NXP HVBMS Reference Design Introduction
恩智浦高压BMS参考设计

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01

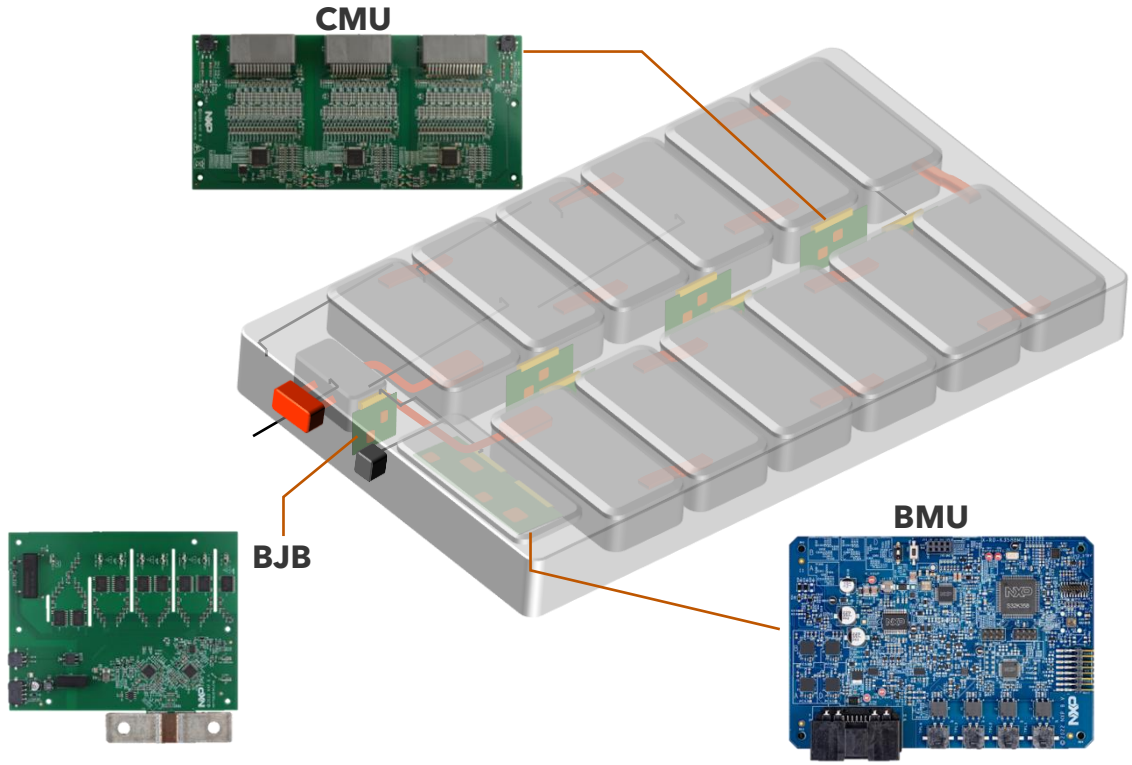
HVBMS Reference Design Overview

HVBMS Reference design
three reference designs covering all HVBMS functions

NXP offers a **full system reference design suitable for ASIL compliant BMS systems**

HVBMS Reference design strategy

- Contextualization of IC safety concept
- Optimize Component Safety features
- Ease integration of IC safety analysis
- Reduce customer's development time

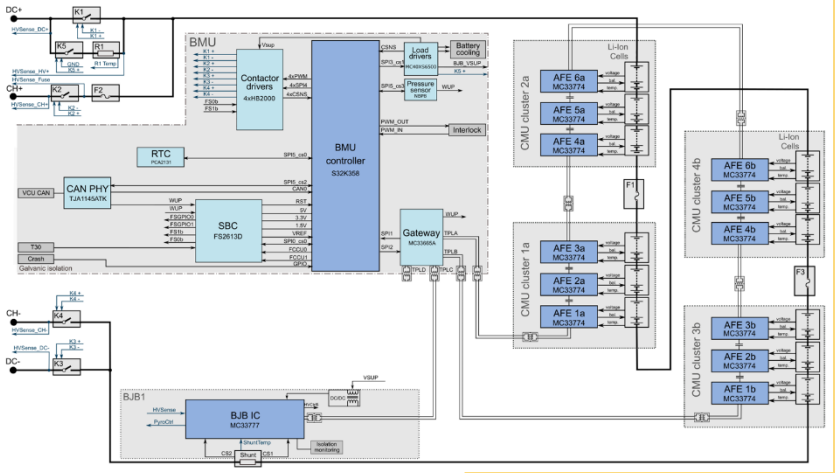


HVBMS-RD Hardware
Three main application boards:
- BMU (Battery Management Unit)
- BJB (Battery Junction Box)
- CMU (Cell Management Unit)

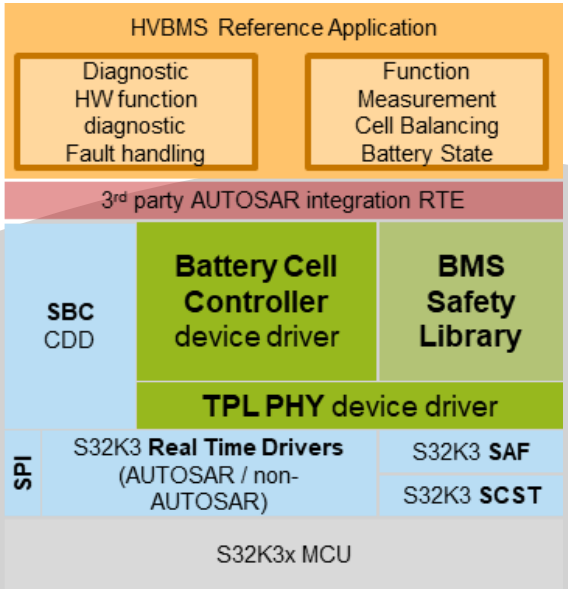
HVBMS-RD Software
Production ready Software including safety library implementing necessary safety mechanisms

HVBMS-RD Safety analysis
Full documentation, database and analysis for a full ASIL D BMS

The Big Picture

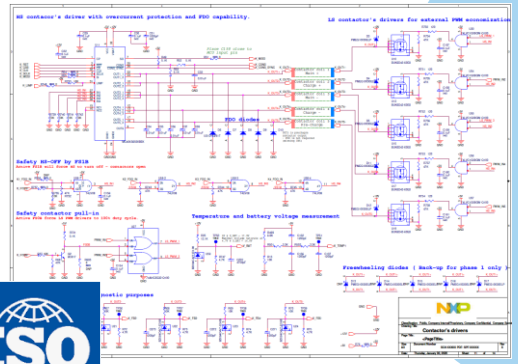


BMU, CMU, BJB hardware incl. schematics



HVBMS-RD

Software and tools for the BMS and S32K3 devices, for AUTOSAR and non-AUTOSAR



Full safety analysis with complete safety documentation

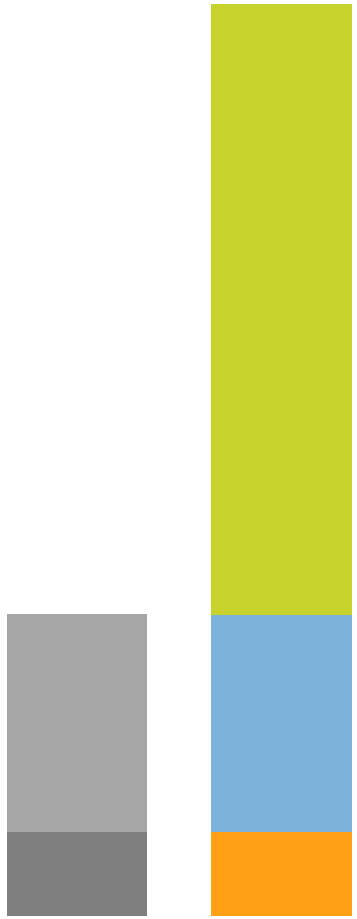
ISO 26262

ISO 26262

NXP.com/hvbms

NXP system solution a visualization

- Application Notes
- Demo / Ref. Software
- EVBs
- Datasheets



- Production Grade devices' CDD and Safety Libraries
- Reference HW to satisfy up to B-Samples
- Reference SW and integration of SW components
- Reusable ISO 26262:2018 Analysis and Collaterals
- System level examples on devices integration
- Integration Partners network
- Functional safety partners network
- System validation collaterals for reference
- Ref. process to support fulfilment of safety and quality standards
- Local Support
- Application Notes
- EVBs
- Datasheets

