CDB4396/7

Evaluation Board for CS4396 and CS4397

Features

- Demonstrates recommended layout and grounding arrangements
- CS8414 receives AES/EBU, S/PDIF, & EIAJ-340 Compatible Digital Audio
- Supports 32kHz - 192kHz PCM Audio and SACD Audio
- Requires only a digital signal source for a complete Digital-to-Analog Converter system
- Included Wall Mount power supply

Description

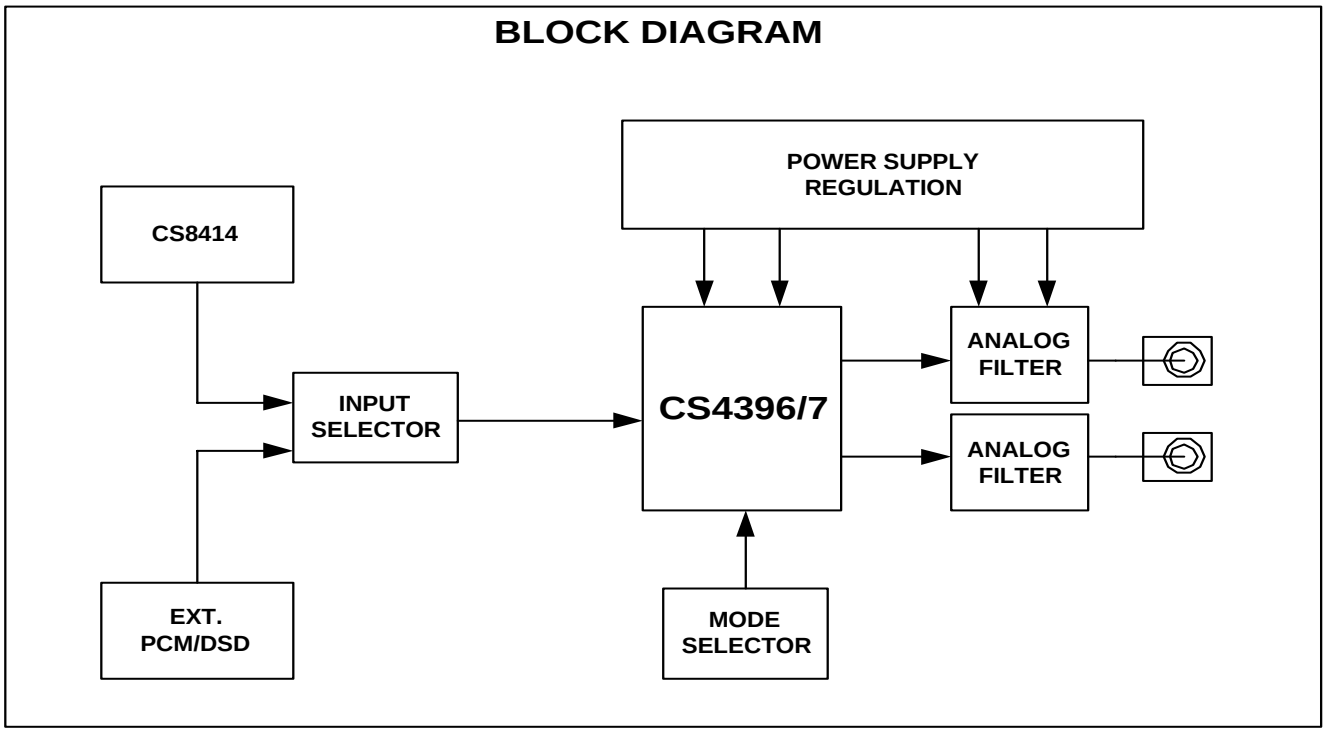
The CDB4396/7 evaluation board is an excellent means for quickly evaluating the CS4396 or CS4397 24bit-192 kHz D/A converters. The board accepts SPDIF and SACD inputs and, with an analog output interface, presents line level signals via RCA connectors. Evaluation requires an analog signal analyzer and a digital signal source.

The CS8414 digital audio receiver I.C. provides the system timing and data signals necessary to operate the Digital-to-Analog converter and will accept AES/EBU, SPDIF and EIAJ compatible audio data. The evaluation board may also be configured to accept external timing signals for operation in a user application during system development in PCM and DSD modes.

ORDERING INFORMATION

CDB4396C.0	Evaluation Board
CDB4397C.0	Evaluation Board

BLOCK DIAGRAM



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

CIRRUS LOGIC®
P.O. Box 17847, Austin, Texas 78760
(512) 445 7222 FAX: (512) 445 7581
http://www.cirrus.com

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Contacting Cirrus Logic Support

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http://www.cirrus.com/corporate/contacts/sales.cfm

1. CDB4396C.0 SYSTEM OVERVIEW

The CDB4396C.0 evaluation board is an excellent means of quickly evaluating the CS4396 or CS4397 24 bit - 192 kHz audio D/A converters. The evaluation board features a CS8414 digital audio input interface receiver, an analog output buffer/filter, and on board power supply regulation to be used with a supplied AC Wall Mount power supply. The CS8414 provides an easy interface to 32 kHz to 96 kHz digital audio signal sources. The evaluation board also allows the user to supply external PCM data and DSD data through a 10-pin header for system development.

2. CS4396 AND CS4397 DIGITAL TO ANALOG CONVERTER

Please refer to either the CS4396 or CS4397 product datasheet for a complete detailed description of these components.

3. CS8414 DIGITAL AUDIO RECEIVER

The system receives and decodes the standard S/PDIF data format using a CS8414 Digital Audio Receiver, Figure 1. The outputs of the CS8414 include a serial bit clock, serial data, left-right clock (FSYNC), de-emphasis control and a 256 Fs master clock. The operation of the CS8414 and a discussion of the digital audio interface are included in the CS8414 datasheet.

