

# **Semiconductor Foundry Market – Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Technology Node (10/7/5 nm, 16/14 nm, 20 nm, 28 nm, 45/40 nm, 65 nm), By Application (Consumer Electronics and Communication, Automotive, Industrial, HPC), By Region, By Competition, 2018-2028**

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## **Abstracts**

Global Semiconductor Foundry Market has valued at USD 76 Billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 7.1% through 2028. The global semiconductor foundry market is experiencing significant growth, driven by a confluence of factors that underscore its pivotal role in the modern digital economy. Semiconductor foundries, specializing in the fabrication of integrated circuits (ICs), have become the linchpin for innovation across a multitude of industries. The relentless pursuit of miniaturization and performance enhancement in electronics, coupled with the emergence of transformative technologies like 5G, artificial intelligence (AI), and the Internet of Things (IoT), has led to an insatiable demand for advanced microchips.

Furthermore, the rising complexity and cost of semiconductor manufacturing processes have prompted an increasing number of fabless semiconductor companies and integrated device manufacturers (IDMs) to outsource their fabrication needs to foundries. This strategic shift has spurred the growth of foundry services, making them a vital ecosystem player. Companies like TSMC, GlobalFoundries, and Samsung Foundry have risen to prominence, catering to a broad spectrum of semiconductor applications.

## Key Market Drivers

### Increasing Demand for Advanced Semiconductor Solutions

The Global Semiconductor Foundry Market is experiencing significant growth due to the increasing demand for advanced semiconductor solutions across various industries. As industries such as automotive, consumer electronics, telecommunications, and IoT devices continue to evolve and demand higher performance and efficiency from their electronic products, the need for advanced semiconductors has become paramount. This surge in demand is driven by several factors. Firstly, technological advancements have led to the development of innovative applications and products that require more powerful and sophisticated semiconductors. For instance, the rise of electric vehicles, autonomous driving, and smart homes has created a need for semiconductors with higher processing capabilities, improved energy efficiency, and enhanced connectivity. Secondly, the growing trend of outsourcing semiconductor manufacturing to specialized foundries has contributed to the market's growth. Many companies prefer to focus on their core competencies while relying on semiconductor foundries for efficient and cost-effective manufacturing processes. Outsourcing allows companies to access advanced fabrication technologies, reduce capital expenditure, and benefit from the expertise of specialized foundries. Additionally, the complexity of semiconductor design has increased significantly, requiring specialized expertise and resources. Foundries offer design services, process technologies, and manufacturing expertise to help companies bring their complex semiconductor designs to market.

This collaboration enables companies to leverage the foundries' capabilities and accelerate time-to-market. Furthermore, the global semiconductor foundry market is driven by the need for customization and reduced time-to-market. Foundries provide flexible manufacturing solutions that allow companies to customize their semiconductor designs according to specific requirements. This customization enables companies to differentiate their products in the market and meet the evolving demands of consumers. Additionally, foundries offer shorter production cycles and faster time-to-market, allowing companies to quickly launch their products and gain a competitive edge. Lastly, the increasing focus on energy efficiency is also contributing to the growth of the semiconductor foundry market. As energy consumption becomes a critical concern, companies are seeking energy-efficient semiconductor solutions. Foundries are developing advanced fabrication processes and materials that enable the production of energy-efficient chips with lower power consumption. This focus on energy efficiency aligns with global sustainability goals and regulations, further driving the demand for semiconductor foundry services. In conclusion, the increasing demand for advanced

semiconductor solutions in various industries, coupled with the outsourcing trend, complexity of semiconductor design, need for customization, and focus on energy efficiency, are the key drivers behind the rising growth of the Global Semiconductor Foundry Market.

