

Semiconductors

China boosts AI chip output by upgrading older ASML machines

Restricted chipmaking tools are being retrofitted to make advanced AI chips, exposing cracks in US-led export controls

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China's semiconductor manufacturers are upgrading their advanced chipmaking equipment in ways that bypass global export controls, as the country seeks to rival the US in developing artificial intelligence.

According to people familiar with the matter, Chinese fabrication plants producing advanced smartphone and [AI](#) chips have bolstered the performance of advanced deep ultraviolet lithography (DUV) machines made by Netherlands-based ASML.

US and Dutch export controls prevent ASML from supplying its most advanced DUV machines to China, leaving many Chinese fabs to rely on older equipment — notably the Twinscan NXT:1980i system — to manufacture the seven-nanometre chips needed to develop [AI](#) systems.

In industry parlance, “nanometres” denotes successive generations of chip, rather than physical dimensions.

According to those familiar with the techniques, Chinese fabs have obtained components on the secondary market. This includes an upgraded “stage”, a mechanical platform for the silicon wafer, as well as lenses and sensors that help ensure that chip layers are aligned with greater precision.

These improvements to ASML's DUVs have enabled Chinese fabs to bolster their AI chip production.

China's chipmakers Semiconductor Manufacturing International Corporation (SMIC) and Huawei are among those known to be using older ASML machines to build seven-nanometre production lines — although it is unclear if they have secured further component upgrades.

The moves underscore how Chinese chipmakers are finding methods to overcome global export controls meant to stall the country's technological rise.

The US has sought to apply curbs to stop China accessing cutting-edge chips, while pressuring governments in the Netherlands, South Korea and Japan to also tighten their sales controls. The American-led effort is designed to push companies across the global [semiconductor](#) supply chain to curtail business with Chinese customers.

Under this regulatory regime, ASML is allowed to provide engineering support for Chinese customers to service their existing equipment.

But the Dutch company is restricted from servicing upgrades to the “overlay”, or positioning accuracy of the DUV machines, or from making changes that improve the “throughput” — or speed — of the machines beyond 1 per cent.

Multiple people familiar with the arrangements said local fabs sourced components overseas and ship them to China. They said that third-party companies provided on-site engineering to upgrade existing DUV machines.

ASML said it “fully complies with all applicable laws and regulations . . . The company operates strictly within these legal frameworks and does not support system upgrades that allow customers to improve performance levels beyond what is permitted by law.”

Export controls also prevent ASML from supplying China with even more advanced extreme ultraviolet (EUV) machines.

That has led Chinese fabs to use techniques such as multiple DUV exposures — a process known as “multi-patterning” — to produce advanced chips. But the method demands longer machine run-times, increasing production costs and reducing “yield” — the percentage of functional chips.

Component upgrades had enabled the fabs to mitigate some of these constraints and raise output of AI and advanced smartphone chips, said those familiar with the matter.

Analyst group TechInsights said this month that SMIC continued to push the boundaries of this multi-patterning technique beyond the seven-nanometre process. It added that Huawei's latest Kirin 9030 processor revealed China's most [advanced chip manufacturing](#) process to date.

"Chinese fabs have been able to achieve impressive feats without full access to the best equipment available to others like TSMC and Samsung," said TechInsights chief strategy officer Dan Kim.

The US Bureau of Industry and Security had been probing what support ASML has been providing to Chinese customers and had been preparing to make the rules stricter to stop it providing some servicing support permitted under the current rules, said two people familiar with the agency's thinking.

It is unclear if BIS will push ahead with rule changes after the Trump administration signalled a truce in its trade war with Beijing.

ASML has lobbied against export controls on China, an important market and the world's largest purchaser of wafer fabrication equipment in 2024.

Former chief executive Peter Wennink argued such curbs provided no additional security benefit for the west, since China already had the equipment it needed to make chips for military purposes.

China's newest production lines are running ASML's newer 2050i and 2100i DUV tools, which incorporate an upgraded stage mechanism.

The Dutch government revoked ASML's export licence for both machines in September 2024, but only after numerous units had been shipped and installed.

ASML's revenue from China has jumped as local chipmakers rushed to secure equipment before expected restrictions took effect.

In 2023, the company booked €7.2bn in China sales, accounting for 26 per cent of global revenue.

In 2024, that figure climbed to €10.2bn, or 36 per cent of total sales. It warned investors in October that sales to China would “decline significantly” next year.

BIS, SMIC and Huawei did not respond to requests for comment.

Additional reporting by Demetri Sevastopulo in Washington and Tim Bradshaw in London

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