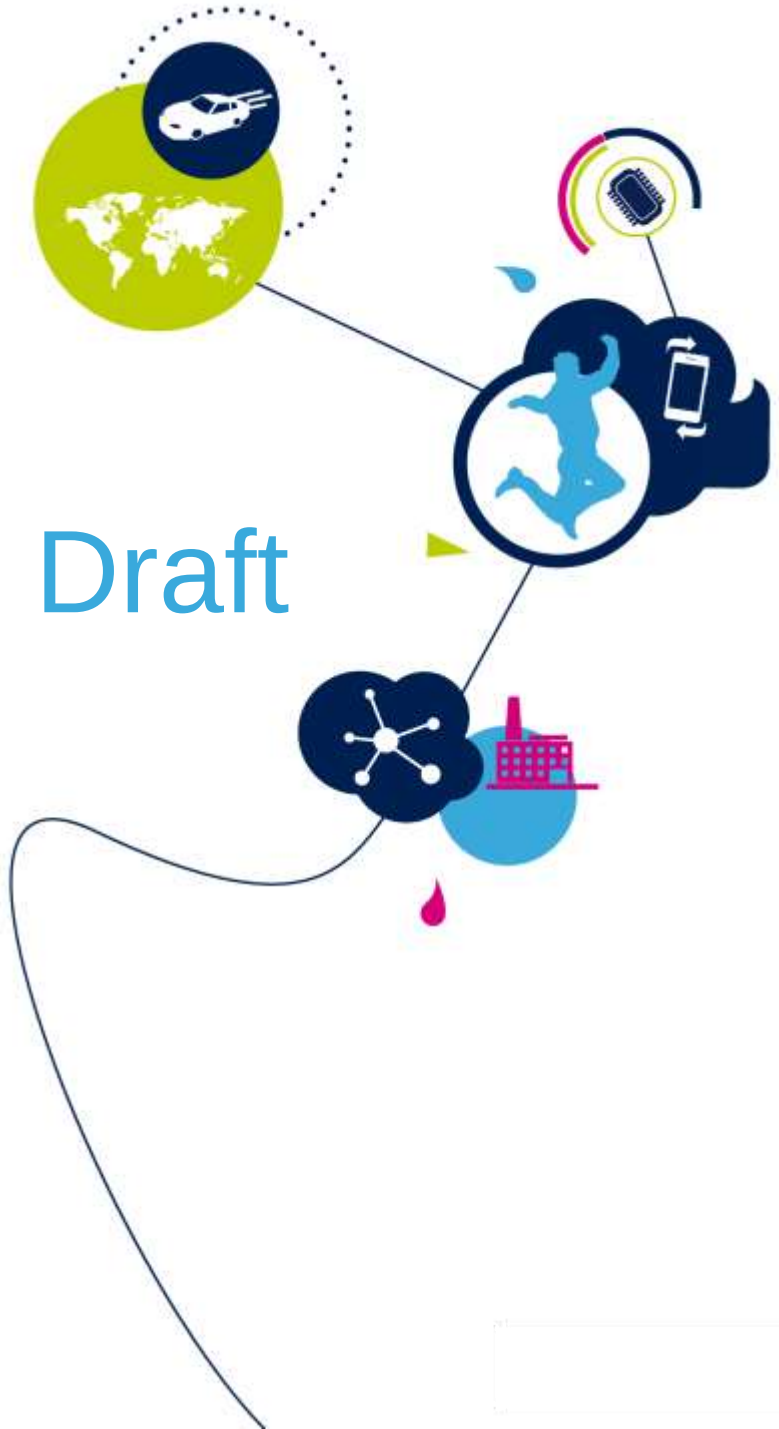

CES 2020 Body Domain Wall Draft

Karl, Aravind, Tom

12/03/19 Update

Revision 0.7

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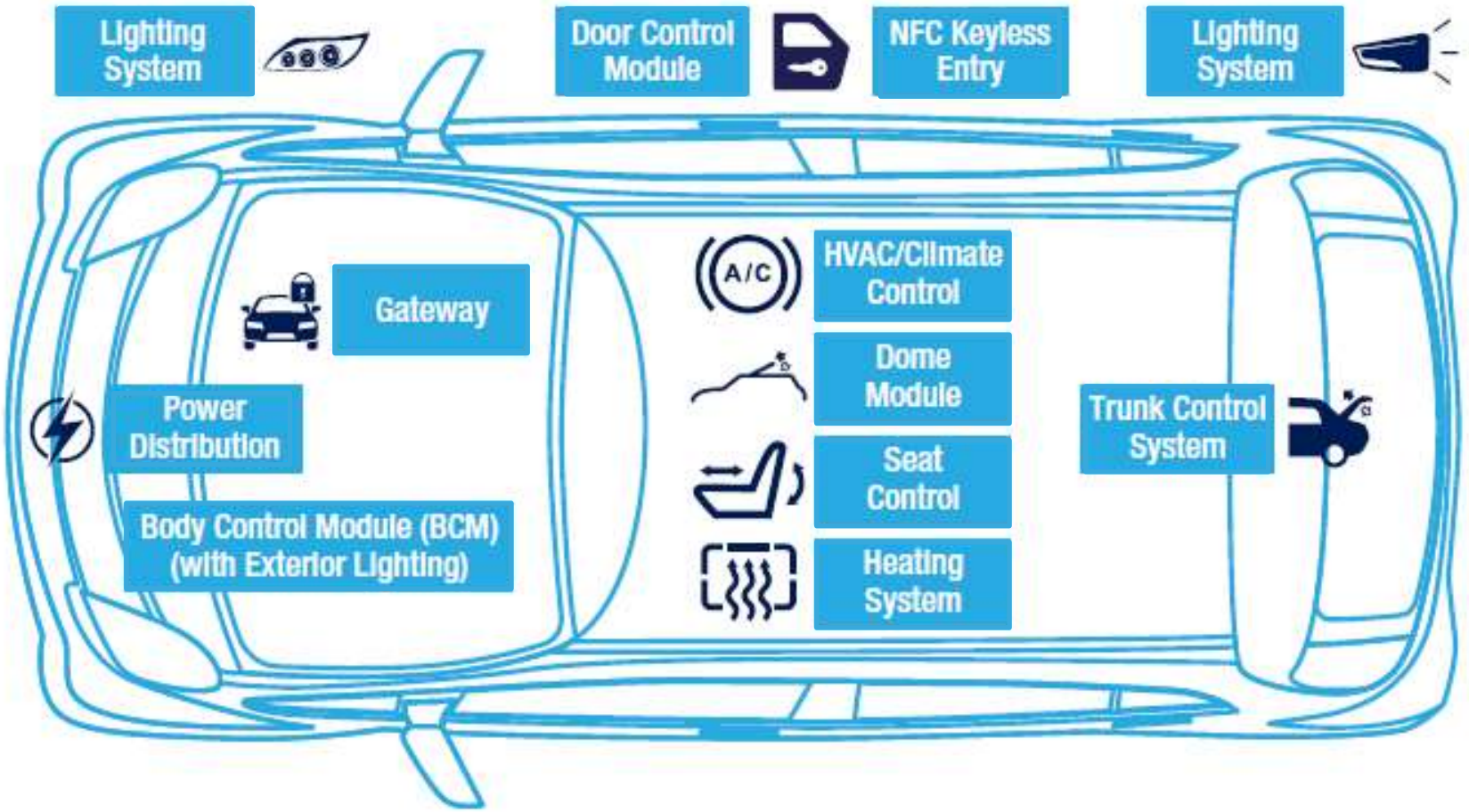
Body Vehicle Domain



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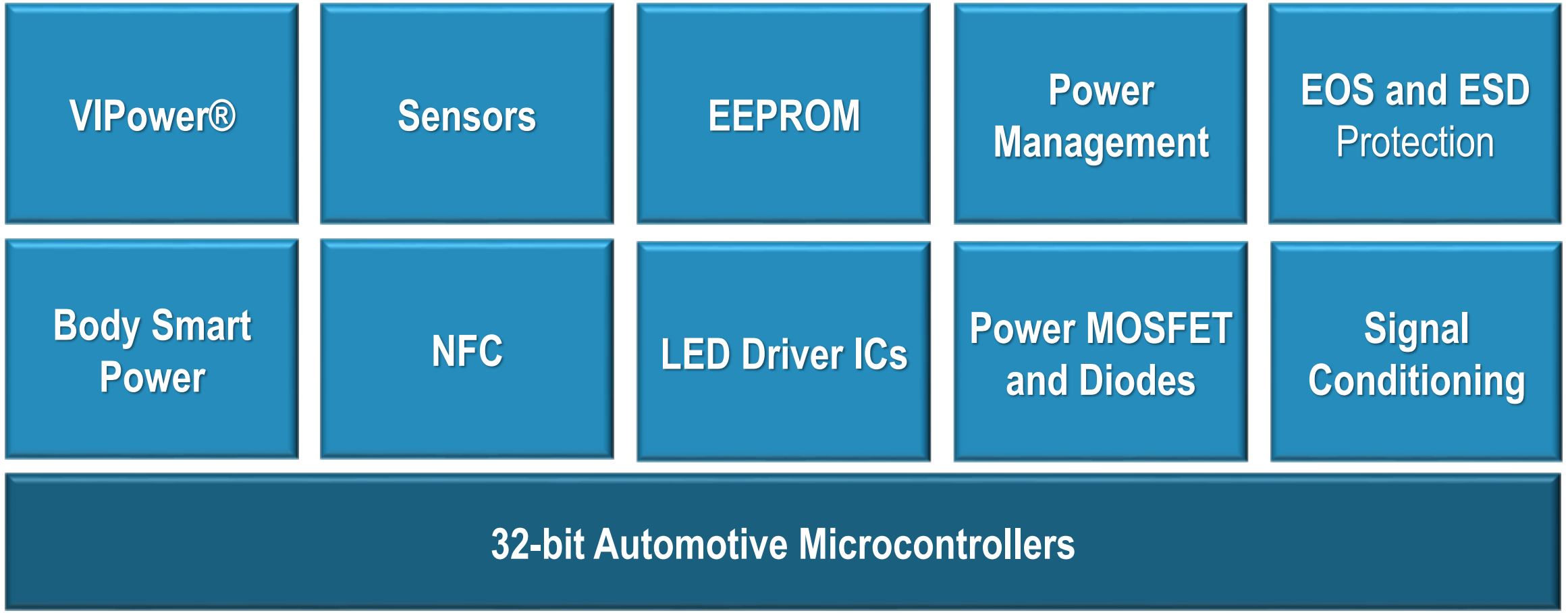
Product Information

Product Information



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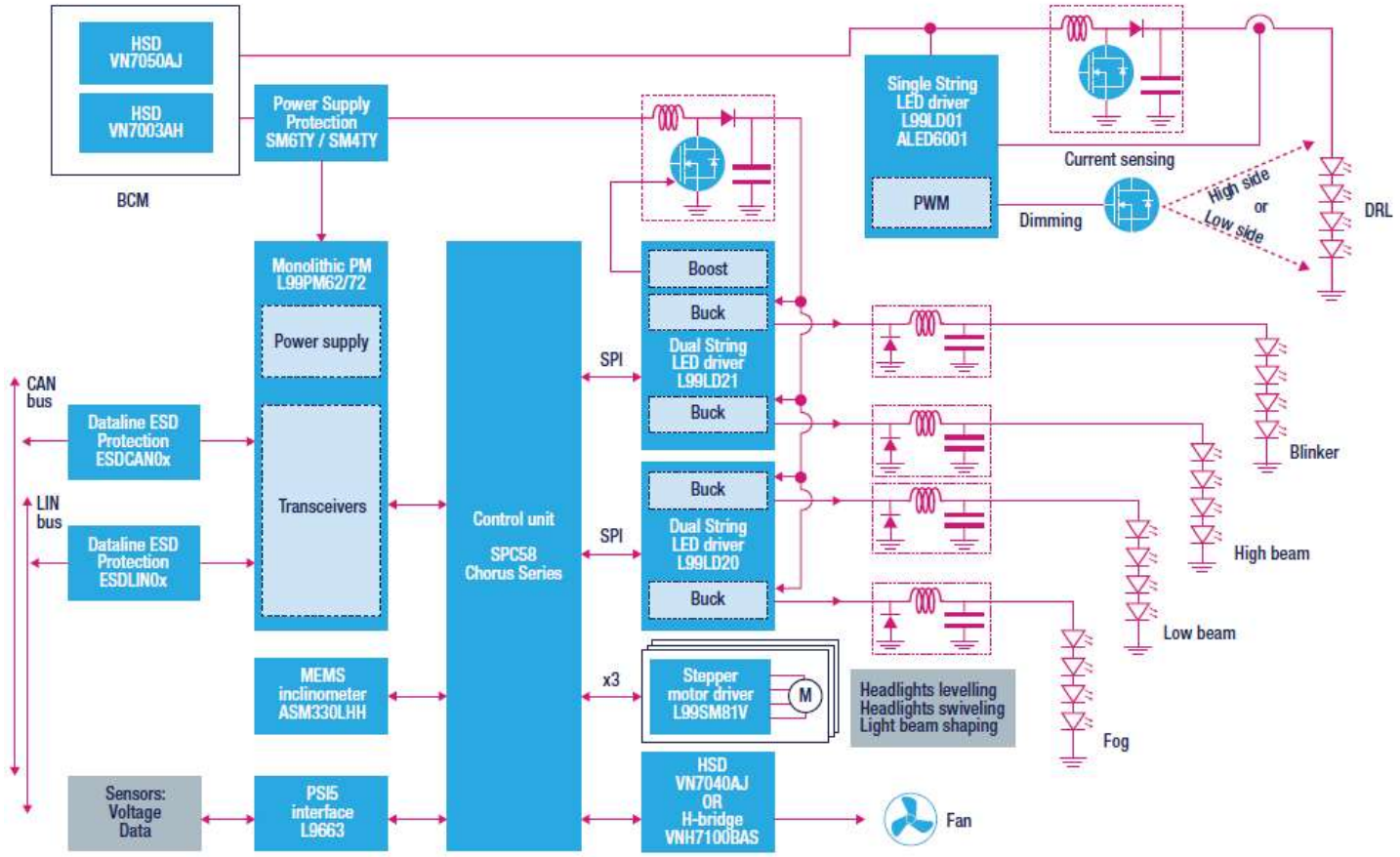
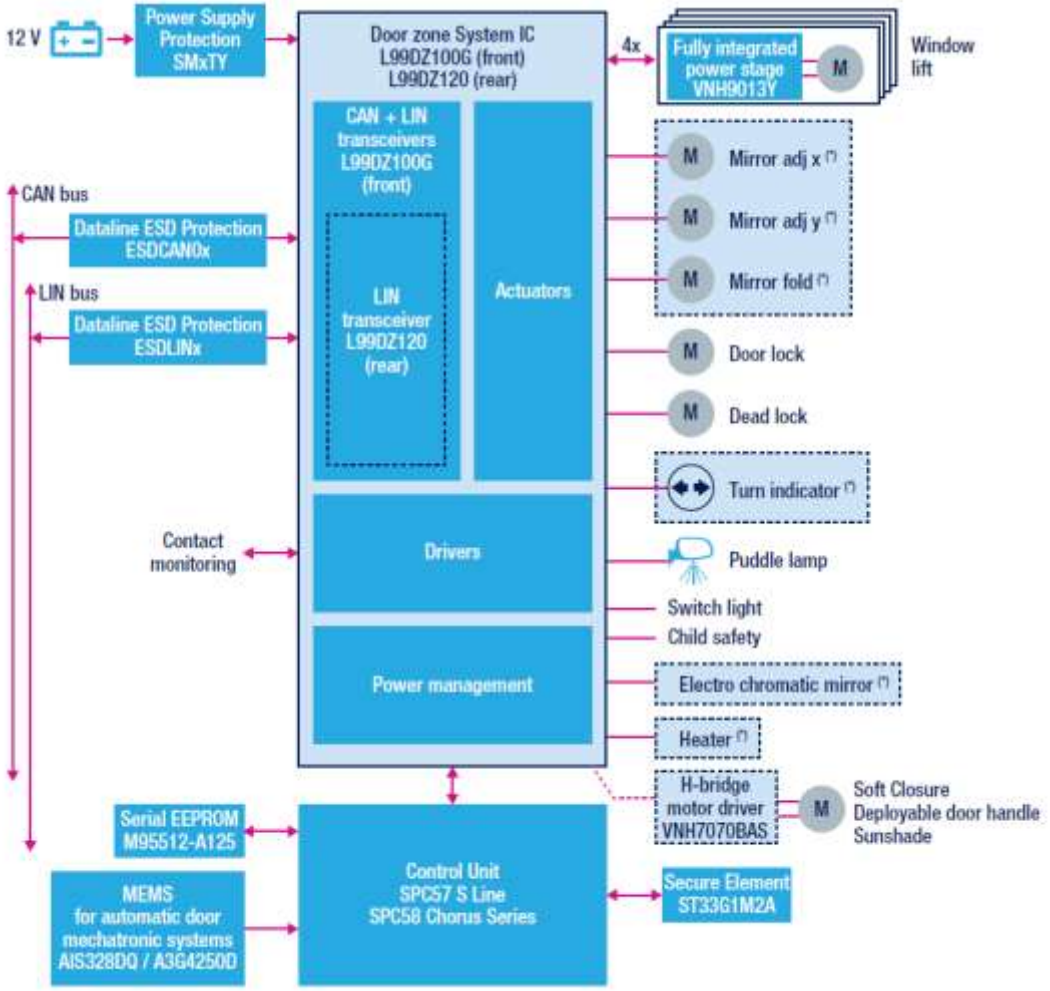
System Information

Lighting System



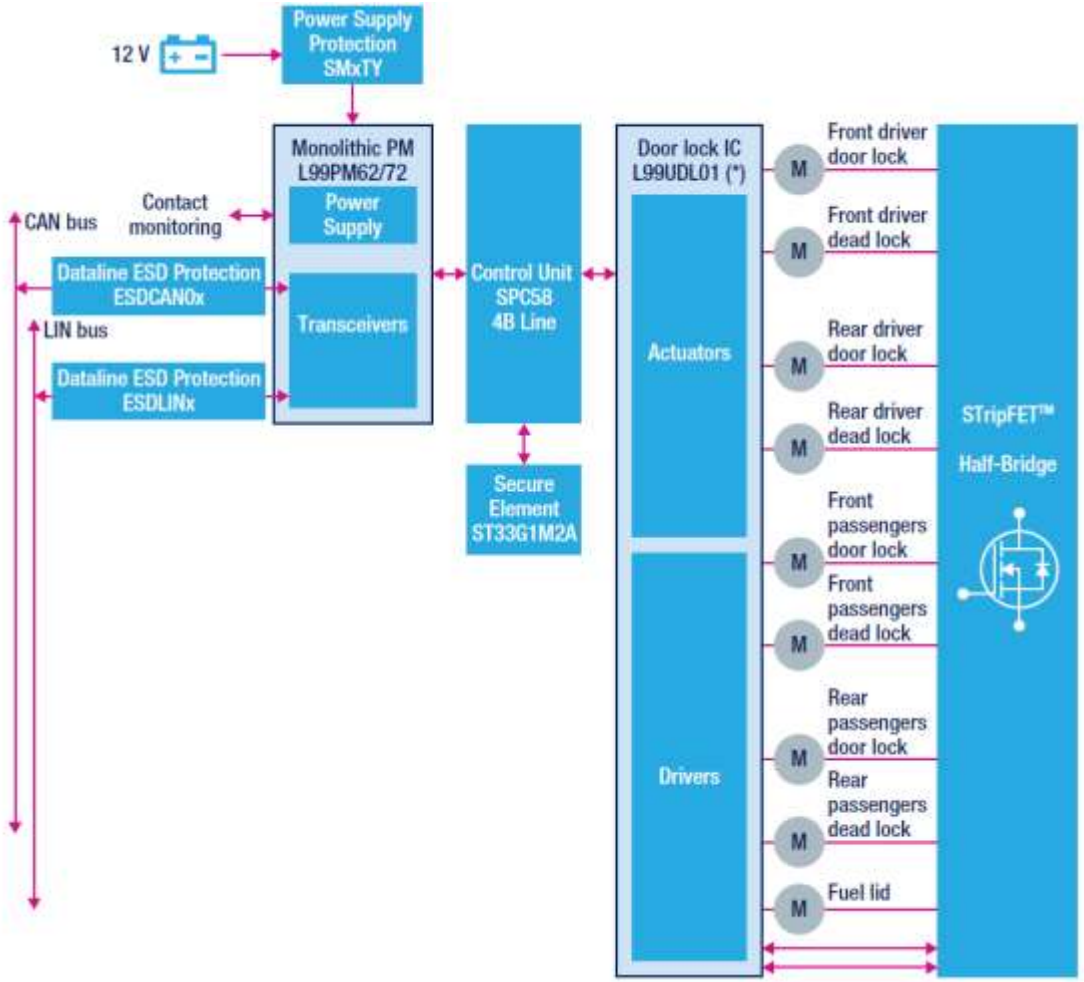
Door Control Module

Decentralized Architecture

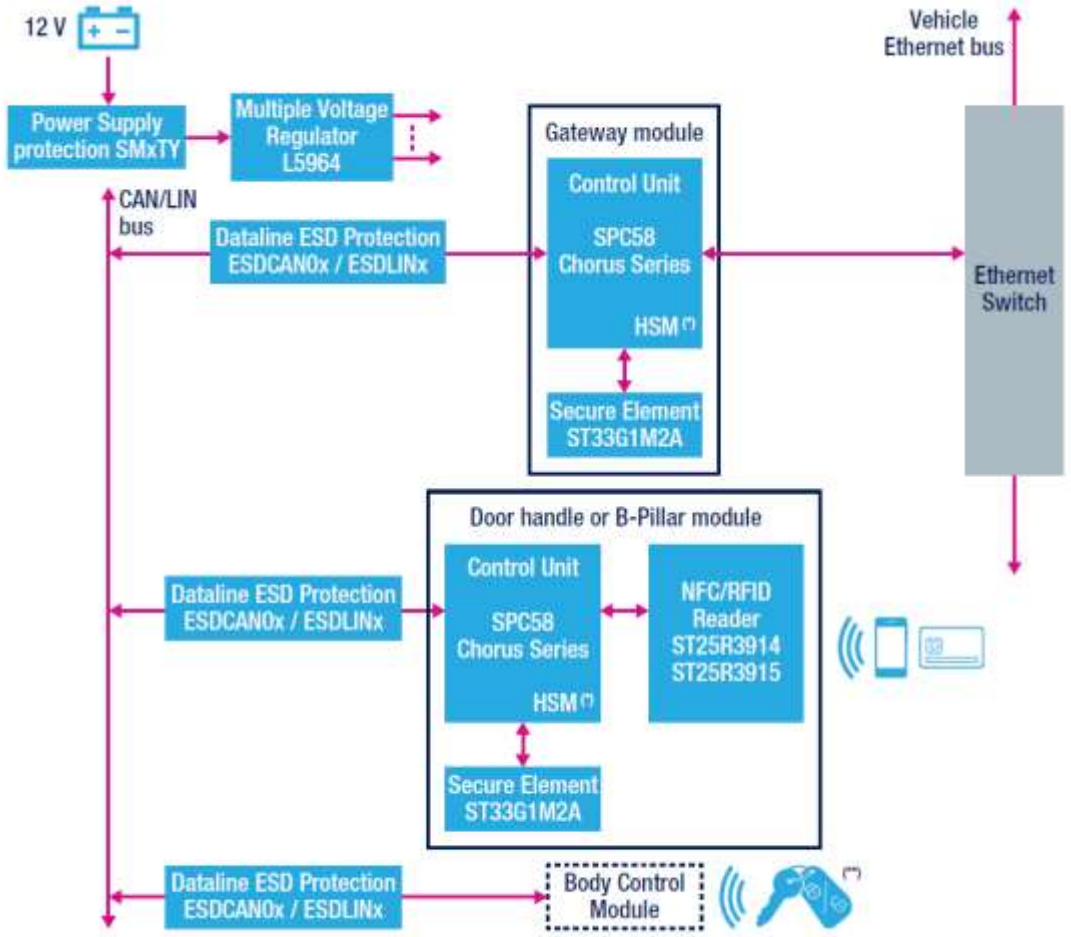


Door Lock

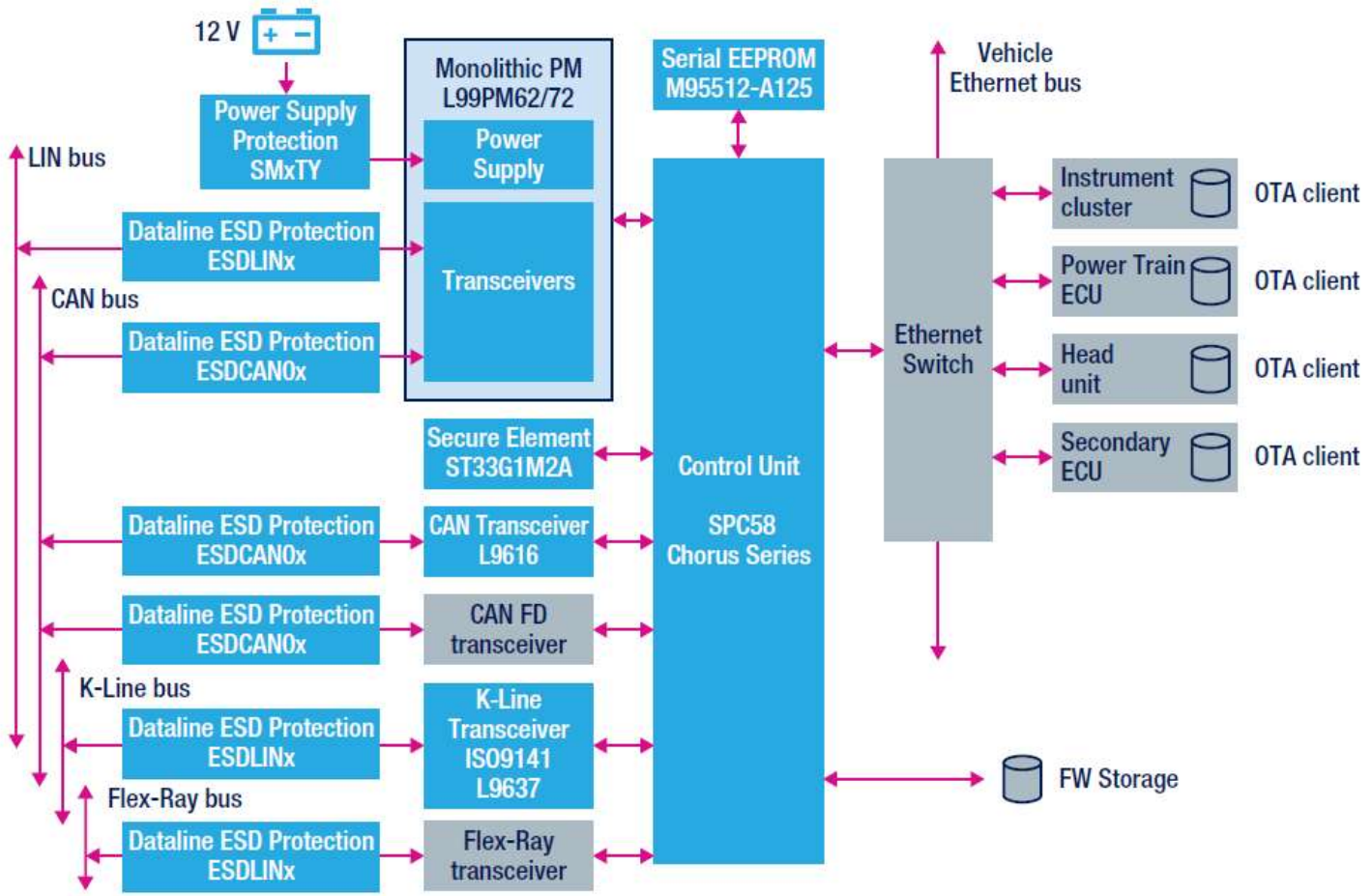
Centralized Architecture



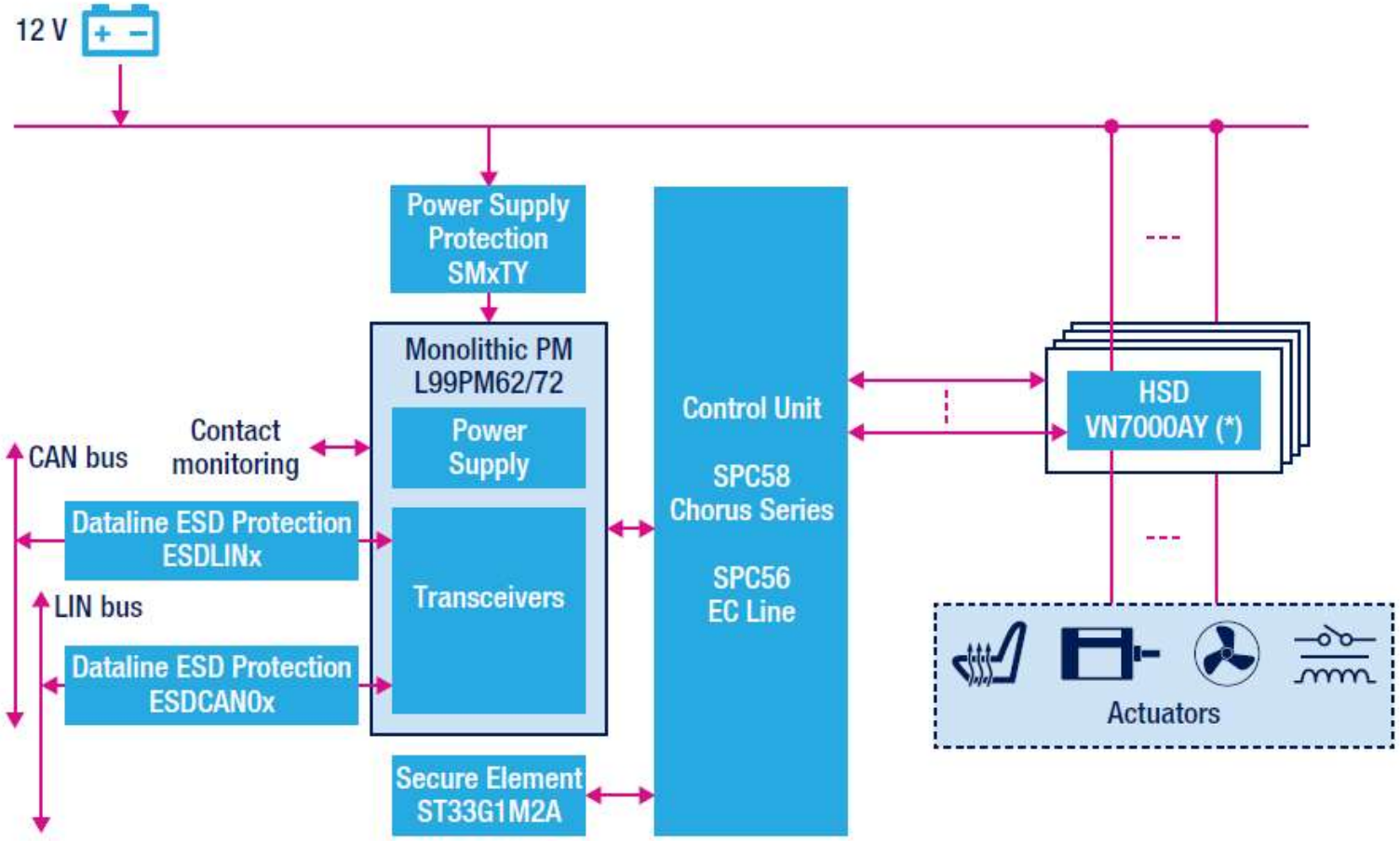
NFC Keyless Entry



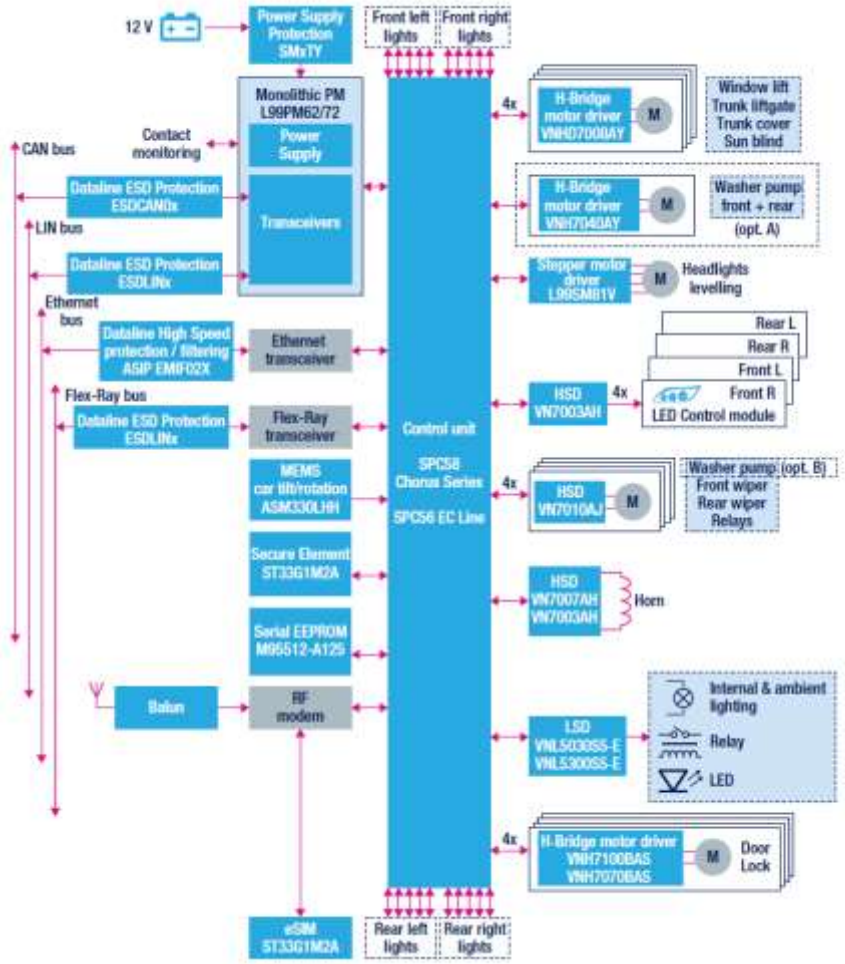
Gateway


12 V
Power Supply Protection SMxTY
Monolithic PM L99PM62/72
Power Supply
Transceivers
Serial EEPROM M95512-A125
Vehicle Ethernet bus
LIN bus
Dataline ESD Protection ESDLINx
CAN bus
Dataline ESD Protection ESDCANOx
Secure Element ST33G1M2A
Control Unit
SPC58 Chorus Series
Ethernet Switch
Instrument cluster
OTA client
Power Train ECU
OTA client
Head unit
OTA client
Secondary ECU
OTA client
Dataline ESD Protection ESDCANOx
CAN Transceiver L9616
Dataline ESD Protection ESDCANOx
CAN FD transceiver
K-Line bus
Dataline ESD Protection ESDLINx
K-Line Transceiver ISO9141 L9637
Flex-Ray bus
Dataline ESD Protection ESDLINx
Flex-Ray transceiver
FW Storage

