Automation comes of age for power system design, ordering & manufacturing

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The manufacturing process includes assembly of electronic components onto printed circuit boards; automatic testing of components; wave, reflow, and infrared soldering of assembled components; encapsulation of converter subassemblies; final environmental stress screening of certain products and product test using automatic test equipment.

Contemporary power designers routinely search the websites of module manufacturers seeking solutions and to buy online. Most suppliers have a product selector function that enables designers to enter, say, input voltage, output voltage, and power level to specify the product they need. Some selectors work better than others, but the fact is that most suppliers of power modules make only a limited set of in-demand parts, mainly 48-volt input or maybe 24-volt input. If that's all you need, that works fine for you. In any event, the product selector is just that: a means to help a prospective buyer select an existing product.

Now, however, power system design, ordering, and manufacturing automation is coming of age, passing from adolescence to maturity, as it were. An online suite of advanced power design tools called PowerBench™ (Figure 1) is in place that enables power designers to specify and verify the performance and attributes of custom power design solutions in real time. The comprehensive tool suite exploits Vicor's mass-customization capability, enabling design engineers to apply their expertise to maximizing the performance of their application vs. working around the constraints imposed by off the shelf, commoditized power supplies.

PowerBench has several independent expert-system modules that allow users to configure or design dc-dc converters, converter arrays, or complete ac-dc and dc-dc power systems. The remainder of this article will focus on the dc-dc module design capability.

Typically, a designer looking for a solution would begin with the library of over 290 base electrical designs covering five different input ranges, eight or nine output voltages, three package sizes and multiple power levels. After selecting the appropriate base design, the designer can configure the design with any of six pin styles, three baseplates, and five environmental grades. A part number, price, and lead-time are then generated by the system.

When an order is placed for that part, the back end of the process is completely automated. The order triggers a bill of materials (BOM) generator to run and create this variant of a base design. The base electrical design and everything else – such as pins and base plates are configured around it automatically. Every night, the BOM generator searches for new models that were added during the day to create new and unique bills of materials.

It is essential that the process be an automated expert system because of the numbers involved: each base design can be configured 90 different ways, with more than 25,000 possible part numbers. It doesn't make sense to create bills of materials for that number of part numbers in advance, so it's done as needed — usually in less than a day. In fact, in an emergency, it could run on request and generate a BOM in about a minute.

FIG. 1

Maxi, Mini and Micro models (full, half, quarter-brick) feature a patented low-noise design with the high reliability and power density. Selecting the right model for the application is streamlined since there are an unlimited number of models that can be configured using intelligent design tools.

When the BOM is created, everything is in place for the build, and the design takes its place on the production line. No standard modules are in stock; each is built on demand resulting in a four-week lead time. An order for a part that has never been made, a configuration that has never been made, can be fulfilled four weeks later. Actually, small quantities of these base model designs with five different input ranges and eight or nine output voltages, and different power levels and package sizes can be done in two weeks.

Creating the BOM

If the designer, however, needs something that's not in that matrix, the system allows the designer to perform a search, in real time, for customized designs that have been done in the past. Perhaps a designer needs a 300-Volt input module with a 9-Volt output. A 9-Volt output is not a base model design. The designer knows that a 12-Volt output can be trimmed down, but may not want to do that. So a search can be done for 9-Volt output modules. Assuming that one was found, the electrical design can be configured with the required pin style, temperature grade, and base plate, and RoHS compliance (if required). With the desired design in hand, the designer can create a part number, and when the new customized design is ordered, the same process as before takes place in the background. The BOM generator creates the BOM, and the parts are scheduled on the production line.

There is a modest setup fee for creating variations of customized designs because of the additional documentation work required and the other steps being done in the background. But overall, it is a very highly automated process that results in benefits to the customer. In real time, they can get a part number, place an order, and receive their order in as little as two weeks.

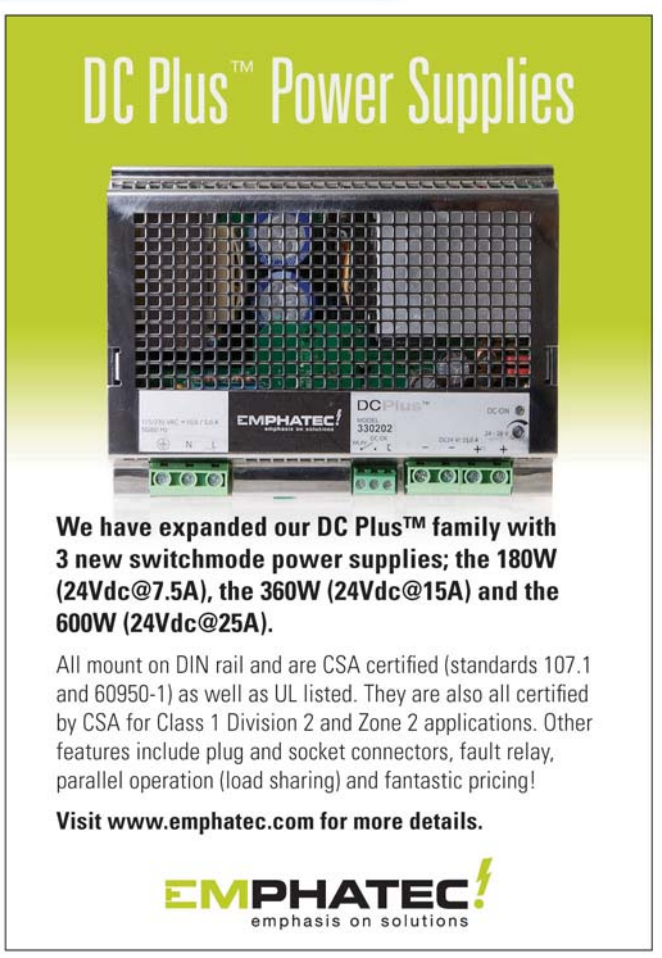
The third section of PowerBench enables user-defined designs. In this case, the customer can input an infinitely variable set of requirements such as input voltage range, output voltage, and maximum power output. The designer can, for example, select minimum input voltages as low as 18 V and as high as 420 V. Output voltage can be anything between 2 and 48 V – if you want 13.5 Volts, you can get 13.5 Volts.

After defining the critical specifications of the module, the user then runs a feasibility check. This is a real-time analysis of the requirements by a sophisticated expert system that creates multiple designs that would meet the required specifications. If the optimal system-generated design is determined to be feasible, the user can generate a part number and a price.

Note that this whole process is highly automated. The design engineer no longer has to produce a design, have it breadboarded, build it, and then verify it – and then change it if it doesn't work quite right. All of that is done automatically. The engineer only verifies that the design was done properly. If it wasn't done correctly, the design generator is reworked to avoid that problem in the future.

Finally, these modules do not have to undergo additional qualification tests such as life testing or shock and vibration because they are built on the same platform as standard modules using the same qualified components. The standard products have undergone extensive life and environmental testing to ensure the quality of design and manufacture, and these new designs are qualified by similarity.

For more information on power system design from Vicor Corp.,go to http://ept.hotims.com/16420-146.



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