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Automotive and Discrete Group

Marco Monti

President
Automotive and Discrete Group (ADG)

ADG addresses four end markets

Automotive

2019
~70%
of ADG revenues

2020 YTD Q3
~68%
of ADG revenues

Industrial

2019
~25%
of ADG revenues

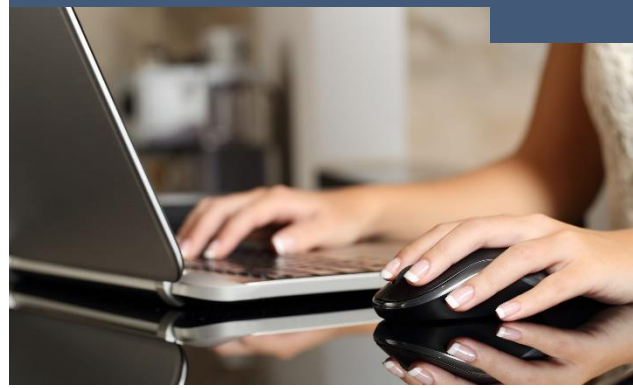
2020 YTD Q3
~28%
of ADG revenues

Personal electronics

2019
~5%
of ADG revenues

2020 YTD Q3
~4%
of ADG revenues

Communications equipment, computers & peripherals



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Automotive and Discrete Group
Key financial figures

38%
ADG contribution
to ST 2019 revenues

2019 revenues

$ 3.61B
2019 Net revenues

ADG
+1.5%
2019 vs. 2018

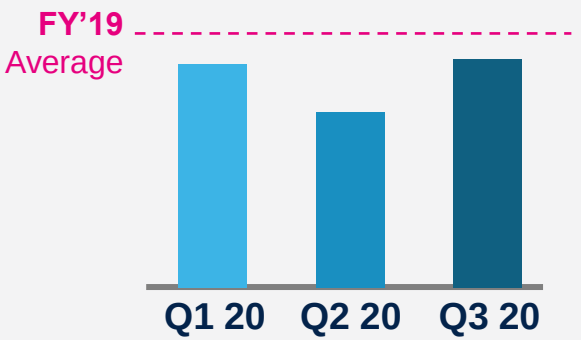
ADG
+8.6%
CAGR FY'17-'19

2020 YTD Q3

$ 2.33B
Net revenues

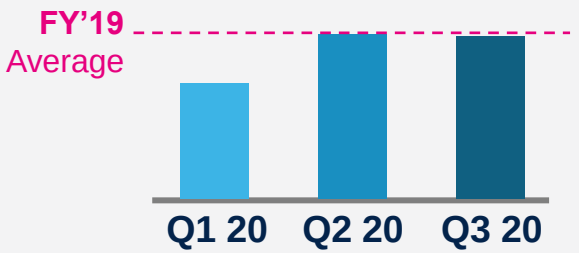
Automotive Product Sub-Group

$1.52B



Power Discrete Sub-Group

$0.81B



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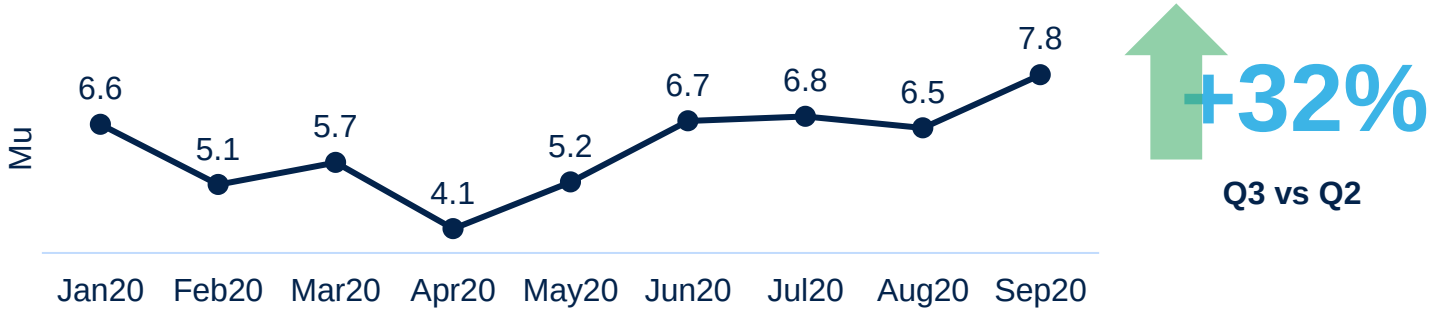
Q3 Automotive market pick up

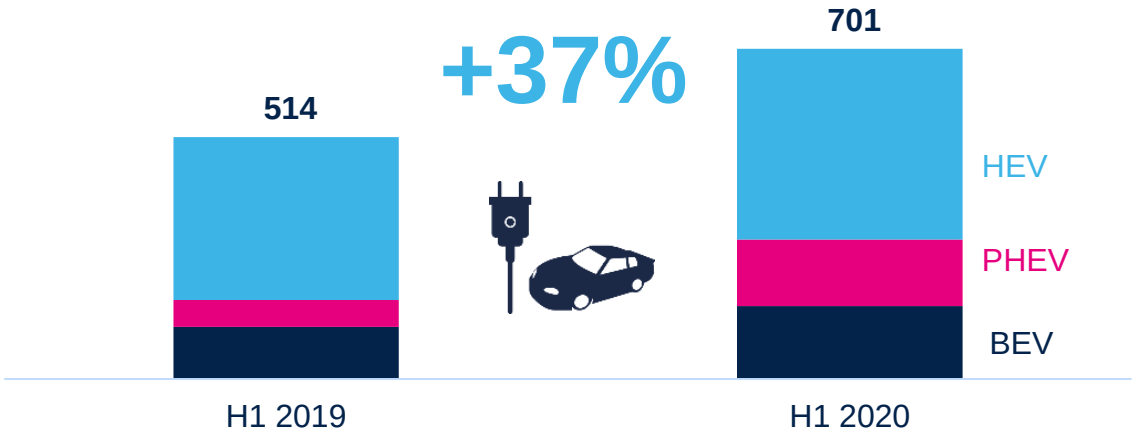
2020 monthly light vehicle sales



+32%

Q3 vs Q2

European xEV vehicles outperforming market growth



Automotive Product Sub-Group

'20 Q3 vs '20 Q2 growth rate

+35%

32-bit Auto-grade MCU

+14%

ADAS vision based

+40%

Smart Power

Source: LMCA 2020 LV Projection Oct. 13th 2020: ACEA European Automobile Manufacturers Association, Fuel type Q2 2020

