# CDB44L11

# Evaluation Board for the CS44L11

## Features

- 23 mW/Channel into 16 Ω at 2.4 V
- Variable power supplies from 1.8 V to 2.4 V
- Digital bass boost and treble boost
- Programmable digital volume control
- Short circuit protection
- >90% amplifier efficiency

## Description

The CDB44L11 is an excellent means to quickly demonstrate the CS44L11 Cirrus Digital Power Headphone Amplifier IC. Analysis requires only a digital signal source and an analog signal analyzer.

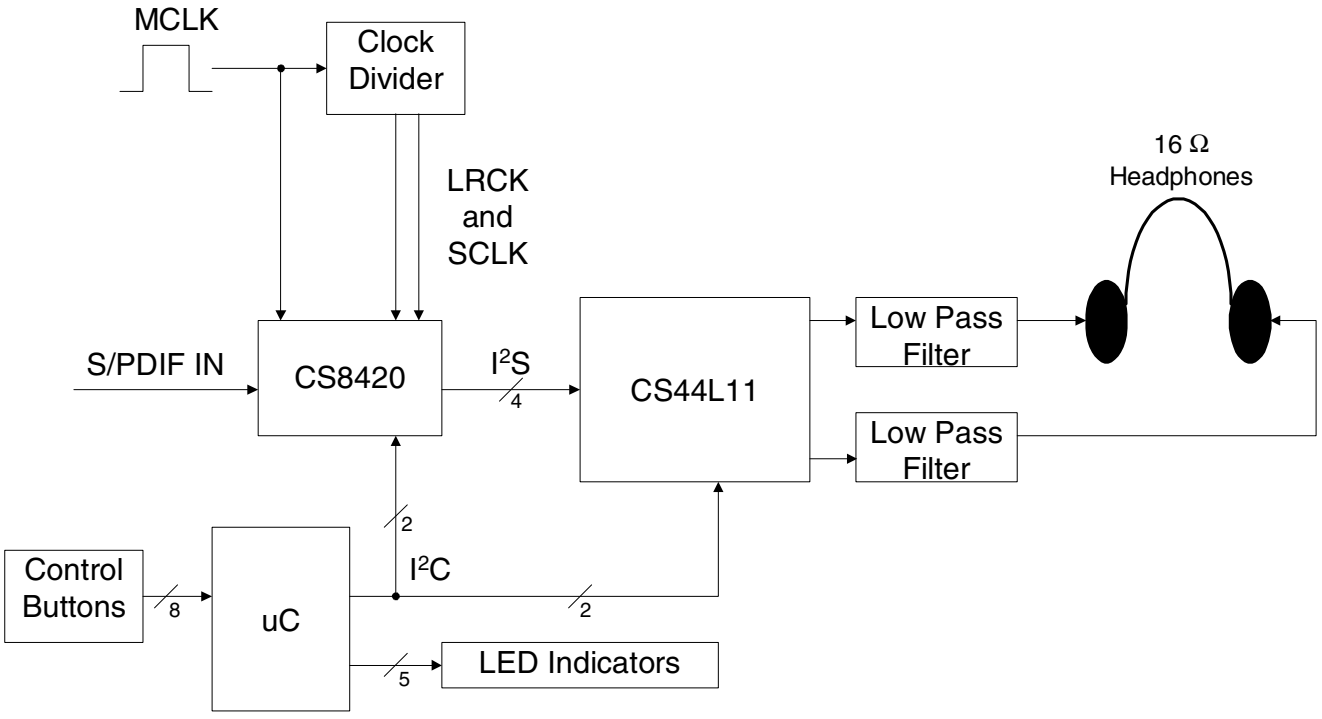
As shown below, the CS44L11 takes PCM digital audio input and converts it to a PWM output. This 16-pin TSSOP IC provides volume up/down, treble boost, bass boost and mute functions via push buttons and a micro controller using an I²C interface. A RS232 interface is provided for programming the micro controller.

The CS8420 is a receiver and sample rate converter. It takes in the S/PDIF at a range of input sample rates and generates a PCM output signal at a fixed sample rate.

The low pass filter removes high frequency components from the output PWM signal effectively converting it from digital to analog.

**ORDERING INFORMATION**

| | |
|---|---|
| CDB44L11 | Demonstration Board |



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# 1. CDB44L11 SYSTEM OVERVIEW

The CDB44L11 is an excellent means of quickly demonstrating the CS44L11. The CS8420 digital audio interface receiver provides an interface to digital audio sources including the majority of digital audio test equipment.

# 2. SCHEMATIC DESCRIPTIONS

## 2.1 CS44L11 Headphone Monitor and Output Filter

The CS44L11, shown in Figure 1, can accept sampling frequencies varying from 8 kHz to 96 kHz and can produce a PWM frequency ranging from 8 X Fs to 48 X Fs (refer to CS44L11 datasheet). In this design the 8 X Fs mode is used with a 48.25 kHz sample frequency (Fs), which will result in a 386 kHz PWM switching frequency.

As shown in Figure 1, L3, L4, C29, and C30 form the 2nd order low pass LC filter for the output audio. The following equations show how to calculate the filter values:

$$C_{filter} = 0.707 / (6.283 * f_c * R_L)$$

$$L_{filter} = (1.414 * R_L) / (6.283 * f_c)$$

where:

$f_c$ = desired -3 dB frequency of the filter

$R_L$ = the nominal speaker load impedance

If you choose $f_c$ = 35 kHz, $R_L$= 16 W, then:

$$C_{filter} = 0.707 / (6.283 * 35000 * 16) = 0.2009\ \mu F$$

$$L_{filter} = (1.414 * 16) / (6.283 * 35000) = 102.881\ \mu H$$

Choosing practical component values:

$$C_{filter} = 0.22\ \mu F$$

$$L_{filter} = 100\ \mu H$$

Output distortion is directly related to the inductor quality. The inductors should have a saturation current of at least 150 mA for $R_L$= 16 Ω. This design uses the Central Technologies CTGSR74B 100 µH inductors for the output filter. 220 µF capacitors are used to block any DC signal from being heard at the output. For maximum output power, low ESR capacitors should be used on the output.

## 2.2 Clocking

The provided MCLK oscillator frequency is 12.352 MHz. Any oscillator between 6.4 MHz and 24.576 MHz may be used in the socket. The MCLK signal is divided by the clock divider to produce SCLK (MCKL/4), and LRCK (MCKL/256). Using a 12.352 MHz MCLK, SCLK is 3.088 MHz, and LRCK is 48.25 kHz.

## 2.3 CS8420 Sample Rate Converter

Refer to Figure 2. The CS8420 is a S/PDIF receiver and sample rate converter. It is configured to accept data at any sample rate between 32 kHz and 96 kHz and transmits data in PCM audio data format based on the MCLK oscillator frequency. The CS8420, while not required, improves system performance by reducing clock jitter and providing one fixed output frequency. In this design, the 48.25 kHz sample rate was chosen so that the CS8420 does not perform 1:1 conversion when receiving 48 kHz input data. Noise can be introduced into the system when a 1:1 conversion is performed and should be avoided for optimal performance. For more information please refer to the CS8420 datasheet.

