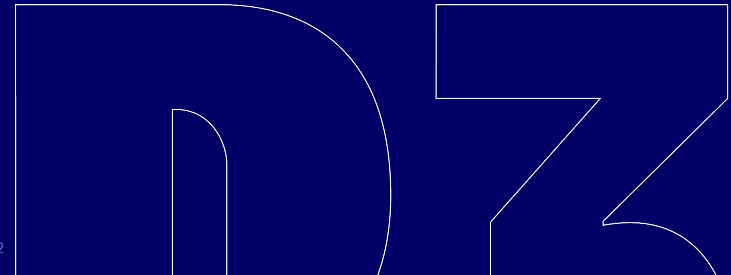


Electronica/Semicon 2022

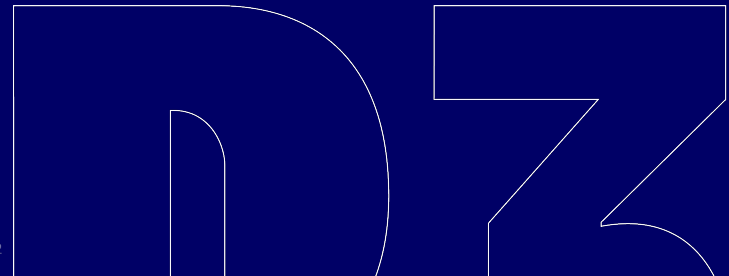
Insights by P3

Electronica, in cooperation with Semicon Europa, is one of the biggest electronic components fairs in the world. From the 15th – 18th of November 2022 hundreds of exhibitors presented cutting edge technology and trend reports at the Messe München. P3 participated in numerous presentations and is keen to share its interpretation of those four information-packed days.



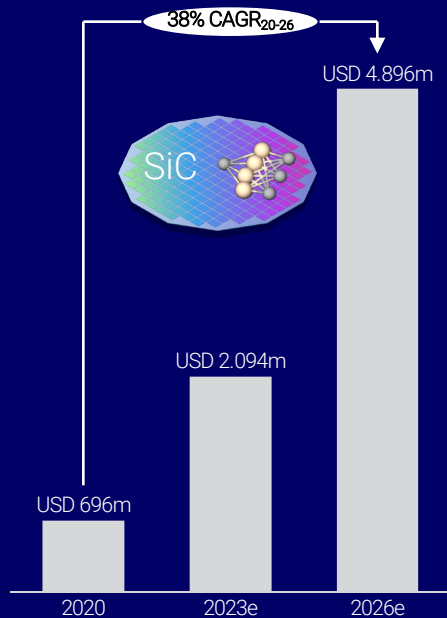
Management summary

1. Large scale market maturity of the semiconductor materials SiC (Silicon Carbide) and GaN (Gallium Nitride) is expected from 2025 onwards
2. The European Chips Act (specifically TRANSFORM) offers the potential to realize local supply chains (e.g. for SiC)
3. The value-chain of semiconductors is shifting with new business-models currently developing (e.g. value networks)
4. New regulations pose new requirements for semiconductors in automotive applications (e.g. 120.000h lifetime)

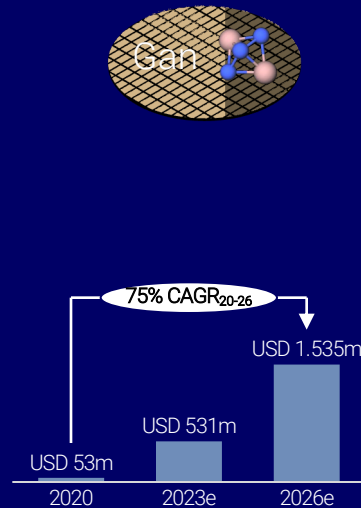


Power electronics: SiC and GaN and their enormous market development

SiC (Silicon Carbide) market development



GaN (Gallium Nitride) market development



P3 interpretation

- Change in semiconductor material:
 - Current power electronics market is 95% Si (Silicium) based, but in the next decade SiC and GaN will take over market shares.
 - The initial shift will take place from Si to SiC by 2025 for power electronics, followed by a shift to GaN after 2026.
 - Main affected components: Inverter, on board charger, DC-DC converter will eventually shift to GaN in the next decade.
- Advantages SiC
 - Smaller size and reduced cooling requirements
 - Improved range by 3-8% due to higher efficiency
 - Ideal for higher voltage architectures
- Advantages GaN
 - Faster switching frequency hence reduces losses
 - Higher power density compared to Si and SiC

