

usb_joystick_routed

Design Report

kicad-tools 0.20.0

Rev 1 | 2026-09-10 | jlcpcb-tier1

Board Summary

Property	Value
Layers	4 copper (F.Cu, In1.Cu, In2.Cu, B.Cu)
Footprints	38 (37 SMD, 1 THT, 0 other)
Nets	27
Traces	2048 segments
Vias	151
Board Size	80.0 x 60.0 mm

Stackup

Layer	Type	Thickness (mm)	Material
F.Cu	copper	0.035	—
dielectric 1	prepreg	0.2104	7628
In1.Cu	copper	0.0152	—
dielectric 2	core	1.065	FR4
In2.Cu	copper	0.0152	—
dielectric 3	prepreg	0.2104	7628
B.Cu	copper	0.035	—

Design Overview

Theory of Operation

USB joystick controller — ATmega32U4

USB bus powered, 8MHz crystal, AVR ISP programming

GPIO and ADC map is fixed to Microchip TQFP-44 pinout

Communication Interfaces

Protocol	Signals
SPI	ISP_MISO, ISP_MOSI, ISP_SCK
USB	USB_D+, USB_D-, VBUS

Power Architecture

Power Rails: PWR_FLAG

Assembly Notes

1 fine-pitch component

- **Fine-pitch components:** 1 (U1)

Hand-Solder (THT) Components

The following 1 through-hole component is **excluded from the SMT pick-and-place file** and must be hand-soldered (or wave/selective-soldered) after SMT assembly. It appears in the BOM for sourcing.

Value	Package	Qty	References
USB4085-GF-A	USB_C_Receptacle_GCT_USB4085	1	J1

ERC Status

Metric	Count
Errors	0
Warnings	0

Status: PASS — independent native ERC: zero errors and warnings; see native-erc.json.

