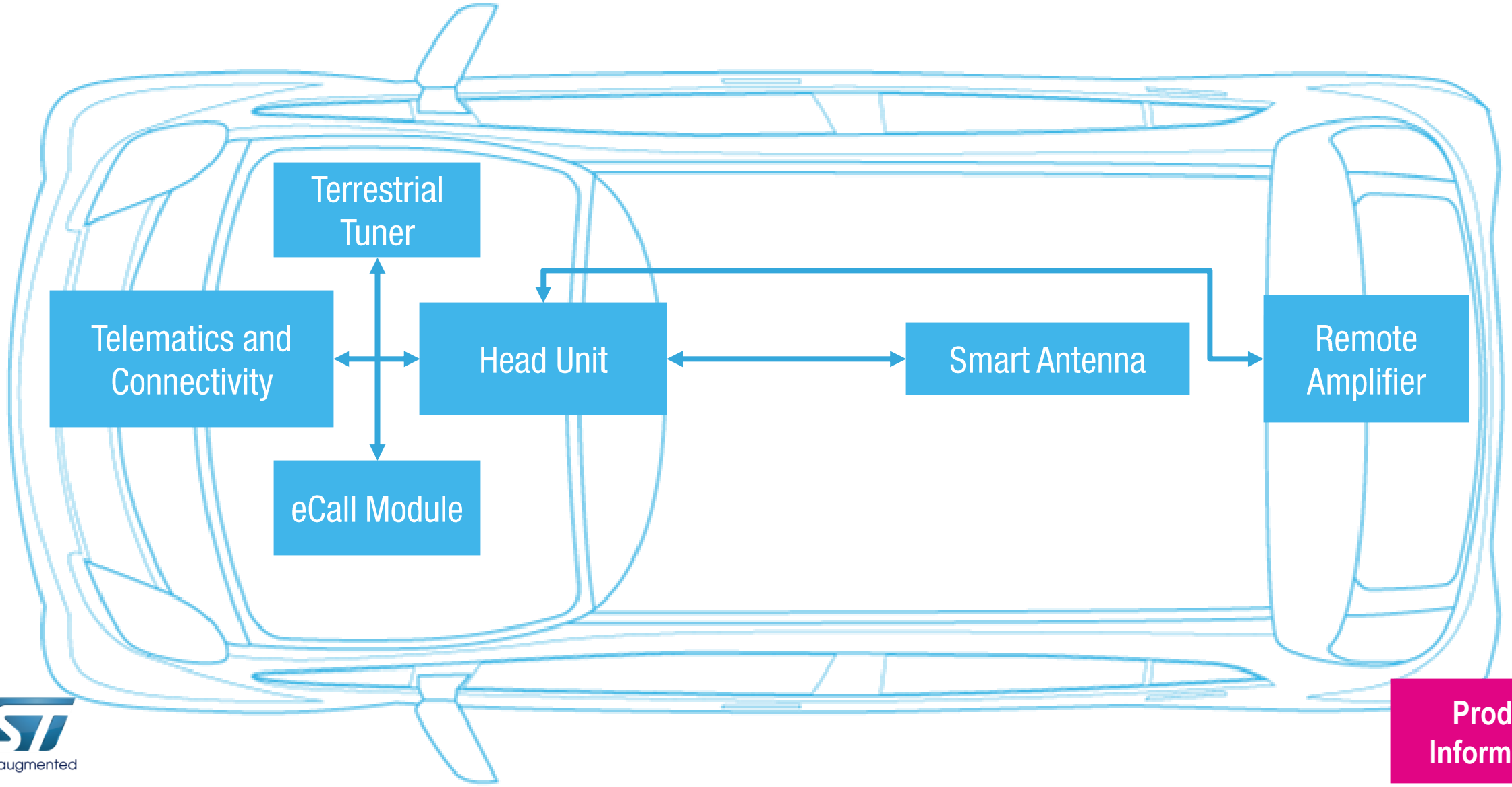
CES 2020 Infotainment Domain Wall

life.augmented

Infotainment



life.augmented

Product Information

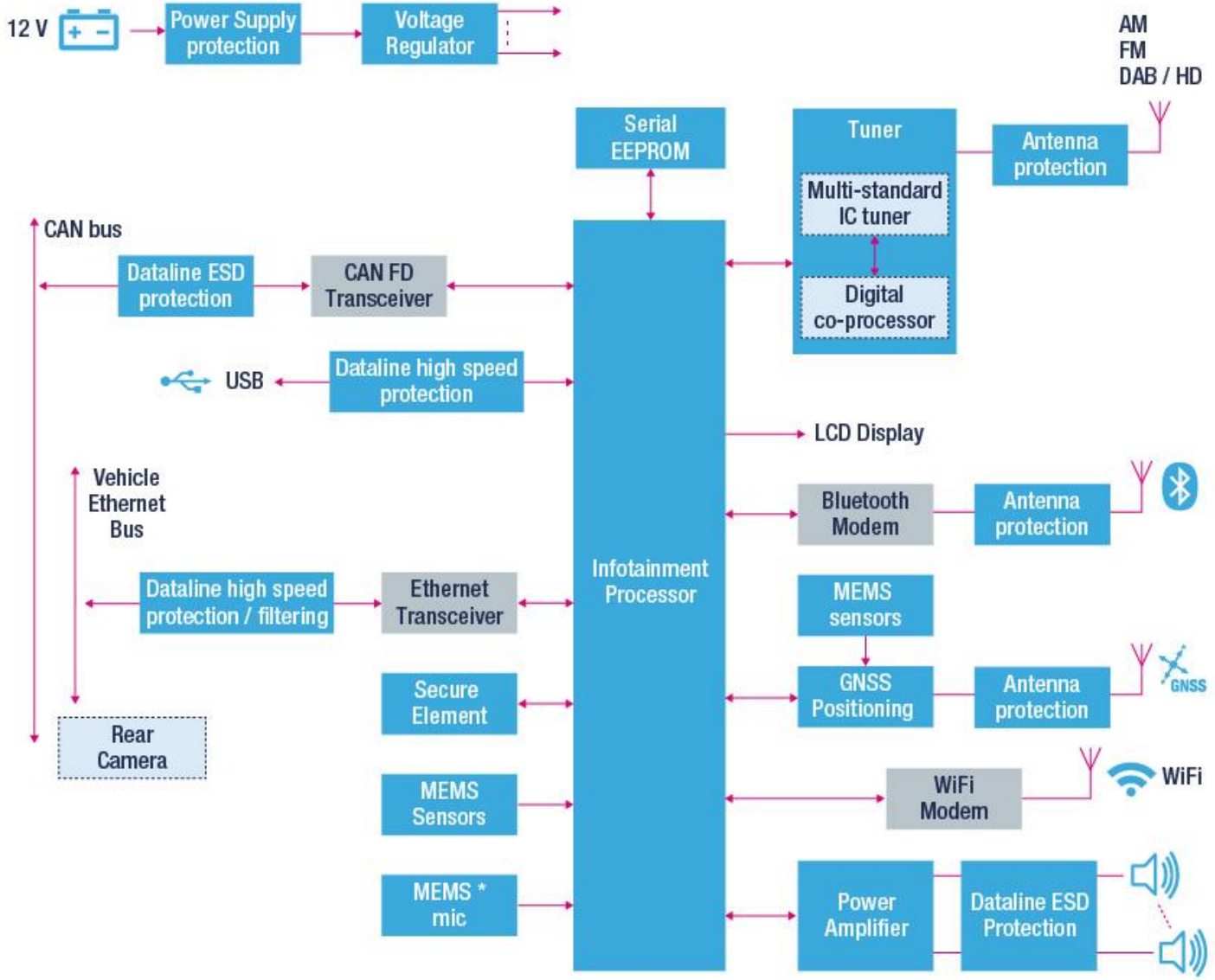
Product Information

Audio Power Amplifiers	MEMS Sensors	Signal Conditioning	Power Management	Telematics & Secure Processors	Infotainment & Digital Audio Processors
Tuners	NFC	EEPROM	GNSS	EOS and ESD Protections	32-bit Automotive MCUs

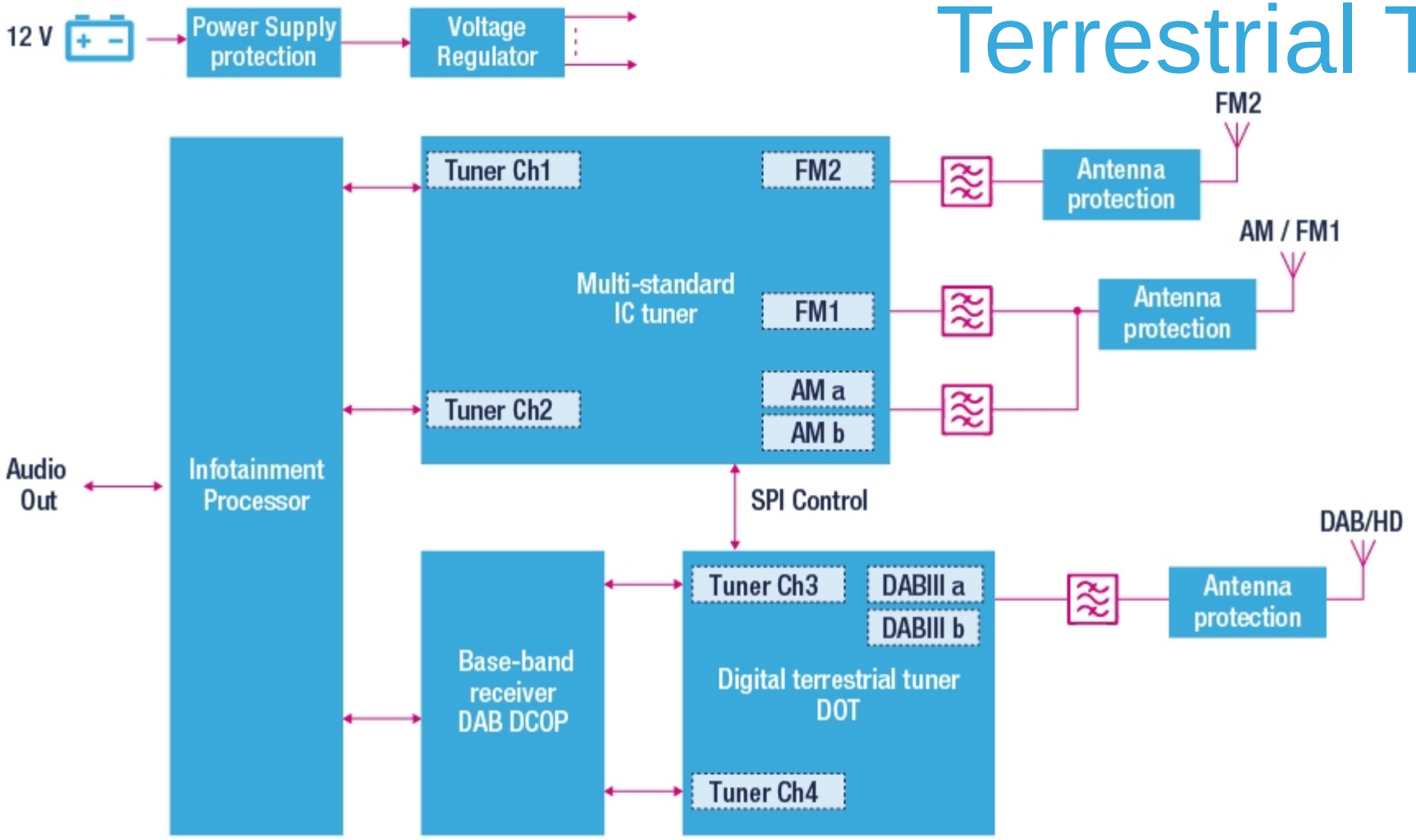
life.augmented

System Information

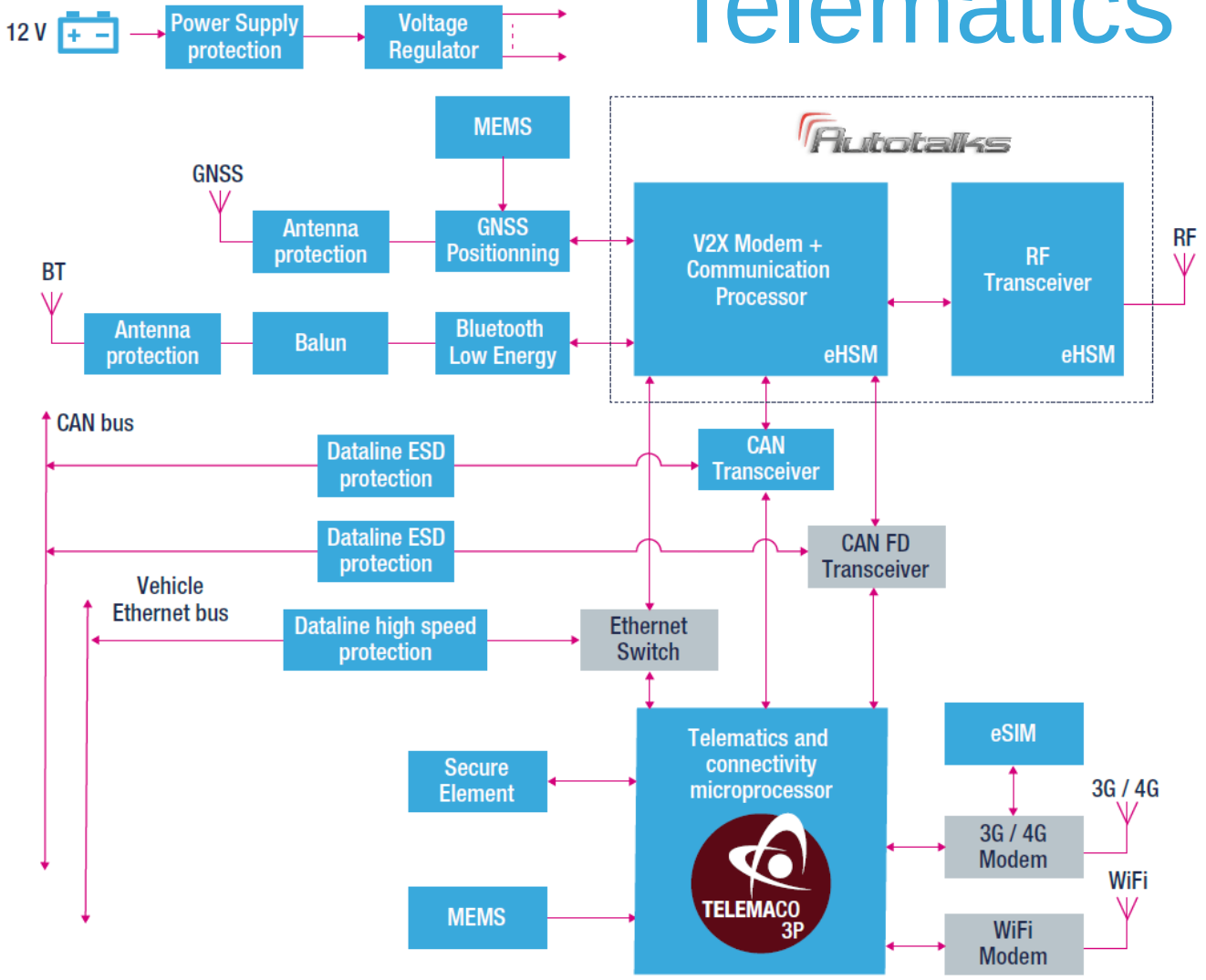
Head Unit


12 V
Power Supply protection
Voltage Regulator
AM
FM
DAB / HD
Serial EEPROM
Tuner
Multi-standard IC tuner
Digital co-processor
Antenna protection
CAN bus
Dataline ESD protection
CAN FD Transceiver
USB
Dataline high speed protection
LCD Display
Vehicle Ethernet Bus
Dataline high speed protection / filtering
Ethernet Transceiver
Secure Element
Rear Camera
MEMS Sensors
MEMS * mic
Infotainment Processor
Bluetooth Modem
Antenna protection
MEMS sensors
GNSS Positioning
Antenna protection
GNSS
WiFi Modem
WiFi
Power Amplifier
Dataline ESD Protection

