

# Amulet Motion Controller Fabrication Document

A

## Layer Stack Legend

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

Total thickness: 1.66mm

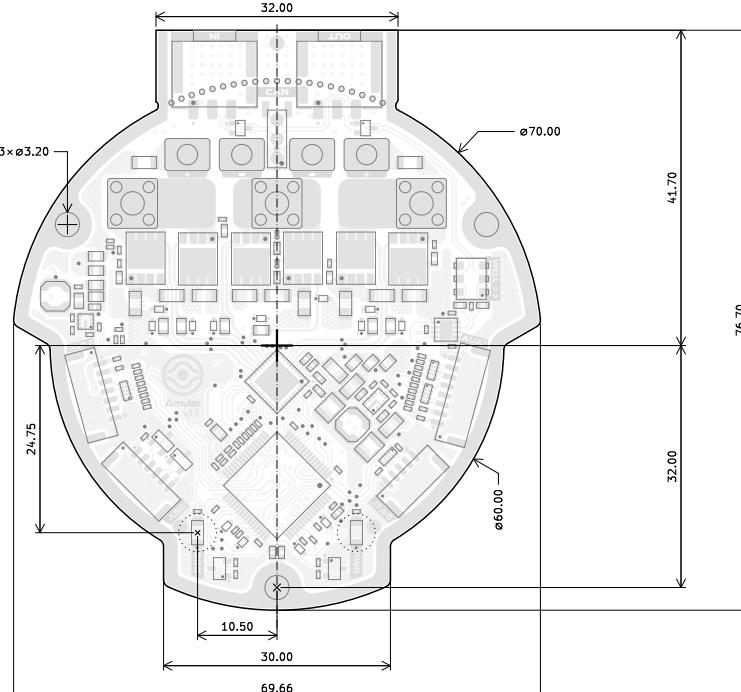
Note: external layer thicknesses are specified after plating

## FABRICATION NOTES (UNLESS OTHERWISE SPECIFIED)

- OUTLINE DEFINED IN SEPARATE GERBER FILE WITH "Edge\_Cuts.GBR" SUFFIX.  
DIMENSIONS OF CIRCUMSIZEZED RECTANGLE SHOWN ON THIS DWG FOR REF ONLY.
- SEE SEPARATE DRILL FILES WITH ".DRL" SUFFIX FOR HOLE LOCATIONS.  
SELECTED HOLE LOCATIONS SHOWN ON THIS DWG FOR REF ONLY.
- IMPEDANCE CONTROL REQUIRED.  
Microstrip 100-Ohm Differential (L1 ref. L2)  
0.2032mm width, 0.28mm spacing
- CONFIRM TRACE WIDTHS AND SPACINGS.
- DESIGN GEOMETRY MINIMUM FEATURE SIZES:  

|                  |          |
|------------------|----------|
| TRACE WIDTH      | 0.20 mm  |
| TRACE TO TRACE   | 0.20 mm  |
| MIN. HOLE (PTH)  | 0.25 mm  |
| MIN. HOLE (NPTH) | 0.70 mm  |
| ANNULEAR RING    | 0.15 mm  |
| COPPER TO HOLE   | 0.254 mm |
| COPPER TO EDGE   | 0.25 mm  |
| HOLE TO HOLE     | 0.254 mm |

