# 面向电动汽车的电池接线盒解决方案

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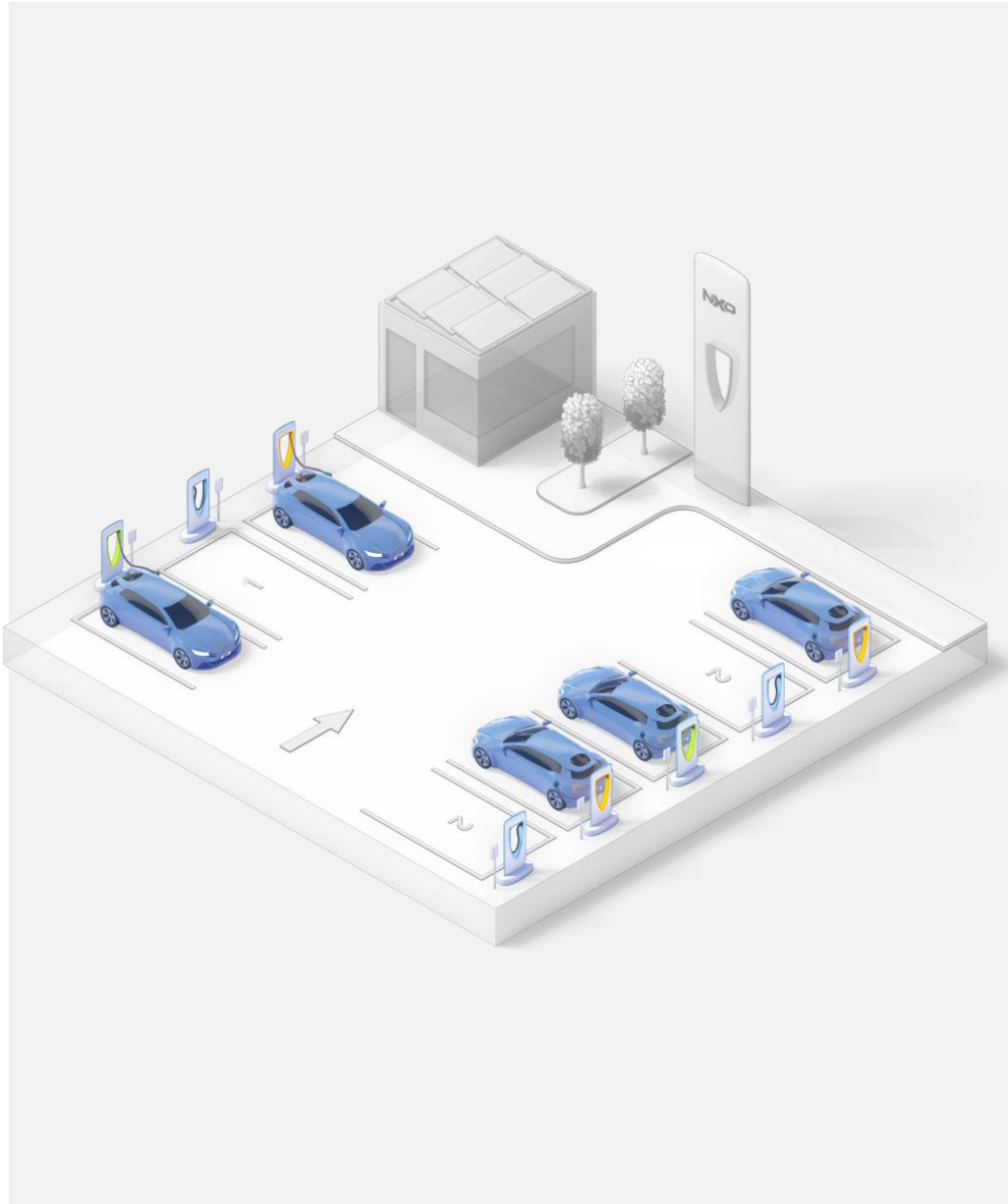
