CRD4610-1

Advanced Product Databook

FEATURES

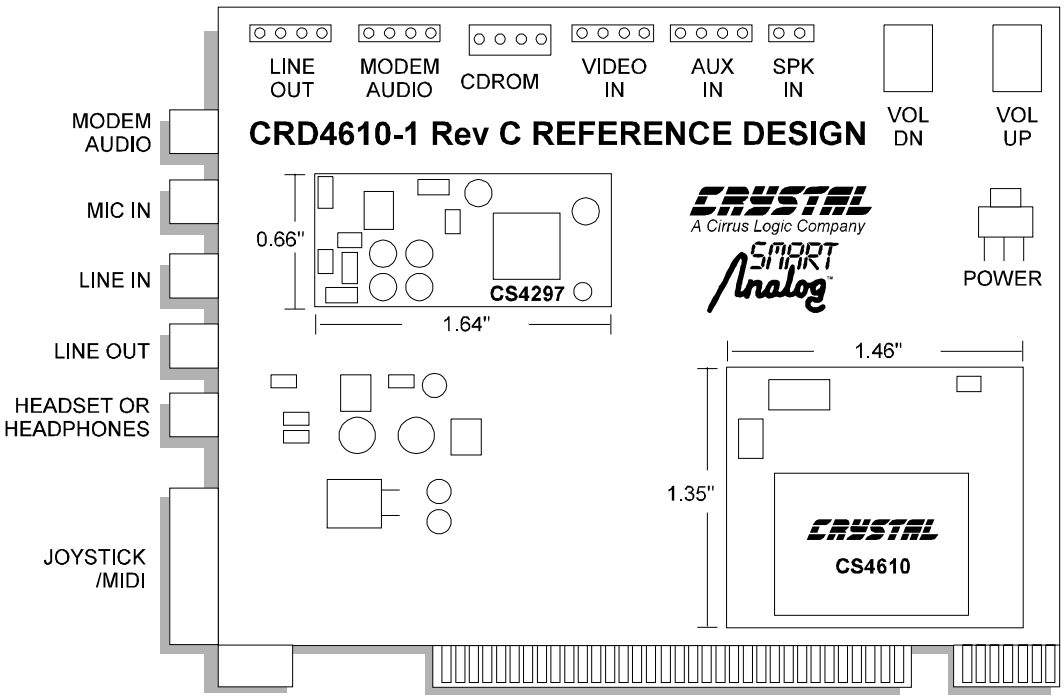
- **PCI Audio Accelerator card designed to meet AC '97 specifications**
- **4-layer single sided planar example board**
- **CS4610 SoundFusion™ PCI Audio Accelerator**
- **CS4297 SoundFusion™ Audio Codec '97**
- **Complete suite of Analog I/O connections:**
  - — Line In, Line Out, Mic In, Headphone or Headset connection, Modem audio connection, CD Audio In, Video In, Aux In, and PC Speaker In
- **Joystick/MIDI Interface**
- **Meets or exceeds Microsoft's® PC'97 and PC'98 , both required and advanced, audio performance requirements.**

ORDERING INFO
CRD4610-1

CrystalClear™ AC '97 Motherboard Reference Design

DESCRIPTION

The CRD4610-1 showcases Cirrus Logic's Cystal Audio AC '97 motherboard solution using the CS4610 SoundFusion Audio Accelerator and the CS4297 SoundFusion Audio Codec '97. This design illustrates a single sided motherboard implementation on a PCI adapter card. Using the Mic In, Line Out and Line In analog connectors only, the combined motherboard footprint is approximately 3.1 sq. in. This area is outlined around the CS4610 and the CS4297. The card includes other optional analog inputs and outputs, as well. Volume control buttons are also included to demonstrate the hardware master volume control.



CIRRUS LOGIC ADVANCED PRODUCT DATABOOK

GENERAL INFORMATION

Today's multimedia applications demand high quality PC audio and many audio connections. To meet this demand Intel® defined the AC '97 (Audio Codec '97) specification that defines a two chip audio solution [1]. The idea behind the two-chip solution is to have a separate audio controller chip connected to the PCI bus to accelerate increasingly popular audio processing functions such as Aureal A3D™, DirectSound 3D™, wavetable synthesis, and Dolby® Digital (AC-3®) decoding. A separate audio codec is connected to the controller for analog mixing and data conversion. Audio data is transferred between the controller chip and the audio codec through a standard digital interface called an AC Link at a 48 kHz frame rate. For more information on AC '97 and the AC Link, please consult the AC '97 specification [1].

The advantage of a two chip audio solution is that the analog section of a system can be completely separated from the noisy digital environment of a personal computer. A digital link is all that is required to connect the audio codec to the PCI bus-based AC'97 controller. This allows the audio section to reach the required signal to noise ratio of ~90 dB while making the layout and placement of the audio section easier to implement.

The CRD4610-1 demonstrates Cirrus' two-chip solution using the CS4610 SoundFusion PCI Audio Accelerator and the CS4297 SoundFusion Audio Codec. These two integrated circuits demonstrate Cirrus' powerful DSP controller and unsurpassed CrystalClear audio quality in a single PCI add-in card reference design.

REFERENCE DESIGN FEATURES

The reference design illustrates a typical four-layer, single sided motherboard layout. The reference design card is sectioned into three main parts: the CS4610 PCI Audio Accelerator section, the CS4297 Audio Codec '97 section, and the Optional Extended Analog I/O section.

CS4610 PCI Audio Accelerator Section

The area around the CS4610 includes the required bypass capacitors, PLL power supply filter components, an EEPROM, the components for the joystick connection and a buffer circuit for the external MIDI connection. The layout of this section complies with the PCI specification version 2.1 [2] for add-in cards. Please refer to the Schematic and Layout sections of this document for more information. For more information on the CS4610, refer to the CS4610 Data Sheet [3]. The required area for this particular layout is 1.97 sq. in.

External EEPROM

The CS4610 EEPROM contains the required Subsystem Vendor ID and Subsystem ID values as well as two configuration registers which configure the software driver of the CS4610 to operate in AC '97 link mode. The CS4610 currently requires 7 data bytes in the EEPROM for configuration. The PCI Special Interest Group assigns manufacturers a Subsystem Vendor ID. To meet WHQL™ standards, the Subsystem ID must be a non-zero value. Please call Cirrus Logic PC Products Crystal Audio Division at (512) 445-7222 to have a Subsystem ID assigned to a particular project.

If the CS4610 is implemented on a mother board, an external EEPROM is not required for proper operation. A host-load procedure may be used for configuration in this case. However, silicon revisions rev. C and prior must use an EEPROM if a unique Subsystem ID is required. This is due to an errata which causes the upper byte of the subsystem vendor ID to be duplicated in the subsystem ID field during host load to the SSVID register.

It is recommended that an EEPROM be used during system development to allow debug and configuration changes without having to modify BIOS code. If host load will be used in production, the EEPROM circuitry can be left unpopulated.

For information regarding the programming and timing of the EEPROM, refer to the CS4610 Data Sheet [3].

CS4297 Audio Codec '97 Section

This section contains the components for the Mic In, Line In, and Line Out audio connections. It also includes a 24.576 MHz crystal that acts as the master clock in an AC '97 configuration. The capacitors required for the CS4297 and their placement are discussed in the CS4297 Data Sheet. Refer to the *Grounding and Layout* section of the data sheet for the recommended routing the audio section [4]. The required area for this particular layout is 1.08 sq. in.

Optional Extended Analog I/O Section

The CS4297 has many analog inputs and outputs that may or may not be used depending on the system's application. Unused inputs should be tied to Vrefout (pin 28) or capacitively coupled to the analog ground plane. The optional section contains the components for a headphone amplifier and another microphone amplifier for the MIC2 input. This section also contains a population option for headphones or headset operation on the 1/8" external jack. The reference card ships with headphone operation enabled. To enable headset operation, R24 and R26 should be removed and one of the resistors placed in the space for R25. This will enable the microphone 2 input on the tip connection of the external jack and the right headphone channel on the ring connection of the external jack.

The Modem Audio, CD ROM, Video In, Aux in, and Spk In headers are also part of the Extended Analog I/O section. Each header has a few resistor packs and capacitors associated with it. The header and its associated components may or may not be necessary depending on the audio inputs implemented.

Audio Inputs and Outputs

The entire set of the CS4297's analog I/O is represented on the reference design card through internal headers and external connectors:

- Line Out
- Mic In
- Line In
- CD ROM In
- Modem audio connection
- Headphone Out or Headset connection
- Aux In
- Video In
- PC Speaker

Five external 1/8" jacks and six internal header connections are used for analog inputs and outputs. The modem audio connection and the line out connection have an internal header and an external 1/8" jack connection. When a plug is inserted into the external jack for the modem audio or the line out connections, the corresponding internal connector is disabled.

The line out, line in and microphone in circuits are included in the area outlined around the CS4297 codec. The other analog connections are considered to be part of the optional extended analog I/O.

Line Out

The Line Out connection can either be made through the external 1/8" jack or the internal 4-pin (0.1 inch center) header. If the 1/8" jack is used the internal 4 pin connector is disabled. The Line Out output can only drive input impedances greater than 10 kΩ.

- Maximum output level: 1 Vrms

Mic In

The Microphone In 1/8" jack provides an input to a microphone preamplifier circuit that provides 17 dB of gain.

- Maximum input level:
  - Microphone Boost enabled: 12.7 mV
  - Microphone Boost disabled: 127 mV
- Supports 3-pin phantom power and dynamic microphones
- Microphone power is provided on the ring connection of the 1/8" stereo jack

Line In

The Line In 1/8" jack provides an input to the Line In pins of the CS4297.

- Maximum input level: 2 Vrms

CD ROM In

The CD ROM input header is a 4 pin (0.08 inch center) shrouded connector that fits most CD ROM audio adapter cables.

- Maximum input level: 2 Vrms
- Differential input using the CD common pin as the ground

Modem Audio Connection

The modem audio connection can either be made through the external 1/8" jack or the internal 4-pin (0.1 inch center) header. These connectors have both an input and an output on them.

External 1/8" jack:

- Ring connection: Mono input
  - Maximum input level: 1 Vrms
- Tip connection: Mono output
  - Maximum output level: 0.7 Vrms

Headphone Out or Headset

An external 1/8" jack is provided for a headphone or headset connection. The card comes configured for headphone operation with the selection being made by a 0 Ω resistor population option. The headphone option is selected by populating R24 and R26 and not populating R25. The headset option is selected when R25 is populated and R24 and R26 are not populated.

Headphone output option:

- Capable of driving low impedance loads such as 32 Ω headphones
- Maximum output level: 1.4 Vrms

Headset option:

Ring connection: Right headphone output

- Maximum output level: 1.4 Vrms

Tip connection: Microphone 2 input

- Maximum input level:
  - Microphone Boost enabled: 12.7 mV
  - Microphone Boost disabled: 127 mV
- Microphone power is provided on the tip connection. This setup supports phantom power mics only (not dynamic mics)

Aux In

- Internal 4 pin header (0.1 inch center)
- Maximum input level: 2 Vrms

Video In

- Internal 4 pin header (0.1 inch center)
- Maximum input level: 2 Vrms

PC Speaker

- Internal 2 pin header (0.1 inch center)
- Mono input for the internal PC speaker output

Other Reference Card Features

Other reference card features that are not associated with the other sections are the external volume control buttons, the joystick/MIDI connection, and the power regulators.

Volume Control Buttons

The volume control buttons are connected to the CS4610 and act as a master volume control. The four-pin header can be populated to provide a cable connection for volume control buttons that can be placed elsewhere in the system. There is a volume up button and a volume down button. Pressing both buttons at the same time enables the mute/unmmute function.

Joystick/MIDI connection

The DB-15 connector allows a joystick or an external MIDI device to be connected to the CS4610. In the AC' 97 configuration, the CS4610 handles the joystick operation. The external connection can also take MIDI data from an external source to the CS4610. A buffer circuit allows the MIDIOUT pin of the CS4610 to drive an external MIDI input.

