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Battery management system

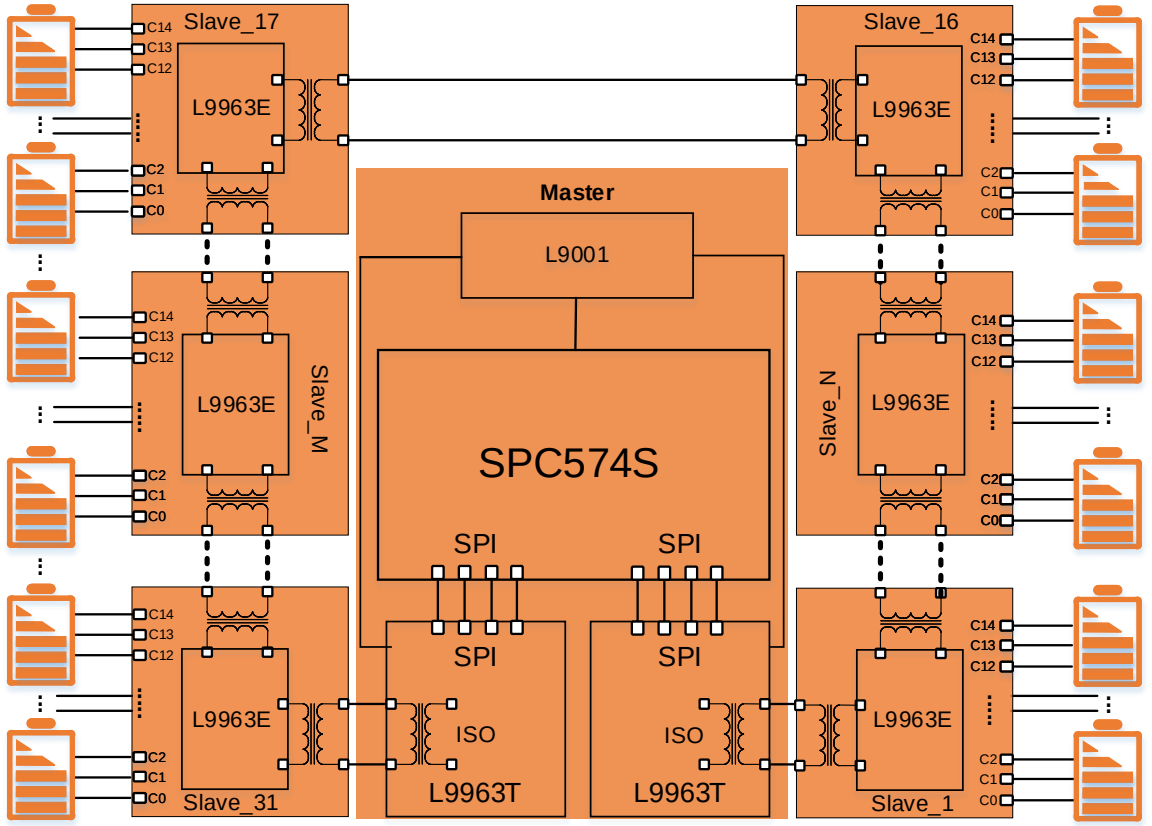
June 2020

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

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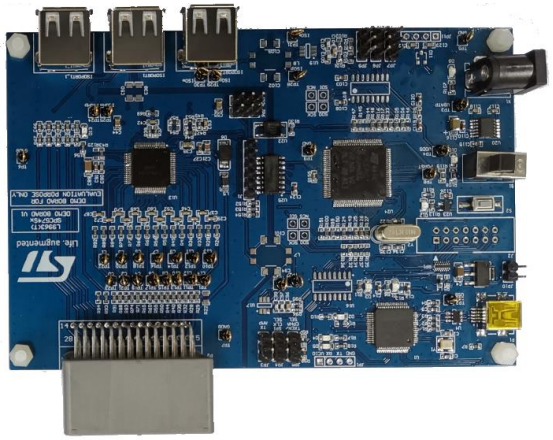
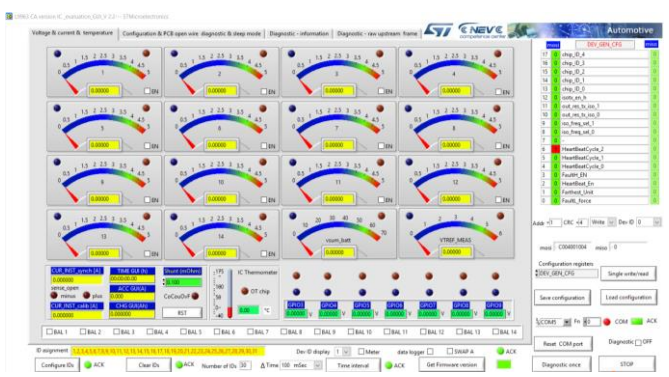
BMS demo

