Outsourcing 101

Carving out strategic partnerships can pay handsome dividends. by ZULKI KHAN

Increasingly, it is becoming paramount that OEMs focus on their core competencies, such as systems R&D, design, architecture, system software and branding. Outsourcing such key aspects of their product as board design, fabrication, assembly and procurement is part of the mix for maintaining a competitive edge and keeping the bottom line healthy. Outsourcing can also offer OEMs significant advantages, including reductions in capital risks, increased asset productivity, increased access to current technologies and reduced time to market.

And it’s not just OEMs cashing in on outsourcing. Even fabricators and design bureaus can reap the benefits of outsourcing, by sending out work that doesn’t fit their core competencies, so they won’t have to turn work away.

In this regard, creating, nurturing and sustaining strategic manufacturing partnerships with EMS providers can be the bedrock of your business plan. In this role, your company and the partner work in tandem as partners, not as customer and vendor. In fact, many OEMs rely heavily on their design and manufacturing partner as a significant entity to help expand its business.

An OEM’s business is often boosted, for instance, because a strategic partner can create economies of scale that OEMs cannot, thus providing cost savings the OEM cannot achieve on its own. EMS providers buy more electronic materials than OEMs, so they usually have more clout with suppliers. They also reduce risk to the OEM because they take on the risk of managing materials and work-in-progress or finished goods, and can therefore schedule the flow of sub-assemblies and finished goods to take just-in-time orders.

Outsourcing with strategic partners is even more important for OEMs as the July 2006 deadline for the Restriction of Hazardous Substances Directive (RoHS) fast approaches. There remains considerable confusion about the elements comprising lead-free electronics. For example, for successful lead-free PCB manufacturing, laminates, surface finishes, solder pastes, thermal profiles and inventory management all demand new methods and materials, giving rise to a myriad of issues and problematic areas. Consequently, OEMs should seek out EMS providers who have a solid history of successful OEM partnerships and a thorough understanding of lead-free design and manufacture.

But finding the right partner is not easy. Multi-billion-dollar EMS giants may not be ideally suited for certain OEM needs. Plus, all but the biggest OEMs run the risk of becoming just another number to these huge manufacturers. At the other end of the scale, a small EMS company may not have the infrastructure in place to support an OEM’s business growth. Many smaller EMS providers are not ISO-certified for a complete round of design, fabrication, layout, assembly and procurement, and may lack the “right” design and layout tools. And the fast fabrication turnaround time offered by a prototype firm usually can’t be matched by EMS companies. An OEM’s ideal outsourcing partner is a suitably sized EMS provider that has the right design and manufacturing methodology for today, as well as the ability to grow with the OEM.

Where Do I Start?

TABLE 1 shows a checklist to help analyze the services and technologies offered, as well as the breadth and effectiveness of the testing strategies offered.

<table>
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<tr>
<th>CHECKLIST FOR ANALYZING EMS STRENGTHS</th>
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<tr>
<td>✓ ISO 9001:2000 Certification and Others for Quality Assurance</td>
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<tr>
<td>✓ Complete Capabilities – Design, Fabrication, Assembly, Procurement</td>
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<tr>
<td>✓ Trained Testing Staff &amp; Advanced Test Equipment</td>
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<tr>
<td>✓ Comprehensive Fulfillment Center</td>
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<td>✓ Sufficiently Large Organization</td>
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<tr>
<td>✓ Purchasing Power To Dictate Better Component Pricing</td>
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<td>✓ Box Build Capabilities</td>
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<td>✓ Long-Standing Component Vendor Relationships</td>
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Your partner must demonstrate effective test strategies that assure manufacturing quality and reliability. Also, quality claims must be fully supported by strict adherence to appropriate certifiable standards and approvals; for example, ISO 9001:2000 applies to quality management, ISO 13485/ISO 12488 to medical devices manufacturing, AS-9100 to the aerospace industry and TL-9000 to the telecommunications industry.

Complying with these standards ensures that quality measures are in place and strictly followed to achieve overall operational quality (TABLE 2). To meet this quality objective, a good partner should offer a wide array of capabilities of the services you require, whether design, fabrication, assembly, parts procurement or all of these.

Let’s look at parts procurement. If a component is new to the market, there could possibly be long lead times, up to six to eight weeks or longer. But if your design and time-to-market schedule demand it immediately, your partner should have enough of a vendor and/or reseller base to get samples to build a prototype.

