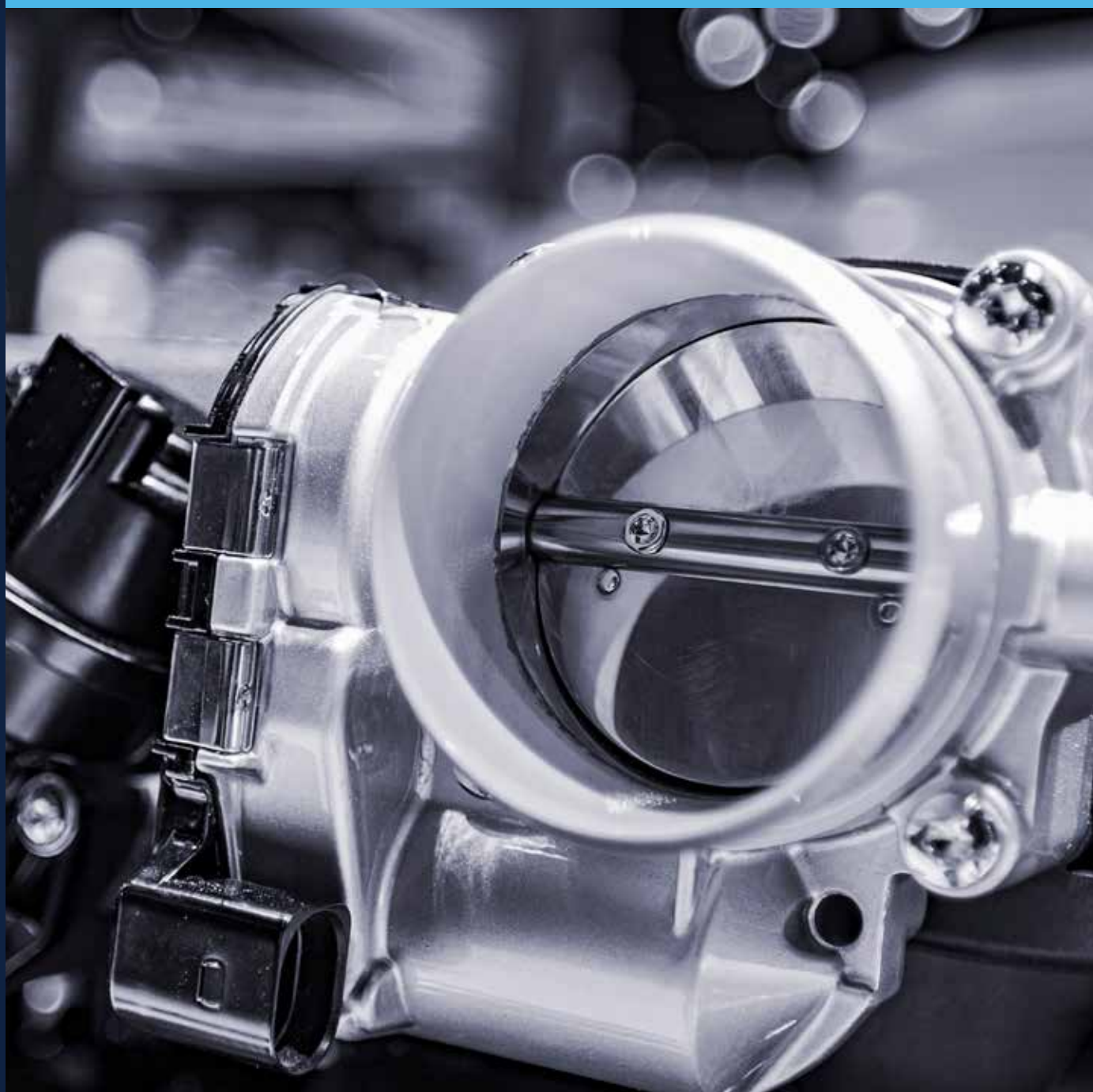




life.augmented

Motor control solutions for automotive applications



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Motor Control Overview

Today, Motor Control is a key focus segment for automotive applications, from conventional body & convenience and chassis & safety to smart and more innovative domains like electro-mobility and e-powertrains.

Electric motors are today omnipresent inside every vehicle segment. In battery electric vehicles, an electric traction motor even replaces the combustion engine. And thanks to smarter starter generator and e-turbochargers systems, 48 V small electric motors play a crucial role in reducing CO₂ emissions.



ST is definitely the right partner with whom to develop reliable and cost-effective solutions for automotive motor control applications.

Developers will appreciate the broadest portfolio dedicated to Motor Control solutions for automotive applications.

Discover our leading-edge portfolio of Automotive-grade motor drivers that can control brushed DC motors, BLDC motor and stepper motors.

