



Battery Management System (BMS) solution based on NXP MC33771 Battery Cell Controller IC

Description

In general, High Voltage Battery Management System consists of a master control unit and multiple slave control units. The slave control unit is directly connected to the battery pack and collects the battery voltage, current, and temperature. Master control unit would manage the multiple slave units via Daisy chain or CAN topology.

WPI's battery management system reference solution is based on NXP chips. The main control unit uses NXP MPC5774PF from Ultra-Reliable MPC574xP family that features 32bit embedded Power Architecture and meets the highest functional safety standards for automotive (ISO26262/ASIL D). NXP functional safety SBC FS6500 provides a variety of configurable power options to MCU, optimizes energy consumption and handles the communications to in-vehicle network. The analog front-end NXP MC33771 is responsible for battery data collection. One MC33771 can connect up to 14 single cells. Multiple MC33771s can be cascaded to handle more than 14 cells design.

This BMS reference solution by WPI is made with great flexibility, it's specially designed to be modular (master control unit, slave control unit, communications/isolations and AFE) to meet the needs of different customers, ie CAN or TPL topology, you can choose the right version of AFE (SPI or TPL) accordingly, or choosing different MCUs for the different functional safety requirement.

Functional safety is the trend in future automotive electronics industry and this is also key consideration in WPI's BMS reference design part selection. WPI would provide a complete set of BMS reference solutions with development boards, which would enable customers to jump start design development reducing time to market.

Functions

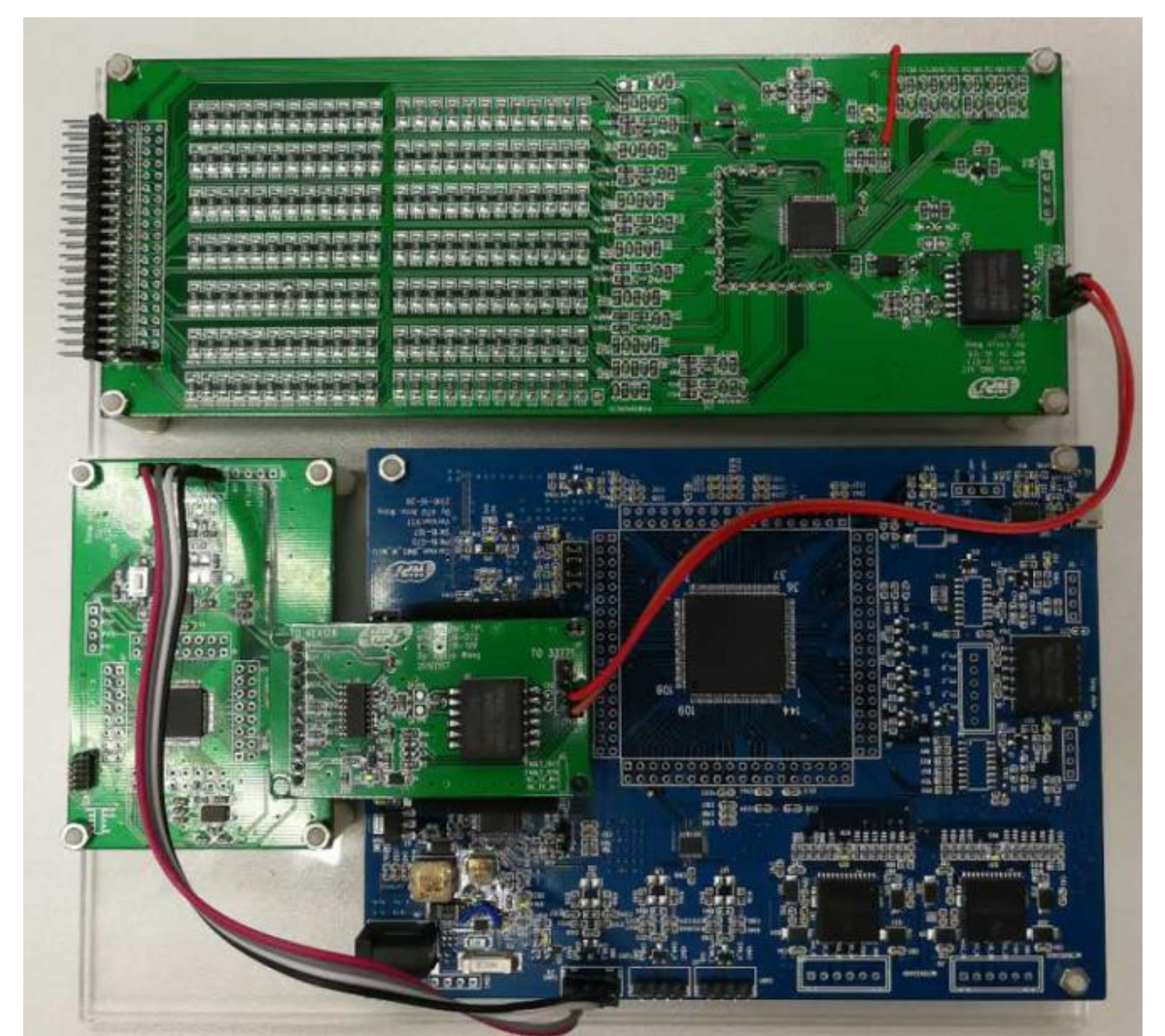
- Sense and monitor voltage and temperature of single battery cell
- Sense and monitor string of battery cells voltage, current and temperature
- Cell balancing
- Supports CAN or daisy chain topology
- Functional verification and diagnostics