3D (HW/ SW/ FuSa) System Solution Maturity Model

Hardware

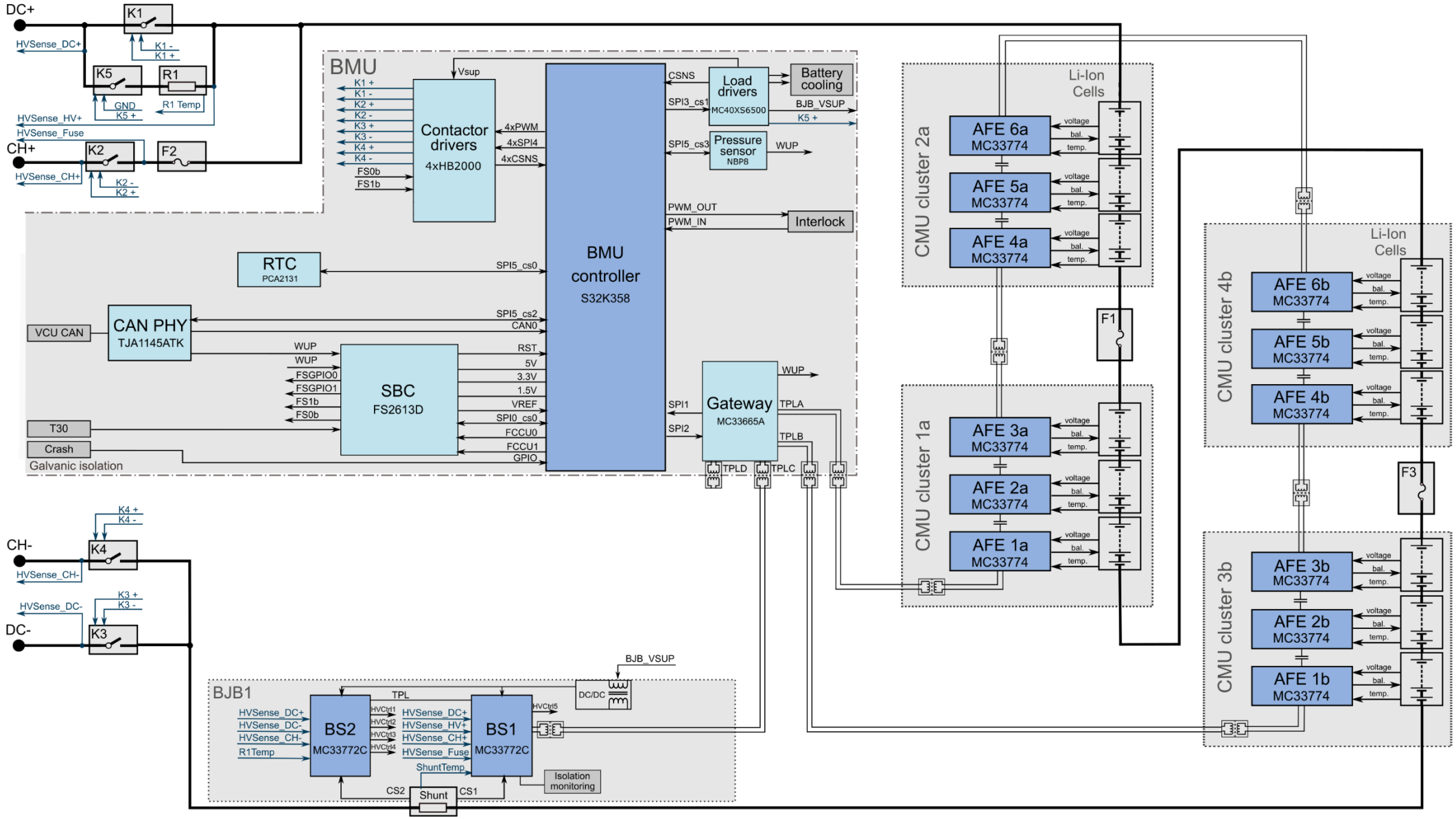
Software

SINERGY VALUE

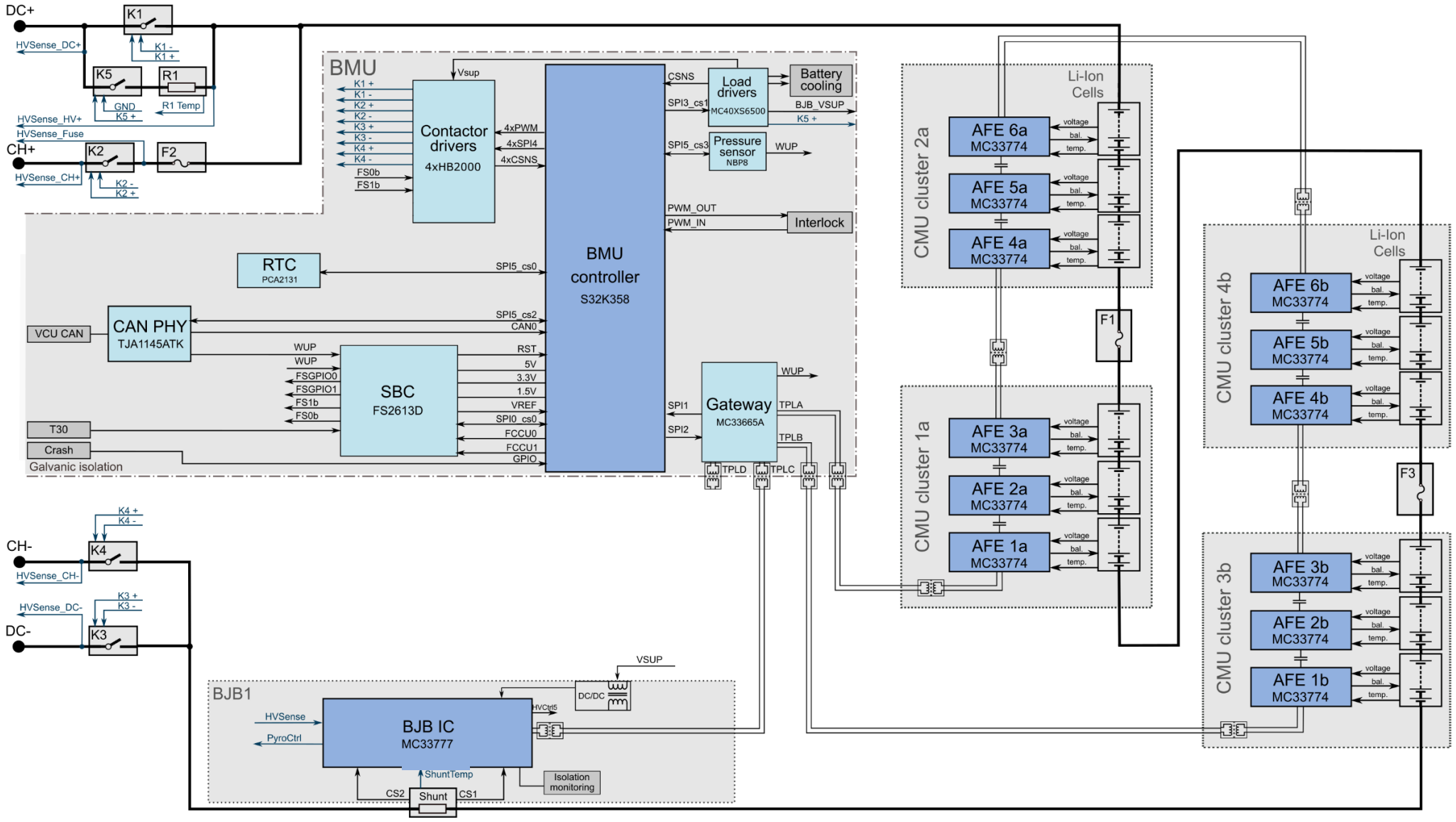
COMPLEXITY

	Evaluation Basic evaluation board customers use to start development	**Demo Kit** Basic hardware to demonstrate use cases, very limited test	**Reference board** Starting point for customers to develop their final product, more extensive test & documentation	**Production ready** Fully validated & tested system solution, production ready form factor
Basics Basic firmware and drivers when customers need to evaluate the IC	**Evaluation HW** • Evaluation board • Basic Customer package • GUI to drive EVB	**HW Demo Kit** • **Solution HW** • Firmware & driver SW (optional)	**HW Reference board** • **Solution HW targeting B-Sample** • Firmware & driver SW (optional)	
Demo Software Demo software of one or several layers with very limited test	**Evaluation KIT** • Evaluation board • Basic customer package • **Demo SW** • GUI to drive EVB	**Demo Kit** • Solution HW • **Demo** SW	**Solution Reference Kit** • Solution HW targeting B-Sample • **Demo** SW	
