

Testimony of Micron CEO Sanjay Mehrotra
Senate Commerce Committee Hearing:
Developing Next Generation Technology for Innovation
March 23, 2022 – 10:00 am

Chair Cantwell, Ranking Member Wicker, and members of the Committee, I am honored to appear before you to discuss the semiconductor industry and its importance in helping our country maintain global competitiveness and secure a leadership role in semiconductor manufacturing and critical future innovation and technology. I commend this committee for its leadership on these important issues.

The COVID 19 crisis and the ongoing conflict in Russia & Ukraine have underscored the fragility of our supply chain and the national security and economic risks of a decline in chip manufacturing in the United States. In this environment, it is increasingly urgent that Congress move forward on efforts to reconcile and pass an innovation and competition bill that includes full funding for the CHIPS Act. This investment will kick start investment in workforce development, R&D, innovation, and expansion of manufacturing in the near term. It is equally important that Congress passes the refundable investment tax credit, part of the FABS Act, to create a long-term incentive that would invigorate domestic manufacturing in the semiconductor industry and allow companies to invest with confidence for the future. With your permission I will submit my full statement for the record.

I appreciate the opportunity to speak today about the important responsibility that we in the semiconductor ecosystem have in partnership with the government to protect United States Technology Leadership for the future. I testify today as Chief Executive Officer of Micron – the world leader in memory and storage technology. Micron manufactures DRAM chips, which provide rapid access to data for processing, and NAND flash chips, which provide long term data storage. Memory is the leading-edge of semiconductors and Micron is leading the world in both DRAM and NAND memory. Memory chips can be found anywhere that data is stored or processed – cell phones, automobiles, computers, defense systems – and is truly foundational for all future technological innovation and development. -Micron is the only company developing leading-edge memory and storage technology here in the U.S., with operations in seven different states – Idaho, Colorado, Texas, Minnesota, Virginia, California, and Georgia.

We are headquartered in Boise, Idaho, and we have 43,000 team members worldwide, with nearly 10,000 of them located in facilities across the country. These facilities include our Manassas, Virginia, plant just 30 miles from here, where we manufacture memory and storage solutions. These products not only unlock innovation across American industries, but also create the much-needed legacy chips for our automotive and defense industry. Our Boise headquarters is home to the world's most advanced memory research center including 6,000 researchers, engineers, technicians, and other support functions.

We also recently opened an advanced memory design center in Atlanta, Georgia, where we will partner with leading institutions like Georgia Tech and the Atlanta University Center Consortium of Historically Black Colleges and Universities to source outstanding and diverse STEM talent. This work is critically important because it helps address the workforce development and national security challenges of the present moment.

Micron is committed to investing in the United States and we have already made significant contributions to leading-edge research and development and other areas that will lay the foundation for the more robust domestic manufacturing programs and facilities of the future.

I hope to leave you with two key takeaways today:

- First: The United States must be self-sufficient in development and production of semiconductors. This is crucial to our technology leadership in the world and imperative to our national security. Our country requires a robust semiconductor industrial base to maintain our global technological leadership in areas from essential consumer products to cloud computing capabilities and defense systems. In particular, memory and storage technologies, which are foundational for all modern computing, are indispensable to a digital and data-intensive future. Incentive programs such as those included in the CHIPS legislation are a good start. This initial funding must be immediately supplemented by long-term incentives, including a refundable investment tax credit, to ensure the continued viability of the scaled-up industrial base and guarantee the domestic supply of semiconductors – both leading-edge and legacy chips – into the future. I want to emphasize that the CHIPS legislation is necessary but not sufficient – the refundable investment tax credit is equally important to enable confident long-term investments in significant manufacturing infrastructure. As this ambitious process will require years, if not decades, of sustained investment, speed is of the essence. Strengthening U.S.

capacity to manufacture memory and storage semiconductors will leverage industry's technological leadership to enhance the country's national and economic security;

- Second: A renewed focus on supply chains and American manufacturing must be matched by continued investment in research and development to sustain the technological leadership of American universities and semiconductor companies and to meet the technological demands of the emerging data economy. The semiconductor industry invested \$40 billion in research and development in 2020. The industry consistently spends 20% of revenue in R&D on average, the highest of any industry. CHIPS Act funding for the National Semiconductor Technology Center (NSTC) and the Department of Defense-led Microelectronics Commons will support these efforts by leveraging the innovation of American researchers and startups to bring new technologies from "lab-to-fab," unlocking the benefit of these technologies for American industry. At the same time, expanded funding for research by the NSF, NIST, and Energy Department's Office of Science among others authorized under the pending innovation legislation will enable the basic research needed to unlock the next generation of advances in microelectronics. An increase in R&D investment supported by the CHIPS Act will generate strong growth in employment and economic output. In fact, according to the Semiconductor Industry Association's research, every dollar invested by the government in R&D creates \$16 in GDP growth.

