

# Amulet Motion Controller Fabrication Document

## Layer Stack Legend

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Material	Layer	Thickness	Dielectric	Type	Gerber
	F.Paste			Paste Mask	
	F.Silkscreen		Direct Printing	Legend	GBR
Copper	F.Mask	0.02mm	Solder Resist	Solder Mask	GBR
Prepreg	L1 (Sig, PWR)	0.07mm (2oz)	FR4_7628	Signal	GBR
Copper	L2 (GND)	0.18mm		Dielectric	
Core	L3 (GND)	0.035mm (1oz)	FR4	Plane	GBR
Copper	L4 (Sig, PWR)	0.4mm		Dielectric	
Prepreg	L5 (Sig, PWR)	0.035mm (1oz)	FR4_7628	Signal	GBR
Copper	L6 (GND)	0.18mm		Dielectric	
Core	B.Mask	0.035mm (1oz)	FR4_7628	Signal	GBR
Prepreg	B.Silkscreen	0.02mm	Solder Resist	Solder Mask	GBR
B	B.Paste		Direct Printing	Legend	GBR
				Paste Mask	

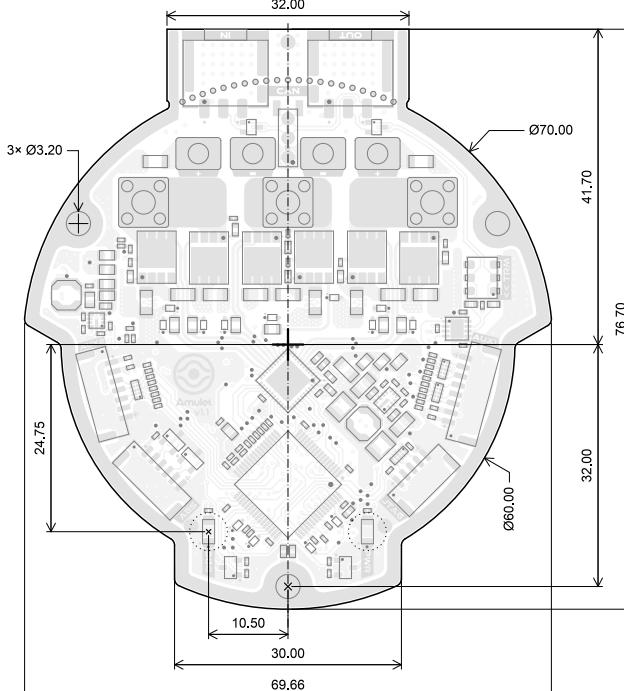
Total thickness: 1.66mm  
Note: external layer thicknesses are specified after plating

## Impedance Table

C

Transmission Line	Impedance [ohms]	Tolerance [ohms]	Layer	Trace Width [mm]	Gap [mm]	Ref. Layers
Edge-Coupled Coated Microstrip	100	±10 %	L1	0.2032	0.28	L2

## Top Fabrication (Scale 1:1)



All dimensions are in millimeters unless otherwise specified.

## FABRICATION NOTES (UNLESS OTHERWISE SPECIFIED)

- 1) FABRICATE PER IPC-6012A CLASS 2.
- 2) OUTLINE DEFINED IN SEPARATE GERBER FILE WITH "Edge\_Cuts.GBR" SUFFIX.
- 3) SEE SEPARATE DRILL FILES WITH ".DRL" SUFFIX FOR HOLE LOCATIONS.
- 4) SELECTED HOLE LOCATIONS SHOWN ON THIS DRAWING FOR REFERENCE ONLY.
- 5) SURFACE FINISH: IMMERSION GOLD
- 6) SOLDERMASK ON BOTH SIDES OF THE BOARD SHALL BE LPI, COLOR BLACK.
- 7) SILK SCREEN LEGEND TO BE APPLIED PER LAYER STACKUP USING YELLOW NON-CONDUCTIVE EPOXY INK.
- 8) ALL VIAS ARE TENTED ON BOTH SIDES UNLESS SOLDERMASK OPENED IN GERBER.
- 9) VENDOR SHOULD FOLLOW ROHS COMPLIANT PROCESS AND Pb FREE FOR MANUFACTURING
- 10) PCB MATERIAL REQUIREMENTS:
  - A. FLAMMABILITY RATING MUST MEET OR EXCEED UL94V-0 REQUIREMENTS.
  - B. Tg 170 C or EQUIVALENT.
  - C. EQUIVALENT MATERIAL SHALL BE RoHS COMPLIANT, HALOGEN FREE AND APPROVED BY EPFL XPLORER RESEARCH.