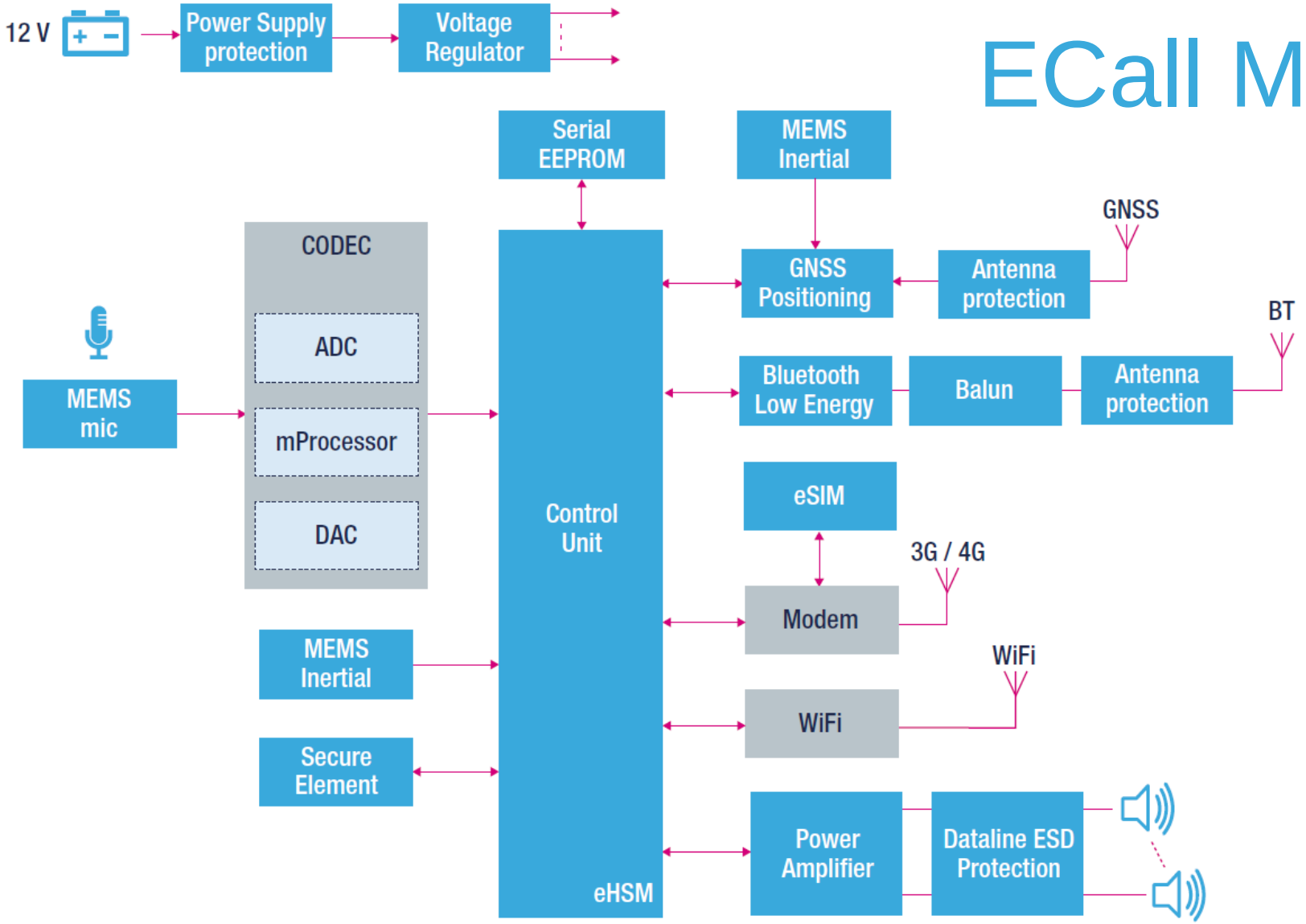
Terrestrial Tuner



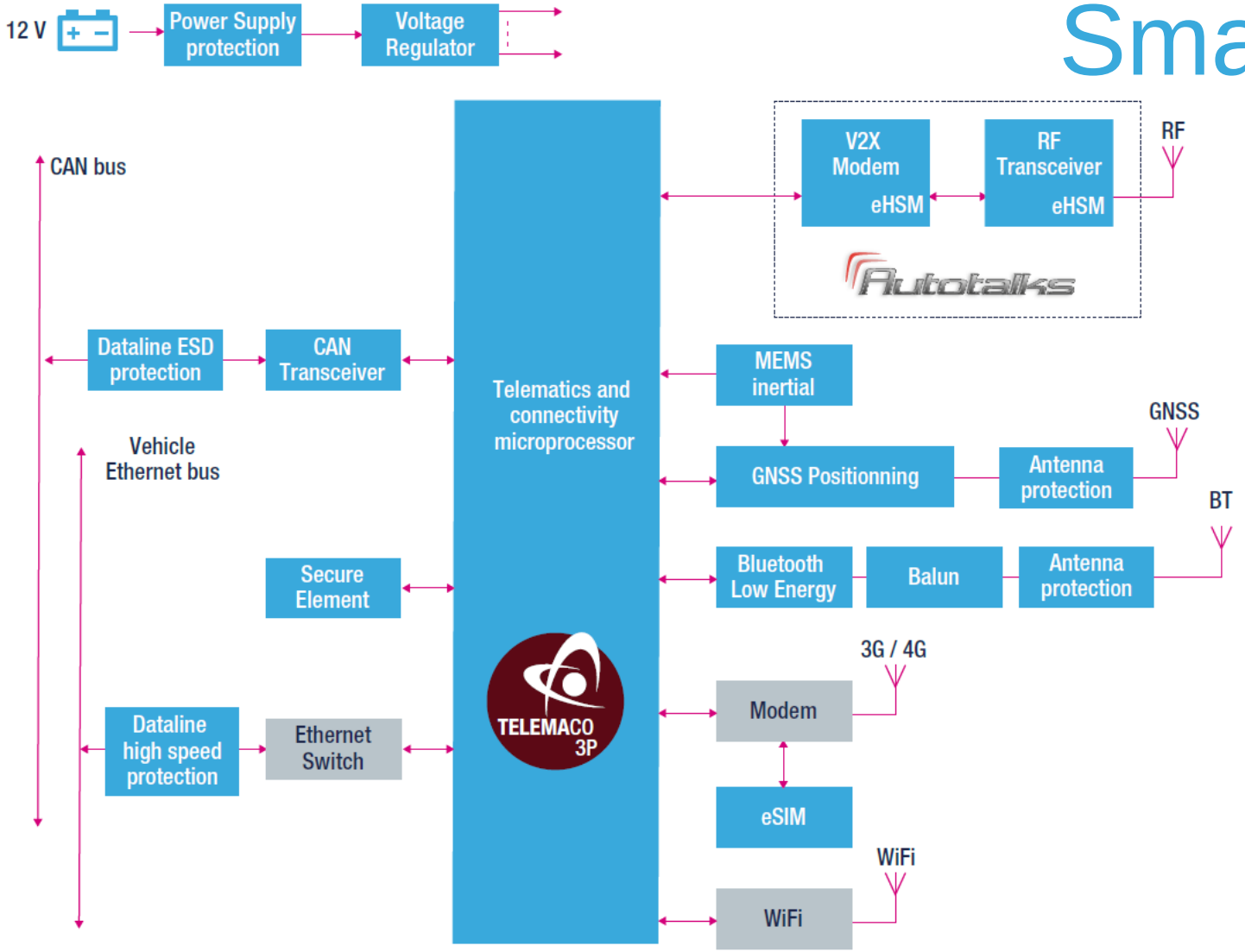
Telematics and Connectivity



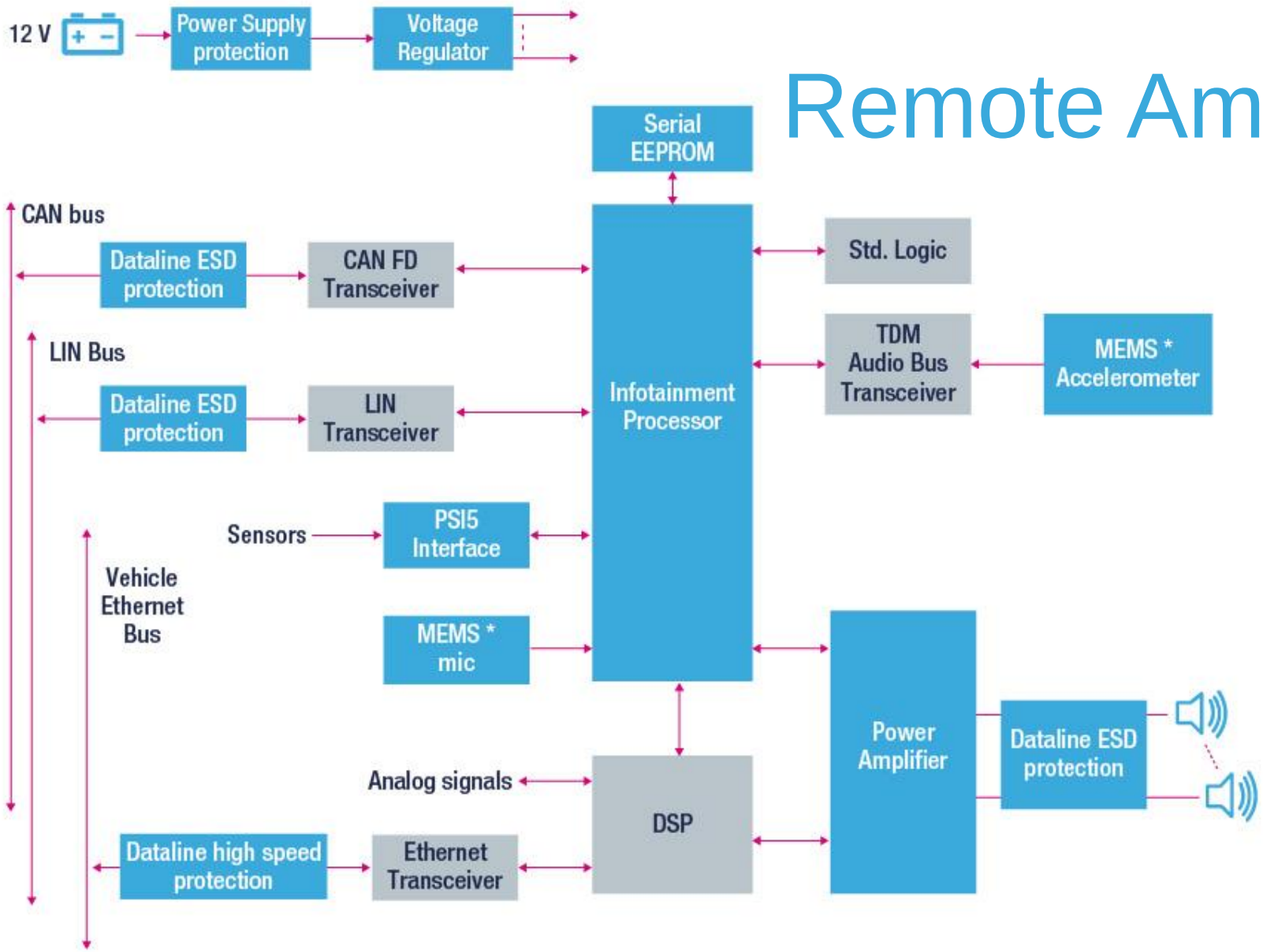
ECall Module



Smart Antenna



Remote Amplifier



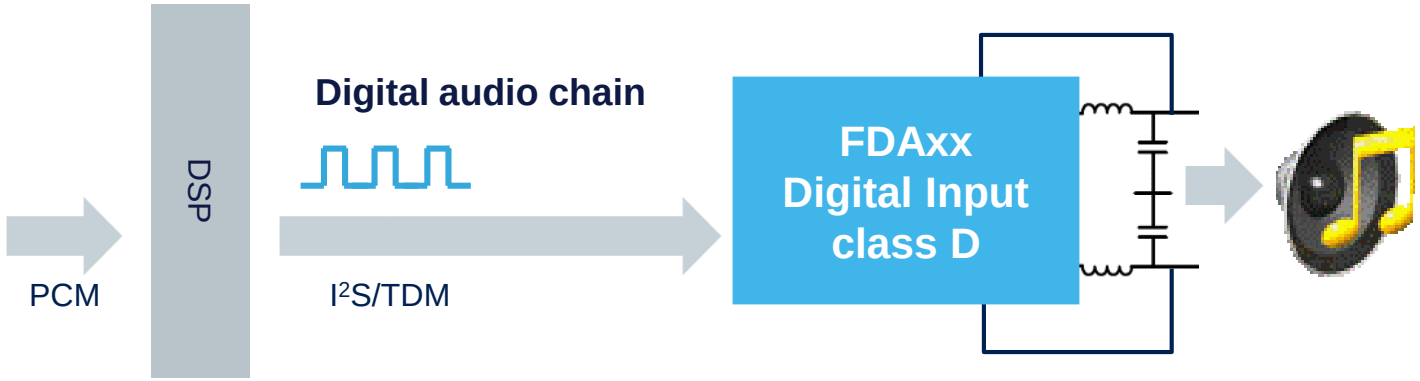
Audio Power Amplifiers

Application	Product Family	Products	Highlights
Aftermarket and entry OEM head units	**The MOSFET family** raising the audio quality bar	• **TDA785x/78x8** – the standard • **STPA008** – the **sound quality** champion	• **Simply** very good audio • Low-cost package solutions • Best cost/performance ratio
OEM Head Units	**Intelligent Audio Power** >200Mu shipped to OEMs	• **TDA756x** – **analog** de-facto standard • **TDA7802/03** – the **digital** revolution • **TDA7808** – **digital** made affordable • **TDA790x** – coming soon	• Solutions for high efficiency and green cars • Embedded intelligence and diagnostics • Digital classAB: state-of-the art performance and **the lowest** power dissipation
Premium Audio	**FDA: Fully Digital Amplifiers** the best classD ever designed	• **FDA4-series** • **FDA8-series** **the coolest Class Ds** on the market • **FDA9-series** • **HFDA-series** - coming soon	• Setting the **standard for automotive classD** with Fully Digital processing and patented feedback architecture • Very advanced diagnostic capabilities • decreasing cost, size and increasing EM compatibiilty

Keeping the leadership in automotive audio by **renewing entry-level solutions** and **introducing higher value** products

life.augmented

Digital Input Class D Power Amplifiers



Product	Digital Input ClassD Power Amlpifier	PoutMax	Features	Vbatt
FDA4100LV		4x135W	Step up, full diag	**6-25V**
FDA450LV		4x135W	full diag	**6-25V**
FDA2100BLV		2x180W	Step up, full diag	**6-35V**
FDA801/FDA801B (FDA901)		4x130W	Low diss, Fulldiag/DIM	**6-25V**
FDA801s		4x50W	Low diss. Full diag	**6-18V**
FDA802/FDA802B (FDA902)		2x250W	Low diss, Fulldiag/DIM	**5.5-50V**
FDA802s		2x50W	Low diss. Full diag	**5.5-25V**
FDA803 (FDA903)		1x80W	Low diss	**3.3-18V**

Key Benefits

- ✓ Immunity to RF noise injection
- ✓ Outstanding S/N ratio
- ✓ Reduced BOM cost
- ✓ Integrated digital intelligence
- ✓ Innovative Feedback topology
  - ✓ Improved audio quality at low system cost

…and more

- ✓ Class D
  - ✓ High power with the lowest dissipation
- ✓ Integrated digital diagnostics
  - ✓ check audio system in manufacturing
  - ✓ real-time speaker monitoring
- ✓ Start-stop compatibility
- ✓ Load value flexibility: 1/2/4... Ω

4x50 W Class D Digital Input

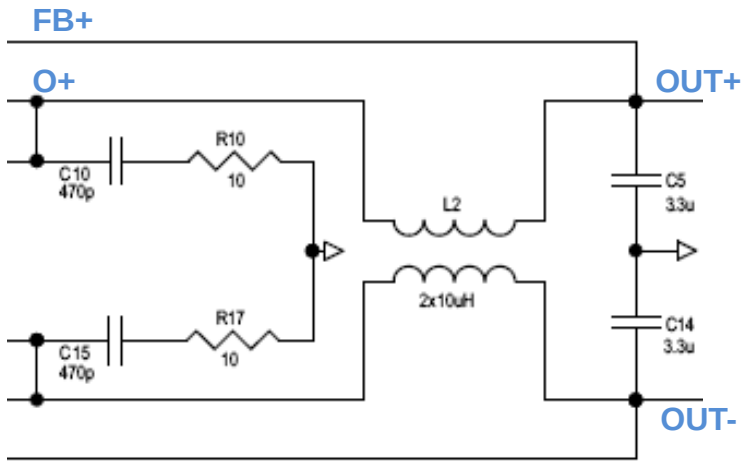
Power Amplifier with Diagnostics Features

FDA801/901

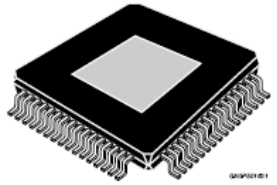
Digital input

I²S bus

- I2S and TDM digital input
- **6-25V operating**
- 44.2kHz, 48kHz, 96kHz, 192kHz input sampling frequency
- **115dB SNR/ 110dB DR**
- EMI compliance IEC61967-4 IEC62132-4
- **Real time current sense feedback***
- **4x50W 4ohm, 25V, 1kHz, 1%**
- Legacy mode or I2C bus controlled
- I2C diagnostic **Digital Impedance Meter (FDA802B)**



LPF included in the loop



LQFP64 (exposed pad up)

*901 only

2x150 W / 1x300 W Class D Digital Input

Power Amplifier with Diagnostics Features

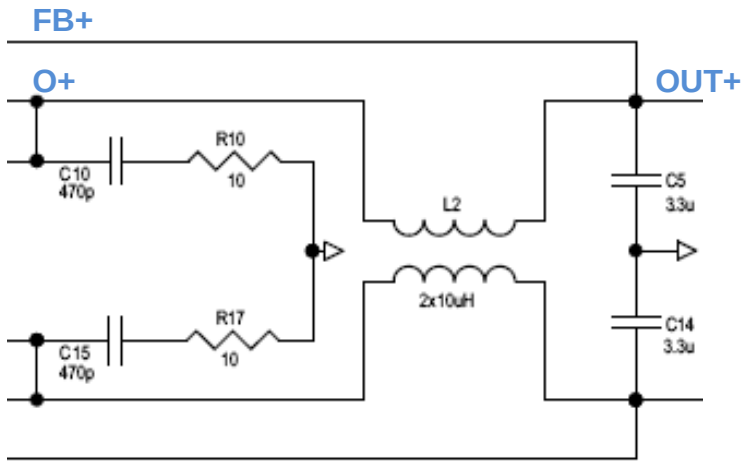
FDA802/B

Digital input

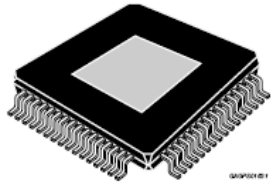
I²S bus

Pin-to-pin compatible with FDA801/901 to allow scalable systems design

- I2S and TDM digital input
- **5.5-50V operating: 125W on 8 ohm**
- 44.2kHz, 48kHz, 96kHz, 192kHz input sampling frequency
- **115dB SNR/ 110dB DR**
- EMI compliance IEC61967-4 IEC62132-4
- **Power Limiting function**
- **2x150W 4ohm, 35V, 1kHz, 10%**
- Legacy mode or I2C bus:
- I2C diagnostic **Digital Impedance Meter (FDA802B)**



LPF included in the loop



LQFP64 (exposed pad up)

life.augmented

1x45 W Class D Digital Input

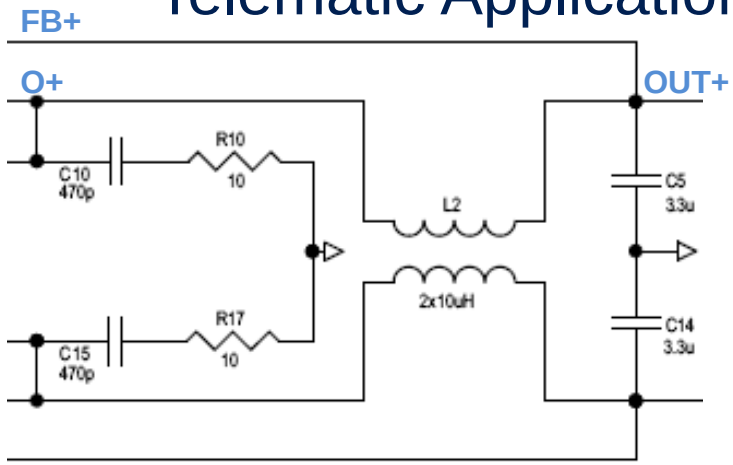
Power Amplifier with Diagnostics and Wide Voltage Range for Car Audio and Telematic Applications

FDA803/903

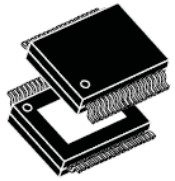
Digital input

I²S bus

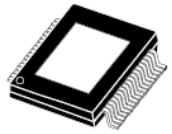
- I2S and TDM digital input
- 44.1kHz, 48kHz, 96kHz, 192kHz Fs
- 1x20W / 4 Ω @ 14.4 V, 1 kHz, 1%
- Legacy or I2C bus control modes
- **3.3V to 18V operating range**
- **Integrated 110 dB D/A conversion**
- FDA903 **real-time output current sense**
- **Power limiting function**
- Feedback **before or after** LC filter
- DC diagnostic & full diagnostic **IN PLAY MODE**
- EMI compliance CISPR25



LPF included in the loop:
Lower THD
Flat frequency response
Precise diagnostic
Better EMI suppression



PowerSSO-36
(Exp. pad down)



PowerSSO-36
(Slug-up)

Safety features
Output DC Offset detection
Open Load detection
during Play Mode

life.augmented

Audio Product Portfolio

Application | **Product offer**

High end /
Premium sound systems

1st ST First to introduce Fully Digital Audio

FDA2100BLV
2CH, digital in, 6-35V

FDA4100BLV
4CH, digital in, 6-25V

FDA802/B
2CH, digital in, 5.5-**50V**

FDA801/B
4CH, digital in 6-25V, **Efficiency>90%**

FDA901
4CH, digital in 6-25V, **speaker monitoring, Efficiency>90%**

High frequency (**2MHz**) classD and high efficiency **together !**

HFDA808
4CH, digital in, 4.5-37V
2Mhz, Efficiency>90%

Head units
Entry sound systems

TDA7803
4CH, **High eff,** diagnostic, **digital in**

TDA75610s
4CH, **High eff** , diagnostic, **analog in**

STPA003/8
4CH, cellphone immunity, **analog in**

1st Class AB going **digital**
Adding classG for super-efficiency

TDA7808
4CH High eff, **digital in**

HFDA801
4CH, digital in, 4.5-25V, **2Mhz**

HFDA80x

TDA7901
4CH, digital in, 4.5-18V
classG

HFDA802
2CH, digital in, 4.5-18V, **2Mhz**

ClassD
Class AB
Concept

Telematics /
EV sound /Accessories

FDA8/903
1CH, 3.3-18V, Digital in

FDA805

FDA803A
1CH, **analog in**

Production | Development

life.augmented

CMOS Tuner Family - STAR

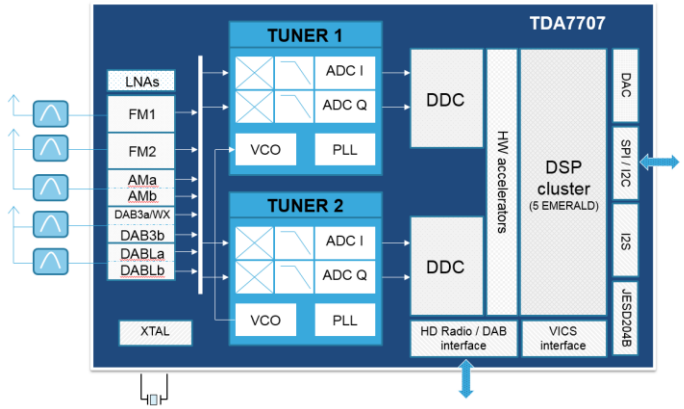
ST Advanced Radio (STAR)

TDA7707 is a monolithic dual-channel quad-band AM/FM and DAB* tuner IC for automotive radio receiver applications

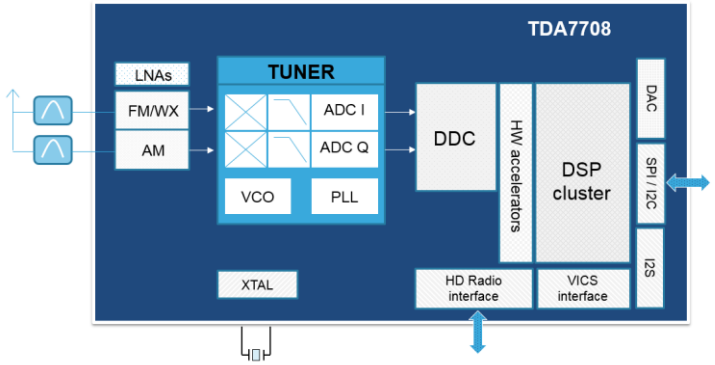
TDA7708 is a monolithic single-channel AM/FM tuner IC for automotive radio receiver applications

STAR family is the ideal solution for cost-optimized dual-channel and Single-channel receiver architectures

* With external co-processor



Pin-to-Pin Compatible



life.augmented

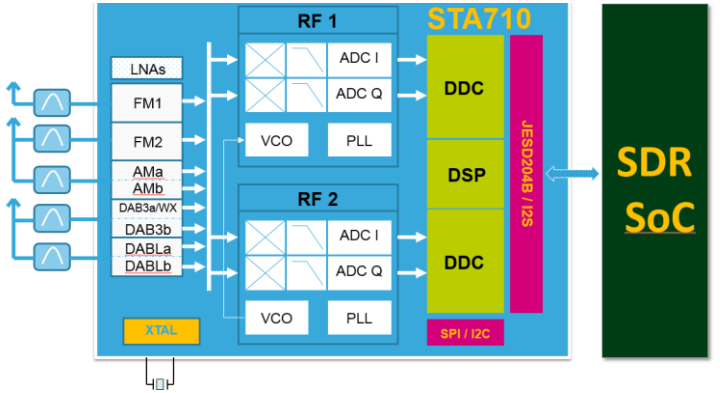
CMOS Tuner Family - DOT

Digital Output Tuners (DOT)

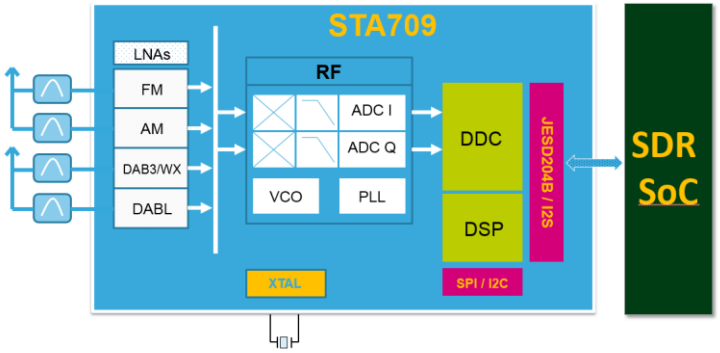
Multi-standard RF Tuner for Software Defined Radio applications, with Digital Output interfaced to an SoC

