SEMICONDUCTOR INDUSTRY ASSOCIATION

May 7, 2025

***Via Regulatory Portal***

Ms. Katherine Reid
Director, Office of Strategic Industries and Economic Security
Bureau of Industry and Security
U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, D.C. 20230

cc. Mr. Stephen Astle, Director, Defense Industrial Base Division, Office of Strategic Industries and Economic Security

**Re: Notice of Request for Public Comments on Section 232 National Security Investigation of Imports of Semiconductors and Semiconductor Manufacturing Equipment**

Dear Ms. Reid,

The Semiconductor Industry Association (SIA) welcomes the opportunity to respond to the Bureau of Industry and Security's (BIS) *Notice of Request for Public Comments on Section 232 National Security Investigation of Imports of Semiconductors and Semiconductor Manufacturing Equipment*, 90 Fed. Reg. 15950 (April 16, 2025) (the "Notice").

SIA has been the voice of the U.S. semiconductor industry for nearly half a century. Our member companies, representing more than 99 percent of the U.S. semiconductor industry by revenue, as well as major non-U.S. chip firms, are engaged in the full range of research, design, manufacture, and back-end assembly, test, and packaging of semiconductors. Semiconductors are historically a top U.S. export sector, running a healthy trade surplus for nearly three decades.[1] SIA's members design and produce all major advanced and mature-node semiconductor types, including logic, memory, analog, microprocessors, and optoelectronics. The semiconductor was invented in America more than 65 years ago, and the U.S. semiconductor industry remains the global leader in semiconductor technology and innovation, driving America's economic strength, national security, and global competitiveness in a range of downstream industries. More information about SIA and the semiconductor industry is available at www.semiconductors.org.

The semiconductor industry is critical to U.S. economic security, national security, and industrial competitiveness across a range of critical downstream sectors, including artificial intelligence (AI) and high-performance computing, automotive, aerospace and defense, data centers, 5G/6G communications, medical technology, and advanced manufacturing.

[1] U.S. International Trade Commission, "DataWeb," accessed March 3, 2025, HTS codes: 8541 (excluding photovoltaic cells and modules) and 8542.

Strengthening U.S. semiconductor supply chains is a top priority for SIA and its members in our efforts to support economic security and national security, and to maintain global technological leadership. We support President Trump's goal of reshoring U.S. semiconductor manufacturing. However, as the Trump Administration pursues a strategy in support of U.S. semiconductor manufacturing, it is critically important to advance policies designed to make U.S. semiconductor production cost-effective, maintain the U.S. lead in design and core intellectual property (IP) development, and increase demand for end market products that incorporate chips – both here at home and abroad.

To that end, we urge the administration to work closely with SIA and its member companies to ensure that any Section 232 remedies advance U.S. global leadership in advanced semiconductor technology and support the industry's investments in building new U.S. capacity.

In the course of this Section 232 investigation and consideration of potential measures, we ask BIS and other relevant agencies to take account of the following points:

- The **U.S. semiconductor industry holds a leadership position with 50.7% market share** of global semiconductor sales (See **Figure 1**). Any U.S. policy intervention should be designed to maintain and grow this position.

- SIA member companies have announced over **$540** billion (and counting) in private investments in semiconductor production capacity in the United States.

- Roughly **70%** of the U.S. semiconductor industry's revenue comes from sales to overseas customers, which has driven a U.S. trade surplus in semiconductors for nearly 30 years. Without continued access to foreign markets, U.S. goals to expand domestic capacity may not be economically viable.

- Approximately **two-thirds** of front-end manufacturing facilities of U.S.-headquartered semiconductor companies are already located in the United States.

- The total construction and operating costs of a semiconductor wafer fabrication facility (fab) in the U.S. are historically **30-50% more expensive** than in Asia,[2] though recent tax and other incentives have helped to narrow the cost gap and should be sustained.

- Between 2001 and 2024, the U.S. semiconductor industry has invested an average of roughly **20%** of its revenue in research & development (R&D), one of the highest rates of any sector.[3]

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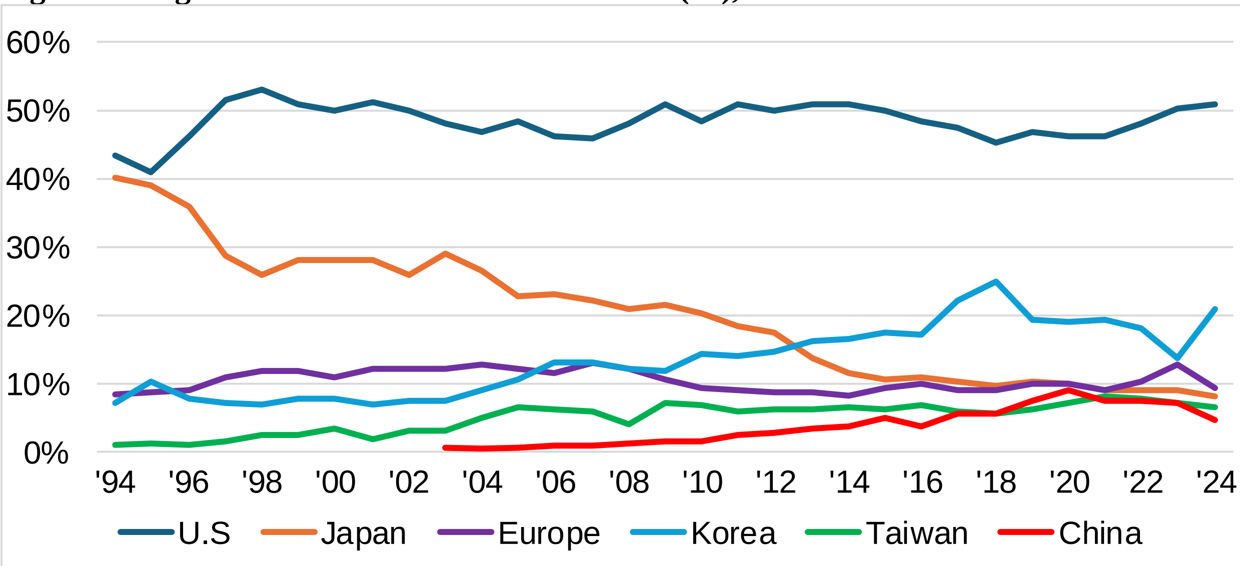
[2] SIA and BCG, "Government Incentives and US Competitiveness in Semiconductor Manufacturing", September 2020. https://www.semiconductors.org/wp-content/uploads/2020/09/Government-Incentives-and-US-Competitiveness-in-Semiconductor-Manufacturing-Sep-2020.pdf
[3] SIA, Databook 2024, December 2024.

**Figure 1. Region Share of Global Sales Revenue (%), 1994-2024**




Source: World Semiconductor Trade Statistics (WSTS), Gartner, Omdia, and SIA Estimates

Given the global nature of the semiconductor market, the complexities of our upstream and downstream supply chains, and the critical role of exports in providing revenue to support U.S. investment, R&D, and jobs, there is a high risk of inadvertent consequences from the United States pursuing government policies, coupled with other governments' responses, which are not narrowly tailored to address identified national security risks. We therefore urge the Commerce Department to approach each step of this investigation carefully through a deliberative process, in close consultation with SIA, our member companies, and other industries that produce derivative products. We also urge the Commerce Department and other involved agencies to coordinate closely with allied and partner governments – in particular other leading semiconductor-producing and consuming economies – to inform a comprehensive approach that enhances the effectiveness of U.S. policies and avoids potential actions that could inadvertently harm our critical sector. As laid out in further detail in this submission, **first and foremost we recommend the administration pursue a multi-country sectoral agreement focused on semiconductors and derivative products to better address economic and national security threats, as well as ensure access, to global markets where U.S. companies must compete in, operate in and, ultimately, win**.

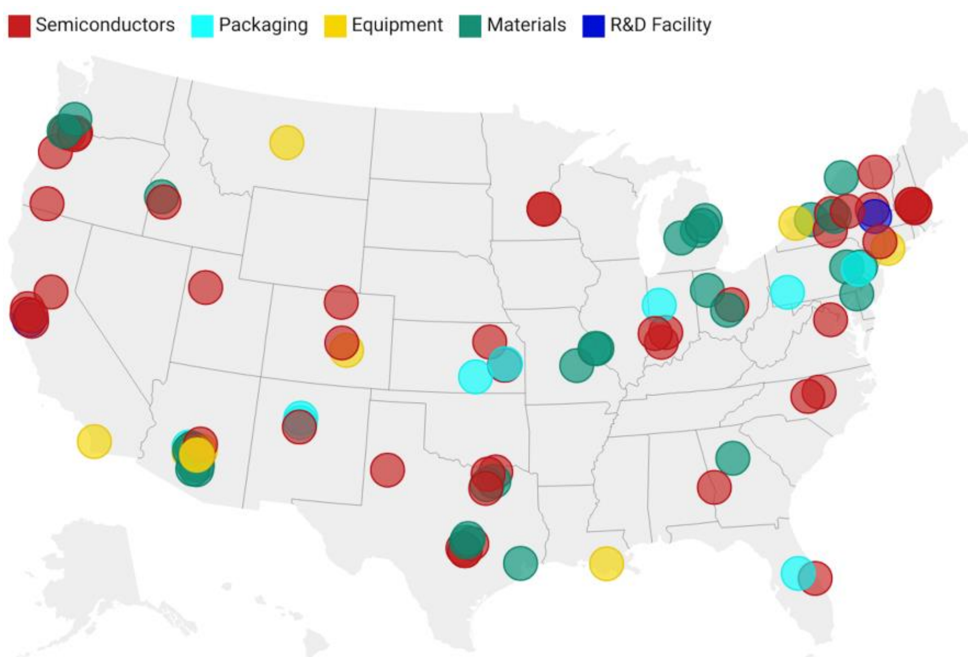
Part I of these comments provides background on the semiconductor industry, ongoing investments in domestic semiconductor ecosystem capabilities, and the importance of chips to America's AI ambitions. Part II explains the economics of the different segments of the industry. Part III explains the negative impact of broad-based, non-tailored tariffs on the semiconductor industry. Part IV outlines our recommendations, notably moving towards negotiations with likeminded partners to secure a semiconductor sectoral agreement, increase domestic incentives, and mitigate any unintended harm to the industry from a potential Section 232 remedy, avoiding a one-size-fits-all approach and ensuring remedies are tailored to our critical and evolving sector.

