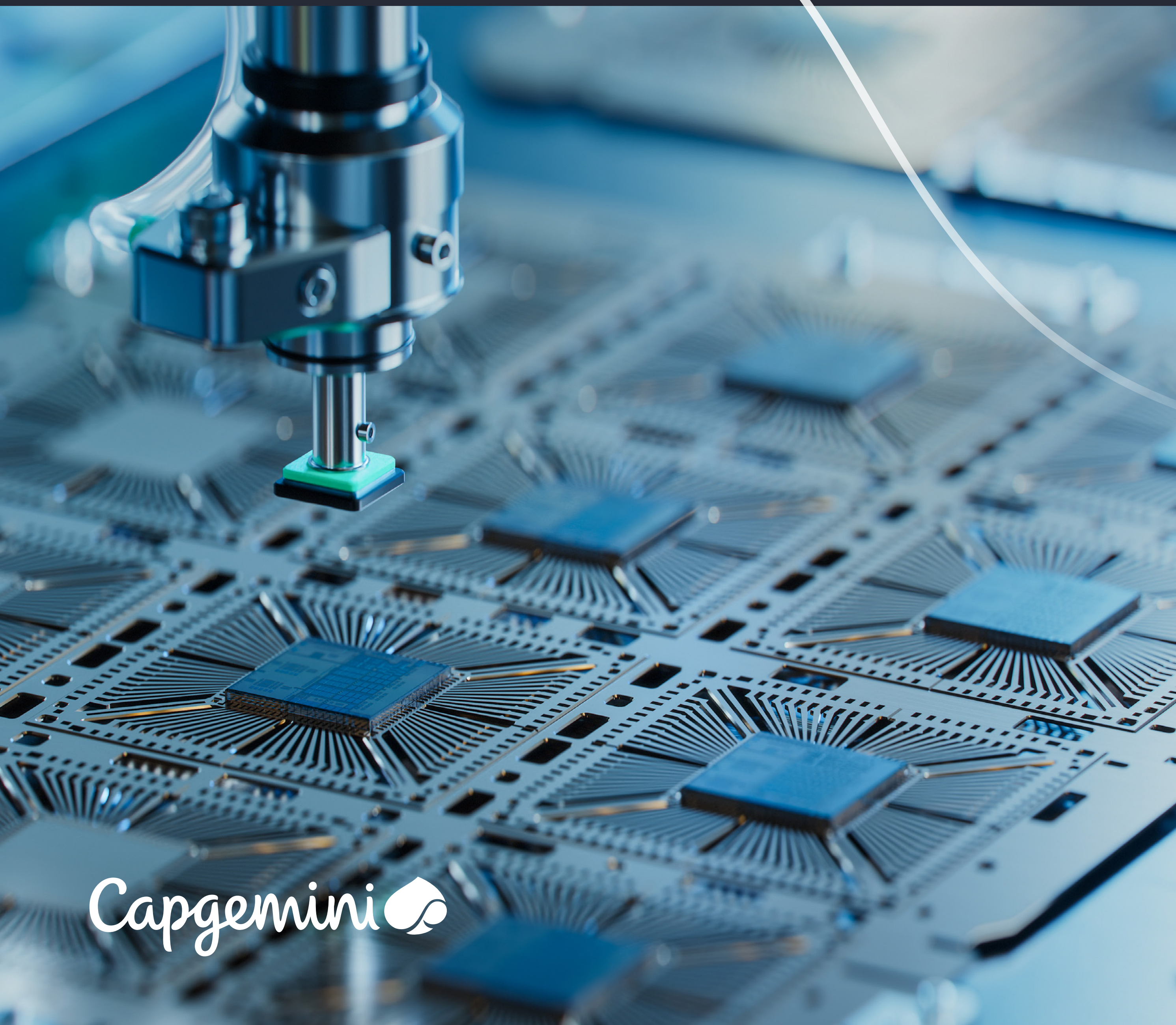
The rise of *derivative chips* - Driving “new” out of “now”