Schematic: usb_joystick

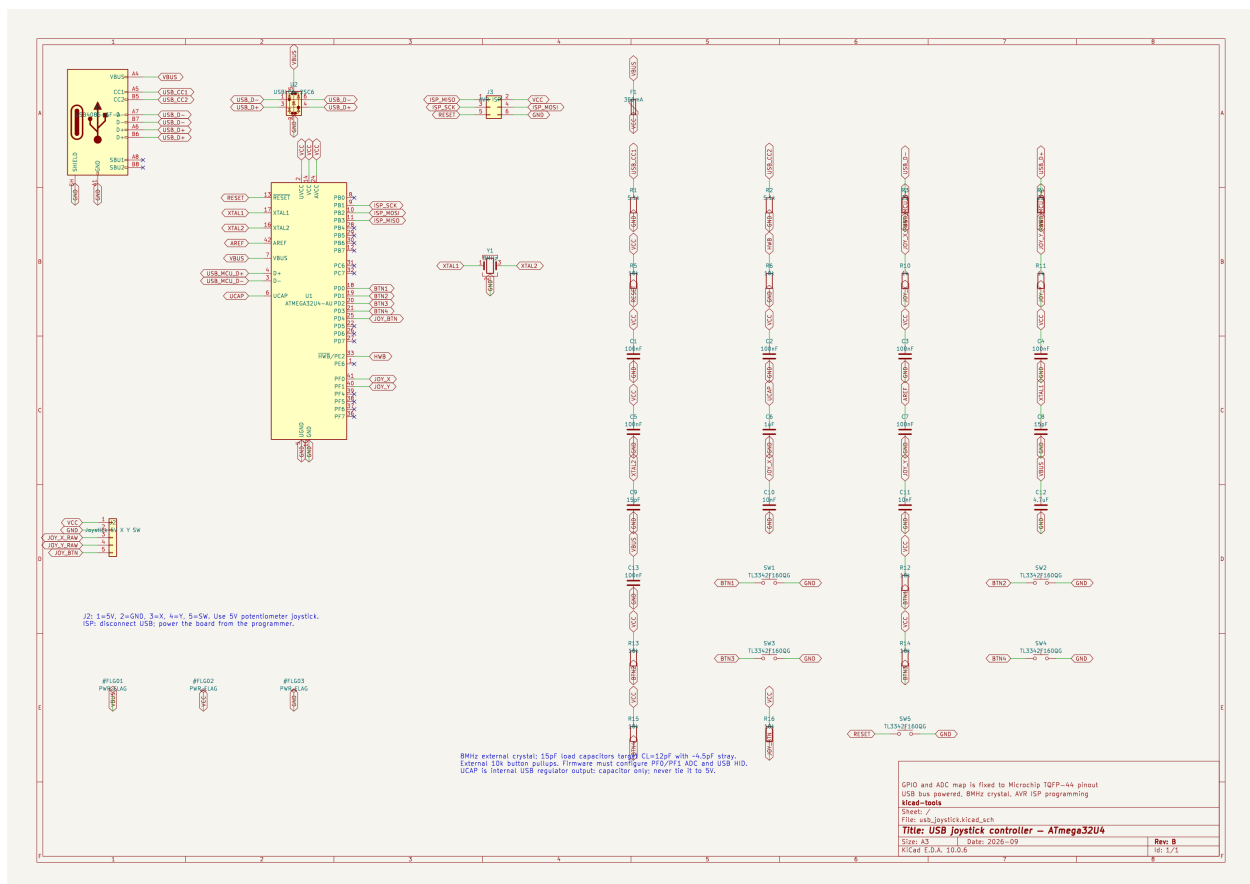


Figure 1: Schematic: usb_joystick

PCB Layout

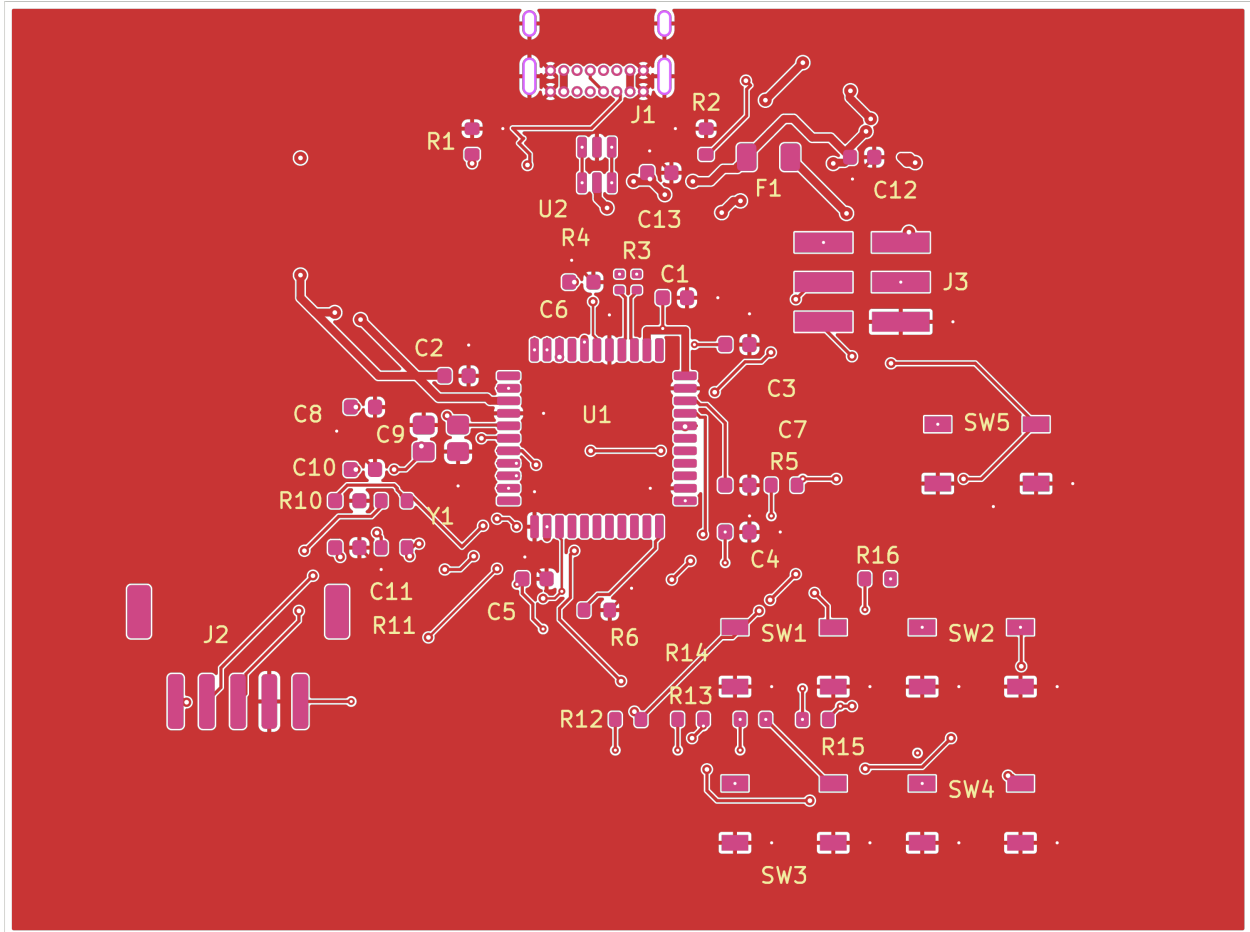


Figure 2: PCB Front

Copper
Assembly

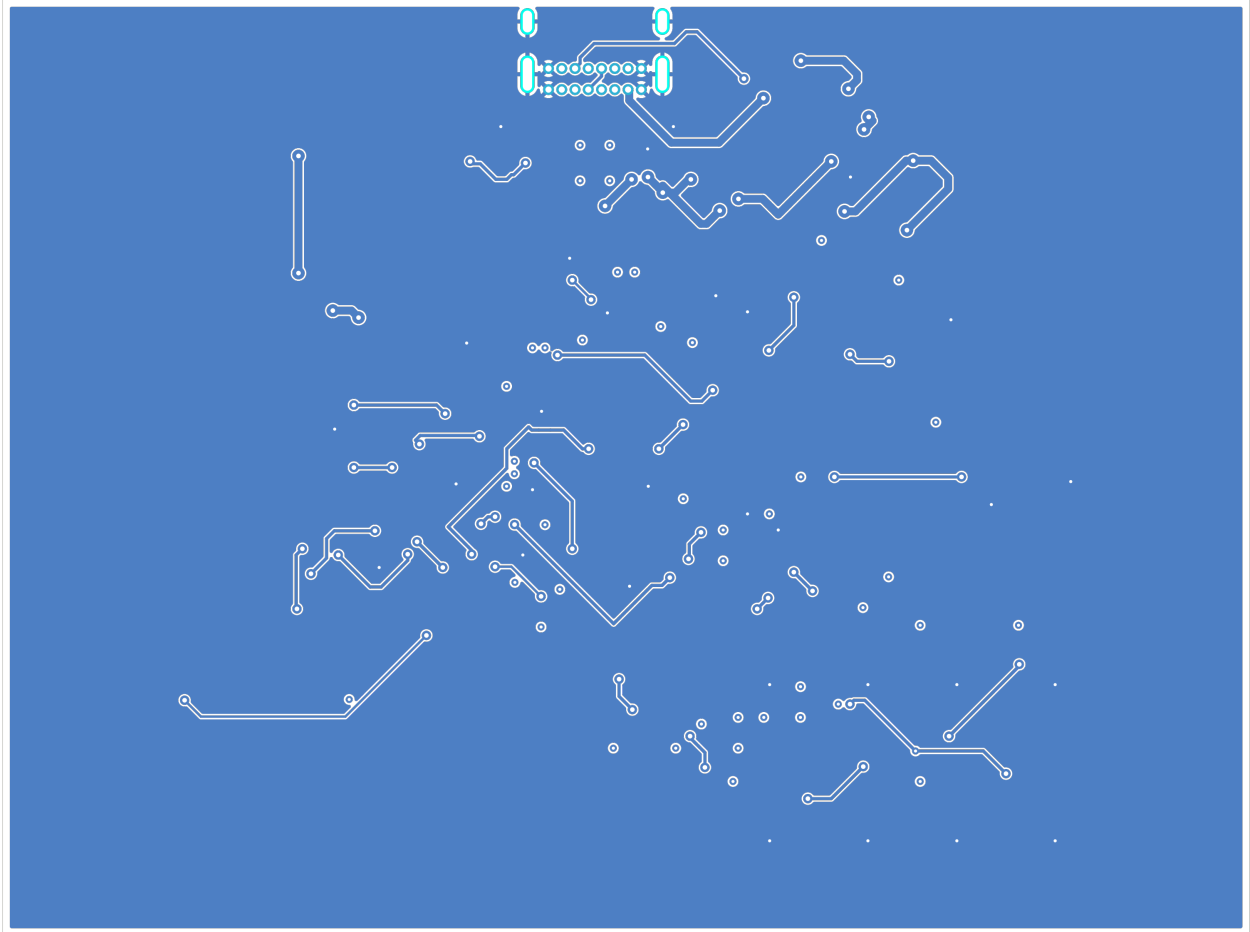


Figure 3: PCB Back

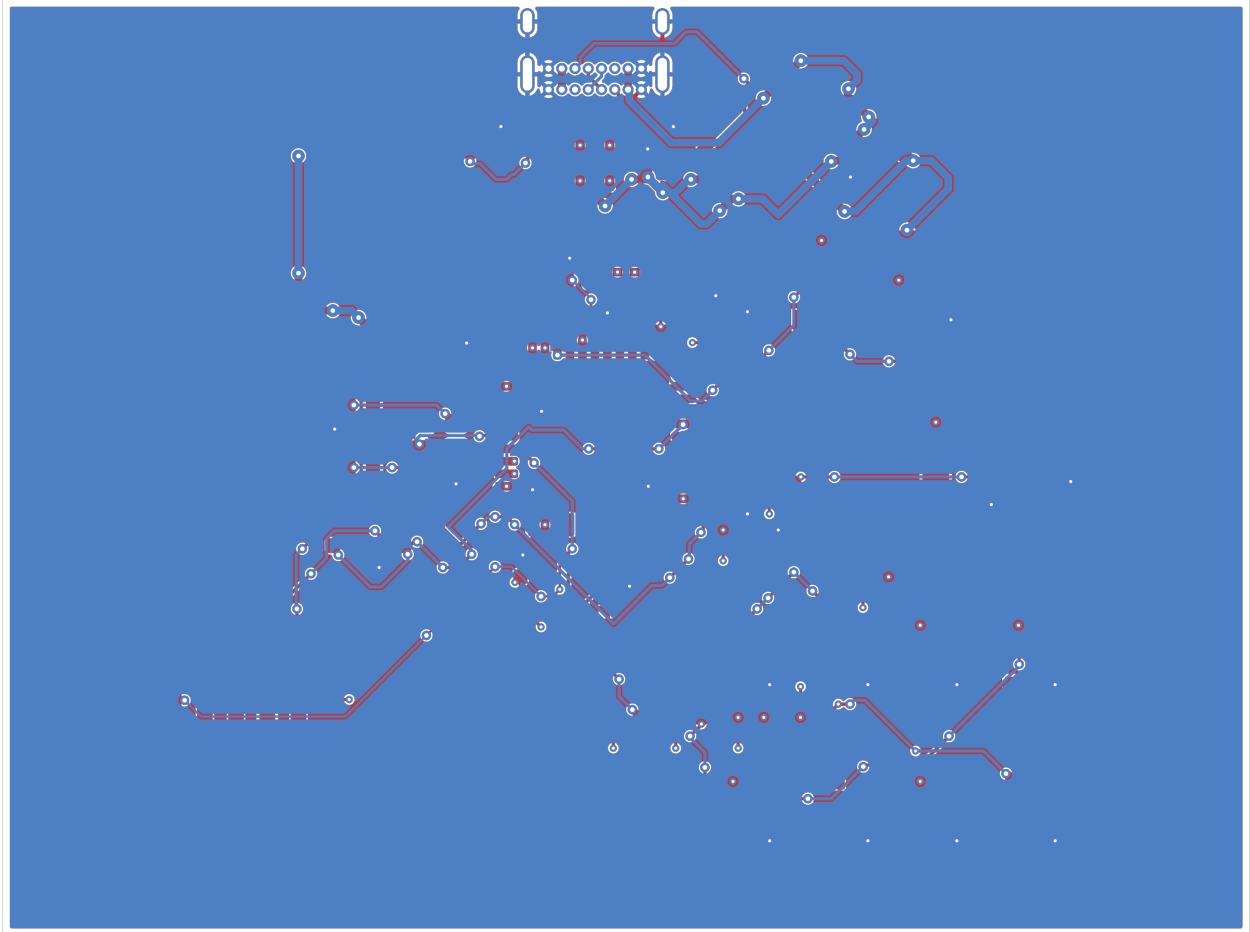


Figure 4: PCB Copper

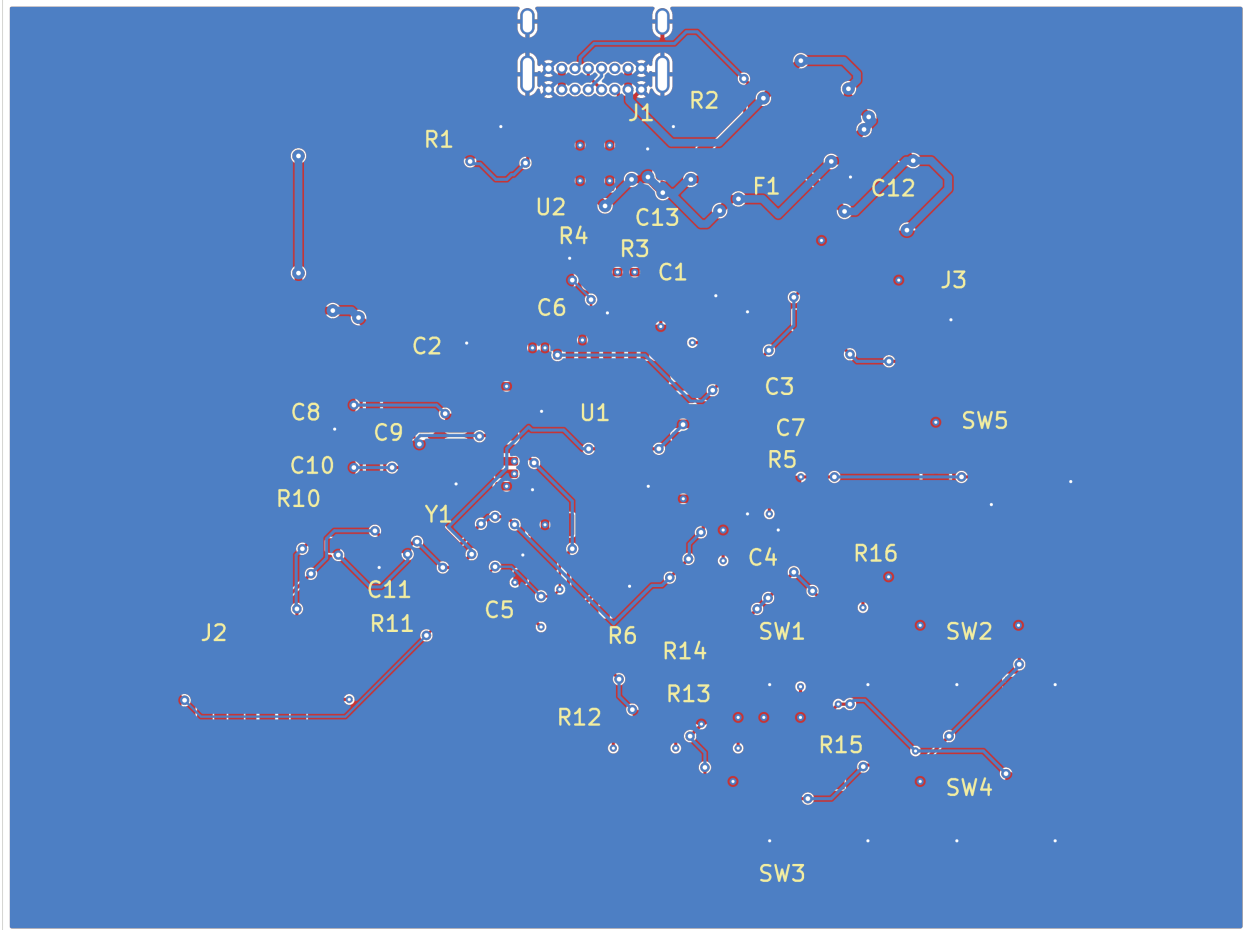


Figure 5: Assembly

Copper Layers

F.Cu

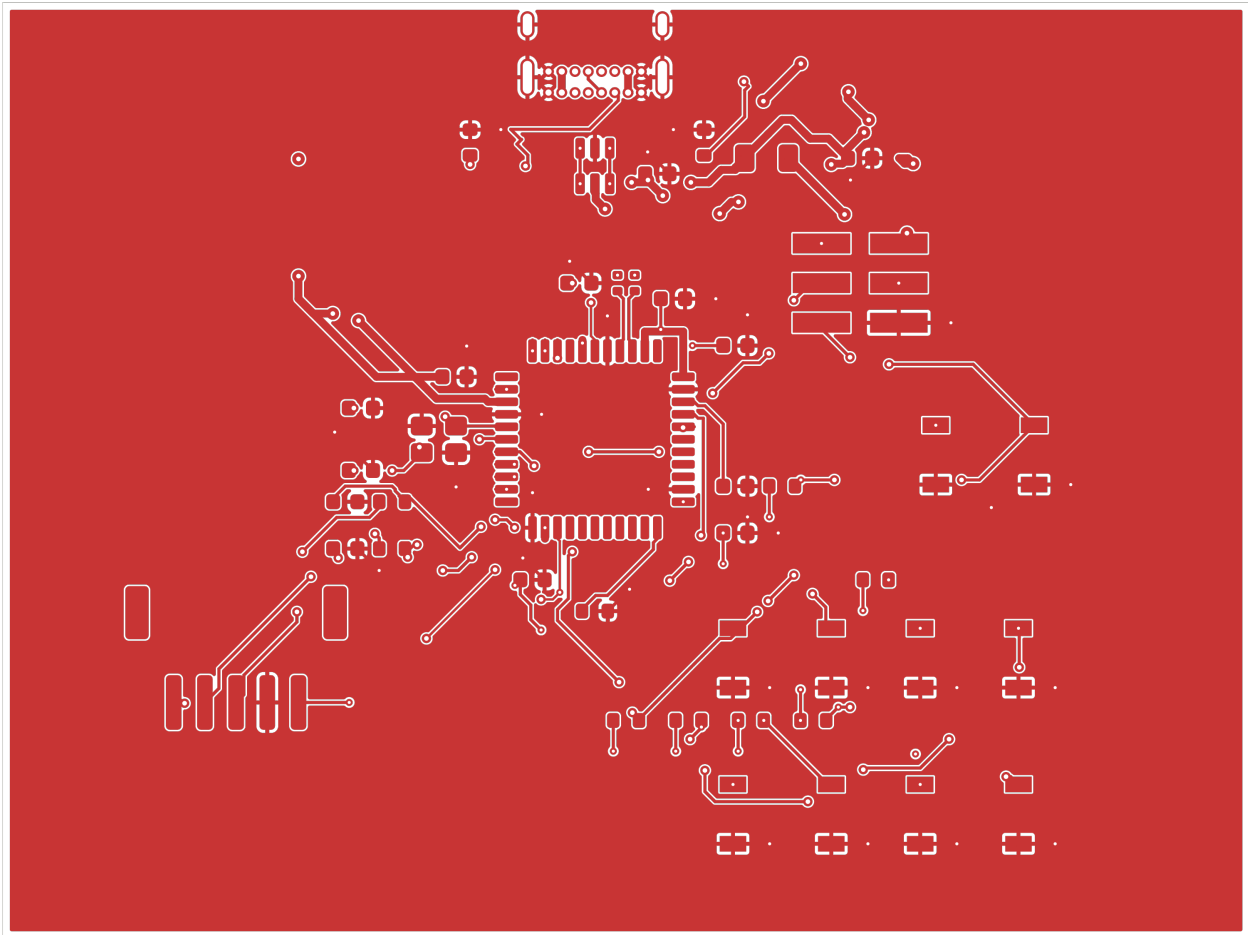


Figure 6: F.Cu

In1.Cu

In2.Cu

B.Cu

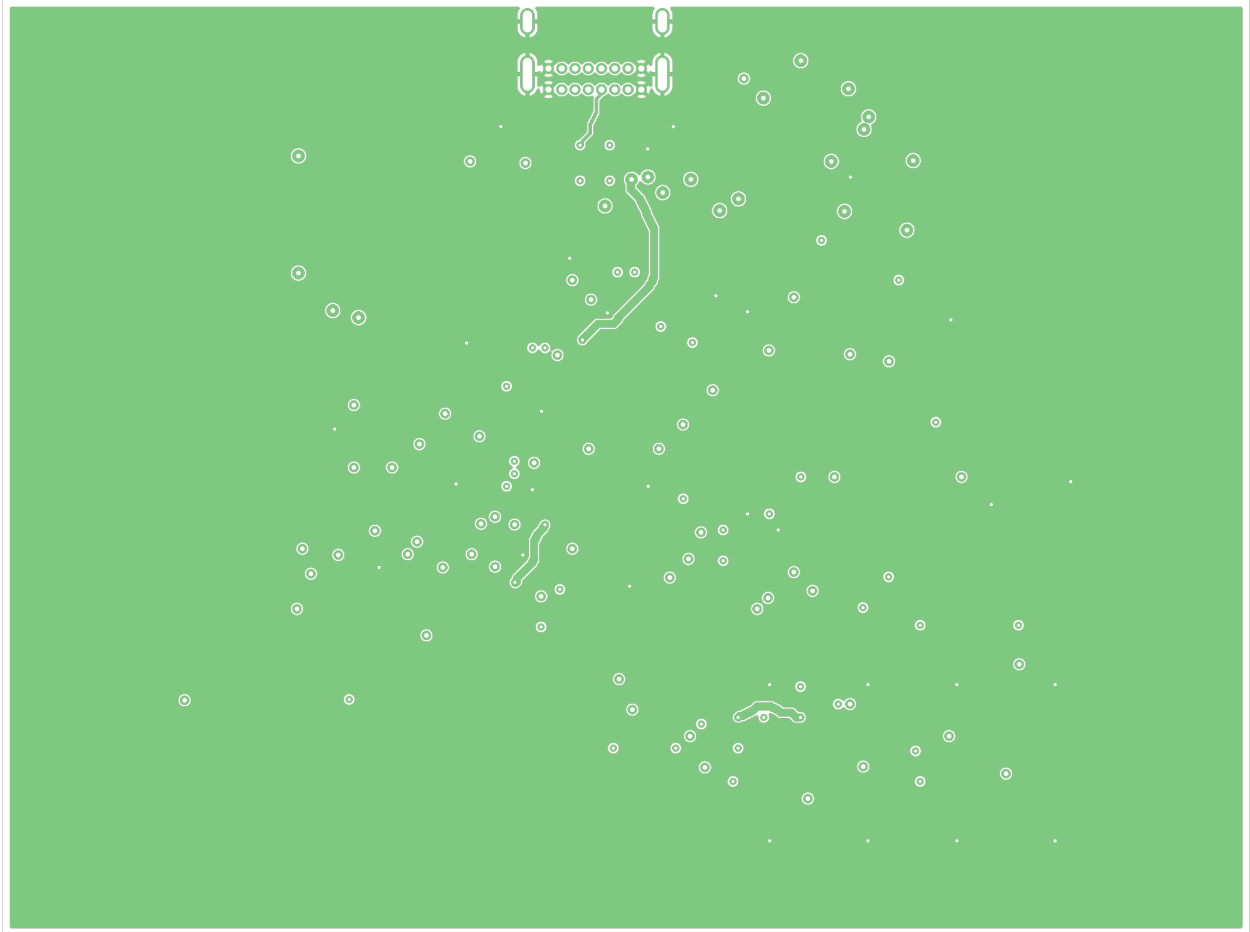


