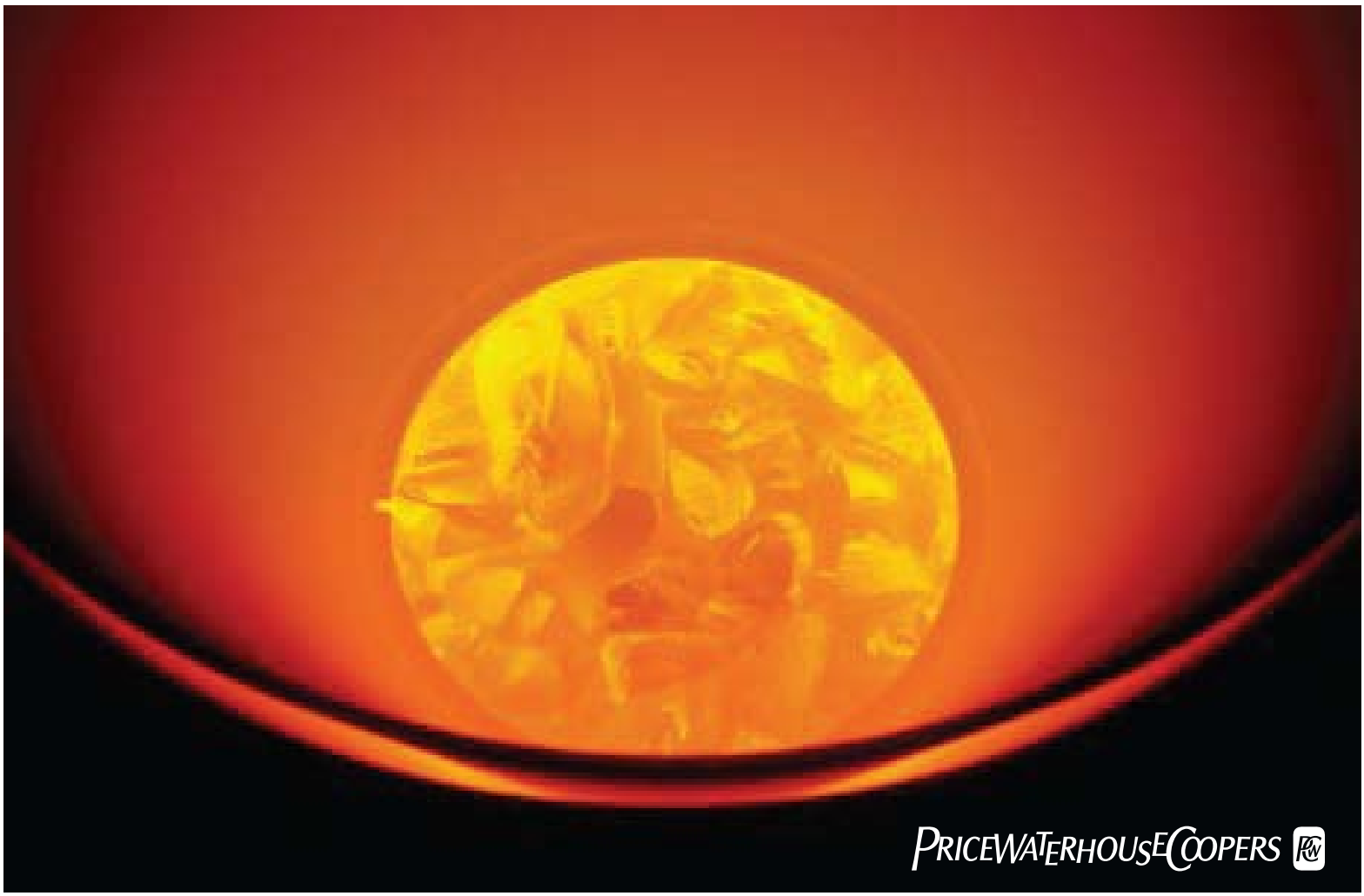
Technology industry

China's impact on the semiconductor industry: 2008 update



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Cover image: Production of pure silicon: Rods of metallurgical-grade silicon are mechanically broken into chunks and then melted at 2,593 degrees Fahrenheit to produce the pure silicon used for computer chip production. Shown here, the chunks are beginning to melt into liquid form.

Welcome

Raman Chitkara
Semiconductor Industry Leader
PricewaterhouseCoopers

The impact of China on the world's semiconductor industry—both as a consumer and supplier—is massive. It demands to be analyzed so that companies can react strategically with speed and agility. The 2008 edition of *China's impact on the semiconductor industry* was developed by PricewaterhouseCoopers to gain a better understanding of China's impact on the global semiconductor industry. This is our third and most comprehensive update to our original study in 2004. The 2008 update evaluates the current status of the semiconductor industry in China, assesses geographical and product category demand, reviews shifts in the semiconductor value chain, and analyzes three different IC production growth scenarios.

Semiconductors lie at the heart of ongoing advances across the electronics industry and play a central role in the digital revolution. Semiconductor companies are continuously creating smaller, faster, and more complex chips to meet the demand for rapidly-changing technology. Driven by both the continued growth of silicon content in end-products and the number of products with silicon components, the semiconductor industry maintained phenomenal growth over the last five years, and growth is expected to continue indefinitely.

The worldwide semiconductor industry is significantly impacted by the strategic focus of individual territories and geographies. With its emerging dominance in electronics manufacturing, China is poised to play a significant role in the semiconductor industry. China's semiconductor consumption market grew by 23% in 2007 to reach US$88 billion, accounting for just over one-third of the worldwide market. China's share of worldwide semiconductor production was about 9% in 2007 and is expected to increase gradually.

China's impact on the semiconductor industry: 2008 update is a part of a series of thought leadership documents published by PwC to continue its strong leadership and commitment to serving the semiconductor industry. To learn more about PwC's commitment to the industry, visit pwc.com/technology.

If you would like further information, or to discuss any of the findings in our report in more detail, please do not hesitate to contact me (raman.chitkara@us.pwc.com) or a member of the team around the world, listed in the back of this document.

About this report

The 2008 update assesses the current status of the semiconductor industry in China. As with our previous reports on this issue, the work is based on a second-order analysis. To accomplish this, first we reconciled data from assorted incomplete and, though reputable, often contradictory reports from various sources. These include industry associations and third-party research firms located in Asia and the West.

Next, we analyzed the reconciled data with an eye toward filling in gaps and revealing information that was not apparent in the original source material. We also interviewed industry executives to obtain current views from various segments of the value chain.

Our intent with this method was to construct a more comprehensive, meaningful, and yet quantitatively based picture of the industry than is otherwise available. This methodology leads to insights, observations and recommendations that might not otherwise be available to leading semiconductor companies and their advisors. For 2008, our latest iteration presents a current set of insights and recommendations.

China's semiconductor market consists primarily of electronics manufacturing services (EMS) companies, original design manufacturers (ODMs), and original equipment manufacturers (OEMs) that consume chips in China. The growth of this marketplace continues to be a major catalyst for changes in the industry. For this reason, we assessed the status of this market in depth, in particular considering its effects on semiconductor production, wafer fabs, packaging, assembly and test facilities and integrated design manufacturers (IDMs). We also reviewed the status of fabless and design companies in China.

In addition, our report examines the composition of the semiconductor value chain in China, comparing and contrasting with the worldwide value chain. As part of that analysis, we reviewed both the demand for semiconductor equipment in the country and for the primary equipment suppliers to the market. Finally, we reviewed three production forecast scenarios against actual production and consumption growth realized during the period.

A couple of further points regarding our data sources and metrics are worth noting. Both our data sources and the metrics we use—or in some cases developed ourselves—had to be sufficiently comprehensive and consistent to be useful for the type of report we wanted to publish. For that reason, we elected to use the World Semiconductor Trade Statistics (WSTS) values for the worldwide semiconductor market wherever possible—even though several other market research firms report greater values. The WSTS values are the only official values recognized by the various industry associations, including the China Semiconductor Industry Association (CSIA), that are members of the World Semiconductor Council.

We also elected to convert the Renminbi (RMB) currency values from various Chinese data sources to US dollar values at the average foreign exchange rate for the year reported on rather than at the year-end rate. We use this approach for simplicity and consistency because most of the semiconductor transactions in China are originally priced in dollars or other foreign currencies and converted to RMB on a contemporaneous basis for local reporting purposes. Therefore, throughout the report the totals on charts may not add to exactly 100% due to exchange rate and rounding effects.

The current report represents our latest analysis of the Chinese semiconductor marketplace. However, our original 2004 report explores in detail the overall dynamics of the global semiconductor industry along with the various issues that make China's role both influential and unique. That fundamental analysis remains valid. Readers who would like to gain a better understanding of these fundamentals should refer to the original report available at www.pwc.com/technology.

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Executive summary

PricewaterhouseCoopers began the study series, *China's Impact on the Semiconductor Industry*, in 2004 in response to our clients' interest in the rapid growth of the semiconductor industry in China. Specifically, clients wanted to find out whether China's production volumes would contribute to worldwide overcapacity and a subsequent downturn. Since then, it has become clear that market growth in China is far more significant to the worldwide semiconductor industry than mere production volumes.

Electronic systems manufacturers in China continue to increase their consumption of semiconductors at a rate three to five times the worldwide rate. As a result, China's semiconductor consumption market grew by 23% in 2007 to reach US$88 billion, accounting for just over one-third of the worldwide market. China's consumption of semiconductors now exceeds the markets in Japan, North America, Europe and the rest of the world for the third consecutive year.

As China's share of the worldwide semiconductor market increases so does its dependence on the export market. Export market consumption of semiconductors is the major contributor to the growth of China's semiconductor market. Since 2005, the consumption of semiconductors in China for export products has increased by 59% (US$21.8 billion), accounting for 69% of China's total market. Meanwhile, domestic market consumption increased by a significantly lower but still very robust 27% (US$5.7 billion).

A growing number of selling opportunities for the Chinese market are actually taking place offshore. That is, a significant number of buying decisions for customer-specified semiconductors devices consumed in China are being made outside of China. This is because some customers—due to supply chain considerations such as control of key inventory items, intellectual property protection and/or toll processing business models—will buy semiconductor devices outside of China and transship them to China for use and consumption. This "dislocated" purchasing of semiconductors has increased noticeably from about a third in 2004, to almost 48% in 2007.

The largest suppliers to the Chinese market continue to be multinational semiconductor companies. There were no Chinese companies (or brands) among the top 55 suppliers to the Chinese semiconductor market in 2007. Even if the largest Chinese semiconductor companies sold all their output within China, no Chinese semiconductor company would be among the top 50 suppliers to the Chinese semiconductor market in 2007.

At the same time, China's leading OEMs are purchasing a significant and increasing number of semiconductor devices. They could be important customers for many of the international semiconductor companies intending to participate in the continuing growth of the Chinese semiconductor market. Semiconductor consumption by eight of the largest Chinese OEMs represented about 15% of China's total 2007 semiconductor consumption market.

Though China's semiconductor market continues to grow faster than the global market, its growth rate is gradually decreasing from its 2003 peak. While further slowing is expected, forecasts for China's growth rate still exceed the worldwide rate by at least 50% for the remainder of this decade.

On the production side, international investment in Chinese wafer fabrication facilities (fabs) has not materialized to the extent that some industry observers expected. Still, Chinese semiconductor production growth overall continues to be strong—at 27% in 2007. China's share of worldwide semiconductor industry production is growing. It is becoming noticeable and significant, accounting for 9% of worldwide production in 2007. China's semiconductor industry remains much more heavily concentrated in discrete devices and integrated circuit (IC) packaging and testing rather than in IC wafer manufacturing and IC design. During the past two years much of the growth in China's semiconductor industry has come from multinational rather than domestic semiconductor companies.

Historically, IC design was the fastest growing segment of China's semiconductor industry. In 2007, however, the sector's growth was relatively disappointing. This is a result of severe competition leading to significant erosion in average selling prices in the medium- and low-end consumer products, as well as the IC card chip market where most of China's fabless semiconductor companies had been focused. China's fabless semiconductor companies constituted about 6% of the worldwide fabless semiconductor market in 2007.

During 2007, the government of China enacted major revisions to their corporate income tax and labor contract laws. These will affect almost all high-tech companies with operations in China and, as a result, could have an impact on the semiconductor supply chain and industry in China.

The new tax law changes the tax and incentive environment for many semiconductor companies operating in China. Many of the more recent entrants may see some reduction in expected incentive benefits. Essentially, the new law provides a more level playing field for foreign and domestic companies. Future incentives seem to favor R&D, IC design and foundry companies. Enhanced and more standardized enforcement means companies that put more effort into tax planning and preparation may benefit.

In the near term, the new labor law may substantially increase labor costs and reduce flexibility for many employers compared to their prior practices. However, for most multinational semiconductor companies, the new law will most likely provide a more level playing field in that it requires local competitors to provide a comparable level of human resources management practices and costs.

The greatest potential adverse effect these new laws could have on China's semiconductor market and industry would be to slow down further transfer of worldwide electronic systems manufacture to China.

Findings

The following is a summary of our findings for this 2008 update. These conclusions reflect secondary research, interviews with industry executives and our own analysis.

China's semiconductor market growth continues to outrun the rest of the world. Since 2001, the bottom of the last semiconductor business cycle, China's semiconductor consumption market has grown at a 31.5% compounded annual growth rate (CAGR) compared to a worldwide market CAGR of only 10.6%.

For the first time ever, China's consumption of semiconductors exceeds one-third of the worldwide market. Measured in US dollars, China's semiconductor market grew by 23% in 2007 to reach US$88.1 billion, representing 34.4% of the worldwide semiconductor market.

China's IC market is now growing at the expense of the IC market in other countries. China's IC consumption market increased by 24% in 2007 to US$73.9 billion, representing 33.8% of the worldwide IC market. This is the first year in which China's IC consumption growth exceeded the worldwide IC market growth, indicating that China's IC consumption grew by displacing consumption in other regions.

The OSD (optoelectronics, sensors and discrete) consumption market in China grew 18% in 2007 to reach a new peak of US$14.2 billion and 37.5% of the worldwide market. Most of this consumption can be attributed to discrete devices, which also grew 18% in 2007 to US$11.1 billion. China's discrete consumption market growth displaced consumption in other regions first in 2005 and again in 2007.

China's semiconductor consumption market is a bifurcated market. China's purchase market for semiconductors increased by 9.7% in 2007 to US$46.2 million and 18.0% of the worldwide market. At the same time, China's dislocated (i.e., purchased outside and transshipped/consigned into China for consumption) market for semiconductors increased by 20% in 2007 to US$41.9 billion and 16.4% of the worldwide market.

Reported revenues for China's semiconductor industry increased 27% in 2007 to US$27.4 billion, accounting for about 9% of the worldwide industry. Much of the growth in China's semiconductor industry is being driven by multinational, foundry and package, assembly and test enterprises. The combined 2007 revenues of the 29 largest Chinese semiconductor companies was just US$2.3 billion, representing less than 1% of the worldwide industry. Of the 27 of those companies that reported revenues for both 2006 and 2007, reported revenues increased an average of only 13% in 2007—notably less than the 27% increase reported for China's semiconductor industry overall.

While the Chinese domestic semiconductor industry is becoming slightly more concentrated, it remains far less concentrated than the worldwide industry. The top 50 Chinese semiconductor manufacturers in 2007 account for 53.5% of China's semiconductor industry revenue, up from 46% in 2005. But this is significantly less than the 82% share of worldwide revenue held by the top 50 worldwide semiconductor companies.

China's integrated circuit consumption/production gap increased by the greatest amount yet during 2007, reaching a new peak of US$54.9 billion for the year. That gap—the difference between IC consumption and IC industry revenues—has grown from US$5.9 billion in 1999 to US$54.9 billion in 2007. Chinese authorities expect this gap will continue expanding through at least 2010, providing continuing motivation for the Chinese government's initiatives to increase indigenous production.

Materials and equipment that are exclusively Chinese-made are entering the global semiconductor supply chain. At least two multinational semiconductor companies are complementing their product portfolios by purchasing, re-branding and selling semiconductor products from Chinese semiconductor companies. These products are designed and manufactured by Chinese companies and are usually fabricated using Chinese-sourced raw materials. Similarly, there are at least two wafer foundries and several semiconductor package assembly and test plants

that have started to use manufacturing equipment designed and built by local Chinese equipment companies. At this time, neither the indigenous Chinese-made materials or equipment represent a meaningful percentage of China's total use.

To continue to capture new demand growth, many major semiconductor companies will need to expand their presence in China. China is the world's fastest-growing marketplace. Still, of the top 70 suppliers to the worldwide semiconductor market in 2007, 32 still have below-average shares of the Chinese purchase market.

The symbiotic relationship between semiconductor companies in China, Hong Kong and Taiwan continues to grow. A number of developments indicate that Taiwan is loosening its restrictions on semiconductor investments in China. Also, while China's semiconductor consumption market grew by 57% over the past two years, Taiwan's market decreased by 13%. This reflects the continuing transfer—or offshoring—of electronic equipment production to China.

As a result, China's semiconductor market was more than seven times as large as Taiwan's market in 2007, even though a portion of that market demand was created by Taiwanese EMS and ODM companies. During the past two years, the Greater China semiconductor market grew by 39% to reach US$101 billion in 2007, representing over 39% of the worldwide market. The Greater China share of the worldwide semiconductor market has grown from 32% in 2005 to 39.4% in 2007, a gain of more than 7 percentage points. At the same time, Greater China's reported industry revenues grew by 41% over the past two years to reach US$73 billion in 2007—which we estimate is about 24% of equivalent worldwide industry revenues.

Recommendations

The following recommendations are intended to provide general guidance based upon our current findings. Issues addressed by this series include investment, intellectual property protection, risk assessment and contingency planning. Several recommendations are unchanged from prior reports while others are new or updated.

Reassess company presence. In 2007, China's semiconductor consumption market grew at the expense of semiconductor consumption in other countries. Many new opportunities for serving the worldwide market are emerging from inside China. Consequently, companies whose benchmarking reveals their China presence is less than that of their peers need to ramp up their business development efforts.

Adapt to China's "dislocated" buying structure. Almost half of the semiconductors consumed in China in 2007 were purchased outside of China. Suppliers need a team effort with design-in, qualification and purchasing focus at the OEM locations outside China coordinated with application and supply chain focus at the manufacturing locations in China to ensure success.

Keep an eye on home-grown competition. Continually monitor the efforts of local EMS and ODM enterprises to gain control over their BOM (bill-of-material) sourcing. Their success could lead to the OEM qualification of local competitors and displacement of multinational suppliers.

Pursue multiple points of entry. Use a range of different channels to gain access to the market. Chinese foundries and other local participants in the supply chain, for example, are in a position to help multinational companies tap sources of local demand.

Think: location. Locate packaging, assembly and test facilities near electronic manufacturing services, original design manufacturer and original equipment manufacturer facilities. The supply chain continues its process of integrating in these areas.

Design for the marketplace. China has become the largest site of low-cost consumer electronic system production and therefore the largest user of low-ASP analog and standard logic devices. Companies should design products that meet the specific requirements of this market.

Adapt to China's unique standards. China continues to propose alternate and unique standards which, if successful, may provide more desirable and effective solutions for specific developing-country environments that have large potential markets. Consequently, companies should monitor evolving Chinese standards, keeping an eye out for emerging opportunities.

Explore partnering opportunities. The majority of domestic design companies are small. Moreover, many are focused on domestic opportunities that foreign companies tend to overlook. Multinational design companies can bring considerable local market intelligence and relationships to bear on Chinese market initiatives. In general, multinational companies should consider partnerships with Chinese design companies as a strategy to address the local market.

Use Chinese foundries to gain pricing leverage. With their preponderance of 150mm and 200mm wafer fabrication facilities, local foundries may provide a lower cost alternative for some product categories.

Move mature products to China. Companies should consider transferring mature product lines to China. This can extend the competitiveness of those lines as well as free up scarce capacity and resources. First movers are using this strategy successfully.

Re-brand for local markets. Companies may find they can expand a product line by re-branding products for the Chinese and other markets. A local enterprise can even be used to manage the development effort. First movers are also using this strategy successfully.

Preempt discrete competition. Chinese companies continue to compete most effectively in the discrete area. As such, they could be gaining the scale, qualifications and recognition necessary to grow into potential worldwide competitors. So, leading discrete device companies should consider preempting these market share losses by participating actively in the Chinese market.

Adapt to the new corporate income tax law. Companies with operations in China should carefully examine their business strategy, model and structure in light of China's new Corporate Income Tax law and related incentive programs. Recent entrants, for example, may see reduction in expected incentives with future incentives seeming to favor R&D, design and foundry operations.

Promote participation in global industry forums. Encourage the China Semiconductor Industry Association (CSIA) and its member companies to participate in the World Semiconductor Trade Statistics (WSTS) and Semiconductor International Capacity Statistics (SICAS) programs. Their participation in these industrywide statistic programs would contribute to a better and more accurate understanding of their capabilities and contributions to the worldwide industry totals which would benefit the entire industry as well as themselves.

Keep an eye on Taiwan. It is widely accepted that Taiwan will loosen its restrictions on semiconductor investments in China. Taiwan-based companies have already increased their presence in China, and the supply chain is starting to follow suit. So, companies should monitor the status of Taiwan with an eye toward new market opportunities and risks in China.

