

All about the boards: Why efforts to boost US chip manufacturing could fall short

Massachusetts used to be a hub for the crucial circuit board technology. But no more.

By [Hiawatha Bray](#) Globe Staff, Updated August 27, 2024, 12:43 p.m.



A technician at Remtec in Canton, one of the few companies left in Massachusetts making printed circuit boards. DANIELLE PARHIZKARAN/GLOBE STAFF

Printed circuit boards, the panels found in virtually every electronic device, were once a cornerstone of high-tech manufacturing in New England. Massachusetts alone was home to 17 companies churning out printed circuit boards in communities along the state's tech corridors.

“You could drive up [Route] 128 and you could hit a printed circuit board maker with a golf ball from pretty much anywhere,” said William Gately, sales manager at [Mass Design](#), an electronics manufacturer in Nashua, N.H.

Today, only four companies make printed circuit boards in Massachusetts after two decades of production moving overseas and low-cost foreign competitors grabbing market share, according to industry veteran Gene Weiner, founder of the consulting firm [Weiner International Associates](#). And that has become a problem not only for the state, but also for the US as it tries to protect its technological dominance and national security.

The sharp decline in printed circuit board manufacturing here and across the country threatens to undermine efforts to reduce the nation's reliance on foreign manufacturers for critical technology. For all the money that the Biden administration is spending to revive US computer chip manufacturing — [some \\$52 billion under the 2022 CHIPS Act](#) — it may have limited impact without a similar revival in circuit-board manufacturing.

That's because chips are worthless without printed circuit boards. The boards let chips talk to each other, making them just as essential to the technological future as Intel's fastest microprocessors or Nvidia's latest artificial intelligence chip.

Today, more than half of the printed circuit boards worldwide are made in China. Throw in production from Taiwan, South Korea, and Japan, and 90 percent of all boards are made on the far side of the Pacific.

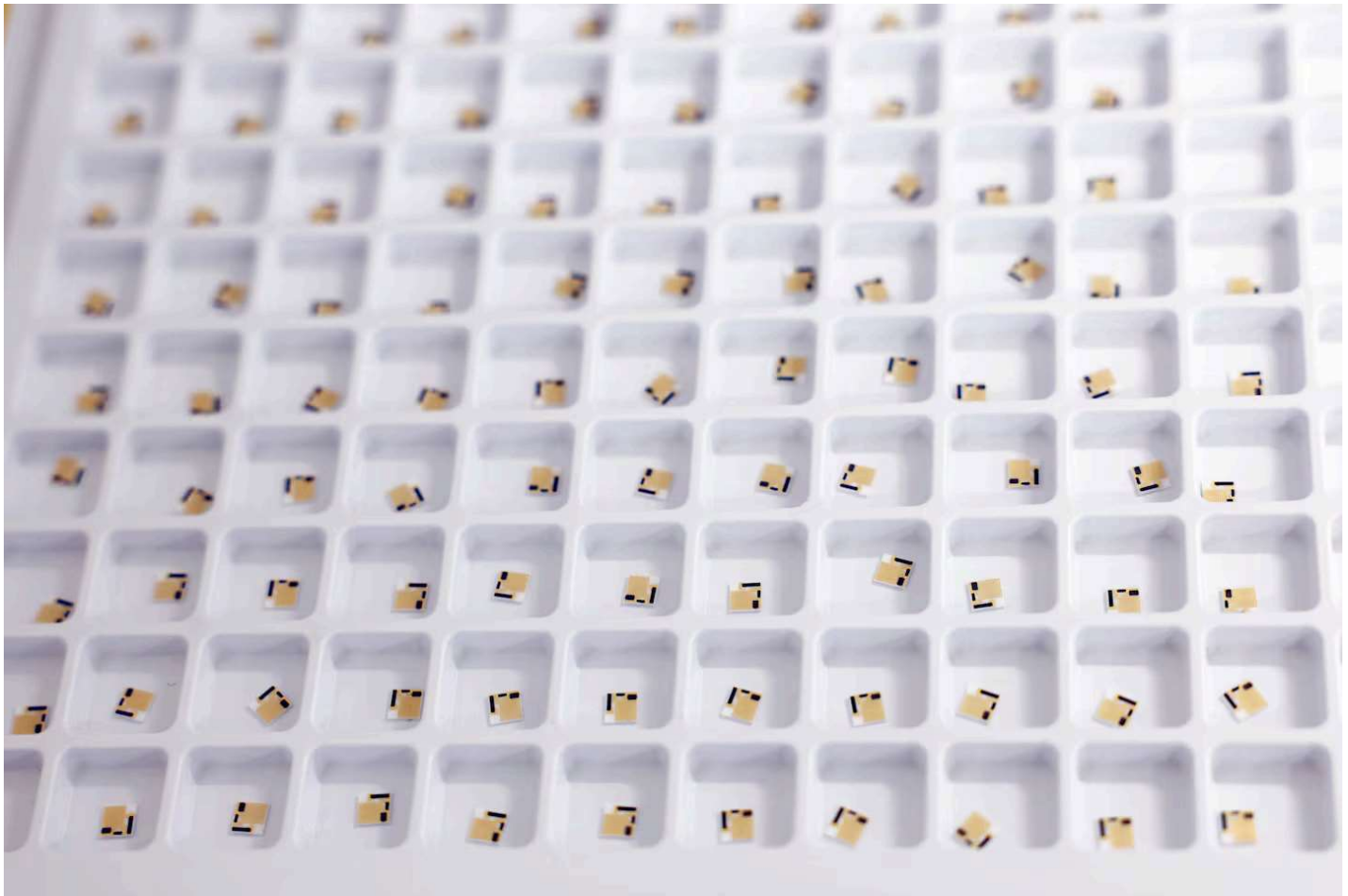
The US manufactures only about 4 percent of the world's printed circuit boards, down from 30 percent in 2000.