## Top Fabrication (Scale 1:1)



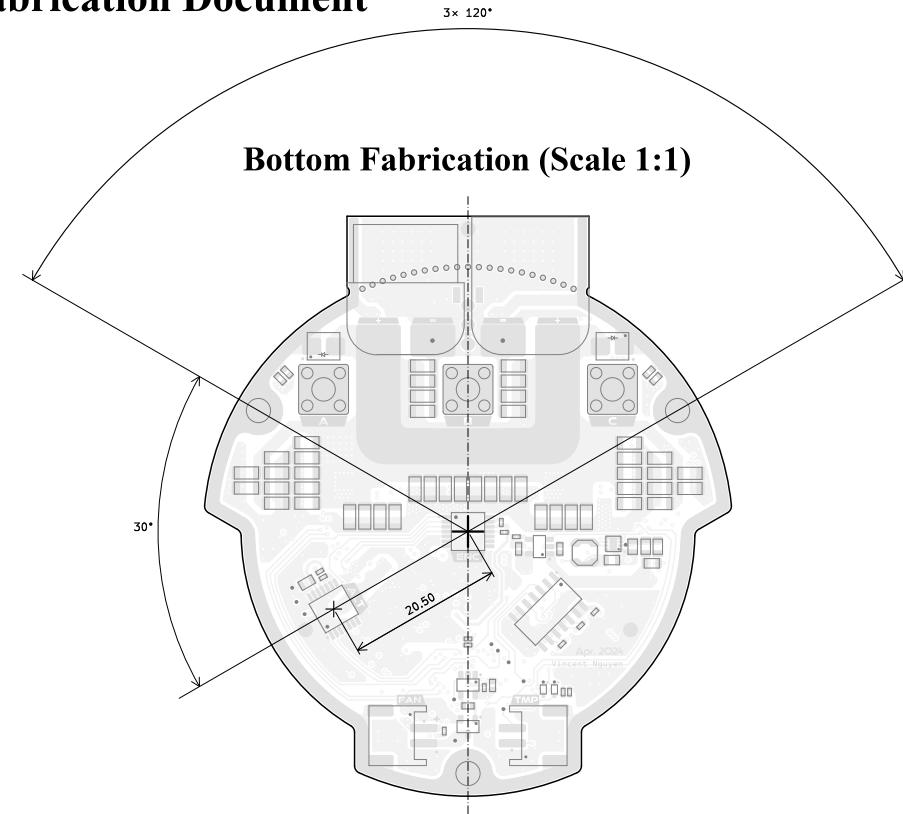
All dimensions are in millimeters unless otherwise specified.

C

D

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research          | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                    |
|  | Board Name:<br><b>Amulet Motion Controller</b> |   |                             | Project Name:<br><b>Chienpanzé</b>                      |
|  | Sheet Title:<br>Top Fabrication (Scale 1:1)    | File Name:<br>amulet_controller.kicad_pcb | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13    Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>1</b> of 11             |

# Amulet Motion Controller Fabrication Document



All dimensions are in millimeters unless otherwise specified.

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research          | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> |   |                             | Project Name:<br><b>Chienpanzé</b>                        |
|  | Sheet Title:<br>Bottom Fabrication (Scale 1:1) | File Name:<br>amulet_controller.kicad_pcb | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>2</b> of 11               |

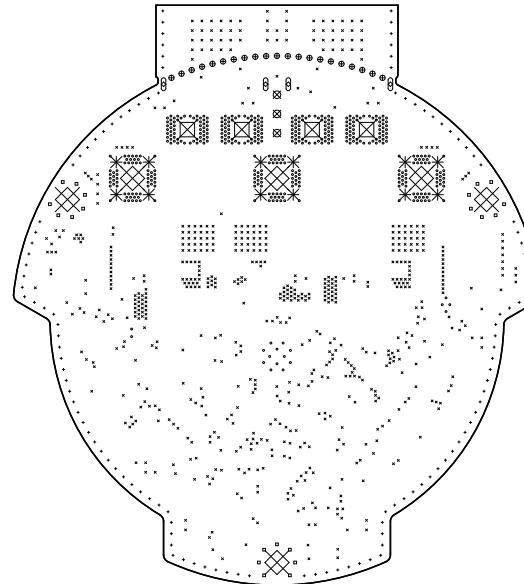
# Amulet Motion Controller Fabrication Document

