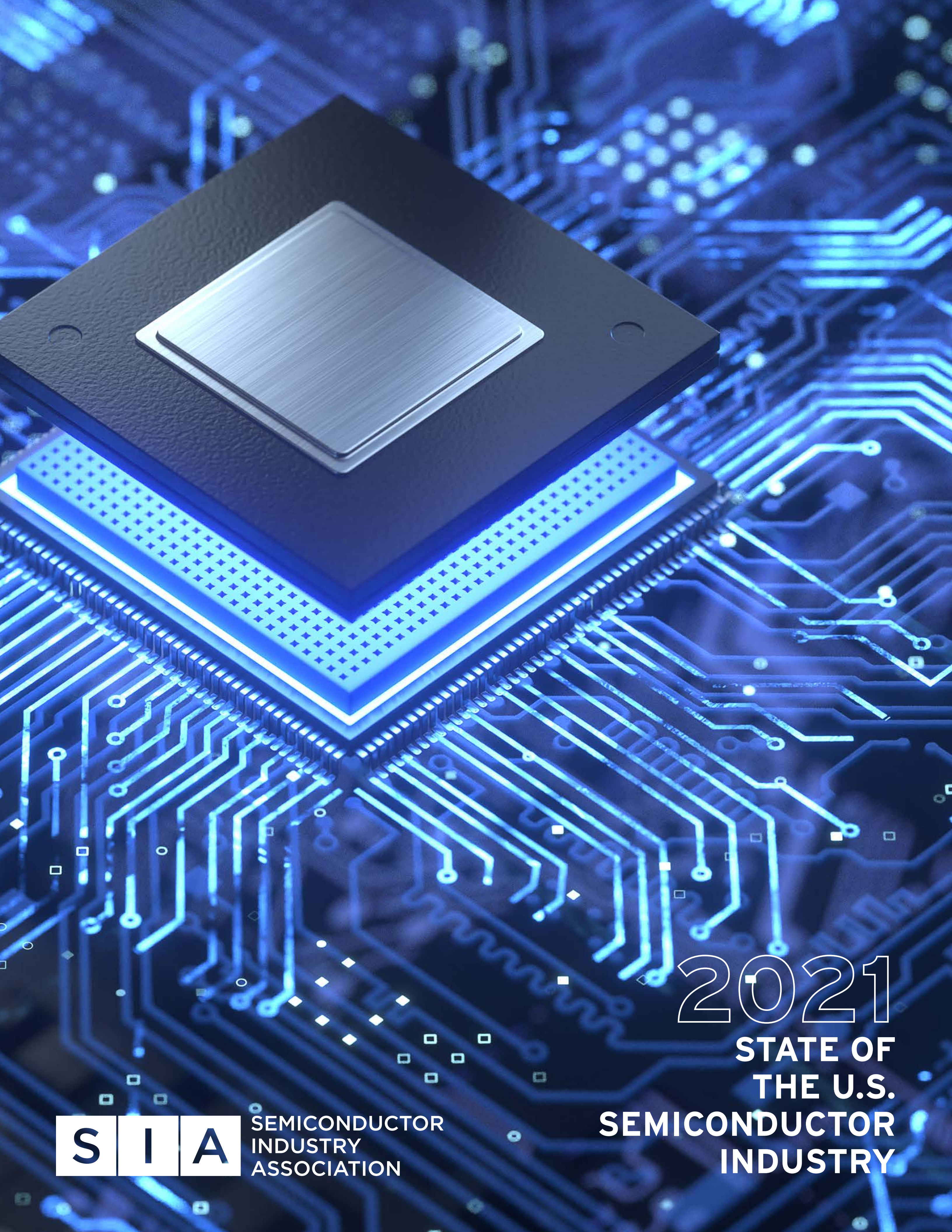
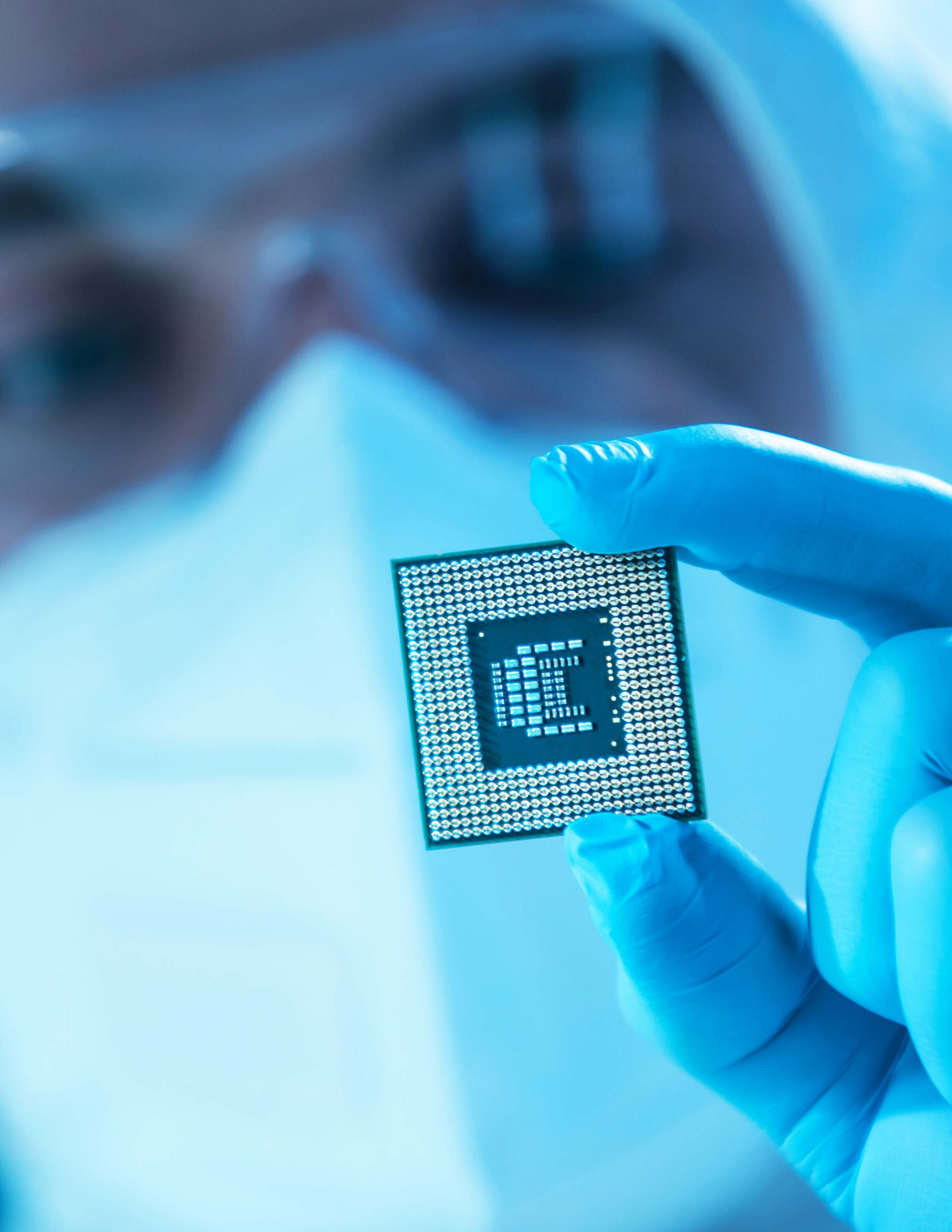


2021 STATE OF THE U.S. SEMICONDUCTOR INDUSTRY

SIA SEMICONDUCTOR INDUSTRY ASSOCIATION



INTRODUCTION

SEMICONDUCTORS ARE A MARVEL OF MODERN TECHNOLOGY AND THE FOUNDATION OF MODERN LIFE. PACKED WITH UP TO TENS OF BILLIONS OF TRANSISTORS ON A PIECE OF SILICON THE SIZE OF A QUARTER, SEMICONDUCTORS ENABLE EVERYTHING FROM CARS TO COFFEE MAKERS, NOT TO MENTION NEW, POTENTIALLY GAME-CHANGING APPLICATIONS SUCH AS ARTIFICIAL INTELLIGENCE, QUANTUM COMPUTING, ADVANCED WIRELESS NETWORKS, AND MORE.

Over the last year, with the world still gripped by the COVID-19 pandemic, semiconductor-enabled technologies allowed us to remotely work, study, treat illness, order goods online, and stay connected. As much of the world shut down, semiconductors enabled the gears of the global economy, healthcare, and society writ large to continue spinning.

And, critically, semiconductors helped doctors and scientists develop treatments and vaccines to begin making the world healthy again. Without the semiconductors that power the world's most advanced supercomputers, for example, the historically rapid development of COVID-19 vaccines would not have been possible.

While the semiconductor industry has achieved great successes in 2021, it also faces significant challenges. Chief among them is a widespread global semiconductor shortage. Unanticipated rising demand for semiconductors needed during the pandemic response, coupled with significant fluctuations in chip demand for other products such as cars, triggered a rippling supply-demand imbalance felt across the world. The semiconductor industry has worked diligently to increase production to address high demand, shipping more semiconductors on a monthly basis than ever before by the middle of 2021, but most industry analysts expect the shortage to linger into 2022.

The shortage increased awareness of the importance of America's semiconductor supply chains. Although geographic specialization in the global chip supply chain has enabled tremendous growth and innovation in the industry, vulnerabilities in the supply chain have emerged in recent years. For example, in 2019, 100% of the world's most advanced logic semiconductors (< 10 nm) were produced overseas.

The U.S. government has taken notice of the need to fortify America's semiconductor supply chains through robust investments in U.S. chip production and innovation. In June 2021, the U.S. Senate passed the United States Innovation and Competition Act (USICA), broad competitiveness legislation that includes $52 billion to bolster domestic chip manufacturing, research, and design. The semiconductor industry has urged the U.S. House of Representatives to follow suit and send legislation to the President's desk to be signed into law.

In 2021, semiconductors helped steady a world wobbled by COVID-19, and the industry's future has never been brighter. As semiconductor innovation and global chip demand continue their inextricable rise, government and industry must work together to maintain America's leadership in this foundational, indispensable technology.

