EN-2160
Electronic Design Realization

Expandable Battery Management System

Individual Contribution

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My Contribution to the Battery Management System (BMS) Project

As a key member of the BMS project team, I focused on designing and developing the battery cell module Printed Circuit Board (PCB). This module is crucial for real-time monitoring and management of individual battery cells (3.7V nominal voltage) in various applications, optimizing performance, safety, and lifespan.

Key Contributions:

1. **Circuit Design:** I meticulously designed the cell module circuit with advanced features for over-voltage monitoring and voltage balancing. This included creating a control strategy to prevent overcharging, critical for battery health and safety. A microcontroller unit (MCU) continuously monitors cell voltages. Upon over-voltage detection, the MCU activates a Dump Load Enabler to control a MOSFET, safely dissipating excess current through resistors as heat, stabilizing cell voltage.
2. **Schematic Design:** I created detailed schematics for the cell module, outlining component connections. This blueprint ensures all elements function together. The design incorporates resistors, MOSFETs, and the MCU for efficient over-voltage protection and voltage balancing.
3. **PCB Layout Design:** I designed the cell module PCB layout to accommodate five modules, allowing for simultaneous evaluation of five battery cells. This space-optimized design ensures reliable connectivity and integration of all components. The layout facilitates effective heat dissipation and minimizes interference, contributing to BMS stability and performance.
4. **Cell Module Programming:** I actively participated in programming the cell module for intercommunication and data transmission. This involved developing firmware for the ATTINY1624-SSU microcontroller to handle temperature, voltage, and current monitoring. The program facilitates communication between modules using the UART protocol for real-time data transmission to the main controller.
5. **Enclosure Design:** I participated in designing the enclosure for mounting the cell modules using SolidWorks. This moldable enclosure securely houses the PCB and provides environmental protection. The design ensures ease of installation and maintenance, contributing to overall BMS durability and functionality.
6. **Conceptual BMS Design:** Beyond the cell module, I significantly contributed to the overall BMS conceptual design. This involved outlining the system architecture and defining interactions between components and modules. My contributions ensured a cohesive integration of monitoring and control mechanisms across the entire battery pack, enhancing system scalability, reliability, and efficiency.