~100

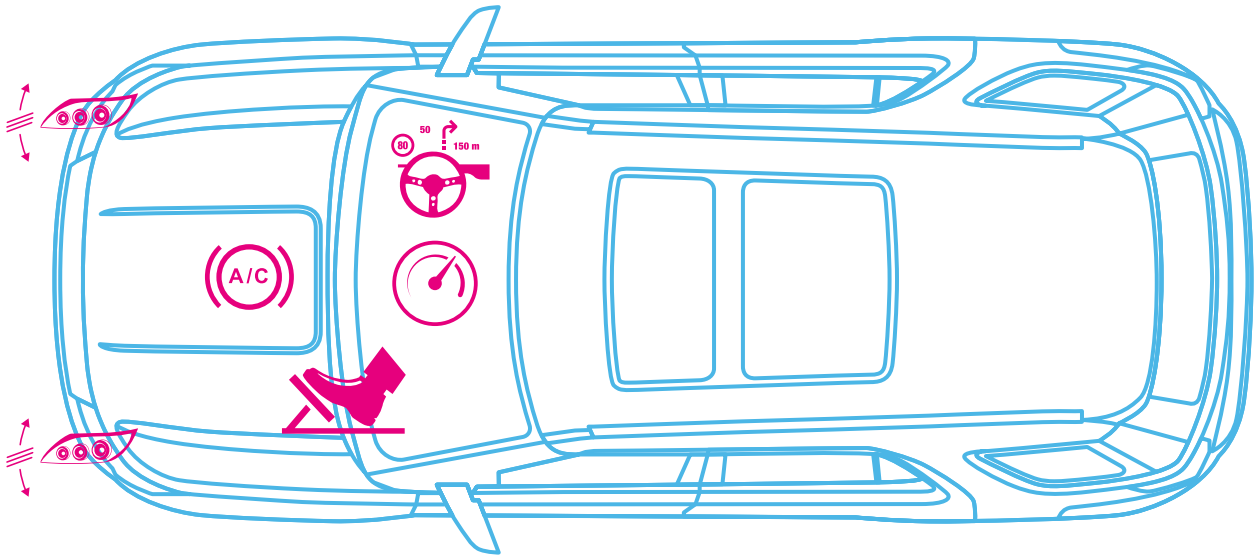
Motors can be present in a premium vehicle



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www.st.com/auto-motorcontrol

Bipolar stepper motors for automotive



Adaptive
lighting

HVAC flaps

Head-up
display

Idle actuator

Analog gauges



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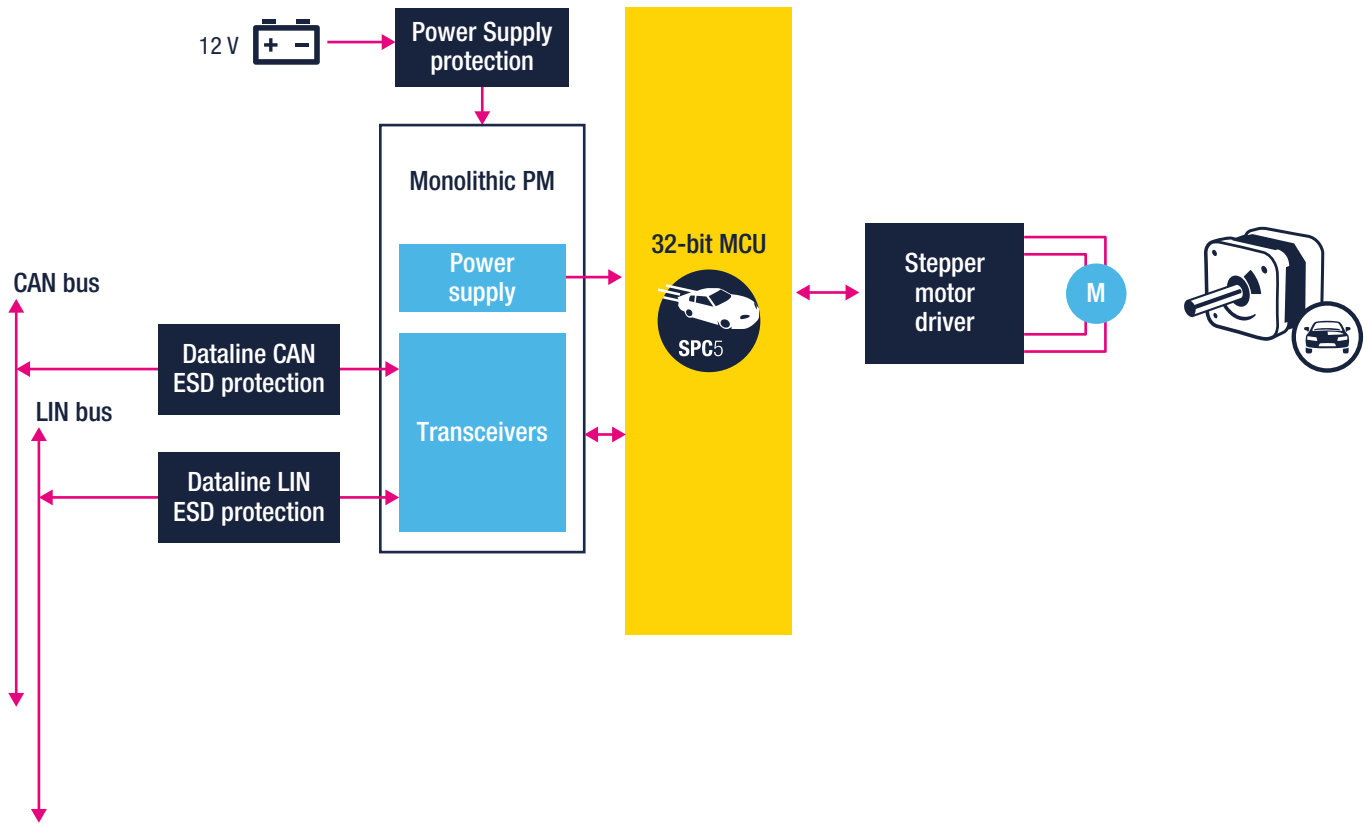
www.st.com/auto-bipolar-stepper

