CRD4297-1 AMR

Advanced Product Databook

FEATURES

- **AMR Audio Codec add-in card designed to meet the Intel® Audio/Modem Riser Specification**
- **High quality, low cost, 2-layer, single sided adapter board**
- **CS4297 SoundFusion™ Audio Codec '97**
- **Complete suite of Analog and Digital I/O connections:**
  - — Line In, Line Out, Mic In, Modem Audio connection, CD Audio In, Video In, Aux In, Headphone Out and Optical Digital Out
- **Meets or exceeds Microsoft's® PC 97, PC 98, and PC 99, both required and advanced, audio performance requirements.**

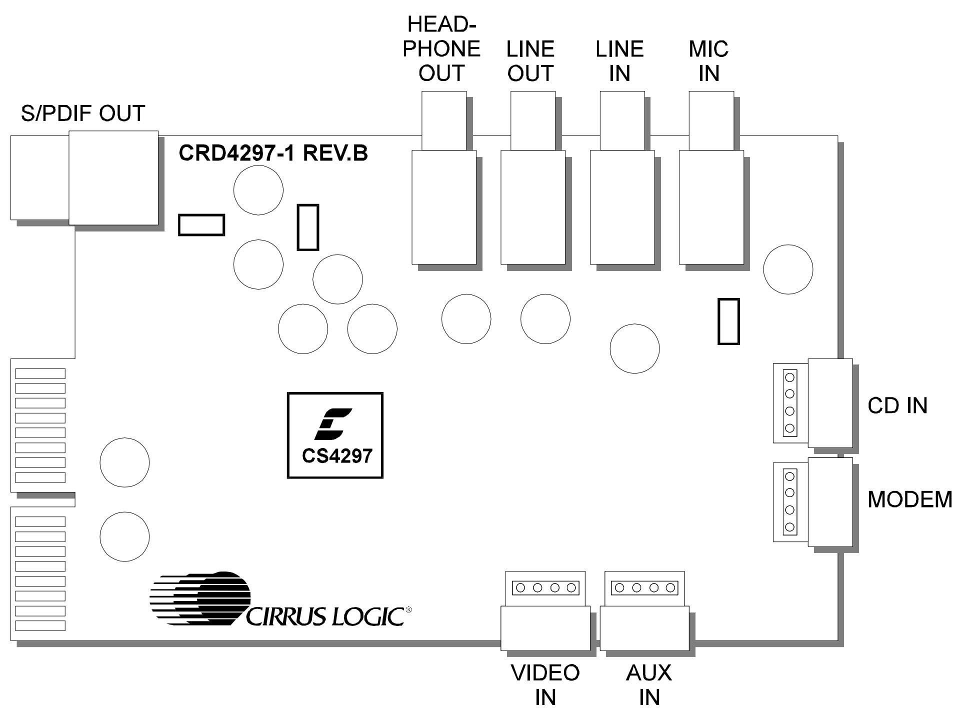
ORDERING INFO CRD4297-1 AMR

CrystalClear™ AC '97 AMR Audio Modem Riser Reference Design

DESCRIPTION

The CRD4297-1 AMR add-in board reference design showcases Cirrus Logic's Crystal Audio AC '97 CS4297 SoundFusion Audio Codec '97, and is Audio/Modem Riser Specification[2], compliant. The CRD4297-1 AMR card is 2.7" high by 3.6" long.

The CRD4297-1 AMR reference design includes a customer ready manufacturing kit. Included in the kit are a full set of schematic design files (OrCAD® 7.2 format), PCB job files (PADS® ASCII), PCB artwork files, bracket drawings (Gerber), and bill of materials. The design is production ready as is, or can be easily modified to incorporate specific OEM changes. Documentation source files are available to assist the OEM to quickly provide an accurate end user manual.



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GENERAL INFORMATION

The CRD4297-1 AMR is a production-grade AMR audio card reference design using the CS4297 SoundFusion Audio Codec ‘97. The design supports the functionally compatible CS4297, CS4297A, or CS4299 AC ‘97 SoundFusion Audio Codecs.

The AMR board advantage lies in the complete separation of the analog section from the noisy digital environment of a personal computer. A 5-wire digital link is all that is required to connect the audio codec to the AMR bus-based AC ‘97 controller. This allows the audio section to reach the required dynamic range of ~90 dB FS A while making the layout and placement of the audio section easier to implement. The CS4297 performs the Digital-to-Analog Conversion (DAC) for the digital audio output stream and also provides multiple analog audio inputs and outputs, analog mixing and Analog-to- Digital Conversion (ADC).

This card is designed to provide the highest possible functionality, along with industry leading audio performance at a low manufacturing cost. Care was taken with component placement and signal routing to minimize sources that can degrade audio performance. Cirrus’ analog design know-how has resulted in a board that preserves the exceptional analog performance of the CS4297.

REFERENCE DESIGN FEATURES

The CRD4297-1 AMR reference design illustrates a high quality, low cost two-layer add-in card layout. The card is sectioned into three main parts: the AMR bus section, the *CS4297 Audio Codec ‘97* section, and the *Analog I/O* section.

Digital Audio Out

The AMR bus provides digital out in a format compatible with the consumer portion of IEC 958. An older version of this standard is also known as S/PDIF. Depending upon the codec, the SPDIF signal originates either from the AMR bus or the codec. Digital out is provided through a Toshiba TOTX173 optical TOS-LINK jack on the board edge. There are many advantages in using a Fiber optic link versus the traditional coaxial link. Fiber optic is a non-metallic insulator thereby preventing ground loops and electromagnetic interference. For signal transmission, it offers low attenuation, high bandwidth, low propagation delay, low bit error rates, small size, and cost efficiency. The signal is IEC 958 and CP-1201 compliant.

CS4297 Audio Codec ‘97

The CS4297 is a mixed-signal serial Codec based on the AC ‘97 specification. It is designed to be paired with a digital controller, located on the AMR bus. The AC ‘97 Controller is responsible for all communications between the CS4297 and the rest of the system. The CS4297 functions as an an-

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alog mixer, a stereo ADC, a stereo DAC, and a control and digital audio stream interface to the AC '97 controller.

The CS4297 contains two distinct functional sections: digital and analog. The digital section includes the AC-link registers, power management support, SYNC detection circuitry, and AC-link serial port interface logic. The analog section includes the analog input multiplexer (mux), stereo output mixer, mono output mixer, stereo ADCs, stereo DACs, and analog volume controls. This section contains the components for the various analog audio connections, and the 24.576 MHz crystal master clock. For more information refer to the *CS4297 Data Sheet* [3]. The capacitors required for the CS4297 and their placement are discussed in the *CS4297 Data Sheet* [3]. Refer to the *Grounding and Layout* section of the data sheet for the recommended routing of the audio section.

Power Requirements

The CS4297 requires both a digital +3.3 V and an analog +5 V supply. The digital power is supplied from the AMR bus. A voltage regulator is recommended for the analog supply. A Motorola MC78L05 regulates the AMR +12 V supply down to provide a clean +5 V analog supply for the CS4297. The MC78L05 regulator can provide adequate current, which is enough for the CS4297 and associated analog circuitry.

Analog I/O

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 via 0.1 µF to the analog ground plane. The analog section contains the components for a headphone amplifier. The Modem Audio, CD In, Audio In, and Aux In headers are also part of the Analog I/O section. The header and its associated components may or may not be necessary depending on the audio inputs implemented.

Audio I/O

A full feature set of the CS4297's analog I/O and digital out is represented on the reference design card through internal and external connectors:

- Line Out
- Headphone Out
- Line In
- Mic In
- CD Audio In
- Aux In
- Video In
- Modem Audio connection
- Optical Digital Out

Four external 1/8" jacks, one external TOS-LINK jack, and four internal header connections are used for analog and digital inputs and outputs.

Line Out

The output of the CS4297 is capable of driving impedances greater than 10 kΩ with a maximum output voltage of 1 Vrms. The Line Out connection is made via an external 1/8" jack.

- Maximum output level: 1 Vrms

Headphone Out

An external 1/8" jack provided for a headphone connection. This output is driven by an amplifier for low impedance loads such as 32 Ω headphones.

- Maximum output level: 2.0 Vrms (no load); 1.5 Vrms (32 Ω load)
- Maximum output power: 70 mW/channel (32 Ω load)

Line In

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

- Maximum input level: 2 Vrms

Mic In

The Microphone In 1/8" jack provides an input to a microphone pre-amplifier circuit that applies 18 dB of gain to the signal.

- Maximum input level:
  - Microphone Boost enabled: 12.5 mVrms
  - Microphone Boost disabled: 125 mVrms
- Supports 3-pin electret (power on ring) and 2-pin dynamic microphones

CD Audio In

The CD Audio input provides a 4-pin (0.1 inch center) right-angled connector that is compatible with the SONY standard.

- Maximum input level: 2 Vrms
- Differential input using the CD Common pin as the ground
- 0.1 inch connector wired as:
  - Pin 1 : Left Channel
  - Pin 2 : Analog Ground
  - Pin 3 : Analog Ground
  - Pin 4 : Right Channel

Aux In

- Internal 4-pin (0.1 inch center) right-angled connector
- Wired as:
  - Pin 1 : Left Channel
  - Pin 2 : Analog Ground
  - Pin 3 : Analog Ground
  - Pin 4 : Right Channel
- Maximum input level: 2 Vrms

Video In

- Internal 4-pin (0.1 inch center) right-angled connector
  - Pin 1 : Left Channel
  - Pin 2 : Analog Ground
  - Pin 3 : Analog Ground
  - Pin 4 : Right Channel
- Maximum input level: 2 Vrms

Modem Audio Connection

The modem audio connection can be made through the internal 4-pin (0.1 inch center) right-angled connector. This connector carries both a mono input and a mono output.

- Internal 4 pin header (0.1 inch center)
  - Pin 1 : Mono Out (to modem)
  - Pin 2 : Analog Ground
  - Pin 3 : Analog Ground
  - Pin 4 : Phone In (from modem)
- Maximum input level: 1 Vrms
- Maximum output level: 1 Vrms
- Minimum load impedance: 10 kΩ

SCHEMATIC DESCRIPTION

Figures 11 through 17 show the schematics for the CRD4297-1 AMR card. This section will describe particular pages of the schematic that need to be discussed.

Figure 11: Block Diagram

The block diagram is an interconnection overview between schematic pages.

Figure 12: AMR Bus Interface

The +5 V power pin is decoupled through C1 and supplies power for the SPDIF_OUT circuit. All ground pins are tied to digital ground except for B2, which is tied to analog ground.

The AC-link, which consists of ASDOUT, ARST#, ASYNC, ASDIN, and ABITCLK, transfers digital audio data between the audio codec and the host. PC_BEEP_BUS routes the motherboard beep/speaker signal from the motherboard to the audio subsystem, for use in hearing POST codes (refer to the *Intel Audio/Modem Riser Specification* [2]).

