

Layer Name	Type	Material	Thickness (mm)	Color	Epsilon R	Loss Tangent
F.Silkscreen	Top Silk Screen	Not specified	0 mm	White	1	0
F.Paste	Top Solder Paste		0 mm		1	0
F.Mask	Top Solder Mask	Not specified	0.01 mm	Green	3.3	0
F.Cu	copper		0.035 mm		1	0
Dielektrikum 1	prepreg	FR4	0.138 mm	FR4 natural	4.5	0.02
In1.Cu	copper		0.035 mm		1	0
Dielektrikum 2	core	FR4	1.13 mm	FR4 natural	4.5	0.02
In2.Cu	copper		0.035 mm		1	0
Dielektrikum 3	prepreg	FR4	0.138 mm	FR4 natural	4.5	0.02
B.Cu	copper		0.035 mm		1	0
B.Mask	Bottom Solder Mask	Not specified	0.01 mm	Green	3.3	0
B.Paste	Bottom Solder Paste		0 mm		1	0
B.Silkscreen	Bottom Silk Screen	Not specified	0 mm	White	1	0

Manufacturability/DFM

- Edge clearance:
- Copper: 0.6 mm (humidity), at break-out tabs: 1.5 mm
  - Parts: 3 mm, 1 mm with edge rails (line transport de-panelization, pick & place)
  - Test points: 2.5 mm
  - Fiducials: 4 mm
  - Silkscreen: 0.4 mm

- Edge clearance for assembly:
- 1.5 mm distance from mounting hole screw head area to control board edge (assembly).

- PTH:
- FR-4: Ø ≥0.2 mm, distance: 0.5 mm (= 0.7 mm center/center)

- NPTH:
- FR-4: Ø ≥0.6 mm, distance: 0.5 mm (= 1.1 mm center/center)
  - Al, 1 layer: Ø ≥1 mm, distance: 0.5 mm (= 1.5 mm center/center)

- Slot PTH:
- Aisler: Ø 0.7..2.6 mm, annular ring ≥0.3 mm

- Slot NPTH:
- Aisler: Ø ≥0.8 (preferred 1.8 mm)

- Depanelization:
- Board edge mill: Ø 2 mm
  - Edge rail: ≥5 mm (incl. milling, if break-away tabs are used)
  - Break-away tab width: ≥2 mm
  - Mouse bite: see NPTH

- Isolation:
- Int. & ext. layers ≤30 V: 0.2 mm (manufacturability, IPC2221: 0.1 mm)
  - Int. layers ≤100 V: 0.2 mm (manufacturability, IPC2221: 0.1 mm)
  - Ext. layers ≤100 V: 0.6 mm (altitude ≤3 km MSL)
  - Ext. layers. 1.8 mm clearance from mounting hole screw head area (IEC 60664-1: OVC III, 100 V, PD2, mat. IIIa, alt. 3 km).

Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet:  
File: bmm.kicad\_pcb

Title: Battery module manager (BMM)

