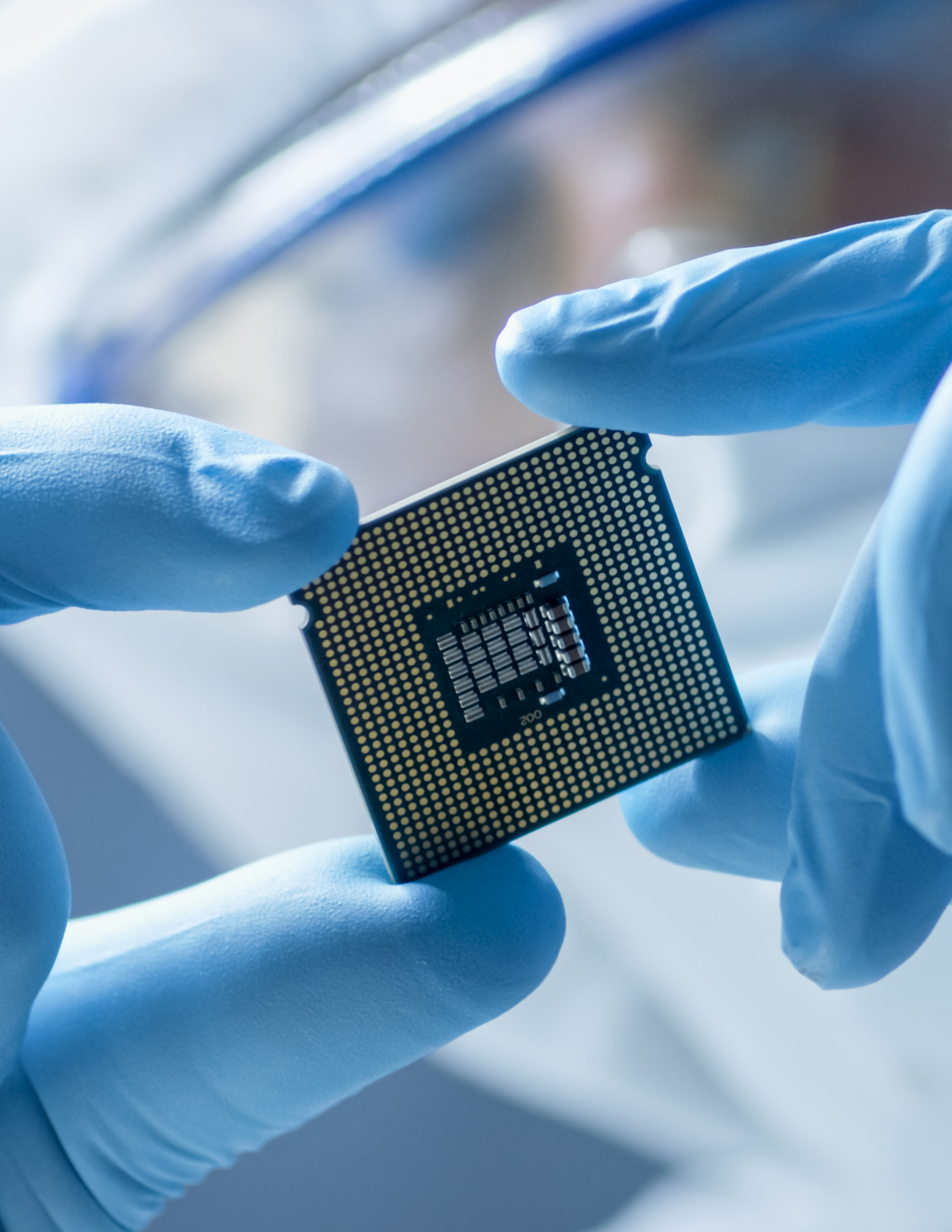
2022 STATE OF THE U.S. SEMICONDUCTOR INDUSTRY

SIA SEMICONDUCTOR INDUSTRY ASSOCIATION



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SEMICONDUCTORS—THE TINY CHIPS POWERING MODERN ELECTRONICS—HAVE ENABLED BREATHTAKING INNOVATION IN VIRTUALLY ALL AREAS OF SOCIETY, FUNDAMENTALLY SHIFTING THE BOUNDARY BETWEEN THE POSSIBLE AND THE IMPOSSIBLE. TODAY'S SEMICONDUCTORS ARE SO ADVANCED THEY CAN CONTAIN MORE THAN 100 BILLION TRANSISTORS ON A SINGLE PIECE OF SILICON—SO MANY THAT IT WOULD TAKE A PERSON MORE THAN 1,000 YEARS TO COUNT EACH ONE ALOUD.

In 2022, with the importance of semiconductors to the global economy continuing to grow, the semiconductor industry has worked tirelessly to speed the pace of innovation and ramp up production. In fact, the global industry is on pace to ship more semiconductors this year than during any year in history, an achievement that has helped ease the ongoing global chip shortage. Meanwhile, U.S. semiconductor companies continue to invest roughly one-fifth of annual revenue in R&D — amounting to a record $50.2 billion in 2021, the last full year of available data — to turbocharge chip advancements.

This year also saw the enactment of landmark, bipartisan legislation, the CHIPS and Science Act, that will substantially strengthen domestic semiconductor production and innovation in the years ahead. The CHIPS Act includes $52 billion in chip manufacturing incentives and research investments, as well as an investment tax credit for semiconductor manufacturing and semiconductor equipment manufacturing. These investments will help reinvigorate U.S. leadership in chip technology and reinforce America's economy, national security, and supply chains.

Despite an historic year in 2022, the semiconductor industry continues to face significant challenges. Global semiconductor sales growth slowed substantially during the second half of the year, for example, and the market—known for its cyclicality—is not projected to rebound until the second half of 2023. In addition, U.S.-China tensions continue to have repercussions on the global supply chain, leading to the proliferation of government controls on sales of chips to China, the world's largest semiconductor market. And other significant policy challenges remain, including the need to enact policies to maintain U.S. leadership in semiconductor design, reform America's high-skilled immigration and STEM education systems, and promote free trade and access to global markets.

Overall, 2022 was a highly successful and consequential year for the industry, as semiconductors are poised to have a greater positive impact on the world than ever. With effective government-industry collaboration in the years ahead, the industry can continue to grow, innovate, and realize an even brighter future built on semiconductors.

CHIPS AND SCIENCE ACT

The COVID-19 pandemic, coupled with other supply chain shocks, was a perfect storm of disruptions to the global semiconductor supply chain and significantly impacted industries that rely heavily on chips to manufacture their goods. These disruptions, along with geopolitical tensions, highlighted the need to strengthen the domestic chip industry by expanding manufacturing capacity and reinforcing leadership in innovation. To meet these challenges, Congress enacted the bipartisan CHIPS and Science Act, which President Biden signed into law on August 9, 2022. This historic legislation provides critical semiconductor manufacturing incentives and research investments that will strengthen the U.S. economy, national security, supply chain resiliency, and technology leadership.

The attention of government and business leaders has now turned to implementation of the CHIPS programs in order to supercharge the U.S. semiconductor industry and boost our nation's global competitiveness. The CHIPS and Science Act is already spurring new commitments to construct fabs and other facilities throughout the supply chain, and the new law will transform the nation's future through job creation and economic investment. Substantial challenges for the industry remain, however, including developing a skilled workforce, countering global competition to U.S. leadership in chip design, and maintaining access to global markets and supply chains.

CHIPS INCENTIVES

Manufacturing Incentive Program

A cornerstone of the CHIPS Act is a $39 billion manufacturing incentive program, administered by the Department of Commerce, to revitalize the U.S. chipmaking ecosystem across a wide range of technologies, ranging from large-scale leading-edge fabs to projects for mature and current-generation chips, new and specialty technologies, and manufacturing equipment and material suppliers.

CHIPS Advanced Manufacturing Investment Credit

The CHIPS and Science Act also established a 25 percent advanced manufacturing investment tax credit, to be implemented by the U.S. Department of Treasury, as a complement to the manufacturing incentive program. Together, these incentives will lower the cost gap between investing in the U.S. and investing abroad, while generating greater benefits to the U.S. economy, national security, supply chain, and technology leadership.

$39 Billion

Manufacturing Incentive Program

25%

Advanced Manufacturing Investment Tax Credit

THE CHIPS ACT – ALREADY MAKING AN IMPACT

From the time the CHIPS Act was originally introduced in June 2020, semiconductor companies have announced dozens of projects to increase manufacturing capacity in the U.S. and expand the domestic semiconductor value chain. Some projects were commenced in anticipation of CHIPS Act funding, while others moved forward following enactment of the legislation. Additional projects are anticipated in the coming years as the CHIPS Act is fully implemented. Highlights of these announcements include:

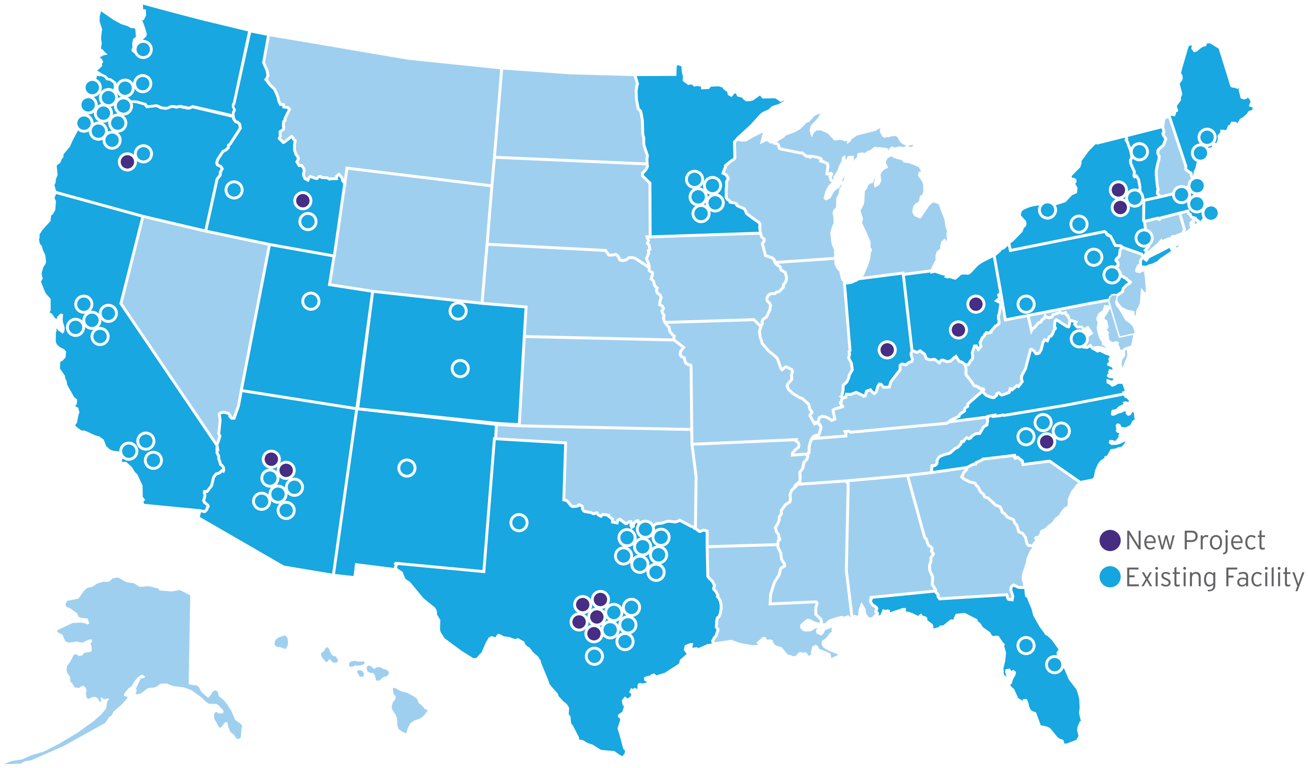
46
new semiconductor ecosystem projects across the U.S., including the construction of new semiconductor manufacturing facilities (fabs), expansions of existing sites, and facilities that supply the materials and equipment used in manufacturing.

