MPS Battery Management

BMS System Webinar

Key Considerations when Designing Battery Management

June 2023

Webinar will begin at 10:00 AM CEST | 1:00 AM PDT | 4:00 AM EDT

Presenters Introduction

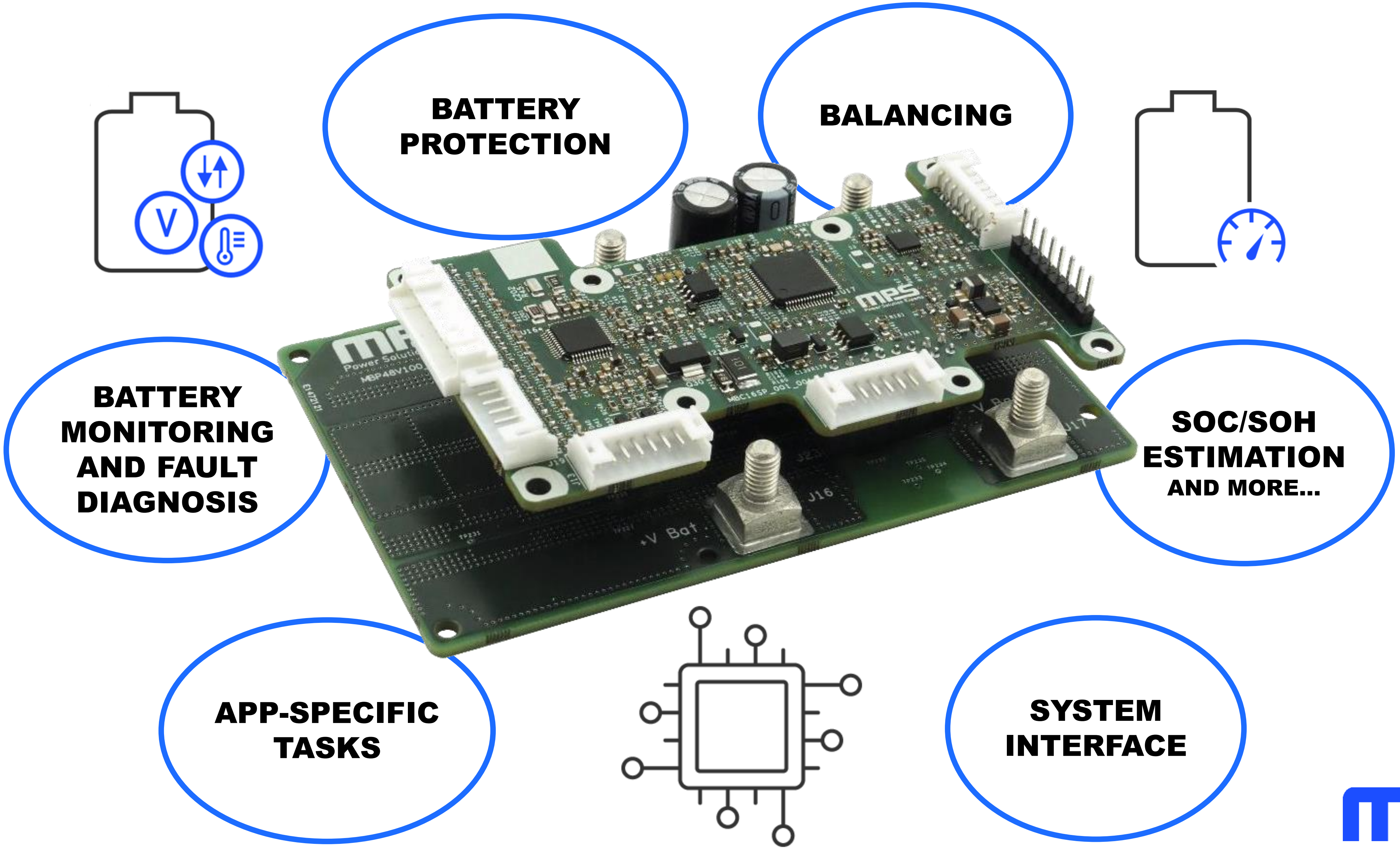
Albert Rodriguez

- Senior Battery Applications Engineer at MPS since 2019
- MS and PhD in battery controls at UCCS
- Deeply involved in:
  - Battery modeling, simulation, and identification
  - Fuel gauge algorithm development

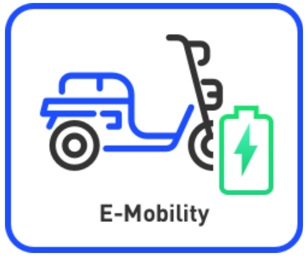
Miguel Angel Sanchez

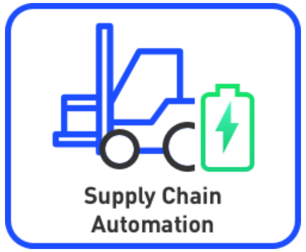
- MPS Battery Applications Engineer since 2020
- Deeply involved in:
  - Creating reference designs and complete BMS solutions
  - New BMS products definition and architectures
- Technical Point of Contact in Europe and US for BMS Products