OVERVIEW

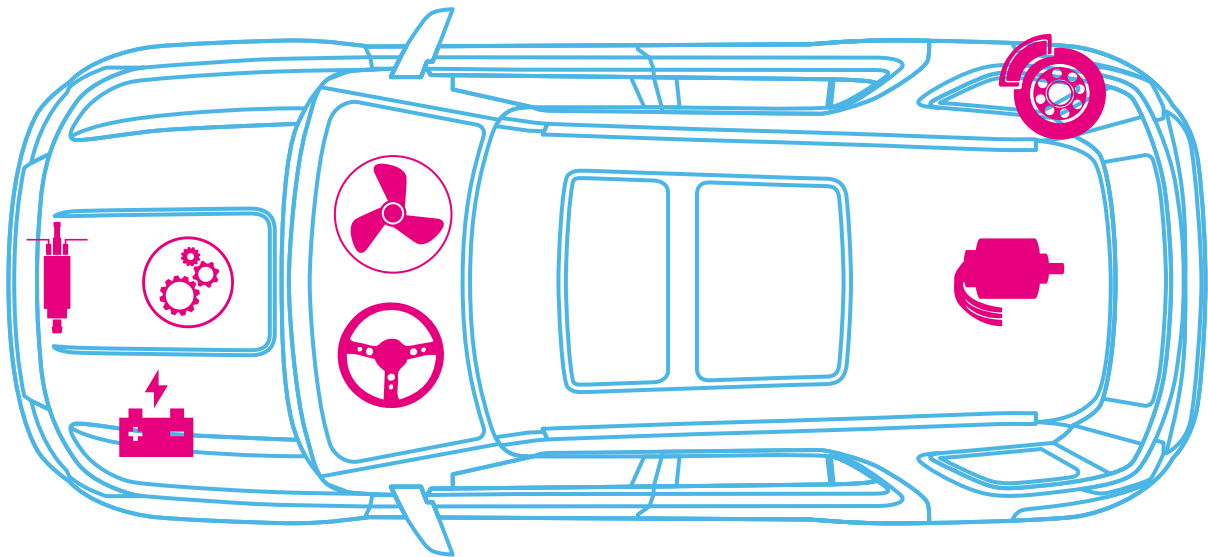
For headlight levelling/swivelling, climate-control flap adjustments or Head-up Display (HUD) positioning, a stepper motor is often the ideal and cost-effective choice for your design. Thanks to its operation mode, a stepper motor runs through a discrete number of positions, so it can then be driven to repeatedly move and hold at one of these steps.

ST offers the best-in-class solutions for stepper motor control, providing integrated drivers for bipolar two-phase stepper motors, capable of current controlled micro-stepping and embedding diagnostic features.

In addition, our SPC5 32-bit automotive microcontrollers are the perfect choice together with voltage regulators and ESD protection ICs to complete your bill of materials and start prototyping.



