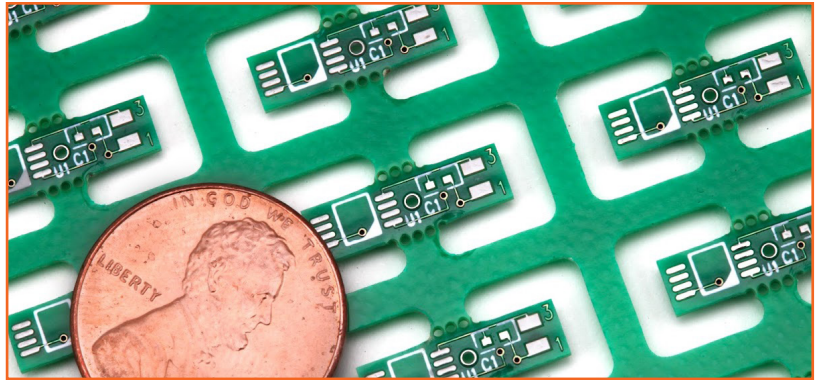


PCB Prototyping for Smarties



Best Practices for Ensuring a Smooth, Successful Manufacturing Process

PCB Prototyping for Smarties examines how to align your prototyping strategy with business requirements, maintain flexibility in a fast-paced, always-evolving competitive environment, and—perhaps most importantly—produce quality boards.

Tight production deadlines often present a seemingly compelling reason to head straight for full production. Don't be fooled. Designing your PCB is just step one for ensuring manufacturability. Prototyping is the critical next step in the process, one that can make you more confident about your production runs.

Some feel prototyping costs too much or it takes too much time or has to be outsourced abroad. Even if you're in a hurry, prototyping makes sense. It also doesn't have to cost a lot or happen five thousand miles away.

We believe prototyping is vital to a smooth, successful production run. Here's why:

- Cost-effectively validates manufacturability of design
- Avoids expensive mistakes during full production
- Creates opportunities to iterate, innovate, and improve functionality
- Tests your boards for quality and durability

The second in our series of white papers, PCB Prototyping for Smarties examines how to align your prototyping strategy with business requirements, maintain flexibility in a fast-paced, always-evolving competitive environment, and—perhaps most importantly—produce quality boards.

Rapid Prototyping: All the Kids Are Doing It

Prototyping doesn't have to slow you down. Just ask the participants of [MakeHarvard](#), a maker hackathon held annually at the revered Harvard University. With only thirty-six hours to turn concepts into prototypes for everything from doors that recognize your face to smarter bike lights that promote safety, students from all over the country prove that prototyping can happen quickly.



Nolan Johnson and Dustin Jablonski present the award for Best Reverse Engineering at MakeHarvard 2018.

Every idea and every prototype presents unique challenges and solutions. The participants used the same tools available to manufacturers, makers, and hobbyists—creating innovative and potentially impactful devices in less than two days.

To learn more about the event, read this recent article about [MakeHarvard](#).

We encourage you to take a close look at how you approach prototyping for each type of project.

Needs assessment is a moving target.

No two projects are the same, so your approach to prototyping should be flexible—even if you are always in a hurry. What you require from a prototyping service depends on what you're trying to achieve. For example, new product development presents a different set of challenges than does making small adjustments to an existing one.

We encourage you to take a close look at how you approach prototyping for each type of project.

Rapid prototyping services can help optimize board quality, save money during production, and keep you on schedule.

If you are already confident about manufacturability and, for example, simply want to validate a minor design change, it makes sense to focus on speed, simplicity, and cost-effectiveness. Fast and economical prototyping would also be favorable for quality assurance or tolerance testing for boards that operate in harsher environments.

For projects associated with a new design or product, expert help becomes an even higher priority. A more consultative approach also lends itself to troubleshooting for a board not meeting performance specifications.

Board complexity is always a factor, regardless of what you are trying to achieve. Rapid prototyping services can help optimize board quality, save money during production, and keep you on schedule.