>$180 Billion
in company investments in the U.S.

>200,000
jobs created across the U.S. economy, including 36,000 direct jobs in the semiconductor ecosystem.

These projects include the construction of 15 new fabs and the expansions of nine fabs across 12 states, in addition to numerous investments in semiconductor materials, chemicals, gases, raw wafers, and more.

SEMICONDUCTOR MANUFACTURING ACROSS AMERICA



CHIPS R&D PROGRAMS

The CHIPS and Science Act invests $13 billion in semiconductor R&D that will spur innovation for decades to come and help ensure the U.S. retains its technology leadership. These programs provide investments to foster collaboration and long-term innovation between government, industry, academia, and other stakeholders. Importantly, these programs help develop the pipeline of scientists and engineers necessary to fuel future innovation in the semiconductor industry.

National Semiconductor Technology Center

To ensure that technologies bridge the gap from "lab to fab," the National Semiconductor Technology Center (NSTC) will serve as a public-private consortium engaging with government, industry, and universities to innovate all aspects of semiconductor technology and enhance U.S. technology leadership.

National Advanced Packaging Manufacturing Program

The National Advanced Packaging Manufacturing Program (NAPMP) is a federal R&D program to strengthen advanced assembly, test, and packaging (ATP) capabilities. This program is expected to coordinate closely with the NSTC and Manufacturing USA Institutes.

Manufacturing USA Institutes

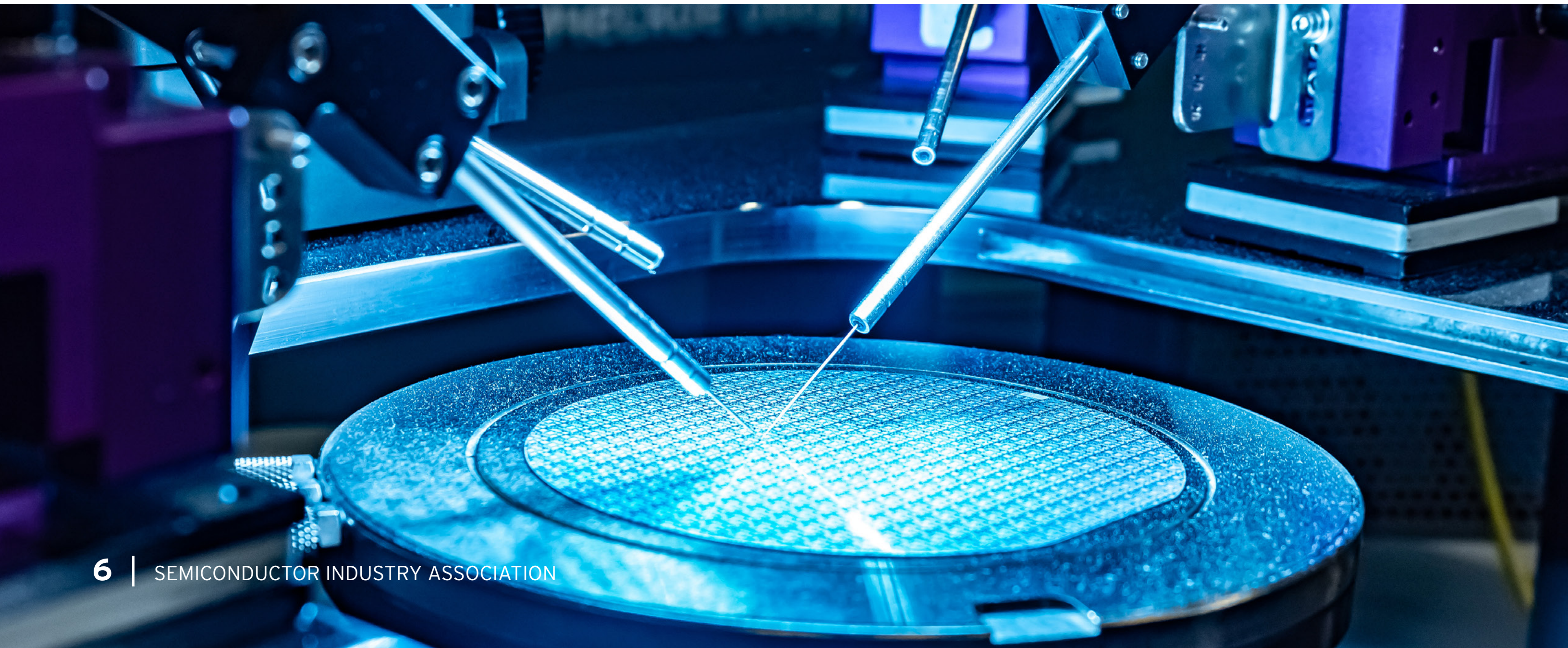
The CHIPS Act establishes up to three Manufacturing USA Institutes in partnership with government, industry, and academia. The research will focus on several different areas, including the automation of semiconductor machinery, development of ATP capabilities, and the development and deployment of skills training.

CHIPS Defense Fund

The CHIPS and Science Act puts $2 billion toward the CHIPS Defense fund, which will supplement investments in the DoD's National Network for Microelectronics R&D. The fund will support onshore, university-based prototyping, lab-to-fab transition of semiconductor technologies (especially those with defense-unique applications), and workforce training.

NIST Metrology R&D

As semiconductor devices become smaller and more complex, the ability to measure, monitor, predict and ensure quality in manufacturing becomes more difficult. The CHIPS and Science Act supports NIST's efforts to conduct critical metrology R&D to enable advances and breakthroughs for metrology of next-generation microelectronics.



U.S. SEMICONDUCTOR RESEARCH: LEADERSHIP THROUGH INNOVATION

An October 2022 report published by SIA identifies five key areas of the semiconductor R&D ecosystem that should be strengthened by the CHIPS and Science Act's R&D funding.

1
Transitioning and Scaling Pathfinding Research
Support pre-competitive research into technologies that are 5-15 years away from volume production

2
Research Infrastructure
Upgrade or expand access to research tools, equipment, or other necessities for ecosystem as a whole

3
Development Infrastructure
Upgrade or expand access to existing development facilities, tools, equipment, or other necessities for whole ecosystem

4
Collaborative Development
Convene companies for full stack and collaborative innovation to accelerate development of key technologies, tools, industry standards, and methodologies

5
Workforce
Promote programs to increase size of U.S. workforce in semiconductor R&D, support workforce readiness and skills development

STRENGTHENING THE U.S. SEMICONDUCTOR WORKFORCE

Leadership and innovation in the semiconductor industry requires a skilled workforce. From construction workers and manufacturing technicians to process engineers and chip designers — and every position in between — talent gaps and worker shortages are expected to increase across the entire semiconductor ecosystem in the U.S. and abroad.

To fully realize the promise and opportunity of the CHIPS and Science Act, it is imperative for the U.S. to have a strong semiconductor workforce pipeline. The CHIPS Act includes workforce development measures as part of the manufacturing incentives and R&D programs, as well as a $200 million workforce and education fund under the National Science Foundation (NSF). These programs are vital in ensuring the industry has the skilled workforce to meet widespread needs both in the short- and long-term, ranging from workers with high school diplomas or technical certifications to engineers and scientists with advanced master's or doctoral degrees.

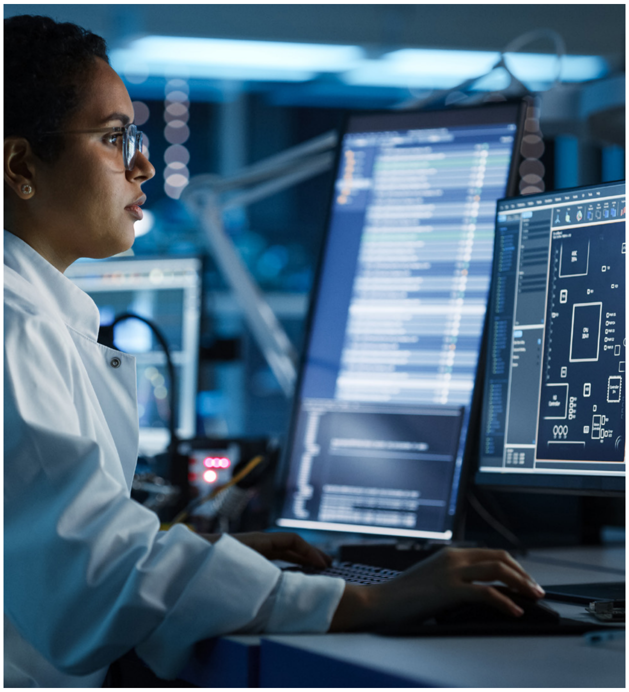
To strengthen the semiconductor workforce pipeline, the U.S. needs to provide additional K-12 STEM education funding and encourage young Americans to choose careers in STEM. This effort will require a major societal effort, with contributions from government, industry, the education community, and other stakeholders in the areas of curriculum development, the expansion of apprenticeships, increased vocational and community college semiconductor programs, higher education research fellowship funding, and recruitment programs. These programs must ensure access for diverse, underrepresented, and economically disadvantaged groups, including minorities, veterans, and those from traditionally excluded geographies.

