

Support the board!

Having done the design, engineers want to get the prototype under their belts and make the NPI stage as short as possible. What difference can the prototyping/bare board partner bring in this respect? **Tim Fryer** reports

Prototyping should be easy: collect together the designer's array of components and put them together. Assuming the initial design is good – what could go wrong? As many will have experienced, there is plenty that can go wrong – or even just go slow – before a working, manufacturable prototype emerges.

At the heart of the prototype is the bare board and its importance within the system is often overlooked, according to Robert Keating of Beta Layout. "They may be seen as a commodity because they are found in so many different products, industries and locations. Although they may be common, each pcb design that goes to manufacture should really be considered as a custom built specific product."

Philip King, managing director of Newbury Electronics and PCB Train, agrees: "It is false economy to take chances with manufacturing the pcb. It is often the only unique component in an electronic assembly. Problems with delivery or quality of the pcb are often only fixed with a complete remake, including sourcing and replacing all the components. This a huge penalty for the sake of a few pounds apparently saved on the cost of a pcb."

But do pcbs really vary that much? Very much so – taking an engineer's designs and bringing them to reality is often more dynamic and complex than just a 'build to print' process. "The pcb fabricator has a dual role," explained Tim Tatton, managing director of Invotec Group. "Naturally, it is to take the customer's design and convert that to a product that satisfies the shortest possible time deadline.



"Successful and timely NPI requires a contractor to be fast on their feet and to have all the significant production processes under their control."
Philip King



"The NPI structure and process flow can lack clarity, coordination and standardisation."
Tim Tatton

That does not tell the story; the added value comes to the fore by ensuring innovation, quality, reliability and cost requirements are met."

Speaking at the recent RF & Wireless Forum, consultant Alan Walker of A&S described what happens when the first prototype doesn't work. "Perhaps the gain is low or a filter is off frequency," he said. "Your design team then gets involved and starts playing about with component values. They get the design in spec and hit the production button."

Inevitably, at some point, a new procurement strategy, changes in personnel, a drive to cut costs or any of a number of other reasons will force the designer to look for a second supplier. Walker continued: "What often happens, especially in a multilayer rf design, is that the board you have been working with – that had all those value changes applied to it after the first production run – does not work when supplied by a second source. This is where we start to find that the design documentation set doesn't quite live up to the design intent or you have inadvertently inherited an unknown fabricated attribute. Let's call it a new design feature – and a design feature that affects performance.

"A number of the reputable fabricators may come back to you if they feel there's something amiss in your design documentation set but, even then, they will rarely come back to you on all attributes. Others may not come back to you at all, due to lack of experience by staff or possibly time pressures. Ambiguity often leads them going down their own chosen path."

And that is where design

documentation can part company with the reality of the design that is being made.

Despite such technical problems, there persists the impression that engineers regard pcbs as a commodity. "This is a subjective viewpoint, claimed Tatton. "In the purchasing environment, we perceive the answer in a lot of cases is 'yes'. In our view, that is not the case. The pcb is not an off the shelf product, it is bespoke. Granted, there are core processes that make up a pcb, but every design is unique and that will bring distinct challenges. The work of customer design engineers is technically challenging and highly complex. That said, few get to see how the pcb fabricator takes this design and converts it to a real product. It is not surprising to hear on factory tours they have a new appreciation for the service that we provide!"

According to King, product complexity is an important factor. "At

"Even prototype PCB quantities seem nowadays to be considered a commodity - unlike components which are used in the assembly process, each PCB design is unique and is designed for its own particular use and function."

Robert Keating



the simpler end of the market, pcbs are perhaps commodities, especially if lead times are long. The cut off is from 15 to 20 working days delivery and around 0.2mm track and gap. The more technical the pcb and the shorter the lead time, then the more specialist the supplier needs to be to satisfy the customer's delivery and quality demands."

When time and cost are of the essence, there are arguments for and against having a fully integrated outsourced service provider offering a complete range of services to take the engineer's design and deliver a working prototype ready for manufacture. Take this a step further, or a step back in time perhaps, then nothing would be outsourced and everything done in a true OEM environment, but this is a rare business model these days. Keating sees the responsiveness of the supplier as the key issue. "For time sensitive projects, being able to liaise directly with the supplier's

manufacturing engineer, working on the project is crucial. As important, consider the time zone of the supplier; local companies offer the advantage that if any potential design or manufacturing 'showstoppers' arise, they can be contacted quickly and the issue addressed immediately."

The latter point refers to the trend of outsourcing everything to China in the belief that this has to be the best option. But a supply chain that includes providers in the Far East is a chain that is being stretched – and this is not always desirable for prototyping. Tatton commented: "The length of the supply chain can have an influence. Increasingly, manufacturing and design can be outsourced so there is another relationship layer to be considered. I cannot stress this enough; optimum results will occur only when the supply chain works together and at the concept stage, rather than the design freeze stage. If all participants invest the time to



"No fabricator uses the exact same process as another one. Consequently there will be subtle variations in the stack up of your board, copper weights, etch factors, I could go on."
Alan Walker

understand each other's needs a learning curve is established and routine issues can be eliminated, processes streamlined and waste eliminated."

Walker agreed this point and added a few practical tips. "If you can get an additional fabricator and assembly house on the books, it will help to make sure you are not going down a blind alley. Document your design and ask the fabricator and assembly house to agree your intent prior to issuing the drawings; when it's fabricated, ask for a micro section report; do these reports (ask for others to cover critical parts of the design) agree with the design intent and the design set?; when assembled and tested, ask for an assembly report; once it's working, make sure you update the design set to reflect those features that were different and you feel are of significant importance in order for your design to work over production spreads or for potential changes in suppliers."