Features

- Single MC33771 can sense and monitor 7 to 14 cells
Integrated Balancing FETs up to 300mA
Integrated Coulomb counter
Single chip functional safety ASIL C capable
- Scalable SW/HW up to 15 MC33771 cascades (210 Cells)
- Simultaneous current and voltage measurement

Key components

- NXP MPC5744 Master MCU
- NXP FS6500 safety power SBC
- NXP MC33771 Analog Front End
- NXP MC33664 Isolated High Speed Transceiver





MC33771 and MC33664 Batter Cell Controller and Transformer Physical Layer

The MC33664 transformer physical layer and MC33771 battery cell controller solution enable reliable, safe low-cost Li-ion cell control applications with affordable, robust and high-speed isolated communication.

AUTOMOTIVE APPLICATIONS

- High-voltage battery management systems (> 800 V)
- 48 V battery management systems

INDUSTRIAL APPLICATIONS

- Energy storage systems (ESS)
- Uninterrupted power supply (UPS)
- E-bikes, E-scooters

These fully integrated battery monitoring devices are for automotive and industrial mission-critical applications. Battery topology flexibility is supported with compatibility including 48 V batteries with one analog front end (AFE).

High-speed and robust daisy chain provides a smart alternative to CAN solutions. Fast data acquisition and communication to the pack controller can be achieved in only 3.0 ms for the pack controller to acquire conversions from 96 cells. Also, determination of individual cell impedances in one shot is synchronized for cell voltages and current measurements within 114 μ s.

With functional verification and diagnostics, the MC33664 transformer physical layer and MC33771 battery cell controller support ISO 26262 SafeAssure[®] functional safety. Functional verification of cell measure, current measure, cell terminal openings or leakage and ADC precision checks are all performed.