## 10) DESIGN GEOMETRY MINIMUM FEATURE SIZES:

BOARD SIZE	69.666 × 76.700 mm
BOARD THICKNESS	1.660 mm
TRACE WIDTH	0.200 mm
TRACE TO TRACE	0.200 mm
MIN. HOLE (PTH)	0.250 mm
MIN. HOLE (NPTH)	0.700 mm
ANNULAR RING	0.150 mm
COPPER TO HOLE	0.254 mm
COPPER TO EDGE	0.250 mm
HOLE TO HOLE	0.254 mm

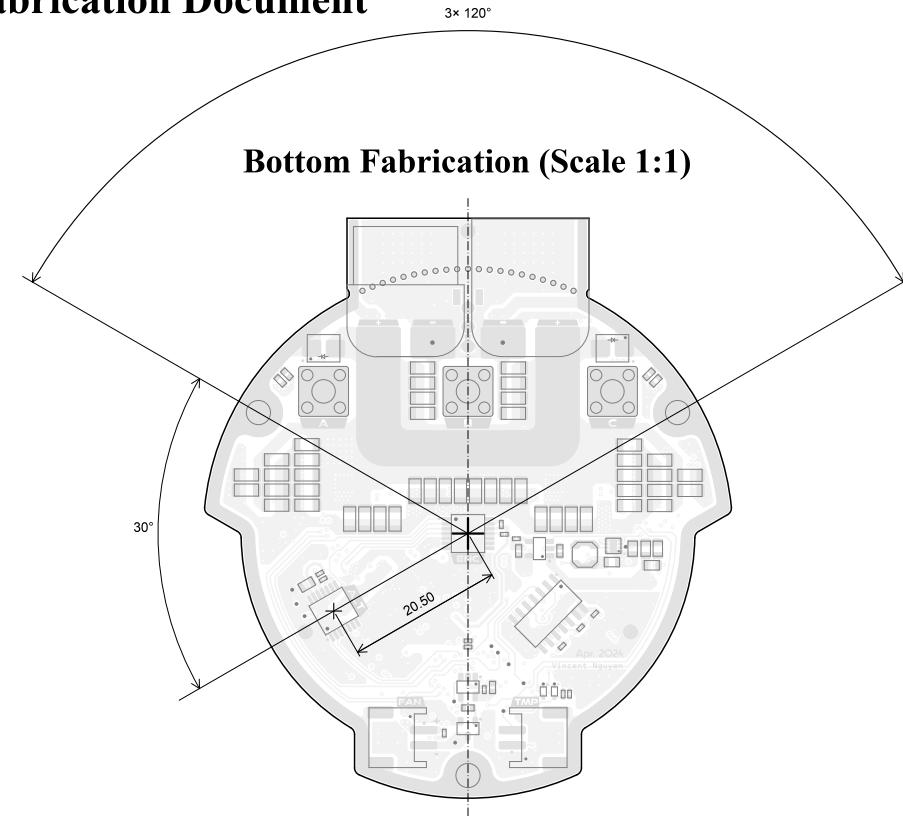
11) REFER TO IMPEDANCE TABLE FOR IMPEDANCE CONTROL REQUIREMENTS.

12) CONFIRM SPACE WIDTHS AND SPACINGS.

D

	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: e6e10e6
	Board Name: <b>Amulet Motion Controller</b>	Project Name: <b>Chienpanzé</b>		
	Sheet Title: Top Fabrication (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13    Revision: 1.1.1+ (Unreleased)
	Sheet Path:	Reviewer:		Size: A4    Sheet: 1 of 12

# Amulet Motion Controller Fabrication Document



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	Sheet Title: Bottom Fabrication (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
	Sheet Path:		Reviewer:	Size: <b>A4</b> Sheet: <b>2</b> of 12

