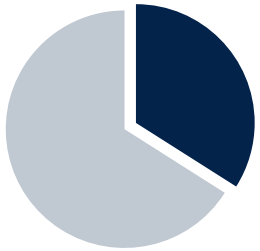
life.augmented

Capital Markets Day 2022

Automotive and Discrete Group

Marco Monti

President, Automotive and Discrete Group



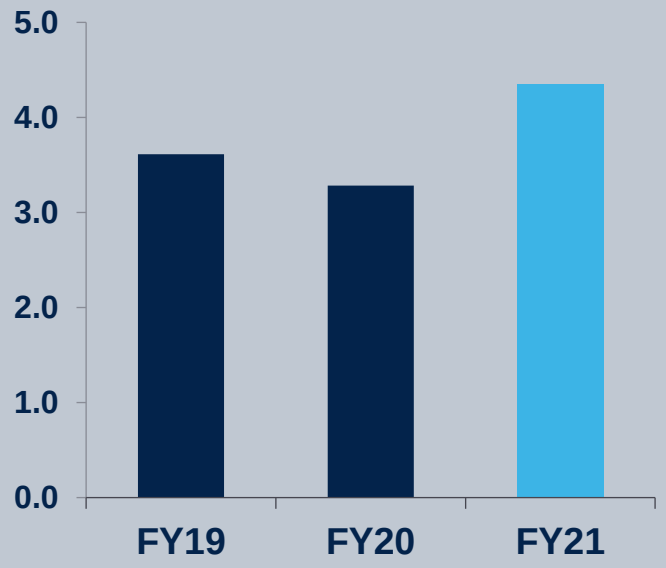
34% of ST FY21 Revenues

Revenue overview - ADG

ADG Group Revenue $B

2021

$4.35B



ADG Sub-Group Revenue $B

Automotive Sub-Group

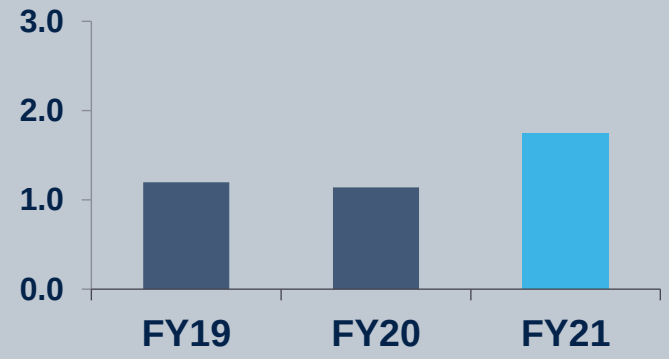
2021

$2.61B

Power Discrete Sub-Group

2021

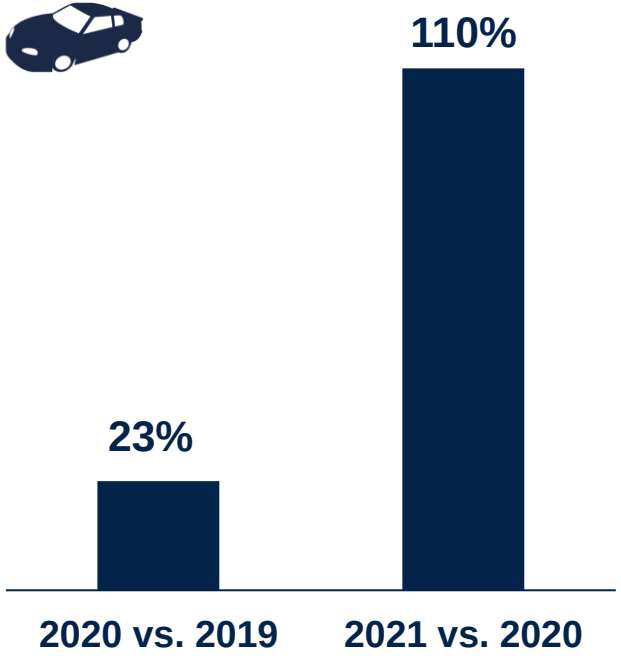
$1.74B



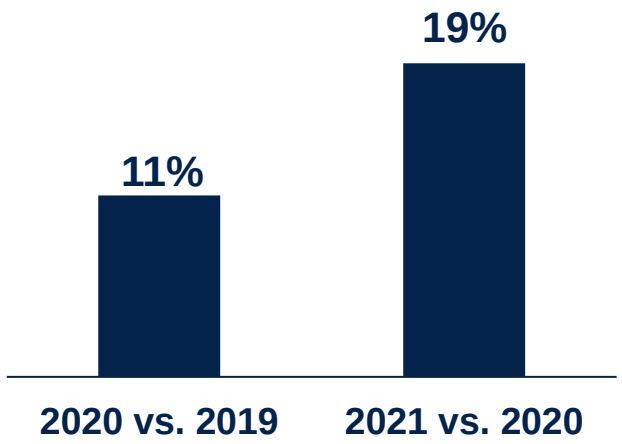
life.augmented

ADG revenue expansion driven by strong growth in new automotive trends

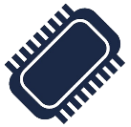
Car electrification

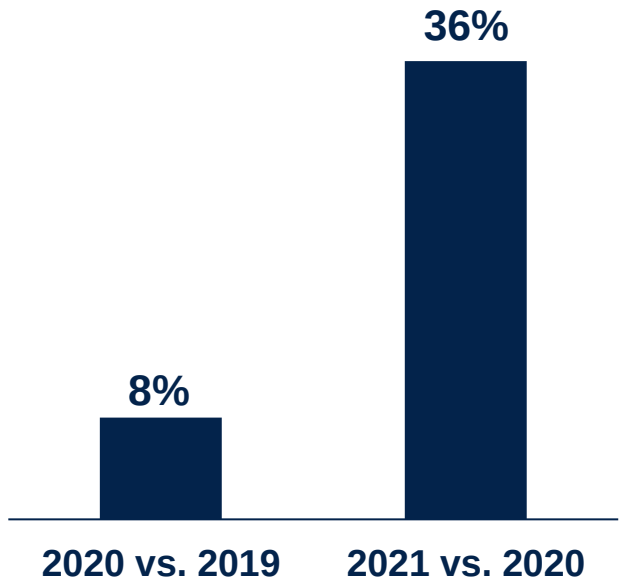


ADAS systems



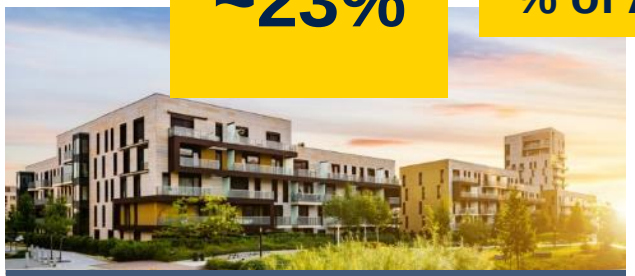
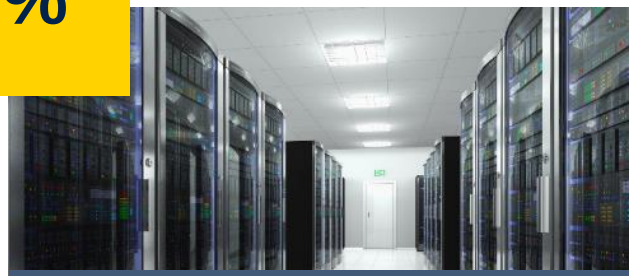
32-bit automotive MCUs





