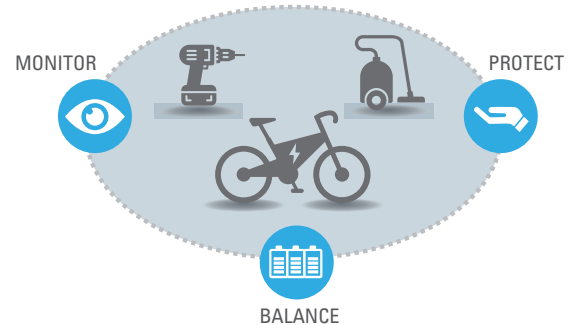


BATTERY MANAGEMENT

Management and Protection of Lithium-ion Batteries

Protect, Monitor & Balance Rechargeable Battery Packs

Renesas' Li-ion battery pack monitoring, protection and balancing ICs are specifically designed to meet the stringent safety, reliability and performance requirements of portable and battery powered applications such as consumer, industrial & medical products.



Battery Front End (BFE), Battery Management ICs

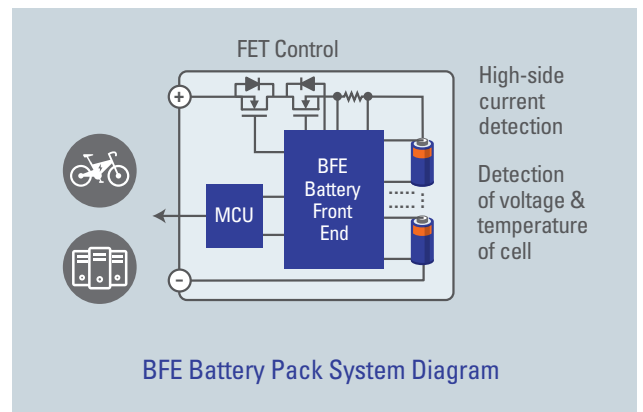
Benefits and Key Features

Protection and Cell Balancing

- Hot plug tolerant
- Over/under voltage
- Charge/discharge current
- FET control when error detected
- Open-wire detection
- Auto-cell balancing

Host Controlled Features

- Current measurement
- Cell voltage measurement
- Pack voltage measurement
- Temperature measurement
- LED indication by GPIO
- Power supply for MCU



ISL94202

Standalone Battery Protection System Accurately Monitors & Balances Rechargeable Battery Packs

- 8-cell voltage monitors support Li-ion CoO₂, Li-ion Mn₂O₄, and Li-ion FePO₄ battery chemistries
- Highest level of integration: cell voltage level shift, automatic cell balance, 14-bit ADC, current sense monitor, power FET control, and temperature sensor interface
- Multiple cell voltage protection options up to 4.8 V
- Integrated charge/discharge FET drive circuitry with built-in charge pump supports high-side N-channel FETs



www.intersil.com/battery_management

Battery Front End, Multi-Cell Li-Ion Battery Management ICs

Cells		Pack Voltage (V)	Part No.	Interface	Cell Balance	Current Sense	Charge/Discharge FET	Stand-alone capable	Internal ADC	Features	Package
Min.	Max.						Location				
3	8	4 to 36	ISL94202/203	I ² C	External	High Side	N-channel, High Side	Yes	Yes	High-side current sense, standalone capable	48TQFN
4	6	8 to 26.4	ISL94208	I ² C	Both	Low Side	N-channel, Low Side	No	No	Low-side current sense, internal cell balance	32QFN
6	12	6 to 60	ISL94212	SPI	External	No	N/A	No	Yes	60V pack voltage, daisy-chain	64TQFP

Battery Fuel Gauge ICs (FGIC)

Dedicated 1-package solution with MCU and AFE for Battery Management System provides intelligent battery system by constantly monitoring the battery state.