Based on company presentations of Infineon @Electronica 2022

Supply-Chain nearshoring for Europe with the support of the European Chips Act (ECA)

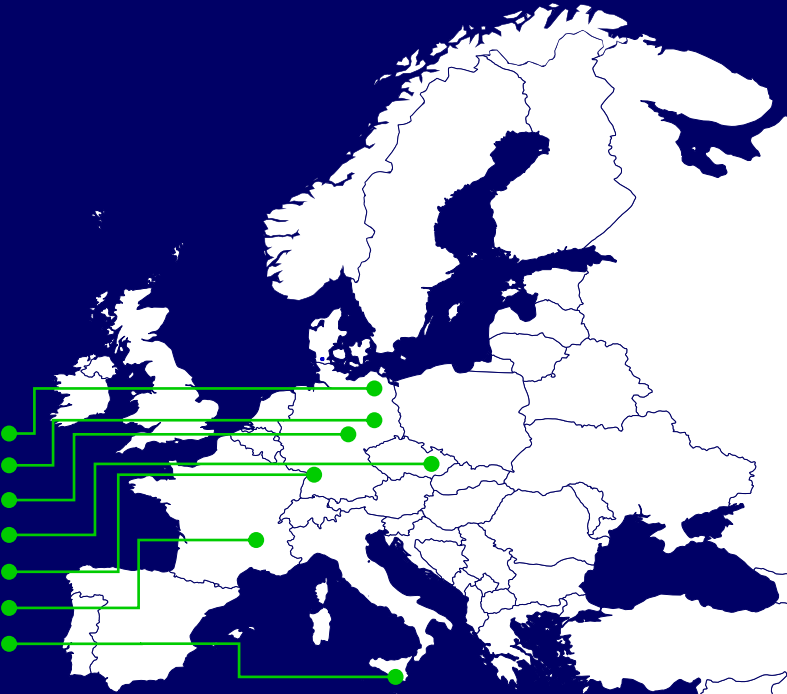
P3 interpretation

- The European Chips Act (ECA) has a volume of EUR 42bn with the goal to assure 20% nearshore chips in 2030
- Major projects (e.g. Intel in Magdeburg) will focus on consumer electronics (cutting edge node sizes 3-5nm)
- To localize supply chains in Europe TRANSFORM specifically focuses on power electronics in the combination with SiC.

Capacities to be installed in Europe

<u>Company</u>	<u>Application</u>	<u>Country</u>	<u>City</u>	<u>SOP</u>
Wolfspeed	SiC for automotive	Germany	n.a.	n.a.
Intel	Consumer Electronics	Germany	Magdeburg	2027
Infineon	Automotive	Germany	Dresden	2026
On-Semi	SiC for automotive	Czech Republic	Roznov	2022
Bosch	SiC for automotive	Germany	Reutlingen	2023
Soitec	SiC for automotive	France	Bernim	2023
ST-Micro	SiC for automotive	Italy	Catania	2023

Based on company presentations of TECHCET & sic-transform @Electronica 2022 + P3 analysis

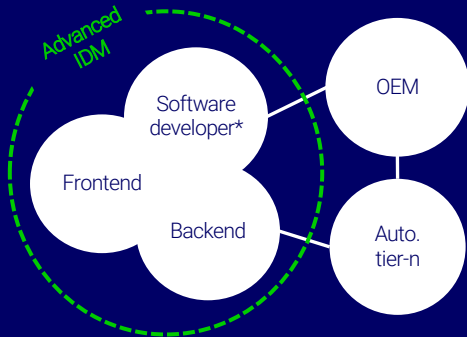


The evolution of the automotive semiconductor value chain towards a value network