FEATURES

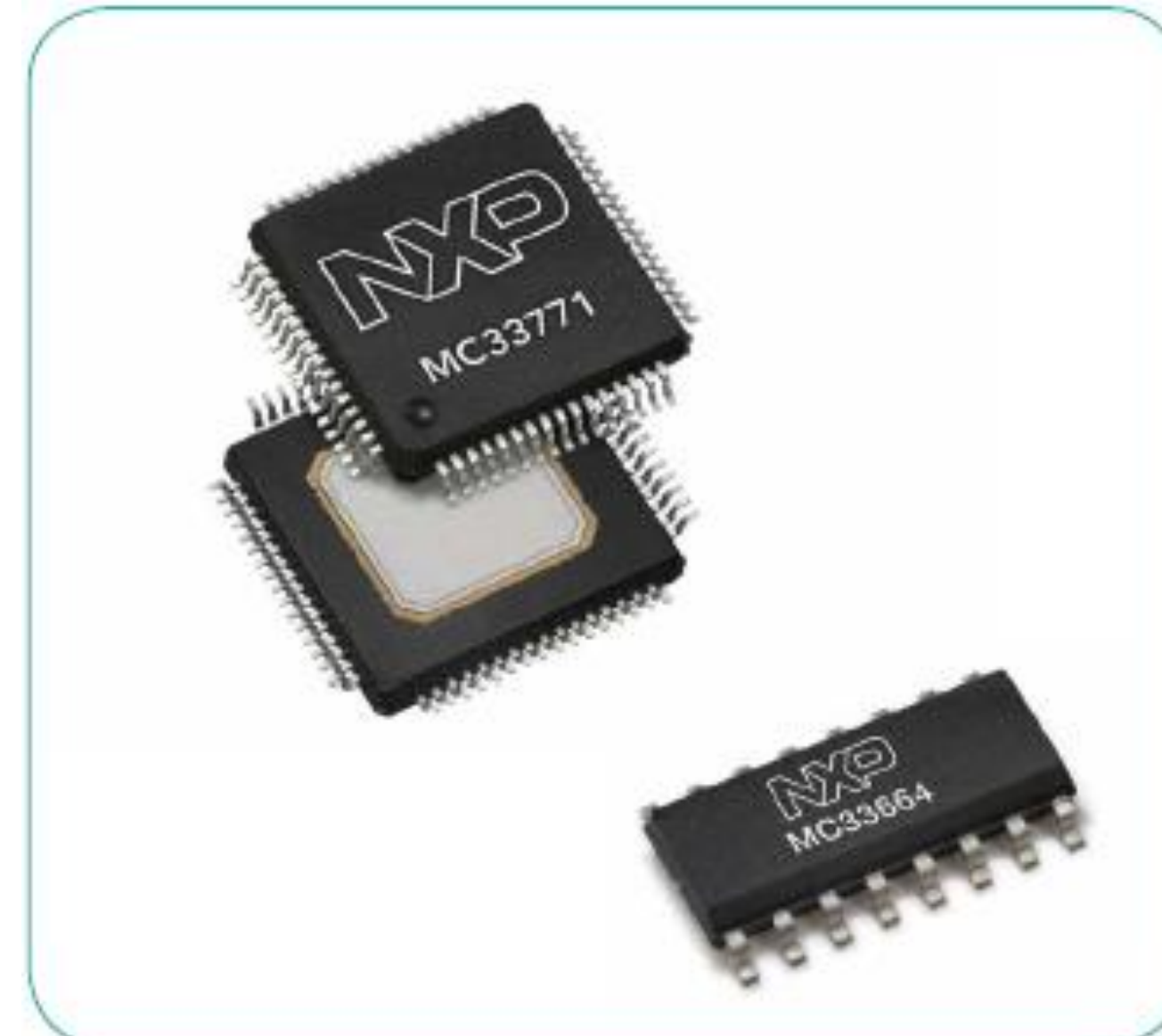
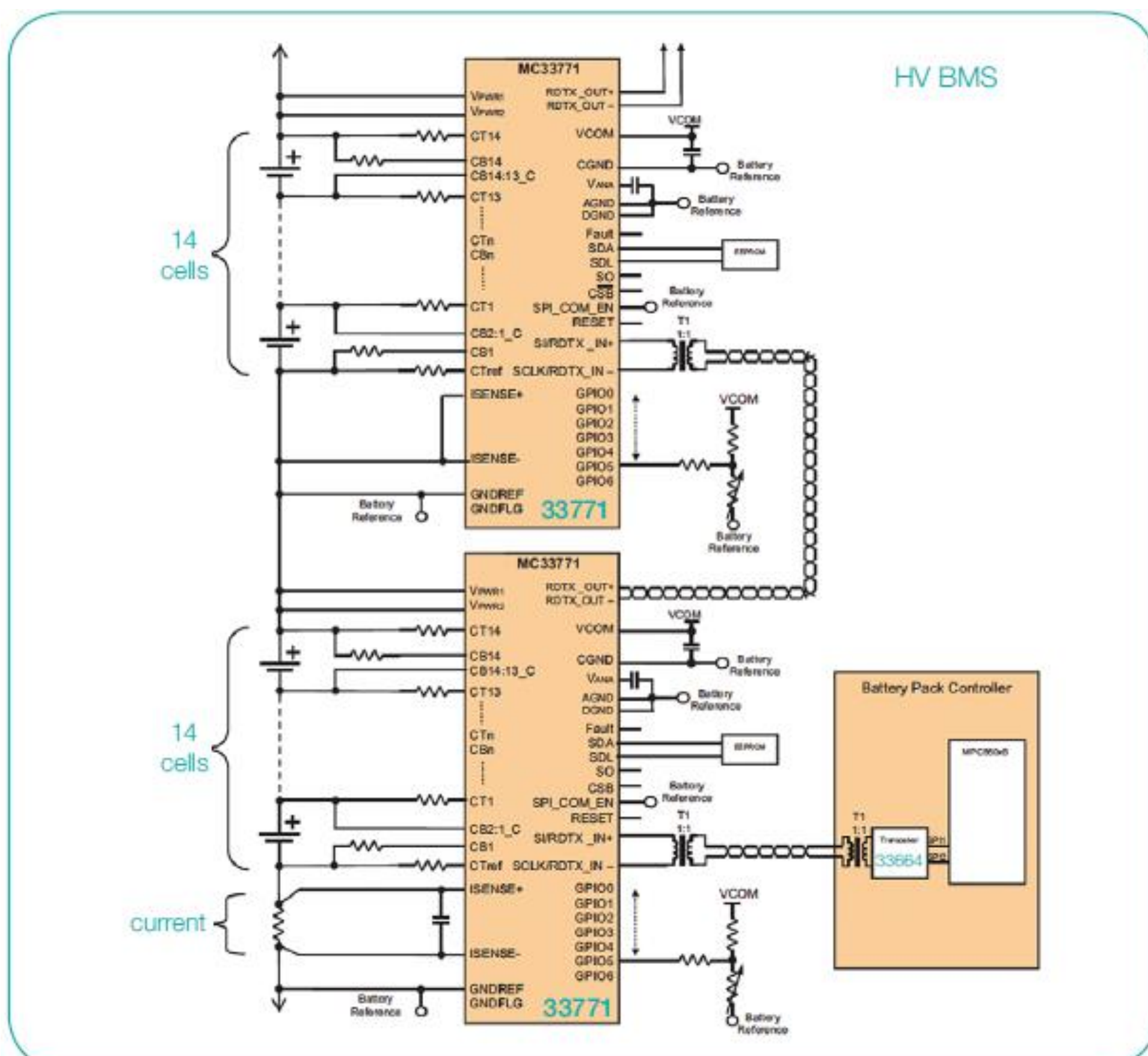
- $9.6\text{ V} \leq \text{VPWR} \leq 61.6\text{ V}$ operation, 75 V transient
- Isolated 2 Mbps differential communication or 4 Mbps SPI
- 14 x differential cells voltage and stack voltage measurements
- High-precision current measurement (+/- 1500 A) with low resolution
- Coulomb counter
- Synchronized cell voltage/current measurement 100 μ s skew
- 7 x ADC/GPIO/temperature sensor inputs
- Addressable on initialization
- Onboard 300 mA passive cell balancing low ohmic MOSFETS with diagnostics
- Low-power modes
- 64-pin LQFP package
- Designed to support ISO 26262, up to ASIL D safety capability



