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Mixed-signal SoCs alter analog scene

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Lisbon, Portugal — There are two good reasons you probably haven't heard about Chipidea Microelectronica. First, it's an IC company based in Portugal, where no large semiconductor manufacturer exists and the local IC market is virtually nil. Second, anyone who understands the complexity of analog technologies and the intellectual property business wisely regards "analog IP" as a risky proposition.

So when Chipidea claims it's actually generating real revenue--more than $25 million in 2006, with an annual compound growth rate of 50 percent--the experts are even more skeptical. They ask, with good reason, "How do you know the analog IP will actually work? How can it be assured that it integrates properly? How do you 'test' analog IP anyway?"

Despite such well-reasoned doubts, market statistics show an analog IP market on the rise. The analog and mixed-signal IP market grew 34 percent in 2006, accounting for 16 percent of the overall design IP market, according to Christian Heidarson, senior research analyst at Gartner. Chipidea, Gartner's figure shows, ranked ninth among all IP vendors in 2006.

Chipidea has earned a reputation as a rare success in merchant analog/ mixed-signal IP. The company supplies single-function analog IP and subsystem cores including RF, wireless, power management, wireline, audio, video and connectivity interfaces. While Chipidea doesn't disclose its customer list, leading fabless mobile-TV chip suppliers such as DiBcom and Siano, which do not have in-house analog capabilities, reportedly got Chipidea's help in bringing their DVB-H tuner/demodulators to market in record time.

Chipidea's emergence poses questions about the changing nature of the analog business. As more systems-on-chip (SoC) integrate analog content, will discrete analog IC vendors, with no virtual components to sell, be forced to fight for survival? Will integrated device manufacturers (IDMs) that design their own analog IPs need to shift focus elsewhere?

Enter José Franca, founder and CEO of Chipidea. The executive occupies a sort of nonoffice office--no walls, no door--at Chipidea's headquarters near Lisbon. His desk is tucked away in a corner of the same airy floor where the company's engineers have workbenches. Here, Franca patiently outlined a relatively nascent analog IP market. He talked of an inevitable future where all technology components will be brought into the SoC fold.

Franca has never said, however, that analog IP companies like Chipidea might one day replace discrete analog chip companies. "Analog is an extremely diverse business. It needs to cover a vast space of technology," he said. Nor has he suggested that Chipidea could go head-to-head against IDMs.

But he does predict that IDMs with internal analog-engineering resources will start divesting some of their standard analog IP.

"Look back on the history," Franca said. Semiconductor companies that once developed their own design tools internally no longer do so, thanks to the rise of the EDA industry. Wafer manufacturers are yielding to the foundry business. Those who once designed proprietary processors now embrace cores from ARM or MIPS. Next to go, Franca posits, will be some of the analog/mixed-signal IP that IDMs now develop for SoCs.

Chipidea already works with "eight of the top 10 IDMs in the world," developing IP that the IDMs can integrate into their chips, said Franca. The "disintegration" of IDMs' internal analog IP business may not yet be obvious to the industry, he said, but it's a "relentless process."

Analog expertise has always been regarded as a crown jewel at IDMs, differentiating them from digital-only chip companies and startups. And analog, is in vogue again; even DSP vendor Texas Instruments Inc. today calls itself an analog company. So why would an IDM with significant analog expertise use someone else's analog IP?

Franca offers an answer. Today, even large IDMs such as Freescale, TI and NXP are embracing the "fab lite" model. The pressure to turn around SoCs quickly makes such companies more receptive to using external analog IP to meet deadlines. But they also continue to pursue their own pure analog plays, with their solutions highly optimized for their own process technologies, Franca said.

Franca may be correct that a trend is under way, but it's not a revolution. Pieter Hooijmans, technology competence manager for analog and RF IP at NXP Semiconductors (Eindhoven, Nether- lands), said the IP used in the company's SoCs "is developed in-house, by dedicated IP design teams or by development teams inside the business lines. Purchased IP is still rare. We consider analog IPs critical for SoC performance, primarily because they are the SoC's interface to the physical world."

But Hooijmans acknowledged that "external sourcing of IP is indeed an option" under certain circumstances. Declining to comment specifically on Chipidea's business, he laid out a few industry trends that may accelerate the analog IP market.

First, he said, "the number of IP blocks that needs to be supported is continuously increasing, especially in the serial-interfaces domain." Second, the process technology spread between component and SoC products is increasing, he said, "in the sense that a function needs to be supported in quite a number of CMOS nodes." Today, it ranges from 0.25 to 0.13 micron for components and from 90 to 45 nm for SoCs. "This makes it increasingly difficult to have the IP supported internally for every node."

Under such circumstances, "external players may have [more] interesting or timely solutions," said Hooijmans.

Back at Chipidea, Franca views the company's mission as "making captive technology available to the world. We foster competition and accelerate the trend for SoCs with analog content."

Analog IP content in SoCs is a growing concern even for digital IP companies. Oliver Gunasekara, vice president of corporate business development at ARM (Cambridge, England), predicted that, "in time, the discrete analog IC business will decline and be replaced with single SoC and SiP [system-in-package] devices that contain analog IP."

The question is how to get there. ARM, for one, has dabbled in analog IP; it provides PCI Express PHYs.

Compared with the digital IP business, Gunasekara noted, the challenge in the analog IP market is the business model itself.

"Analog IP is delivered as a GDSII hard macro, which means that it needs to be ported to each specific foundry and process," he said. "The majority of this work is done by hand, as there are few tools to automate it, and as a result it is very labor-intensive."

Moreover, "as new processes are updated, the IP needs to be retested and validated," he said. "It is much more expensive in comparison with digital IP, which is mainly delivered in RTL."

The key to success in the ana- log IP business, in Franca's mind, is to offer multifunction IPs supporting multiple process nodes across multiple foundries. Today, Chipidea supports more than 40 merchant and captive processes from more than 15 different wafer manufacturers, with process generations ranging from 0.18 micron to 65 nm.

In contrast, most analog semiconductors work with very few fabs, offering SoC vendors few options when their analog content needs to be integrated. Chipidea is also focused only on CMOS—no SiGe or BiCMOS.

"CMOS is our strategy because it's the cheapest process technology available," said Franca.

But there are other challenges. As ARM's Gunasekara said, "The interface to the analog IP is proprietary, and as a result the IP vendor needs to do the customization." For digital IP, by contrast, "you have the Amba bus, which is a standard, thereby reducing the need for custom interfaces."

Franca readily acknowledged that no single piece of analog IP will fit well in every customer's product without adjustments. "We have a lot of silicon-proven analog IP that gives confidence to our customers. But there are no guarantees that it will work correctly in every application," he said.

The quality of analog IP is affected by the accuracy of a transistor model. Further, elements of technologies in analog are "parasitic," requiring proper extractions, Franca said.

In the end, he said, analog IP quality "is a shared responsibility among foundries, IP vendors and SoC developers."

Franca's great source of pride is that 70 percent to 75 percent of his business is based on repeat customers. But that raises another question: Isn't the analog IP business a design service, after all?

No, Franca replied adamantly. "We wouldn't do design for hire."

Chipidea's quest to become an integral part of "a virtual system semiconductor company" has only begun. "Diversity of technologies and functions is a huge challenge in scaling our business," commented Franca.

Earlier this year, Chipidea acquired Nordic Semiconductor's data converter IP business unit, a move Franca characterized as "strategic for building human capital." It has also acquired TransDimension, Oxford Semiconductor's subsidiary, for high-speed USB IP controllers. "That's to complete our USB global solution," he said.

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