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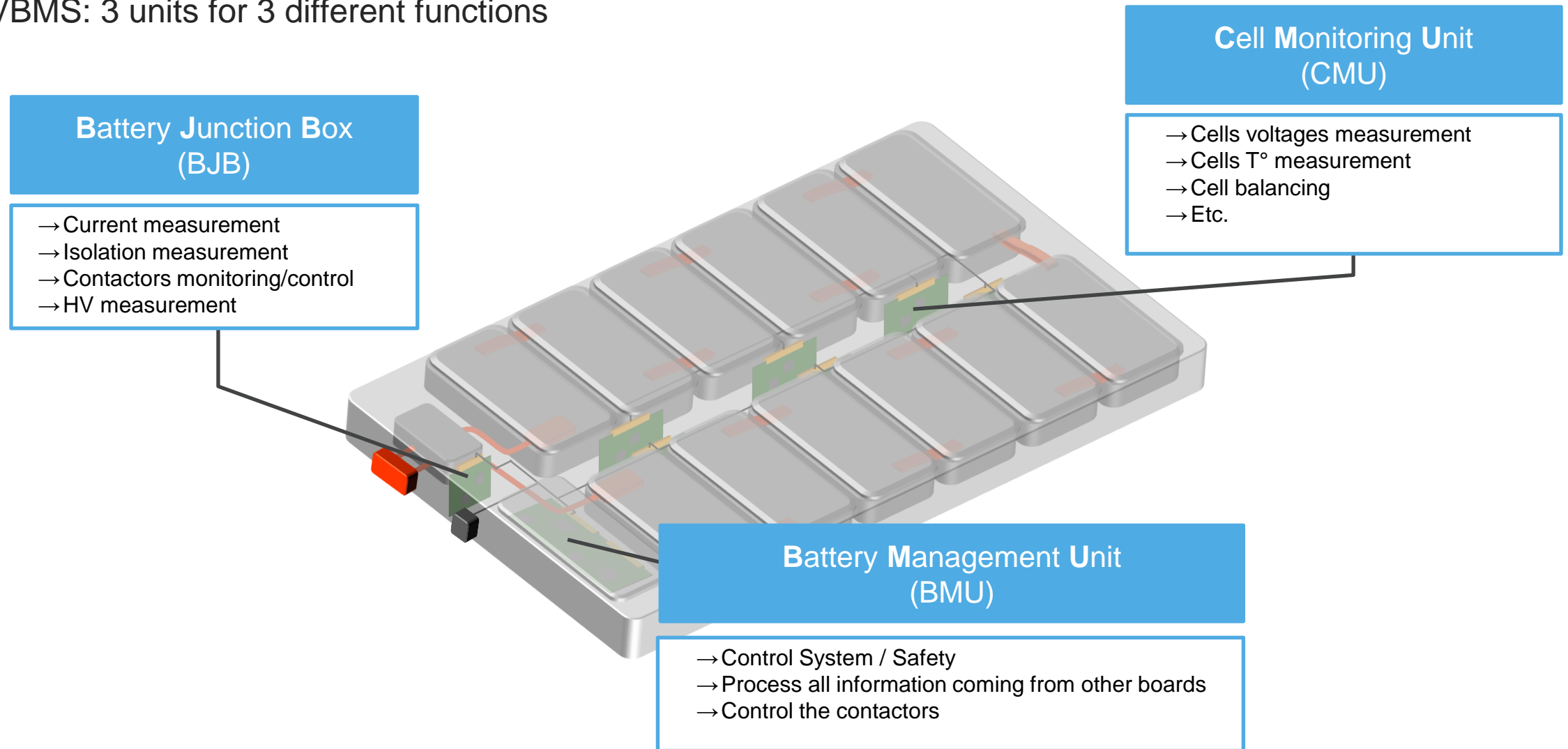SECURE CONNECTIONS
FOR A SMARTER WORLD