Further, a good manufacturing partner should have a well-trained testing staff and advanced test equipment, as well as a comprehensive fulfillment center. It should be large enough to handle volume orders from different customers, with sufficient buying power to obtain lower component pricing. And it should maintain a high-caliber inventory management system, and have long-standing relationships with component vendors. If possible, talk to the company’s past customers; they’re the ones who can best detail the quality of the company’s work, its turnaround time and its work ethic.

Outsourced designs can be performed at several levels, such as hardware, board and system. Some OEMs may even want to include integrating hardware and software. With such design variances, it is wise to investigate an EMS provider’s design and test strengths, design engineering and technician staffs, effectiveness at implementing product specifications, and previous design projects.

If you’re looking for a PCB design partner, it’s important to check out the company’s PCB layout tools. Does the company have leading-edge layout and simulation tools, and veteran designers to drive them? Getting a solid understanding of the company’s process control and how well it is linked to the design process is critical.

For example, imagine that the wrong component with the wrong footprint is specified in layout. Usually, this is easy to catch and correct at the layout phase. However, if proper process control isn’t in place, the error will not be caught, and a PCB with the wrong footprint will go to fabrication. Fabricating this PCB can incur a loss ranging from $3,000 to $5,000, and severely affect an OEM’s product schedule and time-to-market.

If your potential outsourcing partner provides design and fabrication services, you’ll want to ensure that the various departments communicate well. Communication between design and fabrication staff is critical, especially when working with HDI. Blind vias are fairly simple to design, and they resolve a number of routing and placement issues. But blind vias and other aspects of HDI can make fabrication more difficult and expensive (in the short term), increasing the cost by 20 to 30% at the prototype stage.

DFT and DFM

There is no single inspection or testing system that meets the requirements of every manufacturing environment.
Therefore, several factors must be taken into account in adopting any given strategy. Those include product design and testability, test equipment availability, and the manufacturing process to be used. Test systems may include built-in self-test (BIST) firmware, automated optical inspection (AOI) systems, in-circuit testing (ICT), x-ray inspection, and functional test and environmental stress testing. X-ray imaging systems with capability of up to 120 kV are integral to ensuring reliability on solder joint connections, especially with BGA populated PCBs (FIGURE 1). X-ray systems like these represent a major portion of good failure analysis.

Along this line, design for manufacturability (DFM) and design for testability (DFT) strategies are targeted at dealing with manufacturing and test issues when the product is being designed to achieve the most cost-effective production. Applying well thought-out, specific DFM/DFT techniques to analyze and recommend revisions to product designs as early as prototype stages can improve manufacturability and testability.

To augment DFM/DFT techniques, EMS engineers must also consider such details as the number of test points required and clearly identify probe locations for a given PCB. If BGAs populate the board, does the customer want to test it from the bottom side? If so, clearances must be created so that those BGAs can be probed. PCBs with analog and digital sections require special attention because they are probed in different ways, and it’s important early on to determine the number of test nodes needed to verify the analog and digital segments.

More considerations must be taken into account when evaluating outsourcing partners. High-complexity PCBs with node and solder joint counts nearing 5,000 and 30,000, respectively, pose a unique set of challenges for EMS providers. For this reason, OEMs should carefully evaluate an EMS provider's experience and capabilities before selecting it as a strategic manufacturing partner.

**Pick Your Partner**

Once you’ve narrowed your selection down to a few highly qualified companies, consider creating a criteria profile. A criteria profile of the ideal outsourcing partner is a valuable tool in the selection process. For example, let’s take an OEM that wants to contract $1 million worth of business. A suitable candidate should have an annual $15 to $20 million business, two to three SMT lines (FIGURE 2), and 50 to 80 trained personnel, and it should purchase $5 to $6 million worth of components a year. Quality and flexibility are your main concerns when qualifying an outsourcing partner.

Also, it can be beneficial if your partner can transition seamlessly from prototype to production. If an OEM’s product can be designed and manufactured in the U.S. at reasonable cost, it stays at the EMS provider’s location. However, for consumer applications destined for mass production, ensure that your EMS provider has highly reputable offshore partners to take prototypes into production without any glitches. **PCD&M**

**FIGURE 2.** An SMT process is a focal point in assembly, especially with new product introduction.

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