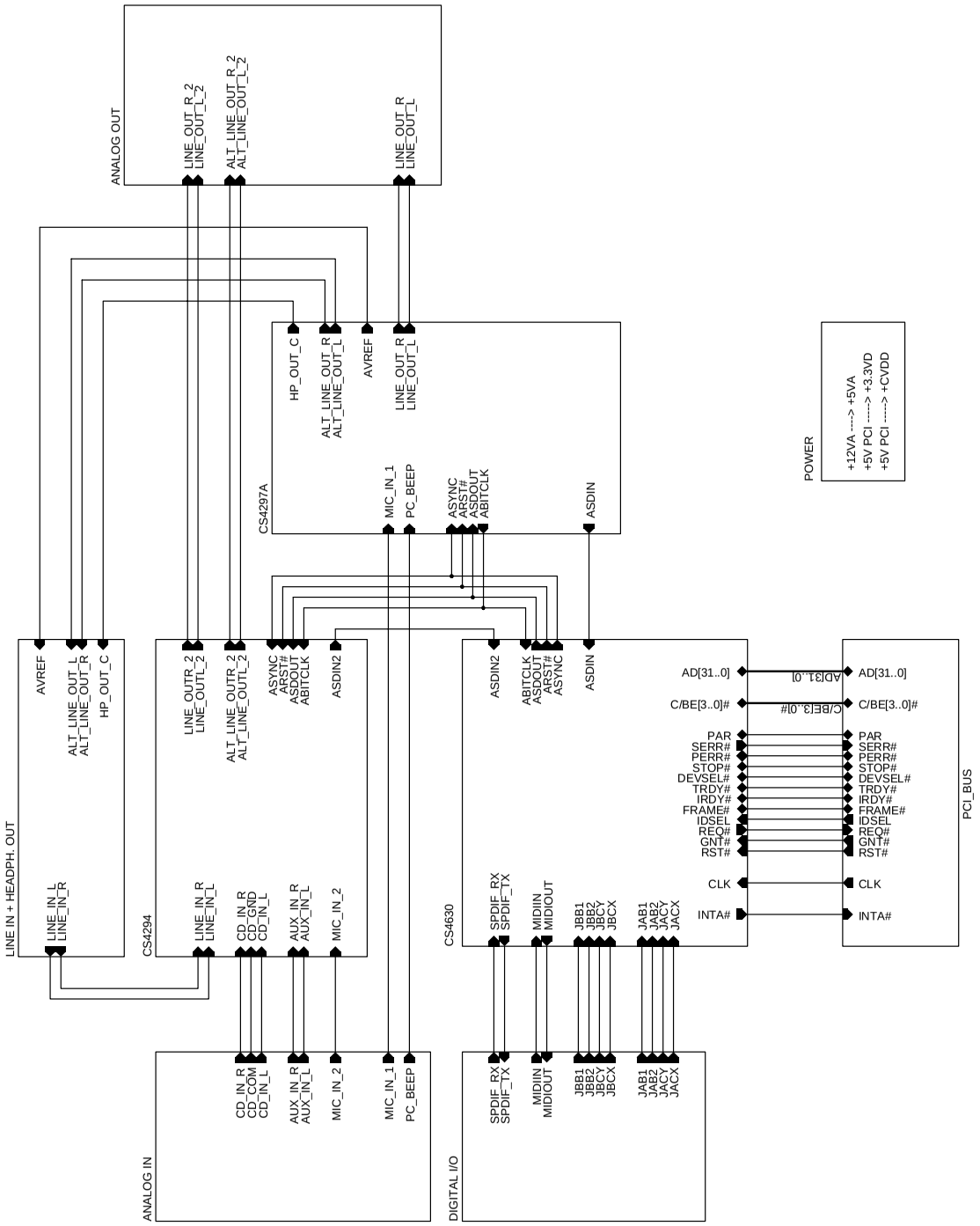

Figure 2. CRD4630-10 Block Diagram

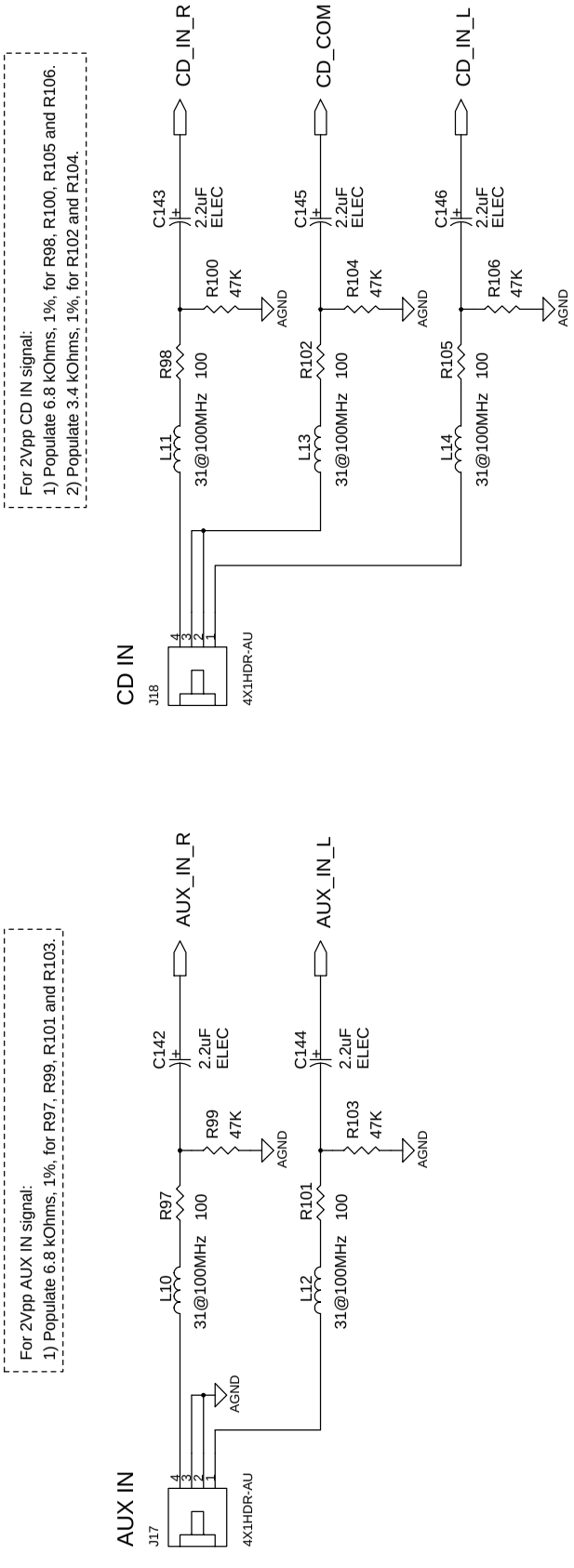

Figure 3. Aux, CD, and PC BEEP Inputs

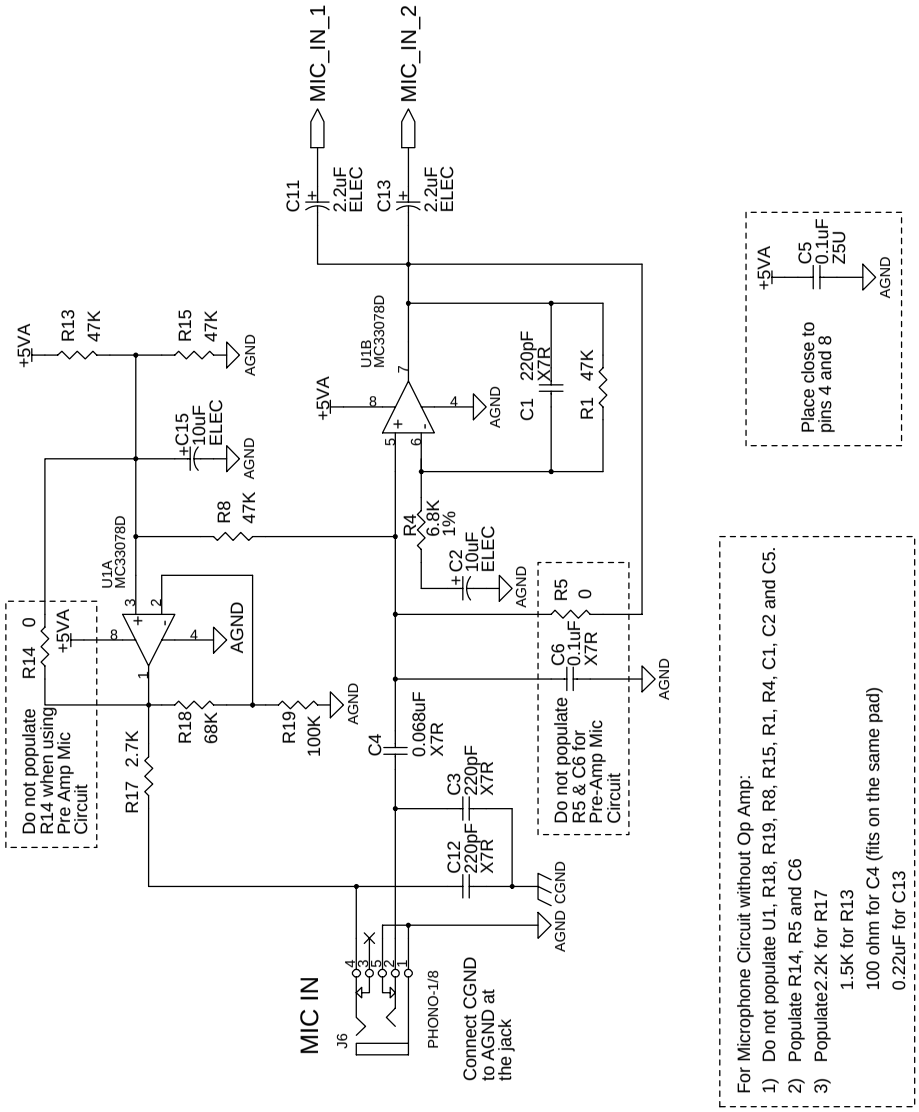

Figure 4. Microphone Input

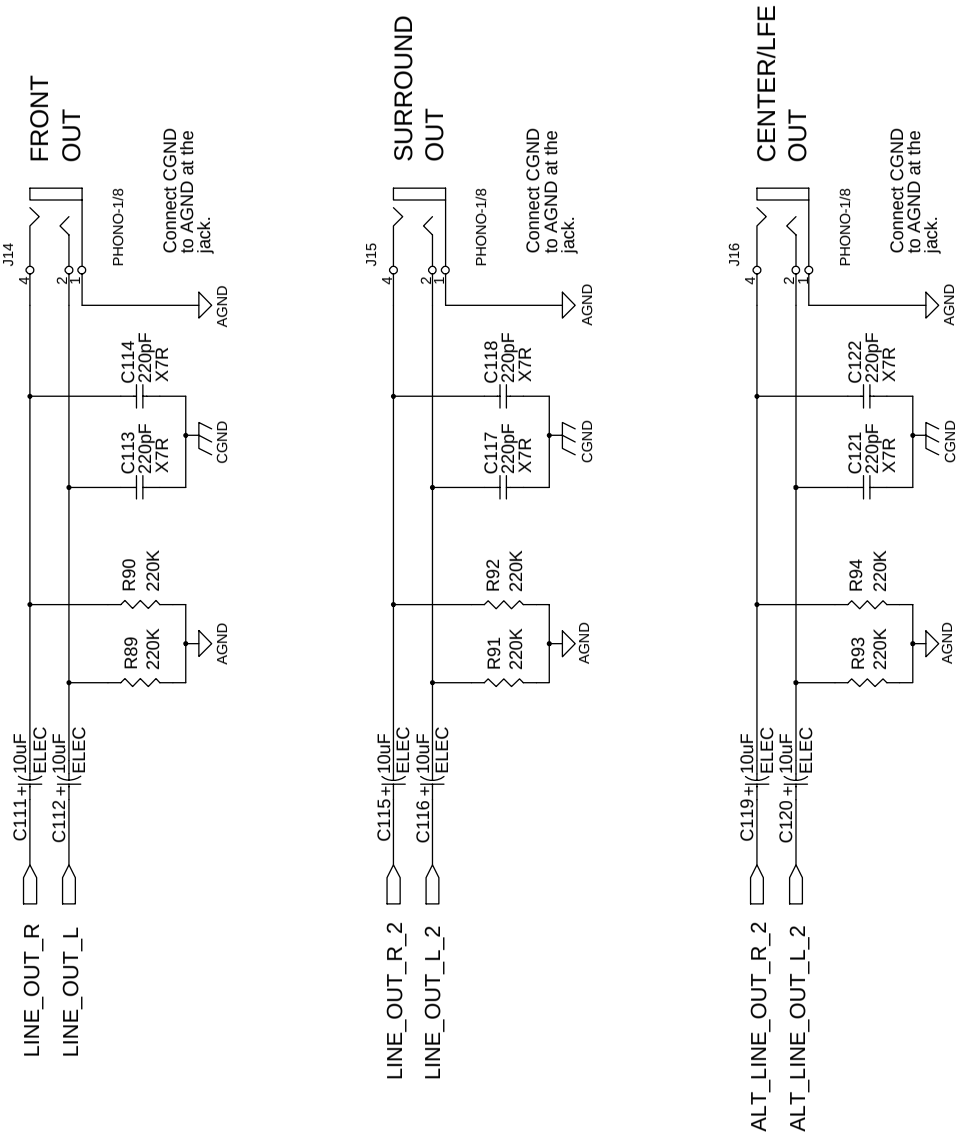

Figure 5. Front, Surround, and Center/LFE Outputs

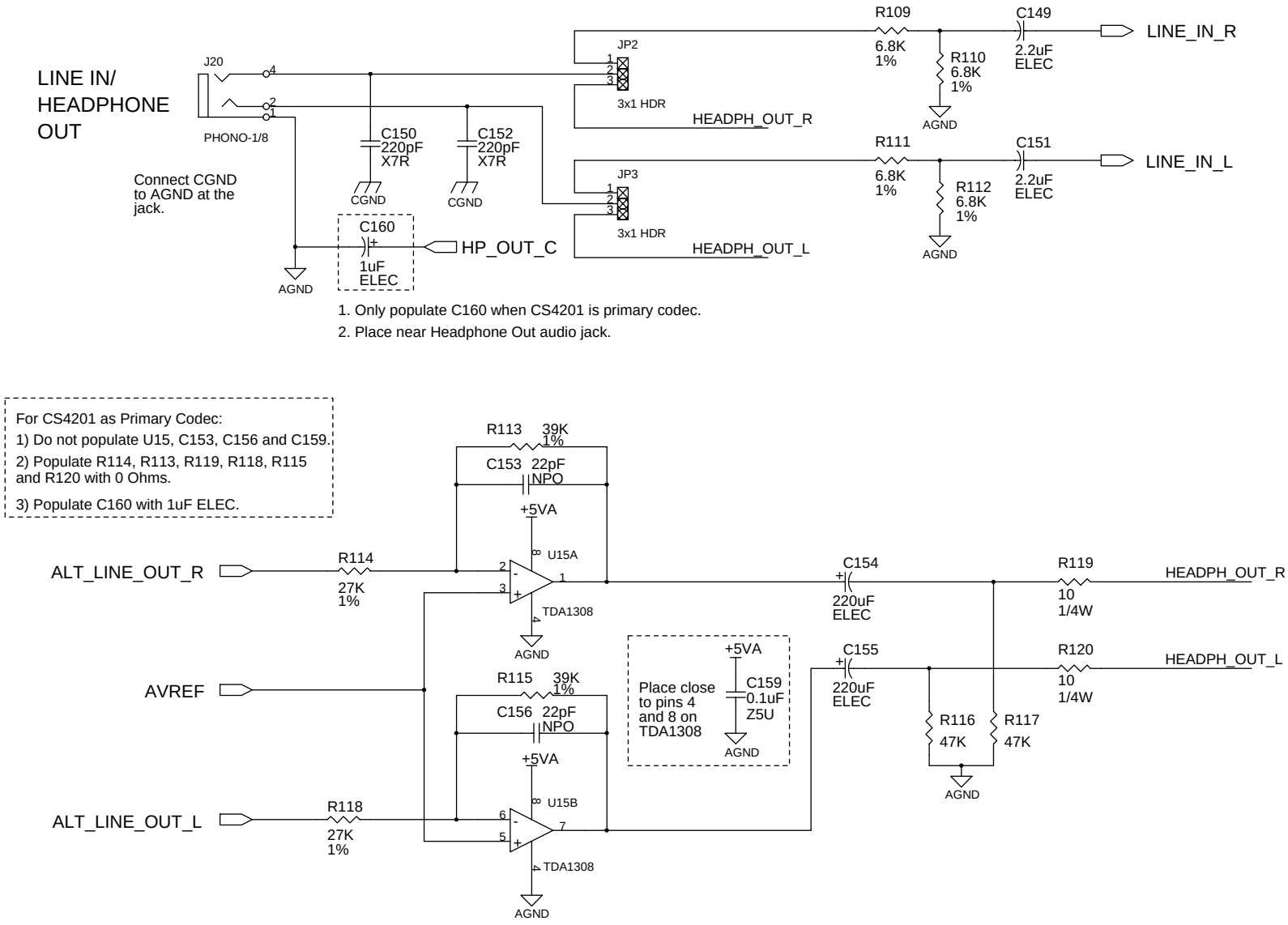

Figure 6. Line Input and Headphone Output

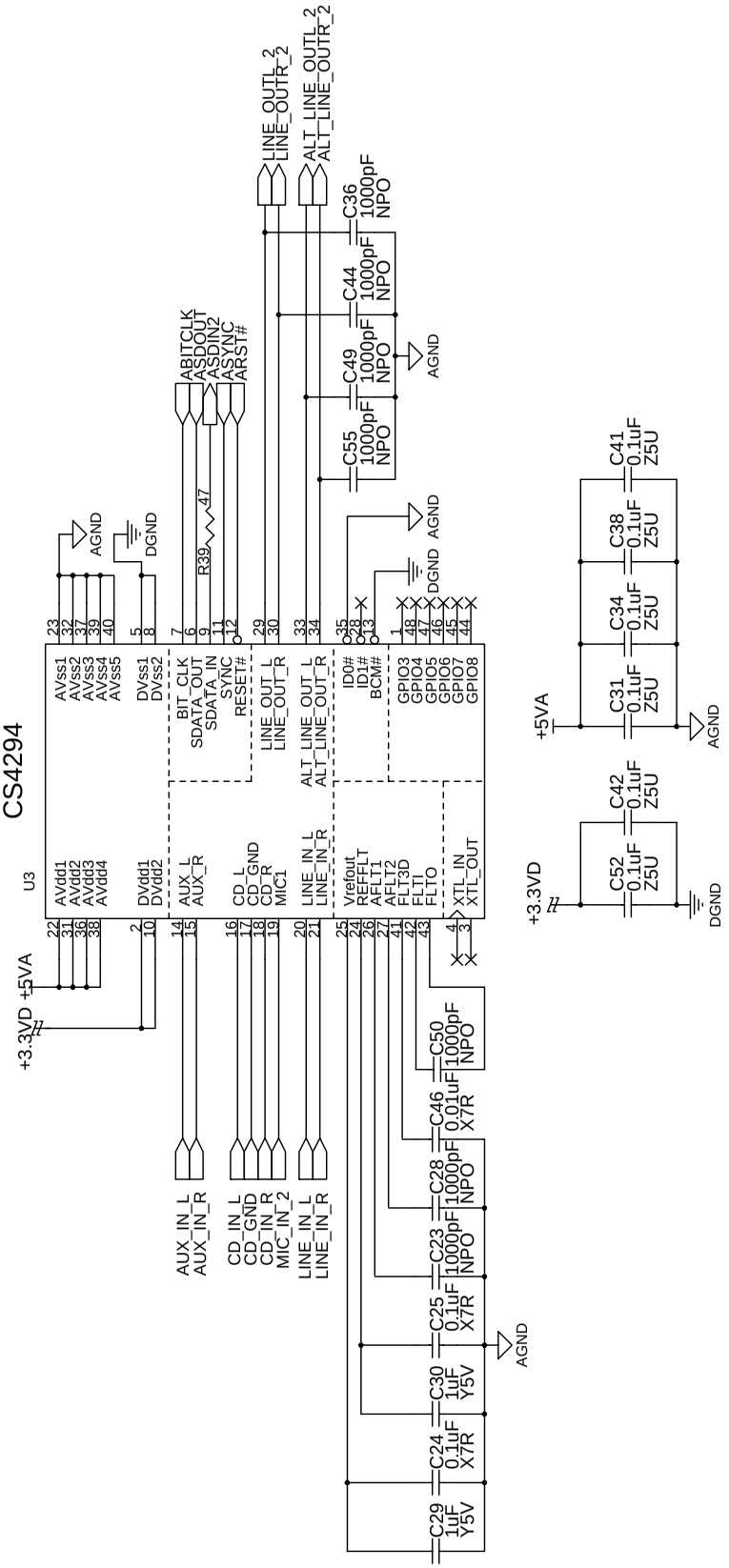

Figure 7. Secondary Audio Codec, CS4294

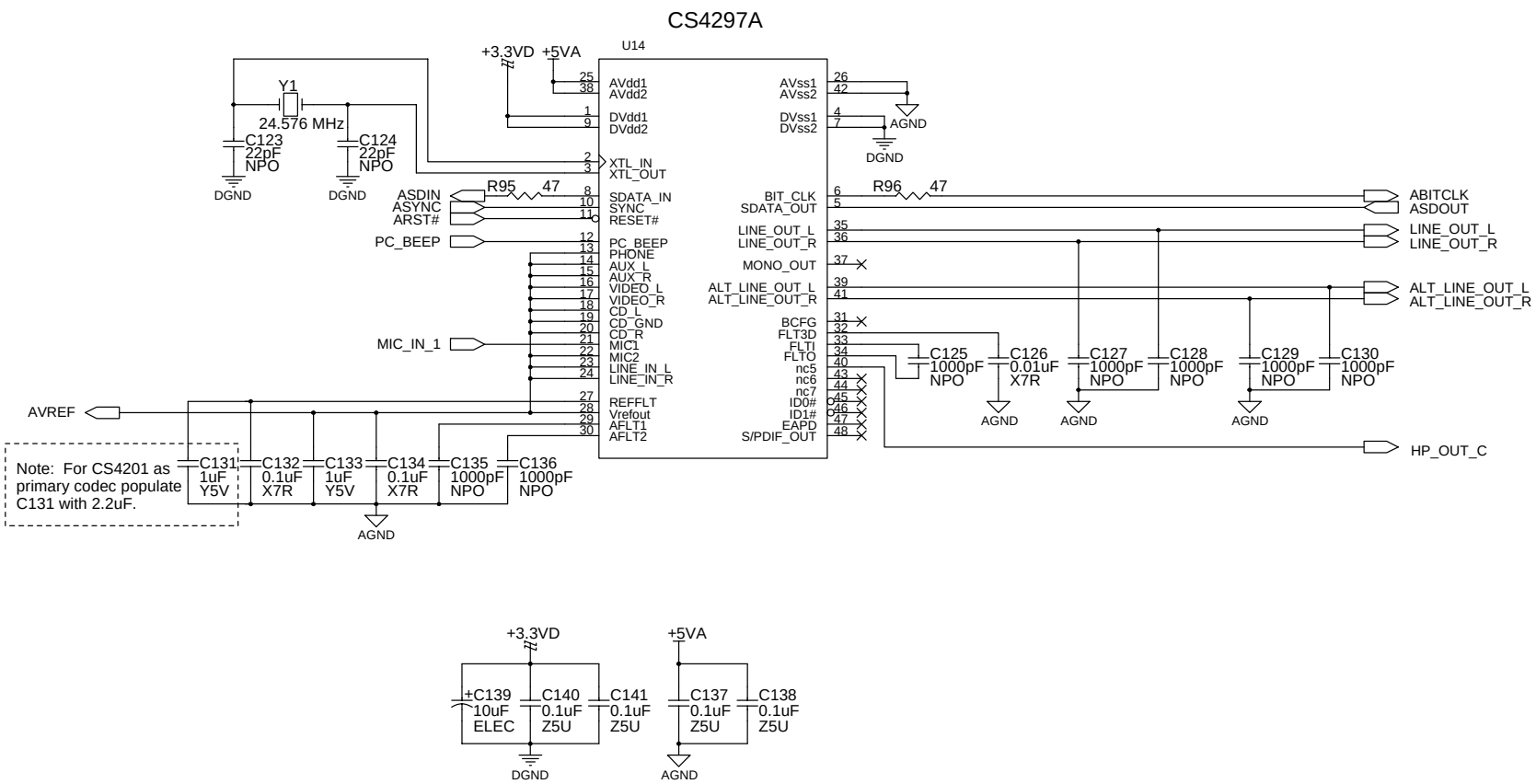

Figure 8. Primary Audio Codec, CS4297A

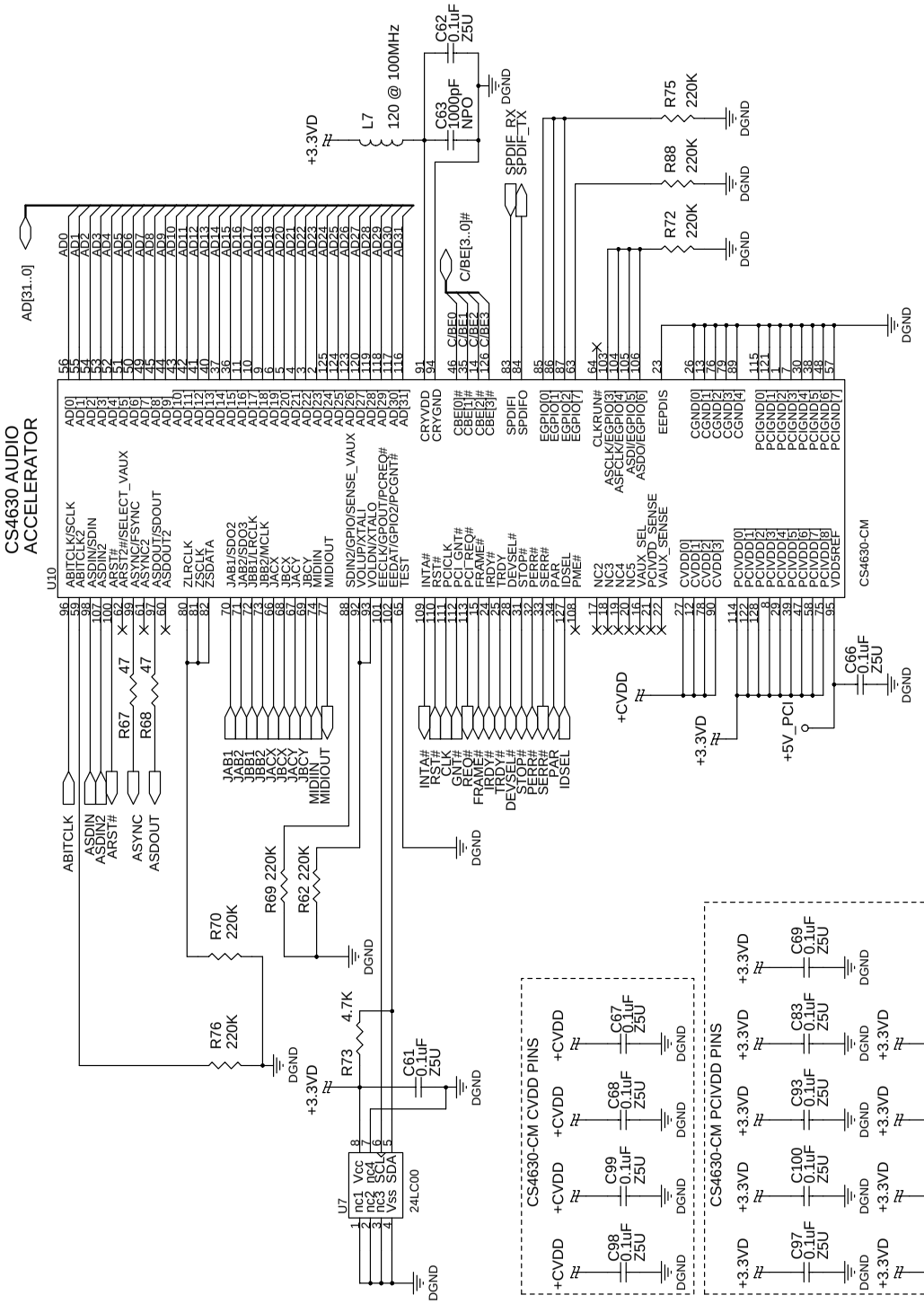

Figure 9. Audio Controller, CS4630

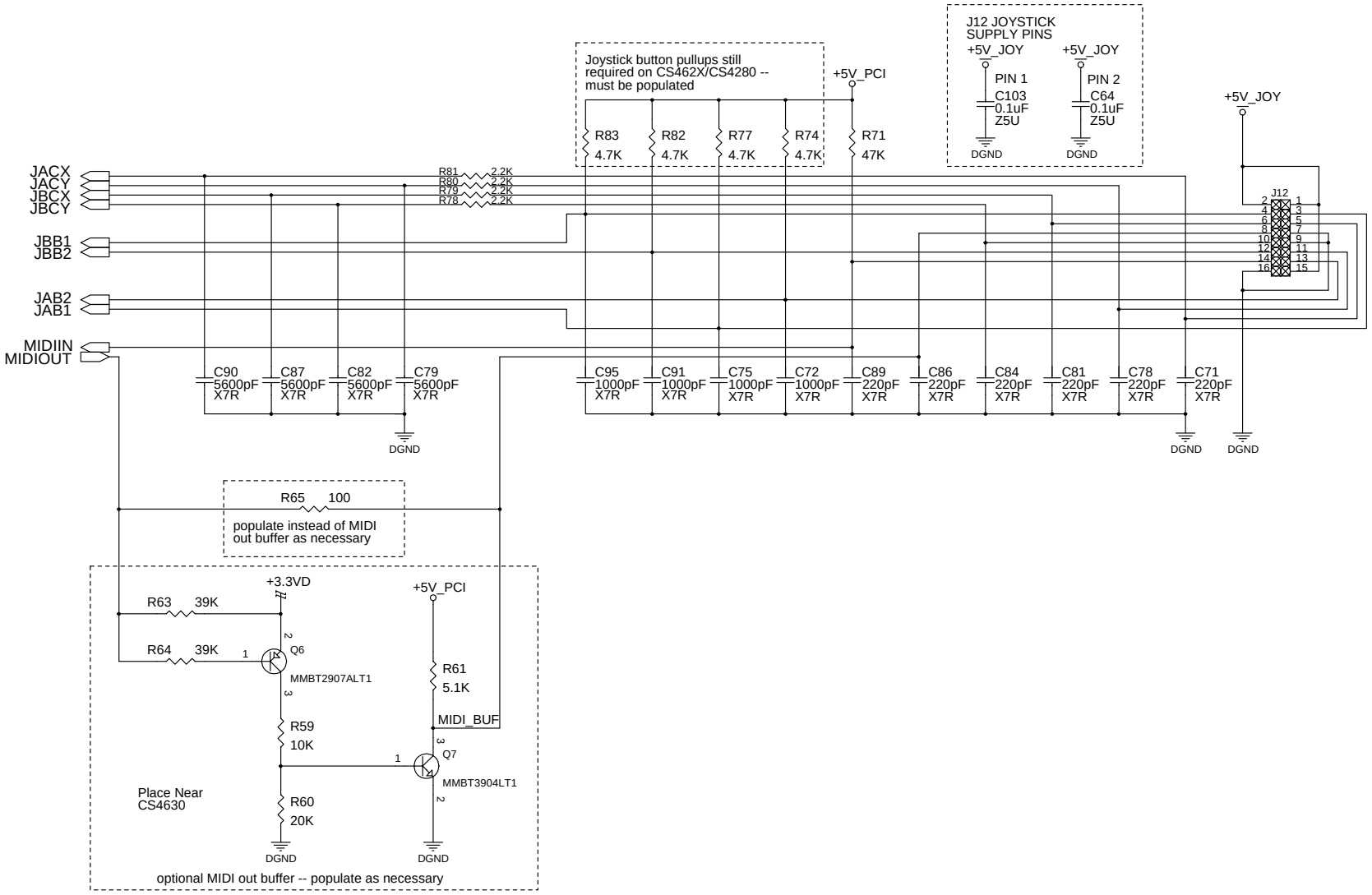

Figure 10. Joystick/MIDI Interface

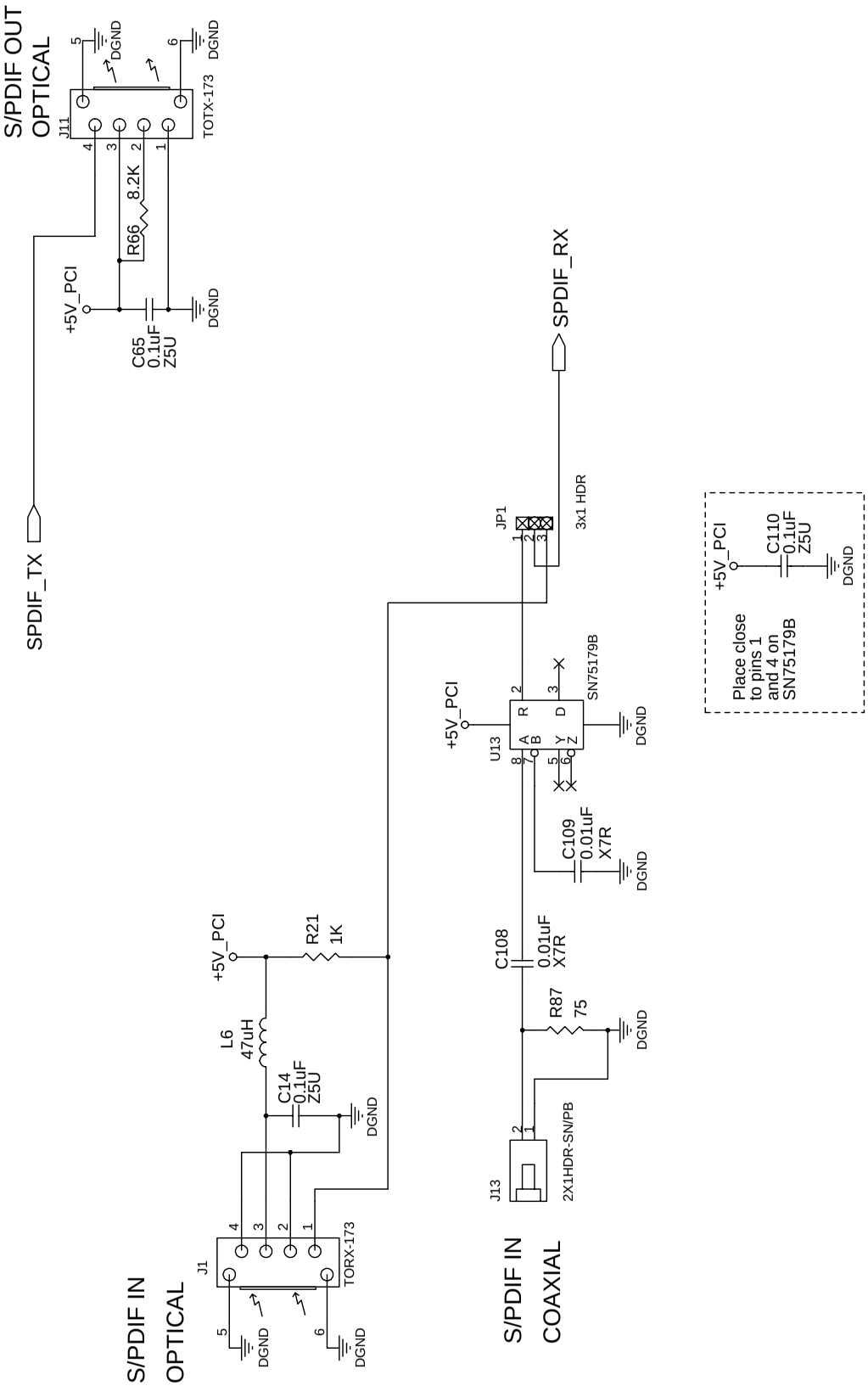

Figure 11. S/PDIF Output and Inputs

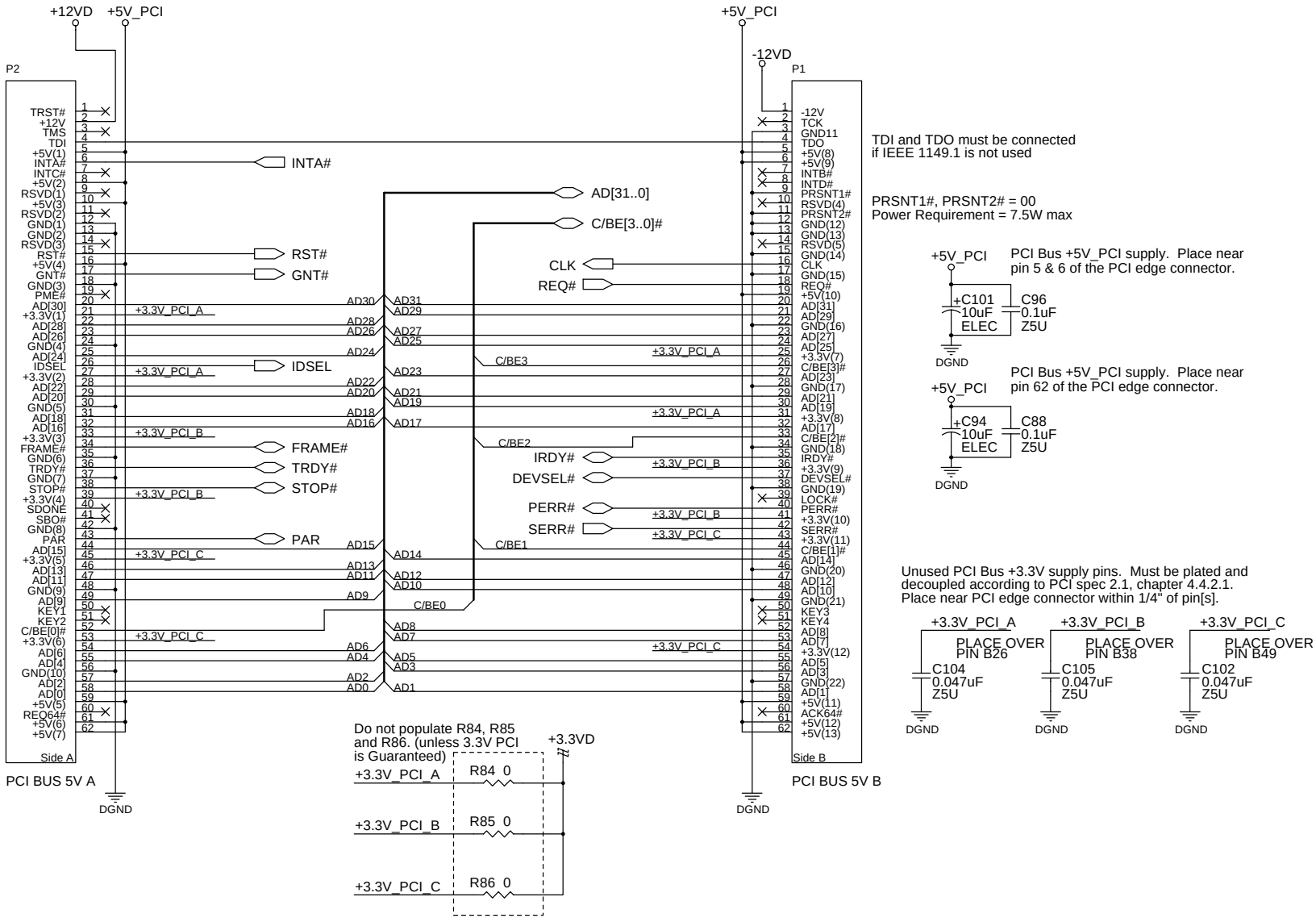

Figure 12. PCI Bus

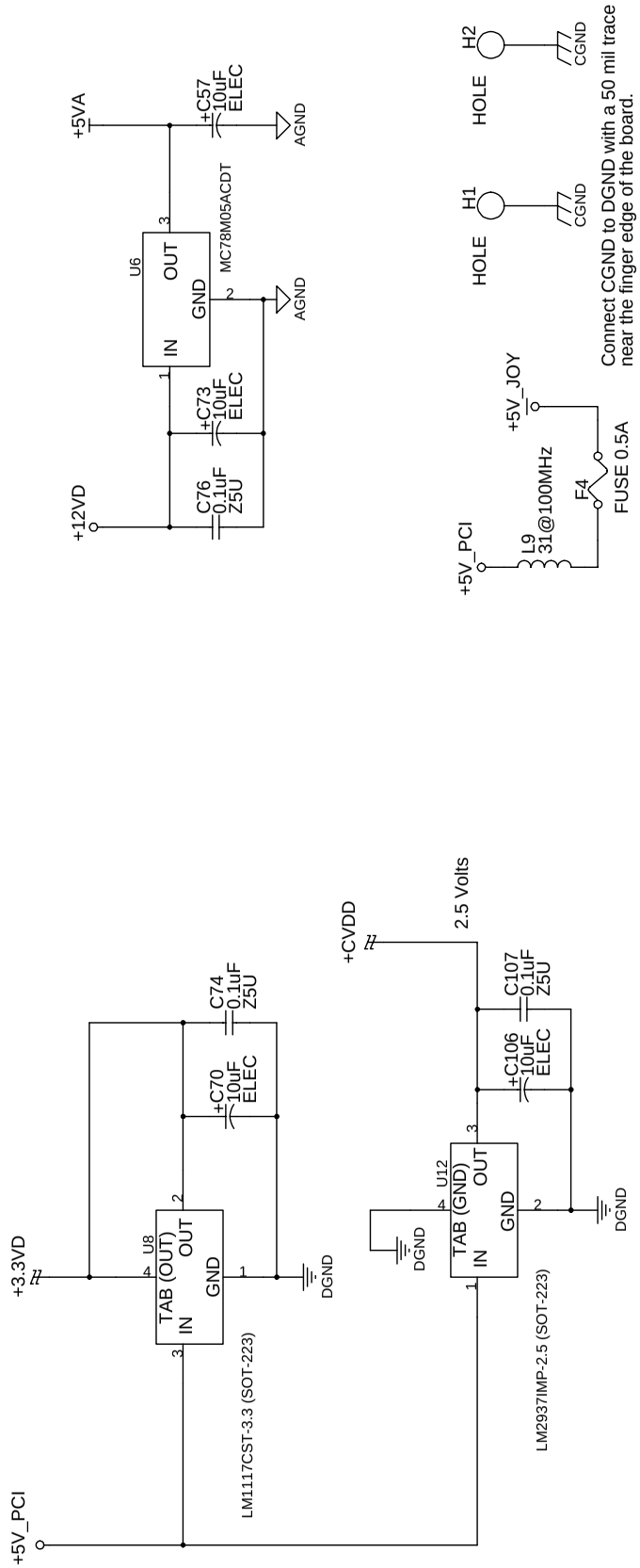

Figure 13. Power Supplies

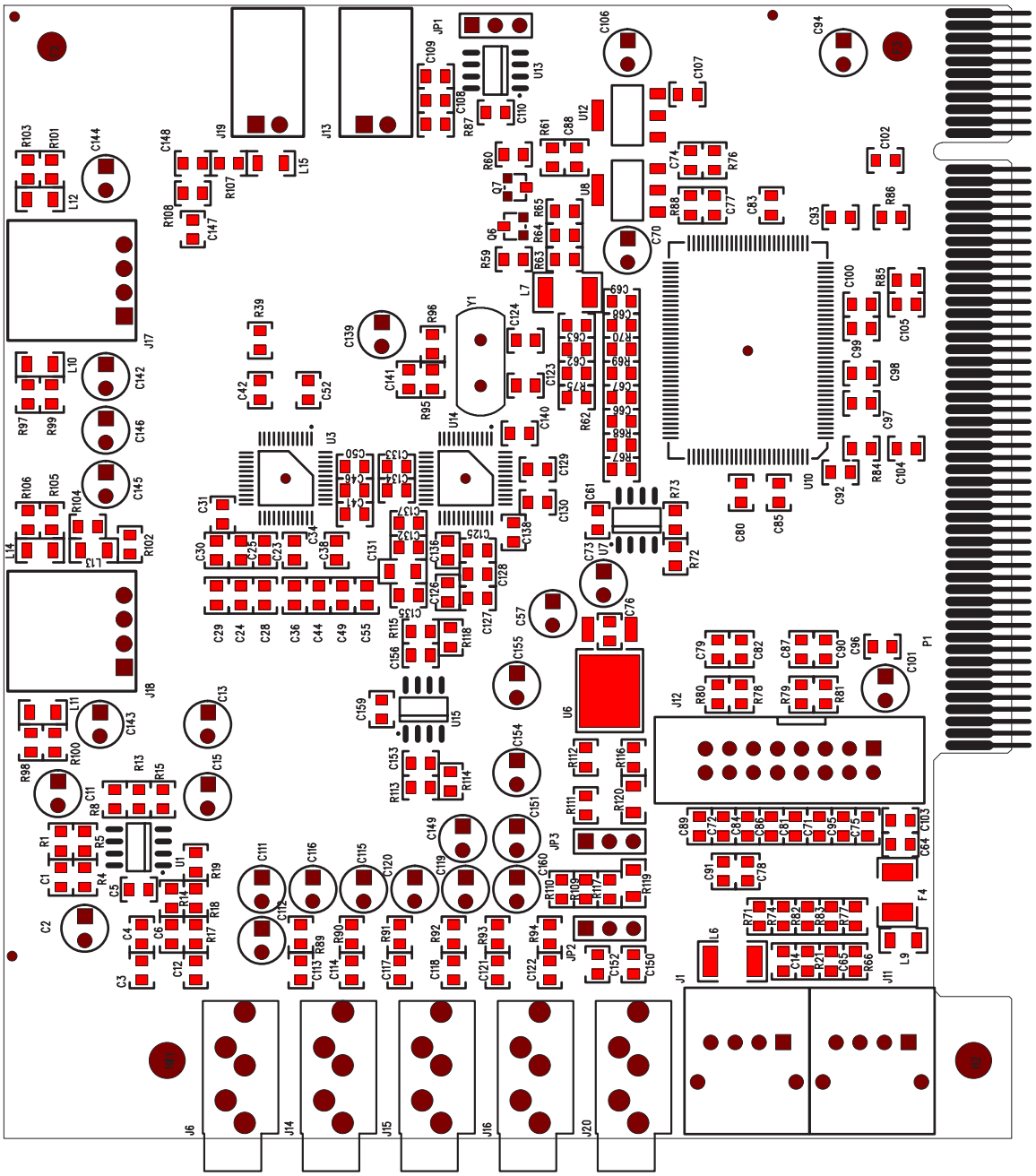