BLDC motors for automotive



Fan

Transmission

Traction

Starter
generator

Turbo charger

Fuel pump

Power steering

Brake booster



FIND OUT MORE

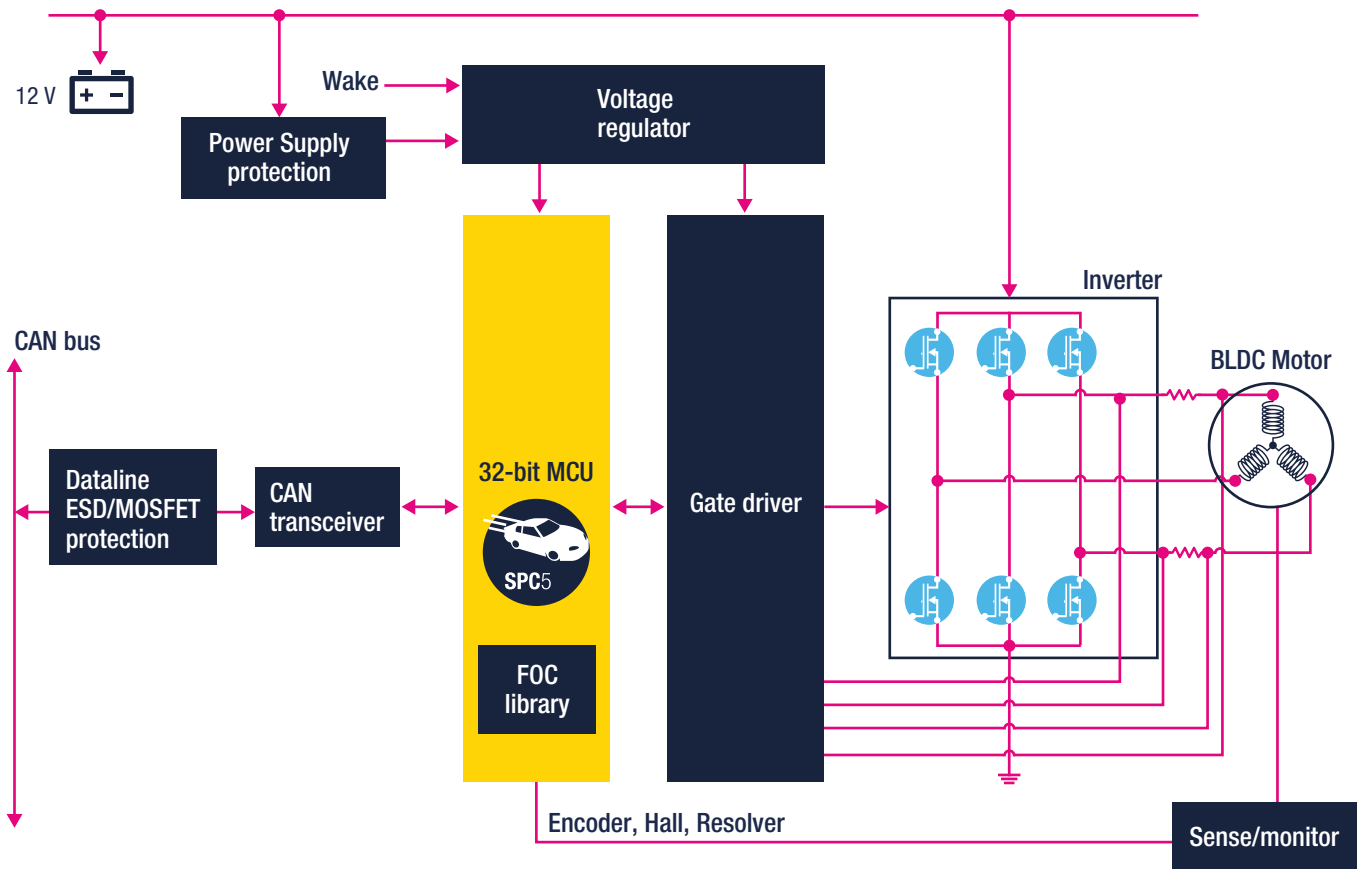
www.st.com/auto-bldc

OVERVIEW

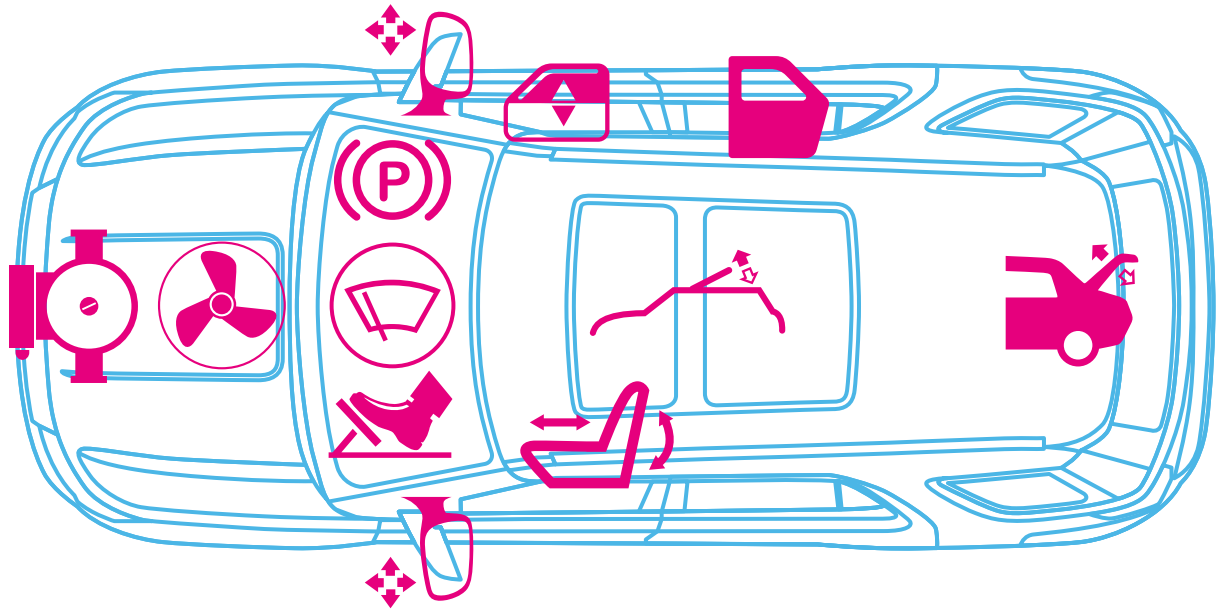
From low-voltage fluid pumps, 3-phase systems for chassis and safety, to high-voltage traction inverters for e-powertrains, brushless DC (BLDC) motors are the most suitable choice for applications demanding continuous operating cycles. This requires sophisticated control algorithms and, therefore, higher computing power than for driving a brushed DC motor.

The electric vehicles (xEV) segment requires compliance to even more stringent CO₂ emission requirements and safety features, leading to the electrification of systems for mild hybrid vehicles including starter generator (BSG) and e-turbocharger motors, to extremely efficient 3-phase inverters for full battery electric vehicles (BEV).

Thanks to its huge portfolio, ST provides a comprehensive offer to support your BLDC motor control design. From automotive "High Performance" SPC5 MCUs, ISO26262 ASIL-D compliant and specifically designed for real-time applications, to intelligent VIPower switches, SiC MOSFETs, 3-phase gate drivers for 6-step/FOC controlled BLDC motors, ESD and TVS protections against transients or spikes, we are the right partner for all automotive manufacturers and OEMs developing the most advanced and cost-effective motor control solutions.