# AGENDA

- What is a Battery Junction Box?

- Main Functions & IC Requirements

- MC33772CTC BJB IC

- Reference Designs

# HVBMS SYSTEM ARCHITECTURE

HVBMS: 3 units for 3 different functions

**Cell Monitoring Unit (CMU)**

→Cells voltages measurement
→Cells T° measurement
→Cell balancing
→Etc.

**Battery Junction Box (BJB)**

→Current measurement
→Isolation measurement
→Contactors monitoring/control
→HV measurement

**Battery Management Unit (BMU)**

→Control System / Safety
→Process all information coming from other boards
→Control the contactors

# BATTERY JUNCTION BOX
## MAIN FUNCTIONS & REQUIREMENTS

- ASIL D current measurement with shunt temperature compensation for higher accuracy

- Fast current measurement for short circuit detection

- High voltage measurements

- Temperature measurements

- Vpack & current measurements synchronization (power calculation)

- Communication link to BMU MCU

- EEPROM interface for data/configuration recording
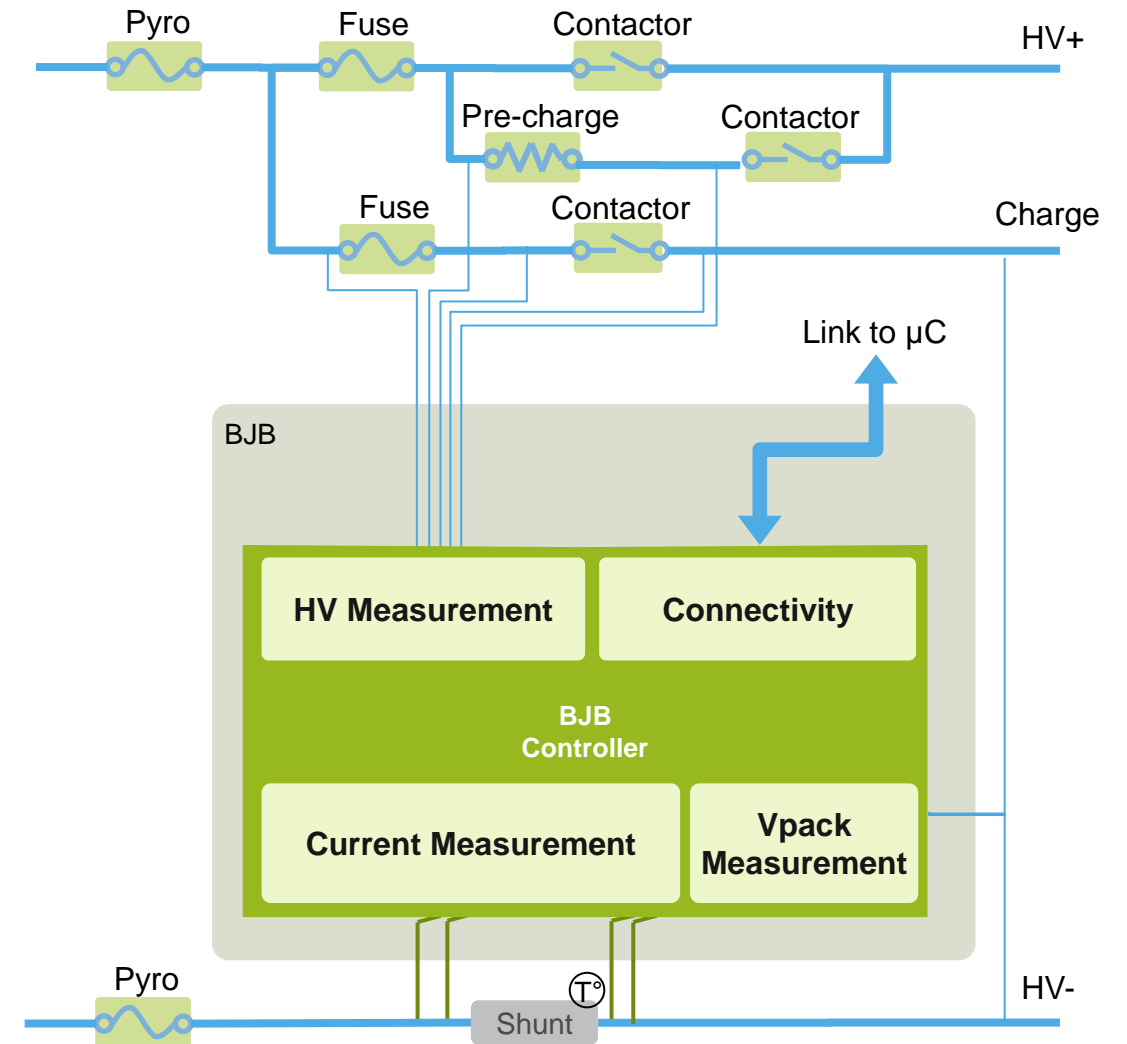
# BATTERY JUNCTION BOX
## FUNCTION ALLOCATION

