Before the U.S. Department of Commerce
Bureau of Industry and Security
Office of Technology Evaluation
Washington, D.C.

In the Matter of	)	
	)	
Risks in the Semiconductor Supply Chain	)	BIS-2021-0036
	)	Docket No. 210915-0189
	)	RIN 0694-XC08

COMMENTS OF CTIA

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I. INTRODUCTION AND SUMMARY

CTIA[1] welcomes the opportunity to offer comments in response to the U.S. Department of Commerce ("Commerce") Bureau of Industry and Security's ("BIS") Request for Public Comments on *Risks in the Semiconductor Supply Chain*.[2] As CTIA has previously explained, a diverse and robust semiconductor supply chain is essential for the telecommunications industry and continued innovation and U.S. leadership in this area.[3] Wireless technologies depend on semiconductors to provide unparalleled global connectivity that is the hallmark of modern society. Accordingly, a functional, resilient semiconductor supply chain is critical for our wireless future and, in particular, for winning the race to 5G.[4]

CTIA appreciates Commerce's efforts, following the agency's review of semiconductors and advanced packaging as required by President Biden's February 2021 Executive Order on *America's Supply Chains*,[5] to continue this important work with this latest *Request for Comment*. CTIA agrees with the agency's objectives of "facilitating the flow of information across the various segments of the supply chain, identifying data gaps and bottlenecks in the supply chain, and potential inconsistent demand signals."[6]

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1 CTIA-The Wireless Association® ("CTIA") (www.ctia.org) represents the U.S. wireless communications industry and the companies throughout the mobile ecosystem that enable Americans to lead a 21st century connected life. The association's members include wireless carriers, device manufacturers, suppliers as well as apps and content companies. CTIA vigorously advocates at all levels of government for policies that foster continued wireless innovation and investment. The association also coordinates the industry's voluntary best practices, hosts educational events that promote the wireless industry and co-produces the industry's leading wireless tradeshow. CTIA was founded in 1984 and is based in Washington, D.C.

2 Bureau of Industry and Security, Office of Technology Evaluation, U.S. Department of Commerce, *Risks in the Semiconductor Supply Chain*, Notice of Request for Public Comments, 86 Fed. Reg. 53031 (Sept. 24, 2021) ("*Request for Comment*").

3 Comments of CTIA, BIS-2021-0011, Docket No. 210310-0052 (filed Apr. 5, 2021) (*CTIA April 2021 BIS Comments*).

4 *Id*. at 1-2.

5 Exec. Order. No. 14017, *America's Supply Chains*, 86 Fed. Reg. 11849 (Feb. 24, 2021).

6 *Request for Comment*, 86 Fed. Reg at 53031.

CTIA offers these comments to help BIS understand the bottlenecks and supply chain challenges affecting the semiconductor industry and to offer policy recommendations to improve access to semiconductors. Specifically, CTIA recommends that the U.S. Government: (i) continue to take steps to boost domestic production; (ii) engage in diplomacy to improve relationships between countries integral to the semiconductor supply chain to strengthen global supply; (iii) ensure that humanitarian aid programs include areas with facilities critical to the semiconductor supply chain; (iv) avoid actions that would distort the market for semiconductors; and (v) in lieu of market interventions, share non-confidential market information with U.S. companies to help inform semiconductor purchasing decisions.

II. THE SEMICONDUCTOR SUPPLY CHAIN FACES SEVERAL BOTTLENECKS.

The semiconductor supply chain has been experiencing multiple recent challenges that have created bottlenecks spanning the entire production vertical. These comments address five particular supply chain challenges: (i) export restrictions on semiconductor production materials from Japan to South Korea; (ii) reduction in semiconductor production output in Taiwan; (iii) packaging and testing disruptions in Southeast Asia; (iv) challenges in the semiconductor manufacturing equipment market; and (v) weather-related outages in Texas.