Power Regulators

There are two power regulators on the board. One is a Linear Technologies LT117CST-3.3 voltage regulator that derives the +3.3 V supply for the CS4610 and the CS4297 from the +5 V on the PCI bus. This regulator is unnecessary on mother boards with a +3.3 V supply. The regulator was used in this reference design because the +3.3 V PCI bus power pins are not guaranteed to be on the PCI bus connector. The card is also designed to be used in a 5 V PCI Connector [2].

A Motorola MC78M05CDT regulates the PCI +12 V supply down to provide a clean +5 V analog supply for the operational amplifiers and the CS4297. A power regulator is recommended for the analog voltage supply to provide good audio signal quality. The MC78M05CDT regulator can provide up to 500 mA of current with adequate heat-sinking, which is enough power for the CS4297 and the three audio op-amps. The MC78L05 power regulators do not provide enough current to power the same devices, and are not recommended for use with the CS4297.

SCHEMATIC DESCRIPTION

Figures 1 through 8 show the schematics for the CRD4610-1 card. This section will describe particular pages of the schematic that need to be discussed.

Figure 7 : CD Audio Input

C5 and C6 are used in parallel to make a 2 µF capacitor on the CD Common line because the input impedance on that line is half of what is on the CD In Right and CD In Left. A 2 µF capacitor could be used, but many of the 2 µF capacitors tested have shown distortion problems.

Figure 3 : CS4297

A 10 µF electrolytic capacitor should be added next to pins 25 and 26 if the capacitor connected to the output of the power regulator is located far away from the CS4297. For the best audio performance, the analog voltage regulator should be located near the CS4297. R1 and R2 are termination resistors in the serial AC link between the CS4297 and the CS4610. NPO-type capacitors should be used on all loading capacitors of audio signals to ensure minimal added distortion.

Figure 2 : CS4610

The 0.1 µF capacitors connected to the power pins of the CS4610 should be as close as possible to the chip. The inductor L6 is used to filter the power supply for the internal PLL circuit. R7 can be removed from a production design, and pin 51 can be connected directly to digital ground. R3 and R4 are termination resistors in the serial AC link between the CS4297 and the CS4610.

Figure 4 : Line Input

Two parallel 1 µF capacitors are used on the line in circuit to decrease the low frequency corner since this input is usually used for high signal quality input. A 2 µF capacitor could be used, but 2 µF surface mount capacitors are often not high quality capacitors and can add distortion to audio signals.

Figure 6 : Headphone or Headset

A resistor population option is included to choose between a headphone or headset connection. The headset connection incorporates the right headphone and MIC2 on one external jack.

Figure 14 : MIDI and Joystick Connection

A buffer driver circuit is used on the MIDI output pin to provide the necessary drive for MIDI devices connected through a long cable. This circuit can be removed, and R28 populated to bypass the buffer driver circuit if it is unnecessary.

Figure 15 : PCI Bus Connection

The PCI 2.1 specification requires that each unused +3.3 V power pin should be connected with an average of 0.01 µF capacitor [2]. Two 0.1 µF capacitors in parallel provide the required capacitance for the power pins.

EMC Components

A number of capacitors and inductors are included to help the board meet EMC compliance tests, such as FCC Part 15. These components are outlined in the schematic. They may or may not be needed in a particular design, so the footprints are added in case they are necessary. EMC testing should show where problem areas exist, and components can be added to those areas. EMC components can also be removed in areas that do not show problems.

GROUNDING AND LAYOUT

The routing of the CRD4610-1 provides a good example of how a PCI add-in card should look. 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 2.1 Specification Section 4.3.6 for information on routing PCI bus signals on a motherboard [2].

Partitioned Voltage and Ground Planes

The CRD4610-1 is partitioned into a digital and analog section. Correspondingly, the voltage and ground planes are partitioned to keep digital and analog ground currents from crossing. Ground currents from digital signals are inherently noisy with respect to analog signals and should be isolated from the audio section. The first rule in laying out mixed signal PCBs is to keep all digital signals over the digital ground plane and all analog signals over the analog ground plane. When digital and analog signals cross planes, they introduce noise into the audio section reducing performance.

The pinout of the CS4297 allows the ground split to completely separate digital signals on one side and analog signals on the other. This split is located very close to the CS4297 so analog and digital ground return currents originating from the CS4297 may flow through their respective ground planes. A bridge is made across the split to maintain the proper reference potential for each ground plane.

Another small partition in the digital ground plane is for the crystal oscillator. The data converters in the CS4297 are highly susceptible to noise on the

crystal pins. This partition serves to keep noise from coupling into these pins.

A separate chassis ground is also used on the VCC Layer for EMC purposes. All of the components that are for EMC compliance are referenced to this plane. The chassis ground plane is connected to the analog ground plane at the external jacks.

CS4297 Layout Notes

Please refer to the CS4297 Data Sheet on how the area under the chip should be partitioned and how the bypass capacitors should be placed [4]. Pay close attention to the suggestions for the bypass capacitors on REFFLT, AFLT1, AFLT2 and the power supply capacitors. The pinout of the CS4297 is designed to keep digital and analog signals from crossing when laying out the board.

REFERENCES

1) Intel, Audio Codec '97 Component Specification, Revision 1.03, September 15, 1996. *http://developer.intel.com/pc-supp /platform/ac97/*

2) PCI Special Interest Group, PCI Local Bus Specification, Revision 2.1, June 1, 1995. *http://www.pcisig.com/*

3) Cirrus Logic, CS4610 SoundFusion PCI Audio Accelerator Data Sheet *http://www.cirrus.com/products /overviews/cs4610.html*

4) Cirrus Logic, CS4297 SoundFusion Audio Codec '97 Data Sheet *http://www.cirrus.com/products /overviews/cs4297.html*

5) Steve Harris, Clif Sanchez, Personal Computer Audio Quality Measurements, Ver 0.5 *http://www.cirrus.com/products /papers/meas/meas.html*

