life.augmented

Automotive Smart Gateway with SPC58 H Line MCUs

Contents

4 ST makes gateways smart

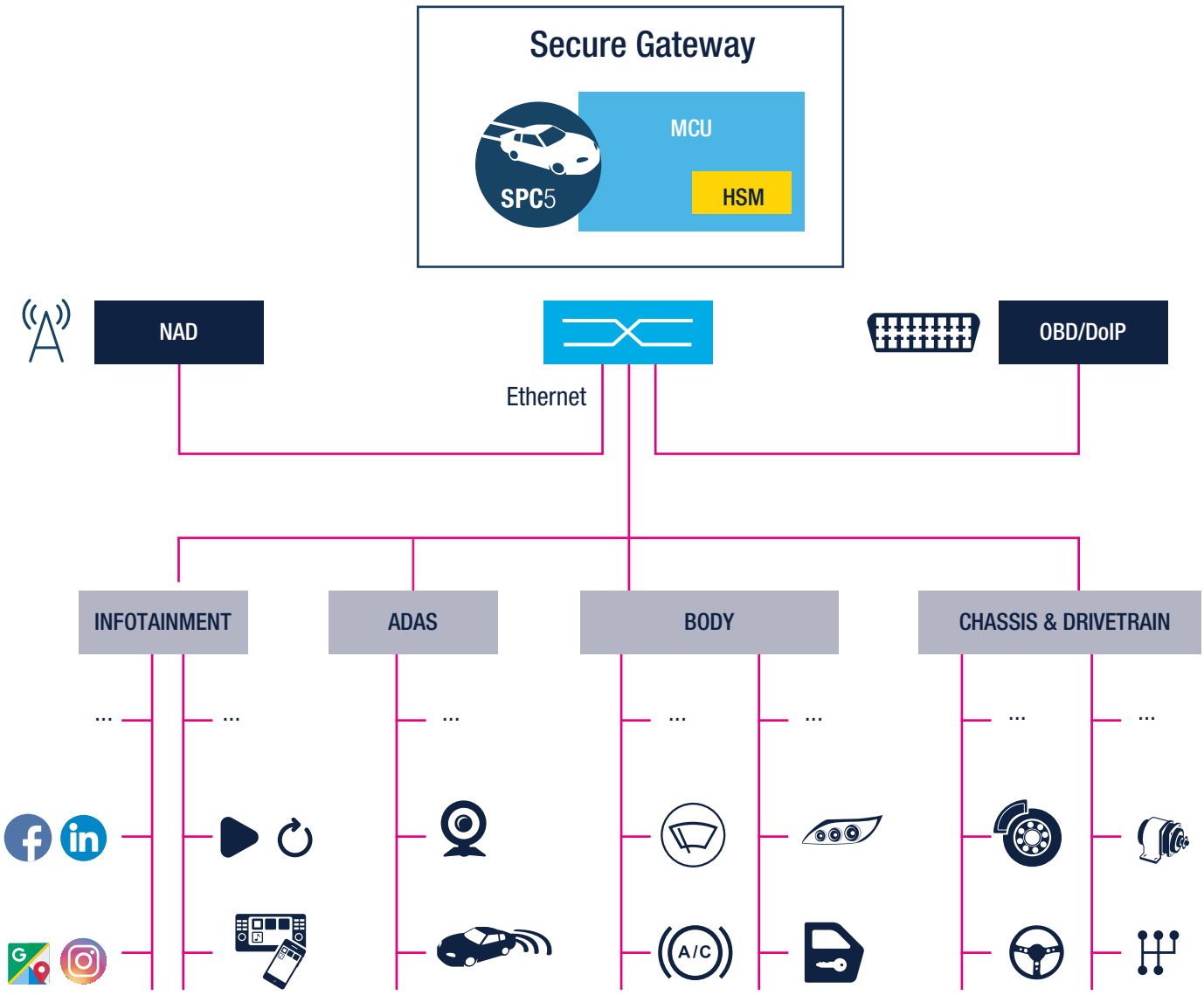
6 SPC58 H Line MCUs
A scalable solution for
smart gateways