4. EXTERNAL DIGITAL AUDIO DATA AND DSD INPUT PORT

The evaluation board has been designed to allow interfacing to external systems via the 10-pin header, JP1. This header allows the evaluation board to accept externally generated clocks and data.

The port is activated by setting the "MODE" Control Switch " S2" position 6 "INT/EXT" switch to the closed position.

This port accepts PCM data, DSD data or data from an external 8X interpolator such as an HDCD PMD100 or PMD200. Notice that the board has provisions for terminating this input port for proper signal integrity using resistors R20 through R24.

The board also features automatic mode switching between this port and the SPDIF port when used with a SACD player. See Section 6- "Automatic Mode Switching" for a complete description of this feature.

5. MODE CONTROL

The board utilizes a Dip Switch, "S2" to allow the user to select various operational modes of the CS4396 or CS4397. These modes include selection of the Digital Interface Format, De-emphasis, Sample Rate modes, Internal-External Digital Audio Data, PCM-DSD Automatic Mode Switching, 64x - 128x DSD Data, +3 V/+5 V Digital Supply voltage selection, and Mute control. See Tables 1 through 8 for a complete description of how the switch settings set the different operating modes of the CS4396/7. To manually set the CS4396/7 modes, set S2 position 7 to open and use S2 positions 1 through 5 to set the various modes. To set the board into "Automatic Mode Switching" set the S2 position 7 to the closed position. See Table 8 for PCM-DSD settings that are set in Automatic Mode by circuitry U2, U3, U4, U7. When using the CS4397 with a DSD source, two input clock frequencies are possible, either 64 or 128x and are selectable by S2 position 8 The DSD clock mode, 256fs or 384fs is selectable by resistor stuffing option R19. The external mute circuitry is enabled by setting S2 position 10 to closed.

6. AUTOMATIC MODE SWITCHING

The board features an automatic PCM or DSD input data switching mode for use with an external SACD player. When used with an external SACD player that has both a SPDIF output connected to J1 (U5) and DSD data output connected to the JP1 port, will allow the board to switch automatically between the two.

Theory of operation - When an SACD player switches from playing a CD to a DSD disc, the SPDIF output data is disabled, the internal circuitry (U6, U2, U3, U4, U7) detects loss of an SPDIF source and automatically switches the Digital Data Input path (U8) to the DSD input port JP1. This feature can also be controlled from an external control signal by removing R60 and inputting a control signal into JP2. Logic low = PCM mode, Logic high = DSD mode. (For use only with the CS4397)

7. OUTPUT FILTER

The CDB4396C.0 output filter is a single op-amp circuit that combines a balanced to single-ended converter and 2-pole output filter. This topology was chosen to demonstrate a low-cost design implementation, however, the trade-off is a slightly compromised noise performance. Other output circuit topologies are available that optimize noise and distortion but at a higher cost.

The circuit was designed such that the user can select between DC coupled or AC coupled modes. To select AC coupling, remove Jumpers J2, J4, J5 and J7. The board also allows the user to test other op-amps by replacing the socketed op-amps with ones of their choice. Also surface mount op-amps can be tested by removing the socketed op-amps and soldering down the surface mount versions to SKT1X, SKT3X or SKT2X. This may involve the need to remove socket pins 2,3,4 on SKT1 and SKT3 and pins 1,2,3 on SKT2 to get the IC body to mount flush.

8. POWER SUPPLIES

The CDB4396C.0 comes supplied with an external 14 VAC Wall Mount power supply for convenience in setup, and to make measurements easier by eliminating ground loop problems between lab power supplies and measurement equipment. The external 14 VAC voltage supplied at J11 is rectified, filtered and regulated to produce ±12 volts by regulators U13 and U14. The CDB4396A.0 evaluation board can also be powered by an external lab power supply by connecting +12 vdc to connector J8, and -12 vdc to connector J10. J9 is the Ground connection. Up to ±13 volts is allowed before reverse voltage protection diodes D3 and D4 will clamp the input voltage.

The CDB4396C.0 uses separate voltage regulation for the digital control circuitry and for the digital power section and analog section for the CS4396 - CS4397. The digital power for the CS4396 - CS4397 is user selectable by switch S2 position 9. The (default) open position sets the voltage regulator VREG2 to +5.0 volts, the closed position sets the voltage regulator to +3.3 volts.

9. GROUNDING AND POWER SUPPLY DECOUPLING

For the user to be able to realize the high performance capabilities of the CS4396/7, it is recommended to pay careful attention to PC board layout, grounding, and placement of the power supply and decoupling capacitors. It is recommended when doing the PC board layout to use one ground plane underneath the part and for this ground plane to be the analog ground plane. The digital ground pin connection (pin 9) should tie to the analog ground plane and to the digital ground plane. This should be the "star" ground connection of the analog and digital ground planes. Please review the attached PC board photo plots for an example of the suggested grounding method.

It is also recommended to pay careful attention to the placement of the decoupling capacitors tied to VREF (pin 28). This pin requires a very low impedance path to ground at high frequencies as this pin draws high frequency current pulses at 6 MHz. It is important to place the .01 uF capacitor and 100 uF capacitor right next to the pin. Keep the connecting trace as short as possible. A low ESR electrolytic or tantalum for the 100 uF is recommended.

