Semiconductor industry in Europe under pressure – chances for more cooperation ?

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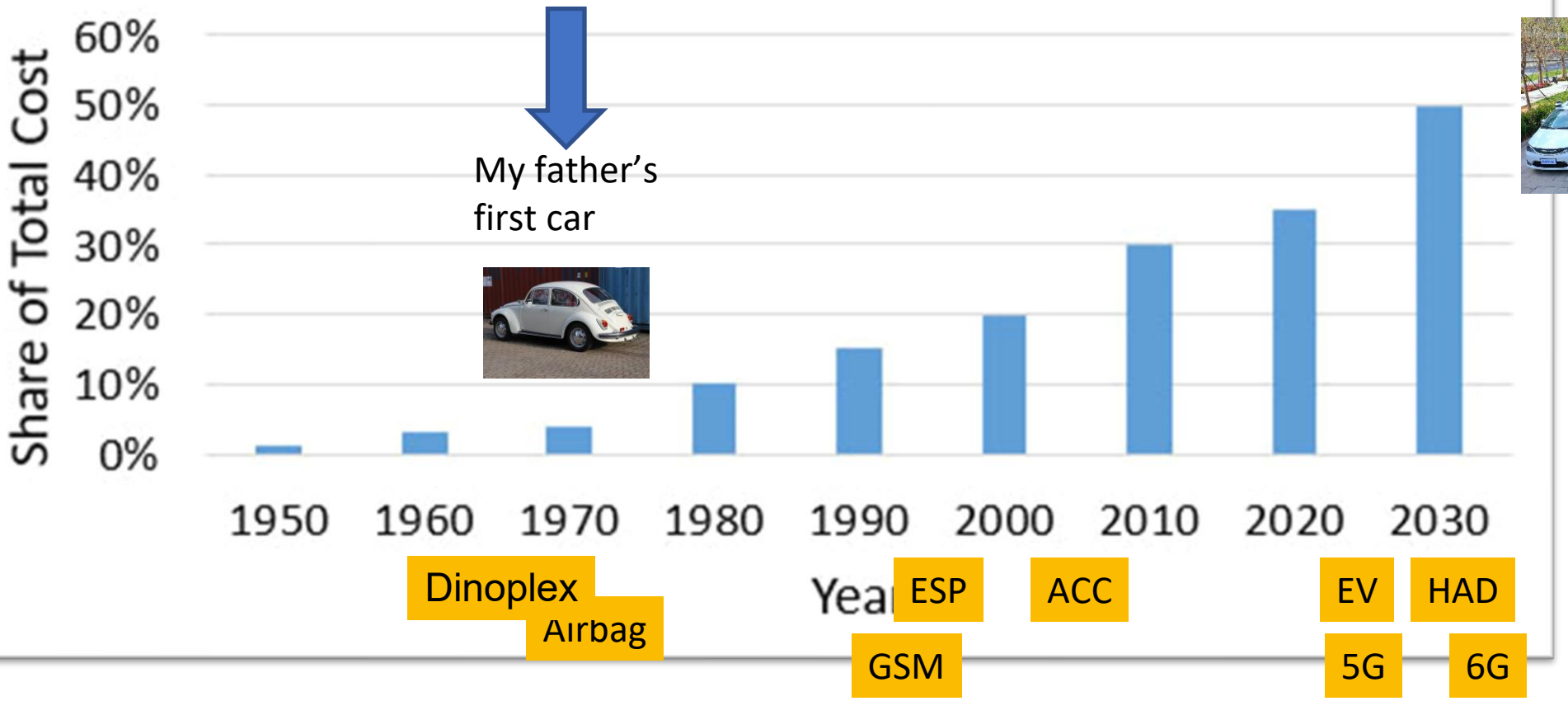
Content

- Software and semiconductors in cars
- Semiconductor market evolution
- Costs and amortisation
- US, China, Europe
- Vertical integration
- Power Electronics
- Dual Use
- Conclusion
- Recommendations

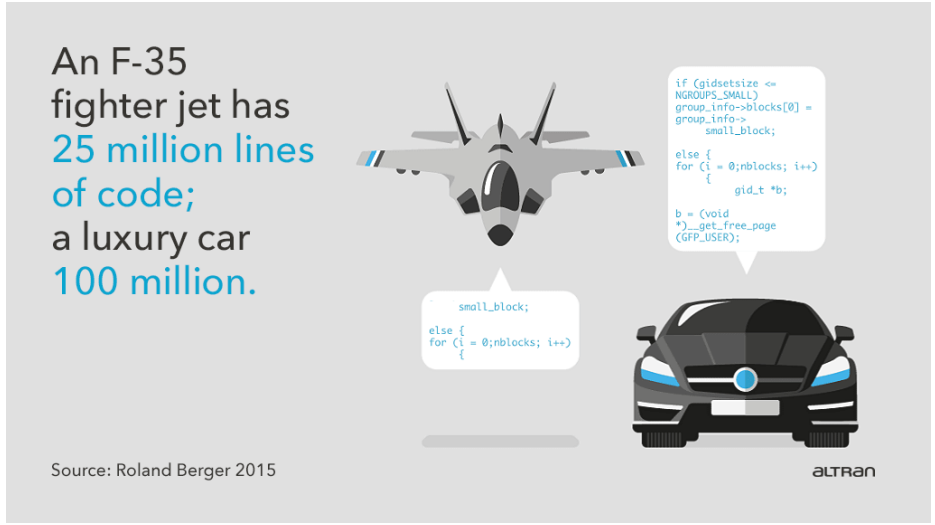
Automotive Electronics Cost as a Percentage of Total Car Cost Worldwide from 1950 to 2030



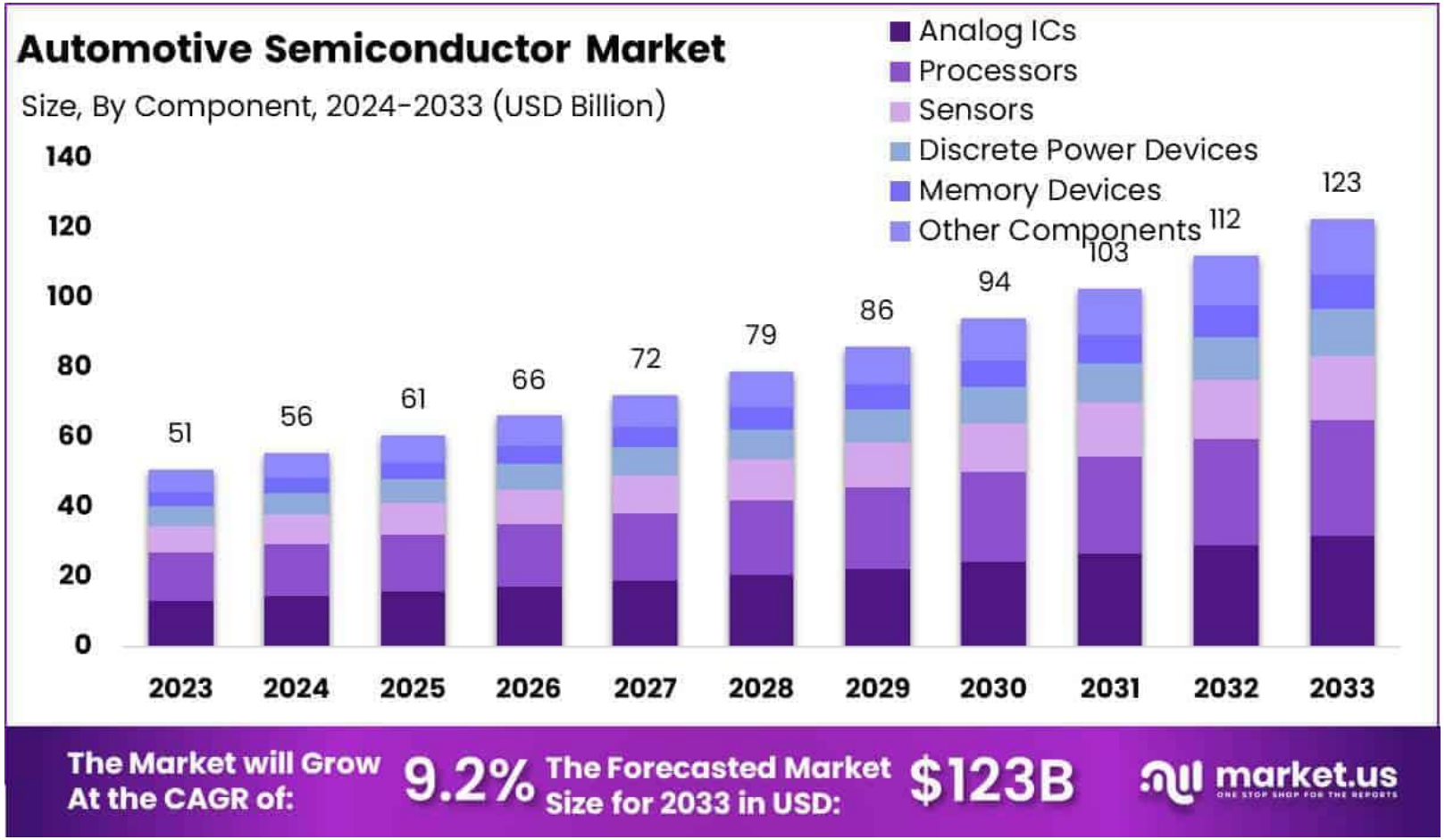
https://www.qualitydigest.com/read/content_by_author/67187

Electroncs = hw+sw , the SDV Challenge

- Vehicles where software plays a central, dynamic role
- Functions not fixed at manufacturing: can evolve over time
- Enable over-the-air (OTA) updates, modular software, connected services
- Asia-Pacific as a leading growth region
- **Semiconductor** / hardware bottlenecks
- How fast will OEMs transition from legacy architectures ?