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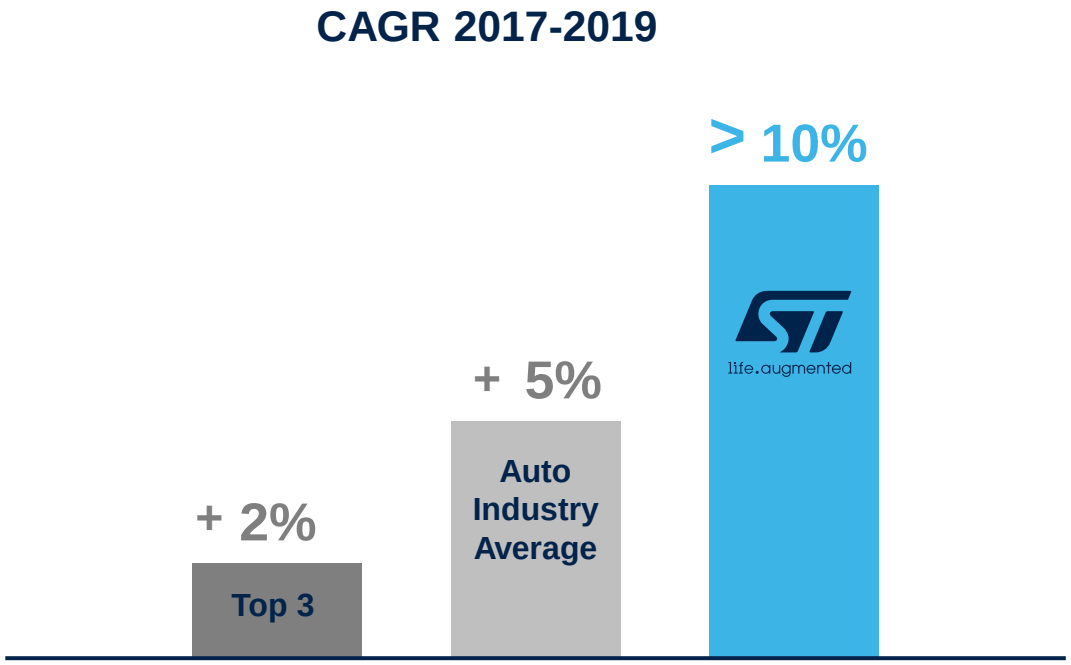
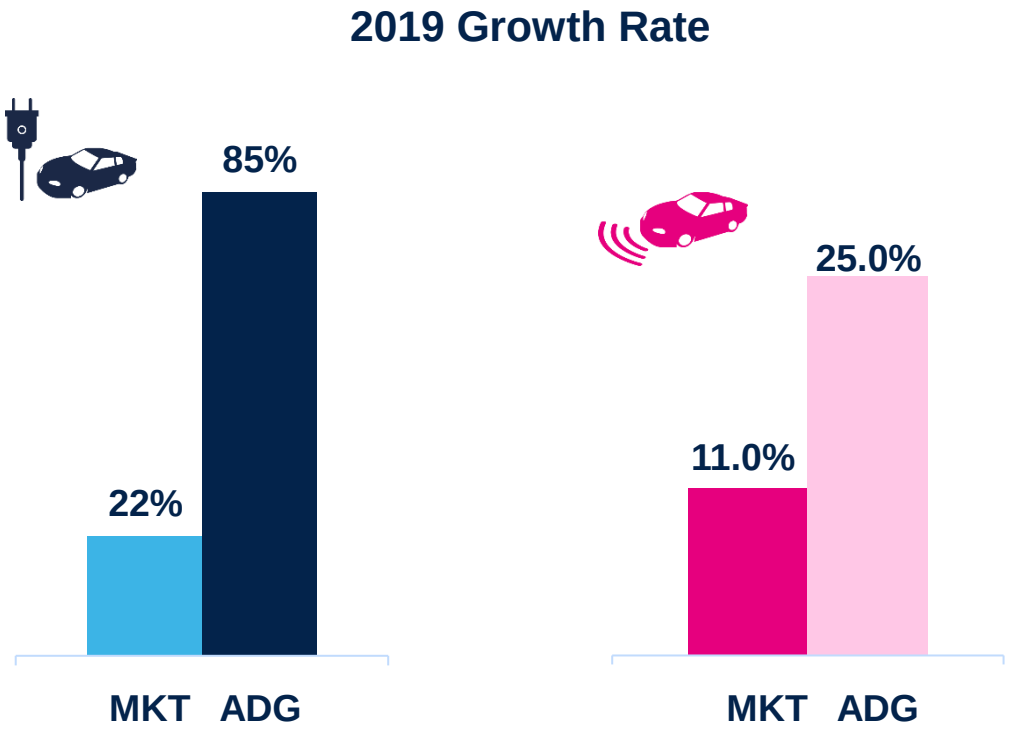
ST outperforming the market

ST is the only top 5 player growing stably in the past 2 years



ST outperformed the 2019 market in electrification & ADAS



Source: IHS - Automotive semiconductor market tracker - June-2020; OMDIA, Annual 2001 to 2019 Semiconductor Market Share, Aug 2020

Market evolution since the last CMD

What has stayed the same

Smart Mobility trends

- Strong electrification trend in automotive and industrial markets
- Car connectivity, active safety and domain control drive the digitalization of the vehicles

Increasing semiconductor content

- Semiconductor pervasiveness in automotive
- Power semiconductors are a key enabler for automotive and industrial

Car sales under pressure

- Macro economic trends and consumer behavior

What has changed after last CMD

Deteriorated environment

- Pandemic and macro-economy trend deterioration pushed down 2020 car sales by 20% and strongly impacted factory automation
- Trade tensions increasing pressure in the supply chain

Car makers adapting

- Full autonomous driving projects postponed
- Tailwinds in ADAS L2 and L2++ increasing adoption
- Vehicle electrification is now mainstream at all car makers around the globe

ADG perspective and strategy evolution

What has stayed the same

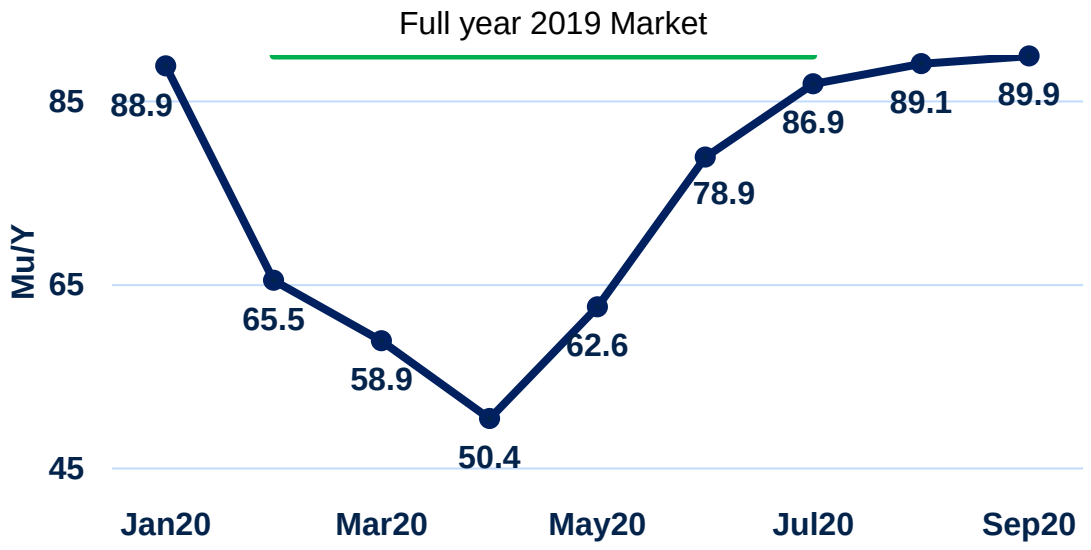
- Company commitment to automotive and industrial
- Investments in technology innovation
- Commitment on power technologies in both traditional silicon and new materials
- Ambitions to lead in car electrification and digitalization
- Success in SiC with fast new program acquisition run-rate
- All key R&D programs on track, in spite of the pandemic

What has changed after last CMD

- Car sales softening leading to higher pressure on legacy automotive weakening group top-line
- Acceleration of the ongoing actions plan to better serve automotive macro-trends
- Expanded electrification programs based on SiC, IGBT, Microcontrollers, and Smart power solutions
- Accelerated partnerships in Asia for electrification including emerging players who are now leading
- Better ADAS volumes with pervasion of L2/L2++ more than compensating volume reduction
- Increased effort on GaN with acquisition to improve time-to-volume - complementing internal programs