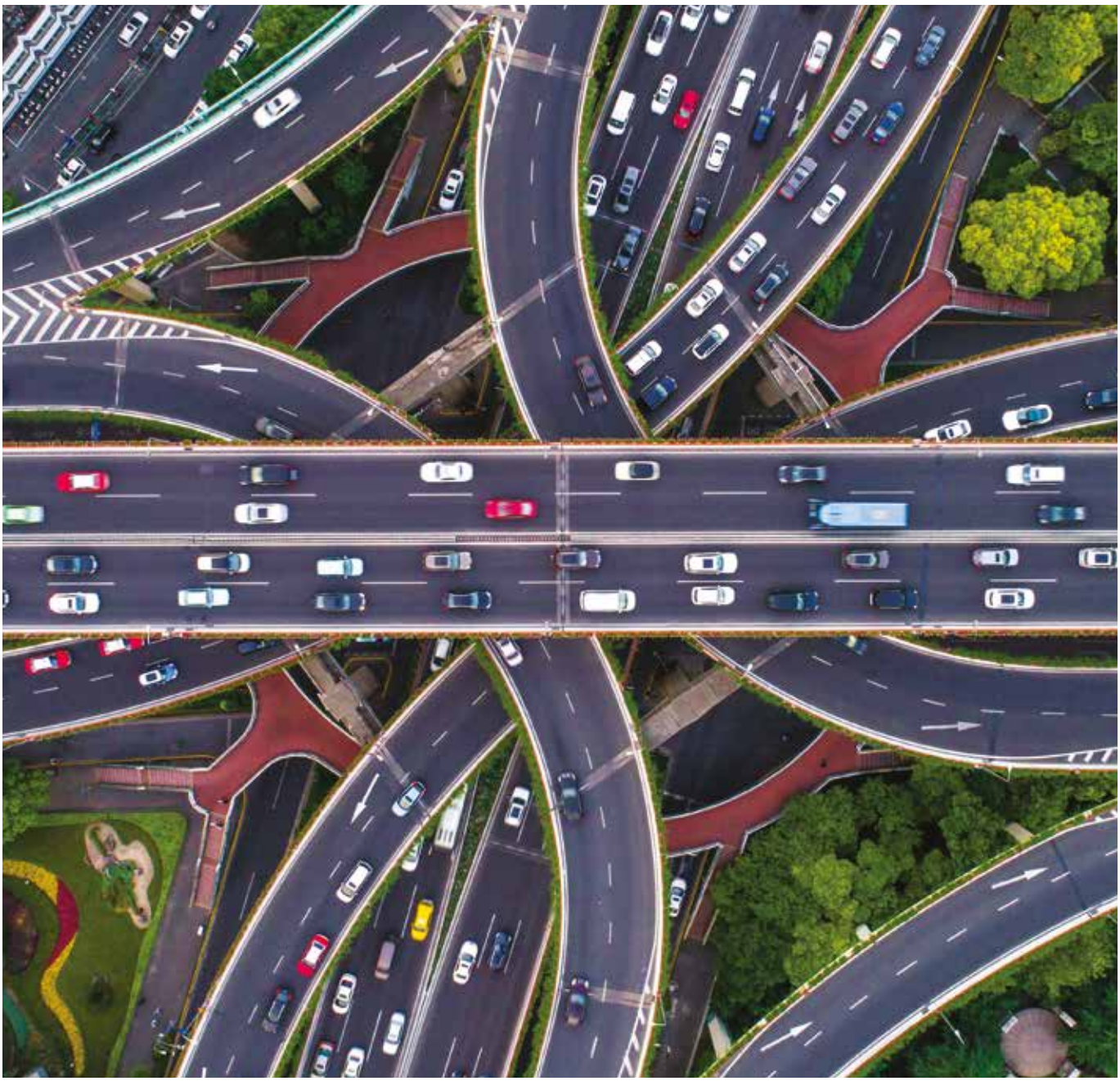
8 Connected & Secure
Main use cases

10 SPC58 H Line MCU
Features and ecosystem

ST makes gateways smart

The evolution of automotive architectures is increasing the vehicle electronics content and its complexity. High-throughput in-vehicle networking and high data-rate communication to the cloud have grown the demand for efficient and secure Smart Gateways, acting as central hubs for in-vehicle communication and connectivity with the outside world.





YOUR SECURE HUB FOR IN-VEHICLE & OUTSIDE WORLD CONNECTIONS

In addition to requiring wide connectivity, flexibility, and performance, Smart Gateways need to ensure the maximum level of protection from potential cyber-attacks that may inject malicious data in the vehicle, compromising driver's safety or violating their privacy.