Figure 14. Assembly Drawing

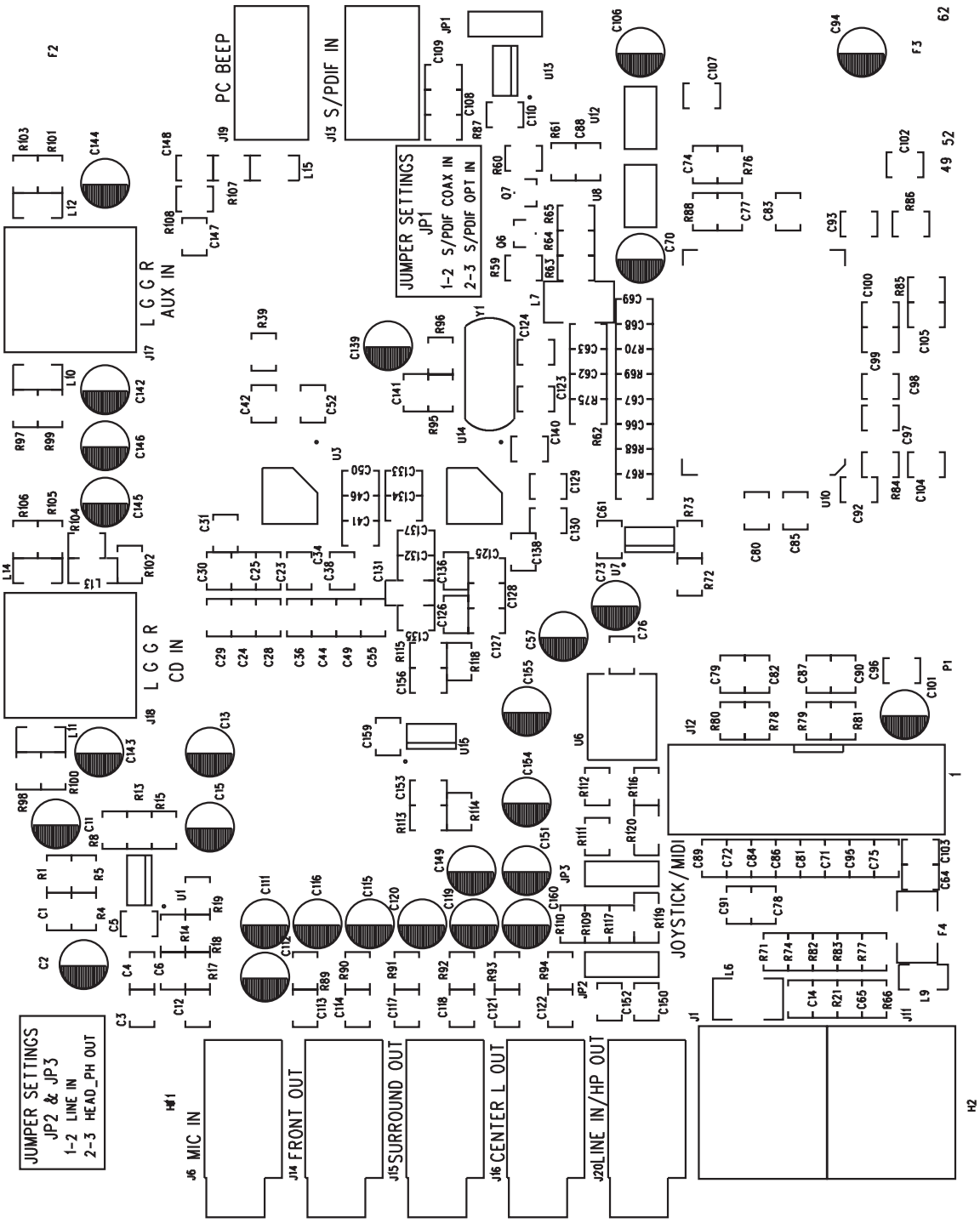

Figure 15. Top Silkscreen

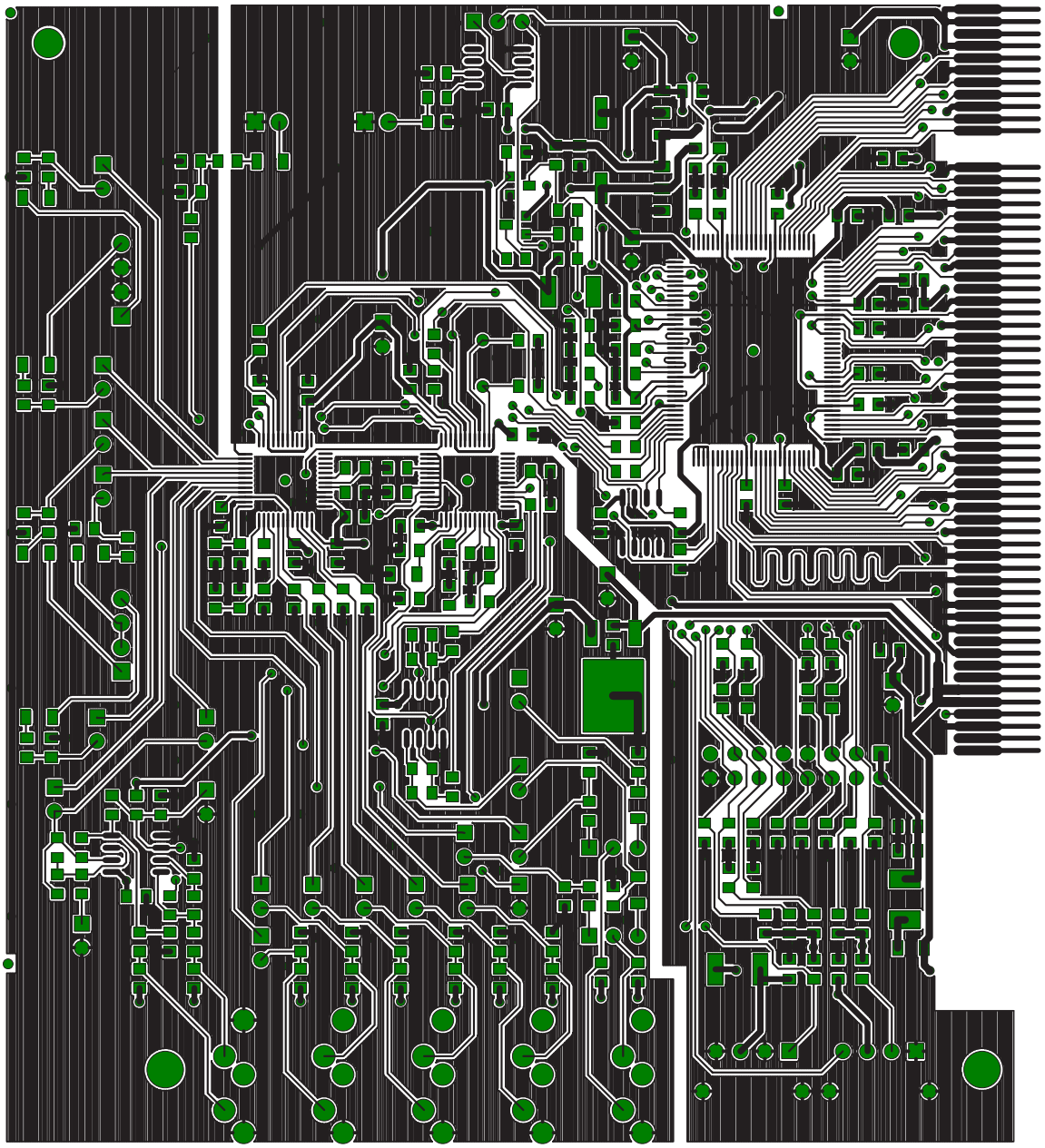

Figure 16. Top Layer

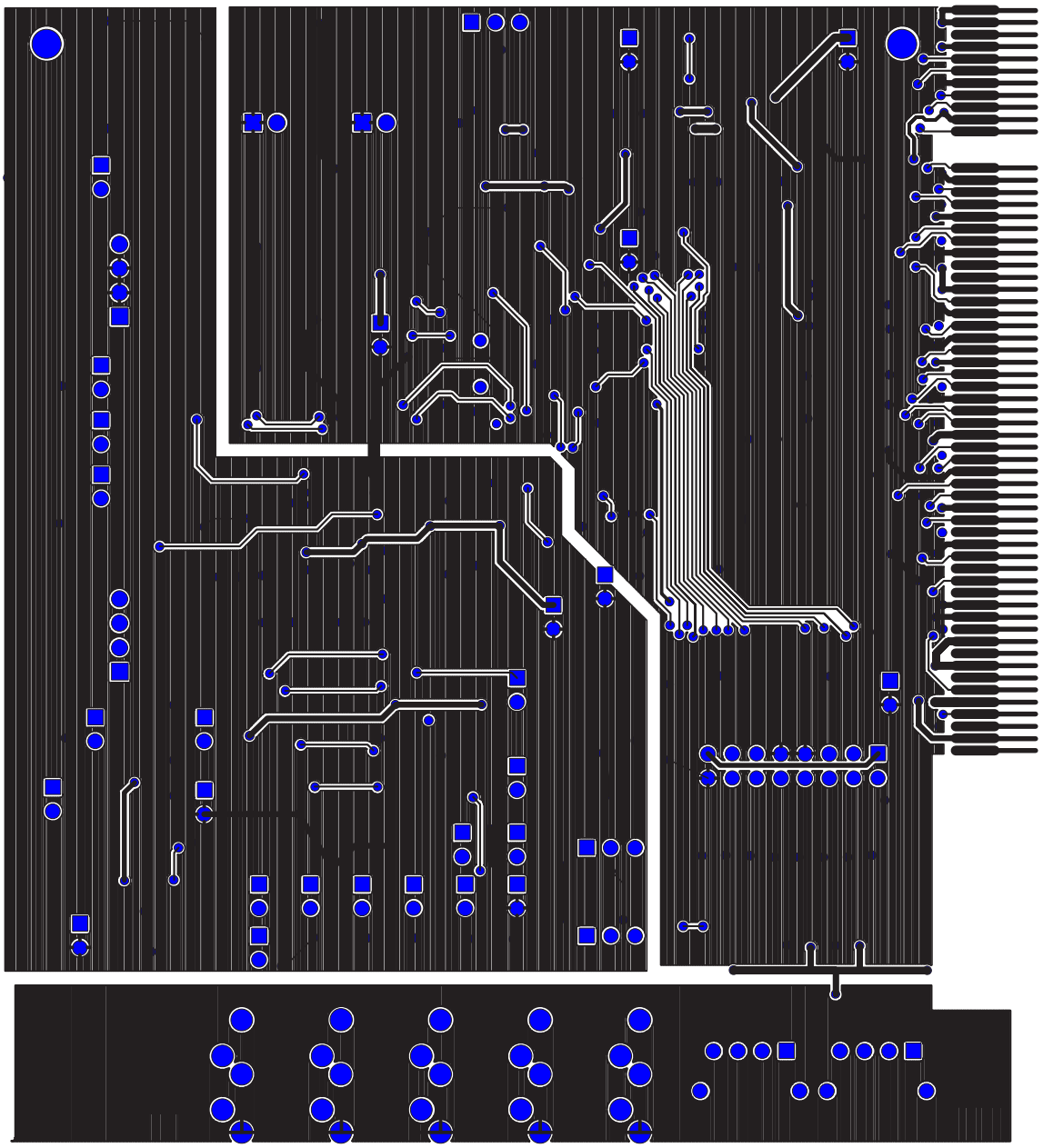

Figure 17. Bottom Layer

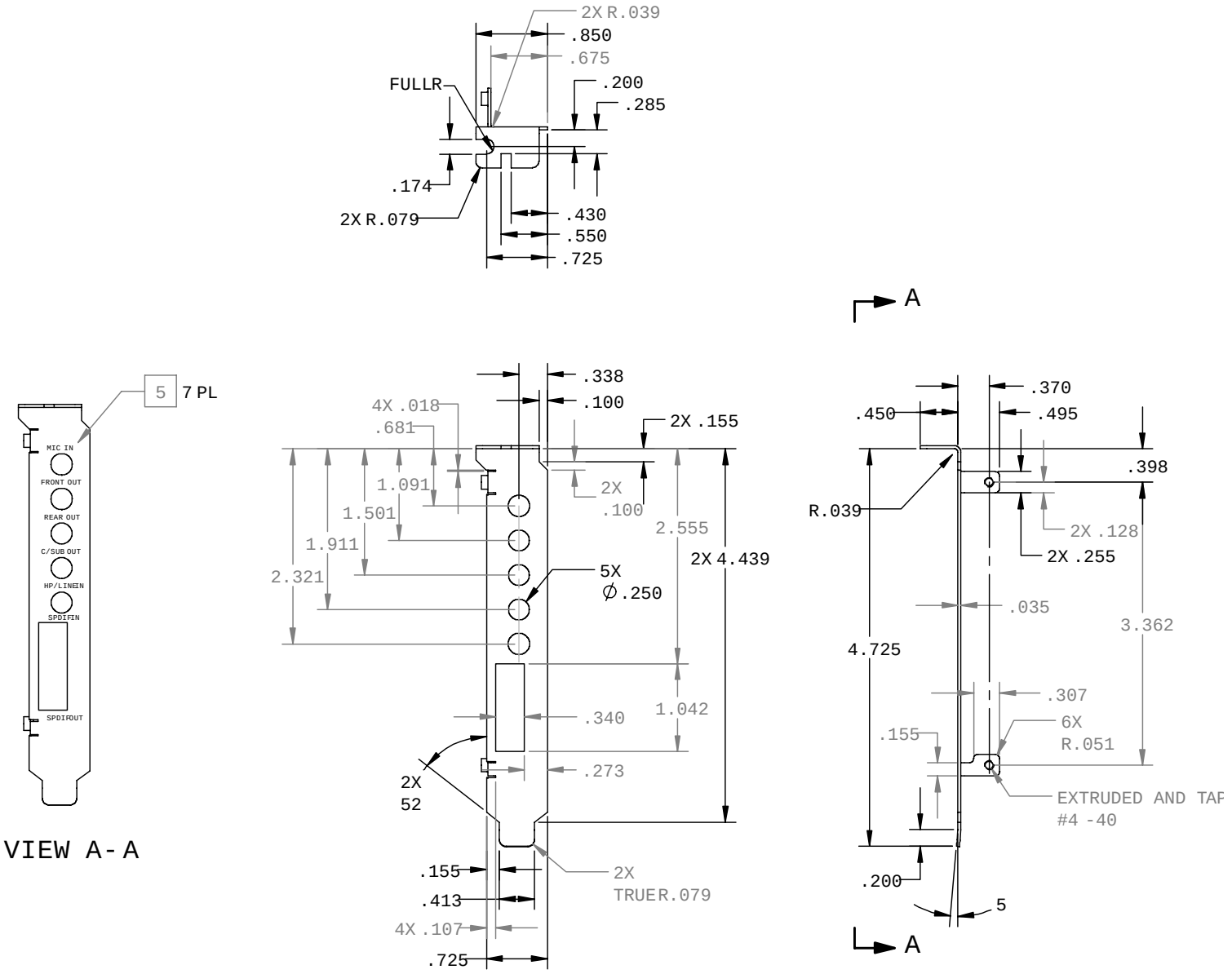

Figure 18. Bracket A Drawing

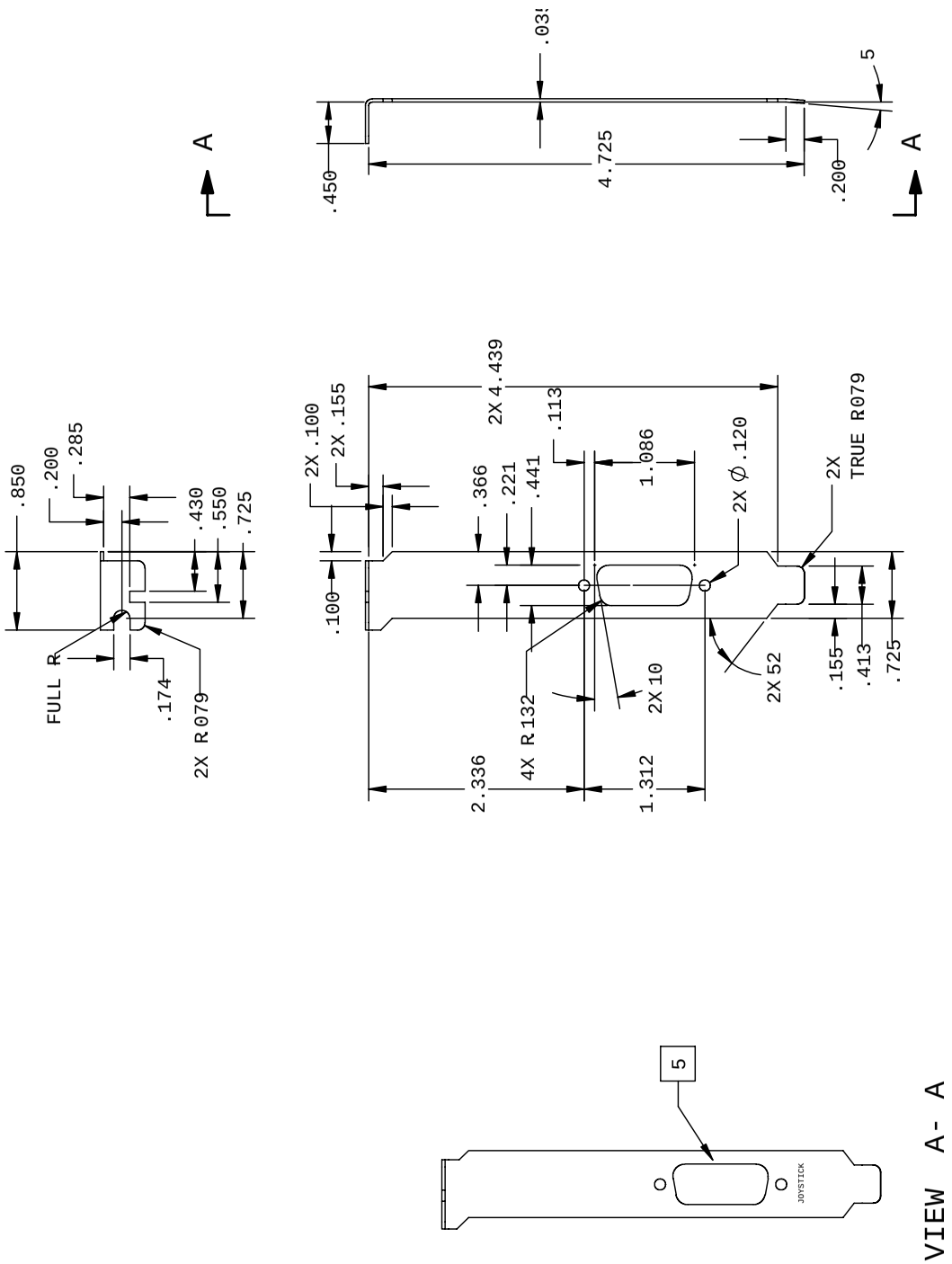

Figure 19. Bracket B Drawing

6. BILL OF MATERIALS

Item	Qty	Pop	Reference	Description	PCB Footprint	Manufacturer.	Part Number
1	17		C1,C3,C12,C71,C78,C81,C84, C86,C89,C113,C114,C117,C118, C121,C122,C150,C152	CAP, 0805, X7R, 220pF, 10%, 50V	CSN_0805	KEMET	C0805C221K5RAC
2	15		C2,C15,C57,C70,C73,C94,C101, C106,C111,C112,C115,C116, C119,C120,C139	CAP, ALU 5.0MM, ELEC, 10uF, 16V	ALU5.0MM	PANASONIC	ECA-1CM100
3	1		C4	CAP, 0805, X7R, .068uF, 10%, 50V	CSN_0805	KEMET	C0805C683K5RAC
4	38		C5,C14,C31,C34,C38,C41,C42, C52,C61,C62,C64,C65,C66,C67, C68,C69,C74,C76,C77,C80,C83, C85,C88,C92,C93,C96,C97,C98, C99,C100,C103,C107,C110,C137, C138,C140,C141,C159	CAP, 0805, Z5U, .1uF, 20%, 50V	CSN_0805	KEMET	C0805C104M5UAC
