



# Automotive Solutions for Mobility Services



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# Smart Mobility

It is estimated that 80% of all innovations in the automotive industry today are directly or indirectly enabled by electronics. With vehicle functionality improving with every new model this means a continuous increase in the semiconductor content per car.

With over 30 years' experience in automotive electronics, ST is a solid, innovative, and reliable partner with whom to build the future of transportation.

ST's Smart Mobility products and solutions are making driving safer, greener and more connected through the combination of several of our technologies.

**80%**  
of all innovations  
in the automotive  
industry today  
are enabled by  
electronics



## SAFER

Driving is safer thanks to our Advanced Driver Assistance Systems (ADAS) – vision processing, radar, imaging and sensors, as well as our adaptive lighting systems, user display and monitoring technologies.

## GREENER

Driving is greener with our automotive processors for engine management systems, high-efficiency smart power electronics at the heart of all automotive sub-systems and devices for hybrid and electric vehicle applications.

## MORE CONNECTED

Vehicles are more connected using our infotainment and telematics processors and sensors, as well as our radio tuners and amplifiers, positioning technologies, and secure vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2X) connectivity solutions.

ST supports a wide range of automotive applications, from Powertrain for ICE, Chassis and Safety, Body and Convenience to Telematics and Infotainment, paving the way to the new era of car electrification, advanced driving systems and secure car connectivity.



# Mobility Services



Mobility services are growing rapidly as vehicles become more connected. Powerful processing, vehicle connectivity and innovative sensors enable new possibilities for software service developers and a wealth of applications for car owners.

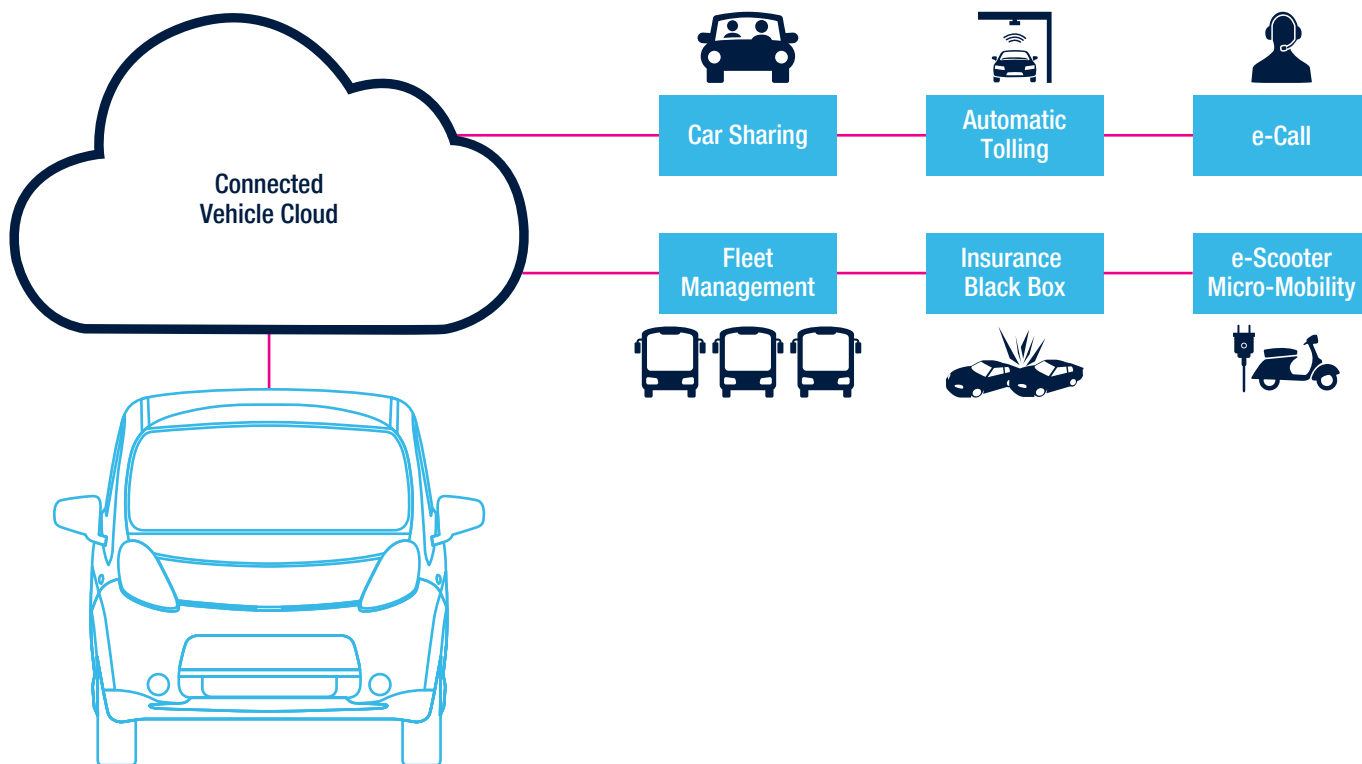
Services designed to enhance car safety such as “emergency call” in the event of an accident rely on sensors to detect an accident, on telematics processing and GNSS positioning to determine the accident location, and on cameras to record the event and provide advance information to the arriving emergency services.

Insurance boxes can record events prior to accidents but are also changing the market by enabling driver monitoring which provides data to customize tariffs on the driver's behavior.

Other mobility services range from fleet management, to car sharing, from free parking place detection to road tolling. All these services rely on automotive sensors, processors and communication ICs available from ST.

As the car evolves from a personal vehicle to a shared service provided by a fleet of driverless vehicles in a smart city environment, the level of offered services will grow dramatically. ST's solutions are used in many advanced driving systems, and our proven record in secure connectivity and sensor technologies can serve as the platform on which Mobility services can be built.

## KEY APPLICATIONS



## SOLUTIONS

ST's key products and solutions for Mobility Services applications include:

GNSS	Bluetooth, NFC and Connectivity	Ultrafast and Schottky Diodes	Transceivers and Interfaces	Telematics Processors and 32-bit Automotive Microcontrollers
Audio Power Amplifier	Power Management	EOS & ESD protection, EMI filters	Sensors	
HW & SW development and evaluation tools				