Figure 7: In1.Cu

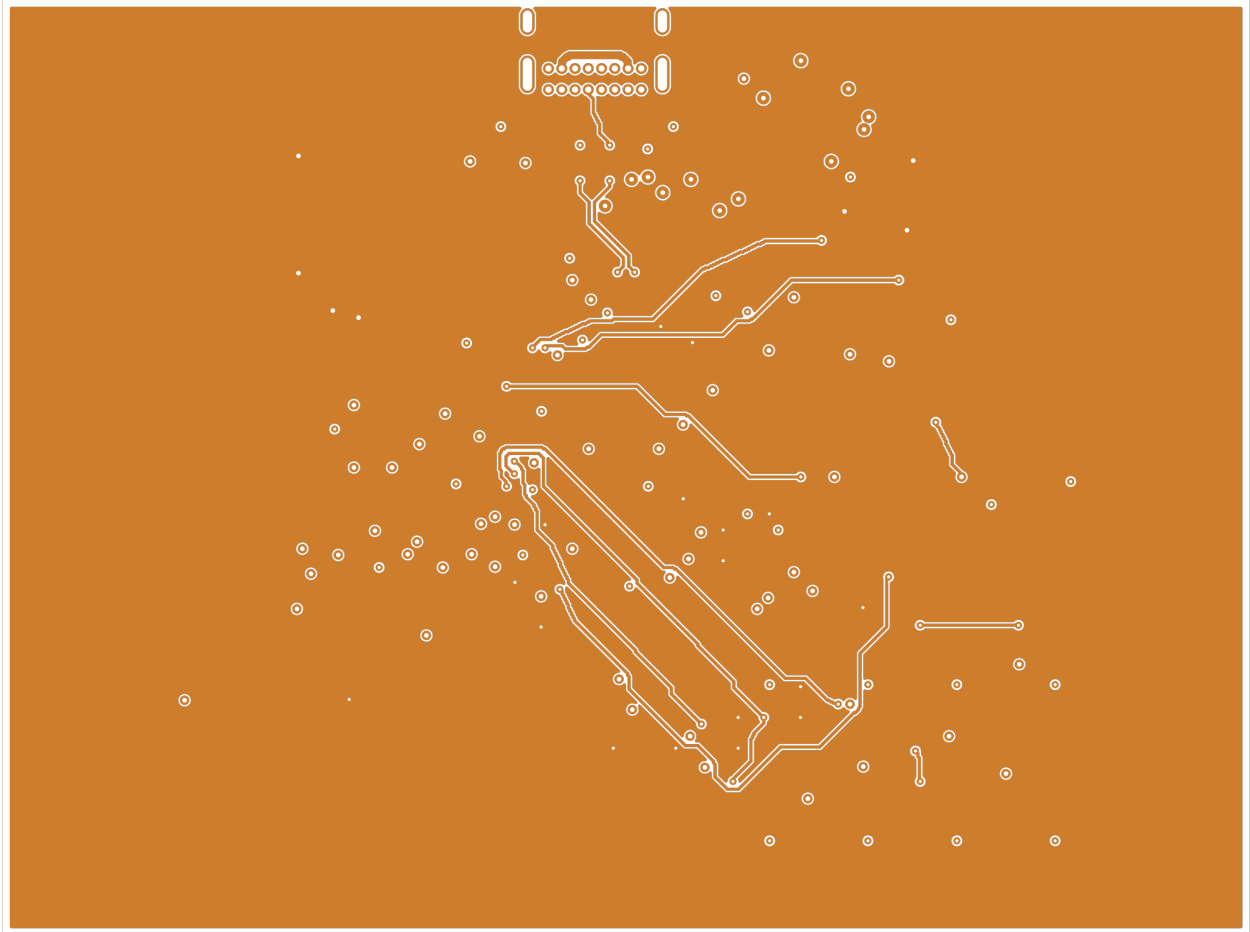


Figure 8: In₂Cu

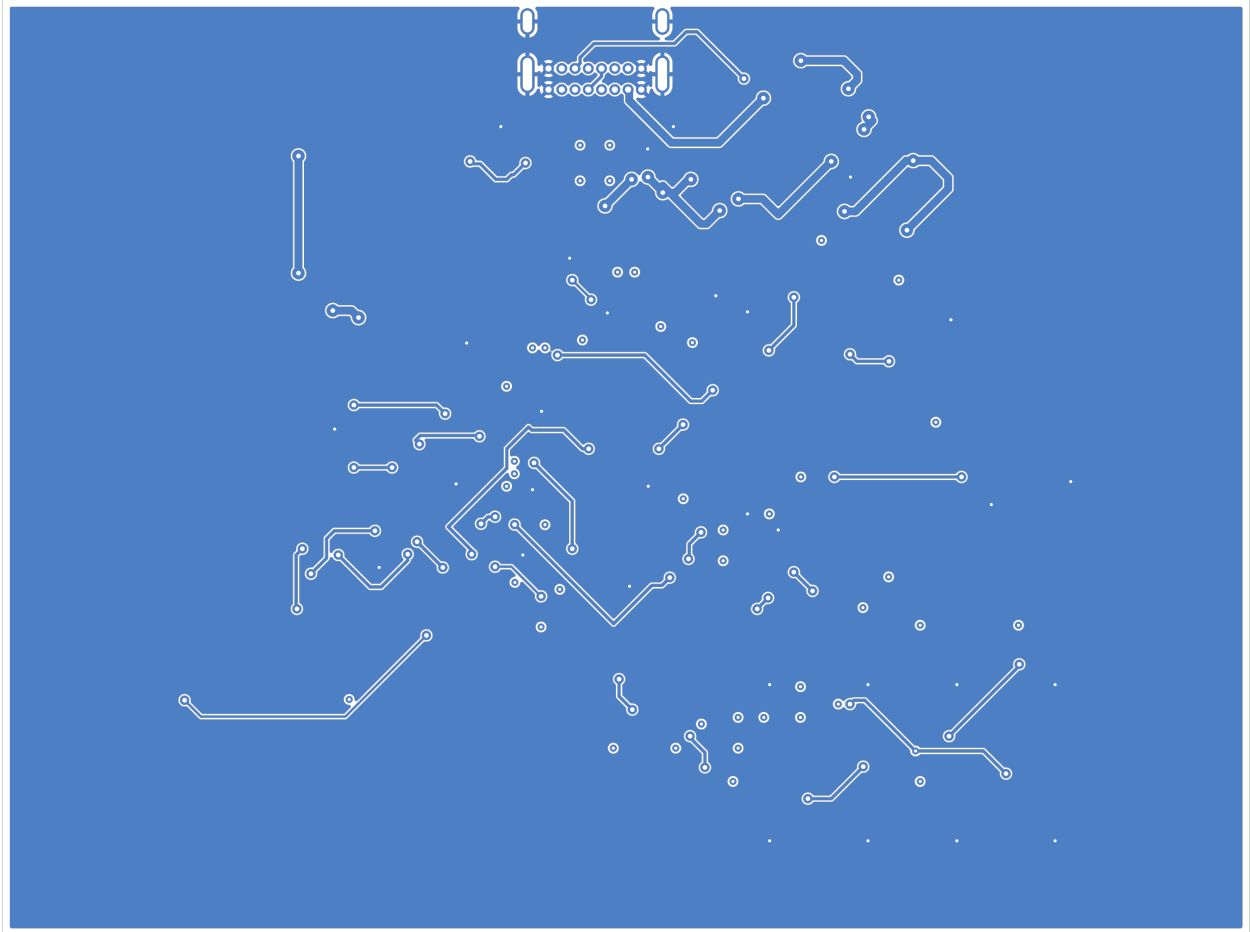


Figure 9: B.Cu

Bill of Materials

Value	Package	Qty	References	MPN	LCSC
100nF	C_0603_1608Metric7	7	C1, C2, C3, C4, C5, C7, C13	GRM188R71C4500K	A01D
10nF	C_0603_1608Metric2	2	C10, C11	GRM188R71C7703K	A01D
15pF	C_0603_1608Metric2	2	C8, C9	GRM1885C1C71551A	A01D
1uF	C_0603_1608Metric	1	C6	GRM188R71C9785K	A61D
4.7uF	C_0603_1608Metric	1	C12	GRM188R61C7475K	E15D
350mA	Fuse_1206_3216Metric	1	F1	1206L035/10YB	6817
