

The AI chip supply chain in brief

The fourteen stages that turn sand and software into an AI accelerator: who leads each one, how concentrated it is, and where China and the United States stand.

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Concentration counts the firms that credibly supply a stage. Every stage rates Extreme or High.

Substitutability rates how hard it would be for a well-funded state or firm to build an alternative: Very hard, Hard or Moderately hard.

#	Stage	Who leads	Concentration	Substitutability
01	Chip Design, EDA and IP	Synopsys US, Cadence US	 Extreme	Hard
02	Silicon and Wafers	Shin-Etsu Handotai JP, SUMCO JP	 High	Moderately hard
03	Chemicals, Gases and Photoresist	JSR JP, Tokyo Ohka Kogyo JP	 High	Moderately hard
04	Lithography	ASML NL, Canon JP	 Extreme	Very hard
05	Photomasks and Pellicles	AGC JP, Hoya JP	 Extreme	Hard
06	Deposition and Etch	Applied Materials US, Lam Research US	 High	Moderately hard
07	Metrology and Inspection	KLA US, Applied Materials US	 High	Moderately hard
08	Foundries and Fabs	TSMC TW, Intel US	 Extreme	Very hard
09	Memory and HBM	SK hynix KR, Samsung KR	 Extreme	Hard
10	Advanced Packaging	TSMC TW, Intel US	 Extreme	Hard
11	Substrates and PCBs	Ajinomoto JP, Nitto Boseki JP	 Extreme	Hard
12	Test and Assembly	Advantest JP, Teradyne US	 High	Moderately hard
13	Systems and Networking	Nvidia US, Broadcom US	 High	Moderately hard
14	Data Centers and Power	GE Vernova US, Hitachi Energy CH	 High	Moderately hard

Across the chain

Two chapters look across all fourteen stages, at what a chip costs and at the contest over who controls them.

15 The Economics of AI Chips

Epoch AI estimated in December 2025 that Nvidia's B200 AI chip cost about \$6,400 to build, mostly for memory and packaging. Its processor silicon cost about \$900.

Epoch AI says Nvidia's margin on Blackwell may be lower than the gap between the B200's build cost and its selling price suggests. It cites reports from March 2024 that put the B200's selling price at \$30,000 to \$40,000 per chip. Epoch AI notes that most Blackwell revenue comes from servers and rack-scale systems, which may carry lower margins.

Sources: chipsupplychain.org/component-costs/

16 Who Controls the Chain

Since 2018 the United States has used export controls to limit China's access to advanced chips and chipmaking tools, and China has been learning to make both.

Japan and the Netherlands have aligned their own export controls with the American rules on chipmaking equipment. China has answered by building its own tools and by restricting sales of US chips in China. Chinese toolmakers supplied 35 percent of China's own chipmaking equipment market in 2025, up from 10 to 15 percent before 2022. Nvidia says the Chinese government restricted the sales of its H200 chip that the United States licensed in February 2026.

Sources: chipsupplychain.org/geopolitics/

The fourteen stages

In the order a chip is made.

01 Chip Design, EDA and IP

■■■ Extreme concentration · Hard to substitute

Synopsys, Cadence and Siemens EDA make the software used to design every advanced chip. In 2025 they took over 85 percent of its \$18 billion market, licensed blocks included.

- **Synopsys** United States. Over 90 percent of the timing-synoff market at advanced nodes as of 2026
- **Cadence** United States. 55 to 60 percent of the hardware emulator market at advanced nodes as of 2026

China China designs its own AI accelerators, but Huawei's most powerful chip in 2026, the Ascend 950, delivers about half the computing performance of Nvidia's H100 from 2022, on Epoch AI's estimate. CSIS found that as of 2025 Chinese design tools were still far from replacing the full range of advanced capabilities US firms offer, especially for 5 nm and 3 nm chips.

United States Synopsys and Cadence, the two largest design-software vendors by 2025 revenue, are American.

Sources: chipsupplychain.org/design-and-eda/

02 Silicon and Wafers

■■■ High concentration · Moderately hard to substitute

Firms based in Japan, Taiwan, Germany and South Korea make most 300 mm wafers used for advanced chips. China makes most polysilicon, almost all of it for solar cells.

- **Shin-Etsu Handotai** Japan. Its parent's electronics materials segment, wafers included, had ¥1,015.7 billion of sales in the year to March 2026
- **SUMCO** Japan. ¥409,670 million of net sales in 2025

China China made about 93 percent of the world's polysilicon in 2023, and an estimated 98 percent of China's output was solar-grade. Eswin, mainland China's largest maker of 300 mm wafers, says it had about 7.7 percent of world 300 mm shipments in the first half of 2026.

