

An On-Cell Monitoring and Balancing System with Near-Field Communications for EV Batteries

D. McMitchell, S. Foster, S. Block, M. Manson, S. Quinn and J. Sylvester,

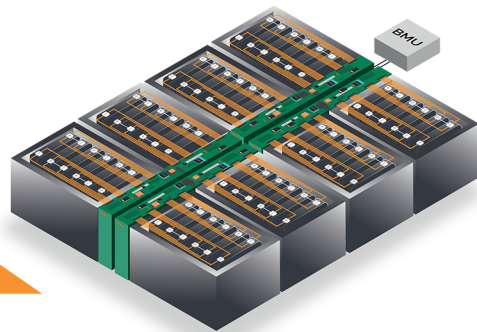
"8.9: An On-Cell Monitoring and Balancing System with Near-Field Communications for EV Batteries."

2025 IEEE International Solid-State Circuits Conference (ISSCC), San Francisco, CA, USA, 2025, pp. 174-176

Motivation

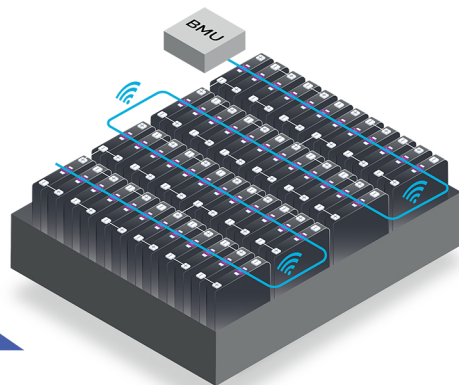
- Space for wiring and related circuit boards can occupy up to **15% of a battery pack volume**.

Conventional Wired Battery Pack



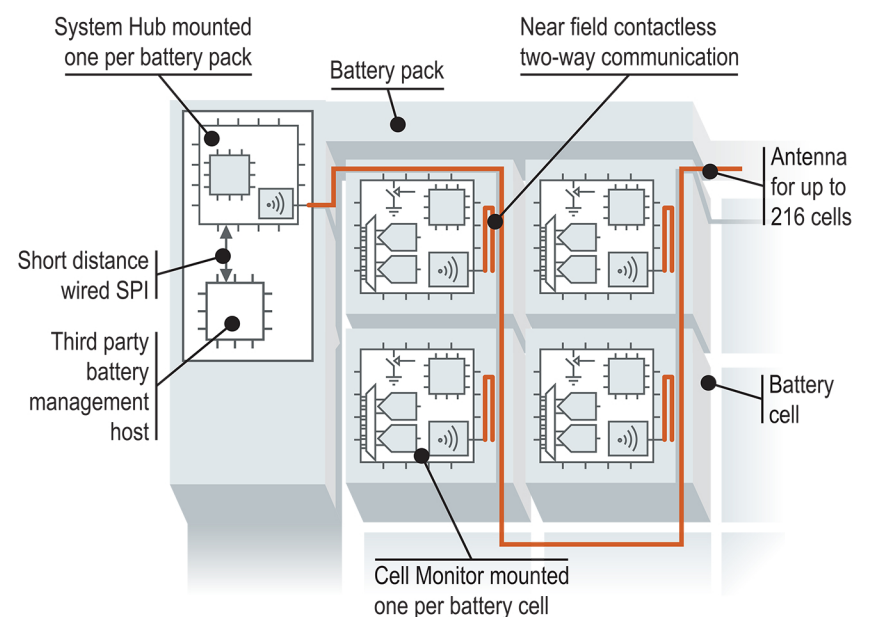
- Removal of PCBs, connectors, wiring and isolated communications leads to safer and more reliable system.

Contactless Battery Pack



- This system consists of individual **Cell Monitors** connected via a **near-field antenna** to a **System Hub** and BMS host. Persistent memory allows data to be stored alongside the cell to second life applications.