| Actuator | System Function | IC Function | IC Feature | Comment |
|---|---|---|---|---|
| | Crash Signal Monitoring | | GPIO | Need to disconnect battery in case of crash |
| | Isolation Monitoring | Isolation Voltage Measurement | AINx | Up to 8x AINx inputs that can be combined with GPIOs |
| | Contactor Monitoring | HV Voltage Measurement | HV Voltage Measurement | Precision HV measurement to monitor the Pack voltage in synchronicity to the current measurement |
| | Precharge Monitoring | | | |
| | Impedance Measurement (SOH) | Synchronous I/V Measurement | | |
| | State of Charge (SOC, SOF) | Coulomb Counting | Precision Current Measurement | Highly accurate current measurement Integrated shunt temperature compensation |
| General Purpose DO | Over-Current (Li-Plating) | Slow Over-Current Detection | | |
| Pyro Breaker Driver | Over-Current (Short Circuit) | Fast Over-Current Detection | Fast Current Measurement | |
| Pyro Maker Driver | HV-Circuit Active Discharge | | | |
| | Isolated Communication | Daisy Chain interface | | |

# MC33772CTC1 – ASIL C ISOLATED CURRENT MEASUREMENT IC
## KEY FEATURES

- **High-performance integrated functions**

  - Operating voltage:
    - 6V ≤ VPWR ≤ 30 V operation, 42 V transient (for SPI communication)
    - 7V ≤ VPWR ≤ 30 V operation, 42 V transient (for TPL communication)
  - SPI or isolated 2.0 Mbps differential communication
  - Total stack voltage measurement
  - Current measurement with ±0.5% accuracy (±1500 A)
  - 7 GPIOs/Analog sensor inputs
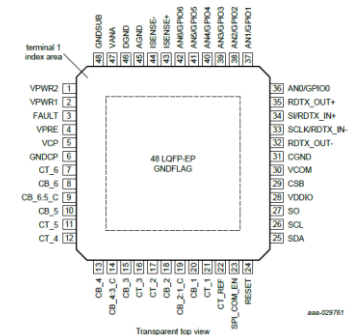  - Internal diagnostics

- **Quality & robustness**

  - AEC-Q100 automotive qualified
  - Temp range: -40°C to 125°C (for SPI communication)
  - Operational low-power mode
  - Hot plug capable / EMC/ESD robustness

- **Typical applications**

  - Automotive: Battery Junction Box IC
  - Industrial: current sensor IC for
    - Energy Storage Systems (ESS)
    - E-bikes, E-scooters…