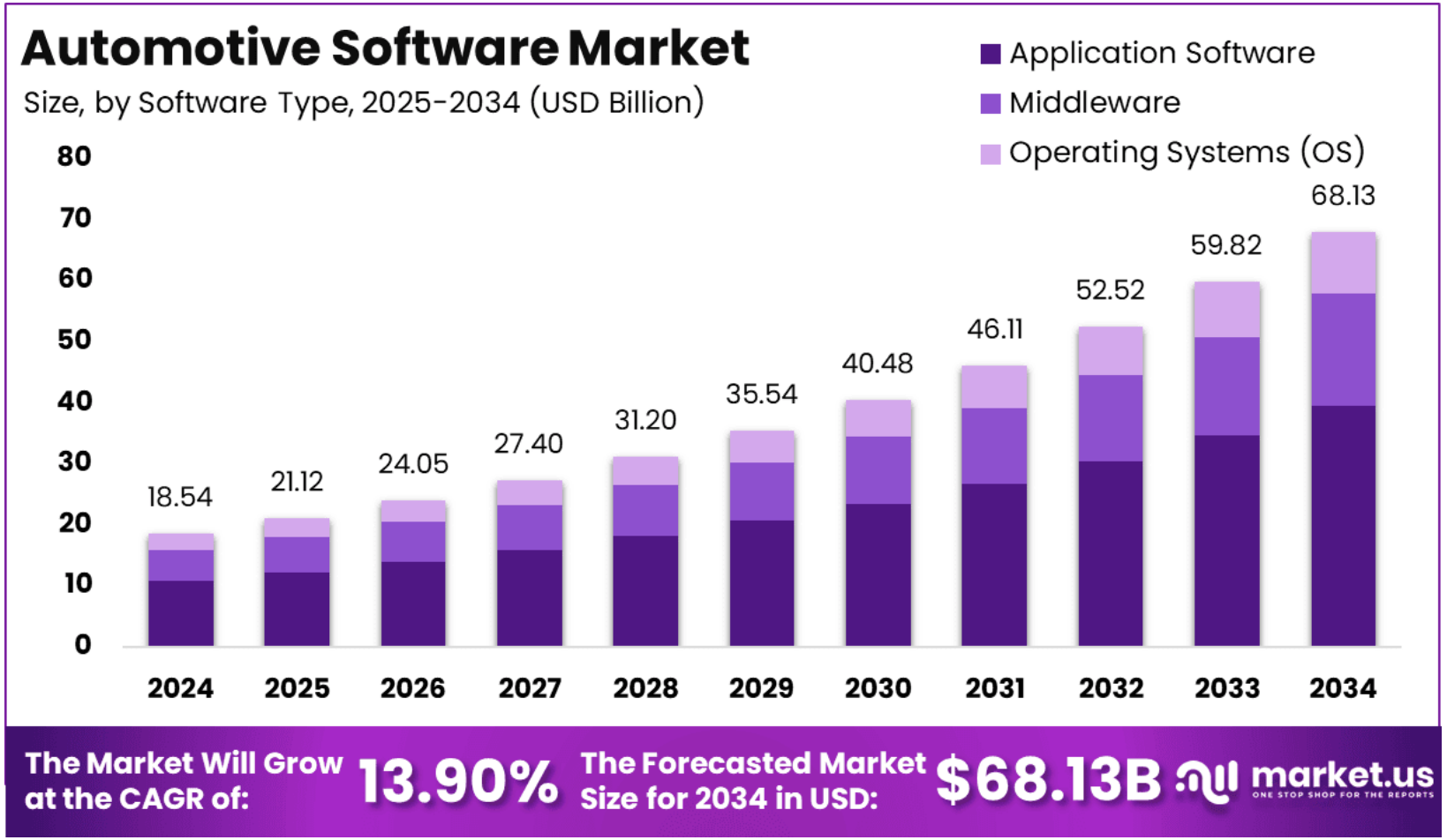


Automotive semiconductors = 20–30% of the value of automotive electronics today



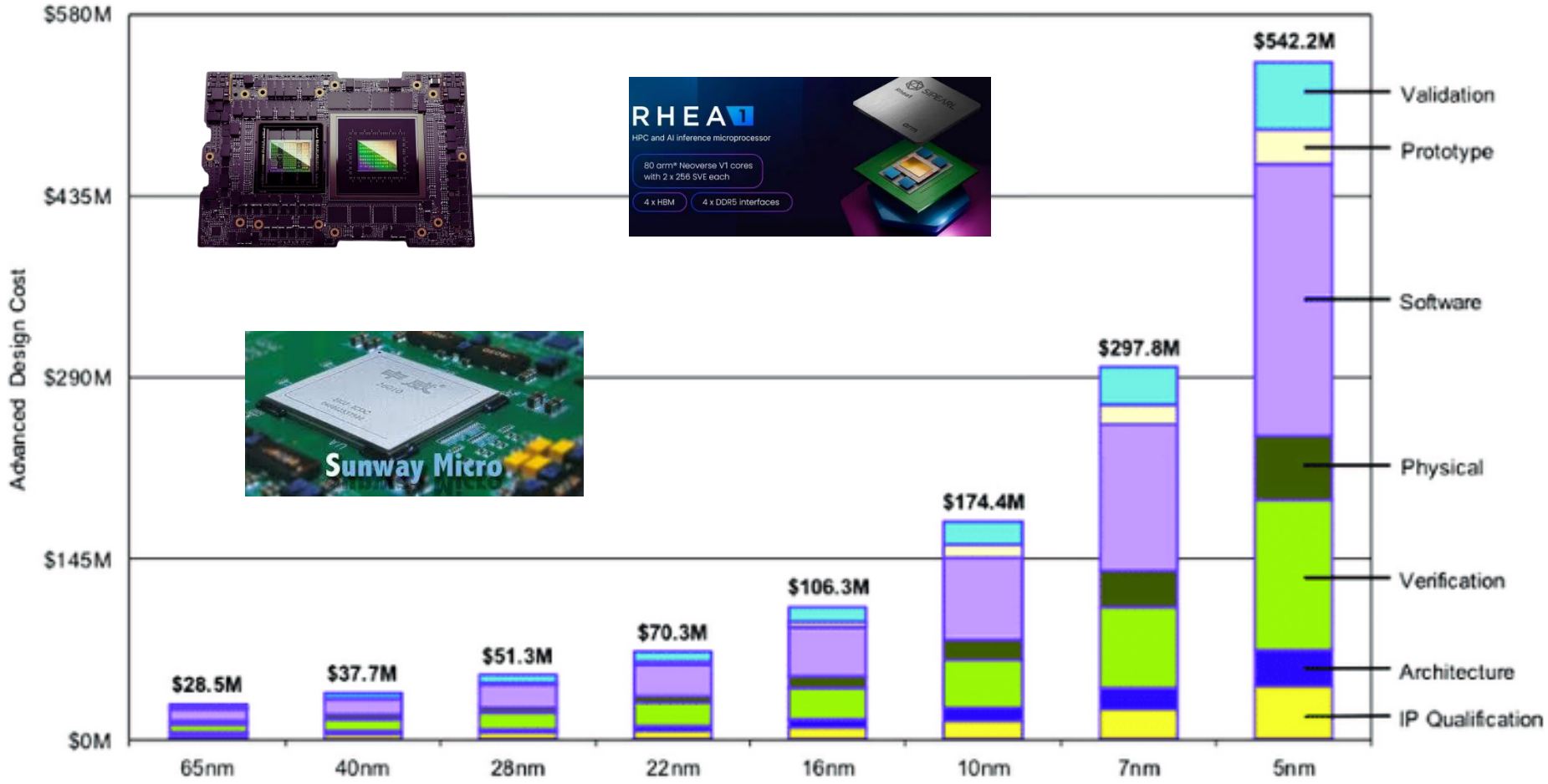
Semiconductors in the car:
15–20% by 2030