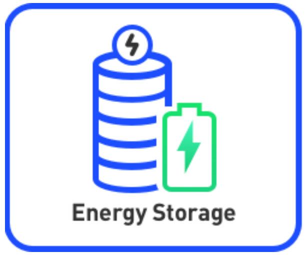
BMS Design Key Considerations



BMS Target Applications

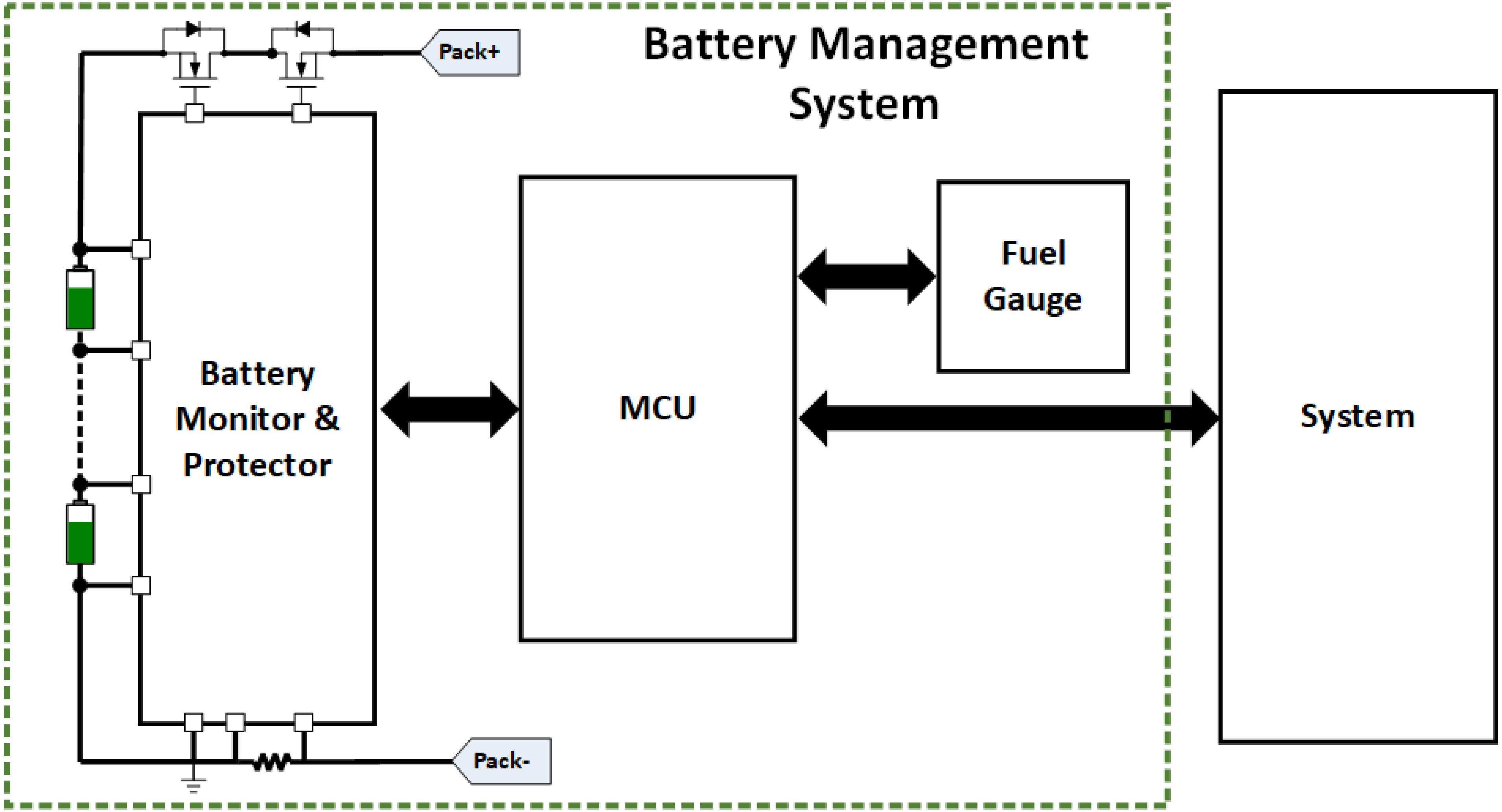




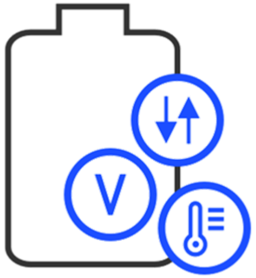


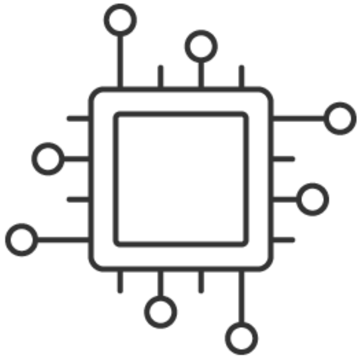
Power Tools Vacuums Gardening Tools Scrubbers Sweepers	E-Bikes Pedelecs Mopeds Scooters Golf Carts	Datacenters Medical Security Lighting A/V Equipment	Forklifts Pallet Jacks AGVs Robotics Drones	Portable Residential Commercial Utility
5 to 24 Cells **Power Cells** **High Charging rate**	**10 to 24 Cells** **Regeneration** **Connected**	**14 to 22 Cells** **Battery Parallelization** **Long No-Use Time**	**16 to 24 Cells** **High Charging Rate** **20-80% SOC** **Working Area**	**48V Up to 1000V** **Scalability** **Special** **Architectures**

