NXP Battery Management Solutions

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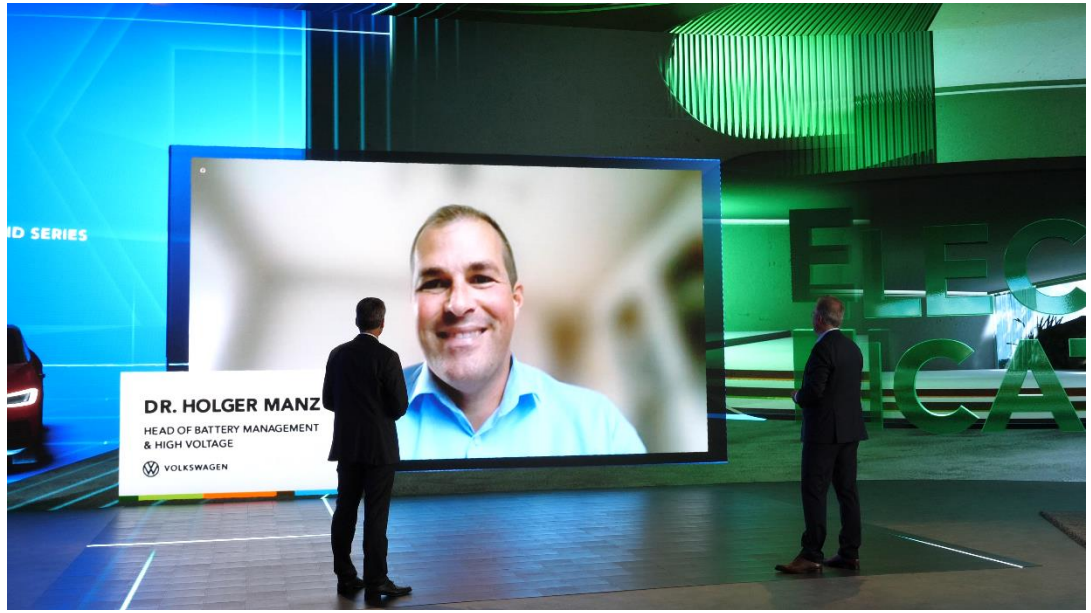
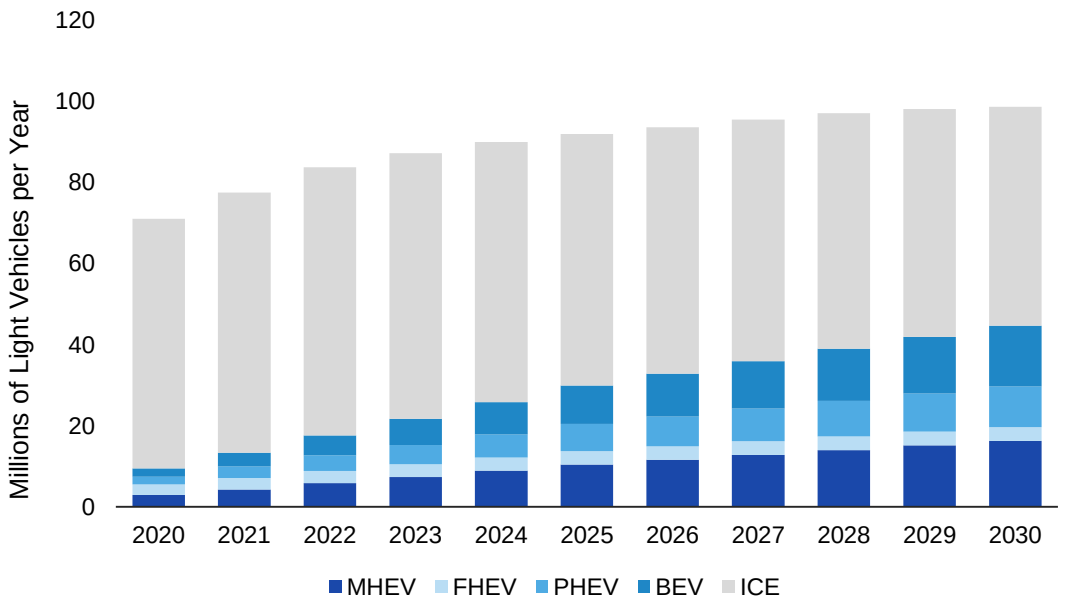
WHAT ARE WE ANNOUNCING

Volkswagen Adopts NXP Battery Management Solutions for its MEB Electrical Vehicle Platform

- Volkswagen's **newly launched ID series**, powered by its groundbreaking MEB platform, is pressing the boundaries of Electrical Vehicle (EV) travel
- NXP battery management systems (BMS) are flexible **and easy to design-in** across low- or high-voltage batteries, delivering high accuracy, optimal robustness and functional safety
- Precision Battery Management helps to **improve Range, Longevity, Safety**



XEV MARKET CONTINUES STRONG GROWTH



Legislation demands drastic decrease of fleet CO^2 emissions.

