HETEROGENEOUS INTEGRATION ROADMAP

Heterogeneous Integration Roadmap

Chapter 5: Automotive

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Chapter 5 Key Sections

HETEROGENEOUS INTEGRATION ROADMAP

- Section 4: Autonomous, ADAS and Sensing Needs
- Section 5: Data Processing for Autonomous, ADAS, Infotainment and Connectivity
- Section 6: Vehicle Electrification
- Section 7: Reliability

https://eps.ieee.org/images/files/HIR_2021/ch05_automotive.pdf

Focus Areas for Next Revision

- Automotive Processors
- Sensors – Lidar, Imaging Radars
- Powertrain – Inverter, Battery Management System, On Board Charger

Semiconductors in Automotive

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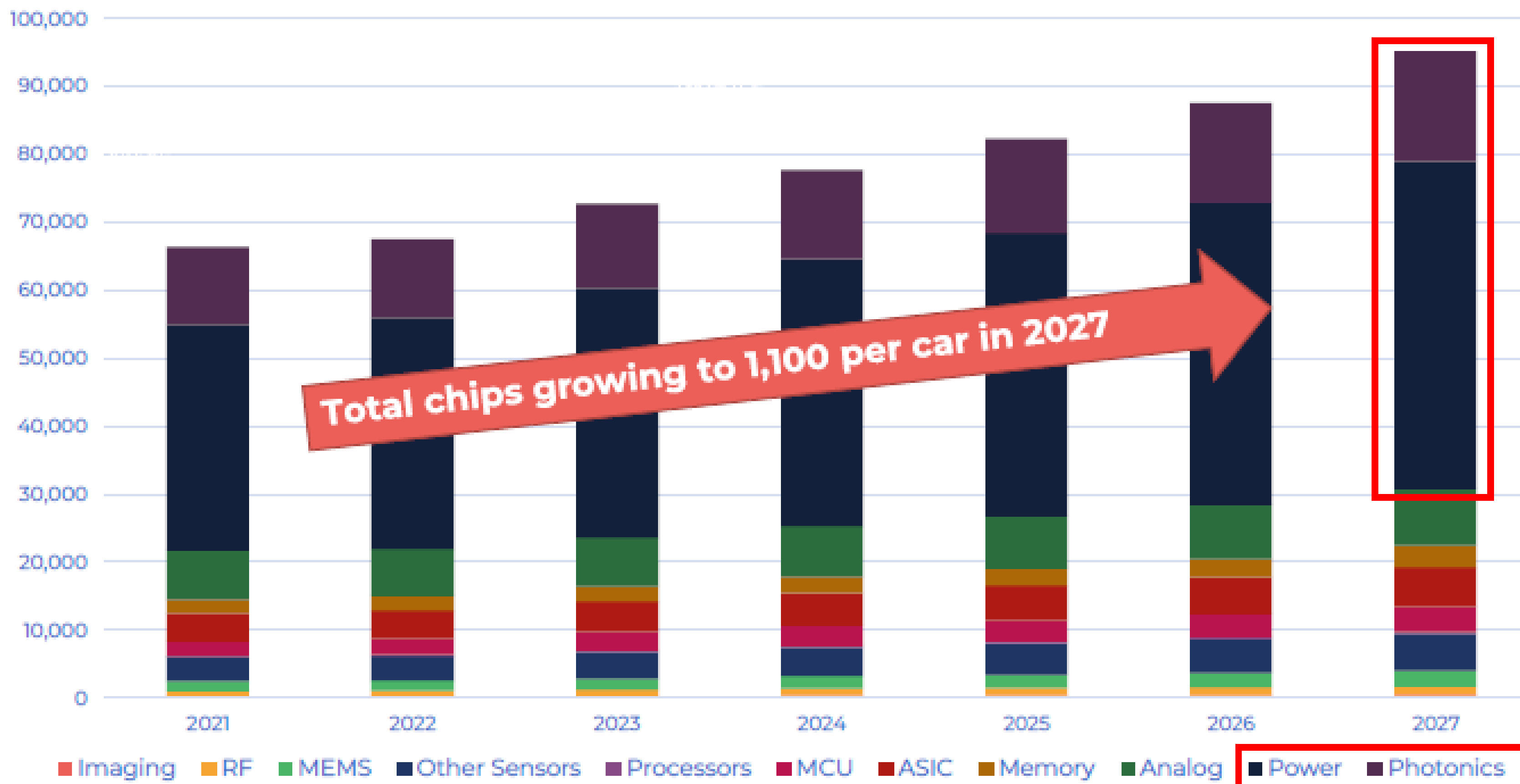
In 2027, over 95 billion chips will be integrated in cars.