United States None of the five largest wafer makers in 2025 was American. GlobalWafers of Taiwan won CHIPS awards of up to \$406 million in December 2024 for wafer plants in Texas and Missouri.

Sources: chipsupplychain.org/silicon-and-wafers/

03 Chemicals, Gases and Photoresist

■■■ High concentration · Moderately hard to substitute

Japanese companies held 78 percent of world photoresist sales in 2023. Supply of chip chemicals, gases and metals has been disrupted three times since 2019.

- **JSR** Japan. A vehicle of the state-backed Japan Investment Corporation bought 84.36 percent of JSR in April 2024
- **Tokyo Ohka Kogyo** Japan. Resist maker with ¥139,668 million of sales in the first half of fiscal 2026

China In March 2026 the Chinese resist maker Hubei Dinglong said China had yet to reach large-scale production of advanced resist for 248 nm, 193 nm or extreme-ultraviolet printing. Since August 2023 China has required licenses to export gallium and germanium.

United States In photoresist, American companies ranked a distant second to Japanese companies by sales in 2023. In 2021 JSR of Japan agreed to buy Inpria, an Oregon-based US maker of resist for extreme ultraviolet.

Sources: chipsupplychain.org/chemicals-gases-and-photoresist/

04 Lithography

■■■ Extreme concentration · Very hard to substitute

ASML, a Dutch firm, is the only maker of extreme ultraviolet scanners, the machines that print the finest layers of a chip. It sold 48 of them in 2025.

- **ASML** Netherlands. 327 lithography systems sold in 2025, including all 48 EUV (extreme ultraviolet) systems
- **Canon** Japan. 234 chip lithography systems sold in 2025

China In July 2026 Reuters reported, citing one unnamed source, that a Shanghai firm with two state shareholders had started producing immersion DUV tools. The Center for Technology & Statecraft found in September 2026 that Chinese firms had begun small-batch production of such scanners, but none had yet been shown fit for producing advanced chips. Its central estimate in 2026 was that China would have a commercially viable immersion scanner for 7 nm chips in the mid-2030s, with the early 2030s plausible, and EUV not before the second half of the 2030s. Meanwhile Chinese fabs had built a stockpile of more than 330 immersion DUV systems by the first quarter of 2026, most of them ASML's NXT:1980i.

United States CSET found in 2021 that no American firm made lithography scanners. In September 2026 the Center for Technology & Statecraft found that ASML held about 99 percent of the market for immersion DUV scanners and Japan's Nikon the rest. But every immersion DUV scanner holds a light source from Cymer, a US company now part of ASML, or from Japan's Gigaphoton, so the two governments could stop sales by controlling those parts, the Center for Technology & Statecraft found in September 2026. A US rule published in October 2023 already covers immersion scanners with an alignment error between 1.5 nm and 2.4 nm bound for advanced chipmaking if they hold any American-made parts. The US entity list also requires a license to supply the firms it names.

Sources: chipsupplychain.org/lithography/

05 Photomasks and Pellicles

■■■ Extreme concentration · Hard to substitute

Only three firms in the world make the blank plates for the masks used to print the finest layers of leading-edge chips. Japan's AGC and Hoya are two of them.

- **AGC** Japan. Ranks itself No.2 worldwide in EUV mask blanks on its own fiscal 2026 estimates
- **Hoya** Japan. Said in its 2026 report that its share of mask blanks is exceptionally high

China As of 2026 SMIC runs two mask shops of its own in Shanghai. No Chinese firm appears in CSET's 2025 market shares for electron-beam mask writers, the machines that draw the pattern onto a mask.

United States In December 2025 Photronics called itself a leading worldwide maker of photomasks. As of 2026 KLA sells tools that inspect EUV masks and optical masks, the quartz masks used with deep ultraviolet light.

Sources: chipsupplychain.org/photomasks-and-pellicles/

06 Deposition and Etch

■■■ High concentration · Moderately hard to substitute

Deposition and etch tools build a chip layer by layer. China-based toolmakers' share of deposition tools rose from 2 to 7 percent between 2019 and 2024, by CSET's count.