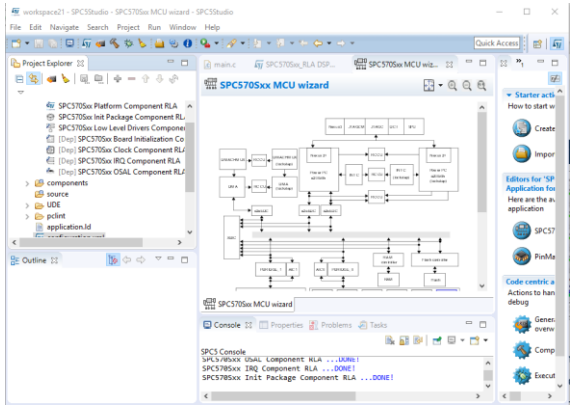
Hardware



- **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.

Software





- **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**

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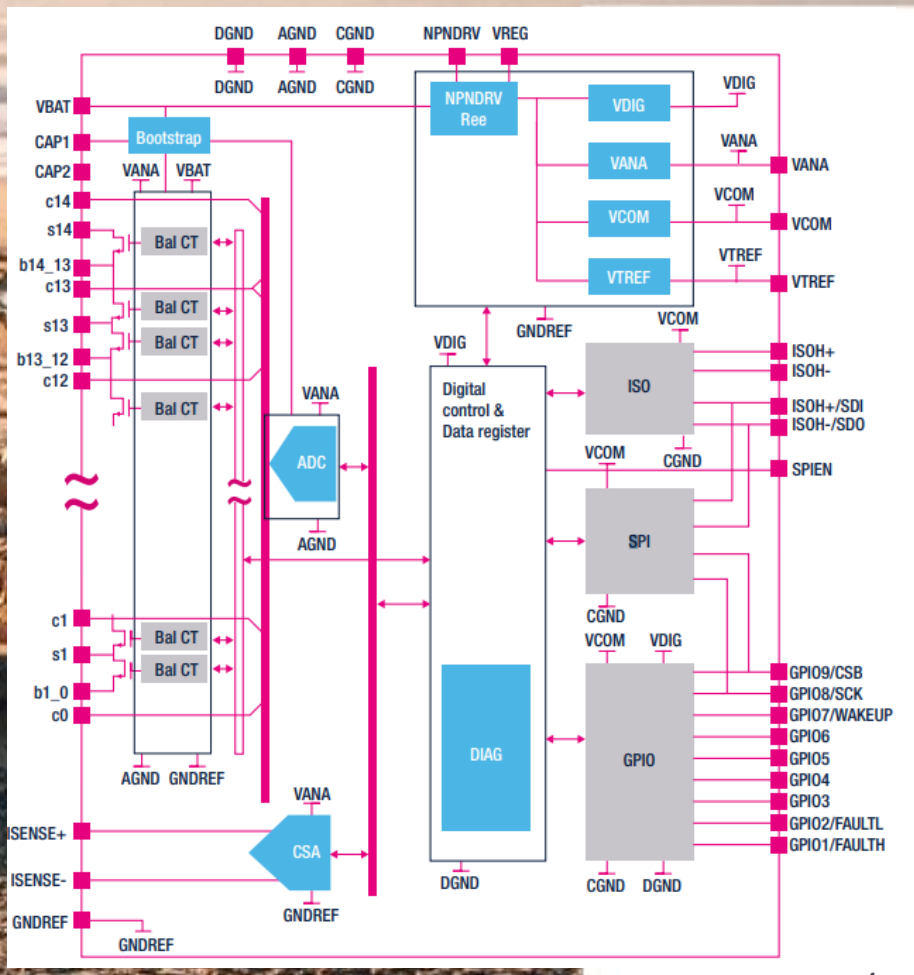
BMS key component advanced AFE L9963E

