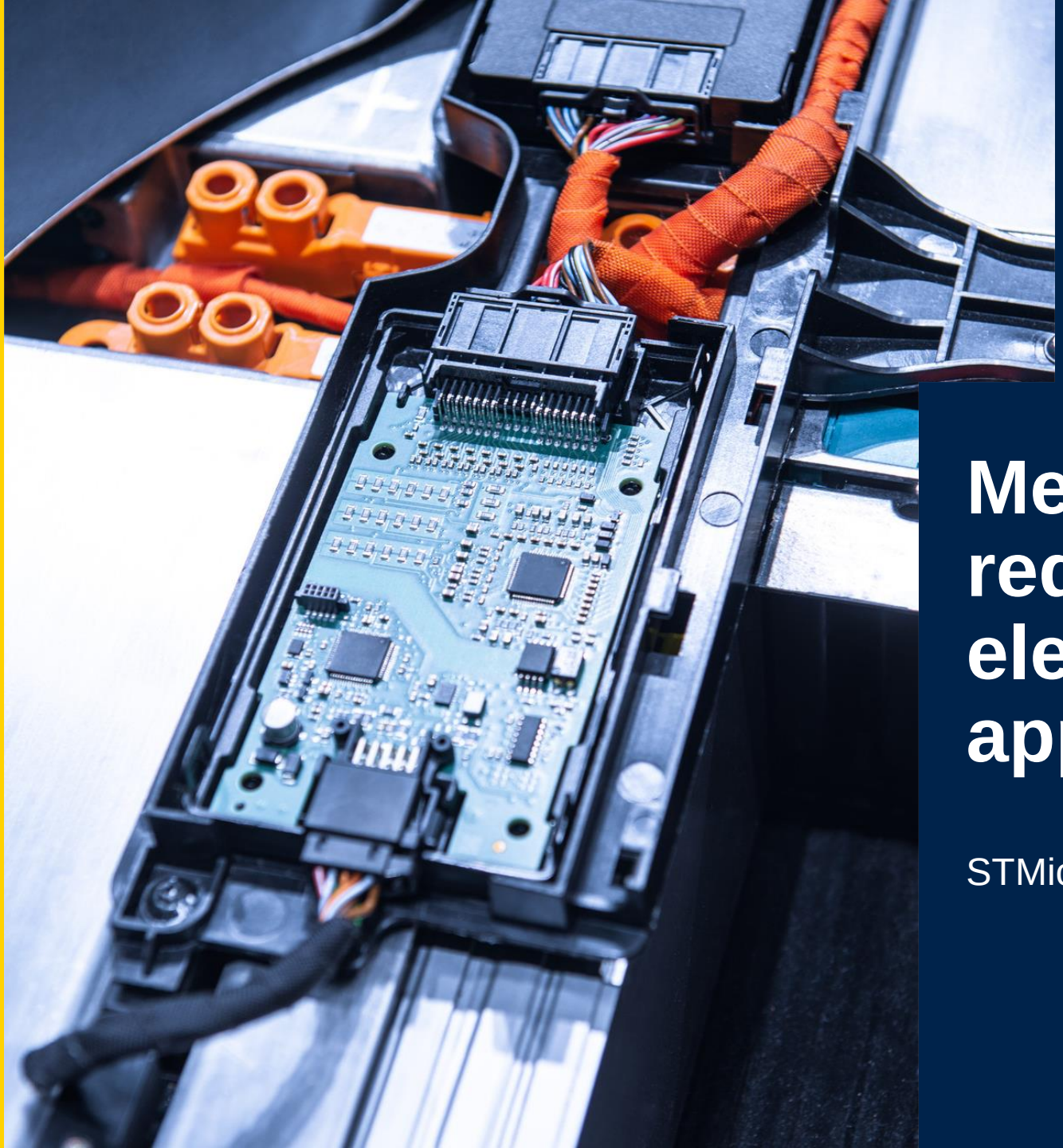

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Meet BMS performance requirements for your electric vehicle applications