Brushed DC motors for automotive



Wipers

Seat positioning

Window lift

Door lock

Mirror

Fan

Washer pump

Car trunk

Parking brake

Turbo waste
gate

Throttle valve

Sunroof

HVAC flaps

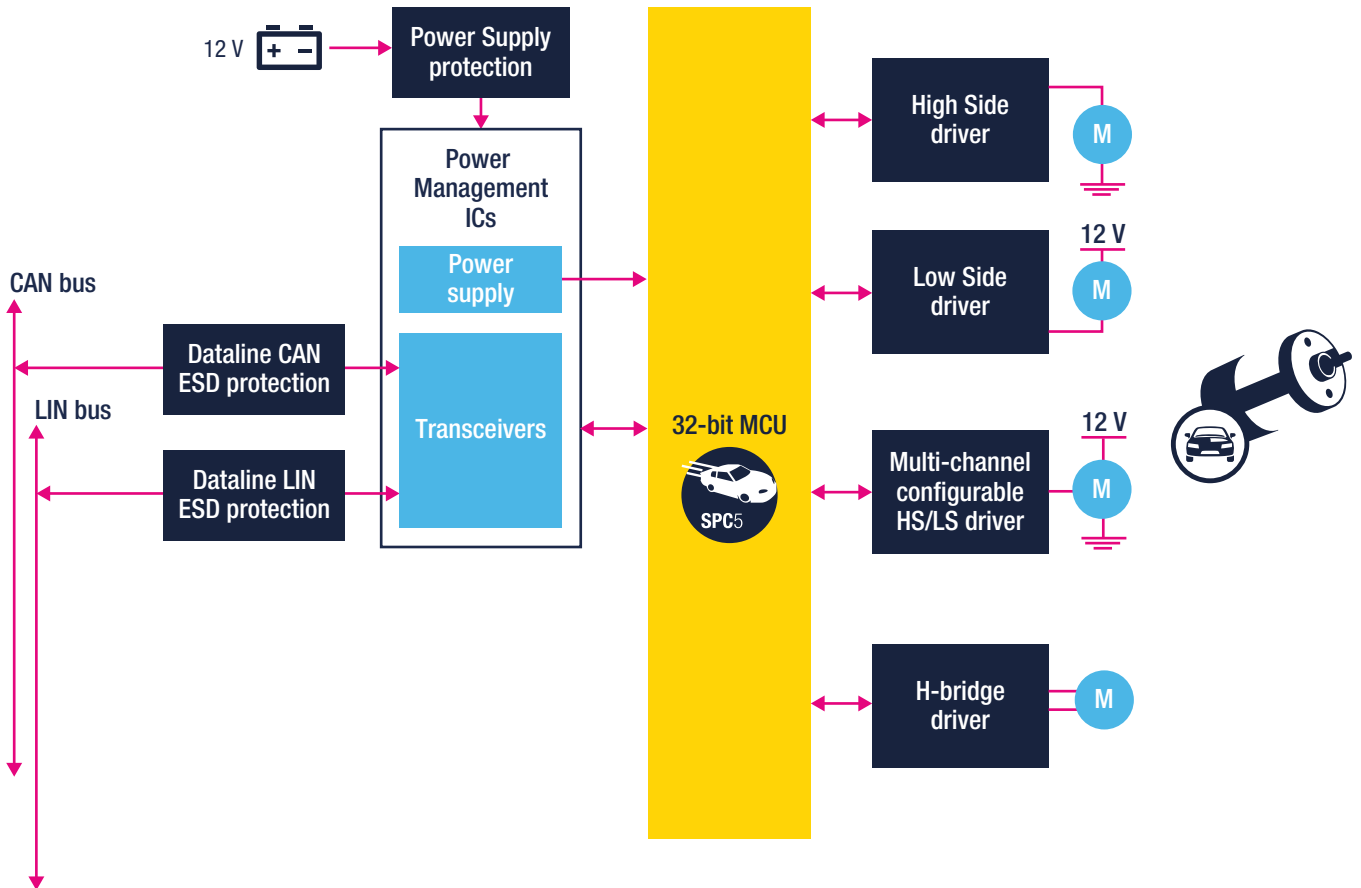


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www.st.com/auto-brushed

OVERVIEW

Brushed DC motors represent the perfect solution in automotive applications where short operating cycles are required. These internally-commutated motors are easy-to-drive components used in low-voltage applications ranging from trunk control and window lifts, seat positioning, door control, HVAC flaps, EGR, turbo waste gates and throttle valves.



Key Technologies

RESEARCH & DEVELOPMENT AND MANUFACTURING

To keep its technology edge, ST maintains a strong commitment to innovation, with approximately 7,400 people working in R&D and product design and spending about 16% of its revenue in R&D. Among the industry's global technology leaders, ST owns and continuously refreshes a substantial patent library (~17,000 patents; ~9,500 patent families and ~500 new patent filings per year).

The Company draws on a rich pool of chip-manufacturing technologies, including advanced FD-SOI (Fully Depleted Silicon-on-Insulator) CMOS (Complementary Metal Oxide Semiconductor), differentiated Imaging technologies, RF-SOI (RF Silicon-On-Insulator), BiCMOS, BCD (Bipolar, CMOS, DMOS), Silicon Carbide, VIPower™, and MEMS technologies.

ST believes in the benefits of owning manufacturing facilities and operating them in close proximity to its R&D operations.

ST has a worldwide network of front-end (wafer fabrication) and back-end (assembly and test and packaging) plants. ST's principal wafer fabs are located in Agrate Brianza and Catania (Italy), Crolles, Rousset, and Tours (France), and in Singapore. These are complemented by assembly-and-test facilities located in China, Malaysia, Malta, Morocco, the Philippines, and Singapore.

KEY TECHNOLOGIES FOR AUTOMOTIVE PRODUCTS

Silicon Carbide

Silicon Carbide (SiC) is a wide bandgap material, with many advantages compared to silicon in the field of power electronics. Operating temperatures are higher, heat dissipation is improved and switching and conduction losses are lower, making it an ideal technology for vehicle electrification. SiC-based traction inverters can increase electric vehicle range and SiC-based chargers reduce the charge time.

ST produces the automotive-grade SiC power devices in a dedicated 6" front-end wafer fab and they are becoming the key enabler in the automotive industry for vehicle electrification.



SiC



SiC

VIPower™

VIPower™ is a technology developed by ST and in production since 1991. Vertical Intelligent Power technologies provide control, protection and diagnostics for medium/high power automotive loads. The technology combines Vertical Double Diffused MOS Power devices with their own temperature and current sensors with CMOS and HV components for Power-Analog- Mixed design.

VIPower™ technology will play a key role in the move towards electric vehicles. The smart 48 V power nets used in mild- and full-hybrid cars require intelligent power switches to drive high- and low-sided loads and electric motors, with very low losses and high current sense accuracy, all monitored via the connections to the ECU microcontroller.



BCD (BIPOLAR-CMOS-DMOS)

BCD (BIPOLAR-CMOS-DMOS) is a key technology for power ICs. BCD combines the strengths of three different process technologies onto a single chip: Bipolar for precise analog functions, CMOS (Complementary Metal Oxide Semiconductor) for digital design and DMOS (Double Diffused Metal Oxide Semiconductor) for power and high-voltage elements.