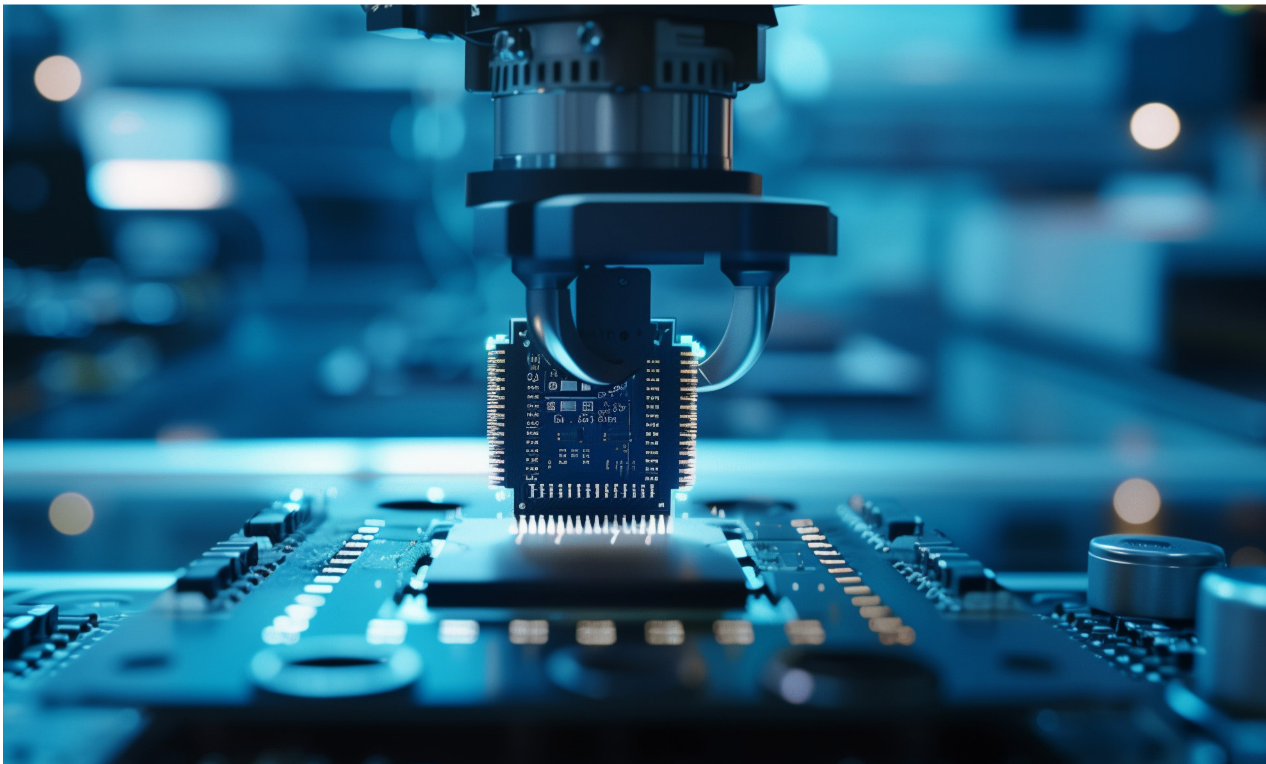
Capgemini

It’s no longer about how long a chip lasts but how to keep a chip relevant

The global semiconductor market is expected to hit $1 trillion by 2030, according to the Semiconductor Industry Association and McKinsey. It’s an exciting number, but that massive growth creates gripping pressure in the industry. Talent and resources continue to be constrained, and designing a chip from the ground up is no longer commercially viable every time there is a new use case or application.

As technology advances rapidly, chips must change in months, not years. Most semiconductor companies have leveraged derivative chips for years because modifying features of an existing, proven chip is more manageable than developing brand-new technology. It also prolongs the lifecycle of a chip that took millions of dollars to develop. It could stretch out that resource by as much as six-plus years.

Every six months, a new technology emerges that may need the latest generation of memory, a new core feature, or a faster IO interface for more efficient computing. Modifying the existing chip’s base design can achieve any of these incremental demands. Derivative chips are no longer just a way to extend the life of a chip for return on investment (ROI), but a necessity for keeping up with market demands and assuring chips are relevant.