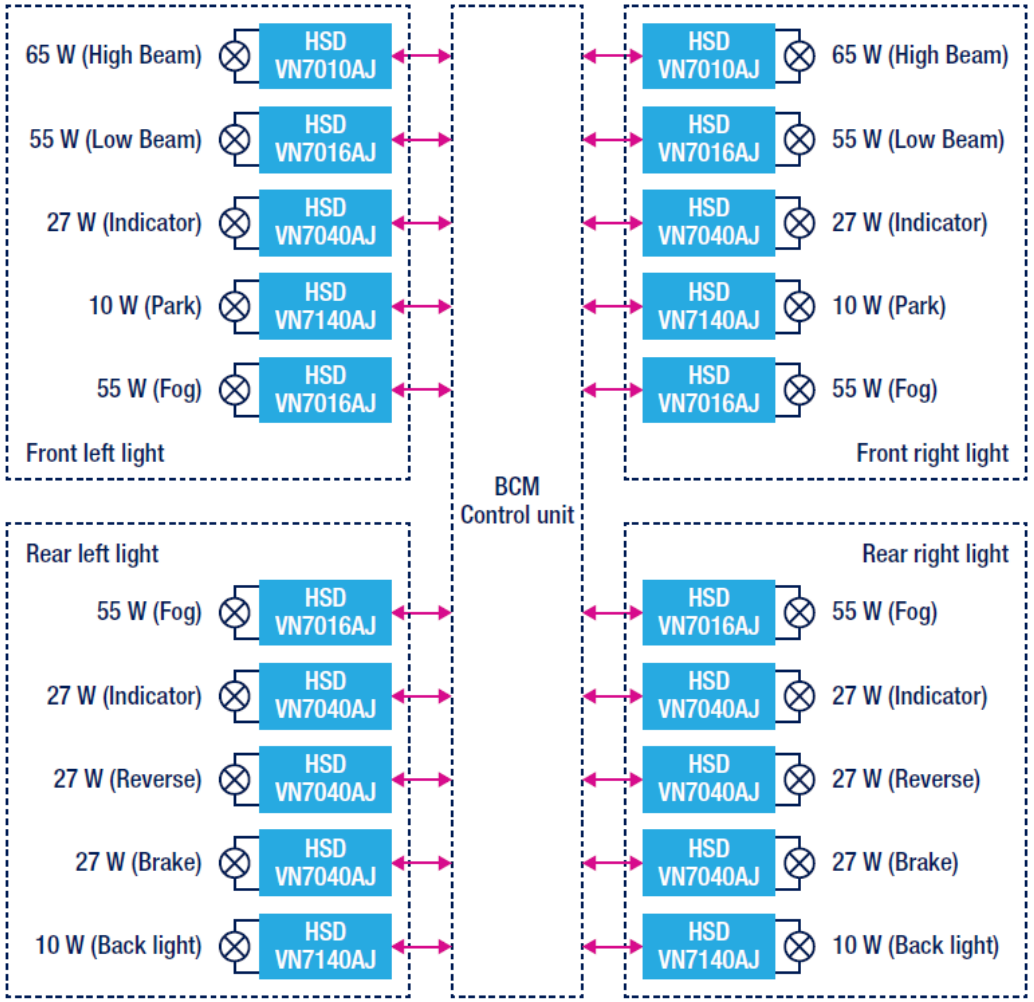
Power Distribution



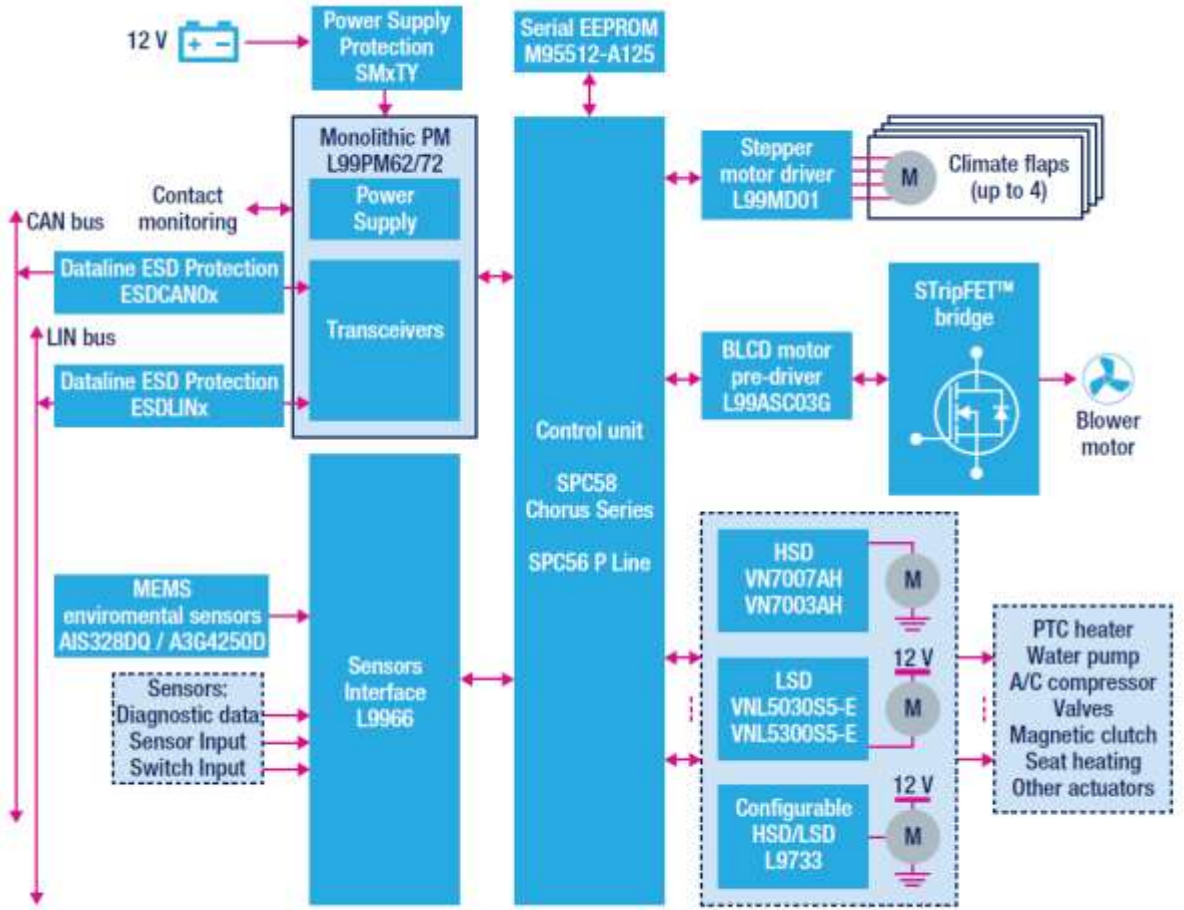
Body Control Module (BCM)



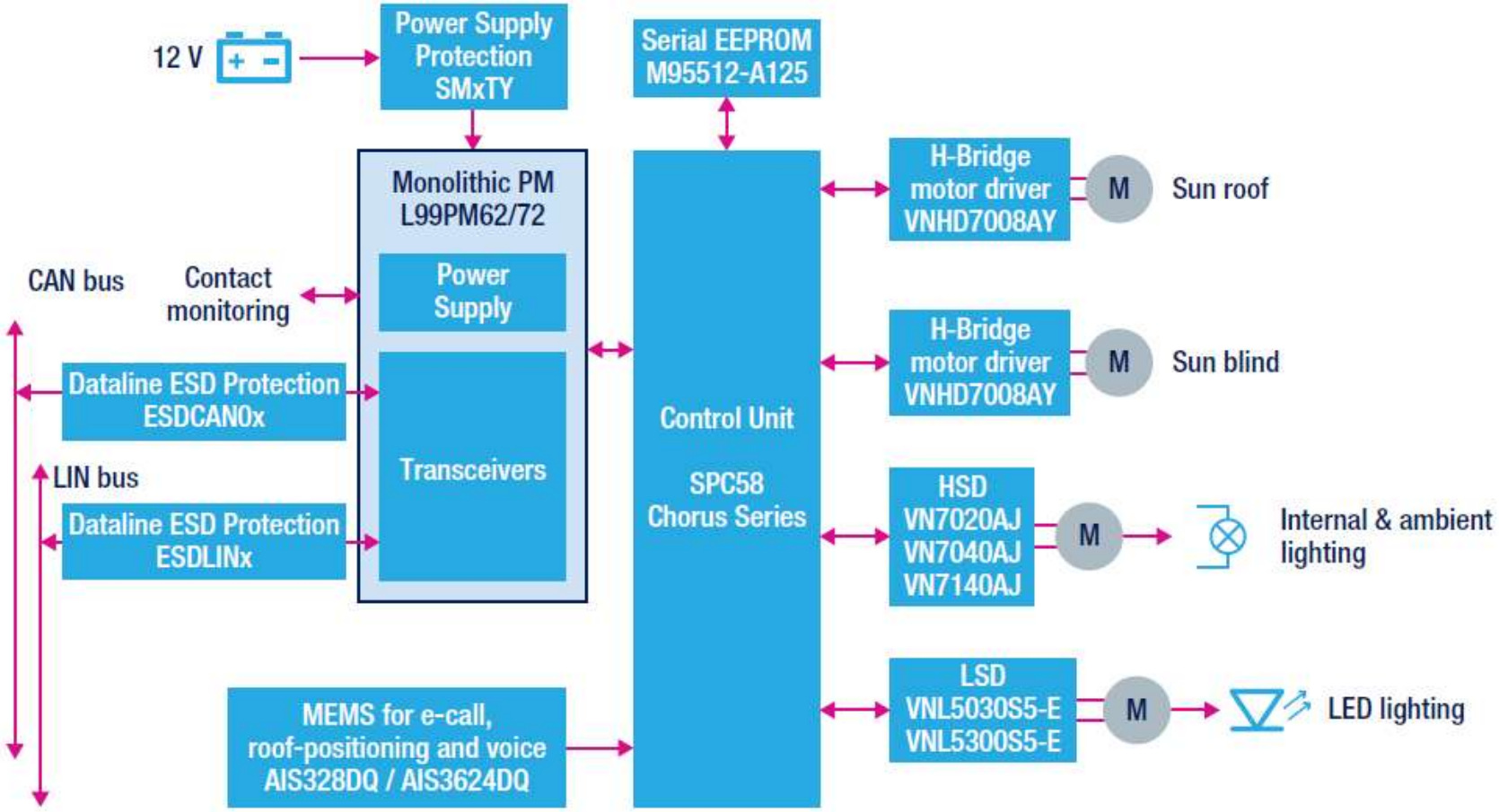
Exterior Lighting



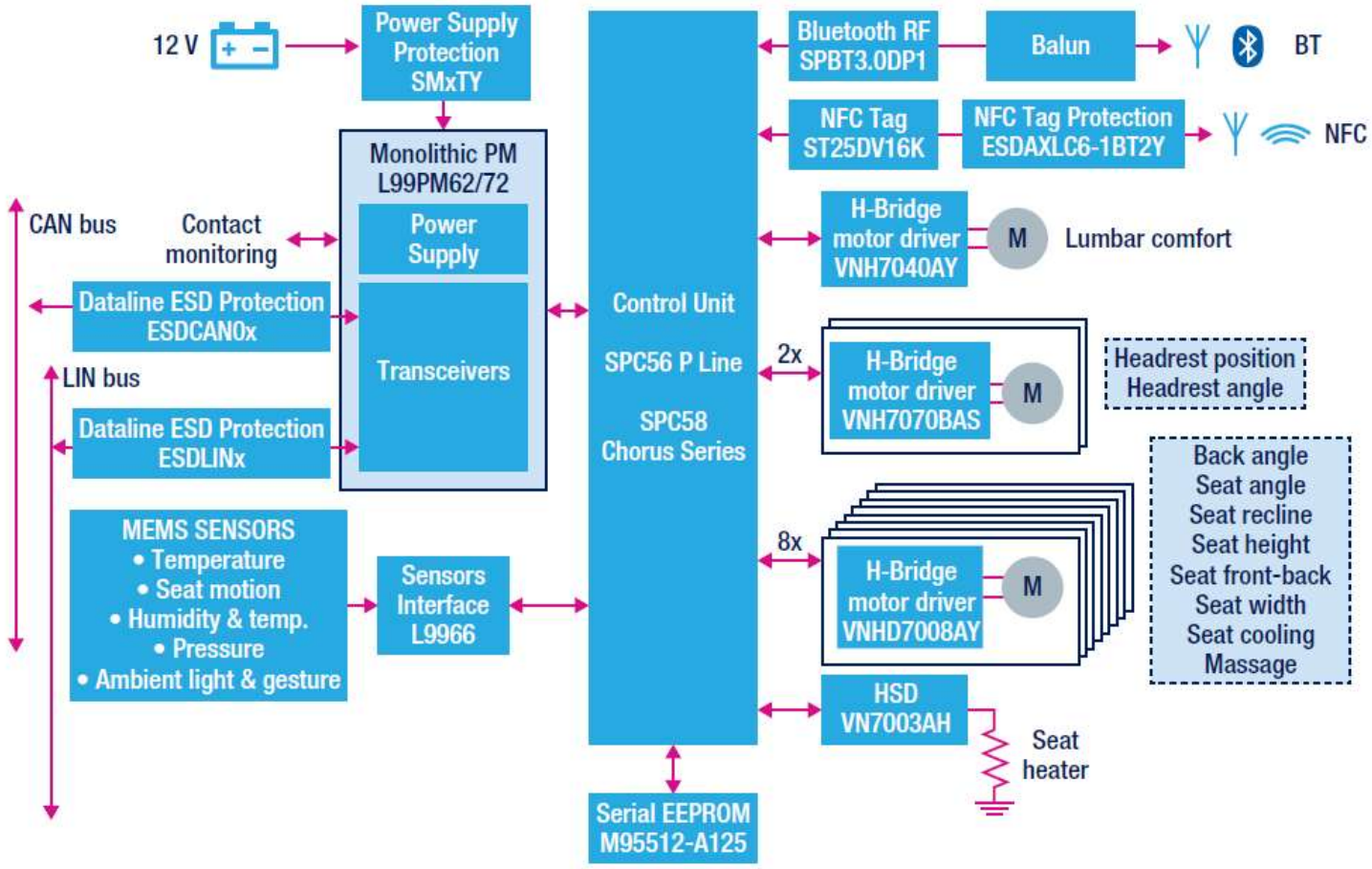
HVAC / Climate Control



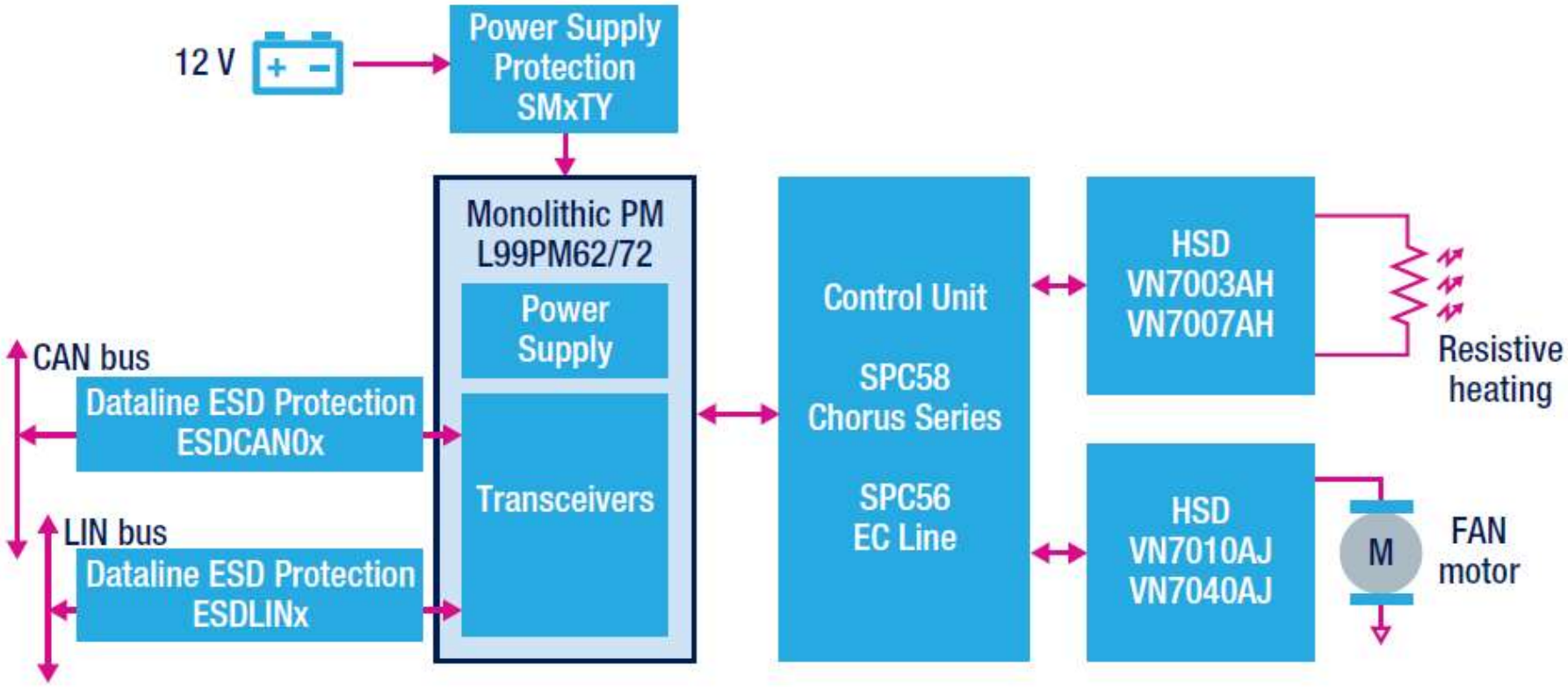
Dome Module


12 V
Power Supply Protection SMxTY
Serial EEPROM M95512-A125
Monolithic PM L99PM62/72
Power Supply
Transceivers
CAN bus
Contact monitoring
Dataline ESD Protection ESDCAN0x
LIN bus
Dataline ESD Protection ESDLINx
MEMS for e-call, roof-positioning and voice AIS328DQ / AIS3624DQ
Control Unit
SPC58 Chorus Series
H-Bridge motor driver VNHD7008AY
M
Sun roof
H-Bridge motor driver VNHD7008AY
M
Sun blind
HSD VN7020AJ VN7040AJ VN7140AJ
M
Internal & ambient lighting
LSD VNL5030S5-E VNL5300S5-E
M
LED lighting

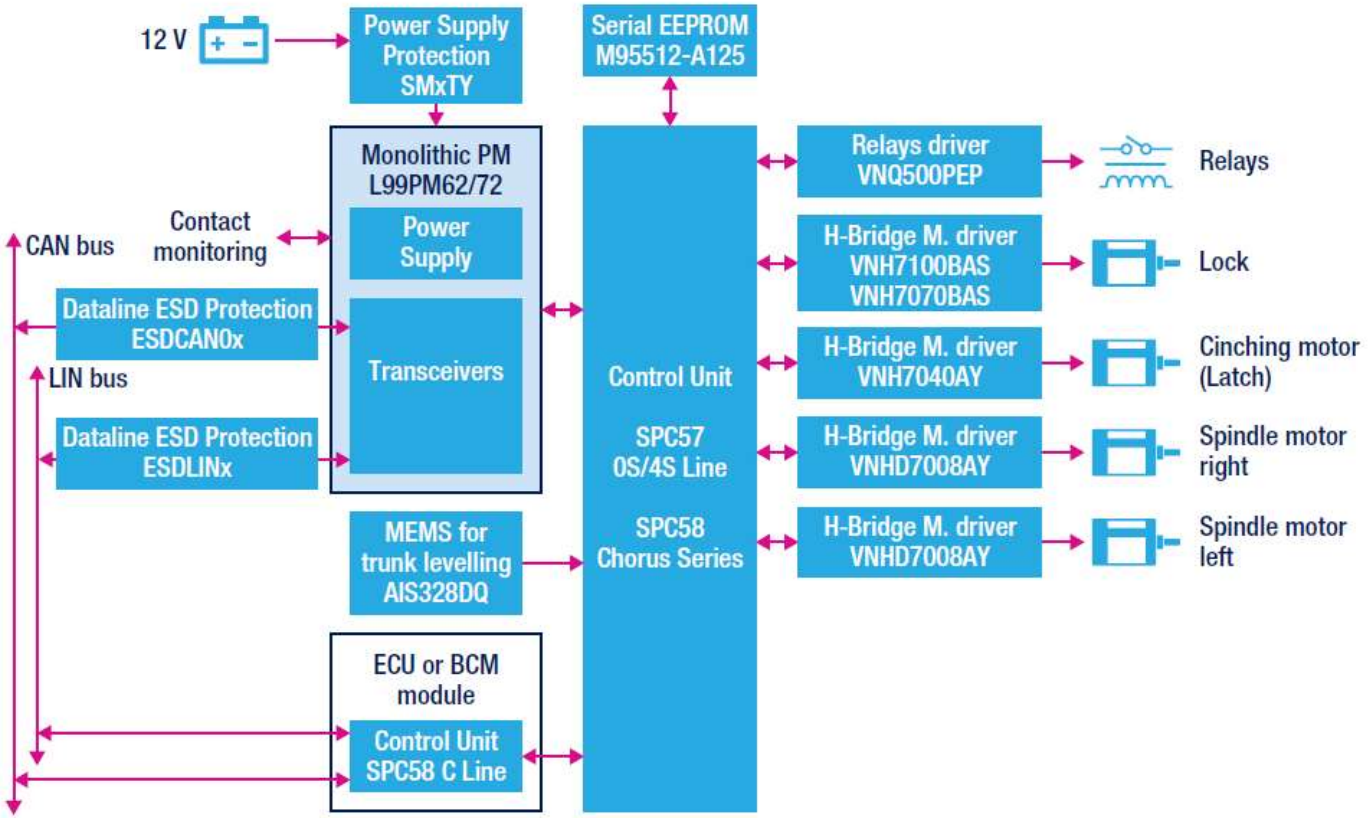
Seat Control



Heating System

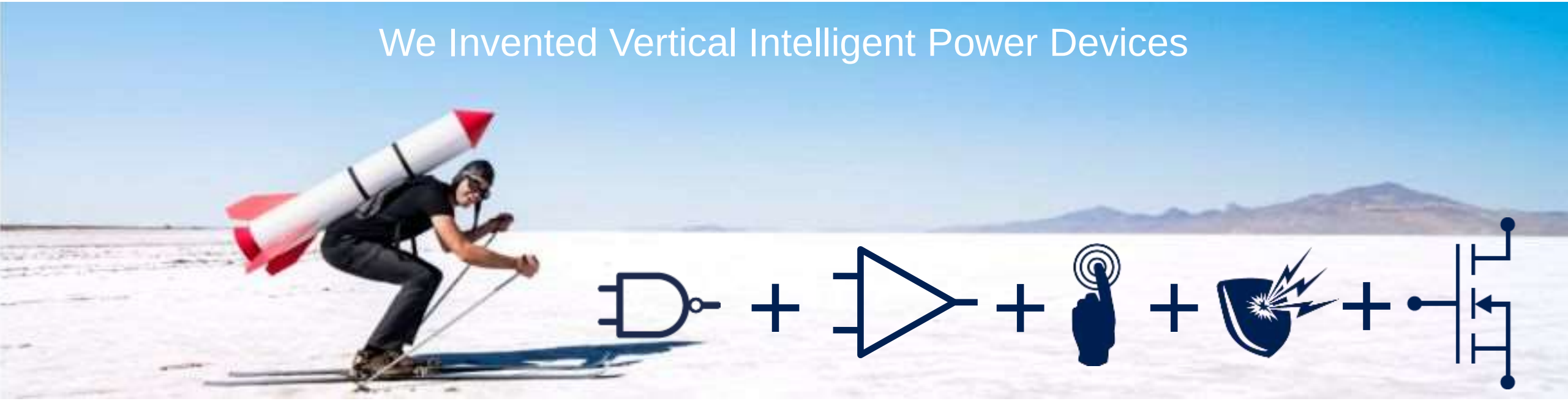


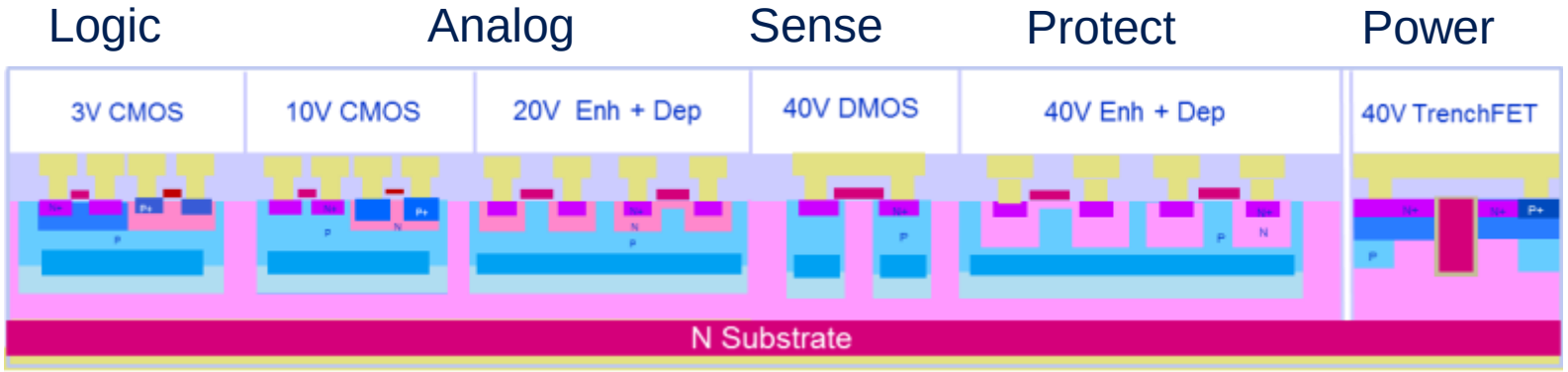
Trunk Control System



VIPower®

Inventors by Nature





VIPower 25 YEARS 1991-2016

VIPower®

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VIPower® M0-7/M0-7E

High Side Drivers

VIPower® M0-7 / M0-7E

VIPower® Zero

Four output channels

VNQ7E110AJ

VNQ7140AJ | VNQ7050AJ | VNQ7040AY

Two output channels

VND7E070AJ | VND7E040AJ | VND7E025AJ

VND7140AJ (*) | VND7050AJ (*) | VND7040AJ | VND7030AJ | VND7020AJ | VND7012AY | VND7004AY

One output channel

VN7E010AJ | VN7007ALH | VN7004CLH | VN7003ALH (*)

VN7140AJ | VN7050AJ | VN7040AJ | VN7020AJ | VN7016AJ | VN7010AJ | VN7008AJ | VN7007AH | VN7004CH | VN7003AH (*)

VN7140AS (*) | VN7050AS | VN7040AS

On-state resistance

140mΩ	50mΩ	40mΩ	30mΩ	20mΩ	16mΩ	12mΩ	10mΩ	8mΩ	7mΩ	4mΩ	3mΩ
2.5A	4A	4.5A	5A	6A	7A	9A	9.5A	10A	13A	17A	20A


PSSO-36


PSSO-16


Octapak


SO-8

M0-7E series (PSSO-16)

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(*) cold cranking capability on specific part numbers in PSSO-12

VIPower® M0-9

SPI High Side Drivers

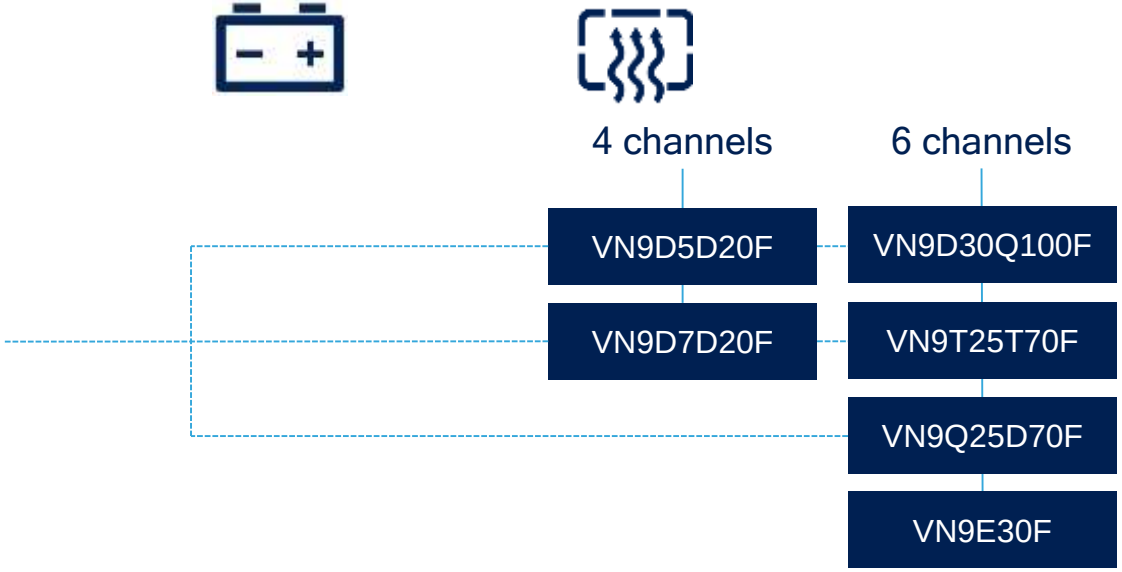
Welcome to Digital Current Sense

- Worlds first family of power HSDs with **Digital Current Sense**
- The **best current sense accuracy** ever reached in a High Side Driver
- The first with **Integrated PWM generation** and **sampling synchronization unit**
- Footprints up to **42% smaller** than the best competitor

Applications

Product line

QFN32L 6x6



VIPower® M0-9

Standard High Side Drivers

Lower $R_{DS(on)}$, Smaller Packages

- M0-9 Standard further extends the largest family of HSDs in the market
- Full **pin-to-pin** and SW compatible with M0-7
- The **best current sense accuracy** ever reached in a High Side Driver
- Incorporated **self turn on** in reverse battery conditions

VIPower HSDs

Applications

Product line

PowerSSO-16

1 channels	2 channels	4 channels
VN9004AJ	VND9800AJ	VNQ9025AJ
VN9006AJ	VND9012AJ	VNQ9080AJ
VN9008AJ	VND9016AJ	
VN9012AJ	VND9025AJ	
VN9016AJ		

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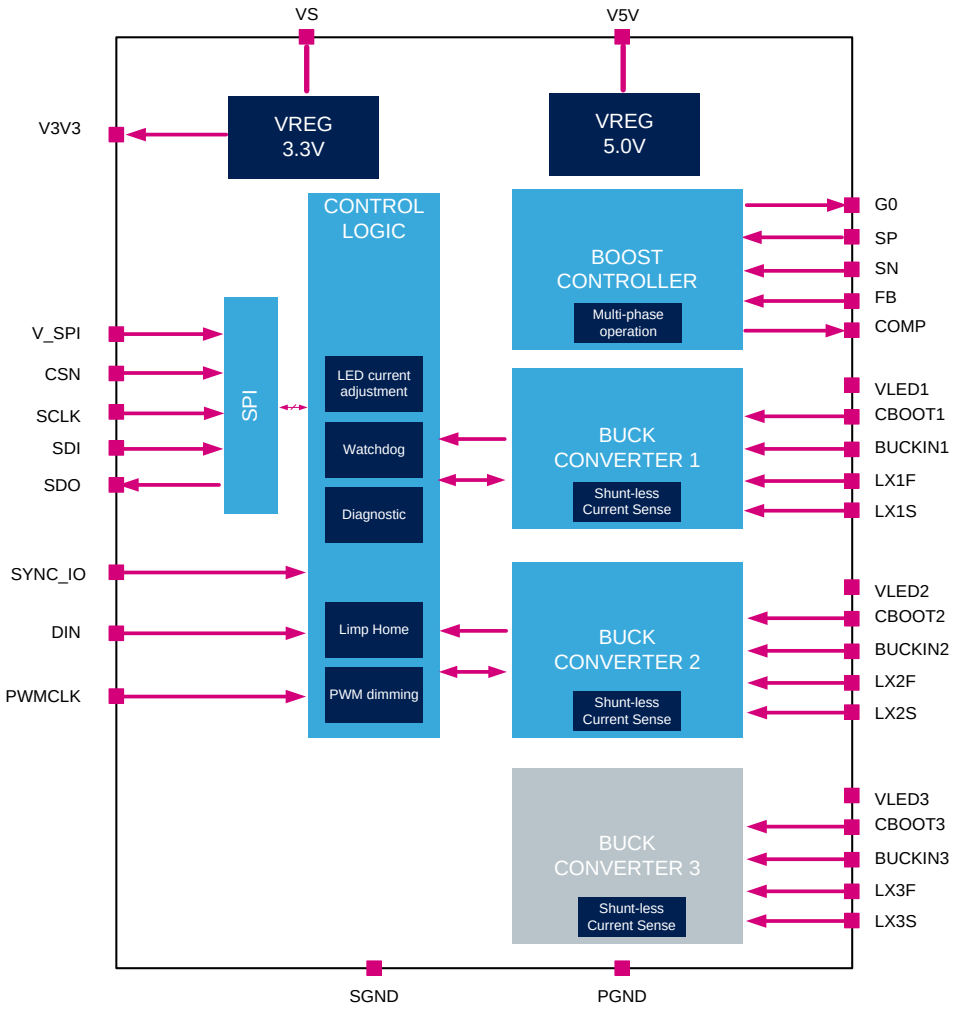
LED Headlight System Solution



Highly Integrated and scalable LED drivers featuring programmability and functional safety

Multiple DC-DC converter integration provides single solution for multi-function front light assembly

Integrated power stage and shunt-less buck converter improves efficiency and reduces cost

Extensive software configurability with **exhaustive diagnostics** provides significant design flexibility

Unique features such as **phase shift** and **fixed off-time architecture** enable optimization of EMC footprint

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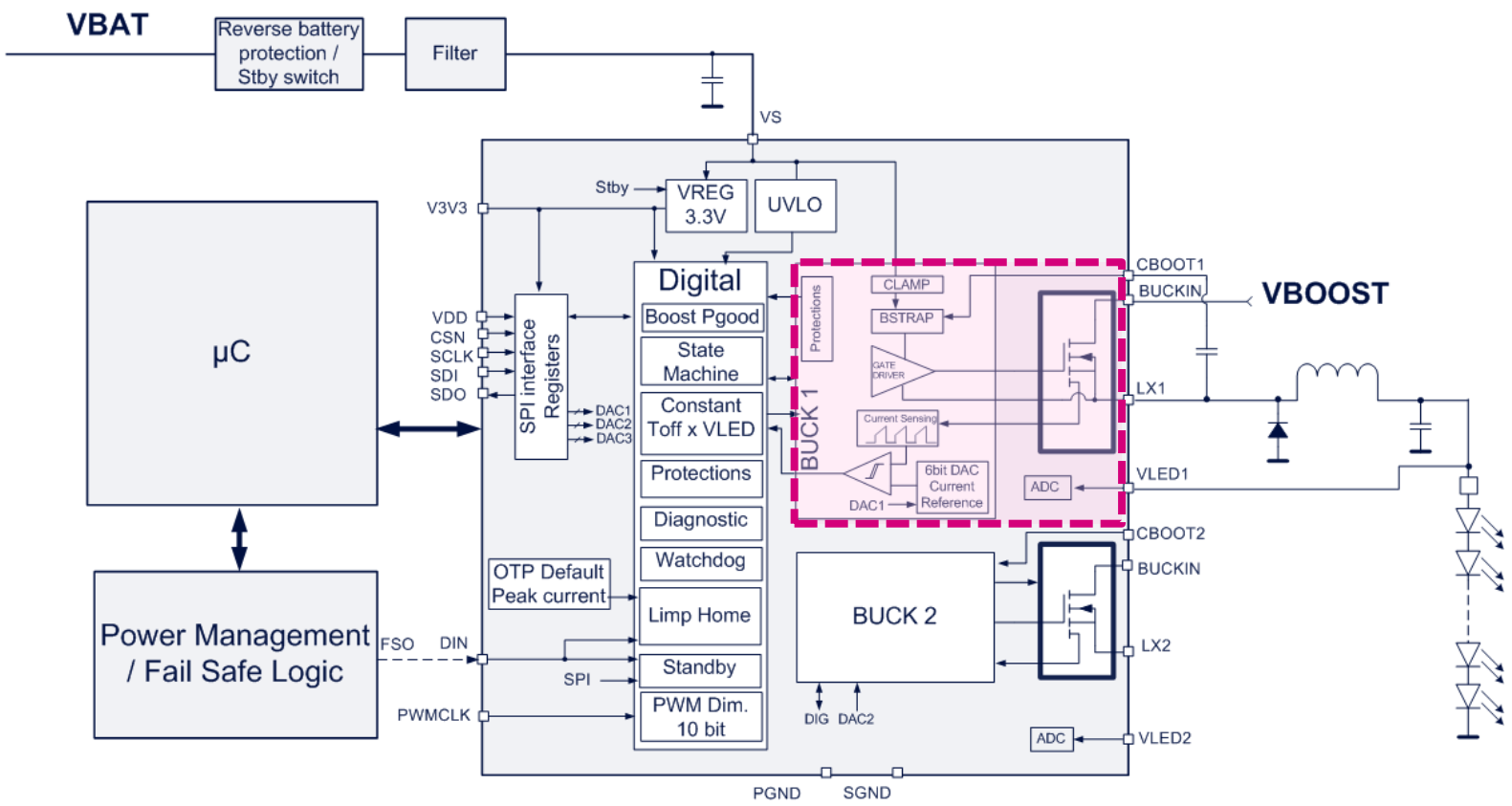
L99LDxy Features

Buck Converter



1 General

- SPI communication
- Timeout watchdog
- Limp home function
- Standby mode **(< 10µA)**
- Tj operating **-40°C … 150°C**

2 Power Stage

- Integrated mosfets **(1.5 A)**
- Built in Current sensing with High side sensefets
- Buck input voltage up to **60V**
- Adaptive off-time architecture

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L99LDxy Features

Buck Converter

3 LED Control

PWM dimming

- Option 1: PWM input (DIN)
- Option 2: Integrated PWM unit
  - 10 bit resolution, up to 400Hz
- 16 combinations of phase shift

SPI adjustable LED current (analog dimming)

- Min / max inductor peak current : 165mA / 1650mA

LED current in Limp Home Mode

- Inductor current programmed by OTP

4 Protections

LED protections

- Pulse by pulse current limitation
- LED string shorted to GND
- Overcurrent detection

Device protections

- Temperature warning with 2 thresholds (130°C and 140°C)
- Overtemperature latch off
- VS undervoltage shutdown: 5.5V rising, 5.0V falling

5 Diagnostics

LED diagnostics

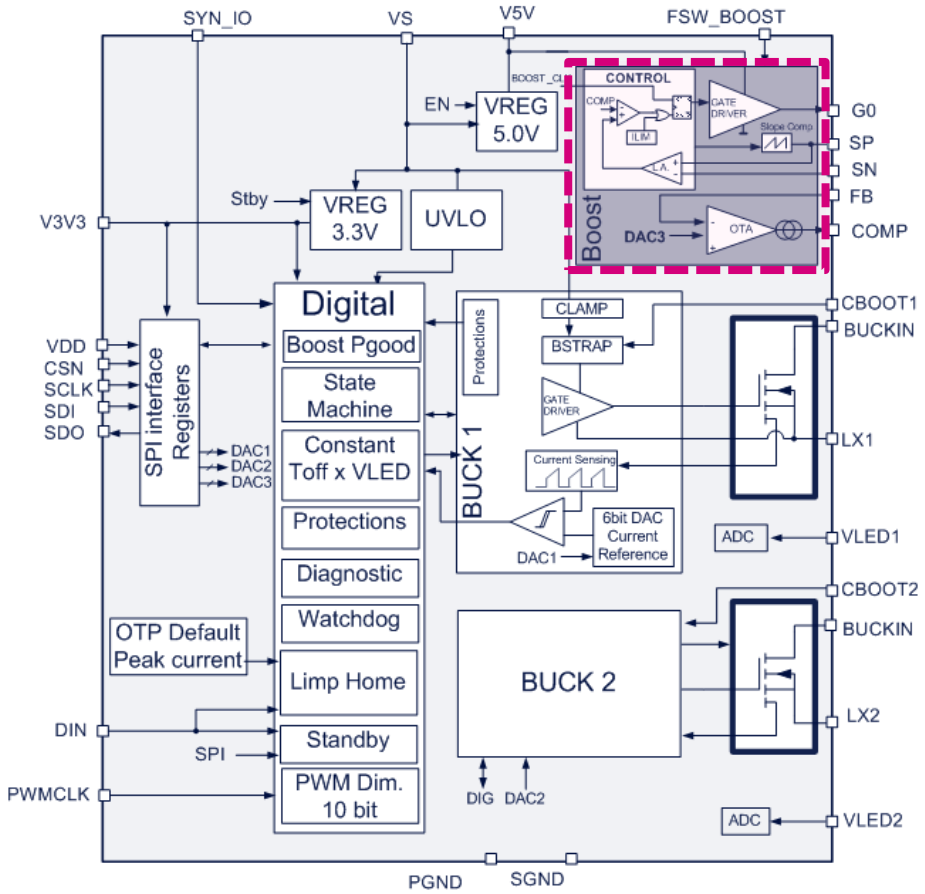
- Shorted LED string to GND
- Open load
- Partial shorted LED through VLED
  - 8 bit resolution, 60V range, +/- 2%
- OFF-state VLED measurement
  - Short between different LED strings
  - Short of anode to VBAT

