



Managed Technical Service

Closing Note

Submitted to :

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Managed Technical Service Closing Note

We are pleased to confirm the successful completion of the project as per the agreed-upon scope of work. The deliverables outlined in the engagement were achieved across the following milestones:

1. BMS Design and Development (Milestone #1)

- The Battery Management System (BMS) was designed and tested to provide an 8-hour backup in ideal environmental conditions.
- The design adheres to safety standards using off-the-shelf components from reputable suppliers.

2. PCB Design and Printing (Milestone #2)

- The PCB layout was finalized with client approval before printing.
- A minimal engraved PCB (without silkscreen) was delivered, suitable for its enclosure.

3. Enclosure Design and Printing (Milestone #3)

- The 3D-printed enclosure design was finalized based on discussions with the client to ensure compatibility with the PCB and overall product dimensions.

The finalized product in the form of three units has been delivered, incorporating the feedback provided during the iteration and testing phases. Attached to this note are the following supporting files:

- **PCB Design Files (schematics, layout, and Gerber files)**
- **Enclosure 3D Design Files (STL format and related documents)**
- **Documentation on iteration fixes applied during testing**

We appreciate the opportunity to collaborate with Maxvy Private Limited and look forward to further engagements. If you have any additional feedback or require support, feel free to reach out.

Executive Summary

This project aimed to deliver a fully functional prototype in alignment with the agreed-upon scope of work. The engagement was structured into three key milestones, each addressing distinct aspects of product development:

1. **BMS Design and Development**
 - The Battery Management System (BMS) was designed to support 8 hours of backup under ideal environmental conditions.
 - Industry-standard off-the-shelf components were utilized, ensuring safety and adherence to battery standards.
 - Initial tests and power ratings were evaluated, and the finalized design was delivered.
2. **PCB Design and Printing**
 - The PCB layout and dimensions were finalized in collaboration with the client.
 - An engraved PCB without silkscreen was produced, meeting the specified requirements for integration into the enclosure.
3. **Enclosure Design and Printing**
 - A 3D-printed enclosure was designed and iteratively refined to ensure compatibility with the PCB.
 - The form factor was finalized based on discussions with the client and incorporated all required feedback.

Key Deliverables

- Three fully developed units of the product.
- PCB design files (schematics, layout, and Gerber files).
- 3D enclosure design files (STL format).

The project was completed with regular client feedback integrated into the final product. Forge Innovation and Ventures successfully delivered on its commitment, ensuring a high-quality outcome for Maxvy Private Limited.

This engagement highlights our capability to provide end-to-end product development services, from initial design to final delivery, ensuring alignment with client objectives and technical requirements. Refer Annexure for the Informations.

Annexure - 1 : Materials and Component Used

Annexure - 2 : Assembling and Testing

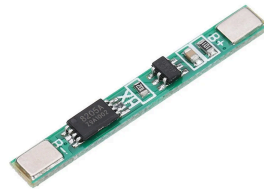
Annexure - 3 : Design Files

Annexure - 1

Materials and Components Used

These are the components and used in the Product that are:

- 1) 1S 18650 Li-ion Lithium Battery BMS Charger Protection Board for 3.7V Battery



Protections

The system includes the following protection features to ensure safe and reliable operation:

1. **Short Circuit Protection**
Automatically cuts off the power in the event of a short circuit to prevent damage to the components.
2. **Overcharge Protection**
Prevents overcharging of the battery, ensuring it does not exceed safe voltage levels during charging.
3. **Over-Discharge Protection**
Prevents the battery from discharging beyond its safe limit, extending the life of the battery and preventing damage.
4. **Over-Current Protection**
Monitors and limits the current to avoid overloading the system, protecting both the battery and components.

Pins Description

The following pin designations correspond to the power and battery connections in the system:

- **P-**: Negative terminal of input or output power.
- **P+**: Positive terminal of input or output power.
- **B-**: Negative terminal of the battery.
- **B+**: Positive terminal of the battery.

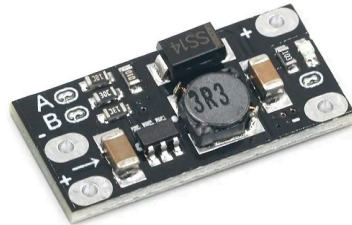
Features

The system includes the following advanced features for enhanced performance and safety:

- **High Accuracy Voltage Detection Circuit**
Ensures precise voltage monitoring for optimal battery management and protection.
- **High Voltage Device Charging Terminal**
Supports high voltage charging for efficient energy transfer while maintaining safety.
- **Built-in Three-Stage Overcurrent Detection Circuit**
This includes:
 - **Overcurrent 1**: Protection from initial overcurrent conditions.
 - **Overcurrent 2**: Further protection to handle prolonged overcurrent situations.
 - **Load Short Circuit**: Automatic disconnection in case of a short circuit in the load.