This combination of technologies brings many advantages: improved reliability, reduced electromagnetic interference and smaller chip area.

BCD has been widely adopted and continuously improved to address a broad range of products and applications in the fields of power management, analog data acquisition and power actuators. For EV charging, BCD is ideal for battery management systems.

1200 V AEC-Q101 qualified technologies for EV charging

High-voltage rectifier and thyristor technologies are the keys to develop robust, immune AC line connected systems exhibiting high power density. ST has developed a set of automotive grade technologies for full rectification functions in the low frequency (AC line) or high frequency ranges (DC-DC conversion). AEC Q101 qualified, these rectifier diode and thyristor series are available to design robust converters compatible with the most stringent EMC standards.

TRANSIL™

TRANSIL™ is a key planar technology for Automotive TVS series designed to protect automotive sensitive circuits against surges as defined in ISO 7637-2 and ISO 16750 tests A and B also called load dump (battery lines), ISO7637-3 (data lines) and ESD as defined in ISO 10605. Protection is also provided against other perturbations generated by elements like ignition, relay contacts, alternators, injectors, SMPS, etc.

This technology is compatible with high-end circuits where low leakage current and high junction temperatures are required to provide reliability and stability over time.

STPOWER

Leading-edge power technologies for both high- and low-voltage applications combined with a full package range and innovative die bonding technologies exemplify ST's innovation in power transistors of the STPOWER™ family.

ST offers a wide portfolio of power MOSFETs ranging from -100 to 1700 V, IGBTs with breakdown voltages ranging from 300 to 1250 V and power bipolar transistors ranging from 15 to 1700 V. Improved thermal design of ST's power electronics systems, and our silicon-carbide (SiC) MOSFETs ensure automotive robustness with the industry's highest temperature rating of 200 °C.

Our extensive STPOWER™ product portfolio combined with state-of-the art packaging and protection solutions enable designers to create applications with high reliability, efficiency and safety.



Development Tools

PRODUCT SELECTORS, SAMPLES, EVALUATION BOARDS

ST provides a set of Smart Selectors tuned to the needs of the Automotive Industry. Once the appropriate products have been selected, a wide range of samples and evaluation boards are available to help you get started and reduce your development times. In addition to evaluation boards, ST provides schematics, BOM and Gerber files to facilitate your hardware design and demonstration software packages are available too.

VIpower™ Smart Selector

VIpower's Smart Selector is designed to help and assist users to choose the best VIpower™ high/low-side switch or H-bridge device for their Automotive application.

All you need to do is select a few parameters related to your specific application, and the selector provides the relevant device. Parameters include nominal voltage (12 V for automotive cars or 24 V for trucks), a topology (high-side, low-side or H-bridge), the number of channels and type of load to drive (bulbs, motors, etc.). The selection can be further refined by setting source type (DC or PWM), temperature and PCB type.



FIND OUT MORE

www.st.com/vipower-smartselector

VIpower-FINDER

VIpower-FINDER is the application available for Android™ and iOS™ that allows you to explore the ST VIpower product portfolio using portable devices.

You can easily find the device that best fits your application using the smart or the parametric search engine. You can also find your product thanks to the efficient part number search engine.

Key Features

- Smart, parametric or part number search capability for product
- Technical datasheet downloading and off-line consulting
- Ability to share technical documentation via social media or via email
- Available on Android™ and iOS™ app stores



FIND OUT MORE

www.st.com/vipower-finder



Easyboards

The Easyboard concept was created to give customers the chance to evaluate products without committing to the expense, time and resources typically needed to design a custom circuit board. Easyboards are simple and low-cost evaluation tools that connect a VIPower™ product to a load. This allows a straightforward evaluation of the device and of all the application functionalities, including the auto-protection capability for hazardous conditions. Each evaluation board includes a VIPower™ device soldered onto a small 2-layer PCB with heavy copper and thermal vias, to support maximum device current and manage the power dissipation.

Easyboards come with the following part numbers:

- EV-VNx7xxx: VIPower M0-7 High Side Switches single, dual and quad channels for 12 V battery lines
- EV-VNx5Txxx: High Side Switches for 24 V systems
- EV-VNH7xxx: Motor Control solutions



L99LD21-ADIS



SPC560B-DIS



FIND OUT MORE

www.st.com/automotive-evalboards

Dynamic Electro-Thermal simulator for devices in VIPower technology

TwisterSIM is a unique electro-thermal simulator that helps shorten the design time by enabling, in a few clicks, complex engineering evaluations with accurate simulations like load compatibility, wiring harness optimization, fault condition impact analysis, diagnostic behavior analysis and dynamic thermal performance.

