

# China's Semiconductor Market Prospects in the Next Several Years

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**Abstract.** Semiconductors are the core of the modern electronics industry and are crucial for economic growth, national security, technological innovation, and global competitiveness, which can promote technological innovation and economic development. Nowadays, the market scale of semiconductors expands a lot in China every year, since it is the critical component for everything from consumer electronics to advanced AI. The use of semiconductors because they are the essential materials that enable the operation of modern electronics. Semiconductors have unique properties that allow them to act as either conductors or insulators depending on the conditions, such as the application of voltage or light. This versatility makes them ideal for building electronic components like transistors, diodes, and integrated circuits (ICs), which are the building blocks of all electronic devices. Without question, the use of semiconductors is increasing after it shows up in everyone's view. Therefore, this research introduces the requirement for semiconductors in the overall market and the prospects in the next ten years.

**Keywords:** Semiconductor; Technology; Semiconductor Market; Government Support.

## 1. Introduction

China is the largest consumer of semiconductors, because these years, China has focused on the development of electronic information technology and artificial intelligence (AI). However, China imports around 70% of the semiconductors it uses, China's integrated circuit production has accounted for 16% of the world's total IC production, ranking third in the world. Yet, China is a net semiconductor importer, and it continues to increase its imports. In Q3 2023, China experienced a significant 93% surge in chip-making equipment imports compared to the same period last year, reaching USD 8.75 billion (RMB 63.4 billion). Notably, lithography equipment imports, a crucial part of chip-making, increased nearly fourfold. Import data reveals a notable increase in semiconductor equipment imports from the Netherlands, even with implemented export restrictions. ASML, the Dutch market leader in lithography machines, saw a substantial rise in sales revenue from China, doubling from 24% to 46% in Q3 2023 [1]. However, the country's strategic policies and investments aim to reduce this dependency. Therefore, the Chinese Government decided to develop semiconductors and release the import of it. Only a few technology enterprises focused on exploiting semiconductors. Some of these companies achieve an advanced breakthrough, for example, TianyueXianjin(SICC), San'anguangdian, and Luxiaokeji. Especially Tianyuexianjin (SICC), is the top 3 enterprise in selling or producing. Between the years 2014 and 2030, the Chinese government continuously focuses its resources on intensifying the production of semiconductors by investing as much as US\$ 150 billion [2]. It includes the following industries: consumer electronics, consumer electronics, data centers, industrial, aerospace and defense, and healthcare, among others. The data center had the most market share, the research stated. In the Chinese semiconductor market, data center end users are the leading user type. China is experiencing a surge in demand for data centers due to the rapid expansion of big data, cloud computing, and digital transformation projects. A wide range of semiconductor parts, such as CPUs, memory chips, storage units, networking hardware, and power management programs, are needed for data centers. The data center end-user category in the Chinese semiconductor market is growing and becoming more dominant due to the substantial demand from data centers [3]. Therefore, China's technology corporations are now purchasing tonnes of chip equipment, accounting for nearly half of all semiconductor equipment worldwide [4]. By retaining control over important "chokepoints" in the semiconductor industry, where it has a

considerable advantage since the United States is taking advantage of these mismatches. China is mostly dependent on imports of chips because the US and its allies control more than 90% of the world market for semiconductor equipment manufacture. With a focus on artificial intelligence (AI), the Biden administration is utilizing this leverage to slow down China's semiconductor industry growth. By controlling vital supply chain nodes like advanced AI chips and lithography equipment from the Dutch company ASML, they are implementing a "small yard, high fence" strategy in an effort to minimize wider economic impacts while focusing on target locations [5]. However, the potential of the Chinese semiconductor market is inestimable because of its gigantic requirement and development spaces. If the Chinese Government invests and encourages enterprises to improve this technique. In the future, China will occupy the largest market of semiconductors [6]. This research examines the prospects of China's semiconductor market over the next decade by analyzing key trends, government policies, and global dynamics shaping the industry.

## **2. Market Growth Drivers**

There are a number of anticipated factors that would assist market growth within the semiconductor in China during the next decade:

### **2.1. New Source of Technologies**

**Artificial Intelligence (AI):** There has been accelerated progress in the use of AI by China in various sectors and semiconductors like the GPU as well as AI chips are necessary for data processing, and training algorithms.

**5G and Telecommunications:** The 5G rollout with its corresponding infrastructure will create a market for semiconductor components, more so for base stations and for 5G capable gadgets.

**Electric Vehicles (EVs):** With the increase of electric vehicles in China, the telecommunication and transportation industries call for better semiconductors for controlling the power, sensing and system communication within the vehicles.

**Internet of Things (IoT):** Along with the growth of the IoT network in China, there will be a growing second need for chips for appliances such as in smart cities, healthcare, and manufacturing.

### **2.2. Massive Consumer Electronics Market**

Indeed China has the most advanced consumer electronics market in the world dominated by manufacturing activities of items such as mobile phones, laptops and smart devices. Such internal markets will continue to sustain the requirement for new and even old semiconductor technology.