Power & Photonics dominate, Memory & Processors highest growth rate



Source: Yole, 2023

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Next Gen E/E Architecture and Compute

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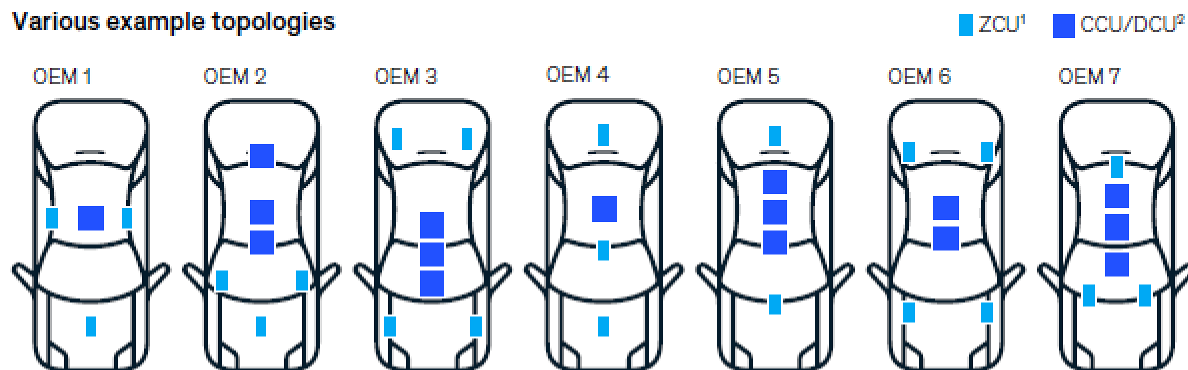
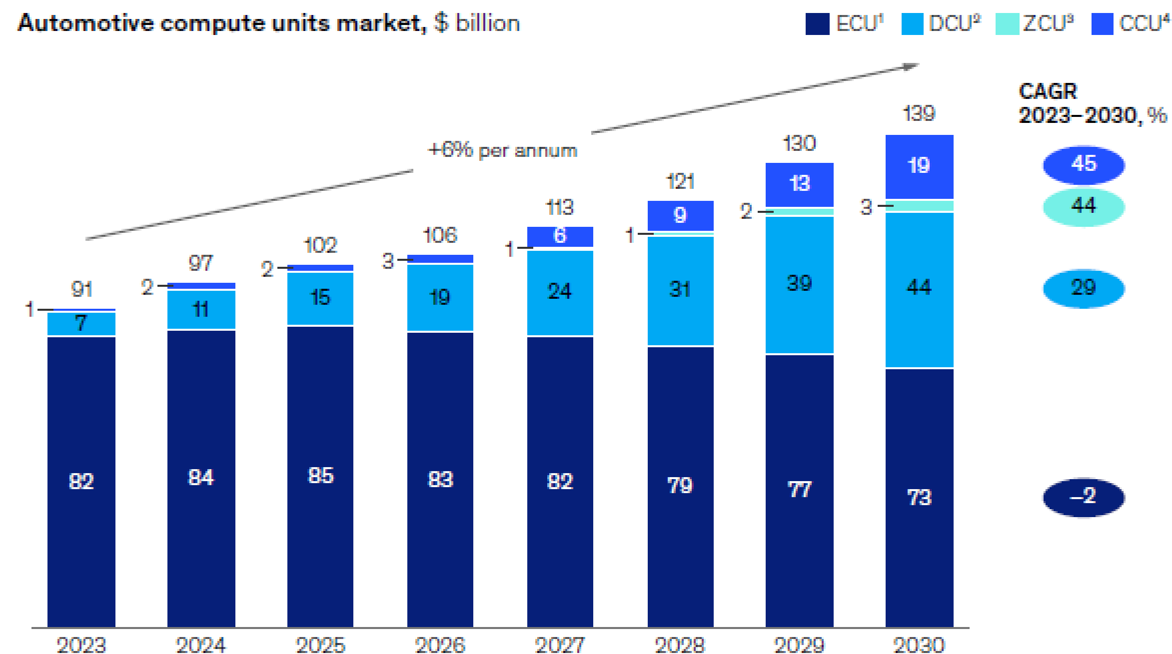


[1]Zonal compute units.
[2]Central compute units / domain compute units.

