bldc_controller_routed

Design Report

Rev 1 | 2026-06-12 | jlcpcb

kicad-tools 0.13.0

Board Summary

Property	Value
Layers	4 copper (F.Cu, In1.Cu, In2.Cu, B.Cu)
Footprints	55 (40 SMD, 11 THT, 4 other)
Nets	52
Traces	881 segments
Vias	56
Board Size	80.0 x 100.0 mm

Design Overview

Theory of Operation

BLDC Motor Controller

3-Phase Brushless DC Motor Driver

Thermal analysis and high-current routing demo

Power Architecture

Power Rails: +24V, +3V3, +5V, GND, PWR_FLAG

Regulator	Device
U1	LM2596-5.0
U2	AMS1117-3.3

Assembly Notes

1 fine-pitch component; 4 polarized components

- **Fine-pitch components**: 1 (U10)
- **Polarized components**: 4 -- check orientation markings

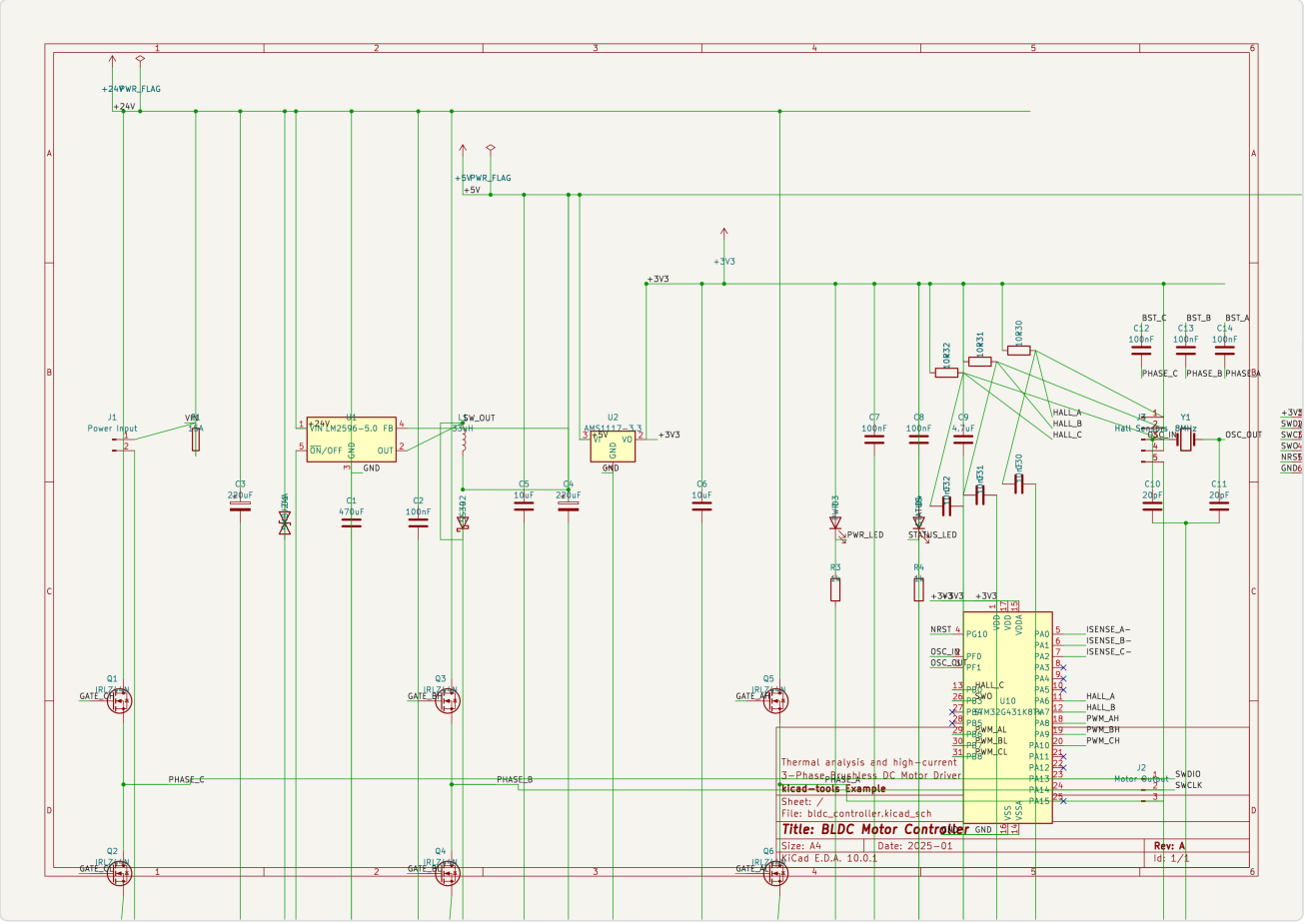
ERC Status

Metric	Count
Errors	0
Warnings	0

Status: SKIPPED -- ERC skipped by user request

Schematic Overview

Schematic: bldc_controller



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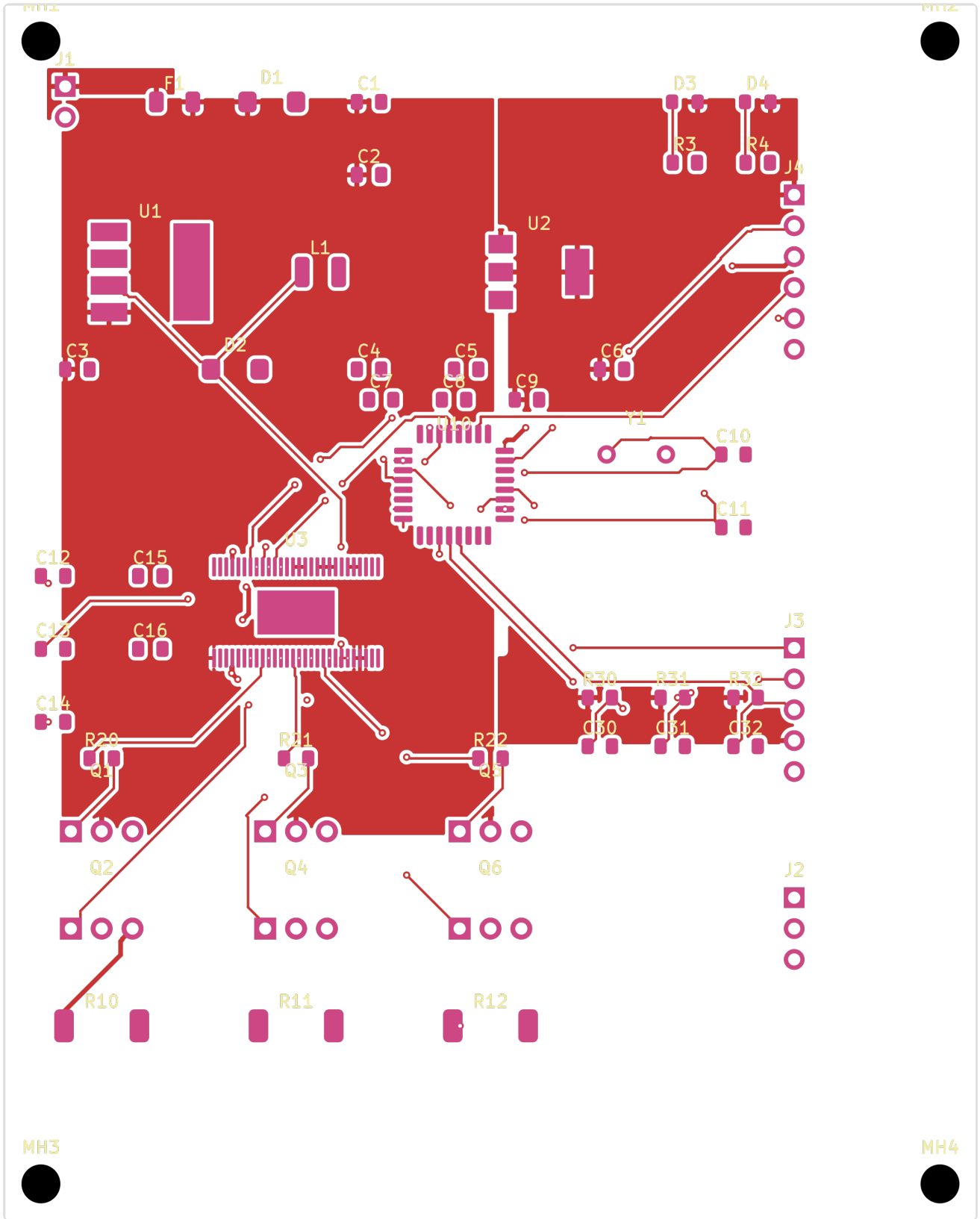
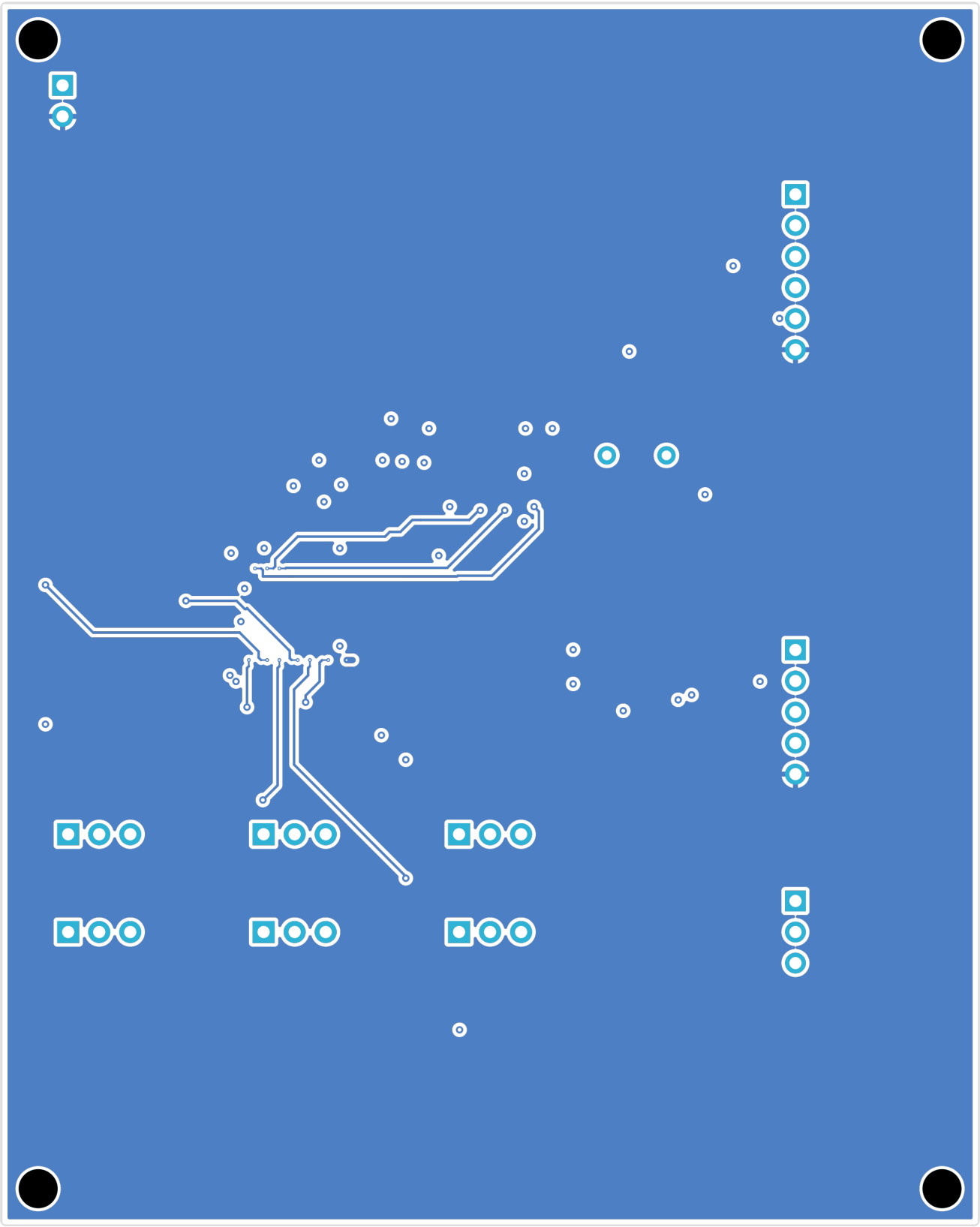
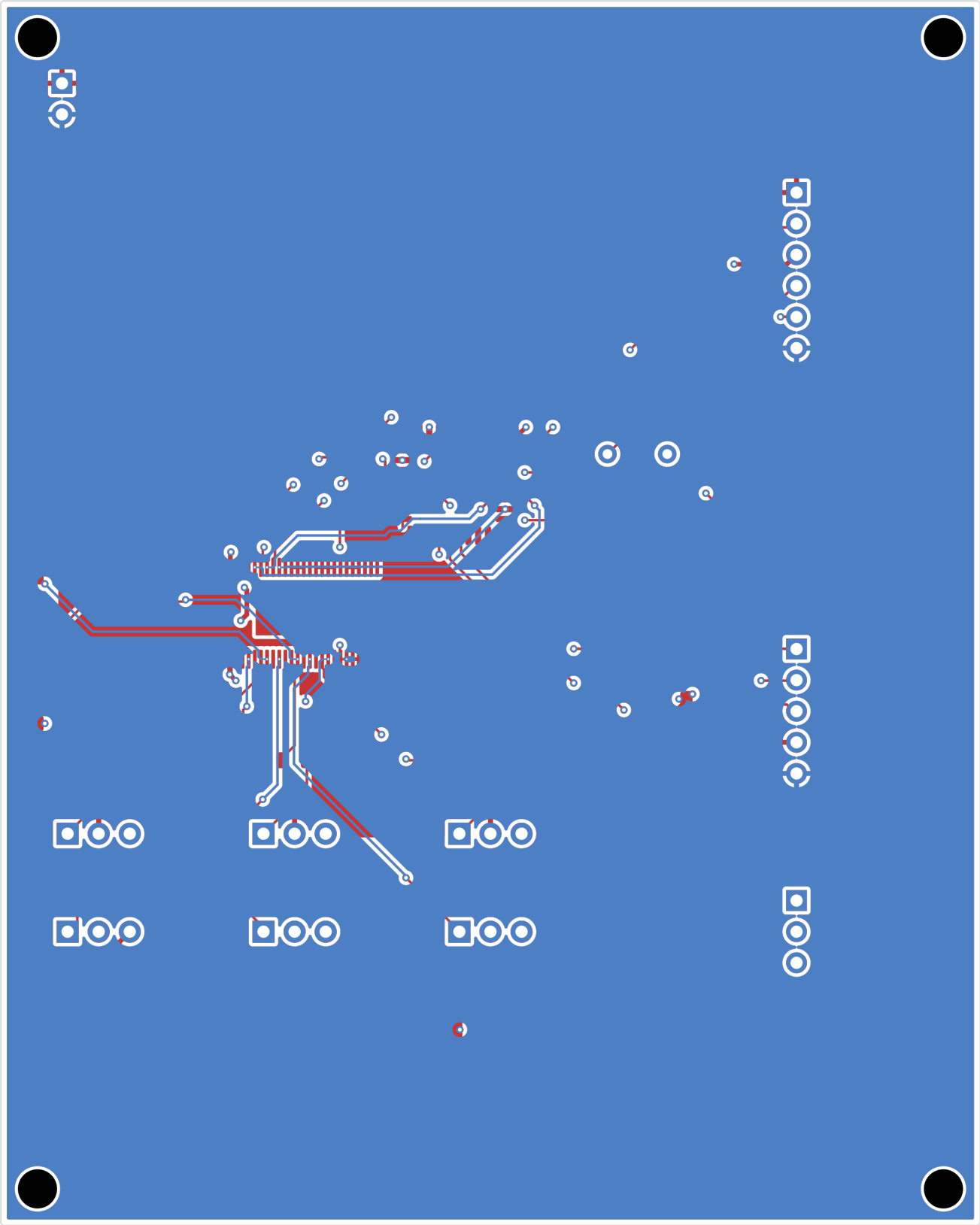
PCB Layout