life.augmented

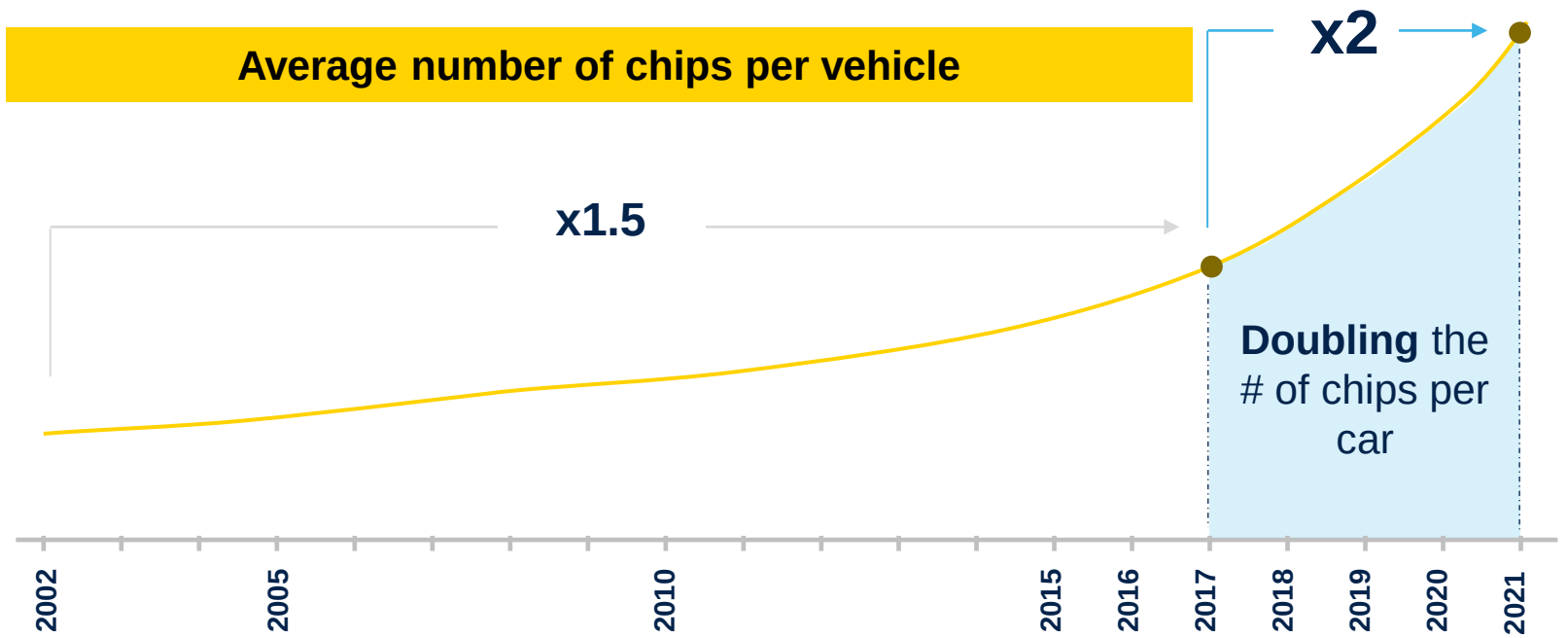
ADG addresses ST's four end markets

Automotive	Industrial	Personal Electronics	Communications Equipment, Computers & Peripherals
			
~70%	**~23%**	**% of ADG revenues 2021** **~7%**	
			
Continue to reinforce leadership	Further expansion	Focus on product Innovation	New partnerships for fast growing growth on emerging markets

life.augmented

Acceleration of silicon content pervasion in automotive

Semiconductor content per car steadily increased over the two past decades and strongly accelerated recently



Automotive **electronics demand** continuously rising, confirming secular trends

Average number of automotive **chips per car** accelerated in last 4 years

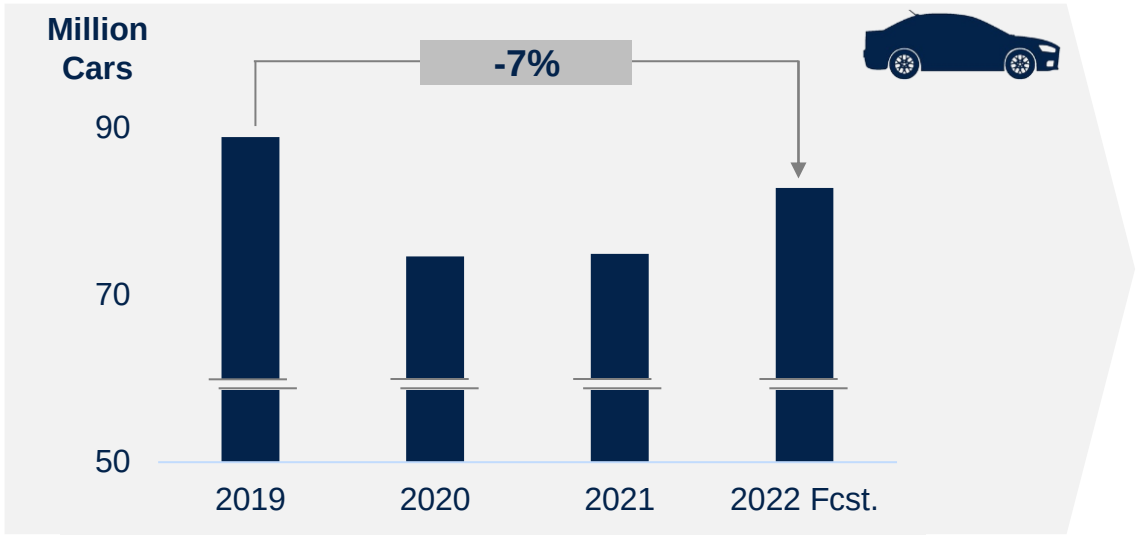
Expectation for further **acceleration** in the **next few years**

Source: IHS Markit, ST

life.augmented

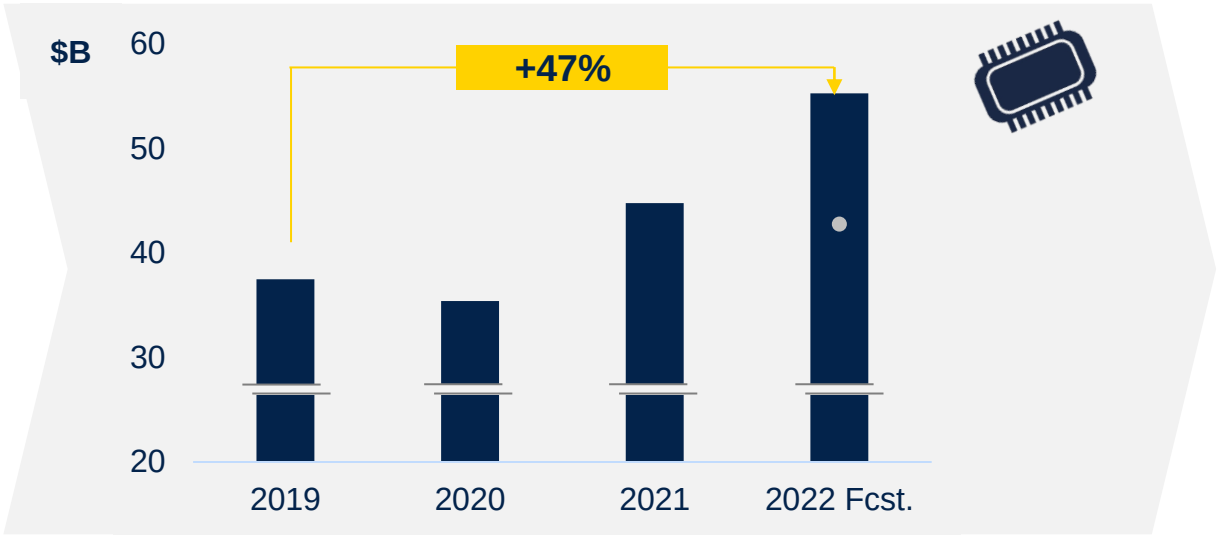
Automotive semiconductor demand has become uncorrelated with car production

