User Guide

MPS Ultrasound Controller Board (EV-EVK-RD-01A)

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Overview

Introduction

The EV-EVK-RD-01A is an ultrasound controller board that forms a key component of the MPS ultrasound IC evaluation kit, which includes the controller board and a compatible MPS ultrasound IC evaluation board.

Designed for versatility, the EV-EVK-RD-01A supports multiple evaluation board configurations. It connects to a PC via USB, and facilitates communication between the evaluation system and the PC using the MPS Ultrasound Test Bench software.

This user guide provides step-by-step instructions for setting up the controller board and establishing a reliable connection with the PC, enabling seamless evaluation and testing of MPS ultrasound ICs.

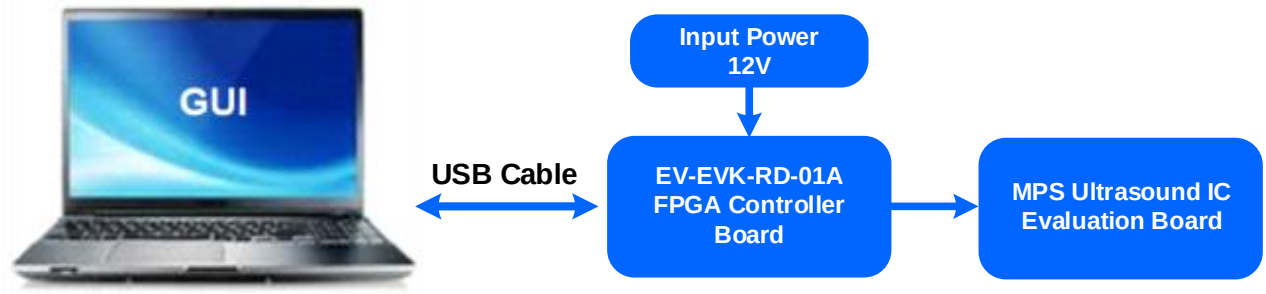

Figure 1: Evaluation Kit Set-Up

Controller Board Contents

EV-EVK-RD-01A controller board contents include:

#	Part Number	Item	Quantity
1	EV-EVK-RD-01A	MPS ultrasound controller board includes one USB 3A male to Micro B male cable and one 12V DC/DC power supply	1
2	Online resources	Includes the graphical user interface (GUI) and supplemental documents	-

Features and Benefits

- Advanced FPGA control powered by the Spartan-7 XC7S50-2FGGA484C FPGA
- Delivers precise and reliable control signals for seamless integration with MPS ultrasound IC evaluation boards
- Intuitive PC-based operation enables full system control via a user-friendly PC GUI
- Communication is established through a high-speed USB interface, streamlining evaluation, configuration, and data acquisition

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Section 1. Hardware Specifications

1.1 Personal Computer Requirements

The following minimum conditions must be met to use the EV-EVK-RD-01A:

- Operating system of Windows 7 or later
- Net Framework 4.0
- PC with a minimum of one available USB port
- At least 35 MB of free space

1.2 EV-EVK-RD-01A Specifications

Figure 2 shows the EV-EVK-RD-01A, the MPS ultrasound controller board.

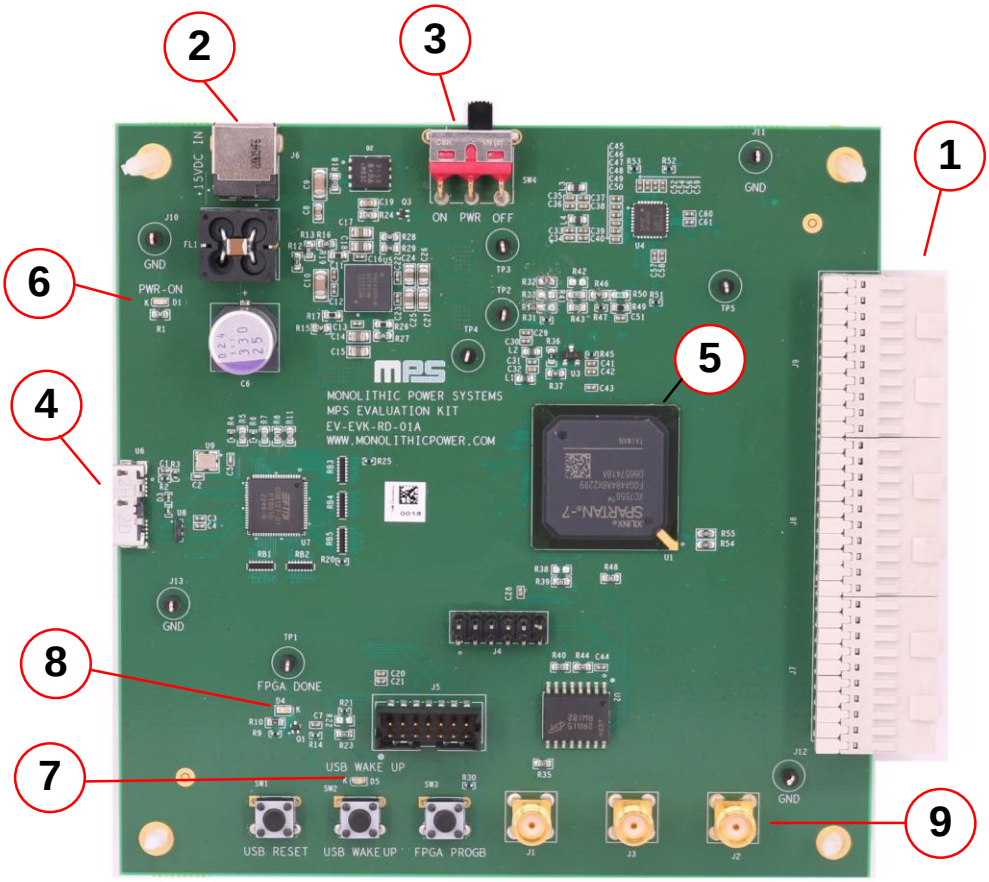

Figure 2: EV-EVK-RD-01A Evaluation Board

Table 1 on page 5 shows the EV-EVK-RD-01A components.

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Table 1: EV-EVK-RD-01A Components

#	Component Name	Description
1	Connector	Provides interface connections to the MPS ultrasound IC evaluation board
2	Input power	Accepts a 12V/300mA input power via a center-positive connector
3	Power switch	Toggles the input power on or off
4	USB connector	Connects the controller board to a PC using a USB 3.0 Type-A to Micro-B cable
5	FPGA	Spartan-7 XC7S50-2FGGA484C for signal control
6	Power-on LED	Illuminates blue when power is supplied to the board
7	USB wake-up LED	Illuminates green when a USB wake-up signal is requested by the controller board
8	FPGA done LED	Illuminates green when the FPGA has successfully booted up
9	SMA connectors	Outputs evaluation board-specific signals such as trigger pulses via SMA connectors

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Section 2. Software Requirements

2.1 Software Installation Procedure

The MPS Ultrasound Test Bench software can be downloaded from the MPS website. Follow the instructions below to install the software:

1. Double-click the “MPS Ultrasound Test Bench V1.0.0.2.exe” file to initiate the installation process.
2. Review the License Agreement, and click “Next” to agree to the terms and proceed with installation.
3. In the Installation Directory dialog box, browse to the preferred location, or click “Next” to use the default path (see Figure 3).

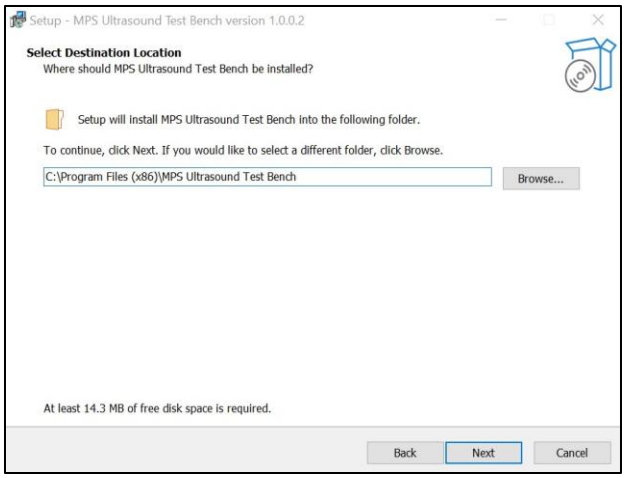

Figure 3: MPS Ultrasound Test Bench Installation Directory Dialog Box

4. Select any optional tasks to perform during installation (e.g. creating shortcuts), then click “Next.”
5. When prompted, click “Install” to start installing the software.
6. Allow the installation process to complete, which may take a few moments.
7. Once prompted, click “Extract” to begin installing the FTDI USB Driver required for USB communication (see Figure 4).

Figure 4: MPS Ultrasound Test Bench FTDI USB Driver

8. Click “Next” to initiate driver installation.
9. Review and accept the FTDI Driver License Agreement, then click “Next” to continue.
10. When the “Installation Complete” dialog box appears, click “Finish” to exit the installer.

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Section 3. EV-EVK-RD-01A Set-Up Instructions

3.1 Controller Board Set-Up

The EV-EVK-RD-01A ultrasound controller board is designed to support multiple evaluation board configurations. For detailed operating instructions specific to your evaluation board, refer to its corresponding user manual.

Follow the steps below to start up the EV-EVK-RD-01A and connect it to the PC:

1. Connect the target evaluation board to the EV-EVK-RD-01A using interface connectors J7, J8, and J9. Figure 5 shows the evaluation board connection to the EV-EVK-RD-01A, using the EV4865-BD-02A as an example.

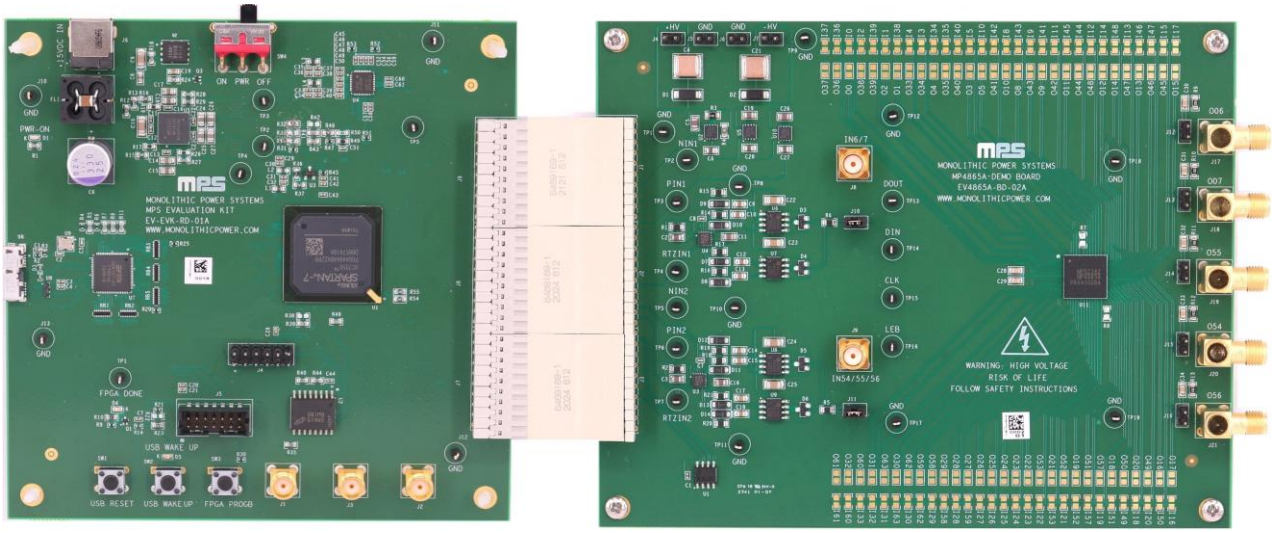

Figure 5: Evaluation Board Connection to the EV-EVK-RD-01A

2. Plug the provided 12V DC/DC power supply into power connector J6.
3. Insert the provided USB 3A male to Micro B male cable into USB jack U6, and connect the other end of the USB cable to a USB 2.0 or USB 3.0 port on the PC.
4. Slide power switch SW4 to the On position to power the board. The following indicator lights should turn on:
   a. Power-on LED (D1) should light up blue, indicating good power.
   b. USB wake-up LED (D5) should light up green, confirming USB connection.
   c. FPGA done LED (D4) should light up green, indicating successful firmware load.
5. Open the MPS Ultrasound Test Bench graphical user interface (GUI) software. Click the icon corresponding to the IC part number of the connected evaluation board. This loads the appropriate GUI interface (see Figure 6 on page 8).

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Figure 6: Select the Relevant IC Part Number for MPS Ultrasound Test Bench

6. If the FPGA firmware on the controller board does not match the connected evaluation board, the GUI prompts a firmware update (see Figure 7).

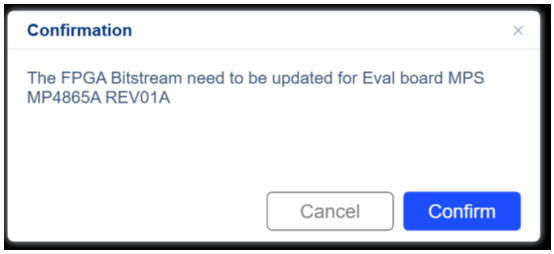

Figure 7: Firmware Update Prompt

7. Click “Confirm” to proceed. The update typically takes 1 to 2 minutes.
8. To activate the new firmware, follow the steps below:
   a. Slide SW4 to the Off position and wait 5 seconds.
   b. Switch SW4 back to the On position.
   c. Click “Restart” in the GUI to reload the software (see Figure 8).

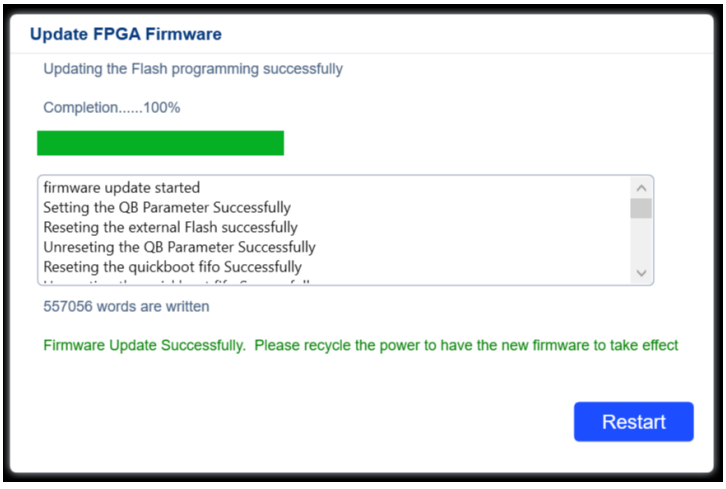

Figure 8: Firmware Update Completed

9. After restarting, select the icon for the connected evaluation board again. The GUI for the selected board is now loaded and ready for use.