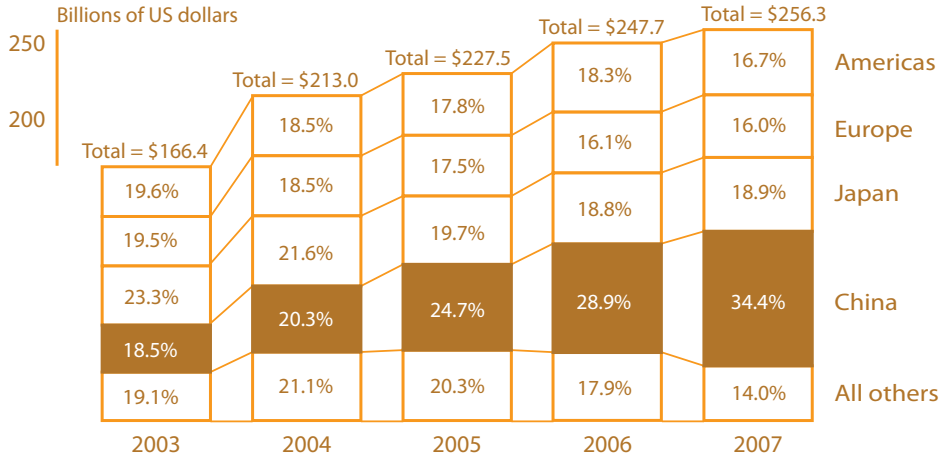
Diversify—globally. Companies should at all times keep tabs on global production and consumption trends. For example, there is always a need to diversify manufacturing by location to reduce risk. Trends to watch: greater China had 49% of all new fabs and 57% of all fab capacity under construction in 2007.

The semiconductor market in China

Overall consumption

Measured in US dollars, China's semiconductor consumption market grew by 23% in 2007 to reach US$88.1 billion, representing 34.4% of the worldwide semiconductor market. This exceeds the markets in Japan, North America, Europe and the rest of the world for the third consecutive year.

Figure 1: Worldwide semiconductor market by region, 2003-2007



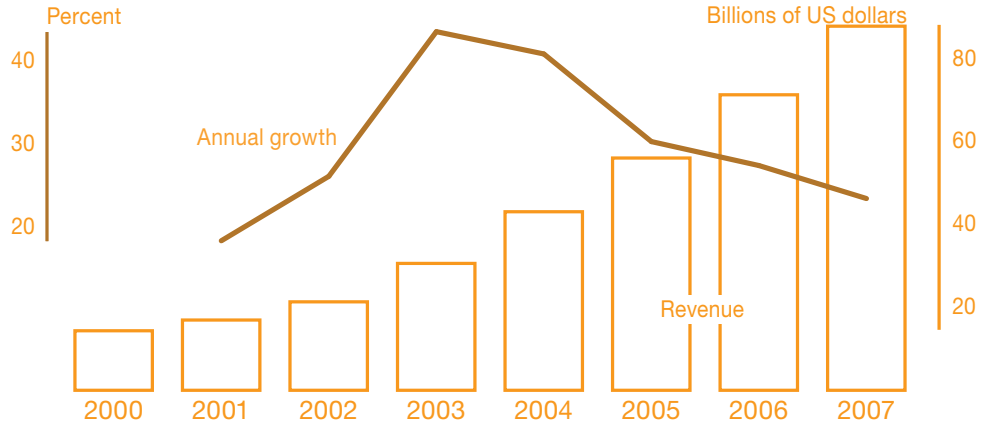
Source: CCID, SIA, 2008

Moreover, for the first time ever, China's consumption of semiconductors exceeds one-third of the worldwide market—a threshold China has achieved a full three years earlier than previously predicted. It should be noted, however, that 5.6% of China's 23.2% increase in 2007 semiconductor market consumption is due to currency exchange rate changes.

China's semiconductor market growth continues to outrun the rest of the world. Since 2001, the bottom of the last semiconductor business cycle, China's semiconductor market has grown at a 31.5% compounded annual growth rate (CAGR), while the worldwide market has grown at a 10.6% CAGR.

During the past two years, China's semiconductor consumption market (measured in US dollars) grew by 27% in 2006 and 23% in 2007. In contrast, the worldwide market grew by only 9% in 2006 and 3% in 2007. China's semiconductor consumption market continues to grow many times faster than the worldwide market as a result of two driving factors—the continuing transfer of worldwide electronic equipment production to China and the above-average semiconductor content of that equipment.

Figure 2: China's semiconductor market growth, 2000-2007



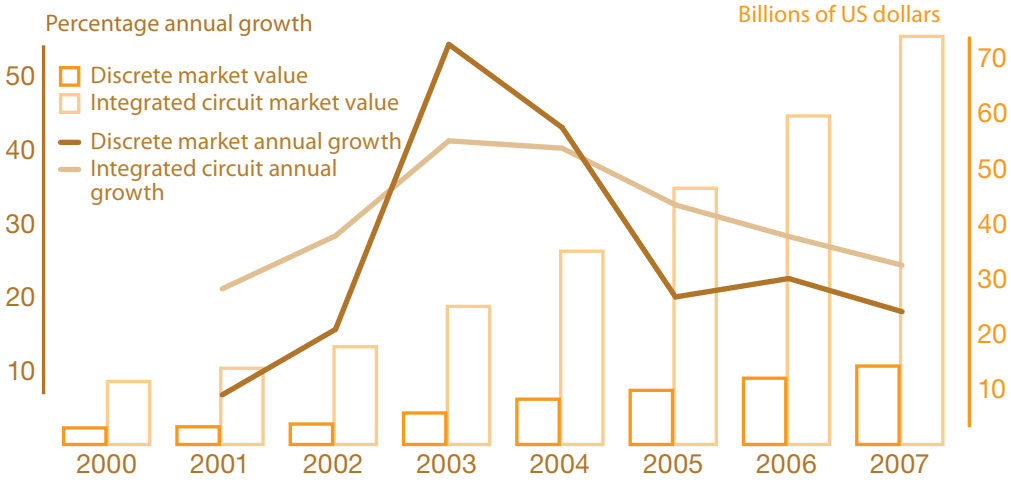
Source: CCID, SIA, 2004-2008

China's share of worldwide electronic equipment production has increased from 9% in 2000 to 20% in 2005, 23% in 2006, and to 27% in 2007. The semiconductor content of the electronic equipment produced in China averaged 25% in 2006 and 24% in 2007 while the worldwide average remained 20% in both years.

The market for discrete devices and integrated circuits

In 2007, China's OSD (optoelectronics, sensors and discrete) consumption market grew 18% to reach a new peak of US$14.2 billion, representing 37.5% of the worldwide market. Most of this consumption was of discrete devices, which grew 18% in 2007 to US$11.1 billion.

Figure 3: China's IC and discrete market growth, 2000-2007



Market reporting has changed since 2003 and the definition of the discrete device market now includes sensors and optical semiconductors.

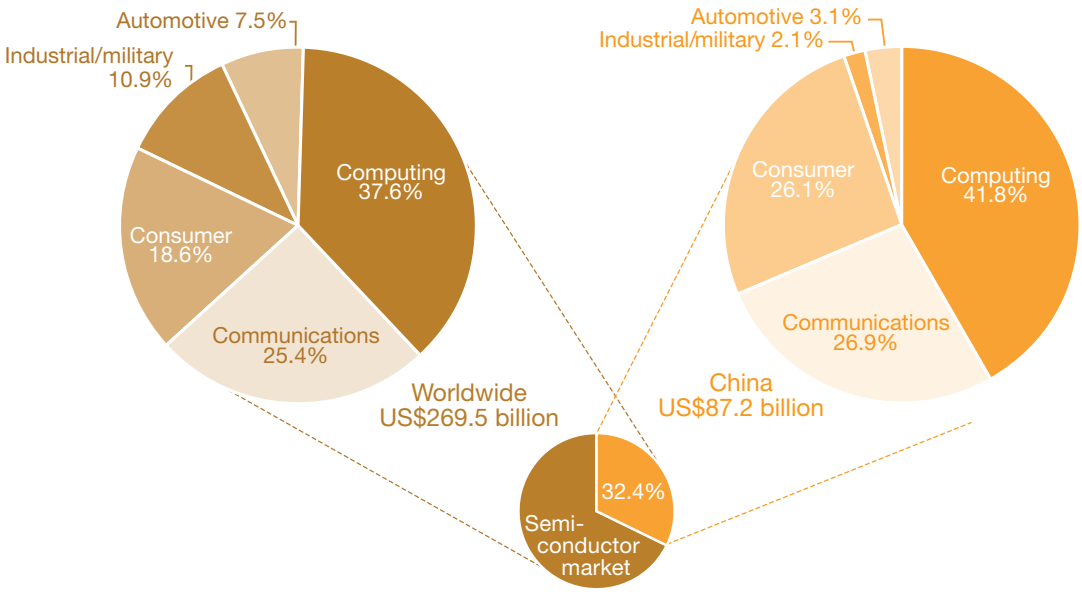
Source: CCID, CSIA, 2004-2008

The integrated circuit (IC) consumption market in China grew 24% in 2007 to reach a new peak of US$73.9 billion, 33.8% of the worldwide market. Meanwhile, 2007 was the first year that the value of China's IC consumption growth exceeded that of worldwide IC market growth. During 2007, China's IC consumption increased by US$14.4 billion while the worldwide IC market only grew by US$9 billion. This infers that in absolute value China's IC consumption market grew by displacing consumption in other regions during 2007. Similarly, China's discrete consumption market growth has displaced consumption in other regions, first in 2005 and again in 2007.

Market by application

Compared with the worldwide semiconductor market, the distribution of China's 2007 IC consumption remained somewhat more concentrated in the consumer and computing sectors, slightly more concentrated in the communications sector, and less concentrated in the automotive and industrial/military sectors.

Figure 4: China compared with worldwide semiconductor market by application, 2007

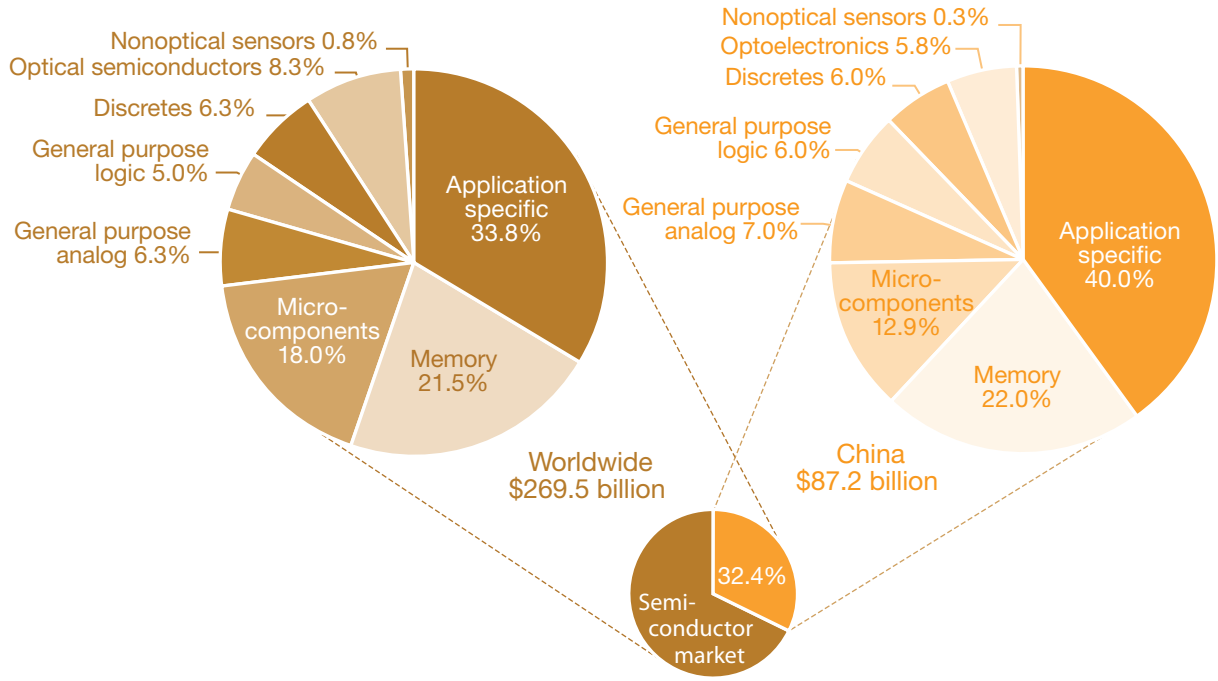


Source: CCID, Gartner Dataquest, 2008

Market by device type

China's semiconductor consumption market in 2007 became somewhat more concentrated in the application-specific and slightly more concentrated in the general-purpose logic, general-purpose analog and memory sectors. Meanwhile, the market became somewhat less concentrated in the microcomponent and optoelectronics sectors and slightly less concentrated in nonoptical sensors and discrete sectors compared to the worldwide market.

Figure 5: China compared to worldwide semiconductor market by device, 2007



Source: CCID, Gartner Dataquest, 2004-2008

Suppliers to the Chinese market

The largest suppliers to the Chinese market continue to be the multinational semiconductor companies. In 2007, China's consumption of semiconductor products from these largest suppliers increased by 24%, which was slightly greater than the growth of the overall market. Table 1 lists the suppliers that have the largest sales revenue from the Chinese market. Together these 10 largest suppliers had a total 43% share of the Chinese market in 2007, which is almost identical to the share of the top 10 suppliers to that market in the three preceding years.

The Chinese semiconductor market remains slightly less concentrated than the worldwide market, where the top 10 suppliers have had a gradually declining share ranging from 50% in 2004 to 46% in 2007. It seems reasonable to conclude that the shift of worldwide semiconductor consumption to China may be contributing to a decrease in worldwide supplier concentration.

According to Gartner Dataquest, no Chinese companies (or brands) were among the top 55 suppliers to the Chinese semiconductor market in 2007. Even if the largest Chinese semiconductor companies sold all of their output within China, no Chinese semiconductor company would be among the top 50 suppliers to the Chinese semiconductor market in 2007.

Since China now represents a third of the worldwide semiconductor market, it should not be surprising that most of the same companies are the largest suppliers to both the Chinese and worldwide markets. In 2007, only Freescale and Micron were not among the 10 largest suppliers to the worldwide market. Of the 10 largest worldwide suppliers only Infineon (including Qimonda) and Renesas were not among the 10 largest suppliers to the Chinese market in 2007.

Table 1: Semiconductor suppliers to the Chinese market 2006-2007

Rank			Revenue in millions of US dollars			Market share %
2006	2007	Company	2006	2007	% change	2007
1	1	Intel	9,855	12,737	29.2	14.4
2	2	Samsung	3,921	4,730	20.6	5.4
3	3	Hynix	2,598	3,479	33.9	3.9
4	4	TI	2,497	2,978	19.2	3.4
6	5	Toshiba	2,210	2,958	33.8	3.3
5	6	AMD	2,397	2,731	13.9	3.1
7	7	NXP	2,017	2,445	21.2	2.8
8	8	ST	1,938	2,365	22.0	2.7
9	9	Freescale	1,747	1,998	14.4	2.3
	10	Micron (MTK)	1,010	1,549	53.4	1.8
10		Qimonda	1,491	N/A	N/A	N/A
Total for top 10			30,672	37,970	23.8	43.1
Top 10 share of:						
China integrated circuit market			50.3%	51.4%		
China semiconductor market			42.9%	43.1%		

Source: CCID Review and Forecast of China Semiconductor Market, 2008

Domestic consumption and the Chinese export market

The Chinese semiconductor market has two distinct parts: the domestic market and the much larger export market. During the past two years, the share of semiconductors consumed in China that were used in components of finished products assembled in China and exported for sale in other countries has continued to increase, from 64% in 2005 to 66% in 2006 and to 69% in 2007.

Table 2: China's semiconductor exports by segment, 2006–2007

In billions of US dollars	Total sales		Export sales			
Market segment	2006	2007	2006	% of total	2007	% of total
Data processing	33.9	36.4	20.3	60	22.3	61
Communications	17.0	23.5	11.1	66	16.9	72
Consumer	18.4	22.8	15.0	82	19.0	83
Automotive	1.7	2.7	0.4	21	0.7	25
Totals	71.0	85.4	46.8	66	58.9	69

Source: Gartner Dataquest, PricewaterhouseCoopers, 2008

The export market consumption of semiconductors has been the major contributor to the growth of China's semiconductor market. Since 2005, the consumption of semiconductors in China for export products increased by 59% (US$21.8 billion), while the consumption for domestic products increased by 27% (US$5.7 billion).

2007 was the first year since at least 2003 in which China's semiconductor industry revenue was greater than its domestic consumption of semiconductors.

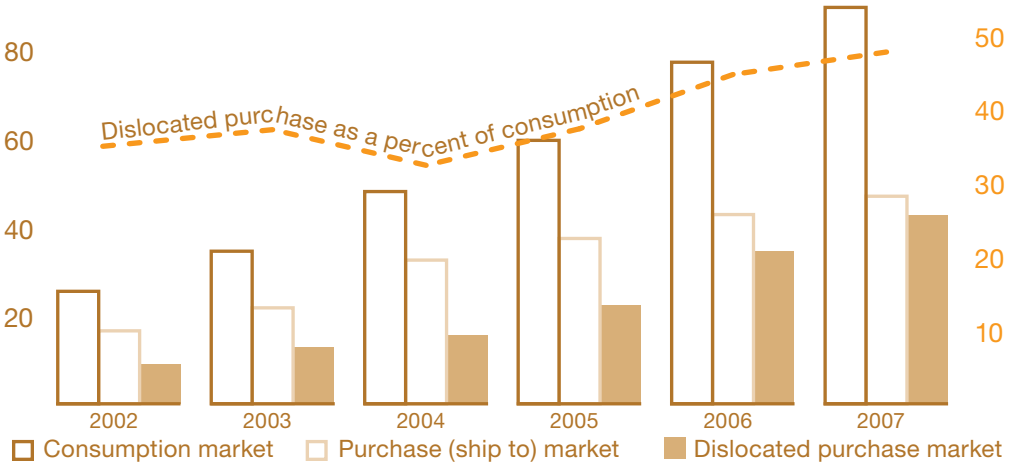
Since 2003, China's domestic market—the value of semiconductors consumed in China that were used in components of finished products assembled and sold in China—has grown at a 27.3% compounded annual rate. So from US$10.4 billion in 2003, the market reached US$27.2 billion in 2007. China's domestic consumption of semiconductors contributed 29% of China's total semiconductor market growth and 19% of the worldwide market growth over the last four years. During those four years, China's annual domestic consumption grew by US$16.9 billion, while China's total consumption market grew by US$54.7 billion. China's domestic consumption of semiconductors grew from 6% of the worldwide semiconductor market in 2003 to almost 11% by 2007.

Dislocated purchasing

Many of the values shown in Table 2 may be larger than the values of semiconductor devices sold to customers in China. This is because some customers—due to supply chain considerations such as control of key inventory items, intellectual property protection and/or toll processing business models—will buy semiconductor devices outside of China and transship them to China for use and consumption. This "dislocated" purchasing of semiconductors for the Chinese consumption market has increased noticeably from about a third in 2004 to almost 48% in 2007.

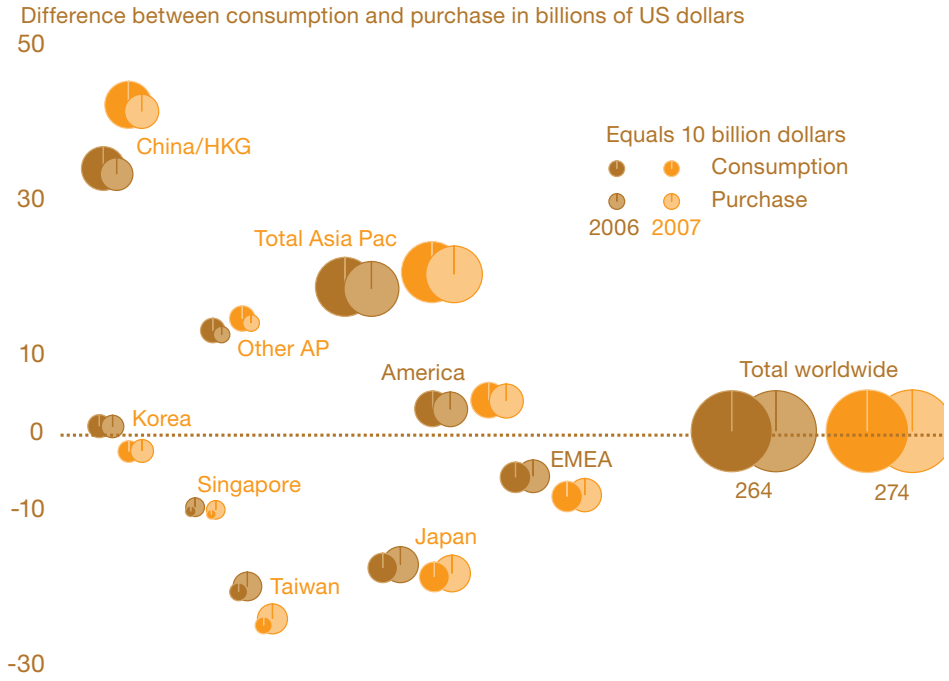
This suggests that a significant amount of buying decisions—and therefore selling opportunities—for customer-specified semiconductors devices consumed in China are being made outside of China. During the last two years, the largest share of this dislocated purchasing of semiconductors for consumption in China took place in Taiwan and Japan, which corresponds to the continuing transfer of electronic equipment production from these regions to China. The other regions with a smaller share of this dislocated purchasing include Singapore and Europe.

Figure 6: Dislocated purchase versus China/Hong Kong consumption market, 2002-2007



Source: Gartner Dataquest, 2008

Figure 7: Analysis of 2006 & 2007 semiconductor consumption vs. purchases; China vs. worldwide by regions



Source: Gartner Dataquest, 2008

Successful suppliers will need to address this high proportion of dislocated purchasing of semiconductor devices. For example, they will need to have a coordinated marketing effort that focuses on design-in, qualification and procurement at the remote headquarters location. At the Chinese consumption location, suppliers will need to address functionality of the devices' applications as well as supply chain considerations. These requirements, which favor multinational semiconductor companies, will probably continue for a number of years. After that, the share of dislocated purchasing for the Chinese consumption market is expected to gradually decrease as: more electronics equipment design activities move to China; local EMS and ODM enterprises gain control over their BOM (bill-of-material) sourcing; Chinese OEM (original equipment manufacturers) gain market share; and local Chinese semiconductor companies grow stronger.

