HETEROGENEOUS INTEGRATION ROADMAP

Heterogeneous Integration Roadmap

Chapter 5: Automotive

TWG Chairs: Vikas Gupta (ASE), Veer Dhandapani, (NXP)

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

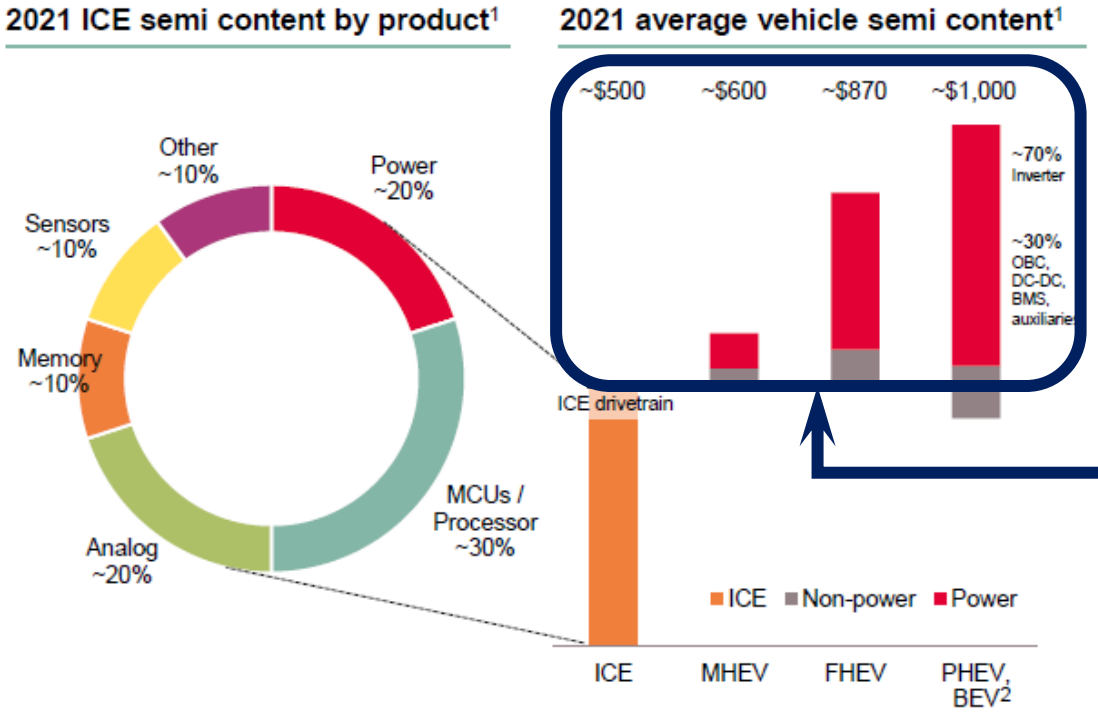
https://eps.ieee.org/images/files/HIR_2021/ch05_automotive.pdf

Key Contributors:

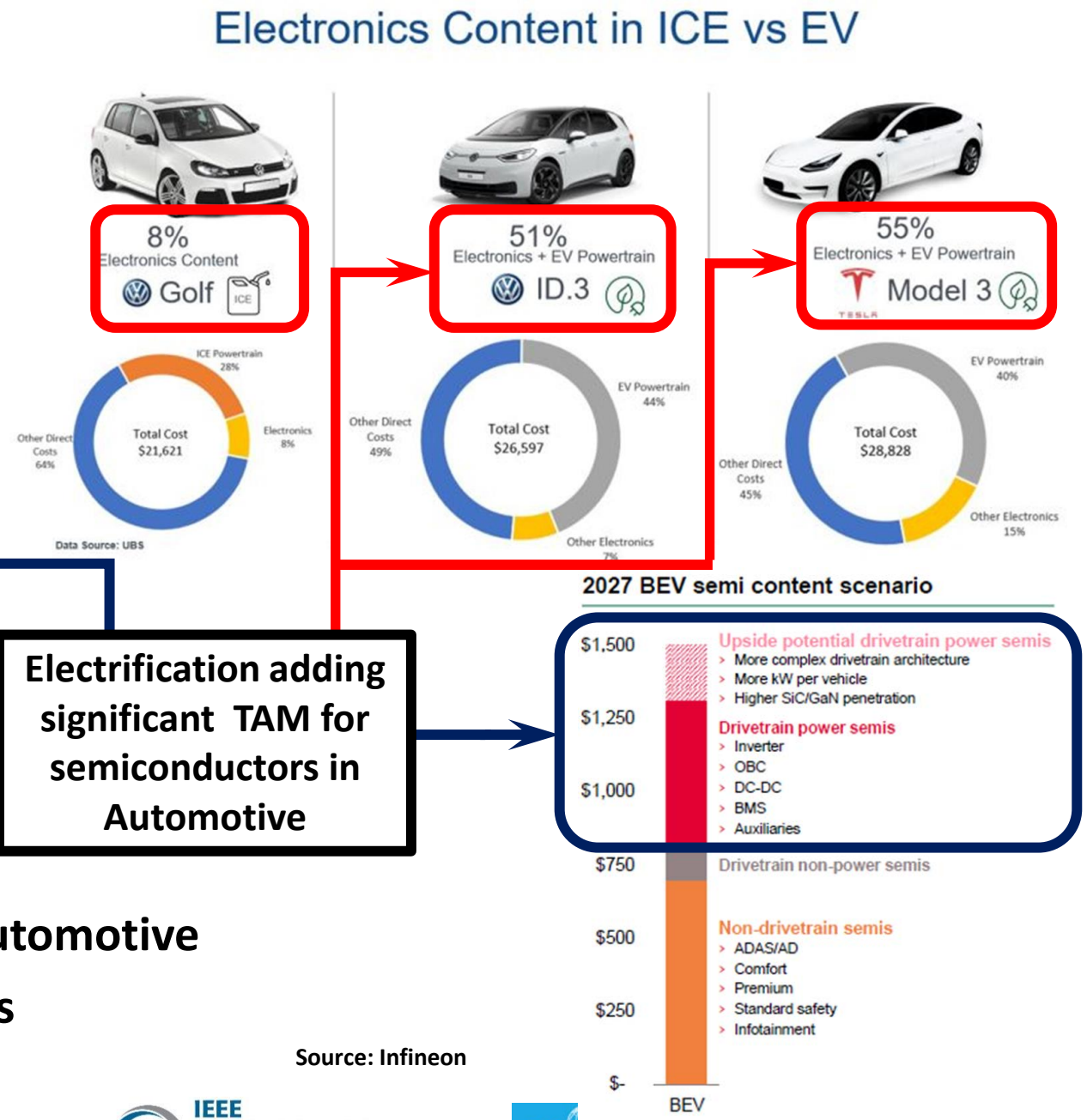
Rich Rice, Veer Dhandapani, Venkat Sundaram, Sandeep B Sane
Shalabh Tandon, Przemyslaw Jakub Gromala, Marco Munzel, Johannes Duerr
Sven Rzepka, Rene Rongen, Hongbin Yu, Rao Tummala
Simon Stefan Franz, Thorsten Meyer, Klaus Pressel, Andreas Grassman
Abhijit Dasgupta, Wolfgang Froehlich, Vikas Gupta, Michael Liu
Heinz Wagensonner

*Next Revision Focus

Semiconductors in Automotive



1 Based on Strategy Analytics: *Automotive Semiconductor Demand Forecast 2019 - 2028*. July 2022; Infineon. "power" includes voltage regulators, ADCs and ASIC
2 Due to missing ICE engine in BEV the weighted incremental semiconductor content for PHEV and BEV starts below the "~$500" line.