“The bigger companies all took the business and moved it all either to China or Taiwan because of price,” said Gately. “That’s what started the dwindling and it just became a domino effect.”

The board makers that are still standing rely on the US military, bolstered by a law that bans the use of Chinese-made circuit boards in military gear. For example, [Amphenol](#), a maker of electronic connectors with 95,000 employees worldwide, runs a circuit-board plant in Nashua that sends 90 percent of its output to defense contractors.

[Remtec](#), a board maker in Canton, devotes about half its output to military uses, including boards made of ceramic material that can keep working even when heated to 700 degrees — just the thing for a hypersonic missile, said Brian Buyea, Remtec’s president. Remtec also sells boards to makers of semiconductor manufacturing systems, the complex machines that fabricate microchips.

Amphenol and Remtec said they would welcome the [money and support that the CHIPS Act](#) has provided to semiconductor firms. Like chip making, manufacturing printed circuit boards on a large scale requires huge capital investments.



Printed circuit boards at Remtec in Canton. DANIELLE PARHIZKARAN/GLOBE STAFF

For example, the systems that imprint the circuit traces onto each board cost about \$900,000. Amphenol's Nashua plant has two of them. In another room, four huge machines, each costing \$600,000, drill holes in the boards.

Four other machines use lasers to cut tiny holes into the surface of each board — sometimes as many as a million holes per board. These laser cutters go for about \$750,000 apiece.

“The equipment is incredibly expensive but you have to have it,” said general manager Kurt Whitcomb.

The national security implications of maintaining reliable and secure sources of printed circuit boards are attracting bipartisan support for aiding domestic manufacturers. US Representatives Anna Eshoo, Democrat of California, and Blake Moore, Republican of

Utah, have proposed legislation that would provide up to \$3 billion in subsidies to help US board makers expand and upgrade.

Even the libertarian think tank Cato Institute sees a need for government to get involved in the printed circuit board industry.

“There’s a very legitimate case for US government support to maintain a sufficient amount of onshore production that’s necessary for defense-related purposes,” said Scott Lincicome, vice president of general economics and trade at Cato.

David Schild, executive director of the trade group Printed Circuit Board Association of America, said national security reaches beyond the military. Critical systems, from financial services to energy to health care, shouldn’t depend on foreign-made circuit boards that make them potentially vulnerable to adversaries, Schild said.

“We should be securing banking infrastructure, medical devices, the water and power grid,” he said.