Chinese companies

Table 3 lists the Chinese semiconductor companies that have the largest 2007 revenues, the threshold of which was US$30 million. By definition, the companies on the list are the largest indigenous Chinese companies that design, manufacture (or have manufactured, the legal term for outsourcing), market and sell semiconductor devices. They do not include foundries or packaging and testing companies. As such, the companies included in our ranking should also be included in the semiconductor market share reports compiled by industry analysts, yet many companies continue to be overlooked.

In fact, more than half of the companies on the PricewaterhouseCoopers list are missing from other industry rankings. For example, only 14 of the companies were included in third-party research firm Gartner Dataquest's database entitled "Top Companies (ALL) Revenues from Shipments of Total Semiconductors – Worldwide (Millions of $US)," which ranked 277 companies by their 2007 revenues.

Ten of the first twelve companies on the PricewaterhouseCoopers list were included in the Gartner listing. The Chinese company with the largest 2007 revenue, HiSilicon Technologies Co. Ltd. was ranked 156th among worldwide semiconductor companies by Gartner.

Most of the largest Chinese companies missing from the Gartner ranking were from the discrete sector, which is an indication of the general lack of industry awareness of the significance of China's discrete semiconductor industry sector. The companies at the bottom of Gartner's list had less than US$10 million in revenue and their list included five additional smaller Chinese companies from the design (fabless) sector with 2007 revenues less than US$30 million. Industry awareness of Chinese semiconductor companies has continued to slowly increase, with the Gartner 2007 database including 19 Chinese companies out of 277 worldwide semiconductor companies, up from 15 out of 227 companies in 2005.

The revenue threshold for PricewaterhouseCoopers' ranking of the largest Chinese semiconductor companies increased from US$20 million in 2005 to US$30 million in 2007, while the number of qualifying companies remained at 29. This year's ranking included ten new Chinese semiconductor companies. The most significant new addition was HiSilicon Technology Co. Ltd., a design (fabless) company that was the former chip R&D center of the Huawei Company that was spun out in 2005. HiSilicon has considerable experience in telecom ASIC device R&D. With capabilities of designing at the 0.11µm technology node, its technical level ranks among the top tier of China's IC design companies. Since being spun out of Huawei, HiSilicon Technology Co. Ltd's revenue has grown by 78% in 2006 and 50% in 2007.

Table 3: Chinese semiconductor companies by revenue, 2007

Rank		Revenue in 100 million RMB				Revenue in millions of US dollars		
2007	Company	2006	2007	Change (%)	Sector	2006	2007	Change (%)
1	HiSilicon Technologies Co., Ltd.	9.04	12.90	42.7	Design (Fabless)	113	170	49.6
2	Jilin Sino-Microelectronics Co., Ltd.	6.92	11.30	63.3	Discrete	87	149	71.2
3	Spreadtrum Communications Inc.	3.32	11.06	233.1	Design (Fabless)	42	145	249.2
4	Datang Microelectronics Technology Co., Ltd.	9.19	10.79	17.4	Design (Fabless)	115	142	23.1
5	Actions Semiconductor Co., Ltd	13.46	8.78	-34.8	Design (Fabless)	169	115	-31.6
6	Wuxi China Resources Semico Co., Ltd.	8.43	8.50	0.8	Design (Fabless)	106	112	5.7
7	Wuxi China Resouces Huajian Microelectronics Co., Ltd.	10.50	8.40	-20.0	IDM & Discrete	132	110	-16.1
8	Hangzhou Silan Microelectronics Co., Ltd.	8.20	8.20	N/A	Design (Fabless)	103	108	4.8
9	Beijing Vimicro Co., Ltd.	10.13	7.06	-30.3	Design (Fabless)	127	93	-27.0
10	TianJin Zhonghuan Semiconductor Co., Ltd.	5.66	7.00	23.7	Discrete	71	92	29.6
11	Shanghai Huahong IC Co. Ltd.	6.57	6.83	4.0	Design (Fabless)	82	90	9.0
12	CEC Huada Electronic Design Co., Ltd. (HED)	5.90	5.63	-4.6	Design (Fabless)	74	74	N/A
13	Shenzhen Si Semiconductor Co. Ltd.	4.10	5.90	43.9	Discrete	51	78	50.8
14	Changzhou Galaxy Electrical Co., Ltd.	3.27	5.80	77.4	Discrete	41	76	85.9
15	Shenzhen ZTE Microelectronics Technology Co., Ltd.	N/A	5.66	N/A	Design (Fabless)	N/A	74	N/A
16	No. 50 Research Institute of China Elect. Tech Grp Corp.	5.46	5.52	1.1	IDM	68	73	6.0
17	Tongfang Microelectronics Company	5.06	4.57	-9.7	Design (Fabless)	63	60	-5.3
18	NingBo Hualong Electronics Co.,Ltd.	3.88	4.50	16.0	Discrete	49	59	21.6
19	Shanghai Belling	8.61	3.98	-53.8	IDM & Foundry	108	52	-51.5
20	Suzhou Good-Ark Electronics Co.,Ltd.	4.04	3.80	-5.9	Discrete	51	50	-1.4
21	NingBo KangQiang Electronics Co.,Ltd.	3.02	3.50	15.9	Discrete	38	46	21.5
22	Foshan Blue Rocket Electronics Co., Ltd.	3.10	3.40	9.7	Discrete	39	45	15.0
23	Jinan Jingheng Co. Ltd.	2.03	3.40	67.5	Discrete	25	45	75.6
24	Shanghai Fudan Microelectronics Co., Ltd.	2.79	3.27	17.2	Design (Fabless)	35	43	22.9
25	Shantou Huashan Electronic Device Co.,Ltd.	2.56	3.10	21.1	Discrete	32	41	26.9
26	Beijing Sigma Jinghua Microelectronics Co., Ltd..	2.63	2.66	1.1	Design (Fabless)	33	35	6.0
27	Hangzhou Youwang Electronics Co.,Ltd.	2.93	2.62	-10.6	Design (Fabless)	37	34	-6.3
28	Yuejing High Technology Co., Ltd.	N/A	2.40	N/A	Discrete	N/A	32	N/A
29	Yangzhou JingLai Semiconductor (Grp) Co. Ltd.	2.09	2.30	10.0	Discrete	26	30	15.3

Source: CCID, CSIA, and PwC, 2007–2008

Another of China's largest semiconductor companies, Spreadtrum Communications, achieved worldwide notice when they completed a successful NASDAQ public offering in 2007. Spreadtrum's sales increased almost 250% in 2007 to US$145 million based upon its success in penetrating the wireless broadband communications market. However, the first two of China's largest semiconductor companies to complete successful NASDAQ public offerings in 2005, Actions Semiconductor and Beijing Vimicro, experienced declining revenues in 2007. Their respective non-iPod MP3 player system-on-a-chip and PC video camera chip market niches slowed, leaving the companies to face the challenges of product transition.

The combined 2007 revenues of the 29 companies on the list was US$2.3 billion, still representing less than 1% of the worldwide industry. In 2007, these top companies together constituted 43% of the Chinese IC design sector and 8% of the Chinese discrete sector. Of the 27 companies on the list that had reported revenues for both 2006 and 2007, 19 companies reported increases ranging from 5% to almost 250%; one reported no change and seven companies reported decreases ranging from 1% to just over 50%. Overall, those 27 companies reported an average 13% increase in 2007 revenues. This is notably less than the 27% increase reported for China's total semiconductor industry, which leads us to conclude that much of the growth in China's semiconductor industry is being driven by multinational, foundry and package, assembly and test enterprises.

Domestic OEM buying power

China's 10 largest OEMs had an almost 25% increase in their combined revenue during 2007 to reach a record total of US$58 billion (see Table 4). Assuming the semiconductor content of their products was 24% (the average for all of China's electronic systems production in 2007) these 10 Chinese OEMs were responsible for semiconductor consumption of US$14.0 billion, or 15.9% of China's total semiconductor market.

Eight of these largest of China's OEMs were listed among the Top 100 Semiconductor-consuming companies 2007 by Gartner Dataquest. Their 2007 semiconductor consumption was reported to be US$13.2 billion or 15% of China's total 2007 consumption market.

Table 4: Chinese OEMs by electronic equipment revenue and semiconductor consumption 2006-2007

	Electronic revenue			Semiconductor consumption
Name of company	2006	2007	Change %	2007
Lenovo	13.3	14.6	9.9	7.0
Huawei	8.5	12.6	47.7	1.9
TCL	6.1	5.1	-15.9	0.8
Gree	3.3	5.0	51.3	
ZTE	2.9	4.6	58.3	1.0
Midea	2.7	4.4	64.9	
Haier	2.9	3.9	33.1	1.1
Changhong	2.4	3.0	27.9	0.6
Hisense	1.7	2.0	12.9	0.4
Skyworth	1.4	1.6	17.1	
Konka Group	1.6	1.6	0.2	0.4
Totals	46.7	58.3	24.8	13.2

In billions of US dollars

Source: Company reports, Gartner Dataquest 2008, PwC

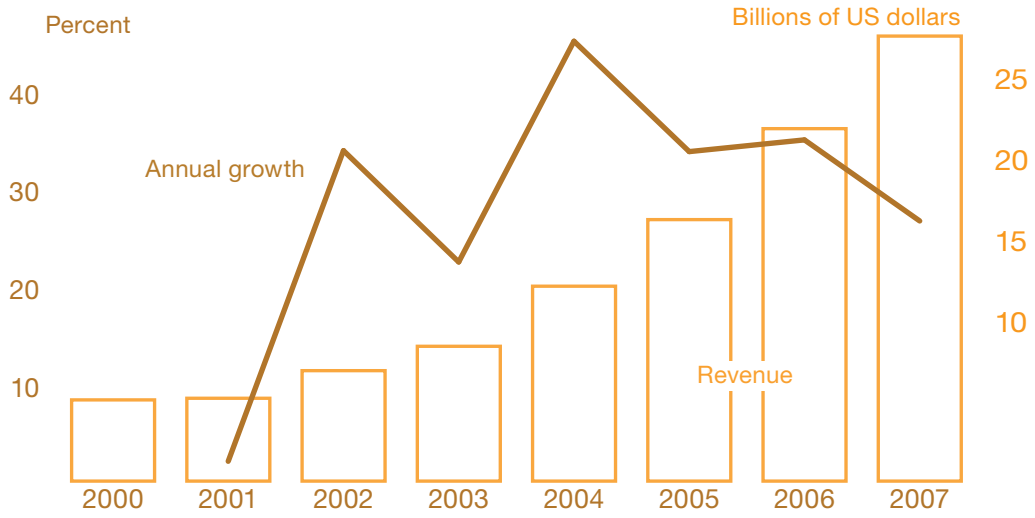
These leading Chinese OEMs purchase a significant and increasing number of semiconductor devices. They could be important customers for many of the international semiconductor companies intending to participate in the continuing growth of the Chinese semiconductor market. As a result, the strategies of these OEMS could affect the design and sales operations of several international semiconductor companies.

The semiconductor industry in China

Production growth

Measured in US dollars, China's semiconductor industry's reported revenues grew by 27% in 2007 to reach US$27.4 billion. By segment, the breakdown of China's 2007 semiconductor industry revenues includes: discrete devices (40.0%); IC design (10.8%); IC manufacturing (19.1%); and IC packaging and testing (30.1%).

Figure 8: China's semiconductor industry revenue and growth, 2000-2007



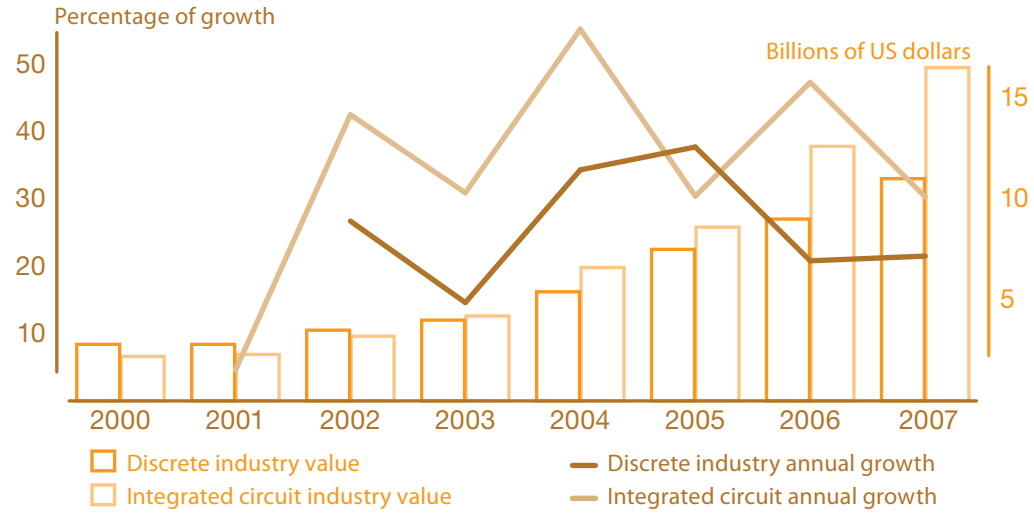
Source: CCID, CSA, PwC, 2004-2008

China's discrete industry grew by 22% in 2007 to US$11B and almost 28% of worldwide discrete revenues. Discrete devices accounted for 40% of China's reported semiconductor industry revenue and accounted for 32% of its increase.

By contrast, China's IC industry (the sum of IC packaging and testing; IC wafer manufacturing; and IC design) grew by 30% in 2007 to reach US$16.5B, which represented just over 7% of worldwide IC revenues.

As measured in local currency, China's reported 2007 IC industry growth is a slightly slower 24.3%. Although this 2007 industry growth rate was greater than the 24% consumption market growth rate, the absolute difference between IC consumption and production continued to increase. In fact, in 2007, the IC consumption/production gap reached a record US$54.9 billion, an increase of US$9.8 billion from 2006.

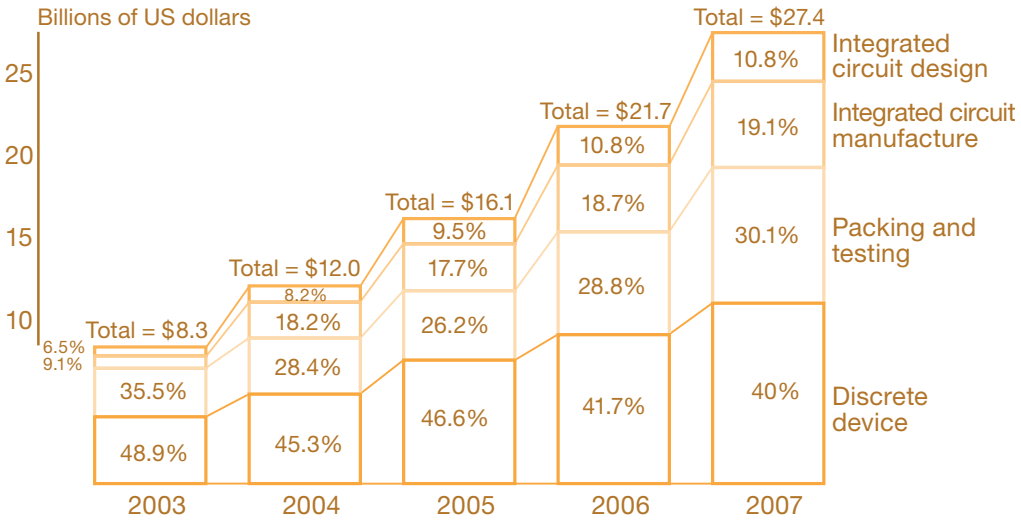
Figure 9: China's discrete and IC industry revenue and growth, 2000-2007



Source: CCID, CSA, PwC, 2004-2008

Because of the possibility of overstatement or double counting, a comparison between China's reported semiconductor industry revenue and the sum of worldwide semiconductor device sales, plus foundry and semiconductor assembly and test services (SATS) revenue, may provide a more representative measurement of China's impact on the semiconductor industry. That comparison indicates that China's semiconductor industry accounted for 7.4% and 9.1% of the worldwide semiconductor industry in 2006 and 2007, up from 5% and 6% in 2004 and 2005 (and from just 2% in 2000). Even though this measurement is probably overstated, the trend is very clear: China's semiconductor industry's share of the worldwide industry is growing, becoming noticeable and significant.

Figure 10: China's semiconductor industry by sector 2003-2007



Source: CCID, CSA, PwC 2004-2008

Still, these measurements may be overstated because some integrated device manufacturers (IDMs) use the sale/buy-back or die-included price model for semiconductor packaging, assembly and test (SPA&T) transfer pricing. For an explanation of how such double counting could occur, see “Probable double counting: A hypothetical example,” on page 63.

The top Chinese semiconductor manufacturers

Table 5 lists the 50 largest semiconductor manufacturers in China—those reporting 2007 revenue of US$54 million or more. This revenue threshold is up significantly from the US$28 million threshold of the top 50 in our 2006 report.

Also, instead of listing individual companies only, this table includes five groups that each now own one or more companies in the various sectors of China’s semiconductor industry. This approach better reflects these companies’ increasing significance in the growth and concentration of China’s semiconductor industry. This also corresponds to the CSIA’s (China Semiconductor Industry Association’s) current reporting practice, which now reports the group totals (by industry sector) in response to requests by the groups.

The five groups with their most significant companies are:

	Revenue (US$M)	
	2006	2007
China Resources Microelectronics (Holding) Ltd.	482	613
CSMC (Central Scientific Manufacturing Corp.) —Foundry	114	143.
Wuxi China Resources Semico Co., Ltd.—Design	106	112
Wuxi China Resources Juajian Microelectronics Co., Ltd.—Discrete	132	110
XINCCHAO Group	396	497
JECT (Jiangsu Changjiang Electronics Technology Co. Ltd.)—Pkg & Test	396	
Shanghai Huahong (Group) Company, Ltd.	497	461
HHNEC (Shanghai Hua Hong NEC Electronics Co. Ltd.)—Foundry	357	319
Shanghai Huahong IC Co. Ltd Design—Design	82	90
China Huada Integrated Circuits Design (Group) Co. Ltd.	151	192
CEC Huada Electronics Design Co. Ltd.—Design	74	74
Hangzhou Silan Microelectronics Co. Ltd.	97	128
Hangzhou Silan Microelectronics Co. Ltd. —Design	92	108

Table 5: Chinese semiconductor manufacturers by revenue, 2007

Rank				Revenue in 100 million RMB			Revenue in millions of US dollars		
2006	2007	Company	Sector	2006	2007	Change (%)	2006	2007	Change (%)
2	1	Freescale Semiconductor (China) Co.,Ltd.	Packaging & Testing	108.45	134.63	24.1	1,360.34	1,770.03	30.1
1	2	SMIC (Semiconductor Manufacturing International Corp.)	Foundry	113.44	111.43	-1.8	1,422.93	1,465.01	3.0
3	3	Qimonda	Packaging & Testing	68.95	100.33	45.5	864.87	1319.07	52.5
11	4	Hynix-Numonyx	IDM	23.87	93.59	292.1	299.41	1230.46	311.0
4	5	RFMD (RF Micro Devices (Beijing) Co.,Ltd.	Packaging & Testing	43.83	54.15	23.5	549.78	711.93	29.5
	6	China Resources Microelectronics (Holdings) Ltd.	IDM, Discrete, Design	38.46	46.63	21.2	482.42	613.06	27.1
6	7	XINCHAO Group	Packaging & Testing	31.55	37.80	19.8	395.75	496.97	25.6
	8	Shanghai Huahong (Group) Company Ltd.	Design & Foundry	39.62	35.09	-11.4	496.97	461.34	-7.2
10	9	Renesas Semiconductor (Beijing & Suzhou) Co.,Ltd.	Packaging & Testing	24.59	34.72	41.2	308.44	456.48	48.0
7	10	Shangahi Panasonic Semiconductor Co., Ltd.	Packaging & Testing	31.35	32.67	4.2	393.24	429.52	9.2
5	11	ST Microelectronics	Packaging & Testing	35.01	30.61	-12.6	439.15	402.44	-8.4
13	12	Natong Fujitsu Microelectronics Co., Ltd.	Packaging & Testing	21.79	22.86	4.9	273.32	300.55	10.0
15	13	STATS ChipPAC	Packaging & Testing	17.18	20.59	19.8	215.50	270.70	25.6
12	14	HeJian Technology (Suzhou) Co., Ltd.	Foundry	23.5	19.70	-16.2	294.77	259.00	-12.1
15	15	Leshan Radio Co., Ltd.(incl ON Semiconductor JV)	Discrete	16.1	19.34	20.1	201.95	254.27	25.9
25	16	Infineon Technologies (Wuxi) Co.,Ltd.	Packaging & Testing	9.96	19.02	91.0	124.93	250.06	100.2
9	17	Intel Products (Shanghai) Co., Ltd.	Packaging & Testing	26.07	18.80	-27.9	327.01	247.17	-24.4
21	18	Samsung Electronics (Suzhou) emiconductor Co.,Ltd.	Packaging & Testing	12.48	18.53	48.5	156.54	243.62	55.6
22	19	Shanghai Grace Semiconductor Manufacturing Co., Ltd	Foundry	12.22	15.34	25.5	153.28	201.68	31.6
33	20	ASEK (formerly GAPT)	Packaging & Testing	11.53	14.77	28.1	144.63	194.19	34.3
	21	China Huada Integrated Circuits Design (Group) Co., Ltd.	Design (Fabless)	12.00	14.61	21.8	150.52	192.08	27.6
14	22	Shougang NEC Electronics	Foundry	18.54	14.04	-24.3	232.56	184.59	-20.6
19	23	TSMC (Shanghai) Co., Ltd.	Foundry	12.87	13.40	4.1	161.43	176.17	9.1
28	24	HiSilicon Technologies Co., Ltd.	Design (Fabless)	9.04	12.90	42.7	113.39	169.60	49.6
17	25	ASMC (Advanced Semiconductor Manufacturing Co., Ltd.)	Foundry	13.52	11.83	-12.5	169.59	155.53	-8.3
34	26	Jilin Sino Microelectronics Co., Ltd.	Discrete	6.92	11.30	63.3	86.80	148.56	71.2
	27	Spreadtrum Communications Inc.	Design (Fabless)	3.32	11.06	233.1	41.64	145.41	249.2
	28	China Wafer Level CSP Ltd. (Suzhou)	Packaging & Testing	2.62	11.02	320.6	32.86	144.88	340.9