Software Market



Softwarea in the car:
10–15% by 2030

Cost of chip development



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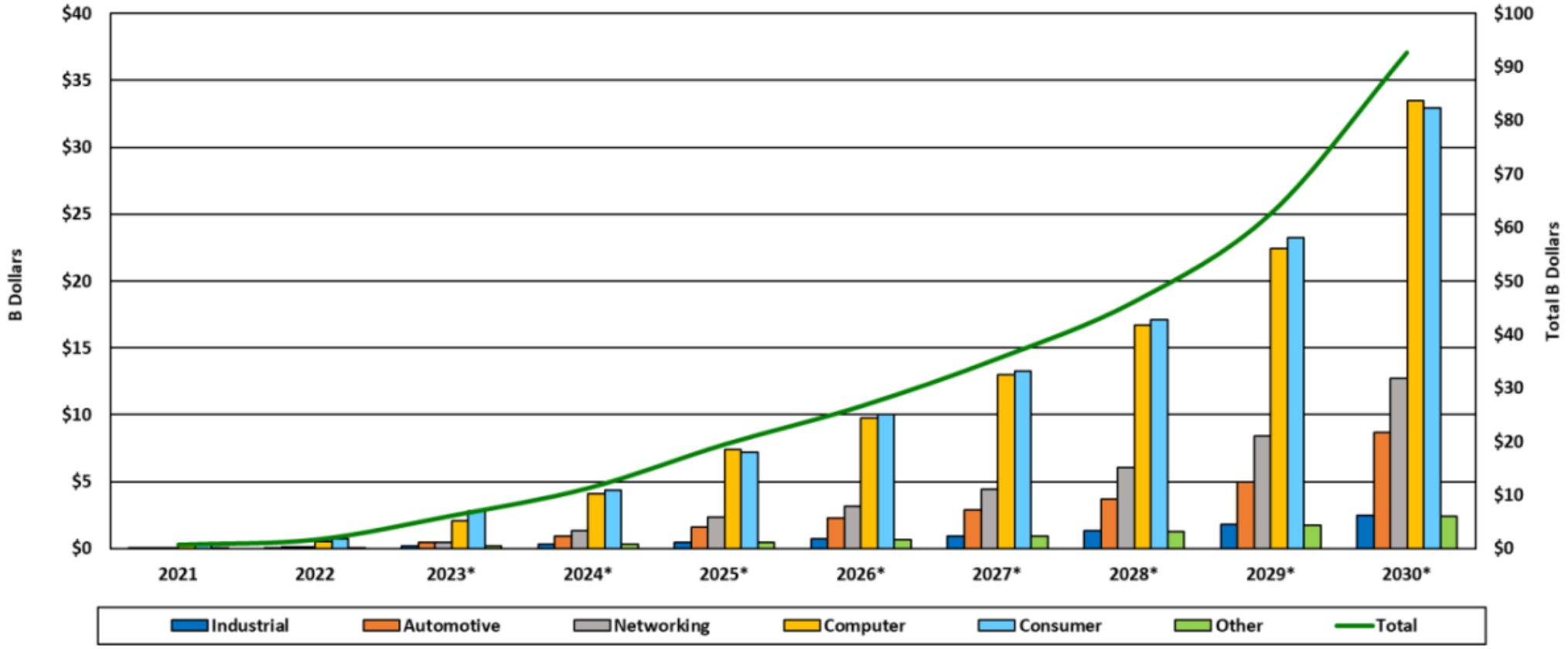
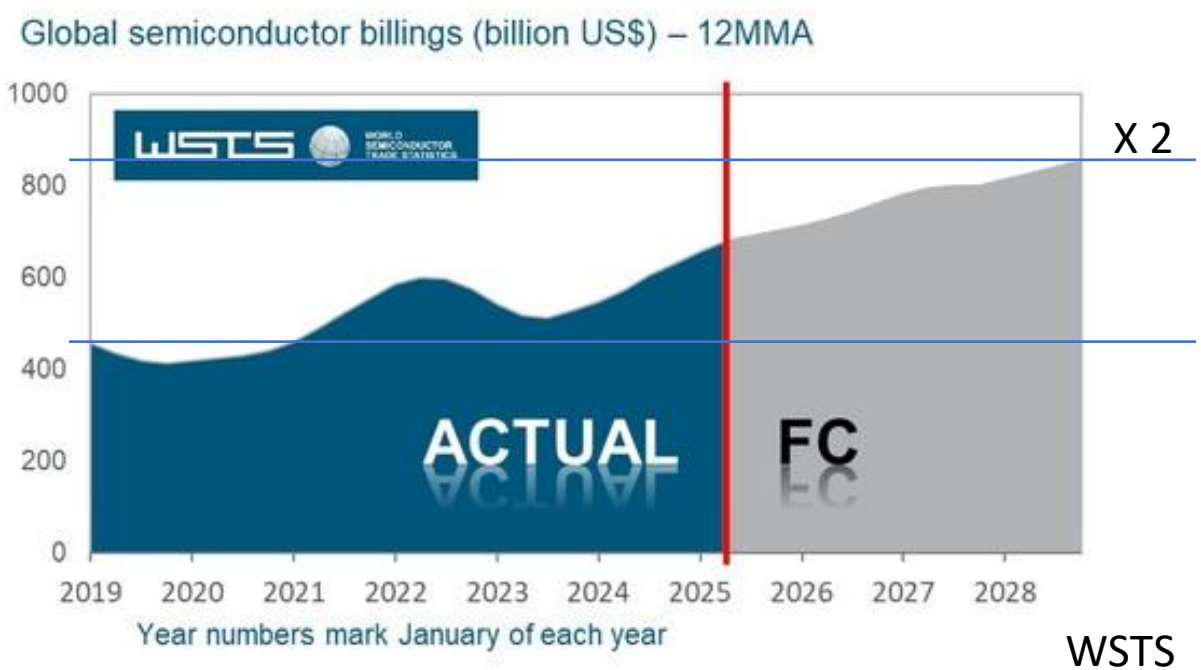
Market Revenues for All RISC-V SoC by application 2021-2030



*Forecast

Source: The SHD Group, January 2024

Semiconductors in the world



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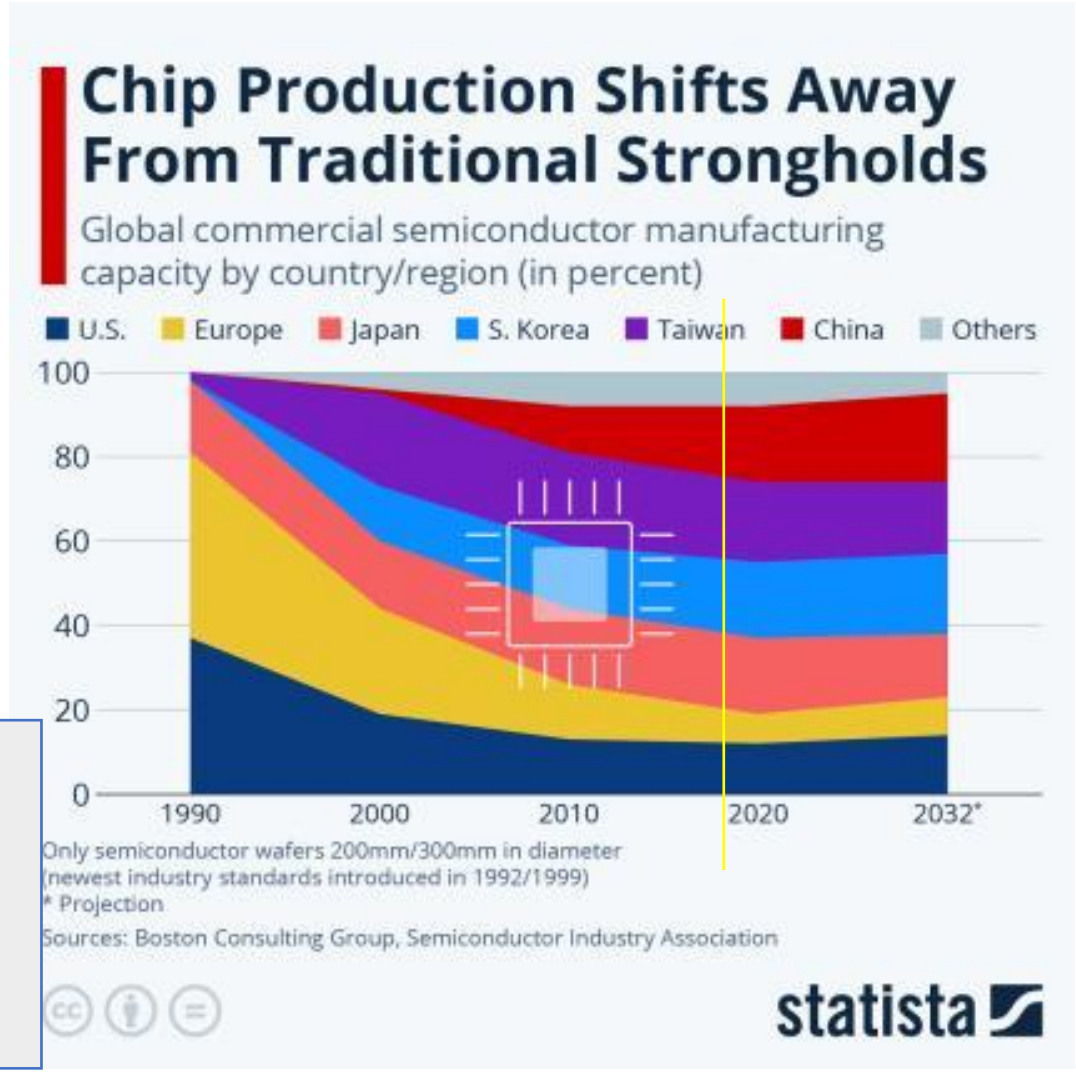
WSTS