## I. BACKGROUND

As recently stated by the Director of the White House Office of Science and Technology Policy,[4] America must run faster to win the technology race of the future. To do this, we need a comprehensive, whole-of-government strategy encompassing: (i) policies that incentivize domestic chip research, design, and manufacturing and address the significant cost gap to conduct these activities in the United States vs. other economies; (ii) a proactive, market-opening trade and investment agenda that creates new demand for and facilitates sales of American chips in new and emerging foreign markets; (iii) investments in basic research to power the next generation of semiconductor technologies; (iv) stable and predictable national security policies pursued in coordination with other key equipment and semiconductor supplier economies; (v) continued cost-competitive access to the global supply chain and critical material inputs sourced from overseas markets; (vi) programs and policies that support the development of a skilled American workforce with access to global talent; and (vii) collaboration with trusted international partners through a sectoral trade agreement.

SIA shares the Trump Administration's goal to position the United States as a global manufacturing superpower, particularly for semiconductors, and SIA applauds recent efforts by the Trump Administration to further facilitate investments in manufacturing capacity. SIA member companies have announced over half-a-trillion dollars (and counting) in private investments to manufacture and develop semiconductors in the U.S., with over 100 projects across 28 states (See **Figure 2**).

**Figure 2. Semiconductor Supply Chain Investment Announcements, 2020-2025**
Projects throughout the chips supply chain:




*Source*: SIA Analysis, news reports, corporate press releases, U.S. Department of Commerce

[4] The White House, "Remarks by Director Kratsios at the Endless Frontiers Retreat," April 14, 2025. https://www.whitehouse.gov/articles/2025/04/8716/

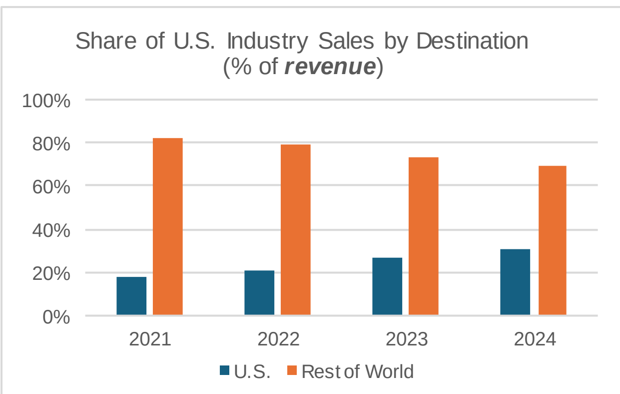
These projects include significant investments announced since President Trump took office. These announced projects will create and support over 500,000 American jobs — 68,000 facility jobs in the semiconductor ecosystem; 122,000 construction jobs; and over 320,000 additional jobs throughout the U.S. economy.[5] If we maintain this current trajectory, U.S. fab capacity is projected to increase by 203% by 2032, tripling U.S. capacity and growing our national capabilities in critical technology segments, such as leading-edge fabrication, dynamic random-access memory (DRAM), analog and mixed signal, and advanced packaging. In particular, U.S. capacity for advanced logic will grow substantially to 28% by 2032, including new capabilities at the leading edge.[6] The U.S. share of advanced memory manufacturing will grow from around 2% today to approximately 12% by 2035.[7]

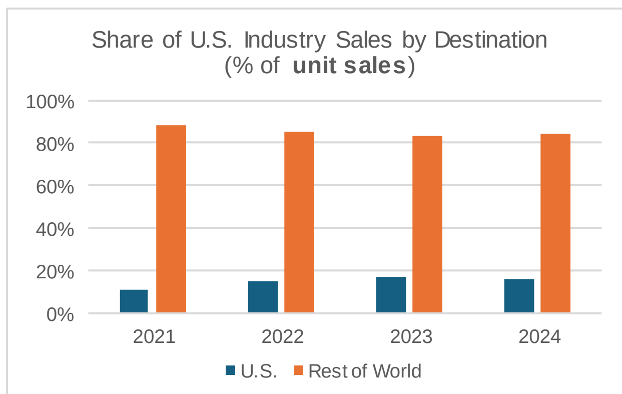
These supply-side investments in the United States are reversing the decades-long downward trajectory in the U.S. share of global semiconductor manufacturing capacity, increasing the resilience of America's access to chip supply chains, and reducing strategic supply chain dependencies in critical downstream sectors.

To justify and support long-term, capital-intensive investments in U.S. semiconductor production, chipmakers need confidence that their products will have access to global markets and a global customer base in addition to robust domestic demand. Roughly 70% of U.S. semiconductor industry revenue in 2024 came from sales to customers *outside* the United States. The percentage share of overseas sales is even higher on a volume basis (*see* **Figures 3 and 4**).

**Figures 3 and 4. Share of U.S. Industry Sales by Destination, by Revenue vs. by Volume**

*Source:* World Semiconductor Trade Statistics, *Americas by base report*, accessed February 20, 2025.




Our customers, both foreign and domestic, seek the highest quality chips for the lowest price. We are concerned about public policies that will lead to higher costs for domestic chips manufacturing by driving up the price of imported inputs and semiconductor manufacturing equipment (SME).

[5] Semiconductor Industry Association, "America's Chip Resurgence: Over $540 Billion in Semiconductor Supply Chain Investments," updated March 2025. https://www.semiconductors.org/chip-supply-chain-investments/

[6] Semiconductor Industry Association / Boston Consulting Group, "Emerging Resilience in the Semiconductor Supply Chain," May 2024. https://www.semiconductors.org/wp-content/uploads/2024/05/Report_Emerging-Resilience-in-the-Semiconductor-Supply-Chain.pdf

[7] Estimates per SIA's discussions with member companies.

As a result, SIA member companies and their chips will be less globally competitive, leaving a vacuum that global competitors will readily fill.[8] Loss of global market share would seriously undercut U.S. semiconductor competitiveness and, in turn, U.S. global leadership.

To maintain U.S. semiconductor leadership – which underpins U.S. leadership in critical downstream technologies like AI – the United States must undertake additional measures and initiatives to ensure semiconductor production in the U.S. is cost-effective, boost demand, and increase the market base for U.S. chips here at home and, crucially, around the world.

While semiconductors are foundational to a number of critical technologies and downstream sectors, it is worth focusing in on the role of semiconductor technologies for AI – a technology for which the Trump Administration has said the United States must act decisively to retain its global leadership.[9] SIA recently submitted comments to the Office of Science and Technology Policy to inform the development of the Trump Administration's Artificial Intelligence (AI) Action Plan, which outlines how the semiconductor supply chain enables the production of AI systems.[10] AI infrastructure is a critical demand driver for the semiconductor industry and will only grow in importance in the coming years. Semiconductor technology comprises the computing, memory, and networking backbone that powers and enables the whole range of AI systems. Advanced AI applications – from natural language processing to autonomous systems – benefit from high-performance chips called AI accelerators. AI accelerators include processing logic highly effective for AI training and inferencing workloads (e.g., GPUs, CPUs, ASICs) and often include high bandwidth memory to accommodate the rapid movement of increasing data volumes, along with networking and optical connectors, among other critical components. AI servers are comprised of AI accelerators and a host of mature-node semiconductor components, including power chips, analog-to-digital converters, and input-output controllers.

Together, the entire semiconductor supply chain, involving many U.S. semiconductor design, manufacturing, and manufacturing equipment companies, enables the production of AI systems. In short, without semiconductors there is no AI. Industry observers forecasted that the data center industry invested $180 billion in 2024.[11] Untargeted tariffs on semiconductors and derivative goods could raise these costs significantly, as we understand that semiconductor content can account for upwards of 60% of these costs. If implemented, tariffs on semiconductors and derivative goods will raise the costs for data center investments, which will make the U.S. a less competitive destination for AI investments.

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[8] Notably, it currently takes almost twice as long to build a semiconductor fab in the United States as it does in Asia due to lack of efficiency and experience as well as cost disparities. Techspot, "Building semiconductor plants in the US takes twice as long, costs twice as much as in Taiwan," February 20, 2025. https://www.techspot.com/news/106848-building-fabs-us-takes-twice-long-costs-twice.html

[9] The White House, "Fact Sheet: President Donald J. Trump Takes Action to Enhance America's AI Leadership," January 23, 2025. https://www.whitehouse.gov/fact-sheets/2025/01/fact-sheet-president-donald-j-trump-takes-action-to-enhance-americas-ai-leadership/

[10] SIA, "Comments to the National Science Foundation (NSF) On the Development of an Artificial Intelligence (AI) Action Plan", March 14, 2025. https://www.semiconductors.org/wp-content/uploads/2025/03/FINAL-SIA-Comments-to-OSTP-AI-Action-Plan-RFI-03_14_25.pdf

[11] Ashare, "Big Tech on Track to Pour More than $180B into Data Center This Year," December 4, 2024. https://www.constructiondive.com/news/cloud-data-center-q3-spend-aws-azure-microsoft/734579

## II. ECONOMICS OF THE SEMICONDUCTOR INDUSTRY

The semiconductor industry has developed a global supply chain based on increasingly exacting technical requirements and complex economics, which require firms to achieve economies of scale to support massive capital investments.[12] In short, the semiconductor industry provides disproportionate rewards to firms that produce goods at the lowest marginal cost while meeting complex technical requirements. The market incentives for technological leadership also require that firms reinvest a significant percent of revenue back into research and development. As noted above, in 2024, U.S. semiconductor firms reinvested roughly 20% of their revenue into research and development.[13]

The semiconductor industry makes a wide range of products that carry out distinct, but critical functions. **Table 1** below provides a simplified semiconductor taxonomy. It is important to highlight that the semiconductor product types listed below are not interchangeable. Further, there is a limited ability to manufacture different products at the same facility. Firms do not produce many different types of goods at a single manufacturing facility because each product type requires unique manufacturing flows and sophisticated manufacturing equipment. As such, it is not cost-effective to make different types of chips in the same production line.[14]

**Table 1**: Semiconductor product taxonomy

| Type | Function | Examples | Node sizes (nanometers) |
|---|---|---|---|
| Logic | Perform basic logic operations on digital signals | CPUs, GPUs, digital signal processors, microcontroller units, smart cards | ≤7nm (advanced)<br>10-22nm (current generation)<br>≥28nm (mature) |
| Memory | Store data or program code necessary to process and perform computations | DRAM, NAND flash, others (NOR flash, SRAM, EEPROM) | [A] DRAM 10+<br>[A] NAND 230+ |
| Analog | Convert electrical signals into digital signals | Radio frequency, power management ICs, amplifiers | ≥40nm |
| Discretes | Perform specific electronic function within a circuit | Diodes, thyristors, rectifiers, transistors | ≥28nm |
| Sensors and actuators | Convert physical or chemical properties into electronic signals | Temperature sensors, pressure sensors, acceleration detectors | ≥28nm |
| Optoelectronics | Convert electrical energy into light | Image sensors, opto couplers, displays, infrared and lasers | ≥28nm |

Source: SIA analysis
Notes: + indicates that there may legacy products requiring node sizes greater than those listed above.