STMicroelectronics

Meet BMS performance requirements for your electric vehicle applications

Battery Management Systems for EVs

L9963 Battery Management Integrated Circuit (IC) & L9963T Isolated Transceiver

Battery Management Evaluation Tools

SPC5 Microcontroller Family for your EV Applications

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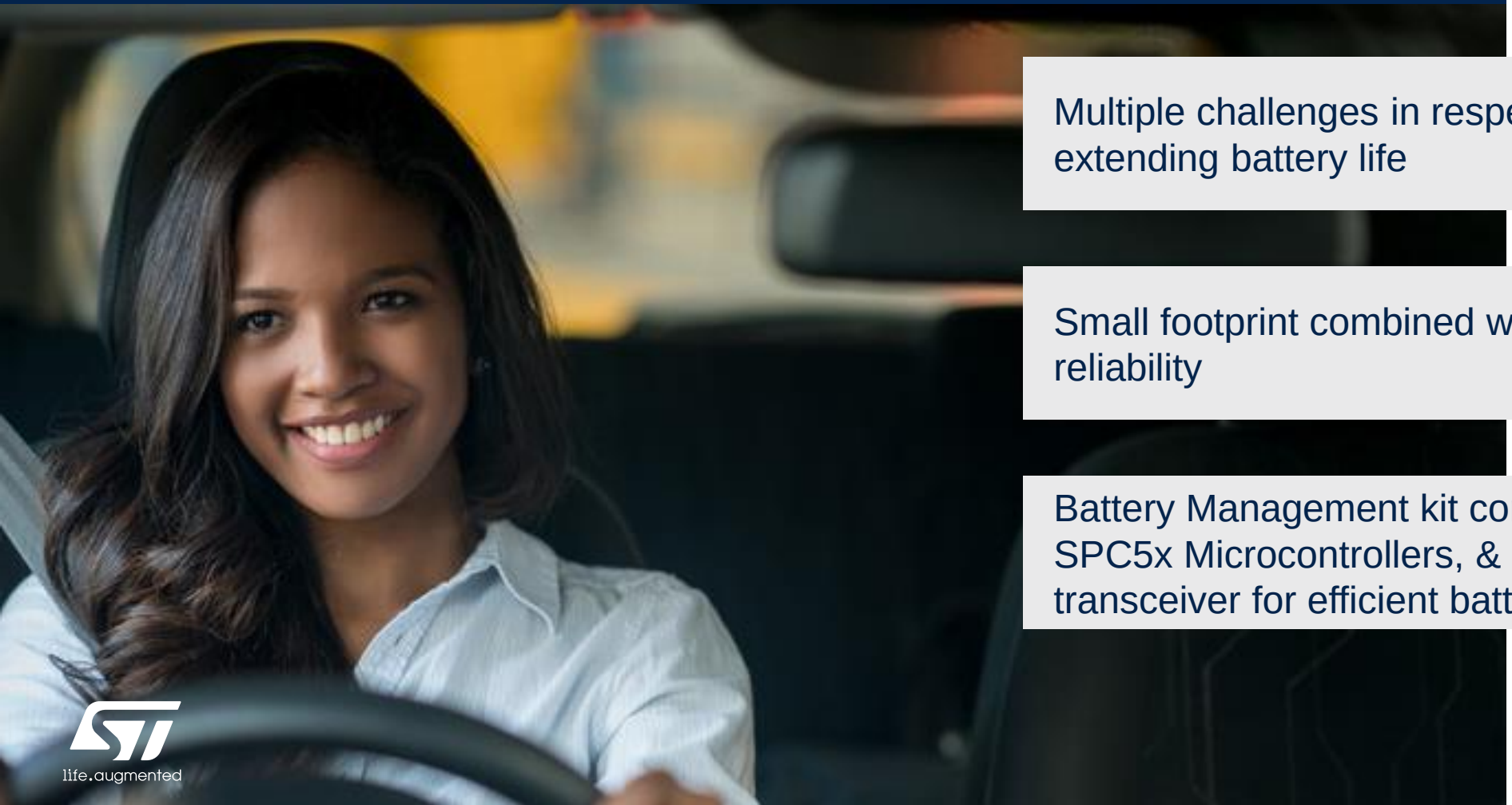
Battery Management Systems for Electric Vehicles

Challenges, requirements & solutions



Multiple challenges in respect of diagnostics and extending battery life

Small footprint combined with high performance and reliability

Battery Management kit combining L9963 BMS IC, SPC5x Microcontrollers, & L9963T Isolated transceiver for efficient battery management

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ST’s Battery Management System Solution

ST’s solution includes Hardware and GUI components

Reference Battery Management kit for Lithium Ion BMS electronic control unit combining

- L9963 BMS Integrated Circuit
- SPC5x automotive-grade microcontrollers (MCU)
- L9963T isolated transceiver to efficiently manage battery charging duties & challenges.

SPC5x MCUs

Another important building block of a BMS is the MCU which performs cell balancing, state of health (SOH), state of charge (SOC), temperature management, smart battery management and prediction of battery life computation, based on measurements data from our L9963 battery management chip.

L9963T isolated transceiver

In Battery Management Systems, a communication bridge between devices located in different voltage domains (High and Low Voltage) is a prerequisite. The L9963T isolated transceiver can transfer data incoming from a classical 4-wire based serial peripheral interface (SPI) to a 2-wire isolated interface and vice versa.