CHIPS FIGHTING COVID-19

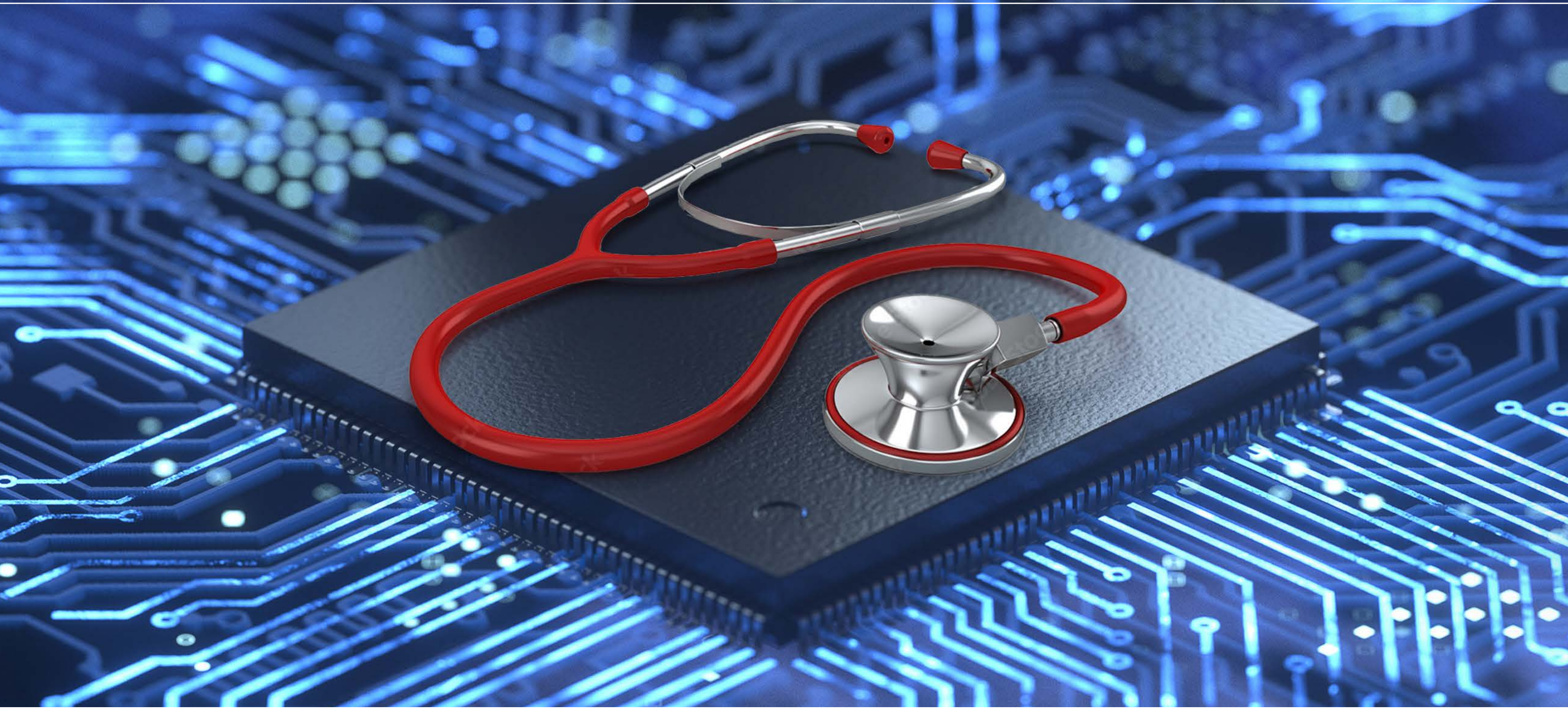
As the "brains" of electronic devices, semiconductors have been crucial to the pandemic response and recovery of the global economy. They have provided display, wireless connectivity, processing, storage, power management, and other essential functions to a wide array of essential products, life-saving equipment and critical infrastructure. This includes healthcare and medical devices, telecommunications, energy, finance, transportation, agriculture, manufacturing, aerospace, and defense. Semiconductors also underpin the IT systems that have made remote work and school possible and have provided access to essential services across every domain, including medicine, finance, education, government, food distribution, and more.

Throughout this global pandemic, semiconductor-rich devices have become increasingly prevalent in developing solutions for numerous problems in the economic and public health sphere. The ability of semiconductors to drive performance in these critical sectors is tied to "Moore's Law," the observation that the capabilities of semiconductor chips will double roughly every two years, while the price goes down. Today, the most advanced microprocessors contain nearly 40 billion transistors.

THERE ARE A NUMBER OF WAYS SEMICONDUCTORS HAVE PROVEN ESSENTIAL IN SUPPORTING THE WORLD THROUGH THE PANDEMIC:

1. **Medical Devices**
2. **Public Testing and Tracing**
3. **Accelerating Vaccine Development**
4. **Virtual Everything**
5. **Remote Healthcare and Vulnerable Populations**

CHIPS FIGHTING COVID-19



1

Medical Devices

Semiconductors are an integral component of many medical devices used in hospitals and doctors' offices today, including many devices that are critical to treating COVID-19 patients. Any medical device that can be plugged into an electric socket or has batteries depends on semiconductors to operate. Semiconductors provide functions such as operations control, data processing and storage, input and output management, sensing, wireless connectivity and power management. By enabling functions previously performed by non-semiconductor devices, semiconductors have often lowered costs and improved performance at the same time. This has proved critical to the COVID-19 response and improving health care in general.

Two specific examples of semiconductors in medical devices helping in the COVID-19 fight are below:

Portable Ultrasound Devices

In a hospital setting, the first line of detection for COVID-19 is identifying recognizable symptoms of the virus such as lung lesions. Quickly identifying this trait of the severe acute pneumonia associated with the virus has allowed doctors to treat afflicted patients without having to wait for tests on viral infection. This rapid response is possible with handheld ultrasound devices and temperature screening. These portable ultrasound devices have transitioned from utilizing piezoelectric crystals to semiconductors, greatly reducing the cost and improving performance. Now, due to the utilization of semiconductors, hospitals have access to vastly more affordable and efficient technologies to assess internal injuries in patients.

Ventilators

Ventilators are utilized to treat patients with severe lung damage by assisting breathing and are controlled by semiconductor chips. The ventilator system uses semiconductor sensors and processors to monitor vital signals; determine the rate, volume, and amount of oxygen per breath; and accurately adjust oxygen levels according to the needs of the patient. These signals are read and interpreted by the machine's semiconductor processors, which control the speed of the motor that translates to mechanized breathing to support a patient.

CHIPS FIGHTING COVID-19

2 Public Testing and Tracing

Accurate and timely testing for COVID-19 was a vital part of assessing risk and determining treatment needs for the public, and semiconductor-enabled medical instruments helped advance testing efforts. Temperature screenings have become common for many workplaces and public facilities hoping to reopen their spaces to large amounts of people. This has been done using thermal cameras or non-contact forehead infrared thermometers that are enabled by semiconductors such as sensors and analog chips that translate real world phenomena such as temperature into digital readings.

3 Accelerating Vaccine Development

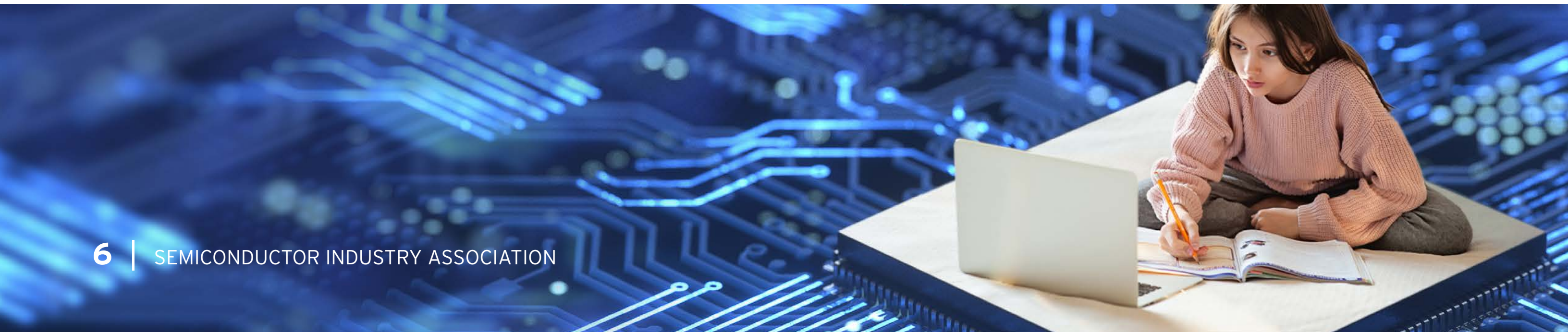
The pandemic rapidly generated data that researchers could use to develop a COVID-19 vaccine, but the sheer volume of this data made it difficult for scientists to find the specific data they needed. Fortunately, cutting-edge semiconductor-enabled technologies are streamlining the research process for present-day developers. For example, an engineer from a U.S. semiconductor company developed a platform called Deep Search, which uses natural language processing to mark-up research papers for more accurate discovery by search engines. Such technologies have helped scientists more rapidly develop vaccines to combat illness and disease such as COVID-19.

In addition to the work of individual technologists, cooperative research organizations have maximized vaccine development capacity by leveraging economies of scale. The COVID-19 High-Performance Computing (HPC) Consortium is a cooperative network designed to join the computing capacities and data collection of groups including industry, academia, federal agencies, and international government agencies. Early in the pandemic, semiconductor-enabled AI technology was deployed to help universities, companies, and clinics lower the time required to model and run different potential treatments from weeks to minutes. This significantly saved time and resources needed to develop hypothetical solutions in wetlabs.