## 2.4 Microcontroller

Figure 3 shows the host microcontroller circuitry. There are 8 buttons for control features, 5 LEDs to indicate status, and an $I^2C$ interface to the CS8420 and the CS44L11. See Table 3 for the initial CS44L11 register settings. After power is first applied to the board or the reset button is pressed, all settings will revert to the default settings.

The board is populated with a Motorola MC68HC908GP32 with the software preprogrammed to run the CDB44L11. The microcontroller code was written in C and compiled with the 'COSMIC C Compiler'.

The microcontroller uses the $I^2C$ control bus to read and write to the CS44L11 control registers - refer to CS44L11 data sheet for more information.

## 2.5 Power Supplies and Level-Shifting

Figure 4 shows the power supply and level shifting circuitry. Due to the CS44L11 operating at below +5.0 V, level-shifting circuitry has been included to allow for operation with the microcontroller and the CS8420, both of which must run at +5.0 V.

The CS44L11 uses a half bridge output stage and is therefore affected by power supply pumping. Power supply pumping is a phenomenon observed in half-bridge switching amplifiers. It is caused by stored energy in the output inductor that is fed back into the power supply during switching. To compensate for power supply pumping, a resistive load is used to dissipate the

switching current. In most designs this may be omitted due to other system components loading the supply line and dissipating the current. The resistive load is only used to simulate a circuit load.

In the CS44L11, the output MOSFETs directly switch between ground and VA_HP, therefore the performance of the audio output from the amplifier is adversely affected any disturbance on the power rails. To get the best performance power supply characteristics and power supply de-coupling are critical.

Dynamic Range will be affected by switching noise. To reduce switching noise large value power supply bypass capacitors must be used. This circuit uses a 0.1 µF and 1.0 µF ceramic capacitor as well as a 100 µF low ESR tantalum capacitor between the VA_HP supply rail and ground. Optimally these should be placed as close to the CS44L11 pins 12 and 13 as possible. If a DC-DC converter is used in the system its switching frequency should be locked to the CS44L11 PWM switching frequency to reduce switching noise.

Power supply source impedance has a direct affect on the output distortion. A DC-DC converter is a very low impedance source and will offer the best THD+N performance. Using a linear power supply offers the next lowest impedance, while running directly from batteries to the VA_HP pins offers the highest impedance and therefore the highest distortion.

A 47 µH inductor (L1) is used on the digital power supply of the CS44L11 to suppress noise. This may be omitted if system noise is not an issue in your design.

# 3. OPERATION INFORMATION

## 3.1 Operating Instructions

1) Connect an optical or coaxial S/PDIF signal to the S/PDIF input (OPT1 or J5).
2) Connect the output to either headphones or an analog analyzer. If using the RCA test jacks (J8 and J9) a 16 Ω dummy load is provided in circuit. If using the headphone jack (J3) please use a 16 Ω dummy load or 16 Ω headphones.
3) Verify that all power supplies are turned off and:

   a. Connect +5.0 V to the terminal marked +5 V (J4).

   b. Connect from +1.8 V to +2.4 V to the terminal marked VD_HP (J6).

   c. Connect from +1.8 V to +2.4 V to the terminal marked VA_IN (J7).

   d. Connect the power supply common ground to the terminal marked GND.

   e. Verify that all power supply output voltages are set correctly to correspond to the setting on the CDB44L11 and apply power to the board.

4) Once power is applied the volume LEDs will illuminate. Adjust settings as required with buttons - note that the volume, bass, and treble buttons do not 'ramp' and must be pushed for each increment/decrement. The volume level will initialize at -24 dB.

# 4. CONTROL FUNCTIONS

## 4.1 Control Buttons

The function of the Control Buttons (Tables 1 and 2) is as follows:

- **Volume Up** - Adds 1 dB to current volume setting.
- **Volume Dn** - Subtracts 1 dB from current volume setting.
- **Treble Up** - Adds 1 dB to current treble setting.
- **Treble Dn** - Subtracts 1 dB from current treble setting.
- **Bass Up** - Adds 1 dB to current bass setting.
- **Bass Dn** - Subtracts 1 dB from current bass setting.
- **Mute** - Mutes audio and sets PWM to modulated 50% duty cycle.
- **Reset** - Upon release of the RESET Button, the microcontroller loads the default settings from the flash memory into RAM. The $\overline{\text{RST}}$ line is pulled HI and these default settings are written to the CS44L11 and the CS8420.

## 4.2 LED Status

The CDB44L11 has 5 LEDs (D20 - D24) to indicate volume, tone and mute settings and 1 fault LED (D25). The LED readout will normally indicate the volume level per Table 1. When one of the Treble Up/Down or Bass Up/Down buttons is pressed, the LEDs will show the Treble Boost or Bass Boost setting as depicted in Table 2. When the button is released the LEDs will continue to show the Treble/Bass Boost setting for a period of 2 seconds and will then return to indicating the volume setting. In Table 1 and Table 2, a “1” indicates that the LED is lit up.

The MUTE button toggles operation between mute and un-mute. When the amplifier is muted the LEDs flash at a 0.5 Hz rate.

D25 (LED near the CS8420 Receiver) indicates when there is a loss of input signal or any other problem in the receiver.

| Volume [dB] | LED Pattern | | | | |
|---|---|---|---|---|---|
| | D20 | D21 | D22 | D23 | D24 |
| +12 | 1 | 1 | 1 | 1 | 1 |
| +11 | 1 | 1 | 1 | 1 | 0 |
| +10 | 1 | 1 | 1 | 0 | 1 |
| +9 | 1 | 1 | 1 | 0 | 0 |
| +8 | 1 | 1 | 0 | 1 | 1 |
| +7 | 1 | 1 | 0 | 1 | 0 |
| +6 | 1 | 1 | 0 | 0 | 1 |
| +5 | 1 | 1 | 0 | 0 | 0 |
| +4 | 1 | 0 | 1 | 1 | 1 |
| +3 | 1 | 0 | 1 | 1 | 0 |
| +2 | 1 | 0 | 1 | 0 | 1 |
| +1 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 0 | 0 | 1 | 1 |
| -1 | 1 | 0 | 0 | 1 | 0 |
| -2 | 1 | 0 | 0 | 0 | 1 |
| -3 | 1 | 0 | 0 | 0 | 0 |
| -4 | 0 | 1 | 1 | 1 | 1 |
| -5 | 0 | 1 | 1 | 1 | 0 |
| -6 | 0 | 1 | 1 | 0 | 1 |
| -7 | 0 | 1 | 1 | 0 | 0 |
| -8 | 0 | 1 | 0 | 1 | 1 |
| -9 | 0 | 1 | 0 | 1 | 0 |
| -10 | 0 | 1 | 0 | 0 | 1 |
| -11 | 0 | 1 | 0 | 0 | 0 |
| -15 to -12 | 0 | 0 | 1 | 1 | 1 |
| -18 to -16 | 0 | 0 | 1 | 1 | 0 |
| -21 to -19 | 0 | 0 | 1 | 0 | 1 |
| -24 to -22 | 0 | 0 | 1 | 0 | 0 |
| -32 to -25 | 0 | 0 | 0 | 1 | 1 |
| -36 to -33 | 0 | 0 | 0 | 1 | 0 |
| -42 to -37 | 0 | 0 | 0 | 0 | 1 |
| -48 to -43 | 0 | 0 | 0 | 0 | 0 |

