CHIP WARS

Episode 2022

ONSHORING ON THE RISE

About me

Software Engineer from Berlin with roots in German hacker culture & wireless communities

Arrival in Taiwan by mid 2000s on discovery mission where the hardware is coming from

Hardware development & production from large commercial to open hardware projects

Roadmap

IC 101

2022

Outlook

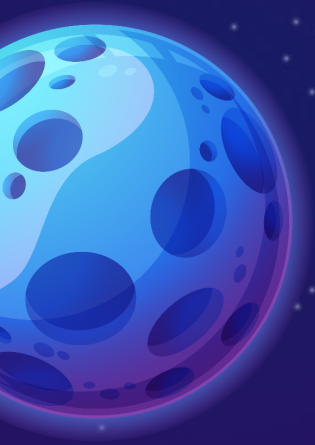
1.15 Trillion

(1 150 000 000 000)

global annual semiconductor production in 2021

148 ICs per person [population 7.75 billion]

IC production by region



EUROPE 10%

Earth is the third planet from the Sun

USA 20%

Despite being red, Mars is a cold place

ASIA 70%

(Taiwan, South Korea, China & Japan)

IC Foundries

Pure-Play

TSMC (~54% share)

Samsung (~17% share)

UMC (~7% share)

GlobalFoundries (~7% share)

SMIC (~5% share)

