



# Discover MOTIX™ TLE994x/5x: Compact SoC solution for motor control with FOC capability at a competitive price

Infineon Technologies AG  
Automotive Smart Power | Motor Control Solutions



# MOTIX™ 32-bit motor control SoC portfolio expansion: MOTIX™ TLE994x/5x



In production



## BDC MOTOR CONTROL

Relay

Half-Bridge

H-Bridge

**TLE984x**



Cortex®-M0, ≤64k, QFN

**TLE985x**



Cortex®-M0, ≤64k, QFN

**TLE985x**



Cortex®-M0, ≤96k, QFN

**TLE986x**



Cortex®-M3, ≤256k, QFN-48

**TLE988x**



Cortex®-M3, ≤256k, QFP

**TLE994x**



Cortex®-M23, 72k, TSDSO-32

ISO26262



## BLDC MOTOR CONTROL

3-phase

**TLE987x**



Cortex®-M3, ≤256k, QFN-48

**TLE989x**



Cortex®-M3, ≤256k, QFP

**NEW!**

**TLE995x**



Cortex®-M23, 72k, TSDSO-32

# MOTIX™ TLE994x and TLE995x 32-bit motor control SoC based on Arm® Cortex®-M23



## KEY BENEFITS

- Small PCB size** with compact design
- System cost saving** through integration
- ASIL-B certified **safe motor operation**
- Optimized motor control** derived by improved peripherals
- Premium design-in experience**



