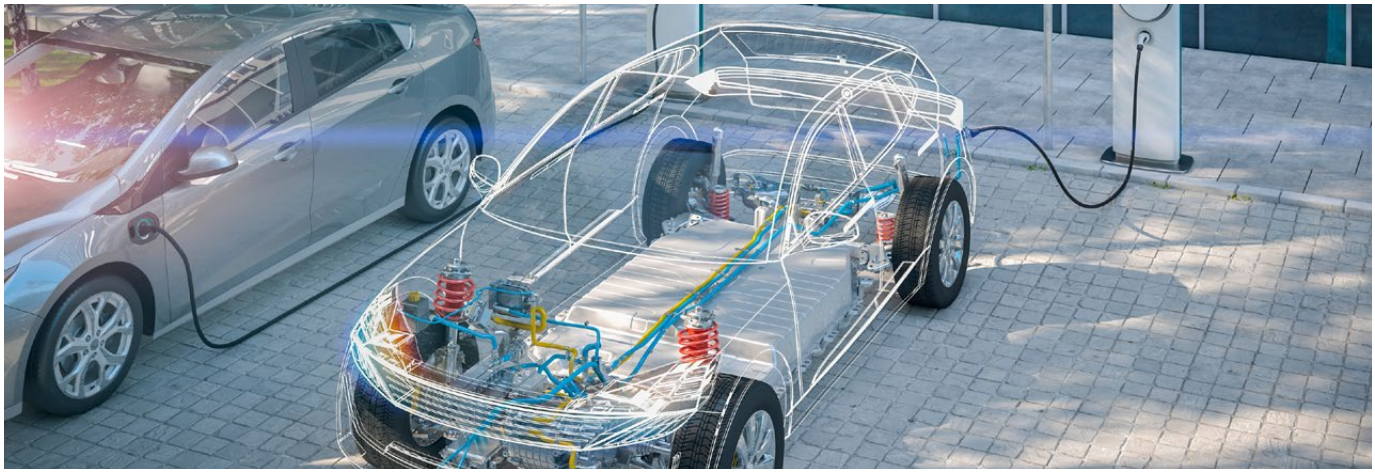
EV traction inverter reference design GEN 3

Proven system solution with extensive collaterals



The new NXP traction inverter control reference targets the upcoming trend of 800 V Silicon carbide (SiC)-based inverter applications by leveraging the latest generation of NXP high-performance electrification devices.

Acceleration time to market

This reference design aims to accelerate, de-risk and streamline/simplify customer design by providing system solution collaterals such as optimized hardware, complete software offer and extensive documentation like system-wide application notes.

Extending vehicle range

Tested according to the WLTP standard, this solution offers valuable performance indicators that developers can use for comparison and reference. Higher efficiency is achievable using NXP optimized GD3162 for SiC and S32K39 MCU capability with low latency control loop.

Designing with safety

The extensive safety documentation includes an ASIL D system safety concept that leverages the extensive NXP know-how by providing safety requirements from assumed system safety goals down to HW and SW levels.

Reducing costs

Thanks to system-wide features integration such as DC Link discharge, several analog optimizations and an extensive SW offering which include an ASIL D and production-intent software Resolver, our portfolio allows cost savings at system level.

Ease predictive system maintenance

The need to ensure performance across the lifetime is becoming more and more critical. This could be achieved thanks to NXP Gate Driver which supports device health monitoring and the MCU core that can be utilized to run a simulation model for analysis.

Addressing future trends

Anticipating future trends such as dual inverter use, a 6-phase motor and zonal architecture is critical. This can be handled by the S32K39 MCU internal 2x motor control co-processor and CoolFlux DSP, which run independently from the MCU core. Also TSN Ethernet for network communication is supported by this MCU.

Target applications

- Electric vehicles up to 800 V motor traction inverters based on SiC Mosfets

Reference design perfromance KPI

Supported by HV HIL testing.

Parameters	Value
Motor	3-phase PMSM
Peak power	>300 kW
DC Link	800 V
Peak current	525 Arms
Peak efficiency	>99.3%
Power density	50.4 kW/L
Rated torque	600 Nm
Top speed	>12000 RPM

Extensive system solution optimized hardware

- 2 optimized SiC mosfet agnostic hardware: one with MCU+SBC and communication devices and one with our 6 advanced gate drivers

Software

- Motor control application software (demo level)
- ASIL D software resolver
- System real-time drivers (RTD)
- Optimized motor control library

Documentation

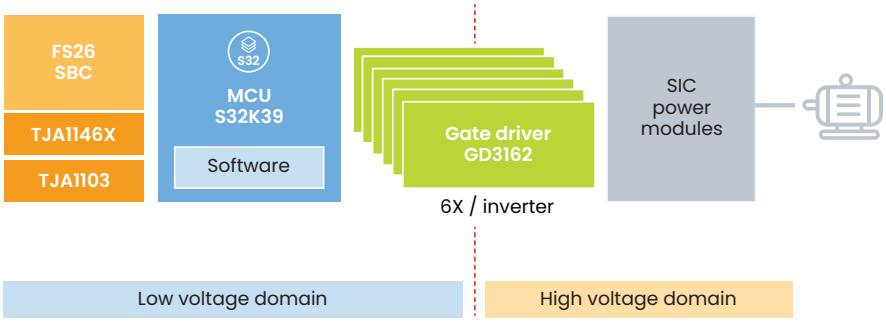
- System safety concept (safety architecture and system safety analysis)
- Software application note

Tools

- S32K39 model-based design tool (MBDT)

Key challenges for traction inverter system

Traction inverter system block diagram



Traction inverter portfolio

S32K39 MCU	• Processing performance: capability to execute low latency control loop for SiC and GaN based mosfet • ASIL D software resolver integration • Support TSN ethernet
FS26 SBC	• Attached to S32K39 MCU • New generation of safety ASIL D SBC
GD3162 HV gate driver	• Dynamic gate strength to improve efficiency for SiC mosfet • Device health monitoring (power device $R_{DS(ON)}$ monitoring and VT aging detection) • DC link discharge feature for cost savings
TJA146X CAN SIC	• Reduce signal ringing on a network • Accelerate network running 5-8 Mbps • Robust design with self-diagnostics
TJA1103 ethernet	• IEEE802.3bw compliant 100BASE-T1 PHY • Functional safety ISO 26262 ASIL B compliant

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