

DIGITAL WE DAYS 2024



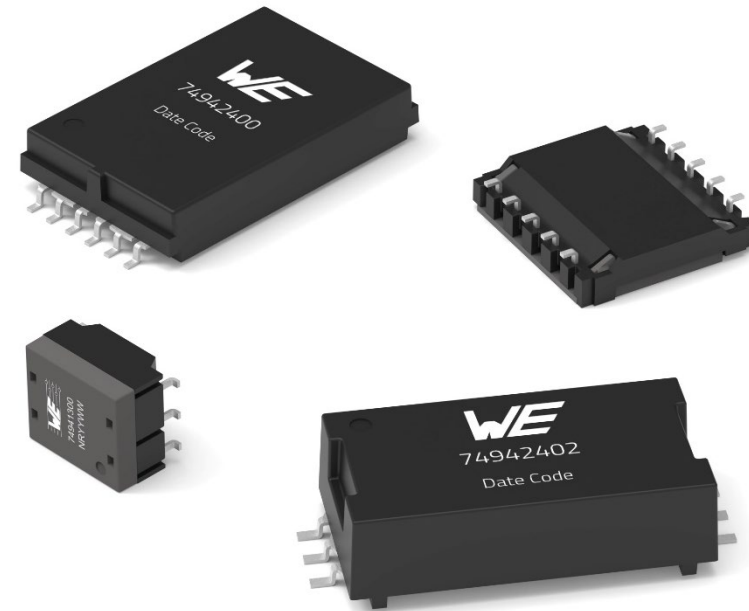
THE ROLE OF TRANSFORMERS IN HIGH VOLTAGE BMS (UP TO 1500 V)

Samuel Lamprecht

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

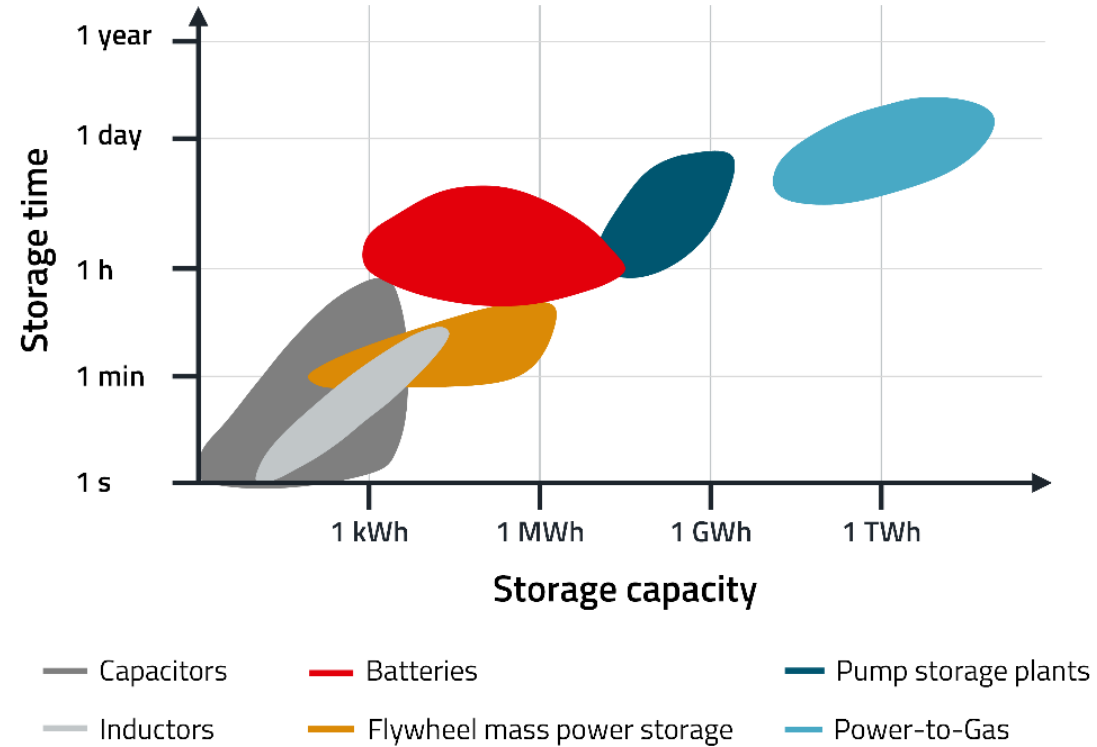
AGENDA

- Current trends and challenges in energy storage
- Necessity of Battery management systems
- Specific challenges for transformers with high operating voltages
- Essential safety standards
- Transformer solutions for insulation up to 1500 V
- Conclusions and outlook