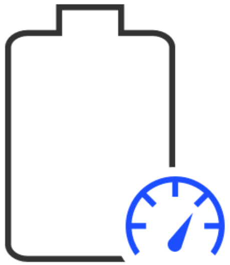
BMS Architecture Example



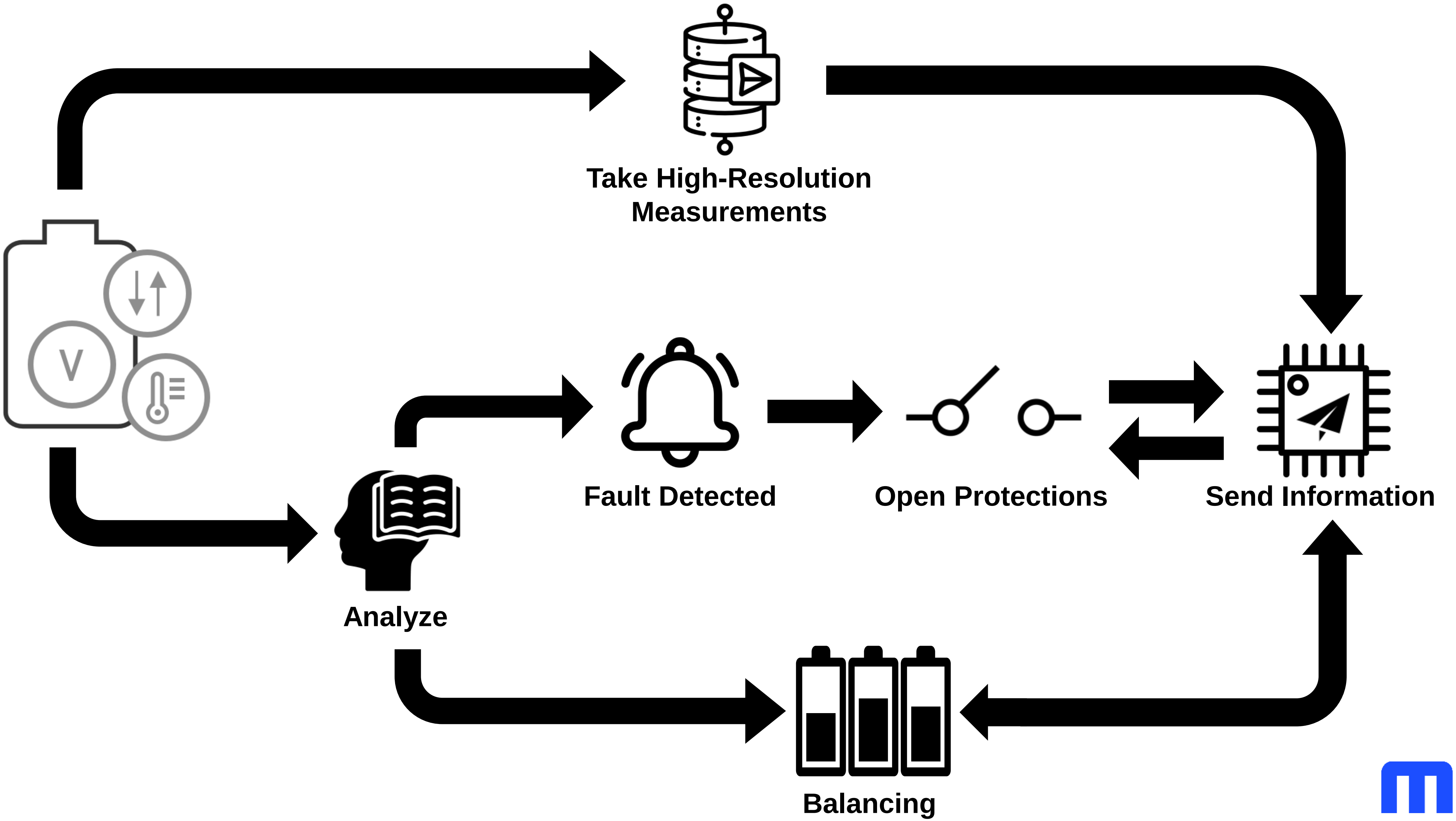
Key BMS Components





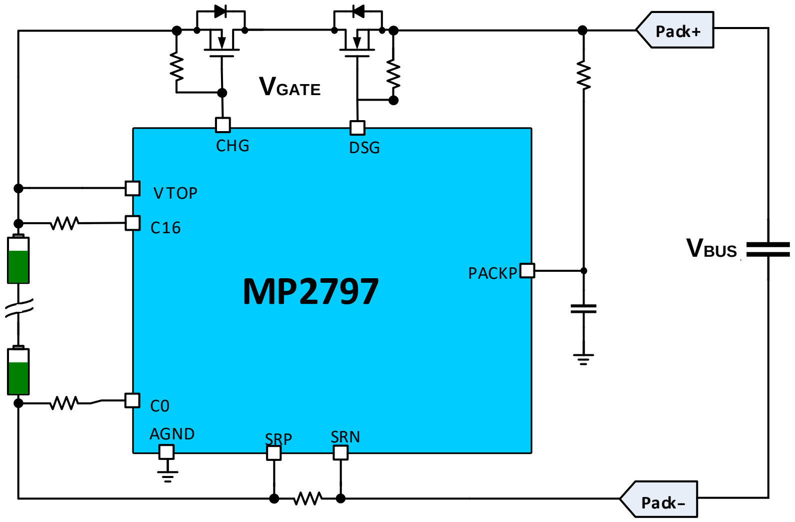


Battery Monitor & Protector

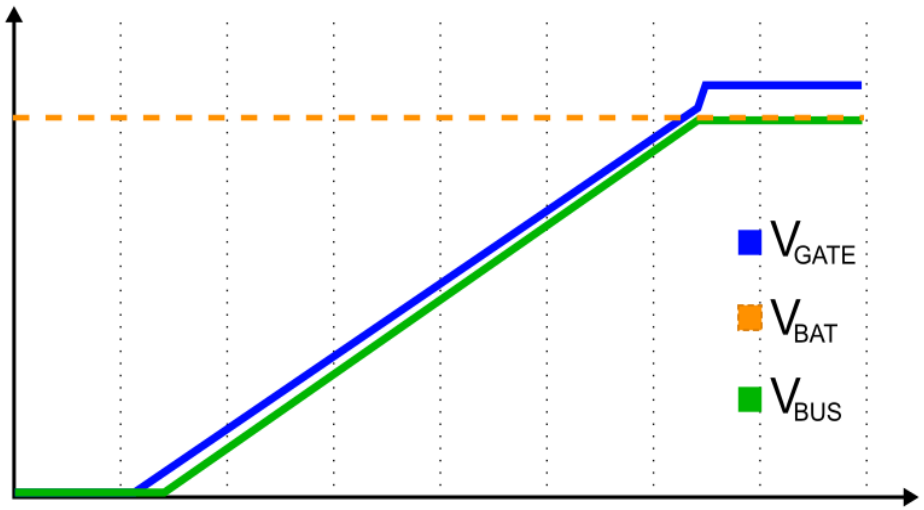


Battery Monitor & Protector Key Features