5	5		C24,C25,C132,C134,C147	CAP, 0805, X7R, .1uF, 10%, 50V	CSN_0805	KEMET	C0805C104K5RAC
6	1	NOPOP	C6	CAP, 0805, X7R, .1uF, 10%, 50V	CSN_0805	KEMET	C0805C104K5RAC
7	2		C11,C13	CAP, SMT A, ELEC, 2.2uF, 20%, 35V	CSP_ELEC_A	PANASONIC	ECE-V1VS2R2SR
8	15		C23,C28,C36,C44,C49,C50,C55, C63,C125,C127,C128,C129,C130, C135,C136	CAP, 0805, C0G, 1000pF, 10%, 50V	CSN_0805	KEMET	C0805C102K5GAC
9	3		C29,C30,C133	CAP, 0805, Y5V, 1uF, 20%, 10V	CSN_0805	KEMET	C0805C105M8VAC
10	4		C46,C108,C109,C126	CAP, 0805, X7R, .01uF, 10%, 50V	CSN_0805	KEMET	C0805C103K5RAC
11	4		C72,C75,C91,C95	CAP, 0805, X7R, 1000pF, 10%, 50V	CSN_0805	KEMET	C0805C102K5RAC
12	4		C79,C82,C87,C90	CAP, 0805, X7R, 5600pF, 10%, 50V	CSN_0805	KEMET	C0805C562K5RAC
13	3		C102,C104,C105	CAP, 0805, Z5U, .047uF, 20%, 50V	CSN_0805	KEMET	C0805C473M5UAC