Requirements by domain

Domains	Body	Powertrain	Chassis	ADAS/AD[1]	Infotainment
	Zonal compute units			Domain/centralized compute units	
Typical functionality	• Climate control • Interior/exterior lighting • Seat functions	• Motor control • Thermo management	• Steering • Suspension • Braking systems	• L2+: ACC,[2] AEB[3] • L3: ALKS[4]/traffic jam chauffeur	• Display control • Audio control • User applications
Compute requirements	Low-medium	Low-medium	Low-medium	High	High

High → Low
Integration of functionality into zonal controller



Source: McKinsey, 2023

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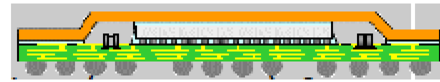
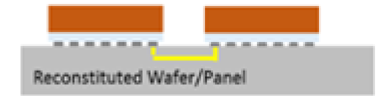
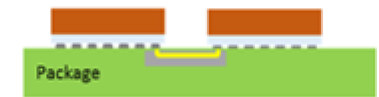
Automotive Processor Roadmap

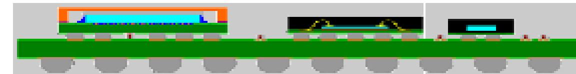


Grade 1, 2 (AEC Q100), FCBGA
(Including multi die)

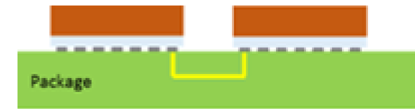




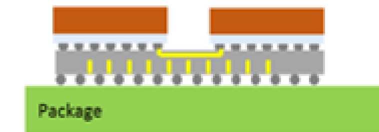
Chiplets, Memory



Grade 2, 3 BGA SiP Module



Including HBM Integration



Advanced Si Node Acceleration, Processor Power, Increased Graphics and Memory BW

Attribute	Current	3-5 year	5+ year
Si Node	7nm (HVM), 5/4nm (Dev.)	5/4nm (HVM), 3nm (Dev.)	3/2nm (HVM), TBD
Bump Pitch	130/110um	<100um, micro-bump	<100um, micro-bump
Integration Level	PCB	Package	Die
Reliability	AEC Q100 Grade 3/2/1; AEC Q104 (SiP)		TBD
Safety	ASIL-B	ASIL-D?	

Opportunities for Cross TWG Collaboration

Autonomous, ADAS and Sensing Needs

- Processors Auto vs. HPC requirements (*HPC & Data Center TWG*)
    - Chiplets
- Sensing (*MEMS & Sensors Integration*)
    - Lidar
    - Imaging Radar