Electrification adding significant TAM for semiconductors in Automotive

- **Increasing semiconductor content & value in Automotive**
- **Electrification and Autonomous key megatrends**

Source: Infineon

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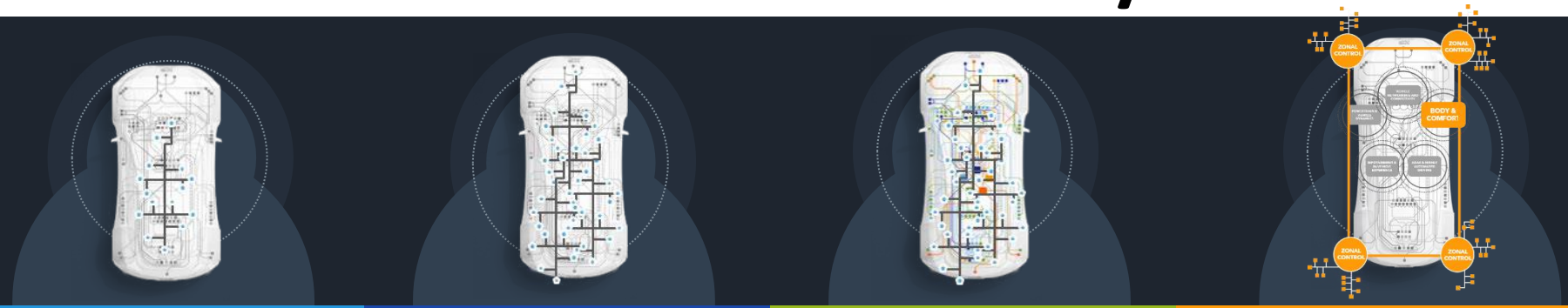
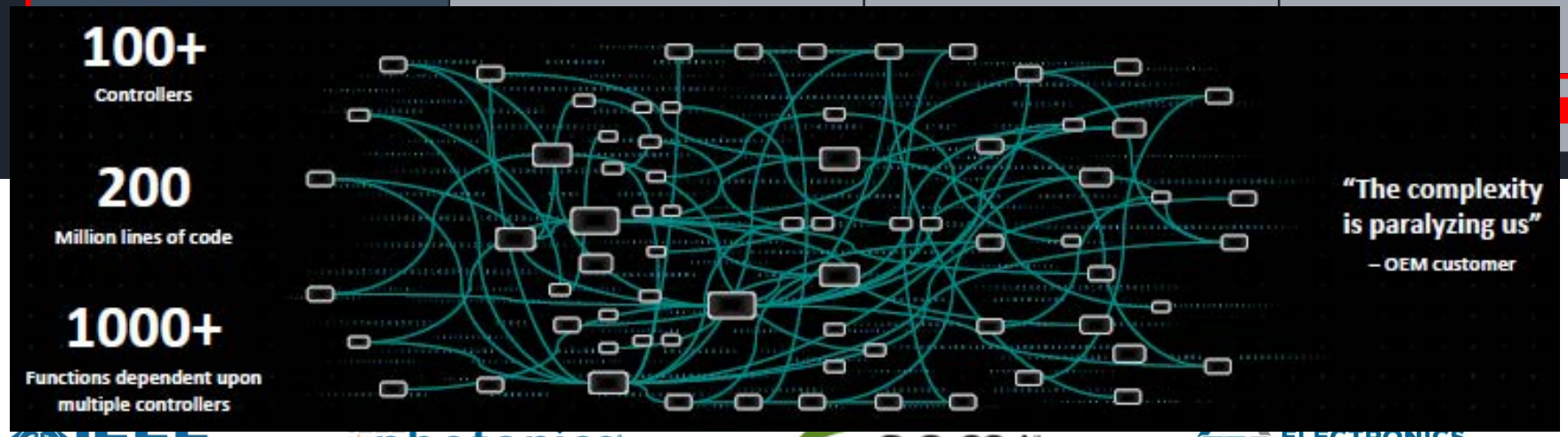
Value Shift to More Safe and Secure MPUs/MCUs (1)



