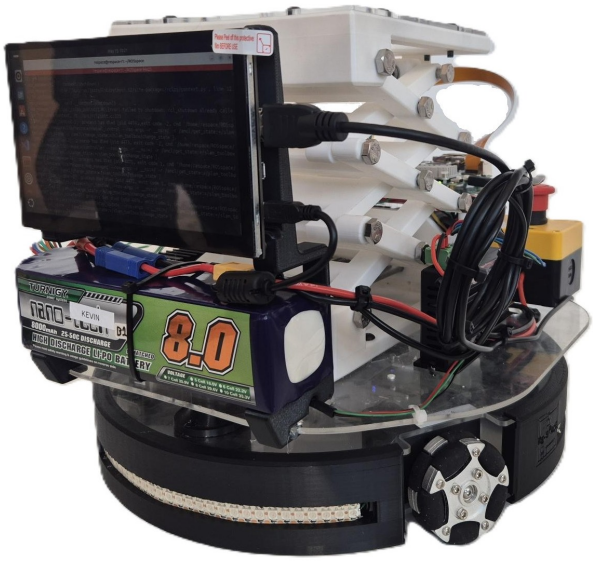
K3VN Datasheet

1 Components

- Wheels X3
- Wheel motors X3
- Lift Motor
- LIDAR
- Camera
- Robot Single Board Computer
- Secondary microcontroller
- PCB
- Battery
- Neopixel LED Strips
- 2X microswitches
- 4X 8mm Guide Rods
- 4X Linear Bearings (8mm ID 26mm OD)
- Coupling (9mm to 8mm)
- Threaded rod (140123-L-Tr10x2-1R-1000-C15)
- Micro SD card 64GB
- Acrylic panel bases
- 3D printed parts
- LCD screen
- Router for the hub
- Single Board computers for the hub



2 Description

- K3VN is a fully autonomous furniture lifting robot.
- The robot is wifi controlled via the Re-Space app.
- It features a scissor lift consisting of 3D printed parts at 20% gyroid style infill designed to lift the furniture from beneath.
- The base consists of 3mm laser cut acrylic plates separating and supporting the other components, held together by 3D printed parts.
  - The first (bottom) layer houses the wheel motors and their respective drivers.
  - The second layer is exclusively for the lidar scanner so it has the most unobstructed view of the room possible.

  - The top layer holds the scissor lift itself as well as its motor and driver, it also holds the battery and LCD screen with an additional acrylic shelf for the PCB with the single board computer and microcontroller attached.

- A large red emergency stop button is located on the top acrylic layer, which cuts all power from the battery in the event of an emergency.

- Another toggle switch is located on the PCB shelf to cut power to the motors without cutting power to other processes to reduce the risk of damage to other components when a non-emergency stop is required.

- Locomotion is achieved using 3 omni wheels propelled via individual encoded motors, facilitating the use of PID control to create smoother, more precise movement. Data from the encoders are processed by the on-board microcontroller which then issues commands for movement while maintaining accurate PID control.

- The LiDAR camera scans the environment for obstacles and is used to map the room, sending it's sensing information via the single board computer on the robot to the Hub, then to the mobile app where the map is then saved.

- The single board computer and microcontroller attached to the PCB both process data from the robot and issue commands to all other components based off of this data and the information it receives from the Hub. The single board computer also sends any necessary information to the Hub. Communications too and from the Hub are all conducted via wifi facilitated by the router on the Hub.

- The scissor lift is operated using a stepper motor with a dedicated stepper driver attached to a screw mechanism that converts the rotational motion into linear to make the lift ascend and descend depending on the direction of rotation.

- The camera (PiCam) is located at the top of the scissor lift, just below the level of the platform that makes contact with the furniture to lift it. The camera faces directly upwards and is central to the platform in a cut-out that allows it to view the area directly above the platform. The camera data is then processed through the on-board single board computer to identify QR codes on the underside of the furniture when they come into view, for furniture identification and centering the robot correctly before initiating lifting.

- An LCD screen is located next to the battery on the top layer of the robot base for communicating the robot's current state to the user.