## TARGET APPLICATIONS



Water pump



Cooling fan



HVAC blower



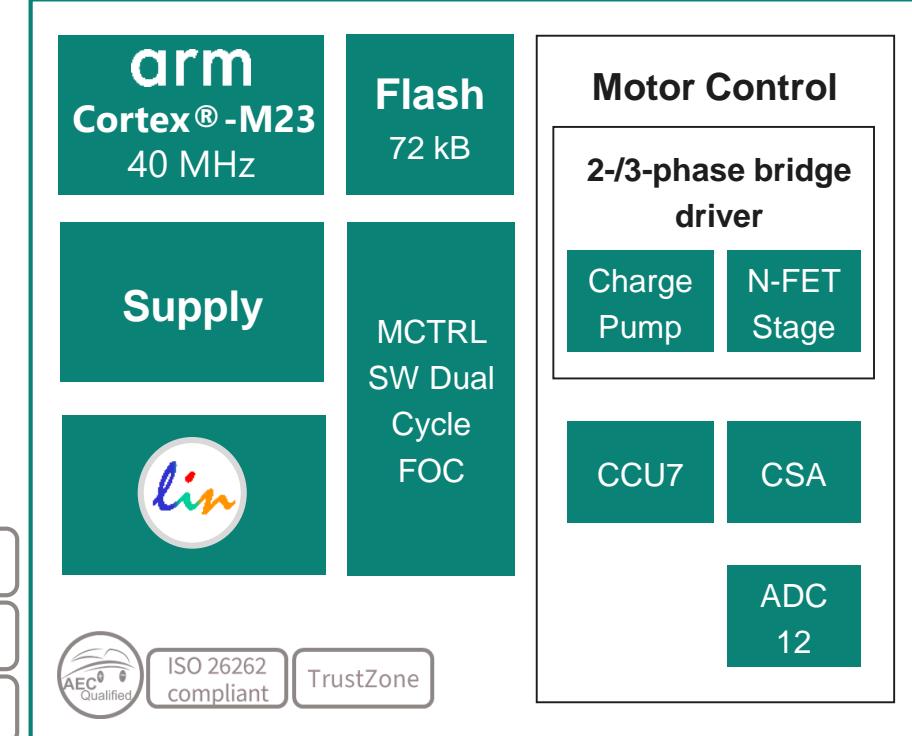
Fuel pump



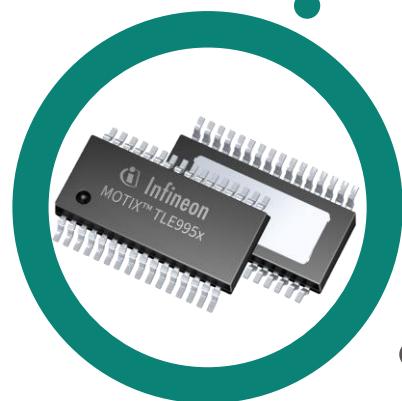
Oil pump



Sunroof



# MOTIX™ TLE994x/5x: Evolving the TLE987x peripherals with enhanced features



	Improvement	Benefit
– LINUART	Automatic LIN message handling	– Less CPU load $\downarrow \sim 5 - 10\%$
– CCU7	Flexible PWM generation	– Advanced motor control
– ADC12	Precise conversion	– Accurate current measurements
– FuSa	ASIL-B features	– Safe motor operation – Safe communication and computation
– CyberSecurity*	Arm TrustZone and memory protection	– IP protection

\* The TLE994x/5x not developed in accordance with the ISO21434. For detailed information, please refer to the official technical documentation provided by Infineon.

# MOTIX™ TLE994x/5x variants



BLDC motor

**3-Phase  
Bridge  
Driver IC**

Device Name	Temperature Grade	Flash / RAM Memory
TLE9954EQA40	Grade 1	72kB / 6kB
TLE9954EQW40	Grade 0	72kB / 6kB



Brushed  
motor

**H-Bridge  
Driver IC**

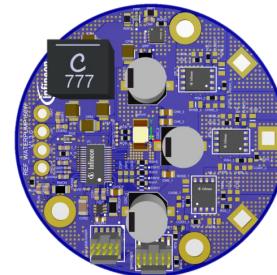
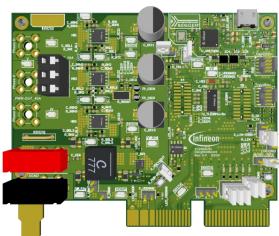
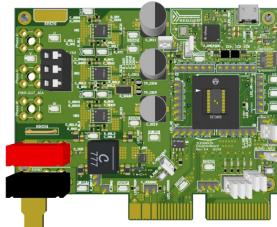
Device Name	Temperature Grade	Flash / RAM Memory
TLE9944EQA40	Grade 1	72kB / 6kB
TLE9944EQW40	Grade 0	72kB / 6kB

# MOTIX™ TLE994x/5x solution offering



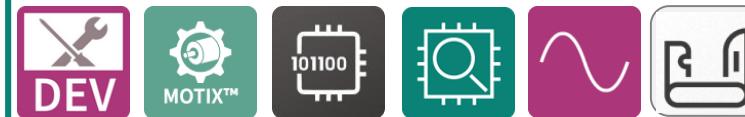
## HARDWARE SUPPORT

Evaluation hardware for an easy getting started



## TOOLS

Comprehensive set of tools to facilitate development process



- Device **configuration**
- **Register** viewer and **power simulator**
- **Motor control SW parametrization** and runtime analysis
- **Programmer, memory analyzer**



## SOFTWARE

SW for evaluation in target applications and partner ecosystem for productive implementation

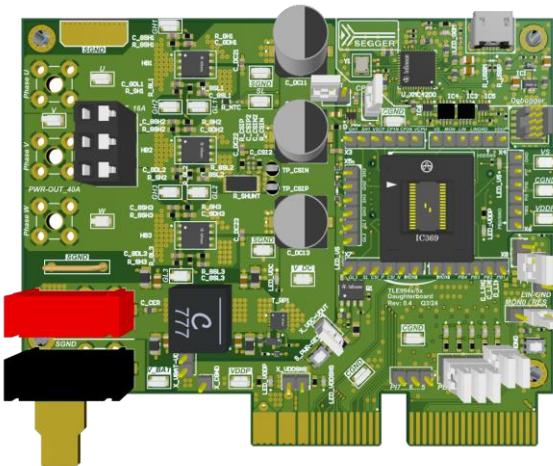
- **Free evaluation SDK** including **PDL**, peripheral drivers, example codes and tool configs, KEIL µVision support
- **Free motor control target application examples**: configurable 6/12-step block commutation, CPU load optimized FOC
- Licenses for productive use and end-to-end engineering services by **MOTEON**
- Certified LIN stacks from **IHR**