Battery Management Systems for EVs

L9963 BMS IC & L9963T Isolated Transceiver

- ISO26262 Ready for ASIL D system
- Isolated SPI interface
- Robust conducted and radiated immunity performance

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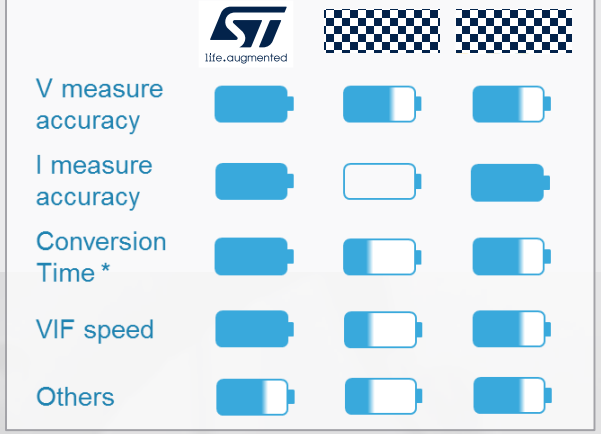
Battery Management IC for EV L9963

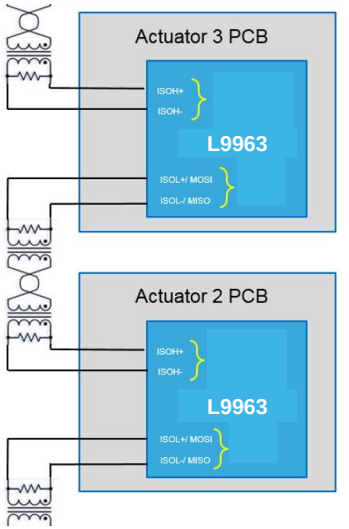
- Up to 14 cells monitoring and balancing
- 16-bit Σ-Δ ADC for cell voltage monitoring
- 18-bit Σ-Δ ADC for battery current monitoring
- Internal balancing FET up to 200mA
- Configurable for external FET balancing
- Vertical interface up to 3Mbps

- ISO26262 Ready for ASIL D system
- Cell voltage measurement maximum error of ± 2 mV
- Current sense error 0.5%
- Real simultaneous conversion of 14 cells in < 300 µs.

Outperforming Competition



ISO 26262



TQFP64 package

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Battery Management IC for EV L9963

Key Highlights

- 14-cell monitoring and balancing, 100V ST BCD9sL tech
- 16-bit Σ-Δ ADC → Cell total conversion error 2mV
- 18-bit Σ-Δ ADC → Current sense error 0.5%
- Internal and external balancing configurability
- Ready for ASIL D system

TQFP64 package

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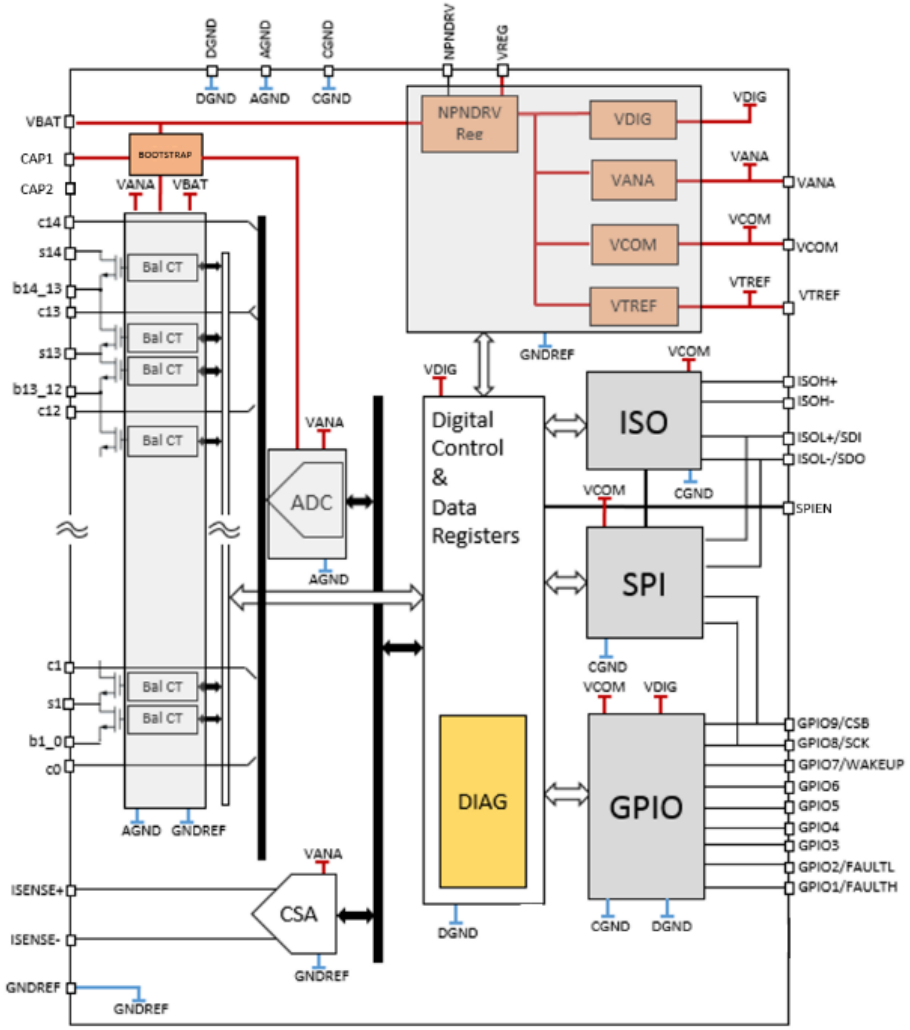
Block Diagram