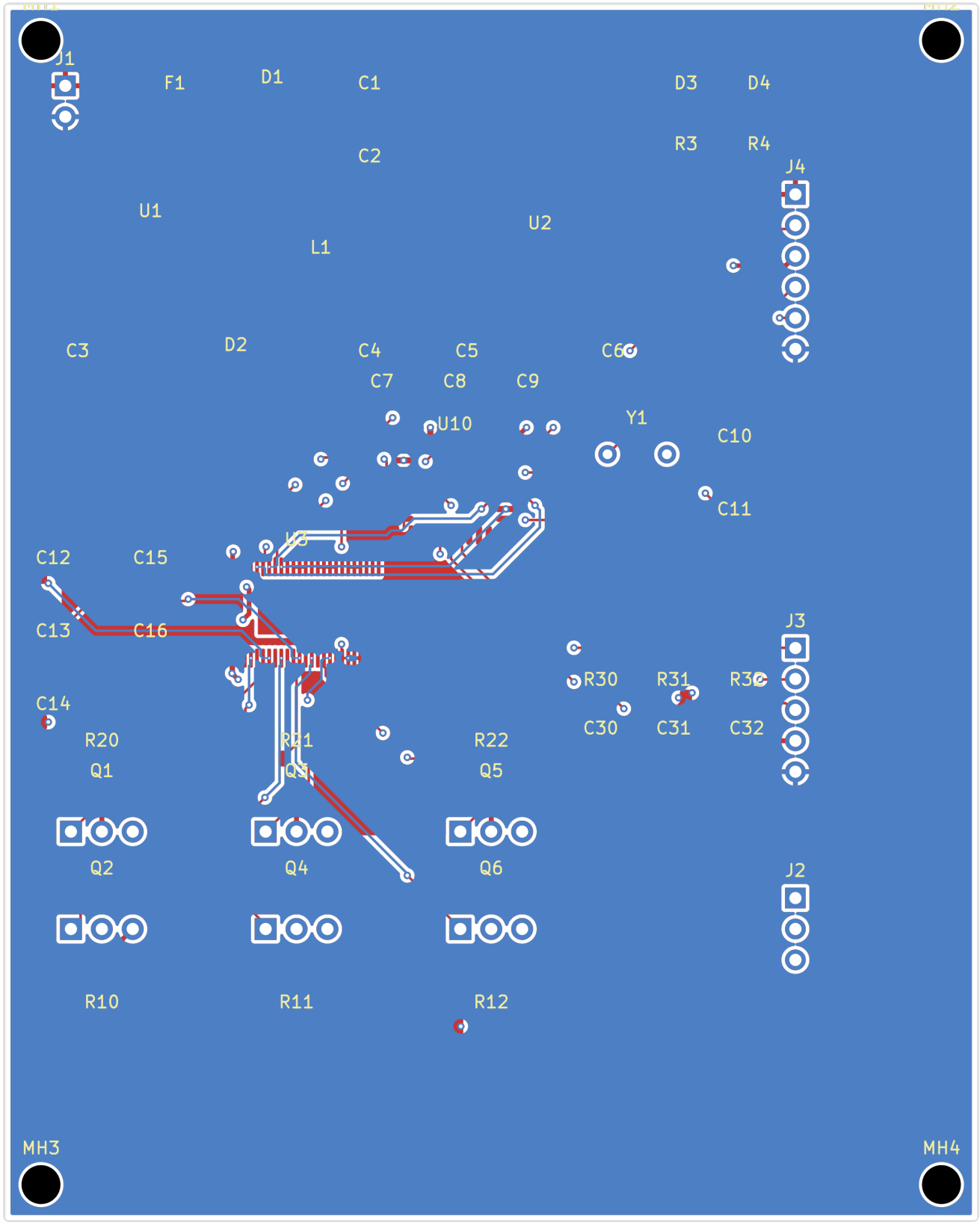

J1
F1
D1
C1
D3
D4
R3
R4
J4
C2
U1
U2
L1
C3
D2
C4
C5
C6
C7
C8
C9
U10
Y1
C10
C11
C12
C15
U3
C13
C16
J3
R30
R31
R32
C14
R20
R21
R22
Q30
Q31
Q32
Q1
Q3
Q5
Q2
Q4
Q6
J2
R10
R11
R12
MH3
MH4