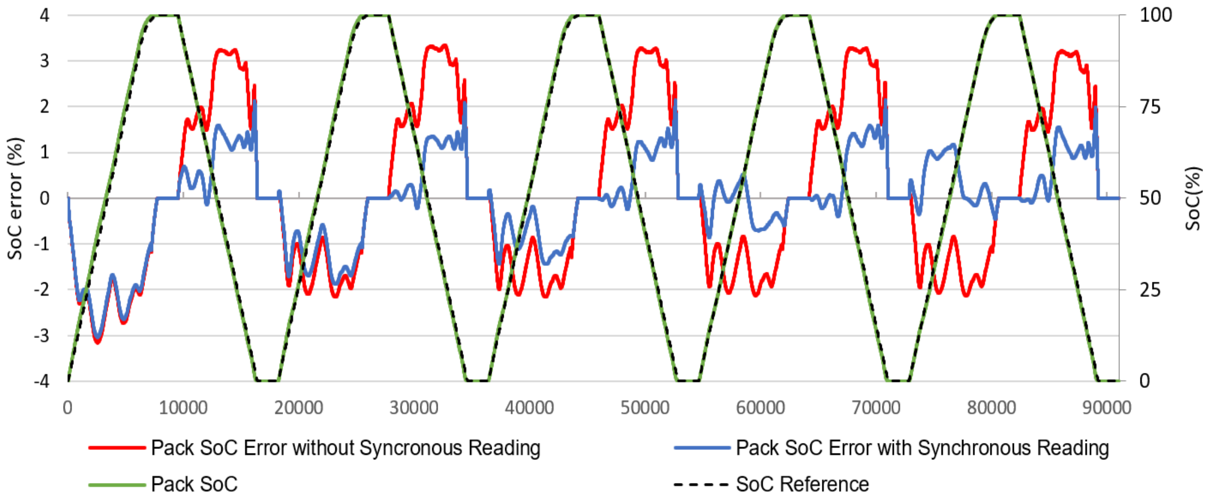
Integrated High-Side MOSFET Driver



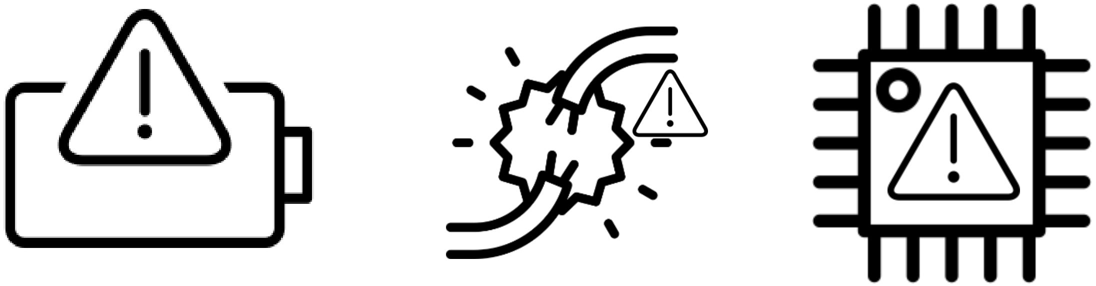
Soft Start Capability



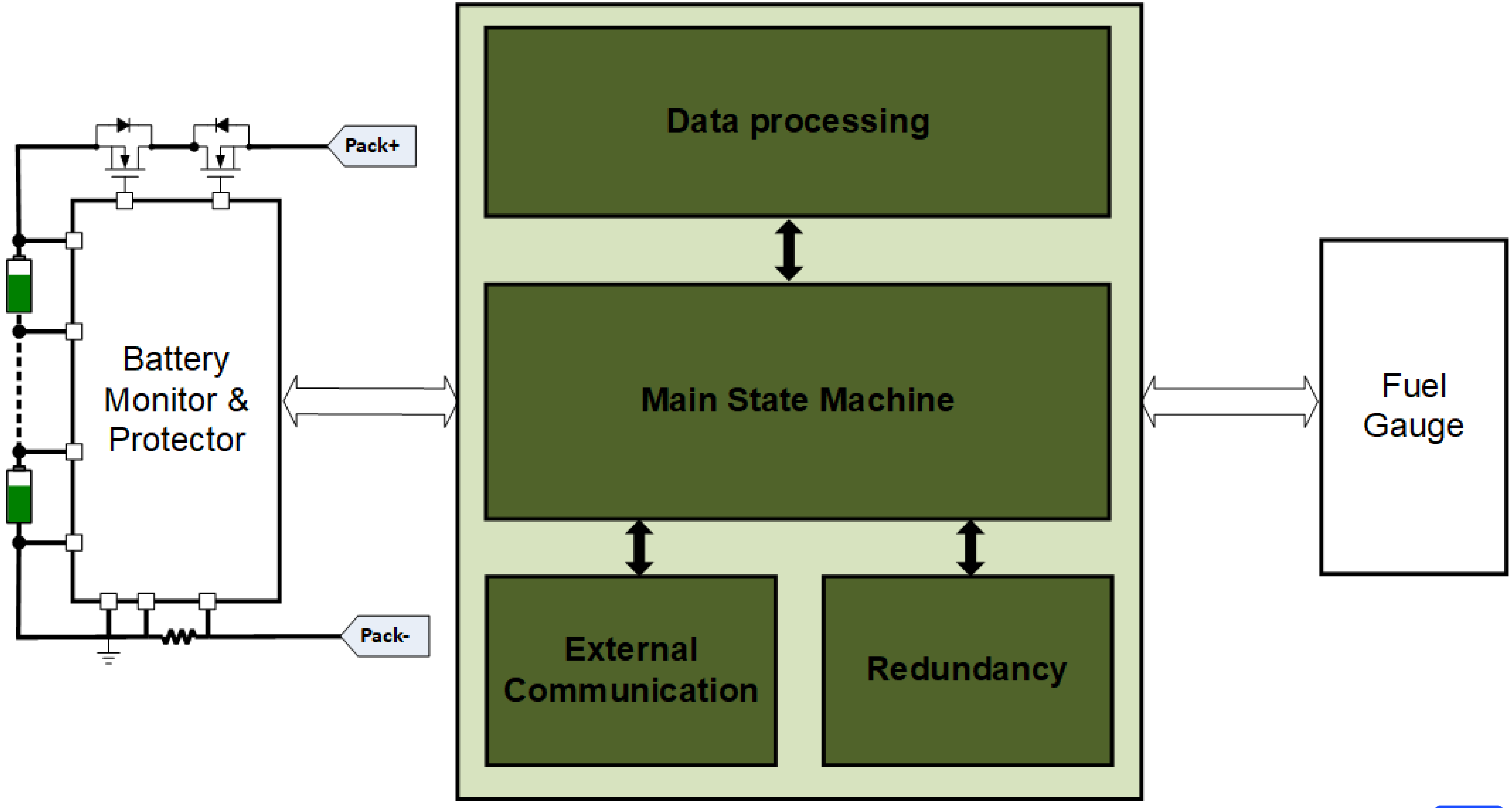
Synchronous Readings



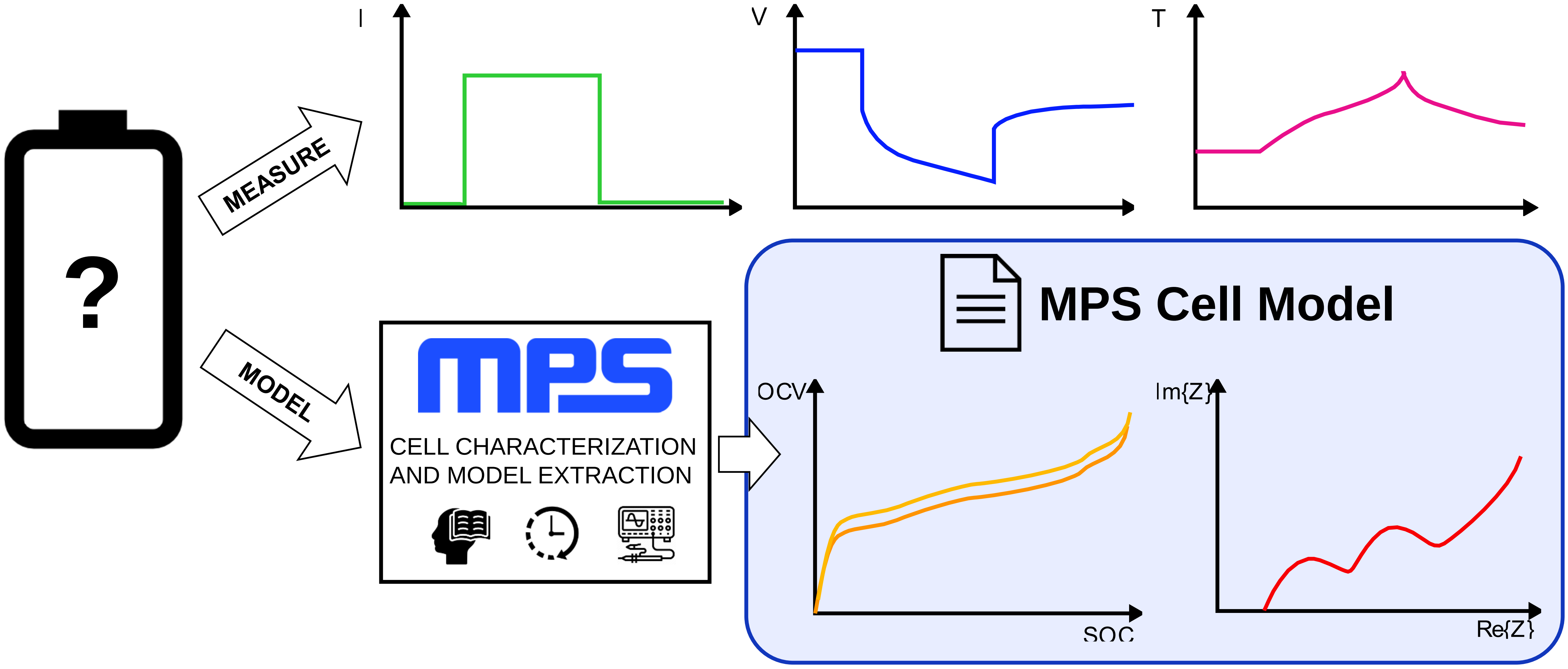
True Hardware Protection



