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viewpoint

Circuit card assembly — how to select your high-reliability product outsource partners

By Layne Shumaker

The conventional wisdom of outsourcing circuit card assemblies has changed in the last 15 years. Many military and aerospace suppliers are at a crossroads on how to manufacture their high/mix low-to-medium-volume circuit cards. Although many of them have in-house circuit card assembly capabilities (CCA), staffing and managing low-volume production does not yield high profit or guarantee technology insertion for items such as small packaging density, soldering technology, or procurement process changes.

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For those military and aerospace suppliers who do not have CCA capability or who are just beginning board products, there is an endless supply of CCA manufacturers to choose from. Choosing the correct vendor or outsourcing partner is crucial. Here are a few items to consider:

- What stage are you in the design cycle?
- Who should perform critical design steps?
- When should you involve the manufacturing partner?

Many articles address specific details on the design and manufacturing processes, yet not many articles show the benefit of involving the manufacturer as a partner or solution supplier. My aim is to answer some of the questions related to the outsourcing partnership.

First, the earlier the involvement of the manufacturer, the greater the return on such intangibles as component and material selection, lead time performance, obsolescence, and realistic scheduling for delivery.

Next, manufacturers should start with a complimentary outsource partner. Choosing the right partner and involving him early in the design process will help resolve and minimize long-term problems.

Company experts should ask:

- Can the design even be manufactured?
- Are the package densities available? and
- Can the supplier place the types of components selected using automated and controlled processes?

Early involvement by the manufacturer as part of the integrated product team (IPT) minimizes the negative impact caused by these issues. In the event the design cannot be compromised, it allows the manufacturing team time to develop new processes, new tooling, or new technologies. Remember, capital planning can be an 18-month activity ... if developers miss the planning window.

In addition, many outsource partners offer post-design capability. Many offer board-layout services using the latest component libraries. This enables the manufacturer to work directly with the printed wiring board (PWB) suppliers to reduce and keep board-layout constraints to a minimum. This helps reduce the costs of raw printed wiring boards. Some manufacturers also offer component design services, such as application-specific integrated circuits (ASICs), while others offer component-screening services for commercial off-the-shelf (COTS) components.

The reality of components and materials

Component assembly processes and technology have improved tremendously over the past 30 years. Component selection used in the design may not require the use of fully qualified parts. In many cases, due to lower volumes and higher test costs, fully qualified parts are no longer available

in all package types. Many suppliers offer industrial quality parts that meet the military and aerospace requirements.

Although I am not a proponent of source control drawings, these drawings allow material suppliers to provide off-the-shelf components that can be screened for unique test requirements like DPA, PIND and RLAT. These tests can be specified at the designer's discretion. Outside test services are becoming more popular and are easily administered by the manufacturers' procurement departments. Many of the large component distributors even provide these services by managing their own test house suppliers.

We find managing the bill of materials from prototyping through production centralizes the outsource partners ability to work with the initial design and production teams to assure materials availability and processes creation and validation. In addition, many documentation errors can be corrected during the prototyping process. Many of the components are defined incorrectly, resulting in loss of parts, incorrect package configurations (i.e. flatpak versus gull wing), and lack of availability. Some outsource partners do not have the ability to lead form components. This can be an expensive mistake. Look for universal lead forming equipment.

One additional tip: use electronic copies of the parts lists to minimize manufacturing process time — from procurement and quoting, to automated placement, to first article inspection, and finishing with customer acceptance of the product. If your partner uses paper — explore methods to change.

It is easy to forget materials requirements planning (MRP), and electronic parts lists help to load these fundamental system requirements. Each project and product is at a different phase in a product life cycle.

The use of a flexible MRP system should include the ability to use consigned or provide full turnkey procurement of parts and materials. Although it is desirable to start product development in the lab and finish at an outside assembly house for prototyping, low rate initial production (LRIP), or production, it is important to know that costs can be contained or reduced by ordering parts at the time of initial development.

Manufacturers may use many items procured for production during the assembly of prototype hardware at little or no cost. Many times minimum buys or automated equipment processes drive the quantity of components procured for production. There are benefits to using production-grade parts such as placing a single purchase order or buying bulk material issues, such as tape and reel or tubes. Parts ordered at the time of prototyping are stocked and available for production.

One strategic question when selecting your partner is "Do they have the ability to demonstrate process compliance?" Many outsourcing suppliers do not possess documented processes for controlling customer-supplied documentation. How does the supplier handle non-recurring activities or how is the process set-ups validated? Are processes in-place to support repeatable techniques required for the aerospace environment?

ISO-9000 has created a standard baseline for validating the suppliers understanding of assembly. Can the supplier live up to the task? How detailed or specific is their quality program? It is imperative there is a closed-loop system for addressing non-conformance to process? Does the supplier have certifications from more than one source? How do customers view the supplier? Can the supplier assemble in low volume and do they have processes in place to support low volume prototyping versus low volume production?

Component advantages

In addition to the assembly advantages, some component suppliers have assembly capabilities. This relationship creates some unique benefits. Those suppliers who have a reputation for supplying high-reliability components have an understanding of what the components will be subjected to in their application. This expertise demonstrates a clear understanding of the processes and process controls necessary to deliver high-reliability circuit card assemblies. Looking for an outsource partner who provides assembly services and high-reliability parts can also minimize handling which is a very big concern when reviewed against long-term reliability and the high cost of these materials. The component supplier's providing his own parts for assembly reduces the potential for damage from handling. Other cost advantages, such as reduced pricing, may be something the supplier may be willing to discuss.

Aside from the obvious reasons, there are times when it does not make good sense to go to an outside assembly house. Here are a few things to consider:

- in-house assembly capability and the time to perform the assembly task;
- the selection, certification, and qualification of an outsource candidate;
- new technology or processes unique to the particular design that may be a significant factor;
- whether the quantity of assemblies justifies the amount of support required to outsource (a big factor if the assembly can be easily assembled by hand and non-recurring dollars can be avoided);
- whether another supplier successfully assembled the circuit card;
- whether the potential for repeat business has been assessed to ensure that all of the cost factors have been reduced;
- what the partner brings to the relationship;
- quality of the documentation package so the supplier can deliver product and be successful;
- whether the design is far enough along to prevent multiple non-recurring activities, thus avoiding increased costs; and
- the existence of established communications and processes in place to provide immediate feedback.

When selecting an outside contract manufacturer, it is important to view the relationship as a partnership. This can be more important than the delivery of product, at least for the first time.

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