Source: CSIA, CCID, PwC, 2007-2008

Table 5: Chinese semiconductor manufacturers by revenue, 2007

Rank				Revenue in 100 million RMB			Revenue in millions of US dollars		
2006	2007	Company	Sector	2006	2007	Change (%)	2006	2007	Change (%)
	29	Chipmore Technology Corporation Ltd.	Packaging & Testing	N/A	11.02	N/A	N/A	144.88	N/A
26	30	Datang Microelectronics Technology Co., Ltd.	Design (Fabless)	9.19	10.79	17.4	115.27	141.86	23.1
	31	SIPIN Technology (Suzhou) Co., Ltd.	Packaging & Testing	N/A	9.77	N/A	N/A	128.45	N/A
31	32	Hangzhou Silan Microelectronics Co., Ltd.	Design, Discrete, Foundry	7.74	9.70	25.3	97.09	127.53	31.4
32	33	GEM Electronics (Shanghai) Co., Ltd.	Packaging & Testing	7.95	8.88	11.7	99.72	116.75	17.1
18	34	Actions Semiconductor Co., Ltd	Design (Fabless)	13.46	8.78	-34.8	168.83	115.43	-31.6
	35	Phoenix Semiconductor Telecommunication (Suzhou) Co., Ltd.	Packaging & Testing	2.10	8.64	311.4	26.34	113.59	331.2
36	36	Tianshui Huatian Microelectroics Co., Ltd.	Packaging & Testing	6.53	8.44	29.2	81.91	110.96	35.5
	37	EHS Engineering	Packaging & Testing	5.50	8.14	47.9	69.01	107.02	55.1
25	38	Amkor Technology China Ltd.	Packaging & Testing	9.29	7.90	-15.0	116.53	103.86	-10.9
39	39	BCD Semiconductor Manufacturing Ltd.	Foundry	5.20	7.57	45.6	65.23	99.53	52.6
	40	Shangahi Kai Hong Electronics Co., Ltd.	Packaging & Testing	6.87	7.49	9.0	86.17	98.47	14.3
24	41	Beijing Vimicro Co., Ltd.	Design (Fabless)	10.13	7.06	-30.3	127.06	92.82	-27.0
37	42	TianJin ZhongHuan Semiconductor Co., Ltd.	Discrete	5.66	7.00	23.7	71.00	92.03	29.6
	43	Suzhou Zhenkun Technology Co., Ltd.	Packaging & Testing	N/A	6.74	N/A	N/A	88.61	N/A
	44	Shenzhen Si Semiconductor Co. Ltd.	Discrete	4.10	5.90	43.9	51.43	77.57	50.8
	45	Changzhou Galaxy Electrical Co., Ltd.	Discrete	3.27	5.80	77.4	41.02	76.25	85.9
	46	No.50 Research Institute of China Electronics Tech. Grp Corp.	IDM	5.46	5.52	1.1	68.49	72.57	6.0
	47	Tongfang Microelectronics Company	Design (Fabless)	5.06	4.57	-9.7	63.47	60.08	-5.3
	48	Suzhou Good-Ark Electronics Co., Ltd.	Discrete	4.02	4.72	17.4	50.42	62.06	23.1
	49	Ningbo Hualong Electronics Co., Ltd	Discrete	3.88	4.50	16.0	48.67	59.16	21.6
	50	AMD Technologies (China) Co., Ltd.	Packaging & Testing	3.06	4.09	33.7	38.38	53.77	40.1

Source: CSIA, CCID, PwC, 2007-2008

The combined reported 2007 revenues for these top 50 enterprises is US$15 billion, representing 53.5% of China's total semiconductor industry revenue of US$27.4 billion. China's industry remains significantly less concentrated than the worldwide industry in which the top 50 companies represent almost 82% and the top 12 companies more than 50% of the total market. In PwC's 2006 update, the top 50 manufacturers in China represented 46% of total 2005 revenue, so there have been some gains in local share by the largest enterprises.

The table also contains 16 Chinese semiconductor manufacturers that were not among the top 50 manufacturers in the 2006 update. The most significant truly new company is Hynix-ST Semiconductor. The firm is a joint venture wafer fab that just started production in 2006, achieving revenues of US$299 million in 2006 and increasing to US$1,230 million in 2007. The next two largest of these new companies are Qimonda and HiSilicon Technologies, which were spinouts from Infineon and Huawei.

During the past two years since our 2006 update, China's reported semiconductor industry revenues have increased by just over 70%, from US$16.1 billion in 2005 to US$27.4 billion in 2007. Currency exchange rate changes accounted for 17% of that increase.

On a local currency basis, China's reported semiconductor industry revenues grew by 59%, or 771.1 RMB:100M during those two years. Much of this growth comes from multinational rather than local domestic semiconductor companies. The top five contributors to that increase in reported revenues include:

- Hynix-Numonyx (contributing 12.1% of the total growth)
- Qimonda (10.9%)
- Freescale (9.1%)
- RFMD (3.1%)
- Infineon Technologies (2.2%)

The Hynix-Numonyx performance was noteworthy because it demonstrated the significant impact of a large, advanced wafer fab going from zero revenue start-up in 2005 to volume production in 2007. We anticipate a somewhat similar impact when the Intel Dalian 300mm wafer fab ramps up to volume production in 2010.

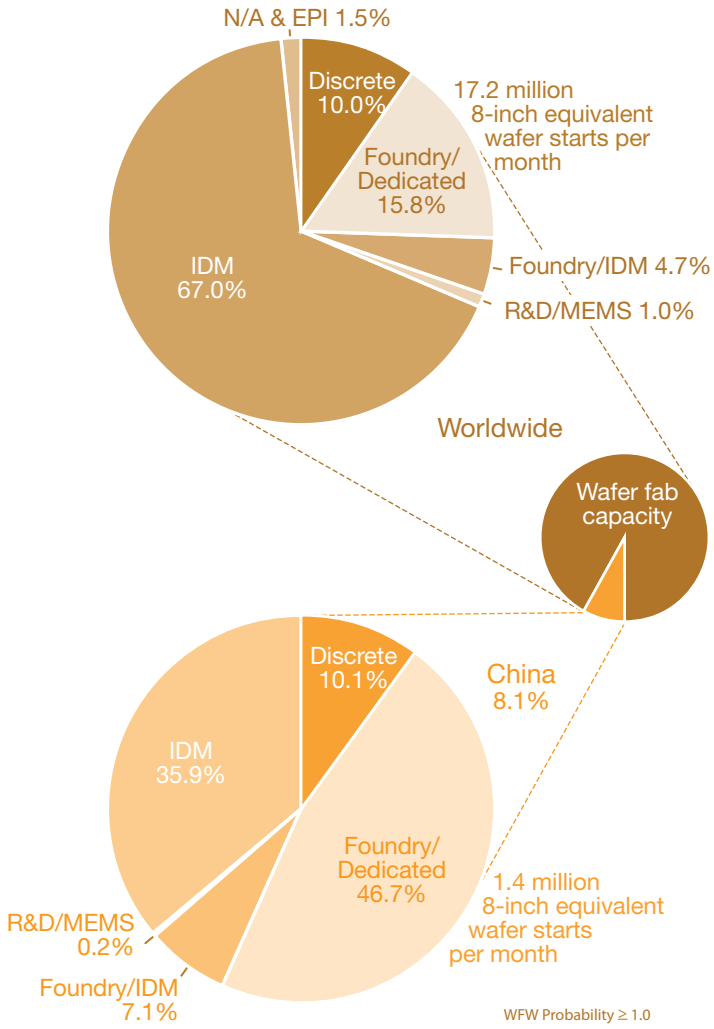
Meanwhile, the largest Chinese companies contributing to this increase are SMIC (2.1%) followed by Xinchao Group (1.7%).

Wafer fab capacity

Based upon its current capabilities (rather than intentions, i.e., World Fab Watch WFW, Probability $\geq$1.0), China can now increase its share of total worldwide semiconductor wafer production from the $\leq$ 2% realized in 2003 to $\geq$ 8.1% by 2010 by just fully equipping and ramping to full capacity at mature yields all of its existing wafer fabrication modules. While this would more than quadruple its share of worldwide wafer production compared to 2003, it only represents a 10% change in China's relative capacity during the past two years from 7.4% to 8.1%.

During the past two years, China has rationalized its current wafer fab capacity by replacing 16 smaller fabs with 10 larger fabs, including the two very large Hynix-Numonix DRAM fabs. As a result, China decreased the net number of fabs in production by six, or 8%, while increasing production capacity by 53%. By comparison, worldwide capacity increased by only 40%.

Figure 11: Current wafer fab capacity comparison, China and worldwide



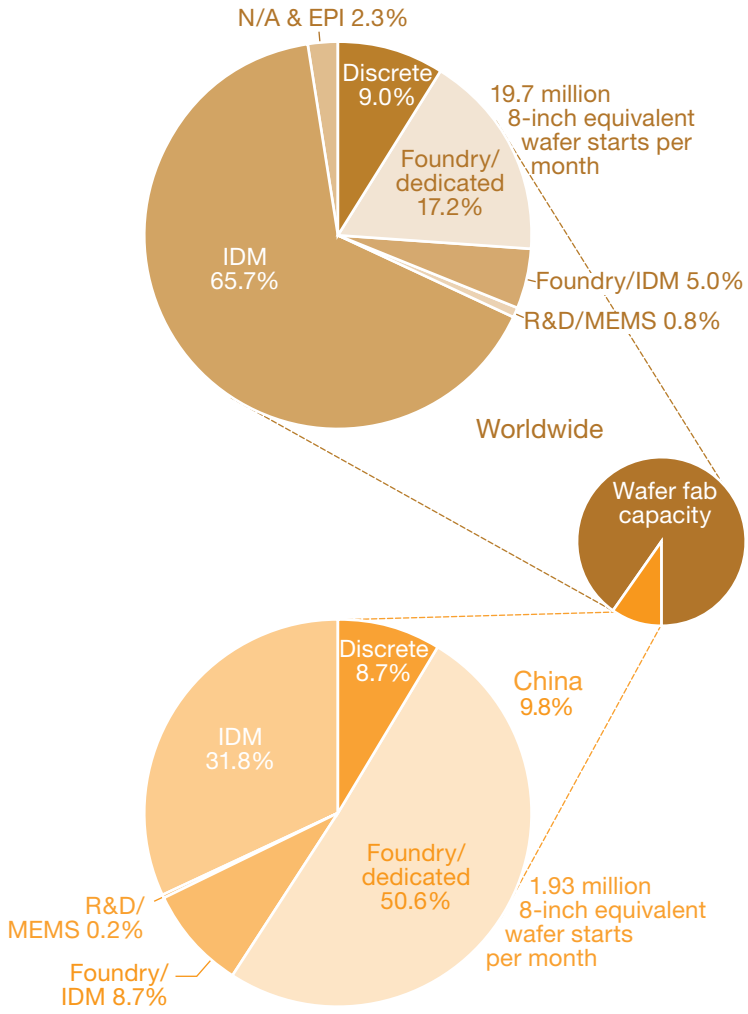
Source: SEMI Wafer Fab Watch, 2008

China currently has 14 new wafer plants under construction, which represents 34% of the 41 new fab plants under construction worldwide, but only 22% of the worldwide new plant capacity. China is getting less capacity per new wafer fab plant because it is adding a greater proportion of 6-inch (150mm) and 8-inch (200mm) plants than other regions and less than half the proportion of 12-inch (300mm) plants.

During the past two years, the number of wafer fabrication modules committed and under construction in China has decreased from 20 to 14. But the capacity of each has increased, so the total additional committed capacity has not changed significantly. These 14 modules under construction have the potential to further increase China's wafer fabrication capacity by 40%, and represent 22% of the capacity of all wafer fabrication modules currently committed and under construction worldwide.

Based upon China's current plus committed capabilities, i.e., plants in production plus plants under construction (i.e., WFW Probability $\geq$0.8), China can now increase its share of total worldwide semiconductor wafer production from the $\leq$ 2% realized in 2003 to $\geq$ 9.8%% by 2012. Achieving this would require obtaining needed financing, completing the 14 wafer fabrication plants currently under construction, and then fully equipping and ramping to full capacity at mature yields those new plants plus all of the existing wafer fabrication modules. If it all comes to pass, this would increase China's share of worldwide wafer production by almost five fold, exacting a moderate to significant impact on the semiconductor industry.

Figure 12: Current and committed wafer fab capacity comparison, China and worldwide



Source: SEMI Wafer Fab Watch, 2008

Capacity by process node and wafer size

From a geometry/technology node distribution standpoint, China's current wafer fabrication capabilities after the 2006-7 rationalization are reasonably comparable with worldwide capabilities. China has 21% of capacity at the mature ≥0.4µm nodes versus worldwide 18%, 18% in the mid-range of < 0.4 to ≥ 0.16µm versus 17% worldwide. When fully equipped and ramped, China will have 12% at the more attractive < .16µm to ≥ 0.12µm node versus 10% worldwide, but a lower 49% at the leading edge < 0.12µm node versus 53% worldwide.

Table 6: Comparison of current wafer fab capacity, 2007

	China capacity	%	World capacity	%
Total	**1,384.3**		**17,163.4**	
By geometry				
≥ 0.7 µm	201.5	15	2,124.3	12
< 0.7 to ≥ 0.4 µm	89.5	6	971.2	6
< 0.4 to ≥ 0.3 µm	82.1	6	1,020.1	6
< 0.3 to ≥ 0.2 µm	64.9	5	1,185.5	7
< 0.2 to ≥ 0.16 µm	100.0	7	651.9	4
< 0.16 to ≥ 0.12 µm	170.0	12	1,782.7	10
< 0.12 µm	676.3	49	9,110.0	53
N/A	0	0	317.7	2
By wafer size				
≥ 4-inch	84.9	6	584.5	3
5-inch	64.1	5	792.2	5
6-inch	259.0	19	2,546.7	15
8-inch	515.0	37	6,225.1	36
12-inch	461.3	33	7,014.9	41

Capacity = 8-inch equivalent wafer starts per month in thousands
World Fab Watch probability ≥ 1.0

Source: SEMI World Fab Watch, 2008

In terms of wafer size, China's current capabilities remain more concentrated in the smaller ranges. For example, China has:

- 30% of its capacity in 6-inch or smaller wafers versus the worldwide mix of 23%
- 37% of its capacity in 8-inch wafers comparable to the worldwide mix of 36%
- 33% in 12-inch wafers compared to the worldwide mix of 41%.

Of the 82 12-inch (300mm) wafer fabrication plants currently in production worldwide, only four are in China. The result is that for at least the next three years wafer fab plants in other locations will continue to have the capabilities for retaining low mix/ high volume/advanced technology (e.g., DRAM) wafer manufacturing cost leadership.

But China has commitments for four additional 12-inch (300mm) wafer fabs. When completed, equipped and fully ramped to full capacity at mature yields—about three years from now—these will constitute 53% of China's wafer fab capacity and slightly more than 9% of worldwide 12-inch (300mm) capacity.

Offsetting this relative lack of 12-inch (300mm) wafer fab capacity, China has a greater than worldwide average concentration of 6-inch and smaller fab capacity. China currently has 52 6-inch or smaller wafer fabs in production, constituting 30% of total capacity compared to a worldwide average of 23%.

Table 7: Current and committed wafer fab capacity, 2007

	China capacity	%	World capacity	%
Total	1,933.4		19,658.0	
By geometry				
≥ 0.7 µm	204.3	11	2,131.7	11
< 0.7 to ≥ 0.4 µm	89.5	5	971.2	5
< 0.4 to ≥ 0.3 µm	143.9	7	1,105.2	6
< 0.3 to ≥ 0.2 µm	84.9	4	1,216.7	6
< 0.2 to ≥ 0.16 µm	220.0	11	798.4	4
< 0.16 to ≥ 0.12 µm	170.0	9	1,832.7	9
< 0.12 µm	1,020.8	53	11,097.6	56
N/A	0	0	504.5	3
By wafer size				
≥ 4-inch	87.7	5	591.8	3
5-inch	64.1	3	792.2	4
6-inch	285.9	15	2,587.1	13
8-inch	715.0	37	6,522.6	33
12-inch	780.7	40	9,164.2	47

Capacity = 8-inch equivalent wafer starts per month in thousands
World Fab Watch probability ≥ 0.8

Source: SEMI World Fab Watch, 2008

From a business model standpoint, China's current wafer fabrication capabilities remain noticeably different from worldwide capabilities. Foundry capacity dominates China's current capabilities. For example, when fully equipped and ramped, almost 54% of China's current wafer fabrication capabilities will be dedicated to foundry production—compared to just over 20% worldwide.

China's wafer foundries accounted for about 13% of worldwide wafer foundry revenues in 2007. Based upon these current capabilities, China will be able to increase its share of worldwide foundry production to 21% by 2010—which could have a significant impact on the semiconductor industry.

The 36% of China's current wafer fab capacity dedicated to IC IDMs remains significantly less than the 67% of those worldwide. This is probably the result of the timing of China's opening the semiconductor sector to foreign investments, an election to mimic the Taiwan model, and the very weak market position of China's state-owned semiconductor companies. Currently, there are only seven foreign IDMs with some form of invested wafer fabrication capacity in China: Hynix, Intel, NEC (Hua Hong & SG JVs), Numonyx, NXP (ASMC & JiLin JVs), ON, and ProMOS.

As of the April 2008 WFW, there were nine additional new wafer fabs announced and/or planned (i.e., WFW Probability $\geq$0.45 <0.8) for China. This represents 17% of the 54 new fab plants announced and/or planned worldwide, but only 7% of their equivalent capacity. If all of these additional new fabs were completed and ramped into full production at mature yields, China's share of total worldwide semiconductor wafer production would increase from the $\leq$2% realized in 2003 to $\geq$ 9.3% by 2015. This is somewhat lower than the plans of one or two years ago, and could have an only moderate impact on the semiconductor industry.

While it is unlikely that all of these announced and/or planned wafer fab plants will be realized, they do provide a measure of the changing enthusiasm for China semiconductors. There are only three 12-inch (300mm) fabs included among these nine additional announced and/or planned new fabs, along with two 6-inch (150mm) and four 8-inch (200mm) fabs. The 12-inch (300mm) fabs constitute 52% of this possible additional capacity. The greatest number of these planned plants are for foundry capacity, which accounts for 80% of the total planned capacity. IC IDMs account for the remaining 20%. Elpida, Taiwan-based UMC (He Jian Technology) and Ultimate (Malaysia) are involved with three of these nine possible additional wafer fabs, representing 42% of the possible additional capacity.

Design in China

Integrated circuit design

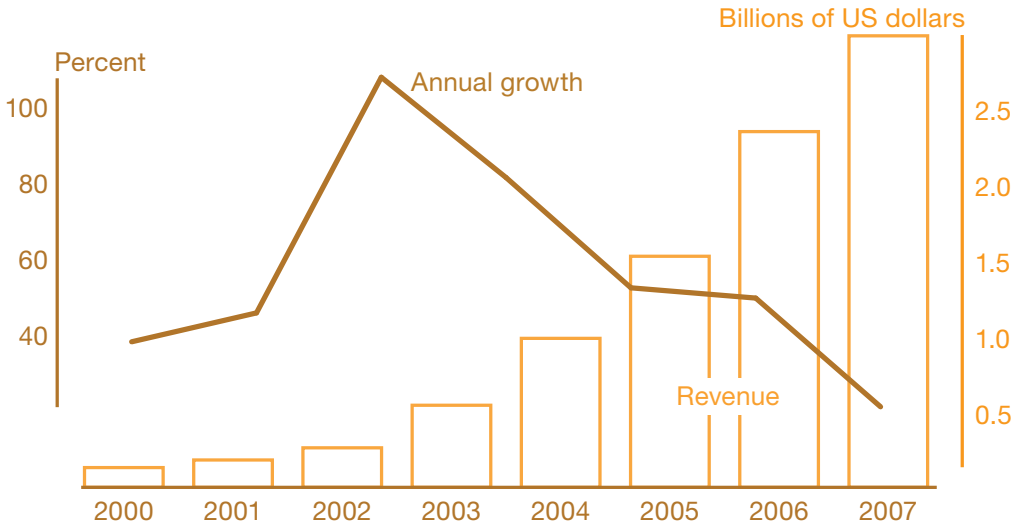
Integrated circuit (IC) design has been the fastest growing segment of China's semiconductor industry. However in 2007, the sector's growth was relatively disappointing.

IC design revenue grew from US$178 million in 2001 to US$3.0 billion in 2007—experiencing a compounded annual growth rate (CAGR) of 60%. However, the IC design year-over-year (YoY) growth rate has decreased from a peak of 108% in 2003 to a plateau of 55% and 54% in 2005 and 2006, followed by a further drop to 27% in 2007 (see Figure 13). Measured in local currency, the IC design YoY growth rate has declined steadily from 108% in 2003 to 21% in 2007.

China's IC design revenue growth of 27% in 2007 only equaled the average of China's semiconductor industry and was less than that of China's IC manufacturing and IC packaging and testing industry sectors for the first time since 2004. Consequently, the design segment's share of China's semiconductor industry remained at 10.8% in 2007—the same as 2006—after having increased steadily from 3.5% in 2001. Growth of this sector can be almost solely attributed to China's fabless semiconductor companies, which in 2007 constituted about 6% of the $53 billion worldwide fabless semiconductor market, up from a 1% share in 2001 and a 4% share in 2005.

Contributing to this decline in the growth rate are results from various IC design enterprises such as Actions Semiconductor and Vimicro—both experiencing significantly declining revenues. Similarly, most of China's fabless semiconductor companies have been focusing on medium- and low-end consumer products, as well as IC card chips, where duplication of designs is severe. As a result, the competition has increased, leading to significant erosion in ASP (average selling price) and therefore lower profits.