# MOTIX™ TLE994x/5x hardware support for getting started



## HARDWARE SUPPORT

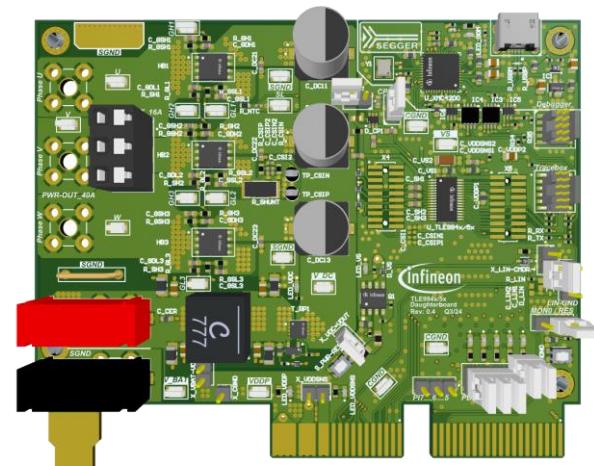
**TLE995x Evaluation Board**



OPN: TLE995XEVALBOARDTOBO1

Enablement tool with a spring socket for evaluating and testing MOTIX™ TLE994x and TLE995x families.

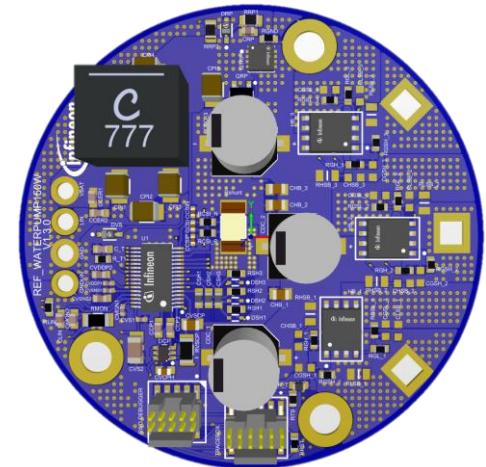
**TLE995x Evaluation Kit**



OPN: TLE995XEVALKITTOBO1

Evaluation of all functions and peripherals of the super set device, TLE9954EQW40.

**150W Water Pump Reference Design**



OPN: REFWATERPUMP150WTOBO1

System reference design for a water pump application to simplify design process, enabling reduced development effort and time-to-market.

# MOTIX™ TLE994x/5x PC Tools for an easy design-in



## MOTIX™ TOOLS



### Infineon Developer Center

Extensive development environment offering a comprehensive set of tools by MOTIX™



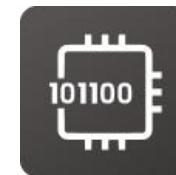
#### Device Configurator

Allows to enable and configure device peripherals.



#### Solution Designer

A graphical configuration tool to analyse, debug and tune motor control applications.



#### BSL

User interface to control the firmware of an MCU target via the provided BSL commands interactively.



#### Automotive Power Explorer

GUI-based Tool which allows users to easily and swiftly compute power dissipation of the device



#### Register Viewer

Online tool designed to provide users with easy access to accurate and up-to-date information about registers of Infineon devices.



#### Memory Analyzer

A graphical visualization tool that analyses the memory consumption of Infineon microcontroller families

# MOTIX™ TLE994x/5x Software support



## MOTIX™ SOFTWARE

### Peripheral Driver Library (PDL)

- MOTIX™ MCU peripheral drivers, optimized for integration with Motor Control SW
- Automotive SPICE and MISRA C:2012 compliant
- [Infineon Device Configurator](#) GUI tool for device initialization and configuration
- PDL is deployed as part of free [MOTIX™ MCU SDK](#) including code examples and tool configs, supported by KEIL µVision and IAR Embedded Workbench
- Licenses for productive use and end-to-end engineering services by [MOTEON](#)
- Easy start and faster time-to-market