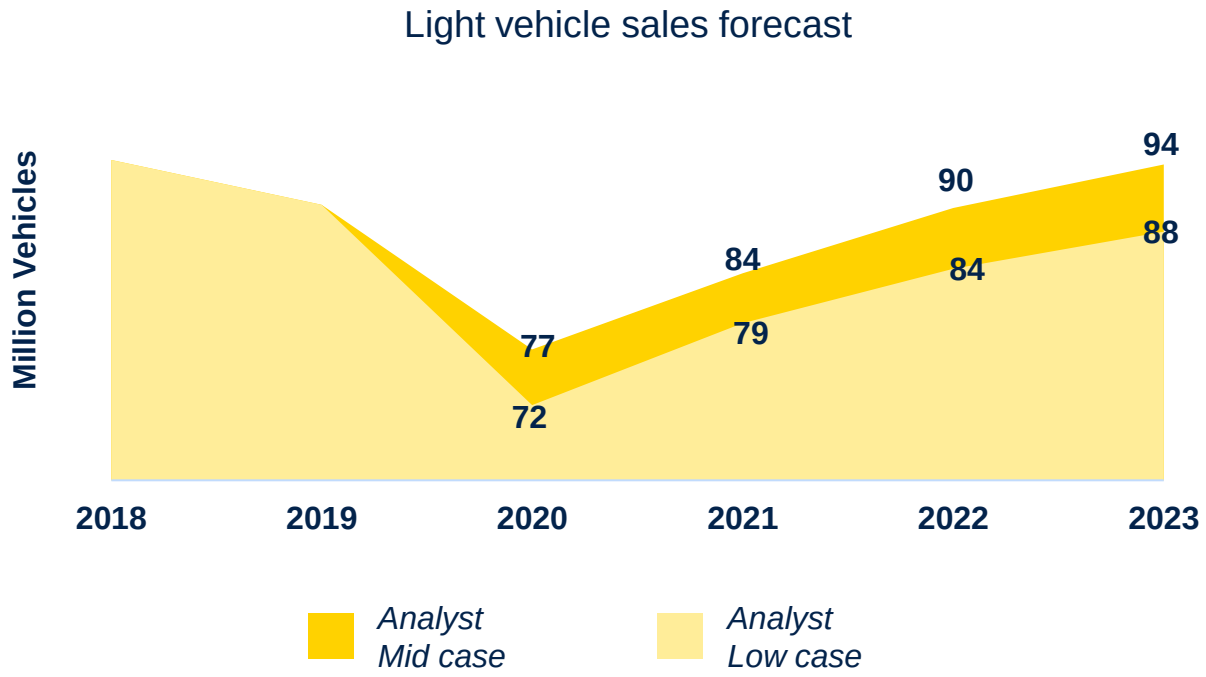
Automotive market recovering

Short term global vehicle sales shows **V-shape** rebound



Source: LMC

Mid-term recovering better than expected



Source: LMC, IHS Automotive, ST Internal

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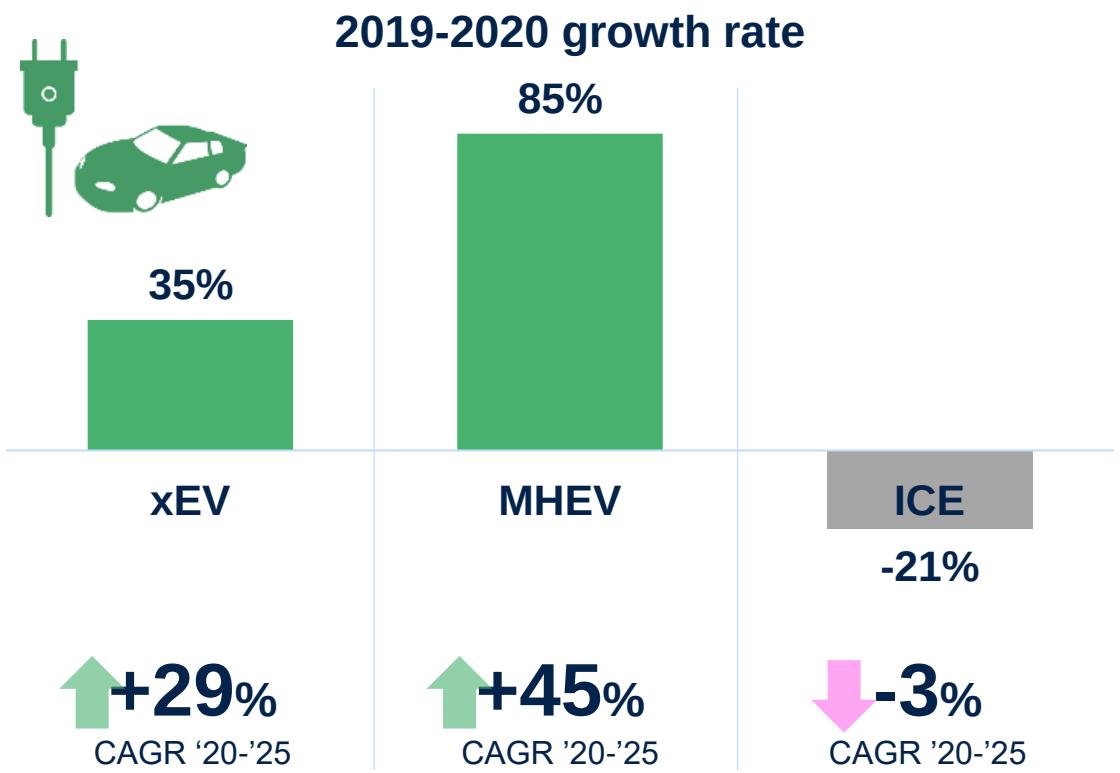
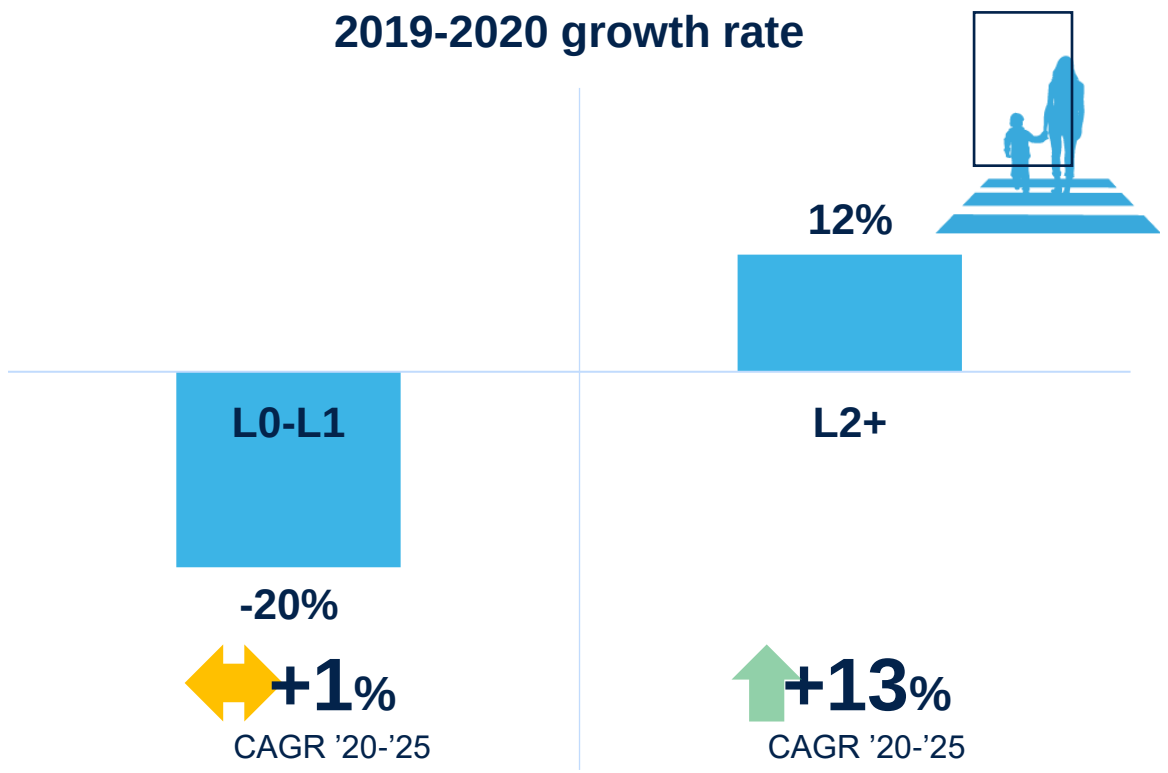
Electric and assisted vehicle volume are growing despite light-vehicle market headwind

Light vehicle production



Source: IHS - Car production by propulsion system and Region - Sep.23.2020. ST internal

ADAS autonomous level pervasiveness



Source: IHS - Vehicle Production by Autonomy Level May 2020 forecast; ST internal