- The lipo battery is located on the top layer of the robot base to power all on-board components.

- Neopixel LED strips are fixed to bumpers on the outside of the lowest level of the robot base to indicate which direction the robot is moving in depending on where and how the lights are lit at any time. This is informed by the microcontroller recognising the current process the robot is doing and sending the corresponding commands to the LED strips.

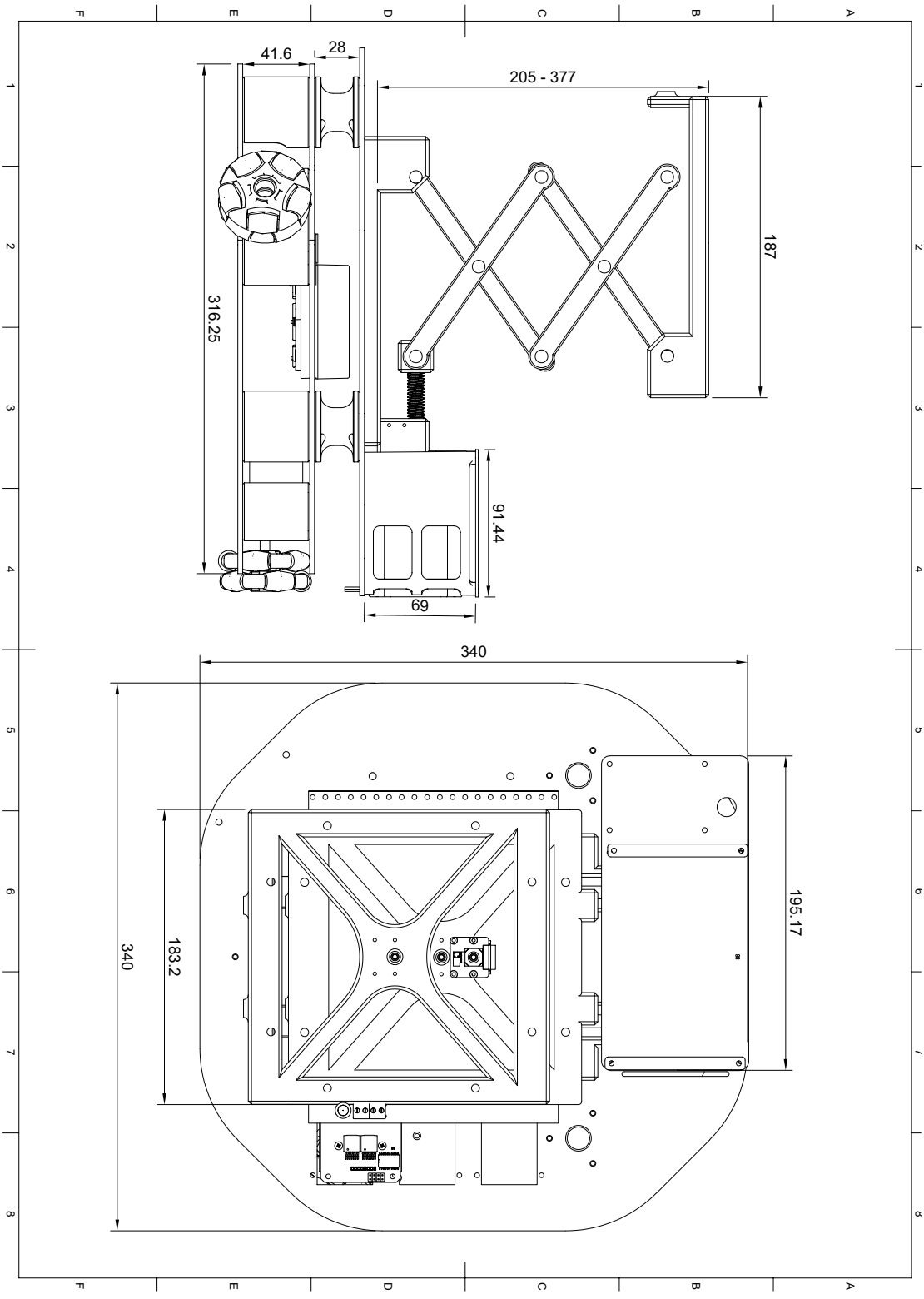
3 Technical specifications

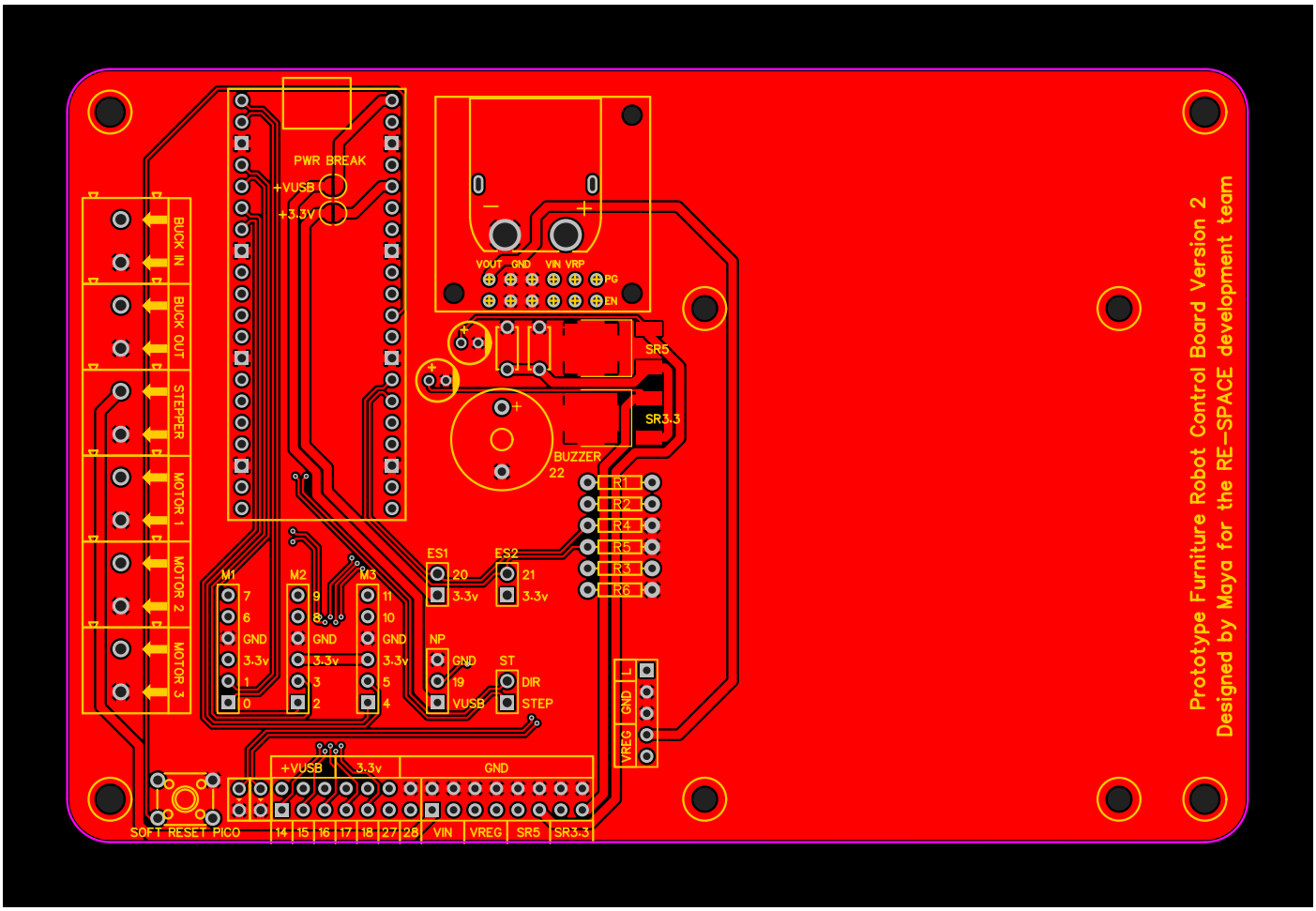
Component	Specs
Wheels X3	15KG Load 58mm Aluminum Alloy Omni Wheel (6mm hubs)
Wheel motors X3	520 DC high torque motor with encoder 205RPM, 12V
Wheel motor drivers x3	BTS7960 Motor drivers
Lift Motor	Nema 23 Stepper Motor, 8mm shaft, 2.4Nm
Lift Motor driver	23HS32-4004S Stepper driver
LIDAR	RPLiDAR- 360 degree, 12m range, 2-10Hz
Camera	Picam
Robot Single Board Computer	Raspberry Pi 5 (+ heat sink and fan)
Secondary microcontroller	Pi pico
PCB	Bespoke, ordered using the Gerber file
Battery	High discharge lipo battery- 22.2V 8000mAh
LCD screen	7 inch LCD Display, 1024 X 600 px, HDMI, Raspberry Pi compatible
Hub router	Huawei B310- input 12V, 1A
Hub Single board computers X2	2X Raspberry Pi 4B

