Rosefinch Research | 2024 Series # 4

Semiconductor – recovery and domestic breakthrough

In the intelligent era, semiconductors can be said to be the "new oil". Smaller, faster, more efficient chips can make AI models run faster and handle more complex tasks. New semiconductor technologies such as quantum computing and neural network chips have also opened up new possibilities for AI development. In turn, breakthroughs in AI technology will also lead to an explosion in semiconductor demand, driving the semiconductor cycle upwards. What stage is the semiconductor cycle in? Can independent development of advanced process be achieved? The following is Rosefinch's research sharing at this year's strategy meeting

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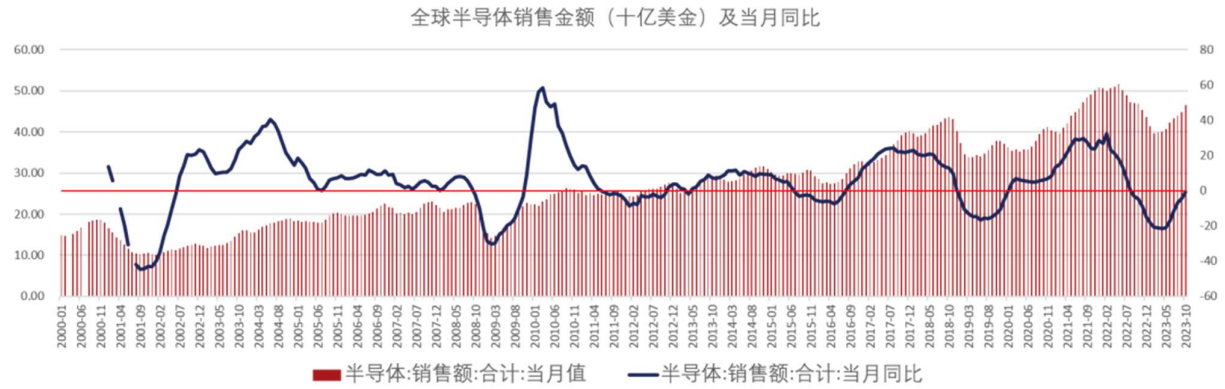
1. Semiconductor cycle is likely entering recovering phase

The main issue that the market is concerned about is: have we seen the bottom of the semiconductor cycle? Our view is that the answer is probably yes, with three signals that indicate the semiconductor cycle is already at a relatively bottom position.

First, global semiconductor sales revenue data, the blue line is the year-on-year growth data of global semiconductor sales month-on-month, and the red columns are the absolute value of sales revenue. Taking the historical lowest year-on-year growth point as a calculation, the start of this semiconductor cycle was June 2019, and the end was March 2023. It can be seen that the year-on-year decline in global semiconductor sales in the second quarter of 2023 has already reached a historical low, and since June 2023, global semiconductor sales revenue has narrowed its year-on-year decline for four consecutive months.



Data source: Semiconductor Industry Association of the United States, Rosefinch.

Historically, the cyclical pattern of semiconductors has continued since the "dot-com bubble" burst. Under the uncertain global environment currently, although sales continue to decline, it has entered the stage of narrowing the year-on-year decline rate in the semiconductor cycle according to the historical rules of the semiconductor cycle.

Secondly, we have seen an increase in storage prices. Storage as one of the major products in semiconductors, the industry is highly concentrated, and storage prices can serve as a very good indicator of economic sentiment.

Currently, storage industry giants have implemented production capacity control measures to stabilize product prices while maintaining a relatively low capacity-utilization rate, and have recently proposed upward price adjustment strategies to downstream customers. This strategy has taken effect since August 2023 - some storage product prices have stabilized after declines and risen month-on-month since September, more product prices have started to increase in October. Given stable supply, the premise for price increases is that inventory destocking is nearing an end and demand is showing some improvement.

Thirdly, in the third quarter earnings calls this year, leading global semiconductor manufacturers did not issue downward guidance for results. Taking TSMC as an example, from the beginning of this year, in the first three quarters, it almost lowered its full-year guidance in every quarterly earnings call, and the latest change is that there was no further downgrade in the third quarter guidance.