Why derivative chips make sense

Derivative chips are the quickest way to enhance features and deliver variants to the market. The original derivative strategy enabled incremental revenue over a chip's codal life or avoided the investment in a completely new chip design. But now, semiconductor companies must pursue derivatives more aggressively to keep up with the emerging technologies and rapidly changing demand. Derivatives offer the following benefits

Enter new market segments faster while keeping share in native segments

For example, a leading chip supplier for medical imaging systems may have saturated its device market but see an opportunity in another medical imaging device or imaging segment with broad functionalities met by the chip they mass manufacture. However, this new application needs additional IO and memory subsystem features to meet the adjacent market. This is a good case for creating a derivative chip, as it offers an increased return on investment, product life span, and revenue for the original chip design over its lifecycle.

Compete on features and price

If a new chip is designed for a new segment from the ground up, it will take a year plus significant research and development investment and most likely create an impossible target OEM price. Derivative chips enhance features, performance, and cost competitiveness by leveraging existing product, which helps quickly address new market needs, deliver customizations, and optimize performance and new features at a competitive cost.

Maintain product quality and retain clients

Any new chip design requires significant time from the first tape-out to verify and validate the functionality, fix bugs, and tune features to meet the target performance. Derivative chips leverage proven novel IP and verification and QA processes and standards to ensure a chip is high quality and delivered to the market on time.

De-risk shortages and onshore

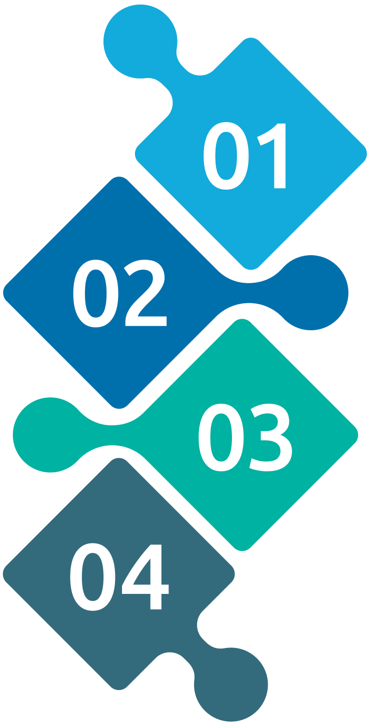
All industries have endured chip shortages or continuity challenges, particularly during the COVID era. In addition, chip designs for certain industrial use cases like heavy engineering require a very long PLM cycle because these chips were designed decades ago using legacy tools, such as EDA software and older manufacturing processes that are not supported or end of life. Manufacturing on older fabs and tools is expensive, and finding skills and technical support is a big challenge. It is a good practice both for the chip manufacturer and its OEM client to consider second sourcing models like derivatives that migrate the base chip design and chip manufacturing from legacy node to the latest nodes (process migration) and from remote fab to a sovereign or onshore or nearshore fab (fab migration) to achieve operational efficiency, continuity of PLM, and mitigate the risks to business continuity.

Migrate chip form-factor – FPGA to ASIC

Field programmable gate arrays (FPGAs) have been tremendously successful in offering the flexibility of features and functions in system design. However, many FPGA applications were only programmed for a fixed function, and the more optimized design for the same application could have been an application-specific integrated circuit (ASIC) instead. This creates an exciting opportunity for semiconductor companies that provide the base or platform chip for FPGAs. Migrating from FPGA to ASIC can have several benefits, including cost savings since ASICs are cheaper to mass produce. They can also eliminate the need for thermal measures like heatsinks, which are required for FPGAs. ASICs can offer higher performance than FPGAs and reduce power consumption, which can also reduce system power consumption. ASICs are hard-coded and cannot be reprogrammed, making them a good choice for critical applications.

Making derivative chips successful

While derivative chips help address many adjacent applications and new markets in a fast and cost-effective way, there are challenges. Semiconductor companies need to focus on quality and consider the following.



Balance Cost and ROI in design

Manufacturers must continually offer new chip designs that meet client's demands for the latest features. Balancing design cost efficiency with ROI is challenging, especially when skilled systems integrators for comprehensive projects are scarce.

Scarce budget and talent

Manufacturers' engineering and R&D teams must engineer ever-changing silicon features in a flat budget environment and achieve tape out on time. There's considerable pressure for the new derivative chip to meet the quality, performance, and functionality goals with preferred fab and tools.

