

**Comments Submitted to the U.S. Department of Commerce
Implementation of the CHIPS Incentives Program
Request for Information
Docket #: 21006–0213
Deadline: November 14, 2022
Submitted by: IPC**

Introduction

IPC thanks the U.S. Department of Commerce for its commitment to timely implementation of the CHIPS for America Act and for its ongoing engagement with stakeholders. We welcome the opportunity to provide our views on the implementation of the CHIPS Incentives Program.

IPC is the global trade association for the electronics manufacturing industry. Our 3,000 member companies represent all facets of the electronics industry, including design, printed circuit board (PCB) manufacturing, electronic assembly, and advanced packaging. IPC is the leading source for industry standards, training, industry intelligence, and public policy advocacy. Our work with industry is focused on one goal: building electronics better.

CHIPS Incentives Program

The CHIPS Incentives Program offers a unique and meaningful opportunity to support the long-term growth of a strategically important sector of the U.S. economy. Even in advance of the request for proposals, the Incentives Program is already stimulating investment commitments and interest in the U.S. industry, including in areas where significant supply chain gaps exist. To maximize the incentive funding available, IPC urges the Department of Commerce to take into consideration the following four priorities:

- Invest in advanced packaging (IC substrates and package assembly & test)
- Invest in supply chain partnerships
- Invest in high density interconnects
- Invest in industry-recognized workforce programs

Invest in advanced packaging capacity

Tomorrow's most cutting-edge electronics systems will rely on the most cutting-edge chips which, in turn, will rely on next-generation advanced packaging. In fact, advanced packaging is already overtaking silicon scaling as the leading driver for semiconductor innovation. As such, the United States urgently needs to cultivate a more robust domestic advanced packaging ecosystem if it wants to maintain global leadership in semiconductor design and manufacturing. Failing to strengthen U.S. advanced packaging capabilities will not only curb innovation; it will also *lengthen* the semiconductor supply chain, as manufacturers will still need to send their chips abroad for final component packaging and assembly.

The industrial base challenge to the United States is daunting, as the domestic advanced packaging ecosystem— which includes integrated circuit (IC) substrate fabrication and semiconductor assembly and test—is anemic. As IPC detailed in its [North American Advanced Packaging Ecosystem Gap Assessment](#) last November, the United States has little to no IC substrate fabrication capabilities or capacity and severely limited assembly and test capacity. Today, North America’s share of global packaging production is a mere 3 percent. Virtually every U.S.-fabricated chip is assembled outside of the United States using IC substrates that are also fabricated outside of the United States.

Bolstering advanced packaging is critical to safeguarding U.S. economic and national security, as well as U.S. leadership in technological innovation. In developing final criteria for the CHIPS Incentives Program, the Department of Commerce should encourage and favorably review applications that boost capacity and innovation in advanced packaging. The Department especially should support applications that establish a solid foundation for state-of-the-art, commercial IC substrate manufacturing in the United States. The IC substrate market is fiercely competitive with relatively low margins. New IC substrate facilities will likely be impossible without federal assistance.

Failure to fund incentive applications for advanced-packaging-related projects would undermine the goals laid out in the CHIPS Act and the long-term strength of the U.S semiconductor industry.

Invest in supply chain partnerships

Final component makers ultimately decide where to source each element of a finished component. Component makers and their suppliers need to see each other as partners instead of as customers and suppliers. Partners work to support each other’s success; whereas customers tend to seek the lowest prices even if they weaken the suppliers’ ability to remain solvent and invest in innovation. In the context of geopolitical tensions and global supply chain risks, customers and suppliers are dependent upon each other’s success, so their business relationships should reflect this fact.

In allocating funding, IPC urges the Department of Commerce to affirm its support for building resilient supply chains domestically and in collaboration with ally countries. To that end, the Department of Commerce should make supply chain partnerships a key criterion in evaluating incentive applications. Chip component manufacturers should be required to identify their supply chain partners and the degree to which their partners support the growth of robust semiconductor and electronics manufacturing ecosystems in the U.S. and/or allied countries. These partnerships should encompass capacity building projects, as well as R&D and workforce development.