Device diagnostics

- VS undervoltage
- Temperature warning
- Overtemperature shutdown

L99LDxy Features

Boost Converter



- Soft start
- Gate driver output 5V
- Fixed frequency architecture
  - Frequency setting by SPI
  - 100kHz to 450kHz
- Peak current mode architecture
  - Pulse by pulse current limitation
  - Slope compensation by ext. resistor
  - Dual phase capability with phase shift
- Output overvoltage protection (OVP)
- OVP diagnostic information
- Power health status information

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Body Smart Power

VREGs/
SBCs

Door Zone

Door Locks

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Voltage Regulators

BCD4S BCD5S BIPOLAR	Vo = 5V
BCD9SL	Conf. for 8 fixed Vo

Feature Set

L99VR02XP
Com.Mat. Wk 15 ‘21

L99VR01J
Com.Mat. Wk 11 ’20

L99VR02J
Com.Mat. Wk 02 ‘21

L99VR01S
Com.Mat. TBD

L5150

L5300

L4993
L4979

L4988

L4995

L5050SD

L5050S

L4949

50 | 100 | 150 | 200 | 250 | 300 | 500

Output current (mA)

BSP

Voltage Regulators

New Product Line-up

L99VR01S

CONFIGURABLE FOR 8 FIXED VOUT

ENABLE | RESET

SO-8

L99VR01J

CONFIGURABLE FOR 8 FIXED VOUT

ENABLE | RESET

WD | Thermal Warning

Ishort CTRL

POWERSSO-12

200 mA

L99VR02J

CONFIGURABLE FOR 8 FIXED VOUT

ENABLE | RESET

WD | Thermal Warning

Ishort CTRL

POWERSSO-12

500 mA

L99VR02XP

LDO1 8 CONF. FIXED VOUT | LDO2 8 CONF. FIXED VOUT

ENABLE | CONF. RESET

WD | Thermal Warning

Ishort CTRL | Thermal Clusters

POWERSSO-36

2x250 mA

Output Current

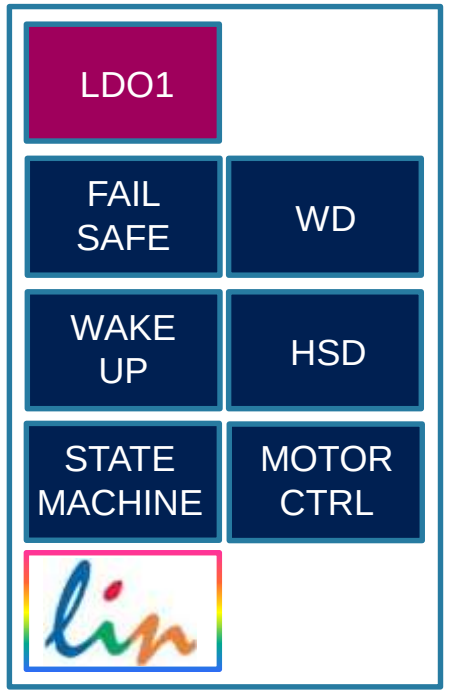
Automotive Power Management ICs

Portfolio Review

Power Management Line up

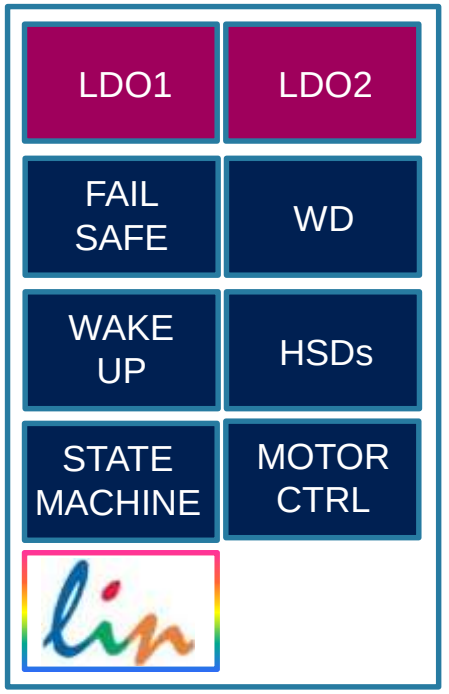
L99PM60J

Motor Control, LIN, Vreg, HSDs



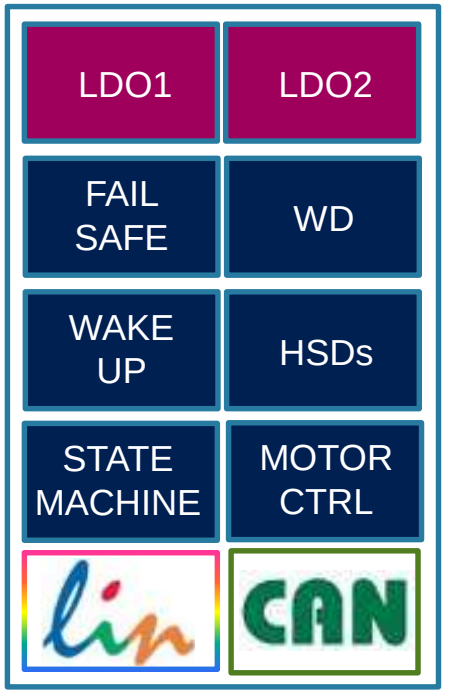
L9952GXP

Motor Control, LIN, Vregs, HSDs Wakeup, Opamps, etc



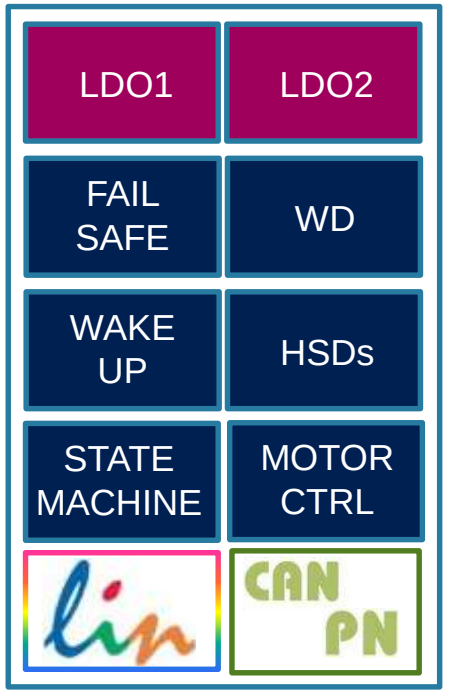
L99PM62GXP

Motor Control, LIN, CAN, Vregs, HSDs Wakeup, Opamps, etc

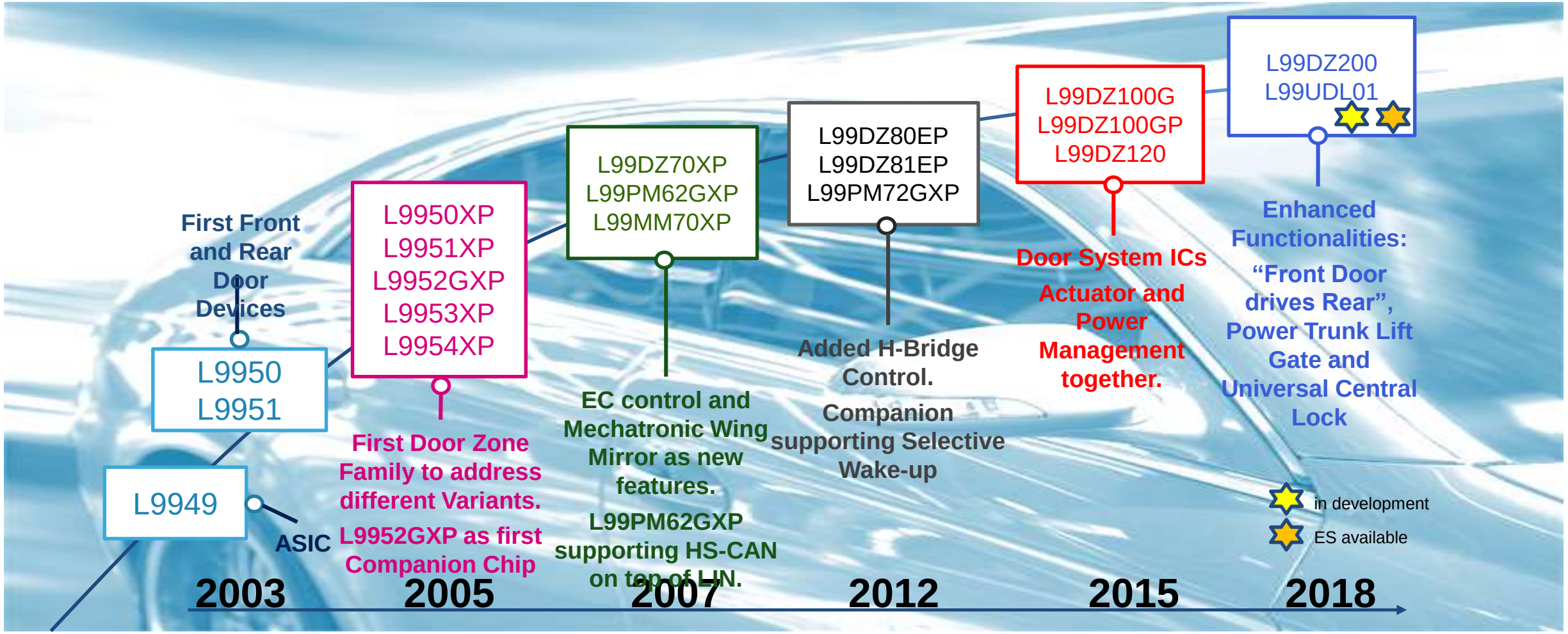


L99PM72GXP

Motor Control, LIN, CAN-PN, Vregs, HSDs, Wakeup, Opamps, etc



Door Zone
Road Map



BSP

Door Zone: L99DZxxx Roadmap

L99DZ100GP (Front Door)

Power window, door-lock, door lights

Mirror heater, adjust, fold and EC control

L99DZ1xx family members are 100% HW and SW compatible to support a customer platform development

In Development

L99DZ100G (Front Door)

Power window, door-lock, door lights

Mirror heater, adjust, fold and EC control

L99DZ120 (Rear Door)

Power window, door-lock, door lights

L99DZ200 (Front Drives Rear)

Dual H-bridge gate drivers, door lights

Mirror heater, adjust, fold and EC control

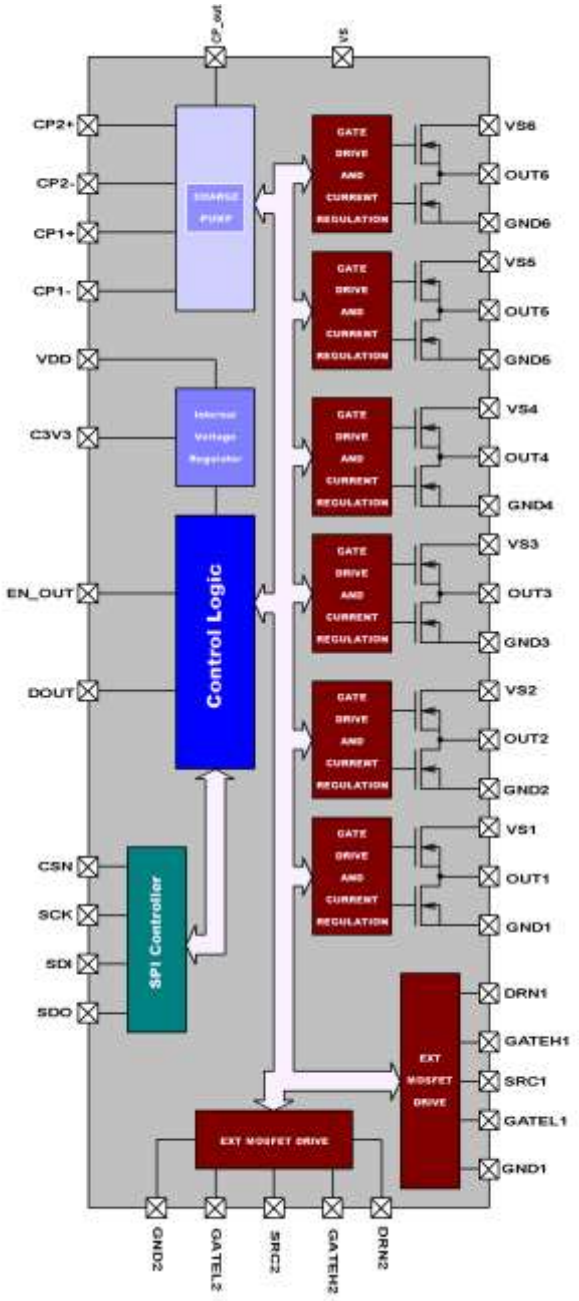
Front-drives-Rear Power Trunk Lift Gate

BSP

Door Lock

Door Lock IC: L99UDL01

Block Diagram/Features



Charge Pump

- 2 Stage
- 5 pins

Control logic

- Fully programmable

SPI I/O

- 16 bit
- 17 registers

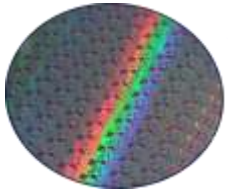
6 Half Bridges

- Power Stage: 90 mΩ per FET
- Current regulation loops for each HSD and each LSD
- Mechanism for paralleling up to 2x3 outputs

External MosFET Control

- Flexible loading
- Programmable V_{DS} monitor

Package:
Power-TQFP64L



Process:
BCD8S Auto

BSP

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Automotive MEMS Sensors

for Smart Driving

Non-Safety	Airbag	Active Safety	Autonomous Driving
			

ISO26262 — **FUNCTIONAL SAFETY / ASIL**

AEC-Q100

MEMS Sensors vs Safety Requirements

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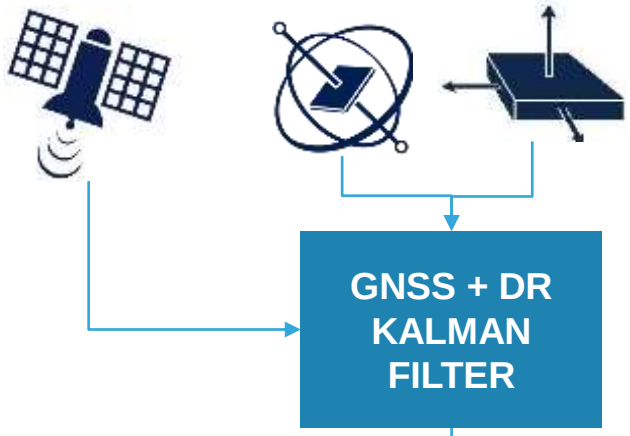
Smart Driving

Sensors for Smart Driving

Focus Applications

Navigation

6DOF IMU as GNSS assistant for Inertial Navigation System



Precise Positioning

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TBOX

On Board Diagnostic

Driving Style

Insurance Boxes

Shock detection

Anti-theft

Inclination

eCall

Voice

Passive Key Entry

Low power Accelerometer for Passive Key Entry

Accelerometer

User Interaction
Detect walking type

SECURITY
Detect no move

Battery saving
Detect no move

ASM330LHH for Accurate Navigation

Temperature Features

Extended Temp. Range: up to **+105°C**

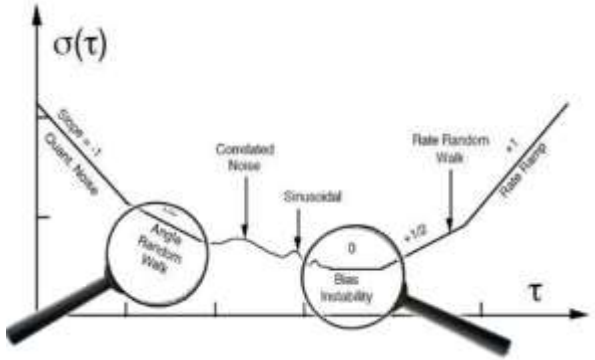
High Resolution: **256 LSB/°C**

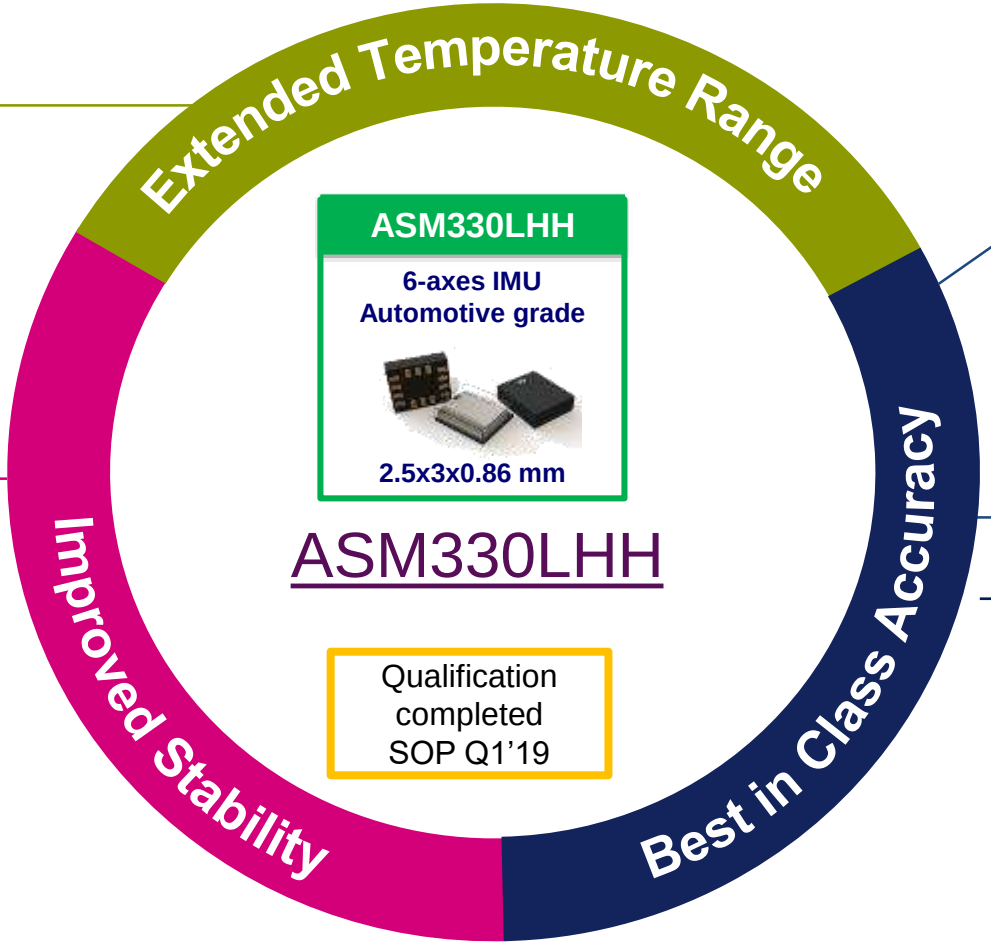
Stability Features

Typ. Angular Random Walk (ARW): **0.21 deg/√h**

Typ. Bias Instability (BI): **3°/hr (High accuracy)**

Stability: **Over time & Temperature**





Accurate Navigation

Accuracy 1st

Accelerometer range	2/4/8/16 g
Gyroscope range	125 dps to 4000 dps
Typ current	1.3 mA (6 axis)
FIFO	3kb
Accelerometer noise density	60 ug/√Hz
Gyroscope noise density	5 mdps/√Hz

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AIS2IH: High Performance Low Power

Automotive Grade Accelerometer

Features

- #3 axis
- Selectable FS ±2/ ±4/ ±8/ ±16 g
- Low noise (90µg/√Hz)
- Ultra low power: 120µA in HP mode
- ODR up to 1600 Hz
- 2 independent programmable interrupt
- FIFO 32 level

Benefits

- Flexibility between High performance and Low power in the same device
- Motion and acceleration detection embedded
- Data storage (FIFO)
- LGA wettable flanks

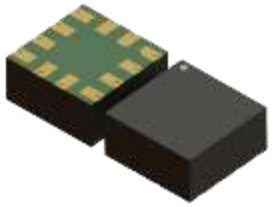
Applications

- Anti-theft device / Car Alarm
- Inclination/orientation detection
- In-dash car navigation
- Telematics and black boxes
- Motion-activated functions

Status: Under Development

AEC-Q100 compliant

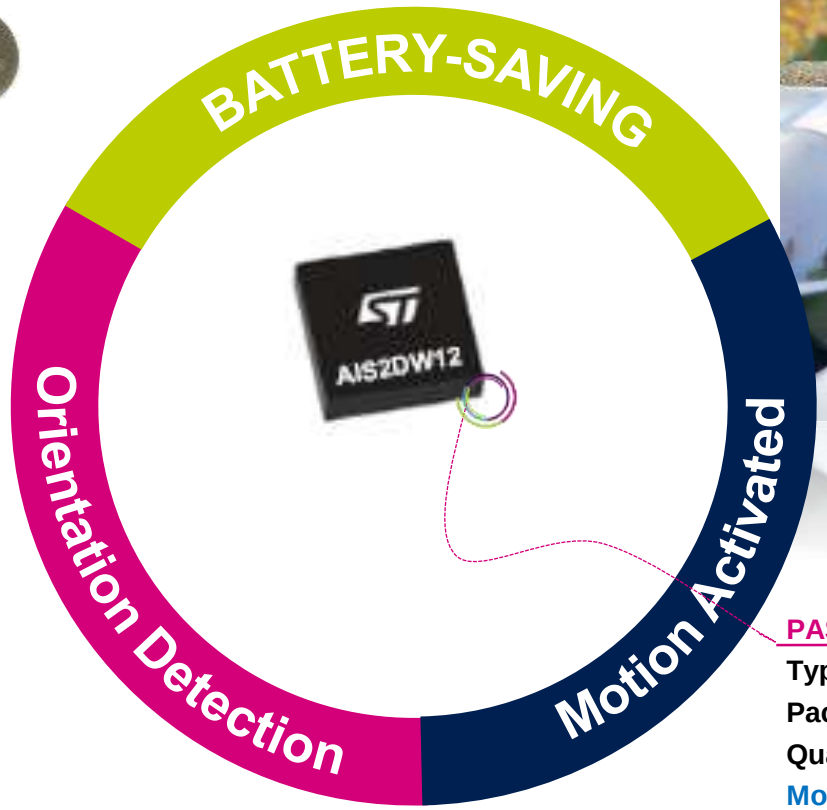
PPAP level-3



LGA-12
2x2x0.93 mm³

ST MEMS for PKE Application

Application Benefits



3D

PASSIVE KEY ENTRY

Typ Cur Cons: <1uA @3V @1.6Hz

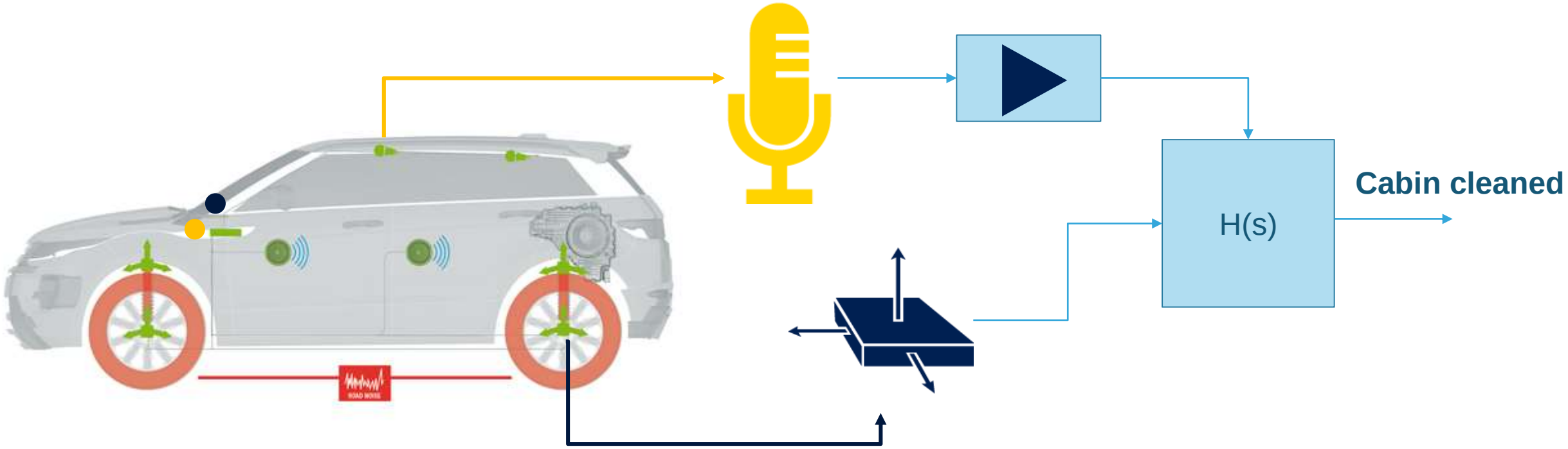
Package: 2x2x0.93mm³ **wettable flanks**

Qualification: AEC-Q100

Motion / no-motion detection

Audio and Motion Fusion

…Vehicles Cabin Noise Cancelling Application



Background: Road noise is picked up by accelerometer and microphones allow the engine to estimate the transfer function from vibration to noise into the cabin. 180° shifted signal is finally injected into the cabin to cancel the noise

Product requirements

- Accelerometer with wide bandwidth
- High SNR, High AOP microphone

MEMS Microphones

Mobile Accessories

MP23ABS1

Flat Frequency
Highest fidelity

Industry standard
3.5x2.65x0.98, 5Leads

ST Advantage:

- Lowest roll-off (15Hz)
- Best in class AoP (130dB)
- Very Low current consumption

IoT

MP23ABS1
MP23DB01HP*

Performance
Highest fidelity

Industry standard
3.5x2.65x0.98, 5Leads

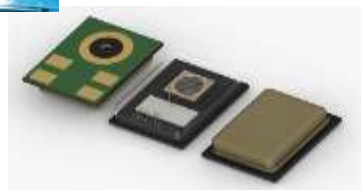
ST Advantage:

- Power Consumption
- Best in class performance

Automotive

MP23DB01HP

Optimized @ 3MHz
for A2B Systems



Industry standard
3.5x2.65x0.98, 5Leads

ST Advantage:

- SNR and AoP performance
- Proven on A2B system

Top Port

MP34DT05-A IMP34DT05
MP34DT06J

High performance
Top Port Microphone

Industry standard
3x4x1, 5Leads

ST Advantage:

- Best in class THD in 3x4x1
- ±1dB for DT06J
- IMP34DT05 for 10y Longevity program

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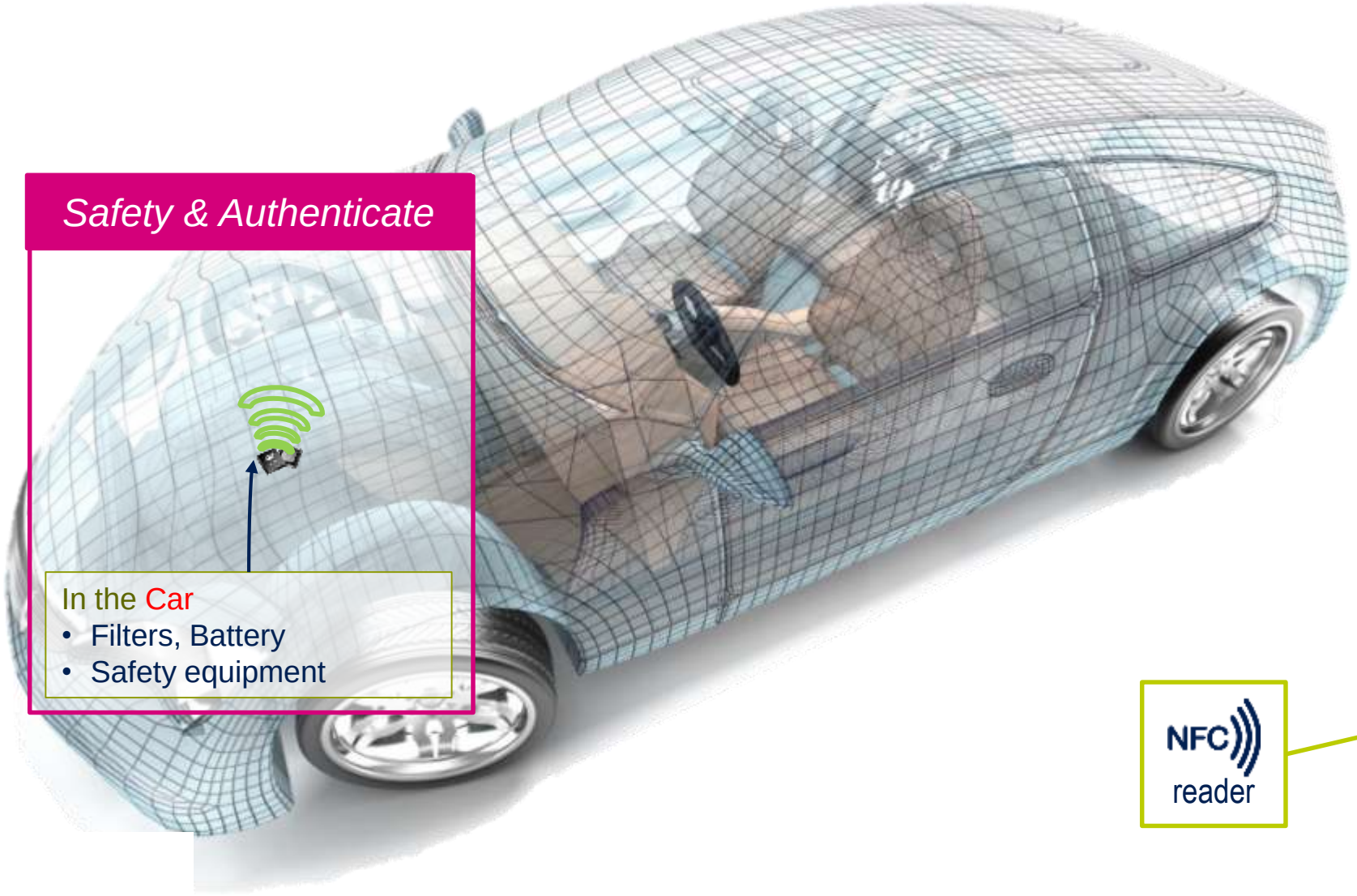
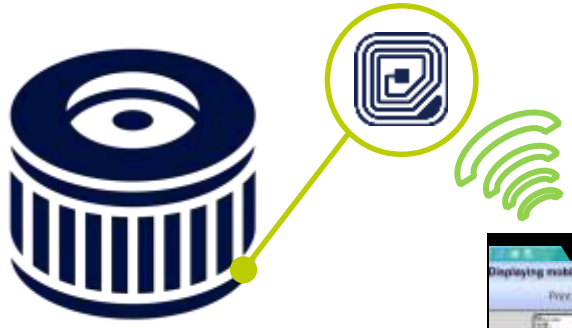
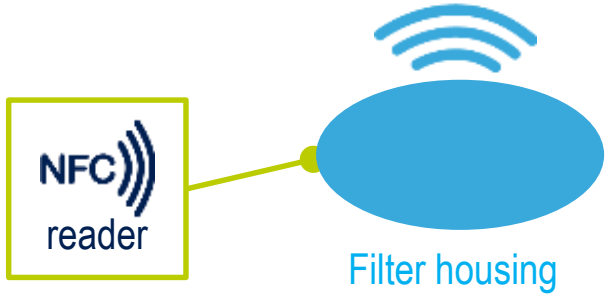
NFC & Consumables

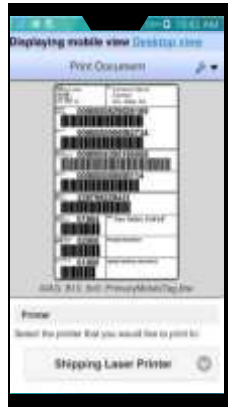


Safety & Authenticate

In the Car
- Filters, Battery
- Safety equipment

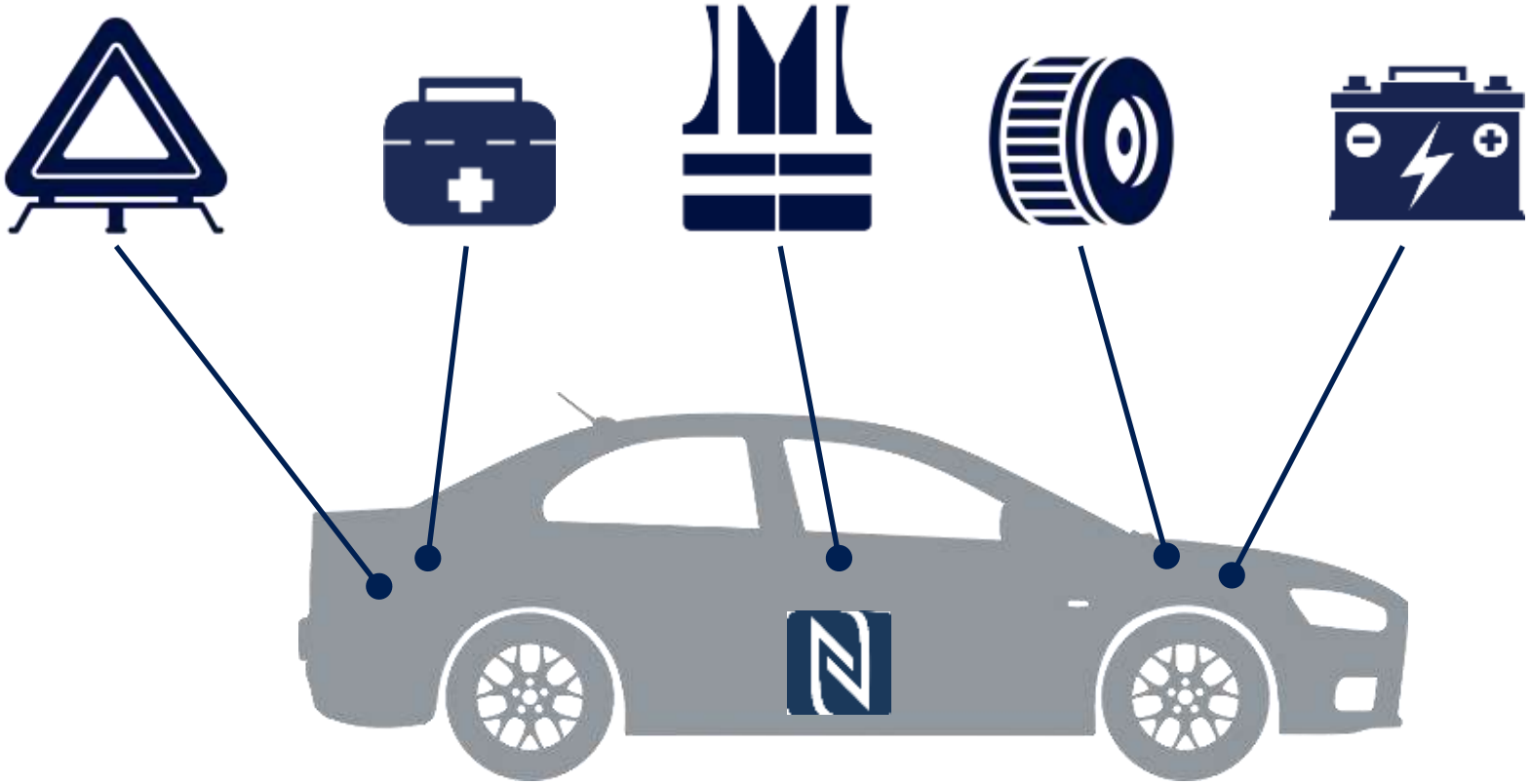






Consumables in Cars

Authentication and detection of consumables



- Proof of origin
- Lifetime counter
- Parts in place
- Parameter readout
  - Temperature
  - Voltage
  - …

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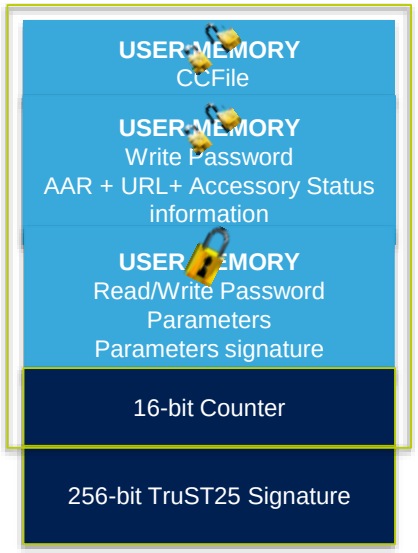
System Configuration at Factory

The maker sets the contents of the tag during manufacture.

The maker sets the contents of the main unit during manufacture.

ST25TV



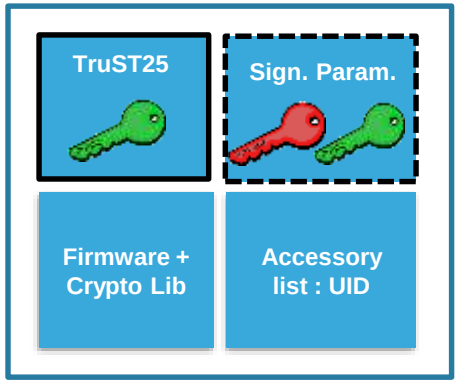
Accessories

CCFILE in read-only.

Area1 password for write.
Password = HASH of UID+Signature.