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Section 4. Ultrasound Controller Board Schematic

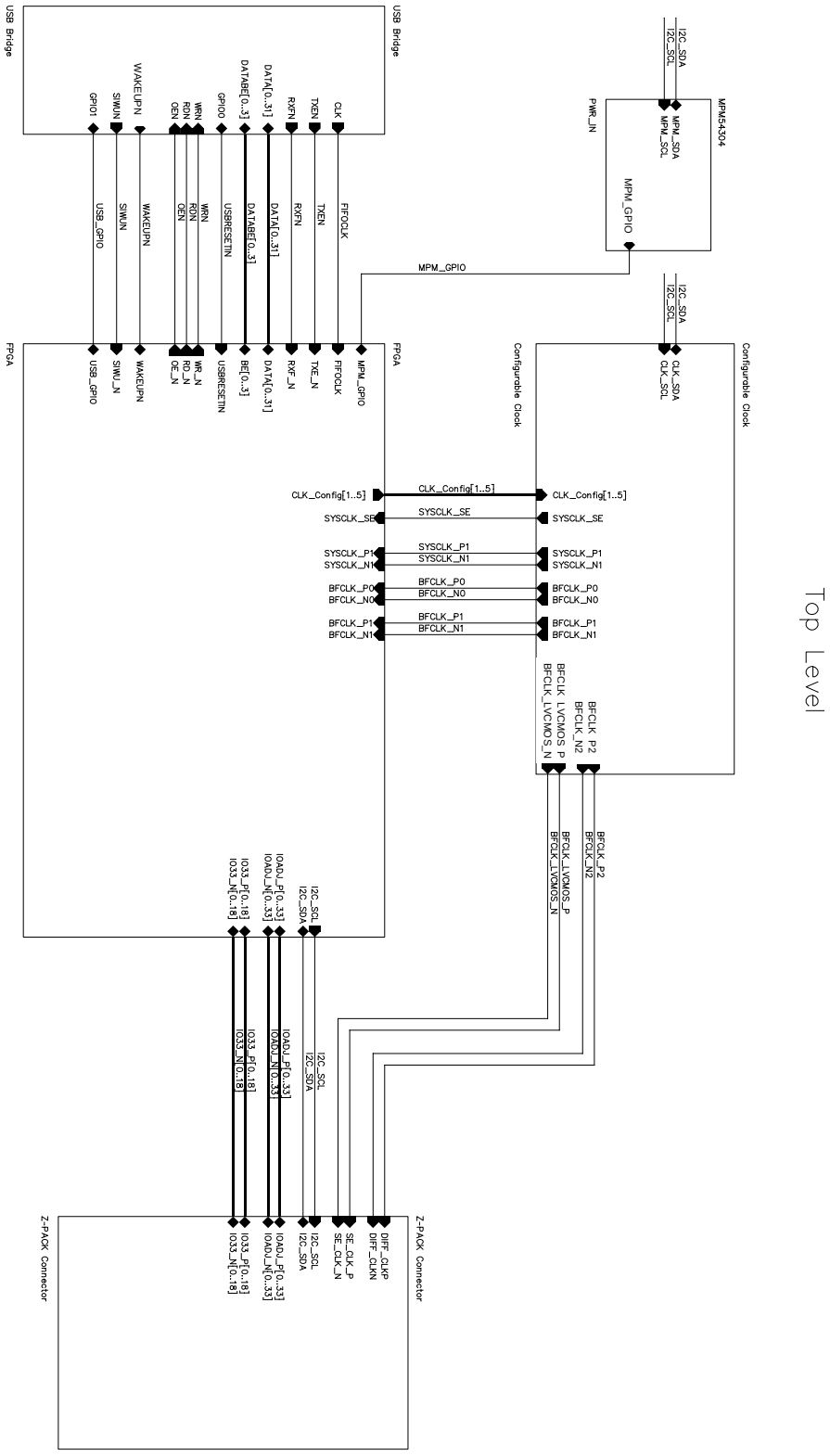

Figure 9: Evaluation Board Schematic (Top Level)

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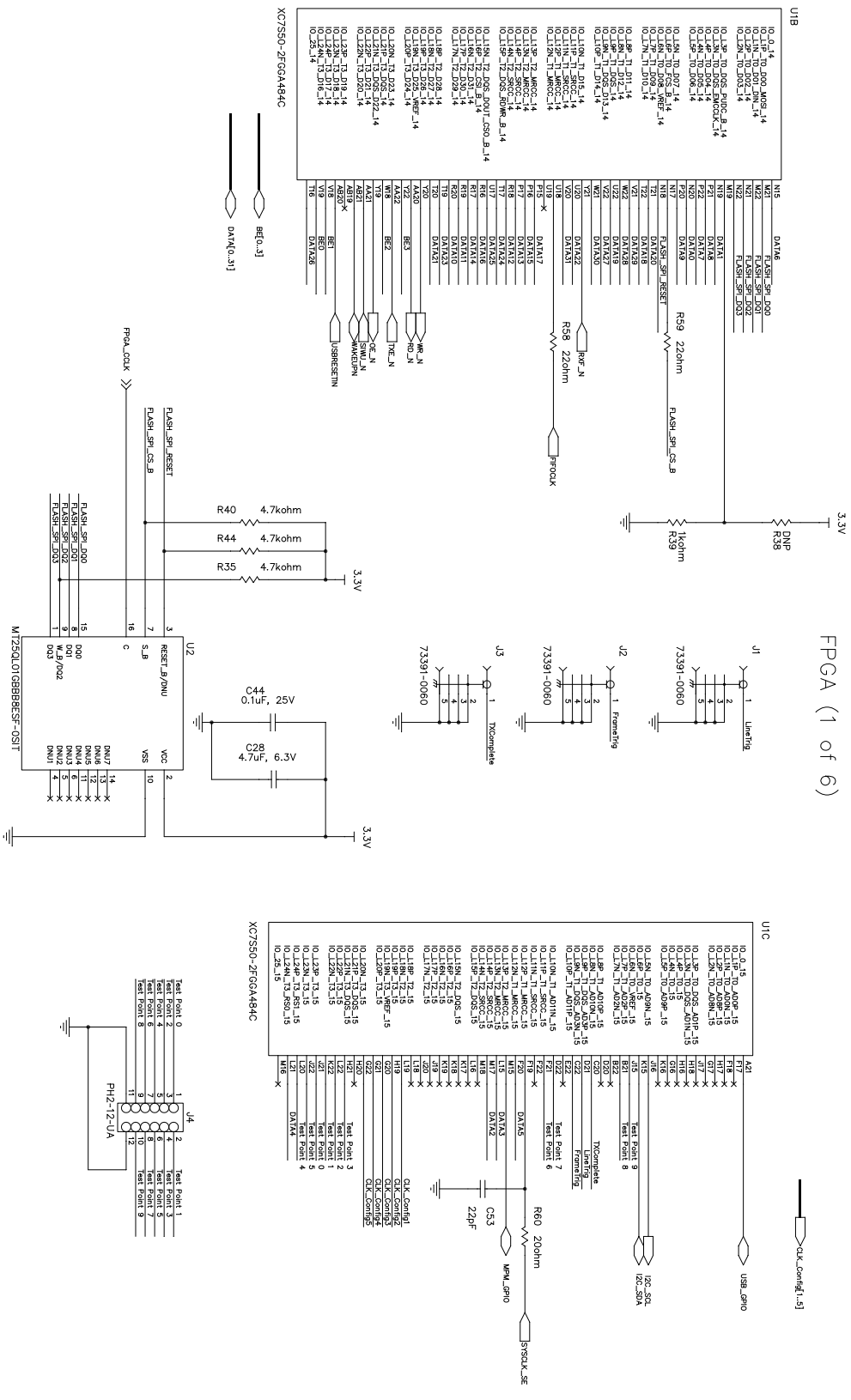

Figure 10: Evaluation Board Schematic (FPGA Page 1)

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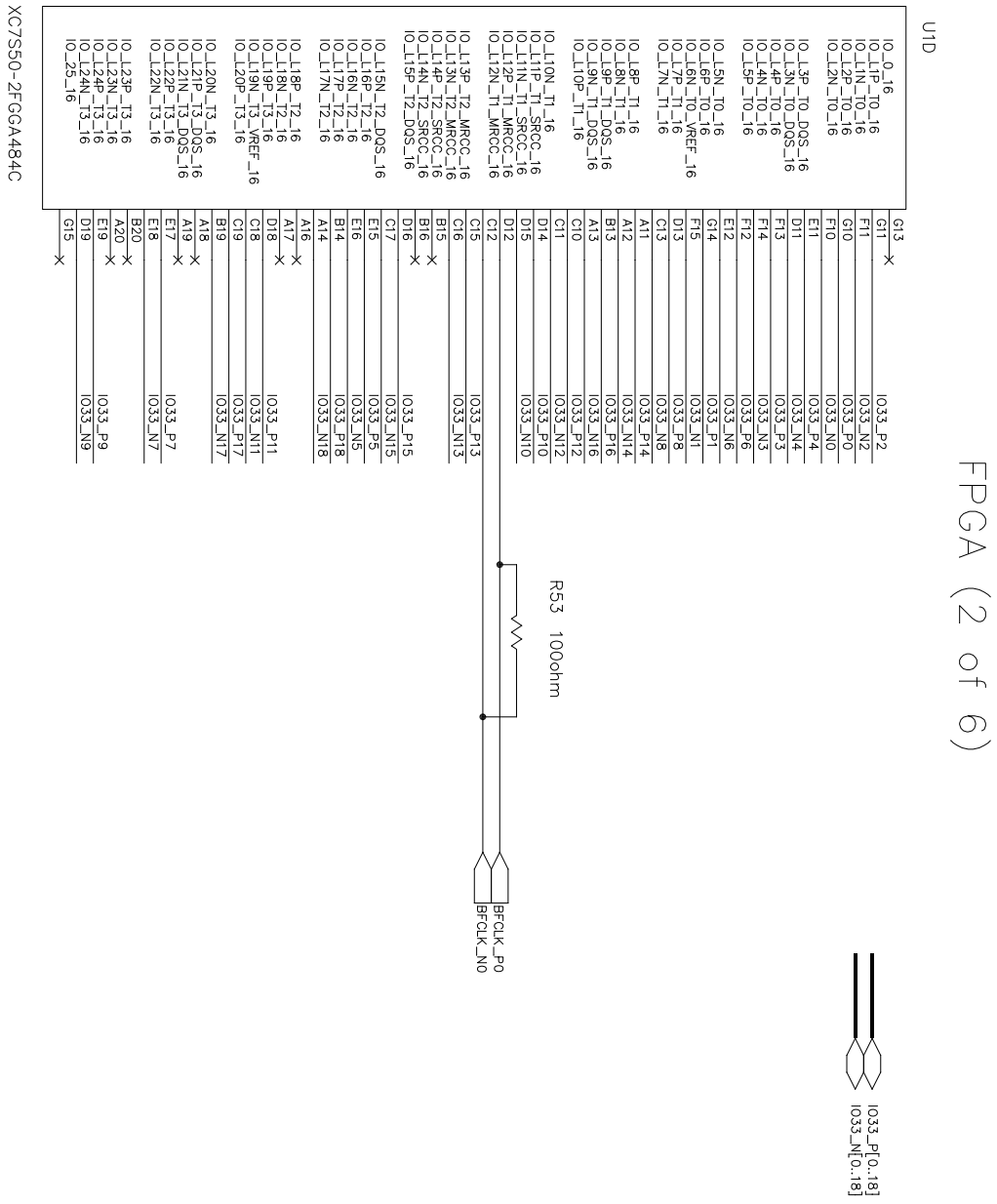

Figure 11: Evaluation Board Schematic (FPGA Page 2)

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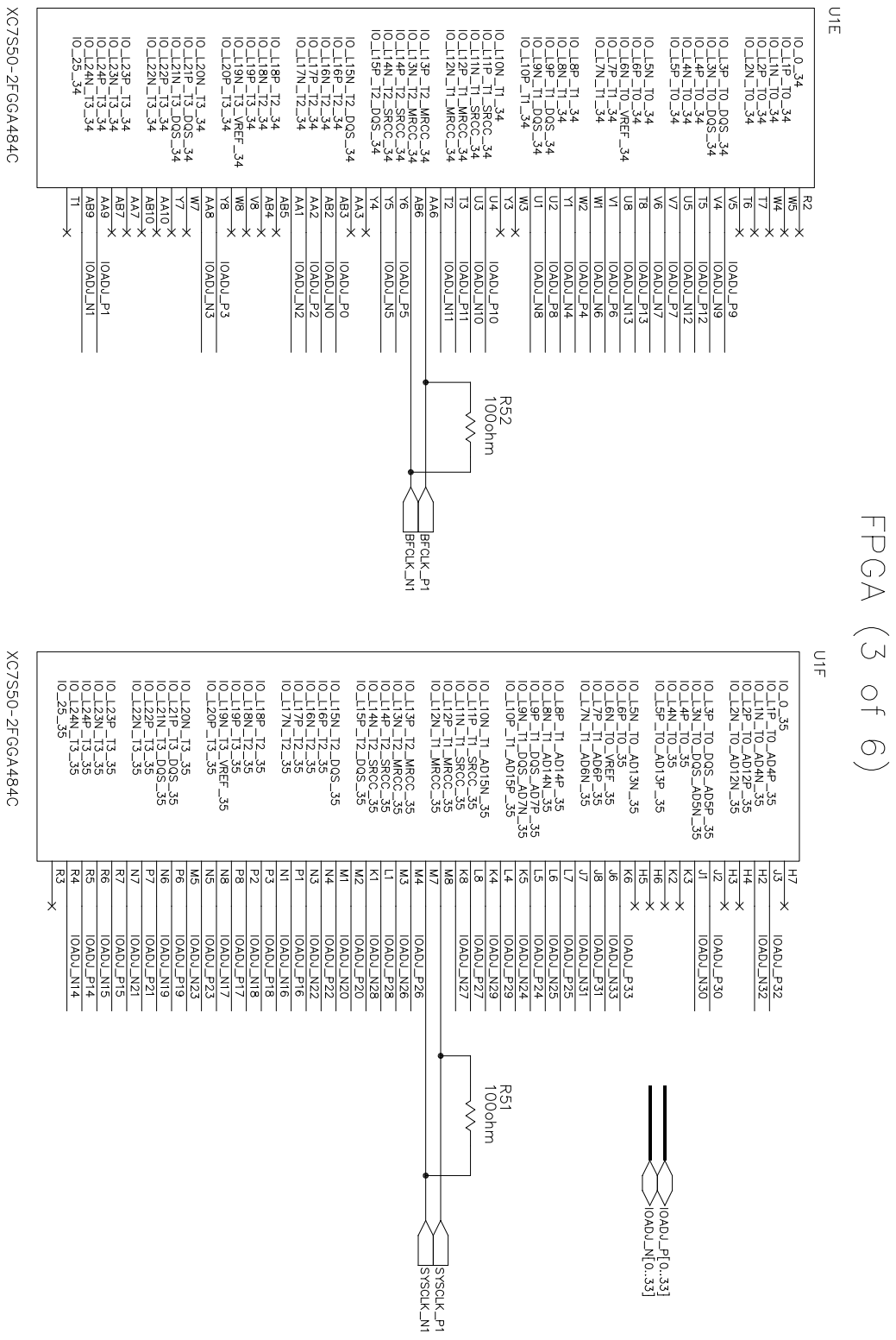