**Table 1. Volume Status LED Decodes**

| Treble or Bass Boost [dB] | LED Pattern | | | | |
|---|---|---|---|---|---|
| | D20 | D21 | D22 | D23 | D24 |
| 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 |
| 2 | 1 | 1 | 1 | 0 | 1 |
| 3 | 1 | 1 | 1 | 0 | 0 |
| 4 | 1 | 1 | 0 | 1 | 1 |
| 5 | 1 | 1 | 0 | 1 | 0 |
| 6 | 1 | 1 | 0 | 0 | 1 |
| 7 | 1 | 1 | 0 | 0 | 0 |
| 8 | 1 | 0 | 1 | 1 | 1 |
| 9 | 1 | 0 | 1 | 1 | 0 |
| 10 | 1 | 0 | 1 | 0 | 1 |
| 11 | 1 | 0 | 1 | 0 | 0 |
| 12 | 1 | 0 | 0 | 1 | 1 |

**Table 2. Treble/Bass Boost Status LED Decodes**

## 4.3 CS44L11 Initialization

Table 3 shows the CS44L11 register settings at startup. Refer to the CS44L11 Data Sheet for more information.

| Addr | Function | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| 2h | Power and Muting Control | SZC1 | SZC0 | PDN | FLT | RUPBYP | RDNBYP | Reserved | Reserved |
| | default | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 3h | Channel A Volume Control | VOLA7 | VOLA6 | VOLA5 | VOLA4 | VOLA3 | VOLA2 | VOLA1 | VOLA0 |
| | default | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 4h | Channel B Volume Control | VOLB7 | VOLB6 | VOLB5 | VOLB4 | VOLB3 | VOLB2 | VOLB1 | VOLB0 |
| | default | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5h | Tone Control | BB3 | BB2 | BB1 | BB0 | TB3 | TB2 | TB1 | TB0 |
| | default | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6h | Mode Control 1 | BBCF1 | BBCF0 | TBCF1 | TBCF0 | TC1 | TC0 | TC_EN | LIM_EN |
| | default | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 7h | Limiter Attack Rate | ARATE7 | ARATE6 | ARATE5 | ARATE4 | ARATE3 | ARATE2 | ARATE1 | ARATE0 |
| | default | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 8h | Limiter Release Rate | RRATE7 | RRATE6 | RRATE5 | RRATE4 | RRATE3 | RRATE2 | RRATE1 | RRATE0 |
| | default | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 9h | Volume and Mixing Control | IS1 | IS0 | RMP_SP1 | RMP_SP0 | ATAPI3 | ATAPI2 | ATAPI1 | ATAPI0 |
| | default | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| Ah | Mode Control2 | MCLKDIV | CLKDV1 | CLKDV0 | DBS | FRQSFT1 | FRQSFT0 | DEM1 | DEM0 |
| | default | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bh | Mode Control 3 | DIF1 | DIF0 | A=B | VCBYP | CP_EN | FREEZE | Reserved | Reserved |
| | default | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Ch | Revision Indicator | Reserved | Reserved | Reserved | Reserved | REV3 | REV2 | REV1 | REV0 |
| | default | 0 | 0 | 0 | 0 | Read Only | Read Only | Read Only | Read Only |