Area2 password for read/write.
Password = HASH of
UID+Signature+counter

ST25R3914 + MCU



Main Unit

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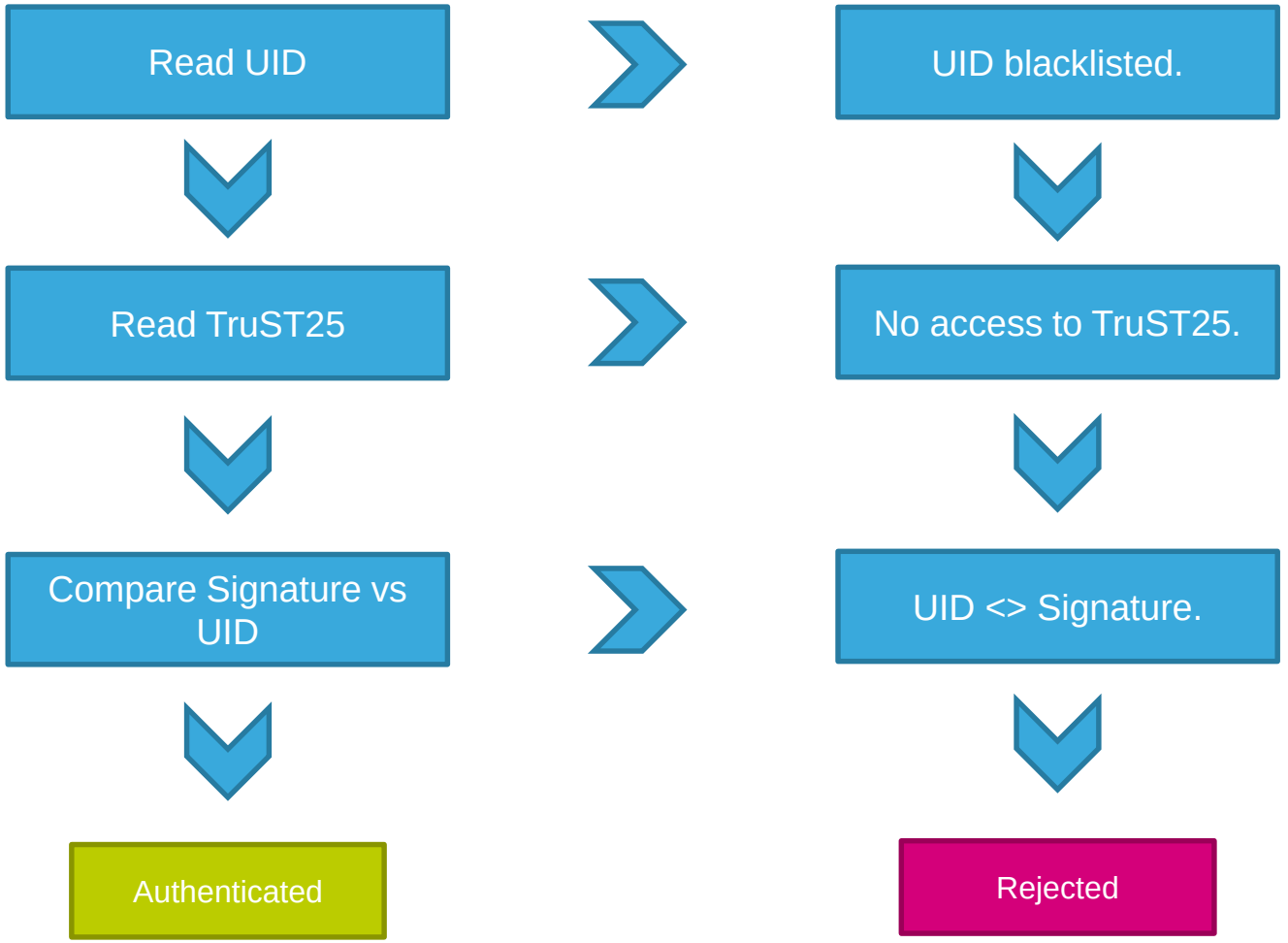
Accessory Authentication

• HF Reader

• Tag



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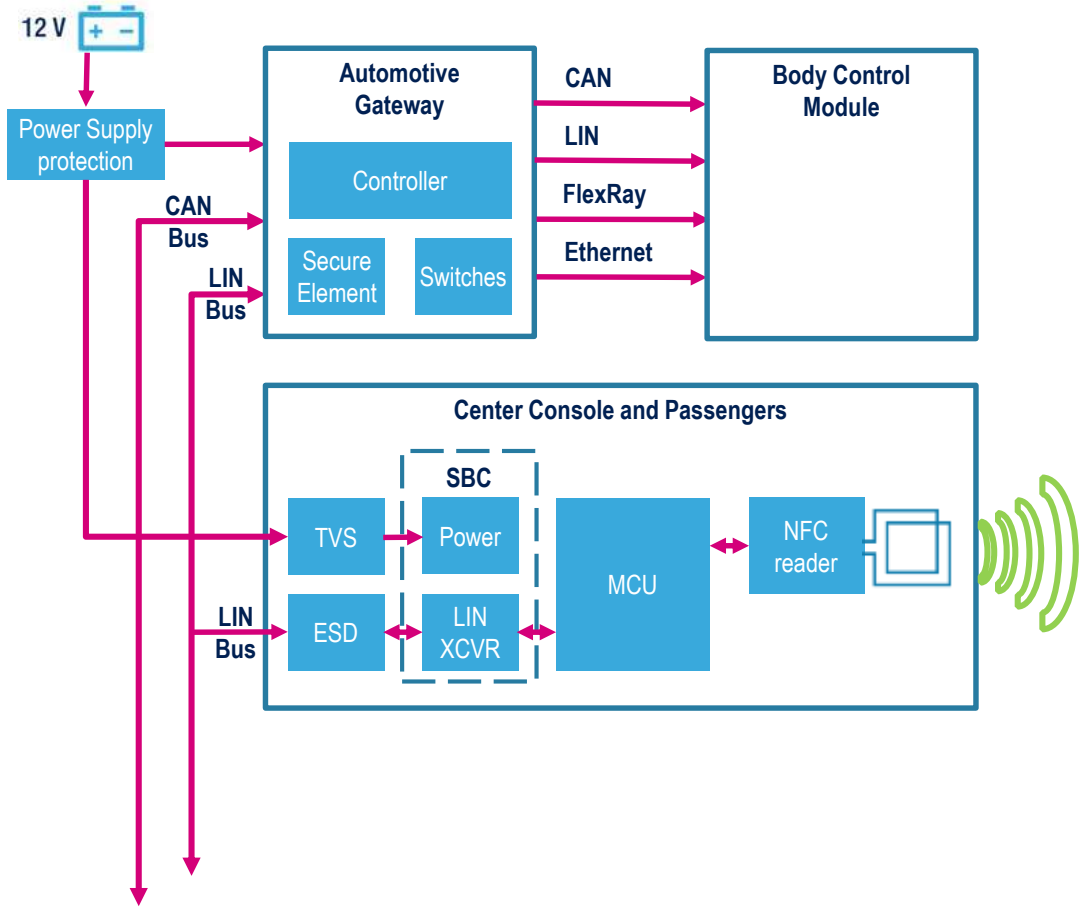
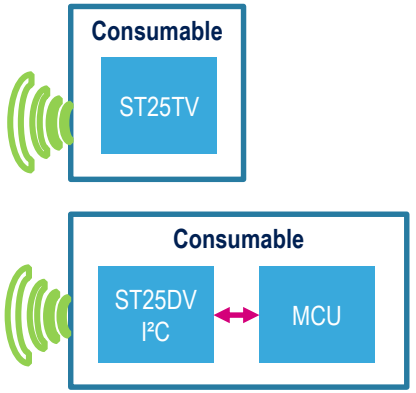
NFC Consumables



ST available parts:

- NFC: ST25R3914/3915
  ST25R3920 (Q4/19)
- MCU: STM8A
- SBC: L99PM60J
- ESD: ESDLIN1524BJ
- TVS: SMA4F14AY

(*) Non AEC-Q101



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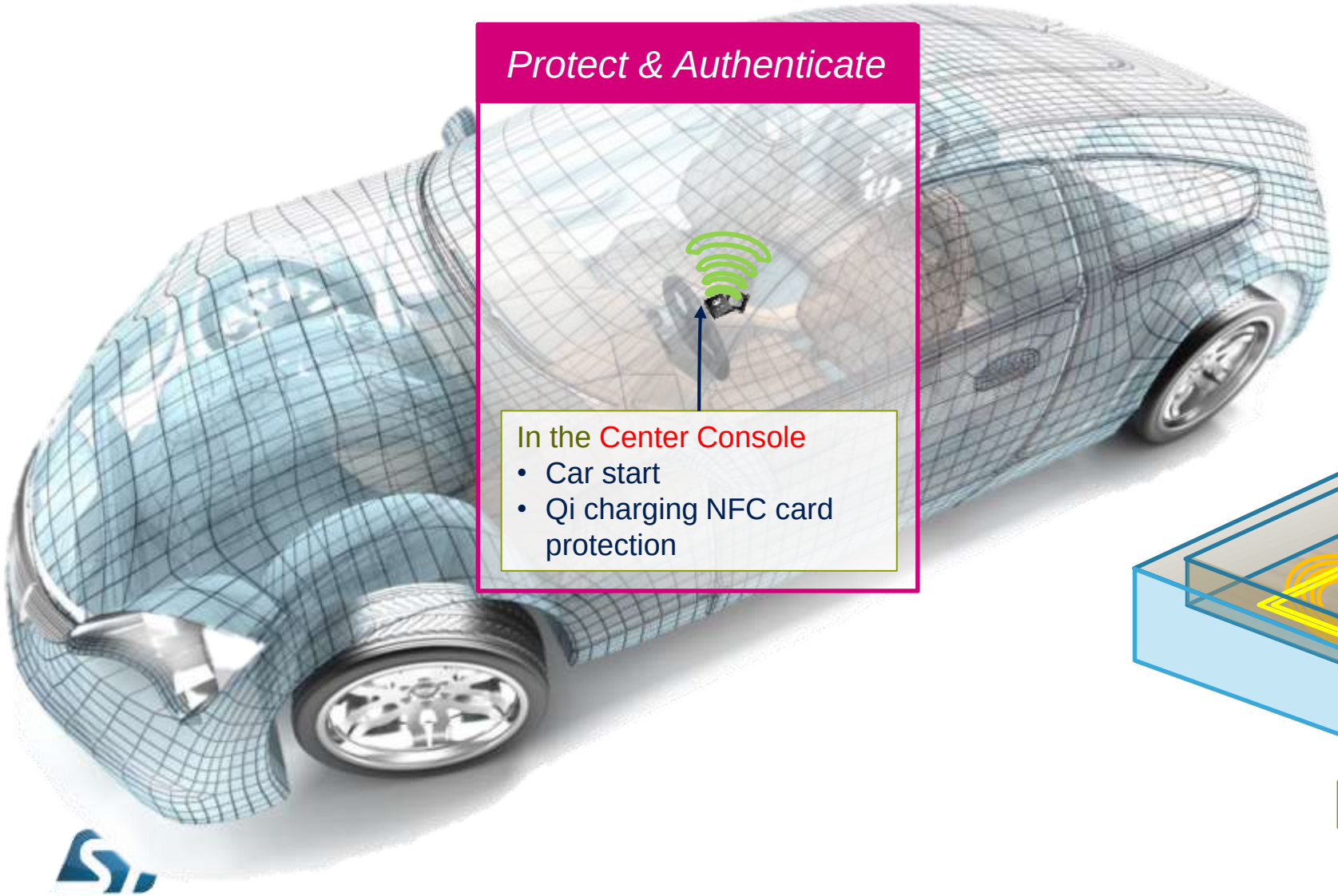
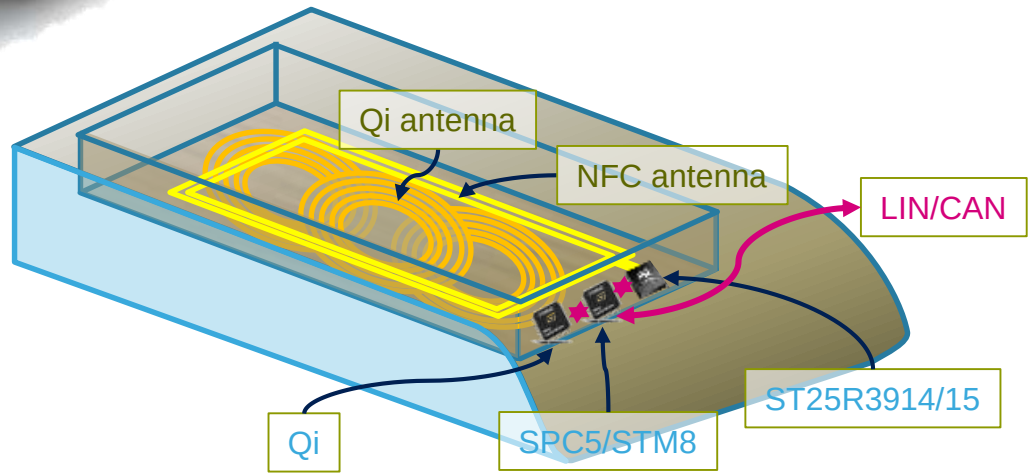
NFC Qi Protection



Protect & Authenticate

In the Center Console

- Car start
- Qi charging NFC card protection



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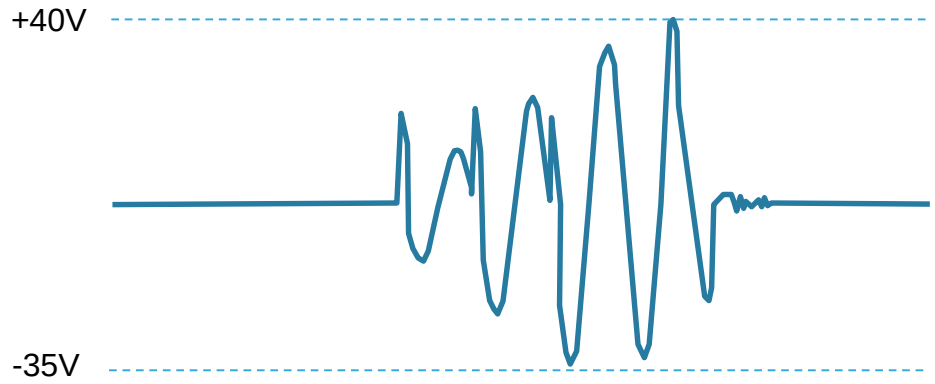
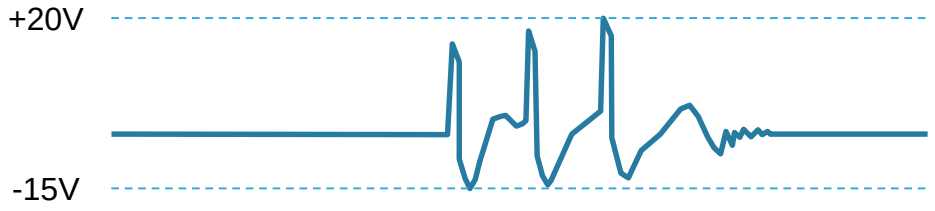
Qi Analog Ping

- Qi power transmitters constantly search for a Qi receiver using an analog “ping” signal. This signal can have an amplitude > +/- 40V.
- When a Qi receiver is in range the transmitter coil impedance changes, altering the shape and amplitude of the ping waveform.
- This analog ping signal can be large enough to damage an RFID/NFC tag or card



TX Voltage – no nearby receiver



TX Voltage – nearby receiver

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NFC+Qi Card Protection Scheme

Protect Cards Against Damage by Qi Charger

Use case 1:
One or more Card(s):
Do not Charge

Use case 2:
One or more Card(s) + Phone
Do not Charge

Use case 3:
Phone:
Charge

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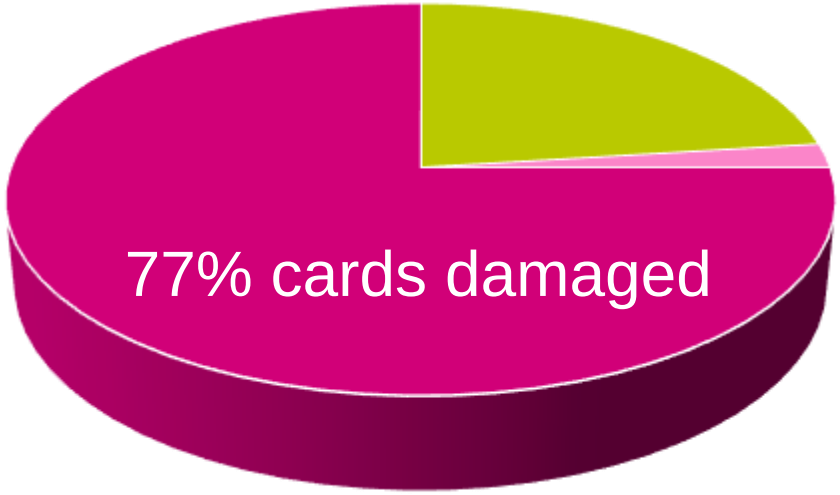
NFC Gives Better a Customer Experience

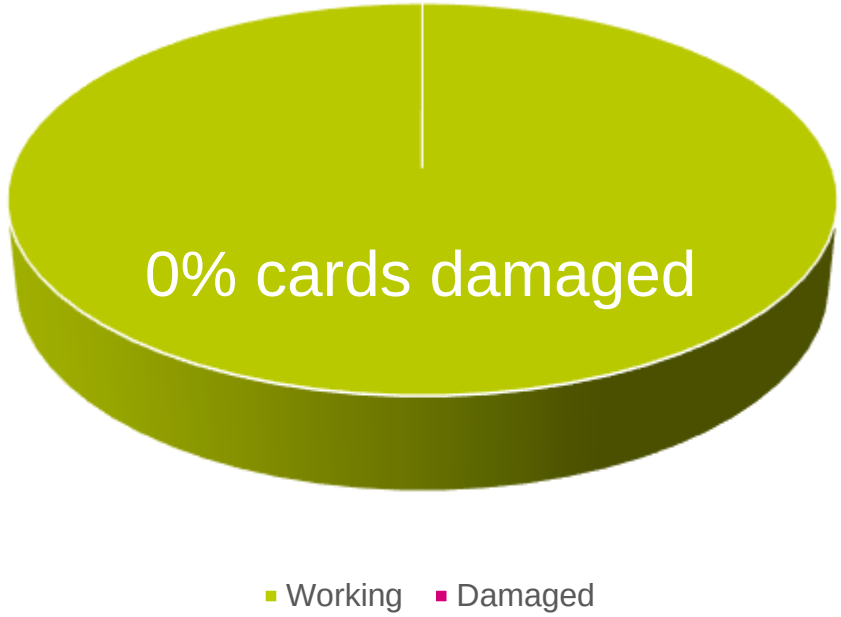
Enhance the customer experience with coexistence of NFC & Qi

Without NFC



Wireless Charging (Qi)

With NFC



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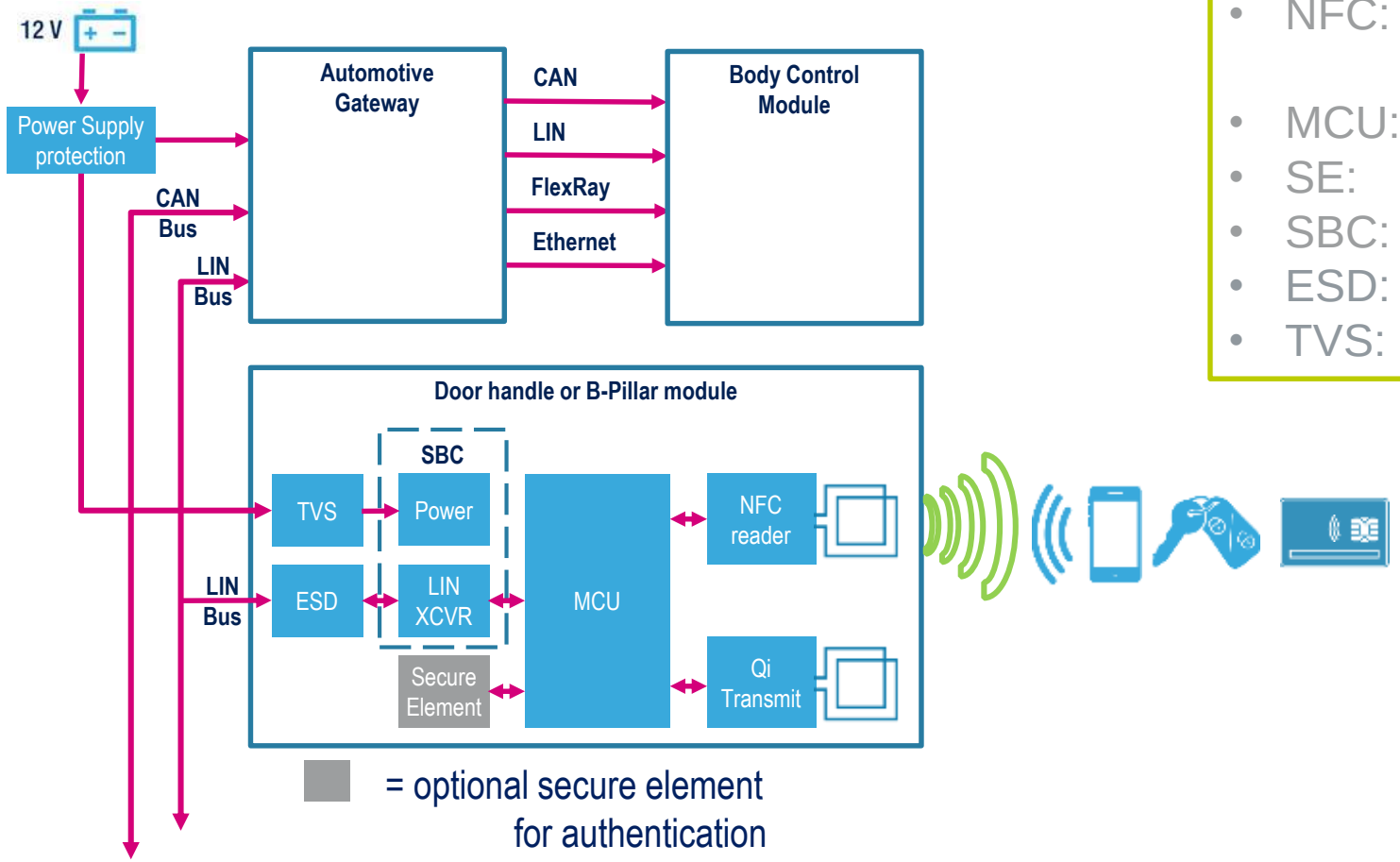
NFC + Qi Block Diagram



ST available parts:

- NFC: ST25R3914/3915
  ST25R3920 (Q4/19)
- MCU: STM8A, SPC5
- SE: STSAFE-A100*
- SBC: L99PM60J
- ESD: ESDLIN1524BJ
- TVS: SMA4F14AY

(*) Non AEC-Q100

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Qi-NFC Automotive Reference Design

BD57121MUF-EVK-001 Evaluation Board

The BD57121MUF-EVK-001 Evaluation Board is a evaluation board based on the ST25R3914 high performance reader frontend and the automotive-grade wireless power transmitter BD57121MUF-M from Rohm.
It is driven by an STM8 MCU and available at Rohm:
https://www.rohm.com/news-detail?news-title=new-automotive-wireless-charging-solution-with-nfc-communication

Features:

- Compliance to WPC Qi ver1.2.4
- Support of Multiple coils to increase charging area (Qi MP-A13 coil type)
- Power control using fixed frequency and variable voltage
- NFC card / tag detection & Protection of Type A, B, F, V
- Housing size: 120 mm x 65 mm x 30 mm

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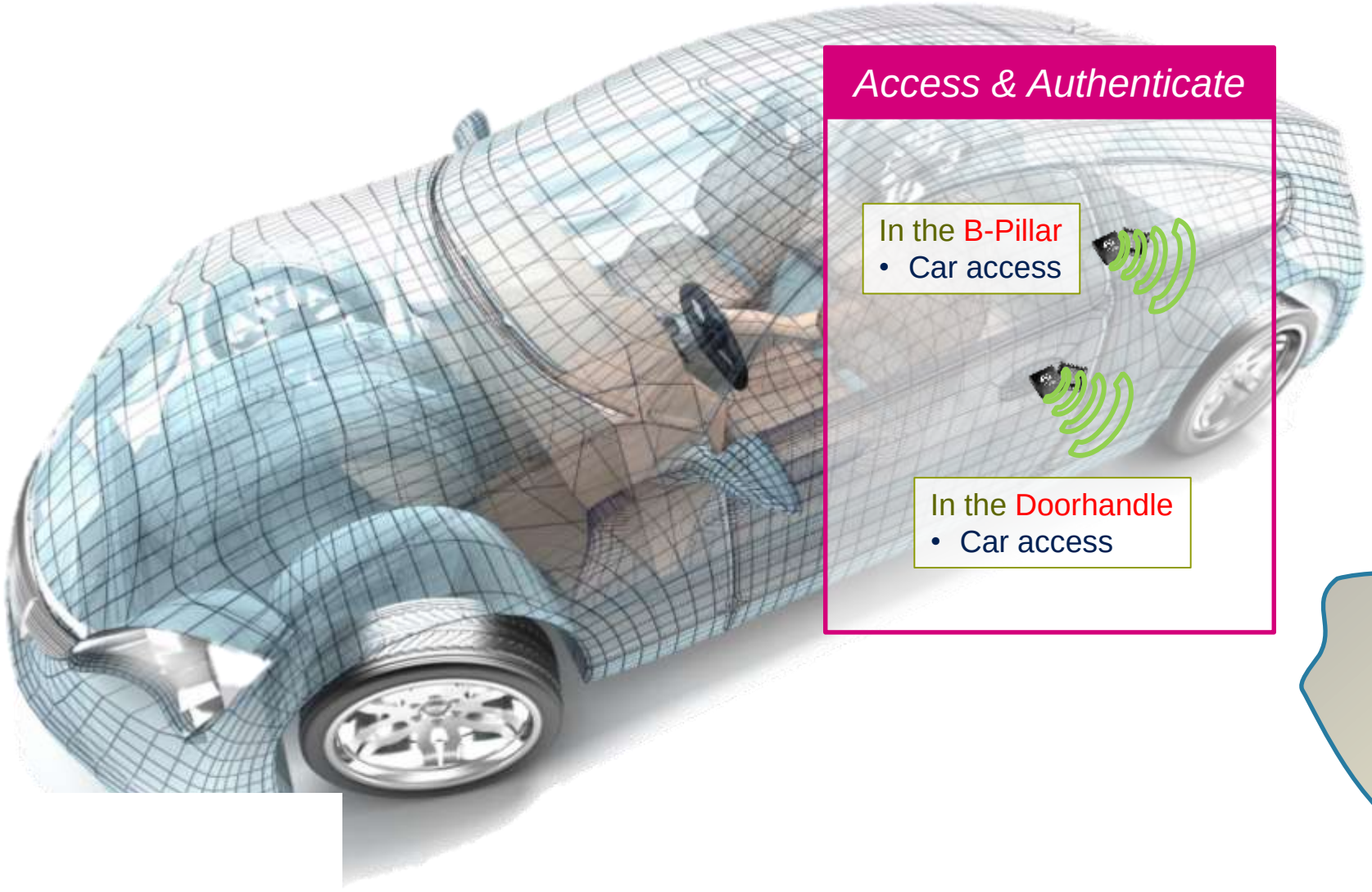
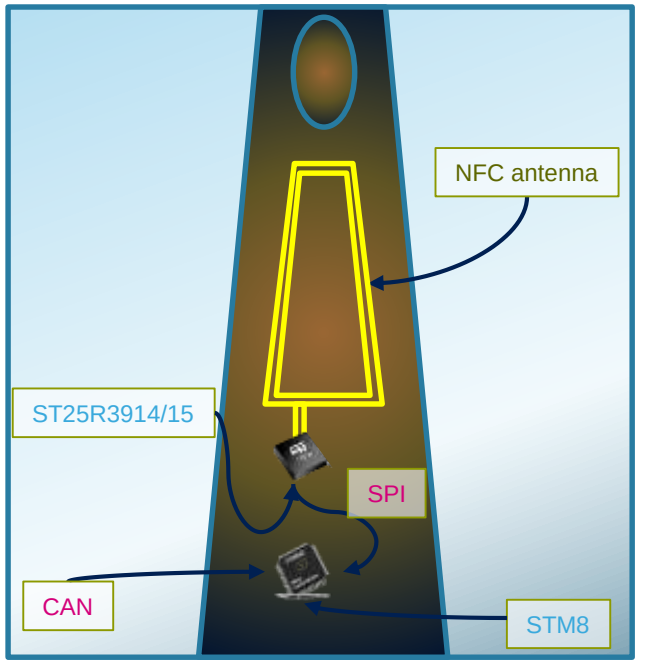
NFC Door Access & Digital Key

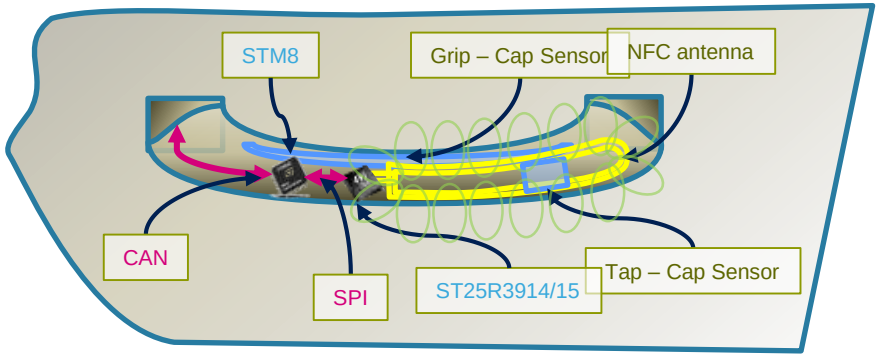


Access & Authenticate

In the B-Pillar
- Car access

In the Doorhandle
- Car access





Benefits of NFC Car Access

Problem Mechanical Keys and Fobs	Solution Electronic NFC Smartphone Key
Requires physical distribution of keys/fobs to customers	Customers can easily request a key using a secure app or a inexpensive access card
What if the key/fob is lost or cloned?	Electronic keys can be easily resent to the end user while encryption prevents cloning
No user identification/customization	Mutual authentication allows the vehicle to verify the users identity and enable paid-for features
How to collect the key once the ride share contract is complete	Secure electronic keys can be made temporal and programmed to automatically expire at the end of the contract
Vehicle theft prevention	Keys can be revoked “on-the-fly” and the vehicle disabled if the end user violates the terms of the ride share contract

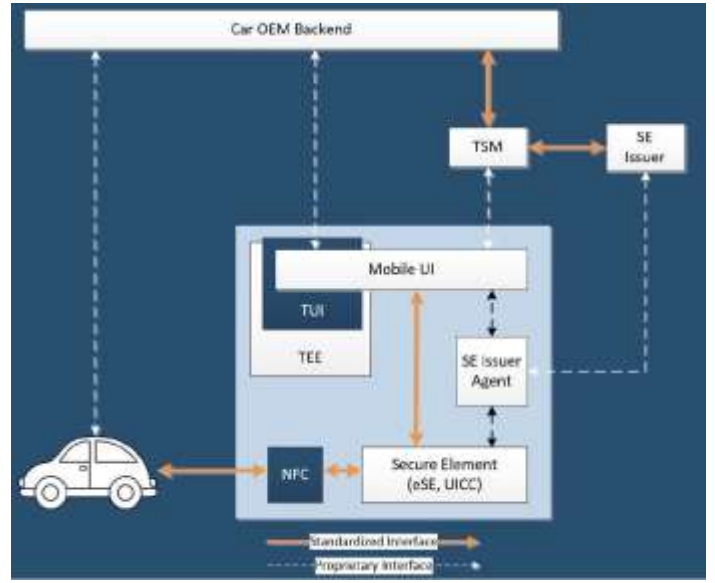
Car Connectivity Consortium

A uniform standard for car access

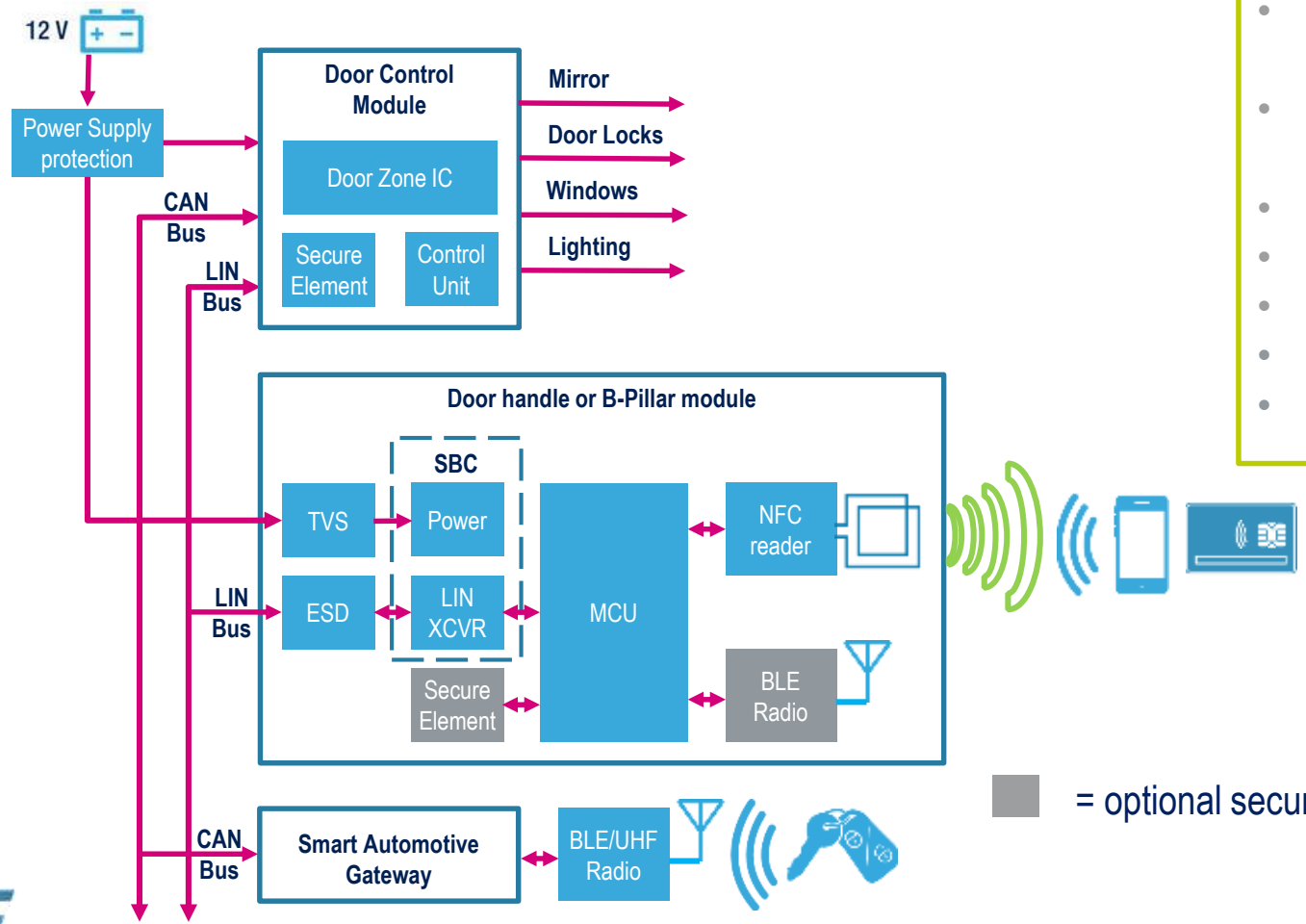
- Founded by Qualcomm, it is an organization that would establish a uniform standard for car access called Digital Key using GlobalPlatform (security), GSMA, and NFC
- **Major Benefits**
  - **Car OEM** – Achieve security, ease of use, and end-user data collection
  - **Device Vendors –** Enable integrated solutions for smart home and transportation applications
  - **Rental Companies –** Expand privacy and flexibility, efficiently manage rentals, create new business models
  - **Car Sharing –** Securely transfer keys, streamline vehicle management, drive new opportunities
  - **Fleet Management –** Optimize fleet management through smart device-based Digital Key solutions

The CCC Digital Key Overview

- **Release 1.0** specifies a deployment method that allows OEMs to securely transfer a digital key to a smart device using an existing Trusted Service Manager (TSM) infrastructure.
- By leveraging the existing NFC controller with integrated secure element already present in smart devices, CCC is assuring state-of-the-art secure vehicle access.
- **Release 2.0** provides a standardized authentication protocol between the vehicle and smart device.
- **Release 2.0** delivers a fully scalable solution to reduce development costs for adopters and ensure interoperability between different smart devices and vehicles.
- This specification is under development in collaboration between CCC's charter member companies including Apple, Audi, BMW, General Motors, HYUNDAI, LG Electronics, Panasonic, Samsung, and Volkswagen, Continental Automotive GmbH, DENSO, Gemalto, etc.



