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Busting Through the Front-End Bottleneck

By Nicola Kay

A standardized format for PCB fabrication data is now available to fabricators and OEM designers alike, eliminating misinterpretation and confusion.

For most printed circuit fabricators, the manufacturing bottleneck is usually found within the front-end engineering and preparation work. That was the case for Artetch, a UK-based company that was being asked to build more and more controlled impedance boards. Paul Wells, the company's CAM Engineering Manager was tasked with finding a solution to the bottleneck problem, especially since he and his technical manager had the in-house knowledge to perform the complex calculations required to ensure specifications were met.

Wells' initial plan was to train additional engineers in the process of impedance calculations. But Artetch found Polar Instruments' SB8000 software tool in January 2005—and Wells' plans changed. The SB8000 is a PCB stack-up and construction tool that serves both OEM interconnect designers and PCB front-end engineers.

According to Wells, it solved all the issues in one tool. "It was a breath of fresh air, removing the need for more highly skilled engineers," he said. "Now technicians can be trained to use the software on a short learning curve."

With the SB8000's introduction to the front-end process system at Artetch, the hours saved at the front-end and the reduction in material

wastage due to design faults, miscalculations, and rejected PCBs offered substantial returns. Wells said, "It increased our in-house front-end productivity because the calculation time of complex structures has been reduced by 70%—a saving of senior management time."

"There is no need for sketches or using spreadsheets to build the stack-ups," he explained. "SB8000 made it easy to create structures and calculate controlled impedances. The automatic design rule checker and impedance calculator has taken away the guesswork and eliminated areas for error and shop-floor queries, enabling faster turn-round on batches and higher productivity levels."

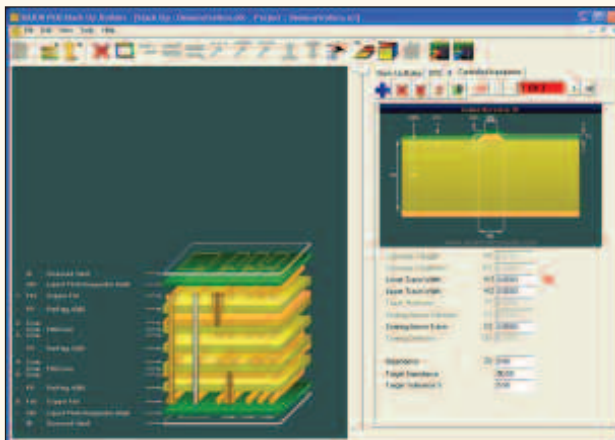
Using traditional methods of calculating a Controlled impedance stack it has not been possible until now to treat the design as one complete structure; each individual layer and structure had to be calculated in isolation and with no consideration for the limitations of manufacturing or the effects of other controlled impedance structures within the build. This has meant that it has always been a juggling act to get all the design requirements correct and in tolerance within the final stack. Now the user is able not only keep an eye on the overall board thickness but also on all the other controlled impedance requirements and manufacturing considerations the stack is altered to meet the requirements of the design.

Within the PCB fabrication industry technical data is held in many differing formats by the various fabrication houses. SB8000 can hold all the required materials information and will now enable standardization of data formats to take place within the industry as it offers the use of a real-time materials library covering specifications for the major suppliers of the cores, pre-pregs and other necessary materials. It is actively updated and downloadable from the Polar Instruments website.

Current in-house materials libraries can also be imported into the SB8000 library using a comma-delimited format such as Excel, so old information is not redundant. The software is Microsoft-based, icon-lead and defined, taking a matter of minutes to specify and stack up a board. One can then assign the controlled impedance structures to the critical layers and let the tool perform the calculations instantly.

Harbing Integrated Systems and Artetch: A Case Study

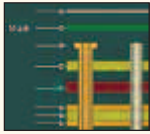
Impedance requirements are ever-increasing, as is the level of information demanded by both customer and supplier. With this comes the need to eliminate confusion and misinterpretation during the transfer of data. The SB8000 takes away any controversy over a design that can often occur between the PCB fabricator and PCB



SB200 PCB Stack-Up Builder.

Busting Through the Front-End Bottleneck

designer. This benefit was immediately recognized when Harting Integrated Systems (Northampton, UK), an Artetch customer for many years, began to use the Polar SB8000 software as the confirmation and approval route for all of its PCB fabrication requirements.



Polar Instruments' PCB Stack-Up Image.

With 99% of all Harting backplanes having impedance-controlled areas as a standard part of their specification, Adrian Jones, one of the company's design engineers, saw the benefits of using the new tool almost immediately. The first project handled by the two companies was a 12-layer PCB that had difficult impedance requirements. Using the SB8000, Jones was able to create the basic stack and input his impedance requirements. He then sent this information to Artetch for verification and minor adjustments. The live file was then returned to Harting for approval.

Before the SB8000, Controlled Impedance specifications were represented in a variety of formats that had to be translated by the individual FAB shop; now that there is a standard format which, by following a few simple steps, a design can be specified within minutes. Before the introduction of the SB8000 some of Harting's more complex backplanes would take hours to calculate and verify.

Harting Integrated Systems, as the OEM and design authority, now specify the information to a certain level, but leave it to Artetch to use their expertise to finalize the stack-up and confirm the controlled impedance calculations. The file is then sent back electronically to Harting for approval. The file has become a replacement for paper as one electronic document controls all the build data between the designer and PCB fabricator.

Jones said, "Because it encapsulates all finished PCB parameters within a single file, into which you can build in as many impedance requirements as necessary, it tells you everything you need to know about the overall design structure. This makes the SB8000 the ideal solution to guarantee a known end-result repeatedly and quickly. It

has reduced the design cycle times along with the error rate, and is proving invaluable in achieving more and more complex designs."

'Eliminating the Guesswork'

For all PCB designers within the OEM environment the SB8000 also eliminates guesswork and allows 'what if' questions to be answered. The designer can then forward his file to any number of PCB fabricators, knowing he will always get boards to his exact specification, whomever he uses to manufacture the PCB.

Until now customer requirements for fast turn-around of batches has always been harder to achieve on PCBs requiring controlled impedances. But recently Artetch completed a six-layer build with six impedance controlled structures in 24 hours, from receipt of basic design data to delivery.

Wells stated that "SB8000 has definitely helped us retain the competitive edge and increase our customer base in a fiercely competitive market place." Every impedance and multi-layer job goes through the SB8000 tool now as well as jobs with blind and buried vias, flexible circuits, and flex-rigid circuits, due to its excellent graphical representation and ease of interpretation."

PCB fabricators are now also using the tool as the first part of the manufacturing process (before CAM engineering). The data gives a clear bill of materials enabling the planners to use the waiting time at CAM to plan and procure the materials, thereby reducing further lead-times to manufacturing.

Wells and Jones have already identified future possibilities for further enhancements to the PCB design and build process, and look forward to more innovations in the months to come. **CT**

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