Copper



Assembly


J1
F1
D1
C1
D3
D4
R3
R4
C2
J4
U1
U2
L1
C3
D2
C4
C5
C6
C7
C8
C9
U10
Y1
C10
C11
U3
C12
C15
C13
C16
J3
R30
R31
R32
C14
C30
C31
C32
R20
R21
R22
Q1
Q3
Q5
Q2
Q4
Q6
J2
R10
R11
R12
MH3
MH4

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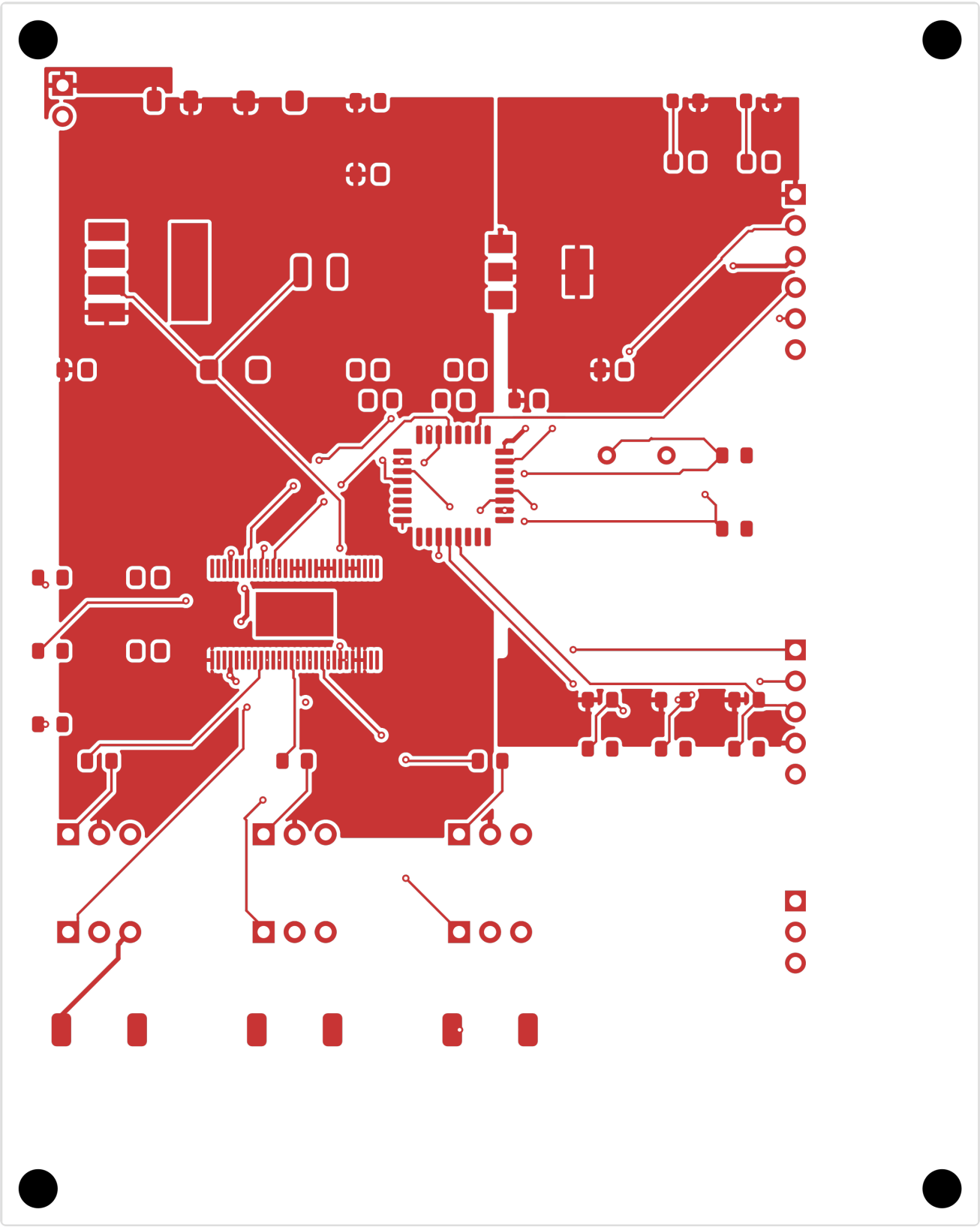
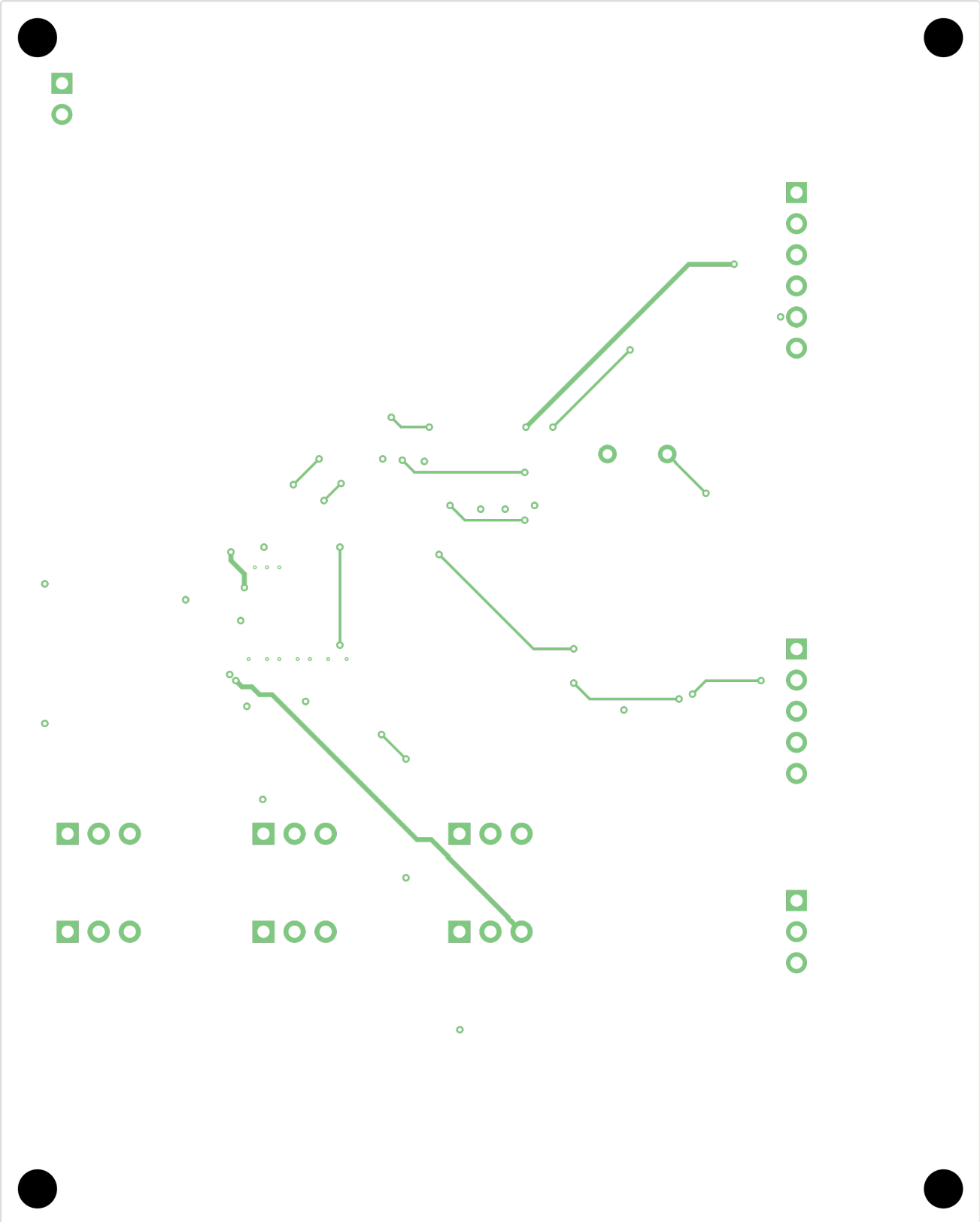
Copper Layers