- China today: 44 fabs, including 25 12-inch fabs
  total monthly capacity: ~ 1.189 million wafers
- **expansions** ➔ 4.14 million wafers by end of 2026 = + 248.19%
- Europe: Crolles (ST) or Dresden (IFX/ESMC/BOSCH):
  ~ 80 000 to 100 000 wafers per month

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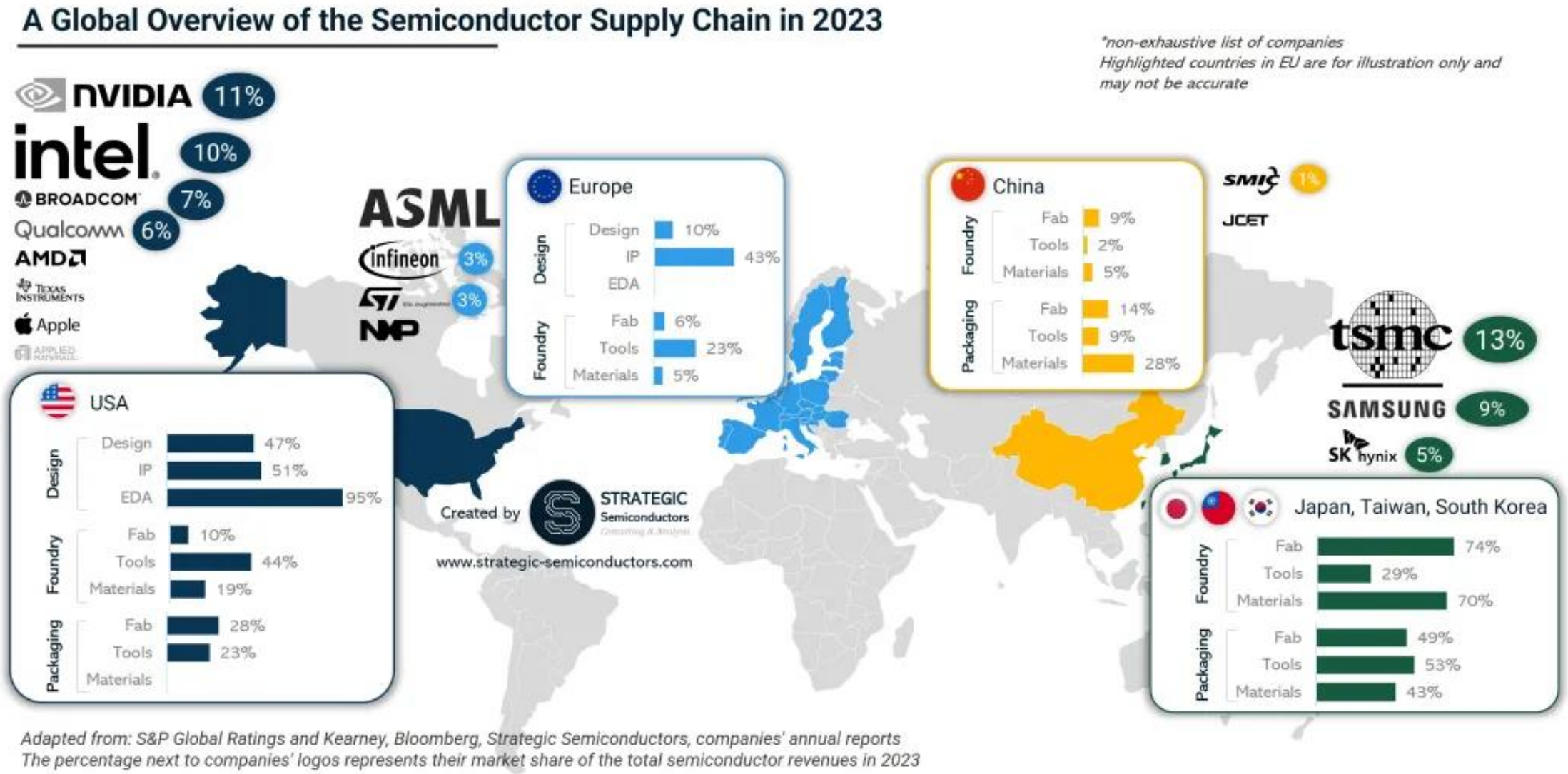
Semiconductors in the world



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GaN production in China based on German technology

- 8-inch GaN-on-Si Epitaxy

MOCVD Reactors

Innoscience is using the latest generation of Aixtron MOCVD reactor G5+C™ to grow Innoscience 8-inch GaN-on-Si wafers.

China 2025

- Core material and technologies:
  - 2020: 40% internal
  - 2025: 70% internal
- 10 key industries including
  - Information and communication technologies incl. semiconductors
  - Energy saving and e-mobility
  - Robot technologies
  - Electricity equipment
  - High end pharma and biomedical equipment
  - …
  - Strong link to military industry (e.g. CETC)
- Target: more efficient, better quality, higher competitiveness

RISC V

FREIER BEFEHLSSATZ

China arbeitet an nationaler RISC-V-Strategie

Chinesische Entwickler entwerfen seit Jahren eigene Prozessoren. Künftig soll der Fokus dabei auf RISC-V liegen.

in Pocket speichern | merken

5. März 2025, 14:22 Uhr, Johannes Hiltscher

(Bild: Johannes Hiltscher/Golem.de)

Bislang arbeiten RISC-V-Kerne wie die von Spacemit aus China entwickelten K1 hauptsächlich in Mikrocontrollern.

National RISC V strategy
Open software
In particular use for AI accelerators
Better ecosystem than Longsoon architecture

Expected market size: 95 bn$

To avoid disputes with some specific IP, creation of IP pool

Support by 8 ministries

First processor announced March 2025

Source: https://www.golem.de/news/freier-befehlssatz-china-arbeitet-an-nationaler-risc-v-strategie-2503-193976.html

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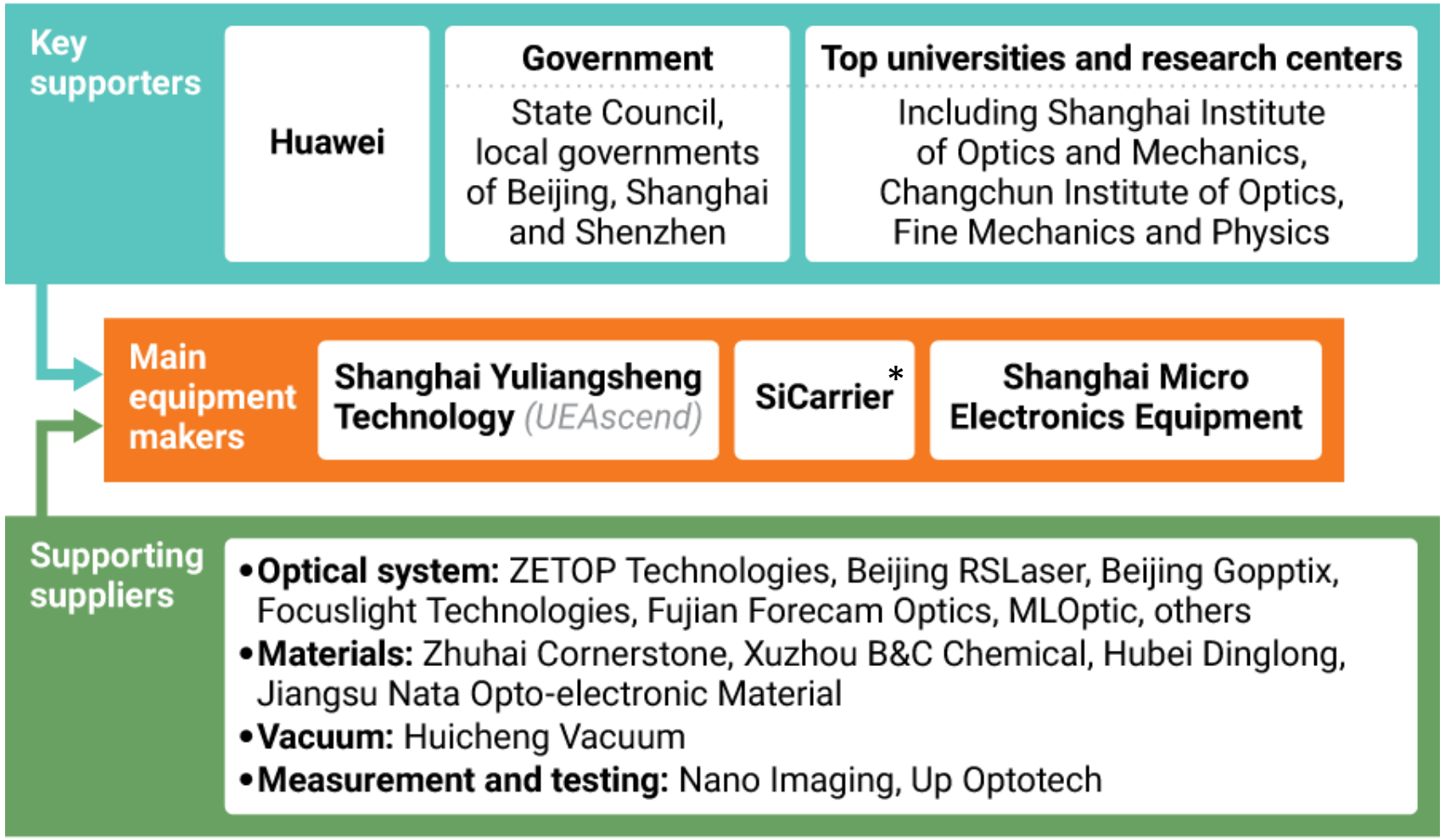
China is building its own ASML