**Table 3. Initial CS44L11 Register Settings**

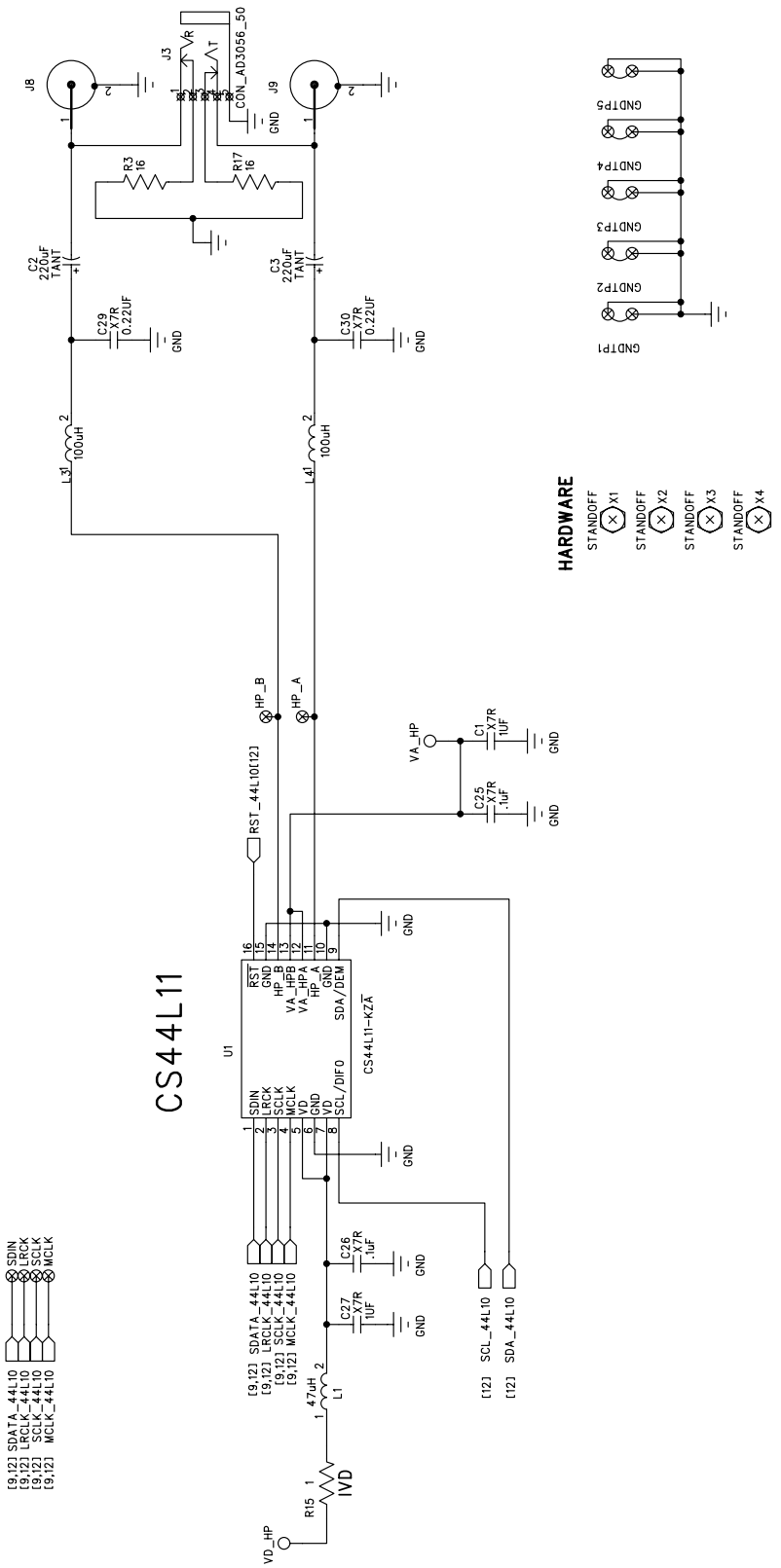


**Figure 1. CS44L11 PWM Headphone Amplifier**

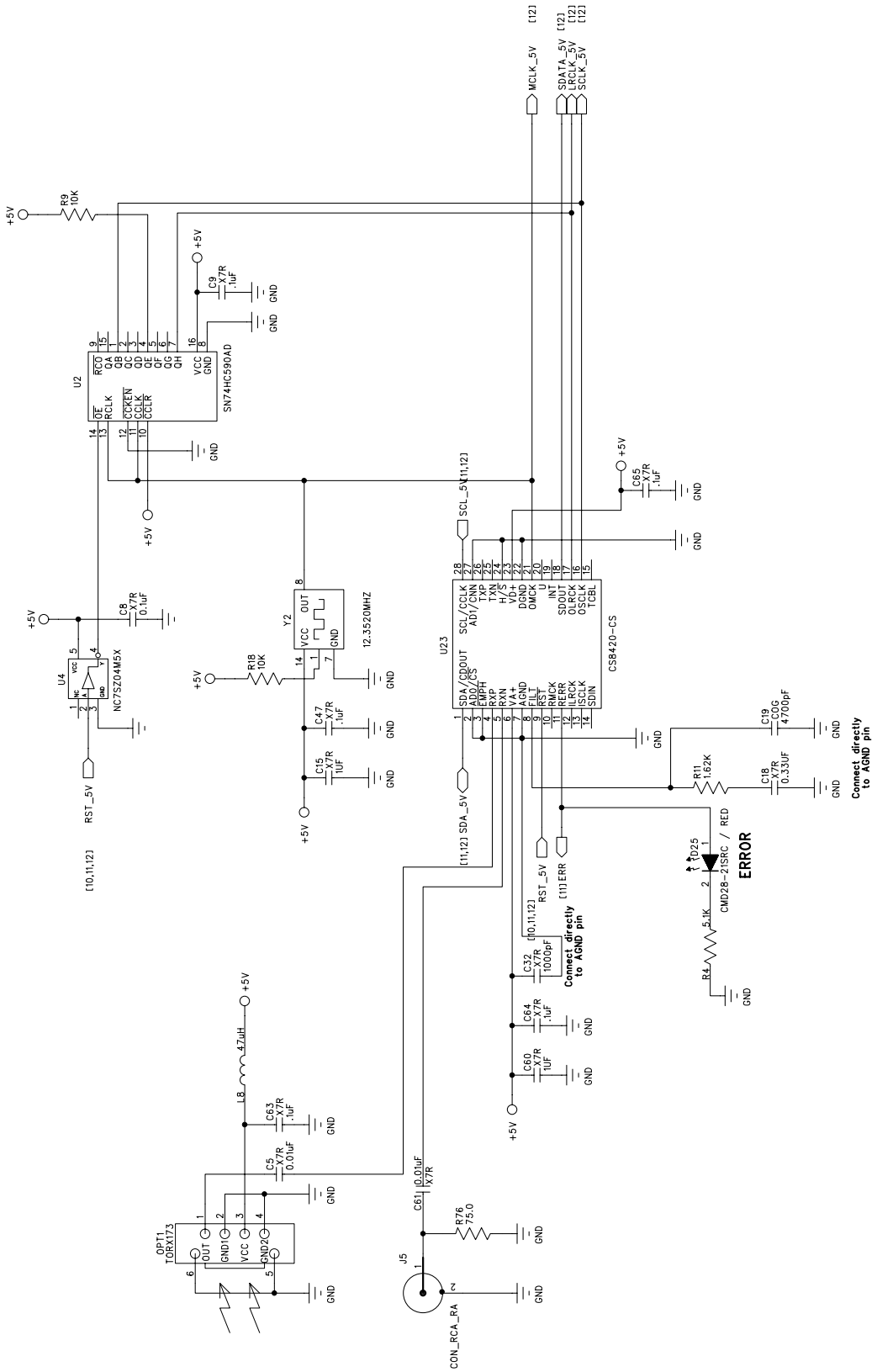


**Figure 2. CS8420 S/PDIF Receiver and Sample Rate Converter**

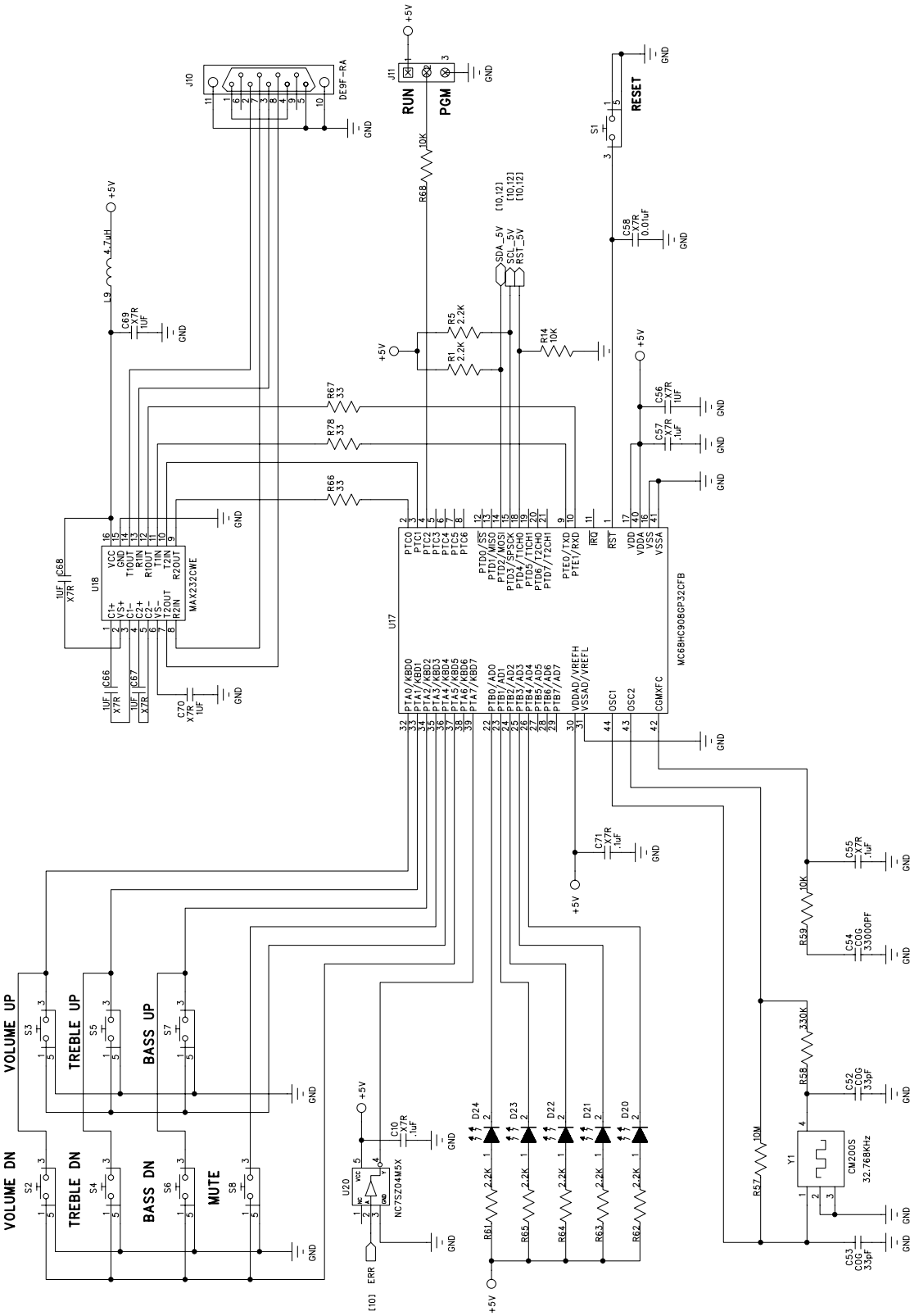


**Figure 3. Microcontroller**

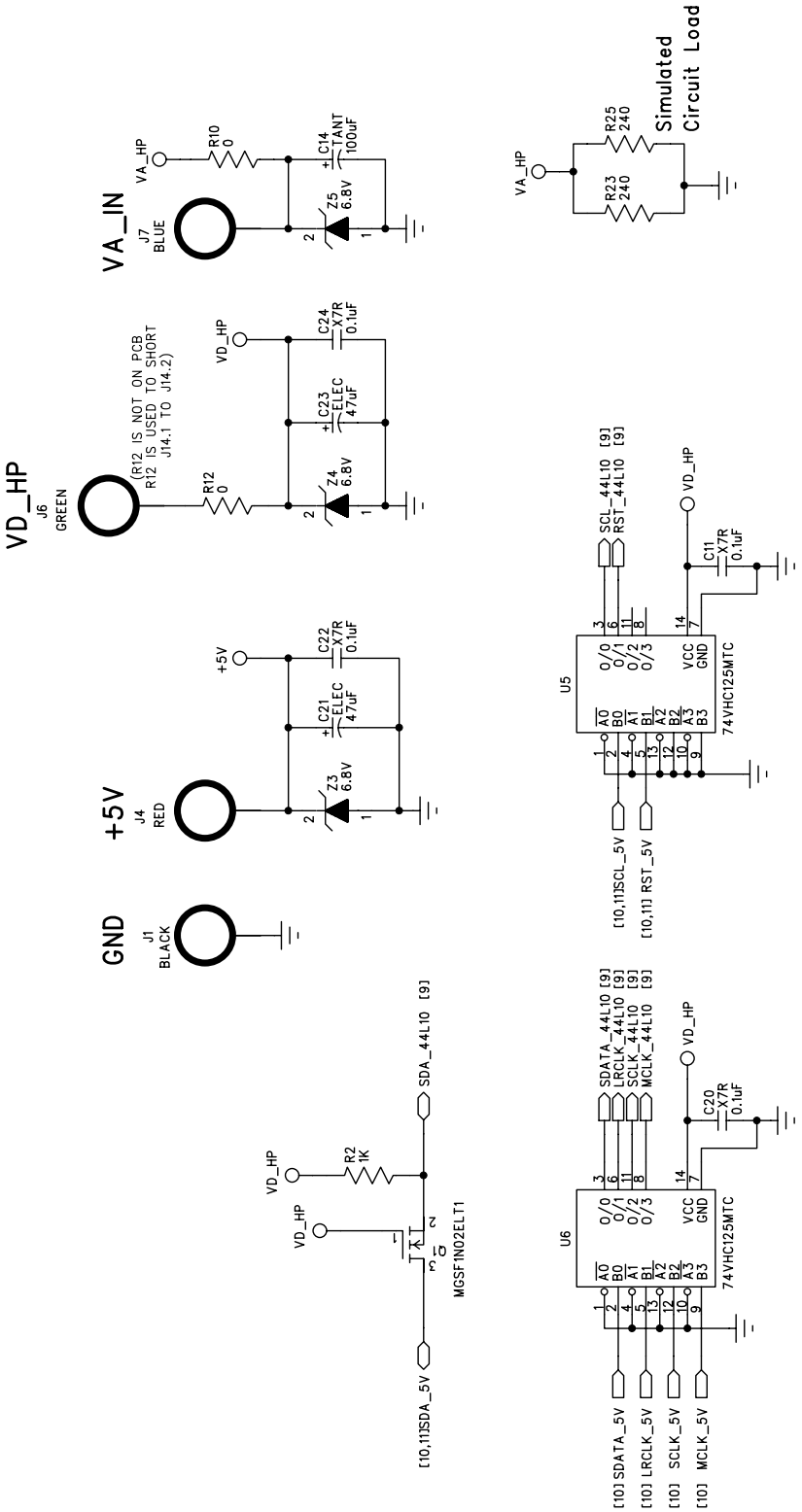


**Figure 4. Power Supply**

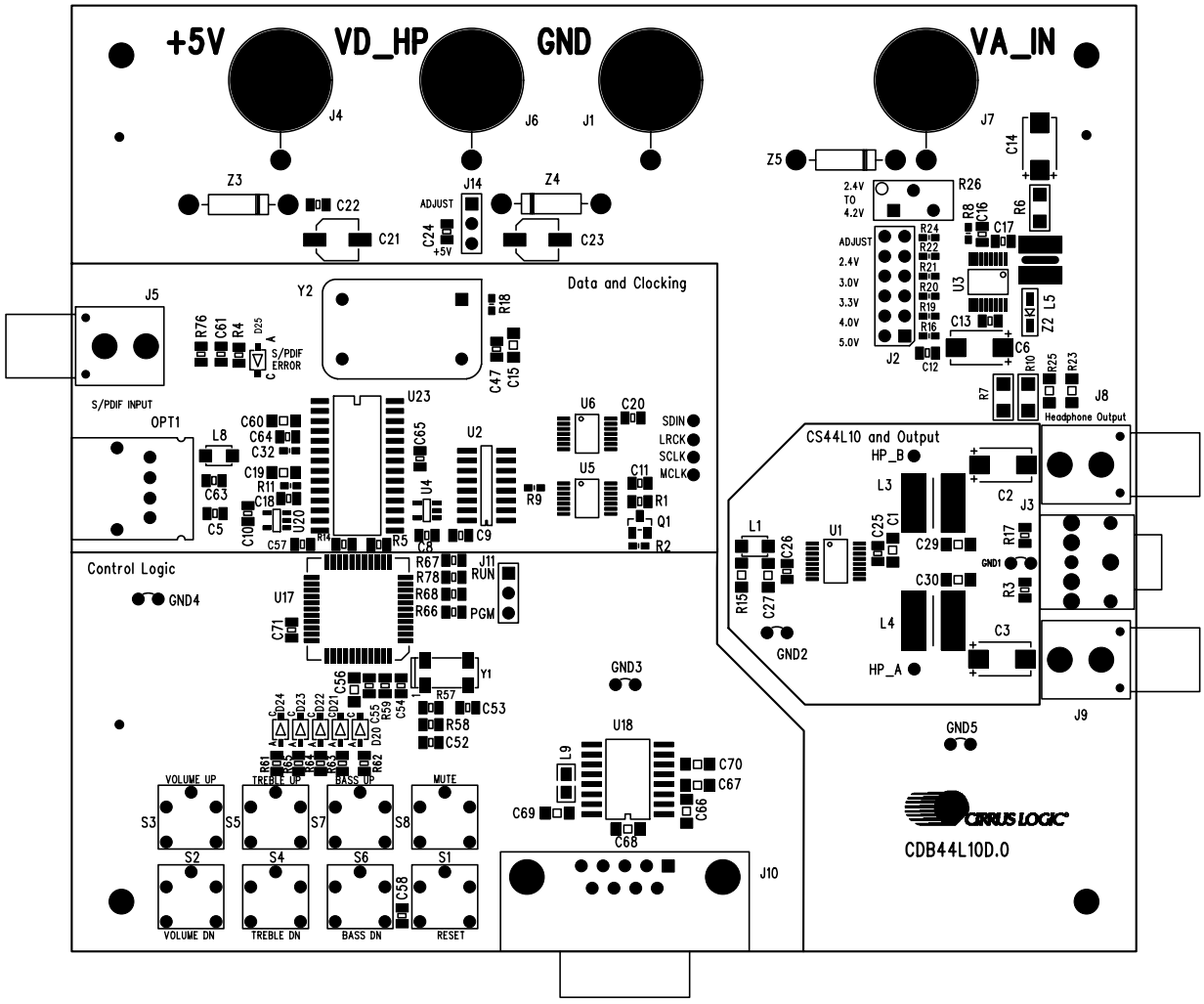


**Figure 5. Assembly Drawing**

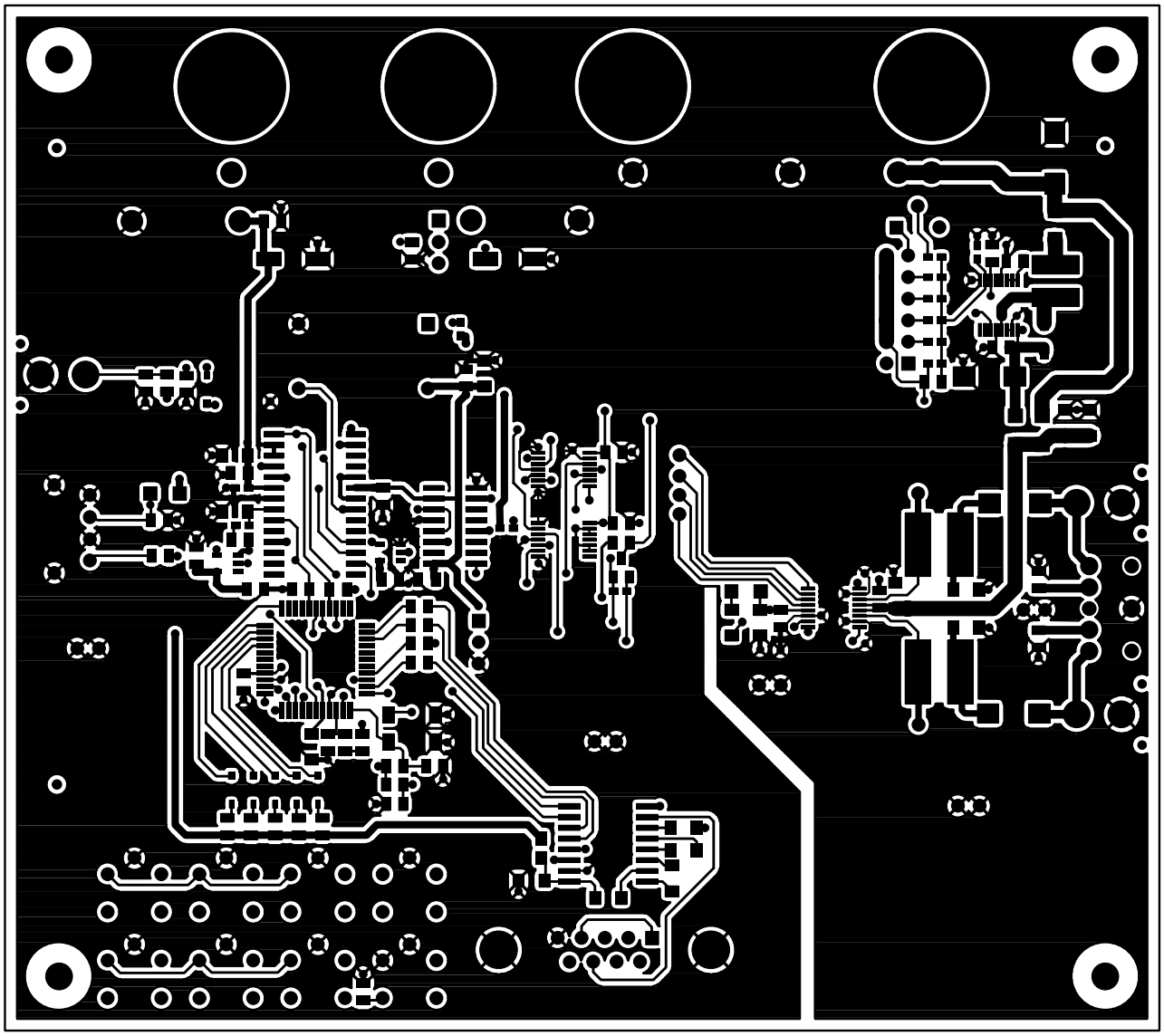

Figure 6. Top Layer

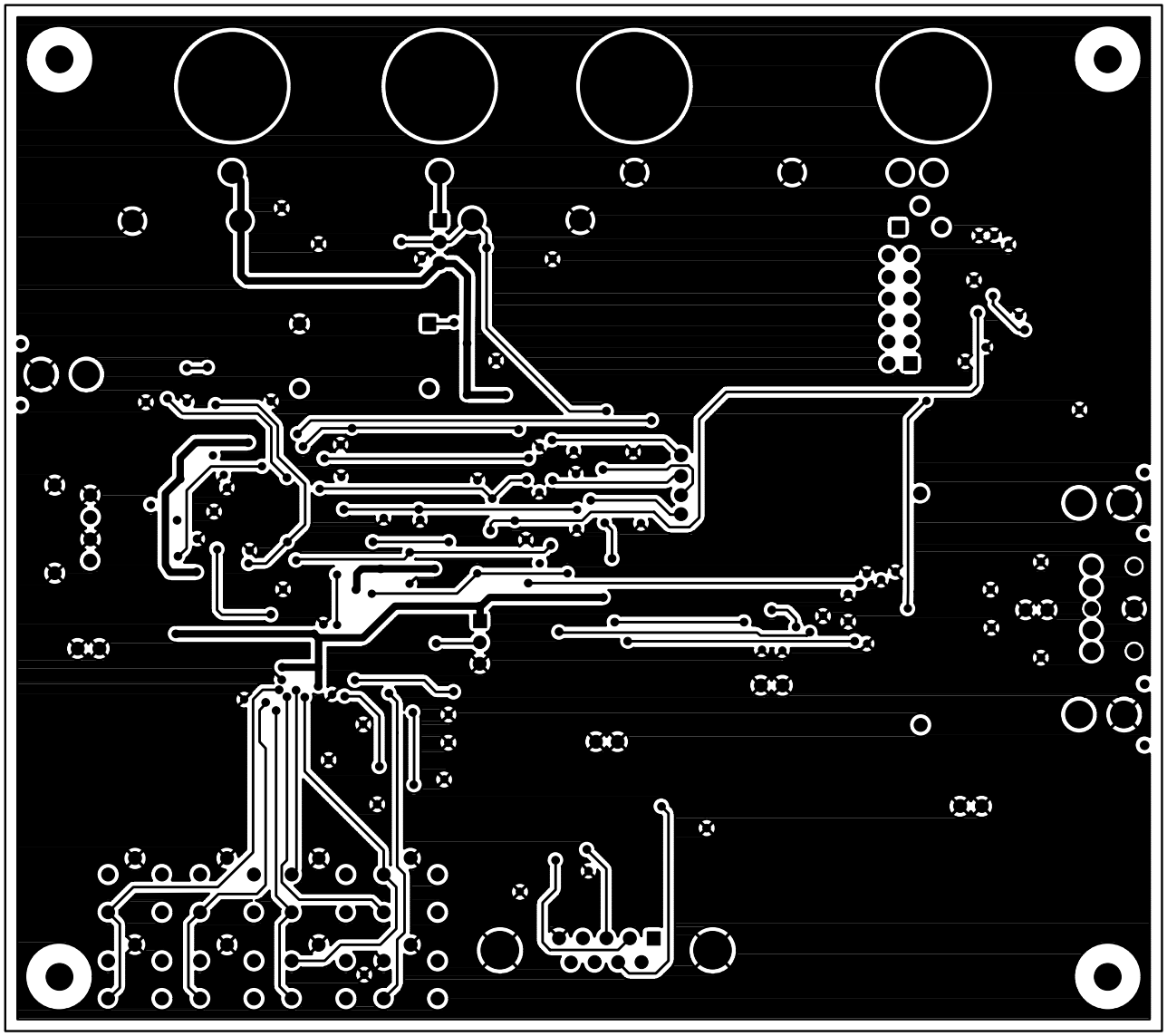

**Figure 7. Bottom Layer**

## 5. BILL OF MATERIALS

| Item | Rev | Description | Qty | Reference Designator | MFG | MFG P/N |
|---|---|---|---|---|---|---|