The PRIMARY_DN# signal indicates the presence or the absence of a primary codec on the motherboard. The MSTRCLK is the 24.576 MHz master clock for the AC ‘97 link. Populate R51 since the CS4297 is always the primary codec. Populate R50 for CS4297A/99, when they are the secondary codec.

The CS4297 does not support S/PDIF, R3 is populated so the S/PDIF signal originates from the AMR bus. For a CS4297A/99 by populating R2 instead of R3, the SPDIF_CODEC signal is directly routed to the S/PDIF circuit, bypassing the AMR bus.

Figure 13: Power Supply

The CS4297 requires both a digital +3.3 V and an analog +5 V supply. The digital power is supplied from the AMR bus. A separate regulator is recommended for the analog voltage supply to provide good audio signal quality. A Motorola MC78L05 regulates the +12 V supply from the AMR bus down to a clean +5 V analog supply. Two packaging options are supported, where U5 is an SO8 surface mount package and U4 is a TO-92 pin-in-hole package. The -12 V power pin is decoupled through C73/C74, and supplies power to the headphone circuit.

Figure 14: CS4297 AC ‘97 Audio Codec

For the best audio performance, the analog voltage regulator, an MC78L05, is located near the 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. All filtering capacitors of audio signals are NPO-type to ensure minimal added distortion. Two footprints are provided for the crystal XTAL: a CA-301 pin-in-hole footprint, Y1, for miniature crystal; and a standard HC-49U package, Y2. The HC-49U package can be bent over and soldered to the card. R47 is a termination resistor in the serial AC-link between the CS4297 and the AMR bus.

Figure 15: Analog Inputs

The inputs for AUX, VIDEO, CD, and LINE are passed through a divider circuit that reduces the voltage by 6 dB to allow connection of line level sources up to 2 Vrms. The 220 pF capacitors are provided on Line_In, Mic_In, CD_In, Aux_In, Video_In, and Internal Modem connection for EMC suppression. These may be removed if EMC testing determines they are not required. 1 µF AC-coupling capacitors are used on the Line_In, Mic_In, CD_In, Aux_In, Video_In, and Internal Modem circuit to minimize the low frequency roll-off. The internal CD audio connection utilizes a pseudo-differential interface with CD_GND as the common return path for both the left and right channels. Therefore, the input impedance of this block is half of that of the other inputs.

The modem connection is both a mono input and output. The output is fed from the CS4297’s MONO_OUT pin through a divider made of R22/23. The divider ratio is preset to 0 dB for an output voltage of 1 Vrms. If a lower output voltage is desired, the resistors can be replaced with appropriate values, as long as the total load on the output is kept greater than 10 kΩ. The input is not divided to accommodate line level sources up to 1 Vrms.

Figure 16: Audio Outputs

The line out is driven directly by the CS4297. The headphone out amplifier, a Motorola MC1458, is capable of driving stereo headphones with impedances greater than 32 Ω or powered speakers. R37/38 are added for short-circuit protection. An optical S/PDIF (IEC 958 consumer) output is also supported.

Figure 17: Microphone Pre-amp and Bias

A Motorola MC33078D low noise dual op-amp provides an +18 dB gain stage for the microphone and buffers the phantom power supply for the mic. The 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 on the ring, as required by the *PC 99 System Design Guide*, Chapter 17, Audio Components [5].

Component Selection

Great attention was given to the particular components on the CRD4297-1 AMR 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
- use single package components, no resistor packs
- right-angled headers for all internal connections to provide sufficient headroom for the jacks
- dual footprint for XTAL. Standard H49U with GND pad and small circular CA-301 pin-in-hole package
- Dual footprint for +5 V and +3.3 V regulators. Surface mount and pin-in-hole package are supported.

EMC Components

A number of capacitors and inductors are included to help the board meet EMC compliance tests, such as FCC Part 15. Modifying this selection of components without EMC testing could cause EMC compliance failure.

GROUNDING AND LAYOUT

Partitioned Voltage and Ground Planes

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.

The area around the crystal oscillator and the two XTAL signals is filled with copper on the top and bottom sides and attached to digital ground. This ground plane serves to keep noise from coupling onto these pins. All data converters are highly susceptible to noise on the crystal pins.

A separate chassis ground provides a reference plane for all of the EMC components. 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* [3] on how the area under the chip should be partitioned and how the bypass capacitors should be placed. 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.

AUDIO PERFORMANCE EVALUATION

Signal Name	Connector	Maximum Voltage	Reference Designator	Imp. (kΩ)
Line In	Jack	2.341 V_{RMS}	0 dB FS (li)	
Mic In	Jack	0.146 V_{RMS}	0 dB FS (mi)	
Line Out	Jack	1.058 V_{RMS}	0 dB FS (lo)	N/A
Speaker Out (8Ω)	N/A	N/A	0 dB FS(so)	N/A

In the above reference designators, the letters in parenthesis designate the full-scale value for that particular I/O. These are used in the tables below to help clarify which full-scale value applies to the particular measurement. Values referenced to digital numbers on the PC are listed with the (d) suffix.

Microphones Supported	Support	Comments
3-Pin Phantom Power (power on ring)	Yes	
2-Pin Dynamic	Yes	
2-Pin Phantom Power (power on tip)		

Full Duplex (A-D-PC-D-A): Line In to Line Out	Reference	Left	Right	Units	Figures
Dynamic Range		83.8	83.8	dB FS A (lo)	97 - 1NXL
THD+N	-3 dB FS (li)	-81.1	-80.5	dB FS (lo)	97 - 1DXL
Frequency Response	Ac = -0.25 dB	20-20k	31-20k	Hz	97 - 1MXL

NOTE: TM004: combined test used in lieu of TM002 and TM003

Analog Mixer (A-A): Line In to Line Out	Reference	Left	Right	Units	Figures
Dynamic Range		95.4	95.3	dB FS A (lo)	97 - 1NAL
THD+N	-3 dB FS (li)	-91.2	-90.6	dB FS (lo)	97 - 1DAL
Frequency Response	Ac = -0.1 dB	20-20k	20-20k	Hz	97 - 1MAL
Crosstalk	f = 10 kHz	-66.7	N/A	dB FS (lo)	97 - 1CAL

Analog Mixer (A-A): Mic In to Line Out	Reference	Left	Right	Units	Figures
Dynamic Range	Gain = 0 dB	93.9	N/A	dB FS A (lo)	97 - 1NAM
THD+N	-3 dB FS (mi)	-85.9	N/A	dB FS (lo)	97 - 1DAM
Frequency Response	Ac = -3 dB	58-15.5k	N/A	Hz	97 - 1MAM

NOTE: Mic In is Mono

Plots

In the following plots, stereo measurements have two sets of data per plot and two vertical axes. Above each vertical axis is a label indicating a channel that relates to that axis. The data set extends beyond the vertical axis to indicate its association with that axis. Using Figure **X** as an example, the top set of data extends beyond the right vertical axis, which is labeled at the top “RIGHT’, indicating that the top set of data is the right channel and associated with the right vertical axis. Likewise, the bottom set of data extendds beyond the left vertical axis which is labeled at the top “LEFT”, indicating that the bottom set of data is the left channel and associated with the left vertical axis.