STA710 Dual RF Tuner with I2S or LVDS digital output

STA709 Single RF Tuner with I2S or LVDS digital output



Pin-to-Pin Compatible



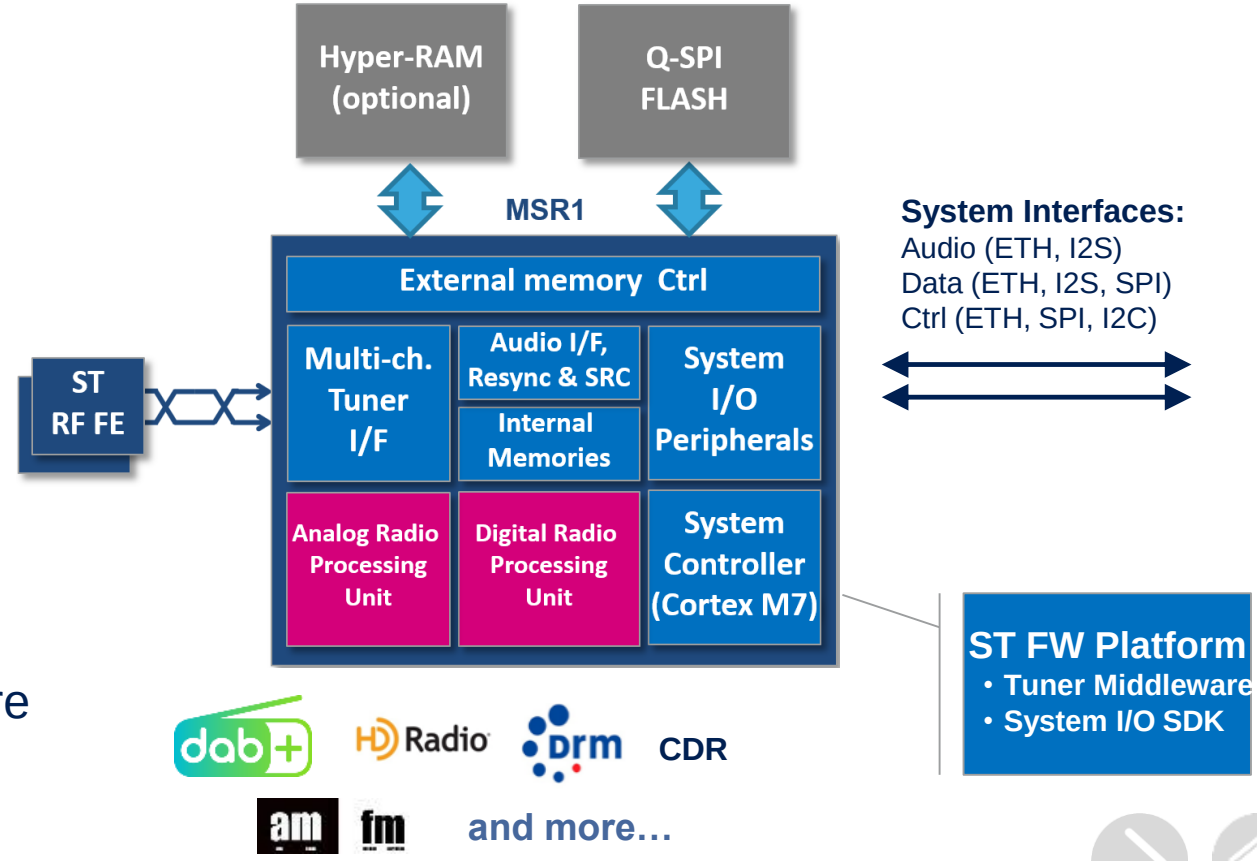
life.augmented

MSR1 at a Glance

MSR1 is ST new Digital Radio Receiver adding DAB, HD, DRM and CDR decoding capabilities to the STAR/DOT line-up

Key advantages:

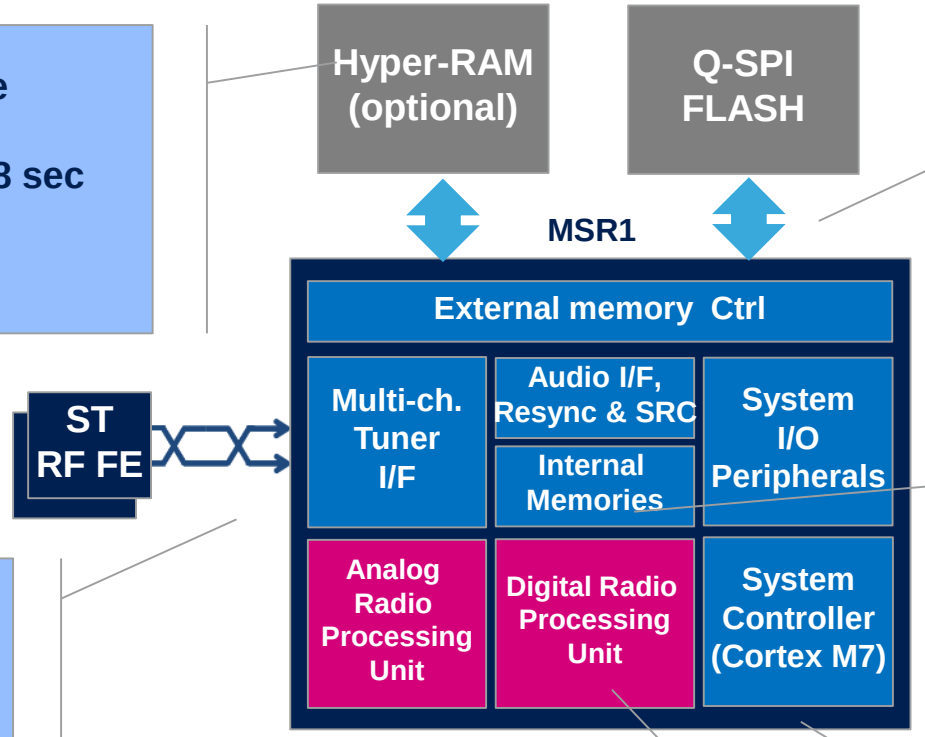
- Powerful and cost-efficient scalable platform from low to (very) high end
- True SDR Processor
  - World-Wide Receiver
  - Upgradable
- Prepared for the challenges of the future radio receivers



life.augmented

MSR1 Key Benefits

For extended audio storage Capabilities:
- Seamless Switching > 8 sec
- Broadcast to IP-Radio Seamless Switching



Quad-SPI @ 150 MHZ
- Fastest Boot Ever
- Automatic - No need to wait for Host Micro boot
- FM Audio Out < 500 ms

- Up to 4x DOT + MSR with a single XTAL
- EMI Optimized JESD204 Tuner I/F

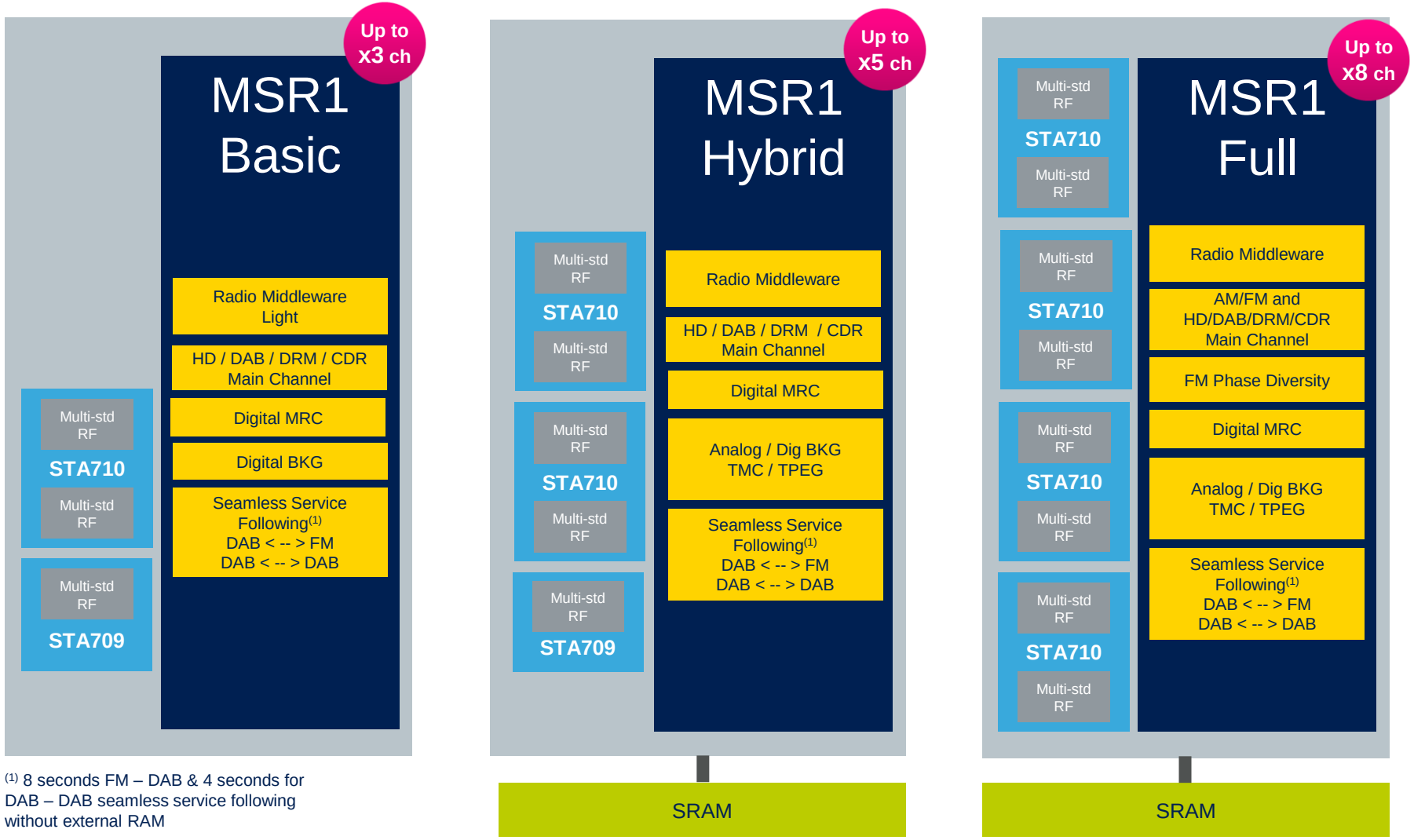
Seamless service following on internal RAM
- 8 sec FM-DAB
- 4 sec DAB-DAB

Extremely powerful Radio Processor
- RPU architectures specific to the challenges of Analog and Digital demodulation
- Radio specific HW Accelerators
- Performant yet flexible architecture

MIPS and Memory reserved for Customer or 3rd Party Radio Control Strategy

life.augmented

MSR1 Open Market Product Variants



(1) 8 seconds FM – DAB & 4 seconds for DAB – DAB seamless service following without external RAM

Legend: standard optional

life.augmented

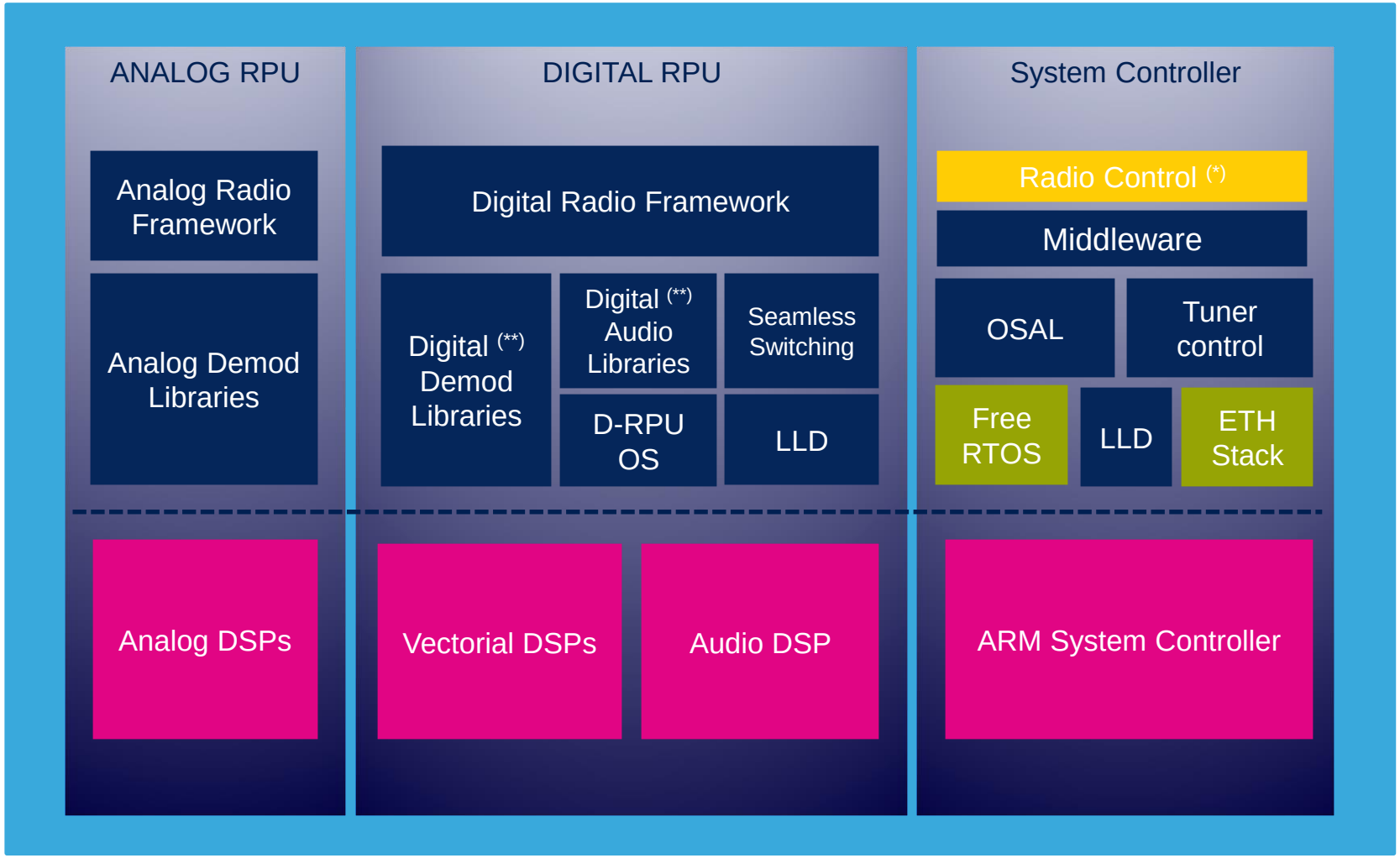
Software Architecture

3rd Party

Open-Source SW

STM SW

Hardware



(*) Not included in ST offer - To be licensed by 3rd party

(**) CDR and DRM/DRM+ Demodulation Library available under specific licence agreement