| 1 | A | CAP 1 µF 10% 16V X7R 0805 | 9 | C1 C15 C56 C60 C66 C67 C68 C69 C70 | KEMET | C0805C105K4RAC |
| 2 | A | CAP 220 µF 10% 6V TANT CASE D | 2 | C2 C3 | KEMET | T491D227K006AS |
| 3 | A | CAP 0.01 µF 10% 50V X7R 0805 | 2 | C5 C61 | KEMET | C0805C103K5RAC |
| 4 | A | CAP 100 µF 20% 6.3V TANT CASE C | 0 | C6 | VISHAY SPRAGUE | 595D107X06R3C2T |
| 5 | A | CAP 0.1 µF 10% 50V X7R 0805 | 16 | C8 C9 C10 C11 C20 C22 C24 C25 C26 C47 C55 C57 C63 C64 C65 C71 | KEMET | C0805C104K5RAC |
| 6 | A | CAP 0.1 µF 10% 50V X7R 0805 | 0 | C12 C16 | KEMET | C0805C104K5RAC |
| 7 | A | CAP 0.33 µF 10% 16V X7R 0805 | 0 | C13 C17 | KEMET | C0805C334K4RAC |
| 8 | A | CAP, 100 µF 20% 6.3V TANT CASE C | 1 | C14 | VISHAY SPRAGUE | 595D107X06R3C2T |