A built-in Interactive selector provides a short list of suitable devices based on first level system requirements. It assists you in detailing your actual system configuration with layout, load and driving profile customization to build an accurate model of the final application.

TwisterSIM supports a large selection of Low/High-side driver and H-bridges for Motor Control.



FIND OUT MORE

www.st.com/twistersim

SPC5 AUTOMOTIVE MCU EVALUATION TOOLS: EASIER EVALUATION AND FASTER DEVELOPMENT

A complete range of hardware evaluation and emulation tools supports the SPC5 family of automotive microcontrollers. Discovery and Premium development boards are available to support your development from preliminary evaluation to advanced solution development.

ST Discovery boards, available for each product line, enable a quick and easy way to evaluate the microcontroller's main features. The expansion connector makes it easy to plug in application and extension modules for rapid prototyping.

ST Premium boards, available for all lines and packages, provide user access to the device's complete features set and functionalities for advanced development. The SPC5 motherboards, used in combination with adapters, enable full access to all of the MCU's signals and peripherals (such as CAN, SPI, LIN, FlexRay and Ethernet).

The offer is complemented by a series of emulation solutions for high-speed tracing, monitoring and bypassing.

A full range of state-of-the-art tools and software from major third parties is also available for the SPC5 family.

SPC5
SPC5 MCUs toolchain

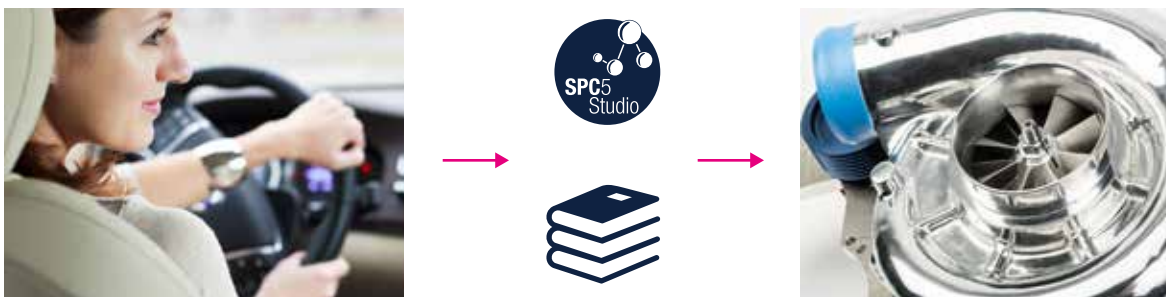
- Discovery kits**
Quick starter kit for early evaluation
ST Discovery boards enable a quick evaluation of the main device features for users
- Premium boards**
Complete HW solutions for advanced development
ST Premium boards ensure full access to device's features and functionalities
- SPC5Studio**
Freeware Eclipse based Development Studio
SPC5Studio integrates our Resources Configurator, Code Generator supporting major third party tools
- Embedded Software & AUTOSAR Solutions**
Drivers and Software Libraries
Crypto and flash SW Libraries
Core & Instruction Self test Libraries
AUTOSAR MCAL

SPC5 MOTOR CONTROL TOOL KIT FOC LIBRARY

The SPC5 Motor Control Tool Kit FOC Library (SPC5-MCTK-LIB) includes ready-to-use FOC firmware code to help reduce design time and costs.

The SPC5Studio Motor Control Configurator plug-in lets engineers generate, fine-tune and evaluate the performance of SPC5 microcontrollers in applications driving single or dual Field Oriented Control algorithms for 3-phase PMSM and BLDC motors through a user-friendly graphical user interface (SPC5Studio).

The package also includes the SPC5 Motor Control Live Monitor (LM), so you can monitor speed and power variables on a running motor in real time as well as change directly firmware settings like amplification gain or reference speed.



FIND OUT MORE

www.st.com/auto-sp5-mcu-evaltools



FIND OUT MORE

www.st.com/spc5-mctk-lib



AUTODEVKIT™

A viable, simple, low-cost tool for automotive application engineers

A new development flow and toolset dedicated to the Automotive & Transportation market delivering to engineers the best and easiest way for quick evaluation and rapid prototyping in a common, integrated and flexible environment supporting complete ECU-like development.

AutoDevKit is an Eclipse plug-in running under SPC5Studio Integrated Development Environment.



AEK MCU Discovery
and Functional
Boards

KEY FEATURES

- Focus on developing your application without bothering about hardware and software implementation details
- Assemble and re-assemble hardware and software components without compatibility issues
- Expand and customize your application adding new components, scaling your microcontroller for cost optimization, changing the compiler, adding a real-time operating system and other Eclipse-compatible plug-ins

AEKD System
Solution
Demonstrators

STSW Embedded
Software

FIND OUT MORE

Find out more at www.st.com/autodevkit

Software download www.st.com/autodevkitsw

Join our Community at <https://community.st.com/autodevkit>

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