Technical information

- Measures 4 to 14 cells in series
- Synchronized High-precision cell voltage and current measurement within ±1500A range with Coulomb counter included
- 8 programmable filtering options for cell&battery stack Vconversion
- 16-bit voltage measurement with maximum error of ±2mV in whole operating temperature range
- 2.66mbps isolated serial communication and 6Mbps SPI are integrated for daisy-chained connection
- Supports both mono and bi-directional daisy chain configuration
- Maximum 200 mA passive internal balance for single cell in both normal and sleep-balancing mode. If balance is enabled on more cells, the maximum current of each single cell is reduced according to power dissipation
- Two balancing modes: Manual and Timed mode
- Supports both internal and external balancing
- Single or multiple channel cell balancing simultaneously
- -40/200° C temp. measure. range with support for NTC monitoring
- 9 General purpose digital I/O or analog inputs (single-ended and differential voltage measurement)
- Robust hot-plug performance
- Engineered for ISO26262, ready for ASIL D system
- Passes 200 mA Bulk Current Injection (BCI) test

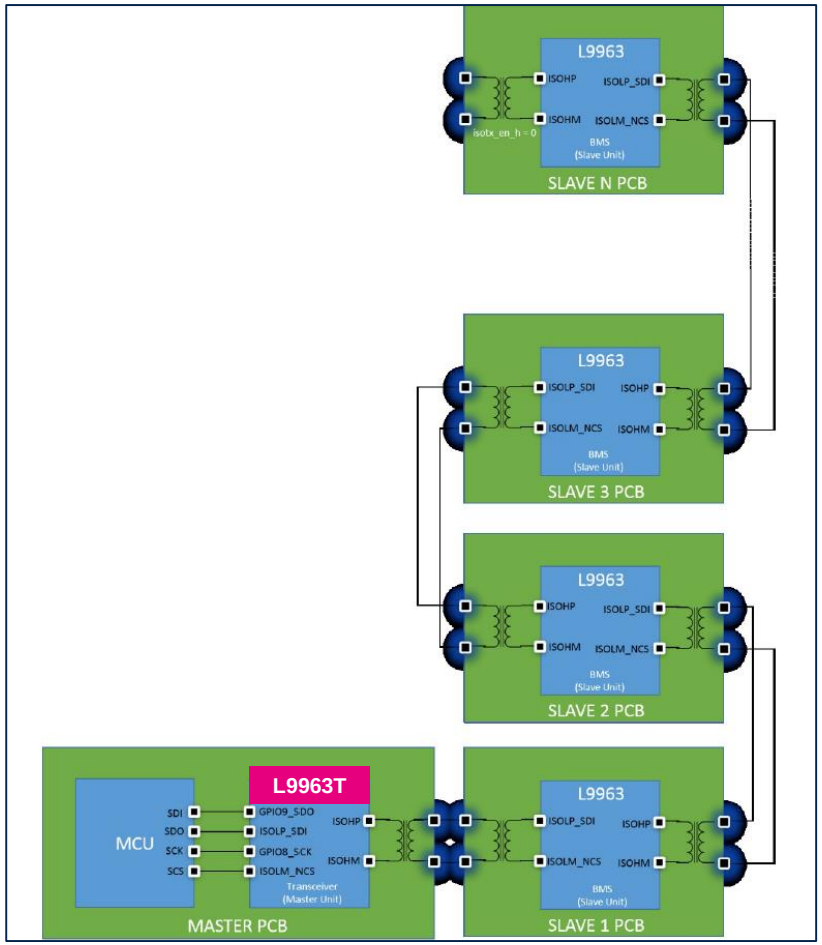
Battery Management System for EV
L9963T Isolated Transceiver