By 2030 half of all vehicles sold contain electrified powertrain.

Current EU & China stimulus programs focused on xEV.

China continues to be major market driver for xEVs.

EU drives complete fleet electrification leading in HEV/PHEV.

Tesla stays strong; US Big-3 increase xEV focus.

EMERGING MARKET HAS REACHED INFLECTION POINT

Cost parity of xEV & ICE expected ~2024;

xEV performance improved: up to 400 miles & fast charging;

Infrastructure established: 7M chargers WW by 2019;

Number of annual launches of xEVs increases.

OEM SUCCESS FACTORS

Continuous cost & performance optimization;

Increasing functional safety;

Short innovation cycles & scalable platforms;

High volume automotive xEV mass production.

Source: NXP CMI based on Strategic Analytics and IHS, 2020

“As part of the first wave of Volkswagen’s battery electric vehicle initiative we’ll deliver up to 75 full-electrical vehicle models to market by 2029[1],” said Dr. Holger Manz, Head of Development for Vehicle Energy Supply and High Voltage Systems, Volkswagen AG. “Incorporating a functionally safe battery management system that can scale across many car models makes it easier to achieve the full power potential of a battery, optimized range and the extension of the battery’s lifetime.”

https://www.volkswagen-newsroom.com/en/e-mobility-3921

CHALLENGES FACING EV CARMAKERS

Reduce battery cost
Simplified architecture
Automated assembly

Extend range, lower charge time
Functional safety
Accurate diagnostics

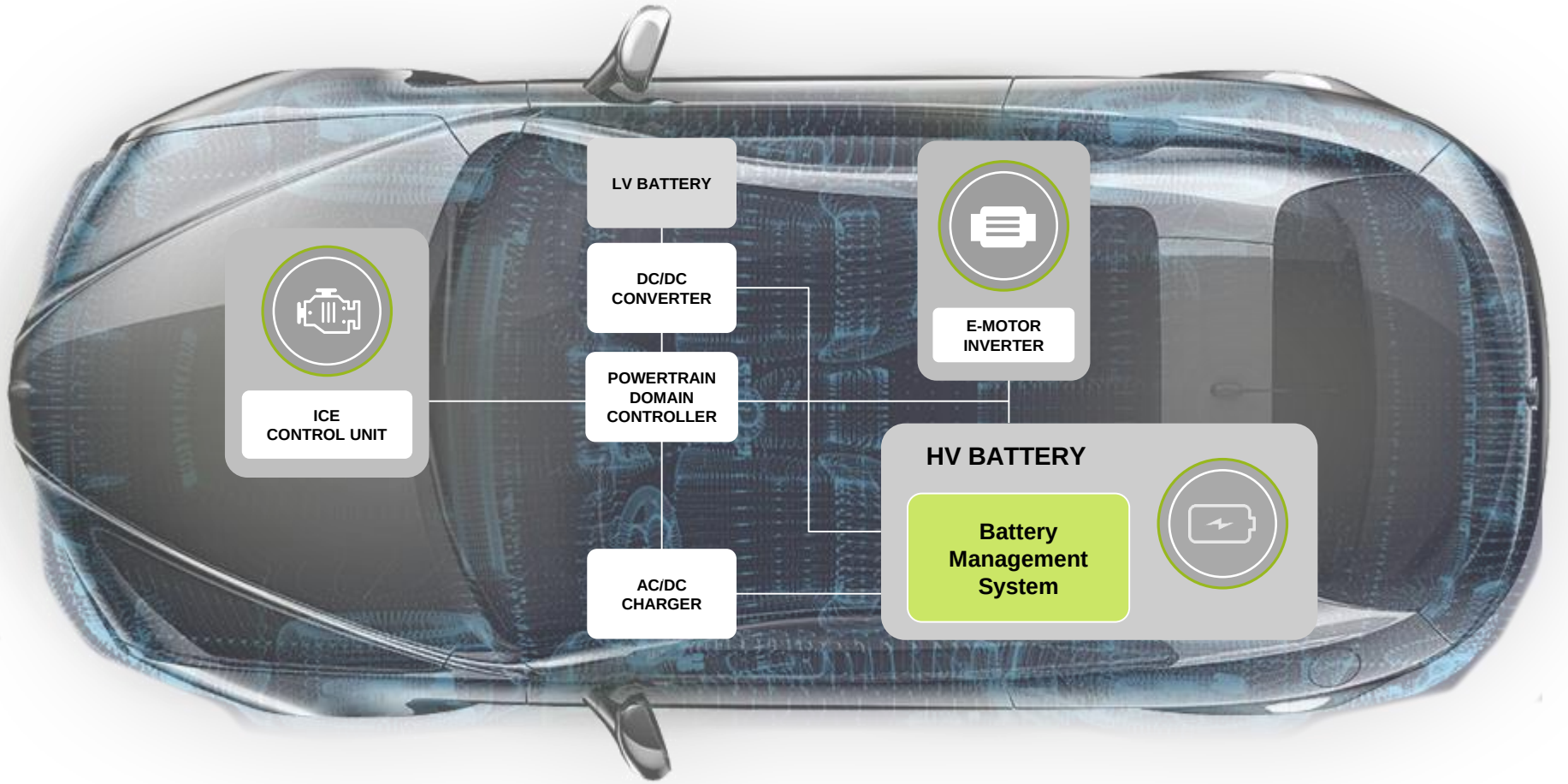
Electrify entire fleet
Platform concept
Maximize reuse