BMS Microcontroller



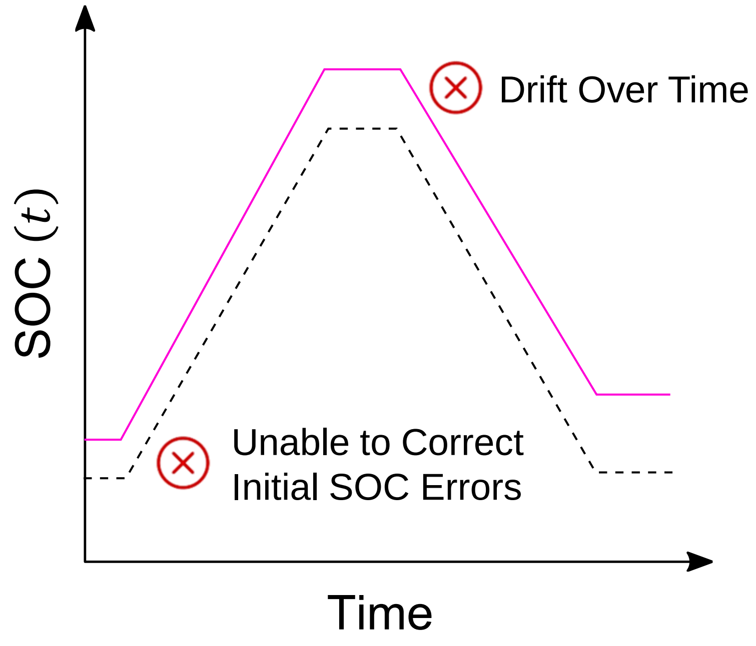
Considerations for Fuel Gauging



Fuel Gauge Methods

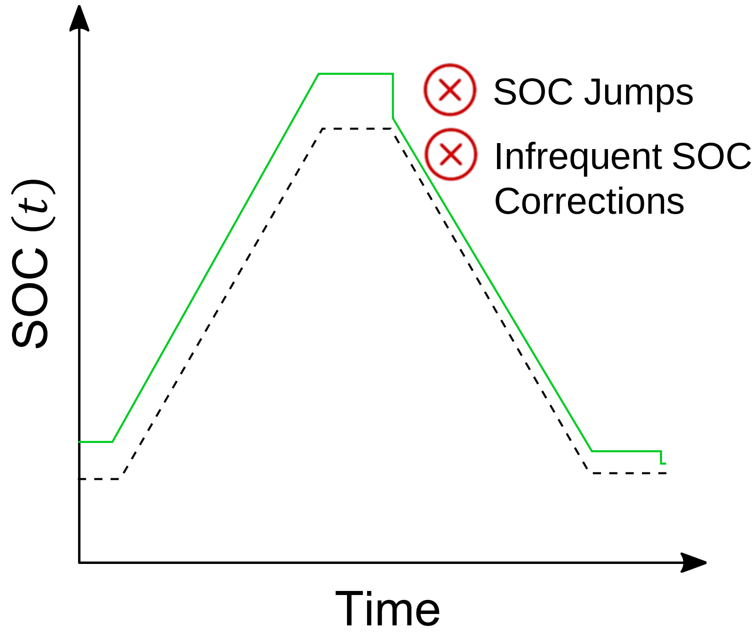
Coulomb Counting (CC) Method

- Inputs: current
- Assumption: total capacity of battery never changes under any condition