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| Symbol | Count    | Hole Size | Plated   |
|--------|----------|-----------|----------|
| •      | 674      | 0.25mm    | Plated   |
| •      | 438      | 0.25mm    | Plated   |
| •      | 120      | 0.30mm    | Plated   |
| ▫      | 21       | 0.50mm    | Plated   |
| ◊      | 4 (slot) | 0.60mm    | Plated   |
| ☒      | 3        | 1.00mm    | Plated   |
| ✳      | 12       | 1.50mm    | Plated   |
| ☒      | 4        | 2.70mm    | Plated   |
| ☒      | 6        | 3.20mm    | Plated   |
| ●      | 21       | 0.70mm    | Unplated |

**Drill Drawing Top View (Scale 1:1)**



B

B

C

C

D

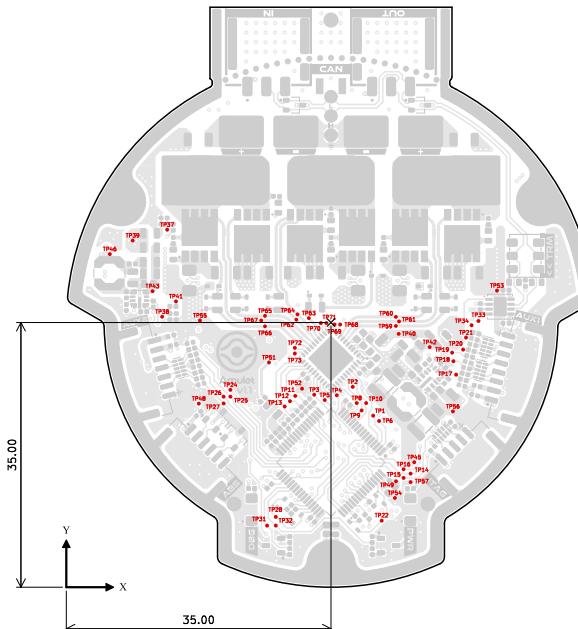
D

|  |  |  |                             |                                    |                                  |
|--|--|--|-----------------------------|------------------------------------|----------------------------------|
|  | Comments:  | Company:<br>EPFL Xplore Research               |                             | Variant:                           | Git Hash:                        |
|  |  | Board Name:<br><b>Amulet Motion Controller</b> |                             | Project Name:<br><b>Chienpanzé</b> |                                  |
|  | Sheet Title:<br>Drill Drawing Top View (Scale 1:1) | File Name:<br>amulet_controller.kicad_pcb      | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13                | Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:  |  | Reviewer:                   | Size:<br><b>A4</b>                 | Sheet:<br><b>3</b> of <b>11</b>  |