Reference Software Reference software that customer can use to develop their own application.	**Advance Evaluation KIT** • Evaluation board • Basic customer package • **Reference** SW • GUI to drive EVB	**HW reference design** • Solution HW • **Reference** SW	**System reference design** • **Solution HW targeting B-Sample** • **Reference** SW • Functional Safety Package (opt.)	
Production Ready SW Production adaptable and fully (field) tested, validated & documented SW		**HW reference design** • Solution HW • **Ref. + Prod.** ready SW	**Full System reference design** • Solution HW targeting B-Sample • Reference + **production ready** SW • Functional Safety package	**Production System** • HW targeting C-Sample • Production ready SW • Certified FuSa package

800+V BMS Reference Design architecture

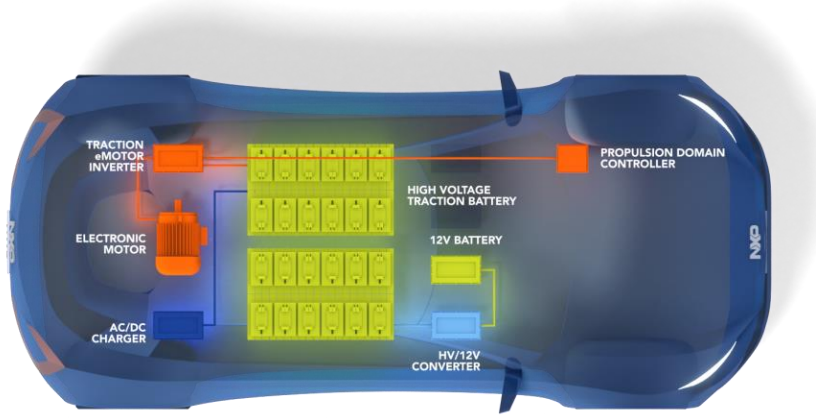


800+V BMS Reference Design architecture - Upcoming

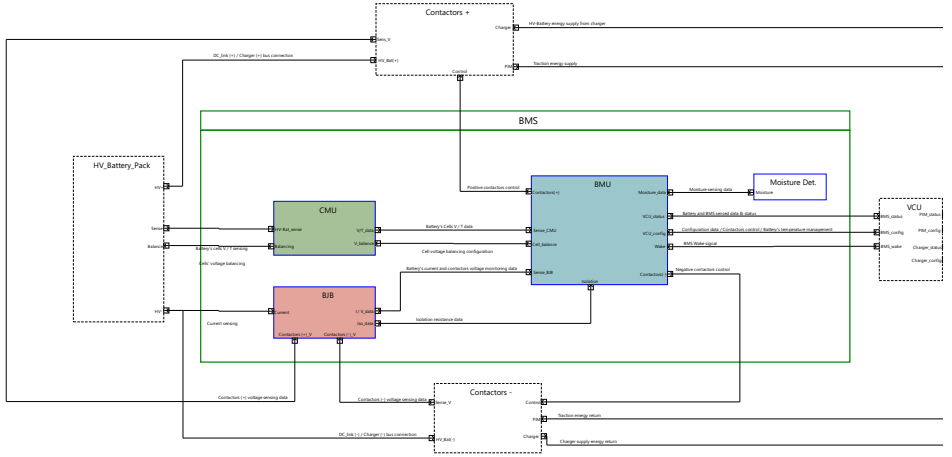


Typical (Helicopter view) System safety development flow

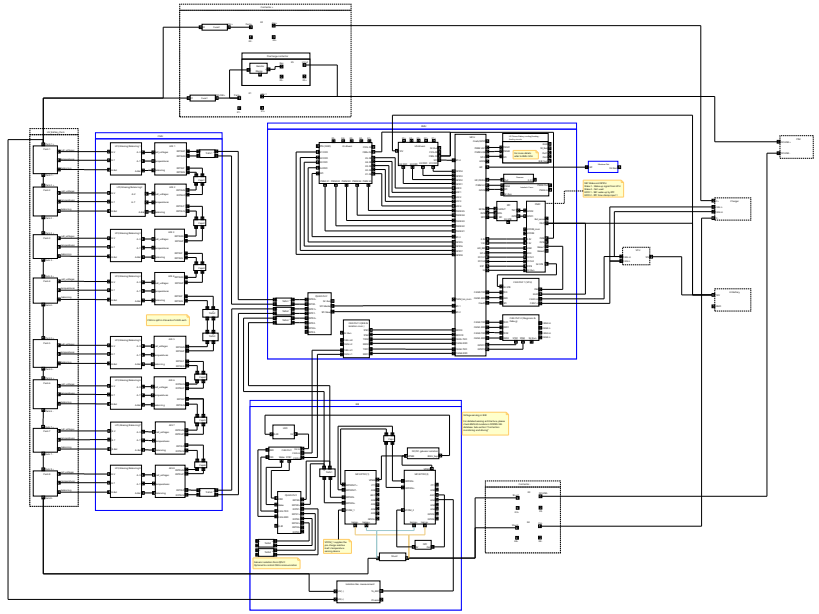
System context definition: Powertrain (AoU)



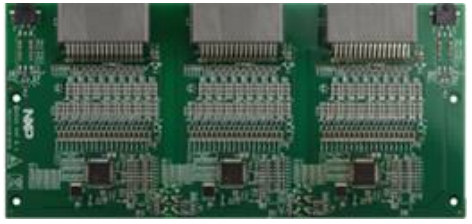
System concept creation

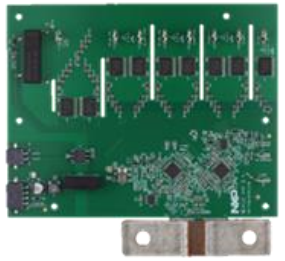


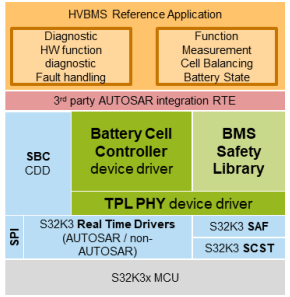
System technical requirements and architecture



