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Growing Digital Power Market Attracts Strong Analog Backers

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The printed circuit board (PCB) landscape is changing rapidly, especially across telecom and server systems. Some computer OEMs are reporting dozens of different point-of-load (POL) dc-dc converters, voltage regulators and other power supply needs on a single board. Hence, it is not practical anymore, as well as cost effective, to address these board requirements with analog power solutions. Obviously, to simplify design, reduce components and provide some flexibility, designers are resorting to digital power management techniques.

In fact, a recent study by market watcher IMS Research shows that the digital power market has entered the mainstream adoption stage. As a result, senior market research analyst Ryan Sanderson estimates that the digital power IC market will grow at a compound annual growth rate (CAGR) of 30 percent per year for the next five years. At this rate, it is projected to go from about $200 million in 2010 to close to a billion by 2016. In 2010, according to IMS Research, the digital power IC market accounted for approximately 3.7% of the worldwide voltage regulation and control ICs market. The market share for digital power ICs is expected to grow to 9.6% by 2016, as shown in Fig. 1.

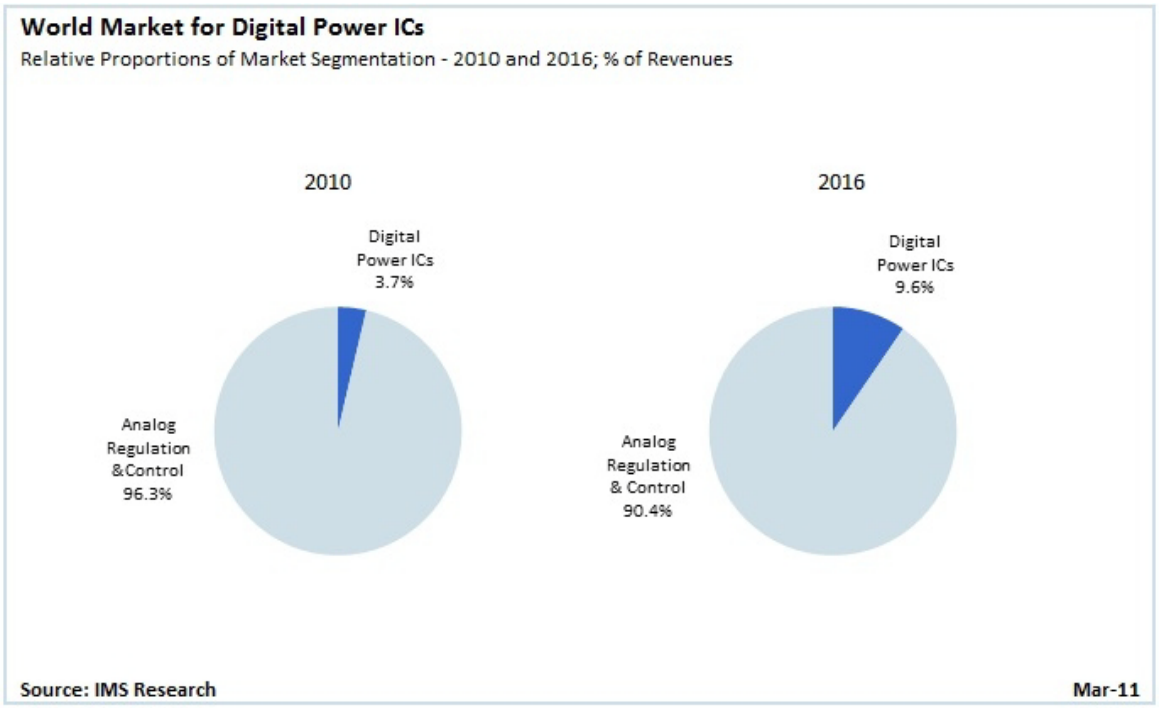

Fig.1. Market watcher IMS Research predicts that digital power ICs will account for 9.6% of the worldwide voltage regulation and control ICs market by 2016. If it comes to pass, that will be nearly a 6% gain in market share since 2010.

Consequently, more and more players are entering the contest. Some recent well known names to announce entry into this space include Maxim Integrated Products and International Rectifier. Interestingly, both these newcomers are making entry into this space via acquisitions and patent licensing.

To quickly gain presence in this rapidly evolving digital power market, power management semiconductor supplier Maxim has acquired a digital power converter developer by the name L&L Engineering, in addition to internal development efforts. L&L was acquired in early 2010 for a cash value of $4.0 million. Plus, it has also obtained related high-level patents from the University of Toronto, Canada. The Toronto University patents are related to auto-tuning methods for switch-mode power supplies (SMPS). To ensure there are no legal issues concerning use of PMBus, the company also recently licensed digital power technology “DPT” patents from Power-One. Likewise, IR has inked a deal to acquire privately held CHiL Semiconductor for $75 million in cash.