10. CS4396/CS4397 MODE SETTINGS (SW2)

M4	M1 (DIF1)	M0 (DIF0)	DESCRIPTION
0	0	0	Left Justified, up to 24-bit data
0	0	1	I^2S, up to 24-bit data
0	1	0	Right Justified, 16-bit Data
0	1	1	Right Justified, 24-bit Data

Table 1. Single Speed (16 to 50 kHz) Digital Interface Format Options

M3 (DEM1)	M2 (DEM0)	DESCRIPTION
0	0	32 kHz De-Emphasis
0	1	44.1 kHz De-Emphasis
1	0	48 kHz De-Emphasis
1	1	De-Emphasis Disabled

Table 2. Single Speed (16 to 50 kHz) De-Emphasis Options

M4	M3	M2	M1	M0	DESCRIPTION
1	1	1	0	0	Left Justified up to 24-bit data, Format 0
1	1	1	0	1	I^2S up to 24-bit data, Format 1
1	1	1	1	0	Right Justified 16-bit data, Format 2
1	1	1	1	1	Right Justified 24-bit data, Format 3

Table 3. Double Speed (50 to 100 kHz) Sample Rate Mode Options

M4	M3	M2	M1	M0	DESCRIPTION
1	1	0	0	0	Left Justified up to 24-bit data, Format 0
1	1	0	0	1	I^2S up to 24-bit data, Format 1
1	1	0	1	0	Right Justified 16-bit data, Format 2
1	1	0	1	1	Right Justified 24-bit data, Format 3

Table 4. Quad Speed(100 to 200 kHz) Sample Rate Mode Options

M4	M3	M2	M1	M0	DESCRIPTION
1	0	0	0 (DIR)	0	Right Justified 20-bit data
1	0	0	0 (DIR)	1	Right Justified 24-bit data

Table 5. 8x Interpolated Input Mode Options (CS4397 only)

M4	M3	M2	M1	M0	DESCRIPTION
1	0	1	0 (DSD_R)	0	64x Oversampled DSD
1	0	1	0 (DSD_R)	1	128x Oversampled DSD

Table 6. Direct Stream Digital Options (CS4397 only)

	SWITCH S2
POSITION 1	MO - OPEN = 1 NOTE: SWITCH MUST BE OPEN FOR AUTO MODE TO WORK
POSITION 2	M1 - OPEN = 1 NOTE: SWITCH MUST BE OPEN FOR AUTO MODE TO WORK
POSITION 3	M2 - OPEN = 1 NOTE: SWITCH MUST BE OPEN FOR AUTO MODE TO WORK
POSITION 4	M3 - OPEN = 1 NOTE: SWITCH MUST BE OPEN FOR AUTO MODE TO WORK
POSITION 5	M4 - OPEN = 1 NOTE: SWITCH MUST BE OPEN FOR AUTO MODE TO WORK
POSITION 6	INT/EXT - SETS THE INPUT MUX TO THE CS8414 OR TO JP1 - OPEN=CS8414
POSITION 7	PCM/DSD-SETS THE BOARD TO AUTO MODE-SWITCHES BETWEEN PCM AND DSD-OPEN=DISABLED
POSITION 8	64/128X - SETS THE CLOCK MODE FOR DSD - OPEN =128X
POSITION 9	+3V/+5V - SETS THE DIGITAL POWER SUPPLY TO +3 OR +5 VOLTS - OPEN = +5V
POSITION 10	MUTE - ENABLES THE EXTERNAL MUTE CIRCUITRY - OPEN = DISABLED
DEFAULT	ALL SWITCHES IN OPEN POSITION

Table 7. SWITCH S2 MODE SETTINGS TABLE

- MODE TABLE - AUTO SWITCHING	
PCM	DSD
M0 = 1	M0 = 1
M1 = 0	M1=DSD_R
M2 = 1	M2 = 0
M3 = 1	M3 = 0
M4 = 0	M4 = 1
LRCLK = 0 = 256FS	
LRCLK = 1 = 384FS	