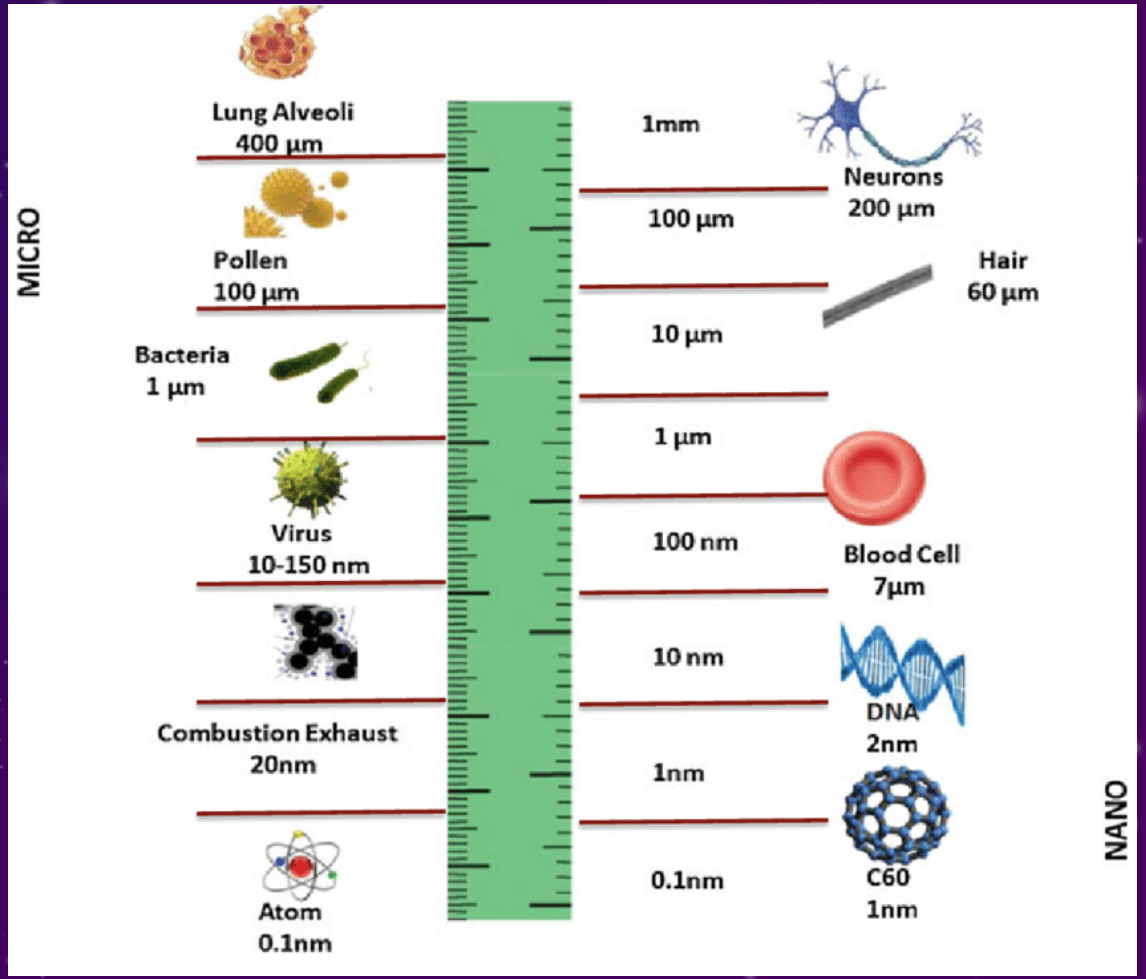
IDM

Intel

Samsung

Texas Instruments

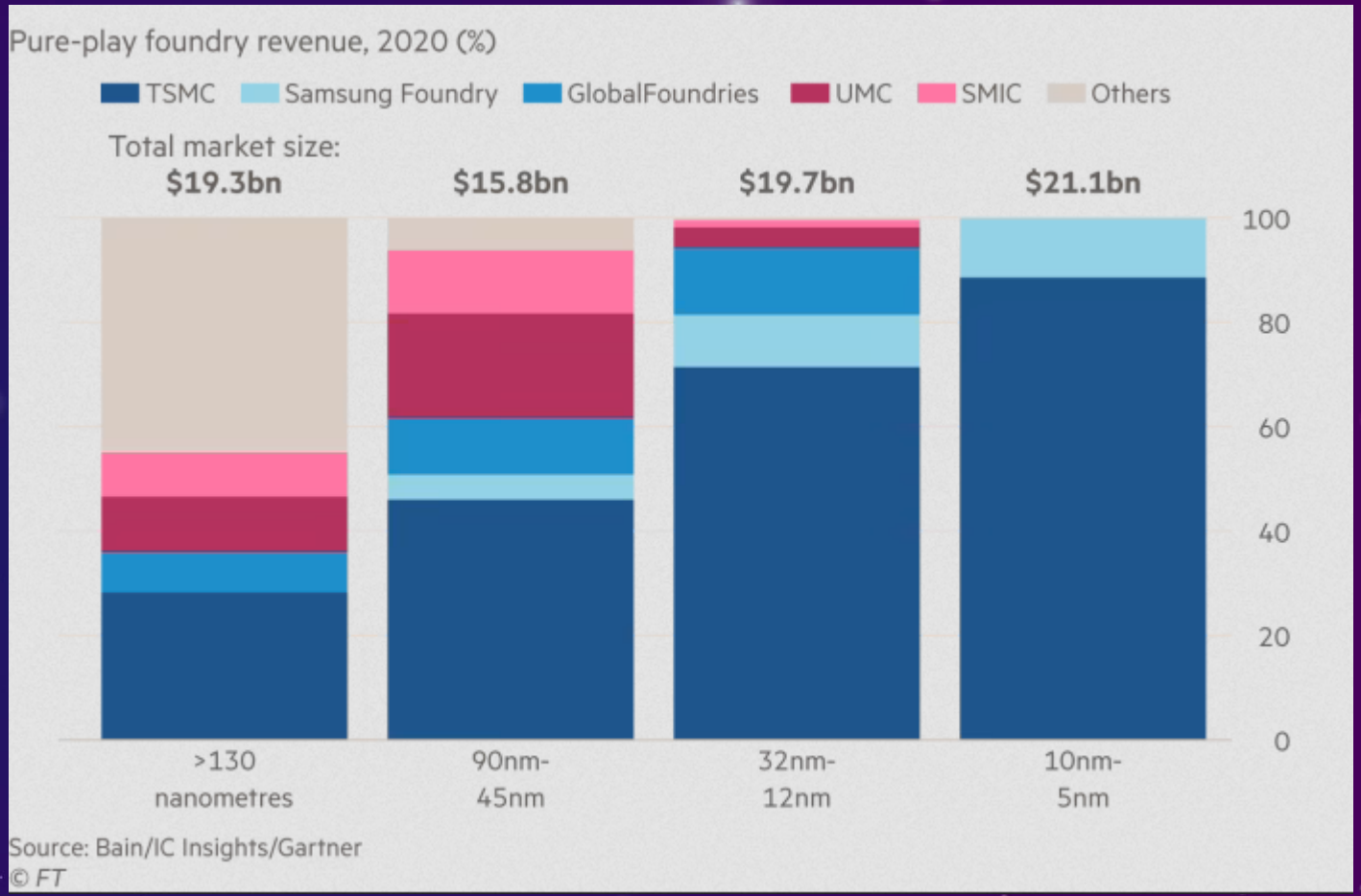
Size matters !