To compete, the U.S. must have access to the best and brightest from around the world. The U.S. should also increase access to international STEM talent, particularly foreign graduate students in the STEM fields who receive their degrees from U.S. colleges and universities. Two-thirds of STEM graduates with advanced degrees at U.S. universities are foreign nationals, and the U.S. needs to be able to retain that talent rather than force it to return overseas. The semiconductor industry has always benefited from access to the talent from around the world, but restrictions on visa availability and "per country" caps have resulted in foreign STEM students leaving the U.S. because they are unable to receive a green card. Facilitating the issuance of green cards for foreign STEM Master's and PhD's would be transformative for the semiconductor industry. Congress should take action to permanently reform and improve our broken immigration system in order to recruit and retain international talent needed for continued innovation and growth.

SEMICONDUCTOR DESIGN LEADERSHIP

While the CHIPS and Science Act provides important incentives to address key gaps and vulnerabilities in our manufacturing supply chain, it is also essential to take direct steps to maintain U.S. leadership in chip design.

Chip design is the first step in the manufacturing process, and innovation in chip design is vital to future advancements in semiconductor technology. Chip design is a complex process requiring highly trained engineers and scientists, advanced technology, and intellectual property to create the designs for the performance and functionality of the chip. As a result of its leadership in semiconductor design, the U.S. has benefitted from a virtuous cycle of innovation, improving its ability to shape technical standards, enhance national security, and receive spill-over benefits for original equipment manufacturers (OEMs) in industries ranging from information technology and telecommunications to transportation and energy. U.S. semiconductor companies lead the global industry in chip design, and the U.S. accounts for the largest share of the global design workforce: in 2021 there were roughly 187,000 semiconductor design engineers globally and 94,000 work for U.S. headquartered semiconductor companies.



Fabless companies.

~47% **of design-related value add**

These companies focus exclusively on chip design, and partner with third-party merchant foundries to fabricate (that is, manufacture) their chips.

Integrated device manufacturers (IDMs).

~51% **of design-related value add**

IDMs both design and manufacture chips. Within IDMs, design and manufacturing teams work together to bring to market new chips usually at in-house fabrication facilities, or "fabs."

Original equipment manufacturers.

<2% **of design-related value add**

OEMs, like auto makers, use semiconductors as inputs for other products. Some OEMs have begun to design their own chips, primarily for their own products. OEMs are a growing presence in chip design and increasingly participate in the same product and talent markets as fabless companies or IDMs.

EDA/IP providers.

EDA companies are trusted intermediaries between design companies and foundries providing design tools, reference flows and some services. Third party IP providers design and license IP building blocks (processors, libraries, memories, interfaces, sensors, and security).

SEMICONDUCTOR DESIGN LEADERSHIP

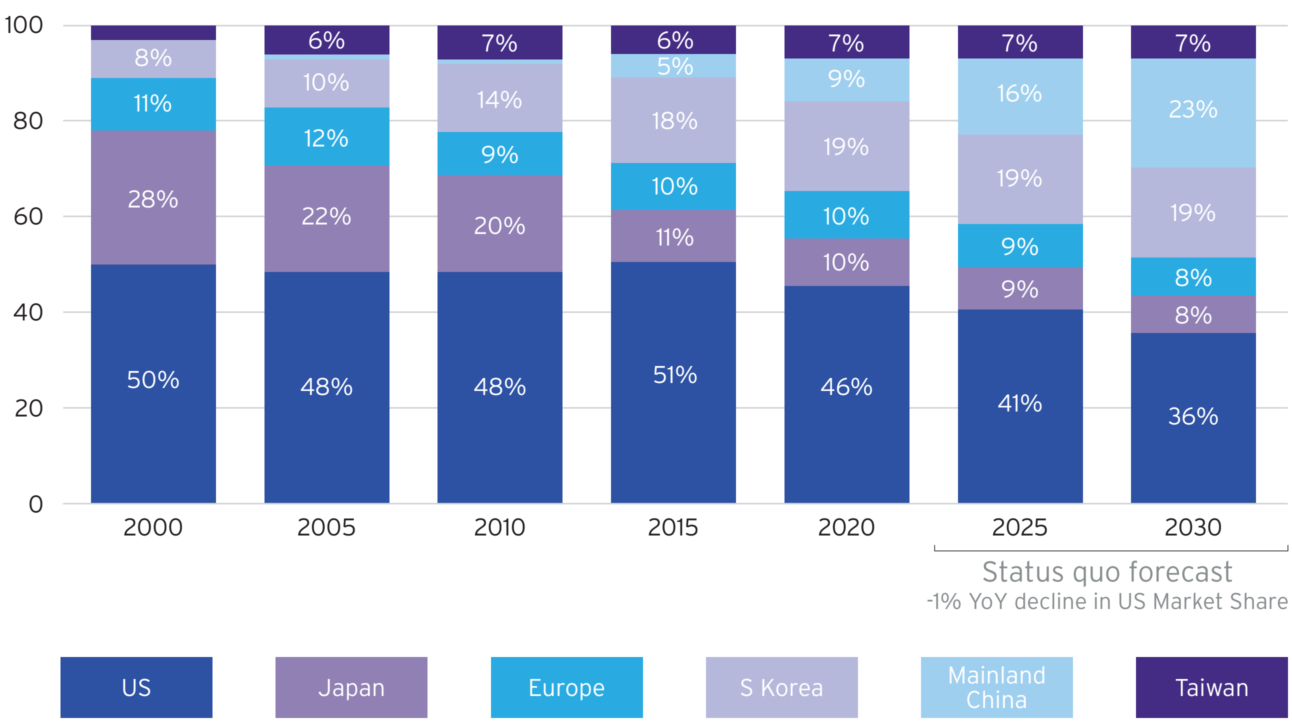
U.S. leadership in semiconductor design contributes to GDP, creates high-skilled jobs, and provides an innovation multiplier effect that benefits industries across the economy, from telecommunications and automotives, to aerospace and energy. For example, the development of modern complex chips, such as "system-on-chip" (SoC) processors that power today's smartphones, requires many years of work by hundreds of engineers, sometimes leveraging external intellectual property (IP) and design support services.

Continued U.S. design leadership – and the innovation multiplier effect that benefits industries across the economy – is not assured. In addition to rising design costs, a shortage of skilled talent, and increasing strains on access to global markets, global competitors are seeking to challenge U.S. leadership. Global competitors recognize the strategic importance of chip design and are investing heavily to build their domestic design capabilities. China, South Korea, Taiwan, the European Union, Japan, and India have committed to new, multi-billion-dollar chip design investments, including enacting design investment tax credits as high as 50 percent. Similarly, the support from the U.S. R&D tax credit lags behind global competitors, and 2017 legislation now requires companies to amortize their R&D expenditures over a five-year period, rather than being able to deduct expenses immediately. Without action to secure American competitiveness in design and R&D, the U.S. market share of global sales revenue is projected to decline from 46 percent in 2021 to 36 percent by 2030 (See Exhibit), while China's share is expected to shoot up from 9 to 23 percent over the same period.

SIA is urging Congress to adopt a holistic, integrated strategy to maintain U.S. design leadership. Among other things Congress should take action on the following:

- A 25% investment tax credit for advanced semiconductor design, comparable to the manufacturing credit included in CHIPS
- High-skilled immigration reform to ensure access to top scientific and engineering talent
- Restore full deductibility to R&D expenditures

DESIGN MARKET SHARE BY REGION OF COMPANY HQ (%)



SEMICONDUCTORS – DRIVING INNOVATION IN DIVERSE FIELDS

Semiconductor Impacts on Life Sciences

Semiconductors have substantial impacts on emerging technologies in a wide variety of adjacent sectors. This includes more high-profile examples like artificial intelligence, high performance computing, autonomous systems, and robotics, as well as some fields where the impact may not seem as straightforward, such as life sciences.

Semiconductor innovation can help unlock new life sciences technologies in many ways. As an example, providing researchers with access to powerful computing resources for biological and pharmaceutical simulations can help drastically reduce the costs and timelines of drug development. The COVID-19 pandemic and development of the mRNA-based vaccines has demonstrated the value of accelerated innovation timelines for critical life sciences technologies.

Another category of life sciences technologies that depend on advanced semiconductors is modern medical devices. These can include wearable sensors for health monitoring, medical robotics, advanced imaging technologies for high-resolution ultrasound, neural interface technologies, and implantable devices for trauma intervention. These technologies may rely on advanced semiconductors to assist with data collection and processing for actionable feedback or to help navigate within the body for appropriate treatment. Such devices often have a unique set of packaging needs, given the challenges associated with the chip-bio interface. There is still a great deal of materials and packaging research required to engineer high-performing medical devices that minimize inflammatory response and device contamination.

The U.S. semiconductor industry was second only to the U.S. pharmaceuticals & biotechnology industry in terms of the rate of R&D spending as a percent of sales. While global competitors are increasing their R&D investments to compete with the U.S. semiconductor industry, American firms spend more on R&D as a percent of sales than any other country's semiconductor industry. These high levels of reinvestment into R&D drives innovation in the U.S. semiconductor industry, which in turn helps maintain its global sales market share leadership position and generate jobs throughout the United States.

SUPPLY CHAIN REBALANCING

Beyond the United States, government and industry stakeholders worldwide are also making significant efforts to bolster their positions within the global supply chain. This includes new initiatives by governments in Europe, Asia, and Latin America to create government advisory bodies, assess their risks and vulnerabilities, and roll out new tax, fiscal, and other incentives. This major wave of global semiconductor policy incentives provides an opportunity for the semiconductor industry to rebalance supply-chains, thereby reducing bottlenecks and the risk posed by over-concentration of the supply-chain. Government policies and incentives can also provide helpful benefits to improving the global semiconductor research and workforce ecosystem.

The European Union: In February 2022, the European Commission began formal consideration of the "EU Chips Act," which includes up to $43 billion in targeted support for Europe's semiconductor sector. This includes incentives aimed at bolstering the EU's front-end manufacturing for "first-of-a-kind" technologies and new investments in cutting-edge research and development.

South Korea: In May 2021, South Korea unveiled the "K-Semiconductor Belt" strategy aimed at building the world's largest semiconductor supply chain by 2030. The initiative offers investment tax credits for semiconductor R&D to attract more private sector investment.

Japan: In November 2021, Japan approved $6.8 billion in funding for domestic semiconductor investment as a part of its goal to double domestic chip revenue by 2030. In November 2022, Japan proposed an additional $8 billion in funding for a joint research hub with the U.S., including advanced semiconductor manufacturing lines, and semiconductor materials.