Not an exhaustive list, supply chain continuing to grow *Source: Nikkei Asia research, Qichacha*

*) Huawei spin-off in 2021 with backing of a Shenzhen state fund

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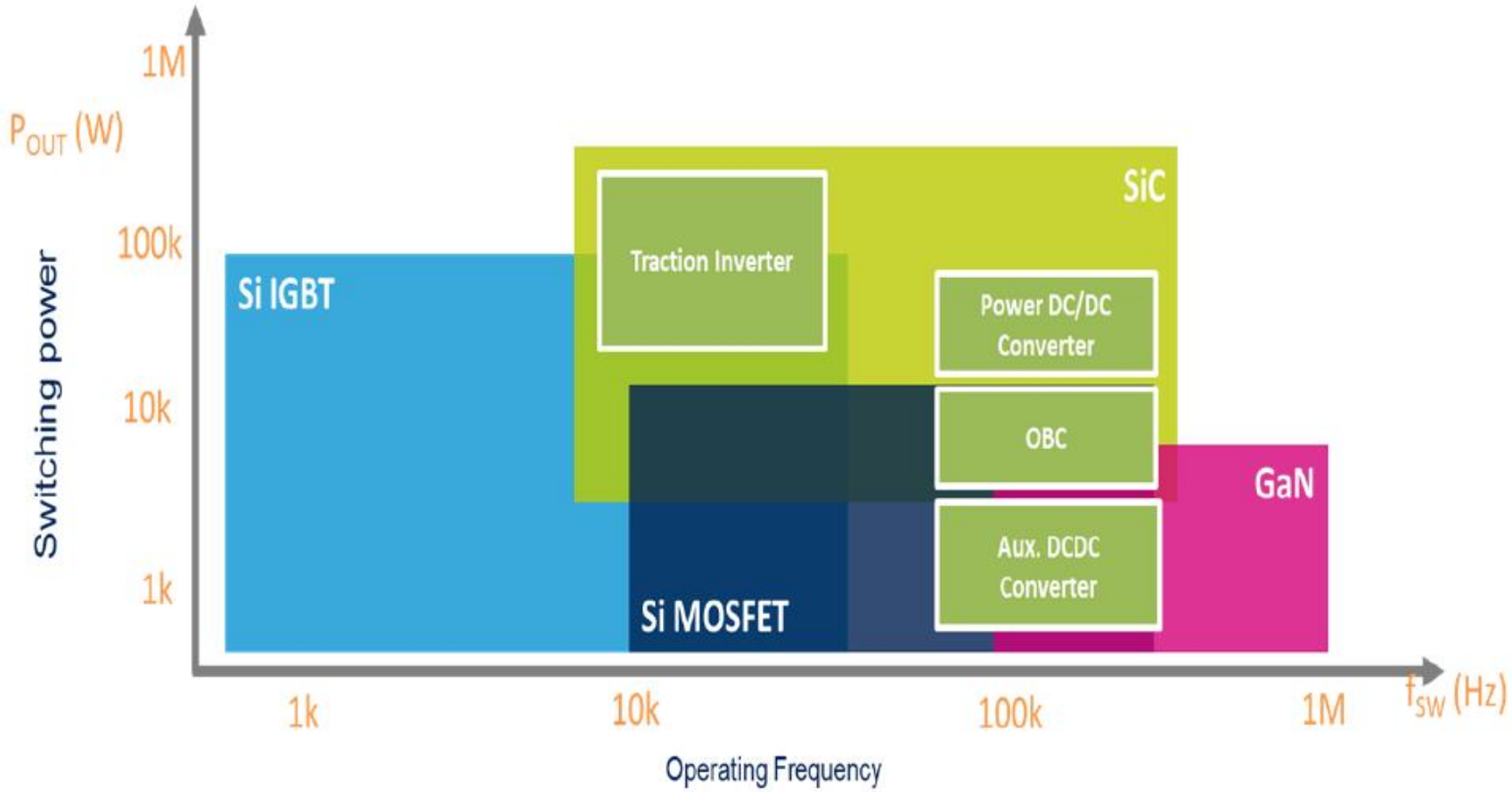
Power Electronics – GaN / SiC



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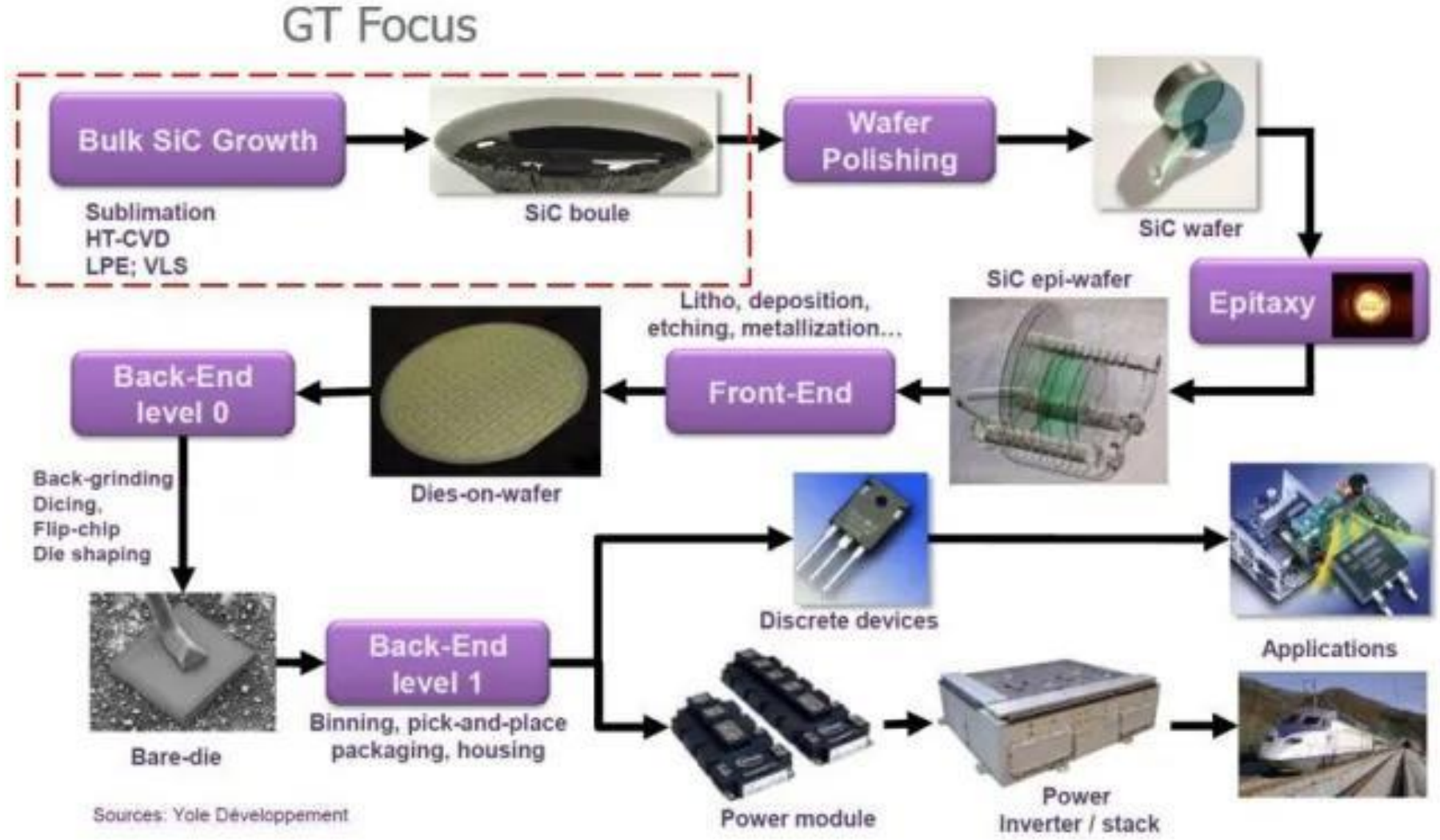
SiC competency