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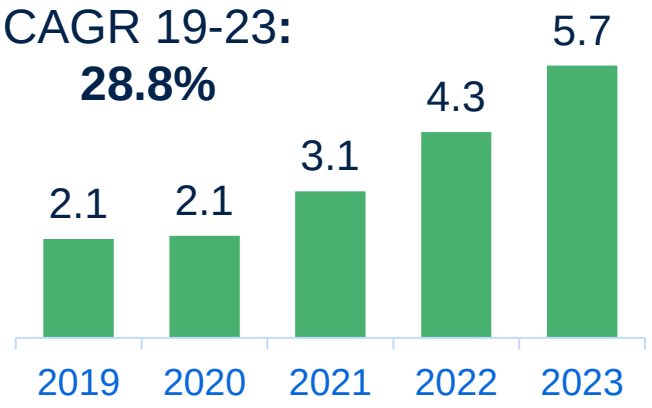
Automotive megatrends driving silicon pervasion

Automotive transformation boosting silicon value in the Car

2019 **$36.6B** → Auto Semi TAM **+5.4% CAGR** → 2023 **$45.1B**

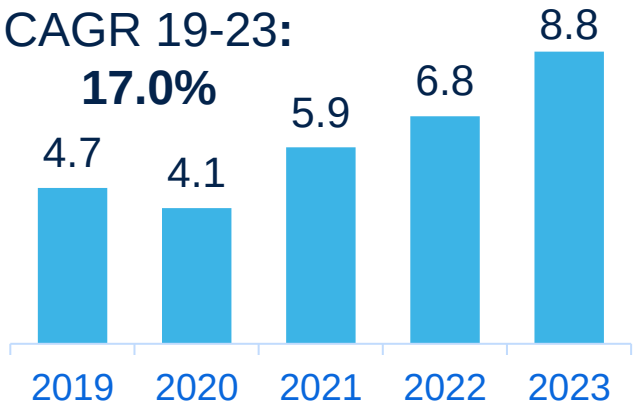
Electrification TAM [B$]

CAGR 19-23: **28.8%**



ADAS TAM [B$]

CAGR 19-23: **17.0%**



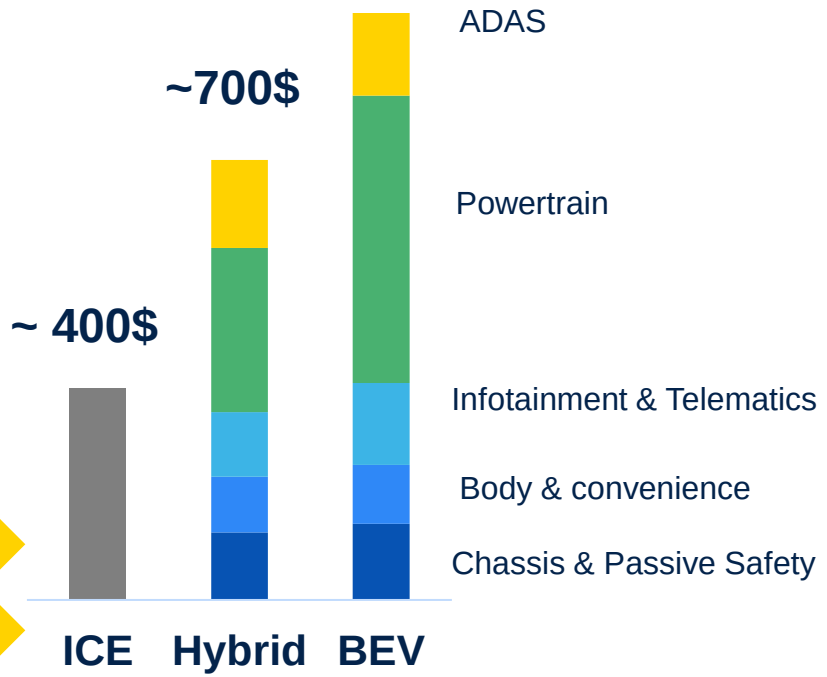
Increase Semi content by level of **ADAS**

Increase Semiconductor content by level of **Electrification**

Light vehicle semiconductor content

Average semiconductor content per car [$]

>1000$



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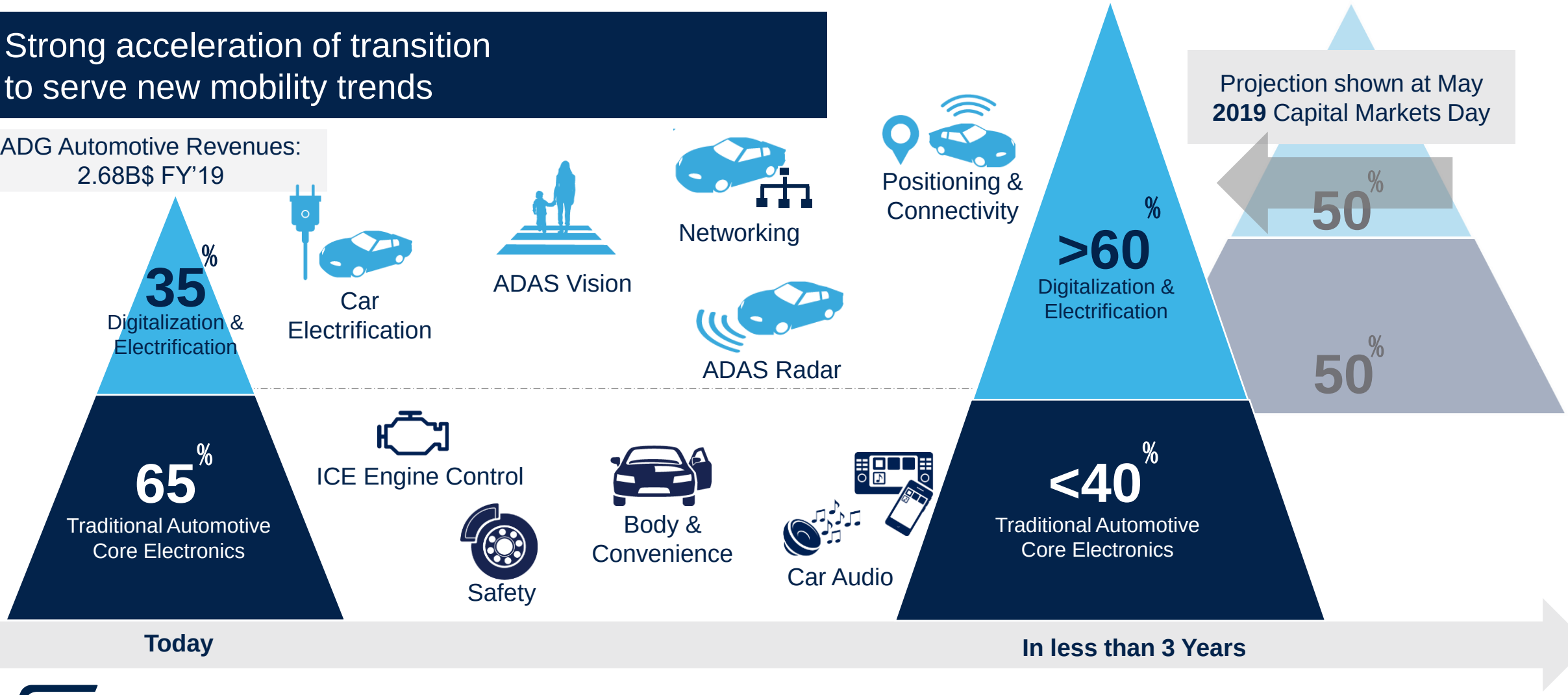
Source: IHS - Automotive semiconductor market tracker - June-2020; ST internal

ADG automotive business evolution

Strong acceleration of transition to serve new mobility trends

ADG Automotive Revenues: 2.68B$ FY'19



Key actions taken by ADG to accelerate the focus on new Automotive trends

1 Boost innovation in traditional automotive Smart Power

Transform **current portfolio** focusing on:

- LED/OLED Drivers
- EV - Battery management system
- EV - Gate driver
- Transmission & Steering
- ADAS power management
- Power Distribution 12-48V