6) Microsoft, PC Design Guidelines, *http://www.microsoft.com/hwdev/desguid/*

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

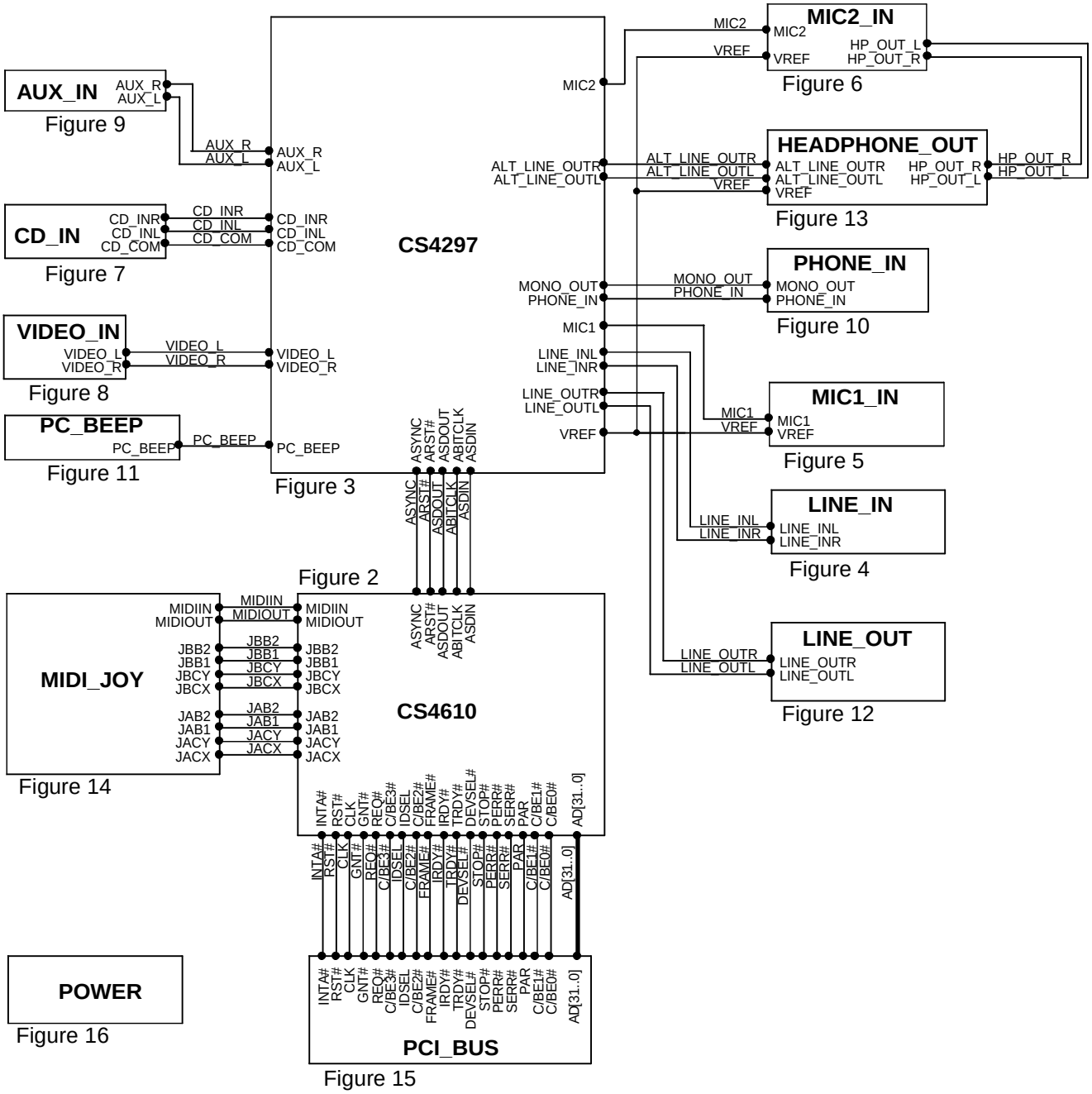


Figure 1. Block Diagram of CRD4610-1

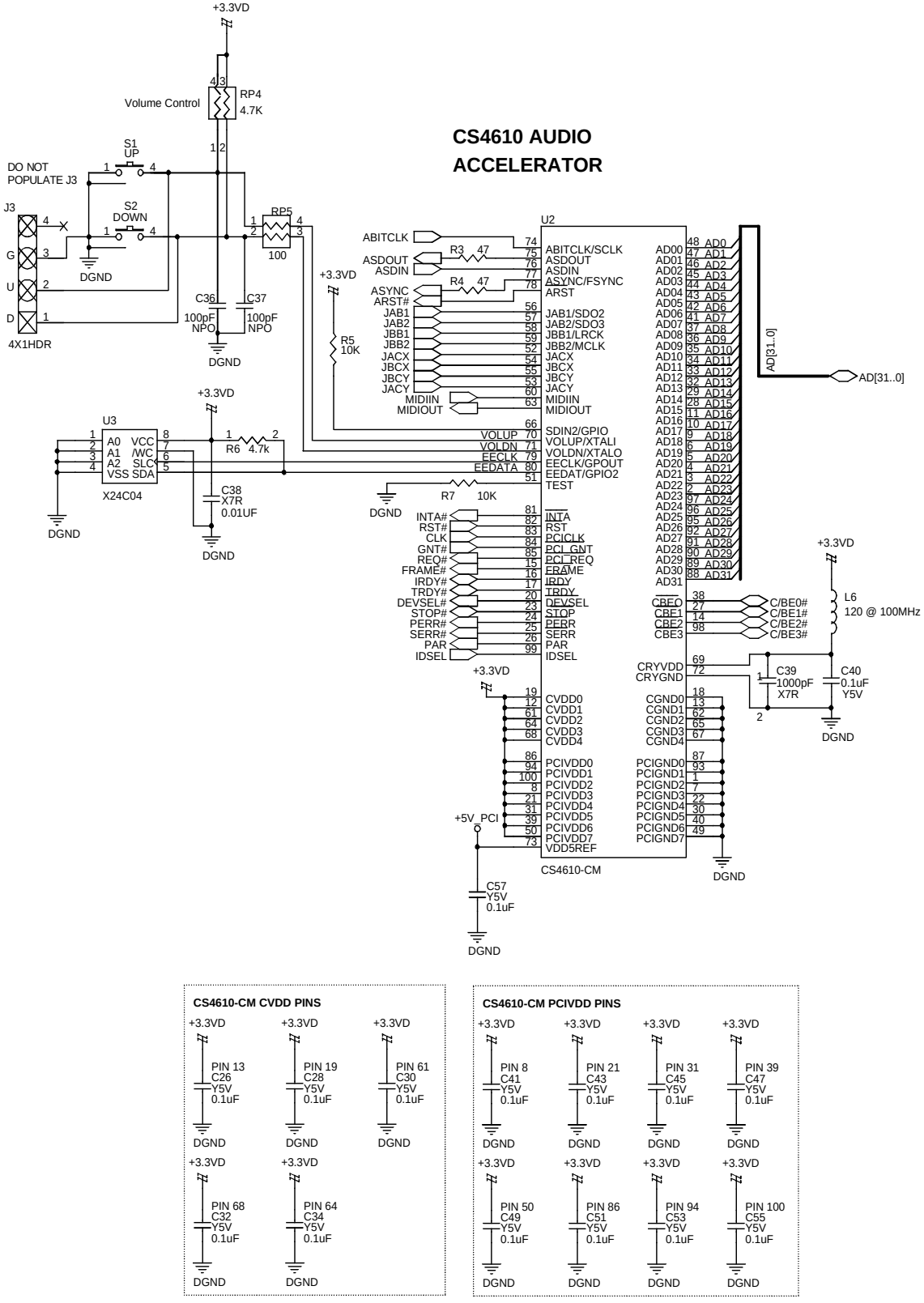
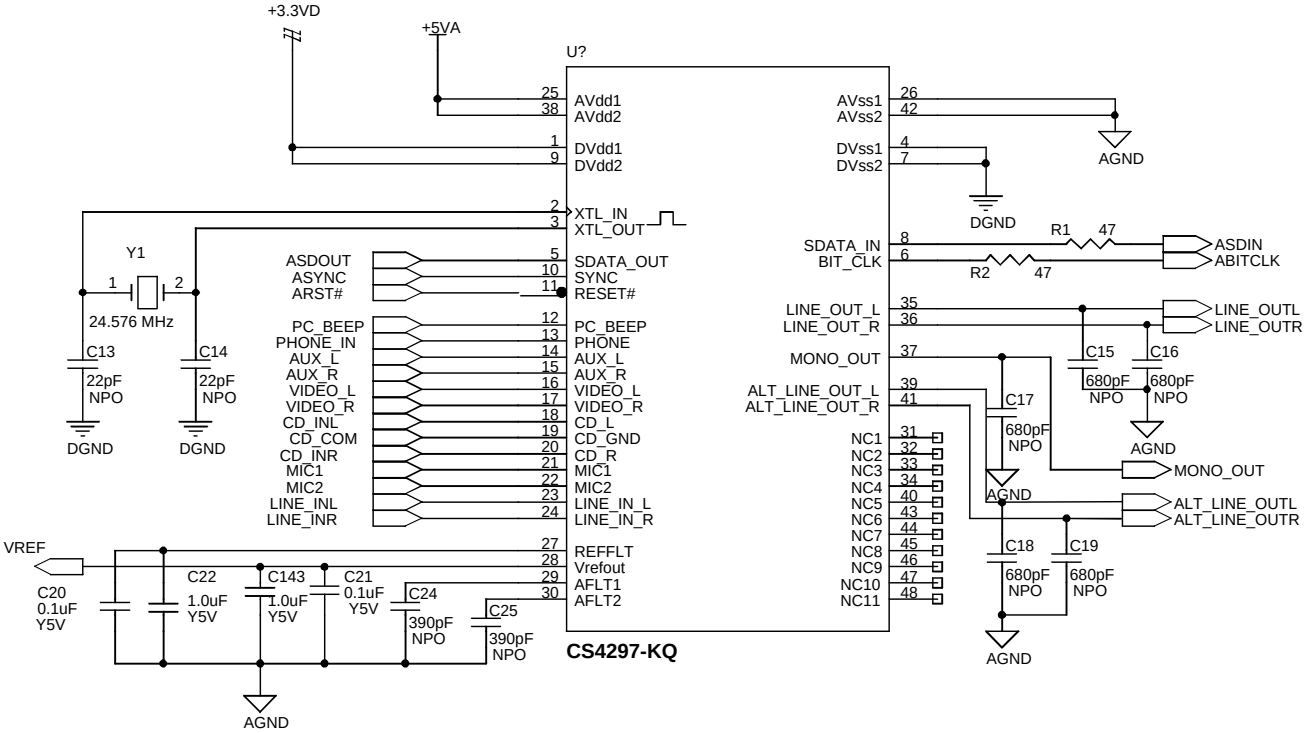
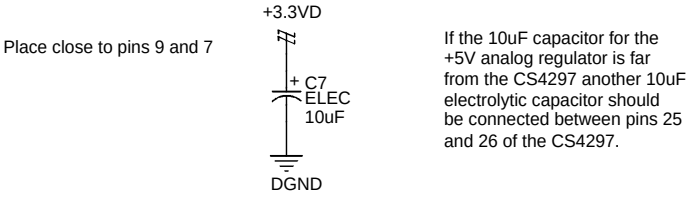