# Amulet Motion Controller Fabrication Document

| Ref. | Net             | X       | Y       |
|------|-----------------|---------|---------|
| TP1  | MOTOR_ENABLE    | 40.5766 | 22.6861 |
| TP2  | MOTOR_HIZ       | 37.8754 | 26.4999 |
| TP3  | MOTOR_FAULT     | 32.7804 | 25.4599 |
| TP4  | DRV_SCLK        | 35.7704 | 25.3799 |
| TP5  | DRV_MISO        | 34.1704 | 24.7499 |
| TP6  | DRV_MOSI        | 41.3617 | 21.9806 |
| TP8  | PWM_PHASEA      | 38.4004 | 24.3499 |
| TP9  | PWM_PHASEB      | 39.0504 | 23.3749 |
| TP10 | PWM_PHASEC      | 39.6504 | 24.3499 |
| TP11 | SOA             | 30.2754 | 25.2999 |
| TP12 | SOB             | 29.5754 | 24.5999 |
| TP13 | SOC             | 28.8754 | 23.8999 |
| TP14 | SWDIO           | 45.5254 | 15.0249 |
| TP15 | SWCLK           | 44.6004 | 14.4499 |
| TP16 | NRST            | 44.6004 | 15.5999 |
| TP17 | AUX1_A          | 51.5477 | 28.1109 |
| TP18 | AUX1_B          | 51.1875 | 29.8875 |
| TP19 | AUX1_C          | 51.0189 | 31.0189 |
| TP20 | AUX1_D          | 52.4750 | 31.4250 |
| TP21 | AUX1_E          | 52.8566 | 33.0161 |
| TP22 | AUX1_I2C_PULLUP | 41.7004 | 8.7999  |
| TP24 | AUX2_A          | 21.7004 | 26.0999 |
| TP25 | AUX2_B          | 21.7004 | 25.1999 |
| TP26 | AUX2_C          | 20.8004 | 25.1999 |
| TP27 | AUX2_D          | 20.8004 | 24.2999 |
| TP28 | AUX2_I2C_PULLUP | 27.7004 | 9.2999  |
| TP31 | LED_DBG         | 26.5504 | 8.1499  |
| TP32 | LED_PWR         | 27.7004 | 8.1499  |
| TP33 | FDCAN_RX        | 54.5004 | 35.2044 |
| TP34 | FDCAN_TX        | 53.5904 | 34.6399 |
| TP37 | SENSE_TEMP_FET  | 13.3400 | 47.2800 |
| TP38 | SENSE_VBAT      | 12.6749 | 35.7749 |
| TP39 | +VBAT           | 8.7754  | 45.8499 |
| TP40 | +VBAT           | 43.9504 | 33.4999 |
| TP41 | +VBAT           | 14.5004 | 37.7999 |
| TP42 | F_VIN_12V       | 48.0504 | 31.7499 |
| TP43 | F_VIN_5V        | 11.4004 | 39.1499 |
| TP45 | +12V            | 46.0104 | 16.5299 |
| TP46 | +5V             | 5.7504  | 44.0499 |
| TP48 | +3V3            | 17.5204 | 24.2799 |
| TP49 | +3V3            | 43.6004 | 13.9999 |
| TP51 | +A3V3           | 26.8004 | 29.7249 |
| TP52 | GND             | 31.1750 | 26.2500 |
| TP53 | GND             | 56.9504 | 39.2249 |
| TP54 | GND             | 43.4504 | 11.7999 |
| TP55 | GND             | 17.6754 | 35.2749 |
| TP56 | GND             | 51.1232 | 23.2471 |
| TP57 | GND             | 45.5254 | 13.8999 |
| TP59 | GHA             | 43.5804 | 34.5499 |
| TP60 | GLA             | 43.5804 | 35.7499 |
| TP61 | SHA             | 44.0004 | 35.1499 |
| TP62 | GHB             | 30.4189 | 35.3799 |
| TP63 | GLB             | 32.0704 | 35.5799 |
| TP64 | SHB             | 30.5675 | 36.0799 |
| TP65 | GHC             | 26.2704 | 35.8835 |
| TP66 | GLC             | 26.2704 | 34.4999 |
| TP67 | SHC             | 25.7704 | 35.2749 |
| TP68 | SA_P            | 36.2167 | 34.7396 |
| TP69 | SA_N            | 35.4667 | 34.7396 |
| TP70 | SB_P            | 33.6511 | 34.9263 |
| TP71 | SB_N            | 34.4011 | 34.9263 |
| TP72 | SC_P            | 30.2139 | 31.6529 |
| TP73 | SC_N            | 30.2139 | 30.9029 |

Top Test Points (Scale 1:1)



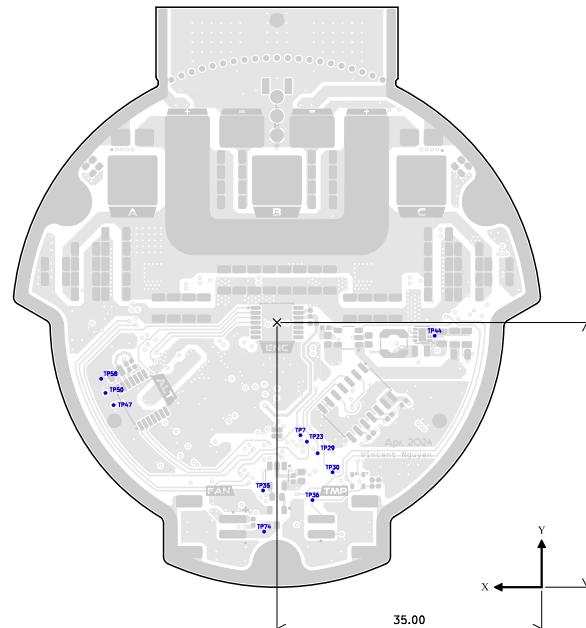
All dimensions are in millimeters unless otherwise specified.