Figure 12: Evaluation Board Schematic (FPGA Page 3)

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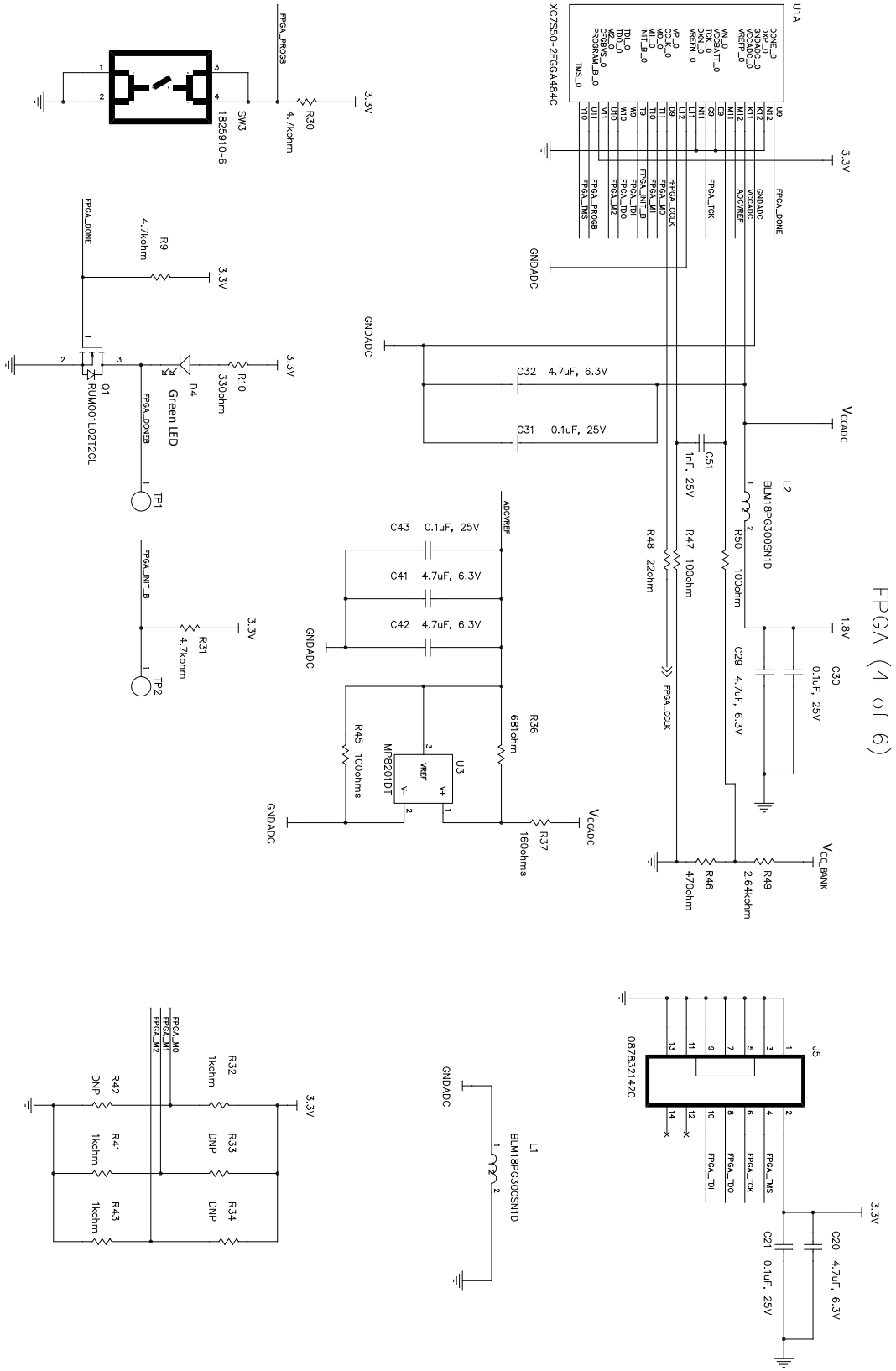

Figure 13: Evaluation Board Schematic (FPGA Page 4)

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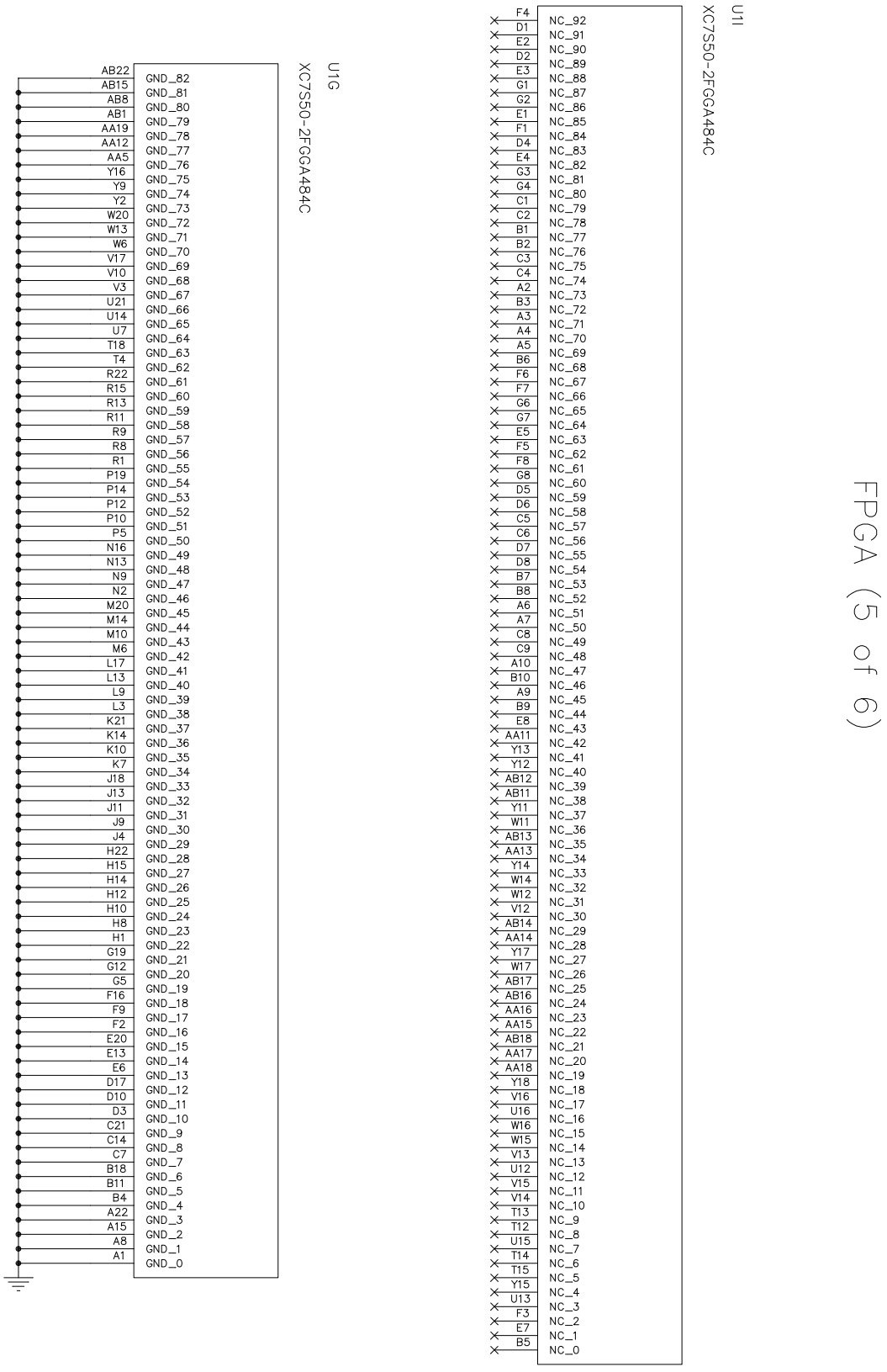

Figure 14: Evaluation Board Schematic (FPGA Page 5)

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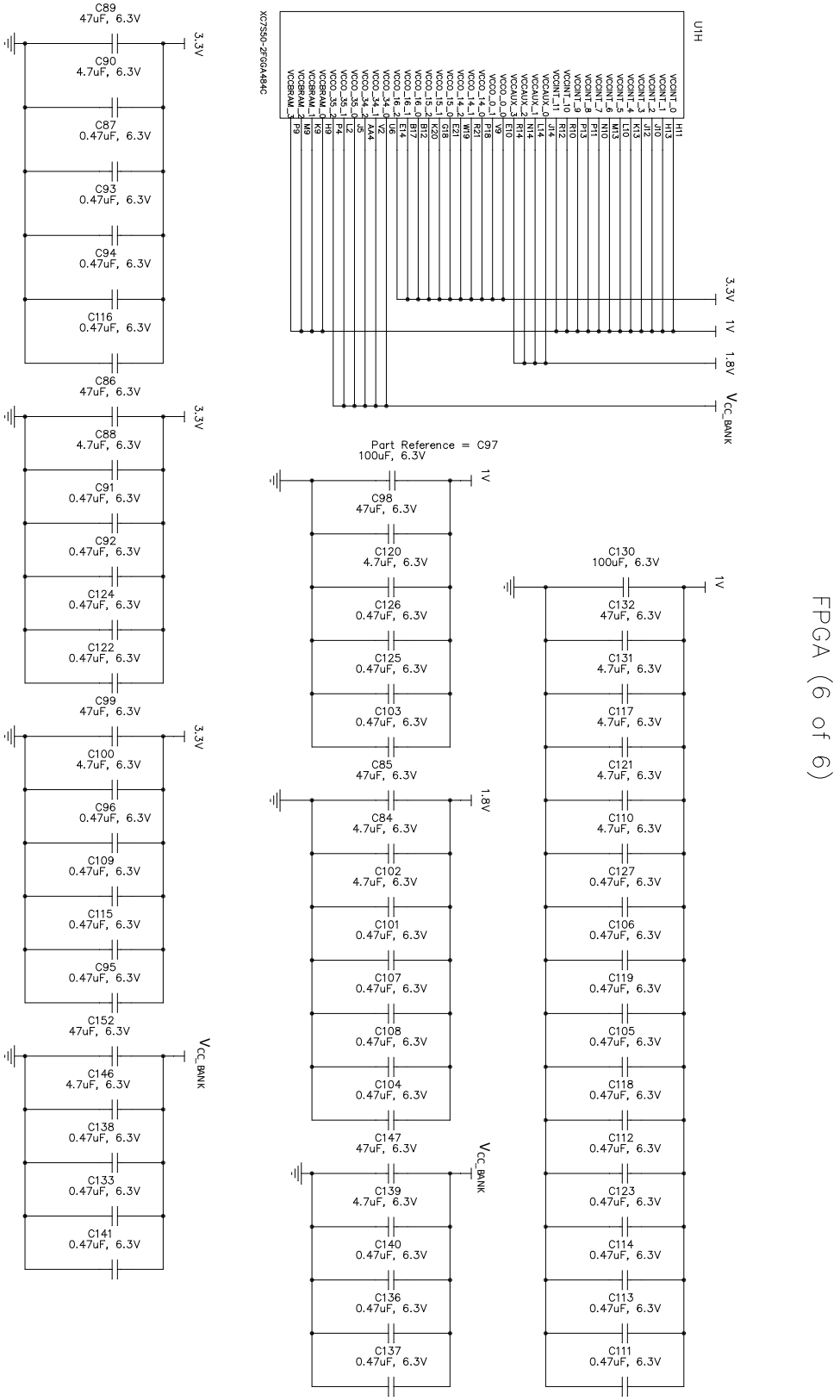

Figure 15: Evaluation Board Schematic (FPGA Page 6)

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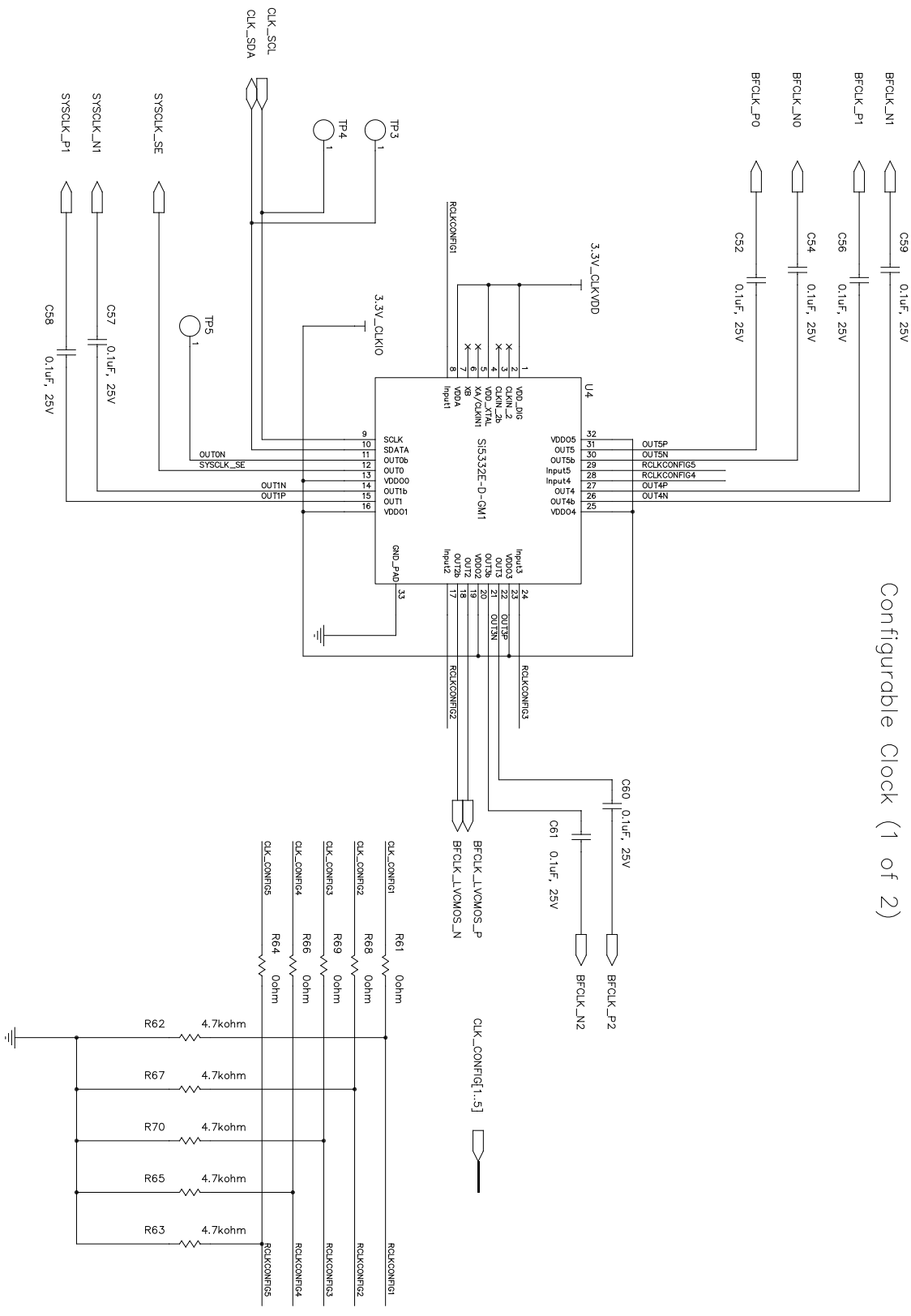