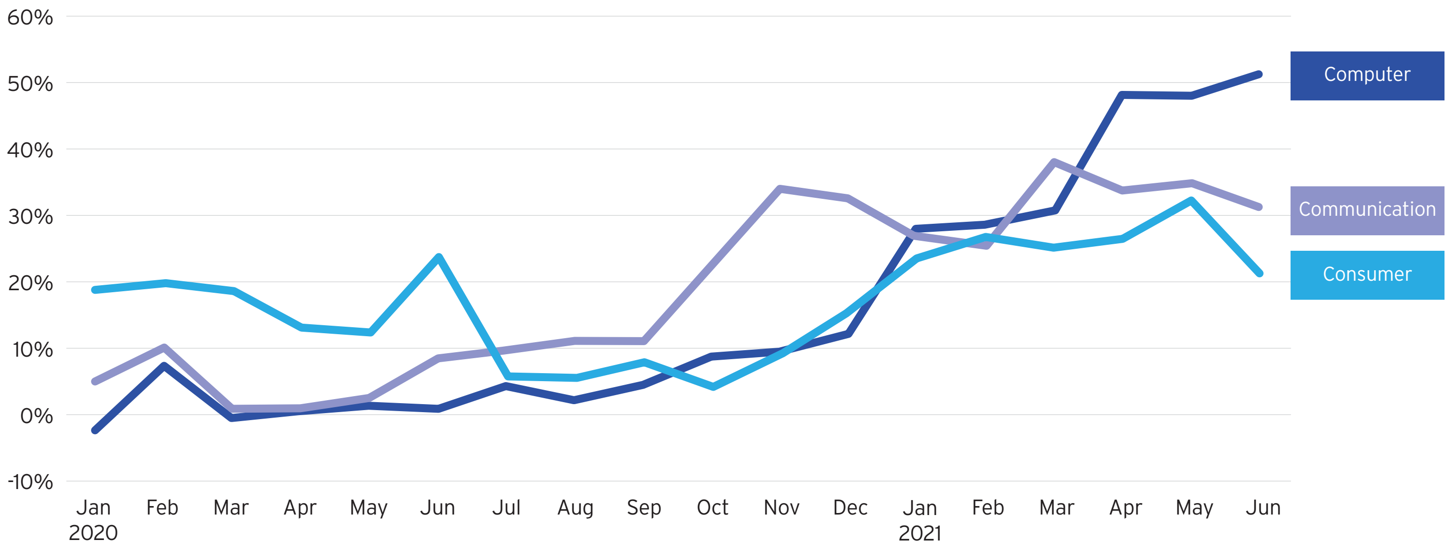
4 Virtual Everything

Semiconductors underpin the IT infrastructure necessary for maintaining communication networks between colleagues and classmates outside of a traditional office and school setting. Firms that could conduct business remotely quickly reacted to the pandemic by shifting resources to digital communication, and the trend may be here to stay. With network usage growing between 30 to 50% for top providers, chip-enabled communication infrastructure has provided a lifeline to businesses and schools to carry on with remote work and school for many throughout the pandemic.

Delivery and transportation services are heavily dependent upon rapid communication capabilities. Some examples are the large fleets of truck drivers that operate long shifts and require coordinated support from fleet managers. Both pick-up and delivery options for store items, groceries, and restaurant food have been popular during the pandemic because mobile phone apps have made the transactions easy and safe. Grocery delivery companies utilize the ubiquity of smartphones to connect shoppers and customers, and these semiconductor-enabled services have seen a massive increase in application downloads and order quantities.



YEAR-OVER-YEAR MONTHLY CHIP SALES GROWTH TO MAJOR CONSUMER SECTORS RAPIDLY INCREASED



5 Remote Healthcare and Vulnerable Populations

A critical aspect of safely reopening economic sectors has been protecting vulnerable populations such as the elderly, diabetic, and hard of hearing. Managing contact with these populations is the first step, but real-time monitoring systems have allowed physicians access to information regarding the daily status of their patients both in-house and remotely. Semiconductors have played an important role in this.

Remote healthcare, or telemedicine, has been necessary and highly beneficial during the COVID-19 crisis, and semiconductors are vital to IT infrastructure and to wearable medical technology for patient monitoring. This technology is especially helpful to the elderly population and patients with underlying health conditions.

People with diabetes are also at higher risk from the coronavirus. This risk can be mitigated with new semiconductor-rich technologies that make use of advanced sensors such as continuous glucose monitoring (CGM) and wearable insulin pumps. CGM works by placing a sensor on your skin that transmits information to a device that will alert you if your blood sugar fluctuates greatly. Similarly, insulin pumps manage your glucose levels by releasing small doses of insulin according to your programmed schedule. For diabetic COVID-19 patients, access to such technologies has helped to prevent life-endangering complications.

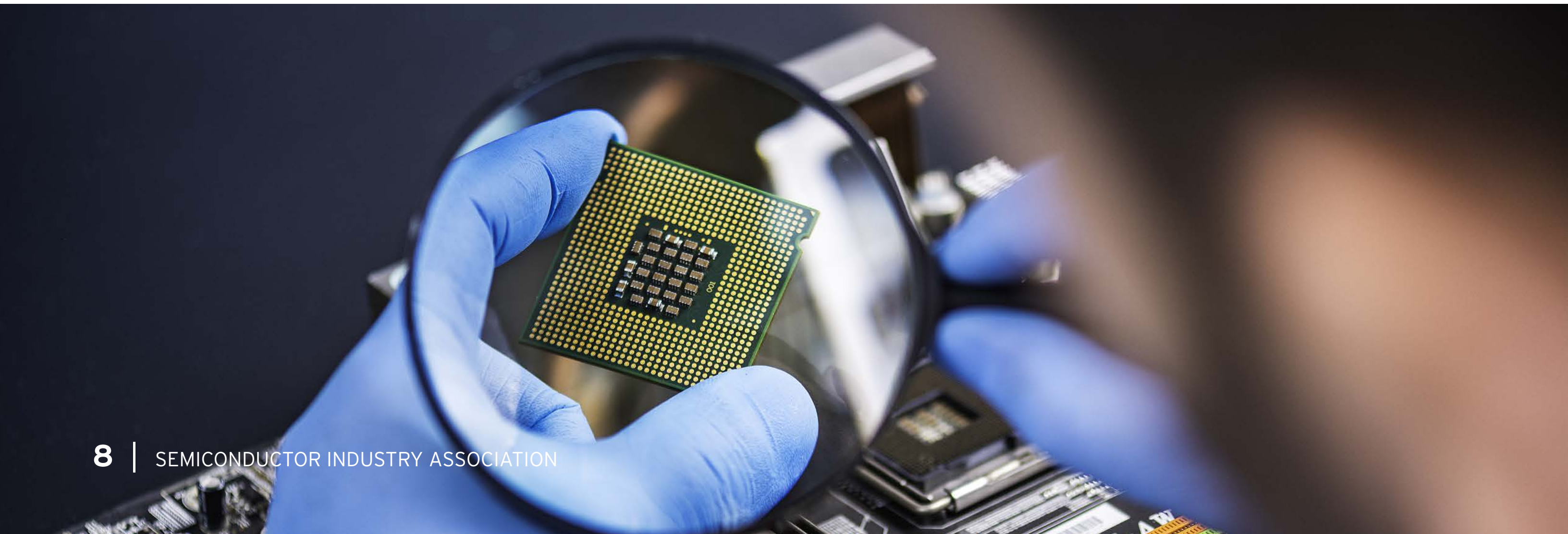
Semiconductors have also improved COVID-19 care for underserved and vulnerable populations in less well-known ways. Hard of hearing patients have been at a distinct disadvantage during the COVID-19 crisis, as medical masks degrade speech quality, making it difficult for hearing impaired patients to understand the advice given by health care professionals. A study in Hearing Review concluded, "Many of the people who have fallen victim to the virus have hearing loss, are unaccompanied by family members, are frail, have multiple chronic conditions and are likely without hearing assistance." Hearing aids use semiconductors to filter, process, and amplify sound, all in a small package that fits discretely on or in the ear. To help patients acquire hearing aids, several hearing care firms have launched platforms to allow remote patient care. Other telemedicine platforms have seen a more than 700% increase in users in areas highly affected by the virus.

THE GLOBAL CHIP SHORTAGE AND THE INDUSTRY'S RESPONSE

One significant consequence of the pandemic over the past year has been the global chip shortage that has impacted a number of end markets, including the automotive market. The pandemic was a once-in-a-generation event that created substantial and unanticipated swings in demand.

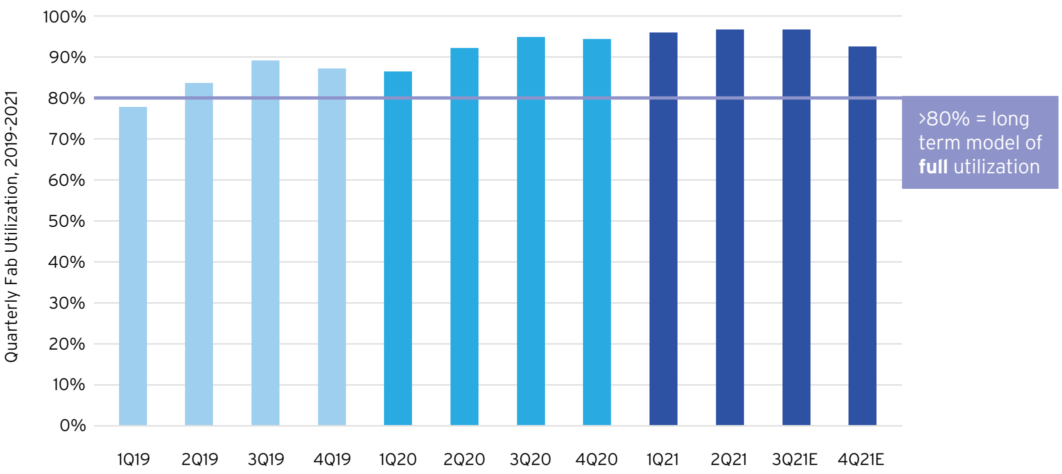
The shortage took hold in 2020, largely due to significant swings in demand caused by the COVID-19 pandemic as far back as Spring 2020. Some customers reduced production and chip purchases as the virus spread across the globe. In addition, a number of countries and regions went into lockdown in early 2020, which significantly interrupted semiconductor supply. Chipmakers, meanwhile, saw surging demand for semiconductors in other sectors used to enable remote healthcare, work-at-home, and virtual learning, which were needed during the pandemic. The shortage continues to affect a range of downstream sectors, including cars, consumer electronics, home appliances, industrial robotics, and many other key goods.