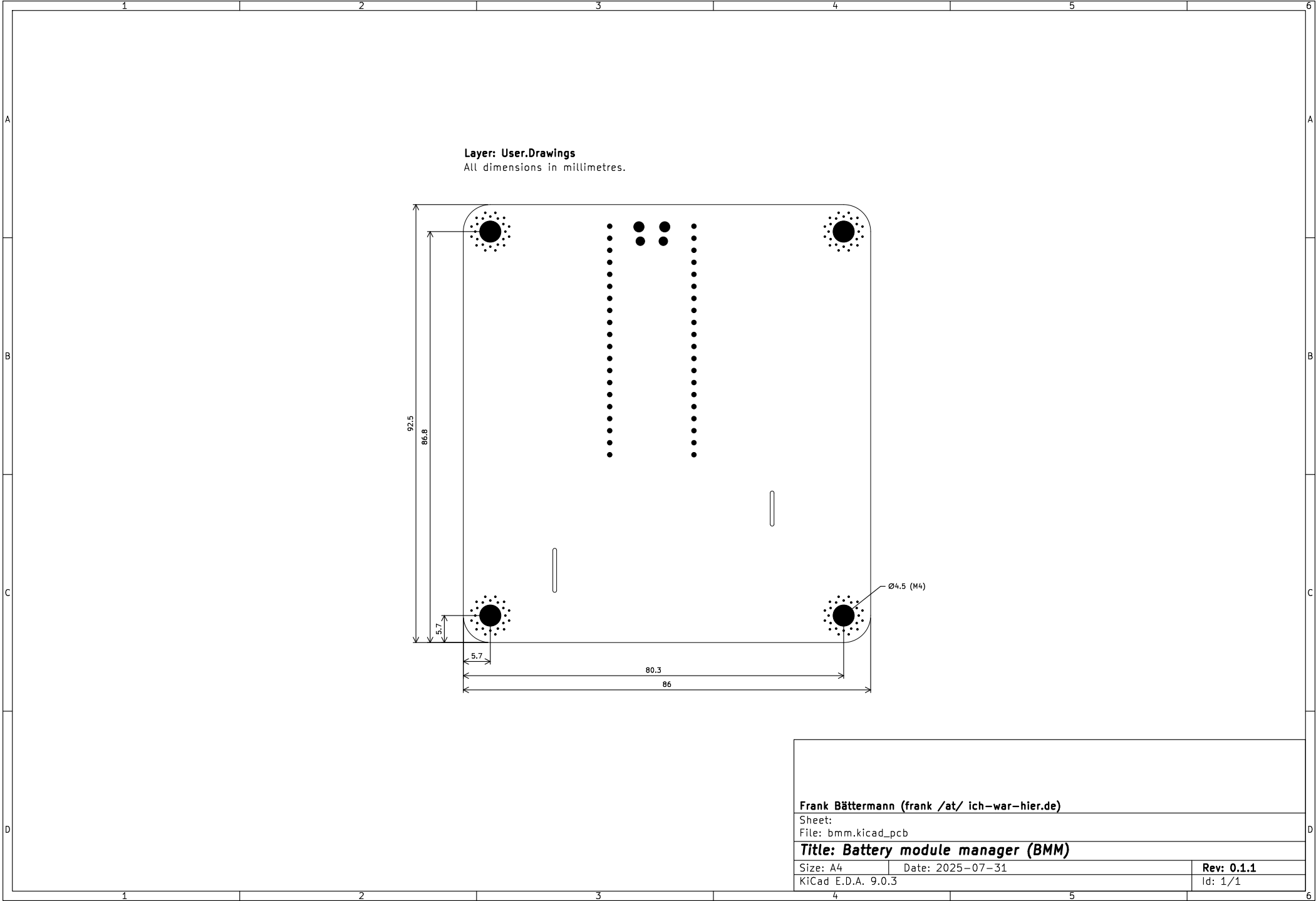
Size: A4

Date: 2025-07-31

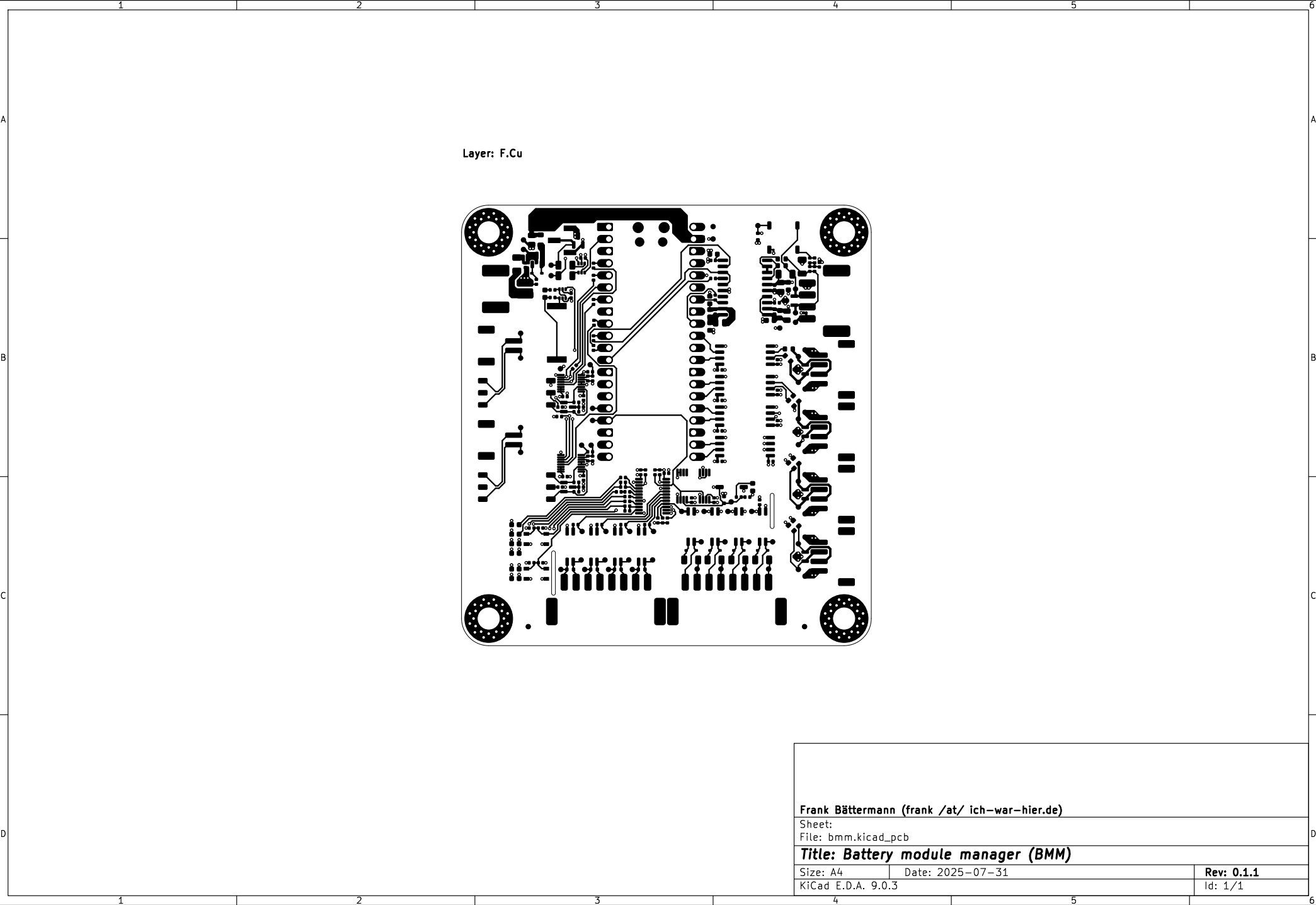
Rev: 0.1.1

KiCad E.D.A. 9.0.3

Id: 1/1



Id: 1/1