**FIND OUT MORE**  
[www.st.com/mobility-services](http://www.st.com/mobility-services)

e-Call  
 Insurance Black Box  
 Fleet Management  
 Car Sharing

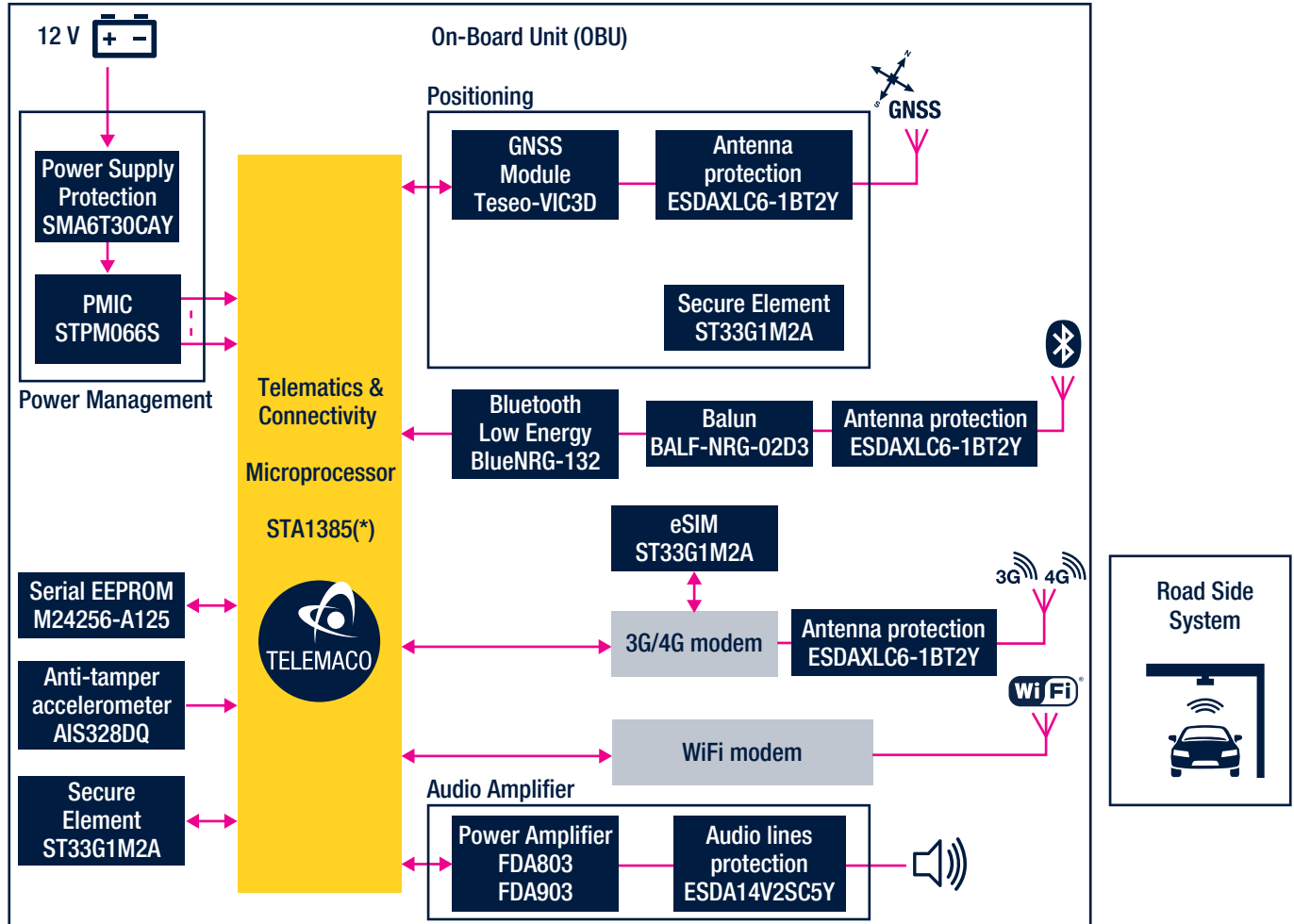
Automatic Tolling  
 Micro-Mobility

## AUTOMATIC TOLLING SYSTEM

Originally designed for highway access toll collection, automatic tolling systems are now enabling a growing range of digital payment services when accessing restricted areas, parking lots, toll bridges and other controlled areas, including zones subject to congestion charges or urban toll schemes.

The technology used for electronic toll collection (ETC) and open road tolling (ORT) systems relies on a dedicated short-range communication (DSRC) wireless data link between the vehicle and the toll gate that enables a secure identification and payment process.

ST helps developers build advanced automated tolling systems with an extensive range of dedicated wireless connectivity ICs, GNSS receivers and application processors, MEMS inertial sensors, and secure elements as well as highly secure smartcard and radio-frequency identification (RFID) tags and readers.



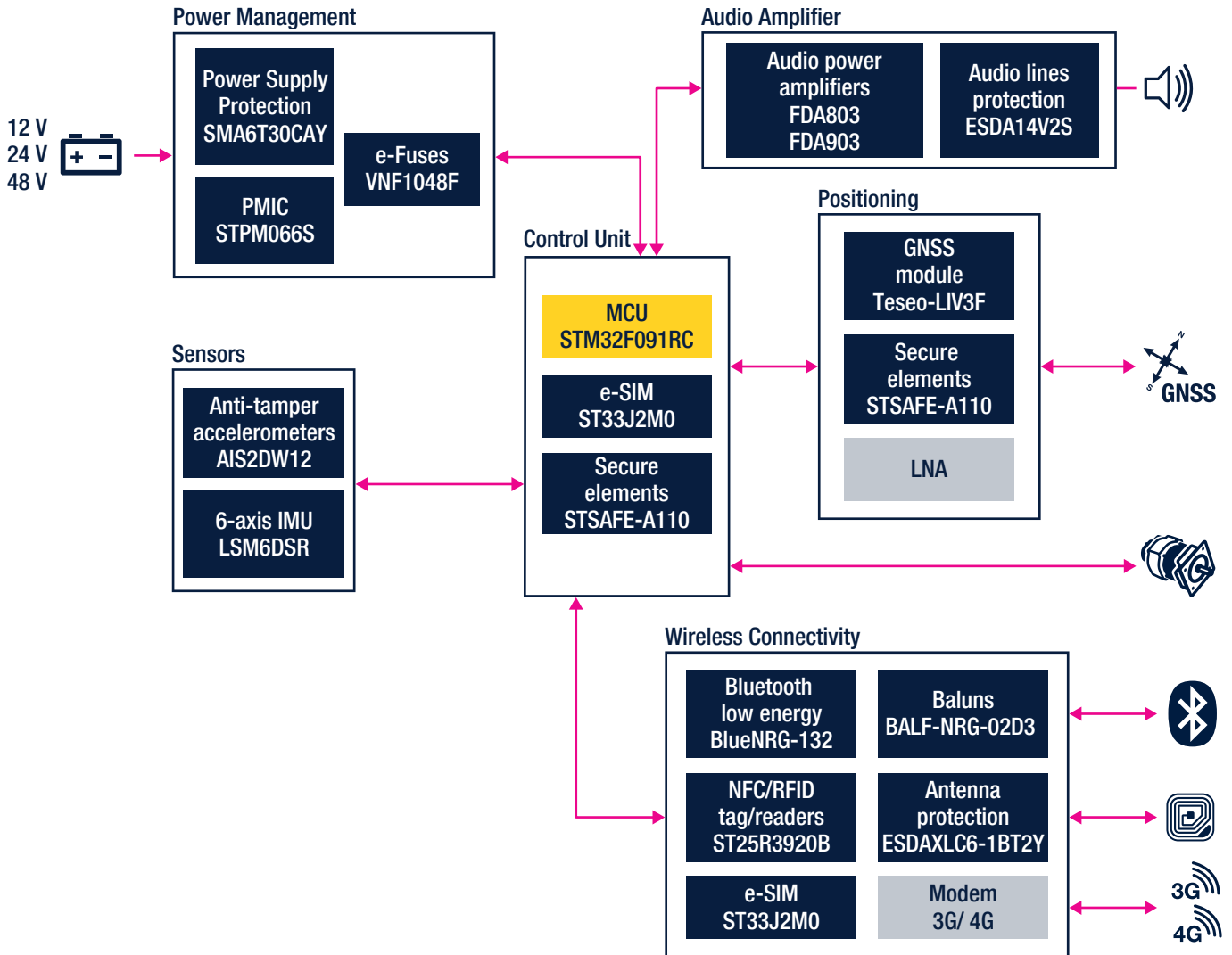
(\*) With a modem embedding an application processor, an SPC58 Chorus 32-bit Automotive MCU can be used as option.