- **Applied Materials** United States. 82.4 percent of physical vapor deposition tools in 2025, by CSET's count from TechInsights data
- **Lam Research** United States. 51.2 percent of conductor etch tools in 2025

China Chinese toolmakers held 12.4 percent of dry etch in 2025, according to CSET's analysis of TechInsights data. They held 2.6 percent of atomic layer deposition that year, by the same count.

United States A December 2024 US rule lists some dry etch, atomic layer deposition and deep-hole deposition tools as controlled exports. Its foreign direct product rule reaches some tools built outside the United States.

Sources: chipsupplychain.org/deposition-and-etch/

07 Metrology and Inspection

■ ■ ■ **High concentration** · Moderately hard to substitute

KLA, an American firm, held 56.8 percent of the market for tools that measure and inspect wafers in 2025, by CSET's count.

- **KLA** United States. 56.8 percent of process control tools in 2025 by CSET's count
- **Applied Materials** United States. 11.2 percent of process control tools in 2025

China Chinese firms held 0.7 percent of the world market for tools that measure and inspect wafers in 2025, by CSET's count. Skyverse, a Shenzhen maker of inspection and metrology tools, reported 2,053,298,171.74 yuan of revenue in 2025, up 48.75 percent on 2024.

United States In 2025 the American firm KLA was the world's largest maker of metrology and inspection tools. Citing Gartner, KLA puts its 2024 share at 56.5 percent, 6.5 times its nearest rival's share.

Sources: chipsupplychain.org/metrology-and-inspection/

08 Foundries and Fabs

■ ■ ■ **Extreme concentration** · Very hard to substitute

The newest chips need the know-how to build the newest transistors and a fab that costs tens of billions of dollars. Only TSMC, Intel and Samsung have both.

- **TSMC** Taiwan. N2, its first nanosheet node, in volume production since 4Q25
- **Intel** United States. 18A in high-volume production in the United States, as of 2026

China China's SMIC made its most advanced chips on N+3, a 7 nm-class process built without extreme ultraviolet scanners, SemiAnalysis found in June 2026. SMIC cannot buy those scanners, so it prints its tightest layers in several passes on older deep-ultraviolet machines. China will keep the world's largest installed fab capacity in 2026 and 2027, SEMI projected in its third-quarter 2026 forecast.

United States Intel is the only chipmaker that both develops and manufactures leading-edge logic chips in the United States, by its own account in August 2025. The United States had almost no logic capacity below 10 nm in 2022, and SIA and BCG projected in May 2024 that its share would reach 28 percent by 2032. In July 2026 TSMC raised its planned investment in Arizona to \$265 billion across 12 facilities. The US government agreed in August 2025 to buy a passive 9.9 percent stake in Intel, with no board seat.

Sources: chipsupplychain.org/foundries-and-fabs/

09 Memory and HBM

■ ■ ■ **Extreme concentration** · Hard to substitute

SK hynix, Samsung and Micron make nearly all high bandwidth memory (HBM), the stacked memory beside AI chips. SK hynix took 63.2 percent of HBM revenue in 2025.

- **SK hynix** South Korea. 63.2 percent of HBM revenue in 2025
- **Samsung** South Korea. 19.3 percent of HBM revenue in 2025

China The Institute for Progress estimated in October 2025 that China would make virtually no HBM that year. Huawei said in September 2025 that its Ascend 950 chips would use two HBM designs of its own, without saying who would manufacture the memory.

United States Micron is the only American HBM maker. As of October 2026, License Exception HBM lets US and allied exporters ship HBM below 3.3 GB per second per square millimeter without a license, including to China when the chip designer buys it directly and it goes straight to the packaging site.

Sources: chipsupplychain.org/memory-and-hbm/

10 Advanced Packaging

■ ■ ■ **Extreme concentration** · Hard to substitute

Epoch AI estimates that in 2025 Nvidia, Google, AMD and Amazon used around 90 percent of the capacity for CoWoS, TSMC's packaging for AI chips.

- **TSMC** Taiwan. CoWoS packaging used by Nvidia, Google, AMD and Amazon in 2025
- **Intel** United States. Foveros 3D packaging in volume at Rio Rancho, New Mexico, since January 2024

China Chinese firms had 5.3 percent of the market for fabrication tools built for advanced packaging in 2025, by CSET's analysis of TechInsights data. Between 2019 and 2024 they gained 5 percentage points of share in test tools but lost share in bonding and other conventional assembly and packaging tools.

United States Intel opened Fab 9 in Rio Rancho, New Mexico, in January 2024 to make its Foveros 3D packages in volume. Amkor broke ground in October 2025 on a \$7 billion packaging and test campus in Peoria, Arizona, and expects production to start in early 2028.