ASIL Ready

- **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

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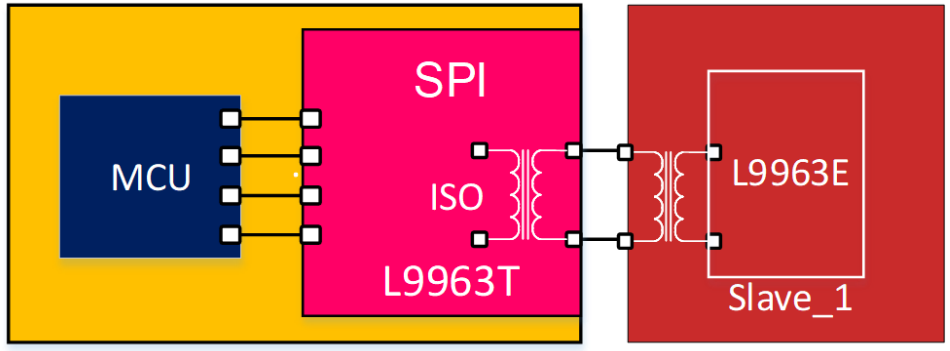
BMS key component isolated transceiver L9963T

- 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



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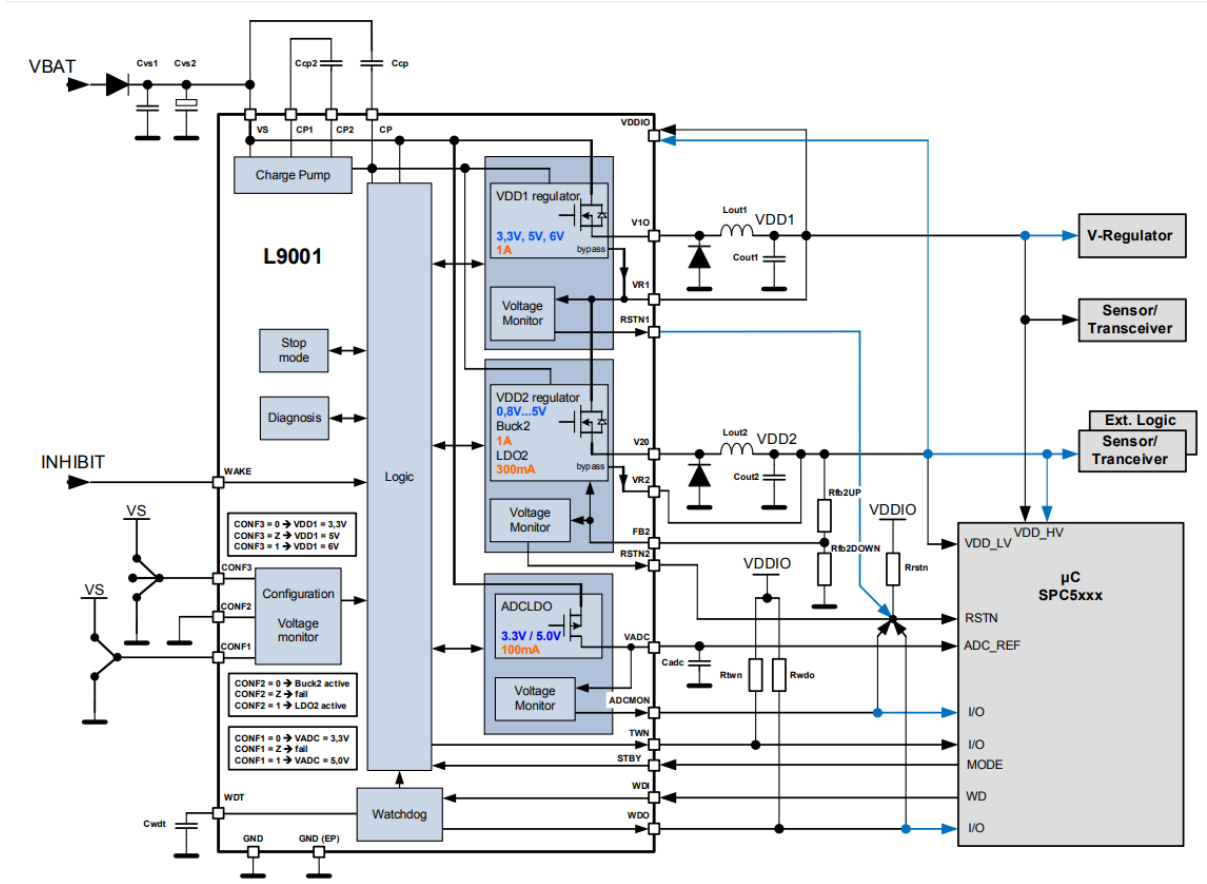
BMS key component simple power supply L9001

