


Halbleiter und Geopolitik

ChinaForum, Zürich – 04/04/2024

Über uns.



unabhängig | überparteilich | gemeinnützig

Tech-Policy **Think Tank**

**Wir sind zu 98% finanziert durch
gemeinnützige Stiftungen und
öffentliche Mittel.**

stiftung-nv.de/en/financial-transparency

Woran wir arbeiten.

Chips und Geopolitik

- ❑ **Analyse** der globalen Halbleiter-Wertschöpfungskette
- ❑ **Identifizieren** und Bewerten von Abhängigkeiten
- ❑ **Entwicklung** politischer Handlungsempfehlungen zur Stärkung des europäischen Ökosystems.

15+ Publikationen seit 2020.

<https://bit.ly/SNVChips>

Unsere Papiere...

Europas Chip-Ökosystem

June 2022 - Jan-Peter Kleinhans, Julia Hess, Wiebke Denkmann

Governments' role in the global semiconductor value chain #1

Analysis of the EU Chips Act: Challenges of government monitoring of the supply chain

Stiftung
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Verantwortung

Think Tank at the Intersection of Technology and Society

September 2022 - Jan-Peter Kleinhans, Julia Hess

Governments' role in the global semiconductor value chain #3

Analysis of the EU Chips Act: The Crisis Response Toolbox

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Think Tank at the Intersection of Technology and Society

July 2023 - Julia Hess, Jan-Peter Kleinhans

Governments' role in the global semiconductor value chain #2

Recommendations for the EU Chips Act: Long-term government value chain mapping

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Verantwortung

Think Tank at the Intersection of Technology and Society

April 2021 - Jan-Peter Kleinhans

The lack of semiconductor manufacturing in Europe

Why the 2nm fab is a bad investment.

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Think Tank at the Intersection of Technology and Society

Die globale Wertschöpfungskette

November 2021 - Jan-Peter Kleinhans & Julia Hess

Understanding the global chip shortages

Why and how the semiconductor value chain was disrupted

Stiftung
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Think Tank at the Intersection of Technology and Society

October 2020 - Jan-Peter Kleinhans & Dr. Nurzat Baisakova

The global semiconductor value chain

A technology primer for policy makers

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October 2023 - Julia Hess and Jan-Peter Kleinhans

Chip Diplomacy

Analysis of technology partnerships

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Verantwortung

Think Tank at the Intersection of Technology and Society

April 2023 - Julia Hess, Wiebke Denkmann, Jan-Peter Kleinhans, Pegah Maham

Who is funding the chips of the future?

Analysis of global semiconductor startup funding activities

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Think Tank at the Intersection of Technology and Society

Chinas Wettbewerbsfähigkeit

December 2021 - Jan-Peter Kleinhans & John Lee

China's rise in semiconductors and Europe

Recommendations for policy makers

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MERICs
MERICS Institute for China Studies

testimony before the
U.S.-China Economic and Security Review Commission

Hearing on
"U.S.-China Competition in Global 'Supply Chains'"
June 8, 2022

Jan-Peter Kleinhans
Director of Technology and Geopolitics
Stiftung Neue Verantwortung e.V.
Berlin, Germany

Presented by the
European Union
EU CHIPS ACT
COMMISSION

China Semiconductor Observatory
Baseline Report 2022

Jan-Peter Kleinhans, Director of Technology and Geopolitics, Stiftung Neue Verantwortung e.V.
Julia Hess, Director of Geopolitics

INTRODUCTION
EXECUTIVE SUMMARY
China's sector-wide front-end manufacturing capacity
China's back-end manufacturing capacity
China's chip design ecosystem
CONCLUSIONS
China's leading edge front-end manufacturing
China's electronic design automation (EDA) tool suppliers
China's semiconductor manufacturing equipment (SMTE)

June 2021 - John Lee & Jan-Peter Kleinhans

Mapping China's semiconductor ecosystem in global context

Strategic Dimensions and Conclusions

Stiftung
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Verantwortung

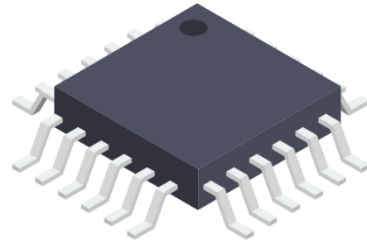
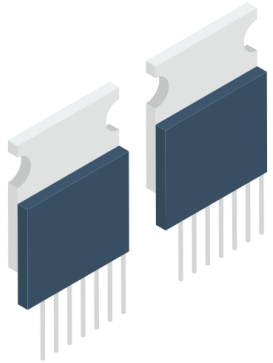
MERICs
MERICS Institute for China Studies

Ziel für die nächsten 40 Minuten...

- ① Überblick zur globalen Halbleiter-Wertschöpfungskette
- ② Geopolitische Relevanz von Chips: US-China Technologie-Rivalität
- ③ Auswirkungen auf Europa und DACH

① Überblick zur globalen Halbleiter-Wertschöpfungskette

Chip ist nicht gleich Chips...



Leistungselektronik

Infineon (DE)

STMicroelectronics (FR/IT)

Onsemi (US)

...

Microcontroller im Auto

Infineon (DE)

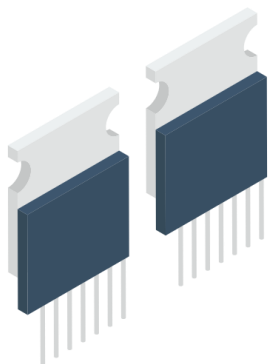
NXP (NL)

STMicroelectronics (FR/IT)

...



Chip ist nicht gleich Chips...



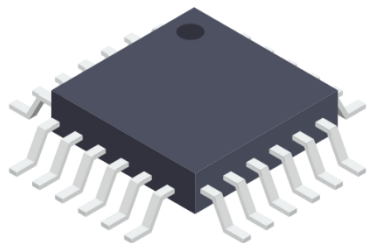
Leistungselektronik

Infineon (DE)

STMicroelectronics (FR/IT)

Onsemi (US)

...



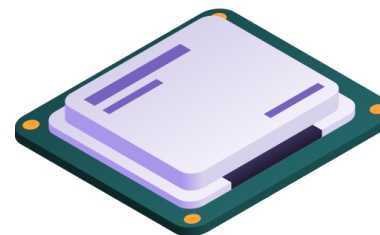
Microcontroller im Auto

Infineon (DE)

NXP (NL)

STMicroelectronics (FR/IT)

...