**FIND OUT MORE**  
[www.st.com/automatic-tolling-system](http://www.st.com/automatic-tolling-system)

## eSCOOTER MICRO-MOBILITY

To address traffic congestion and pollution issues caused by rapid urbanization, electric bike and scooter sharing platforms provide a convenient option for last-mile transportation while supporting a faster transition to a greener world. ST is keen on helping people share mobility and offers a wide range of GNSS-based asset management solutions for monitoring and tracking vehicles to reduce costs and manage their fleets.



**FIND OUT MORE**

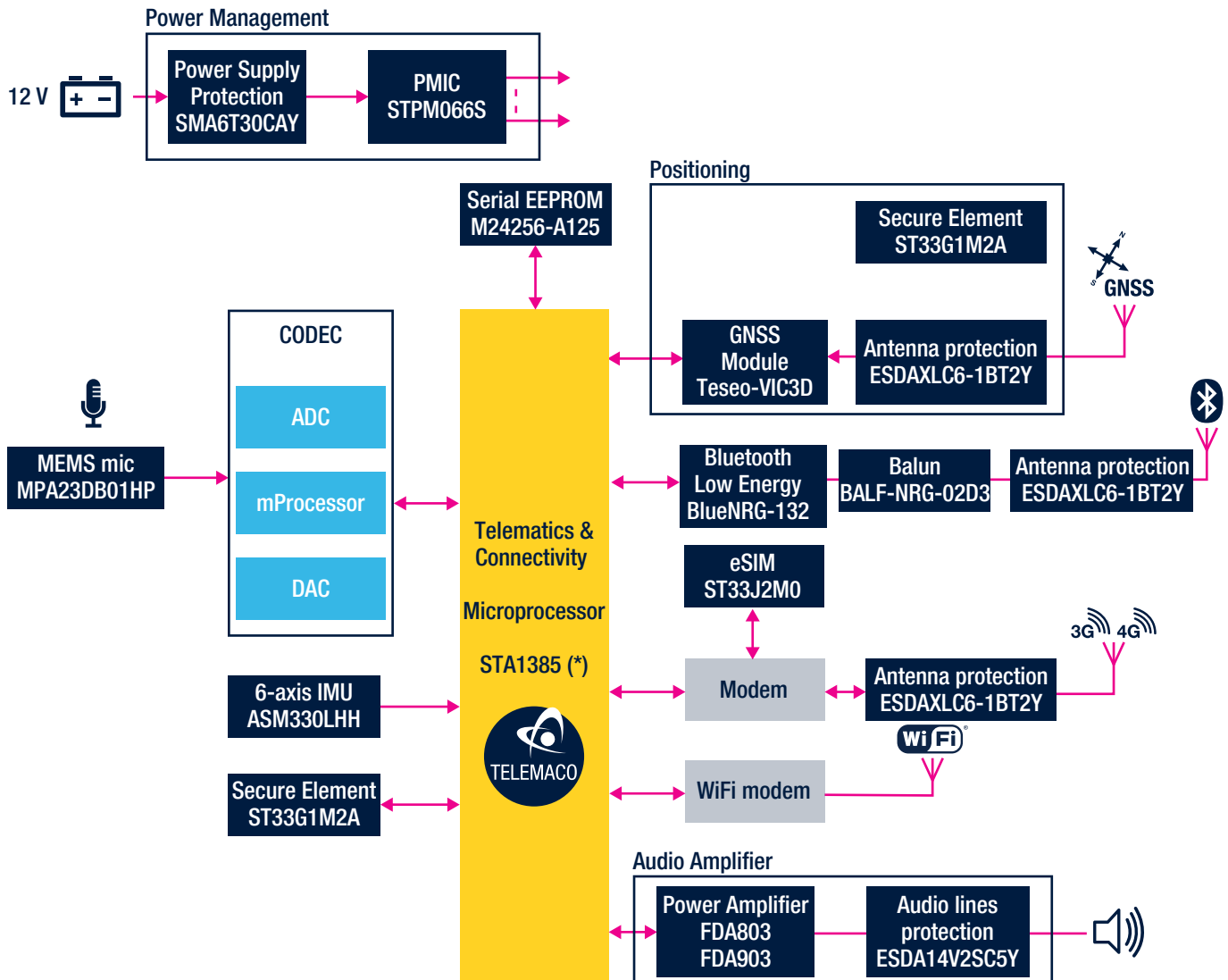
[www.st.com/en/applications/mobility-services/escooter-micro-mobility.html](http://www.st.com/en/applications/mobility-services/escooter-micro-mobility.html)

## E-CALL

Governments and agencies worldwide are setting increasingly demanding and strict rules and policies to enhance the security of both drivers and passengers. This has led to the adoption of emergency call systems – or e-call systems – that can automatically alert first-responder services whenever an accident or car breakdown occurs.

To enable this service, vehicles will need to be equipped with a module that can sense fault conditions, send localization data, and provide a voice interface to communicate with the vehicle's occupants.

ST's portfolio includes automotive-grade motion and environmental sensors, GNSS receivers and application processors to help design the modules required to enable in-car e-call systems.



(\*) With a modem embedding an application processor, an SPC58 Chorus 32-bit Automotive MCU can be used as option.



