SMART PDB MODULE

1. Introduction

The Smart Power Distribution Board (Smart PDB) module is an advanced safety addition to the existing PDB of TEAM VYADH's rover. This module is designed to protect the rover's electrical components from current and voltage overloads, ensuring the longevity and reliability of the rover during missions.

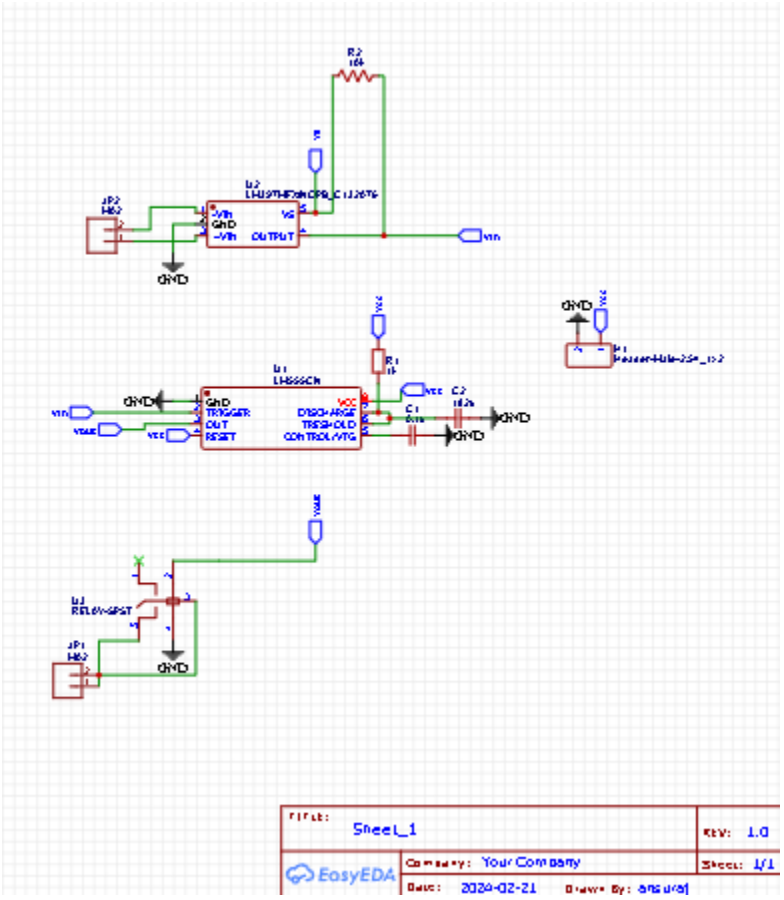
2. Components List

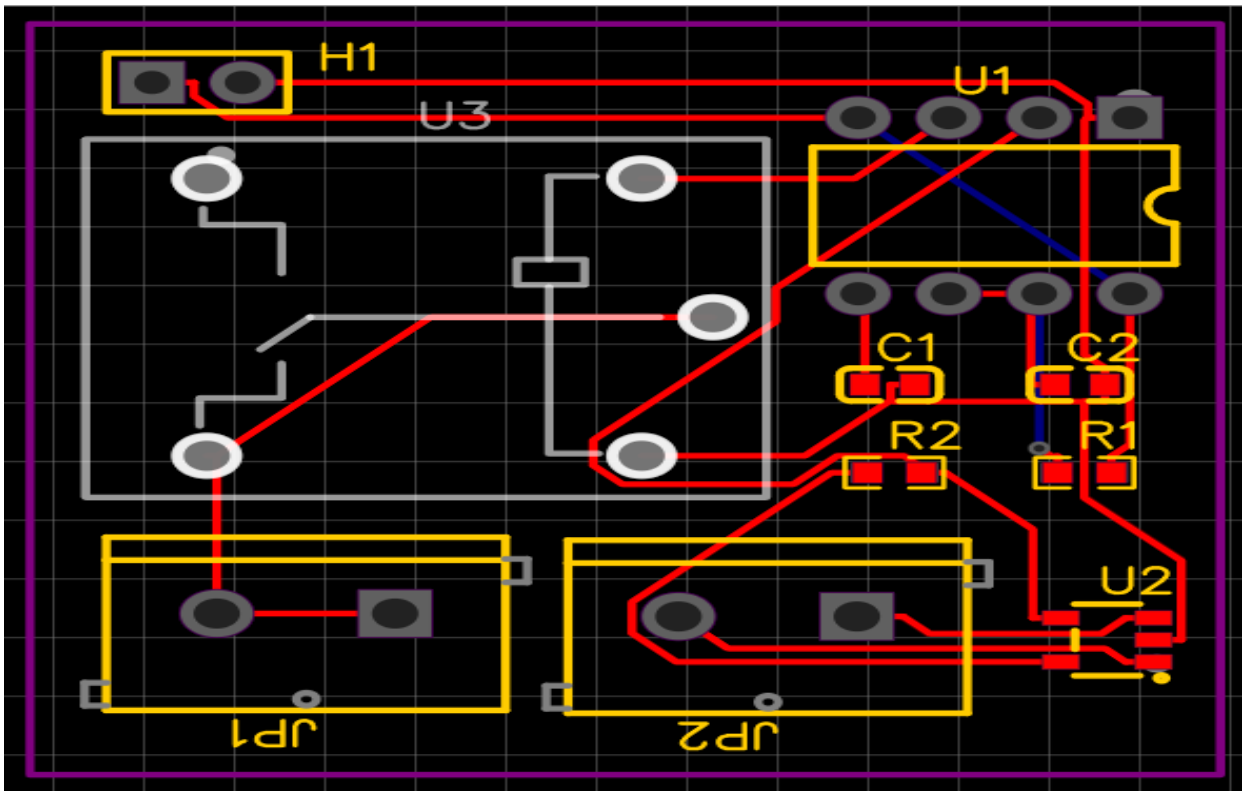
The Smart PDB module includes the following components:

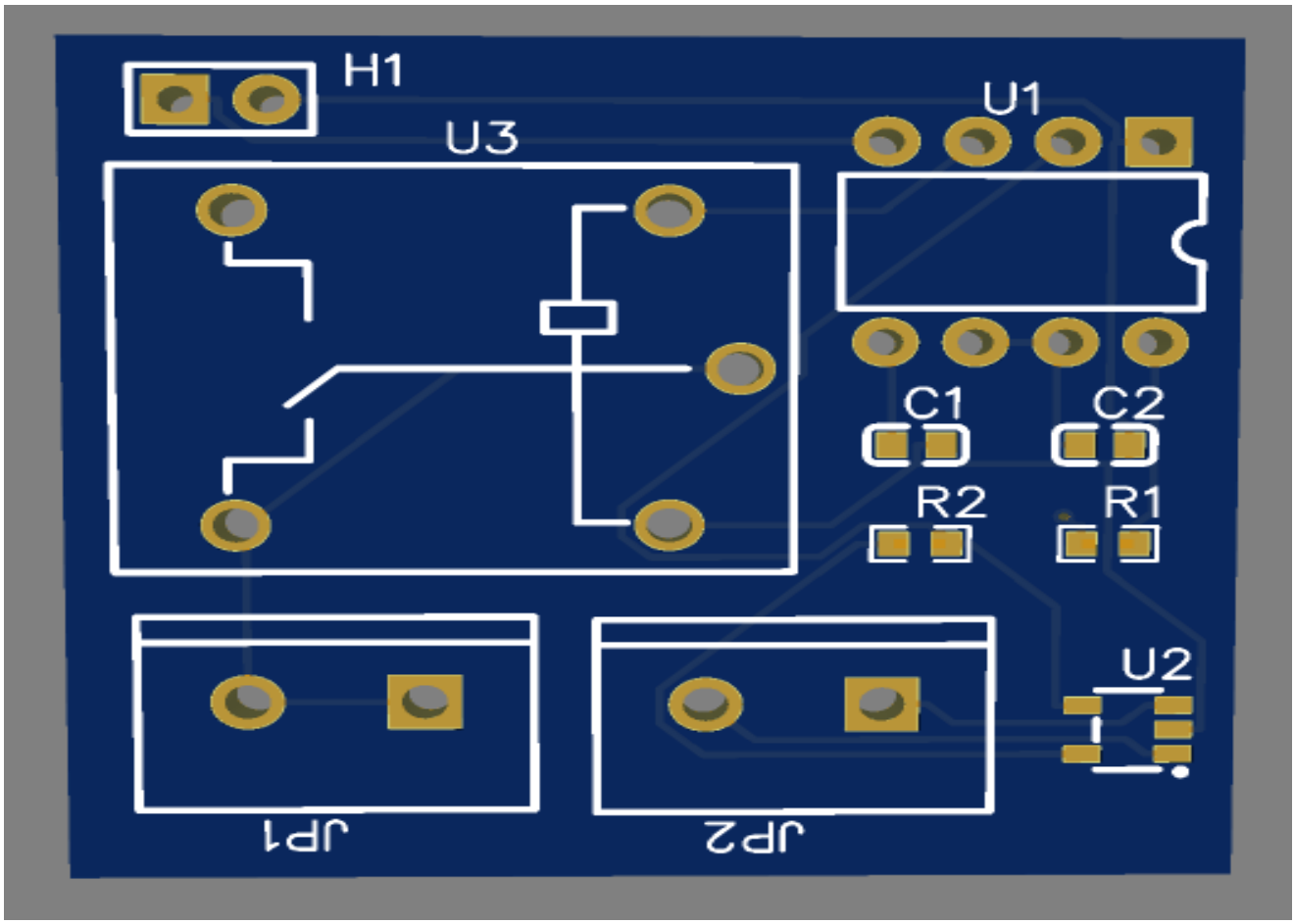
ID	Name	Designator	Footprint	Quantity	Manufacturer Part	Manufacturer	Supplier	Supplier Part	Price
1	0.1uF Capacitor	C1	C0603	1					
2	182uF Capacitor	C2	C0603	1					
3	Screw Terminal	JP1, JP2	SCREWTERMINAL-5MM-2	2					
4	1kΩ Resistor	R1	R0603	1					
5	10kΩ Resistor	R2	R0603	1					
6	LM555CN Timer IC	U1	DIP-8_L9.7-W6.4-P2.54-LS7.6-BL	1	LM555CN	onsemi	LCSC	C110322	
7	LM397MFX/NOPB IC	U2	SOT-23-5_L3.0-W1.7-P0.95-LS2.8-BR	1	LM397MFX/NOPB	TI	LCSC	C132076	0.456
8	Relay-SPST	U3	RELAY-TH_RELAY-SPST	1	Relay-SPST		LCSC	C2941249	
9	Header-Male-2.54_1x2	H1	HDR-TH_2P-P2.54-V-M-1	1	826629-2	TE Connectivity	LCSC	C86471	0.361

