

First class to China
By Bill Roberts -- 9/1/2006
Electronic Business

Homestead High School in Silicon Valley produced Steve Jobs and Steve Wozniak, founders of **Apple Computer**. A generation later, it bred John Yu and David Hu, founders of **Chipnuts Technology**, a Shanghai-based startup that designs multimedia chip sets for mobile phones.

Yu and Hu are among a small band of midcareer Chinese engineers returning to their roots to start fabless chip companies after getting their education and spending their formative business years in the West. They bring the same passion to IC design that Jobs and "the Woz" brought to computers, and they're determined to make China the Mecca of microelectronics.

"If you want to make a commitment to this industry, you need to be where the market is," says Yu, chief operating officer at Chipnuts (see "Two high school buddies" on page 42). "Chipnuts deals with multimedia and consumer electronics, and the biggest direct market is here in China."

Returnees like Yu and Hu have several advantages over Americans. They speak both English and Chinese and know the cultures of China and the West. And they're well versed in the latest IC design methods. Some know Western business practices and how to manage engineers. There aren't more than a thousand engineers with these qualities working in the Chinese IC design industry, but they bring skills the domestic companies desperately need.

"At least 20 percent of our 450 IC design companies have returnees [working for them]," says Shaojun Wei, vice president of the IC design branch of the China Semiconductor Industry Association (CSIA). "They could have a huge impact on our industry."

Returnees are just one reason IC design is advancing quickly in China. Others include the government's commitment to IC design, improved university training and global design centers teaching Chinese engineers the latest methods. Entrepreneurial spirit and venture capital investing are on the rise, too. Yet Chinese IC design falls short in several areas: innovation, skill in leading-edge processes, qualified engineers, intellectual property (IP) libraries and experience in project management.

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Berardino Baratta,
Freescale
Semiconductor

Despite the limitations, many China watchers at global chip companies, EDA vendors and market research firms see IC design competence advancing quickly and anticipate China could be a global force by the end of the decade.

Breaking through fast

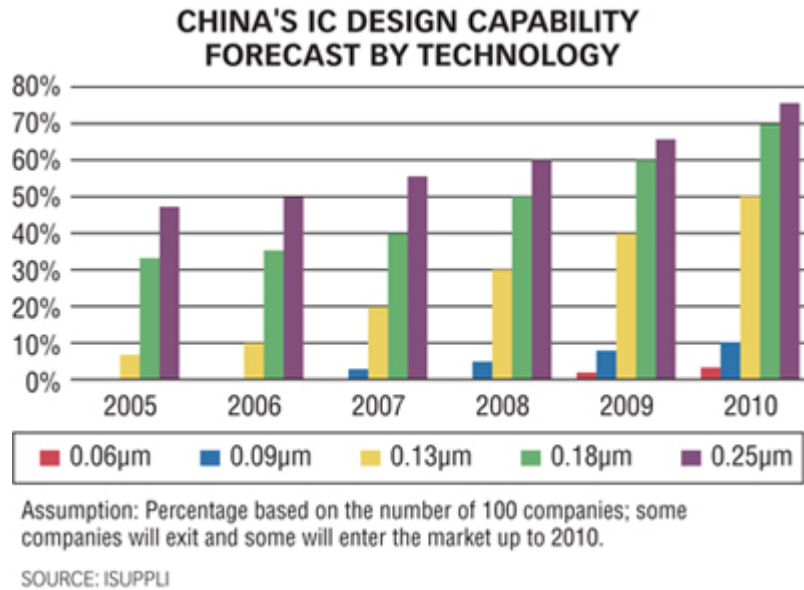
"Five years ago I would not have guessed how fast the Chinese would break through," says Berardino Baratta, general manager of the multimedia applications division in the wireless business group at **Freescale Semiconductor**, which has 250 designers at two centers in China. "Today, I think they are going to overcome these limits. They all want to change the world and make a lot of money doing it."

China is determined to control its own destiny across the electronics value chain, including IC design, product design, chip foundries, end products, IP, software and semiconductor equipment. It is already a force in manufacturing, but recognizes that manufacturing is the low end of the value chain and could eventually move to cheaper labor in places like Bangladesh and Vietnam. China seeks to build its own value-added electronics industry, not dependent on others for chips, software or IP.