**FIND OUT MORE**  
[www.st.com/ecall](http://www.st.com/ecall)

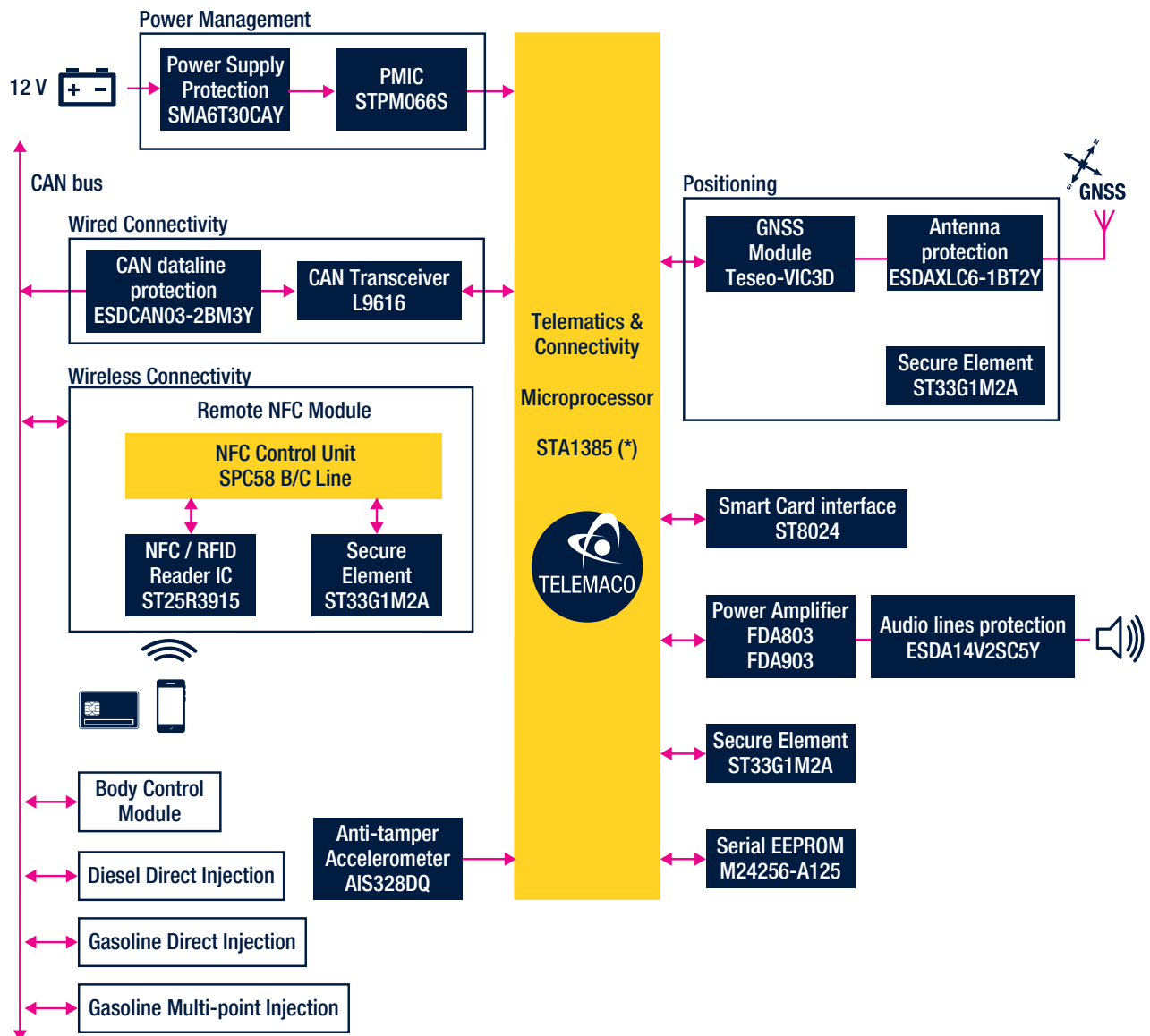


## FLEET MANAGEMENT AND CAR SHARING ON-BOARD UNIT (OBU)

Companies owning or leasing vehicle fleets as well as fleet-management service providers need more advanced means than ever to access information about each vehicle's position and status in real-time in order to best monitor, track and deploy their vehicle, and save energy.

Dedicated telematics systems installed in each vehicle collect this wealth of information and make it available to the fleet manager for scheduling maintenance and servicing tasks – to lower the risk of breakdown and help protect the investment – and to ensure user's rights in accessing the vehicle for use in remote vehicle disabling systems, for example.

ST's wide product portfolio can help build complete vehicle telematics systems for fleet management solutions with a range of automotive-grade NFC transceiver ICs for smart car access, application processors with an embedded hardware security module (HSM), secure elements, GNSS devices and Bluetooth connectivity ICs and anti-tamper MEMS motion sensors.



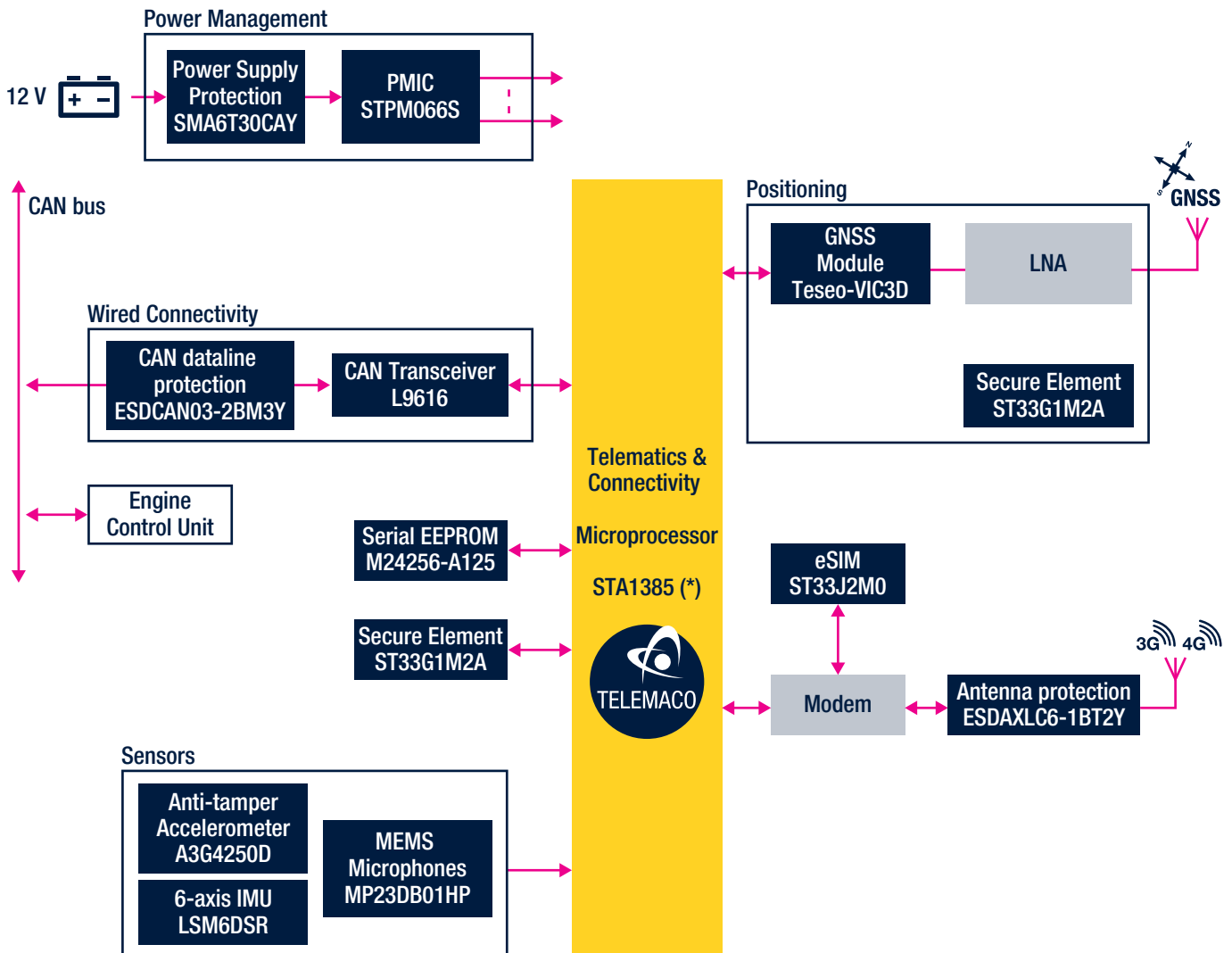
**FIND OUT MORE**

[www.st.com/car-sharing-on-board-unit](http://www.st.com/car-sharing-on-board-unit)

## INSURANCE BLACK BOX

Companies are increasingly promoting the use of a telematics box or black box that constantly monitors a vehicle's position, acceleration rate and speed. It can also detect collisions, help assess driver behavior and locate the vehicle in the event of theft. Insurance companies can also use this information to assess a driver's responsibility whenever an event that involves the driver's liability occurs. Drivers can benefit from more personalized insurance premiums, even on a pay-as-you-drive basis.