|  |                             |                             |  |            |                     |                         |
|--|-----------------------------|-----------------------------|--|------------|---------------------|-------------------------|
|  | Comments:                   | Company:                    |  EPFL Xplore Research | Variant:   | Checked             | Git Hash:               |
|  | Board Name:                 | Project Name:               |  |            |                     |                         |
|  | Amulet Motion Controller    | File Name:                  | Designer:  | Date:      | Revision:           | D                       |
|  | Sheet Title:                |                             |  |            |                     |                         |
|  | Top Test Points (Scale 1:1) | amulet_controller.kicad_pcb | Vincent Nguyen   | 2024-04-13 | 1.1.1+ (Unreleased) | Sheet:<br>A4<br>4 of 11 |
|  | Sheet Path:                 | Reviewer:                   | Size:  |            |                     |                         |

# Amulet Motion Controller Fabrication Document

| Ref. | Net            | X       | Y       |
|------|----------------|---------|---------|
| TP7  | DRV_CS         | 31.9004 | 20.0999 |
| TP23 | POS_SENSOR_CS  | 31.0504 | 19.2499 |
| TP29 | RS422_RX       | 29.6284 | 17.7083 |
| TP30 | RS422_DE       | 27.6504 | 15.1999 |
| TP35 | FAN_CTRL       | 36.8394 | 12.7906 |
| TP36 | SENSE_TEMP_MOT | 30.3132 | 11.5244 |
| TP44 | F_VIN_3V3      | 14.1504 | 33.2499 |
| TP47 | +5V            | 56.6093 | 24.0781 |
| TP50 | +3V3           | 57.6804 | 25.6899 |
| TP58 | GND            | 58.2504 | 27.5649 |
| TP74 | FAN_SW         | 36.7004 | 7.3499  |

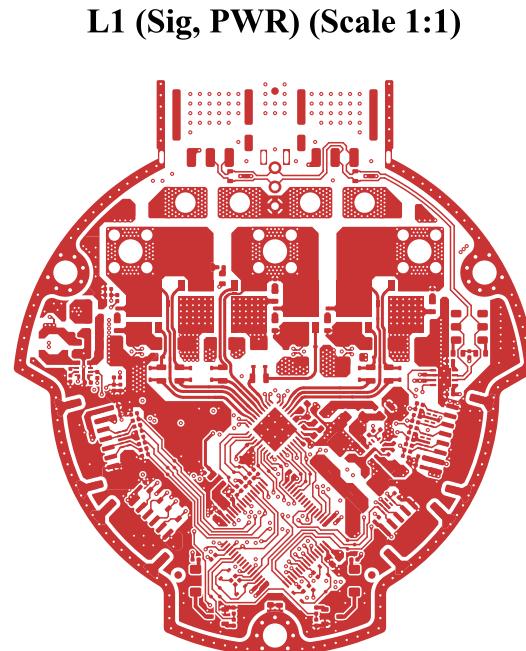
## Bottom Test Points (Scale 1:1)



All dimensions are in millimeters unless otherwise specified.