"China is a manufacturing powerhouse, and there is a lot of activity to make it a force in design and in semiconductor equipment," observes Chi-Foon Chan, president of **Synopsys**, one of many EDA companies helping to train Chinese designers. "They have a focused effort on all aspects of electronics, but they are far behind in IC design."

China consumed about \$49 billion in semiconductors in 2005, 23 percent of the worldwide total, making it the second-largest user after the United States. However, China imported more than 90 percent of its chips, a factor it desperately wants to change. Wei says the domestic IC industry grew to \$9 billion in 2005, including the entire value chain from design to foundries (about 40) to packaging. IC design accounted for only \$1.5 billion of that activity, less than 2 percent of the \$49 billion in chips consumed.

China has ambitious plans. It wants to increase ICs designed and manufactured in China from 3.7 percent of the global market in 2005 to 8 percent by 2010, according to Zhang Qi, director general of the Department of Electronics and IT Products in China's Ministry of Information and Industry (MII). It hopes to sustain 30 percent growth per year for the next five years across the entire semiconductor ecosystem, according to Qi, in comments that appeared in [*Movers and Shakers 2005*](#).



The gap between where China is and wants to be is likely to motivate it. "The potential for domestic IC design is huge," says Lung Chu, president of Cadence Asia Pacific and corporate vice president of **Cadence Design Systems**. "Their market potential is between \$1.5 billion and \$49 billion. That is an awful lot of domestic market the Chinese can aim to fill."

For years, the government has encouraged fabless startups. Some were government-funded, often incubated in one of seven IC design centers; others were joint ventures with local universities or foreign chip companies; some were spun off from domestic OEMs; and recently there has been a wave of Silicon Valley-style startups that are backed by VC funding or, as in Chipnuts' case, bootstrapped.

Homegrown companies

At the end of 2005, Wei says, China boasted about 450 homegrown IC design companies, including fabless companies and design services firms, which the CSIA does not track separately. As many as three-fourths are two- and three-engineer shops that contribute little to the market and are not expected to ever amount to much. At present, about 100 are serious companies, but few of them have annual revenue of \$50 million or more. At least one-third have domestic or foreign VC backing, Wei says.

According to MII's Qi, China is aiming for between five and 10 domestic IC design companies each with \$100 million or more in annual revenue by 2010.

In a report published in January, market research firm **iSuppli** noted that China's IC design companies tend to work in one of three areas. The main focus is consumer electronics for the domestic market: chips for MP3 players, microprocessors, LCD drivers, motor drivers, single-chip radio ICs and microcontrollers. In telecommunications and networking, they design ICs for 3G handsets and for equipment in mobile infrastructure, switching, broadband and optical networks. Many companies mainly

design ICs for smart cards, a third market. The government mandated a new national identity smart card for which foreign chip companies need not compete; the Chinese companies have it locked up.

The Chinese are hampered by a lack of IP, which of course accounts for some of the well-documented IP theft in China (see "Protect your IP," May 2006, page 36). The CSIA is well aware of the problem. "We don't have enough IP cores," says Wei. "The most important ones we don't have are the most widely used ones, and you have to buy or license them."

iSuppli concludes: "There is no doubt that domestic Chinese fabless companies will pose a serious threat to multinational semiconductor vendors in specific markets. [But] iSuppli does not expect that China's fabless industry can catch up to North America, Taiwan and Israel within the next five years, as the majority of fabless companies are still small with less than \$5 million in annual revenue."

No one should overestimate or underestimate China's level of IC design competence. Take manufacturing process nodes as one example.

Behind on process

Most fabless companies are one or two process generations behind global companies. The Chinese are still mostly designing at 0.25 and 0.18 microns. iSuppli estimates that less than 10 percent of designs were at 0.13 microns in 2005, and that the first 90-nanometer designs won't appear until 2007, reaching 10 percent of the total by decade's end (see "China's IC Design Capability Forecast by Technology," at left).

Yet a few Chinese companies are working at 0.13 microns. The Chipnuts chip sets in products currently on the market were designed at 0.18 microns, and the company is now designing at 0.13, says Yu. He hopes to be designing for 90 nm by 2007, which would make Chipnuts a leader.