Table 8. AUTOMATIC MODE OPERATION SETTINGS

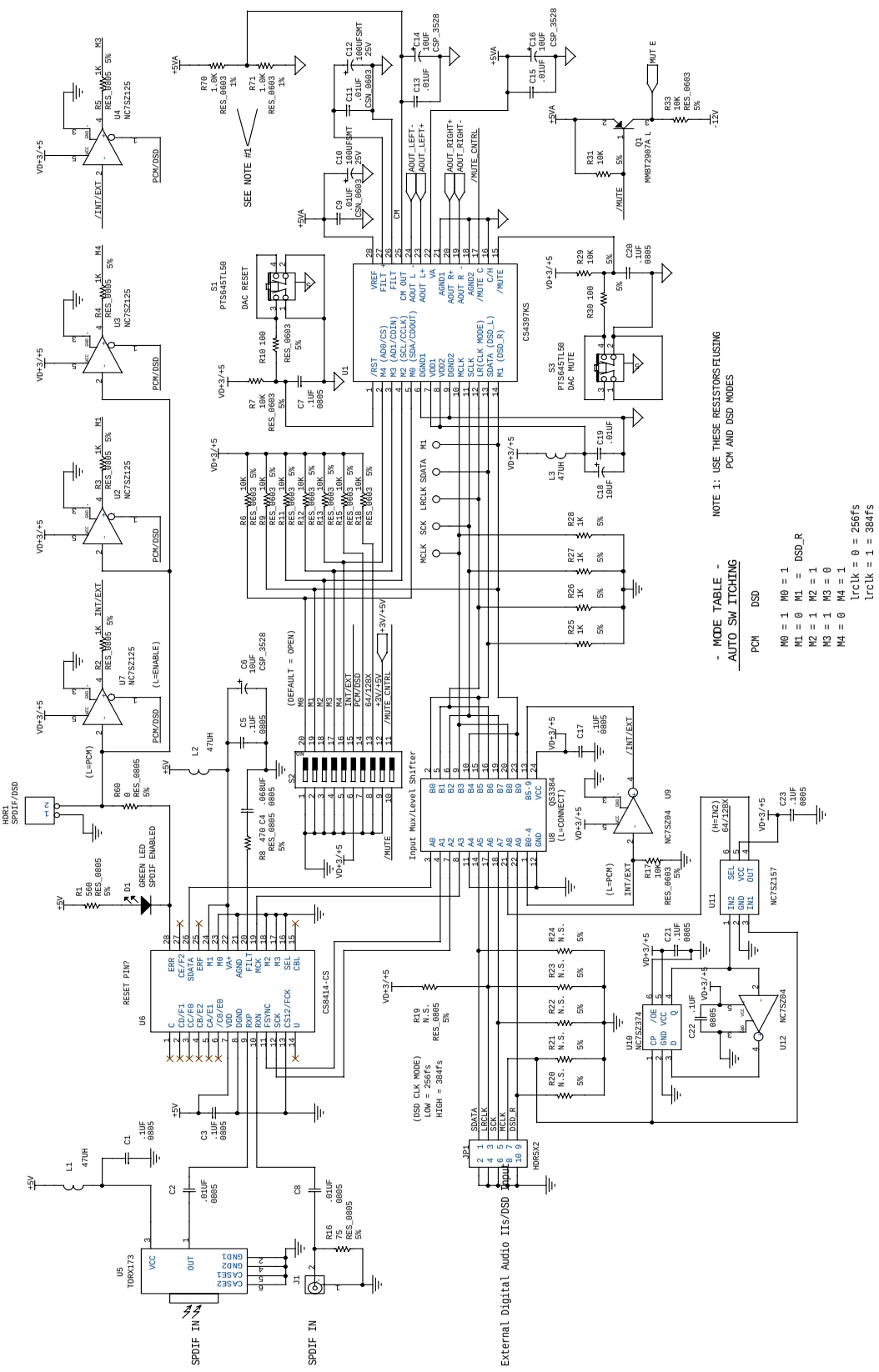

Figure 1. System Schematic