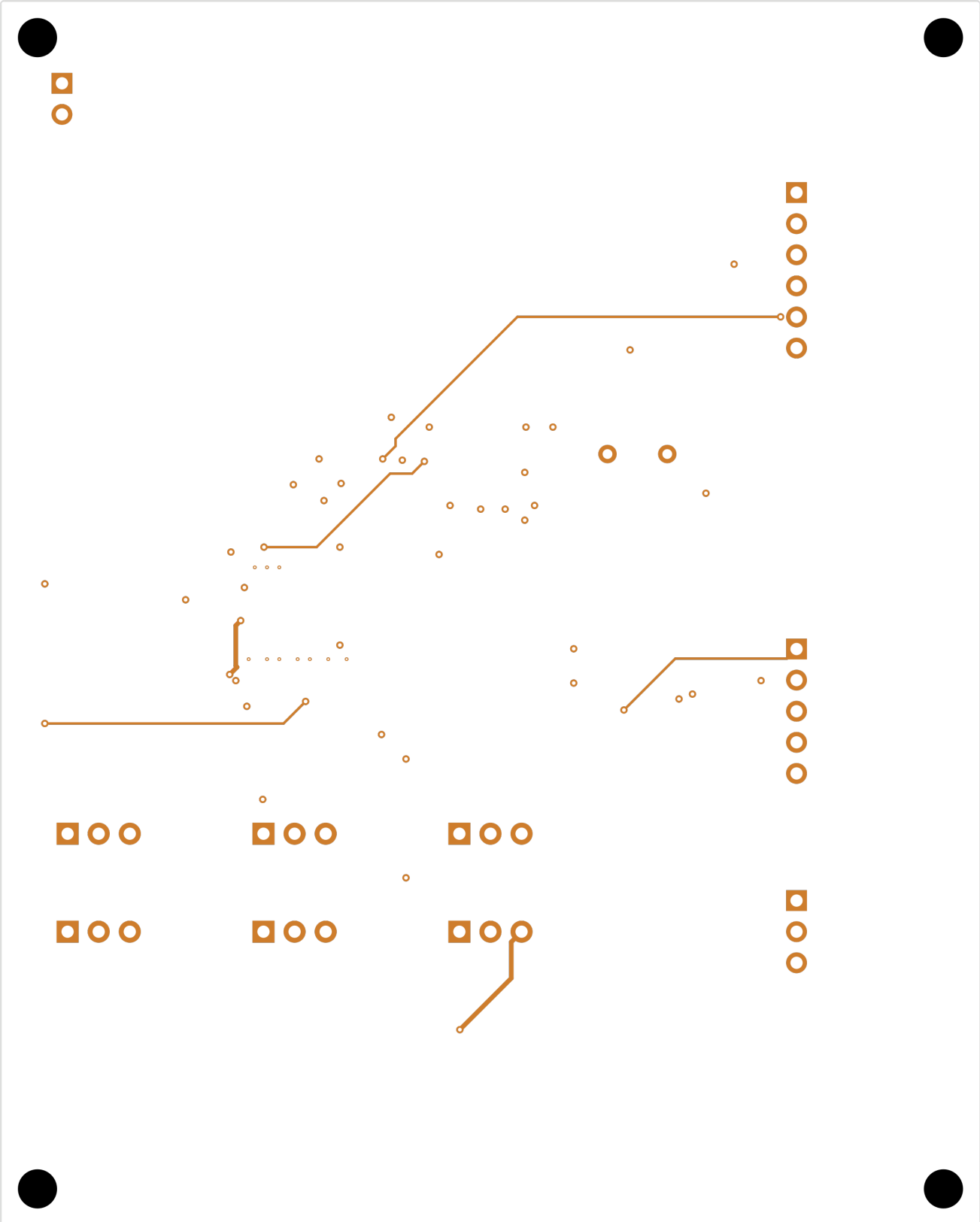
F.Cu



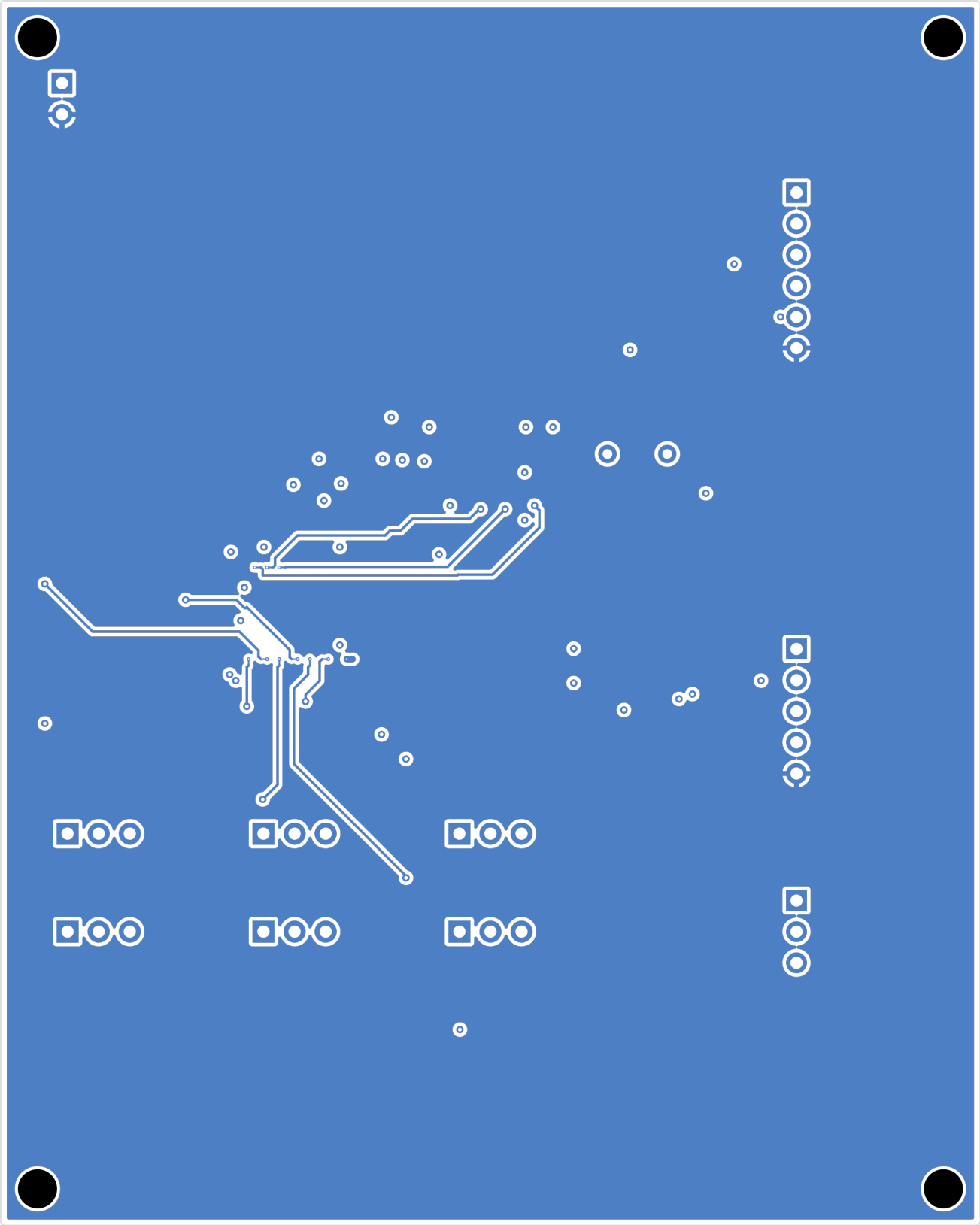
In1.Cu



In2.Cu



B.Cu



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Bill of Materials

Value	Package	Qty	References
100nF	C_0805_2012Metric	7	C2, C7, C8, C12, C13, C14, C15
10nF		3	C30, C31, C32
10uF	C_0805_2012Metric	3	C5, C6, C16
20pF		2	C10, C11
220uF	C_0805_2012Metric	2	C3, C4
4.7uF	C_0805_2012Metric	1	C9
470uF	C_0805_2012Metric	1	C1
PWR		1	D3
SMBJ24A	D_SMA	1	D1
SS34	D_SMA	1	D2
STATUS		1	D4
15A	Fuse_1206_3216Metric	1	F1
Hall Sensors	PinHeader_1x05_P2.54 mm_Vertical	1	J3
Motor Output	PinHeader_1x03_P2.54 mm_Vertical	1	J2
Power Input	PinHeader_1x02_P2.54 mm_Vertical	1	J1
SWD-6		1	J4
33uH	L_1210_3225Metric	1	L1
IRLZ44N		6	Q1, Q2, Q3, Q4, Q5, Q6
10k		3	R30, R31, R32
1k		2	R3, R4
22		3	R20, R21, R22
5mR		3	R10, R11, R12
AMS1117-3.3	SOT-223-3_TabPin2	1	U2
DRV8301	HTSSOP-56-1EP_6.1x1 4mm_P0.5mm_EP3.61x 6.35mm	1	U3
LM2596-5.0	TO-263-5_TabPin3	1	U1

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Value	Package	Qty	References
STM32G431K8Tx	LQFP-32_7x7mm_P0.8mm	1	U10
8MHz		1	Y1

DRC Status

Metric	Count
Errors	14
Warnings	0
Blocking	14

Status: FAIL

Violations by Type

Violation Type	Count
via_in_pad	14
connectivity	8
single_pad_net	8

Manufacturing Readiness

Verdict: NOT_READY

Action Items

- **[CRITICAL]** Fix 14 blocking DRC violations (via_in_pad (14))
- **[CRITICAL]** Increase min via drill: 0.150mm < 0.200mm required
- **[OPTIONAL]** Verify zone fill in KiCad: 7 nets appear incomplete but may be connected via zone fills