ST helps developers, designing vehicle telematics systems, with a range of solutions including application processors, the latest generation of global navigation satellite system (GNSS) ICs with reduced power consumption and carrier-phase tracking for higher positioning accuracy.



(\*) With a modem embedding an application processor, an SPC58 Chorus 32-bit Automotive MCU can be used as option



**FIND OUT MORE**  
[www.st.com/telematics-box](http://www.st.com/telematics-box)

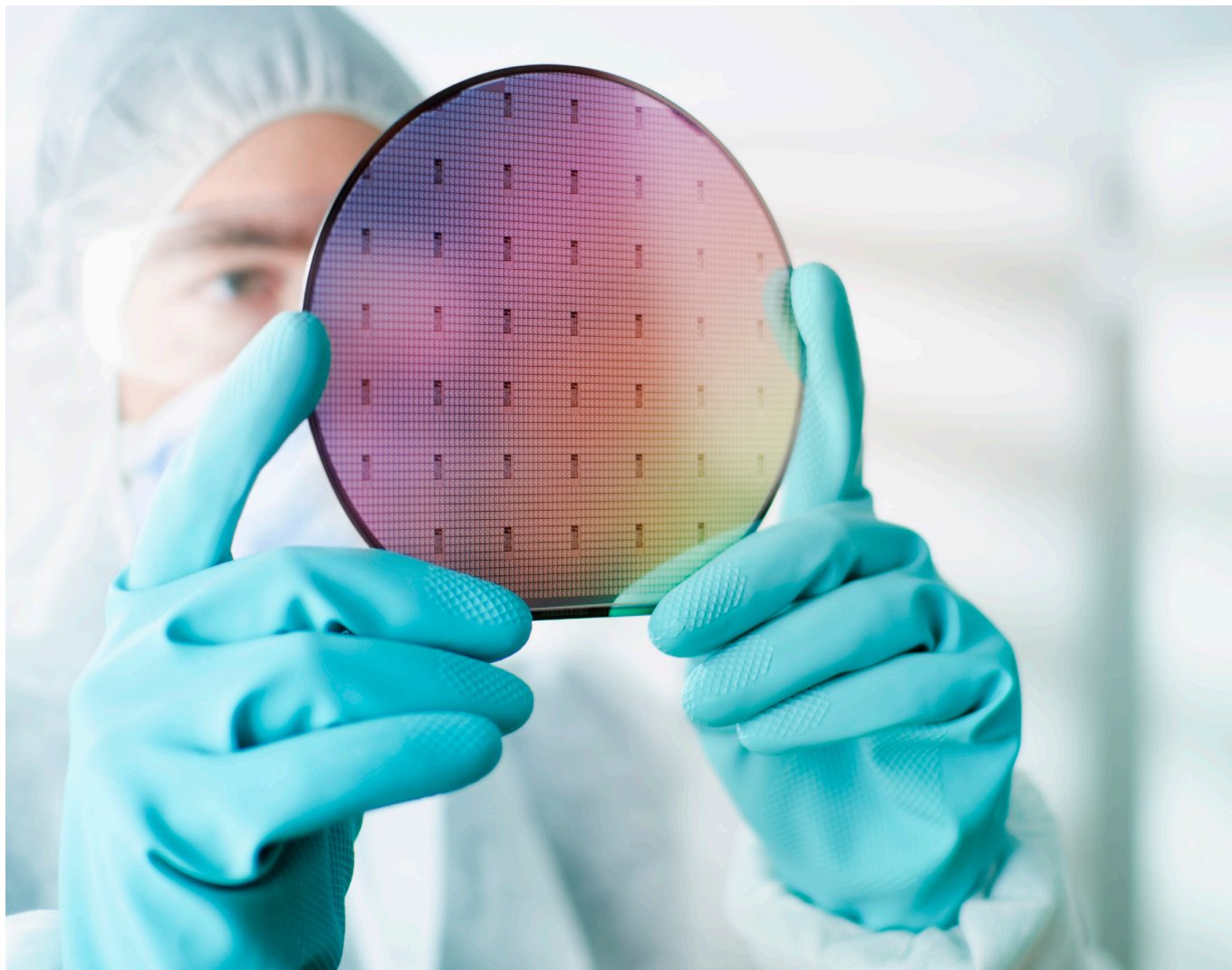
# Key Technologies

## RESEARCH & DEVELOPMENT AND MANUFACTURING

To keep its technology edge, ST maintains a strong commitment to innovation, with approximately 9,000 people working in R&D and product design and spending about 12% of its revenue in R&D. Among the industry's global technology leaders, ST owns and continuously refreshes a substantial patent library with over 19,500 active and pending patents. The company also uses its over 200 R&D partnerships to further foster its innovation.

ST 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), Si MOSFET, SiC MOSFET, Si IGBT, VIPower, Transil, Trench Schottky Diodes, 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

### CMOS (Complementary Metal Oxide Semiconductor)

CMOS (Complementary Metal Oxide Semiconductor) is a pure digital technology invented in the 60's. It is largely used in digital products for processing purposes. Starting from CMOS, other technologies have been set up including BCD (Bipolar-CMOS-DMOS) used for mixed signal products, FD-SOI that allows to reduce silicon geometries below 28nm, and embedded NVM at the heart of MCUs. The robustness and versatility of this technology, present in billions of devices, makes it very suitable for all automotive applications.

### FD-SOI / RF-SOI

Fully Depleted Silicon-on-Insulator, or FD-SOI, is a planar process technology that delivers the benefits of reduced silicon geometries while actually simplifying the manufacturing process. The buried oxide layer, specific to FD-SOI MOS, lowers the parasitic capacitances and efficiently confines the electrons flowing from the source to the drain, dramatically reducing performance degrading for leakage currents. This is a key advantage for pure digital products, especially when required to operate at high temperature, allowing very innovative power management techniques. The advanced ADAS platforms are based on this technology and produced in Crolles 300 facility on a 28nm node. Moreover, thanks to the tight electrostatic control of the transistor, FD-SOI is recognized as a leading technology for low-power, RF and millimeter-wave applications.

Associated with the high-density PCM embedded non-volatile memory, ST offers a unique platform for automotive applications.

Key applications include ADAS, RF switches and tuners, low-noise amplifiers, power amplifiers, monolithic integrated RF and FEMs (switches, LNAs, PAs and passives).