Global light vehicle production



Production rate struggling to return to pre-pandemic levels

Automotive semiconductor TAM



Source: IHS Markit

Multiple positive trends driving increasing automotive semiconductor content

DIGITAL

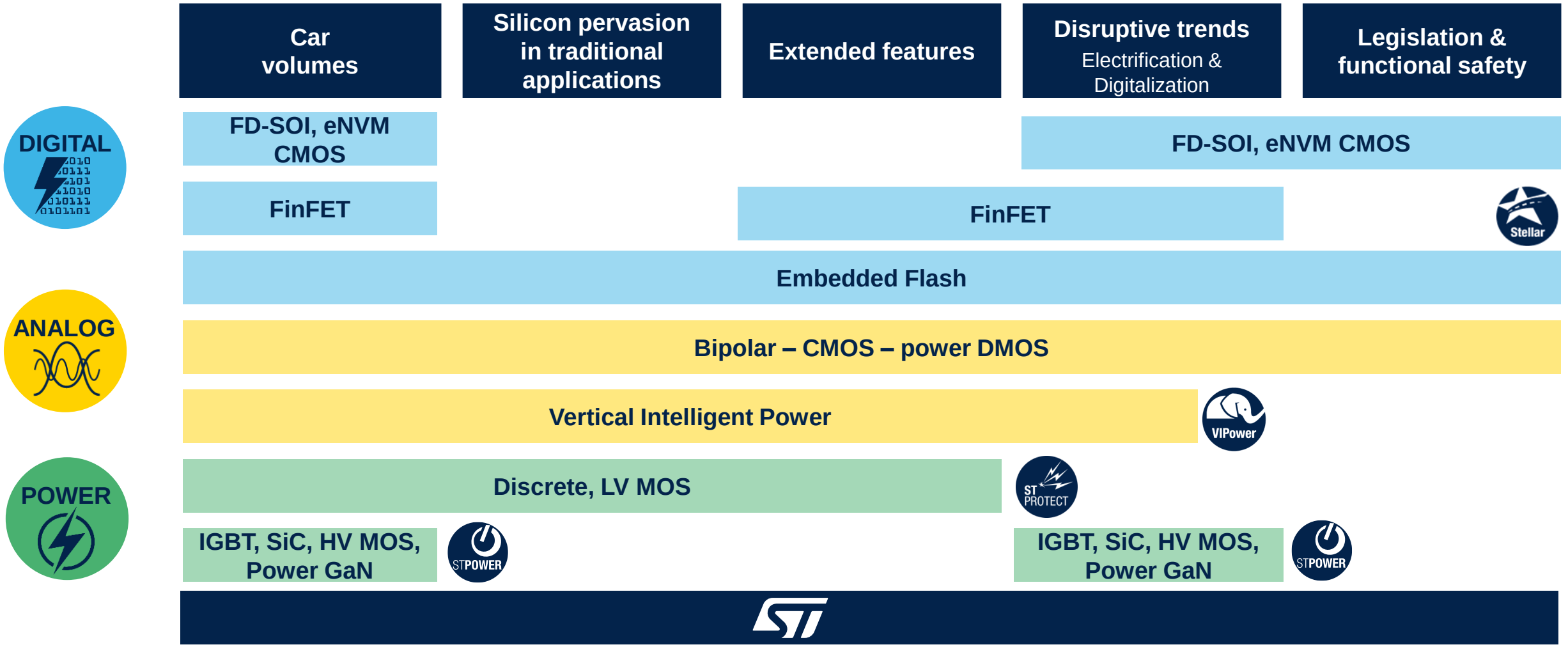
ANALOG

POWER

Car volumes	Silicon pervasion in traditional applications	Extended features	Disruptive trends Electrification & Digitalization	Legislation & functional safety
↘ ↗	↗	↗	↗ ↗	↗
Vehicle production recovering after pandemic slow down China is growing at higher speed than the rest of the market	Legacy automotive applications require more silicon content	Better driving experience, additional safety, extended comfort drive the introduction of new car functions	eMobility, ADAS, connectivity, SW reconfigurable vehicles … strongly impact silicon content	Legislation requires fault tolerant vehicles. This drives usage of more silicon per car – e.g. redundant functionality

life.augmented

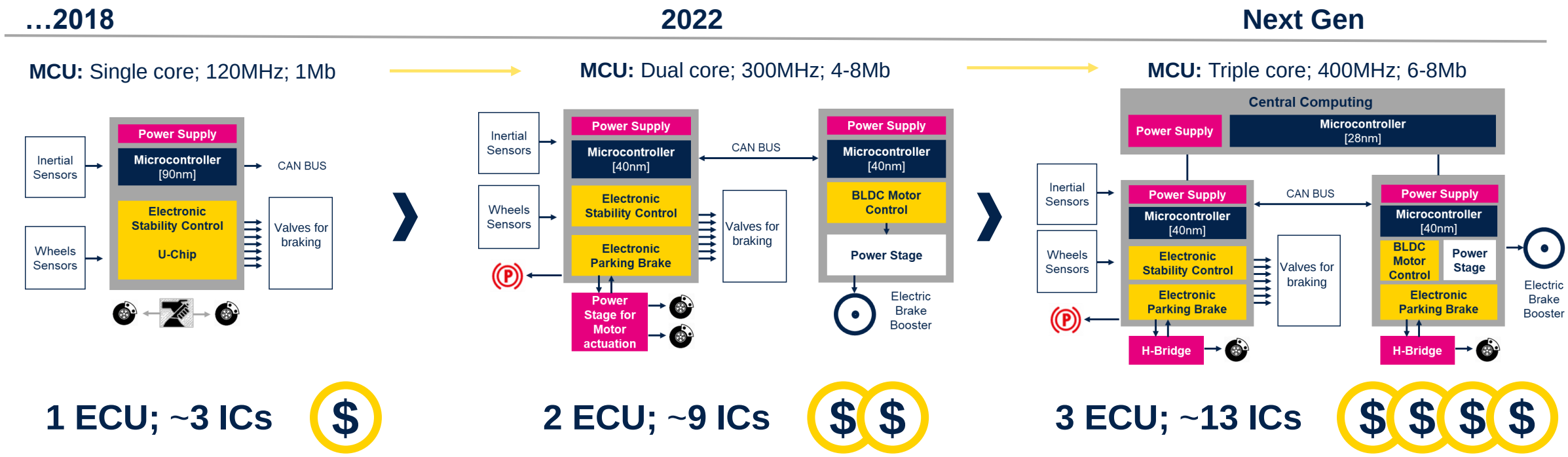
ST has the portfolio of differentiated technologies needed to serve new automotive requirements



life.augmented

Silicon content increasing in traditional applications

The same Electronic Stability Control functionality requires additional and more complex ICs