Figure 2. CS4610





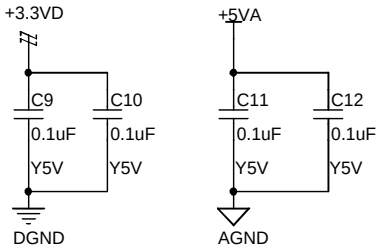


Figure 3. CS4297

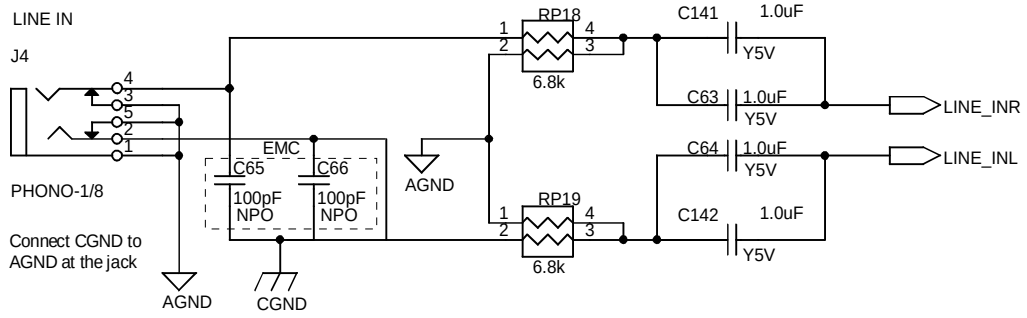


Figure 4. Line Input

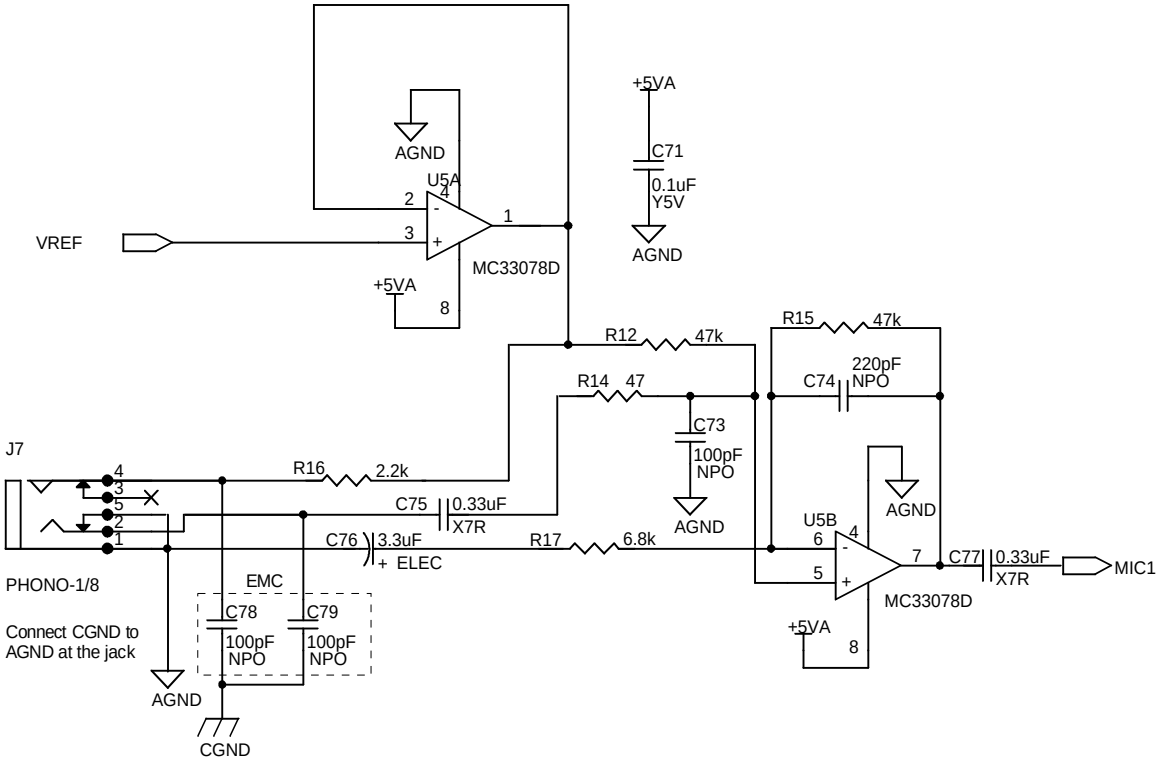


Figure 5. Microphone Input and Amplifier

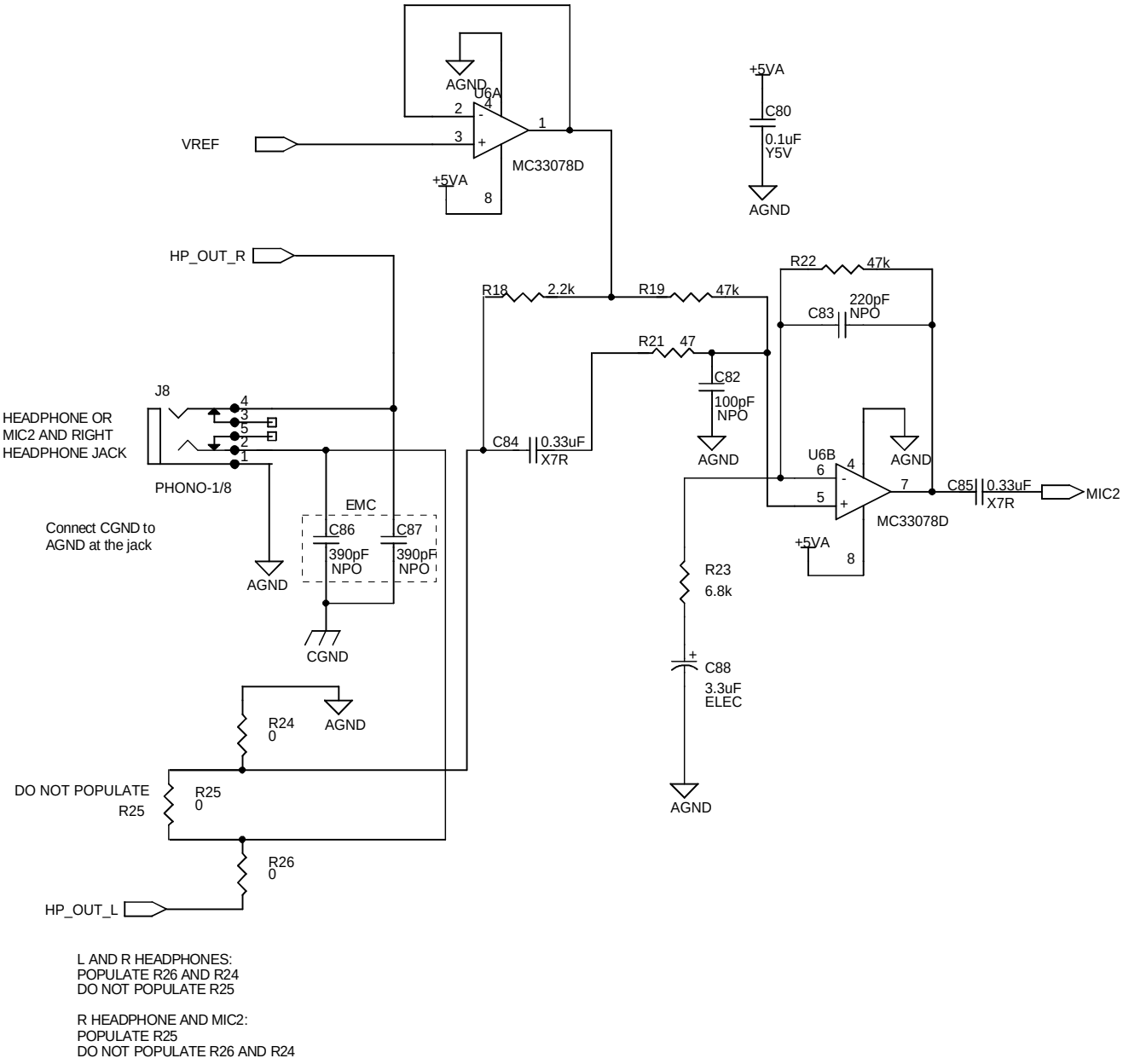


Figure 6. Headphone or Headset Connection and Microphone 2 Amplifier

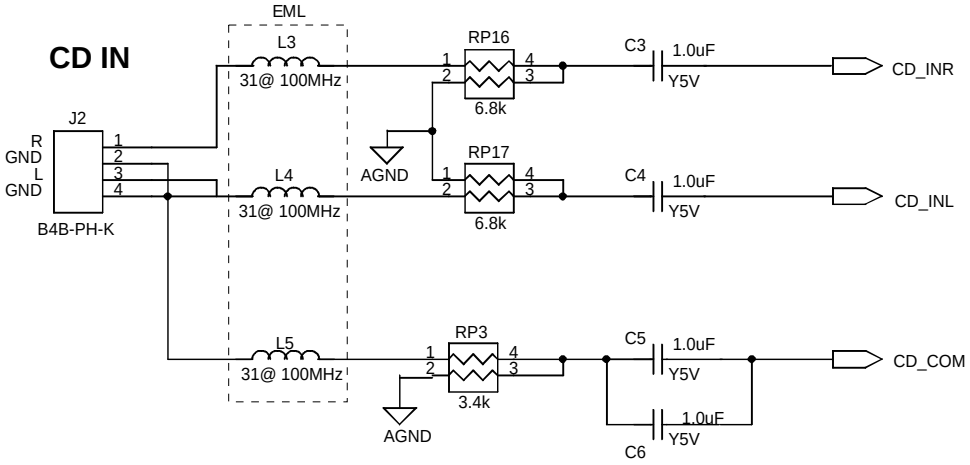


Figure 7. CD Audio Input

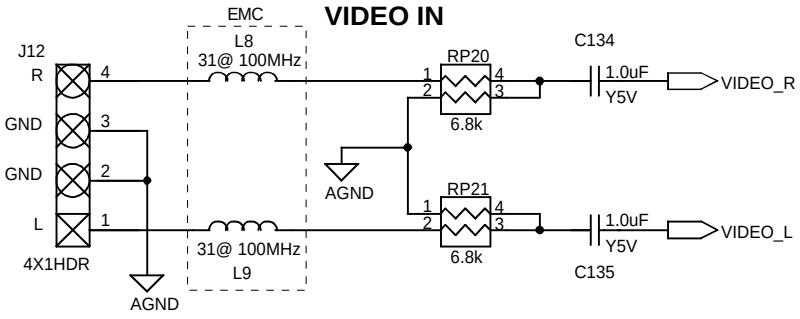


Figure 8. Video Audio Input

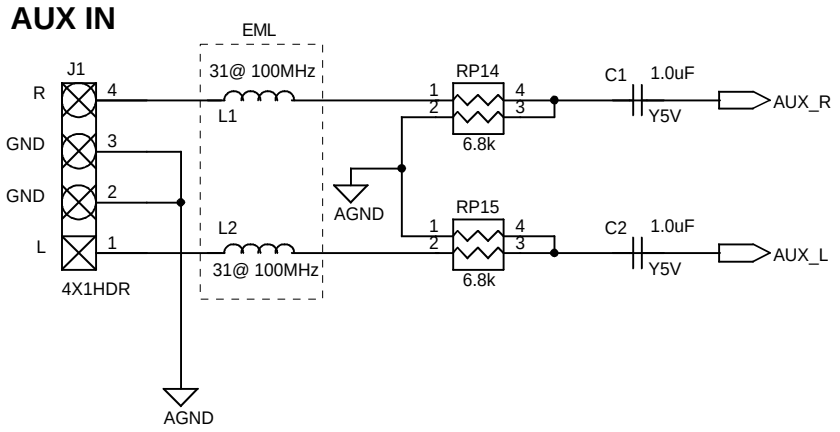


Figure 9. Aux Input

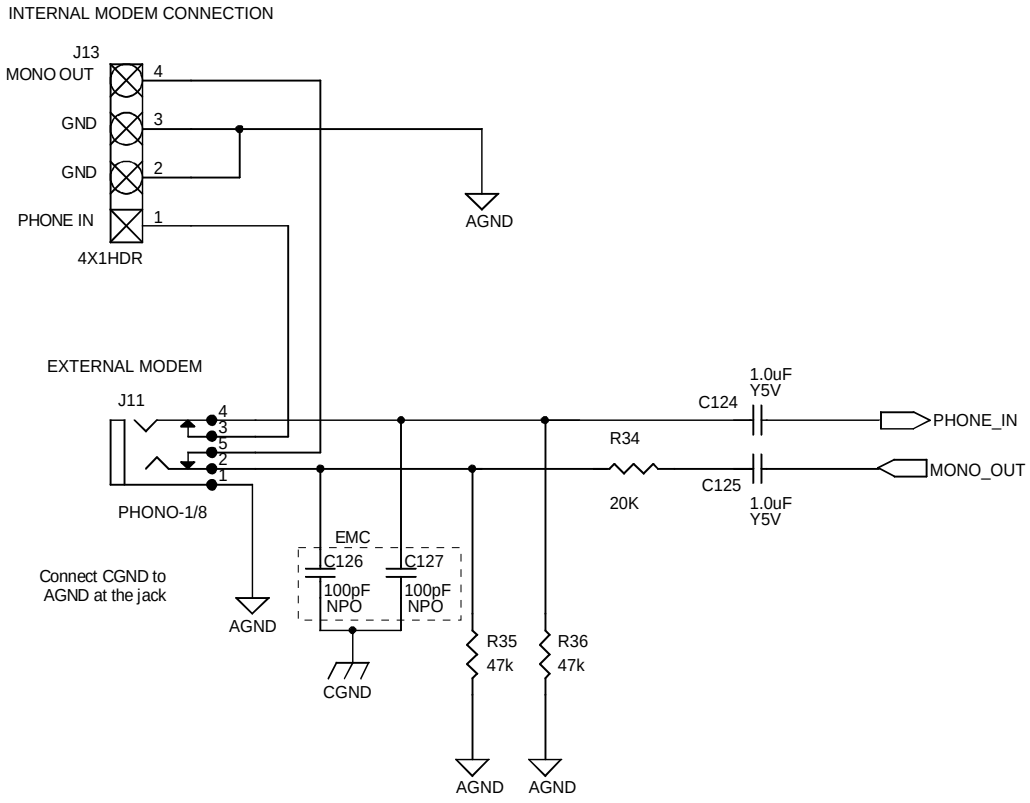