Invest in High-Density Interconnects

Semiconductor chips—as marvelous as they are—do not float in the air. They are useless on their own. So, too, are the advanced IC-substrates that the chips are bonded to. While they too are important and critical pieces of an electronic system, they are intermediate steps in a much larger process of designing and manufacturing final products and systems for use in key sectors such as defense, high performance computing, networking, aerospace, automotive and medicine. It is not until the final package is assembled—when semiconductor chips are bonded to substrates, encapsulated, and tested—when an advanced package becomes functional, valuable, and available to be integrated into electronic systems and products.

Advancements in semiconductor packaging also have direct impacts on PCB fabrication and electronic hardware assembly. The more sophisticated IC packages become, the more complex the corresponding

PCB designs must become. Final system-level assembly by EMS/ODM providers is where the final product comes to life; it's where electronics are assembled, powered-on, burned-in, firmware/software loaded, and final system tests are performed. Both PCB and EMS/ODM providers play a critical role in final system delivery and availability.

A healthy, capable assembly ecosystem is needed to bring a wide variety of technologies together to manufacture finished products. Any disruptions, bottlenecks, or capability gaps within this end-to-end ecosystem can lead to delays in new products and innovations, limiting the ability of the United States to manufacture the most advanced electronic systems. Therefore, it takes all elements within the supply chain—from silicon to systems—to successfully produce electronic hardware products that meet customer demands.

This silicon-to-systems mindset is especially important given the blurring of the lines between EMS manufacturers and OSATs and between PCB and IC substrate fabricators. High-density interconnects (HDIs) manufactured by PCB fabricators, as an example, are very similar in sophistication and function to lower-end IC substrates. These HDIs, moreover, are critical in facilitating integration of cutting-edge chips into electronic assemblies. The United States is desperately in need of increased investment in HDI technology as the innovation and supply chain have largely moved offshore. Accordingly, we urge the Commerce Department to make PCB fabricators eligible for incentive grants given their likeness to IC substrate makers and their criticality to electronics assembly.

Invest in Industry-Recognized Workforce Programs

An emergent U.S. advanced packaging industry will require a skilled workforce, but this workforce should be cultivated as part of ongoing initiatives to create stackable, portable job training programs and career pathways in the electronics manufacturing industry. Despite the critical importance of electronics in modern society, a meaningful and sustainable domestic workforce pipeline for electronics manufacturing has never been established. Initiatives to develop such a pipeline lost traction in the early 2000s as high-volume electronics manufacturing migrated from the United States to Asia. A resurgent U.S. industry, however, is collaborating in new, exciting ways to expand workforce training programs and to create career pathways for individuals entering electronics manufacturing.

The U.S. advanced packaging industry is likely to remain relatively small over the next five to 10 years, meaning that the number of Americans needed to work in advanced packaging will be small as well. Trying to establish independent workforce training programs to serve this niche market will be challenging and expensive, not to mention a disservice to workers who are already striving for portability in addition to upskilling. By creating a workforce pipeline for the electronics industry, we will also organically create an ongoing, sustainable pool of potential workers for advanced packaging.

Aligning advanced packaging workforce training with broader electronics manufacturing workforce development also makes sense because the lines are blurring between IC substrate and PCB fabrication as well as between first- and second-level assembly. In fact, it is likely the case that the sophistication of IC substrate manufacturing today characterizes the PCB and EMS manufacturing of tomorrow. For this reason, the U.S. Government should view electronics interconnection as a key strategic priority, requiring a skilled workforce. This skilled workforce will naturally pivot to the opportunities that exist as the industry evolves.

Ultimately, establishing this pipeline will be a multifaceted effort, requiring a variety of curricula for use by different stakeholders training workers for different roles. Engineers will have different needs from

technicians, inspectors, and operators. It is critical, however, that the curricula be developed through job task analyses to align with industry needs and that industry-recognized credentialing be used to validate worker competencies. We urge the U.S. Government to better understand the existing mechanisms for workforce training in the electronics sector and to support these mechanisms through the CHIPS Incentives Program.

Conclusion

Thank you for the opportunity to provide input on federal incentives, infrastructure, and R&D needs to support the growth of the U.S. semiconductor industry. We offer these views on behalf of the electronics manufacturing industry and stand ready to support federal agencies, including NIST and DoD, as they implement programs and allocate funding authorized by the CHIPS for America Act.