life.augmented

Automotive MEMS Sensors
for Smart Driving

MEMS Sensors vs Safety Requirements

Non-Safety	Airbag	Active Safety	Autonomous Driving
			

ISO26262 — FUNCTIONAL SAFETY / ASIL

AEC-Q100

life.augmented

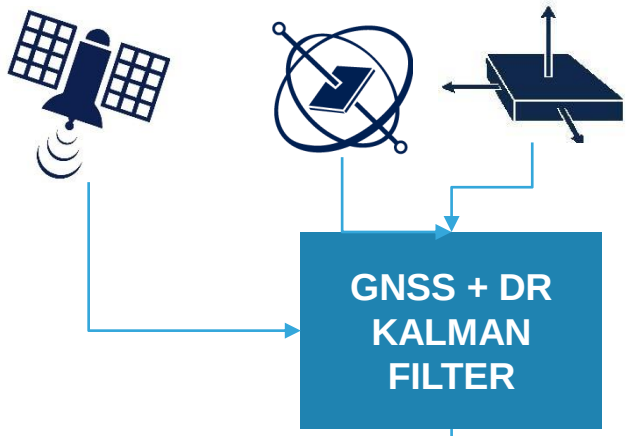
Smart Driving

Sensors for Smart Driving

Focus Applications

Navigation

6DOF IMU as GNSS assistant for Inertial Navigation System



Precise Positioning

TBOX

On Board Diagnostic

Driving Style

Insurance Boxes

Shock detection

Anti-theft

Inclination

eCall

Voice

PKE

Low power Accelerometer for Passive Key entry

Accelerometer

User Interaction
Detect walking type

Battery saving
Detect no move

SECURITY
Detect no move

life.augmented

ASM330LHH 6-axis Inertial Module

for Accurate Navigation

Temperature Features

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

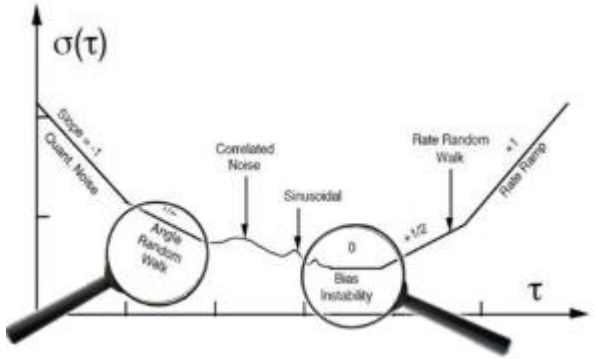
High Resolution: **256 LSB/°C**

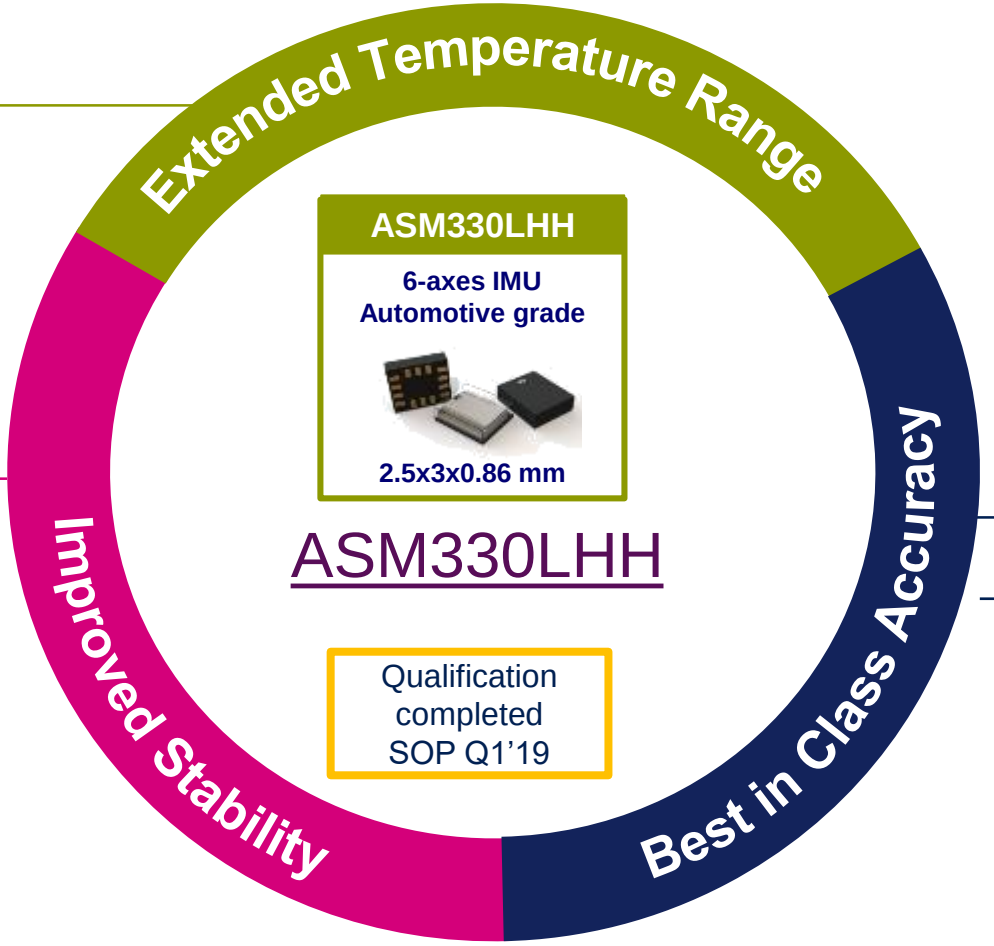
Stability Features

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

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

Stability: **Over time & Temperature**





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

life.augmented

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

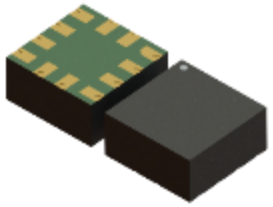
Applications

- 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

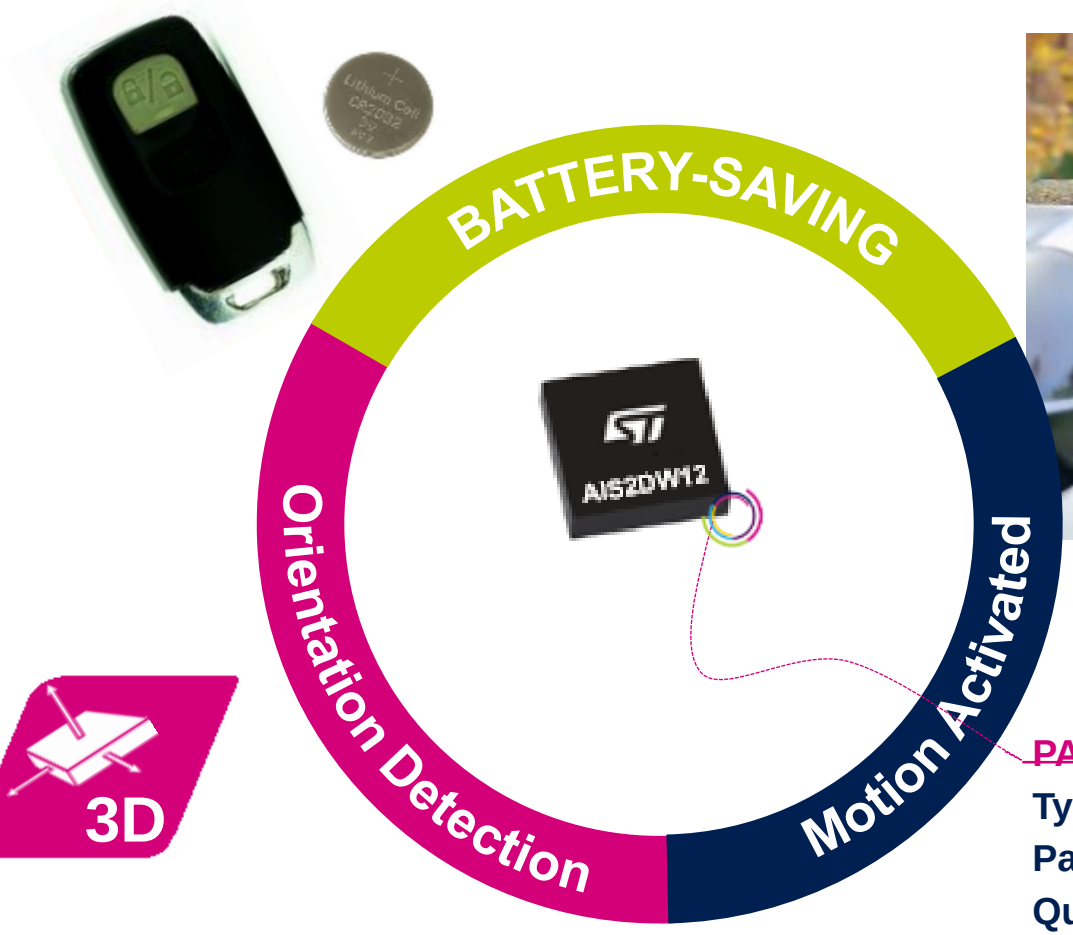
PPAP level-3



LGA-12
2x2x0.93 mm³

ST MEMS for PKE Applications

Applications Benefits



PASSIVE KEY ENTRY

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

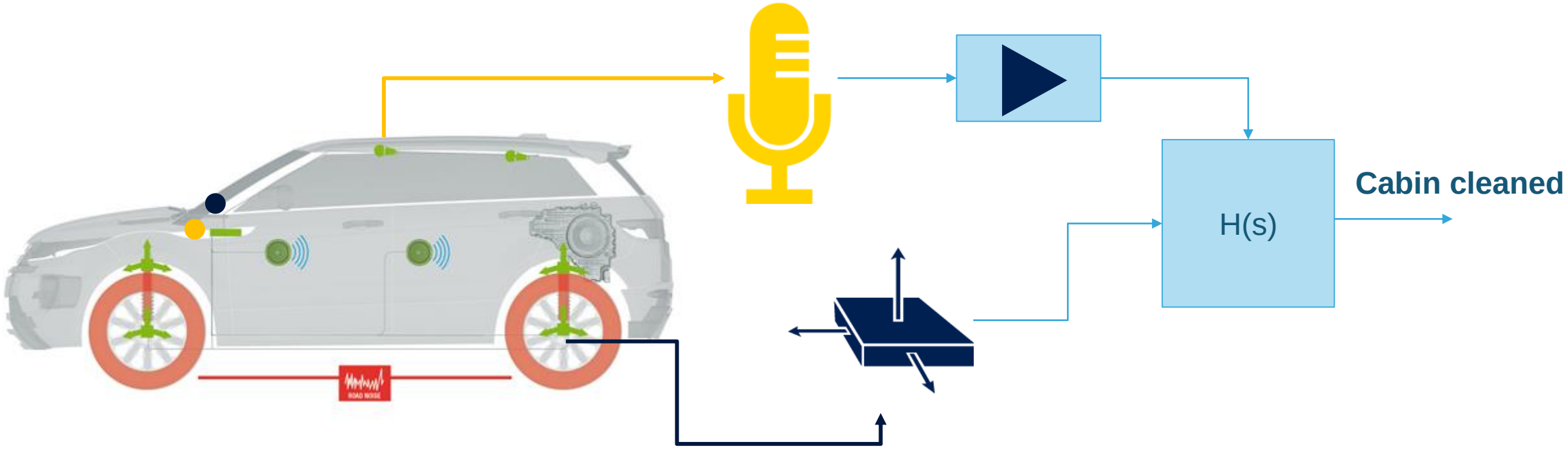
Package: 2x2x0.93 mm² **wettable flanks**

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

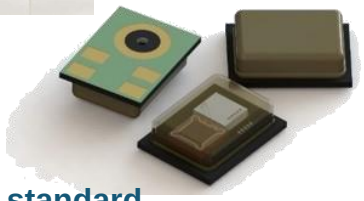
- Accelerometer with wide bandwidth
- High SNR, High AOP microphone

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 s
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

LONGEVITY 10 YEARS COMMITMENT

ST Advantage:

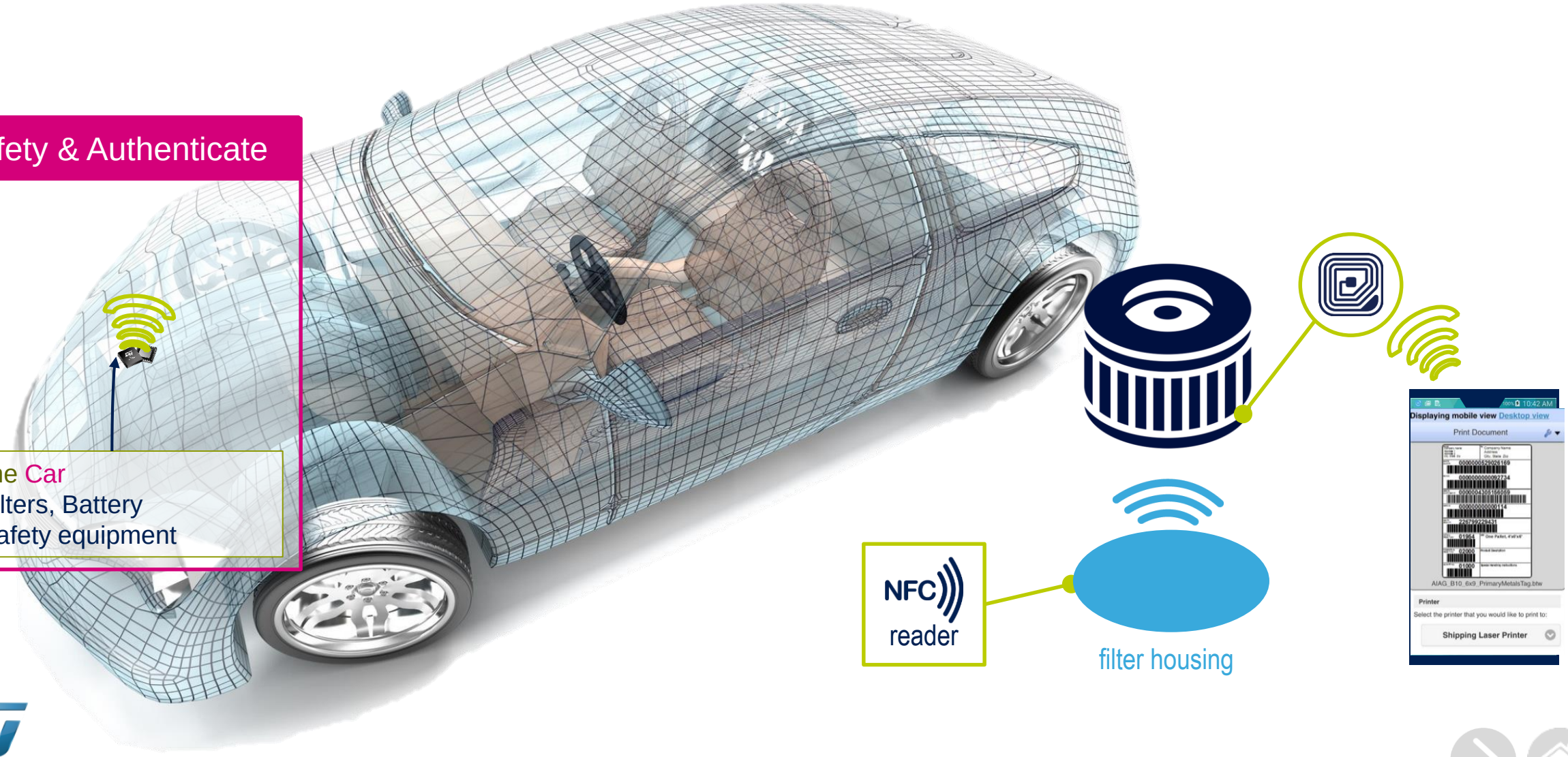
- Best in class THD in 3x4x1
- ±1dB for DT06J
- IMP34DT05 for 10y Longevity program

life.augmented

NFC and Consumables

Safety & Authenticate

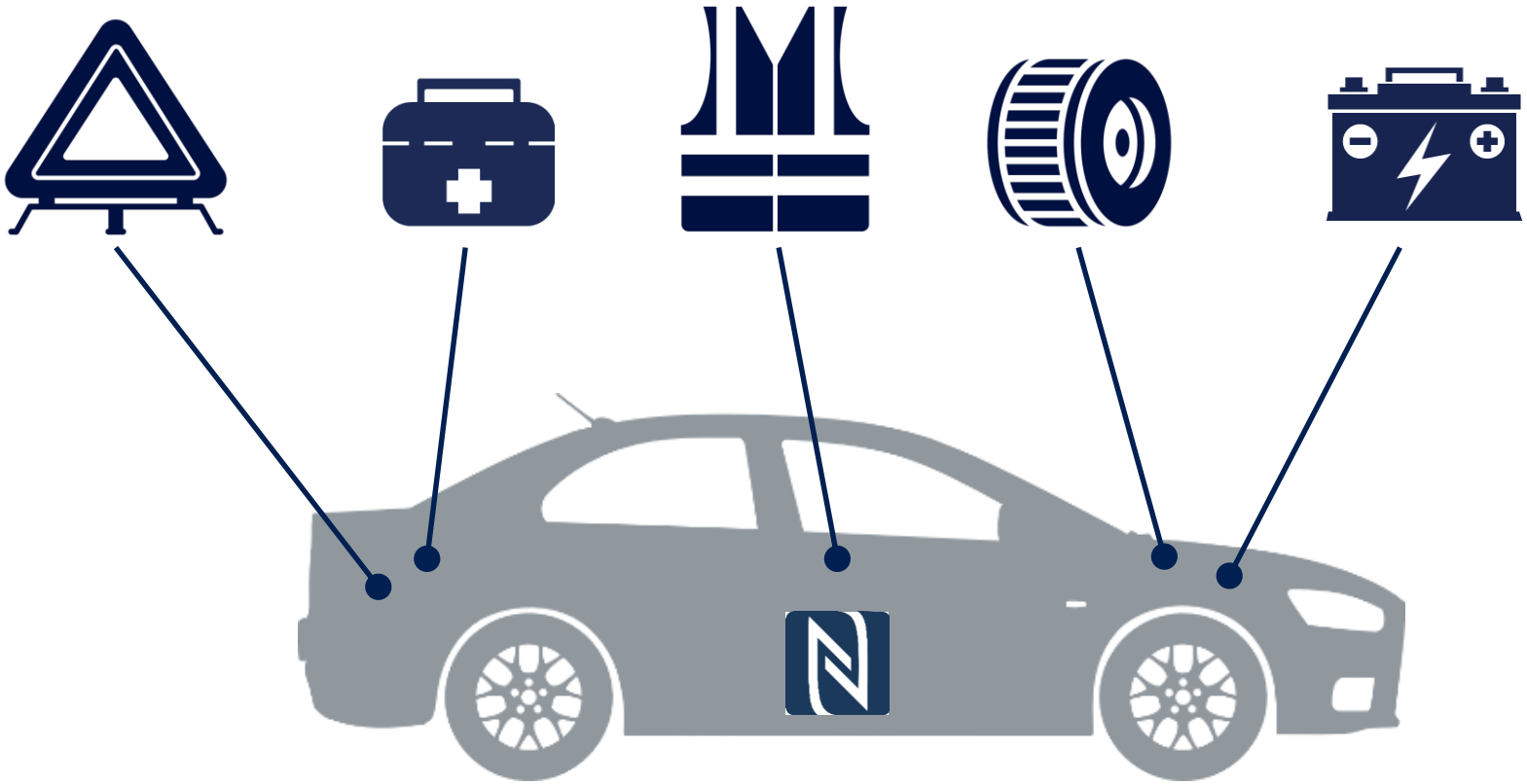
In the Car
- Filters, Battery
- Safety equipment



life.augmented

Consumables in Cars

Authentication and detection of consumables



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

life.augmented

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

USER MEMORY
CCFile

USER MEMORY
Write Password
AAR + URL+ Accessory Status information

USER MEMORY
Read/Write Password
Parameters
Parameters signature

16-bit Counter

256-bit TruST25 Signature

Accessory

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

TruST25

Sign. Param.

Firmware + Crypto Lib

Accessory list : UID

Main Unit

life.augmented

Accessory Authentication

- HF Reader

- Tag

Read UID

Read TruST25

Compare Signature vs UID

Authenticated

UID blacklisted.

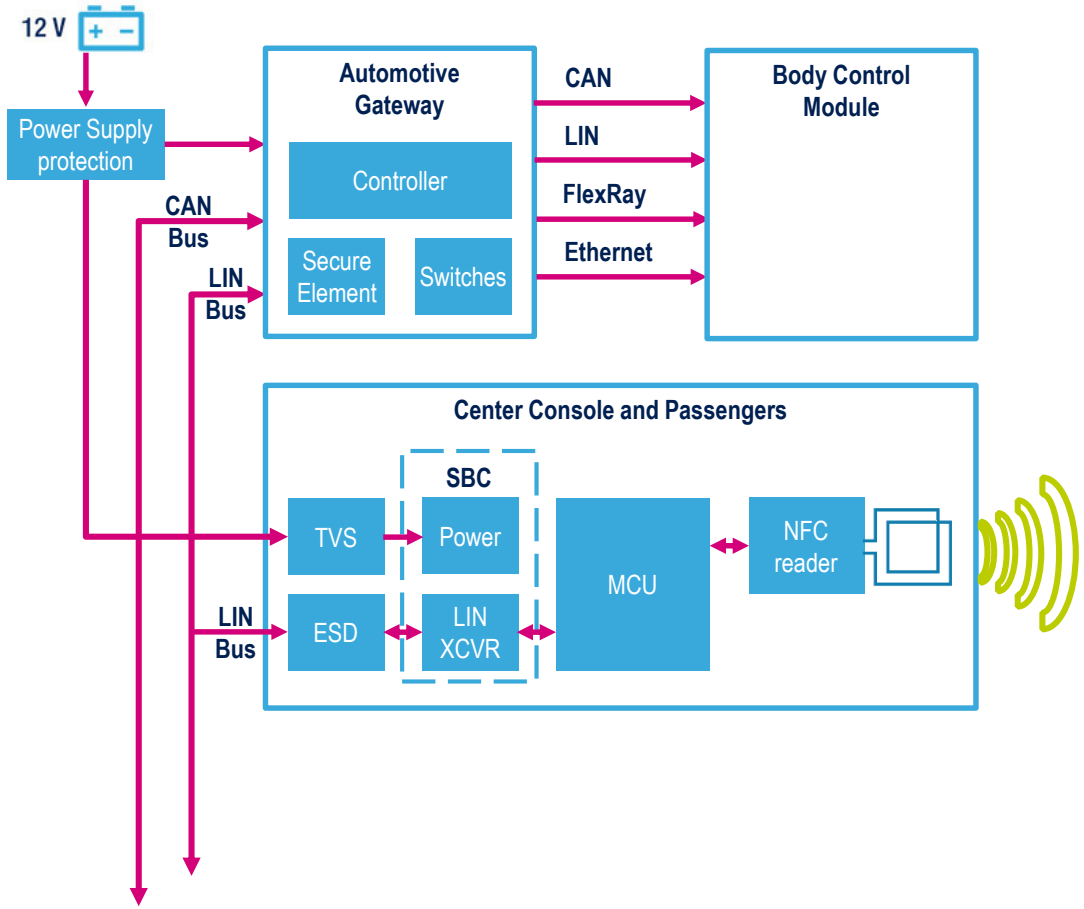
No access to TruST25.

UID <> Signature.

Rejected

life.augmented

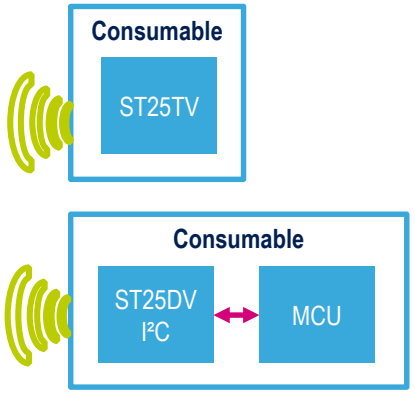
NFC Consumables



ST available parts:

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

(*) Non AEC-Q101

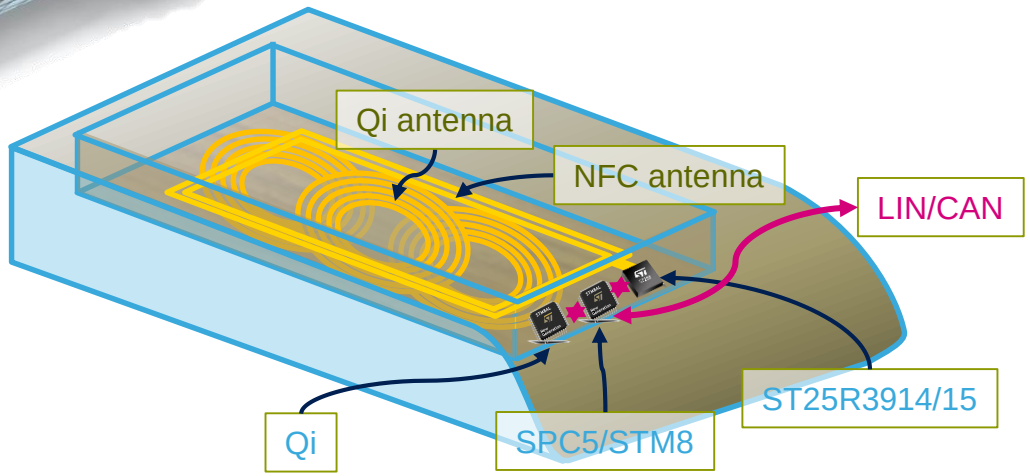


life.augmented

NFC Digital Key & Qi NFC Protection

Protect & Authenticate

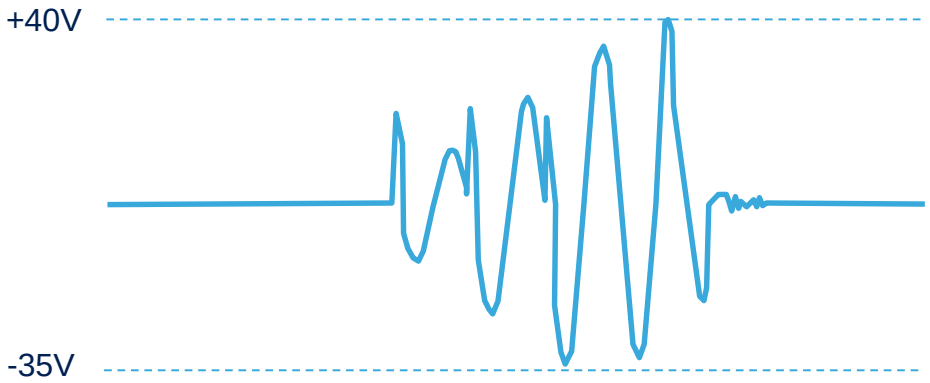
In the Center Console
- Car start
- Qi charging NFC card protection