[12] For example, it can take 10 years or longer to recuperate from chip sales the cost to build and operate a fab.
[13] Figure is an aggregation based on member company annual and quarterly filings to the U.S. Securities and Exchange Commission.
[14] For example, certain components may require a gold plating process, which as a material may be a contaminant for other or different materials, or machinery that may be underutilized.

[A] Node sizes in memory are not the best indicator of device complexity. DRAM bit density and cell area measurements better characterize advanced node DRAM process technology capability. NAND flash measures complexity by counting the layers of vertically stacked memory cells.

The semiconductor supply chain is highly complex and specialized. Semiconductor manufacturing consists of hundreds of steps to produce a single wafer (i.e., a thin, round slice of a semiconductor material varying in size between 6 and 12 inches in diameter) and ultimately between 1,000 and 1,500 steps to turn the silicon into the final chip, depending on the complexity of the chip. Patterned layers are added on and into the wafer creating interconnected electrically active regions on the surface, ultimately forming the complete semiconductor.

An abridged overview of the semiconductor supply chain is included below:

- *Design:* Firms involved in design and development of nanometer scale integrated circuits, which perform the critical tasks that make electronic devices work, such as computing, storage, connectivity to networks, and power management. Design activity is largely knowledge- and skill-intensive, and accounts for the majority of both industry R&D and value added.

- *Electronic design automation* (*EDA) & Core IP*: Core IP and EDA are R&D-intensive, non-manufacturing segments of the supply chain. At the design stage, EDA companies provide sophisticated software and services to support designing semiconductors.

- *Equipment and Tools*: More than 50 types of specialized equipment in three segments—lithography, deposition, and materials, removal, & cleaning. Most of this equipment, such as lithography and metrology tools, incorporates hundreds of technology subsystems, including modules, lasers, mechatronics, control chips, and optics.

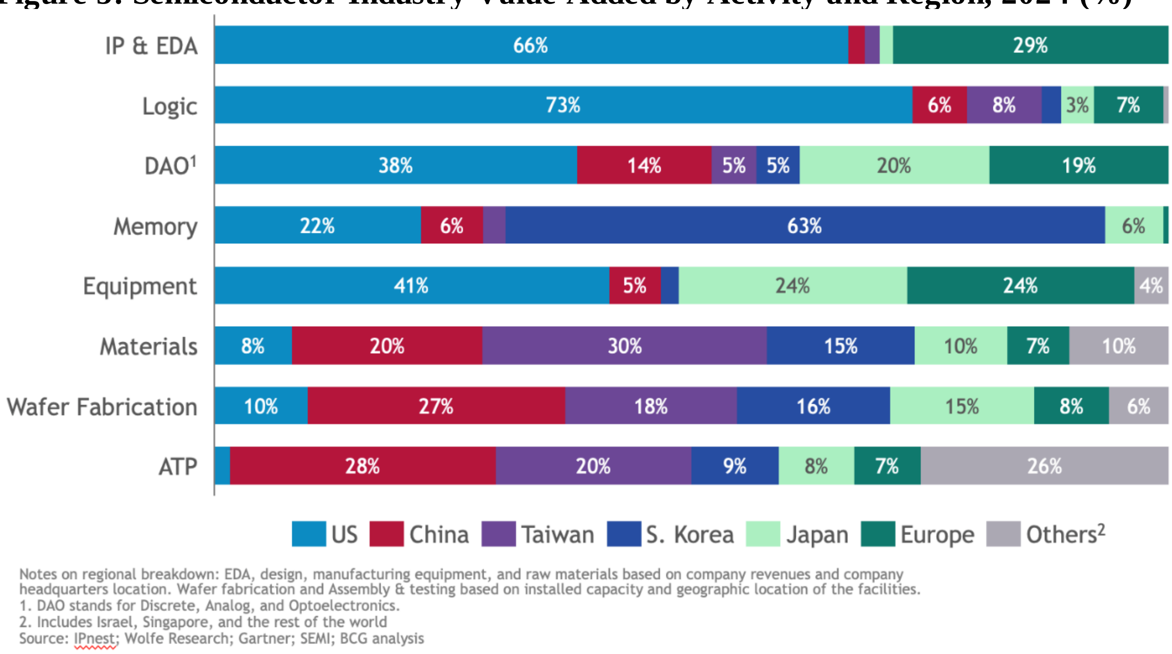
- *Materials*: Firms involved in semiconductor manufacturing also rely on specialized material suppliers. Semiconductor manufacturing uses hundreds of different inputs, many of which also require advanced technology to produce. The main front-end materials include polysilicon, bare and epitaxial (epi) wafers, photomask, photoresist chemicals, wet processing chemicals, gases, and chemical mechanical planarization slurries. Back-end materials include leadframes, organic substrates, ceramic packages, encapsulation resins, bonding wires and die-attach materials.

- *Front-End Wafer Fabrication*: The heart of any semiconductor manufacturing business is the fabrication. Highly specialized semiconductor manufacturing facilities, typically called "fabs," print the nanometer-scale integrated circuits from the chip design into silicon wafers. Each wafer contains multiple chips of the same design. Front-end manufacturing is highly R&D and capital intensive, especially for advanced chips, due to the scale and complex equipment needed to produce semiconductors.

- *Back-End Wafer Assembly, Test, and Packaging (ATP)*: This stage involves converting the silicon wafers produced by the fabs into finished chips that are ready to be assembled into electronic devices. Firms involved at this stage first slice silicon wafers into individual chips. Chips are then packaged into protective frames and encased in a resin shell. Chips are then rigorously tested before being shipped to electronic device manufacturers.

A 2024 SIA-Boston Consulting Group (BCG) report illustrated the degree of specialization in the global semiconductor supply chain (*see* **Figure 5**). For example, U.S.-headquartered companies lead in design and core IP, and command almost half the global market share in SME,[15] which are key value-add segments of the global supply chain. Nearly all of the remaining global market share for SME is in allied countries, including the Netherlands and Japan, whose companies conduct significant manufacturing and R&D in the United States. For materials used in semiconductor manufacturing – such as bare and epi wafers, photoresist chemicals, photomasks, gases, wet chemicals, substrates, lead frames, etc. – U.S. semiconductor manufacturers rely principally on suppliers from Taiwan, Japan, South Korea, and China. It is in United States' economic and national security interests to ensure U.S. companies maintain continued cost-competitive access to these materials, many of which lack readily available domestic substitutes and would take years, and in some cases decades, to secure new sources of supply.

**Figure 5: Semiconductor Industry Value Added by Activity and Region, 2024 (%)**




Source: Updated from SIA and BCG, "Emerging Resilience in the Semiconductor Supply Chain," May 2024.

Given the complexity and scale of the semiconductor supply chain, it is critical for the U.S. industry to be able to maintain market access to critical components, particularly ones without a viable U.S. substitute. The semiconductor ecosystem is a complex global supply chain wherein participants must balance technical capabilities with commercial viability. To contextualize the scale of complexity, the semiconductor industry patterns integrated circuits with feature sizes as

[15] U.S.-headquartered companies rely fully on the EU for critical lithography semiconductor manufacturing equipment.

small as one-thirty-thousandth of the width of a human hair.[16] Fab operators must manage sophisticated supply chains, potentially involving thousands of upstream suppliers, that provide fabs with more than 100 chemical and material inputs, each with precise requirements and their own sophisticated supply chains.[17] For example, the upstream semiconductor ecosystem requires raw materials with precise chemical purities, advanced chemical compounds to soften silicon with light, and machinery to deposit materials at a near atomic level. With this context, industry experts found that there is currently insufficient domestic supply for approximately 60% of the semiconductor industry's critical inputs, highlighting the U.S. industry's need for reliable access to the global supply chain, particularly when competing with other markets that can secure access to these materials through domestic production or trade.[18]

A persistent challenge facing the semiconductor industry is achieving efficient scales of production—i.e., high-volume wafer fabrication with low marginal costs. Semiconductor manufacturing has high fixed capital costs and lengthy timelines.[19] Once a fab is constructed and equipped, profitably running a fab requires ramping up production by increasing the facility wafer throughput and achieving and maintaining high yields.[20] [21] A recent report by McKinsey notes that up-front capital and long-term operating costs for front-end capacity such as advanced logic fabs, as well as materials, packaging, and other segments, are inherently higher in the United States relative to other regions.[22]

Successful semiconductor manufacturing firms conserve capital to expand capacity based on demand. These calculations are made more complex by the variety of business models within the industry. For example, an integrated device manufacturer[23] engages in R&D and design, as well as in-house wafer and back-end manufacturing. Alternatively, fabless chip designers may rely on contract manufacturing with a foundry service. A major determinant for fab success is having sufficient end-demand for a given product, so that these new fabs operate at full capacity and do not sit idle. Lack of clarity in market demand – which includes both dynamics in key downstream