NFC Keyless Entry Block Diagram



ST parts:

- NFC: ST25R3914/3915
  ST25R3920 (Q4/19)
- MCU: STM8A / STM32WB*
  STM32L0 AEC-Q100**
- UHF: S2-LP* / BLUENRG1*
- SE: STSAFE-A100*
- SBC: L99PM60J
- ESD: ESDLIN1524BJ
- TVS: SMA4F14AY

(*) Non AEC-Q100
(**) Proposed

= optional secure element or radio

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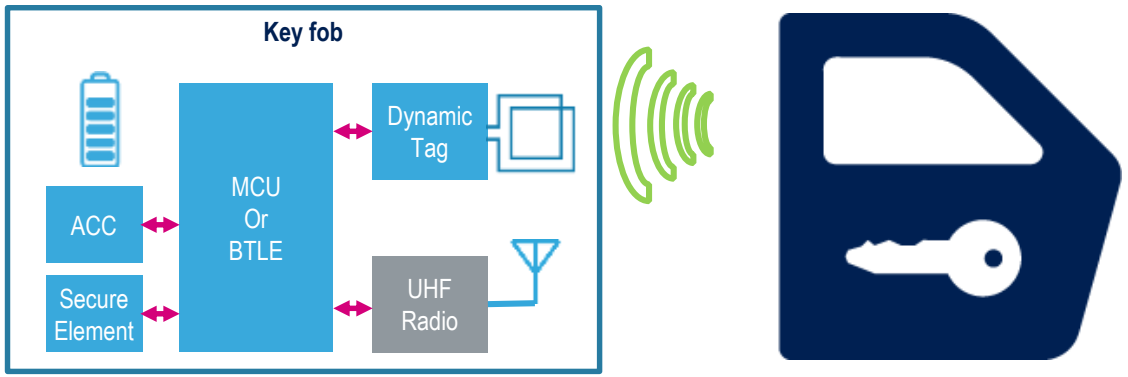
NFC Key Fob



= optional separate radio

ST available parts:

- NFC: ST25DV-I2C*
- MCU: STM8A / STM32WB*
- SE: STSAFE-A100*
- ACC: AIS2DW
- UHF: S2-LP*

(*) Non AEC-Q101

EEPROM and NFC Solutions

Standard EEPROM

-40 to +85°C Industrial
-40 to +105°C Industrial-Plus
Up to 2Mbits, also in Ultrathin WLCSP

Complete portfolio at competitive price

NFC Tags and Readers

RFID / NFC / Dynamic NFC Tags
RFID / NFC Readers
UHF Readers

Connect to any object thanks to NFC tags and readers

Automotive EEPROM

-40 to +125°C AEC-Q100 grade 1
-40 to +145°C AEC-Q100 grade 0
Up to 2Mbits, SO8N, TSSOP and DFN8

Nb.1 Automotive EEPROM supplier with 45% market share

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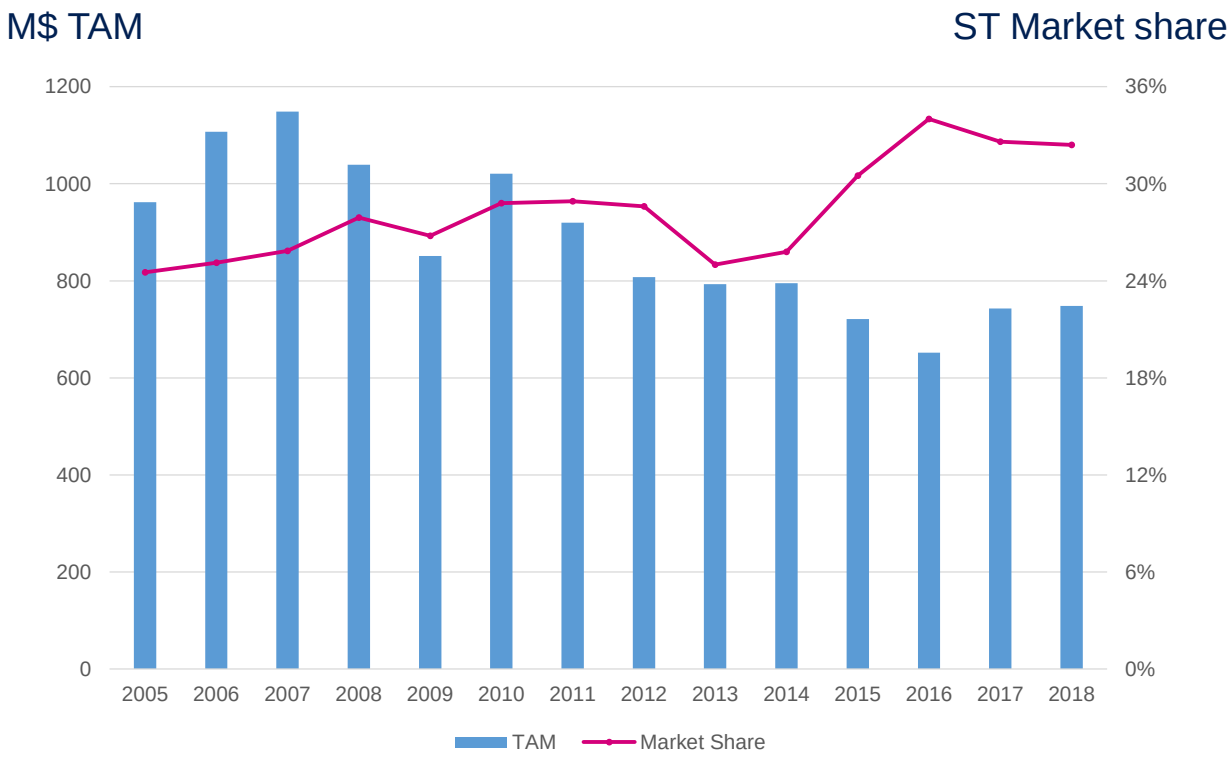
ST #1 for EEPROM for 14 Years

MMY (EEPROM) 2018 :
242M$, 32.4% market share



EEPROM is a mature market

- Around 700 M$ / year
- Estimated total volume 8-9B units

EEPROM remains a very popular standard solution for “small data” storage

- Very flexible data update
- Variety of offer (Bus, Power Supply range, Package, Temperature range) covers all needs

ST maintains dominant position in 2019

- More than 32% market share (overall),
- 45% market share at Automotive Customers

• Source: IHS 2019 Competitive Landscaping Tool March 2019

ST EEPROM is Everywhere in Cars

Audio/Infotainment Telematics

AM/FM Tuner, Digital radio, Amplifiers, Navigation, Passenger entertainment, Emergency/crash call

ADAS

Rear and Front Camera, Night vision Radars, blind spot detection, line deviation, Heads up displays, Head lamp control

Body and Comfort

Junction box, gateway, Keyless Entry, Air conditioning, Door, Seat, Roof modules Dashboard, cockpit, face plate

Power Train

Engine management, transmission control, Fuel pumps/gauge, exhaust control, Hybrid power management

Safety/Chassis

Airbag, Occupant detection, Pedestrian safety, ABS, ESP, active suspension Steering, Drive by Wire Electric parking brake, TPMS, Black box, Event recording

Traceability, calibration tables, manufacturing and user settings, error and event recording, data logging, easy and flexible for parameter management

Automotive EEPROM Families

SPI, 3-wire interface
M95xxx-A125
M95xxx-A145

- Robust interface
- Easy for upgrade
- Fast: up to 20MHz clock rate
- Up to 150°C

- *All automotive applications*

I²C, 2-wire interface
M24xxx-A125

- Low cost 2-wire interface
- Easy for upgrade
- Slow: 1MHz clock rate
- 125°C

- *ADAS, Body, multimedia and infotainment*

µWire, 3-wire interface
M93Cxx-A125

- Robust interface
- Limited to 16kbit
- Slow: 2MHz clock rate
- 125°C

- *All automotive applications*

Automotive Package Options

SO8N

6mm x 5mm
1.75mm Thick
80mg

up to 2Mb

TSSOP8

6.4mm x 3mm
1.2mm Thick
34mg

up to 1Mb

WFDFPN8

3mm x 2mm
0.8mm Thick
16mg

up to 512kb

Qualified to AEC-Q100 Grade 0

Leader in Product Features

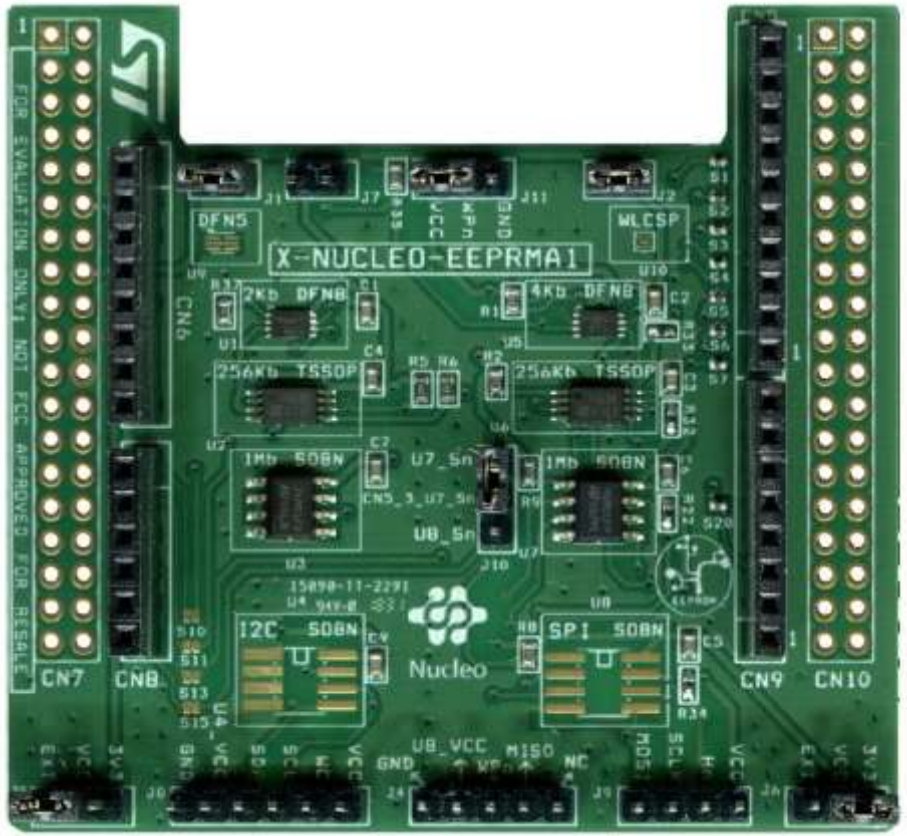
Performance	SPI 20MHz I^2C 1MHz	**Fastest Write time 4ms**	**Lowest Supply Voltage 1.7V @ 125°C**
Endurance	**Highest Cycling** 4Million per byte	Datalog 100 Million per device	**Longest Data retention 100 Years**
Reliability Traceability	Error Code Correction	Software IDentification	**Traceability Customization** Lockable page

ST Automotive EEPROM Portfolio

		Density	1Kb	2Kb	4Kb	8Kb	16Kb	32Kb	64Kb	128Kb	256Kb	512Kb	1 Mb	2 Mb
AUTOMOTIVE 125 °C & 145 °C	I²C		**M24C01**	**M24C02**	**M24C04**	**M24C08**	**M24C16**	**M24C32**	**M24C64**	**M24128**	**M24256**	**M24512**	**M24M01**	**M24M02**
		SO8		•	•	•	•	•	•	•	•	•	•	•
		TSSOP8		•	•	•	•	•	•	•	•	•	•	
		DFN8		•	•	•	•	•	•	•	•	•		
	SPI		**M95010**	**M95020**	**M95040**	**M95080**	**M95160**	**M95320**	**M95640**	**M95128**	**M95256**	**M95512**	**M95M01**	**M95M02**
		SO8		•	•	•	•	•	•	•	•	•	•	•
		TSSOP8		•	•	•	•	•	•	•	•	•	•	
		DFN8		•	•	•	•	•	•	•	•	•		
	MICROWIRE		**M93C46**	**M93C56**	**M93C66**	**M93C76**	**M93C86**							
		SO8	•	•	•	•	•							
		TSSOP8	•	•	•	•	•							
		DFN8												

EEPROM Evaluation Board

Standard I²C and SPI EEPROM memory expansion board



X-NUCLEO-EEPRMA1

Low Cost
Easy To Implement

Easy portability across different MCU families
Equipped with Arduino™ UNO R3 connector
Compatible with STM32 Nucleo boards
Free comprehensive development firmware library and sample implementation

Developer can choose and solder an EEPROM to be tested using the evaluation software provided

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Power Management

PMICs

VREGs

SBCs

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Infotainment and ADAS Power Supply

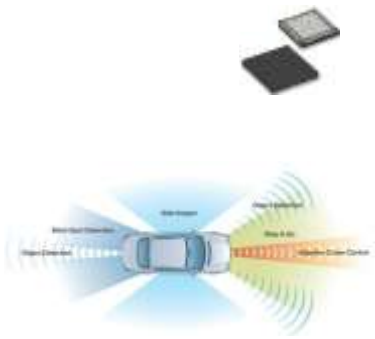
Product Roadmap

2016 — L5963

Dual monolithic switching regulator with LDO and HSD (3A x 2 + 250mA)

2018 — ADAS L5965

Multiple power management for automotive **vision and radar** systems ISO26262

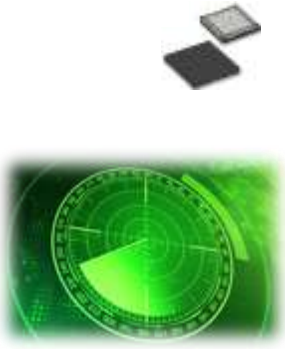


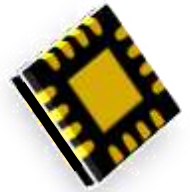
2019 — L5964

Dual monolithic switching regulator with LDO and **watchdog, reset** (3.5A x 2 or 7A + 250mA)

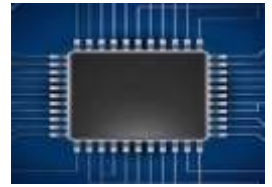
2020 — NEW ADAS PMIC

Second generation ADAS PMIC





Multiple power management for automotive **cameras** (ADAS) Targeting QFN flip-chip package



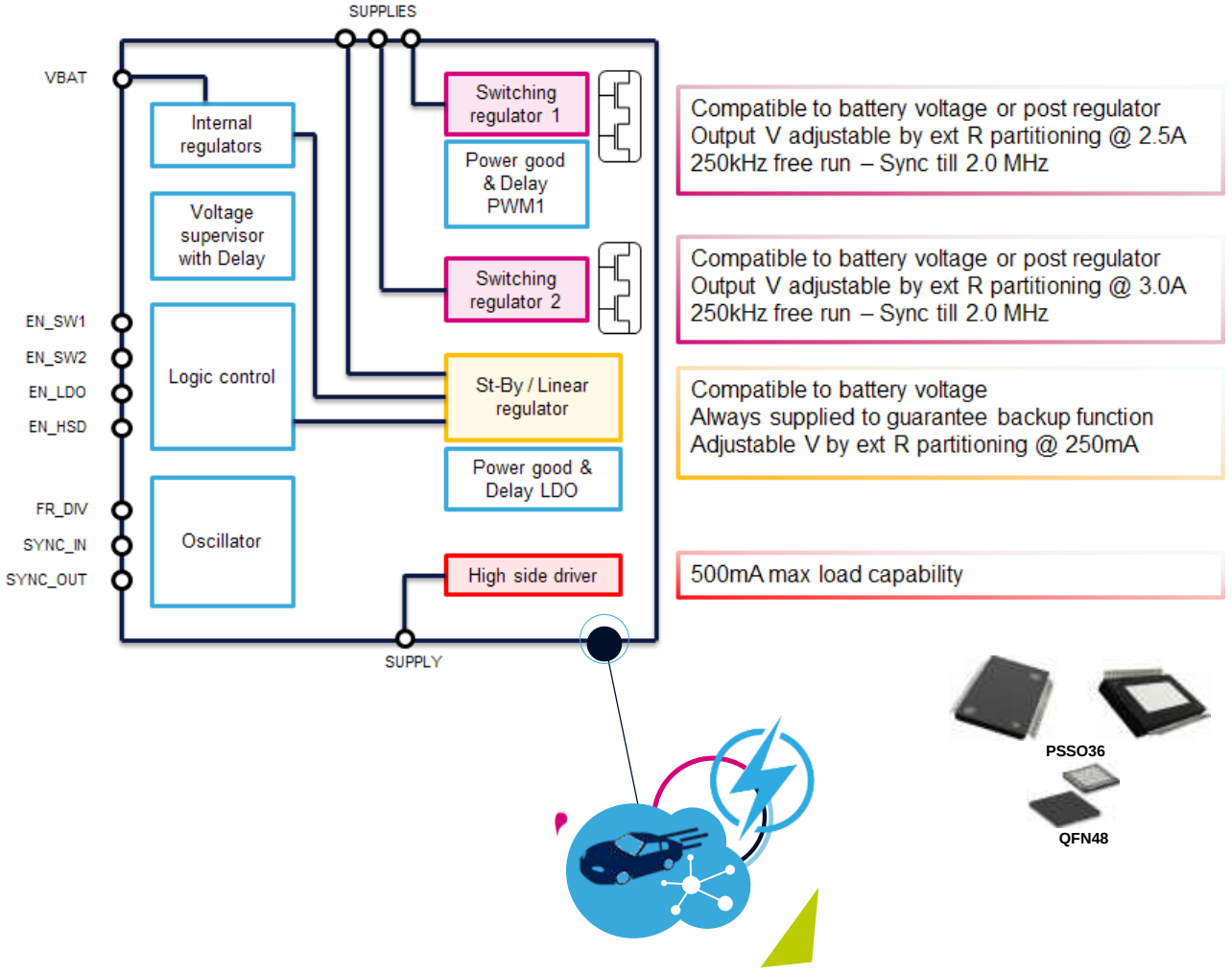
ASICs
Adopting all IPs developed for ADAS PMICs

Multiple buck-boost power management for Audio and USB Type-C power delivery

Type-C

L5963

Dual Monolithic Switching Regulator with LDO and HSD



MAIN FEATURES

- Compact solution in a small package
- Every regulator is battery compatible
- High switching frequency, up to 2MHz
- High current capability, up to 3A
- Extremely low quiescent current in st-by (25uA typ)
- Possibility of synchronization
- Voltage monitoring and power goods
- 180° phase shift between dc-dc

BENEFITS

- Use of just a single device with 3 outputs
- Flexibility
- High integration level
- Small external components
- Master slave configuration and customized power up sequences without any external control
- Low EMI emissions
- Automotive qualified AEC Q100

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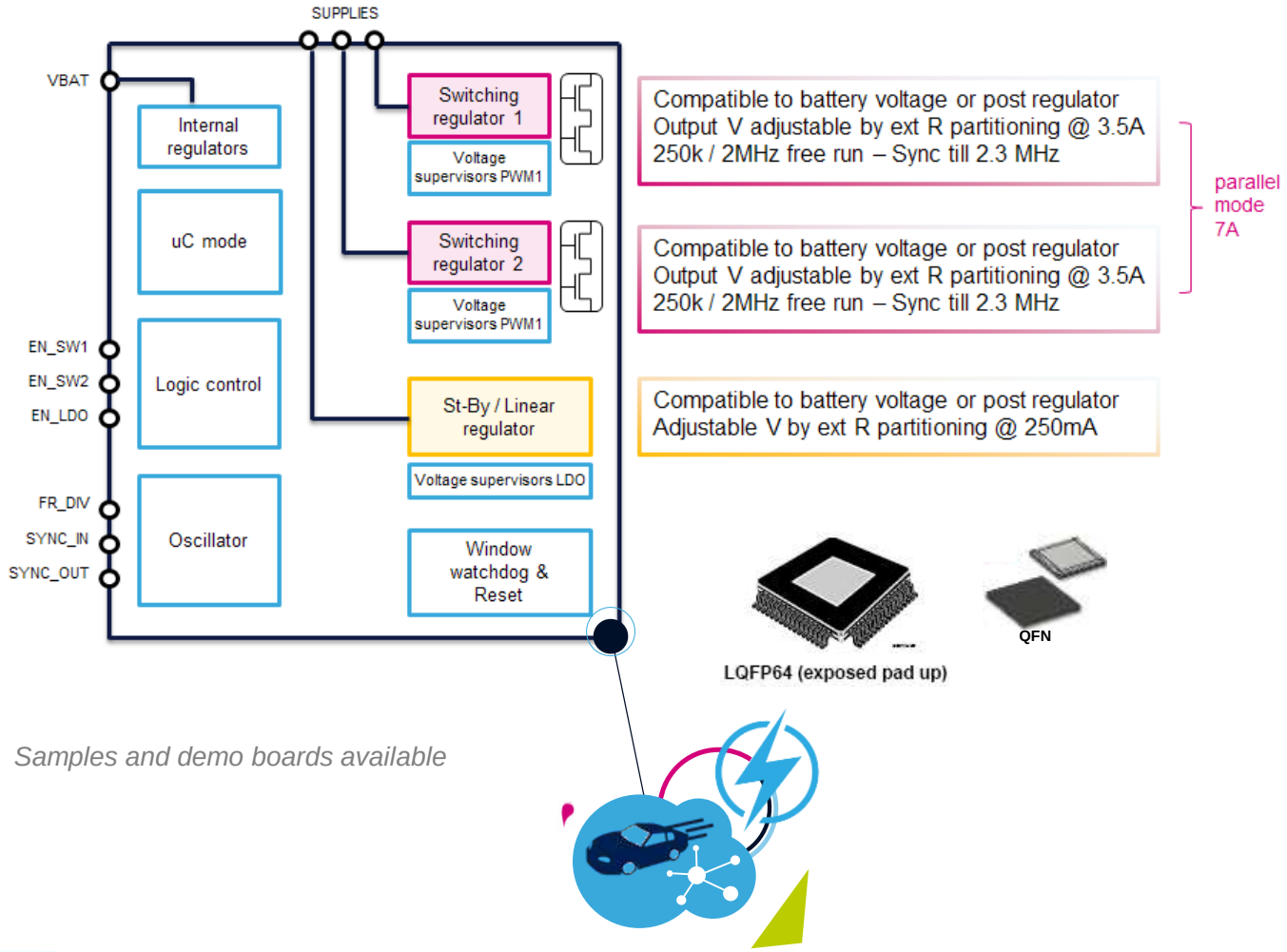
PM

L5964

Dual Switching Regulator with LDO and UC Power Mgmt



LQFP64 (exposed pad up)

QFN

Samples and demo boards available

MAIN FEATURES

- Compact solution in a small package
- Current mode
- Every regulator is battery compatible
- High switching frequency, up to 2.3MHz
- High current capability, up to 7A multi-phase
- Possibility of synchronization
- Voltage supervisors and power goods
- Phase shift between regulators
- Microcontroller management

BENEFITS

- Few external components
- Flexibility of use and high integration level
- Internal oscillator or external synch
- Use of small inductors
- Can be used as high current pre-regulator
- Master slave configuration and customized power up sequences without any external control
- Low EMI emissions
- Automotive qualified AEC Q100

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L5965

PMIC for Cameras and Radars

L5965 is a multiple voltage regulator including pre and post regulators, 7 output voltages with the target to supply ADAS systems and to be compatible to ST ICs:

- Vision processors (EyeQ3, EyeQ4, … (Vision-System-on-Chip))
- Radar sensors (STRADA431 - 24GHz Transceiver, …)
- Microcontrollers (SPC58NE84E7, SPC58NE84C3 – 32-bit MCU for automotive ASIL-D applications, …)

An SPI interface is present

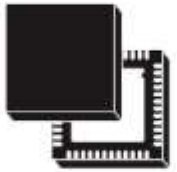
OTP for programming

Designed with reference to

CERTIFIED FUNCTIONAL SAFETY JQA

Certification for Products
in accordance with
ISO 26262

VFQFPN-48



VFQFPN-48 (7x7x1.0mm)
Very Fine Quad Flat Package No lead

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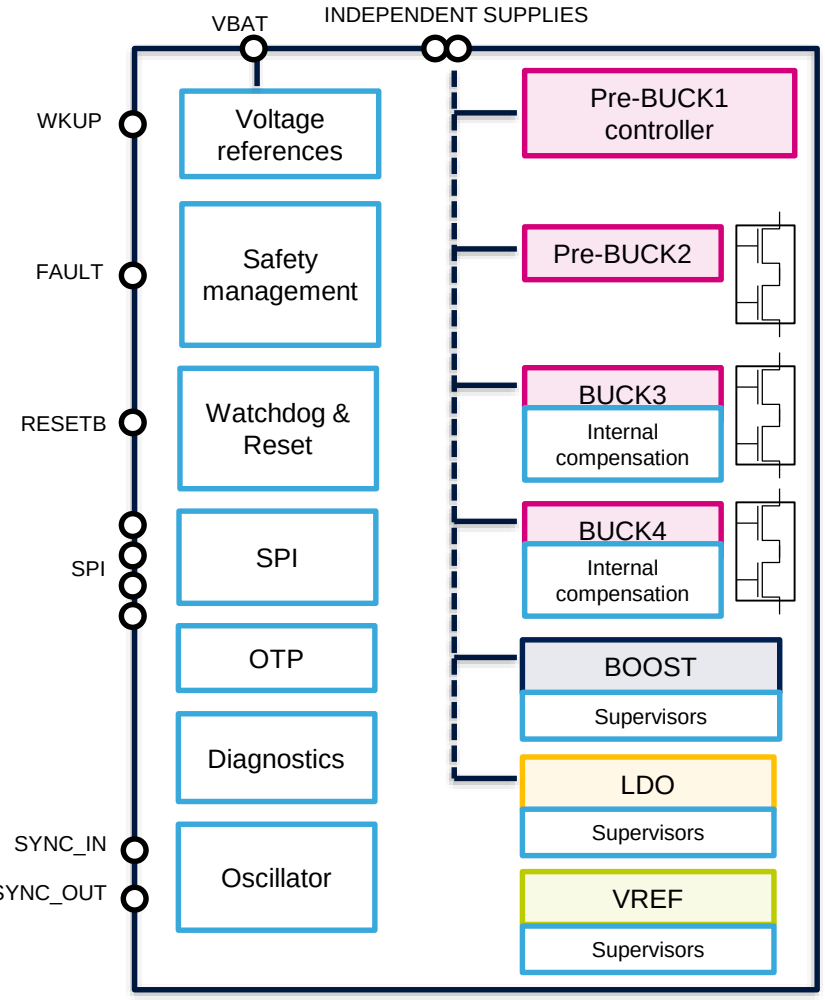
PM

L5965

Multiple Power Mgmt. for Vision and Radar Systems



Buck pre/post controller compatible to battery V
5-3.8-3.3-1.8-1.2-1.1-1.0-0.8 V @ 0.4 MHz

Buck pre/post regulator compatible to battery V
5.0-3.6-3.3-1.5-1.35-1.2-1.1-1.0 V @ 1-2 A ● 0.4 - 2.4 MHz

Buck post regulator compatible to 5.5V max
3.3-2.5-2.3-2.0-1.8-1.35-1.2-1.0 V @ 1.2 A ● 2.4 MHz

Buck post regulator compatible to 5.5V max
3.3-1.8-1.35-1.3-1.25-1.2-1.12-1.1 V @ 0.9 A ● 2.4 MHz

Boost post regulator compatible to 5.5V max
7 – 5 V @ 0.3 A ● 2.4 MHz

Linear post regulator compatible to 5.5V max
5-3.3-2.8-2.5-1.8-1.3-1.25-1.2 V @ 300/600 mA

Internally connected to the battery
4.1 - 3.3 – 2.5 – 1.8 V @ 20 mA

OTP programmable!

VFQFPN

Samples and demo boards available

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PM

ISO 26262 - ASIL Compliance

ISO26262 ASIL compliance

- VIN/VOUT monitors
- Two independent Band-gaps: one for reference and one for monitor
- Ground loss monitors
- Internal compensation network and resistor divider
- Digital BIST on internal logic
- Analog BIST:
  - Voltage comparator toggle
  - Temperature comparators toggle
  - Reset assertion check
- Fault pin to Microcontroller

OTP programmable parameters

- BUCK1 output values
- BUCK2 output values
- BUCK2 current limit value
- BUCK2 free running frequency
- BUCK3 output values
- BUCK4 output values
- LDO output values
- LDO output current limitation
- BOOST output voltage
- VREF output voltage
- Main BUCK selection (to decide which regulator between BUCK1 and BUCK2 is the main pre-regulator)
- Power up sequence

Second Generation ADAS PMIC

- Pre Buck1 controller, OTP V, battery compatible
- Buck2 controller OTP V
- Buck3 converter OTP V, 3A
- Buck4 converter OTP V, 3A
- Buck5 converter OTP V, 1.25A
- Boost converter / controller
- LDO1 OTP V, 0.75A
- LDO2 OTP V, 0.75A
- LDO3 OTP V, 0.75A
- LDO4 OTP V, 0.75A
- LDO5 OTP V, 0.75A
- LDO6 OTP V, 0.25A
- LDO7 OTP V, 0.25A
- FD CAN interface, SPI, protections, OTP, safety

Powerful power management IC offering a full set of features to support applications that need to fulfill functional safety requirements as defined by Automotive Safety Integrity Level (ASIL) A-B-C-D.

Evolution of L5965 with improved functionalities, higher current capability, higher number of power rails and controller, higher voltage precision.

Complete programmability by OTP

ST has all IPs to provide PMICs for ADAS and, in general, for the automotive environment

- First engineering samples in H1’19
- Final samples in H2 2020
- Production H2 2021

TQFP128L
(Exposed pad up)

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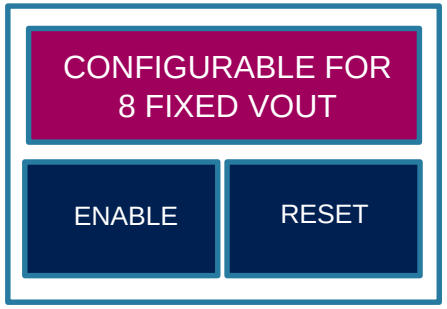
VREGs – New Product Line-up

L99VR01S

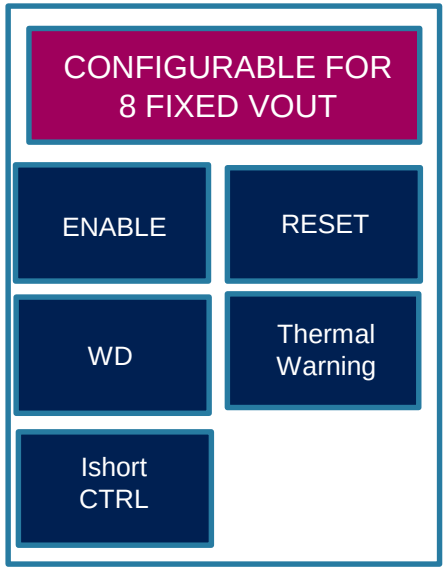


SO-8

L99VR01J

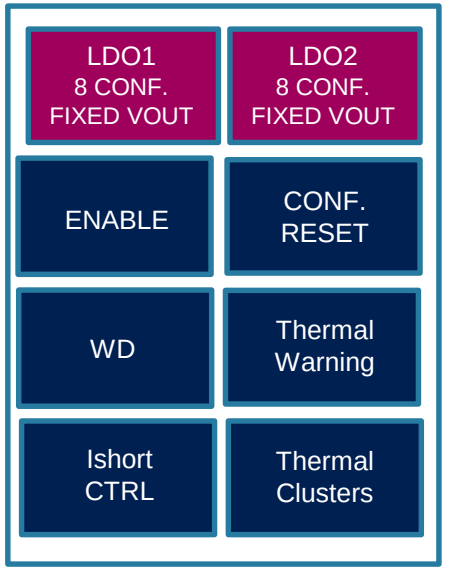
POWERSSO-12

L99VR02J



POWERSSO-12

L99VR02XP



POWERSSO-36

Output Current

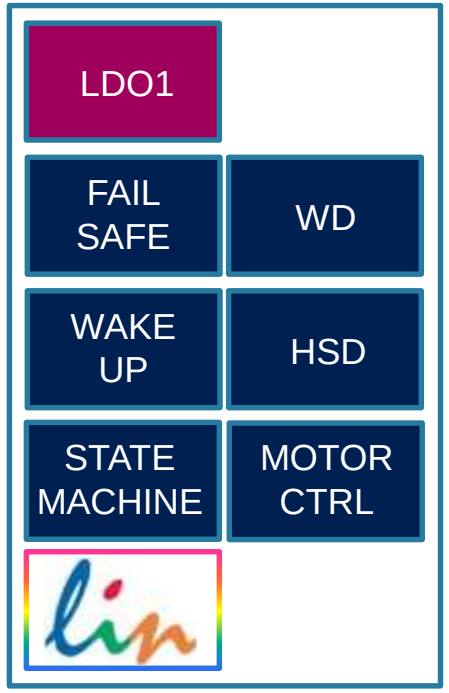
200 mA | **200 mA** | **500 mA** | **2x250 mA**

Automotive Power Management ICs

Power Management Line up

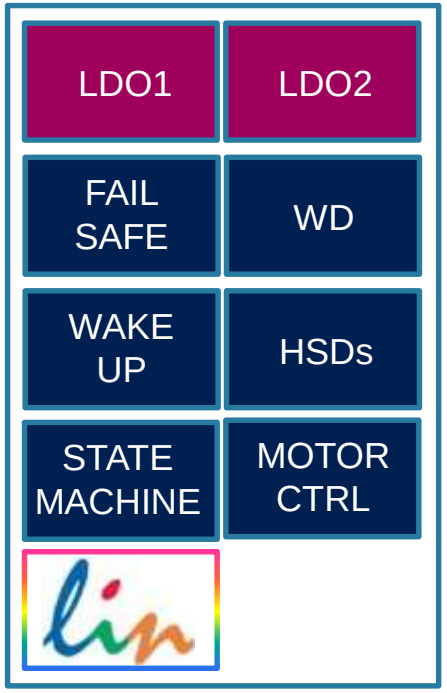
L99PM60J

Motor Control, LIN, Vreg, HSDs



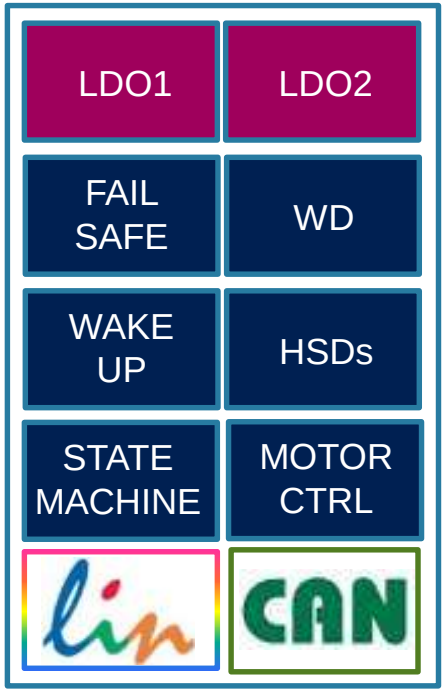
L9952GXP

Motor Control, LIN, Vregs, HSDs Wakeup, Opamps, etc



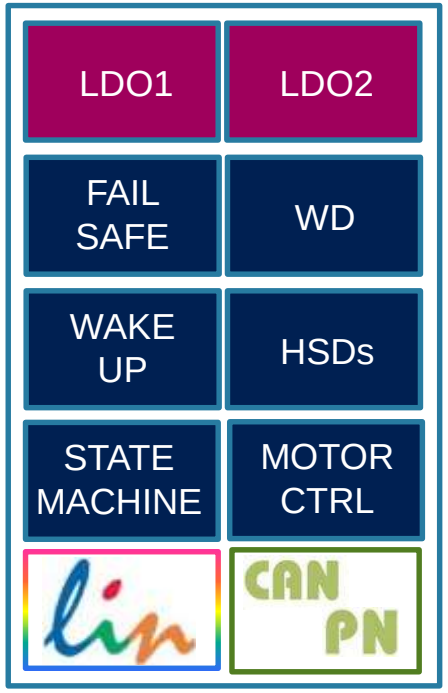
L99PM62GXP

Motor Control, LIN, CAN, Vregs, HSDs Wakeup, Opamps, etc



L99PM72GXP

Motor Control, LIN, CAN-PN, Vregs, HSDs, Wakeup, Opamps, etc



Low Voltage Power MOSFET

STripFET™ Evolution

STripFET™ F6

- P-channel 30 ÷ 100V
- N-channel 30 ÷ 80V
- Good performance for Motor control applications

STripFET™ F7

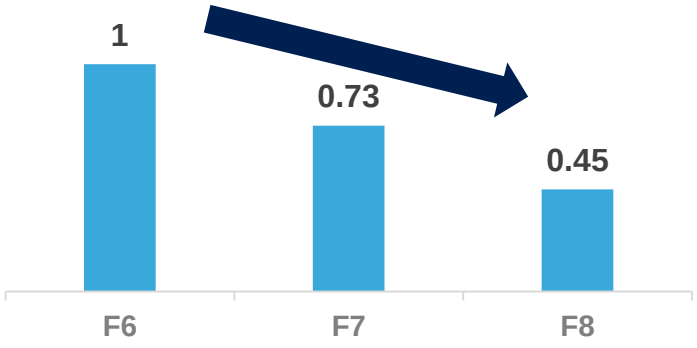
- N-channel 40÷100V
- 120V option under development
- Optimized Qrr and Crss/Ciss to reduce EMI emissions
- Outstanding performances in DC/DC and motor control

STripFET™ F8

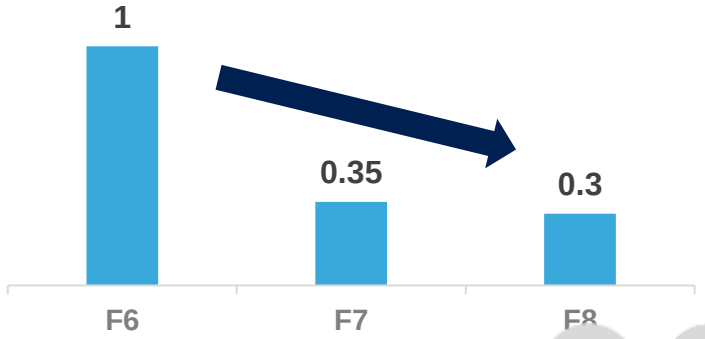
- N-channel 30÷150V
- Extremely low on-Resistance
- Same level of EMI emission vs. F7
- Optimized FOM (R_{DS}(on) * Qg) vs. F7
- Increased power density and reduced losses

2016 — 2018 — 2021

RDSon x Area



FoM (RDSon x Qg)



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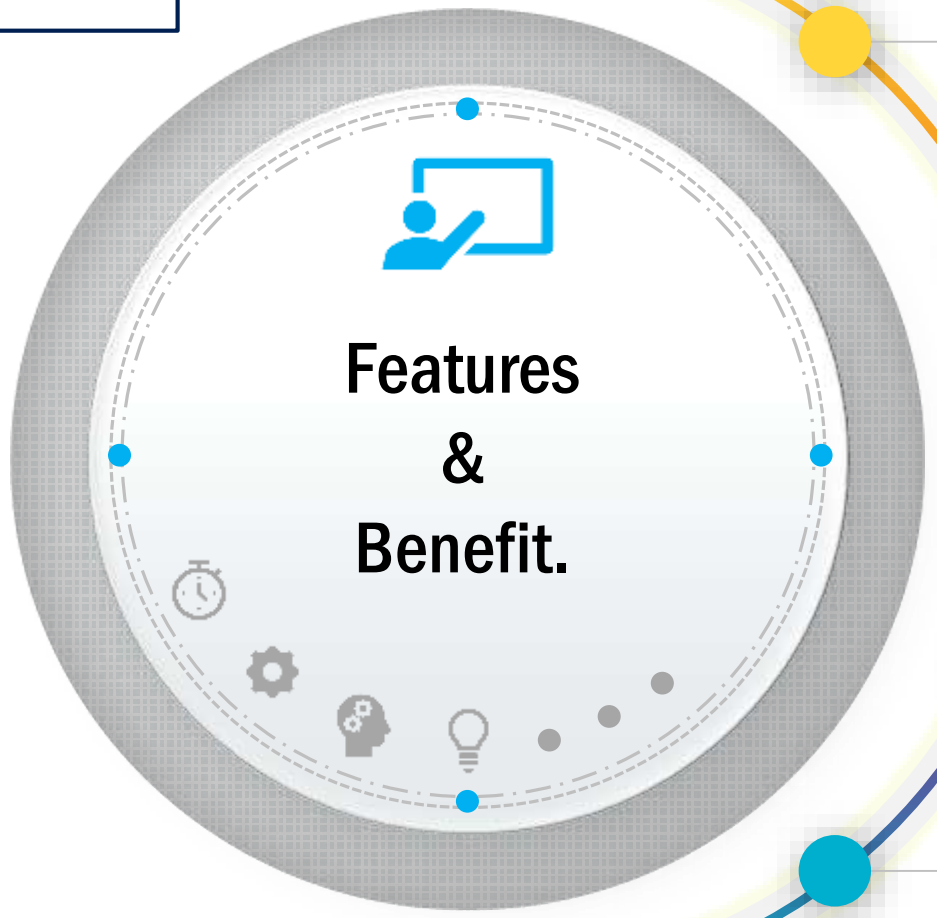
STripFET F7 Series Highlight