Balacing the now and the next

The chip design team is responsible for developing and actioning the strategy for the subsequent product development, but considerable time, talent, and resources are spent sustaining the present product. They are seriously challenged to focus on the innovations and features needed for future derivative chips.

Working between core and outsourced teams

Even in an outsourced design and development mode, derivative chips are primarily managed by the core design teams within semiconductor companies, often with ad-hoc resources from outsourced service providers. This model forces the client to trade between developing next-generation platforms and derivative products.

The pathway to derivative chip success

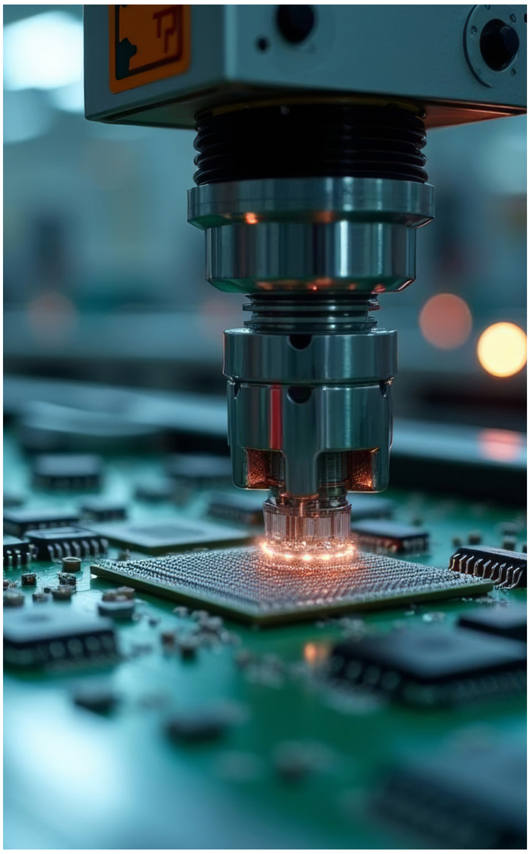
Derivative chips need more focus and attention from leadership in Semiconductor companies.

There are several approaches to adding resources for derivative chips. One is to outsource a turnkey or partial service to a third-party service provider to manage the complete development of derivative chips, from design to foundry sign-off. However, this approach needs to evolve beyond what it is today: mainly external headcount augmentation of existing internal resources. Just adding more people is not going to solve the derivative equation.

In the past, the semiconductor industry experienced severe challenges with outsourced product engineering due to a lack of the appropriate skills at service providers. This is no longer the case.

Semiconductor manufacturers must look for strategic partnerships with a seasoned R&D service provider specializing in the scalable, end-to-end development of derivative products and variants to reduce production failures.

Vendors must add value and embrace the same quality standards as their clients. Customers do not care where, who, or how a chip is made, but they do expect it to have the same quality and performance as previous products from the manufacturer. They just want the technology to work.



Establish a factory mindset Enter the derivative factory

Semiconductor companies must engage a partner considered a one-stop shop and be responsible for derivative chip development for the entire lifecycle, from core and subsystem design to foundry sign-off.

A service provider should offer expert very-large-scale-integration (VLSI) engineering services and fab alliances preferred by a client to design, engineer, validate, and support derivative chip roadmaps. Engineering services should function with high quality and precision that aligns seamlessly with the manufacturers' standards and expectations. This allows chip manufacturers to focus on their following roadmap, optimize cost, and grow business while assuring the right time to market (TTM).

An ideal Derivative Chip Factory has foundry partnerships and core IP alliances to deliver access and experience from current foundries, their processes, design flows, and early access to process design kits (PDKs) and tools for advanced nodes. The factory's focus should ensure that clients improve operational excellence, optimize cost, and grow business by delivering derivative chips to meet market demands.

To succeed in the $1 trillion semiconductor chip industry, companies must create a Derivative Factory that goes beyond just an engineering house. The factory must provide value-added services like fab and process migration, software development for chips, platform, and reference board development, and industry-leading testing capabilities. This will keep chips relevant and ensure market share and revenue do not erode.

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