MC33772CTC1
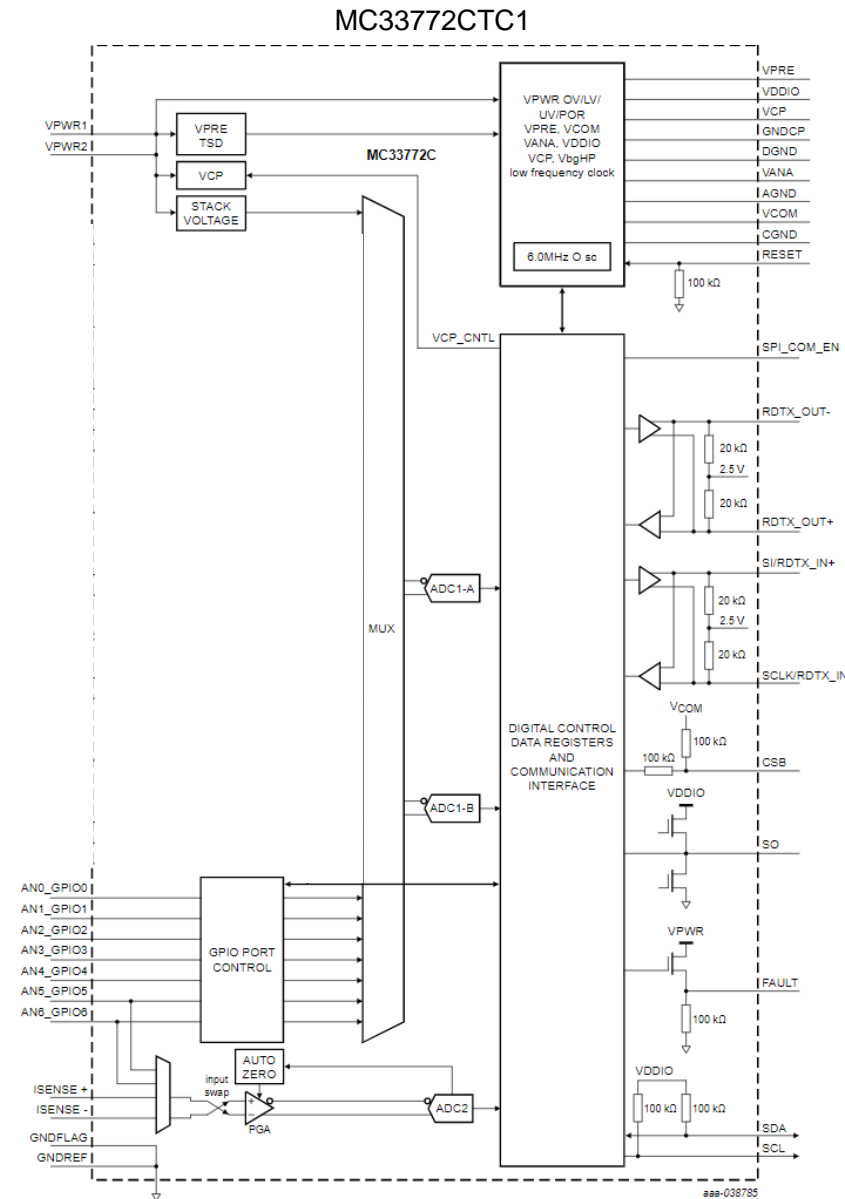
Package:
48 LQFP-EP

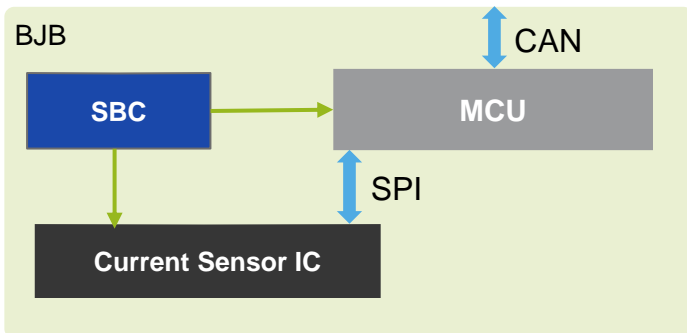*CT & CB pins are not specified or calibrated*

# BATTERY JUNCTION BOX
## INTEGRATION OPTIONS

## Classic BJB with MCU

Originally BJB integrate the MCU for several calculations. High SW effort and additional HW cost for extra microcontroller and communication devices
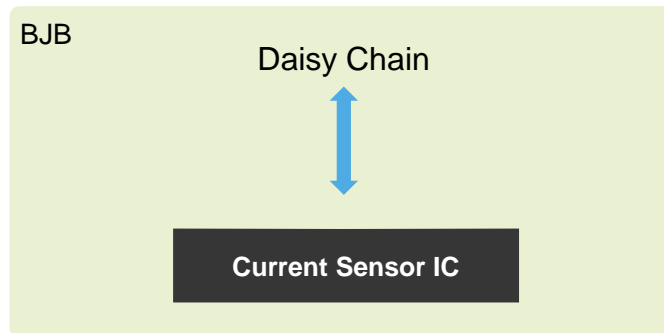
Traditionally, BMU connection is done via CAN