Secure Gateways act as robust and reliable nodes for over-the-air software updates, predictive maintenance, and on-board diagnostics in addition to secure interconnections between any type of in-vehicle bus including the different vehicle ECUs and domain or zone controllers.

WHAT IS A GATEWAY?

A gateway is a central hub that securely and reliably interconnects and transfers data across the many different networks found in vehicles. It provides physical isolation and protocol translation to route signals between functional domains (powertrain, chassis and safety, body control, infotainment, telematics, ADAS and more) that share data.

SPC58 H Line MCUs
A scalable solution for smart gateways

SPC58 H Line Automotive MCUs efficiently meet all smart gateway requirements, delivering performance and real-time execution blended with a comprehensive approach to security and safety. High-throughput communication protocols offer a perfect match for today's and tomorrow's next-generation smart gateway architecture needs.

The leading line of ST's SPC58 Chorus series, SPC58 H Line MCUs, is based on a PowerPC architecture and boasts a proven long-standing success in automobile applications.

WIDER CONNECTIVITY

The transition from distributed to domain/zone vehicle architectures requires high-throughput communication interfaces to reliably convey the ever-increasing amount of data passing through in-vehicle buses and outside communication networks including Wi-Fi and cellular.

To be able to handle this amount of data, Smart Gateways must have a Gbit Ethernet backbone along with several high-speed/low-latency communication channels for connecting with the vehicle's various sensors and actuators in addition to cloud services.

ST's SPC58 H Line Automotive MCUs support the evolving high-speed communication protocols with a wide set of connectivity options including Fast (100 Mbit/s) and Gigabit (1 Gbit/s) Ethernet controllers as well as numerous CAN-FD, LIN, DSPI, and I^2C interfaces (and more) to help reduce BOM costs and shorten design times to ensure a quicker time to market.

MAXIMUM SECURITY

A vehicle's vulnerability to malicious attacks is a serious threat that requires a trusted security approach.

Through a robust design embedding a reliable and isolated hardware security module (HSM), SPC58 H Line MCUs provide efficient state-of-the-art cryptography for data encryption, authentication and message integrity checks, while running secure communication protocols. To ensure effective isolation of trusted subsystems, the HSM relies on an independent CPU, dedicated memories separated from the main CPU as well as application software. With support for both symmetric and asymmetric algorithms that add advanced functions such as digital signature and key sharing over unsecure channels, the SPC58 H Line ensures the highest level of security and support for the EVITA® Full profile.

SCALABILITY

The scalability of SPC58 H Line MCUs lets designers find the most cost-effective solution for their application with a wide choice of Flash memory sizes and package offerings.

The pin compatibility of SPC58 Chorus microcontrollers from the same series will save development time and effort in design upgrades and updates, leveraging the easy code portability between devices. SPC58 H Line MCUs also embed an Octal-SPI interface for data storage extension and code execute-in-place (XiP) facility, as well as a versatile eMMC interface.

ON-DEMAND WEBINAR: AUTOMOTIVE GATEWAY APPLICATIONS

Learn more about E/E architectures and design challenges and see how ST's SPC58 automotive microcontrollers can improve your designs for gateway applications.

Connected & Secure
Main use cases

OVER-THE-AIR (OTA) SOFTWARE UPDATES

Over-The-Air (OTA) software updates are becoming more and more important as they allow OEMs to immediately overcome potential software vulnerabilities without a vehicle recall. With the increase of electronic components in the car, the capability to easily run software updates at no cost becomes a key factor in enhancing driver safety.
Data integrity checks are managed by the MCU's hardware security module (HSM) to ensure that no code manipulation has occurred. Code authentication mechanisms verify origin, content, time, etc.
Once integrity is verified, data decryption is executed in the HSM engine, and the new firmware is flashed in the embedded non-volatile memory.

The SPC58 H Line MCUs' large memory size and embedded Flash A/B context swap feature enable high-efficiency OTA software updates.

DIAGNOSTICS OVER IP (DOIP) AND OVER CLOUD

Smart gateways need to manage the transfer of diagnostic data and services over IP, cloud or Wi-Fi in a fast and secure way.