Taiwan: In October 2022, Taiwan is mulling additional tax incentives for the semiconductor industry. The new incentives may include proposals to attract overseas semiconductor talent and semiconductor materials and equipment suppliers.

Southeast Asia: Thailand in November 2021 approved a preferential tax policy for news semiconductor investments. Vietnam also recently announced semiconductor-specific incentives, such as zero percent corporate income tax for chips firms.

India: In December 2021, the Government of India rolled out a $10 billion semiconductor incentive package to, among other things, attract investments in chip manufacturing, assembly test, packaging, and chip design.

Mexico: In September 2022, the Mexican federal government began to draft a new incentives package to attract semiconductor investment, particularly focused on assembly, test, and packaging. Several Mexican states have also begun to develop similar incentives at the local level.

Canada: In 2022, Canada announced a desire to offer incentives for new investments in chip design, manufacturing, and associated critical materials. In addition, Canada is aiming to increase its talent development through educational partnerships between universities and design or manufacturing companies.

At the same time, it is important for all governments, including the United States to ensure that their efforts improve, not harm, the health of the global semiconductor ecosystem. This means ensuring their policies and incentives are consistent with international trade obligations and commitments under the World Trade Organization (WTO) and the World Semiconductor Council (WSC). Doing so will guarantee that government incentives will not create artificial competition or lead to significant market disruptions.

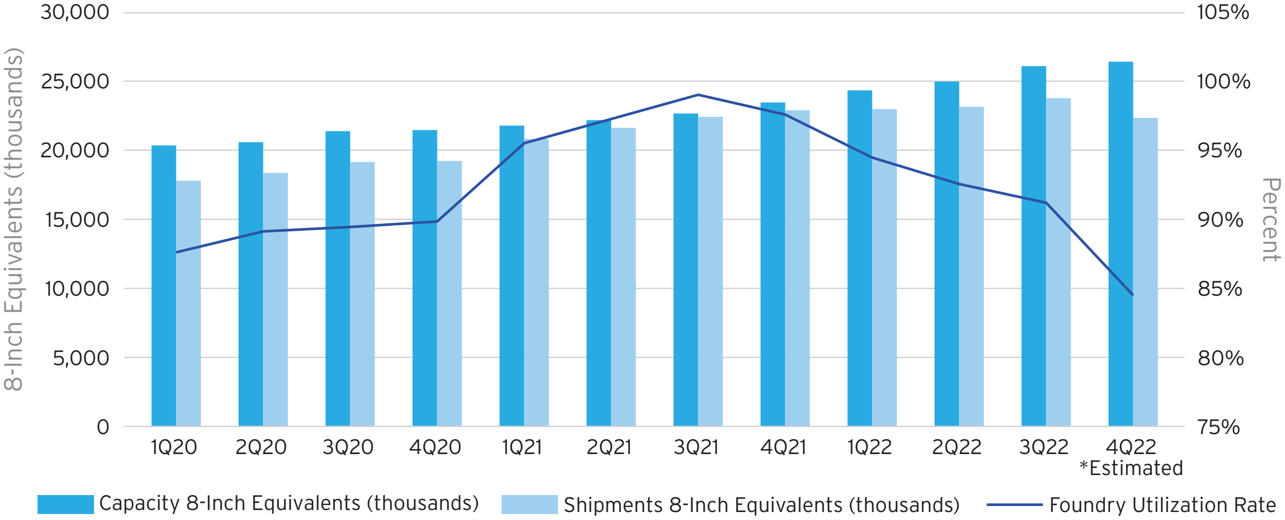
THE GLOBAL CHIP SHORTAGE AND THE INDUSTRY'S RESPONSE

A significant consequence of the pandemic has been the global chip shortage that impacted a number of end markets. The pandemic was a once-in-a-lifetime event that created substantial, unanticipated swings in demand.

The shortage took hold in 2020 due to a confluence of factors impacting both supply and demand caused by the COVID-19 pandemic. In some industries, customers canceled chip purchases as the virus spread across the globe and disrupted their production, while in other industries demand increased rapidly as a result of increased remote healthcare, work-at-home, and virtual learning. At the same time market demand was shifting, the chip supply chain was disrupted as several countries and regions went into lockdown throughout 2020 and in early 2021. The shortage continues to affect a range of downstream sectors in 2022, including automotive, consumer electronics, home appliances, industrial robotics, and even the manufacturers of the equipment used in the production of semiconductors.

The industry worked diligently to ramp up production and increase capacity to meet unprecedented demand during the shortage. In 2021, semiconductor unit sales reached an historic 1.15 trillion-unit shipments as a result of increases in fab utilization rates far above the normal "full utilization" rate of 80 percent, as well as industry efforts to keep operations running globally and government efforts to allow semiconductor industry operations to continue. While fabs are generally unable to sustain utilization rates above 80 percent for an extended period of time, the industry continued high levels of production above "full utilization" into 2022 to meet increased demand. As a result, the industry is expected to meet or exceed the record levels of output achieved the year earlier.

SEMICONDUCTOR COMPANIES WORKING HARD TO MEET MARKET DEMAND



Source: Gartner®, Samauel Wang, October 7, 2022

While the chip shortage and the impact of the pandemic began to ease in 2022, increased demand for semiconductors is expected to persist over the next decade. The global semiconductor industry is planning to meet this projected market growth in the years ahead through record levels of investment in manufacturing and R&D. Global fab capacity is expected to grow by 30 percent from 2020 to the end of 2022 and is forecasted to grow even higher in 2023. The global semiconductor industry continues to invest heavily in capital expenditure in 2022, spending over $166 billion to meet the long-term demand for chips.

The shortage is a reminder of the essential role semiconductors play in so many critical areas of society, including transportation. This trend will only continue as demand for electronics and connectivity grows. In the automotive industry, new vehicles increasingly rely on chips for fuel efficiency, safety, and other features. The expected growth in electric cars will only further this reliance. In the long term, as chips play an even bigger role in an ever-expanding array of products, global demand for chips will continue to rise.

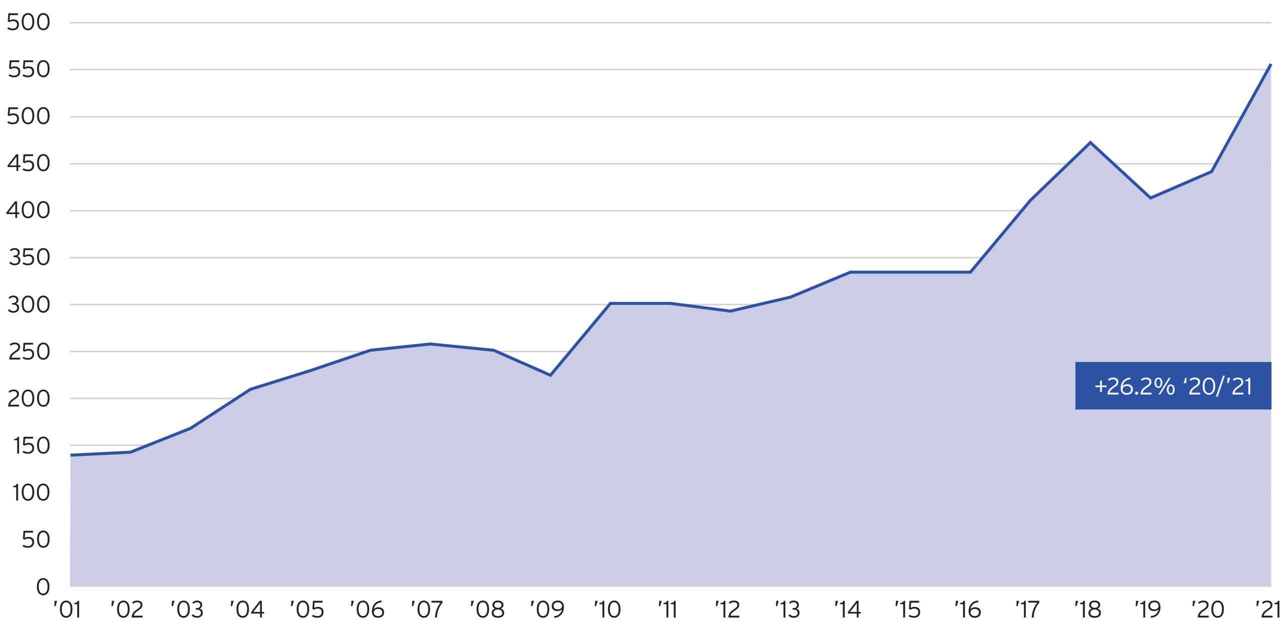
THE GLOBAL SEMICONDUCTOR INDUSTRY

Over the past three decades, the semiconductor industry has experienced rapid growth and delivered enormous economic impact. Chip performance and cost improvements made possible the evolution from mainframes to PCs in the 1990s, the Web and online services in the 2000s, and the smartphone revolution in the 2010s. These chip-enabled innovations have created incredible economic benefits. For example, from 1995 to 2015, an estimated $3 trillion in global GDP has been directly attributed to semiconductor innovation, along with an additional $11 trillion in indirect impact. Semiconductors have become essential to our modern world, which is why long-term market demand for semiconductors remains strong.

The 2021 market experienced strong growth throughout the year due to the increased demand caused by the pandemic.

Following relatively strong sales of $440.4 billion in 2020, global semiconductor sales in 2021, the most recent full year of data, increased by a record 26.2 percent to $555.9 billion, due largely to demand growth spurred by the COVID-19 pandemic. Industry estimates, including from the World Semiconductor Trade Statistics (WSTS) and other semiconductor sales analyses, project worldwide semiconductor industry sales to increase significantly to between $618 - $633 billion in 2022. Other analyst projections state the industry will achieve a growth rate between 4 and 14 percent, due mainly to the continued strong demand growth in the overall market from 2020.

GLOBAL SEMICONDUCTOR SALES ($B)



SEMICONDUCTOR DEMAND DRIVERS

Over the next decade, further innovation in semiconductors will enable a host of transformative technologies, including artificial intelligence (AI), autonomous electric vehicles, and the internet of things (IoT). Indeed, long-term growth drivers for semiconductor demand are firmly in place. The relationship between semiconductors and the markets they serve is truly symbiotic, as innovations in semiconductors themselves help to spur further market demand and open up new markets entirely. For example, successive generations of cellular technology were made possible by advances in semiconductors themselves, leading to 5G. While demand drivers in the short-term experienced unexpected shifts brought on by societal changes due to the pandemic, in many ways these shifts resulted in an overall increase in demand, as society has recognized and leaned on the semiconductor-enabled technologies more than ever.