Key Highlights

- Transformer isolated communication interface
- L9963 companion transceiver for BMS application
- Robust conducted and radiated immunity performance
- ISO26262, ready for ASIL D system

SO16 package

Block Diagram



Technical information

- Isolated SPI interface
- Automotive EV application
- Up to 2.66 Mbps
- 3.3V and 5V compatible logic threshold
- ISO26262, ready for ASIL D system

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Battery Management Systems for EVs Evaluation Tools

Wide range of evaluation tools according to your needs

EVAL-L9963-MCU with mounted microcontroller and pre-loaded firmware

EVAL-L9963 to use without our MCU offer &
EVAL-L9963-NDS as addition to our L9963 eval board choices

STSW-L9963 Graphical User Interface (GUI) allows you to initialize and control the EVAL-L99963-MCU eval board by changing parameters

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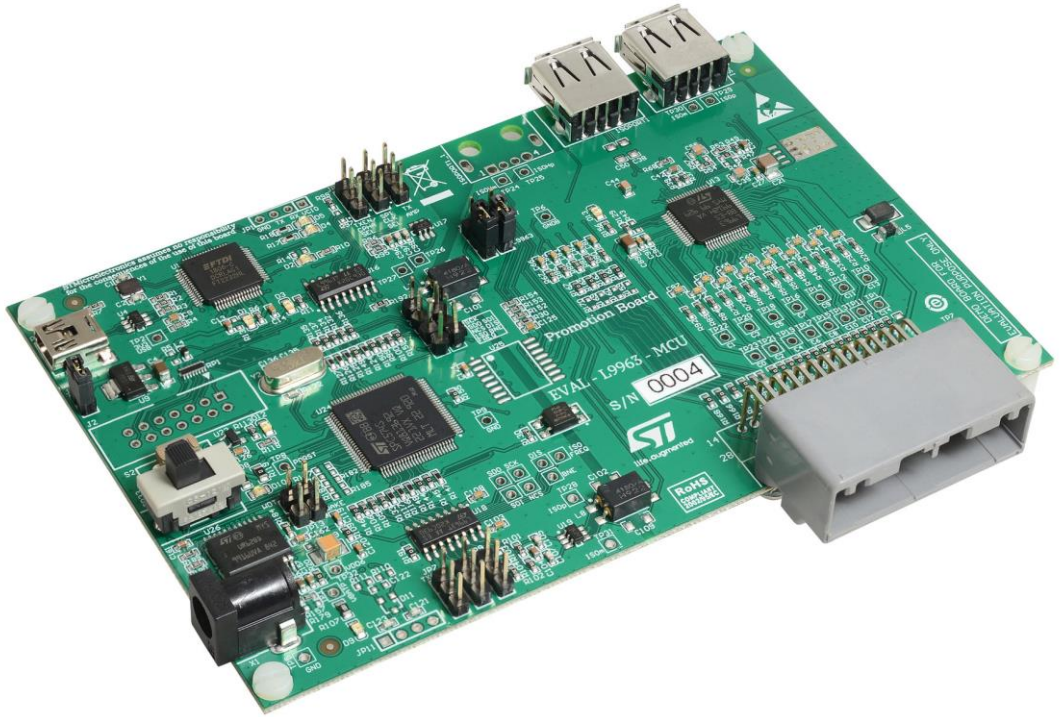
EVAL-L9963-MCU
Evaluation tools

With mounted microcontroller and pre-loaded firmware

- The EVAL-L9963-MCU is a hardware tool for evaluation and development and is ideal for rapid prototyping of a 48 V battery management system (BMS) or as lower stage of a distributed BMS. This board can be used to evaluate the features of the L9963 and L9963T devices.
- It features also the SPC57 4S microcontroller with preloaded firmware intended to be used with STSW-L9963 Graphical User Interface.
- The EVAL-L9963 allows the user to connect up to 14 channels for cell voltage sensing, one channel for current sensing, and up to 4 channels for temperature sensing (plus an additional on-board NTC to sense PCB temperature).



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EVAL-L9963-NDS
Evaluation tools

Single node L9963 board for distributed multi-cell BMS

- In case the battery to be monitored exceeds 14 cell capability (i.e. higher than 48V, 5V is the maximum cell voltage input measurement), ST offers the possibility to address higher voltage batteries by adding further stages with **EVAL-L9963-NDS**.