- **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



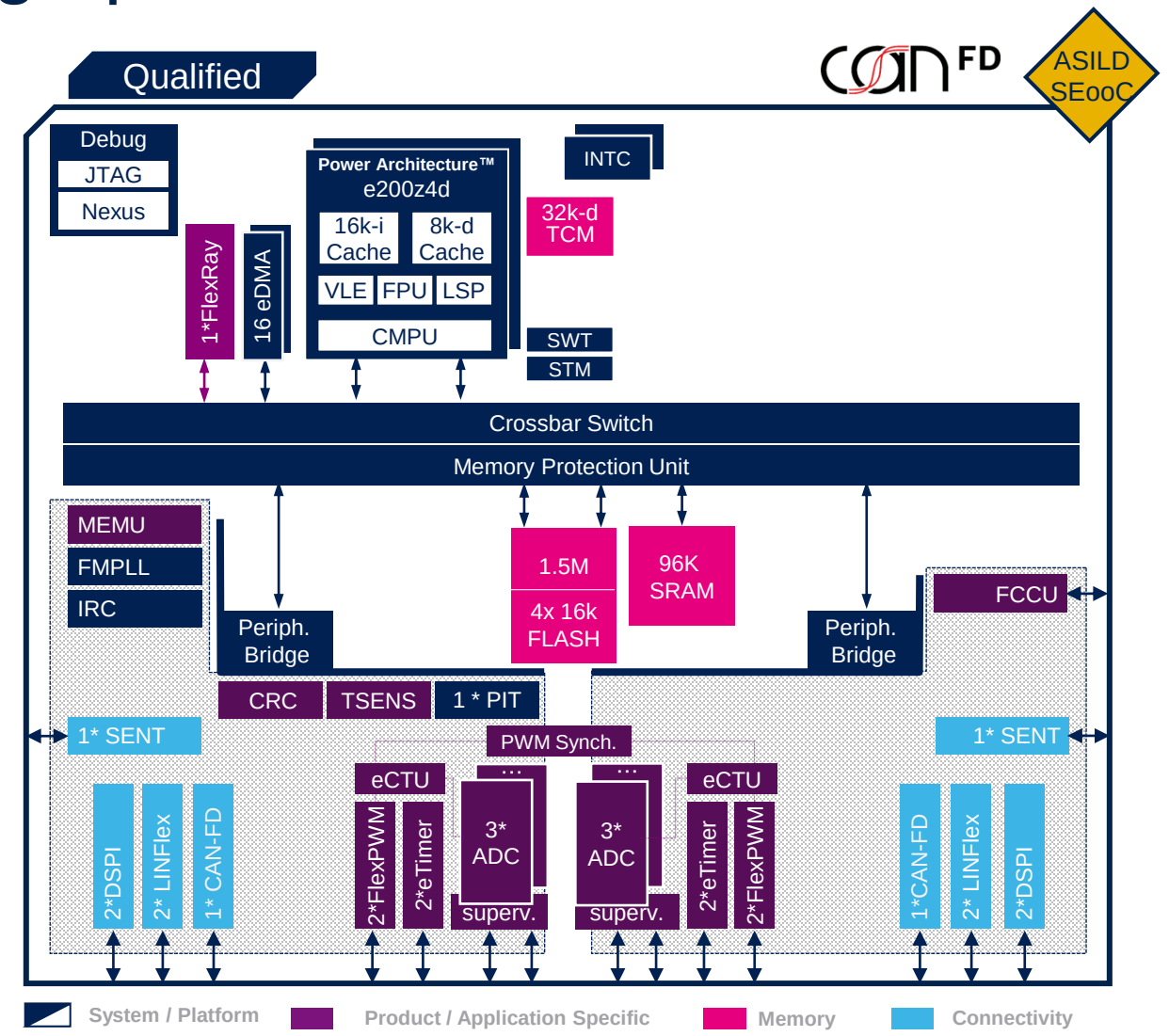
BMS key component high performance MCU SPC574S