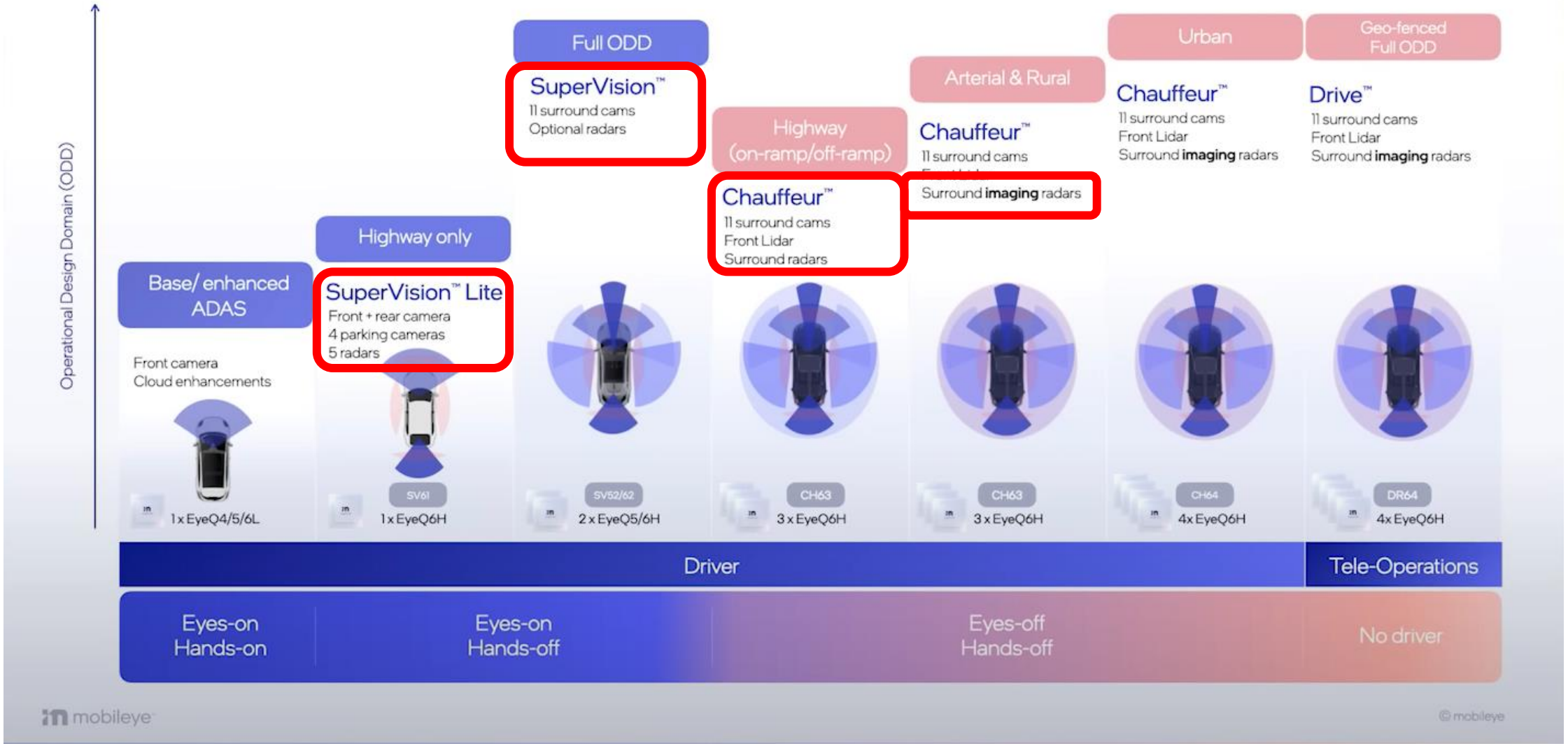
	YEAR 2000	YEAR 2010	YEAR 2020	YEAR 2030
Total processors per car	~10	~30	~45	~60
Domain/zonal controllers			Emerging	~4
Lines of code	4K	10M	100 - 200M	500



Evolution from domain approach ECU topology to logical domains on central compute

Source: Aptiv

Example Autonomous System (Mobileye, CES 2023)



Opportunities for Cross TWG Collaboration

Autonomous, ADAS and Sensing Needs

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

Role of 6G in Autonomous driving (*Mobile TWG*)