- In this case, the EVAL-L9963-MCU will be the first stage of a board stack for higher voltage battery. Communication between EVAL-L9963-MCU and EVAL-L9963-NDS (second stage) and between two EVAL-L9963-NDS (next stages) is through a dedicated interface called Vertical Interface

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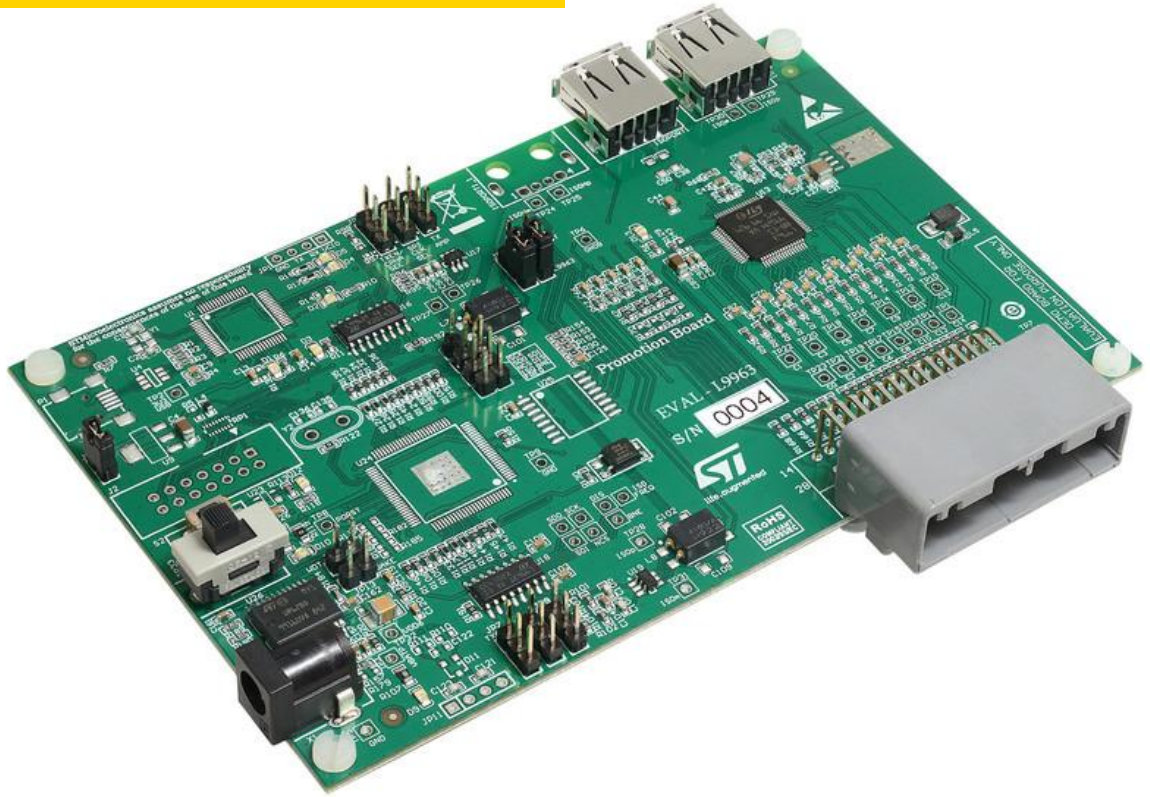
EVAL-L9963
Evaluation tools

Without mounted microcontroller

- A specific board derivative of EVAL-L9963-MCU was designed to offer users the possibility to develop the complete application software with an alternative MCU.

- The **EVAL-L9963** has the same form factor/layout as the EVAL-L9963-MCU, but does not embed an MCU.



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STSW-L9963
Evaluation tools

Graphical User Interface with preloaded firmware

The **STSW-L9963** Graphical User Interface (GUI) allows to initialize and control the EVAL-L9963-MCU evaluation board by changing parameters through the SPI protocol. STSW-L9963 GUI has been developed using Labview and it uses, as microcontroller interface the onboard microcontroller SPC574S64E3 with preloaded FW.

The GUI allows to configure voltage and current thresholds, and makes available the following data:

1) Cell Voltage
2) Cell Temperature
3) Total Battery Voltage
4) VTREF Measurement
5) IC temperature
6) Coulomb counter