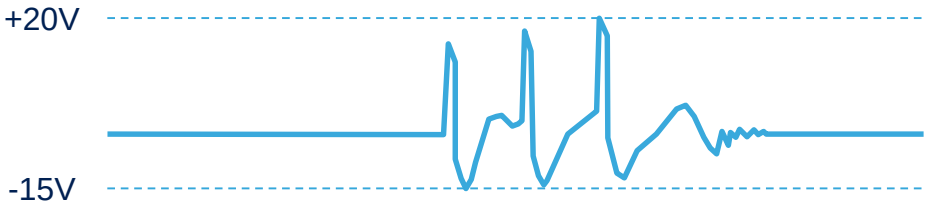
life.augmented

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

life.augmented

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

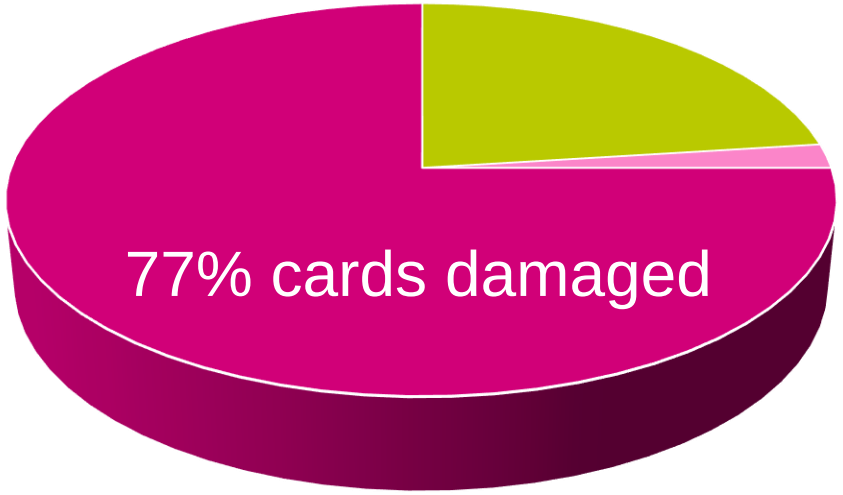
Use case 3:
Phone:
Charge

life.augmented

NFC Gives Better a Customer Experience

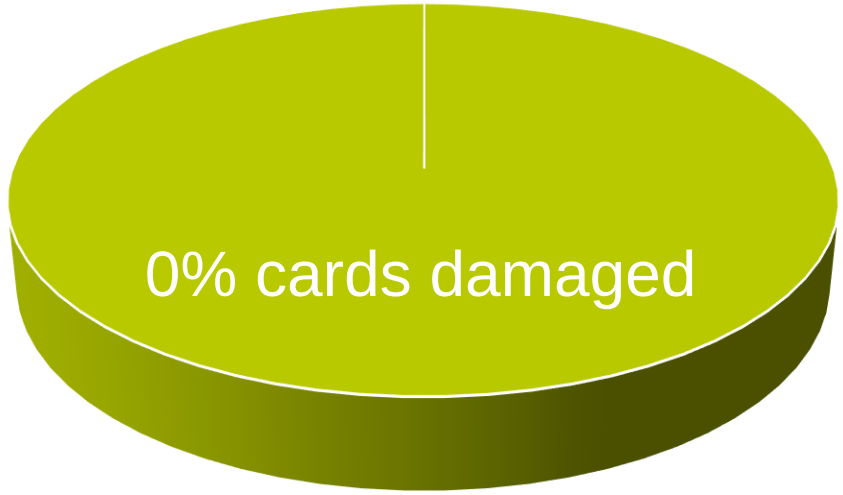
Enhance the customer experience with coexistence of NFC & Qi

Without NFC



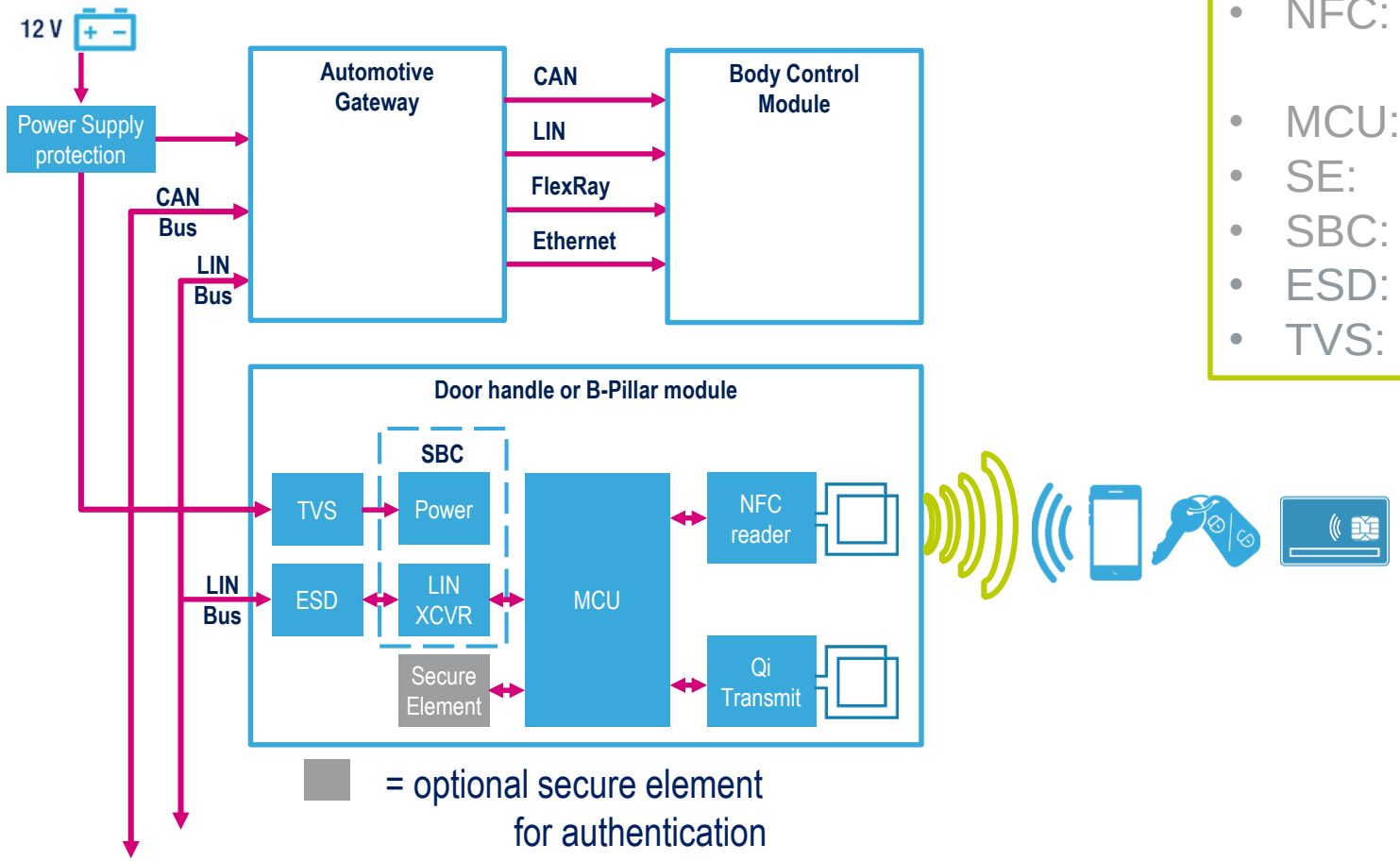
Wireless Charging (Qi)

With NFC



life.augmented

NFC + Qi Block Diagram



ST available parts:

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

(*) Non AEC-Q100

life.augmented

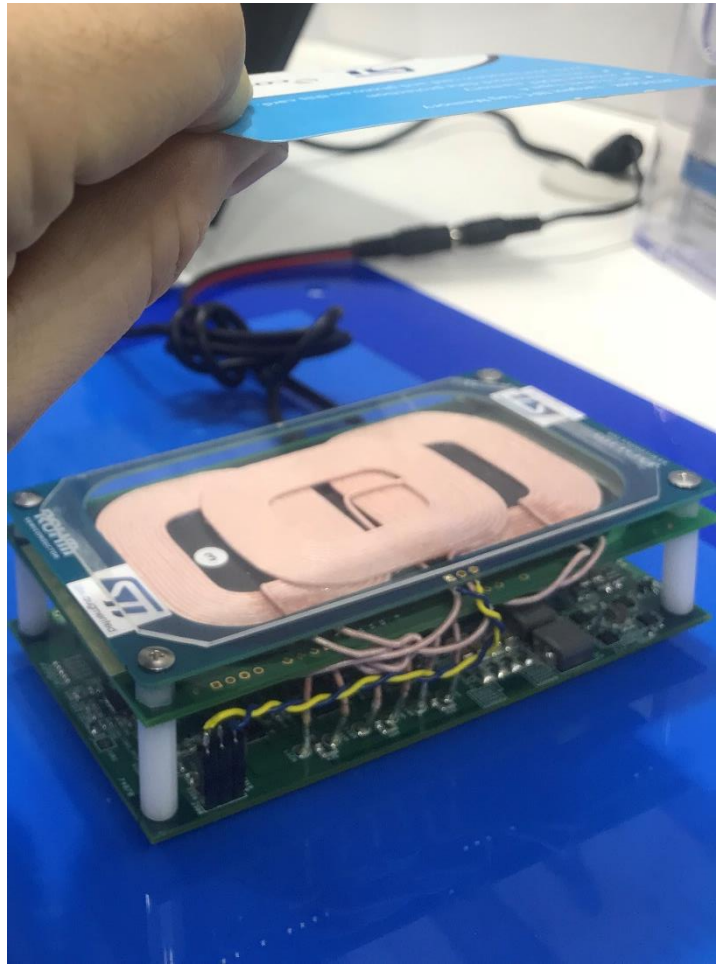
Qi-NFC Automotive Reference Design

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



life.augmented

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

life.augmented

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

life.augmented

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

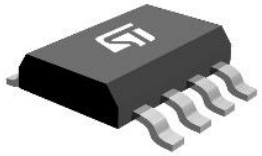
Leader in Product Features

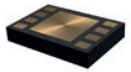
Performance	SPI 20MHz I²C 1MHz	**Fastest** **Write time** **4ms**	**Lowest Supply Voltage** **1.7V @ 125°C**
Endurance	**Highest Cycling** 4Million per byte	Datalog 100 Million per device	**Longest** **Data retention** **100 Years**
Reliability **Traceability**	Error Code Correction	Software IDentification	**Traceability** **Customization** Lockable page

life.augmented

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												

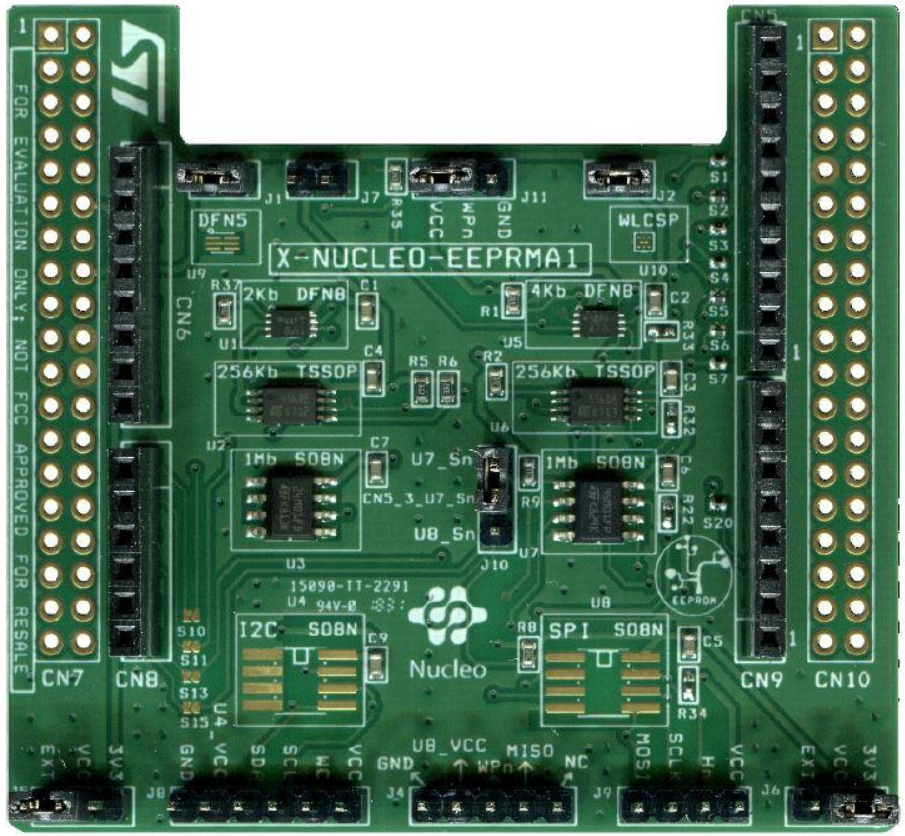




life.augmented

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

life.augmented

TESEO V & TESEO APP
for GNSS Solutions

Absolute Precise Location for Assisted and Autonomous Driving

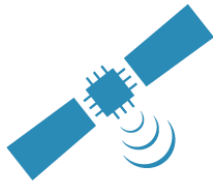
Full Production

MultiConstellation*
Single-Band (L1)

Sub-meter positioning

Production Q3 2020

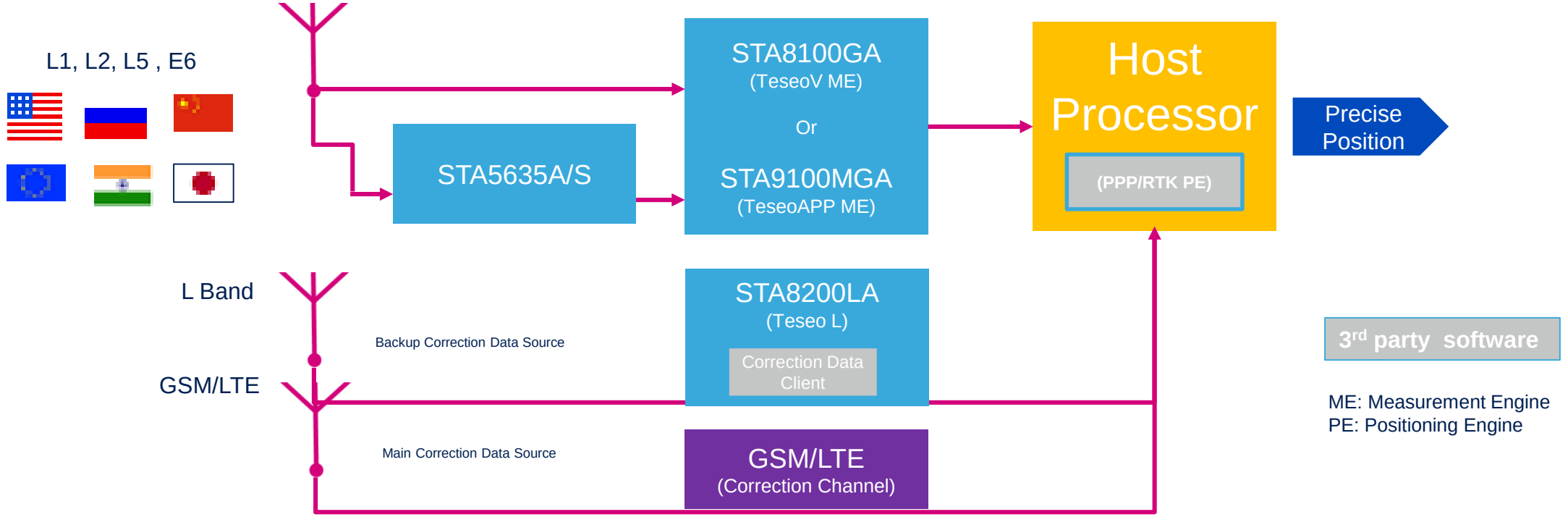
MultiConstellation*
MultiBand (L1, L2, L5)
ASIL-B



* GPS, Galileo, Glonass, Beidou, IRNSS (NAVIC), QZSS, SBAS

life.augmented

TeseoV / TeseoAPP ME

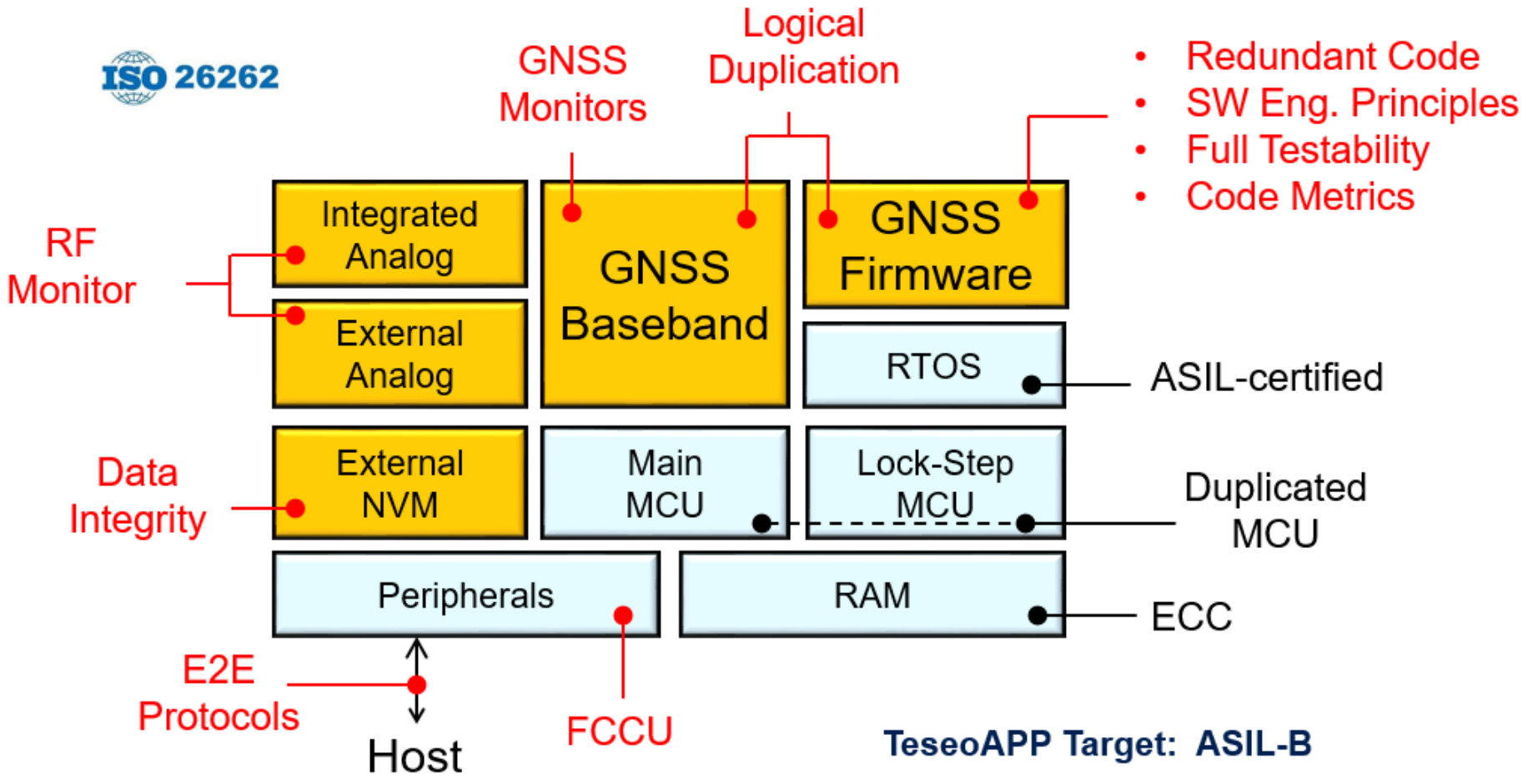


		GPS / QZSS			GLONASS		BEIDOU			GALILEO				IRNSS	SBAS
		L1C/A	L2C	L5	L1OF	L2OF	B1I / B1C	B2I	B2a	E1	E5a	E5b	E6	L5	L1
case1	Dual Band L1/L5 (without STA5635A) *	I		I			I		I	I	I			I	I
case2	Dual Band L1/L5 *	I		E	I		I		E	I	E			E	I
case3	Dual Band L1/L2 *	I	E		I	E	I	E		I		E			I
case4	Triple Band L1/L5/E6*	I		I						I	I		E		I
case5	Triple Band L1/L2/L5 *	I	E	I			I	E	I	I	I	E			I

>> I => when using internal tuner
>> E => when using external STA5635A
* Max 72 satellites tracked simulatenosly

life.augmented

TeseoAPP Functional Safety



life.augmented

Power Management

PMICs

VREGs

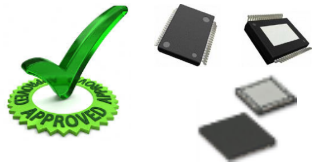
SBCs

life.augmented

Infotainment and ADAS Power Supplies

L5963

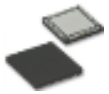
Dual monolithic switching regulator with LDO and HSD (3A x 2 + 250mA)

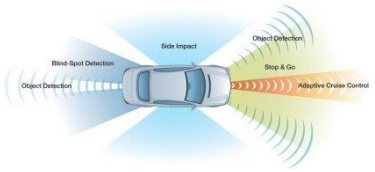


2016

ADAS L5965

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

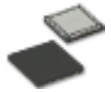




2018

L5964

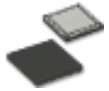
Dual monolithic switching regulator with LDO and **watchdog, reset** (3.5A x 2 or 7A + 250mA)