Sources: chipsupplychain.org/advanced-packaging/

11 Substrates and PCBs

■ ■ ■ **Extreme concentration** · Hard to substitute

Ajinomoto, a Japanese food company, told investors in June 2026 that its build-up film, the insulation inside high-end chip packages, has held over 95 percent of its market since its launch.

- **Ajinomoto** Japan. Told investors in June 2026 that its build-up film has held over 95 percent of its market since its launch
- **Nitto Boseki** Japan. Claimed an overwhelming advantage in low thermal expansion glass in its 2025 integrated report

China TTM, an American circuit board maker, said in its annual report for 2025 that its circuit board competitors are mostly based in China and Taiwan. Nitto Boseki, a Japanese glass fiber maker, said in its 2025 integrated report that Chinese and Taiwanese companies are aggressively catching up with it in the special glass sector.

United States The White House's 2021 supply chain review listed no American firm among the key substrate makers. In December 2024 the US Commerce Department finalized an

award of up to \$75 million to Absolics, an affiliate of Korea's SKC, for a glass substrate plant in Covington, Georgia.

Sources: chipsupplychain.org/substrates-and-pcbs/

12 Test and Assembly

■ High concentration · Moderately hard to substitute

Testing finds bad chips before they go into an expensive package. Japan's Advantest took about 65 percent of 2025 spending on chip testers, by its own estimate.

- **Advantest** Japan. About 65 percent of the tester market in 2025, by its own estimate
- **Teradyne** United States. \$2.52 billion of semiconductor test revenue in 2025, service included

China Georgetown's CSET, analyzing TechInsights data, finds that between 2019 and 2024 Chinese toolmakers gained 5 percentage points of world market share in test tools and 4 points in fabrication tools built for advanced packaging. But they lost share in bonding and other conventional assembly and packaging tools.

United States American firms held 23.5 percent of the market for test tools in 2025 and Japanese firms 63.0 percent, by CSET's analysis of TechInsights data. Amkor raised its planned investment in an Arizona packaging and test campus to \$7 billion in October 2025. In June 2026 it announced a long-term partnership with TSMC, which will buy packaging and test services from it in Arizona.

Sources: chipsupplychain.org/test-and-assembly/

13 Systems and Networking

■ High concentration · Moderately hard to substitute

Nvidia's and AMD's racks wire 72 AI chips together to run as one computer. Many firms can assemble the racks, but lasers for the optical links were scarce in 2026.

- **Nvidia** United States. NVLink, InfiniBand and Spectrum-X Ethernet, which it credited for data center growth in the quarter to April 2026

- **Broadcom** United States. \$16.7 billion of AI semiconductor revenue in the quarter to August 2026, up 221 percent

China Chinese firms such as InnoLight assemble high-speed optical modules in volume, at sites including Suzhou and, since 2019, Thailand. In February 2025 China put indium under new export restrictions. The same month it began requiring export permits for indium phosphide substrates, the wafers that lasers for optical links are grown on.

United States Coherent broke ground in Sherman, Texas, in June 2026 on an expansion of its factory there, which makes optical devices from indium phosphide. In August 2026 Nvidia said that Wistron's new plant in Fort Worth, Texas, was producing its GB300 superchips and that Foxconn was building a factory in Houston.

Sources: chipsupplychain.org/systems-and-networking/

14 Data Centers and Power

■ High concentration · Moderately hard to substitute

SemiAnalysis forecast in October 2026 that 50 GW of data center capacity would be added in 2027, about as much as the world had built through 2024. The large transformers that connect such sites to the grid commonly took three years to arrive in 2024.

- **GE Vernova** United States. Gas equipment, transformers and switchgear, including through Prolec GE
- **Hitachi Energy** Switzerland. Power transformers and switchgear

China China used 25 percent of the world's data center electricity in 2024, second to the United States, by the International Energy Agency's estimate. Data centers made up around 3 percent of the growth in China's electricity demand from 2022 to 2024.

United States US factories supplied 29.2 percent of the large power transformers bought in the United States in 2023, measured by capacity. Constellation said in August 2026 that it expects to restart the Crane nuclear plant in 2027. Microsoft has agreed to buy the plant's power.

Sources: chipsupplychain.org/data-centers-and-power/

Chip Supply Chain: How AI Chips Are Made, by Yashvardhan Sharma. Edition of 29 October 2026. The full chapters, with a source for every figure, are at chipsupplychain.org.

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