Figure 13: China's integrated circuit design industry revenue and growth, 2000-2007



Source: CCID, 2006-2008

Chinese industry executives and market analysts view this setback as short term. Forecasts for China's IC design sector say that during the next five years, growth will resume, eclipsing other industry sectors and achieving a CAGR of more than seven percentage points higher than the industry average. Insiders say this is based on:

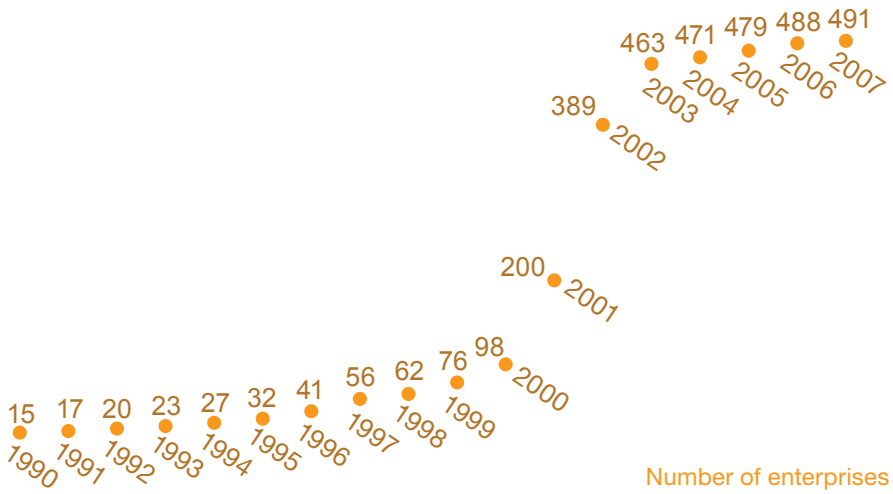
- the continuing growth of China's market;
- a transition to more advanced IC consumer products;
- a transition to more advanced processes;
- growth in the scale of enterprises;
- an enhanced focus on China's domestic market.

Overall, market participants see the demand for locally designed products being driven by Chinese and regionally based OEMs and EMS companies as well as regional ODMs that develop products for Chinese OEMs.

Design enterprises

China had 491 IC design enterprises at the close of 2007, according to the China Semiconductor Industry Association (CSIA). (See Figure 14) Following explosive increases in new startups during the first three years of the decade, the number of reported design enterprises has since remained relatively constant. New additions are only slightly greater than deletions due to closure, consolidation or acquisition.

Figure 14: Number of integrated circuit design enterprises in china, 1990-2007



Source: CCID, 2006-2008

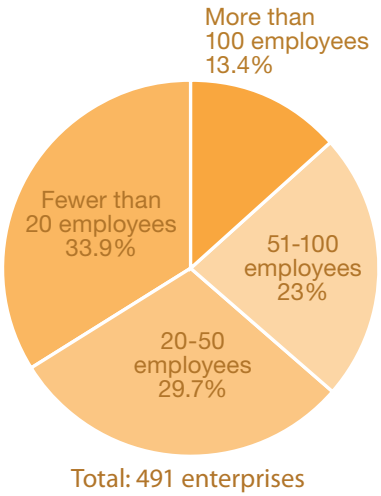
Of these 491 enterprises, approximately 390 are domestic companies and the other 100 or so are design units or activities of foreign-invested or subsidiary multinational companies. Of this latter group, PricewaterhouseCoopers analysis can identify over 90 participants. This group remains concentrated among the largest of the more than 275 multinational semiconductor companies and the 100 largest semiconductor-consuming OEMs identified in the Gartner Dataquest market share databases. It includes Chinese design activities of 18 of the top 25 multinational semiconductor companies and 24 of the top 100 semiconductor-consuming OEMs.

Design employees

Although the number of reported IC design enterprises in China has grown by only 2.5% (to 491) during the past two years, the number of employees has increased by at least 10%. There has been a moderate increase in the employee density among the IC design activities. Compared to 2005, the number of enterprises with more than 100 employees has increased by 47%, or 21 enterprises, while the number with less than 50 employees has decreased by 3.4%, or 11.

Still, by the end of 2007, more than a third of IC design enterprises had less than 20 employees and almost two-thirds had less than 50 employees. (See Figure 15) Of the four relatively large Chinese IC design companies that were reported in the Global Semiconductor Alliance (GSA) Global Financials Report, only Actions Semiconductor, with 257 employees, had a sales per employee productivity level that was equal to or above the GSA's worldwide 180 fabless company average of $381,000 per employee. The company achieved sales of US$454,000 per employee in 2007. The other three were significantly lower: Vimicro, with 324 employees (US$286,000 sales per employee); Spreadtrum Communications, with 576 employees (US$253,000); and Shanghai Fudan Microelectronics, with 200 employees (US$216,000).

Figure 15: China's integrated circuit design enterprise by employee count, 2007

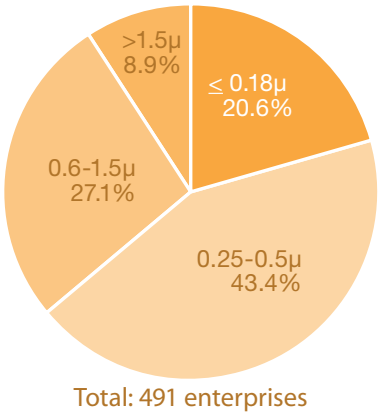


Source: CCID, 2008

Design focus

China's IC design industry seems to be achieving only modest qualitative improvement. For example, over the past two years, there has been only a very gradual migration of design capabilities to finer design line widths. According to the China Center of Information Industry Development (CCID), the number and percentage of enterprises with design capability of equal to or less than 0.5 micron increased by 18 enterprises, or almost 4%. Meanwhile, the number and percentage of design enterprises with design capability of over 0.5 micron has decreased by six enterprises or slightly more than 1%. During 2007, the number of Chinese IC design enterprises with design capability equal or less than 0.18 micron has increased from 92 to 101.

Figure 16: China's integrated circuit design industry by process technology, 2007



Source: CCID, 2008

Design industry outlook

China's 11th Five Year Plan, which covers 2006 through 2010, calls for the development of five IC design companies, each worth 3 billion to 5 billion yuan (revenue of US$394 million to US$674 million) and 10 companies each worth 1 billion to 3 billion yuan (revenue of US$131 million to US$394 million). If these goals are realized, these 15 companies alone would contribute IC design industry revenue of US$3.9 to US$7.2 billion by 2010. Similarly, CCID's current forecast is that China's IC design industry revenue would grow to US$6.9 billion, although this is about a 25% reduction from their forecasts of one and two years ago.

During the remainder of this decade, the fairly large number of existing local design startup companies should decrease to a likely core of about 100 viable companies. Those that are successful will represent the best opportunity for the Chinese government to achieve progress in developing some degree of IC technology independence. However, even if China's IC design industry achieves the goals of its 11th Five Year Plan, it would place China's share of worldwide fabless semiconductor revenue at only 6-8%. This share would constitute no more than 3% of the worldwide IC market by 2010. Though this could have a noticeable but moderate impact on the semiconductor industry, it continues to appear that this is an unlikely outcome.

Even the lower range of the 11th Five Year Plan revenue goals would require China's 15 current IC design leaders to achieve a 43% CAGR for the next three years from 2008 through 2010. Meanwhile, achieving the upper range would require a much higher average CAGR of 76%, while companies other than the top 15 would need to reach an average CAGR of 140% or more just to achieve the lower range of the 11th Five Year Plan.

Simply meeting the latest CCID forecast will require the IC design industry to achieve an average 32% CAGR. By comparison, only 23 (13%) of the 188 public fabless semiconductor companies included in the GSA's Global Financial Report (GFR) database maintained a CAGR of 32% or higher for the past three years (2005 through 2007). Only six of those 23 companies were of a size comparable to China's top 15 IC design companies. This history suggests that China's IC design industry will face significant challenges in achieving the revenue goals of its 11th Five Year Plan.

The primary factors that could spur such industry growth include:

- China's continually growing IC market;
- support from favorable government policies;
- increased domestic wafer fabrication capabilities;
- continuing availability of low-cost engineers and technicians;
- increasing presence of foreign design enterprises;
- progress in local product design innovation.

Factors that could hinder IC design industry growth include:

- lagging technology;
- low research and development (R&D) spending;
- increasing global competition;
- low value-added IC industry services;
- the small IC industry scale;
- increasing investment requirements;
- a shortage of high-level design and design management talent.

Again, though achievement of these goals of the 11th Five Year Plan is within the range of possibility, it appears to be an unlikely outcome.

China and the semiconductor value chain

Value chain revenue

In aggregate, semiconductor value chain revenue increased 16.1% in 2006 and 5.4% in 2007 year-over-year for a combined 22.4% increase since 2005. During those past two years, every sector of the value chain except the IDM sector increased at a rate greater than the combined 22.4%, reflecting the industry's continuing shift to the outsourced or fabless business model and to more advanced and expensive materials. The large IDM sector only increased by 8.5% during that same period.

Table 8: Worldwide semiconductor value chain revenue and original forecast, 2000-2010

	Actual			Original report	
In billions of US dollars	**2000**	**2006**	**2007**	**2010**	**CAGR 2000–2010 (%)**
Electronic design automation	3.8	4.3	5.8	7.8	7
Semiconductor intellectual property	0.7	1.0	1.9	2.3	13
Equipment	52.5	40.6	42.7	43.3	-2
Materials	26.6	36.1	42.4	35.7	3
IDMs	184.0	199.8	203.3	291.7	5
Fabless	20.4	49.7	53.0	44.6	9
Foundries	7.4	23.1	24.3	49.6	21
SATS	10.9	19.1	20.6	26.0	9
Totals	306.3	373.7	394.0	501.0	5

Source: Source: EDAC, Gartner Dataquest, GSA. SEMI, PwC, 2001-2008

Table 8 lists worldwide semiconductor value chain revenue for 2000, 2006 and 2007 compared with forecasts for 2010. For comparison purposes, the 2010 forecast and the compounded annual growth rate (CARG) for the ten-year period remain unchanged from our original 2004 report.

A comparison of value chain data from 2000 and 2007 also demonstrates the impact of the continuing shift to the outsourced or fabless business model. Here, foundry revenue increased 228%, fabless revenue increased 160% and SATS revenue increased 89%. For the same period IDM revenue increased only 11%, while equipment revenue decreased 19%. During the first seven years of this decade the aggregate semiconductor value chain revenue has increased at only a 3.7% CAGR, which is less than the 5% CAGR originally forecast for the decade.

Table 9 presents our current analysis of China's estimated contributions to worldwide semiconductor value chain revenue for 2007. China's role within each value chain segment is characterized on the basis of its relative revenue for production and consumption (where data is available).

Table 9: China's contribution to worldwide semiconductor value chain revenue, 2007

	Worldwide	China		
In billions of US dollars	**Revenue**	**Sales**	**Consumption**	**China's role**
Electronic design automation	5.8	N/A	.015	Software user, not producer automation
Semiconductor intellectual property	1.9	N/A	.026	Licensee of IC design and foundries, not licensor
Equipment	42.7	0.1	2.9	First-tier and wafer-fab buyer; used equipment favored
Materials	42.4	0.85	3.4	First-tier buyer, second- or third-tier producer
IDM	203.3	12.1	69.9	Plant location for large IDMs' SPA&T: Local source of Discrete & smaller IC IDMs
Fabless	53.0	3.0	18.2	Small but rapidly growing local capabilities
Foundries	24.3	3.3	8.4	Substantial: 21% worldwide capacity by 2010
SATS	20.6	4.1	7.1	Substantial: almost 20% of worldwide SATS

Chinese domestic equipment and materials companies only, without local subsidiaries of foreign companies.
Source: EDAC, Gartner Dataquest, GSA. SEMI, PwC, 2001-2008

China's role on the production side continues to be most significant in SATS and foundry operations, and somewhat significant in IDM assembly and test and discrete manufacturing. In the two years since our 2006 update, China's SATS revenues increased 52% and foundry revenues 43% to represent nearly 20% and 14% of worldwide revenues.

China's noticeable presence in the SATS and foundry segments has increased market competitiveness, putting downward pressure on pricing as well as providing alternate sources of capacity for small and startup fabless companies. In the last two years, China's fabless revenue increased by 100%, but still represents less than 6% of worldwide fabless revenues. During that same time period, China's IDM, including OSD revenues, increased by 53%, but again to represent only 6% of worldwide IDM revenues. In aggregate, China's semiconductor value chain production revenue increased 57% during the past two years, but still represents only about 6% of the worldwide semiconductor value chain.

On the consumption side, China's role remains first and foremost as a consumer of semiconductor devices. It now appears that role that will remain predominant well into the next decade. More than 69% of the semiconductor devices China consumed in 2007 were used in the manufacture of electronic products for export from China.

Since our 2006 update, China continues to be a growing buyer of materials, a cyclical user of equipment and a modest licensor of semiconductor intellectual property and electronic design automation tools. Due to China's relatively large and growing share of semiconductor packaging, assembly and test production, its material use has been somewhat more concentrated in back-end materials rather than in wafer fab materials. We estimate that during the past two years the total revenue of China's aggregate consumption activities increased by almost 68%. As such, it now represents nearly 28% of the worldwide semiconductor aggregate value chain activities as compared to only 21% in 2005.

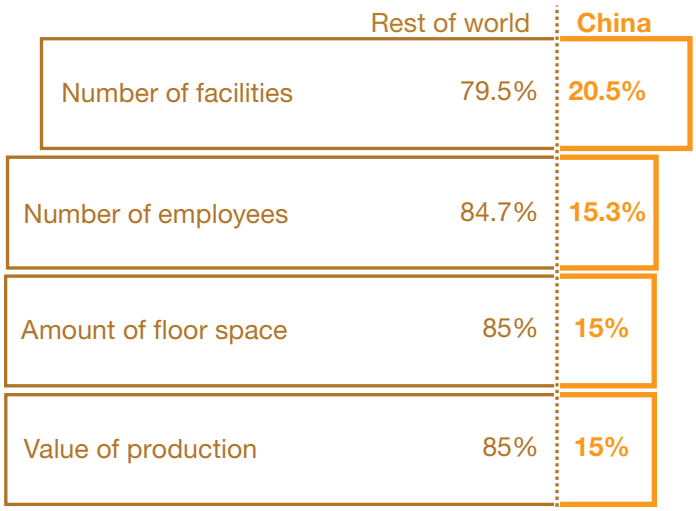
Packaging, assembly and test production

Since the end of 2005, China has added eight additional semiconductor packaging, assembly and test (SPA&T) facilities. So by the end of 2007, the number reached 99, up from 91 at the end of 2005. These 99 facilities represent 21% of the total number of worldwide SPA&T facilities, 15% of worldwide SPA&T manufacturing floor space and 15% of reported worldwide SPA&T employees. China has now reached a fractionally larger share of worldwide SPA&T manufacturing floor space than Taiwan, but both are second to Japan at 20%.

Also during the past two years China has closed seven existing SPA&T facilities while adding 15 new facilities for a net addition of eight facilities and 1.4 million square feet of manufacturing floor space. China's net additions represent 35% of the SPA&T facilities, but only 19% of the net SPA&T manufacturing floor space added worldwide since 2005. This reverses the trend seen in 2004 and 2005, when China was adding the largest share of new SPA&T facilities.

However, this may change again. China has in fact announced plans for five new SPA&T facilities with 1.4 million square feet of manufacturing space. This represents 25% of new facilities, but 56% of new manufacturing floor space planned worldwide. During the past five years, from 2003 through 2007, half of all the new SPA&T facilities that were started worldwide were in China, accounting for 57% of the manufacturing floor space added worldwide.

Figure 17: Comparison of China and all remaining countries' SPA&T resources, 2007



Source: Gartner Dataquest, PwC, 2008

Of the total SPA&T facilities in China, about 33% belong to Chinese companies, a modest increase from 30% in 2005. More significant is that these Chinese companies now represent 28% of China's SPA&T manufacturing floor space, up from 15% in 2005 and 24% of employees, up from 17% in 2005. A further 14% of China's SPA&T facilities belong to companies from Taiwan (11%) and Hong Kong (3%), representing 21% of manufacturing floor space.

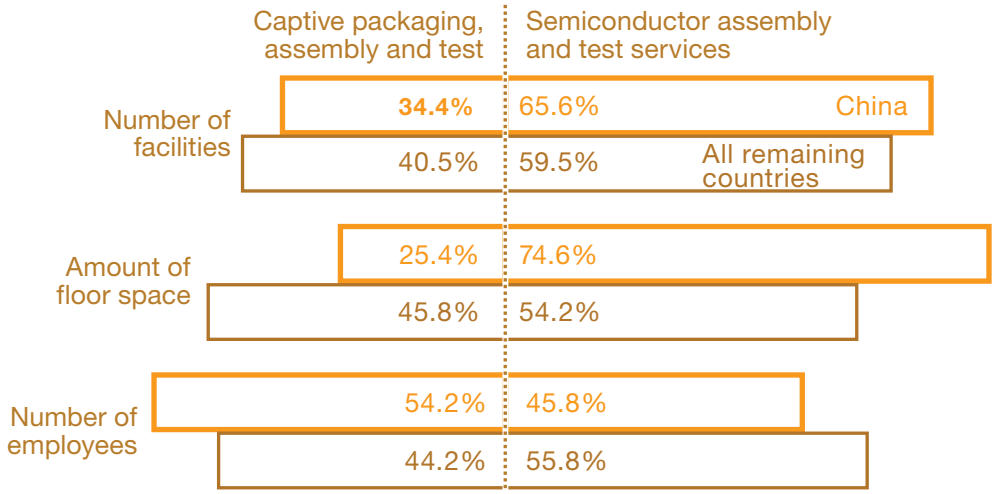
The value of China's IC SPA&T production increased in both 2006 and 2007 to represent 13% of the value of worldwide production in 2007, up from just under 11% in 2005. Similarly, the value of China's discrete production reached an estimated 26% of worldwide production in 2007, an increase from 21% in 2005 and 24% in 2006. The composite weighted average value of China's SPA&T is estimated to be 15% of worldwide SPA&T production, up from 13% in 2005 and 2006.

Semiconductor assembly and test services (SATS)

Figure 18 shows China's share of its SPA&T capacity that is dedicated to SATS (semiconductor assembly and test services) suppliers compared with all other regions' SATS share of SPA&T capacity. China's share remains somewhat more concentrated than that of other regions. SATS resources represent 75% of China's SPA&T manufacturing floor space and 66% of China's SPA&T facilities.

At the end of 2007, 65 SATS facilities were in production in China. Of these, 32 belong to Chinese companies and 33 to foreign companies. Each of the five largest multinational SATS companies has one or more facilities in China. By comparison, 33 of the 34 IDM SPA&T facilities in production in China by the end of 2007 were owned by foreign companies and only one, Jiangsu Changjiang, was owned by a Chinese company.

Figure 18: Comparison of China and all remaining countries' SATS share of SPA&T capacity 2007



Source: Gartner Dataquest, 2008

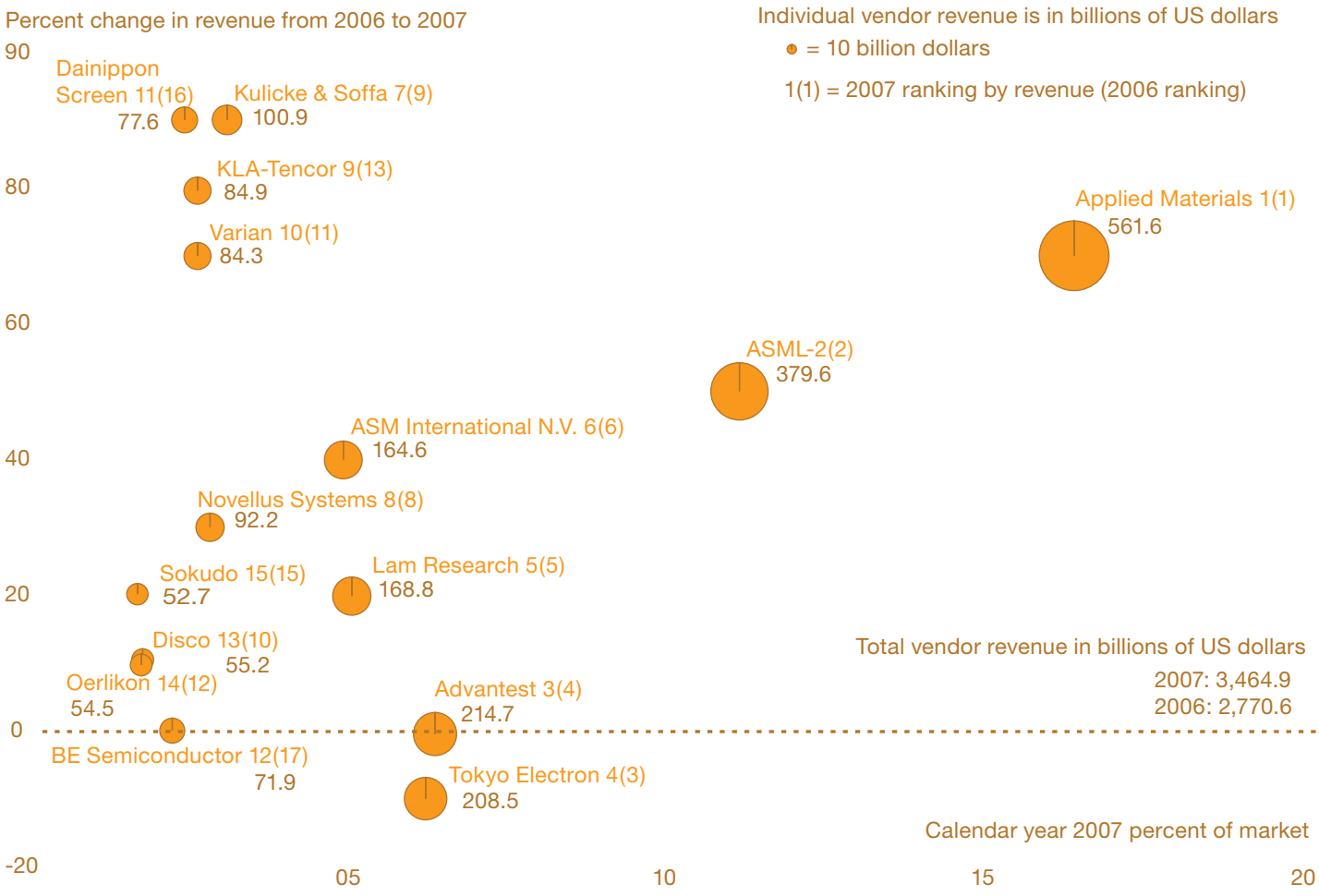
Equipment sales and market share

Semiconductor equipment sales to China increased by 26% in 2007 to a record US$2.92 billion. This compares with worldwide equipment sales, which grew 6% in 2007 to US$42.8 billion, second only to 2000's record high of US$47.7 billion. China's 2007 equipment sales growth of 26% was second to that of Taiwan, which grew 46% in 2007.