Very strict access control is mandatory as both sensitive information on the driver's behavior and his private data as well as technical information about the vehicle are shared.

Authentication with security credentials, data integrity measures and secure communication protocols are essential to prevent potential cybersecurity attacks and ensure reliable operation. Only once the HSM authenticates the communication and data integrity is confirmed can the MCU can start accessing vehicle data.

The robust HSM embedded in SPC58 H Line microcontrollers ensures maximum security along with high data-rate channels, such as Gigabit (1 Gbit/s) Ethernet, which support fast diagnostic data transfers. With its ASIL-D support, the SPC58 H can run safety compliant tasks to control actuators while monitoring essential parameters.

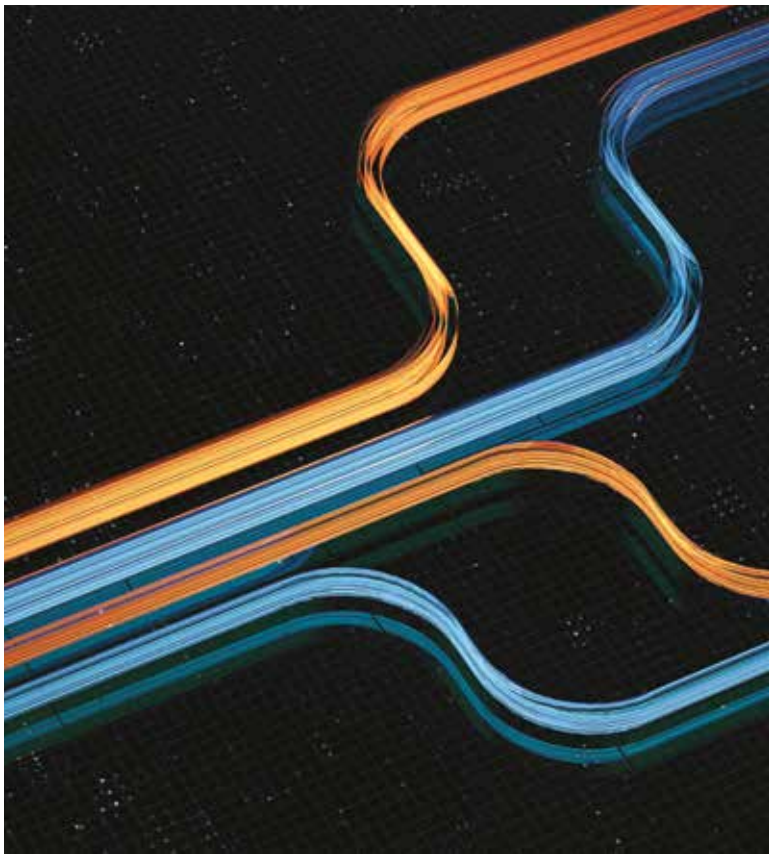
IN-VEHICLE SECURE COMMUNICATION

Communication buses access crucial components of the vehicle including engine control, braking, and steering functions as well as systems allowing partial control of the vehicle's behavior such as adaptive cruise control.

Vehicle networks need to be managed through security policies that work as a firewall controlling the access to the in-vehicle ECUs, authenticate the communication and ensure data integrity.

SPC58 H Line MCUs offer wide connectivity options including CAN FD for multi-drop connectivity as well as Gbit Ethernet, now becoming the digital backbone for today's and tomorrow's vehicles..

With their multicore architecture, SPC58 H Line MCUs ensure an efficient routing among different protocols, such as CAN to ETH, LIN to CAN, LIN to ETH, etc.



SPC58 H Line MCU Features and ecosystem

SPC58 H Line Automotive MCUs based on Power Architecture® technology are designed for applications where performance, stringent security requirements and high-speed connectivity matter.