| 9 | A | CAP 0.33 µF 10% 16V X7R 0805 | 1 | C18 | KEMET | C0805C334K4RAC |
| 10 | A | CAP 4700 pF 5% 50V C0G 1206 | 1 | C19 | KEMET | C1206C472J5GAC |
| 11 | A | CAP 47 µF 20% 16V ELEC CASE C | 2 | C21 C23 | PANASONIC | ECEV1CA470WR |
| 12 | A | CAP 1 µF 10% 25V X7R 1206 | 1 | C27 | KEMET | C1206C105K3RAC |
| 13 | A | CAP 0.22 µF 10% 50V X7R 1206 | 2 | C29 C30 | KEMET | C1206C224K5RAC |
| 14 | A | CAP 1000 pF 5% 50V X7R 0603 | 1 | C32 | KEMET | C0603C102J5RAC |
| 15 | A | CAP 33 pF 10% 50V C0G 0805 | 2 | C52 C53 | KEMET | C0805C330K5GAC |
| 16 | A | CAP 0.033 µF 10% 50V X7R 0805 | 1 | C54 | KEMET | C0805C333K5RAC |
| 17 | A | CAP 0.01 µF 5% 50V X7R 0805 | 1 | C58 | KEMET | C0805C103J5RAC |
| 18 | A | LED CLR GRN, 2.1V 1mA .16MCD, SMD | 5 | D20 D21 D22 D23 D24 | CHICAGO MINIATURE | CMD28-21VGC/TR8/T1 |
| 19 | A | LED CLR SRED, 1.7V 1mA 1.6MCD, SMD | 1 | D25 | CHICAGO MINIATURE | CMD28-21SRC/TR8/T1 |
| 20 | A | WIRE, JUMPER 2P, 0.1""CTR, BRASS | 5 | GNDTP1 GNDTP2 GNDTP3 GNDTP4 GNDTP5 | COMPONENTS CORPORATION | TP-101-10 |
| 21 | A | CONN, TEST PT, .1""CTR TIN PLATE BLK | 2 | HP_A HP_B | KEYSTONE | 5001 |
| 22 | A | CONN, BPOST 2"" SILV, NYLON INS, BLK | 1 | J1 | JOHNSON COMPONENTS | 111-0103-001 |
| 23 | A | HDR 6x2, MLE .1""CTR, S GLD | 0 | J2 | SAMTEC | TSW-106-07-G-D |
| 24 | A | JACK STEREO HEADPHONE | 1 | J3 | A/D ELECTRONICS | 3056-50 |
| 25 | A | CONN, BPOST 2"" SILV, NYLON INS, RED | 1 | J4 | JOHNSON COMPONENTS | 111-0102-001 |