The semiconductor industry has worked diligently to ramp up production to meet renewed demand during the shortage. First, the semiconductor industry worked hard to keep operations running globally, especially during the start of the pandemic in Spring 2020 when many foreign and state governments imposed lockdown orders on businesses. The semiconductor industry worked to classify its operations as "essential" so they could continue operations. For all quarters during the shortage, the industry has run fab utilization well above the normal utilization level of 80 percent. When market demand runs high, such as in a cyclical market upturn like the one the market is in now, front-end semiconductor fabrication facilities, or fabs, will typically run above 80 percent capacity utilization, with some individual fabs running as high as between 90-100 percent. As the table below shows, the industry has been steadily increasing overall fab utilization over the past two years and is estimated to increase utilization even more during most of 2021 to meet demand. Higher fab utilization will increase chip output and help the industry to meet the increased demand in the market. In short, the semiconductor industry has done precisely what is in its power to do in the short-term to meet the increase in demand, which is to expand fab utilization and run fabs at their highest capacity possible.



THE GLOBAL CHIP SHORTAGE AND THE INDUSTRY'S RESPONSE

SEMICONDUCTOR COMPANIES WORKING HARD TO MEET MARKET DEMAND



The global semiconductor industry is planning accordingly to meet this projected market growth in the years ahead, through record levels of investment in manufacturing and R&D. For example, the global industry has invested in adding new fab capacity for the medium and long-term to ensure that more fab capacity continues to be added to address the rise in demand for semiconductors. Besides increased fab capacity, another indicator the industry is addressing is the record-setting amounts of capital expenditure (capex) by the industry recently. Industry capex in 2021 is forecast to reach close to $150 billion in 2021 and over $150 billion in 2022. Prior to 2021, the industry had never spent above $115 billion on annual capex. Long-term demand drivers for chips will not be able to be met through increased utilization alone.

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 auto space, 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.

CHIPS FOR AMERICA ACT/FABS ACT

The U.S. share of global semiconductor manufacturing capacity has eroded from 37% in 1990 to 12% today, mostly because other countries' governments have invested ambitiously in chip manufacturing incentives and the U.S. government has not. In fact, three-quarters of the world's chip manufacturing capacity is now concentrated in East Asia, with China projected to command the largest share of global production by 2030, due to its government's massive investments in this sector.

Meanwhile, federal investments in chip research have held flat as a share of GDP, while other countries have significantly ramped up research investments.

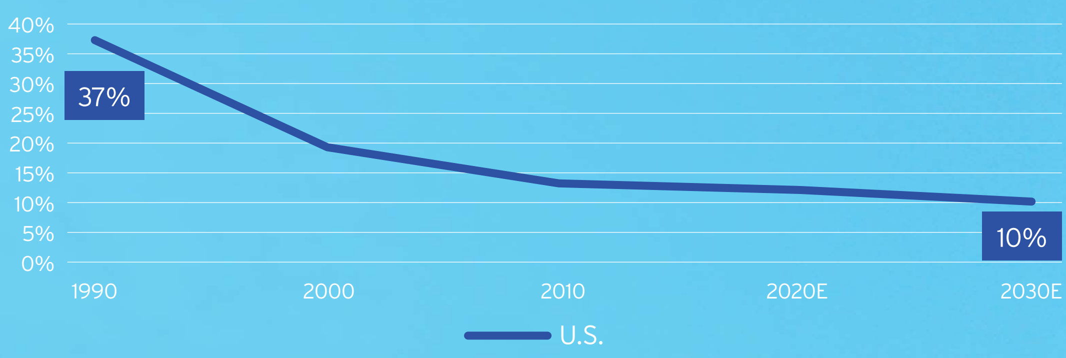
The dramatic decline in the U.S. share of global chip manufacturing, coupled with insufficient federal investments in semiconductor R&D, undermine our country's long-term ability to manufacture, research, and design the advanced chips needed to support our economic recovery, power our military and critical infrastructure, create new high-paying jobs, reduce costs for clean energy technologies, and drive innovations in the must-win technologies of tomorrow. For our country to succeed in the future, we must continue to lead the world in semiconductor technology.

To address this challenge, bipartisan legislation called the CHIPS for America Act was enacted in 2021. It authorizes investments in domestic chip manufacturing incentives and research initiatives, but funding must still be provided through congressional appropriations.

Congress is also considering legislation called the FABS Act that would establish a semiconductor investment tax credit. The FABS Act should be expanded to include expenditures for both manufacturing and design to help strengthen the entire semiconductor ecosystem.

By funding the CHIPS for America Act and expanding and enacting the FABS Act, leaders in Washington can usher in a historic resurgence of chip manufacturing in America, strengthen our country's most critical industries, boost domestic chip research and design, and help ensure the U.S. leads in crucial, chip-enabled technologies — artificial intelligence, quantum computing, 5G/6G communications, and countless others. This resurgence will define America's strength for decades to come.

SHARE OF GLOBAL SEMICONDUCTOR MANUFACTURING 1990-2030E



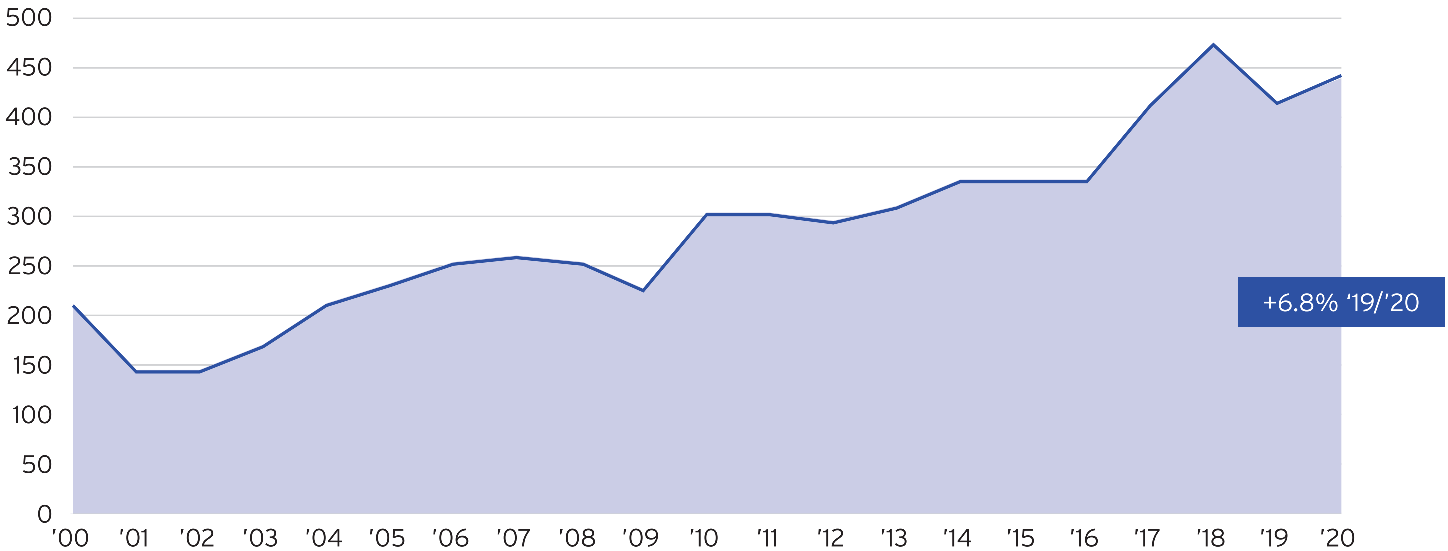
THE GLOBAL SEMICONDUCTOR MARKET

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. Indeed, 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. In the near-term, however, the COVID-19 pandemic and the global chip shortage present significant market challenges to the industry.

While 2020 market forecasts fluctuated throughout the year due to demand uncertainty caused by the COVID-19 pandemic, the global market actually increased in 2020, and the outlook for 2021 is very strong.

Following weak sales of $412.3 billion in 2019, global sales in 2020 increased by 6.8 percent to $440.4 billion, due largely to demand growth spurred by the COVID-19 pandemic. The World Semiconductor Trade Statistics (WSTS) Semiconductor Market Forecast released in June 2021 projected worldwide semiconductor industry sales will increase significantly to $527 billion in 2021, an upward revision from its Fall 2020 forecast for 2021, due mainly to the continued strong demand growth in the overall market from 2020. In 2022, WSTS forecasts global sales will continue growing to $573 billion.

GLOBAL SEMICONDUCTOR SALES ($B)



SEMICONDUCTOR DEMAND DRIVERS

Over the next decade, further innovation in semiconductor technology will enable a host of transformative technologies including 5G, 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 have been made possible by advances in semiconductors, leading to the recently introduced 5G. While demand drivers in the short-term experienced some unexpected shifts, brought on by societal changes due to the COVID-19 pandemic, in many ways these shifts have resulted in an overall increase in demand, as society has recognized and leaned on semiconductor-enabled technologies more than ever to make it through this unprecedented period.

Current end-use drivers destabilized by COVID-19 demand shock.