High volume production
Automotive quality
Simplify service

UNIQUE VALUE PROPOSITION

NXP can address every OEM pain point

KEY SYSTEMS IN XEV POWERTRAINS

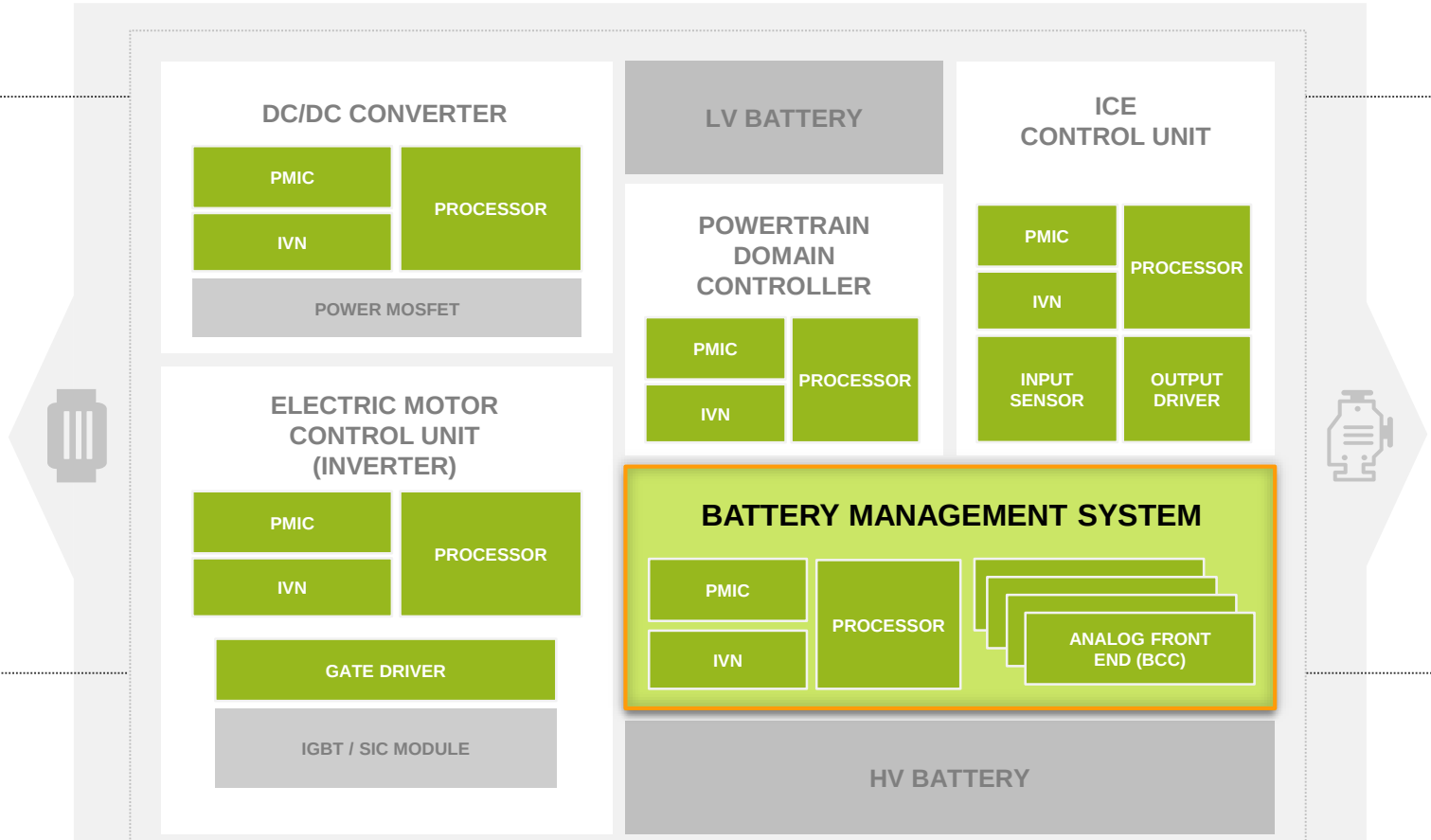


Source: NXP

HOW IS NXP INVOLVED IN XEVS?