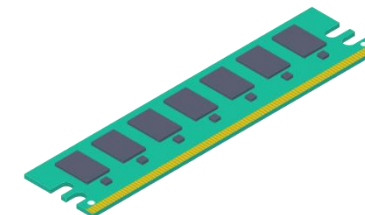
Cloud KI Beschleuniger

Nvidia (US)

AMD (US)

Intel/Google/Amazon (US)

...



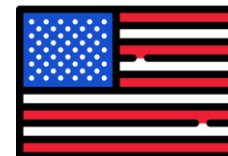
Speicherchips

Samsung (KR)

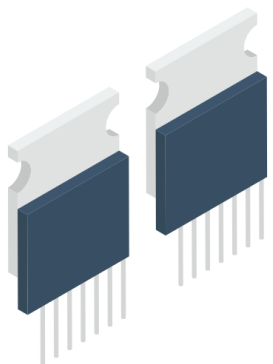
SK Hynix (KR)

Micron (US)

...



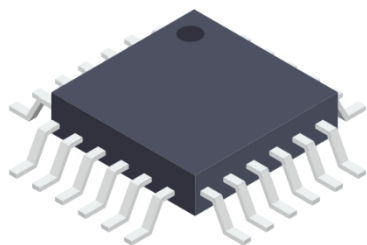
Chip ist nicht gleich Chips...



Leistungselektronik

Infineon (DE)
STMicroelectronics (FR/IT)
Onsemi (US)

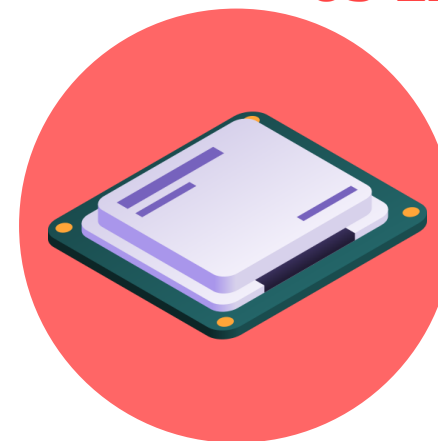
...



Microcontroller im Auto

Infineon (DE)
NXP (NL)
STMicroelectronics (FR/IT)

...

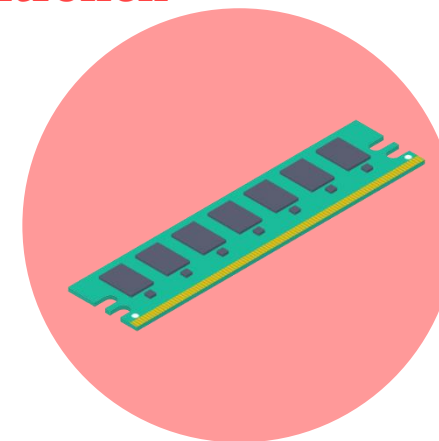
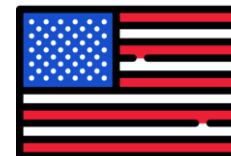


US-Exportkontrollen

Cloud KI Beschleuniger

Nvidia (US)
AMD (US)
Intel (US)

...



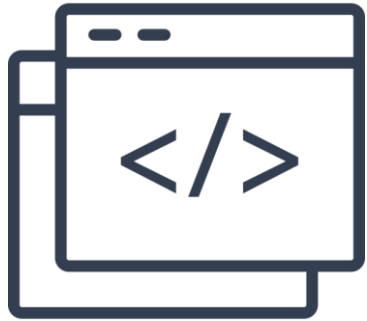
Speicherchips

Samsung (KR)
SK Hynix (KR)
Micron (US)

...



Jeder Chip durchläuft 3 Produktionsschritte.

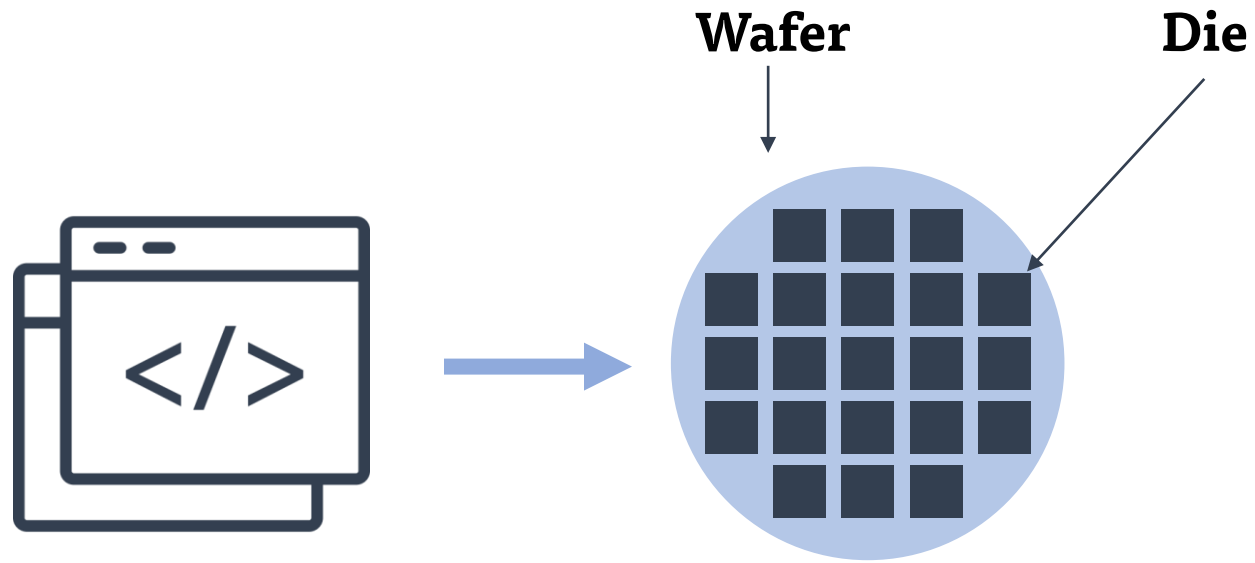


Chip Design

>40 Schritte

Spezialisierte Software

Jeder Chip durchläuft 3 Produktionsschritte.