More characteristic is **Actions Semiconductor**, which makes a system-on-a-chip (SoC) for non-iPod MP3 players. Actions, based in Zhuzhai, with centers in Beijing and Shenzhen, drew worldwide attention in 2005 when it became one of two Chinese fabless companies to go public on Nasdaq. The other was **Vimicro**, which designs microprocessors for multimedia applications. With annual revenue of \$149.6 million in 2005, Actions is the second-largest domestic fabless company behind **Solomon Systech** (see "Chinese company with an American history" on page 44). Actions recently moved to 0.18 microns but is not sure when it will design at 0.13, says Chung Hsu, the company's director of investor relations.

Actions proves that leading-edge designs are not necessary to win market share. Actions shipped 49.8 million units and captured 30 percent of the global market for non-iPod MP3 player SoCs in 2005, according to iSuppli. The Actions SoC sold for \$3, compared with an industry average of \$5.67, yet the company sustained a profit margin of 55

percent. Actions is a rarity: More than 90 percent of IC designs by Chinese companies were for domestic consumption in 2005.

Domestic companies may not be moving to smaller geometries, but global companies are, giving Chinese employees opportunities to work at the leading edge. Freescale recently had its Chinese engineers tackle a complex module design from start to finish, a block that involved third-party IP. The team's first 90-nm effort, the piece has been included in a multimedia design that has been successfully taped out.

Leading generation parts

"The part is reusable across Freescale, and this was the first time they had handled something like this," says Baratta. "I could see leading-generation parts being made entirely from scratch in China within five years."

Yu is thrilled that fellow Chinese are getting this kind of experience because Chipnuts hires most engineers from multinationals. Chipnuts employs about 200 workers, 70 percent of whom are engineers, he says. "We hire mostly from the global IC companies in China, typically someone with three to five years of experience and a bachelor's degree." One-third of his engineers have a graduate degree from a domestic or foreign university.

Yu was surprised at how quickly the Chinese learn. "They work hard and learn very fast. I would match my team against any in our [technology] area," he says. Chipnuts had revenue just under \$20 million in 2005 and is on track to triple it in 2006, he says. Its primary market is China, but it will soon sell to OEMs in Korea, Singapore and Taiwan.

It's widely acknowledged that Chinese IC designers have solid basic circuit design skills and quite a bit of hands-on training in methods and tools if they went to graduate school.

An engineer with a master's degree is ready to tackle elementary design and will learn quickly; a Ph.D. can contribute immediately in some areas.

Wally Rhines, CEO of **Mentor Graphics**, one of many EDA companies helping to train Chinese designers, has visited several universities. "I'm impressed with how rapidly they have moved forward with a basic curriculum in electrical engineering and IC design involving hands-on activity with commercial design tools," Rhines says.

Last year, MII's Qi said China would need 250,000 design engineers by 2010, but it is not clear to what level of expertise she was referring. Gary Smith, a Gartner analyst who has studied China's IC design community, cautions that the Chinese often lump together all levels of expertise, including people with two-year technical training. More precisely, Qi also said China hopes to add 10,000 midlevel and advanced IC designers each year over the next five years.

The CSIA estimates that China had about 10,000 advanced IC designers at the end of 2005, a number Smith believes may be high. Wei confirmed the goal of adding about 10,000 designers a year for the next several years. Given China's 1.3 billion population and 300,000 engineering students of all kinds each year, Wei is confident that China will produce 40,000 to 50,000 IC designers over the next several years.

Wei, however, isn't confident that the IC designers will have the right skill sets. He and others say the Chinese lack product-definition capabilities—turning a customer's needs into IC specs. They're not deft at designing architecture or other breakthrough innovation, lack project management and general business skills, and need more entrepreneurial attitudes.

Lacking managers

"It is generally accepted that they need a pool of talented architecture people, who are more available in other countries," says Synopsys' Chan. "But it is not the top problem." Chan says Chinese IC design companies desperately lack first-line managers. A company with 300 engineers needs about 30 first-line managers, he argues. The Chinese do not have anywhere near the number it needs to build globally competitive companies.

Yu says Chipnuts had problems finding first-line managers when it launched in 2004. Yu, Hu and two other returnees had to do most of the managing at all levels in the early days. Now, several of his engineers have been promoted to first-line management positions.

The multinationals help, too. Infineon, for example, sends engineers to Infineon design centers around the world as part of their training, says Michael Tiefenbacher, managing director of the design center in Xi'an, which employs about 350 engineers who work on memory, communications, industrial and automotive. The result: "Some local hires are beginning to move into first-line management. They're not fresh talent from the universities and have all had both overseas and local experience with Infineon."

