Technical Article

Functional Safety-relevant Wireless Communication in Automotive Battery Management Systems

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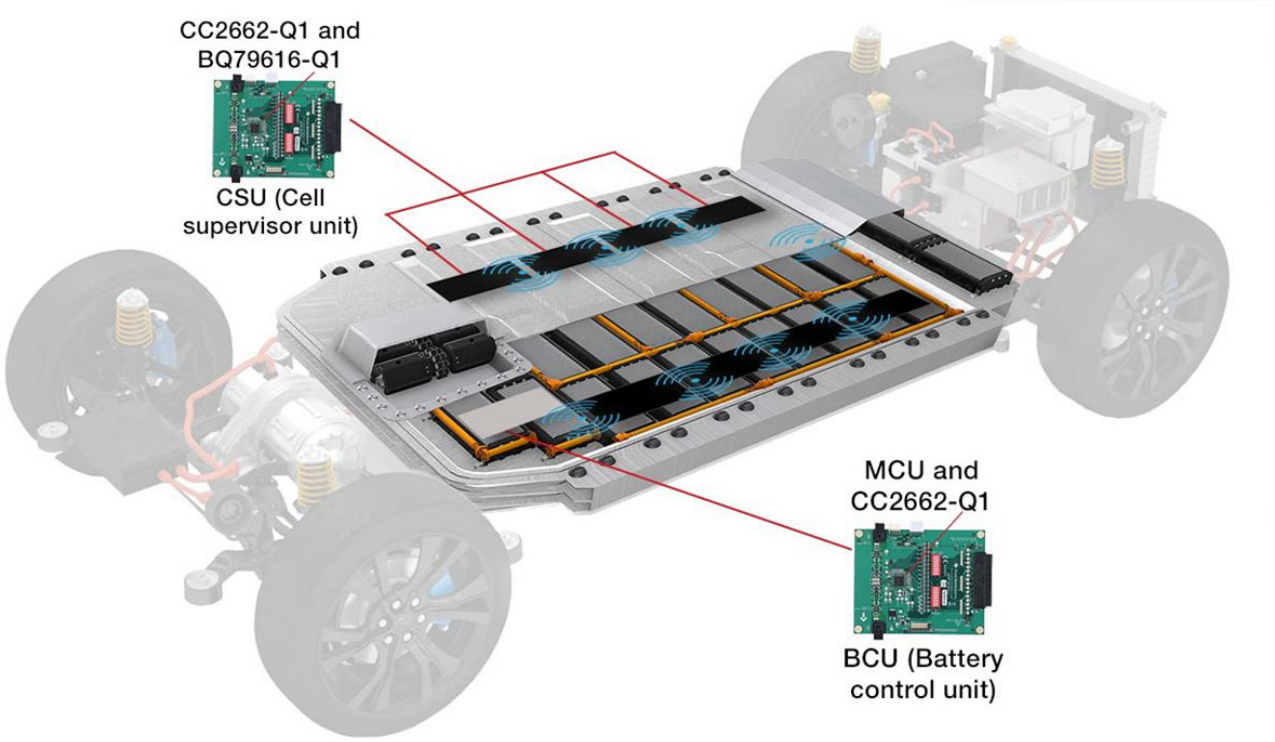

A wireless BMS allows vehicle designers can remove heavy, expensive, maintenance-prone cabling and improve the reliability and efficiency of hybrid and electric or hybrid vehicles (HEV/EV). TI's solution for wireless BMS empowers you to reduce the complexity of your designs, improve reliability and reduce vehicle weight to extend driving range.

To speed automakers' development time for wireless BMS, we requested that TÜV SÜD, the industry's leading functional safety authority, independently evaluate the quantitative and qualitative error-detection performance as well as the feasibility for automakers to achieve Automotive Safety Integrity Level (ASIL) D, the highest level of International Organization for Standardization (ISO) 26262 certification, using TI's wireless BMS functional safety concept.

How *can* You Transfer Data in a Wireless BMS While Meeting Functional Safety Requirements?

In the technical white paper, "Functional safety-relevant wireless communication in automotive battery management systems," I outline four topics to help streamline your design:

Communications architectures for safety-relevant data transmission

Generally, there are two possible architectures for safety-relevant data transmission:

- White channel is where complete hardware and software (including transmission protocols) are developed and validated according to functional safety standards.

- Black channel is where end elements including hardware and software (including transmission protocol) comply with functional safety standard and part or parts of the communication channel between compliant end interfaces do not comply with any specific functional safety standard.

As described later in the white paper, TI's wireless BMS solution implements the black-channel approach by using non-compliant wireless controller chips, which also helps reduce the overall system cost.

Communication errors in wired versus wireless data transmission

One of the most important disciplines in safety-relevant data transmission is the ability of the hardware and the software to detect potential errors. Fortunately, the types of the errors and recommended approaches for detecting them have been standardized. The white paper provides a chart to make it simple to review the types of communications errors for both wired and wireless BMS.

Evaluation of detection performance for ISO 26262

Since the wireless BMS targets HEV/EV, the ISO 26262 compliance is demonstrated on the system level. The white paper outlines error detection mechanisms such as information redundancy, frame counter and timeout monitoring and points to their qualitative and quantitative evaluation.

The WP actually does not evaluate this – the full concept document does.

Implementation of communication protocols

In this section, I explain how TI's wireless BMS implements the black-channel model in compliance with IEC 62280.

Read the white paper to learn more about implementing functional safety in your wireless BMS design.

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