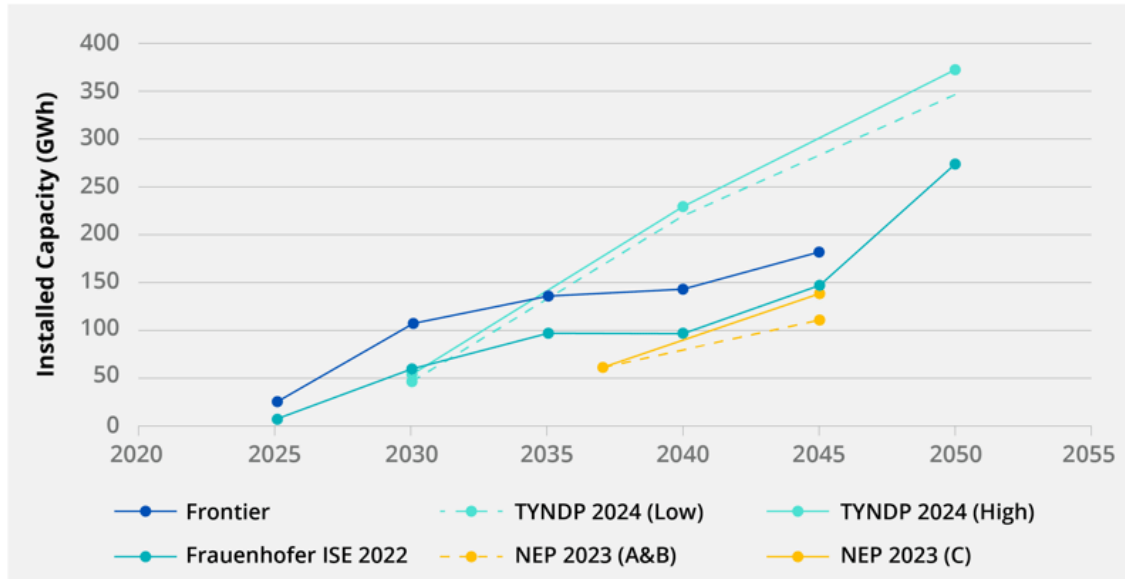
INTRODUCTION

Current trends and challenges in energy storage

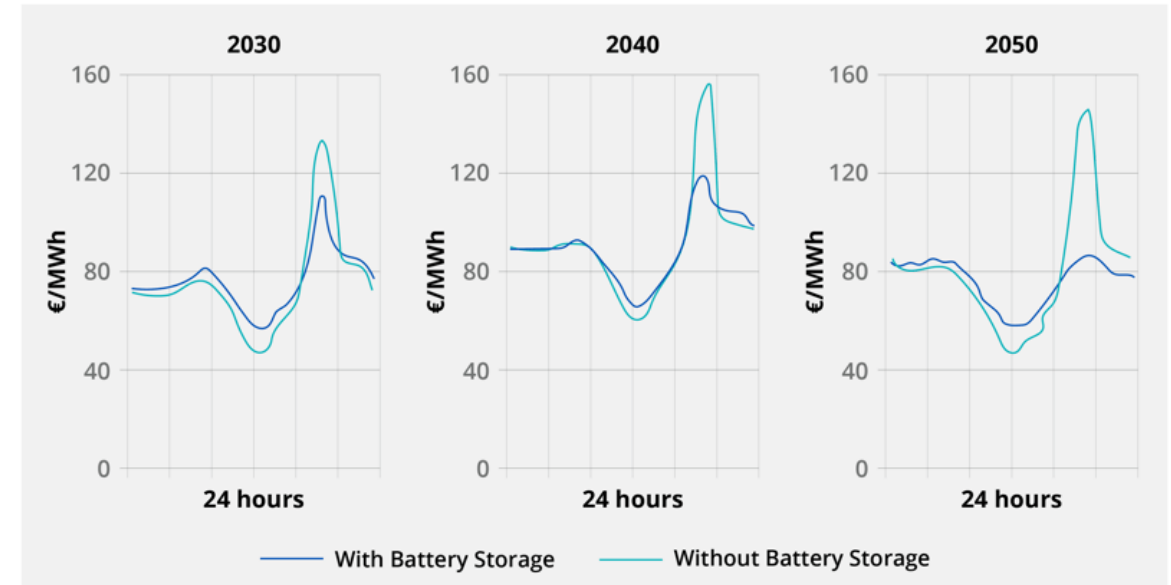


INTRODUCTION

Current trends and challenges in energy storage



Overview of expected roll-out of large-scale energy storage systems in Germany



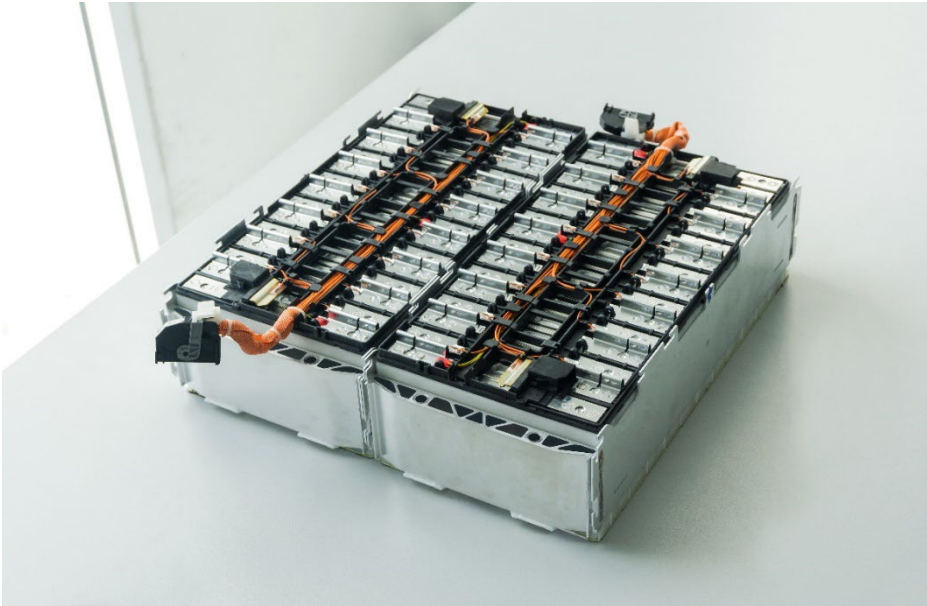
Average price development over a day with and without stationary battery storage

Source: Frontier Economics (<https://blog.fluenceenergy.com/energy-storage-roll-out-can-save-german-energy-consumers-12-billion-euros>)