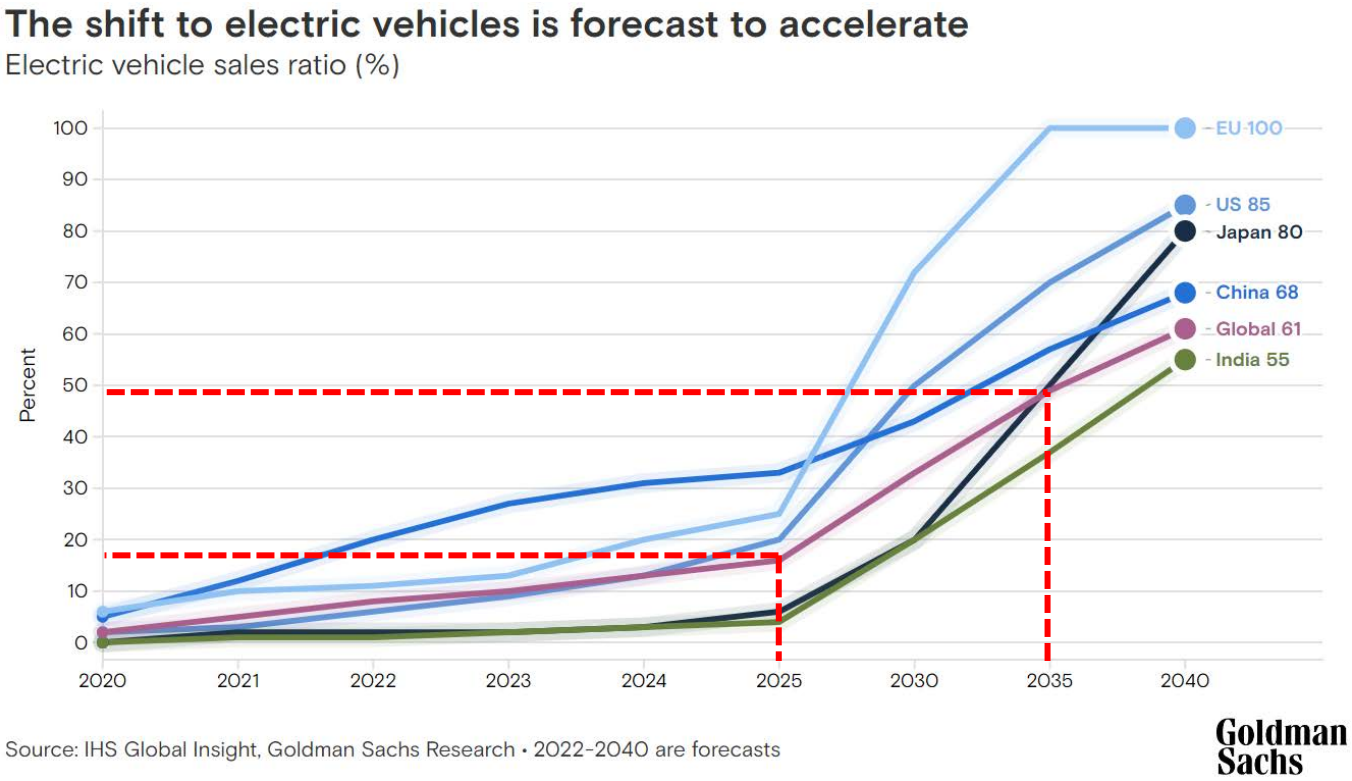
Vehicle Electrification (*Power Electronics TWG*)

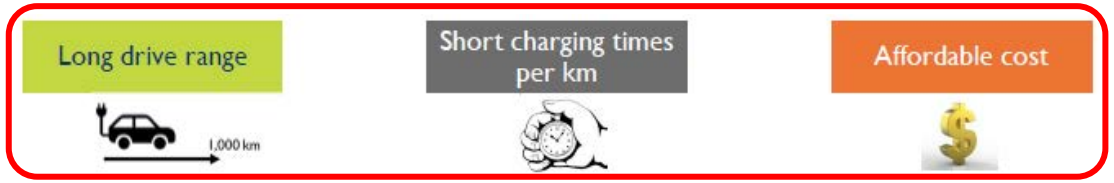
- Inverter
- On Board Chargers
- DC-DC Converters, Battery Management Systems