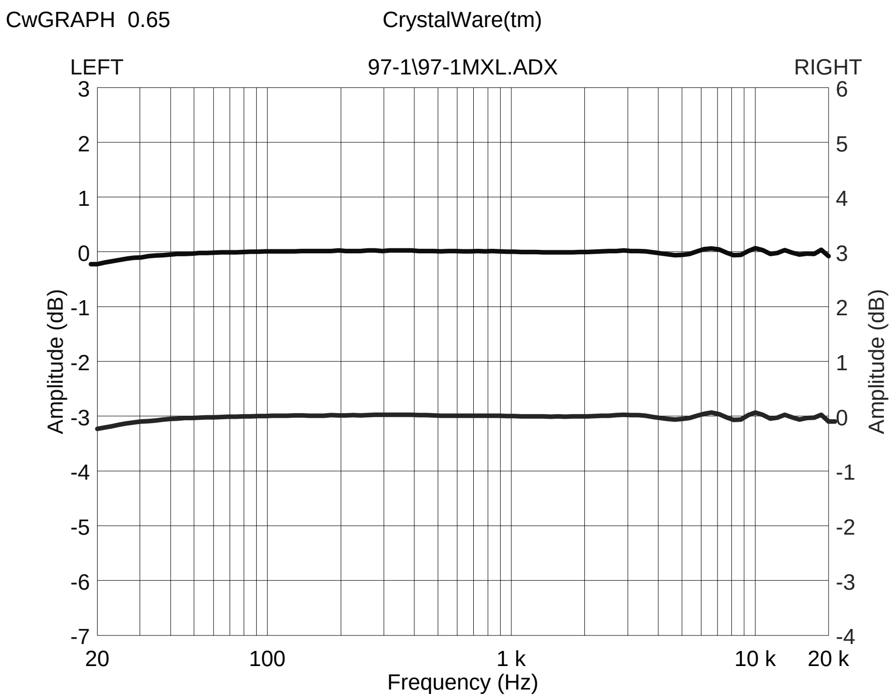


Figure 1. Full Duplex (A-D-PC-D-A): Line In/Out Frequency Response

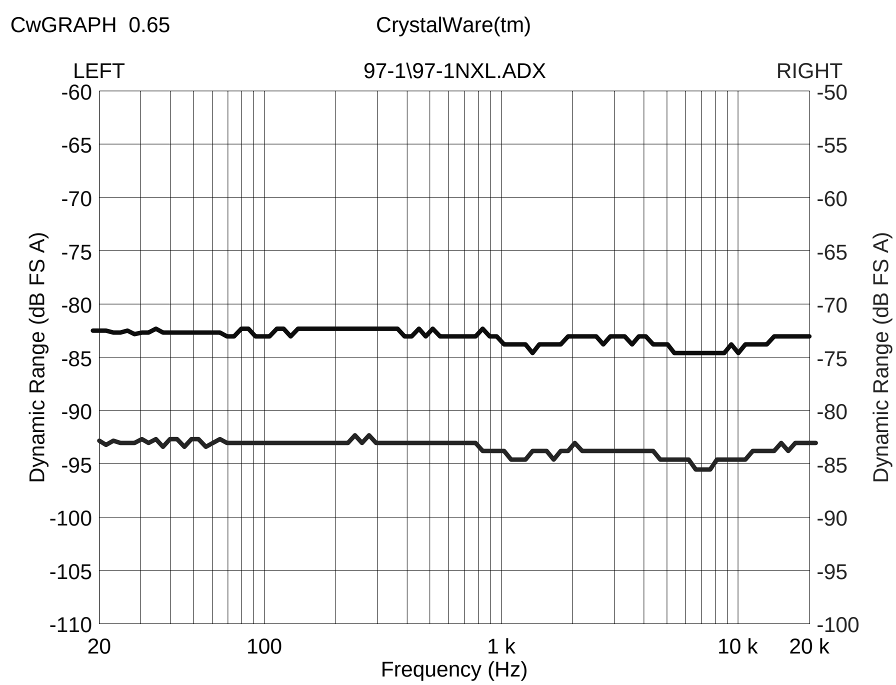


Figure 2. Full Duplex (A-D-PC-D-A): Line In/Out Dynamic Range

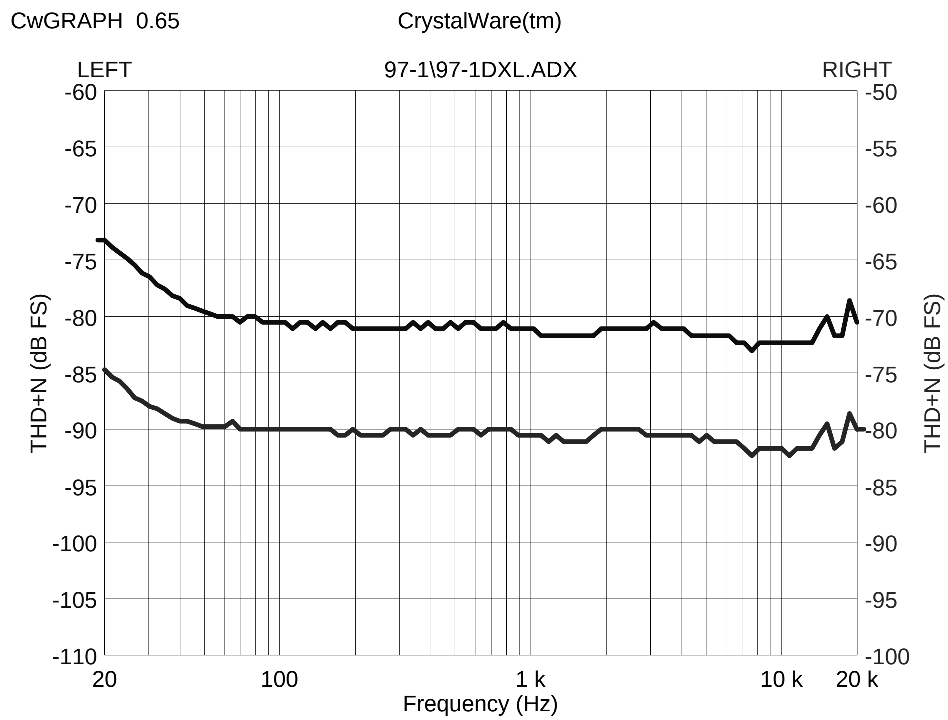


Figure 3. Full Duplex (A-D-PC-D-A): Line In/Out THD+N vs. Frequency

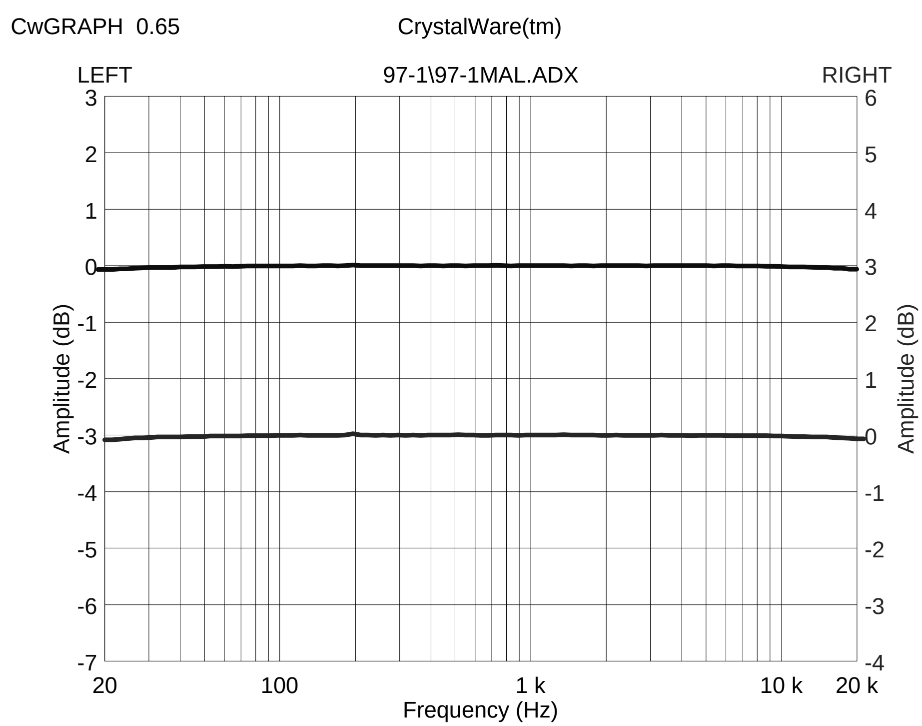


Figure 4. Analog Mixer (A-A): Line In/Out Frequency Response

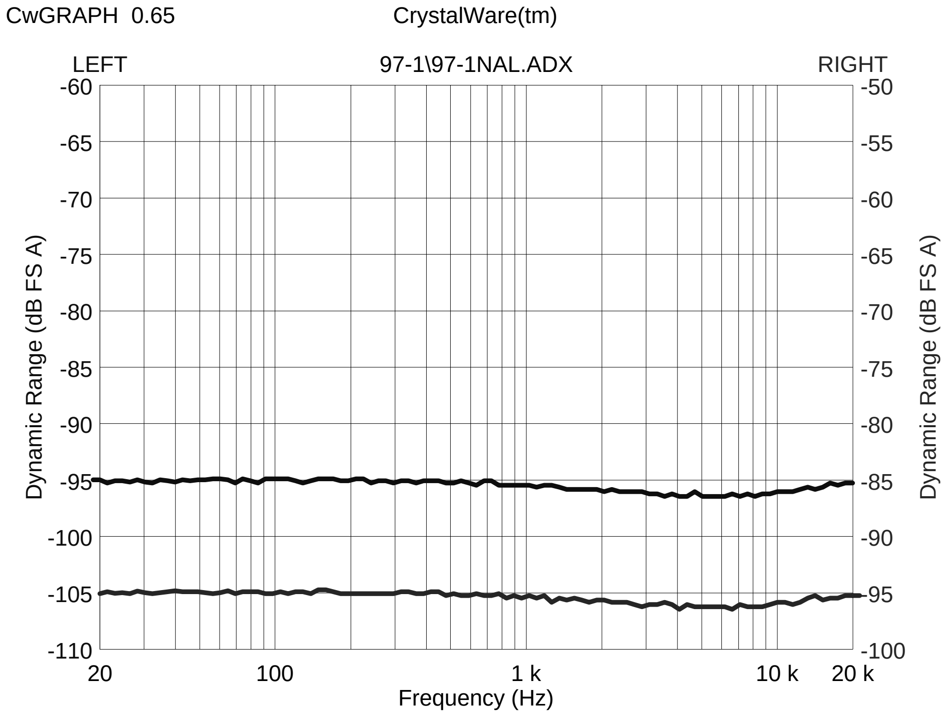


Figure 5. Analog Mixer (A-A): Line In/Out Dynamic Range

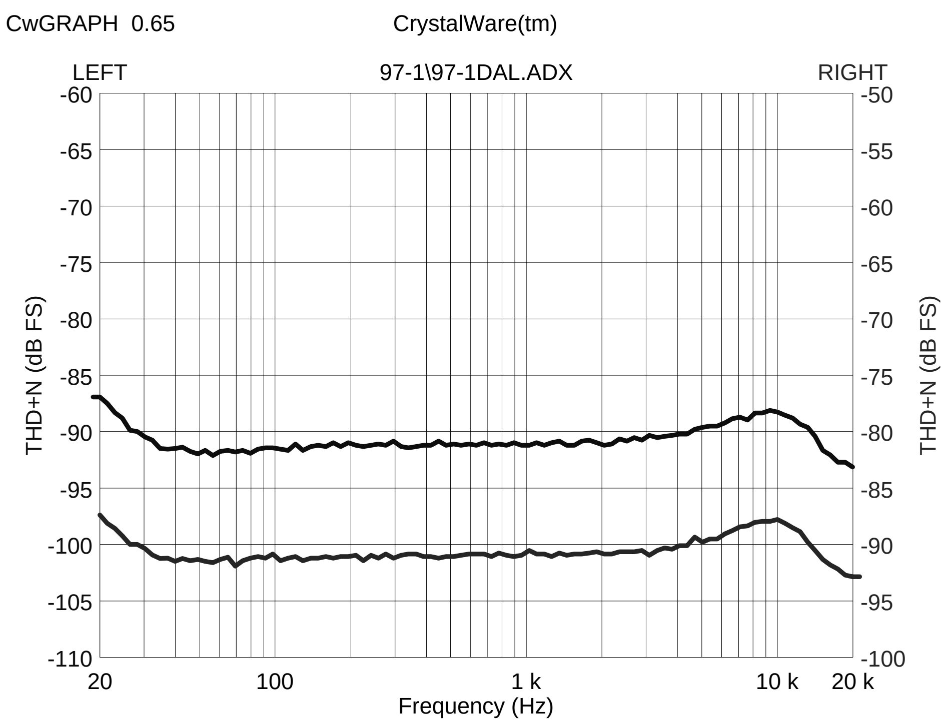


Figure 6. Analog Mixer (A-A): Line In/Out THD+N vs. Frequency

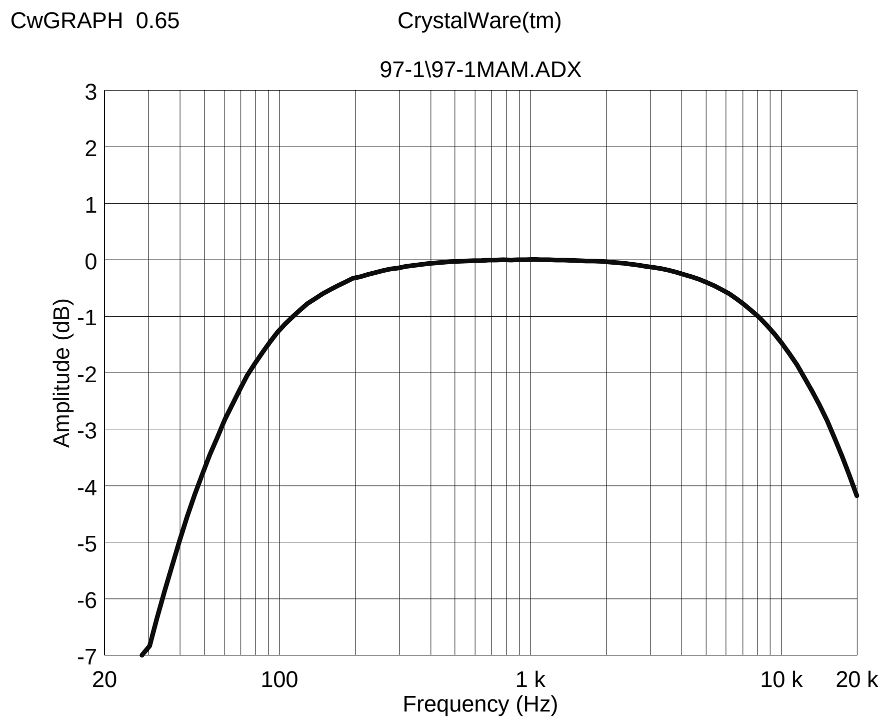


Figure 7. Analog Mixer (A-A): Mic In/Line Out Frequency Response

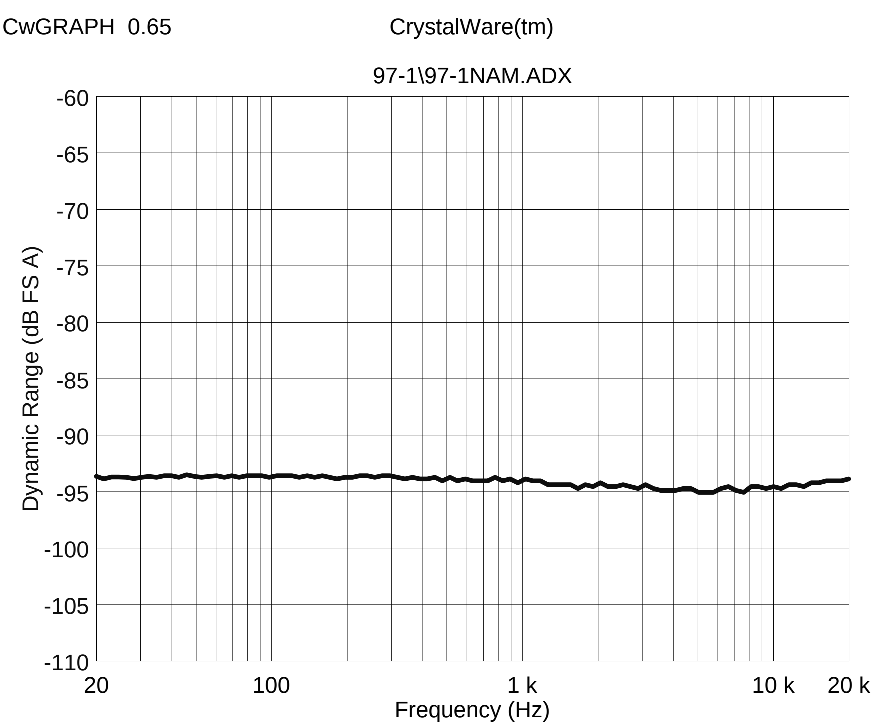


Figure 8. Analog Mixer (A-A): Mic In/Line Out Dynamic Range

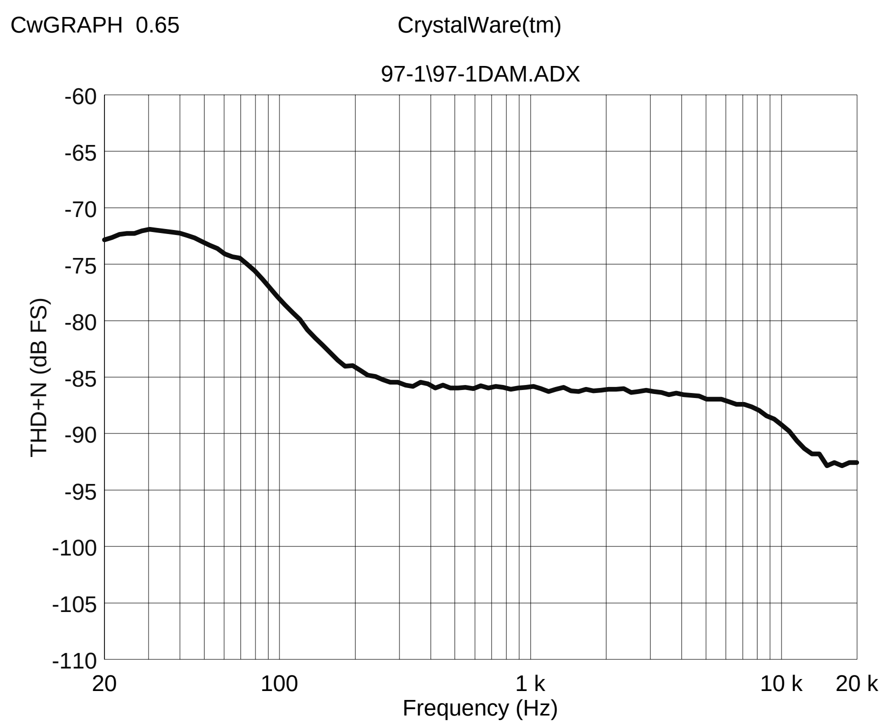