Export restrictions from Japan. Restrictions on exports of specific semiconductor materials from Japan to South Korea threatens to reduce much of South Korea's semiconductor production volumes, upon which U.S. manufacturers rely. South Korea accounts for 16 percent of the global semiconductor value chain,[7] and it has been heavily reliant on Japan for certain chemicals necessary for semiconductor production. Japan reportedly produces 90 percent of fluorinated polyimide, 70

[7] Byun Duk-kun, *U.S.-S. Korea on semiconductor will benefit both: U.S. official*, Yonhap News Agency (Sept. 9, 2021), https://en.yna.co.kr/view/AEN20210908010200325.

percent of etching gas, and 90 percent of photoresists worldwide.[8] As of 2019, South Korea relied on Japan for more than 70 percent of its photoresists and etching gas.[9]

However, a longstanding, historical dispute between the countries spilled over into trade relations in 2019, when Japan began regulating the sale of critical semiconductor inputs to Korean chipmakers.[10] Imports of these materials from Japan into South Korea dropped sharply as a result and have remained low.[11] Further, in July 2021, Japan formally removed South Korea from its list of preferred trading partners, an action which continues to make Japanese chemicals shipments to South Korean uncertain.[12] Even though South Korea has taken steps to alleviate the shortage of semiconductor inputs, such as by increasing domestic sources, that effort remains in progress.[13] In many instances, South Korea has had no choice but to increase chemicals inputs from China, a fact which has made it even more vulnerable to supply chain disruptions.

Production challenges in Taiwan. Production challenges in Taiwan likewise have created a significant bottleneck in the semiconductor supply chain. Taiwan is critical to semiconductor supply, as four of the ten global semiconductor foundries have facilities located in Taiwan and the Taiwan Semiconductor Manufacturing Company ("TSMC") alone holds 56% of the foundry business.[14] As

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8 David Dolan, *Factbox: The high-tech materials at the heart of a Japan-South Korea row*, Reuters (July 2, 2019), https://www.reuters.com/article/us-southkorea-japan-laborers-factbox/factbox-the-high-tech-materials-at-the-heart-of-a-japan-south-korea-row-idUSKCN1TX12I.

9 *Id*.

10 Julien Happich, *Korean IC makers to suffer from photoresist shortage*, eeNews Europe (July 8, 2019), https://www.eenewseurope.com/news/korean-ic-makers-suffer-photoresist-shortage.

11 Suzanne Shaw, *Fluorspar: Semiconductor disruption continues as South Korea imports of HF remain low in H1*, Roskill (June 30, 2021), https://roskill.com/news/fluorspar-semiconductor-disruption-continues-as-south-korea-imports-of-hf-remain-low-in-h1/.

12 *Id*.

13 *See* Joyce Lee, Hyunjoo Jin, *South Korea government, Samsung team up for self-sufficiency after Japan export curbs on chip material*, Reuters (Sept. 13, 2020), https://www.reuters.com/article/us-southkorea-japan-chip-analysis-idUSKBN26501U.

14 Alan Crawford, Debby Wu, and Iain Marlow, *World's Supply of Chips Is in Danger Unless Taiwan Gets Vaccines*, Bloomberg (May 23, 2021), https://www.bloomberg.com/news/articles/2021-05-23/world-s-supply-of-chips-is-in-danger-unless-taiwan-gets-vaccines; *Looming Effects of Continued Drought in Taiwan*, Fusion World Wide (June 2, 2021), https://info.fusionww.com/blog/manufacturers-in-taiwan-deal-with-drought.

the dominant player in the foundry market, TSMC makes 92% of the world's most sophisticated chips, including those used for smartphone processors, and 60% of the microcontrollers needed for automated vehicles.[15]

Taiwan has faced multiple challenges this year that have impacted its ability to produce semiconductor chips for the rest of the world. Earlier this year, Taiwan experienced its worst drought in 50 years, leading to water rationing for more than a million businesses and residents, triggering power outages, and causing semiconductor manufacturers to focus their efforts on water conservation and obtaining water from alternate sources.[16] This crisis constrained production output, which had already been reduced due to the pandemic. As of May 2021, only 1% of the Taiwanese population had been vaccinated against COVID-19 as a new surge in cases threatened to trigger a government lockdown.[17] Consequently, access to chips from Taiwan continues to be uncertain. Furthermore, global shipping challenges that have grown more acute over the course of the past several months are expected to last well into next year. This fact, in addition to surging chips and commodity prices, may very well limit not only supply of semiconductor chips but also the downstream products incorporating the chips.[18]

Packaging and testing disruptions in Southeast Asia. Compounding the challenges in Taiwan, semiconductor packaging and testing facilities in Southeast Asia also have been

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15 Yang Jie, Stephanie Yang, and Asa Fitch, *The World Relies on One Chip Maker in Taiwan, Leaving Everyone Vulnerable*, The Wall Street Journal (June 19, 2021), https://www.wsj.com/articles/the-world-relies-on-one-chip-maker-in-taiwan-leaving-everyone-vulnerable-11624075400.