"Tape out" + HW/SW V&V + System integration

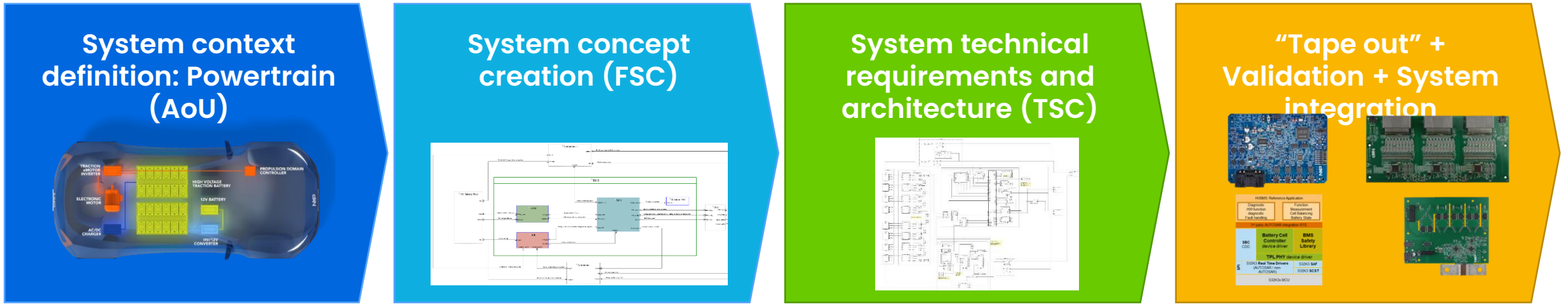




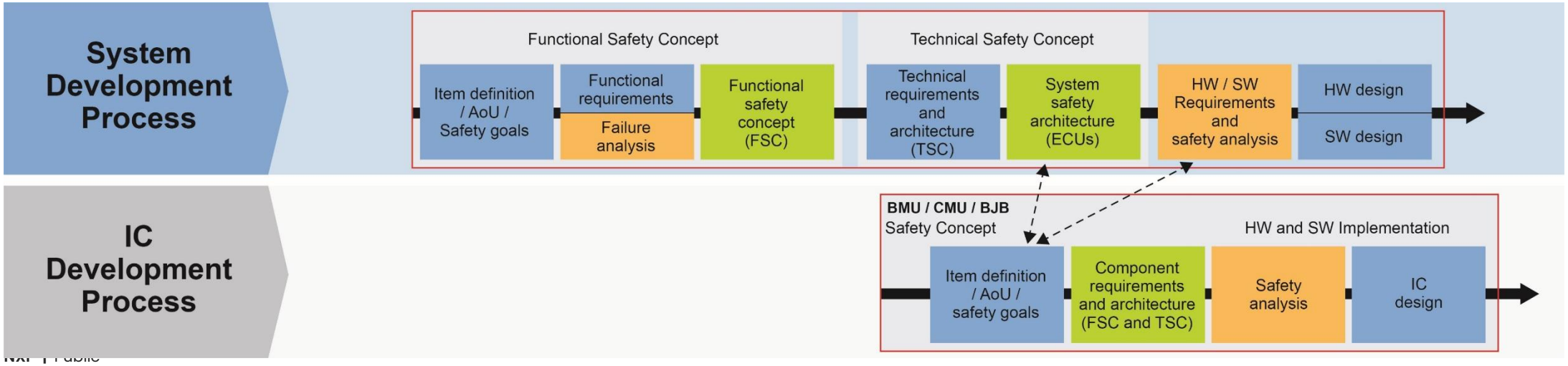


System development process

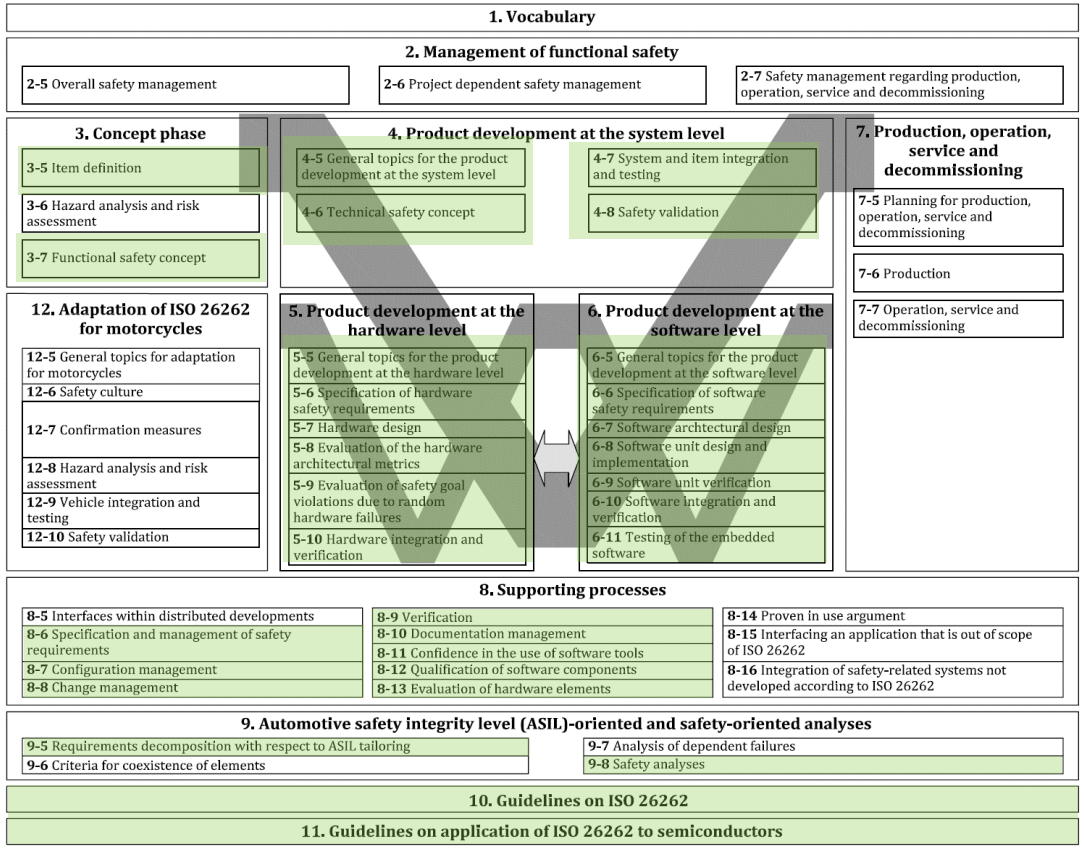
- System design flow (simplified): From powertrain domain to BMS HW and SW solutions



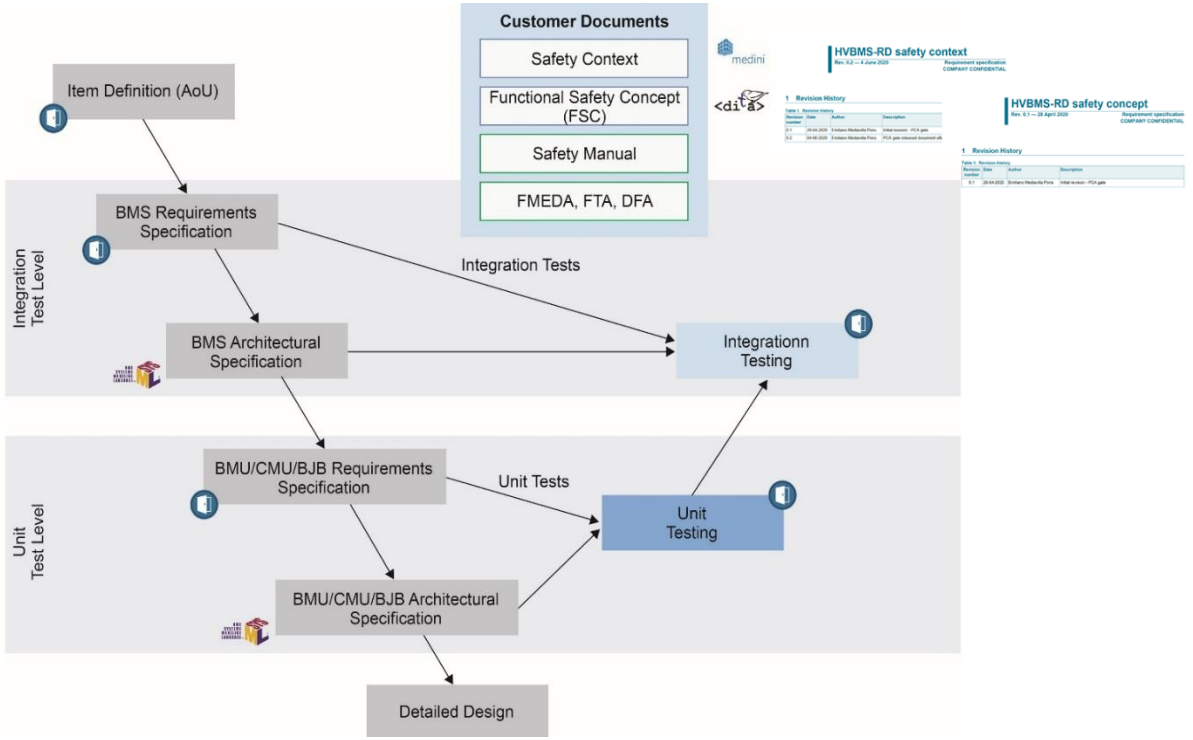
- System development and IC development: Where do they match?