BVDss

40V ÷ 120V



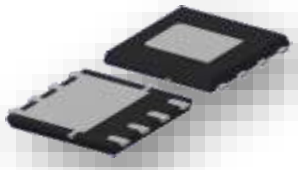
Extremely Low R_{DS}(on)
Low conduction losses

Optimized body diode (low Qrr) Excellent switching perfomance

Optimal capacitance Crss/Ciss
No EMI issue

Extremely low thermal resistance
High current capability and Power dissipation

Several package solutions
Wide product portfolium



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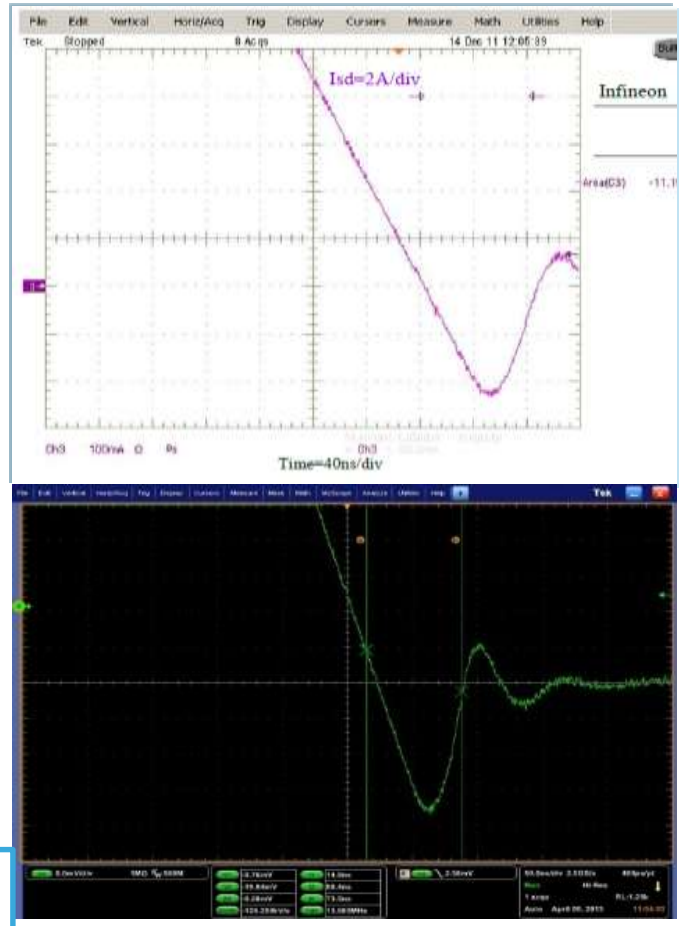
STripFET™ F7

Best Choice for Synchronous Rectification

Part number	I_{rrm} [A]	t_{rr} [ns]	Q_{rr} [nC]	
Test #1 conditions: I=120 A di/dt=100 A/us T_j=25° C				
STx315N10F7AG	4.0	77	185	+21%
Best competition	4.6	79	225	
Test #2 conditions: I=100 A di/dt=100 A/us T_j=25° C				
STx105N10F7AG	3.2	62.2	98.3	+35%
Best competition	3.6	73.5	132.3	



STripFET™ F7 specifically designed to minimize intrinsic diode Qrr

- **>20% lower Qrr than best competition**
- **Quite good softness factor**

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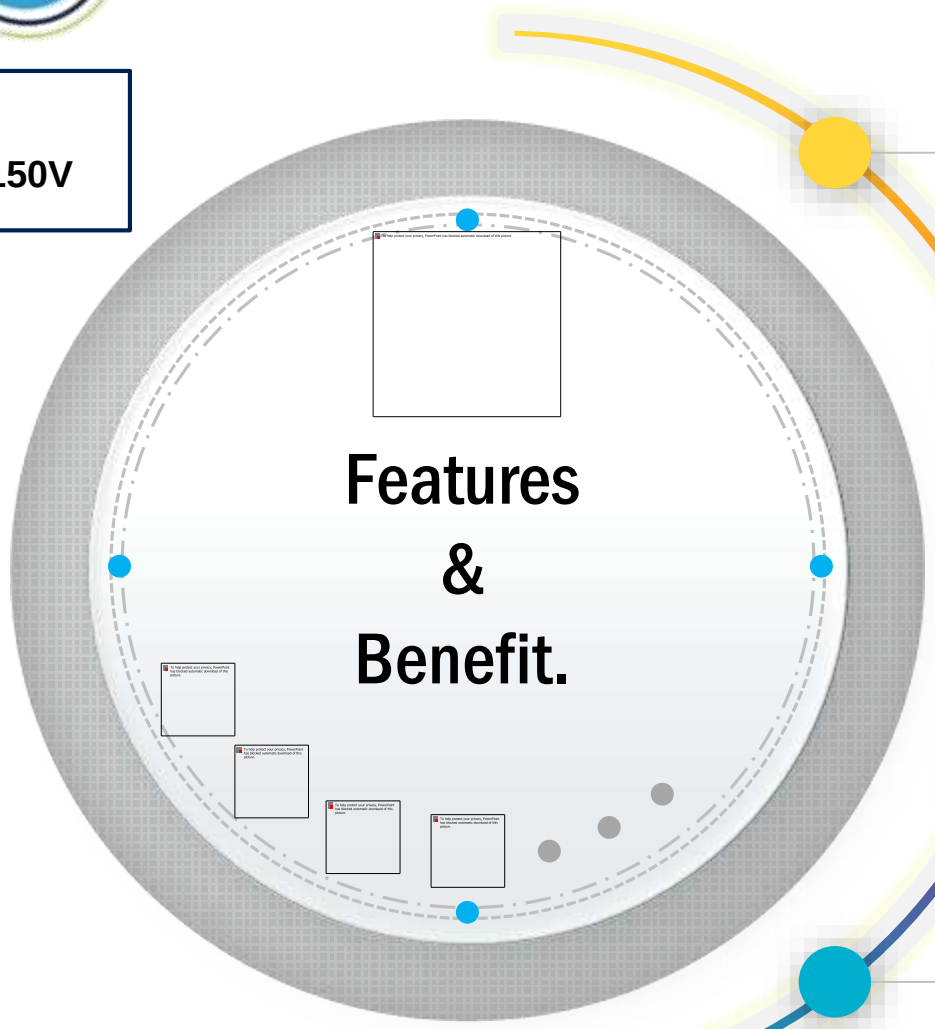
STripFET F8 Technology
for High End Solutions

LV BU

BVDss

30V ÷ 150V



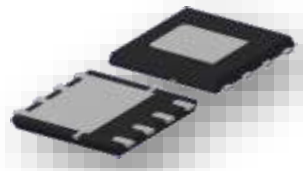
Lowest R_{DS}(on) x Area -40% Vs F7
Ideal for high power density

Extremely Low Qg/Qgd
Tailored for high switching frequency >500KHz

Qrr & Soft switching F7 like
low EMI & turn on losses

Extremely low thermal resistance
High current capability and Power dissipation

Several package solutions
Wide product portfolium



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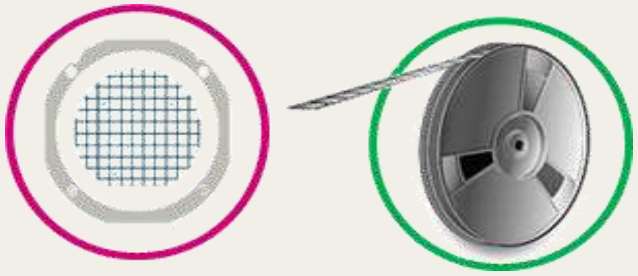
LV Power MOSFET

Automotive-Grade Packaging

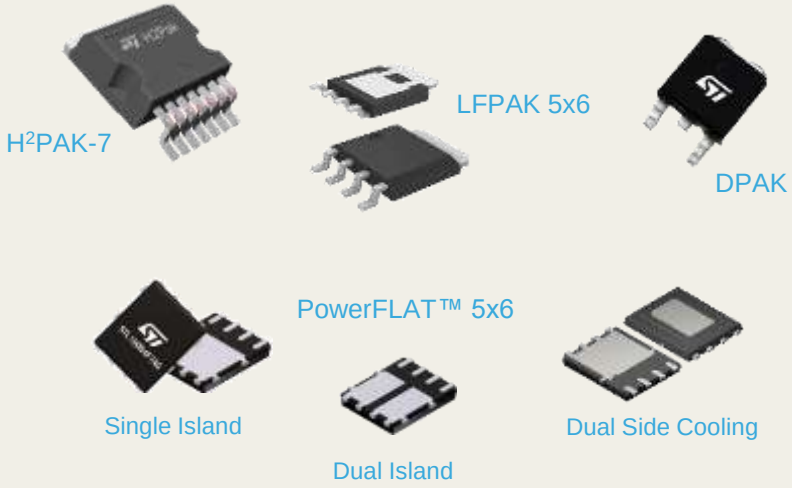
Bare die



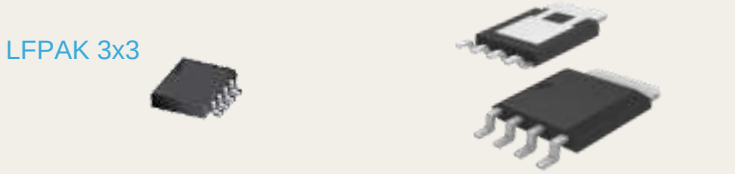
Bare die options:

- **D1/D9** wafers tested, uncut on sticky foil on metallic ring, inked or electronic maps
- **D7** wafer (6/8inches) tested, cut on sticky foil on metallic ring, inked or electronic maps
- **D8** dice tested, cut and placed inside reel pocket and sealed with a cover tape (KGD option available)

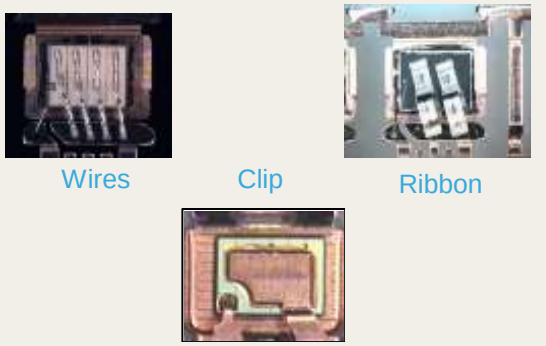
Standard package solution



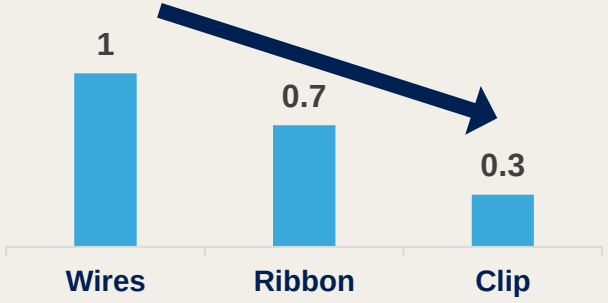
Under feasibility study…



Bonding processes



Parasitic $R_{(DS)}$on comparison



Wide offer of packaging & bonding solutions to match the required trade-off between cost and performance

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PowerFLAT™ 5x6 Dual Side Cooling

Increased Power Density and Thermal Performance

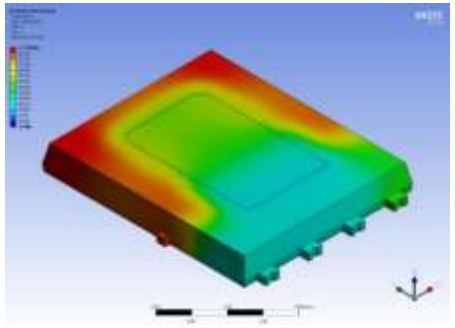
- Exposed source metal on top side
- Low package profile 0.8mm
- Lead protrusions with wettable flanks

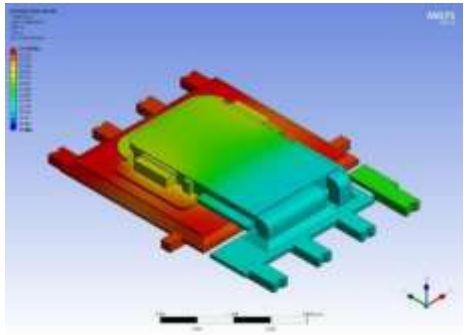
- Low operating temperature
- Outstanding PCB-package joint reliability
- Higher current handling capability
- Enables higher power density

AEC-Q101 Qualified

Dual Side Cooling Thermal Impedance

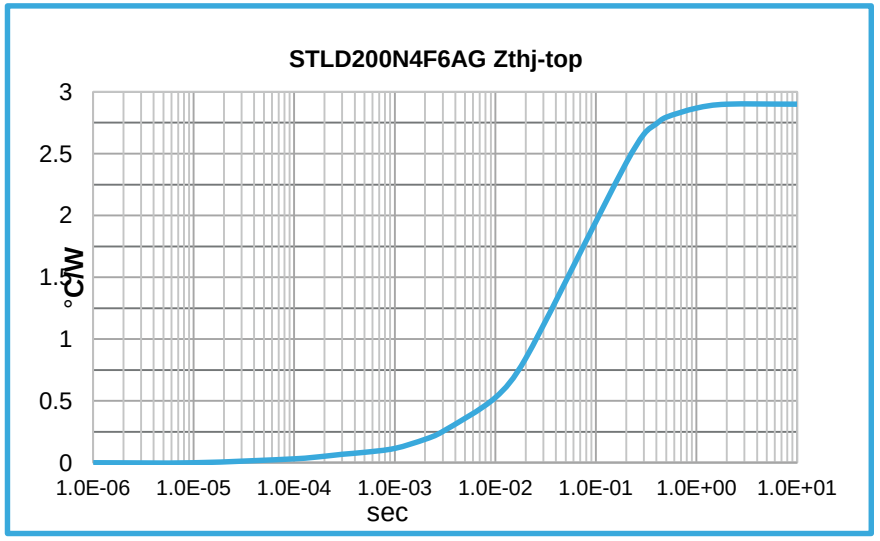
Lower Thermal Resistance for higher power density

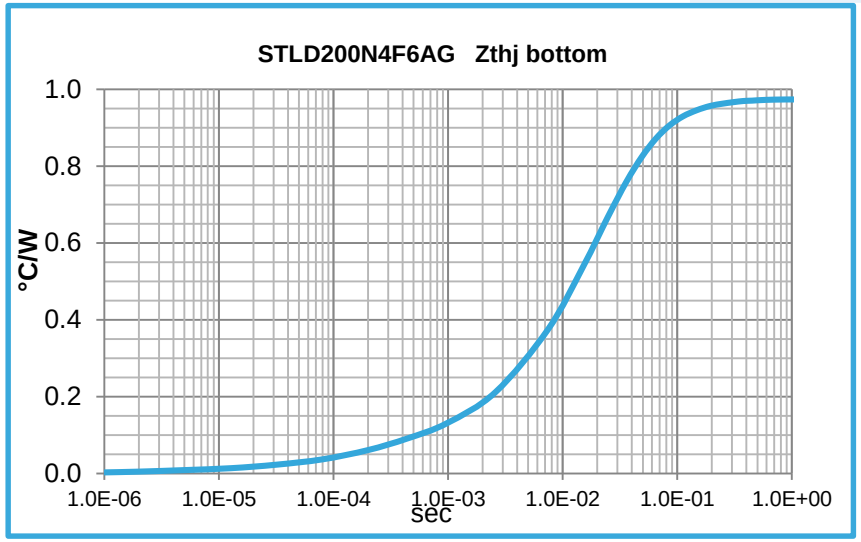




Experimental Results	
Max Rth (°C/W)	STLD200N4F6AG
$Rth_{j\text{-}bottom}$	0.95
$Rth_{j\text{-}top}$	2.90
Rth_{DSC}	0.72

Experimental Results	
Max Rth (°C/W)	PowerFLAT™ std
$Rth_{j\text{-}bottom}$	0.95
$Rth_{j\text{-}top}$	7.0
Rth_{std}	0.84





Thanks to overall lower Thermal Resistance, due to exposed top slug, you can improve the Power density level of your power design

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PowerFLAT™ 5x6 Dual Side Cooling

Product Plan

Package						DSC
BV [V]	I_D [A]	R_{DS} max @10V [mΩ]	Qg @10V [nC]	Samples	Production	
40	120	1.1	66.5	●	●	STLD257N4F7AG
	120	1.5	175	●	●	STLD200N4F6AG
	120	3	91	●	●	STLD125N4F6AG
80	120	3.6	96	●	●	STLD130N8F7
100	120	6	72	●	Q4 '20	STLD110N10F7

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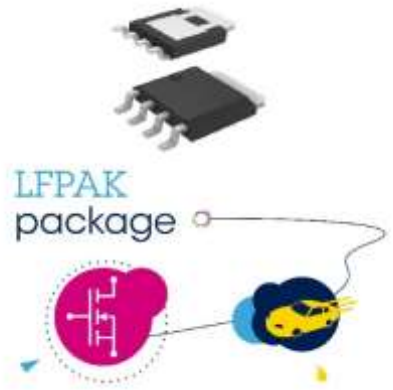
LFPAK

Good thermal and electrical performances combined to high reliability and robustness

- 46% footprint reduction compared to DPAK
- Reduced height package
- External “Gullwings” leads
- 5x6 version single island, double island under eval.



- Extremely compact design
- Easy optical inspection
- Improved reliability
- Mechanical Robustness
- 100% Compatible with second source

AEC-Q101 qualification ongoing

LV BU

LFPAK Product Plan

Part number	BV_{DSS} [V]	R_{DS} [mΩ] max 10V	Qg [nC] 10V	Samples & Prel. DS	MC 30 & Prod.DS
STK224N4F7AG	40	1.5	50	√	√
STK184N4F7AG	40	2.0	35	√	√
STK130N4LF7AG	40	3.0	37	Q2 ’20	Q3 ‘20
STK76N4F6AG	40	7.2	37	Q1 ’20	Q2 ’20
STK47N10LF7A	100	20.0	20	Q4 ’20	Q2 ‘21

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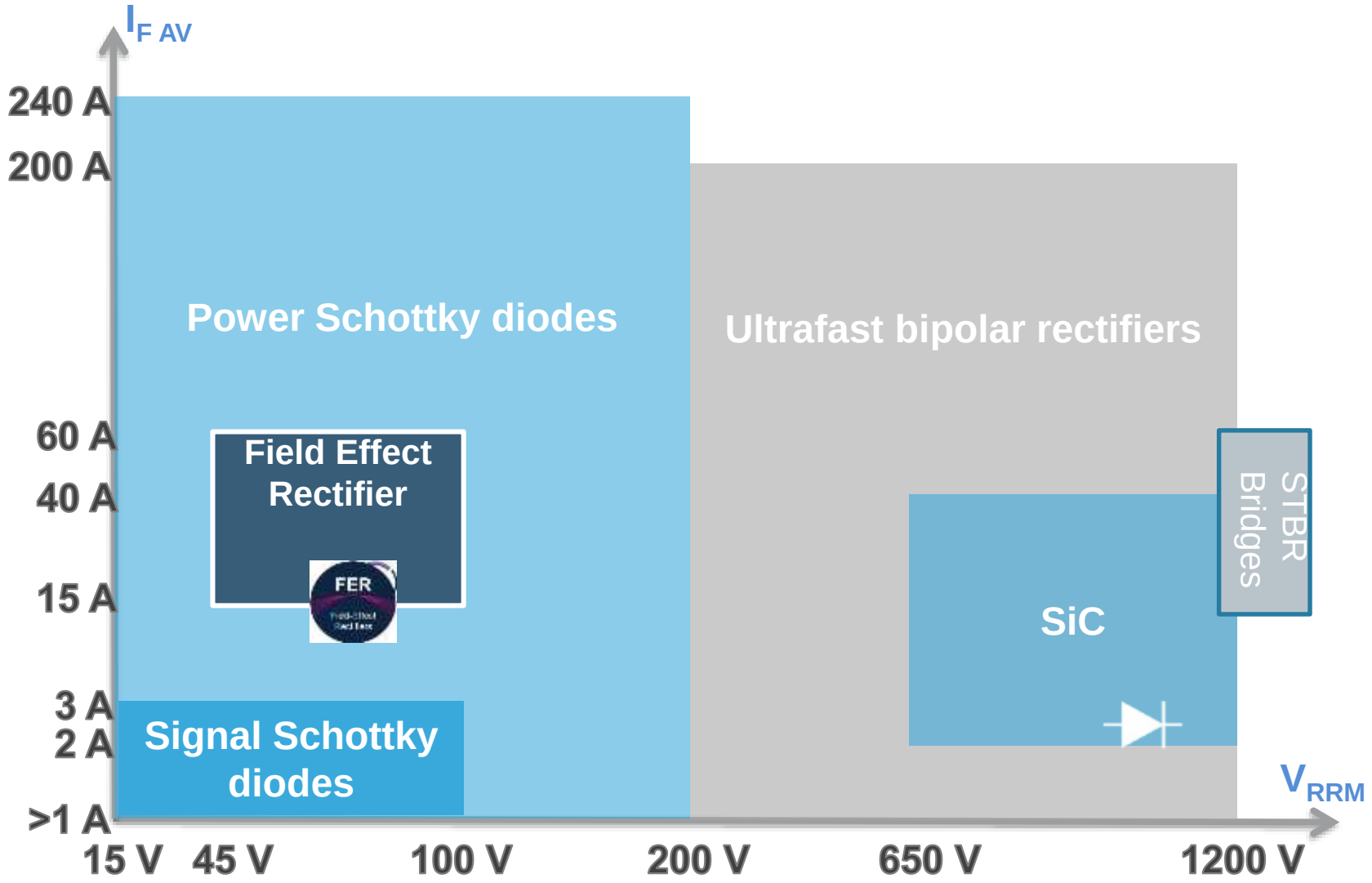
ST Diodes Portfolio



Automotive Rectifiers Main Features

Power Schottky Rectifiers

- Planar Power Schottky technology
- Lowest V_F with “L” series
- Optimized V_F/I_R trade-off (H, M series)
- Avalanche specification
- Tj max = 175°C

Ultra Fast Rectifiers

- Planar Ultra Fast technology
- Lowest Q_{RR} with “R” series
- Tuned for all applications (L, R & S, ST series)
- Tj max = 175°C

Very High Efficiency

- FERD **technology***
  - Power integration
  - PowerFlat 5x6
  - TO-277A
  - Best in class V_F/I_R
  - “U” & “M” series
- SiC **technology**
  - Get the highest efficiency on the market
  - Downsize your global system

Environment & quality

- Lead Free components
- RoHS compliant
- Halogen free resin
- PPAP capable
- AEC-Q101 compliant

4 pillars to drive innovation and leadership

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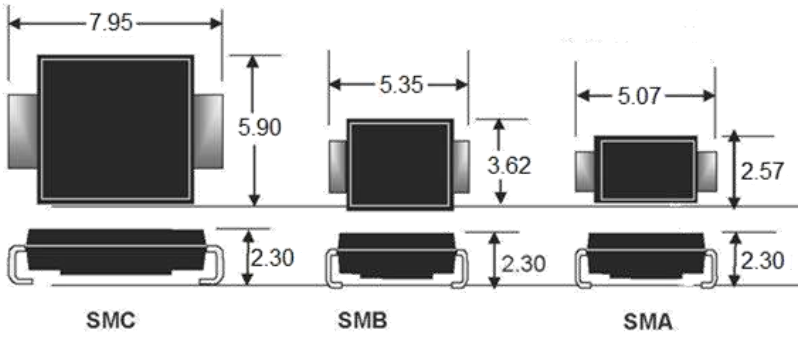
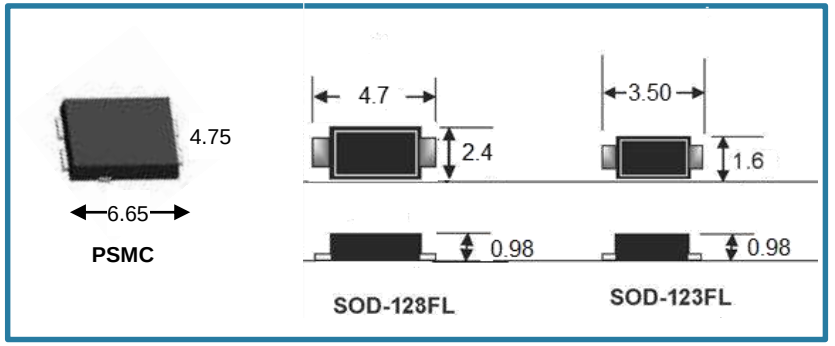
* In development for Automotive

Flat Packages for Diodes

Product Introduction with 50-70% size reduction: Smaller, Thinner, Better



SOD Space Reduction



D²PAK
- Area: 174 mm²
- Thickness: 4.5 mm

PowerFLAT™ 5x6
- Area: 33.7 mm²
- Thickness: 1 mm

DPAK
- Area: 85 mm²
- Thickness: 2.3 mm

PowerFLAT™ 3.3²
- Area: 12.3 mm²
- Thickness: 1 mm

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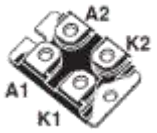
Power Schottky

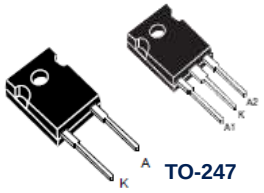
PSMC Release

Power Schottky Product Range

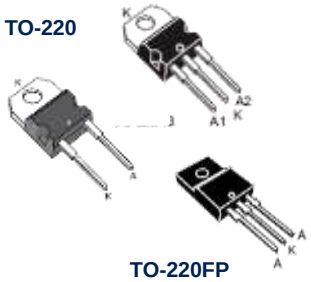
- 15 to 100 V
- 1 to 240 A
- From ISOTOP to SMA Flat
- Extension in Flat Packages: SOD-128 Flat, SOD-123 Flat



ISOTOP



TO-247



TO-220

TO-220FP

D2PAK

DPAK

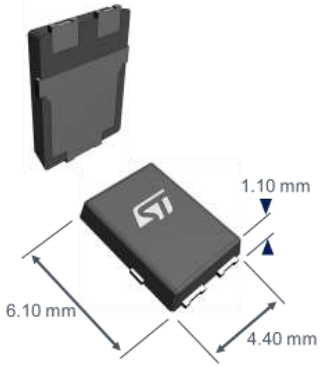
SMA
SMB
SMC

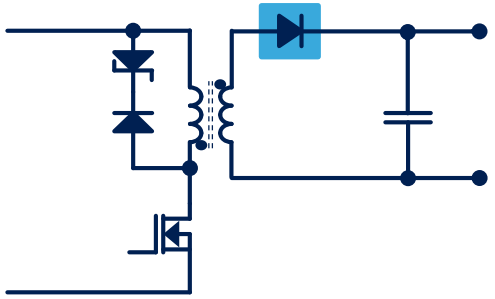
SMA Flat
SMB Flat

*Not exhaustive package list

Released in PSMC

- ✓ TO-277
- ✓ Exposed pad
- ✓ Wettable flanks
- ✓ RoHS- Halogen Free
- ✓ Includes AG products





Ideal for high-performance DC/DC converters and auxiliary power supplies

Ideal for low space environment

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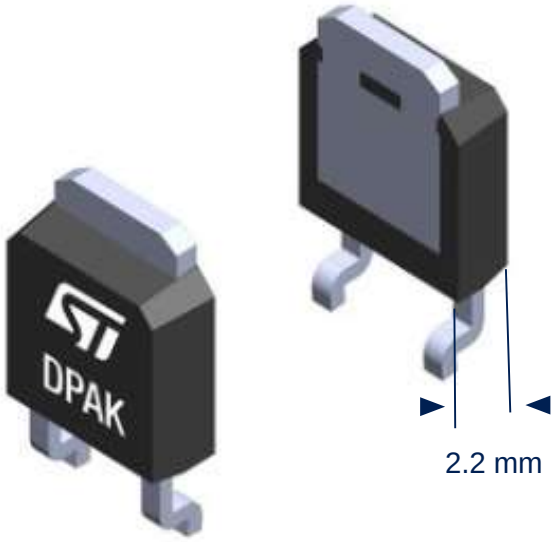
PSMC Key Benefits

Size

New package allowing higher thermal conduction with reduced space and cost



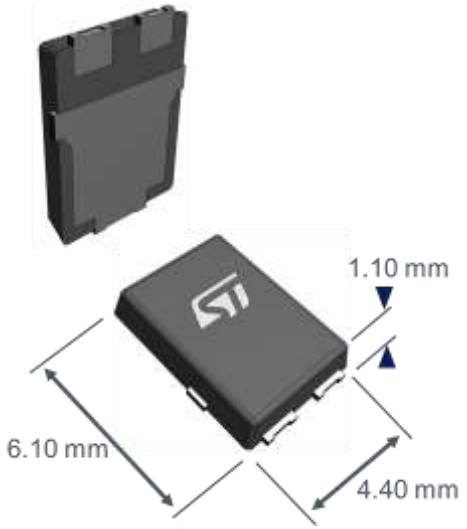
~ 85 mm³
2.2 mm height - 300 mg

-65% *

* DPAK vs. PSMC compared in terms of volume

Volume shrink

PSMC



~ 30 mm³
1.1mm height - 90 mg

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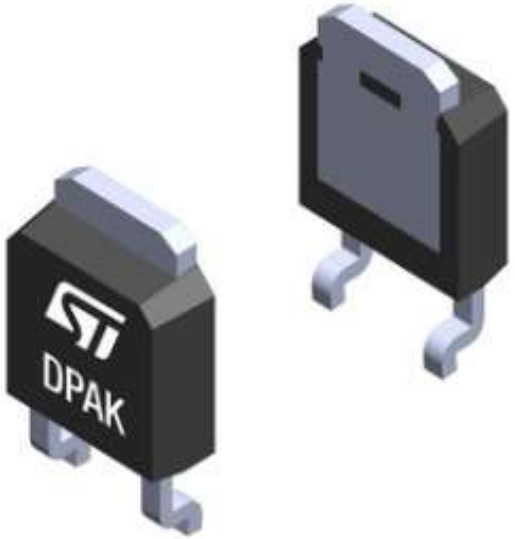
PSMC Key Benefits

Thermal Characteristics

New package allowing higher thermal conduction with reduced space and cost



Rthjc = 2.5 °C / W *
Tj max = 175 °C

-15% *

* STPS5H100B vs. STPS5H100SF compared in terms of thermal resistance

Enhanced thermal conductivity

PSMC

Rthjc = 2.1 °C / W *
Tj max = 175 °C

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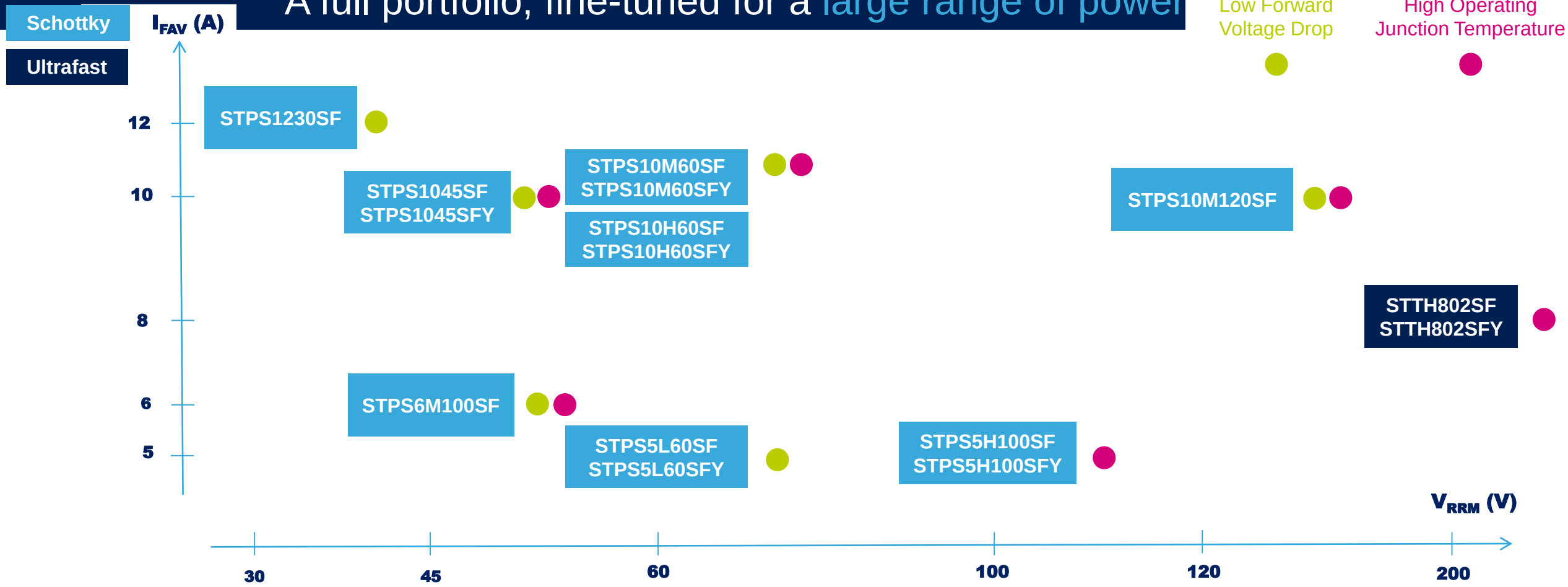
PSMC Schottky Product Line

A full portfolio, fine-tuned for a large range of power



STxxxx = Automotive grade products

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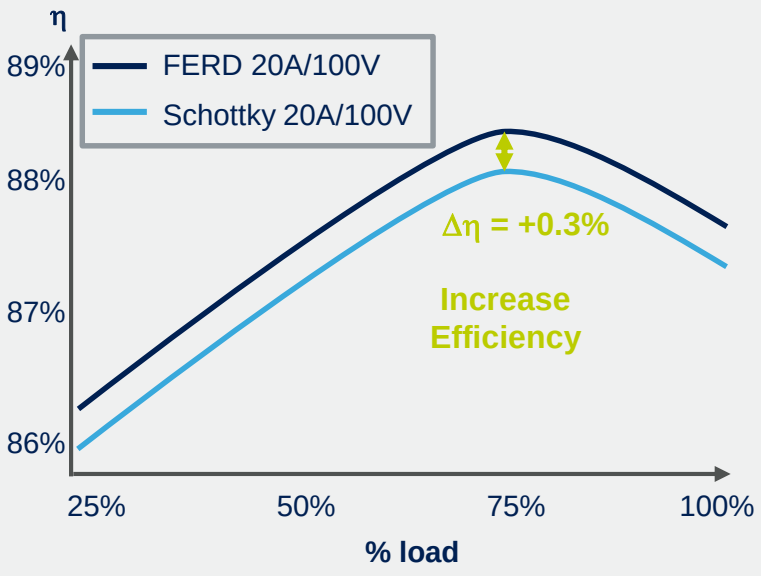
FERD Features

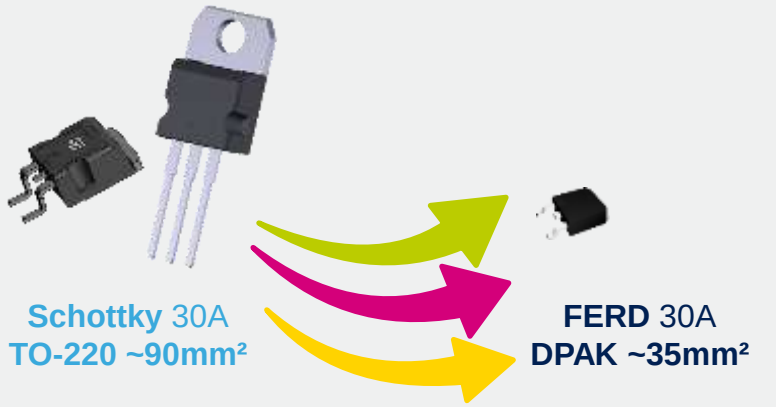
FERD vs Schottky technology
example of 40 W AC/DC converter

Improved efficiency



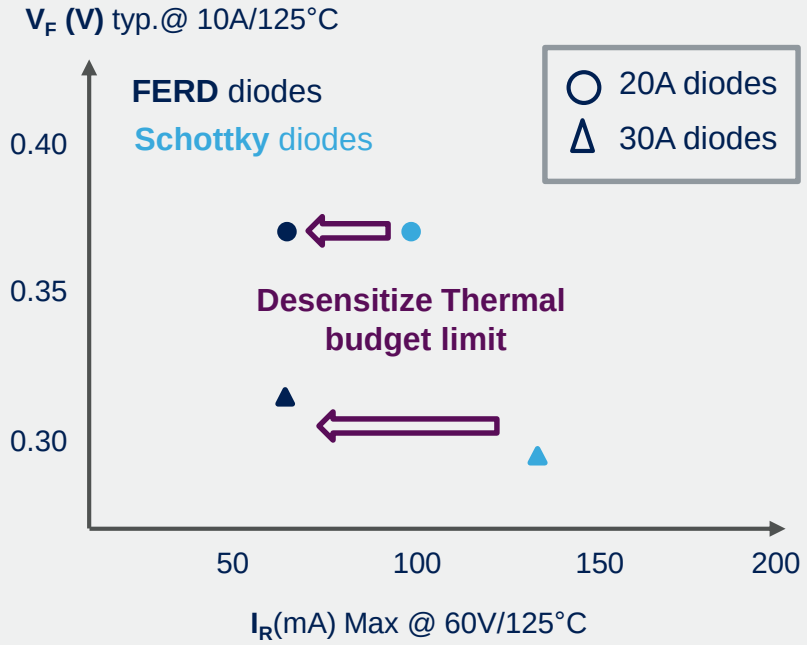
FERD vs Schottky technology
example of 100 V

Integration



FERD vs Schottky technology
example with 60 V diodes

Lower thermal risks



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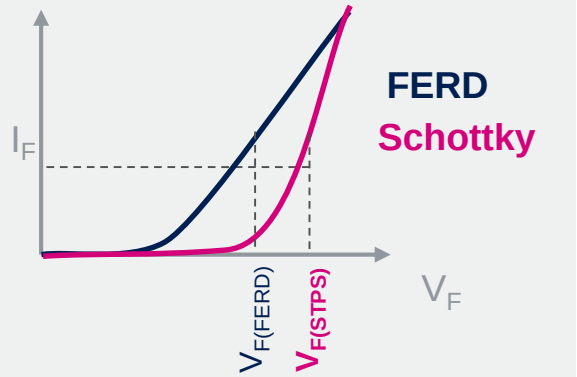
FERD
2018 Releases