*EPB: Electric Parking Brake

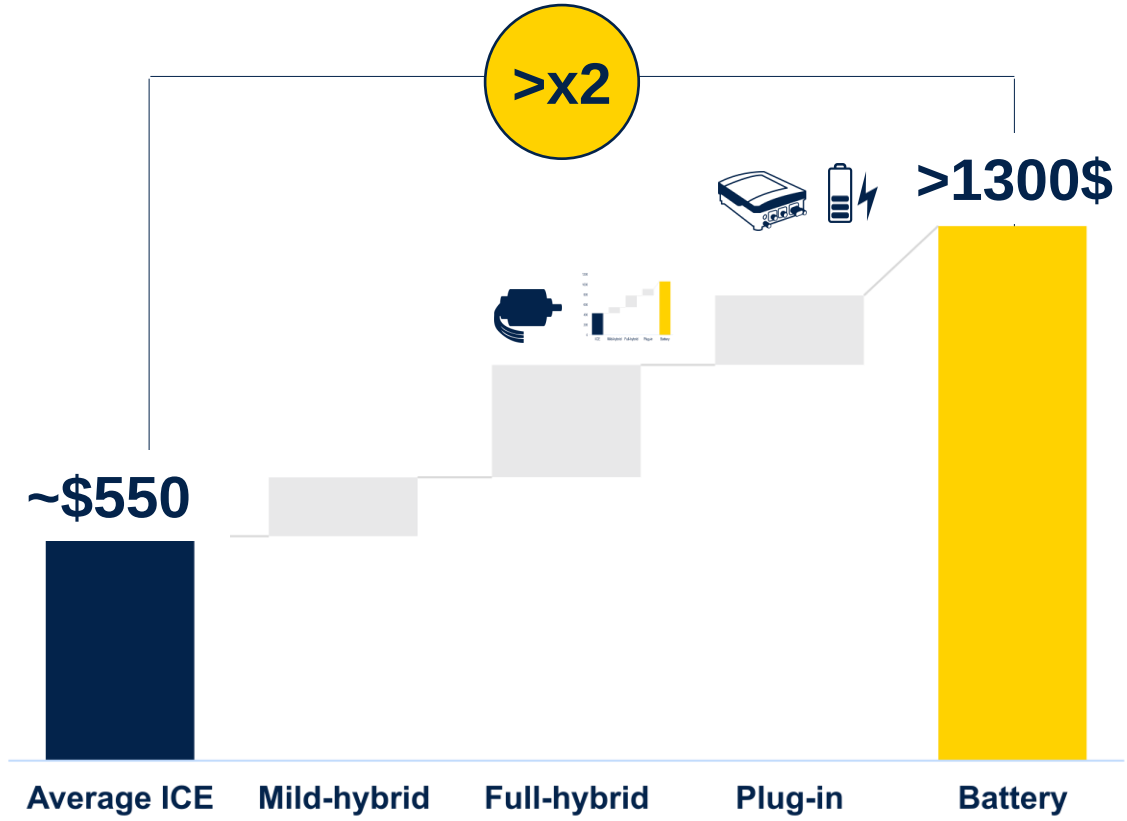
EPB* penetration: ~30% | **>50%** | **>70%**

ST made early investments in products and manufacturing capabilities to serve the needs of the automotive industry

life.augmented

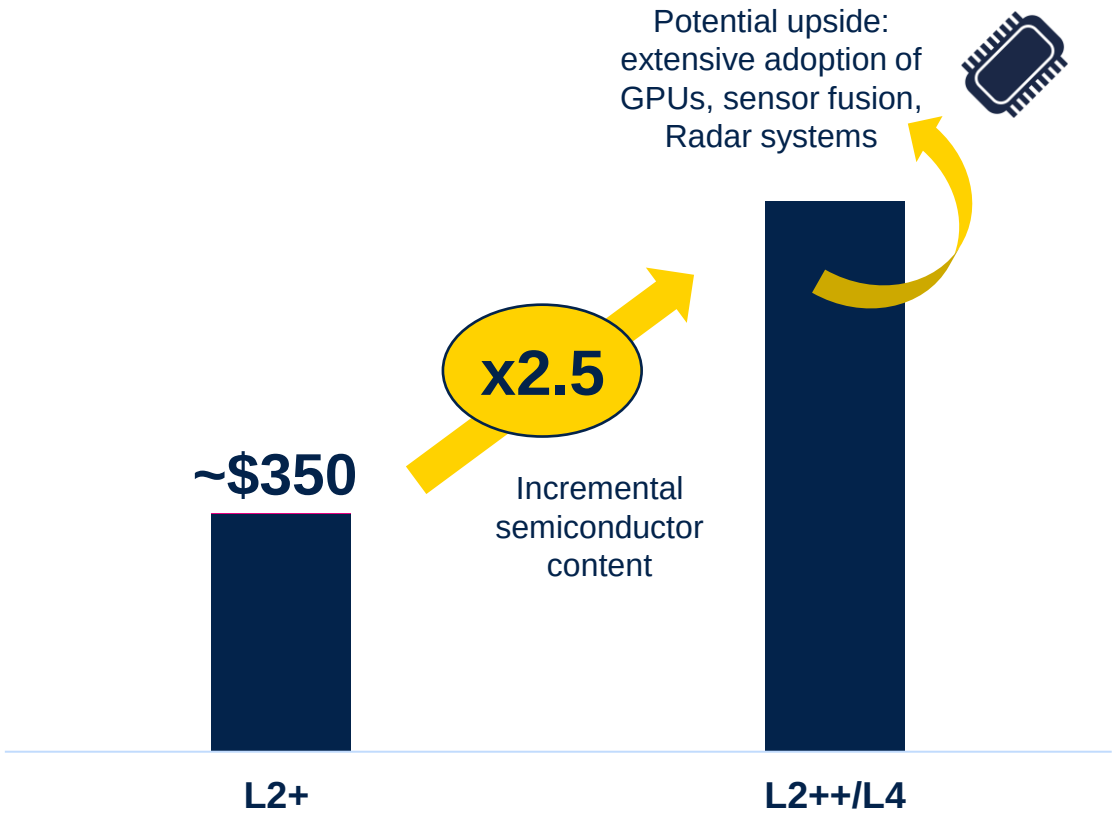
Electrification and digitalization drive disruptive increase in silicon content

