How Huawei produces 2-nm chips without EUV?

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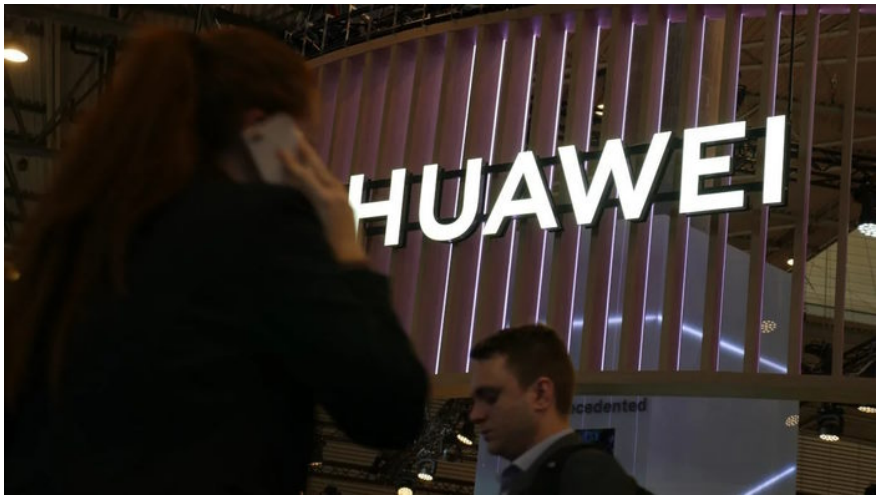
In a development that could reshape the global semiconductor race, Huawei has filed a patent outlining a path to 2-nanometer chips using only deep ultraviolet (DUV) lithography tools – equipment the company can still access despite strict Western export controls blocking ASML's extreme ultraviolet (EUV) lithography machines.

The patent, originally filed in 2022 but only recently made public, was written by veteran semiconductor researcher Dr. Frederick Chen. He describes a sophisticated multi-patterning technique that could allow Huawei and its manufacturing partner SMIC to achieve ultra-dense 21nm chips – a key dimension that would put the resulting nodes on par with the '2nm-class' processes being prepared by TSMC and Samsung, both of which rely heavily on EUV lithography.

How Huawei Creates 2nm Chips Without EUV

At the heart of Huawei's approach is an optimized four-sample self-alignment process (SAQP), which is said to reduce the number of DUV exposures required to just four, a significant improvement over conventional multi-sample methods, which typically require more scans and skyrocket in complexity.

By pushing existing DUV infrastructure to its absolute limit, the company aims to leapfrog from the newly demonstrated Kirin 9030 (fabricated on SMIC's N+3 node) to future 2nm chips without having to use constrained EUV tools.



Commercial viability remains a question mark.

Industry experts remain cautious, however. Even if the technical feasibility is proven in the lab, the commercial viability of such a robust DUV process remains in widespread doubt. Quadruple patterning at this size can result in reduced yield, is prone to defects, and is prohibitively expensive compared to single-exposure EUV, which is why the rest of the advanced industry has moved to newer technology at 3nm and below.

If Huawei 's SAQP-based 2nm process does make it into mass production, it would be a remarkable act of technological defiance. For now, the patent is both a statement of intent and a reminder of how far China is willing to push decades-old lithography technology in its pursuit of self-sufficiency.