Applications

350nm - 28nm	Sensors: face cams, proximity, gestures, touch, fingerprint
180nm - 28nm	Vehicle: airbags, battery charger, breaks, stability control
40nm > 28nm	Power: all forms of PMIC, chargers, audio amplifier, led drivers
90nm - 22nm	Touch & Sound: LDC/OLED driver, touch IC, audio codecs
180nm - 6nm	Radar: SRR, MRR, LRR, WiFi, Bluetooth
65nm - 6nm	RF: WiFi, Bluetooth, GPS

Production distribution by nm



Electronic Design Automation (EDA)

Litho-sphere

DUV

Deep Ultra Violet

transistor density: 90-28nm

vendors: ASML, Canon & Nikon

EUV

Extreme Ultra Violet

transistor density: 22-5nm

vendors: ASML

High NA

High numerical aperture

transistor density: 5-2nm

vendors: ASML

ASML

- market value: €225 billion
- 4700 suppliers
- key suppliers:
  - Carl Zeiss SMT
  - Luxoft
  - Coorstek
- supplier acquisition:
  - Berliner Glas

ASML Lithography

100 000

number of EUV machine components

Vacuum

prevents absorption of ultra short wave length

Complexity

rivals LHC or the moon landing

4 Jumbo Jets

required to transport the machine to destination

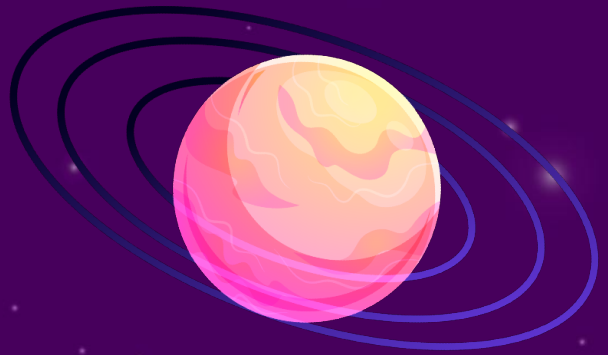
EUV

costs $200 million per piece

High NA

costs $300 million per piece

Semiconductor industry



dispersed

industry spreads across the globe with concentrations in USA, Europe & SE Asia

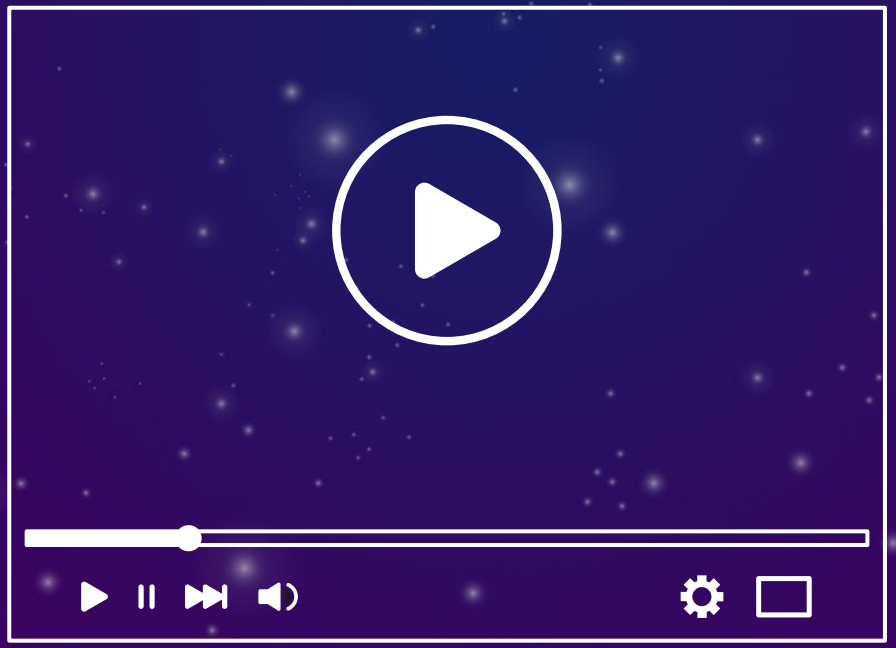
concentrated

in the hands of few highly specialized companies in quasi-monopoly state

powered

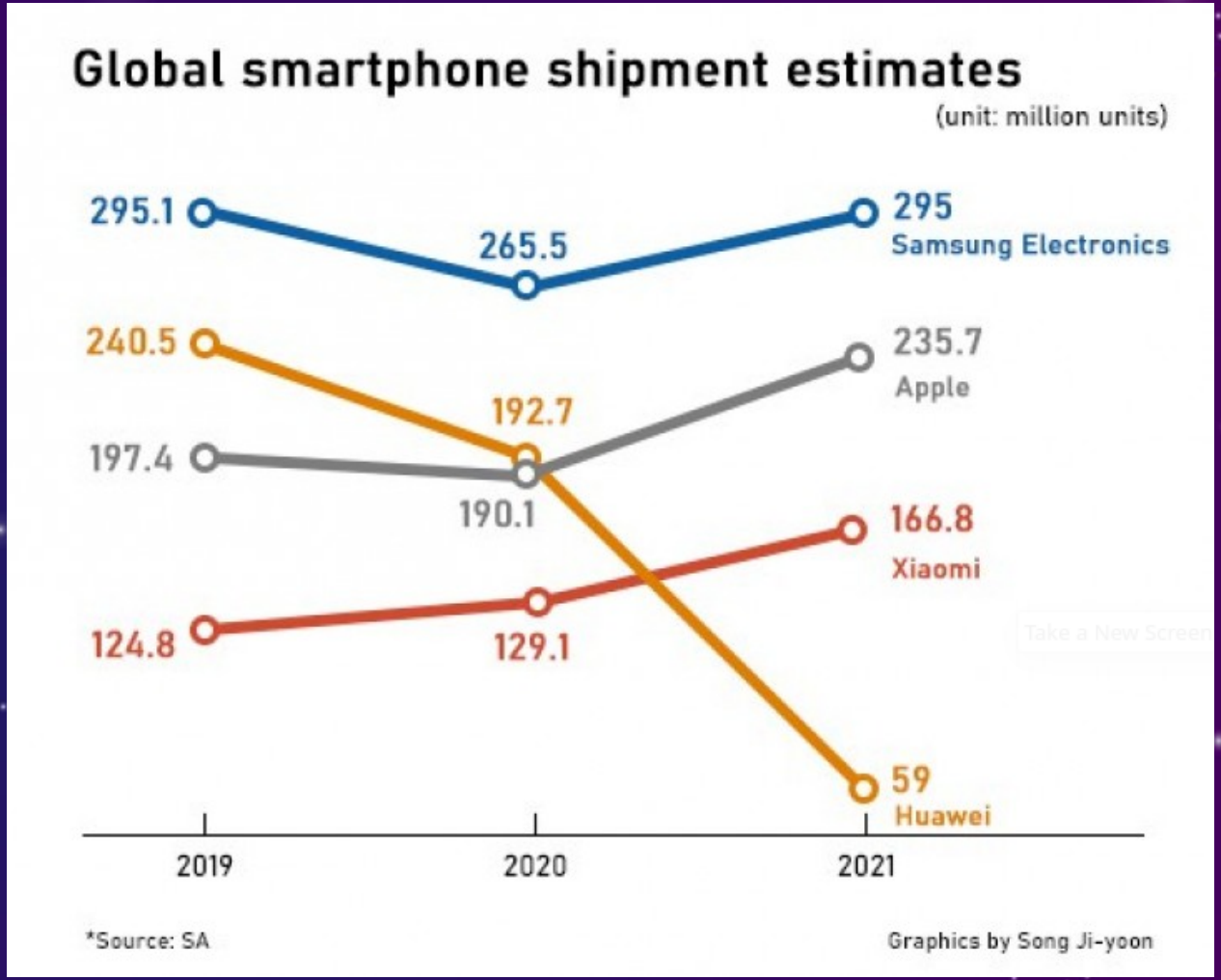
by western technologies (USA & Europe)