End-use drivers reflect shifts from COVID-19 demand shock.

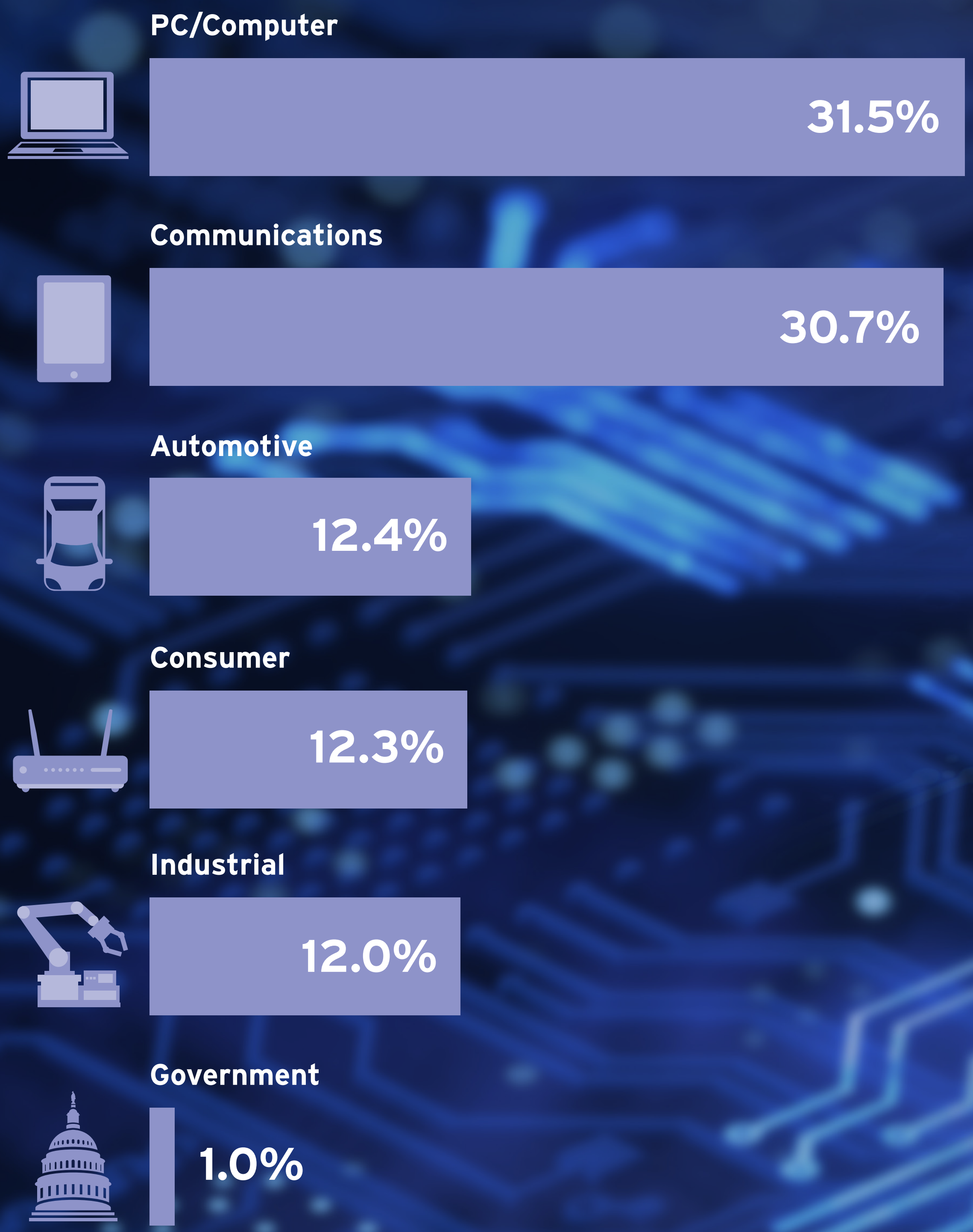
In 2021, end-use sales of semiconductors experienced significant increases across almost all categories, as industry worked tirelessly to meet growing demand for semiconductors. Sales into end-use categories such as computers experienced significant increases, as more jobs shifted to remote work and school from home. Other markets, such as automotive experienced dramatic increases throughout the year, and ultimately gained market share in 2021, leading to becoming the third largest end-use market for semiconductors. As highlighted earlier, 2021 saw record sales of $555.9 billion, and also saw record unit shipments of 1.15 trillion.

2021 DEMAND BY END-USE

End-Use Category	Computer	Communication	Automotive	Consumer	Industrial	Government
Annual Growth	23.1	24.0	37.9	28.9	26.6	26.4
Total Value ($B)	**175.0**	**170.6**	**69.1**	**68.4**	**66.9**	**5.8**

SEMICONDUCTOR DEMAND DRIVERS

2021 TOTAL GLOBAL SEMICONDUCTOR DEMAND SHARE BY END USE



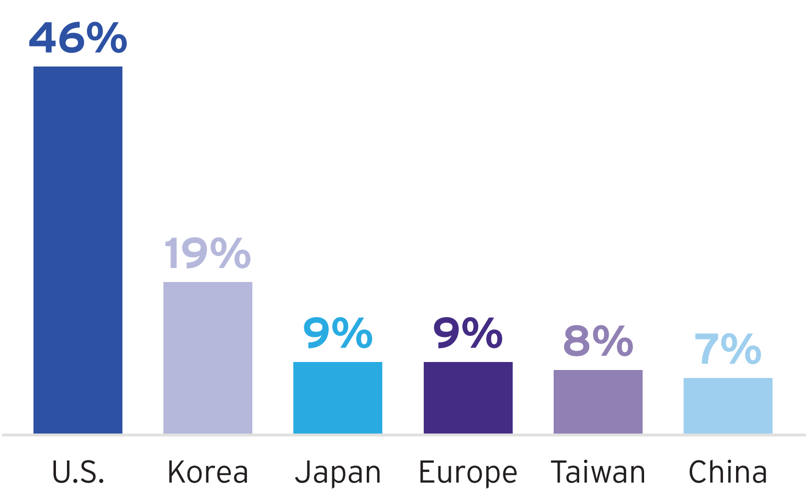
U.S. INDUSTRY MARKET SHARE

Semiconductors were invented in the United States, and the U.S. industry remains the leader in the market today for chip sales. While America's position has been challenged many times over the decades, it has always prevailed due to its resiliency and ability to run faster. This does not mean the United States will go unchallenged as many others strive to be or become more competitive in various aspect of this critical industry.

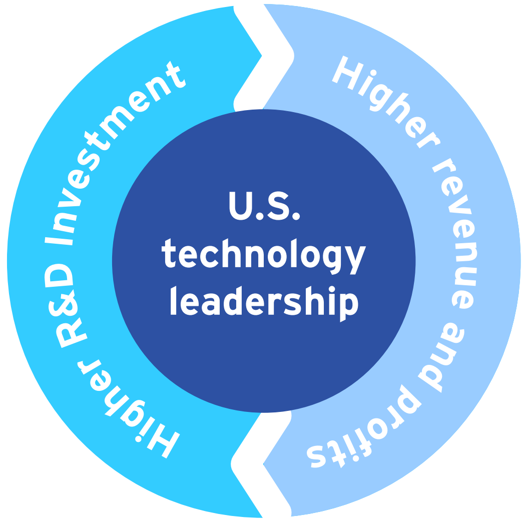
The U.S. semiconductor industry has nearly half the global market share and has displayed steady annual growth.

Since the 1990s, the U.S. semiconductor industry has been the leader in global chips sales, with nearly 50 percent of the annual global market share. In addition, U.S. semiconductor firms maintain a leading or highly competitive position in R&D, design, and manufacturing process technology. Global sales market-share leadership also allows the U.S. semiconductor industry to benefit from a virtuous cycle of innovation; sales leadership enables the U.S. industry to invest more into R&D, which helps ensure continued U.S. sales leadership. As long as the U.S. semiconductor industry maintains global market-share leadership, it will continue to benefit from this virtuous cycle of innovation.