Features	Benefits
Integrated current channel and coulomb counting	Reduces bill of materials (BOM) for 48 V battery applications (only one AFE required)
Integrated current channel synchronized with cell voltage measurements	Determination of individual cell impedances in one shot for improved SoC/SoH prediction
Optional high-speed isolated or SPI communication	Addresses all existing battery management system topologies (centralized, distributed daisy chain, distributed CAN)
High-speed (2.0 Mbit/s) isolated high-speed differential communication	Allows BOM cost reduction by transition from CAN to daisy chain without compromise on communication speed
Fast data acquisition and communication to pack controller	Determination of individual cell impedances in one shot, synchronized cell voltages and current measurements within 114 μ s
Robust against hot plug and random cell connection	No pre-damaging of cell and no damaging of devices during customer battery/electronics assembly
ESD/EMC robustness	Strong electrostatic discharge (ESD) protection and electromagnetic compatibility (EMC) avoid the need for external components
Supports ISO 26262 SafeAssure [®] functional safety with single package solution	Has functional verification and diagnostics
Low-level drivers	Simplifies software development and reduces switching cost

MC33771 AND MC33664 HIGH-VOLTAGE BATTERY MANAGEMENT SYSTEM

MC33664 AND MC33771 PRODUCTS



DEVELOPMENT TOOLS:

FRDM33771BTPLEVB

FRDM33771BSPIEVB

FRDM33664BEVB

- For further technical details (schematic/PCB layout, etc), enquiry or support, please contact NXP.SA@wpi-group.com.
- Welcome to browse WPI Group website <https://www.wpgholdings.com/wpig/branches/en> for more information.

