BUILD ELECTRONICS BETTER

April 1, 2025

Bureau of Industry and Security
Department of Commerce
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RE: Notice of Request for Comments on Section 232 National Security Investigation of Imports of Copper

Introduction

IPC, the global electronics association, appreciates the opportunity to provide comments to assist in your investigation of copper imports under Section 232 of the Trade Expansion Act of 1962. Electronics manufacturing underpins virtually every sector of the economy – including automotive, medical, defense, artificial intelligence and quantum computing. To meet the nation's economic and national security needs, the United States must revitalize its domestic electronics manufacturing industry and build a strong ecosystem with resilient supply chains powered by international trade.

The domestic electronics industry necessarily depends on a global supply chain to source copper and products containing copper to manufacture integrated circuit (IC) substrates, bare printed circuit boards (PCBs), PCB assemblies (PCBAs), wiring and cabling, and finished products. The U.S. does not produce copper at the scale and/or with the attributes required by the domestic electronics industry. Tariffs on key inputs like copper and its derivative products would increase manufacturing costs, hindering the industry's competitiveness.

Electronics Manufacturing Needed for National and Economic Security

Electronics are fundamental to national security. President Trump wisely ordered a review of national defense and economic infrastructure vulnerabilities in his 2017 Executive Order 13806. This review, and subsequent reviews conducted by the Departments of Defense, Commerce, and Homeland Security, have identified electronics manufacturing as a key national and economic security dependency and one for which the U.S. is alarmingly vulnerable. Government reports, in fact, have encouraged increased investment in PCB and PCBA industries, along with more favorable sourcing policies, to support a more resilient electronics manufacturing industry with greater capabilities and capacities.

Domestic Industry Challenges

Despite its strategic importance to national and economic security, the U.S. electronics industry is weak and in need of rebuilding after 25 years of offshoring. To stem the decline, domestic industry, the larger business community, and academics, have called on the U.S. Government to invest in the industry through the Defense Production Act, and to expand tax incentives to cover PCB and PBA manufacturing.

In 2022, the U.S. electronics manufacturing industry produced approximately $781 billion in output and directly employed nearly 1.3 million Americans. In 2024, the industry's outlook was optimistic, driven by reshoring trends and increased electronics demand. However, this optimism is undermined by uncertainty and rising input costs.

According to a recent industry sentiment survey, U.S. manufacturers are already taking precautionary actions:

- 60% are freezing (13%) or considering freezing (47%) salaries
- 58% are freezing (13%) or considering freezing (45%) hiring
- 39% are considering layoffs
- 8% have already initiated layoffs
- Additional cutbacks noted were reductions to pay, benefits, and training budgets

In contrast, Asia Pacific manufacturers report fewer cutbacks (in some cases 0%), highlighting the potential competitive disadvantage U.S. firms face with rising costs of manufacturing. Every dollar spent on higher material costs is a dollar not invested in equipment, facilities, automation, or workforce development. U.S. electronics manufacturers already operate at a cost disadvantage; increased tariffs on copper would exacerbate this.

Copper Use in Electronics
Copper is an essential across the electronics manufacturing value chain. It serves as a conductor, thermal management medium, and interconnect material. In some components, copper can account for up to 80% of material content.

Common copper-based materials in electronics include:

Material	Uses
Copper Foil	Conductive layers of a PCB
Copper Clad Laminates (CCL)	The base material for most PCBs
Copper anodes	Used in electroplating baths for depositing copper
Copper sulfate solution	Used in the copper plating process
Copper-based solder materials	Copper-tin or Copper brazing alloys are used for lead-free soldering or in high-temperature applications
Copper bus bars and copper heatsinks	Used in power electronics PCBs to handle high currents

IC Substrates
IC substrates, akin to miniaturized circuit boards, provide interconnection within a semiconductor package and connect semiconductor chips to the PCB and the broader system. Manufacturing this essential technology relies on high-purity, ultra-thin copper foils – none of which are manufactured in the U.S. and must be imported from Japan and elsewhere in Asia.

These foils support fin-line circuit definitions (<25 microns), used in semiconductor advanced packaging.

Printed Circuit Boards (PCB)
Cooper is an essential material in the fabrication of PCBs. It is the base material for the conductive traces, pads, and vias that facilitate electronics interconnection. Copper comprises 25-35% of total PCB material costs, though some types of boards can be higher due to specialty products or higher copper content. Flexible PCBs and high-reliability boards used in military and medical systems depend on specialty copper products.

Types of PCB Applications

PCB Type	Application
Single-layer PCBs	Basic automotive controls, simple lighting, power supplies, toys, home appliances
Double-layer PCBs	IoT devices, thermostats, sensors, industrial control panels, medical monitoring devices, security systems
Multilayer PCBs (4–10 layers)	Computer motherboards, graphic cards, servers, network infrastructure, aerospace and avionics systems, industrial automation
HDI PCBs	Smartphones, tablets, wearables, high-speed networking, advanced medical devices, aerospace, AI and high performance computing
Heavy Copper PCBs (≥2 oz copper)	Power electronics and inverters, EV charging, renewable energy systems, industrial motors, robotics, military and aerospace radars
Metal-Core PCBs (MCPCBs)	Automotive LED lighting, power amplifiers and RF communication systems, high-power industrial equipment, EV battery management systems
Flexible PCBs (FPCs)	Wearable sensors, Medical implants, dashboard and senor connections, defense electronics, robotic arms and flexible automation
RF/Microwave PCBs	5G antennas, radar systems, satellite communication equipment, military grade RF systems, GPS tracking devices, high-speed data transmission systems