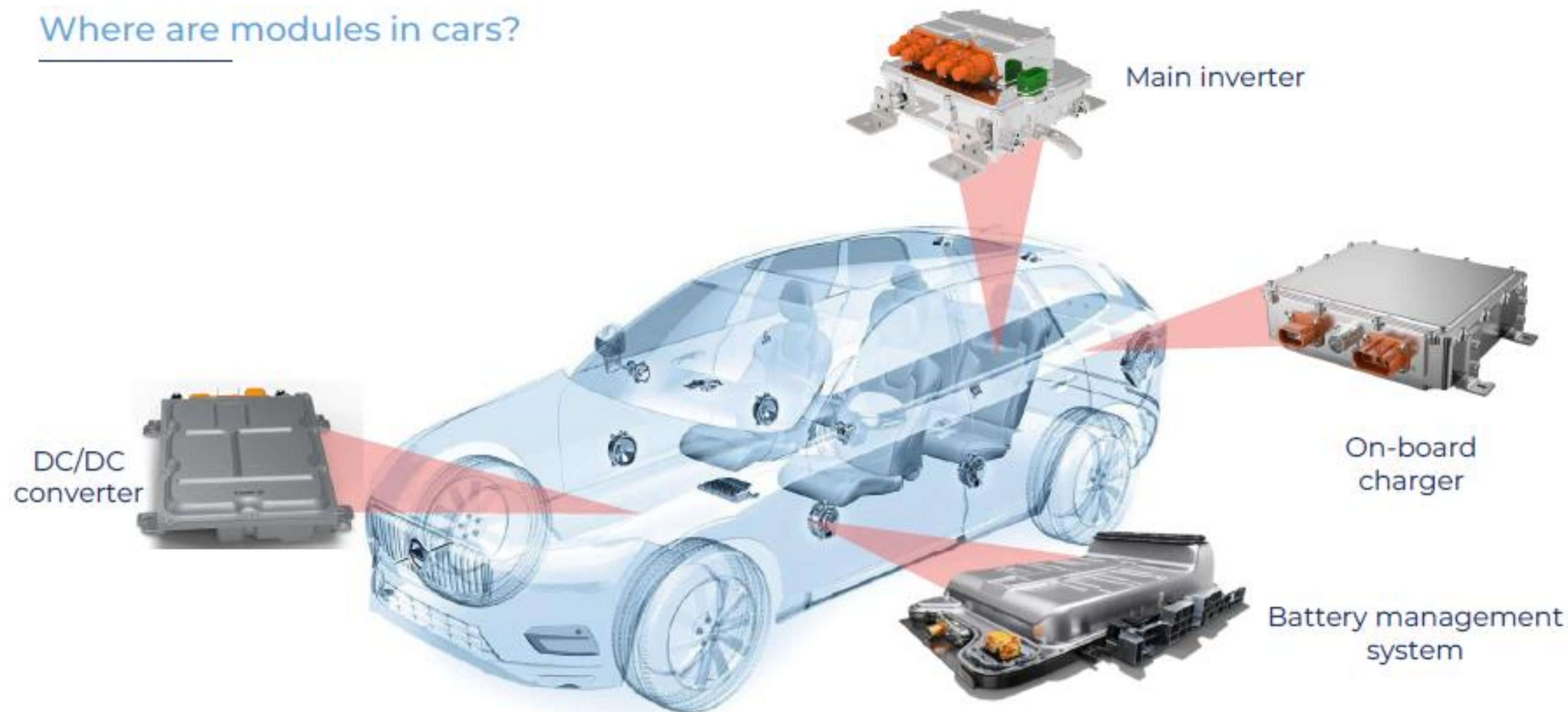
Vehicle Electrification (*Power Electronics TWG*)

- Inverter
- On Board Chargers
- DC-DC Converters, Battery Management Systems

Reliability (*Reliability TWG*)

- Reliability requirements and qualification strategies for evolving use conditions