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

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

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)

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 LQFP package (0.5mm pitch)
- -40ºC - + 150ºC Tj



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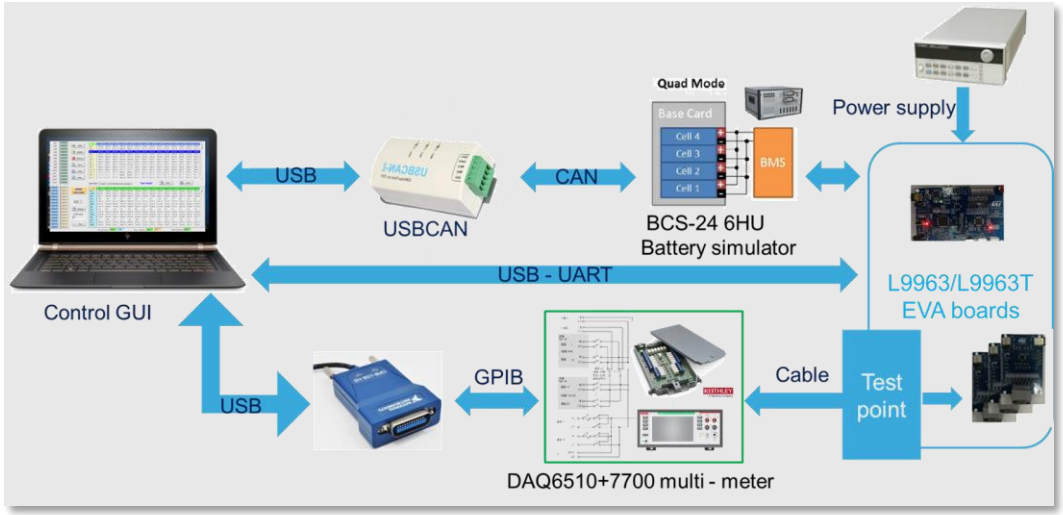
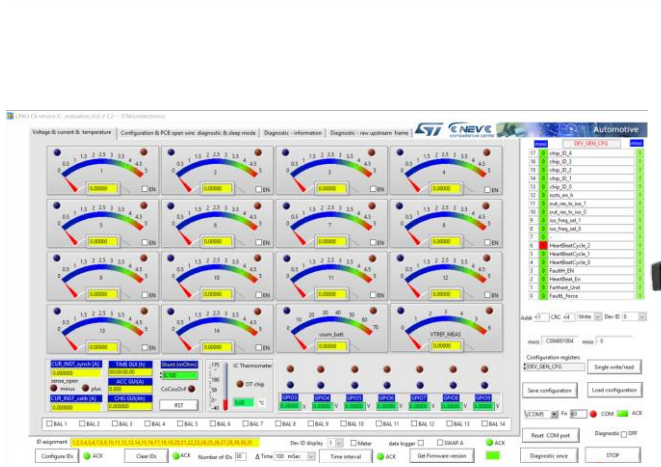
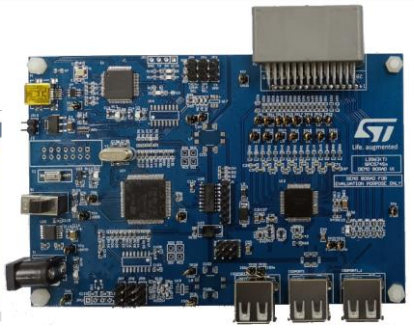
BMS demo support package

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







Thank you

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