Figure 10. MODEM Audio Connection

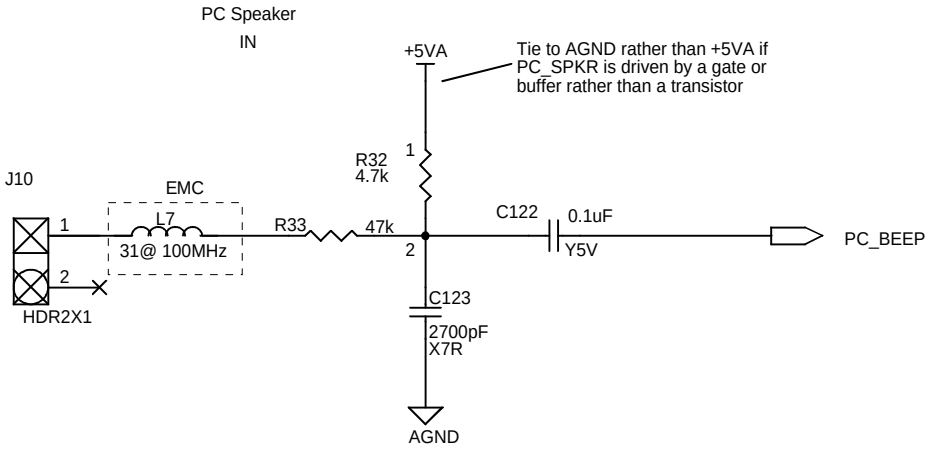


Figure 11. PC Speaker Input

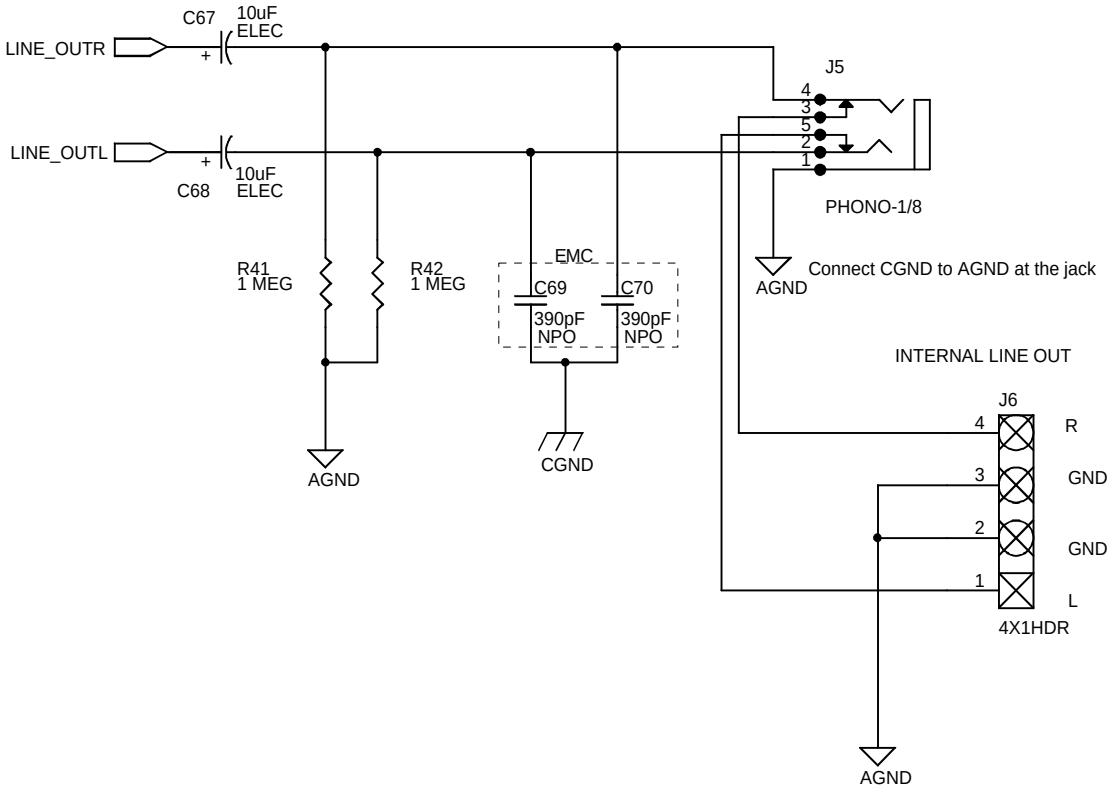


Figure 12. Line Output

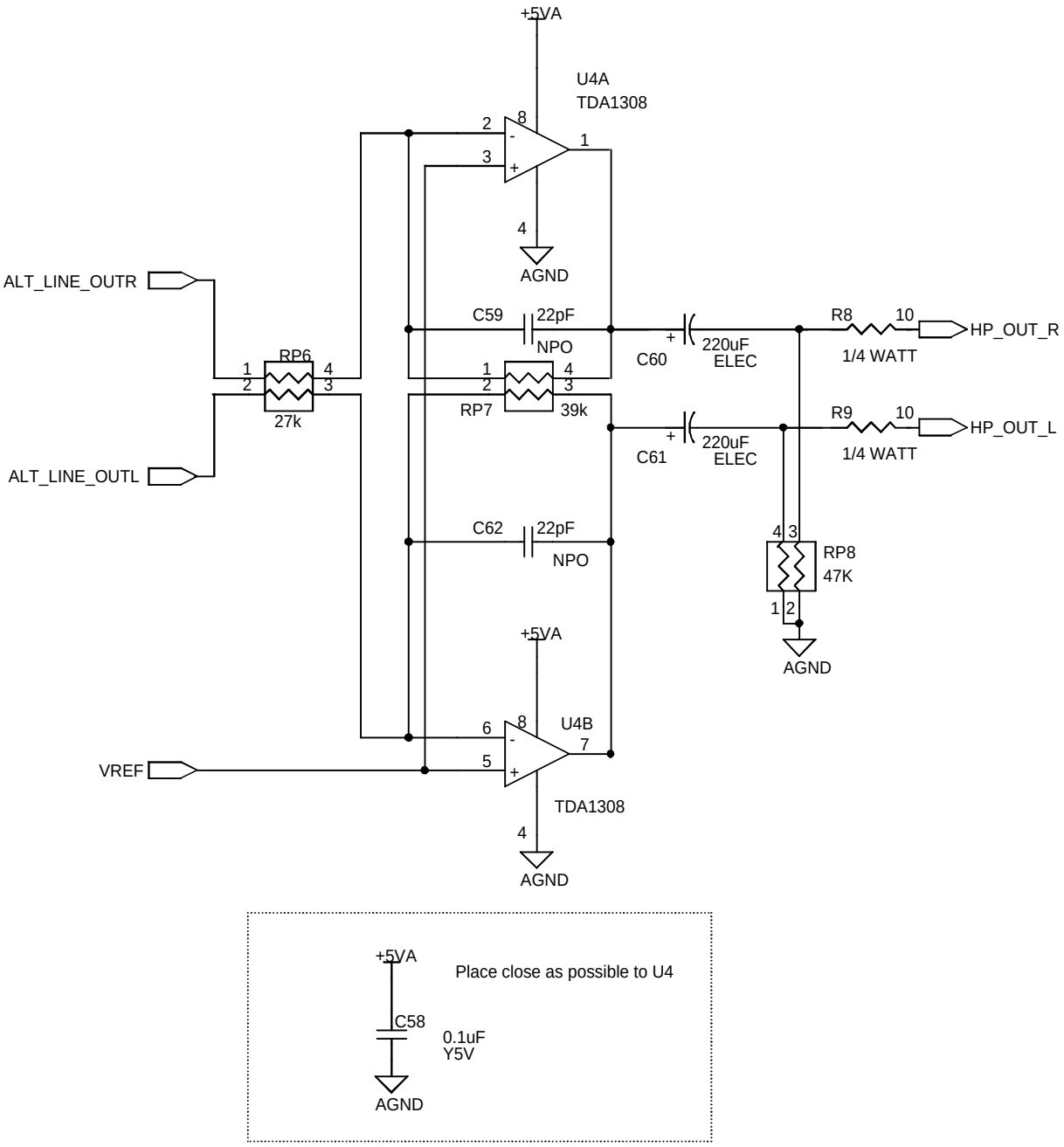


Figure 13. Headphone Amplifier

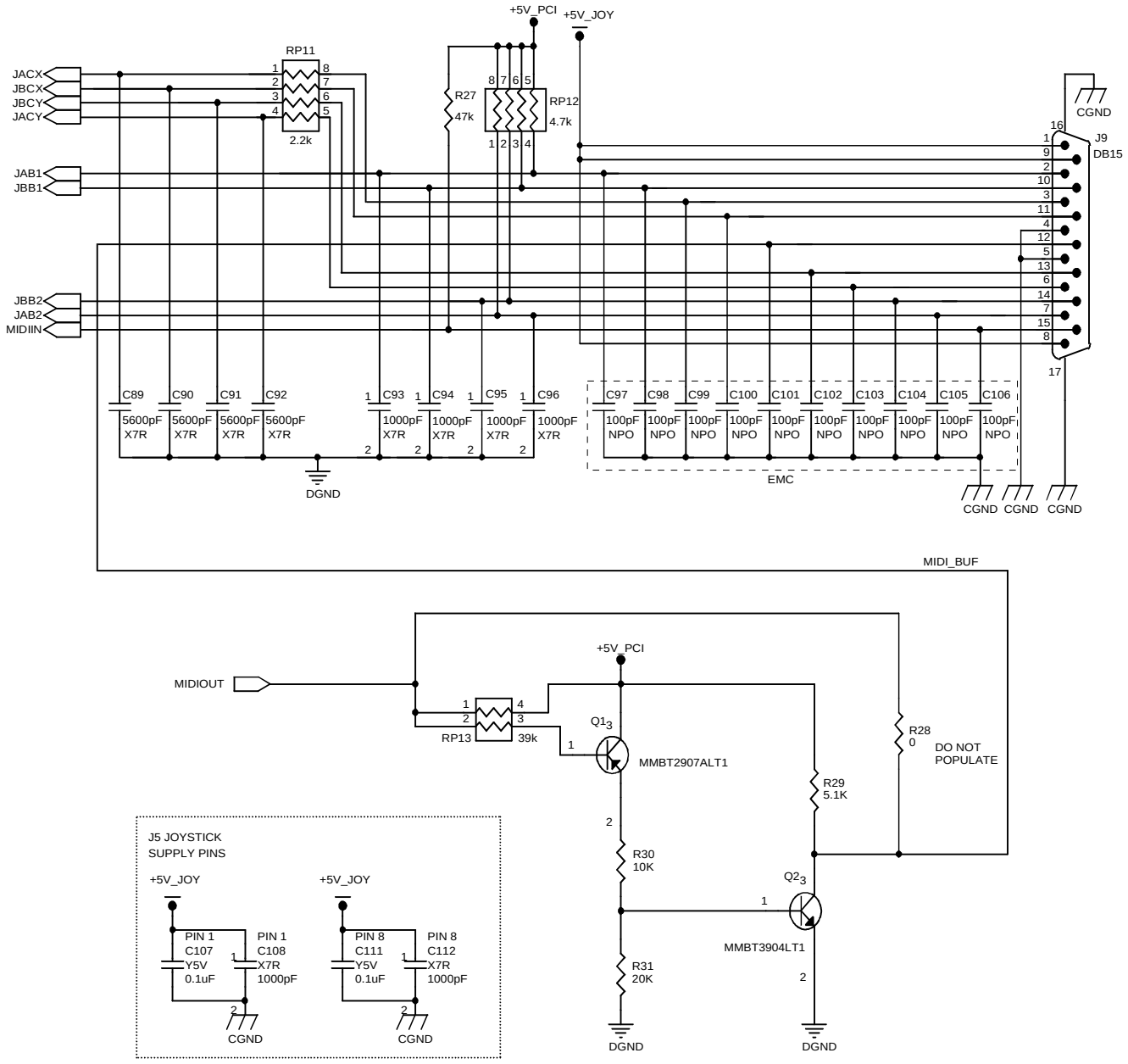


Figure 14. MIDI and Joystick Connection

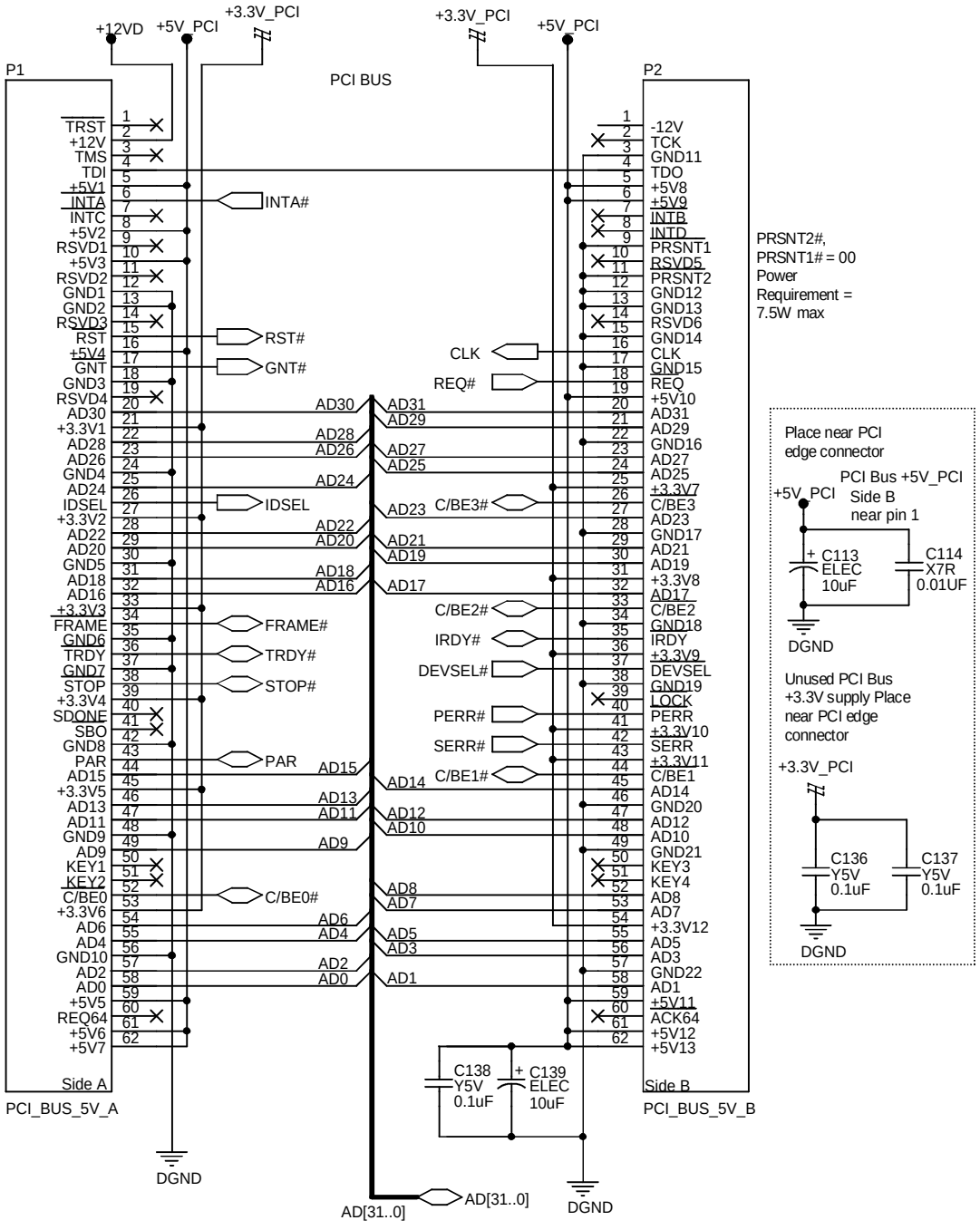
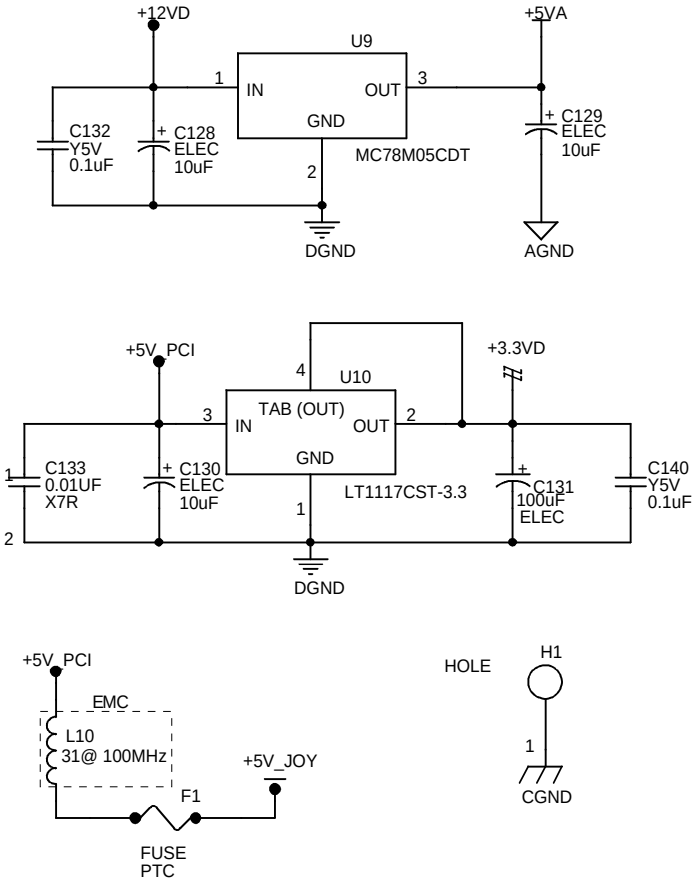


Figure 15. PCI Bus Connection

POWER SUPPLIES



Connect AGND to DGND with a 50 mil trace near the 4297
Connect CGND to DGND with a 50 mil trace near the finger edge of the board.