AVR ISP	Samtec_TSM-103-01-T-DV	1	J3	TSM-103-01-T-DV-P-TR	C21285200
Joystick 5V X Y SW	JST_PH_S5B-PH-SM4-TB_1x05-1MP_P2.00mm_Horizontal	1	J2	S5B-PH-SM4-TB(LF)(SN)	C265104
USB4085-GF-A	USB_C_Receptacle1_GCT_USB4085	1		USB4085-GF-A	C7095263
10k	R_0603_1608Metric7	7	R5, R6, R12, R13, R14, R15, R16	RC0603FR-0710KL	C98220
1k	R_0603_1608Metric2	2	R10, R11	RC0603FR-071KL	C22548
22	R_0402_1005Metric2	2	R3, R4	RC0402FR-0722RL	C114765
5.1k	R_0603_1608Metric2	2	R1, R2	RC0603FR-075K1L	C105580
TL3342F160QGSW_SPST_TL3342		2	SW1, SW2, SW3, SW4, SW5	TL3342F160QGS	C886898
ATMEGA32U4-TQFP-AU	44_10x10mm_P0.8mm	1	U1	ATMEGA32U4	C44854
USBLC6-2SC6	SOT-23-6	1	U2	USBLC6-2SC6	C7519
8MHz	Crystal_SMD_322514Pin_3.2x2.5mm	1	Y1	ECS-80-12-33-JGN-TR	C2442665

DRC Status

Metric	Count
Errors	0
Warnings	14
Blocking	0

Status: PASS ### Violations by Type

Violation Type	Count
hole_to_hole_clearance	14

Reviewed Factory Verification

The generic report above uses a conservative 0.50 mm pad-hole floor and reports 14 hole-spacing warnings. The selected factory process explicitly permits 0.45 