#### **Challenges and Barriers**

Nevertheless, despite this rosy foretelling, China has to grapple with a lot of challenges if at all it plans to achieve semiconductor self-sufficiency as well as be the forerunner in this market.

### **2.3. Government Support and Strategic Policies**

The Chinese government has also placed semiconductors at the core of its agenda, regarding it as essential as any other manufacturing industry within the broader concept of the "Made in China 2025" policy. China aspires to enhance its self-sufficiency with regard to semiconductor fabrication through substantial state-sponsored investments, tax breaks as well as R&D assistance. National policy of technological self-sufficiency through sustained investment development, "Made in China 2025" semiconductors as centers.

**National IC Managerial Fund** American state financial resources to enterprises developing semiconductors.

Subsidizing local policies with the local semiconductor industry and offering a favorable tax regime. Presence of policy frameworks targeting local capacities and bridge universities with industries.

China, on the other hand, understands the political environment and therefore is determined to achieve self-sufficiency in the semiconductor industry owing to the current trade tensions with the US and its Technology Transfer Policies and the Huawei Company. The technology transfer policies put China at risk of continuing to be dependent on Western technologies which has been the case for years now.

## **2.4. Technological Lag**

Even if China started engaging in the production of semiconductors, it is yet to overcome the technological bottleneck at this very moment managed by the semiconductor manufacturing giants i.e. Taiwan's TSMC and South Korea's Samsung and American's Intel and Qualcomm companies. The most advanced foundries in China are now operating at 14nm processes while the likes of the likes of TSMC and Samsung have already moved to the 3nm processes. China also faces challenges in semiconductor equipment and materials. Key semiconductor manufacturing equipment, such as lithography machines, etching machines, and cleaning equipment, as well as high-purity semiconductor materials, heavily rely on imports. The complexity and technical threshold of these devices are high, and domestic enterprises still have significant room for improvement in research and development as well as production.

In addition, design software and intellectual property are also weaknesses in China's semiconductor industry. Advanced chip design relies on professional EDA (Electronic Design Automation) software, which is currently mainly provided by foreign companies such as Cadence, Synopsys, and Mentor Graphics. Chinese companies are striving to catch up in these key technological fields, but achieving complete autonomy and controllability requires time and sustained investment in technological innovation.

### **2.4.1. Geopolitical Pressures.**

U.S.-China tensions continue to pose a major threat to China's technology specifically semiconductors. Instruments like the U.S. Entity List impose export controls that prevent Chinese corporations from obtaining important technologies and high-end instruments such as EUV lithography machines which are needed for the manufacture of high-end chips [7]. Since 2019, Chinese technology companies have been subject to penalties by the United States. Furthermore, this has extended to a growing variety of businesses in recent years, both in terms of exports and the capacity of US businesses to invest in them. Significantly, the 2022 prohibition on the sale of semiconductor chips to China and the ensuing comparable legislation from Japan and the Netherlands show a clear uptick in efforts to impede the development of China's tech industry [8].

### **2.4.2. Talent Shortage.**

China suffers from skilled semiconductor engineers shortages. To be able to compete on the global stage, it is vital for China to have a competent workforce capable of lead chip design, fabrication, and materials science, and this is something that has been developed over time. The Chinese government can help businesses build factories and buy equipment, and it can also set up various university training programs, such as developing IC talent in 168 key colleges and 82 key institutions across the country. However, it is unable to control talent migration, which leads to a growing structural imbalance in the middle of the talent gap in the Chinese IC industry [9].

## **3. China's Endeavors with Challenges**

China is undertaking several initiatives to overcome technological and geopolitical challenges. Support from the government is essential; programs like the 14th Five-Year Plan and Made in China 2025 are meant to lessen dependency on foreign technology. Modern chip manufacturing depends on essential technology like sophisticated lithography equipment and EDA tools, but access to them has been impeded by U.S. export regulations and sanctions. China is lagging behind global heavyweights like TSMC and Samsung in the production of sophisticated chips at 5nm or 3nm nodes, despite encouraging domestic manufacturing initiatives spearheaded by SMIC. To compete in consumer

electronics and high-performance computing, it is imperative to close this technology gap. China's plans for scaling are further complicated by quality and yield difficulties in mass production. China continues to be reliant on foreign design tools and intellectual property even while it is making significant R&D investments and encouraging innovation in fields like AI chips and quantum computing. The lack of qualified personnel is another barrier to the sector's expansion since China is in competition with other international tech hubs for the best engineers and researchers. Furthermore, supply chain vulnerabilities still exist because China imports necessary supplies and machinery from abroad. Even with efforts to localize production, advancements could be seriously hampered by problems in the global supply chain. China has enormous forces to propel it forward in the global semiconductor business, such as government support, investments, and rising domestic demand, but it also faces formidable geopolitical, technological, and talent-related challenges.

China is hot on the heels of the market by constructing its own semiconductor fabrication plants or fabs. Leading companies like SMIC (Semiconductor Manufacturing International Corporation) keep getting government support to raise their production capacity and improve baseline technology. China has attempted to purchase other countries' semiconductor companies as well as develop cooperation with other countries for enhancement purposes, though there were challenges due to government defense constraints in the countries targeted.