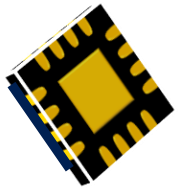
2019

NEW ADAS PMIC

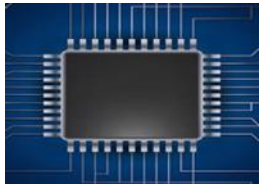
Second generation ADAS PMIC



2020



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



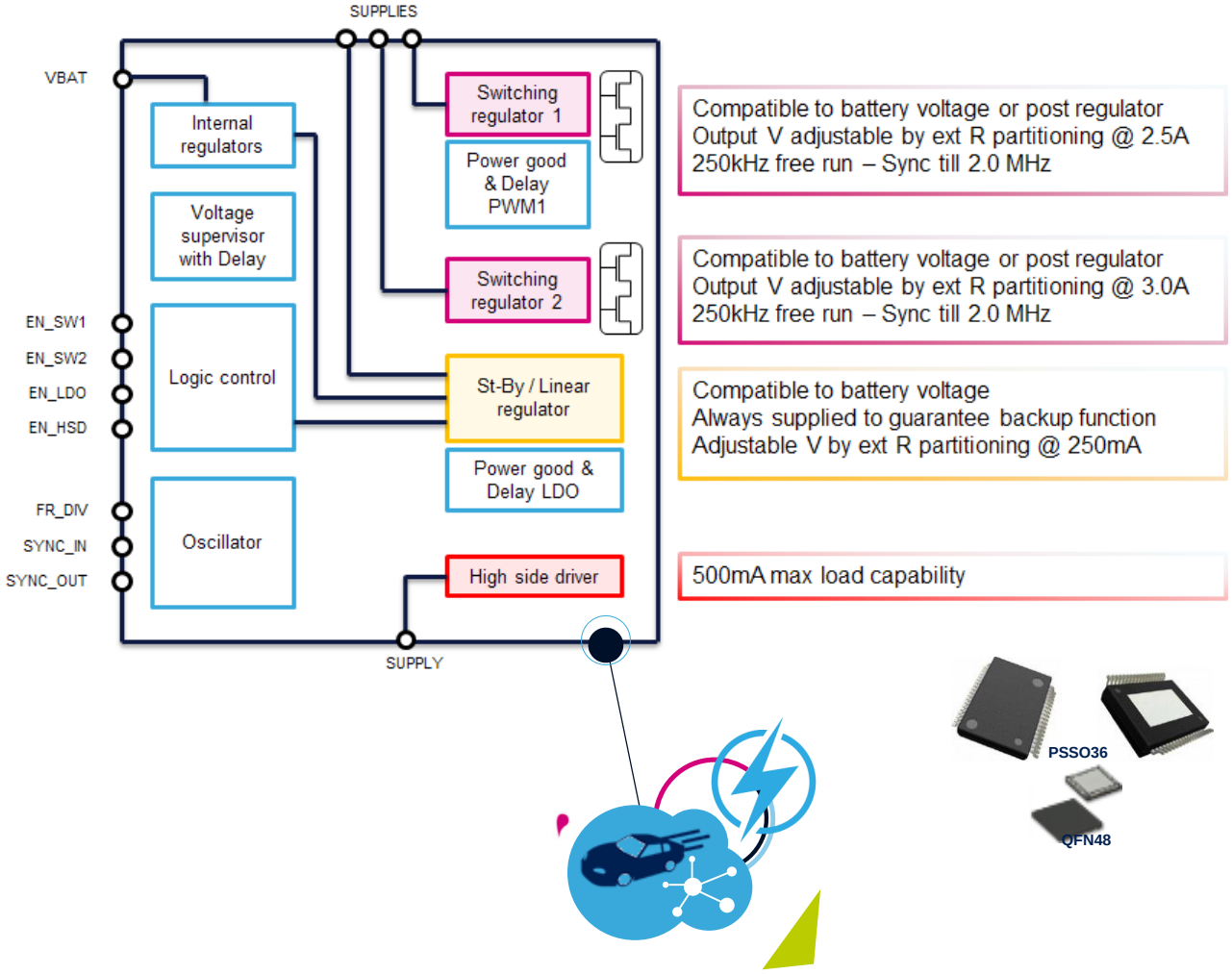
ASICs
Adopting all IPs developed for ADAS PMICs

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

life.augmented

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

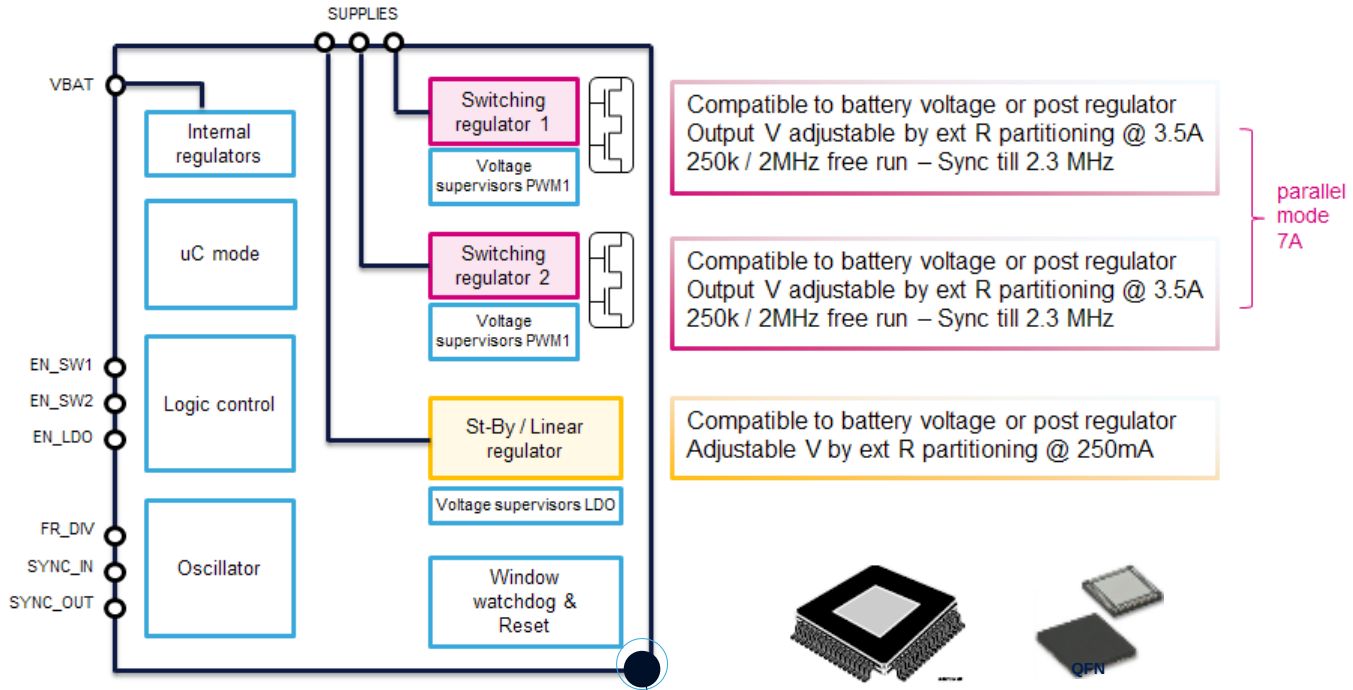
BENEFITS

- 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

life.augmented

L5964

Dual Switching Regulator with LDO and UC Power Mng



LQFP64 (exposed pad up)

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

life.augmented

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 MCUs for automotive ASIL-D applications, …)

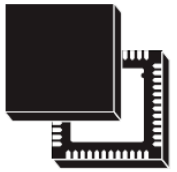
An SPI interface is present

Designed with reference to

CERTIFIED FUNCTIONAL SAFETY JQA

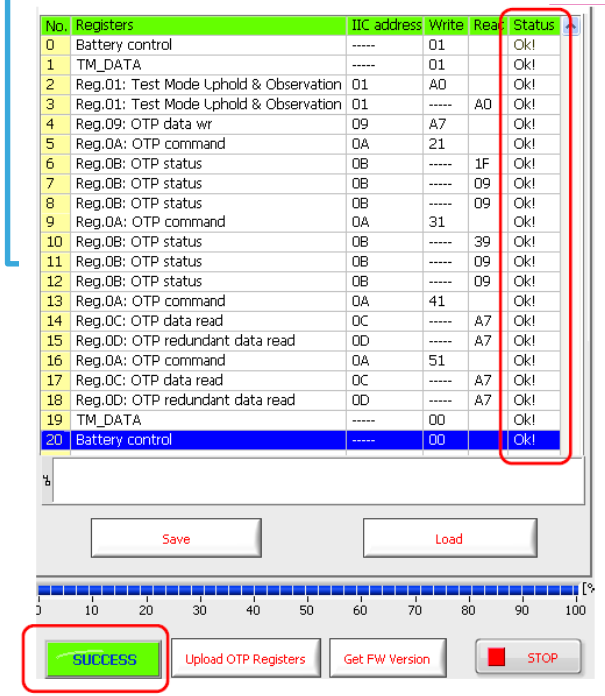
Certification for Products
in accordance with
ISO 26262

VFQFPN-48



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

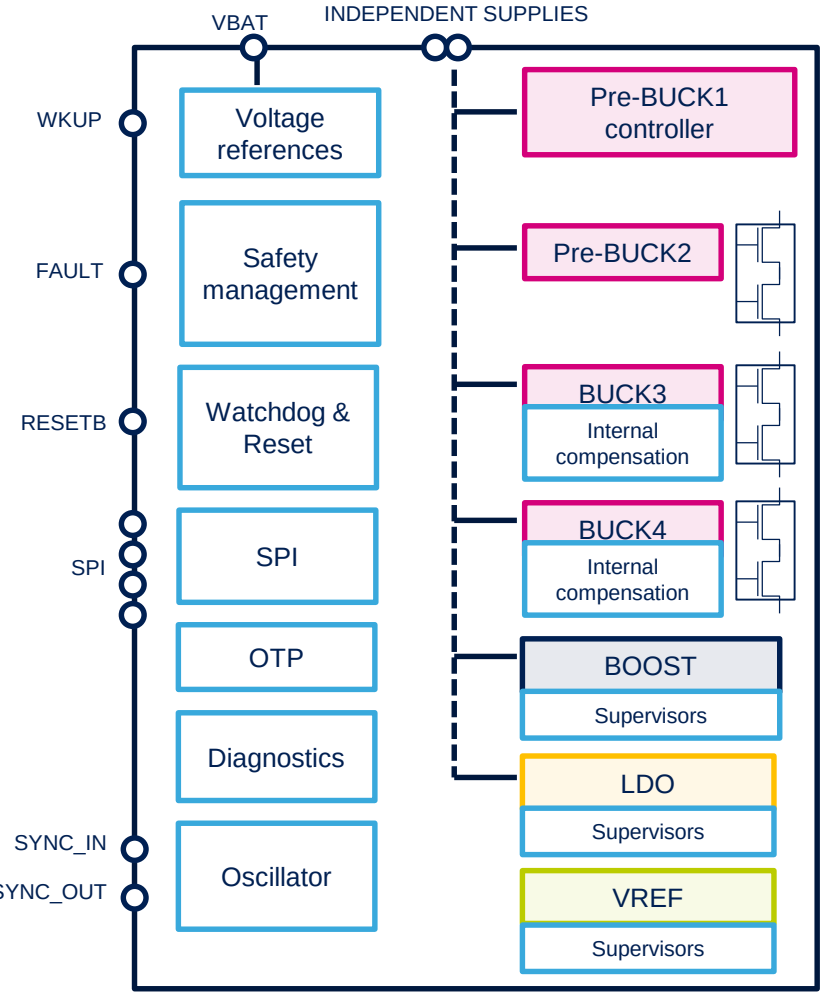
OTP for programming



life.augmented

L5965

Multiple Power Mgmt IC 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

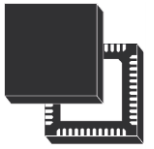
Buck post regulator compatible to 5.5V max
3.3-1.8-1.35-1.3-1.25-1.2-1.12-1.1 V @ 0.9 A ● 2.4 MHz

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

life.augmented

ISO26262 - 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

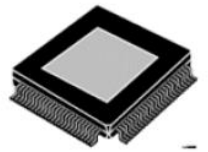
Powerful power management IC offering a full set of features to support applications that need to fulfill functional safety requirements as defined by Automotive Safety Integrity Level (ASIL) A-B-C-D.

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)

life.augmented

VREGs – New Product Line-up

L99VR01S

CONFIGURABLE FOR 8 FIXED VOUT

ENABLE | RESET

SO-8

200 mA

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

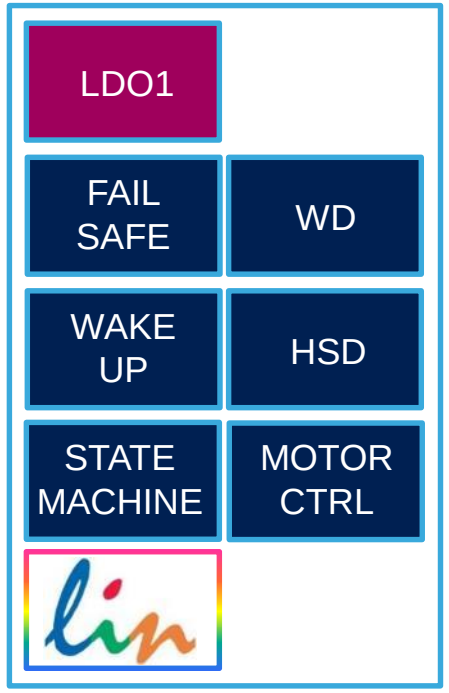
life.augmented

Automotive Power Management ICs

Power Management Line up

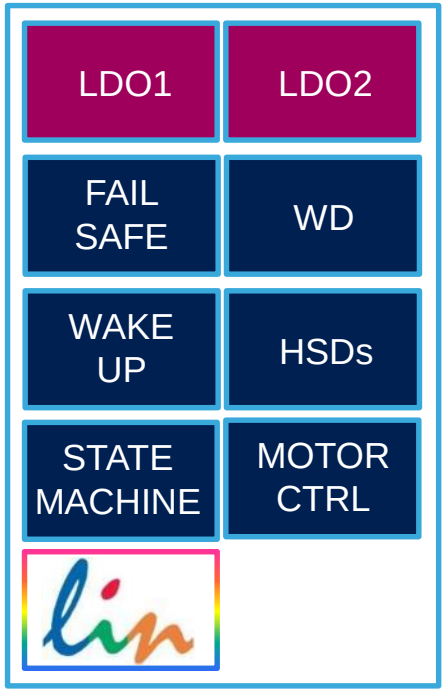
L99PM60J

Motor Control, LIN, Vreg, HSDs



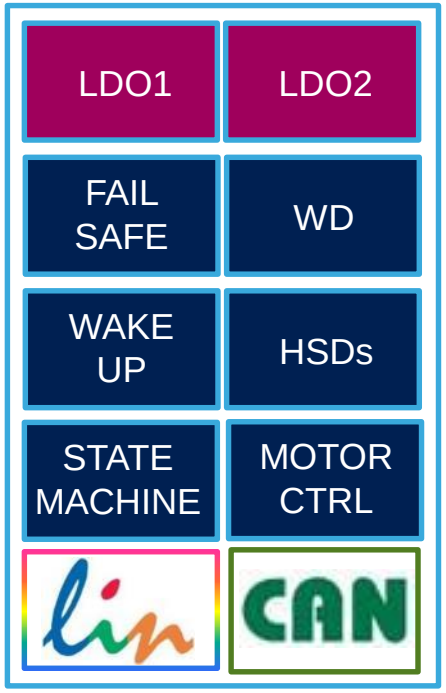
L9952GXP

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



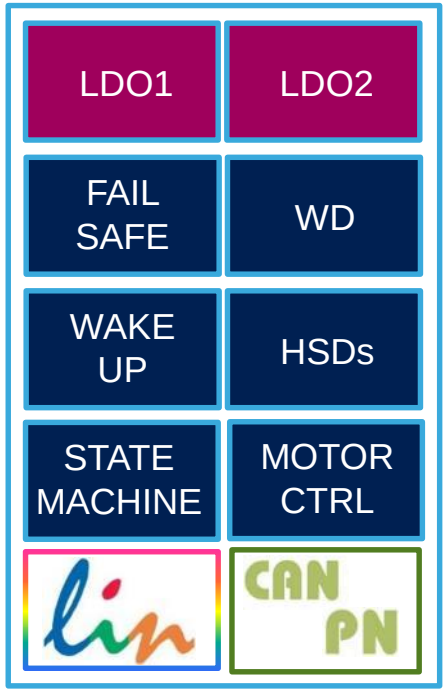
L99PM62GXP

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



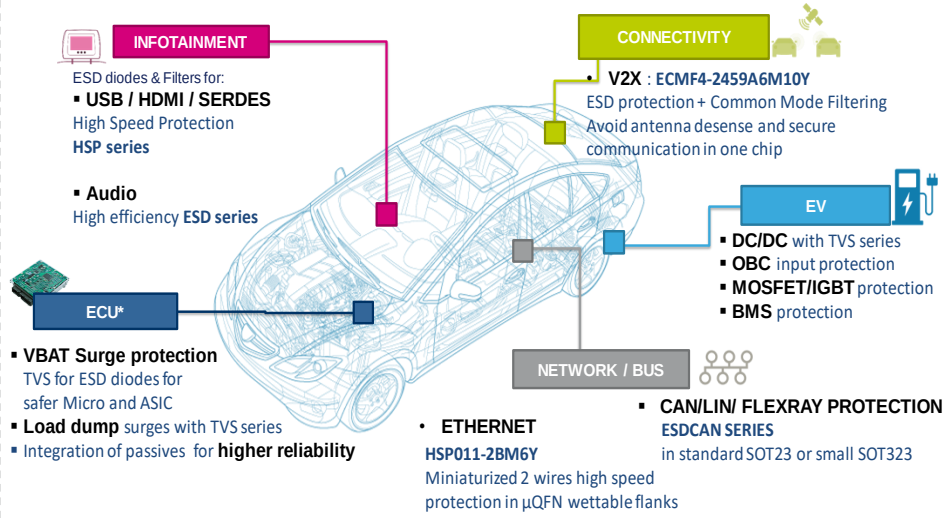
L99PM72GXP

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



life.augmented

Automotive Protection ICs



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

Infotainment Protections and Filters
USB / HDMI / SERDES / Audio

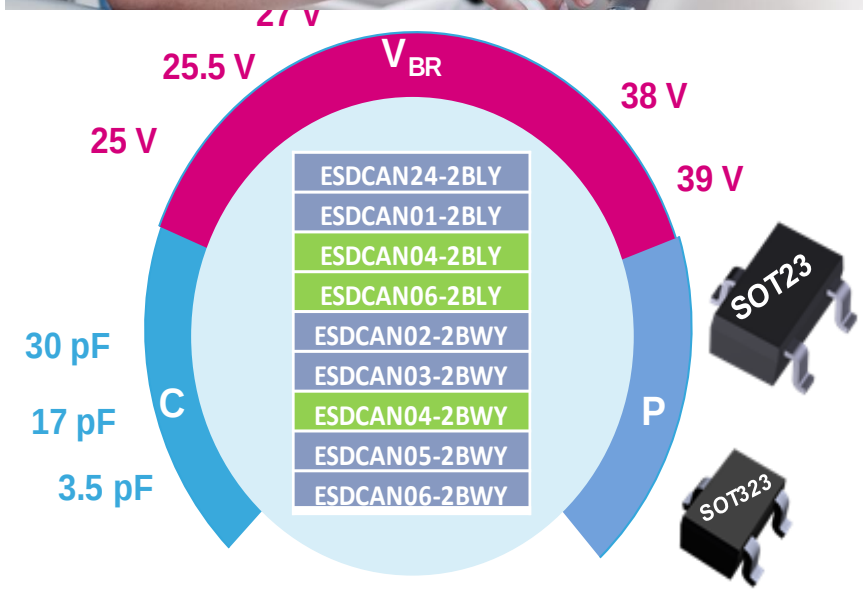
Communication Bus Protections
CAN / LIN / FLEX RAY / ETHERNET

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

life.augmented

Transient & ESD Surge Suppressors

Automotive-grade ESD protection solutions



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

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

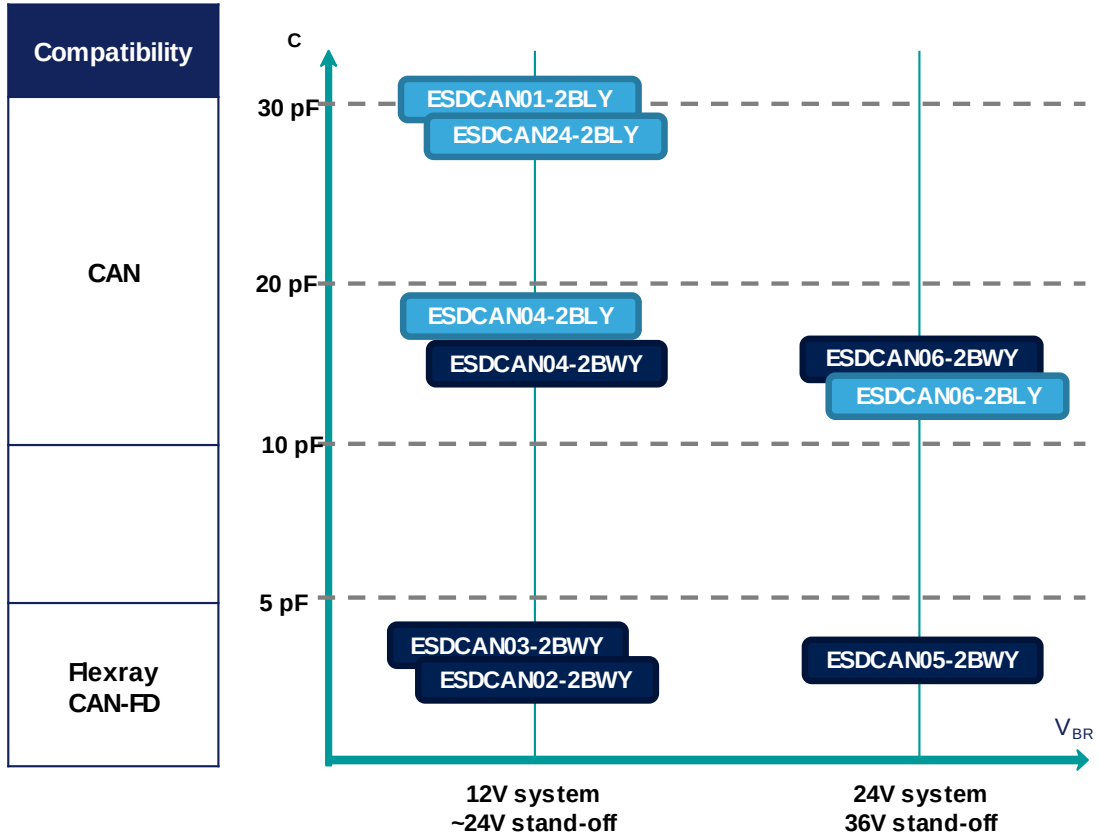
AEC-Q101 Compliant ISO 7637 3a & 3b, ISO 10605 / IEC 61000-4-2, ISO 16750-2