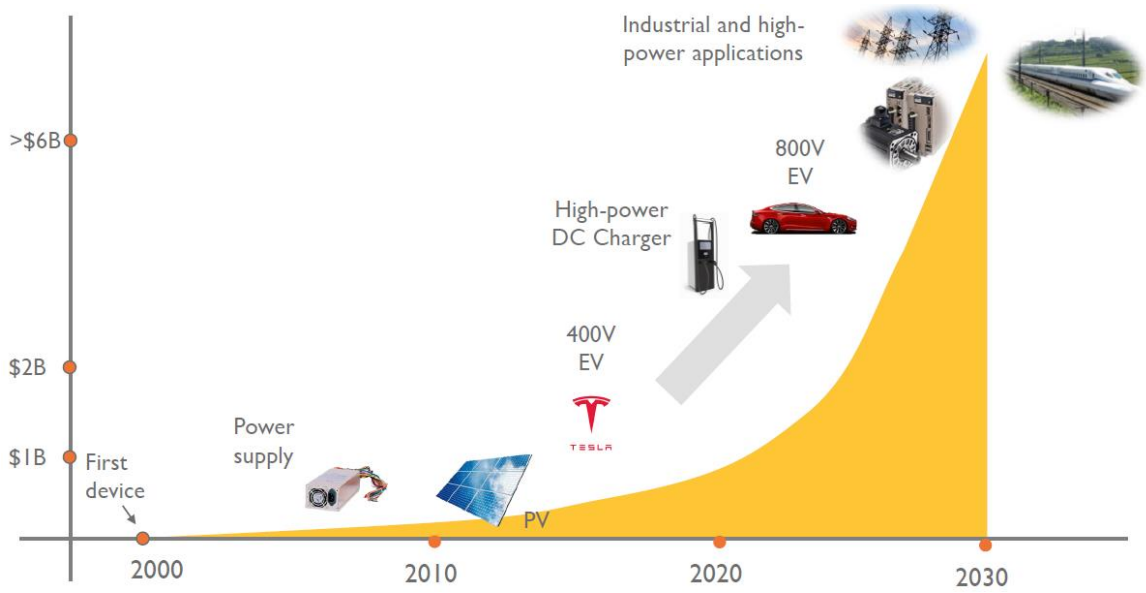
Reliability (*Reliability TWG*)

- Reliability requirements and qualification strategies for evolving use conditions