### Outsourcing Semiconductor Manufacturing

Outsourcing semiconductor manufacturing has emerged as a significant driver of growth in the Global Semiconductor Foundry Market. The trend of outsourcing semiconductor manufacturing to specialized foundries has gained momentum due to several key factors. Firstly, companies across industries, such as automotive, consumer electronics, telecommunications, and IoT devices, are increasingly focusing on their core competencies and strategic priorities. By outsourcing semiconductor manufacturing to specialized foundries, these companies can leverage the expertise and resources of the foundries, allowing them to allocate their internal resources and investments towards research, development, and innovation. This strategic shift enables companies to stay competitive in the rapidly evolving market by accelerating time-to-market and reducing capital expenditure. Secondly, semiconductor foundries offer advanced fabrication technologies and manufacturing processes that may not be readily available or economically feasible for companies to develop in-house. Foundries invest heavily in research and development to stay at the forefront of technological advancements, enabling them to provide cutting-edge solutions to their clients. By outsourcing to these foundries, companies can access state-of-the-art facilities, advanced equipment, and specialized expertise, ensuring high-quality and efficient manufacturing of their semiconductor products. Additionally, outsourcing semiconductor manufacturing provides companies with flexibility and scalability.

The demand for semiconductors can fluctuate, and outsourcing allows companies to adjust their production volumes based on market demand without the need for significant investments in additional manufacturing infrastructure. This flexibility also enables companies to respond quickly to changing market dynamics and customer requirements. Furthermore, outsourcing semiconductor manufacturing to specialized foundries mitigates the risks associated with manufacturing complexities and supply chain management. Foundries have established robust supply chain networks, ensuring a consistent supply of raw materials and components. They also have stringent quality control processes in place to maintain high manufacturing standards. By leveraging the expertise and capabilities of foundries, companies can reduce the risks associated with manufacturing challenges, such as yield optimization, process variability, and quality control. In conclusion, the outsourcing of semiconductor manufacturing to specialized

foundries is driving the growth of the Global Semiconductor Foundry Market. This trend allows companies to focus on their core competencies, access advanced fabrication technologies, achieve flexibility and scalability, and mitigate manufacturing risks. By partnering with semiconductor foundries, companies can optimize their manufacturing processes, accelerate time-to-market, and remain competitive in the dynamic semiconductor industry.

### Technological Advancements

Technological advancements play a crucial role in driving the growth of the Global Semiconductor Foundry Market. The semiconductor industry is characterized by rapid innovation and continuous technological advancements, which have a direct impact on the capabilities and offerings of semiconductor foundries. Firstly, technological advancements enable the development and implementation of advanced fabrication processes. Foundries invest heavily in research and development to enhance their manufacturing processes, improve chip performance, and reduce power consumption. Innovations such as the development of smaller transistor sizes, 3D packaging technologies, and the integration of new materials enable foundries to produce more advanced and efficient semiconductors. These advancements not only cater to the increasing demand for high-performance chips but also contribute to the overall progress of various industries, including automotive, consumer electronics, telecommunications, and IoT devices. Secondly, technological advancements drive the development of advanced design tools and methodologies. As semiconductor designs become more complex, foundries need to stay at the forefront of design technologies to support their customers' requirements.

This includes the adoption of advanced design-for-manufacturability (DFM) techniques, simulation tools, and verification methodologies. By leveraging these technological advancements, foundries can optimize the design process, improve yield rates, and reduce time-to-market for their customers. Additionally, technological advancements enable foundries to offer a broader range of services and solutions. For instance, the integration of advanced packaging technologies, such as system-in-package (SiP) and wafer-level packaging (WLP), allows foundries to provide more comprehensive and integrated solutions to their customers. These advancements enable the miniaturization of electronic devices, improve performance, and enhance functionality. Moreover, technological advancements also contribute to the development of specialized process technologies. Foundries continuously invest in research and development to develop and implement advanced process nodes, such as FinFET and EUV lithography. These process technologies enable the production of chips with higher transistor densities,

improved power efficiency, and enhanced performance. By offering access to these advanced process technologies, foundries can cater to the increasing demand for cutting-edge semiconductor solutions. In conclusion, technological advancements are instrumental in driving the growth of the Global Semiconductor Foundry Market. These advancements enable the development of advanced fabrication processes, design tools, and specialized process technologies. By leveraging these technological advancements, foundries can meet the evolving demands of various industries, offer comprehensive solutions, and stay competitive in the dynamic semiconductor market.

