Battery management system

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Battery management system

Automotive BMS must be able to meet critical features such as voltage, temperature and current monitoring, battery state of charge (SoC) and cell balancing of lithium-ion (Li-ion) batteries.

Main functions of BMS

- **Battery protection** in order to prevent operations outside its safe operating area.
- **Battery monitoring** by estimating the battery pack state of charge (SoC) and state of health (SoH) during charging and discharging.
- **Battery optimization** thanks to cell balancing that improves the battery life and capacity, thus optimizing the driving range for hybrid (HEV), plug-in (PHEV) and full electric vehicles (BEV).

- L9963E and L9963T for cell management
- SPC574S MCUs for monitoring, control and delivery
- L9001 Simple Power Supply - Multiple Voltage Regulator
• Easy connection, quick evaluation and low-cost demonstration kit
  • To quick check 1x L9963 cell voltage/GPIO/current sense ADC conversion performance and diagnosis/safety function by periodically running conversion
  • To check/understand ISOSPI daisy chain communication interface with L9963(T) and several L9963s in ISOSPI mode.

• Evaluation GUI
  • Register write / read function
  • Easy multi L9963 device ID assignment and clear
  • Friendly interface to configure ov/uv threshold and get the ADC conversion and diagnostic return data through configurable periodically running.
  • Configuration and data save / load function
  • Reference code on SPC5Studio
BMS key component advanced AFE L9963E

- **Advanced voltage measurement for up to 434 cells**
- **High precision with maximum error of ±2mV in whole operating temp range**
- **Synchronized current and voltage samples**
- **200 mA passive internal balancing current**
- **2.66 MPS daisy chain Supports both XFMR and CAP based isolation**
- **Fully redundant cell measurement path with ADC Swap**
- **Intelligent diagnostics, Function Safety and Robustness**

L9963 block diagram with its main core blocks
BMS key component
isolated transceiver L9963T

- Transformer isolated communication interface
- Up to 2.66 Mbps
- 3.3V and 5V compatible logic threshold
- Robust conducted and radiated immunity performance
- ISO262622, ready for ASIL D system
• **Voltage regulator for multiple power supply schemes**
  - First stage asynchronous switch mode regulator (VDD1) 5 V output
  - Second stage regulator (VDD2) supplied by VDD1 with 1.2 V output (i.e. μC-core)
  - DC LDO 5 V for ADC μC supply

• **Supervision and diagnosis**
  - VS monitoring
  - Over temperature detection
  - Output supply supervision
  - Output overcurrent protection

• **Fail-safe functionality**
  - Output under or over voltage reset generation
  - Configurable Watchdog
  - Over temperature shutdown
  - Low power mode
BMS key component
high performance MCU SPC574S

Core
- Up to 140 MHz Power Architecture™ ISA e200z4 Core (VLE)
  - Dual Issue Core with Floating Point Unit
  - 12k Cache (8k-Instruction Cache, 4k-Data Cache)
  - 32k TCM (32k d-RAM)
- ASILD SEooC

I/O
- 1 x FlexRay Dual Channel with 128MB (optional)
- 3x MCAN (with ISO CAN-FD on Cut2.0)
- 4 x LINFlex (3x master only)
- 4 x DSPi
- 2 x SENT (2x3ch overall)
- 2 x FlexPWM (4x3ch each) + 2 x FlexPWM (2ch each)
- 4 x eTimer (6ch each)
- ADC – 2x (3+1)x 12Bit, 18/32/33Ch. (on QFP100/144/BGA)
  - fast 10Bit conversion & supervisor ADC concept
- 2 x ADC enh’d cross triggering unit (eCTU)

Memory
- 1.5Mbyte + 4x16k Flash with ECC
- 128k RAM with ECC (96k SRAM + TCM)
- Crossbar with MPU (16 regions)

System
- 16Ch eDMA
- CRC Unit
- Fault Collection & Control Unit
- Software watchdog timer (inc. window mode, flow monitoring)
- 3.3V or 5V advanced supply (internal or external logic supply)
- FM-PLL_FlexRay PLL and 16MHz internal RC OSC
- Nexus Class 3+ / JTAG (2 pin or 5 pin)
- 100-144 pins LFQFP package (0.5mm pitch)
- -40°C - + 150°C Tj

System / Platform | Product / Application Specific | Memory | Connectivity
BMS demo support package

- Databrief / Datasheet
- Application notes
- FMEDA / DFA
- Safety manual
- Evaluation board
- User GUI
- EMC report
Thank you