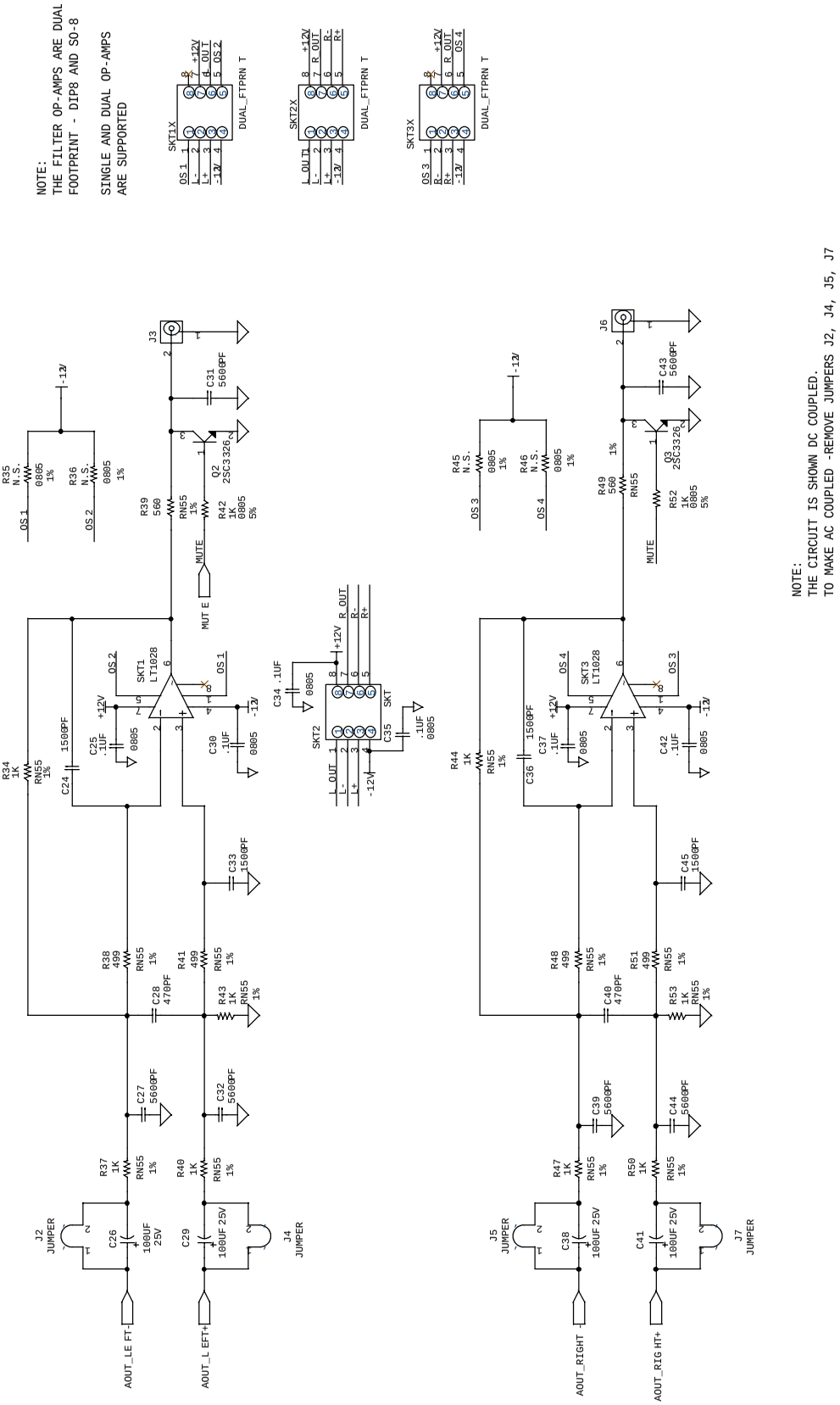

Figure 2. Output Stage Schematic

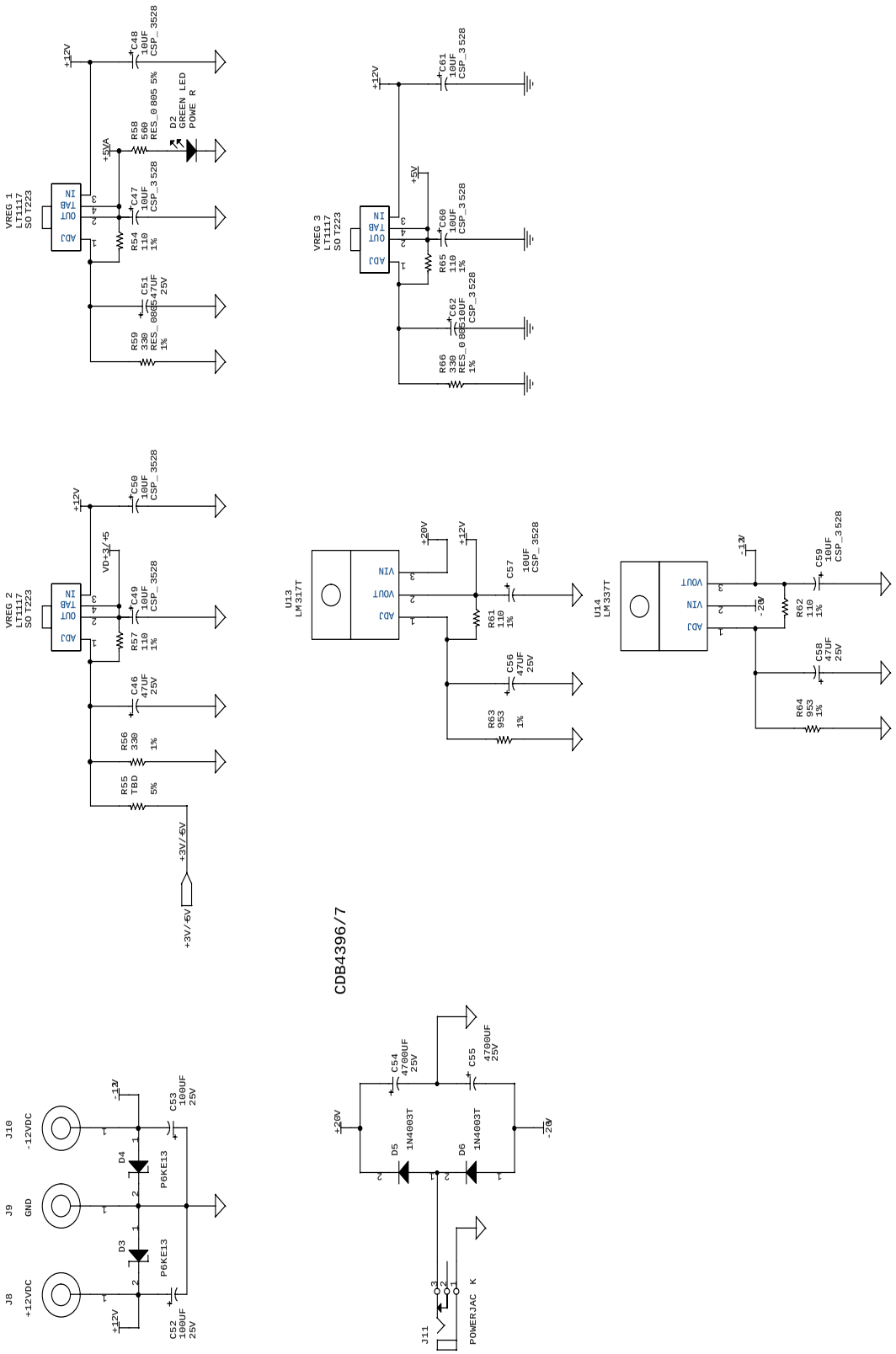

Figure 3. Power Supply