BJB

SBC → MCU — CAN

SPI
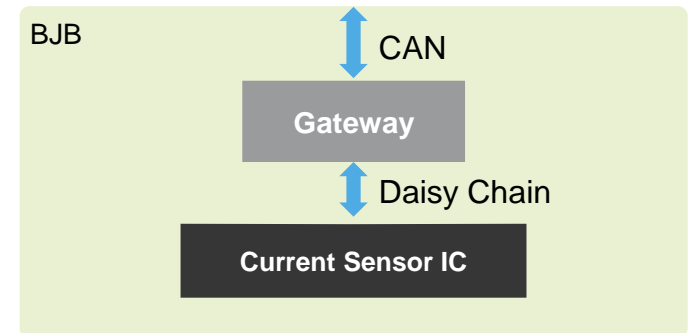
Current Sensor IC

## Daisy chain integrated BJB

First step of cost reduction is removal of BJB MCU
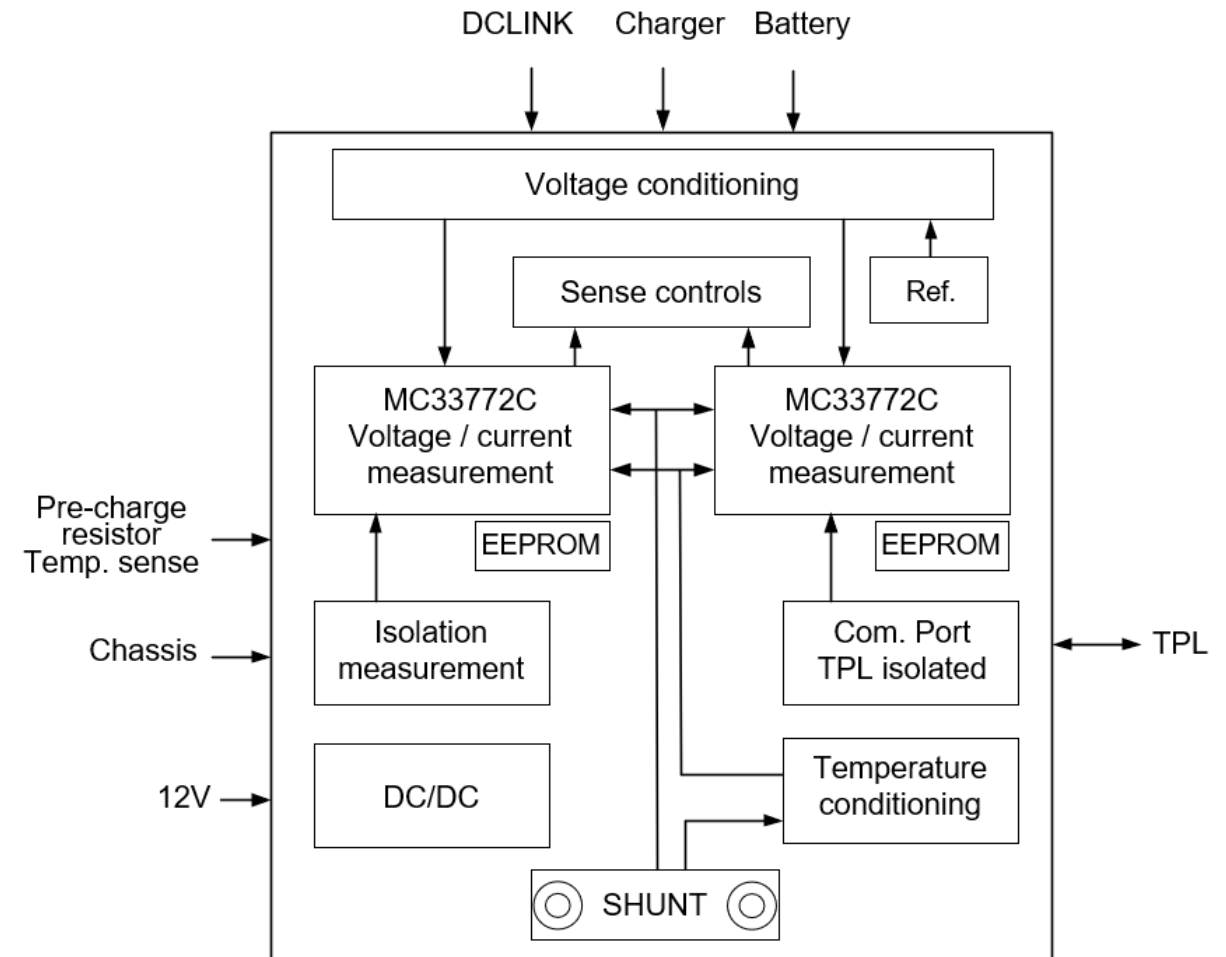
BJB may be included in CMU daisy chain

BJB

Daisy Chain

Current Sensor IC

## CAN BJB w/o MCU

If standard communication is required, a gateway can be used to bridge from daisy chain to CAN (FD)