Figure 16. Power Supplies

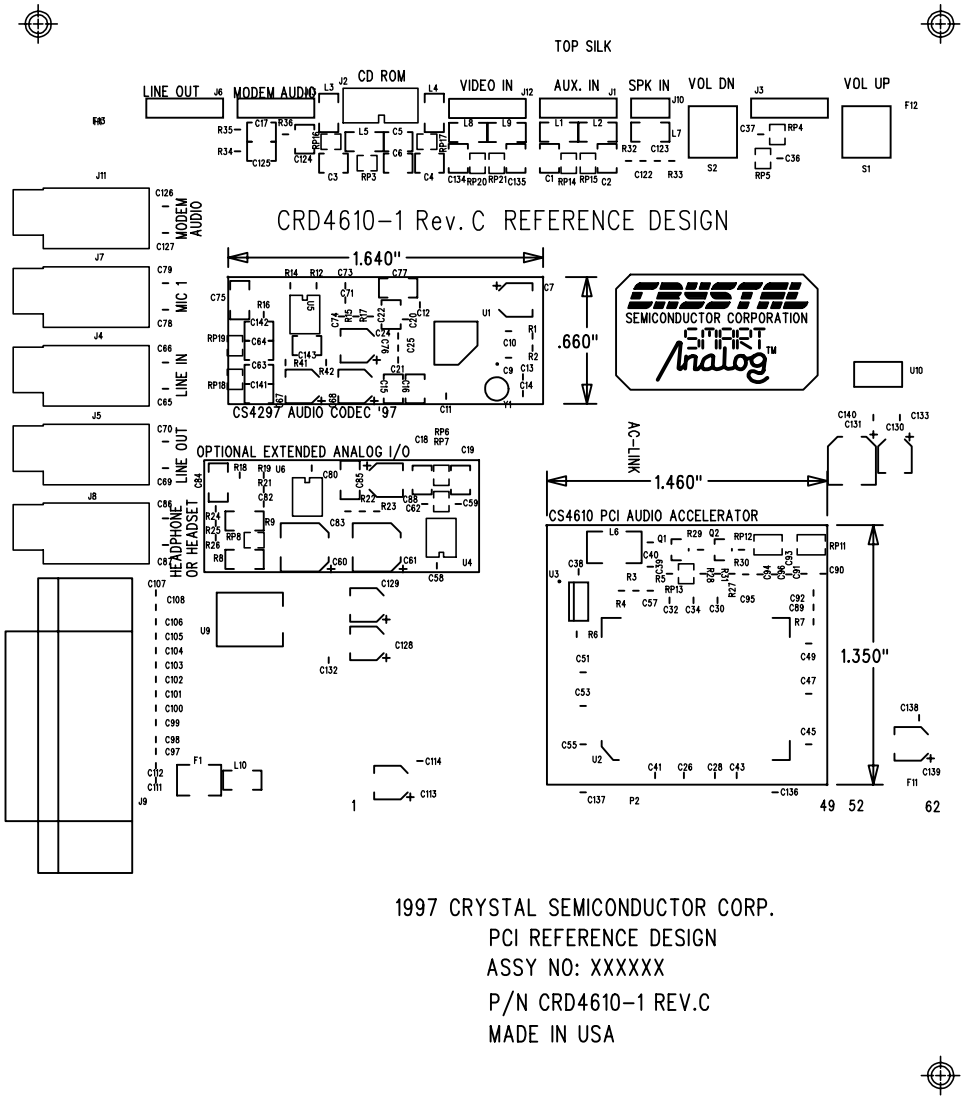


Figure 17. Top Side Silk Screen

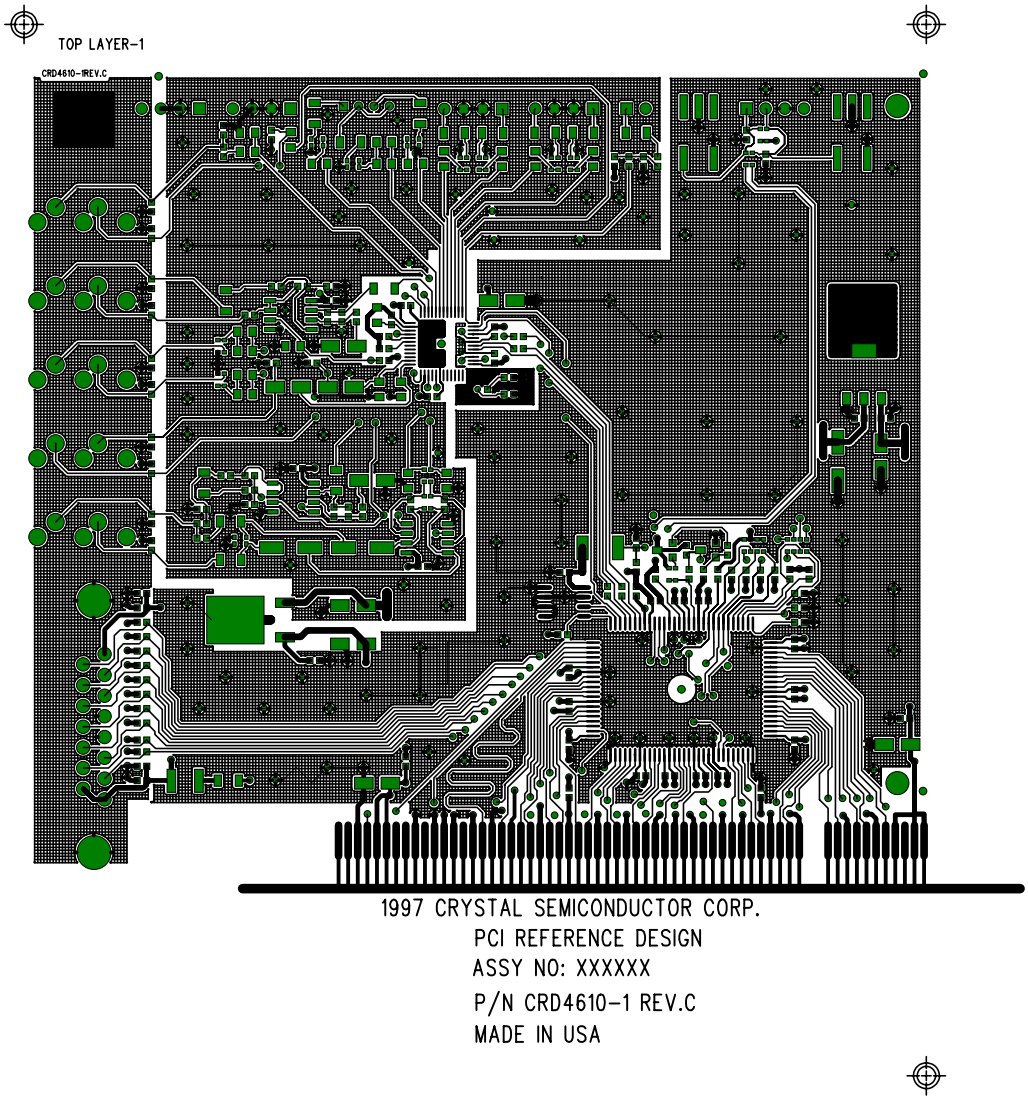


Figure 18. Top Layer Route

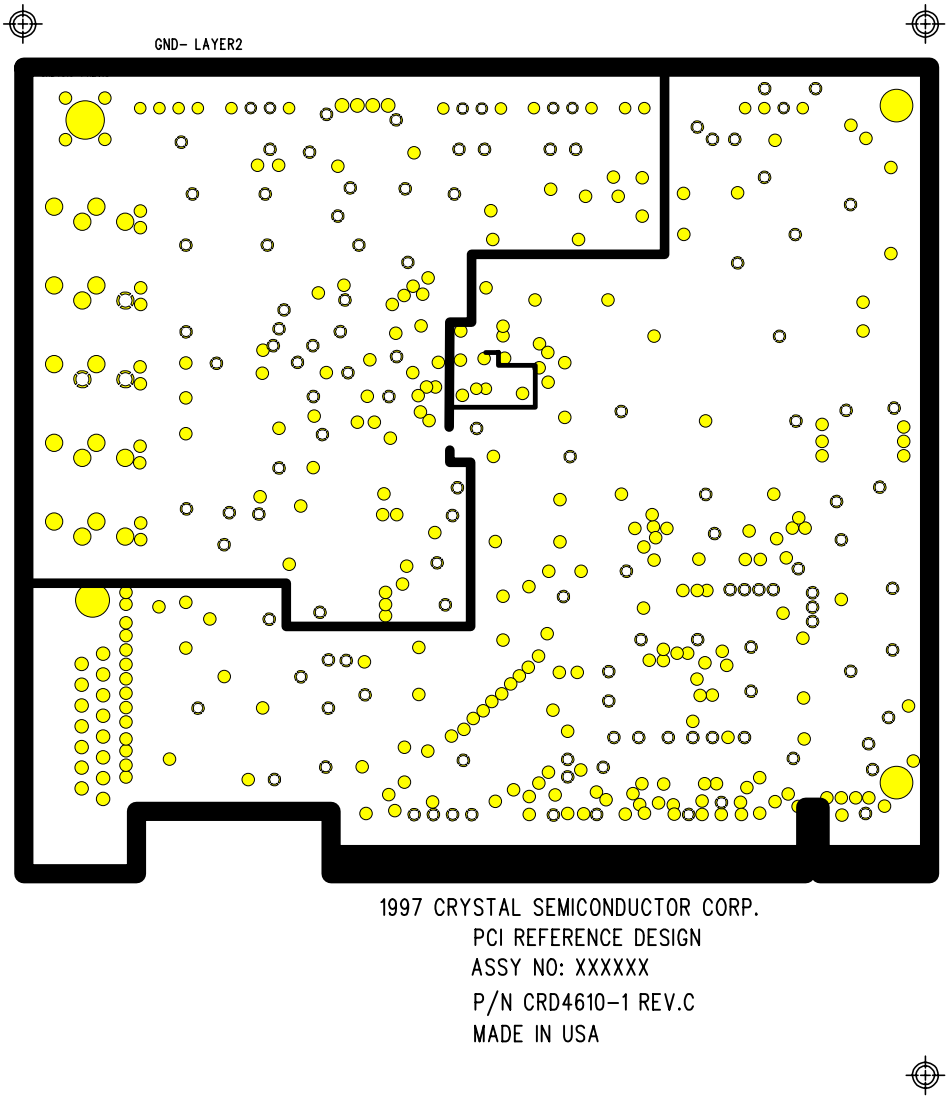


Figure 19. Gnd Layer

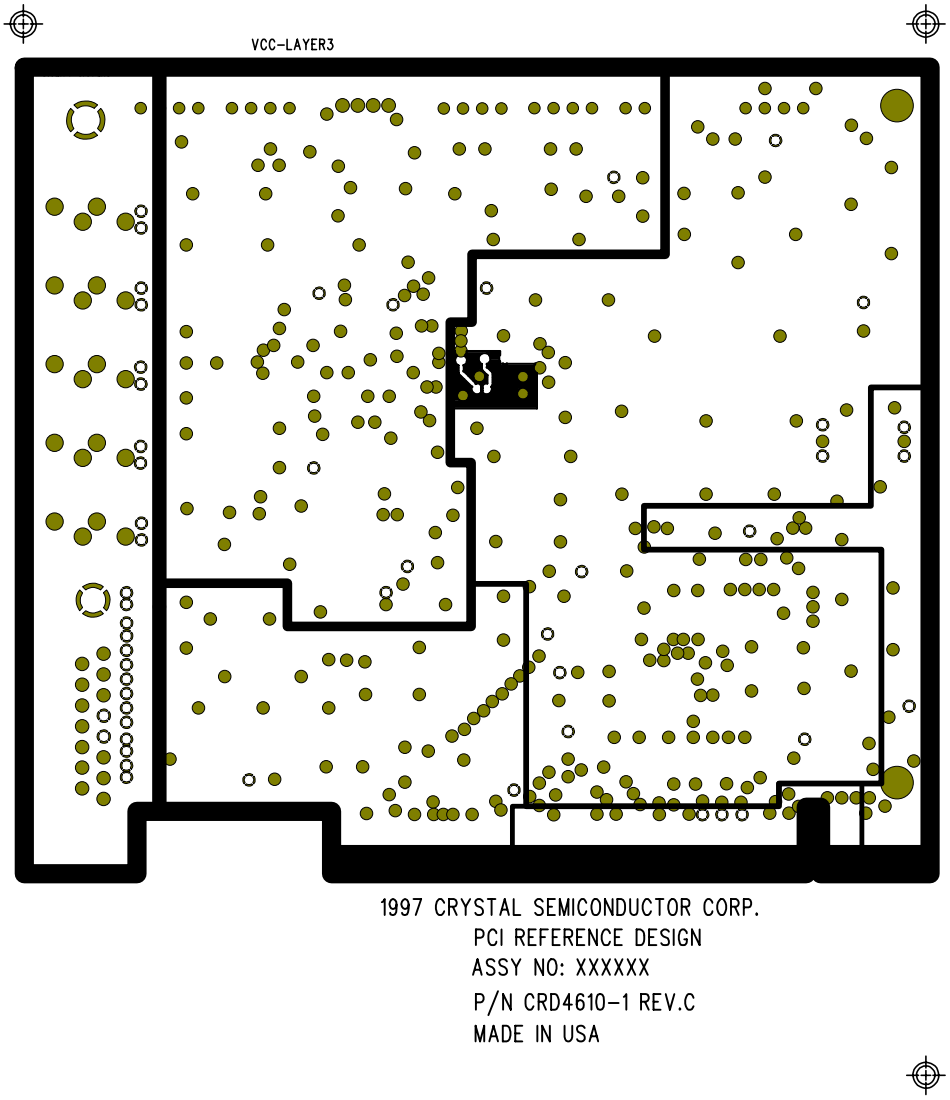


Figure 20. VCC Layer

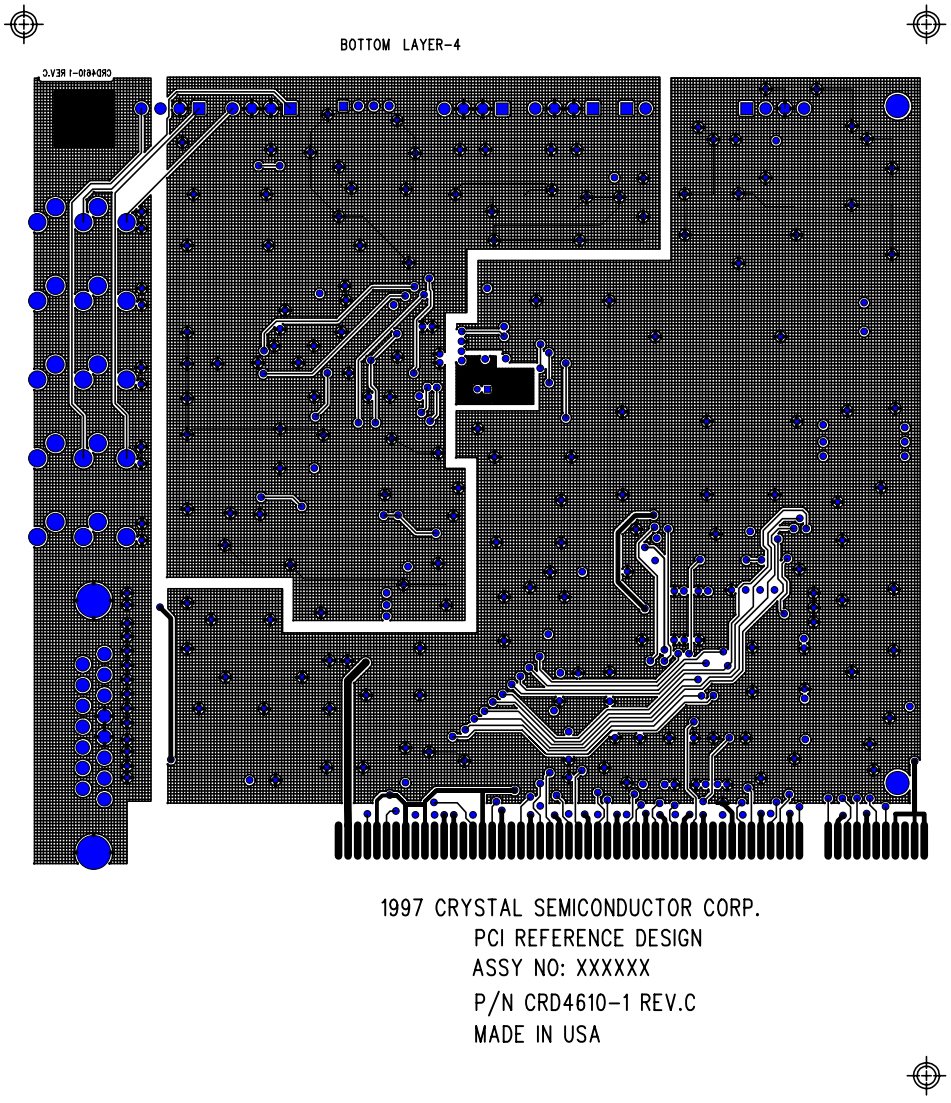


Figure 21. Bottom Side Route

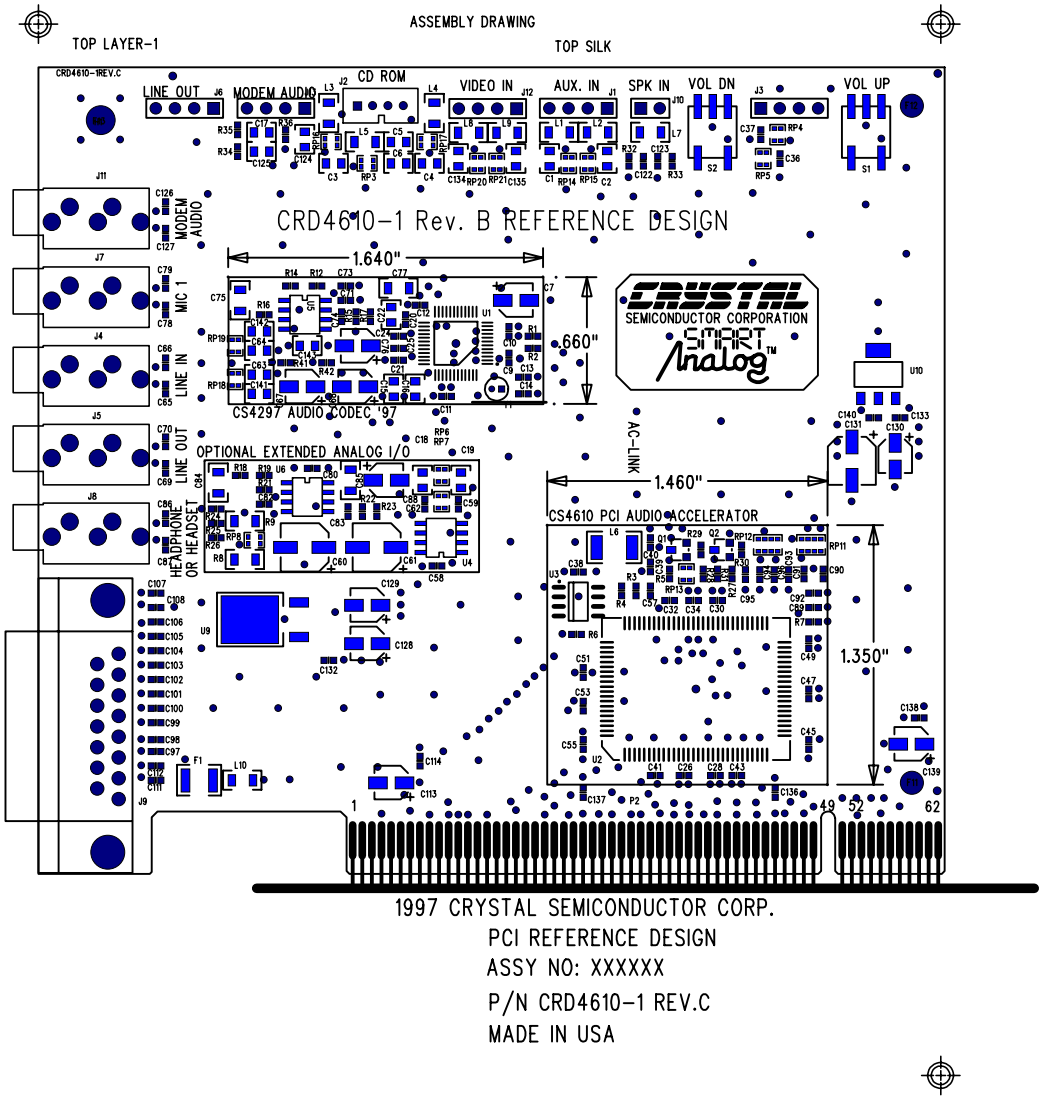


Figure 22. Assembly Drawing

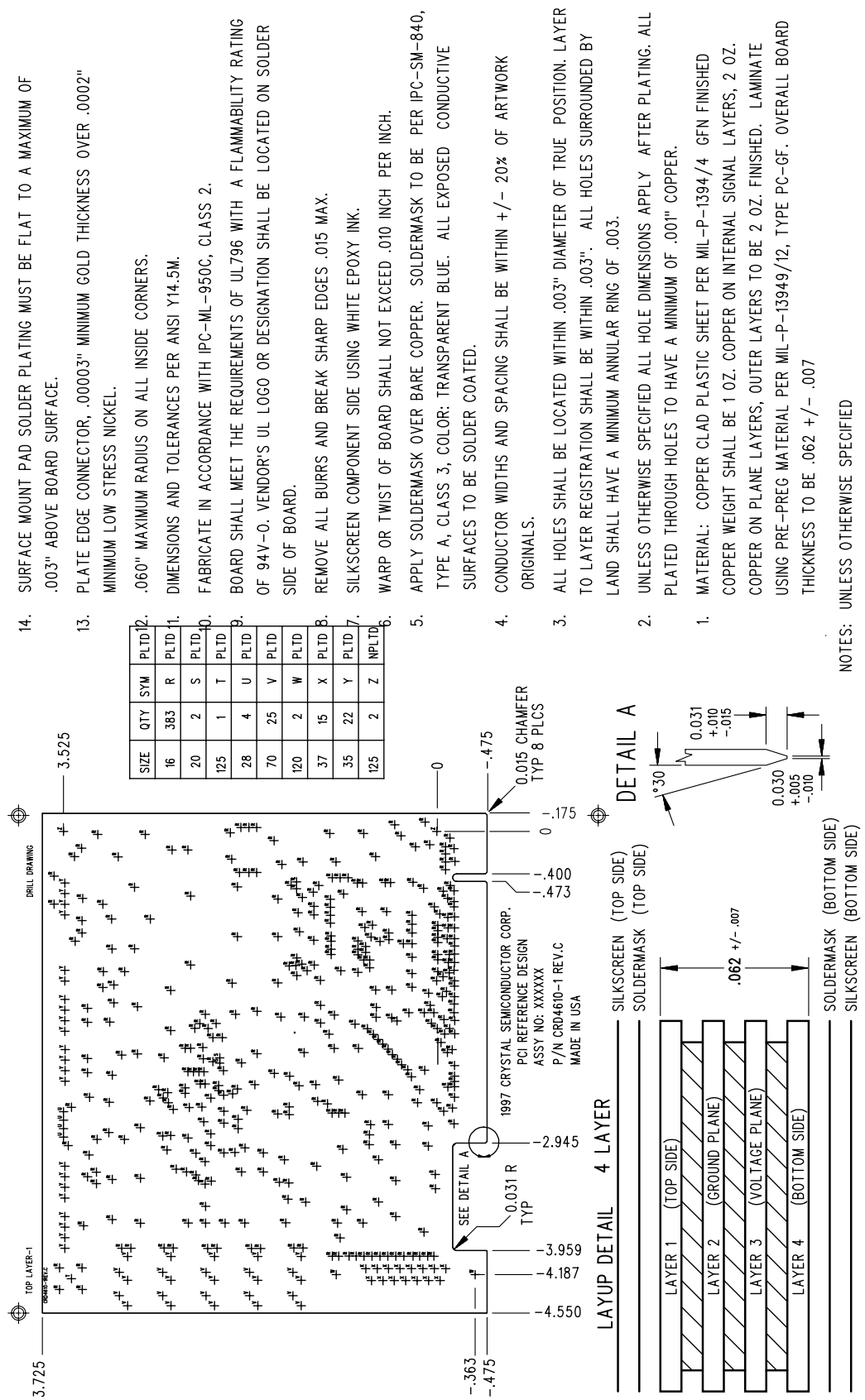


Figure 23. Drill Drawing and Manufacturing Instructions

CRD4610-1 Revised: Thursday, June 19, 1997
RD10-1C1A Revision: C1A

Bill Of Materials June 19,1997 12:06:27

Item	Quantity	Reference	Part	MFG	PN	DESCRIPTION
1	16	C1,C2,C3,C4,C5,C6,C22,C63,C64,C124,C125,C134,C135,C141,C142,C143	1.0uF	MURATA	GRM40-6Y5V105Z016AD	CAP,1.0UF,SO,0805,+80/-20%,16V,Y5V
2	8	C7,C67,C68,C113,C128,C129,C130,C139	10uF	NICHICON	UUK1C100MCU1GS	CAP,10uF,ELEC,20%,16V,4mm(B)
3	32	C9,C10,C11,C12,C20,C21,C26,C28,C30,C32,C34,C40,C41,C43,C45,C47,C49,C51,C53,C55,C57,C58,C71,C80,C107,C111,C122,C132,C136,C137,C138,C140	0.1uF	PANASONIC	ECU-V1C104ZFV	CAP,0.1uF,16V,+80/-20%,0603,Y5V
4	4	C13,C14,C59,C62	22pF	PANASONIC	ECU-V1H220KCV	CAP,22pF,0603,5%,50V,NPO
5	5	C15,C16,C17,C18,C19	680pF	PANASONIC	ECU-V1H681JCX	CAP,680pF,0805,5%,50V,NPO
6	6	C24,C25,C69,C70,C86,C87	390pF	PANASONIC	ECU-V1H391KCV	CAP,390pF,0603,10%,50V,NPO
7	20	C36,C37,C65,C66,C73,C78,C79,C82,C97,C98,C99,C100,C101,C102,C103,C104,C105,C106,C126,C127	100pF	PANASONIC	ECU-V1H101KCV	CAP,22pF,0603,5%,50V,X7R
8	3	C38,C114,C133	0.01UF	PANASONIC	ECU-V1H103KBV	CAP,0.01F,50V,10%,0603,X7R
9	7	C39,C93,C94,C95,C96,C108,C112	1000pF	PANASONIC	ECU-V1H102KBV	CAP,1000pF,50V,10%,0603,X7R
10	2	C60,C61	220uF	NICHICON	UUK0G221MCU1GS	CAP,220uF,ELEC,20%,4V,6.3mm(D)
11	2	C74,C83	220pF	PANASONIC	ECU-V1H221KCV	CAP,220pF,50V,10%,0603,NPO