NECESSITY OF BATTERY MANAGEMENT SYSTEMS

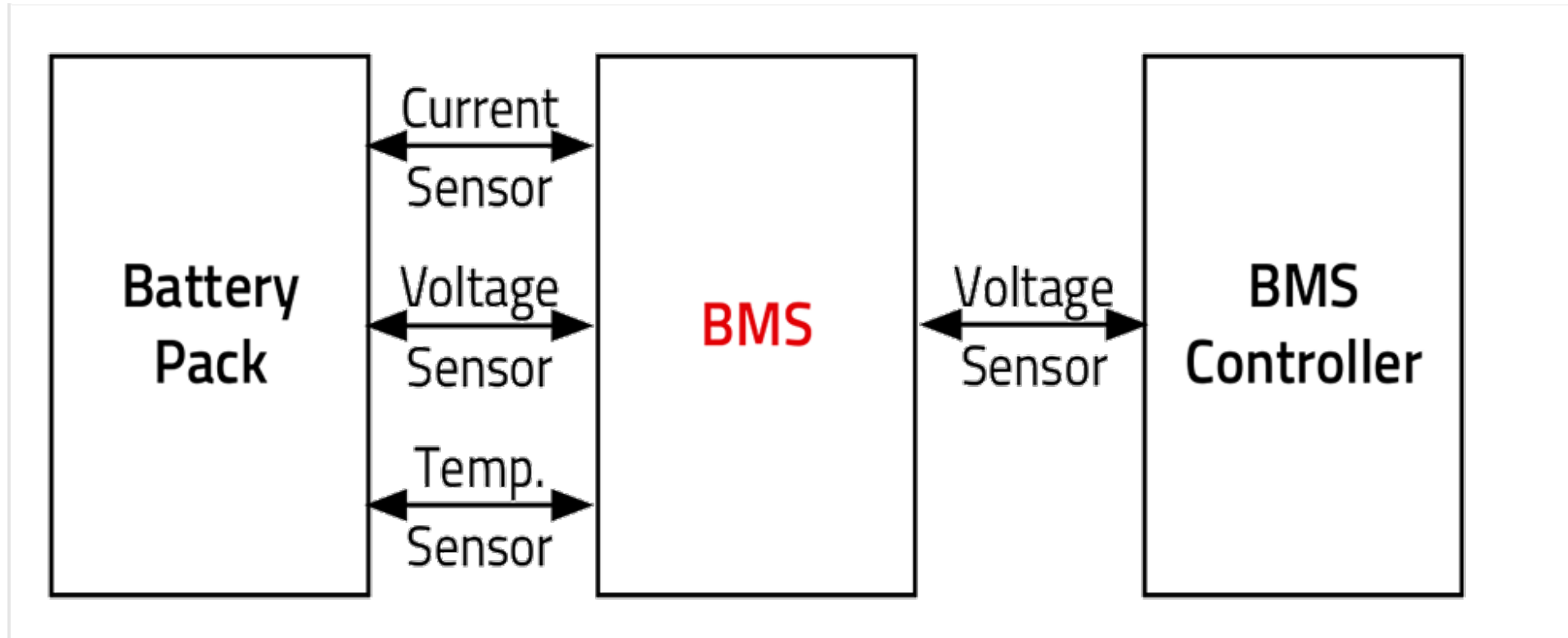
Different BMS

- There are different types of BMS based on different battery technologies and requirements.
E.g. for Lithium or Nickel based batteries
- Size ranges:
 - Energy storage for households and small businesses, 3 kWh to 20 kWh
 - Energy storage for communities and businesses, 20 kWh to 100 kWh
 - Energy storage for electricity grid operators 100 kWh to 5 MWh



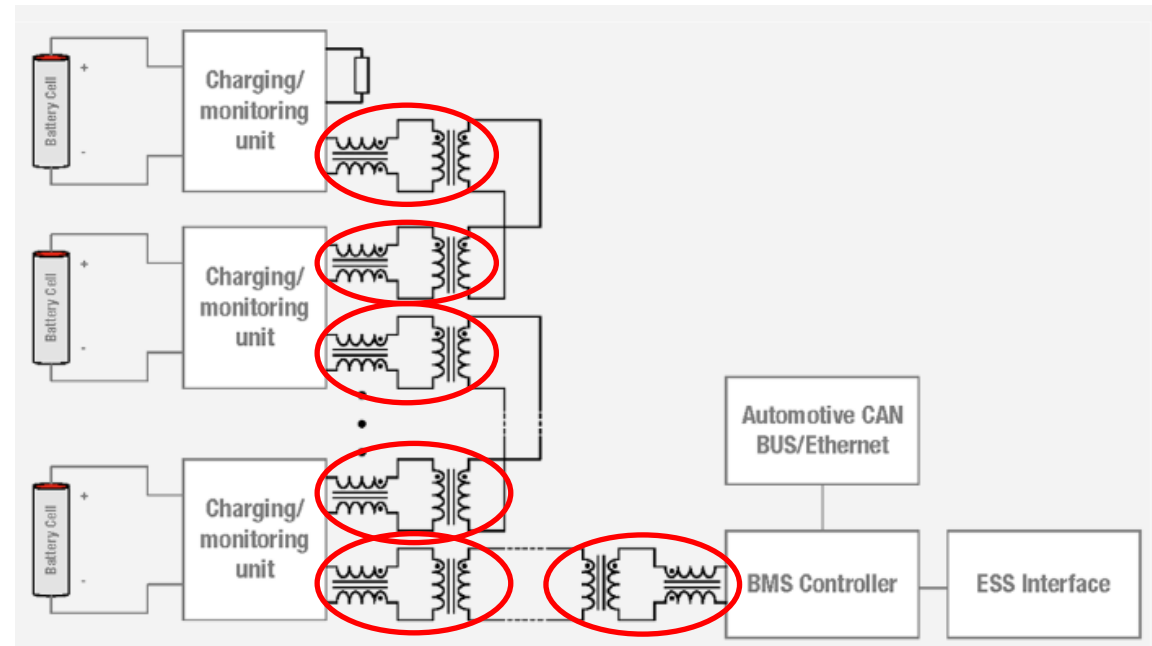
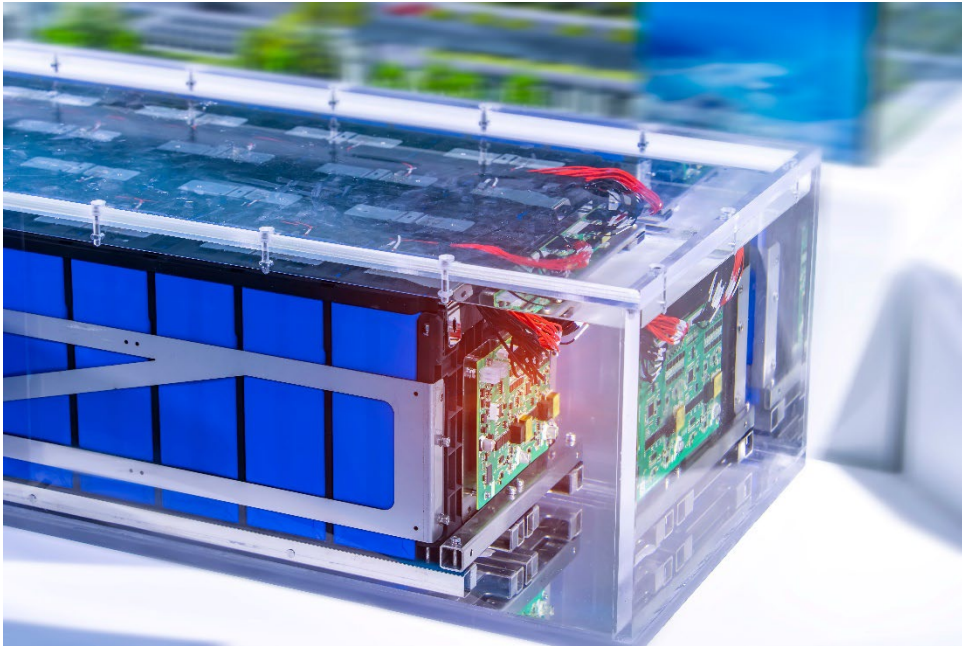
NECESSITY OF BATTERY MANAGEMENT SYSTEMS