Electrification significantly increases car silicon content



Source: Strategy Analytics, ST

To increase autonomy additional silicon is needed in every car

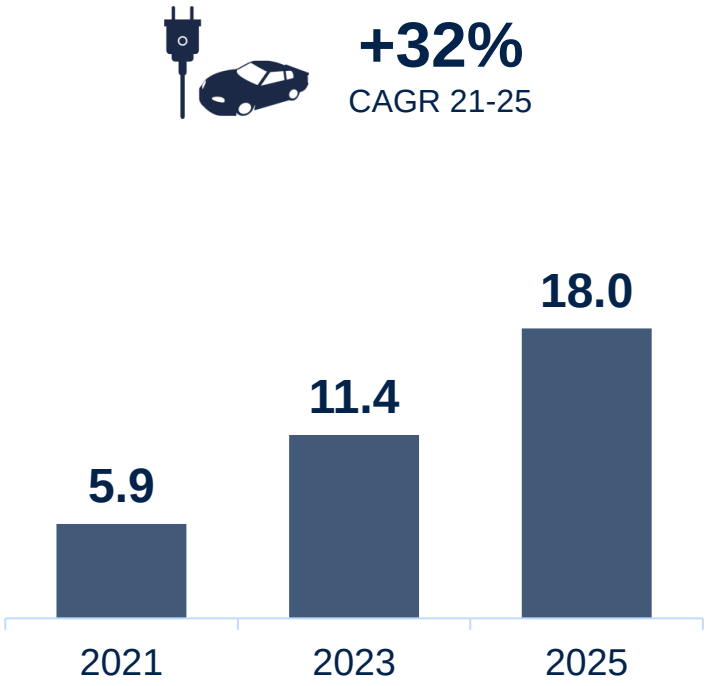


Source: Goldman Sachs, ST

New automotive trends drive semiconductor TAM

Electrification

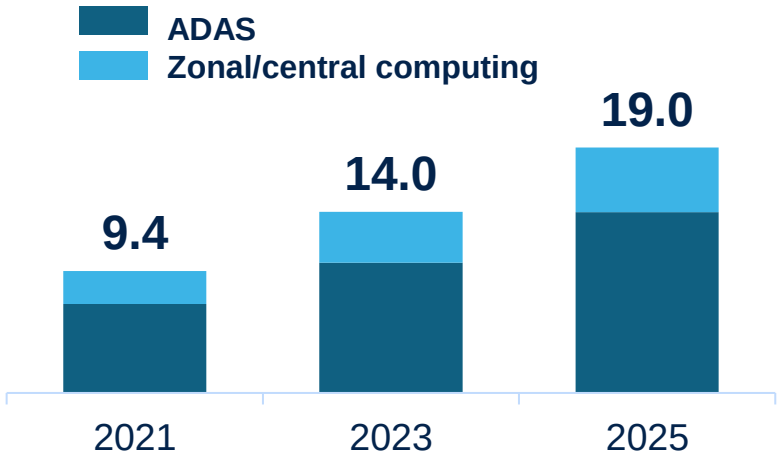
+32%
CAGR 21-25



Vehicle electrification TAM [$B]

Software-defined vehicles

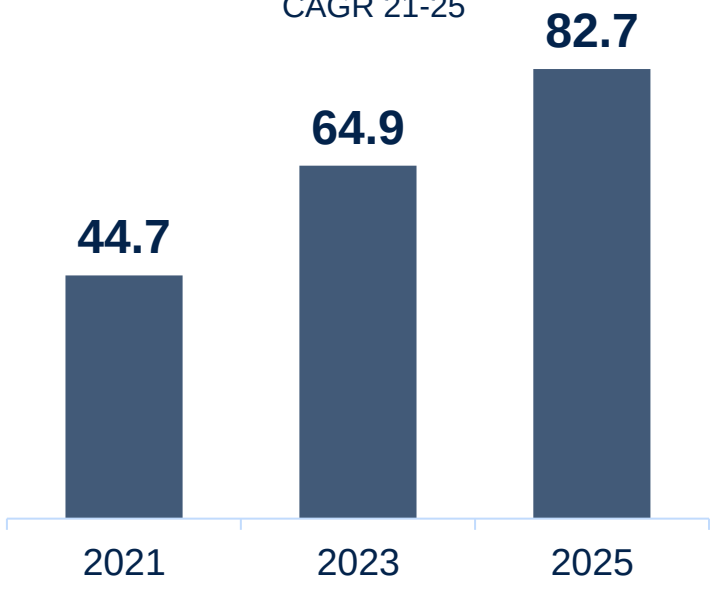
+19%
CAGR 21-25



Vehicle digitalization TAM [$B]

Automotive TAM

16.6%
CAGR 21-25



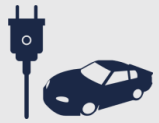
Overall automotive TAM [$B]

Source: IHS Markit

ST leads in eMobility thanks to timely investment and a strong technology and product offering

ST offers a truly broad range product portfolio for electrification based on state-of-the-art technologies

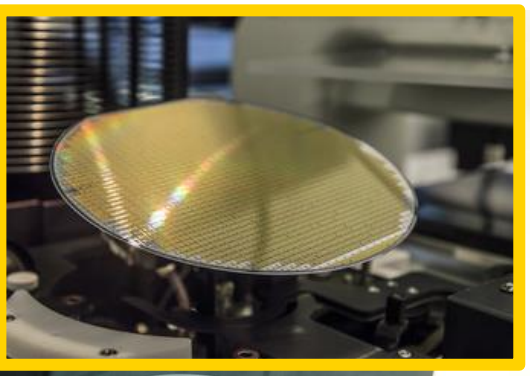
ST anticipated the right technology development and capacity planning to serve the disruptive demands of eMobility



	Traction Inverter	On-board charger	DC-DC converter	Battery management
Silicon $/car	~$520	~$260	~$130	~$80
POWER	WBG materials: SiC MOSFET series (650/1200V range) SiC rectifier, Power GaN (STPOWER)			
	Power Module, Intelligent Power Module (IPM)	High Voltage Si MOSFET: Mdmesh Product Family (ST PROTECT)		
	IGBT Product Family (650/1200V range)			
ANALOG	PMIC Product Family, Linear Voltage Regulators, System Basis Chips			
	Isolated gate drivers	Isolated gate drivers		BMS Family
DIGITAL	Stellar	SPC5 product family Stellar E (tailored for electrification) (SPC5)		

life.augmented

ST silicon carbide focus areas



Business Development

~$500M revenue in 2021, **>$700M** in 2022

> $1B target anticipated in 2023 (75% Auto - 25% Industrial)

~80 customers, **~20 c**armakers, ~**100** programs awarded

Fully integrated Manufacturing

SiC production-flow entirely mastered in-house

Dual sourcing: Singapore launched 2021 complementing Catania

New **integrated 200 mm fab**, ready by 2023 - 200 mm substrates, epitaxy and SiC MOSFETs

200 mm industrialization line in Catania to accelerate time to volumes

Portfolio & Strategy

Portfolio of **SiC MOSFETs & Diodes, & IGBT** from 650V to 1700V

3rd Gen SiC MOSFETs in production, 4th in qualification, 5th planned with **radical innovation** thanks to a disruptive SiC trench concept

Flexible approach **covering packages, modules, dice**

life.augmented

Solid silicon carbide customer base

life.augmented

ST meets the needs of the software-defined vehicle ADAS and new electrical/electronic architecture

Full system coverage with controllers, processors, sensors and power management meeting increased computation power requirements

Comprehensive ST product offer based on innovative technologies, efficient product development, long- lasting partnerships

	Adv. MCU & Processor	Vision System	V2X & Connectivity	Radar system
Silicon $/car	~$120	~$140	~$25	~$45

DIGITAL

Stellar processor for zonal module (M40, P28)

Stellar

Mobileye EyeQ Vision Processor | **FD-SOI GNSS positioning** | **Autotalks V2X** | **Radar Transceiver MMIC**