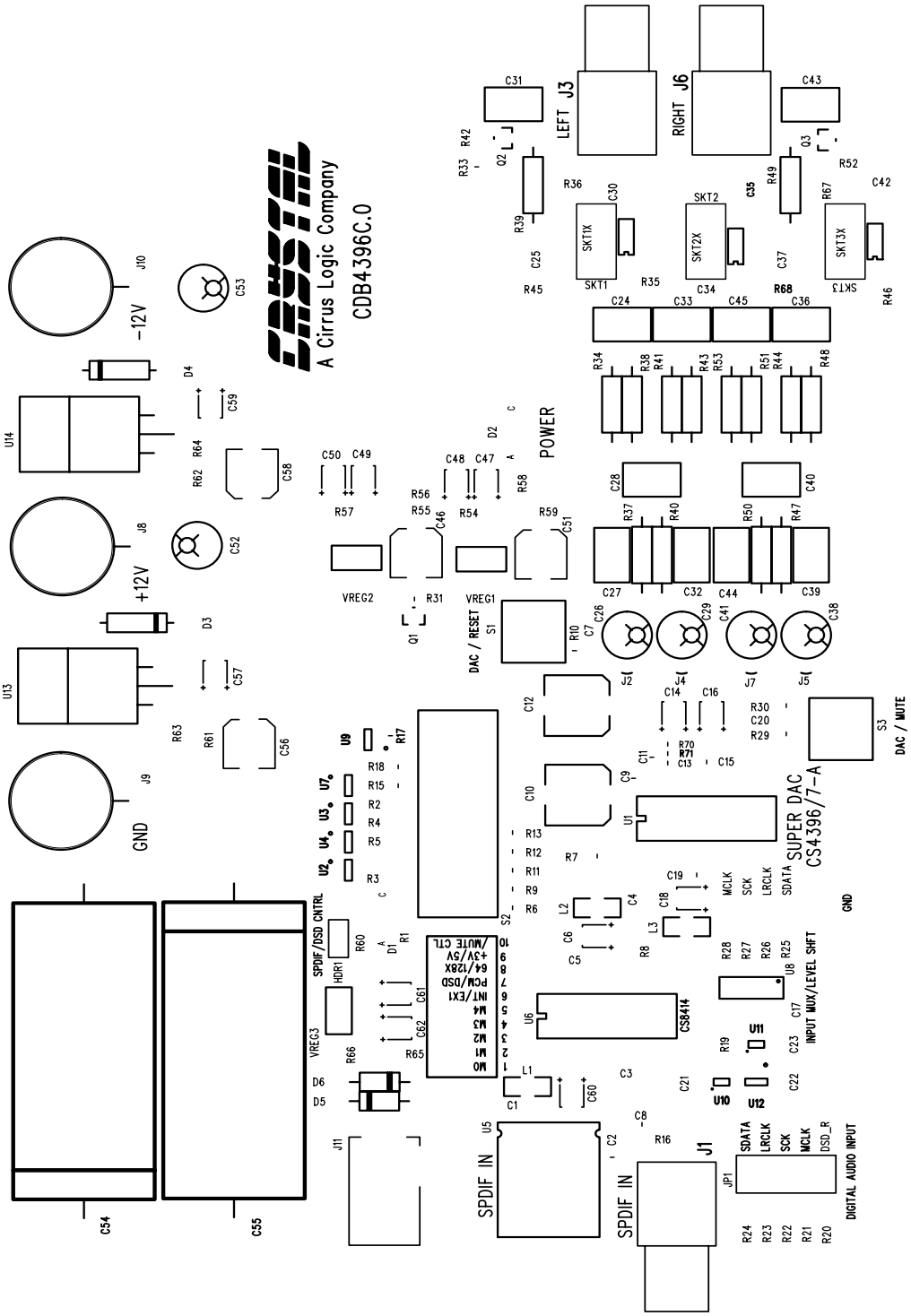

Figure 4. Component Placement

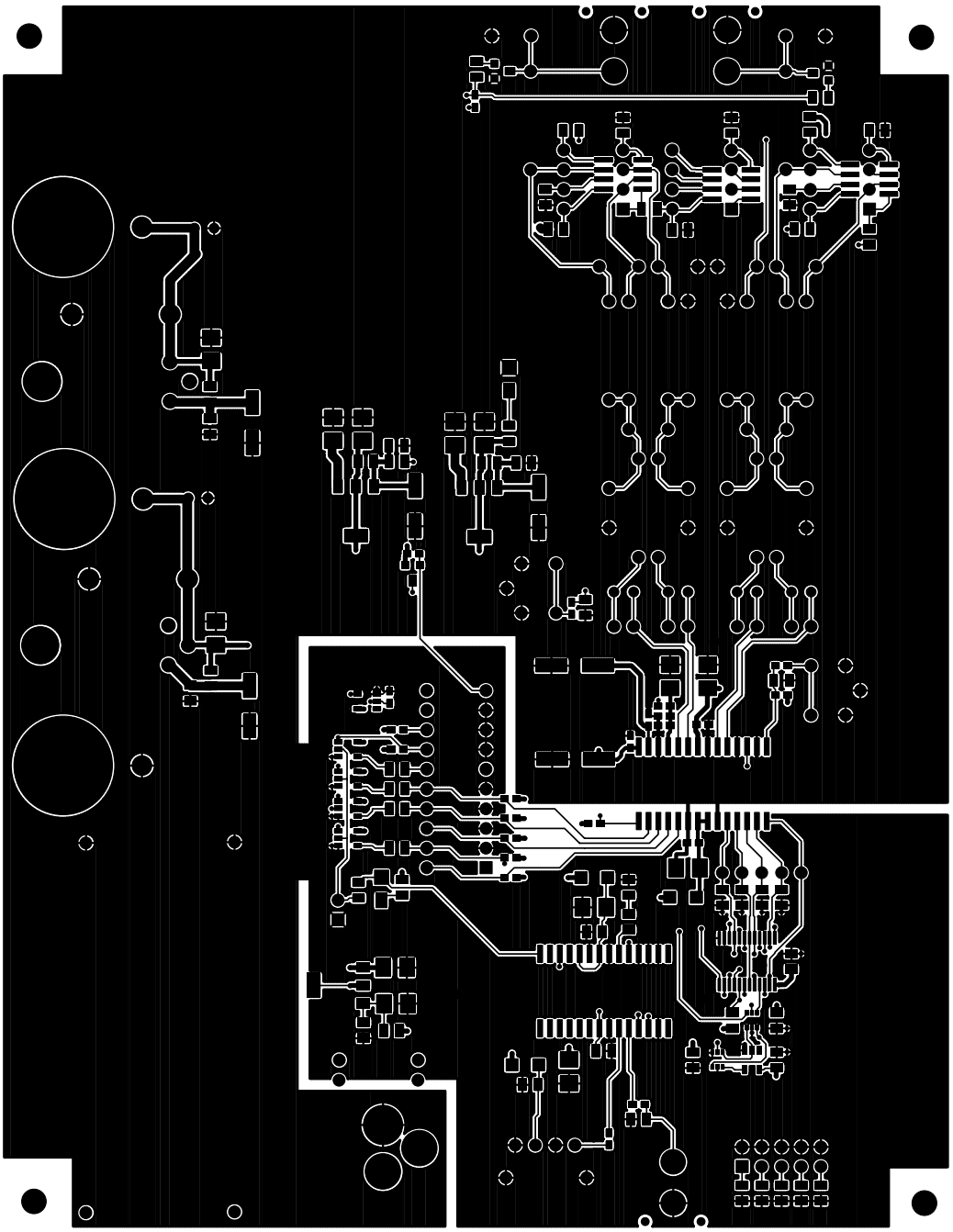

Figure 5. Top - Layer 1