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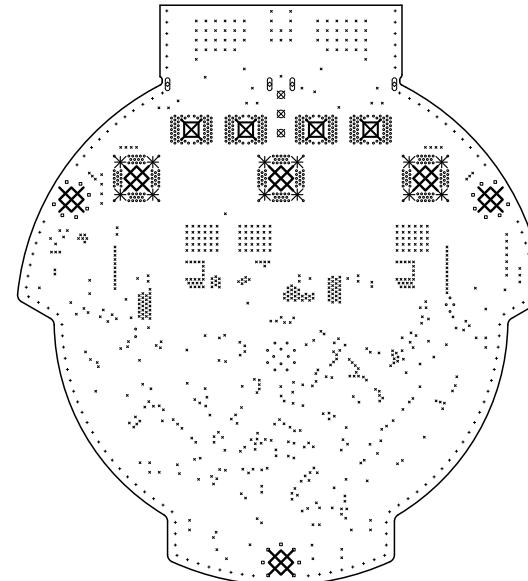
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## Drill Table

Symbol	Count	Hole Size	Plated	Hole Shape	Drill Layer Pair	Hole Type
X	674	0.25mm (9.84mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Via
O	438	0.25mm (9.84mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
+	120	0.30mm (11.81mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Via
□	21	0.50mm (19.69mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
◊	4	0.60mm (23.62mils)	PTH	Slot	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
☒	3	1.00mm (39.37mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
*	12	1.50mm (59.06mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
☒	4	2.70mm (106.30mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
☒	6	3.20mm (125.98mils)	PTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Pad
Total 1282						

Drill Drawing L1 - L6 (Scale 1:1)



B

B

C

C

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D

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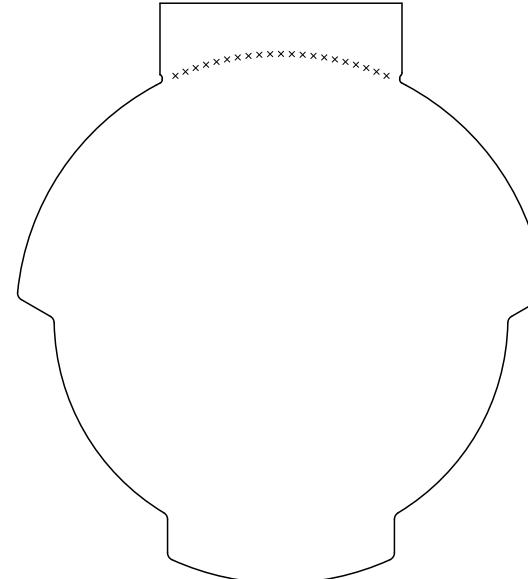
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## Drill Table

Symbol	Count	Hole Size	Plated	Hole Shape	Drill Layer Pair	Hole Type
X	21	0.70mm (27.56mils)	NPTH	Round	L1 (Sig, PWR) - L6 (Sig, PWR)	Mechanical
Total 21						

## Drill Drawing L1 - L6 (Scale 1:1)



B

B

C

C

D

D

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# Amulet Motion Controller Fabrication Document

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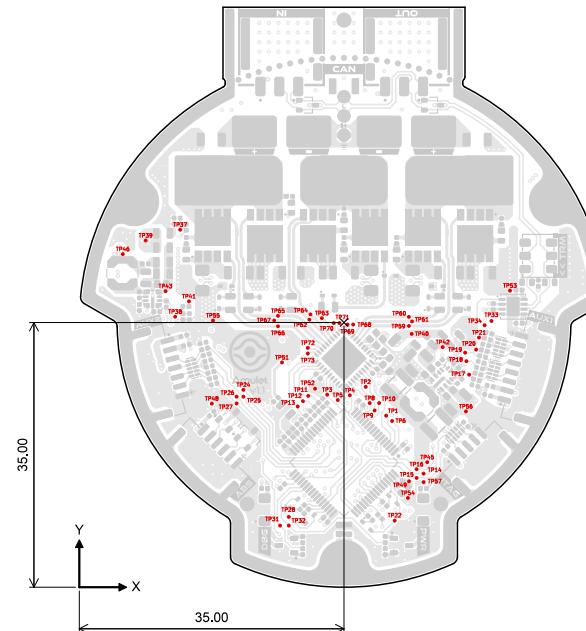
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**Top Test Points (Scale 1:1)**