Wire and Cable

Wire and cable harnesses are prevalent in electronics in every sector of the economy. From telecommunications networks and industrial robotics to automobiles and passenger airplanes. These critical electronics components ensure the transmission of power and information at high-speed, and high temperature, with high reliability. Depending on the product and application, a significant percentage of wire or cable harness content is made of copper

Electronics Assembly
In addition to the fabrication of core electronics components like PCBs and IC substrates, electronics manufacturing consists of both component-level and system level assembly. These critical processes pull together the various components and parts within an electronic design to assemble them in a package. Semiconductor chips, substrates, PCBs, passive components, and wire harnesses among other components are all inputs to electronics assembly.

Whether in automotive, telecom, defense and aerospace, healthcare, AI, high performance computing the basic components of electronic systems contain copper.

Below are some of the materials used to build the electronics that enable our modern infrastructure.

Component Type	Copper Contents
Bare Printed Circuit Boards	Traces, plating, vias, copper-clad laminates
ICs & Semiconductors	Interconnects, wire bonding, microbumps, RDLs
Resistors	Wire-wound coils, terminations
Capacitors	Copper terminations, leads
Inductors & Transformers	Copper windings
Connectors & Cables	Copper contacts, conductors
Solder & Heatsinks	Copper solder, thermal dissipation
Power Components	Copper traces, leads, terminals
EMI Shielding	Copper-based RF shields

Supply Limitations
Certain copper materials used in electronics, especially thin foils and specialty laminates are not produced domestically in the near future. In some cases, it would take years to develop the capability to produce specially made copper foil, which would likely not be produced at a cost comparable to existing sources. Of the materials that can be sourced in the U.S., the capacity of these domestic suppliers is not sufficient to meet current demand. One IPC member has already

reported receiving notices from U.S. suppliers about increased lead times and production limits, underscoring the lack of capacity.

Impact of Tariffs
The U.S. is rebuilding its electronics manufacturing base. Collectively, these industries are in need of investment and incentives to build capacity to serve domestic infrastructure needs. Electronics manufacturing is governed by two criteria: cost and reliability. Adding cost to the bill of materials for domestic producers with tariffs on copper will harm their competitiveness. Further cost increases in addition to other pending and active tariffs, could risk reversing the early stages of the revitalization of the U.S. electronics industrial base.

Consider the current state of key segments of the industry in the U.S. It is worth noting, that IC substrate and bare PCB fabricators utilize copper as a primary input and consumable material in their manufacturing processes which includes depositing copper and etching it away to form fine conductive traces. IC Substrate and PCB manufacturing are two of the most vulnerable segments of the industry identified by DoD and Commerce in need of revitalization, yet a tariff on copper would disproportionally impact their production by making them pay a duty on the full value of all copper used in the manufacturing process. Conversely, foreign competitors would only face a tariff on the contents of a finished board, which is much smaller.

IC substrates
- U.S. produces <1% of global supply
- Identified as a critical vulnerability in the semiconductor supply chain

PCBs
- U.S. produces ~4% of global supply; capacity is largely focused on military needs
- Identified as a critical industrial base shortfall for national defense capabilities

PCB Assembly and EMS
- More robust but still limited
- Thin operating margins
- Critical for AI, telecom, and defense

Conclusion
Copper is a foundational material for electronics. Tariffs would harm domestic manufacturers, increase costs, and weaken supply chain resilience – the very issues the U.S. seeks to address.

We welcome President Trump's commitment to strengthening American manufacturing. Electronics design and production are the backbone of innovation and industrial resilience, and we stand ready to work with the administration on a bold strategy to rebuild this vital sector.

President Trump led the way in 2017 with Executive Order 13806 directing a thorough assessment of the U.S. manufacturing and defense industrial base. This review, and subsequent assessments have shed light on the need to revitalize U.S. electronics manufacturing, especially PCB, substrate, and advanced packaging capabilities.

We urge the administration to invest in building domestic capabilities, leverage the tax code to incentivize production, and to exempt copper and its derivatives used in electronics manufacturing from any proposed tariffs. A tariff on copper would set back current efforts to reshore the U.S. electronics manufacturing base by raising costs, and disrupting supply chains. Manufacturers in the United States will be forced to pay higher prices and navigate supply chain delays and disruptions, while foreign competitors will continue to manufacture and export globally without these added costs.

About IPC
IPC is a U.S.-headquartered, global trade association serving all segments of the roughly $3 trillion global electronics industry with more than 1,400 U.S.-based electronics manufacturing members. Approximately 80 percent of IPC members are small-and medium- sized businesses, but some are large household names. Our members span the electronics supply chain from design to raw materials to finished product and everything in between. These industries include equipment and tool manufacturers, bare printed circuit board fabricators, IC substrate manufacturers, advanced packaging, outsourced semiconductor assembly and test, printed circuit board assembly, electronics manufacturing services providers, wire and cable harness manufacturers, and original equipment manufacturers.

Sincerely,

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North American Government Relations