SPC5

SPC5 Product Family
Stellar MCU tailored for domain and zonal architecture

ANALOG

Power Management ICs

Multi-phase, buck-boost
Linear Voltage Regulators, System Basis Chip

POWER

TVS protections

ST PROTECT

life.augmented

Long-standing partnership in ADAS with Mobileye

mobileye An Intel Company

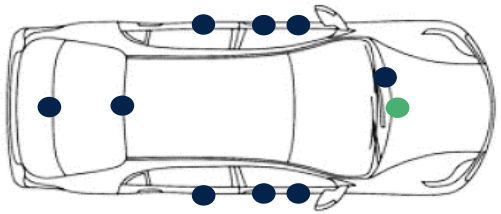
>100 Million EyeQ chips on the road

EyeQ5 Family
High-end ADAS/AD** partial

ADAS targeting L2++ → AD L4

7 nm, up to 26 DL Tops*

- L2 front camera solution (1xEyeQ5M)
- Up to L4, partial/full surround (2xEyeQ5H)



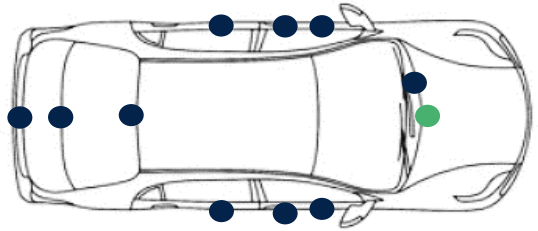
In Production (SOP 2021)

EyeQ6 Family
Premium, high-efficiency ADAS/AD partial

ADAS & AD levels up to L4

7 nm single chip, 34 DL Tops

- L2+ front camera solution (1x EyeQ6L)
- Up to L4 partial/full surround(1x EyeQ6H)



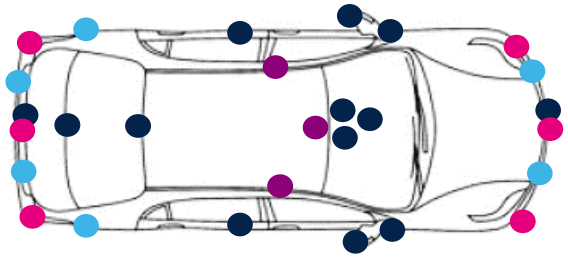
SOP 2023

EyeQ Ultra
Single SoC for end-to-end full AD

ADAS & AD levels up to L5

5 nm, 176 DL Tops

- 13 cameras
- 6 radar
- 6 Short Range LiDARs
- 3 Long Range LiDARs



Prototypes for CES Jan 2024

Leading edge products capable to support the evolution of the system

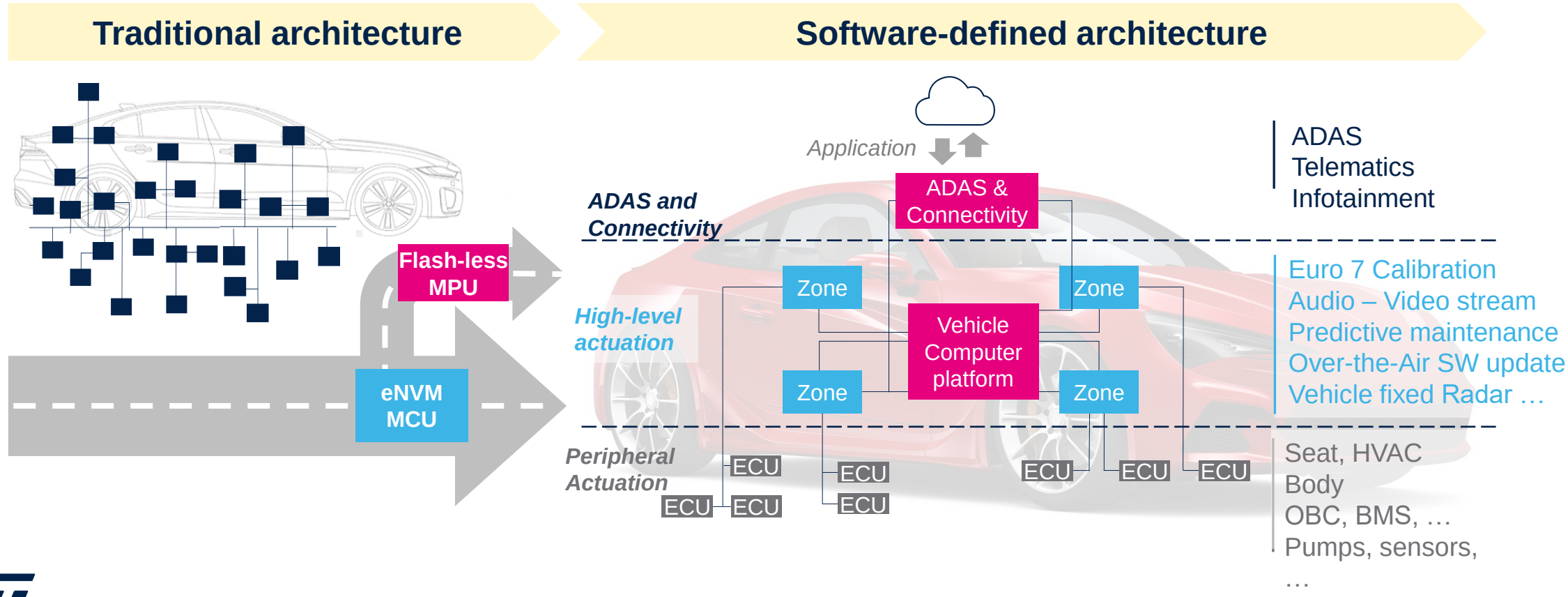
life.augmented

* DL Tops: Deep Learning Tera Operations per second

**AD: Autonomous Driving

Software defined vehicles require a new architecture

New architecture requires both flash-less MPUs & eNVM*-based MCUs to meet high computation requirements and real time control needs



*eNVM embedded non-volatile memory

life.augmented

Implications of SW-defined vehicle architectural change

For car makers

Enabling savings

Optimized number of ECUs

Harness cost and weight reduction

SW cycle time and reuse

Enabling new services

Preventive maintenance

Remote re-mapping (OTA)