John Gallagher, director of outbound marketing at **Synplicity**, another EDA firm involved in China, thinks the problem with first-line managers isn't their skill level per se, but a nonquantifiable trait.

"First-line management usually requires a certain amount of take-charge thinking," he says. "In China, that first line is often quite timid. 'Take charge-ism' is an American trait."

China's Top Ten Semiconductor Suppliers in 2005
(Revenue in \$ millions)

2004 Rankings	2005 Rankings	Supplier	2005 Revenue from China	2004/2005 Change
1	1	Intel	5,774	14%
2	2	Texas Instruments	2,270	23%
4	3	STMicroelectronics	1,799	21%

2004 Rankings	2005 Rankings	Supplier	2005 Revenue from China	2004/2005 Change
5	4	Samsung Electronics	1,741	28%
3	5	Philips Semiconductors	1,720	7%
6	6	Toshiba	1,435	7%
7	7	Hynix	1,243	-6%
9	8	Freescale Semiconductor	1,239	13%
8	9	Infineon Technologies	1,000	-11%
10	10	Micron Technology	704	5%

Source: iSuppli Corp. July 2006

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Two high school buddies

It's a typical Silicon Valley story. Two high school buddies pursue engineering careers at different universities and companies. They keep in touch and dream of starting their own business. They gain technical and business experience and, in their late 30s, join forces and resources to launch a fabless startup.

The only difference: John Yu and David Hu launched their company in Shanghai after getting their education and career starts in the West. Hu is CEO and Yu is chief operating officer of **Chipnuts Technology**, founded in 2004 to develop multimedia chip sets for mobile phones sold in the Chinese market and increasingly throughout Asia.

Now both 38, they met at Homestead High School in Cupertino, Calif., where Steve Jobs and Steve Wozniak graduated a generation earlier. Born in Taiwan, Yu came to the United States at age 13; born in Shanghai, Hu landed at age 15. Yu graduated from Homestead in 1985 and Hu in 1987.

Yu got a bachelor's degree in electrical engineering at the University of California, Berkeley, and a master's degree in electrical engineering at Stanford University. He worked at **Tandem Computers** and **Cirrus Logic**, and then helped found **Altius Solutions**, which merged with **Simplex Solutions**, which merged with **Cadence Design Systems**.

Hu earned his bachelor's degree in electrical engineering at Santa Clara University, and then worked at **Philips Consumer Communications** and **Avaya** in the United States

before returning to Shanghai in 2001 to launch **Yuhua Telecom**, a mobile phone design house. Hu left Yuhua Telecom in late 2003 to start Chipnuts.

Yu invested and got involved from afar while still working at Cadence. In the fall of 2004, he moved to Shanghai to work full time at Chipnuts.

"I've been an IC guy from the beginning," says Yu. "David focused on systems, and in the last nine years only focused on the mobile phone."

Shaojun Wei, vice president of the IC design branch of the China Semiconductor Industry Association, estimates 800 to 1,000 returnees like Yu and Hu work in China's fabless industry, mostly at startups. He says most have pure engineering backgrounds. No more than 200 have experience in engineering and management like Yu and Hu, Wei says.

Chinese company with an American history

If every fabless company in China were like **Solomon Systech**, the domestic IC design industry would already be a force to reckon with beyond its own shores.

Hong Kong-based Solomon Systech is an exception among Chinese fabless companies: the core team has existed for more than a decade and serves world markets with ICs for display panels, from mobile phones to large TV flat panels. It posted just under \$400 million in revenue last year and is by far the largest fabless company in China.

With 330 engineers, it staffs three design centers in China and a center in Singapore. It has a 15 percent to 20 percent global market share in its segment and competes for design wins globally, says Yvonne Chan, corporate communications manager.

A number of factors explain the company's anomalies. Solomon Systech was founded in 1999 by about 30 Chinese engineers who had worked for a design center operated by **Motorola** for a decade. When Motorola realigned to focus on core strengths, it spun off the display IC design team. Solomon Systech launched with engineering talent, managerial experience, some proprietary IP and a customer base.

"We don't think of ourselves as a Chinese company," says Chan, an early employee.

"We retain a Western management style, and English is our main language. We have a different history and a different culture than most Chinese fabless companies."