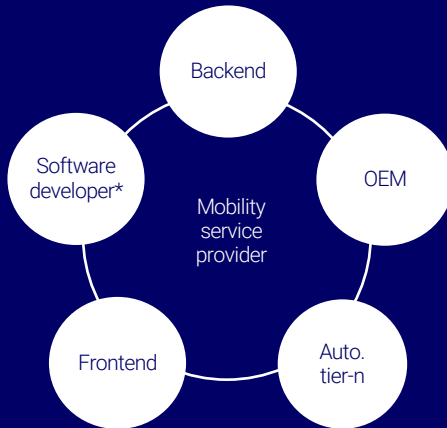
Traditional value chain



Future scenario 1



Future scenario 2



*New addition of the value chain

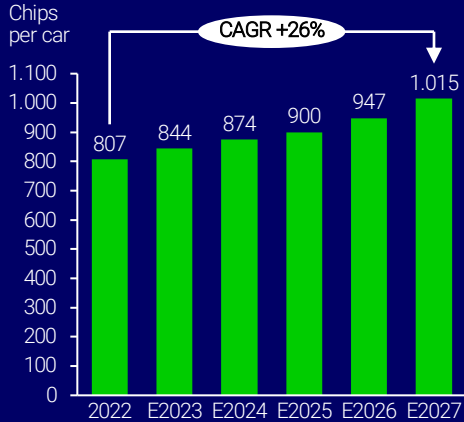
P3 interpretation of various presentations

- Traditional semiconductor value chain is being transformed into a value network
- Software developers are a new member of the value creation process
- Potential future business models are currently being discussed as an evolution of the traditional automotive value chain
 - E.g. advanced IDM incorporates frontend, backend and software in one value step

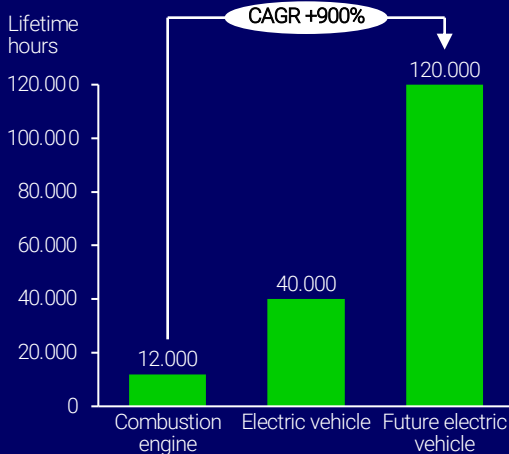
Based on company presentations of Bosch, JCET & ST Micro @Electronica 2022

New requirements for semiconductors within future automotive applications

Average number of chips per car



Upcoming requirements for semiconductors



Combustion engine spec: AEC-Q101

Electric vehicle spec: AEC-Q101 & AQG 324

P3 interpretation

- Complexity 1:
 - Increase in overall chip content in the vehicle
 - Higher need for chip sourcing and interdependencies between semiconductors

- Complexity 2:
 - Change from combustion engine spec: AEC-Q101 towards electric vehicle spec: AEC-Q101 & AQG 324
 - Semiconductors need to withstand more usage in order to outlast the lifetime of the vehicle
 - Increase in lifetime requirements for semiconductors

- Dual complexity requires active supply chain management and implies further technical challenges

P3's services in semiconductor supply chain management

Strategy

Purchasing strategy

- Semiconductor database
- Contract management
- Inventory management
- Risk-monitor
- Market trend analysis
- Real dual-source (e.g. dual-fab)
- Organizational benchmark
- Vertical integration – definition of supply chain processes

Development strategy

- Design guidelines
- Modular semiconductor portfolio
- Redesign governance process
- Technology trend analysis

Partnership strategy

- Create win-wins within the supply chain (e.g. OEM & Semiconductor manufacturer)
- Mediation & negotiation playbook

Operations

Task force management

- Short-term supplier tracking
- Plant allocation management
- On-site process optimization
- Escalation governance to semiconductor manufacturers

Supplier management

- Supplier risk monitoring
- Escalation management

Redesign project management

- Best practice decision metric (incl. monetary evaluation)
- Standardized project management tools

Technology

Cost breakdown

- PCBA-level (printed-circuit-board)
- Component level

Technology benchmark

- Semiconductor-level
- Component level (e.g. inverter)

Manufacturing concepts

- Machinery selection
- Supplier selection

Contacts



Markus Hackmann

Managing Director P3

Markus.Hackmann@p3-group.com



Nicolai Dill

Principal P3

Nicolai.Dill@p3-group.com



Mauritz Schwartz

Principal Operations & Supply Chain

Mauritz.Schwartz@p3-group.com

DISCLAIMER

This document and all information contained herein are the sole property of P3. No intellectual property rights are granted by the delivery of this document or the disclosure of its content. This document shall not be reproduced or disclosed to a third party without the express written consent of P3. This document and its content shall not be used for any purpose other than that for which it is supplied.

ADDRESS:

P3 Group
Heilbronner Str. 86
70191 Stuttgart
Germany

WEBSITE:

www.p3-group.com