Ref.	Net	X [mm]	Y [mm]
TP1	MOTOR_ENABLE	40.58	22.69
TP2	MOTOR_HIZ	37.88	26.50
TP3	MOTOR_FAULT	32.78	25.46
TP4	DRV_SCLK	35.77	25.38
TP5	DRV_MISO	34.17	24.75
TP6	DRV_MOSI	41.36	21.98
TP8	PWM_PHASEA	38.40	24.35
TP9	PWM_PHASEB	39.05	23.37
TP10	PWM_PHASEC	39.65	24.35
TP11	SOA	30.28	25.30
TP12	SOB	29.58	24.60
TP13	SOC	28.88	23.90
TP14	SWDIO	45.53	15.02
TP15	SWCLK	44.60	14.45
TP16	NRST	44.60	15.60
TP17	AUX1_A	51.55	28.11
TP18	AUX1_B	51.19	29.89
TP19	AUX1_C	51.02	31.02
TP20	AUX1_D	52.47	31.42
TP21	AUX1_E	52.86	33.02
TP22	AUX1_I2C_PULLUP	41.70	8.80
TP24	AUX2_A	21.70	26.10
TP25	AUX2_B	21.70	25.20
TP26	AUX2_C	20.80	25.20
TP27	AUX2_D	20.80	24.30
TP28	AUX2_I2C_PULLUP	27.70	9.30
TP31	LED_DBG	26.55	8.15
TP32	LED_PWR	27.70	8.15
TP33	FDCAN_RX	54.50	35.20
TP34	FDCAN_TX	53.59	34.64
TP37	SENSE_TEMP_FET	13.34	47.28
TP38	SENSE_VBAT	12.67	35.77

Ref.	Net	X [mm]	Y [mm]
TP39	+VBAT	8.78	45.85
TP40	+VBAT	43.95	33.50
TP41	+VBAT	14.50	37.80
TP42	F_VIN_12V	48.05	31.75
TP43	F_VIN_5V	11.40	39.15
TP45	+12V	46.01	16.53
TP46	+5V	5.75	44.05
TP48	+3V3	17.52	24.28
TP49	+3V3	43.60	14.00
TP51	+A3V3	26.80	29.72
TP52	GND	31.17	26.25
TP53	GND	56.95	39.22
TP54	GND	43.45	11.80
TP55	GND	17.68	35.27
TP56	GND	51.12	23.25
TP57	GND	45.53	13.90
TP59	GHA	43.58	34.55
TP60	GLA	43.58	35.75
TP61	SHA	44.00	35.15
TP62	GHB	30.42	35.38
TP63	GLB	32.07	35.58
TP64	SHB	30.57	36.08
TP65	GHC	26.27	35.88
TP66	GLC	26.27	34.50
TP67	SHC	25.77	35.27
TP68	SA_P	36.22	34.74
TP69	SA_N	35.47	34.74
TP70	SB_P	33.65	34.93
TP71	SB_N	34.40	34.93
TP72	SC_P	30.21	31.65
TP73	SC_N	30.21	30.90

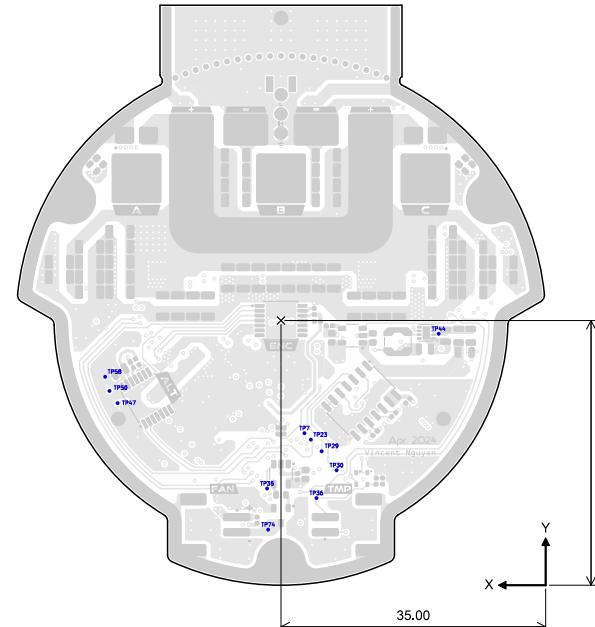
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			CHECKED	
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	Sheet Path:		Reviewer:	Size: A4    Sheet: 5 of 12

# Amulet Motion Controller Fabrication Document

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## Bottom Test Points (Scale 1:1)