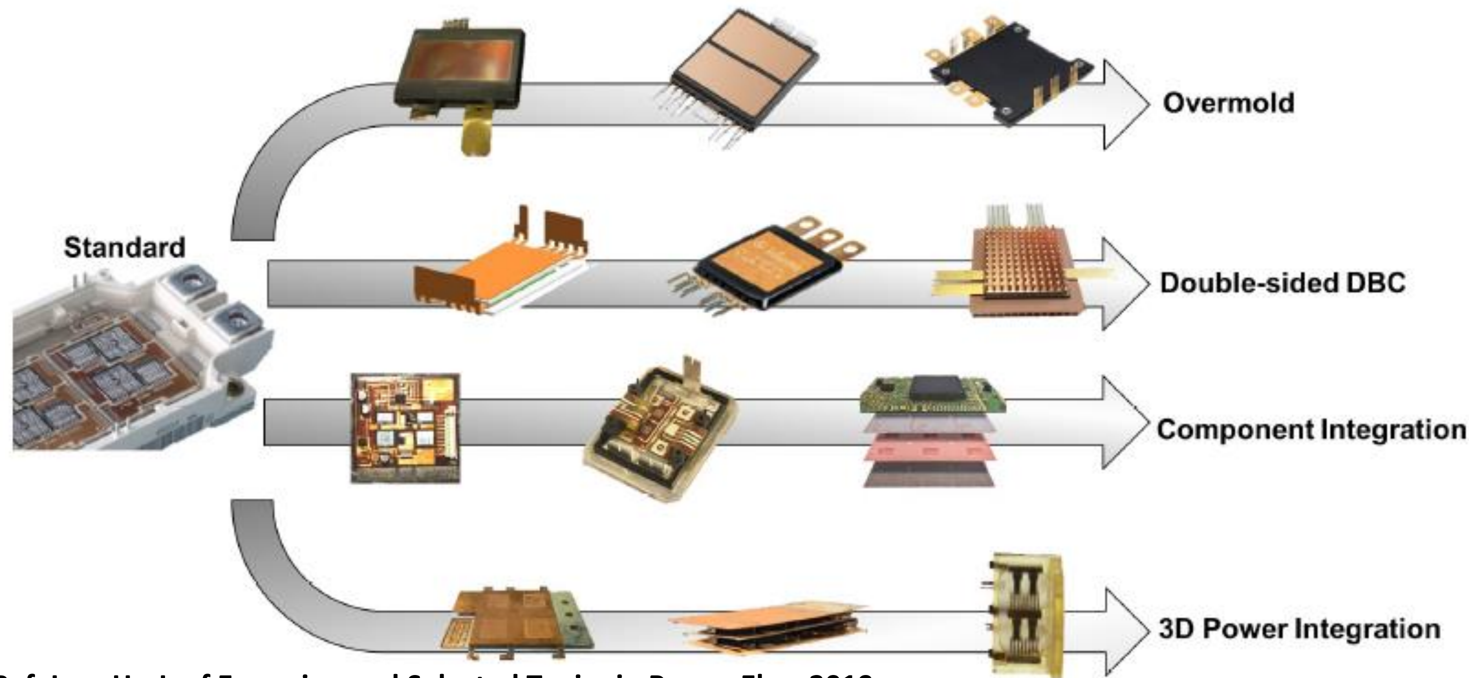
Electrification – Powertrain



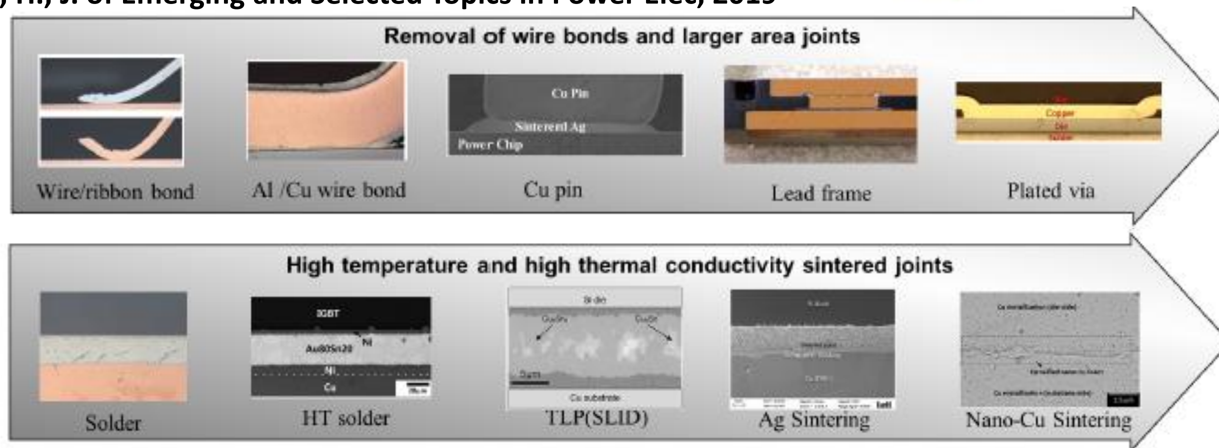
Integration and Miniaturization to improve overall efficiency

Source: Yole, 2023

Electrification and Packaging



Ref: Lee, H., J. of Emerging and Selected Topics in Power Elec, 2019



- Key Drivers
  - Lower cost $/kW
  - Higher Power Density kW/kg
  - Smaller Size kW/L
- Enhanced modularity coupled with low inductance, low loss, improved thermal performance through advancement in package designs
- Advances in package interconnections, die-attach and substrate technologies playing a key role in package innovation and performance

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Automotive Technical Working Group

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Many Thanks for your Attention and Support

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