14	4		C123,C124,C153,C156	CAP, 0805, C0G, 22pF, 10%, 50V	CSN_0805	KEMET	C0805C220K5GAC
15	1		C131	CAP, 1206, Y5V, 1uF, 20%, 25V	CSN_1206	PHILIPS	12062F105M8BB0
16	7		C142,C143,C144,C145,C146, C149,C151	CAP, ALU 5.0MM, ELEC, 2.2uF, 50V	ALU5.0MM	PANASONIC	ECA-1HM2R2
17	1		C148	CAP, 0805, X7R, 2700pF, 10%, 50V	CSN_0805	KEMET	C0805C272K5RAC
18	2		C155,C154	CAP, ALU 5.1MM, ELEC, 220uF, 6.3V	ALU5.0MM	PANASONIC	ECA-0JM221
19	1	NOPOP	C160	CAP, ALU 5.0MM, ELEC, 1uF, 50V	ALU5.0MM	PANASONIC	ECA-1HM010
20	1		F4	FUSE, SMT, 0.5A hold, 1.0A trip	FUSE_1812	RAYCHEM	miniSMD050-2
21	2		H1,H2		HOLE		
22	3		JP1,JP2,JP3	HDR, 3x1, 0.025" PIN, 0.1" CTR	HDR3X1	SAMTEC	TSW-103-07-T-S
23	1		J1	OPTICAL TOSLINK RECEIVER	TORX173	TOSHIBA	TORX-173
24	1		J6	CONN, 1/8" DOUBLE SW. STEREO PHONE JACK	CON_STEREO_LZR	LZR ELECTRONICS	SJ372
25	1		J11	OPTICAL TOSLINK TRANSMITTER	TOTX173	TOSHIBA	TOTX-173
26	1		J12	CONN, 8x2 RIBBON, MALE, STRAIGHT, SHROUDED	HDR8X2_SHR	AMP	103309-3
27	2		J13,J19	HDR, 2X1, 0.025" PIN, 0.1" CTR, 150u" SN/PB	CON_MLX_70553_2	MOLEX	70553-0036