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research<br> | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                    |
|  | Board Name:<br><b>Amulet Motion Controller</b> |   |                             | Project Name:<br><b>Chienpanzé</b>                      |
|  | Sheet Title:<br>Bottom Test Points (Scale 1:1) | File Name:<br>amulet_controller.kicad_pcb   | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13    Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>5</b> of <b>11</b>      |

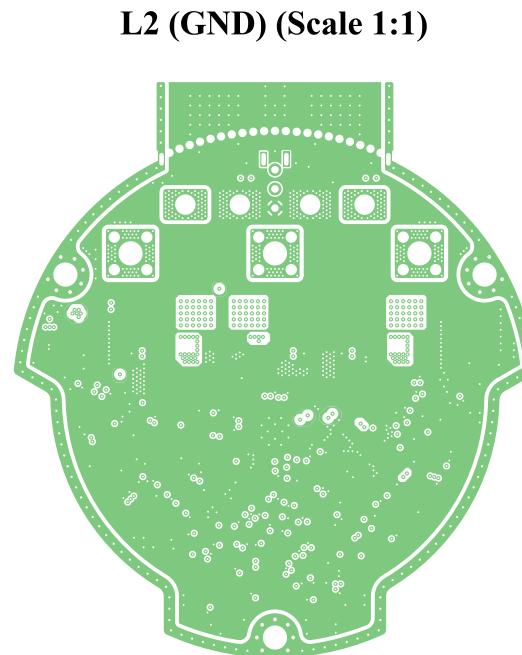
# Amulet Motion Controller Fabrication Document



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

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research<br> | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>  |                             |   |
|  | Sheet Title:<br>L1 (Sig, PWR) (Scale 1:1)      | File Name:<br>amulet_controller.kicad_pcb   | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>6</b> of <b>11</b>        |

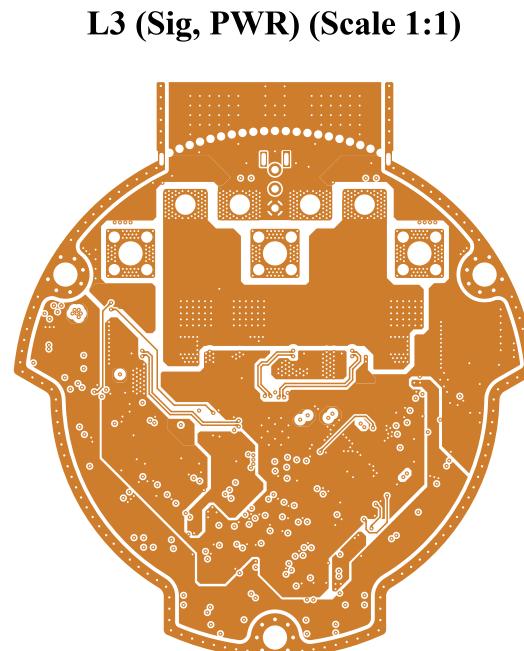
# Amulet Motion Controller Fabrication Document



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

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research<br> | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>  |                             |   |
|  | Sheet Title:<br>L2 (GND) (Scale 1:1)           | File Name:<br>amulet_controller.kicad_pcb   | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>7</b> of <b>11</b>        |

# Amulet Motion Controller Fabrication Document

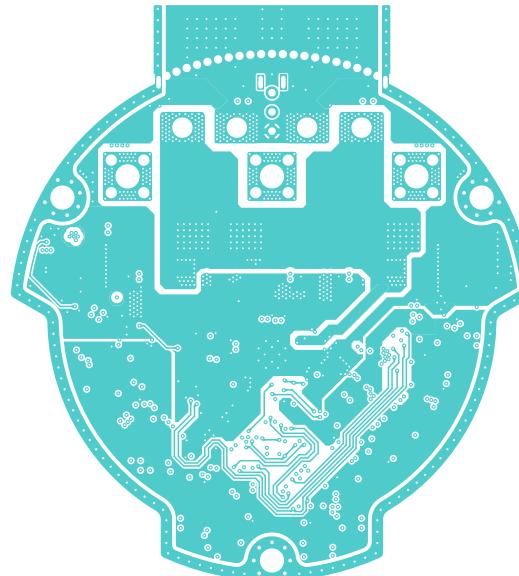


L3 (Sig, PWR) (Scale 1:1)