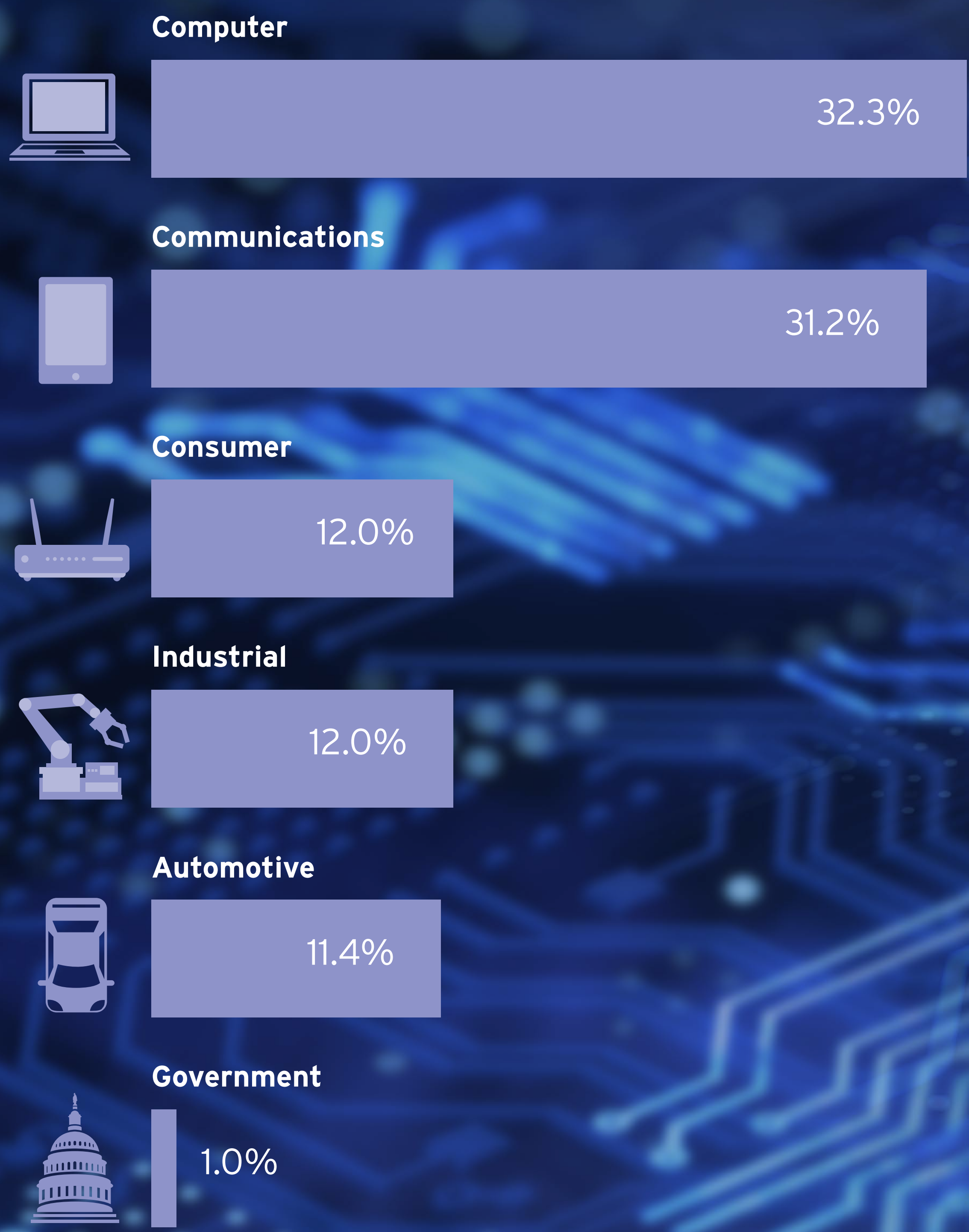
In 2020, end-use sales of semiconductors experienced significant and unexpected shifts across almost all categories, as the impact of COVID-19 destabilized end-use demand drivers throughout 2020. Sales into some end-use categories, such as computer, experienced significant increases, as COVID-19 spurred more remote work and school. Other markets, such as automotive, experienced radical highs and lows throughout the year, but ultimately ended the year with negative annual growth. The first half of 2021 has seen strong end market sales across the board.

2020 DEMAND BY END-USE

End-Use Category	Computer	Communication	Consumer	Industrial	Automotive	Government
Annual Growth	21.2	1.2	-3.0	8.2	-0.3	-11.8
Total Value ($B)	**142.2**	**137.6**	**53.0**	**52.9**	**50.1**	**4.6**

SEMICONDUCTOR DEMAND DRIVERS

2020 TOTAL GLOBAL SEMICONDUCTOR DEMAND SHARE BY END USE



U.S. INDUSTRY MARKET SHARE

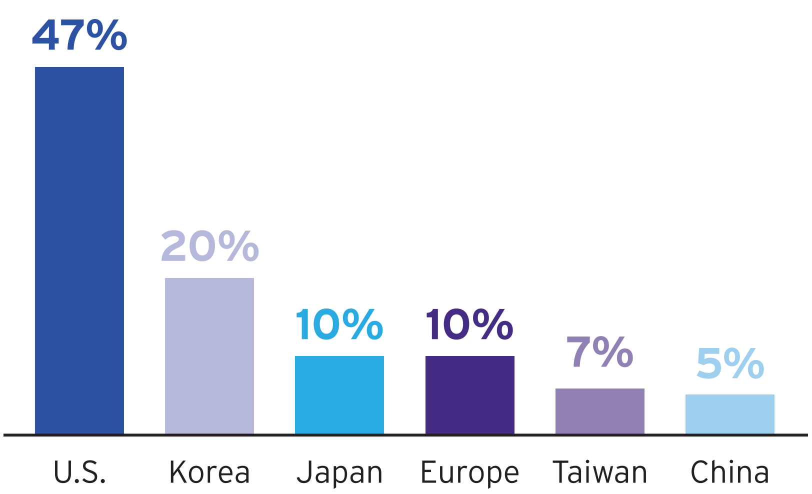
Semiconductors were invented in the United States, and the domestic industry remains the leader in the global market. While America's position has been challenged many times over the decades, it has always prevailed due to its amazing resilience and ability to run faster. This does not mean the United States will go unchallenged in the future. The importance of semiconductors is so great that most Information-Age nations strive to be competitive in at least some aspect of this critical industry, and the world's most ambitious nations seek to chase the U.S.

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

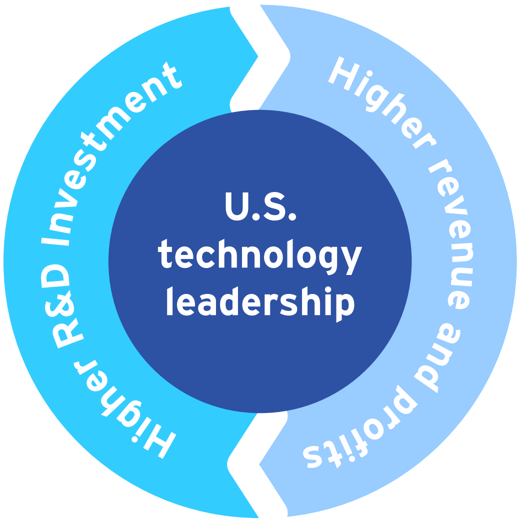
Since the late 1990s, the U.S. semiconductor industry has been the global sales market share leader with almost 50 percent annual global market share. In addition, U.S. semiconductor firms maintain a leading or highly competitive position in R&D, design, and manufacturing process technology.

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 in turn 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.

2020 GLOBAL MARKET SHARE



A VIRTUOUS CYCLE OF INNOVATION



U.S. INDUSTRY MARKET SHARE

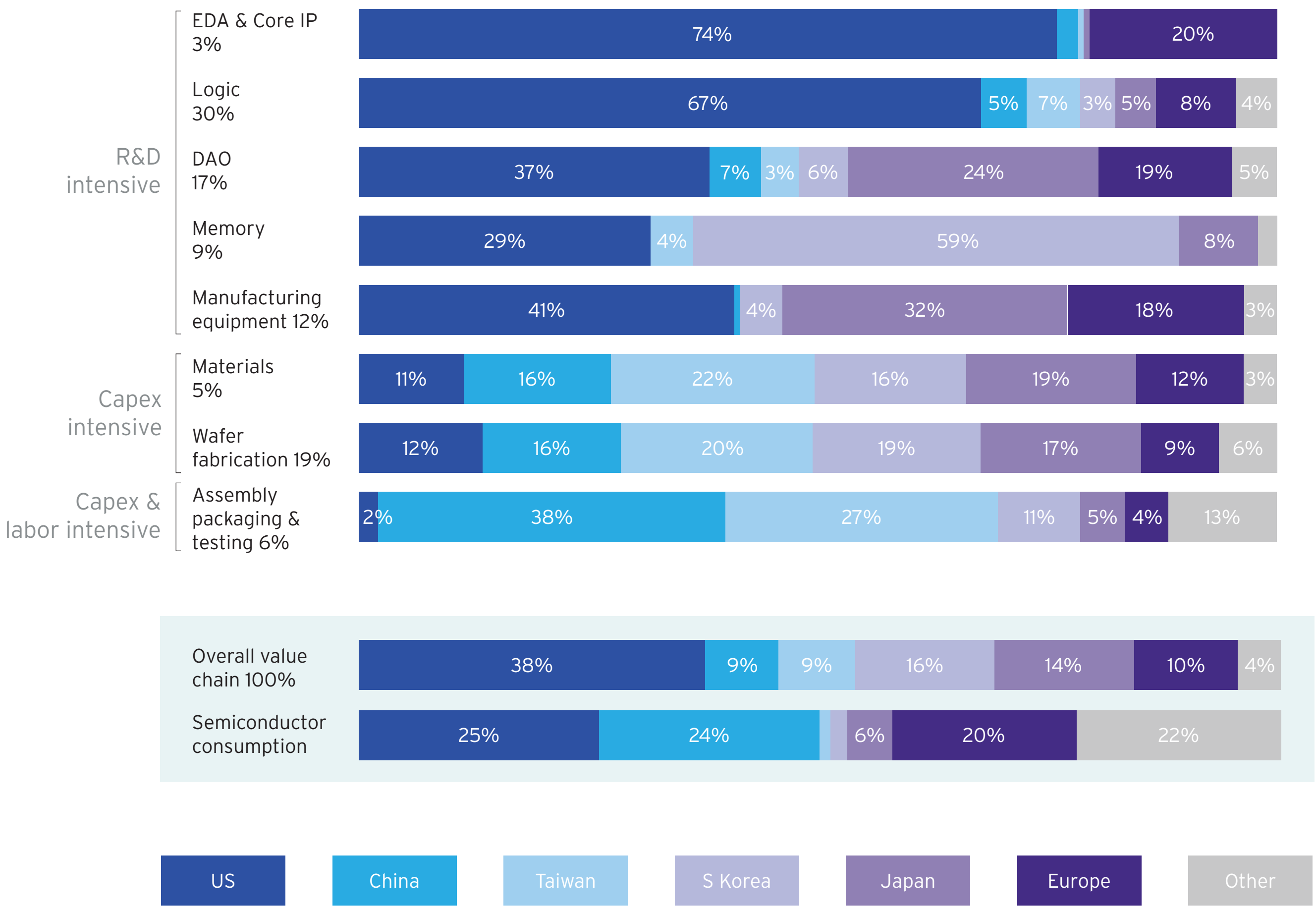
U.S.-based semiconductor companies are a market leader by business model and subproduct, but for some business model subsegments, the U.S. industry lags its Asian-based competitors.

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.

Raw materials and manufacturing, both wafer fabrication and assembly, test, and packaging, which are more capital intensive, are largely concentrated in Asia. Asia is home to about 75 percent of the world's total semiconductor manufacturing capacity - including all the leading-edge capacity less than 10 nanometers. This imbalance has highlighted the need for the United States to consider strategic incentives to support more domestic manufacturing.