2. AI is the influencing factor for this cycle's peak

Looking globally, a semiconductor recovery in 2024 is very likely. More importantly, how strong will this semiconductor cycle recovery be? The key factors that determined the previous semiconductor cycle were geopolitical tensions and supply-demand distortions caused by the pandemic. We judge that the core driving force behind the strength of this semiconductor cycle's upturn will most likely be the AI revolution.

While the global semiconductor industry declined in 2023, taking a longer-term view, the continuing trend of deepening global digitalization is unlikely to change. Demand for computing, storage and transmission is very likely to continue growing. Data shows the global semiconductor market is already over US$500 billion currently, and the US Semiconductor Industry Association expects it to surpass US$600 billion by 2025 and potentially exceed US$1 trillion by 2030.

Classifying by downstream applications, if we calculate data related to smartphones, some PCs and entertainment/advertising-related data centers, communications and consumer-related markets will account for nearly 60% of the total semiconductor market size.

Data source: Semiconductor Industry Association of the United States, Rosefinch.

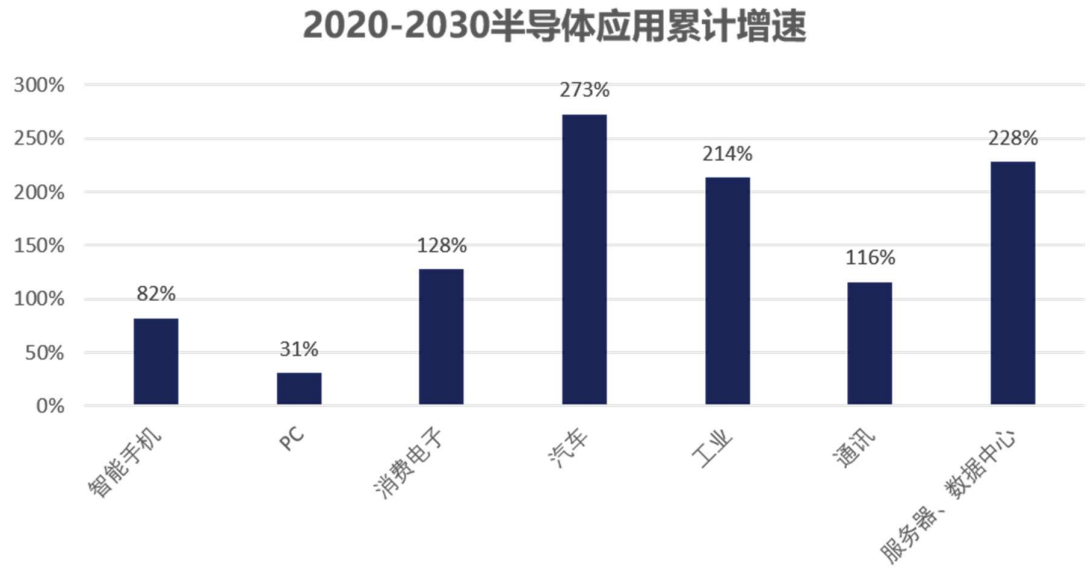
The semiconductor market is like a big fish in a big pond. Structurally, consumer-related markets account for nearly 60% (some PC and data center demand is directly related to consumption), making consumer products a major downstream application market for global semiconductors. This is attributable to the transition during the mobile internet era, where electronic products have changed from cyclical products to consumption products, giving them large volumes and fast iteration.

Semiconductors is a typical industry that follows economy of scale. Only the consumer sector has a sufficiently huge user base, relatively few product categories and rapidly iterative product cycles. Meanwhile consumer applications drive enormous data computing and storage demands. Therefore, the consumer sector is currently an important essential foundation for global semiconductors.

As artificial intelligence continues to grow, we believe computing and storage demands will come primarily from the cloud, similar to how it was for mobile internet. As infrastructure improves continuously and AI capabilities evolve gradually, the positive feedback loop between hardware capabilities and application capabilities will likely eventually drive data centers to surpass smartphones as the single largest semiconductor application market. Core demand drivers will likely continue coming directly or indirectly from the consumer sector, very similar to the demand drivers of the previous mobile internet era.