Maxim's goals are high. It envisions becoming a top supplier of digital power solutions by closing the gap between digital and analog power performance that exists today. Hence, to accomplish that goal, it brought on board Jim Templeton, the founder of Zilker Labs, which was later acquired by Intersil. Templeton is now director of business management at Maxim, leading the company's digital power efforts.

Combining internal developments with acquired technologies, Maxim has developed a patented state-space or model-predictive controller architecture that overcomes several limitations of today's proportional-integral-derivative (PID) based digital power solutions (Fig. 2). Called InTune digital power technology, it performs an automatic compensation routine that is based on measured parameters. This, in turn, enables the construction of an internal mathematical model of the power supply including the external components. As a result, SMPS supplies built with this technology can achieve the highest-possible dynamic performance while guaranteeing stability, claims Maxim.

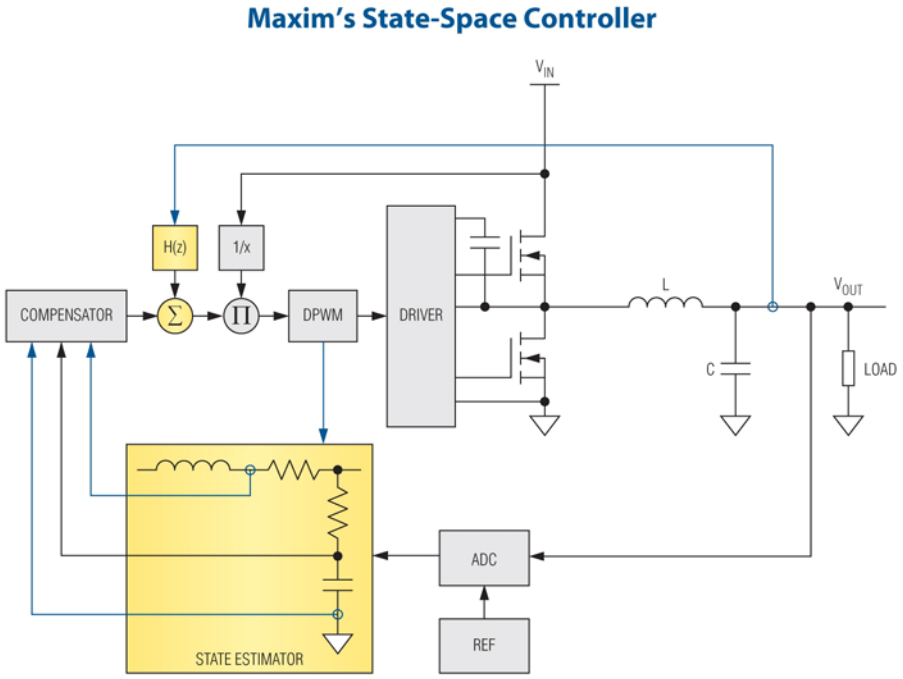

Fig.2. Maxim's InTune digital power technology is a patented state-space or model-predictive (deterministic) controller architecture that overcomes limitations of modern proportional-integral-derivative (PID) based digital power solutions. It is tailored to provide high efficiency and best transient response over all operating conditions.

"Unlike competing technology, Maxim's InTune digital power technology is not an iterative tuning technique. It is deterministic and resolves several limitations present in today's digital power solutions," states Templeton. "Unlike PID-based solutions, the loop used by InTune digital power technology provides seamless small- and large-signal response without the need to cross back and forth between linear and nonlinear modes. This enables loop response up to 10x faster than competitors and does not require any user-set thresholds."

According to Templeton, "Maxim's InTune represents the next-generation of digital power technology. It is tailored to provide high efficiency and best transient response over all operating conditions, asserted Templeton. Furthermore, continues Templeton, besides high performance it requires up to 5x lower bias current than competing devices.

Highlighting the fast transient-response capability of InTune, Templeton says that because there is no integrator in the control loop, Maxim's digital power technology enables zero to 100% duty cycle in less than half a switching cycle. Plus, it permits zero to 100% duty cycle at any moment in time. Fig. 3 compares the step-load performance of Maxim's InTune with a traditional auto compensated solution.

