Li–Ion Battery Management Platform Include Pre-Validated Firmware

Renesas Electronics has introduced all-in-one solutions for managing lithium-ion (Li-ion) battery packs in a wide range of battery-powered consumer products, such as e-bikes, vacuum cleaners, robotics and drones. With pre-validated firmware provided, the R-BMS F (Ready Battery Management System with Fixed Firmware) will significantly reduce the learning curve for developers, enabling rapid designs of safe, power-efficient battery management systems, according to the vendor.

Designed for lithium-ion batteries in both 2- to 4- and 3- to 10-cell series (S), R-BMS F solutions include Renesas' fuel gauge ICs (FGICs), an integrated microcontroller (MCU) and an analog battery front end, pre-programmed firmware, software, development tools and full documentation—all available in complete evaluation kits that are now ready to ship (see the figure).

Firmware is essential in battery management systems as it is used to monitor batteries' state of charge (SoC), state of health (SoH), current, and temperature, as well as actively balancing the voltages of the individual cells, and detect faults. In some cases, however, consumer electronics developers may lack the highly specialized expertise needed to develop control algorithms that keep the batteries operating in a safe temperature region and ensure adequate battery life over many charge/discharge cycles.

Renesas' R-BMS F solutions include built-in, pre-tested firmware designed to work with the FGIC's on-board MCU. The firmware includes critical pre-programmed functions to maximize battery life and ensure safe operation. These include cell balancing, current control, and voltage and temperature monitoring. For added flexibility, the battery management system lets developers set many parameters to meet specific requirements and adjust the solution for different cell chemistries via a graphical user interface (GUI), without the need for a full integrated development environment (IDE).

"One of the biggest bottlenecks for designing advanced power management solutions is the complex task of firmware development and validation," said Chris Allexandre, senior vice president and general manager of power at Renesas. "Not everyone has the expertise or in-house resources to write their own algorithms. Our all-in-one R-BMS F battery management system eliminates this process and provides market-ready power solutions that work without requiring specialized technical knowledge of MCU programming or advanced battery management design."

Both R-BMS F solutions contain a full evaluation kit, which has all the hardware, software, tools and documentation required to start developing. The underlying hardware powering the R-BMS F is Renesas' FGIC solution, which combines an analog battery front end and an ultra-low-power RL78 MCU into a single, small package.

The analog portion provides accurate measurements of cell voltage, current and temperature, as well as controlling the external MOSFETs and converting analog data to digital signals. The digital section is where synchronous functions reside, including the main CPU, clocks, timers and serial interfaces.

Also included in the evaluation kits are: pre-programmed firmware stored in embedded flash memory with the flexibility to set the battery pack and cell chemistry parameters; the USB System Management Bus (SMBus) interface; GUI-based software; cables to communicate with the host system; dedicated development tools for parameter setting; and full documentation, including schematics and an engineering bill of materials (eBOM).

With these resources, developers can confidently innovate intelligent power management systems that safely monitor battery usage and provide longevity, while reducing their impact on the environment, says the vendor. Renesas plans to include turn-key R-BMS F solutions in all future FGICs.

The R-BMS F for 2 to 4S cell (~8-V to 16-V) solution (RTK0EF0163DK0002BU) targets small vacuum cleaners, robotic vacuums, consumer and medical devices and runs on Renesas' RAJ240055 Li-ion battery FGIC. The R-BMS F for 3 to 10S cell (~12-V to 40-V) solution (RTK0EF0136DK0002BU) runs on Renesas RAJ240100 and RAJ240090 Li-ion battery FGICs, with target applications including e-bikes, e-mobility, vacuum cleaners, robotics, drones and industrial, consumer and medical systems.

Renesas has combined these FGICs with other devices from its portfolio to offer the Wall to Battery Low Power Energy Storage System and the USB-PD All in One Battery and Charging Solution. These Winning Combinations

are technically vetted system architectures from mutually compatible devices that work together seamlessly to bring an optimized, low-risk design for faster time to market.

Both R BMS-F solutions are available today in production volumes. For more information about the 2-4S cell R-BMS F solution see the RTK0EF0163DK0002BU page and for more on the 3-10S cell R-BMS F solution see the RTK0EF0136DK0002BU page.

Figure. The R-BMS F (Ready Battery Management System with Fixed Firmware) are all-in-one solutions for managing Li-ion battery packs in a wide range of battery-powered consumer products, such as e-bikes, vacuum cleaners, robotics and drones. The solutions include fuel gauge ICs, MCU, pre-validated firmware, software and documentation to drastically simplify and speed battery pack design. The RAJ240055 and RAJ240100 fuel gauge ICs are pictured here.