HVBMS – ISO 26262:2018 tool-based Development Flow



- To ensure maximum reusability as reference design, the development flow follows the ISO 26262:2018 standard's V-MODEL
- The HVBMS reference design is the umbrella project to drive:
  - System level safety analysis (3-5, 3-7, 4-5, 4-6, 4-7 and 4-8)
  - Reference boards for BMU, CMU and BJB, including safety deliverables (5-6, 5-8, 5-9 and 5-10), supporting ASIL D BMS safety goals.
  - Production grade software for complex device driver and NXP devices' safety libraries (6-6, 6-7, 6-8, 6-9 and 6-10)



Doors-NG

DITA (oXygen)

SysML / UML

Medini Analyze

Medini & Cameo

HVBMS RD Functional safety collaterals

- Battery management system (BMS) **Functional & Technical safety concept** (FSC &TSC)
- Extensive requirements (RS) and architectures (AS) database (Doors-NG)
- **Requirement management plan** describing the full process to comply with ISO 26262:2018 development
- **Safety mechanisms' catalogues** to be used in their own analysis
- **Functional safety analysis and reports** (FTA, FMEDA) showing how to achieve required metrics
- **Sub-systems functional and technical models (SysML)** with requirements allocation
- **Software safety schedules** for full system coverage targeting ASIL D safety goals
- **All sub-systems safety manuals** to ease the solution implementation
- **Production grade safety libraries and device drivers** following ISO 26262:2018 process
- **Reference application software and integration layer**

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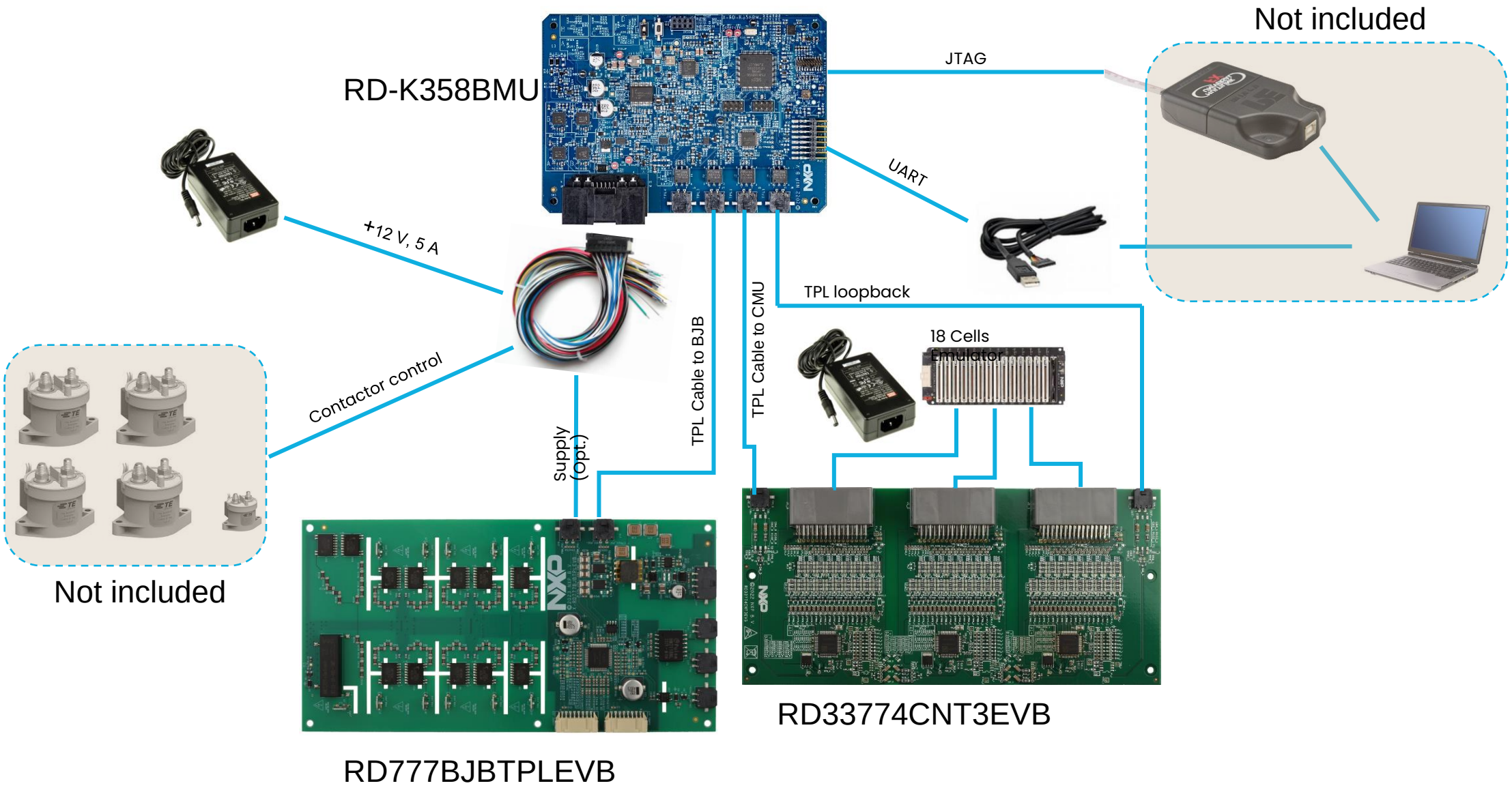
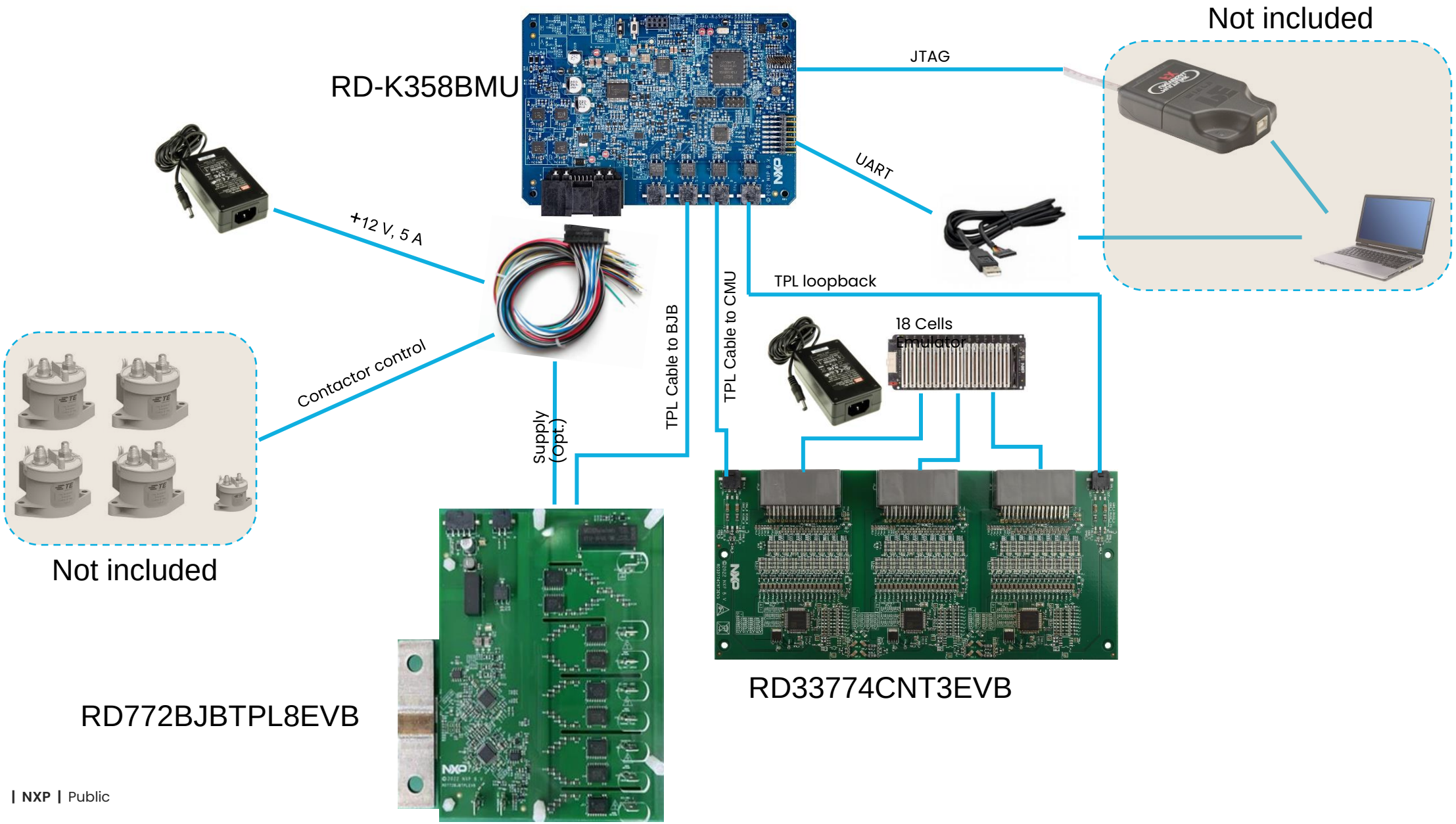
HVBMS Reference Design Hardware Offering