28	4		J14,J15,J16,J20	CONN, 1/8" NON-SW. STEREO PHONE JACK	CON_STEREO_LZR	LZR ELECTRONICS	SJ373
29	2		J18,J17	HDR, 4X1, 0.025" PIN, 0.1" CTR, 15u" AU	CON_MLX_70553_4	MOLEX	70553-0003
30	1		L6	IND,47uH,10%,210mA	IND_1812	SIEMENS	SIMID03-47uH
31	1		L7	IND,FBEAD,1812,120@100MHz,25%	IND_1812	TDK	HF30ACB453215-T

Table 3. Bill of Materials

32	7		L9,L10,L11,L12,L13,L14,L15	IND, FBEAD, 1206, 31@100MHz, 25%	IND_FB1206	TDK	HF50ACB321611-T
33	1		P1	PCI BUS 5V SIDE B	PCI_BUS_5V_B		
34	1		P2	PCI BUS 5V SIDE A	PCI_BUS_5V_A		
35	1		Q6	TRAN, SO, PNP, SOT23	SOT23	NATIONAL	MMBT2907ALT1
36	1		Q7	TRAN, SO, NPN, SOT23	SOT23	NATIONAL	MMBT3904LT1
37	13		R1,R8,R13,R15,R71,R99,R100, R103,R104,R106,R107,R116,R117	RES, SO, 0805, 47K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A4702J
38	5		R4,R109,R110,R111,R112	RES, SO, 0805, 6.8K, 1%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A6801F