Figure 9. Analog Mixer (A-A): Mic In/Line Out THD+N vs. Frequency

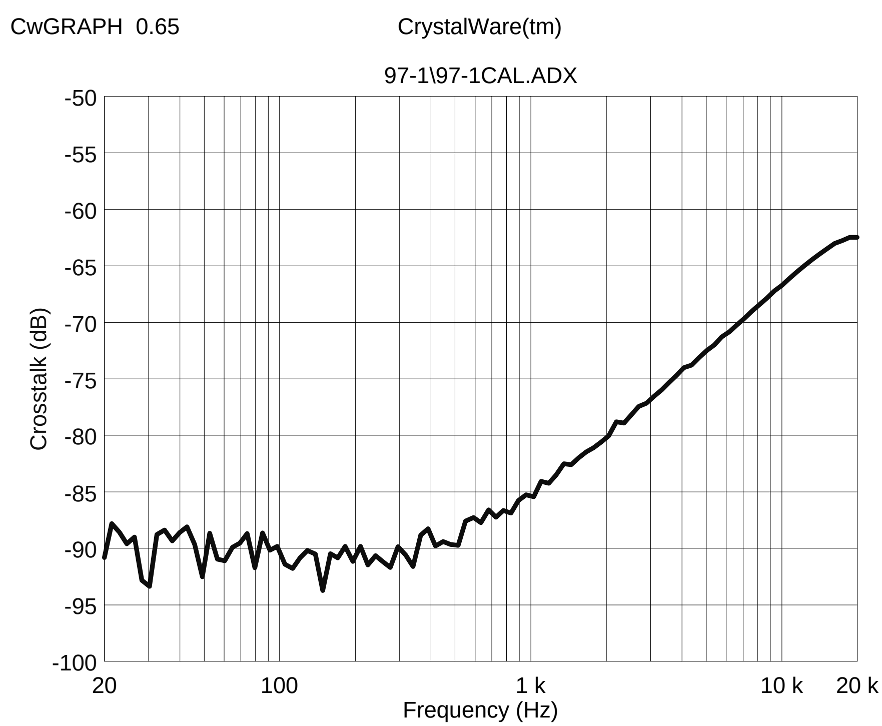


Figure 10. Analog Mixer (A-A): Line In/Out Crosstalk vs. Frequency

REFERENCES

1) Intel, Audio Codec ‘97 Component Specification, Revision 2.1, *http://developer.intel.com/pc-supp/platform/ac97/*
2) Intel, Audio/Modem Riser Specification, Revision 1.01, Sep 10, 1998. *http://developer.intel.com/pc-supp/platform/ac97/INDEX.HTM*
3) Cirrus Logic, CS4297 SoundFusion Audio Codec ‘97 Data Sheet, July 1998. *http://www.cirrus.com/products/overviews/cs4297.html*
4) Steve Harris, Clif Sanchez, Personal Computer Audio Quality Measurements, Ver 0.5 *http://www.cirrus.com/products/papers/meas/meas.html*
5) Intel and Microsoft, PC 99 System Design Guide *http://www.microsoft.com/hwdev/desguid/*
6) M. Montrose. Printed Circuit Board Design Techniques for EMC Compliance, IEEE Press, New York: 1996.