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet:  
File: bmm.kicad\_pcb

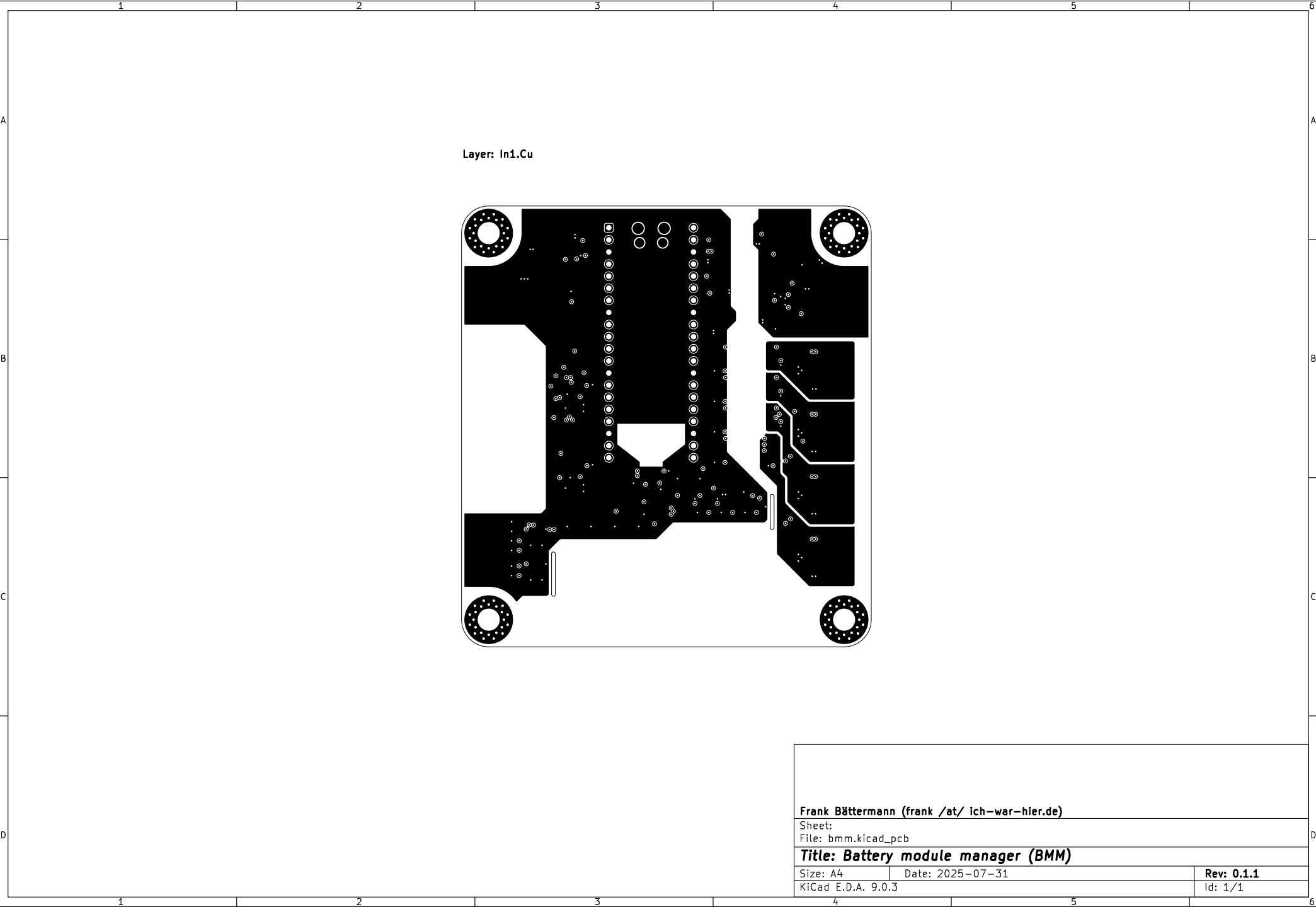
**Title: Battery module manager (BMM)**

Size: A4  
KiCad E.D.A. 9.0.3