39	5	NOPOP	R5,R14,R84,R85,R86	RES, SO, 0805, 0, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A0R00J
40	1		R17	RES, SO, 0805, 2.7K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A2701J
41	1		R18	RES, SO, 0805, 68K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A6802J
42	1		R19	RES, SO, 0805, 100K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A1003J
43	1		R21	RES, SO, 0805, 1K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A1001J
44	5		R39,R67,R68,R95,R96	RES, SO, 0805, 47, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A47R0J
45	1		R59	RES, SO, 0805, 10K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A1002J
46	1		R60	RES, SO, 0805, 20K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A2002J
47	1		R61	RES, SO, 0805, 5.1K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A5101J
48	13		R62,R69,R70,R72,R75,R76,R88, R89,R90,R91,R92,R93,R94	RES, SO, 0805, 220K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A2203J
49	2		R63,R64	RES, SO, 0805, 39K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A3902J
50	5		R97,R98,R101,R102,R105	RES, SO, 0805, 100, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A1000J
51	1	NOPOP	R65	RES, SO, 0805, 100, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A1000J
52	1		R66	RES, SO, 0805, 8.2K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A8201J
53	6		R73,R74,R77,R82,R83,R108	RES, SO, 0805, 4.7K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A4701J
54	4		R78,R79,R80,R81	RES, SO, 0805, 2.2K, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A2201J
55	1		R87	RES, SO, 0805, 75, 5%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A75R0J
56	2		R115,R113	RES, SO, 0805, 33K, 1%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A3302F
57	2		R114,R118	RES, SO, 0805, 27K, 1%, 1/10W, METAL FILM	RES_0805	PHILIPS	9C08052A2702F
58	2		R119,R120	RES, SO, 1206, 10, 5%, 1/4W, METAL FILM	RES_1206	PHILIPS	9C12063A10R0J