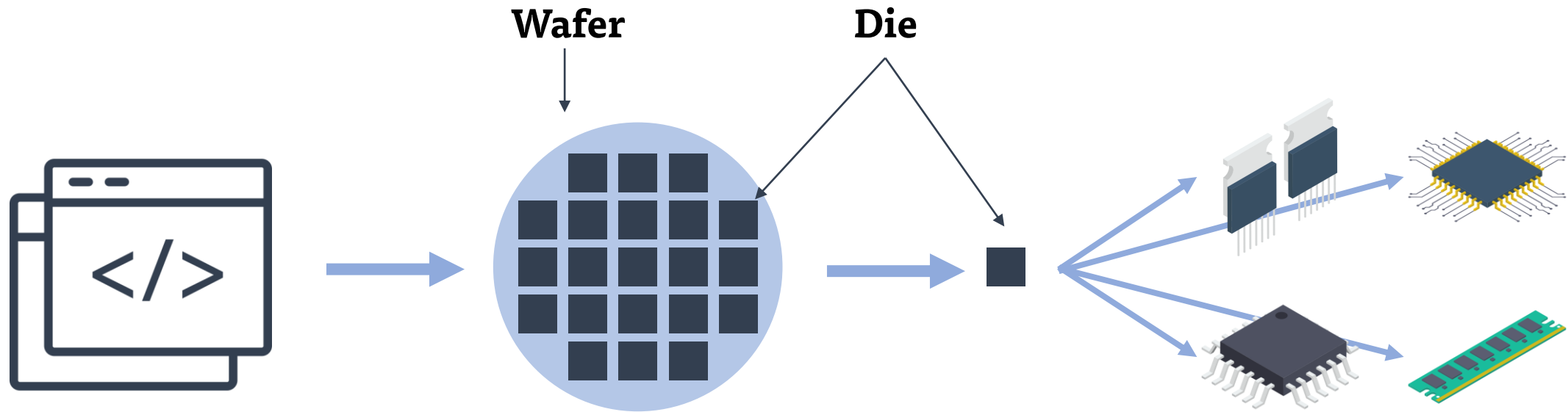
Chip Design

>40 Schritte
Spezialisierte Software

Wafer-Fabrication (Front-End)

>12 Wochen
50+ unterschiedliche Maschinen
>300 Chemikalien
>1000 Prozess-Schritte

Jeder Chip durchläuft 3 Produktionsschritte.



Chip Design

>40 Schritte
Spezialisierte Software

Wafer-Fabrication (Front-End)

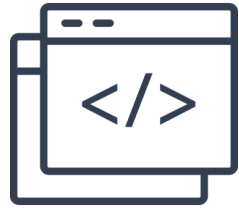
>12 Wochen
50+ unterschiedliche Maschinen
>300 Chemikalien
>1000 Prozess-Schritte

Packaging (Back-End)

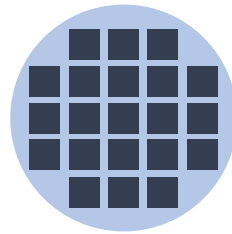
Assembly, Test, Packaging (ATP)
>4 Wochen
20+ unterschiedliche Maschinen
90% in Asien

Die Art des Chips bestimmt das Geschäftsmodell.