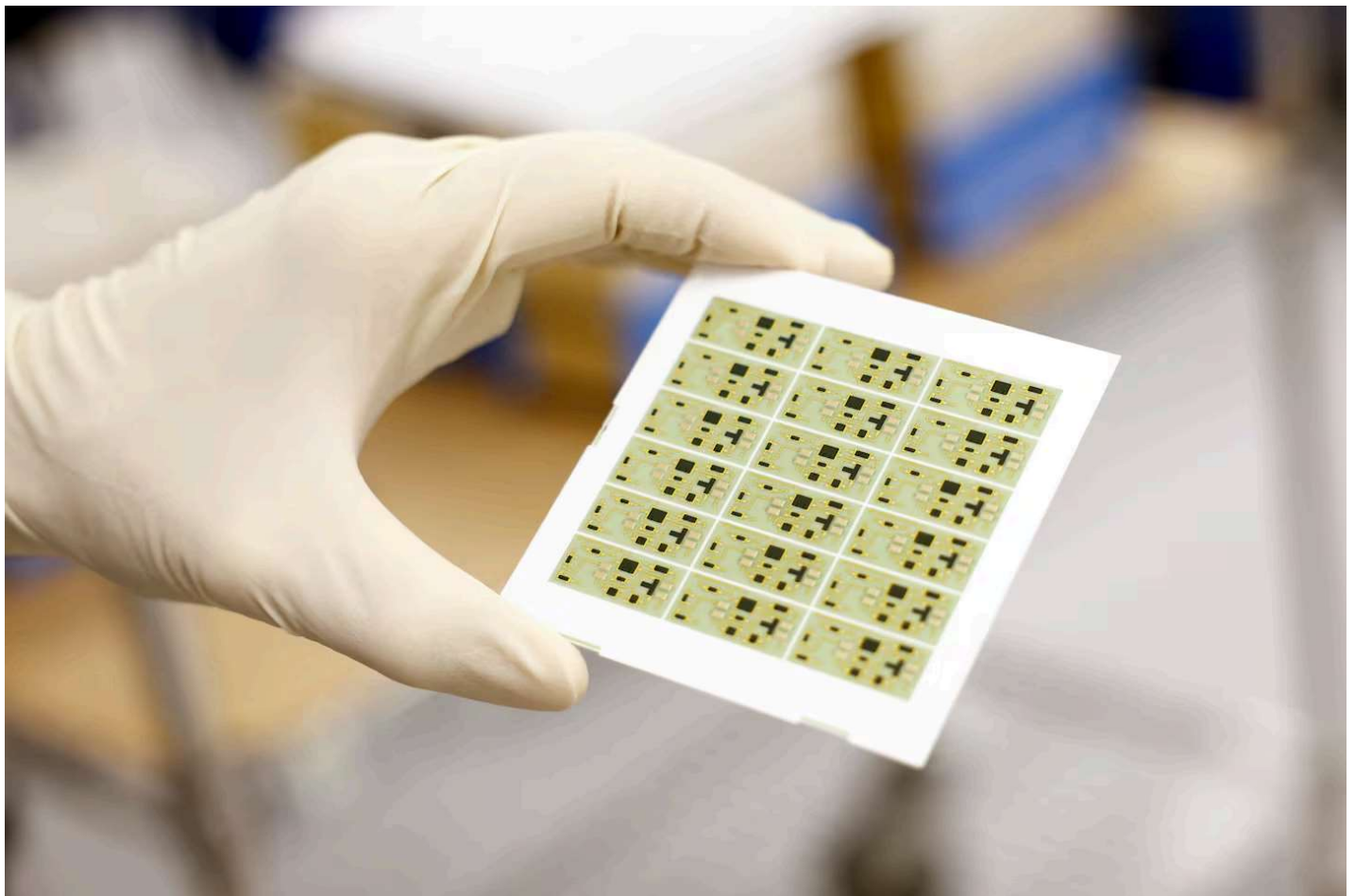
That could mean requiring that electronics used in such critical fields be built with US-made circuit boards. Such a requirement would provide a major incentive to expand domestic board production.

But that poses another hurdle for the industry: finding workers. The contraction of manufacturing has shrunk the pool of skilled technicians and engineers needed to build printed circuit boards.

Remtec, for example, faces the challenge of having to replace workers who have more than 30 years of circuit-board experience, including one production technician who’s 70 years old. The answer, said Buyea, is federal policies and subsidies that grow the industry and job opportunities, and make printed circuit board manufacturing attractive to a new generation of workers.

This type of industrial policy, in which governments shower money on industries considered critical, is not without risks. The Obama administration, for example, targeted the clean energy industry with billions in subsidies, but ended up with high-profile failures, including California solar-panel maker Solyndra, which defaulted on some \$535 million in federal loans, and Waltham battery maker A123, which burned through \$250 million in federal grants before filing for bankruptcy in 2012.

Still, both Democrats and Republicans, unnerved by the rising threat of China, have supported pouring billions into US chipmaking. The printed circuit board industry might be next.



A printed circuit board at Remtec in Canton. DANIELLE PARHIZKARAN/GLOBE STAFF

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