**FD-SOI**

### NON-VOLATILE MEMORIES (eNVM)

ST has a strong background in non-volatile memories (NVM) and has developed embedded NVM technologies to enable real-time MCUs and other products that benefit from real-time access to NVM. Today, automotive volumes are at 90 nm and 40 nm technology nodes, and the new Stellar MCU family uses phase-change memory (PCM) to exploit the features of CMOS FD-SOI technology. This evolution to PCM places ST at the forefront of automotive MCUs.

ST standalone non-volatile memories (NVM) are also highly regarded in the industry, especially our automotive serial EEPROM, which is ideal for high-quality and flexible parameter storage, with a wide portfolio ranging from 1 Kbit to 4 Mbits. The automotive Serial EEPROM is robust, high-performance, and designed for intensive operation at high temperatures, making it suitable for all high-reliability applications. The EEPROM is AEC-Q100 qualified, screened through a specific high-reliability testing flow, and PPAP Level 3 compliant. The EEPROM is manufactured in 150 nm technology nodes and is progressively extending to 110 nm. The I<sup>2</sup>C, SPI, and Microwire buses are supported for three packages: SO8N, TSSOP8, and DFN8 up to 150°C.



### 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.

## VIPOWER

Vertical Intelligent Power (VIPOWER) is a technology developed by ST and in production since 1991. VIPOWER technology provides 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 and CMOS and HV components for power, analog, and mixed-signal designs.

VIPOWER technology plays a key role in the move towards electric vehicles. The smart 48 V networks 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 ECUs microcontroller.

The new VIPOWER M0-9 SPI drivers feature full digital diagnostics with embedded ADC for load current sensing. These new devices implement sophisticated software logic that also simplifies AUTOSAR compatibility.

Designed to replace standard melting fuses in automotive power distribution systems, our new STi2Fuse smart switches feature wire harness protection on top of the typical high-side driver functions for additional savings on component and production costs, while extending EV range and reducing the carbon footprint of vehicles.



## TRANSIL

TRANSIL is a key planar technology for our Automotive transient voltage suppressors (TVS) series designed to protect automotive sensitive circuits against surges as defined in ISO 7637-2 and ISO 16750 also called load-dump (battery lines), ISO 7637-3 (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.



## Data line ESD protection

ST's automotive data line ESD protection devices include transient voltage suppressors (TVS) and application-specific discrete devices that provide system level protection against ESD surges according to standard IEC 61000-4-2. ESD protection devices are manufactured using automotive-grade processes and qualified to AEC-Q101 standards. As such, they can address all automotive applications and domains including advanced driver-assistance systems (ADAS), vehicle-to-everything (V2X), CAN-FD, SerDes (serializer/deserializer), and Ethernet Base-T standards to name just a few, in order to achieve immunity with the very low clamping voltage. Moreover, ST offers innovative, miniature wettable flank DFN packages to ease Automatic Optical Inspection (AOI).

## A growing and diversified portfolio of MEMS and sensor solutions

Enabling the transition to a sustainable Onlife era, ST offers an extensive MEMS sensor portfolio based on more than 25 years of experience and innovation. Moreover, our new generation of MEMS sensors features an embedded intelligent sensor processing unit (ISPU) to help meet the challenges of incorporating AI into energy-saving Edge-based applications.



Our sensors offer three key attributes:

- Capable of directly processing the data they capture and delivering meaningful insights in the local device, **smart sensors** reduce transmitted data and cloud processing requirements, thus lowering power consumption at the system level.
- Able to interface with other sensor applications, our **open sensors** let third parties benefit from ST's in-sensor processing innovations, while building an ecosystem to jointly create value for customers.
- Providing high-precision data that allows better quality decisions and makes interactions smoother and more natural, our **accurate sensors** also reduce factory calibration time and resources, which also reduces energy needs.

To reduce design costs and effort for a more rapid time to market, our comprehensive ecosystem includes helpful developer resources with ready-to-use boards as well as software tools and real-life example code.



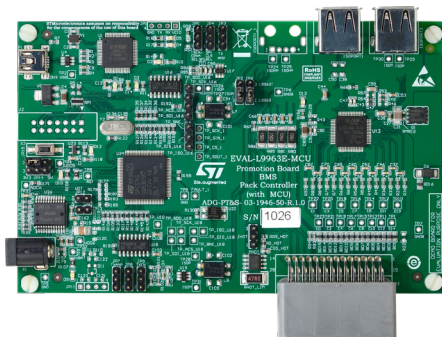
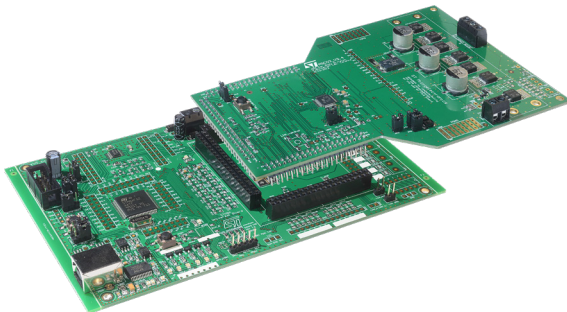
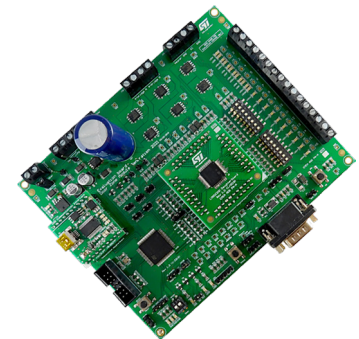
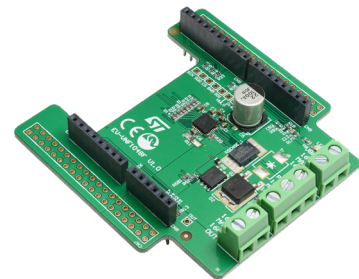
# Development Tools

## EVALUATION BOARDS, eDESIGN SUITE, AND SOFTWARE TOOLS

ST provides a set of eDesign suites 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 boards, ST provide schematics, BOM and Gerber files to facilitate your hardware design and demonstration software packages are also available.

### Evaluation kits

Product evaluation kits help you to design, test, and calibrate your automotive application. A wide range of boards is available to evaluate the specific features of products and solutions in their applications. A complete set of documents and resources including circuit diagrams and bills of material as well as reference guides is available. Additional software including ready-to-use example code and user-friendly GUIs complete our offer.



**FIND OUT MORE**  
[www.st.com/automotive-evalboards](http://www.st.com/automotive-evalboards)

## eDesignSuite

eDesignSuite is a comprehensive set of easy-to-use design-aid utilities ready to help you streamline the system development process with a wide range of ST products.



### TwisterSIM

TwisterSIM is an off-line Electro-Thermal simulator for our VIPower automotive power devices. It helps shorten design solution cycle by enabling complex evaluations including load-compatibility, wiring harness optimization, fault condition impact and diagnostic behavior analysis and Dynamic Thermal performance.



### STPOWER Studio

The STPOWER Studio dynamic electro-thermal simulation software offers comprehensive power and thermal analysis for a growing number of STPOWER devices. It helps users select the best power device for the specific application mission profile and predicts device behavior under given operating conditions.