Similarly, in terms of subproduct leadership, the U.S. leads in logic and discrete, analog, and opto semiconductors. However, for memory semiconductors, other countries' industries lead.

SEMICONDUCTOR INDUSTRY VALUE ADDED BY ACTIVITY AND REGION 2019 (%)



U.S. TECHNOLOGY COMPETITIVENESS

The U.S. semiconductor industry is the global leader in semiconductor R&D and chip design. For U.S. companies, both fabless firms and integrated device manufacturers (IDMs), which have a combined share of almost 50 percent of global semiconductor sales, the critical success factors are access to highly skilled engineering talent and a thriving innovation ecosystem, particularly from leading universities. While the U.S. industry leads in R&D intensive activities, Asia leads in manufacturing process technology, supported by government incentives. When it comes to leading-edge logic capacity below 10 nanometers currently in operation, none is done in the United States. The United States is also well behind as a location for logic capacity 28 nanometers and above.

The U.S. as leader in semiconductor design.

Before a semiconductor is physically manufactured, it must first be designed. Semiconductors are highly complex products to design. Firms involved in semiconductor design develop the nanometer-scale integrated circuits that perform the critical tasks that make electronic devices work, such as connectivity to networks, computing, storage, and power management. Chip designers must use highly advanced electronic design automation (EDA) software and reusable architectural building blocks ("IP cores") to do this task.

Design activity is chiefly knowledge- and skill-intensive, accounting for 65% of the total industry R&D and 53% of the value added. By far, these represent the highest shares of R&D and value added of any stage of semiconductor fabrication. Companies focusing exclusively on semiconductor design typically invest 12-20% of their annual sales back into R&D. 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 IP and design support services. As chips have become increasingly complex, development costs have rapidly risen.

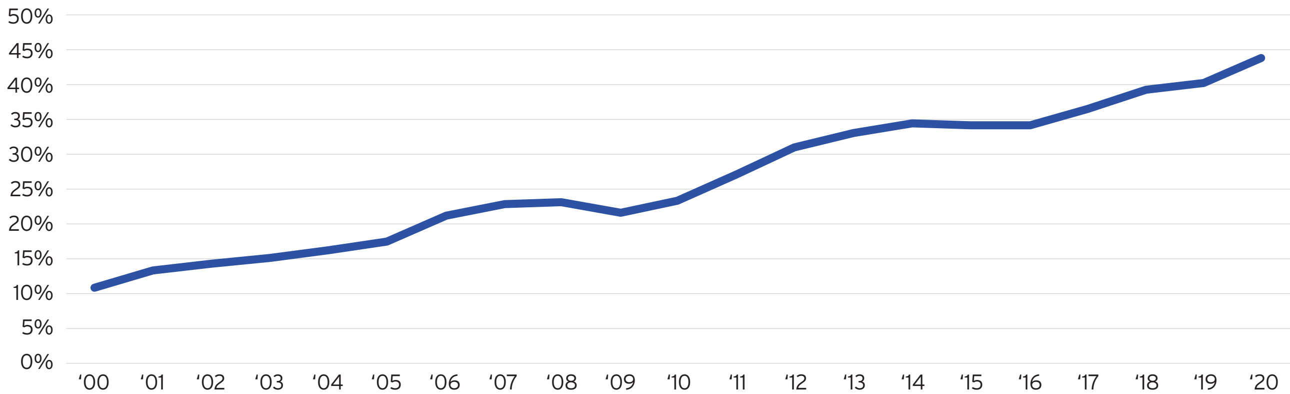
While both IDMs and fabless firms design semiconductors, fabless firms choose to focus exclusively on design and outsource fabrication, as well as assembly, packaging, and testing. Fabless firms typically outsource fabrication to pure-play foundries and outsourced assembly and test (OSAT) firms. The fabless model has grown along with the demand for semiconductors since the 1990s, as the pace of innovation made it increasingly difficult for many firms to manage both the capital intensity of manufacturing and the high levels of R&D spending for design. As technical difficulty and upfront investment soared with the migration to smaller manufacturing nodes, total semiconductor sales accounted for by fabless firms increased from less than 10% in 2000 to almost 30% in 2019.

The U.S. semiconductor industry is a leader in chip design. U.S. fabless firms account for roughly 60% of all global fabless firm sales, and some of the largest IDMs, which do their own design, are also U.S. firms. In addition, the U.S. accounts for the largest share of the global design workforce, which highlights the strength of the U.S. industry and academic ecosystem for chip design. Given the importance of semiconductor design in terms of value added in the manufacturing process, it is critical that the U.S. industry has – and maintains – leadership in this stage of production.

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. R&D expenditures by U.S. semiconductor firms tend to be consistently high, regardless of cycles in annual sales, which reflects the importance of investing in R&D to semiconductor production. In 2020, total U.S. semiconductor industry investment in R&D totaled $44.0 billion.

R&D EXPENDITURE ($B)



SEMICONDUCTORS HELPING TO SOLVE THE CLIMATE CHANGE CHALLENGE

Innovative uses of semiconductor technology have the potential to make significant contributions towards solutions to global climate change. The deployment of information and communications technology (ICT), enabled by semiconductors, throughout the economy can achieve dramatic improvements in energy efficiency and the production of clean energy. Moreover, while the number of semiconductors continues to grow as we fully digitize our economies, semiconductor-enabled technologies present opportunities to drive dramatic reductions in emissions from virtually all sectors of the economy, ranging from transportation and manufacturing to buildings, energy, and agriculture. According to the World Economic Forum, semiconductor-enabled technologies, such as digital technologies, can reduce greenhouse gas emissions by 15 percent - almost one-third of the 50 percent reduction required by 2030.

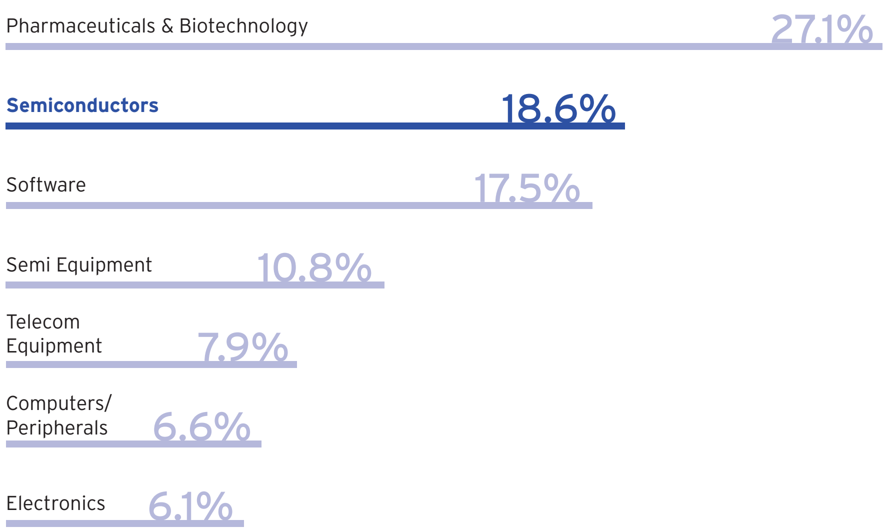
Semiconductors serve as the backbone of the ICT industry: electronics, computing hardware, telecommunications, and connected devices such as sensors and thermostats. Connected devices that run on semiconductor chips (i.e., the Internet of Things (IoT)) numbered 22.6 billion in 2019 and are projected to grow to 75 billion by 2025. Semiconductors are also fundamental to innovations such as 3D printing, machine learning, and artificial intelligence (AI) that in turn enhance healthcare, reduce building costs, strengthen food supply, and enable advancements in science.

U.S. TECHNOLOGY COMPETITIVENESS

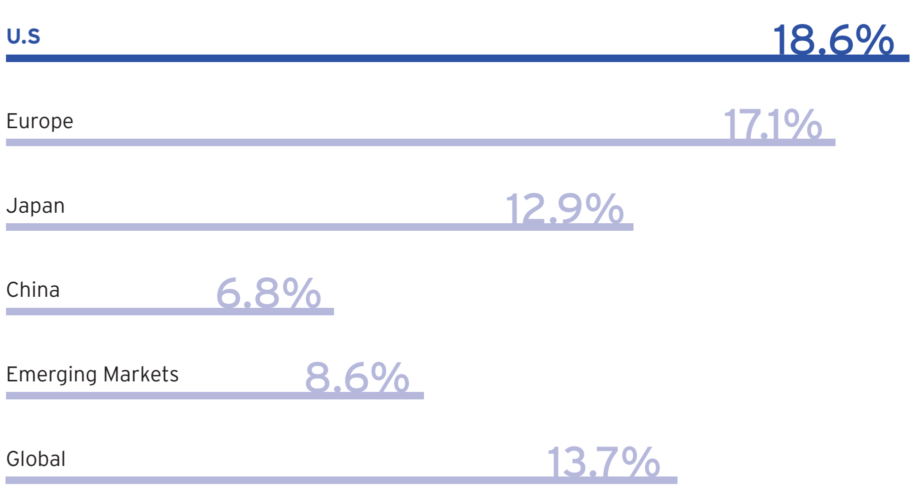
The U.S. semiconductor industry maintains one of the highest levels of R&D as a percent of sales of any U.S. industry.

The U.S. semiconductor industry is 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. 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 its global sales market share leadership position and generate jobs throughout the United States.

R&D EXPENDITURES AS A PERCENTAGE OF SALES BY INDUSTRY IN THE U.S.