mm; native project rules and the reviewed checker use that same floor. No findings are suppressed. Fresh check-report.json records 51 evaluated rules, zero errors/warnings, and label plus copper LVS with 129 bound pads and zero mismatches. Independent native DRC/refill and ERC report zero violations and zero opens. Per-net, per-layer filled copper matches the independent refill exactly (fill-consistency.json). All 23 repaired off-angle segments are now 45-degree aligned; the USB branch skew is 0.165685 mm, within the reviewed bound.

Manufacturing Readiness

Verdict: READY for the specified fabrication and assembly process.

Order the reviewed four-layer construction and Epoxy-filled & Capped POFV/VIPPO option in manufacturing-requirements.json. The exact supplier BOM covers 37 SMT placements; J1 is a separate through-hole assembly operation in manual-assembly-bom.csv. The editable project includes the custom ISP footprint library and native rules. Unchanged compiled firmware and its source are supplied with programming instructions. Physical bring-up, USB electrical qualification, and first-article inspection remain unperformed; this is not a USB certification claim.

Routing Status

Metric	Value
Signal Net Completion	100.0% (25/25)
Overall Completion	100.0%
Complete Nets	27 / 27
Zone-Connected Nets	2
Incomplete Nets	0
Unconnected Pads	0

Zone-Connected Nets

- GND
- VCC

Cost Estimate

Metric	Per Board (estimated)
PCB Fabrication	~2.96 USD
Components (estimated)	~2.11 USD
Assembly (estimated)	~2.16 USD
Total (estimated)	~7.23 USD
Batch Quantity	5
Batch Total (estimated)	~36.14 USD