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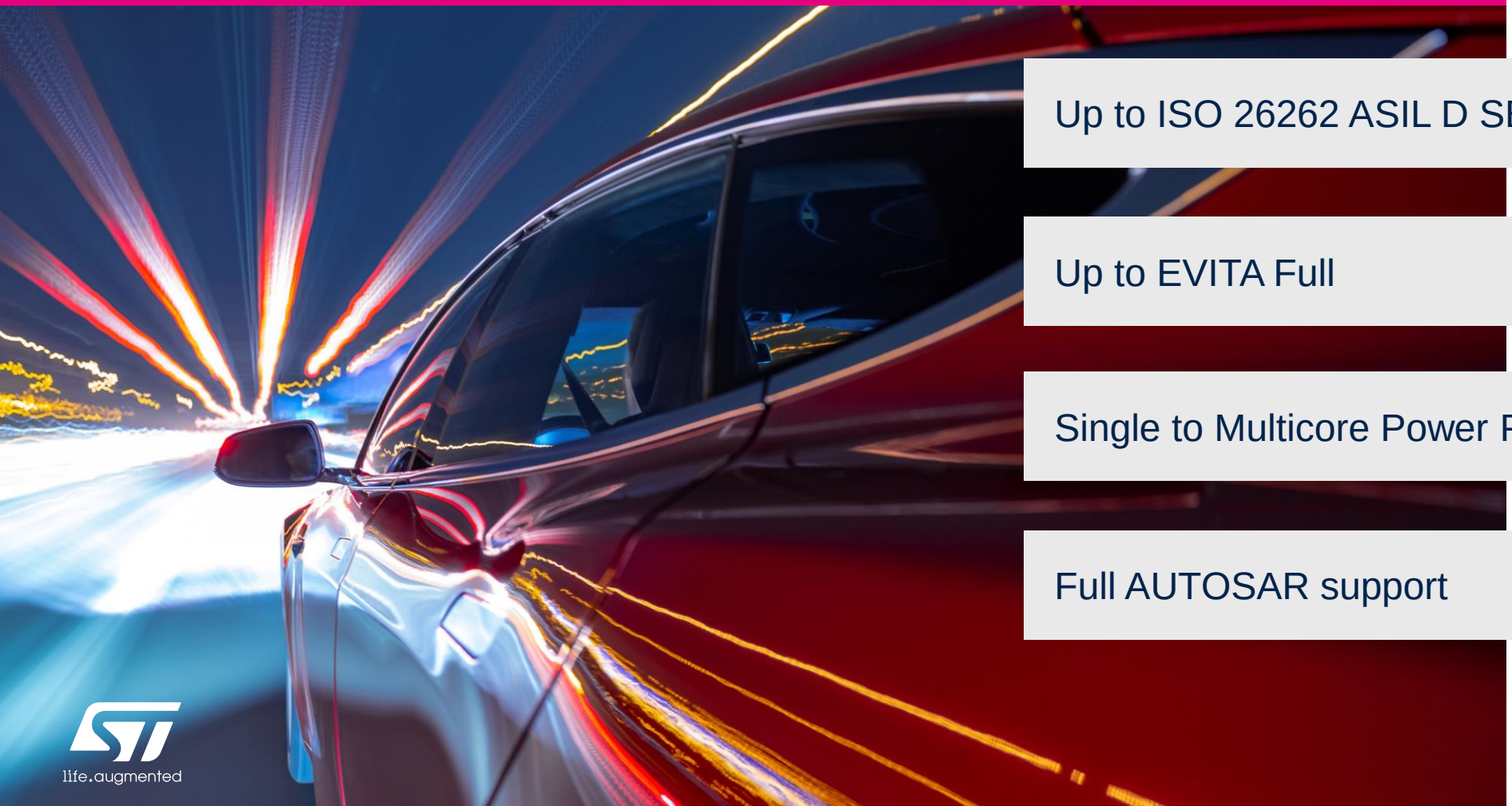
SPC5x 32-bit automotive microcontrollers

SPC5 automotive-grade microcontroller family



- Up to ISO 26262 ASIL D SEooC
- Up to EVITA Full
- Single to Multicore Power PC based
- Full AUTOSAR support

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32-bit automotive microcontrollers SPC5 family

SPC5 P for Performance	**SPC5 G** for General purpose
Advanced timers (GTM), ASIL-D Safety, Sigma Delta ADCs, High Temperature operation	Scalable family with Security, CAN-FD, Ethernet and Low Power Modes
Specialized for real-time controls	For all applications
SPC57 series SCP58 Performance series	SPC56 series SPC58 Chorus series

