



## From PCBs to Biosensors: The Growing Applications of Printed Electronics

Global printed electronics are on a growth trend and estimated to reach \$45 billion by 2031.

A term that encompasses any electronics created by printing onto a variety of substrates, **printed electronics** are made by printing conductive or semiconductive inks onto a substrate to create electronic parts. These inks are usually made with silver, copper or carbon. Once printed, the ink is dried in place and additional layers applied or printed in order to isolate and protect various components of the final part.

Thin flexible circuits are the most commonly printed electronics, but printed circuit boards (PCB) are now often made using these printing techniques. Other printed electronics include sensors, batteries, photovoltaic cells and antennae. According to General Label, Inc., the benefits of printing electronics versus using traditional printing

methods include lower cost, the ability to print onto flexible materials, better scalability, more customizability and reduced environmental impact.

“Printing also allows you to create prototypes quickly and to modify your designs quickly and efficiently,” the company points out. “This reduces the need for tooling and lowers costs.”

### Poised for Growth

Calling the printed electronics market a “transformative force in the electronics industry,” [Transparency Market Research](#) says the sector is poised for growth and on track to reach \$45.5 billion globally by 2031—up from just \$13.6 billion in 2022.

Demand for printed electronics is skyrocketing right now and driving a compound annual growth rate (CAGR) of nearly 15% for the devices.

The research firm credits the integration of advanced printing technologies with next-generation materials with helping to drive innovation in printed electronics design and manufacturing. “Companies are increasingly investing in research and development to enhance the performance, durability, and functionality of printed electronics,” it says. “From wearable devices to smart packaging, the applications of printed electronics are expanding across industries, driving the market’s rapid growth.”

The printed electronics market is being shaped by several other notable trends, including:

- **Rising demand for flexible and wearable electronics in healthcare, consumer electronics and automotive industries.** Printed electronics enable the production of ultra-thin, lightweight devices that can conform to various shapes, making them ideal for wearable health monitors, smart labels and in-car displays.
- **Growing adoption of sustainable manufacturing practices.** Printed electronics offer an eco-friendly alternative to traditional electronics manufacturing processes, as they consume less material and generate lower waste.
- **The growth of the Internet of Things (IoT) and smart devices.** Printed electronics play a crucial role in the development of IoT applications, enabling the integration of sensors, antennas and energy storage devices into compact and cost-effective formats.

Printed electronics are in use in many practical settings. In healthcare, for example, printed electronics enable the creation of advanced medical devices, such as biosensors, e-skin patches and drug delivery systems, which are transforming patient care and diagnostics. And in the smart packaging field, printed electronics are being used to embed sensors, displays and near-field communication technology into packaging materials, enhancing product tracking and consumer engagement.

### Printed Electronics in Action

This year, a team of researchers from Simon Fraser University and USask developed a material that stores up to 1,000 times more charge than current forms of printed electronics. [Phys.org](#) says that work could move the concept of the IoT—which involves adding printed electronics to everyday objects—another step closer to reality.

The team used an intensely bright synchrotron light (the “Canadian Light Source” or CLS) to analyze its material and improve its performance. “The CLS allowed us to understand the nanoscale structure of our material and understand what enables good performance and what hinders it,” Loren Kaake, SFU associate professor, told [Phys.org](#). “The data we collected at the synchrotron provides some ways to better engineer the materials further.”

Printed electronics are expected to enter the marketplace within about seven years. When the time comes, their material could be readily implemented when the prototypes are being created. “Developing new materials is a very important line of research because one can always use a better material in an application if it’s discovered,” Kaake added. “If our material is amenable to future electronic printing techniques, they’re very much a ‘plug and play’ type of replacement.”