China is seeking to shorten its dependency on US high tech by building a new semiconductor supply chain. Specifically, it includes constructing factories for raw materials, manufacturing equipment and designing software for semiconductors.

Therefore, faced with challenges, the Chinese semiconductor industry is making various efforts to enhance its competitiveness. Firstly, with financial support from the government and enterprises, China is significantly increasing its investment in semiconductor research and development to promote technological innovation and product development. At the same time, China is establishing and improving a national-level semiconductor research and development platform to promote the deep integration of industry, academia, research and application. In terms of talent cultivation, China provides scholarships, research funding, and career development opportunities to cultivate and attract professionals in the semiconductor field. In terms of industrial chain integration, China has improved the synergy and overall competitiveness of the industrial chain through mergers and acquisitions, joint ventures, and strategic cooperation. In addition, Chinese semiconductor companies are developing competitive products based on market demand, especially customized chips for emerging markets such as 5G, artificial intelligence, the Internet of Things, and electric vehicles. In terms of international cooperation, the Chinese semiconductor industry actively participates in international cooperation, obtaining advanced technology and management experience through technical exchanges, joint ventures, and market cooperation. At the policy level, the Chinese government has provided a series of policy support for the semiconductor industry, including tax incentives, funding support, research and development subsidies, and market access facilitation. At the same time, the Chinese semiconductor industry is establishing a risk management system to cope with the uncertainty of the international market and technological development. Finally, the Chinese semiconductor industry is committed to improving energy efficiency and reducing environmental pollution, promoting green manufacturing and sustainable development. Through these comprehensive measures, the Chinese semiconductor industry is gradually reducing its dependence on external technologies and laying the foundation for long-term independent development.

#### **4. Future Prospects**

The potential expansion of the semiconductor market in China, due to the importance that the government attributes strategically to semiconductors within both national security and technological competition, is another factor that needs to be taken into account. Some analysts have predicted that China's dependency on imported semiconductors could be slashed by as much as 30% by the year 2030. However, for all practical comprehension, achieving full self-sufficiency, especially in

advanced technologies may still be an aspiration for some coming years. Although there is a strong risk that China will be behind in state-of-the-art semiconductor processes, its current position in consumer electronics and government initiatives in the future may convert it to a key market participant for mid as well as legacy chips. If the Chinese nurture human skills and supporting systems, the nation would become a global hub for AI chips, IoT sensors, 5G memories, and such. The increasing demand for Chinese-made semiconductors will be stimulated by the favorable growth of demand in markets such as the AI industry, electric vehicles, and the 5G demand. This is especially true regarding AI chip development, which is the direction China strives to follow anyway, becoming a leading position in such technology as AI. China has actively maneuvered through the ban on semiconductor policies in the United States and other countries and has quickly adjusted its policies. However, as semiconductor equipment and related components are still heavily dependent on imports, it will not be easy to achieve full autonomy within five years. Relying on external advanced technology and equipment, we expect China's semiconductor development will be a gradual process even with the strategy of upgrading technology and gradually increasing manufacturing experience [10].

The future development prospects of China's semiconductor industry are broad, but there are also many challenges. In order to achieve leapfrog development, the Chinese government has made the semiconductor industry an important component of its national strategy. Under the promotion of policies, China's semiconductor industry will increase research and development investment, and promote technological innovation, especially in key areas such as chip design, manufacturing processes, packaging and testing. By establishing a national-level semiconductor research and development center, attracting top talents at home and abroad, strengthening the integration of the industrial chain, improving the independent and controllable ability of the industrial chain, and reducing dependence on external factors. At the same time, China will pay more attention to market demand, develop semiconductor products that meet market demand, actively participate in international cooperation, introduce advanced foreign technology and management experience, and strengthen its competitiveness in the international market.

Faced with the uncertainty of the international political and economic situation, China's semiconductor industry will strengthen risk management, formulate response strategies, and ensure the stable development of the industry. At the same time, China will focus on talent cultivation and introduction, cultivating more semiconductor professionals through cooperation between universities, research institutions, and enterprises, and attracting high-end overseas talents to return to China for development. The government will continue to provide policy support, including tax incentives, funding support, market access, etc., to create a favorable market environment for the development of the semiconductor industry. In addition, China's semiconductor industry will also focus on green development, improve energy efficiency, reduce pollution, and achieve sustainable development. Through these measures, China's semiconductor industry is expected to achieve leapfrog development in the coming years, meeting domestic market demand while occupying a more important position in the global semiconductor market.

## **5. Conclusion**

China's semiconductor market is set for substantial growth in the next ten years, driven by domestic demand, strategic government support, and the country's ambition to become self-sufficient in critical technologies. However, technological challenges, geopolitical risks, and a global semiconductor talent shortage remain significant obstacles. To succeed, China must continue to invest in innovation, talent development, and supply chain diversification while navigating the complex global political landscape. Despite these hurdles, China's semiconductor industry is expected to play a larger role in shaping the future of global technology.

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