15 years longevity commitment

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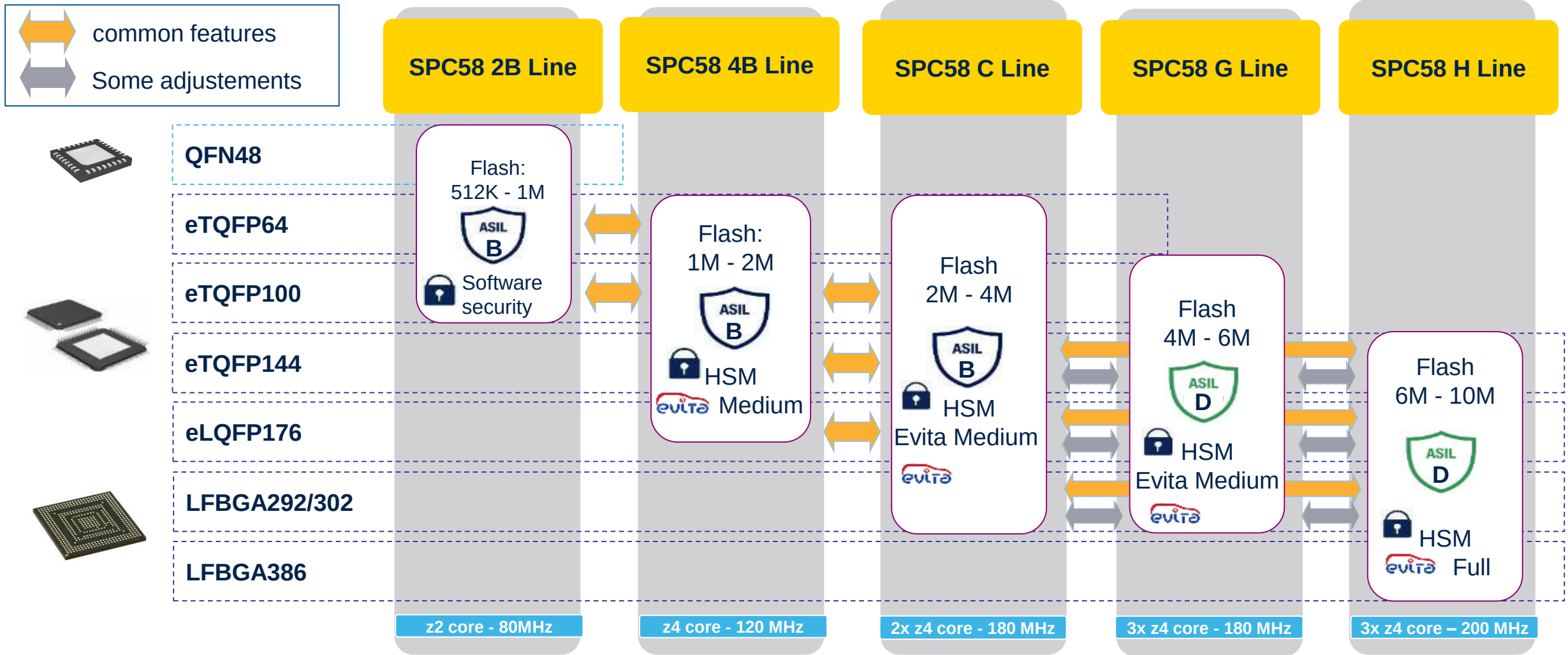
SPC58 Chorus Series
Package Scalability with PIN to PIN compatibility



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SPC58 Chorus Advantage

SPC5 Chorus

SECURITY

Best Subsystem Separation

Fast data decryption capability

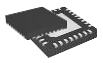
Evita Medium and Full

ISO CAN FD & Ethernet

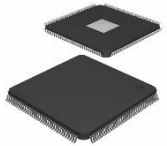
100% Can FD

SW & Pin to PIN scalability

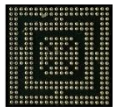
Unprecedented Scalability



QFN 7x7



eTQFP 64-176



BGA292/302/386

Ready for on the fly reprogr.

SW and HW modes, eMMC, USB, Hyper-bus

New low power modes

ADC monitoring capability in Stand By

Across family

RAM up to 1.376Mbyte

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SPC5 family… not only for BMS

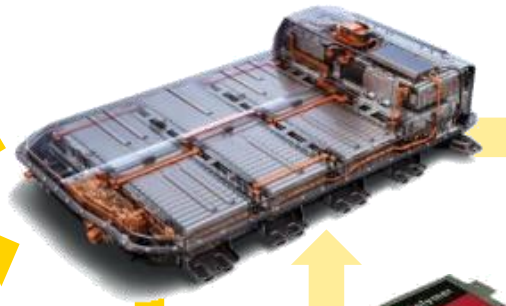
SPC5x MCUs provides full path from (wireless) plug to traction

On Board Charger

SPC58 General Purpose Family
SPC56 General Purpose Family
SPC56 P Line
SPC58 N Line

Battery Management

SPC58 General Purpose Family
SPC56 General Purpose Family
SPC57 4S Line

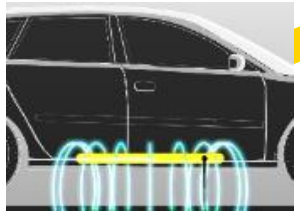


DC/DC

SPC58 General Purpose Family
SPC56 General Purpose Family
SPC56 P and AP Lines
SPC56 L Line

Wireless Charging

SPC57 4 K Line



Battery Pack

SPC56 General Purpose Family
SPC56 P and AP Lines
SPC57 0S Line, SPC57 4S Line
SPC57 4K Line

Powertrain Inverter

SPC58 N Line
SPC56 L Line
SPC57 0S Line

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Thank you

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