SEMICONDUCTOR R&D EXPENDITURES AS A PERCENTAGE OF SALES BY COUNTRY

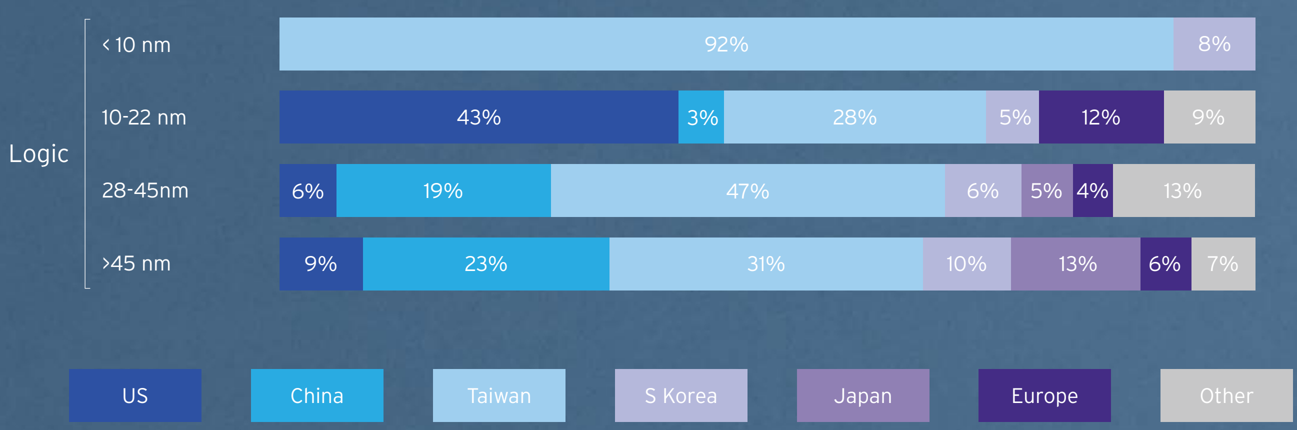


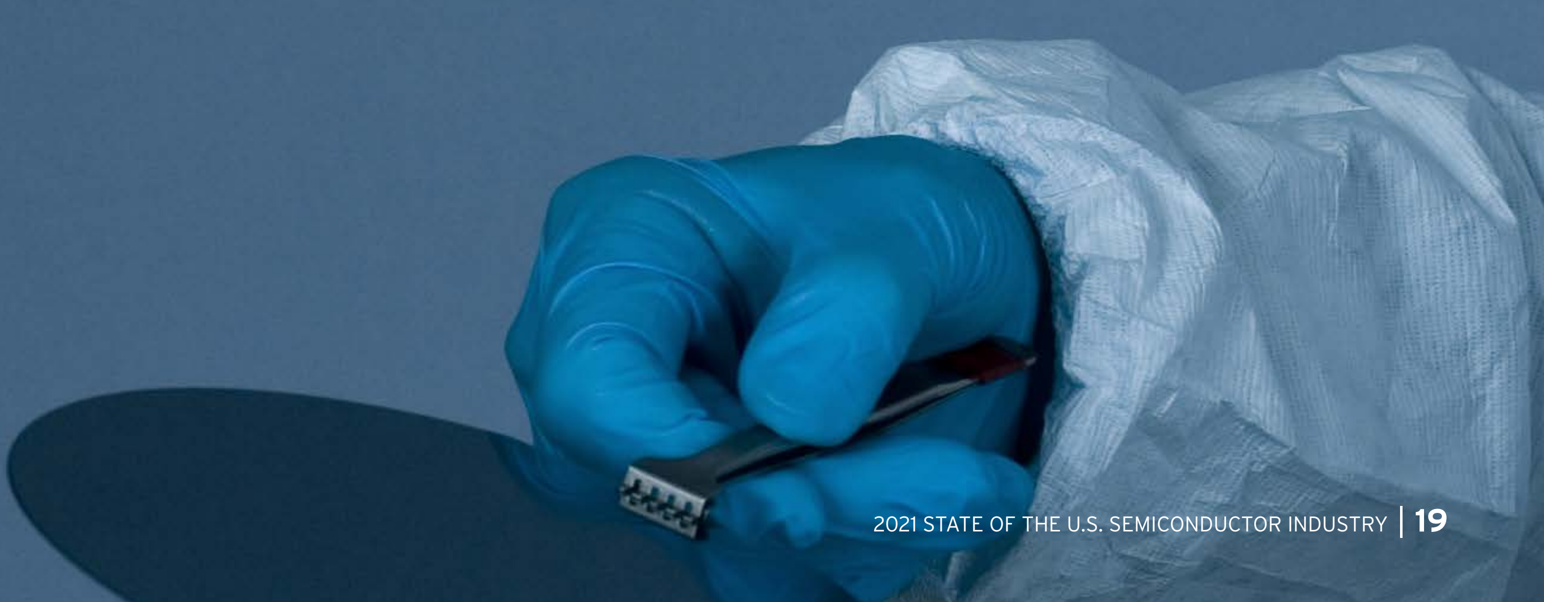
U.S. TECHNOLOGY COMPETITIVENESS

While the U.S. leads in R&D intensive activities, it has fallen behind as a location for manufacturing technology.

Government policies have played a major role in the strong growth of cutting edge manufacturing technology in Asia. At the same time, the U.S. has fallen behind Asia in manufacturing technology particularly for logic. In fact, according to a recent SIA/BCG report, there is currently no cutting edge logic capacity below 10 nanometers being done in the United States. It is all being done in Asia where 5 nanometer process technology has been achieved and 3 nanometer technology is on the horizon. In memory manufacturing technology, the United States has regained competitiveness in DRAM and 3D-NAND, and U.S. firms are fully embracing EUV. U.S. firms are also at the cutting edge of advanced packaging technology using 3D-heterogenous integration. Finally, the U.S. industry is leading the way in a number of the emerging manufacturing technologies such as compound semiconductor manufacturing technology and silicon carbide (SiC).

BREAKDOWN OF GLOBAL LOGIC PROCESS TECHNOLOGY BY REGION, 2019 (%)





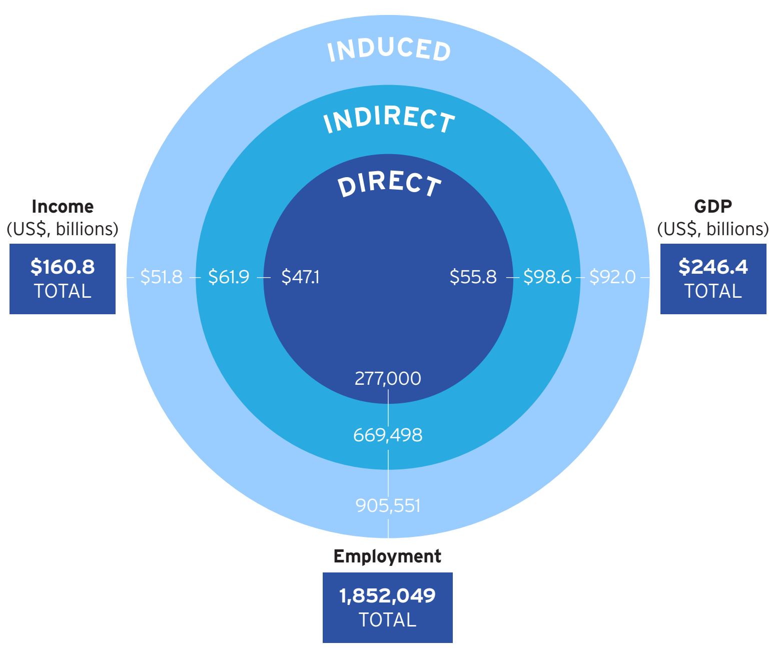
U.S. DOMESTIC WORKFORCE AND MANUFACTURING

Having a competitive domestic workforce and manufacturing capabilities are 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 277,000 people work in the industry, designing, manufacturing, testing, and conducting R&D on semiconductors throughout 49 states in the U.S. 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 in the U.S. economy, the U.S. semiconductor industry is essential to the U.S. economy by stimulating jobs and paying income to workers. In total, the U.S. semiconductor industry supported 1.85 million U.S. jobs in 2020. 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.

In addition to job creation, the U.S. semiconductor industry has a significant impact on GDP and income. In 2020, the total impact of the U.S. semiconductor industry on GDP was $246.4 billion. In terms of the impact on income, the industry was responsible for generating $160.8 billion in income in 2020 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 1.85 million total direct and indirect jobs created by the industry, many were created in sectors as diverse as construction, financial activities, and leisure and hospitality.