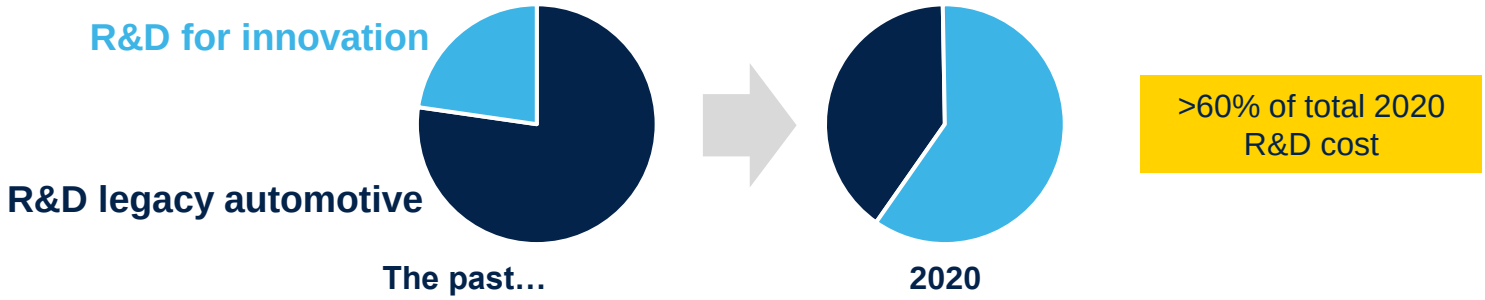
2 Expand portfolio leveraging ST cutting-edge technologies

- Product proliferation on **SiC**
- Time to volume acceleration on **GaN**
- Dedicated MCU for **RF-based ADAS**
- **Stellar** roadmap expansion
- **IGBT Trench** for mid-level inverters
- **48V** hybrid solutions
- Full system solution for **smart charging**

3 Focus on new macro trends, differentiating customer base

- Redeploy smart power ASIC resources to **SiC, GaN and Low Voltage** for EVs and battery tools
- Leverage BCD competence and resources to speed up **GaN development & deployment**
- Boost **Asia support** with dedicated R&D team
- Dedicated development support team for **new applications** leveraging competence centers

Move product R&D expenses progressively to new automotive trends



>60% of total 2020 R&D cost

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Innovation in the traditional domain: Smart Power (BCD)

Smart Power leadership In car electrification

Battery management system

L9963 Family

Scalable solutions from 48V up to 800V
Best in class cells voltage accuracy

In production

Power distribution

L9678 & L9679

Battery cut-off & fire-off disconnecting power line in case of emergency or crashes

In production

Traction inverter & on-board charger

L950x Family

SiC & IGBT Isolated pre-driver up to 6kV for traction inverter, DC-DC & OBC

In qualification

ADAS and autonomous driving power management

Radar-based systems

L5965S and STPM066S family

Power management for radar system

Full production 2020

Camera-based system

STPM80x family

Integrated & distributed power management solution for L2+ ADAS systems

Production H1’22

Autonomous driving L3/4

STPM020

High current power management for powerful processors ASIL-D

In development

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Digitalization and shared mobility boost silicon content

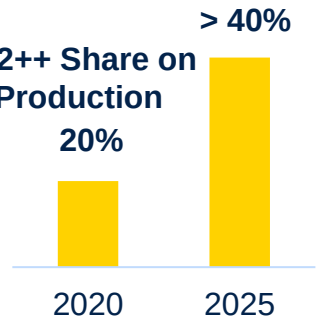
ADAS L2 & L2++ acceleration trend supporting pervasion

NCAP Regulation (L2) boosting Si content for assisted driving system, increasing safety

+160 $

Increased Si/$ x Car

L2 & L2++ Share on Car Production



ADAS L4/L5 to support Robo-Taxi & Shared Autonomous Mobility increasing silicon value per car

High-value electronics for Autonomous Vehicles enable mobility-as-Service

Average silicon content per car

>5 K$

L4/5

SW reconfigurable vehicle: new car architecture

Remote, seamless SW update needs new Vehicle Architecture

x10 Computational Power x Car

+30 %

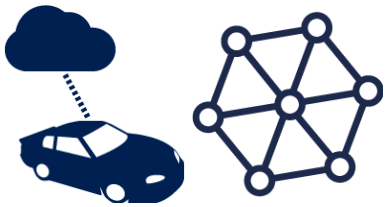
Digital Silicon Value

Cloud connectivity for Big-Data harvesting

Global Big Data from vehicles opens Service Company opportunities

+200 $

Vision & Telematics processors



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Source: data based on ST internal estimation

ST car digitalization portfolio matches market trends

ADAS L2 & L2++ acceleration trend supporting pervasion

STRADA431

Radar MMIC

EyeQ4, EyeQ5L, EyeQ6L
for L2++

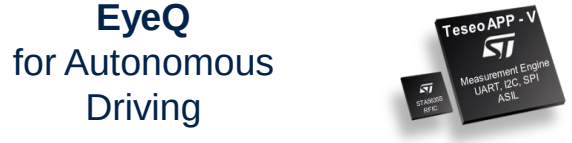
V2x Kit with **Autotalks**

32-bit MCU for Radar

>54Munits
of Intel Mobileye **EYQx** delivered on the market

ADAS L4/L5
to support Robo-Taxi & Shared Autonomous Mobility increasing silicon value per car

EyeQ
for Autonomous Driving



TeseoV
Precise Positioning

32-bit MCU automotive
Tailored for ADAS

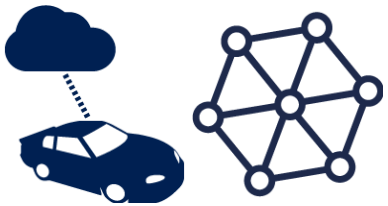
SW reconfigurable vehicle: new car architecture

32-bit 28 nm FD-SOI
MCUs enabling Software isolation &
Over-the-air SW updates

Cloud connectivity for Big-Data harvesting

Telemaco3P
cloud connectivity & telematics

TELEMACO



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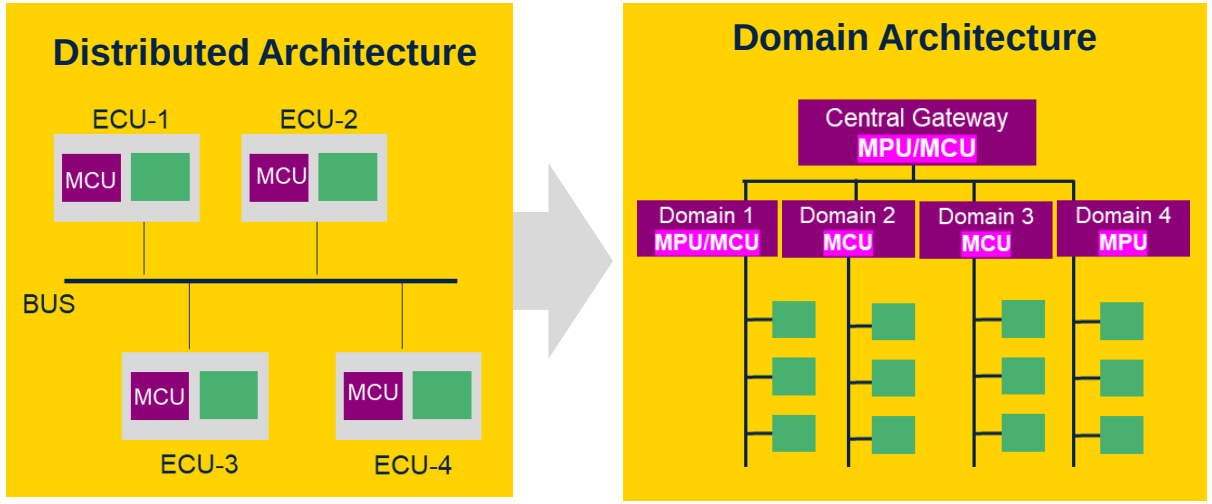
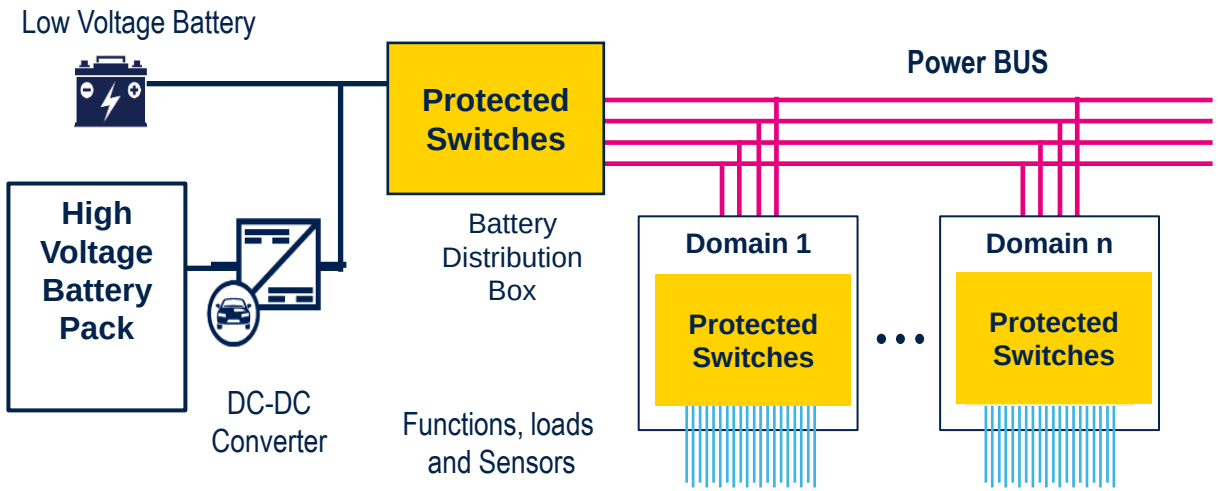
Architecture migration increases MCU and smart power silicon content per vehicle