Ref.	Net	X [mm]	Y [mm]
TP7	DRV_CS	31.90	20.10
TP23	POS_SENSOR_CS	31.05	19.25
TP29	RS422_RE	29.63	17.71
TP30	RS422_DE	27.65	15.20
TP35	FAN_CTRL	36.84	12.79
TP36	SENSE_TEMP_MOT	30.31	11.52
TP44	F_VIN_3V3	14.15	33.25
TP47	+5V	56.61	24.08
TP50	+3V3	57.68	25.69
TP58	GND	58.25	27.56
TP74	FAN_SW	36.70	7.35

B

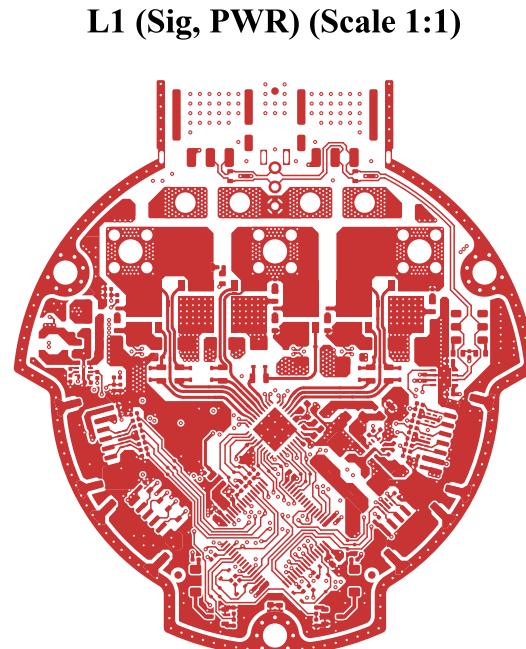
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D

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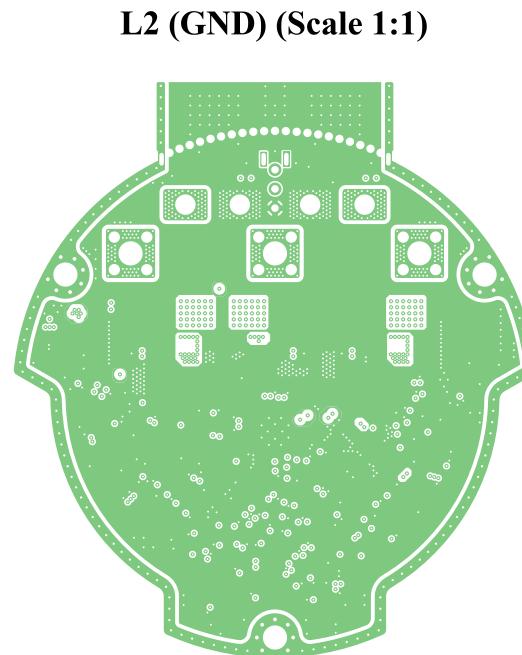
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**L1 (Sig, PWR) (Scale 1:1)**

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	Sheet Title: L1 (Sig, PWR) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
	Sheet Path:		Reviewer:	Size: <b>A4</b> Sheet: <b>7</b> of <b>12</b>

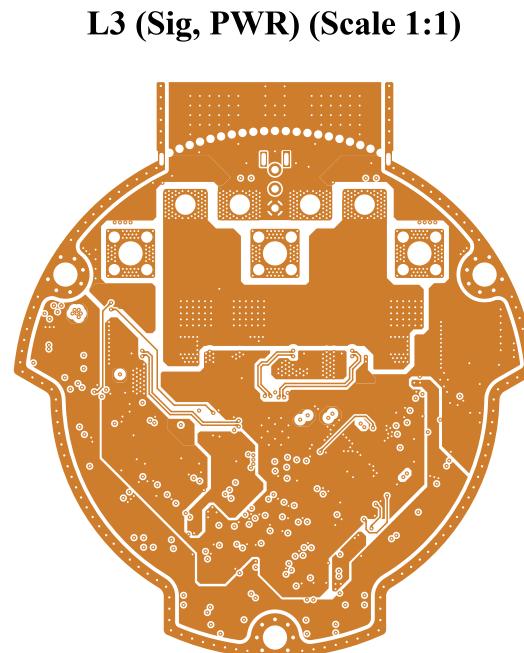
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**L2 (GND) (Scale 1:1)**

	Comments:	Company: EPFL Xplore Research	Variant: CHECKED	Git Hash: e6e10e6
	Board Name: <b>Amulet Motion Controller</b>	Project Name: <b>Chienpanzé</b>		
	Sheet Title: L2 (GND) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
	Sheet Path:		Reviewer:	Size: <b>A4</b> Sheet: <b>8</b> of <b>12</b>