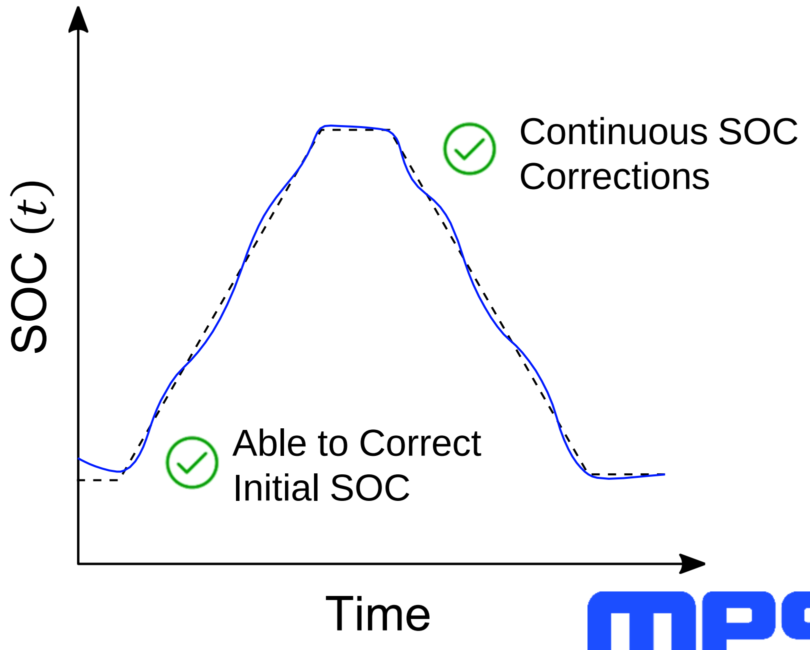
CC + OCV Method

- Inputs: current, voltage, OCV characterization
- Assumption: Total capacity changes can be corrected by measuring OCV and comparing to lookup table



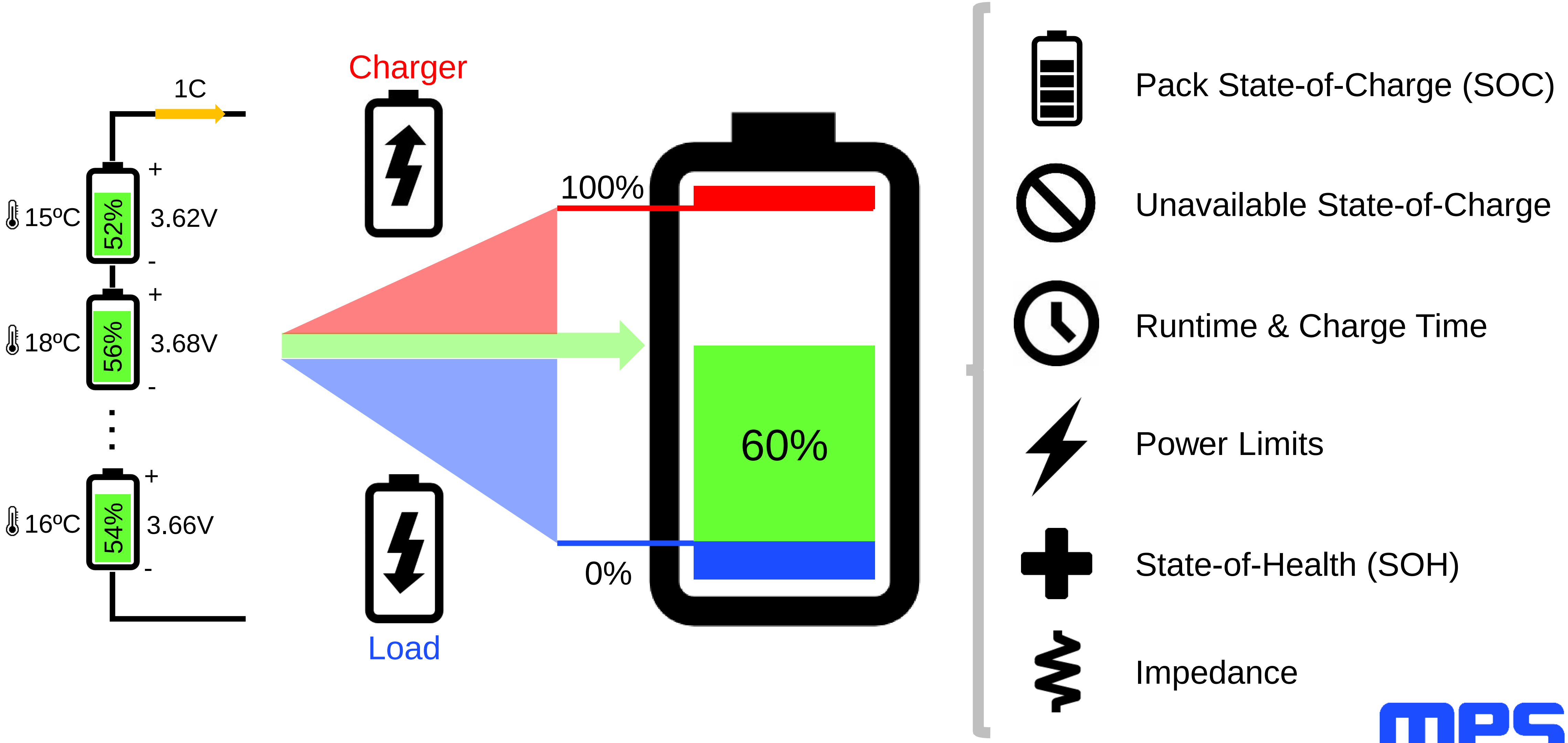
MPS Hybrid Method

- Inputs: synchronous current + voltage, temperature, cell model
- Assumption: Accurate state of charge is dependent on many factors that require complete cell model