China's semiconductor equipment market retains a relatively small but growing share of the worldwide market, rising from 5.7% of worldwide equipment sales in 2003 to 6.9% in 2007. Most of this gain in relative share is the result of China's capturing an above-average portion of the equipment market's recovery. From its 2005 cyclical trough that market has grown 120% compared to the worldwide market's growth of 30%.

During this two-year period, China put into production 11, or 44%, of the 25 new SPA&T plants started worldwide, representing about 45% of their overall capacity. China also started production at nine, or 16%, of the 58 new wafer fab facilities completed during that period, with 17% of their overall capacity. At the same time, the distribution of China's equipment market has remained about 25% back-end, assembly and test equipment and 75% front-end wafer fab equipment. Meanwhile, almost 20% of the front-end wafer fab equipment sales during this two-year period have been of used equipment, a trend that is a decreasing: used sales were 25% in 2005, but have fallen to around 16% in 2007.

Figure 19: Equipment sales to China by vendor revenue, 2007



Source: Gartner Dataquest, 2008

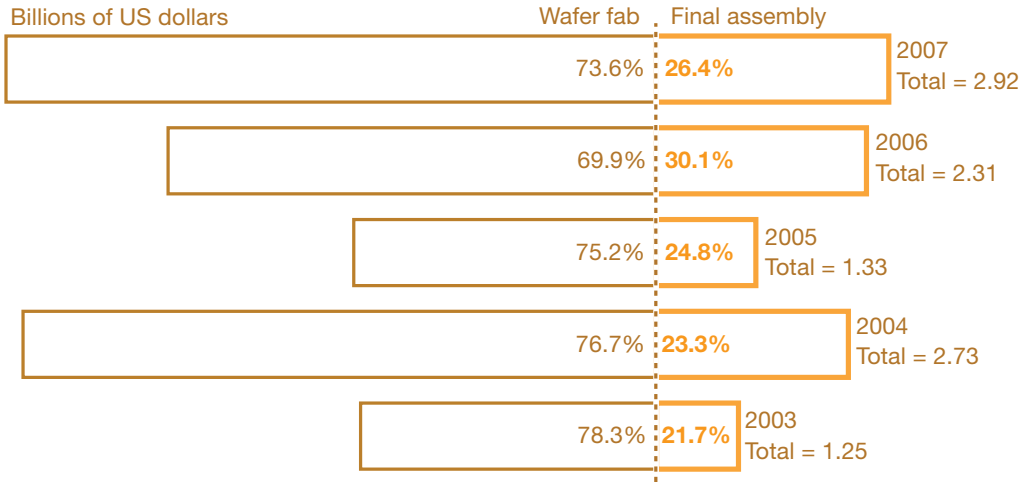
According to Semiconductor Equipment and Materials International (SEMI), the forecast for China's semiconductor equipment sales is that they will remain relatively flat for the remainder of the decade, increasing by just 2% or so by 2010, compared to worldwide sales that are expected to increase by 12%.

China currently has 14 new wafer plants under construction, representing 34% of the 41 new fab plants under construction worldwide, but only 22% of the worldwide new plant capacity. China is adding less capacity and spending less on equipment per new wafer fab plant because they are adding a greater proportion of 6-inch (150mm) and 8-inch (200mm) plants than other regions, and less than half the proportion of 12-inch (300mm) plants.

Sales of the 15 largest semiconductor equipment suppliers to China increased 32% in 2007 to almost US$2.4 billion, representing 69% of the market. The concentration and ranking of the top 15 suppliers with the largest market share (shown in Figure 19) changed somewhat in the last two years as a number of wafer fab equipment suppliers displaced assembly equipment suppliers.

Similarly, the concentration of suppliers to the China market has increased a bit as these top 15 suppliers achieved a 69% market share, up from 65% in 2006 and 64% in 2005. In the past two years, the sales of the 15 largest semiconductor equipment suppliers to China have increased by 130%, while the total market grew by 120%. In addition to the recognized international suppliers to the China semiconductor equipment market, there are a large and growing number of other suppliers, including many regional and about 80 indigenous Chinese suppliers, that are trying to establish a viable presence in the market. However, the sales of this other group of numerous suppliers increased only 88% in the past two years, while the market grew by 120% and the top 10 suppliers by 135%.

Figure 20: China's semiconductor equipment market and growth, 2003-2007



Source: SEMI, Solid State Technology, 2006-2008

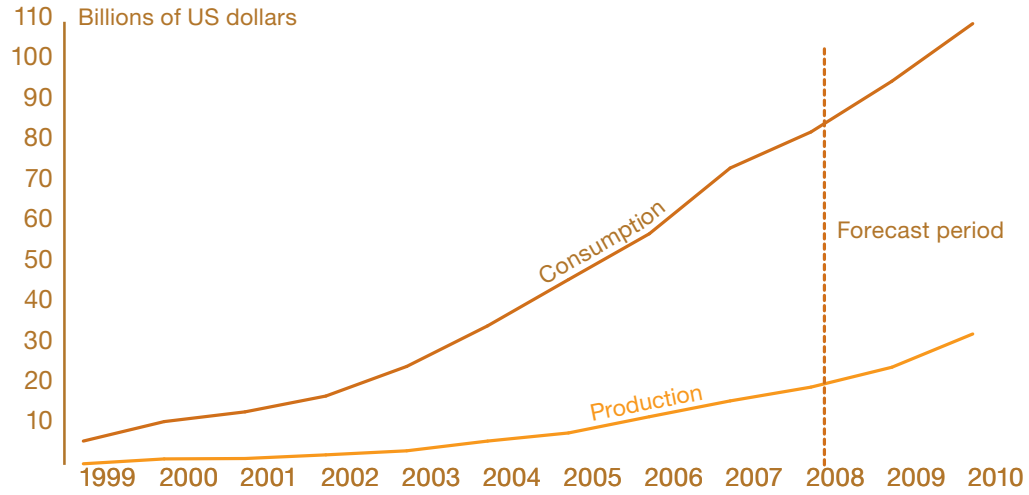
Integrated circuit consumption/production gap

China recorded its largest ever single year increase and absolute value annual IC consumption/production gap in 2007. This gap is the difference between IC consumption and IC industry revenues.

Over the past two years, China's IC consumption/production gap continued to increase despite government plans and efforts to contain it. Although China's IC industry revenues grew at a faster rate than the IC market, they represented only 22% of the market. And while they increased by US$4.0 billion and US$3.9 billion in 2006 and 2007, the market grew by US$11.3 billion and US$16.2 billion in the same years. As a result, China's IC consumption/production gap increased by US$19.6 billion during those two years to reach US$57.5 billion for 2007.

This gap has grown from US$5.7 billion in 1999 to US$57.5 billion in 2007, and the Chinese authorities expect that it will continue to increase through at least 2010.

Figure 21: Comparison of China's integrated circuit consumption and production: 1999-2010



Source: CCID, CISA, PwC, 2004-2008

According to the China Semiconductor Industry Association (CSIA) 2008 report, China's IC market is forecast to grow to US$110 billion by 2010, with IC industry revenues expected to reach US$33 billion. This forecast implies a further widening of China's IC consumption/production gap to US$77 billion. It is our belief that this gap contributes to the Chinese government's continuing initiatives to increase indigenous production.

Greater China

Preface

We first reported on the increasing amount of interdependence and interaction among China, Hong Kong and Taiwan in the semiconductor industry in our 2006 update report. Since then there have been a number of developments that indicate Taiwan is loosening restrictions on semiconductor investments in China in order to further improve that symbiotic relationship.

Taiwan's recently elected government favors closer ties with China, including a further easing of technology transfer restrictions. This government secured a three-fourths majority in Taiwan's parliament, giving it a green light to move forward with economic reforms. Still, the Taiwanese government strictly controls investment in China's semiconductor industry over fears that the technology could be used by the Chinese military, as well as the possibility of job losses on the island. It currently only allows Taiwanese chipmakers to build 8-inch or smaller wafer fabs in China using 0.18 micron or larger process technology. But Taiwan's current leader now states that Taiwanese companies should be allowed to use whatever technology the US allows its chipmakers to transfer to China. Intel Corp., for example, has already been granted permission by US authorities to build a 12-inch fab in Dalian, albeit with lagging 90-nanometer process technology.

The main reason behind Taiwanese chipmakers' eagerness to set up shop in China is to access the mainland's fast-growing market rather than to lower production costs. They need to be able to supply companies that produce electronics goods in China for export, but they are also aware that those with a local manufacturing presence have better prospects of getting orders from customers producing for the domestic market.

In 2002, Taiwan ended a total ban on semiconductor investments in China and said it would allow a limited number of chipmakers to move some more mature manufacturing capacity to the mainland. Two years later, after a lengthy review process, Taiwan Semiconductor Manufacturing Co. Ltd. (TSMC), the world's largest chip foundry, set up an 8-inch chip plant in Shanghai under those rules. However, it was limited to producing chips of 0.25 microns and above, less advanced than the processes already being used by Chinese and international competitors.

Over the past few years, process technology has progressed much faster than the Taiwanese government's opening of economic exchanges with China, so that 0.18 microns have become mainstream technology for Chinese chipmakers. As a result, Taiwanese chipmakers have lobbied the government to further ease its restrictions.

In December 2006, the Taiwanese government allowed Taiwanese semiconductor firms to use 0.18 micron technology and gave the green light for Powerchip Semiconductor Corp. and ProMOS Technologies Inc., the island's largest and third largest memory chipmakers, to set up 8-inch plants in China. So far, only TSMC and

ProMOS have built semiconductor plants in China. Powerchip has not yet moved forward on its China project due reportedly to still strong demand at its 8-inch plant in Taiwan.

Taiwan's second largest foundry, United Microelectronics Corporation (UMC), has not yet applied to set up a wafer fab in China. However, its ties with China-based Hejian Technology (Suzhou) Co. Ltd. were scrutinized by Taiwan's previous government over concerns that it had violated technology transfer restrictions. The Chinese contract chipmaker was set up by former UMC executives in 2001 and assisted by the Taiwanese foundry. More recently, UMC said it may consider merging with Hejian if it secures the go-ahead from Taiwan's new government. Meanwhile, Hejian itself will reportedly work with Japan's Elpida Memory Inc. to build a 12-inch plant in Suzhou under a joint venture to be named "Hefa". If confirmed, it would be the first 12-inch fab constructed in China that (indirectly) involves a Taiwanese firm.

Even if the Taiwanese government eases its investment restrictions, the possibility that other Taiwanese semiconductor firms will build 12-inch wafer fabs in China is low, as these companies are currently focusing on expanding their 12-inch capacity in Taiwan. In March 2008, a groundbreaking ceremony was held for the construction of five 12-inch fabs in the Hsinchu Science-based Industrial Park (HSIP)—two operated by TSMC, two by Powerchip and one by Vanguard International Semiconductor Corp. The total investment of this construction is about US$15 billion. Following completion of the facilities in two to three years' time, Taiwan's 12-inch wafer manufacturing capacity will exceed that of any other country. The HSIP alone will boast 11 such facilities.

Taiwan's fabless IC design houses are just as eager as their foundry partners to be part of China's semiconductor industry. Several Taiwanese chip designers have already set up Chinese operations. However, these are set up mainly for customer service and marketing purposes, not design work, due to technology transfer restrictions. Even so, many of China's chip designers are driven by Taiwanese money. MediaTek Inc., VIA Technologies Inc., Sunplus Technology Co. Ltd. and Novatek Microelectronics Corp., four of the island's largest IC design companies, have either bought into chip designers on the mainland or begun sponsoring research at Chinese universities.

As for Taiwan's IC assemblers, the government lifted its ban on investment in the low-end parts of chip testing and packaging in China in 2006. They can now legally extend their low-end lead-frame base IC testing and packaging to China. However, they are still forbidden from producing associated raw materials in China, which is affecting their costs.

Even so, their Chinese operations have grown vigorously since the ban was lifted. Advanced Semiconductor Engineering Inc. (ASE), for instance, received approval from Taiwan's Investment Commission in early 2008 to expand its investment in its Shanghai subsidiary, which it had taken over from a Chinese company in 2006.

In view of ASE's success, other IC assemblers are following its lead. For example, Siliconware Precision Industries Co. Ltd., Taiwan's second-largest IC assembler, has established a subsidiary in Suzhou which it plans to expand further in 2008.

In July 2008, the Taiwanese government decided to abolish limits on investment in China by companies whose operational headquarters are on the island. For other companies, the mainland investment ceiling will be raised to 60% of net worth, up from 40%. Further deregulation is expected to come later in the year in the form of a removal of restrictions on China-bound investment in the semiconductor industry and others.

Greater China's impact on the semiconductor industry

China's semiconductor (consumption) market grew by 57% over the past two years to US$88.1 billion in 2007. But during this same period, Taiwan's market decreased by 13% to US$11.6 billion. These changes reflect the continuing transfer (or offshoring) of worldwide electronic equipment production to China from other locations, including Taiwan. As a result, China's semiconductor market was more than seven times as large as Taiwan's market in 2007 even though a portion of that market demand was created by Taiwanese electronic manufacturing services (EMS) and original design manufacturer (ODM) companies.

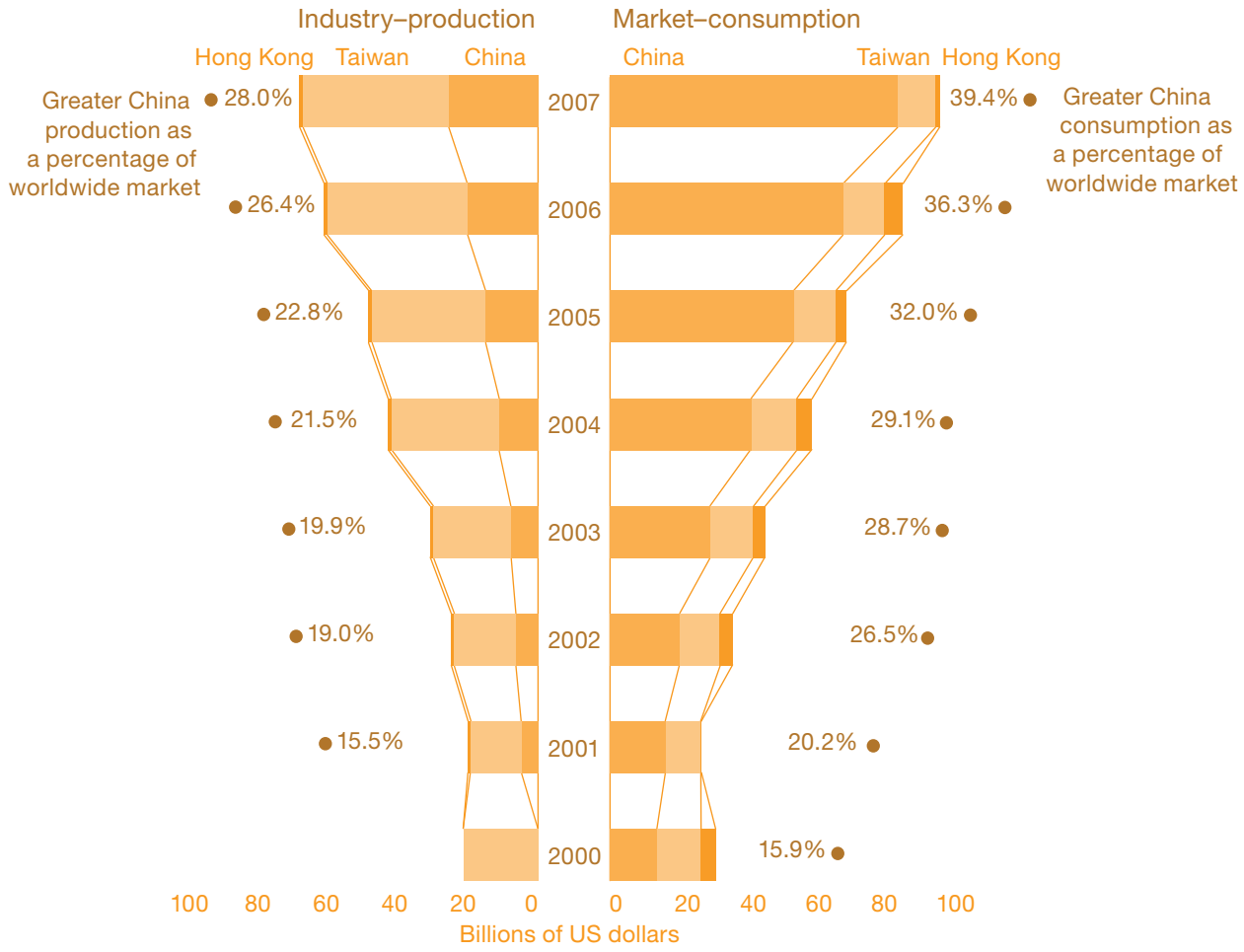
During the past two years, the Greater China semiconductor market, including Hong Kong, grew by 39% to reach US$101 billion in 2007, representing over 39% of the worldwide market. The Greater China share of the worldwide semiconductor market has grown from 32.0% in 2005 to 39.4% in 2007, a gain of more than seven percentage points.

Based upon the SIA's reported worldwide semiconductor markets for 2005 and 2007, we gauge market share by region including Greater China as follows:

	2005	2007	Change
Greater China	32%	39%	+7%
Japan	20%	19%	-1%
Americas	18%	17%	-1%
Europe	17%	16%	-1%
Rest of world	13%	09%	-4%

Compared to China, Taiwan's semiconductor industry is much larger, uses more advanced technology and features more renowned companies. Still, Taiwan did not grow as fast as China during the two years since our last report.

Figure 22: Greater China share of the worldwide semiconductor industry, 2000–2007



Source: CCID, Gartner Dataquest, ICI, TSIA, WSTS, PwC 2004-2008

During that period, Taiwan's semiconductor industry revenues grew by 28%, US$9.8 billion, to reach US$44.6 billion by 2007. Meanwhile, China's reported semiconductor industry revenues grew by 70%—US$11.3 billion—to reach US$27.4 billion. So, Taiwan's industry is no longer twice as large as China's. Taiwan's reported revenues have dropped from 2.2 times that of China's in 2005 to 1.6 in 2007. However, since a larger portion of China's industry revenues and growth came from its discrete sector, Taiwan's IC industry revenues continue to be 2.7 times as large as China's in 2007.

During the past two years, Greater China's semiconductor reported industry revenues grew by 41%, to reach US$73 billion in 2007, which we estimate represents about 24% of equivalent worldwide industry revenues.

China's semiconductor consumption/production gap (value of consumption less production) has been growing consistently since 2000 to reach over US$60 billion in 2007. By comparison, Taiwan maintains a semiconductor production/consumption surplus which in 2007 reached over US$33 billion. Therefore, Greater China, including Hong Kong, had a semiconductor consumption/production gap of US$26 billion in 2007. That's an increase from US$21 billion in 2005, but it's still significantly less than that of China (PRC) alone—and only about 10% of the total worldwide semiconductor market.

Based upon all the wafer fabs in production by 4Q 2007, Greater China will have 25% of total worldwide fab capacity. When fully-equipped and ramped-up to full capacity, this will represent 63% of worldwide foundry capacity, 31% of 300mm capacity, and 28% of advanced, <0.12μm capacity.

Fifty-nine percent (59%) of all the wafer fabs under construction as of 4Q 2007, representing 57% of their total capacity, were located in Greater China. When all of these fabs are completed, put into production, fully-equipped and ramped to full capacity, Greater China will have 29% of total worldwide fab capacity, including 68% of worldwide foundry capacity, 36% of 300mm capacity and 34% of advanced <0.12μm capacity.

Nearly 65% of the 68 new semiconductor package, assembly and test facilities added worldwide during the past five years have been located in Greater China. As a result, Greater China currently accounts for more 30% of total worldwide semiconductor package, assembly and test capacity. In addition, 40% of all the new semiconductor package, assembly and test facilities announced to be added worldwide as of 4Q 2007 are planned for Greater China, representing 55% of all planned additional capacity.

In summary, in 2007, Greater China represents:

- 39% of the worldwide semiconductor (consumption) market;
- 24% of the worldwide semiconductor industry (production) revenue;
- 49% of all new wafer fabs and 57% of all fab capacity under construction;
- 29% of worldwide committed wafer fab capacity;
- 68% of worldwide committed foundry fab capacity;
- 36% of worldwide committed 300mm fab capacity; and
- 34% of worldwide committed advanced <0.12μm capacity; and
- 30% of worldwide semiconductor package, assembly & test capacity.

Source: CCID, Gartner Dataquest, ICI, SEMI World Fab Watch, TSIA, WSTS, PwC, 2008.

China's revised laws

Corporate income tax law

During 2007, the government of China enacted major revisions to their corporate tax and labor laws that will affect almost all high-tech companies with operations in China and, as a result, could have an impact on the semiconductor supply chain and industry in China.

In March 2007, National People's Congress of China adopted a new Corporate Income Tax law (CIT law) which became effective January 1, 2008 and repealed the prior foreign-invested enterprises and foreign enterprises (FIEs/FEs) and domestic-invested enterprises (DEs) income tax laws. Under the prior law, China had two distinct sets of income tax laws, one for FIEs/FEs and one for DEs. Although both DEs and FEIs/FEs were nominally subject to the same statutory tax rate of 33%, FIEs/FEs enjoyed so many preferences and tax holidays that their effective tax rate was generally 15%. The CIT law eliminates many of these preferences and imposes a uniform 25% tax rate on both domestic and foreign enterprises. The new law unifies the income tax law applicable to DEs and FIEs/FEs, income tax rates, deductions and preferential income tax policies (which are the mainstay) with the regional-based ones that are the supplement.