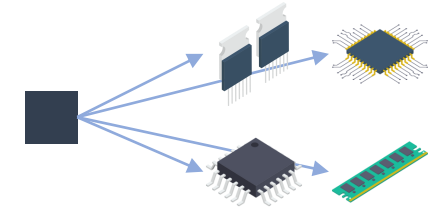
Chip Design



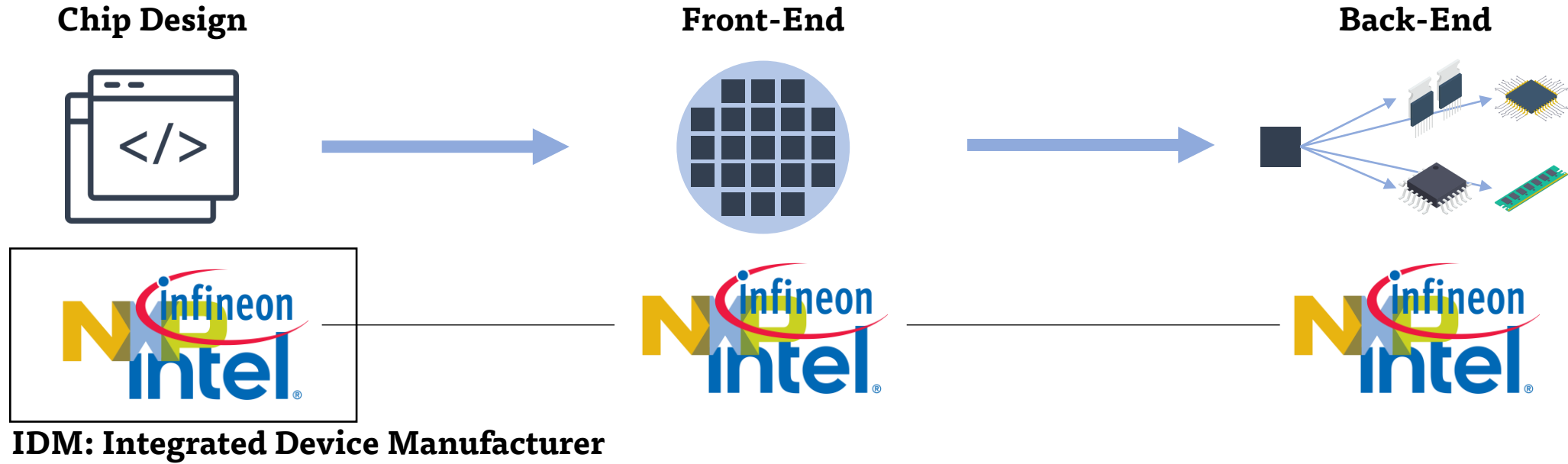
Front-End



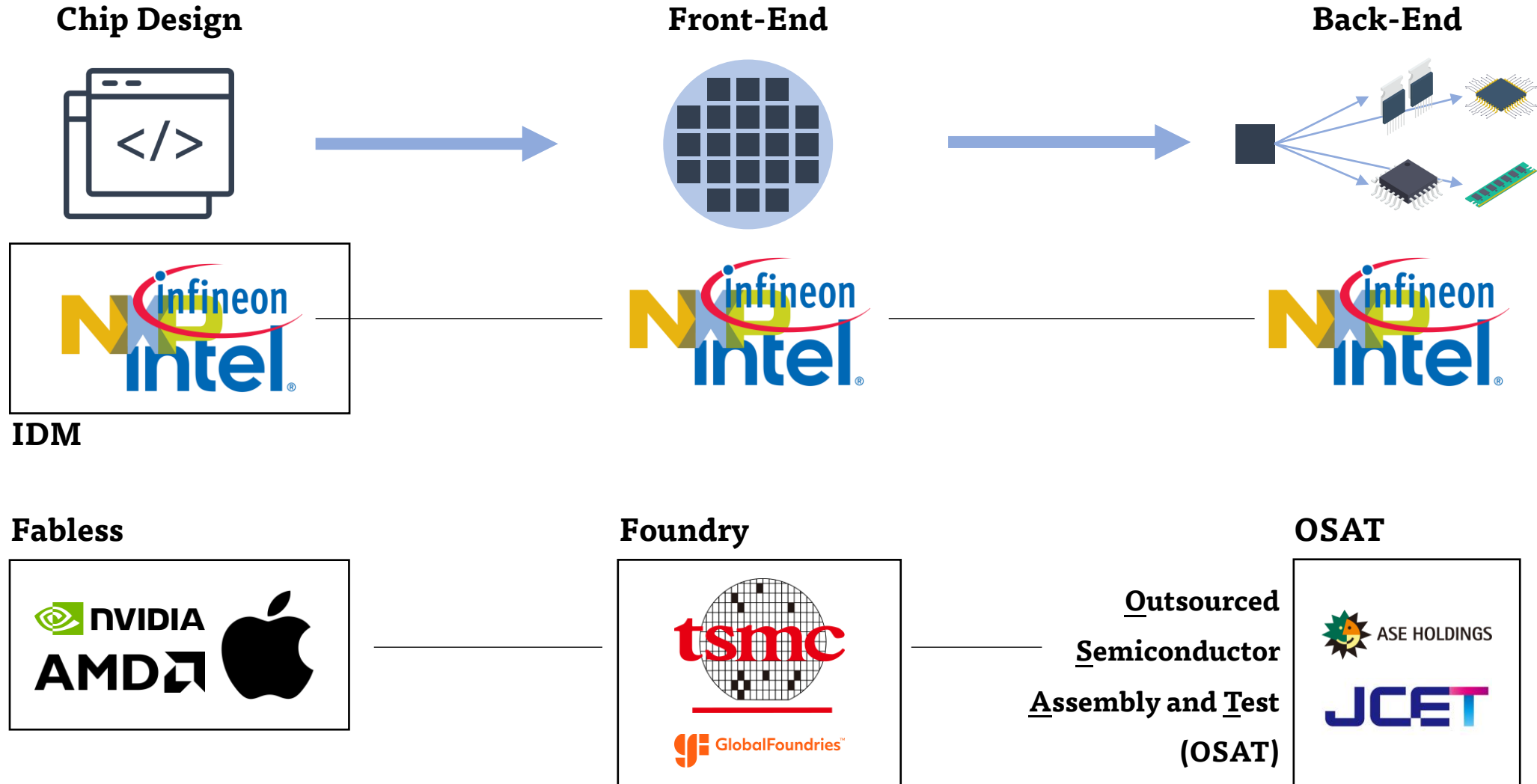
Back-End



Die Art des Chips bestimmt das Geschäftsmodell.

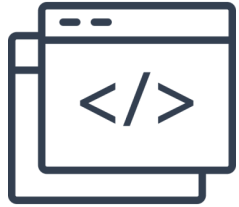


Unternehmen spezialisieren sich auf einen Prozess-Schritt

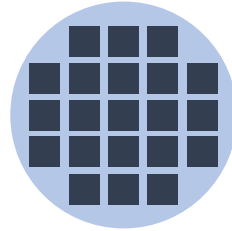


Die Realität ist deutlich komplexer.

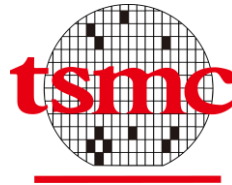
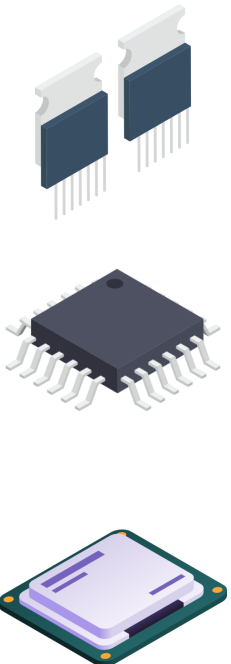
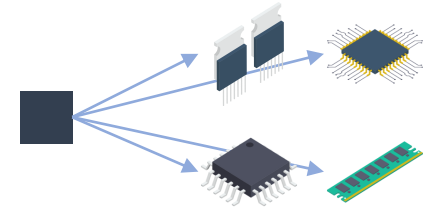
Chip Design



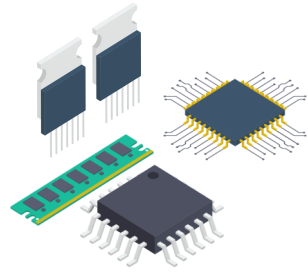
Front-End



Back-End



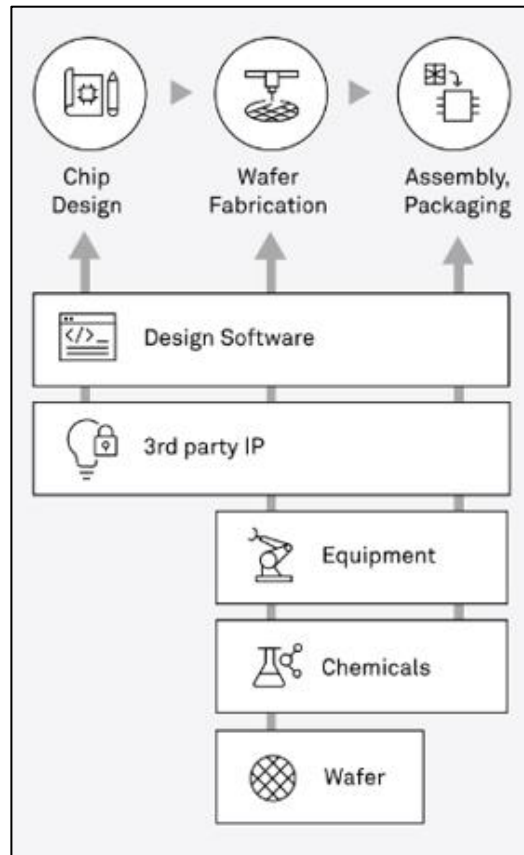
Ergebnis...