The role of the BMS in electric driven vehicles and energy storage systems



TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

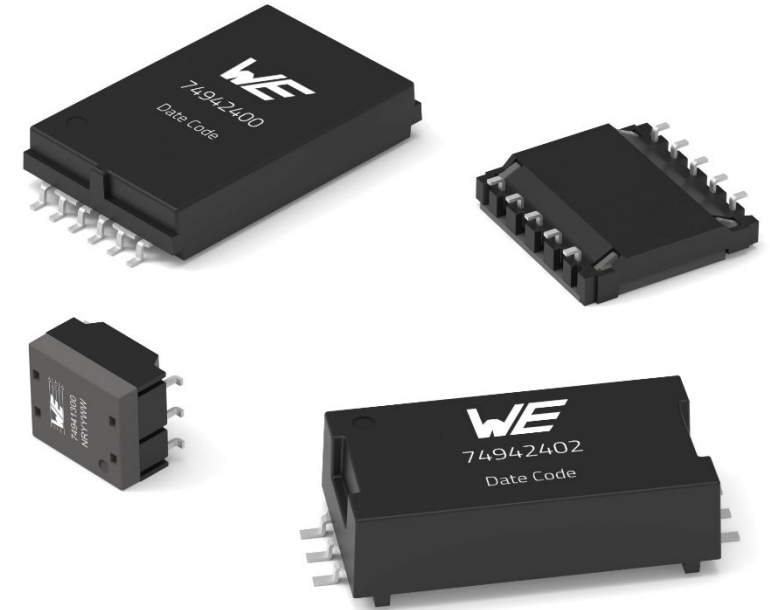
Introduction to BMS transformers and their role in BMS



TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

Specific challenges for transformers with high operating voltages

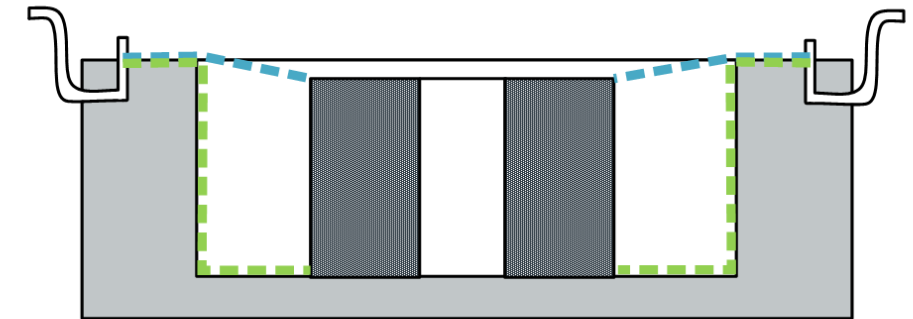
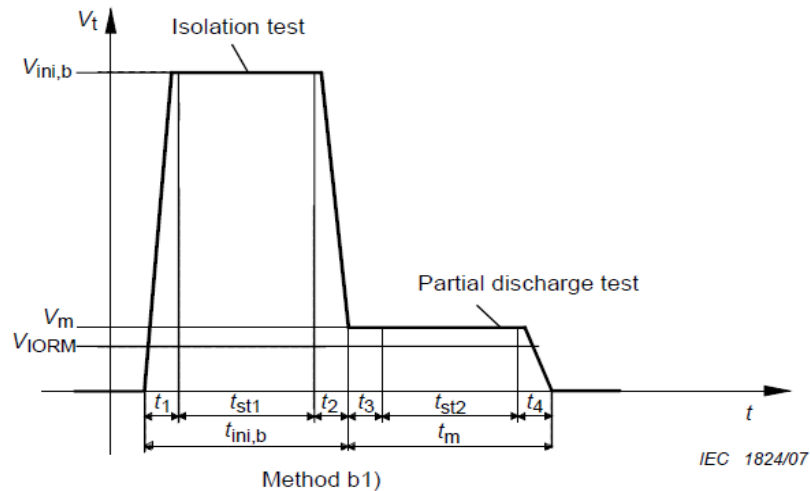
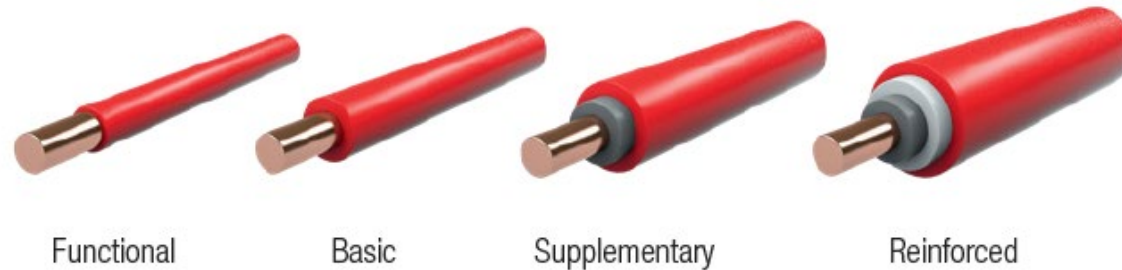
- Signal transformers for high operating voltages have different challenges
 - Isolation and safety
 - Creepage and clearance distances
 - Size
 - Weight
 - Frequency range



