

LPCB market: Growth, trends, and innovation on the horizon

Have you seen those green (sometimes blue or black) little boards inside your favourite gadgets? Yes, they are printed circuit boards (PCBs). Without them, there would be no magic happening—and it's a thin line between magic and really good technology.

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According to Statista research, PCB monthly production since May this year was 30.26 million units. That is significantly higher than 23.75 million units produced in April.

So let's see what trends and innovations are laying ahead on the PCB path of production from now on.

The PCB market

Ever since the beginning, the PCB market has been on an incredible journey. In 1941, Paul Eisler, the Austrian inventor living in the UK, invented the first PCB. The design he produced was rather simple compared to today's look (copper foil on a non-conductive glass base). But the product itself became popular in the mid '50s when the US Army found a practical application.

Till the '80s, PCBs were designed by hand and the only way to save the design was by taking photographs. Then, the first computer was invented. At some point, PCBs were banned because the materials used in production were harmful for the environment.

Luckily, *PCB manufacturing and assembly* has gone a long way to accommodate rules and regulations. Every day they are going more green, and that is just one of the trends that PCB is growing with.

What are the current PCB trends?

Remember when mobile phones were the size of a brick? We used to joke that the only one braking when the phone hits the ground would be the ground. Now they're wafer-thin with the computing powers of a supercomputer.

The trend toward miniaturization is huge in the PCB market. Engineers are pushing the limits all the time to make smaller and more efficient boards that can fit into tinier spaces.

Flexible PCBs are another trend that's taking the market at double speed. So far, the boards were stiff, which limited their use. But with the introduction of flexible boards, the usage is wider.

Since flexible PCBs can bend and twist, you can place more o2

f them in the same space, or fit them into unconventional shapes and spaces. Also, they're very sought for in certain industries, such as medicine. Think wearable tech, flexible displays, and medical devices that need to conform to the human body.

High-Density Interconnected (HDI) PCBs are like the rock stars of the PCB world. They pack more functionality into a smaller area by using finer lines and spaces, smaller vias, and higher connection pad density. This feature is perfect for smartphones, tablets, and other compact devices.

Green is not just the color of these boards. Going green is a new must for every industry, and PCB is not an exception. There's growing emphasis on environmentally friendly practices, such as using lead-free solder to

develop recyclable and biodegradable PCB materials. Companies are not just looking to make innovations, but to do so in a way that's kind to our planet.

Innovations in the PCB market

The future of PCBs isn't just about making them more flexible or smaller. Sometimes it's about rethinking what's possible and pushing the boundaries of technology.

For instance, 3D printing is starting to be part of many industries, and PCBs are no exception. Can you imagine printing a completely functional PCB in your garage? Then we have organic PCBs (nothing to do with farmers' products, sadly) that use materials like cellulose and biodegradable polymers instead of traditional substrates. The main feature of these PCBs is that they are eco-friendly and also cheaper to produce. 3D technology can allow you just that. You can have fast prototyping while *significantly reducing* manufacturing costs and time. Plus, it opens the door to custom, on-demand PCBs.

Why stop at just mounting components on a PCB when you can embed them inside it? These innovations in manufacturing can help create even more compact designs. They can improve performance and reliability. It's like hiding Easter eggs in your electronics—only way cooler.

Last but not least innovation in the PCB market is photonic integration. Photonics is all about using light to transmit information. Can you imagine what this kind of technology could do for PCBs? It could lead to faster and more efficient data transfer, for one. We're talking about blazing-fast speeds and reduced energy consumption.

What's causing the growth of the PCB market?

We love our gadgets, and we love them to be fast, smart, and always connected. From smartphones to smartwatches, consumer electronics are a major driver of PCB demand. As devices become more sophisticated the need for more advanced PCBs increases.

Cars are getting smarter, too. You can't buy one these days without advanced driver-assistance systems (ADAS). Unlike cars from the past century, they're all electric now. All these systems are relying on PCBs. And the automotive industry is not standing in place—they are moving toward smarter and greener vehicles, so the demand for advanced PCBs is going to skyrocket.

PCBs used in aerospace applications are under the similar requirements to those used in the automotive sector. However, the difference is that aerospace PCBs might be exposed to harsher conditions. PCBs can be used in planes, space shuttles, radio communications systems, and satellites.

Materials used for aerospace PCBs need to withstand, among other harsh conditions, high amounts of vibrations and extreme temperatures. For satellites and space shuttles, PCBs need to be extremely durable, possibly made of light materials like aluminium. Anodized aluminium is particularly good since it increases resistance to oxidation.

As for marine vessels, they need PCBs as well. You can find them in small vessels, submarines, large cargo ships, navigation and communication systems. They might not be going into space, but PCBs used for marine vessels also need to be durable and withstand harsh conditions.

The rise of Industry 4.0, with its focus on automation and smart factories,

is another big driver. Did you think that only gadgets require PCBs? Robots need them too. So do sensors and other industrial devices. They need stronger and reliable PCBs to function, especially since factories are becoming more automated.

Do you have a smart oven, or smart washing machine, with an option to connect them to your smartphone? The more devices we connect, the more PCBs we need. The Internet of Things (IoT) is connecting everything—from your fridge to your fitness tracker to the internet.

When we talk about connectivity, another set of equipment that rely on PCBs are safety and security equipment. PCBs for this purpose need to be reliable and to operate as expected. Some security devices are used outdoors, so PCBs that are part of them also need to withstand outdoor conditions. It's not only about security cameras—you can find PCBs in smoke detectors and electronic door locks.

It's not all smooth sailing

Of course, no industry is without its challenges, and the PCB market is no different.

Global supply chains have been under pressure, and the PCB market is feeling the strain. Shortage of key materials and components can cause delays and increase the cost.

Another challenge concerns the innovations of PCBs. The more advanced they become, the more it gets more complicated to design and manufacture them. It's never easy to keep up with the latest technological requirements. The industry also needs a skilled workforce.

While going green is a great trend, there are strict *environmental challenges* that the industry needs to follow. That can be costly and time-

consuming.

The road ahead

If current trends are anything to go by, the PCB market is in for an exciting ride. PCBs need to be smaller, flexible, and environmentally sustainable. With every new generation of gadgets, PCBs are expected to fit in the needs.

Also, technologies like 3D printing and embedded components can make PCBs better in terms that they can be produced faster, and have improved performance. Not to mention photonics. The future of PCBs might not just be electric—it could be photonic!

What drives the industry forward are constant demands. Many other industries are relying on the production of PCBs, such as the automotive, marine, and aerial industries.

There are also challenges that this industry needs to face: environmental regulations, biodegradable materials, complexity, and cost-effectiveness.

However, the PCB industry is full of surprises just waiting to happen. For every challenge, there is a solution. For every push forward, there are many more on the path of innovations. We only talked about some trends waiting in 2024, but what after that?

Join in and see.