Vehicle Electrification



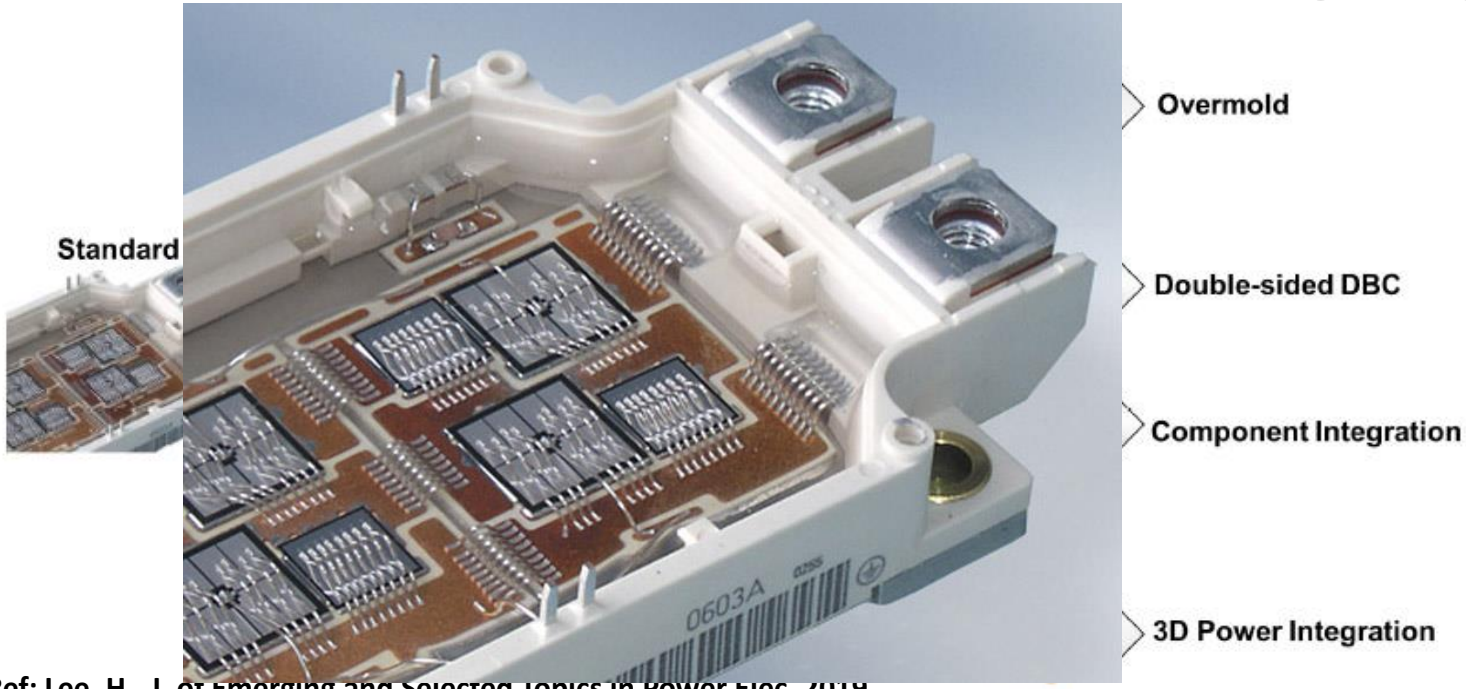




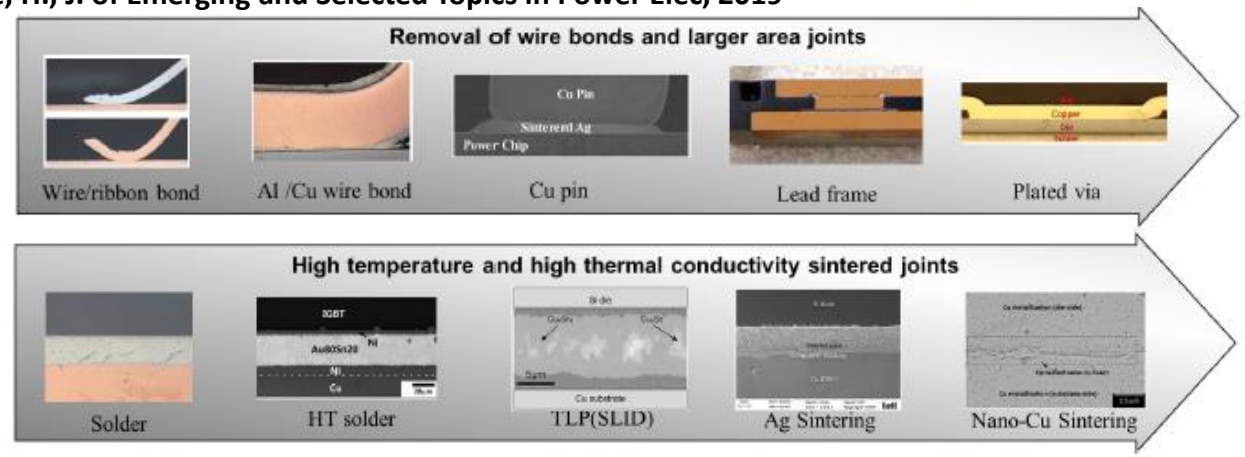
Source: Yole

- **Electrification, higher voltage adoption are the key drivers**
- **xEV market expected to grow at ~34% CAGR from 2021-27**

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

Many Thanks for your Attention and Support

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