ELECTRIFICATION PROCESSORS

ANALOG FRONT END (BCC)



IN-VEHICLE NETWORK, SENSORS & DRIVERS

SAFE POWER MANAGEMENT

SYSTEM OPTIMIZED, SCALABLE, SECURE AND SAFE

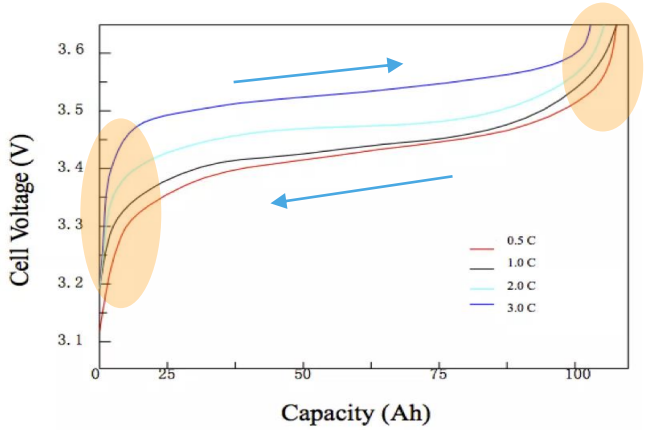
Automotive electrification solutions from NXP

Not addressed by NXP

Source: NXP

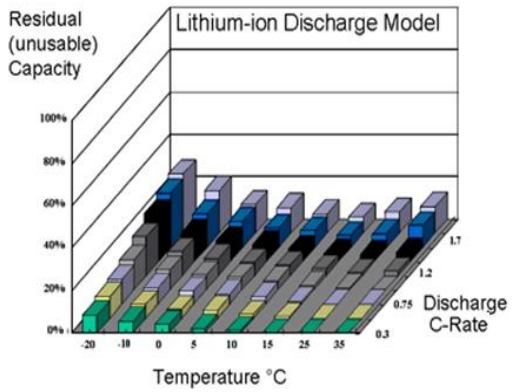
MAIN FUNCTIONS OF BMS SYSTEMS

Safety



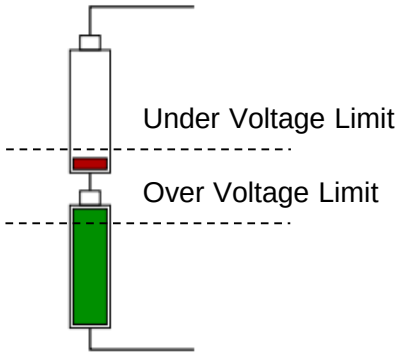
Danger:
- Over voltage
- Extra heat
- Unstable chemical stage
- Thermal runaway=>fire/explosion
- Low temperature charge

Performance



Requirements:
- Safe & fast charging
- Discharge optimization
- State of charge (SOC) estimation
- State of health (SOH) estimation