4 Operating Conditions

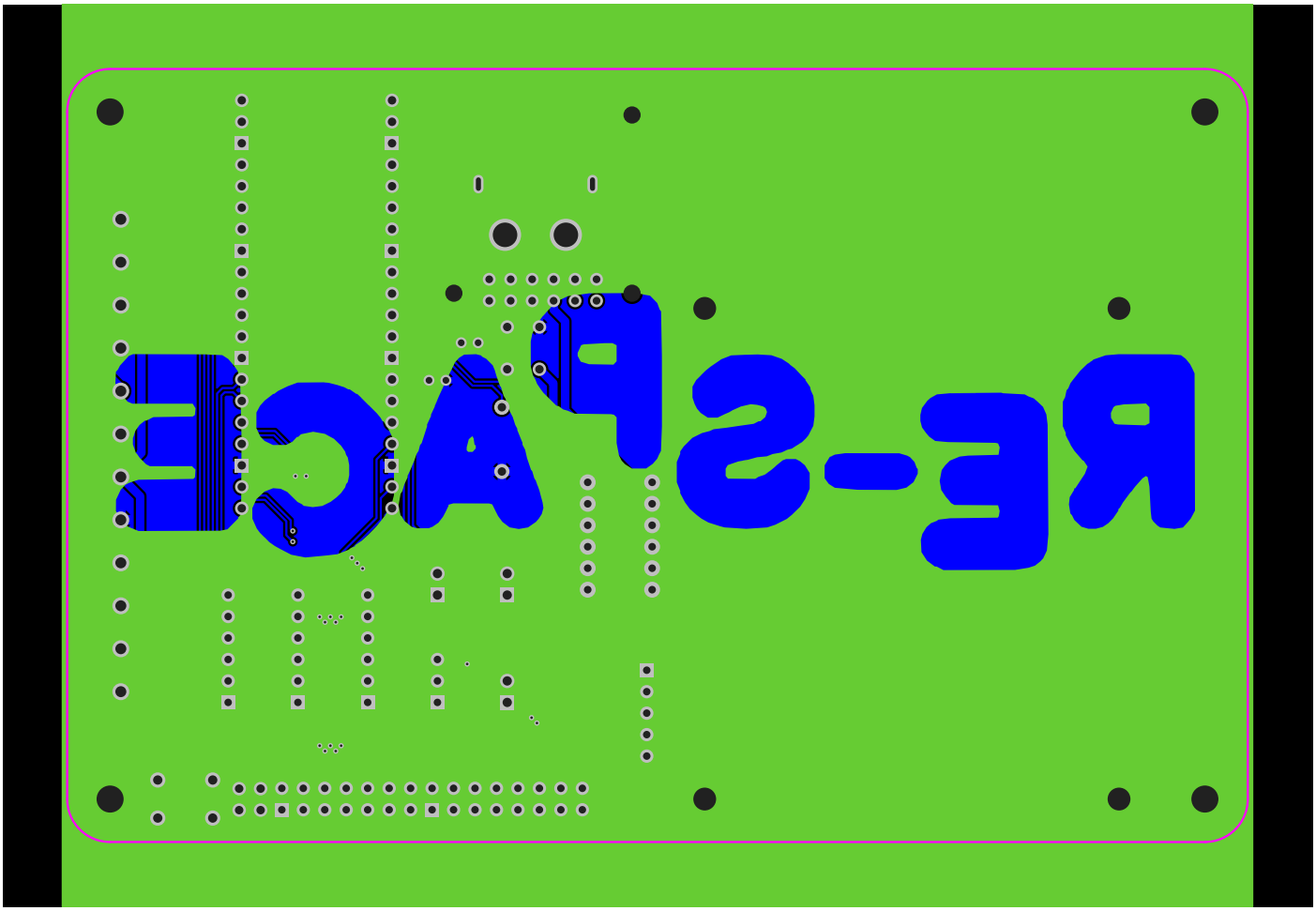
	Min	Operating	Max	Value
weight/Load capacity	0	7	13.4	Kg
Operating Temp	0		60	°C
Storage Temp	0		40	°C
Power Supply	21	22.2	24	V