2021 GLOBAL MARKET SHARE



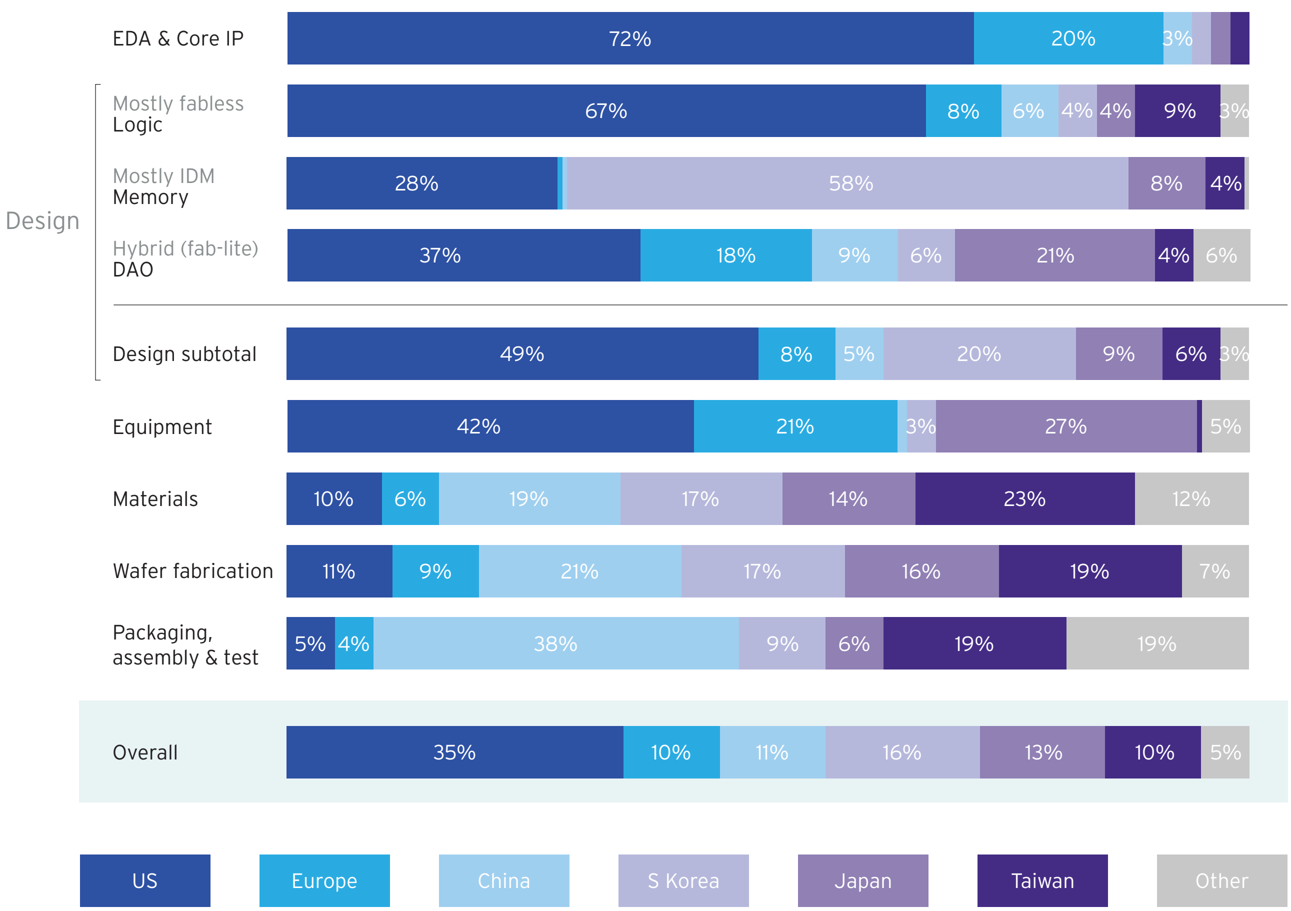
A VIRTUOUS CYCLE OF INNOVATION



U.S.-based semiconductor companies are a market leader by business model and subproduct semiconductor devices, but for some business model subsegments, the U.S. industry lags its Asian-based competitors.

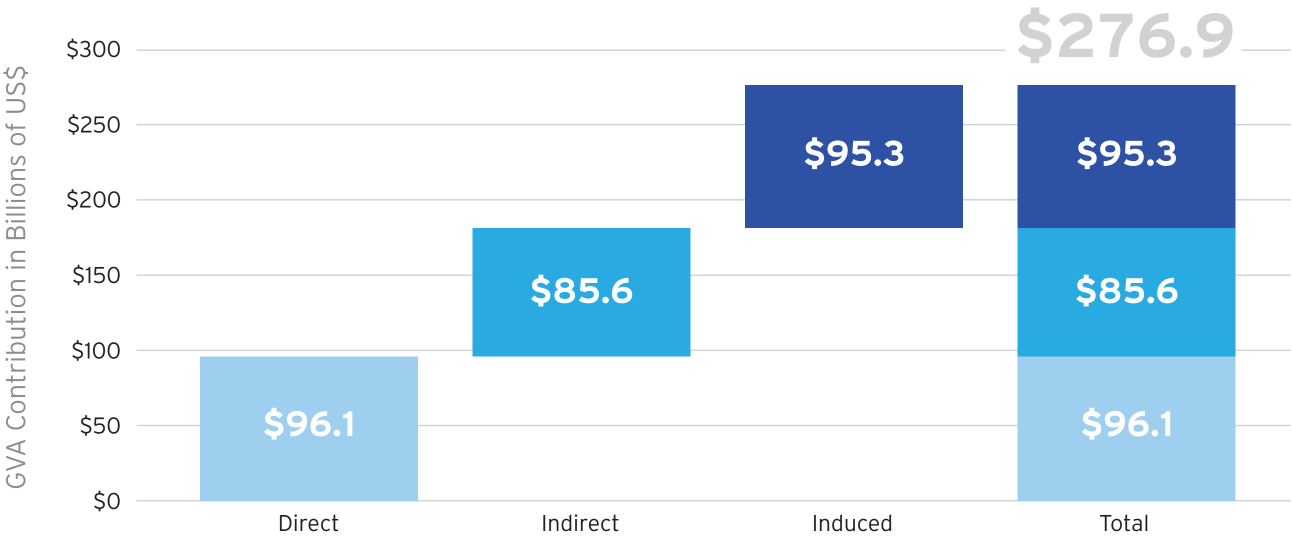
Broadly speaking, the U.S. semiconductor industry maintains market share leadership in the activities that are most intensive in R&D: EDA and core IP, chip design, and manufacturing equipment. Front and back-end manufacturing processes, however, are largely concentrated in Asia. Seventy-five percent of global manufacturing capacity, including wafer fabrication, assembly, test, and packaging of leading-edge chips at 7 nanometer is concentrated in the region. In addition, while the U.S. leads in certain subproducts, such as logic and discrete, analog, and opto semiconductors, it lags behind in memory semiconductors. These vulnerabilities underscore the need for the investments included in the CHIPS Act, which provides needed incentives to support more domestic manufacturing.

SEMICONDUCTOR INDUSTRY VALUE ADDED BY ACTIVITY AND REGION 2021 (%)



U.S. SEMICONDUCTOR INDUSTRY DOMESTIC ECONOMIC CONTRIBUTION

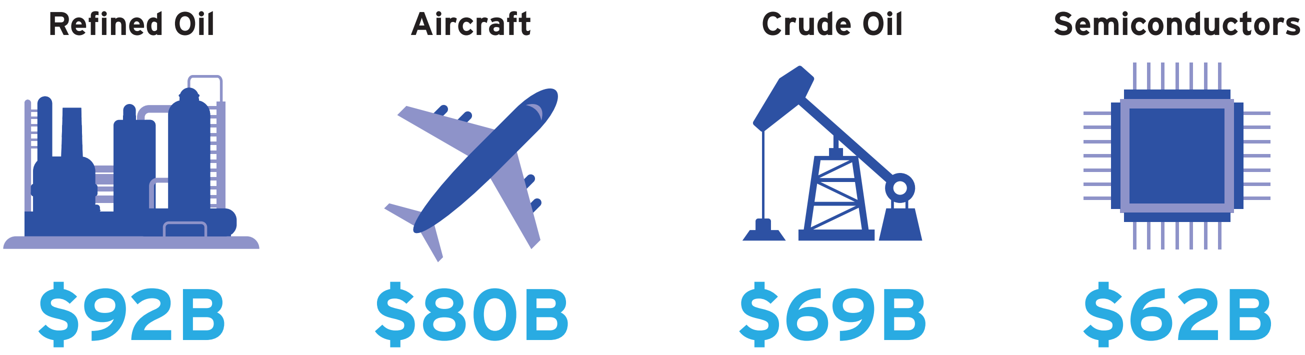
THE TOTAL GROSS VALUE ADDED (GVA) CONTRIBUTION TO GDP OF THE U.S. SEMICONDUCTOR INDUSTRY



Semiconductors are one of America's top exports.

U.S. exports of semiconductors totaled $62 billion in 2021, fourth highest among U.S. exports behind only airplanes, refined oil, and crude oil. This consistently high level has been due to the fact that over 80 percent of semiconductors sold to customers today are sold outside of the U.S. market.