ADDENDUM

- Schematic drawings
- Layout drawings
- Bracket drawing
- Bill of materials

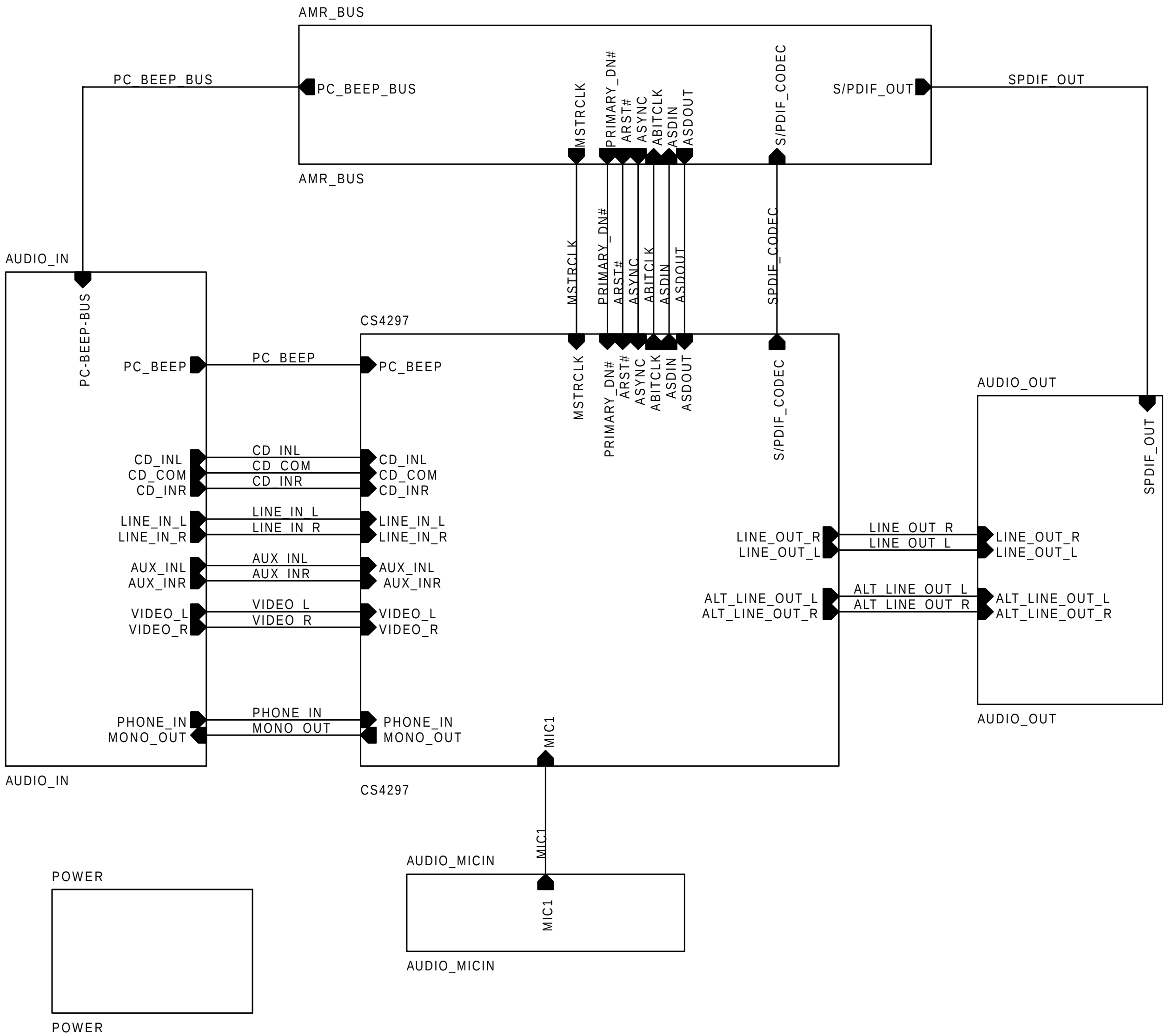


Figure 11. Block Diagram

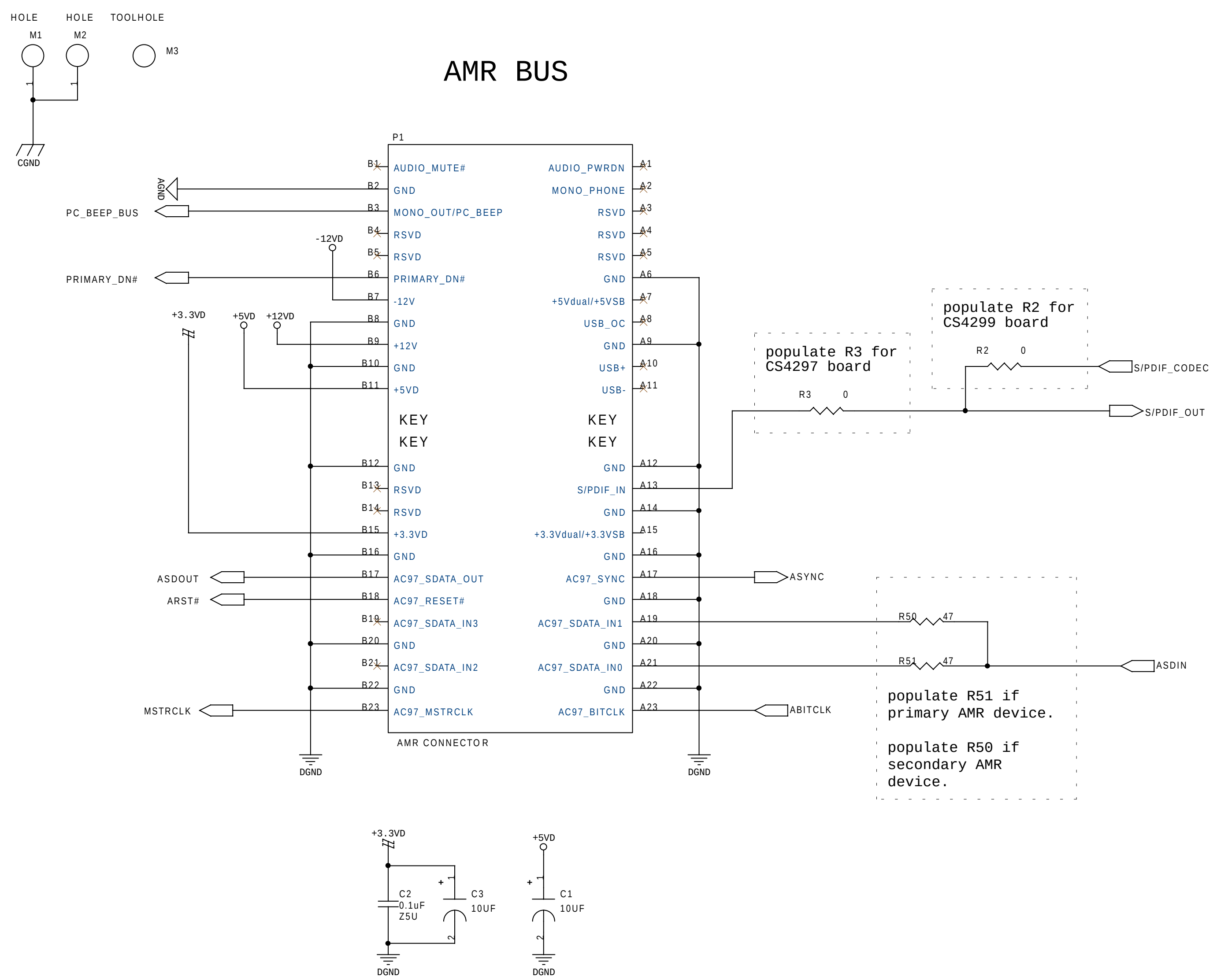
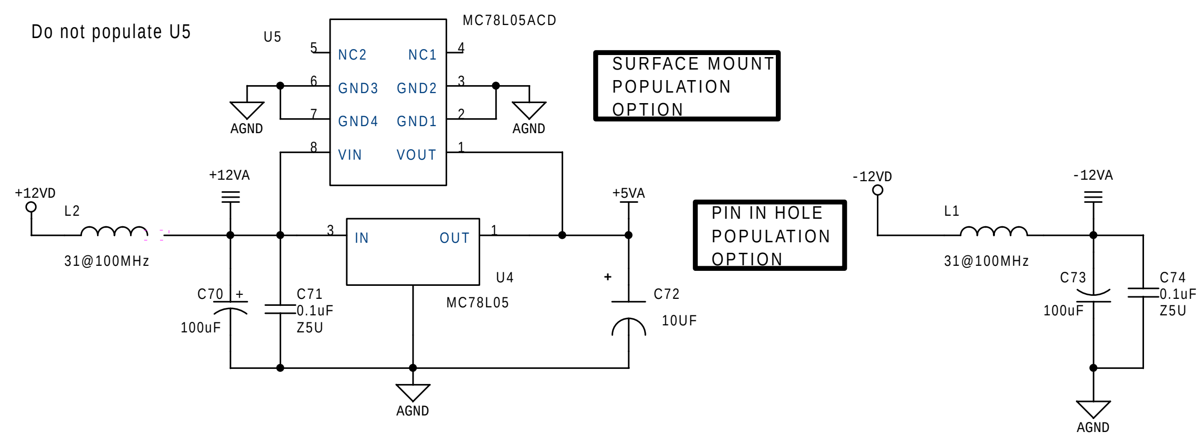