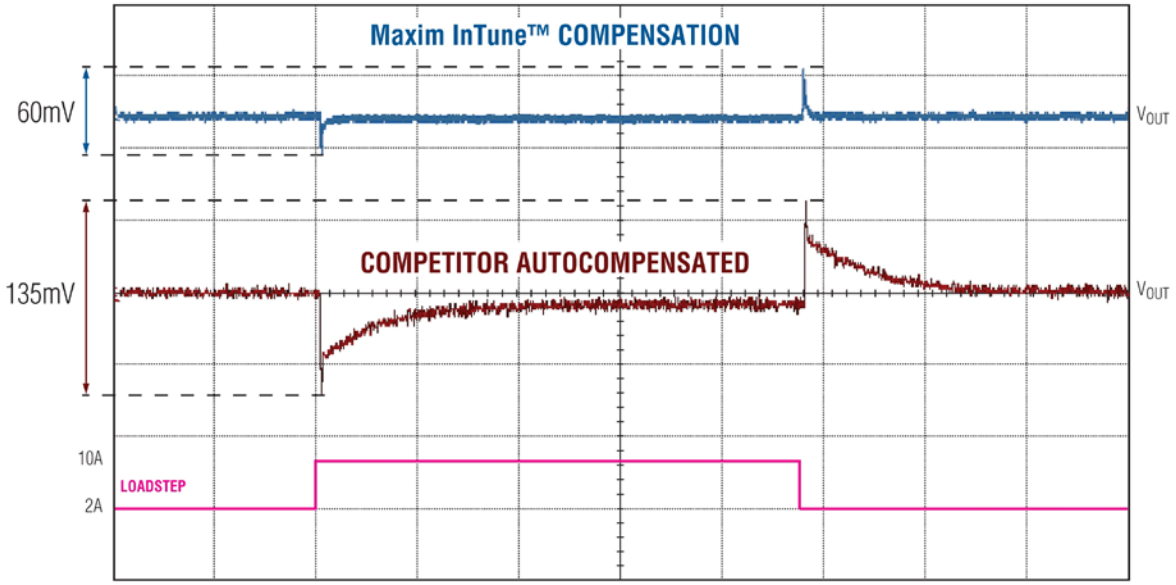

Fig.3. *In comparison with auto compensated solutions on the market, InTune's deterministic auto compensation technique offers significant improvement in transient response and recovery time for a rapid load change.*

Currently implementing InTune technology in 0.18 µm BiCMOS process, Maxim has realized controller silicon that it is sampling to key customers. Although the company did not provide specific details of the new digital controller chip, it is designed for 10 to 30 A single-phase 12 V input to 1.2 V output converters using external MOSFETs.

Internal tests show that it offers above 90 percent efficiency at rated current with transient recovery time 5x better than competitive parts. Likewise, the bias current is twice lower than the nearest competitor, while the turn-on time is twice as fast as the next competitor. However, the company did not identify any of the major players against whom the InTune-based controller chip was compared.

The preferred package choice for Maxim's InTune controllers is PQFN. "Maxim will release the first product based on InTune at the end of the second quarter," says Templeton. Although, the initial products will be aimed at telecom and server applications, the plan is to extend it to mobile products in the future.

With regards to IR, the acquisition of CHiL gives the power management leader a digital platform that has been missing from its product portfolio. It also augments IR's digital power design and applications engineering team. Prior to this acquisition, the two have been working jointly for about a year.

Precisely, it will complement IR's current line of POLs and multiphase dc-dc converters. To realize multiphase power solutions that save energy, CHiL has developed patented digital techniques in mixed-signal technology. According to IR, CHiL brings an open architecture approach to digital control that promises to significantly reduce board space and bill-of-materials (BOMs) while integrating many analog features into the digital core of the technology.

"The addition of CHiL's technology and expertise to our broad portfolio of industry leading products such as DirectFET, PowIRstage and SupIRBuck, offers IR's customers a unique value proposition by providing a high performance, cost effective, complete end-to-end integrated solution," states Tim Phillips, vice president and general manager, Enterprise Power Business Unit of IR.

Vishwas Karve, IR's vice president for Strategy and Business Development, thinks that the acquisition of CHiL expands IR's presence immediately in the high-performance computing and graphics segments, and over the medium-term in the server, storage and notebook end markets. Down the road, IR intends to extend the digital technology to other vertical end markets such as energy savings products, automotive and hi-reliability applications.

According to CHiL's CEO, Ram Sudireddy, "To date, CHiL has secured a significant number of design-wins across a wide spectrum of graphics, high-performance computing and server platforms that IR can help grow."

About The Author

Ashok Bindra is a veteran writer and editor with more than 25 years of editorial experience covering RF/wireless technologies, semiconductors and power electronics. He has written, both for print and the web, for leading electronics trade publications in the U.S, including Electronics, EETimes, Electronic Design and RF Design. Presently, he has his own technical writing company called Technika through which he does writing projects for different trade publications and vendors. Prior to becoming an editor, Bindra worked in industry as an electronics engineer. He holds an M.S. degree from the Department of Electrical and Computer Engineering, Clarkson College of Technology (now Clarkson University) in Potsdam, NY, and an M.Sc (Physics) from the University of Bombay, India. He can be reached by email at bindra1[at]verizon.net.