ESSENTIAL SAFETY STANDARDS

Overview of relevant standards for the design of (high-voltage) BMS transformers

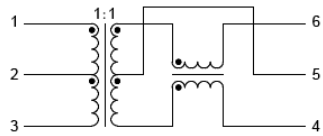
- IEC 60664-1: Transformers
- IEC 62368-1: Audio/Video, information and communication technology equipment



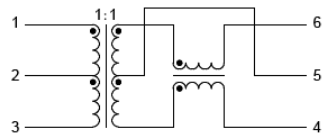
--- Creepage --- Clearance

TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

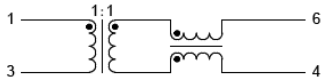
Battery Management System Transformers for 1000 V



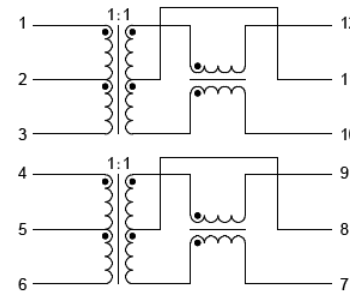
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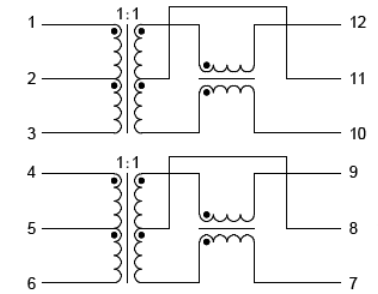
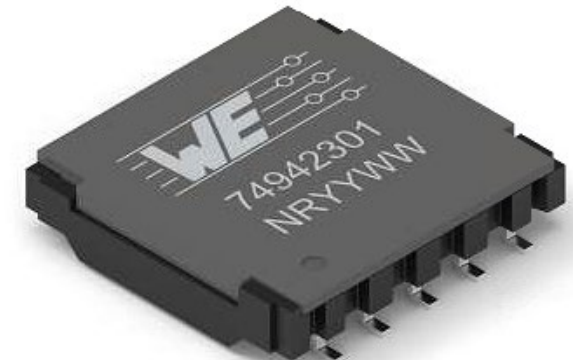
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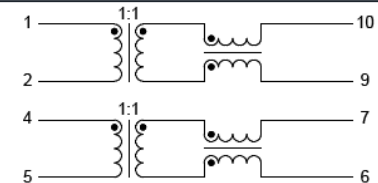
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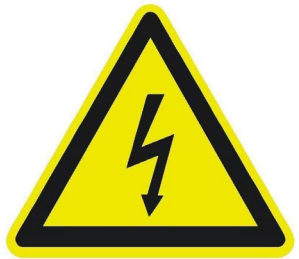
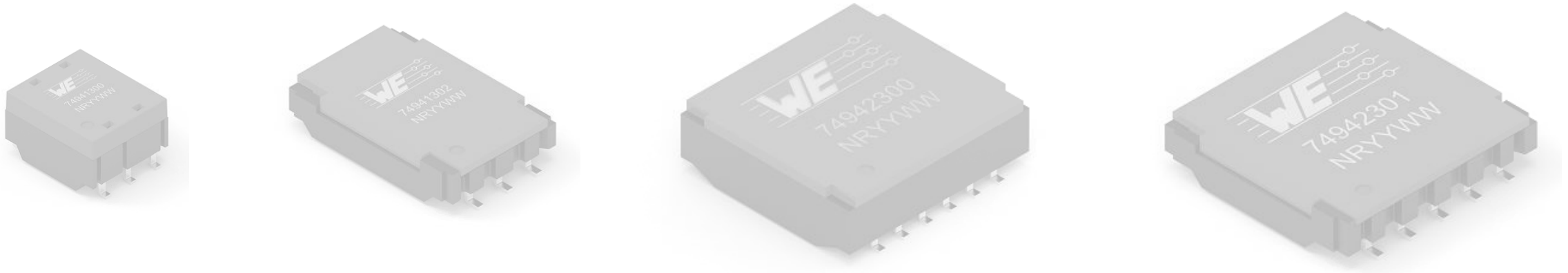
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TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