EMBEDDED SECURITY, CONNECTIVITY AND SAFETY

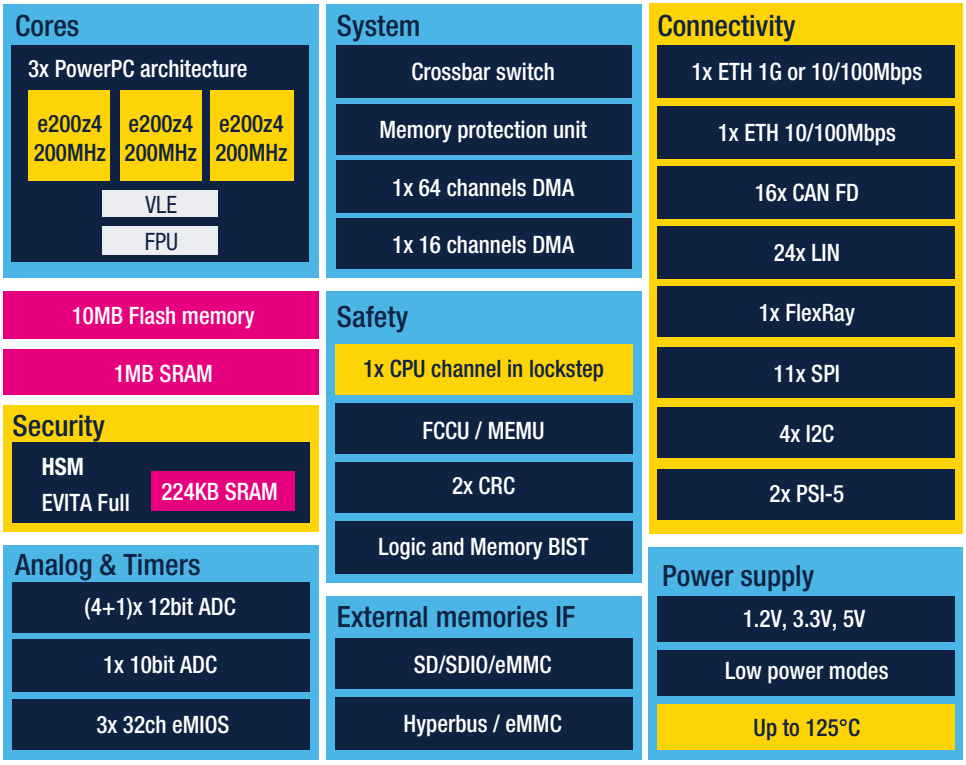
The SPC58 H Line offers a triple-core e200z4 running at 200 MHz with up to 10 Mbytes of Flash memory and 1 Mbyte of RAM. It embeds a Hardware Security Module with dedicated memories, supporting EVITA Full security profile, to ensure robust protection of in-vehicle networks and secure over-the-air software updates to prevent cyberattacks.

The SPC58 H Line offers a wide set of connectivity options including Fast (100 Mbit/s) and Gigabit (1 Gbit/s) Ethernet, CAN-FD, LIN, DSPI, OSPI, I²C and more, and supports 125°C operating temperatures. The SPC58 H Line is designed for system scalability to address any type of design complexity leveraging on a single solution: two SPC58 H Line devices can be coupled through their inter-processor communication interface to build a system with 6 cores, 20 Mbytes of Flash memory and two Gigabit Ethernet interfaces.

Efficient low-power modes including signal monitoring for smart wake-up make the MCUs eco-friendly, helping to reduce energy consumption.

Designed in compliance with ISO 26262 specifications, the SPC58 H Line meets safety standards up to the most stringent ASIL-D level.

SPC58 H Line MCUs are available in multiple packages ranging from eTQFP144 and eLQFP176 to LFBGA302/386.



KEY FEATURES

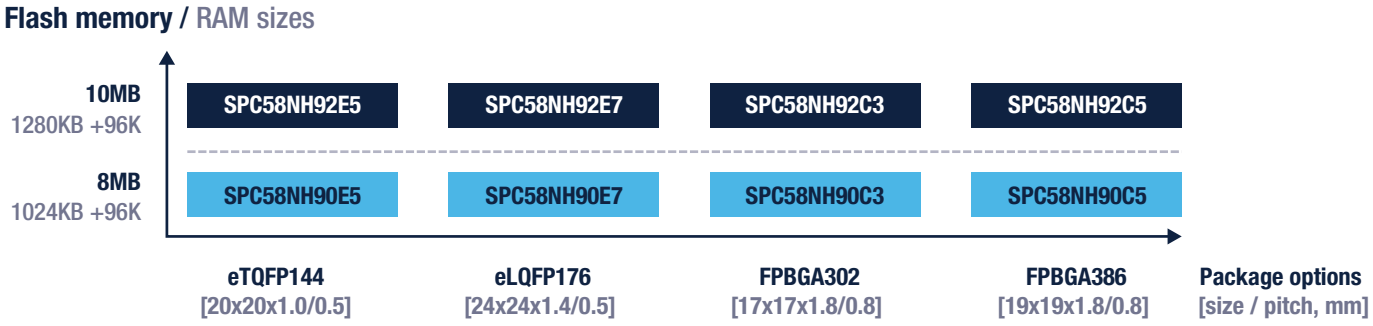
- 3 cores @ 200 MHz
- 10-Mbyte Flash memory
- 1-Mbyte SRAM
- Hardware Security module (HSM) supporting Evita Full
- AES-256, hash, and asymmetric key management
- 1Gbps Ethernet and 100Mbps Ethernet along with a wide set of peripherals
- Up to 16 CAN-FD interfaces in addition to a rich connectivity set
- Efficient low-power modes
- ASIL D support
- Operating temperature up to 125°C