The importance of a domestic industrial base

Two-thirds of silicon wafers produced globally today are in memory and storage semiconductors. Of that total, only 2% is produced in the United States, all of it at our Manassas, Virginia fab. The remaining 98% is produced in Asia in large-scale fabrication facilities supported by supplier and talent ecosystems that have been developed with extensive domestic government support over the past 20 years. Collaboration between government and industry beginning with CHIPS Act funding and a refundable investment tax credit will kick-start the process of bringing investments back to the United States but will not fully reverse this trend.

As a result, U.S. manufacturers have come to rely on semiconductors produced overseas, primarily in Asia. With global supply chains facing unprecedented pressure in recent years, it is critical that the U.S. address this systemic vulnerability and invest to expand its domestic industrial base across all fronts,

including R&D, manufacturing, skilled workforce, and essential component supply chains. In addition, as recent events have demonstrated, U.S. leadership in semiconductor technology is a core component of our country's leverage in defending a peaceful international order.

Memory and storage have grown from 10 percent of the global semiconductor industry twenty years ago to about 30 percent of the semiconductor industry today. We expect this trend to continue. For example, 5G phones have 50 percent more memory (DRAM) and double the storage (NAND) content compared to 4G phones. Today's autonomous vehicles require more than ten times the amount of memory and storage that previous generation cars used to use and this memory consumption will continue to increase as this technology evolves and proliferates.

Given that memory and storage will play an indispensable role in driving innovation and manufacturing not only in the semiconductor industry, but across the global economy, it is essential to create and sustain an environment that will enable ambitious expansion of memory and storage manufacturing capabilities in the United States.

Federal Incentives

Federal incentives are critical to enabling the large scale of manufacturing required in memory and storage at a globally competitive pace. To be commercially viable over the long term, memory and storage fabs must produce at very high volumes consistently over time. Multiple facilities are required to achieve this scale, each costing more than \$20 billion fully equipped. Technological advancements come with increasing complexity, requiring ever-higher capital and operating expenses on the part of memory and storage manufacturing companies. Our competitors abroad have benefited from 35-45% lower operating costs due to the investments of other governments.

For example, incentives offered by South Korea resulted in the ROK government's announcement that the country's leading semiconductor companies will invest more than \$450 billion in the semiconductor industry by 2030. European nations have also been successful in attracting large-scale investment due to their significant government incentives. To ensure the long-term impact of such investments, manufacturing incentives must be coupled with a refundable investment tax credit (ITC). While the CHIPS grant program as currently envisioned will help bridge the cost differential between the United States and other countries in upfront costs, a refundable ITC is critical to bridge the

differential in ongoing costs of operation. A refundable ITC will also provide an equitable and efficient means to allocate government funds toward strategic projects with the greatest potential to help build domestic semiconductor self-sufficiency. Micron appreciates efforts in this chamber and in the House to date to introduce robust ITC initiatives such as the FABS Act. The exponential and transformational impact this will have on the U.S. economy should not be underestimated. If semiconductor companies can make these large investments in this country in partnership with the US government, the impact will be significant. The chip industry tends to benefit from colocation and highly concentrated clusters or ecosystems. When fabs are sited in new locations, extensive pools of talent and resources inevitably follow. Those investments have in recent years been primarily in Asia and combined with other economic factors have led to a 35-45% cost disadvantage for U.S. semiconductor memory companies to build and operate domestic fabs vs. Asian competitors. This is a momentous opportunity to change that trajectory and put the U.S. on competitive ground for the future.

Micron has announced plans to invest more than \$150 billion globally over the next decade in leading-edge memory manufacturing and research and development. As part of this process, we continue to explore plans to build new fabs in the United States. Our expansion plans, which if executed would constitute the largest single semiconductor investment in the history of the United States, require close coordination with federal and state policies to ensure the economic viability of our operations in a global, competitive marketplace.

Micron is fully aware of its responsibility to the American people whose tax dollars would fund proposed incentives programs. While we anticipate that a significant amount of federal funding will be required to make a mega-fab viable, a major investment in a new domestic fab would be an investment that benefits the entire U.S. supply chain. For example, building a fab require tens of billions of dollars of capital expenses in manufacturing equipment, construction, and IT systems, as well as billions of dollars annually in operational expenses related to gases and chemicals, technical services, repair and maintenance, utilities, and other materials. These costs manifest as direct, sustained investment in the U.S. supplier base. Further, a new fab would result in tens of thousands of community jobs over the long term, a large proportion of which would be in trade roles for constructing and maintaining these leading-edge clean room facilities. In other words, successful and sustainable investments in new manufacturing will not only benefit the U.S. semiconductor industry, but also the prosperity and national security of the United States as a whole.

Micron and our partners stand ready to work with members of this Committee, the entire Congress, and the Executive Branch to ensure the United States achieves the world's leading digital and data-intensive economy in the decades ahead. I urge all parties to capitalize on the momentum generated by today's hearing and help pass both the CHIPS Act and the FABS Act into law. Doing so will set the stage for a transformational investment in large-scale leading-edge memory manufacturing in the United States and ensure the United States does not lose out to its competitors abroad. Thank you again, Chair Cantwell, Ranking Member Wicker, and members of the committee for the opportunity to testify today and I look forward to your questions.