The four main reasons for this reform were:

- China joined the World Trade Organization (WTO) and needed to conform to WTO principles of "national treatment" and "transparency" by creating an environment for fair competition among all enterprises through a standardized and transparent fiscal system.
- China needed to update its income tax provisions to reflect the rapid changes in its economy and society.
- Reform was essential to enhance Chinese economic development.
- To eliminate preferential policies of the prior bifurcated tax code that distorted behavior and led to revenue loss.

The four underlying principles of this new law, intended to establish an enterprise income tax system uniformly applicable to various types of enterprises, include:

- simplifying tax regimes
- broadening the tax base
- lowering tax rates
- strict enforcement

The CIT law:

- Harmonizes corporate taxation of FIEs/FEs and DEs
- Applies a uniform tax rate of 25% for all enterprises
- Corporate Income Tax shall be levied at the reduced rate of 20% for qualified Small and Thin-profit Enterprises
- Applies a withholding rate of 20% (reduced to 10% in Article 91 of the Detailed Implementation Rules of the Corporate Income Tax law)
- Applies preferential rates for certain types of enterprises (notably high/new tech enterprises (HNTEs))
- Eliminates most prior tax incentives
- Provides transitional rules for prior favorable FIE tax rates and pre-existing tax holiday incentives (grandfathering)
- Contains a new tax-resident concept
- Contains a series of broad anti-abuse rules
- Holds that Chinese bilateral tax treaty provisions take precedence over domestic law provisions when there is a conflict

The CIT law provides a basic framework which is subject to the Detailed Implementation Regulations (DIR) promulgated by the State Council and supplemented by an extensive array of tax circulars and guidelines. In addition, the Ministry of Science and Technology (MST), Ministry of Finance (MoF) and State Administration of Taxation (SAT) have joint responsibility for administering the details for the qualification of HNTEs. While the CIT law, DIR and several related tax circulars, administrative measures, and guidelines have now been issued, we expect that more will be issued in the near future to further clarify the CIT law and its DIR.

The following is a summary of the main tax implications for semiconductor companies under the new CIT law:

CIT rate and grandfathering tax treatment. The new CIT law standardizes the CIT rate at 25% for all DEs and FIEs (including joint ventures, JVs, and wholly foreign-owned enterprises, WFOEs)/FEs. However, existing DEs (e.g., enterprises established in special zones such as Shenzhen, Zhuhai and Hainan provinces) and FIEs that were enjoying a reduced tax rate of 15% will be eligible for a grandfathering treatment that increases their CIT rate gradually to the standardized rate within five years (i.e., 18% for 2008, 20% for 2009, 22% for 2010, 24% for 2011 and 25% for 2012). Also, existing DEs and FIEs that have unused tax holidays will be grandfathered for the remaining years of their tax holiday, but all will have to start their holiday by 2008 regardless of profitability.

High/New technology enterprises (HNTE). Under the new CIT law, HNTEs that meet specific qualifying criteria—including core proprietary intellectual property (IP) rights, proportion of university graduates employed and engaged in R&D, percentage of revenue spent on R&D and percentage of income from high/new tech products or services—are eligible for a reduced income tax rate of 15%. Also, newly established

and qualified HNTEs set up in the five special economic zones (namely Shenzhen, Zhuhai, Shantou, Xiamen, and Hainan) and the New Area of Pudong (5+1 Zones) may be eligible for a two-year tax exemption and a three-year 50% tax rate reduction with the holiday commencing from the first income-generating year.

However, the 50% tax rate reduction is based on the statutory rate of 25%, rather than the incentive rate of 15%. This implies that the income tax rate for those new HNTEs that meet the qualifying and 5+1 Zone location criteria will be 0% for the first two years, 12.5% for the next three years and 15% thereafter. New companies will have to apply, complete and satisfy an assessment by a government Assessment Institution in order to be awarded a HNTE certificate which is valid for three years from the issuance date. Re-assessment is required to renew the HNTE certificate for another three years.

The new criteria for qualifying as an HNTE for the tax incentives are much higher than the same designation under the prior tax laws. In addition, the application process is not perfunctory in light of higher levels of authorities' supervision and approval, more standardized requirements, more examination of technical requirements, more transparency, etc. Therefore, we believe that companies will need to be better prepared for the application process.

Special tax incentives for integrated circuit (IC) companies including both DEs and FIEs/FEs. IC design companies are treated the same as software production companies for a number of tax preferences. VAT rebates used for R&D and production expansion will be exempt from CIT. Newly established IC design companies shall enjoy a two-year tax exemption followed by a three-year 50% tax reduction starting from their first profit-making year. Key companies listed in the State's plan that do not enjoy the 2+3 tax exemption and reduction for a given year shall be subject to tax at a reduced 10% rate. Staff training expenses shall be tax deductible. Purchased software is allowed to be depreciated or amortized over a minimum period of two years upon approval of tax authorities.

In addition, IC production companies may be entitled to additional tax preferences. The depreciation period of production equipment may be shortened to a minimum of three years with approval of tax authorities. Companies with a total investment greater than RMB 8 billion or which produce ICs with a line-width of less than 0.25μm may be eligible for a reduced tax rate of 15%. If the operating period of the company is more than 15 years, it may also be eligible for a five-year tax exemption followed by a five-year 50% tax reduction starting from their first profit-making year. Companies which produce ICs with a line-width of less than 0.8μm may be eligible for a two-year tax exemption followed by a three-year 50% tax reduction upon assessment of and approval by tax authorities, except for those companies who have already enjoyed a 2+3 preferential tax treatment.

For the period of 2008 through 2010, an investor in an IC production or assembly company who reinvests after-tax profits from that company to increase the registered capital of that company or another IC production or assembly company which operates for a period of not less than five years shall be eligible for a refund of 40% of the income tax already paid on the reinvested profits.

Also for the period of 2008 through 2010, any investor (domestic or foreign) who reinvests after-tax profits obtained from within China to establish a new IC production or assembly company located in the Western Region which operates for not less than five years shall be eligible for a refund of 80% of the income tax already paid on the reinvested profits. In either of these reinvestment refund preferences, if the reinvestment is withdrawn within five years the refund will be forfeited.

It is also expected that the new CIT law will result in wider use of advanced pricing agreements (APAs). In China, an APA is an arrangement that determines in advance an appropriate set of criteria to ascertain the transfer price of a specified related party's transactions over a period of time.

Transfer pricing has been a significant concern for multinational companies in China. In recent years, Chinese authorities have increasingly strengthened their transfer pricing enforcement efforts. The CIT law contains a provision on APAs which enhances the legal status of the APA. Therefore multinational semiconductor companies may find it more attractive to use an APA due to the increased certainty.

The new CIT Law changes the tax and incentive environment for many semiconductor and semiconductor value chain companies operating in China. Many of the more recent participants may see some reduction in expected incentive benefits. Essentially, the playing field is being leveled for domestic companies. Future incentives seem to favor R&D, IC design and foundry companies. Enhanced and more standardized enforcement means companies that put more effort into tax planning and preparation may benefit.

Labor contract law

In June 2007, the National People's Congress of China adopted a new Labor Contract Law (LCL). First drafted almost three years earlier, the law became effective January 1, 2008. This LCL emphasizes the legal protection of employee rights and combats potential exploitation during China's rapid economic growth. It was enacted during a time when employees in China are becoming more aware of their employment rights and how to uphold them. While introducing more stringent regulations, the LCL offers better and more comprehensive guidance on the employment relationship which in the past has tended to be quite ambiguous and subject to local jurisdiction. It includes sections on probationary periods, redundancy, liquidated damages, severance pay, collective bargaining, noncompete, and part-time employment, etc.

The LCL is meant to maintain a long-term labor relationship between employer and employee in order to better protect the rights and interests of the employee. A labor contract without a fixed term shall be established for employees who have worked

for an employer for ten consecutive years or who have consecutively completed two fixed-term contracts with that employer. Furthermore, employers who terminate employees early from a fixed-term contract shall be liable for severance pay.

On the other hand, an employee may terminate a labor contract without justified reason upon providing 30 days-advance notice in writing. Under certain circumstances—such as unsafe working conditions, failure to pay full wages including overtime pay, failure to pay legally required social insurance, etc.—an employee may terminate a labor contract at any time by notifying the employer.

Finally, an employee may resign without notification if an employer forces him or her to work by violence or threat, illegally limits the employee's personal freedom or illicitly commands or forces the employee to perform operations which may endanger the employee's personal safety. Under these circumstances, the employer remains liable for severance pay.

The LCL shortens the term of probation periods to no longer than six months and specifies a minimum salary during the probationary period. It also requires that the employer provide a justifiable reason for terminating an employee during the probationary period. Meanwhile, an employee may terminate during the probationary period with or without justifiable reason upon three days-advance notice.

According to the LCL, noncompete obligations are confined to only senior managers, senior technicians and other personnel accountable for nondisclosure obligations. Their scope, jurisdictions, term and compensation may be agreed to in a labor contract, provided the term may not exceed two years and compensation may be paid on a monthly basis immediately after the termination or dissolution of the contract. Employees who violate their noncompete obligations are liable for both liquidated damages as maintained in the contract and for consequential damages if the employer suffers any economic losses as a result of the violation.

If an employer pays special expenses for an employee's training, the employer may reach an agreement on a service period with the employee. If the employee violates the agreement by leaving before completing the service period, they become liable to pay the employer a penalty for breach of contract in an amount not exceeding the training expenses attributable to the unfulfilled service period.

If companies are planning major restructuring, to lay off more than 20 employees or over 10% of total staff, they are now required to provide 30-day advance notification to the labor union or all employees, consult with the labor union or other employee representatives and submit the layoff plans to the labor authorities. When reducing the workforce, the employer is required to retain with priority those employees with

long-term contracts or contracts without a fixed term and employees without other working family members or with elderly or minor family members to support. The laid-off employees shall be given priority if the company rehires again within six months.

The new LCL provides for wider application and introduces tighter controls of severance pay. Severance pay is set at one month's salary for each year of service, with the maximum amount capped at three times the average salary of the local district multiplied by a maximum of 12 years.

The new LCL specifies collective bargaining contracts in several categories, including corporatewide contracts, specialized contracts (e.g., safety and hygiene, protection of female employees and salary adjustment mechanisms), industrywide contracts (e.g., construction, mining and catering) and regionwide contracts. Trade unions or employee representatives may negotiate with an employer on the collective bargaining contract applicable in the same company, industry or region. For a collective bargaining contract applicable in the same company, the contract shall be reviewed and approved by a congress of employees or a congress of employee representatives. The contract will take effect if there is no objection from the local labor authority within 15 days of submission. *We understand that most semiconductor companies expect to be able to comply with this requirement by establishing and negotiating their collective bargaining agreements with a local employee council.*

In the near-term, the new LCL may substantially increase labor costs and reduce flexibility for many employers compared to their prior practices. However, for most multinational semiconductor companies, the new LCL will most likely provide a more level playing field in that it requires local competitors to provide a comparable level of human resources management practices and costs.

Production growth scenarios

Overview

PricewaterhouseCoopers' original 2004 report examined the effects that different levels of growth in the Chinese integrated circuit semiconductor industry would have on the greater industry. We evaluated scenarios spanning the time period of 2003 through 2010 and we also analyzed the developments, investments and milestones that would need to occur for China to achieve each level of growth during the forecast periods. Finally, we predicted the likelihood that China would achieve each level of growth—conservative, moderate or aggressive—based upon then-current market conditions.

In subsequent updates, we reexamined these original production growth scenarios and revised our analysis. So far, we have not identified any fundamental changes that would cause the basic tenets of our original production growth scenarios to be significantly altered. However, we now believe it would be helpful to add revisions to each scenario to reflect the current market conditions. These revisions—along with our original forecasts—are shown in Figure 22, where we have also added actual consumption and production through 2007 for comparison.

Our conservative growth scenario was based upon the assumption that China would be able to equip and ramp to full capacity at mature yields only those current and committed wafer fabrication plants that existed as of mid-2004. Under those original assumptions, we forecasted that China's IC industry revenues would reach US$16 billion by 2010.

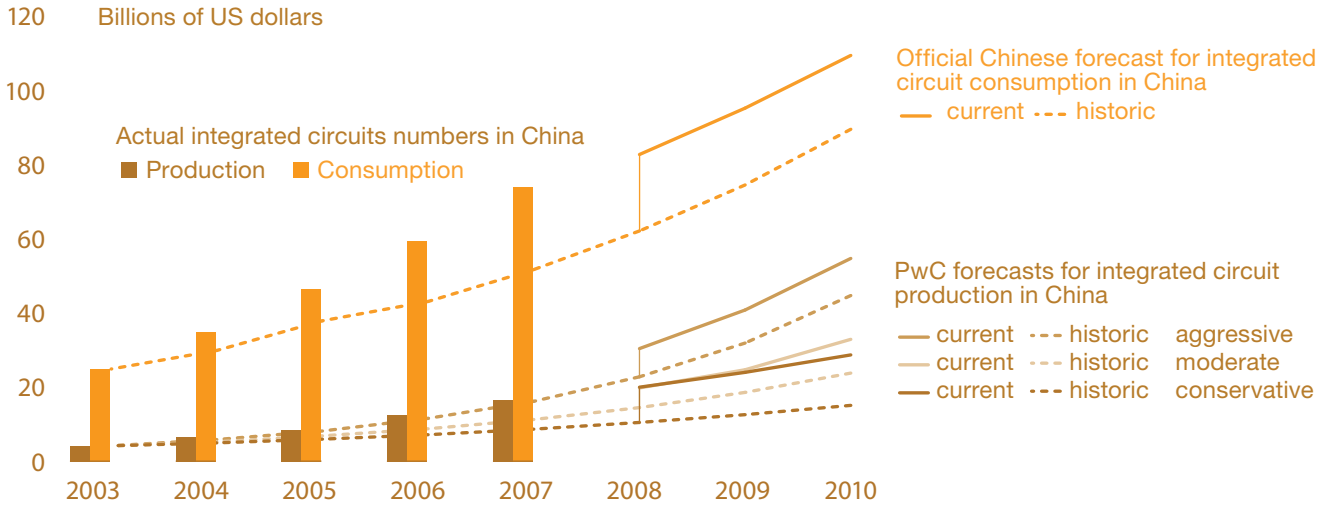
Our moderate growth scenario was based upon China achieving the specific objectives articulated by the China Semiconductor Industry Association (CSIA) in 2002, with IC production revenues forecasted to reach US$24.1 billion by 2010.

Our aggressive growth scenario was based upon the assumption that the Chinese semiconductor market would grow from its 2003 level at 20% compounded annual growth rate (CAGR), twice the worldwide rate. It also called for China achieving its goal of having its IC industry revenues equal at least half of its market demand by 2010, amounting to US$44.8 billion in that year. Under those original assumptions, China's IC market would reach US$89.5 billion by 2010.

China's performance compared with the scenarios

Figure 22 includes China's actual performance for 2003 through 2007. Comparing actual performance to our original scenarios we see that both China's IC consumption and its production continue to exceed our aggressive growth scenarios for each year since 2003.

Figure 23: China's integrated circuit production and consumption forecasts compared with actual: 1999-2010



Source: CCID, CISA, PwC, 2004-2008

Several factors have contributed to this outcome. China's IC consumption market has grown more than twice the worldwide rate, which itself has grown faster than forecast. China's IC market has grown at a 31.1% CAGR from 2003 to 2007, while the worldwide IC market has grown at an 11.8% CAGR. The higher-than-expected worldwide rate peaked in 2004, followed by growth in the following three years of 8%, 9% and just 4% in 2007.

The current forecast is for the worldwide IC market to average less than 10% CAGR for the remainder of this decade. By contrast, the Chinese IC market grew even faster than the worldwide market during the peak of 2004. After that, while China's growth slowed, it still achieved results that were three to five times the worldwide rate for each of those years. China, in fact, accounts for 62% of the total net increase in the worldwide IC market between 2003 and 2007.

However, China's IC market growth is now expected to slow. The CSIA forecasts that China's IC market growth in local currency (RMB) will average less than 16% CAGR for the remainder of this decade.

During the past four years, China's IC production has increased by an average 40% CAGR, slightly exceeding our aggressive scenario. This very high rate of growth was the result of an extraordinary 190% increase in the IC manufacturing sector (primarily foundry) in 2004, three years of greater than 50% per year growth in the IC design (fabless) sector between 2004 and 2006 and a greater than 40% increase in the IC packaging and test sector in 2006.

China has fewer but much larger wafer fabs than was expected in 2004. By the end of 2007, China had fewer (70) wafer fabs in production than committed at the start of 2004 (73) but with significantly more capacity (1,384K versus 992K 8-inch equivalent Wafer Starts per Month). Also, China has almost doubled the amount of IC packaging and testing done with imported wafers since 2005. However, China's IC production is now expected to slow, albeit relatively slightly. The CSIA forecasts that China's IC production in local currency (RMB) will average 26% CAGR for the remainder of this decade, while CCID forecasts a slightly more conservative 24% CAGR.

Conservative growth scenario

The potential capacity of all current and committed wafer fabrication plants in China as of the end of 2007 has increased by about 94% over the capacity levels in our original forecast (2004). This capacity increase is the result of 12 additional plants, net of closures, being put into production, plus 11 additional new plants starting construction. It is our estimate that during 2007 only about 50% of the potential revenue capacity of those existing wafer fabrication plants was realized because many plants were not yet fully-equipped or were in the process of ramping to nominal capacity.

To reflect current SICAS reports, we have refined our scenario model to incorporate a trend of continuing decreasing average wafer values to $800 per 8-inch equivalent wafer and an average capacity utilization of 90%. We also assume that the plants under construction will realize only 50% of their nominal capacity by 2010.

Under those assumptions and current conditions, our conservative growth scenario could result in an increase in 2010 IC production revenue to US$28.8 billion, requiring an additional investment of at least US$20 billion for capital equipment and facilities. This projection represents an IC production CAGR of slightly more than 20% during the period from 2007 to 2010. Attainment of this projection continues to appear reasonably probable.

Moderate growth scenario

The moderate growth scenario assumed China would achieve the specific objectives articulated by the CSIA in 2002. These objectives called for meeting 50% of domestic demand by 2010. By 2005, IC production would stand at 20 billion pieces, with revenue ranging from 60 billion to 80 billion Yuan (US$7.2 to 9.6 billion). By 2010, the industry would produce 50 billion pieces with revenue of 200 billion Yuan (US$24.1 billion at then current FX rates) by 2010. This forecast represented a CAGR of 25% from 2004 to 2010.

According to the CCID 2007-2008 report, China's IC production was 26.1 billion pieces and 70.2 billion Yuan (US$8.7 billion) in 2005, and 40.9 billion pieces and 125.1 billion Yuan (US$16.5 billion) in 2007. CSIA now forecasts it to increase to 251 billion Yuan (US$33 billion at 2007 FX rates) by 2010.

While this forecast achieves CSIA's original revenue objectives, it falls noticeably short of their 50% of domestic demand objective as it will satisfy no more than 30% of China's consumption demand by 2010. In order to realize this revised moderate growth scenario, China will have to complete the construction, equipping and ramping into full production the equivalent of slightly more than 12 of the 14 wafer fabrication plants currently under construction. This would require a further capital investment of US$6 billion in addition to the US$20 billion needed for the conservative growth strategy, bringing the total capital investments to US$26 billion.

A very substantial amount of this capital investment seems to be in line with China's 11th Five Year Plan, which calls for a total investment of 300 billion Yuan (US$39.4 billion at 2007 FX rates) in the IC industry for the five-year period 2006 through 2010. However, Chinese authorities expect that foreign investments will take up a major percentage of this total, and that could prove to be a limiting constraint on achievement of the scenario.

If China can achieve the goals of their 11th Five Year Plan, their IC industry will have grown to reach revenues that represent almost 12% of the worldwide market by 2010. Realization of this scenario now means that China's IC industry will have to maintain an average 26% CAGR over the last three years of the decade and, as a result, will have achieved an average 29% CAGR for the five-year period from 2005 through 2010. That would be an unprecedented achievement, as the three countries to previously enjoy breakout growth in their own semiconductor industries—Japan, Korea and Taiwan—did not sustain a CAGR of 30% for more than two consecutive years. Therefore, attainment of this revised projection appears to be somewhat optimistic.

Aggressive growth scenario

It now appears that the Chinese authorities are postponing their goal of growing their IC industry revenues to equal half of their IC consumption market from 2010 to some indefinite time in the future. However, for purposes of comparison and consistency, our aggressive growth scenario remains based upon that original goal.

According to the CSIA 2008 report, China's IC market is now forecasted to reach US$109.5 billion by 2010. Under the aggressive growth scenario, China's IC industry would now have to reach revenues of US$54.8 billion by 2010, a 49% CAGR from 2007 to 2010, which remains very unlikely. Under the most likely business model, this scenario would require China to increase its wafer fab capacity to more than 3.5 million 8-inch equivalent WSpM (Wafer Starts per Month). This would require the construction and ramping to full production of at least 14 additional wafer fabrication plants, which are not currently under construction. Moreover, all of these plants would

have to be of the largest size currently planned for China (e.g., Intel Dalian) and this new capacity would require an additional investment of about US$46 billion beyond that required under the conservative growth scenario. The size of this required investment, plus the uncertainties of undertaking such a plan, are likely factors in explaining why this IC revenue growth goal has been indefinitely postponed.

This scenario is most sensitive to China's IC industry business model and reporting practices. Assume China could radically expand its design (fabless) sector and achieve a business model in which all its wafer fabrication and packaging and testing production were used to support that design sector. If it also then continued its current reporting practices, with the inherent double counting, the aggressive scenario could be achieved by just completing and fully utilizing all the current and committed wafer fabrication plants. This would reduce the required additional capital investment to about US$7 billion. However, it would also entail China's design (fabless) sector growing by more than ten times during the remainder of the decade. This is an impractical scenario. However, it provides valuable insight into the impact of that business model and China's motivation for continuing to highly incentivize the development of their IC design sector.