Secondary header

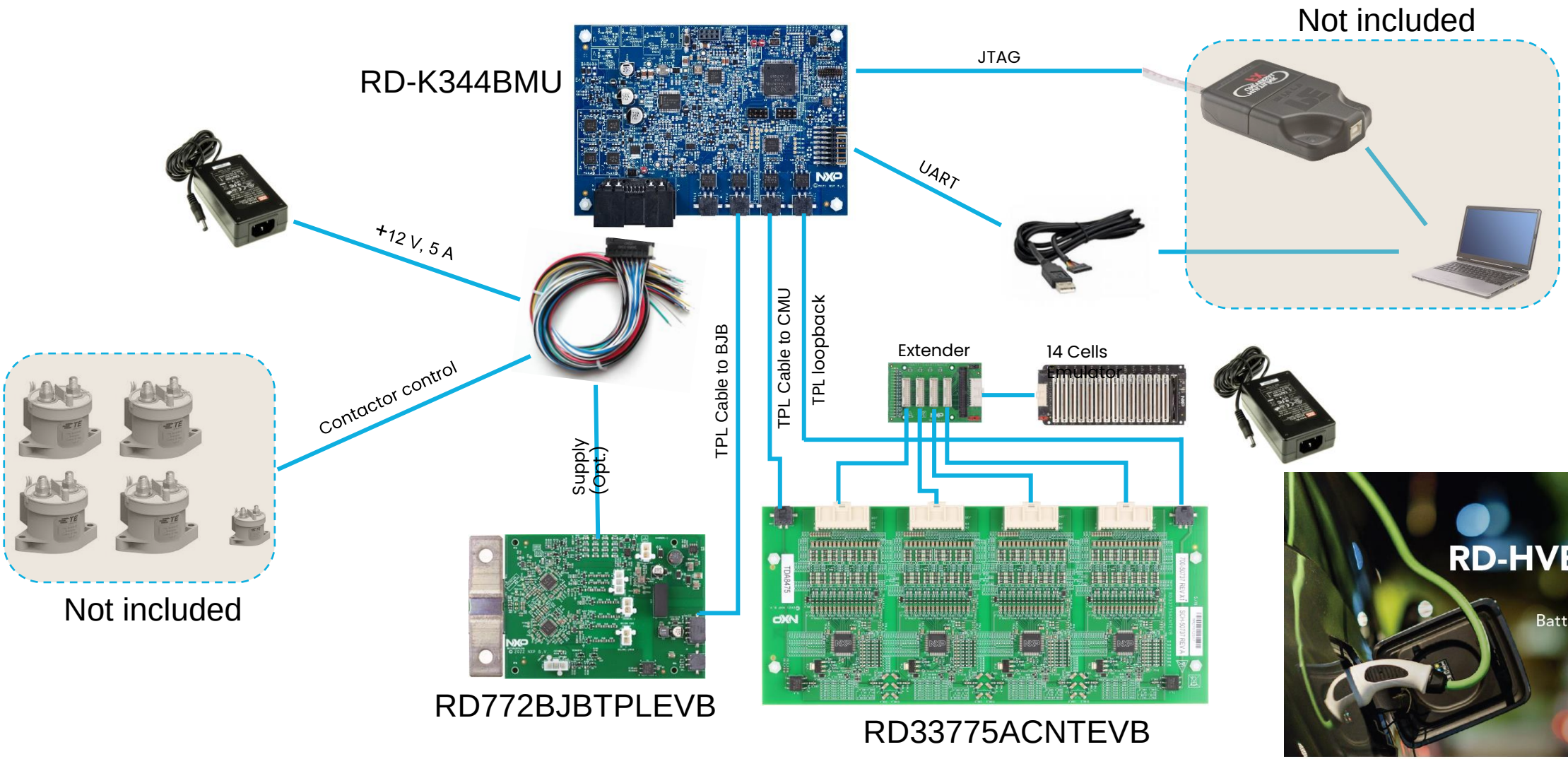
HVBMS 800+ V TPL BUNDLE setup and Accessories



HVBMS 800 V TPL BUNDLE setup and Accessories (RDHVBMSCT800BUN)



HVBMS 400 V TPL BUNDLE setup and Accessories



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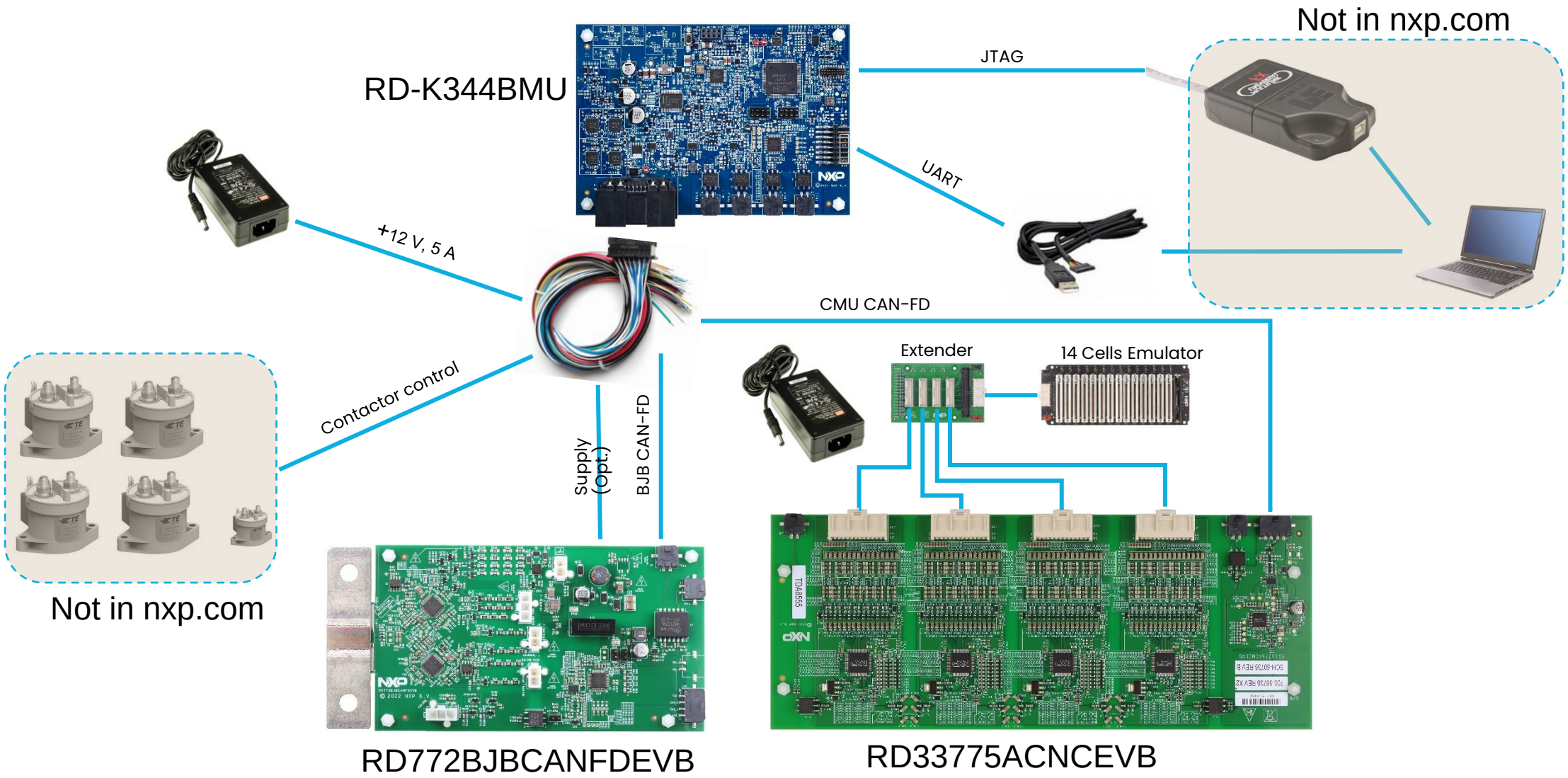
HVBMS 400 V CAN-FD – Recommended setup and Accessories