Figure 12. AMR Bus

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 13. Power Supplies

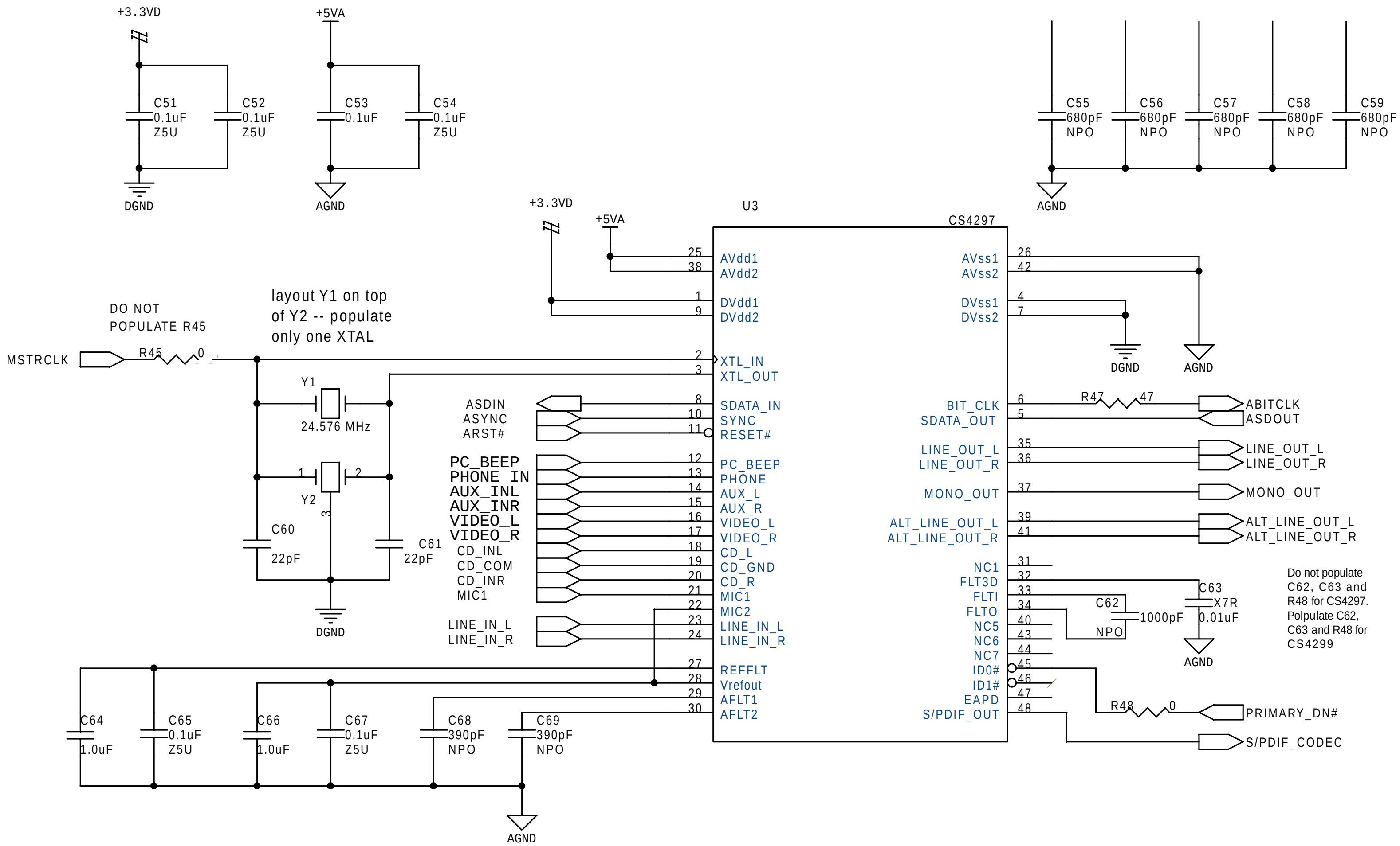


Figure 14. CS4297

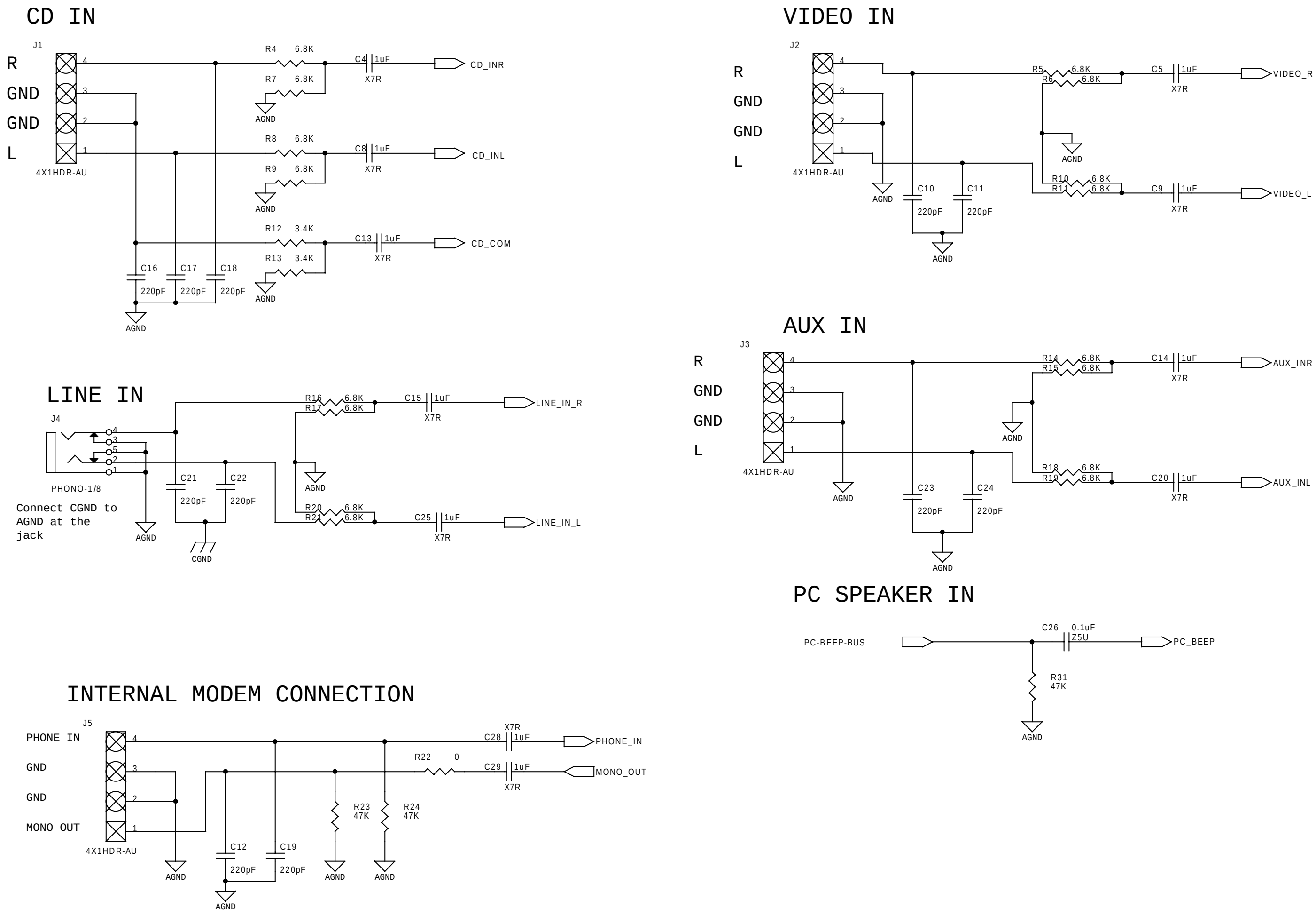


Figure 15. Audio In

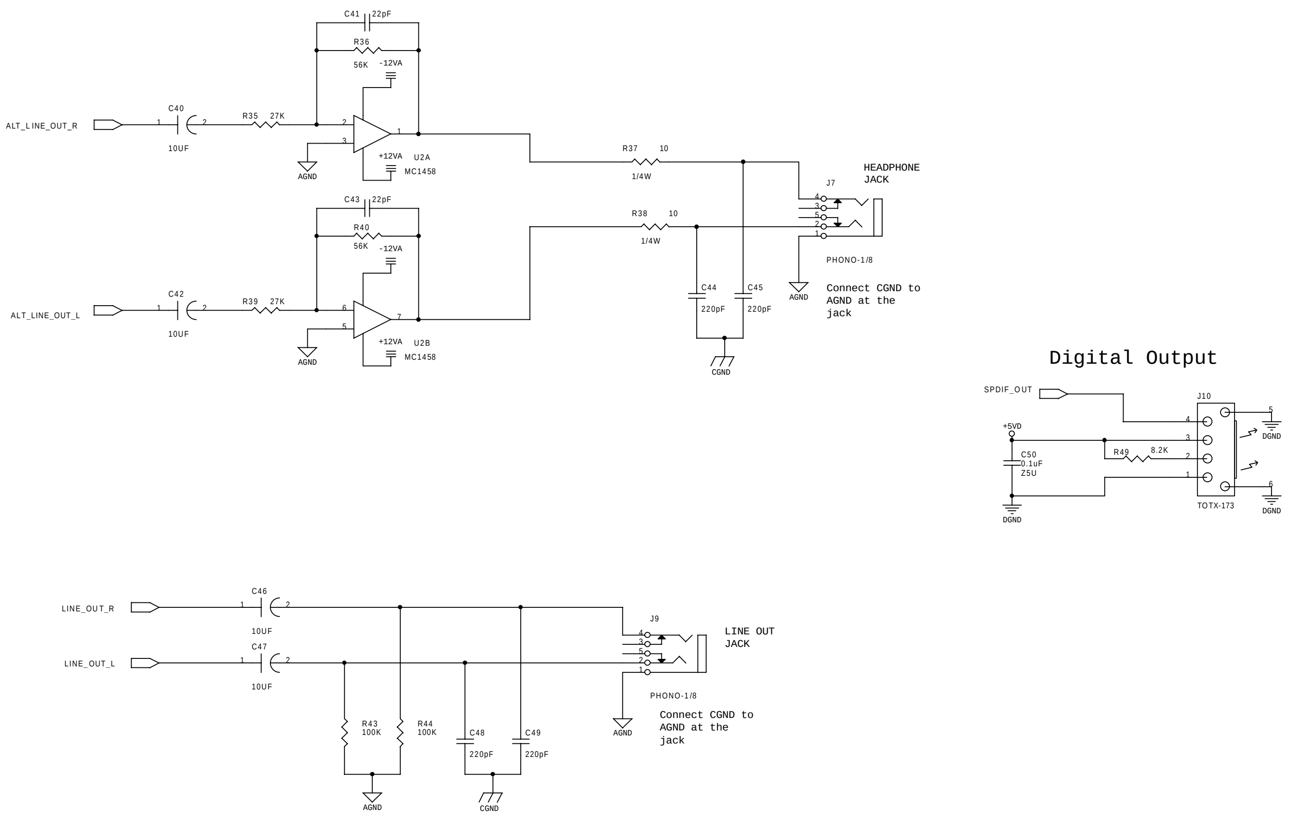


Figure 16. Audio Out

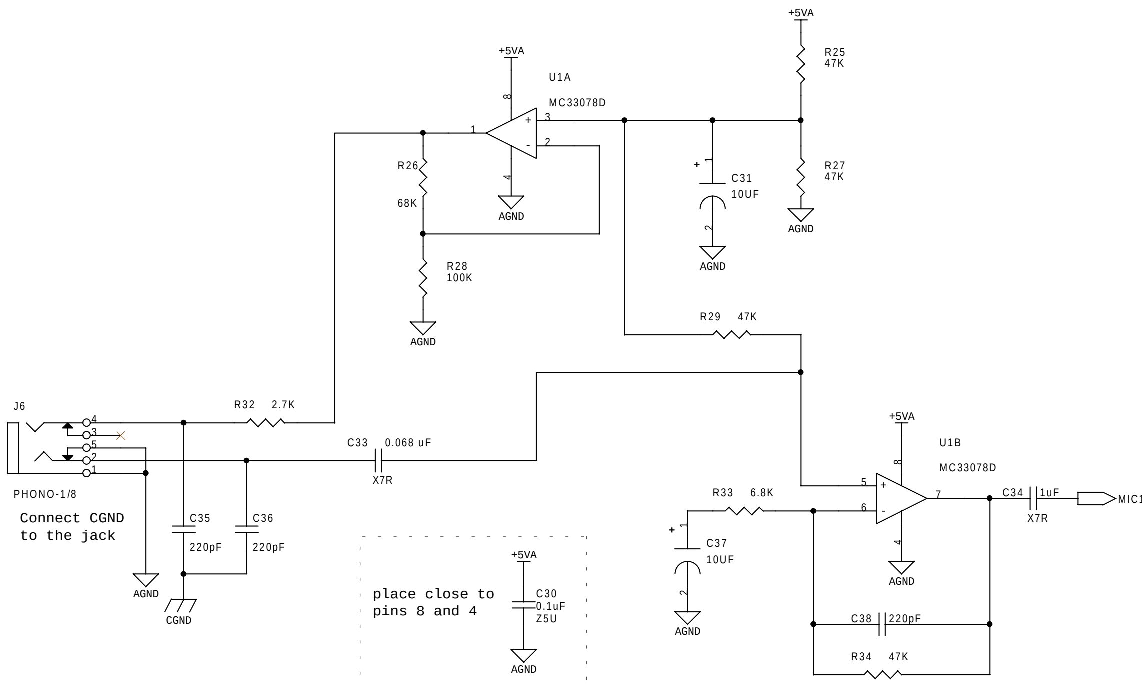


Figure 17. Mic Pre-Amp

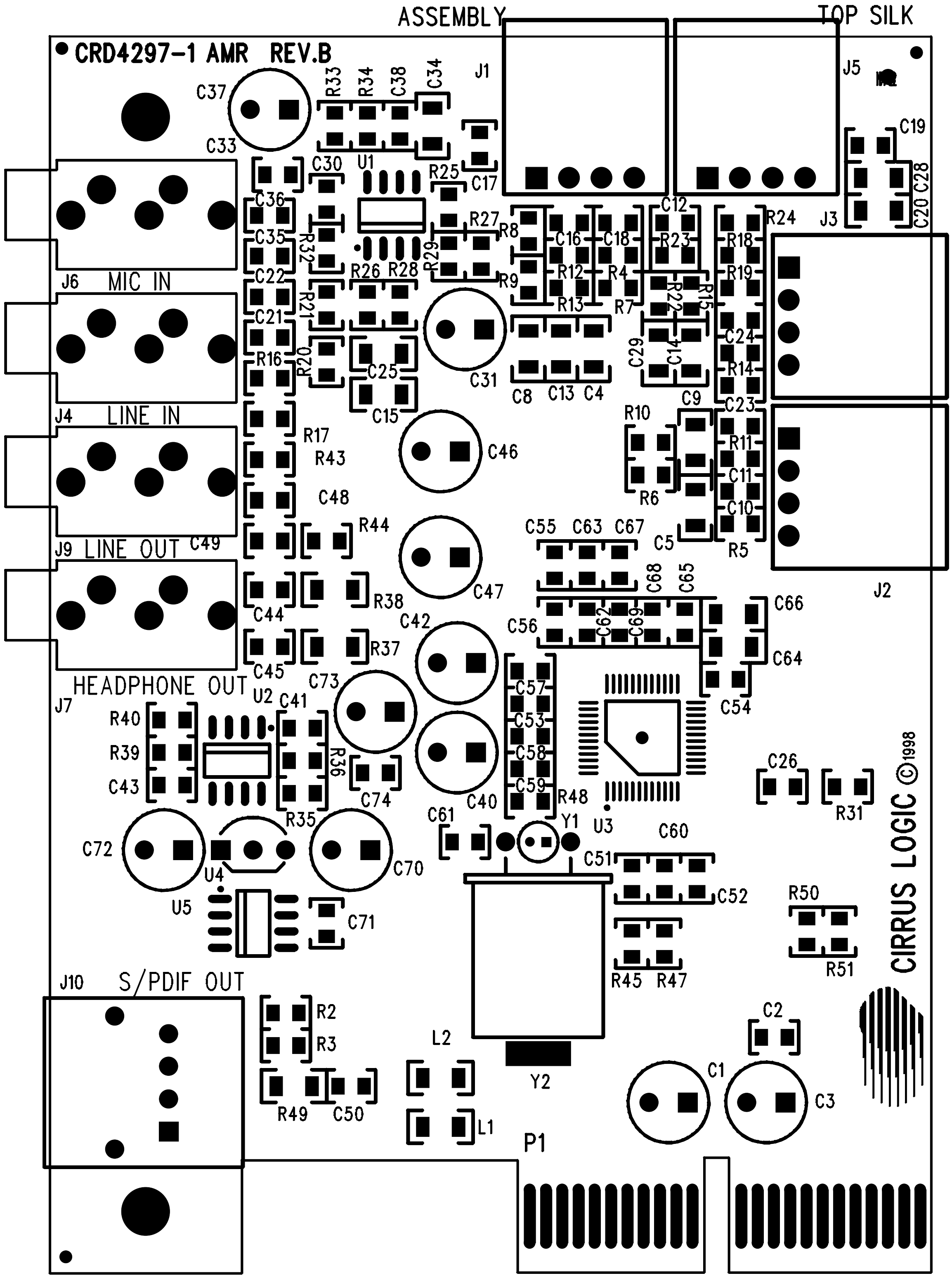


Figure 18. Assembly Drawing

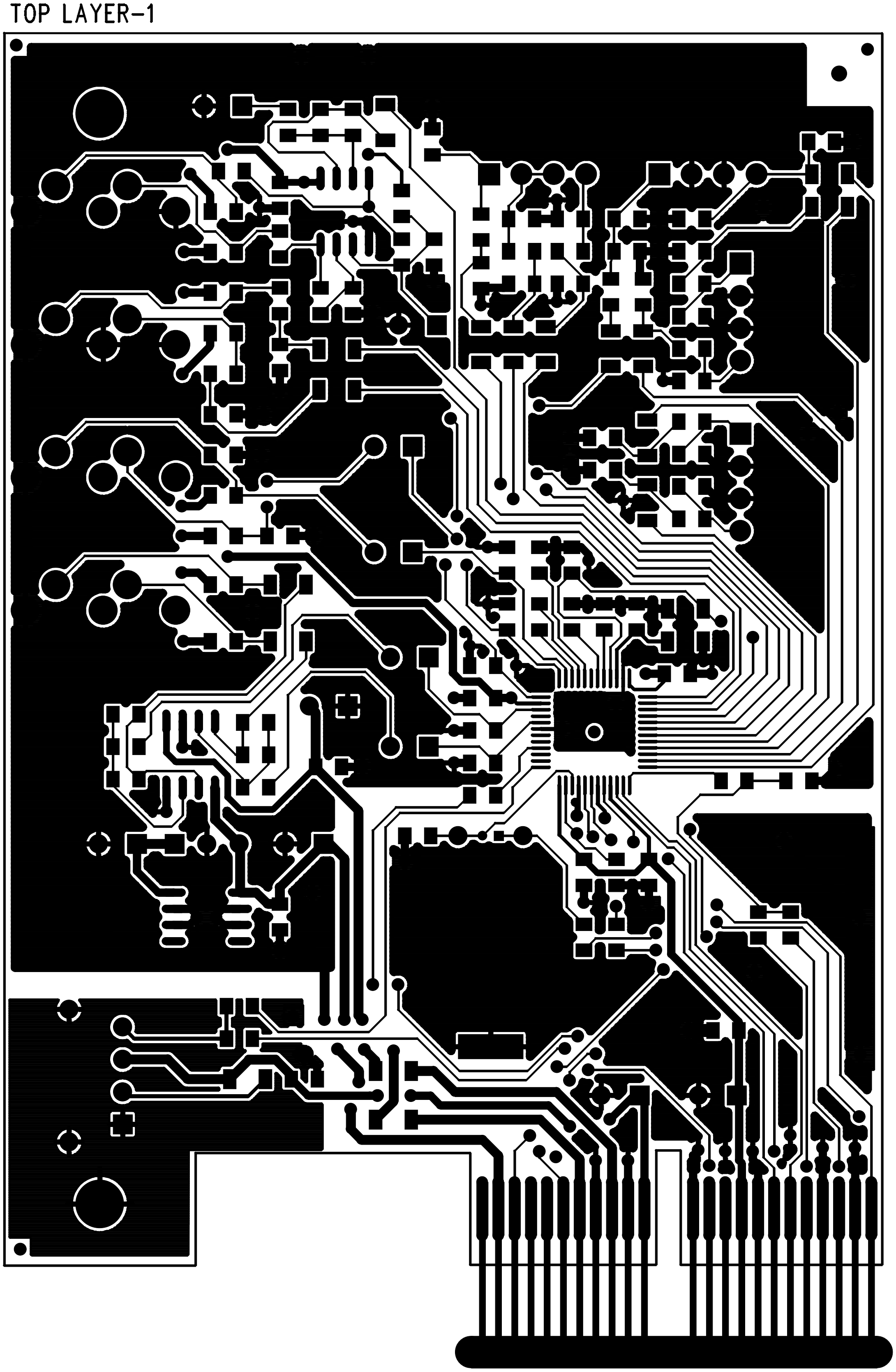