12	4	C75,C77,C84,C85	0.33uF	MURATA	GRM42-6X7R334K016AD	CAP,0.33uF,1206,+80/-20%,16V,X7R
13	2	C76,C88	3.3uF	NICHICON	UUK1H3R3MCU1GS	CAP,3.3uF,SMT,ELEC,20%,50V,4mm(B)
14	4	C89,C90,C91,C92	5600pF	PANASONIC	ECU-V1H562KBV	CAP,22pF,0603,5%,50V,X7R
15	1	C123	2700pF	PANASONIC	ECU-V1H272KBV	CAP,2700pF,50V,10%,0603,X7R

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16	1	C131	100uF	PANASONIC	ECE-V1AA101P	CAP,100uF,SMT,ELEC,20%,10V
17	1	F1	FUSE	RAYCHEM	MINISMD050-2	FUSE
18	1	H1	HOLE		HOLE	
19	4	J1,J6,J12,J13	4X1HDR	SAMTEC	TSW-104-07-T-S	HDR,4X1,0.025"PIN,0.1"CTR
20	1	J2	B4B-PH-K		B4B-PH-K	4 PIN SHROUDED HEADER, .08"
21	5	J4,J5,J7,J8,J11	PHONO-1/8	LZR	SJ-372	CONN,1/8" SWITCHED STEREO PHONE JACK,TH
22	1	J9	DB15	AMP	747845-3	CONN,15D SHELL,FEMALE,RT ANGLE PC MOUNT
23	1	J10	HDR2X1	SAMTEC	TSW-102-07-T-S	HDR,1X2,0.025"PIN,0.1"CTR
24	9	L1,L2,L3,L4,L5,L7,L8,L9,L10	31@ 100MHz	TDK	HF50ACB321611-T	IND,FBEAD,1206,120@100MHz,25%
25	1	L6	120 @ 100MHz	TDK	HF30ACB453215-T	IND,FBEAD,1812,120@100MHz,25%
26	1	P1	PCI_BUS_5V_A		PCI_BUS_5V_A	PCI BUS 5V SIDE A
27	1	P2	PCI_BUS_5V_B		PCI_BUS_5V_B	PCI BUS 5V SIDE B
28	1	Q1	MMBT2907ALT1	NATIONAL	MMBT2907ALT1	TRAN,PNP,SOT23,SMT
29	1	Q2	MMBT3904LT1	NATIONAL	MMBT3904LT1	TRAN,NPN,SOT23,SMT
30	1	RP3	3.4k	PANASONIC	EXB-V4V342GV	RES ARRAY,2 ISOLATED, 3.4k,1/16W,2%,0.6mm,SMT
31	1	RP4	4.7K	PANASONIC	EXB-V4V472JV	RES ARRAY,2 ISOLATED, 4.7K,1/16W,5%,0.6mm,SMT
32	1	RP5	100	PANASONIC	EXB-V4V101JV	RES ARRAY,2 ISOLATED, 100,1/16W,5%,0.6mm,SMT
33	1	RP6	27k	PANASONIC	EXB-V4V273JV	RES ARRAY,2 ISOLATED, 27k,1/16W,5%,0.6mm,SMT
34	2	RP7,RP13	39k	PANASONIC	EXB-V4V393JV	RES ARRAY,2 ISOLATED, 39k,1/16W,5%,0.6mm,SMT
35	1	RP8	47K	PANASONIC	EXB-V4V473JV	RES ARRAY,2 ISOLATED, 47K,1/16W,5%,0.6mm,SMT
36	1	RP11	2.2k	PANASONIC	EXB-V8V222JV	RES ARRAY,4 ISOLATED, 2.2K,1/16W,5%,0.6mm,SMT
37	1	RP12	4.7k	PANASONIC	EXB-V8V472JV	RES ARRAY,4 ISOLATED, 4.7K,1/16W,5%,0.6mm,SMT