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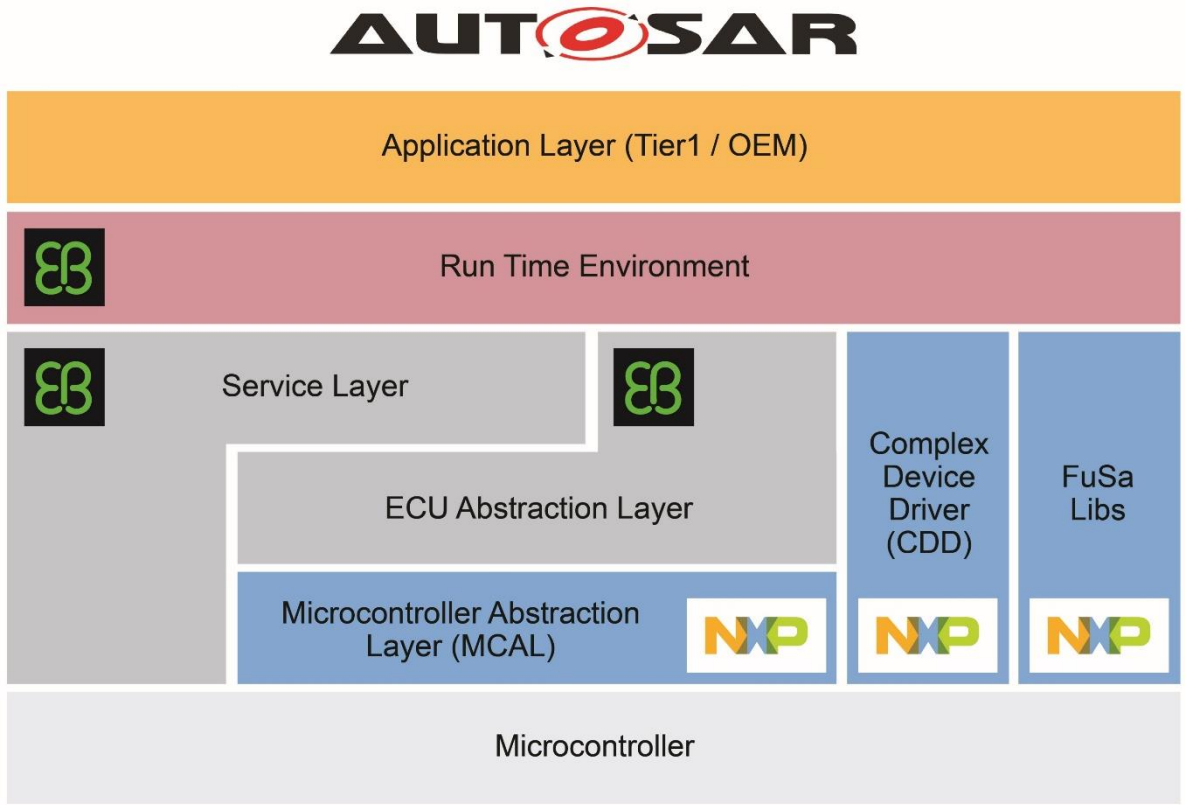
HVBMS Reference Design Software Offering

Secondary header

NXP BMS Software Package

- **Production-grade** complex device driver and MCAL software package for use in **AUTOSAR®**. May also be used in non-AUTOSAR environments.
- Significant reduction of **time-to-market** and **SW development cost**
- Developed according to **ISO26262:2018** and **ASPICE level 3**
- Developed and tested in close collaboration with **Elektrobit.**

Customer may use Elektrobit or any other AUTOSAR integrator.



Targeting ASIL D Systems

ISO 26262 Compliant

ASPICE Level 3

Tested with AUTOSAR® 4.4

Performance Optimized

High Voltage Battery Management Software

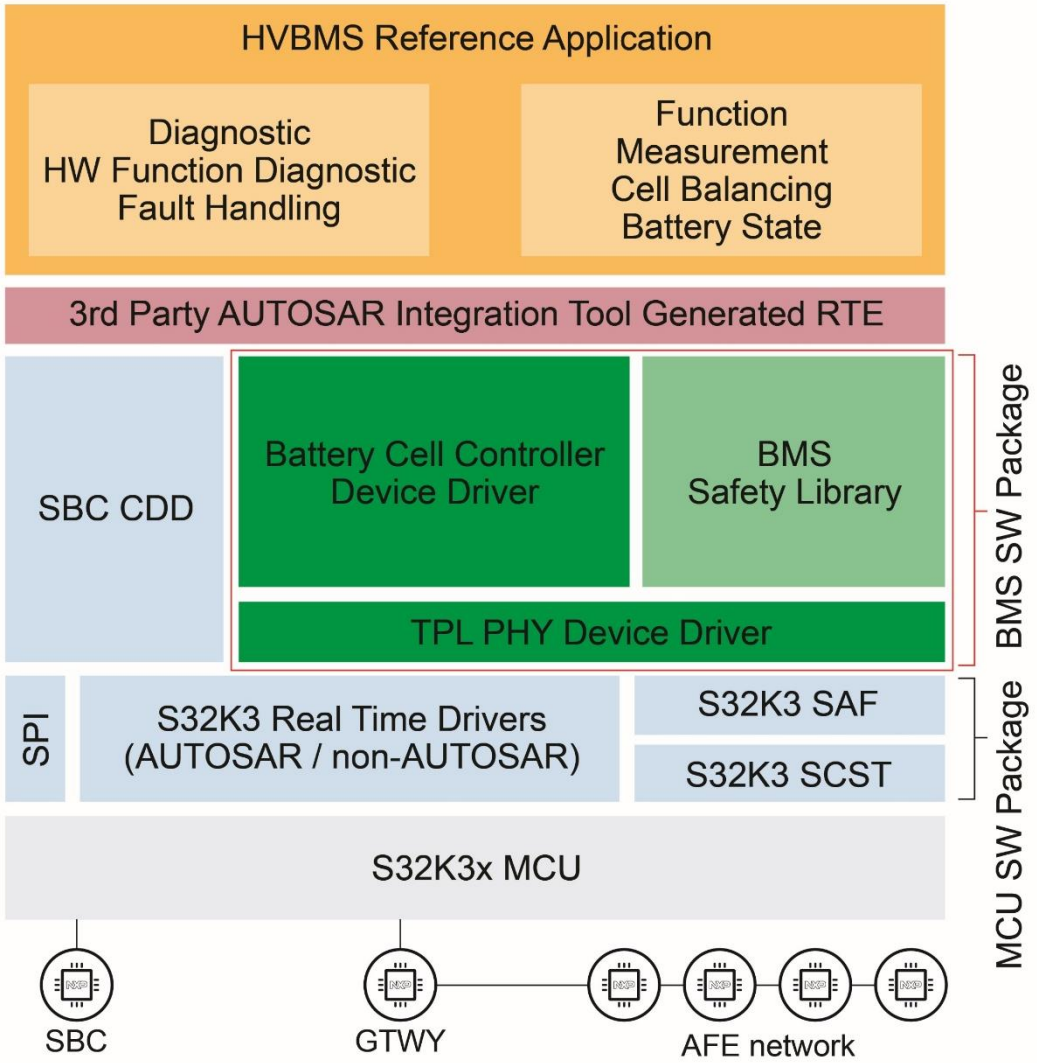
NXP’s BMS software provides an AUTOSAR compliant middleware enabling BMS functional safety applications.