16 Stephanie Yang, *The Chip Shortage Is Bad. Taiwan's Drought Threatens to Make It Worse*, The Wall Street Journal (Apr. 16, 2021), https://www.wsj.com/articles/the-chip-shortage-is-bad-taiwans-drought-threatens-to-make-it-worse-11618565400?reflink=desktopwebshare_permalink; Crawford, Wu, and Marlow, *World's Supply of Chips Is in Danger Unless Taiwan Gets Vaccines*; Cindy Sui, *Why the world should pay attention to Taiwan's drought*, BBC News (Apr. 20, 2021), https://www.bbc.com/news/world-asia-56798308; *see also Looming Effects of Continued Drought in Taiwan*, Fusion World Wide.

17 Alan Crawford, Debby Wu, and Iain Marlow, *World's Supply of Chips Is in Danger Unless Taiwan Gets Vaccines*.

18 *See id*.

experiencing disruptions. As the Washington Post recently reported, "[a] wave of delta-variant cases in Malaysia, Vietnam and the Philippines is causing production delays at factories that cut and package semiconductors, creating new bottlenecks on top of those caused by soaring demand for chips."[19] These delays are challenging for the semiconductor industry and the industry sectors that rely on semiconductors because the affected factories are "'critical suppliers' for chip testing and packaging as well as 'sources for passive components such as resistors and capacitors in various electronic equipment."[20]

The disruptions in Malaysia are particularly problematic for the United States' access to semiconductors, as "[t]he U.S. imports more chips directly from Malaysia than from any other country in the world."[21] Moreover, the recent delays at these packaging and testing facilities follow reports from earlier this year of delays at packaging plants caused by short supply of bonding wires,[22] thus placing further challenges on an already-constrained segment of the supply chain. Given that testing and packaging are essential to the functionality of semiconductor chips, any continued disruptions to the South East Asian operations directly threaten U.S. supply.

Challenges in the semiconductor manufacturing equipment market. The market for manufacturing equipment necessary to produce semiconductor chips is itself highly concentrated and prone to supply chain disruptions. The "narrowest chokepoint in the supply chain in terms of tools" for semiconductor manufacturing is controlled by operations in just three countries—the United

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[19] Jeanne Whalen, *Semiconductor shortage that has hobbled manufacturing worldwide is getting worse*, The Washington Post (Sept. 23, 2021), https://www.washingtonpost.com/us-policy/2021/09/23/chip-shortage-forecast-automakers/.

[20] R. Dallon Adams, *Chip shortage: Should you buy tech now or wait out the silicon storm?*, TechRepublic (Sept. 21, 2021), https://www.techrepublic.com/article/chip-shortage-should-you-buy-tech-now-or-wait-out-the-silicon-storm/.

[21] Feliz Solomon, *Covid-19 Surge in Malaysia Threatens to Prolong Global Chip Shortage*, The Wall Street Journal (Aug. 29, 2021), https://www.wsj.com/articles/covid-19-surge-in-malaysia-threatens-to-prolong-global-chip-shortage-11630234802?reflink=desktopwebshare_permalink.

[22] Jeong-Soo Hwang, *Chip shortages spread to backend firms, disrupting supply chains*, The Korea Economic Daily (Feb. 15, 2021), https://www.kedglobal.com/newsView/ked202102150017.

States, Japan, and the Netherlands.[23] ASML, a Dutch company, "holds a near-monopoly" in lithography systems, a "critical part of the chip-making process."[24] Given ASML's dominance in the market, "for certain components, especially regarding [extreme ultraviolet] lithography equipment, there is often only one supplier in the world."[25] However, ASML has experienced its own share of supply constraints, recently reporting a decrease in expected fourth-quarter earnings due to "a materials shortage in the supply chain."[26] Moreover, as the world's diminished access to critical minerals, such as nickel and magnesium, spills over into other minerals and rare-earth elements, this will also impact the ability of the United States, Japan, and the Netherlands to produce wafer fabrication equipment, and will also affect producers located in other countries such as Germany.[27]

Weather-related outages in Texas. The severe winter weather event in Texas earlier this year, and the pervasive power and water outages it caused across the state, resulted in supply disruptions for chips for many end-users. Austin, Texas is a hub for semiconductor fabrication plants

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[23] Jeffrey D. Bean and Stephen Ezell, *When the Chips are Down: Policy Priorities for Sustaining U.S. Semiconductor Leadership*, War on the Rocks (May 14, 2021), https://warontherocks.com/2021/05/when-the-chips-are-down-policy-priorities-for-sustaining-u-s-semiconductor-leadership/.