- **MOS Transistor Control for Battery Charge and Discharge**
Efficient control of the battery's charge and discharge cycle through the built-in MOS transistors, ensuring stable and controlled power flow.

2) 3.7V to 12V Mini DC-DC Boost Step Up Converter Board Module 5V/ 8V/ 9V 12V Output



A **boost converter** is a DC to DC converter that steps up the input voltage to a higher output voltage. It is sometimes referred to as a **step-up converter** because it increases the source voltage. To maintain power conservation, the output current is lower than the source current.

This particular module is a **high-voltage step-up power supply** commonly used in electronics experiments and demonstrations. It utilizes the principles of the **Tesla coil** to generate voltages as high as **400KV** from an input range of **3-6V**, typically powered by a standard Li-ion battery.

Module Description

- **DC-DC Boost Step-Up Converter**
This module is designed to step up the input voltage, providing stable output voltages at various input ranges between **3.7V to 12V**. The module amplifies the input voltage and produces a stabilized output of **5V**, **8V**, **9V**, or **12V** depending on the application and input conditions.
- **Voltage Boost**
The module is capable of delivering a **3.7V DC** stable voltage output while boosting the input voltage. Depending on the input range, the module consumes varying amounts of current to ensure a balanced and stable output.

Features

- **Easy to Use:** User-friendly design for simple integration into electronics projects.
- **Color:** Black
- **High Voltage Output:** Can step up to high voltages, up to **400KV** from a 3-6V input.
- **Output Current:** Capable of delivering a maximum output current of **1A**.
- **Low Power Consumption:** Designed to operate efficiently with minimal energy loss.
- **High-Quality Materials:** Constructed using high-quality materials for durability and reliability.
- **Precise Craftsmanship:** Built with attention to detail and precision to ensure performance and longevity.
- **LED Indicator:** Includes an LED indicator that can be turned off using the pad next to it.

3) JST SH 2 pin Connector 2mm Pitch



The JST SH 2-pin Connector is a type of electrical connector commonly used in various electronic devices. It has a pitch of 2mm, which means the distance between each pin is 2 v mm.

The connector consists of two pins, one male and one female, which are designed to be inserted and locked into each other to form a secure electrical connection. The pins are made of high-quality metal, such as copper or brass, which ensures excellent conductivity and durability.

4) 4 Pin JST XH 2.54mm Pitch Plug and Socket with Cable



This **4-pin JST XH 2.54mm Pitch Plug and Socket with Cable** is a versatile and reliable connector cable commonly used in various electronics projects. The cable is designed to connect components efficiently, providing secure and stable data transfer between devices. It features a **JST XH 2.54mm pitch connector**, which is a popular choice in electronic applications due to its compact size, reliable connection, and ease of use.

5) 1.27mm Female Single Row Header Strip



It is a 1.27mm 1×40 Pin Female Single Row Header Strip . It has a single row of 40 pins. Ideal for through-hole mounting.

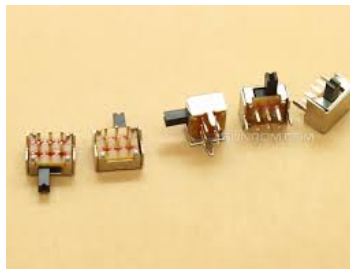
6) USB 3.1 Type-C 6 pin for Power/Charging Reversible Connector



USB 3.1 Type-C 6 pin for Power/Charging Reversible Connector is a reversible USB connector for cables and devices. The USB Type-C cable is now considered the “universal” cable, as it has a reversible form factor, transfers USB3.1 SuperSpeed Plus data at 10Gbps and USB Power Delivery up to 100W of continuous power flow.

USB Type-C features a tiny connector that is reversible, no longer forcing you to check that you are plugging the connector in the right way. USB Type-C can also support a wide variety of protocols, this means that you can send different signals down the cable. You can transmit video, audio, and power down a single cable. So one minute you can be using your USB Type-C cable to charge your smartphone and the next you can unplug and use it to send video to your monitor or backup data on your external hard drive. This connector is a surface mount device.