3. High-automation around automobile, industrial, and data center

From the perspective of application growth rates in the semiconductor industry over the next decade, the three fastest growing areas will be automotive, industrial, and data centers. All will likely have cumulative growth exceeding 200%. Automotive will grow the fastest, but it currently accounts for a relatively low proportion in the semiconductor industry. Overall, the key driving force will be the continued deepening of digitalization and the transformation from digitalization to intelligentization. We will focus research resources on these three areas.

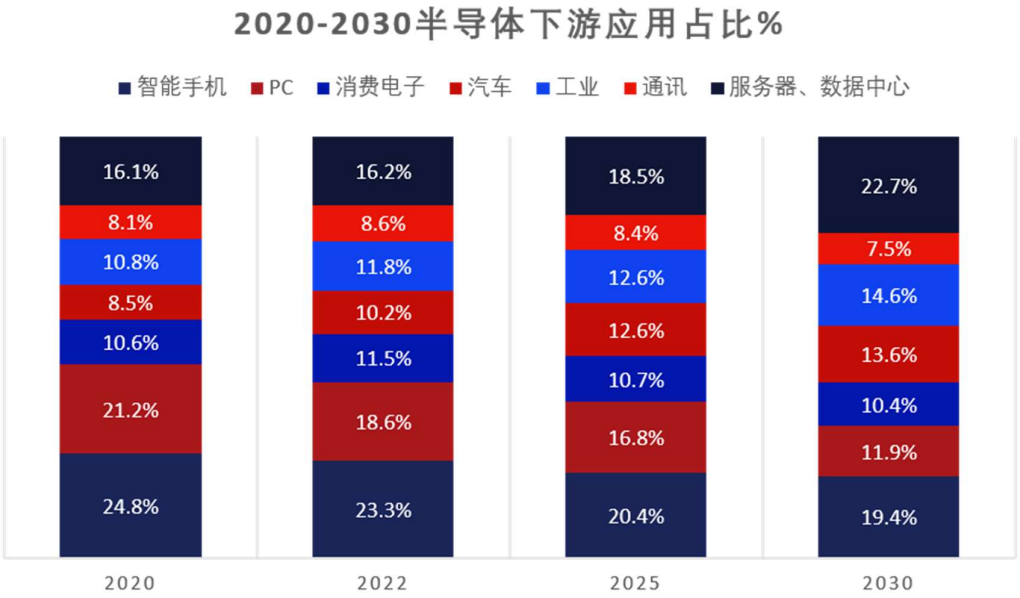


Data source: Gartner, Semiconductor Industry Association of the United States, Rosefinch.

Consumer electronics such as smartphones and PCs were once one of the most dynamic areas in terms of changes in the semiconductor field. It showed very obvious consumption attributes due to their huge user base and continuous iterative technical advances, making it a key focus sector. However, with smartphone penetration peaking, daily personal screen time also peaking, consumer electronics seems to have re-entered a phase where cyclical attributes dominate, with innovation and iteration mainly coming from the wearable device sector.

In the short term, although the market discusses AI PCs and phones a lot, the core changes are mainly in the main chips, with limited changes to the products themselves. Total volumes have also reached industry ceilings, and public data shows the proportion of consumer electronics in the semiconductor industry may drop from the current 55% to 40% by 2030. Therefore, we will focus on product innovations and the structural & competitive changes they bring.

Long-term, we still hope that the AI era will recreate the glory of the mobile internet era and boost consumer electronics' consumption attributes again.



Data source: Gartner, Semiconductor Industry Association of the United States, Rosefinch.