Multi-Cell function

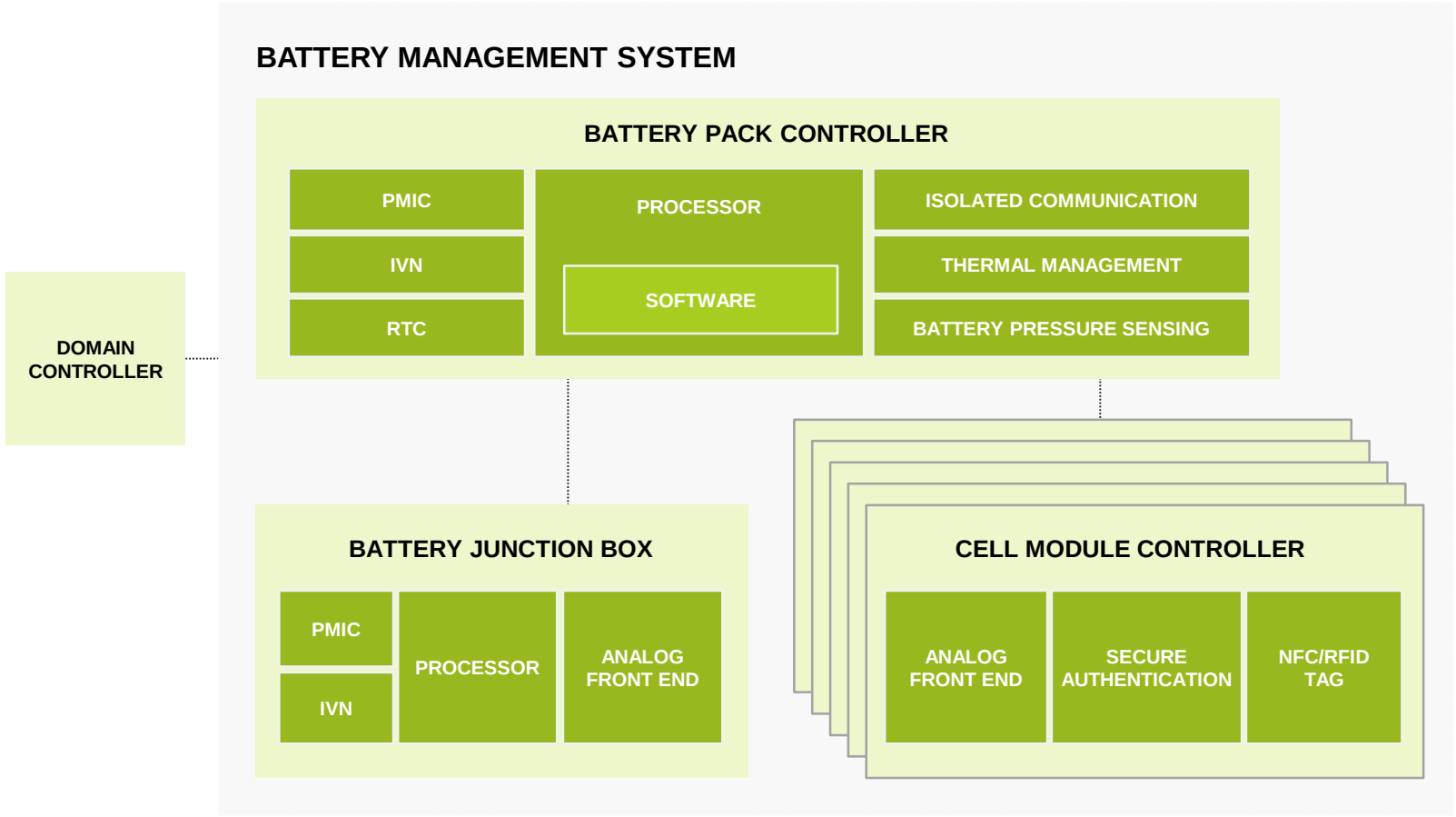


Challenges:
- Up to hundreds of cells
- Manufacture mismatch
- Capacity degradation
- Lifetime degradation

Key BMS Functions

V/I/T measurement	V/I/T measurement Coulomb counting Internal resistance calculation	Cell balancing