### Increasing Complexity of Semiconductor Design

The increasing complexity of semiconductor design is a significant driver of growth in the Global Semiconductor Foundry Market. As the demand for advanced electronic devices with higher performance and functionality continues to rise, semiconductor designs have become increasingly intricate and integrated. This complexity poses challenges for companies that lack the specialized expertise and resources to handle the intricacies of semiconductor design. Semiconductor foundries, on the other hand, are equipped with the necessary capabilities and knowledge to address these challenges. They invest heavily in research and development to develop advanced design tools, process technologies, and design-for-manufacturability (DFM) techniques. By leveraging their expertise, foundries can assist companies in designing and optimizing complex semiconductor designs, ensuring manufacturability, and improving yield rates. The collaboration between companies and foundries enables the successful production of complex chips, meeting the evolving demands of industries such as automotive, consumer electronics, telecommunications, and IoT devices.

Moreover, the increasing complexity of semiconductor design drives the need for specialized foundry services. Foundries offer a range of services tailored to specific applications and industries, such as automotive-grade processes, high-performance computing, and AI chips. This specialization allows foundries to cater to the unique requirements of different industries and provide customized solutions that meet their specific needs. By offering specialized services, foundries can differentiate themselves in the market and attract customers seeking expertise in complex semiconductor designs. Additionally, the complexity of semiconductor design drives collaboration and partnerships between industry stakeholders, design houses, and foundries. These collaborations foster innovation, knowledge sharing, and the development of cutting-edge solutions. By working together, companies and foundries can overcome the challenges posed by the increasing complexity of semiconductor design, accelerate time-to-market, and stay competitive in the rapidly evolving semiconductor industry. In



conclusion, the increasing complexity of semiconductor design is a key driver of growth in the Global Semiconductor Foundry Market. Foundries play a crucial role in addressing the challenges associated with complex designs, offering specialized services, and fostering collaboration. By leveraging their expertise and resources, foundries enable companies to successfully design and manufacture complex semiconductor chips, meeting the demands of various industries and driving the growth of the semiconductor foundry market.

### Growing Need for Customization and Time-to-Market

The growing need for customization and reduced time-to-market is a significant driver of growth in the Global Semiconductor Foundry Market. In today's fast-paced and competitive business landscape, companies across industries are seeking ways to differentiate their products and bring them to market quickly. This need for customization and accelerated time-to-market has led to an increased reliance on semiconductor foundries. Foundries provide flexible manufacturing solutions that allow companies to customize their semiconductor designs according to specific requirements. This customization enables companies to tailor their products to meet the unique demands of their target markets, enhancing their competitiveness. Additionally, foundries offer shorter production cycles and faster time-to-market, enabling companies to swiftly launch their products and gain a competitive edge. By outsourcing semiconductor manufacturing to specialized foundries, companies can leverage the foundries' expertise, advanced fabrication processes, and manufacturing capabilities to streamline their production processes and reduce time-to-market. This partnership allows companies to focus on their core competencies, such as product design and marketing, while relying on the foundries' specialized manufacturing expertise. Furthermore, the collaboration between companies and foundries fosters innovation and knowledge sharing, enabling the development of cutting-edge solutions.

The growing need for customization and reduced time-to-market also drives the adoption of advanced design tools and methodologies. Foundries invest in research and development to stay at the forefront of design technologies, such as design-for-manufacturability (DFM) techniques and simulation tools. These tools enable companies to optimize their semiconductor designs for manufacturability, improve yield rates, and reduce time-to-market. By leveraging the expertise and resources of semiconductor foundries, companies can accelerate their product development cycles, respond quickly to market demands, and stay ahead of the competition. In conclusion, the growing need for customization and reduced time-to-market is a key driver of growth in the Global Semiconductor Foundry Market. Foundries provide flexible manufacturing

solutions, faster production cycles, and access to advanced design tools, enabling companies to customize their semiconductor designs and bring their products to market quickly. By partnering with semiconductor foundries, companies can optimize their manufacturing processes, accelerate time-to-market, and maintain a competitive edge in the dynamic business environment.