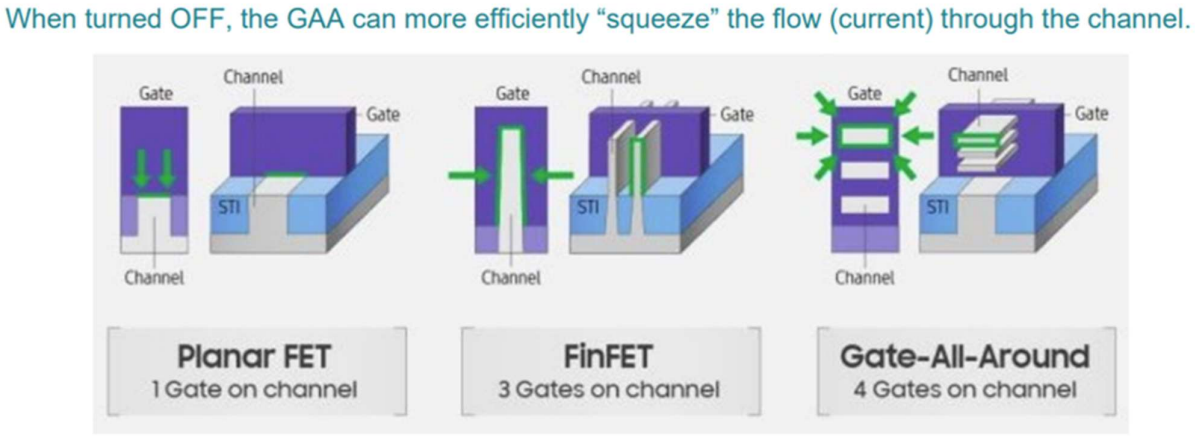
Our research focuses on automotive, industrial, and data centers center around high levels of autonomous controllability. The current autonomous controllability fields differ somewhat from when the trade war began in 2018 - at that time self-sufficiency rates were very low, but now self-sufficiency rates are relatively high in many areas, especially consumer and home applications including general industrial and automotive chips.

However, self-sufficiency rates remain very low in the high-level autonomous controllability areas we emphasize. Key among these are advanced computing chips, high-performance storage, and high-performance data transmission. These areas are in line with AI-driven technological progress.

Starting from the most basic manufacturing capabilities, we focus on domestic advanced semiconductor manufacturing plants, advanced process manufacturing equipment, advanced packaging, as well as core computing chips, storage chips, data transmission chips, key raw materials, and consumables.

The following two charts represent the two most cutting-edge directions currently discussed in the market.

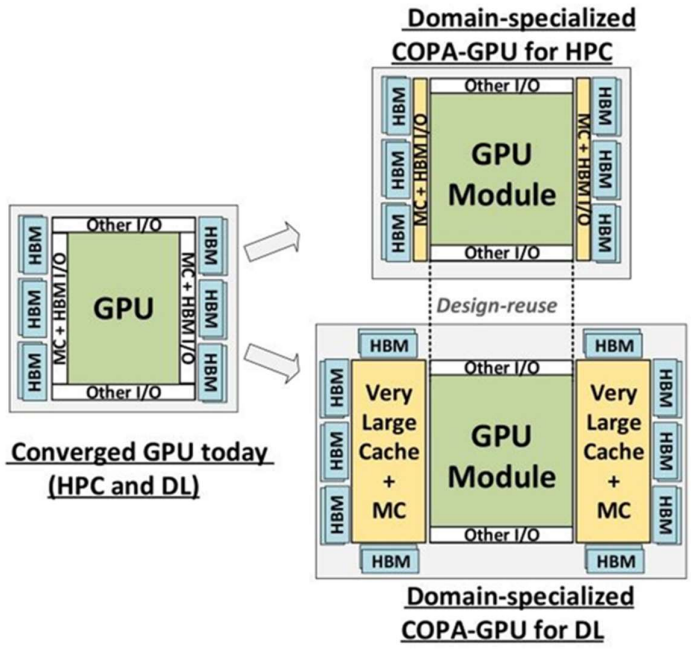
Looking at the evolution of advanced manufacturing processes, structures become more complex and equipment requirements higher from left to right. Also, from the perspective of semiconductor manufacturing, the finer the line width, the higher the requirements for equipment. We will focus on finding equipment that can meet the needs of advanced processes around these main lines.



Source: Samsung

Data source: Samsung, Rosefinch.