### Rectifier diodes simulator

With just a few clicks our on-line FERD & Schottky diode simulator lets you estimate power losses based on application waveforms and select the best components for your solution.



### AC switches simulator

Our AC switch simulator provides graphs of estimated temperature and voltage blocking capabilities to so you can quickly determine the best switch for your solution.



### TVS simulator

Simply specify the surge input waveform and system ratings to be protected and this intuitive simulator lets you sort and select the best TVS protection for your design.



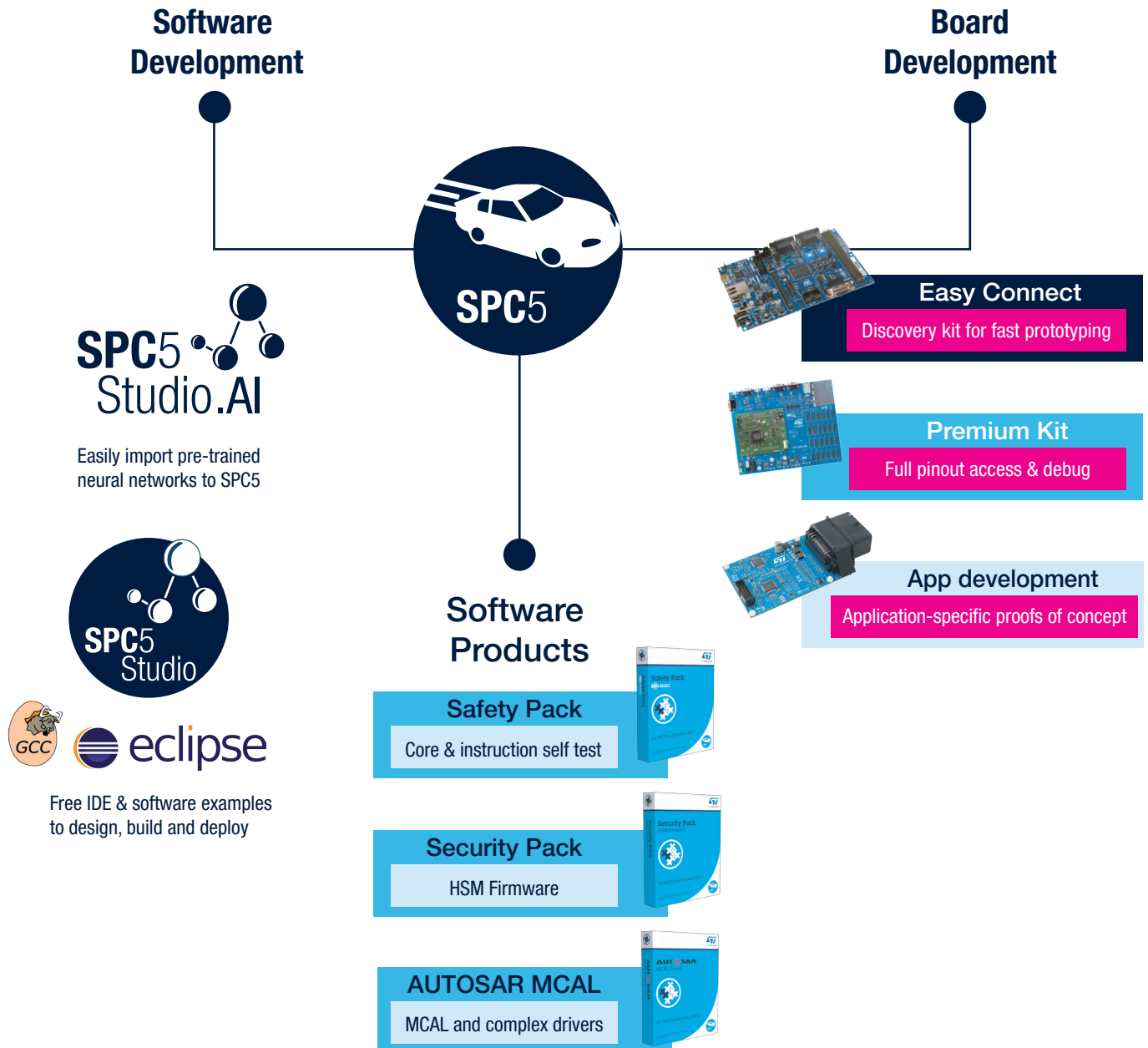
**FIND OUT MORE**  
[www.st.com/edesign](http://www.st.com/edesign)

## COMPREHENSIVE SPC5 AUTOMOTIVE MCU DEVELOPMENT ECOSYSTEM

A rich ecosystem with a full set of hardware and software tools allows developers to save time, simplify implementation, quickly prototype their application and benefit from ready-to-use boards and example code. ST offers a wide set of hardware kits ranging from quick evaluation tools to modular and professional boards for developing final proofs-of-concept.

Together with free downloadable SPC5Studio Integrated Development Enviroments (IDE), engineers can easily set up application projects in a short time. SPC5Studio contains a wide selection of example code for starting projects. Additionally, ST offers a set of licensed software packs addressing Safety, Security and AUTOSAR MCAL components.

ST's network of 3rd parties and partners complement the offer with hardware, such as debugger probes, and software tools including compilers and other services.



**FIND OUT MORE**  
[www.st.com/auto-sp5-mcu-evaltools](http://www.st.com/auto-sp5-mcu-evaltools)

## STELLARLINK FAST PROTOTYPING FOR AUTOMOTIVE MCUs

StellarLINK is a USB to JTAG passive debugger dongle for Automotive MCUs. It supports SR5, SR6, and SPC5 automotive microcontrollers and their evaluation boards. StellarLINK is Integrated into StellarStudio and SPC5Studio

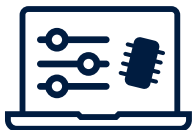
### ST programmer & debugger



Supporting Stellar SR5, SR6, and SPC5 MCUs



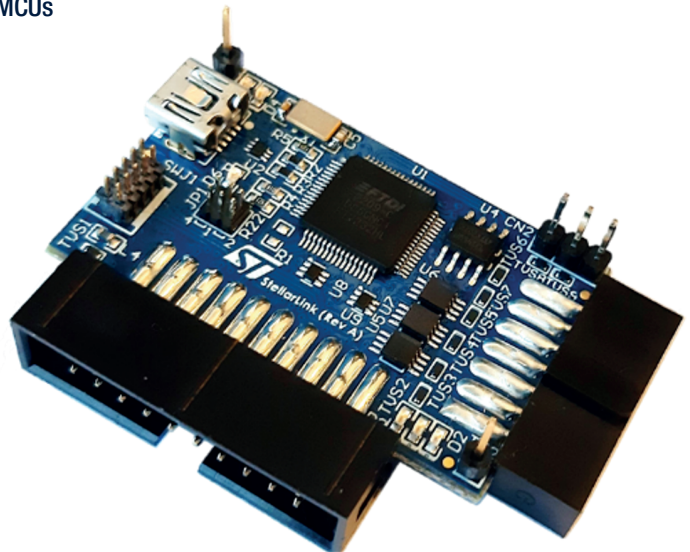
Plug & Play with evaluation boards



Extending Stellar & SPC5 ecosystem



Eco-friendly packaging



**FIND OUT MORE**

[www.st.com/en/development-tools/stellarlink.html](http://www.st.com/en/development-tools/stellarlink.html)

## SPC5 SOFTWARE TOOLS



SPC5Studio is a built-on Eclipse plug-in development environment offering a very intuitive and customizable framework to build and deploy embedded applications for SPC5 Power architecture 32-bit microcontrollers.