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research<br> | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>  |                             |   |
|  | Sheet Title:<br>L3 (Sig, PWR) (Scale 1:1)      | File Name:<br>amulet_controller.kicad_pcb   | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>8</b> of <b>11</b>        |

# Amulet Motion Controller Fabrication Document

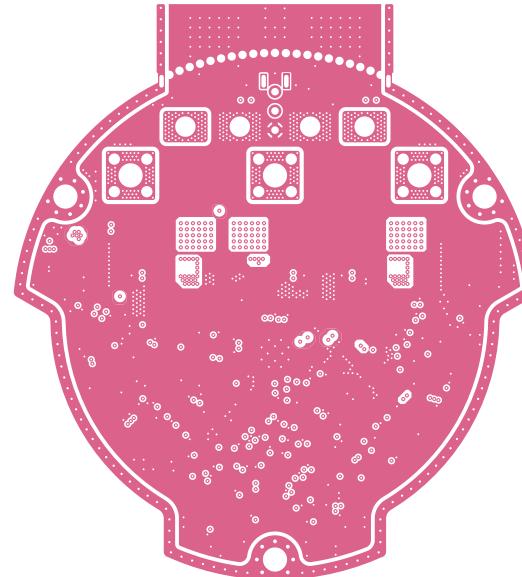
L4 (Sig, PWR) (Scale 1:1)



|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research          | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>        |                             |   |
|  | Sheet Title:<br>L4 (Sig, PWR) (Scale 1:1)      | File Name:<br>amulet_controller.kicad_pcb | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>9</b> of 11               |

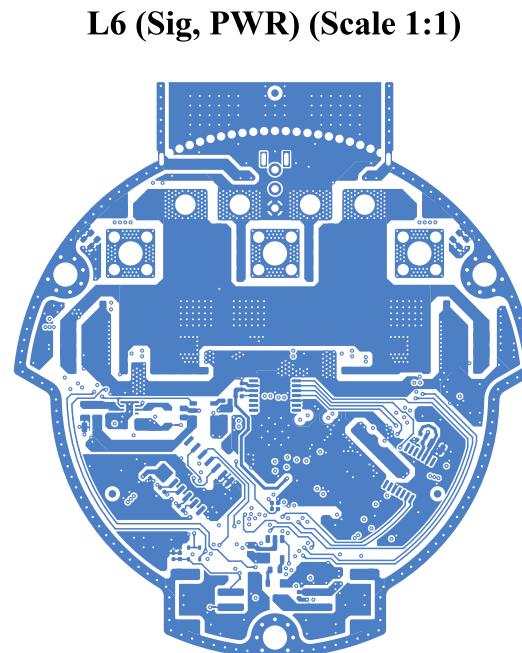
# Amulet Motion Controller Fabrication Document

L5 (GND) (Scale 1:1)



|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research<br> | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>  |                             |   |
|  | Sheet Title:<br>L5 (GND) (Scale 1:1)           | File Name:<br>amulet_controller.kicad_pcb   | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>10</b> of <b>11</b>       |

# Amulet Motion Controller Fabrication Document



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

|  |  |   |                             |   |
|--|--|---|-----------------------------|---|
|  | Comments:                                      | Company:<br>EPFL Xplore Research          | Variant:<br>CHECKED         | Git Hash:<br>50c27cd                                      |
|  | Board Name:<br><b>Amulet Motion Controller</b> | Project Name:<br><b>Chienpanzé</b>        |                             |   |
|  | Sheet Title:<br>L6 (Sig, PWR) (Scale 1:1)      | File Name:<br>amulet_controller.kicad_pcb | Designer:<br>Vincent Nguyen | Date:<br>2024-04-13      Revision:<br>1.1.1+ (Unreleased) |
|  | Sheet Path:                                    |   | Reviewer:                   | Size:<br><b>A4</b> Sheet:<br><b>11</b> of <b>11</b>       |