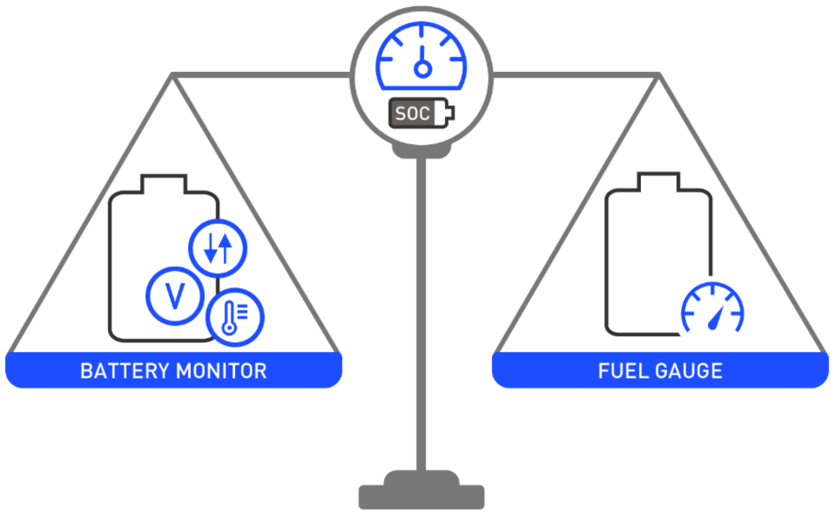


Fuel Gauge MPS Hybrid Method

Cell-Level Quantities + *Application Usage* = *Pack-Level Quantities*



Component Considerations

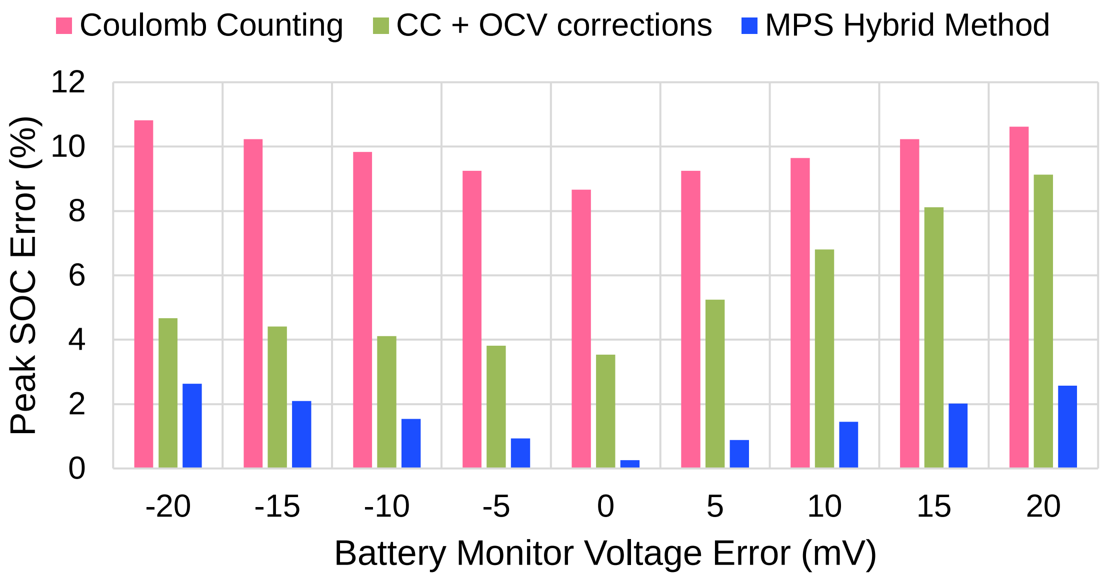


BM & Fuel Gauge Influence on SOC Accuracy

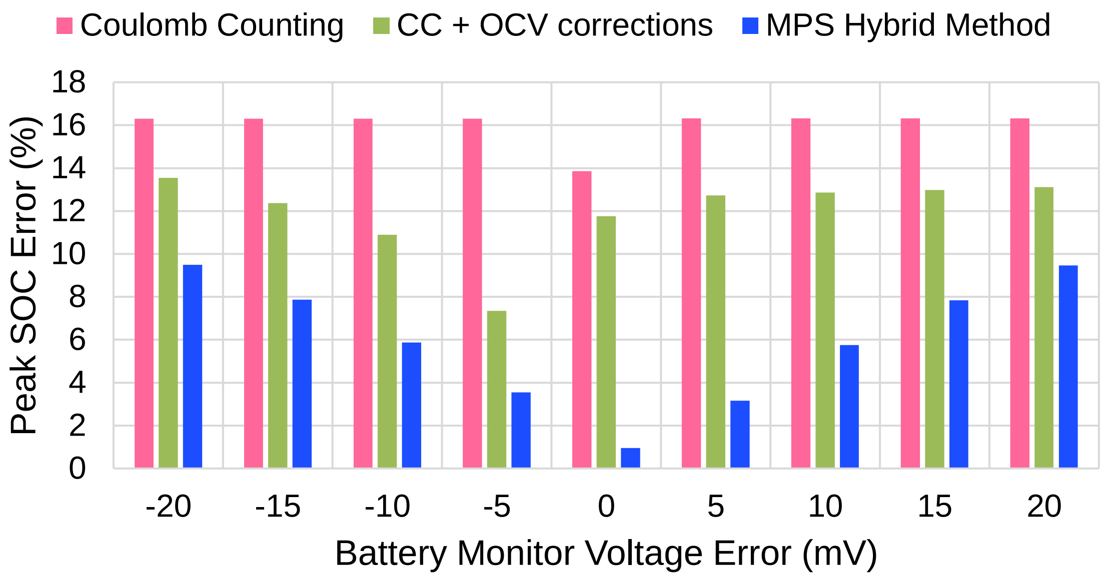
Conditions:

- New Battery
- 50% Initial SOC
- 25ºC
- 15min Relaxations
- 10 Cycles
- 20mA Current Offset

NMC Chemistry Example



LFP Chemistry Example



The fuel gauge method is really the key to achieve good results.