Figure 19. Top Layer

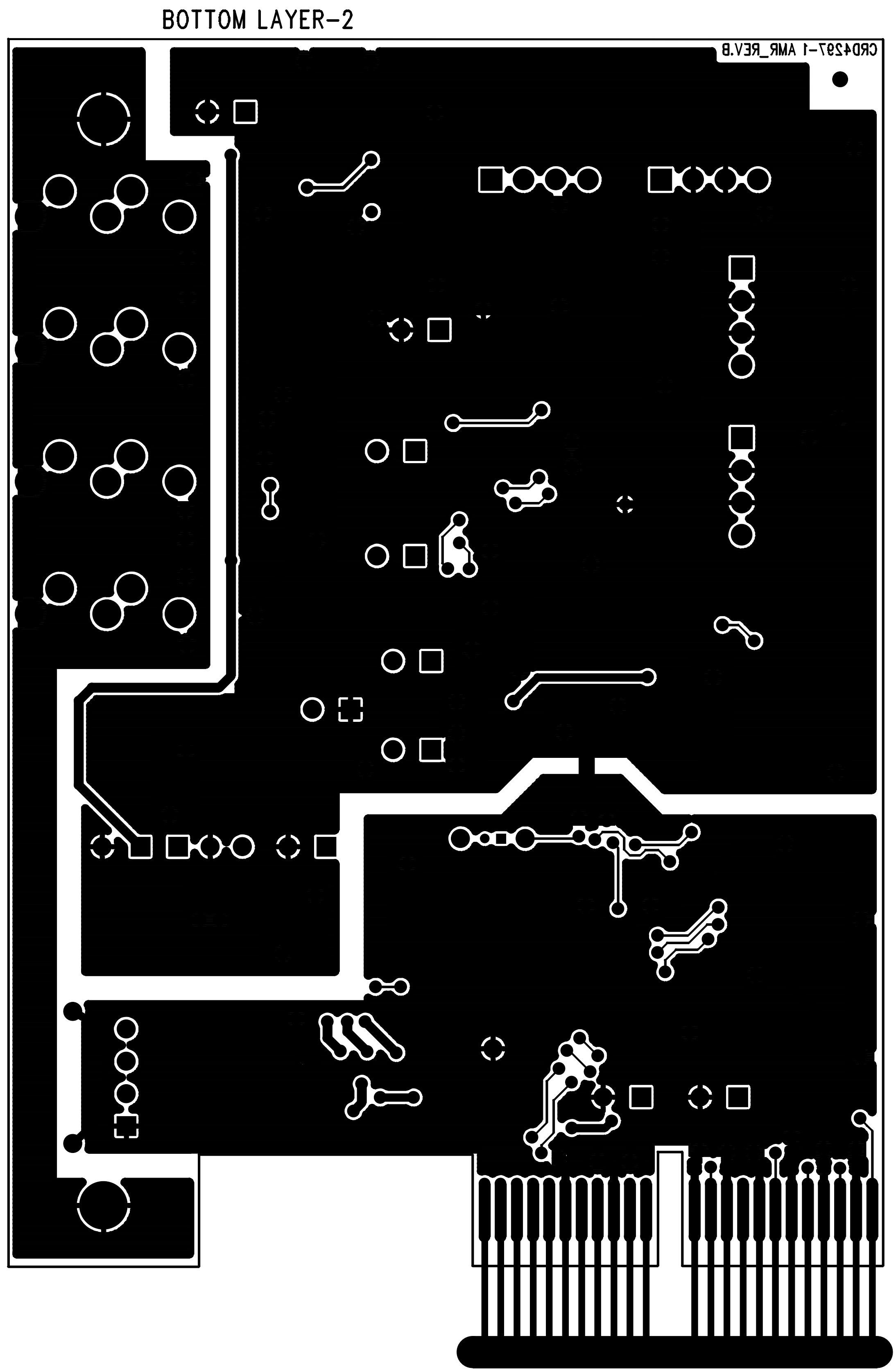
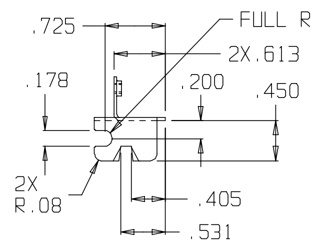


Figure 20. Bottom Layer

NOTES:

1. APPLICABLE STANDARDS/SPECIFICATIONS:
   ASME Y14.5M-1994, DIMENSIONS AND TOLERANCES
   MIL-STD-12, ABBREVIATIONS
2. REMOVE ALL BURRS AND SHARP EDGES.
3. MATERIAL: .035 THK ±.003 #1010 CRS
4. SILK SCREEN CHARACTERS .05 HIGH AND MARKINGS LOCATED APPROXIMATELY AS SHOWN USING BEST SHOP PRACTICE.