[24] Jack Denton, *ASML Cuts Guidance in the Face of Supply Chain Issues. The Chip Stock Is Falling*, Barron's (Oct. 20, 2021), https://www.barrons.com/articles/asml-cuts-guidance-supply-chain-issues-51634728074.

[25] Jan-Peter Kleinhans and Dr. Nurzat Baisakova, *The Semiconductor Value Chain*, Stiftuing Neue Verantowrtung (Oct. 2020), https://www.stiftung-nv.de/de/publikation/global-semiconductor-value-chain-technology-primer-policy-makers.

[26] Denton, *ASML Cuts Guidance in the Face of Supply Chain Issues*.

[27] The U.S. Government has many times expressed serious concerns over China's dominance of the critical minerals and rare earth elements supply chains both during then President Trump's Administration and currently President Biden's Administration, as China has repeatedly threatened to restrict access to these strategic materials. *See, e.g.*, The White House, *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth: 100-Day Reviews under Executive Order 14017*, at 8-9, 48-49, 169 (June 2021), https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf; Executive Order 13953, *Addressing the Threat to the Domestic Supply Chain From Reliance on Critical Minerals From Foreign Adversaries and Supporting the Domestic Mining and Processing Industries*, 85 Fed. Reg. 62,539 (Sept. 30, 2020); Department of Commerce, *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals* (June 4, 2019); https://www.commerce.gov/data-and-reports/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals; Yun Li, *Here's Why China's Trade War Threat to Restrict Rare Earth Minerals Is So Serious*, CNBC (May 30, 2019), https://www.cnbc.com/2019/05/30/ heres-why-chinas-trade-war-threat-to-restrict-rare-earth-minerals-is-so-serious.html; Keith Bradsher, *Amid Tension, China Blocks Vital Exports to Japan*, The New York Times (Sept. 22, 2010), https://www.nytimes.com/2010/09/23/business/global/23rare.html.

in the United States.[28] The massive infrastructure outages in Texas caused by the winter storms and cold fronts forced these plants to close during the crisis, cutting off operations for critical domestic production of downstream products that use semiconductors.[29]

III. THE UNITED STATES SHOULD USE A VARIETY OF POLICY TOOLS TO ADDRESS ONGOING SUPPLY CHAIN CHALLENGES.

In light of the foregoing, CTIA recommends that the U.S. Government take several steps to improve the stability of the semiconductor supply chain. *First,* the U.S. should continue to take steps to boost domestic production. To this end, the Government should use available policy tools to promote and protect domestic production and research and development for products in the semiconductor supply chain. As CTIA previously has explained, financial incentives have a critical role to play in meeting these objectives, including the groundbreaking CHIPS Act passed as part of the 2021 National Defense Authorization Act and the existing mechanisms for government grants, loans, and tax credits for the chip industry and the downstream wireless industry through the Defense Production Act Title III funding authority, Department of Energy grant and loan programs, and tax policies issued by the Department of Treasury.[30] The Administration should continue exploring these avenues and should urge Congress both to complete appropriations for the CHIPS Act and to pass the pending Facilitating American-Built Semiconductors Act ("FABS Act"), which provides for an investment tax credit for semiconductor manufacturing investments.[31]

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[28] Willy Shih, *Severe Winter Weather In Texas Will Impact Many Supply Chains Beyond Chips*, Forbes (Feb. 19, 2021); https://www.forbes.com/sites/willyshih/2021/02/19/severe-winter-weather-in-texas-will-impact-many-supply-chains-beyond-chips/?sh=1c25860d358a.

[29] *Id.*; *see also Winter weather closes Texas chip plants, worsening shortages*, TechExplore (Feb. 19, 2021), https://techxplore.com/news/2021-02-winter-weather-texas-chip-worsening.html.

[30] *CTIA April 2021 BIS Comments* at 10-11.

