

Semiconductors

China struggles to break US chip design 'chokehold'



Beijing pushes for bigger share of crucial electronic design automation market

Christian Davies in Seoul, **Michael Acton** in San Francisco and **Eleanor Olcott** in Beijing 18 HOURS AGO

Chinese companies are struggling to close the gap on US-based rivals in a crucial corner of the global semiconductor market.

Electronic design automation software allows designers and manufacturers to develop and test the blueprints for new generations of chips, many of which consist of tens or even hundreds of billions of transistors, before they are put into production.

While the EDA sector accounts for just 1.6 per cent of the \$600bn global [semiconductor](#) industry, it serves as a critical bottleneck in the supply chain for developing the latest cutting-edge chips.

“It’s the keys to the kingdom,” said G Dan Hutcheson, vice chair of consultancy TechInsights. “It’s like when an artist has the concept of a painting in their mind but it can’t be realised unless they have the paints and brushes to make it.”

The global EDA sector is dominated by three US-based companies — Synopsys, Cadence and Siemens EDA — which between them produce almost all of the software required to design, produce and test the most sophisticated chips.

The trio account for close to 80 per cent of China’s EDA market, according to Shanghai-based consultancy ICWise Research, despite Chinese efforts to produce homegrown cutting-edge chips.

[China](#) is pushing for its companies to take a bigger share as it races to establish a bigger domestic chip industry in the face of sweeping US export controls.

Boosted by government subsidies, Chinese companies have made some inroads. The country’s three leading EDA firms — Empyrean Technology, Primarius and Semitronix — doubled their local market share from 7 per cent per cent to 14 per cent between 2020 and 2023, according to Insight and Info.

“With EDA tools subject to US export controls, this will only further force the hand of domestic Chinese EDA companies to develop good enough tools so they are not reliant on western suppliers,” said Myron Xie of consultancy SemiAnalysis.

China’s latest [five-year economic plan](#), released in 2021, identified chip design software as a top priority for technological breakthroughs in the semiconductor

industry.

The state-backed China Integrated Circuit Industry Investment Fund, known as the Big Fund, and Chinese tech giant Huawei have also made a series of investments in EDA and chip design start-ups.

Last year, China opened a National EDA Innovation Centre in Nanjing, the mission of which was described by its director as to “undertake the critical work of breaking the United States’ chokehold in EDA software”.

Beijing-based Empyrean Technology, the leading Chinese EDA player, has had some limited success. The company’s revenues rose almost 10 per cent in the first half of 2024 to Rmb443.8mn (\$63mn), according to its financial report, with more than 90 per cent of its sales coming from the Chinese market.

Supported by Rmb77mn in government subsidies received over the same period, Empyrean’s research and development spending accounted for 79 per cent of its revenue. Synopsys and Cadence typically budget R&D expenses at 30-40 per cent of sales.

Despite these advances, the challenge remains daunting. Empyrean and fellow leading Chinese EDA companies Primarius and Semitronix accounted for less than 2 per cent of global market share last year, according to Chinese research provider Insight and Info. Empyrean has a market capitalisation of about \$7bn, compared with Synopsys’s market cap of about \$80bn.

Lu Xiaomeng, a director at consultancy Eurasia Group, said Beijing was attempting to make up for lost time, having been slow to grasp its vulnerability to US controls in the sector.

Former US president Donald Trump’s administration banned Huawei from using American EDA tools in 2019, a move followed by sweeping export controls introduced by Joe Biden’s administration in August 2022 to prevent China from accessing the most sophisticated chip design software.

“China’s push on EDA is part of a wider recognition of the need to develop first-class ‘enterprise software’, as opposed to the less sophisticated consumer software that underpins platforms operated by Alibaba and Tencent,” said Lu.

Gregory Allen, director of the Wadhvani Center for AI and Advanced Technologies at the Center for Strategic and International Studies think-tank in Washington, said US restrictions meant Chinese chip designers could not turn to non-Chinese

restrictions meant Chinese chip designers could not turn to non-Chinese manufacturers such as TSMC to produce cutting-edge chips designed with US EDA tools.

But he added that for chips manufactured in China, enforcing sanctions on easily shareable software tools was much harder than enforcing restrictions on bulky chipmaking equipment.

“EDA software can be pirated — you can buy a single licence, break the encryption and have way more users than legally entitled,” he said.

Beijing also appears determined to hinder efforts by the leading US groups to strengthen their hold on the sector. In May, China’s competition authority raised concerns about Synopsys’s \$35bn takeover bid for Pennsylvania-based engineering simulation software maker Ansys.

“This is a small deal with no monopolistic implications, and yet the Chinese regulators are paying special attention to it,” said Lu.

While China has dozens of EDA companies, many of which have made progress in developing chip design software for niche areas such as power chips for electric vehicles, analysts said they were still struggling to combine different tools to produce more comprehensive designs for next-generation integrated circuits.

According to Goldman Sachs research, China’s EDA sector would need to spend \$9bn on R&D each year — 29 times more than was spent in 2023 — for the next 10 years to catch up with the global leaders.

Jimmy Goodrich, senior adviser to the Rand Corporation for technology analysis, said the Chinese EDA sector was suffering from its inability to offer software tools for the development of leading-edge chips, noting that US tools for less sophisticated chips were still available to Chinese companies.

“As a Chinese chip designer or a chip manufacturer, it’s really easy to just go out and work with Siemens, Synopsys and Cadence, where you can buy everything with a one-stop shop approach,” he said.

“But if you want to use indigenous Chinese software, you’re going to have to work with two dozen different companies and stitch together an offering. That can get really complicated really fast.”

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