Fertigungsverfahren, Lieferkette und Geschäftsmodell unterscheiden sich je Art des Chips.

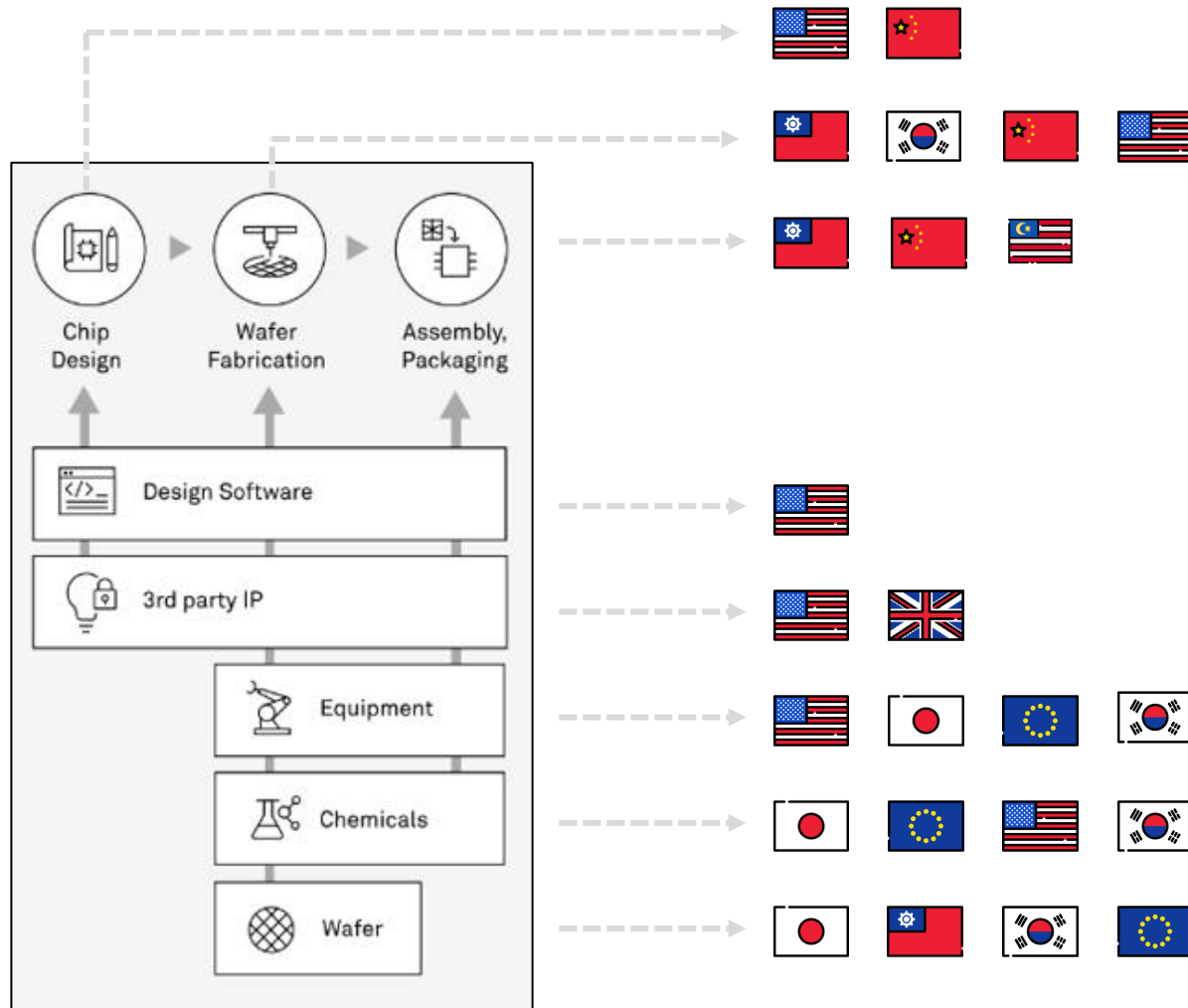
>> Komplexe Wertschöpfungsnetzwerke

Die Vogelperspektive...



- Hohe Arbeitsteilung**
- Transnational**
- Hohe Eintrittsbarrieren**
- Lange Produktionszyklen**
- Starke Zulieferer-Abhängigkeit**

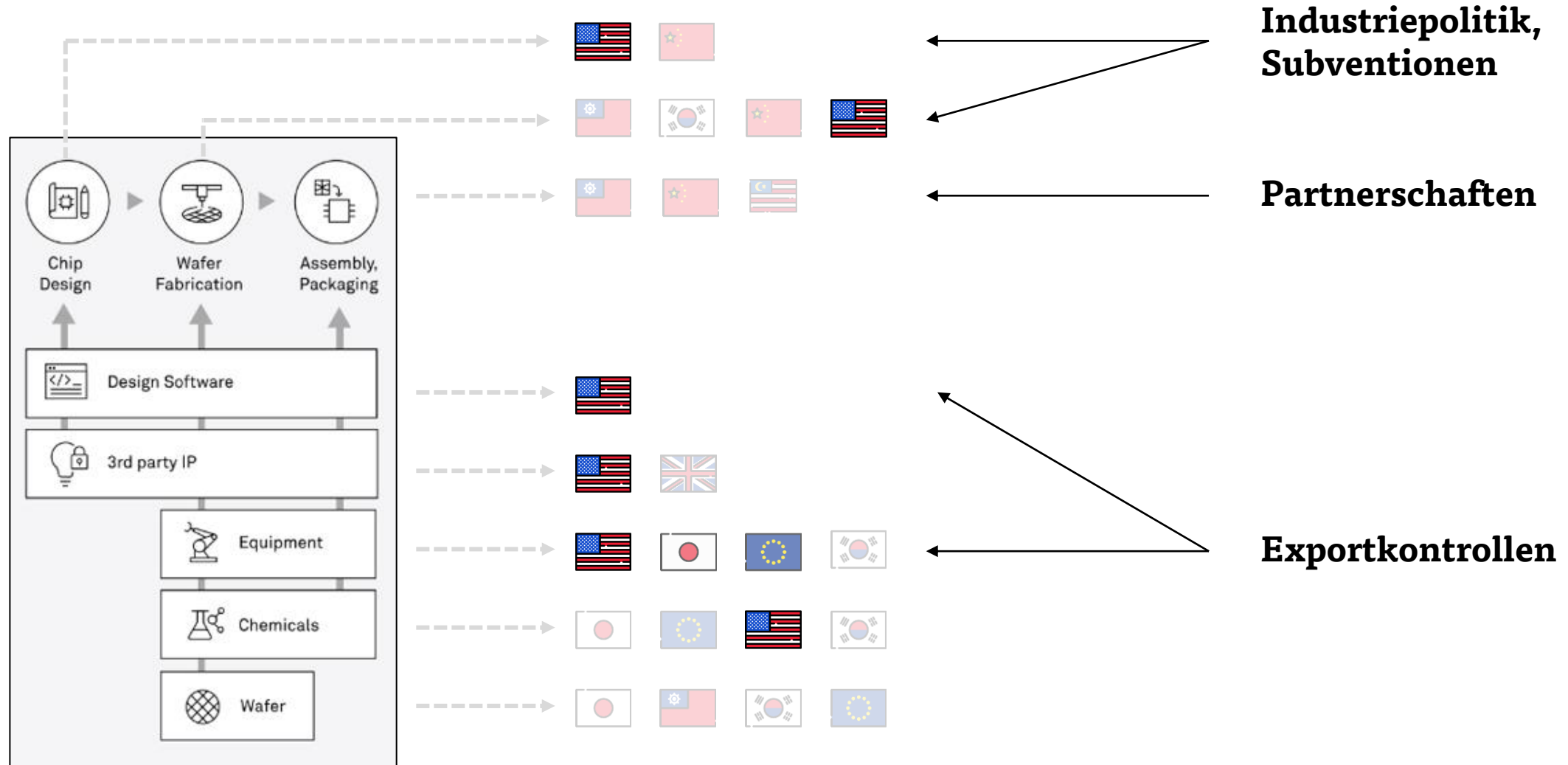
Die Vogelperspektive...