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[16] Today's smallest commercially available feature size is 3 nanometers. An average human hair is approximately 90,000 nanometers in width.
[17] Muso, Aase, and Patel, "Creating a Thriving Chemical Semiconductor Supply Chain in America," March 25, 2025. https://www.mckinsey.com/industries/chemicals/our-insights/creating-a-thriving-chemical-semiconductor-supply-chain-in-america#/
[18] Ibid.
[19] A greenfield fab can take over 5 years to construct in the United States and an expansion at a brownfield can take up to 3 years. BCG, "Navigating the Costly Economics of Chip Making," September 28, 2023. https://www.bcg.com/publications/2023/navigating-the-semiconductor-manufacturing-costs
[20] A fab's costs are typically depreciated as follows: semiconductor manufacturing equipment in 5 years, building systems in 10 years, and the shell may take up to 20 years. IRS, Publication 946 (2024), "How to Depreciate Property," https://www.irs.gov/publications/p946.
[21] Yield is the number of chips successfully produced divided by the total number of chips that could be made on wafer surfaces. Yield rates vary depending upon the process maturity, but most fabs will be financially strained if their yield is below 90%. King, Leung, and Pogkas, "The Chip Shortage Keeps Getting Worse. Why Can't We Just Make More?" May 6, 2021.
[22] McKinsey, "Semiconductors have a big opportunity—but barriers to scale remain," April 21, 2025. https://www.mckinsey.com/industries/semiconductors/our-insights/semiconductors-have-a-big-opportunity-but-barriers-to-scale-remain#/
[23] An Integrated Device Manufacturer (IDM) is a semiconductor company that designs, manufactures, and sells its own integrated circuit (IC) products, while fabless companies, which only design chips and outsource manufacturing, and foundries, which solely focus on manufacturing chips for other companies.

verticals such as AI and automotive and global trade dynamics – could lead to lower capital utilization across the industry's supply chain, which undermines the economic case for new investments and could fuel further boom and bust cycles.[24]

As noted in SIA's submission in the Office of the United States Trade Representative's (USTR's) ongoing Section 301 investigation into "China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance," the semiconductor market can be segmented between advanced and mature-node semiconductors, although even this can be an oversimplification.[25] While all types of semiconductors can be made on both advanced process nodes – which certain U.S. regulations have defined as less than 28nm—and mature process nodes (e.g., 28nm or higher), each production process and downstream utilization is unique to the chip at issue. Most advanced node production makes logic and memory chips, which perform better as features become denser. Dynamic random access memory (DRAM) is differentiated by bit density and cell area measurements, whereas layer counts of vertically stacked memory cells differentiate NAND. In contrast, other types of chips (including, analog, discrete, optoelectronics, and sensors) are often produced with mature-node semiconductor technologies due to technical requirements or cost advantages.[26] Analog technologies, for example, feature a different mix of device performance and integration with less emphasis on maximizing devices onto a single die and more emphasis on the special functionality needed for analog processes.

The economics and market realities for advanced and mature node semiconductors are different, and chipmakers engaged in these various business segments likewise face different challenges. For example, advanced node chips are more expensive to design and produce and have higher input costs than foundational chips.[27] Advanced node, or leading-edge, semiconductor sales account for a large share of the industry's revenue despite modest unit shipments. By contrast, mature node semiconductors are often produced at higher volumes and lower prices. In fact, mature node chips account for 88% of global semiconductor production by volume, but only 40% of sales by revenue. And yet, mature node semiconductors enable a staggering $10.8 trillion of economic activity across a range of downstream industry verticals, equating to around one quarter of U.S. gross economic output.[28] Increased capital costs for both industry segments undermine the investigation's national security objectives by making it less economically viable for chipmakers to invest in building new fabs in the United States. Higher capital costs may undermine the competitiveness of these facilities and undermine the broader national security objectives driving the Section 232 investigation.

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[24] Ibid.

[25] SIA, "SIA Comments on USTR Section 301 Investigation on Chinese Legacy Chips," February 5, 2025. https://www.semiconductors.org/wp-content/uploads/2025/02/USTR-2024-0024-00109674-CAT-5016-Public-Document.pdf

[26] It is worth noting that certain logic and memory products may be made with mature node technologies for similar reasons.

[27] Wiseman, Marcil, and de Jong, "Semiconductors Have a Big Opportunity," April 2025. https://www.mckinsey.com/industries/semiconductors/our-insights/semiconductors-have-a-big-opportunity-but-barriers-to-scale-remain#/

[28] SIA analysis.

All segments of the semiconductor industry rely on commercial sales to achieve economically viable volumes of production, and higher capital costs pose a serious disadvantage to both domestic advanced and mature node semiconductor producers.

## III. IMPACT OF BROAD-BASED TARIFFS

U.S. Semiconductor Manufacturing and R&D

The U.S. share of global manufacturing capacity declined from a relative peak of 37% in 1990 to 10% in 2022.[29] The decline in market share is partially attributable to U.S.-based semiconductor manufacturing facilities facing a significant cost disadvantage. A 2020 report issued by SIA and BCG found that the total construction and operating costs of a semiconductor wafer fab in the United States is 30-50% more expensive than in Asia. Starting in 2020, during the first Trump Administration, the United States took a critical step toward an investment-driven approach to revitalize a robust semiconductor ecosystem in the United States, and those investments are just now starting to pay off. To overcome longstanding cost disadvantages, it is imperative that the government sustain appropriate tax and other incentives to drive future investments in the U.S. semiconductor ecosystem.

Plans to expand U.S.-based semiconductor production are extremely complex and require significant advanced planning, including the management of thousands of inputs from numerous companies and countries around the world. Semiconductor manufacturers, like other high-tech manufacturers, must make capacity and production plans on long timelines to ensure alignment with investors, workforce partners, and partners in national and local governments. These plans require predictable access to resources, including workers, land, power, water, and capital. New, unanticipated cost increases and market uncertainty represent shocks and disruptions that threaten to undermine the ability of companies to fully execute ambitious investment plans (summarized in Part I of these comments), slow the deployment of semiconductor manufacturing in the United States, and reduce the productivity and competitiveness of U.S. fabs. In sum, these additional costs could stifle new projects being considered in the United States, running counter to the administration's stated goals.

SIA has compiled a list of critical inputs, including materials and equipment, for semiconductor design and manufacturing necessary to support our companies' investments in the United States, which can be found in **Annex II**. SME and building systems account for the majority of the cost of building a fab. Restrictive government policies, such as tariffs, are certain to raise the costs of these products, exacerbating the aforementioned 30-50% cost premium to build and operate a fab in the United States when compared to other countries, and risk delaying or even jeopardizing planned investments in domestic semiconductor manufacturing and R&D facilities.

SIA analysis indicates that a 1% increase in duty rates for semiconductor manufacturing inputs is expected to lead to a 0.64% increase in the overall cost of constructing a fab. For every dollar that

[29] SIA and BCG, "Strengthening the Global Semiconductor Supply Chain in an Uncertain Era", April 2021. https://www.semiconductors.org/wp-content/uploads/2021/05/BCG-x-SIA-Strengthening-the-Global-Semiconductor-Value-Chain-April-2021_1.pdf

a semiconductor chip increases in price, products with embedded semiconductors will have to raise their sales price by $3 to maintain their previous margins.

Competitiveness of U.S. Chips in Global Markets

The global backlash and retaliatory tariffs against recent U.S. trade actions also threaten to depress global demand for U.S.-branded chips and cede market share to global competitors. China's retaliation in response to tariffs imposed pursuant to Executive Order 14257[30] and Executive Order 14266[31] are a case in point. On April 4, China strengthened its export control regulations on critical minerals, which include essential ingredients in the production of a broad range of products, including semiconductors, SME, and derivatives, as a retaliatory measure against U.S. tariffs. China also ratcheted its tariffs on imports from the United States up to 125% in a series of tit-for-tat actions.[32]

On April 10, China also announced that country of origin (COO) for all imported semiconductors would be determined based on the location of the wafer fabrication plant regardless of where the final chip is assembled, tested, and packaged. This COO order disadvantages companies that have invested in manufacturing capacity in the United States and encourages customers in China to design their electronics, systems, and broader supply chains to exclude American-made chips and related articles. In short, retaliatory trade actions are already increasing costs and disadvantaging U.S.-fabricated goods that undergo back-end manufacturing abroad, historically a lower-value-add activity. Consequently, U.S.-fabricated goods are cost disadvantaged in China – which is still the second largest market for U.S. chip sales – relative to chips fabricated elsewhere. Retaliatory actions will disincentivize investments in U.S. semiconductor manufacturing and incentivize companies to build non-U.S. supply chains to avoid such tariffs.

So far, most governments have demonstrated restraint and have not imposed trade measures targeting U.S. semiconductor products. However, should tariffs on manufacturing inputs and equipment drive up the average sales price of U.S. chips vis-à-vis non-U.S. chips, U.S. companies are likely to lose market share to companies who sell comparable chips at a lower price globally.

Risks to the U.S. Defense Industrial Base

Semiconductors are foundational to nearly all modern defense and intelligence systems. All types of semiconductors—ranging from logic to memory to analog, covering both advanced and legacy

[30] The White House, "Regulating Imports With a Reciprocal Tariff To Rectify Trade Practices That Contribute to Large and Persistent Annual United States Goods Trade Deficits," April 2, 2025. https://www.federalregister.gov/documents/2025/04/07/2025-06063/regulating-imports-with-a-reciprocal-tariff-to-rectify-trade-practices-that-contribute-to-large-and
[31] The White House, "Modifying Reciprocal Tariff Rates To Reflect Trading Partner Retaliation And Alignment," April 9, 2025. https://www.federalregister.gov/documents/2025/04/15/2025-06462/modifying-reciprocal-tariff-rates-to-reflect-trading-partner-retaliation-and-alignment
[32] PRC Ministry of Finance, "Tax Commission Announcement No. 4 of 2025," April 4, 2025. http://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250404_3961451.htm; PRC Ministry of Finance, "Tax Commission Announcement No. 5 of 2025," April 9, 2025. https://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250409_3961684.htm; PRC Ministry of Finance, "Tax Commission Announcement No. 6 of 2025," April 11, 2025. http://gss.mof.gov.cn/gzdt/zhengcefabu/202504/t20250411_3961823.htm

chips—are used in all five domains of warfare[33] and throughout the military and civilian infrastructure systems, which support defense and intelligence operations. The U.S. national security apparatus has real needs by way of, for example, supercomputers, strategic missile defense, sophisticated battlefield platforms, cyber defense capabilities, secure communications systems, and terrestrial and orbital signals infrastructure. Higher input costs from tariffs could force domestic companies to divert funds away from R&D. This shift undermines the technological edge the United States needs to maintain superiority in both commercial and defense applications. Long-term innovation suffers when resources are reallocated to offset trade barriers. Broad-based tariffs across the chip supply chain would raise costs for microelectronics parts which may not be produced in the U.S. but are necessary components in U.S. weapons systems.