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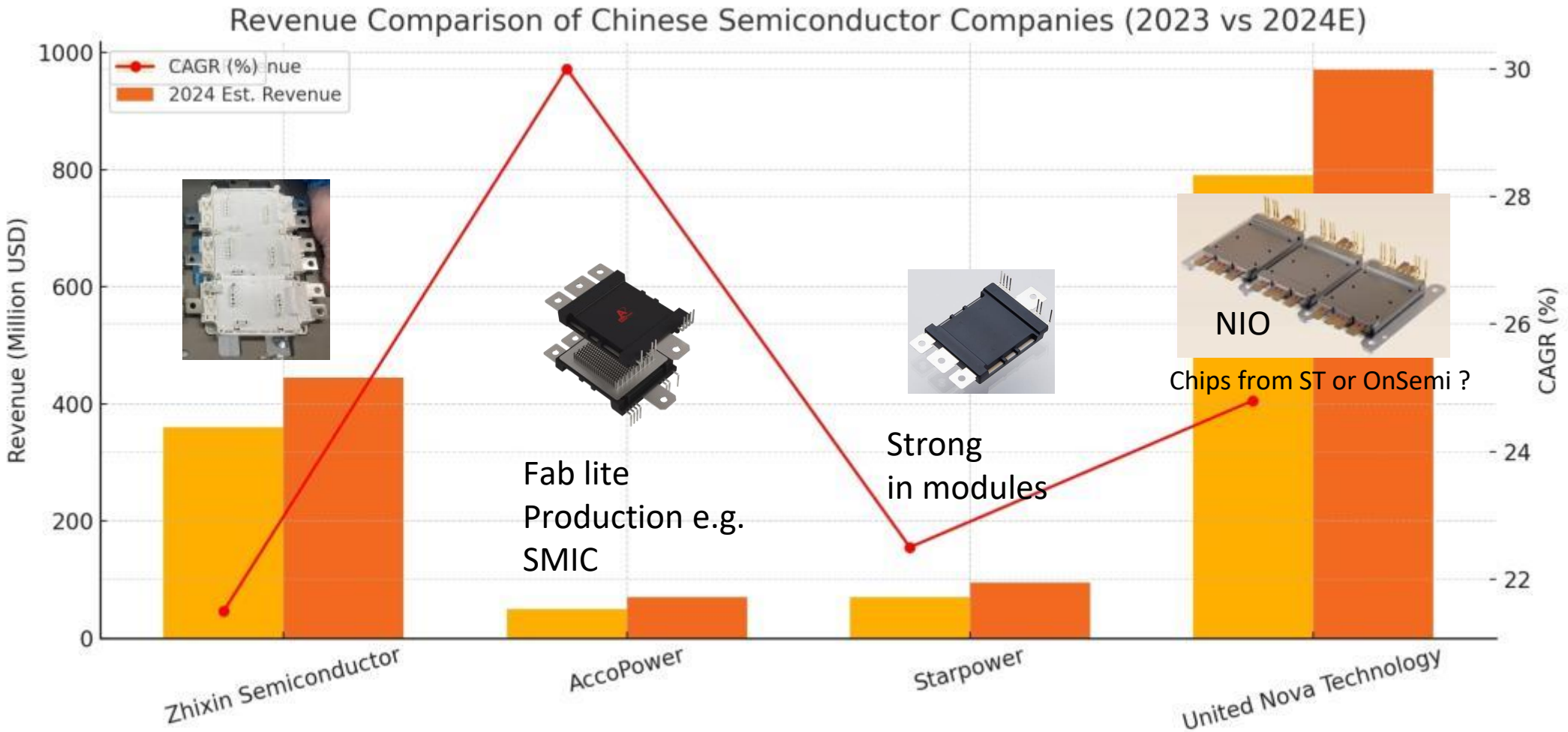
Revenue comparison of chinese PE companies



= Dongfeng + CRRC

From 2018

From 2005

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SiC – Dual Use

- **High Power, High-Frequency Performance, longer lifetime**
  (e.g. in radar systems)
- **Extreme Temperature and Radiation Resistance**
- **Increased Efficiency in Power Electronics**
- **Compact and Lightweight Systems**
- **Directed Energy Weapons (e.g. in high-power lasers and microwave weapons)**
- **Secure and Robust Communication Systems**
  (e.g. 5G and beyond)
- **Stealth and Electronic Warfare**

➔ **EU needs to assess its rules for dual use collaborations**

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More vertical integration

Automaker	Semi-Supplier / -Partner
Stellantis	Infineon
BMW	Onsemi
Volkswagen	Onsemi
Volvo	ROHM
Renault	STMicroelectronics
Mercedes	Wolfspeed
Porsche	STMicroelectronics
GM	Wolfspeed
Tesla	STMicroelectronics, Wolfspeed, Infineon
Hyundai / Kia	Infineon, Onsemi
BYD	In-house (BYD Semiconductor), Hichen Electric (HIITIO)
Geely	ROHM
SAIC Motor	Infineon via BOSCH / UAES (JV Bosch & SAIC)
Great Wall Motor	ROHM
Xpeng	Inventchip, AccoPower, StarPower
Nio	United Nova Technology (UNT)
Dongfeng	Zhixin Semiconductor (Dongfeng / CRRC JV)
Toyota	Denso (in house), ROHM

Source: internet research

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SiC & GaN Powder sources inl. recycling

- 70% of all global e-waste ends up in the China
- China sources almost 100 % of its SiC in China
- GaN considered strategic in « Third generation semiconductor » initiative
- Companies like Sanan or Tianyue receive direct support from central and local government
- GaN industry all over China
- Europe needs to become specialist in recycling

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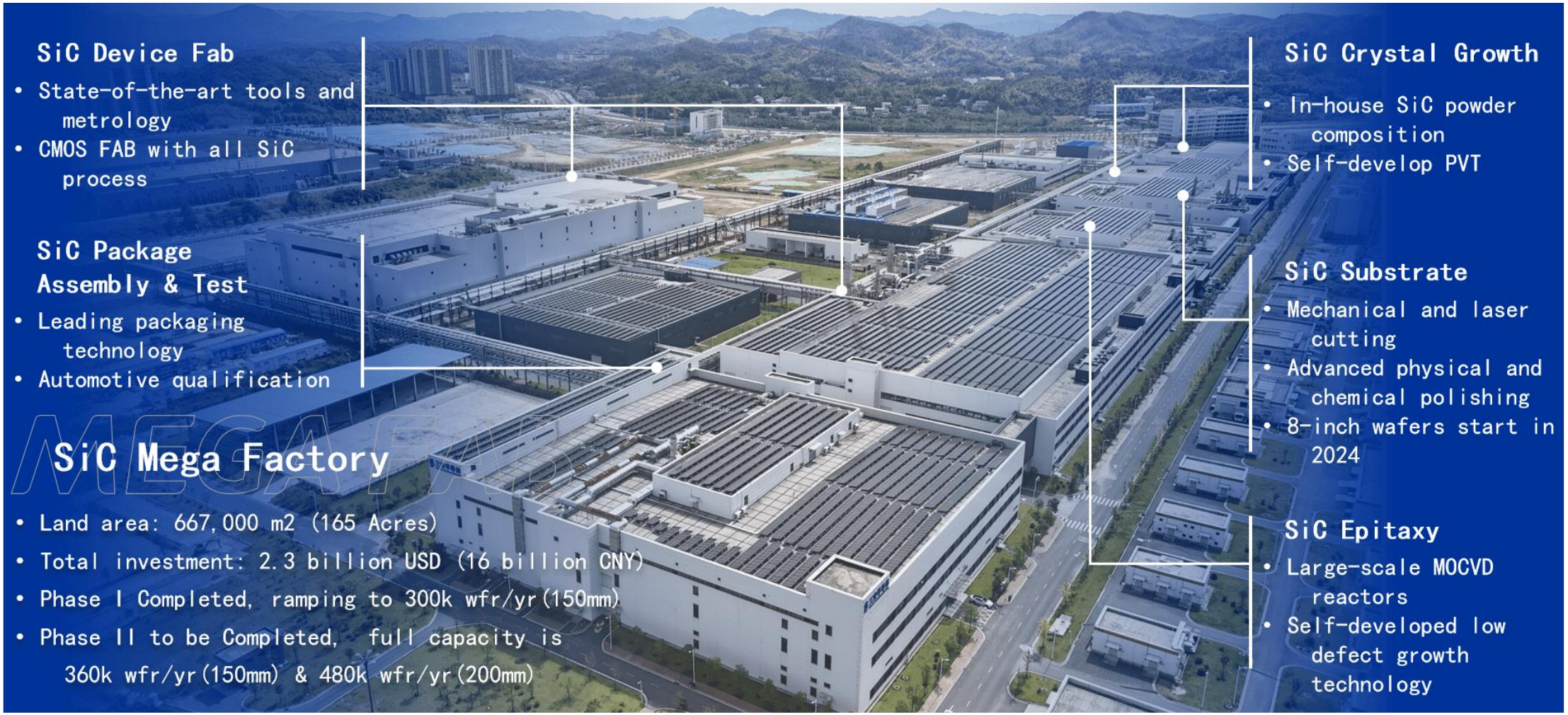
Sanan