NXP DIFFERENTIATES BY OFFERING COMPLETE SYSTEM SOLUTIONS

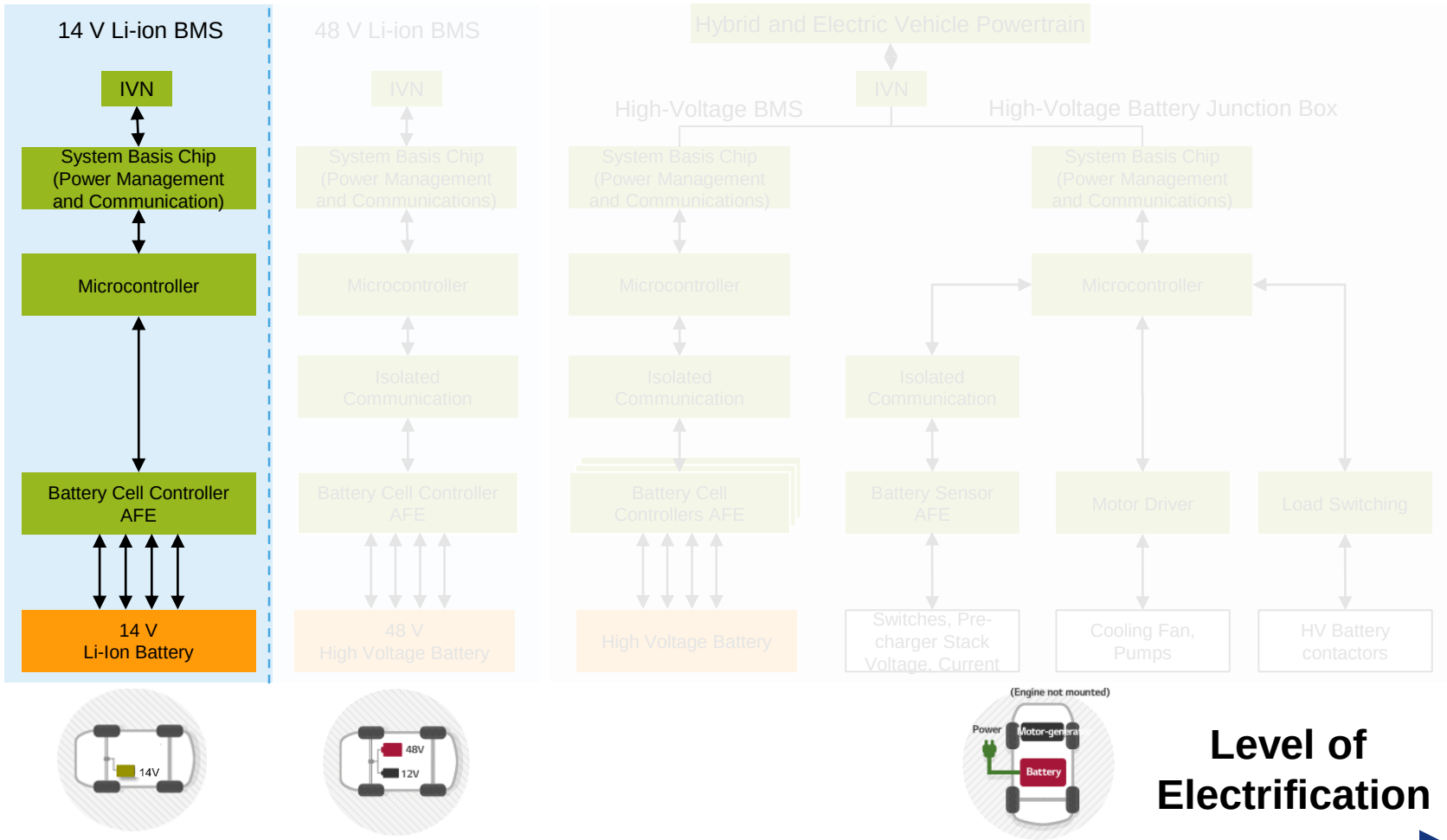


- Capability to optimize & standardize system;
- Fully validated reference designs;
- Coherent functional safety concepts;
- Embedded software drivers;
- System level EMC robustness.

NXP's embedded control & high precision analog solutions for battery management systems

Source: NXP

AUTOMOTIVE LI-ION BMS APPLICATION OVERVIEW



IVN = In-Vehicle Networking

AFE = analog front end

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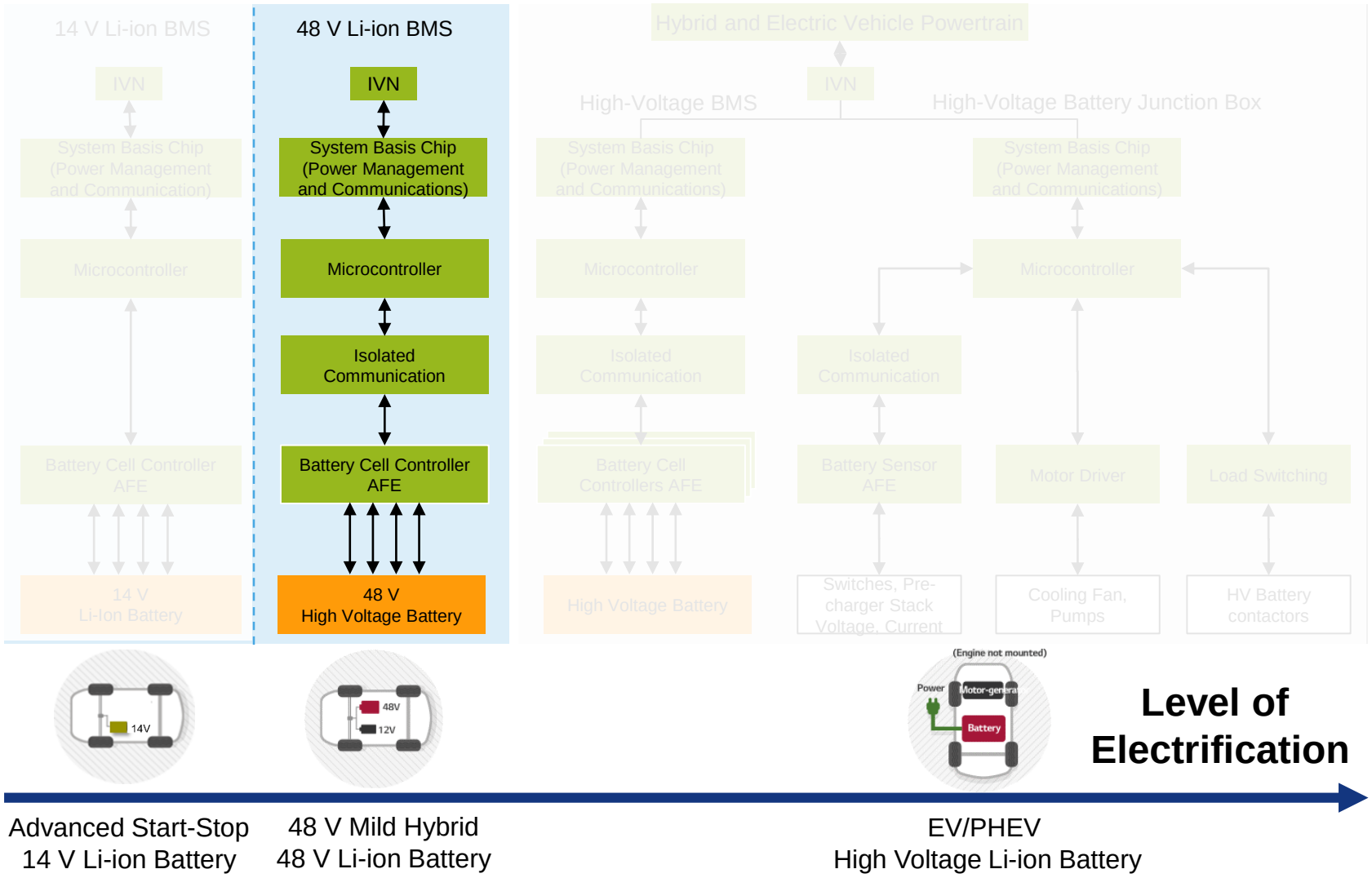