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

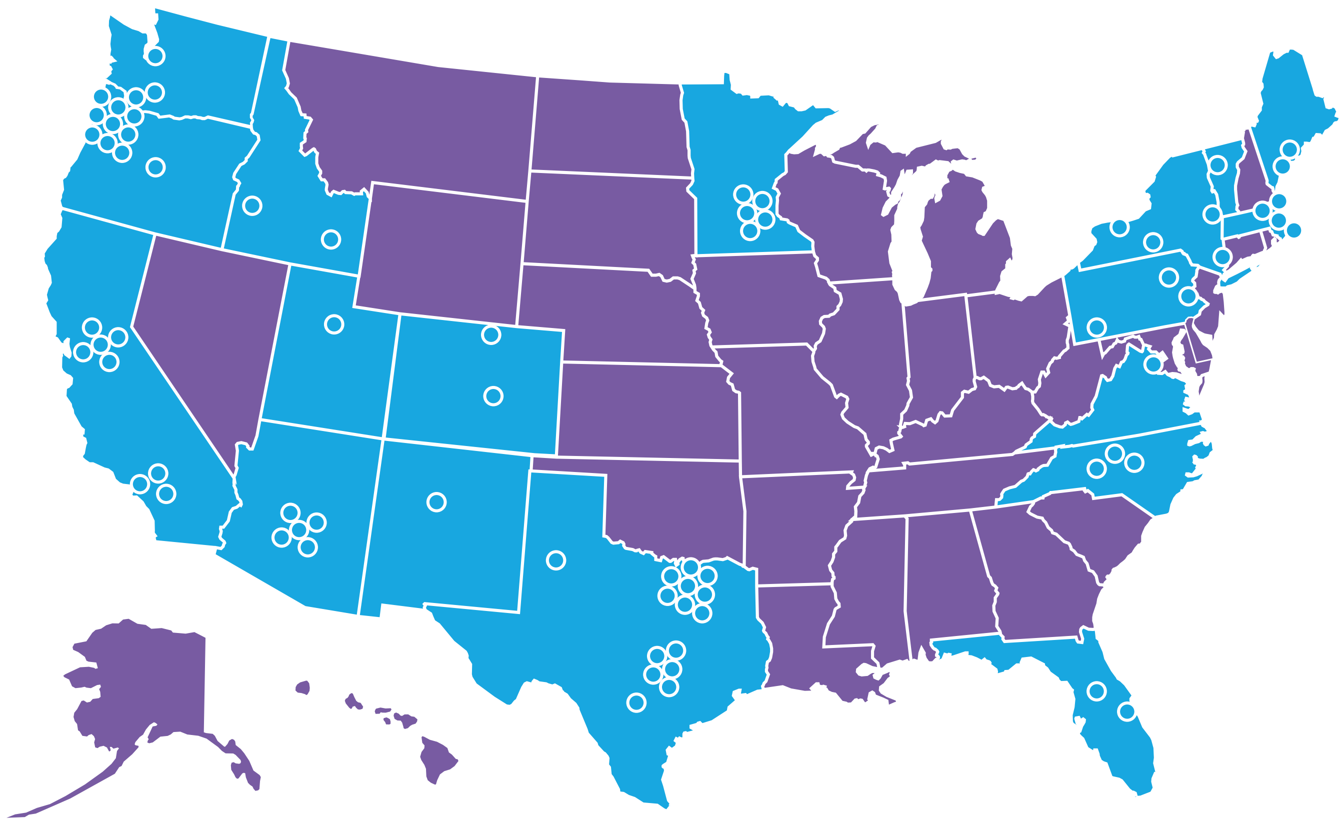
1,600,000 ADDITIONAL

American jobs

U.S. DOMESTIC WORKFORCE AND MANUFACTURING

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

SEMICONDUCTOR MANUFACTURING ACROSS AMERICA

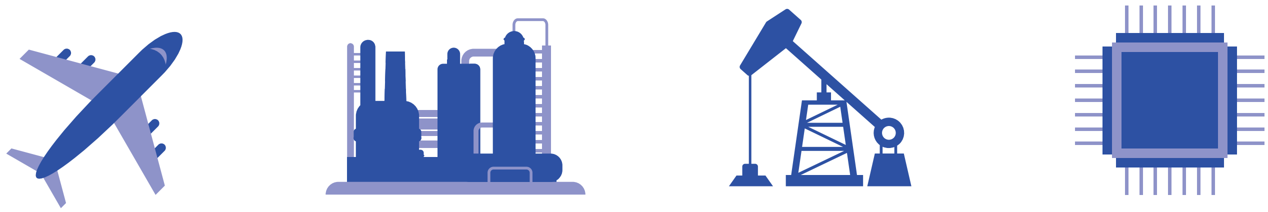


U.S. DOMESTIC WORKFORCE AND MANUFACTURING

Semiconductors are one of America's top exports.

U.S. exports of semiconductors totaled $49 billion in 2020, 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 today are sold outside of the U.S. market.

TOP U.S. EXPORTS IN 2020



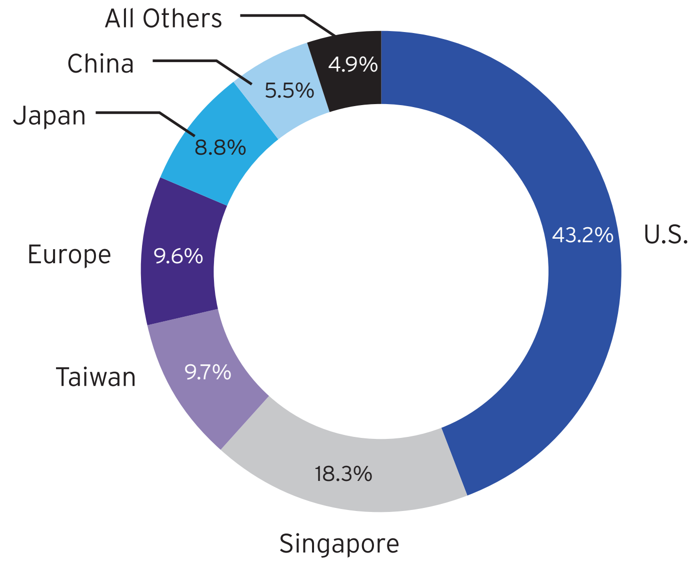
Aircraft	Refined Oil	Crude Oil	Semiconductors
$72B	$65B	$50B	$49B

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 2020, about 43% of U.S. semiconductor manufacturers' front-end 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 were Singapore, Taiwan, Europe, and Japan. It is notable that China has attracted considerably less U.S. investment in front-end fabrication than the other major locations.

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 nations have put in place to attract semiconductor manufacturing. The United States must implement similar incentives in order to remain competitive.

PERCENT OF U.S. SEMICONDUCTOR MANUFACTURERS' WAFER CAPACITY BY LOCATION



U.S. SEMICONDUCTOR INNOVATION POLICY LANDSCAPE

The federal government is a key partner in developing policies that promote a strong and innovative U.S. semiconductor industry.

Over the last year, leaders in Washington have taken steps to ensure continued U.S. leadership in chip technology. Bipartisan legislation called the CHIPS for America Act was introduced in 2020 — and enacted in early 2021 in the National Defense Authorization Act (NDAA) — that authorizes investments in domestic chip manufacturing and research initiatives. It is critical these provisions are fully funded.

The dramatic decline in the U.S. share of global chip manufacturing, coupled with insufficient federal investments in semiconductor R&D, undermine our country's long-term ability to produce the advanced chips needed to support our economic recovery, power our military and critical infrastructure, create new high-paying jobs, reduce costs for clean energy technologies, and drive innovations in the must-win technologies of tomorrow. For our country to succeed in the future, we must lead in semiconductors.

With bold action to address these defining challenges, Congress and the Administration can usher in a historic resurgence of chip manufacturing in America, strengthen our country's most critical industry, and help ensure the U.S. leads in crucial, chip-enabled technologies: artificial intelligence, quantum computing, 5G/6G communications, and countless others. This resurgence will define and determine America's strength for decades to come.

U.S. SEMICONDUCTOR INNOVATION POLICY LANDSCAPE

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

1. Invest in U.S. Semiconductor Leadership:

- Fund the domestic semiconductor manufacturing, research, and design provisions in the CHIPS for America Act.
- Enact an investment tax credit encompassing both manufacturing and design to spur the construction of new onshore advanced semiconductor research, design, and manufacturing facilities and to promote domestic chip innovation.

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 and increase the number of Americans graduating in STEM fields.
- Reform America's high-skilled immigration system to enable access to, and retention of, the best and brightest in the world.

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:

- Recognizing the global nature of the semiconductor industry, expand collaboration with like-minded allies on shaping a regulatory and legal environment more conducive to growth, innovation, and supply chain resilience in such areas as regulatory coherence, standards, and export controls.

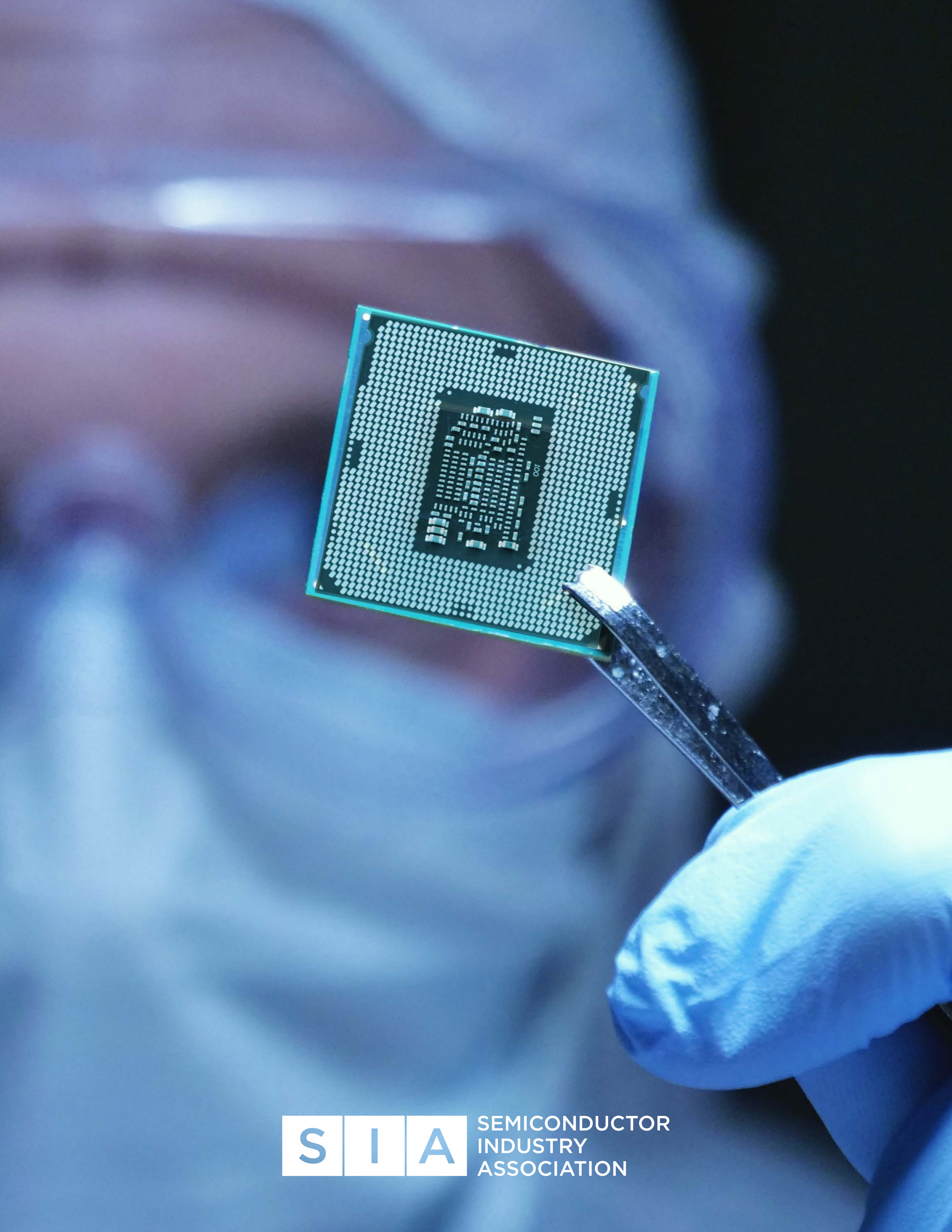
By implementing these policies, Congress and the Administration can take key steps to protect American leadership in semiconductor technology and win the global competition for the technologies of the future.

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. Lastly, industry R&D data was based on company financial reports, as well as data from New York University.

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 $208 billion in 2020. SIA members account for 98 percent of all U.S. semiconductor industry sales and about two-thirds of revenue from non-U.S. firms. 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.


SIA
SEMICONDUCTOR INDUSTRY ASSOCIATION