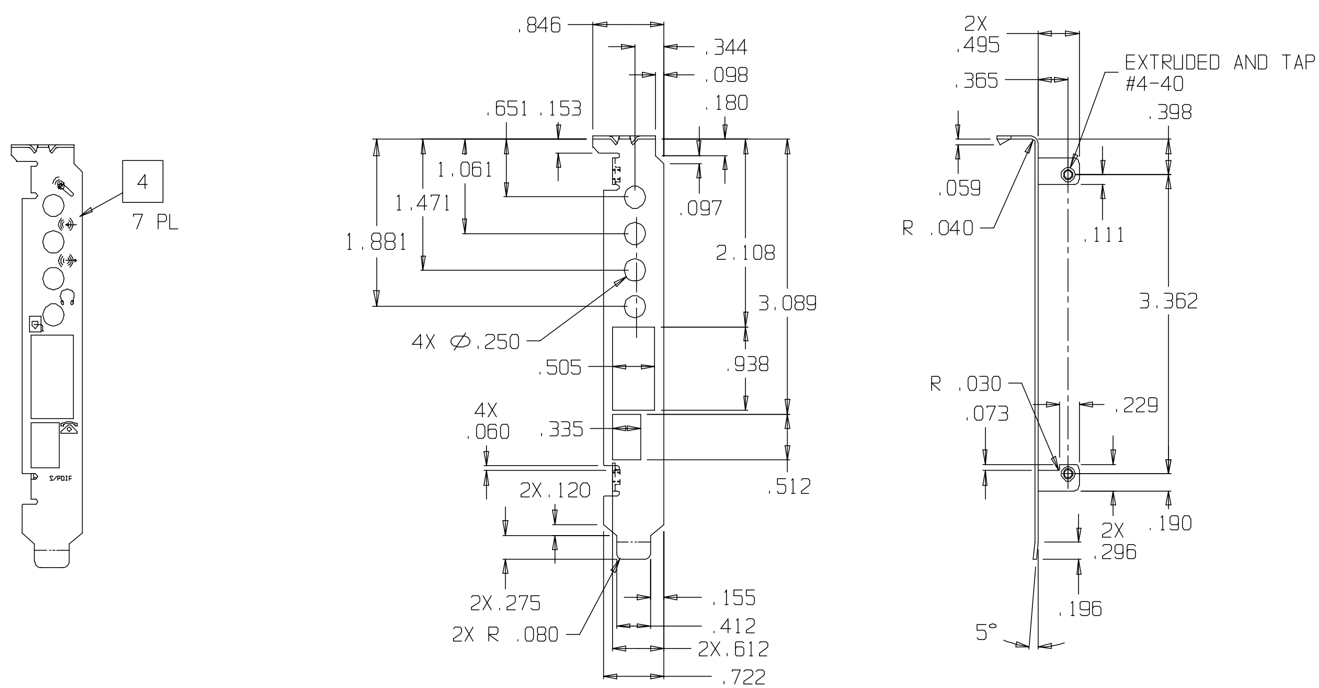


Figure 21. Bracket Drawing

BILL OF MATERIALS

CRD4297-AMR

Item	Qty	Reference	Value	Type	PCB-Footprint	Mnfr	Part Number	Description
1	9	C1,C3,C31,C37,C40,C42, C46,C47,C72	10UF	ELELCT	ALUM/10UF/16P	PANASONIC	ECA-1CM100	ALUM ELECT,10uF,20%,16V,POL
2	12	C2,C26,C30,C50,C51,C52, C53,C54,C65,C67,C71, C74	0.1uF	Z5U	CSN_0805	KEMET	C0805C104M5UAC	CAP, 0805, Z5U, .1uF, 20%, 50V
3	12	C4,C5,C8,C9,C13,C14,C15, C20,C25,C28,C29,C34	1uF	X7R	CSN_1206	VENKEL	C1206X7R500-105KNE	CAP, 1206, X7R, 1uF, 10%, 25V
4	18	C10,C11,C12,C16,C17,C18, C19,C21,C22,C23,C24, C35,C36,C38,C44,C45, C48,C49	220pF	COG	SMT_0805	KEMET	C0805C221J5GAC	CERM CAP,220pF,5%,50V,COG
5	1	C33	0.068 uF	X7R	CSN_0805	KEMET	C0805C683K5RAC	CAP, 0805, X7R, 68000pF, 10%, 50V
6	2	C41,C43	22pF	COG	SMT_0805		C0805C220GAC	CERM CAP,22pF,5%,50V,COG
7	5	C55,C56,C57,C58,C59	680pF	NPO	SMT_0805	KEMET	C0805C681J5GAC	CERM CAP, 680pF, 5%, 50V,COG
8	2	C60,C61	22pF	COG	CC0805			CAP,22pF,SO,0805,5%,50V,COG
9	2	C64,C66	1.0uF	Y5V	SMT_1206	MURATA	GRM42-6Y5V105Z016BL	CERM CAP,1.0UF,25V,Y5V
10	2	C68,C69	390pF	NPO	SMT_0805	KEMET	C0805C391J5GAC	CERM CAP,390pF, 5%, 50V,COG
11	2	C70,C73	100uF	ELECT	PIH	PANASONIC	ECA-1CM101	ALUM ELECT, 100uF,20%,16V,POL
12	4	J1,J2,J3,J5	4X1HDR-AU	CONN	CON_MLX_70553	MOLEX	70553-0003	HDR, 4X1, 0.025" PIN, 0.1" CTR, 15u" AU
13	4	J4,J6,J7,J9	PHONO-1/8	CONN	CON_STEREO_LZR	LZR ELEC-TRONICS	SJ372	CONN, 1/8" DOUBLE SW. STEREO PHONE JACK
14	1	J10	TOTX-173	CONN	TOTX173	TOSHIBA	TOTX173	OPTICAL TOSLINK TRANSMITTER
15	2	L1,L2	31@100MHz	FERRITE	IND_FB1206	TDK	HF50ACB321611-T	IND, FBEAD, 1206, 31@100MHz, 25%
16	2	M1,M2	HOLE					
17	1	M3	TOOLHOLE		TOOLHOLE			
18	1	P1	AMR CON-NECTOR		AMR5V-46			
19	2	R3,R22	0	RES	RES_0805	PHILIPS	9C08052A0R00J	RES, SO, 0805, 0.5%, 1/10W, METAL FILM
20	17	R4,R5,R6,R7,R8,R9,R10, R11,R14,R15,R16,R17, R18,R19,R20,R21,R33	6.8K	RES	RES_0805	PHILIPS	9C08052A6801F	RES, SO, 0805, 6.8K, 1%, 1/10W, METAL FILM
21	2	R12,R13	3.4K	RES	RES_0805	PHILIPS	9C08052A3401F	RES, SO, 0805, 3.4K, 1%, 1/10W, METAL FILM
22	7	R23,R24,R25,R27,R29, R31,R34	47K	RES	RES_0805	PHILIPS	9C08052A4702J	RES, SO, 0805, 47K, 5%, 1/10W, METAL FILM
23	1	R26	68K	RES	RES_0805	PHILIPS	9C08052A6802J	RES, SO, 0805, 68K, 5%, 1/10W, METAL FILM
24	3	R28,R43,R44	100K	RES	RES_0805	PHILIPS	9C08052A1003J	RES, SO, 0805, 100K, 5%, 1/10W, METAL FILM
25	1	R32	2.7K	RES	RES_0805	PHILIPS	9C08052A2701J	RES, SO, 0805, 2.7K, 5%, 1/10W, METAL FILM
26	2	R35,R39	27K	RES	RES_0805	PHILIPS	9C08052A2702J	RES,27K,SO,0805,5%,1/10W,METAL FILM
27	2	R36,R40	56K	RES	RES_0805	PHILIPS	9C08052A5602J	RES,56K,SO,0805,5%,1/10W,METAL FILM
28	2	R37,R38	10	RES	RES_1206	PHILIPS	9C12063A10R0J	RES, SO, 1206, 10, 5%, 1/4W, METAL FILM
29	2	R47,R51	47	RES	RES_0805	PHILIPS	9C08052A47R0J	RES, SO, 0805, 47, 5%, 1/10W, METAL FILM

Item	Qty	Reference	Value	Type	PCB-Footprint	Mnfr	Part Number	Description
30	1	R49	8.2K	RES	RES_1206	Philips	9C12063A820J	RES,8.2k,SM1206,5%,1/4W
31	1	U1	MC33078D	OP AMP	SO8	MOTOROLA	MC33078D	IC, SO, SOIC8, 33078, DUAL OP AMP
32	1	U2	MC1458	SO8	SO8	MOTOROLA	MC1458	DUAL HEADPHONE AMP
33	1	U3	CS4297	CODEC	QFP48_7X7	CRYSTAL SEMICOND.	CS4279	IC, SO, AC '97 2.0 SERIAL CODEC w/ SRC
34	1	U4	MC78L05	VREG	TO-92	MOTOROLA	MC78L05AC	5V POS.VOLT.REG., 100ma
35	1	Y1	24.576 MHz	PAR RES, FUND	XTL_CA-301	EPSON	CA-301_24.576M-C	XTL, 24.576MHz, FUND, PAR RES

DO NOT POPULATE

Item	Qty	Reference	Value	Type	PCB-Footprint	Mnfr	Part Number	Description
1	1	C63	0.01uF	CAP	CSN_0805	KEMET	C0805C103K5RAC	CERM CAP, .01uF, 10%, 50V,X7R
2	1	C62	1000pF	CAP	SMT_0805	KEMET	C0805C102J5GAC	CERM CAP, 1000pF, 5%, 50V,COG
3	1	R50	47	RES	RES_0805	PHILIPS	9C08052A47R0J	RES, SO, 0805, 47, 5%, 1/10W, METAL FILM
4	3	R2,R45,R48	0	RES	RES_0805	PHILIPS	9C08052A0R00J	RES, SO, 0805, 0, 5%, 1/10W, METAL FILM
5	1	Y2	24.576 MHz		XTALHC49PAD	EPSON		CRYSTAL, 24.576MHz, H49-US TYPE, Fund Mode Par Res
6	1	U5	MC78L05ACD	VREG	SO8	MOTOROLA	MC78L05ACD	5V POS. VOLT. REG., 100ma

• Notes •

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