Figure 16: Evaluation Board Schematic (Configurable Clock Page 1)

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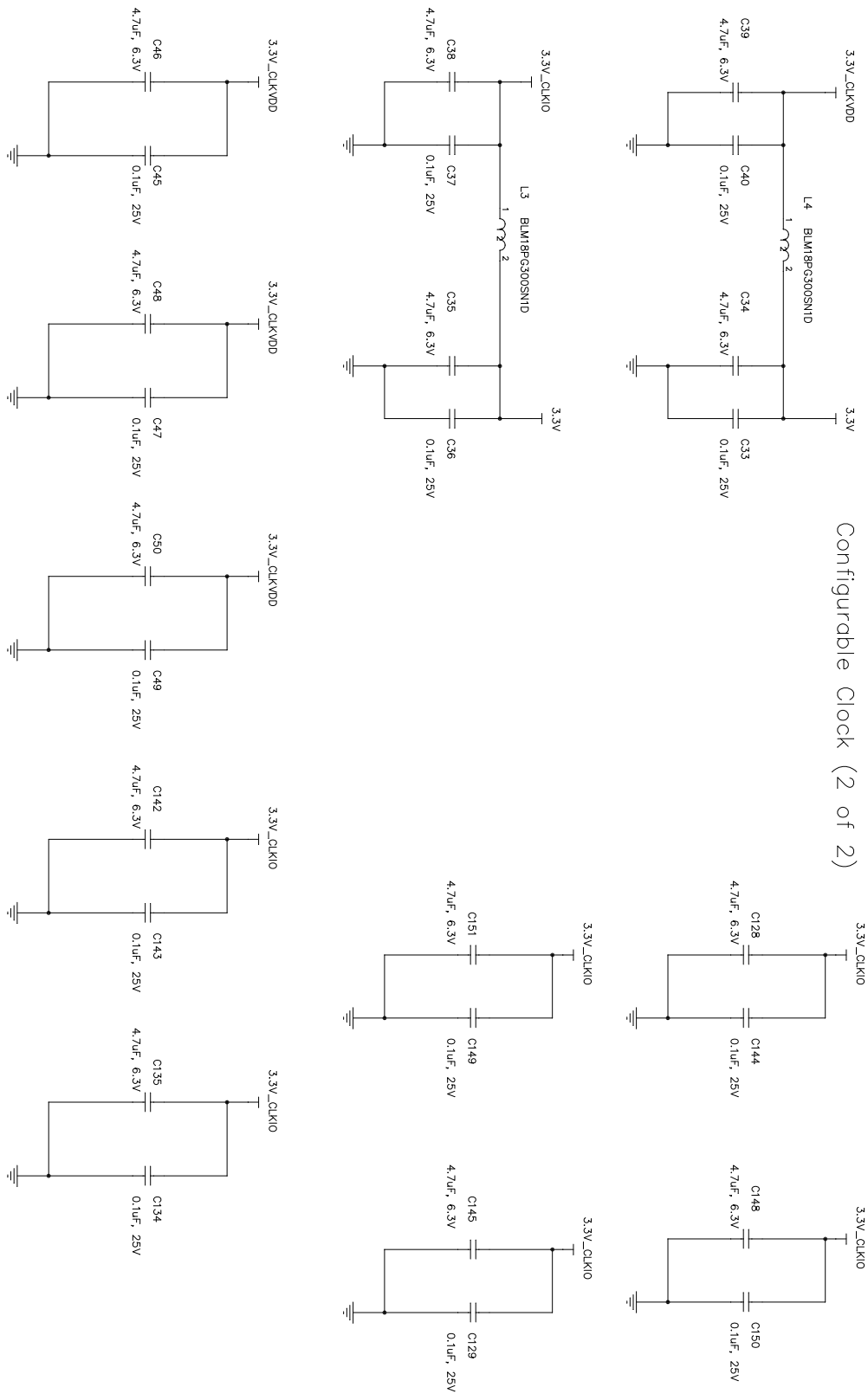

Figure 17: Evaluation Board Schematic (Configurable Clock Page 2)

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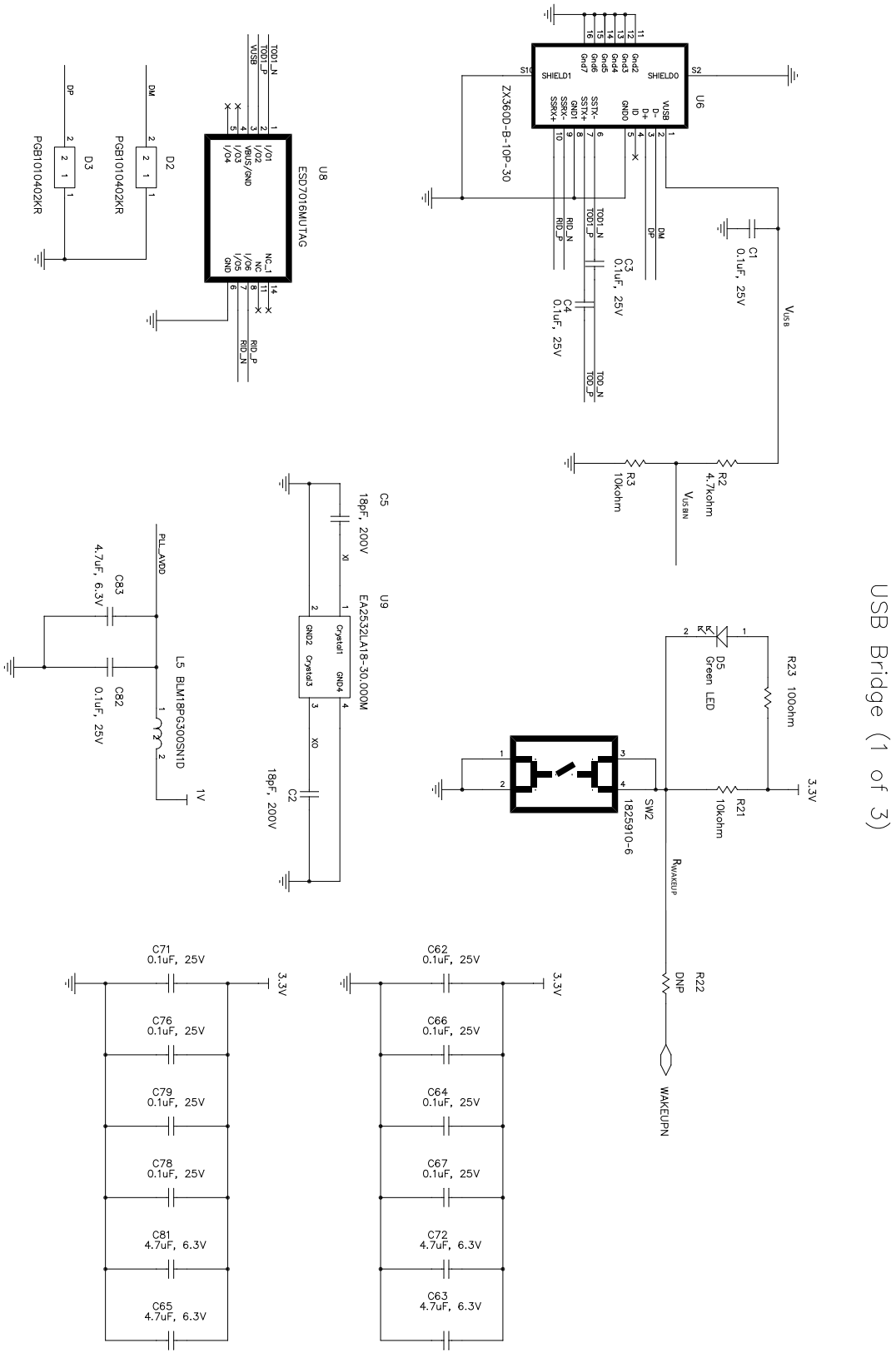

Figure 18: Evaluation Board Schematic (USB Bridge Page 1)

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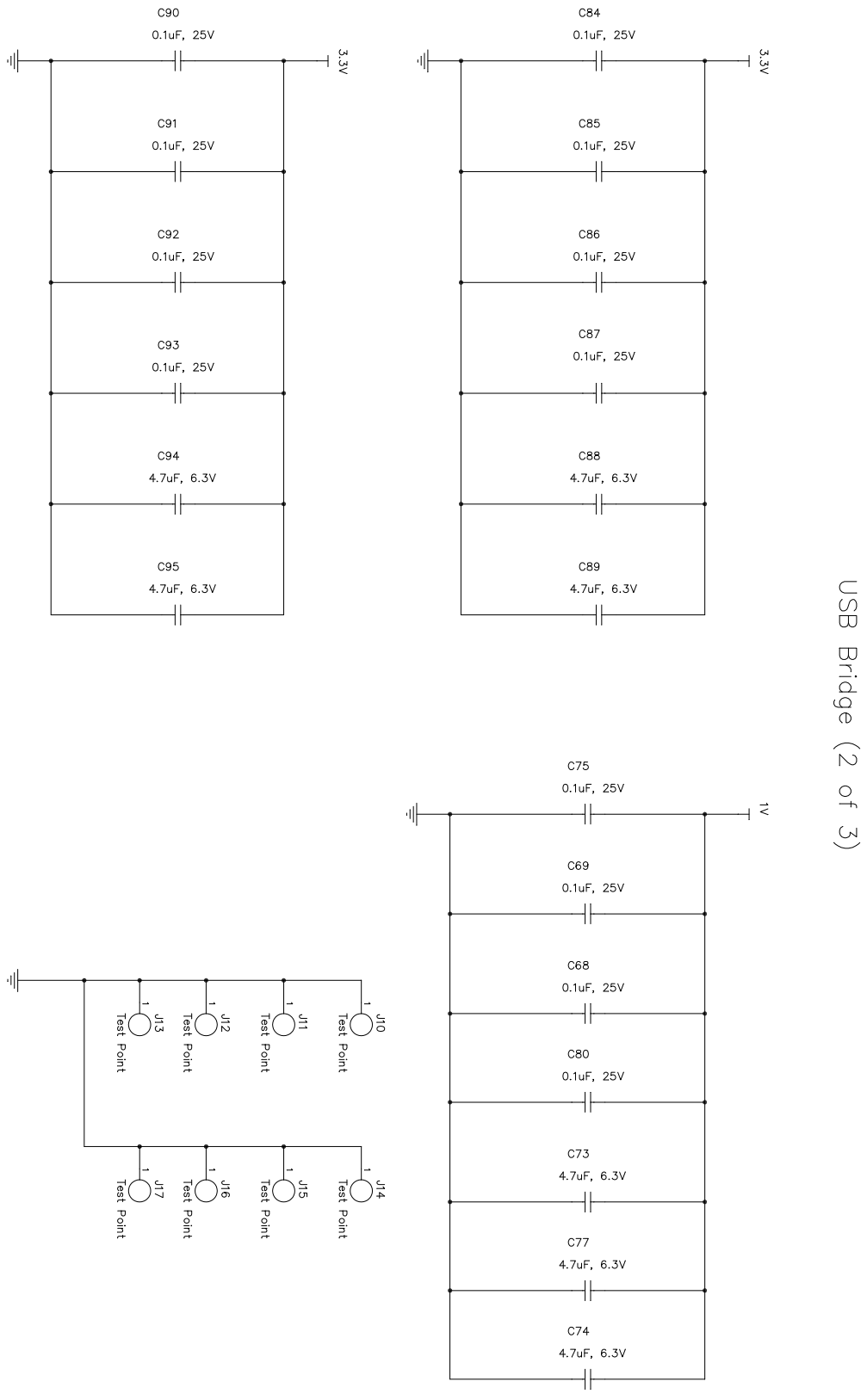

Figure 19: Evaluation Board Schematic (USB Bridge Page 2)

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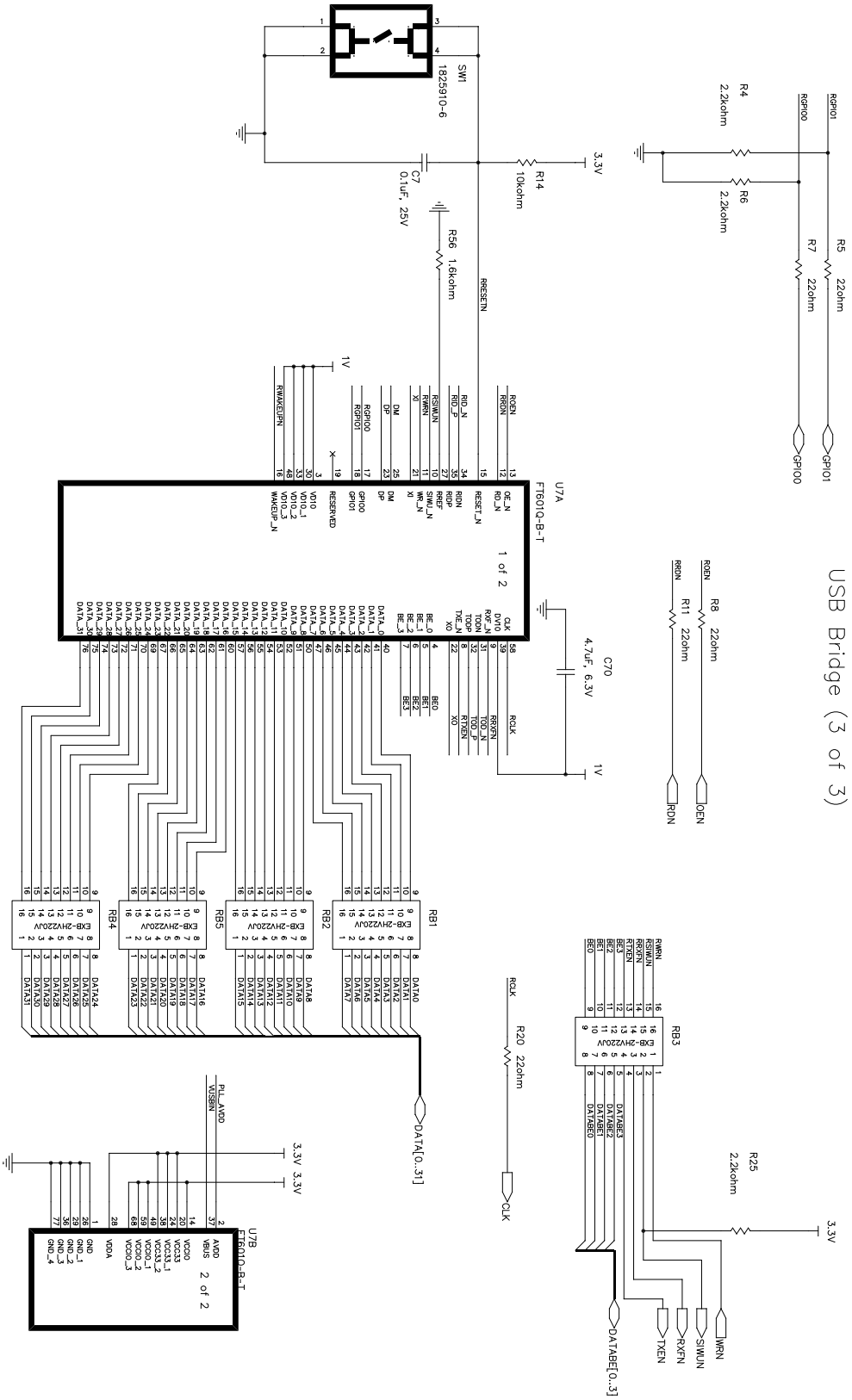