Upgradable SW functions

New post-sales revenue streams

For ST

Strong increase in semiconductor content

Traditional architecture

New car architecture

Broad product offer

MCU 28 nm FD-SOI with PCM for real-time control

MPU 7 nm Flashless for computing platform

Smart Power power management

eFuse – fault tolerant systems smart protections

VIPower

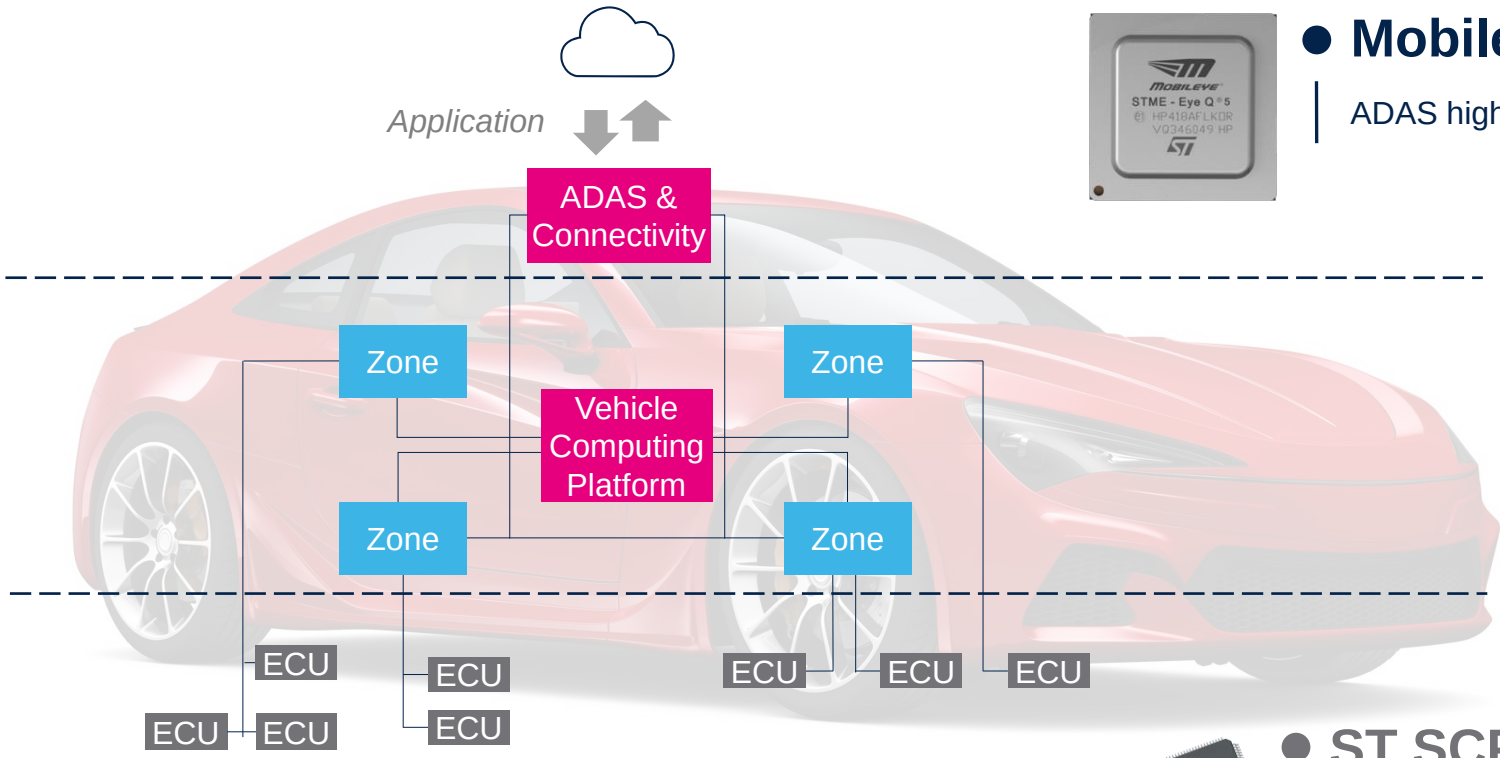
Stellar

Complementing ADAS node offer

life.augmented

ST in the driving seat of the new car architecture

Full system coverage combining MPUs (7 nm FinFET) and MCUs (28 nm FD-SOI-ePCM / 40 nm eFlash)



- **Mobileye EyeQ Ultra**
  - ADAS high-end processor

- **ST Stellar MPU**
  - Processor
  - 7 nm flash-less MPU
  - Up to 2 MPUs per vehicle

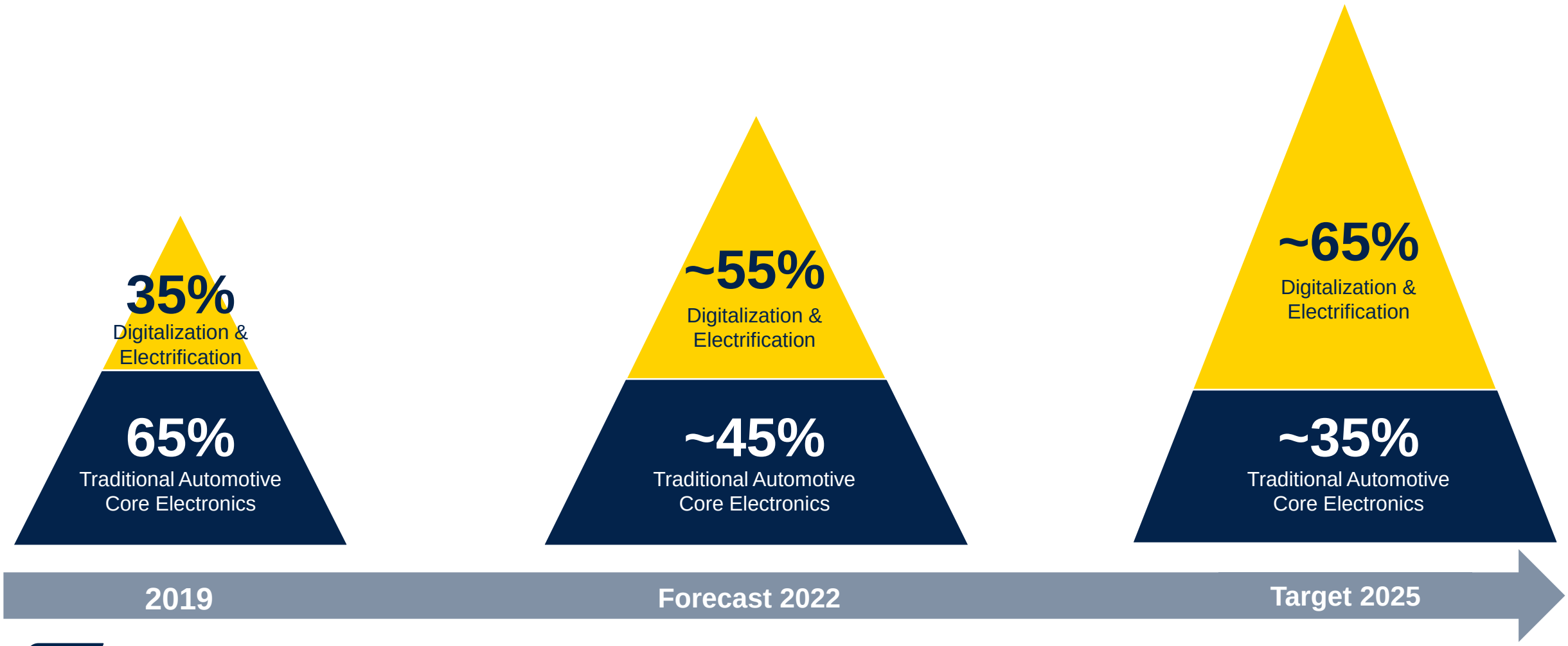
- **ST Stellar MCU**
  - High performance microcontroller
  - Stellar family 28 nm with eNVM
  - Up to 15 MCUs per vehicle

- **ST SCP58 MCU**
  - Microcontroller for actuation
  - Scalable 32-bit family
  - Targeting broad-range ECUs

- **ST Stellar-E MCU**
  - Microcontroller for **Electrification**
  - Family tailored for the specific requirements of e-mobility