TOP U.S. EXPORTS IN 2021

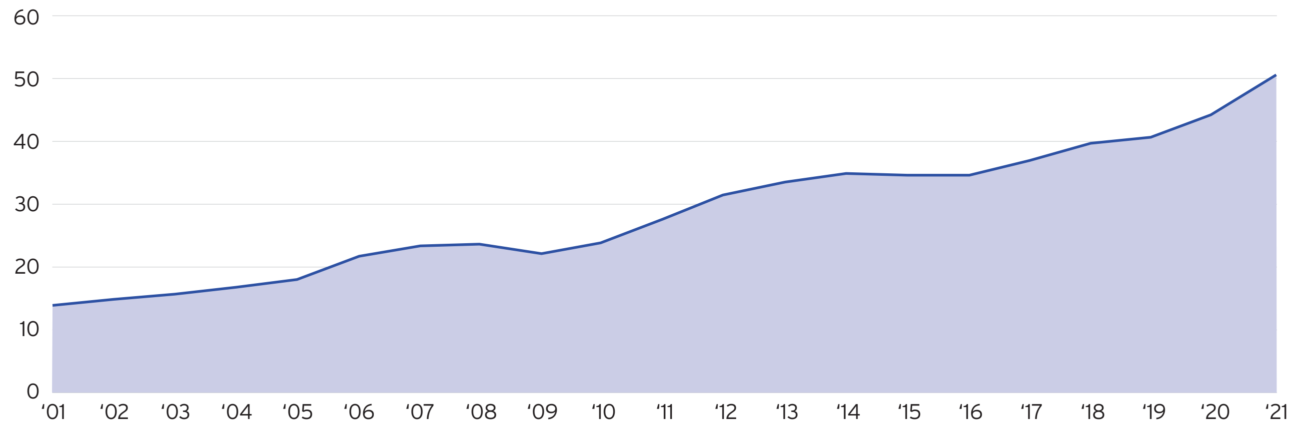


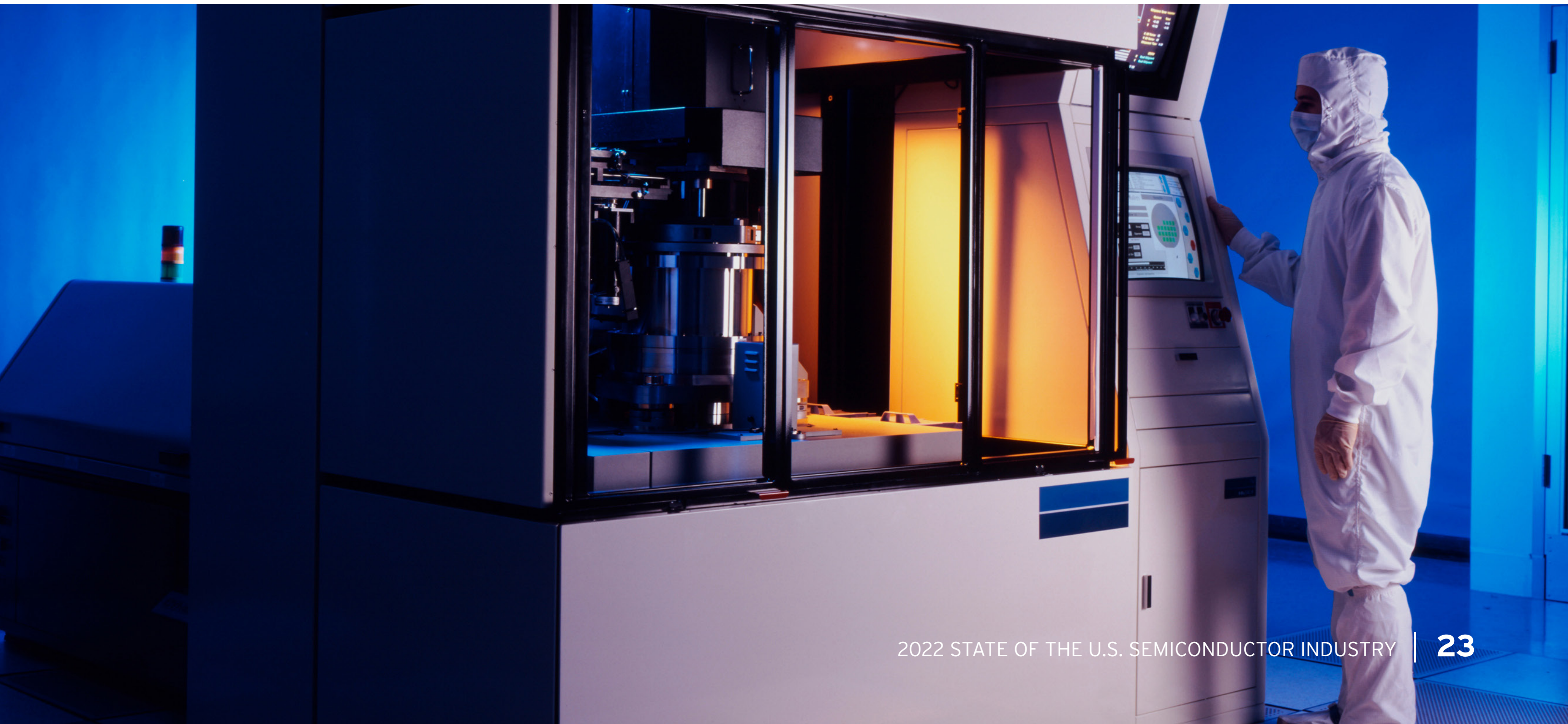
U.S. TECHNOLOGY COMPETITIVENESS

U.S. semiconductor industry R&D expenditures are consistently high, reflecting the inherent link between U.S. market-share leadership and continued innovation.

U.S. semiconductor industry R&D expenditures grew at a compound annual growth rate of approximately 7.2 percent from 2000 to 2020. In 2021, total U.S. semiconductor industry investment in R&D totaled $50.2 billion. R&D expenditures by U.S. semiconductor firms tend to be consistently high, regardless of cycles in annual sales, which reflects the importance of continuously investing in R&D to semiconductor production.

R&D EXPENDITURE ($B)



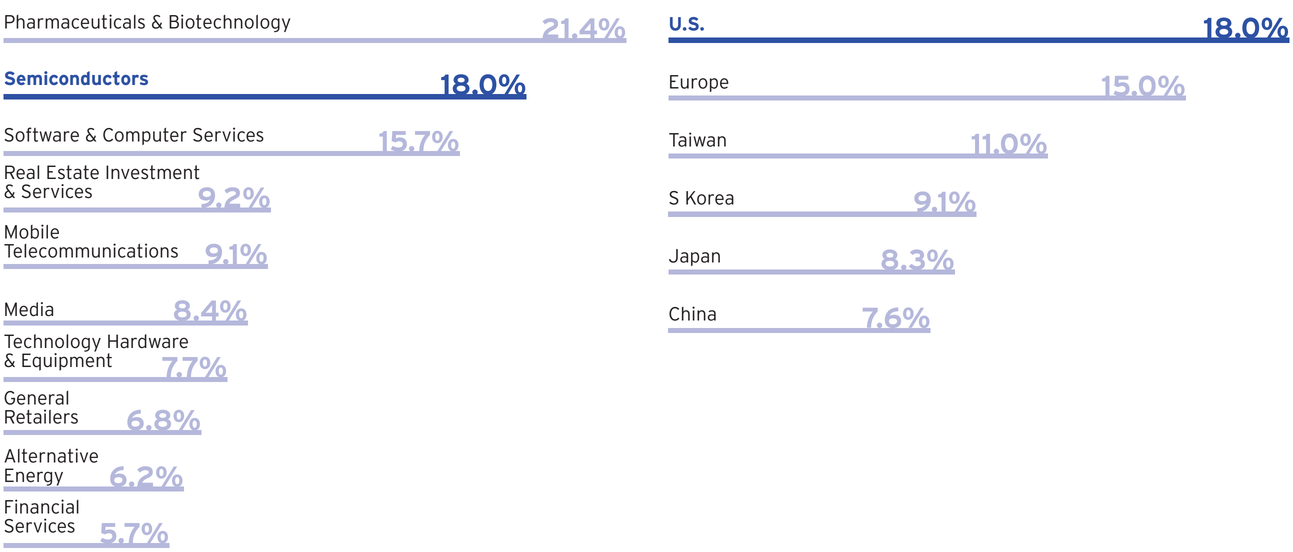


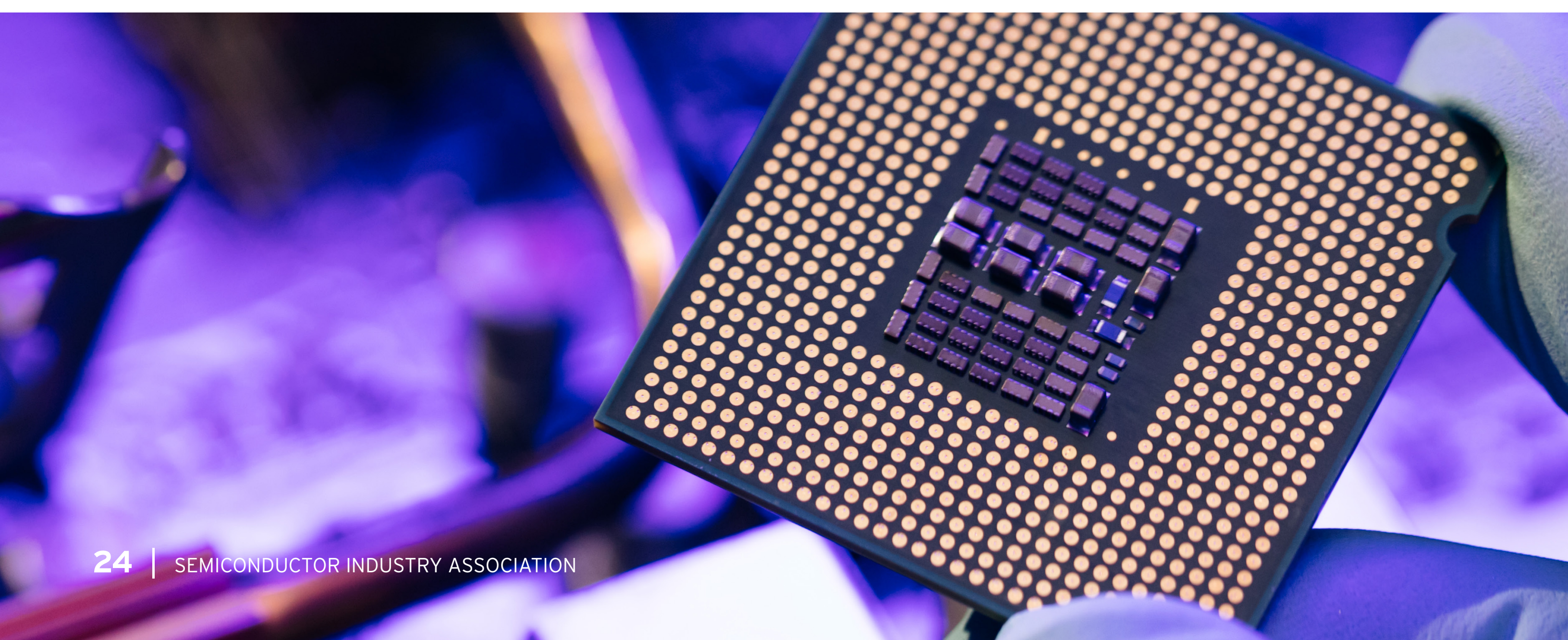
U.S. TECHNOLOGY COMPETITIVENESS

The U.S. semiconductor industry maintains one of the highest levels of R&D as a percent of sales of any U.S. industry.

The U.S. semiconductor industry was second only to the U.S. pharmaceuticals and biotechnology industry in terms of the rate of R&D spending as a percent of sales. While global competitors are increasing their R&D investments to compete with the U.S. industry, American firms spend more on R&D as a percent of sales than any other country's semiconductor industry. These high levels of reinvestment into R&D drive innovation in the U.S. semiconductor industry and, in turn, help maintain global sales market leadership and jobs throughout the United States.

R&D EXPENDITURES AS A PERCENTAGE OF SALES





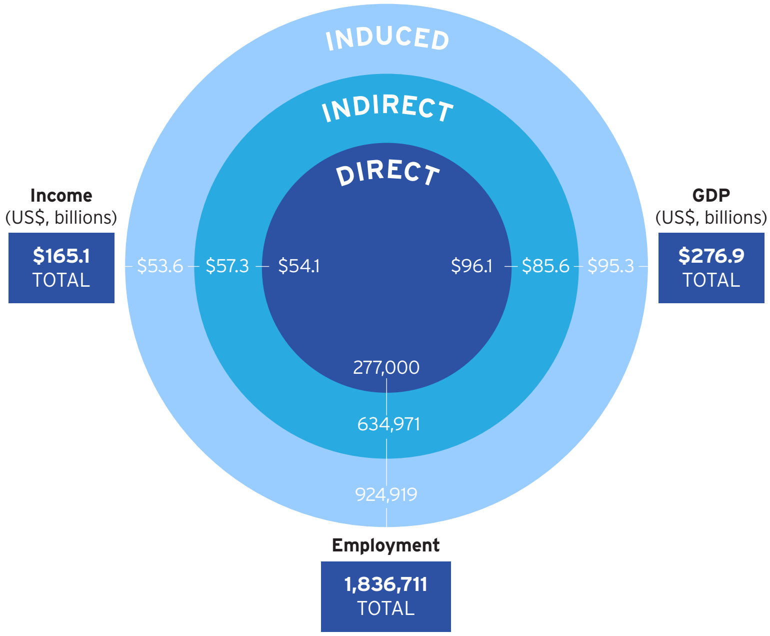
WORKFORCE AND SEMICONDUCTOR LEADERSHIP

Having a competitive domestic workforce is critical to America's lead in semiconductors. In addition, a strong domestic semiconductor industry is essential to the U.S. economy. The semiconductor industry has a considerable economic footprint in the U.S. Nearly 277,00 people work in the industry, designing, manufacturing, testing, and conducting R&D on semiconductors throughout 49 states. Over 300 downstream economic sectors accounting for over 26 million U.S. workers are consumers of, and are therefore enabled by, semiconductors for their sectors.