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- Transnational
- Hohe Eintrittsbarrieren
- Lange Produktionszyklen
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② Geopolitische Relevanz von Chips: US-China Technologie-Rivalität

Ziel der US-Regierung: technologische Überlegenheit + Reduzierung von Abhängigkeiten



Strategie der US-Regierung: Protect, Promote, Partner

1. Exportkontrollen

TABLE 2
October 17 BIS parameters applied to high-performance chips

Cloud AI accelerator	TPP	PD	ECCN 3A090.a (any chip)		ECCN 3A090.b (chips designed or marketed for data centers)	
			≥4800 TPP or ≥1600 TPP AND ≥5.92 PD	≥1600 TPP AND ≥5.92 PD	2400 ≥ TPP ≤ 4800 AND 1.6 ≥ PD ≤ 5.92	≥ 1600 TPP AND 3.2 ≥ PD ≤ 5.92
Nvidia H100	15,832	19.45	Yes	Yes	Yes	Yes
Nvidia A100	4,992	6.04	Yes	Yes	Yes	Yes
Nvidia A800	4,992	6.04	Yes	Yes	Yes	Yes
Nvidia V100	2,000	2.45	No	No	No	No
Nvidia L40	2,896	4.76	No	No	Yes	Yes
Google TPUv4	4,400	7.81	Yes	Yes	Yes	Yes
Google TPUv3	1,968	3.04	No	No	No	No
AMD MI250	5,792	3.76	Yes	No	Yes	Yes
Biren BR100	16,384	15.26	Yes	Yes	Yes	Yes

TABLE 3
A comparison of US and Dutch lithography controls

ASML DUV immersion equipment	Released	NA	WPH	DCO/SMO	US controls: DCO ≤1.5nm or >1.5 to ≤2.4nm	NL controls: DCO ≤1.5nm
NXT:1965Ci	2013	1.35	250	≤2.5nm	Not controlled	Not controlled
NXT:1970Ci	2013	1.35	250	≤2.0nm	Controlled	Not controlled
NXT:1980Di	2015	1.35	275	≤1.6nm	Controlled	Not controlled
NXT:2000i	2018	1.35	275	≤1.4nm	Controlled	Controlled
NXT:2050i	2020	1.35	295	≤1.0nm	Controlled	Controlled
NXT:2100i	2022	1.35	295	≤0.9nm	Controlled	Controlled

NA = Numerical Aperture; WPH = wafers per hour; DCO = dedicated chuck overlay; SMO = single machine overlay