## IV. RECOMMENDATIONS

Section 232 of the Trade Expansion Act (19 U.S.C. 1862) gives the President broad authority to safeguard U.S. national security and economic interests through a wide array of measures. Specifically, the President can take action to promote domestic production, protect U.S. national security, and ensure the economic welfare of domestic industries. This authority specifically includes the negotiation of international agreements under Section 232(c)(3) to limit or restrict the importation into, or the exportation from, the United States of articles that threaten to impair national security.

The subsections below provide specific recommendations for BIS to consider, based on the authority granted to the President under Section 232 of the Trade Expansion Act (19 U.S.C. 1862), that would help drive manufacturing within the United States while avoiding inadvertent harm to the domestic semiconductor industry, as well as those of partner nations.

### Pursue a Sectoral Agreement on Semiconductor Technologies, and Derivative Products

The Trump Administration has adopted a strong posture on trade, building leverage to create new structures for negotiation and international engagement. In Section 2(g) of his "American First Trade Policy Memorandum,"[34] President Trump directed USTR, in conjunction with the Secretary of Commerce and Secretary of Treasury, to "identify countries with which the United States can negotiate agreements on a bilateral or ***sector-specific*** basis…[and] shall make recommendations regarding such potential agreements." [emphasis added] We recommend the President and his negotiating team pursue a sectoral agreement focused on U.S. semiconductor technologies and derivative products that encompasses improved U.S. market access and alignment with foreign governments on national and economic security policies like export controls.

A semiconductor sectoral agreement led by the Trump Administration offers a unique opportunity to address non-market policies and practices in the semiconductor sector in conjunction with likeminded partners and allies with the goal of achieving coordinated, multi-country solutions to the challenges outlined in SIA's submission to inform USTR's ongoing Section 301 investigation into "China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for

[33] The five domains of warfare are land, sea, air, space, and cyberspace.
[34] The White House, "America First Trade Policy," January 20, 2025. https://www.whitehouse.gov/presidential-actions/2025/01/america-first-trade-policy/

Dominance."[35] By leveraging a broader set of economic and diplomatic tools, the President can address economic and national security threats more effectively and avoid unintended adverse consequences that import restrictions alone might create. It will also reaffirm the administration's new approach to trade and could serve as a blueprint for trade policies in other domains.

Elements of a negotiated sectoral agreement with trusted and likeminded partners could include:

- Preferential access for chips and SME manufactured in countries party to the agreement, to include government procurement and critical infrastructure markets;
- Coordinated measures to address non-market policies and practices;
- Mutual recognition arrangements for semiconductor testing and standards;
- Protection and enforcement of IP rights;
- Coordinated inbound and outbound investment policies/requirements for semiconductors;
- Alignment on export control regulations, enforcement, and other national and economic security policies (e.g., investment screening); and
- Initiatives to facilitate secure research and development collaboration on critical and emerging technologies.

In comments submitted to USTR in February 2025,[36] we highlighted a semiconductor-focused working group established by Group of Seven (G7) Leaders[37] under Italy's G7 Presidency to promote resilient and reliable semiconductor supply chains. We believe that the Trump Administration could effectively use this and other relevant fora to develop a sectoral approach amongst key partners and allies that could create new demand for Made-in-America semiconductors.

We note there is precedent for a sectoral agreement as a Section 232 remedy. In a Section 232 investigation of *Machine Tools*, President Reagan directed (1) Commerce and USTR to negotiate agreements with Japan, Taiwan, West Germany, and Switzerland and (2) the Commerce and Defense Departments to develop a Domestic Action Plan to aid the industry's revitalization.[38] By designating the machine tool industry as a major focus for Department of Defense (DoD) concentration, the machine tool industry secured a better opportunity to obtain funding from MANTECH and other DoD programs for advances in critical technologies, leading to advances in

[35] SIA, "SIA Comments on USTR Section 301 Investigation on Chinese Legacy Chips," February 5, 2025. https://www.semiconductors.org/wp-content/uploads/2025/02/USTR-2024-0024-00109674-CAT-5016-Public-Document.pdf

[36] SIA, Request for Public Comments: China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance, February 5, 2025. https://www.semiconductors.org/wp-content/uploads/2025/02/USTR-2024-0024-00109674-CAT-5016-Public-Document.pdf

[37] G7, "Apulia G7 Leaders' Communiqué," June 15, 2024. https://www.g7italy.it/wp-content/uploads/Apulia-G7-Leaders-Communique.pdf

[38] Reagan Presidential Library, "Statement on the Revitalization of the Machine Tool Industry," December 16, 1986. https://www.reaganlibrary.gov/archives/speech/statement-revitalization-machine-tool-industry

process and state-of-the-art technology. This balanced approach resulted in obtaining agreements from Japan and Taiwan (two leading suppliers of the subject merchandise), informal commitments from West Germany and Switzerland, and greater Commerce and DoD funding for the U.S. industry, displaying the effectiveness of the authority granted to the President under Section 232.[39]

The administration should also leverage U.S. government export facilities such as the Export-Import Bank, maintain economic security cooperation programs such as the International Technology Security and Innovation fund, and continue to explore areas of supply chain diversification and resilience in adjacent areas such as critical minerals, rare earths, and chemicals.

Pursue Domestic Tax Incentives to Support the U.S. Semiconductor Sector

To support continued expansion of the American semiconductor manufacturing supply chain, the United States needs to double down on an investment-based approach toward rebuilding an advanced domestic semiconductor ecosystem. To start, the administration and Congress should work together to extend and expand the Advanced Manufacturing Investment Credit (AMIC) (IRC Section 48D) to spur additional investments in the domestic semiconductor ecosystem and bolster supply chain resilience. The AMIC has already proven to be a powerful driver of private investment in the U.S. semiconductor ecosystem; however, the credit is set to expire in 2026, threatening the ability of companies to make sustained, long-term investments in the United States to bolster domestic semiconductor manufacturing capabilities in the face of growing global competition. Extending the credit would ensure the continued growth of U.S. manufacturing capacity and provide the business certainty necessary for companies to plan future investments in America. Expanding the credit to include semiconductor research and design would ensure more innovation takes place in America and that the United States retains its first-mover advantage in the semiconductor-enabled technologies of the future. Congress should also consider increasing the rate of the credit to enhance global competitiveness and reduce the cost differential between manufacturing in the United States versus abroad.

We note two promising bills have been introduced in Congress, 1) the Semiconductor Technology Advancement and Research (STAR) Act (H.R. 802),[40] which would extend the duration of the AMIC for 10 years and expand the eligibility of the credit to chip research and design; and 2) the Building Advanced Semiconductors Investment Credit (BASIC) Act (H.R. 3204),[41] which would extend the existing credit for an additional four years and increase the rate of the existing credit from 25% to 35%.

Additionally, we recommend the administration or Congress clarify regulations implementing IRC Section 48D to include the production of semiconductor-grade polysilicon and compound semiconductor substances, such as silicon carbide and gallium nitride, for the manufacture of

[39] The U.S. machine tool industry would likely not exist today but for these agreements. For more information on the complexities and challenges of the machine tool industry, see Rand Corporation, "The Decline of the U.S. Machine-Tool Industry and Prospects for Recovery," 1994 (https://www.rand.org/pubs/research_briefs/RB1500.html) and Bismark, "Machine Tools: A Case Study in Advanced Manufacturing," February 2020 (https://www.bismarckanalysis.com/Machine_Tools_Case_Study.pdf).
[40] STAR Act, H.R. 802. https://www.congress.gov/bill/119th-congress/house-bill/802
[41] BASIC Act, H.R. 3204. https://www.congress.gov/bill/119th-congress/house-bill/3204

semiconductor devices. These highly complex manufacturing processes are integral to semiconductor manufacturing and should be covered by the AMIC.

Support Streamlined Regulation to Accelerate Investment in the U.S. Chip Supply Chain

The administration should also continue to partner with industry and government stakeholders at the federal, state, and local level to ensure semiconductor manufacturing facilities can be built in the United States efficiently and without delays. A recent report found that, due to permitting and construction delays, timelines for some U.S. chip manufacturing facilities can exceed 50 months, whereas "in East Asia, fabs have been completed and have achieved volume production 28 to 32 months after construction started."[42] For example, several factors may contribute to delays in bringing domestic manufacturing facilities online, including environmental regulations and permitting processes, access to reliable and affordable electricity, shortages of workers with necessary skills, and the need for demand signals that create the necessary business case to justify expansion in the United States.

SIA is encouraged by the Trump Administration's approach to smart regulation as a means of unleashing American innovation and manufacturing.[43] As part of a holistic strategy to strengthen the U.S. semiconductor ecosystem, SIA supports efforts to review government policies and regulations that may inadvertently stifle the ability to build fabs, make the supply chain more resilient, innovate the next generation of technology, acquire the best talent, and drive American-made chip sales domestically and around the world. SIA welcomes the opportunity to engage with the administration and federal agencies to identify opportunities to streamline certain policies, regulations, or approval processes to help unleash America's chip resurgence.