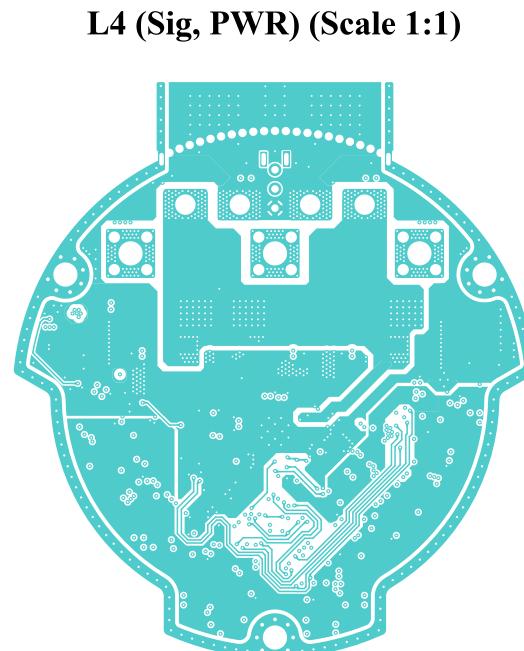
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**L3 (Sig, PWR) (Scale 1:1)**

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	Sheet Title: L3 (Sig, PWR) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
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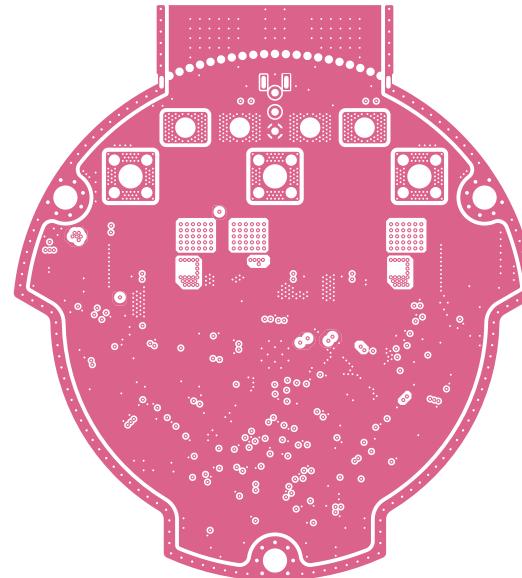


**L4 (Sig, PWR) (Scale 1:1)**

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	Board Name: <b>Amulet Motion Controller</b>	Project Name: <b>Chienpanzé</b>		
	Sheet Title: L4 (Sig, PWR) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
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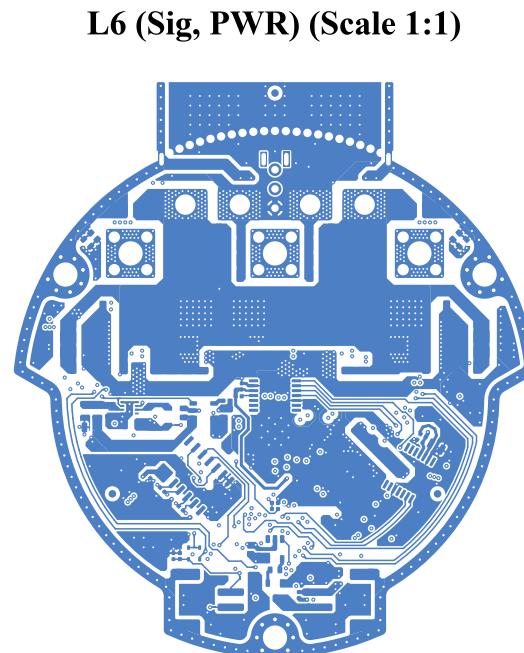
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L5 (GND) (Scale 1:1)



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	Sheet Title: L5 (GND) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
	Sheet Path:		Reviewer:	Size: <b>A4</b> Sheet: <b>11</b> of <b>12</b>

# Amulet Motion Controller Fabrication Document



**L6 (Sig, PWR) (Scale 1:1)**

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	Sheet Title: L6 (Sig, PWR) (Scale 1:1)	File Name: amulet_controller.kicad_pcb	Designer: Vincent Nguyen	Date: 2024-04-13      Revision: 1.1.1+ (Unreleased)
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