KEY APPLICATIONS

- Smart gateways
- Advanced body application
- EV battery management

SPC58 H LINE PORTFOLIO AND FEATURES AT A GLANCE

Memory and package options for design flexibility



Features by package type

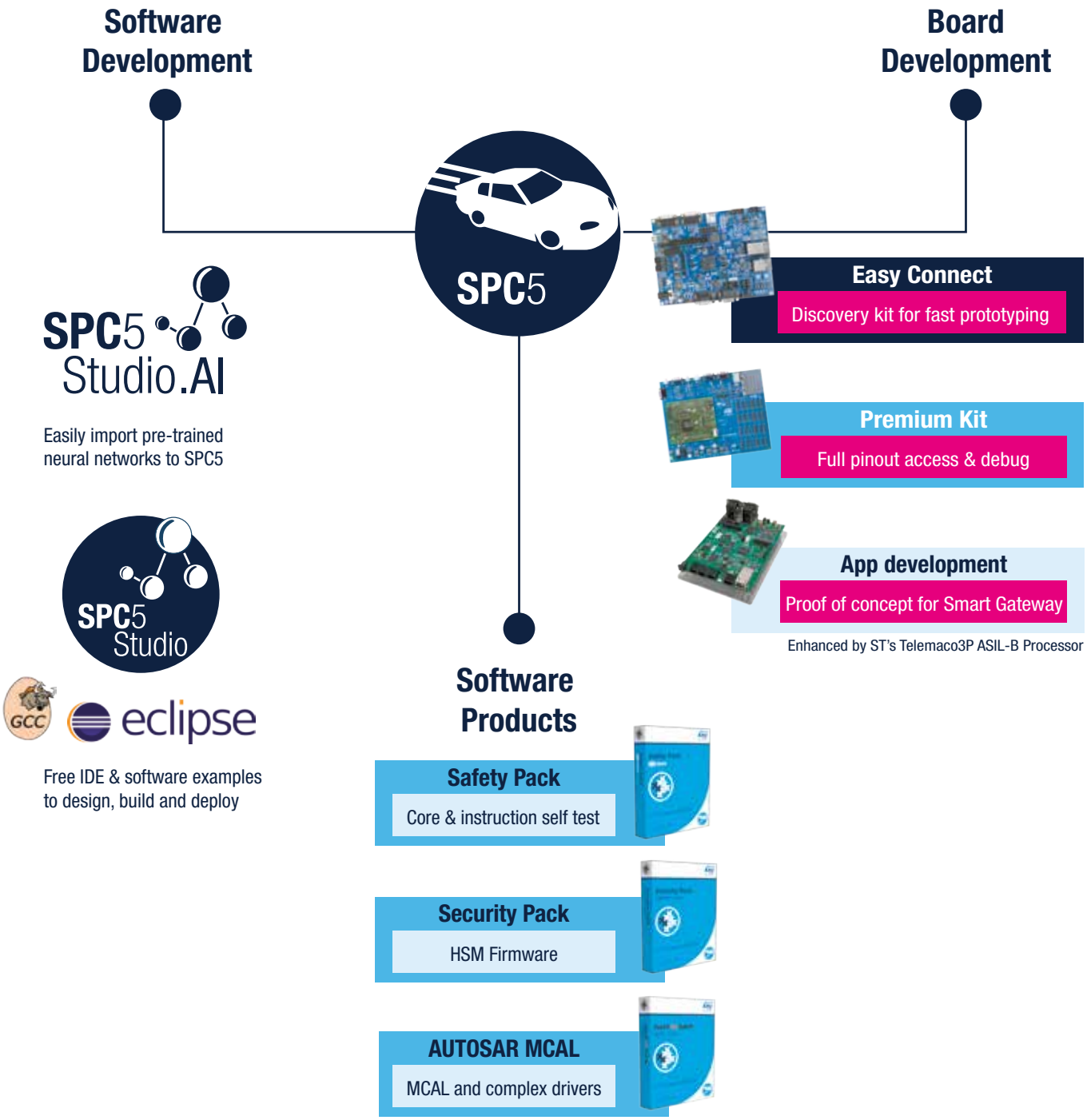
Package	GPIOs	Connectivity								Timers eMIOS 16bit	ADC		Security	Safety
		SPI	LIN	CAN-FD	IC2	FlexRay	Ethernet	SD/SDIO/ eMMC	OSPI		Channels	Resolution		
FPBGA386	272	10 + 1 Low power	24	16	4	1	2 (1x1 Gbit)	1	1	96	95	1 x 10 bit 5 x 12 bit	HSM Evita Full	ASIL-D
FPBGA302	192	10 + 1 Low power	24	16	4	1	2 (1x1 Gbit)	1	1	96	95			
eLQFP176	135	10 + 1 Low power	24	16	4	1	2 (1x1 Gbit)	1 4 bit max	1	92	62			
eTQFP144	105	10 + 1 Low power	23	16	4	1	2	0	1	97	48			