Integrating software development tools, device configuration tools and examples, SPC5Studio is a complete solution to speed up project development.

Available free for download on the [st.com](https://www.st.com) website.



SPC5Studio includes **SPC5Studio.AI**, a plug-in for Artificial intelligence-based applications, a seamless way to generate, execute and validate pre-trained NN models on automotive MCUs.

Pre-trained neural networks can be automatically generated into an efficient “ANSI C” library that can be compiled, installed and executed.

Pre-trained neural networks can be easily imported by SPC5Studio.AI from the most widely used deep learning frameworks, such as Keras, TensorFlow Lite, Lasagne, Caffe, ConvNetJS, and ONNX.

## SOFTWARE PRODUCTS



**SPC5 Security Pack** provides basic capabilities to support root-of-trust (RoT) where private encryption keys are kept secret during the microcontroller lifetime using a dedicated location inside the OTP space. To further ensure application security, encryption and decryption functionalities are fully executed on the HSM core.



**SPC5 Safety Pack** is a comprehensive software package rigorously developed according to an ISO 26262-compliant development process, and helps developers achieve the required safety target, up to the most rigorous ASIL-D level. It includes a Safety kit for the Microcontroller Abstraction Layer (MCAL) as well as Core self-test programs that implement safety counter-measures to ensure compliance with MCU ASIL level requirements.



**SPC5 AUTOSAR MCAL Driver** offers a full set of Microcontroller Abstraction Layer software components in addition to Complex Device Drivers (CDD) to support specific hardware peripherals. MCAL software components are developed in house, through an ISO 26262-certified development process. ST's CDD and MCAL drivers are integrated by 3rd party partners with all the components required for the AUTOSAR architecture including basic software layer and OS, offering a complete off-the-shelf AUTOSAR solution.

*ST Security Pack, Safety Pack and AUTOSAR MCAL Pack are licensed products.*



## AutoDevKit AUTOMOTIVE DEVELOPMENT INITIATIVE

AutoDevKit is a fast growing toolset for Automotive & Transportation Application Development. It allows design engineers to quickly build their prototype combining hardware, firmware and software in an easy way and fully supported by our community.

Our ecosystem offers a wide selection of Automotive MCU and devices covering several automotive applications:

- Battery management systems (BMS)
- Logistics and delivery robots
- AI on standard MCUs
- Internal and external lighting
- Power distribution
- Audio generation and AVAS
- Motor control: door control, side mirror, tailgate and seat adjustment
- HVAC, ventilation, and air quality
- USB type-C power delivery



Once the MCU platform and the functions needed for the application are selected, the developer can start from existing demo codes and customize them using high-level programming, without going into deep technical details.

The automatic pin configuration and the visual procedure enable an easy board assembling with the correct wiring and the embedded debug allows to get a working prototype quickly.

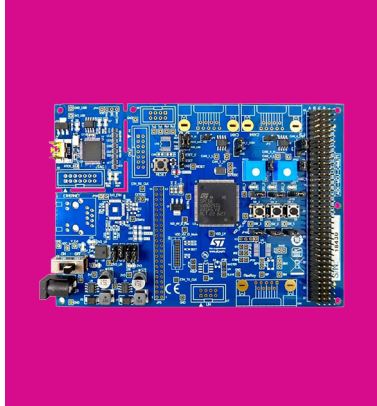


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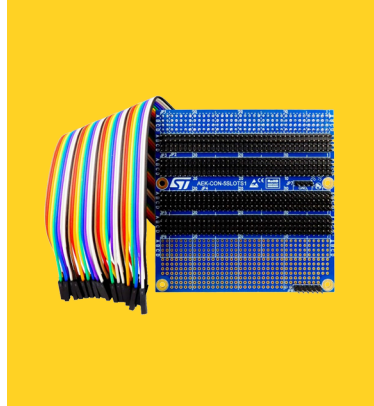
## THE AUTODEVKIT ECOSYSTEM INCLUDES:

- MCU Discovery and Functional boards
- System solution and demonstrators
- Embedded software and firmware components and tools

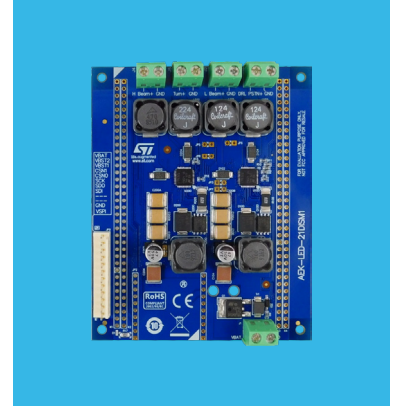
**MCU Boards**



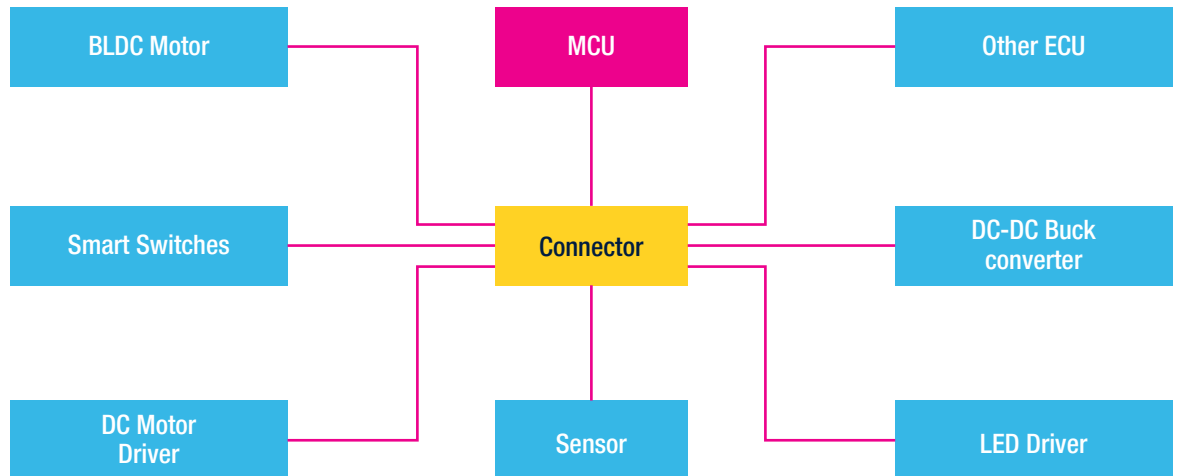
**Connector Boards**



**Functional Boards**



### Solution /Demonstrator KIT



MCU + Connector + Functional boards