FERD Product Range

TO-220 TO-220FP D2PAK DPAK PowerFLAT5x6

- 45 to 100 V
- 15 to 60 A
- TO-220/220FP, D2PAK, DPAK, PowerFLAT™ (5 x 6 mm)

Main Characteristic

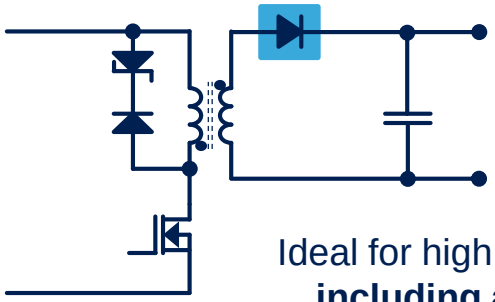


Released in DPAK

20A and more integration in DPAK

✓ FERD2045SB-TR Available

⇒ **Package downscaling from D2PAK**



Ideal for high performance,
including at low load
DC/DC converters,
Auxiliary power supply,

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General Purpose Analog for Automotive

A long history of Automotive general purpose products

- DC-DC converters
- LED Drivers
- LDOs
- Voltage Reference
- Op Amps, Comp, current sense
- Interfaces
- Reset and supervisors
- Automotive Standard Logics

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Automotive Op Amps/Comparators

Products Highlights

TSZ18x series Zero Drift Amplifiers	• Very low offset 25µV max • Very low drift in Temperature 0.1µV/°C • Excellent Speed/power ratio 3MHz /1mA
TSX7x Series Precision 16V Amplifiers	• Very low offset 200µV max • Very low drift in Temperature 2.5µV/°C • Energy efficient
TSB7x series Low Power 36V Amplifier	• 6MHz / 22 MHz GBP • 300 µV max input offset Voltage • Operating from 2.7V to 36V
LM290xH series Grade 0 (150°C)	• SO/TSSOP/MiniSO packages • High Temperature guarantee • Op-Amps and Comparators
TSX370x/TSX339/TSX393 Open drain Comparators	• 16V CMOS Dual & Quad series • MicroPower 5µA max • DFN8 2x2mm & QFN16 3x3mm

Automotive

O2 sensor

Current measurement

Steering angle sensor

Resistance temperature detector

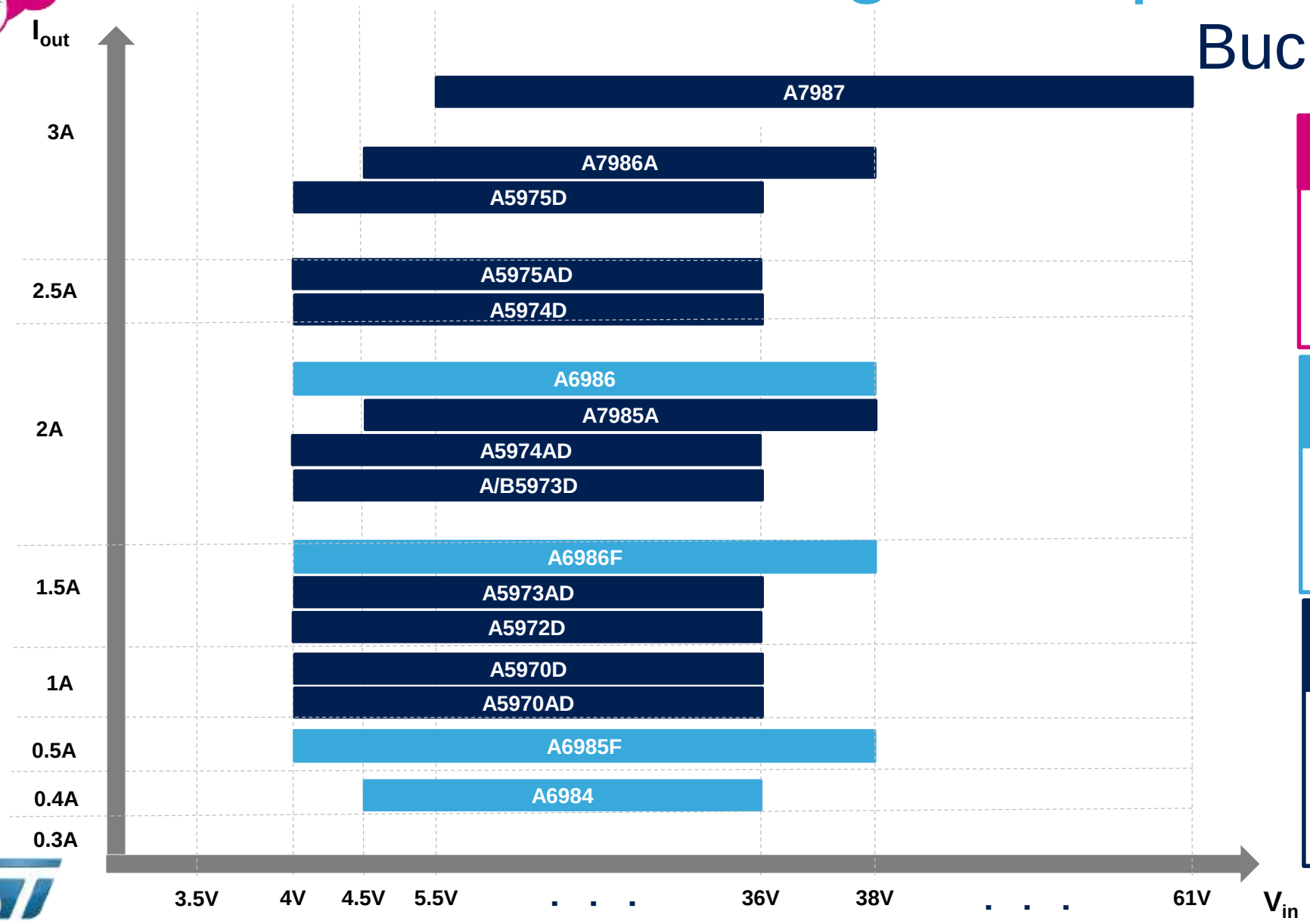
Gear box

Engine control

Breaking system

Single Output Front-End

Buck Converters



DC-DC Converters

- ✓ *3.3V to 61V input voltage*
- ✓ *Adjustable Switching Frequency*
- ✓ *Low quiescent current (I_Q = 30µA)*
- ✓ *Low minimum Ton (80ns)*
- ✓ *Synchronization capability*

Linear Voltage Regulators

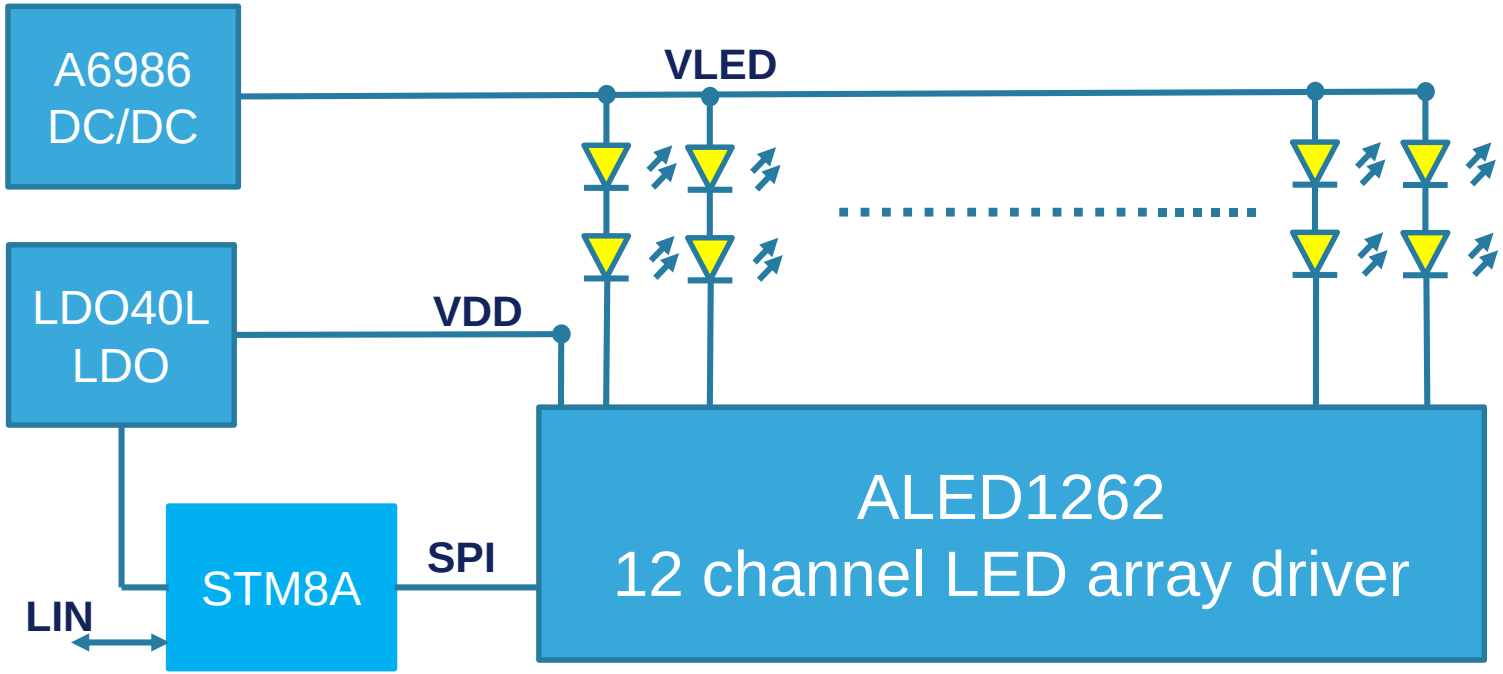
- ✓ *Front-end and post regulation*
- ✓ *Low quiescent current*
- ✓ *Low noise and high PSRR*
- ✓ *DFN or leaded packaging*

Automotive LED Drivers

- ✓ *High brightness and accuracy*
- ✓ *Analog and Digital Dimming*
- ✓ *Custom configuration by OTP*
- ✓ *I2C interface*
- ✓ *Error Detection*

ALED1262 for Rear Combination Lights

LED Array driver for Rear Combination Lights



Typical application

Features

- Supply voltage: 5.5V to 38V
- 19V current generators rated voltage
- Output current: from 6mA to 60mA
- 7 bit PWM local brightness control
- Slow turn on/off time for EMI reduction
- Gradual Output Delay
- Error detection for open LEDs
- Stand alone or I2C driven
- Wired OR error flag connection

Automotive Processors and MCUs

Scalable General Purpose & Performance MCUs

Power

Actuation
Networking

eFlash

AEC Grade0

Advanced MCUs

Stellar

ARM

Gateways
Domain & Zone Controller

PCM FDSOI

AEC Grade0/1

Computing & Connectivity MPUs

ARM

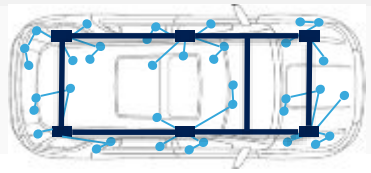
Smart Gateways
Domain & Zone Controller
Fusion & Gbit telematics

FinFET

AEC Grade1

Multicore 3xZ4
with GTM & HSM
Up to 150Deg

Multicore Cortex R52 with HSM
& Accelerators



Cortex A 10-40K DMIPS
R52 Safety & Security
MCU subsystem

Concept product

Audio & Graphics MPUs

ARM

AEC Grade1-2

Car Radio
Car Display Audio & Digital Cluster

- **Cortex R4 with GFx**
- **2xA7 with GPU & Video Decoder 85Deg**

Communication MPUs

ARM

Telematics
V2X communication

2x Cortex A7
+ M3 + HSM
105Deg

ADAS MPUs & Flashless MCUs

ARM

FinFET

AEC Grade1

Multi channel Radar
Safety , Performance extension

Flasheless MCUs
with R52 Core, DSP accelerator
Mipi DSI-2 RX/TX interfaces

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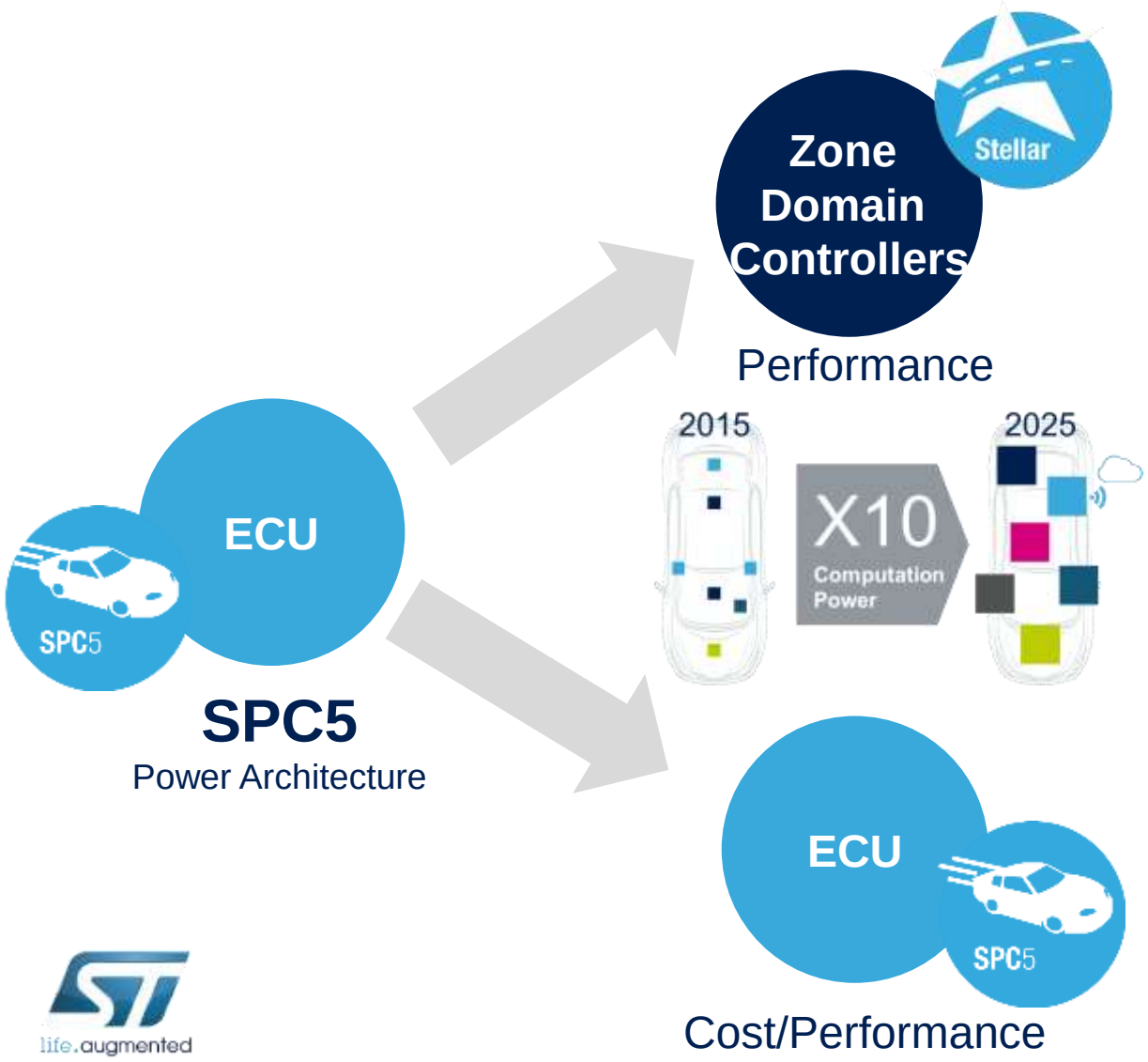
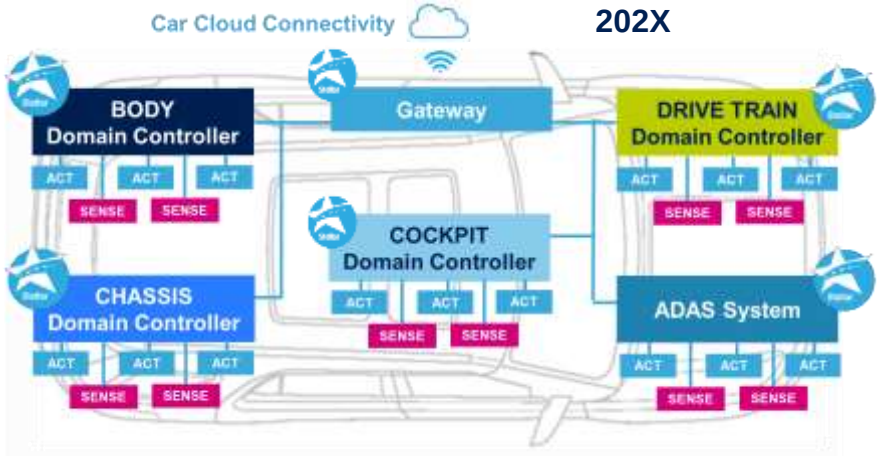
32-bit Automotive MCU Evolution

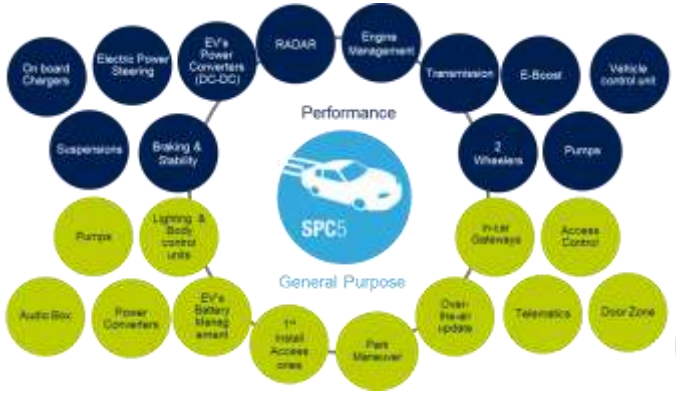
Application View



Stellar Arm R52 28nmFDSOI PCM for High end



SPC5 Power Architecture Flash NVM for Single ECUs



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32-bit Automotive MCU Evolution

Family/Technology View

64M
32M
24M
20M
16M
12M
10M
8M
6M
4M
2M
1M
512K
256K

SPC5x Families

SPC56 Families 90nm

z0-64MHz
to z4-150MHz

256K to 4M

first ASILD MCU

QFP64..176 / BGA256..324

SPC57 Families 55nm

z0-80MHz
to z4-160MHz

256K to 2.5M

QFP64..176

SPC58 Families 40nm

z2-80MHz
to 3xz4-200MHz

512K to 10M

QFN48
QFP64..176
BGA292..386

SR6 Families 28nm

ARMv8-R Cortex-R52
From 1x to 6x core
Up to 400MHz

6M to 24M
(up to 47M in „OTA X2“ mode)

QFP144..176
BGA292..516

Power Architecture e200 | ARMv8-R

z0 | z4 | Cortex-R52

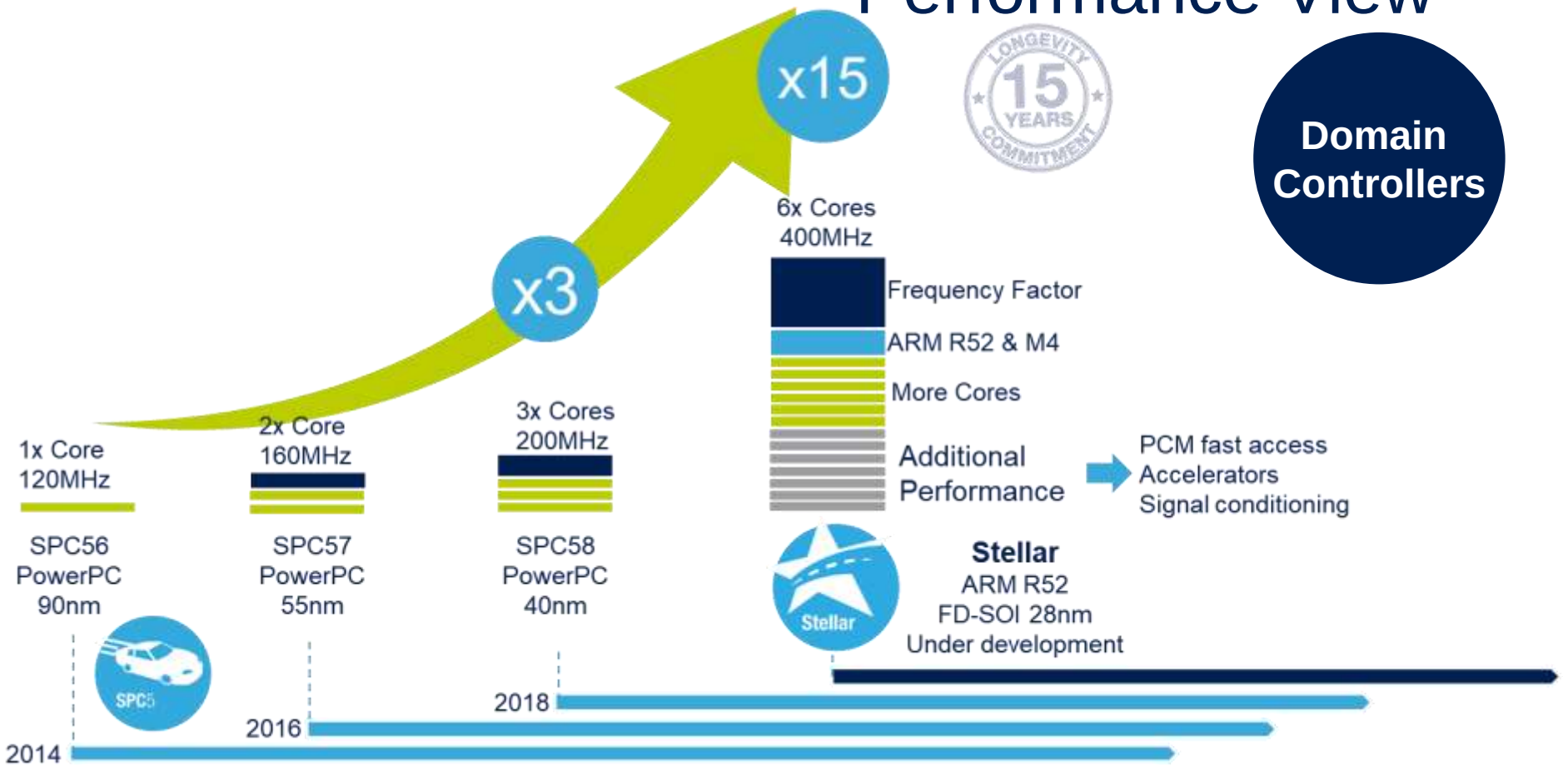
64MHz 120MHz 150/160MHz 180MHz 200MHz 250/300MHz 400MHz

32-bit Automotive MCU Evolution

Performance View

New generation of Real-Time MCU

Domain Controllers



28FDSOI + embedded NVM with automotive qualitiy

1st Samples available since Nov'18

Stellar Family

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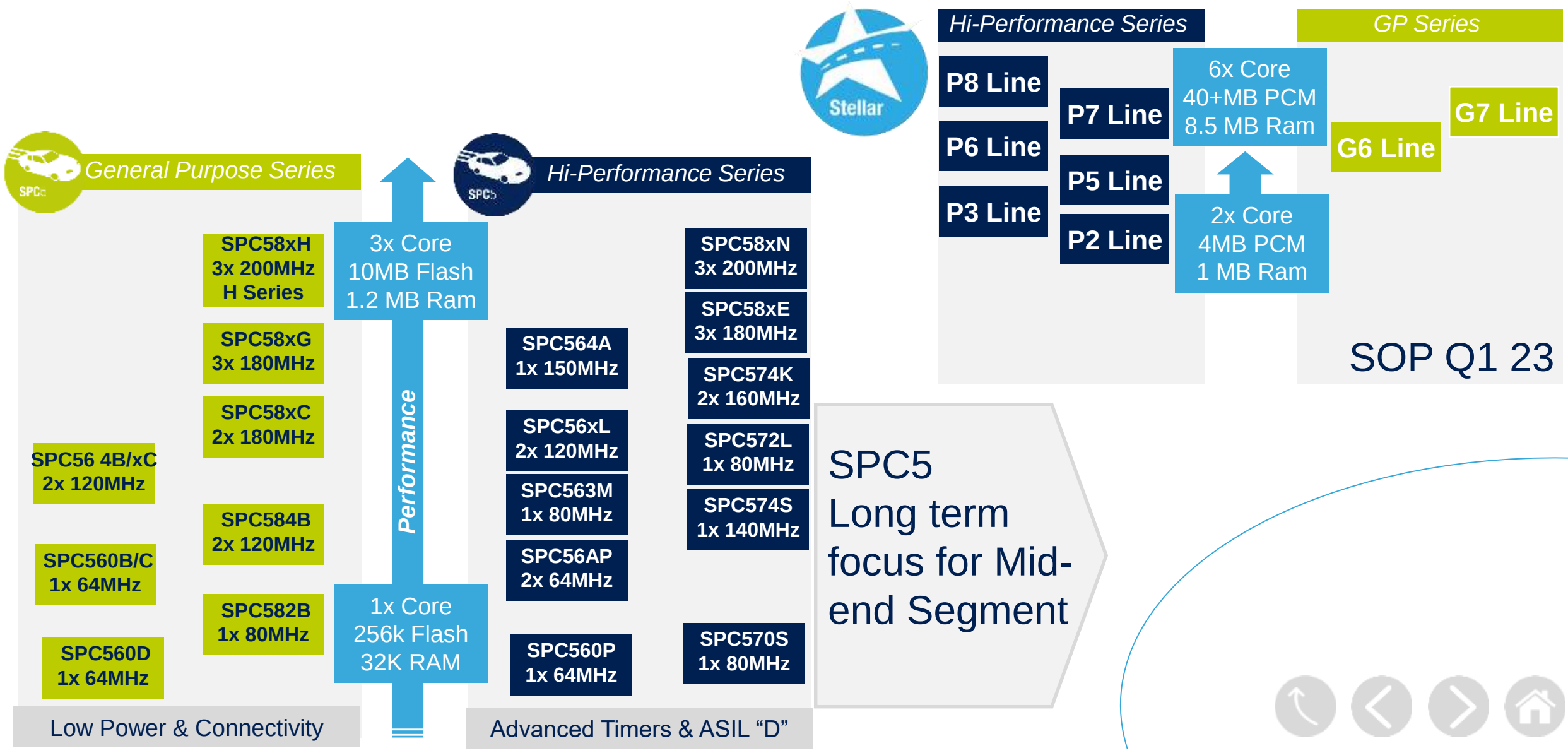
32-bit Automotive MCUs Roadmap



Automotive Package Roadmap

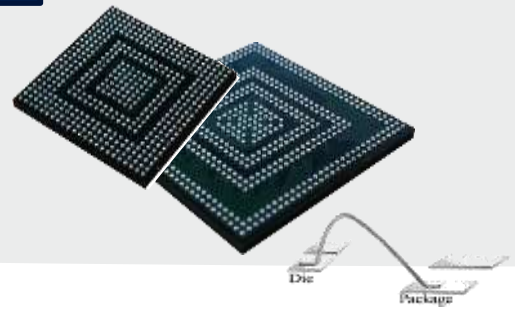
Performance

Efficient
Pins vs Size

Small

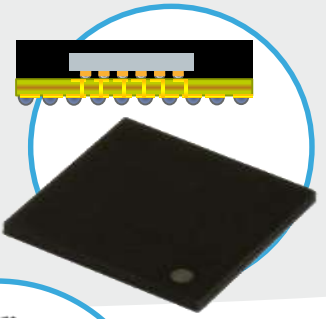
BGA

Wire bonding



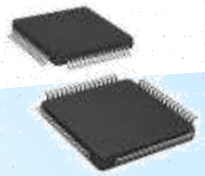
Flip-chip

Molded
Flip-Chip

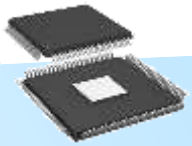


Higher Freq
Better Safety
Better Thermal
Performance

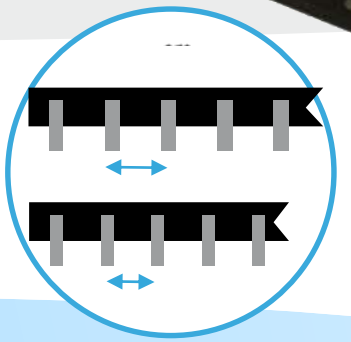
QFP



eQFP



More I/Os same size

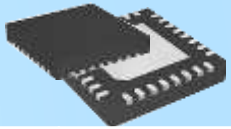


0.5mm pitch

0.4mm pitch

Up to 4Mbyte Flash
in 10x10 64Pin

QFN



7x7 Body- 48Pins

Today

Roadmap

ST leading the way towards smaller, faster and cooler MCUs

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Automotive Technology Roadmap

Embedded NVM

1-Transistor NOR Flash

PRODUCTION

M10
CMOS90nm
0.18 µm²
Flash cell

PRODUCTION

M55
CMOS55nm
0.135 µm²
Flash cell

PRODUCTION

M40
CMOS40nm
0.082 µm²
Flash cell

BCD10
90nm
PCM

beyond Flash

M28
28nmFDSOI
0.038 µm2
PCM NVM

M18
18nmFDSOI
PCM NVM

Crolles

In- house Embedded NVM Development & Manufacturing in Advanced 300mm Wafer Fab (<28nm)

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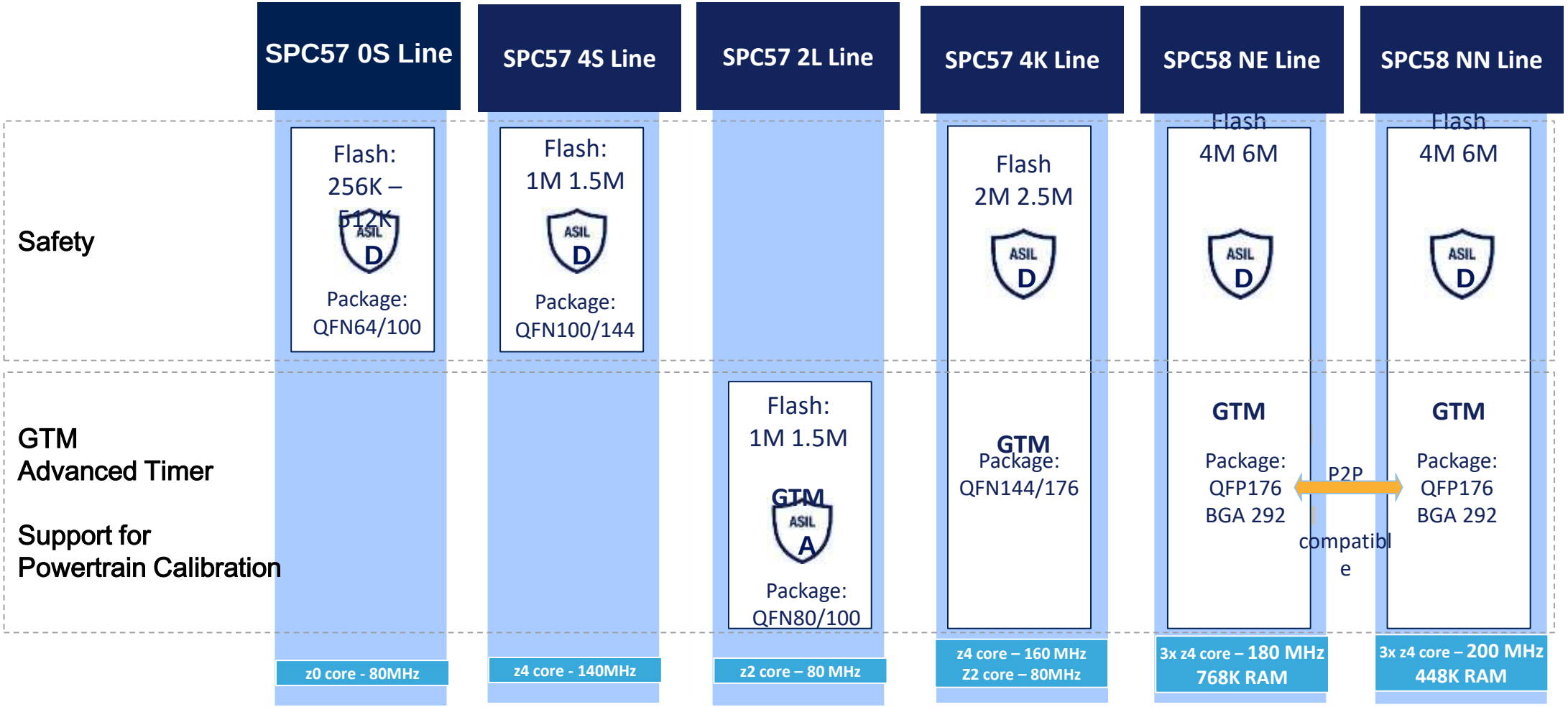
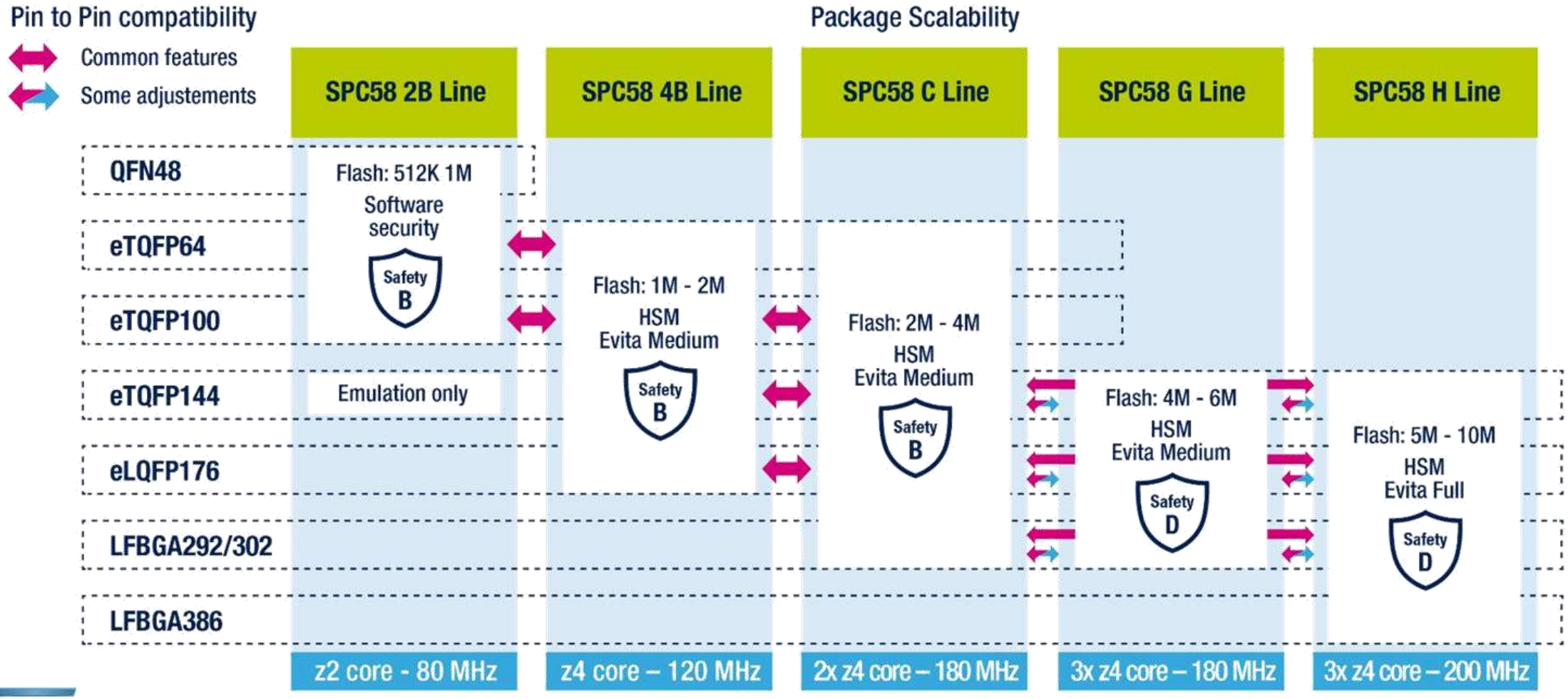
SPC5 High Performance Series

Safety and Advanced Timer



SPC5 General Purpose Series

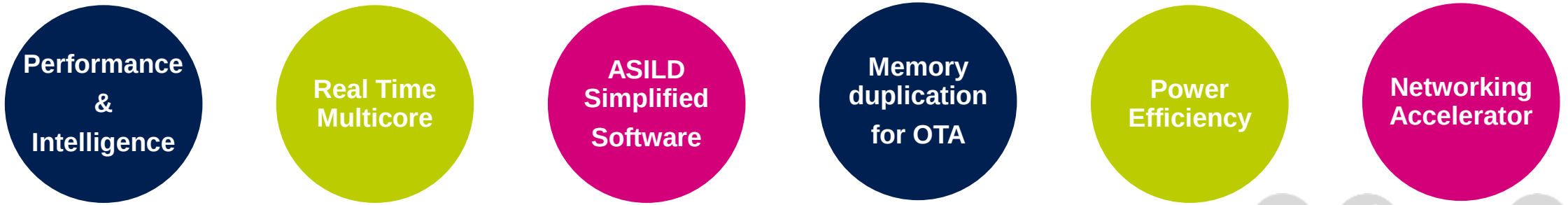
Fully Scalable Chorus Product Family



Stelllar High Performance
Automotive Microcontrollers

Technology Innovation to enable new market segments

- Advantages in **Performance** and Resources
  - ARMR52 @400/600Mhz, 6Cores, 40+Mbyte NVM, 8Mbyte RAM, Accelerators
- Advantages for **Real-time**
  - core enhanced performance
  - GTM4 with picosecond Timer
  - HW Virtualization
- Advantages for **Simplified ASIL D software**
  - Spatial Virtualization
- Advantages for **Over-the-air Software update**
  - Memory temporary duplication
  - A/B memory swap
- Advantages in **Power Consumptions**
  - FDSOI leakage and dynamic performance
- Advantage for **Messages Networking**
  - Routing accelerator for crypted messages



A mix of Technology and Product innovation

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Automotive Protection Mapping