Battery Management System Transformers for 1000 V



Test Voltage 4300 VDC

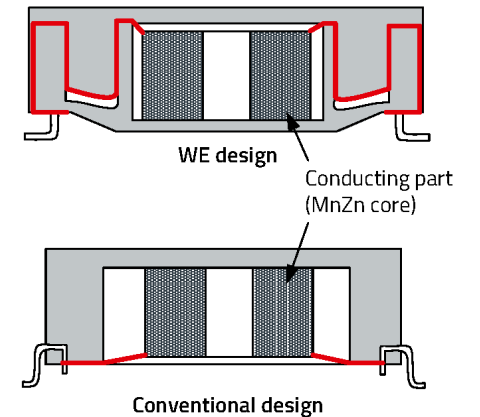
Working Voltage **1000 VDC**



**125 °C
GRADE 1**

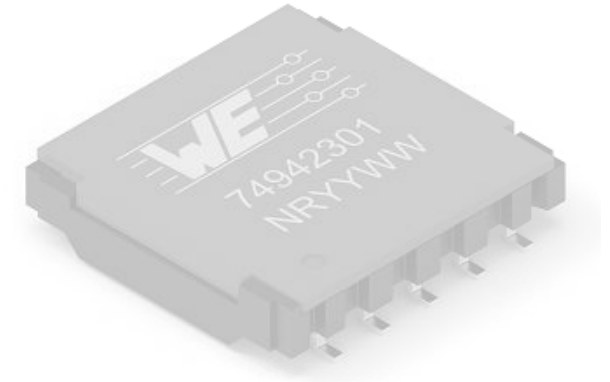
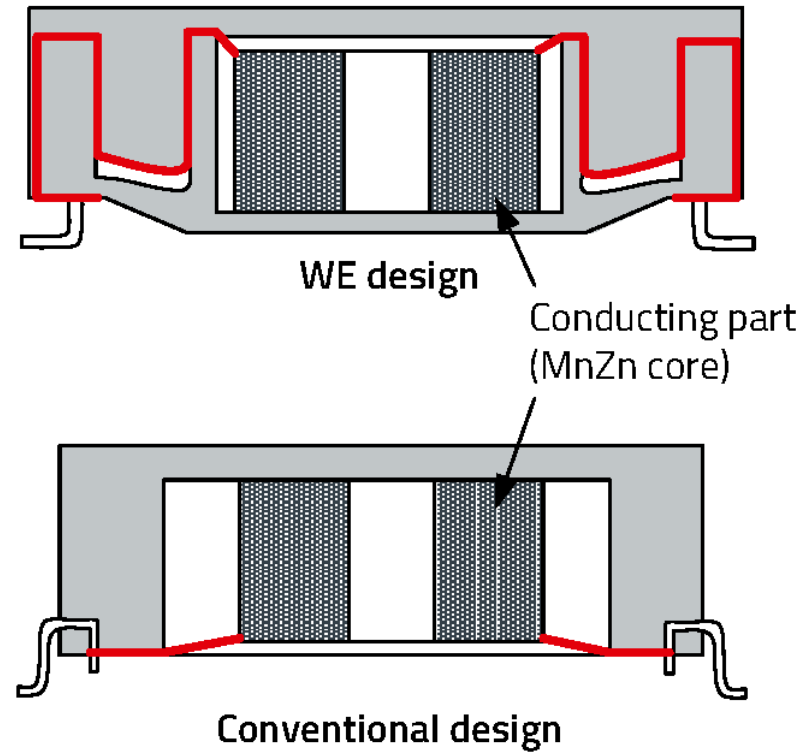
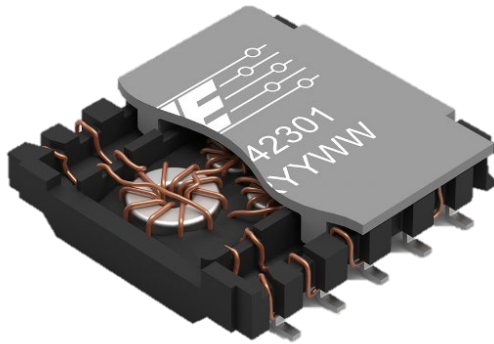


High quality wire



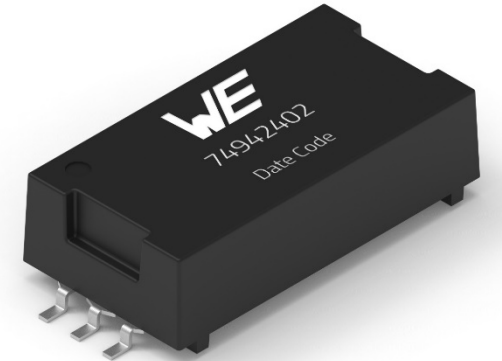
TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

Battery Management System Transformers for 1000 V

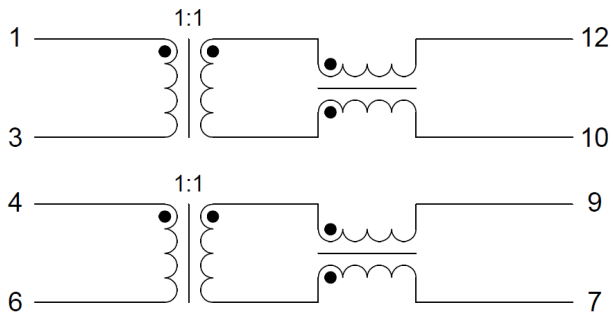


TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

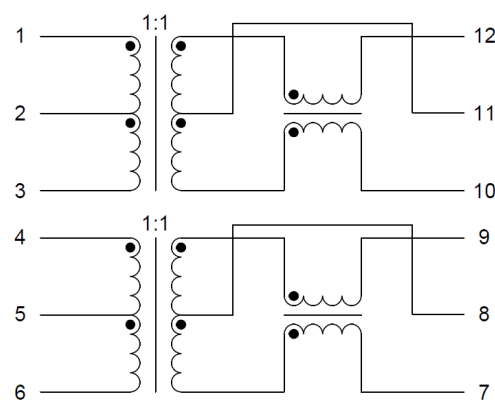
Battery Management System Transformers for 1500 V