2022



Huawei


‘Entity List’ grace period expires
Huawei acknowledges Kirin ‘unproducable’
May 2019
Aug 2019
May 2020
Aug 2020
Huawei & affiliates are added to ‘Entity List’
Ban extended to all chips made with U.S. equipment, software & blueprints


Global smartphone shipment estimates
(unit: million units)
295.1
265.5
295
Samsung Electronics
240.5
192.7
235.7
Apple
197.4
190.1
166.8
Xiaomi
124.8
129.1
59
Huawei
2019
2020
2021
*Source: SA
Graphics by Song Ji-yoon

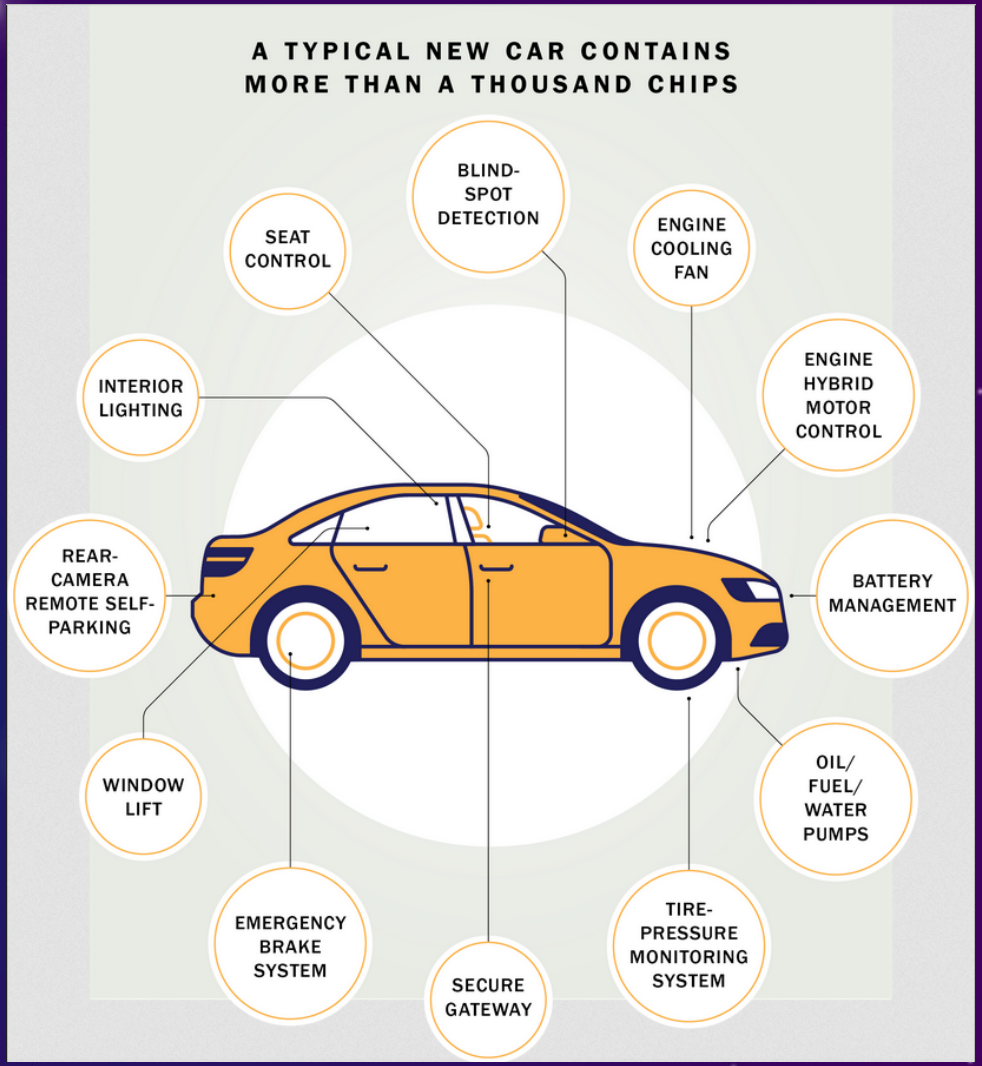
Russia

February 24th 2022, USA emposed chip “embargo” on Russia

ban on products “made with U.S. equipment, software and blueprints”

direct chip imports, chip production outside of Russia & any products with chips built anywhere affected