Date: 2025-07-31

Rev: 0.1.1  
Id: 1/1

D



Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet:  
File: bmm.kicad\_pcb

**Title: Battery module manager (BMM)**

Size: A4  
KiCad E.D.A. 9.0.3

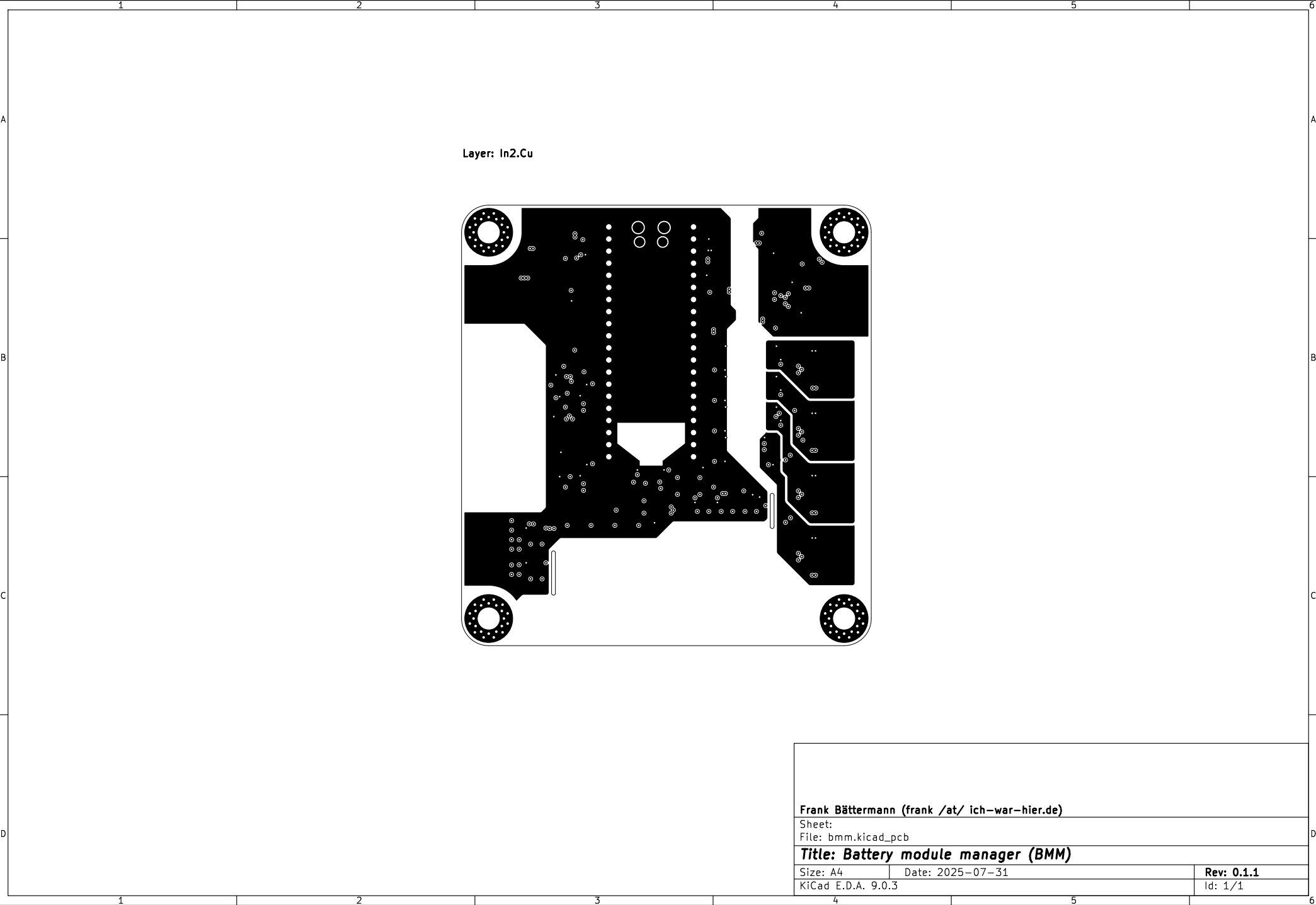
Date: 2025-07-31

Rev: 0.1.1  
Id: 1/1

4

5

6



Layer: In2.Cu

Frank Bättermann (frank /at/ ich-war-hier.de)