## Key Market Challenges

### Limited Access to Advanced Process Technologies

Limited access to advanced process technologies poses a significant challenge in the global semiconductor foundry market. The development and implementation of advanced fabrication processes require substantial investments in research and development, specialized equipment, and technical expertise. This creates a barrier for small and medium-sized foundries, as they may struggle to keep up with the rapid advancements and acquire the necessary resources to offer cutting-edge process technologies. As a result, these foundries may face a competitive disadvantage and find it challenging to meet the evolving demands of customers. The semiconductor industry is characterized by continuous innovation and the constant push for smaller, faster, and more power-efficient chips. Advanced process technologies, such as FinFET, 3D transistors, and extreme ultraviolet (EUV) lithography, are crucial for achieving these goals.

However, the development and implementation of these technologies require substantial investments in research and development, specialized manufacturing equipment, and highly skilled personnel. Large foundries with significant financial resources and established research and development capabilities are better positioned to invest in and adopt these advanced process technologies. They can leverage their economies of scale to spread the high costs associated with technology development and equipment acquisition. In contrast, small and medium-sized foundries may struggle to make similar investments due to limited financial resources and a lack of in-house research and development capabilities. This limited access to advanced process technologies can hinder their ability to offer cutting-edge solutions and meet the increasing demands of customers who require high-performance, energy-efficient, and compact semiconductor devices. Furthermore, the lack of access to advanced process technologies can impact the competitiveness of small and medium-sized foundries in the global market. Customers, especially those in industries such as consumer electronics, automotive, and telecommunications, often prioritize working with foundries that can provide the latest process technologies to ensure their products remain at the

forefront of innovation. Therefore, limited access to advanced process technologies can result in a loss of potential customers and market share for smaller foundries. To address this challenge, collaboration and partnerships between foundries, research institutions, and industry stakeholders can play a crucial role. By pooling resources, sharing expertise, and jointly investing in research and development, smaller foundries can gain access to advanced process technologies and remain competitive in the global semiconductor foundry market. Additionally, governments and industry associations can provide support through funding programs, grants, and initiatives aimed at promoting technology development and adoption among smaller foundries. These efforts can help level the playing field and ensure that all players in the semiconductor foundry market have access to the latest process technologies, fostering innovation and driving the industry forward.

### Increasing Complexity of Semiconductor Designs

The growing complexity of semiconductor designs presents significant challenges for semiconductor foundries. As chip designs become increasingly intricate and integrated, foundries are required to make substantial investments in advanced tools, software, and expertise to effectively handle this complexity. They must address various challenges associated with power consumption, thermal management, signal integrity, and manufacturing yield. The intricate nature of these designs can result in longer development cycles, increased costs, and potential difficulties in achieving high yields, which can ultimately impact the profitability and competitiveness of foundries in the market. The complexity of semiconductor designs necessitates a comprehensive approach to ensure successful production. Foundries must invest in cutting-edge design tools and software that can handle the intricacies of these designs, enabling efficient power management, effective thermal dissipation, and robust signal integrity.

Additionally, they need to implement advanced manufacturing processes and techniques to optimize yield rates and minimize defects during production. The longer development cycles associated with complex designs require foundries to carefully manage resources, time, and costs to meet project timelines and customer expectations. Moreover, the increased complexity of semiconductor designs demands a highly skilled workforce with expertise in areas such as design engineering, process optimization, and quality control. Foundries must attract and retain top talent to effectively navigate the challenges posed by complex designs and maintain a competitive edge in the market. By addressing these challenges head-on, semiconductor foundries can overcome the complexities of modern chip designs and deliver high-quality, reliable, and efficient semiconductor solutions to their customers.



This, in turn, enables them to remain competitive, meet the evolving demands of the industry, and drive innovation in the semiconductor market.