3. Schematic Diagram

The schematic diagram of the Smart PDB module is shown below:




H1
U3
U1
C1
C2
R2
R1
U2
JP1
JP2



4. Circuit Description

The Smart PDB module consists of several key components that work together to protect the rover's power system from overloads:

1. **Capacitors (C1, C2):**
   - **C1 (0.1uF):** Provides noise filtering and stabilizes the voltage.
   - **C2 (182uF):** Acts as a bulk capacitor to smooth out the voltage supply.
2. **Resistors (R1, R2):**
   - **R1 (1kΩ):** Used for timing and control circuits.
   - **R2 (10kΩ):** Used for voltage sensing and protection circuits.
3. **Screw Terminals (JP1, JP2):**
   - Connects the input and output power lines securely to the Smart PDB module.
4. **LM555CN Timer IC (U1):**
   - A versatile timer IC used to generate precise time delays and oscillations required for control circuits.
5. **LM397MFX/NOPB IC (U2):**
   - A comparator IC used for voltage sensing and protection. It compares the input voltage with a reference voltage and triggers the relay if the voltage exceeds a predefined limit.

6. **Relay-SPST (U3):**
    - A single-pole single-throw (SPST) relay used to disconnect the power supply in case of an overload. It is controlled by the LM397MFX/NOPB IC.
7. **Header-Male-2.54_1x2 (H1):**
    - Provides easy access to connect additional modules or monitoring equipment.

5. Working Principle

1. **Power Input and Noise Filtering:**
    - The input power is connected to the Smart PDB module through JP1. The capacitors C1 and C2 filter out any noise and stabilize the voltage.
2. **Voltage Sensing:**
    - The input voltage is sensed by the LM397MFX/NOPB IC (U2). The voltage is compared with a reference voltage set by the resistors R1 and R2.
3. **Overload Protection:**
    - If the input voltage exceeds the predefined limit, the LM397MFX/NOPB IC triggers the relay (U3). The relay disconnects the power supply to protect the rover's components from damage.
4. **Control and Timing:**
    - The LM555CN Timer IC (U1) is used to generate precise time delays and control signals for the relay and other protection mechanisms.

6. Applications

- **Rover Power Management:** Enhances the safety and reliability of the rover's power distribution system.
- **Overload Protection:** Protects the rover's components from current and voltage overloads, preventing potential damage.
- **Versatility:** Can be adapted to other projects requiring smart power distribution and overload protection.

7. Advantages

- **Safety:** Provides robust protection against current and voltage overloads.
- **Reliability:** Ensures stable and uninterrupted power supply to critical rover subsystems.
- **Efficiency:** Optimizes power distribution by disconnecting only the affected components in case of an overload.

8. Conclusion

The Smart Power Distribution Board module is a critical addition to the rover's power management system. It significantly enhances the safety and reliability of the rover by protecting its components from current and voltage overloads. This module ensures the longevity and optimal performance of the rover during missions.