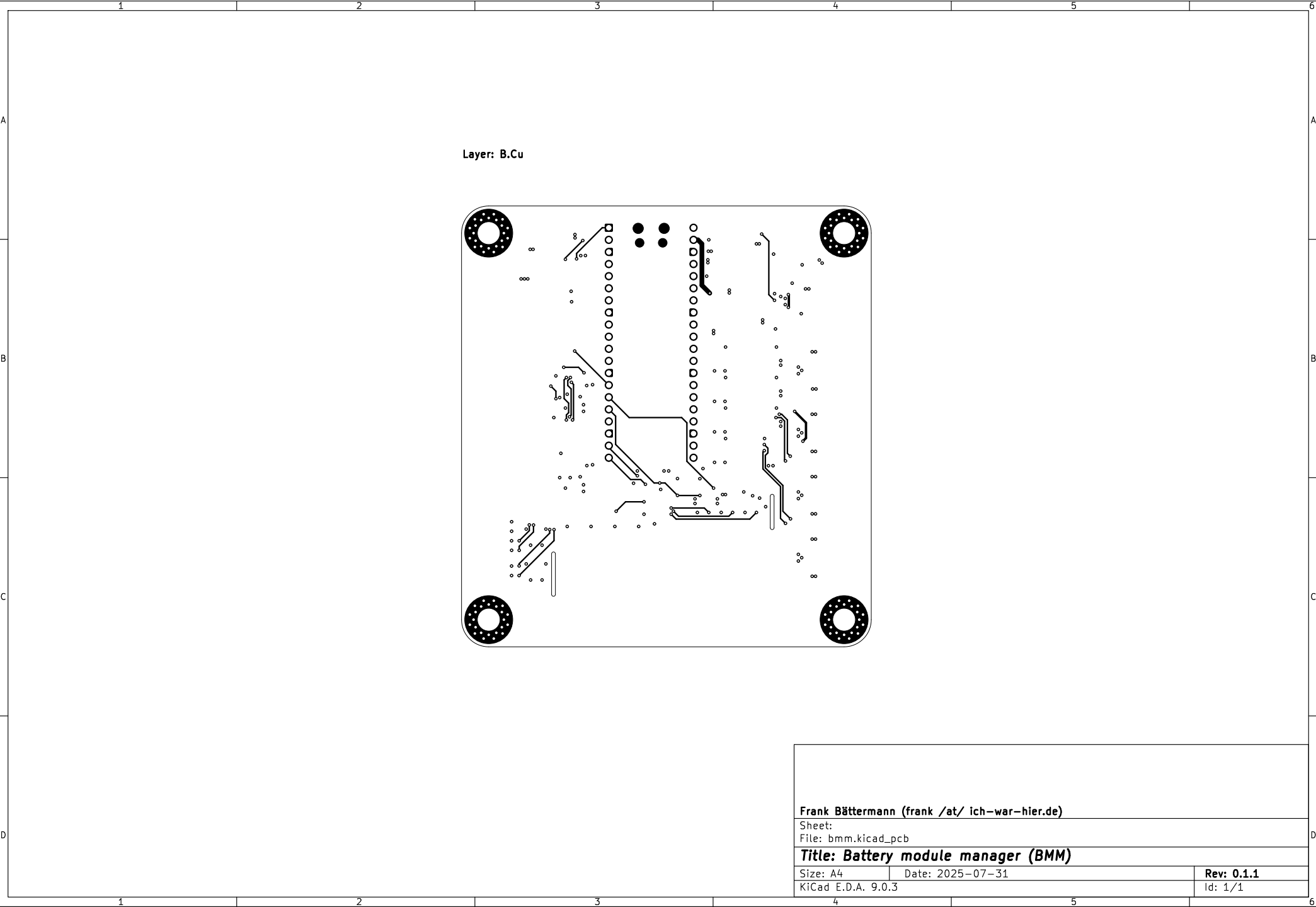
Sheet:  
File: bmm.kicad\_pcb

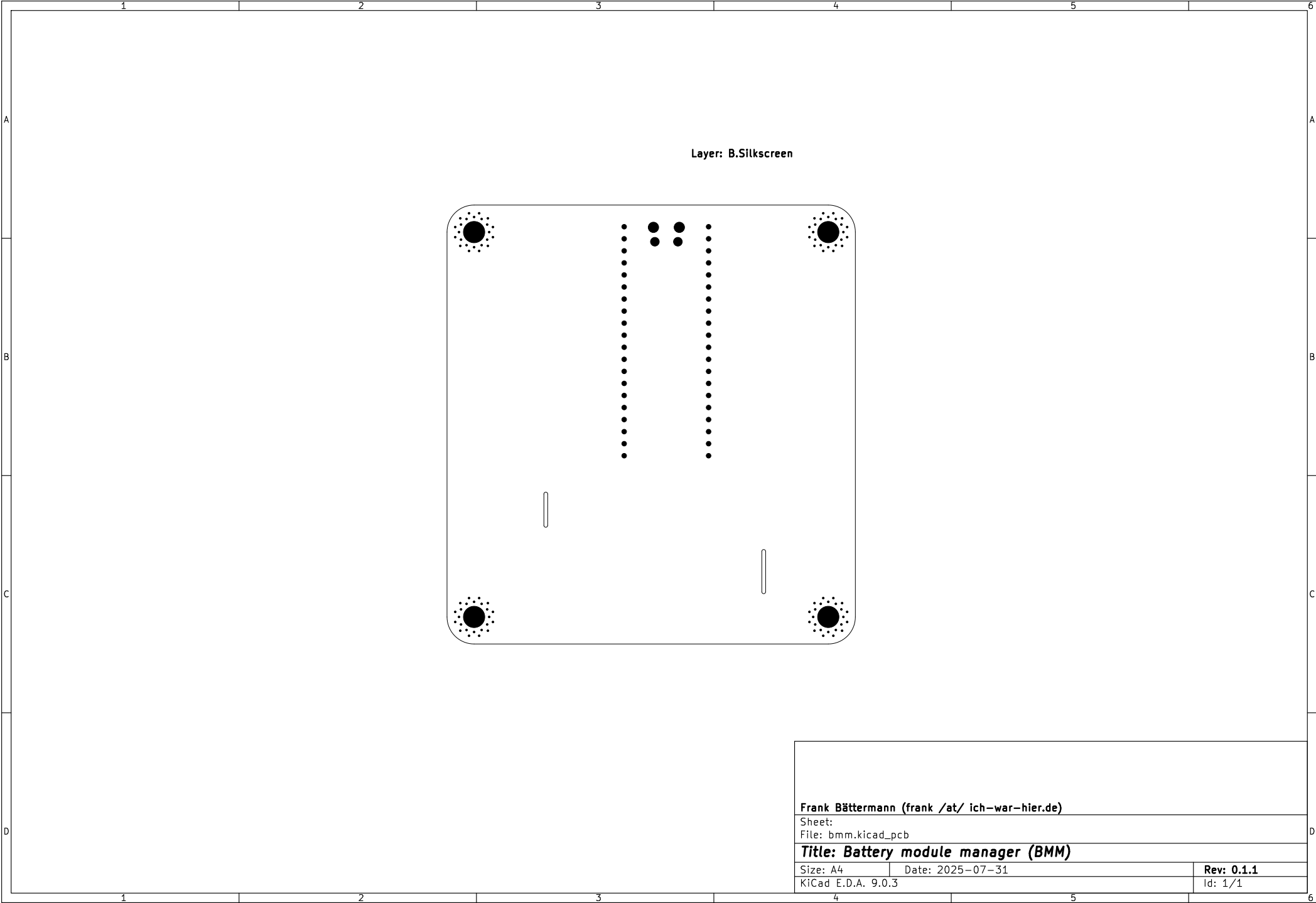
**Title: Battery module manager (BMM)**

Size: A4 Date: 2025-07-31

KiCad E.D.A. 9.0.3

Rev: 0.1.1  
Id: 1/1







	1	2	3	4	5	6
A	<div>Revision history</div> <div>0.1.1 (2025-07-31)<ul style="list-style-type: none"><li>Replaced R43-R48 with 1.3kΩ.</li><li>Added 1kΩ pull-up on SPI MISO (LTC6820 Pin 3 is open drain output)</li><li>Added pull-ups for digital inputs (R29-R32).</li><li>Removed slot underneath digital inputs.</li><li>Added polarity indication in silkscreen for digital I/Os.</li><li>Eliminated four solitary 0.3/0.7mm vias.</li><li>Bump to KiCad 9</li></ul></div> <div>0.1.0 (2024-05-18)<ul style="list-style-type: none"><li>First revision</li></ul></div>					<div>Version number: X.Y.Z</div> <div>X+1: Changes on interfaces, downwards compatibility is not ensured, changes on provisions</div> <div>Y+1: Changes without impact on interfaces, downwards compatibility is ensured, improvements</div> <div>Z+1: Formal changes, spelling mistakes, corrections</div>
B						
C						
D						<div></div> <div>Frank Bättermann (frank /at/ ich-war-hier.de)</div> <div>Sheet:</div> <div>File: bmm.kicad_pcb</div> <div>Title: <b>Battery module manager (BMM)</b></div> <div>Size: A4Date: 2025-07-31</div> <div>KiCad E.D.A. 9.0.3Rev: 0.1.1Id: 1/1</div>
	1	2	3	4	5	6

1	2	3	4	5	6
A					A
B					B
C					C
D					D
1	2	3	4	5	6

Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet:  
File: bmm.kicad\_pcb

**Title: Battery module manager (BMM)**

Size: A4	Date: 2025-07-31	Rev: 0.1.1
KiCad E.D.A. 9.0.3	Id: 1/1	

1	2	3	4	5	6
A					A
B					B
C					C
D					D
1	2	3	4	5	6

Frank Bättermann (frank /at/ ich-war-hier.de)

Sheet:  
File: bmm.kicad\_pcb

**Title: Battery module manager (BMM)**

Size: A4	Date: 2025-07-31	Rev: 0.1.1
KiCad E.D.A. 9.0.3	Id: 1/1	