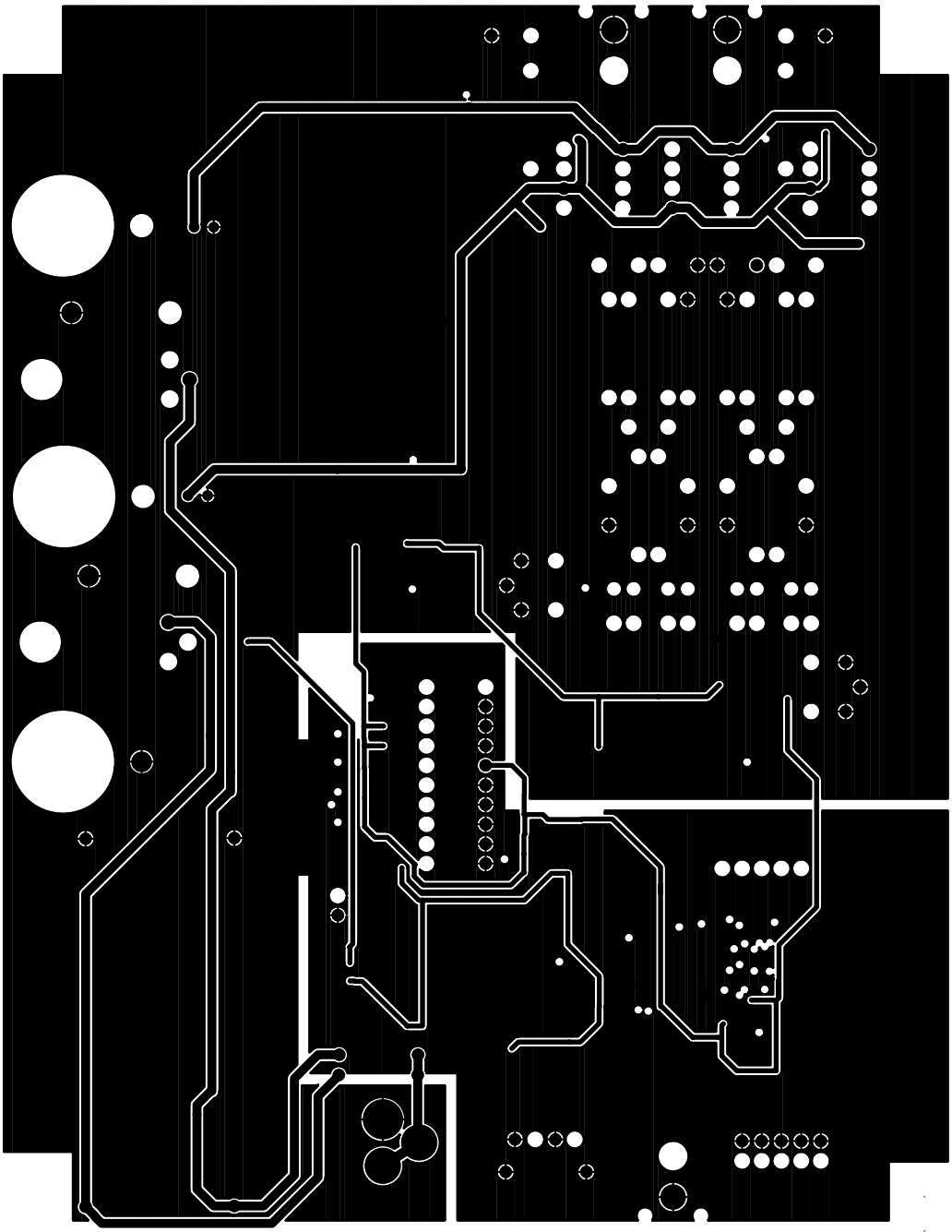

Figure 6. Layer 2

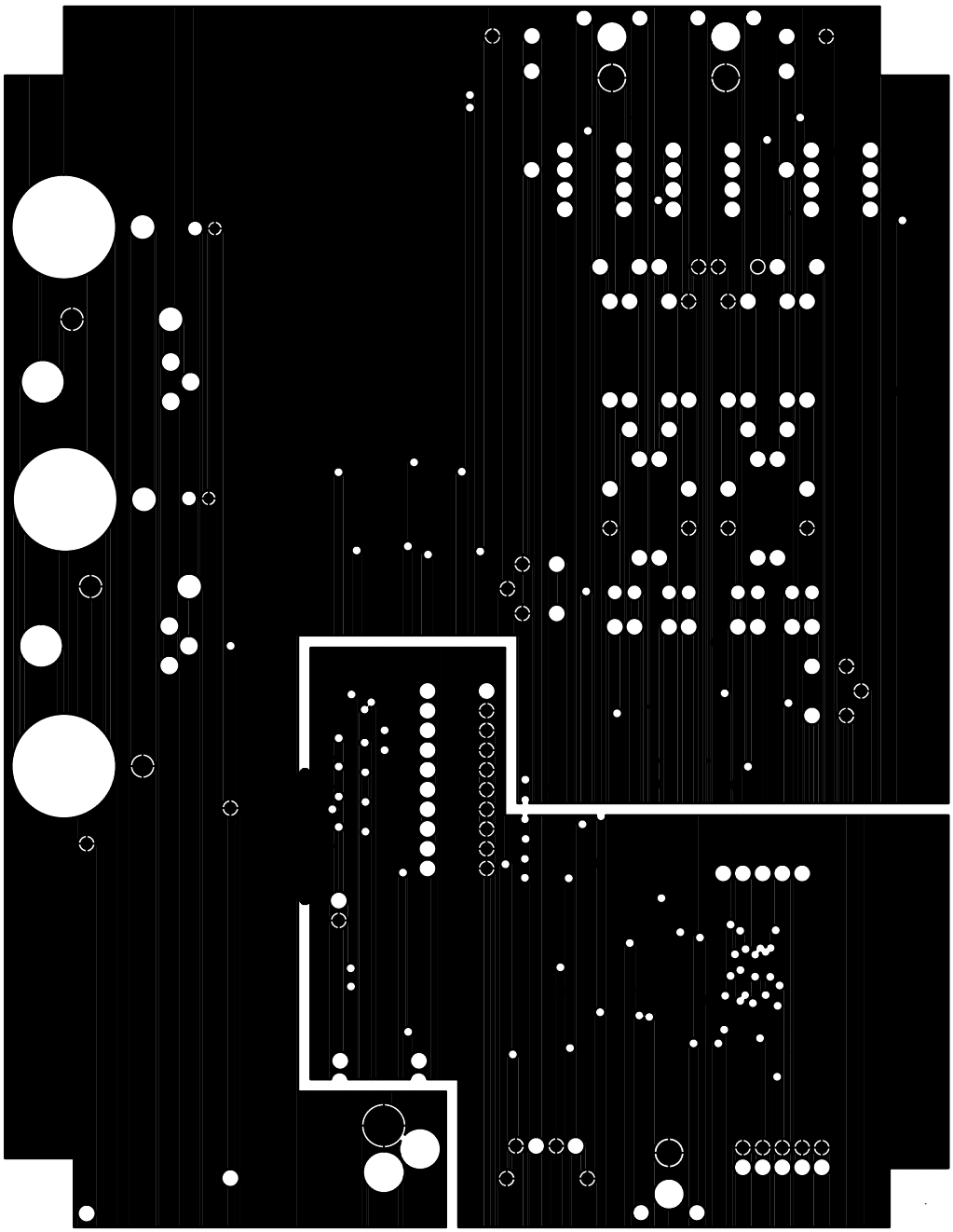

Figure 7. Layer 3