Another area seeing much discussion currently is the chiplet architecture. The core technology involves integrating computing cores, I/O, and storage on a large baseplate at the chip level, allowing cost savings, increased flexibility and yield enhancement compared to integrating onto a single complete chip, as well as faster product launch speeds to market.



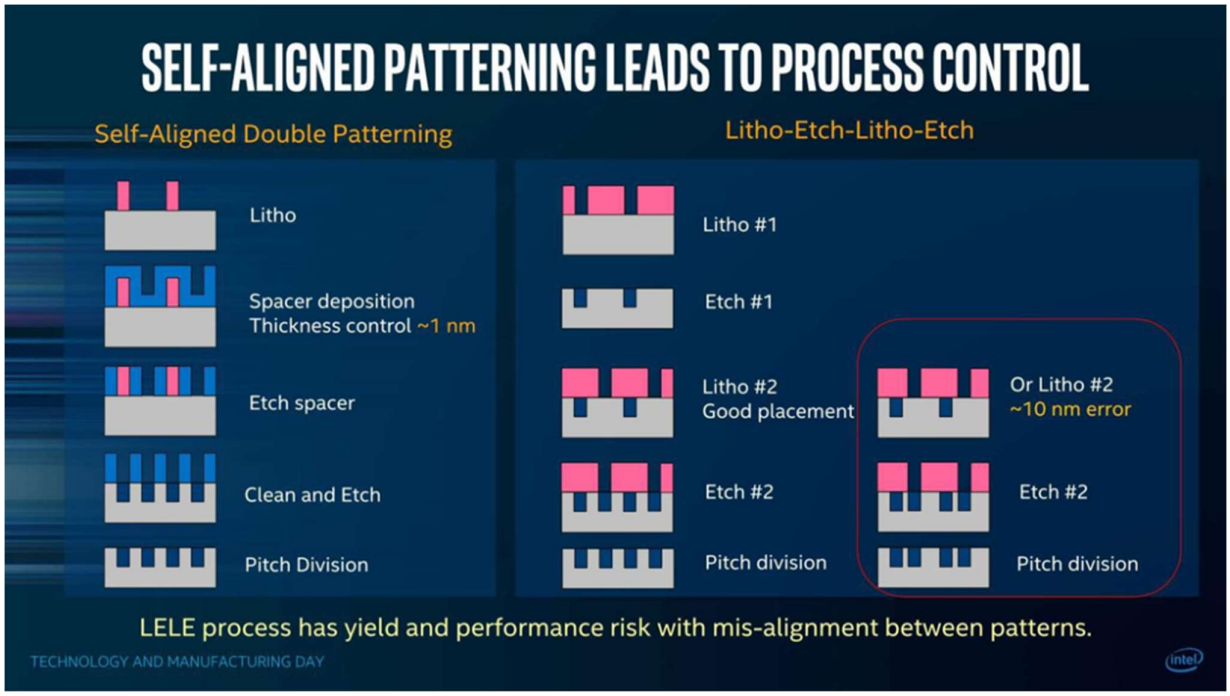
Data source: AMD, Rosefinch.

Looking at Intel's notebook PC chips, small chip forms will likely be the mainstream going forward. The core technology of small chips is advanced packaging - how to integrate different chips onto a board within a relatively small space while controlling transmission and heat dissipation.

4. Maintain patience and confidence on self-development

The final unavoidable question is, under extreme pressure from the US, can China achieve independent development in the field of advanced processes?

The following figure is a simple schematic diagram using multiple exposures with a 1980 lithography machine to achieve finer line widths using a relatively backward process. On the left side from top to bottom is the first lithography, followed by thin film deposition on the lithography pattern, then a third lithography, and a fourth lithography to clear the original pattern by etching based on the lithography pattern, finally forming a finer pattern.



Data source: Intel, Rosefinch.

Looking at Huawei's well-publicized phone breakthrough this year, domestic companies have already mastered relatively advanced lithography processes. Moreover, China is not exploring these processes in an uncharted field - leading manufacturers achieved this several years ago, with ample industrial resources and technological materials that can be utilized. As long as sustained investment is made according to industrial rules, combining active feedback from domestic customers, we believe breakthroughs can likely be achieved given sufficient time.

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