The positive impact of the semiconductor industry on the American workforce.

Beyond providing inputs to nearly every industry, the U.S. semiconductor industry is essential to the U.S., generating value for the economy, stimulating jobs, and paying income to workers. In total, the U.S. semiconductor industry supported 1.84 million U.S. jobs in 2021. The industry directly employs more than 277,000 domestic workers in R&D, design, and manufacturing activities, among others. In addition, for each U.S. worker directly employed by the semiconductor industry, an additional 5.7 jobs are supported in the wider U.S. economy, either in the supply chains of the semiconductor industry or through the wage spending of those employed by the firms themselves of their supply chains.

In addition to job creation, the U.S. semiconductor industry has a significant impact on GDP and income. In 2021, the total impact of the U.S. semiconductor industry on GDP was $276.9 billion. In terms of the impact on income, the industry was responsible for generating $165.1 billion in income in 2021 in the United States. These benefits were distributed widely within the U.S. economy in terms of other sectors positively impacted. For example, in terms of the 1.84 million total jobs created by the industry, many were created in sectors as diverse as construction, financial activities, and leisure and hospitality.



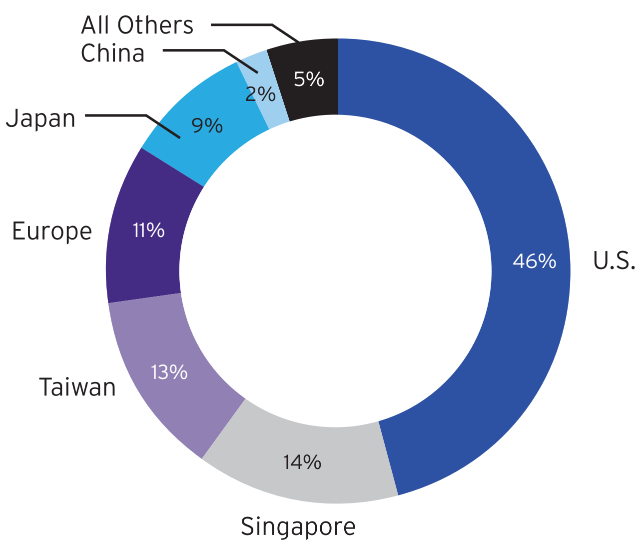
WORKFORCE AND DOMESTIC MANUFACTURING

U.S. semiconductor manufacturers maintain more of their manufacturing base in the United States than in any other country, though this share has decreased steadily over the past 8 years.

In 2021, roughly 46 percent of U.S.-headquartered firms' front-end semiconductor wafer capacity was located in the United States. This share has steadily decreased from 57 percent in 2013. Other leading locations for U.S. headquartered front-end semiconductor wafer fab capacity are Singapore, Taiwan, Europe, and Japan. It is notable that China has attracted far less U.S. investment in front-end fabrication than the other major markets.

The reality is the average rate of chip manufacturing output has grown five times faster overseas than it has in the United States over the last decade. This is largely due to robust incentive programs other countries have put in place to attract semiconductor manufacturing. The CHIPS Act is expected to reverse this long-term decline and allow the U.S. to capture a higher percentage of the global growth in semiconductor manufacturing.

PERCENT OF U.S.-HEADQUARTERED FIRMS MANUFACTURING BY LOCATION



The U.S. semiconductor industry accounts for over a quarter of a million direct U.S. jobs and nearly 1.6 million additional indirect and induced U.S. jobs.

277,000
direct jobs in the U.S. semiconductor industry

ONE
U.S. semiconductor job supports

5.7
jobs in other parts in the U.S. economy...

...that's nearly
1,600,000 ADDITIONAL
American jobs

U.S. SEMICONDUCTOR INNOVATION POLICY LANDSCAPE

To ensure continued U.S. leadership in the global semiconductor industry, the U.S. must advance an ambitious competitiveness and innovation agenda.

1. Invest in U.S. Semiconductor Leadership:

- Implement the policies and programs in the CHIPS and Science Act efficiently, promptly, and transparently.
- Devise regulations for the advanced manufacturing investment credit in the CHIPS Act to encompass the full scope of investments in the semiconductor ecosystem.
- Adopt policies to promote innovation and U.S. competitiveness, such as enacting an investment tax credit for semiconductor design and strengthening the R&D tax credit.
- Maintain U.S. technology leadership by investing in the research and science programs authorized by the CHIPS and Science Act.

2. Strengthen America's Technology Workforce:

- Implement a national strategy – backed by appropriate investments and in consultation with education leaders and the private sector – to improve our education system, increase the number of Americans graduating in STEM fields, support those pursuing careers in microelectronics, and ensure training and education opportunities to fill open positions.
- Reform America's high-skilled immigration system to enable access to the best and brightest in the world, including foreign students with graduate degrees in STEM fields from U.S. universities.
- Secure funding to strengthen the semiconductor workforce at all levels and ensure a robust pipeline at all education levels and skills needs.

3. Promote Free Trade and Protect IP:

- Approve and modernize free trade agreements that remove market barriers, protect IP, and enable fair competition.
- Expand the Information Technology Agreement, one of the World Trade Organization's most successful free trade agreements.

4. Cooperate Closely with Like-Minded Economies:

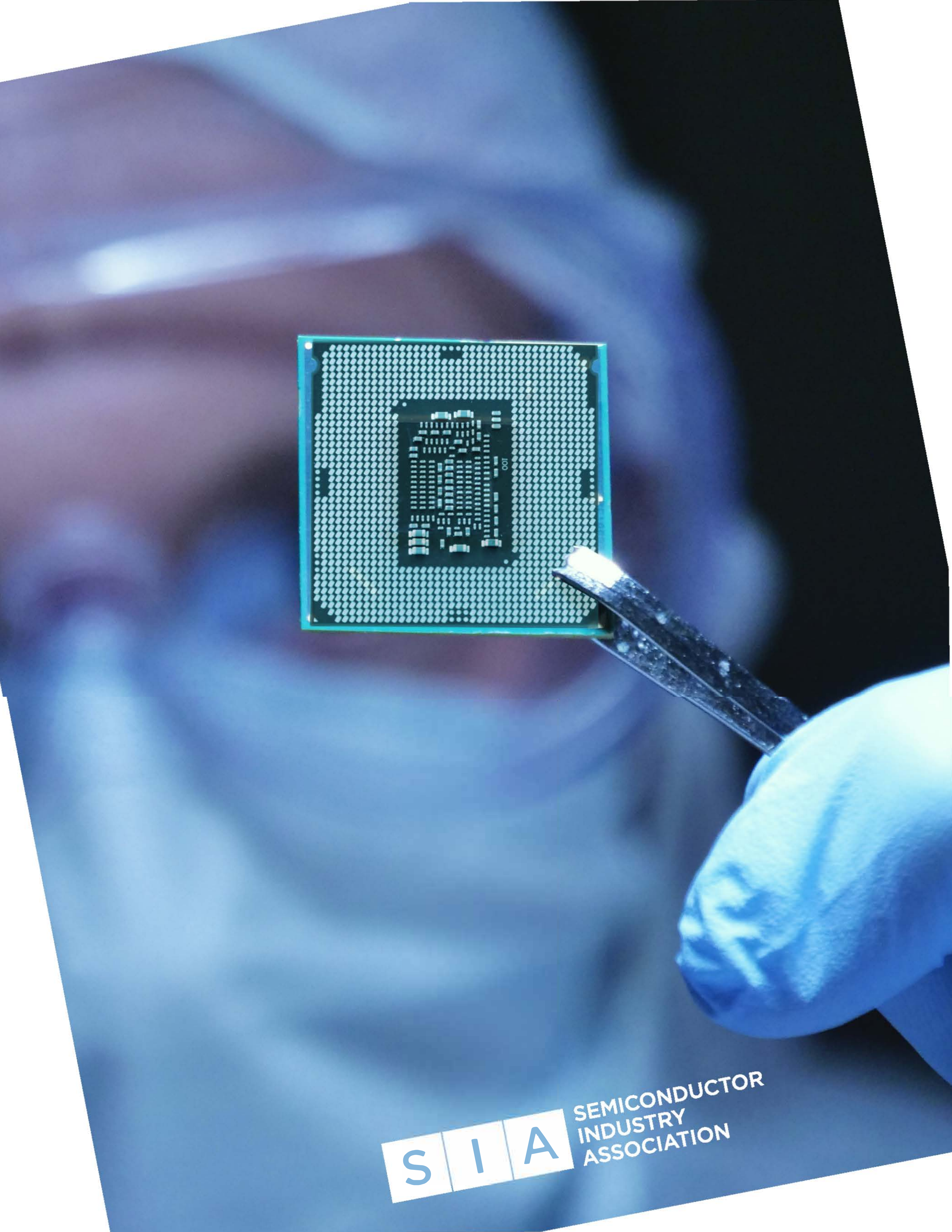
- Align policies and regulations with like-minded allies to strengthen national security, promote growth, innovation, and supply chain resilience.

METHODOLOGY

This report is based on data developed independently by the Semiconductor Industry Association and in conjunction with the Boston Consulting Group and Oxford Economics. Figures pertaining to the industry's employment are based on data from the U.S. Census Bureau and the U.S. Department of Labor. Figures regarding the industry's international trade activity are based on an analysis of official U.S. government trade data from the U.S. International Trade Commission. Figures regarding industry manufacturing, capacity, and capital spending were based on data from SEMI, VLSI Research, New York University, McKinsey, The Economist, Tokyo Electron, J.P. Morgan, and IC Insights. Market data was based on World Semiconductor Trade Statistics data. Industry R&D data was based on company financial reports, as well as data from the 2021 EU Industrial R&D Investment Scoreboard. Lastly, data for the industry job multiplier, GDP contribution, and labor income are based on an Input-Output model developed by IMPLAN.

ABOUT SIA

The Semiconductor Industry Association (SIA) is the voice of the semiconductor industry, one of America's top export industries and a key driver of America's economic strength, national security, and global competitiveness. Semiconductors – the tiny chips that enable modern technologies – power incredible products and services that have transformed our lives and our economy. The semiconductor industry directly employs over a quarter of a million workers in the United States, and U.S. semiconductor sales totaled $257.5 billion in 2021. SIA members account for 99 percent of all U.S. semiconductor industry sales. Through this coalition, SIA seeks to strengthen leadership of semiconductor manufacturing, design, and research by working with Congress, the Administration, and key industry stakeholders around the world to encourage policies that fuel innovation, propel business, and drive international competition. Learn more at www.semiconductors.org.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