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

life.augmented

Flexibility & 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

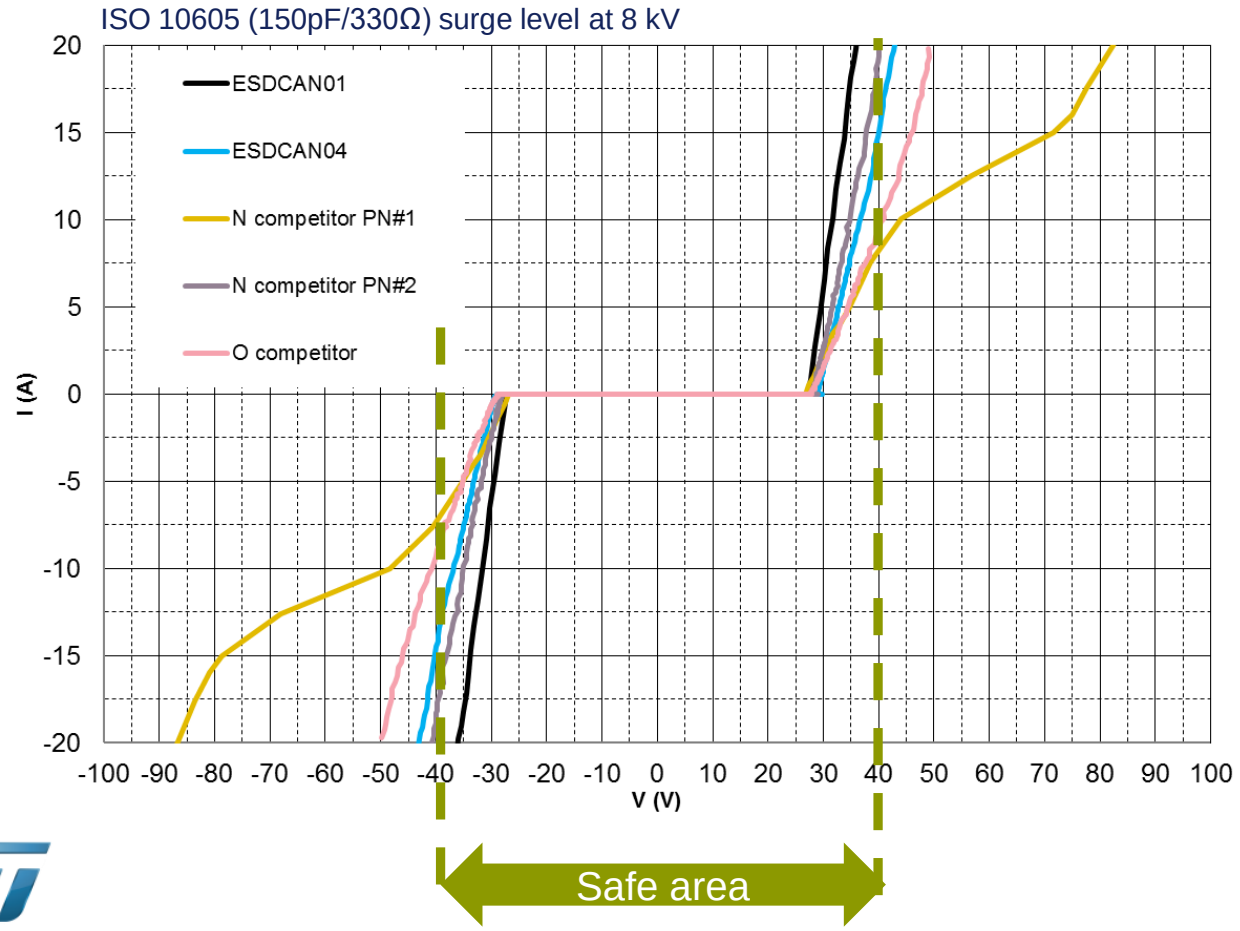
SAE INTERNATIONAL

APPROVED

life.augmented

Robustness & Performance

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



Performance 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

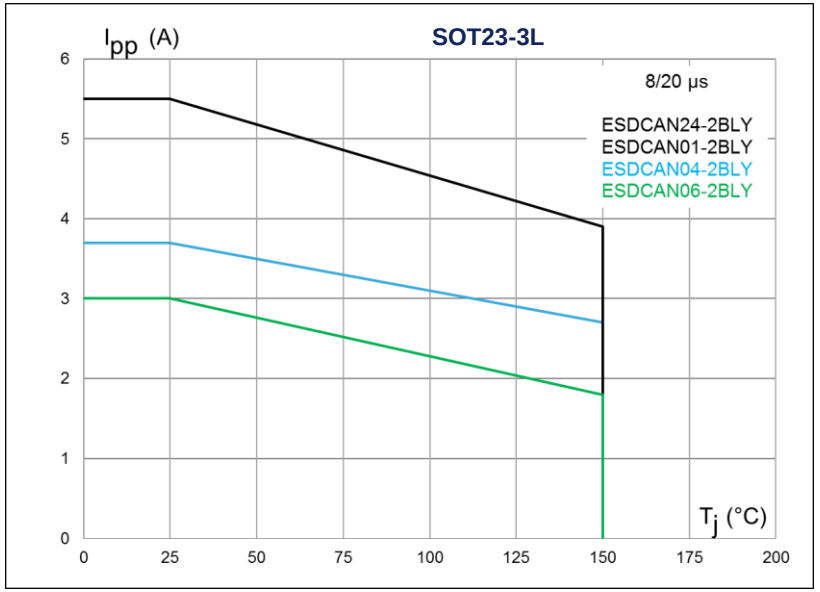
N vendor ISO pulse test at 16A V_{CL} = 75 V

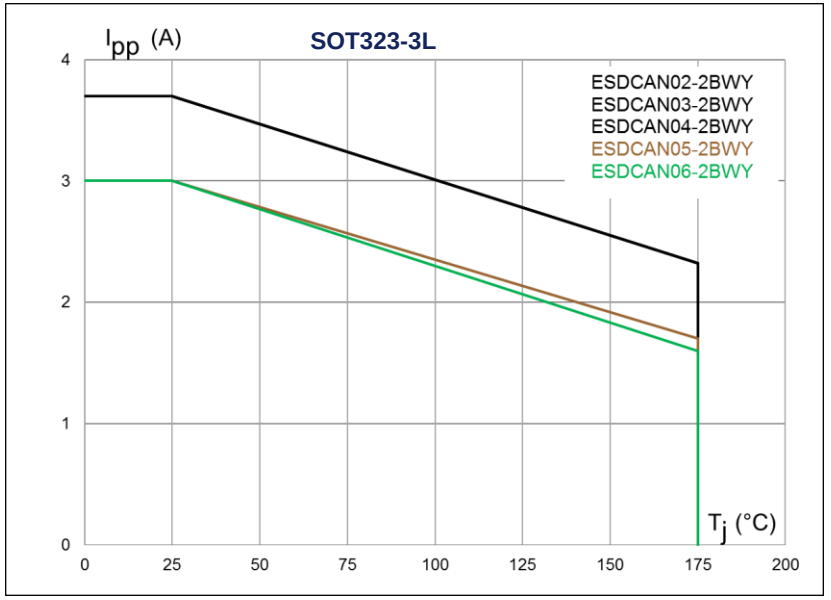
STMicroelectronics ESD diodes are providing **80%** better ESD surge immunity than competitors

life.augmented

Reliability

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

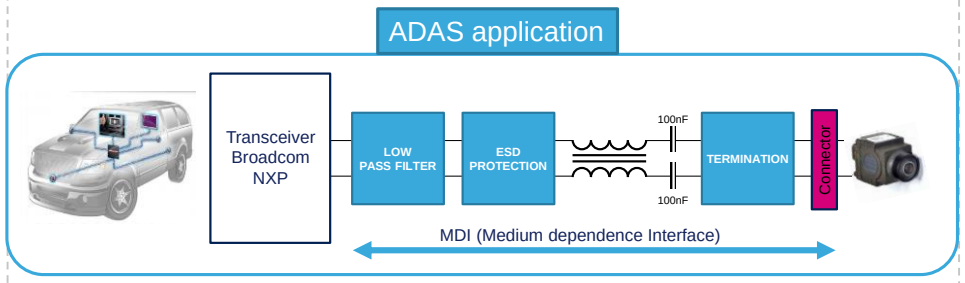


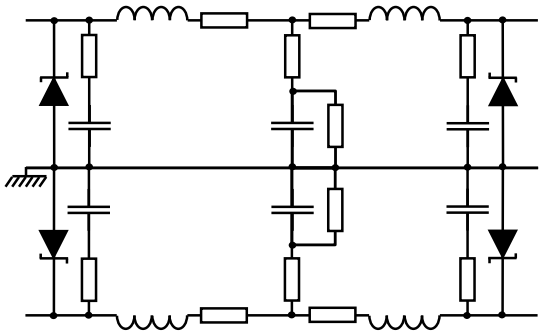


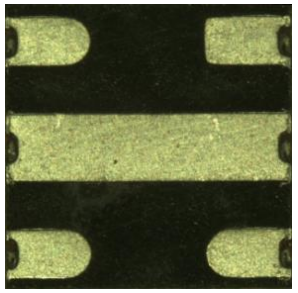
Best in class in the market with the lowest power deratings over the temperature range

life.augmented

BroadR-Reach Integrated Low Pass Filter







EMIF02-02ABRY
3 x 3mm uQFN

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

ROBUSTNESS

15 KV ISO10605
Rated -40C to 125C

PERFORMANCES

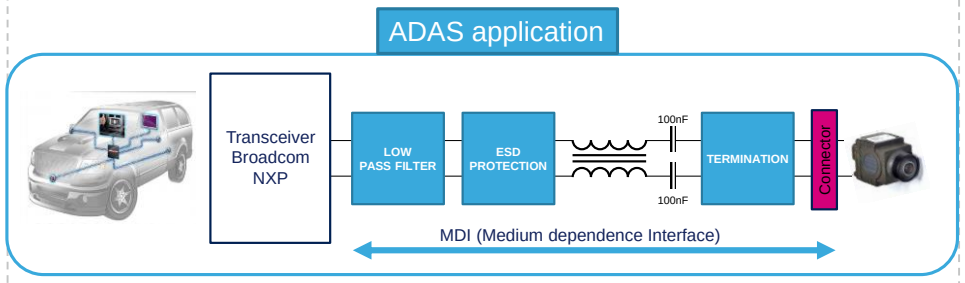
S11D -20dB min
up to 60MHz

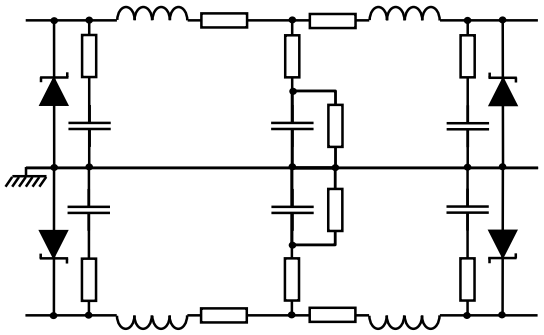
SIMPLIFICATION

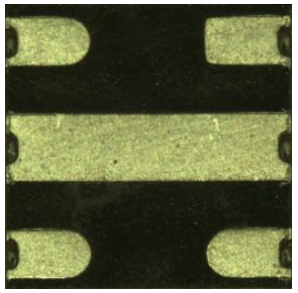
70% PCB saved
80% BOM reduction

life.augmented

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

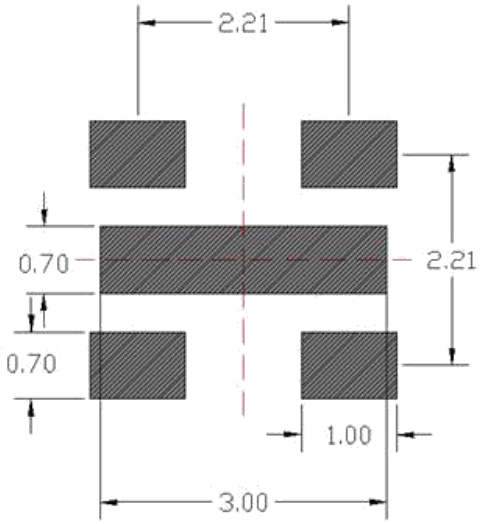
70% PCB saved
80% BOM reduction

life.augmented

2-Line EMI Filter and ESD Protection

For Broad'R Reach

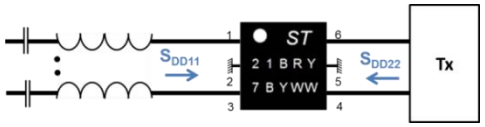
- Benefits :
  - AEC-Q101 qualified
  - Space saving versus discrete and existing integrated solution: 9 mm²
  - Robust against surges: ISO 10605: 15 kV
  - Wide temperature range of application:
  - Rated -40°C to 125°C for tough environment
  - Automated Optical Inspection compatible with wettable flanks
  - Compliant with Open Alliance BroadR Reach specification
- Package : QFN 3 x 3 wettable flank
  Dimensions : 3 x 3 x 1 mm
- Footprint in millimeters



Order codes :

EMIF02-02OABRY

Status : in production

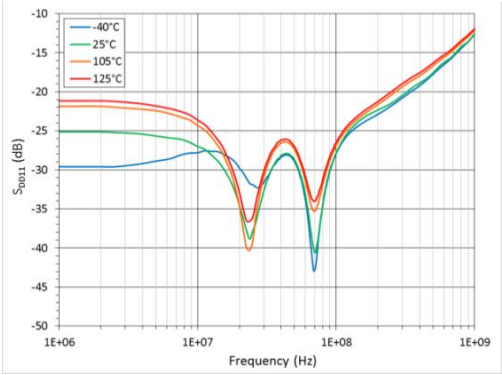


Datasheet : available on www.st.com

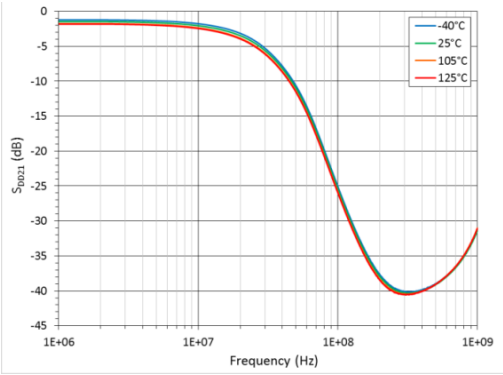
Key parameters :

V_{BR}	6 V
S_{11DD}	-20 dB up to 60 MHz
R,L,C matching	< 1 %

S_{DD22}



S_{DD12}



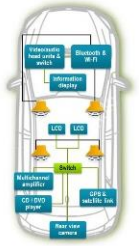
life.augmented

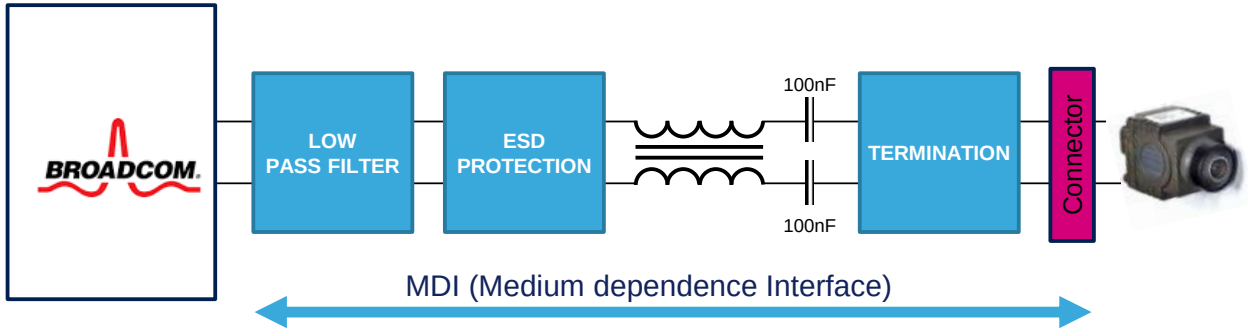
ADAS Protection and Filters

ADAS application

What is BroadR-Reach?

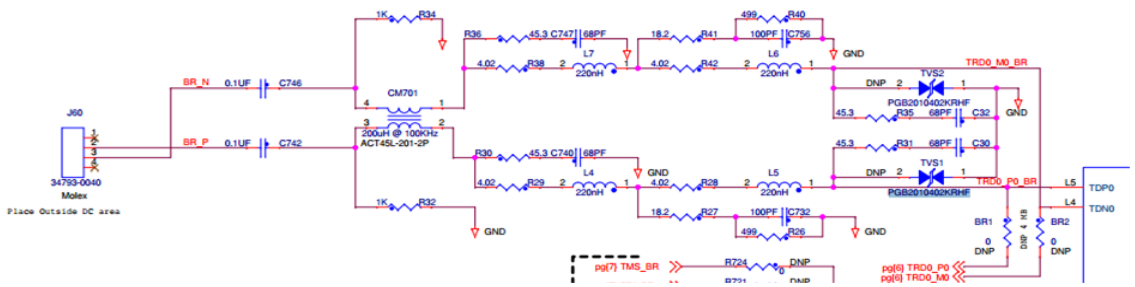
- Leverages standard Ethernet technology designed for automotive applications
- 100 Mb/s Ethernet over unshielded twisted pair (UTP) cabling up to 15m
  - 40m reach over shielded twisted pair
- Pioneered by Broadcom





life.augmented

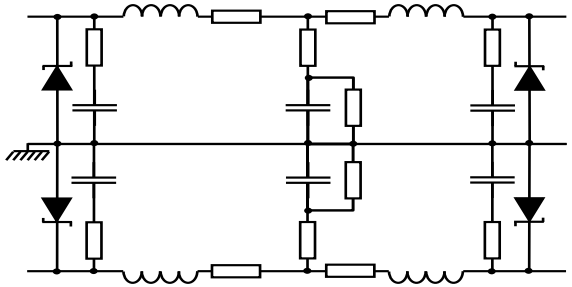
ADAS Protection and Filters



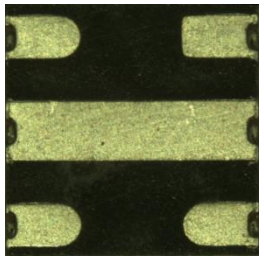
Discrete version (best case)
30.7mm²

28 components

ADAS Protection and Filters



3 x 3 mm



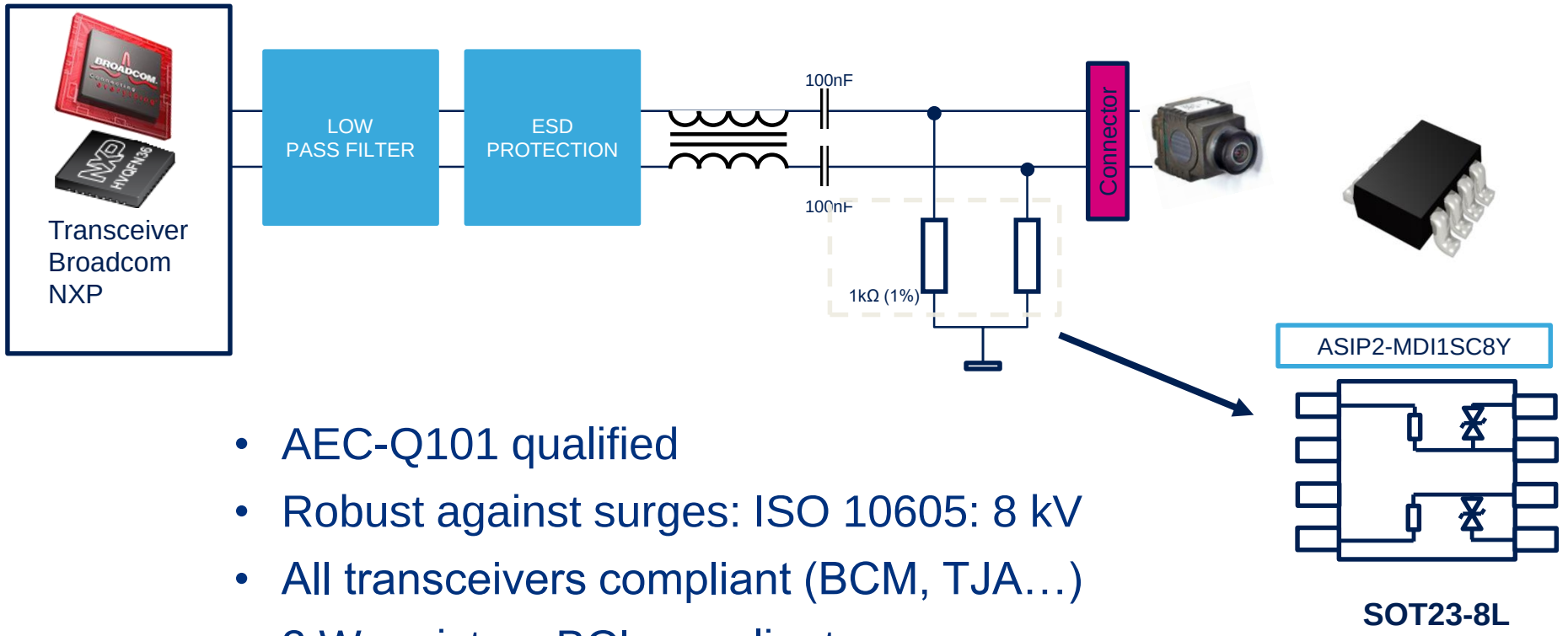
AEC-Q101 qualified

EMIF02-02OABRY

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

life.augmented

Termination – ASIP2-MDI1SC8Y



- AEC-Q101 qualified
- Robust against surges: ISO 10605: 8 kV
- All transceivers compliant (BCM, TJA…)
- 2 W resistors BCI compliant
- Space saving with SOT23-8L package : 2.8 x 2.9 = 8 mm²
- Wide temperature range of application: -40°C to 125°