38	8	RP14,RP15,RP16,RP17,RP18,RP19,RP20,RP21	6.8k	PANASONIC	EXB-V4V682JV	RES ARRAY,2 ISOLATED, 6.8k,1/16W,5%,0.6mm,SMT
39	6	R1,R2,R3,R4,R14,R21	47	PHILIPS	9C06031A47R0J	RES,47,SO,0603,5%,1/16W,METAL FILM
40	3	R5,R7,R30	10K	PHILIPS	9C06031A1002J	RES,10K,SO,0603,5%,1/10W,METAL FILM
41	2	R6,R32	4.7k	PANASONIC	ERJ-3GSYJ472V	RES,4.7k,0603,1/16W,5%,MTL FILM
42	2	R8,R9	10	PHILIPS	9C12063A10R0J	RES,10,SO,1206,5%,1/4W,METAL FILM
43	8	R12,R15,R19,R22,R27,R33,R35,R36	47k	PANASONIC	ERJ-3GSYJ473V	RES,47k,0603,1/16W,5%,MTL FILM
44	2	R16,R18	2.2k	PANASONIC	ERJ-3GSYJ222V	RES,2.2k,0603,1/16W,5%,MTL FILM
45	2	R17,R23	6.8k	PANASONIC	ERJ-3GSYJ682V	RES,6.8k,0603,1/16W,5%,MTL FILM
46	2	R24,R26	0	PHILIPS	9C06032A0R00J	RES,0,SO,0603,5%,1/10,METAL FILM
47	1	R29	5.1K	PHILIPS	9C06031A5101J	RES,5.1K,SO,0603,5%,1/10W,METAL FILM

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48	2	R31,R34	20K	PHILIPS	9C06031A2002J	RES,20K,SO,0603,5%,1/10W,METAL FILM
49	2	R42,R41	1 MEG	PHILIPS	9C06031A1004J	RES,1M,SO,0603,5%,1/16W,METAL FILM
50	2	S1,S2	EVQ-PHP03T		EVQ-PHP03T	PUSH BUTTON SWITCH
51	1	U1	CS4297-KQ	CRYSTAL	CS4297-KQ_0	AC '97 Serial CODEC w/ 3D
52	1	U2	CS4610-CM	CRYSTAL	CS4610-CM	PCI AUDIO ACCELERATOR
53	1	U3	X24C04	ATMEL	AT24C04N-10SC	IC,24C04,512X8BIT,SO,SOIC8,EEPROM
54	1	U4	TDA1308	PHILIPS	TDA1308S8	IC,1308,SO,SOIC8,LOW NOISE HEADPHONE AMP
55	2	U5,U6	MC33078D	MOTO	MC33078D	IC,33078,SO,SOIC8,DUAL OP AMP
56	1	U10	LT1117CST-3.3	LINEAR TECHNOLOGY	LT1117CST-3.3	3.3V REGULATOR, SOT_223, 0.2%, 800mA
57	1	U9	MC78M05CDT	MOTOROLA	MC78M05CDT	+5V REGULATOR, DPAK, 2%, 500MA
58	1	Y1	24.576 MHz	EPSON	CA-301_24.576M-C	CRYSTAL, 24.576MHz, CA-301, Fund Mode Par Res
DO NOT POPULATE						
	2	R25, R28	0	PHILIPS	9C06032A0R00J	RES,0,SO,0603,5%,1/10,METAL FILM
	1	J3	4X1HDR	SAMTEC	TSW-104-07-T-S	HDR,4X1,0.025"PIN,0.1"CTR


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