BJB

CAN

Gateway

Daisy Chain

Current Sensor IC

# BJB TPL REFERENCE DESIGN
## OVERVIEW

Main features:
- 5 inputs high voltage positive measurement up to 500 V
- 2 inputs high voltage negative measurement down to -500 V
- 2 high voltage measurement from -500 V to 500 V
- 1 shunt for current measurement +/- 1500 A
- 1 shunt temperature measurement from -40 °C to 105 °C
- 1 pre-charge resistor temperature measurement from -40 °C to 140 °C
- 1 battery to chassis isolation measurement
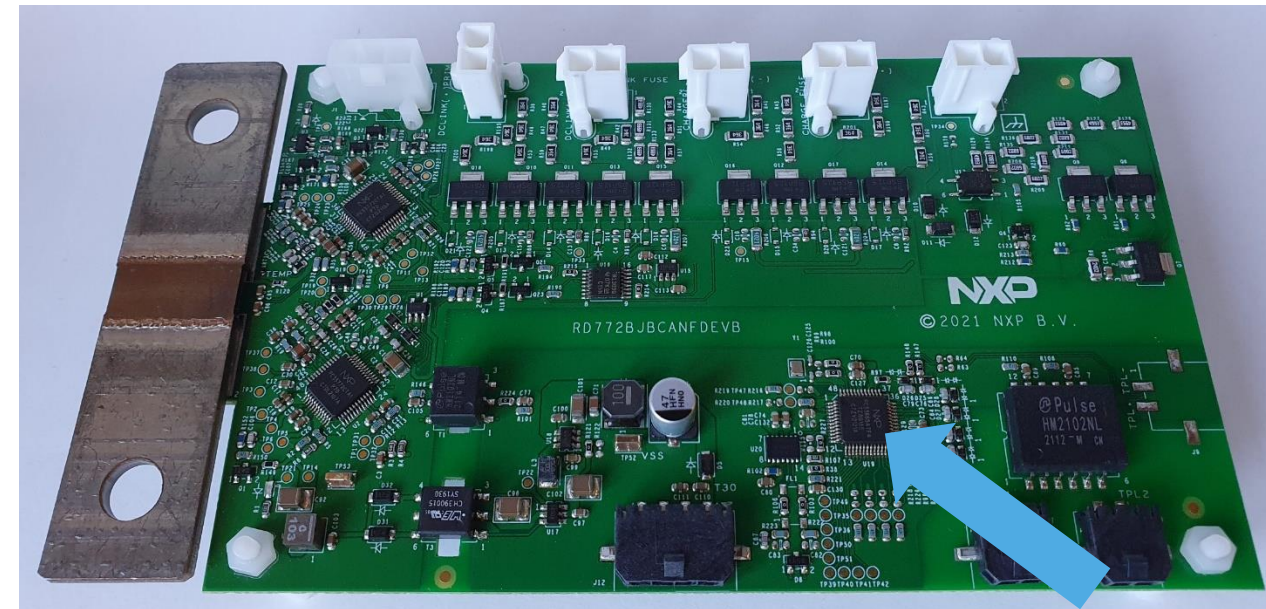- 2 EEPROM for data/calibration recording
- 1 TPL communication





RD772BJBTPLEVB

Adding MC33665 Gateway for SW-free CAN-FD interface

MC33665 Main features:

- MCU host interface supporting SPI, CAN (FD) or UART
- Four independent TPL daisy chain ports
- Configurable response and request buffers
- Operational Low power mode
- AEC-Q100 grade 1 qualified: −40 °C to +125 °C ambient temperature range

# BJB REFERENCE DESIGN
## PART OF THE 400 V HVBMS DESIGN

### SCOPE

- 400V BMS reference design, covering (**BMU**), (**BJB**) and up to 8 cell monitoring units (**CMU**)

- **ASIL D** ready hardware for voltage, current and temperature measurements

- Comprehensive system **safety collaterals** for reuse by customers

- Comprehensive reference **software** offering, including production ready complex **drivers** for AutoSAR

The Battery Junction Box is the **pack-level sensing part** of the BMS

With the MC33772CTCXAE, NXP offers **dedicated ICs** for the BJB application

Multiple options to integrate BJB into BMS **without dedicated MCU and local software** effort

