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Semiconductors, CHIPS for America, and Appropriations in the U.S. Innovation and Competition Act (S. 1260)

Global Landscape for Semiconductor Fabrication

Semiconductors, or computer chips, enable nearly all industrial activities, including systems that undergird U.S. industrial competitiveness and national security. They are instrumental in technologies that address a wide spectrum of national needs, such as defense weapon systems, medical equipment, automobiles, industrial machinery, consumer electronics, and environmental systems.

Semiconductor design and manufacturing is a global enterprise, with materials, design, fabrication, assembly, testing, and packaging operating across national borders. U.S. industry dominates many parts of the semiconductor supply chain, such as chip design. Six U.S.-headquartered or foreign-owned semiconductor manufacturing companies currently operate 20 fabrication facilities, or fabs, in the United States. However, with the movement of many U.S. firms toward a fabless model (companies that design, but do not manufacture, semiconductors), the U.S. share of semiconductor fabrication capacity was 12% in 2020, down from 13.8% in 2015, continuing a long-term decline from around 40% in 1990. The U.S. share is expected to fall further as planned new fabs open globally in the next few years, particularly in East Asia. In 2019, nearly four-fifths of global fab capacity was in Asia—South Korea (28%), Taiwan (22%), Japan (16%), and China (12%).

Concerns About U.S. Fabrication Capacity

Some Members of Congress have expressed concerns about the economic and military implications of a loss of U.S. leadership in parts of the semiconductor supply chain and, relatedly, the adequacy of U.S.-based semiconductor fabrication capacity to meet U.S. commercial and defense needs. Others have become increasingly concerned about the concentration of production in East Asia and related vulnerability of semiconductor supply chains to disruption in the event of a trade dispute or military conflict, as well as other risks such as product tampering and intellectual property theft. These concerns have been exacerbated by the semiconductor supply chain challenges that emerged during the Coronavirus Disease 2019 (COVID-19) pandemic due to shifting industrial and consumer demands, and production declines and transportation/logistics disruptions. Some Members are concerned that China's state-led efforts to develop an indigenous, vertically integrated semiconductor industry, unprecedented in scope and scale, if successful, could significantly shift global semiconductor production and related design and research capabilities to China. China's government outlays (\$150 billion to date, according to the plan and industry estimates), its role as a central production point for global consumer electronics, and internal Chinese demand are generating strong incentives and pressures on U.S. and

foreign firms to focus on China and helping to advance its domestic capabilities through sales of equipment, tools, and software; technology licensing; and investment.

The following sections of this In Focus discuss selected authorization provisions in Title XCIX (**Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America**) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (2021 NDAA, P.L. 116-283), as well as related appropriations provisions included in the proposed United States Innovation and Competition Act (USICA, S. 1260). No House bills include CHIPS for America appropriations.

CHIPS for America (Title XCIX, 2021 NDAA)

Several bills were introduced in the 116th Congress that sought to expand U.S. semiconductor fabrication capacity. Certain provisions from these bills were incorporated into CHIPS for America. The NDAA authorized a number of programs and activities (described below).

Section 9902 of the act authorizes the Secretary of Commerce to provide financial assistance to “covered entities” to incentivize investment in facilities and equipment in the United States for semiconductor fabrication, assembly, testing, advanced packaging, or research and development of semiconductors. Covered entities include “a private entity, a consortium of private entities, or a consortium of public and private entities with a demonstrated ability to substantially finance, construct, expand, or modernize a facility relating to fabrication, assembly, testing, advanced packaging, or research and development [R&D] of semiconductors.”

Under the act, a covered entity may submit an application for financial assistance to the Secretary of Commerce. Subject to availability of funds and considerations specified in the act, the Secretary may determine the appropriate amount and funding type for each award made to a covered entity, up to \$3.0 billion. Awards in excess of \$3.0 billion may be made if the Secretary, in consultation with the Secretary of Defense and the Director of National Intelligence, recommends such an award to the President, and the President certifies and reports to the appropriate committees of Congress, that a larger investment is necessary to significantly increase the proportion of reliable domestic supply of semiconductors relevant for national security and economic competitiveness.