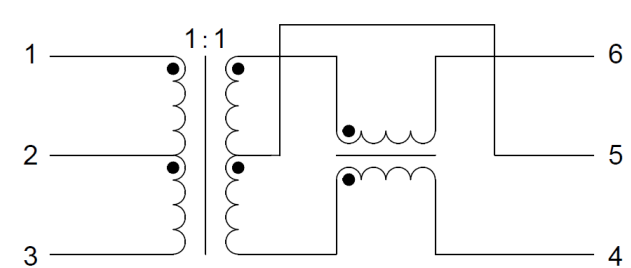
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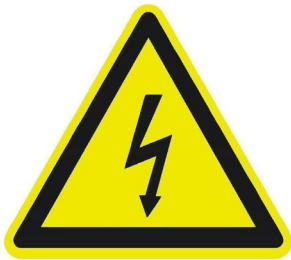
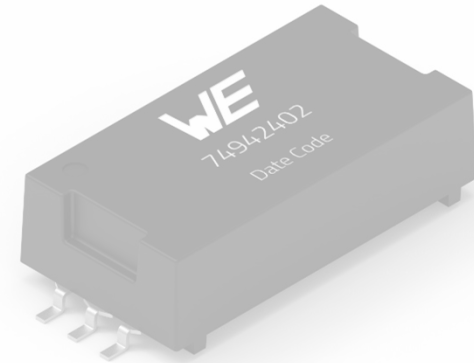
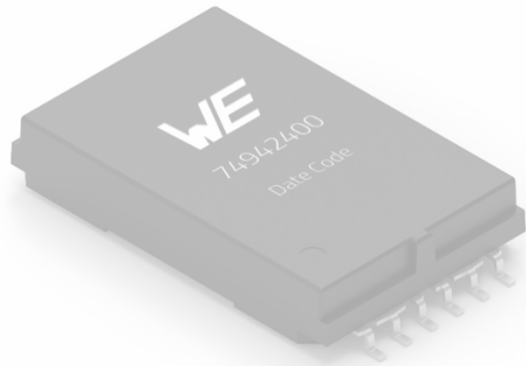


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TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

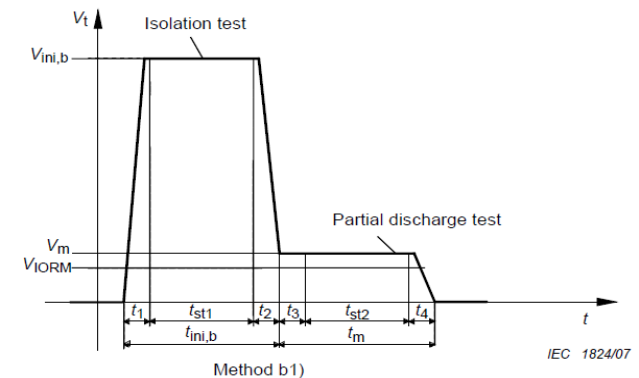
Battery Management System Transformers for 1500 V



Test Voltage 6400 VDC
Working Voltage **1500 VDC**

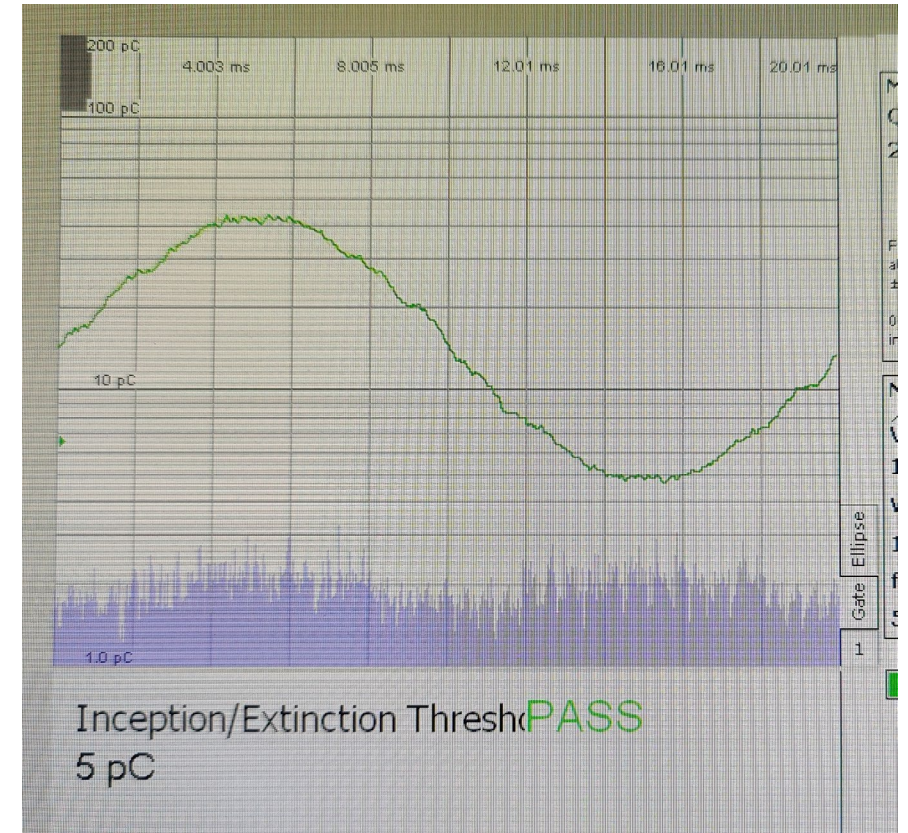
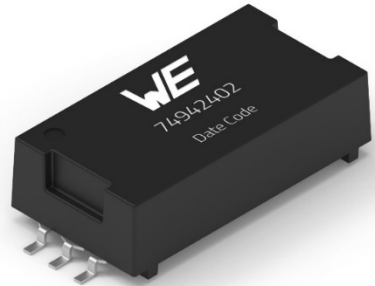
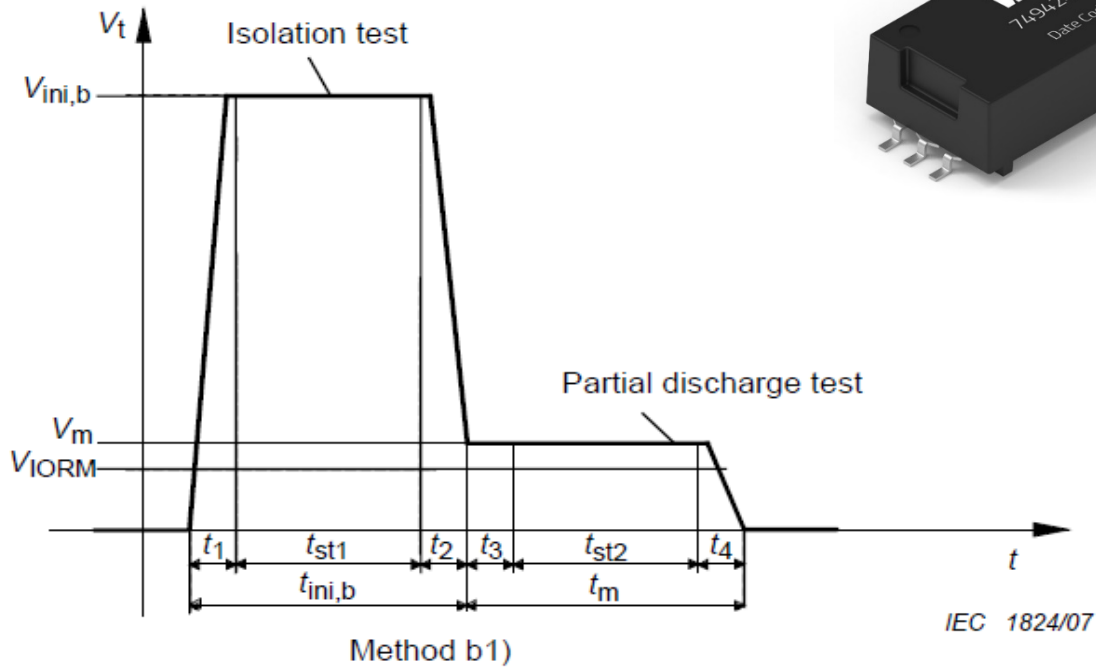