5 Measures

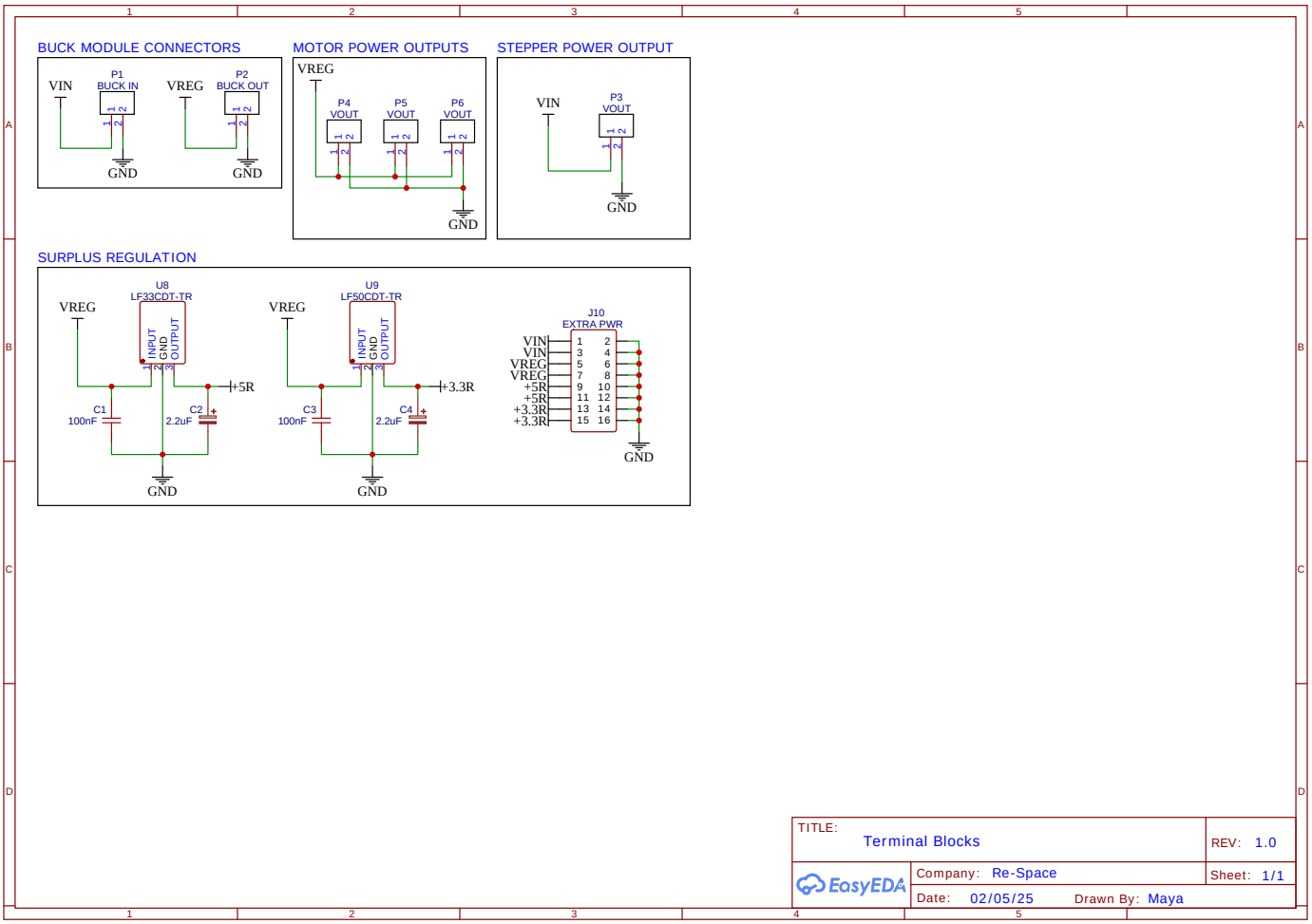


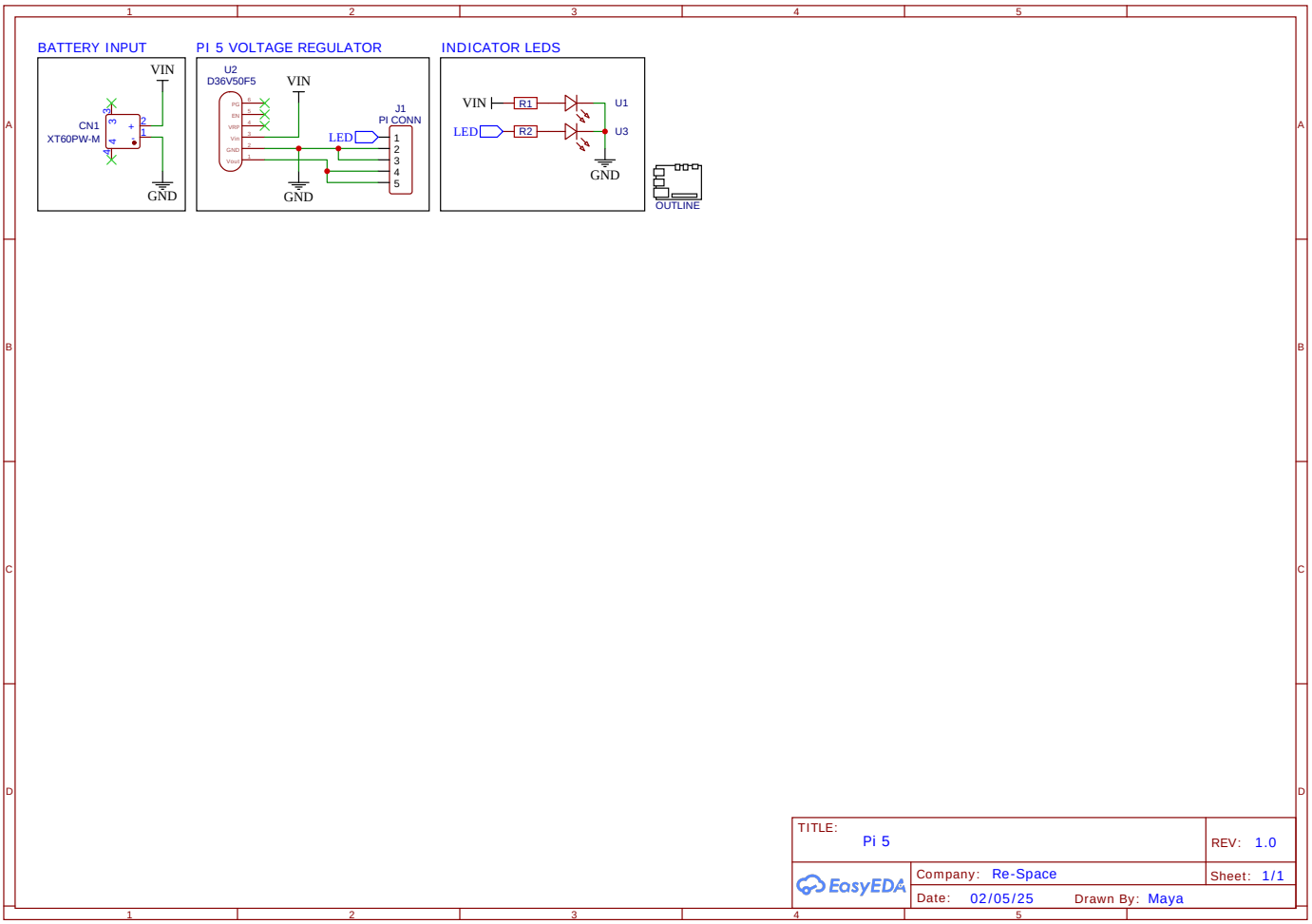


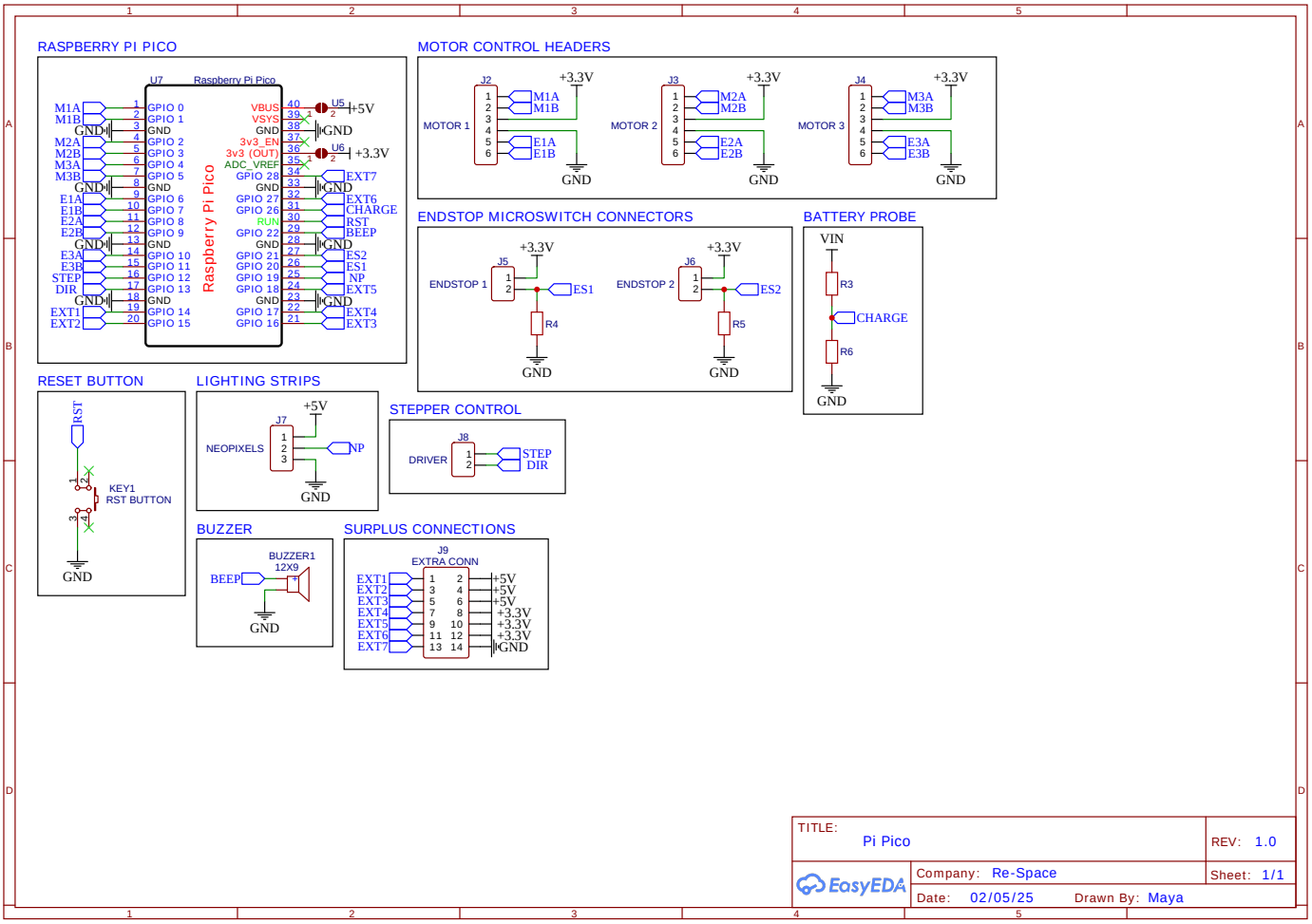
Top of PCB



Bottom of PCB


BUCK MODULE CONNECTORS
P1
BUCK IN
VIN
GND
P2
BUCK OUT
VREG
GND
MOTOR POWER OUTPUTS
VREG
P4
VOUT
P5
VOUT
P6
VOUT
GND
STEPPER POWER OUTPUT
VIN
P3
VOUT
GND
SURPLUS REGULATION
U8
LF33CDT-TR
VREG
INPUT
GND
OUTPUT
+5R
C1
100nF
C2
2.2uF
GND
U9
LF50CDT-TR
VREG
INPUT
GND
OUTPUT
+3.3R
C3
100nF
C4
2.2uF
GND
J10
EXTRA PWR
VIN
VIN
VREG
