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## Analog design expertise is rare, valuable

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PORTLAND, Ore. — An enduring shortage of analog engineers--that may be getting worse rather than better--is requiring even digital chip powerhouses like Freescale Semiconductor Inc. (Austin, Texas) to redouble their efforts to recruit and groom analog engineers in the "black art" of mixed-signal processing.

"Analog integrated chip design remains something of an art," said Gary Grandbois, principal analyst for iSuppli's Analog ICs and Semiconductor Forecast. "Today, analog designers have to be comfortable in both analog and digital design, a demanding task that makes these designers rare, highly regarded and well paid."

Mixed signal chips that combine both digital and analog circuitry allow chip makers to combine their manufacturing expertise in digital device cores with proprietary analog interfaces to the outside world.

"Mixed signal expertise is what we look for when investing in semiconductor makers," Alex Woodward sector portfolio manager for technology at Mazama Capital Management (Portland, Ore.). "Analog circuitry on a digital chip is the 'secret sauce' that can make a proprietary semiconductor uniquely qualified for high-volume applications--and that's where the money is."

But analog engineers are becoming increasingly hard to find. The U.S. still leads the world in electrical engineering graduates, but digital engineering has become so popular that [new graduates specializing in analog electronics](#) are outnumbered by at least 10 to 1, according to Freescale, which has been trying to build-up its analog capabilities since separating from parent Motorola in 2006.

"In the U.S. we are producing maybe 1,000 analog engineers per year from our top universities, but 10 or 20 times that many digital engineers are graduating," said Jignasha Patel, Freescale's director of global talent sourcing. "There are a lot of EEs graduating, but fewer and fewer of those are specializing in analog."

When Freescale was spun off from Motorola as a private company two years ago, most of its analog engineers remained at Motorola. Freescale immediately began an aggressive program to recruit analog engineers to design mixed-signal chips.

"With 23,000 employees in 30 countries, we tried to make up our shortfall in the U.S. by recruiting from other countries, so we opened development centers in many areas across the world in order to tap into the analog talent wherever it might be," said Patel. "We found that eastern Europe and Asia both had growing markets with analog engineering talent. In China, for instance, there is significant analog talent."

"Unfortunately, we also found that they were without the depth of expertise you need to participate in the global economy. We can find really great digital talent everywhere in the world, but we are still having a hard time finding experienced analog talent anywhere in the world," he added.

As a result, Freescale concluded that it had to start a homegrown effort to recruit experienced analog engineers. Managers also realized they had to foster an internal culture that provided newly graduated engineers with the experience they needed to develop a deeper analog expertise.

Freescale's first step was to hire a corporate-wide analog engineering manager with a proven track record, and with the experience necessary to develop Freescale's internal analog engineering resources. That manager is Arman Naghavi, a 19-

year veteran of Analog Devices, who had more recently overseen design, product and test and applications development at Intersil Corp. (Milpitas, Calif.)

Naghavi, vice president and general manager of its analog, mixed signal and power division, said: "Our heritage was to use Motorola as our analog supplier, but as an independent company we had to start our own programs to attract analog engineers, and we have been very fortunate. Now we have many talented recruits, but we still need more and will hire as many as we can get."

Since Naghavi came to Freescale, the company has been able to attract several analog "gurus," which the company said it has leveraged by instituting a "mentoring" culture in its analog engineering group.

"The way we organize our analog group now is to complement one of our senior guys with several less experienced analog engineers so that he can mentor them," said Naghavi. "That allows the guru to work on more than one design at a time by dividing down the tasks that are time consuming, but require less experience."

According to Naghavi, mentoring is a lengthy but necessary process.

"Digital engineer can often start making significant contributions to a company just six months after graduating, but analog technology requires five to seven years of on-the-job experience before engineers can begin making significant contributions," said Naghavi.

Compounding the problem is the perception that analog technology is "old" while digital engineering is viewed as on the cutting edge.

"Digital has become so popular that people often assume that analog is the old technology," said Naghavi. "I say the best thing that ever happened to analog was the digital revolution because all the new digital gadgets have to interface with the real world--which is analog--and to create those interfaces you need analog engineers."

Demand for analog engineers today also is increasing because even digital companies need analog engineers, contributing to the worldwide shortage. "When I put out a call for applications to digital engineers I get hundreds of qualified applicants," said Patel. "But when I call for analog applicants, I often get only four or five qualified candidates."

Freescale's is not only fostering its internal mentoring program, but is also courting universities to develop new analog programs. Analog engineering has languished at U.S. universities as digital technology has grown in popularity.

"Fewer students are specializing in analog, and many of the professors who are experts in analog have taken higher paying jobs at companies, so there are fewer professors to teach analog too," said Naghavi. "What's worse is that analog is a whole lot more difficult to learn--you have to deal with all of the harsh environment problems in the real world--[transients](#), temperature changes and all that digital designers can often ignore."

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