Figure 20: Evaluation Board Schematic (USB Bridge 3)

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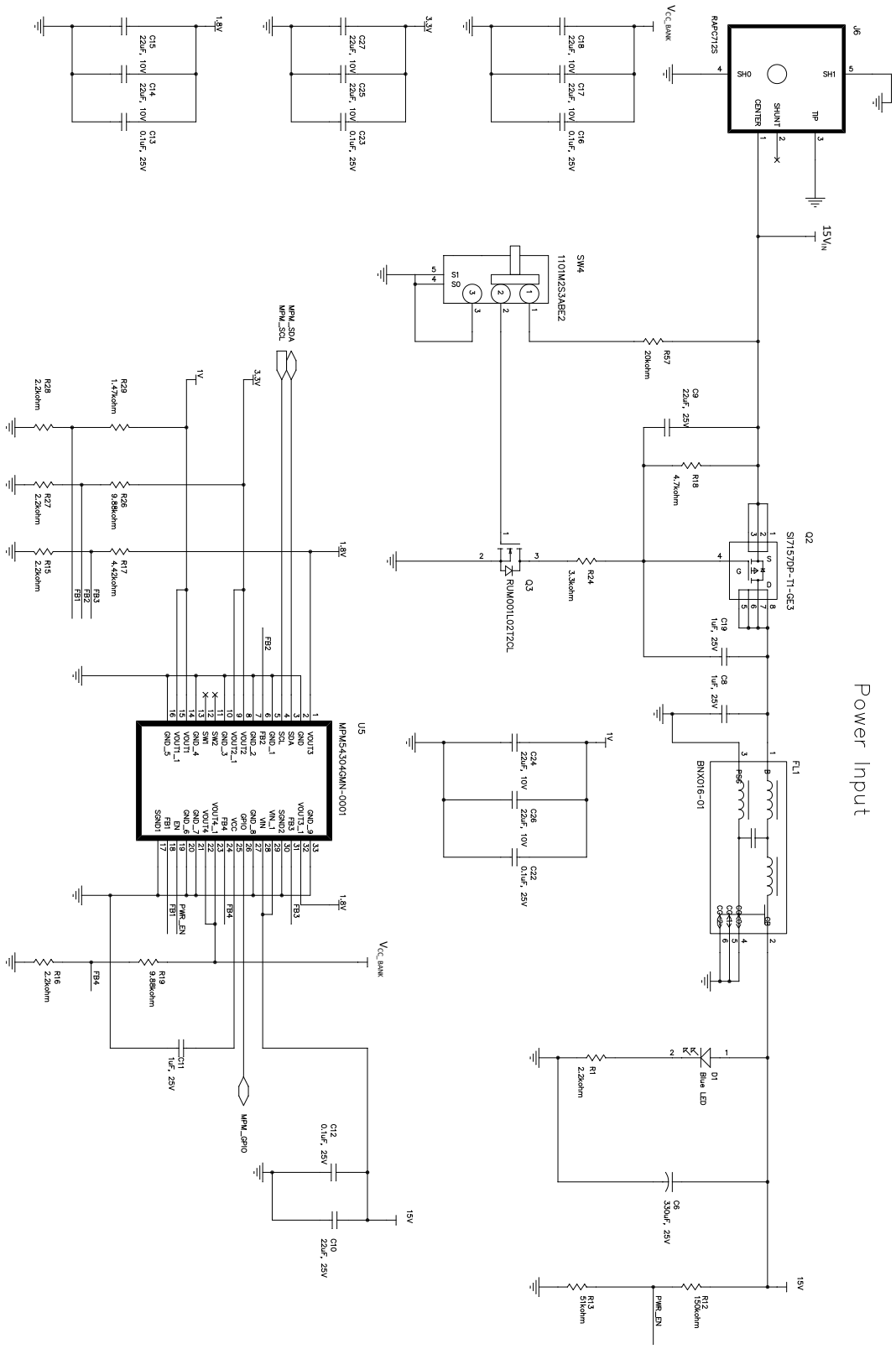

Figure 21: Evaluation Board Schematic (Power Input)

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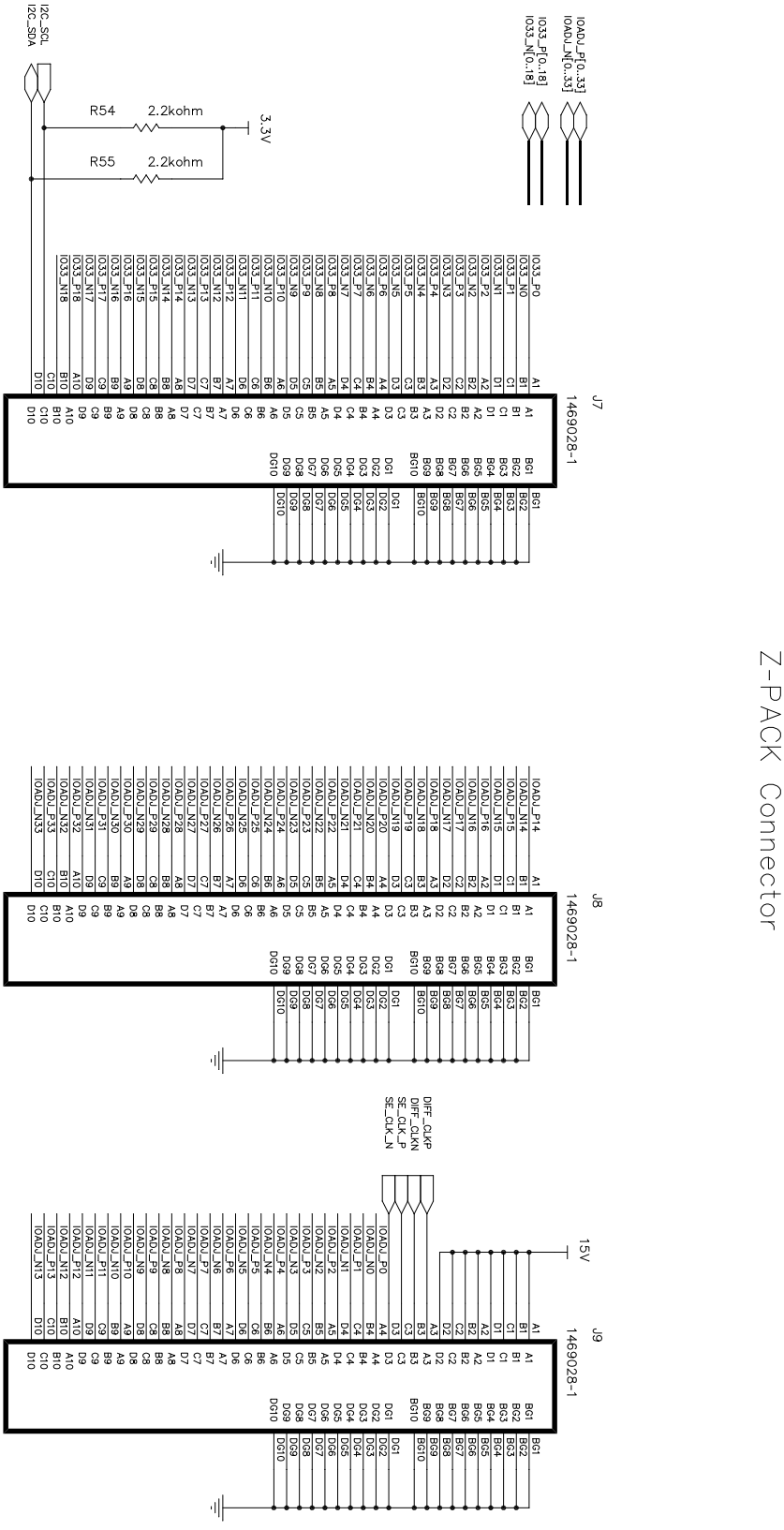

Figure 22: Evaluation Board Schematic (Z-PACK Connector)

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4.1 EV-EVK-RD-01A Bill of Materials

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
48	C1, C3, C4, C7, C12, C13, C16, C21, C22, C23, C30, C31, C33, C36, C37, C40, C43, C44, C45, C47, C49, C52, C54, C56, C57, C58, C59, C60, C61, C62, C64, C66, C67, C68, C69, C71, C75, C76, C78, C79, C80, C82, C129, C134, C143, C144, C149, C150	0.1µF	Ceramic capacitor, 25V, X7R	0402	Samsung Electro-Mechanics	CL05B104KA5NNNC
2	C2, C5	18pF	Ceramic capacitor, 200V, C0G/NP0	0402	KEMET	CBR04C180F2GAC
1	C6	330µF	Aluminum polymer capacitor, 25V, 14mΩ, 2000 hours at 125°C	Radial, can SMD	Panasonic Electronic Components	25SVT330M
2	C8, C19	1µF	Ceramic capacitor, 25V, X5R	0603	KEMET	C0603C105K3PACTU
2	C9, C10	22µF	Ceramic capacitor, 25V, X5R	1206	Samsung Electro-Mechanics	CL31A226KAHNNNE
1	C11	1µF	Ceramic capacitor, 25V, X6S	0402	Murata	GRM155C81E105KE11D
8	C14, C15, C17, C18, C24, C25, C26, C27	22µF	Ceramic capacitor, 10V, X5R	0805	Samsung Electro-Mechanics	CL21A226MPQNNNE

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Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
28	C20, C28, C29, C32, C34, C35, C38, C39, C41, C42, C46, C48, C50, C63, C65, C70, C72, C73, C74, C77, C81, C83, C128, C135, C142, C145, C148, C151	4.7µF	Ceramic capacitor, 6.3V, X5R	0402	KEMET	C0402C475M9PAC7867
1	C51	1nF	Ceramic capacitor, 5%, 25V, X7R	0402	KEMET	C0402C102J3RECAUTO
1	C53	22pF	Ceramic capacitor, 50V, NP0	0402	KEMET	C0402C220G5GACTU
12	C84, C88, C90, C100, C102, C110, C117, C120, C121, C131, C139, C146	4.7µF	Ceramic capacitor, 6.3V, X5R	0201	Murata	GRM035R60J475ME15D
8	C85, C86, C89, C98, C99, C132, C147, C152	47µF	Ceramic capacitor, 6.3V, X5R	1206	Samsung Electro-Mechanics	CL31A476MQHNNNE
35	C87, C91, C92, C93, C94, C95, C96, C101, C103, C104, C105, C106, C107, C108, C109, C111, C112, C113, C114, C115, C116, C118, C119, C122, C123, C124, C125, C126, C127, C133, C136, C137, C138, C140, C141	0.47µF	Ceramic capacitor, 6.3V, X5R	0201	Kyocera AVX	02016D474KAT2A
2	C97, C130	100µF	Ceramic capacitor, 6.3V, X6S	1210	TDK Corporation	C3225X6S0J107M250AB
1	D1	20mA	Blue LED, 3.3V, diffused, 0603	0603	Lumex	SML-LX0603USBW-TR

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Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	D2, D3	250V	TVS diode, (typ) clamp - I_{PP} surface mount	0402	Littelfuse	PGB1010402KR
2	D4, D5	20mA	Green LED, 2.2V, diffused, SMD	0603	Lumex	SML-LX0603GW-TR
1	FL1	15A	LC EMI filter, 5th order, low pass, 2-channel, 15A block, 4 lead	THD	Murata	BNX016-01
3	J1, J2, J3	50Ω	SMA connector receptacle, female socket, through hole solder	THD-SMA	Molex	733910060
1	J4	2.54mm pitch	Connector header, through hole, 12-position, 0.100in	THD header 2x6	Adam Tech	PH2-12-UA
1	J5	2mm pitch	Connector header, surface mount, 14-position, 0.079in	SMD	Molex	878321420
1	J6	2.5mm	Power barrel connector jack, 2.5mm ID (0.098in), 5.5mm OD (0.217in), through hole, right angle	THD	Switchcraft	RAPC712S
3	J7, J8, J9	2.5mm	Connector receptacle, 60-position, female sockets board edge, through hole, right angle, high speed	THD	TE Connectivity	1469028-1
13	TP1, TP2, TP3, TP4, TP5, J10, J11, J12, J13, J14, J15, J16, J17	2.54mmx 4.57mm	Black PC test point, miniature phosphor bronze silver plating through hole mounting type	THD	Keystone Electronics	5001
5	L1, L2, L3, L4, L5	30Ω	Power line ferrite bead, 30Ω at 100MHz, (1608 metric) 1A at 50mΩ	0603	Murata	BLM18PG300SN1D
2	Q1, Q3	20V	N-channel MOSFET, 100mA (T_A), 150mW (T_A), surface mount, VMT3	SOT-723	Rohm	RUM001L02T2CL
1	Q2	20V	P-channel MOSFET, 60A (T_C), 6.25W (Ta), 104W (T_C), surface mount	PowerPAK SO-8	Vishay Siliconix	SI7157DP-T1-GE3

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Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
5	RB1, RB2, RB3, RB4, RB5	22Ω	Power per element isolated x8 resistors, ±5%, 62.5mW, network/array, ±200ppm/°C	1506, convex, long side terminals	Panasonic	EXB-2HV220JV
1	R1	2.2kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT2K20
9	R2, R9, R30, R31, R62, R63, R65, R67, R70	4.7kΩ	Resistor, 5%, 1/10W	0402	Panasonic	ERJ-2GEJ472X
3	R3, R14, R21	10kΩ	Resistor, 5%, 1/10W	0402	Panasonic	ERJ-2GEJ103X
3	R4, R6, R25	2.2kΩ	Resistor, 5%, 1/10W, SMD	0402	Panasonic	ERJ-2GEJ222X
7	R5, R7, R8, R11, R48, R58, R59	22Ω	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT22R0
1	R10	330Ω	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT330R
1	R12	150kΩ	Resistor, 5% 1/10W	0603	Stackpole Electronics	RMCF0603JT150K
1	R13	51kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT51K0
4	R15, R16, R27, R28	2.2kΩ	Resistor, 1%, 1/10W	0603	Yageo	RC0603FR-102K2L
1	R17	4.42kΩ	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FT4K42
4	R18, R35, R40, R44	4.7kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT4K70
2	R19, R26	9.88kΩ	Resistor, 1%, 1/10W	0603	KOA Speer Electronics	RN73H1JTTD9881F100
1	R20	22Ω	Resistor, 5%, 1/10W	0402	Panasonic	ERJ-2GEJ220X
5	R22, R33, R38, R42, R34	NC				
1	R23	100Ω	Resistor, 5%, 1/10W	0603	Yageo	RC0603JR-07100RL
1	R24	3.3kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT3K30
1	R29	1.47kΩ	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FT1K47
4	R32, R39, R41, R43	1kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JT1K00
1	R36	681Ω	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FT681R
1	R37	160Ω	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FT160R
5	R45, R47, R51, R52, R53	100Ω	Resistor, 1%, 1/16W, SMD	0402	Vishay Dale	CRCW0402100RFKEE

