Consider Volume Manufacturing During Package Design
by Dr. Joseph Dallas and Dave Winick, Avo Photonics
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When designing component packages, considerations for volume manufacturing are too often overlooked. Just because a prototype works does not mean it can be efficiently transitioned to volume manufacturing. Redesign for volume manufacturing can be costly, and design reconfigurations can have a negative impact on the performance of a device. These are just a few of the reasons why it is critical for component designers to consult with an experienced contract manufacturer early in the design phase. Precision component assemblies, such as optical and RF packages, require specialized manufacturing knowledge.

The primary concern for most OEMs is manufacturing quality, cost-effective parts since competitive advantage typically comes from providing the highest value to the market at the lowest cost. However, “cost effective” can mean different things in the development of a new technology. In highly competitive markets like computers and telecommunications, designers must weigh the trade-offs of cost and performance carefully. Quality is achieved when the product meets the grade of excellence established by the user base, and cost will be driven by the requirements of manufacturing to meet that grade. Matching the design to the quality/cost goals to be attained in manufacturing is the challenge. There are four primary elements that must be considered to successfully navigate the common manufacturing challenge:

1. Designing for target capability,

2. In-house versus distant manufacturing,

3. Affordable rapid response, and

4. Cycle time to mass production.

Target Capabilities and In-house Versus Distance Manufacturing

Any factory’s manufacturing strategy has a roadmap for upgrading capital equipment, quality systems implementation and training operators. Traditionally, the efforts have been focused on increased flexibility to meet changing market demands, but in many industries where cost has besieged responsiveness, strategic forecasting integrated with the development process is playing a more critical role.

The most common errors are in designing for the manufacturing capability at hand without regard for a parallel investment in the factory. In some cases this drives a need for more vertical integration, in others a more integrated team of suppliers.

The need for an integrated strategy shows up first in the early design phase. During this time, the designers are converging functionality and market requirements. The most successful designers know the real nexus of a winning product is the cost of manufacturing. The design team will ensure that manufacturing is cost-effective for the design, making it a critical step in the integrated levels of product readiness. Only in this fashion is progress steady and predictable.

The second major element involves the advantages of “in-house” versus distant manufacturing. In-house manufacturing provides a more conducive atmosphere for design for manufacturability, along with the ability to prototype with the preproduction manufacturing team. Manufacturing issues are more quickly fed back into the design culture, resulting in optimized designs. Figure 1 shows one instance where a designer knew how to model the design along with the tool that manufacturing would use. It was a simple step to include the tool into the layout and check for interferences. The design of the part along with a narrow taper tool was chosen to provide a solution that was functional, and one that could be planned by manufacturing.

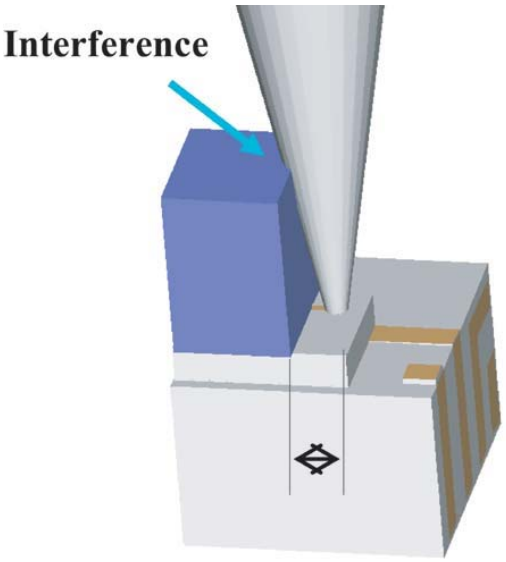

Figure 1. Tool-to-part interference. (click image to enlarge)

Affordable Rapid Response

Target capability and the manufacturing location consideration can also affect the affordable rapid response. The preproduction team can provide a rapid response to limited production requirements along with customization of product that can expand or enhance market penetration. There are numerous advantages to keeping capacity close to the design team. For instance, problems arise when the preproduction capacity is of a different generation than the full production capacity, leading to designs that are not compatible across the board.

When keeping rapid response manufacturing close to the design team, it is critical to align limited production capabilities with full production so that the cost advantages can be realized, often merging many of the high-volume materials into the limited run. This also lends itself to using similar equipment and standardizes the training of both teams.

Cycle Time to Mass Production

Cycle time to mass production can be defined as the amount of time it takes from management's decision to develop a product to full scale production. However, this often does not take into account the design changes to meet changing market needs, let alone many of the other three considerations. Designers must accommodate constantly changing requirements, and therefore they need to confer often with the manufacturing team. Checking the design at each phase of development for market compatibility, as well as manufacturability, is key for a smooth transition to production. For example, early test devices are often sent to customers to ensure conformance. The closer these devices are to the final production device, the smoother and more affordable the development will be.

Boiled down into a single piece of advice, work closely with your manufacturer. These are just a few of the reasons why it is critical for component designers to consult with a contract manufacturer early in the design phase, particularly with high-end components and specialized contract manufacturing such as with optical and RF packages. An experienced contract manufacturer has worked through the transition to production on multiple designs — experience not commonly found in many design houses.

Further, a few contract manufacturers have even successfully integrated design services into their offerings, creating an integrated approach to the production of complex devices. The design team of a specialized contract manufacturer is necessarily agile to move between different products for different markets, always keeping in mind the manufacturing capability available. This experience allows them to select the passive and mounting components necessary, along with feedback to the constituent designers to achieve optimum results.

For example, packaging RF and optical components, in particular, requires that the parts, including the substrates, mounts and/or sub-mounts, be placed accurately enough to work at specific frequency ranges, and they require specific manufacturing capabilities to be properly aligned. The sequence of alignment is a key manufacturing concern and for optimized results, the contract manufacturer should be consulted and play an integral role in the design process. The passive components must be compatible to the active and other passive elements. In the early phases of the active element design, key features such as interfaces and isolation should be considered with feedback from the contract manufacturer.

Conclusion

There are many ways to avoid the design pitfalls that lead to manufacturing cost overruns and delays. By integrating the development process, design and manufacturing concerns into every step of the design, the end result is significantly more likely to meet the quality grade and the cost goal with an on-time

product.

About the author

Dr. Joseph Dallas is CEO and Dave Winick is Vice President of Engineering at Avo Photonics, 700 Business Center Dr., Ste. 125, Horsham, PA 19044; (215) 441-0107; avophotonics@avophotonics.com; www.avophotonics.com.