### Shortage of Skilled Workforce

The global semiconductor foundry market is grappling with a shortage of skilled workforce, particularly in specialized areas such as process engineering, device physics, and advanced packaging. These areas require highly skilled professionals who possess the expertise to design, develop, and optimize complex semiconductor processes. The scarcity of such talent poses several challenges for the industry, including increased competition for qualified personnel, higher labor costs, and potential delays in project timelines. To tackle this issue, it is imperative for companies to make strategic investments in education and training programs. Collaborations with academic institutions can play a crucial role in developing a pipeline of skilled professionals who are equipped with the necessary knowledge and expertise to meet the demands of the semiconductor foundry market. By partnering with universities and technical schools, companies can contribute to the development of specialized curricula that align with the industry's requirements.

This can include internships, apprenticeships, and cooperative education programs that provide students with hands-on experience and exposure to real-world challenges in semiconductor manufacturing. Additionally, companies can establish scholarship programs and provide financial support to students pursuing degrees in relevant fields. By investing in the education and training of future professionals, the semiconductor foundry market can address the shortage of skilled workforce and ensure a sustainable talent pool for the industry. Furthermore, companies can also focus on internal training and development initiatives to upskill their existing workforce. This can involve providing employees with opportunities for continuous learning, attending industry conferences and workshops, and encouraging participation in professional development programs. By nurturing and retaining talent within the organization, companies can mitigate the impact of the skilled workforce shortage and maintain a competitive edge in the global semiconductor foundry market. Overall, addressing the shortage of skilled workforce in the semiconductor foundry market requires a multi-faceted approach that involves collaboration with academic institutions, investments in education and training programs, and internal talent development initiatives. By taking proactive measures, the industry can overcome this challenge and ensure a steady supply of skilled professionals to drive innovation and growth in the semiconductor foundry market.

### Key Market Trends

## Increasing Demand for Advanced Process Technologies

The global semiconductor foundry market is experiencing a surge in the need for advanced process technologies. With the growing demand for smaller, faster, and more power-efficient semiconductors, foundries are making significant investments in cutting-edge fabrication processes. These include technologies like FinFET, 3D transistors, and EUV lithography. The adoption of these advanced process technologies allows foundries to manufacture high-performance chips that offer improved power efficiency, higher transistor densities, and enhanced functionality. The development of FinFET technology, for instance, has revolutionized semiconductor manufacturing by enabling the production of transistors with superior performance and reduced power consumption. This technology involves the use of a three-dimensional transistor structure that enhances control over the flow of current, resulting in faster and more energy-efficient chips. Similarly, the implementation of 3D transistors has further pushed the boundaries of chip performance by increasing transistor density and enabling better integration of components. This technology allows for the stacking of transistors on top of each other, maximizing the use of available space and enabling the creation of more complex and powerful chips. Additionally, the introduction of EUV lithography has significantly improved the precision and resolution of semiconductor manufacturing.

EUV lithography utilizes extreme ultraviolet light to create intricate patterns on silicon wafers, enabling the production of chips with smaller feature sizes and higher levels of integration. This advancement in lithography technology has paved the way for the development of advanced semiconductor devices with enhanced functionality and improved performance. The rising demand for advanced process technologies in the global semiconductor foundry market is driven by the need for smaller, faster, and more power-efficient chips across various industries, including consumer electronics, automotive, telecommunications, and IoT devices. Foundries that can successfully adopt and implement these advanced process technologies are well-positioned to meet the evolving demands of customers and maintain a competitive edge in the market.