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Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	R46	470Ω	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FT470R
1	R49	2.64kΩ	Resistor, 1%, 1/10W	0603	KOA Speer Electronics	RN73R1JTTD2641F50
1	R50	100Ω	Resistor, 1%, 1/10W	0603	Stackpole Electronics	RMCF0603FG100R
2	R54, R55	2.2kΩ	Resistor, 1%, 1/10W	0603	Yageo	RC0603FR-102K2L
1	R56	1.6kΩ	Resistor, 1%, 1/16W	0402	Stackpole Electronics	RMCF0402FT1K60
1	R57	20kΩ	Resistor, 5%, 1/10W	0603	Stackpole Electronics	RMCF0603JG20K0
1	R60	20Ω	Resistor, 1%, 1/16W	0402	Stackpole Electronics	RMCF0402FT20R0
5	R61, R64, R66, R68, R69	0Ω	Jumper chip resistor, 1/8W, SMD	0603	Susumu	YJP1608-R001
3	SW1, SW2, SW3	0.05A, 24V	Tactile switch SPST-NO, top actuated through hole	THD	TE Connectivity	1825910-6
1	SW4	0.4VA, 20V	Slide switch SPDT through hole, right angle	THD	C&K	1101M2S3ABE2
1	U1	484 pins	Spartan-7 FPGA IC	484-BBGA	AMD	XC7S50-2FGGA484C
1	U2	133MHz	NOR flash memory IC, 1Gbit SPI, quad I/O	16-SO	Micron Technology	MT25QL01GBBB8ESF-0SIT
1	U4	312.5MHz	IC clock generator	TFQFN-32 (5mmx 5mm)	Skyworks Solutions	SI5332E-D-GM1
1	U6	10-position	Micro B USB 3.2 Gen 1 (USB 3.1 Gen 1, superspeed USB 3.0) receptacle connector, surface mount, right angle, through hole	SMD	Hirose Electric	ZX360D-B-10P(30)
1	U7	76 Pins	USB bridge, USB to FIFO USB 3.0, FIFO interface	QFN-76 (9mmx 9mm)	FTDI	FT601Q-B-T
1	U8	10V	Clamp I_{PP} TVS diode, surface mount	UDFN-8 (3.3mmx 1mm)	onsemi	ESD7016MUTAG
1	U9	30MHz	Crystal, ±15ppm, 18pF, 50Ω	4-SMD, no lead	Ecliptek	EA2532LA18-30.000M
1	U3	MP8201	Low-voltage, adjustable, shunt voltage regulator	SOT23-3	MPS	MP8201DT
1	U5	MPM54304	4V to 16V input, quad-output power module with I^2C and MTP	LGA-33 (7mmx 7mmx 2mm)	MPS	MPM54304GMN-0001

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Section 5. PCB Layout

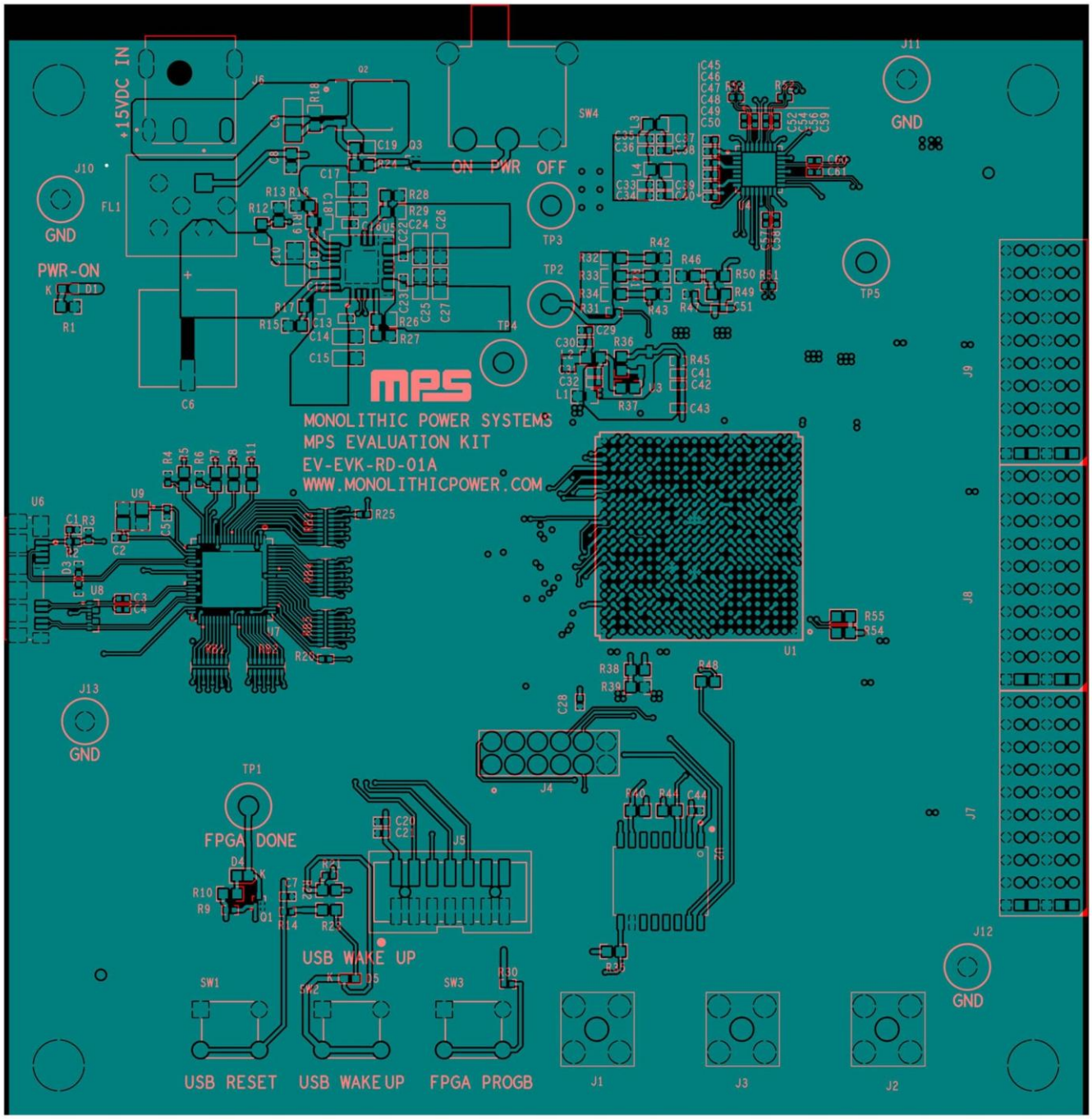

Figure 23: Top Silk and Top Layer

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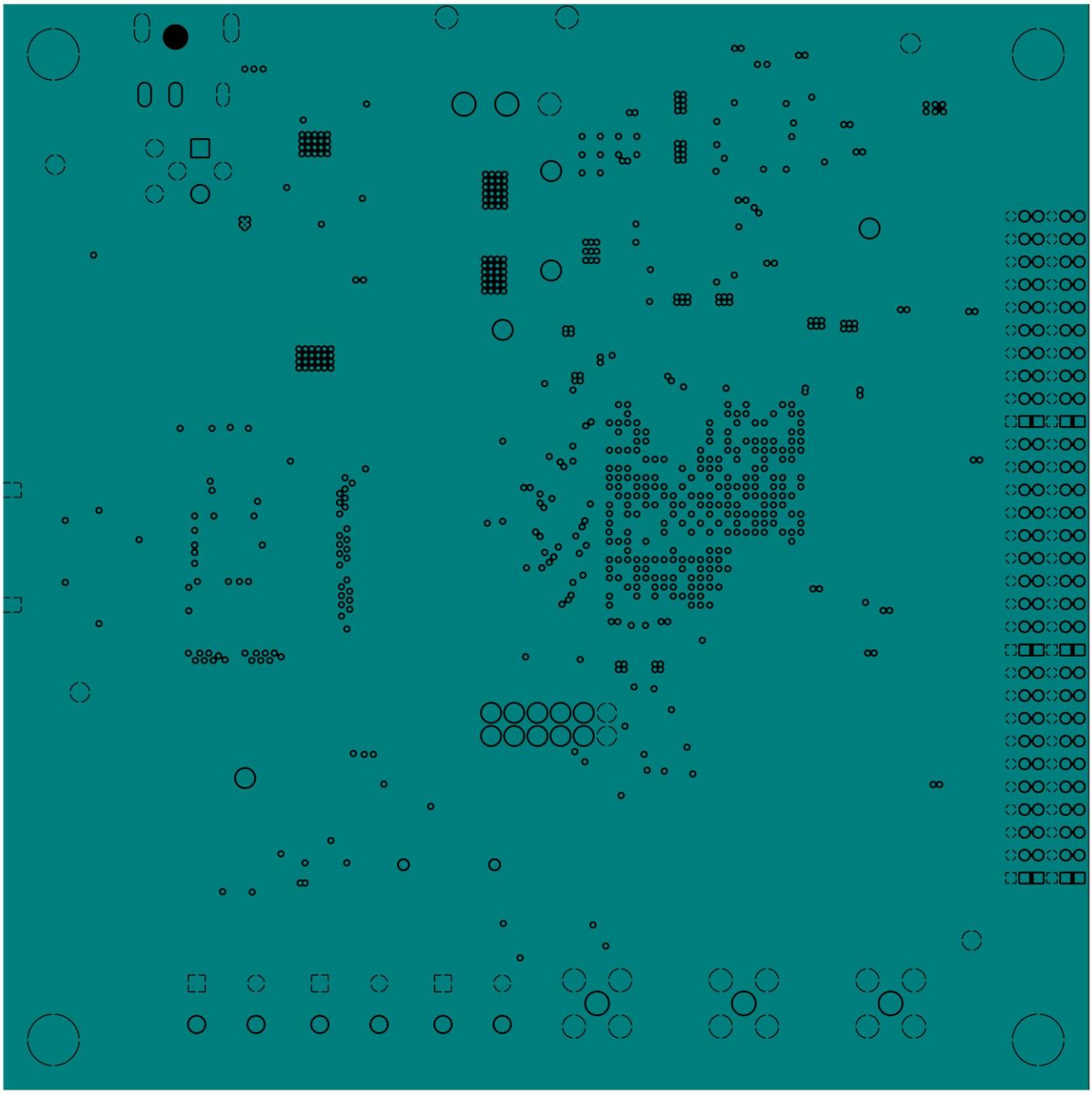

Figure 24: Mid-Layer 2, 5, 8, 9, 12, and 15 (Ground Plane)

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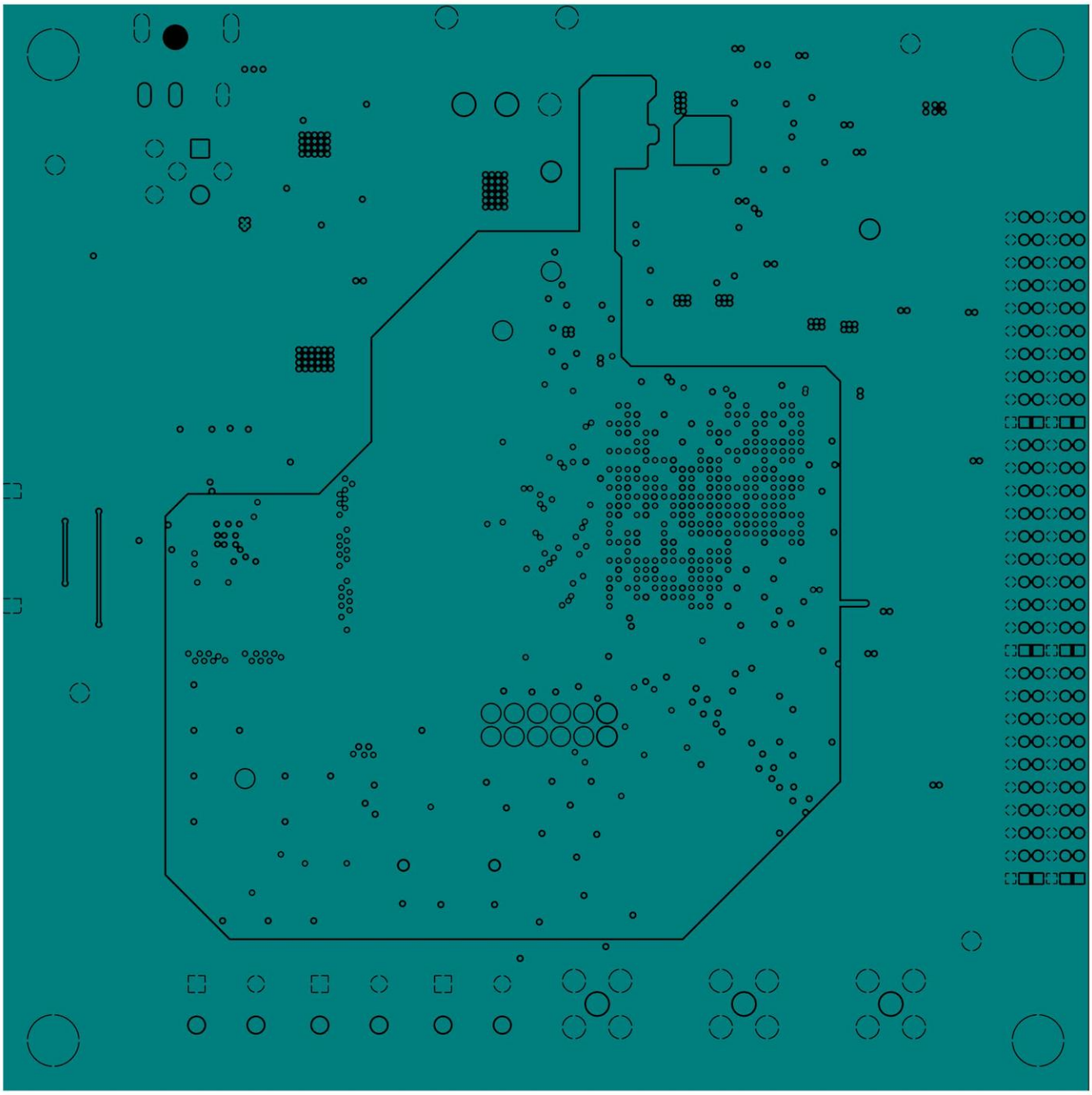