- **[OPTIONAL]** Verify zone fill in KiCad for 5 zone-connected nets
- **[OPTIONAL]** Analog net: ISENSE_A+ — analog signal; noise-sensitive, avoid crossing digital signals
- **[OPTIONAL]** Analog net: ISENSE_A- — analog signal; noise-sensitive, avoid crossing digital signals
- **[OPTIONAL]** Analog net: ISENSE_B+ — analog signal; noise-sensitive, avoid crossing digital signals
- **[OPTIONAL]** Analog net: ISENSE_B- — analog signal; noise-sensitive, avoid crossing digital signals
- **[OPTIONAL]** Analog net: ISENSE_C+ — analog signal; noise-sensitive, avoid crossing digital signals
- **[OPTIONAL]** Analog net: ISENSE_C- — analog signal; noise-sensitive, avoid crossing digital signals

Routing Status

Metric	Value
Signal Net Completion	82.1% (32/39)
Overall Completion	84.6%
Complete Nets	44 / 52
Zone-Connected Nets	5
Single-Pad Nets	8 (no routing needed)
Incomplete Nets	8
Unconnected Pads	56

Zone-Connected Nets

- +24V
- +3V3
- +5V
- GND
- VIN

Single-Pad Nets

8 single-pad nets (no routing needed) -- not listed individually.

Unrouted Signal Nets

- ISENSE_A-
- ISENSE_B+
- ISENSE_B-
- ISENSE_C-
- PHASE_A
- PHASE_B
- PHASE_C

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Unrouted Signal Nets

- ISENSE_A-
- ISENSE_B+
- ISENSE_B-
- ISENSE_C-
- PHASE_A
- PHASE_B
- PHASE_C

Cost Estimate

Metric	Per Board (estimated)
PCB Fabrication	~3.6 USD
Components (estimated)	~3.2 USD
Assembly (estimated)	~2.35 USD
Total (estimated)	**~9.16 USD**
Batch Quantity	5
Batch Total (estimated)	~45.78 USD