



ASML: The Printing Press of the AI Age

Summary:

ASML makes what many consider to be the most complex machines in the world. They print the vanishingly small patterns that make leading-edge computer chips possible. NVIDIA, Amazon and Anthropic all rely on it to create their products and services. Without EUV [extreme ultraviolet light technology]... you don't have AI," the firm's chief executive, Christophe Fouquet, tells Scottish Mortgage deputy manager Lawrence Burns in this podcast.

Background:

When Scottish Mortgage invested in ASML, it couldn't be certain that its efforts to harness EUV light would succeed. The holding was effectively an informed bet that the Dutch company could pull off one of the "greatest technical endeavours" of the time, as Burns puts it.

To achieve this, the firm had to solve engineering challenges, such as generating plasma many times hotter than the sun's surface tens of thousands of times a second to create the special light. Then, it had to work out how to capture and control it with specialised multilayer mirrors. All this was done to print billions of transistors in spaces often as small as a fingernail.

ASML's achievements have pushed computing to new limits, not least enabling the training of artificial intelligence models, including Claude, ChatGPT, Gemini, Mistral and MiniMax. As Fouquet discusses in the podcast, the company has recently launched a next-generation version of its EUV system to underpin further AI advances and other capabilities for years to come.

"Whatever happens... ASML wins," says Burns. "It's an agnostic royalty on AI demand, and more broadly, compute demand."



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Glossary of terms (in order of mention):

EUV (extreme ultraviolet): A type of lithography that uses extremely short-wavelength light to print the finest, most advanced chip features.

Node: A generation of chip-manufacturing technology, loosely named for the size of its smallest features – smaller numbers mean denser, more advanced chips.

Transistor: A microscopic on/off switch; packing more of them onto a chip is what increases computing power.

Transistor density: The number of transistors packed into a given area of a chip – the measure that Moore's law tracks.

Lithography: The process of printing the pattern of a chip's circuitry onto a silicon wafer using light.

Compute: Computing capacity – the processing power needed to train and run AI models.

Semiconductor: The material (usually silicon) at the heart of a computer chip. Also used as shorthand for the chip industry.

Logic chips and memory chips: The two main chip types – logic chips process information, memory chips store it.

Moore's law: There are various definitions, but a common one is that the number of transistors on a chip roughly doubles every two years.

TWINSCAN: ASML's breakthrough lithography system that uses two stages, one to measure and one to expose the wafer.

Wafer: The thin disc of silicon on which chips are patterned, layer by layer, before being cut into individual chips.

Immersion technology: A lithography advance that places water between the lens and the wafer to sharpen the printed image.

Deep UV (DUV): ASML's lower-resolution lithography machines.

TSMC: Taiwan Semiconductor Manufacturing Company, the world's largest contract chipmaker and a key ASML customer.



Fab: A semiconductor fabrication plant – the factory where chips are manufactured.

Inference: The stage where a trained AI model is actually used to answer queries or make predictions, as opposed to training it.

Cyclical (industry): An industry whose sales rise and fall in boom-and-bust cycles, rather than growing steadily.

Numerical aperture (NA): A measure of how much light an optical system can gather and focus. High NA EUV gathers more, allowing finer printing.

Reticle: The mask carrying the chip-pattern information that the lithography machine projects onto the wafer.

Supply chain: The chain of companies that supply the parts, materials and equipment needed to make a finished product.

Frontier models: The most advanced AI models, at the leading edge of capability, from a small number of developers.

Free cash flow: Cash left after a company has paid its operating costs and the investment needed to run the business.