BMU Driver Package

- **Battery Cell Controller AFE** software drivers
  - for MC33775A, MC33774 and MC33772C
  - tested on S32K3 but independent of MCU
  - configurable with EB tresos Studio or NXP S32 Design Studio
- **Battery Cell Controller TPL PHY** software drivers
  - for MC33664 and MC33665A
  - tested on S32K3, portable to non-NXP MCUs
  - configurable with EB tresos Studio or NXP S32 Design Studio

- **Functional Safety Libraries**

- Safety libraries to cover the safety requirements derived from BMU, CMU, BJB safety analysis



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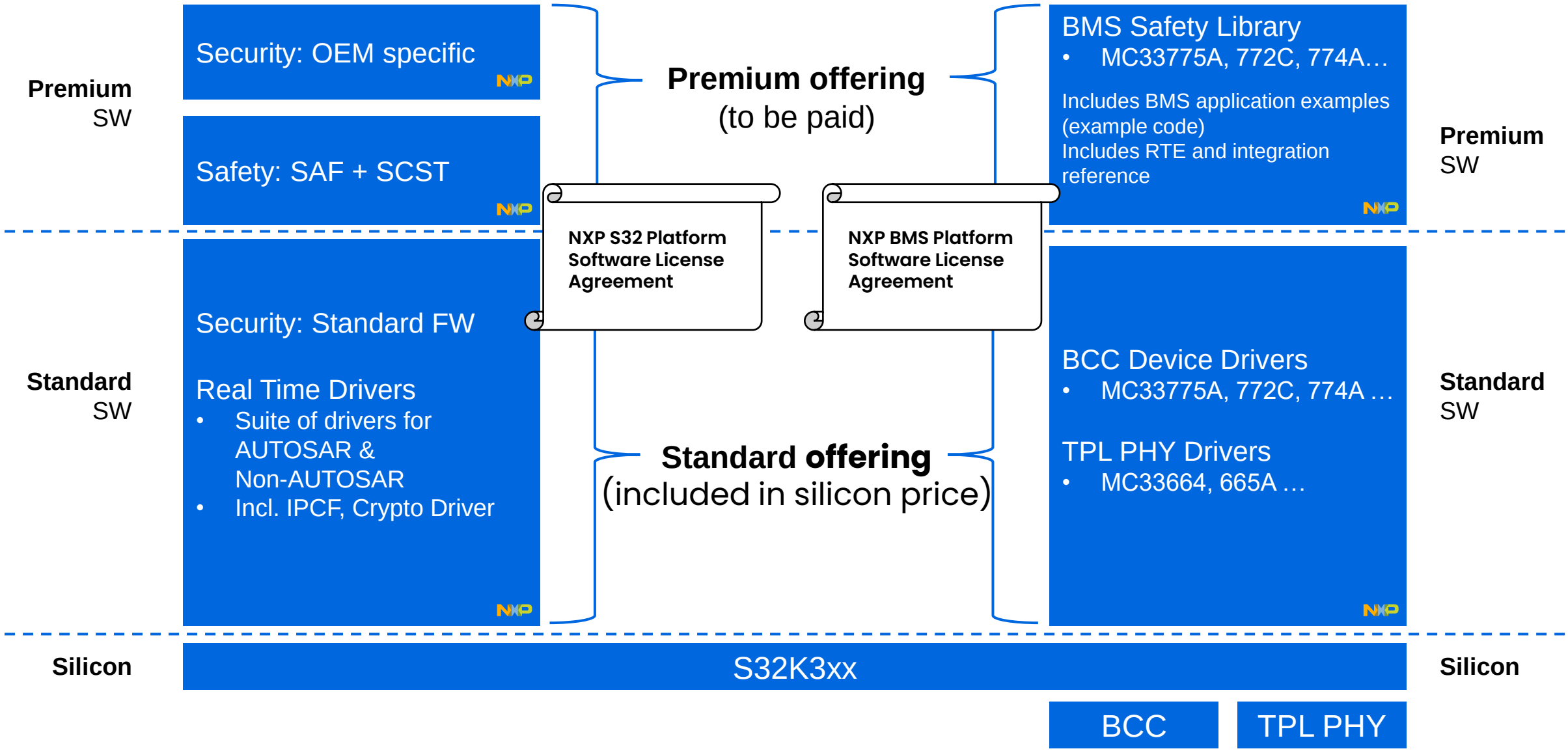
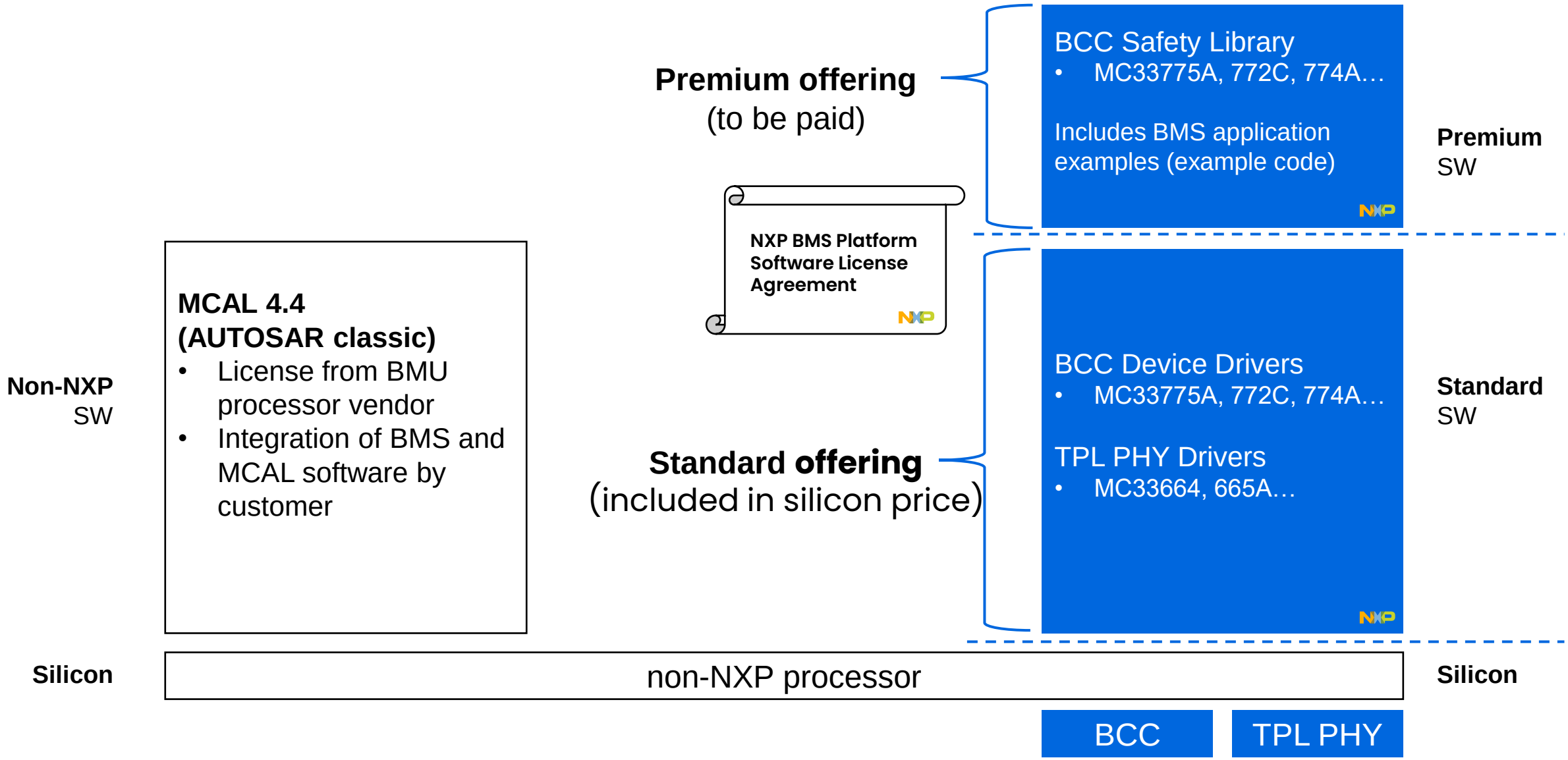
BMS Software Offering for S32K3xx family and BMS portfolio



BMS Software Offering for use with non-NXP Microcontroller



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Together

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