Three Approaches to Prototyping—Fastest, Faster, and Fast

You've finalized your design and assessed your needs. Now it's time to pick a manufacturing partner and level of service for the rapid prototyping process. Though no two projects are the same, there are several foundational elements of production that will almost always speed the overall process and help ensure PCB quality.

Here are some basic questions to ask at the outset of your evaluation of each prospective manufacturer:

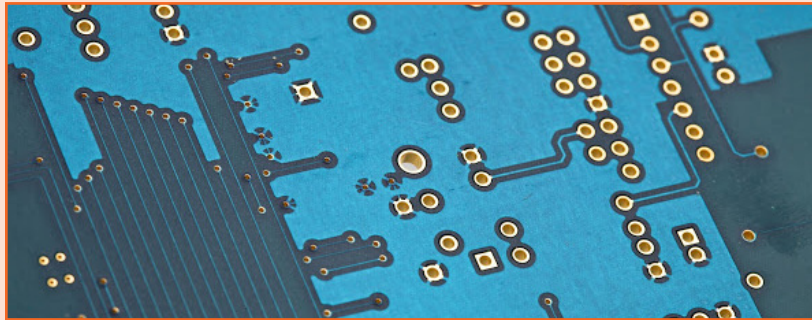
- How fast can you get a quote?
- Are small production runs available for a reasonable price?
- Can you get a quick turnaround when you are iterating?
- Does the manufacturer produce quality PCBs?

Without quality, speed and cost-effectiveness mean nothing. Whether your idea of rapid prototyping is fast, faster, or fastest, quality should still be a top priority.

We recommend finding a PCB manufacturing partner who can provide economical prototyping along with more collaborative, customized services.

Best Practices—Collaborating with Your Manufacturing Partner

As you evaluate manufacturing partners and begin working with them, there are several critical elements to keep in mind when diving deeper into the prototyping process.



- **PCB Layout Review**—Many manufacturers offer feasibility assessment of your design to ensure PCB manufacturability and viability, as well as reduce the risk of costly rework.
- **Full-Service Manufacturing Partner**—Layout review may uncover the need to change course. We recommend finding a PCB manufacturing partner who can provide economical prototyping along with more collaborative, customized services.
- **State of the Art**—Don't be afraid to ask questions about a potential partner's processes and the equipment they use. This matters if you've designed a small, highly functional board or need a PCB with more than two or three layers. Simply put, proven process and advanced equipment expand your options, increase the speed of production, and improve the quality of the product.

As a best practice for establishing a solid relationship with your PCB manufacturing partner, provide their team with clear guidelines for production. This will help their engineers focus on the most important features, promote more efficient collaboration, and focus on budget concerns if that is a priority.

It's good to have
an economical
prototyping option.
A fast one.

Fastest: Sometimes, you don't have a lot of time or money to spend on prototyping.

Some PCBs aren't all that complex or challenging to design and manufacture. For boards that perform basic functions, do not have strict layout limitations, or are not exposed to harsh environmental conditions, it's good to have an economical prototyping option. A fast one.

Speed and cost-effectiveness are also important when you are iterating. Not all new product development is funded by a healthy corporate R&D budget and since new product failure rates range from [50 percent](#) to as high as [97 percent](#), faster and cheaper are better.

Kickstarting New Product Development

When you are crowdfunding development of high-quality, time-lapse photography technology, there's no room for error. Alpine Labs partners with Sunstone to deliver unprecedented remote control over time-lapse photography gear.



"Our product challenges are pretty straightforward," said Stephen Hibbs, CTO and lead engineer at Alpine Labs. "Work fast, work smart, and don't make costly mistakes."

Discover the Alpine Labs story [here](#).

Just because you can get boards quickly from a manufacturer doesn't mean you always should.

Use caution with value-priced services because they're not all created equal. In addition to pricing, consider the following:

- Is the manufacturer capable of one-day lead times?
- What, if any, are the design limitations: maximum hole size, shape restrictions, number of layers?
- Are there costs associated with expedited delivery?
- Does the manufacturer offer 24/7/365, live customer support?

There are many benefits to value-priced PCB prototyping. The trick is to use it when appropriate and not compromise your PCB design or its functionality to save money or time.