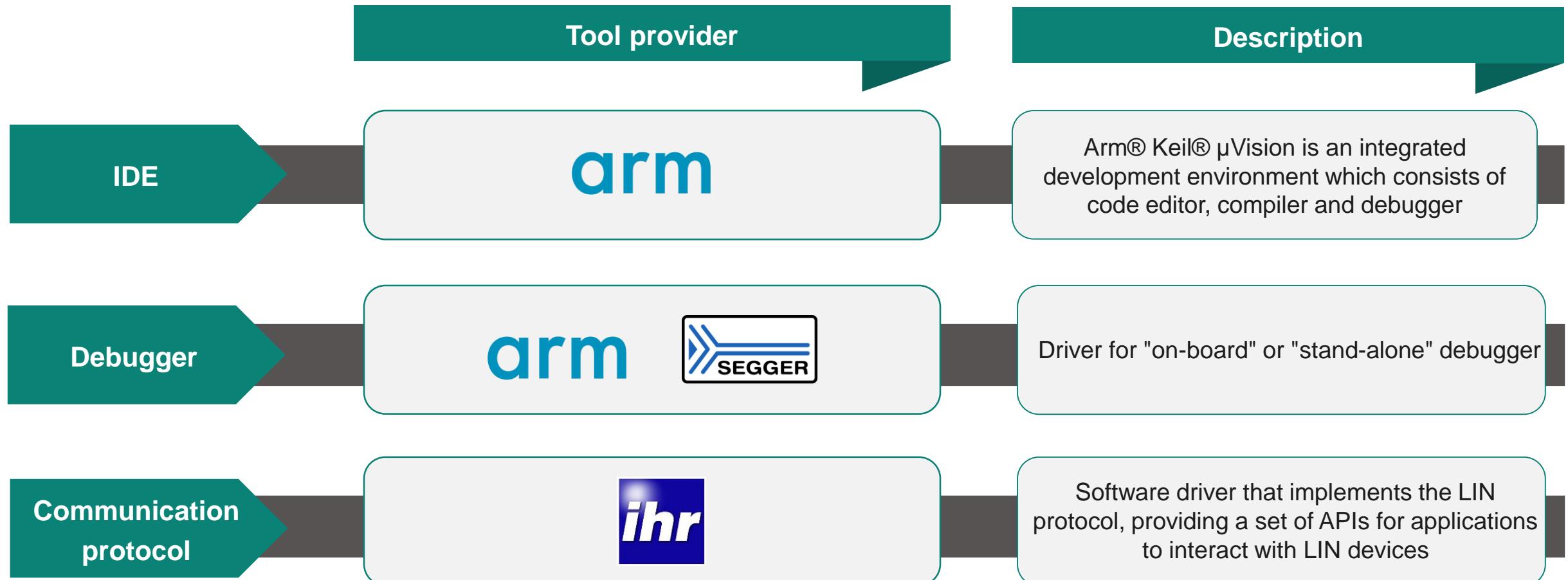
### Motor Control SW

- Best-in-class SW scalability and reuse by modular and layered architecture
- Rich library\* of standard and advanced functions optimized for single shunt FOC with MOTIX™ MCU family, **Automotive SPICE** and **MISRA C:2012** compliant
- [Solution Designer](#) GUI tool supports in parametrization for various motors, evaluation and runtime analysis
- Free [TLE995x](#) Demos:
  - Configurable [6/12-step block commutation](#)
  - CPU load optimized FOC
- SW and licenses for productive use and end-to-end engineering services by [MOTEON](#)
- Scalable motor control developments