59	1		U1	IC, SO, SOIC8, 33078, DUAL OP-AMP	SO8	MOTOROLA	MC33078D
60	1		U3	IC, TQFP, AC '97 2.0 SERIAL QUAD CODEC	QFP48_7X7	CRYSTAL SEMICOND.	CS4294-JQ
61	1		U6	IC, SO, +5V REGULATOR, DPAK, 2%, 500mA	DPAK	MOTOROLA	MC78M05ACDT
62	1		U7	IC, SO, SOIC8, SERIAL EEPROM, 16 x 8, 2.5V	SO8	MICROCHIP	24LC00/SN
63	1		U8	IC, SO, +3.3V REGULATOR, SOT-223, 2%, 800mA	SOT223	NATIONAL SEMICOND.	LM1117MPX-3.3
64	1		U10	IC, MQFP, AC '97 PCI AUDIO CONTROLLER	MQFP-128	CRYSTAL SEMICOND.	CS4630-CM
65	1		U12	IC, SO, +2.5V REGULATOR, SOT-223, 5%, 400mA	SOT223	NATIONAL SEMICOND.	LM2937IMP-2.5
66	1		U13	IC, SO, SOIC8, DIFF. DRIVER/RECEIVER PAIR	SO8	TI	SN75179B
67	1		U14	IC, TQFP, AC '97 2.1 SERIAL CODEC	QFP48_7X7	CRYSTAL SEMICOND.	CS4297A-JQ
68	1		U15	IC, SO, SOIC8, 1308, LOW NOISE HEADPHONE AMP	SO8	PHILIPS	TDA1308T
69	1		Y1	XTAL, 24.576MHz, HC49S, Fund Mode, Par Res	XTL_HC49S	FOX	FS24.576

Table 3. Bill of Materials *(cont.)*

• Notes •


SMART
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