Fund Research & Development and Workforce Development

To further support the medium- to long-term development and leadership of the semiconductor and semiconductor equipment industry in the United States and enhance the resiliency of the U.S. semiconductor supply chain, the administration should:

- Support scientific progress and technological innovation by accelerating research and development, dismantling regulatory barriers, strengthening domestic supply chains and manufacturing, spurring robust private sector investment, and advancing American companies in global markets.[44]

- Promote innovation and workforce development through robust federal semiconductor R&D programs, such as the NSTC, NAPMP, SMART USA Institute, CHIPS Metrology

[42] McKinsey, "Semiconductors have a big opportunity—but barriers to scale remain," April 21, 2025. https://www.mckinsey.com/industries/semiconductors/our-insights/semiconductors-have-a-big-opportunity-but-barriers-to-scale-remain#/
[43] The White House, "Unleashing Prosperity Through Deregulation," January 31, 2025. https://www.whitehouse.gov/presidential-actions/2025/01/unleashing-prosperity-through-deregulation/
[44] President Donald Trump, "A Letter to Michael Kratsios, Director of the White House Office of Science and Technology Policy," March 26, 2025. https://www.whitehouse.gov/briefings-statements/2025/03/a-letter-to-michael-kratsios-director-of-the-white-house-office-of-science-and-technology-policy/

Program, and DOD Commons,[45] to effectively compete in the global semiconductor innovation race and enable technology leadership in critical industries and national security applications, such as AI.[46]

- Close the semiconductor workforce talent gap[47] through: (1) Strengthening programs aimed at growing the pipeline for skilled technicians; (2) Growing the domestic STEM pipeline for engineers and computer scientists vital to the semiconductor industry and other sectors that are critical to the future economy; and (3) Retaining and attracting more international advanced degree students in STEM fields.[48]

Considerations for Potential Tariff Action

While SIA believes a sectoral semiconductor agreement is the preferred action pursuant to this Section 232 investigation, should the administration seek to impose a tariff remedy, SIA strongly requests that any such remedy is designed to 1) limit inadvertent harm to the semiconductor industry in the United States and our companies' investment plans, including investments in SME, and 2) target in a manner as to drive increased demand for our chips, which will in turn drive greater revenue for our companies to reinvest domestically.

Overly broad import barriers—as opposed to targeted measures supporting domestic production, sectoral trade negotiations, or targeted restrictions—risk disrupting the semiconductor supply chain in the United States and in partner and allied countries, jeopardizing the availability of chips for critical downstream industries in the United States, imperiling U.S. technological leadership, and benefiting foreign competitors in an industry that operates on low margins with revenue driven back into the industry through R&D to stay ahead. This lost revenue can create a negative feedback loop, where reduced revenue relative to competitors will lead to less R&D funding, a subsequent reduction in technology leadership, and further revenue declines.

We offer the following recommendations:

- ***Narrow Country and Product Scope***: The scope of any imposed tariffs should be narrowly tailored to address specific nonmarket problems in the global semiconductor marketplace. As explained above, semiconductors are a diverse set of products with different economics at play within each segment. As such, a one-size-fits all approach would not be appropriate. The Trump Administration could, for example, focus this

[45] National Semiconductor Technology Center (NSTC), the National Advanced Packaging Manufacturing Program (NAPMP), the Semiconductor Manufacturing and Advanced Research with Twins USA (SMART USA) Institute, the CHIPS Metrology Program, and the Department of Defense Microelectronics Commons. These programs are delivering on an aggressive, comprehensive, and industry-led strategy to ensure the most cutting-edge semiconductor technologies are developed in America, made in America, and benefit the American economy and workforce.
[46] Semiconductor Industry Association, "American Semiconductor Research: Leadership through Innovation," Oct. 2022. https://www.semiconductors.org/american-semiconductor-research-leadership-through-innovation/
[47] Semiconductor Industry Association / Oxford Economics, "Chipping Away: Assessing and Addressing the Labor market Gap Facing the U.S. Semiconductor Industry," July 2023. https://www.semiconductors.org/chipping-away-assessing-and-addressing-the-labor-market-gap-facing-the-u-s-semiconductor-industry/
[48] Semiconductor Industry Association, "Semiconductor Workforce Development: A Policy Blueprint," April 2024. https://www.semiconductors.org/workforceblueprint/

investigation on certain countries or types of chips, such as non-market economy legacy chips. Doing so would address unfair trade practices and the risks of excess capacity in key industry segments. Please see SIA's recent submission in response to USTR's ongoing Section 301 investigation into "China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance."[49]

- ***U.S. Content Exemption:*** Exclude U.S. content from the scope of tariffs, as was implemented in the case of tariffs on automobiles and automotive parts.[50] Given the vitally important role of research and design in continued U.S. semiconductor leadership, the administration could also consider including the value of U.S. intangible content (e.g. the value of semiconductor design) as non-dutiable U.S. content. Keeping innovative semiconductor research and design in the U.S. advances American security.

- ***Tariff Phase-ins to Accommodate Investments in U.S. Manufacturing***: The typical semiconductor fab can take upwards of five years to be fully operational and recovering upfront costs through manufacture and sale of chips can take another 5-10 years. In light of this, SIA recommends that any tariffs should have delayed implementation—e.g., phased-in over time—or be structured as a tariff rate quota (TRQ) to allow the U.S. industry to continue operating efficiently while U.S. manufacturing facilities are completed. A TRQ could be phased in as new U.S. capacity comes online.

- ***Maintain Duty Drawback***: Duty drawback permits a company that manufactures goods in the United States to be refunded duties, taxes, and fees paid on an imported parts, components, and materials that are incorporated in an exported product. Maintaining duty drawback would ensure the United States remains at the forefront of global chip technology as Section 232 duties could be refunded by CBP and remain available for investments in expanding U.S. manufacturing capacity and advanced research and development, as opposed to handed over to the U.S. Treasury.

- ***Avoid overlapping remedies across different trade actions***: Several of the trade actions and investigations[51] currently underway by the Trump Administration are overlapping in both country and product scope. Given the far-reaching consequences of imposing tariffs on semiconductors, SME, and related parts and components, maintaining as simple of a tariff regime for semiconductors as possible is important. Therefore, SIA

[49] SIA, Request for Public Comments: China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance, February 5, 2025. https://www.semiconductors.org/wp-content/uploads/2025/02/USTR-2024-0024-00109674-CAT-5016-Public-Document.pdf

[50] *See* Presidential Proclamation 10908 of March 26, 2025, "Adjusting Imports of Automobiles and Automobile Parts Into the United States," Federal Register, Vol. 90, No. 63. https://www.govinfo.gov/content/pkg/FR-2025-04-03/pdf/2025-05930.pdf

[51] *See* Executive Order 14257 of April 2, 2025, "Regulating Imports With a Reciprocal Tariff To Rectify Trade Practices That Contribute to Large and Persistent Annual United States Goods Trade Deficits," 90 FR 15041 (https://www.govinfo.gov/content/pkg/FR-2025-04-07/pdf/2025-06063.pdf); A Notice by the Trade Representative, Office of United States on December 30, 2024, "Initiation of Section 301 Investigation; Hearing; and Request for Public Comments: China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance," 89 FR 106725 (https://www.govinfo.gov/content/pkg/FR-2024-12-30/pdf/2024-31306.pdf); Executive Order 14272 of April 15, 2025, "Ensuring National Security and Economic Resilience Through Section 232 Actions on Processed Critical Minerals and Derivative Products," 90 FR 16437 (https://www.govinfo.gov/content/pkg/FR-2025-04-18/pdf/2025-06836.pdf).

strongly requests the administration to avoid imposing overlapping remedies that could result in stacked tariffs for the same products.

- ***Clear Implementation Guidance***: Customs clearance procedures for any potential tariffs should be clear and simple. Specific information requirements, such as the declaration of country of origin and content ratio, as seen with tariffs on aluminum derivatives, may create confusion and pose a significant burden on companies without clear guidance and adequate time for companies to gather necessary information. The Trump Administration should mitigate compliance challenges arising from complex customs procedures to the maximum extent possible, as they could cause an increase in operational costs and delays in procurement procedures, further reducing the competitiveness of related businesses.

Should the Administration determine to impose tariffs as a result of this investigation, these recommendations – e.g. narrowing the scope of any tariffs, excluding domestic content, opting for a phase-in or TRQ approach, maintaining duty drawback, and avoiding overlapping remedies and tariffs resulting from different trade actions – would collectively mitigate some of the risks to the U.S. semiconductor industry.

Again, we note the imposition of tariffs on certain critical supply inputs and certain chips carry a significant risk of inadvertent but serious harm to the U.S. semiconductor industry and downstream sectors, and the above recommendations can only partially mitigate that risk. The best way for President Trump to support this critical sector of the U.S. economy is to prioritize other supporting measures, like negotiating sectoral agreements to improve market access for U.S. chips, address non-market economy excess capacity, and provide additional support for investments in U.S. semiconductor operations, as set out in the President's American First Trade Policy Memorandum on January 20, 2025.

## V. CONCLUSION

SIA and its members greatly appreciate the opportunity to comment on the current Section 232 national security investigation of imports of semiconductors and SME. As noted earlier, we urge BIS to consult closely with SIA and its member companies to understand and consider the effects of potential actions on the global semiconductor market and on our upstream and downstream supply chains, and to inform a comprehensive approach that avoids inadvertent harm to the semiconductor industry in the United States and in partner nations. As noted above and shown in Figure 1, U.S. semiconductor firms maintain a leading position in the industry – including R&D, design, and process technology – holding more than 50 percent share of global semiconductor sales. We strongly request that the effectiveness of any government policy intervention contemplated by the Trump Administration be evaluated in terms of this metric, among others.

SIA and our member companies stand ready to work with BIS to reinforce U.S. economic strength, national security, innovation, and technology leadership. Continued engagement with SIA, U.S. stakeholders, other semiconductor-producing economies, and allied partners will be critical in ensuring an appropriate and beneficial response and avoiding unintended consequences. We would also encourage the administration to hold a public hearing with respect to this investigation. SIA is happy to answer any additional questions or respond to any additional requests for information.