| Item | Rev | Description | Qty | Reference Designator | MFG | MFG P/N |
|---|---|---|---|---|---|---|
| 26 | A | JACK RCA, RA-BLK, PHONO, GLD TABS | 3 | J5 J8 J9 | A/D ELECTRONICS | ARJ-2018-NIL-1-NIL |
| 27 | A | CONN, BPOST 2"" SILV, NYLON INS, GRN | 1 | J6 | JOHNSON COMPONENTS | 111-0104-001 |
| 28 | A | CONN, BPOST 2"" SILV, NYLON INS, BLU | 1 | J7 | JOHNSON COMPONENTS | 111-0110-001 |
| 29 | A | CONN, DE9 FMLE, RT. ANGL | 1 | J10 | ADAM TECH | DE09-SL-24 |
| 30 | A | HDR 3x1, MLE .1""CTR, S GLD | 1 | J11 | SAMTEC | TSW-103-07-G-S |
| 31 | A | HDR 3x1, MLE .1""CTR, S GLD | 0 | J14 | SAMTEC | TSW-103-07-G-S |
| 32 | A | IND 47 µH, 10%, 1210 | 2 | L1 L8 | PANASONIC | ELJFA470KF |
| 33 | A | IND 100 µH 20% CTGSR74B SERIES SM | 2 | L3 L4 | CENTRAL TECHNOLOGIES | CTGSR74B-101M |
| 34 | A | IND 220 µH 20% CTGS54 SERIES SM | 0 | L5 | CENTRAL TECHNOLOGIES | CTGS54-220M |
| 35 | A | IND 4.7 µH 10% 0805 | 1 | L9 | PANASONIC | ELJFD4R7KF |
| 36 | A | CONN, TEST PT, .1""CTR TIN PLATE BLK | 0 | LRCK MCLK SCLK SDIN | KEYSTONE | 5001 |
| 37 | A | OPTICAL RCVR, 6Mb/s, 7V 20MA 10M | 1 | OPT1 | TOSHIBA | TORX173 |
| 38 | A | TRAN, MOSFET nCHAN 750mA 20V SOT-23 | 1 | Q1 | MOTOROLA | MGSF1N02ELT1 |
| 39 | A | RES 2.2k OHM 1/8W 5% 0805 FILM | 7 | R1 R5 R61 R62 R63 R64 R65 | DALE | CRCW0805222J |
| 40 | A | RES 1k OHM 1/16W 1% 0603 FILM | 1 | R2 | DALE | CRCW06031001F |
| 41 | A | RES 16 OHM 1/8W 5% 0805 FILM | 2 | R3 R17 | DALE | CRCW0805160J |
| 42 | A | RES 5.1k OHM 1/8W 5% 0805 FILM | 1 | R4 | DALE | CRCW0805512J |
| 43 | A | RES 0 OHM 1/8W 1% 1206 FILM | 0 | R6 R7 | DALE | CRCW1206000Z |
| 44 | A | RES 51.1k OHM 1/16W 1% 0603 FILM | 0 | R8 | DALE | CRCW06035112F |
| 45 | A | RES 10k OHM 1/16W 1% 0603 FILM | 2 | R9 R18 | DALE | CRCW06031002F |
| 46 | A | RES 0 OHM 1/8W 1% 1206 FILM | 1 | R10 | DALE | CRCW1206000Z |
| 47 | A | RES 1.62k OHM 1/16W 1% 0603 FILM | 1 | R11 | DALE | CRCW06031621F |
| 48 | A | RES 0 OHM 1/10W 1% 0805 FILM | 1 | R12 | DALE | CRCW0805000Z |
| 49 | A | RES 10k OHM 1/8W 5% 0805 FILM | 3 | R14 R59 R68 | VISHAY | CRCW0805103J |
| 50 | A | RES 1 OHM 1/8W 5% 1206 FILM | 1 | R15 | DALE | CRCW12061R0J |
| 51 | A | RES 158k OHM 1/16W 1% 0603 FILM | 0 | R16 | DALE | CRCW06031583F |
| 52 | A | RES 432k OHM 1/16W 1% 0603 FILM | 0 | R19 | DALE | CRCW06034323F |

| Item | Rev | Description | Qty | Reference Designator | MFG | MFG P/N |
|---|---|---|---|---|---|---|
| 53 | A | RES 191k OHM 1/16W 1% 0603 FILM | 0 | R20 | DALE | CRCW06031913F |
| 54 | A | RES 137k OHM 1/16W 1% 0603 FILM | 0 | R21 | DALE | CRCW06031373F |
| 55 | A | RES 69.8k OHM 1/16W 1% 0603 FILM | 2 | R22 R24 | DALE | CRCW06036982F |
| 56 | A | RES 240 OHM 1/8W 5% 1206 FILM | 2 | R23 R25 | DALE | CRCW1206241J |
| 57 | A | RES POT 500K 10%10TURN TOP-ADJ TH | 0 | R26 | BOURNS | 3266W-1-504 |
| 58 | A | RES 10M OHM 1/10W 1% 0805 FILM | 1 | R57 | DALE | CRCW08051005F |
| 59 | A | RES 330k OHM 1/8W 5% 0805 FILM | 1 | R58 | DALE | CRCW0805334J |
| 60 | A | RES 33 OHM 1/8W 5% 0805 FILM | 3 | R66 R67 R78 | PANASONIC | ERJ6GEYJ330V |
| 61 | A | RES 75 OHM 1/10W 1% 0805 FILM | 1 | R76 | DALE | CRCW080575R0F |
| 62 | A | SWITCH 0/1 TACT, W/ESD | 8 | S1 S2 S3 S4 S5 S6 S7 S8 | C&K | PTS645TL50 |
| 63 | A | IC, DIGITAL PWM HEADPHONE MONITOR,T | 1 | U1 | CIRRUS LOGIC | CS44L11-KZ/A |
| 64 | A | IC LOG 8-BIT W/3-ST OUT REG SOIC16 | 1 | U2 | TEXAS INSTRU-MENTS | SN74HC590AD |
| 65 | A | IC LIN H-CUR L-NOISE CNVTR SSOP16 | 0 | U3 | MAXIM | MAX1706EEE |
| 66 | A | IC LOG, INVERT, 5P, UHS TINY, SOT23 | 2 | U4 U20 | FAIRCHILD SEMI-CONDUCTOR | NC7SZ04M5X |
| 67 | A | IC LOG, 4 BUF W/3ST 14P TSSOP | 2 | U5 U6 | FAIRCHILD SEMI-CONDUCTOR | 74VHC125MTC |
| 68 | A | IC PGM, mCNTR 32K PQFP44 | 1 | U17 | MOTOROLA | MC68HC908GP32CFB |
| 69 | A | IC LNR 5V MCH RS-232 DRV/RCV SOIC16 | 1 | U18 | MAXIM | MAX232CWE |
| 70 | D1 | IC CRUS DIG AUD SAMP RTE CNV SOIC28 | 1 | U23 | CRYSTAL SEMICON-DUCTOR | CS8420-CS/D1 |
| 71 | A | SPCR, STANDOFF 4-40 THR, 0.875""L | 4 | X1 X2 X3 X4 | KEYSTONE | 1809 |
| 72 | A | OSC 32.768KHZ 20ppm 8mm x 3.8mm SMT | 1 | Y1 | CITIZEN | CM200S32.768KDZFT |
| 73 | A | OSC 12.352MHZ 50PPM 5V FULL DIP14 | 1 | Y2 | CAL CRYSTAL | CX21AF-12.3520MHZ |
| 74 | A | DIODE, SCHTKY POWER RECT, SOD123 | 0 | Z2 | MOTOROLA | MBR0520LT1 |
| 75 | A | DIODE TRANS. SUPPRESSOR, 6.8V, 600W | 3 | Z3 Z4 Z5 | MOTOROLA | P6KE6.8 |
| 76 | D | CONN, SHUNT, 2P, .1""CTR, BLK | 3 | XJ2,XJ11,XJ14 | MOLEX | 15-29-1025 |

## 6. REVISION HISTORY

| Release | Date | Changes |
|---|---|---|
| DB1 | April 2004 | Initial Release |

**Table 4. Revision History**

## Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.

To find the one nearest to you go to **www.cirrus.com**