Faster: Strike a balance between velocity and complexity.

Just because you can get boards quickly from a manufacturer doesn't mean you always should. Sometimes, you save time and money by investing in a bit of both. For more complex boards, it makes sense to leverage expert help with layout review.

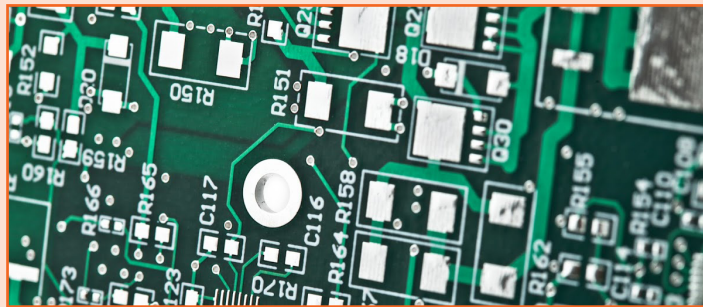
Look for manufacturing partners that can provide detailed, comprehensive feedback on your PCB design before the prototypes are produced. This will reveal yield or reliability issues with your design, improve the integrity of your production schedule, and ultimately improve the quality of the boards.

It's also critical in these situations that your PCB design software supports production of more complex boards. Look for tools that will ensure smooth collaboration with your manufacturer.

Collaboration Increases Prototyping Efficiency

Eagle Harbor Technologies (EHT) delivers high-quality pulse power solutions to organizations such as NASA and the United States Navy.

“To generate sufficient pulse duration within [parameters](#), our products use specialized boards that just aren’t all that easy to design or build,” said Ken Miller, head research scientist at EHT.



If a manufacturer can step outside their established service offerings and provide custom solutions, that's a huge advantage when a big, complex project comes along.

Fast: When you need expert help with your prototype.

Sometimes, product development and improvement projects are just as complex as the PCBs that make them function. You need a board unlike anything you've used before, and maybe you're not 100 percent confident in your design, even if the layout review didn't reveal any issues. You find yourself a little uncertain about panelization, assembly, materials, or finish requirements.

Personal assistance from an expert can help remove the uncertainty.

If a manufacturer can step outside their established service offerings and provide custom solutions, that's a huge advantage when a big, complex project comes along.

When your manufacturer can integrate good old-fashioned human interaction with their technology platforms, tailor a solution to your needs, and still maintain an expedited production pace, you can move forward with confidence.

Custom Solutions Improve Quality

Electronic Controls Design Inc. (ECD) builds thermal monitoring technology for the electronics, baking, and solar industries. These are complex systems requiring high-functioning PCBs that can literally tolerate the inside of an oven.



“It’s not enough that we make premium products,” said Mark Waterman, manufacturing manager at ECD. “We gain competitive advantage through our ability to customize those high-quality solutions for new and diverse applications.”

Sunstone supports ECD with a wide range of prototyping services. Depending on the situation, ECD can get boards in as short as twenty-four hours using one of Sunstone’s prototyping services or, when necessary, pick up the phone and talk to an expert about a custom order.

Conclusion

PCB prototyping, like PCB design, is a continuous learning process. A service level that works for one board may not be ideal for the next. It takes time and experience to know intuitively what is right for you in each case. Resources like this one can help you stay informed about industry best practices.

If you’re interested in learning more about Sunstone’s prototyping services, click on one of the following links:

- [**ValueProto®**](#)—Offers an affordable option for ordering as many as twenty-five boards, up to six layers.
- [**PCBExpress®**](#)—With lead times as quick as twenty-four hours, this is an ideal choice for more complex prototyping.
- [**PCBpro®**](#)—Complex circuits, boards of up to twenty layers, and high-volume order options. This flexible service can be tailored to your needs.
- [**Custom PCB**](#)—Sometimes, you just want assistance from an expert. We’re here 24/7/365.

To learn more about Sunstone, visit our resource [page](#). We also encourage you to join our [community forum](#) to share ideas, stay up-to-date, and read what industry experts are saying.