SiC Device Fab
• State-of-the-art tools and metrology
• CMOS FAB with all SiC process
SiC Package Assembly & Test
• Leading packaging technology
• Automotive qualification
SiC Mega Factory
• Land area: 667,000 m2 (165 Acres)
• Total investment: 2.3 billion USD (16 billion CNY)
• Phase I Completed, ramping to 300k wfr/yr(150mm)
• Phase II to be Completed, full capacity is 360k wfr/yr(150mm) & 480k wfr/yr(200mm)
SiC Crystal Growth
• In-house SiC powder composition
• Self-develop PVT
SiC Substrate
• Mechanical and laser cutting
• Advanced physical and chemical polishing
• 8-inch wafers start in 2024
SiC Epitaxy
• Large-scale MOCVD reactors
• Self-developed low defect growth technology

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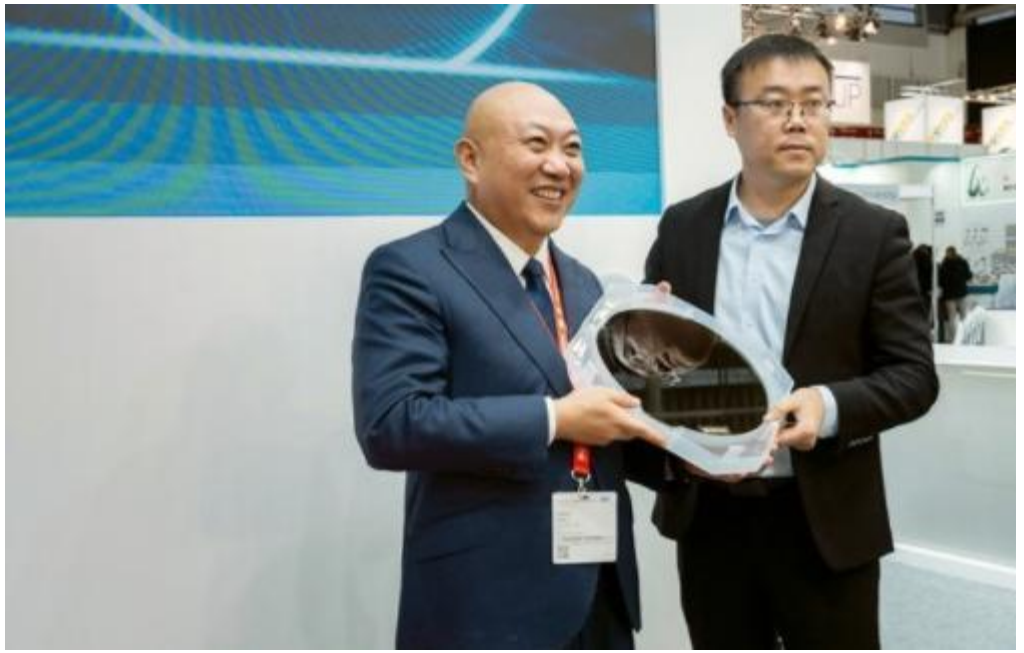
SiC Wafer Suppliers

- SICC
  - https://www.sicc.cc/en
- TANKBLUE
  - https://en.tankeblue.com/
- CETC 46 (military)
- EPI World
- Hebei Synlight

- Further info:
  - https://www.xkh-semitech.com/



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GaN

- Cooperation Innoscience – ST (4/25)
  - Common development
  - Mutual use of production capacities in
- 1100 employees
- Products up to 1200 V available
- Normally off (e-mode)
- Lawsuit against EPC won
- Lawsuit against Infineon ongoing
- Price offerings half of what usually has been asked for by GaN vendors

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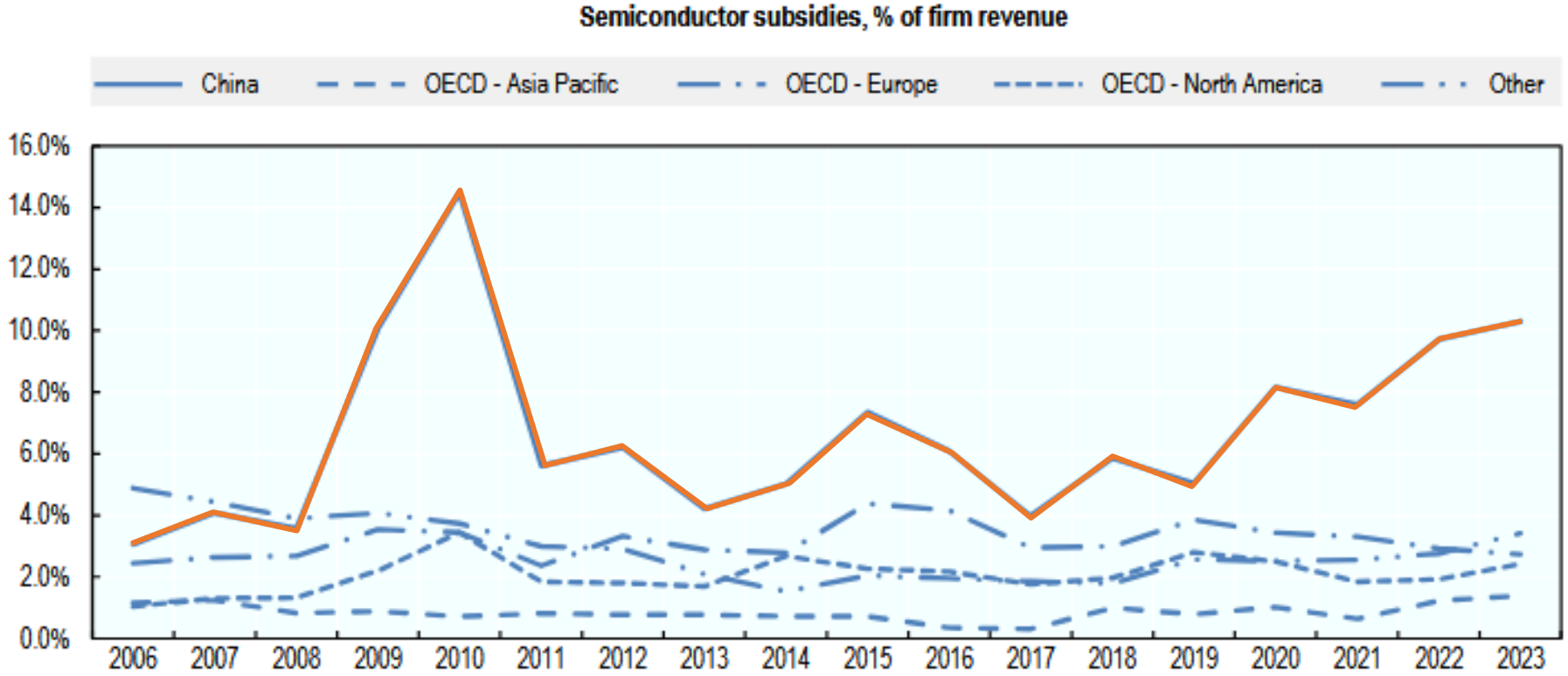
China Subsidies

Figure 2. Semiconductor firms based in China continue to receive relatively larger subsidies



Note: This graph averages subsidies by country or region, using firms' revenue as weights. More information on the OECD MAGIC database can be found in OECD (2025).
Source: OECD MAGIC database.

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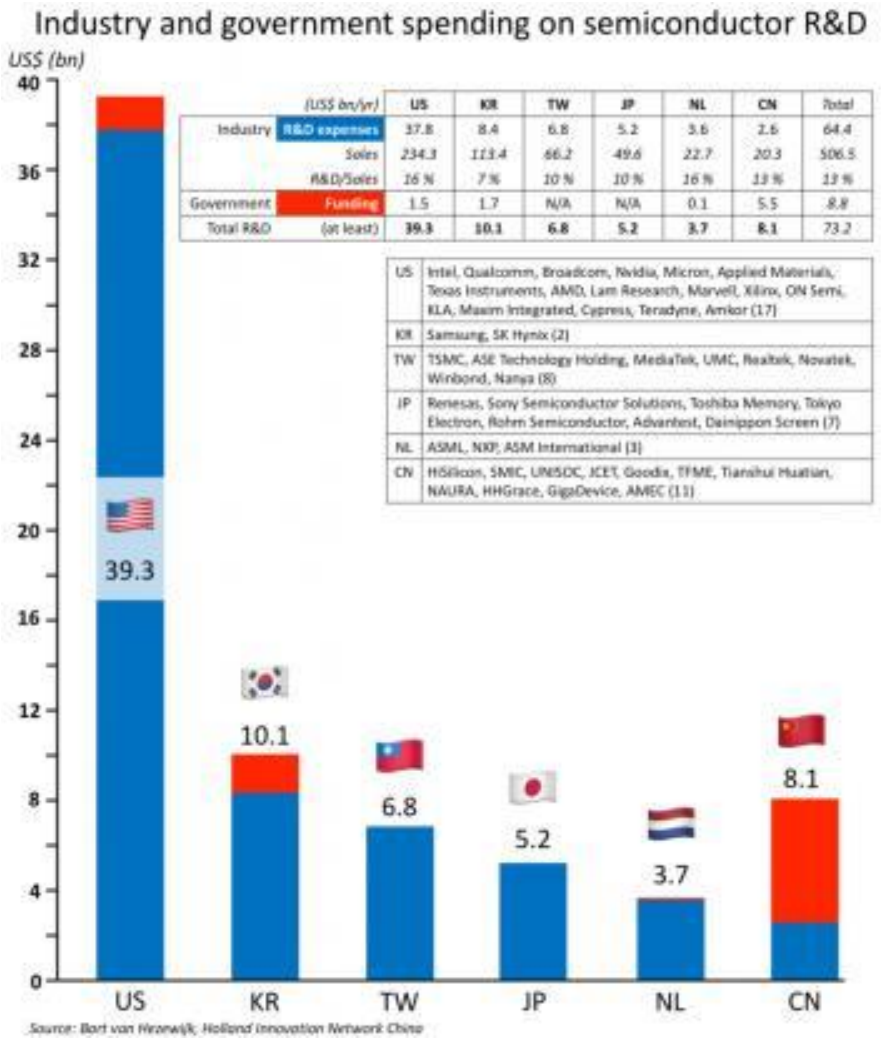
Semiconductor investments in the world