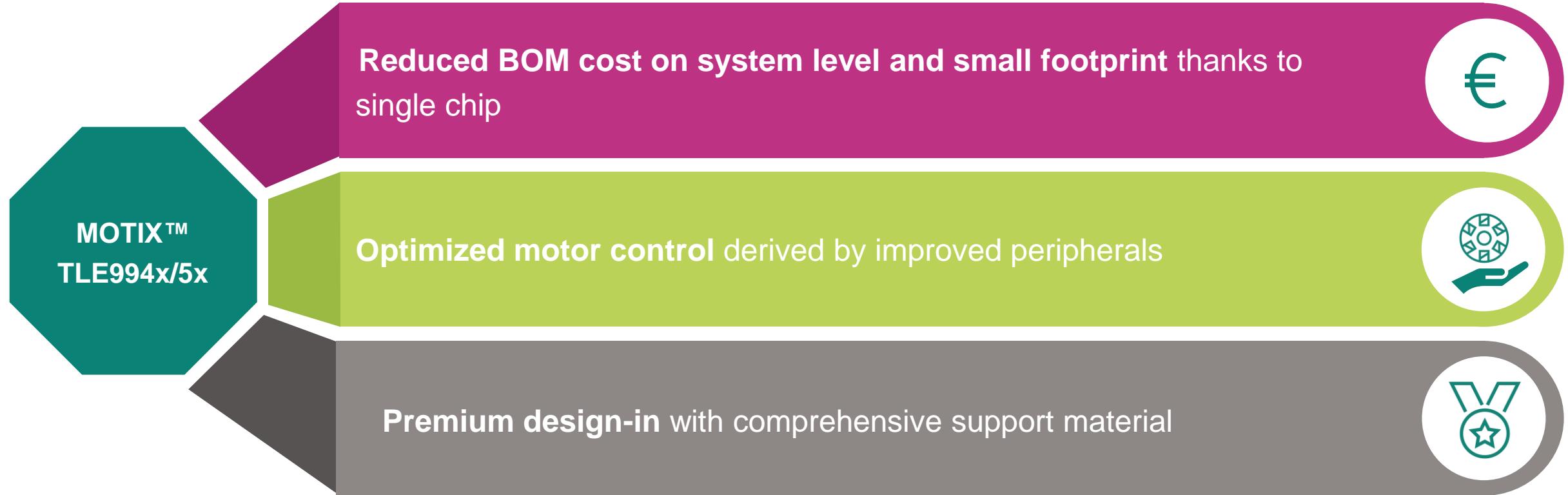
\* For free source code evaluation access of latest version please contact your local FAE

# MOTIX™ TLE994x/5x Toolchain ecosystem partners

In addition to Infineon's IDC Tools, MOTIX™ TLE994x/5x is supported by a variety of third-party tools, including debuggers, IDEs, and communication protocol software drivers to ensure a seamless development experience



# Why MOTIX™ TLE994x/5x?



# Overview collaterals, software and design tools



Technical documents	Status
<a href="#">Datasheet</a>	available*
<a href="#">User Manual</a>	available*
<a href="#">Firmware Reference Manual</a>	available*
<a href="#">HW Design Guideline</a>	available*
<a href="#">Safety Documentation</a>	available*



Software	Status
<b>SDK incl. Low-Level Driver</b> for TLE995x peripherals and getting started examples	available*
<b>Field Oriented Control SW</b> , supports configuration of runtime and static parameters to fit to various motors	Q3 25
<b>12-step block commutation SW</b>	available*

\* Please consider NDA restrictions for TLE994x/5x collaterals, software and design tools and contact your regional Infineon sales partner in order to get access to restricted information.



Boards	Status
<a href="#">Evaluation Board</a>	available*
<a href="#">Evaluation Kit</a>	available*
<a href="#">150W Water Pump Reference Design</a>	Q3 25



Design and simulation tools	Status
<a href="#">Simulation Models</a>	available
<a href="#">Device Configurator</a>	available
<a href="#">BSL Tool</a>	available*
<a href="#">Register Viewer</a>	available*
<a href="#">Infineon Automotive Power Explorer</a>	available*
<a href="#">Solution Designer</a>	available
<a href="#">Memory Analyzer</a>	available

**More info about products & design support:**

[www.infineon.com/TLE994x](http://www.infineon.com/TLE994x)

[www.infineon.com/TLE995x](http://www.infineon.com/TLE995x)

**Download and manage software & tools in the  
Infineon Developer Center (IDC):**

[www.infineon.com/idc](http://www.infineon.com/idc)

**Ask the community:**

[MOTIX MCU | 32-bit motor control SoC](#)

**All about MOTIX motor control ICs**

[www.infineon.com/motor-control-ics](http://www.infineon.com/motor-control-ics)