ECU & EV Protections
POWER LINES / LOAD DUMP / DC RAIL

INFOTAINMENT Protections and Filters
USB / HDMI / SERDES / Audio

COMMUNICATION BUS Protections
CAN / LIN / FLEX RAY / ETHERNET

CONNECTIVITY Protection and Filters
V2X $ ADAS ESD protected COMMON MODE FILTERS

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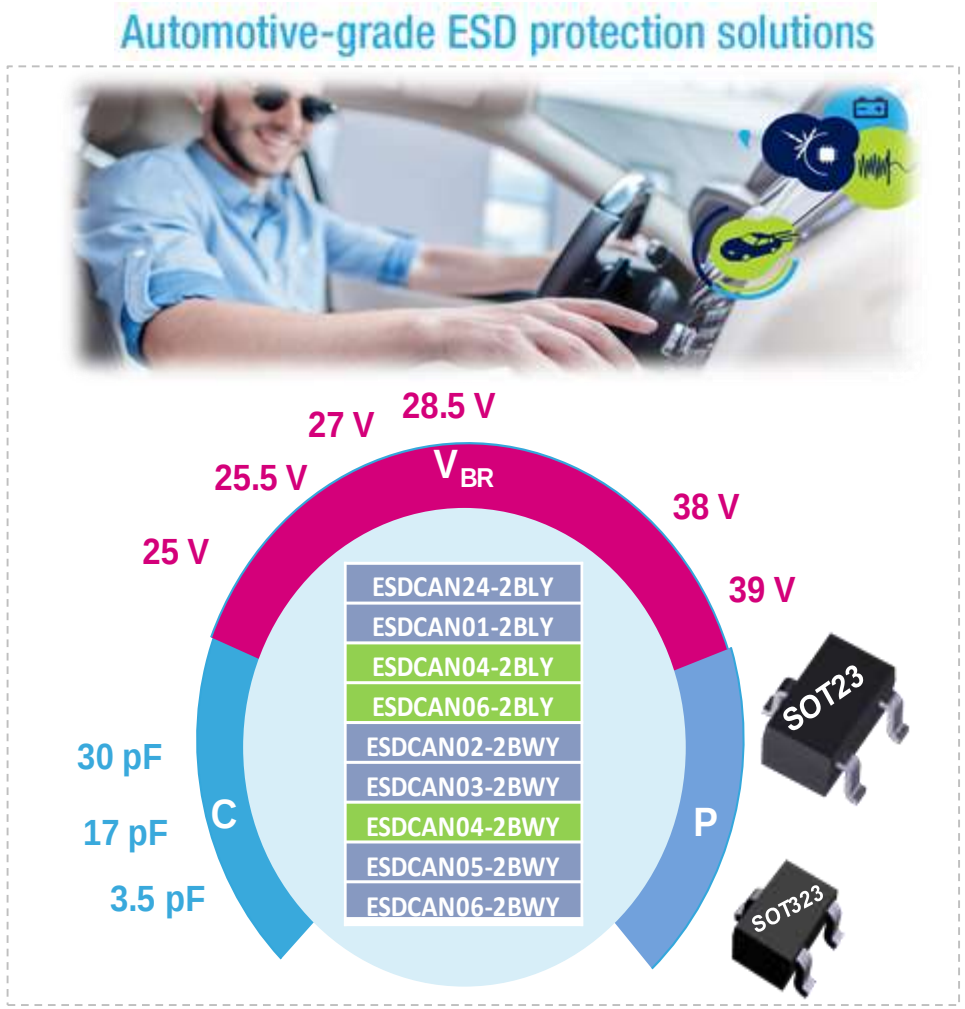
AG CAN/LIN Transient & ESD Surge

Suppressors



Enables high-density PCB designs with SOT23-3L and SOT323-3L small packages

Stand-off voltage: from 24 V up to 36 V

AEC-Q101 Compliant ISO 7637 3a & 3b, ISO 10605 / IEC 61000-4-2, ISO 16750-2

High Tj max rated at 175 °C
And wide range of low capacitance diodes

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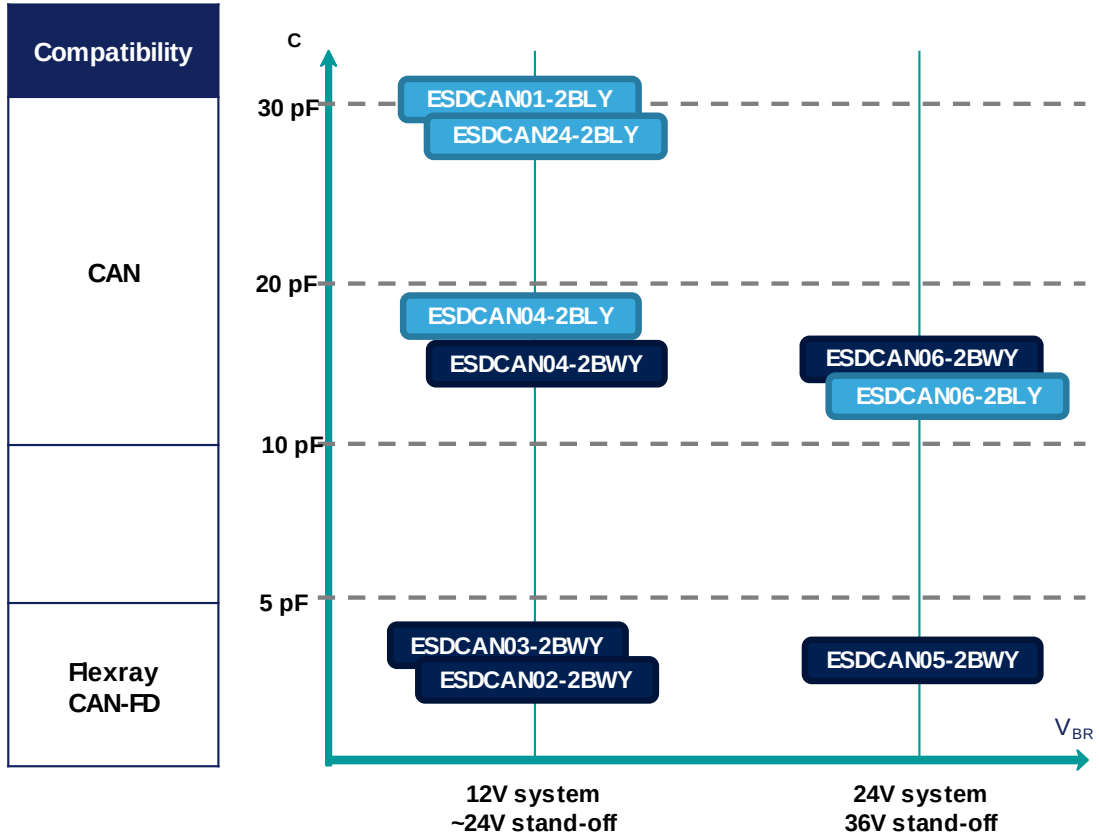
Flexibility and Miniaturization

Stand-off voltage: from 24 V up to 36 V



	V_{RM}	IRmax @ V_{RM}	V_{BR} min	C @ 0 V	ISO 10605 C = 150 and 330 pF	Package	Status
ESDCAN24-2BLY	24 V	100 nA	27 V	30 pF	30 kV	SOT23-3L	Prod
ESDCAN01-2BLY	24 V	100 nA	25 V	30 pF	30 kV	SOT23-3L	Prod
ESDCAN04-2BLY	25.5 V	50 nA	25.5 V	19 pF	30 kV	SOT23-3L	Prod
ESDCAN06-2BLY	35 V	100 nA	38 V	15 pF	22 kV	SOT23-3L	Prod
ESDCAN02-2BWY	26.5 V	10 nA	28.5 V	3.5 pF	30 kV	SOT323-3L	Prod
ESDCAN03-2BWY	24 V	10 nA	26.5 V	3.5 pF	30 kV	SOT323-3L	Prod
ESDCAN04-2BWY	24 V	10 nA	27.5 V	19 pF	30 kV	SOT323-3L	Prod
ESDCAN05-2BWY	36 V	100 nA	39 V	3 pF	30 kV	SOT323-3L	Prod
ESDCAN06-2BWY	35 V	100 nA	38 V	15 pF	22 kV	SOT323-3L	Prod

SAE INTERNATIONAL

APPROVED

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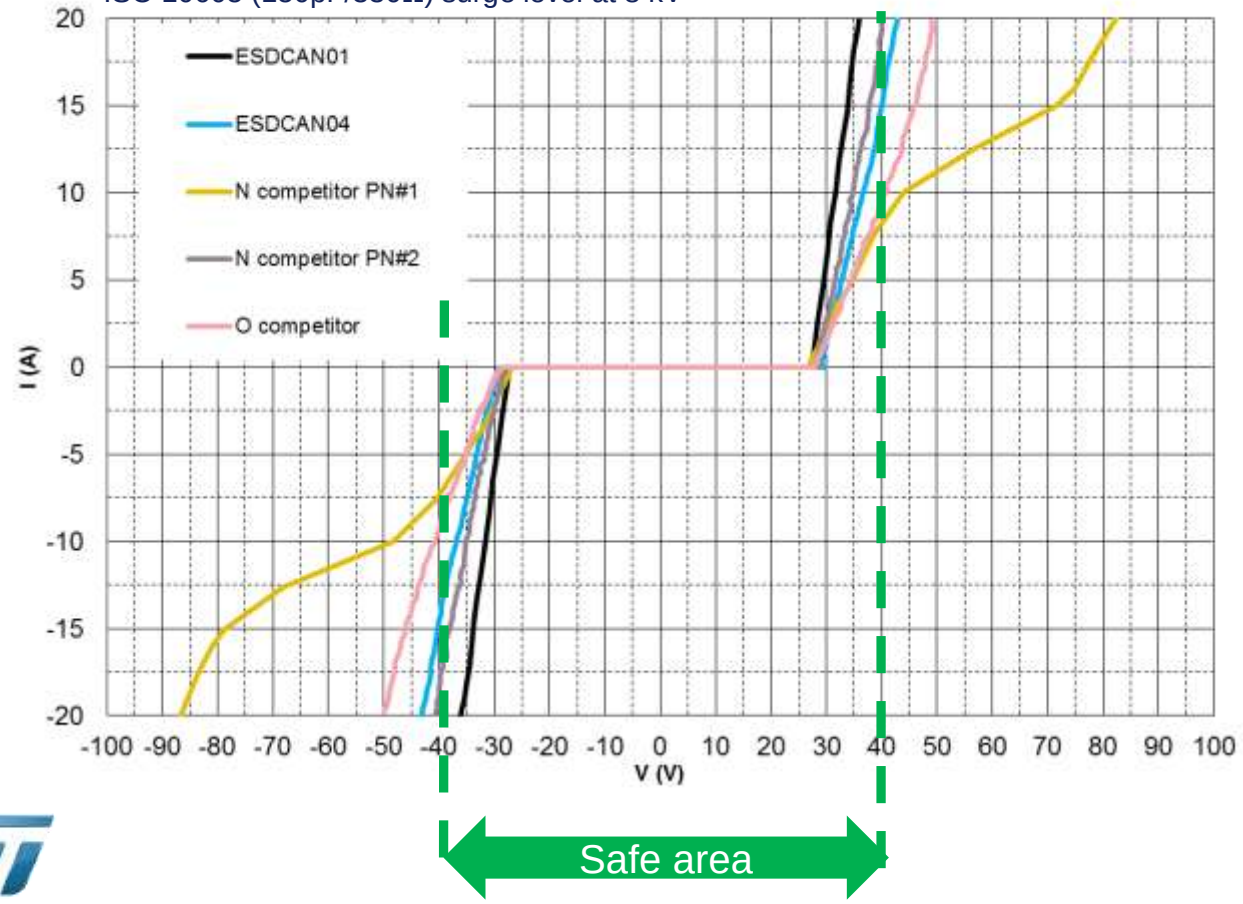
Robustness & Performance

Best of the silicon technology to lower the Clamping Voltage during ESD tests

ISO 10605 (150pF/330Ω) surge level at 8 kV



PERFORMANCES COMPARISON

ESDCAN04 ISO pulse test at 16A **V_{CL} = 40 V**
ESDCAN01 ISO pulse test at 16A **V_{CL} = 35 V**

Most of the automotive CAN transceiver ICs are rated max operating voltage at 40 V

N vendor ISO pulse test at 16A **V_{CL} = 75 V**

*STMicroelectronics ESD diodes are providing **80%** better ESD surge immunity than competitors*

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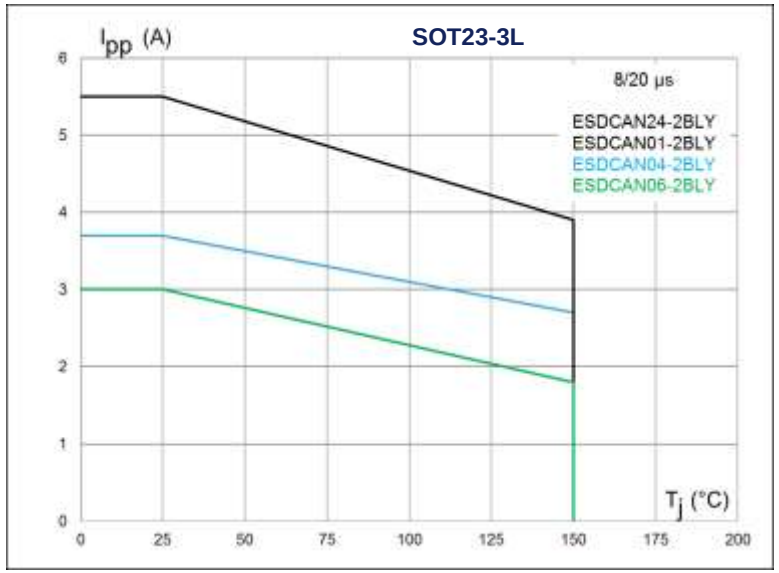
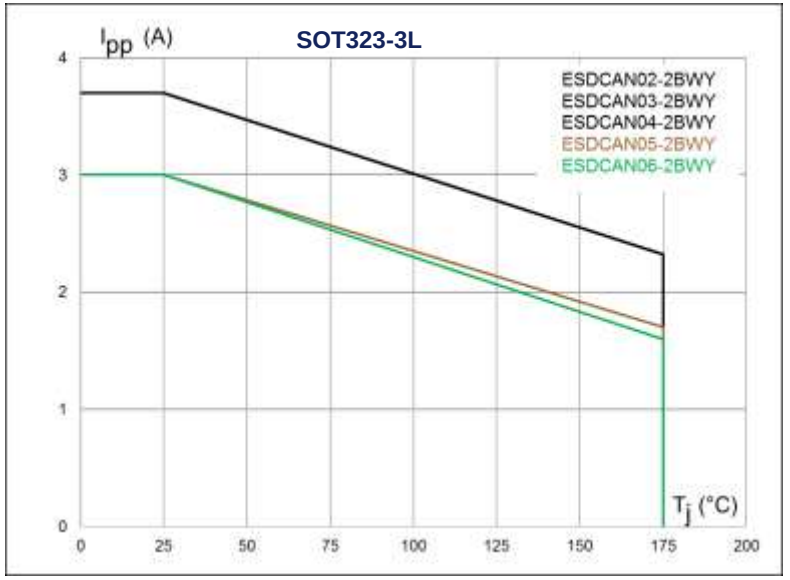
Reliability

AECQ101 / Designed to work in extreme tough environment at max Tj 175C





Best in class in the market with the lowest power deratings over the temperature range

Approved by

Ford GMC VOLVO

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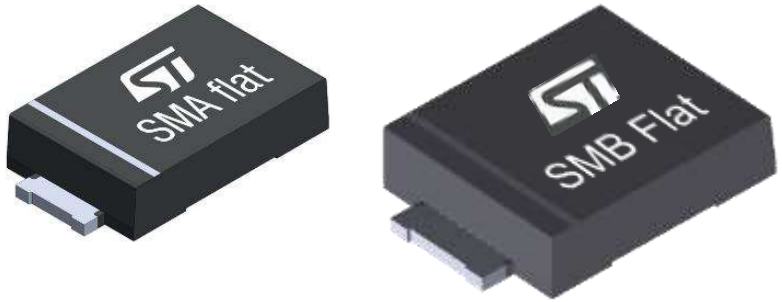
TVS Diode Flat Packages



400W to 600W TVS DIODES

SMAF & SMBF

400W to 600W
10/1000us EOS

ROBUSTNESS

Qualified up to 175C

COMPACTNESS

52% Thinner
29% Smaller

SIMPLIFICATION

FOOTPRINT
COMPATIBLE

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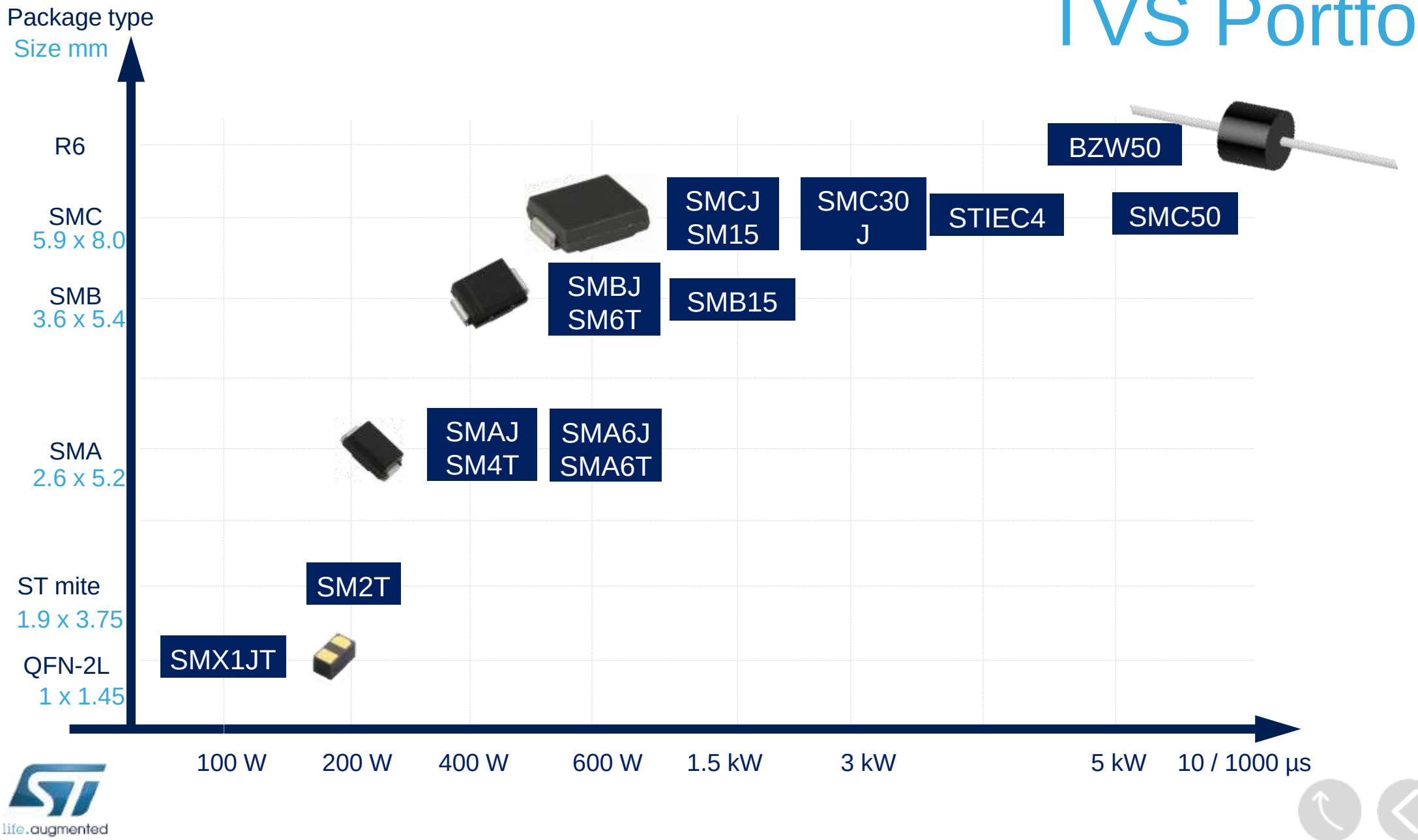
TVS Portfolio



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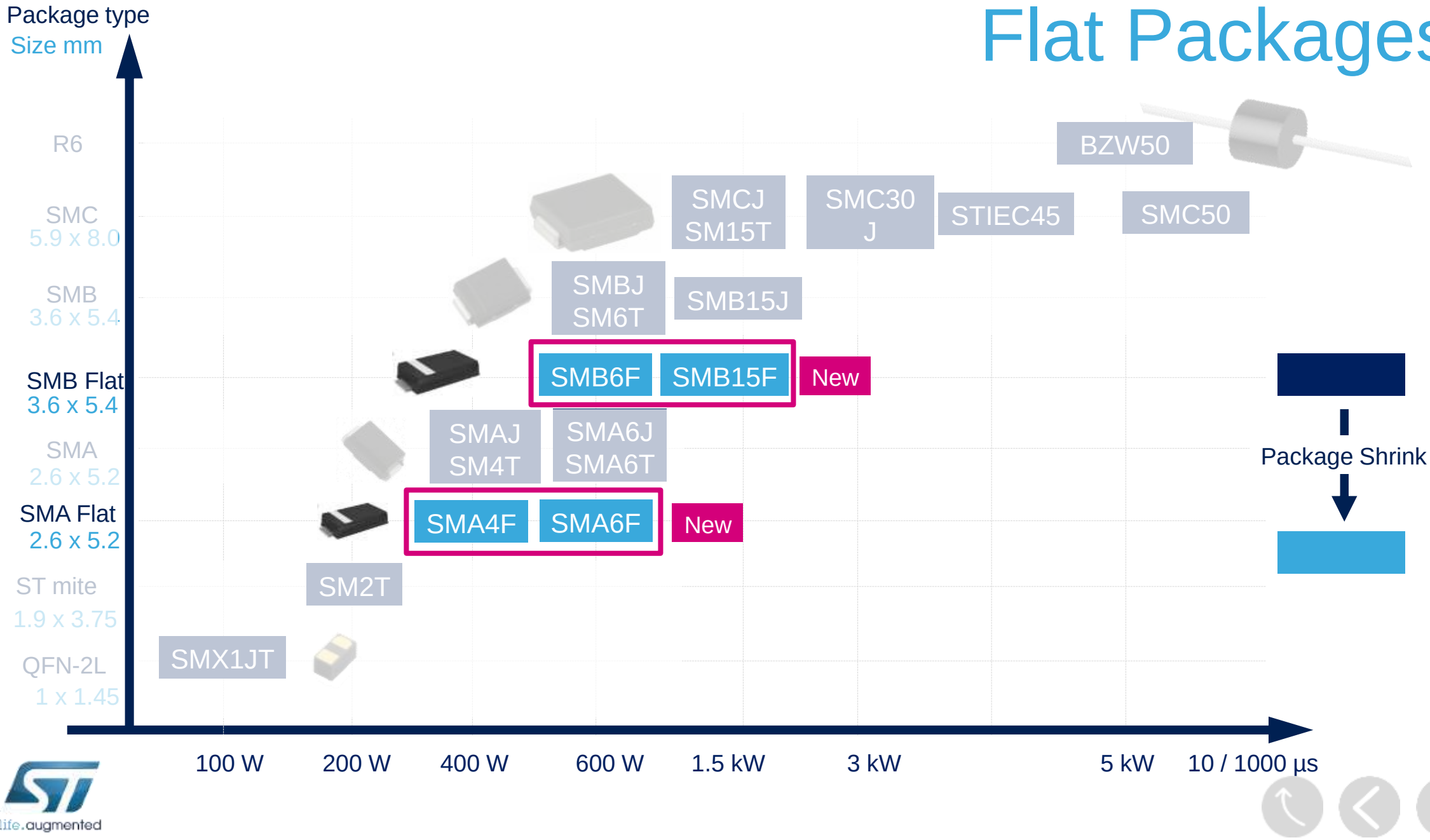
Flat Packages



ST TVS Flat Packages

A well proven technology in a brand new thin package

UNCHANGED

- Electrical parameters
- Footprint (compatibility)
- ST internal production line

IMPROVEMENTS

- Package thickness
- Solderability : wettable flank for AOI and notch for wave soldering 
- Tj max increased up to 175°C
- Product line capacity
- Power density (600W in SMA flat package)

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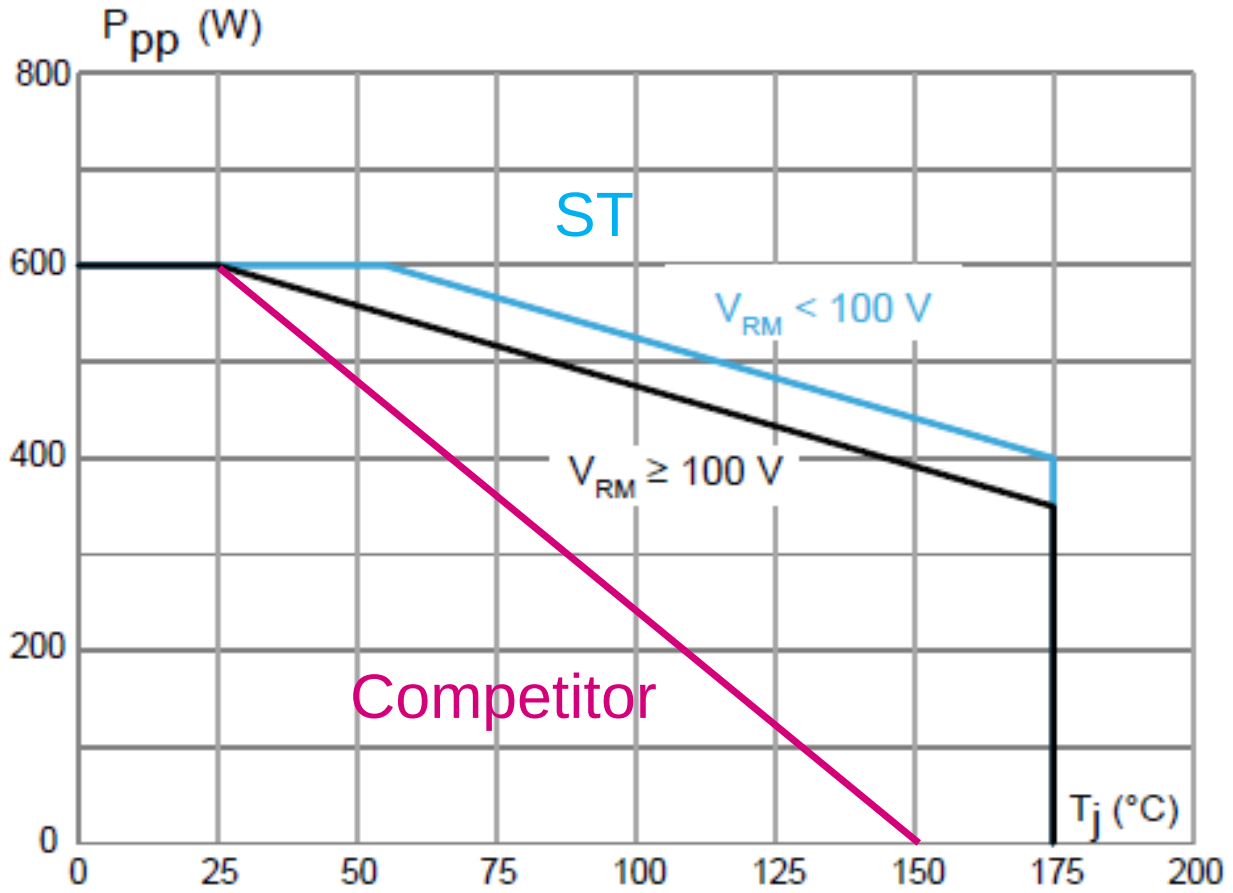
SMB6Fxx

Temperature Derating Impact

ST TVS key differentiator : Tjmax = 175°C

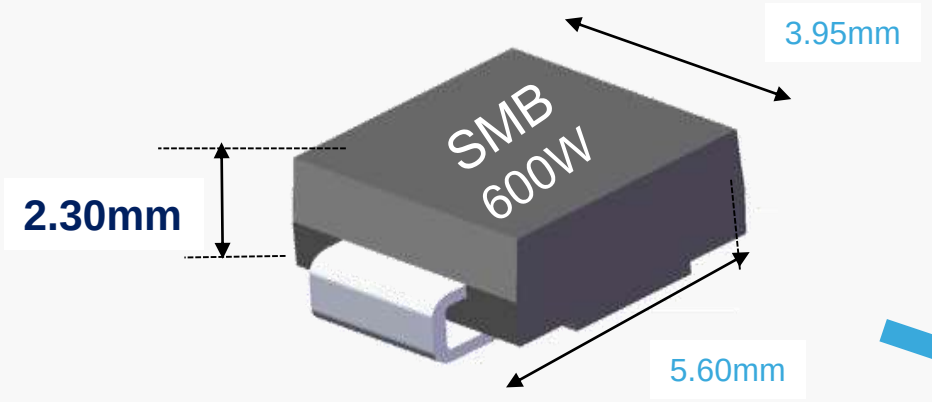
Maximum peak power dissipation versus initial junction temperature



600W Smart Package Swap

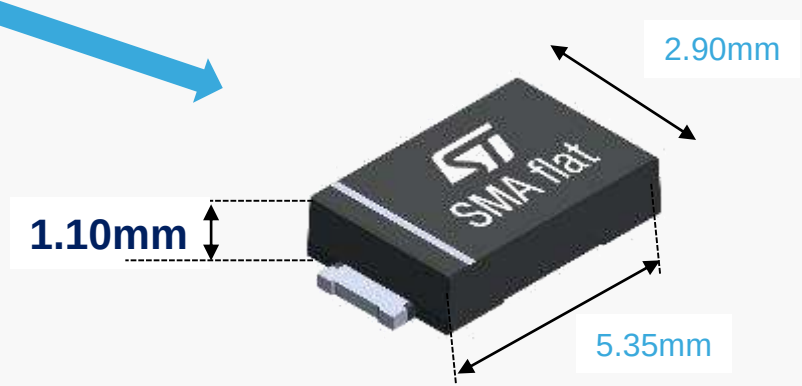
Without Footprint Changes

Thinner + Smaller packages + Cost Effective Solution



FOOTPRINT
COMPATIBLE

52% Thinner
29% Smaller
Iso Power Capability 600W



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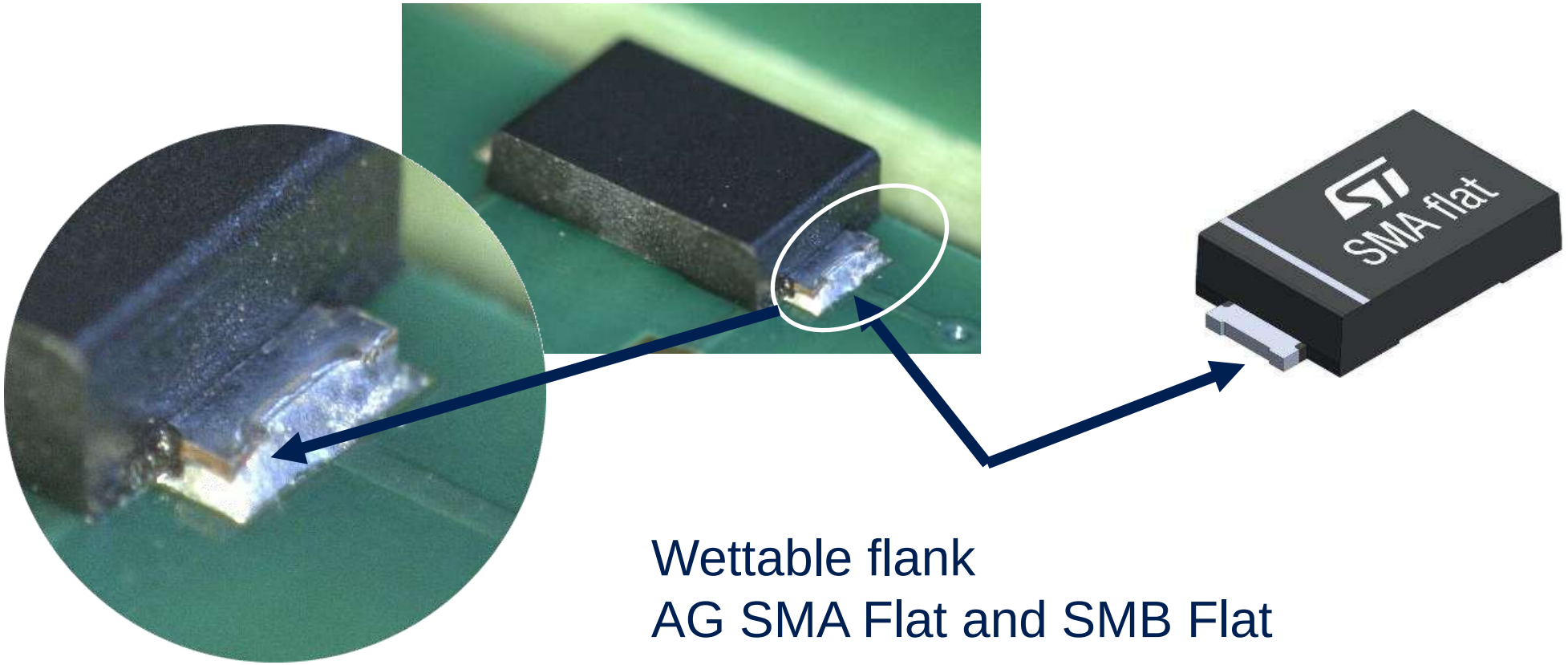
Automotive Grade Packages

Automatic Optical Inspection Compatibility



Wettable flank
AG SMA Flat and SMB Flat

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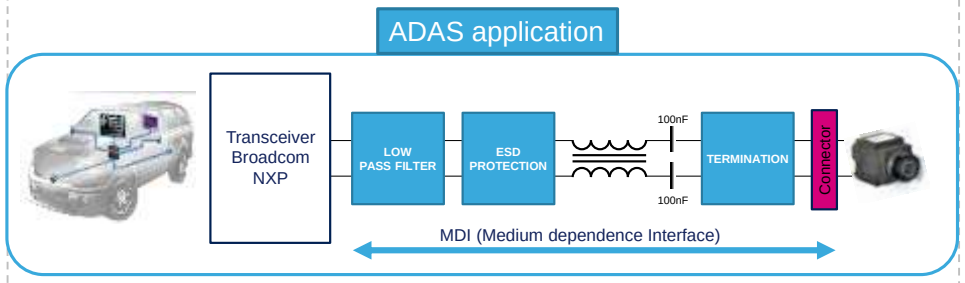
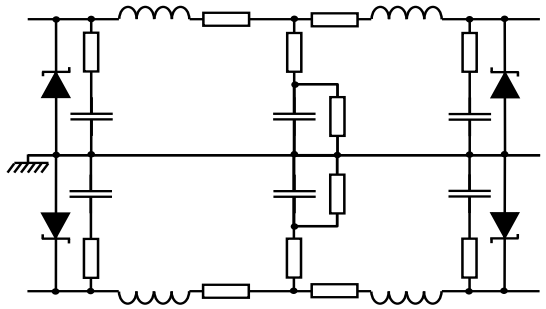
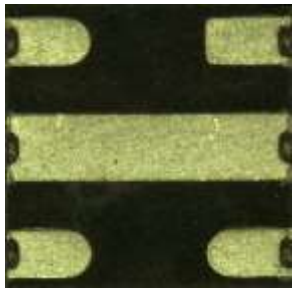
BroadR-Reach Integrated Low Pass Filter







EMIF02-02ABRY
3mm x 3mm uQFN

EMIF02-02ABRY
2 lines EMI filter
with Integrated
ESD Protection

ROBUSTNESS

15 KV ISO10605
Rated -40C to 125C

PERFORMANCES

S11D -20dB min
up to 60MHz

SIMPLIFICATION

70% PCB saved
80% BOM reduction

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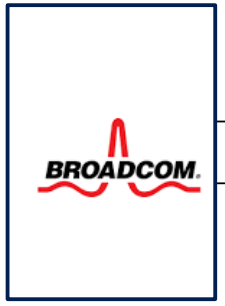
ADAS Protection and Filters

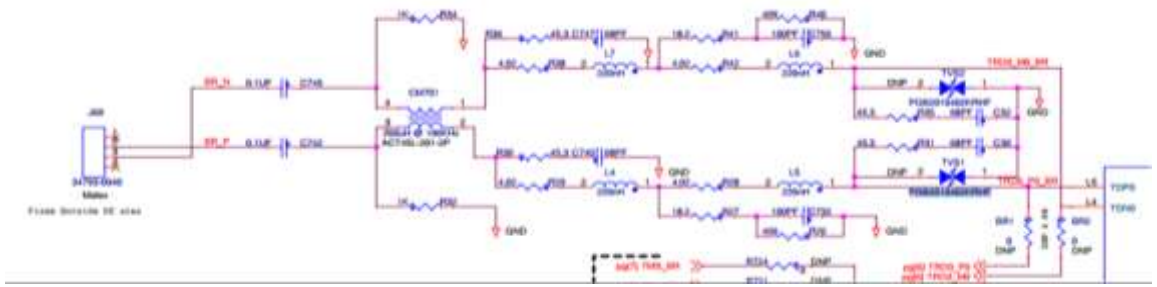
ADAS application

What is BroadR-Reach?

- Leverages standard Ethernet technology designed for automotive applications
- 100 Mb/s Ethernet over unshielded twisted pair (UTP) cabling up to 15m
  - 40m reach over shielded twisted pair
- Pioneered by Broadcom



ADAS Protection and Filters



Discrete version (best case)
30.7mm²

28 components

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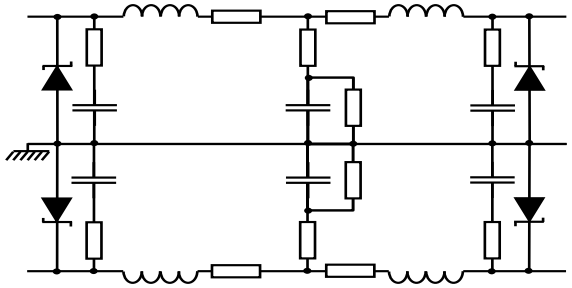
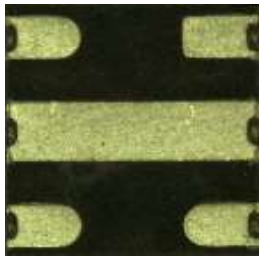
ADAS Protection and Filters



3 x 3 mm



AEC-Q101 qualified

EMIF02-02OABRY

95% BOM REDUCTION
70% PCB SPACE SAVED
BETTER RELIABILITY / LAYOUT
IMPROVED MATCHING
LOWER VARIATION OVER TEMP

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