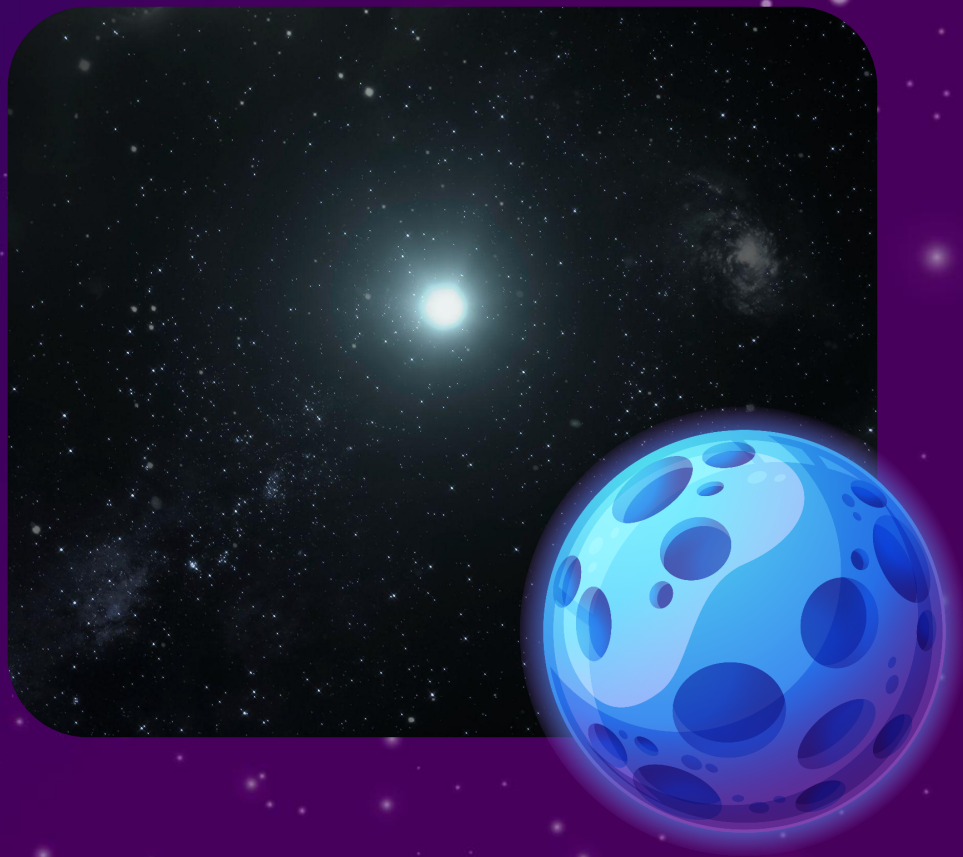

Mobile phones/ smart phones
Televisions
Alarm system
Cameras
Washing machines
Refrigerators
Toaster
Coffee machine
Computers
LED bulbs
Laptops
Airplanes
Advance medical care/life-saving pharmaceutical devices
ATMs
Tablets
Agri-tech devices
Vehicles/EVs


A TYPICAL NEW CAR CONTAINS
MORE THAN A THOUSAND CHIPS
BLIND-SPOT DETECTION
SEAT CONTROL
ENGINE COOLING FAN
INTERIOR LIGHTING
ENGINE HYBRID MOTOR CONTROL
REAR-CAMERA REMOTE SELF-PARKING
BATTERY MANAGEMENT
WINDOW LIFT
OIL/ FUEL/ WATER PUMPS
EMERGENCY BRAKE SYSTEM
SECURE GATEWAY
TIRE-PRESSURE MONITORING SYSTEM

China

- July 2022, USA pushes for ASML DUV export ban to China
- August 12th 2022, US ban on export of ECAD software (target: high-end 3nm designs)
- September 1st, US export ban of high-end GPUs (NVIDIA & AMD) dubbed ‘A.I. chips’

Outlook



ONSHORING

February 2022, EU announced European Chips Act worth €15 billion (in addition to previously allocated €30 billion + Horizon Europe + ..)