Figure 25: Mid-Layer 3

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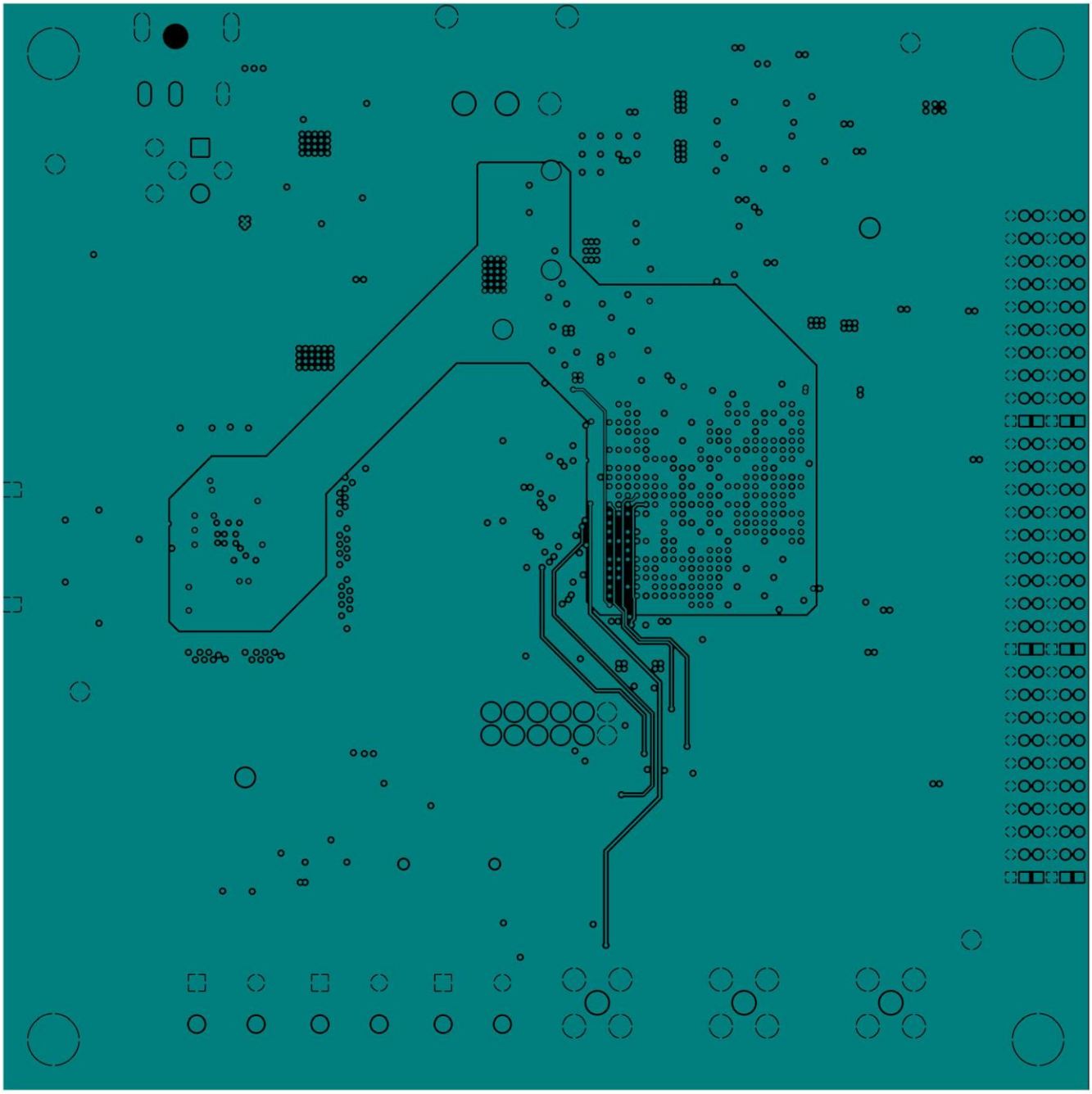

Figure 26: Mid-Layer 4

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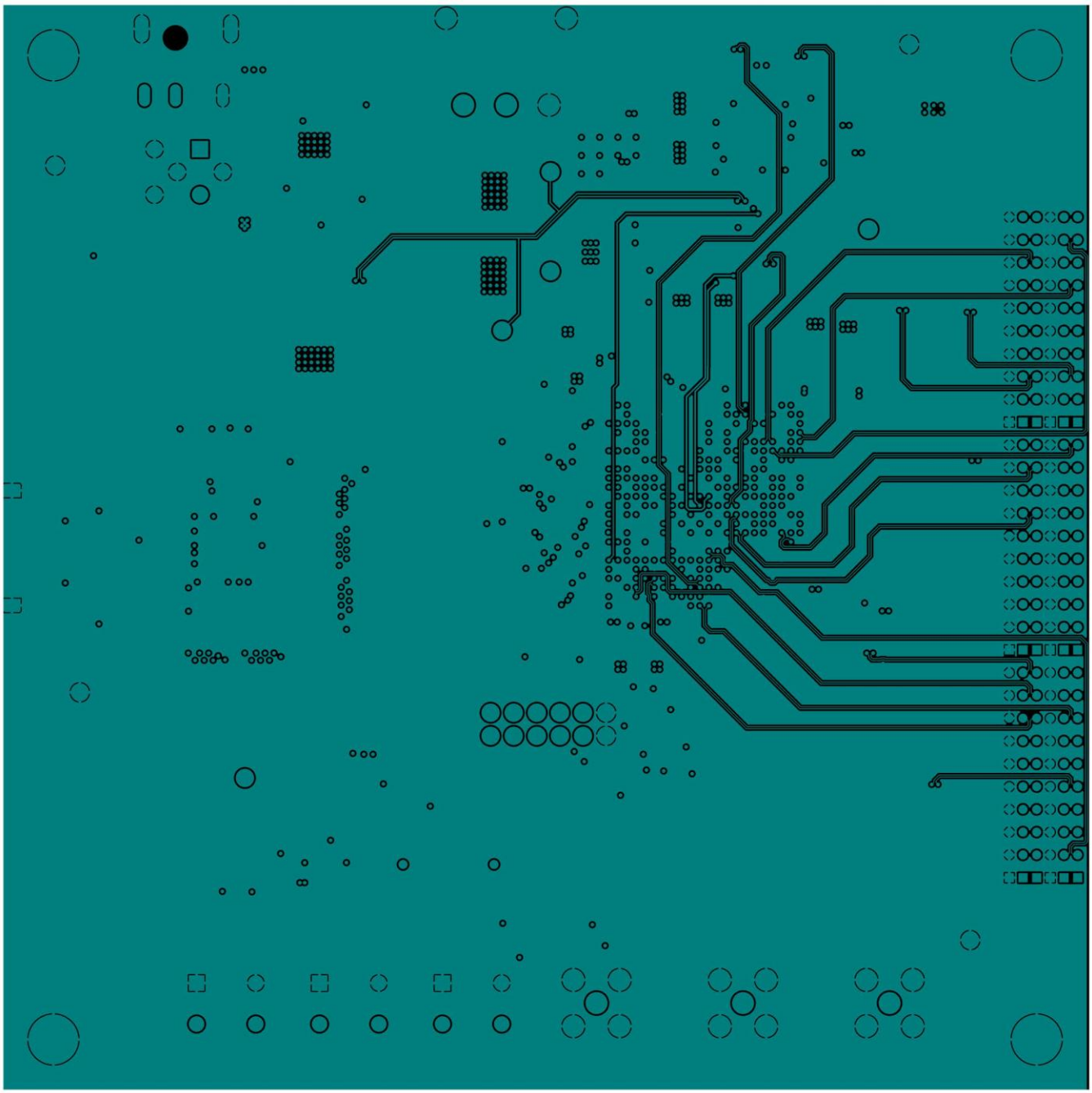

Figure 27: Mid-Layer 6

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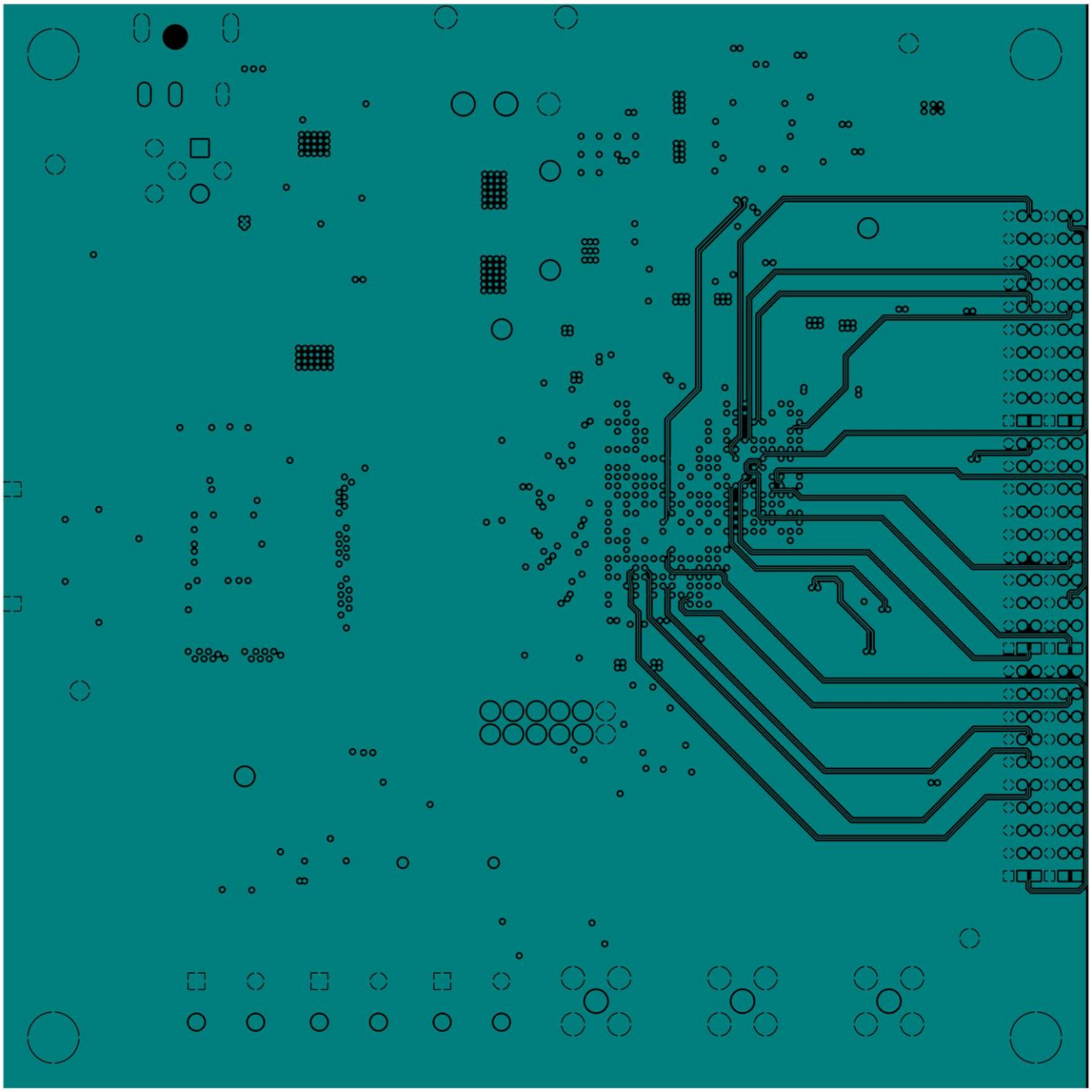

Figure 28: Mid-Layer 7

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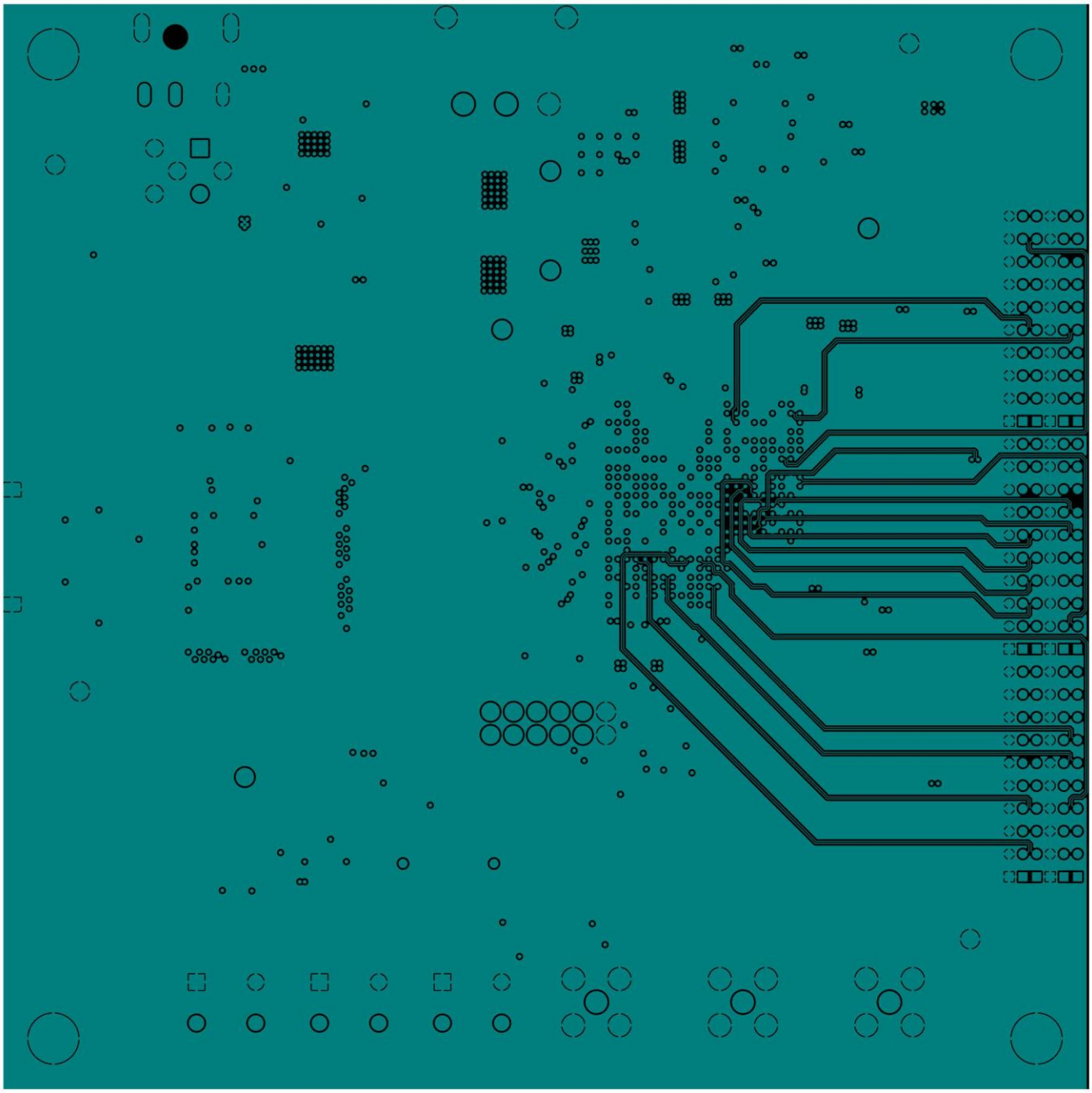