High quality wire



TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

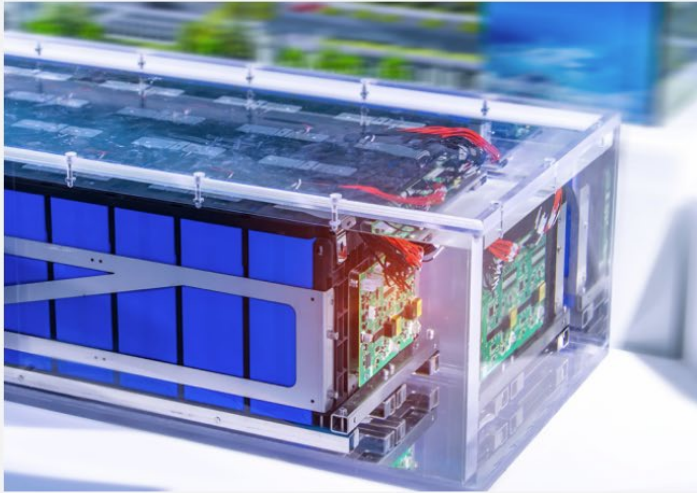
Battery Management System Transformers for 1500 V



TRANSFORMER SOLUTIONS FOR INSULATION UP TO 1500 V

Battery Management System Transformers for 1500 V

From the smallest to the largest applications



The transformers with 1000 V_{DC} working voltage are suitable for smaller energy storage systems such as consumer energy storage and for applications with lower voltages such as 600 V_{DC}



BMS transformers with a working voltage of 1500 V_{DC} and a test voltage of 6400 V_{DC} are available for applications with large battery packs, such as in energy storage systems for solar and wind farms.

What is a battery management system (BMS)?



Why is a transformer needed in a BMS?



What is the partial discharge test?

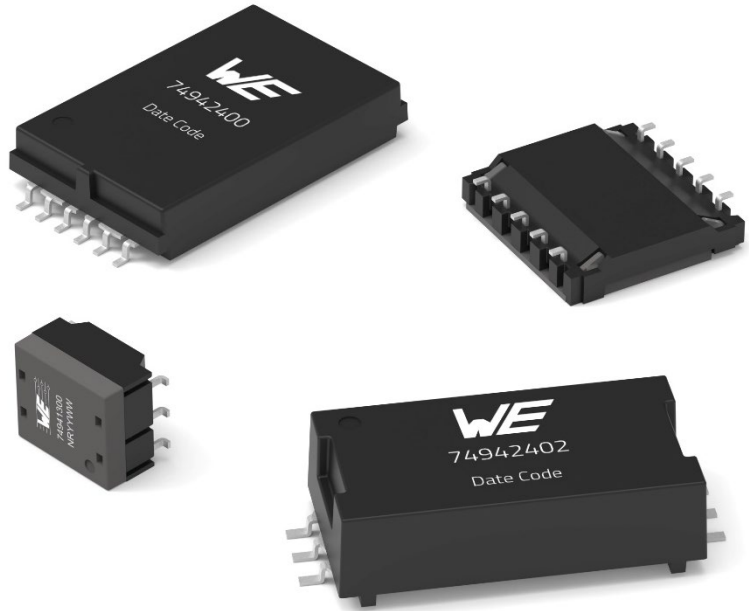


Transformer with or without center tap?



CONCLUSIONS AND OUTLOOK

The role of transformers in high voltage BMS (up to 1500 V)



Questions

& Answers



We are here for you now!
Ask us directly via our chat or via E-Mail.

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