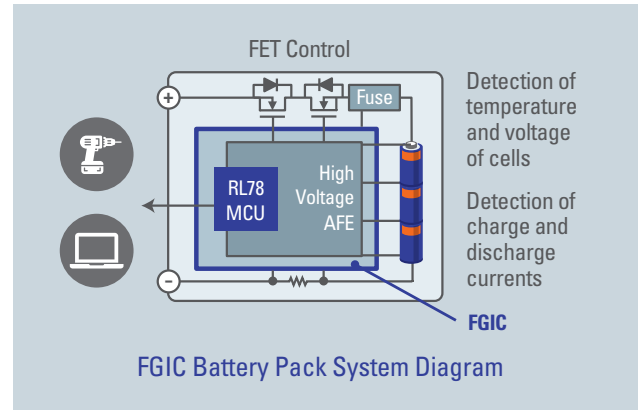
Benefits and Key Features

Safety and Protection Control

- Over/under voltage
- Charge/discharge current
- FET control when error detected
- Chemical fuse control
- Cell balancing

Remaining Capacity Management

- Current/voltage detection
- Precise coulomb counter
- Deterioration detection
- Calculation and learning of battery capacity
- Fault detection/history management



FGIC Block Diagram

Voltage and Current Measurement by Independent A/D Converters

- Current detection: 153 $\mu\text{A}/\text{LSB}$ resolution (18-bit $\Delta \Sigma$ 5 m Ω shunt resistor), support for continuous measurement
- Voltage/temperature measurement: 15-bit $\Delta \Sigma$ ADC

High Reliability & High Integration

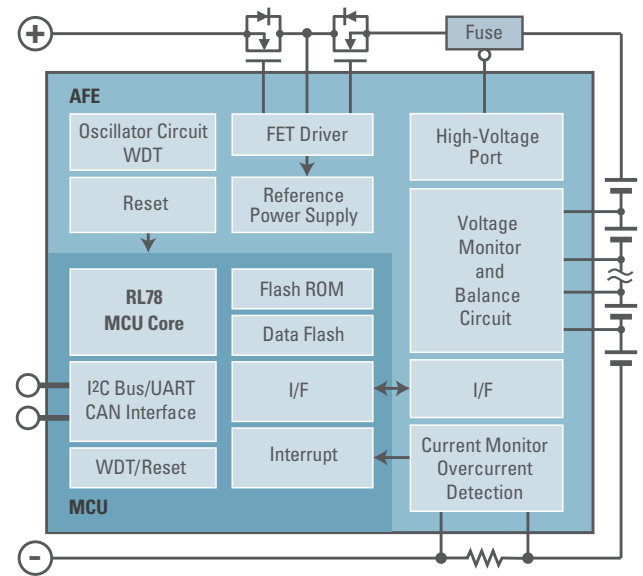
- Built-in FET protection for overcurrent or short circuit conditions
- Redundant fault detection by both MCU and AFE
- Ability to set lifecycle related limits and maintain battery parameter and operation history using data flash guaranteed for 100,000 erase/write cycles
- Integrated CAN interface and RTC (Real Time Clock) circuit for industrial apps, ICs can manage date and time in a single device (RAJ240090 and RAJ240100)

Few Parts, Low System Cost

- Supports large-current discharge with N-channel FET drivers
- Integrated pull-up resistors for thermistor

Extended Battery Life

- Low power mode with consumption of 25 μA or less and cell balance circuit to maximize battery capacity (RAJ240090 and RAJ240100)



Internal Block Diagram of FGIC

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Battery Fuel Gauge ICs

Cells		Pack Voltage (V)	Part No.	Flash ROM	RAM	ADC Port	Serial I/F	I/O	Features	Package
Min.	Max.									
2	4	4 to 25	RAJ240045	64 KB	4.0 KB	2-ch	I ² C, UART	12	Compact package (4 mm×4 mm)	32QFN
2	5	4 to 25	RAJ240075	64 KB	4.0 KB	3-ch	I ² C, UART	11	Compact package (4 mm×4 mm) 5 cell support	32QFN
2	5	4 to 28	RAJ240080	64 KB	5.5 KB	3-ch	I ² C, UART	22	GPIO: I/O×18, input×2, NOD×2	48LQFP
3	8	4 to 50	RAJ240090	128 KB	7 KB	4-ch	I ² C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 μA)	64LQFP
3	10	4 to 50	RAJ240100	128 KB	7 KB	4-ch	I ² C, UART, CAN	31	High voltage tolerance, on-chip CAN, low power consumption (25 μA)	64LQFP

* Specifications are subject to change without notice