EU targets 20% global chip production by 2030

Aug 9th 2022, USA signs US CHIPS and sience Act (initially $52 billion, now $280 billion)

Intel

EU: Leixlip / Ireland ($12 billion by 2023), Magdeburg / Germany ($17 billion by 2025-2027), Italy ($5 billion by 2025-2027), R&D in France & Poland

US: Arizona ($20 billion by 2024), Ohio ($20 billion by 2025), New Mexico ($3.5 billion by 2023/2024)

Future in “pure-play” ?!

TSMC, Samsung & TI

TSMC: Arizona / USA ($12 billion by 2024)

Samsung: Texas / USA ($17 billion by 2024)

TI: Texas / USA ($30 billion by 2025)

Thought experiment

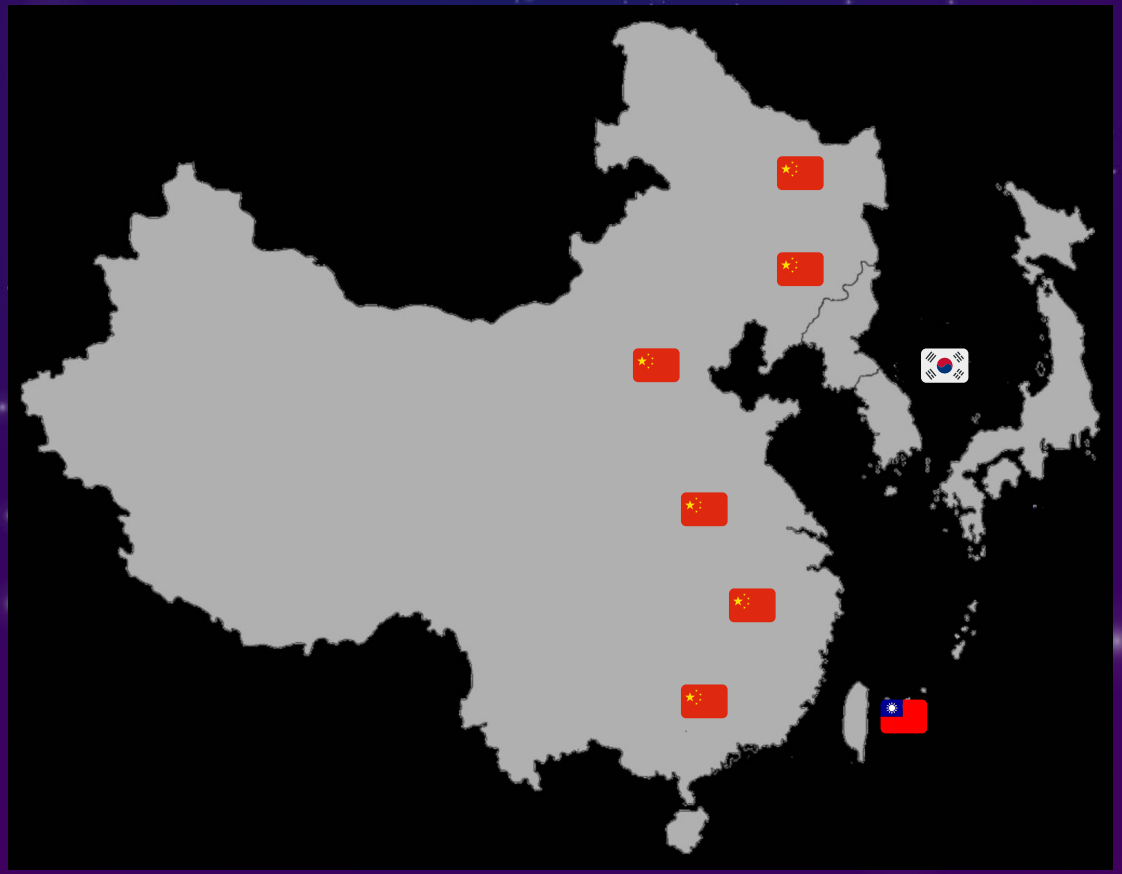
most important nation in the world

$432 billion for IC imports in 2021
($257 billion for oil imports)

burned $100s billions trying to build an IC industry without much progress

national champion was obliterated by rivaling nation

Thought experiment



THANKS

Do you have any questions?

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Sources

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