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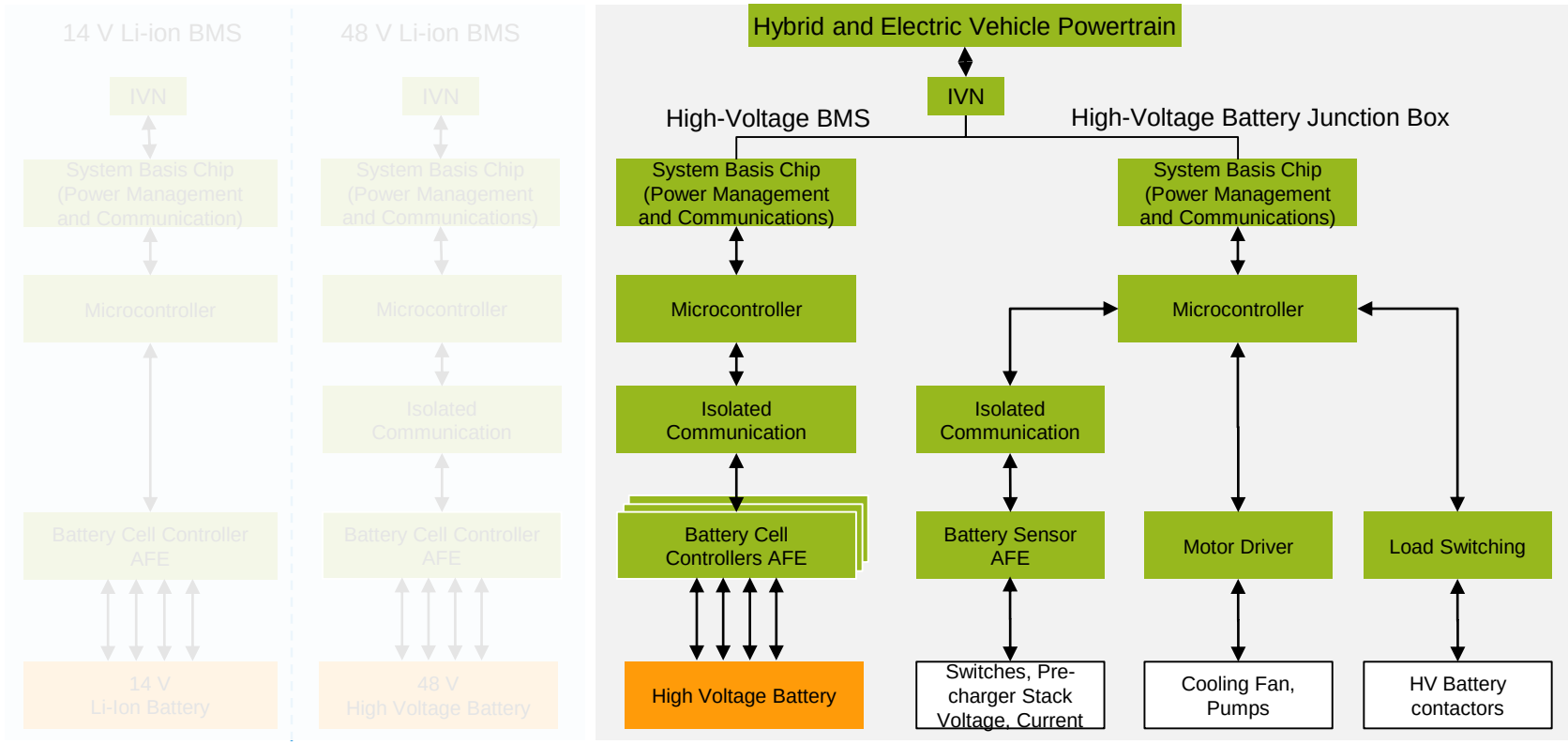