Domain architecture increasing MCU TAM by > 1B$



- Need for MCU with high computational power and specialized embedded memory for real-time operation & over-the-air SW update
- Increased ASP to thanks to extended functionality
- 30% MCU TAM increase thanks to new architecture

In-vehicle power distribution creates additional TAM >1B$



- Protected switches require optimized power stage to manage mid/high current load
- High logic computation requirement to manage overload and hazard conditions during abnormal operation

ST estimations based on new vehicle generations from 2025 onwards

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ST offer for architecture migration to domain/zone controller

Stellar 32-bit ARM Multicore Real-Time MCU
Verified and Selected by **Bosch for** next Gen Systems

- Simplify the execution of multiple software programs in hardware isolated “virtual” CPUs with peripherals firewalls
- Phase change memory enables cost effective OTA software updates with no interruption of software execution *but* without doubling the memory size

ST Smart power for new architecture power distribution

- New VIPower technology (M0-A11) the best choice for in-vehicle power grid
- Partnership with key market players to capture an important share of the 1B$ additional TAM

Stellar

28 nm FD-SOI Technology

Phase Change Memory

VIPower Fuse

180 nm VIPower Technology

Reference partner

BOSCH

Leading Partner

Leading European Car maker

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ADG system offer for electrified mobility – beyond SiC

Galvanic Isolated Drivers

- Galvanic isolated families of functional safety pre-drivers up to 6 kV isolation

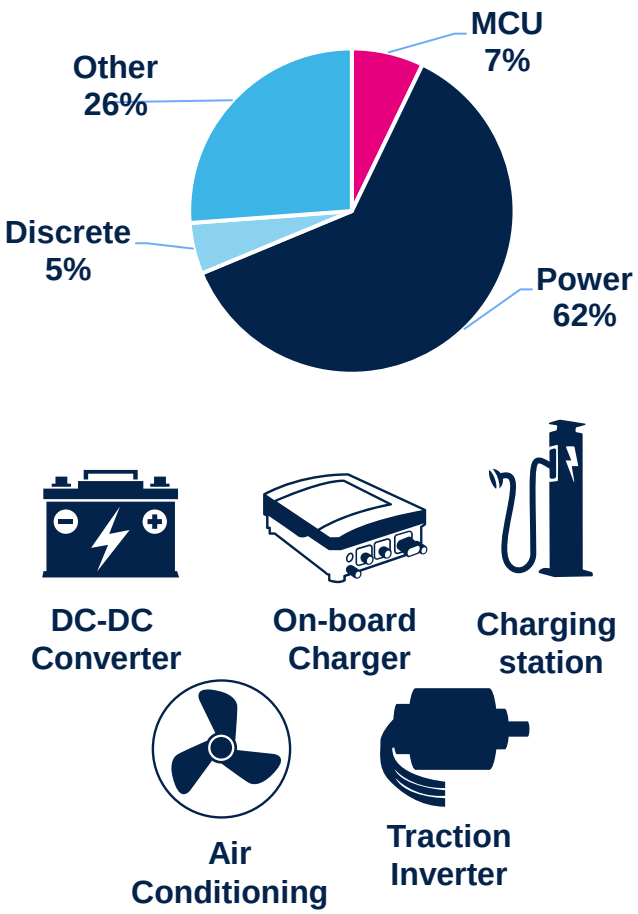
Rectifier, Fast Diodes & AC Switches: TRIAC & SCR

- Extensive offer for multiple customer needs for On-board charger and Charging Pile

32-bit MCU for electrification

- Dedicated for power conversion system - entry-level electrification to Battery EV

Electrification device types % value



Power Module

Standard & Custom solutions for

- Molded / Ceramic Modules
- Air flow / Liquid cooling

Partnership for SiC MOSFET/ IGBT for Semikron power modules for electric vehicle traction inverter & high-end industrial

SEMIKRON innovation+service

Low Voltage MOSFET

- Family covering 30 V ~ 150 V applications
- Specific target to 48 V hybrid mobility

IGBT & HV MOSFET

- Complementing SiC offer
- Broad range IGBT solution (600 V – 1700 V)

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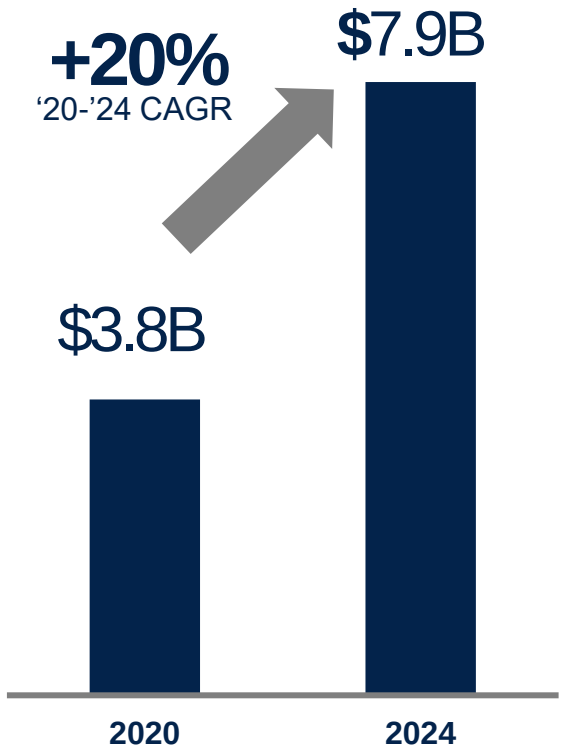
Power semiconductors are vital for automotive and industrial applications

