

# TSMC and Synopsys Bring Breakthrough NVIDIA Computational Lithography Platform to Production

## NVIDIA cuLitho Accelerates Semiconductor Manufacturing's Most Compute-Intensive Workload by 40-60x, Opens Industry to New Generative AI Algorithms

**GTC**—NVIDIA today announced that TSMC and Synopsys are going into production with NVIDIA's computational lithography platform to accelerate manufacturing and push the limits of physics for the next generation of advanced semiconductor chips.

TSMC, the world's leading foundry, and [Synopsys](#), the leader in silicon to systems design solutions, have integrated [NVIDIA cuLitho](#) with their software, manufacturing processes and systems to speed chip fabrication, and in the future support the latest-generation NVIDIA Blackwell architecture GPUs.

"Computational lithography is a cornerstone of chip manufacturing," said Jensen Huang, founder and CEO of NVIDIA. "Our work on cuLitho, in partnership with TSMC and Synopsys, applies accelerated computing and generative AI to open new frontiers for semiconductor scaling."

NVIDIA also introduced new generative AI algorithms that enhance cuLitho, a library for GPU-accelerated computational lithography, dramatically improving the semiconductor manufacturing process over current CPU-based methods.

### Semiconductor Leaders Advance cuLitho Platform

Computational lithography is the most compute-intensive workload in the semiconductor manufacturing process, consuming tens of billions of hours per year on CPUs. A typical mask set for a chip — a key step in its production — could take 30 million or more hours of CPU compute time, necessitating large data centers within semiconductor foundries. With accelerated computing, 350 NVIDIA H100 systems can now replace 40,000 CPU systems, accelerating production time, while reducing costs, space and power.

"Our work with NVIDIA to integrate GPU-accelerated computing in the TSMC workflow has resulted in great leaps in performance, dramatic throughput improvement, shortened cycle time and reduced power requirements," said Dr. C.C. Wei, CEO of TSMC. "We are moving NVIDIA cuLitho into production at TSMC, leveraging this computational lithography technology to drive a critical component of semiconductor scaling."

Since its introduction last year, cuLitho has enabled TSMC to open new opportunities for innovative patterning technologies. In testing cuLitho on shared workflows, the companies jointly realized a 45x speedup of curvilinear flows and a nearly 60x improvement on more traditional Manhattan-style flows. These two types of flows differ — with curvilinear the mask shapes are represented by curves, while Manhattan mask shapes are constrained to be either horizontal or vertical.

"For more than two decades Synopsys Proteus mask synthesis software products have been the production-proven choice for accelerating computational lithography — the most demanding workload in semiconductor manufacturing," said Sassine Ghazi, president and CEO of Synopsys. "With the move to advanced nodes, computational lithography has dramatically increased in complexity and compute cost. Our collaboration with TSMC and NVIDIA is critical to enabling angstrom-level scaling as we pioneer advanced technologies to reduce turnaround time by orders of magnitude through the power of accelerated computing."

Synopsys is the pioneer in delivering advanced techniques for accelerating the performance of computational lithography. [Synopsys' Proteus](#)<sup>TM</sup> optical proximity correction software running on the NVIDIA cuLitho software library significantly speeds computational workloads compared to current CPU-based methods. With Proteus mask synthesis products, manufacturers like TSMC can achieve exceptional precision, efficiency and speed in proximity correction, model building for correction, and analyzing proximity effects on corrected and uncorrected IC layout patterns, revolutionizing the chip fabrication process.

### Breakthrough Generative AI Support for Computational Lithography

NVIDIA has developed algorithms to apply generative AI to further enhance the value of the cuLitho platform. The new generative AI workflow delivers an additional 2x speedup on top of the accelerated processes enabled through cuLitho. The application of generative AI enables creation of a near-perfect inverse mask or inverse solution to account for diffraction of light. The final mask is then derived by traditional and physically rigorous methods, speeding up the overall optical proximity correction (OPC) process by a factor of two.

Many changes in the fab process currently necessitate a revision in OPC, driving up the amount of compute required and creating bottlenecks in the fab development cycle. These costs and bottlenecks are alleviated with the accelerated computing cuLitho provides and generative AI, enabling fabs to allocate available compute capacity and engineering

bandwidth to design more novel solutions in development of new technologies for 2nm and beyond.

To learn more, watch [Huang's GTC keynote](#). [Register for GTC](#) to attend 900+ sessions from NVIDIA and industry leaders through March 21.

### **About NVIDIA**

Since its founding in 1993, [NVIDIA](#) (NASDAQ: NVDA) has been a pioneer in accelerated computing. The company's invention of the GPU in 1999 sparked the growth of the PC gaming market, redefined computer graphics, ignited the era of modern AI and is fueling industrial digitalization across markets. NVIDIA is now a full-stack computing infrastructure company with data-center-scale offerings that are reshaping industry. More information at <https://nvidianews.nvidia.com/>.

Certain statements in this press release including, but not limited to, statements as to: the benefits, impact, performance, features, and availability of NVIDIA's products and technologies, including NVIDIA's computational lithography platform, NVIDIA Blackwell architecture GPUs, NVIDIA H100 systems, and the NVIDIA cuLitho software library; third parties using our products, services and platforms and our collaborations with them; our work on cuLitho, in partnership with third parties, applying accelerated computing and generative AI to open new frontiers for semiconductor scaling; the new generative AI algorithms introduced by NVIDIA that enhance cuLitho dramatically improving the semiconductor manufacturing process over current CPU-based methods; a typical mask set for a chip taking 30 million or more hours of CPU compute time, necessitating large data centers within semiconductor foundries; the ability of manufacturers like TSMC to achieve exceptional precision, efficiency and speed in proximity correction, model building for correction, and analyzing proximity effects on corrected and uncorrected IC layout patterns, revolutionizing the chip fabrication process with Synopsys' Proteus mask synthesis products; the application of generative AI enabling creation of a near-perfect inverse mask or inverse solution to account for diffraction of light; and the accelerated computing cuLitho provides and generative AI enabling fabs to allocate available compute capacity and engineering bandwidth to design more novel solutions in development of new technologies for 2nm and beyond are forward-looking statements that are subject to risks and uncertainties that could cause results to be materially different than expectations. Important factors that could cause actual results to differ materially include: global economic conditions; our reliance on third parties to manufacture, assemble, package and test our products; the impact of technological development and competition; development of new products and technologies or enhancements to our existing product and technologies; market acceptance of our products or our partners' products; design, manufacturing or software defects; changes in consumer preferences or demands; changes in industry standards and interfaces; unexpected loss of performance of our products or technologies when integrated into systems; as well as other factors detailed from time to time in the most recent reports NVIDIA files with the Securities and Exchange Commission, or SEC, including, but not limited to, its annual report on Form 10-K and quarterly reports on Form 10-Q. Copies of reports filed with the SEC are posted on the company's website and are available from NVIDIA without charge. These forward-looking statements are not guarantees of future performance and speak only as of the date hereof, and, except as required by law, NVIDIA disclaims any obligation to update these forward-looking statements to reflect future events or circumstances.

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