## Growing Focus on Specialized Foundry Services

In the global semiconductor foundry market, there is a noticeable shift towards specialized foundry services. Foundries are recognizing the importance of catering to specific applications and industries by offering tailored solutions. This trend is driven by the understanding that different industries have unique requirements and demands when it comes to semiconductor manufacturing. As a result, foundries are providing

specialized processes and services to meet these specific needs. For instance, foundries are developing specialized processes for automotive applications, enabling the production of semiconductors that meet the stringent requirements of the automotive industry in terms of reliability, durability, and performance. Similarly, foundries are offering specialized services for IoT devices, which require low power consumption, small form factors, and high connectivity. By providing customized solutions for IoT applications, foundries can address the specific challenges and requirements of this rapidly growing industry. Additionally, the demand for specialized foundry services extends to the field of artificial intelligence (AI) chips. AI chips require specialized architectures, high computational power, and efficient memory management. Foundries are investing in specialized processes and technologies to meet the unique needs of AI chip manufacturers. This specialization allows foundries to leverage their expertise and resources to deliver customized solutions that optimize the performance and efficiency of AI chips. By offering specialized foundry services, foundries can differentiate themselves in the market and attract customers seeking expertise in specific industries or applications. This trend towards specialization in the global semiconductor foundry market enables companies to access tailored solutions that meet their specific needs, resulting in improved product performance, faster time-to-market, and enhanced competitiveness.

### Emergence of More Complex Chip Designs

As the semiconductor foundry market evolves, there is a noticeable emergence of more complex chip designs. This shift is driven by the growing demand for advanced functionalities and the integration of multiple components on a single chip. However, this trend poses significant challenges for foundries in terms of manufacturing complex designs with high yields. To overcome these challenges, foundries are making substantial investments in advanced design tools, process technologies, and design-for-manufacturability (DFM) techniques. These investments are crucial for ensuring the successful production of complex chips. Advanced design tools enable foundries to handle the intricacies of complex chip designs, allowing for efficient power management, effective thermal dissipation, and robust signal integrity. Process technologies play a vital role in enabling the manufacturing of complex designs by providing the necessary capabilities to fabricate intricate structures and integrate multiple components on a single chip. Additionally, foundries are adopting design-for-manufacturability (DFM) techniques, which involve optimizing chip designs to enhance manufacturability and improve yield rates. DFM techniques consider various manufacturing constraints and challenges during the design phase, allowing for the identification and mitigation of potential issues early on. By implementing DFM

techniques, foundries can minimize the risk of manufacturing defects, reduce production costs, and improve overall yield rates. The combination of advanced design tools, process technologies, and DFM techniques enables foundries to effectively address the challenges posed by complex chip designs. This, in turn, ensures the successful production of high-quality chips with improved performance and functionality. By investing in these areas, foundries can stay competitive in the market and meet the increasing demand for complex semiconductor solutions.

## Segmental Insights

### Technology Node Insights

In 2022, the 7/5 nm technology node segment dominated the Global Semiconductor Foundry Market and is expected to maintain its dominance during the forecast period. The 7/5 nm technology node represents the most advanced and cutting-edge semiconductor manufacturing process available in the market. This technology node offers significant advantages such as higher transistor densities, improved power efficiency, and enhanced performance compared to previous nodes. These benefits make it highly desirable for a wide range of applications, including high-performance computing, artificial intelligence, 5G, and automotive electronics. The demand for advanced functionalities and the need for smaller, faster, and more power-efficient semiconductors have been the key drivers behind the dominance of the 7/5 nm technology node. Additionally, the increasing adoption of technologies like Internet of Things (IoT), cloud computing, and data centers has further fueled the demand for chips manufactured using the 7/5 nm technology node. The dominance of the 7/5 nm technology node is also attributed to the significant investments made by foundries in research and development, equipment, and expertise to develop and optimize this advanced manufacturing process. Furthermore, the continuous advancements in semiconductor technology and the ongoing race among semiconductor foundries to offer the most advanced and competitive solutions are expected to maintain the dominance of the 7/5 nm technology node in the Global Semiconductor Foundry Market during the forecast period.

### Application Insights

In 2022, the consumer electronics and communication segment dominated the Global Semiconductor Foundry Market and is expected to maintain its dominance during the forecast period. The consumer electronics and communication segment encompasses a wide range of devices, including smartphones, tablets, wearables, and networking

equipment. This segment's dominance can be attributed to the increasing demand for advanced semiconductor solutions in the consumer electronics industry, driven by factors such as technological advancements, ris



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