Increasing power semiconductor contents in **automotive** applications



4.6B$

2024 xEV Power TAM

+26%

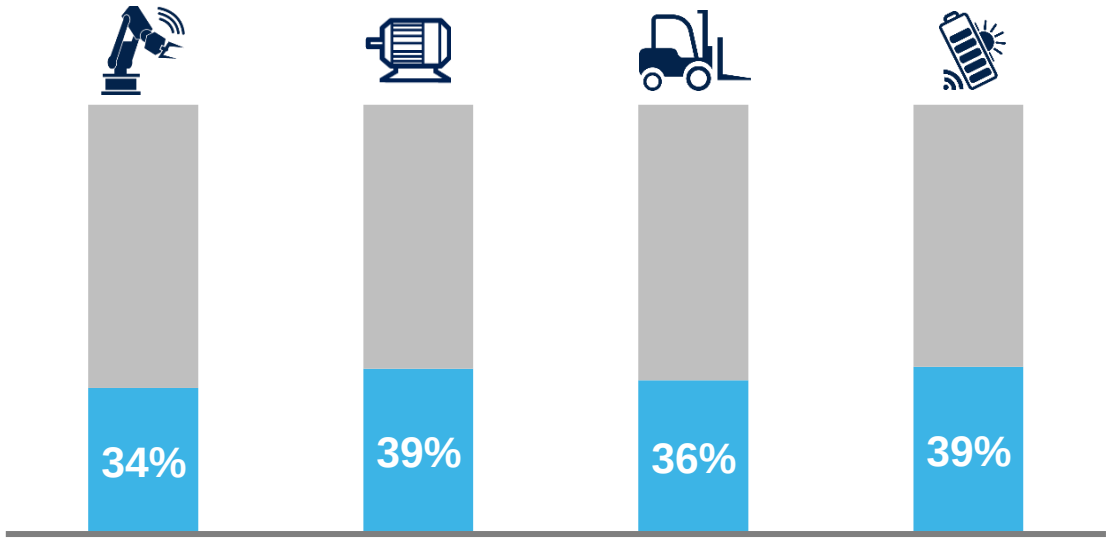
'20-'24 IGBT CAGR

+47%

'20-'24 SiC CAGR

Source: IHS Automotive– June 2020; ST Internal

Power semiconductor pervasiveness in key **industrial** applications



	Average	Motor Drive	Transport	Energy
2020 Semi Power TAM	3.8	1.2	0.5	1.5
'20-'24 CAGR	7.6%	5.0%	5.4%	10.8%

Source: Industrial Semiconductor Market Tracker – June 2020

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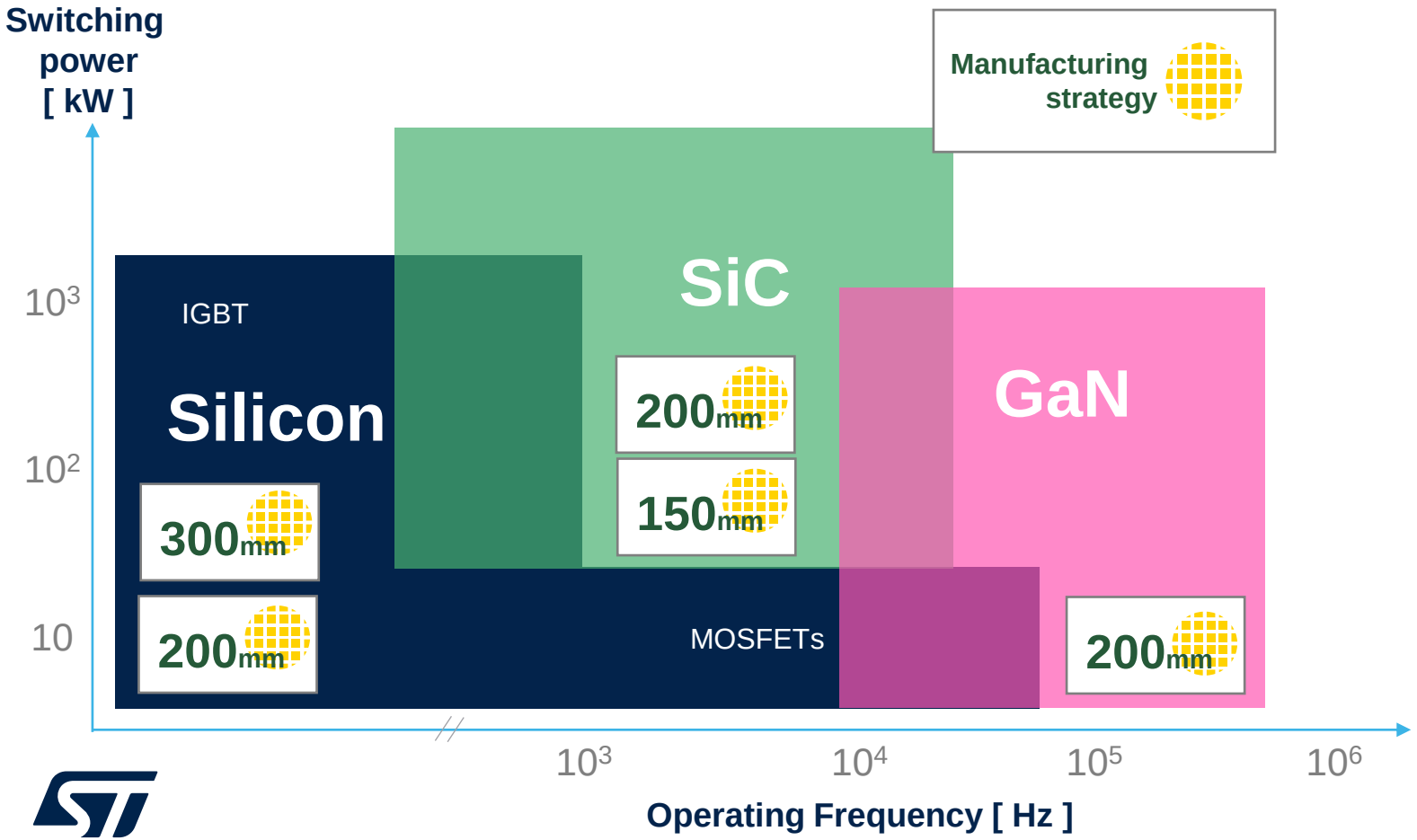
Silicon & Wide-Bandgap material

Broad offer to cover power applications in automotive & industrial



Examples of power application coverage

- Traction inverter, DC-DC converters, motor control
- On-Board Charger, Lidar, 48V Hybrid
- Braking, conventional power train, mid power motor control

- Motor drives and energy conversion Energy storage
- Power supply, DC-DC / AC-DC converters, portable solutions
- Power tools, home appliances, battery operated tools

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Continue to strengthen our SiC market leadership

Leading global supplier for Silicon Carbide
>50% market share

for SiC MOSFETs in automotive and industrial markets

Partnering with leading global players with solutions already in production

<u>Award rate acceleration</u>

More than **68 projects** in development:

~50% Industrial & ~50% in Automotive

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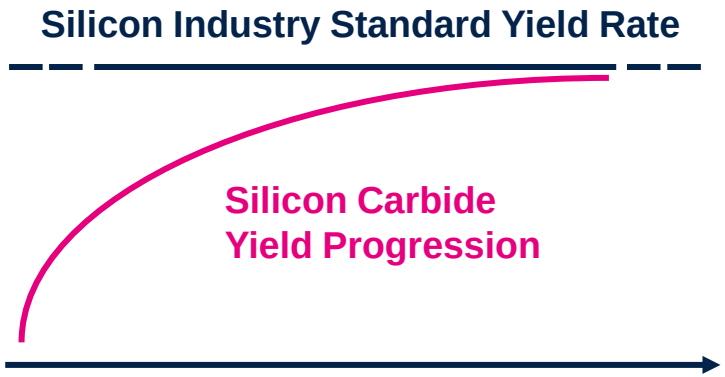
Source: OMDIA power-semiconductor-market-share-database-2020-v3– Sept. 2020; ST Internal

Silicon Carbide leadership differentiators

ST key differentiators in SiC

- Two manufacturing sites
- Silicon architecture with the best-in-the-market channel resistivity thanks to an optimized planar structure and dedicated EPI
- Strong synergy between R&D and Manufacturing
- Evolution planned with a trench structure but with a Super Junction approach

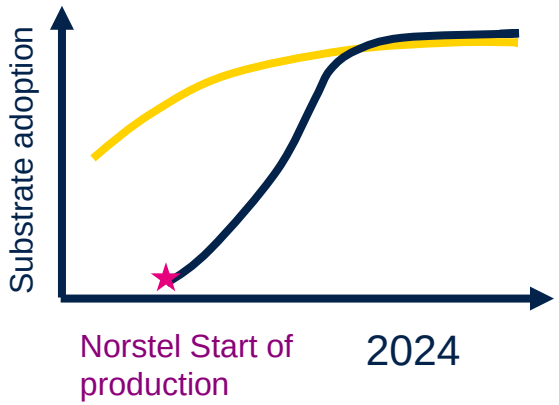
Manufacturing performance in line with silicon standard