The **BJB Reference Design** is available from July 2022 as part of the HVBMS RD

Learn more visiting **NXP.com/bms**

![NXP Logo]
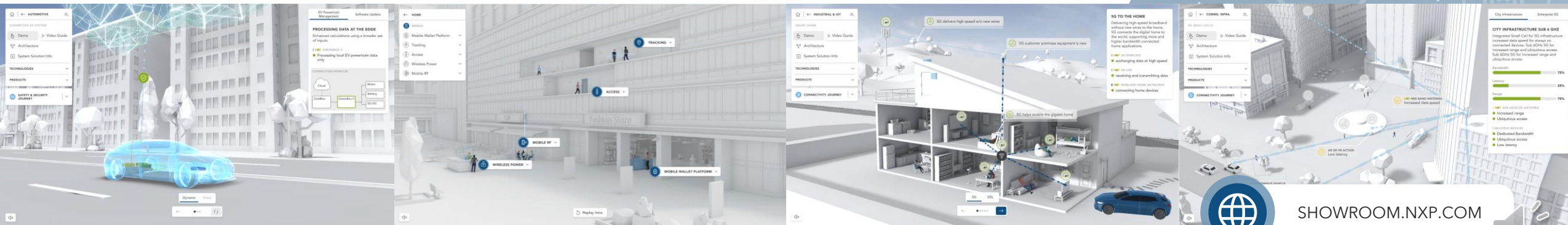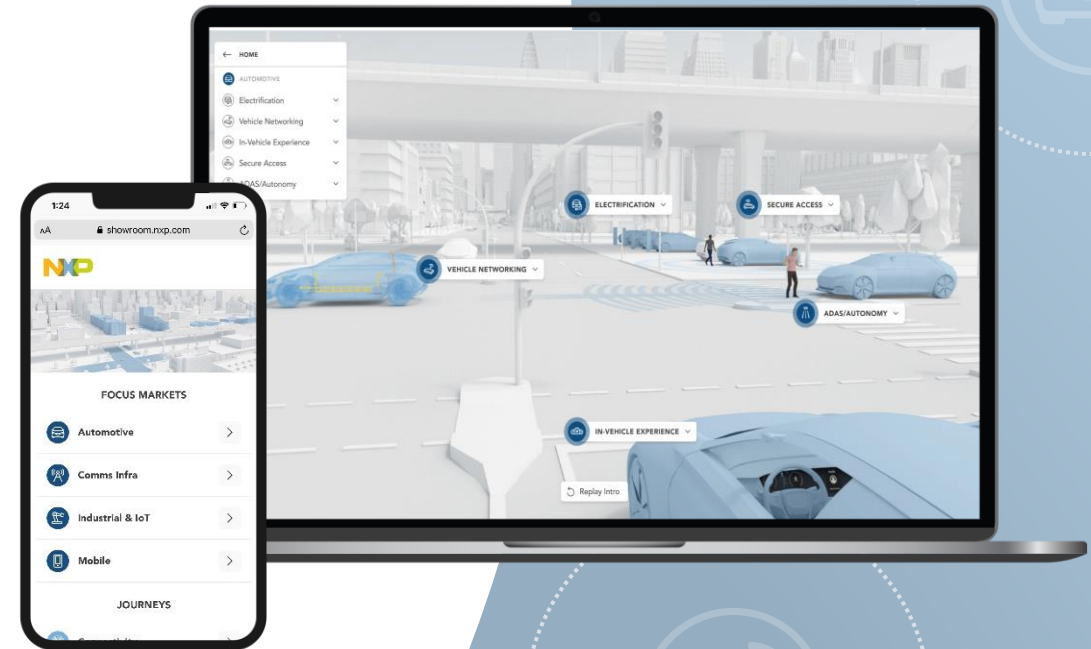
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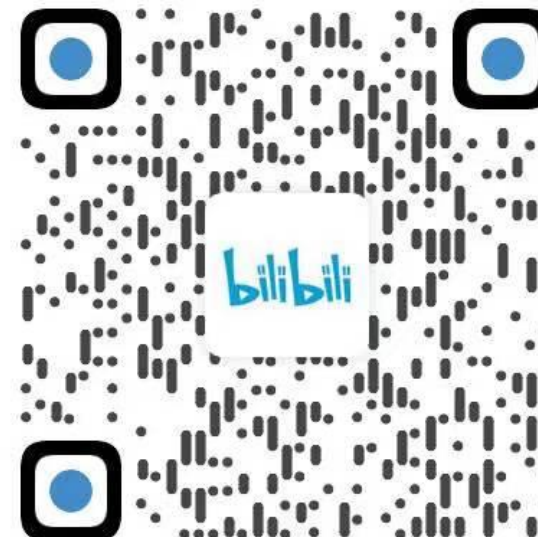
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# Q&A

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