Figure 29: Mid-Layer 10

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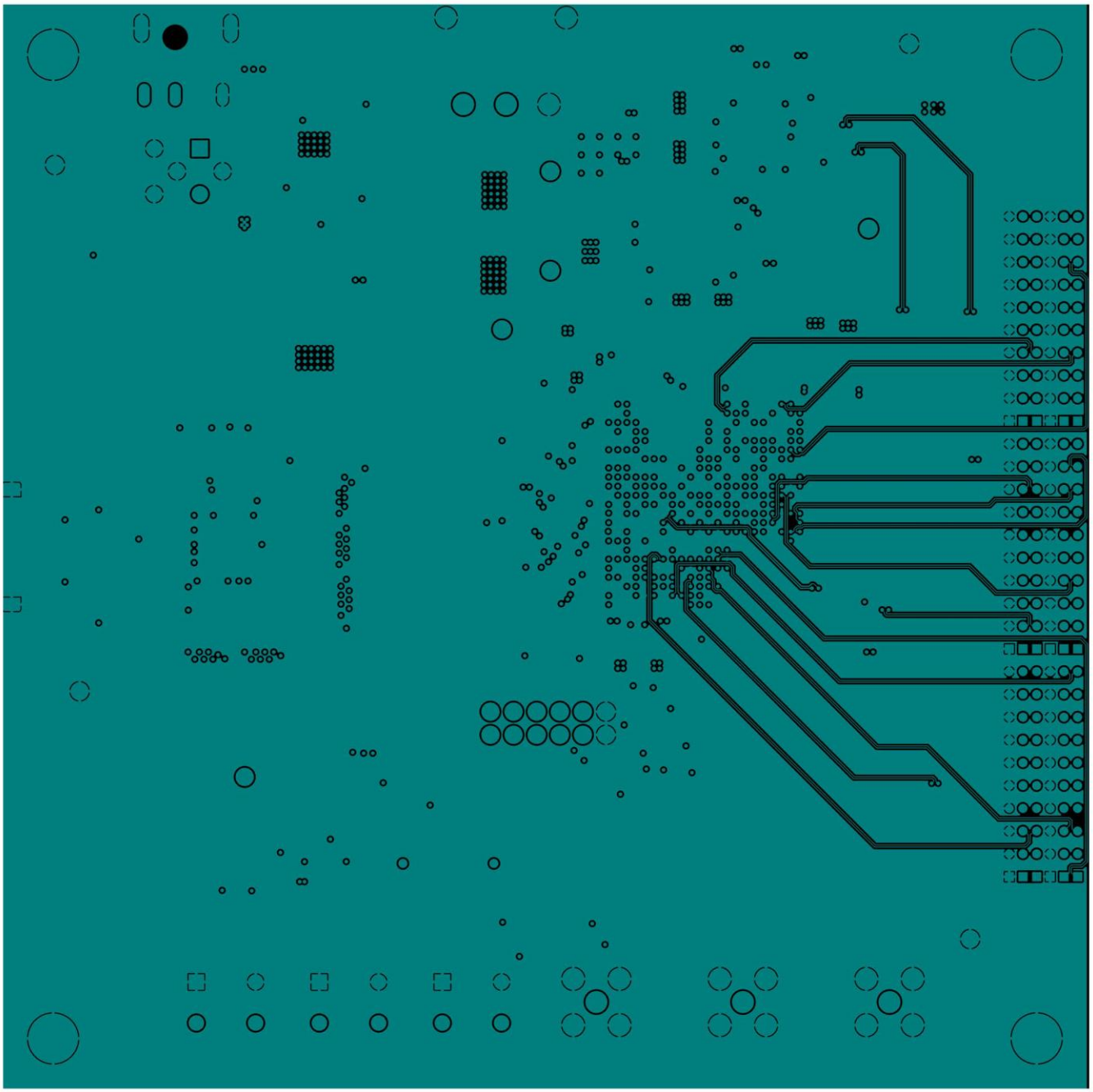

Figure 30: Mid-Layer 11

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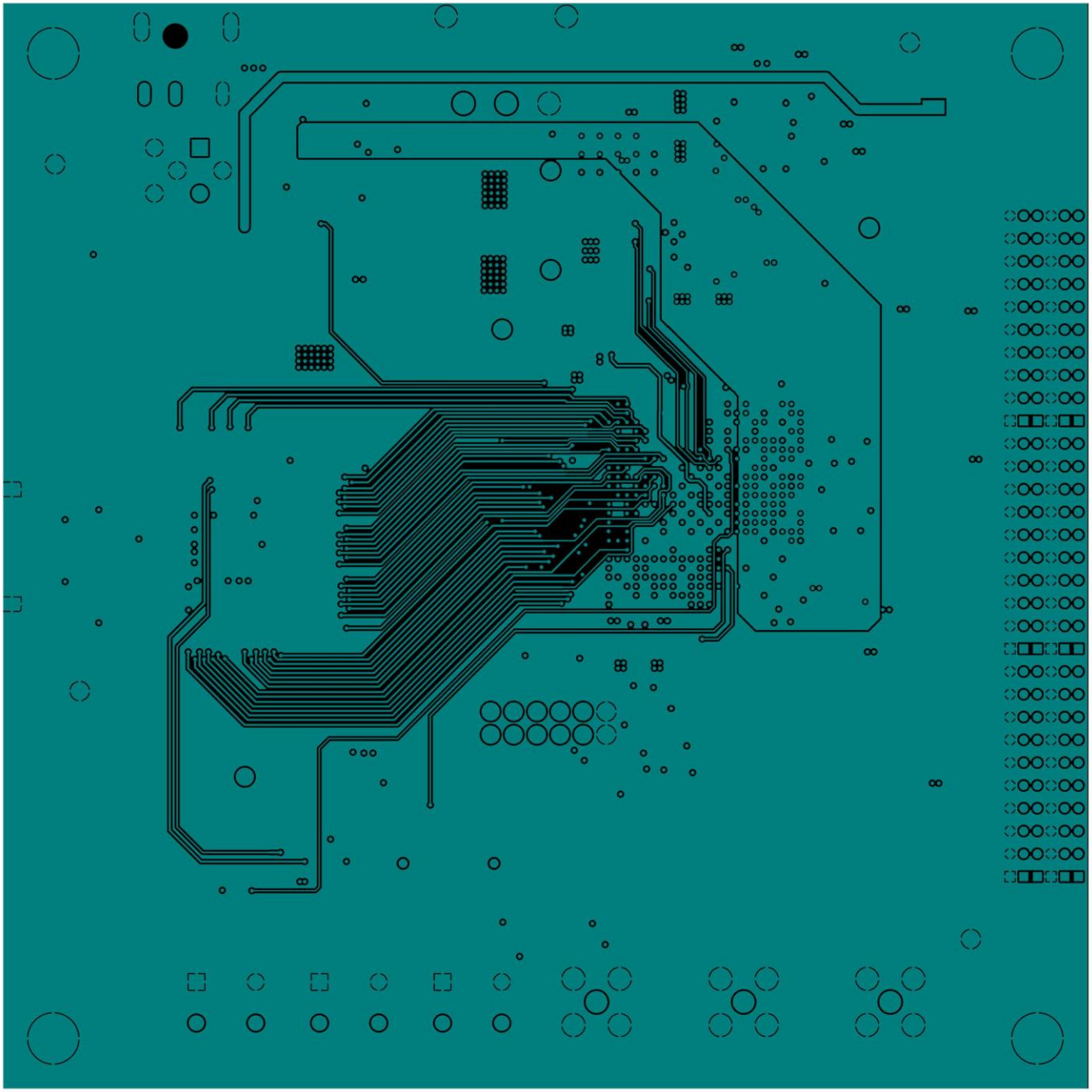

Figure 31: Mid-Layer 13

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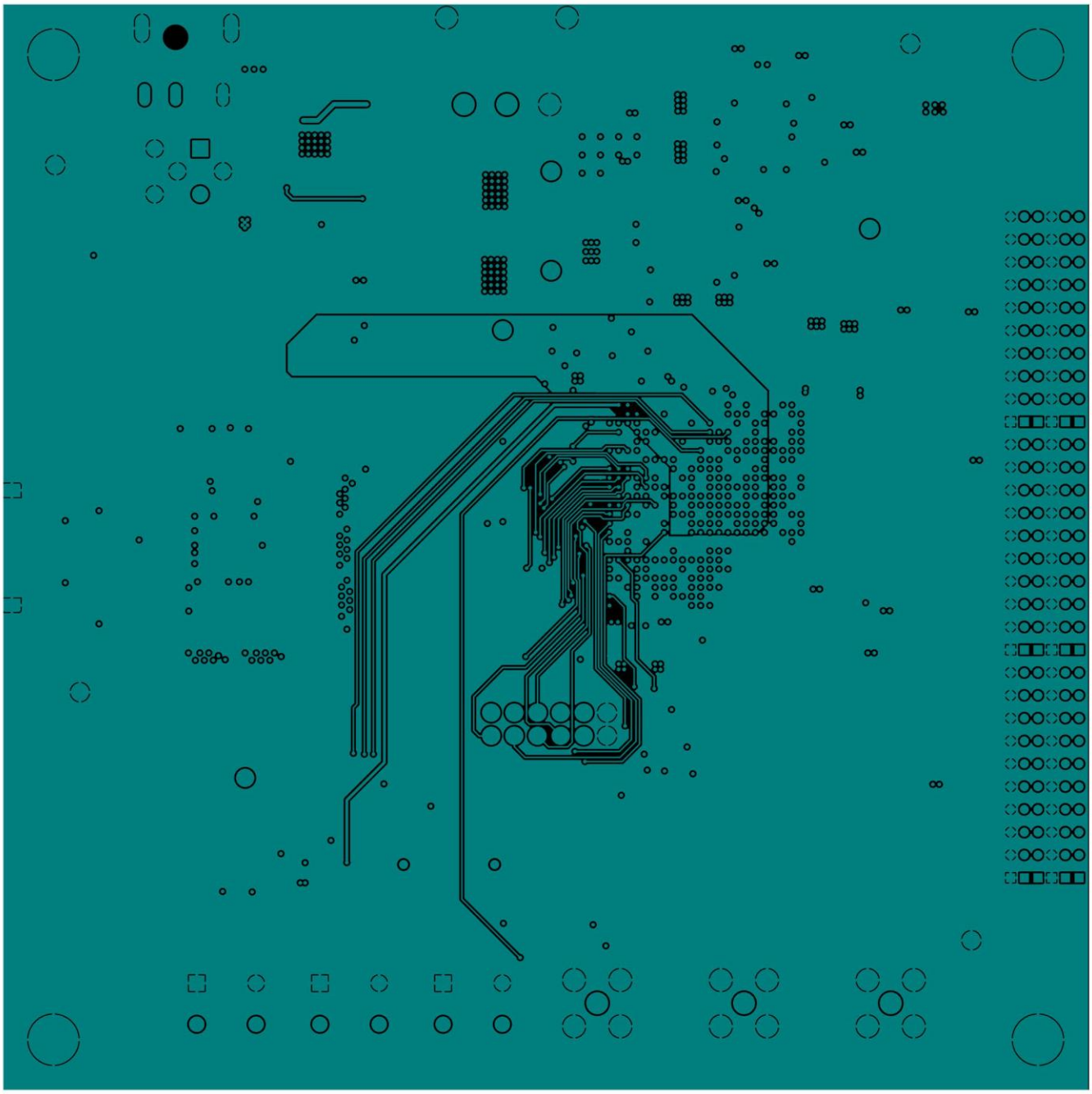

Figure 32: Mid-Layer 14

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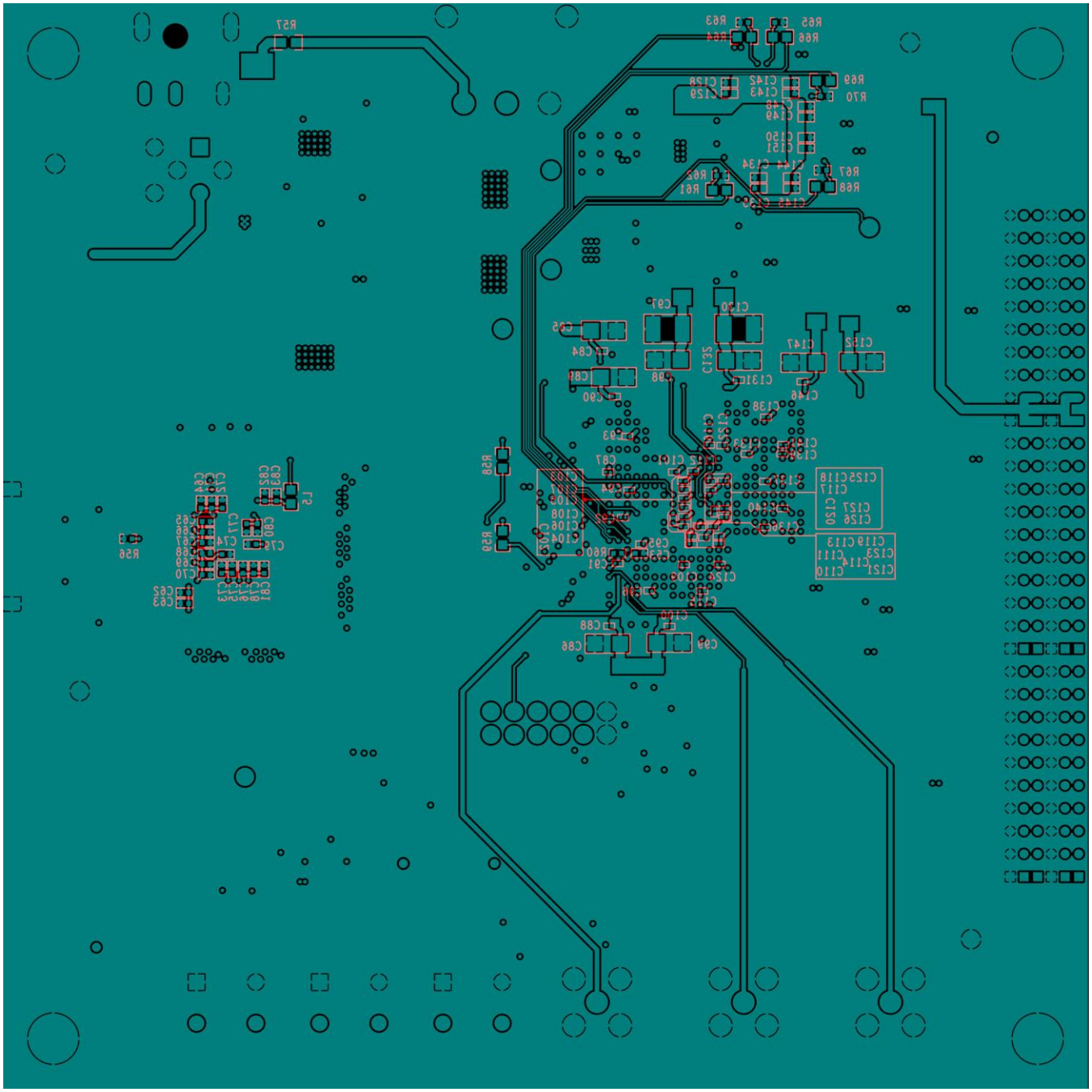

Figure 33: Bottom Layer and Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	3/6/2026	Initial Release	-

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