7) Slide Switch - 8.6mm - Horizontal 2P2T



The SS Series Slide Switch is a reliable, high-quality switch designed for various electronic applications, offering efficient operation and flexibility. Below are the key specifications and features:

Key Specifications

- **Switch Type: Slide Switch**
A simple and effective switch type commonly used in a wide range of devices for its compact design and reliable performance.
- **Number of Positions: 2**
The switch offers two distinct positions, allowing for clear state toggling between two options.
- **Number of Stable Positions: 2**
The switch is designed with two stable positions, ensuring a firm and stable on/off state for each selection.
- **Number of Poles: 1**
The switch is single-pole, meaning it controls one circuit or path at a time.
- **Contact Groups: SPDT Switching**
The switch operates in a Single Pole Double Throw (SPDT) configuration, allowing for two alternate paths for electrical flow.
- **Algorithm of Work: ON-ON**
The switch operates with an ON-ON function, meaning it has two active positions, with no off state between them.
- **Maximum Current: 0.5 A**
The switch is rated to handle a maximum current of 0.5 A, making it suitable for low-power circuits and devices.

- **Max. DC Voltage: 50 V**
The switch can handle a maximum direct current (DC) voltage of 50 V, ensuring compatibility with various low-voltage applications.
- **Pusher Orientation: Angular 90°**
The switch features an angular 90° pusher orientation, allowing for easy and ergonomic operation.
- **Backlight: Yes**
The switch comes with backlighting, making it visible and easy to operate even in low-light environments.
- **Method of Installation: Soldering into Holes**
The switch is designed for through-hole soldering, ensuring a secure and durable connection to the PCB.
- **Body Material: Metal**
The switch body is made from metal, providing durability and strength, making it ideal for long-term use in various electronic environments.
- **Operating Temperature: -25°C to +85°C**
The switch is capable of operating in a wide range of temperatures, from -25°C to +85°C, ensuring reliable performance in various environmental conditions.

8) FR4 Copper Clad Plate Laminate Single Side PCB



FR4 Copper Clad Plate Laminate Single Side PCB is a glass fibre epoxy resin-based PCB with copper foil on one side.

The epoxy glass fibre forms the substrate on which the copper foil is hot pressed only on one side and the other side remains bare. It has a copper core for strength and the substrate acts as electrical insulation.

The PCB is ideal for prototyping and experimenting.

9) 1.75mm White PLA Filament 3D Printing Filament



Polylactic Acid (PLA) filament is a recyclable, natural thermoplastic polyester that is derived from renewable resources such as corn starch or sugar cane. The filament is biodegradable under certain conditions with high heat capacity and high mechanical strength. It can be melted without significant damage and does not emit toxins or fumes

Annexure -2

Assembly and Testing

1. Preparation

Gather Essential Components:

- **PCB Assemblies:** Ensure you have all the required PCBs, including the main control board, power board, and any peripheral boards.
- **Enclosure:** The 3D-printed enclosure should be a perfect fit for the assembled PCBs.
- **Hardware:** This includes screws, nuts, bolts, washers, standoffs, and any specific fasteners required for the enclosure.
- **Connectors:** Prepare all necessary connectors, such as power connectors, data connectors, and any custom connectors.
- **Cables and Wires:** Have a variety of cables and wires ready for internal and external connections.

Tools and Equipment:

- **Soldering Iron:** A reliable soldering iron with appropriate tips for delicate components.
- **Soldering Station:** A soldering station with a temperature-controlled iron is ideal for precise soldering.
- **Multimeter:** For measuring voltage, current, and resistance.
- **Screwdriver Set:** A variety of screwdrivers for different screw sizes.
- **Wire Strippers:** To strip insulation from wires.
- **Crimping Tool:** For crimping connectors onto wires.
- **Rivet Nut Tool:** For installing rivet nuts into the enclosure.
- **Drill:** For drilling holes in the enclosure if needed.

Workspace Setup:

- **Clean and Organized:** Maintain a clean and organized workspace to prevent component damage and short circuits.
- **Anti-Static Mat:** Use an anti-static mat to protect sensitive electronic components from electrostatic discharge (ESD).
- **Good Lighting:** Ensure adequate lighting to aid in precise assembly and inspection.

2. PCB Assembly

- **Component Placement:** Carefully place components onto the PCBs according to the schematic and layout.
- **Soldering:** Solder components using proper soldering techniques to ensure strong and reliable connections.
- **Inspection:** Visually inspect each soldered joint for proper alignment and solder quality.
- **Testing:** Use a multimeter to test the functionality of each PCB individually.

3. Enclosure Preparation

- **Rivet Nut Installation:** Use a rivet nut tool to install rivet nuts into the designated holes in the enclosure. These will provide secure mounting points for the PCBs.
- **Drilling and Tapping:** If necessary, drill holes and tap threads for screws or other fasteners.