SPC58 H Line provides a seamless extension of SPC58 general-purpose MCUs, a complete series that delivers from 1 up to 10 Mbytes of Flash memory. For easier portability, pin-to-pin compatibility with SPC58 4B and SPC58 C Lines reduces development time and effort. Visit the **SPC5 32-bit Automotive MCUs** web page for details about the full SPC58 Chorus series.

SPC58 H LINE DEVELOPMENT ECOSYSTEM

A rich ecosystem with full set of hardware and software tools allow developers to save time, simplify implementation, quickly prototype their application and benefit from example code. ST offers wide set of hardware kits ranging from quick evaluation tools to modular and professional boards for final application proof-of-concept development. Together with the free-downloadable SPC5Studio Integrated Development Environment, engineers can easily set up application projects in a short time frame. 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.



HARDWARE TOOLS

Easy Connect

Discovery kit for fast prototyping

Quick and easy hands-on to explore the device and accelerate development.

SPC58NH-DISP

FPBGA386

Debugger

SPC5-UDESTK-EVAL

(dongle + demo license)

SPC5-UDESTK-EVAL license schemes:

SPC5-UDEDEBG-TL (1Year)

SPC5-UDEDEBG (perpetual)

Premium Kit

Full pinout access & debug

For professional evaluation and prototypes with tracing capability. Modular approach with multiple package options and wide automotive grade connectors to interface with existing systems.

Motherboard part number **SPC58XXMB**

Package	Daughter boards Part Number
eLQFP176	SPC58NHADPT176S
FPBGA302	SPC58NHADPT302S
FPBGA386	SPC58NHADPT386S

App development

Proof of concept for Smart Gateway

Reference design based on a modular gateway architecture for easy integration and scalability in performance, networking and software. Enhanced with ST's Telematic processor Telemaco3P.

SGP-TC-EVK

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** 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 provide 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.

FIND INFORMATION AND SUPPORT

Visit www.st.com for valuable online information and support on our products to bring your project to life.

Access SPC5 online documentation and development ecosystem from any desktop or mobile device.

ST Community SPC5

@ST_World

STonlineMedia

STMicroelectronics

STMicroelectronics

STMicroelectronics

life.augmented

MIX
Paper from responsible sources
FSC® C003379

Order code: BRCH10MSPC58H0721

For more information on ST products and solutions, visit www.st.com

© STMicroelectronics - July 2021 - Printed in the United Kingdom - All rights reserved
ST and the ST logo are registered and/or unregistered trademarks of STMicroelectronics International NV or its affiliates in the EU and/or elsewhere. In particular, ST and the ST logo are Registered in the US Patent and Trademark Office. For additional information about ST trademarks, please refer to www.st.com/trademarks.
All other product or service names are the property of their respective owners.

life.augmented