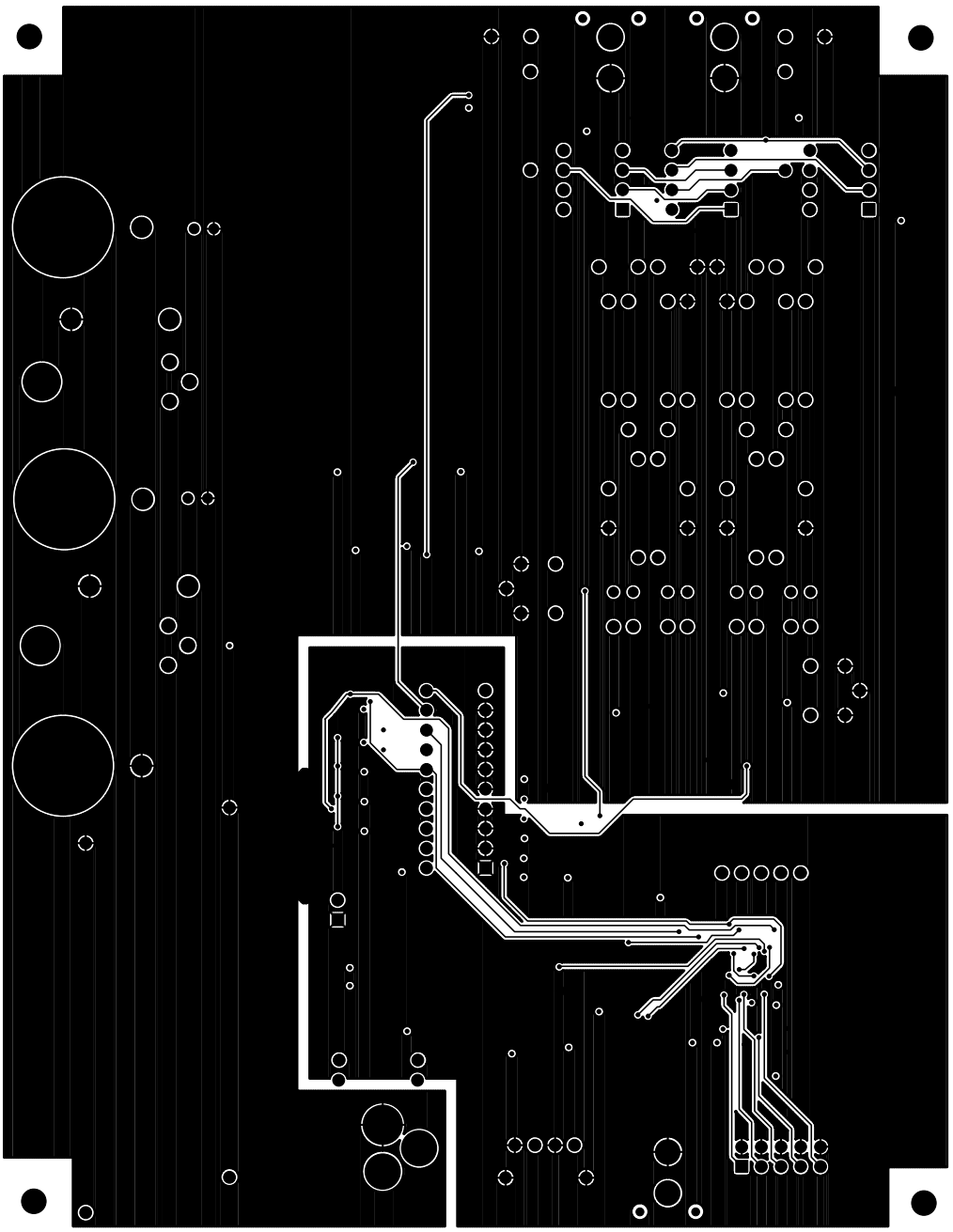

Figure 8. Layer 4

• Notes •


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