Please contact Mary Thornton (mthornton@semiconductors.org) or Carrie Esko (cesko@semiconductors.org) with any follow-up requests.

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# ANNEX I

Below are SIA's responses to certain topics listed in BIS' notice of public comment.

**1. The current and projected demand for semiconductors (including as embedded in downstream products) and SME in the United States, differentiated by product type and node size.**

The table below shows current and forecasted demand revenue for semiconductors in the Americas markets.[52] The product segments expected to see the largest growth are in advanced logic and DRAM, which are seeing strong growth due to demand for artificial intelligence-related hardware.

It's important to note that industry forecasts, produced between November 2024 and early 2025, have since been revised. Analysts predict that declining market conditions may drive annual semiconductor sales growth rates to fall from 14% to 2% in 2025 and from 9% to -20% in 2026.[53] Shipments of SME annual growth rates may decline from 5% to –7% in 2025 and from 14% to –8% in 2026.[54]

**Current and projected demand by Revenue ($B), 2024-2027**

| Semiconductor Type | 2024 | 2025(f) | 2026(f) | 2027(f) |
|---|---|---|---|---|
| Logic - Advanced | 42.8 | 59.7 | 65.8 | 71.5 |
| Logic - Current-gen | 17.0 | 18.6 | 19.6 | 20.7 |
| Logic - Mature | 16.7 | 18.4 | 19.8 | 20.7 |
| Memory - DRAM | 44.3 | 55.6 | 54.6 | 55.6 |
| Memory - Flash | 29.4 | 26.9 | 28.4 | 31.1 |
| Memory - Other | 0.3 | 0.4 | 0.3 | 0.5 |
| Analog | 12.1 | 12.4 | 13.1 | 13.7 |
| Optoelectronics | 11.9 | 14.6 | 15.3 | 15.9 |
| Sensors | 2.5 | 2.6 | 2.7 | 2.8 |
| Discrete | 3.4 | 3.7 | 3.9 | 4.1 |

Source: SIA Analysis on WSTS, "SDI Forecast," November 2024 and Gartner, "Semiconductor Forecast—Q4-2024," accessed March 2025.
Note: WSTS product classification does not report individual logic chips by node size. Therefore, SIA analysis estimated forecasted shipments by approximating distribution from Gartner semiconductor forecasts.

We note that BIS previously collected data germane to this question in various mandatory surveys from 2017-2024.[55]

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[52] The WSTS and Gartner publications do not map node sizes to specific products. Please refer to Table 1 for SIA's high-level mapping of semiconductor types to featured node sizes.
[53] TechInsights, "Tariff Scenarios: Semiconductor Sales 2025 and 2026," April 17, 2025.
[54] TechInsights, "Tariff Scenarios: Semiconductor Equipment Sales 2025 and 2026," April 24, 2025.
[55] See BIS, U.S. Bare Printed Circuit Board Industry Assessment, 2017; BIS, Assessment of the Status of the Microelectronics Industrial Base in the United States, December 2023; and BIS, Public Report on the Use of Mature-Node Semiconductors, December 2024.

**2. The extent to which domestic production of semiconductors can or is expected to be able to meet domestic demand at each node size for each product type, and similarly the extent to which domestic production of SME can or is expected to be able to meet domestic demand.**

Please refer to SIA's submission in response to the Office of Management and Budget's (OMB's) request for information on advancing domestic manufacturing semiconductors through federal procurement of commercial information technology.[56]

**3. The role of foreign fabrication and assembly, test and packaging facilities in meeting United States semiconductors demand, and similarly the role of foreign supply of SME in meeting domestic demand.**

As noted in SIA's response to USTR's ongoing Section 301 investigation into "China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance," fabless companies rely on foundry capacity to manufacture the chips they design. The relatively limited share of mature-node capacity by pure-play foundries creates supply challenges for fabless companies, which often are unable to rely on U.S. installed capacity and must rely on international suppliers. Similar supply and dynamics exist for advanced node semiconductor manufacturing capacity.

**5. The impact of foreign government subsidies and predatory trade practices on United States semiconductor and SME industry competitiveness.**

**6. The economic or financial impact of artificially suppressed semiconductor and SME prices due to foreign unfair trade practices and state-sponsored overcapacity.**

**7. The potential for export restrictions by foreign nations, including the ability of foreign nations to weaponize their control over semiconductors and SME supply chains.**

Please refer to SIA's recent submission in response to USTR's ongoing Section 301 investigation into "China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance" in response to questions 5-7.[57]

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[56] SIA, "SIA Comments to OMB on Resilience of Domestic Semiconductor Manufacturing through Federal Procurement of Commercial IT Products," March 17, 2025. https://www.semiconductors.org/wp-content/uploads/2025/03/OMB-RFI-SIA-COMMENTS-3.17.25.pdf

[57] SIA, Request for Public Comments: China's Acts, Policies, and Practices Related to Targeting of the Semiconductor Industry for Dominance, February 5, 2025. https://www.semiconductors.org/wp-content/uploads/2025/02/USTR-2024-0024-00109674-CAT-5016-Public-Document.pdf

**8. The feasibility of increasing domestic semiconductors capacity (in different product types and node sizes) to reduce import reliance, and similarly the feasibility of increasing domestic SME capacity to reduce import reliance.**

Please refer to SIA's submission in response to OMB's request for information on advancing domestic manufacturing semiconductors through federal procurement of commercial information technology.[58]

**9. The impact of current trade and other policies on domestic semiconductor and SME production and capacity, and whether additional measures, including tariffs or quotas, are necessary to protect national security.**

Certain remedies imposed under this Section 232 investigation could have a detrimental effect on the administration's priority to onshore more U.S. manufacturing and protect national security. For example, the application of broad-based tariffs will make U.S.-based fabs less competitive globally. Companies may opt to manufacture outside of the United States. Manufacturers will need to raise prices for government clients or choose not to supply government clients due to the relatively small volumes needed. The net effect will be a diminished U.S. manufacturing footprint, weakened domestic industry, and greater dependency on foreign suppliers.

SIA analysis indicates that a 1% increase in duty rates for semiconductor manufacturing inputs is expected to lead to a 0.64% increase in the overall cost of constructing a fab. For every dollar that a semiconductor chip increases in price, products with embedded semiconductors will have to raise their sales price by $3 to maintain their previous margins.

Please see Section IV above regarding SIA's recommendation for a sectoral trade agreement and the critical need to create demand for U.S.-made semiconductors globally.

**11. What SME is manufactured abroad and faces limited competition from U.S.-made products?**

U.S. semiconductor manufacturers rely on a variety of manufacturing equipment produced in both the U.S. and allied countries. These tools include metrology systems (i.e., thin film measurement tools), vertical furnaces, epitaxy process tools, panel plating and cleaning systems, wafer and defect inspection systems, and lithography systems. SME producers worldwide have developed specialized technologies and supply networks over decades, contributing unique strengths to the industry that is impossible to decouple. For example, U.S. semiconductor companies are reliant on imports of photolithography tools—specifically steppers/scanners—which are primarily manufactured abroad. Some finished products of foreign-headquartered companies contain significant U.S. content, as they rely on U.S. suppliers for key components and parts which are exported to the country of ultimate SME manufacture. Building new semiconductor manufacturing capacity in the United States requires highly specialized SME, some of which incorporates hundreds of technology subsystems. This SME is manufactured both within and outside of the

[58] SIA, "SIA Comments to OMB on Resilience of Domestic Semiconductor Manufacturing through Federal Procurement of Commercial IT Products," March 17, 2025. https://www.semiconductors.org/wp-content/uploads/2025/03/OMB-RFI-SIA-COMMENTS-3.17.25.pdf

United States and is critical to efforts to increase domestic semiconductor production capacity and capability.

**13. Where the U.S. workforce faces a talent gap in production of semiconductors, SME or SME components.**

The following answer is drawn from, and more detail is available in, SIA and Oxford Economics' 2023 report "Chipping Away – Addressing the Labor Market Gap Facing the U.S. Semiconductor Industry."[59]

There is a significant shortage of skilled and highly educated workers, particularly technicians, engineers, and computer scientists.[60] We estimate a workforce gap for technicians of 20% and a 39% workforce gap for both engineers and computer scientists. By 2030, roughly 67,000 jobs in the U.S. semiconductor industry risk going unfilled at current degree completion rates. Without action to address this gap, 58% of projected new semiconductor industry technical jobs and roughly 80% of projected new jobs in technical occupations, including technicians, engineers, and computer scientists, risk going unfilled. The U.S. also currently lacks a skilled employment base of construction workers with customized training both for the construction of the fab and for the ongoing maintenance and repair of facilities. SIA member companies have begun taking action to address these gaps, but shortages are likely to persist, especially among workers with advanced degrees.

The largest pain point for the industry continues to be at the advanced-degree level. More than half of students in U.S. advanced degree programs in electrical engineering, computer science, and other critical fields continue to be foreign nationals. We recommend that the administration take additional steps to address the gaps stemming from this reality. These steps should include both (1) efforts to increase the number of domestic students choosing to enter advanced degree programs in fields critical to the industry, and (2) efforts to improve industry's ability to recruit and retain foreign nationals with advanced degrees in needed fields.

Ongoing cuts to federal funding risk compounding these challenges through a cascade effect that will result in reduced enrollment and graduation levels for the next few years. For example, cuts in certain research programs are causing many current research students to shift to new research programs, which may significantly delay their expected graduation dates. This, in turn, will reduce the capacity of many institutions to enroll new students. This double whammy of lower graduation and enrollment levels is likely to impact industry hiring efforts right when the industry is poised to see significant growth.

[59] Semiconductor Industry Association and Oxford Economics, *Chipping Away – Addressing the Labor Market Gap Facing the U.S. Semiconductor Industry*, July 2023. https://www.semiconductors.org/wp-content/uploads/2023/07/SIA_July2023_ChippingAway_website.pdf

[60] Certain industry representatives have identified high turnover and labor shortages, particularly for production specialists, skilled manufacturing technicians, and product verification engineers due to a training demands and pay competition.