(US$ bn/yr)		US	KR	TW	JP	NL	CN	Total
Industry	R&D expenses	37.8	8.4	6.8	5.2	3.6	2.6	64.4
	Sales	234.3	113.4	66.2	49.6	22.7	20.3	506.5
	R&D/Sales	16 %	7 %	10 %	10 %	16 %	13 %	13 %
Government	Funding	1.5	1.7	N/A	N/A	0.1	5.5	8.8
Total R&D	(at least)	**39.3**	**10.1**	**6.8**	**5.2**	**3.7**	**8.1**	73.2

US	Intel, Qualcomm, Broadcom, Nvidia, Micron, Applied Materials, Texas Instruments, AMD, Lam Research, Marvell, Xilinx, ON Semi, KLA, Maxim Integrated, Cypress, Teradyne, Amkor (17)
KR	Samsung, SK Hynix (2)
TW	TSMC, ASE Technology Holding, MediaTek, UMC, Realtek, Novatek, Winbond, Nanya (8)
JP	Renesas, Sony Semiconductor Solutions, Toshiba Memory, Tokyo Electron, Rohm Semiconductor, Advantest, Dainippon Screen (7)
NL	ASML, NXP, ASM International (3)
CN	HiSilicon, SMIC, UNISOC, JCET, Goodix, TFME, Tianshui Huatian, NAURA, HHGrace, GigaDevice, AMEC (11)

Europe Chips Act

Leverage 43 bn€

.. ASML
.. ST
.. Infineon
.. ESMC
.. Intel
.. BOSCH
.. CEA, IMEC, FHG
...

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V2G in China

- V2G charging identified as important technology in 2024 to promote renewable energies and benefit from EV fleet
- Launch of pilot projects on V2G in 9 cities + Beijing
  (Shanghai, Shenzhen, Changzhou, Hefei, Huaibei, Guangzhou, Haikou, Chongqing, Kunming)
- Business case(s) are not clear due to fragmentation of contractual environments
- Interconnection between regions a challenge
- Stationary chargers need upgrades to be V2G compatible (costly)
- Europe and US slightly ahead in terms of development

➔ **Chinese market offers opportunities**

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Standards

South China Morning Post

- Regulations are key (not a pain)
- Support of China 2025 & “Standards 2035” strategy
  - Independence of China
  - Dominance of the world
- National and international standardization participation
- National: little preparation time can be observed
- Examples:
  - Test protocols
  - Specific certificates (CCC, SELO) needed to be allowed to enter market
  - Company standards for SiC modules at BYD, CRRC, State Grid; only local suppliers with correct dimensions and tolerances allowed
  - EV Batteries must not burn (from July 1st 2026 onwards)

  = technocracy hurdle

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ARCHIMEDES example

- Topic: mobility & power electronics
- Issue: new technologies AND new use cases
  - bidirectionnal chargers for EVs with GaN or SiC
  - Incoming inspection of components:
    - How & what to test ?
    - How to optimise components for use cases in different markets ?
  - Car: standard quality + extended lifetime + new architectures
  - Plane: standard quality + high altitude + new architectures
- Solution: cooperation throughout supply chain including specialized R&D labs (50 partners)
- Dissemination e.g. through link to SEMI Europe and in further workshops

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Conclusion

- Industry is dramatically changing
- Semiconductors and software are crucial for automotive in the next years
- Value share of semiconductors and software e.g. in cars will reach 30 % of the car value
- Development of semiconductors is expensive and needs markets for amortisation
- **US and China** are investing heavily into the race as technology
- Huge investments create overcapacities, competition in China and ultimately also in Europe / price pressure
- Ferocious competition in China
    - Consolidation expected in China
    - Competition will swap over to Europe
- China has key industries to amortise
  (automotive, communication, energy transition)
- Europe has not enough industry wide strategic exchange (like KET initiative)

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Recommendations

- Make sure everyone understands the
  - Challenge of semiconductors and software in cars
  - Mechanisms of costs and amortisation
  - The industrial revolution driven by China and by Tech Giants
- European Industries need to cooperate stronger cross value chain to share costs, develop markets and common resilience
- EU rules must allow response to w/w market pressure
- Look deeply into China and copy best practices
- Abandon separation in Europe between military and civil R&D
- More strategic cooperation / consolidation between European companies needed

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MERCI

Jochen Langheim

Frederic Hannoyer

Nicola Staiano

Patrick Blouet

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Ad-on

SiC Technology Progress Comparison (2025)

Aspect	USA	China	Europe (EU + UK)
Strategic Focus	- EVs, defense, power electronics	- National SiC self-sufficiency	- Focus on green energy, e-mobility
	- Reshoring advanced semiconductors	- Competitive scaling and cost advantage	- Coordinated EU-wide development
Key Companies / Institutions	Wolfspeed, Bosch USA, University of Arkansas	Silan Microelectronics, Sanan Optoelectronics, United Nova Technology	STMicroelectronics, Infineon, Bosch Germany
Government Investment	- CHIPS Act funding	- Major state support for fab construction	- €2B from Italian govt for ST fab (EU Chips Act)
	- $750M for Wolfspeed	- Joint ventures encouraged (e.g., ST-Sanan)	- National subsidies and EU-level partnerships
	- $225M for Bosch CA plant	- National SiC roadmap development	
Collaboration & R&D	- Strong industry-academic links (e.g., Univ. of Arkansas)	- JV with ST and Sanan	- Cross-European R&D programs
	- Long-term expansion plans	- UNT and Silan heavily state-backed	- Partnerships (e.g., Infineon & SK Siltron)
Major Projects	- Wolfspeed 8” fab in NY (operational)	- Silan’s 8” fab in Xiamen (trial prod. Q1 2026)	- STMicro: €5B 200 mm fab in Catania (2026 start)
	- $5B SiC crystal plant in NC (opens June 2025)	- ST & Sanan 8” fab in Chongqing (prod. starts Feb 2025)	- Infineon: 200 mm prod. started in Austria (2025)
	- Bosch 8” fab in CA (opens 2026)	- UNT 8” fab in Shaoxing (mass prod. in 2025)	- Bosch: Reutlingen site with 6” & 8” SiC wafers
	- Univ. of Arkansas fab (opens 2025)		
Production Scale	- Wolfspeed: Leading 8” wafer fab globally	- Rapid ramp-up in multiple 8” fabs; 12" under dev.	- ST aims for full capacity by 2033 with 8" in Catania
	- Bosch to add 40% of US capacity	- Ambitious chip production targets	- Infineon running 200 mm production lines
Production Timeline	2023–2026 (operational fabs expanding)	2025–2026 (mass production begins across key projects)	2025–2026 (Infineon operational, ST ramping up)

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GaN Technology Progress Comparison (2025)

Aspect	USA	China	Europe
Strategic Focus	Defense (radar), 5G/6G, data centers, EVs	Consumer electronics, EVs, 5G, renewables	Energy efficiency, e-mobility, AI & renewables
Key Companies / Institutions	Transphorm, GaN Systems (Infineon), Northrop Grumman, Raytheon	Innoscience+ST, Sanan IC, UNT, GaN Systems (Shenzhen)	Infineon, AIXTRON, GaN Systems (EU), STMicroelectronics
Government Support	CHIPS Act support DARPA GaN R&D grants	"Made in China 2025" Local gov't cluster support (e.g., Shenzhen)	EU Chips Act subsidies National grants & R&D support
Major Projects	Transphorm SiP GaN devices Northrop Grumman $236.9M GaN radar Raytheon-GF GaN-on-Si for 5G/6G	Innoscience Zhuhai & Suzhou fabs (8") Sanan IC fabs in Xiamen & Changsha	Infineon GaN for EVs & servers AIXTRON €100M GaN R&D center (300 mm)
Production Scale	RF apps GaN Systems scaling for EVs & data centers	Innoscience runs world's largest GaN fab Sanan IC scaling multiple GaN lines	Infineon active in Austria & Germany AIXTRON scaling to 300 mm wafers
Production Timeline	Ongoing production & R&D expansion	Scaling production through 2025	Infineon producing in 2025 AIXTRON R&D center operational

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