Appendix 1

Interpreting Chinese semiconductor statistics

Despite increasing international interest and press coverage, market reports on and statistics for the Chinese semiconductor industry are difficult to obtain and often subject to misinterpretation or skepticism. Nonetheless, this report is based, in part, on data derived from Chinese sources. We use this data for two reasons. First, Western sources on the subject are incomplete and somewhat divergent and second, this is the same data used by the Chinese policy makers.

The two principal indigenous sources for most Chinese semiconductor industry and market reports, data and statistics are the China Center for Information Industry Development (CCID) Consulting and the China Semiconductor Industry Association (CSIA). Both are associated with the Ministry of Industry and Information Technology[1] (MIIT) and share common data sources and industry analysts. Below we delineate how these Chinese sources differ from conventional semiconductor industry statistics.

Definitional differences

Because both sources compile their data and write their reports in Chinese, their English-language translations of the reports contain a number of anomalies. For example, while traditional industry reports use three orders of magnitude such as thousands (kilo), millions (mega), and billions (giga), China's reports use two orders of magnitude such as ten-thousands and hundred-millions. So, analysis requires a translation to a common standard.

In addition, both the CCID and CSIA compile and analyze their data based upon an industry structure that is somewhat different from that employed by Western analysts. This industry structure is not clearly defined in their English-language reports, but may be best described by the following statement contained in CSIA's seminal report, *An Investigation Report of China's Semiconductor Industry 2002*:

"The term 'the semiconductor industry' in this report covers IC [integrated circuit] design, IC manufacture, packaging and test, semiconductor discrete device and semiconductor supporting sector, etc. In view that the investigation on supporting sector is not comprehensive, the term 'China semiconductor industry' in 'General Introduction' and in its relevant statistic data excludes this sector."

Therefore, according to CCID, CSIA and MIIT usage, their reports on the Chinese semiconductor industry are based upon an industry structure organized into the following sectors:

IC design—This sector includes IC design companies, institutes and laboratories, as well as all fabless IC semiconductor companies in China regardless of ownership structure. Most of the revenue and all of the unit production reported for this sector come from product sales by fabless semiconductor companies.

IC manufacture—Sometimes identified as the chip manufacturing industry, this sector includes wafer foundries, wafer fabrication plants of foreign IC semiconductor companies and Chinese IC integrated device manufacturers (IDMs). As a result, the revenue and unit production reported for this sector is a heterogeneous mix of wafer and finished product unit sales.

Packaging and testing—This sector, which is sometimes identified as the encapsulation and testing industry, includes the IC semiconductor packaging, assembly and test (SPA&T) plants of foreign semiconductor companies, as well as all IC semiconductor assembly and test services (SATS) plants and companies in China.

This sector *does not include* the discrete SPA&T plants of foreign semiconductor companies or the IC SPA&T activities of Chinese IDMs. Because some SPA&T plants of foreign semiconductor companies use a wafer/die sale/buy-back or imported processing business model and others use a consigned wafer/die or another toll-processing business model, the revenue reported for this sector is not homogeneous and is potentially misleading. However, reported unit production is relatively homogeneous.

Discrete device—This sector includes all Chinese discrete IDMs and several Chinese SPA&T plants, as well as all discrete wafer fabrication and SPA&T plants of foreign

1 Formerly known as Ministry of Information Industries or MII.

semiconductor companies in China. Because many of the SPA&T plants of foreign semiconductor companies use a consigned wafer/die business model rather than the fully-costed IDM business model, the revenue reported for this sector is not homogeneous and can be misleading. However, reported unit production is relatively consistent and reliable.

Data compilation methods

Both the CCID and CSIA compile their data from reports or survey responses filed by the various entities in each industry sector. These entities usually report their activities as separate standalone companies, and the CCID and CSIA consolidate the reports from each company in an industry sector without any eliminations or offsets. The results are often industry-sector totals that are aggregates of different inputs and therefore misleading. For example, the data might include foundry wafer revenues and wafer shipments combined with IDM finished-unit product sales revenues and unit shipments.

One of the most confusing terms used in the reports is "pieces" or "pcs," which is sometimes mistranslated as "wafers." As used in the reports, the definition of this term varies with the type of company, so that it includes finished devices from a fabless semiconductor company, wafers from a wafer foundry, finished devices from an IDM and assembled and possibly tested units from a SPA&T plant or SATS company. It is very difficult to relate one to the other and therefore almost impossible to determine average selling prices (ASPs) from the CCID's or CSIA's industry sector data.

Because at least three of the largest SPA&T plants of foreign semiconductor companies use a wafer/die sale/buy-back business model, their reported revenues are approximately four times as large as they would be if reported using the conventional consigned wafer/die (cost less die) basis. This reporting difference is very significant and could account for an overstatement of 34% in the 2007 revenues for the IC packaging and testing sector, 17% in the 2007 revenues of the Chinese IC industry and 10% in the 2007 revenues of the overall Chinese semiconductor industry.

Probable double-counting: A hypothetical example

Because of the way the CCID and CSIA compile their data without any eliminations or offsets, it is very probable that there will be instances of double-counting between sectors. The following example—a hypothetical manufacturing flow for a Chinese fabless semiconductor company that uses both a Chinese wafer foundry and SATS company to manufacture its products—illustrates the impact of this approach.

In our example, Average Semiconductor is a fabless semiconductor company in the IC design sector; XMIC is a wafer foundry in the IC manufacturing sector; XSE is a SATS company in the packaging and testing sector; and Solectron is an electronics manufacturing services (EMS) customer.

Further assume:

- Average buys 1,000 wafers (200mm) from XMIC for US$900 per wafer, for a total of US$900,000.
- Average consigns the 1,000 wafers to XSE for assembly and testing in plastic ball grid array (PBGA) packages with 1,400 net die per wafer and a die-free package cost of US$0.27 per package, for a total of 1,400,000 finished units and value of US$378,000.
- Average sells the 1,400,000 finished units to Solectron for an average selling price of US$1.50 per device, for a total of US$2,100,000.

Using CCID and CSIA reporting practices, these transactions would be classified and recorded as shown in Table 10.

Under CCID and CSIA reporting practices, the revenue at each stage is included in the total—a divergence from traditional industry standards. Consequently, in this example, the total Chinese semiconductor industry revenue is overstated by 61% and the unit shipments by 100% relative to conventional industry standards.

Table 10: Revenue comparison

	Pieces	Revenue	Revenue using industry standards
IC manufacturing sector	1,000	900,000	Not reported
Packaging and testing sector	1,400,000	378,000	Not reported
IC design sector	1,400,000	2,100,000	2,100,000
Total	2,801,000	3,378,000	2,100,000

All revenues are in US dollars

Implications of statistical disparities

Compared with the more conventional practices and standards of the World Semiconductor Trade Statistics (WSTS) and related industry associations and analysts, these differences in CCID and CSIA reporting practices and standards could lead to noticeable variability in reported Chinese semiconductor industry results. This variance would be greater or lower depending upon the mix of business models employed.

Furthermore, these differences could have a significant impact on China's ability to gauge the need for or to even manage the output of nationwide IC production (for example, to meet a greater share of its domestic consumption).

Consider the accounting impact as it relates to an IC device that is wafer fabricated, packaged, assembled and tested in China. Using the current CCID/CSIA reporting practices, the average reported semiconductor industry revenue could range from 67-167 yuan, depending on the scenario:

67 yuan The device is manufactured by a wafer foundry and SATS supplier for a foreign fabless semiconductor company.

100 yuan The device is manufactured and sold by a Chinese IDM.

167 yuan The device is manufactured by a Chinese wafer foundry and SATS supplier for a Chinese fabless semiconductor company and sold by that fabless company.

This variance is significant, creating an operational and planning challenge for both China and the global semiconductor industry.

In the future, increasing international interest and visibility may encourage the CCID and CSIA to replace their current Chinese semiconductor industry reporting practices and standards with more common international standards and practices. For example, the CSIA recently joined the World Semiconductor Council (WSC). They should be further encouraged to participate in the World Semiconductor Trade Statistics (WSTS) and Semiconductor International Capacity Statistics (SICAS) programs. If China elects to change to more conventional semiconductor industry reporting practices and standards, the country may find it desirable to revise the CSIA objectives accordingly.

Statistics used in our report

Despite the evident disparities, we use the aggregate statistics as reported, while carefully noting that they represent China's semiconductor industry as reported in China—that is, the sales revenue of all semiconductor companies in China as reported to the Chinese authorities. We do so because we have no way to determine which business model is being used by every company, and because Chinese policymakers themselves rely upon these results.

As the tendency is for these sources to overstate the size of the industry, understatement is far less likely—and the fact is, we want to be careful not to understate the impact of China on the industry as a whole. Still, in cases where the Chinese have identified individual company revenues, we have been able to augment that data with information from other sources.

Identifying Chinese semiconductor companies

For a variety of translation and structural reasons, the English names of many of the Chinese semiconductor companies are often a source of confusion. Many companies have English names that are different from the literal translation of their Chinese names and often inconsistently incorporate location prefixes. As a result, the same company may be identified by a number of different English names in various reports and articles.

Appendix 2:

Sales performance in China of multinational semiconductor companies

As a performance assessment, we have compared the 2006 and 2007 sales of companies to China with their sales worldwide, deriving a percentage of each company's revenue for sales to China (See Table 11 on pages 67-68). For internal consistency, this table relies on data from Gartner Dataquest*—a ranking of more than 200 of the top worldwide semiconductor companies—combined with PwC's own assessment of the data, from which we selected the 70 largest for this purpose.

However, China's semiconductor consumption market has grown in the past two years to be almost twice as large as China's purchase (or sales to) market. Since Gartner Dataquest does not identify consumption market share by company, we have had to extend our definition of average from 15-25% of a company's worldwide sales to China (used in our 2006 update) to 15% to 30%. The following information represents PwC's assessments and calculations based on Gartner Dataquest data.

On that basis, six of the companies in our analysis had an above-average (greater than 30%) share of their worldwide sales to China in 2007. While their worldwide sales grew by an average of 26%, their sales to China grew by a remarkable average of 78%.

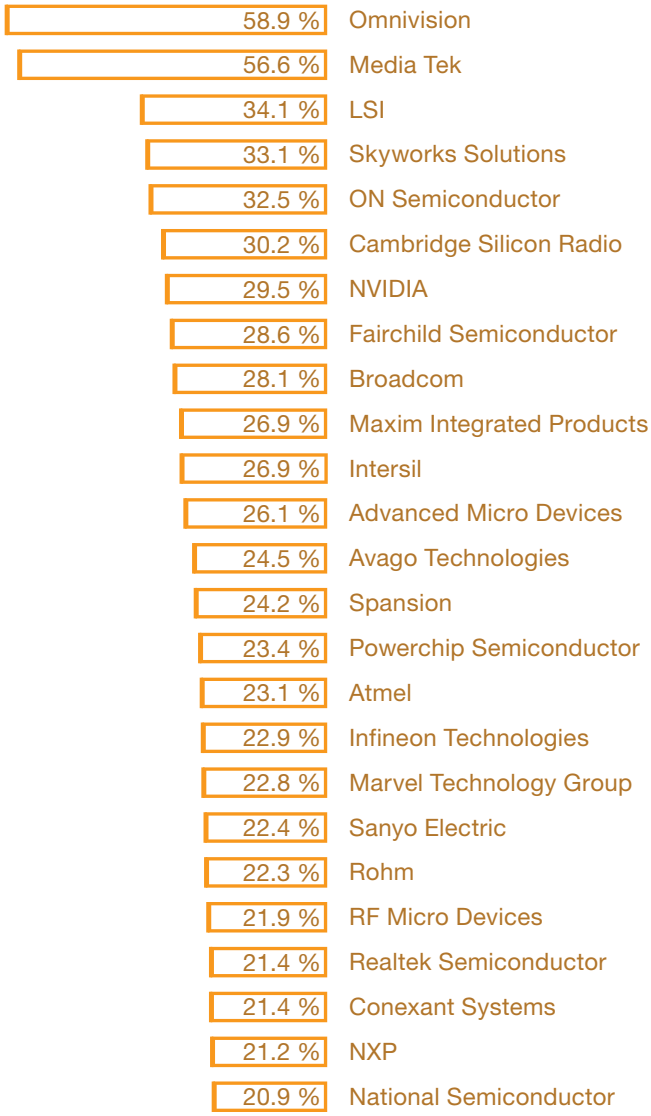
Next, 32 of the companies in our analysis achieved an average share (between 15 and 30%) of their worldwide sales to China in 2007. While this group had zero average worldwide sales growth between 2006 and 2007, their sales to China grew by an average of 9%.

The remaining 32 companies in our analysis had a below-average (less than 15%) share of their worldwide sales to China in 2007, including three companies with zero sales to China and another 13 with less than 10% of their sales to China. Nine of the 13 companies with less than 10% of their 2007 sales to China were Japanese companies, which may be indicative of a unique business model or practice. Worldwide sales of the 32 below-average companies grew by an average of 6% in 2007, while their sales to China grew by 8%.

Overall, the worldwide semiconductor sales of these top 70 companies grew by 4% in 2007, accounting for just over 87% of total worldwide sales. Meanwhile their sales to China grew by 12% to account for just over 14% of total worldwide sales.

The figure on the following page (Figure 24) ranks the top 25 companies according to their sales in China as a percentage of their total 2007 sales:

Figure 24: Top 25 companies by sales in China as percentage of total revenue



Source: Gartner Dataquest, 2008

Table 11: 2006 and 2007 sales performance in China of multinational semiconductor companies

Rank			Worldwide revenue in billions of US dollars			China revenue in billions of US dollars			Percentage of revenue from China	
2006	2007		2006	2007	% change	2006	2007	% change	2006	2007
1	1	Intel	30.52	33.80	11	4.03	4.28	6	13.2	12.7
2	2	Samsung Electronics	20.14	20.46	2	2.01	2.17	8	10.0	10.6
6	3	Toshiba	9.78	11.82	21	1.36	1.72	26	13.9	14.5
3	4	Texas Instruments	11.98	11.77	-2	2.41	2.39	-1	20.1	20.3
4	5	Infineon Technologies (incl. Qimonda)	10.53	10.19	-3	1.40	2.34	67	13.3	22.9
5	6	STMicroelectronics	9.85	9.97	1	1.76	1.91	8	17.9	19.1
7	7	Hynix Semiconductor	8.01	9.10	14	1.33	1.45	9	16.6	15.9
8	8	Renesas Technology	7.90	8.00	1	0.63	0.75	19	8.0	9.3
9	9	Advanced Micro Devices	7.43	5.88	-21	1.85	1.54	-17	24.9	26.1
10	10	NXP	5.87	5.87	0	1.18	1.25	6	20.1	21.2
14	11	QUALCOMM	4.53	5.62	24	0.77	1.14	48	17.1	20.4
12	12	NEC Electronics	5.68	5.59	-2	0.53	0.49	-8	9.2	8.7
11	13	Freescale Semiconductor	5.78	5.32	-8	1.24	1.01	-19	21.4	18.9
15	14	Sony	4.43	5.10	15	0.32	0.43	32	7.3	8.3
13	15	Micron Technology	4.99	4.89	-2	0.63	0.53	-16	12.6	10.8
16	16	Matsushita	3.83	4.09	7	0.49	0.62	25	12.9	15.1
17	17	Broadcom	3.67	3.74	2	1.00	1.05	5	27.2	28.1
20	18	Elpida Memory	3.49	3.71	6	0.20	0.21	9	5.6	5.7
18	19	Sharp	3.57	3.53	-1	0.33	0.37	12	9.3	10.6
26	20	NVIDIA	2.49	3.11	25	0.57	0.92	60	23.0	29.5
19	21	IBM Microelectronics	3.52	3.02	-14	0.57	0.59	3	16.3	19.6
25	22	Marvell Technology Group	2.52	2.83	12	0.63	0.65	3	24.9	22.8
21	23	Rohm	2.86	2.83	-1	0.60	0.63	6	20.9	22.3
24	24	Fujitsu	2.55	2.78	9	0.17	0.18	10	6.5	6.6
22	25	Analog Devices	2.60	2.62	1	0.35	0.31	-13	13.6	11.8
23	26	Spansion	2.58	2.50	-3	0.58	0.61	4	22.6	24.2
34	27	MediaTek	1.61	2.43	51	0.69	1.37	99	42.8	56.6
29	28	Maxim Integrated Products	1.99	2.07	4	0.54	0.56	4	27.0	26.9
32	29	SanDisk	1.67	2.00	20	0.12	0.17	47	7.1	8.7
28	30	National Semiconductor	2.03	1.84	-9	0.44	0.38	-13	21.7	20.9
30	31	Xilinx	1.87	1.81	-3	0.24	0.26	6	13.0	14.3
45	32	LSI	1.22	1.71	39	0.29	0.58	99	23.9	34.1
31	33	Sanyo Electric	1.85	1.70	-8	0.41	0.38	-7	22.1	22.4
33	34	Fairchild Semiconductor	1.65	1.63	-1	0.41	0.47	14	24.9	28.6

Source: Gartner, Inc., “Semiconductor Industry Worldwide Annual Market Share: Database” by John Barber et al, March 27, 2008, and “Semiconductor Industry Asia/Pacific, Annual Market Share: Database” by Gerald Van Hoy et al, June 20, 2008.

Rank			Worldwide revenue in billions of US dollars			China revenue in billions of US dollars			Percentage of revenue from China	
2006	2007		2006	2007	% change	2006	2007	% change	2006	2007
35	35	ON Semiconductor	1.53	1.55	1	0.40	0.51	25	26.4	32.5
37	36	Atmel	1.48	1.55	5	0.32	0.36	13	21.4	23.1
40	37	Vishay	1.36	1.48	9	0.11	0.11	-4	8.2	7.3
27	38	Nanya Technology	2.11	1.48	-30	0.35	0.26	-28	16.7	17.2
41	39	Avago Technologies	1.35	1.35	0	0.33	0.33	-1	24.7	24.5
46	40	Nichia Chemical	1.21	1.31	8	0.08	0.08	3	6.4	6.1
43	41	International Rectifier	1.27	1.31	3	0.24	0.25	4	19.1	19.3
44	42	Mitsubishi	1.25	1.30	4	0.05	0.06	19	4.3	4.9
42	43	Altera	1.29	1.26	-2	0.19	0.22	21	14.4	17.6
36	44	Powerchip Semiconductor	1.49	1.24	-17	0.36	0.29	-18	23.9	23.4
53	45	Novatek	0.96	1.17	21	0.16	0.20	24	17.0	17.5
62	46	Q-Cells	0.67	1.14	70	0.0	0.0	0.0	0.0	0.0
48	47	Cypress Semiconductor	1.06	1.13	7	0.11	0.12	15	10.2	10.9
54	48	Robert Bosch	0.96	1.12	17	0.02	0.03	82	1.8	2.8
47	49	Linear Technology	1.14	1.09	-4	0.13	0.12	-4	11.3	11.3
51	50	RF Micro Devices	0.99	1.08	9	0.22	0.24	10	21.7	21.9
49	51	Microchip Technology	1.03	1.04	1	0.16	0.15	-2	15.3	14.9
50	52	Oki Electric	1.02	0.97	-5	0.11	0.09	-15	10.7	9.6
38	53	ProMOS Technologies	1.46	0.97	-34	0.14	0.10	-34	9.8	9.8
73	54	SunTech Power	0.47	0.94	98	0.08	0.16	98	17.1	17.1
58	55	Himax Technology	0.74	0.92	24	0.17	0.16	-9	23.1	17.0
55	56	Denso	0.82	0.87	5	0.0	0.0	0.0	0.0	0.0
61	57	Cambridge Silicon Radio	0.71	0.85	20	0.08	0.26	241	10.6	30.2
56	58	Integrated Device Technology	0.79	0.81	3	0.09	0.11	22	11.3	13.4
60	59	OSRAM	0.71	0.78	10	0.10	0.11	8	14.2	14.0
52	60	Conexant Systems	0.99	0.76	-23	0.21	0.16	-23	21.3	21.4
59	61	Intersil	0.74	0.76	2	0.18	0.20	12	24.6	26.8
57	62	Skyworks Solutions	0.77	0.76	-2	0.22	0.25	16	28.0	33.1
71	63	Omnivision	0.54	0.75	38	0.29	0.44	52	53.5	58.9
67	64	Fuji Electric	0.61	0.74	20	0.04	0.06	49	6.0	7.5
65	65	Winbond Electronics	0.63	0.67	6	0.14	0.12	-14	22.1	18.0
66	66	Macronix International	0.62	0.66	7	0.03	0.04	65	4.2	6.6
64	67	Micronas	0.65	0.59	-8	0.05	0.06	15	8.2	10.3
63	68	Sun Microelectronics	0.66	0.59	-11	0.0	0.0	0.0	0.0	0.0
69	69	Sanken	0.57	0.58	0	0.07	0.06	-6	11.5	10.8
77	70	Zoran	0.46	0.53	16	0.05	0.06	18	11.1	11.3

Source: Gartner, Inc., “Semiconductor Industry Worldwide Annual Market Share: Database” by John Barber et al, March 27, 2008, and “Semiconductor Industry Asia/Pacific, Annual Market Share: Database” by Gerald Van Hoy et al, June 20, 2008.

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Industry Perspectives
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Gerald Yin, Ph.D.: Chairman and Chief Executive Officer, Advanced Micro-Fabrication Equipment Inc.

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Of further interest

PricewaterhouseCoopers began the study series *China's impact on the semiconductor industry* in 2004 in response to our clients' interest in the rapid growth of the semiconductor industry in China. Subsequent updates were published in 2005 and 2006. Visit www.pwc.com/technology to access all these reports.

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PricewaterhouseCoopers delivers value with a global perspective through local implementation. Please contact the technology industry leader nearest you to discuss the challenges facing your company and how we can help.

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