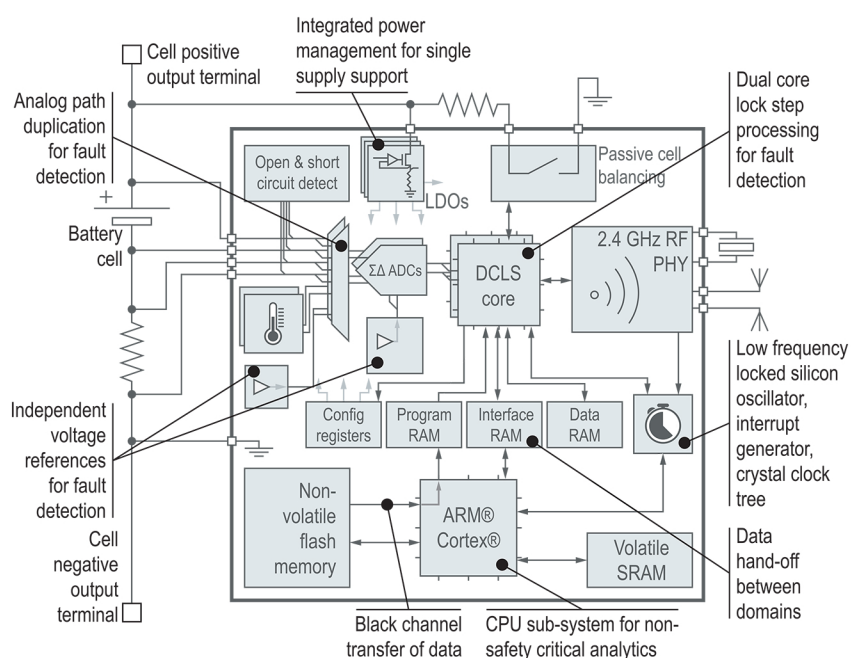
Architecture



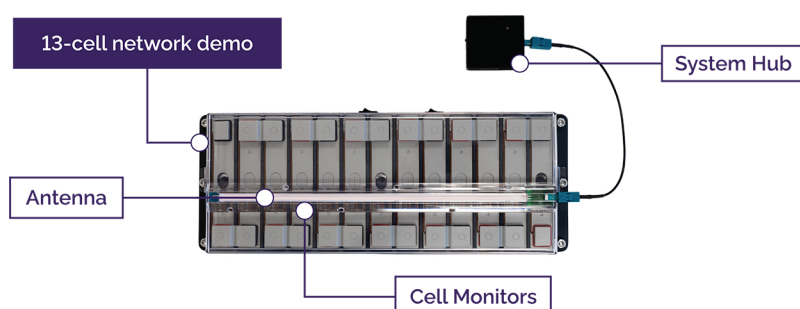
- The System Hub provides the wired communication to the BMS host via a SPI interface.
- Up to 216 cell monitors form a single network.
- Cell voltage, die and external temperature measurements are communicated every 100ms.
- On-demand cell balancing is provided with continuous fault checking and overcurrent monitoring.
- Continuous diagnostic measurement and fault checking ensure only accurate data is sent to the BMS host.

System Implementation

Cell Monitor Architecture highlighting key blocks



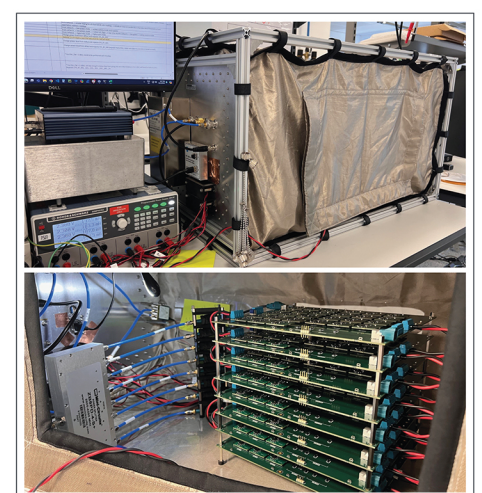
13-cell network demo



www.dukosi.com

Verification

- Extensive testing of the complete 216-cell network carried out to ensure robustness in the presence of RF noise with five-way split antenna.
- An interference tone steps between channels every 30 seconds. This 3-day test provided coverage of data and interference collisions in every channel. It showed the packet retry algorithm reduces data loss by 10x in a high noise environment and eliminates it completely in low noise.



Packet/Data Loss and Device Down Time as a Function of Narrow Spectrum Interference in a 216 Cell Network