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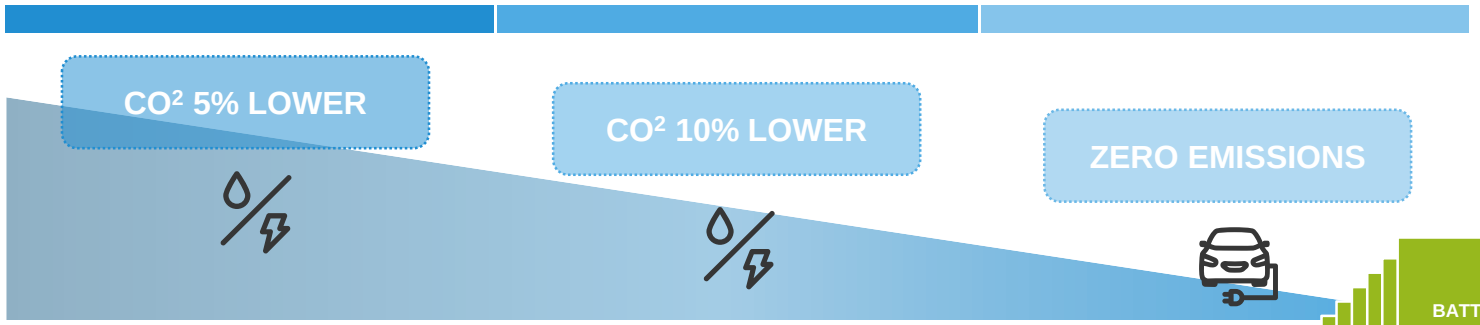
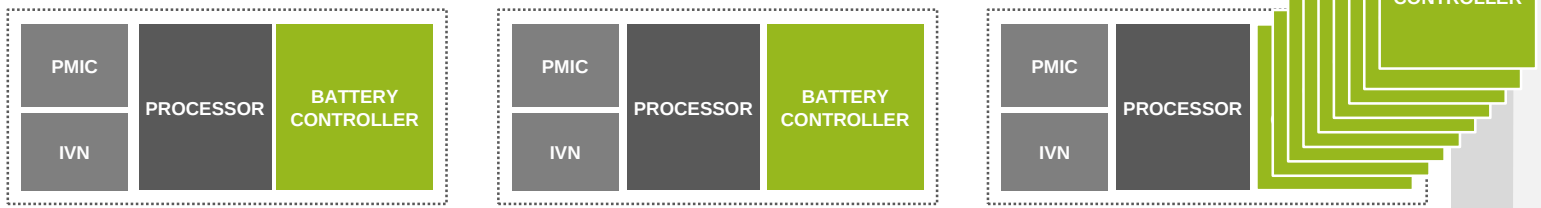
NXP BATTERY MANAGEMENT SCALABLE ACROSS ALL EV POWERTRAINS

MICRO HYBRID (START/ STOP)
14V Li-ion Battery

MILD HYBRID EV
48V Li-ion Battery

EV/PHEV
HV (High Voltage) Li-ion Battery





IMPROVE ICE EFFICIENCY

ZERO EMISSIONS

NXP OFFERS A SYSTEM SOLUTION SCALABLE ACROSS ALL EV POWERTRAINS

SCALABILITY BASED ON COMMON HW & SW PLATFORM

OEM APPLICATION
High reuse, ease of HW/SW qualification and FuSa certification

SOFTWARE DRIVER
Coherent interface to application layer

HARDWARE CHIPSET
Common data acquisition, communication, functional safety concepts across xEV systems

Source: NXP

SECURE CONNECTIONS
FOR A SMARTER WORLD