Infotainment Signal Conditioning Mapping

SERDES

HDMI

USB

NFC

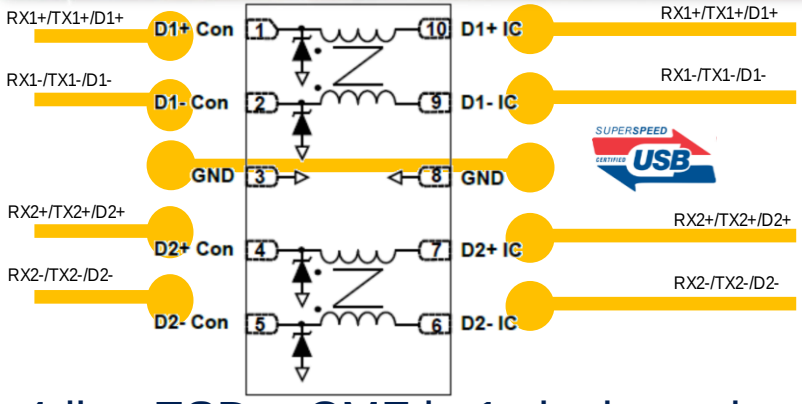
AM
FM

DAB+

SD

PCIe

USB / HDMI Integrated Low Pass Filter



4-line ESD + CMF in 1 single package

ECMF04-4HSM10Y
2 Differential Pairs CM filter
with ESD Protection

ROBUSTNESS

15 KV ISO10605
Rated -40C to 125C

PERFORMANCE

-20dB
700Mhz to 1.2Ghz
& Clamping 27V

SIMPLIFICATION

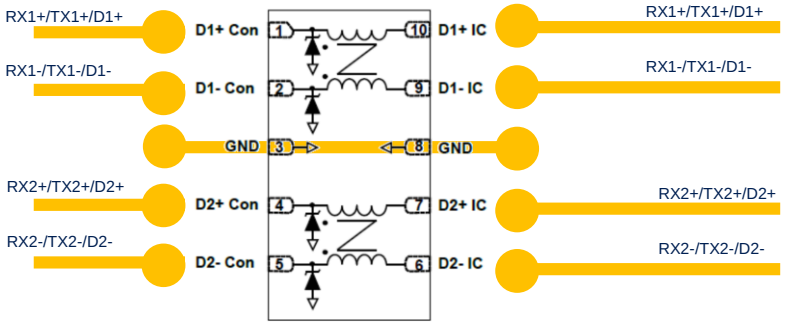
80% PCB saved
80% BOM reduction
Single Component

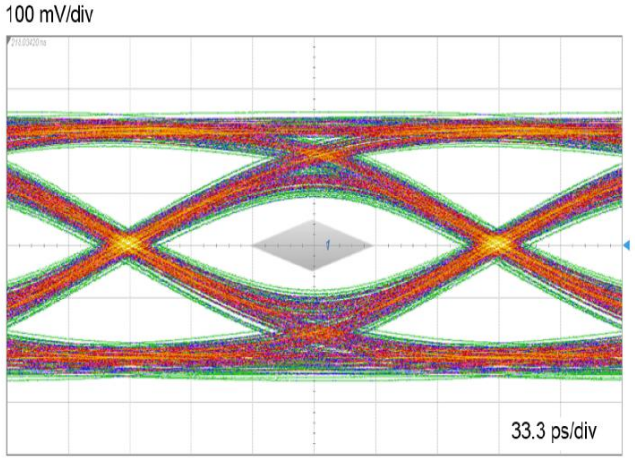
life.augmented

ESD + Common Mode Filter

USB Datalines

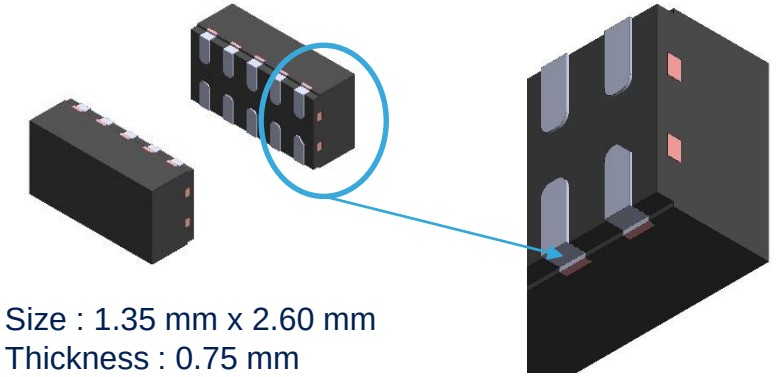
Flow-through layout





5 Gbps eye diagram with device

Wettable flank package



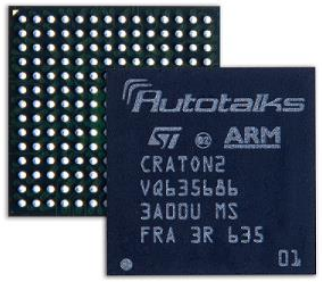
Size : 1.35 mm x 2.60 mm
Thickness : 0.75 mm

- 4-line ESD + CMF in 1 single package
- Low V_{CL} : **27 V** @ 16A TLP (8kV contact)
- High common mode attenuation:
  - **-20 dB** from 700 MHz to 1.2GHz
- ISO10605 (C = 330 pF, R = 330 Ω):
  - 8 kV contact discharge
  - 15 kV air discharge

life.augmented

Telematics

Market 1st dual-mode solution supporting 5G Cellular V2X



Single IC Solution

Cellular
(Automotive low latency 5G)

&

Wi-Fi 11.p
(for Automotive)

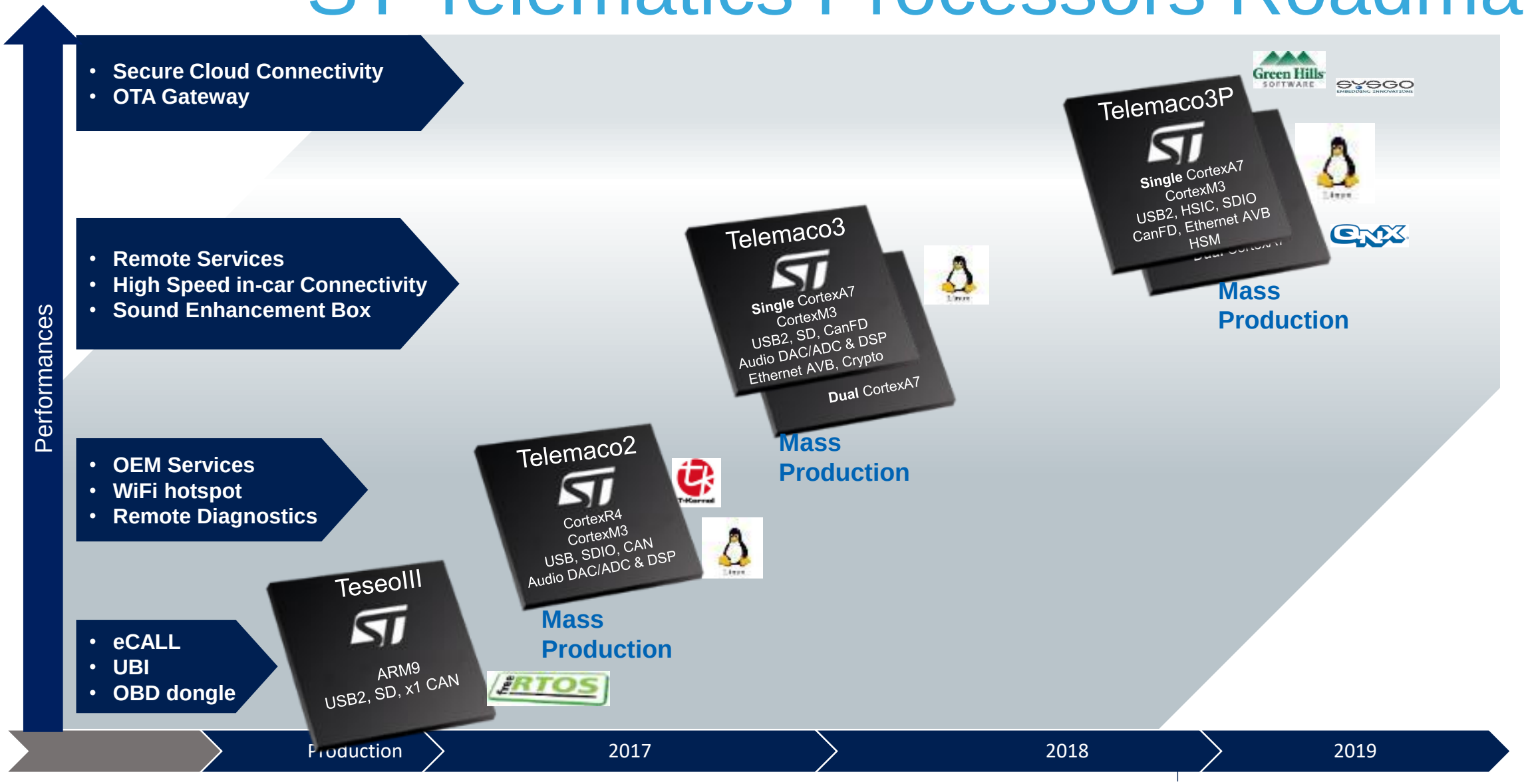
life.augmented | Autotalks

Autotalks solution awarded for production:

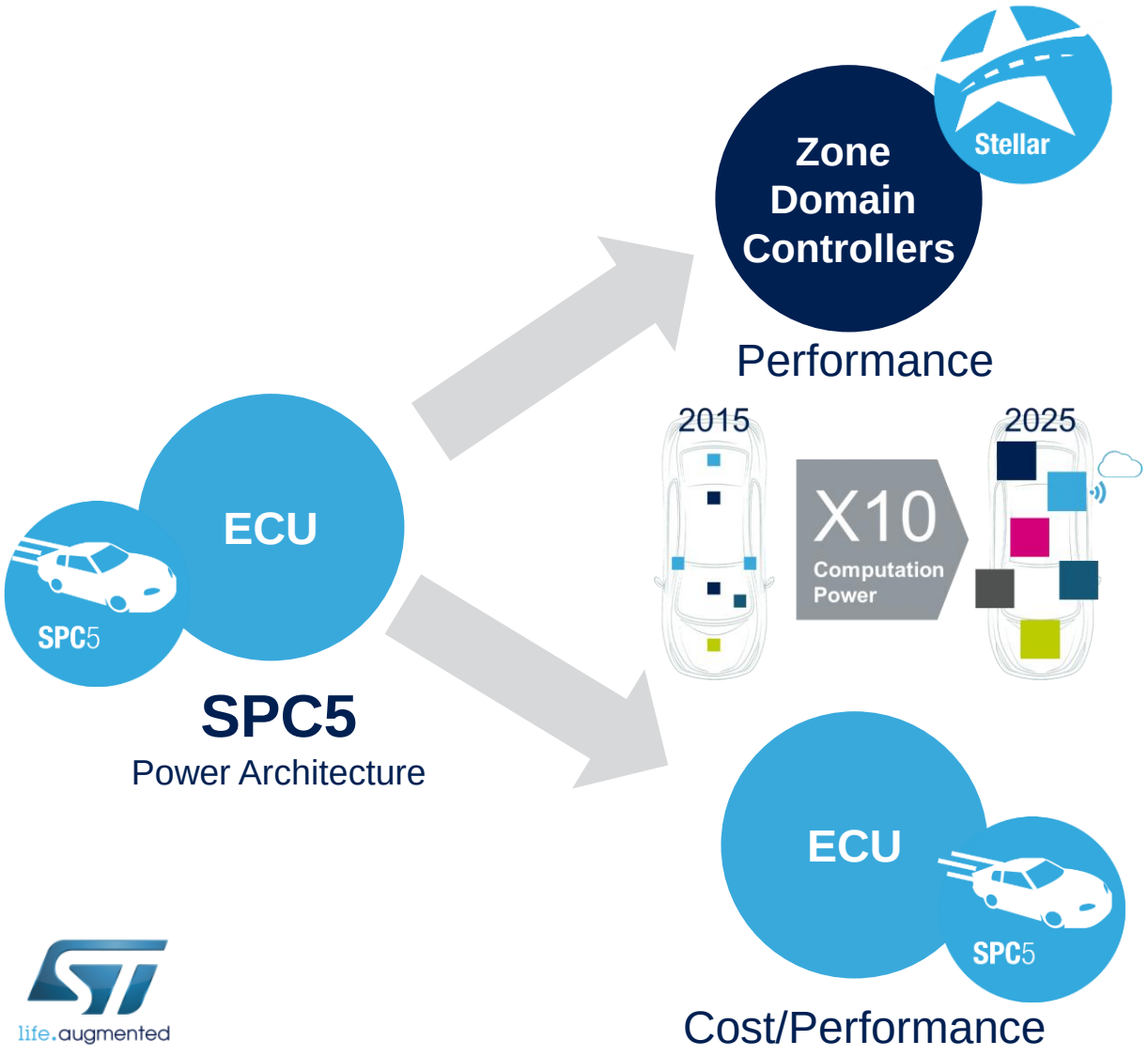
- 4 of the top 10 automakers deploy Autotalks V2X solution
- > 10 Tier1s selected the chipset
- Volume production by 2020

life.augmented

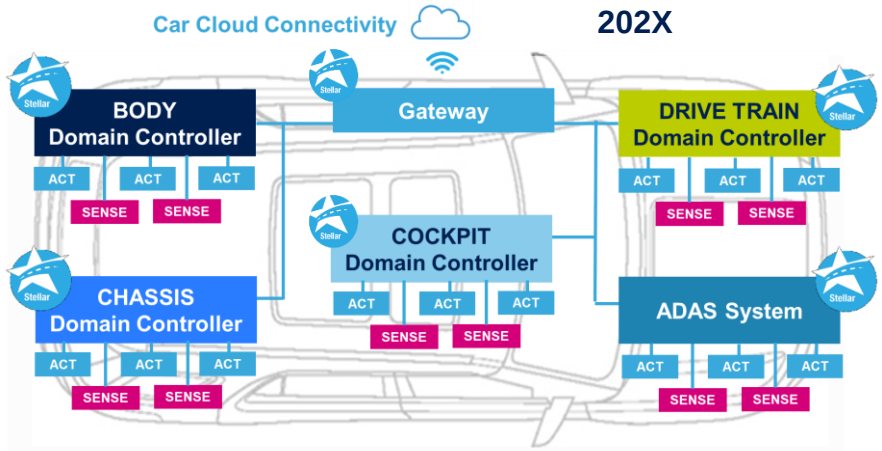
ST Telematics Processors Roadmap



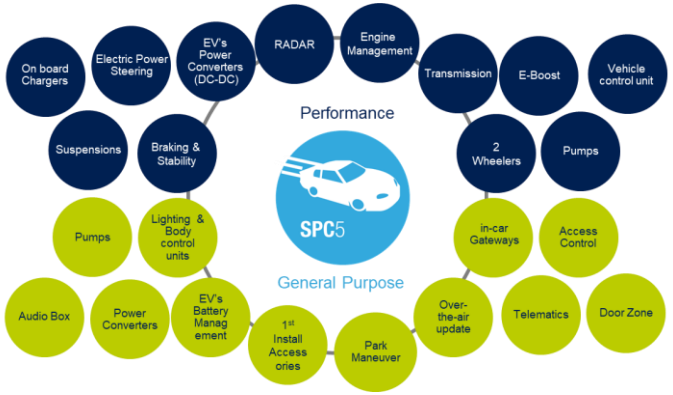
32-bit Automotive MCU Evolution



Stellar Arm R52 28nmFDSOI PCM for High end



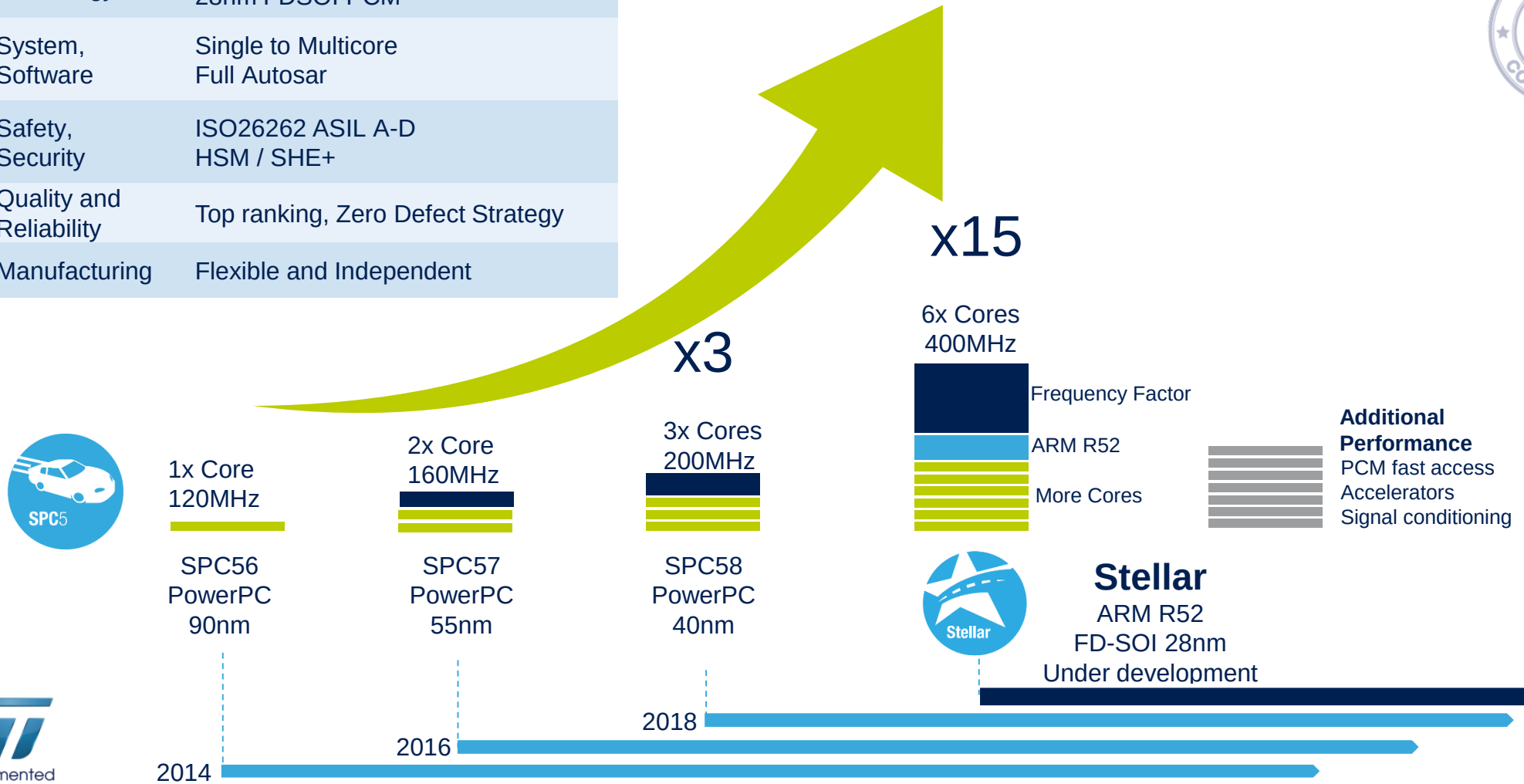
SPC5 Power Architecture Flash NVM for Single ECUs



life.augmented

32-bit Automotive MCU Roadmap

Silicon technology	CMOS 90/55/40nm Flash 28nm FDSOI PCM
System, Software	Single to Multicore Full Autosar
Safety, Security	ISO26262 ASIL A-D HSM / SHE+
Quality and Reliability	Top ranking, Zero Defect Strategy
Manufacturing	Flexible and Independent



life.augmented

SPC58x General-Purpose MCUs

common features

Some adjustements

	SPC58 2B Line	SPC58 4B Line	SPC58 C Line	SPC58 G Line	SPC58 H Line
QFN48					
eTQFP64		Flash: 1M - 2M	Flash 2M - 4M	Flash 4M - 6M	Flash 6M - 10M
eTQFP100					
eTQFP144		HSM Evita Medium	HSM Evita Medium	HSM Evita Medium	HSM Evita Full
eLQFP176					
LFBGA292/302					
LFBGA386					
	z2 core - 80MHz	z4 core – 120 MHz	2x z4 core – 180 MHz	3x z4 core – 180 MHz	3x z4 core – 200 MHz

life.augmented

Infotainment and Digital Audio Processors

Scalable family targeting differentiated market needs