[31] Facilitating American-Built Semiconductors Act, S. 2107, 117th Cong (introduced in Senate June 17, 2021), https://www.congress.gov/bill/117th-congress/senate-bill/2107/text. As of the filing of these comments, a version of the FABS Act was included in the pending Build Back Better legislation. *See* Build Back Better Act, H.R. 5376, Rules Committee Print 117-18 (Nov. 3, 2021), https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-117HR5376RH-RCP117-18.pdf.

In addition to these incentives, the U.S. Government should look to other policy solutions to boost domestic semiconductor supply. These could include providing better workforce training through a range of educational programs to strengthen the skilled labor force; enhancing access to highly skilled workers through visa programs and tax-incentives to offset the rise in domestic wage rates; and offering better asset depreciation offsets for plant and manufacturing equipment investments. As the U.S. considers how to improve domestic production and innovation in the semiconductor market, it should remain focused on the entire semiconductor production vertical, including assembly, testing, and packaging.

Second, the U.S. should engage in diplomacy to improve relationships between countries integral to the semiconductor supply chain in order to foster global supply at all phases of production. Strong diplomacy efforts not only will help to ease tensions between countries that are critical to semiconductor production, but also will help to foster multilateral policies that serve the United States' "shared interest[s]" with its allies such as South Korea, including "strong protections against countries that disrupt free and open competition," "protect[ing] intellectual property," and "prevent[ing] core technologies from being exported to bad actors."[32]

Third, given the centrality of semiconductors to U.S. national security, the U.S. should ensure that global humanitarian aid, including pandemic relief, vaccine distribution, and natural disaster aid reaches areas with facilities critical to the semiconductor supply chain. To this end, CTIA appreciates the Biden Administration's recent announcement that it is providing an additional 1.5 million COVID-19 vaccine doses to Taiwan with no "strings attached."[33] CTIA encourages these

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[32] Center for Strategic and International Studies, *Supply Chain Resilience: Opportunities for U.S.-Korea Cooperation*, Transcript at 5 (Sept. 8, 2021) (Remarks of Don Graves), https://www.csis.org/events/supply-chain-resilience-opportunities-us-korea-cooperation.

[33] Michael Martina, *U.S. gives 1.5 million more COVID-19 vaccine doses to Taiwan*, Reuters (Nov. 1, 2021), https://www.reuters.com/world/asia-pacific/us-gives-15-million-more-covid-19-vaccine-doses-taiwan-2021-10-31/.

and other efforts to ensure that our allies and partners worldwide can weather the storms caused by the pandemic, environmental disasters, and other crises.

Fourth, the U.S. Government should avoid heavy-handed policies that could distort the market for semiconductors. Interventions such as set-asides for certain industries or efforts to micromanage the supply, while well-intentioned, could lead to unintended consequences including strains on the semiconductor supply chain and access challenges for downstream industries that are not targeted by the interventions. In fact, doing so would be impracticable as semiconductor chips are specifically designed for very particular uses and applications such that one chip designed for a specific application is not interchangeable with another chip used in a different application. This fact, in combination with the hundreds and thousands of semiconductor chip types and designs produced abroad, would render any effort by the U.S. Government to allocate chips ineffective. Further, shifting supply away from the wireless sector could undermine the Administration's broadband objectives. In that vein, advancing the move to 5G deployment, where devices largely use next generation chips, could free up capacity for other industries that are more dependent upon the previous generation of chips.

After taking steps to boost domestic supply and facilitate and protect production capabilities of our allies and trade partners worldwide as set forth above, the best action that the United States Government can take to improve access by downstream users is empower those users to make informed purchasing decisions based on the realities of the market. Accordingly, *fifth*, the U.S. should share critical, publicly-available, non-confidential market information with U.S. companies, on an industry-neutral basis, to help downstream semiconductor users make purchasing decisions. Indeed, the impact of supply bottlenecks is exacerbated when companies lack adequate access to information to manage inventory and plan future supply sources. The U.S. government should do what it can to minimize panics in the market by sharing such information as appropriate with companies that rely on semiconductors to make products that serve the U.S. market.

IV. CONCLUSION

Given the importance of the semiconductor supply chain to the wireless communications industry, and the importance of wireless technology to modern life and the United States' success and prosperity, we hope the Government considers implementing the recommendations proposed in these comments. CTIA remains committed to doing its part to advance the United States' leadership in technology and innovation, and looks forward to continuing to work with Commerce and BIS on critical supply chain issues.

Respectfully Submitted,

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