# ANNEX II

## LIST OF CRITICAL SEMICONDUCTOR DESIGN & MANUFACTURING INPUTS

The following is a *non-exhaustive* list of inputs, materials, and equipment necessary to design and manufacture semiconductors in the United States.

| HS Code | Product/Input |
|---|---|
| 2529.22.00 | Fluorspar is a critical raw material used to produce hydrofluoric acid which is used for etching processes, cleaning surfaces, and removing impurities during chip fabrication. |
| 2804.21.00 | Raw material argon acting as a cleaning agent that protects metals from oxidation and contamination and enables a non-reactive atmosphere to facilitate etching and deposition processes. |
| 2804.29.00 | Critical raw materials used in semiconductor manufacturing, often as a cleaning or reducing agent. |
| 2804.40.00 | Ultra-high purity oxygen is a critical raw material acting as oxidizing agent in processes such as silicon layer deposition, etching, and reactive gas neutralization. |
| 2804.61.00 | Critical raw material for semiconductor manufacturing due to its ability to form insulating oxide layers and ideal properties to create transistors and integrated circuits. |
| 2811.11.00 | Specialty chemical used for cleaning and etching silicon wafers, removing silicon dioxide, and preparing surfaces for further processing. |
| 2811.19.30 | Specialty chemical used for etching polysilicon to create fine grooves and holes on silicon wafers for electronic circuits. |
| 2811.29.50 | A specialty chemical used in semiconductor manufacturing, often for deposition or etching processes. |
| 2849.20.20 | Silicon carbide ingots or wafers for further processing. |
| 2850.00.50 | Silicon precursor acting as the starting materials for creating thin films of silicon-based materials. |
| 2909.19.18 | Solvents used in semiconductor manufacturing, including photoresist formulations and cleaning agents. |
| 2929.90.50 | A specialty chemical used in semiconductor manufacturing, often for deposition or etching processes. |
| 3208.20.00 | Specialty materials used to form protective coatings on equipment such as piping and wet benches during the cleaning, etching, and rinsing processes of silicon wafers. |
| 3208.90.00 | Specialty materials used to form protective coatings on equipment such as piping and wet benches during the cleaning, etching, and rinsing processes of silicon wafers. |
| 3405.90.00 | Specialty materials used to form protective coatings on equipment such as piping and wet benches during the cleaning, etching, and rinsing processes of silicon wafers. |
| 3701.99.60 | Photomask blanks serving as the base material for creating photomasks used to transfer circuit patterns onto silicon wafers during the photolithography process. |
| 3707.90.32 | Photoresists used in photolithography as light-sensitive materials to create patterned coatings on a surface, enabling the transfer of circuit patterns onto silicon wafers. |
| 3707.90.60 | Specialty materials used in photolithography to assist in creating patterned coatings on a surface, enabling the transfer of circuit patterns onto silicon wafers. |
| 3818.00.00 | Silicon wafers |
| 3923.10.90 | Packaging trays for system-on-chip devices during semiconductor manufacturing and testing to ensure proper handling and prevent damage. |
| 3923.90.00 | Packaging supplies for semiconductors. |
| 3926.90.45 | Packaging supplies for semiconductors. |
| 3926.90.99 | Packaging supplies for semiconductors. |
| 4016.93.50 | Packaging supplies for semiconductors. |
| 4016.99.15 | Packaging supplies for semiconductors. |
| 4016.99.60 | Packaging supplies for semiconductors. |
| 6211.43.10 | Cleanroom garments that prevent contamination and maintain a controlled environment to ensure high-quality semiconductor manufacturing. |
| 6804.21.00 | Diamond dresser discs used to condition and restore polishing pads and ensure uniform surface profiles. |

| HS Code | Product/Input |
|---|---|
| 6909.12.00 | Ceramic Semiconductor Production Components/Parts that have high strength, thermal, and electrical insulation and corrosion resistance. |
| 7020.00.30 | Quartz reactor tubes and holders that are inserted into diffusion and oxidation furnaces, providing a controlled environment for thermal processing during semiconductor wafer manufacturing. |
| 7601.10.60 | Ultra-pure aluminum used in thin films, interconnects, and other critical semiconductor components. |
| 8103.99.00 | Tantalum used as an insulating layer in semiconductor devices. |
| 8108.20.00 | Unwrought titanium sponge or powder used as a barrier metal to enable electrical signal flow and in advanced semiconductor packaging. |
| 8111.00.47 | Unwrought manganese flake used to modify electrical properties of semiconductor material. |
| 8413.50.00 | Pumps that play a crucial role in handling of fluids such as corrosive chemicals, ultra-pure water for semiconductor manufacturing. |
| 8414.10.00 | Pumps that play a crucial role in vacuum creation and gas handling in processes such as material deposition and etching. |
| 8414.59.30 | Fans that play a crucial role in maintaining cleanroom environments, cooling equipment, and managing hazardous materials. |
| 8414.59.65 | Compressors that power tools, maintain controlled environments, and ensure the purity and quality of the semiconductor manufacturing process. |
| 8414.80.16 | Compressors that power tools, maintain controlled environments, and ensure the purity and quality of the semiconductor manufacturing process. |
| 8414.90.91 | Parts of compressors that power tools, maintain controlled environments, and ensure the purity and quality of the semiconductor manufacturing process. |
| 8419.50.50 | Thin heaters used for processes such as wafer processing, thin film deposition, and temperature control. |
| 8419.89.95 | Thin heaters used for processes such as wafer processing, thin film deposition, and temperature control. |
| 8421.21.00 | A centrifugal system for treating industrial wastewater before disposal or recycling. |
| 8421.29.00 | A system to treating industrial wastewater before disposal or recycling. |
| 8421.39.01 | Specialized filtration device to purify gases for semiconductor manufacturing. |
| 8443.91.30 | Heatsink - device attached to a heat-generating component to prevent overheating. |
| 8460.31.00 | Silicon ingot modification machines to make wafers such as wiresaws, grinding machines, and edge grinders |
| 8471.49.00 | Tools and equipment used for the design, verification, optimization, debug, and testing of semiconductors |
| 8471.50.01 | Tools and equipment used for the design, verification, optimization, debug, and testing of semiconductors |
| 8473.30.11 | Evaluation Kits/Boards/Graphics card/DIMMS (dual in-line memory module that holds memory chips and is installed in a computer's motherboard) for testing performance and functionality. |
| 8473.30.51 | Heatsinks or L6 systems attached to motherboards or validation boards. |
| 8479.50.00 | Robots that automate certain tasks to increase efficiency in semiconductor manufacturing. |
| 8481.80.10 | Valves used in various processes including gas delivery, ultra-pure water systems, and chemical processing that require a high degree of precision and reliability. |
| 8481.80.30 | Valves used in various processes that require corrosion resistance and durability. |
| 8481.80.90 | Other valves used to control the flow of liquids and gases in various semiconductor manufacturing processes. |
| 8481.90.90 | Parts of valves used to control the flow of liquids and gases in various semiconductor manufacturing processes. |
| 8486.10.00 | Any machine used to manufacture silicon wafers such as ingot (silicon) (i.e., crystal pullers) and Boule (SiC) growth machines. |
| 8486.20.00 | Equipment used for semiconductor manufacturing such as photolithography equipment, wafer cleaning equipment, diffusion furnace, chemical mechanical planarization equipment, and other semiconductor production equipment/tools. |

| HS Code | Product/Input |
|---|---|
| 8486.40.00 | Front opening utility pod used in semiconductor manufacturing to efficiently transport and manage wafers and other materials within a fabrication facility. |
| 8486.90.00 | Parts and accessories of equipment used for semiconductor manufacturing such as photolithography equipment, wafer cleaning equipment, diffusion furnace, chemical mechanical planarization equipment, and other semiconductor production equipment/tools. |
| 8486.90.00 | Photomask pellicles serving as thin, transparent membranes stretching over photomasks to protect them from contamination during the lithography process. |
| 8501.32.20 | Motors used in the automation of semiconductor manufacturing processes such as wafer handling and positioning. |
| 8504.32.00 | Power supplies used to power various semiconductor manufacturing equipment. |
| 8504.40.95 | Power supplies used to power various semiconductor manufacturing equipment. |
| 8534.00.00 | Used in printed circuit board assemblies. |
| 8536.69.40 | Sockets for semiconductor load boards used for testing purposes. |
| 8537.10.91 | PCB assemblies serve as the foundation for mounting and connecting various semiconductor components. |
| 8541.10.00 | Used in printed circuit board assemblies. |
| 8541.90.00 | Processed wafers serving as the foundation for manufacturing integrated circuits and microchips. |
| 8543.90.12 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.15 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.35 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.65 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.68 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.85 | Critical inputs for semiconductor equipment maintenance. |
| 8543.90.88 | Critical inputs for semiconductor equipment maintenance. |
| 8544.20.00 | Critical inputs for semiconductor equipment maintenance. |
| 8544.42.20 | Critical inputs for semiconductor equipment maintenance. |
| 8544.42.90 | Critical inputs for semiconductor equipment maintenance. |
| 8544.49.90 | Critical inputs for semiconductor equipment maintenance. |
| 8547.10.80 | Insulating Fitting for Semiconductor Production Equipment/Tool |
| 8547.90.00 | Insulating Fitting for Semiconductor Production Equipment/Tool |
| 9025.19.80 | Crucial for monitoring and controlling semiconductor manufacturing processes such as thin film deposition, annealing, and lithography. |
| 9026.20.40 | Instruments that control the flow and distribution of ultra-high purity gases and liquids used for semiconductor manufacturing. |
| 9027.30.40 | Used for process monitoring and material analysis in semiconductor manufacturing. |
| 9030.40.00 | Tools and equipment used for the design, verification, optimization, debug, and testing of semiconductors. |
| 9030.82.00 | Various equipment or tools needed for measuring or checking semiconductor wafers or devices. |
| 9030.90.66 | Evaluation Kits/Boards used for testing performance and functionality. |
| 9031.41.00 | System level test equipment to test the operation of semiconductors in final user environments. |
| 9603.50.00 | Chemical mechanical polishing brushes for cleaning and slurry distribution. |