Section 9906(c) directs the Secretary of Commerce, in collaboration with the Secretary of Defense, to establish a National Semiconductor Technology Center to conduct research and prototyping of advanced semiconductor

technology to strengthen the economic competitiveness and security of the domestic supply chain. The center is to be operated as consortium, with participation from the private sector, the Department of Energy, and the National Science Foundation. The center's work is to emphasize advanced test, assembly, and packaging capability in the domestic semiconductor ecosystem; materials characterization, instrumentation and testing for next-generation microelectronics; virtualization and automation of maintenance of semiconductor machinery; and metrology for security and supply chain verification.

Section 9906(d) directs the Secretary of Commerce to establish a National Advanced Packaging Manufacturing Program, led by the Director of the National Institute of Standards and Technology (NIST), to strengthen semiconductor advanced test, assembly, and packaging capability in the United States, and to coordinate its efforts with the National Semiconductor Technology Center, authorized by Section 9906(c), and the Manufacturing USA institute, authorized by Section 9906(f) (discussed below).

Section 9906(e) authorizes the Director of NIST to conduct an R&D program to enable advances and breakthroughs in measurement science, standards, material characterization, instrumentation, testing, and manufacturing capabilities for next-generation microelectronics metrology, and to ensure U.S. competitiveness and leadership in microelectronics.

Section 9906(f) authorizes the establishment of a Manufacturing USA institute to pursue research in support of the virtualization and automation of maintenance of semiconductor machinery; the development of new advanced test, assembly and packaging capabilities; and the development and deployment of educational and skills training curricula needed to support the industry sector and to ensure the United States can build and maintain a trusted and predictable talent pipeline.

USICA Appropriations for CHIPS for America

USICA passed the Senate on June 8, 2021, by a vote of 68-32. Section 1002(a) would provide emergency appropriations for certain activities authorized in CHIPS for America:

- \$39.0 billion for the semiconductor incentives authorized by Section 9902 of P.L. 116-283, including \$19.0 billion for FY2022 and \$5.0 billion for fiscal years 2023 through 2026;
- \$2.0 billion in FY2022 for the establishment of the National Semiconductor Technology Center authorized by Section 9906(c) of P.L. 116-283;
- \$2.5 billion in FY2022 for the National Advanced Packaging Manufacturing Program authorized by Section 9906(d) of P.L. 116-283; and
- \$500.0 million for NIST microelectronics research authorized by Section 9906(e) of P.L. 116-283 and the semiconductor research-focused Manufacturing USA institute authorized by Section 9906(f) of P.L. 116-283.

USICA would also provide additional funding for activities authorized by Section 9906(c), (d), (e), and (f) of P.L. 116-283, in aggregate, for FY2023 (\$2.0 billion), FY2024 (\$1.3 billion), FY2025 (\$1.1 billion), and FY2026 (\$1.8 billion).

These appropriations, totaling \$50.2 billion over the FY2022-FY2026 period, are summarized in **Table 1**.

Table 1. S. 1260 Appropriations for CHIPS for America (Title XCIX of P.L. 116-283) Provisions
(in billions of dollars)

P.L. 116-283 Section	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	Total
9902	19.0	5.0	5.0	5.0	5.0	39.0
9906(c)	2.0					2.0
9906(d)	2.5					2.5
9906(e) and (f)	0.5					0.5
9906(c), (d), (e), and (f)		2.0	1.3	1.1	1.8	6.2
Total	24.0	7.0	6.3	6.1	6.8	50.2

Source: CRS analysis of P.L. 116-283, S. 1260.

Note: Table does not include appropriations for two related funds established in S. 1260 but not mentioned in P.L. 116-283. See text.

Section 1002(b) of USICA also would establish a CHIPS for America Defense Fund to support research, development, test and evaluation; workforce development; and other requirements unique to the Department of Defense and the intelligence community. The act would provide appropriations of \$400 million per year for fiscal years 2022-2026 for the fund.

Section 1002(c) of USICA would establish a CHIPS for America International Technology Security and Innovation Fund to provide for international information and communications technology security and semiconductor supply chain activities, among other things. The act would provide appropriations of \$100 million per year for fiscal years 2022-2026 for the fund.

Related CRS Products

CRS Report R46581, *Semiconductors: U.S. Industry, Global Competition, and Federal Policy*, by Michaela D. Platzer, John F. Sargent Jr., and Karen M. Sutter.

CRS Report R46703, *Manufacturing USA: Advanced Manufacturing Institutes and Network*, by John F. Sargent Jr..

CRS Report R46767, *China's New Semiconductor Policies: Issues for Congress*, by Karen M. Sutter.

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