<https://rhg.com/research/all-in/>

2. Industriepolitik

WH.GOV

AUGUST 09, 2022

FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China

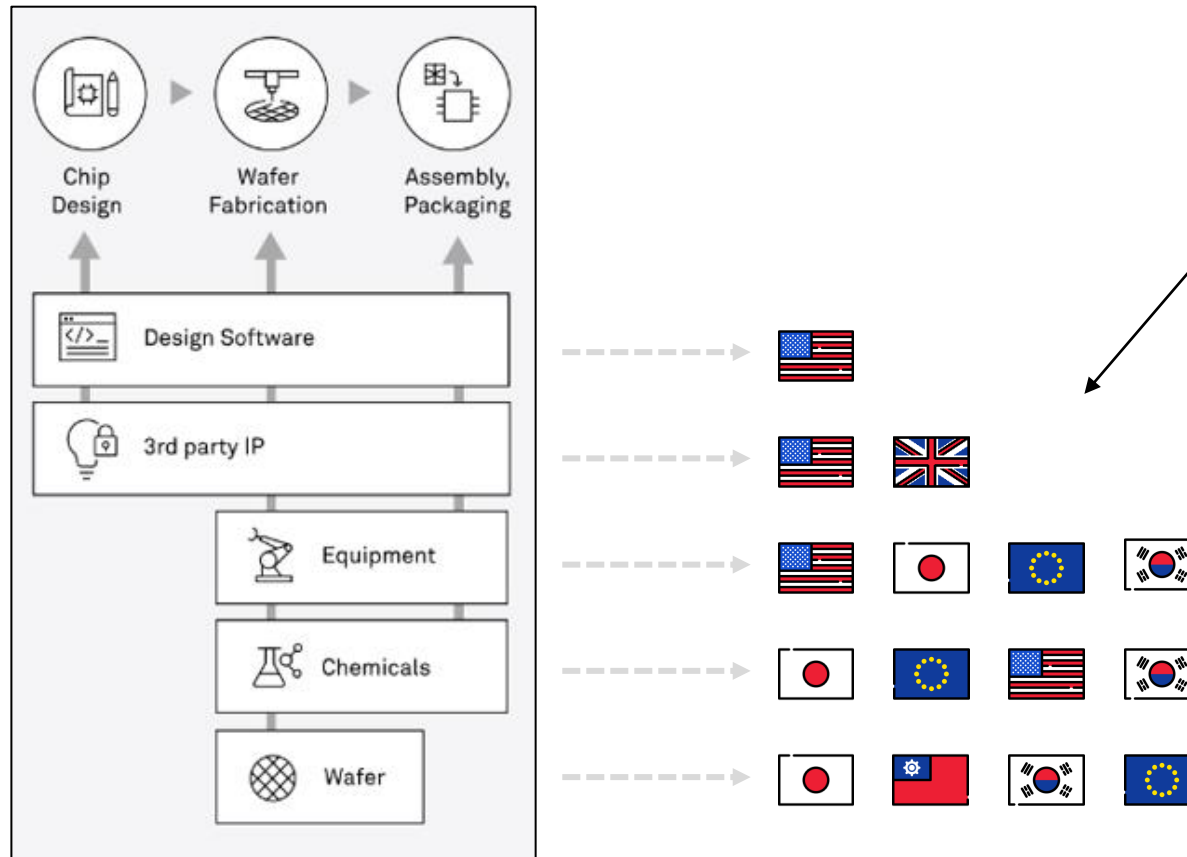
BRIEFING ROOM
STATEMENTS AND RELEASES

In President Biden's first year in office, the Biden-Harris Administration has implemented an industrial strategy to revitalize domestic manufacturing, create good-paying American jobs, strengthen American supply chains, and accelerate the industries of the future. These policies have spurred an historic recovery in manufacturing, adding 642,000 manufacturing jobs since 2021. Companies are

3. Partnerschaften

"...expand capacity in reliable partners where it cannot be reshored to the United States..."

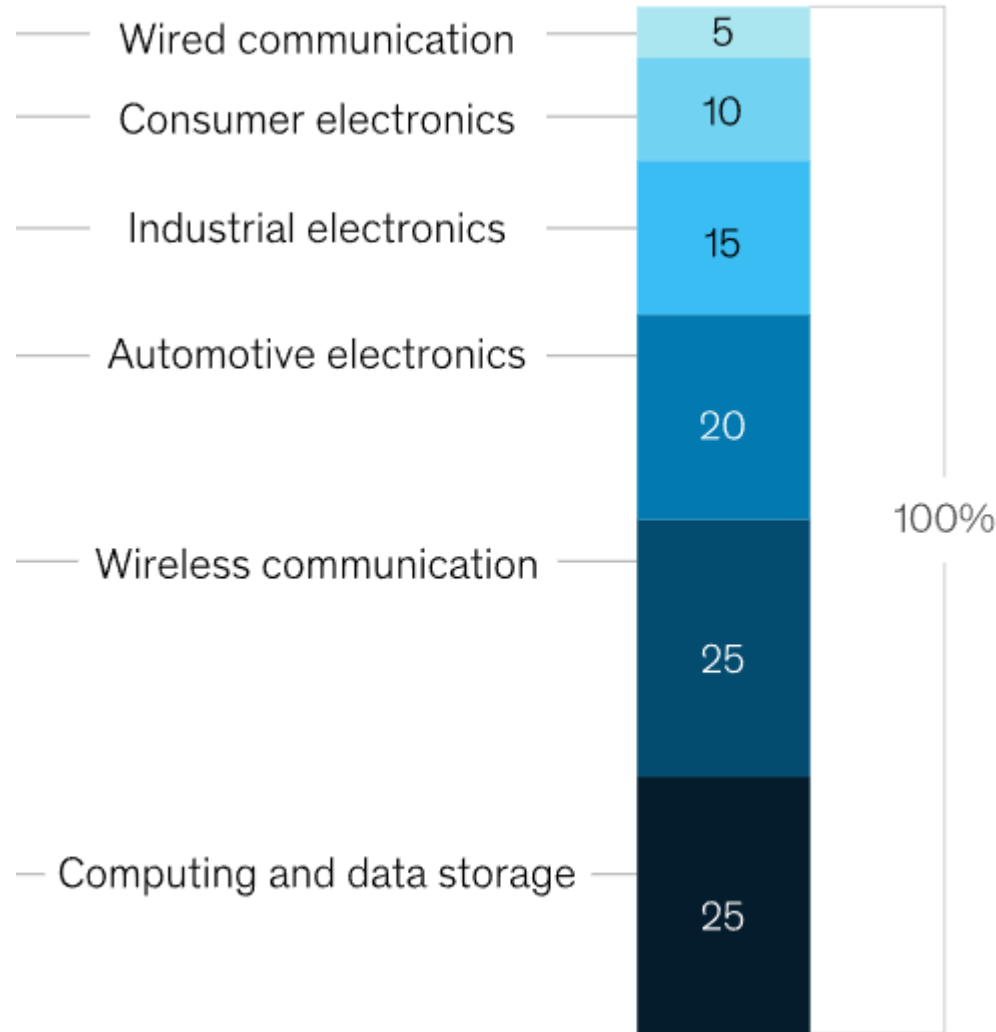
China schwächelt in Zulieferermärkten, noch...



Chinas Chip-Hersteller sind massiv von ausländischen Zulieferern abhängig:

- Fertigungsequipment
- Chemikalien
- Wafer
- Chip-Design Software

Chinas Reaktion: „Coordinated Development and Security“

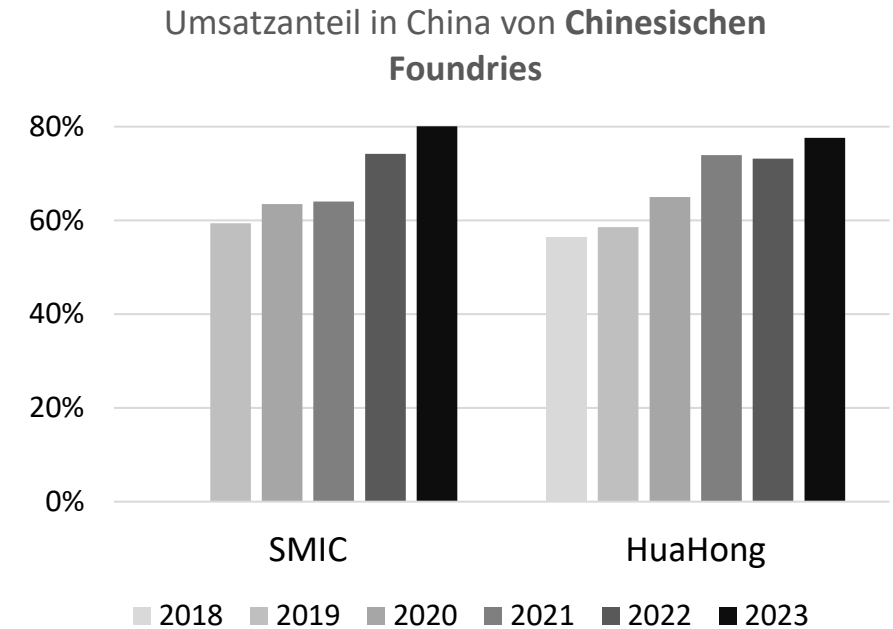
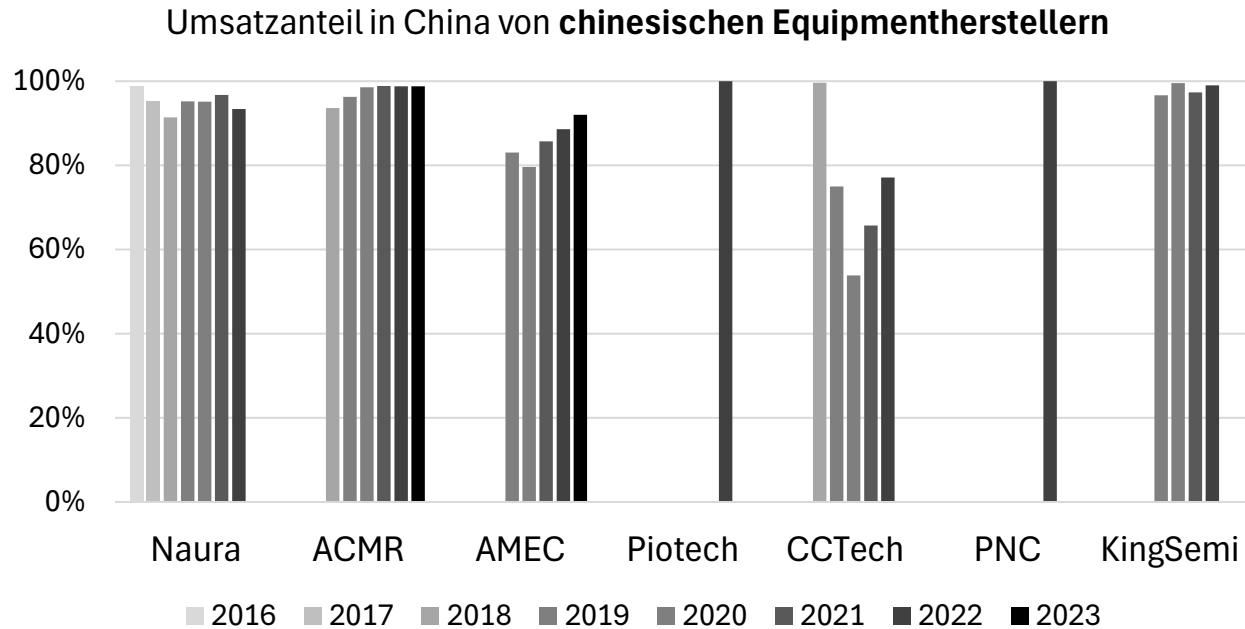


Consumer electronics: Xiaomi, HUAWEI
Automotive electronics: BYD, GEELY, NIO, HUAWEI
Wireless communication: oppo, mi xiaomi, HUAWEI, HONOR
Computing and data storage: Alibaba.com, Bai du 百度, Tencent, HUAWEI, Sugon, inspur, Lenovo



[McKinsey 2022](#)

Nachfrage im Binnenmarkt: Abnehmermärkte > Chip-Hersteller > Zulieferer



Ausblick: China wird mittel- bis langfristig wettbewerbsfähiger in Chip-Technologien

Nvidia SEC Filings 2024:

“**Our current competitors** include:

- **suppliers and licensors of hardware** and software for discrete and integrated GPUs, custom chips and other accelerated computing solutions, including solutions offered for AI, such as ... **Huawei**
- **large cloud services companies with internal teams designing hardware** and software that incorporate accelerated or AI computing functionality as part of their internal solutions or platforms, such as **Alibaba ... Baidu ... Huawei**
- **suppliers of Arm-based CPUs** and companies that incorporate hardware and software for CPUs as part of their internal solutions or platforms, such as ... **Huawei”**

Bloomberg, März 2024:

China Urges EV Makers to Buy Local Chips as US Clash Deepens

- Directive could hurt Nvidia, NXP and other EV chip suppliers
- Order is a response to US efforts to curb Chinese chip tech

Washington Post, September 2023

A UBS teardown of a **2022 BYD Seal** found **75% of its components were manufactured in-house** — a figure that’s double the global average. The Seal is almost wholly made in China, with around 10% or less of its parts coming from foreign suppliers, UBS estimated.

③ Auswirkungen auf Europa und DACH

Europa: viel Rhetorik, wenig Ressourcen

- **Economic Security Strategy der EU Kommission:** Risikoanalyse ohne gemeinsames Verständnis über Gefahr.
- **Risiko-Analyse „Advanced Semiconductors“:** ohne gemeinsame, einheitliche Definition, was „Advanced Semiconductors“ sind.
- **EU Chips Act:** Starker Fokus auf Subvention von Fertigung, Ziel „20% Produktionsanteil bis 2030“ ist sinnfrei.
- **Kaum neue Planstellen in Verwaltung (Brüssel, Berlin),** um Abhängigkeiten zu analysieren, zu bewerten und Policy Instrumente zu identifizieren.

Herausforderungen für Unternehmen in Europa

- **Wettbewerb in China** wird zunehmen, einschließlich **Präferenz für chinesische Zulieferer**.
- **US-Exportkontrollen** werden weiter vorangetrieben, einschließlich **extra-territoriale Anwendung** (siehe FDPR und 0% De Minimis).
- „**Small yard, high fence**“ **Argumentation der US-Regierung kaum noch haltbar**. Für chinesische Unternehmen werden ausländische Zulieferer zum **Business Continuity Risk** → **ökonomischer Anreiz für die Stärkung des einheimischen Ökosystems**.
- Aber: Europäische Chip-Hersteller (z.B. Automotive) sind **auf chinesischen Absatzmarkt angewiesen**.