- Cable Routing: Plan the routing of cables and wires within the enclosure to minimize clutter and potential interference.

4. Product Integration

- PCB Mounting: Secure the PCBs to the enclosure using screws and the installed rivet nuts.
- Cable Connections: Connect all cables and wires to their respective connectors on the PCBs and the enclosure.
- Enclosure Sealing: Seal any openings in the enclosure to protect the internal components from dust, moisture, and physical damage.

5. Power-Up and Testing

- Initial Power-Up: Apply power to the product and monitor for any unexpected behavior or errors.
- Functional Testing: Test all features and functionalities of the product, including , communication modules, and user interfaces.

6. Documentation and Reporting

- Assembly Log: Maintain a detailed log of the assembly process, including any modifications or troubleshooting steps.
- Test Reports: Document the results of all tests, including functional tests, stress tests, and environmental tests.
- Final Inspection: Conduct a final inspection to verify that the product meets all quality standards and specifications.

Annexure - 3

Enclosure and PCB Design

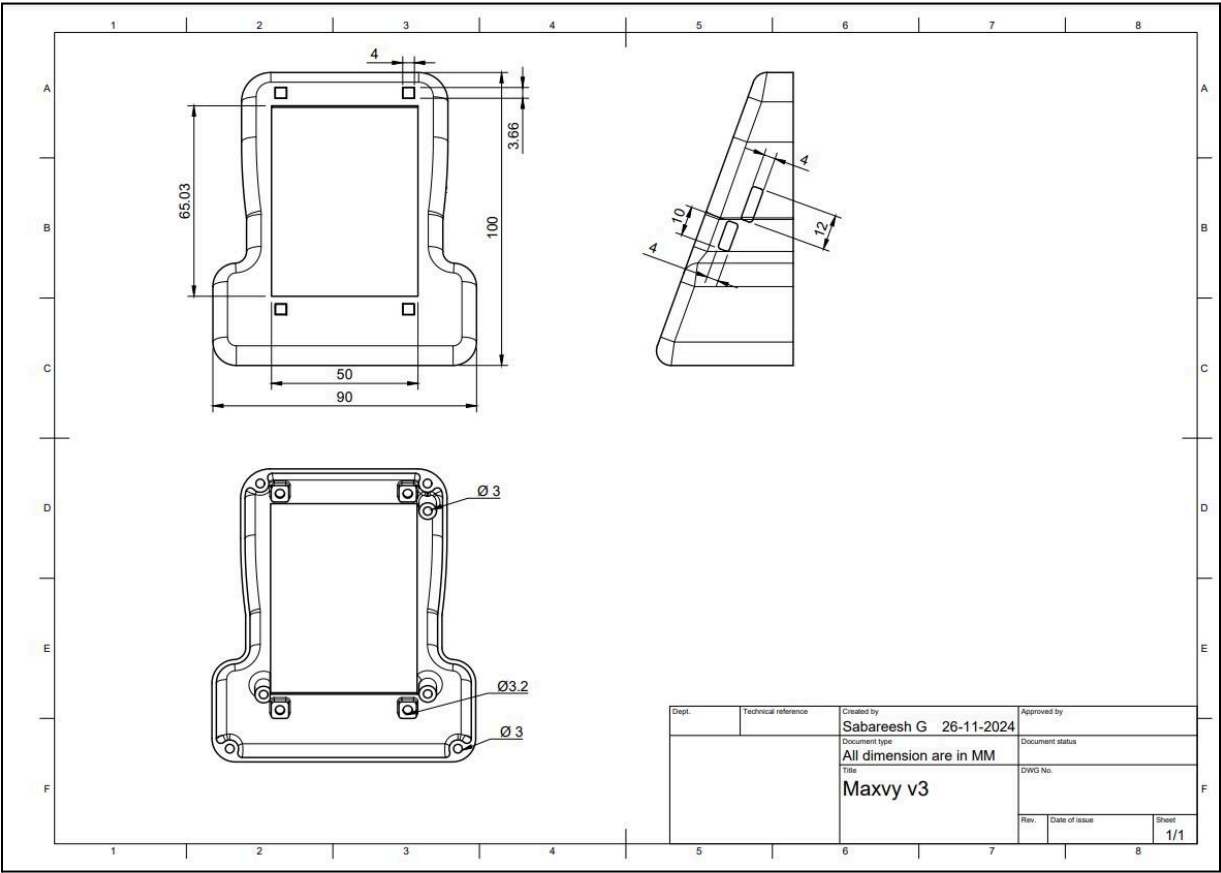


Fig 3.1 2D draft of Front Closing

Fig 3.2 PCB Designs