Coulomb Counting Method

- Poor initial SOC due to voltage inaccuracy
- SOC drift over time due to current inaccuracy

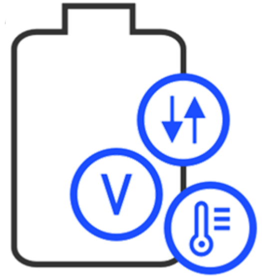
CC + OCV Method

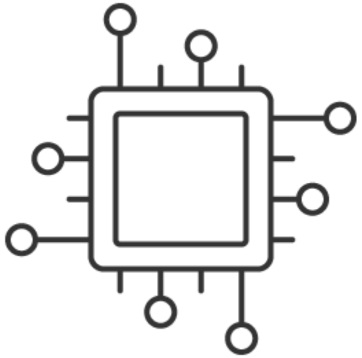
- Inaccurate SOC corrections due to voltage inaccuracy (and voltage relaxation)
- SOC drift in between OCV corrections due to current inaccuracy

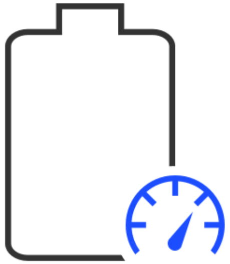
MPS Hybrid Method

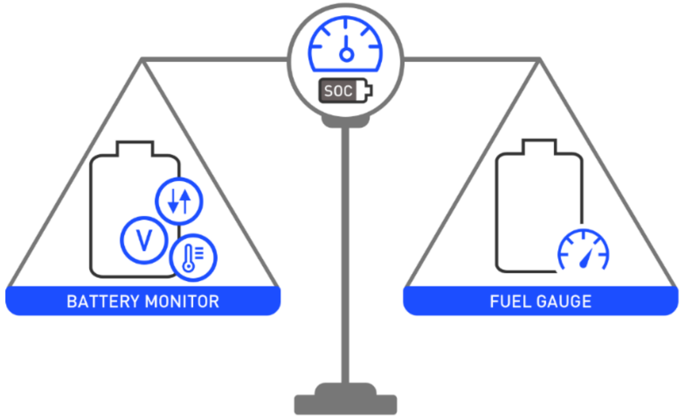
- Optimally corrects SOC (deals with voltage and current inaccuracies)
- Provides more battery insights!

Summary

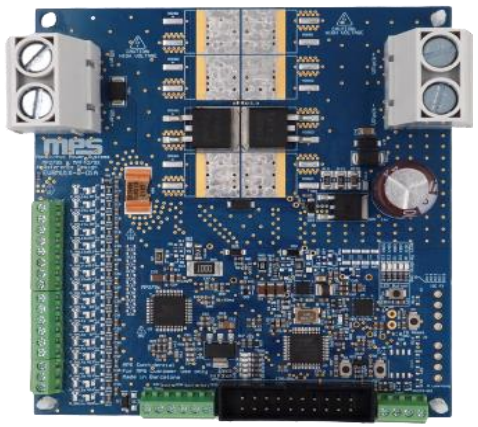




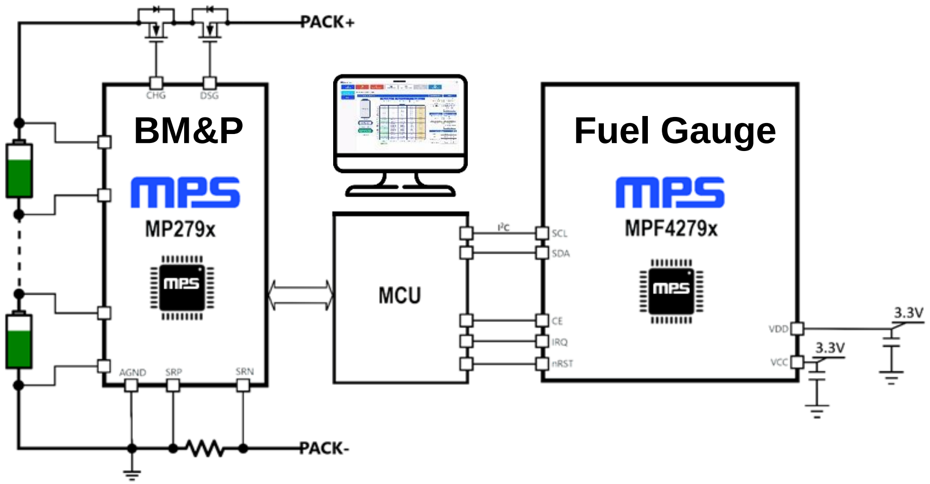


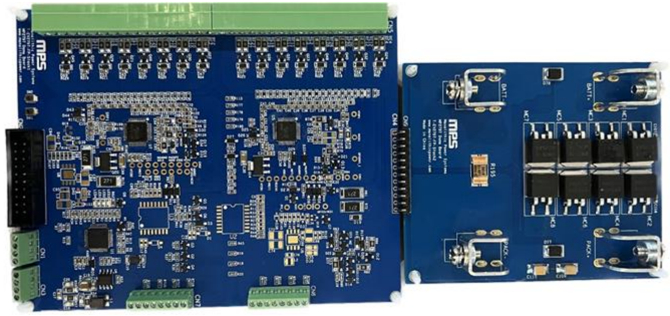


MPS Offers BMS Complete Solution



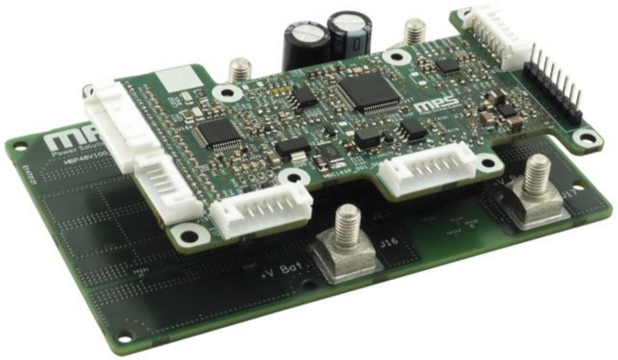
Standard BMS board
50A Continuous Current





Stacked MP279x
70A Continuous Current for 17-cell to 32-cell applications

Requirements → Cell & Component Selection → BMS Design & Configuration → Validation



Complete Solution
100A Continuous, 180A Peak Current

Q&A