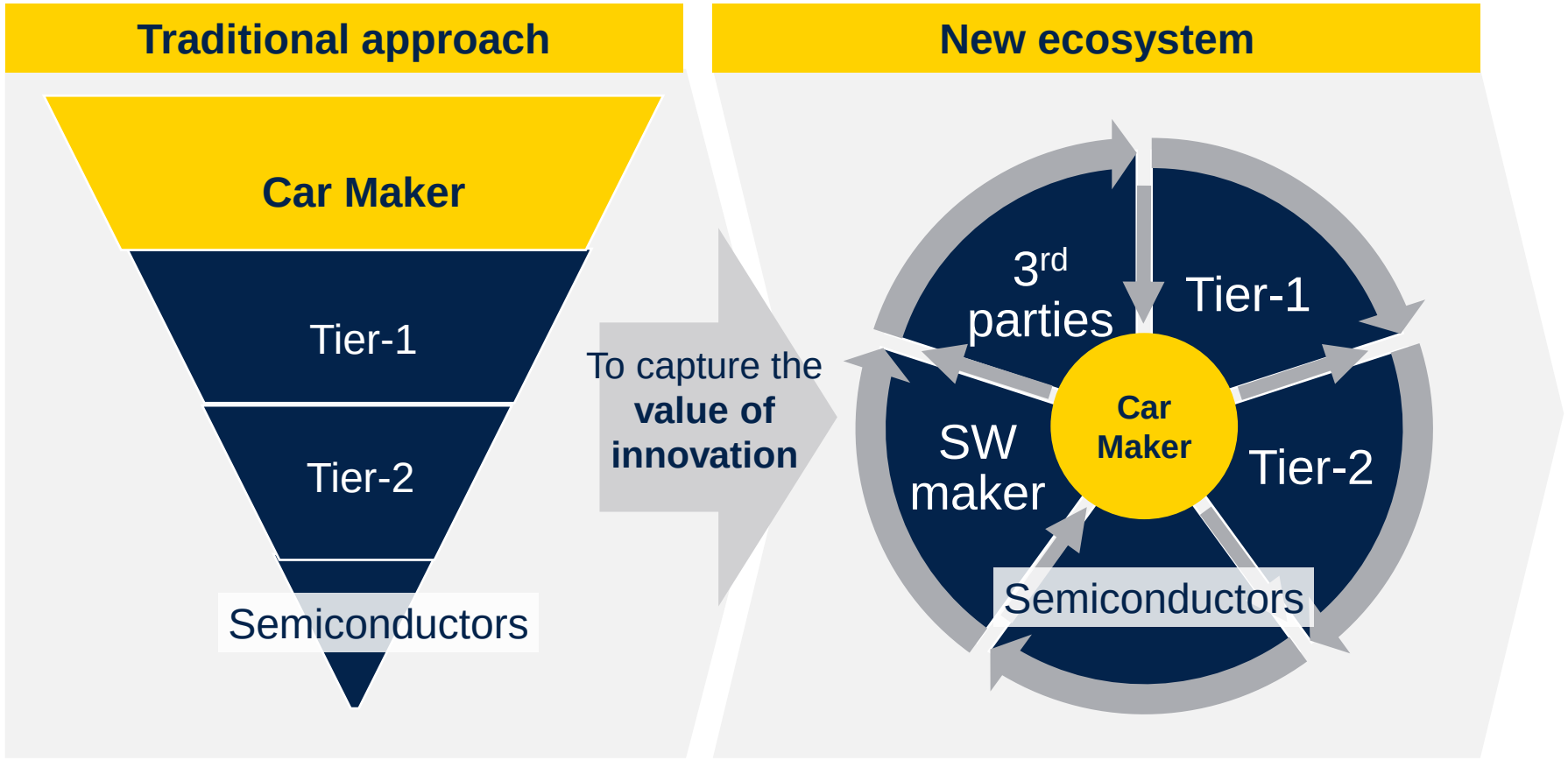
life.augmented

ST is accelerating the transition to serve new mobility trends, consistent with our strategy



life.augmented

Car makers becoming more centric in the semiconductor strategy



From car makers to mobility provider

Vehicle content and car differentiation strongly depend on semiconductors

ST's is committed to play a major role in this new business model with multiple cooperations

life.augmented

Maximizing ST content in industrial applications

Typical industrial application

- AC-DC
- DC-DC
- Control Unit STM32
- Gate Driver
- MOSFET/ IGBT
- Signal conditioning
- Sensors
- Connectivity

+

- Low voltage MOSFET
- Power GaN
- High voltage MOSFET
- TVS, ESD & Protections
- IGBT
- ASIP Integrated Passive
- SiC MOSFET, Diode, Rectifier
- RF IPD

Driving ST Growth

		STM32	ADG
 Charging stations		$6	$187
 Factory automation		$8.8	$19.6
 Photovoltaics		$17.1	$33.5
 HVAC 2 kW		$2.4	$10

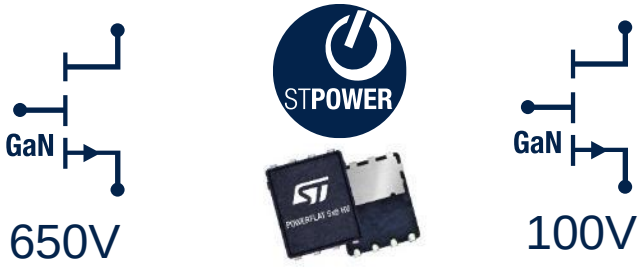
Actual implementation based on selected customer products

life.augmented

ST is developing a comprehensive GaN portfolio serving multiple markets

ST Power GaN

Broad portfolio of discrete solutions leveraging flexible internal & external manufacturing

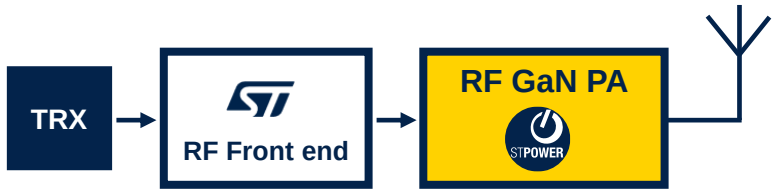


Application coverage: Power conversion systems for superior energy efficiency

Main Markets: Consumer first, while targeting high-value industrial (Solar Inverter, Charging pile…) and automotive (OBC, DC/DC…)

ST RF-GaN

GaN-on-Silicon solution with competitive performance, cost & manufacturing scale vs GaN-on-SiC

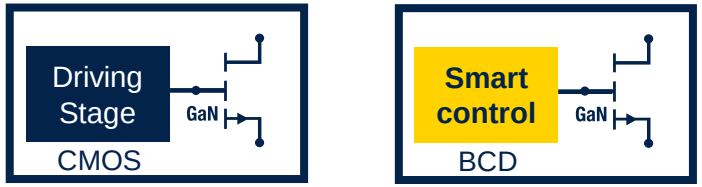


Application coverage: 5G Power amplifiers

Main Markets: Telecom 5G Infrastructure and satellites (aerospace)

Smart Integrated GaN

Advanced solutions integrating power stage and BCD driver & advanced control system (CMOS)



GaN in CMOS **GaN in BCD**

Application coverage: DC-DC, LiDAR, class-D amplifiers

Main Markets: Automotive and industrial

life.augmented

Supporting ST $20B+ revenue ambition

Automotive silicon content is strongly increasing driven by multiple positive trends:

- Increased content of traditional applications
- Disruptive evolution to digitalization and electrification
- New and advanced features in modern vehicles

ST made early investments in innovation and manufacturing capabilities to serve the needs of the automotive industry
Complete and innovative product offer
Wide application coverage
Extended network of partners

ADG innovation in power technologies and products is core to ST's strategy in industrial

life.augmented

Our technology starts with You

Find out more at www.st.com

life.augmented