VREG
+5R
+5R
+3.3R
+3.3R
1 2
3 4
5 6
7 8
9 10
11 12
13 14
15 16
GND
TITLE:
Terminal Blocks
REV: 1.0
EasyEDA
Company: Re-Space
Sheet: 1/1
Date: 02/05/25
Drawn By: Maya


BATTERY INPUT
VIN
CN1
XT60PW-M
GND
PI 5 VOLTAGE REGULATOR
U2
D36V50F5
VIN
LED
J1
PI CONN
1
2
3
4
5
GND
INDICATOR LEDS
VIN
R1
U1
LED
R2
U3
GND
OUTLINE
TITLE:
Pi 5
REV: 1.0
EasyEDA
Company: Re-Space
Sheet: 1/1
Date: 02/05/25
Drawn By: Maya


RASPBERRY PI PICO
U7
Raspberry Pi Pico
Raspberry Pi Pico
M1A
M1B
GND
M2A
M2B
M3A
M3B
GND
E1A
E1B
E2A
E2B
GND
E3A
E3B
STEP
DIR
GND
EXT1
EXT2
GPIO 0
GPIO 1
GND
GPIO 2
GPIO 3
GPIO 4
GPIO 5
GND
GPIO 6
GPIO 7
GPIO 8
GPIO 9
GND
GPIO 10
GPIO 11
GPIO 12
GPIO 13
GND
GPIO 14
GPIO 15
VBUS
VSYS
GND
3v3_EN
3v3 (OUT)
ADC_VREF
GPIO 28
GND
GPIO 27
GPIO 26
RUN
GPIO 22
GND
GPIO 21
GPIO 20
GPIO 19
GPIO 18
GND
GPIO 17
GPIO 16
U5
+5V
GND
U6
+3.3V
EXT7
GND
EXT6
CHARGE
RST
BEEP
GND
ES2
ES1
NP
EXT5
GND
EXT4
EXT3
MOTOR CONTROL HEADERS
J2
J3
J4
+3.3V
MOTOR 1
MOTOR 2
MOTOR 3
M1A
M1B
M2A
M2B
M3A
M3B
E1A
E1B
E2A
E2B
E3A
E3B
GND
ENDSTOP MICROSWITCH CONNECTORS
J5
J6
ENDSTOP 1
ENDSTOP 2
ES1
ES2
R4
R5
BATTERY PROBE
VIN
R3
CHARGE
R6
GND
RESET BUTTON
RST
KEY1
RST BUTTON
GND
LIGHTING STRIPS
J7
+5V
NEOPIXELS
NP
GND
STEPPER CONTROL
J8
DRIVER
STEP
DIR
BUZZER
BUZZER1
12X9
BEEP
GND
SURPLUS CONNECTIONS
J9
EXTRA CONN
EXT1
EXT2
EXT3
EXT4
EXT5
EXT6
EXT7
+5V
+5V
+5V
+3.3V
+3.3V
+3.3V
GND
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Pi Pico
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