20+ Years of R&D commitment

SiC manufacturing strategy for vertical integration

Substrate supply chain strategy: **Norstel 100%** acquisition pursuing vertical integration to support the **1B$** SiC revenue target **by 2025**



- >40% production with internal substrate by 2024
- R&D investments to move to 200mm production

Internal **Substrate** production volume with an **additional manufacturing plant** with **200mm** compatible equipment for supply security and cost optimization

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Accelerating our Gallium Nitride execution strategy

Partnerships and acquisitions to accelerate our GaN roadmap

TSMC partnership

A step forward in product development and epitaxy expertise for our long-term GaN roadmap, ecosystem and business

EXAGAN majority stake acquisition

Leveraging ST's market expertise and TSMC foundry know-how to bring Power GaN & GaN ICs to market

STPOWER

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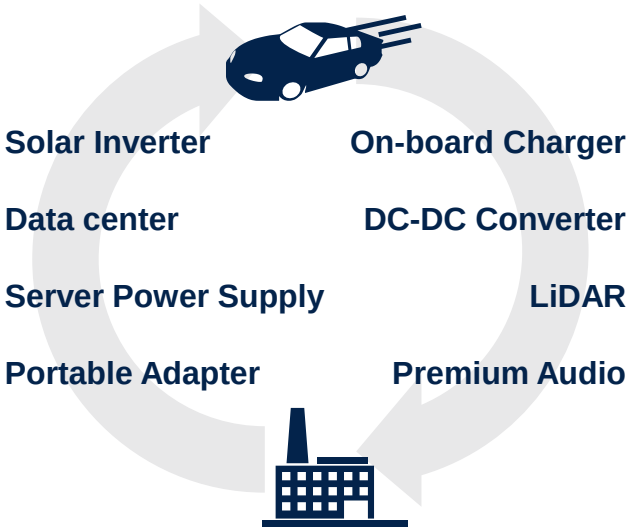
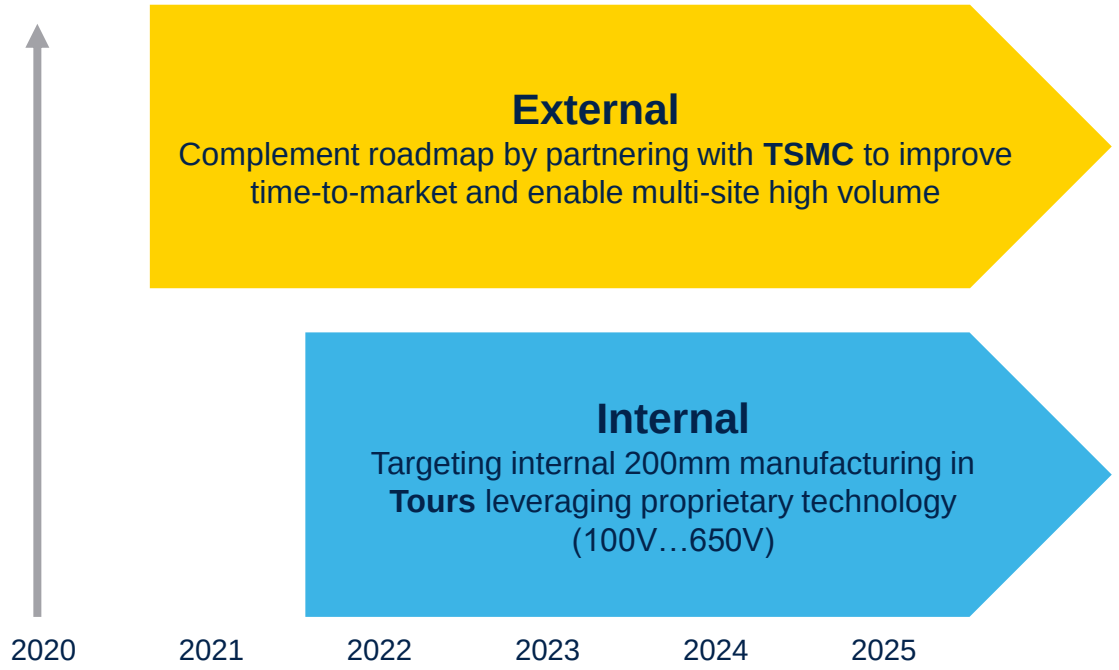
ST GaN: comprehensive strategy to support innovation, time-to-market and high volume

Full application coverage



STPOWER

Optimized manufacturing strategy



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IGBT: Leadership in fast growing industrial and automotive domains

ST Ambition

To become a leader in IGBT for automotive and industrial

ST IGBT

Growth vs. the market
2019-2023

x3

Innovation drives our market share gains thanks to tailored application focus

IH Series	**HB2** Series	**MS** Series	**NMII** Series
Soft switching applications	Power Density solution	Suitable for Motor Drive	Tailored for EV traction
Induction Heating, Welding	Solar, Energy Storage, OBC, Charging Station	Car Air-Con, Inverter for Motor control	EV Traction Inverter

- Product offer based on **10 technology options** with **~600 products**
- Plan to enrich the offer with an additional **6 Series by 2023**

Growth rate comparison based on ST projection (award pipeline) and OMDIA/IHS, power-discrete-module-market-tracker-interim-2019

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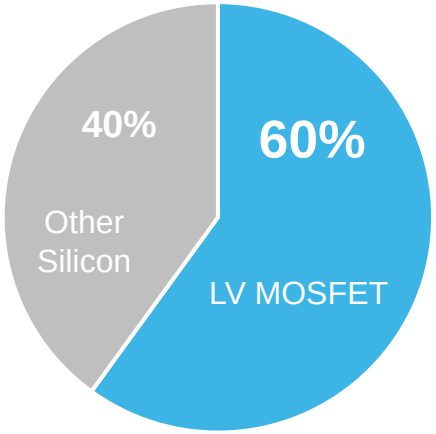
Continue growth in Industrial focusing on newer high-silicon content applications

Battery operated tools as a main driver of growth

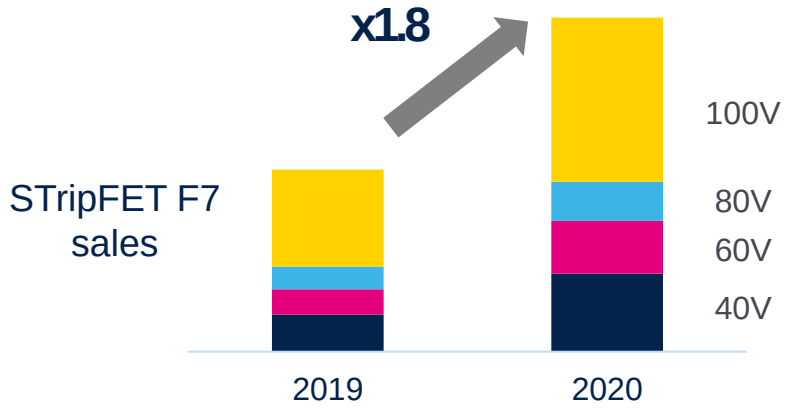
Fast market growth driven by Silicon Low voltage (<150 V) MOSFET

~20%
CAGR FY'19-'23



Served market

Fast growth of ST's latest low voltage MOSFET technology



ST STripFET

Broad product family of Low Voltage MOSFET

Source: IHS Industrial semiconductor Market Tracker Q3 2019, Tool Market estimated by Market data and ST Internal

ADG takeaways

- ADG is growing faster than the market in all application domains it addresses
- ST has anticipated the automotive market transformation and is focused on growing business in smart mobility applications, driven by electrification and digitalization
- Action has been taken to progressively move skills and R&D resources to enlarge our product portfolio and market coverage
  - Benefitting of strong internal know-how
  - Optimizing R&D cost vs market dynamics

Thank you

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